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Combined Degree Programs (Purdue Undergraduate/Graduate)

A combined-degree program is reserved for exceptional students and results in the joining of curricula of an existing baccalaureate or professional degree program and an existing master's degree program within the Purdue University system. Combined degree programs formally approved by the participating academic units and the Graduate School may use a limited number of dual counted credit hours of 50000- and 60000-level coursework taken to satisfy the baccalaureate or professional degree on the master's degree plan of study. Undergraduate excess credits can be used in combination with shared credits in the combined degree but the sum of the dual-counted and undergraduate excess credits may not exceed maximum shown below.

Master's Degree Required Credit Hours	**Maximum Number of Credit Hours (From Free Electives)**
30-36	12
37-45	15
46-+	18

Combined Degree Programs

Undergrad Program:	**Graduate Program:**
B.S.C.E.	M.S.C.E. (Civil Engineering)
B.S. in Biomedical Engineering	M.S.B.E. (Biomedical Engineering) (thesis)
B.S. in various undergraduate programs	M.S.E.E.E. (Environmental and Ecological Engineering)
B.S.M.E.	M.S.M.E. (Mechanical Engineering)
B.S. in Management	M.B.A. (Management)
B.S. in Chemical Engineering	M.B.A. (Management)
B.S. in Management	M.S. (Management)
B.A. in Communication	M.S. (Management)
B.S. in Psychological Sciences or B.S. in Brain and Behavioral Sciences	M.S. (Management) (HRM concentration)
B.S. in General Health Sciences	M.B.A. in Management
B.S. in Electrical Engineering	M.B.A. (Management)
B.S. in Industrial Engineering	M.B.A. (Management)
B.S. in Mechanical Engineering	M.B.A. (Management)
B.S.I.M in Industrial Management	M.B.A. (Management)
B.S. in Various Areas	M.B.A. (Management)
B.S. in STEM Disciplines	M.S. (Economics)
B.S. (Various Depts. in Agriculture)	M.S. (Various Depts. in Agriculture)
B.S. in Electrical Engineering Technology	M.S. (Engineering Technology)
B.S. in Aviation Technology	M.S.A.A.M. (Aviation and Aerospace Management in Aviation and Transportation Technology)
B.S. in Statistics	M.S. (Statistics)
B.S. in Mechanical Engineering Technology	M.S. (Engineering Technology)
B.S. in Computer Graphics Technology	M.S. in Computer Graphics Technology
B.S. in Computer Science	M.S. in Computer Science

B.S./B.A. with Various Undergraduate Programs	M.P.H in the Department of Public Health
M.S.A.A. with The School of Aeronautics and Astronautics	M.B.A in the School of Management
B.S. in Kinesiology	M.S. in Athletic Training
B.S. in Biomedical Engineering	M.S.B.M.E. (Biomedical Engineering) (thesis)
B.S. in Biomedical Engineering	M.S.B.M.E. (Biomedical Engineering) (non-thesis)
B.S. in ROET	MSET in SOET
BS in MSE	M.S. in MSE
B.A. in Communication (Distance)	M.S. in Communication
B.A. in Materials Engineering	M.S. in Materials Engineering
B.S. in Human Resource Development	M.S. in Management (Concentratrion: Human Resource Mgmt)
B.S. Human Resourse Development	M.S. Human Resourse Development
B.S. in Communication	M.S. in Human Resourse Management
B.S. in Biomedical Engineering	MPH in Public Health
B.S. in Biochemistry	MPH in Public Health
B.S. in Kinesiology	M.S. in Kinesiology
B.S. in Nuclear Engineering	M.S. in Nuclear Engineering
B.A. in Sociology	MPH in Publich Health

B.A. in History	M.A. in History
B.S. in Electrical Engineering	M.S.E.C.E. (Electrical and Computer Engineering)
B.S. in Computer Engineering	M.S.E.C.E. (Electrical and Computer Engineering)
B.A. in English	M.A. in English
B.S. in Pharmacy	M.P.H. in Public Health
B.S. in Consumer Science	M.S. in Consumer Science
B.S. in Hospitality & Tourism Management	M.S. in Hospitality & Tourism Management
Concurrent Degree Program:	
M.S. in Microelectronics and Semiconductors	M.B.A.
M.S. and M.S.E. in Microelectronics and Semiconductors	M.S. in Management (Major in Global Supply Chain Management)
M.S.A.A.	M.B.A. (Online)
M.D.	M.S.B.M.E
M.S. in Business Analytics	M.B.A.
M.S. in Engineering	M.B.A.
M.S. in Global Supply Chain	M.B.A.
M.S. in Human Resource Management	M.B.A
Dual Degree Programs:	
Ph.D. from Purdue Mechanical Engineering	Ph.D. from SJTU Mechanical Engineering

Ph.D. from Purdue Department of Physics and Astronomy	M.S. from Morgan State Department of Physics and Astronomy
M.S.M.E. from Purdue Mechanical Engineering	M.S. from Hanyang University (South Korea) School of Mechanical Engineering
M.S.B.M.E. from Purdue Biomedical Engineering	M.S. from Hanyang University (South Korea) School of Mechanical Engineering
Miscellaneous:	
M.S. in Engineering Technology	Student exchange with University of Reutlingen
M.S. in Defense Engineering Technology	In cooperation with Cranfield University (a diploma - UK non-thesis equivalent)
M.S.M.E. in Mechanical Engineering	Student exchange with Leibniz University Hannover
M.S. in ECE degree (project-track, with concentration in semiconductors and microelectronics)	Student exchange with NYCU
Professional Degree:	**Graduate Degree:**
Pharm. D.	Ph.D. (Pharmacy)
Pharm. D.	M.S.I.A. (Management)

Articulation Agreements and TSAP

Articulation Agreements

These are agreements between Purdue and other higher education institutions to create linkages for students to transfer to Purdue or to transfer credit to Purdue.

Please see domestic agreements and international agreements for an active list of partners for undergraduate and graduate programs.

Transfer Single Articulation Pathway (TSAP)

TSAP is a type of articulation agreement originating from the Indiana Commission for Higher Education (ICHE). The table below includes a list of plans of study for TSAP Pathways. The database above includes more details about the partnerships with Ivy Tech Community College and Vincennes University.

TSAP Name	Purdue
Biology	TSAP - Biology, BS
Business Administration	TSAP - General Management, BS
Chemistry	TSAP - Chemistry, BS
Computer Science	TSAP - Computer Science, BS * (various concentrations)
Criminal Justice	TSAP - Law and Society, BA

Cybersecurity	TSAP - Cybersecurity, BS
Early Childhood Education	TSAP - Early Childhood Education & Exceptional Needs, BS
Electrical Engineering Technology	TSAP - Electrical Engineering Technology, BS *
Elementary Education	TSAP - Elementary Education, BA
Human Services	TSAP - Human Services, BS
Information Technology and Informatics	TSAP - Computer & Information Technology, BS
Mechanical Engineering	TSAP - Mechanical Engineering, BSME *
Mechanical Engineering Technology	TSAP - Mechanical Engineering Technology, BS *
Psychology	TSAP - Psychological Sciences, BS
Secondary Education - Biology	TSAP - Biology Secondary Education, BS
Secondary Education - Chemistry	
Secondary Education - English	TSAP - Secondary Education English, BA
Secondary Education - Mathematics	TSAP - Secondary Mathematics Education, BS
Secondary Education - Social Studies	TSAP - Social Studies Education, BA
Sociology	TSAP - Sociology, BA
Special Education	TSAP - Special Education/Mild Intervention P-12, BA

*Available at Indianapolis and West Lafayette

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Academic Regulations & Student Conduct

This is information for all Purdue students on the structure, policy, regulations, and procedures of the University that govern their relationship to the University in both academic and personal progress toward their ultimate educational goals. It is designed as a reference, with direct quotations from the University Code where applicable, covering the basic areas relating to all students on the campus.

Each of the three campuses maintains additional administrative policies specific to their needs and structure. Individual colleges, schools and departments may adopt distinct procedures, standards or guidelines, all of which must be consistent with these system-wide policies. The Helpful Links page provides a list of where this additional information may be found.

There may be problems or questions of detail, particularly with reference to policies or procedures of a student's instructor, school, or housing facility, for example, which can be answered only by the staff directly involved. Where a question regarding interpretation of a policy or procedure arises, a student should consult the Office of the Dean of Students, the Office of the Registrar, an academic advisor, a school counseling office or other appropriate office. For the comprehensive list of all university policies, please see the University Policy Office website.

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Academic Year and Calendar

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Academic Programs

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Degrees and Requirements

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Registration and Course

Assignment

- **Classes**
- **Financial Obligations and Responsibilities**
- **Grades and Grade Reports**
- **Academic Notice and Separation**
- **Scholastic Recognition**
- **Scholastic Records**
- **Scheduling of Examinations**
- **Academic Calendar**
- **Final Examinations**
- **Quiet Period**
- **Summer or Winter Sessions**

Work

1. **Courses are scheduled during the academic year and summer session. The academic year shall consist of two 16-week semesters. Summer session(s) may be one 4-week and one 8-week or two 6-week or other configurations as approved by the Provost's Office. In each semester/session, classes shall begin with the first instructional period of the first day.**
2. **In each semester/session, classes shall begin with the first instructional period of the first day.**
1. **The calendar for students enrolled in the fourth year of veterinary medicine will comprise 12 blocks of approximately one month duration. The starting dates for the blocks will be chosen so that the end of the 12th block coincides with the end of the second semester (University Senate Document 73-15, March 18, 1977).**
2. **The second semester for fifth-year pharmacy students will begin on the first Monday in January and end the 18th following Saturday. During this semester, each of these students will be scheduled for two six-week externships and one three-week clerkship.**
3. **The first semester shall begin on either the third or fourth Monday of August, be in recess Monday and Tuesday of the**

eighth week, and Wednesday, Thursday, Friday, and Saturday of Thanksgiving week, and classes will end on the 17th following Saturday, which shall not occur after the 20th day of December. The second semester shall begin on either the first or second Monday of January, which shall not occur prior to the seventh day of January, be in recess during the tenth week, and end on the 17th following Saturday (University Senate Document 96-4, February 17, 1997).

4. **The summer session shall begin on the next Monday following the spring commencement and will be comprised of one 4-week and one 8-week, or two 6-week module(s) or other configurations as approved by the Provost Office. Courses may be scheduled during any one or any combination of modules throughout the 12-week period. There shall be no classes on Memorial Day, the last Monday in May, or on July 4, nor on the nearest class day when July 4 is not a regular class day.(University Senate Document 96-4, February 17, 1997).**
5. **The winter session shall begin on the next Monday following the end of the fall semester and will be comprised of one 3-week term. No on-campus instruction will be provided. There shall be no classes on Christmas (December 25), on the Extra Day at Christmas time, on New Year's Day (January 1), and on the President's designated holiday (which traditionally has been allocated to the winter break), (University Senate Document 96-4, February 17, 1997; University Senate Document 21-23, February 21, 2022).**
6. **Faculty shall enter grades as completed, but no later than 5 p.m. on the second working day after the end of the respective academic semester/session.**
7. **Commencement will be held as follows: First Semester: first**

Sunday following the end of the first semester; Second Semester: next subsequent weekend after the end of the second semester; Summer Session: first Saturday following the end of the last summer module. No commencement will occur with the winter session. (University Senate Document 21-23, February 21, 2022)

8. **The faculties at regional campuses shall be free to establish their own calendar dates.**

1. **In regular semesters, the final examination period shall consist of six scheduled days comprising the 16th week of the semester. The two-hour class meetings during the six days of the final examination period will be scheduled at the discretion of the Educational Policy Committee on the advice of the Office of the Registrar as, at most, 30 two-hour periods (five periods per day, including evenings). Upon request, a single coursewide examination will be scheduled for any course. In the summer session, the final examination schedule shall be appropriately scaled to meet the demand. It shall be scheduled at the discretion of the Educational Policy Committee on the advice of the Office of the Registrar in, at most, 12 two-hour periods on the last three days of the session (four periods per day, excluding evenings).**
2. **Each class will be scheduled for a two-hour meeting during the final examination period. Excepted are those courses classified as individual study, clinic, student teaching, industrial experience (co-op), or research and those offered for zero credit. However, any such course will be included in the schedule upon the specific request of the appropriate schedule deputy. If no educational purpose will be served by any type of meeting during the 16th week because the educational objectives of the course have been achieved,**

a department may dismiss this class meeting during the 16th week.

3. Two weeks after the beginning of any regular semester and one week after the beginning of the summer session, schedule deputies shall inform the Office of the Registrar of the courses requiring coursewide examinations. It will be the responsibility of the department head or, where appropriate, the school head to inform the Office of the Registrar which courses within the department or school will not need a meeting. A schedule implementing Section B will then be developed by the Office of the Registrar in consultation with the Educational Policy Committee. Guiding principles include

- Minimize the number of direct student examination conflicts.
- Minimize the number of students who have more than two examinations on the same day.
- Minimize the number of students who have consecutive (back-to-back) examinations.

1. No student shall be required to take more than two examinations on one day.
2. The Office of the Provost shall implement a procedure to inform faculty and students of the academic regulations governing end-of-semester exams and activities each semester to coincide with the release of the final examination class schedule.
3. Students scheduled for more than two examinations in one calendar day are entitled to reschedule any examinations in excess of two. Similarly, students faced with a direct exam conflict are entitled to reschedule either examination. It is the responsibility of the student to make the necessary arrangements before the last week of regularly scheduled classes. Course instructors shall not penalize a student who chooses to reschedule an examination under these options (University Senate

Document 90-22, March 25, 1991).

4. **Regional campuses may modify these provisions to meet local differences through established procedures of the local faculty governing bodies or, lacking these, the regional campus chancellor or designee.**
5. **The final examination period is intended for end-of-semester assessments (such as a final exam, quiz) Any such assessment that requires students to be present must conform to the central scheduling of, and time limitations of, a final examination.**
6. **Comprehensive final examinations (examinations for laboratory, intensive or minicourses excluded) are prohibited except during the regular final examination periods of the last week of the semester.**

1. **"Quiet Period" shall occur during the last Monday through Saturday (during the fall and spring terms), or the last three days (for 8 week terms), or the 1 day (in 3-4 week terms) of the instruction period preceding the final examination period. Distance learning, hybrid and asynchronous classes are subject to this same regulation as in-person instruction.**
2. **"Quiet Period" is defined as a time during which courses that conduct or collect an assessment during the final exam period shall refrain from assigning or collecting assessments. Here, "assessments" are defined as activities relating to the course's learning objectives that students turn in for class credit that the course instructor intends to use to judge whether students have met the associated learning objectives. Assessments do not include class participation during normally-scheduled class time. Courses that do not offer an assessment (such as a final exam, quiz) during the final examination period are exempt**

from following the restrictions on Quiet Period. It is the responsibility of the unit head to ensure that the unit's faculty preserves this regulation thusly.

- Unit of Credit
- Definitions Relating to Academic Requirements
- Academic Classification of Undergraduate Students
- Transfer of Students between Curricula
- Students without a Degree Objective
- Transfer of Credits between Curricula
- Credit in Courses by Examination
- Courses Taken in Post baccalaureate or Teacher License Status
- Excess Undergraduate Credits
- Correspondence Courses

1. Transfer Credit is credit earned at another accredited college or university and accepted by Purdue. The University will accept transfer credit only for work done at those institutions fully approved by a regional accrediting association of secondary schools and colleges or those whose regional accreditation designation is Associate/Vocational-Technical (A/V) when agreements with academic departments exist that specify courses or blocks of credit that will transfer into specific Purdue University degree programs. In addition to regional association approval, certain programs may require accreditation by professional organizations and/or societies before credit will be considered for transfer.

1. Dual Credit is credit earned for a college course that is used as a part of a high school's curriculum and is taught concurrently for high school credit and college credit by a secondary school employee.

1. Faculty must verify that the student has earned a grade of at least C in a higher-level course taken at Purdue that has as a prerequisite the course for which credit is being sought; or

2. Faculty must certify that the student has performed satisfactorily either on an appropriate standardized achievement examination or Purdue departmental advanced-credit examination or has earned a grade of at least C on a current comprehensive final examination for the Purdue course in which the student wishes to gain credit; or

3. Faculty must affirm that a dual-credit course offered at a specific high school by another postsecondary institution is essentially the same as a specific Purdue course by approving at least the syllabus and the examinations. In addition, faculty must confirm that the student earned a grade of at least C in the course (University Senate Document 95-8, April 22, 1996).

1. Directed Credit is academic credit awarded by the University on bases other than a student's enrollment in and satisfactory completion of a course.

1. Credit by Examination. Credit awarded to a student on the basis of achievement in a Purdue departmental proficiency examination. Credit by Examination is indicated on the transcript with the code of CR.

2. Departmental Credit. Credit for a course offered by a department and awarded to a student on the basis of substantially equivalent experience. May be granted only by the head of that department or their designated representative. Departmental Credit is indicated on the transcript with a code of DC.

3. Achievement Credit. Credit awarded to a student on the basis of demonstrated achievement in a nationally administered college-level examination (University

Senate Document 79-5, October 15, 1979).

1. To Substitute is to replace a course required in a specific curriculum by another course specified by the head of the school in charge of that curriculum or their designated representative.
2. To Excuse is to replace a course required in a specific curriculum by an equal number of credit hours in courses not specified.
3. To Exempt is to waive a course required for graduation together with its equivalent hours.

1. Undergraduate students, without respect to the school in which they are enrolled, may be exempted by the University faculty from any general requirement that has been established by the University faculty.
2. An undergraduate student in a specific school may be exempted by the faculty of that school from any requirement established by that school faculty.

4. Advanced Placement is the assignment of entering students to courses beyond the first course or courses in a normal sequence without allowing credit for courses not taken.
5. Advanced Standing means that an entering student has credit for or exemption from one or more courses.

1. A student at Purdue University is any person who has been admitted to the University and who is currently enrolled in one or more courses for which there will be a permanent academic record.
2. Each student shall be admitted and identified as one of the following:

1. Degree. A student who has been admitted and registered for the purpose of earning a degree.
2. Nondegree (University Senate Document 88-17, April 24, 1989). A student who is not in a program of study leading to a degree. A nondegree student has a limited purpose for their registration. A nondegree student is enrolled for personal or professional enrichment or to strengthen their academic background to gain degree-seeking status. Such a student must provide evidence their are qualified to enroll in the course(s) desired. An applicant currently enrolled in high school will be admitted as a non-degree student only when all of the following conditions are met:

1. The student ranks in at least the top half of the high school class and maintains an above-average grade(s) in subjects related to the course(s) in which they wish to enroll, and
2. The high school guidance counselor or principal has signed a recommendation for the student and has included a current copy of the high school transcript for review by members of the admissions committee. A nondegree student is generally limited to enrolling in a maximum of seven hours per semester during the fall and spring semesters, and is generally limited to enrolling in no more than four hours during the summer session; however, a nondegree student who has earned a bachelor's degree is eligible to enroll on a full-time basis. In order to continue to register as a nondegree student they must meet the same minimum grade index required of degree students. A student may apply no more than 18 semester hours of work completed as a nondegree student toward an undergraduate degree at Purdue University. The dean of the school to which the student applies may determine which credits will be accepted toward a degree in that school. A department may limit the number of nondegree students acceptable in any course (University Senate Document 87-13, April 25, 1988, revised by University Senate Document 02-6, February 17, 2003).

3. A student's academic classification for an associate or bachelor's degree shall be classified by numerals 1, 2, 3, etc., corresponding to the total number of credit hours of college work earned.

1. The starting date for degree requirements for an approved curriculum is the Fall semester of the academic year. When a

new or revised curriculum or degree requirement is approved by a college or school, the new requirements shall not apply to the students currently enrolled in the University. This limitation will expire 6 academic years after the new/revised curriculum is adopted. Current students may elect to use the new/revised curriculum or degree requirements for graduation on written request to the school or college. Curriculum or degree requirement changes made to satisfy requirements for professional accreditation may have a starting date in the semester in which the changes are made (University Senate Document 09-6, April 19, 2010).

1. **Prepare the prescribed request form.**
2. **Secure the approval of the deans or their designee of both colleges/schools concerned.**
3. **Submit the completed form at the Office of the Registrar before the end of the second week of the effective term. Forms received after the second week will be effective for the next term. The request form may be honored after the second week if it is accompanied by a special petition setting forth the extenuating circumstances. Any student who has been inactive for three consecutive semesters may request a change of curricula as part of the students' application for reentry.**

1. **The student had junior or senior standing when taking the course,**
2. **The student received a grade of B or better (work taken under the pass/not-pass option is not acceptable),**
3. **The course was designated as a graduate course, and**
4. **If the work is completed satisfactorily on this basis, the academic advisor (or candidate coordinator, or other designee) shall then complete the Academic Record Change Form 350, which indicates that the course may be used for graduate credit, and submit the form to the registrar, along with the grade reported, at the close of the student's final semester. The academic advisor's (or candidate coordinator's, or designee's) signature will attest to the fact that the credit is in excess of that required for the baccalaureate degree so that the registrar can then enter the notation available for graduate credit on the student's record.**

1. **All Purdue courses that are proposed for correspondence credit, including existing courses, must be approved through a school's normal approval process before being offered. Correspondence courses are defined as those courses that are characterized by instructor-student interaction that occurs primarily outside the traditional classroom setting.**
2. **Courses offered for credit will be taught by instructors approved by the department offering such courses. Whether a correspondence course is to be considered a normal teaching responsibility or an overload will be at the department's discretion.**
3. **Courses offered as correspondence courses will count toward degree requirements the same as any other approved course within the curriculum. Limitations on correspondence courses applicable toward a degree will be determined through a school's normal course and degree approval process.**
4. **Correspondence courses taken for credit will require the individual to be admitted to the University and officially registered for the course. Fees will be assessed separately from any other fees in accordance with the current standard per-credit-hour fee structure for the**

University or, if warranted, a special fee structure for the course will be requested through the Office of the Executive Vice President and Treasurer. The grade in the correspondence course will be incorporated in the computation of the scholastic index for the student, and a permanent academic record will be maintained.

5. The beginning date and time period allotted, up to one calendar year, for a correspondence course will be established by the department and recorded by the registrar. A student withdrawing during the first half of the time period established may be assigned a grade of W, WF, or WN by the instructor. Within one calendar year of enrollment a final grade will be reported to the registrar by the instructor for each enrolled student. If, due to extenuating circumstances, an incomplete grade is issued, the established regulations for removal or assignment of a permanent grade will apply.

6. Departments may wish to offer non-credit correspondence courses under an alternate course number that does not require the individual to be admitted to Purdue. No permanent academic record will be maintained, and fees will be established in accordance with the policies administered by the Office of the Executive Vice President and Treasurer.

- **Conferring of Degrees**
- **Requirements for Degrees**
- **Associate Degree**
- **Baccalaureate Degree**
- **Advanced Degrees**
- **Professional Degree - Doctor of Pharmacy**
- **Professional Degree - Doctor of Veterinary Medicine**
- **Multiple Degree Programs**
- **Diplomas**
- **Meeting Degree Requirements**

1. The completion, either by resident coursework, as directed credit, or by credit accepted from another institution, of the plan of study underlying the degree. Deans of schools may refuse to accept as credit toward graduation any course that was completed 10 or more years previously. Former students shall be notified immediately of all such decisions upon reentering. Substitutions of courses required for graduation may be made by the dean of the school conferring the degree.

2. Resident study at Purdue University for at least two semesters and the enrollment in and completion of at least 32 semester hours of coursework required and approved for the completion of the degree. Students normally are expected to complete the entire second year in residence; however, with the approval of the dean of the school concerned, students who have at least three semesters of resident study may complete not to exceed 16 semester hours of the second year in another approved college or university. For the purpose of this rule, two summer sessions may be considered as equivalent to one semester.

3. Registration, either in residence or in absentia, as a candidate for the desired degree during the semester (or summer session) immediately preceding its conferment.

4. A minimum cumulative GPA of 2.00 shall be required for graduation (University Senate Document 93-2, November 29, 1993). *(See Academic Regulations and Procedures: Grades and Grade Reports, sections A and J.)* A student who has completed all other requirements for an associate degree, but has failed to meet the quality requirements may register for additional courses with the approval of an authorized representative of the dean of the school after a review of the students record. The additional courses that the student may take after meeting all quantity requirements shall not exceed 10 credit hours. Credit in these additional courses must be established within three years of the date on which all degree requirements except the minimum cumulative GPA were met. The student will be considered as having met the quality requirement for graduation if their graduation index, including the above extra courses, meets the quality standard in effect at the time when all other graduation requirements were satisfied.

1. The completion, either by resident course work, as directed credit, or by credit accepted from another institution, of the plan of study underlying the degree. Deans of schools may refuse to accept as credit toward graduation any course that was completed 10 or more years previously. Former students shall be notified immediately of all such decisions upon reentering. Substitutions of courses required for graduation may be made by the dean of the school conferring the degree.

2.

Resident study at Purdue University for at least two semesters and the enrollment in and completion of at least 32 semester hours of coursework required and approved for the completion of the degree. These courses are expected to be at least junior-level courses. Students normally are expected to complete the senior year in residence; however, with the approval of the dean of the school concerned, a student who has had four semesters of resident study may complete the last year or a portion of it at another college or university, provided that the number of semester hours of credit to be taken does not exceed 25 percent of the total hours required for the degree. The foregoing stipulations do not apply to students who earn credit elsewhere through a contract or arrangement entered into by the University or one of its academic units.

3.

Registration, either in residence or absentia, as a candidate for the desired degree during the semester (or summer session) immediately preceding its conferment.

4.

A minimum cumulative GPA of 2.00 shall be required for graduation. (See Sections VII-J and VII-A.)
A student who has completed all other requirements for a bachelor's degree but has failed to meet the quality requirements may register for additional courses with the approval of an authorized representative of the dean of their school after a review of the students record. The additional courses that the student may take after meeting all quantity requirements shall not exceed 20 credit hours. Such a student may take in another approved college or university not more than 9 of the 20 credit hours permitted, provided such courses are approved in advance in writing by an authorized representative of the dean of their school. A copy of such approval must be filed in the Office of the Registrar. Credit in these additional courses must be established within five years of the date on which all degree requirements except the minimum cumulative GPA were met. The student will be considered as having met the quality requirements for graduation if the cumulative GPA, including the above extra courses, meets the quality standards in effect at the time when all other graduation requirements were satisfied.

5.

The demonstration of satisfactory knowledge of the English language, with particular reference to composition and spelling. Junior and senior students who are determined by the Office of Writing Review to be markedly deficient in English shall be assigned to a noncredit English course, which they will be required to pass before graduation.

1.

The satisfactory completion of the prescribed pre-professional curriculum of two or more years prior to admission to the School of Veterinary Medicine.

2.

The satisfactory completion of the four-year professional curriculum in veterinary medicine.

1.

If the degree programs are in different schools, two (or more) degrees may be awarded upon special request approved by the deans of the schools concerned and filed with the registrar at the beginning of the semester or session in which the degrees are to be awarded.

2. If the degree programs are in the same school and lead to different degrees, the appropriate degrees shall be awarded.
3. If the degree programs are in the same school and lead to the same degree, only one degree shall be awarded. The academic record shall reflect multiple fields of study, as appropriate.

- Registration
- Immunization Requirements
- Allowable Academic Load
- Assignment to Intensive Courses
- Assignment to a Dependent Course
- Schedule Revisions
- Withdrawal from the University
- Refunding of Fees and Tuition
- Granting Academic Credit to Students Who Withdraw from the University upon Order of Induction into Military Service

1. Evidence of immunization or immunity may be documented by completion of the Purdue Health History Form and signed by a healthcare provider. Other immunization records acceptable to the Indiana State Department of Health also may be used to document compliance with the immunization requirements. These include (1) a physician's certificate, (2) immunization records forwarded by another school, (3) a record maintained by the student or parent showing the month and year during which each dose of vaccine was administered.
2. Requests for exemption to these requirements based on medical or religious grounds must be accompanied by written documentation. Medically based requests must be signed by a healthcare provider; requests based on religious convictions must be signed by the student and submitted to the Purdue Student Health Center.
3. Exemptions for medical reasons may be granted upon receipt of a written statement from a healthcare provider:
1. Indicating the nature and duration of a medical condition that contraindicates an immunization, along with the specific vaccine identified as detrimental to the student's health.
2. Certifying pregnancy or suspected pregnancy.
3. Verifying that the student is currently completing the course of all required immunizations.
4. In the event of an outbreak of any of the vaccine preventable diseases covered by this law on or near campus, students holding exemptions will be excluded from all campus activities for their protection until the outbreak is declared to be over.
5. Medical exemptions expire when the medical condition(s) contraindicating immunization change in a manner that permits immunization.
1. Credit hours in excess of 18 hours during a regular session shall be carefully monitored by the academic advisor, who may wish to consult with appropriate University personnel concerning the student's prognosis for success. Unless the student's curriculum requirement for that session is specified as greater than

18 credit hours, approval by the dean of their school or the dean's designee must be obtained before the student may be assigned more than 18 credit hours.

2. In summer session, a student may not be assigned to more than nine credit hours without approval by the dean of their school or the dean's designee (University Senate Document 83-5, as amended and approved January 23, 1984).

1. Course Additions. A student may add a course during the first four weeks of a semester or the first two weeks of the proportional dates of summer or winter session by obtaining the necessary permission to be added if, in their judgments the student could satisfactorily fulfill the course objectives.
1. Cancellation of Assignment. Students shall receive a grade for every course in which they are assigned unless the course assignment has been properly cancelled at the registrar's office upon presentation by the student of a request approved by the academic advisor. If there are extenuating circumstances, these must be stated on the request.
1. Exceptions. Exceptions to the preceding regulations for registration, schedule revision, and cancellation of assignment may be made for courses that do not span the regular semester or summer session.

1. Fall or spring semester

1. Withdrawal during the first or second week - 80 percent refund

2. Withdrawal during the third or fourth week - 60 percent refund

3. Withdrawal during the fifth or sixth week - 40 percent refund.

2. Summer modules
Refunds for summer modules are proportionate on the same basis as semester refunds.
No portion of the health, student activity, recreation facilities, or academic building facilities fees will be refunded on or after the beginning of classes.
For first-time students to Purdue University with Title IV Aid, and once classes begin, refunds are prorated based on the date of withdrawal from class(es). Refunds are calculated on all fees and tuition based on a diminishing scale. The refund period is through week 10 of the fall and spring semesters and through week five for an eight-week summer module. An administrative fee of $100 or five percent of tuition, fees, room, board, and other charges, whichever is less, will be deducted. Questions should be addressed to the Bursar's Office.

1. Seniors who are candidates for degrees during any semester will receive full credit after the completion of eight or more weeks provided the grades are passing at the time of withdrawal. There will be no refund of fees in such cases.

2. No credit will be granted to a student who withdraws during the first five weeks of any semester. After the end of the fifth week, academic credit will be granted according to the following plan, with the understanding that the student concerned has a passing grade or better in those courses in which academic credit is desired. When the grade is not passing, a W will be entered in the students record. Fractions of credit other

than those specified below will be adjusted to the nearest specified fraction. In no case will credit for less than one-third of an hour be recorded.

- **Attendance**
- **Auditor**
- **Athletic Affairs Committee Missed Class Time Policy**
- **Grief/Bereavement**
- **Military Service**
- **Jury Duty**
- **Parenting Leave**
- **Medical Excuse**
- **Absences related to those covered under the Grief Absence Policy for Students (GAPS)**
- **Absences related to those covered under the Military Absence Policy for Students (MAPS)**
- **Absences related to those covered under Jury Duty Policy for Students**
- **Absences related to those covered under the Parenting Leave Policy for Students**
- **Absences related to those covered under the Medical Excused Absence Policy for Students (MEAPS)**
- **Within 150 mile radius of West Lafayette - no additional excused absence days**
- **Between 150-300 mile radius of West Lafayette - one additional excused absence days**
- **Beyond 300-mile radius of West Lafayette - two additional excused absence days**
- **Outside the 48 contiguous United States - four additional excused absence days.**
- **Within 150-mile radius of West Lafayette - no additional excused absence days**
- Between 150-300 mile radius of West Lafayette - one additional excused absence days
- **Beyond 300-mile radius of West Lafayette - two additional excused absence days**
- **Outside the 48 contiguous United States - four additional excused absence days**
- **Within 150-mile radius of West Lafayette - no additional excused absence days**
- Between 150-300 mile radius of

West Lafayette - one additional excused absence days

- **Beyond 300-mile radius of West Lafayette - two additional excused absence days**
- **Outside the 48 contiguous United States - four additional excused absence days**

- **Basis of Grades**
- **Semester Grades**
- **Pass/Not-Pass Option**
- **Directed Grades**
- **Completion Grades**
- **Grade Corrections**
- **Mid Semester Academic Progress**
- **Final Grade Report**
- **Scholastic Indexes**
- **Academic Renewal**
- **Grade Appeals Process**

1. **The option is open to all students in the University subject to the regulations of the school in which the student is enrolled. In particular, the school will specify under what conditions a course that is passed under this option may be used to satisfy its graduation requirements. A department or school may specify that certain courses intended only for students in that department or school are available only on the pass/not-pass option (University Senate Document 75-10, as amended and approved, April 19, 1976).**
2. **Subject to the regulations of their school, students may elect this option in any course that does not already appear on their academic record and in which they are otherwise eligible to enroll for credit with letter grade. A student may not elect this option for more than 20 percent of the total credit hours required for graduation. Schools with Professional degree programs may elect to modify grading options to Pass/Not-Pass for clinical experiences even if the percent of Pass/Not-Pass exceeds 20 percent of the total credit hours required for graduation.**
3. **The registrar's class roster will indicate which students have elected this option.**
4. **A student who is enrolled in a course under this option has the same obligations as those who are enrolled in the course for credit with letter grade. When reporting final grades in the course, the instructor will report that any such student who would have earned a grade of A+, A, A-, B+, B, B-, C+, C, or C- has passed the course, and that any other such student has not passed. The registrar will make an appropriate notation on the student's academic record in place of a letter grade, but will not use the course in computing GPA.**

1. **The semester GPA is an average determined by weighting each grade received during a given academic semester by the number of semester hours of credit in the course.**
2. **The cumulative GPA for an undergraduate student is a weighted average of all grades received as an undergraduate student. With the guidance of the student's academic advisor, a student may enroll in a non-repeatable course up to three times. In such cases, the same course* is to be used, the same grade mode and only the most recent grade received shall be included in the cumulative GPA. In the case of a course in which a conditional grade has been improved by examination, the most recent grade received shall be used.**

1. **The program GPA is derived from a degree audit and will be used as a criterion to accept a student to a program during the process of Change of Degree Objective (CODO). The degree audit relevant to the program to which a student transfers is used to determine the program grade point average. In a case where no courses of the initial program apply to the new program, the same criteria for acceptance to a program may be used as for a student applying out of high school.**
2. **The cumulative GPA for a student enrolled in the professional curriculum in pharmacy is a weighted average of all grades received by the student while in the professional curriculum plus all grades included in the student's undergraduate graduation GPA, as defined in section J-2 above, prior to entering the professional curriculum. All students shall be allowed to enroll in a non-repeatable course at most three times. In the case of such a repeated course* is to be used, the same grade mode and only the most recent grade received shall be included in the graduation GPA.**

1. **The cumulative GPA for a graduate student is a weighted average of all grades received by the student in graduate-level courses (those numbered 500 or**

higher) since entering a graduate program, plus all grades received in undergraduate-level courses, taken while in the graduate program as part of the graduate plan of study. All students shall be allowed to enroll in a non-repeatable course at most three time. In the case of such a repeated course, the same course* is to be used, the same grade mode and only the most recent grade received shall be included in the graduation GPA. Grades received in foreign language courses to establish reading knowledge as specified by the Graduate Council are not used in computing graduation indexes.

1. The semester GPA is the sum of all index points for one semester for grades A+/A, A-, B+, B, B-, C+, C, C-, D+, D, D-, E, IF, and F divided by the sum of all corresponding semester hours. This index is represented by the following formula:

1. In the formula, NA+ , NA , NA- , NB+ , etc., are, respectively, the number of credit hours of A+, A, A-, B+, etc.
2. The cumulative and program GPAs are computed similarly using the grades specified in sections J-2 and J-3 above. (University Senate Document 7-5, April 21, 2008)
3. The registrar shall compile and report semester and cumulative GPAs after the close of each academic session.

1. All Purdue University System graded courses that comprise the Academic Record prior to Re-entry or Readmission will receive zero credit, are not included in the credit hour total, and make zero contribution to the calculation of the Program GPA or the Cumulative GPA.
2. The original course grade record will remain unchanged on the transcript.
3. The Academic Renewal Policy shall be a Purdue University policy and be independent of the student's School or College.
4. Academic Renewal applies to students who have been admitted to the University under the current University Standards and Policies for Re-Entry or Readmission and have not been enrolled at Purdue University in the preceding five years.
5. Students must petition the Readmission and Academic Renewal Committee (RARC) to have their Scholastic Indices recalculated using the Academic Renewal Policy. This recalculation will not be implemented unless the student is in good standing according to University policy, and has completed at least 12 credit hours after Re-Entry or Readmission. The petition for recalculation of the Scholastic Indices must be made by students within one full year from the start of the semester in which they are readmitted or granted Re-Entry.
6. Academic Renewal may only be granted once for a student.
7. The faculty CSDR will administer the Academic Renewal Policy.

1. Adoption by Faculty. The faculty of the University at the West Lafayette Campus has adopted the following procedures for grade appeals pursuant to the authority delegated to the faculty. The Board of Trustees hereby approves such procedures for the West Lafayette Campus.
2. General

1. The responsibility for assessing student achievement and assigning grades rests with instructors, and, except for unusual circumstances, the course grade given is final.
2. The grade appeals system affords recourse to a student who has evidence or believes that evidence exists to show a grade has been assigned contrary to what has been outlined in the syllabus, or due

to error or arbitrariness, such as a grade inconsistent with those assigned other students. A student may challenge the reduction of a grade for alleged violation of course policies related to academic integrity.

3. **The only University authorities empowered to change grades are the instructor, or in the case of teaching assistants, the faculty member in charge of the course in question, and the chair of the University Grade Appeals Committee. In addition, the department head and the chair of the University Grade Appeals Committee can change grades as a part of the grade appeal process.**
4. **Informal attempts must be made to resolve grade grievances and appeals at the lowest possible level - through the course instructor.**
5. **Graduate students who wish to appeal grades received in regular coursework may do so through the grade appeals system. Cases involving the decisions of graduate examination committees, the acceptance of graduate theses, and the application of professional standards relating to the retention of graduate students shall be handled by procedures authorized by the Graduate Council rather than the grade appeals system.**
6. **When a student initiates a formal grade appeal, they should be prepared to state in what way their grade was inconsistent with the syllabus, arbitrary, in error, or assigned incorrectly due to alleged violation of course policies associated with academic integrity. At that time, they may seek assistance from the Office of Student Rights and Responsibilities (OSRR), their academic advisor, or another professional staff member.**
7. **In appealing a grade, the burden of proof is on the student, except in the case of alleged violation of course policies associated with academic integrity, where the instructor must support the**

allegation

3. Department Head Formal Appeal

1. University Grade Appeals Committee

1. A University Grade Appeals Committee, with the authority to hear appeals from decisions made by Department Heads (or their designee), shall be established for the West Lafayette Campus. The University Grade Appeals Committee shall be a Faculty Committee responsible to and reporting to the Educational Policy Committee of the University Senate. In all appeal cases, the committee shall consist of a total of 5 members: two students (undergraduate or graduate to correspond to the status of the appealing student) and two members of the instructional faculty, and the chair of the University Grade Appeals Committee. The OSRR will serve as a facilitator of the appeal process to ensure consistency and adherence to process. The two student and two instructional faculty members will be selected from pools of possible participants. The pools (N = 10 or more) are established using the undergraduate and graduate student governments, and the University Senate, respectively. Pools will include at least one representative from each of the disciplinary colleges. Students will serve one-year terms and the instructional faculty will serve three-year terms.

2. The members shall be selected in the spring (not later than May 1) to start serving on the last day of the spring semester. No member shall serve more than two consecutive terms. If any appointing authority fails to make the initial appointments to the University Grade Appeals Committee within the specified time, or to fill any vacancy on the panel of members within five days after being notified to do so by the chair of the University Grade Appeals Committee, or if at any time the

University Grade Appeals Committee cannot function because of refusal of any member to serve, the chair of the Educational Policy Committee may make appointments, fill vacancies, or take such other actions as they deem necessary to constitute a University Grade Appeals Committee.

3. **Annually, at the last University Grade Appeals Committee final meeting of the academic year (April), members of the committee will (by majority vote) select one of the eight regular faculty members to act as the new chair.**
4. **The Office of Student Rights and Responsibilities shall facilitate the hearing proceedings of the University Grade Appeals process and establish uniform procedures. The chair of the University Grade Appeals Committee shall be responsible for ensuring that University Grade Appeals committees are properly constituted and functional.**

2. **Initiating a Grade Appeal**

1. **Prior to initiating a grade appeal, the student is required to attempt to resolve the situation with the instructor.**

2. **Appeal Process**

1. **If informal resolution with the instructor is not successful, a student who wishes to initiate a grade appeal must file a written statement of allegations, facts, and circumstances concerning the grade assigned with the Department Head (or their designee) in which the relevant course is taught. This must be done within 30 university business days after the posting of the grade for the course.**
2. **After receipt of the student's written statement, the Department Head (or their designee) will furnish a copy of the statement within 5 university business days to the instructor. The instructor will provide a written response within 5 university business days. (Instructors not currently in a period of employment will respond within 5 university**

business days following the beginning of their next period of employment.) The Department Head (or their designee) will then schedule a review meeting with both the instructor and the student to attempt to gather additional details and to attempt resolve the situation. This review meeting shall occur within 5 university business days of receipt of the instructor's written response.

3. The instructor will make all pertinent grading records available to the Department Head (or their designee) within 2 university business days of the review meeting. The Department Head (or their designee) may at their discretion make available to the student those records (or portions thereof) that they judge to be relevant in light of the student's allegations.

4. The Department Head (or their designee) will submit a decision regarding the appeal within 5 university business days after the review meeting. If a grade change is part of the decision, the Department Head (or their designee) will engage with the Office of the Registrar to initiate the grade change.

3. Appeal of Department Head Decision

1. Conduct of University Grade Appeal Committee Hearing, General

1. The appeal hearing shall be closed. The chair's determination of the hearing location and the number of individuals that can be conveniently accommodated shall be final. The appellant and opposing parties are both entitled to be accompanied at the hearing by advisors of their choice. Both parties have the right to present evidence and witnesses on their behalf and to confront and question opposing witnesses. If a duly notified appellant does not appear for the hearing, the committee may close the case and it will be subject to no further hearing or appeal. If the

opposing party (having been duly notified) does not appear, the hearing will continue on the presumption that there is no desire to challenge evidence or witnesses that may be presented.

2. **An official audio recording shall be made of each hearing.**
3. **After the University Grade Appeals Committee hears an appeal, it may vote (by a majority vote of the committee membership) to uphold or change the original grade. The University Grade Appeals Committee's decision shall be sent to both parties no later than 5 university business days after the conclusion of the hearing. If the instructor who originally gave the grade is not willing to initiate any recommended grade change, the chair of the University Grade Appeals Committee shall file the change with the Office of the Registrar who shall record the new grade. The University Grade Appeals Committee's decision is final, and shall not be subject to further hearing or appeal.**
2. **Other Academic/Grade Appeal Jurisdictions**

- **A student at Purdue University shall be placed on academic notice if the student's fall or spring semester or overall or cumulative GPA at the end of any fall or spring semester is less than a 2.0.**
- **A student on academic notice shall be removed from that standing at the end of the first subsequent fall or spring semester in which the student achieves semester and overall GPAs equal to or greater than 2.0.**
- **Any grade change due to a reporting error will result in a recalculation of the GPA and determination of notice standing.**
- **Academic standing will not be assessed in summer sessions.**
- **A student on academic notice shall be separated from the University at the close of any fall or spring semester in which the student's semester and overall**

GPA is less than a 2.0.

- **Any grade change due to a reporting error will result in a recalculation of the GPA and determination of academic separation.**

1.

The University Senate establishes academic notice and separation status levels. The current levels can be found in University Regulations, Part 2, Section VIII.

2.

A student may not be academically separated from Purdue unless they have been on academic notice the previous semester or was admitted on academic notice the previous semester. Throughout this policy, Purdue includes Purdue West Lafayette, Purdue in Indianapolis and Purdue Polytechnic Statewide.

3.

Students may only apply for Readmission in the fall and spring semesters.

4.

Students academically separated from Purdue for the first time must stop out for at least one semester. Students academically separated for a second time must stop out for at least one year (two full semesters; summer session (modules 1,2,3) and other short-term programs do not count as a semester). During that stop out period, students must enroll in at least 12 credit hours during one of the semesters. The exception is if the department requirement for readmission indicates that no classes should be taken during the stop out period.

5.

The exceptions to the required stop out period are:

• Seniors who can complete degree requirements in one semester with 15 or fewer credit hours, if they have the support of their school/department

• The school/department may petition on behalf of a student with more than 15 credit hours remaining to reach degree completion

• Students who satisfy an incomplete grade within 15 days of the end of term

All exception requests must be filed no later than 15 days after the receipt of an academic separation notice. These exceptions are reviewed by the Readmission and Academic Renewal Committee.

6.

A student on academic separation status is not eligible to enroll in any course at Purdue, Purdue Fort Wayne, or Purdue Northwest.

7.

Students who are academically separated from Purdue may choose, after a one semester stop out, to apply for readmission at Purdue Fort Wayne or Purdue Northwest and must adhere to the procedures established at that particular campus.

8.

A student academically separated from Purdue who is readmitted as described in item 7 above is eligible to apply for transfer to Purdue under normal Purdue Fort Wayne
or Purdue Northwest transfer procedures after they have successfully completed 12 credit hours with grades of C or better.

9.

Students must remove all University holds and pay the non-refundable application fee by the deadline of the academic session for which they are seeking readmission. The Office of Admissions may waive the application fee if there is sufficient evidence of economic hardship.

10.

A newly readmitted student may request a change of term for up to one year from the date of original application. This request will be reviewed by the chair of the Readmission and Academic Renewal Committee. Beyond one year the student must file a new readmission application and will be charged the application fee.

11.

A student who has been denied readmission by the academic department may request an appeal to the Readmission and Academic Renewal Committee from their application portal. This Readmission and Academic Renewal Committee review must be based on additional relevant information not previously considered by the academic department.

12.

All students readmitted are readmitted on academic notice, with the stipulations to register for no more than 15 credit hours and earn no less than a 2.0 semester index.

13.

Exceptions to the credit hours limitation for a readmitted student's first semester back can be made

for extenuating circumstances by petitioning the chair of the Readmission and Academic Renewal Committee.

14.

Summer session grades do not immediately affect the academic notice or separation status of a student. However, the summer term grades are included in the cumulative GPA of the next semester of enrollment.

15.

An academically separated student from Purdue Fort Wayne or Purdue Northwest must complete the campus' readmission policy and complete 12 or more hours with grades of C or better at Purdue Fort Wayne or Purdue Northwest prior to being eligible to transfer to Purdue.

16.

An academically separated student is eligible to register as a non-degree student provided:

• The course load is limited to 7 hours or fewer

• The student will have been separated for at least 5 years prior to registration

17.

The Readmission and Academic Renewal Committee will review post-baccalaureate reentry applications for students who graduated on academic separation status and want to enroll in additional undergraduate course work. The Office of Graduate Studies will decide whether a student who graduated on academic separation may enroll in graduate courses.

18.

Readmission processing for non-degree students is handled by the Office of Admissions. The following guidelines are used in instances of a non-degree student's Academic Separation:

• All non-degree students who are academically separated for the first time must observe a one semester stop out

• A second readmission will not be considered

• Any high school student academically separated from Purdue must observe a one semester stop out before becoming eligible to reapply to Purdue

1. Have at least 12 hours included in the overall GPA.

2. Have at least 6 hours included in the semester GPA.

3. Attain at least a 3.5 overall GPA.

4. Have at least a 3.0 current semester GPA.

1. Have at least six credit hours included in the semester GPA.

2. Attain at least a 3.5 semester GPA.

3. Have at least a 2.0 overall GPA.

1.

A candidate for the baccalaureate degree with distinction must have a minimum of 65 hours of credit earned at Purdue University included in the computation of the overall GPA. A candidate for an associate degree with distinction must have a minimum of 35 hours of credit earned at Purdue University included in the computation of the overall GPA.

2.

The minimum overall GPA for graduation with distinction in each school shall be no less than the 90th percentile of the graduation indexes of the graduates in each school, for the spring semester, provided that the index is at least 3.30. The minimum overall GPA so determined in the spring for each school shall be applied for graduation with distinction for the subsequent summer session and fall semester. In administering this rule, all baccalaureate engineering graduates will be considered as one school.

3.

Of those graduates who qualify for distinction under these rules for the spring semester, the three-tenths of the baccalaureate graduates having the highest overall GPA shall be designated as graduating with highest distinction, irrespective of the schools from which they graduate. The three-tenths of the spring associate degree graduates having the highest overall GPA will be designated as graduating with highest distinction.

The minimum overall GPAs so determined for graduation with highest distinction shall be applied for graduation with highest distinction for the subsequent summer session and fall semester.

1.

Original thinking of consistently good quality.

2.

Achievement of other than classwork; publication of literary, artistic, or scientific work.

3. Work that requires great ingenuity or industry, but that may not lead to definite publication.

4. Independent projects of reasonable magnitude carried out by the student on the students own initiative. Projects carried out by such students may receive special achievement credit. Such achievement credits may be substituted for elective courses of instruction as determined in each case upon the recommendation of the dean of the school concerned.

- Good Standing
- Transcripts
- The Certificate of Completion
- Encumbrance
- Record of Actions on Transcripts
- Replacement of Diplomas
- Duplicate Diplomas

1. the dates of attendance;
2. a summary of the courses successfully completed; and
3. a statement, "This is a summary of the courses successfully completed. An official transcript showing all courses taken may be obtained from the registrar, upon authorization by the student."

1. By the comptroller for nonpayment of fees, deposits, residence hall charges, or any other sums owed to the University.

2. By the Business Office Student Organizations in the case of a responsible officer or officers of any student organization that has a delinquent account due to the University.

3. By the dean of students for disciplinary reasons.

4. By the director of the Student Health Center countersigned by the dean of students, for medical reasons. A degree candidate who is in arrears to the University may be denied their diploma until the financial record is cleared.

1. The Office of the Registrar will schedule examinations as requested under the provisions of this policy. Such scheduling will be subject to limitations on available facilities and will be based on the concept of minimizing the number of students scheduled for more than one examination at the same time.

2. Evening examinations will be scheduled when requested for multidivision courses whose daytime classrooms and schedule prohibit effective common examinations during regular class periods.

3. Single-division course evening exams are not encouraged and may be requested only under the most unusual circumstances (e.g., space limitations preclude the establishment of valid examining environment) and after the personal review of the department heads.

4. Graduate-level courses (60000 level) are exempted from this policy.

5. Evening examinations may be scheduled during either of the following periods:

1.

Multiple-period evening examinations may be requested only when the unique nature of the course as testified by the department head precludes effective testing within the regular 60-minute evening examination period.

2.

Examinations will be held on Monday, Tuesday, Wednesday, and Thursday, with the exception that no examinations will be held on the day preceding an official University holiday.

3.

For all examination periods scheduled, roughly equivalent regular class periods are to be omitted. Omitted meetings are to be selected by the instructor according to the principle that meetings for each course should be distributed uniformly over its assigned term of instruction.

4.

Requests for the scheduling of evening examinations shall conform to the following procedures:

1.

Requests shall be forwarded to the Office of the Registrar by and with the approval of the departmental schedule deputy. The request should include a preferred date and two alternative dates (one of which should be in another week) for each evening exam requested.

1.

Multidivision courses at the 10000 and 20000 level must submit requests at the time departments submit their schedule of classes. A statement that these courses require evening examinations will be printed in the Schedule of Classes.

2.

If possible, all other courses requesting evening examinations should submit requests at the same time departments submit their schedule of classes. These courses will also be identified in the Schedule of Classes.

3.

If after the beginning of classes it becomes necessary to submit a request for an evening examination not previously scheduled, this request should be submitted at least four weeks prior to the proposed examination date. These requests will be honored only as space and the principle of conflict minimization permit.

4.

Scheduled times for evening examinations may be changed after the beginning of the semester providing a request for the change is submitted at least four weeks in advance of the earlier of the two scheduled dates. These requests will be honored only as space and the principle of conflict minimization permit. Changes in scheduled examinations should be avoided as much as possible. In particular, requests for changes in scheduled examinations in 10000- and 20000-level courses should be requested only under the most unusual circumstances.

2.

Examinations coincident with convocations, intercollegiate athletic events, and student activities will be avoided if possible; but if necessary, such examinations may be scheduled on the premise that the examination process takes priority over any of these events. In this case, the Office of the Registrar has the authority to start the first period of evening exams as early as 6:00 p.m.

3.

Conflicts shall be resolved as follows (University Senate Document 81-4, April 19, 1982; revised by University Senate Document 14-2, February 16, 2015):

1.

In case of examination conflicts (exams scheduled for the same student at the same time), similar to final examinations, students faced with a direct exam conflict are entitled to reschedule either examination. It is the responsibility of the student to make the request for the necessary arrangements at least one week before the scheduled exam. Course instructors shall not penalize a student who chooses to reschedule an examination under these options. In the event the student is unable to reach an agreement with the course instructors to reschedule one of the exams, the student will contact the Office of the Registrar; the Registrar will make the final decision as to which exam is to be rescheduled and offered at an alternate time; the Registrar will communicate this decision to the course instructor and relevant department head.

2.

In case of examination conflicts with a scheduled evening course, the conflict should be resolved by the course instructors, provided that the student informs them of the conflict at least a week before the exam. If the instructors cannot resolve the conflict, the scheduled evening course takes priority. The examination instructor must offer an alternative time for their exam.

3.

Other conflicts should be resolved between the instructor and the student. Reasons for conflict should be taken under careful and reasonable consideration by

the instructor and student. If conflict resolution is not possible, the examination shall take precedence, subject to appeal through the head of the department in which the course is offered.

4. The Office of the Dean of Students will be available for assistance in conflict resolution.

5. The Office of the Provost shall implement a procedure to inform faculty and students of the academic regulations governing the scheduling and conducting of evening examinations.

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Students are responsible for observing the policies, rules, and regulations of Purdue University.

These, in general, state the expectation that Purdue students will at all times conduct themselves as responsible citizens. Failure to show respect for duly established civil laws or University regulations will be handled by the Office of the Dean of Students in conformance with the various policies and regulations hereafter stated. The Student Honor Code and the Bill of Student Rights are documents initiated by the students themselves and approved by the faculty and the Board of Trustees for the purpose of indicating both the rights and the responsibilities of students. In the interest of specificity in regulations, the resolution of the Board of Trustees states in detail the kind of serious misconduct for which students are subject to suspension or expulsion from the University and the methods of appealing disciplinary decisions.
This section is followed by other miscellaneous regulations concerning the conduct of students. It is imperative that students become thoroughly familiar with this part of Student Regulations in order to avoid jeopardizing their relationships with the University and to understand fully their responsibility as citizens and members of the University community.

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Purdue University Bill of Student Rights

(West Lafayette Campus)
(From Vice President and Treasurer Memo A-16. Board of Trustees, April 30, 1970. Revised by the January 9, 1975, July 10, May 31, 1997.)

Preamble

At an institution of higher learning, the pursuit of knowledge and the attainment of mature attitudes will be greatly facilitated by freedom of expression and decision making as enumerated in the following Bill of Rights. In exercising these rights, however, students must bear the responsibility to act in accordance with local, state, and national laws, and University rules. No right specified by this bill is meant to be construed as enabling students to infringe upon the individual rights of another member of the academic community. We, the students, thereby endorse the Purdue Honor Code and the following Bill of Rights, expecting in all instances to accept these documents with maturity and a level of responsibility that enables the University to retain its academic excellence and to foster an atmosphere conducive to thoughtful and productive individual and collaborative inquiry.

Article 1

The student has the right to accurately and plainly stated information that enables the student to understand clearly:

The general qualifications for establishing and maintaining acceptable academic standing within a particular major and at all other levels within the University.

The graduation requirements for the student's specific curriculum and major.

The course objectives, requirements, and grading policies set by individual instructors for their courses.

Article 2

Changes in graduation requirements that would delay completion of a student's program or impose a hardship on the student shall not be applied retroactively. This article shall not apply to professional certification or other requirements imposed from outside the University.

Article 3

A student's education record or other personally identifiable information except directory information shall not be disseminated outside the University without the student's consent, except under legal compulsion. Within the University, the use of the student's education records or other personally identifiable information shall be limited to providing student services. Disciplinary records of a student other than those required to support encumbrances of the academic transcript and/or registration shall be destroyed within five years after the student's separation from the University.

Article 4

Purdue University recognizes that in the community of scholars there are certain indisputable rights to freedom of inquiry, freedom of thought, and freedom of expression. The University encourages the search for truth and knowledge and does not abridge searchers' rights to reveal their findings, by both spoken and written word, even if in so doing they might find themselves at variance with their peers as well as the lay community. To dissent, to disagree with generally accepted truth and knowledge, is acceptable, and in many ways is essential to free debate and inquiry. Accordingly, the student shall be free to discuss and express any view relevant to subject matter presented by the instructor or other class members. However, in exercising this freedom, the student shall not interfere with the academic process of the class by speaking to or behaving towards others in a manner constituting unwelcome, targeted conduct that is so severe, pervasive, and objectively offensive, and that so undermines and detracts from the educational experience of those to whom the speech or behavior is targeted, that the targeted person is effectively denied equal access to the University's resources and opportunities.

Article 5

The student's course grade shall be based upon academic performance, and not upon opinions or conduct in matters unrelated to academic standards. The students have the right to discuss and review their academic performance with their instructors. Any student who feels that any course grade has been based upon something other than academic performance has the right to appeal through the University Grade Appeals system.

Article 6

Within the limitations generally accepted for proprietary and collaborative work, and those imposed by the relevant standards of academic honesty, the student has the right to freedom of inquiry, to exchange findings and recommendations, and consistent with applicable University regulations, to publish. No publication by a student shall imply University endorsement.

Article 7

A student, student group, or student organization has the right to distribute written or electronic material on campus without prior approval, providing such distribution is consistent with appropriate regulations concerning the time, place, and manner of distribution and does not interfere with University activities. The student press shall be free of censorship or pressure aimed at controlling editorial policy or staff appointments or removals. The editors and managers shall not be arbitrarily suspended because of student, faculty, administrative, alumni, or community disapproval of editorial policy or content. The same freedom shall be assured oral statements or views on an institution-controlled and student-operated radio or television station. Such editorial freedom entails a corollary obligation under the canons of responsible journalism, applicable regulations of the Federal Communications Commission, and their station constitution or activity guidelines. All student communications shall explicitly state on the editorial page or in broadcast that the opinions expressed are not necessarily those of the University or of the student body.

Article 8

The student has the right to freedom from unlawful discrimination on the basis of race, gender, religion, color, age, national origin or ancestry, disability, marital status, parental status, sexual orientation, or status as a military veteran. A perceived violation of these principles shall be the basis for a grievance procedure with the Campus Appeals Board.

Article 9

Students should have clearly defined means to participate in the formation of University policy affecting academic and student affairs. Student representation on University committees shall be provided wherever appropriate as a mode of student participation. In any case, University committees, when appropriate, should schedule and announce hearings at which representatives of the Purdue Student Government, Purdue Graduate Student Government, student organizations, and individual students as well, can present oral or written statements as effective to the committee deliberations.

Article 10

Students living in University-operated housing shall have the right to share equally in the establishment, modification, and enforcement of residential rules and regulations. Such right shall be exercised through their residential student organizations in cooperation with appropriate University administration. The landlord-tenant rights and responsibilities of both parties shall be recognized as shall all law bearing on such relationships. A perceived violation of this right shall be the basis for a grievance procedure with the Campus Appeals Board.

Article 11

The student has the right to freedom from illegal search and seizure. No contractual arrangement with the University shall be interpreted as waiving this right.

Article 12

Any group of students may become a recognized Purdue student organization by registration with the University in accordance with the provision of University regulations. Any appeal of a University decision to discontinue or refuse recognition of a student group shall be made through the Campus Appeals Board.

Article 13

Any student group recognized as a Purdue student organization shall be entitled to the use of available University facilities in conformity with regulations. Recognition shall not imply University endorsement of group goals and activities.

Article 14

Any recognized Purdue student organization or any group of students that is able to secure sponsorship by a recognized student organization and that is able to demonstrate financial responsibility has the right to present speakers of its choice to address members of the University community using appropriate University facilities. These assemblies shall be subject to regulations necessary to prevent space and time conflicts and to protect the operations of the University and the safety of persons or property.

Article 15

Freedom of assembly shall be guaranteed to all members of the University community. Such assemblies shall be consistent with University regulations regarding the time, place, and conduct of such assemblies.

Article 16

Every student and recognized student organization has the right to substantive and procedural fair play in the administration of discipline and the imposition of academic sanctions. This requires that in all situations the

student be informed of the nature of the charges, that the student be given an opportunity to refute them, and that the institution not be arbitrary in its actions.

Article 17

The student who violates civil law may incur penalties prescribed by civil authorities. Only where the University's interests as an academic community are distinct from those of the general community should the special authority of the University be asserted.

Article 18

It is the right of every student to exercise freely full rights as a citizen. Any student may participate in off-campus activities singly or with any group provided that no claim is made that the student represents the University.

Article 19

This Bill of Student Rights is a reaffirmation by the entire University community that the constitutional guarantees and the basic principles of fair treatment and respect for the integrity, judgment, and contribution of the individual student, coinciding with each student's freedom to learn set forth in the foregoing articles, are essential to the proper operation of an institution of higher learning. Accordingly, in the interpretation and enforcement of the policies, rules, and regulations of Purdue University, these student rights shall be preserved and given effect, but they shall not be construed or applied so as to limit the rights guaranteed students under the Constitution of the United States or the Constitution of the state of Indiana. Whenever a student or a group of students claims that these rights have been violated and that the student or group of students has been or will be adversely affected thereby, and such complaint is not resolved informally by the interested parties, it may be presented to an appropriate body of the campus appeals system. Through this system, an appropriate board or committee shall have the power and duty to hear the interested parties and to make findings on complaints within its jurisdiction. In case of grade appeals, the University Grade Appeals Committees shall have final authority. In all other cases, the Campus Appeals Board shall submit recommendations to the president of the University; provided that all such claims that arise out of or are connected with alleged misconduct for which disciplinary proceedings have been instituted shall be presented and determined in such proceedings. If necessary the president may present such recommendations to the Board of Trustees for its consideration.

Article 20

The enumeration of this bill of certain rights shall not be construed to deny or disparage others retained by the student. Nothing contained in this bill shall be construed as any denial or limitation upon the legal authority or responsibility of the Board of Trustees to establish policies and to make rules and regulations governing the operation of Purdue University.

Article 21

Proposed amendments of this Bill of Student Rights may be initiated by the Purdue Student Government, Purdue Graduate Student Government, University Senate, administrative officials, or the Board of Trustees and shall be submitted to the Purdue Student Government and

University Senate for consideration and recommendation before adoption by the Board of Trustees. In the event the Board of Trustees adopts an amendment not approved by the Purdue Student Government, Purdue Graduate Student Government, and University Senate, then the Purdue Student Government or University Senate may withdraw its endorsement of the bill in whole or in part.

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Purdue University Code of Honor

(From Vice President and Treasurer Memo A-16. Board of Trustees, April 30, 1970. Revised by the January 9, 1975, July 10, May 31, 1997.)
The purpose of the Purdue University academic community is to discover and disseminate truth. In order to achieve these goals, the university commits itself towards maintaining a culture of academic integrity and honesty. For this to be possible, self-discipline and a strong desire to benefit others must be present within each individual. Therefore, we students must follow the Regulations Governing Student Conduct of Purdue University out of a sense of mutual respect, rather than out of fear of the consequences of their violation.

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Regulations Governing Student Conduct, Disciplinary Proceedings, and Appeals

(From Vice President and Treasurer Memo A-16. Board of Trustees, April 30, 1970, with revisions dated January 9 and July 10, 1975, May 31, 1997, April 2, 1999, April 9, 2010, May 10, 2013, June 1, 2014, August 15, 2016, July 1, 2018, August 19, 2020, August 19, 2022, March 18, 2023, April 1, 2025, and August 22, 2025.)

Authority, Application, Amendments

Authority. These regulations are enacted pursuant to the power and authority conferred by the laws of the state of Indiana upon the Trustees of Purdue University, including without limitation, the power to do all acts necessary and expedient to put and keep Purdue University in operation, and to make all by-laws, rules, and regulations required or proper to conduct and manage the University, as provided in Indiana Code 21-27-7-4 and 21-27-7-5, and the power and duty to do all acts and things mandated or provided for in Indiana Code 21-39-2-2, 21-39-2-3, 21-39-2-4, and 21-39-2-5.

Application: These regulations, as from time to time amended, and except to the extent adapted for regional campuses pursuant to Subsection A-4 below, shall apply to all undergraduate, graduate, and professional school students of Purdue University at the West Lafayette campus, each regional campus, and each Purdue Polytechnic Statewide location, and shall be deemed a part of the terms and conditions of the admission and enrollment of all students as of the stated effective date. Unless specifically noted, these regulations apply to behaviors that occur both off and on campus. Alleged violations of the University's Anti-Harassment Policy and of the University's Equal Access, Equal Opportunity, and Affirmative Action Policy are governed exclusively by the Procedures for Resolving Complaints of Discrimination and Harassment and not by these regulations. In case of any conflict or inconsistencies with any other rules, regulations, directives, or policies of the University now existing, these regulations shall govern. They shall be enforced by the President.

Amendments. Pursuant to the authority delegated to the President of the University by resolution of the Board of Trustees adopted April 9, 2010, any amendments to these regulations shall take effect on a date prescribed by, and shall remain in effect until rescinded or modified by, the President. Amendments may be proposed at any time by the Purdue Student Government, Purdue Graduate Student Government, University Senate, administrative

staff, or by the Board of Trustees. The Office of the Dean of Students shall, in consultation with the Office of Legal Counsel, conduct a review of these regulations every two years for the purpose of identifying any necessary updates resulting from changes in applicable law or University policy.

Adaptation for Regional Campuses. The Chancellors are hereby authorized and directed to make and promulgate modifications of these regulations, as applied to the regional campuses, which are necessary because of the different student or faculty organizations or governments existing at the regional campuses. Such revisions shall be effective when approved by the President, acting under the delegated authority of the Board of Trustees.

Definitions:

Advisor means any person selected by a student to assist in a disciplinary proceeding. A student has the right to be assisted by an advisor, but the advisor is not permitted to speak or participate directly in any other manner during any disciplinary proceeding, nor may an advisor appear in lieu of the student. Students are responsible for representing themselves. The advisor need not be an attorney, but the student is allowed to have an attorney serve as their advisor in the disciplinary proceeding, at the student's own expense, with the understanding that the attorney's role is as an advisor rather than as an advocate. It is the responsibility of the student to arrange for an advisor who is available at the time of the scheduled disciplinary proceeding. Postponement or rescheduling of student disciplinary proceedings due to availability of an advisor will not be permitted.

Chancellor means the chief executive officer of the Indiana University-Purdue University Ft. Wayne and Purdue Northwest regional campuses.

Conduct Officer means a staff member authorized by the Office of the Dean of Students to administer disciplinary proceedings and represent the University at Community Standards Board hearings.

Dean of Students/Dean's Office means the dean of students or another person authorized to act on their behalf.

Degree deferral means a decision issued as to a student who has completed the coursework of their degree program but who, at the time of the conduct in

question, had not yet received a degree. In the case of such a decision, student status shall be suspended, no grades (other than directed grades) or academic credit shall be given, no degree shall be awarded, and no diploma shall be given, in each case for such a period of time and subject to the satisfaction of such conditions as the University decision-maker imposing the decision may determine. In cases where a degree deferral decision has been issued, it will be notated on the student's academic transcript until the date, if any, on which a degree is awarded based on the expiration of the deferral or the satisfaction of the imposed conditions, or both. The term "degree deferral" is not intended to cover the University's temporary withholding of a degree from a student pending the completion of any educational decisions imposed under these regulations.

Degree revocation means rescinding a degree previously awarded by the University. In cases where a degree revocation decision has been issued, it will be noted on the student's academic transcript on a permanent basis.

Disciplinary outcome or disciplinary decision means expulsion, degree deferral, suspension, probated suspension, disciplinary probation, written warning, restriction(s), and/or educational decisions, as these terms are defined herein.

Disciplinary probation means a probationary student status imposed for a limited time as a result of an official determination of conduct. In the event the student is found in violation (under the procedures set forth in these regulations) of subsequent charges of conduct, records of such disciplinary probations shall be taken into consideration in determining the disciplinary decision, if any, to be imposed because of such subsequent conduct. Students placed on a status of disciplinary probation are

restricted from holding elected and/or appointed positions in recognized student organizations and may be subject to additional restrictions as determined by the Conduct Officer.

Disciplinary proceeding means an administrative hearing conducted by a Conduct Officer or by a Community Standards Board panel in the manner described in these regulations for the purpose of considering whether a violation has been committed and making a determination as to any related disciplinary outcome/decision to be imposed.

Educational decisions means the imposition of mandatory learning opportunities for students who violate the University's regulations, which require them to participate in reasonable and relevant educational activities that foster their personal, ethical and social development. Educational decisions may be proposed in combination with other disciplinary actions. Examples of educational decisions include but are not limited to referrals for assessments for substance use and abuse, educational seminars/workshops, community service, reflective writing assignments, research projects and presentations, and academic assessment referrals. Some educational decisions may have fees associated with them, with the fee being the responsibility of the student to pay.

Executive Vice President for Academic Affairs and Provost ("Provost") is the chief academic affairs officer or another person authorized to act on their behalf.

Expulsion means permanent termination of student status, generally without grades; however, in cases such as academic dishonesty, a directed grade for a particular course may be appropriate. In cases where an expulsion is issued, it will be notated on the student's academic transcript on a permanent basis. In cases where an expulsion is issued

against a student who has completed the coursework of their degree program but who, at the time of the conduct in question, had not yet received a degree, the expulsion will result in no grades or academic credit being given, no degree being awarded, and no diploma being given.

Informal action means an action designed to educate students about the behavioral standards expected of them as members of the University community and to hold them accountable for inappropriate conduct.

Obstruction or disruption of a University activity means any unlawful or objectionable act or conduct (1) that seriously threatens the ability of the University to maintain or use its facilities for the performance of its educational, research and engagement activities, functions, or processes; (2) that is in violation of the reasonable rules and standards of the University designed to protect the academic community from unlawful conduct; or (3) that presents a serious threat to person or property of the academic community. Such phrase shall include, without limitation of the foregoing general definition: (a) the unlawful use of force or violence on or within any buildings or grounds owned, used, occupied, or controlled by the University; (b) using or occupying any such buildings or grounds in violation of reasonable rules or regulations of the University, or for the purpose or with the effect of denying or interfering with the lawful use thereof by others; (c) injuring or harming any person or damaging or destroying the property of the University or the property of others within such buildings and grounds; (d) obstructing building entrances, walkways, and rights-of-way or otherwise obstructing vehicular or pedestrian traffic on or adjacent to campus; and (e) interfering with classes, meetings, events or ceremonies sanctioned or sponsored by the

University or with other essential processes of the University.

Office of Student Rights and Responsibilities (OSRR) is an administrative unit of the Office of the Dean of Students (ODOS) responsible for promoting student responsibility and encouraging honesty, integrity, and respect among Purdue students through education, compliance with behavioral standards, and support of individual rights.

President means the chief executive officer of the University.

Probated suspension means conditional continuation of student status for a limited and defined period of time. The student is permitted to retain student status upon the condition that the student does not further violate any provision of Subsection B(2) of these regulations that would normally result in a disciplinary outcome/decision during the time probated suspension is in effect. If, during the period of probated suspension, the student is found responsible for an additional violation of Subsection B(2) after a hearing, suspension may become immediately effective and may be extended for a longer period of time than the period of probated suspension originally assigned. Students placed on a status of probated suspension are restricted from holding elected and/or appointed positions in recognized student organizations and may be subject to additional restrictions as determined by the Conduct Officer.

Restriction means the withdrawal or limitation of privileges for a defined period of time. This may include the ability to access or enter certain campus facilities, the ability to participate in co-curricular activities, and the ability to hold positions in which one may represent the University in an official capacity.

Sealing means a process by which the Dean of Students or designee may seal or void a student conduct record for good cause.

Student means an individual who

has been offered and accepted an offer of admission to Purdue University at the West Lafayette campus, the Indianapolis campus, a regional campus, or a Purdue Polytechnic Statewide location or who is otherwise enrolled or participating in any Purdue course or program of study at one of the foregoing campuses or locations. This definition includes individuals who withdraw after allegedly violating this code or who are registered for a future semester, even if not currently enrolled. In addition, persons who are living in University Residence Halls, but not enrolled in the institution, are considered "students" for the purpose of enforcing this code.

Summary action means an immediate disciplinary suspension and exclusion from University property imposed under certain circumstances, as more particularly described in Subsection C(9) of these regulations.

Suspension means termination of student status for a limited time, generally without grades; however, in cases such as academic dishonesty, a directed grade for a particular course may be appropriate. In cases where a suspension decision has been issued, it will be notated on the student's academic transcript for the duration of the suspension. At the end of the period of Suspension, the student is permitted to petition to return to the University. Reentry to the University is not guaranteed.

University activity is any teaching, research, service, administrative, or other function, proceeding, ceremony, program, or activity conducted by or under the authority of the University, or with which the University has any official connection, whether taking place on or off campus, including without limitation University cooperative education programs, internships, practicum, field experiences, and athletic or other

intercollegiate activities.

University business day means a day when the University is open for normal business, regardless of whether classes are in session (e.g., the day preceding Thanksgiving).

University property means property owned, controlled, supervised, used, or occupied by the University.

Vice Provost for Student Life (VPSL) is the chief student affairs officer or another person authorized to act on their behalf.

Written Warning is a disciplinary decision consisting of an official notification to a student that their behavior is inappropriate and not in compliance with the standards set forth in these regulations.

Student Conduct

General. Students are expected and required to abide by the laws of the state of Indiana and of the United States and the rules and regulations of Purdue University, to conduct their academic and scholarly pursuits with the highest levels of ethical and honest behavior, to conduct themselves in accordance with accepted standards of social behavior, to respect the rights of others, and to refrain from any conduct that tends to obstruct the work of the University or to be injurious to the welfare of the University. A student who violates these general standards of conduct may be subject to informal actions (as defined in Subsection A(5) of these regulations). If the violation falls within one of the categories of conduct listed in Subsection B(2) of these regulations, the student may also be subject to disciplinary action. No disciplinary outcome/decision may be imposed except for conduct covered by one of the categories listed in Subsection B(2). Violations of any anti-harrassment or non-discrimination policies promulgated by the Office of the Vice President for Ethics and Compliance, as well as the investigation and resolution of complaints made under those policies, are governed exclusively by the Procedures for Resolving Complaints of Discrimination and Harassment and/or Procedures for Resolving Complaints of Title IX Harrassment and not by these regulations.

Conduct Subject to Disciplinary Outcomes/Decisions. The following actions constitute conduct for which students may be subject to informal action or disciplinary outcomes:

Dishonesty in connection with any University activity. The expectation to uphold the standards of academic integrity and honesty is a responsibility of every member of the University community. Cheating, plagiarism, including acts of self-plagiarism and multiple submissions, or knowingly furnishing false information to the University are examples of dishonesty. As recognized by the University Senate, "the commitment of the acts of cheating, lying, stealing, and deceit in any of their diverse forms (such as the use of ghost-written papers, the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." (University Senate Document 72-18, December 15, 1972). Accordingly, the following behaviors will be considered violations of these standards and are subject to disciplinary action as set forth in these procedures.

***Cheating:* Students are expected to adhere to the guidelines provided by instructors for academic work so that no student gains an unfair advantage. Using or attempting to use unauthorized materials, information, study aids, notes, or any other device in any academic exercise will not be tolerated. Unauthorized materials may include anything which or anyone who gives a student assistance that has not been approved by the instructor in advance.**

***Plagiarism:* Intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise, including presentation of generative Artificial**

Intelligence (AI) or similar output as one's own, or as any other person's product, without proper attribution. The sole exception of the requirements of acknowledging sources is when the information is considered common knowledge. Plagiarism includes "self-plagiarism", which is reusing portions of the student's previously written text and/or assignments, without acknowledgement or proper attribution.

Fabrication: **Intentional and/or unauthorized falsification or invention of any information or citation in any academic exercise. Includes but is not necessarily limited to (A) the changing and/or manipulation of research data, results, processes, or research record; (B) the omission of results from the research record; and (C) the alteration and resubmission of a graded academic exercise.**

Multiple Submissions: **The submission of substantial portions of the same academic work for credit more than once without authorization from the instructor.**

Collusion: **Intentionally or knowingly helping or attempting to help another to violate any regulation governing the standards of academic integrity described in these regulations. Students may only collaborate on academic work within the limits prescribed by the instructor.**

Forgery, alteration, or the unauthorized use of any documents, records, or identification.

Obstruction or disruption of any University activity (as defined in Subsection A(5) of these regulations) or inciting, aiding, or encouraging other persons to engage in such conduct.

Actions constituting (i) physical abuse of any person or conduct that threatens or endangers the health or safety of any other person, (ii) an act of intimidation or a threat communicated with the conscious disregard of a substantial and unjustifiable risk that it may cause, or be viewed as threatening, harm to another person, or (iii) the wearing of a mask or personal disguise, or otherwise the concealing one's identity with the intent to intimidate any person or group, or for the purpose of evading or escaping discovery, recognition, or identification in the commission of violations of University policy, University regulations, or municipal, state, or federal laws, whether or not, in each case, such abuse, conduct, act of intimidation, threat, or identity concealment occurs on or in University property.

Hazing: Any intentional, knowing, or reckless act committed by a person (whether individually or in concert with others) against other person(s) that (1) is committed in the course of initiation, admission into, or affiliation with, or as a condition for continued membership in, a group or organization, or as part of any activity of a recognized student organization or student group; and (2) causes or creates risk of physical injury or psychological injury above the reasonable risk encountered in the course of participation in the institution of higher education or the organization. Examples of prohibited behavior under the hazing category include but are not limited to:

Misuse of authority by virtue of one's leadership position

Assaulting an individual by paddling, beating, striking, or hitting

Preventing an individual from attending class

Requiring another to engage in any form of forced physical activity or exercise

Causing sleep deprivation, exposure to elements, confinement in small spaces, or other similar activity

Inducing a person to consume food, liquid, alcohol, drugs or other substances

Causing or coercing another person to perform sexual acts

Any activity that places another person in reasonable fear of bodily harm through the use of threatening words or conduct

Any activity against another person that includes a criminal violation of local, state, or federal law and/or any of Purdue's policies

Any activity that induces another person to perform a task that involves a criminal violation of local, state, or federal law and/or any of Purdue's policies

Failing to report any of the foregoing behavior to the appropriate University officials (e.g., the Office of the Dean of Students and/or the Purdue University Police Department) after having firsthand knowledge of the planning of such activities or firsthand knowledge that an incident of this type has occurred.

Individuals or groups may not consent to these types of prohibited behavior. Individuals will be held accountable for their own actions, and neither citing the activity as a "tradition" nor being coerced by current or former members, alumni, and/or student leaders of such groups or organizations will suffice as a justifiable reason for participation in such activity.

The foregoing list of prohibited behaviors under the hazing category is not intended to prohibit the following conduct:

Planning or participating in customary public athletic events, contests, or competitions that are sponsored by the University or the organized and supervised practices associated with such events; or

Planning or participating in any activity or conduct that furthers the goals of a legitimate educational curriculum, a legitimate extracurricular program or a legitimate military training program as defined and approved by the University.

f. Theft or attempted theft of, or the unauthorized use or possession of, or the unauthorized exertion of control over, or causing damage to property of any kind.

g. Unauthorized entry or access to, or unauthorized use or occupancy of, any University property, including without limitation lands, buildings, structures, telecommunications, computer or data processing equipment, programs, systems, software, or other facilities or services connected with a University activity.

h. Violation of any University rule governing student organizations, or the use of University property (including the time, place, and manner of meetings or demonstrations on University property), or of any other University rule that is reasonably related to the orderly operation of the University; provided, however, that no disciplinary outcome shall be imposed in any such case unless it is shown that the accused student knew, or, in the exercise of reasonable care, should have known, of the rule in question.

i. Use, possession, providing, selling, manufacturing, or

distribution of any illegal drug, controlled substance, narcotic or prescription drug, except as expressly permitted by law.

Intentionally or recklessly inhaling or ingesting any substance (e.g., nitrous oxide, glue, paint, etc.) for the purpose or effect of altering a student's mental state is also prohibited.

j. Lewd, indecent, or obscene conduct on University property or in connection with a University activity.

k. Failure to comply with directions of University officials acting in the performance of their duties, including but not limited to failing to present identification upon request of a University official acting in the official capacity of their position.

l. Any conduct that substantially threatens or interferes with the maintenance of appropriate order and discipline in the operation of the University, or any conduct on University property or in connection with a University activity that invades the rights of others, including acting in concert with or at the direction of another to injure, oppress, threaten or intimidate any person in the free exercise of their rights.

m. The possession, sale, use, or manufacturing of alcohol beverages in or on any University property, unless expressly permitted by law or University Regulations (University Senate Document, 99-9, April 24, 2000).

Additionally, prohibited behavior includes displaying behavior of public intoxication, operating a vehicle or other mode of transportation under the influence of alcohol, and providing or distributing alcohol to a minor, whether or not such conduct occurs on University property.

n. The possession, use, or distribution of any explosives, guns, or other deadly or dangerous weapons reasonably calculated to cause bodily injury on University property or in connection with a University activity, unless specifically

authorized by the University (University Senate Document 99-10, April 24, 2000).

o. Violating the terms of any University disciplinary outcome/decision. This behavior includes violating standards outlined in these regulations while currently under a University disciplinary outcome/decision for previous behavior or failing to meet deadlines and/or requirements assigned in conjunction with a violation of these regulations.

Demonstrations. Any individual or group expressive activity that has the intent or effect of calling attention to the participants' point of view on an issue is not of itself misconduct. Demonstrations that do not involve conduct beyond the scope of constitutionally protected rights of free speech and assembly are, of course, permissible. However, conduct that is otherwise improper cannot be justified merely because it occurs in the context of a demonstration. Demonstrations that involve violations of any provision of Subsection B(2) of these regulations will not be permitted. A student will be charged with misconduct for any individual misconduct committed by the student in the course of a demonstration.

Status During Suspension and Degree Deferral. No grades (other than directed grades) or academic credit shall be given, no degree shall be awarded, and no diploma shall be given to any student who has been suspended from the University so long as the Suspension is in effect. Similarly, no grades (other than directed grades) or academic credit shall be given, no degree shall be awarded, and no diploma shall be given to any student who received the decision of a degree deferral until such time as the degree deferral period has expired and all conditions related thereto have been satisfied.

Status During Appeal. No grades (other than directed grades) or academic credit shall be given, no degree shall be awarded, and no diploma shall be given to any student who is appealing an Expulsion or Suspension. After the time for any appeal of Suspension or Expulsion has expired, or upon the conclusion of any unsuccessful appeal of Suspension or Expulsion, no grades or academic credit shall be given, no degree shall be awarded, and no diploma shall be given.

Status During Disciplinary Proceedings. Except where summary action is taken as provided in Subsection C(9) of these regulations, the status of a student charged with misconduct shall not be affected pending the final disposition of charges; provided, however, that no diploma shall be given, and no grades (other than directed grades), academic credit, or degree shall be awarded, to a student against whom charges are pending for which a disciplinary decision may be imposed. The effective date of any disciplinary decision shall be a date established by the final adjudicating University authority.

Conduct Subject to Other Penalties. As provided by Indiana Code 21-39-2-5, conduct that constitutes a violation of these rules and regulations may be subject to a disciplinary or educational outcome/decision after determination of responsibility by the procedures herein provided, without regard to whether such conduct also constitutes an offense under the criminal laws of any state or of the United States or whether such conduct might result in civil liability of the violator to other persons.

C. Procedures in Student Conduct Cases

Any individual from inside or outside the University community may file a complaint against a student suspected of violating University regulations. The complaint shall be directed to the Office of Student Rights and Responsibilities (OSRR). Complaints should be submitted as soon as possible after the event takes place, preferably no later than during the semester in which the event happened. Upon receipt of an alleged violation, the Conduct Officer will conduct an initial review of the information provided.

After this initial review of the complaint, the Conduct Officer will determine:

Whether there is insufficient information to move forward with student disciplinary proceedings:

The Conduct Officer may elect to conduct a preliminary investigation of the complaint to determine if additional information may be obtained that would lead to student disciplinary proceedings being initiated.

In addition, the Conduct Officer may request to meet with the student identified as the subject of the complaint to discuss the circumstances surrounding the incident. (This meeting may, but need not, also serve as the pre-hearing information session described in Subsection C(2)(b) of these regulations, below.)

Whether there is sufficient information to initiate student disciplinary proceedings as described in these regulations; and

If student disciplinary proceedings are to be initiated: (i) whether an individual hearing with the Conduct Officer of record or a hearing before the Purdue University Community Standards Board (CSB) panel should occur, or (ii) whether, in the Conduct Officer's sole discretion and judgment, the information supports the offer of diversion from formal proceedings involving the Community Standards Board via the Diversion Program described in Section D of these regulations.

Disciplinary Proceedings, General. Except for a disposition pursuant to the Summary Action procedures described in Subsection C(9)(e)(ii) of these regulations and the Diversion Program procedures described in Section D, the procedures hereby established and set forth in Subsection C(1) to C(7) of these regulations shall be followed in all cases in which the University initiates disciplinary proceedings against students for alleged violations of the standards of student conduct set forth in Subsection III-B of these regulations.

Relationship to Other Procedures. These procedures shall not affect additional jurisdiction or procedures established by recognized student organizations or agencies/offices authorized to act on behalf of the University (e.g., Office of Vice President for Ethics and Compliance, University Residences, Recreation and Wellness, Student Activities and Organizations, Intercollegiate Athletics, etc.).

Pre-Hearing Information Session. At any pre-hearing information session held with the student, a representative of the OSRR will meet informally with the student prior to the hearing to explain the disciplinary process and to answer questions about the procedures and possible consequences. The attendance of the student at such a pre-hearing information session is required in cases where the alleged misconduct may result in the student's being suspended or expelled from the University or receiving a degree deferral decision. In other cases, the pre-hearing information session will be offered to the student as an optional step in the process. The pre-hearing information session may be held either before or after a notice of charges is formally delivered to the student.

Initiation of Disciplinary Proceedings

Disciplinary proceedings shall be initiated by the Conduct Officer by the issuance of a written notice of charges.

The notice of charges (and all other written notices given to students against whom disciplinary proceedings are initiated) shall be delivered by the most effective method (including electronic means) to the student's address as it then appears on the official records of the University. The notice shall inform the student of the rule or regulation allegedly violated, fairly inform the student of the reported circumstances of the alleged violation and either (i) require the student to appear before the Conduct Officer for an individual hearing regarding the alleged violation, or (ii) inform the student that there will be a hearing regarding the alleged violation before a panel of the Community Standards Board as described in Subsection C(7) of these regulations. A reference to these regulations shall accompany each notice of charges. A copy of the notice of charges may be sent to the parent or guardian of the student if the student is a dependent as defined in Section 152 of the Internal Revenue Code of 1986, as amended.

Failure to Respond to Charges

If the notice of charges requests the student to appear before the Conduct Officer and the student fails or refuses to appear, the Conduct Officer may, after conducting such investigation as they may deem necessary, dismiss the charges or impose a disciplinary outcome/decision as defined in Subsection A(5) of these regulations.

If the Conduct Officer imposes a disciplinary outcome/decision as defined in Subsection A(5) of these regulations, they shall notify the student in writing of such action, and the student may, subject to the eligibility criteria and procedures set forth in Subsection C(8) of these regulations, appeal this action to the VPSL (or designee), the Provost (or designee), or the Dean of the

Graduate School (or designee), as applicable, in each case as provided in Subsection C(8) of these regulations.

When it appears necessary to avoid undue hardship or to avoid injustice, the Conduct Officer may extend the time to enable a student to respond to the charges.

Response to Charges

If the student appears before the Conduct Officer in response to the notice of charges, either (i) for the purpose of an individual hearing regarding the alleged violation as provided in Subsection C(3)(b) or (ii) of these regulations for the purpose of a pre-hearing information session as provided in Subsection 2(b) of these regulations, the Conduct Officer shall advise the student as fully as possible of the facts concerning the charges.

The student will be informed that they are afforded the following rights in connection with the student disciplinary proceeding:

The right to be informed of the allegations that have formed the basis for the charges;

The right to make a statement regarding the allegations and the right not to make a statement regarding the allegations, which will not be held against the student in determining whether or not they are responsible for committing a policy violation;

The right to be informed of any witnesses that the University will call as part of the disciplinary proceeding;

The right to present witnesses as part of the student's response to the allegations. Students may present witnesses in person, with the exception of character witnesses, which will be considered in written format only. It is the responsibility of the student to present witnesses at the time of the scheduled disciplinary proceeding. Postponement or rescheduling of student disciplinary proceedings due to the availability of a witness will not be permitted.

The right to have one person of the student's choosing serve as a non-speaking advisor to the student during the disciplinary proceeding;

The right to be informed of the outcome of the student disciplinary proceeding; and

The right to appeal the decision of the Conduct Officer subject to the eligibility criteria and procedures set forth in Subsection C(8) of these regulations (Appeal of the Disciplinary Decision).

Procedures for Conducting Individual Hearings with Conduct Officer

Each hearing shall be conducted before a Conduct Officer. Although the hearing process is informal in nature, it shall be conducted in accordance with the rights described in Subsection C(5) of these regulations and shall provide the following procedural safeguards:

The student shall have the opportunity to hear information regarding the alleged violation;

The student shall have the opportunity to rebut statements made by witnesses;

The student shall have the opportunity to present witnesses or any relevant information on the student's own behalf; and

The student shall be given the opportunity to respond to any new information gathered during any investigation conducted subsequent to a preliminary meeting with the Conduct Officer as described in Subsection C(1)(a)(ii) of these regulations or subsequent to the individual hearing described in this Subsection C(6) of these regulations.

After hearing all relevant information and conducting such further investigation as the Conduct Officer may deem necessary, the Conduct Officer has the responsibility to determine whether it is more likely than not that the student is responsible for the alleged violation(s). The decision of the Conduct Officer shall be based solely on information obtained at any preliminary meeting between the student and the Conduct Officer, introduced at the hearing, or obtained during any subsequent investigation conducted by or at the request of the Conduct Officer. The finding shall be rendered by the Conduct Officer, who shall be present for all testimony and discussion of the results of any such investigation.

No person other than the student, their advisor as defined above, witnesses, the Conduct Officer, and staff members of OSRR shall be present during the discussion between the Conduct Officer and the student except by mutual agreement of both parties.

Normally, within five University business days following the conclusion of the hearing and any subsequent investigation that the Conduct Officer may have deemed necessary, the Conduct Officer shall make the determination as to whether it is more likely than not that the student is responsible for the alleged violation(s). The Conduct Officer shall notify the student of the decision. The decision letter shall contain a finding as to the responsibility of the accused student and a brief statement of the reasons for the disciplinary decision/outcome(s), if any. Any disciplinary decision imposed or informal action taken is subject to the provisions of Subsection B(4) and B(5) of these regulations, as well as all other applicable University rules, regulations, or directives.

Subject to the eligibility criteria and procedures set forth in Subsection C(8) of these regulations (Appeal of the Disciplinary Decision), a student may appeal a disciplinary outcome/decision that has been issued. If an appeal is allowed and properly submitted in accordance with Subsection C(8) of these regulations, instructions regarding the appeal form and notification of appeals procedures, including the address (which may be an email address) to which the appeal may be submitted, shall be provided in the decision letter to the student.

Community Standards Board Hearings

Purpose. The Community Standards Board (CSB) is organized by the OSRR to adjudicate student conduct cases that may result in suspension, degree deferral, expulsion, or degree revocation for the charged student. Cases that may not result in separation from the University may also be forwarded to the CSB for adjudication at the discretion of the OSRR.

Composition. The CSB membership is composed of a pool of panelists representing undergraduates, graduate students, staff and faculty who have voluntarily applied and been trained to serve on a CSB panel. CSB members are trained to function as a team, to ask clear, sensitive and relevant questions designed to determine the facts of the case, and to consider the facts carefully and make recommendations for fair disciplinary outcome/decisions.

Organization and Governance. For each case brought before it, the empaneled CSB generally consists of three students, one faculty member and one administrative staff member selected by OSRR from among the CSB membership. In cases involving alleged academic dishonesty or in cases where degree revocation is a possible outcome, the CSB panel must include a faculty member. Each CSB panel selects a chair from among its membership to preside over its proceedings. In order to constitute a quorum necessary to proceed with a hearing, the CSB panel must have three members present, including at least two students and one staff or faculty member. Decisions of the CSB panel shall be rendered by vote of a majority of the quorum. In the event of any tie, the chair of the CSB panel shall be empowered to break the tie.

Procedures for CSB Hearings.

Each hearing shall be conducted before the members of a CSB panel and shall follow procedures similar to those of an individual hearing with the Conduct Officer. Although the hearing is formal in nature, it shall be conducted in accordance with the rights described in Subsection C(5) of these regulations and shall provide the student with the opportunity (A) to hear information regarding the alleged violation; (B) to rebut statements made by witnesses; (C) to present witnesses or any relevant information in the student's own behalf; and (D) to respond to any new information gathered during any investigation conducted subsequent to the preliminary meeting with the Conduct Officer as described in Subsection C(1)(a)(ii) of these regulations.

Both the referred student and the Conduct Officer will have the opportunity to appear before the CSB panel to present information about the incident. As noted above, the student may present witnesses. The Conduct Officer may also present any of the witnesses who were previously disclosed to the student. CSB panel members may direct questions to the student and/or to the witnesses.

No person other than the student, their advisor, witnesses, or staff members of the OSRR shall be present during the hearing except by mutual agreement of the CSB panel and the student.

Recommendation of the CSB Panel. After hearing all relevant information, the CSB panel will (A) deliberate and

make a written recommendation to the Dean of Students regarding whether it is more likely than not that the student is responsible for the alleged violation(s), and, if so (B) recommend disciplinary outcomes/decisions to the Dean of Students. The recommendation of the CSB panel shall be based solely on information introduced at the hearing. In cases in which degree revocation is the recommended outcome, this recommendation will also be forwarded to the Vice Provost for Teaching and Learning (for undergraduate students) or to the Vice Provost of the Office for Graduate Students and Postdoctoral Scholars (OGSPS) (for graduate students), or their respective designee.

Decision by Dean of Students. Normally, within five University business days following the conclusion of the hearing and any further investigation deemed necessary, the Dean of Students, or in cases involving degree revocation, the Dean of Students and Vice Provost for Teaching and Learning (for undergraduate students) or the Vice Provosts of OGSPS (for graduate students) (or their respective designee), shall review the recommendation of the CSB panel and make the determination as to whether it is more likely than not that the student is responsible for the alleged violation(s) and if so, the appropriate disciplinary outcomes/decisions. The Dean of Students may elect to affirm or modify the recommendations made by the CSB panel. The Dean of Students shall notify the student of the decision. The decision letter shall contain a finding as to the responsibility of the accused student and a brief statement of the reasons for the disciplinary outcomes, if any. Any disciplinary outcome imposed or informal action taken is subject to the provisions of Subsections B(4) and B(5) of these regulations (relating to status during suspension degree deferral or expulsion), as well as any other applicable University rules, regulations, or directives.

Appeal. Subject to the eligibility criteria and procedures set forth in Subsection C(8) of these regulations (Appeal of the Disciplinary Decision), a student may appeal a disciplinary outcome/decision that has been issued by the Dean of Students. Instructions regarding the appeal form and notification of appeals procedures, including the address (which may be an email address) to which the appeal may be submitted, shall be provided in the decision letter if the student is found responsible for the violations.

Appeal of the Disciplinary Outcome/Decision

A student may appeal a disciplinary outcome/decision where:

There is significant new information related to the case that was not available at the time of the individual hearing with the Conduct Officer or initial hearing and that would alter the finding and/or disciplinary outcome/decision(s) assigned in the case. The new information must be detailed in an appeal letter with an explanation of why the information was not available at the time of the individual hearing with the Conduct Officer. A student who fails to appear for his/her initial disciplinary proceeding after notice has been sent to his/her University-issued email address will be deemed to have waived the right to present witnesses and relevant information in the student's own behalf and thus foreclosed from presenting "significant new information" on appeal:

There is evidence that the University failed to follow established procedures; or

The assigned outcome of expulsion, suspension, degree deferral, probated suspension, disciplinary probation, or restrictions, is grossly disproportionate to the violation. Assigned decisions of a written warning and/or educational decisions may not be appealed.

A student involved in alleged academic dishonesty or degree revocation may appeal a disciplinary decision of the OSRR or the Dean of Students to the Provost or designee provided the above appeal criteria has been meet. All other appeals of disciplinary decisions by the OSRR or the Dean of Students may be appealed to the VPSL or designee provided the above appeal criteria has been met.

The appeal must be submitted by the student in accordance with the instructions provided and state the specific grounds for the appeal. The appeal must be received by the appropriate appeal officer within five University business days of the date of the decision letter. It is the student's responsibility to ensure that the appeal notice is received by the appropriate appeal officer by the specified due date. Disciplinary decisions not properly appealed by such date are deemed final, or in the case of degree revocation, are recommended to the Board of Trustees for final action.

Appeals will be decided solely on the basis of the record of the original proceeding and the written materials provided to support the appeal.

The appeal officer shall review all material pertinent to the case. The appeal officer may affirm the findings and/or decisions, decrease the disciplinary decisions, or remand the case to the original hearing authority for a second hearing. The appeal officer may also, at their discretion remove or add additional educational decisions.

The appeal officer shall notify the student in writing (which may be sent to their University-issued email address) of the outcome of the case, normally within ten University business days of the appeal officer's receipt of the appeal. All decisions of the appeal officer are final, subject only, in the case of a degree revocation, to the final action by the Board of Trustees.

Summary Action

Summary action by way of an immediate disciplinary suspension and exclusion from University property may be imposed when the student's continued presence poses a threat to (i) the safety, security, or well-being of members or guests of the University community, (ii) University property, or (iii) the ability of the University to maintain normal operations and carry on its programs, services and activities free of disruption.

Summary action may be taken by the Dean of Students, the VPSL, the Provost, or the President.

During the period of summary action, the student may be denied access to University-owned housing, University property, and classes (whether delivered through on-campus or on-line methods). In addition: (i) the student may be restricted from all other University activities or privileges for which the student might otherwise be eligible.

Whenever summary action is taken under this Subsection C(9) of these regulations, the applicable procedures provided for in Subsection C for a hearing and any appeal in the related disciplinary proceeding shall be expedited so far as possible to shorten the period of summary action.

A student subject to summary action may submit a written appeal to the Conduct Officer of record within five University business days of receiving notice of the summary action. The appeal may be accompanied by written evidence, which may include written testimony of witnesses, bearing on the issue of whether summary action is appropriate in the case. The Conduct Officer of record shall make a decision on the appeal normally within five business days following its receipt.

A favorable decision on the appeal shall be limited to lifting or modifying the terms of the summary action and shall not affect the conduct of the hearing and any appeal in the related disciplinary proceeding.
D. Community Standards Diversion Program

Purpose. The University's Community Standards Diversion Program presents students who would otherwise be referred to the Community Standards Board an opportunity to have their cases resolved through an alternative adjudication process that allows students to accept responsibility for their behaviors and be disciplined by a sole Conduct Officer in lieu of the more formal Community Standards Board process.

Process. At the sole discretion of the Conduct Officer, a student whose case would be referred to the Community Standards Board may be offered a diversion from these formal proceedings.

In determining whether any alleged violation is eligible for disposition through the Diversion Program, the Conduct Officer may consider:

The nature and severity of the alleged violation, including any mitigating or aggravating circumstances;

The student's past conduct record;

The likelihood that the student will accept responsibility for the behaviors documented and that the student will benefit from the Diversion and comply with its requirements and;

Whether there are specific and tangible actions that the student can take that will correct the violation.

Disciplinary proceedings will be initiated as outlined in Section C(3)(a) of these regulations.

During the pre-hearing information session, the Conduct Officer, at their sole discretion, may present the student with the option of having their case resolved through the

Diversion Program or to have their case forwarded to the Community Standards Board. If a student chooses to have their case forwarded to the Community Standards Board, the case will be resolved as outlined in Section C(7) of these regulations.

If a student chooses to have their case resolved through the Diversion Program, the Conduct Officer will provide the student an opportunity to respond to the allegations as outlined in Section C(6)(a) of these regulations. The Conduct Officer may provide the student a reasonable amount of time, normally three to five university business days, to prepare a response to the allegations and to obtain any witness statements for the Conduct Officer to consider.

In response to the allegations, the Conduct Officer, normally within three business days, will prepare and present a written Diversion Agreement, which will contain the following:

The specific disciplinary decisions and/or educational requirements that the student must complete and the deadlines by which they are to be completed;

Any limitations to campus access pending fulfillment of the requirements of the Diversion Agreement;

A statement indicating that the student's violation of the Diversion Agreement, including not meeting deadlines of assigned disciplinary outcomes/decisions and/or educational requirements will constitute a violation of B(2)(o) of these regulations; and

The specific duration of the Diversion Agreement.

The student will be given three business days to either accept or reject the terms of the Diversion Agreement. If the student agrees to the terms of the Diversion Agreement, they shall do so in writing by signing the Diversion Agreement. If the student rejects the terms of the Diversion Agreement, their case will be referred to the Community Standards Board for resolution. A student who fails to respond to an offered Diversion Agreement by the prescribed deadline will by default reject the terms of the Diversion Agreement and will have their case referred to the Community Standards Board for resolution.

A student who is offered this diversion will be afforded the same procedural rights as described in Section C(5)(b) of these regulations, with the exception of the right to appeal the decision of the Conduct Officer. The decision of the Conduct Officer pursuant to this Section D is final.

A student will be eligible for only one CSB Diversion Program during their enrollment at the University.

A student who commits a violation of these regulations while subject to the terms of a Diversion Agreement may be disciplined for both the original violation and the subsequent violation.

E. Student Conduct Records

Student conduct files and records are maintained and controlled by the Office of Student Rights and Responsibilities within the Office of the Dean of Students. In order to protect the privacy of these records, the OSRR, in conjunction with the Office of Legal Counsel maintains strict policies regarding the review and duplication of these files. Students have the opportunity to review their record in the OSRR. Individuals may not remove, make any copies of files, or photograph any records located in or associated with the OSRR without the explicit permission of the OSRR. Records will not be provided to a student's advisor or other party without the authorization of that student.

Student Conduct records will be maintained by the Office of Student Rights and Responsibilities in accordance with record retention policies of the University. Student conduct records will be maintained for as long as administratively valuable. Normally, student conduct records will be maintained for a period of seven years from the student's graduation date or from the last semester of enrollment. Student conduct records of students who have been Expelled, Suspended, blocked from reenrollment or in which may result in future litigation will be retained permanently.

Some student conduct records may be sealed for good cause by the Dean of Students and/or designee upon receipt of a written request by the student. Factors to be considered in review of such petitions shall include, but are not limited to:

the nature of the violation and the severity of any damage, injury or harm resulting from the incident;

the student's demonstrated understanding of their behavior and its impact;

the completion of any required disciplinary outcomes/decisions associated with the violation; and

the behavior of the student following the incident

If a student's conduct record is sealed, the University will not release any information from that record, including the existence thereof, without the written consent of the student or as otherwise required to do so by law.

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Miscellaneous Conduct Regulations

Guests in Student Residence Units

Within certain University-set limitations, residence units may determine the hours during which guests of the opposite sex may visit individual student rooms in undergraduate residence units. By secret ballot, a majority of the residents of the

unit can approve a more restrictive policy. Any resident must be guaranteed his/her privacy, which takes priority over a guest. Individual students wishing to visit friends of the opposite sex in their rooms must do so in conformance with the approved plan in that particular residence unit. Check the guest hours policy posted in the residence unit.

Guest hours for students of the same sex are limited only by the policy of the particular residence unit.

Financial Obligations

Students should make every effort to keep their credit good in the community for their own benefit and that of all students. Students with past due financial obligations to the University may have a hold placed on their record. (See Scholastic Records, Holds, in Section D.) Degree candidates delinquent in financial obligations must remove such debts at least one week before the close of any term. Otherwise his/her diploma may be withheld, or if the degree is granted without knowledge of such delinquency, the degree may be revoked and the diploma cancelled.

Absence from the University

For emergency purposes, it is important that the University be able to locate students at all times. All students are requested, therefore, to leave information with the office of their University residence unit and the officer of any other unit or at least a roommate when they are off campus and especially if they are going out of town. They are also encouraged to let their parents know when they will be away from campus for out-of-town travel.

Change of Address

Students are required to notify the registrar of any change of campus or home address.

Use of Alcoholic Beverages

All Purdue students are responsible for complying with the Indiana state laws. Attention is called to the Indiana Alcoholic

Beverages Law that states specifically:

No person under 21 years of age may use or be in possession of alcoholic beverages.

Persons 21 or over may not make alcoholic beverages available to minors.

Misrepresentation of age for the purpose of purchasing alcoholic beverages is a violation of state law.

In addition to Indiana state laws, the following University regulations apply:

The University prohibits the possession, consumption, distribution, or sale of alcoholic beverages, as defined by state law, in or on any University property, with the following exceptions:

Personal possession and consumption of alcoholic beverages are permitted in Purdue Village (family apartments only), resident rooms in Young and Hawkins halls occupied exclusively by graduate students, and by registered occupants of guest rooms in the Union Club and Young and Hawkins halls, subject to compliance with all University regulations and applicable Indiana state laws.

Possession, consumption, distribution, and sale of alcoholic beverages are permitted, with advance approval by the Executive Vice President and Treasurer or his/her designee, in areas designated by the University and under the supervision of the Purdue Memorial Union or the Department of Hospitality and Tourism Management, subject to compliance with all University regulations and applicable Indiana state laws.

b. The University prohibits the serving of alcoholic beverages in any University undergraduate residence hall, and at any function on campus where a majority of attendees are projected by University management to be less than 21 years of age. All policies and procedures regarding the approval of and funding for a

student organizational event must be complied with and completed before a request for service of alcoholic beverages will be considered (Approved by the Board of Trustees, May 31, 1997).

c. Members of recognized fraternities, sororities, and cooperative housing organizations shall be subject to the following conditions concerning the possession and consumption of alcoholic beverages on the premises of their houses.

Under no circumstances may alcoholic beverages be sold. Alcoholic beverages may not be available at any event where an admission fee is charged.

Alcoholic beverages may not be consumed outside the house.

Alcoholic beverages and containers for alcoholic beverages may not be displayed outside the house.

Alcoholic beverages may not be provided or consumed at any open event. (For purposes of these regulations, an event is open if verbal or written invitations are extended en masse to the general public or to an unreasonable large segment of the campus community [i.e., a number of invited guests greater than a host house can reasonably expect to accommodate, which is determined by the Office of the Dean of Students to be no more than three invited guests for each resident of the host house]. An event is closed if only members of the sponsoring organization[s] and their personally invited guests participate. There may be no more than four organizations participating in an event at a host house, regardless of the aforementioned three-to-one policy.)

All sponsoring organizations are equally responsible for open and closed events and for compliance with University regulations and applicable laws.

See Executive Memorandum C-44, Alcohol and Drug-Free Campus and Workplace Policy (June 12, 1998).

Use of Motor Vehicles, Bicycles, Skateboards, In-line Skates, and Traffic Regulations

Anyone using motor vehicles or bicycles on the West Lafayette Campus is responsible for observing the detailed regulations regarding their use. Copies are available at the Parking Facilities Office. Before considering the use of a vehicle a student should be aware of the following basic regulations:

In general, all parking during restricted hours (7 a.m.-5 p.m., M-F) is by permit or in the Grant Street Parking Garage. Some areas and spaces are restricted at all times.

All motor vehicle and bicycle operators must comply with state and municipal laws or ordinances.

Bicycles are not permitted inside any University building and must be parked in bicycle racks or pads provided for this purpose. (It is recommended that parked bicycles be locked.)

Skateboards are prohibited on the north and south academic campuses. Skateboards and in-line skate usage is prohibited on any surface that could be damaged.

Operators or owners of vehicles are subject to fines if they are in violation of the motor vehicle or bicycle regulations.

Student Identification Cards

Every student who pays fees is issued a permanent

identification card by the ID Card Office. The student identification card permits him/her to attend various events, check books out of the library, access residence halls and dining facilities, establish charge accounts, ride CityBus, etc., where his/her identification as a student is required. These identification cards are University documents and may not be altered in any way. Any defacement or alteration of the identification card is a violation of University regulations and is subject to disciplinary action. The identification card is a personal document and should never be out of its owner's possession. If the identification card is lost, it can be replaced by the ID Card Office. A replacement fee will be charged.

All students are subject to University policy V.III, "Intellectual Property", as amended from time to time.

Use of Copyrighted Materials

All members of the Purdue University community are responsible for complying with the United States Copyright Law and with Purdue University's Executive Memorandum B-53, as amended from time to time, which governs the use of copyrighted works for educational and research purposes.

Copyright is a federal law that protects creative works such as Web sites, CDs, DVDs, audio and visual works, computer programs, books, and journals. Copyright allows authors to control the use of their works for a limited period of time. Authors or the owners of the copyrighted work have exclusive rights to the work. It is their decision as to whether the work can be copied and/or distributed. Violating the copyright owner's rights is considered copyright infringement and may be subject to legal action.

Works are protected for a limited period of time but once that time period has expired, the work becomes part of the public domain. The public can then freely use the works without paying royalties or obtaining

permission from the copyright holder.

Works created on or after January 1, 1978, are protected for a term of the life of the author plus 70 years. If the work is a product of a corporate author, then the protection is for the shorter of 95 years from first publication or 120 years from creation. Works that were published prior to 1923 no longer have copyright protection and are in the public domain. Any work created or published from 1923 to the present time should be considered still protected by the copyright law. There are exemptions to the copyright law that allow use of a work without seeking permission. One of the most utilized exemptions in higher education is the fair use exemption. This exemption is a four factor test that weighs whether the use of a work is fair under certain circumstances. If the use is not fair and no other exemption is applicable to the specific use of the work, then permission from the copyright holder must be granted before the work can be used.

For further information on the copyright law, please visit the University Copyright Office's Web site at www.lib.purdue.edu/uco.

Commercial Note Taking in Classes (University Senate Document 03-9, April 19, 2004.)

As used in this paragraph, the term "instructor" is defined as the individual who authored the material being presented as part of the course.

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from

enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

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Commitment to Freedom of Expression

Because Purdue University (the "University") is committed to free and open inquiry in all matters, it guarantees all members of the University community the broadest possible latitude to speak, write, listen, challenge, and learn. Except insofar as limitations on that freedom are necessary to the functioning of the University, the University fully respects and supports the freedom of all members of the University community "to discuss," in the words of former University of Chicago President Robert M. Hutchins, "any problem that presents itself."

Of course, the ideas of different members of the University community will often and quite naturally conflict. But it is not the proper role of the University to attempt to shield individuals from ideas and opinions they find unwelcome, disagreeable, or even deeply offensive. Although the University greatly values civility, and although all members of the University community share in the responsibility for maintaining a climate of mutual respect, concerns about civility and mutual respect can never be used as a justification for closing off discussion of ideas, however offensive or disagreeable those ideas may be to some members of our community.

The freedom to debate and discuss the merits of competing ideas does not, of course, mean that individuals may say whatever they wish, wherever they wish. The University may restrict expression, for example, that violates the law, that falsely defames a specific individual, that constitutes a genuine threat or harassment, that unjustifiably invades substantial privacy or confidentiality interests, or that is otherwise directly incompatible with the functioning of the University. In addition, the University may reasonably regulate the time, place, and manner of expression to ensure that it does not disrupt the ordinary activities of the University. But these are narrow exceptions to the general principle of freedom of expression, and it is vitally important that these exceptions never be used in a manner that is inconsistent with the University's commitment to a completely free and open discussion of ideas.

In a word, the University's fundamental commitment is to the principle that debate or deliberation may not be

suppressed because the ideas put forth are thought by some or even by most members of the University community to be offensive, unwise, immoral, or wrong-headed. It is for the individual members of the University community, not for the University as an institution, to make those judgments for themselves, and to act on those judgments not by seeking to suppress speech, but by openly and vigorously contesting the ideas that they oppose. Indeed, fostering the ability of members of the University community to engage in such debate and deliberation in an effective and responsible manner is an essential part of the University's educational mission.
As a corollary to the University's commitment to protect and promote free expression, members of the University community must also act in conformity with the principle of free expression. Although members of the University community are free to criticize and contest the views expressed on campus, and to criticize and contest speakers who are invited to express their views on campus, they may not obstruct or otherwise interfere with the freedom of others to express views they reject or even loathe. To this end, the University has a solemn responsibility not only to promote a lively and fearless freedom of debate and deliberation, but also to protect that freedom when others attempt to restrict it.

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Statement of Integrity and Code of Conduct

Preamble

Purdue University has a tradition of ethical conduct spanning its history. As a land-grant institution, we demonstrate our responsiveness to our constituencies and extend to them access to our knowledge resources. We nurture relationships with other partners in education who support our vision or join us to foster common interests. We integrate our mission with our responsibilities. We contribute our knowledge resources impartially in serving our public purposes. As faculty, students, staff, and administrators, we are a community of dedicated learners, scholars, professionals, and practitioners - all contributing our talents to uphold our standards, and improve ourselves and the broader community in which we live and work. Our responsibilities and obligations toward the advancement of learning, discovery, and engagement in the University and in Indiana extend to our nation and the world. This statement of integrity is meant to provide an overarching declaration that informs specific policies and procedures regarding conduct, enforcement, and accountability. Such policies and procedures either exist in official University documents or will be developed as necessary.

Statement

At Purdue, integrity is indispensable to our mission. We act with honesty and adhere to the highest standards of moral and ethical values and principles through our personal and professional behavior. We demonstrate our understanding of these values and principles and uphold them in every action and decision. Trust and trustworthiness go hand in hand with how we conduct ourselves, as we sustain a culture that is based upon ethical conduct. We expect our actions to be consistent with our words, and our words to be consistent with our intentions. We accept our responsibilities, share leadership in a democratic spirit, and subject ourselves to the highest standards of public trust. We hold ourselves accountable for our words and our actions.
We champion freedom of expression. To ensure our integrity, we safeguard academic freedom, open inquiry, and debate in the best interests of education, enrichment, and our personal and professional development. We embrace human and intellectual diversity and inclusiveness. We uphold the highest standards of fairness, act as responsible citizens, respect equality and the rights of others, and treat all individuals with dignity. To fulfill our goals as a learning community, we insist that the objectives of student learning are not compromised. We treat all students equitably, and our evaluations of learning achievements are impartial based on demonstrated academic performance. As students, we understand that learning is the most important goal and we embrace ethical values and principles, and reject

academic dishonesty in all our learning endeavors. In the realm of new discoveries, we place the highest value upon truth and accuracy. We acknowledge the contributions of others. We place a higher value on expanding and sharing knowledge than on recognition or ownership.
We work diligently drawing from the strong work ethic of our state of Indiana and are committed to always acting in the best interests of the University. We pledge to make wise use of our resources and to be good stewards of financial, capital, and human resources. We operate within the letter and spirit of the law and prescribed policies, and strive to avoid impropriety or conflict of interest.
As members of the Purdue community, we demonstrate unyielding and uncompromised integrity in support of the highest standards of excellence for the University. As individuals, we all contribute to this Purdue standard of integrity as an exemplary model for all universities.

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Statement of Values

We Are Purdue

Boilermakers, who are we?
We are a family that embodies integrity through the practice of honesty, humility, and accountability.
We are a unified community that respects each other by embracing diversity, promoting inclusion, and encouraging freedom of thought and speech.
We are innovators discovering new ideas and solutions that will foster a positive global impact.
We are honored to share our long-lasting traditions instilling a legacy of loyalty and pride within ourselves and others.
We are determined to build ourselves and our community, always One Brick Higher.
We are ever grateful ever true, WE are ONE PURDUE!

Six Pillars of Purdue

INTEGRITY, RESPECT, HONOR, INCLUSION, INNOVATION, GROWTH

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Purdue University Student Disability Grievance Procedures

Requesting and Implementing Curricular Accommodations
Requesting and Implementing Student Life Accommodations

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Liaison with Outside Agencies

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General Responsibilities

- **Procedures for Forming and Maintaining Student Organizations**
- **Requirements for Members, Officers, and Advisors**
- **Recognized Student Organizations**
- **Publicity**
- **Campus Mail**
- **Financial Arrangements**
- **Policy Against Hazing**
- **Violation of Rules and Regulations**
- **Liability Insurance**

1. **A group of Purdue students may become a student organization upon formal recognition by the Office of the Dean of Students. According to Article 13 of the Purdue University Bill of Student Rights, any student group recognized as a Purdue student organization shall be entitled to the use of available University facilities in conformity with regulations. Recognition shall not imply University endorsement of group goals and activities. Such recognition is contingent upon the following considerations:**
   1. **The approval of the constitution of the proposed student organization by the Office of the Dean of Students. An outline of the basic information to be included in a constitution is available in the Student Organization Handbook online, or at Office of the Dean of Students in Schleman Hall.**
   2. **The filing of a list of eligible officers including the name of a faculty advisor.**
   3. **The establishment of a financial account with the Business Office for Student Organizations.**
   4. **Any student organization not covered by Purdue University's liability insurance program (those whose finances are not managed through the Business Office for Student Organizations) must provide proof of liability insurance. Such proof shall be in the form of a Certificate of Insurance showing a minimum of $1.0**

million of commercial general liability insurance. The Certificate shall also name Purdue University and The Trustees of Purdue University as additional insureds.

2. To maintain status as a recognized student organization the following conditions must be met:

1. Any new or revised constitution must be submitted to the Office of the Dean of Students for approval.

2. All amendments to the current constitution must be submitted to the Office of the Dean of Students for approval.

3. A list of new eligible officers must be filed in the Office of the Dean of Students within three weeks of their election.

4. Submit a new Certificate of Insurance annually within 30 days of expiration of the previous year's policy.

5. Members of student organizations are required to abide by the laws of the state of Indiana, the United States, the community, the state or country in which the organization's activities occur, and University rules and regulations.

3. The Office of the Dean of Students will notify any recognized student organization that has failed to meet the conditions for maintaining active status:

1. The student organization will be deactivated if the conditions listed in Section B above (this is true of all section references in this part unless otherwise specified) are not satisfied.

2. The organization may request to be returned to active status once it has met the necessary qualifications.

3. If a recognized student organization is in a state of deactivation for a period of at least two years, the Office of the Dean of Students will withdraw recognition from that organization.

4. An organization may request to have recognition withdrawn at any time it chooses.

1. General Membership

1. The control and operation of a student organization must remain with the student members. Full voting privileges may be granted only to Purdue University students.
2. Membership and participation in student organizations must be free from discrimination based on race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability or status as a disabled or Vietnam-era veteran.
3. Students must be free to join or leave an organization without being subjected to pressure, harassment, or intimidation.
4. Hazing is prohibited by university regulation (Policy against Hazing) and state statute.

2. Requirements for Holding Office

1. These regulations shall apply to the student officers of recognized student organizations on the West Lafayette Campus, and to the student participants in student activities representing Purdue University off campus, including extramural sports clubs, bands, glee club, and debate teams, and to those presented as student participants in all-campus dramatic and musical productions.
2. Each student organization or director of an activity shall be expected to define the requirements for eligibility of its own officers and participants.
3. Regardless of further requirements that may be established by a student organization or director of an activity, an officer or candidate for office of an organization or participant in an activity as defined in Requirements for Members, Officers and Advisors, Section B-1, must satisfy the following:

1. He/She must be in good standing, i.e., has not been dismissed, suspended, or

dropped from the University without thereafter having been readmitted.

2. Undergraduate students must have:

1. Earned a total number of semester hours of credit not less than the number of his/her current classification according to the registrar minus one times 12; or
2. Earned a minimum of 12 semester hours of credit in the semester immediately preceding and be currently enrolled in a minimum of 12 hours of coursework.
3. Graduate students must be enrolled as full-time, degree-seeking students.

4. University probation

1. A student placed on disciplinary probation or probated suspension, as part of that probation, may be required to resign from an office in a student organization, refrain from seeking such an office or discontinue participation in a special activity.
2. Students on academic probation are not eligible to hold an executive officer position.

5. Students may not hold more than one executive officer position within an organization.

3. Advisors to Student Organizations

1. All organizations are required to have an advisor, who should serve in an advisory role only and may not have voting rights, including voting to approve expenditures or programs. Advisors provide advisement and support, and enhance student life outside the classroom.
2. Advisors must be either full-time faculty or administrative/professional staff at Purdue University or otherwise approved by the Office of the Dean of Students. Individuals classified as graduate student staff are not eligible to be advisors to student organizations.
3. In addition to their primary advisor, organizations may have community advisors,

instructors, and coaches with limited authority. Many recreational and sports clubs have non-university affiliated instructors and coaches because of a need for specialized instruction or discipline. However, the direction of the group remains with the student members. Provisions must be made in the constitution for selection and removal of such instructors and coaches.

4. The officers of each student organization shall be responsible for confirming the eligibility of the members, officers, and advisors of the organization.

1. Social Events

1. Social functions may be scheduled to end no later than the following times:

1. Sunday - Thursday: Midnight

2. Friday and Saturday: 3 a.m. (Subject to facility availability and necessary requirements.)

2. Student organizations may not serve or possess alcoholic beverages in any University student residence unit. Student organizations may seek approval from the Executive Vice President and Treasurer or his/her designee to have alcoholic beverages served at on-campus organizational functions in areas designated by the University and under the supervision of the Purdue Memorial Union or the Department of Hospitality and Tourism Management, subject to compliance with all University regulations and applicable Indiana state laws. Under no conditions may organizational funds maintained in the Business Office for Student Organizations be used to buy, sell, or provide alcoholic beverages on or off campus (Board of Trustees, May 31, 1997, and revised April 2, 1999).

3. Under no conditions may organizational funds maintained in the Business Office for Student Organizations be used to buy, sell, or provide tobacco

products on or off campus.

4. Officers of student organizations carry responsibility for the conduct of their groups at social functions. In all matters related to the discipline of a student organization, the officers shall act on behalf of the organization and shall be responsible for notifying all members of the status of the organization.

5. Social activities and events sponsored by student organizations that meet any one of the following criteria must be scheduled on an Event Planning Form ***(available through the Office of the Dean of Students online Student Organization Handbook):***

1. The event is open to the public, the University community, or an invitation is extended to a specific group outside of Purdue University.

2. The event is sponsored by a student organization with an account in the Business Office for Student Organizations and the expenditure or receipt of money is involved.

3. The event is sponsored by a housing organization and is to take place in University facilities other than those of the housing organization.

4. The event will terminate later than the hours listed in section A above.

6. Business Meetings

1. Demonstrations, Rallies, and Parades

1. A basic general requirement for staging a demonstration, rally, or parade is that the activity must not interfere with academic programs or other scheduled functions of the University. Sound and amplifying equipment is generally not permitted and when permitted will be regulated to prevent interference with academic programs or other officially sponsored activities.

2. In order to insure availability of appropriate space, demonstrations, rallies, and parades must be registered far enough in advance of the event so that all departments of the

University involved with the scheduling of such events can be properly notified. To register an event, an Event Planning Form must be submitted to the Office of the Dean of Students.

3. In the event that more than one demonstration or rally is planned for the same area, the one that is properly registered and is scheduled first will have priority.
4. The south end of Memorial Mall (area west of Stewart Center) is reserved for demonstrations and rallies. If a student group wishes to consider other areas of the campus for similar activities, the plans must be discussed with staff in the Office of the Dean of Students and the appropriate approval obtained.
5. Approval from the Office of the Dean of Students must be obtained if off-campus speakers are to address participants of demonstrations, rallies, or parades held on campus. An Event Planning Form may be used to obtain such approval.
6. If demonstrations, rallies, and parades are to be sponsored by student organizations off the University campus, such plans should be discussed with the staff in the Office of the Dean of Students, and proper arrangements must be made with the appropriate community or county officials.

2. Conferences

1. Participation by Students with Disabilities

1. Must submit an Event or Travel Planning form at least two weeks in advance of the program or activity;
2. Describe the requested auxiliary aids and services; and
3. Provide the name of each student for whom auxiliary aids and services are requested.

1. Trips

1. Any trips away from campus sponsored by student organizations must be registered on a Travel Planning Form available through the Office of the Dean of Students.
2. Trips scheduled by sports

clubs must follow guidelines published by the director of recreational sports.

3. Additional requirements must be met when a student organization is planning a trip outside of the United States.

2. Events at Which Outside Speakers Participate (Executive Memorandum No. B-6, July 17, 1972)

1. There are three types of meetings at which recognized student organizations may sponsor outside speakers on the Purdue campus:

1. Meetings closed to all but student organization members.
2. Meetings restricted to members of the University community.
3. Meetings open to the general public.

2. Meetings open only to organization members need not be registered on an Event Planning Form unless the meeting will involve the expenditure or receipt of money. Meetings restricted to members of the University community or open to the general public must be registered on an Event Planning Form and approved through the Office of the Dean of Students.

3. Members of student organizations planning to invite speakers to the campus should consult with staff members in the Office of the Dean of Students so that they follow the regulations set forth in the Student Organization Speaker Scheduling Procedures and the Regulations Governing the Use and Assignment of University Facilities.

3. Schedule Limitations during Final Examination Period (From University Senate Document 72-17, December 18, 1972).

1. All publicity related to a student organization activity including posting inside buildings, posting outside on kiosks and sidewalks, chalking on sidewalks, and posting on Web sites must identify clearly the student organization sponsoring the activity and

must adhere to the Posting of Publicity guidelines available in the Office of the Dean of Students. Any publicity that includes the advertisement of an agency outside the University must be cleared first through the Business Office for Student Organizations and the Office of the Dean of Students.

2. Publicity is not to be released until an Event Planning Form has been given final approval.
3. Posters and signs may be displayed in specified areas within buildings and on the campus, provided that clearance has been obtained from the appropriate people in the following offices:

1. In the Purdue Memorial Union and Stewart Center, the scheduling office in the Union.
2. In residence halls, the central desk in each residence hall.
3. In all other buildings, the building deputy or director whose office is located in that building.
4. On campus grounds, the Academic Classrooms and Event Scheduling.

4. Printed material may be distributed in buildings only if permission has been obtained from the building deputy or director. Printed material may be distributed on campus grounds provided that the rights of individuals are not violated and there is no interference with the flow of traffic and the orderly operation of the University.
5. Student organizations and/or individuals involved will be held responsible for the improper posting of signs and materials that result in damaging or defacing property. Not only will the group and/or individuals involved be subject to disciplinary sanctions, but they will be required to cover the cost of removal of the materials, resulting damages, and replacement of property, if necessary.
6. Tables are provided in Stewart Center and the Purdue Memorial Union for promotional projects by student

organizations. Such tables may be reserved in the Purdue Memorial Union scheduling office. When collections or solicitations of money are to be made, an Event Planning Form must be initiated in the Office of the Dean of Students.

1. The Campus Mail Service is provided by the Purchasing Department through the General Stores Operation. The service is designed to deliver U.S. mail and campus mail to all departments, staff members and recognized student organizations whose fiscal affairs are audited by the director of student finance.
2. The service is established to deliver mail within a place of business. Mail from and to Purdue Village, social sororities, fraternities, cooperatives, student organizations, clubs or similar off-campus groups will not be delivered by Campus Mail Service. These areas are served by the U.S. Post Office.
3. By arrangement with the Housing and Food Services, student organizations may prepare mailings to be placed without postage in the residence halls' post office boxes. Approval will be limited to student organizations that are registered with the Office of the Dean of Students and whose fiscal affairs are audited by the Business Office for Student Organizations.

1. Regulations applicable to student organizations that conduct financial and business service transactions through the Business Office for Student Organizations:

1. An account relationship with the Business Office for Student Organizations must be established after the student organization is formally recognized by the Student Activities and Organizations Office. Refer to the "Procedures for Forming and Maintaining Student Organization" section within the Student Regulations. Upon formal recognition, an account

will be established.

2. **Business and financial procedures, including receiving and dispersing of funds and cash handling activities are to be managed in accordance with University policies and procedures as administered by the Business Office for Student Organizations.**
3. **The Business Office for Student Organizations is to be consulted before contractual services are solicited. All contracts and agreements entered into on behalf of recognized student organizations are to be approved in advance by the Business Office for Student Organizations in accordance with University procedures.**
4. **Treasurers appointed by their respective recognized student organizations are required to attend training workshops as determined by the Student Activities and Organizations Office and Business Office for Student Organizations.**
5. **All financial transactions are to be reviewed and authorized by the responsible student organization officer. Financial records and documents that support financial and business related activities are to be maintained by the recognized student organization.**
6. **Financial records may be requested at any time for audit purposes.**
7. **Each recognized student organization is assessed a financial service fee of one and one-half percent of gross income to defray costs of student organization operations. This fee is subject to change. The fee provides the following support to those recognized student organizations that manage accounts through the Business Office for Student Organizations: general liability insurance coverage, general banking and payment services, a web-based accounting system, web-based store fronts, contract review and approvals, and general**

business services.

2. Financial responsibility of student organization officers:

1. To collect amounts due, or to pay the organization's debts legally incurred by him/her; or
2. To account for cash received and expended by him/her; or
3. To account for other property entrusted to him/her as an officer of a student organization, shall be referred to the Office of the Dean of Students, Office of Rights and Responsibilities for appropriate action.

4. Sales, canvassing, fundraising projects:

1. Certain forms of hazing are criminal offenses in Indiana. All forms of hazing are prohibited by Purdue University both on and off campus.
2. Hazing means forcing or requiring another person, regardless of that person's consent, to perform an act that:

1. Creates a substantial risk of physical harm;
2. Substantially or seriously demeans or degrades any person; or
3. Interferes with any person's scholastic activities.

3. Any hazing allegation against a student organization will be investigated by the University. If found guilty in a disciplinary action, the student organization may incur a disciplinary penalty as specified in "Violations of Rules and Regulations." University action occurs whether or not civil or criminal actions take place.
4. In addition to action taken against a student organization, the University may take action against individual students for hazing when their conduct falls within "Regulations Governing Student Conduct, Disciplinary Proceedings and Appeals," section B-2.
5. Any person suffering or witnessing a hazing activity is strongly encouraged to report the incident to the staff of the Office of the Dean of Students.
6. The president of each student organization is responsible for informing pledges, affiliates,

initiated members, and guests of this policy.

1. **Members of student organizations are required to abide by the laws of the state of Indiana, the United States, or the community and the state or country in which the organization's activities occur. In addition to a violation of the above-mentioned laws, a violation of any University rules and regulations by any member of a student organization may subject that organization and/or its members to disciplinary action by the Office of the Dean of Students. After official representatives of the student organization have been informed of the nature of the charges and have been given an opportunity to refute them, the Office of the Dean of Students may initiate action against the organization and/or its members that may take the following forms:**
1. **A verbal or written warning to the officers of the organization;**
2. **A limitation of privileges;**
3. **Probation that may include a restriction of privileges;**
4. **Suspension of the student organization for a prescribed period of time (The actions may be appealed through the Campus Appeals Board.);**
5. **Withdrawal of recognition of the student organization. (The actions may be appealed through the Campus Appeals Board.)**
1. **Submit evidence of a comprehensive liability insurance policy covering such functions, or**
2. **Obtain special insurance for the event.**

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Safety

The University strives to provide a safe and secure environment for students, staff, and visitors. The University distributes an Annual Security Report containing campus crime statistics and information relating to campus safety and security policies and programs. The report is available at Purdue Police Department website. For a printed version of any of these Annual Security Reports, please contact the Clery Compliance Administrator at clerycompliance@purdue.edu.

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Nondiscrimination Policy Statement (website)

Graduate and Undergraduate Programs Lists

For a dynamic list of programs/majors, please see: Curriculum Resources & Reports - Office of the Registrar - Purdue University

Undergraduate Program Lists

- Undergraduate Programs List
- The below list of minors are active and admitting as of June 1, 2025. Please visit the Office of the Registrar website for a dynamic list.
- The below list of certificates are active as of June 1, 2025. Please visit the Office of the Registrar website for a dynamic list of active programs.
- Polytechnic Institute (Undergraduate - Statewide Locations)

Graduate Program Lists

- Graduate Degrees
- Graduate Certificates

Academic Colleges

College of Agriculture

Overview24 ag rank

Purdue University's College of Agriculture is one of the world's leading colleges of agricultural, food, life, and natural resource sciences. As a land-grant institution, we are committed to preparing our students to make a difference, wherever their careers take them; stretching the frontiers of science to find solutions to some of our most pressing global challenges; and, through Purdue Extension and engagement programs, helping the people of Indiana, the nation and the world improve their lives and livelihoods.

Website: College of Agriculture

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Undergraduate DegreeAgriculture Main Picture

Your undergraduate program will blend courses and experiences in your major with preparation in the life and physical sciences, written and oral communication, social sciences and humanities, multicultural awareness, and international understanding. Professional work experiences, leadership development, participation in student organizations, study abroad, and directed research can add to your professional development.
Program Information for Undergraduate: **Undergraduate Programs**

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Graduate Degree

Your master's or doctoral program will be specialized and flexible to prepare you to meet your professional objectives. You'll find that we offer a growing number of multidisciplinary graduate degree programs, using directed experiences and courses from faculty members in one or more Purdue departments or colleges. Business and industry, government, and academic institutions throughout the world

recruit our graduates for leading positions.

Program Information for Graduate: **Graduate Programs**

Daniels School of Business

Overview

Website: Mitch Daniels School of Business

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Undergraduate DegreeBUS Accounting

Program Information for Undergraduate: Undergraduate Programs

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Graduate Degree

Program Information for Graduate: Graduate Programs

College of Education

Overview

Education Main Photo

Change the world - become a teacher. At Purdue, you'll gain the knowledge and confidence you need to inspire your students and be a great teacher. We offer more than 20 different teaching majors that will leave you fully equipped to transform students' lives. Learn more about our programs and all the ways you can become a teacher at Purdue.

Website: College of Education

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Undergraduate Degree

The College of Education is the hub of teacher education at Purdue. Seventeen undergraduate majors are part of a collaborative teacher education program organized across six colleges with shared curriculum goals and jointly-appointed faculty.
Each of these majors leads to a bachelor's degree, and if you meet all of the requirements and deadlines, licensure in the state of Indiana.

Program Information for Undergraduate: **Undergraduate Programs**

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Graduate Degree

Purdue Quality. Nationally Ranked Graduate Programs. Are you considering graduate school? You'll grow professionally and personally in our graduate programs. Develop your leadership and scholarship with teaching and research opportunities that abound at our research-intensive university. If you are searching for internationally recognized, professional degree programs, you'll find them with the College of Education.

Program Information for Graduate: **Graduate Programs**

College of Engineering

OverviewEngineering Main Photo

A World-Class Engineering Institution - U.S. News & World Report and corporate recruiters consistently rank Purdue Engineering near the top of their lists as one of the best engineering schools in the country for both academics and career preparation.

Purdue's engineers stand at the forefront of industry, education, and discovery, with a goal of impacting the world and those who live in it. Students receive a top-quality experience, at the best value, with some of the industry's most competitive starting salaries.

Website: College of Engineering

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Undergraduate Degree

You have an interest in changing the world. To get there, you need strong leadership characteristics, ingenuity, adaptability, and technical proficiency. Purdue Engineering is here to help! We are dedicated to helping you attain the skills and attributes needed to succeed in this rapidly-changing global economy.

Program Information for Undergraduate: **Undergraduate Programs**

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Graduate Degree

Purdue's College of Engineering Graduate Engineering Program was named #4 for the third consecutive year in the 2023-24 edition of the *U.S. News & World Report* national rankings. The #4 ranking places the College in the top 2% nationally and second among public universities. Agricultural and Biological Engineering is ranked #1 for the third straight year with six other schools ranked in the top 10. In May 2022, Purdue launched the nation's first comprehensive Semiconductor Degrees program-just one part of the College of Engineering's plan to educate the next generation of workforce leaders in semiconductors and microelectronics. Home to national hubs for hypersonics and cybersecurity, Purdue's graduate student enrollment continues to rise.

Program Information for Graduate: **Graduate Programs**

College of Health and Human Sciences

Overview

Health Main Photo

Enhancing **human health** and well-being at every stage of life - From preventing disease to tackling food insecurity to building sustainable organizations, our faculty and students engage in specialized research that improves lives and communities.

Website: College of Health and Human Sciences

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Undergraduate Degree

In the College of Health and Human Sciences, you'll explore innovative ways to improve lives - from informing behavioral choices to fostering healthier lifestyles. With nine departments and schools and 22 undergraduate majors, you'll embark on a journey of discovery through hands-on learning opportunities and strong community connections.

Program Information for Undergraduate: **Undergraduate Programs**

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Graduate Degree

With more than 20 doctoral programs and 31 master's programs ranging from hospitality to healthcare, business to brain behavior, early childhood education to environmental health

science and more, we educate and train future health professionals, educators, researchers and business leaders, so you can take your next giant leap into your chosen field.
In the College of Health and Human Sciences (HHS), you'll work alongside our award-winning faculty in HHS clinics and research laboratories to solve some of today's toughest challenges and heighten HHS research through your own innovative research projects. You'll also enhance the undergraduate curriculum through teaching a variety of courses.

Program Information for Graduate: **Graduate Programs**

College of Liberal Arts

OverviewLiberal Arts Photo

Liberal Arts students work side-by-side with STEM students, mindful that complex challenges demand creative, collaborative, multi-faceted, innovative, and meaningful solutions. The College of Liberal Arts develops students who are independent, creative thinkers, and problem solvers who contribute to their communities as productive, engaged citizens working as a force for good in the world.
Think Broadly. Lead Boldly.

Website: College of Liberal Arts

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Undergraduate Degree

With over 40 different majors, as well as numerous minors and certificates, the College of Liberal Arts will help you develop the communication, collaborative, and analytical skills that will prepare you to achieve your personal and professional goals in our fast-changing world.

Program Information for Undergraduate: **Undergraduate Programs**

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Graduate Degree

The College of Liberal Arts is committed to supporting our globally recognized, collaborative, and diverse graduate student programs. Click below to learn more about our programs and resources.

Program Information for Graduate: **Graduate Programs**

Polytechnic Institute

Overview24 PI

The Purdue Polytechnic Institute, one of the 10 academic colleges of Purdue University, provides a unique array of high-demand technology disciplines for bachelor's, master's and PhD degrees available on Purdue's flagship campus in West Lafayette, Indiana, and at other locations throughout the state. The Polytechnic's faculty and staff encourage innovation, collaboration and creativity among diverse interdisciplinary groups in the persistent pursuit of big ideas and novel approaches.

Website: Purdue Polytechnic Institute

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Undergraduate Degree

The Polytechnic consists of six academic departments and is proud to be the college for Purdue's Division of Military Science and Technology and its three Reserve Officers' Training Corps (ROTC) programs on campus.

Program Information for Undergraduate: **Undergraduate Programs**

Polytechnic Institute Statewide Programs: **Polytechnic Statewide Programs**

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Graduate Degree

Graduate study options are available within all Purdue Polytechnic Institute disciplines. The college also provides a Ph.D. degree that allows students to focus in any of our academic departments.
Graduates become leaders in business and industry and many pursue entrepreneurial and consulting opportunities. Graduate alumni are employed by some of the top Fortune 500 companies, including Arthur Andersen, Ford Motor Company, General Motors, Delco Electronics, Symbol Technologies, Eli Lilly, and Northern Telecom.

Program Information for Graduate: **Graduate Programs**

Libraries and School of Information Studies

Overview24 Libraries

Purdue Libraries and School of Information Studies is a non-degree granting department that offers innovative graduate and undergraduate courses and certificates on several different information-focused topics.
Purdue Libraries and School of Information Studies offers both graduate and undergraduate courses in fields such as information and data literacy, digital humanities and geographic information systems, systematic reviews, digital citizenship and information ethics, and foundational concepts in undergraduate research. ILS courses may meet elective, core curriculum, or certificate requirements for your major and other programs.
Purdue Libraries and School of Information Studies offers two graduate certificates: Digital Humanities, co-sponsored by the College of Liberal Arts, and Geographic Information Science, in collaboration with seven colleges at Purdue University. We also co-sponsor an undergraduate Digital Humanities Certificate with the College of Liberal Arts.

Website: School of Information Studies

Contact Information:

Telephone:
(765) 494-2900
Address:
Libraries Administration
504 West State Street
West Lafayette, IN 47907-2058
Contact Us | Purdue Libraries

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Program Information for Undergraduate: **Undergraduate Programs**

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Program Information for Graduate: **Graduate Programs**

College of Pharmacy

OverviewPharmacy Main Photo

The Purdue College of Pharmacy, consistently ranked among the 10 best pharmacy programs in the nation, offers a uniquely diverse range of undergraduate and graduate study opportunities. A total of 10 different programs and 700 pharmacy practice experiences prepare students for a range of top-paying careers in the fields of pharmacy, pharmaceutical sciences, and the health sciences.

Website: College of Pharmacy

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Undergraduate Degree

At the Purdue College of Pharmacy, we train our students to become the pharmacy leaders of tomorrow. We equip them to meet global health challenges through innovative thinking and practice. And we give them firsthand experience in our cutting-edge research programs that are transforming healthcare.

Program Information for Undergraduate: **Undergraduate Programs**

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Professional Degree

The Purdue University Doctor of Pharmacy Admissions Committee will strive to admit qualified students who exhibit character, integrity, academic readiness, and outstanding interpersonal skills, as these are important traits when providing comprehensive, compassionate patient care and public service to diverse patient populations. Evidence of community volunteer service and leadership experience is also valued in the selection process.

Program Information for Professional: **Professional Programs**

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Graduate Degree

With one of the oldest, most respected, and most comprehensive graduate programs in the U.S., Purdue College of Pharmacy prepares students for challenging, top-paying careers in the field of pharmacy. PhD degrees are available from each of the three departments of Purdue College of Pharmacy

Program Information for Graduate: **Graduate Programs**

College of Science

OverviewCollege of Science Main Photo

Purdue University's College of Science is committed to the persistent pursuit of the mathematical and scientific knowledge that forms the very foundation of innovation. Nearly 350 tenure-track faculty conduct world-changing research and deliver a transformative education to more than 6,000 undergraduates and 1,750 graduate students. We develop practical solutions to today's toughest challenges with degree programs in the life sciences, physical sciences, computational sciences, mathematics, and data science.

Website: College of Science

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Undergraduate Degree

Program Information for Undergraduate: **Undergraduate Programs**

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Graduate Degree

Purdue University College of Science graduate students achieve excellence through groundbreaking research, teaching and scholastics. Often working side-by-side with their professors, these students experience cutting-edge work in their respective fields and the results of this work are newsworthy.

Program Information for Graduate: **Graduate Programs**

College of Veterinary Medicine

Overviewvet7

The College of Veterinary Medicine focuses on globally advancing animal and human health and well-being through excellence in learning, discovery and engagement, as the leading veterinary college for comprehensive education of the veterinary team and for discovery and engagement in selected areas of veterinary and comparative biomedical sciences.

Website: College of Veterinary Medicine

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Undergraduate Degree

We offer a Bachelor of Science degree in our On Campus Veterinary Nursing program. This option is recommended for students who do not have a previous degree. It is a full-time, undergraduate program and successful applicants must meet competitive admission criteria.
We also offer the Associate of Applied Science degree (AAS) on campus. This option is recommended for students with a previous degree. The AAS degree is a requirement to become credentialed as a veterinary nurse/technician.
For busy students students who cannot attend our on-campus program and working adults looking for a career change, we offer an online Associate of Applied Science degree in Veterinary Nursing. The curriculum allows a student to gain the information, knowledge, and the skills necessary to succeed as a veterinary nurse. This program is for students who are self-directed, self-motivated, and self-disciplined.

Program Information for Undergraduate: **Undergraduate Programs**

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Professional Degree

Earn Your DVM Degree - The veterinary profession is a diverse, exciting and rewarding occupation that allows for pursuits in a variety of fields including community health, food resource management, wildlife preservation, marine biology and many others. It allows you to take your passions and apply them to advance both animal and human health.

Program Information for Professional: **Professional Programs**

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Graduate Degree

Basic Medical Science research programs focus on signal transduction in development and oncogenesis, cell adhesion molecules in development and oncogenesis, musculoskeletal atrophy and countermeasures, ovarian follicle development,

neural regeneration, implantable therapeutic or diagnostic devices and application of computers in veterinary education. Comparative Pathobiology research programs focus on epidemiology and public health, microbiology and immunology, clinical and anatomic pathology and laboratory animal medicine. Veterinary Clinical Sciences research programs focus on clinical and translational research.

Program Information for Graduate: **Graduate Programs**

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Joint and Special Programs (Graduate & Undergraduate)

Overview

Joint and Special Programs is an area that houses programs that are developed with a combination of departments and colleges within Purdue.

Undergraduate Degree

Program Information for Undergraduate: Joint and Special Programs (Undergraduate) - Office of the Provost

Graduate Degree

Program Information for Graduate: Joint and Special Programs (Graduate)

Degree in 3

College of Agriculture
College of Health and Human Science
College of Liberal Arts
College of Science
Polytechnic Institute

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College of Agriculture

- Agribusiness, BS
- Agricultural Communication, BS
- Agricultural Economics, BS
- Animal Sciences, BS
- Farm Management, BS
- Natural Resources and Environmental Science, BS

College of Health and Human Science

- Biomedical Health Sciences, BS
- Brain and Behavioral Sciences, BS
- Developmental and Family Science, BS
- Financial Counseling and Planning, BS
- Hospitality and Tourism Management, BS
- Human Services, BS
- Kinesiology, BS
- Psychological Sciences, BS
- Public Health, BS
- Retail Management, BS
- Selling and Sales Management, BS
- Speech, Language, and Hearing Sciences, BS

College of Liberal Arts

- Anthropology, BA
- Artificial Intelligence, BA
- Asian Studies, BA
- Classical Studies, BA
- Communication, BA
- Creative Writing, BA
- Digital Criminology, BS
- English, BA
- Film & Video, BA
- French, BA
- German, BA
- History, BA
- Law and Society, BA

- Linguistics, BA
- Philosophy, BA
- Political Science, BA
- Professional Writing, BA
- Sociology, BA
- Sound for the Performing Arts, BA
- Spanish, BA
- Studio Arts and Technology, BA
- Theatre, BA
- Women's, Gender & Sexuality Studies, BA

College of Science

- Atmospheric Science, BS
- Biology, BS
- Chemistry, BS
- Physics, BS

Polytechnic Institute

- Animation And Visual Effects, BS
- Computer and Information Technology, BS
- Construction Management, BS
- Data Visualization, BS
- Electrical Engineering Technology, BS
- Engineering Technology, BS (Statewide Locations Only)
- Game Development, BS
- Industrial Engineering Technology, BS
- Mechanical Engineering Technology, BS
- Organizational Leadership, BS
- Professional Flight Technology, BS
- Robotics Engineering Technology, BS
- UX Design, BS
- Web Programming & Design, BS

Undergraduate Requirements

Courses

Information for Course Subject Codes by Department can be found

College	Department	Course Subject Code	Level	Description
College of Engineering - WL	School of Aeronautics and Astronautics - WL	AAE		AAE-Aero & Astro Engineering
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	AAS		AAS-African American Studies
College of Engineering - WL	Department of Agricultural and Biological Engineering - WL	ABE		ABE-Agri & Biol Engineering
College of Liberal Arts - WL	Patti and Rusty Rueff School of Design, Art, and Performance - WL	AD		AD-Art & Design
Polytechnic Institute - WL	School of Aviation and Transportation Technology - WL	AFT		AFT-Aerospace Studies
College of Agriculture - WL	Department of Agricultural Economics - WL	AGEC		AGEC-Agricultural Economics
College of Agriculture - WL	College of Agriculture Administration - WL	AGR		AGR-Agriculture

College of Agriculture - WL	Department of Agronomy - WL	AGRY		AGRY-Agronomy
College of Science - WL	Department of Computer Science - WL	AIS		AIS-Artificial Intel Sci-IU
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	AMST		AMST-American Studies
College of Agriculture - WL	Department of Animal Sciences - WL	ANSC		ANSC-Animal Sciences
College of Liberal Arts - WL	Department of Anthropology - WL	ANTH		ANTH-Anthropology
College of Liberal Arts - WL	School of Languages and Cultures - WL	ARAB		ARAB-Arabic

Polytechnic Institute - WL	School of Construction Management Technology - WL	ARCH		ARCH-Architectural Technology
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	ASAM		ASAM-Asian American Studies
College of Agriculture - WL	Department of Agricultural Sciences Education and Communication - WL	ASEC		ASEC-Agric Sciences Educ &Comm
College of Liberal Arts - WL	School of Languages and Cultures - WL	ASL		ASL-American Sign Language

College of Engineering - WL	Department of Agricultural and Biological Engineering - WL	ASM		ASM-Agricultural Systems Mgmt
College of Science - WL	Department of Physics and Astronomy - WL	ASTR		ASTR-Astronomy
Polytechnic Institute - WL	School of Aviation and Transportation Technology - WL	AT		AT-Aviation Technology
College of Liberal Arts - WL	College of Liberal Arts Administration - WL	BAND		BAND-Bands

College of Agriculture - WL	Department of Biochemistry - WL	BCHM		BCHM-Biochemistry
College of Science - WL	Department of Biological Sciences - WL	BIOL		BIOL-Biological Sciences
College of Engineering - WL	Weldon School of Biomedical Engineering - WL	BME		BME-Biomedical Engineering
College of Veterinary Medicine - WL	Department of Basic Medical Sciences - WL	BMS		BMS-Basic Medical Sciences
College of Agriculture - WL	Department of Botany and Plant Pathology - WL	BTNY		BTNY-Botany & Plant Pathology

College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	CDIS		CDIS-Critical Disability Std
College of Engineering - WL	Lyles School of Civil Engineering - WL	CE		CE-Civil Engineering
College of Engineering - WL	Lyles School of Civil Engineering - WL	CEM		CEM-Construction Engr & Mgmt
Polytechnic Institute - WL	School of Construction Management Technology - WL	CEMT		CEMT-Constr Engr Mgmt Tech
Polytechnic Institute - WL	Department of Computer Graphics Technology - WL	CGT		CGT-Computer Graphics Tech
College of Engineering - WL	School of Chemical Engineering - WL	CHE		CHE-Chemical Engineering
College of Science - WL	Department of Chemistry - WL	CHM		CHM-Chemistry
College of Liberal Arts - WL	School of Languages and Cultures - WL	CHNS		CLCS-Classics
Polytechnic Institute - WL	Department of Computer and Information Technology - WL	CIMT		CIMT-Computer Integr Mfg Tech

Polytechnic Institute - WL	Department of Computer and Information Technology - WL	CIT		CIT-Computer & Info Tech
College of Liberal Arts - WL	School of Languages and Cultures - WL	CLCS		CLCS-Classics
College of Pharmacy - WL	Department of Pharmacy Practice - WL	CLPH		CLPH-Clinical Pharmacy
Polytechnic Institute - WL	School of Construction Management Technology - WL	CM		CM-Construction Management
College of Liberal Arts - WL	Department of English - WL	CMPL		CMPL-Comparative Literature

Polytechnic Institute - WL	Department of Computer and Information Technology - WL	CNIT		CNIT-Computer & Info Tech
College of Liberal Arts - WL	Brian Lamb School of Communication - WL	COM		COM-Communication
College of Veterinary Medicine - WL	Department of Comparative Pathobiology - WL	CPB		CPB-Comparative Pathobiology
College of Science - WL	Department of Computer Science - WL	CS		CS-Computer Sciences
College of Science - WL	Department of Computer Science - WL	CSCI		CSCI-Computer Science

College of Health and Human Sciences - WL	School of Hospitality and Tourism Management - WL	CSR		CSR-Consumer Science
College of Liberal Arts - WL	Patti and Rusty Rueff School of Design, Art, and Performance - WL	DANC		DANC-Dance
Office of the Provost - WL	Innovation Hub - WL	DCTC		DCTC-Defense Civiln Trng Corps
College of Science - WL	Department of Earth, Atmospheric, and Planetary Sciences - WL	EAPS		EAPS-Earth Atmos Planetary Sci

College of Engineering - WL	School of Electrical and Computer Engineering - WL	ECE		ECE-Electrical & Computer Engr
Polytechnic Institute - WL	School of Engineering Technology - WL	ECET		ECET-Electrical&Comp Engr Tech
Mitch Daniels School of Business - WL	Department of Economics (Graduate) - WL	ECON	GR	ECON-Economics
Mitch Daniels School of Business - WL	School of Management Administration and Instruction - WL	ECON	UG	ECON-Economics

College of Education - WL	Department of Curriculum and Instruction - WL	EDCI		EDCI-Educ-Curric & Instruction
College of Education - WL	Department of Educational Studies - WL	EDPS		EDPS-Educ-Ed'l and Psy Studies
College of Education - WL	Department of Educational Studies - WL	EDST		EDST-Ed Leadrship&Cultrl Fnd
College of Engineering - WL	Division of Environmental and Ecological Engineering - WL	EEE		EEE-Environ & Ecological Engr
College of Engineering - WL	School of Engineering Education - WL	ENE		ENE-Engineering Education

College of Liberal Arts - WL	Department of English - WL	ENGL		ENGL-English
College of Engineering - WL	College of Engineering Administration - WL	ENGR		ENGR-Engineering
Polytechnic Institute - WL	School of Engineering Technology - WL	ENGT		ENGT-Engineering Technology
College of Agriculture - WL	Department of Entomology - WL	ENTM		ENTM-Entomology
Office of the Provost - WL	Entrepreneurship Certificate - WL	ENTR		ENTR-Entrepreneurship

College of Engineering - WL	College of Engineering Administration - WL	EPCS		EPCS-Engr Proj Cmity Service
Exploratory Studies - WL	Department of Exploratory Studies - WL	EXPL		EXPL-Exploratory Studies
College of Liberal Arts - WL	Patti and Rusty Rueff School of Design, Art, and Performance - WL	FLM		FLM-Film & Video
Polytechnic Institute - WL	School of Construction Management Technology - WL	FMGT		FMGT-Facilities Management

College of Agriculture - WL	Department of Forestry and Natural Resources - WL	FNR		FNR-Forestry&Natural Resources
College of Liberal Arts - WL	School of Languages and Cultures - WL	FR		FR-French
College of Agriculture - WL	Department of Food Science - WL	FS		FS-Food Science
College of Liberal Arts - WL	Patti and Rusty Rueff School of Design, Art, and Performance - WL	FVS		FVS-Film And Video Studies

College of Engineering - WL	College of Engineering Administration - WL	GEP		GEP-Global Engineering Program
College of Liberal Arts - WL	School of Languages and Cultures - WL	GER		GER-German
Graduate Programs - WL	Graduate Programs Administration - WL	GRAD		GRAD-Graduate Studies
College of Liberal Arts - WL	School of Languages and Cultures - WL	GREK		GREK-Greek
College of Liberal Arts - WL	College of Liberal Arts Administration - WL	GS		GS-General Studies

College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	GSLA		GSLA-Global Studies Lib Arts
College of Health and Human Sciences - WL	Department of Human Development and Family Science - WL	HDFS		HDFS-Human Dev & Family Sci
College of Liberal Arts - WL	School of Languages and Cultures - WL	HEBR		HEBR-Hebrew
Polytechnic Institute - WL	School of Engineering Technology - WL	HEMT		HETM-Healthcare Engr Tech Mgmt

College of Liberal Arts - WL	Patti and Rusty Rueff School of Design, Art, and Performance - WL	HER		HER-Herron Art-IU
College of Health and Human Sciences - WL	College of Health and Human Sciences Administration - WL	HHS		HHS-College Health & Human Sci
College of Liberal Arts - WL	Department of History - WL	HIST		HIST-History
College of Health and Human Sciences - WL	Department of Health and Kinesiology - WL	HK		HK-Health And Kinesiology
Honors College - WL	Honors College - WL	HONR		HONR-Honors
College of Agriculture - WL	Department of Horticulture and Landscape Architecture - WL	HORT		HORT-Horticulture
College of Health and Human Sciences - WL	School of Health Sciences - WL	HSCI		HSCI-Health Sciences
College of Health and Human Sciences - WL	Department of Human Development and Family Science - WL	HSRV		HSRV-Human Services

College of Health and Human Sciences - WL	School of Hospitality and Tourism Management - WL	HTM		HTM-Hospitality & Tourism Mgmt
College of Engineering - WL	School of Engineering Education - WL	IDE		IDE-Interdisciplinary Engr
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	IDIS		IDIS-Interdisciplinary Studies
College of Engineering - WL	School of Industrial Engineering - WL	IE		IE-Industrial Engineering
Polytechnic Institute - WL	School of Engineering Technology - WL	IET		IET-Industrial Engr Technology

Libraries and School of Information Studies - WL	Department of Information Studies - WL	ILS		ILS-Information & Library Sci
College of Pharmacy - WL	Department of Industrial and Molecular Pharmaceutics - WL	IMPH		IMPH-Indstrl & Mlculr Phrmcutc
College of Science - WL	Department of Computer Science - WL	INFO		INFO-Informatics -IU
Polytechnic Institute - WL	School of Construction Management Technology - WL	INT		INT-Interior Architecture

Polytechnic Institute - WL	School of Construction Management Technology - WL	INT		INT-Interior Architecture
College of Pharmacy - WL	Department of Industrial and Molecular Pharmaceutics - WL	IPPH		IMPH-Indstrl & Mlculr Phrmcutc
Polytechnic Institute - WL	School of Engineering Technology - WL	IT		IT-Industrial Technology
College of Liberal Arts - WL	School of Languages and Cultures - WL	ITAL		ITAL-Italian

College of Liberal Arts - WL	School of Languages and Cultures - WL	JPNS		JPNS-Japanese
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	JWST		JWST-Jewish Studies
College of Liberal Arts - WL	School of Languages and Cultures - WL	KOR		KOR-Korean
College of Agriculture - WL	Department of Horticulture and Landscape Architecture - WL	LA		LA-Landscape Architecture

College of Liberal Arts - WL	College of Liberal Arts Administration - WL	LALS		LALS-Latina Am&Latino Studies
College of Liberal Arts - WL	School of Languages and Cultures - WL	LATN		LATN-Latin
College of Liberal Arts - WL	School of Languages and Cultures - WL	LC		LC-Languages and Cultures
Libraries and School of Information Studies - WL	Department of Information Studies - WL	LIBR		LIBR-Library & Inform Science
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	LING		LING-Linguistics

College of Engineering - WL	Lyles School of Civil Engineering - WL	LS		LS-Land Surveying
College of Science - WL	Department of Mathematics - WL	MA		MA-Mathematics
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	MARS		MARS-Medieval &Renaissance Std
College of Science - WL	Department of Mathematics - WL	MATH		MATH-Mathematics
College of Pharmacy - WL	Department of Medicinal Chemistry and Molecular Pharmacology - WL	MCMP		MCMP-Med Chem &Molecular Pharm

College of Engineering - WL	School of Mechanical Engineering - WL	ME		ME-Mechanical Engineering
Polytechnic Institute - WL	School of Engineering Technology - WL	MET		MET-Mechanical Engr Tech
Polytechnic Institute - WL	School of Engineering Technology - WL	MFET		MFET-Manufacturing Engr Tech
Mitch Daniels School of Business - WL	Department of Management (Graduate) - WL	MGMT	GR	MGMT-Management

Mitch Daniels School of Business - WL	School of Management Administration and Instruction - WL	MGMT	UG	ME-Mechanical Engineering
College of Engineering - WL	School of Materials Engineering - WL	MSE		MSE-Materials Engineering
Polytechnic Institute - WL	Polytechnic Institute Administration - WL	MSL		MSL-Military Science & Ldrshp
College of Engineering - WL	School of Mechanical Engineering - WL	MSPE		MSPE-Motorsports Engineering

College of Liberal Arts - WL	Patti and Rusty Rueff School of Design, Art, and Performance - WL	MUS		MUS-Music History & Theory
Polytechnic Institute - WL	Department of Computer Graphics Technology - WL	NEWM		NEWM-New Media
College of Agriculture - WL	College of Agriculture Administration - WL	NRES		NRES-Natural Res & Environ Sci
Polytechnic Institute - WL	Department of Technology Leadership and Innovation - WL	NS		NS-Naval Science
College of Engineering - WL	School of Nuclear Engineering - WL	NUCL		NUCL-Nuclear Engineering
College of Pharmacy - WL	College of Pharmacy Administration - WL	NUPH		NUPH-Nuclear Pharmacy
College of Health and Human Sciences - WL	School of Nursing - WL	NUR		NUR-Nursing
College of Health and Human Sciences - WL	Department of Nutrition Science - WL	NUTR		NUTR-Nutrition Science

Mitch Daniels School of Business - WL	Department of Organizational Behavior & Human Resource Management (Graduate) - WL	OBHR	GR	OBHR-Orgnztnl Bhvr &Hum Resrce
Mitch Daniels School of Business - WL	School of Management Administration and Instruction - WL	OBHR	UG	OBHR-Orgnztnl Bhvr &Hum Resrce
Polytechnic Institute - WL	Department of Technology Leadership and Innovation - WL	OLS		OLS-Organiz Ldrshp &Supervision

College of Health and Human Sciences - WL	Department of Health and Kinesiology - WL	PES		PES-Physical Education Skills
College of Pharmacy - WL	Department of Pharmacy Practice - WL	PHAD		PHAD-Pharmacy Administration
College of Liberal Arts - WL	Department of Philosophy - WL	PHIL		PHIL-Philosophy
College of Pharmacy - WL	Department of Pharmacy Practice - WL	PHPR		PHPR-Pharmacy Practice
College of Pharmacy - WL	Department of Pharmacy Practice - WL	PHRM		PHRM-Pharmacy

College of Pharmacy - WL	College of Pharmacy Administration - WL	PHSC		PHSC-Pharmaceutical Science
College of Science - WL	Department of Physics and Astronomy - WL	PHYS		PHYS-Physics
College of Liberal Arts - WL	Department of Political Science - WL	POL		POL-Political Science
College of Health and Human Sciences - WL	Department of Psychological Sciences - WL	PSY		PSY-Psychological Sciences
Polytechnic Institute - WL	Polytechnic Institute Administration - WL	PTEC		PTEC-Polytechnic

College of Liberal Arts - WL	School of Languages and Cultures - WL	PTGS		PTGS-Portuguese
College of Health and Human Sciences - WL	Department of Public Health - WL	PUBH		PUBH-Public Health
College of Science - WL	Department of Physics and Astronomy - WL	QSCI		QSCI-Quantum Science
College of Health and Human Sciences - WL	Department of Health and Kinesiology - WL	RECR		RECR-Recreation Leadership
College of Liberal Arts - WL	College of Liberal Arts Administration - WL	REL		REL-Religious Studies

College of Liberal Arts - WL	School of Languages and Cultures - WL	RUSS		RUSS-Russian
Study Abroad - WL	Study Abroad - WL	SA		SA-Study Abroad
College of Science - WL	College of Science Administration - WL	SCI		SCI-General Science
College of Liberal Arts - WL	College of Liberal Arts Administration - WL	SCLA		SCLA-Studies Coll Liberal Arts
College of Agriculture - WL	Department of Horticulture and Landscape Architecture - WL	SFS		SFS-Sustainable Food&Farm Sys

College of Health and Human Sciences - WL	Department of Speech, Language, and Hearing Sciences - WL	SLHS		SLHS-Speech, Lang&Hear Science
College of Liberal Arts - WL	Department of Sociology - WL	SOC		SOC-Sociology
College of Liberal Arts - WL	School of Languages and Cultures - WL	SPAN		SPAN-Spanish
College of Science - WL	Department of Statistics - WL	STAT		STAT-Statistics
Office of the Provost - WL	Purdue Systems Collaboratory - WL	SYS		SYS-Purdue Sys Collaboratory

College of Health and Human Sciences - WL	School of Hospitality and Tourism Management - WL	TCEM		TCEM-Tour Conventns&Event Mgmt
Polytechnic Institute - WL	Polytechnic Institute Administration - WL	TCM		TCM-Technical Communications
Office of the Provost - WL	Department Of The Data Mine - WL	TDM		TDM-The Data Mine
Polytechnic Institute - WL	Polytechnic Institute Administration - WL	TECH		TECH-Technology

College of Liberal Arts - WL	Patti and Rusty Rueff School of Design, Art, and Performance - WL	THTR		THTR-Theatre
Polytechnic Institute - WL	Department of Technology Leadership and Innovation - WL	TLI		TLI-Technology Ldrshp Innovatn
College of Veterinary Medicine - WL	Department of Veterinary Clinical Sciences - WL	VCS		VCS-Veterinary Clinical Sci
College of Engineering - WL	College of Engineering Administration - WL	VIP		VIP-Vertically Integrated Proj

College of Veterinary Medicine - WL	College of Veterinary Medicine Administration - WL	VM		VM-Veterinary Medicine
College of Liberal Arts - WL	School of Interdisciplinary Studies - WL	WGSS		WGSS-Women Gend& Sexuality Std

Courses list University Core Curriculum abbreviation if they are approved to meet the foundational learning outcomes for Undergraduates.

- Human Cultures: Behavioral/Social Science (UCC: BSS)
- Human Cultures: Humanities (UCC: HUM)
- Information Literacy (UCC: IL)
- Oral Communication (UCC: OC)
- Quantitative Reasoning (UCC: QR)
- Science #1 (UCC: SCI)
- Science #2 (UCC: SCI)
- Science, Technology, and Society (UCC: STS)
- Written Communication (UCC: WC)

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Course Numbering Information

Since September 1953, the following numbering system has been in effect:

Course Numbering	Numbering Definition
10000-29999	* Lower-division courses - normally scheduled for freshmen and sophomores
30000-49999	* Upper-division courses - normally scheduled for juniors and seniors
50000-59999	Dual-level courses - may be scheduled by juniors, seniors and graduate students for graduate credits
60000-69999	Graduate-level courses - Undergraduate student may take a 600-level course upon graduate office approval
80000-89999	Professional-level courses - Professional degree courses (i.e. DPHARM - Doctor of Pharmacy; DVM - Doctor of Veterinary Medicine)

*Classification of Undergraduate Students
**Prior to September 1953, courses designated by letter rather than number (e.g., English A) were non-credit. Courses numbered 1 through 99 were primarily for undergraduate credit. Courses numbered 100 through 199 enrolled advanced undergraduate and some graduate students. Courses numbered 200 through 299 were for graduate students.

001-049 - Precollege and deficiency courses - no longer taught at Purdue University
050-099 - Nondegree courses (e.g., agriculture short courses) - no longer taught at Purdue University

AAE-Aeronautical and Astronautical

Engineering

AAE 20000 - Undergraduate Sophomore Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn the requirements for earning a BSAAE degree. 2. Learn advising and registration processes in AAE. 3. Learn professional ethics. 4. Learn current events in Aerospace Engineering. Credits: 0.00

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 20401 - Aeromechanics II Laboratory

Credit Hours: 1.00. Introduction to strain gauges, dial gauges, and photoelasticity. Tensile test. Torsion of solid and hollow propeller shafts. Stress concentration around skin cut-outs. Bending of symmetrical box wing beams. Combined axial and flexural test of aircraft stringers. Buckling of slender stringers.

Credits: 1.00

AAE 25100 - Introduction To Aerospace Design

Credit Hours: 3.00. The role of design in aerospace engineering. Introduction to aerodynamics, performance, propulsion, structures, stability and control, and weights. Layout and general arrangement of aerospace vehicles. Design concept generation and selection. Computational methods for design. Trade studies and graphical optimization. Conceptual design exercise involving aircraft, spacecraft, or both. Technical presentations and communication for aerospace engineering.

Learning Outcomes: 1. Acquire and apply basic technical knowledge about aerospace engineering. 2. Develop intuition about aerospace engineering and aerospace vehicles. 3. Understand and implement the design process for aerospace systems. 4. Use computers in aerospace design. 5. Solve problems as part of a team. 6. Design an aerospace vehicle/system. 7. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

AAE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 30000 - Undergraduate Junior Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn how to program options within the AAE degree and how to choose them. 2. Learn how to interview. 3. Learn how to get an internship or other engineering experience. 4. Learn professional ethics. 5. Learn about current events in Aerospace Engineering. Credits: 0.00

AAE 30100 - Signal Analysis For Aerospace Engineering

Credit Hours: 3.00. Signal processing and spectral analysis for aerospace engineering. Fourier and fast Fourier transforms. Vibration analysis; estimation of natural frequencies, wing vibrations. Introduction to linear circuits, operational amplifiers and filtering. Noise suppression.

Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

AAE 33301 - Fluid Mechanics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Experiments in incompressible viscous flow; flow measurement and visualization; laminar and turbulent boundary layers; wakes.

Learning Outcomes: 1. Measure and differentiate between absolute, differential, and gauge pressure. 2. Make basic pressure and velocity measurements. 3. Utilize elementary flow visualization tools. 4. Deduce fluid physics information from flow visualization. 5. Calculate flow characteristics such as Reynolds number, friction factor, pressure and drag coefficient from laboratory measurements. 6. Identify and discuss foundation-level fluid phenomena including boundary layers, wakes, laminar to turbulent transition, turbulence, flow separation, drag on a body, and surface pressure distributions. 7. Design an experiment to meet a defined objective, conduct the experiment, analyze the data, and draw conclusions. Credits: 1.00

AAE 33400 - Aerodynamics

Credit Hours: 3.00. Incompressible airfoil and lifting line theory. Steady and unsteady, one-dimensional, linear and nonlinear flows. Normal shock waves. Steady, supersonic, two-dimensional linear and nonlinear flows. Oblique shock waves. Perturbation theory for wings and bodies. Design applications.

Credits: 3.00

AAE 33401 - Aerodynamics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Airfoil pressure distribution. Finite wing lift, drag, and moment. Supersonic flow around bodies. Shock waves.

Credits: 1.00

AAE 33800 - Thermal Sciences

Credit Hours: 3.00. A fundamental course covering a range of topics selected from the disciplines of engineering thermodynamics, fluid mechanics, heat transfer and combustion, with an emphasis on their application to propulsion.

This is an entry level course to prepare students for advanced analysis of propulsion and energy systems. Upon completion of this course, students are expected to be able to apply fundamental principles to perform thermodynamic analysis for thermophysical problems involving fluid flow, heat transfer and combustion.

Learning Outcomes: 1. Identify types of problems from thermo-fluid systems. 2. Perform heat conduction analysis for steady and unsteady problems. 3. Perform analysis for radiation heat transfer. 4. Develop deeper understanding of the laws of thermodynamics and their applications to various problems. 5. Apply fundamentals of fluid mechanics to various fluid flow problems. 6. Analyze convection heat transfer problems. 7. Conduct analysis of simple combustion systems such as adiabatic or chemical equilibrium. 8. Analyze simple thermo-fluid systems using fundamentals we learn from the class. Credits: 3.00

AAE 33900 - Aerospace Propulsion

Credit Hours: 3.00. Survey of air-breathing and rocket propulsion systems for AAE students not in the propulsion option. Thermodynamic cycles, analysis of air-breathing systems and components. Rocket Equation, rocket cycles, liquid and solid propellants, chemical equilibrium.

Learning Outcomes: 1. Knowledge of propulsion applications that use gas turbine engines and rockets. 2. Understanding of the Brayton cycle and ability to calculate enthalpy and work balance. 3. Ability to solve mass, momentum, and energy balances using a control volume approach. 4. Ability to perform top-level performance and sizing calculations of gas turbine engines. 5. Ability to apply Euler's work equation to compressors and turbines to calculate work. 6. Ability to use the Rocket Equation to calculate impulse requirements and size rocket thrusters. Credits: 3.00

AAE 34000 - Dynamics And Vibrations

Credit Hours: 3.00. Kinematics and kinetics of particles and rigid bodies. Topics include a particle in orbit, systems of particles, vibrations, Euler's equations of motion, Eulerian angles, and aerospace vehicle dynamics.

Learning Outcomes: 1. Analyze the free and forced response of a spring/mass/damper. 2. Formulate the EOMs of particles, systems of particles and rigid bodies. 3. Solve the EOMs numerically. 4. Understand the various forms of Euler angles and be able to apply them to rigid body dynamics. 5. Simulate the motion of a spacecraft in MATLAB. Credits: 3.00

AAE 35103 - Aerospace Systems Design

Credit Hours: 3.00. Aerospace system lifecycle and design process. Stakeholder needs elicitation and requirements generation. Quality function deployment and hierarchical objective trees. Concept generation and creativity techniques. Introduction to safety, risk, cost and value analysis. Critical evaluation of the applicability of systems engineering techniques in specific contexts. Application of these techniques to a team semester design project.

Learning Outcomes: 1. Identify appropriate tools, methods and processes to formulate an aerospace system design problem including realistic constraints from technical, economic, social, political, safety, and other relevant contexts. 2. Apply those tools, methods and processes to generate solutions to the aerospace system design problem. Credits: 3.00

AAE 35200 - Structural Analysis I

Credit Hours: 3.00. Properties of wing and fuselage sections. Beam-column moments. Torsion of thin-walled and skin-stringer multiple-cell sections. Nonsymmetrical bending of skin-stringer wing sections. Flexural shear in open and closed thin-walled and skin-stringer sections. Loads and stresses in the rib system. Cutouts and shear lag. Modified beam theory for wing and fuselage design. Deflection by energy method. Introduction to composite structures.

Learning Outcomes: 1. Use analytical/empirical tools for determining the distribution of load (or displacement) in typical aerospace components. 2. Understand and implement the procedures for relating applied loads (or displacements) to component "failure." 3. Select of materials to resist structural failure. 4. Be exposed to other professional development topics are also to be presented as time permits (e.g., technical communications, teamwork issues, economic considerations, engineering ethics, case

histories, regulatory and certification, topics, etc.). Credits: 3.00

AAE 35201 - Structural Analysis I Laboratory

Credit Hours: 1.00. Location of shear center. Torsion of thin-walled open and closed sections. Torsion of multiple-cell, thin-walled section. Nonsymmetrical bending of skin-stringer cross section. Shear lag effect. Bending of composite beam.

Credits: 1.00

AAE 36400 - Control System Analysis

Credit Hours: 3.00. Modeling and analysis of dynamical systems with aerospace applications. Laplace transforms, transfer functions, block diagrams. Transient and steady-state response of dynamical systems. Root Locus, Bode, Nyquist methods for control systems analysis. Introduction to controller design.

Credits: 3.00

AAE 36401 - Control Systems Laboratory

Credit Hours: 1.00. Enhance student awareness of control systems by providing hands-on experience using dynamic systems representative of air and space vehicles. Design of a control system from start to finish by mapping requirements into control solutions through the process of modeling, identification, and controller design (PID and Lead-Lag).

Credits: 1.00

AAE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

AAE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

AAE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

AAE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

AAE 40000 - Undergraduate Senior Seminar

Credit Hours: 1.00. A lecture-demonstration series emphasizing evaluation of career options, identification and development of professional skills. Example of career-related topics include choosing a job, and post graduate education in engineering or other disciplines. Examples of professional skills topics covered include interviewing, writing, and ethics. Assessment of student achievement of AAE program learning outcomes.

Learning Outcomes: 1. Learn how to get a job 2. Learn how to get into graduate school (and why) 3. Learn how to succeed in the workplace 4. Learn about current events in Aerospace Engineering Credits: 1.00

AAE 41200 - Introduction To Computational Fluid Dynamics

Credit Hours: 3.00. Introductory course in the formulation and application of finite difference methods for solving fluid flow problems. Classification of partial differential equations and formulation of well-posed problems. Discrete approximation of partial differential equations: stability, consistency, and convergence. Finite-volume formulations. Survey of methods for solving hyperbolic, elliptic, and parabolic problems. Formulation of discrete boundary conditions. Application of methods to one- and two-dimensional flow problems.

Credits: 3.00

AAE 41600 - Viscous Flows

Credit Hours: 3.00. Navier-Stokes equations, boundary layer theory, frictional drag and heating, separation and transition. Turbulent flows. Computational methods for laminar and turbulent flows.

Credits: 3.00

AAE 41800 - Zero-Gravity Flight Experiment

Credit Hours: 3.00. Team-based design-build-test engineering experience to maximize the benefits of student participation in the NASA Reduced Gravity Student Flight Opportunity Program (or similar). Gravity, orbits, and weightlessness. Low-gravity capillary fluid physics, scaling laws, and components. Experiment design for multiple short zero gravity test times. Technical proposal writing, design for manufacturability, experiment fabrication, planning, testing, and execution.

Credits: 3.00

AAE 42100 - Flight Dynamics And Control

Credit Hours: 3.00. Flight vehicle rigid-body equations of motion; linearization via small perturbation techniques. Trim analysis, static and dynamic stability, aerodynamic stability derivatives and control effectiveness. Vehicle transfer functions, stability augmentation, aircraft handling qualities. Introduction to flexible vehicle effects.

Credits: 3.00

AAE 43200 - Orbital Analysis

Credit Hours: 3.00. The design and operation of spacecraft is a multidisciplinary endeavor covering many aspects of engineering. This course introduces the physics of the orbits and the space environment near the Earth as well as mission trajectory analysis including constraints, launch windows, ground tracks, some communications and tracking, some constellations, relative motion and contingencies.

Learning Outcomes: 1. Apply basic technical knowledge about spacecraft trajectory and architecture requirements. 2. Understand the physics and demonstrate intuition behind motion in space. 3. Design and characterize orbits. 4. Define launch geometry, time windows, and maneuvers to reach the operative orbits. 5. Retrieve orbital information from ground tracks and characterize spacecraft visibility from ground. Credits: 3.00

AAE 43800 - Air-Breathing Propulsion

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of propulsion systems for air-breathing aerospace vehicles. Ramjet, turbojet, turbofan and turboprop cycle analysis. Propeller analysis and design. Analysis of flow through inlets, combustors, nozzles, compressors, and turbines. Component matching. Not open to students with credit in ME 43800.

Learning Outcomes: 1. Determine the thrust and fuel consumption of gas turbine and turboprop engines. 2. Understand advantages/disadvantages of turbojet, turboprop, turbofan, and ramjet air-breathing propulsion systems. 3. Understand the thermodynamics of the Brayton cycle and how they contribute to overall propulsion system performance. 4. Understand the role and fundamental performance of gas turbine components. 5. Determine the basic performance and/or design of axial turbines and compressors. 6. Determine the basic performance of air breathing combustors. Credits: 3.00

AAE 43900 - Rocket Propulsion

Credit Hours: 3.00. Flight mechanics and the propulsion system requirements for terrestrial and interplanetary flight. Converging-diverging nozzle analysis and design. Thermochemistry of propellants and performance calculations. Solid rocket motor interior ballistics and design. Thrust chamber and turbo machinery analysis and design. Liquid rocket engine cycle

analysis and design. Elements of nuclear and electric propulsion systems.

Learning Outcomes: 1. Determine the thrust and fuel consumption of gas turbine and turbo prop engines. 2. Understand advantages/disadvantages of turbojet, turboprop, turbofan, and ramjet air-breathing propulsion systems. 3. Understand the thermodynamics of the Brayton cycle and how they contribute to overall propulsion system performance. 4. Understand the role and fundamental performance of gas turbine components. 5. Determine the basic performance and/or design of axial turbines and compressors. 6. Determine the basic performance of air-breathing combustors.

Credits: 3.00

AAE 44000 - Spacecraft Attitude Dynamics

Credit Hours: 3.00. Description of orientation, angular velocity, and angular acceleration in terms of direction cosines, Euler parameters, and angles. Forces and moments acting on space vehicles. Attitude stability of various types of satellites in circular and elliptic orbits. Spin stabilization and gravity gradient torques. Gyroscopic devices and energy dissipation. Introduction to attitude control.

Credits: 3.00

AAE 45000 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the aerospace curriculum. Components include analysis methods for preliminary design, development of an initial vehicle concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with spacecraft, rocket and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Demonstrate design viability through testing, both real and virtual. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

AAE 45100 - Aircraft Design

Credit Hours: 3.00. Senior students perform a team-based aircraft design, requiring application of the education and skills developed in the aerospace curriculum. Aircraft mission requirements include engine cycle selection and airframe/engine integration, performance, stability and control, structures, human factors, avionics, sensors, and manufacturing processes. The teams present oral and written reports on their designs.

Learning Outcomes: 1. Deepen your knowledge of topics relevant to aircraft design. 2. Identify and formulate the design requirements for an aircraft. 3. Conduct a set of trade studies to make decisions about the aircraft design. 4. Describe an aircraft design that is likely to meet the set of requirements. 5. Use modern engineering tools to complete the design process. 6. Apply engineering knowledge and skills acquired in previous classes to the design problem. 7. Solve problems as part of a team.

Credits: 3.00

AAE 45400 - Design Of Aerospace Structures

Credit Hours: 3.00. Design/failure criteria for aerospace structures, materials selection, introduction to manufacturing methods, structural assemblies, component details, concurrent engineering, and interdisciplinary design teams.

Credits: 3.00

AAE 49000 - Special Problems In Aeronautical Engineering

Credit Hours: 0.00 to 18.00. Hours and credit to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

AAE 49700 - Independent Study In Aerospace Engineering

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest outside the scope of the standard undergraduate curriculum. Interested students seek a faculty advisor in their area of special interest and together prepare a brief description of the work to be undertaken. Permission of instructor required.

Credits: 0.00 to 6.00

AAE 50700 - Principles Of Dynamics

Credit Hours: 3.00. Kinematics, fundamental laws of mechanics, constraints, and generalized coordinates. Lagrange's equations, virtual work. Application to particle dynamics, rigid body motion, and spacecraft dynamics. Knowledge of differential equations required.

Credits: 3.00

AAE 50800 - Optimization In Aerospace Engineering

Credit Hours: 3.00. Formulation of optimization problems encountered in aerospace engineering. Minima of functions and functionals, necessary conditions, calculus of variations, control formulation, two-point boundary-value problems. Applications to typical problems in aerospace engineering, such as optimal launch, minimum time to climb, maximum range, and optimal space trajectories.

Credits: 3.00

AAE 51100 - Introduction To Fluid Mechanics

Credit Hours: 3.00. The basic conservation equations are derived for a compressible viscous fluid, and then are specialized for applications in potential flow, viscous flow, and gas dynamics.

Learning Outcomes: 1. Use index notation to derive vector and tensor relations. 2. Manipulate and derive governing equations in various forms. 3. Determine streamlines, pathlines, streaklines and timelines for unsteady flow. 4. Determine how vorticity is produced by various mechanisms. 5. Determine the motion of two-dimensional point vortices. 6. Use conformal mapping to find the lift coefficient on an airfoil shape. 7. Use a Schwarz-Christoffel transformation to solve for potential flow with corners. 8. Use three-dimensional potential flow to solve for flow over axisymmetric bodies. 9. Solve for steady and unsteady exact solutions of the Navier-Stokes equations. 10. Derive and use the Stokes drag law for a sphere. 11. Derive boundary layer equations, find self-similar solutions and determine scaling laws. 12. Compute skin friction on an airfoil using an approximate boundary layer method. 13. Determine the qualitative effects of turbulence on a flow. Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 51400 - Intermediate Aerodynamics

Credit Hours: 3.00. Thin airfoil theory and panel methods. Three-dimensional elementary solutions, lifting-line and lifting-surface models. Slender wing and slender body theory. Normal/oblique shock waves. One- and multi-dimensional flows and conical flows. Method of characteristics. Introduction to transonic flow, hypersonic flow, and airfoil design.

Credits: 3.00

AAE 51800 - Low-Gravity Fluid Dynamics

Credit Hours: 3.00. Theory and design for control of liquid propellants in weightlessness. Gravity and orbits review. Satellite and space-probe acceleration environments. Capillary-dominated fluid dynamics: contact angle, surface tension, curvatures, and solution methods. Industry practice and current topics.

Credits: 3.00

AAE 51900 - Hypersonic Aerothermodynamics

Credit Hours: 3.00. Aerodynamics of satellites and planetary re-entry. Continuum hypersonic flow. Inviscid and viscous effects, boundary layers, and heat transfer. Shock and boundary-layer

interactions. Equilibrium flow of high-temperature reacting gases. Nonequilibrium effects. Kinetic theory and rarefied flows. Direct simulation Monte Carlo techniques.

Credits: 3.00

AAE 52000 - Experimental Aerodynamics

Credit Hours: 3.00. Theory and application of experimental techniques and instrumentation for aerodynamics and fluid mechanics. Computer data acquisition, wind tunnels, force balances, flow visualization, pressure probes, hot wire anemometry, laser Doppler velocimetry and turbulence measurements.

Credits: 3.00

AAE 52100 - Plasma Laboratory

Credit Hours: 3.00. The laboratory course will include lab prep lectures, practical classes and mini-projects. Lab prep lectures will briefly cover topics of the basic plasma physics and diagnostics relevant to the subsequent practical classes. In addition, details of the corresponding lab procedure, instructions and lab report assignment will be discussed. Practical classes will involve students in practical creation and operation of various plasma sources and plasma diagnostics. Specifically, students will operate DC high voltage breakdown facility, electrostatic accelerator (ion thruster), cross-field accelerator (Hall thruster), Atmospheric-Pressure Plasma Jet facility, and will conduct measurements of plasma parameters using Langmuir probes, microwave interferometer and optical spectrometer.

Learning Outcomes: 1. Operate laboratory electronic equipment and conduct basic electrical measurements. 2. Demonstrate fundamental understanding of Paschen breakdown law, and measure breakdown parameters. 3. Demonstrate fundamental understanding of Child-Langmuir law and calculate space-charge limited current density. 4. Operate electrostatic accelerator at different acceleration voltages, and conduct measurements of total ion current carried by the plasma jet using plane Langmuir probe. 5. Demonstrate fundamental understanding of operation of single electrostatic Langmuir probes, conduct measurements of V-I curves, and calculate plasma parameters based on the measurements. 6. Operate cold atmospheric-pressure plasma jet and conduct spectroscopic measurements of the jet emission using spectrometer. 7. Computationally simulate the emission spectra of the second positive system of nitrogen molecule, and determine vibrational and rotational gas temperatures based on the measured and simulated spectra. 8. Operate Hall-effect accelerator, and measure basic operational parameters. 9. Operate pendulum thrust stand and conduct thrust measurements. 10. Demonstrate fundamental understanding of operation principle of microwave interferometry and construct the interferometer from basic microwave components. 11. Conduct interferometry measurements of phase shift in plasma column and determine plasma density. 12. Conduct search of the journal papers on a given topic, and compare the reported results with that measured in the lab. Credits: 3.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.

Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application. Credits: 3.00

AAE 53200 - Orbit Mechanics

Credit Hours: 3.00. Orbit determination of near-earth satellites and various perturbations; libration and attitude control; orbit transfer and interception; lunar theory and interplanetary orbits; ascending mechanics and re-entry.

Credits: 3.00

AAE 53300 - Space Traffic Engineering Management

Credit Hours: 3.00. The course teaches the basic techniques and concepts relevant to Space Traffic Management (STM) and Space Situational Awareness (SSA) from a rigorous engineering

perspective. The class starts with learning how measurements are collected and processed and then moves on to the non-linear orbital motion and astrodynamics in the near-Earth realm. The focus is on orbit determination and orbit improvement of satellites and space debris to detect new objects and maintain custody of them. Lastly, the class focuses on determining the probability of collision of two resident space objects. At the end of the course, the students are equipped with a fundamental Matlab toolset to investigate their own STM or SSA problems.

Learning Outcomes: 1. Demonstrate fundamental understanding of sustainable use of space. 2. Determine engineering and simulation of information collection for STM. 3. Demonstrate Initial Orbit Determination and Orbit Improvement using passive measurements. 4. Determine Orbital perturbations in the near-Earth and cislunar region. 5. Determine Computation Probability of Collision. Credits: 3.00

AAE 53400 - Spacecraft Electric Propulsion

Credit Hours: 3.00. Spacecraft electric propulsion systems are intended to provide thrust for propelling spacecrafts in interplanetary missions, orbital maneuvers, and attitude control. The course will start with reviewing material on the mechanics and thermodynamics of propulsion, and identifying the niche occupied by the electric propulsion systems. The course will cover elements of plasma physics and electromagnetic theory essential for studying the electric propulsion systems. The core of the course will focus on studying various electric propulsion concepts which utilize electric power produced on-board to generate thrust. Mechanisms of the utilization of the electric power to accelerate gas or plasma and produce thrust will be considered, including electrothermal, electrostatic, electromagnetic, and gasdynamic acceleration mechanisms.

Learning Outcomes: 1. Determine optimal specific impulse of electric propulsion system based on specific mission requirements 2. Demonstrate fundamental understanding of differences between electric and chemical propulsion systems performance and space applications. 3. Calculate basic plasma parameters and characteristics of collisional processes. 4. Demonstrate fundamental understanding of concepts of quasineutrality and collective behavior in plasmas. 5. Perform analysis of electrothermal accelerator at a given frozen flow fraction 6. Apply Maxwell equations in differential and integral forms to solve basic electromagnetism problems 7. Perform analysis of space-charge limited electrostatic accelerator in ion acceleration zone, in deceleration zone, and in neutralization zone. 8. Perform analysis of motion of charged particles in crossed electric and magnetic fields 9. Derive and apply modified forms of Ohm's law in two-component moving plasma in presence of magnetic field. 10. Perform elementary analysis of crossed-field electromagnetic accelerator with small Hall parameter 11. Perform elementary analysis and calculate basic parameters of Hall effect accelerator. 12. Demonstrate fundamental understanding of the differences of acceleration concepts used in Hall effect and in electrostatic accelerators. 13. Calculate body force in magnetoplasmadynamic accelerator. Credits: 3.00

AAE 53500 - Propulsion Design, Build, Test

Credit Hours: 3.00. Intensive one-semester treatment of the aerospace propulsion component development process. Derivation of design requirements from mission objective to detailed components; the design process. Standard methods for thermostructural, life, performance, and combustion stability design analysis; combustor design. Experimental procedures; fabrication; test. Special topics according to student interest.

Credits: 3.00

AAE 53700 - Hypersonic Propulsion

Credit Hours: 3.00. Analysis of advanced high speed air breathing propulsion concepts for hypersonic flight. Missions and trajectories. Engine/airframe integration. Aerothermodynamic analysis of ramjets, scramjets, and oblique detonation wave engines. On- and off-design of compression inlets and minimum length nozzles. Cryogenic fuels and skin cooling. Ram accelerator ballistic launch concepts.

Learning Outcomes: 1. Develop understanding of high-speed inlet systems. 2. Develop understanding of mixing systems employed in airbreathing engines. 3. Develop understanding of turbine-based combined cycle systems. 4. Develop understanding of detonative-based propulsion systems. 5. Develop understanding of ducted rockets. 6. Develop understanding of ramjet and scramjet propulsion systems.

Credits: 3.00

AAE 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (ME 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

AAE 53900 - Advanced Rocket Propulsion

Credit Hours: 3.00. Generalized internal compressible and incompressible flows. Thermochemistry and heat transfer in rocket applications. Advanced topics in solid rocket motor performance and internal ballistics. Liquid rocket engine cycle analysis and turbopump design. Combustion of liquid and solid propellants. Hybrid rockets and thermal-nuclear engines.

Credits: 3.00

AAE 54500 - Dynamic Behavior of Materials

Credit Hours: 3.00. Materials' responses to high-rate loading are different from their quasi-static behavior. Applications of materials in structures subjected to impact loading from events such as bird strike require the understanding of dynamic material behavior. Such high-rate materials behavior is not available in standard materials handbooks or design manuals. This course introduces stress wave propagation in solids, which is the foundation to characterization and understanding of high-rate response of materials. Then, the theoretical background and working principles of high-rate experimental methods are presented to characterize the material response under high-rate loading conditions. Finally, rate-dependent material models are introduced to describe the dynamic material behavior and deformation mechanisms.

Learning Outcomes: 1. Express local equations of motion. 2. Derive one dimensional wave equations in solid materials. 3. Calculate elastic wave speeds in solids with and without constraints. 4. Understand and calculate local stresses as an elastic wave passes through an interface. 5. Understand and predict local stress concentrations resulted in from wave interactions. 6. Utilize elastic waves as loading methods and as diagnostic methods. 7. Design experiments to measure dynamic behavior of materials. 8. Determine dynamic yield strength of ductile materials in Taylor impact tests. 9. Determine plastic wave speeds in ductile material under intensive loading. 10. Understand shock wave propagation in solids. 11. Understand physics and calculate shock properties of materials. 12. Understand physical origins of plastic waves and shock waves. 13. Understand rate-dependent material models. 14. Conduct a thorough search of literature on a subject of interest. 15. Understand the critical issues of the subject of interest. 16. Identify research gaps in the subject of interest. 17. Present effectively a summary of the literature survey. Credits: 3.00

AAE 54600 - Aerospace Structural Dynamics And Stability

Credit Hours: 3.00. Dynamics of continuous systems: rod, beam, frame, and plate structures. General structural principles: virtual work, Hamilton's principle, Lagrange's equation, and Ritz method for discrete approximations. Modal analysis: eigenanalysis, mode shapes, mode superposition, and complex modes. Nonlinear vibrations: phase plane, Poincare, bifurcation plots, and chaos. Stability of the motion: classification of problems, follower loads, aerodynamic loads, divergence, flutter, pulsating compression, and gyroscopic systems.

Credits: 3.00

AAE 54800 - Mechanical Behavior Of Aerospace Materials

Credit Hours: 3.00. This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smartphones. In fact, breakthroughs with material research are often accompanied by rapid advancements in technology. Thus, it is paramount for all engineers to have an understanding of the structure and behavior of materials. In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and, ultimately, failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms. Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal-material levels and their use in explaining the deformation and failure characteristics in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of aerospace materials: metal alloys, ceramic-matrix composites, and fiber-reinforced polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, creep, and failure mechanisms; design criteria; special topics. We will attempt to have minimal overlap with AAE 55400,

Fatigue of Structures and Materials. Therefore we will not cover fracture, fatigue, or stress concentrators.

Learning Outcomes: 1. Express vector and tensor equations using indicial notation. 2. Express crystallography according to Miller indices and define slip systems in basic crystal structures. 3. Calculate and understand the physical basis of elastic anisotropy. 4. Understand, calculate, and use basic states of stress and yield criteria. 5. Define and understand the physical basis of point, line, and area defects in crystalline materials. 6. Calculate the strain fields, stress fields, and energy of dislocations, in addition forces between dislocations. 7. Understand dislocation motion as well as interactions between dislocations. 8. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 9. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 10. Understand origins of twinning, stacking faults, and the shape memory effects. 11. Understand physics and calculate strengthening influence of solutes, precipitates, grain boundaries, and strain hardening. 12. Understand physical origins of creep, calculate creep using Larson-Miller expressions, and use creep deformation mechanism map. 13. Understand origins of residual stress and apply to constrain problems. 14. Understand and apply statistical approaches to identify probability of failure and property variations. 15. Define and classify polymer structures. 16. Understand viscoelasticity and calculate behavior using classical models. 17. Distinguish physical mechanisms of polymer deformation, crazing, and fracture. 18. Express stiffness and strength of fiber reinforced composite structures. Credits: 3.00

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55100 - Design Theory And Methods For Aerospace Systems

Credit Hours: 3.00. Introduction to design theory, aerospace design process, design specification and requirements, concept generation and selection, design decomposition, improving designs, process design, and concurrent engineering. Design for assembly/manufacture. Projects allow for application and critical analysis of design methods.

Credits: 3.00

AAE 55200 - Nondestructive Evaluation Of Structures And Materials

Credit Hours: 3.00. Overview of methods employed for nondestructive evaluation of structures and materials taught in the context of damage tolerant structural analysis. Major inspection topics include: radiography, ultrasonics, eddy current, penetrant, magnetic, and visual/optical techniques. Other new emerging inspection techniques also are discussed. Offered in alternate years.

Credits: 3.00

AAE 55300 - Elasticity In Aerospace Engineering

Credit Hours: 3.00. A basic course in the theory of elasticity with emphasis on understanding the fundamental principles and solution techniques used in the stress analysis of structures. Cartesian tensors. Governing equations for linear elasticity. Rigorous derivation of beam and plate equations from the three-dimensional elasticity equations. Torsion. Thermoelasticity. The stress functions and complex functions approaches to two-dimensional problems. Energy methods and approximate solutions. Three-dimensional problems. Knowledge of differential equations assumed.

Learning Outcomes: 1. Give student an in-depth background in mechanics of solids including large deformation, and the ability to perform stress analyses in elastic bodies, especially two-dimensional bodies. Credits: 3.00

AAE 55400 - Fatigue Of Structures And Materials

Credit Hours: 3.00. Development and application of methods for predicting the fatigue life of structural components. Characterization and response of materials to cyclic loading.

Fatigue resistant design of aerospace structures. Both fatigue crack initiation and crack propagation concepts are discussed.

Credits: 3.00

AAE 55500 - Mechanics Of Composite Materials

Credit Hours: 3.00. Current and potential applications of composite materials. Review of elasticity of anisotropic solids. Methods for determining mechanical properties of heterogeneous materials. Static and dynamic analyses of laminated composites. Fracture and fatigue of laminates. Reliability, testing, and design of composites.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 55800 - Finite Element Methods In Aerospace Structures

Credit Hours: 3.00. Introduction to the use of advanced finite element methods in the calculation of deformation, strain, and stress in aerospace structures. Topics include: 1-D, 2-D, 3-D, and axisymmetric elements, isoperimetric element formulation, convergence, treatment of boundary conditions and constraints. Special topics include stability, dynamic analysis, and nonlinear material behavior. Emphasis is on the theoretical knowledge of the finite element method. Applied experience is gained by solution of aerospace structural analysis problems through use of professional software.

Credits: 3.00

AAE 56000 - System-Of-Systems Modeling And Analysis

Credit Hours: 3.00. Introduction to features of system-of-systems problems; problem definition tools; role of complexity; network topology analysis and agent-based simulation models; architecture analysis; metrics for multi-stakeholder problems; semester team projects allow students to exercise and critique such methods for analyzing system-of-systems problems. Some background in probability and statistics (e.g. random variables, probability density and distributions, sampling methods) is expected.

Learning Outcomes: 1. Introduce to modeling and analysis techniques for system-of-systems (SoS) problems in engineering. 2. Center on students' ability for understanding, modeling, and analyzing SoS problems, which consist of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. These problems are often large-scale and interdisciplinary, involving systems and behaviors found in diverse fields such as engineering, economics, social science, policy, etc. 3. Present developments in addressing system-of-systems problems, describes criteria, lexicon, and analysis methodology for their study, and, through semester-long team projects, allows students to explore the many unknowns that persist in this emerging field. 4. Know the major subjects covered: distinguishing traits of and behaviors of SoS problems, complexity and complex adaptive systems, agent-based modeling, modern network theory and analysis tools, modeling for decision-making, and exploratory modeling. Credits: 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 56700 - Introduction To Applied Stochastic

Processes

Credit Hours: 3.00. An introductory course in the concept of a discrete and continuous stochastic process based upon physical phenomena that originally gave rise to the specific stochastic models that are studies. Spectral analysis, response of time invariant systems to noise inputs. Estimation theory, Kalman and Winer filtering.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 59500 - Aerospace Seminar

Credit Hours: 0.00. An interdisciplinary seminar that provides a forum for invited speakers and staff to discuss new developments in practice and current research in aerospace engineering.

Credits: 0.00

AAE 59700 - Independent Study In Aerospace Engineering

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Special Topics in Aerospace Engineering course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

AAE 60700 - Variational Principles Of Mechanics

Credit Hours: 3.00. Basic concepts of analytical mechanics, calculus of variations, Hamilton's equations, Hamilton-Jacobi theory, canonical transformations. Offered in alternate years. Prerequisite: AAE 50700.

Credits: 3.00

AAE 61300 - Viscous Flow Theory

Credit Hours: 3.00. Compressible, laminar boundary layer theory; Buseman and Crocco integrals; skin friction and heat transfer. Introduction to turbulent boundary layers and transition phenomena. Advanced boundary layer theory; the method of inner and outer expansions. Boundary layers with chemical reaction; applications to hypersonic flow and combustion. Prerequisite: AAE 51100.

Credits: 3.00

AAE 61500 - Aeroacoustics

Credit Hours: 3.00. (ME 61500) Quantitative measures of sound (decibel) scales, spectra, energetics of acoustic motions, and measurement techniques. The wave theory of sound (basic equations and properties, sound propagation in homogeneous and inhomogeneous media, one-, two-, and three-dimensional sound fields, and distributed sources). Effects of source movement. Aerodynamic noise generation-acoustic analogy (Lighthill's equation and Ffowcs Williams-Hawkins equation). Introduction to Computational Aeroacoustics (CAA). Noise from turbulent shear flows (jet noise, cavity noise, and noise from flow over objects). Noise from turbomachinery, propellers, and rotors. Prerequisite: AAE 51100 or ME 50900 or ME 51300.

Credits: 3.00

AAE 62400 - Laminar-Turbulent Transition

Credit Hours: 3.00. Instability mechanisms, such as Kelvin-Helmholtz, Tollmien-Schlichting, Gortler, and crossflow. Secondary instabilities. Nonlinear and nonparallel effects; the Parabolized Stability Equations; receptivity; transition prediction. Effects of compressibility, heating, roughness, turbulence, noise, curvature, etc. Turbulent spots and the extent of transitional flow. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62600 - Turbulence And Turbulence Modeling

Credit Hours: 3.00. Physical description of turbulence. Reynolds averaged equations. Scaling of basic turbulent flows. Homogeneous turbulence, spectra and two-point correlations. Hierarchy of turbulence models, including zero-, one-, and two-equation models, Reynolds stress models, large eddy simulations, and direct numerical simulations. Additional topics, such as compressibility effects on turbulence and probability density function methods, as time allows. Prerequisite: AAE 51100.

Credits: 3.00

AAE 63200 - Advanced Orbital Dynamics

Credit Hours: 3.00. Discussion of more advanced concepts in astrodynamics. Includes fundamental theories from celestial mechanics, as well as trajectory determination and perturbation analysis with application to the motion of Earth-orbiting and interplanetary spacecraft. Assumes experience with the two-body problem. Offered in alternate years. Prerequisite: AAE 50700, AAE 53200.

Credits: 3.00

AAE 64200 - Graduate Professional Practice

Credit Hours: 0.00. Practice in industry and comprehensive written reports of this practice. Approval by the student's adviser or major professor and by the Graduate professional practice administrator. Prerequisite: Approval by the student's adviser or major professor and by the Graduate professional practice administrator. Permission of instructor required.

Credits: 0.00

AAE 64600 - Elastic Wave Propagation

Credit Hours: 3.00. Elastic wave propagation in rods, beams, and plates. Wave motion in semi-infinite bodies; Rayleigh, Lamb and Love waves. Pochhammer-Chree theory for rods. General properties of dispersive waves and approximation techniques. Impact. Wave front and ray methods. Introduction to wave propagation in anelastic and nonhomogenous media, and to large amplitude and shock waves. Prerequisite: AAE 55300 or ME 56300.

Credits: 3.00

AAE 64800 - Modeling Damage And Strengthening Mechanisms In Materials

Credit Hours: 3.00. The usage of materials is the backbone of engineering practice. Yet, advances in materials have stagnated due to overly conservative approaches, trial-and-error testing, and long qualification times. Material modeling offers tremendous opportunities to address these issues. This class offers advanced modeling strategies at the intersection of mechanics and materials science for both polycrystalline and composite materials. The course topics are defined as follows: First, advanced micromechanics analysis of modern engineering materials with emphasis on relating elastic microstructural phenomena to the mechanics of material behavior, via the Eshelby inclusion problem and its application to fiber reinforced composites. Second, classical plasticity is summarized via phenomenological and mathematical formulation of the constitutive laws, including yielding, yield surface; von Mises, Tresca yield criteria; Drucker's stability postulate; strain or work hardening, normality rule, perfect plasticity, and stress-strain law. Third, crystal plasticity is discussed, specifically physical and mathematical foundation for plasticity in crystalline materials, with a detailed description of the Bishop and Hill implementation of the Taylor model for deformation of polycrystals. Lastly, concepts of dislocations leading to strengthening mechanisms in metals are discussed: (i) by studying the anisotropy of material and elastoplastic properties at crystal level, microstructural basis for deformation in metals, polymers, and ceramics and (ii) failure mechanisms and toughening in metals, with primary emphasis on work/strain hardening, solid solution hardening, precipitate hardening, and grain boundaries. The course will be comprised of three projects, where the student chooses the topic of the third and final project. Prerequisite: AAE 55300 or equivalent.

Learning Outcomes: 1. Express displacement

field for an arbitrary elliptical inclusion via a Green's function. 2. Prove the stress/strain fields within inclusion is uniform. 3. Calculate Eshelby interaction tensor for arbitrary shape inclusion. 4. Express the stress/strain fields external to the inclusion. 5. Implement Eshelby problem via Mori-Tanaka approach and apply to stiffness of composites. 6. Express interaction energy of inclusion. 7. Understand physical basis of plasticity. 8. Express yield surface and associated criteria via stress invariants and on the Pi-plane. 9. Express flow rules for evolution of the yield surface and implement into principal of virtual velocities. 10. Express convexity and normality constraints. 11. Express crystal orientation as a series of rotations and express via a pole figure representation. 12. Identify texture of materials 13. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 14. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 15. Calculate the Taylor factor, geometric hardness of a polycrystalline material. 16. Express grain orientation evolution, via an exponential mapping. 17. Implement the Taylor model within a Bishop and Hill implementation to express texture evolution of polycrystalline materials. 18. Understand and express kinetics (strain rate and temperature) into deformation via thermodynamic expressions. 19. Model work hardening in crystalline materials. 20. Understand the physical origins and model incompatibilities. 21. Define grain boundary structure and their affect on mechanical behavior. 22. Apply concepts learned from this class into a research project of the student's choice. Credits: 3.00

AAE 65400 - Fracture Mechanics

Credit Hours: 3.00. Methods of stress analysis in elastic media containing cracks. Fracture criteria. The strain energy release rate and J-integral. Crack tip plasticity. Interface cracks. Cracks in anisotropic solids. Bending of cracked plates. Dynamic crack propagation. Prerequisite: AAE 55300.

Credits: 3.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

AAE 67500 - Advanced Signals And Systems For Satellite Navigation

Credit Hours: 3.00. Fundamental theory of ranging signal design. Generation of pseudorandom noise. Methods for detecting, tracking, and estimating delay using ranging signals. Probability of detection, probability of false alarm, and tracking threshold derived from a stochastic signal model. Models for multiple access, quantization, clock and multipath errors. Examples drawn from present-day Global Navigation Satellite Systems (GNSS). Prerequisites: ECE 60000, AAE 56700, or equivalent (Random Variables and Stochastic Processes).

Learning Outcomes: 1. Understand current literature in radio navigation signal processing. 2. Develop signal processing algorithms for radio navigation applications. 3. Predict performance of radio navigation signal processing algorithms. 4. Implement radio

navigation signal processing algorithms in a software-defined radio, using a programming language such as MATLAB. Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

AAE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

African American Studies

AAS 27100 - Introduction To African American Studies (UCC: HUM)

Credit Hours: 3.00. Introduction to the philosophical and methodological principles underlying Afro-American studies. Dimensions of the black experience, including history, education, politics, psychology, economics, religion, social organization, and art, will be covered, and the requisite academic tools and sources will be examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AAS 27700 - African American Popular Culture

Credit Hours: 3.00. This course focuses on the production of popular culture through African-based and non African-based traditions among African Americans in the United States. Pop culture forms covered include film, theatre, visual arts, literature, dance, sports, music and religious traditions.

Credits: 3.00

AAS 35900 - Black Women Writers

Credit Hours: 3.00. (ENGL 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

AAS 37100 - The African American Experience

Credit Hours: 3.00. Focus on specific topics of the personal experiences of blacks, in Africa and the diaspora, including black identity, black culture, and the relationships between blacks and society.

Credits: 3.00

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 39200 - Caribbean History And Culture

Credit Hours: 3.00. This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 47400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers research techniques used by researchers to observe and to interpret scholarly investigation on race, class and gender from an African-American perspective.

Credits: 3.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African

Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 57400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers techniques used by researchers and to interpret scholarly investigation on race, class and gender from an African American perspective.

Learning Outcomes: 1. Critically analyze & synthesize theoretical paradigms of the African American Experience. 2. Apply research methods associated with African American Studies . 3. Enhance interpretive skills. 4. Conduct ethical research. 5. Enhance critical thinking. Credits: 3.00

AAS 57500 - Theories Of African American Studies

Credit Hours: 3.00. This course addresses the development of an African American intellectual tradition. The course will span disciplines and swathes of time in order to understand how scholars not only created new ideas but developed theories that shaped and changed academic inquiry.

Learning Outcomes: 1. Critically analyze & synthesize Theoretical Paradigms of the African American experience. 2. Present material clearly and facilitate discussion. 3. Enhance interpretive skills. 4. Conduct ethical research. Credits: 3.00

AAS 59000 - Directed Readings In African American Studies

Credit Hours: 1.00 to 4.00. This directed readings course allows students to work with African American Studies faculty on work that cannot be achieved through one of the regular course offerings. This is a variable topics course that can be satisfied through individual course work with an instructor. A student wishing to earn such credit is required to obtain permission of the instructor in order to enroll for the course. This does not include work for thesis or dissertation projects. Permission of instructor required.

Learning Outcomes: 1. Analyze and synthesize theoretical paradigms involving the African American experience. 2. Enhance interpretive and critical thinking skills. 3. Develop and understand the methodological approaches employed in gathering data, and in presenting material clearly to facilitate discussion. Credits: 1.00 to 4.00

AFT-Aerospace Studies

AFT 11000 - Heritage And Values I

Credit Hours: 1.00. A survey course designed to introduce students to the United States Air and Space Forces and provides an overview of the basic characteristics, missions, and organization of the Air and Space Forces.

Learning Outcomes: 1. Describe general aspects of the Department of the Air Force. 2. Describe leadership fundamentals for Air Force Officers. 3. Identify service benefits and opportunities for officers serving in the Air Force. 4. Explain the history and evolution of the United States Air Force and Space Force. 5. Demonstrate fundamental written and verbal communication skills. Credits: 1.00

AFT 12000 - Heritage And Values II

Credit Hours: 1.00. A survey course designed to introduce students to the United States Air and Space Forces and provides an overview of the basic characteristics, missions, and organization of the Air and Space Forces.

Learning Outcomes: 1. Describe general aspects of the Department of the Air Force. 2. Describe leadership fundamentals for Air Force Officers. 3. Identify service benefits and opportunities for officers serving in the Air Force. 4. Explain the history and evolution of the United States Air Force and Space Force. 5. Demonstrate fundamental written and verbal communication skills. Credits: 1.00

AFT 20220 - Air Force ROTC Leadership Laboratory

Credit Hours: 1.00. Leadership Laboratory (LLAB) is a dynamic and integrated grouping of leadership developmental activities designed to meet the needs and expectations of prospective Department of the Air Force second lieutenants and to complement the AFROTC academic program. It is a student planned, organized, and executed practicum conducted under the supervision of the Detachment Commander and Operations Flight Commander.

Learning Outcomes: 1. Explain and practice the Air Force Core Values - Integrity First, Service before Self, and Excellence in All We Do. 2. Discuss characteristics of the Air/Space Force way of life. 3. Practice basic leadership, followership, and teamwork skills. 4.

Demonstrate the mental and physical skills necessary to succeed in the AFROTC Field Training Environment. 5. Apply intermediate leadership, followership, and teamwork skills. Credits: 1.00

AFT 23000 - Team And Leadership Fundamentals I

Credit Hours: 1.00. Provides a fundamental understanding of both leadership and team building. The lessons and course flow are designed to prepare students for field training and leadership positions in the detachment.

Learning Outcomes: 1. Explain Air Force core values. 2. Discuss examples of how Air Force core values were used throughout Air and Space Force history. 3. Describe the employment of Air and Space power from institutional, doctrinal, and historical perspectives. 4. Demonstrate basic Air Force verbal and written communication skills. Credits: 1.00

AFT 23100 - Air Force ROTC Leadership Laboratory III

Credit Hours: 1.00. Cadets experiment with and develop leadership/management skills. Study of Air Force customs and courtesies, drill and ceremonies, and giving military commands; instructing, correcting, and evaluating the preceding skills, and study the Air Force officer environment.

Credits: 1.00

AFT 24000 - Team And Leadership Fundamentals II

Credit Hours: 1.00. Provides a fundamental understanding of both leadership and team building. The lessons and course flow are designed to prepare students for field training and leadership positions in the detachment.

Learning Outcomes: 1. Explain Air Force core values. 2. Discuss examples of how Air Force core values were used throughout Air and Space Force history. 3. Describe the employment of Air and Space power from institutional, doctrinal, and historical perspectives. 4. Demonstrate basic Air Force verbal and written communication skills. Credits: 1.00

AFT 35100 - Leading People And Effective Communication I

Credit Hours: 3.00. Leading People and Effective Communication utilizes student's field training experience to take a more in-depth look at leadership. Special emphasis is placed on enhancing communication skills, and why that is important as a leader. Students have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

Learning Outcomes: 1. Compare and contrast individual leadership skills and approaches. 2. Analyze personal leadership strengths and weaknesses. 3. Explain the responsibility and authority of an Air Force officer. 4. Explain Air Force officer's duties and responsibilities as a subordinate leader. 5. Practice the Air Force officer's responsibilities in the counseling and feedback process. 6. Evaluate and apply concepts of ethical behavior. 7. Evaluate and analyze concepts, principles, and theories of quality in Air Force leadership and management. 8. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. Credits: 3.00

AFT 36100 - Leading People And Effective Communication II

Credit Hours: 3.00. Leading People and Effective Communication uses the student's field training experience to take a more in-depth look at leadership. Special emphasis is placed on enhancing communication skills, and why that is important as a leader. Students have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

Learning Outcomes: 1. Compare and contrast individual leadership skills and approaches. 2. Analyze personal leadership strengths and weaknesses. 3. Explain the responsibility and authority of an Air Force officer. 4. Explain Air Force officer's duties and responsibilities as a subordinate leader. 5. Practice the Air Force officer's responsibilities in the counseling and feedback process. 6. Evaluate and apply concepts of ethical behavior. 7. Evaluate and analyze concepts, principles, and theories of quality in Air Force leadership and management. 8. Demonstrate listening, speaking, and writing skills in Air Force-specific

formats. Credits: 3.00

AFT 40220 - Air Force ROTC Leadership Laboratory

Credit Hours: 1.00. Leadership Laboratory (LLAB) is a dynamic and integrated grouping of leadership developmental activities designed to meet the needs and expectations of prospective Department of the Air Force second lieutenants and to complement the AFROTC academic program. It is a student planned, organized, and executed practicum conducted under the supervision of the Detachment Commander and Operations Flight Commander.

Learning Outcomes: 1. Demonstrate the supervision, management, and leadership skills expected of an Air/Space Force Officer. 2. Apply and evaluate advanced leadership, followership, and teamwork concepts. 3. Plan to transition from the AFROTC environment to that Active Duty Service environment. 4. Apply and evaluate the advanced supervision, management, and leadership skills expected of an Air/Space Force Officer. Credits: 1.00

AFT 47100 - National Security, Leadership Responsibilities, And Commissioning Preparation I

Credit Hours: 3.00. National Security/Commissioning Preparation is designed for college seniors and gives them the foundation to understand their role as military officers and how they are directly tied to our National Security Strategy. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

Learning Outcomes: 1. Describe the basic elements of national security policy and process. 2. Identify the basic Air Force and Space Force warfighting domains. 3. Describe the roles of the military in society. 4. Discuss current domestic and international issues affecting the military profession. 5. Describe fundamental provisions of the military justice system. 6. Describe the responsibility, authority, and functions of an Air Force commander. 7. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. 8. Plan for life as a second lieutenant. Credits: 3.00

AFT 48100 - National Security, Leadership Responsibilities, And Commissioning Preparation II

Credit Hours: 3.00. National Security/Commissioning Preparation is designed for college seniors and gives them the foundation to understand their role as military officers and how they are directly tied to our National Security Strategy. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

Learning Outcomes: 1. Describe the basic elements of national security policy and process. 2. Identify the basic Air Force and Space Force warfighting domains. 3. Describe the roles of the military in society. 4. Discuss current domestic and international issues affecting the military profession. 5. Describe fundamental provisions of the military justice system. 6. Describe the responsibility, authority, and functions of an Air Force commander. 7. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. 8. Plan for life as a second lieutenant. Credits: 3.00

Agricultural and Biological Engineering

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common

to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 20200 - Thermodynamics In Biological Engineering

Credit Hours: 3.00. Thermodynamic principles and their applications to biochemical and biological systems with emphasis on the second law of thermodynamics and use of molecular interpretations of energies and entropies. Concept of entropy balances and process efficiency. Free energy and chemical equilibrium. Equilibrium between phases, colligative properties, binding of ligands and formation of biological membranes. Molecular motion and transport properties and their application in biochemical analytical methods. Development of physical chemical problem solving skills using MathCad and MatLab software.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations to macro scale thermodynamic processes. 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering disciplines (First & Second Law of Thermodynamics; Open vs closed systems o Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility; Path dependence/independence). 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with bioprocesses. 4. Solve multiphysics and multi-scale problems for thermodynamic processes using the computer. 5. Develop the attitudinal dimensions of computational thinking. 6. Gain experience in working with non-linear systems and systems away from equilibrium. Credits: 3.00

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and

engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting pertinent information from scientific journal articles. Credits: 2.00

ABE 28100 - Professional Internship

Credit Hours: 0.00. Supervised professional experience in agricultural and biological engineering. Program conducted under the direction of an engineering faculty member and with the cooperation of an employer. Student submits a summary report. Permission of department required.

Credits: 0.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS)

Credits: 1.00

ABE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in

biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

ABE 30200 - Biochemical Laboratory Techniques For Biological Engineers

Credit Hours: 1.00. Experiments that introduce methods for analysis and recovery of biological molecules and that utilize the mathematical concepts to manipulate collected data. Introduction to engineering experimental design.

Learning Outcomes: 1. Perform statistical analysis on collected data to produce results to be interpreted and disseminated both written and orally. 2. Demonstrate proficiency in the following lab skills: Read and understand both digital and analog outputs; Liquid handling and dilutions; Protein purification and determination assays; Column chromatography; Spectrophotometric assays; Enzyme activity assays. 3. Understand and apply scientific methods of experimental design and analysis. Credits: 1.00

ABE 30300 - Physical Chemistry In Biological Engineering

Credit Hours: 3.00. Physical chemical principles associated with transport of mass, momentum and energy in bioprocesses. Principles for measuring physical chemical properties, a description of predictive equations for their evaluation and the role of these principles in the design and optimization of bioprocesses.

Learning Outcomes: 1. Design complex engineering problems by applying physical chemistry. 2. Explain the principles of characterizing biological materials using physical and optical techniques. 3. Determine the appropriate methods to characterize or purify biological materials based on their physical properties. 4. Predict the results of a spectroscopic technique based on the optical properties of materials and vice versa. Credits: 3.00

ABE 30400 - Biological Engineering Laboratory

Credit Hours: 3.00. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Learning Outcomes: 1. Understand and analyze the flow behavior in biological systems. 2. Understand and analyze enzymatic reasons in biological systems. 3. Understand and analyze fermentation processes. 4. Understand and analyze mixing and heat transfer in biological systems. 5. Collect and analyze rheological properties. 6. Design and safely execute experiments in a process laboratory. 7. Collection and statistical analysis of experimental data. 8. Present the results of analysis in the form of written report and oral presentation. Credits: 3.00

ABE 30500 - Physical Properties Of Biological Materials

Credit Hours: 3.00. Physical properties of agricultural crops and food products and their relationship to harvesting, storage, and processing. Physical properties covered include: density, shape, moisture content, water potential, water activity, friction and flow or particulate solids, terminal velocity, thermal properties,

interaction with electromagnetic radiation, and viscoelastic behavior of solids.

Credits: 3.00

ABE 30700 - Momentum Transfer In Biological Engineering

Credit Hours: 3.00. Fluid statics, Newton's law of viscosity, shell momentum balances, equations of continuity and motion, one dimensional flow problems, flow through porous media, velocity distributions with more than one independent variable, two dimensional flow through a channel, stream function, velocity potential, dimensional analysis, boundary layer, turbulent flow, Reynolds stress, form and skin friction, application of macroscopic momentum and mechanical energy balances to engineering problems.

Learning Outcomes: 1. Know the principles of fluid statics. 2. Know the principles of dimensional analysis for analysis of flow problems. 3. Know the characteristics and analysis of the flow of food and biological fluids. 4. Gain an understanding of the principles of turbulent flow. 5. Know how to apply macroscopic mass and momentum balances to flow problems in food and biological systems. Credits: 3.00

ABE 30800 - Heat And Mass Transfer In Biological Engineering

Credit Hours: 3.00. Principles of transport of energy and mass. Mechanisms of heat transfer, heat conduction, heat convection and heat radiation. Development of applications using macroscopic and microscopic balances of energy. Application of thermal energy balances and Fourier's Law to describe steady state and transient conduction applications including heat generation. Effect of the geometry on these processes. Basic principles of design of heat transfer equipment and its operation. Application of species mass balances and Fick's Law to steady state and transient diffusion problems. Effect of geometry on these processes. Analogies between transport of momentum, heat and mass applications to the solution of practical problems in the Food Process and Biological Engineering fields.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multidisciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. Have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. A recognition of the need for, and an ability to engage in life-long learning. 8. A knowledge of contemporary issues. 9. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 32000 - Solid Modeling, Simulation, And Analysis

Credit Hours: 3.00. Introduction to parametric, feature-based solid modeling; dimensioned 2D and 3D engineering drawings; tolerancing; mechanical dynamic simulation; kinematic models, analysis and simulation of simple linkages and complex systems; mechanism design and evaluation; visualization and animation of results; interfacing of computer aided engineering software. Projects involving industrial parts and assemblies will be discussed and assigned.

Credits: 3.00

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired goal subject to constraints. Credits: 4.00

ABE 32700 - Biotechnology Laboratory II

Credit Hours: 2.00. The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (http://www.hhmi.org/grants/sea/) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (www.phagesdb.org and the Purdue institution page can be found here: https://phagesdb.org/institutions/PURD/).

Learning Outcomes: 1. Analyze the genetic code of a unique phage in order to determine potential genes. 2. Discover the genomic organization of their unique phage. 3. Use algorithms to define potential genes, assign putative functions to them, and determine the order in which they appear in the genome. 4. Read and discuss scientific literature related to their research project. 5. Share the information gathered with others in the scientific community. Credits: 2.00

ABE 33000 - Design Of Machine Components

Credit Hours: 3.00. Introduction to design; stress analysis; deformation and stiffness considerations; static and fatigue strength design; design of components of the food processing, farm and off-highway machines, and mechanical systems.

Credits: 3.00

ABE 35100 - Microbes In Germany

Credit Hours: 3.00. Since before pre-history, microorganisms have been responsible for what we now recognize as biotechnology applications-initially used for beverage applications including beer and wine-making and expanding to food applications like leavening dough for bread, or preserving food through pickling. Today, modern fermentation is a multibillion-dollar industry that includes a variety of sectors from foods to pharmaceuticals. This course will explore a range of industrial facilities to produce enzymes, pharmaceuticals, foods, and commodity chemicals. We will travel to various parts of Germany to explore these sectors.

Learning Outcomes: 1. Understand, describe, and calculate quantitative features of microbial biotechnology. 2. Appreciate German cultural heritage through cultural experiences and discussions. 3. Reflect thoughtfully on the cultural differences and similarities of America and Germany through writing blogs posts and commenting on the posts of peers. Credits: 3.00

ABE 37000 - Reaction Kinetics In Biological Engineering

Credit Hours: 3.00. This course will introduce students to the tenets of kinetics/rates of chemical/biochemical reactions. Reaction rate models will be developed and used to design basic ideal reactors and non-ideal flow reactors. Models for homogeneous, heterogeneous, and catalytic reactions will be developed and used to develop reactor designs. A variety of computational numerical modeling skills will be used in the solution of these models, including numerical interpolation, and numerical solution of set of differential equations. MatLAB software programming tools will be used by students for computational analysis.

Learning Outcomes: 1. Gain an understanding of the basic concepts of reaction kinetics for chemical and biochemical systems. 2. Gain an understanding of basic engineering reactor design models. 3. Gain an understanding of the application of kinetic models to reaction processes involving diffusive and convective mass transport. 4. Understand how kinetic reaction and reactor design models are applied to food and biological engineering processes. 5. Apply mathematical skills to developing analytical and numerical solutions. Credits: 3.00

ABE 38199 - Professional Practice Coop I

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of department required. Professional Practice

students only.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry

principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 40600 - Ag/Biol Engineering Ambassador Leadership Seminar

Credit Hours: 1.00. Students engage in a weekly seminar/lab that includes topics such as leadership, professional skills, teamwork, engaging audiences and Purdue culture. Students utilize these skills while representing the Department of Agricultural and Biological Engineering to current and prospective students, alumni, donors, legislators, and other supporters of Purdue' Agricultural and Biological Engineering department. Students must be selected as an ABE Ambassador. Permission of department required.

Learning Outcomes: 1. Provide students with theoretical and experiential basis from which they may acquire and enhance their knowledge and skills in the areas of leadership principles and models; instructional techniques; curriculum/program design; Purdue structure, culture, and engineering education opportunities; and, personal/professional effectiveness, including teamwork and public speaking. 2. Provide students with the opportunity to develop effective engagement skills that will enable to effectively communicate, through hands-on learning experience, engineering/technology skills and concepts to youth and adults. 3. Provide students with the skills to successfully develop, implement and evaluate educational programs designed for specific audiences. Credits: 1.00

ABE 42500 - Water Quality Engineering

Credit Hours: 3.00. This course provides in-depth perspectives on water quality in source and environmental water systems (lakes, rivers, groundwaters, and coastal waters) including sources and causes of water quality impairments and design of workable and cost-effective management solutions. The course integrates hydrology, chemistry, biology, and ecology as foundations of water quality management and incorporates operation mechanisms of management practices in designing solutions for pollution control. Students will have opportunities to engage with lectures, water quality measurements and data analysis, computer modeling, case studies, design, and discussion sessions.

Learning Outcomes: 1. Identify causes and sources of water quality impairments. 2. Explain the health, ecological, and societal consequences of impaired waters. 3. Collect in-field water quality measurements. 4. Analyze water samples and associated data. 5. Design watershed-based solutions for pollutant control and water quality protection. Credits: 3.00

ABE 42600 - Ecological Restoration Engineering

Credit Hours: 3.00. This course focuses on ecologically-based design principles to restore degraded ecosystems, specifically wetlands, stream/floodplains, and prairies. Students will identify and synthesize design elements, natural and anthropogenic stresses, and management considerations to develop resilient restoration designs. Laboratory experience provides open-ended projects, data collection, and field trips to reinforce the design process.

Learning Outcomes: 1. Identify and synthesize design elements, natural and anthropogenic stresses, and management considerations for restored streams, floodplains & riparian zones, wetlands, and prairies. 2. Apply governing principles of ecological engineering, including biological, chemical, and physical conditions to develop resilient restoration designs. 3. Characterize and give examples of ecological concepts, such as water and elemental cycling, vegetation succession, food web dynamics, and ecological disturbance and how they apply to monitoring restoration success. 4. Read and extract key findings from readings. 5. Communicate effectively in written and oral

format to a wide audience. Credits: 3.00

ABE 43500 - Hydraulic Control Systems For Mobile Equipment

Credit Hours: 3.00. Design of basic fluid power components and systems. Includes power steering, hydrostatic and hydromechanical transmission, electrohydraulic servo valves, servomechanism, and manually controlled systems.

Credits: 3.00

ABE 44000 - Cell And Molecular Modeling In Biological Engineering

Credit Hours: 3.00. This course examines the design principles underlying the organizations and dynamics of biological networks with an emphasis on genetic/molecular circuits. Topics include the structure and tuning of network motifs and relationship to performance parameters such as robustness to internal noise, temporal response, noise filtering, bi-stability, pattern generation and temporal programs. Examples are presented from the study of natural systems and the design of new synthetic systems.

Learning Outcomes: 1. Understand, describe, and calculate quantitative features of biological networks. 2. Create simple, mechanistic models of gene expression. 3. Identify different types of networks motifs in biological networks. 4. Describe when particular motifs would be useful for specific types of biological functions. 5. Ananlyze the dynamics and steady state behavior of simple transcriptional motifs or gene circuits. 6. Tune the parameters of a genetic circuit to design a particular behavior such as a temporal program, an asymmetric, or a bistable switch. 7. Design and characterize a transcriptional motif or genetic to result in a particular function, behavior of feature such as robustness, noise filtering, or patterning. 8. Understand the importance of and describe the basic requirements for generating oscillations in cells. Credits: 3.00

ABE 44400 - Design And Advanced Manufacturing Processes For Internal Combustion Engines

Credit Hours: 3.00. This course introduces the manufacture and assembly of machined piece parts into a functional assembly. The creation of a prototype internal combustion engine will be utilized as the base project for the course, and students will design and create the parts and final assemblies. Students will be given a background on the process flow of modern manufacturing by general metal machining processes, manual machine tool operation, digital machine tool programming, numerical machine tool operation, the measurement of critical machining output variables, and the assembly of piece parts into subassemblies and final products. Course participants will work as a team to develop their production parts, final presentation, and final report.

Learning Outcomes: 1. Identify and understand the forces present on various components of internal combustion engines (ABET 1). 2. Design specific components for internal combustion engines and plan for their manufacture (ABET 1). 3. Identify the sequence of machining operations for the construction of engine components (ABET 1). 4. Download specific instructions to numerically controlled machines to execute manufacturing instructions for specific parts (ABET 1). 5. Perform specific operations on traditional machine tools to create specific engine parts (ABET 1). 6. Understand how to measure critical dimensions in manufactured parts (ABET 1). 7. Understand the concepts of component assembly to create a functional device (ABET 2). 8. Understand the safety concerns of machine shops and how to mitigate danger to personnel and equipment (ABET 4). 9. Spread workloads between colleagues, assist one another in self-learning, and collaborate to meet collective course objectives (ABET 5). 10. Understand the concepts of professionalism, ethical responsibility, and integrity when applied to technical projects (ABET 4). 11. Enhance written and oral communication skills through the production of a comprehensive final report and summary technical presentation (ABET 3). Credits: 3.00

ABE 45000 - Computational Modeling And Data Analysis In Agricultural Engineering

Credit Hours: 3.00. The course is divided into three sections. Students will (1) learn about first and second-order dynamic systems, block diagrams, modeling of mechanical and electrical systems, and control theory while using Matlab and Simulink for modeling; (2) Learn about numerical methods for modeling of continuum mechanics and transport phenomena including finite

element method and finite difference method. Applications in heat transfer, fluid flow, and solid mechanics will be studied in the computer lab; (3) Learn about data analysis topics including statistical models, probability theory, regression analysis, classification techniques, and machine learning.

Learning Outcomes: 1. Understand the fundamentals of dynamic systems modeling. 2. Create block diagram models for mechanical and electrical systems. 3. Understand control theory concepts and use it to design controllers. 4. Understand the fundamentals of finite element method and finite difference method including 1-D and 2-D formulations, boundary conditions, and postprocessing. 5. Use a major FEA software tool. 6. Evaluate the accuracy of the results. 7. Understand probability theory and regression analysis. 8. Explore classification techniques and machine learning concepts. 9. Apply data analysis skills to real-world datasets.

Credits: 3.00

ABE 45300 - Leadership In Biotechnology

Credit Hours: 1.00 to 3.00. This course provides students who have completed the research experience in ABE biotechnology laboratory courses an opportunity to continue their professional development by serving as peer leaders in the classroom. The ABE biotechnology laboratory courses are part of the Howard Hughes Medical Institute's (HHMI) Science Education Alliance and provide an authentic laboratory research experience with the students engaged in hands-on discovery as a scientist with the ultimate objective of contributing new viral genomes to the scientific literature and public databases. As part of the model for implementing the course-based undergraduate research experience in the biotechnology laboratory courses, senior-level students that successfully completed those courses serve as peer leaders in the classroom. Peer leaders attend the course section along with the currently enrolled students and build competencies in leadership by guiding their team on their research project throughout the semester. Permission of instructor required.

Learning Outcomes: 1. Mentor peers in the use of scientific practices. 2. Guide peers through the process of discovery including iteration as their team isolates and characterizes a unique mycobacteriophage and designs a phage synthetic biology research project. 3. Mentor peers in collaboration by guiding their efforts to work productively together on a team and communicate the results of their project.

Credits: 1.00 to 3.00

ABE 45700 - Unit Operations In Biological Engineering

Credit Hours: 3.00. Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipe flow, pumps, mixing, emulsification, extrusion, sheeting, heat exchanges, aseptic processing, sterilization, freezing, and evaporation.

Learning Outcomes: 1. Gain and understand the principles, design and analysis of biological and food process engineering operations. 2. Know the characteristics and analysis of the flow of biological fluids. 3. Gain an understanding of the principles, design and analysis of thermal processing operations. 4. Gain an understanding of the principles and analysis of freezing. Credits: 3.00

ABE 46000 - Sensors And Process Control

Credit Hours: 3.00. Fundamental aspects of transducers, biosensors, instrumentation, and computer control are presented, with particular emphasis on sensors and controls used in agricultural, biological, and food applications. Laboratory and pilot plant scale computer controlled equipment is used to examine response of process variables, sensor calibration, control system modeling, and controller selection and tuning. Prerequisite: differential equations and a course in either heat transfer or fluid mechanics.

Credits: 3.00

ABE 48400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Credits: 1.00

ABE 48500 - Agricultural Engineering Project Management And Design

Credit Hours: 4.00. Team based projects are completed during the semester and documented with a written report and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or

a machine system. 2. Write a comprehensive design report and/or project report for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams which include government, and industry engineers and marketing personnel supporting the specific projects. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering practice with professionalism and ethical responsibility. Credits: 4.00

ABE 48600 - Agricultural Engineering Design

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ABE 48400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive design report and/or project reports for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams with consultation available to students from government and industry engineers and marketing personnel. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering or project management practice with professionalism and ethical responsibility. Credits: 3.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

ABE 49500 - Select Topics In Agricultural And Biological Engineering

Credit Hours: 1.00 to 3.00. Credit and hours to be arranged. Special topics and projects of contemporary importance or of special interest that are outside the scope of the standard agricultural and biological engineering curriculum. The specific topic that is offered will be indicated on the student's record. A written report and oral presentation of final results are required. Permission of instructor required.

Credits: 1.00 to 3.00

ABE 49800 - Undergraduate Research In Agricultural And Biological Engineering

Credit Hours: 1.00 to 3.00. Credit and hours to be arranged. Individual research projects for students with the approval of their advisors. Requires prior approval of, and arrangement with, a faculty research advisor. A written report and public oral presentation of final results are required. Permission of instructor required.

Credits: 1.00 to 3.00

ABE 50100 - Welding Engineering

Credit Hours: 3.00. Design of weldments and modeling of heat transfer and residual stresses of the welding processes. Finite element theory of nonlinear properties for the many processes including laser, submerged arc, manual, Gas Tungsten Arc Welding (GTAW), plasma, and electron beam. Metallurgy topics include continuous cooling transformation curves in optimizing engineered joint strength, including cutting and welding. Offered in alternate years.

Learning Outcomes: 1. Analyze and effectively discuss positive and negative sides of major welding processes and make a sound choice of the most appropriate welding process for the given requirements. 2. Analyze and critique currently accepted theories of heat transfer and rapid solidification applied to welding processes. 3. Predict development of microstructure in the weld and residual stresses in the welded structure. Analyze the evolution of microstructure and segregation in the three main zones of welded joints. 4. Design the geometry of welded joints and determine proper welding parameters. 5. Recognize and analyze major welding defects, know inspection methods used to detect them, the major causes for their occurrence, and measures for their prevention or correction. Credits: 3.00

ABE 50300 - Surface Properties And Powder Performance Of Microparticulate Systems

Credit Hours: 3.00. Material Surface Science is the study of properties that occurs at the interface of two phases. Surface

phenomena needs to be addressed to understand and manipulate the behavior of particulate materials. Probing particulate surface properties at the nano- and micro-level helps to relate these to the macroscale powder performance. The main focus of this course is on the application of surface analytical techniques for assessing the physical and chemical factors that dictate particulate interactions in various food, pharmaceutical, biological, mineral, environmental (soil and water) and aerosol systems. This course will provide the student both a broad overview of the state-of-the-art analytical tools available to assess particulate surfaces and a fundamental insight into the characteristic behavior of system of particles. This course is unique because the student will learn and articulate how surface, physical, chemical and bulk properties are relevant in the performance of microparticulate systems of his/her interest.

Learning Outcomes: 1. Identify the state-of-the-art surface characterization techniques to probe materials. 2. Analyze data, interpret the results and hypothesize complex properties for surface characteristics and material interfaces. 3. Assess surface and physicochemical properties of microparticulates associated with powder behavior. 4. Articulate and propose relationships between surface properties (composition, interactions, functionality) and performance of various particulate systems. Credits: 3.00

ABE 50501 - Particle, Powder, and Compact Characterization

Credit Hours: 2.00. The goal of this course is to familiarize students with the properties and methods used to characterize the physical and mechanical behavior of particles, granules, and compacts with the intention of using these properties for process and performance design.

Learning Outcomes: 1. Define and describe the significant properties of particles, granules, powders, and compacts. 2. Explain how these properties are measured. 3. Illustrate how these properties influence the performance of particle-based products and manufacturing processes. 4. Create a computational or a web-based tool that demonstrates or implements concepts from the course. Credits: 2.00

ABE 50502 - Particles, Powders, And Compact Characterization Laboratory

Credit Hours: 1.00. The goal of this laboratory course is to train students on state-of-the-art laboratory equipment used to measure the mechanical properties of particles, granules, powders, and compacts.

Learning Outcomes: 1. Follow laboratory safety guidelines. [6] 2. Operate common laboratory equipment and follow standard operating procedures used to measure the mechanical properties of particles, granules, powders, and compacts. [6] 3. Plan and perform measurements, analyze results, and summarize the results in a written report. [3,5,6] Credits: 1.00

ABE 51100 - Drug Development

Credit Hours: 3.00. A review of drug discovery and drug development, with emphasis on the regulatory aspects of these activities. Animal preclinical research and human clinical research are discussed in detail. In addition, the process for the assembly of an IND and NDA is discussed along with the Phases (I,II,III) of human clinical trials. The CMC (chemistry manufacturing and control) aspects of drug development are presented along with ICH documents and manufacturing process analytical technologies. The course concludes with a brief review of international regulatory issues and patents.

Learning Outcomes: 1. Comprehend strategies used for biotechnology innovation: regulatory and quality documents and materials in the areas of drug development and discovery. 2. Ability to meld theory and practice. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use data, media and computers to send and respond effectively to communication for varied audiences and purposes. 5. Demonstrate sensitivity to and facility with personal values and ethical principles in professional and social contexts. Credits: 3.00

ABE 51200 - Good Regulatory Practices

Credit Hours: 3.00. Includes a review of the FDA and ICH regulations on good manufacturing, good laboratory, good clinical practices. The meaning of these regulations, the globalization of practices and the roles and responsibilities of various professionals implementing these regulations will be

addressed. Special emphasis will be detailed coverage of the process for the assembly and submission of an IND or NDA, and the function of the regulatory affairs department in a pharmaceutical company.

Learning Outcomes: 1. Identify cGMP regulations, and relationship to maintaining control of the chemical and ultimately the drug product with a focus on Phase 3, product introduction, and post marketing. 2. Examine about the regulatory history of the FDA and the GxP framework. 3. Identify NDA and BLA applications, product control including specifications, quality outcomes, critical quality attributes, and ICH framework. 4. Evaluate the regulations governing the manufacture of drug products, including the methods used to prove this, validation of those methods, validation of the manufacture, quality by design, comparability protocols, and continuous improvement. 5. Identify and evaluate compliance to GMP and warning letters. 6. Evaluate Good Distribution Practices (GDP) and the integration of supply chain controls into the Quality Management System. 7. Learn GCP, clinical regulations, and relationship to ensuring the drug or device is safe and efficacious. 8. Evaluate and describe basic clinical trial design and how to write the investigator's brochure that informs patients (through the informed consent document that they sign) of clinical information. 9. Examine the rigid control that governs the clinical protocols and processes such as compliance oversight procedures, the role of clinical auditors and the process of auditing a clinical trial to ensure that it is done right. 10. Identify about the impact of technology and patient involvement in clinical trials through online resources, such as clinicaltrials.gov, YouTube instruction videos including videos describing GCP for devices. 11. Summarize the impact of recent adverse clinical trial events with innovative applications such as in biologics (Tegerno) and gene therapy (Gelsinger). Students will also identify and describe the role of approved Risk Evaluation and Mitigation Strategies (REMS), pharmacovigilance programs and adverse drug event reporting. 12. Identify and evaluate GLP and regulations that ensure a drug product is safe. 13. Examine GLP protocols, toxicology testing, including animal and human safety, and indicators for safety (irregular heartbeats in animals, etc.). 14. Evaluate the ethical considerations of testing, including impact of falsifying safety testing. 15. Analyze how GLP regulations are implemented during development and testing of devices. 16. Discover how technology and innovation impact the regulatory process. 17. Review data integrity and compliance with cGMP. 18. Evaluate the role of computer systems and computer systems validation. 19. Assess the emerging area of predictive toxicology and the potential for testing without animals. 20. Evaluate and explain innovation in safety and adaptive clinical trials. 21. Examine innovation in CMC including quality by design and predicting the quality of manufacturing on the large scale with small scale experiments, including analytics modeling. 22. Discover how the global environment impacts the regulatory process. 23. Evaluate special considerations of implementing a generic system in the developing and third world country . 24. Analyze global regulatory authorities and WHO PQ process. 25. Examine special considerations of the regulatory process as applied to devices, diagnostics and generics. 26. Identify the importance of design to a device, attributes that lead to the specifications and raw materials for diagnostics and the importance of product equivalence for generics and special considerations for biologics. Credits: 3.00

ABE 51300 - Quality Management, Audits,

Inspections

Credit Hours: 3.00. This course provides advanced topics in quality management and business improvement methods that apply to the pharmaceutical industry. Emphasis will be placed on specific issues of industry, audits, and inspections, as well as the successful selection and presentation of business and quality improvement projects to produce compliance and competitive advantage.

Learning Outcomes: 1. Understand quality management definitions, concepts, and guidelines. 2. Define quality and how to establish a quality management system. 3. Define quality plan, describe its purpose for the organization as a whole and identify various functional areas and people that have responsibility for contributing to its development. 4. Understand the audit process and quality control, including the various approaches to audits, inspections and reviews. 5. Understand basic skills required to manage audits, inspections and reviews. 6. Learn how to set up effective self audit systems. 7. Understand the impact of changing technologies, such as electronic systems, on supporting a quality management system. 8. Understand how quality management functions support global business decisions for asset acquisitions and growth of a company. 9. Understand the key elements of supply chain management, assessing risk, and managing outcomes from supplier and vendor audits. 10. Understand regulatory compliance aspects and implementation of ICH and global quality principles in supply chain management, including good distribution practices. 11. Define a continuous quality improvement or business improvement project within an organization. 12. Select and define continuous quality improvement tools and techniques in order to achieve operational excellence. 13. Develop in-depth knowledge of how to implement and obtain operational excellence and present the findings in a coherent and informative manner. Credits: 3.00

ABE 51400 - Documents And Dialogues Of Drug Development And Registration

Credit Hours: 3.00. This capstone advanced course will integrate previous learning relating to laws and regulations, quality principles and practices, and the preparation and submission of documents for preclinical research clinical trials and new drug approvals. Special topic lectures will be given. Considerable time will be devoted to preparing regulatory documents and conducting "mock" dialogues and negotiations with "pretend" agency officials.

Learning Outcomes: 1. Obtain and apply broad knowledge of FDA and international law, regulations, and guidance documents for at least one category of medical products (drugs, biological products, devices). 2. Ability to meld theory and practice in regulatory affairs. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use data, media and computers to send and respond effectively to communication for varied audiences and purposes. 5. Recognize the factors that influence regulatory decisions, develop methods to incorporate regulatory trends and practices, and think strategically about product development and marketing. 6. Obtain and apply broad knowledge of FDA and international requirements for the approval and conduct of pre-and post-market clinical studies with regulated products and understand the basic principles of clinical study design and clinical data analysis for at least one category of medical products (drugs, biological products, devices). Credits: 3.00

ABE 51500 - Molecular Basis Of Manufacturing

Credit Hours: 3.00. This advanced course addresses important Chemistry Manufacturing and Control (CMC) issues related to manufacturing and quality by design. The course provides important information on strategies for quality by design, manufacturing strategies for early development, the best approaches to analyzing data, and strategies for reporting the

information to the FDA. This course will also focus on product design and processing. Using product and process design helps achieve quality by design (QbD), strong development reports, excellent regulatory submissions and allows continuous improvement. The course includes laboratory exercises, laboratory tours, and/or workshops outlining how to interpret the data.

Learning Outcomes: 1. Identify GMP manufacturing procedures operations including blending, granulation, drying, compression, coating, etc.; Specifications in manufacturing; Statistical principles important in manufacturing. 2. Characterize GMP manufacturing procedures. 3. Evaluate how drug products (solids, liquids, injectables) are characterized especially related to: Dissolution; Weight variation; Content uniformity; Instrumental methods including X-ray diffraction; Approaches to determining critical quality attributes; Factors that influence the quality of the final product; DOE approaches to product optimization. 4. Construct QOS and Critical quality attributes diagram. 5. Outline how technology and innovation impact the manufacturing process: Strategies for continuous manufacturing; Process analytical technology methods; Innovations in manufacturing methods; How the global manufacturing environment impacts pharmaceutical manufacturing. Credits: 3.00

ABE 52700 - Computer Models In Environmental And Natural Resources Engineering

Credit Hours: 3.00. Offers students in environmental and natural resources engineering programs an understanding of the hydrological processes and related design skills. Principles of soil erosion by water; drainage of agricultural lands; surface runoff; flood and reservoir routing; hydrodynamic and water quality in pipe network; nonpoint source pollution; and transport phenomenon are studied. Current computer models utilized in industry for decision support are applied using case studies to further enhance the understanding of the hydrological processes. Limitations and advantages of the models are discussed. Offered in alternate years.

Credits: 3.00

ABE 52900 - Nonpoint Source Pollution Engineering

Credit Hours: 3.00. Engineering principles involved in assessment and management of nonpoint source (NPS) pollution. Effect of NPS pollution on ecosystem integrity. Use of GIS/mathematical models to quantify extent of pollution. Design/implementation of best management practices to reduce nonpoint source pollution and improve water quality. Discussion of total maximum daily load (TMDL) principles and processes.

Learning Outcomes: 1. Understand sources and nature of NPS pollution originating from agricultural and urban land use. 2. Link nature of diffuse pollution with physical, chemical and biological integrity of ecosystems and water usage. 3. Quantify amount of diffuse pollution from a watershed using state-of-the-art methods and models. 4. Design best management practices to minimize nonpoint source pollution from agricultural and urban land use. 5. Understand TMDL issues, and processes involved in developing TMDL plans. 6. Understand basic monitoring and modeling principles. 7. Apply engineering principles in developing pollution prevention plan. Credits: 3.00

ABE 53000 - Plant Phenotyping Technologies

Credit Hours: 3.00. Introducing concepts, models, algorithms, and tools in plant phenotyping development and application projects. Class topics include high-throughput phenotyping in greenhouse, field phenotyping platforms, Ag remote sensing, plant sensors (hyperspectral, 3D thermal, florescent, X-ray, etc.), plant image processing technologies, statistical modeling, big data, database requirement, artificial intelligence algorithms, and hybridizations of the above techniques applied in plant phenotyping. Permission of instructor required.

Learning Outcomes: 1. Know the concept of digital agriculture and plant sensors' applications. 2. Understand the plant phenotyping technologies, in both software and hardware. 3. Learn the skills of designing a professional phenotyping imaging system and collecting data. 4. Understand the current phenotyping activities in academia and industry. 5. Know the major plant sensors and their applications. 6. Have the capability of choosing or designing the most feasible sensor system for specific phenotyping projects. 7. Understand the role of the plant sensors in a precision agriculture system. 8. Learn basic image

processing skills. 9. Have the capability of applying computational intelligence and machine learning techniques to classification, prediction, pattern recognition, and optimization problems. Credits: 3.00

ABE 53100 - Instrumentation And Data Acquisition

Credit Hours: 3.00. This course educates students in the use, selection, and design of instrumentation and data acquisition for agricultural, food, environmental, and biological systems. Emphasis is on measurement of position (GPS), force, pressure, power, torque, flow, and temperature along with environmental sensors. Labs focus on building and using measurement systems and programming PC computers for data acquisition and analysis. Prior knowledge of electrical circuitry is desirable.

Learning Outcomes: 1. Understand the principles of operation and limitations of common measuring instruments. 2. Model instruments and their operating conditions to use the instruments correctly. 3. Design and use signal conditioning devices. 4. Program computers to automate the acquisition and processing of data. 5. Design systems for the acquisition, analysis, and communication of data. 6. Gain awareness of economical and societal aspects of instrumentation systems and communication of data. Credits: 3.00

ABE 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Demo labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic hydraulic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy-efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

ABE 54000 - Principles Of Systems & Synthetic Biology

Credit Hours: 3.00. Synthetic biology harnesses the power and adaptability of biology to engineer living systems that address grand societal challenges. This course introduces students to fundamental concepts and techniques in this interdisciplinary discipline, and studies state-of-the-art techniques from the primary literature. The course follows the standard Design-Build-Test-Learn (DBTL) cycle of contemporary practice and includes topics such as biological circuit design, advanced DNA assembly techniques, genome editing technologies, next generation sequencing, and directed evolution.

Learning Outcomes: 1. Identify and select biological parts needed for a specific engineering objective. 2. Use modern DNA assembly techniques to build biological circuits and designs. 3. Describe the performance of biological circuits and their components. 4. Design biological circuits for specific applications. 5. Evaluate design performance with modern analytical techniques. 6. Discuss the ethical concerns of engineering biology. Credits: 3.00

ABE 54500 - Design Of Off-Highway Vehicles

Credit Hours: 3.00. Problems associated with the design of off-highway vehicles, with special emphasis on farm and industrial tractors and self-propelled machines; engines; power trains; traction; vehicle control systems; human factors; testing and evaluation of performance.

Credits: 3.00

ABE 54700 - Models And Microbiomes

Credit Hours: 3.00. Determine the use of computational, physical, and biological models for studying and engineering microbiomes. Study peer-reviewed literature and synthesize findings in the form of oral and written deliverables. Background in microbiology either from coursework or research and interest in microbiomes recommended.

Learning Outcomes: 1. Review primary papers and books for state-of-the-art developments in the field of microbiome. 2. Analyze the

relationships between multiple modeling approaches for the microbiome. Credits: 3.00

ABE 55700 - Biological Engineering Design I

Credit Hours: 3.00. Course includes analysis and design of operations, such as dehydration, fermentation, and separation processes. Development of experimental designs, integration of pilot plant results into the design, operation and scale-up process systems. Emphasis on how the properties of biological materials influence the quality of the processed product.

Learning Outcomes: 1. Develop ability for self-learning and preparation for lifelong learning. 2. Apply principles learned to the development of typical industrial processes. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Communicate technical information effectively. 5. Improve computer skills. 6. Work in teams. 7. Meet deadlines. 8. Evaluate ethical, global, and societal contemporary issues. Credits: 3.00

ABE 55800 - Biological Engineering Design II

Credit Hours: 3.00. This course will focus on the design, synthesis, creation, evaluation, and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Course will include group projects, oral and written reports.

Learning Outcomes: ". Develop an understanding of Bio and Food Separation Processes. 2. Evaluate the economic aspects of product costs. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Develop processes to minimize environmental and energy impact. 5. Develop an understanding of optimization (zero discharge/minimum energy). 6. Develop a business plan. 7. Communicate technological information. 8. Improve computer skills to operate and schedule processes (superPro Designer/Batches). 9. Work in teams to design a biological/food process. 10. Review technical and patent literature Credits: 3.00

ABE 56000 - Biosensors: Fundamentals And Applications

Credit Hours: 3.00. (BME 52100) An introduction to the field of biosensors and an in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and biosecurity applications.

Credits: 3.00

ABE 58000 - Advanced Processes In Biological Engineering

Credit Hours: 3.00. Physical and chemical structure of biomass. Reaction kinetics of hydrolysis of hemicellulose and cellulose to fermentable sugars. Fundamentals of ethanol production by fermentation. Separation of fermentation products into pure components.

Learning Outcomes: 1. Analyze bioprocesses using engineering design principles, bioreactor simulations, application of basic separations methods, and applying engineering economic analysis. 2. Develop process models for batch and continuous fermentation, cell culture, and enzymatic bioreactors. 3. Analyze the impact of fundamental advances in bio-sciences on bioprocess engineering and the environment, and the potential of these advances to solve societal problems. 4. Understand the impact of biosafety and regulatory considerations on process design. Credits: 3.00

ABE 58500 - Soil Microbiology

Credit Hours: 3.00. The soil microbial population and its role in the soil ecosystem; microbial transformations of inorganic and organic compounds; decomposition of residues; and dynamics of soil organic matter.

Learning Outcomes: 1. Interrelate the importance of soil microorganisms, and the biological processes they mediate, to soil properties and ecosystem functions. 2. Know the importance of soil as a habitat for organisms and critical biogeochemical processes they control. 3. Know the morphology, physiology, and ecology of the major groups of soil microorganisms. 4. Relate soil microbiology to your own area of research interest and be able

to articulate correctly a response on questions related to microbiology or microbial functions in the environment. Credits: 3.00

ABE 59000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of the instructor in the selected field of study. Laboratory, field, and library studies and reports on special problems related to agricultural and biological engineering not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 6.00

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ABE 61600 - Medical Devices And Diagnostics In BIRS

Credit Hours: 3.00. This advanced course will integrate diverse aspect of Medical Devices including diagnostics and drug-device combinations relating to laws and regulations, quality principles and practices, and the preparation and submission of documents for preclinical research, clinical trials and new drug and device approvals. Special topic lectures will be given. Considerable time will be devoted to case studies and independent work.

Learning Outcomes: 1. Apply knowledge of regulations involving manufacturing and clinical studies of devices. 2. Utilize strategic concepts in the design and development of devices. 3. Demonstrate the ability to effectively communicate their field of study to the scientific community as well as regulators. 4. Demonstrate the ability to think critically, creatively and solve problems in their field of study. Credits: 3.00

ABE 61700 - Global Leadership In BIRS

Credit Hours: 3.00. This course provides a foundation to the theoretical foundation and empirical research associated with emerging strategies and theories in the study of global leadership. The course also addresses the practical application of leadership to the biotechnology industry including activities to help encourage collaboration and innovation. Students will build self-awareness and learn about the evolution of leadership as a process that requires vision, passion and discipline. Guest lecturers from both industry and regulatory organizations will provide applications of the topics above within the biotechnology manufacturing and regulatory industry.

Learning Outcomes: 1. Describe foundational theories of leadership, including the history and development of the leadership theories over time, and relate leadership theories to current events. 2. Explain major components of key leadership models and approaches, identifying strengths and weaknesses of each model and applying knowledge to practical uses of leadership theories in global biotechnology organizations. 3. Apply methods of self-analysis to discover leadership strengths and abilities and integrate knowledge of self-analysis and leadership models to the context of your current organization. 4. Explore the human dimension of leadership and develop awareness of yourself, your strengths and abilities, and how to apply this knowledge to a life-long leadership development plan. Credits: 3.00

ABE 61800 - Project Management In BIRS

Credit Hours: 3.00. The factors influencing decisions during the initiation, implementation, and termination of industrial and manufacturing projects are examined. Students work as project teams, using project management tools to develop implementation strategies.

Learning Outcomes: 1. Understand and learn the latest tools and techniques used in projects. 2. Develop a systems perspective for understanding projects. 3. Align projects with strategic objectives. 4. Develop and think analytically in order to successfully apply knowledge and technical expertise to the solution of real business problems. Credits: 3.00

ABE 61900 - Biotechnology Innovation In Regulatory Science

Credit Hours: 3.00. This course is an introduction to biotechnology innovation and strategy. The framework for innovation and how this translates to regulatory science and drug development will be the focus. Students will learn key pharmaceutical strategy concepts including dierences between large and small molecules, clinical and manufacturing statistics, and current pharmaceutical trends. Guest lecturers from both industry and regulatory organizations will provide applications of the topics above within the biotechnology manufacturing and regulatory industry. This course is an elective for the M.S.

degree in Biotechnology Innovation and Regulatory Science.

Learning Outcomes: 1. Describe how the framework for innovation translates to a biotechnology organization by developing a topic of interest into a research paper. 2. Explain the major steps in large molecule development by applying to an mRNA vaccine business case study: Select a mRNA vaccine to manufacture and provide rationale and describe the manufacturing methodology to be utilized. 3. Describe how you will set up a GMP system within your manufacturing facility. 4. Provide rationale for manufacturing facility to be utilized (pod versus bricks and mortar). 5. Describe analytical testing to be employed. 6. Depict the strategy canvas for your project. 7. Understand the role of novel delivery systems in drug development. 8. Understand how data and computer systems enhance innovation. 9. Explain the risk of innovation and identify risk mitigation strategies. Credits: 3.00

ABE 62000 - Foundations Of Research In BIRS

Credit Hours: 3.00. Students identify a problem within their organization, define the current state supported by evidence, develop a proposal based upon literature review and evidence within their organization, and develop a plan with rationale and recommendations for an improved future target state. The course places a strong emphasis on leadership, professional communication, and the interpretation of research findings within the biotechnology industry to build a foundation for integrating theoretical research approaches with a unique project that has practical application in the field of biotechnology. Quantitative and qualitative research methodology will be introduced, including the application of fundamental statistical methods in design and interpretation of research findings in professional academic, industrial, and regulatory organizations.

Learning Outcomes: 1. Describe the conceptual aspects of research methods. 2. Describe the process of conducting a literature review and develop a plan to conduct a literature review exploring a current research area within a biotechnology organization. 3. Compare and contrast the use of theory in qualitative, quantitative, and mixed methods research and apply the appropriate method to investigating a practical research problem within a biotechnology organization. 4. Identify ethical concerns to anticipate in research. 5. Apply critical thinking skills to write the key elements of a research proposal and integrate knowledge of qualitative, quantitative, and mixed methods approaches into developing a research design for a project within the context of a biotechnology organization. 6. Identify and employ audience-appropriate communication strategies. 7. Critique own and others' written and oral communications to facilitate continual improvement to prepare and deliver effective presentations. Credits: 3.00

ABE 62600 - Technology Entrepreneurship And Research Translation

Credit Hours: 3.00. (TLI 62600) The course is designed to introduce graduate students and faculty mentors to the intellectual, financial, and management processes associated with translating research into tangible products through university initiated, early-stage commercialization (start-up) activities. Lectures will present case studies of technologies and pathways to commercialization. Guest speakers will illustrate the start-up process through real-world experience, and will also address approaches for managing entrepreneurial activities, intellectual property and conflicts of interest in a university environment. Permission of Instructor required.

Learning Outcomes: 1. Understand the processes through which translation of research from laboratory to products occur. 2. Describe technologies and commercialization strategies for IT, analytical instrumentation, biopharmaceutical, biomedical, biofuels, and other technologies. 3. Achieve literacy in the business and other discourse related to intellectual property and technology commercialization. 4. Be connected to a network of innovators, entrepreneurs, and service providers on and off campus. 5. Execute analysis required to determine if, how, and when to launch new technologies into a translational pathway. Credits: 3.00

ABE 62700 - Colloidal Phenomena In

Bioprocessing

Credit Hours: 3.00. The structure, stability, and rheology of biological dispersions, emulsions, and foams are explained in terms of the principles of electrostatics, hydrodynamics, thermodynamics, and statistical mechanics. Additional topics include colloidal phenomena in downstream bioprocessing, as well as colloidal aspects of some food systems. Prerequisite: Thermodynamics and physical chemistry.

Credits: 3.00

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 69100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for advanced specialized topic areas in agricultural and biological engineering for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate study 2. Complete required training for graduate student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

ABE 69600 - Graduate Seminar

Credit Hours: 1.00. Best practices for effectively presenting scientific research are taught and practiced. Students will also present a twenty-minute seminar of original research results, as well as provide and receive constructive criticism on presentation form and content for improved future presentations.

Learning Outcomes: 1. Enhance ability of ABE graduate students in presenting graduate research. 2. Improve ability of ABE graduate students to think critically about research and presentation skills of others. 3. Increase student's ability to critique his or her own work. Credits: 1.00

ABE 69700 - Doctoral Professional Development

Credit Hours: 1.00. Discussion of research problems, methods,

procedure, and reports. Discussion and practice to improve written and oral communication. Professional development activities.

Learning Outcomes: 1. Improve your ability to write, read and review scientific documents 2. Improve your skills in preparing and presenting scientific presentations 3. Become more familiar with Responsible Conduct of Research 4. Broaden your knowledge by attending and/or planning research seminars and presentations by peers 5. Become familiar with professional development opportunities. Credits: 1.00

ABE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ABE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Agricultural Economics

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and

global, which occur during the rest of your life.

Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 26000 - Mentoring Leadership

Credit Hours: 1.00. This course is designed to teach upperclassmen how to mentor freshman to thrive and survive as entering freshmen in Agricultural Economics. The main focus is on the transition to college life, as well as practical information on time management, taking and rewriting classroom notes, preparing for examinations and quizzes, dealing with stress and interpersonal relationships, and health. Additional topics include opportunities for student involvement in campus life and organizations, career paths for the various programs of study in Agricultural Economics, and how to successfully work in groups. Mentors are restricted to AGBS, AGEC, AGFN, AGMG, FARM, FIMM, QAEC, and SLMK students. Permission of department required.

Learning Outcomes: 1. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 2. Demonstrate the ability to work effectively as part of a problem-solving team. 3. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 4. Demonstrate awareness of civic responsibility to community and society at large. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

AGEC 28900 - Foundational Internship

Credit Hours: 1.00. Foundational internship that is preplanned and conducted under the direction of a faculty or staff member working in cooperation with an employer representative. A learning plan must be developed and approved by the student, faculty or staff coordinator, and employer representative prior to beginning the internship. A comprehensive report describing the management strategies used by the company or organization when he/she spent their internship is required. Permission of department required.

Credits: 1.00

AGEC 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 29600 - Selected Topics In Agricultural Economics

Credit Hours: 1.00 to 3.00. Special topics in agricultural economics aimed at sophomore-level students. May be repeated for credit under a different topic title.

Credits: 1.00 to 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue

University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

AGEC 30500 - Agricultural Prices

Credit Hours: 3.00. Analysis of prices and the movement of farm product prices; relations of farm product prices to farm input and other prices; conceptual and statistical analysis of agricultural supply and demand relationships; application of price analysis, price forecasting, agricultural outlook, agricultural policy; adjustment of farming to new price conditions.

Learning Outcomes: 1. Understand economic principles that determine prices in markets. 2. Provide knowledge of markets and the entities and factors that impact market equilibrium outcomes. 3. Apply economic principles and empirical estimation tools to inform decision-making. Credits: 3.00

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency

in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 33300 - Food Distribution - A Retailing Perspective

Credit Hours: 3.00. Distribution factors that affect the food industry. Particular attention to the food wholesaling and retailing sectors. Presentation of economic tools to evaluate performance in the food industry. Discussion of the relative importance of each of the major departments in the modern supermarket. Discussion of current and future industry prototypes.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 34000 - International Economic Development

Credit Hours: 3.00. This course is designed to introduce students to issues and problems related to international economic development. Topics covered include a description of the current situation in developing countries and the history of growth and development. The course is grounded in the body of theory associated with economic development, but concentrates on the many practical problems such as poverty, population growth, urbanization, education and the environment. The three areas with the greatest attention are agricultural development, international trade, and policy analysis for developing countries.

Learning Outcomes: 1. Build an appreciation for the conditions and constraints of contemporary life in developing countries. 2. Have your own notions of what it means to live in poverty, the challenges of improving welfare, and the role of economics in development. 3. Demonstrate how economic principles, models, and analysis can help evaluate and refine approaches to improving human welfare in developing countries. 4. Develop the ability to analyze and write about real-world problems and solutions.

The course, particularly the assignments, will allow you to acquire technical skills that will contribute to your future professional work. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 37500 - The Process Of Economic Research

Credit Hours: 1.00. This course is a study of the process of conducting economic research. The course examines the research problem and objectives, literature review, conceptual framework, methods and procedures, and reporting research. Students will identify a research topic and project advisor. For Honors program students only in Agricultural Economics. Permission of instructor required.

Learning Outcomes: 1. Understand and appreciate the process of conducting economic research. 2. Develop a research plan of work for an honors thesis. 3. Discuss your research and the research of others. Credits: 1.00

AGEC 39001 - Professional Internship Programs In Agricultural Economics

Credit Hours: 0.00. Supervised professional experiences in agricultural economics. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of instructor required.

Credits: 0.00

AGEC 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry

principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 40000 - Agricultural Economics Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 41100 - Farm Management

Credit Hours: 4.00. Principles of farm organization and management, farmer interviews, and the application of computerized farm decision-making methods.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 41200 - Farm Business Management Workshop

Credit Hours: 1.00 to 3.00. Making decisions regarding the organization and operation of farm businesses with which students will be associated after graduation. Areas of decision-making include enterprise selection, farm growth, organizing large-scale farms, communication, labor management, machinery management, operating agreements, legal organization, and tax strategies.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 1.00 to 3.00

AGEC 42100 - Advanced Commodity Marketing

Credit Hours: 3.00. Application of commodity marketing principles to grain, livestock, and other commodity sectors. Applications include hedging, speculation, risk management, and fundamental and technical price analysis. Examination and testing of pricing strategies and the development of commodity marketing plans.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42500 - Estate Planning And Property Transfer

Credit Hours: 3.00. The ownership and transfer of farm business property. Includes tax and other implications of life estates, trust arrangements, sale of property, and charitable contributions.

Credits: 3.00

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 43100 - Advanced Industrial Sales And Marketing

Credit Hours: 4.00. Advanced presentation techniques, sales management and analysis, improving communication skills, study of industrial marketing strategies, interaction with industry executives, and strategies for career development. Requires class trips. Students will pay individual lodging or meal expenses when necessary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGEC 45600 - Federal Income Tax Law

Credit Hours: 3.00. Introduction to the federal income tax laws applicable to individuals and small business with emphasis on the farming business. The course includes management implications and the policy basis for the tax law system. Techniques and practice for the preparation of selected forms will be included. There will be limited exposure to taxation of partnerships, corporations, estates, and to federal gift and estate tax law.

Learning Outcomes: 1. Develop an understanding of the federal income tax law: for individuals and small businesses and for economic and financial decision making. 2. Gain an understanding of the management opportunities for the income tax law and how they can be applied by individuals, families, and small businesses. 3. Develop the ability to analyze facts for tax law alternatives and to communicate tax planning alternatives. Credits: 3.00

AGEC 49800 - Special Problems

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who want to study special problems in agricultural economics not covered in regular work. Permission of instructor required.

Credits: 1.00 to 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

AGEC 51600 - Mathematical Tools For Agricultural And Applied Economics

Credit Hours: 3.00. This course provides first year graduate students and advanced undergraduate students with the specific set of applied mathematical tools needed to support graduate coursework in microeconomics, macroeconomics, economic programming, and econometrics. The course reviews skills and concepts from a number of fields of mathematics including matrix algebra, calculus, optimization theory, and mathematical statistics. The course emphasizes specific applications to economic theory and applied problems in agricultural economics and related areas. Students should be comfortable with introductory-level calculus before entering the course. Permission of instructor required.

Learning Outcomes: 1. Knowledge and Scholarship: The ability to identify and conduct original research, scholarship or creative endeavors. 2. Communication: The ability to effectively communicate their field of study. 3. Critical Thinking and Problem Solving: Think critically, creatively and solve problems in their field of study. 4. Ethical Conduct: Conduct research in an ethical and responsible manner. 5. Professional Development: demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 52400 - Agricultural Finance

Credit Hours: 3.00. Designed to provide students the concepts and tools to apply financial management principles to farm businesses. Topics include financing alternatives, preparation and interpretation of financial statements, and capital investment analysis using discounted cash flows.

Learning Outcomes: 1. Prepare, interpret, and analyze financial statements used for agricultural businesses. 2. Analyze and suggest methods to improve the financial performance of agricultural businesses. 3. Evaluate capital investments using discounted cash flow methods. 4. Describe and analyze the risk and returns faced by agricultural businesses. Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

AGEC 52600 - International Food And Agribusiness Marketing Strategy

Credit Hours: 3.00. Students will develop their analytical, decision-making, and communication skills related to marketing management of food systems in the world economy. They will analyze a foreign market's potential and market entry strategies; compare consumer differences and similarities across markets; define issues related to marketing mix standardization or adaptation; and evaluate effects of economic, social, and legal environments on marketing strategy.

Credits: 3.00

AGEC 52800 - Global Change And The Challenge Of Sustainably Feeding A Growing Planet

Credit Hours: 3.00. This course investigates the major drivers of global agricultural and environmental change associated with the global farm and food system. This includes demography, income growth, biofuels, climate change, environmental and ecosystem services, livestock consumption, food waste and land use change. Weekly modules include a guest lecture, student led discussion of readings and discussion of lab assignments undertaken using the SIMPLE model of global agriculture, environment and food security. The class culminates with a course project which is presented to the class and written up in a term paper.

Learning Outcomes: 1. Gain exposure to different disciplines and their approaches to analyzing global change. 2. Master the basic economic concepts of demand and supply in the context of the global food economy. 3. Become proficient in undertaking economic analysis using the SIMPLE model. 4. Gain a knowledge of the role which economic analysis plays in analyzing long run sustainability of the global food system. Credits: 3.00

AGEC 53000 - Strategic Agribusiness

Management

Credit Hours: 3.00. Addresses issues in the strategic management of agricultural and food businesses. Emphasis is on developing a framework for formulating strategy, making strategic choices in a variety of business environments, and implementing strategy. Extensive use of management case studies and a major term project with an agribusiness firm focus on developing managerial problem-solving skills.

Credits: 3.00

AGEC 53200 - World Food Problems

Credit Hours: 3.00. This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Learning Outcomes: 1. Understand global food production and consumption, food trade and its history including: the major plants produced and consumed; where they are grown; patterns and extent of global food trade; major food animals and animal production systems; countries involved in food trade; urbanization and food transportation; and effects of post-harvest processing on food trade and availability. 2. Understand basics of world population growth and its relationship to past and future food production and consumption globally. 3. Understand what malnutrition looks like, where it occurs, how it is measured, and the interactions between malnutrition (both under nutrition and obesity) and human health. 4. Understand the basic economic principles that affect consumer food costs and consumption patterns globally. 5. Understand how culture, communication and politics influence food availability, world food problems and malnutrition. 6. Predict, based on available information, likely scenarios for the future of world food problems and malnutrition. Credits: 3.00

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

AGEC 57100 - Global Issues In International Agribusiness

Credit Hours: 1.00. This is the first course in a required three-course sequence designed for students in the "Professional Masters in International Agribusiness" concentration in the Department of Agricultural Economics. The course objective is to expose students to a wide range of global issues directly and indirectly related to the production, processing, and marketing of agricultural products (food, fuel, fiber). Topics vary and may include food security, malnutrition, food safety, biofuels, the environment, trade and agricultural policy, emerging agricultural technologies, and climate change. Prerequisites: Enrollment in Professional Masters in International Agribusiness or permission of instructor required.

Learning Outcomes: 1. Understand key global issues affecting the business environment for international agribusiness. 2. Understand the structure and function of international agribusiness firms. 3. Reinforce foundational learning of topics through study and written assignments. 4. Facilitate their training as professionals. Credits: 1.00

AGEC 57200 - International Agribusiness Market Opportunities

Credit Hours: 2.00. This is the second course in a required three-course sequence designed for students in the "Professional Masters in International Agribusiness" concentration in the Department of Agricultural Economics. The course objective is to assist students in identifying and exploring market opportunities in international agribusiness, including those related to the production, processing, and marketing of agricultural products including food, fuel, and fiber. The course combines lectures with discussion and project-based learning and group activities.

Learning Outcomes: 1. Understand key business opportunities for international agribusiness. 2. Reinforce foundational learning of topics through case studies, written assignments and oral presentations and discussion. 3. Facilitate their training as professionals. Credits: 2.00

AGEC 57300 - International Business Analysis

Credit Hours: 3.00. This is the third course in a required three-course sequence designed for students in the Professional Masters in International Agribusiness concentration in the Department of Agricultural Economics. The course objective is to assist students in conducting a professional business analysis focusing on either a market opportunity, financial management, or other management issue in international agribusiness. The course is project-based and includes group activities and written and oral presentations.

Learning Outcomes: 1. Develop hands on experience to facilitate their training as professionals. 2. Develop report writing and oral presentation skills. Credits: 3.00

AGEC 59500 - Internship

Credit Hours: 0.00 to 3.00. This course allows students to work in firms, government agencies or non-profit organizations undertaking projects with the supervision of faculty mentors and onsite supervisors. Permission of department required.

Credits: 0.00 to 3.00

AGEC 59600 - Seminars In Current Issues In Agricultural Economics

Credit Hours: 1.00 to 3.00. Study of selected current developments in agricultural economics. Topics will be announced in advance. Permission of instructor required.

Credits: 1.00 to 3.00

AGEC 60000 - Agricultural Finance

Credit Hours: 3.00. Advanced capital budgeting topics including: tax policy, inflation, optimal replacement, bid models, and inclusion of financing flows; application of expected utility theory and mathematical programming to optimal capital structure decisions of proprietors; farmland investment, pricing, and dynamics; pricing contingent claims. Prerequisite: AGEC 52400; AGEC 55200 suggested.

Credits: 3.00

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 60500 - Agricultural Markets And Price Analysis

Credit Hours: 3.00. Agricultural markets are multi-faceted, having been studied using a wide range of analytical tools. This graduate-level course emphasizes charactering demand and supply of agricultural markets and understanding forces that determine commodity and food prices. It also aims to cover a set of economic studies of prices and assist students in applying theoretical frameworks and time-series econometrics to empirical analysis of agricultural prices. In addition to studying prices in perfectly competitive markets, the first half of the course highlights several classic models of consumer demand and agricultural supply, prices under imperfect competition, price spreads (marketing margins), and the economics of information. The second half of the course focuses on empirical price analysis. Popular time-series econometric tools are introduced to study price relationships over space and time, price discovery mechanisms, and functions of futures markets.

Learning Outcomes: 1. Work with classic demand and supply models in the context of agricultural markets. 2. Derive classic models of price setting and marketing margins. 3. Understand econometrics of time-series models. 4. Apply time-series models to agricultural price data. Credits: 3.00

AGEC 60900 - Applied Welfare Analysis

Credit Hours: 3.00. This course develops the theory and methods used to assess the benefits and costs of economic policies and projects. Topics include benefit-cost analysis, economic impact analysis, nonmarket valuation, and analysis of risk and uncertainty. Prerequisites: A graduate course in microeconomic theory; a graduate course in regression analysis.

Learning Outcomes: 1. Estimate a project's benefit's and costs, including shadow pricing project inputs and outputs and valuing non-market goods and services. 2. Appropriate apportion various benefits and cost across different project stakeholders to estimate the distribution of project benefits and costs across society. 3. Derive and interpret economic measures of project performance, including net present value, internal rate of return, and benefit-cost ratios. 4. Incorporate risk and uncertainty into project analysis. Credits: 3.00

AGEC 61300 - Introduction To Economics Of Risk

Credit Hours: 3.00. A background in expected utility theory and applications. EUH axioms, risk aversion, utility elicitation, expected utility and moments, stochastic dominance, mean-variance, risk free asset, diversification, single index model, increasing risk, production under risk, programming models and applications. Prerequisite: AGEC 55200, ECON 51100, STAT 51100.

Credits: 3.00

AGEC 61400 - Advanced Agricultural Production

Economics

Credit Hours: 3.00. Course covers advanced techniques for economic analysis of agricultural production economics. Students are required to produce a course project demonstrating competency at the applied research frontier of the field and participate in presentation, discussion, and peer review of course members' work. Prerequisites: AGEC 61200 and ECON 60700 or Consent of Instructor.

Learning Outcomes: 1. Demonstrate knowledge. 2. Demonstrate applied research methods. 3. Demonstrate critical thinking. 4. Demonstrate communication. Credits: 3.00

AGEC 61600 - Resource Economics And Policy

Credit Hours: 3.00. Natural resource development and allocation in both static and dynamic contexts. Analysis of scarcity and growth issues, equity considerations, derivation of optimal pricing and depletion rules. Application of advanced production concepts to national resource problems. Prerequisite: AGEC 60400, ECON 51100.

Credits: 3.00

AGEC 61800 - Applied General Equilibrium Analysis

Credit Hours: 3.00. Theory and empirical techniques behind numerical general equilibrium analysis. The course is divided into two parts: 1) development of the basic analytical framework and model properties, and 2) in-depth study of selected applications in international trade, price analysis, and resource and environmental economics. Homework assignments involve a mix of qualitative analysis and microcomputer-based computational exercises. Prerequisite: AGEC 60400; Prerequisite: ECON 51100 or ECON 60700.

Credits: 3.00

AGEC 61900 - Applied Microeconomic Theory

Credit Hours: 3.00. Provides students with the capability to apply microeconomic theory and econometrics to analyses of economic issues and problems. Students will work through applied producer/consumer problems to gain experience in the uses of econometric estimation. Topics include: primal-dual approaches, direct and indirect functions, flexible functional forms, static optimization, separability and aggregation, risk and expectations, dynamics and demographics. Examples are drawn from both consumer and producer applications. Prerequisite: AGEC 65100, ECON 60700.

Credits: 3.00

AGEC 62200 - Food System Organization And Policy

Credit Hours: 3.00. Development of framework to study food system organization and policy; survey of measurement and empirical testing problems in industrial-organization research on food-system market structure and performance; review of competition policies and evaluation of policy alternatives. Prerequisite: Graduate courses in microeconomic theory and marketing.

Credits: 3.00

AGEC 62500 - Macroeconomic Issues In Agriculture

Credit Hours: 3.00. Studies the nature and importance of linkages between agriculture and the macro economy, and examines theories and methods used to establish or quantify these linkages in agricultural models. Extensions of macroeconomic accounting and theory into an open economy are explored by examining attempts by agricultural economists to estimate macroeconomic linkages and build them into commodity models, and considering consequences of implicit and explicit macroeconomic assumptions in much of our work. The changing role of agriculture in an economy under structural transformation will be key to understanding these linkages and how they evolve, as shown in several new developments seeking to explain both recent events and policy history in macro-theoretical frameworks consistent with observed empirical regularities.

Credits: 3.00

AGEC 63000 - Urban And Regional Economics

Credit Hours: 3.00. The literature discussed in this urban and regional economics course covers theoretical texts, conceptual as well as statistical, and empirical applications in order to introduce the student to the economist's view on spatial variation in economic outcomes. This ranges from coverage of the theory of industrial location choice, through theoretical and empirical analysis of the spatial distribution of economic activities (agglomeration theory, industrial clusters, central place theory), to theoretical and empirical explanations for the spatial structure of cities, the working of regional labor markets and migration. The course covers various empirical tools utilized in spatial data analysis (spatial econometrics) and modeling of regional economies and their interrelations (interregional input-output analysis). Prerequisites: AGEC 20300 or ECON 34000 or ECON 51100.

Credits: 3.00

AGEC 63100 - The Theory And Practice Of Spatial Econometrics

Credit Hours: 3.00. This course deals with the analysis of spatial data and centers on both exploratory tools developed in spatial statistics and GIScience, as well as on econometric models that have been the main focus in spatial econometrics. During the course, the theoretical basis for the analysis of spatial data and spatial models will be covered. This theoretical angle will be combined with ample opportunities to acquire hands-on experience in the analysis of spatial data. To the effect, up-to-date software, such as GeoDa, R, Stata, and MATLAB will be used. A good working knowledge of basic statistics and regression techniques is needed. Prior experience with GIS is helpful but not required. Prerequisites: AGEC 45100 or AGEC 65000 or ECON 67100 or STAT 41700 or STAT

51200 or STAT 51700.

Credits: 3.00

AGEC 63300 - Advanced Topics In Space, Health, And Population Economics

Credit Hours: 1.00. This course is designed to introduce students to advanced research in space, health, and population economics. It is designed to introduce both topical content and state-of-the-art research tools to students through a combination of guest speakers, faculty presentations, and discussions. The seminar also serves as a forum for students to present their own work and receive critical commentary from faculty and peers. The course is organized as a graduate seminar and gives students a chance to actively explore their own research ideas.

Credits: 1.00

AGEC 64000 - Agricultural Policy

Credit Hours: 3.00. Policy analysis for agriculture in the world economy. Emphasis on application of economic theory to analyze commodity programs, international trade, environmental concerns, and investment in human capital and agricultural research. Prerequisite: AGEC 41000, AGEC 60400.

Credits: 3.00

AGEC 64300 - Theory Of Economic Development

Credit Hours: 3.00. The economic theories behind the predominant approaches to economic development are reviewed. Both the sources of growth and problems in the development process are stressed. Emphasis is on the analysis and evolution of the models supporting the different approaches and the empirical analysis leading to changes in the paradigms. The role of agriculture in the economic development process is one of the topics. Other important issues are technological change, income distribution, structural adjustment, and the debt problem. Prerequisite: ECON 51100 , ECON 51200 .

Credits: 3.00

AGEC 64400 - International Agricultural Trade

Credit Hours: 3.00. International trade theory relevant to understanding world agricultural trade and the problems of agriculture in an open economy. Models for analyzing the effects of trade policy and market conditions on the agricultural sector. Welfare analysis of restrictions on trade. Prerequisite: ECON 51100 , ECON 51200

Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

AGEC 65100 - Application Of Quantitative Analysis: Econometrics II

Credit Hours: 3.00. Emphasis is on using advanced econometric techniques. The course covers use of computer software and interpretation and reporting of econometric results. The first part of the course includes general econometric concepts, such as least squares and maximum likelihood estimation, desirable statistical properties, assumptions of the classical linear regression model, Monte Carlo methods, nested and non-nested hypothesis tests. Later, more specialized topics are covered, including multiple equation models, simultaneous equation models, limited dependent variable models, and other topics that are deemed relevant. Prerequisite: AGEC 65000.

Credits: 3.00

AGEC 65200 - Application Of Quantitative Analysis: Mathematical Programming

Credit Hours: 3.00. Recent literature on the theory and application of mathematical programming and agricultural modeling. Model building and analysis techniques with focus on matching solution methods to problems. Prerequisite: AGEC 55200, ECON 61200; a course in matrix algebra.

Credits: 3.00

AGEC 65400 - Economic Dynamics

Credit Hours: 2.00. Focuses on the application of the tools of dynamic optimization to problems in economics. Covers continuous-time and discrete-time dynamic optimization techniques, including the calculus of variations, optimal control theory, and dynamic programming. Applications are drawn from a range of problems in microeconomics and macroeconomics, including current topics in agricultural economics, natural resource economics, and investment theory. Course meets weeks 1 - 10. Prerequisite: AGEC 65200, ECON 60700.

Credits: 2.00

AGEC 65500 - Applied Economic Time Series Analysis

Credit Hours: 3.00. This course is designed to improve students' abilities to estimate and interpret time series models. The course begins with univariate models and progresses to multivariate analysis. Alternative methods for identifying, estimating, and forecasting with time series models will be discussed. In addition, analysis of non-stationary time series and co-integration modeling will be covered in this course. Prerequisite: AGEC 65100 or consent of instructor. Mastery of applied statistics, calculus, and microeconomic theory at the Masters level or higher is desirable.

Learning Outcomes: 1. Translate data and statistical results. 2. Apply knowledge and ethical research to data and data analysis literacy. 3. Integrating economic theory with

applied analysis techniques. Credits: 3.00

AGEC 68100 - Economics For Food And Agribusiness Managers

Credit Hours: 3.00. Addresses the institutional setting, business climate, and structure of the food and agricultural markets. Encompasses both the domestic and international dimensions of the food chain, including consumer demand, global sourcing, and worldwide production potential. Focuses on managerial economics, as applied to such topics as food system market structure, the nature and dimensions of domestic and global competition, the components of cost and revenue, and the food system value chain. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68200 - The Macroeconomics And Trade Environment Of The Food System

Credit Hours: 3.00. Exposes students to the nature of linkages among agriculture, international markets, and the macro-economy, which are key to the fortunes of U.S. farmers and agribusiness. Exam theories and methods that allow students to establish or quantify these linkages and evaluate the consequences of alternative policies, demonstrating the usefulness of economic analysis as a tool. Also explores current policy issues facing the food and agribusiness industries, which might include farm legislation; environmental regulations; and food safety and nutrition labeling rules, among other policy topics. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68400 - Applied Quantitative Methods For Decision Making

Credit Hours: 3.00. Explores the application of contemporary concepts and quantitative techniques for decision making in the face of uncertainty. Focus is on application of statistical tools to decisions facing the food and agricultural business manager. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68500 - Advanced Quantitative Methods For Decision Making Under Uncertainty

Credit Hours: 3.00. Explores key areas of risk management of the food and agricultural firm, including price, production, strategic, regulatory, technology, market/competitor, political, financial, and exchange rate risk. Contemporary tools, such as score carding, decision trees, and real options are introduced for quantifying and managing uncertain decisions. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68600 - Strategic Food And Agribusiness Management

Credit Hours: 3.00. This course explores integration of the functional areas of business at the corporate level. Heavy emphasis is on analysis of the business environment, setting strategic direction, assessing core competencies, choosing a market position and developing competitive advantage, and organizational implementation and control in the context of the food and agricultural markets. The course makes heavy use of case studies of firms in the food and agricultural marketplace. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner.

5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68700 - Problem Solving And Project Management For Decision Makers

Credit Hours: 3.00. Develops a structured approach to problem solving, including problem definition, development of alternatives, identifying consequences, assessing trade-offs, and making informed choices. Research methods and project management concepts will be addressed. A major business analysis project will be framed during the course, to be completed as part of the capstone course in business analysis. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68800 - Business Analysis Capstone Course

Credit Hours: 3.00. Capstone experience where students will work on individual projects focused on a comprehensive detailed analysis of an issue facing their employer or an issue of general interest to the student. It is expected that this project will draw on tools and concepts developed throughout the MS program and be delivered to an appropriate audience of decision-makers upon completion. Permission of department required.

Credits: 3.00

AGEC 69000 - Seminars In Agricultural Economics

Credit Hours: 0.00 to 18.00. Intensive study of selected current developments in agricultural economics. Topics will be announced in advance. Permission of instructor required.

Credits: 0.00 to 18.00

AGEC 69100 - Topical Research In Agricultural Economics

Credit Hours: 1.00 to 6.00. Topics of interest to the student. Designed to give training in research. Credit dependent upon amount of work done. Permission of instructor required.

Credits: 1.00 to 6.00

AGEC 69200 - Workshop In Applied Economics

Credit Hours: 1.00. A workshop on how to communicate research results in a seminar setting. Students present at least once during the course and will be present for other students' presentations. Students may present their own research, or a paper from a recent journal also is acceptable. The course is open to master's students, and one credit of this course is required of doctoral students.

Credits: 1.00

AGEC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

AGEC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Agricultural Sciences Education & Communication

ASEC 10100 - Agriculture, Science And Social Issues

Credit Hours: 1.00. This course introduces Purdue Agriculture students to social issues that influence the future of science innovation and the agriculture industry. It will particularly focus on areas of apparent disconnect with regard to agriculture, scientific evidence and the general public. In order to learn how to communicate with others on controversial issues, concepts of engagement will be discussed as ways to better understand audiences and find areas of common interest. Featuring guest speakers on current social issues, students will learn how issues impact the agriculture industry and science innovation and consider how to engage stakeholders regarding these concerns.

Learning Outcomes: 1. Identify current social issues that affect agriculture and science. 2. Understand various perspectives on issues and how those perceptions are influenced and shaped. 3. Articulate how engagement on social issues can build relationships and establish common ground. 4. Analyze how an engagement strategy could be used by those in agriculture and science to communicate with concerned stakeholders on specific issues.

Credits: 1.00

ASEC 15200 - Agricultural Communication Seminar

Credit Hours: 3.00. This course provides an introduction to agricultural communication as a professional field, including its current status and role within the larger U.S. mass media system. The course will also provide an overview of career options and professional skills and competencies required of

agricultural communicators.

Credits: 3.00

ASEC 24000 - Seminar In Agricultural Education

Credit Hours: 1.00. Development of an understanding of the origin, scope, and objectives of agricultural education; role of the agricultural science and business teacher as a professional educator; basic responsibilities of a teacher of agricultural science and business; and significance of legislation affecting agricultural education.

Learning Outcomes: 1. Summarize the history, philosophy and aims of agricultural education. 2. Demonstrate small group communication through committee activities. 3. Practice the roles of an advisor to a student organization. 4. Evaluate self-awareness and understanding of own style of working with and relating to others and begin to make appropriate modifications. 5. Explain the importance of professional networks and the techniques to develop them. Credits: 1.00

ASEC 25000 - Storytelling For Professional Communication

Credit Hours: 3.00. In this course students will develop skills to help them develop and produce professional-quality narratives for a variety of professional communication applications, including content creation, marketing, and advocacy. Students will understand how to identify, focus, and structure stories and messages that resonate with audiences and help them achieve practical communication goals. The work students produce will include both written and visual components.

Learning Outcomes: 1. Focus stories for effective results. 2. Structure ideas to create consistently compelling stories. 3. Apply storytelling principles to written media and understand how they apply to other media, such as photography, video, and audio. 4. Know when and how to use storytelling techniques to inform, market, and advocate to various audiences. 5. Demonstrate professionalism and professional "improvisation." Credits: 3.00

ASEC 28000 - Digital Storytelling

Credit Hours: 3.00. Students will plan, shoot, and edit videos; collaborate in teams; plan and generate social media; and write feature pieces for digital platforms. Students will gain meaningful digital storytelling experiences that will enhance their understanding of various platforms and build their professional portfolios.

Learning Outcomes: 1. Develop compelling, audience-appropriate written and video feature stories for online platforms. This requires critical thinking (for planning, audience analysis, etc.), knowledge (effective storytelling techniques), and communication (must collaborate with classmates to coordinate topics and schedules). 2. Plan and integrate social media strategies into your work. This requires critical thinking (must plan ahead to include these pieces from the beginning of the project, must analyze audience), communication (must create and schedule effective, audience-relevant posts), and communication (must collaborate with classmates to coordinate posts and schedules). 3. Develop projects that meet a client's expectations and communication goals. This requires communication (with the client and source), knowledge (of effective interviewing and shooting principles), and critical thinking (to determine what audiences want to know and assess what they may already know). 4. Communicate science topics to lay audiences. This requires communication (to translate sometimes difficult subjects in ways that even elementary age audiences will understand), critical thinking (to determine what should and should not be covered), and knowledge (of effective video storytelling techniques). 5. Collaborate effectively with others. This requires communication (with colleagues all topics and schedules) and ethics (to be reliable team members who are just as responsible to each other as to themselves). 6. Reflect the diversity of the community you report on. This requires ethics (students must ensure that their work is diverse and inclusive) and critical thinking (students must be aware of when their work does not reflect the diversity of the population they serve). Credits: 3.00

ASEC 28500 - Introduction To Publication

Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

ASEC 29000 - Special Problems In Agricultural Science And Education Communication

Credit Hours: 1.00 to 6.00. Open primarily to freshmen and sophomores who desire to study special problems in agricultural communication, agricultural education, life science education, extension education, leadership education or youth development not covered in regular coursework. To be arranged with instructor or departmental representative prior to registering. Permission of instructor required.

Learning Outcomes: 1. Course will address the college Communications and Critical Thinking outcomes. 2. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 6.00

ASEC 30100 - Building Intercultural Partnerships (UCC: HUM)

Credit Hours: 3.00. This course uses a combination of readings, videos, experiential activities, presentations, and face-to-face & virtual excursions/engagement with "other/different" international cultural groups to deepen students' ownership of their own learning and to identify and understand both similarities and differences in values and social norms across countries and cultures. Students will enhance their intercultural communication skills, their emotional resilience, and their ability to engage effectively and equitably in conversations and partnerships with people from other countries and cultures.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate that you recognize the relevance of the learning process and the roles you and other play in that process. 2. Recognize and participate in cultural differences in verbal and nonverbal communication and begin to appropriately engage with people from other countries and cultures to negotiate a shared understanding based on those differences. 3. Recognize your own strengths and understand both the values and social norms across countries and cultures and challenges in adapting and adjusting under stress, and identify practices and techniques for managing your emotions. 4. Analyze substantial connections between the worldviews, experiences, and power structures of multiple cultural groups while incorporating respectful interactions with them. Credits: 3.00

ASEC 31800 - Coordination Of Supervised Agricultural Experience Programs

Credit Hours: 2.00. Record keeping and supervisory skills needed to advise and coordinate supervised agricultural experience programs for secondary agricultural science and business students. Integration of supervised agricultural experiences with programming in youth organizations and classroom instruction for secondary agricultural science and business classrooms.

Learning Outcomes: 1. Model a comprehensive design for school-based agricultural education. 2. Analyze Supervised Agricultural Experiences for learner career readiness. 3. Utilize a comprehensive record-keeping system. 4. Utilize student recognition tools such as FFA degree and proficiency applications. Credits: 2.00

ASEC 31900 - Planning Agricultural Science And

Business Programs

Credit Hours: 2.00. Development of course content plans that coordinate and utilize agricultural science and business, community resources, FFA, and supervised agricultural experience programs.

Learning Outcomes: 1. Explain the functions of an advisory committee. 2. Develop a philosophy/mission statement, vision, and goals. 3. Conduct a needs assessment. 4. Plan and implement strategies to build school and community support, including recruitment of students. 5. Describe the purpose of developing an effective FFA Program of Activities. 6. Describe the purpose and process of evaluating an agricultural education program. Credits: 2.00

ASEC 33100 - The Role Of Horses In Human History, Culture And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ASEC 34000 - Laboratory Practices In Agricultural Education

Credit Hours: 2.00. This course is designed to introduce pre-service agricultural education teachers to laboratory integration into the agricultural education curriculum at the middle school and secondary school level. Emphasis is placed on laboratory safety, skill acquisition, developing knowledge of laboratory components in Agriscience, laboratory utilization, facilitating student learning in the laboratory setting, appropriate teaching methods and techniques, curriculum applications, and classroom resources. Travel to on and off-campus sites will be required.

Learning Outcomes: 1. Facilitate learning in agricultural teaching laboratory settings. 2. Utilize resources in agricultural teaching laboratory settings. 3. Practice safe procedures with agricultural teaching laboratory equipment, supplies, and materials. Credits: 2.00

ASEC 34100 - Curriculum Development In Agricultural Education

Credit Hours: 2.00. This course is designed to expose students to appropriate teaching techniques, curricula and resources within agricultural education. Procedures for designing, implementing, and evaluating curriculum will be examined. Emphasis will be placed on new and emerging areas in agriculture, food, and natural resources.

Learning Outcomes: 1. Design curriculum for instruction in agriculture, food, and natural resources. 2. Implement curriculum for instruction in agriculture, food, and natural resources. 3. Evaluate curriculum for instruction in agriculture, food, and natural resources. Credits: 2.00

ASEC 35500 - Controversial Science And Media In The Public Sphere (UCC: HUM/STS)

Credit Hours: 3.00. This course will utilize case studies of controversial science news to explore the multiple factors that converge to influence how science and technology become controversial issues across a variety of social/ political domains. In addition to foundational understanding of communication theory, students will develop two primary skills: 1) a structure for the critical analysis of science news, 2) the skills to meaningfully communicate across stakeholders. The science content (GMOs, climate change, pesticide use, etc.) will provide the background information for analysis of the main focus of the course, which is in learning the communication process for effectively communicating science to non-science audiences. Case studies and applied critical media theory will be utilized to explore such controversies as climate change, genetically modified foods, and other emergent science controversies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Evaluate forces shaping public understanding of/and engagement with/science, including the role of technology in misinformation (fake news, bots, algorithms, misinformation campaigns, and propaganda) and the role of commercial funding of media. 2. Able to critically analyze media reports of science issues including: Types of

Journalism, Levels of Completeness, and Evidence within the story. 3. Apply reliable evidence from your critical news analysis to your projects. 4. Identify and analyze prominent and recurrent patterns in the communication of controversial issues. 5. Apply the skills learned to communicate controversial science to a non-science audience. 6. Critically evaluate the evolving role of media in shaping understanding of science across democratic societies. 7. Know content (quizzes and reflection papers). 8. Process Knowledge (Discussion and applied projects). 9. Use integrated knowledge to meaningfully critique others work. 10. Demonstrate process comprehension through construction of a critical news analysis of a current controversial issue. Credits: 3.00

ASEC 38000 - Feature Writing And Production

Credit Hours: 3.00. Students gain hands-on studio experiences in all phases of features writing, storytelling, and production. Students will analyze audiences, generate story ideas, research, interview, write, edit, shoot photos, plan social media, design pages, and can shoot short-form video.

Learning Outcomes: 1. Develop audience-appropriate story ideas consistent with Destination Purdue's mission. This requires critical thinking (will a topic actually interest readers and our client) and communication skills (students must articulate to the instructor and others why their stories will work). 2. Distinguish the differences between feature and news stories. This requires knowledge (what are the technical differences between these two seminal communication styles). 3. Write compelling, newsworthy feature stories. This requires critical thinking (what parts of conversations with sources will appeal to our readers). 4. Produce and prepare publication-quality photos. This requires knowledge (how to shoot and prepare an effective photo). 5. Demonstrate basic skills in desktop publishing software, design, and layout. This requires knowledge (of basic design principles and publishing software). 6. Develop and demonstrate reporting skills that accurately reflect the diversity of the Purdue Agriculture community. This requires ethics (students must ensure that their work is diverse and inclusive) and critical thinking (students must be aware of when their work does not reflect the diversity of the population they serve). 7. Demonstrate professionalism and professional "improvisation". This requires ethics (students must learn how to operate as professionals) and critical thinking (students must be able to solve unexpected problems that arise during the process). Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

ASEC 40000 - Agricultural Education Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ASEC 43100 - Planning For International

Engagement Methods

Credit Hours: 1.00. A team-based laboratory course for students who seek experience working with international partners to plan and conduct quality service-learning projects. Using established partner relationships, students will work with international partners to address hands-on, real-world, identified challenges to learn the principles of extension methodology and sustainable community development by integrating their discipline knowledge and technical skills from previous courses. Students will also learn the intercultural communication, market analysis, project design and planning, entrepreneurial business planning for micro-credit loans and business ventures, and cultural factors affecting community food security while they work in bi-national teams to determine how best to apply their classroom knowledge and experience to respond to partners' needs and local resource constraints.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their economic and social challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and emotional intelligence in evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate the ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

ASEC 43110 - International Engagement Methods

Credit Hours: 1.00 to 3.00. Using established partner relationships, students will travel to and live in Cap Haitien for 8-10 days and work with Haitian partners and students to learn the principles of extension methodology, sustainable community development, and how to most effectively work with local leaders. Students will also learn the intercultural communication, entrepreneurial business planning, and cultural factors affecting community food security status while they work bi-national teams to determine how best to apply their classroom knowledge and experience.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate personal growth in cultural worldview and self-awareness to confidently address specific food security-related challenges and belief in their personal ability to succeed in a particular situation. 4. Demonstrate critical thinking, intercultural curiosity, and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 5. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 6. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 7. Demonstrate intercultural openness, empathy, flexibility, and open-mindedness to work constructively as part of a bi-national problem-solving team. Credits: 1.00 to 3.00

ASEC 43120 - Evaluating International Engagement Methods

Credit Hours: 1.00. Designed for students who have just returned from the Engagement Methods for Int'l Food Security course or have previous experience working with our partners. In order to 1) fully comprehend the impact of the experience and 2) foster true long-term relationships with and service to our partners, it is required to work on our projects when we return. Matt McGregor, Former Exec. Dir. of Timmy Global Health, told us that "it's not really about the trip". It is essential that we accomplish: 1) Closure of trip experiences with partners and contacts - thank you's and complete follow-up; 2) Reflection of Purdue student experiences and personal goals/follow-up actions; 3) Promotion of food insecurity realities and opportunities for support; and 4) Planning, recommendations, and promotion of future service learning courses.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

ASEC 44000 - Methods Of Teaching Agricultural Education

Credit Hours: 3.00. Principles and procedures for teaching agricultural science and business in public schools. Must be admitted to teacher education program.

Learning Outcomes: 1. Describe the role of the instructor in the learning process, including characteristics of effective instructors and teaching. 2. Identify factors affecting individual learner differences. 3. Prepare lesson plans which address diversity in student populations. 4. Correctly demonstrate the use of the teacher-centered, social interaction, and student-centered learning activities within the agricultural education setting. 5. Develop and teach lessons using appropriate learning activities which build learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 6. Select appropriate educational technology to enhance learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 7. Design lessons which incorporate the use of agricultural teaching laboratories and/or equipment. Credits: 3.00

ASEC 44100 - Field Experience In Agricultural Education Programs

Credit Hours: 1.00 to 3.00. Field experience in agricultural science and business programs to include observation and participation in the teaching process and program development activities.

Learning Outcomes: 1. Document scope and sequence of secondary agricultural education curriculum. 2. Conduct an on-site review of facilities, equipment, supplies and procedures for an agricultural education program. 3. Reflect on the Agricultural Education Model and its impact on teaching and learning. Credits: 1.00 to 3.00

ASEC 44200 - Curriculum Implementation In Agricultural Education

Credit Hours: 2.00. Students develop skills necessary to implement standards-based curriculum in Agricultural Education through hands-on application. Course is designed for students who have an understanding of curriculum development and teaching methodology.

Learning Outcomes: 1. Assess curriculum justifying its use in a given situation. 2. Design instruction based on given standards and curricular materials. 3. Practice safe procedures with laboratory equipment, supplies, and materials. Credits: 2.00

ASEC 48000 - Agricultural Communication Capstone Seminar

Credit Hours: 3.00. Prepares graduating students for entry to the workplace, assesses and enhances their communication knowledge and skills, and provides project experiences that will demonstrate their ability to communicate scientific and technical information through a variety of media. Projects will include student presentations and magazine style articles on issues of concern to agricultural and general audiences; and a final project that requires students to conceive and create a web site that uses converging media to communicate effectively a topical issue.

Learning Outcomes: 1. Display mastery in the art of communicating science (agriculture, health, or environmental science) in explanatory writing form for non-technical audiences. 2.

Conduct interviews, organize and produce professional-quality writing products. 3. Quickly assemble content, seek approvals and make revisions under tight deadlines. 4. Gather data and analyze audiences. 5. Work with a team to identify effective communication goals; determine communications resources and coordinate those for strategic outcomes. 6. Develop creative products for professional portfolios to showcase communication expertise and assist in the job search. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ASEC 49000 - Special Problems

Credit Hours: 1.00 to 6.00. Open to undergraduates who desire to study special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

ASEC 49100 - Special Topics In Agricultural Science And Education Communication

Credit Hours: 1.00 to 3.00. Designed for specialized topic areas for which there is no specific course, but have enough student interest to justify formalized teaching of an undergraduate-level course. The course may be repeated by a student as long as the topic being taught is not repeated. The specific topic that is offered will be indicated on the student's record. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 3.00

ASEC 49700 - Thesis Research

Credit Hours: 1.00 to 6.00. For Honors students only doing specialized youth development and agricultural education research. Arrange with academic advisor and honors research coordinator before registering.

Credits: 1.00 to 6.00

ASEC 49900 - Special Problems In Agricultural Communication

Credit Hours: 1.00 to 3.00. Application of principles of mass communication in the production of agriculturally related news, feature, and magazine articles, radio and television reports, photographs, and publications in the Department of Agricultural Communication Service. Permission of instructor required.

Credits: 1.00 to 3.00

ASEC 52000 - Foundations Of Agricultural Education, Extension, And Communication

Credit Hours: 3.00. Critical analysis of the historical and philosophical assumptions, current strategic intents and relevant policies underpinning the discipline of agricultural education - inclusive of Extension education and agricultural communication - and project the impact existing economic, social and political issues may have in this field in the next 15 to 25 years. Instructor permission required.

Learning Outcomes: 1. Explain how social and economic conditions in the 19th century helped shape AEEC. 2. Identify and discuss how key events, leaders, driving forces, and policies (i.e., legislation) that shaped AEEC. 3. Compare and contrast similarities and differences among school-based agricultural education, non-formal (Extension) education, and agricultural communication regarding their purpose,

development as a field, structure and stakeholders. 4. Discuss the philosophies of pragmatism, behaviorism, and constructivism, and how these philosophical assumptions influenced the policies and practices of AEEC. 5. Identify leaders and what role they played in helping shape AEEC. 6. Discuss how principles of community-based education support the development of human, cultural and social capital in AEEC. 7. Examine current trends regarding existing organizational structures, enrollment, funding, and collaborative partners of AEEC, and project how current social and economic conditions in the 21st century may impact AEEC. 8. Discuss contemporary leadership and program models for the next 25 years, and analyze visions in AEEC are positioned to address grand challenges visions in AEEC. Credits: 3.00

ASEC 53100 - Global Learning For Agriculture, Food And Natural Resources

Credit Hours: 3.00. This is a graduate-level course in which students research, design, and evaluate communication and education methods and theoretical frameworks to apply appropriate cultural, community engagement, targeted outcomes of a population defined by the student. The central experience is an international/intercultural professional development experience immersed in rural and urban communities and cultures. Students will learn and develop global perspectives and effective engagement strategies to address agronomic, cultural, and community engagement realities affecting agriculture, life sciences and natural resources.

Learning Outcomes: 1. Have the skills to distinguish between educational designs needed for different goals and outcomes of global/intercultural learning programs. 2. Understand and apply one's own culture to interact among people with differing cultures, beliefs and values while designing engagement programs. 3. Design an educational intervention/module which is culturally appropriate and meets the needs of the community/learners. 4. Construct meaning from instructional messages, including oral, written and graphic communication applying the intersectionality of Social Identity, Intercultural Sensitivity, and Critical Race theories to engagement situations. 5. Evaluate one's self-awareness and recognition of others such that they can emotionally adapt their thinking and being in global/intercultural engagement efforts. 6. Identify best practices for educational global immersion experience related to food, fiber, and natural resources. Credits: 3.00

ASEC 54000 - Program Development In Agricultural And Extension Education

Credit Hours: 3.00. Application of principles of agricultural and extension education. Emphasis on program development, supervised experience programs, and effective organization of an agricultural and extension education program.

Learning Outcomes: 1. Develop a proposal for a comprehensive agriculture and Extension program plan. 2. Identify appropriate strategies to assess needs and assets, and teaching and delivery methods. 3. Identify the components of the Logic Model and how it is used for efficient program planning. 4. Develop a budget and evaluation plan for their agriculture and Extension program. Credits: 3.00

ASEC 54100 - Program Development In School-Based Agricultural Education

Credit Hours: 3.00. This graduate course in agricultural education concentrates on program planning and delivery of secondary programs in agriculture. Special emphasis is placed on utilizing school and community resources to develop programmatic offerings, recruit and retain students, organize FFA activities, direct supervised agricultural experience programs, and manage the agricultural education program. Various topics to be discussed will be determined based upon current trends in the field of agricultural education as well as the needs and interests of the students enrolled. Foundational procedures involved in conducting a secondary agricultural education program will be addressed. Permission of instructor required.

Learning Outcomes: 1. Facilitate learning through a well-planned school-based agricultural education program utilizing classroom and laboratory instruction, Supervised Agricultural Experience, and FFA. 2.

Describe the qualities of a successful school-based agricultural education program. 3. Identify areas for growth and support within local school-based agricultural education program. 4. Demonstrate comprehension of the foundational philosophies of agricultural education and career and technical education which guide successful implementation of modern school-based agricultural education. Credits: 3.00

ASEC 54500 - Teaching STEM Through Agriculture, Food And Natural Resources

Credit Hours: 3.00. The course focuses on the background and history of STEM movement and agricultural education, contemporary models, strategies, and justification for incorporation of science, technology, engineering and mathematics (STEM) concepts and practices into K-12 formal and non-formal agricultural education programs. Consider and develop the best practices for STEM teaching and learning and enhancement of STEM content in agriculture, food and natural resources (AFNR) context. The goal of the course is to help students develop knowledge about STEM integration and equip them with teaching knowledge and skills for designing K-12 lesson plans by using integrated STEM through AFNR. Students will learn strategies that promote engagement in integrated STEM through AFNR activities. At the end of the course, students should be able to design and implement research-based integrated STEM through AFNR lesson plans and assessment plans.

Learning Outcomes: 1. Analyze integrated models of STEM learning, and justify how a selected model informs best practices for science and agriculture, food, and/or natural resources teaching and learning. 2. Evaluate current national and state standards that help design lesson plans in non formal, and formal educational contexts. 3. Develop lesson plans by using agriculture, food, and/or natural resources as context to teach STEM content and concepts. 4. Describe life and 21st century skills that are relevant in agriculture, food, and/or natural resources contexts and demonstrate how these skills can be integrated into lesson plans. 5. Create an assessment plan to evaluate learning outcomes. 6. Apply learner-centered teaching strategies, such as inquiry-based learning, to teach the lesson plans. 7. Create a manuscript that can be used to disseminate the integrated STEM lesson to professional audiences. Credits: 3.00

ASEC 54600 - Communication And Issues Engagement For Agricultural Professionals

Credit Hours: 3.00. In this eight-week online course, students will be exposed to science communication and issues engagement principles. The course is designed primarily for those with little or no formal communication training. Topics include evidence-based best practices for communicating science; news media and social media influences on controversial science; how to monitor controversial issues; and major theoretical perspectives and strategies for engaging the public on food and agricultural science.

Learning Outcomes: 1. Integrate best communication practices from the literature for engaging audiences about agriculture and science. 2. Analyze audiences and design appropriate messaging based on audience characteristics and needs. 3. Develop and adapt communication strategies for science-based controversial issues. 4. Formulate evidence-based strategies to anticipate controversial issues in agriculture and science. Credits: 3.00

ASEC 54800 - Communicating Science To The Public

Credit Hours: 1.00. This course will help graduate students in science disciplines learn to communicate science to non-expert audiences. Through readings, assignments and guided discussions, students will learn relevant communication theories and recommended strategies for engaging with the public on science and technology topics.

Learning Outcomes: 1. Apply findings from the literature to anticipate how values and culture influence public perceptions of science. 2. Integrate key communication concepts and theories in the development of effective communication strategies for science and technology. 3. Analyze audiences and design messaging for specific audience segments. Credits: 1.00

ASEC 55000 - Program Evaluation In Formal And Non-formal Settings

Credit Hours: 3.00. The purpose of this course it to provide a

basic understanding of program evaluation processes, concepts, and theories and to develop expertise needed to design and conduct systematic evaluation of formal and non-formal programs.

Learning Outcomes: 1. Acquire basic knowledge and skills in program evaluation. 2. Understand key components of various evaluation models/frameworks and identify their strengths and weaknesses. 3. Apply evaluation knowledge and skills to plan, implement, and evaluate a program. 4. Develop knowledge and skills, (including writing skills) to critically evaluate a published evaluation study. 5. Understand the various phases of evaluation from beginning to end, including evaluation utilization of evaluation results. 6. Develop expertise in presenting evaluation results and outcomes to key stakeholders. Credits: 3.00

ASEC 55100 - International Engagement And Development Strategies

Credit Hours: 3.00. Sem. S and SS, cr. 3; an overview of cross-disciplinary, cultural, theoretical frameworks, communication tools, and assessment methods applied to international agricultural development and engagement. Lectures, panel discussions, and case studies on appropriate methods of development and engagement, international project planning, intercultural effectiveness, principles of sustainable agricultural, food, community development, and program/project monitoring and evaluation will be the basis of assignments and team work. This eight-week course will provide the theoretical and social frameworks and principles needed to successfully work in multi-agency partnerships on international development projects.

Learning Outcomes: 1. Select the most culturally-appropriate application of disciplinary knowledge and technologies for agriculture, food, natural resources and related sciences in development programs. 2. Deconstruct self biases and intercultural effectiveness and their critical and creative thinking skills for different contexts in appropriate applications of scientific research as creative interventions and evaluation. 3. Differentiate high and low oral and written communication skills, tolerance of cultural ambiguity, and adaptability. 4. Judge the efficacy of applying appropriate theoretical frameworks for engaging stakeholders in projects to create sustainable impact. 5. Determine the relevance of the result of applying principals and applications of ethical decision making and professional development. 6. Reflect on one's progress and abilities to work in multi-disciplinary teams to carryout developing country assessments and conceptualize a viable project proposal under a tight deadline. Credits: 3.00

ASEC 56500 - Principles Of Adult Education

Credit Hours: 3.00. (EDCI 56500) Principles of adult education applied to helping adults learn, evaluating their performance, and determining their needs. Examines history, philosophy, and research of adult education. Explores techniques required in design and delivery of instruction for adults.

Learning Outcomes: 1. Examine principles and techniques for educating adults including the history, philosophy, and research field. 2. Develop an individual philosophy of continuing and adult education for a wide variety of situations. 3. Apply principles, techniques, philosophy and research in development and design of adult education programs. Credits: 3.00

ASEC 58200 - Introduction To The Application Of Inferential Statistics

Credit Hours: 3.00. The goal of this course is to introduce students to the use and application of statistics with a particular focus on descriptive and inferential analysis procedures. This course will also introduce students to the use of statistical software, namely the Statistical Package for the Social Science (SPSS). Permission of instructor required.

Learning Outcomes: 1. Formulate decisions regarding selecting appropriate statistical techniques to use in analyzing data. 2. Apply data analysis techniques using SPSS and interpret relevant output and information. 3. Synthesize data from SPSS output. 4. Produce data analysis results in appropriate table and narrative form for inclusion in a dissertation, thesis, or journal article. 5. Investigate, analyze and critique the data analysis sections of peer-reviewed journal articles and determine if the

analysis is appropriate for the study. 6. Apply appropriate methods and procedures in the development of survey instruments. Credits: 3.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

ASEC 59000 - Special Problems

Credit Hours: 1.00 to 6.00. A study of special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

ASEC 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. Topics, requirements, and credits to be determined yearly. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 4.00

ASEC 59500 - Internship In Agricultural Sciences Education And Communication

Credit Hours: 1.00 to 10.00. A special course designed to provide practical field experience under professional supervision in selected situation related to the student's area of specialization. Amount of credit to be determined by the nature and extent of the assignment. To be arranged with the instructor of departmental representative prior to registering. Permission of instructor required.

Learning Outcomes: 1. Explore components of Purdue Extension or other agricultural entities. 2. Participate in activities, projects, and programs of Purdue Extension or other agricultural entities. 3. Reflect on organizational philosophy, structure, and outcomes. Credits: 1.00 to 10.00

ASEC 62000 - Adolescent And Youth Development In Context

Credit Hours: 3.00. This graduate-level course examines the major developmental issues of adolescents and youth with attention to their familial, cultural, and socio-economic backgrounds. Topics include health and well-being; biological, socio-emotional, and cognitive development; sexual and racial/ethnic identity; risks and resilience; peer and family relationships; civic engagement and activism; positive youth development; and the transition to adulthood. Course readings focus primarily on adolescents and youth in the United States, although international contexts are also incorporated across the class.

Learning Outcomes: 1. Evaluate empirical studies assessing the major developmental themes of adolescence and the transition to adulthood. 2. Apply and understand major theoretical perspectives relevant to adolescent and youth development. 3. Demonstrate understanding of the contexts that impact development during adolescence and the transition to adulthood. 4. Demonstrate accurate knowledge of physical, cognitive, social, and psychological development of adolescents and youths. 5. Understand how adolescent and youth development is impacted by diverse backgrounds and experiences. Credits: 3.00

ASEC 63000 - Theories Of Learning And Development

Credit Hours: 3.00. The goal of this course is to introduce students to a variety of theoretical perspectives of learning and development and how they may be used in both formal, informal and non-formal educational settings. This goal will be achieved through students' analysis of key concepts, assumptions, propositions and principles of four theoretical areas: (1) Foundational Learning Theory, (2) Student Development Theory, (3) Career & Workforce Development Theory and (4) Youth Development & Experiential Learning Theory. This course will also build on students' prior exposure to behaviorist, cognitive, and constructivist approaches of learning and development. In sum, many of the theories discussed in this course will provide students with a greater understanding of human thought and behavior that will help them become more effective educators, researchers and practitioners. Permission of instructor required.

Learning Outcomes: 1. Demonstrate how to conduct a literature review and synthesis of the literature. 2. Examine the role of framing and focusing a research study using a paradigm position/epistemology, conceptual & theoretical frameworks. 3. Compare and contrast various theoretical perspectives of learning and development. 4. Distinguish the basic assumptions, concepts, and principles of various theoretical perspectives of learning and development. 5. Investigate how each theoretical perspective of learning and development can be applied to formal, informal and non-formal educational contexts. 6. Assess how each theoretical perspective of learning and development can be used in educational research. 7. Consider the implications of each theoretical perspective on teaching and learning formal, informal and non-formal educational contexts. 8. Develop a critical review of a theoretical perspective of learning and development. Credits: 3.00

ASEC 64200 - Seminar In Agricultural And Extension Education

Credit Hours: 1.00 to 4.00. Identification and analysis of contemporary programs used in agricultural and extension education. Prerequisite: 12 credit hours in Education.

Credits: 1.00 to 4.00

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects regulations. Credits: 1.00

ASEC 68100 - Research Design For Social Scientists

Credit Hours: 3.00. The goal of the course is to examine social science theories and research designs in the contexts of agricultural and natural resources education, communication and engagement. Students will develop understanding of the chain of reasoning and create a research design to study a problem of interest. Students will apply the concepts they learned in a research methods course by critiquing research manuscripts and creating a rationale for a research proposal. After taking the course, students should have gained understanding of how research designs are thoughtfully and argumentatively justified to study a researchable problem in informal, non-formal, and formal educational contexts and other social science contexts. Pre-or-Corequisite: FNR 58000 or EDPS 53300 (or instructor's permission for graduate-level social science research methods course).

Learning Outcomes: 1. Identify and focus a research problem. 2. Communicate effectively their research. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

ASEC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ASEC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Agricultural Systems Management

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

ASM 20100 - Construction And Maintenance

Credit Hours: 3.00. Fundamental principles in the selection and use of tools for the construction and maintenance of agricultural and related facilities, equipment, and machines. Areas covered include small engines, concrete and masonry, wood, plumbing, electricity, and metal.

Credits: 3.00

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 21600 - Introduction To Surveying

Credit Hours: 1.00. Introduction to plane surveying, including instruction and practice in the use of surveying instruments. Basic overview of distance/angle measurement, leveling, direction, traversing, and mapping. Each weekly topic includes practical application and field exercises as applied to landscape architecture and forestry.

Learning Outcomes: 1. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 2. Function on multidisciplinary teams. 3. Use economics principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. Credits: 1.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop a general awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5. Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

ASM 24500 - Materials Handling And Processing

Credit Hours: 3.00. Principles of materials handling and processing. Physical properties and characteristics of food, fiber, and feed materials as related to harvesting, handling, processing, and storage. Processing of agricultural materials including drying, preservation, size reduction (e.g. grinding, crushing, shredding), mixing and blending, refrigeration, extrusion, and pelleting. Conveying and transport systems with consideration of their effects on damage and quality. The course elements are tied together by a treatment of scheduling and coordination of biologically based systems, which involve production, handling, quality control, and processing.

Credits: 3.00

ASM 29100 - Special Topics

Credit Hours: 1.00 to 4.00. Designed for specialized topic areas for which there is no specific course, but have enough student interest to justify formalized teaching of an undergraduate-level course. The course may be repeated by a student as long as the topic being taught is not repeated. The special topic that is offered will be indicated on the student's record. Permission of instructor is required.

Credits: 1.00 to 4.00

ASM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 34500 - Power Units And Power Trains

Credit Hours: 3.00. An introduction to power generation and transfer in mechanical and fluid power systems. Internal combustion engines, fuels, and cycles are introduced. Clutches, mechanical transmissions, automatic transmissions, hydrostatic transmissions, and final drives are discussed. Principles of hydraulics, fluids, cylinders, pumps, motors, valves, hoses, filters, reservoirs, and accumulators are studied.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 40000 - Agricultural Systems Management Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6.

Understand basics of circuits programmed using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 42200 - Advanced Machine Technology For Agricultural Crop Production

Credit Hours: 3.00. The course examines technologies and techniques associated with modern farming practices often referred to in general as precision agriculture. It is structured to center around expert presentations from industry, academia, and farming practice, with a focus on technologies and appropriate application of such technologies in crop production systems in the Eastern Cornbelt. Consent of instructor required.

Learning Outcomes: 1. Identify and analyze technologies associated with precision agriculture. 2. Explain the appropriate use of the aforementioned technologies. 3. Compare technological alternatives in various crop production scenarios. Credits: 3.00

ASM 44100 - Methods Of Teaching Agricultural Mechanics

Credit Hours: 2.00. Emphasis on facilities, shop layout, organization, course planning, and demonstrations. Course meets during weeks 8-16. For students seeking career opportunities, certification, and instructional skill of educating others in agricultural mechanics and engineering technology utilizing a hands-on problem--solving approach. Students shall develop skills necessary to educate youth, employees, and/or consumers about complex agricultural systems. Special emphasis will be given to developing materials for kinesthetic learners.

Learning Outcomes: 1. Integrate S.T.E.M. approach in teaching and demonstrations of agricultural mechanics. 2. Develop hands-on demonstrations around agricultural technology and mechanics. 3. Analyze approaches to educational learning objectives. 4. Apply basic principles of agricultural technology and mechanics operations management. 5. Understand and apply the basic principles of creating a safe educational environment (hazard awareness). 6. Estimate project materials, cost, and layout for hands-on learning. Credits: 2.00

ASM 44400 - Design And Advanced Manufacturing Processes For Internal Combustion Engines

Credit Hours: 3.00. This course introduces the manufacture and assembly of machined piece parts into a functional assembly. The creation of a prototype internal combustion engine will be utilized as the base project for the course, and students will create and test the parts and final assembly. Students will be given a background on the process flow of modern manufacturing by general metal machining processes, manual machine tool operation, digital machine tool programming, numerical machine tool operation, the measurement of critical machining output variables, and the assembly of piece parts into subassemblies and final products. Course participants will work as a team to develop their production parts, final presentation, and final report.

Learning Outcomes: 1. Identify the sequence of machining operations for the construction of engine components. 2. Download specific instructions to numerically controlled machines to execute manufacturing instructions for specific parts. 3. Perform specific operations on traditional machine tools to create specific engine parts. 4. Understand how to measure critical dimensions in manufactured parts. 5. Understand the concepts of component assembly to create a functional device. 6.

Know the critical functionalities of an assembled product and be able to test its performance. 7. Understand the safety concerns of machine shops and how to mitigate danger to personnel and equipment. 8. Spread workloads between colleagues, assist one another in self-learning, and collaborate to meet collective course objectives. 9. Understand the concepts of professionalism, ethical responsibility, and integrity when applied to technical projects. 10. Enhance written and oral communication skills through the production of a comprehensive final report and summary technical presentation. Credits: 3.00

ASM 44500 - Grain Elevator And Processing Course

Credit Hours: 1.00. Grain handling and processing industry coursework through the Grain Elevator and Processing Society (GEAPS). Coursework varies by topic and covers technical aspects of grain handling, including safety, grain receiving, grain quality and equipment repair. Special registration required through the ABE Department. Each course can be completed at any pace over five weeks. Permission of department required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00

ASM 49000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. A written report and oral presentation of final results is required. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 49100 - Special Topics

Credit Hours: 1.00 to 4.00. Designed for specialized topic areas for which there is no specific course, but have enough student interest to justify formalized teaching of an undergraduate-level course. The course may be repeated by a student as long as the topic being taught is not repeated. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7.

Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

ASM 49600 - Project Planning And Capstone Project

Credit Hours: 1.00 to 4.00. Topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property, and timelines. Students will develop a project proposal to address contemporary issues in agricultural systems management and complete that plan related to contemporary issues in agricultural systems management. Permission of instructor required.

Learning Outcomes: 1. Identify strategic project objectives and key tasks associated with specific objective completion. 2. Design an environmental and natural resources system or a machine system to solve a specific need. 3. Plan the timeline and details of an intermediate term project. 4. Provide informal progress updates to mentors and instructors regarding project progress. 5. Interface with and seek guidance from project sponsors. 6. Model, prototype, and test project designs within a team environment. 7. Learn how to accomplish specific tactical goals for a project within a larger operational environment (i.e. University Machine Shop & Business Office; Corporate Sponsor's Organization). 8. Understand the compromises and load sharing necessary for effective team harmony. 9. Understand the concepts of professionalism, ethical responsibility, and integrity when applied to technical projects. 10. Enhance written communication skills through the production of a comprehensive final report. 11. Enhance oral communication skills through the production of a summary technical presentation. 12. Learn how to respond to questions and criticism. 13. Understand the concepts of deadline, closure, and delivery. Credits: 1.00 to 4.00

ASM 49800 - Undergraduate Research In Agricultural Systems Management

Credit Hours: 1.00 to 3.00. Individual research projects for students with the approval of their advisors. Requires prior approval of, and arrangement with, a faculty research advisor. A written report and/or public oral presentation of final results are required. Permission of instructor required.

Learning Outcomes: 1. Gain basic knowledge of research methods and techniques used in the field of study. 2. Apply appropriate methods to analyze data and draw meaningful conclusions. 3. Present research findings clearly in written and/or oral formats. 4. Understand and follow ethical guidelines in conducting and reporting research. 5. Work effectively with peers and faculty members on research-related tasks and projects. 6. Evaluate existing research critically and use that knowledge to guide research efforts. Credits: 1.00 to 3.00

ASM 51000 - Agrosecurity-Emergency Management For Agricultural Production Operations

Credit Hours: 3.00. Prepares individuals for management and loss control positions in agricultural production, agribusiness operations, and emergency management agencies. Addresses prevention, preparation, mitigation, response, and recovery from disasters such as fires, explosions, entrapments, tornadoes, floods, winter storms, earthquakes, vandalism, chemical releases, and bio-terrorism. Students complete a community service learning activity, in which they assist a farm or agribusiness manager in developing formal emergency preparedness plans.

Credits: 3.00

ASM 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information

systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

ASM 51200 - Managing Resources and Applications for Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

ASM 53000 - Power And Machinery Management

Credit Hours: 3.00. Management and selection of farm machines and power units with emphasis on cost analysis and evaluation of new machines and practices.

Credits: 3.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or

demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ASM 55000 - Grain Drying And Storage

Credit Hours: 3.00. Crop drying and storage principles including equilibrium moisture, psychrometrics, and drying rates. Modern drying and conditioning techniques including dryeration, in-bin counterflow drying, and combination drying. Estimating fixed and variable drying costs, aeration of stored grain, and maintenance of grain quality. Offered in even-numbered years.

Credits: 3.00

ASM 59000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of the instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for specialized topic areas in agricultural systems management for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

ASM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ASM 69900 - ASM Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate the ability to identify and conduct original research and scholarship in their area of study within the Agricultural Systems Management program. Credits: 1.00 to 18.00

Agriculture

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 10700 - Pathway To Purdue

Credit Hours: 1.00. This course is a required one credit introductory course for students participating in the Pathway to Purdue program. Students will learn about the Pathway to Purdue programs, study skills and techniques, transfer policies and requirements, as well as hear from a variety of guest speakers who will discuss relevant topics. Permission of department required.

Learning Outcomes: 1. Know about the Pathway to Purdue program. 2. Know about the transfer policies between Ivy Tech Community College and Purdue University. 3. Know study skills and techniques to be successful in college. 4. Identify areas of interest in the field of Agriculture. Credits: 1.00

AGR 10800 - Agriculture Technology And Innovation

Credit Hours: 1.00. The course will cover a broad range of innovations and technologies involved in the agricultural industry. The broad topics covered in this class will discuss development of latest technologies assisting in increase in yield, production and efficiency of agricultural systems. This may include, but is not limited to topics regarding environmental protection, plant production, livestock systems, and agricultural machinery.

Learning Outcomes: Learning Objectives: 1. Demonstrate an understanding of technological advancements in areas of: a). Environmental protection; b). Plant production; c). Livestock systems; d). Agricultural machinery. 2. Demonstrate an understanding of innovation processes and commercial development. 3. Communicate an understanding of several agricultural systems. 4. Explain some history of agricultural developments. 5. Appreciate the land grant system and recall specific examples of Purdue impact on global agriculture. 6. Improve ability to critically evaluate sources of information. 7. Connect to your academic program. Credits: 1.00

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11700 - Introduction To Entomology Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Entomology. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11800 - Introduction To Food Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Food Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and

regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12100 - Introduction To Agricultural Sciences Education And Communication Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Sciences Education and Communication which includes Agricultural Communication and Agricultural Education. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12400 - Introduction To College Of Agriculture Pre-Veterinary Medicine Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Veterinary Medicine. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

AGR 15000 - Woman In Agriculture I

Credit Hours: 1.00. Intended to expose first-year students to resources and the development of a network of students across campus. The course will support their transition to Purdue through a sense of community and increased engagement, and provide students access to faculty across the College of Agriculture in a small group setting. Activities include seminars to expose students to college and university resources, hands-on learning activity for team building, study halls, and group meals.

Learning Outcomes: 1. Learn about resources and tools that are available to you as a Purdue Student. 2. Build a rapport with female professors and staff in the College of Agriculture. 3. Introduce you to other students in the College to build a support network. 4. Learn a method to strengthen your confidence in engaging faculty and staff around campus. 5. Connect you with a network of professionals in the agriculture industry. Credits: 1.00

AGR 15100 - Women In Agriculture II

Credit Hours: 1.00. Intended to expose first-year students to academic, industry, government and professionals across the field of agriculture. The course will support networking and internship preparation through increased engagement with professionals across the field of agriculture, site visits and seminars. Activities include student seminars and presentation, field trips, case-studies and mock scenarios for problem solving and team building. Section one will focus on career exposure, development and communication skills.

Learning Outcomes: 1. Build presentation skills through active presentations and review of peer presentations. 2. Build a rapport with industry professionals through a mentorship project. 3. Strengthen skills in working with diverse and varied cultures. 4. Work on group case studies to solve an industry challenge. 5. Connect you with a network of professionals and explore career opportunities. Credits: 1.00

AGR 20100 - Communicating Across Culture (UCC: BSS/IL)

Credit Hours: 3.00. This course will provide students with an opportunity to understand their place in a multicultural, multiethnic, multinational country, the United States. It is designed to provide an academic overview of the field of multicultural education as it evolved to this day. The course will offer an introductory overview of the many differences that exist within all human beings. Because the diversity among individuals is endless, we cannot study all differences, but will study a sampling such as race, ethnicity, gender identity, age, social class, disability, learning styles, and religion/spiritual orientation. Issues of poverty, language, and social justice may also be examined in relationship to the above major areas of emphasis.

University Core Curriculum (UCC): (UCC: BSS/IL) Credits: 3.00

AGR 20500 - Dean's Scholars Seminar

Credit Hours: 1.00. Students are introduced to the breadth and mission of the College of Agriculture. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the opportunities within undergraduate research, and the challenges facing the food, agricultural, and natural resource system. Students will be exposed to a series of guest lecturers to gain an overview of the various fields within the college and undergraduate research or scholarly work opportunities.

Learning Outcomes: 1. Have an increased appreciation for the diversity of disciplines in agriculture and the contributions that a specific discipline can make to addressing human issues. 2. Gain an interdisciplinary understanding of Purdue Agriculture through research, scholarly article reviews, common reading experiences, group discussions and project work. 3. Work collaboratively with fellow students and peer mentors. 4. Develop a relationship with a small group of Dean's Scholars thus enhancing own college experience and learning skills. 5. Understand the requirements for the Dean's Scholars program including honors coursework, undergraduate honors research or scholarly project. Credits: 1.00

AGR 29000 - Special Topics In Agriculture

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. The specific topic that is offered will be indicated on the student's academic record.

Learning Outcomes: 1. Learning outcomes addressed include communication, critical thinking, and professional development. Credits: 0.00 to 3.00

AGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29400 - Directed Readings In Agriculture, Environment, And Society

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. Directed reading and discussion of books and other documents of significant importance and current interest in agriculture, food systems, renewable natural resources, and the environment. The specific topic that is covered will be indicated on the student's academic record. Permission of instructor required.

Learning Outcomes: 1. Develop an appreciation and understanding of the importance for the practice of critical reading. 2. Develop the ability to come up with questions that address the bigger/broader picture as shared through the readings. 3. Clearly articulate position and/or justify and defend stand amongst one's peers. 4. Carefully review and consider the facts, consider and propose future directions, next steps that could be taken as a result of the readings. 5. Develop initial strategies to discover pertinent and reliable information to improve your understanding. Credits: 0.00 to 3.00

AGR 33300 - Data Science For Agriculture

Credit Hours: 3.00. Students will apply data processes including identifying data needs, acquiring data, assessing data quality, data wrangling, filtering, and visualization. In each of several topic areas (forestry, animal science, agronomy, food science, entomology, engineering, economics), data-driven insights and improved decision making will be the culmination of applied data skills. Students will understand data ethics and practice data management skills including the merging of disparate but related data sets.

Learning Outcomes: 1. Construct a research question that helps address a decision. 2. Describe different types of experimental designs and discuss the differences between observational and experimental studies. 3. Identify data needed to address various research questions. 4. Identify how these data sources are used in data analysis: agronomics, machine data, maps, spreadsheets, sensor data. 5. Describe how various data sets are acquired. 6. Describe how the following impact data ethics: ownership, storage, access. 7. Assess data quality and utility. 9. Identify potential limitations of a dataset. 10. Describe the following aspects of data wrangling: data formats, data compatibility, mobility. 11. Describe the following aspects of data management: storage, curation, metadata, FAIR (findable, accessible, interoperable, reusable). 12. List reasons for filtering, cleaning, and pre-processing data. 13. Describe tools for data cleaning. 14. Integrate disparate data sets. 15. Describe uses for the following in data visualization: bar charts, line charts, maps, tables. 16. Use the following tools to analyze data: correlations, mean generation, confidence intervals, simple model building, R Python. 17. Make decisions based on data outcomes. Credits: 3.00

AGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39500 - International Internship

Credit Hours: 3.00. Supervised international internship in agricultural, food, or natural resource disciplines. The international internship must be approved as part of a Purdue University study abroad program and conducted under the supervision of a College of Agriculture faculty member. Students must submit a summary report and fulfill all requirements established by faculty supervisor. Consent of the College of Agriculture International Programs in Agriculture and Office of Academic Programs staff required.

Learning Outcomes: 1. Discuss the agri-business climate/economy of the internship country. 2. Demonstrate knowledge of culture in country of internship. 3. Compare and contrast agriculture practices between country of internship and the US. 4. Demonstrate emerging intercultural knowledge and effectiveness in the following areas: a) Cultural Self-Awareness: Recognizes new perspectives about own cultural rules and biases; b) Worldview frameworks: Demonstrates adequate understanding of the complexity of elements important to members of another culture in relation to its history, values, politics, communications styles, economy, or beliefs and practices: c) Curiosity: Asks deeper questions about other cultures and seeks out answers to these questions. Credits: 3.00

AGR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 40000 - Agriculture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

AGR 49000 - Special Problems

Credit Hours: 0.00 to 3.00. Topics and credit hours to be arranged.

Credits: 0.00 to 3.00

AGR 49300 - Special Topics In International Agriculture

Credit Hours: 0.00 to 3.00. A course that provides students interested in international agriculture opportunity for in-depth study and analysis of major issues associated with the relationship of U.S. agriculture to world agriculture and agricultural development abroad. Current and significant topics will be selected. Permission of instructor required.

Credits: 0.00 to 3.00

AGR 49400 - Advanced Readings In Agriculture, Environment, And Society

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. Directed reading and discussion of books and other documents of significant importance and current interest in agriculture, food systems, renewable resources and the environment. The

specific topic that is offered will be indicated on the student's academic record. Permission of instructor required.

Learning Outcomes: 1. Develop an appreciation and understanding of the importance for the practice of critical reading. 2. Develop the ability to come up with questions that address the bigger/broader picture as shared through the readings. 3. Clearly articulate and/or justify and defend stand amongst one's peers. 4. Carefully review and consider the facts, consider and propose future directions, next steps that could be taken as a result of the readings. 5. Develop initial strategies to discover pertinent and reliable information to improve your understanding. Credits: 0.00 to 3.00

AGR 49500 - International Professional Experience In Agriculture, Food, Or Natural Resources

Credit Hours: 0.00. Supervised international professional experiences in agricultural, food, or natural resource disciplines. The professional experience period must be preplanned and conducted under the supervision of a College of Agriculture faculty member. Students must submit a summary report. Consent of the College of Agriculture international professional experience program coordinator required. Permission of instructor required.

Credits: 0.00

AGR 49600 - Multicultural Professional Experience

Credit Hours: 0.00. The multicultural professional experience must be pre-planned and conducted under the supervision of a College of Agriculture faculty member. The experience must be a minimum of four weeks in length. Students must submit a summary report.

Credits: 0.00

AGR 59500 - Current Topics In Agriculture, Natural Resources, And Related Sciences

Credit Hours: 1.00 to 3.00. Critical examination of developments in specialized and emerging areas of agriculture not taught in other courses. Some topics include lecture, lab, directed reading or independent study. Students must have graduate standing or obtain permission of instructor.

Learning Outcomes: 1. Enhanced discipline knowledge for agriculture, natural resources and related sciences. 2. Enhanced oral and written communication skills. 3. Develop critical and creative thinking skills, mastery of ethics in research. 4. Enhanced professional development skills. Credits: 1.00 to 3.00

Agronomy

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 12000 - Water And Food Security

Credit Hours: 3.00. General science introduction to global and regional water resources issues, especially with respect to food security. It will address the role of water in agriculture throughout the world and agriculture's impact on water resources. Students will focus first on developing the scientific underpinnings of water supply and crop water use. With this background, they will explore key issues relating to water scarcity and balancing agricultural and urban demands for water, water quality and soil salinization, water footprints of food and the use of virtual water embedded in food to offset national water deficits, regulation and roles science and policy in solving water problems.

Learning Outcomes: 1. Be familiar with water resources concepts, including water supply,

water demand, irrigation needs, crop water use and water contamination. 2. Gain qualitative and quantitative understanding of water scarcity, water use efficiency and water footprints. 3. Develop oral and written communication skills and problem solving abilities on topics related to agricultural water resources. Credits: 3.00

AGRY 12300 - Genetics And Society

Credit Hours: 3.00. Introduction to the broad impacts that genetics and genomics have on society, from medicine, genetic testing and DNA evidence to agriculture, genetically modified crops and synthetic life. Background information is provided on a weekly topic followed by extensive in-class discussion.

Learning Outcomes: 1. Describe the issues, facts, and concepts central to a broad range of genetics and genomics topics. 2. Form own opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe work done in three scientific disciplines, biology, genetics and genomics, as well as some intersecting disciplines such as medicine and engineering. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

AGRY 15500 - Introduction To Soil Morphology

Credit Hours: 2.00. This course features an introductory field experience in evaluating soil morphology. Students will develop skills determining horizon nomenclature, texture, soil color, structure, consistence and drainage. Basic concepts regarding the impact of soil morphology on use of soils for various purposes will be presented. Collegiate soil judging is a portion of the subject matter discussed.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 2.00

AGRY 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (HORT 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high quality, low maintenance lawn will be discussed.

Credits: 3.00

AGRY 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (HORT 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 510. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

AGRY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given

information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

AGRY 35000 - Global Awareness

Credit Hours: 1.00 to 3.00. A seminar-type course about world geography, cultures, and agriculture. Speakers are selected from the many Purdue graduate students and visiting scholars from around the world. Extra credit may be earned through independent study of a global issue.

Credits: 1.00 to 3.00

AGRY 35500 - Soil Morphology And Geography

Credit Hours: 2.00. This course features field experience in advanced techniques in soil morphology including the study of the relationship of soils to landscaped, common parent materials of Midwest and classification of soils in the Soil Taxonomy. Course material emphasizes the development of detailed descriptions of soil properties and how these properties directly impact the interpretations and recommendations for land use options. Use and management of soils based on landscape position and morphology will be covered including on-site waste disposal, homes with basements as well as road and street construction. Collegiate soil judging is a portion of the subject matter discussed. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional

conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 2.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

AGRY 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (NRES 38500) Designed as an upper level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 4.00

AGRY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of

department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 39900 - Individual Study

Credit Hours: 1.00 to 3.00. Supervised individual study or research over topics not covered in other courses. Arrange with agronomy faculty before registering. Permission of instructor required.

Credits: 1.00 to 3.00

AGRY 42000 - Computing For The Natural Sciences

Credit Hours: 3.00. Basic programming, problem solving, data visualization and communication in the context of agriculture and natural science research using R. Topics include iteration, functions, vectors, strings, algorithms, graphics and reproducible reports in R. This course is appropriate for undergraduates with a curiosity in computing fundamentals and interest in working with research data, especially those potentially applying to graduate school. Also appropriate for graduate students, researchers or other professionals who desire an introduction to programming with R. NO programming experience is necessary. This is not a statistics course; having had introductory statistics and some background coursework in agricultural or other natural sciences is expected.

Learning Outcomes: 1. Design, code and test small R programs. 2. Use programming to solve problems. 3. Communicate results with clean, reproducible reports. Credits: 3.00

AGRY 43100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (EAPS 42100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 3.00

AGRY 43200 - Atmospheric Dynamics I

Credit Hours: 3.00. (EAPS 42200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations; thermal wind relationships; circulation, vorticity, divergence, and vertical motion.

Credits: 3.00

AGRY 43300 - Atmospheric Dynamics II

Credit Hours: 3.00. (EAPS 42300) An extension of AGRY 43200 with the emphasis on perturbation theory and

hydrodynamic stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

AGRY 44100 - Synoptic Laboratory I

Credit Hours: 1.00. (EAPS 43100) Analysis of vertical distributions of temperature and moisture with applications to adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 1.00

AGRY 44200 - Synoptic Laboratory II

Credit Hours: 1.00. (EAPS 43200) Analysis of horizontal distributions of pressure, temperature, wind, vorticity, and vertical motions. Applications to synoptic scale wave propagation.

Credits: 1.00

AGRY 44300 - Synoptic Laboratory III

Credit Hours: 1.00. (EAPS 43300) Diagnosis of midtropospheric wave propagation and growth. Analysis of surface pressure fields and fronts and their relationships to upper air features. Extensive use is made of teletype and facsimile weather information.

Credits: 1.00

AGRY 44400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (EAPS 43400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 48000 - Plant Genetics

Credit Hours: 3.00. Principles and recent advances in plant genetics including: genetic segregation, linkage, DNA markers and applications, chromosomes and genomes, variation in chromosome number and structure, mutation, recombination and DNA repair, quantitatively inherited traits, introduction to principles of population genetics, gene expression, gene organization, regulation of gene activity, gene function, identifying important genes, cloning genes, reverse genetics, plant transformation, applications of genetic engineering, genome sequencing, using sequence data.

Credits: 3.00

AGRY 48500 - Precision Crop Management

Credit Hours: 3.00. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital georeferenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. May be used in combination with AGRY 49800 to meet the Agronomy undergraduate capstone requirement; will also meet the GIS/GPS requirement in Agronomy plans of study.

Learning Outcomes: 1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from Dupont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input

levels. 2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions. 3. Utilize data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific basis. 4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management. 5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates. 6. Utilize geo-referenced field scouting data and crop models to prescribe effective pest management strategies. 7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources. 8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies. 9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors 10. Evaluate potential crop response to varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions). 11. Describe and explain the impact of productivity influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management). 12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies. 13. Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management. Credits: 3.00

AGRY 49700 - Agronomy Internship Or Research Reporting

Credit Hours: 1.00. Reflection and reporting on participation in government, industrial, or other internship program or research assistantship. This course is intended to provide an opportunity for students to reflect on their internship experience, interact with students with similar experience, and report on the experience, as part of preparation for a career in the environmental sciences. Permission of department required.

Learning Outcomes: 1. Compare and contrast different professional settings and work environments through the internship experience. 2. Reflect on the internship experience and how it informs career goals. 3. Analyze and interpret simple data, appropriate to the professional setting. 4. Communicate effectively using written and oral media. Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

AGRY 50500 - Forage Management

Credit Hours: 3.00. The study of the role of economically important crop species in the soil-plant-animal complex. Physiology, utilization, and management of forage species will be emphasized.

Credits: 3.00

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn

care companies, and sod production facilities in an efficient and environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

AGRY 51400 - Environmental Stress Management For Turfgrass

Credit Hours: 1.00. Designed for students who desire an understanding of how environmental stresses influence turfgrass growth and how they can be managed with cultural practices. The course covers current research findings in stress management and integrates turfgrass environmental physiology with turfgrass management.

Learning Outcomes: 1. Demonstrate ability to identify problems, analyze data and derive conclusions. 2. Demonstrate critical thinking and the ability to write and speak with effectiveness. 3. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 1.00

AGRY 51500 - Plant Mineral Nutrition

Credit Hours: 3.00. Fundamental principles and concepts of the mineral nutrition of higher plants; processes and mechanisms controlling nutrient bioavailability and acquisition; physiological, genetic, and ecological aspects of plant nutrition including rhizosphere dynamics and interaction with disease.

Learning Outcomes: 1. Identify and describe the essential mineral nutrients required for plant growth. 2. Recognize the symptoms of nutrient deficiencies and toxicities in plants and understand the underlying physiological and biochemical changes. 3. Understand the mechanisms of nutrient uptake from the soil by roots, the role of root hairs, mycorrhizal associations, and the transport of nutrients within the plant through xylem and phloem. 4. Comprehend the biochemical pathways and processes through which plants assimilate and utilize nutrients. 5. Explore the signaling mechanisms that regulate nutrient uptake and utilization, including sensing mechanisms, gene expression, and hormonal responses. Credits: 3.00

AGRY 51800 - Plant Physiology And Biotechnology Research Techniques

Credit Hours: 3.00. This course has two components. The physiology section covers some of the popular experiments, such as the measurement of water potential, photosynthesis, stomata density, carbohydrate content, enzyme activity, mineral deficiency, drought stress physiology, plant pigment analysis, etc. The biotechnology section guides students through the entire procedure of genetic engineering, culminating in a project that will serve as an example on how to use molecular tools to answer fundamental physiological questions.

Learning Outcomes: 1. Master the use of a broad array of plant biotechnological and physiological research techniques. 2. Troubleshoot experiments and analyze, interpret and effectively communicate research results. 3. Envision, design and develop new research techniques for future use building upon peer-reviewed literature and meeting emerging research needs. Credits: 3.00

AGRY 52000 - Principles And Methods Of Plant Breeding

Credit Hours: 3.00. Introduction to methods and techniques of breeding field crops, with emphasis on the application of genetic principles; analysis of and present approach to the solution of specific breeding problems in selected field crops.

Credits: 3.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

AGRY 53000 - Advanced Plant Genetics

Credit Hours: 3.00. Advanced treatment of principles and recent advances in plant genetics including: mutagenesis; cell, molecular and direct approaches to genetic analysis and genetic interactions; haploidy; chromosomal organization and aberrations; transposable elements; mutations, para mutation and epigenetics in higher plants; extra nuclear inheritance; cytogenetic and molecular affinities between crop plants and their wild relatives; genetic manipulations; gene discovery; genetic approaches to understanding agriculturally useful plant traits. ESTs and global gene expression analysis, proteomics, metabolic profiling, comparative genomics and genome evolution. Offered in odd-numbered years.

Credits: 3.00

AGRY 53500 - Boundary Layer Meteorology

Credit Hours: 3.00. (EAPS 52500) This course has required class trips. Students will pay individual lodging or meal expenses where necessary. A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

AGRY 53600 - Environmental Biophysics

Credit Hours: 3.00. An analysis of the energy fluxes to and from terrestrial plants, insects, mammals, and humans as they exist in their macro and microclimates. Agricultural meteorology methods (both research and operational) will be presented. Labs will be both in-laboratory and in-field with reports required. A special project will be required of all students and will be presented in class and written as if for publication.

Credits: 3.00

AGRY 54000 - Soil Chemistry

Credit Hours: 3.00. Emphasis on processes controlling the gaseous, solution, and solid phases in soils including precipitation, acid-base, oxidation-reduction, complexation, absorption, and ion exchange.

Credits: 3.00

AGRY 54400 - Environmental Organic Chemistry

Credit Hours: 3.00. The fundamental properties and processes responsible for the fate of organic chemicals in the environment, with emphasis on soil and water chemistry. Areas to be addressed will include both conceptual and theoretical aspects of processes relevant to environmental fate of contaminants; measurement, estimation, correlation, and application of the parameters most commonly used to assess various chemodynamic properties in soil-water systems.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in surface and subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-base speciation and reactivity. 3. Quantify chemical distribution between soil-water, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information.

Credits: 3.00

AGRY 55000 - Field Crops Breeding Techniques

Credit Hours: 2.00. Field nursery experience, including crossing procedures, plant evaluation, selection for pest resistance and for agronomic characters, and field data evaluation.

Credits: 2.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal

expenses when necessary.

Credits: 3.00

AGRY 58000 - Soil And Rhizosphere Microbiology

Credit Hours: 3.00. Soils are complex ecosystems that host a diverse array of organisms, which interact with and respond to their environment. This course explores the ecology, evolution, and functions of soil microbes, with a particular focus on their interactions with plants. Through this course, students will gain an understanding of the metabolic processes and life-history strategies of archaea, bacteria, fungi, and viruses in soil, root, and rhizosphere compartments. Students will also survey the microbiomes of diverse soil ecosystems, such as forests, agroecosystems, and grasslands, and learn principles of soil microbiology and biogeochemistry. In addition, students will acquire practical knowledge about the methods used for characterizing microbes in soil and plant systems.

Learning Outcomes: 1. Demonstrate understanding of the ecology and physiology of major groups of bacteria, archaea, fungi, and viruses found in soils, the rhizosphere, and roots. 2. Compare and contrast soil and rhizosphere microbiomes, and their differences between the managed versus natural ecosystems. 3. Use verbal and basic mathematical descriptions to explain theories related to microbial growth, survival, and symbioses. 4. Predict the occurrence of microbial processes and soil conditions that govern the cycling of carbon, nitrogen, phosphorus, sulfur, and metals in soils and relate this knowledge to ecosystem functions. 5. Envision potential applications for soil and root-borne microbes in natural resource management, such as agriculture, forestry, and soil conservation. 6. Apply knowledge of plant-microbe interactions to develop hypotheses, design experiments, and select appropriate study methods. 7. Recognize and select appropriate resources and tools to effectively analyze microbiome data. Credits: 3.00

AGRY 58500 - Soils And Land Use

Credit Hours: 3.00. Soils as a resource in development planning; soil properties affecting land use; use of soil survey, aerial photos, topographic maps, and other resource data in land-use allocation; nonengineering aspects of site selection for various land uses, water conservation, waste disposal, and erosion control.

Credits: 3.00

AGRY 59600 - Professional Presentations

Credit Hours: 1.00. Develop confidence and skills in preparing and delivering professional presentations to both peer scientific and student audiences. (el. 7)

Credits: 1.00

AGRY 59700 - Communicating With The Public

Credit Hours: 1.00. This course will prepare students being trained as agronomy professionals to enhance their communication skills so they can successfully interact with the public. (el. 7) Offered in alternate years.

Credits: 1.00

AGRY 59800 - Special Problems

Credit Hours: 1.00 to 6.00. Research on agronomic problems conducted in laboratory, field, or library; report required; arrange with an agronomy staff member before registering. Permission of instructor required.

Credits: 1.00 to 6.00

AGRY 60000 - Genomics

Credit Hours: 3.00. An introduction to the technologies and analytical methods used in studying genomes, their functions and systems biology. This course prepares graduate students for further study of these techniques in additional courses and in their research. Students with an understanding of introductory genetics and statistics will be suitably prepared for this course. Offered in even-numbered years.

Credits: 3.00

AGRY 60100 - Introduction To Graduate Research

Credit Hours: 1.00. This course provides framework for graduate studies. It helps the new graduate student understand the roles and responsibilities in graduate education, providing guidance for scientific reading, writing, and research activities. Topics include understanding ethical issues in science, enhancing their ability to communicate with a broad range of people, and establishing initial perspectives on professional development. Permission of department required.

Learning Outcomes: 1. Prepared to practice good research record keeping. 2. Write a hypotheses for their research. 3. Exemplify integrity and honesty in their research. 4. Choose the appropriate mode of communications based on the expected response of their colleagues. 5. Assess their strengths and weaknesses and plan their student careers informed by potential professional careers. 6. Appreciate the value of

diversity and inclusion in their research experience. 7. Consider paths from a wide range of options given their values, abilities and interests. Credits: 1.00

AGRY 60200 - Systematic Reviews In Agriculture And The Environment

Credit Hours: 3.00. This course is primarily intended for PhD students in the broad discipline of agricultural sciences who want to learn how to develop a publishable systematic review (SR) for their dissertation topic and/or in future work. The course goal is for students to understand the distinguishing features of important SR typologies and be able to apply their understanding to selecting and conducting the SRs that are appropriate to their own research questions. Students will meet twice a week with experts in agricultural sciences (e.g., agro-ecology, soils, animal sciences, crop sciences, socioeconomic sciences, etc.), information studies, data sciences and statistics; class time will typically involve lecture followed by collaborative work activities. Students will identify questions to work on individually and/or together in teams in a semester-long effort expected to lead to a peer-review publication. The research questions are anticipated to focus on management and technology efficacy in broadly defined agricultural systems (including livestock), agricultural impacts on ecosystem services, etc. Weekly assignments will follow the sequential steps of a full SR. Note that completion/publication of a full SR is not required to successfully complete the class as a full publication will likely require additional effort beyond the 16-week semester. Additional special project credits may be offered to students for completing work in the following semester(s).

Learning Outcomes: 1. Think originally and independently to develop concepts and methodologies. 2. Identify new research opportunities within one's field. 3. Synthesize existing knowledge, identifying and accessing appropriate resources and other sources of relevant information and critically analyzing and evaluating one's own findings and those of others. 4. Master application of existing research methodologies, techniques, and technical skills. 5. Communicate in a style appropriate to the discipline. 6. Keep abreast of current advances within one's field and related areas. 7. Show commitment to personal professional development through engagement in professional societies, publication, and other knowledge transfer modes. 8. Show a commitment to creating an environment that supports learning through teaching, collaborative inquiry, mentoring, or demonstration. 9. Adhere to ethical standards in the discipline. 10. Listen, give, and receive feedback effectively. Credits: 3.00

AGRY 60500 - Advanced Plant Breeding

Credit Hours: 3.00. Advanced study of genetic principles and their application to plant breeding systems, techniques, and objectives. Offered in alternate years. Prerequisite: AGRY 52000; a course in statistics covering simple analysis of variance.

Credits: 3.00

AGRY 61100 - Quantitative Genetics

Credit Hours: 3.00. Continuation of AGRY 51100, ANSC 51100. Quantitative genetics in animals and plants. Genotypic and environmental variances; covariances between relatives; single- and multiple-trait selection and correlated responses; genotype-environment interaction. Inbreeding and crossbreeding: means, variances, heterosis, intra- and inter-population improvement. Prerequisite: STAT 51200; Prerequisite: AGRY 51100 OR ANSC 51100.

Credits: 3.00

AGRY 62400 - Plant Ecophysiology

Credit Hours: 3.00. This course will explore the influence of the environment on growth and development, reproduction, adaptation, survival and evolution of plants. The fundamental study of physiological mechanisms underlying adaptive strategies and their ecological consequences will be included. Prerequisites: Undergraduate or graduate level of Plant Physiology (HORT 30100 or AGRY 52500 or HORT 55100 or FNR 43400 or equivalent).

Learning Outcomes: 1. Demonstrate ability to identify problem, analyze data and derive conclusions. 2. Demonstrate critical thinking and the ability to write and speak with effectiveness. 3. Demonstrate the ability to work independently as well as effectively as part of a problem-solving team. Credits: 3.00

AGRY 64100 - Statistical Hydrology

Credit Hours: 3.00. This course is designed to serve as an advanced graduate course in the statistical analysis of hydrologic data, including time series analysis and modeling, frequency analysis and uncertainty. Prerequisites: AGRY 33700 or CE 54200 or ABE 32500 and STAT 51100 or STAT 50300.

Learning Outcomes: 1. Apply statistical methods used for hydrologic design, standard time-series methods applied to the modeling of

hydrologic variables and uncertainty techniques. 2. Infer the appropriate statistical method through analysis of hydrologic data. 3. Analyze hydrologic change in response to environmental changes using the concepts learned. Credits: 3.00

AGRY 64900 - Molecular Microbial Ecology

Credit Hours: 3.00. Focuses on the application of various molecular genetic techniques for studying micro-organisms from and in the environment. The method, theoretical basis of each method, and interpretation of results are covered. The major areas discussed are the application of molecular genetic techniques to study: (1) total microbial communities; (2) diversity of micro-organisms in a community; and (3) biotechnological uses of micro-organisms. Prerequisite: AGRY 32000 or AGRY 58000 or BCHM 56200 or BIOL 24100 or BIOL 43800 or BIOL 54900.

Credits: 3.00

AGRY 65000 - Clay Mineralogy

Credit Hours: 4.00. Principles of crystal chemistry, survey of clay mineral structures, and identification of clay minerals by X-ray diffraction, chemical methods, differential thermal analysis, infrared spectroscopy, and specific surface area measurements. Role of clay minerals in the natural environment. Offered in alternate years.

Credits: 4.00

AGRY 69500 - Graduate Professional Practice

Credit Hours: 0.00 to 3.00. An internship experience with a for-profit, non-profit, or governmental entity to complement the student's academic coursework. Practical experience with an employer is required to successfully complete the course. The student must present a letter from the proposed employer describing to a reasonable extent the work to be undertaken, document the expectations, and find an Agronomy faculty advisor/instructor to oversee the experience. Course may be taken in successive semesters. Permission of instructor required.

Learning Outcomes: 1. Experience applying knowledge and skills learned in prior coursework and reading the scientific literature to solve current problems and/or address current issues. Credits: 0.00 to 3.00

AGRY 69600 - Agronomy Graduate Seminar

Credit Hours: 1.00. Weekly discussion of assigned topics in soil and crop science.

Credits: 1.00

AGRY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

AGRY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

American Sign Language

ASL 10100 - American Sign Language I (UCC: HUM)

Credit Hours: 3.00. A basic introduction to American Sign Language. This course introduces students to the tools for mastering the grammar at a basic expressive and receptive level. Introduction to cultural and historical aspects of ASL and the deaf community.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ASL 10200 - American Sign Language II (UCC: HUM)

Credit Hours: 3.00. A continuation of ASL 10100. Further study of the language with more emphasis on receptive and expressive conversational skills. Includes readings of research studies relevant to lectures.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand and manage more complex interactions involving expanded ASL lexical signs, grammatical rules, and sentence structure (syntax). 2. Demonstrate an expanded conversational and narrative skill in ASL using both concrete and abstract concepts. 3. Exhibit the ability to use appropriate ASL grammatical features and functions of the language used in dialogues and story-telling that includes non-manual grammatical signals, and prosodic features of intensity and characterizations. 4. Demonstrate an understanding of and respect for Deaf people and ASL by engaging appropriate conversation strategies used in the Deaf Community and applying their ASL skills within and beyond the school settings. Credits: 3.00

ASL 20100 - American Sign Language III (UCC: HUM)

Credit Hours: 3.00. A more advanced study of American Sign Language. Further development of receptive and expressive skills using more advanced material. Continued emphasis on cultural and historical aspects in relation to the evolution of the language and language usage.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ASL 20200 - American Sign Language IV (UCC: HUM)

Credit Hours: 3.00. A continuation of ASL 20100. Includes some introduction to linguistic structure, especially classifiers, temporal sequencing and aspect, and conversational regulators.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ASL 28000 - American Deaf Community: Language, Culture, And Society

Credit Hours: 3.00. The linguistic, cultural, and societal context of the deaf community in America. Both historical and contemporary aspects of deaf identity will be included, with an emphasis on the central role that ASL plays in the lives of deaf individuals.

Credits: 3.00

ASL 30100 - American Sign Language V

Credit Hours: 3.00. This course is a continuation of ASL 20200 (5th in sequence of courses in ASL). Features of Level 5 are expanded student discourse, advanced ASL structure and vocabulary, roleshift variations, formal storytelling, text analysis and formal/informal presentations.

Learning Outcomes: 1. Students will learn and demonstrate advanced grammatical uses of ASL in conversations and in storytelling. 2. Students will develop increasingly complex receptive and expressive skills in ASL discourse: how sign movements can be modified to change meaning; how and when facial expressions occur; and how body, head, and eye movements are used in phrasing and agreement. 3. Students will demonstrate fluent and appropriate communication skills with competent/native users of ASL by maintaining a high degree of grammatical accuracy. 4. Students will demonstrate increased understanding and appreciation of noted ASL artists performing handshape stories, cheers, songs, poetry, storytelling, and legends. 5. Students will be able to compare, contrast, and exchange opinions on current issues in the field of Deaf and ASL studies. Credits: 3.00

ASL 30200 - American Sign Language Advanced-Level VI

Credit Hours: 3.00. This course is a sequential course in the advanced study of American Sign Language (ASL) with emphasis on basic concepts of language based ASL. This is an application of language usage in ASL in which students will gain an advanced understanding and mastery of ASL grammar. Includes instruction in semantic and grammatical accuracy and appropriate discourse strategies in a variety of communication contexts. Students utilize advanced receptive and expressive skills.

Learning Outcomes: 1. Identify the appropriate use of ASL semantics and conceptual signs. 2. Apply intermediate-to-advanced ASL grammatical features to informal and formal styles. 3. Compose narratives and presentations in ASL. 4. Discuss, debate, and exchange information and perspectives of ASL and Deaf culture. Credits: 3.00

ASL 36100 - The Structure Of American Sign Language I: Phonology And Morphology

Credit Hours: 3.00. Linguistic study of ASL, including the following: phonological features of individual signs (hand shape, orientation, location, movement) and how those features shift when placed in a stream of signs; morphological features of signs, including compounding and lexicalization of fingerspelled words; grammar, focusing on typical word orders found in ASL sentences; meaning of signs and how those meanings have shifted over time (as well as how those meanings shift for particular dialects); and typical pragmatic features of conversation in ASL. Knowledge of ASL is required.

Learning Outcomes: 1. Demonstrate increased vocabulary and grammatical structures necessary to interact with deaf people accurately in ASL. 2. Develop an understanding of the principles of ASL linguistic structure through study of ASL grammar. 3. Articulate the differences between ASL and English grammars. 4. Demonstrate appropriate structure and pragmatics when interacting with deaf and hard of hearing people. 5. Develop an intercultural awareness of the differences between deaf and hearing communities and will learn to adjust their behavior accordingly. Credits: 3.00

ASL 36200 - The Structure Of American Sign Language II: Syntax, Semantics And Language Use

Credit Hours: 3.00. This course introduces students who already have prior knowledge of linguistics (e.g., phonetics, phonology, and morphology) to three areas of study in linguistics: Syntax, Semantics, and language use. Linguistic study of ASL, including the following: Syntax includes units on basic sentence types, lexical categories, word order, time and aspect, verbs, and the function of the spaces. Semantics includes the meanings of individual signs and sentences. Language in Use includes Black ASL, Variation and Historical Change. Bilingualism and language acquisition will be also covered. ASL Discourse has the ways that signed conversations among deaf people differ from speaking conversation of hearing people, why these differences exist, and why they are culturally important. Knowledge of ASL is required.

Learning Outcomes: 1. Compare and differentiate the basic characteristics of signed and spoken languages by text reading. 2. Identify and describe the structure and use of American Sign Language with attention to sociolinguistic rule concerning ASL in the Deaf community by observing the film resources. 3. Apply linguistic knowledge by comparing, identifying parts and relationships of all languages, spoken and signed. 4. Develop an intercultural awareness of the differences between deaf and hearing communities and will learn to adjust their behavior accordingly. Credits: 3.00

ASL 39000 - Undergraduate Research In American Sign Language

Credit Hours: 3.00. This course is designed to allow for the investigation of topics related to the linguistic structure of ASL, populations of ASL language learners, sub-populations of the Deaf Community at the undergraduate level. Permission of instructor required.

Credits: 3.00

American Studies

AMST 10100 - America And The World (UCC: WC)

Credit Hours: 3.00. This course examines the evolution of American culture as the United States transitioned from a relatively isolated country at the end of the 19th century to an active shaper of a global community by the 21st century. We will examine ways in which American Culture shaped and was shaped by international relationships that transcend nation states. We will explore reactions to, and the results of, the spread of American culture both inside and outside the United States. By studying traditional cultural forms like art, music, design, literature, film, and technology the course will build a foundation from which to understand the configuration of American culture. Yet the course will also emphasize American culture expression, that in the forms of television, advertising, sport, cartoons, social media, video games, fashion, food, drugs, and automobiles, have transcended the geographical boundaries of the United States to engage in global interplays of material cultural exchange.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Identify the major themes and issues prompted by the term American Culture. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Recognize important issues that occur among peoples in an increasingly interconnected and interdependent world. 5. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 6. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

AMST 20100 - Interpreting America (UCC: HUM)

Credit Hours: 3.00. Introduction to the interdisciplinary study of American culture, history, and society in its national and global contexts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major themes and issues prompted by the term American. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

AMST 21000 - Sport In American Culture (UCC: BSS)

Credit Hours: 3.00. This course engages critical questions regarding sport and its role in American culture. It examines the ways sport serves as a key site for the study of larger social issues and social problems, including how race, gender, social class and other social locations are simultaneously reproduced and challenged in and through sport. The course also explores the relationships between sport and other major social institutions, such as the economy, education, politics, and media.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand sport as a social construction. Understand sport as a contested activity. 2. Identify and explain the relationships of sport to other institutions in society, including politics, education, economy, and the media. 3. Explain the role of sport in central social issues, including race/racism, gender/sexism, class, homophobia, and violence. 4. Apply academic theories and concepts to the study of sport. Credits: 3.00

AMST 22000 - Technology And Play (UCC: HUM)

Credit Hours: 3.00. This course introduces students to games, as well as investigating innovations and controversies in the gaming industry. It will explore theories of play, how technological innovations and business practices in both digital and analog gaming (through board games, video games, tabletop games, and esports) mediate or structure the experience of play. It will also survey the rise of myriad gaming subcultures, including celebrity streamers and esports.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important categories of games. 2. Demonstrate critical thinking skills of observation, explanation, and interpretation to assess sociological and cultural trends in the different spaces of gaming. 3. Produce original work using logic, creativity, and interpretive skills examining different games and industry practices. Credits: 3.00

AMST 25000 - An Introduction To American Protest Movements: What Are They? What Can They Do? How Can We Make One? (UCC: HUM)

Credit Hours: 3.00. In this course, we will study the reasons people in the United States have historically decided to create social movements, tactics and strategies they use to make and sustain those movements, obstacles to their success, and ways of judging their victories. The course will draw on scholarship on social movements from various fields, especially the field of American Studies. Because social movements are created by ordinary people, we will use a variety of sources they leave behind: speeches, testimonials, pamphlets, historical accounts, autobiographies, manifestos. We will also explore scholarship on social movements to try to understand how best to record and analyze the work social movements do. The course seeks to provide students an understanding of the role of protest movements in American history. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge across a range of chronological, cultural and geographic areas. 2. Show an understanding the ways protest movements shape American culture. 3. Describe how different aspects or types of human endeavor and experience may be connected. 4. Identify the roots of contemporary issues and challenges, with attention to social values and the role of identity in the human experience. 5. Apply a critical perspective to evaluating arguments, including the quality of sources, the validity of the interpretations of those sources, and the soundness of the argument's use of evidence to support that interpretation. 6. Formulate and support an argument in a well-focused, logically organized piece of writing. Credits: 3.00

AMST 30100 - Perspectives On America

Credit Hours: 3.00. Advanced interdisciplinary study of American culture, history, and society in their national and global contexts.

Credits: 3.00

AMST 31000 - Invention, Innovation, And Design (UCC: HUM/STS)

Credit Hours: 3.00. This course focuses on the various ways that invention, innovation, and design shape the modern world. We will investigate the forms, uses, and meanings of a diverse set of objects, networks, and systems that influence the ways we live. We will explore these ideas through the concepts of consumption, waste, and "smart" to gain a deeper understanding of how material infrastructures influence human existence. This project-based course will use readings, discussions, and critical reflections to inform a series of hands-on projects to understand our roles as designers, creators, and users of science, technology, and material culture. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms invention, innovation, and design. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through designed objects. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze invention, innovation and design through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 32000 - Understanding The National Football League

Credit Hours: 3.00. This course counters the cultural myth that sports are "simply a form of entertainment" or "an escape from reality" and takes seriously the notion that sports matter as a social, cultural, and political force. Students will use academically informed inquiry and investigation to examine broader cultural dynamics through a critical examination of the National Football League. Course topics include how the NFL shapes social identities including race, gender, sexuality, and American identity, the connection between football and militarism, the relationship between the NFL and commercialism, the role the NFL plays in the triad of men's violence, among other topics.

Learning Outcomes: 1. At the end of this course you will be able to summarize the evidence and conceptual arguments that the NFL is a cultural institution by which we can understand American society by exploring key topics covered in course in class activities, film response papers, and exams. 2. At the end of the course you will be able to explain how the National Football League matters as a social, political, and cultural force. 3. At the end of the course, you will be able to respond, from a critically informed academic perspective, to common sense beliefs that the NFL is simply "entertainment" or an "escape from reality." Credits: 3.00

AMST 32500 - Sports, Technology, And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines how science, technology, engineering, and data analysis reshape sports. Traditionally, sports have been understood as competitions between humans. However, recent technoscientific developments have altered this arrangement and have changed the ways sports are played. We have reached a place where heated competitions not only take place on the fields of play, but also within scientific and engineering laboratories. The fundamental question this project-based course will address is: how will new and emerging scientific knowledge and technological innovations transform sports? We will explore topics ranging from football, baseball, basketball, and soccer, to e-sports, fantasy sports, and sports analytics.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms sports, technology, and innovation. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through the play and consumption of sports. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze sporting invention, innovation, design, and culture through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 33000 - American Car Culture

Credit Hours: 3.00. The automobile has become one of the most influential technologies of the 20th century, and continues to impact American life in the 21st. This course will examine the immense social, political, technological, and environmental impacts of the car on American culture; and take an interdisciplinary approach to the understanding the automobile industry, its production systems, its marketing strategies, and the way automobiles reflect the changing landscapes of consumer tastes and values over time.

Learning Outcomes: 1. Identify the various

technological innovations that contributed to mass production of the automobile. 2. Understand how automotive design shaped American society. 3. Recognize the cultural effects of widespread automobile use in the United States. Credits: 3.00

AMST 49000 - Senior Capstone In American Studies

Credit Hours: 6.00. Interdisciplinary senior capstone project in American Studies. Permission of department required.

Learning Outcomes: 1. Conceptualizing a research project from two or more disciplinary perspectives, conducting original research designed to reveal key aspects of American culture past or contemporary, and presenting interdisciplinary research findings in verbal, visual, or an approved creative form. Credits: 6.00

AMST 59000 - Directed Readings In American Studies

Credit Hours: 1.00 to 3.00. A reading course in aspects of American Studies directed by the instructor in whose particular field of specialization the content on the reading falls. Permission of Instructor required.

Learning Outcomes: 1. Critically analyze and synthesize American Studies scholarship. 2. Enhance interpretive and critical thinking skills. 3. Develop an understanding of the theoretical and methodological approaches used in American Studies scholarship. Credits: 1.00 to 3.00

AMST 60100 - Introduction To American Studies

Credit Hours: 3.00. An exploration of the cultural and institutional history of American Studies designed to acquaint students with the interdisciplinary concepts of American Studies by focusing on major canonical texts associated with that history. Prerequisite: Master's student standing and American Studies majors only.

Credits: 3.00

AMST 60200 - Contemporary Issues In American Studies

Credit Hours: 3.00. An investigation of analytical categories, particularly race, class and gender, the multiple methodologies, and theoretical premises that shape developments in the field of American Studies. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60300 - American Studies Interdisciplinary Project

Credit Hours: 3.00. Students will conduct independent research under faculty supervision towards completion of the Special Field examination for the Ph.D. degree. The project should be an extended, original research essay, based upon interdisciplinary research. The project should aim to produce original findings on a clearly defined topic or problem. In addition to the research and essay, students must produce a statement of methodology in which they explain their choice of sources and how their project contributes to the field of American Studies. To be taken in the final semester of coursework. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60400 - Transnational American Studies

Credit Hours: 3.00. What does the term transnational mean? How is the term defined, practiced, and studied in different fields? How does one take a transnational perspective, or examine the transnational variable? This course will draw from various fields (sociology, history, anthropology, ethnic studies, etc.) to explore contemporary scholarship on transnationalism in theory and in practice. Specifically, we will examine scholarship that either, 1) utilizes the transnational perspective in understanding history, the globe, and human behavior/interactions, or 2) utilizes transnational behaviors/ties as a variable to measurement adaptation. Materials in this course will examine - through the lens of race, ethnicity, class, gender, and sexuality - individual and comparative transnational case studies related to the Americas, Africa, Asia, and Europe. This is a graduate seminar, and your active participation in discussions is mandatory. You will be asked to lead four seminar discussions on selected topics from the required readings, write three memos, and submit an extended book review. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge across a range of chronological, cultural and geographic areas. 2. Show a familiarity with the concept of transnational, including a sense of changing interpretations and an understanding of various approaches and explanation. 3. Describe how different aspects or types of human endeavor and experience may be connected. 4. Identify the roots of contemporary issues and challenges, with attention to social values and the role of identity in the human experience. 5. Apply a critical perspective to evaluating arguments, including the quality of sources, the validity of the interpretations of those sources, and the soundness of the

argument's use of evidence to support that interpretation. 6. Formulate and support an argument in a well-focused, logically organized piece of writing. Credits: 3.00

AMST 60500 - Theory And American Culture

Credit Hours: 3.00. This course provides an overview of key foundational texts in social and cultural theory, with a focus on theories of import to scholars in American Studies and related fields. We will explore the various types of theory, examining its internal logic, implications, and critiques. Consider this a brief introduction, meant to give you a general feel for the range and sophistication of available theories in American Studies. Moreover, as the "Cultural Politics" website observes, "Recent theory has reminded us that origin stories are powerful determining forces, and thus these tales of the growth and development of the discipline should be read both for what they say and for what they may leave out, read both for their truths and their partialities." Similarly, the course syllabus itself creates a particular narrative regarding the development of the discipline. As such, students are encouraged to consider the syllabus through this perspective.

Credits: 3.00

AMST 60600 - American Studies Methods

Credit Hours: 3.00. This class is specifically designed to be a survey course on the various methods employed by American Studies scholars from different disciplines. The objective of this course is to approach methods from both an epistemological and empirical perspective. In particular, we will investigate the what, why, and how of conducting research in an interdisciplinary field. As such, the following questions will drive this course: What are American Studies methods? Why are certain methodologies utilized (i.e., for what purpose)? How does one conduct research in American Studies? What method(s) should you use in your own research inquiry? And finally, what are some potential drawbacks in using a certain methodology for your project? This is a graduate seminar, and your active participation in discussions is mandatory. You will be asked to submit weekly discussion questions, lead five seminar discussions on selected topics from the required readings, and complete six assignments. The final assignment will include the background and methodological components of a research proposal.

Learning Outcomes: 1. Formulate critiques of the course readings. 2. Have investigated the readings on topics relevant in American Studies Methods. 3. Completed five total assignments, emphasizing the methodological lens, by drawing from course readings and independent research on your specific research topic.

Credits: 3.00

AMST 63000 - M A Research Seminar

Credit Hours: 6.00. A research seminar required of all M.A. students in their final semester. Students write substantial essays based upon original research in which they seek to crystallize, in practice, methods and concepts of American Studies. Prerequisite: AMST 60100.

Credits: 6.00

AMST 65000 - Reading Seminar In American Studies

Credit Hours: 3.00. A reading seminar on a selected topic in American Studies, taught by two faculty members from different disciplines, usually one from the humanities and one from the social sciences. Prerequisite: AMST 60100.

Credits: 3.00

AMST 69500 - American Studies Service Learning/Internship

Credit Hours: 3.00. This course is to be used by students to complete a service learning or internship project that provides professional development towards completion of the degree. The project must be conducted under the supervision of a faculty member and community partner. The faculty supervisor will be responsible for determining the academic content of the course and requirements of service. In addition to academic requirements for the course, a final written report on the project must be filed with the American Studies program. The final report must describe the relationship between work completed for the course and the student's plan of study. Prerequisite: AMST 60100, AMST60200.

Credits: 3.00

AMST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Animal Sciences

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

ANSC 24500 - Applied Animal Management

Credit Hours: 2.00. Skills and practices related to handling and care of beef and dairy cattle, horses, poultry, sheep, and swine.

Credits: 2.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

ANSC 28100 - Career Planning In Animal Sciences

Credit Hours: 1.00. A seminar course designed to inform students of the career opportunities in animal industries, develop their interviewing and other interpersonal skills, and begin to plan the course of study, work experiences, and marketing methods needed to obtain a successful internship and employment.

Credits: 1.00

ANSC 29200 - Special Assignments

Credit Hours: 0.00. To be arranged with individual staff members prior to registration. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Permission of department required.

Credits: 0.00

ANSC 29300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and AGR 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 29500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in formal courses of the department. The specific topic that is offered will be indicated on the student's record. May be repeated for credit with variable title. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 32400 - Applied Animal Nutrition

Credit Hours: 3.00. Application of the principles of animal nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Understand and apply

basic nutritional principles in the use of available ingredients to provide optimum nutrition for growth, development and reproduction. 2. Become familiar and competent with a least cost computer program on feed formulation as used by the commercial feed industry. 3. Enhance student understanding and appreciation of animal research with hands-on experience in conducting and summarizing nutrition research. Credits: 3.00

ANSC 32500 - Applied Ruminant Nutrition

Credit Hours: 2.00. Application of the principles of ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic ruminant nutrition principles are applied to solve ""real world"" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 32600 - Applied Non-ruminant Nutrition

Credit Hours: 2.00. Application of the principles of non-ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic non-ruminant nutrition principles are applied to solve "real world" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 33100 - The Role Of Horses In Human History, Culture, And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art. University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ANSC 33200 - Environmental Physiology Of Domestic Animals

Credit Hours: 2.00. Interactions of environmental factors with physiological processes in domestic animals.

Credits: 2.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 34500 - Animal Health Management

Credit Hours: 3.00. The objectives of this course are to familiarize the student with disease processes and mechanisms. Management techniques in food, companion, and research animal species that minimize or prevent disease will be emphasized, as well as the consequences on animal

production, reproduction, and human health.

Credits: 3.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

ANSC 37000 - Livestock Evaluation

Credit Hours: 2.00. This course is designed to develop logical thinking and speaking skills, while developing the ability to critically evaluate livestock in their production environments. Prior experience in public speaking or judging is not required. The combination of ANSC 37000, ANSC 37100, ANSC 37200, ANSC 47000, ANSC 47100, and ANSC 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 37100 - Dairy Evaluation

Credit Hours: 2.00. This course will enable the student to become familiar with breeds of dairy, parts of dairy cattle and their relationship to function. Opportunities will exist to associate with people from various breed organizations within the dairy industry. The combination of ANSC 37000, 37100, 37200, 47000, 47100, and 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 38100 - Leadership For A Diverse Workplace

Credit Hours: 3.00. An interactive, small group discussion class covering effective interpersonal and group skills needed to enhance career satisfaction in a diverse workplace including building networks within industry, cross-cultural communication and gaining experiences in group problem-solving and decision-making. This course may be used as an additional written communication elective as required in all plans of study in Animal Sciences.

Learning Outcomes: 1. Learn opportunities and mechanisms used to pursue job placement, graduate school or professional schools. 2. Interact with alumni to build networks and appreciate the real-life challenges faced in careers in animal industries. 3. Use numerous team experiences to develop comfort and effectiveness in functioning in teams and committees. Credits: 3.00

ANSC 39000 - Animal Sciences Internship

Credit Hours: 0.00. Internships with producers, businesses, or agencies arranged in cooperation with faculty coordinator. Permission of department required.

Credits: 0.00

ANSC 40000 - Animal Sciences Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 41500 - Advanced Animal Physiology

Credit Hours: 3.00. This course is an advanced physiology course building on concepts and knowledge introduced in ANSC 23000 about whole body physiology. Additionally, this course will introduce interpretation of scientific literature to understand physiological processes.

Learning Outcomes: 1. Interpret and analyze scientific literature in Animal Physiology. 2. Evaluate the background and methodology used in the literature, compare different and opposing lines of thought, including their own conclusions derived from the work. 3. Acknowledge the critical thinking process in scientific work and how it could lead to the right or wrong conclusions if not carefully assessed. 4. Identify and name the components of the body systems. 5. Describe the physiological process that govern the body systems. 6. Describe the interactions between body systems. Credits: 3.00

ANSC 42500 - Ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with the reproductive management of beef cattle, dairy cattle, goats, and sheep will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of ruminant livestock. Credits: 2.00

ANSC 42600 - Non-ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with reproductive management of swine and horses will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in non-ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of non-ruminant livestock. Credits: 2.00

ANSC 43500 - Reproductive Management Of Farm Animals

Credit Hours: 3.00. Management practices associated with improved reproductive efficiency. Procedures for diagnosis of reproductive failure and practical methods of controlling reproduction will be identified.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in farm animals 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 47000 - Livestock Judging

Credit Hours: 1.00. This course is designed to teach livestock evaluation, relationship of production data to live animal evaluation characteristics, expand logical thinking and reasoning skills, and enhance oral communication skills. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 47100 - Dairy Judging

Credit Hours: 1.00. Opportunities will exist to allow the student to practice analysis and enhance decision-making processes in placing animals in collegiate dairy contests. Communication skills will be developed to properly present and defend those decisions with confidence. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

ANSC 48500 - Dairy Farm Evaluation

Credit Hours: 2.00. This course will provide students with an opportunity to integrate and apply knowledge of dairy cattle management systems, nutrition, reproduction, genetics, milk quality, animal handling, physical farm facilities, manure handling and management, personnel and their financial implications. Students will develop critical analysis skills and apply troubleshooting principles in the identification and resolution of dairy farm management issues in a learning environment that is structured around farm evaluation field trips and case studies.

Learning Outcomes: 1. Increase understanding of dairy farm management systems. 2. Integrate knowledge of animal sciences with dairy-specific experiences. 3. Highlight opportunities for lifelong learning. 4. Foster critical thinking and evaluation skills. 5. Promote communication skills. 6. Encourage professionalism through tactful delivery of critical analyses. 7. Provide critical evaluations of dairy farms as a service to the owners.

Credits: 2.00

ANSC 49100 - Special Problems

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or library assignments. Written reports required. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For students doing specialized animal sciences research; report required. Arrange with academic advisor and honors research coordinator before registering. Permission of instructor required.

Credits: 1.00 to 6.00

ANSC 50500 - Advanced Animal Welfare Assessment

Credit Hours: 3.00. Animal welfare assessment is a critical component of working with live animals. Throughout this course, students will receive instruction in the fundamental aspects of animal welfare assessment. Students will learn how behavior, physiology, health and production parameters are used to critically assess animal welfare. The welfare of farm, exotic, companion, and laboratory animals will be assessed, focusing on four example species that change every year. The species of focus will be determined in the summer semester and students can contact the instructor for details prior to registering for the course. Students will engage in classroom discussions and peer evaluation. Students will have the option to represent Purdue University at the American Veterinary Medical Association's annual welfare judging and assessment contest where they will compete with teams from other universities. Field trips may be required.

Learning Outcomes: 1. Discuss and present peer-reviewed articles. 2. Explain how behavior, physiology, production and health measures are used to evaluate animal welfare. 3. Weigh the importance and implications of different animal welfare indicators. 4. Use scientific evidence, as well as general principles and species-specific information to critically compare and assess the welfare of animals in different scenarios. 5. Present oral and written reasons in a concise and well-articulated manner. Credits: 3.00

ANSC 51300 - Design Of Animal Breeding Programs

Credit Hours: 3.00. Integration of principles of animal breeding and genetics into animal improvement programs. Emphasis is placed on the interaction among genetics, nutrition, and physiology.

Credits: 3.00

ANSC 51600 - Molecular Microbiome Analysis

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of microbial ecology in the animal microbiome and how to analyze next-generation sequencing data of amplicon libraries. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and student projects. Permission of instructor required.

Learning Outcomes: 1. Understand and critically review peer-reviewed publications in microbiome studies. 2. Design a microbiome experiment, with considerations for microbiome controls and reproducibility. 3. Analyze next-gen sequencing data from gene amplicon libraries. 4. Use R to manage datasets, perform analyses, and produce descriptive graphics. 5. Develop basic computational literacy in bash and R scripting, and cluster computing. Credits: 3.00

ANSC 52200 - Monogastric Nutrition

Credit Hours: 3.00. Digestion and absorption, nutrient utilization and interrelationships in poultry, swine, and other monogastric animals.

Credits: 3.00

ANSC 52400 - Ruminant Nutrition And Physiology

Credit Hours: 3.00. Physiological, microbiological, and biochemical effects and their interrelationships on digestion and metabolism in the ruminant animal.

Credits: 3.00

ANSC 53400 - Advanced Reproductive Physiology

Credit Hours: 3.00. A study of mechanisms that interact to control reproduction in farm animals. Current scientific literature and hypotheses are presented, and potential methods to enhance reproductive efficiency are examined.

Credits: 3.00

ANSC 53700 - Adipocyte Biology

Credit Hours: 3.00. This course will provide the student with a conceptual background in the development of adipose tissue and its biological function with emphasis on the endocrine and immunologic aspects of the adipocyte. Differences between species will be emphasized where possible.

Learning Outcomes: 1. Discuss the development ontogeny of adipose tissue formation. 2. Discuss the role of adipose tissue in energy balance. 3. Discuss the role of adipose tissue in the regulation of immune function. 4. Understand the role of the extracellular matrix in adipose tissue in the regulation of adipocyte development. 5. Have a better understanding of adipose tissue role in cancer susceptibility. 6. Have a better understanding of the impact of phytochemicals

in the regulation of obesity and adipocyte function. Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology, biochemistry and chemistry of muscle (meat) and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4. Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 62000 - Proteins And Amino Acids In Nutrition

Credit Hours: 3.00. Presentation of concepts concerning requirements for dietary amino acids, nutritional regulation of amino acid metabolism, and regulation of protein metabolism. Integrates biochemical and physiological functions of amino acids and features topics in nutritional regulation of whole-body protein turnover in mammalian and avian species. Offered in odd numbered years. Prerequisite: BCHM 56200.

Credits: 3.00

ANSC 62500 - Nutritional Biochemistry And Physiology I

Credit Hours: 4.00. (FN 605) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing interactions in bone and gut. Prerequisite: ANSC 22100, 23000, BCHM 30700.

Learning Outcomes: 1. Demonstrate knowledge of foundational scientific concepts. 2. Comprehend, interpret and apply knowledge to integrate biochemistry and physiology information relevant to nutrient metabolism with particular emphasis on bone and gut. 3. Develop knowledge of and learn to apply research methods used in nutrition, including biochemical and molecular analyses, preclinical and clinical study designs, and epidemiological approaches. 4. Develop skills important to a career in nutrition and animal science, e.g. critical thinking skills, reading and discussing current scientific literature, and scientific writing. Credits: 4.00

ANSC 62600 - Nutritional Biochemistry And Physiology II

Credit Hours: 2.00. (NUTR 60600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules. Offered weeks 1 - 8. Prerequisite: ANSC 62500.

Credits: 2.00

ANSC 62700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (NUTR 60700) Integration of biochemical and physiological functions of nutrients in humans and animals, emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9-16. Prerequisite: ANSC 62600.

Credits: 2.00

ANSC 66000 - Intestinal Microbiology And Immunology

Credit Hours: 1.00. (FS 66000) Discussion and critique of recent journal articles related to intestinal microbiology/immunology. The specific areas covered under this forum are: (1) intestinal microbiology, (2) food microbiology as it relates to gastrointestinal diseases, (3) probiotics and prebiotics-related to intestinal health or pathogen control, and (4) mucosal immunity with major emphasis on intestinal immunology.

Learning Outcomes: 1. Demonstrate effective oral and written communication skills. This includes such skills as writing technical reports and making formal presentations. 2. Apply critical thinking skills to new situations including critical evaluation of published papers. 3. Research independently: scientific and nonscientific information and use library resource. Credits: 1.00

ANSC 68100 - Animal Sciences Graduate Seminar

Credit Hours: 1.00. Instruction and application of concepts for effective oral professional presentations in the field of Animal Sciences. The course will provide students with knowledge for effective oral communication of scientific information and an opportunity to put guidelines into practice. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking skills for graduate students in animal sciences. 2. Enable students with skills needed to organize information from multiple scientific sources into a coherent oral presentation. 3. Enable development of skills for effective oral communication of research and current research concepts to animal science audiences. Credits: 1.00

ANSC 69100 - Topical Research Problems

Credit Hours: 1.00 to 4.00. To be arranged with individual staff members prior to registration. Requires approval of the department head. Supervised individual research projects. Written reports required. Permission of instructor required.

Credits: 1.00 to 4.00

ANSC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ANSC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Anthropology

ANTH 10000 - Being Human: Introduction To Anthropology (UCC: BSS)

Credit Hours: 3.00. Introduces anthropology's holistic approach to human nature and behavior. This course uses the tools of cultural, biological, archaeological, and linguistic anthropology to follow the human journey of uniformity and diversity through time and across space.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the basic concepts and applications of anthropology, including biological, cultural, archaeological, and linguistic anthropology. 2. Recognize the deep social and biological histories that have shaped contemporary life. 3. Examine processes of ongoing biological and social change that influence the environment, social organization, language, and other aspects of the world they experience. Credits: 3.00

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 20300 - Biological Bases Of Human Social Behavior (UCC: BSS)

Credit Hours: 3.00. This course is an introduction to human social behavior from the perspective of biological anthropology,

with special emphasis on human evolution and non-human primates. Topics include aggression, communication, learning, maturation, sexuality, and the evolution of social systems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Demonstrate understanding of core concepts and theories of human evolutionary biology and ecology. 2. Describe key components of human life course evolution and hunter-gatherer lifestyles. 3. Analyze the evolutionary mechanisms underlying behavioral variation across primates. 4. Assess cross-cultural variation in food acquisition, mating, parenting, and social systems. Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

ANTH 21500 - Introduction To Forensic Anthropology

Credit Hours: 3.00. Introduction to forensic anthropology, the

science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. This course introduces students to methods used to recover and positively identify human remains, and to evaluate trauma and taphonomy in medico-legal situations. Topics include an overview of historical and current developments in the field. Students will develop a comprehensive understanding of the sequential order of applied work from the search for forensic scenes through the recovery of remains, and skeletal analysis in the laboratory.

Learning Outcomes: 1. Understand the legal context in which anthropologists work in both state and federal courts by the standards of the US medico-legal system. 2. Explain the statistical approaches to forensic anthropological problems by analysis of problem sets. 3. Gain general knowledge about the methods of the biological profile (age, sex, ancestry, stature and pathology) to improve competency and understand the errors associated with each method by review and evaluation of relevant literature. 4. Explain the biological basis of the components of the biological profile by advancing reasonable conclusions. 5. Critically examine the use of the terms race and ancestry in forensic contexts by group discussion. Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

ANTH 23500 - The Great Apes

Credit Hours: 3.00. Students will learn the behavior and conservation of our closest relatives and how early ape studies changed our understanding of what it meant to be human. Topics include gender in science, ethics of research and cross-cultural understandings.

Learning Outcomes: 1. Identify the geographic distribution as well as the anatomical and behavioral traits that characterize great ape species. 2. Explain the major achievements of and challenges to great ape research in the wild and captivity. 3. Demonstrate an understanding of why and how anthropologists use great apes to model human evolution. 4. Describe the ethical issues of conducting research on our closest living relatives and conserving them in the wild. Credits: 3.00

ANTH 24000 - Medicine, Science, And Culture

Credit Hours: 3.00. This course explores the intersections of medicine, science, and culture as powerful shapers of our lives and the world today. Anthropology broadly studies the human experience to help explain how our bodies, biologies, and beliefs inform what "medicine," "health," "illness," and "healing" come to mean in diverse and cross-cultural contexts. The course will cover foundations in medical anthropology by exploring a range of topics and applications.

Learning Outcomes: 1. Describe what medical anthropology is and what medical anthropologists do. 2. Analyze the dynamic intersections of medicine, science, and culture. 3. Explain what medical anthropology contributes to understanding the multiple dimensions of health, illness, and healing. 4. Apply anthropological frameworks to real-world examples. Credits: 3.00

ANTH 25400 - Archaeological Hoaxes, Myths And Frauds

Credit Hours: 3.00. This course examines why the ancient past inspires so many theories about aliens, dark conspiracies, lost civilizations, and apocalyptic predictions. Topics include the popularity of pseudoscientific theories in American culture and the historical contexts in which common pseudoscientific ideas have emerged; why they persist in the face of archaeological evidence; and the role of pseudo-archaeology in the growing antagonism toward scientific expertise. Through an understanding of datasets and methods archaeologists use to evaluate claims about the past, the course goes beyond debunking ancient aliens and Atlantis to develop important

critical thinking skills to evaluate evidence and recognize pseudo-scientific arguments in the media.

Learning Outcomes: 1. Evaluate the difference between a scientific and a pseudoscientific claim about the human past. 2. Explain the techniques and scientific methods archaeologists use for evaluating hypotheses or claims about the past. 3. Examine the role and popularity of pseudoscientific theories in American culture and the historical contexts in which popular pseudoscientific ideas have emerged. 4. Articulate how seemingly harmless fringe theories are entangled with larger narratives of cultural memory and erasure among past societies and their descendants. Credits: 3.00

ANTH 25600 - Archaeology Of Beer

Credit Hours: 3.00. Alcoholic beverages are an important aspect of foodways, the cultural practices and values surrounding food and drink. This course provides an overview of the ancient origins of beer and other alcoholic beverages globally, and examines the cultural context and social role of these innovations through a combination of archaeology, material culture studies, historical texts, and ethnography. In addition to examining archaeological case studies of the production and consumption of beer and other alcoholic beverages, topics to be covered include: evolution of brewing and fermenting technology, biology and chemistry of brewing and fermentation, residue and materials analysis, origins of agriculture, emergence of social complexity, sexual division of labor, social identity (gender, class, ethnicity), and recent trends in production and consumption.

Learning Outcomes: 1. Identify the role of Anthropology in understanding the production and consumption of alcohol in cultures past and present. 2. Evaluate several different theoretical and methodological approaches within the field of Archaeology. 3. Assess and debate the role that the innovation of alcohol might have played in the origins of agriculture and social complexity in different times and places in the past. 4. Analyze and explain innovations in brewing technology over time. 5. Describe and explain the way in which identity is shaped by the production and consumption of beer. These learning outcomes will be achieved by reading, evaluating, and summarizing course material (lectures, readings, and films) at regular intervals throughout the course and by engaging in regular group discussions. 6. Outcomes will be assessed by examining student performance on quizzes, exams, and article summaries, as well as participation in class discussion. Credits: 3.00

ANTH 28200 - Introduction To LGBTQ Studies

Credit Hours: 3.00. (WGSS 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding if the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical methods for single variables or for relationships

between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7. Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

ANTH 30800 - Critical Data Studies

Credit Hours: 3.00. Critical Data Studies (CDS), is an interdisciplinary field that addresses the ethical, legal, socio-cultural, epistemological and political aspects of data science, big data and digital infrastructure. This course focuses on current topics in critical data studies scholarship. Particular emphasis will be given to democratic and participatory approaches to algorithm design and responsible data management, curation and dissemination. Students will develop tools and methods to help scholars think critically and identify issues of concern to Local Communities. This is a research and writing intensive course.

Learning Outcomes: 1. Engage in current debates surrounding data science, big data and digital infrastructure from an anthropological perspective. 2. Acquire anthropological tools and methods to analyze societal impact of emergent technologies. 3. Learn to demonstrate collaboration, public engagement and scholarly communication skills. 4. Apply anthropological frameworks to novel research problems. Credits: 3.00

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 31200 - The Archaeology Of Ancient Egypt And The Near East

Credit Hours: 3.00. Selected topics on the archaeology of ancient Near Eastern cultures in Mesopotamia, the circum-Mediterranean area, Egypt, and the Nile Valley, emphasizing an anthropological interpretation of the political, social, religious, and economic systems that contributed to their development.

Learning Outcomes: 1. Summarize the rise and development of civilization in the Near East and North Africa from 10,000 years ago to 331 BC. 2. Distinguish the emergence and strategies of governance between these neighboring regions. 3. Recognize the historical and cultural context that gave rise to the Great Pyramids, cuneiform writing, and other significant achievements in the region. 4. Interpret the Near East and North Africa within Western historical narratives and popular imaginings. Credits: 3.00

ANTH 31300 - Archaeology Of North America

Credit Hours: 3.00. Archaeological overview of North America emphasizing Indigenous cultures prior to the arrival of Europeans, but including Contact and Post-Contact communities of the Historic Period. Topics will include the peopling of the Americas, culture and environment, social complexity, and Cultural Resource Management.

Learning Outcomes: 1. Describe the general historical outline for North America's past. 2. Summarize the diversity of peoples and cultures that existed in North America. 3. Explain how North American archaeologists gather information and interpret the past. 4. Recognize how contemporary archaeologists engage with other stakeholders in North America's past.

Credits: 3.00

ANTH 32700 - Environment And Culture

Credit Hours: 3.00. This course provides a general overview to the field of environmental anthropology, and surveys key methods, and theories that anthropologists use to interpret human-environment interactions. Topics include culture ecology, agroecology, ethnobiology, political ecology, and environmental justice.

Learning Outcomes: 1. Identify and explain the key theories in environmental anthropology. 2. Identify several cross-cultural examples of human-environment interactions. 3. Distinguish between anthropological approaches and other disciplines that study the environment. 4. Apply the theories and methods learned in this course to real world environmental issues. 5. Demonstrate professional skills in research, analysis, presentation and peer review. Credits: 3.00

ANTH 33500 - Primate Behavior

Credit Hours: 3.00. This course is an introduction to the primate order and primate studies. The emphasis is on field studies. Ecological influences on social organization and behavior, learning, play, and communication will be considered as adaptations within an evolutionary framework.

Learning Outcomes: 1. Understand the diversity of anatomical and behavioral traits in primates, and how that diversity is taxonomically organized. 2. Describe the science of primatology, critically evaluate scientific research on primates, and contextualize primatology within Anthropology and closely related fields. 3. Communicate an understanding of the relationships among primates and their ecosystems as well as the ecological, evolutionary, and social forces that shape their lives. 4. Appreciate the complexities of the work of preserving and managing primate populations. Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 33700 - Human Diet: Origins And Evolution

Credit Hours: 3.00. This course will survey humans evolving relationship with food over the last few million years; from our Plio-pleistocene origins (foraging) through the origins of agriculture to modern industrial food production.

Learning Outcomes: 1. Explain "the human diet," its evolution, and its range of variation. 2. Summarize the role that dietary studies have played in the development of anthropological and biological theory. 3. Identify primate dietary adaptations and explain how these adaptive traits inform human evolution studies. 4. Describe major dietary issues faced by humans today. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 34100 - Culture And Personality

Credit Hours: 3.00. A cross-cultural survey stressing different basic personality types and the processes by which adult personality is acquired. Case studies of selected non-Western cultures will be used to provide comparative perspective.

Learning Outcomes: 1. Explain in words and diagrams the dialectical relations among culture, personality, and cognition. 2. Distinguish and relate childhood and adult

processes of enculturation and socialization. 3. Appraise how, why, and to what extent every individual and every society is unique, comparable to some others, and similar to all others. Credits: 3.00

ANTH 34600 - Pregnancy, Birth, And Babies

Credit Hours: 3.00. This course examines human universal patterns and cross-cultural variation in pregnancy, birth, and infant care practices, using evolutionary and biocultural perspectives. Students will connect course themes to current events and controversies, such as medical models of birth, public breastfeeding, and parent-infant co-sleeping.

Learning Outcomes: 1. Identify evolutionarily novel aspects of the human reproductive pattern. 2. Compare birthing, infant feeding, and infant care practices across human societies using a biocultural framework. 3. Evaluate contemporary medical controversies surrounding pregnancy, birth, and babies critically. Credits: 3.00

ANTH 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American speech communities and the culture at large.

Credits: 3.00

ANTH 37300 - Anthropology Of Religion

Credit Hours: 3.00. Anthropological theories of the origin, development, and functions of religion, ritual, and myth. Data drawn from western and non-western societies, with special emphasis on the relationship of religion to social structure, cultural patterns, and social change.

Learning Outcomes: 1. Explain anthropological approaches to the study of religious belief systems. 2. Investigate religious and cultural differences using anthropological skills. 3. Describe a diversity of faiths and worldviews. 4. Summarize the key ways that humans of the past and present have sought to make sense of the mysteries of life and the sacred. Credits: 3.00

ANTH 37700 - Anthropology Of Hunter-Gatherer Societies

Credit Hours: 3.00. Selective global survey of societies whose mode of subsistence is/was based on the collection of wild food resources. Topics to be covered include: the development and current state of theory, ecology, social organization, land use, demography, subsistence rights, and worldview.

Learning Outcomes: 1. Explain the forager lifestyle and the range of variation that researchers continue to discover. 2. Summarize the role that hunter-gatherer studies have played in the development of anthropological and biological inquiry and theory. 3. Recognize why the hunter-gatherer lifestyle has persisted as a human adaptation for as long as it has and how knowledge derived from its study can help scientists understand humanity. 4. Describe major issues faced by foragers and their descendants today. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better

understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

ANTH 38500 - Community Engagement In Anthropology

Credit Hours: 3.00. This course offers hands-on service learning experience with local community organizations involved with minority and immigrant populations. Part of the semester will include class meetings to explore issues and experiences of immigrant and ethnic groups in the U.S.

Learning Outcomes: 1. Explain the ethical, historical, and theoretical approaches and challenges of conducting community-engaged anthropological research. 2. Design community-engaged research projects involving ethical approaches to partnerships, methods, and data analysis. 3. Apply course concepts to real-life situations by conducting community-engaged research with a community partner. 4. Summarize final research findings to a community partner. Credits: 3.00

ANTH 39000 - Individual Research In Anthropology

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of anthropology under the guidance of an anthropology faculty member. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

ANTH 39200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Various topics in anthropology that may change from semester to semester are presented by anthropology faculty members.

Credits: 1.00 to 3.00

ANTH 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ENGL 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish, paraphrase, and translate different disciplinary perspectives on these key environmental and sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

ANTH 40500 - Ethnographic Methods

Credit Hours: 3.00. This course introduces students to the basic methods of ethnographic research: the collection, analysis, and presentation of data derived from the systematic, direct observation of human behavior and interviewing of key informants. Students are required to complete a field project.

Learning Outcomes: 1. Identify and synthesize key theoretical and methodological approaches to ethnographic field work in the following broad domains: 1) research ethics, 2) data collection (field notes, participant observation, interviewing, visual and digital methods), 3) data management, and 4) communication of research results. 2. Demonstrate scientific and

scholarly literacy through critical discussion, production of scholarly reports, and public dissemination of research efforts. 3. Develop qualitative competence and problem solving skills in an active learning environment through practical data collection and processing exercises. Credits: 3.00

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century. Credits: 3.00

ANTH 41400 - Introduction To Language And Culture

Credit Hours: 3.00. An exploration into the nature of human communication, particularly the structures, functions, and substance of human language. Focus is on the interpenetration of language, culture and cognition, on the evolution of language and speech, and on their uses in everyday life.

Learning Outcomes: 1. Explain the separate biological origins and functions for human language and speech/sign (languaging). 2. Distinguish communication, language, and languaging, as these relate to individual cognition and to collective culture and society. 3. Differentiate language and languaging, and written forms for each. 4. Discuss how language and languaging reciprocally shape both cognition and culture. Credits: 3.00

ANTH 41800 - Field Methods In Cultural Anthropology

Credit Hours: 1.00 to 9.00. Introduces basic field methods in Cultural Anthropology. Topics may include ethnographic or other interviewing techniques and methods of inquiry into any of the broad topics covered by Cultural Anthropology. Permission of department required.

Learning Outcomes: 1. Understanding the use of anthropological methods such as participant observation, ethnographic analysis and general interviewing techniques. Credits: 1.00 to 9.00

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

ANTH 42800 - Field Methods In Archaeology

Credit Hours: 1.00 to 9.00. Introduces basic field and laboratory methods in contemporary archaeology: methods of site survey, mapping, and excavation through the excavation of archaeological sites; the basics of archaeological data analysis and classification, and the computer-based analysis of archaeological data. Permission of instructor required.

Learning Outcomes: 1. Describe, document, and record archaeological data and their spatial relationships in the field. 2. Apply basic archaeological field methods, including excavation, mapping, and data recording. 3. Practice database management, including sorting and labeling artifacts and samples, and maintaining a catalog of data. Credits: 1.00 to 9.00

ANTH 43600 - Human Evolution

Credit Hours: 3.00. This class examines the fossil evidence for human evolution and theories proposed to explain the development that led from the origin of primates to modern humans. This course will include lectures, exercises with fossil casts, presentation, and discussions.

Learning Outcomes: 1. Explain the analytical and research methods used in hominin paleobiology. 2. Identify important research questions within human paleobiology as well as theoretical approaches and methods used to evaluate them. 3. Describe the relevant fossil evidence to investigate the evolution of the primate lineage. 4. Demonstrate understanding of evolutionary processes, particularly those that shaped the biocultural evolution of modern humans. 5. Evaluate interpretations of the hominin fossil record and appraise the strengths and weaknesses of current debates in human evolution. Credits: 3.00

ANTH 43800 - Field Methods In Biological Anthropology

Credit Hours: 1.00 to 9.00. Introduces basic laboratory methods in Biological Anthropology. Topics may include analysis of human or primate nutritional and biological markers or laboratory methods in the analysis of human skeletal populations. Permission of department required.

Learning Outcomes: 1. Understanding the use of anthropological methods such as anthropometric measurements, primate behavioral observations and/or general interviewing techniques. 2. Students will gain an appreciation for ethical issues in biological anthropological research. Credits: 1.00 to 9.00

ANTH 48200 - Sexual Diversity In Global Perspectives

Credit Hours: 3.00. This course focuses on anthropological and interdisciplinary research in the study of sexuality with particular attention to lesbian, gay, bisexual and transgender identities. It explores historical, theoretical and ethnographic work on sexualities and genders in the US and globally.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

ANTH 49700 - Senior Honors Seminar

Credit Hours: 3.00. A critical examination of some major works in anthropology and sociology, both classical and modern, and of some current theoretical and substantive issues in these disciplines. Open only to students in the departmental honors program.

Credits: 3.00

ANTH 49800 - Senior Honors Paper

Credit Hours: 3.00. Requires a substantial paper on a topic approved by the instructor. The student is expected to work closely with the instructor on the paper's content and style. A presentation of the results of the work is made at the end of the semester. Open only to students in the departmental honors program.

Credits: 3.00

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural

anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 51900 - Introduction To Semiotics

Credit Hours: 3.00. (COM 50700 , ENGL 57000 , LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods

that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 56300 - Historical Linguistics

Credit Hours: 3.00. (ENGL 56300, LC 56300) A survey of mechanisms and motivations of linguistic change. Topics include: phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

ANTH 56500 - Sociolinguistics

Credit Hours: 3.00. (SLHS 56500, COM 56500 , ENGL 56500 , LC 56500 , LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability.

Credits: 3.00

ANTH 59000 - Individual Research Problems

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of anthropology under an anthropology staff member. Does not include thesis work. Permission of instructor required.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical

research through the goals listed here. 2. Learn about a specialty area or areas in anthropology. 3. Review several types of anthropological products to understand anthropology and its representation in past and present. 4. Learn about or engage in anthropological methods to understand diverse research design techniques. 5. Gain literacy in the anthropological theory across diverse subfields. Credits: 1.00 to 3.00

ANTH 59200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60800 - Proseminar In Graduate Studies In Anthropology

Credit Hours: 2.00. This is an introduction to graduate study in Anthropology at Purdue. Students will be introduced to the research of Purdue Anthropology faculty and how their work fits into the contemporary landscapes of their fields. Students will gain familiarity with tools needed for graduate work in Anthropology at Purdue and be exposed to navigating the world of academic conferences and publishing. Students will have opportunities to engage in discussions on research ethics in our field. Students will engage with visiting speakers and their work as well as participate in learning how to organize academic events. During the semester, students will also be introduced to the resources available at Purdue to support their graduate studies and professional development including funding opportunities, procedures for preparing for research, career planning, supports for teaching, information about the structure of the Anthropology graduate program and supports for work-life balance. Students will receive credit for the course based on participation. Permission of instructor required.

Learning Outcomes: 1. Identify resources to support your graduate study, research, funding, professional development, intellectual community, and work-life balance at Purdue. 2. Demonstrate enhanced understanding of Anthropology at Purdue, including the signature research areas of our department, and the development of Purdue's Anthropologies of Tomorrow. Credits: 2.00

ANTH 60900 - Seminar In Anthropology

Credit Hours: 2.00 or 3.00. Topics vary. Permission of instructor required.

Credits: 2.00 or 3.00

ANTH 61100 - Special Topics In Archaeology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary archaeological research and theory. Topics will vary from year to year.

Learning Outcomes: 1. Learn both methodological and theoretical components by helping graduate students appreciate how archaeologists have conceptualized landscapes as analytical units, and how landscapes are inscribed with meaning by the people who occupy them. 2. Think critically about space and landscapes across a variety of archaeological contexts, and be exposed to a body of method and theory on which they may draw for their own research. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

ANTH 62700 - Political Ecology

Credit Hours: 3.00. Political ecology centers on questions described as a research framework that pairs the strengths of political economic analysis with sociocultural and ecological approaches to environmental change. Students will explore the diverse ways of doing political ecology by drawing upon the fields of anthropology, political science, geography, and history as well as interdisciplinary environmental sciences. Students will critically examine the field through a historical exploration of its intellectual genealogy, an investigation of current research trends, and imagining possible future directions. Emphasis will be placed on both theory and methods while analyzing a variety of case studies. Permission of instructor required.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in political ecology. 3. Understand when and how various theoretical positions and logics of interpretation in political ecology and environmental justice have emerged. 4. Review several genres of political ecological work to understand its application as a research framework in interdisciplinary environmental social sciences. 5. Analyze a series of case studies that illustrate dominant positions and fissures in political ecological thought and practices, including non-western contexts. 6. Gain an understanding of how to apply political ecology frameworks to your own research. Credits: 3.00

ANTH 63000 - Academic Professional Development

Credit Hours: 3.00. This seminar focuses on research design, grant writing, publishing, giving presentations, and the academic job market. As there are other seminars offered in the department that focus on the applied aspects of anthropology, this seminar focuses primarily on academic topics. The substance of the course will come from your own work in the form of proposals, teaching, and job market materials as well as your review of fellow classmates' work.

Learning Outcomes: 1. Articulate research questions, methodology, and theoretical background for your PhD project within the structure of a grant proposal. 2. Present research orally adhering to professional standards. 3. Understand and prepare materials associated with an academic job. 4. Know about various venues for publishing. 5. Analyze your own development as an academic by doing career related research and self-reflective writing. Credits: 3.00

ANTH 64000 - Foundations And Frameworks: Applying Anthropology

Credit Hours: 3.00. This course focuses on using anthropology to address social issues. The course examines topics including: the history of anthropologists working in applied settings, the relationship between theory and practice, professional ethics, job opportunities, and skills needed as anthropological practitioners. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Identify key questions and concerns in applied anthropology. 2. Speak about the relationship of anthropological theory and practice and how that relationship has been discussed in the discipline. 3. Know about a series of anthropological practice areas and their progression over time. 4. Analyze your own development as an anthropologist by doing

career related research and self-reflexive writing in the course. Credits: 3.00

ANTH 64100 - Discovery And Design: Making Projects Work

Credit Hours: 3.00. This course is about using anthropology to make projects work. Students will learn anthropological approaches and methods to discover salient aspects of a design problem and use this understanding to devise responses. Anthropological discovery, design and delivery processes are demonstrated. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Be able to use Rapid Assessment Procedures (RAP), the Delphi Technique, Domain Analysis and Cross-Cultural Survey Design. 2. Understand how community projects are put together from goals and objectives, strategies implementation plans and monitoring and evaluation and be able to use that knowledge in effectively designing projects. 3. Write a funding proposal that clearly explains the purpose, impact, and essential features of the project in order to secure funding or other essential support. 4. Apply the skills of anthropological discovery and design in your own practice area of interest. Credits: 3.00

ANTH 64200 - Public Engagement: Using Anthropological Knowledge

Credit Hours: 3.00. This course is about using and communicating anthropological knowledge. We will discuss what it means to work as an anthropologist and public intellectual. Effectively working with stakeholders, presenting information, offering solutions for addressing problems and implementing change are addressed. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Know how to convey your anthropological ideas and findings for multiple purposes and audiences. 2. Be familiar with how some well-known anthropologists have had broad influence inside and outside our discipline. 3. Prepare your anthropological data and information for disseminating to different audiences and outlets. 4. Develop your anthropological critical thinking, writing and presentation skills to become a more effective anthropological communicator. 5. Consider the most successful ways for being an engaged anthropologist in your own areas of interests. Credits: 3.00

ANTH 69600 - Research MS

Credit Hours: 1.00 to 18.00. Research activities related to the MS degree. Possible activities might include, but are not limited to, data collection, individualized reading or project work, participation in group research meetings, proposal and project writing. Activities must be approved by the faculty supervisor. Permission of instructor required.

Credits: 1.00 to 18.00

ANTH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ANTH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Arabic

ARAB 10100 - Standard Arabic Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to Modern Standard Arabic: the writing and sound systems, and systematic presentation of basic grammatical structures. Reading, writing, and vocabulary building are emphasized throughout. The course also includes an introduction to Arab culture. No previous knowledge of Arabic required. Permission of department required.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify, recognize, and produce correctly Arabic sounds and letters in aural and written texts. 2. Demonstrate familiarity with the Arabic syntactic structures. 3. Produce practical written information including completed forms, directions, and instructions on familiar topics. 4. Demonstrate conversational skills including discussing school, family, and occupations; telling time; discussing schedules and dates; and expressing likes and dislikes. 5. Formulate questions and distinguish functional phrases for talking about themselves and their families. 6. Identify language comprehension by reading, reporting on, and or writing about short passages and translating basic sentences.

Credits: 3.00

ARAB 10200 - Standard Arabic Level II (UCC: HUM)

Credit Hours: 3.00. Further study of Modern Standard Arabic. Continued presentation of the basic structures of Arabic grammar and expansion of vocabulary. Reading and writing will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify language comprehension by reading, reporting on, and or writing about long segments of Arabic text and speech. 2. Use simple grammatical and syntactic structures in daily communication. 3. Compose simple sentences and short paragraphs. 4. Demonstrate language comprehension by discussing familiar topics with peers. Credits: 3.00

ARAB 11100 - Elementary Standard Arabic Conversation I

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Group discussions in Standard Arabic on practical topics.

Credits: 1.00

ARAB 11200 - Elementary Standard Arabic Conversation II

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in Standard Arabic on practical topics. May be taken concurrently with ARAB 10200.

Credits: 1.00

ARAB 12100 - Qur'anic Arabic Level I

Credit Hours: 3.00. Introduces students with knowledge of the Arabic alphabet and elementary Arabic word structure to the basic elements of Qur'anic Arabic and provides them with foundational knowledge of classical Arabic lexicon and grammar. Students will gain insights into the organizational structure of different words and short phrases as they explore the nature of Qur'anic Arabic, its diction, morphology and vocabulary that are crucial for understanding the text. In this course, students will also expand their vocabulary as they work through exercises focusing on identifying the importance of rendering sounds for correct reading, recitation and morphology of different words through sample excerpts from short chapters of the Qur'an. Students can take this course for language credit to meet course requirements in all fields that require a language. Permission of instructor required.

Learning Outcomes: 1. Recognize basic features of Qur'anic language. 2. Analyze short excerpts. 3. Identify key Qur'anic vocabulary and its meaning. 4. Distinguish important features of word order in relation to meaning. 5. Apply learned language rules to short excerpts. Credits: 3.00

ARAB 12200 - Qur'anic Arabic Level II

Credit Hours: 3.00. Continues students' development and mastery of Qur'anic Arabic and expands the foundational knowledge of classical Arabic lexicon and grammar gained in ARAB 121. Students will gain insights into the morphology and syntax of the Arabic of the Qur'an and explore Qur'anic Arabic, its diction, morphology and vocabulary that are crucial for understanding the meaning of the text. In this course, students will also expand their vocabulary as they work through exercises focusing on identifying the importance of rendering sounds for correct reading, recitation and morphology of different words through sample excerpts from short chapters of the Qur'an. Students can take this course for language credit to meet course requirements in all fields that require a language.

Learning Outcomes: 1. Understand a range of lexical items of the Qur'anic vocabulary within context. 2. Analyze basic concepts and principles of Qur'anic grammar, morphology and syntax. 3. Apply key Qur'anic vocabulary and identify its meaning. 4. Distinguish important features of word order in relation to meaning. 5. Recognize basic phonological concepts relative to Qur'anic vocabulary. Credits: 3.00

ARAB 20100 - Standard Arabic Level III (UCC: HUM)

Credit Hours: 3.00. This course is designed to allow students to use the grammar and vocabulary acquired in the first two semesters in dealing with specific social situations. Continued improvement of conversational, reading, and writing abilities and expansion of vocabulary.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 20200 - Standard Arabic Level IV (UCC: HUM)

Credit Hours: 3.00. Increased mastery of the four language skills, with emphasis on reading and translation using materials from literary classical and modern Arabic. The course includes a study of some parts of the Koran.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 21100 - Elementary Standard Arabic Conversation II

Credit Hours: 1.00. Continuation of ARAB 11200. May be taken concurrently with ARAB 20100.

Credits: 1.00

ARAB 21200 - Elementary Standard Arabic Conversation IV

Credit Hours: 1.00. Continuation of ARAB 21100. May be taken concurrently with ARAB 20200.

Credits: 1.00

ARAB 22400 - Arabic Level IV: Business Arabic

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed toward use of Arabic for business purposes, including language needed for business negotiations, financial situations, travel, and memo writing. Aspects of cultural and social appropriateness needed in business situations in the Arab world.

Learning Outcomes: 1. Improve skills of speaking, writing, reading and listening in Arabic, with emphasis on business situations. 2. Understand the cultural appropriateness and cultural conventions that characterize Arabic business situations. 3. Know how to write basic business letters, memos, notices, and short reports in Arabic. 4. Have skills that facilitate both business visits and pleasure travel to Arabic-speaking countries, such as making hotel reservations, using various types of transportation, dealing with customs, and filing official forms and other documents. 5. Have an expanded vocabulary including specific terminology used in trade, finance, banking, accounting, and business transactions. Credits: 3.00

ARAB 23000 - Arabic Literature In Translation

Credit Hours: 3.00. Survey of Arabic literature, from the classical to the postmodern period. Emphasis on connections between literary works and contemporary life. Conducted in English; no knowledge of Arabic required.

Credits: 3.00

ARAB 23900 - Arab Women Writers (UCC: HUM)

Credit Hours: 3.00. Survey of Arab women writers from North Africa, the Middle East, and Arab communities in the Western world. Emphasis on issues of sexuality, marriage, work, travel and immigration. Conducted in English; no knowledge of Arabic required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 28000 - Arabic Culture (UCC: HUM)

Credit Hours: 3.00. A historical and literary survey of defining characteristics of Arabic culture from pre-Islamic times to the modern period.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 28100 - Introduction To Islamic Civilization And Culture

Credit Hours: 3.00. This course is a survey of broad currents in the cultures, thought and civilization of the Muslim world. It emphasizes religious, intellectual and cultural trends, social and political structures and contemporary issues of Muslim societies within the current global cultural world. Taught in English.

Learning Outcomes: 1. Gained understanding of the basic teachings of Islam, sources of Islamic civilization and culture, its historical development and major aspects of Islamic thought and art through today. 2. Make connections and understand the interplay among religion, politics, culture and other forms of artistic expression. 3. Provide students with tools to undertake further research about the cultures of Islam and examine the impact Islam makes in lives of communities and contemporary problems facing Muslims in a globalized cultural world. Credits: 3.00

ARAB 30100 - Standard Arabic Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Arabic speaking, listening, reading, and writing abilities, using materials dealing primarily with the everyday life and civilization of Arabic-speaking countries, from various sources (newspapers, poetry, chapters from the Qu'ran). Conducted primarily in Arabic.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 30200 - Standard Arabic Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading and composition skills in Standard Arabic, using materials dealing with ideas and events that have shaped the Arabic-speaking culture. Conducted primarily in Arabic.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 33000 - The Middle East On Film

Credit Hours: 3.00. This course offers an introduction to films produced in the Middle East and on Middle Eastern Cultures. In this class, we will view films from the Arab world, including North Africa, and the large Middle Eastern region. Parallel to film screening, students will read critical and analytical material that provide background as well as commentary and analysis of cultural and historical contexts on content of films and their making. The course will examine a series of topics such as identity politics, religious affiliation, gender, immigration, belonging, homeland and exile. We will also situate the films within the aesthetic traditions of production and reception and analyze how they provide critical perspectives and insights in central issues in the cultures of Middle Eastern cultures. The overarching goal of the class is to provide students with a solid understanding of the function of cinema and films in representation of the evolution and transformation of the cultures and societies of the region and the issues central to how communal and individual identities in the Middle Eastern region are shaped. The class will also equip the students with skills to analyze meaning making and the role of technical aspects such as cinematography, body language, script, setting and acting in the creation of characters. All films will be screened with English subtitles.

Learning Outcomes: 1. Assess formal and technical elements of Middle Eastern film cultures. 2. Analyze how social and cultural themes are represented in visual means and through the screen. 3. Identify and explain the important aspects of film making in the film industries of the region. 4. Construct critical responses to how cinematic work uses aesthetics to mediate culture. 5. Evaluate the role of films in articulating major shifts and movements in the cultures of the region. Credits: 3.00

ARAB 33400 - North African Literature And Culture

Credit Hours: 3.00. A view of the culture and society of the Maghreb (Morocco, Algeria, Tunisia, and Libya). Emphasis on issues of race, politics, religion, and gender through literature and other forms of artistic expression, including film and music. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Increase ability to think critically about other cultures and societies and appreciate cultural differences. 2. Investigate key cultural, social and political issues that have shaped cultures and societies in North Africa. 3. Develop understanding of contemporary questions such as nationalism, politics, religion and ethnicity in the region as represented through materials (literary and/or visual) from/about North Africa. 4. Develop and improve analytical skills (both oral and written) and enhance their abilities to comprehend, interpret, and analyze texts. 5. Expand familiarity and knowledge about core societal and cultural issues of this region and connect to contemporary events in the various countries and communities in North Africa. Credits: 3.00

ARAB 49000 - Special Topics In Arabic

Credit Hours: 1.00 to 4.00. Study of a selected topic in Arabic literature or culture. The topic will be announced in advance. Conducted in English; readings in English. Permission of instructor required.

Learning Outcomes: 1. Vary due to the nature of the course. Credits: 1.00 to 4.00

ARAB 58700 - Modern Arab Thought

Credit Hours: 3.00. Prominent and critical issues in modern Arab thought. Identity, historical meaning, the Arab-Islamic cultural legacy, and tradition vs. modernity are engaged through Arab encounters with the West. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Become familiar with the main lines of modern Arab thought. 2. Identify critical issues in modern Arab thought, in relation to questions of identity, cultural heritage, and religious faith; situate those issues within their historical, social, and political contexts. 3. Appreciate the nuanced relationship between the Arab world and the West in terms of an often painful dialogue between tradition and modernity. Credits: 3.00

Architectural Technology

ARCH 11700 - Construction Drafting And CAD

Credit Hours: 3.00. Introduction to drafting and CAD fundamentals, with emphasis on architectural and civil engineering topics. Development of basic drafting skills, using orthographic projections, auxiliary views, pictorial drawings, and drafting conventions. Students may not receive credit for both ART 116 and ART 117.

Credits: 3.00

ARCH 12000 - Introduction To Construction Drafting With Building Information Modeling

(BIM)

Credit Hours: 3.00. Introduction to drafting fundamentals using Building Information Modeling (BIM), an intelligent 3D model-based process that equips architecture, engineering, and construction professionals with the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. Autodesk Revit will be the software presented.

Credits: 3.00

ARCH 15500 - Residential Construction

Credit Hours: 3.00. Wood frame construction through a semester project requiring planning, preliminary, and working drawings. Outside lab assignments are required.

Credits: 3.00

ARCH 21000 - History Of Architecture I

Credit Hours: 3.00. Survey of styles and influence of cultures which led to the development of architecture and engineering from the earliest times to the early 20th century.

Credits: 3.00

ARCH 22200 - Commercial Construction

Credit Hours: 3.00. Preparation of preliminary and working drawings for an intermediate-size commercial or institutional building.

Credits: 3.00

ARCH 22300 - 3D Architectural Modeling I

Credit Hours: 3.00. This course will study graphic solutions to visualizing interior spaces and environments by utilizing 3D modeling software. Students will learn the fundamentals and advanced toolset in the 3D modeling software Trimble SketchUp while working on a semester long visualization project.

Credits: 3.00

ARCH 32300 - 3D Architectural Modeling II

Credit Hours: 3.00. This course has been designed to expand the students' knowledge, creativity, and technique when creating 3D digital models and renderings. This class should not be the students' introduction into Autodesk Revit Software, but a course developed to refine modeling and rendering skills. Topics include but are not limited to: understanding the use of architecture, materials, lighting, etc.

Credits: 3.00

ARCH 32500 - Building Science & Energy

Credit Hours: 3.00. The study and practice of interior lighting with an emphasis on environmentally efficient lighting systems and energy economy. Through the design process and execution of luminaire layouts, students will examine the visual process, lamp and luminaire selection, calculation methods, lighting controls and evaluation of effective solutions.

Credits: 3.00

Art and Design

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner.

Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 13000 - Interior Design Communication

Credit Hours: 3.00. Spatial studies, conceptual ideation, and methods of communicating in various two- and three-dimensional media.

Learning Outcomes: 1. Produce basic design drawing and architectural lettering. 2. Apply the use of line weights when sketching and drawing when visualizing design ideas. 3. Explain architectural and interior design vocabulary. 4. Construct one- and two-point perspectives. 5. Apply basic skills and knowledge of AutoCAD Drafting Software. Credits: 3.00

AD 13200 - Introduction To Museums And Archives

Credit Hours: 3.00. This course is an introduction to the structures, history, theories, and professional practices in museums and archives. In addition to providing an overview, this course provides students with career exploration in museums and archives through analyzing opportunities in various professional tracks. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Explain the historical foundations of museums and archives. 2. Identify basic organizational structures and career paths of museums, galleries, archives, and special collections libraries. 3. Analyze the value and educational mission of museums, galleries, archives, and special collections across multiple disciplines. 4. Interpret contemporary theories and practices within museums, galleries, archives, and special collections. 5. Apply learning to future opportunities in chosen specialties, majors, and career fields. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing,

including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 19000 - Special Topics In Art And Design

Credit Hours: 1.00 to 3.00. Topics will vary. Permission of department required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 20100 - Art For Elementary School Teachers

Credit Hours: 3.00. Art theory and experiences, curriculum theory, and materials preparatory for instruction of elementary school children. No undergraduate students may be enrolled in this course until they have been admitted to teacher education and a copy of this acceptance is on file.

Learning Outcomes: 1. Apply visual arts methods to develop appropriate lessons to construct students' knowledge. 2. Utilize two- and three-dimensional media commonly used by elementary students to teach art production and encourage the expression of ideas. 3. Assess elementary students' artistic development levels and design activities to meet their artistic needs in the classroom. 4. Apply elements of art, principles of design, interpretation skills, and judgment conclusions to evaluate and respond to works of art and to foster that ability in their elementary students. Credits: 3.00

AD 20200 - Introduction To Art Education

Credit Hours: 2.00. Lectures, readings, and discussions covering the history, theory, and professional literature of art education.

Learning Outcomes: 1. Analyze children's artistic development to understand its stages and implications for teaching. 2. Evaluate works of art and learn how to develop that ability in their students. 3. Analyze components of visual arts curriculum, assessment, and art education programming. 4. Demonstrate knowledge and skill with teaching techniques appropriate for various teaching levels. 5. Compare art instruction at various levels of public -school education. Credits: 2.00

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 20600 - Studio In Visual Communication Design

Credit Hours: 3.00. Investigation of visual communication design theory, history, skills, and methodology, as well as preparation of art and mechanicals for graphic arts reproduction.

Learning Outcomes: 1. Transition from fundamental design skills to advanced graphic design applications. 2. Introduce layout/grid systems and their theoretical and practical applications. 3. Introduce students to the

fundamentals of typography, exploring the relationships between type and image. 4. Increase proficiency in graphic software in the context of graphic design projects. 5. Gain a better understanding of the history of graphic design. 6. Develop more advanced problem-solving skills. 7. Prepare students for the Sophomore Review, and advanced junior- and senior-level design courses. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment. Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22800 - Visual Communication Design Computing I

Credit Hours: 3.00. An introductory course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Illustrator and Adobe InDesign. 2. Experiment with and iterate through image-making utilizing various methods and vector-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Increase ability to generate and choose intensely metaphoric imagery to enhance visual communication. 5. Understand and use design terminology and design principles. 6.

Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22900 - Visual Communication Design Computing II

Credit Hours: 3.00. An intermediate course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Photoshop and Adobe XD. 2. Experiment with and iterate through image-making utilizing various methods and pixel-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Understand and use design terminology and design principles. 5. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22901 - Visual Communication Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Visual Communication Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Visual Communication Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

AD 23000 - Interior Design I

Credit Hours: 3.00. Study of behavior patterns, perceptions, needs, and usage of three-dimensional space through conceptual solutions to human environments. Interior design theory and application of design process through analysis, research, and synthesis will be explored.

Learning Outcomes: 1. Develop design communication skills through freehand and instrument drawing tools that can be used in both design and presentation work. 2. Explore a wide range of drawing media such as pencil, markers, and colored pencils to develop design communication skills. 3. Develop the ability to make informed and sensitive decisions regarding the use of color in presentation work. 4. Further develop speed and accuracy in constructing perspectives and renderings. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 23500 - Materials And Processes II

Credit Hours: 3.00. Problems in three-dimensional design, incorporating materials, production processes, and applications of current technology, emphasizing aspects of society and technology. An introduction to complete industrial design problems, including problem definition, concepts, resource information, design development, final proposals, and presentation techniques.

Learning Outcomes: 1. Apply knowledge of design for manufacturing and use of materials by creating and fabricating selected projects. 2. Evaluate the aesthetics, ergonomics, and manufacturability of designs by participating in in-class design critiques. 3. Utilize skills to analyze an existing product and redesign it with

an expanded function. Credits: 3.00

AD 23600 - Lighting Fundamentals For Photography

Credit Hours: 3.00. Introductory course in understanding electronic strobe lighting. Begins with a review of basic lighting principles and a series of problem-solving assignments, which introduce control, and applications of electronic strobe lighting. Still life photography and portraiture are emphasized and covers on-location lighting.

Learning Outcomes: 1. Gain an understanding of the basic principles of light and how to use those principles to light photographic subject matter. 2. Gain a basic understanding of the function of photographic lighting equipment. 3. Compile a portfolio of images that demonstrate a skill set learned regarding product and portrait and simple space lighting. Credits: 3.00

AD 24000 - Interior Drafting And Drawing

Credit Hours: 3.00. Basic drafting and drawing techniques used in residential and small commercial buildings. Emphasis on interior projects, on multi-view drawing, isometrics, perspective, and architectural construction drawings, and rendering techniques.

Learning Outcomes: 1. Learn to explore different concepts and present their ideas through sketches, design drawings, and final models for a small multilevel residential project. 2. Further develop hand sketching, drafting, AutoCAD, and model building skills to communicate their ideas and solutions in the residential remodel. 3. Research and apply information on furniture, stairs, equipment, plumbing, and other elements for a small house project. 4. Execute a comprehensive set of construction drawings for a multilevel residential remodel including floor plans, electrical plans, elevations, details and schedules. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 24600 - Design Drawing II

Credit Hours: 3.00. Continuation of the work done in A&D 245. Emphasis on development of skills and presentation quality design drawing.

Credits: 3.00

AD 25000 - Interior Design II

Credit Hours: 3.00. Introduction to space planning methodology applied to small-scale residential and nonresidential environments. Human factors and user requirements, physical and psychological, will be emphasized. Interior materials, components, and special environmental concerns will be explored.

Learning Outcomes: 1. Identify principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Generate multiple solutions to solve a specified design problem, through ideation sketches, drawings, and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definitions and organization, to a specified design problem. 4. Communicate ideas developed in the design process through written, graphic, and oral communication. 5. Assess designed environments as an aesthetic art form within a functional environment. Credits: 3.00

AD 25001 - Interior Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Interior Design upper-level studio courses.

Permission from department required.

Learning Outcomes: 1. Submit selected projects and design portfolio to the Interior Design faculty members and be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

AD 25100 - History Of Photography I (UCC: HUM)

Credit Hours: 3.00. An introduction of the history of photography from the medium's inception until 1950. Emphasis is placed on understanding photographs from a variety of aesthetic, social, and cultural perspectives, including those of race, class, and gender.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 25500 - Art Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the problems overcome by mankind in the origins and growth of art.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 25600 - Presentation Techniques

Credit Hours: 3.00. Studio preparing students for project presentations. Classes will cover graphic techniques, including page layout, typography, portfolio formats, perspective drawings, photography, and verbal communication.

Learning Outcomes: 1. Create original designs using iterative visualization techniques to improve and refine their design concepts. 2. Develop computer-aided design skills to present these design concepts. 3. Demonstrate 3-D computer modeling skills. 4. Demonstrate computer rendering skills. Credits: 3.00

AD 25601 - Industrial Design Sophomore Review

Credit Hours: 0.00. This course is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Industrial Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Industrial Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

AD 26001 - Advanced Drafting And Visualization For Interiors

Credit Hours: 3.00. Advanced drafting and visualization for interior design. Students learn advanced technology skills to detail, draw, visualize, and manipulate architectural spaces, interior furnishings, and objects.

Learning Outcomes: 1. Discuss 3D techniques, visualization processes, and technologies impacting the field of interior design. 2. Critique the quality of two- and three- dimensional graphic representation of an interior design project. 3. Create digital models and renderings that communicate interior design ideas utilizing a combination of software programs. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26300 - Book Arts

Credit Hours: 3.00. This course engages students in the art of the book as a creative practice. The course includes an introduction to book arts concepts, structures, bindings and methods of image making. Emphasis is placed on form and content relationships, construction, and artistic development.

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of book artists and book arts concepts. 2. Develop technical skills in book structures, binding, paper folding and surface treatment. 3. Demonstrate skill in printmaking and mono-printing methods to create imagery and content. 4. Design artwork using existing and innovative book structures with a focus on concept, form and content relationships. 5. Create book art works utilizing multiple dimensions including surface (2D), space & form (3D), time & movement (4D). 6.

Evaluate and critique the work of self, peers, and contemporary book artists. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this

influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

AD 28500 - Interior Components And Materials

Credit Hours: 3.00. Study of surface materials and subsystems and their application to architectural interior spaces. Emphasis on specification guidelines, including product performance, building codes, fire, safety, and health regulations.

Credits: 3.00

AD 29000 - Special Topics In Art And Design

Credit Hours: 1.00 to 3.00. Topics will vary. Permission of department required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

AD 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 29900 - Collections Management In Museums And Archives

Credit Hours: 3.00. This course provides discussion and application of collections management in museums and archives. Students will learn the systems, organizational methods, descriptive processes, ethical/legal considerations, and administration best practices within these cultural heritage institutions. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Understand application of collections systems within their fields. 2. Identify current issues in collections management. 3. Compare and contrast collections management between archives and museums. 4. Demonstrate standards and best practices in collections management. Credits: 3.00

AD 30000 - Life Drawing II

Credit Hours: 3.00. Emphasis is given to organizing the figure in pictorial space.

Learning Outcomes: 1. Draw successful figure drawings through use of gesture, exploration of media, and application of basic art and design principles. 2. Apply expressive and conceptual frameworks to develop their artistic voices. 3. Apply critical thinking skills both as a group and on their own. Credits: 3.00

AD 30200 - Theory And Practice Of Elementary School Art

Credit Hours: 3.00. Theory and practice of art education for elementary school from early childhood through middle childhood. Restricted to art education majors.

Credits: 3.00

AD 30300 - Art In Middle/Junior High Schools

Credit Hours: 3.00. Theory and practice of art education for early adolescent students in the middle/junior high school.

Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 30500 - Industrial Design I

Credit Hours: 3.00. Introduction to design principles in processes employing basic problem-solving techniques. Emphasis will be placed on man's interaction with form, thought processes, procedures, craftsmanship, and use of materials. Acceptance into professional industrial design concentration by successful performance in the mandatory portfolio review. Prerequisites: Passing mandatory portfolio review.

Learning Outcomes: 1. Improve functions, meet production needs efficiently, refine aesthetics, and always keep the user in mind. 2. Control advanced computer modeling, to be able to model complex forms accurately. 3. Create presentations that effectively communicate the student's design ideas. Credits: 3.00

AD 30600 - Industrial Design II

Credit Hours: 3.00. An analysis of design through organic and aesthetic principles, natural solutions, and man-made systems. Skills and techniques for communication of creative design solutions. Rapid visualization, rendering, model making, and working models will be stressed.

Credits: 3.00

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of

historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

AD 31500 - Design Methodology

Credit Hours: 3.00. This course will cover the fundamental concepts of design methodology. Studies in various problem-solving and research methods as they apply to the designer and society.

Learning Outcomes: 1. Design three-dimensional forms with attention to aesthetic and functional aspects. 2. Create presentations that effectively communicate the students' design ideas to diverse audiences. 3. Apply design research skills, including market mapping, ethnographic observation, and ergonomic analysis, to inform design decisions. 4. Develop skills in collaborative design, emphasizing teamwork, communication, and problem-solving. Credits: 3.00

AD 31600 - Seminar On Ideas In Industrial Design I: Design And Society

Credit Hours: 3.00. A study of design and the designer and the factors in society that affect his or her work.

Credits: 3.00

AD 31800 - Fundamentals Of Interactive Multimedia Design

Credit Hours: 3.00. Fundamental issues of interactive multimedia design: Animation, interface design, and experience design from a visual communications perspective.

Learning Outcomes: 1. Produce proposals, storyboards, and project reports. 2. Propose and implement visual communication design strategies for digital media projects. 3. Produce design solutions by applying compositional, typographical, and design elements and principles of new media design. 4. Apply design skills associated with the use of interface design (GUI). 5. Apply design skills associated with the use of digital color theory based on the RGB and HSB Color systems. 6. Apply design skills associated with the use of experience design concepts. 7. Continue to develop computing skills (Illustrator, Photoshop, AdobeAero, etc.). 8. Develop design skills to work collaboratively, presential, and remotely. 9. Develop illustrational and story-telling design abilities. Credits: 3.00

AD 31900 - Web Design For Visual Communication

Credit Hours: 3.00. Introduction to web-based design from a visual communication application.

Learning Outcomes: 1. Design web application prototypes by proposing creative concepts and producing media assets. 2. Apply visual storytelling to web design by incorporating visual communication strategies. 3. Demonstrate teamwork skills in web design by participating in group discussions while sharing ideas and receiving feedback for project improvement. Credits: 3.00

AD 32600 - Physical Computing

Credit Hours: 3.00. Introduction to electronics and computer vision for artists. Students learn to create expressive audiovisual systems that can respond to events in the physical world (movement, light/temperature change, sound, touch, etc.) through custom interfaces.

Learning Outcomes: 1. Analyze key ideas in the field of Physical Computing by preparing a research presentation on the practice of an individual artist or collective. 2. Critique their own creative work as well as the work of their peers through group discussions. 3. Produce a variety of interactive artworks by the creative use of the Arduino microcontroller, simple electronic circuitry, and coding techniques. Credits: 3.00

AD 33000 - Interior Design III

Credit Hours: 3.00. Study of advanced space-planning criteria and selection of furnishings, equipment, materials, and finishes. Design considerations for special populations (e.g., disabled, aged, low-income) will be explored.

Learning Outcomes: 1. Design functional and creative spaces based on the needs of specific building conditions or requirements. 2. Create design solutions through the execution of conceptual diagrams, realistic visualization techniques and 3-dimensional modeling. 3.

Apply information on building codes and the special requirements of barrier-free design and design for physically challenged individuals or groups in design projects. 4. Produce interior materials, furnishings and finishes for commercial spaces in keeping with those needs and as outlined in the design project. Credits: 3.00

AD 33100 - Digital Video Production And Aesthetics

Credit Hours: 3.00. This course is a basic studio introduction to video production and how video can be used as an artistic medium in conjunction with the students' photography. Topics include video/film formats, lighting, audio, editing, distribution, experimental, commercial and music video, production paperwork and extensive time spent on mastering the camera. Classes will consist of hands-on demonstrations, and critiques.

Learning Outcomes: 1. Demonstrate DSLR cameras. 2. Demonstrate basic to intermediate lighting for Video Production. 3. Obtain knowledge on commercial video production: music video and commercial advertisement video. Credits: 3.00

AD 33200 - Visual Communication Design I

Credit Hours: 3.00. A course designed to introduce the student to projects that will develop an understanding of basic problem-solving techniques in the areas of publication and promotional graphics. Acceptance into professional VCD sequence via mandatory portfolio review.

Learning Outcomes: 1. Provide opportunities to explore the elements and principles of design and process as they relate to typography and letter forms. 2. Engage students' conceptual skills in branding design. 3. Further strengthen students' ability to create effective visual communications by way of complex problems emphasizing critical thinking, design process and presentation. Credits: 3.00

AD 33300 - Photo Silk Screen

Credit Hours: 3.00. Advanced study of the techniques of photo silkscreen and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 33700 - Commercial And Professional Practice In Photography

Credit Hours: 3.00. This course introduces students the skills necessary to attain entry-level employment in the photographic field and familiarizes students with the vocabulary, procedures, and working realities specific to occupations in the field of photography in the areas of photo-journalism, magazine illustration, advertising/web design, and fine arts. Permission of department required.

Learning Outcomes: 1. To prepare materials related to practical application within photographic industry. 2. To learn techniques and strategies for job searches, interviewing, and developing portfolio presentation skills. 3. To produce three parts portfolio consisting of a print portfolio, on-line web portfolio, and job interview portfolio. Credits: 3.00

AD 33800 - Advanced Interior Design Communication

Credit Hours: 3.00. Study of graphic design fundamentals and application of interior design visual presentation. To provide a foundation for developing proficiency in the use visual communication design in interior design presentation. Offered 3rd year in the Interior Design BFA program of study.

Learning Outcomes: 1. Learn graphic design fundamentals and techniques as a tool for communicating interior design. 2. Develop the skills, ability, and judgement to visualize, develop, and communicate interior design ideas through graphic representation. 3. Strengthen a student's interior design portfolio through review and organization of contents. 4. Learn to graphically represent design ideas, design

processes, and design outcomes. Credits: 3.00

AD 33900 - Women Artists (UCC: BSS)

Credit Hours: 3.00. A critical overview of the lives, works, and experiences of women artists from the late 19th century to the present, examining the social and cultural challenges they faced, and reflecting on the changing roles women have played in art and society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks and artists. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about women artists and women art by contextualizing and analyzing them and selecting artworks to illustrate your comments. 4. Apply the knowledge they will have acquired to analyze and write about artworks we would not have studied in class. Credits: 3.00

AD 34000 - Furniture Development

Credit Hours: 3.00. This course is an introduction to furniture design. The focus of this course is information relevant to furniture design including: basic ergonomics, structural techniques and materials and processes. Additional pertinent information regarding new and ongoing design trends will be explored. A mid-semester field trip to a major furniture manufacturer and/or design studio is offered. Students will design and build two of the following objects: a small freestanding shelving unit, small table, bench, table top object or stool. Students must pass mandatory portfolio review for this course.

Learning Outcomes: 1. Increase knowledge of materials and processes including furniture design construction methods. 2. Gain a basic understanding of ergonomics. 3. Increase aesthetic sensibility. 4. Develop an awareness of contemporary issues and trends in furniture design. 5. Design and build an original piece of furniture by the end of the class. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 34300 - Northern Renaissance Art

Credit Hours: 3.00. The development of a mature North European art originating in the International Gothic tradition and culminating in the works of Albrecht Durer, Jerome Bosch, and Pieter Bruegel, the Elder.

Learning Outcomes: 1. Be familiar with the history of the period in general and with major artists in particular. 2. Show the ability to read and think critically about a work of art, to look carefully at a work and to discuss what he or she is seeing. 3. Be able to describe clearly a work of art and to compare it to other works and artists of the period. 4. Be able to write an explanation of how a work of art illustrates a particular theme or idea in clear and understandable prose with correct spelling and punctuation in paragraphs that lead logically from one to another. 5. Show the ability to follow instructions and pay attention to detail in the preparation and presentation of research citing sources accurately. Credits: 3.00

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and

Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas. Credits: 3.00

AD 34700 - Lighting For Interior Environments

Credit Hours: 3.00. The study of illuminating principles, design criteria, specifications and environmental systems applied to architectural interiors in public and private spaces.

Learning Outcomes: 1. Describe the fundamentals of lighting, seeing and lighting on color. 2. Identify the range of sources for information and research about light and controlling light in the spatial environment. 3. Explain the effects of lighting on human behavior and well-being. 4. Design appropriate applications of luminaires in terms of function, aesthetics, sustainability, and accessible design. 5. Assess the environmental impact of illumination strategies and decisions. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 34900 - Motion Design

Credit hours: 3.00. This introductory course includes projects, exercises, lectures, and technique demonstrations to cover critical areas like animation, kinetic typography, and motion principles. It aims to broaden students' understanding of Motion Design's scope, focusing on critical thinking, methodology, and technical skills for project execution. Emphasizing the design process and concept development, the course examines Motion Design's influence on visual culture. Students learn to apply visual principles effectively, preparing them for diverse media projects.

Learning Outcomes: 1. Memorize motion design vocabulary and describe its evolution and current trends. 2. Demonstrate your design skills through direct application. 3. Evaluate the work of others, providing constructive feedback and interpreting criticism. 4. Demonstrate your comprehension of motion design's influence and its integration with graphic design fundamentals. Credits: 3.00

AD 35000 - Interior Design IV

Credit Hours: 3.00. Study of large-scale public and social spaces, emphasizing interior systems and components. Application of design for historic preservation, renovation, or adaptive reuse will be considered.

Learning Outcomes: 1. Apply principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Create multiple ideas, which solve a specified design problem, through ideation sketches, drawings and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definition and organization. 4. Describe ideas developed in the design process through written, graphic and oral communication. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important

developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 36101 - The Constructed Image

Credit Hours: 3.00. An intermediate level course focusing on the production of creative images constructed in the studio and in the field. Projects will address the planning and design of photographic images through the use of set design, styling, and post-production. Students will investigate both historical and contemporary trends in the art of the photographically-constructed image.

Learning Outcomes: 1. Construct and compose images using set design, styling, collage, and photomontage. 2. Develop communication skills to successfully interpret proposals and instructions from clients. 3. Analyze theoretical and historical concerns regarding constructed images and demonstrate an understanding of those concerns. 4. Develop visual communication and conceptual image making skills. 5. Develop techniques of creating photographically constructed images and demonstrate an understanding of those techniques. Credits: 3.00

AD 36200 - Jewelry And Metalwork

Credit Hours: 3.00. Lost wax casting and mold making, mechanisms and stone setting for jewelry and metalwork.

Learning Outcomes: 1. Students will be able to design and make wax and non-wax models for jewelry and small metal projects by reductive, addictive, and construction processes. 2. Students will learn to sprue, invest and cast their models by the lost wax centrifugal and vacuum casting methods. 3. They will learn to make waste molds and reusable rubber molds to produce their jewelry projects. 4. They will learn to make mechanisms for jewelry and settings for incorporating stones or other nonmetal materials into their jewelry. Credits: 3.00

AD 36300 - Documentary Photography

Credit Hours: 3.00. This course is an introduction to the great tradition of documentary photography. Students learn to see the world around them in a new way and produce a documentary project. The course requires reading and writing about photography, as well as making photography on a regular basis. The class emphasis is on thinking about why people photograph, what photographs do and do not mean to us, and on doing documentary work, on telling stories with photographs.

Learning Outcomes: 1. Understand the history of documentary photography. 2. Demonstrate a narrative photography experimented through personal, social, cultural, topographical politics. Credits: 3.00

AD 36500 - Intermediate Painting

Credit Hours: 3.00. A studio course concentrating on the development of conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 36600 - Visual Communication Design II

Credit Hours: 3.00. Field trips may be required. The study of corporate graphics and visual identity programs.

Learning Outcomes: 1. Build expertise in problem-solving and expanding a brand visually based on market research. 2. Practice synthesizing research, critical dialogue (feedback), and Critiques within an iterative design process. 3. Develop skills to construct/combine graphic form using various digital tools, software, and screen-based media as well as print and 3D objects. 4. Create system designs and brand identities. 5. Strengthen attention to detail and craft knowledge. 6. Strengthen ability to pitch ideas and create viable solutions for real-world clients. Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36900 - Lithographic Printmaking

Credit Hours: 3.00. An introduction to the techniques of stone and plate lithography. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

AD 38100 - Alternative Photographic Processes

Credit Hours: 3.00. This course is designed to explore methods and concepts for creating photographs using alternative and historic processes. Through technical workshops and assigned projects students will become well-versed in medium and large format film cameras, as well as various 19th century processes.

Learning Outcomes: 1. Know various types of 19th century photographic processes. 2. Know large format photographic cameras. 3. Understand visual language and aesthetics of early photographic processes and printing methods. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 38900 - Introduction To Curatorial Practices

Credit Hours: 3.00. This course will introduce students to historical forms of display and curation. Students will discuss the museum in our society, the different forms of display, and the role of the curator. The primary purpose of this course is to provide students with an understanding of how museums work as educational and political spaces, and the ways in which history, geography, cultural difference, and social hierarchies are mapped through exhibition practices.

Learning Outcomes: 1. Discuss the field of curation including its history and contemporary issues. 2. Analyze exhibitions and installations in modern museums. 3. Debate the role of the museum in society, the different forms of display, and the role of the curator. Credits: 3.00

AD 39100 - History Of Chinese Art

Credit Hours: 3.00. A historical survey of the visual arts and architecture of China from antiquity to the present. Emphasis will be placed on the relation of a broad range of art forms to their social and cultural contexts.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Build knowledge and understanding of Chinese art. 6. Develop analytical and writing skills through textural studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use.

Credits: 3.00

AD 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

AD 39700 - Sustainability In The Built Environment

Credit Hours: 3.00. The study of philosophical concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants. To provide a foundation for evaluation of materials, processes, and applications of design components for environmentally responsible. Field trips will be required.

Learning Outcomes: 1. Define sustainability and assess the ways that sustainable design strategies, processes, and products may be integrated effectively into the built environment. 2. Identify complex social, ecological, and economic dimensions that affect the well-being of humans, neighborhoods, communities, and ecological systems. 3. Apply critical thinking skills to explain how green building methods affect the way built environments are designed, constructed, and operated. 4. Utilize appropriate methodological tools to analyze sustainable problems and provide environmentally responsible solutions for a green-building scenario. 5. Articulate a comprehensive, progressive world view that integrates diverse approaches to sustainability. 6. Utilize USGBC materials and other educational sources to explain the LEED rating system, LEED professional credentials, and Green Building principles and techniques preparatory to obtaining the LEED Green Associate credential.

Credits: 3.00

AD 40000 - Advanced Painting

Credit Hours: 3.00. A studio course concentrating on the development of an advanced body of work built upon the conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 40200 - Art In Secondary School

Credit Hours: 3.00. Theory and practice of art education for adolescent and young adult students in the secondary school. Required prior to professional semester.

Credits: 3.00

AD 40400 - Moldmaking And/Or Wheel-Throwing Production Techniques In Ceramics

Credit Hours: 3.00 to 6.00. This course will teach mold-making

or wheel-throwing (depending on the individual student's interest) with a view to creating ceramic objects suitable for commercial mass-production. Both tableware and/or sculptural objects will be explored. For the wheel-throwing option the students must have at least one year of high school throwing or AD 24200 with a grade of at least "B" or permission of instructor. For the mold making and casting option only, students must be an Art and Design student or have permission of instructor.

Learning Outcomes: 1. The student will learn how to design a model, make the model from clay, make a mold of the designed model (or found object), cast and assemble cast ceramics pieces for possible commercial mass-production. If choosing the wheel-throwing option, the student will learn advanced techniques of throwing and assembling parts to make either functional and sculptural objects for mass-production. 2. Students will also learn simple glazing techniques, and have the option of learning how to screen print and use decals on their final products. Credits: 3.00 to 6.00

AD 40500 - Industrial Design III

Credit Hours: 3.00. Design projects emphasizing sophisticated problem-solving methods. Design projects will stress diversity of industrial design and will trace the development of products from initial concept, research, and development through production.

Credits: 3.00

AD 40600 - Industrial Design IV

Credit Hours: 3.00. Design of products in their relation to economic, physiological, psychological, and behavioral patterns of the consumer. Emphasis upon total thought processes to allow environmental considerations as well as technological realities.

Credits: 3.00

AD 41500 - Professional Techniques

Credit Hours: 3.00. Research development for product design, with emphasis on socioeconomic concerns and documentation techniques. Portfolio refinement, including verbal, written, and other visual documentation and presentation skills in various media, such as drawing. Photography and computer-generated graphics will be stressed.

Credits: 3.00

AD 41600 - Seminar On Ideas In Industrial Design II: Design And Creative Problem Solving Methods

Credit Hours: 3.00. A study of creative problem solving methods as used by the designer in his or her work.

Credits: 3.00

AD 41700 - Variable Topics In Electronic And Time-Based Art

Credit Hours: 3.00. Examination of thematic or specialized topics reflecting the most recent developments and contemporary artistic practices in Electronic and Time-Based Art. Permission of department required.

Learning Outcomes: 1. Use essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production. 2. Able to analyze key works and artists in the emerging field of Electronic and Time-Based Art. Credits: 3.00

AD 42100 - Advanced Studies In Photography And Related Media I

Credit Hours: 3.00. The first of two advanced level courses in photography/related media focusing on production of a formally and conceptually coherent body of work. Course emphasizes development of studio and critical thinking skills, and initiates investigation of the creative process.

Learning Outcomes: 1. Create a photographic series using advanced techniques and processes. 2. Evaluate the work of contemporary working photographers.

3. Define photographic terminology related to a contemporary and commercial photography practice. Credits: 3.00

AD 43000 - Interior Design V

Credit Hours: 3.00. Design of multi-use complex environments, emphasizing program and problem solving, facility planning, building systems, and materials technology. Application of alternative presentation technologies will be explored.

Learning Outcomes: 1. Apply appropriate code and accessibility regulations to commercial design solutions. 2. Use advanced level of space planning strategies in the design of large corporate interior spaces. 3. Identify appropriate evidence that can inform the solution of a design problem. Credits: 3.00

AD 43100 - Visual Communication Design III

Credit Hours: 3.00. The advanced study of communication concepts of poster and poster application in current media.

Learning Outcomes: 1. Demonstrate the ability to initiate and develop creative concepts;

evaluate creative work; apply current technology; and communicate effectively. Credits: 3.00

AD 43200 - Visual Communication Design IV

Credit Hours: 3.00. The study of product identity, packaging, and branding.

Learning Outcomes: 1. Demonstrate ability to initiate and develop creative concepts; present and evaluate creative work; apply current technology related to the profession. Credits: 3.00

AD 43400 - Professional Practice For Visual Communication Designers

Credit Hours: 2.00. Specific professional practice topics for the visual communication designer. Topics include contracts, professional associations, ethics, portfolio and resume preparation, self-promotion and exhibition of creative work, the job market and the future of the profession. Field trips may be required.

Learning Outcomes: 1. Develop proficiency in the use of career search media and tools. 2. Develop a practical understanding of the visual communications job market. 3. Seek functional solutions that meet specific visual communication career goals 4. Develop an expanded ability to generate contacts and leads for employment or graduate school. 5. Strengthen student's design portfolio through review and organization of contents. Credits: 2.00

AD 44000 - Interior Detailing And Construction

Credit Hours: 3.00. The process of designing, detailing, specifying, and constructing interior environments. Emphasis on teams, building systems, architectural drawing, and building codes.

Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 45400 - Modern Architecture

Credit Hours: 3.00. A study of nineteenth- and twentieth-century architecture.

Credits: 3.00

AD 46200 - Metalsmithing

Credit Hours: 3.00. Metal forming and metalsmithing processes for small metal objects and jewelry.

Learning Outcomes: 1. Identify and utilize traditional jewelry and metalsmithing tools and materials in art metal projects. 2. Design and construct specialized tooling for metalworks. 3. Utilize newly developed tools into the fabrication of jewelry and other metal projects. Credits: 3.00

AD 46500 - Professional Practice

Credit Hours: 3.00. The study of professional office and business procedures for the practice of interior design. Includes project administration, contracts, forms, and documents as used in the marketplace.

Credits: 3.00

AD 46800 - Printmaking III

Credit Hours: 3.00. Advanced studies in selected printmaking processes including relief, silkscreen, lithography, intaglio and book arts. Emphasis on color printmaking, photomechanical methods, fine art conceptual issues, creativity, and professional practices.

Learning Outcomes: 1. Create strong contemporary personal work in printmaking with expressive and original ideas. 2. Cultivate personal style through self-directed artist research, image development and experimentation in printmaking. 3. Demonstrate advanced technical skill in one or more printmaking mediums. 4. Acquire advanced technical skills to create multi-colored prints utilizing color, layering, and registration. 5. Describe and critique the work of professional printmaking artists, self and peers. Credits: 3.00

AD 47000 - Advanced Studies In Textiles

Credit Hours: 3.00. A textile seminar and studio course in advanced textile design, with the purpose of developing a personal direction and competence in textiles as fiber art.

Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

AD 49000 - Special Problems In Art And Design

Credit Hours: 1.00 to 6.00. Individual problems in art and design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

AD 49100 - Special Topics In Art

Credit Hours: 1.00 to 4.00. Topics will vary.

Learning Outcomes: 1. Vary due to the nature of the course. Credits: 1.00 to 4.00

AD 49900 - Studio Arts Professional Practice/Senior Exhibition

Credit Hours: 3.00. Study of professional practice in the contemporary art world: ethics, gallery, exhibition, studio practice, writing, visual documentation, and business of art. Seniors meet throughout spring semester to organize, install, and de-install Fine Arts Senior Exhibition.

Learning Outcomes: 1. Develop a professional artist statement and resume. 2. Identify and discuss trends in contemporary professional art practices. 3. Design a digital art portfolio. 4. Demonstrate skills necessary to organize and install art exhibitions. Credits: 3.00

AD 50200 - Curriculum Studies In Art Education

Credit Hours: 3.00. (EDCI 52000) Study of selected theories of curriculum conception as they apply to constructing arts education curricula in the schools. Permission of instructor required.

Credits: 3.00

AD 50400 - Philosophical Studies In Art Education

Credit Hours: 3.00. (EDCI 52100) To introduce students to philosophy as a mode of disciplined inquiry in art education. Students will critically examine the literature of art education and identify problems requiring philosophical resolution. Permission of instructor required.

Credits: 3.00

AD 51200 - Interaction Design Studies

Credit Hours: 3.00. This course examines concepts and methods for interaction design (IXD). It emphasizes a human-centered perspective and explores fundamental components involved in IXD research. Students will explore a wide range of literature and implement IXD theories in multi-disciplinary collaborative projects.

Learning Outcomes: 1. Understand the fundamental architecture and principles of the interaction design. 2. Be familiar with a range of research interests in the domain and start to consider the thesis research topic. 3. Be aware of the diversity of research areas, methodologies and practices relevant to the interaction design program, and be exposed to work of researchers beyond the university, drawn from regional and international venues, to keep informed about updated research achievements. 4. Identify and apply compositional theory to interaction design practice. 5. Develop the ability to articulate intention in work through design iteration. 6. Organize and conduct a design process within an interdisciplinary team. 7. Have a working level of programming fluency, in order to independently produce a working prototype that satisfies given design requirements. 8. Assess and improve production value through design practice, optimization, and media technique. 9. Explore creative process, perception, and problem solving. Credits: 3.00

AD 52000 - Student Visual Design Service

Credit Hours: 3.00. The course simulates the operation of a professional design studio affording the opportunity for hands-on experience in the development of a graphic product from concept to finish and include contact with clients, and printers.

Learning Outcomes: 1. Design and produce portfolio banner to be shown in the Senior Portfolio Exhibition. 2. Produce branding theme, schedule, marketing strategy, for the Senior Portfolio Exhibition. 3. Market, install and takedown the Senior Portfolio Exhibition. 4. Examine current market trends and assess their influence on magazine content and design decisions. 5. Create a comprehensive magazine design that showcases a range of skills in publication typography, page layout and image development. Credits: 3.00

AD 52200 - Interaction Design Evaluation

Credit Hours: 3.00. This course builds a foundation for

interaction designers to conduct evaluation research. Students start from analyzing evaluation cases on interactive designs and systems to employing evaluation in design projects using quantitative, qualitative, or mixed methods of inquiry.

Learning Outcomes: 1. Identify the need, justification, and goal of conducting an evaluation. 2. Understand systematic knowledge, logical-deductive processes and various research types, and recognize causes & effects, systematic bias and measurement/observation errors in research. 3. Be familiar with different kinds of qualitative and quantitative research methods and how they differ from each other. Build up reliable knowledge for them. 4. Understand the structure of paradigms, theories, concepts, hypotheses, constructs, variables and data. 5. Be familiar with the techniques such as observation, interviews, contamination, exogenous effects, and unobtrusive measures. 6. Be able to organize quantitative and qualitative data, and use analysis software such as SPSS and ALTAS.ti to find patterns. 7. Present the evaluation outcomes, and try to organize and write research papers based on the analysis. Credits: 3.00

AD 53200 - Cognition In Design

Credit Hours: 3.00. This course focuses on understanding cognitive issues and theories in design. Students are exposed to different cognitive models and phases while they are designing interactive systems. They will develop the cognitive perspective, analyze user experience, and develop an interaction design.

Learning Outcomes: 1. Explain and evaluate design decisions in terms of elementary cognitive theories. 2. Understand key differences between traditional and emerging models of cognition and the development of these models. 3. Learn about specific human strengths and weaknesses in terms of perception, memory, learning, and cognition and how to use this information to optimally design the interface/interaction to leverage this specific human potential. 4. Apply current models of individual and group cognition to the design of user interaction. 5. Ultimately, analyze, critically evaluate, and improve our interaction with artifacts from the human perspective. Credits: 3.00

AD 53500 - Furniture Design

Credit Hours: 3.00. Examination of furniture design trends and designers. Explore materials and manufacturing processes. Design and build a full-size seating unit. Shop skills required. Permission of instructor required.

Credits: 3.00

AD 54200 - Information Visualization Design

Credit Hours: 3.00. This course starts from exploring visual perception and attention theories, studying modern visualization technologies and toolkits, and reviewing evolving visualization research. Students work on small exercises, and then accomplish complicated virtual and physical visualization projects for information representation and communication.

Learning Outcomes: 1. Learn the principals involved in information visualization. Gain a background that will aid the design of new, innovative visualizations. 2. Learn about the variety of existing techniques and systems in information visualization. 3. Build a sound foundation in human visual perception and how it relates to creating effective information visualization. 4. Proceed through graph and map-making best practices toward advanced topics of data structure and programmatic visualizations. 5. Gain experience describing and critiquing the methods and approaches of data visualization through presentations and critiques. 6. Understand the key design principles for creating information visualizations. 7. Explore the communication and narrative potential of information visualizations. 8. Develop skills in critiquing visualization techniques as applied to particular tasks. 9. Evaluate information visualizations tools. 10.Design new, innovative visualizations. Credits: 3.00

AD 55000 - Research Methods In Art And Design

Credit Hours: 3.00. An intensive course in research methods to assist students in developing a topic for directed study. Introduction to various research tools; exercises exploring

issues of style, content, and organization; research methods and how they pertain to art and design. Permission of department required.

Learning Outcomes: 1. Identify and develop effective research skills and methods as they apply to individual thesis projects. 2. Analyze and critique existing scholarship. 3. Design an effective thesis statement, devise a research plan and begin conducting research. 4. Practice critical writing skills through peer review of section drafts. Credits: 3.00

AD 55800 - Directed Project Research In Studio Arts

Credit Hours: 1.00 to 3.00. Initial M.F.A. project research and production in studio arts. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 56800 - Directed Project Research In Design

Credit Hours: 1.00 to 3.00. Initial M.F.A. project research and production in design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 59000 - Special Art Problems

Credit Hours: 1.00 to 6.00. Individual problems in art history, appreciation, design, crafts, drawing, and painting. Credit dependent upon amount of work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

AD 59100 - Practicum For Art And Design Teaching Assistants

Credit Hours: 0.00. Seminar to train new Art and Design teaching assistants in the content, policies, and format of the courses they support in various roles, such as: primary instructor, primary studio technician, primary grader for the course, or primary student teacher supervisor. Topics include problem/project presentation, critique techniques, grading, and knowledge of materials and processes of the discipline. Subsequent semesters focus on improving and refining teaching and operational skills. Open only to Art and Design teaching assistants each semester they teach. Permission of instructor required.

Learning Outcomes: 1. Recognize the basic objective elements and principles one must know to be acquainted with the discipline in which they are engaging or solving problems in it. 2. Demonstrate a conceptual understanding of the interrelationships among the basic objective elements within a larger structure that enables them to function together related to course goals and instructional objectives. 3. Carry out or use a procedure in a given situation: how to do something, use a method of inquiry and criteria for using skills, techniques, and methods, applicable to their discipline. 4. Differentiate: discriminate, distinguishing, focusing, and selecting successful instructional outcomes. 5. Develop an awareness and responsibility for analyzing and assessing their own professional behaviors and activities and accepting continuing responsibility for their own professional development. Credits: 0.00

AD 59200 - Graduate Seminar In Art Or Design History

Credit Hours: 3.00. This is a graduate seminar that focuses on a particular theme, period, or movement in the history of art or design. Permission from department required.

Learning Outcomes: 1. Analyze and discuss scholarly readings related to the history of art and design. 2. Analyze primary sources, artifacts, images, and other such materials related to the theme of the term. 3. Conduct original primary and scholarly research on a topic related to the seminar and present that research in written, visual, or oral forms. 4. Understand the social, cultural, and/or political context of art and design history. Credits: 3.00

AD 60000 - Painting

Credit Hours: 3.00 to 6.00. Painting. Permission of department required.

Credits: 3.00 to 6.00

AD 60300 - Theory In Art Seminar

Credit Hours: 3.00. Study of critical issues in modern and postmodern art and relevant methodologies: formalism, iconography, biography and autobiography. Marxism (cultural studies), semiotics, and psychoanalyses. Elements of contemporary professional art practice discussed, including writing of artists' and designers' statements, biographies, and resumes. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

AD 60500 - Problems In Industrial Design

Credit Hours: 3.00. Problems in product innovation, product design, product development, and environmental design. Emphasis is placed on the development of working prototypes.

Credits: 3.00

AD 60600 - Problems In Visual Design

Credit Hours: 3.00. Problems relating to printing and digital technology, motion design, computer graphics, perception, and the development of visual communication prototypes.

Learning Outcomes: 1. Study the roles, impacts, and topics in poster design. 2. Examine the various techniques for image generation. 3. Strengthen students' conceptual skills. 4. Engage students' creative solutions through practical and theoretical exercise in poster design and display. Credits: 3.00

AD 60700 - Graduate Seminar In Photography And Related Media

Credit Hours: 3.00 to 6.00. Study and discussion of the aesthetics, theory, and criticism of photography and related media. Applications include historical and contemporary research and/or the development and critical analysis of a body of work. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00 to 6.00

AD 60800 - Advanced Typography

Credit Hours: 3.00. Explores the communicative and structural aspects of traditional and non-traditional typography, its current and past practitioners, and its evolving role in society. Independent research and group projects will supplement lectures, assigned readings, and field trips. Permission of department required.

Learning Outcomes: 1. Provide opportunities to explore creative and ideation processes as they relate to typography and the letter form. 2. Engage students' conceptual skills through typographic expression and form. 3. Encourage students to experiment with typographic form outside of traditional views of typographic design. 4. Strengthen students' ability to create effective visual communications by way of complex problems emphasizing critical thinking, design process and presentation. Credits: 3.00

AD 60900 - Information Design

Credit Hours: 3.00. This course aims to teach specific principles and methods pertaining to information design, an emerging discipline within visual communications design (graphic design) involving the selection, organization and presentation of information to a given audience, covering a wide and varied group of delivery mediums. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

AD 61000 - Advanced Poster Design

Credit Hours: 3.00. Specific principles and methods pertaining to poster design. Explores the historical and social implications of poster design. Practical and theoretical exercise will aid students in creative thinking and concept generation. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

AD 61100 - Advanced Web Design For Visual Communication Design

Credit Hours: 3.00. Explores experimental interface design issues and surveys emerging and advanced theories of interface design for the Web. Application of motion graphics design principles and design experimentation is part of the curriculum. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Learning Outcomes: 1. Conduct web design research and present it. 2. Present and discuss aspects of web design trends in contemporary society. 3. Design and develop web design prototypes. 4. Critique web designs based on established criteria such as content design, graphic design, experience design, navigation design, and performance design. Credits: 3.00

AD 61200 - Color Aesthetic And Research

Credit Hours: 3.00. Explores color aesthetic based on the works of color masters (e.g., Albers, Itten, Chevreul, Birren, Munsell, and Ostwald) and contemporary color research issues applied to art and design. Color research methodology will be addressed.

Learning Outcomes: 1. Identify and apply color aesthetic principles to assigned problems. 2. Produce self-initiated experimental color studies. 3. Write a color research proposal. 4. Propose and develop a small color research project based on theoretical frameworks discussed in class. 5. Investigate and discuss color research related to art and design. 6. Discuss contemporary color design issues. Credits: 3.00

AD 61300 - Drawing

Credit Hours: 3.00 to 6.00. Drawing. Permission of department

required.

Credits: 3.00 to 6.00

AD 61400 - Graduate Installation And Critique

Credit Hours: 3.00. A seminar for all graduate students in the studio arts incorporating the process of installation art to facilitate the exchange of ideas and professional criticism.

Credits: 3.00

AD 61500 - Social Issues In Industrial Design

Credit Hours: 3.00. A study of mass-production materials and processes used by designers. Students will focus on the limitations and benefits of various manufacturing methods. Special attention will be given to injection molding, casting, and stamping. Prerequisite: Admission to the M.F.A. program in Art and Design.

Credits: 3.00

AD 61600 - Electronic And Time-Based Art

Credit Hours: 3.00 to 6.00. This seminar explores contemporary artistic practices in Electronic and Time-Based Art, including emerging fields such as: generative and interactive art, audio-visual installation, and new media performance. The format of the course is a mixture of critique, workshops, research, presentations, and discussion. Permission of department required.

Learning Outcomes: 1. Make use of essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production, collaborative and interdisciplinary team work. 2. Use shared knowledge from online communities that is relevant to their projects. 3. Consider contributing their own findings and knowledge gained in this class to relevant online communities (e.g. arduino.cc, processing.org, instructables.com, makezine.com, etc). 4. Know how to research and find relevant exhibition venues, festivals and competitions. 5. Find the most effective medium for their ideas and concepts. 6. Know how to adjust to a field of artistic expression in which the tools (i.e. digital software and hardware technologies) are changing rapidly. 7. Have developed effective research strategies pertinent to the history of Electronic and Time-Based Art. 8. Able to analyze key works and artists in the merging field of Electronic and Time-Based Art. Be able to place their artistic practice in a rich historical context of related earlier art forms such as: Kinetic Art, Film, Dada, Fluxus and Performance Art. 9. Understand that "A technology is not merely a system of machines with certain functions; rather, it is an expression of a social world. Electricity, the telephone, radio, television, the computer, and the Internet are not implacable forces moving through history, but social processes that vary from one time period to another and from one culture to another. " (Nye 2006, 47). 10. Improve their writing skills toward successful project and exhibition proposals, artist statements and research papers according to CAA's latest Guidelines for Faculty Teaching in New-Media Arts (2007): "In this emergent field, contributions to theory should be seen as having equal significance as aesthetic productions. " (see: http://www.collegeart.org/guidelines/newmedia07.html). Credits: 3.00 to 6.00

AD 61700 - Advanced Motion Design

Credit Hours: 3.00. This course explores Motion Design's multidisciplinary aspects, combining graphic design, animation, film, photography, videography, illustration, broadcast graphics, sound design, and visual effects. It prepares students to tackle common screen media challenges, emphasizing the development of sophisticated Motion Design projects. Offering an in-depth examination of Motion Design, this program highlights the range of techniques, processes, methods, and aesthetic options open to creators. It requires intensive effort, sharp observation, critical analysis, and commitment from graduate students, calling for a significant time commitment to achieve meaningful outcomes. The course highlights the essential role of a well-executed design process in creating work that is both innovative and engaging to the target audience while adhering to high professional standards.

Learning Outcomes: 1. Harness movement, timing, and story to express ideas and feelings unattainable with still images. 2. Learn to use software such as Adobe After Effects and Photoshop, creating animated text, blending animations with video, and using advanced effects for effective storytelling. 3. Offer

constructive feedback using accurate design terms, communicate ideas and techniques clearly, and participate in helpful critique sessions with peers. 4. Employ visual metaphors, mood boards, storyboards, and scripts to improve projects' visual and narrative flow, ensuring clear messaging and audience engagement. 5. Develop a collaboration style that supports a positive learning atmosphere and enhances group design quality through constructive feedback exchange with peers.

Credits: 3.00

AD 62500 - Applied Ornamental Design

Credit Hours: 3.00. Examination of past and present ornamental design applications and of the cultures that created them. Students will generate their own individual visual iconography to be transformed into designs for consumer products, architectural elements, or furniture. Prerequisite: Admission to the M.F.A. program in Art and Design.

Credits: 3.00

AD 63500 - Advanced Materials And Processes

Credit Hours: 3.00. A study of mass-production materials and processes used by designers. Students will focus on the limitations and benefits of various manufacturing methods. Special attention will be given to injection molding, casting, and stamping. Prerequisite: Admission to the M.F.A. program in Art and Design.

Credits: 3.00

AD 64000 - Special Topics In Interior Design

Credit Hours: 1.00 to 6.00. Special topics and theoretical approaches to individual projects within the built environment will be investigated, such as urban environments, existing and new structures, and interior environments. Topics could include either residential or non-residential projects. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of instructor required.

Credits: 1.00 to 6.00

AD 65800 - MFA Project Research In Studio Arts

Credit Hours: 1.00 to 6.00. Intensive M.F.A. project production and thesis research in studio arts. Prerequisite: Three credit hours of AD 55800 with a minimum B- grade. Permission of instructor required.

Credits: 1.00 to 6.00

AD 66100 - Jewelry And Metalsmithing

Credit Hours: 3.00 to 6.00. Jewelry and Metalsmithing. Permission of department required.

Credits: 3.00 to 6.00

AD 66500 - Printmaking

Credit Hours: 3.00 to 6.00. Printmaking. Permission of department required.

Credits: 3.00 to 6.00

AD 66800 - MFA Project Research In Design

Credit Hours: 1.00 to 6.00. Intensive M.F.A. project production and thesis research in design. Prerequisite: Three credit hours of AD 56800 with a minimum B- grade. Permission of instructor required.

Credits: 1.00 to 12.00

AD 66900 - Materials And Processes For The Studio Artist

Credit Hours: 3.00 to 6.00. This course introduces graduate studio artists to various materials, methods and processes to supplement their current practical media of choice. Such methods include, but are not limited to, welding for the artist (MIG and arc), casting, cement, plaster, mold making, structural construction, using fabric for sculptural processes, sewing (machine and hand) printing on fabric. This is a survey course and exposes the student to the above allowing them to select one or multiple processes and materials to enhance and expand their practice. Permission of department required.

Learning Outcomes: 1. Develop a new set of skills that they can continue to practice and use to enhance their current artistic practice. 2. Expand beyond the limits of their current practice to become more well-versed in all aspects of the current climate of a multi-discipline artist. Credits: 3.00 to 6.00

AD 67000 - Textile Art

Credit Hours: 3.00 to 6.00. Textile Art. Permission of department required.

Credits: 3.00 to 6.00

AD 67500 - Sculpture

Credit Hours: 3.00 to 6.00. Sculpture. Permission of department required.

Credits: 3.00 to 6.00

AD 67800 - Graduate Internship

Credit Hours: 1.00 to 6.00. Intensive exposure to professional experience through supervised internship in art or design firms, departments, or studios. The internship will consist of work to enhance the development of future professionals. The internship experience will help students integrate theory and practice and confirm career choices. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of instructor required.

Credits: 1.00 to 6.00

AD 69000 - Advanced Problems In Art And Design

Credit Hours: 0.00 to 18.00. Credit and hours to be arranged.

Permission of instructor required.

Credits: 0.00 to 18.00

AD 69100 - Directed Readings In Art History

Credit Hours: 3.00. A survey of specialized publications for in-depth study in an area of special interest. Permission of instructor required.

Credits: 3.00

AD 69300 - Historical Problems In Art Education

Credit Hours: 3.00. (EDCI 63000) Examination of methods used to investigate art education's history, past theory, and practices. Class work will include readings and discussion and will culminate in guided research and a short historical study. Permission of instructor required. Prerequisite: BA in art education.

Credits: 3.00

AD 69600 - Aesthetic Development In Children

Credit Hours: 3.00. (EDCI 63100) Examination of historical and contemporary theory and research in children's aesthetic development (response and production) and analysis of the influences of such development on art education curricula and methodology. Permission of Instructor required. Prerequisite: BA in Art Education or an equivalent area.

Learning Outcomes: 1. Examine historical and contemporary conceptions of the development of children's responses to works of art. 2. Examine historical and contemporary conceptions of the development of children's art production. 3. Analyze the influence of children's aesthetic development (in response and production) upon art education curricula and methodology. Credits: 3.00

AD 69700 - MFA Graduate Exhibition

Credit Hours: 3.00. Completion of M.F.A. thesis, oral defense, gallery installation of M.F.A. exhibition, public presentation, and documentation of exhibition. Prerequisite: Admission to the M.F.A. program in Art and Design. Concurrent Prerequisite: Must complete 12 credit hours of AD 65800 or AD 66800 during the same or prior session. Only open to M.F.A. graduate students in Art and Design. Permission of instructor required.

Credits: 3.00

AD 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Asian American Studies

ASAM 24000 - Introduction To Asian American Studies (UCC: HUM)

Credit Hours: 3.00. A general introduction to Asian American history and culture, with a focus on the diverse and multifaceted experiences of peoples of Asian descent in America and their contributions to U.S. culture and society.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

ASAM 34200 - Special Topics In Asian American Studies

Credit Hours: 3.00. This course will focus on specific issues and themes in Asian American Studies.

Learning Outcomes: 1. Explore specific topics in Asian American Studies. 2. Acquire knowledge and critical skills pertinent to the examination of Asian American issues, texts and other cultural materials. Credits: 3.00

ASAM 49000 - Special Topics In Asian American Studies

Credit Hours: 3.00. Various topics in Asian American studies, changing from semester to semester as presented by different instructors.

Learning Outcomes: 1. Vary due to the variable nature of the course. Credits: 3.00

Astronomy

ASTR 12300 - Our Place In The Universe: From The Solar System To Distant Cosmos (UCC: STS)

Credit Hours: 3.00. This course is intended for students interested in learning about everything in the cosmos, from the Solar System, stars, our Galaxy, and other external galaxies now and in the distant past. Key physical principles in understanding these topics will be covered at the non-calculus level. The key space missions that enabled space explorations as well as their challenges and societal impact will be also discussed.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a wide range of phenomena seen in the Solar System and in the night sky and explain the key physical principles responsible for them. 2. Understand the technical challenges in space exploration and

the technological developments that overcame them. 3. Develop an appreciation of our place on our planet and in the Solar System in a broader context of the history of the universe as we understand it. 4. Connect our understanding and discoveries in astronomy to the larger changes in society and the development of human civilization and provide biographical information about transformative figures in astronomy research. Credits: 3.00

ASTR 26300 - Descriptive Astronomy: The Solar System (UCC: SCI)

Credit Hours: 3.00. A descriptive course in astronomy intended for non-physics majors. Topics include properties of stars, stellar birth and death; the Hertzsprung-Russel diagram; binary systems; red giants and white dwarfs; supernova; neutron stars and black holes; galaxies; cosmology and the big bang; and dark matter. Includes required night-sky observing sessions.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Think as a scientist by using critical thinking and analytical inquiry, in particular to understand our universe in terms of the laws of physics. 2. Apply basic scientific methods to the solution of astrophysical problems. 3. Use the scientific method and theories to analyze our universe. 4. Provide scientific explanations of the nature of the universe. 5. Acquire an appreciation for our place in the cosmos. Credits: 3.00

ASTR 26400 - Descriptive Astronomy: Stars And Galaxies (UCC: SCI)

Credit Hours: 3.00. A descriptive, nonmathematical course in astronomy intended for non-physics majors. Topics include: properties of stars; stellar birth and death; the Hertzsprung-Russel diagram; main sequence stars; binary systems; stellar clusters; red giants and white dwarfs, nova and supernova; neutron stars and black holes; galaxies and the cosmological red shift. Includes required observing sessions. Not available to students with credit in ASTR 36400.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Able to explain the evolution of our Universe as well as its constituents, such as stars and galaxies. 2. Able to demonstrate how this cosmic perspective impacts your lives, personal decision, or views on societal issues. 3. Able to relate astrophysical observations to basic physical concepts. Credits: 3.00

ASTR 36300 - The Solar System

Credit Hours: 3.00. This course is intended for students in science or engineering. The components of the course consist of an overview of solar system objects and an overview of the physical processes that control the evolution of solar system objects since formation. The overview of solar system includes observations of the Sun, planets, asteroids and Kuiper-belt objects, comets, and interplanetary dust. Specific processes that are discussed include hydrostatic equilibrium, orbital dynamics, radioactive decay, and heat flow. The role of these processes in shaping planetary surfaces and atmosphere is explored.

Learning Outcomes: 1. The students will acquire extensive knowledge on the solar system, including its formation and evolution. Credits: 3.00

ASTR 36400 - Stars And Galaxies

Credit Hours: 3.00. This course is intended for students in Science or Engineering. This is the second of a two-semester introductory sequence on astronomy and astrophysics, although it is designed to be a standalone course. It is intended mainly for Science and Engineering majors who are comfortable with calculus-based contents. The course provides an overview on the formation and evolution of stars, galaxies, and clusters of galaxies. Selected topics that are covered in more detail include stellar structure and atmosphere, properties of black holes, neutron stars, and white dwarfs, galactic dynamics, and dark matter in galaxies and clusters of galaxies.

Learning Outcomes: 1. The students will acquire extensive knowledge on the properties of stars and galaxies. Credits: 3.00

ASTR 37000 - Cosmology

Credit Hours: 3.00. Intended for science and engineering majors. Basic physics and math knowledge will be assumed. The picture of how the Universe came to be and how it has evolved has recently come into sharp focus. This progress is the result of improved observational techniques that have resulted in high resolution images of very distant galaxies, a more accurate mapping of the Large Scale Structure of the Universe or the high resolution picture of the young universe provided by Cosmic Microwave Background observations. We will present a historical perspective of how ideas and data have shaped Cosmology through the centuries. In addition, we will review the theoretical models that are in agreement with the current observations. Our goal will be to provide the students with a broad overview of the current research in Cosmology with an eye toward stimulating the students curiosity about the many questions still awaiting answers in this field.

Learning Outcomes: 1. Students will acquire extensive knowledge and a broad overview of Cosmology, the study of how the Universe came to be and how it has evolved. Credits: 3.00

ASTR 56000 - Stellar Evolution

Credit Hours: 3.00. (PHYS 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

ASTR 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (PHYS 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

ASTR 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (PHYS 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

ASTR 56300 - Astroparticle Physics

Credit Hours: 3.00. (PHYS 56300) An overview of an emerging research frontier in modern physics that lies at the interface of particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology, cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

ASTR 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (PHYS 56700) Fundamental concepts in observational astronomy, including coordinate and time systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal. Credits: 3.00

Aviation Technology

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication. Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 10901 - Introduction To Uncrewed Aircraft System Operations

Credit Hours: 3.00. This course will provide students the aeronautical knowledge required to operate a small UAS in the National Airspace. Students are introduced to various aspects of uncrewed aviation operations, which includes UAS system types and components, regulations and operational approvals, and indoctrination to the civil and commercial applications of UAS. Through the use of UAS simulation technology, students will develop basic small UAS flight skills and successfully complete various UAS operational scenarios. Upon successful completion of the course students will be prepared to obtain a Federal Aviation Administration (FAA) Remote Pilot Certificate with a Small UAS Rating. Permission of department is required.

Learning Outcomes: 1. Obtain an FAA Remote Pilot Certificate with a Small UAS Rating. 2. Understand small UAS terminology and technology. 3. Comply with regulatory framework and understand various UAS approval processes. 4. Understand basic small UAS operating procedures. 5. Appreciate and gain perspective on how to safely operate UAS in the national airspace system. 6. Using simulation technology, demonstrate basic small UAS flight maneuvers and execute basic flight operations. Credits: 3.00

AT 11200 - Introduction To Operational Aviation Safety

Credit Hours: 1.00. This course teaches students about industry safety standards and the School of Aviation and Transportation Technology's Safety Program. This course will emphasize applying various safety models to accident case studies and reported incidents.

Learning Outcomes: 1. Identify safety models commonly used by flight operations. 2. Differentiate amongst commonly used safety models. 3. Given a case study/safety report, students will be able to apply the appropriate safety model to the event. Credits: 1.00

AT 11501 - Experiential Honors Project IA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each

course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Describe the process of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications.

Credits: 0.00 to 3.00

AT 11600 - Aircraft Science For Engineering Technology

Credit Hours: 3.00. Required for AET. This course is an introduction to theory of flight, aircraft nomenclature, aircraft configurations, high speed flight, and helicopter configurations and rotor dynamics. Covers lift/drag and concepts for flight at an engineering technology level beyond that of flight ground school. Federal regulatory systems for aircraft design and persons other than flight personnel and associated technical documents are covered. Introduces center of gravity theory, defines how to locate centers of gravity, and introduces weight and balance procedures for engineering technology, not covered by flight ground school. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Able to explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Able to define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Able to define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Able to successfully demonstrate on time performance of required activities. 7. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment.

Credits: 3.00

AT 11601 - Experiential Honors Project IB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Completion of AT 11501 with a grade of B or higher is required. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Describe the process of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications.

Credits: 0.00 to 3.00

AT 11901 - Uncrewed Aerial Systems: Safety And Risk Management

Credit Hours: 3.00. This course discusses the fundamental concepts of Safety and Risk Management and their application to UAS operations. The course will provide insight into strategies for developing and implementing a formal safety management system (SMS) that effectively supports an organization's UAS operations. In addition, students will gain an understanding of ethical decision-making and its relationship to safety. Laboratory exercises provide students practical application of this knowledge to various UAS operational scenarios, which includes utilizing SMS principles in assessing risks and developing appropriate mitigations. Must possess a valid FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Understand and demonstrate the application of safety and risk

management principles to UAS operations. 2. Exemplify the UAS regulatory environment, which includes related regulatory approval and waiver processes. 3. Understand and apply technical data sources to evaluate UAS airworthiness and system health, to include ground and flight testing, troubleshooting, maintenance and repair. 4. Demonstrate the ability to plan and safely complete basic UAS missions that are regulatory compliant. 5. Understand and demonstrate ethical decision-making. Credits: 3.00

AT 12700 - Publications Records And Regulations

Credit Hours: 3.00. Required for AET. This course provides students with the concepts, and information to understand the regulations and publications specific to aviation and aerospace vehicle repair and maintenance. The privileges and limitations of the 14 CFR Part 65 airmen certificates are covered, as well as the regulations governing repair facilities and repair stations. The specific forms and records, and the proper disposition of those records are covered. In addition, aircraft technical drawings and prints are examined and the student is to develop the ability to read and comprehend aircraft drawings, as well as make drawings/sketches for vehicle repair and/or alteration. Precision measuring equipment is covered as is the hardware specific to aviation and aerospace. Inspection procedures and conformity checks are covered. Engine run up operations for inspection purpose are covered. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Identify the privileges and limitations of their 14 CFR Part 65 certificates. 2. Complete all appropriate forms and records related to aircraft maintenance and repair operations. 3. Solve problems and answer technical questions using these materials. 4. Read and interpret the output of precision measuring devices and be able to take precision measurements. 5. Identify various types of AN, MS, and NAS hardware, and understand the appropriate use of aircraft hardware. 6. Start, operate, and functionally check a reciprocating engine. Credits: 3.00

AT 14400 - Private Pilot Lectures

Credit Hours: 4.00. A study of the subject areas and information needed to operate as a private pilot in the aviation environment. The FAA private pilot written exam will be offered to those who qualify after taking the Lecture Course offering.

Learning Outcomes: 1. Recall the aeronautical subject areas required by the FAA as a private pilot. 2. Analyze aspects of professionalism and decision making within the aviation environment. 3. Compare and contrast the reference information available covering a given aviation concept or best practice. 4. Explain to team members about issues requiring resolution or input. 5. Demonstrate the knowledge, skills, and abilities to manage, lead, and empower others to efficiently address organizational and group needs and objectives. Credits: 4.00

AT 14500 - Private Pilot Flight

Credit Hours: 2.00. In this course, the student will receive the necessary dual flight instruction and solo flight time to qualify for the FAA Private Pilot Certificate under Part 61 of the Federal Aviation Regulations.

Learning Outcomes: 1. Demonstrate proficiency in take-offs and landings. 2. Demonstrate proficiency in flight at minimum controllable airspeed, including stalls and recoveries. 3. Demonstrate proficiency in planning and execution of cross-country flights using various means of navigation. 4. Demonstrate proficiency in night operations and simulated instrument flight. 5. Demonstrate proficiency in abnormal and emergency procedures. Credits: 2.00

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major

aircraft systems work together. Credits: 3.00

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 20501 - Statics For Aerostructures

Credit Hours: 3.00. This course provides an introduction to the static analysis of aerostructures. Force systems, resultants and equilibrium, moments, distributed loads, and centroids as they relate to aeronautical structures are studied. CAD software is introduced.

Learning Outcomes: 1. Determine the resultant of multiple vectors. 2. Draw free-body diagrams and apply equilibrium equations to those diagrams. 3. Demonstrate an understanding of the analysis of distributed loads in aerostructures. 4. Develop knowledge of internal forces and moments in structural members. 5. Develop an ability to calculate centroids and moments of inertia. 6. Use CAD software to represent and analyze aerostructures. Credits: 3.00

AT 20700 - Introduction To Aircraft Systems

Credit Hours: 3.00. Principles and design concepts of aircraft operating systems are covered. Emphasis is given to flight control, electrical, environmental, hydraulic, pneumatic, pressurization, oxygen, heating, cooling, fire protection, and ice and rain protection systems. Also included are theory of operation and design of aircraft instruments and associate systems.

Learning Outcomes: 1. Learn the function and operational principles aircraft instruments. 2. Learn the function of various components in a system for maintaining a healthful and comfortable environment in an aircraft. 3. Study, inspect, and check ice, rain, and fire control aircraft systems. 4. Determine the location of the elements in the aircraft and become familiar with the function and operating procedures for the typical system found on light single or light twin engine aircraft. 5. Learn to recognize various fittings and their application when used for rigid tubing and flexible hose. 6. Learn the use of tools and FAA Regulations in relation to aircraft tube and hose fabrication. 7. Learn the basic fundamentals of hydraulic systems, power, components and control. 8. Learn the different hydraulic fluids, seal design and system compatibility used in hydraulic systems. Credits: 3.00

AT 20802 - Aircraft Materials

Credit Hours: 3.00. In this course students study aluminum and composite materials used in aircraft. The course covers elements of design, fabrication, final assembly, and testing. Students also study the practical application of statics for airframe loads.

Learning Outcomes: 1. Use tools for the fabrication, final assembly, and testing of materials. 2. Use and apply technical information, including drawings, sketches, blueprints, charts, and graphs. 3. Analyze damage and design repairs to aircraft materials. 4. Demonstrate the basic skills of oxyacetylene welding and the concepts of welded repair design. 5. Apply the concepts of statics as they relate to airframe structural members. Credits: 3.00

AT 20900 - Autonomous Aircraft Technology And Maintenance I

Credit Hours: 3.00. This course introduces fundamental concepts of autonomous aircraft technology and maintenance. Topics include history, airframe and powerplant selection, regulations governing uncrewed systems, airspace descriptions, safety, autonomous system programming and calibration, data package options, weather, system maintenance and repair, manual flight training, and aerodynamics and flight controls for autonomous aircraft.

Learning Outcomes: 1. Reflect on the history of UAS and project the future growth of UAS. 2. Analyze data sources to determine flight feasibility and mitigate hazards. 3. Collaborate effectively as a crew member both in the lab and in the field. 4. Design and print flight ready

3D model. 5. Assess airspace and flight feasibility by submission of FAA waiver application. 6. Demonstrate effective design choices. Credits: 3.00

AT 21000 - Ground Trainer I

Credit Hours: 1.00. Included in this course are maneuvers to develop basic attitude instrument flying skills, including tracking, holding, and approach procedures. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in attitude instrument flying skills 2. Demonstrate proficiency in the use of enroute and approach navigation methods 3. Demonstrate proficiency in holding and arc maneuvers Credits: 1.00

AT 21100 - Ground Trainer II

Credit Hours: 1.00. This course is designed to develop a higher degree of coordination and judgement through additional experience in the flight training device. This course will continue to prepare the student for the FAA Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations. 2. Demonstrate proficiency in emergency aircraft operations. 3. Demonstrate proficiency in cross-country navigation procedures. Credits: 1.00

AT 21200 - Operational Risk Assessment

Credit Hours: 1.00. This course gives students a comprehensive understanding of industry incident risk assessment and analyses. Students will learn about Safety Management Systems (SMS) feedback loop processes and techniques utilized to find root causes. Additionally, residual risks of real-world mishaps during flight operations will be examined.

Learning Outcomes: 1. Determine root causes from provided safety reports. 2. Produce a risk analysis from provided safety reports. 3. Extrapolate substitute and residual risk from provided safety reports. Credits: 1.00

AT 21500 - Experiential Honors Project IIA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed the AT 11601 course. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 21600 - Experiential Honors Project IIB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed AT 21500 with a grade of B or higher. The Center for Research and Education in Advanced Transportation Ecosystems (CREATE) approval is required to register. Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 21900 - Autonomous Aircraft Technology And Maintenance II

Credit Hours: 3.00. This course will further develop skills and understanding of autonomous aircraft technology and maintenance. Emphasis will be on design, selection, construction, flight test, evaluation, and repair, of stabilized uncrewed aircraft. Students will work hands-on with open-source flight controllers to perform autonomous missions. Additionally, students will design and deploy scenario-specific sensors using student-constructed rotorcraft. Students will be expected to demonstrate their sensor payload through lab and field demonstration and professional documentation.

Learning Outcomes: 1. Apply flight principles to building a UAS capable of performing a specific

operation. 2. Analyze and compare flight characteristics of UAS under different environmental and physical conditions. 3. Predict and compare flight characteristics of UAS using different components and configurations. 4. Integrate custom sensor payload into UAS design. 5. Safely and efficiently coordinate automated flights with team members. 6. Develop an enterprise-ready online user manual for UAS and sensor payload. Credits: 3.00

AT 22300 - Human Factors For Flight Crews

Credit Hours: 3.00. This course explores the fundamental concepts of single pilot and multi-crew human factors issues. The first part of the course focuses on the physiological factors that affect single pilot aeronautical decision-making. The second part examines human error, threat and error management, and domains of crew resources management. The third segment utilizes team-building exercises, case study presentations, and a formal assignment to emphasis course learning outcomes.

Learning Outcomes: 1. Examine the relationship of human factor issues to aviation safety 2. Examine crew resource management fundamentals in single and multi-crew environments. 3. Apply appropriate decision-making and problem-solving skills in team situations. Credits: 3.00

AT 23300 - Ethics And Aviation

Credit Hours: 3.00. This discussion-oriented class is an introduction to the principles of ethical theory and the application of that theory to practical problems associated with the aviation industry. Actual aviation case studies are used to illustrate major concepts.

Learning Outcomes: 1. Apply ethics to historical situations in aviation. 2. Apply ethics to current situations in aviation. 3. Discuss case studies centered on ethical situations in aviation. Credits: 3.00

AT 24302 - Commercial Flight I Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to develop a higher degree of coordination and judgment through additional experience in more advanced flight maneuvers and cross-country flying under Part 141 of the Federal Aviation Regulations. It will start to prepare the student for the FAA Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in takeoffs, landings, and flight at minimum controllable airspeed. 2. Demonstrate proficiency in advanced commercial pilot maneuvers. 3. Demonstrate proficiency in cross-country flight and electronic navigation. 4. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

AT 24802 - Commercial Flight II Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to finish preparation for the FAA Commercial Pilot Certificate practical exam. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in advanced commercial pilot maneuvers. 2. Demonstrate proficiency in cross-country flight and electronic navigation. 3. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

AT 24900 - Instrument Flight Lectures

Credit Hours: 3.00. A study of the operation of flight instruments and radio navigation aids, federal aviation regulations pertinent to instrument flight, meteorology, instrument charts, instrument flight planning, and air traffic control procedures. Preparation for the FAA Instrument Rating written examination.

Learning Outcomes: 1. Demonstrate competency in aircraft flight instruments and navigation systems. 2. Demonstrate competency in the Federal Aviation Regulations for instrument flight. 3. Demonstrate competency in using instrument enroute charts, approach charts, SIDS and STARS in IFR flight planning. 4. Demonstrate knowledge in conducting instrument approaches and holding patterns. 5. Demonstrate knowledge in aviation weather and aviation weather services. Credits: 3.00

AT 25200 - Aviation Projects

Credit Hours: 3.00. This course will introduce the students to group projects in collaboration with industrial partners in aviation. A new project will be conducted each semester. Students will participate in the development of project goals, conducting field research, and developing a final course document and presentation. Travel outside of the normal assigned classroom time might be required. Permission of Department required.

Learning Outcomes: 1. Become familiar with the conduct of an industry research project. 2. Work in small research teams. 3. Develop presentation skills. Credits: 3.00

AT 25302 - Instrument Flight Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to prepare the student for the FAA Instrument Rating under Part 141 of the Federal Aviation Regulations. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in holding procedures, instrument approaches, and IFR cross-country procedures. 2. Accomplish Instrument rating Practical Test. Credits: 2.00

AT 25400 - Commercial Flight Lectures

Credit Hours: 3.00. The course is designed to review the principles of flight, aircraft systems, pertinent federal aviation regulations, and airman publications and service in order to prepare the student for the FAA Commercial Pilot written examination.

Learning Outcomes: 1. Explain selected concepts from previous flight and ground courses. 2. Describe advanced aircraft systems and appropriate regulations needed in commercial operations. 3. Complete the Commercial Pilot Written Exam. Credits: 3.00

AT 26200 - Basic Aircraft Powerplant Technology

Credit Hours: 4.00. A study of the design, construction, and operating practices of aircraft reciprocating and small gas turbine engines. Laboratory exercises emphasize airworthiness evaluation, fault-isolation techniques, and standard service/maintenance practices.

Learning Outcomes: 1. Compare and contrast different types of reciprocating engines. 2. Explain the principles of the Otto cycle. 3. Explain Volumetric Efficiency. 4. Identify the importance of reciprocating engine designs and construction. 5. Demonstrate the ability to operate and troubleshoot a reciprocating engine. Credits: 4.00

AT 26502 - Aircraft Electrical Systems

Credit Hours: 3.00. An in-depth study of aircraft electrical components, both individually and as systems in the aircraft. DC electrical circuits, series and parallel circuits, magnetism, and electromagnetism are covered, as are DC power systems, schematics, and aircraft wiring practices. Aircraft charging systems, main power distribution, solid state electronics, batteries, and motors are also discussed.

Learning Outcomes: 1. Develop an understanding of electrical principles as they relate to aircraft system operation. 2. Construct, analyze, and isolate faults in circuits. 3. Demonstrate troubleshooting procedures for direct currently electrical aircraft components and power distribution circuits. Credits: 3.00

AT 26700 - Fixed And Rotary Wing Assemblies

Credit Hours: 3.00. An overview of various fixed and rotary wing components and systems. Flight control systems, landing gear, fuel systems, wheels, brakes, and rotor systems are among the subjects studied.

Learning Outcomes: 1. Read, analyze, and interpret technical instructions. 2. Complete a set of aviation maintenance related tasks. 3. Jack, hoist, shore, level, and weigh an aircraft and calculate its weight and balance. 4. Knowledge of radio communications and aircraft mooring. 5. Operate a helicopter rotor balancing computer and balance a helicopter main and tail rotor. Credits: 3.00

AT 27200 - Introduction To Composite Technology

Credit Hours: 3.00. An introduction to basic composite materials, processes, construction, testing, and repair. Students will work with a variety of wet and pre-impregnated fiber and matrix systems including glass, aramid fiber, and carbon-graphite.

Learning Outcomes: 1. Demonstrate familiarity with wet lay, prepreg, and VARTM processes. 2. Use solid modeling software for part design, drafting, and composite design. 3. Demonstrate understanding of basic CNC machining, mold-making, and curing, 4. Repair damaged composite structures. Credits: 3.00

AT 27800 - Nondestructive Testing For Aircraft

Credit Hours: 3.00. A study of nondestructive testing methods used to evaluate the structural integrity of airframes, engines, and components. Magnetic particle, liquid penetrant, electromagnetic, ultrasonic, and radiographic inspection are covered.

Learning Outcomes: 1. Learn basic concepts

and procedures for effective Penetrant Testing, different systems (white light, black light), sequences and evaluation of defects. 2. Learn basic concepts and procedures for effective Magnetic Particle Testing, system set up and checks, calculation of amperage used, identification of issues of materials and choice of methods, evaluation of defects. 3. Learn basic concepts and procedures for effective Eddy Current Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different wave forms on indications, and evaluation of defects. 4. Learn basic concepts and procedures for effective Ultrasonic Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different methods (surface, though, etc.) and evaluation of defects. Credits: 3.00

AT 28600 - National Airspace Systems Operations

Credit Hours: 3.00. An introduction to the technical procedures involved in operating unmanned Aerial Systems in the air traffic control system. Flight operations and procedures will be covered. Weather theory and flight regulations as they apply to UAS operations will also be discussed.

Learning Outcomes: 1. Demonstrate operation of a UAS simulator. 2. Understand and apply appropriate federal aviation regulations as they apply to UAS operations. 3. Understand the principles of flight and flight control as they apply to UAS vehicles. Credits: 3.00

AT 29000 - Aviation Project

Credit Hours: 1.00 to 4.00. Independent study primarily for sophomore students who wish to pursue study and development work in special areas. Subject material must be arranged with the instructor before enrolling in the course. Permission of instructor required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 4.00

AT 30702 - Advanced Aircraft Systems

Credit Hours: 3.00. An in-depth study of aircraft components and operation with an emphasis on transport-category aircraft. Systems covered include fuel, environmental, fluid-power, flight control, fire protection, ice-control, warning, and auxiliary power. Practical projects utilize small ad transport-category aircraft.

Learning Outcomes: 1. Demonstrate an understanding of the terminology of systems analysis and design. 2. Demonstrate proper project planning ability. 3. Demonstrate knowledge of the industrial safety culture and the ability to analyze all safety issues of the project, including team member safety. 4. Determine system airworthiness. 5. Develop troubleshooting skills in an industry environment. Credits: 3.00

AT 30802 - Aircraft Materials Processes

Credit Hours: 3.00. A study of the processes by which aircraft materials are converted into usable components. Laboratory activities include machining, welding, and analysis of material properties.

Learning Outcomes: 1. Demonstrate familiarity with the basic operations of lathes and mills, maintaining close tolerances on work. 2. Demonstrate familiarity with the various properties and strength attributes of aerospace materials and their measurement and application. 3. Demonstrate familiarity with the basic concepts of damage-tolerant repair design. 4. Demonstrate familiarity with the concept of aircraft reliability control as used to support large transport category aircraft. 5. Use teamwork and communication skills to produce parts and/or assemblies. Credits: 3.00

AT 30900 - Unmanned Autonomous Aerial Systems

Credit Hours: 3.00. This course includes the construction and flight test demonstration of fully autonomous aircraft. System performance will be monitored in real time. Post flight analysis, with system performance evaluation and optimization will be covered.

Learning Outcomes: 1. Understand power, autopilot, telemetry, and manual flight systems. 2. Understand telemetry systems. 3. Evaluate systems for possible EMI interference, provide corrective actions. 4. Program flight with multiple waypoints, loiter, return to launch, and landing. 5. Explain EMI reduction techniques

and vibration control measures. 6. Identify information available from and determine practical uses of telemetry. Credits: 3.00

AT 30901 - Introduction To UAS Sensor Technology

Credit Hours: 3.00. This course introduces students to multiple forms of UAS sensors and core fundamentals of Remote Sensing and Geospatial Technology. Students will be introduced to basic data capture and processing techniques and to effectively apply different forms of UAS sensors to real-world applications.

Learning Outcomes: 1. Identify and define core geospatial and remote sensing technology concepts. 2. Effectively associate and relate UAS sensor technology with related portions of the electromagnetic spectrum. 3. Identify and explain geographic coordinate systems and projections. 4. Process and Create UAS data products within a Geographic Information System. Credits: 3.00

AT 31100 - Aerospace Internship

Credit Hours: 3.00. This course consists of placing the student in an existing business or research unit within the department. Students will function as interns as they develop and manage business and/or operational processes within these units. This experience prepares students for the externship experience in the follow-on course.

Learning Outcomes: 1. Solicit and gain a position as an intern in a departmental business or research unit. 2. Successfully complete the requirements of the internship. 3. Develop and deliver a presentation on the work accomplished during the internship. Credits: 3.00

AT 31400 - Operational Safety Mitigation

Credit Hours: 1.00. This course provides students with a hands-on learning experience within the Professional Flight Safety program. Students will use data and evidence from real-world safety reports to assess risks, develop control measures, and generate proposals that may be implemented into flight operations. Students will gain a clearer understanding of how flight operations and safety operations collaborate to mitigate hazards.

Learning Outcomes: 1. Recommend solutions for a risk assessment by using the data and evidence collected from a provided event. 2. Develop a mitigation proposal for an operational circumstance. Credits: 1.00

AT 31500 - Experiential Honors Project IIIA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed the AT 21600 course. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 31600 - Experiential Honors Project IIIB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed AT 31500 with a grade of B or higher. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 31900 - Uncrewed Aircraft Systems: Applications, Data, And Documentation

Credit Hours: 3.00. Focused on applying uncrewed aircraft technology to specific data gathering missions. Sensor types, mounting selection, and control will be demonstrated.

Emphasis will be placed on sensor payloads, mission planning, and data acquisition. Post-flight data processing and analysis will be conducted using GIS and Remote Sensing software applications. All specifications and procedures will be documented in an industry-accepted format.

Learning Outcomes: 1. Develop missions for fully autonomous aircraft. 2. Monitor and control system performance in real-time. 3. Conduct post-flight data analysis, with system performance evaluation and optimization. Credits: 3.00

AT 32001 - Advanced Aviation Operations

Credit Hours: 3.00. This course covers modern principles for managing complex global aviation maintenance, ground and aerospace manufacturing operations. Particular emphasis is placed on "system-of-systems" and organizational resilience concepts in air vehicle lifecycle maintenance, aerospace manufacturing and airport surface/gate operations. Principles of Data Science, systems-thinking, process visualization, emerging technologies and modern workforce challenges and their impact on global sustainable airworthiness, safety, quality and performance reliability are covered in-depth.

Learning Outcomes: 1. Compare/contrast historic versus modern day aviation operations management philosophies and the crucial role of the modern 5P operations management paradigm. 2. Analyze and describe disruptive technology advances driving modern aviation and aerospace operations and the role of Data Science in air vehicle design and lifecycle management. 3. Analyze the tightly coupled nature and system failure modes in high consequence aviation/aerospace operations. 4. Apply System-of-Systems, Resilience Engineering, Safety II and other next generation operations management concepts to problem-based case studies and current issues in aviation and aerospace. 5. Demonstrate understanding of aviation/aerospace industry workforce competency models including applied roles of innovation, teamwork and problem-solving. Credits: 3.00

AT 32501 - Advanced Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who are preparing for careers as professional pilots or dispatchers and require an advanced knowledge of the impact of weather on aviation operations.

Learning Outcomes: 1. Develop increased awareness of meteorology and its application to aviation operations. 2. Demonstrate knowledge of aviation meteorological concepts, with an emphasis on meteorological hazards for instrument flight operations. 3. Demonstrate the use of aviation weather data types and sources. 4. Develop expertise in obtaining and evaluating appropriate weather data, and in integrating these data into the preflight planning required for a professionally-flown instrument flight. Credits: 3.00

AT 32700 - Advanced Transport Flight Operations

Credit Hours: 3.00. This course addresses advanced aviation topics to include high speed aerodynamics, automated cockpit instrumentation, domestic/international flight operations, and global navigation.

Learning Outcomes: 1. Explain subsonic and transonic aerodynamic principles and how they relate to aircraft design and performance. 2. Analyze issues related to CFIT, upset recovery, wind shear, in-flight and low altitude wake encounters, volcanic ash, anti-de-icing, and crossing restrictions/climb and descent planning. 3. Interpret RNP, RNAV, GPS, and Q route IFR charts. 4. Reflect upon, and internalize concepts of professional conduct and professionalism as a professional aviator. Credits: 3.00

AT 33502 - Avionics Systems

Credit Hours: 3.00. This course covers the theory of operation and applications of common electrical components used in various aircraft circuits. The theory and mathematical relationships of alternating current, reactance, impedance, and phase shift are examined. Operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems are investigated.

Learning Outcomes: 1. Demonstrate the theory of operation and application of common electrical components used in various aircraft circuits. 2. Demonstrate the operational theory, installation practices, and troubleshooting concepts of common aircraft communication

and navigation systems. 3. Explain the theory and mathematical relationship of alternating current, reactance, impedance, and phase shift. Credits: 3.00

AT 33800 - Airline Management

Credit Hours: 3.00. This course is a detailed study of airline management principles and processes. Topics include airline, economics, organization, forecasting, marketing, alliances, pricing, scheduling, finance, fleet planning, labor relations and air freight. Business ethics pertaining to airlines are introduced.

Learning Outcomes: 1. Explain the economic characteristics and the management structure of the commercial airline industry. 2. Explain forecasting, marketing, pricing, scheduling, fleeting planning, labor relations, financing, and air cargo operations. 3. Demonstrate oral and written communication skills on topics related to the airline industry. 4. Discuss global geography in relation to the international aviation industry. Credits: 3.00

AT 34001 - Aerospace Business Statistics

Credit Hours: 3.00. This course provides an introduction to business statistics with a specific focus on managerial decision making in the aerospace industry. The course will focus on aircraft leasing and value determination. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to perform their own analyses.

Learning Outcomes: 1. Demonstrate proficiency in the use of statistics to describe aerospace processes. 2. Successfully employ inferential statistics to facilitate aerospace managerial decision making. 3. Demonstrate proficiency in the use of software tools to facilitate statistical analyses. Credits: 3.00

AT 35100 - Flight Instructor Flight

Credit Hours: 2.00. Flight training in preparation for flight instructor certification. Instructional techniques are demonstrated and practiced by the student. Heavy emphasis is placed on student practice teaching of all maneuvers. FAA Commercial Pilot Certificate with Instrument Airplane Rating required. Permission of department required.

Learning Outcomes: 1. Able to perform, critique and analyze all Private Pilot maneuvers. 2. Able to perform, critique and analyze all Commercial Pilot maneuvers. 3. Able to teach all knowledge areas for the Private Pilot Certificate. 4. Able to teach all knowledge areas for the Commercial Pilot Certificate. 5. Able to teach aircraft systems. 6. Accomplish the Flight Instructor Airplane Practical Test. Credits: 2.00

AT 35200 - Flight Instructor Lectures

Credit Hours: 4.00. The course teaches techniques of flight and ground instruction, analysis of maneuvers, aircraft performance, and federal aviation regulations applicable to flight instructors. Some practice teaching will be required. Preparation for the FAA written exam is included.

Learning Outcomes: 1. Know the definitions, objectives, elements, and common errors for all items listed in the FAA practical test standards. 2. Know the learning process, elements of effective teaching, student evaluation and testing, course development, lesson planning and classroom training techniques. 3. Know Flight Instructor privileges and limitations, record keeping and eligibility requirements. 4. Know Flight Instructor endorsements for student pilots, private pilot, and commercial pilot applicants. Credits: 4.00

AT 35300 - Multi-Engine Flight

Credit Hours: 1.00. This course prepares the student for the FAA multi-engine rating. Dual flight instruction is conducted in a multi-engine aircraft. Individual ground instruction will be arranged.

Learning Outcomes: 1. Explain the design and operation of multiengine aircraft systems. 2. Develop proficiency in handling engine power failures. 3. Develop proficiency in flight at minimum controllable airspeeds including stalls. 4. Develop proficiency in takeoffs and landings. 5. Develop proficiency in abnormal and emergency procedures. Credits: 1.00

AT 35400 - Turbine Flight Operations Lecture

Credit Hours: 2.00. A study of corporate aircraft systems and operations and an orientation to operational procedures.

Learning Outcomes: 1. Locate Federal Aviation Regulations related to oxygen requirements. 2. Describe turbine aircraft systems, associated cockpit procedures and checklist usage. 3. Compute turbine basic weight & balance and

flight planning calculations. 4. Demonstrate safety and security procedures related to the operation of turbine aircraft. Credits: 2.00

AT 35900 - Airport Management

Credit Hours: 3.00. This course is a study of the history and development of contemporary airport facilities. Areas of study will include FAA airport design requirements, master plans, and airport operations. Field trips may be required.

Learning Outcomes: 1. Understand how airports are managed. 2. Describe and understand the issues and challenges facing airport managers. Credits: 3.00

AT 36201 - Aviation Operations

Credit Hours: 3.00. This course introduces students to the principles of managing a complex aviation operation. Students will be assigned active roles in monitoring and reporting on aircraft flight and maintenance practices. Every student will be assigned a role as part of a small group whose responsibility is to gather appropriate information, develop reports, and conduct practical research tasks as assigned. Weekly and monthly group meetings will be conducted similar to those found in the airline industry with students playing an active role in these meetings.

Learning Outcomes: 1. Become familiar with the operation of a functioning flight operation. 2. Develop research and presentation skills appropriate to those utilized in airline management. 3. Work within a team as well as how to lead a team. Credits: 3.00

AT 36302 - Fundamentals Of Powerplant Systems

Credit Hours: 4.00. This course covers powerplant systems, including fuel metering devices, ignition systems, and propeller and propeller-related systems. Students learn to use the special tools required for these systems, and the processes for inspection, repair, and overhaul. Airworthiness evaluation and determination is stressed, as are testing and fault diagnosis procedures. The properties and operating characteristics of aircraft fuels are also covered.

Learning Outcomes: 1. Demonstrate the ability to support, maintain, and overhaul powerplant systems. 2. Apply standard testing protocol and procedures to powerplant systems. 3. Develop an understanding of technical information related to powerplant systems. 4. Develop an understanding of fuel characteristics and operation. Credits: 4.00

AT 36900 - Air Traffic Control

Credit Hours: 3.00. An introduction to the principles of air traffic control, including tower and en route separation. Navigation theory as it relates to the ATC system will be explained, as will the theory of operation of ATC radar and computer systems.

Learning Outcomes: 1. Operate ATC simulation equipment. 2. Understand the basic information required to perform the duties of an air traffic controller. 3. Understand operations in the National Airspace System. Credits: 3.00

AT 37002 - Advanced Aircraft Powerplants

Credit Hours: 3.00. This course covers the design, construction, operation, and overhaul practices of aircraft reciprocating and small gas-turbine engines. Airworthiness evaluation, fault-isolation techniques, and standard service and maintenance practices are emphasized. Dimensional and visual inspection and testing of engines following overhaul are stressed, as well.

Learning Outcomes: 1. Demonstrate knowledge of engine operation theory. 2. Demonstrate familiarity with and ability to apply troubleshooting and fault analysis procedures. 3. Develop and follow a plan for the complete overhaul and return to service of an engine. Credits: 3.00

AT 37200 - Aircraft Maintenance Practices

Credit Hours: 3.00. An in-depth study of practices and procedures used to ensure that an aircraft is maintained in an airworthy state. Aircraft publications and maintenance methodology are emphasized.

Learning Outcomes: 1. Develop inspection skills, techniques and associated practices using appropriate technical publications, form, records, tools and equipment. 2. Make airworthiness determinations concerning airframe, engine, propeller and component parts used in the construction of aircraft. 3. Complete the paperwork, records and job card entries for returning aircraft to service according to aircraft industry standards. Credits: 3.00

AT 37600 - Aircraft Gas Turbine Engine Technology I

Credit Hours: 4.00. Basic aircraft gas turbine engine theory, nomenclature, component design, turbine engine systems, operation, and fault isolation techniques are emphasized. Turbine engine maintenance, overhaul, operation, and inspection procedures are studied in detail.

Learning Outcomes: 1. Understand the basic operating principles of gas turbine engines. 2. Understand the operation and function of the major components of the gas turbine engine. 3. Understand the operation, function and troubleshooting of gas turbine engine systems. 4. Explain the basic procedures and operations used or encountered in maintaining airworthiness of gas turbine engines. Credits: 4.00

AT 38100 - Aviation Security

Credit Hours: 3.00. This course introduces the challenges and complexity of aviation security faced by aviation professionals across the industry. It traces the evolution of current security approaches and explores technologies and processes targeting threat mitigation and improved operational efficiency.

Learning Outcomes: 1. Understand the literature in the student's field. 2. Exhibit the highest level of professionalism in the aviation security industry. 3. Solve problems in aviation security. 4. Work effectively as part of a team. 5. Conduct basic research, interpret ad analyze the data and make useful presentations based on that research. Credits: 3.00

AT 38201 - Advanced Flight Instructor Lecture

Credit Hours: 3.00. A discussion of instructional techniques for flight and ground instruction with a focus on instrument and multi-engine flight. This course includes analysis of maneuvers, aircraft performance, and federal aviation regulations applicable to flight instructors. Some practice teaching will be required. Preparation for the FAA practical tests for instrument instructor and multi-engine instructor are included.

Learning Outcomes: 1. Understand and explain the definitions, objectives, elements, and common errors for all items listed in the FAA practical test standards. 2. Understand and demonstrate the learning process, elements of effective teaching, student evaluation and testing, course development, lesson planning, and classroom training techniques. 3. Understand the privileges and limitations, record keeping, and eligibility requirements applicable to certified flight instructors. 4. Appropriately utilize flight instructor endorsements for private pilots, instrument rated pilots, commercial pilots, and multi-engine rated pilot applicants. Credits: 3.00

AT 38300 - Instrument And Multiengine Instructor Flight

Credit Hours: 1.00. This course prepares the student for the FAA Flight Instructor Instrument and Multiengine Instructor ratings. All flight instruction is conducted in a multi-engine aircraft.

Learning Outcomes: 1. Explain and demonstrate the definitions of objectives, elements, and errors common during the performance of instrument and multi-engine maneuvers. 2. Perform, critique and analyze all instrument and multi-engine maneuvers. 3. Demonstrate the ability to teach all required knowledge areas for the instrument and multi-engine ratings in both the aircraft and the classroom. 4. Demonstrate proficiency in flight planning, instrument flight procedures, and simulated aircraft operations including preflight takeoff, departure, holding patterns, approach/missed approach, and normal landing procedures. 5. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 1.00

AT 38500 - Design Support Analysis

Credit Hours: 2.00. This course is designed to teach students interested in engineering design, design support, customer support, or aerospace manufacturing, the elements of product support and the analysis of design as related to the manufacturability, maintainability, and supportability of aerospace products. The students will be expected to complete a life cycle cost analysis and logistics plan for a design.

Learning Outcomes: 1. Able to break the system into its functional groups. 2. Determine the Mean Time Between Failure of the system and the Availability of the system. 3. Determine the Life Cycle Cost of ownership of the system. 4. Determine the facilities, staffing, tooling, and spare parts requirements for a system. Credits: 2.00

AT 38700 - Turbine Aircraft Simulation Lab

Credit Hours: 2.00. This course is a laboratory flight experience in a turbine aircraft flight simulator emphasizing normal and

abnormal aircraft operations. Emphasis is on FAA-required flight procedures for pilot certification and safe operation of turbine powered aircraft. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in flight planning, instrument flight procedures, and simulated aircraft operations. 2. Demonstrate proficiency in preflight, takeoff, departure, holding patterns, approach/missed approach, and normal landing procedures. 3. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 2.00

AT 38800 - Large Aircraft Systems

Credit Hours: 3.00. This course introduces transport aircraft limitations, systems, and systems operation. Topics include turbojet aircraft powerplants, flight instruments, electrical power, air-conditioning, pressurization, hydraulic, and flight control systems. Emphasis is aircraft and systems manufacturer's design and operational philosophies.

Learning Outcomes: 1. Define large aircraft systems terminology and nomenclature. 2. Understand the theory and basic operation of major aircraft systems. 3. Describe aircraft and system manufacturer's design philosophies. 4. Explain how major aircraft systems work together. Credits: 3.00

AT 39300 - Industrial Practice III

Credit Hours: 1.00. Industrial practice and experience in participating industry. Requires written report of the experience.

Credits: 1.00

AT 39400 - Industrial Practice IV

Credit Hours: 1.00. Industrial practice and experience in participating industry. Requires written report of the experience.

Credits: 1.00

AT 39500 - Turbine Aircraft Simulation Laboratory

Credit Hours: 1.00. This course is a laboratory flight experience in a turbine aircraft flight simulator, emphasizing normal and abnormal aircraft operations. Emphasis is on FAA-required flight procedures for pilot certification and safe operation of turbine-powered aircraft. Students seeking an FAA type rating must receive a grade of at least a B- in AT 35300. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in flight planning, instrument flight procedures, and simulated aircraft operations. 2. Demonstrate proficiency in preflight, takeof, departure, holding patterns, approach/missed approach, and normal landing procedures. 3. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 1.00

AT 39600 - Turbine Aircraft Flight Laboratory

Credit Hours: 1.00. This course is a laboratory flight experience in a turbine-powered aircraft, emphasizing normal and abnormal aircraft operations. Emphasis is on FAA-required flight procedures for certification and safe operation of turbine-powered aircraft. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations and instrument flying procedures as well as flight planning. 2. Demonstrate proficiency in preflight, takeoff, departure, holding patterns, approach/missed approach, and normal landing procedures. 3. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 1.00

AT 40300 - Airman Certification Procedures

Credit Hours: 1.00. A survey of the procedures for obtaining federal certification as an Aircraft Maintenance Technician.

Learning Outcomes: 1. Review Airmen Certification Standards for Aircraft Mechanic Certificate for Airframe and Powerplant ratings. 2. Complete General, Airframe, and Powerplant written test. Credits: 1.00

AT 40400 - Turbojet Copilot Operations

Credit Hours: 1.00. Provides students who are selected to participate in the turbojet copilot program with classroom, simulator, and flight instruction in turbojet systems and operation. Permission of instructor required.

Credits: 1.00

AT 40500 - Turbojet Copilot Practicum I

Credit Hours: 1.00. This course provides students with copilot flight experience in a corporate-type turbojet aircraft. Student copilots gain experience in turbojet systems and operation, high-speed/high altitude ATC procedures, advanced navigation, and high-altitude meteorology. Permission of instructor required.

Credits: 1.00

AT 40900 - Advanced Air Mobility: Management And Operations

Credit Hours: 3.00. UAS capstone course. Application of AAM technologies across multiple commercial-type operations, including certification, application, and management. A

demonstration of the cumulative knowledge and skills learned in previous UAS courses. Requires current FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Demonstrate the application of safety and risk management principles to AAM operations. 2. Examine the AAM entrepreneurial ecosystem and formulate a business prospectus based on current industry trends and regulatory policy. 3. Assess technical data sources to evaluate system health, to include ground and flight testing, troubleshooting, maintenance and repair, system configuration and payload integration. 4. Demonstrate the ability to plan, manage, and execute various AAM missions safely, legally, and efficiently. Credits: 3.00

AT 41101 - Aerospace Internship II

Credit Hours: 3.00. Students will be placed in an external industry-sponsored position that exists either within the department or at a location specified by the sponsor. Students will function as interns as they develop and manage business and/or operational processes within these units.

Learning Outcomes: 1. Solicit and gain a position as an intern in a selected external business or research unit. 2. Successfully complete the requirements of the externship. 3. Develop and deliver a presentation on the work accomplished during the externship. Credits: 3.00

AT 41200 - Aviation Finance

Credit Hours: 3.00. The course will focus on the financial knowledge needed to operate and evaluate aviation businesses. Content will cover the impact of financial decisions on operational outcomes that add/decrease value to an aviation company's bottom line. Case studies will be utilized to demonstrate practical aspects of financial decisions as they relate to organizational performance and profitability.

Learning Outcomes: 1. Explain common financial reports and their impact on operations. 2. Demonstrate reading and construction of cash flow, profit and loss, and balance sheets and explain how they are related. 3. Explain hedging concepts and how to build a selective hedging program to mitigate risk. 5. Analyze financial measurements and explain how they affect operational decisions for bottom line improvements. Credits: 3.00

AT 41501 - Experiential Honors Project IVA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed the AT 31600 course. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 41600 - Airline Indoctrination

Credit Hours: 2.00. This course provides the background knowledge required to serve as a crewmember operating a transport-category airplane. Topics include aircraft systems, airline operations, and FAR Part 121 regulations.

Learning Outcomes: 1. Demonstrate knowledge of air carrier operating procedures and techniques, including cockpit scans and flows. 2. Demonstrate knowledge of transport-category aircraft systems. 3. Demonstrate working knowledge of applicable Federal Aviation Regulations. Credits: 2.00

AT 41601 - Experiential Honors Project IVB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed AT 41501 with a grade of B or higher. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the

theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 41901 - Advanced Air Mobility Capstone

Credit Hours: 3.00. The conclusion and demonstration of the cumulative knowledge and skills learned within the UAS curriculum. Students will engage in a series of assignments that will guide them toward proposing and researching a capstone project that demonstrates knowledge gained in UAS and AAM topics. Students are expected to focus on the development of deliverable products that demonstrate their skills as effective UAS operators.

Learning Outcomes: 1. Engage in applied UAS and AAM research that applies skills and knowledge gained in UAS curriculum. 2. Focus on deliverable products that demonstrate marketable skills as a UAS pilot and operator. 3. Develop a strong foundation upon which to pursue UAS and AAM in the workplace or further graduate research. Credits: 3.00

AT 42101 - Managerial Economics In Aviation

Credit Hours: 3.00. This course explores the process of making managerial decisions based on modern economic principles and concepts, and provides the student with a set of tools that can be used to make those decisions. Marginal analysis, forecasting, and cost analysis concepts are introduced, as are game-theoretic and probabilistic decision-making models. Bargaining strategies and linear programming tools are covered, as well.

Learning Outcomes: 1. Identify the practices of a functioning operations department in aviation businesses. 2. Analyze flight operations data similar to those utilized in the aviation industry. 3. Apply aviation operations theory to solve aviation industry related challenges in a group setting. Credits: 3.00

AT 43300 - Supervised Aviation Experience

Credit Hours: 0.00 to 3.00. Supervised aviation experience directed toward providing orientation, background, and insight into flight or ground operations. Permission of department required.

Learning Outcomes: 1. Explore career alternatives prior to graduation. 2. Integrate theory and practice. 3. Assess interests and abilities in their field of study. 4. Learn to appreciate work and its function in the economy. 5. Develop work habits and attitudes necessary for job success. 6. Develop communication, interpersonal and other critical skills in the job interview process. 7. Build a record of work experience. 8. Acquire employment contacts leading directly to a full-time job following graduation from college. Credits: 0.00 to 3.00

AT 43500 - Supervised Instructional Experience

Credit Hours: 1.00 to 4.00. This course provides students with experience as instructors in an aviation classroom or laboratory environment under the supervision of faculty. In addition to the supervisory skills gained, students will become knowledgeable in task planning and communication techniques. Permission of department required.

Credits: 1.00 to 4.00

AT 43800 - Airline Operations

Credit Hours: 3.00. Students in this course study airline operations in depth. Topics include marketing, route analysis, aircraft selection, financial analysis, federal regulations, and scheduling. Currently industry problems are discussed as well.

Learning Outcomes: 1. Demonstrate knowledge of the characteristics, scope, and economic influence of an airline. 2. Develop operations management skills by creating aircraft schedules, forecasting fuel pricing, and budgeting for quality programs. 3. Analyze airline financial statements. Credits: 3.00

AT 43900 - Aviation Command Leadership

Credit Hours: 2.00. Examination of pilot professional development and strategies for career planning and industry advancement. Emphasis is placed on leadership, command training, and mentorship for pilots throughout their career.

Learning Outcomes: 1. Examine regulatory requirements, policies, and procedures that impact authority and leadership. 2. Demonstrate techniques for reinforcing high standards of professionalism. 3. Assemble knowledge and skills necessary for effective leadership. 4. Create a 5 year professional development plan to become an effective

leader. Credits: 2.00

AT 44502 - Aircraft Electronics

Credit Hours: 3.00. A study of the computer-based electronic systems used to control both flight and engine parameters on modern aircraft. The course examines the various systems with an emphasis on how each component integrates into the electronic structure of the aircraft.

Learning Outcomes: 1. Demonstrate an understanding of design, operation, and troubleshooting concepts of advanced digital and analog systems found on modern aircraft. Credits: 3.00

AT 45100 - Airport Operations

Credit Hours: 3.00. This course is an in-depth examination of airport operations for air carrier and general aviation airports, with a strong emphasis on practical problem solving of current operational issues facing local and area airports.

Credits: 3.00

AT 45200 - Aviation Global Experience Seminar

Credit Hours: 1.00. This course prepares students for faculty-led study trips and similar international experiences for which direct course credit is not available.

Credits: 1.00

AT 45300 - Aviation Global Experience

Credit Hours: 0.00 to 3.00. Supervised international study experience for AT students for which direct course credit not available. Specific objectives, requirements, and credit determined by the Aviation Technology department.

Credits: 0.00 to 3.00

AT 45400 - Human Factors in Aviation

Credit Hours: 3.00. Students investigate the disciplines known as human factors and ergonomics and how they apply to various aviation career areas from a management perspective. Common industry models and error management strategies will be studied and evaluated.

Credits: 3.00

AT 45900 - Airport Manager Certification

Credit Hours: 3.00. This course prepares students for the certified manager exam offered by the American Association of Airport Executives (AAAE). This certificate is the first step toward industry accreditation as an airport manager and director.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental aviation safety and security principles as they apply to the national and international aviation environment. 2. Develop the ability to identify and provide realistic recommendations to resolve national and international aviation deficiencies. 3. Demonstrate understanding of alternative views in order to balance historical and modern interpretation of airspace and airfield needs for aircraft operation. Credits: 3.00

AT 47200 - Advanced Composite Technology

Credit Hours: 3.00. Students will perform a variety of fabrication, testing, and repair tasks using specialized composite fibers, matrices, and core materials.

Learning Outcomes: 1. Understand composite part manufacturing process and tooling. 2. Describe different composite part manufacturing process. 3. Understand complex composite materials design solutions and applications. 4. Obtain knowledge of part manufacturing and machining. 5. Design machining tool path using computer-aided manufacturing (CAM) software. 6. Proficient with computer numerical control (CNC) milling machine. 7. Operate different equipment for composite part manufacturing and machining process. Credits: 3.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance.

Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

AT 47600 - Aircraft Gas Turbine Engine Technology II

Credit Hours: 3.00. This is a study of turbofan engines and systems. Engine installation, testing, and operational procedures are stressed. Emphasis is placed on performance evaluation, data calculations, and predictions of operational properties. Turbofan design theory, operational efficiencies, and fault isolation are discussed.

Learning Outcomes: 1. Operate the test cell and perform parameter recording and thrust

evaluations. 2. Given an operable engine installation, remove the engine and simulate procedures to be followed to store the engine. 3. Inspect, perform routine service and troubleshooting on turbine engine fuel system. 4. Using the manufacturer's recommended procedures, simulate adjustment of the fuel metering system and electronic fuel control on a turbine engine. 5. Inspect, check, service, troubleshoot, and repair turbine engine airflow, pressure and temperature measurement systems. Credits: 3.00

AT 47700 - Aircraft Maintenance Practicum

Credit Hours: 1.00. This course provides the knowledge, information and experience required for aviation professionals to interact safely in a general aviation environment.

Learning Outcomes: 1. Demonstrate familiarity with activities related to general, airframe and powerplant maintenance tasks. 2. Demonstrate the ability to safely perform in a general aviation maintenance environment. Credits: 1.00

AT 47900 - Control Tower Operator

Credit Hours: 3.00. This course includes a review of air traffic control procedures, federal aviation regulations, and aviation weather observation and reporting. It is designed to prepare students to pass the FAA Control Tower Operators Examination.

Learning Outcomes: 1. Understand the operation of FAA air traffic control facilities. 2. Understand air traffic communication process, including formatting of authorized communications, phraseology and control symbology. 3. Identify the purpose the VFR, IFR, and dVFR flight plans and uses of such by ATC. 4. Identify the purpose of basic FAA orders and manuals. Credits: 3.00

AT 48000 - Advanced Aviation Manufacturing (Lean Six Sigma Methodologies)

Credit Hours: 3.00. Course is a selective choice in the AET program. This is a study of advanced aviation manufacturing principles, lean six sigma methodologies and project management basics. Permission of instructor required.

Learning Outcomes: 1. Develop the competencies to utilize required advanced manufacturing processes to operate a manufacturing facility. 2. Cultivate the ability to utilize advanced process quality planning methods to implement a quality program in a manufacturing facility. 3. Gain the knowledge and experience required to effectively implement supply chain management techniques and logistic programs in a manufacturing facility. 4. Incorporate an effective continuous improvement process to be utilized and promoted throughout the curriculum. 5. Select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities. 6. Select and apply knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies. 7. Conduct standard tests and measurements; to conduct, analyze, and interpret experiments. 8. Apply project-based learning techniques to improve processes, and communicate a commitment to quality, timeliness, and continuous improvement. All the objectives listed are crucial in the manufacturing world. Credits: 3.00

AT 48100 - Aviation Safety Problems

Credit Hours: 3.00. This course provides the opportunity for students to study problems associated with aviation safety. Particular attention will be given to the formulation of specific recommendations for improvements in aviation safety.

Learning Outcomes: 1. Familiar with the fundamental safety theories and possible applications. 2. Understand the characteristics human errors. 3. Identify and analyze the casual factors of a mishap. 4. Explain the process of emergency response and accident prevention programs. Credits: 3.00

AT 48400 - Transport Aircraft Operations Simulation Laboratory

Credit Hours: 4.00. This course provides jet turbine-type aircraft simulator experience, allowing students to engage in typical aircraft maneuvers in visual and instrument atmospheric conditions. The laboratory lessons emphasize aircraft

procedures in normal and abnormal flight or equipment conditions, focusing on crew resources management, applicable flight regulations, and aircraft systems knowledge in a scenario-based experiential learning environment.

Learning Outcomes: 1. Demonstrate familiarization with normal & non-normal aircraft operations and instrument flying procedures. 2. Perform routine IFR/VFR procedures and crew resource management per industry standards. 3. Demonstrate effective teamwork, communication, leadership, resilience, and decision-making skills. 4. Manipulate flight deck switches accurately in accordance with standard operating procedures. 5. Demonstrates the ability to explain aircraft systems and their interrelatedness. Credits: 4.00

AT 48700 - Transport Aircraft Simulation Laboratory

Credit Hours: 2.00. This is a laboratory course conducted in a turbine-type aircraft simulator. This course emphasizes normal instrument and aircraft procedures as well as aircraft systems and cockpit resource management. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations and instrument flying procedures as well as flight planning. 2. Demonstrate proficiency in crew coordination, normal procedures, instrument procedures, flight planning, and crew resource management. 3. Familiar with the procedures required of all cockpit positions. 4. Demonstrate proficiency in the operation of all aircraft systems in normal and abnormal situations. Credits: 2.00

AT 48900 - Capstone For Professional Flight Students

Credit Hours: 3.00. This capstone for Professional Flight students course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous knowledge of the student's curriculum. It also allows students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Analyze current literature to determine current aviation problems. 2. Plan a project within a small team utilizing effective communication and problem-solving skills. 3. Demonstrate the ability to combine knowledge, skills, and experiences from different areas and sources to create new applications. Credits: 3.00

AT 49000 - Aviation Project

Credit Hours: 1.00 to 6.00. Independent study for junior and senior students who wish to pursue study and developmental work in special areas. Subject matter must be arranged with the instructor before enrolling in the course. Permission of instructor required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 6.00

AT 49200 - Aircraft Airworthiness Assurance

Credit Hours: 3.00. Students apply foundational airworthiness assurance principles from the aviation and aerospace industries, performing maintenance and inspection tasks on the school's large transport category laboratory aircraft. They research OEM data to develop and test air vehicle work instructions, incorporating modern maintenance and inspection practices like MSG-3, Reliability Centered Maintenance, and global Safety and Quality standards and Industry 4.0 data science frameworks relating to air vehicle maintenance. They also practice essential participative team and leadership competencies, taking on leadership roles with their laboratory peers as technical team members in a live airport ramp environment.

Learning Outcomes: 1. Recall and explain the definitions, key components and location of U.S. and global regulatory guidance related to Airworthiness, Safety Management Systems (SMS), Quality Management Systems (QMS) and Reliability Centered Maintenance (RCM) for MRO and Aerospace Advanced Manufacturing operations. 2. Use OEM and FAA technical data/guidance for standard maintenance practices, perform air vehicle maintenance and inspection tasks using the lab's large airplane. 3. Create technical Work Instructions and air vehicle General Familiarization Training using OEM data, demonstrating compliance to airworthiness and quality standards for large air vehicles. 4. Demonstrate key leadership and team coordination competencies for working with hazardous air vehicle systems, technologies and processes. Credits: 3.00

AT 49300 - Industrial Practice V

Credit Hours: 1.00. Industrial practice and experience in participating industry. Requires written report of the experience.

Credits: 1.00

AT 49401 - Capstone Project Proposal

Credit Hours: 2.00. Students will study all aspects of a possible capstone project and will develop a proposal for conducting an applied research project.

Learning Outcomes: 1. Integrate knowledge and skills to design a process/product/service improvement or process/product/service design applicable to the academic major. 2. Develop a project plan. 3. Demonstrate the application of problem-solving skill using knowledge gained in previous coursework and/or experience. Credits: 2.00

AT 49501 - Applied Capstone Research Project

Credit Hours: 1.00. Students will complete the applied capstone project defined in AT 49401.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 1.00

AT 49600 - Applied Research Proposal

Credit Hours: 2.00. Students perform a structured analysis of an industry-based problem or design challenge, producing a professionally written project proposal. Students engage all aspects of a product or process engineering design proposal including problem analysis, identifying design requirements, conceptualizing, and communicating a solution. Students incorporate rigorous research and industry methodologies like Quality Functional Deployment, Failure Mode and Effects Analysis, literature reviews, and project cost/ROI estimates to create and defend a written project proposal.

Learning Outcomes: 1. Integrate knowledge and skills to create a written project proposal reflecting proficiency at professional industry standards. 2. Demonstrate application and proper use of problem-solving methods, tools and research practices salient to the aviation andaerospace industry. 3. Apply life-long learning skills and competencies to acquire the knowledge, skills and resources required to complete the project. Credits: 2.00

AT 49700 - Applied Research Project

Credit Hours: 3.00. Students transform their product/process design proposal created in the proposal design course into a requirements-driven, functional product. During design, they employ rigorous R&D criteria and metrics, global quality, safety, and other industry-based standards, tracking and reporting project development using Technology Readiness Level criteria. For deployment and test phases they incorporate human subject certification, protocols, and develop user-test measures using quantitative and qualitative analysis. The course deliverable is a final written report and functional project demonstration/presentation.

Learning Outcomes: 1. Integrate knowledge and skills to implement a process/product/service improvement or process/product/service design for design, aircraft operations, or maintenance. 2. Develop, deploy, and validate a project from a proposal. 3. Demonstrate the application of research, design, and test methodologies. 4. Demonstrate the application of problem-solving skills and technical knowledge gained throughout the curriculum. Credits: 3.00

AT 49800 - Aviation Technology Capstone

Credit Hours: 3.00. The Aviation Technology Capstone course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous experience of the student's curriculum. It also provides an opportunity for students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 3.00

AT 49900 - Aviation Technology

Credit Hours: 1.00 to 4.00. Hours, credit, and subject matter to be arranged by staff. Permission of department required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 4.00

AT 50500 - Research Methods In Aviation

Credit Hours: 3.00. This course explores the practical approach to research as it applies to identifying and exploring pragmatic problems in aviation industry settings. Industry based problems and issues often require a diversity of research skills, both

quantitative and qualitative, in order to effectively address dynamic problems in complex and often high-risk work environments. This course offers an overview of mixed research methods which lends itself well to practical problem solving in industry. This course may also be offered in an online format. Permission of instructor required.

Learning Outcomes: 1. Select and develop an appropriate design and investigative methodology for commonly-encountered aviation research problems. 2. Perform, and properly interpret, elementary descriptive statistical analysis. 3. Determine the need for, and correctly apply, appropriate inferential statistical tests for a variety of data. 4. Test research and null hypotheses. 5. Prepare well-written scholarly papers, using specific style instructions. 6. Prepare survey instruments appropriate to differing aviation settings. 7. Utilize an accepted style/publication manual in preparation or written work. Credits: 3.00

AT 50700 - Quantitative Research Methodologies In Transportation

Credit Hours: 3.00. This course provides an introduction to business statistics with a specific focus on data analyses and managerial decision making in the transportation industry. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to perform their own analyses. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the use of statistics to describe transportation processes. 2. Employ inferential statistics to facilitate transportation managerial decision making. 3. Demonstrate proficiency in the use of software tools to facilitate statistical analyses. Credits: 3.00

AT 50800 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. (IT 50800) Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology.

Learning Outcomes: 1. Evaluate the key dimensions of quality and their implications for manufacturing and service industries. 2. Assess the philosophies and contributions of prominent thought leaders to the field of quality and productivity critically. 3. Apply core principles of Total Quality Management (TQM) to analyze and improve quality assurance programs. 4. Design and implement process management and improvement methodologies, such as Six Sigma, Lean, and Value Stream Analysis, to enhance productivity. Credits: 3.00

AT 51900 - Aviation Geographic Information Science Applications

Credit Hours: 3.00. This course provides a core set of skills essential for understanding geospatial science and using Geographic Information Systems as a tool to conduct research with a spatial component. The student will learn how to acquire, process, analyze, and interpret geospatial data using real-world data sets in applied situations.

Learning Outcomes: 1. Acquire core geospatial and remote sensing technology concepts. 2. Demonstrate an ability to apply GIS data to real-world applied situations. 3. Demonstrate a fundamental understanding of cartography through the creation of map layouts in a GIS. Credits: 3.00

AT 52000 - Operational Assessment And Improvement

Credit Hours: 3.00. This course focuses on developing the skills to analyze, formulate, and apply techniques for work task improvement. Concepts to be studied include workflow enhancement, critical element streamlining, and value added analysis. Students will explore process map construction, process ownership, measurement system validation, standards creation, and decision factors. An industry project will be assigned and used to facilitate course objectives. Permission of instructor required.

Learning Outcomes: 1. Analyze workflows and critical elements using tools such as SWOT analysis, mind mapping, and process map construction to identify opportunities for improvement. 2. Evaluate and validate measurement systems, establish process ownership, and develop standards to support operational efficiency. 3. Calculate and interpret process time, labor costs, and total

process costs to inform decision-making and improvement strategies. 4. Develop and justify improvement targets, impact analysis, and value-added analysis to enhance operational effectiveness. 5. Design and implement a comprehensive cycle time analysis, metrics framework, and testing and implementation plan for workflow enhancements. Credits: 3.00

AT 52500 - Process Improvement And Simulation

Credit Hours: 3.00. This course explores process modeling and simulation as applied to decision-making for process design and improvement. Emphasis is placed on understanding the application of process simulations to business problems including using fundamental statistical methods in the solution of an industry relevant problem. By planning and executing a computer-based simulation supporting an aviation or aerospace process design and improvement project, students improve analysis and project management skills. In addition to simulation, preparing visualizations of the process is also included for increased understanding of process interactions.

Learning Outcomes: 1. The student will have the knowledge and skills required to plan and execute a process improvement and simulation project. 2. The student will be able to compose and evaluate process models and simulations in terms of validity, verification, and usefulness in decision-making. 3. The student will be proficient in Arena or another appropriate process modeling and simulation computer application, as assigned. 4. The student will demonstrate appropriate use of process modeling techniques and data collection required to support the models. 5. The student will prepare and present a formal report describing a process design and improvement project, the methodology used in the project, and the results. 6. Assessment of the objectives is done by: Student's project plan and report; Individual test scores; and Participation in discussion and collaboration with other graduate students. Credits: 3.00

AT 52600 - Aviation Leadership

Credit Hours: 3.00. This course is intended for future aviation and aerospace managers. Using foundational readings, case studies, and critical analysis techniques, the contribution of past and contemporary aviation leaders will be reviewed. Permission of department required.

Learning Outcomes: 1. Perform a situational analysis of an aviation enterprise management or leadership challenge and recommend appropriate courses of action. 2. Form, lead, and support a team in an aeronautical work setting. 3. Distinguish management roles and actions from leadership roles and actions in both an air carrier organization as well as in a general aviation company. 4. Apply appropriate theories of leadership to realistic organizational situations such as an aviation manufacturing company, a corporate flight department, or aerospace industry organization. 5. Identify salient characteristics of individual and organizational behavior; plan courses of action for organizational change. 6. Identify the competencies of past successful airline leaders; plan a leadership development program for an individual leader in a current aeronautical position. 7. Determine the viability and sustainability of vision strategies as they relate to activities such as flight training schools, fixed-base operator, or airport administration. 8. Recognize global cultural differences and assess the impact of those differences on appropriate leadership styles and organizational change initiatives in selected emerging aeronautical enterprises. Credits: 3.00

AT 52800 - Management And Design Of Training Systems

Credit Hours: 3.00. This course will examine the practical applications of managing the training process in industry and educational settings, including the development of instructional materials from an adult learner perspective. Curriculum design using various forms of media and delivery strategies will be emphasized. This course may also be delivered in an online format. Permission of department required.

Learning Outcomes: 1. Gain management knowledge and skills required to develop a training program for industry or education. 2. Able to design a learning module using

instructional design principles in his/her interest area. 3. Able to assess the effectiveness of the training design process. 4. Write a comprehensive training plan in an area of his/her field of study. Credits: 3.00

AT 53000 - Multi-Cultural Issues In Team Operations

Credit Hours: 3.00. This course explores the nature and origins of professional, national, and organizational culture and their role in multi-disciplinary team activities. Power distance, individualism/collectivism, gender differences, and uncertainty avoidance are examined in terms of research by Hofstede. Management studies of several international air carriers will be utilized to highlight how cultural differences can affect perceptions. Permission of department required.

Learning Outcomes: 1. Examine the effects of professional, national, and organizational cultures on team dynamics, with an emphasis on aviation operations. 2. Investigate how cultural dimensions, including power distance, individualism versus collectivism, gender roles, and uncertainty avoidance, shape perceptions and influence collaboration. 3. Explore the ways cultural diversity can either support or hinder effective communication and teamwork in multi-disciplinary settings. 4. Implement error management strategies to mitigate the risks of cultural misunderstandings and improve team performance in diverse operational contexts. 5. Assess the implications of globalization on cultural norms and behaviors, particularly in professional environments. 6. Engage with peers in multi-cultural group projects to critically analyze industry challenges and recommend actionable solutions. Credits: 3.00

AT 53100 - International Civil Aviation Regulatory Systems

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Discuss the history, organization, and interdependence of international, regional and national civil aviation regulatory systems. 2. Discuss the partnerships and alliances between government, industry, stakeholders and financial organizations to support international civil aviation. 3. Discuss transparency and access to international aviation regulatory oversight programs and efforts to mitigate deficiencies and support efficiency. 4. Identify and conduct research on emerging international aviation issues. 5. Demonstrate critical thinking in developing presentations on emerging international aviation regulatory topics. Credits: 3.00

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

AT 53300 - Aviation Graduate Professional Practice Internship

Credit Hours: 1.00 to 3.00. This course involves a practical internship experience within the aviation industry that provides exposure to the roles and duties commensurate with the student's graduate program focus. Prerequisite: Completion of one term of graduate studies and the instructor will validate that

the student has an offer letter from an approved company. Permission of assigned graduate chair is required. Permission of instructor required.

Learning Outcomes: 1. Experience and understand aviation workplace roles and responsibilities. Credits: 1.00 to 3.00

AT 54200 - Aviation Fuels And Exhaust Emissions

Credit Hours: 3.00. This course focuses on aviation fuels, including engine operation with fuel, combustion principles, chemistry, exhaust emissions, and fuel testing procedures. Additionally, the topics of greenhouse gases, global warming, oil reserves, fuel costs, and other factors driving the development of alternative aviation fuels will be covered. Current research in these areas will be discussed and testing procedures will be studied. Students will research new fuels in development, and will analyze the sustainability and potential for success promised by the new technologies in comparison with existing fuels.

Learning Outcomes: 1. Evaluate the relationship of fuel chemistry, properties, and characteristics to the extent necessary to predict impact on performance. 2. Analyze and differentiate the steps in the refining process to determine the characteristics and costs of the various grades of aviation fuels. 3. Analyze fuel test results to predict engine performance utilizing this information. 4. Analyze and compare the exhaust emissions produced by current and new aviation fuels in relation to current and emerging air pollution regulations and policies. 5. Evaluate new fuels and fuel production processes to determine overall sustainability and projected costs under the European Union Emissions Tax Scheme. 6. Analyze the distribution requirements for new fuels in comparison with the existing infrastructure to determine the modifications or accommodations required for system-wide delivery and implementation. Credits: 3.00

AT 54300 - Contemporary Issues In Airport & Airline Finance

Credit Hours: 3.00. This course provides an overview of aviation financial management and is intended for current and future aviation and aerospace leaders and managers. Taking a global view, the course opens with the tremendous economic impact of the aviation sector that both drives and enables the interdependent global economy. The course material covers the unique business models and best practices in financial management for both the airport and airline industries and analyzes the relationship between the two (including the complications implicit in highly divergent planning horizons). The complexity of aircraft financing decisions is covered that lead up to building a fleet to serve the airlines' forecast growth. The course uses relevant readings and case studies as well as statistical data in time series to demonstrate the way financial management has evolved to improve performance in both the airport and airline industries. Permission of department required.

Learning Outcomes: 1. Recognize the impact of the COVID-19 pandemic on the global aviation sector and impacts on industry finance. 2. Describe the essential link between the enterprise's strategic vision and mission and prudent financial management. 3. Recognize the strengths and weaknesses of an aviation enterprise through an analysis of the balance sheet and income statements. 4. Understand the complexity and the sometimes adversarial nature of the airport/airline relationship. 5. Recognize the changes in the airline business model which have delivered improved financial performance in North America since 2014. 6. Describe the steps involved in re-inventing and rebranding an airport taking the Cincinnati Airport as an example. 7. Understand why privatization of airports, so common in Europe and Asia, has not caught on in the U.S. 8. Enumerate the hurdles to building new infrastructure. 9. Develop an appreciation for the FAA's role in oversight of the U.S. aviation system. 10. Become familiar with the basic elements of aircraft financing including various scenarios for investing in new aircraft to meet future demand. 11. Discuss the applications of new technology in North American air traffic management. This will focus on both the FAA and NAVCAN. 12. Know the basic roles of key players in aviation including Airports Council International (ACI), International Air Transport Association (IATA), the UN International Civil

Aviation Organization (ICAO). Credits: 3.00

AT 54600 - Aviation Financial Instruments And Operations

Credit Hours: 3.00. The course concentrates on increasing the understanding of financial expertise in analyzing trading and hedging programs for application in reducing aviation operational risk exposure. The studies include research into the development and use of operational indexes and their possible relation to hedging with commodity and security instruments. Emphasis will be placed on the understanding of current operational measurements and correlations to trading and hedging financial instruments in providing improved risk management in operational environments.

Learning Outcomes: 1. Propose and defend an analysis using operational data, trading, and hedging programs to reduce financial and operational risk in a specific business area in airline operations. 2. Collect, assess, organize, and present the relationships between operational data, financial data, and commodity volatility. 3. Develop and present the impact of complexity on airline business operations. Credits: 3.00

AT 54700 - Airline Revenue Management

Credit Hours: 3.00. This course aims to provide students with experience in airline revenue management applications. Primarily focusing on the commercial operation of airlines, this course covers various contemporary topics such as the segmentation, inventory control, forecasting, budgeting and pricing. This course will use simulations to enhance the overall learning-teaching experience.

Learning Outcomes: 1. Summarize the development of revenue management in the airline industry, and explain the importance of revenue management to business operation of airlines. 2. Interpret concepts such as segmentation, forecasting, budgeting, pricing, revenue management, and yield in the domain of the airlines industry and the broader hospitality sector. 3. Evaluate pricing schemes used by airlines on different markets (for instance, long-haul & short-haul, domestic & international, competitive & dominant, peak season & low season) in real world. 4. Implement inventory control in a simulated environment to respond to the dynamic and complex market conditions. 5. Develop appropriate strategies to optimize revenue for a specific airline (either full-service carrier or low-cost carrier) in a certain market (simulated environment). Credits: 3.00

AT 54800 - Aircraft Asset Management

Credit Hours: 3.00. This course provides the student with a detailed exploration of aircraft asset management programs in both airlines and business aviation organizations. Students analyze and study the critical components of an asset management program, the financial methods in aircraft asset management, acquisition proposals, and development plans of aircraft acquisitions in this course. An airline industry-relevant project is used to improve student reasoning and application of industry standard aircraft asset management analysis procedures to include forecasting techniques, present value calculations, and benefit-cost analyses. This course serves as the foundational knowledge required for AT 54900.

Learning Outcomes: 1. Review critically, synthesize, document and summarize relevant research literature in the field of aircraft asset management, expressing themselves clearly and concisely in writing and oral presentation. 2. Recognize the critical components of an aircraft asset management program, thoroughly develop a business case for aircraft acquisition, and manage an in-service fleet of aircraft. 3. Develop a simulated asset management team and work effectively and collaboratively as part of the team. 4. Produce a high-quality airline industry aircraft asset management project, conduct financial analyses of aircraft assets, document findings in a paper, and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 54900 - Aircraft Leasing

Credit Hours: 3.00. This course provides students with training and experience managing aircraft leases using financial and risk management methodologies specific to the airline and business aviation industries. Students conduct financial evaluations of leasing versus ownership programs of airlines, as well as analyze debt, equity and capital markets for aircraft financing. The course includes an examination of taxation issues related to aircraft leasing, maintenance reserves, and auditing of aircraft financial performance. The prerequisite for this course is AT 54800.

Learning Outcomes: 1. Review critically,

synthesize, document and present relevant research literature in the field of aircraft leasing and financing, expressing themselves clearly and concisely in writing and oral presentation. 2. Explain the necessary components of an aircraft lease, audit in-service aircraft financial performance, thoroughly analyze aircraft maintenance reserves, and summarize taxation issues with aircraft assets. 3. Develop a simulated aircraft leasing management team and work effectively and collaboratively as part of the team. 4. Generate a high-quality aircraft asset leasing project, conduct financial evaluations of leasing and owning options, document findings in a paper and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 55000 - Critical Systems Thinking

Credit Hours: 3.00. This course explores the application of critical systems thinking to complex problems. Using systems theory and case studies developed by technology visionaries, students will investigate alternative solutions to difficult industrial problems with global impact. Outcomes for this course include written assignments, oral presentations, and a final project that addresses a major industrial problem.

Learning Outcomes: 1. Understand how to frame complex issues in terms of systems thinking methodologies. 2. Able to synthesize information from different sources to develop a comprehensive aviation strategy. 3. Critically evaluate options and alternative solutions to complex problems. 4. Develop an appreciation for key aviation industry concerns as visionary aviation industry leaders. 5. Develop an eye to see and seize opportunities for innovation within industry. 6. Effectively articulate solutions to complex systems problems. Credits: 3.00

AT 57200 - Human Error And Safety

Credit Hours: 3.00. Explores the definition and nature of human error, error chains, and causal factors in error generation. Error taxonomies are reviewed in order to provide a classification scheme for grouping errors and assessing error criticality. Methods for assessing risk and predicting error generation potentials are learned, as well as strategies for controlling or eliminating errors. Case studies are utilized throughout the course to illustrate course concepts. Permission of instructor required.

Learning Outcomes: 1. Classify and evaluate types of human error using established taxonomies and assess their criticality in complex systems. 2. Analyze the antecedents and causal factors of human error, including those related to equipment, operators, organizational practices, regulatory frameworks, and cultural influences. 3. Apply error investigation methods, including data collection and analysis, to identify patterns and inform risk reduction strategies. 4. Examine case studies critically to propose evidence-based strategies for mitigating error incidents and improving safety outcomes. 5. Develop and present a scholarly research project on a contemporary human factors issue, demonstrating effective written and oral communication skills for professional contexts. Credits: 3.00

AT 57300 - Managing The Risk Of Organizational Accidents

Credit Hours: 3.00. Examines strategies various industries use to assess the risk of organizational accidents and to develop safety management programs to prevent, capture, and recover from conditions that lead to disastrous outcomes. Strategies such as High Reliability Organizations, Operational Risk Management, Behavioral Based Safety, Tripod Delta, and Safety Cultures are explored as successful methods for improving organizational safety in high-risk environments and endeavors. Permission of instructor required.

Learning Outcomes: 1. Explain Reason's model of Organizational Accidents (OA) and its application in understanding accident causation and prevention. 2. Analyze everyday operational events through the lens of the OA model to identify latent risks and contributory factors. 3. Evaluate best practices from safety frameworks such as High Reliability Organizations, Operational Risk Management, and Safety Cultures to mitigate the risk of organizational accidents. 4. Develop a detailed, evidence-based analysis of selected aviation accidents or incidents, incorporating the

principles of the OA model. 5. Propose strategies to enhance organizational safety by integrating behavioral-based safety and proactive risk management techniques into safety management systems. Credits: 3.00

AT 57400 - Exploratory Studies In Aviation Human Factors

Credit Hours: 3.00. Exploration of contemporary issues and research related to human factors theory and program strategies as they relate to the aviation industry. The course ventures beyond ergonomic issues into more diverse human factors considerations, while discussing an industry-wide and organizational perspective. The course utilizes a combination of lecture, group discussion, and independent study into issues relevant to student interests and career goals. Permission of instructor required.

Learning Outcomes: 1. Examine emerging human factors concepts and issues of critical concern within the aviation industry, beyond traditional ergonomic considerations. 2. Identify and evaluate human factors models and frameworks, such as the Human Factors Analysis and Classification System (HFACS), for investigating safety events. 3. Conduct and present independent exploratory research on a human factors topic, demonstrating analytical, written, and oral communication skills relevant to aviation professionals. 4. Design aviation workspace requirements that integrate human factors principles to enhance safety, performance, and usability. 5. Analyze contemporary aviation safety challenges from organizational and industry-wide perspectives, incorporating insights from human factors theory and program strategies. Credits: 3.00

AT 58100 - Workshop In Aviation Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 0.00 to 8.00

AT 59000 - Special Problems In Aviation Technology

Credit Hours: 1.00 to 12.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 12.00

AT 60700 - Aviation Applications Of Bayesian Inference

Credit Hours: 3.00. This course provides a critical foundation necessary for understanding Bayesian theory and employing that theory in the analysis of typical data generated in industry. The course will focus specifically on solutions of aviation-related problems through data analysis. Material includes overview and implementation of relevant statistical software applications. Practical skills in presenting advanced analyses to both professional and scientific audiences is a key component of the course. Prerequisites: AT 50700 OR IT 50700 OR STAT 30100 OR STAT 50100 OR STAT 51100. Permission of instructor required.

Learning Outcomes: 1. Articulate and define basic concepts in probability theory, modeling, and Bayesian reasoning. 2. Create hierarchical models using Bayesian concepts and use appropriate software to implement those models. 3. Demonstrate the differences between Bayesian modeling and null hypothesis significance testing. 4. Apply Bayesian models to solve specific aviation problems using realistic data. Credits: 3.00

AT 64000 - Aviation And Aerospace Sustainability

Credit Hours: 3.00. This course explores sustainability as applied to aviation and aerospace industries and agencies, both in the private sector and public sector. Emphasis is placed on understanding aviation and aerospace sustainability academic literature and on connecting the global and national policies that lead to the regulations and practices. Aviation sustainability is comprised of multiple areas of impact such as economic, environmental, operational, and social. Students develop an understanding of existing sustainability assessment frameworks such as GRI that have general sustainability assessments along with specialized aviation industry frameworks. Using a multiple attribute analysis approach, students develop metrics and analyze the potential impact of sustainability initiatives in the aviation and aerospace industry. Prerequisites: STAT 30100 or STAT 31100 or STAT 50100 or STAT 51100 or IT 50700 or an instructor-approved statistical foundations course. Proficiency in statistical foundations is required to understand and evaluate environmental, economic and social sustainability data, information and methods presented in this course.

Learning Outcomes: 1. Create a well-founded

set of metrics for assessing sustainability that consider economic, environmental, social and operational viewpoints. 2. Evaluate projects or initiatives affecting aviation and aerospace sustainability using multi-attribute analysis techniques. 3. Collect, assess, organize and present sustainability information. 4. Demonstrate understanding of sustainability terms, policies, and concepts. 5. Develop, communicate and defend an analysis of a sustainability initiative in the aviation or aerospace industry. Credits: 3.00

AT 67500 - Aviation Safety Program Development

Credit Hours: 3.00. This course is designed to provide graduate students with essential information and practical activities necessary to develop and manage effective and comprehensive safety programs for a wide variety of aviation operations. Students will conduct safety research, analyze data, and make presentations based on developed safety systems. Instructor permission required.

Learning Outcomes: 1. Describe the regulatory and risk environment in which airline safety offices exist. 2. Describe safety theories and models. 3. Describe human factors and accident causation. 4. Collect and analyze safety related data. 5. Process and disseminate information related to accident prevention and risk minimization. 6. Manage an airline safety office and implement procedures. 7. Design a safety management program for an air career or FBO. Credits: 3.00

AT 69000 - Independent Study In Air Transportation

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in air transportation. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Investigate and report on a focused area of air transportation. Credits: 1.00 to 6.00

AT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Plan, manage, conduct, and report original research using appropriate design and analytical techniques. Credits: 1.00 to 18.00

AT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. This course involves intensive research and writing activity associated with a doctoral dissertation. Prerequisite: Doctoral candidate status. Permission of instructor required.

Learning Outcomes: 1. Plan, manage, conduct, and report original research using appropriate design and analytical techniques. Credits: 1.00 to 18.00

Bands

BAND 11000 - Marching Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Mandatory participation required in Marching Band Workshop one week prior to start of fall classes which conflicts with Boilermaker Gold Rush. Workshop covers similar orientation to Gold Rush. Do enroll in BAND 11000 during summer registration prior to the workshop and audition process.

Credits: 2.00

BAND 11100 - Symphony Orchestra

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11200 - American Music Review

Credit Hours: 2.00. Singers and pianists only. American Music Review is a jazz big band plus 4-5 singers open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11300 - Jazz Ensemble

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Permission of instructor required.

Credits: 2.00

BAND 11400 - Basic Jazz

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11500 - String Orchestra

Credit Hours: 2.00. The rehearsal, study, and performance of string orchestra music from the classical, romantic and contemporary areas of composition.

Credits: 2.00

BAND 11600 - Symphonic Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11700 - Concert Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11800 - Collegiate Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11900 - Varsity Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 12000 - Applied Music Studies

Credit Hours: 1.00. Private study on individual wind, string, and percussion instruments. Additional fees involved. Permission of instructor required.

Credits: 1.00

BAND 12100 - Symphony Orchestra

Credit Hours: 2.00. Symphony Orchestra.

Credits: 2.00

BAND 12200 - American Music Review

Credit Hours: 2.00. American Music Review.

Credits: 2.00

BAND 33000 - Summer Concert Bands

Credit Hours: 2.00. Continuation of BAND 32000.

Credits: 2.00

BAND 33100 - Summer Jazz Bands

Credit Hours: 2.00. Continuation of BAND 33000.

Credits: 2.00

BAND 34000 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 34100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

BAND 35100 - Instrument Ensemble Colloquium

Credit Hours: 2.00. Instrument Ensemble Colloquium.

Credits: 2.00

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 36100 - Instrument Ensemble Colloquium

Credit Hours: 2.00. Instrument Ensemble Colloquium.

Credits: 2.00

BAND 43000 - Summer Concert Bands

Credit Hours: 2.00. Summer Concert Bands.

Credits: 2.00

BAND 43100 - Summer Jazz Bands

Credit Hours: 2.00. Summer Jazz Bands.

Credits: 2.00

BAND 44000 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 44100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 47000 - Wind Ensemble III

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante

nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 47100 - Ensemble Colloquium

Credit Hours: 2.00. Ensemble Colloquium.

Credits: 2.00

BAND 48000 - Wind Ensemble IV

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 48100 - Ensemble Colloquium

Credit Hours: 2.00. Ensemble Colloquium.

Credits: 2.00

Basic Medical Sciences

BMS 20100 - Applied Domestic Animal Anatomy With Clinical Correlations I

Credit Hours: 2.00. This course is the first of two in the Purdue College of Veterinary Medicine, Department of Basic Medical Sciences distance learning program covering the basic anatomy of common domestic animals. We will focus on the canine and comparative anatomy of the equine, ruminant, and human, especially where species differentiations exist. The information is organized according to body systems. Clinical correlations are used to emphasize the importance of the basic anatomy. Permission of instructor required.

Learning Outcomes: 1. Obtain a basic understanding of principles that can assist with comparing anatomical structures of major domestic species. 2. Develop mental images of the animal to assist in knowing the orientation of structures in the living animal. 3. Know enough basic anatomy to understand the results obtained from imaging techniques. 4. Identify anatomical structures on dissected images, radiographs, anatomical models and live animals. Credits: 2.00

BMS 20200 - Applied Domestic Animal Anatomy With Clinical Correlations II

Credit Hours: 2.00. This course is the second of two in the Purdue College of Veterinary Medicine, Department of Basic Medical Sciences distance learning program covering the basic anatomy of common domestic animals. We will focus on the canine and comparative anatomy of the equine, ruminant, and human, especially where species differentiations exist. The information is organized according to body systems. Clinical correlations are used to emphasize the importance of the basic anatomy. In this second course we cover thoracic, abdominal and head anatomy. Permission of instructor required.

Learning Outcomes: 1. Obtain a basic understanding of principles that can assist with comparing anatomical structures of major domestic species. 2. Develop mental images of the animal to assist in knowing the orientation of structures in the living animal. 3. Know enough basic anatomy to understand the results obtained from imaging techniques. 4. Identify anatomical structures on dissected images, radiographs, anatomical models and live animals Credits: 2.00

BMS 23100 - Anatomy-VN

Credit Hours: 4.00. Gross and microscopic study of body systems and topographic relationships in major animal species. Laboratory consists of dissection as well as study of living animals.

Learning Outcomes: 1. Identify the Musculoskeletal. Students will be able to identify, draw and describe function of, in models, radiographs and live animals: major bones and bony prominences; major muscles; major nerves; major blood vessels associated with limbs; and describe long bone development. 2. Identify the Thorax. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of lungs, esophagus, trachea, major vessels, nerves and heart; pathway of blood through heart; position of thoracic and pleural cavities; and important topography. 3. Identify the Abdomen. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of major GI and reproductive organs, major vessels, and nerves; GI and UG

development; position of abdominal and peritoneal cavities; and important topography. 4. Identify the Head and Neck. Students will be able to identify and describe, in models, radiographs and live animals: major bones of skull; number teeth; major cavities of skull; major features of the eye and ear; major glands, vessels and nerves of the neck and skull; major topography of the head and neck; and major parts and function of the brain. Credits: 4.00

BMS 23200 - Physiology-VN

Credit Hours: 2.00. Basic mammalian physiology, which covers general physiological processes with emphasis on domestic animals. Laboratory experiences and demonstrations form a major part of the laboratory instruction.

Learning Outcomes: 1. Describe and explain the functions of body fluids. The types of formed elements in blood and their functions. 2. Describe and explain the functions of the central and peripheral nervous systems. 3. Describe and explain the types of muscles in the body and their functions. 4. Describe and explain the regulation of the functions of the heart, lungs, kidneys, endocrine glands and gonads. 5. Describe and explain the regulation of blood pressure, gas exchange in the lungs and acid-base balance. 6. Describe and explain the hormonal regulation of metabolic processes and reproduction. Credits: 2.00

BMS 23300 - Introduction To Pharmacology-VN

Credit Hours: 0.50. This course introduces the concepts and terminology of pharmacology including basic terminology, pharmacokinetics, and pharmacodynamics.

Learning Outcomes: "1. Explain what the different types of drugs names are. 2. Recognize the characteristics of different solid and liquid dosage formulations. 3. Explain the significance of the terminology used in drug references to describe drugs. 4. List and describe the criteria for acceptable extra-label use of drugs. 5. Describe the difference between OTC and prescription drugs. 6. Explain the factors that affect movement of drug molecules throughout the body. 7. Describe the requirements for prescriptions and drug labels. 8. Describe the characteristics of each route of drug administration. 9. Read and write abbreviations commonly used in drug orders accurately. 10. Explain physiological factors that change the way drugs move through the body. 11. Describe regulations and warnings surrounding dispensing containers. 12. Describe factors that alter the way drugs are absorbed, distributed, metabolized, and excreted. 13. Describe reasons and procedures for handling and storing drugs. 14. Explain the interaction between drugs and receptors and how that produces cellular effects. 15. Describe legal requirements for dispensing and storage of controlled substances. 16. Describe how pharmacokinetics and pharmacodynamics impact every drug treatment. 17. Describe special storage and handling requirements for cytotoxic and hazardous drugs. 18. Describe the issues surrounding and guidelines required for acceptable drug compounding. Credits: 0.50

BMS 23400 - Clinical Physiology: A Problem Solving Approach-Distance Learning

Credit Hours: 1.00. This course will provide the physiological basis for clinical functions and medical interventions of the animal. The course is designed to: 1. Complement and expand students' understanding of concepts taught in the general physiology course (BMS 23200, Physiology for Veterinary Technicians); 2. Emphasize how understanding basic physiological concepts can help in solving clinical cases; 3. Promote critical thinking, team work, communication skills and problem solving.

Learning Outcomes: 1. Define basic physiological terms related to the cases presented. 2. Describe basic physiological concepts related to each case. 3. Apply understanding of basic physiological concepts to sort out pathophysiology and solve clinical cases. 4. Explain how knowledge of physiology helps in understanding why particular treatments are used for treating clinical cases. 5. Describe how treatments help to restore the

basic physiology of organ system and the animal as a whole. 6. List his/her contribution that helped his/her team in problem solving clinical cases 7. Be able to obtain, evaluate, and use information to solving clinical cases. 8. Be able to effectively communicate peers, clinicians, and clientele. 9. Be able to function as part of a team. Credits: 1.00

BMS 23700 - Applied Physiology With Clinical Correlations I

Credit Hours: 2.00. This course introduces students to the general physiology of mammalian body systems and physiological processes. This course will address the functions of the different systems and homeostasis; the functions of the cell and its different compartments; solute transport, blood and immunity; general functions of the nervous system, reflexes and special senses; the functions of the nerve and muscle, the cardiovascular system; and the digestive system. The course provides the basic physiological concepts of various organ systems and clinical correlations that emphasize how understanding of basic physiological concepts help students solve problems. The clinical correlations and the students-centered learning activities are deigned to promote critical thinking, team work, communication skills, and problem solving. The targeted undergraduate students are: Pre-vet students, animal science majors, wildlife majors, and students in biological sciences and biomedical engineering, and other students interested in use of animals as models for human diseases. Permission of instructor required.

Learning Outcomes: 1. Describe the organs that makes each system and list the major functions of each system. 2. Explain how each system activities are regulated. 3. Discuss the different physiological processes that occur at cells, organs, and systems levels. 4. Compare and contrast between the functions of regulatory systems and other systems in the body. 5. Summarize the contribution of different systems to the maintenance of the internal environment in which cells live. 6. Use basic physiological concepts to understand clinical correlations. Credits: 2.00

BMS 23800 - Applied Physiology With Clinical Correlations II

Credit Hours: 2.00. This course introduces students to general physiology of mammalian body systems and general physiological processes, with emphasis on domestic animals. The course addresses the functions of the different systems, and the specific functions of the respiratory, renal, endocrine, and reproductive systems. Students will be introduced to ailments that result from malfunctions in each system. The course provides the basic physiological concepts of various organ systems and clinical correlations that emphasize how understanding basic physiological concepts can help in solving problems. The clinical correlations and the students-centered learning activities are deigned to promote critical thinking, team work, communication skills, and problem solving. The targeted undergraduate students are: Pre-vet, students, animal science majors, wildlife majors, and other interested students in biological sciences and biomedical engineering. Permission of instructor required.

Learning Outcomes: 1. Describe the organs that make the respiratory, renal, endocrine and reproductive systems, and list the major functions of each system. 2. Explain how each system activities are regulated. 3. Discuss the different physiological processes that occur at cells, organs, and systems levels 4. Compare and contrast between the functions of regulatory systems and other systems in the body. 5. Summarize the contribution of different systems to the maintenance of the internal environment in which cells live. 6. Use basic physiological concepts to understand clinical correlations. Credits: 2.00

BMS 33100 - Pharmacology-VN

Credit Hours: 1.50. This course introduces the concepts of drugs used in the different body systems. Mechanisms of action, side effects, and therapeutic applications are presented.

Learning Outcomes: 1. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the GI tract. 2. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of cardiovascular system. 3. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the respiratory tract. 4. Identify, describe the mechanisms of action, and

describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the endocrine systems. 5. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-inflammatory drugs. 6. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases/conditions of the nervous system. 7. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-parasitic drugs. Credits: 1.50

BMS 51700 - Problems In Basic Medical Sciences

Credit Hours: 0.50 to 8.00. Studies or investigations in the various disciplines of the basic medical sciences of man and domestic animals for advanced undergraduate and beginning graduate students. Permission of instructor required.

Credits: 0.50 to 8.00

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

BMS 52900 - Basic Bone Biology

Credit Hours: 3.00. This course is designed to present the fundamentals of bone biology. Approximately 45 hours of lecture will help the learner achieve the objectives outlined. Lectures will be given to present information and tie into information learners have acquired or will acquire in other courses (e.g. biomechanics, physiology, molecular biology, etc.) to assist them in combining all of their courses and research experiences together into one interdisciplinary learning experience. It is expected that students take additional time outside of scheduled class time to further learning. Materials for the learners will be posted on the course's website. These materials will include: Lecture notes and PowerPoints: Each lecturer will post his/her lecture notes and associated PowerPoint slides prior to the lecture. Additional information: As the course progresses, instructors may come across additional information that they may find useful for student learning of the material. These materials will be posted for students to utilize as they see fit. * *Materials found on other sites (e.g. social networking sites) will not be official course materials, so use at your own risk.* Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the morphology and organization of bone and supporting/associated tissues (e.g. bone marrow, cartilage, muscle), including cellular structure and structure of the extracellular matrix. 2. Describe the normal processes of bone development and remodeling and the cellular and molecular components of each of these processes. 3. Demonstrate knowledge of the impact of external factors (e.g. nutrition, mechanical loading, genetics) on bone health. 4. Relate bone pathology to disease and dysfunction. 5. Describe the interplay of the skeletal system to other organ systems. Credits: 3.00

BMS 53400 - Systemic Mammalian Physiology

Credit Hours: 4.00. This course is a 4 credit hour course that provides fundamental concepts of mammalian physiology in nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems. The major physiological functions of these systems will be explained at the organ as well as the cellular level. The structure and function relationships will be studied in detail. At the end of the course, the students are expected to have a solid understanding of basic functions of the human body. In addition, the student will be exposed to the current topics and key concepts of experimental research. This course offers an excellent opportunity for those students who are looking to either learn or refresh their physiological knowledge that can benefit a variety academic and professional career goals.

Learning Outcomes: 1. Describe the fundamental concepts of nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems in mammals. 2. Examine the functional relationship among different systems. 3. Apply physiological principles as they relate to the

etiology of common diseases. Credits: 4.00

BMS 59800 - Introduction To Research In Basic Medical Sciences

Credit Hours: 1.00 to 3.00. Introduction to research in pharmacology and physiology under the direction of a member of the departmental graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

BMS 60200 - Special Topics In Basic Medical Sciences

Credit Hours: 0.50 to 8.00. Advanced studies of organismic, cellular, and molecular processes in the basic medical sciences of man and domestic animals. Permission of instructor required.

Credits: 0.50 to 8.00

BMS 63100 - Flow Cytometry: Theory

Credit Hours: 2.00. A thorough excursion into the theory of flow cytometry. An understanding of what the technology is, how it operates, and where the applications exist. Covers optical systems, including filters, light excitation and emissions, fluorescent dyes and fluorescent molecules, electronics including detection systems, signal processing, data analysis, and computer applications. A discussion of lasers and other light sources, as well as quality control. Overview of the application areas in medical sciences, biological research, and other possible areas of use.

Credits: 2.00

BMS 69200 - Seminar In Basic Medical Sciences

Credit Hours: 0.00 or 1.00. Oral presentation of assigned or selected topics pertaining to physiology and pharmacology.

Credits: 0.00 or 1.00

BMS 69699 - Professional Practice Grad Internship

Credit Hours: 0.00. This course is designed to encourage meaningful reflection on students' experiential learning in a Co-op setting. Throughout the internship, students will document key aspects of their experience, including compensation, location, and job responsibilities. As part of this program, the student will complete a Co-op internship at Merck in Pennsylvania from June 2025 to December 2025, focusing on neuroscience research. Their work will involve identifying translational models relevant to Parkinson's disease and Alzheimer's disease. Course assignments will include setting professional goals, evaluating progress, and documenting achievements. Guidance will be provided through the Brightspace platform, along with pre- and post-experience survey assignments. Students can preview all survey questions on Brightspace. Permission of department required.

Learning Outcomes: 1. Gain hands-on experience in neuroscience beyond academia. Credits: 0.00

BMS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BMS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BMS 80100 - Gross Anatomy Of The Dog And Cat

Credit Hours: 3.50. Study of the anatomy of the body systems and the topographic relationships of the dog and cat.

Learning Outcomes: 1. Obtain a basic understanding of principles that can be transferred to the anatomical structures of the live dog. 2. Develop mental images of the animal to assist in positioning and orientation of structures in the living animal. To assist in diagnostic procedures and evaluating the results obtained from imaging techniques. 3. Be able to identify anatomical structures on dissected specimens, skeletons, radiographs, and anatomical models. Credits: 3.50

BMS 80200 - Comparative Anatomy

Credit Hours: 4.00. A comparative study of the body systems and the topographic relationships of the major domestic species. This course is an extension of BMS 80100 and will continue to build on anatomical knowledge so that it may be applied to multiple domestic species.

Learning Outcomes: 1. Describe major anatomical principles of structure and function and identify and describe major anatomical structures which are common among domestic species; demonstrate the ability to translate and apply that knowledge to other species. 2. Use specific topographical and palpable landmarks in horses, ruminant species, and pigs to locate clinically important underlying structures and viscera for purposes of physical examination, imaging and other diagnostics, and therapeutic procedures. 3. Be able to identify major and clinically important anatomical structures on skeletal and other anatomical models; radiographs; cadavers; and live domestic

animals (horses, ruminant species, pigs). 4. Identify and describe the major structural components of birds, using domestic poultry as a model, and demonstrate an understanding of structure-function inter-relationships in the avian body. Credits: 4.00

BMS 80300 - Applied Anatomy Of The Dog And Cat

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 150-minute laboratory sessions, plus a comprehensive final exam. This course builds on basic anatomical knowledge and explores, in depth, the anatomy relevant to medical and surgical conditions of the dog and cat. Laboratory will utilize anatomical models, cadavers as animal models, electronic resources, and limited use of live animals for clinical examinations.

Credits: 1.00

BMS 80400 - Applied Anatomy Of The Horse

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 120-to-150-minute laboratory sessions, plus a comprehensive final exam. Course material is based upon clinical conditions of the horse that have an anatomical basis or emphasis. Laboratory sessions include topographical anatomy; joint and nerve injections and performance of other clinical procedures; use of multimedia learning aids; and dissection of the head, neck, viscera, and legs.

Learning Outcomes: 1. Recognize, describe and demonstrate the features, positions, and topographical locations of normal anatomical structures which are necessary for conduct of physical examination, including rectal palpation; diagnostic procedures, including contemporary imaging procedures; medical and surgical treatment of common disorders; and necropsy examination of equid animals. 2. Identify relevant landmarks and be able to perform the most commonly conducted intra-articular injections; intra-synovial injections; and desensitization of nerves to produce of local and regional anesthesia ("nerve blocks") in horses. Explain the anatomical basis of each procedure, as well as the rationale underlying the procedures, and the level of diagnostic and therapeutic specificity of each procedure. 3. Describe structure-function inter-relationships of clinically important organs and structures in horses, particularly as they relate to commonly encountered clinical abnormalities. Credits: 1.00

BMS 80500 - Applied Anatomy Of Production Animals

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 120-to-150-minute laboratory sessions, plus a comprehensive final exam. Course material is based upon clinical conditions of the production animals that have an anatomical basis or emphasis. Laboratory sessions include topographical anatomy; joint and nerve injections and performance or other clinical procedures; use of multimedia learning aids; and dissection of the head, neck, viscera, and legs.

Learning Outcomes: 1. Recognize, describe and demonstrate the features, positions, and topographical locations of normal anatomical structures which are necessary for conduct of physical examination, including rectal palpation; diagnostic procedures, including contemporary imaging procedures; medical and surgical treatment of common disorders; and necropsy examination of mammalian production animals. 2. Describe structure-function inter-relationships of clinically important organs and structures in production animals, particularly as they relate to commonly encountered clinical abnormalities and disorders. 3. Recognize and describe anatomical structures associated with commonly encountered surgical disorders in production animals. 4. Identify relevant landmarks and be able to perform the most commonly conducted procedures to accomplish local and regional anesthesia in production animals. Explain the anatomical basis of each procedure, as well as the rationale underlying the procedures, and the level of diagnostic and therapeutic specificity of each procedure. Credits: 1.00

BMS 80700 - Veterinary Cell And Tissue Biology Design I

Credit hours: 2.50. The first of a two-semester sequence of courses, emphasizing developmental and microstructural foundations of structural differentiation of cell, tissue, and organ systems. Emphasis is placed upon principles, fundamental

concepts, and applicable details as well as comparative aspects of general importance for veterinary medicine and biomedical research. That you have some background in biochemistry and cell biology is assumed.

Learning Outcomes: 1. Recognize and interpret normal microscopic structure, using the language and conventions of medicine. 2. Understand development resulting in normal structure. 3. Understand relationships of cellular organelles and inclusions to cellular, tissue, organ, and whole animal physiology. 4. Develop skills to effectively use a light microscope for critical observation, identification, and analysis, of cell, tissue, organ, and embryonic microstructure. 5. Develop an awareness of species characteristics and variations of structure that reflect physiology, artifact, gerontology, and pathology. 6. Develop an awareness of links between cellular and tissue structure to other disciplines of veterinary medicine and biomedical sciences (e.g. physiology, gross anatomy). 7. Develop approaches to nurture the "active learning" process required to develop and maintain competency as a veterinarian and/or biomedical scientist. Credits: 2.50

BMS 80800 - Veterinary Cell And Tissue Biology Design II

Credit Hours: 2.00. All lectures will focus on mammalian microanatomy with species differences and aim to include also a brief comparative description for Avian microanatomy when applicable. Structural and molecular basis of cellular processes that are the foundation of fertilization, embryogenesis, histogenesis, and basic tissue specialization in domesticated animals. Structure and function of macromolecules and organelles that mediate signal transduction, differentiation, and integration within a whole animal.

Learning Outcomes: 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine; 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine. 2. An understanding of the relationship of development to normal microscopic structure. 3. An understanding of the molecular mechanisms of fundamental biological phenomena that signal and result in expression of the structures that underlie normal development and cellular physiology. 4. An understanding of the relationships of cellular organelles and inclusions to tissue, organ, and whole-animal physiology. 5. The skills to effectively use the light microscope for critical observation, analysis, and identification of cell, tissue, organ, and embryonic microstructure. 6. An awareness of selected species characteristics as well as structural variation representing physiology, artifact, gerontology, and pathology. 7. An awareness of significant links of cellular and tissue design to other disciplines of veterinary medicine and biomedical sciences. 8. An appreciation of the utility and necessity of the active learning process for developing and maintaining competency as a veterinarian and/or biomedical scientist. Credits: 2.00

BMS 81000 - Foundations In Basic Medical Sciences

Credit Hours: 1.50. The overall objective of this course is to provide the incoming first year DVM students the basic, foundational science principles upon which they will base study of the DVM curriculum. Emphasis is upon basic principles and fundamental concepts of: animal body organization and terminology; cellular and whole body metabolism; macromolecules, membranes, transport, biosynthetic processes, cellular communication/signal transduction, cell cycle and growth regulation, gene expression and embryonic development.

Learning Outcomes: 1. Know the terms of position and orientation of the animal body. 2. Know basic principles of cellular and whole body metabolism, including anabolism, catabolism and homeostasis. 3. Know the properties and composition of key cellular molecules. 4. Know the structure and function of biological membranes, mechanisms of cellular transport and generation of action potential. 5. Know the mechanisms of cellular

communication and signal transduction, including types of secreted signals, structure/function of various receptors, and key mechanisms by which the signal elicits a cellular response. 6. Know the growth factor signaling and the cell cycle; the terms oncogene and tumor suppressor. 7. Know the basic principles of transcription, organization of the animal genome, epigenetic regulation, and molecular mechanisms involved in embryonic development. 8. Know the basic stages of embryogenesis, and genesis of four basic tissues. 9. Know the identify by light and electron microscopy key components of animal cell structure, epithelial cell modifications, and structures/organs of the 10 mm embryo. Credits: 1.50

BMS 81100 - Physiology Of Domestic Animals I

Credit Hours: 3.00. General physiological process of mammals with special emphasis on domestic animals; normal interactions between large populations of cells, organs, organ systems and integrated functions of an entire animal; homeostatic mechanisms, physiology of body fluids and blood formed elements, muscle and cardiovascular systems.

Learning Outcomes: 1. Provide an overview of physiology of mammalian body systems (Body fluids, blood, muscle, cardiovascular system) and general physiological processes (e.g. homeostasis), with emphasis on domestic animals 2. Provide an overview of the integrated function of the different physiological systems and how they are regulated. 3. Familiarize the student with the organization of cells and the functions of the blood, muscle, and cardiovascular system. Credits: 3.00

BMS 81200 - Physiology Of Domestic Animals II

Credit Hours: 4.00. Continuation of Physiology of Domestic Animals I (BMS 81100). Survey of the principles, concepts and mechanisms of physiological processes with special emphasis on interactions between large populations of cells, tissues, organ systems and integrated functions of domestic animals of importance to veterinary medicine. The organ systems covered are respiratory, renal, digestive, endocrine, and reproductive.

Learning Outcomes: 1. Regulation of functions of the lungs, kidneys, stomach, digestive system, endocrine glands & gonads. 2. Processes and regulation of gas exchange in the lungs. 3. Roles of electrolytes and the regulation of acid-base. 4. Regulation of physiological & biochemical processes in stomach, small and large intestines. 5. Hormonal regulation of metabolic processes. 6. Regulation of reproduction. Credits: 4.00

BMS 81300 - Principles Of Pharmacology

Credit Hours: 1.50. Introduction to pharmacokinetics and pharmacodynamics, ethical dimensions of drug use in veterinary medicine, and drug categories that integrate well with other first-year subjects (e.g., drugs that alter endocrine/reproductive function). Emphasis is placed on general principles and prototypical drugs.

Credits: 1.50

BMS 81400 - Basic And Applied Pharmacology I

Credit Hours: 3.00. BMS 81400 follows BMS 81300 and includes the study of drugs with actions related to the nervous system and the immune system at large, anticancer drugs, antiviral drugs, and drugs targeted to organ specific pathologies - e.g. cardiac, intestinal, pulmonary, and renal pathologies.

Credits: 3.00

BMS 81401 - Pharmacology Principles And Applications

Credit Hours: 4.00. This is the first of two pharmacology courses in the DVM curriculum. The first part of this course encompasses an introduction to basic concepts necessary to understand and optimally administer and deliver therapeutic drugs, such as pharmacokinetics, pharmacodynamics, dose forms, dosing regimen and prescriptions. In the second part of the course, drugs are studied not only based on their pharmacological class, but also based on the organs and systems on which they act (e.g., heart and vascular system, lungs, autonomous neuronal pathways, respiratory system, endocrine system, etc.). This course also covers the pharmacology of cancer therapy and drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics). Journal club sessions are included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make informed decisions regarding administration (dosage, duration of treatment, combination with other drugs) of a

class of drugs or a specific drug as appropriate, depending on the patient's vital and pathological characteristics and mechanisms of action of specific drugs or drug classes. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Discuss how drugs used for a particular disease might have an impact on the development of another disease. 5. Discuss the principles and issues behind drug tolerance and addiction and the risk of abuse. 6. Explain the methods of drug delivery developed to reduce drug toxicity and/or improve efficacy. Credits: 4.00

BMS 81500 - Veterinary Neuroscience

Credit hours: 2.00. This course provides an introduction to neuroscience and its diagnostic application in veterinary medicine. Students will acquire terminology describing the anatomy and basic physiology that characterize neural systems. Integration of function/structure relationships will be introduced in lectures and laboratories, by reference to case studies, and by problem-solving.

Learning Outcomes: 1. Acquire of basic knowledge in neuroscience that will enable insightful diagnosis of diseases affecting the nervous system. 2. Know the parts of the nervous system described in each lecture/lab by their name, location, anatomic relationship to other parts and structures and their integrative function. Students will be able to describe how the nervous system of domestic mammals is organized and how these components contribute to nervous system function. 3. Acquire the ability to communicate this information effectively. 4. Know or logically theorize the physiological basis for any dysfunction that might arise due to specific pathological processes and anatomical lesions in the nervous system. The student will begin to develop an appreciation for the clinical signs and altered behavior that occurs following damage to or disorders of nervous system components. 5. Provide an introduction to the utility of the basic Neurological Exam in the diagnosis of nervous system disease. Credits: 2.00

BMS 81600 - Applied Pharmacology II

Credit Hours: 1.50. This DVM curriculum course covers drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics), and drugs for immunomodulation and cancer therapy. New topics are introduced according to upcoming developments in drug use such as pharmacogenomics. A journal club session is included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make an informed decision regarding the administration (dosage, duration of treatment, combination with other drugs) of a class of drugs or a specific drug as appropriate, depending on the patient vital and pathological characteristics. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Understand, anticipate and resolve (whenever possible) resistance to drugs. 5. Apply principles behind the interaction between environment and the organism that guide precision medicine. Credits: 1.50

BMS 81900 - Endocrine And Neural Basis Of Seasonal Activities Of Birds And Mammals In The Wild

Credit Hours: 1.00. This one-credit elective course will be offered to first and second year veterinary students annually (third year students may also take it). The course will explore the physiological basis of seasonal activities of mammals and birds in the wild. An emphasis will be placed on the neural and endocrine changes that are associated with the seasonal and cyclical activities including breeding, hibernation, migration, etc.

Learning Outcomes: 1. Understand the influences of environmental factors and cues by being exposed to the several activities of mammals and birds in the wild such activities. 2. Learn theendocrine and neural pathways that mediate the dictates of the environment.

Credits: 1.00

Biochemistry

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 10100 - Introduction To Biochemistry Laboratory

Credit Hours: 1.00. An entry-level laboratory course to help freshmen students become interested and excited about scientific research, and at the same time, gain the skills necessary to become better prepared for undergraduate research opportunities. Students perform real-world experiments to identify single base-pair changes in a DNA sequence that can change a protein-protein interaction. Students learn common laboratory skills such as pipetting, centrifugation, and sterile technique. Students also learn how to display and interpret scientific results in written form.

Learning Outcomes: 1. Demonstrate common laboratory skills such as sterile technique, micropipetting, centrifugation, plasmid DNA isolation, and culturing bacteria and yeast. 2. Define commonly used laboratory terminology and understand and execute protocols that contain these terms. 3. Display and interpret scientific methods and results in written form. 4. Identify positive and negative controls for an experiment. 5. Write an appropriate aim for an experiment. 6. Analyze DNA and protein sequence information. Credits: 1.00

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BCHM 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by departmental faculty and College of Agriculture Honors Committee. Restriction: Enrollment in an honors program. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 29800 - Introduction To Biochemistry Research

Credit Hours: 1.00 or 2.00. Supervised individual research. This course is intended to provide an introduction to independent undergraduate research. The primary goal of this experience is to learn the mechanics of laboratory science. Students will learn

to work in a real laboratory situation where experiments are not preassembled for them. Students will record their data in laboratory notebooks, and gain experience in trouble-shooting and critically analyzing the results of their experiments. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 3. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 4. Demonstrate knowledge of accepted safe laboratory practices. 5. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 6. Demonstrate the ability to organize and document laboratory procedures and results. 7. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 or 2.00

BCHM 29801 - Head Start To Introductory Biochemistry Research

Credit Hours: 0.50 or 1.00. Supervised individual research. Weeks 9-16. This course is intended to provide a brief introduction to independent undergraduate research. Students should plan on continuing their research in the same laboratory in the following semester. The primary goal of this course is to gain experience working side-by-side with researchers in a real laboratory setting. Students will begin to learn how to best record their data in laboratory notebooks, and gain experience in trouble-shooting and critically analyzing the results of their experiments. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 3. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 4. Demonstrate knowledge of accepted safe laboratory practices. 5. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 6. Demonstrate the ability to organize and document laboratory procedures and results. 7. Appreciate the ethical issues facing professionals in the life sciences. Credits: 0.50 or 1.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and

computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help biochemistry students with professional development and career planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 39100 - Internship In Biochemistry

Credit Hours: 0.00. Professional internship with biochemistry related employers in industry, government or small business. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking, and problem solving, communication and teamwork. 2. Contribute to program outcomes related to understanding the contributions of our discipline to society, appreciating the ethical issues facing professionals in the life sciences, communicating scientific knowledge, performing a wide variety of biochemical and olecular techniques and understanding the scientific method. Credits: 0.00

BCHM 40000 - Biochemistry Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean,

visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the

ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 2. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 3. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 4. Demonstrate awareness of civic responsibility to community and society at large. 5. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. Demonstrate use of the scientific method to identify problems, formulate and text hypotheses, conduct experiments and analyze data, and derive conclusions. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 7. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 1.00 to 4.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

BCHM 49500 - Special Assignments

Credit Hours: 1.00 to 3.00. Special work in biochemistry not included in other courses. Permission of instructor required.

Credits: 1.00 to 3.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits:

1.00 to 6.00

BCHM 49801 - Head Start To Biochemistry Research

Credit Hours: 0.50 to 2.00. Supervised individual research. Weeks 9-16. This course is intended to provide a brief research experience in preparation for in-depth, independent undergraduate research the following semester. The students enrolled in this course will begin to learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 0.50 to 2.00

BCHM 49900 - Honors Thesis In Biochemistry

Credit Hours: 3.00. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in the form of a written thesis. Permission of instructor required.

Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in

writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56600 - General Biochemistry

Credit Hours: 4.00. This course provides an overview of the fundamental biochemical and structural properties of amino acids, nucleic acids, lipids and carbohydrates, the major chemical building blocks of biological systems. The course will connect those properties to the structure and function of macromolecules and cellular structures (e.g. proteins, DNA, membranes). The catalytic mechanisms, kinetic properties and regulation of enzymes will be covered, including the interpretation of data from enzyme assays. Finally, the course provides an overview of how multiple enzymatic activities and their regulation define key metabolic pathways that generate energy, synthesize and degrade biomolecules, and maintain cellular homeostasis.

Learning Outcomes: 1. Identify and interpret the role of weak chemical forces in macromolecular structure and function. 2. Apply the principles of chemistry and thermodynamics to explain the higher order structure of proteins, nucleic acids, and membranes. 3. Interpret chemical and kinetic data to evaluate the specificity, catalytic mechanism and regulation of enzymes. 4. Compare and contrast the roles of lipids and proteins in membrane structure and function. 5. Identify and interpret the function and regulation of the major metabolic pathways that sustain life. 6. Decipher the logic of the enzyme-facilitated chemical transformations of the core metabolic pathways that generate energy and synthesize/degrade the major biochemical building blocks. 7. Interpret the structure of selected enzymes, their regulation, and the biochemical mechanisms by which they catalyze metabolic reactions. Credits: 4.00

BCHM 59500 - Current Topics In Biochemistry

Credit Hours: 1.00 to 4.00. Critical examination of developments in specialized fields of biochemistry not taught in other courses. Some topics include lecture, lab, directed reading

or independent study. Permission of Instructor required.

Learning Outcomes: 1. Gain knowledge of a current topic in Biochemistry. 2. Learn critical thinking through analysis of the primary literature (such as journal articles). 3. Become aware of ethical issues that touch upon the current topic. Credits: 1.00 to 4.00

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60200 - Critical Thinking And Communication In Biochemistry II

Credit Hours: 2.00. Builds on the skills developed in BCHM 601. Students will continue to enhance their analytical skills, and class discussions will be conducted at a more sophisticated level and will go into greater depth. Class discussions will focus more on the analysis and evaluation of current methodologies and hypotheses in the biochemical and molecular biological literature. Students will be evaluated primarily on their preparation and participation in each class discussion. Prerequisite: BCHM 60100. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60300 - Introduction To Graduate Research In Biochemistry I

Credit Hours: 6.00. This course is intended to provide the opportunity for in-depth, mentored graduate research in two biochemistry laboratories. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellow. Co-requisites: BCHM 60100 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 6.00

BCHM 60400 - Introduction To Graduate Research In Biochemistry II

Credit Hours: 3.00. This course builds upon BCHM 60300 to provide continued opportunity for in-depth, mentored graduate research in one biochemistry laboratory. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellows. Co-requisite: BCHM 60200 and Prerequisites: BCHM 60300 and BCHM 60501.

Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 3. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 4. Demonstrate knowledge of accepted safe laboratory practices. 5. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 6. Demonstrate the ability to organize and document laboratory procedures and results. 7. Appreciate the ethical issues facing professionals in the life sciences. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research. Credits: 2.00

BCHM 61200 - Bioinformatic Analysis Of

Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data. Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

BCHM 61501 - Pathways

Credit Hours: 3.00. An advanced level cell biology course offered to first or second year graduate students. Students will learn the major intracellular signaling pathways and cell cycle regulation of eukaryotes. Readings will be from the primary literature. Prerequisites: BCHM 65100 and BCHM 56200; or, BCHM 60501 (can be taken concurrently).

Learning Outcomes: 1. Know the molecular mechanisms in signal transduction and cell cycle. 2. Appreciate how protein modules within signaling molecules impart selective responses, how protein-protein interactions are used to build signaling pathways, and the methods commonly used to analyze signal transduction processes. 3. Appreciate cell cycle is carefully regulated to maintain genomic stability. 4. Enhance oral and written communication skills. 5. Master reading and interpreting scientific literature in signal transduction and cell cycle fields. 6. Develop critical thinking and creativity in signal transduction and cell cycle research. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based

speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BCHM 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (AGRY 64000, BIOL 64000, BTNY 64000 , HORT 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

BCHM 69000 - Seminar In Biochemistry

Credit Hours: 1.00. Seminary In Biochemistry. Permission of instructor required.

Credits: 1.00

BCHM 69500 - Special Topics In Biochemistry

Credit Hours: 1.00 to 4.00. Critical examination of developments in specialized fields of biochemistry. Open to candidates for the Ph.D. degree in biochemistry; others by special permission of the professor in charge. Permission of instructor required.

Credits: 1.00 to 4.00

BCHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BCHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Biological Sciences

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological

processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 11200 - Fundamentals Of Biology (UCC: SCI)

Credit Hours: 2.00. This course is designed primarily to provide an introduction to the principles of biology. BIOL 11200, 11300 is a two-semester principles of biology sequence that introduces students to the major concepts of the discipline, with emphasis on the experimental and logical basis of the information presented. BIOL 11200/11300 includes lectures on diversity and evolution, and on the development, structure, and function of organisms, cell structure, cell function, ecology, genetics, biochemistry, and molecular biology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

BIOL 11300 - Fundamentals Of Biology (UCC: SCI)

Credit Hours: 2.00. This course is designed primarily to provide an introduction to the principles of biology. BIOL 11200, 11300 is a two-semester principles of biology sequence that introduces students to the major concepts of the discipline, with emphasis on the experimental and logical basis of the information presented. BIOL 11200/11300 includes lectures on diversity and

evolution, and on the development, structure, and function of organisms, cell structure, cell function, ecology, genetics, biochemistry, and molecular biology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

BIOL 11500 - Biology Resource Seminar (UCC: IL)

Credit Hours: 1.00. This course is designed to help integrate new biology students into the Department of Biological Sciences, to help them adjust to university life, and to assist them in developing academic and intellectual survival skills using the medium of introductory Biology courses. The course meets twice a week in groups of 20-25 students. Each section is led by an academic advisor and an undergraduate teaching intern. The class periods have an on-going emphasis on connecting students to one another as resources while learning information, critical thinking skills and problem-solving strategies. Topics include bioethics, time management, available academic resources, biology majors and curricula and career development. Students are exposed to opportunities in undergraduate research, summer internships, the study abroad program, and teaching internships. Throughout the course, students are encouraged to plan their college education rather than merely choose their courses. Permission of department required.

University Core Curriculum (UCC): (UCC: IL) Credits: 1.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 14501 - First Year Biology Laboratory With Neuro Research Project (UCC: SCI)

Credit Hours: 2.00. This laboratory course has been designed under the goals of the Center for Authentic Science Practice in Education (CASPiE) which aims to expose students to novel research as a means to teach them laboratory science. This course is designed to engage students in authentic research while acquiring necessary skills and concepts to be successful as a biology major. Our topic is Neuroanatomy of Auditory Pathways. We will begin with a series of skills and knowledge building weeks and then transition into independent research projects that culminate in a public presentation of the data in a poster session. In this course, students will learn the fundamentals in neurobiology as well as use sophisticated analysis and instrumentation to answer a research question. Critical thinking in experimental design as well as interpretation and communication of data will be stressed. The goals for this course are to gain a foundation in basic biological measurements and techniques, hone the analytical skills, appreciate the excitement of scientific discovery, and have fun along the way. Permission of department required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and

hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 19500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 19700 - Biology Freshman Honors Seminar

Credit Hours: 1.00. Discussion meetings with Freshman Honors students to cover various aspects of freshman biology, research opportunities in biology, and career choices in biology. Open only to students in the Biological Sciences Honors Program. The credit may be used only toward free electives. Permission of department required.

Credits: 1.00

BIOL 20100 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 2.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

BIOL 20200 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 2.00. BIOL 20200 is the second semester of a two-semester course that includes two 50-minute lectures designed to give the student a basic understanding of the anatomy, organization and function of the human body. To assist the student in mastering the subject matter, there will be

introductory lectures on the basic concepts of biochemistry and cell biology before the major topics of the course are dealt with. These topics include the organization of the human body; muscle and bone; the nervous system (including the special senses); the cardiovascular system, respiration; digestion; metabolism; excretion; fluid, electrolyte, and acid-base balance; the endocrine system; reproduction and genetics. The subject matter will be related to relevant questions of clinical or health-related importance. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological

techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 20600 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Continuation of BIOL 20500. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and

metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23000 - Biology Of The Living Cell

Credit Hours: 3.00. An introduction to modern cell biology for students who may not have taken a previous college course in biology. All students with the appropriate prerequisites are welcome, and this course will be of special interest to students from engineering, chemistry, physics and computer science. This course will provide a solid foundation in modern cell biology concepts for engineers and students from other disciplines.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal,

and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23101 - Bioinstrumentation Lab

Credit Hours: 1.00. Introduction of laboratory instruments used to measure physiological events. Stimulation and conduction of electric signals within the mammalian nervous system and other excitable tissues are demonstrated. Fundamental circuit elements and concepts include resistance, capacitance, inductance, op-amps, impedance, voltage, current, power, and frequency, following the content introduced in BME 231. Fundamental analog measurement concepts include adequate bandwidth and amplitude and phase linearity. Integrative design project emphasizes the practical aspects of quantitative physiological measurements. This course is to prepare learners with sufficient physics knowledge and lab skills to pursue the Bioinstrumentation and Imaging Depth Areas. Moreover, students are introduced to programming (using Python) to deepen the understanding of basic concepts and learn basic skills in data processing. SPICE software will be used throughout the course to design/simulate various analog circuits.

Credits: 1.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.

Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological

function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 29300 - Sophomore Seminar: Planning Your Future In Biology

Credit Hours: 1.00. Biology 29300 is a one-credit course designed for sophomores in the Department of Biological Sciences. This course will help students maximum the remainder of their undergraduate career. The course will cover biology career information and suggestions for professional development. Students will learn about the various disciplines that make up modern Biological Sciences. Students will learn about opportunities in undergraduate research and tour a research laboratory. In-depth presentations from biology alumni from a variety of fields are featured. Assignments include a Plan of Study, a resume, and a written paper evaluating the career path of one alumni speaker and describing the student's response to the presentation.

Learning Outcomes: 1. Demonstrate the ability to communicate well, both orally and in writing. 2. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 29400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by freshman and sophomores. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 29500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, or laboratory work selected for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 31200 - Great Issues Genomics And Society

Credit Hours: 3.00. The course will revolve around genomics, the science and technology involved in determining the sequence of the entire DNA complement in an organism. Almost everyone has heard of the human genome project, but fewer are aware of the spectacular technical progress in this field and the fact that many thousands of genomes have been sequenced. Until recently, most of these have been microorganisms, but technological and computational progress has made it progressively easier and cheaper to sequence the genomes of higher organisms. This field may have more of an impact on your future lives than almost any other field of the life sciences - mostly because it touches on all areas of study. The course will focus on the impact that genomes will have in selected areas. It will begin with a basic understanding of the science and technology that gave rise to our current capabilities in sequencing and the fact that technology continues to provide greater capacity and cheaper prices. You will soon see that every field in the College of Science is well represented in the science and technology. We will then go on to see how genomics influences many topics that affect our daily lives and can possibly provide answers to some critical questions (or at least pose better questions): What is the basis of personalized medicine? What does genomics tell us about the genealogy of mankind? What impact will genomics have on our future food supply and our ability to feed a population of 9 billion people? What is the human microbiome and what does that mean to me? Similarly, what is the gut microbiome, the mouth microbiome, etc? What impact will genomics have on the development of alternative energy sources, especially biofuels? In every area, we will discuss the scientific challenges, but also the ethical and societal implications. In most cases, there is no one right answer, but a series of choices that can be guided by ethical considerations.

Learning Outcomes: 1. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. Credits: 3.00

BIOL 31800 - The COVID-19 Pandemic

Credit Hours: 3.00. The course will cover the COVID-19 pandemic caused by the SARS-CoV-2. It will provide a window onto the intersection of science and society and the challenges created when leaders and the populace are inadequately informed. We will explore the biology of the virus and the disease caused by it. The primary literature will be reviewed with the aim of critically evaluating data and understanding the basis of inferences or lack thereof. Vaccine and antiviral approaches will be discussed. Historical approaches to pandemics, comparative analyses of responses by countries and states, investigations into the origins of SARS-CoV-2, and

various conspiracy theories will be topics of deliberation. We will see how achieving scientific understanding is a dynamic process. The COVID-19 scientific literature will be dissected with a focus on publication ethics. Students will each make an oral presentation and write an essay on a relevant topic thereby allowing them to fulfill graduation requirements. These assignments will require the demonstration of the capacity to report data, organize the material, and convey it using formal English. All sources will need to be documented and assessed for credibility. The initial tranche of classes will be lectures by the Professor with discussion. Most of the remaining classes will be student presentations on assigned topics with moderation by the Professor. Guest lectures by appropriate experts will also be included.

Learning Outcomes: 1. Understand viruses as a life form. 2. Recognize science as the basis for public policy. 3. Evaluate sources critically. 4. Conduct and present research on media and scientific publications. 5. Write a thoughtful, thorough, well-written and ethical article. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 32701 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 36701 - Principles Of Development Lab

Credit Hours: 1.00. This laboratory will offer students the experience working with different model systems to observe developmental processes, examine key regulatory gene expression, and manipulate gene functions used in different biochemical, molecular and genetic approaches.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 1.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 39300 - Preparing For Your Future In Biology

Credit Hours: 1.00. Biology 39300 is a one-credit course for

junior and seniors in the Department of Biological Sciences. This course will help students begin to prepare for life after Purdue. Students will learn about interviewing, job searching, graduate and professional school searching, resumes, industrial practices, and how to evaluate job/school offers. Construct a polished image on top of your solid biology foundation! Get the job or get admitted to the school you want.

Learning Outcomes: 1. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 39500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 39600 - Premedical Planning Seminar

Credit Hours: 0.00. This course is designed for sophomore and junior students who are planning to attend medical school. The course offers information and advice on the MCAT, the application process, the personal statement, the interview, and letters of recommendation. Students in the course will also formulate an alternative career plan. The course meets the first 10 weeks of the semester.

Credits: 0.00

BIOL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

BIOL 39800 - Biology Teaching

Credit Hours: 3.00. Supervised teaching experience for juniors. Must have approval of course instructor in advance. Permission of instructor required.

Credits: 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their

impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43200 - Reproductive Physiology

Credit Hours: 3.00. This course provides an integrated approach to examining how tissues interact to regulate reproductive processes. Each section begins by describing fundamental commonalities of a reproductive event in a variety of species. This is followed by an emphasis on the difference in the details of that event among species. Students will be strongly encouraged to initiate and participate in discussions related to course topics during class. To gain a deeper understanding of physiological processes, students are asked to select a current research article related to reproductive physiology. Students are then required to present an analysis of article to the class in a formal presentation. Some of the topics to be covered in lecture include ovarian and testicular function, the hypothalamic-pituitary-gonadal axis, fertilization, establishment of the placenta, maternal support of pregnancy, parturition, and lactation.

Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

BIOL 44100 - Biology Senior Seminar In Genetics

Credit Hours: 1.00. This is a required course for genetics majors. It provides exposure to current research in genetics and molecular biology via invited faculty speakers. Students enrolled in the course who have actively participated in research also give a presentation on their own work. Other students are assigned to review current literature in one aspect of the semester's topic. The topic selected for review is in an area of current research in genetics and may vary from year to year.

Credits: 1.00

BIOL 44201 - Introductory Module: Protein

Expression

Credit Hours: 2.00. This is a project-oriented course designed to give the student exposure to laboratory research through a series of five-week modules. During this five-week introductory module, the students will learn the basics of expression, isolation, and characterization of recombinant proteins in *E. coli* using SDS-PAGE and Western blotting. In the first half of the course, students work initially with one recombinant DNA construct and then are given a second construct to use to identify the protein expressed. *Note: additional hours as needed for particular experiments.

Learning Outcomes: 1. Learn principles and basic lab techniques related to protein works such as: Bradford Assay, SDS-PAGE, Western Blot and GST affinity purification. 2. Review their knowledge on over-expression of protein using recombinant DNA cloning in E. coli and other expression systems. 3. Learn experimental design, result analysis and troubleshooting area also emphasized. 4. Learn real lab experience when they design and perform the final project by their own. Credits: 2.00

BIOL 44202 - Animal Physiology

Credit Hours: 2.00. This is a project-oriented course designed to give the student exposure to laboratory research through a series of five-week modules. This module involves measurements of respiratory, cardiovascular, neural and renal function. When appropriate measurements are made in both rats and humans.

Learning Outcomes: 1. Conduct both animal and human physiological experiments and to learn how to deal with the complexities inherent in live animal experiments. 2. Appreciate the advantages and limitations involved in both human and animal experiments. 3. Learn basic surgical anatomy and surgical anatomy and surgical procedures. 4. Gain an appreciation for the accurate measurement, analysis, evaluation and interpretation of physiological results. 5. Gain some practice in presenting and explaining results to a group. Credits: 2.00

BIOL 44203 - Bacterial Synthetic Biology Laboratory

Credit Hours: 1.00. This course will provide an introduction to state-of-the-art bacterial molecular genetics using the intestinal bacterium *Escherichia coli* as a model cell.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Understand the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 3. Demonstrate an understanding of concepts and theories of genetics. 4. Demonstrate an understanding of laboratory skills used in genetics. 5. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 6. Demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. Credits: 1.00

BIOL 44205 - Introduction To LabVIEW

Credit Hours: 1.00. This is an introductory course for LabVIEW programming. During this five-week module students will learn proper data acquisition techniques and be introduced to the fundamentals of the LabVIEW graphical programming environment. Through LabVIEW, students will learn the tools to develop programs capable of acquiring, processing, analyzing, saving and displaying data for engineering and scientific applications.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and

analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 44207 - Exploration Of Protein Structure

Credit Hours: 1.00. This module is a hands-on exploration of the principles of enzyme structure. Students will use computers to retrieve and inspect protein structures from publicly available databases. Through the performance and analysis of sequence structural alignments, students will explore the relationship between primary, secondary and tertiary structures and the final active form of a protein.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 44211 - Laboratory In Anatomy And Physiology

Credit Hours: 1.00. This module will study various organs, and also discuss diseases associated with it. The heart, brain, kidney, stomach, liver etc. will be studied in detail using histology, dissection, and instrumentation. Emphasis will be placed on problem solving using various case studies. The students will be required to give presentation.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. Credits: 1.00

BIOL 44212 - Microscopy And Cell Biology

Credit Hours: 1.00. In this five-week module, students will learn how to prepare specimens for viewing by fluorescence microscopy. Specimens include mammalian tissue culture cells and zebrafish embryos. The emphasis will be on the staining of the cytoskeleton in these preparations, utilizing antibodies and fluorescence probes. The specimens will be viewed by wide-field and confocal laser scanning fluorescence microscopy. Images will be acquired, processed and analyzed by modern computational methods. Students will learn the basics of cell culture, immunocytochemistry, fluorescence microscopy, digital image processing and data analysis. At the end of the course, students prepare a PowerPoint presentation of their images and data.

Learning Outcomes: 1. Students demonstrate proficiency with skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. Credits: 1.00

BIOL 44215 - Multidisciplinary Design Of Systems And Devices For Physiology Measurements

Credit Hours: 2.00. This physiology laboratory course will provide an opportunity for undergraduates from the College of Science (Department of Biology) to collaborate with students in

other colleges (Agriculture, Education, Engineering, Health and Human Science & Technology) to experience and learn how to operate effectively as part of an interdisciplinary team to address physiological problems in the cardiovascular system, respiratory system and in biological transport. Specifically it will emphasize how these teams can use information, tools, techniques and theories from their disciplines to solve problems that are beyond the scope of any single discipline. In this process, the students will develop an appreciation of both engineering design and the classic hypothesis-driven experimental science as tools to solve complex real-world problems. This course will promote effective communication, systems thinking, laboratory skills, self-management and professional ethics. Students will learn to measure and quantify biological changes, analyze data (including statistical analysis) and interpret its meaning as it applied to the larger physiological question at hand. These skills will be necessary for teams to efficiently function in an interdisciplinary setting both in future courses and more importantly when they enter the workforce.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Student will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. 7. Students will demonstrate the ability to measure dynamic changes in living organisms, tissues, and cells.

Credits: 2.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the most current literature.

Credits: 3.00

BIOL 47500 - Senior Seminar In Neurobiology

Credit Hours: 1.00. Students are required to give a 30-45 minute talk based on primary journal articles chosen from a list on current developments in neuroscience or a related topic of the students choice. They are also required to read and contribute questions about each paper, and to provide anonymous feedback to each presenter.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. 4. Understand scientific methods. 5. Interpret and analyze primary literature in biology. 6. Interpret data in a meaningful way.

Credits: 1.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of

genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49500 - Special Assignments

Credit Hours: 0.00 to 18.00. Readings, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 49700 - Biology Honors Seminar

Credit Hours: 1.00. Required of all students participating in honors research. Discussions and presentations of research, including seminars by those students who are completing their honors research thesis.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Become familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Understand the chemical and physical principles that govern biochemical and physiological processes. 9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Understand the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 12. Understand the principles governing the development of multi-cellular animals and plants. 13. Understand ways in which organisms interact ecologically with each other and their environment. 14. Understand how evolutionary forces influence organisms to produce adaptations. 15. Acquire knowledge of the ways in which animals communicate with each other. 16. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 17. Be familiar with taxonomic and phylogenetic relationships among organisms. 18. Extend basic ecological principles to species and ecosystem conservation. 19. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 20. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Demonstrate an understanding of laboratory skills used in genetics. 23. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 24. Become familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to

address environmental and energy problems. 25. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 26. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 27. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 28. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 29. Demonstrate an understanding of prokaryotic cell structure. Credits: 1.00

BIOL 49800 - Biology Teaching

Credit Hours: 3.00. Supervised teaching experience for juniors and seniors. Must have approval of course instructor in advance. Permission of instructor required.

Credits: 3.00

BIOL 49900 - Biology Honors Thesis Research

Credit Hours: 1.00 to 4.00. Research under the guidance of a scientist. Submission of honors tutorial petition and consent of faculty tutor and Honors Committee. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 50700 - Principles Of Molecular Biology

Credit Hours: 3.00. Molecular aspects of structure and function of nucleic acids and proteins, including recombinant DNA research. Prokaryotic and eukaryotic molecular biology are given equal weight.

Credits: 3.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to

publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 51201 - Advanced Cell Biology

Credit Hours: 3.00. This course provides detailed analysis of cell biology, gene regulation and applications of cell biology and genetics. This is a lecture, literature and presentation-driven course that utilizes an advanced graduate-level textbook as a foundation to dive into recent primary literature on new and emerging topics in cell biology.

Learning Outcomes: 1. Understand the fundamentals of gene expression, cytoskeleton, cell signaling, cell-cell communication and how cell systems are visualized. 2. Predict outcomes and analyze experimental approaches. 3. Compare and contrast the use of experimental techniques used in the field of cell biology. 4. Formulate hypotheses based on several pieces of primary data. 5. Evaluate scientific literature critically and communicate their views. 6. Analyze and interpret the quality of primary data. 7. Communicate in oral presentations recent findings in the field. 8. Write a paper that summarizes and integrates the literature associated with a major discovery. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains

within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 53000 - Introductory Virology

Credit Hours: 3.00. Detection, titration, and chemistry of viruses; viral host interactions: bacteriophage-bacterium, animal virus-animal cell, plant virus-plant cell; tumor viruses: infection and transformation.

Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of

a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 54200 - Modular Upper-Division Laboratory Course

Credit Hours: 0.00 to 2.00. This is a project-oriented course designed to give the student exposure to laboratory research through a series of 5-week modules. The student must complete the introductory 5-week module or have the consent of the instructor before taking the other modules. Topics may include animal cell culture, cloning and blot analysis, DNA fingerprinting, analysis of nucleic acid sequences, animal physiology, bacterial genetics, advanced neurophysiology, chromatin structure, eukaryotic gene expression, genomics, yeast molecular biology, and molecular virology, etc.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate the ability to measure dynamic changes in living organisms, tissues, and cells. Credits: 0.00 to 2.00

BIOL 54202 - Computer Laboratory: Data Analysis In Neuroscience

Credit Hours: 1.00. This course introduces students to computational techniques for analyzing real-world neuroscience data using Python and Jupyter Notebooks. Focusing on datasets such as neural time series, students will learn how to preprocess, visualize, and statistically analyze complex data. Topics include basic programming, statistical modeling, and practical applications relevant to neuroscience research. Emphasis is placed on developing hands-on skills for interpreting experimental data and solving real-world problems, preparing students for advanced study or careers in data-driven neuroscience.

Learning Outcomes: 1. Apply Python programming to process and analyze real-life neuroscience datasets, including time-series data. 2. Perform statistical modeling and hypothesis testing on neuroscience data to extract meaningful insights. 3. Use computational tools to create effective visualizations and interpret their relevance to neuroscience research. 4. Design and implement reproducible data analysis workflows using Jupyter Notebooks. 5. Combine programming, statistics, and neuroscience concepts to address real-world research questions. Credits: 1.00

BIOL 54410 - Sensory Systems

Credit Hours: 3.00. The goal of Sensory Systems is to gain an

understanding of the mechanisms that underlie sensory perception at the molecular, cellular, and systems level. This will be accomplished by examining how various forms of energy are transduced into the electrochemical messages of the nervous system, what pathways the information travels within the nervous system, and how this information is processed and perceived.

Credits: 3.00

BIOL 54900 - Microbial Ecology

Credit Hours: 2.00. A study of microbial interactions with other organisms and the environment. Aquatic and terrestrial ecosystems as well as interactions between nonpathogenic microbes and plants and animals will be discussed. Offered in alternate years.

Credits: 2.00

BIOL 55000 - Plant Molecular Biology

Credit Hours: 3.00. A comprehensive study of plant molecular biology and plant molecular genetics. Topics will include the structure and expression of plant nuclear, chloroplast, and mitochondrial genomes, and plant viruses.

Credits: 3.00

BIOL 55001 - Eukaryotic Molecular Biology

Credit Hours: 4.00. This is a general survey course intended for advanced undergrads and beginning grad students. The course will draw upon examples from the plant, animal, and fungal kingdoms, and will familiarize students with the basic principles of molecular biology analyses as they apply to eukaryotic organisms. By the end of the course students should have knowledge of these molecular processes and should be able to design and analyze experiments dealing with these topics. This is not a first course in molecular biology. Permission of department required.

Learning Outcomes: 1. Have knowledge of molecular processes. 2. Be able to design and analyze experiments dealing with these topics. Credits: 4.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 55700 - Physiology II

Credit Hours: 3.00. A study of the human cardiovascular, pulmonary, blood, and gastrointestinal systems. Higher neuronal functions and intersystem interactions will be discussed.

Credits: 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56010 - Clinical And Molecular Aspects Of Neurodegenerative Diseases

Credit Hours: 3.00. This course focuses on the molecular and clinical aspects of neurodegenerative diseases. The first part of the course will briefly introduce critical brain structures, with a focus on neurons and glia and will evaluate molecular mechanisms that underlie protein aggregation and cell death. The remainder of the course will focus on the multiple aspects

of specific neurodegenerative diseases. Permission of instructor required.

Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 56400 - Molecular Genetics Of Development

Credit Hours: 3.00. The course examines the genetics and developmental bases as well as phenotypes of 40 genetic disorders. Chromosomal, single gene, complex and developmental genetic disorders are studied in detail. Emphasis is placed on molecular techniques and understanding current primary literature.

Credits: 3.00

BIOL 56600 - Developmental Biology

Credit Hours: 0.00 to 4.00. Principles of development with emphasis on concepts and experimental evidence for underlying mechanisms, including molecular, cellular, and supracellular approaches.

Credits: 0.00 to 4.00

BIOL 57310 - Stem Cell Biology

Credit Hours: 3.00. In this course students will develop a clear understanding of stem cells' defining features, activities and potential utility. Stem cell research is pursued in nearly all areas of medicine. This course focuses on important definitions and characteristics of stem cells and develops a general overview of stem cell biology. The course builds on this overview of stem cell biology by examining specific example of developmental biology, methodology and the potential applications of stem cell therapy.

Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning

processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58010 - Teaching Evolution: Online Course

Credit Hours: 3.00. Evolution is one of the most important and most widely misunderstood concepts in science. Teaching Evolution is an online course to help you deepen your understanding of evolutionary concepts, develop instructional strategies, and address obstacles in the teaching of evolution.

Learning Outcomes: 1. The nature of scientific processes. 2. The value and limitations of scientific process. 3. The scientist's use of terms such as fact, law, theory, and hypothesis. 4. How multiple forms of evidence are used to test theories. 5. Applications of scientific processes in different situations. 6. How and why evolution is a cornerstone of biology. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations,

communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 58602 - Laboratory In Ecology

Credit Hours: 1.00. This course is intended to complement many of the concepts discussed in BIOL 58601 Ecology Lecture. By studying selected topics in depth, both experimentally and through primary literature, you should gain a greater understanding of ecological principles and the process of science as it is applied to a variety of ecological topics. Permission of department required.

Learning Outcomes: 1. Read and discuss papers from the primary literature. 2. Develop hypotheses and conduct hypotheses testing through discussion of literature and predictions for experiments conducted in class. 3. Write and present on a scientific paper based on experiments conducted in class and lab-related topics. 4. Discuss parametric and non-parametric statistical tests and discuss the proper application of statistical tools. 5. Use multiple field techniques for sampling terrestrial plants, aquatic insects, and avian behavior. Credits: 1.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed

reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

BIOL 61100 - Crystallography Of Macromolecules

Credit Hours: 3.00. The special techniques required in the structure determination of biological macromolecules. Symmetry of macromolecules. Data collection and processing. The isomorphous replacement technique. The molecular replacement technique. Use of anomalous dispersion. Restraint and constraint refinement. Computational techniques. Prerequisite: BIOL 51100. Permission of instructor required.

Credits: 3.00

BIOL 61919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BIOL 62800 - Light Microscopy For Life Scientists

Credit Hours: 2.00. This course provides life science graduate students with fundamental concepts and knowledge related to how modern light microscopes can be used to observe, measure, and manipulate biological samples. Completion of this course will help students understand the capabilities and limitations of current technologies. This knowledge can be used to design new experiments that successfully incorporate modern imaging technologies.

Learning Outcomes: 1. Understand ray and wave properties of light and how they affect image formation in a microscope. 2. Understand the different optical components of a light microscope and how they affect the light to form an image. 3. Understand the principles of modern imaging techniques with a focus on fluorescence to be able to incorporate them into their own research program. 4. Know the dos and don'ts in sample preparation and imaging. 5. Know the potential and limitations of digital image processing and analysis. Credits: 2.00

BIOL 64700 - Membrane Protein Structural Biology

Credit Hours: 2.00. This course focuses on the structural basis of the functions and dysfunctions of diverse membrane proteins, analyzed by X-ray, electron microscopy, and spectroscopy. The functions include transport, biogenesis, and transmembrane signaling. Unique problems associated with the structure analysis of integral membrane proteins are discussed.

Credits: 2.00

BIOL 65001 - Techniques In Molecular Biology

Credit Hours: 1.00. Techniques in Molecular Biology will introduce graduate students to the theory and practice of many commonly used methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth 600-level scientific courses, for their rotations, and for future laboratory work. Exams will be "experimental" in nature (e.g., "design and experiment to do something..." or "in this type of situation, which technique/vector/etc. would best be used, and why...").

Learning Outcomes: 1. Students are expected to learn the theoretical basis for many commonly used molecular biology techniques. An emphasis is placed on how correctly to use these techniques in real-life laboratory situations, and the limitations of each technique.

Credits: 1.00

BIOL 65200 - Advanced Ecology Discussion

Credit Hours: 1.00. Weekly meetings to discuss and evaluate seminal papers in the fields of evolutionary, population, and community ecology. During the last week, students will critically evaluate a contemporary paper on a topic related to the "classic" papers discussed during the semester. Students will have a choice among papers submitted by participating faculty members; their critique will be assessed on content, originality, rigor, and clarity.

Credits: 1.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69100 - Biological Research Methods

Credit Hours: 1.00. Open to graduate students in the Department of Biological Sciences and designed primarily for students in their first year of graduate study. The course consists of two laboratory assignments, each of which lasts about two months. Students may take one or two of these per semester. During each laboratory assignment, the student will be exposed to methods, equipment, and experimental procedures currently in use in a particular departmental research laboratory selected by the student and through arrangement with the professor in charge of that laboratory. Admission by consent of the departmental Graduate and Advanced Studies Committee.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 69600 - Seminar

Credit Hours: 1.00. Each semester there are several separate seminar offerings. They will likely be on the following topics: biochemistry, crystallography, ecology and population biology,

genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. The student's record will indicate the specific seminars in which he/she has participated. Oral presentations required. At least two credits are required of Ph.D. candidates.

Credits: 1.00

BIOL 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BIOL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Biomedical Engineering

BME 19500 - Selected Topics In Biomedical Engineering

Credit Hours: 0.00 to 4.00. Specialized topic areas in BME for which there are not specific courses, workshops, or individual study plans, but having sufficient student interest to justify the formalized teaching of a course.

Learning Outcomes: 1. Students will gain knowledge of topics relevant to the practice and research in Biomedical Engineering. Credits: 0.00 to 4.00

BME 20200 - Thermodynamics In Biomedical Engineering

Credit Hours: 3.00. The major objective for this course is to understand and exploit basic principles of thermodynamics as they apply to biological systems and biological processes. Specifically, the course will focus on biological processes across scales: from the nanometer scale of biomolecules, the micrometer scale of cells, the millimeter and meter scales of tissues and organisms, all the way up to the 100+ meter scale for bioprocess equipment and industry-scale production with a focus on dynamic behaviors of systems. The course can be loosely classified into two parts: (i) guiding principles and fundamental equations for thermodynamics in biological and biomedical engineering, and (ii) applications of engineering principles to the study of biological systems.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations that describe thermodynamic processes. (SO 1, 6, 7) 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering disciplines: First & Second Law of Thermodynamics; Open vs closed systems; Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility. (SO 1, 6, 7) 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with bioprocesses. (SO 7) 4. Solve problems for thermodynamic processes using the computer. (SO 1, 2, 5, 7) 5. Develop the attitudinal dimensions of computational thinking: Confidence in dealing with complexity; Persistence in working with difficult problems; Tolerance for ambiguity; The ability to deal with open-ended problems; The ability to communicate and work with others to achieve a common goal or solution. (SO 2) 6. Gain experience in working with non-linear systems and systems away from equilibrium. (SO 1, 6)

Credits: 3.00

BME 21400 - Introduction To Biomechanical Analysis

Credit Hours: 3.00. The goal of this course is to provide a foundation in biomechanics (analysis of forces, moments, and stresses) that will allow students to quantify the loads in the skeleton as well as design surgical tools and total joint replacements. In addition to the topics on vectors, particle equilibrium, and rigid body mechanics one would expect in a classical mechanics course, biomedical engineers must also have a working knowledge of skeletal anatomy. Consequently, anatomical descriptions and anthropometric data will be incorporated throughout the course. As part of the implant design, students will also be introduced to more advanced topics in mechanics such as Hertz contact theory, shear-lag theory, and composite beam theory.

Learning Outcomes: 1. Understand particle statics, rigid body statics, and the mechanics of deformable solids and their applications to problems in orthopedics. 2. Analyze selected biomechanical systems and measurements at a range of biologically relevant length scales. 3. Evaluate quality and reliability of assumptions and methods used in selected biomechanics applications. Credits: 3.00

BME 21401 - Biomechanical Analysis Laboratory

Credit Hours: 1.00. This course provides hands-on training in engineering and biological principles of biomechanics. Topics include translation of theoretical vector and equilibrium

calculations to three-dimensional body problems, computer aided design and finite element analysis, harvest and storage of biological samples, and tension, compression and bending testing with mechanical testers. A design project reinforces the mechanical testing skills learned in class, combining skill-building in group work and experimental design. This course will prepare students for deeper study of biomechanics.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. 2. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (SO 4). 3. Implement the experimental design process, including proper maintenance of a design laboratory notebook and use of appropriate statistical analysis methods, as it applies to mechanical performance of materials used for medical device design (SO 6). 4. Employ fundamental tools, testing procedures, and analyses relevant to computer-assisted design (CAD), FEA, and biomechanics, for rapid prototype development, analysis of mechanical properties of tissues, materials, and devices (SO 7). 5. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 1.00

BME 22000 - Biomolecules: Structure, Function, And Engineering Applications

Credit Hours: 3.00. Classes of molecules (biomolecules) such as sugars, lipids, proteins, and nucleic acids that form the cellular components of living organisms. Explores the chemistry behind the structure and function of these important classes of biological molecules. Hydrogen-bonding, hydrophobic forces, electrostatic interactions along with other weak interactions discussed with reference to their importance in biomolecular systems in an engineering context.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. Credits: 3.00

BME 22201 - Introductory Biomeasurements

Credit Hours: 3.00. The foundations of basic circuit theory are introduced including voltage-current characteristics of resistive and reactive elements, Ohm's and Kirchhoff's Laws, equivalent sources, transformations and superposition, transient response, instantaneous and average power, AC impedance, dynamic response of first and second order systems. Permission of department required.

Credits: 3.00

BME 22400 - Biomeasurements Lab

Credit Hours: 1.00. Laboratory exercises will reinforce the foundations of basic circuit theory. Electronic instruments are used in the context of biomedical signal measurement and processing and include the use of oscilloscopes, function generators, transducers, electrodes, biopotential amplifiers and digital data collection and analysis. Laboratory exercises utilize industrially relevant instruments for measurement and acquisition of time varying signals arising from electronic and bioelectric sources. Permission of department required.

Credits: 1.00

BME 23100 - Bioinstrumentation and Circuit Theory

Credit Hours: 3.00. In this course, we'll delve into the core principles of circuit theory, covering topics such as voltage-current relationships in resistive and reactive components, Ohm's Law, Kirchhoff's Laws, and source equivalency. We will also explore advanced concepts like transient responses, AC impedance, and the dynamic behavior of first and second-order systems. Students will gain proficiency in phasor analysis of sinusoidal signals, complex number calculations, signal sampling, and spectral analysis. We'll also touch on linear time-invariant systems, frequency response, and both the design and implementation of filters. A portion of the course will focus on control systems via the s-domain. To enrich your understanding and skill set, we will also introduce programming through Python, which will facilitate data processing and deepen your conceptual grasp. This course serves as a preparatory steppingstone for BME 33000 (Bioelectricity), equipping you with the essential physics knowledge and skills required for more advanced studies.

Learning Outcomes: 1. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 3.00

BME 23101 - Bioinstrumentation and Circuit Theory Lab

Credit Hours: 1.00. Introduction of laboratory instruments used to measure physiological events. Stimulation and conduction of

electric signals within the mammalian nervous system and other excitable tissues are demonstrated. Fundamental circuit elements and concepts include resistance, capacitance, inductance, op-amps, impedance, voltage, current, power, and frequency, following the content introduced in BME 231. Fundamental analog measurement concepts include adequate bandwidth and amplitude and phase linearity. Integrative design project emphasizes the practical aspects of quantitative physiological measurements. This course is to prepare learners with sufficient physics knowledge and lab skills to pursue the Bioinstrumentation and Imaging Depth Areas. Moreover, students are introduced to programming (using Python) to deepen the understanding of basic concepts and learn basic skills in data processing. SPICE software will be used throughout the course to design/simulate various analog circuits.

Learning Outcomes: 1. Appraise the validity of established bioelectricity hypotheses and circuit models based on quantitative physiological measurements. 2. Document procedures, measurements, and subsequent data analysis in clear and cohesive laboratory reports. 3. Design an analog bioinstrumentation measurement system meeting prescribed specifications to accurately record a physiological event. 4. Design and simulate analog circuits using SPICE. 5. Create simple Python code to plot, analyze, and denoise physiological data. Build functions to simulate a simple bioinstrumentation system. 6. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. Credits: 1.00

BME 24101 - Introductory Biomechanics

Credit Hours: 3.00. This course uses didactic lecture material to introduce students to the principles of mechanics and how these concepts apply to musculoskeletal tissues. Permission of department required.

Credits: 3.00

BME 24300 - Biomechanics Laboratory

Credit Hours: 1.00. This course uses laboratory experiments to introduce students to the principles of mechanics and how these concepts apply to musculoskeletal tissues. Permission of department required.

Credits: 1.00

BME 25600 - Physiological Modeling In Human Health

Credit Hours: 3.00. Introduction to the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. Engineering skills taught and practiced within the context of human disease, injury, and illness on extended problem sets which include mathematical modeling and problem solving with appropriate documentation. Main physiological systems of focus are cardiovascular, pulmonary, and renal, and common afflictions thereof.

Learning Outcomes: 1. Understand the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. 2. Understand the process of mathematical modeling of human anatomy and physiology, including technical description of objectives, methods, results, and conclusions from modeling exercises. Credits: 3.00

BME 28000 - Frontiers In Biomedical Engineering

Credit Hours: 1.00. This course introduces the rapidly emerging field of biomedical engineering by exposing students to a wide range of research activities in the Weldon School and to a variety of experiential learning opportunities. Topics addressed include career paths, professional development opportunities, and career development skills including creating a plan of study, informational and job interviewing, writing a resume, technical writing, preparing effective oral presentations, and peer-editing.

Learning Outcomes: 1. Construct a logical and articulate argument in written format from independent collection of information. 2. Construct and deliver a logical and articulate oral presentation based on independent collection of information. 3. Evaluate oral and/or written presentations for clarity and content. 4. Identify and/or describe how biomedical engineering solutions affect society 5. Identify multiple career pathways that are available to a biomedical engineer. 6. Recognize opportunities that enhance professional career development. 7. Recognize contemporary issues impacting biomedical engineering. Credits: 1.00

BME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

BME 29600 - Biomedical Engineering Projects

Credit Hours: 1.00 to 4.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report is required. Permission of instructor required.

Credits: 1.00 to 4.00

BME 30200 - Professional Development And Design In Biomedical Engineering

Credit Hours: 2.00. This course explores design, career, and professional topics in Biomedical Engineering. To prepare students for capstone and engineering practice, students will engage in case study design encompassing conceptualization, requirements generation and system design. Essential design elements such as user need, ideation, constraints, regulatory, and documentation will be reviewed and applied. Additional career and professional topics include resume writing, interviewing, and professional conduct; post-graduate education and life-long learning; and industrial, clinical, and research opportunities in Biomedical Engineering.

Credits: 2.00

BME 31300 - Biofluid Mechanics

Credit Hours: 3.00. Fundamental concepts and principles of fluid mechanics in the context of biomedical applications. Governing equations of flow and transport are derived from the first principles and applied to conditions characteristic of the human circulatory system.

Learning Outcomes: 1. Formulate differential equations and determine appropriate boundary conditions to model biomedical fluid mechanics problems. 2. Apply conservation laws of flow physics to describe the fluid flow in various geometries, particularly for flow in a cylindrical tube. 3. Recognize and quantitatively describe flow conditions characteristic of blood flow in human circulation in health and disease. Credits: 3.00

BME 31400 - Experimental Methods In Biomechanics

Credit Hours: 3.00. This course focuses on the concepts and applications of mechanics, imaging, and instrumentation methods towards evaluating experimental biomechanics at multiple length scales. Core concepts include mechanics of materials, dynamics, contact theory, and the simplifying assumptions and standardizations often needed to conduct experiments on biomaterials and living systems. Experimental methods may include atomic force microscopy, digital image correlation, and motion analysis.

Learning Outcomes: 1. Understand solid mechanics and dynamics principles and concepts underlying experimental methods. 2. Apply mathematical equations and underlying assumptions of biomechanics to experimental methods. 3. Analyze selected biomechanical systems and measurements across a range of relevant length scales. 4. Evaluate quality and reliability of assumptions and methods used in selected biomechanics applications. Credits: 3.00

BME 32000 - Introduction To Biomaterials Science And Engineering

Credit Hours: 3.00. This junior-level course will introduce fundamental materials science and biomaterial concepts to BME students and will lay the foundation for more advanced courses in biomaterials and tissue engineering. The course will introduce the vocabulary and technical concepts in biomaterials science relevant for problems in medical device, biotechnology, or biomaterials industries. The course material will present phenomena at the intersection of materials science and biology.

Learning Outcomes: 1. Identify the basic classes of biomaterials and understand their chemical makeup. 2. Understand the relationship between chemical structure and biomaterial properties. 3. Understand interactions of implantable biomaterials with proteins and cells. 4. Describe the major components of the biological response to implanted materials. 5. Select basic in vitro and in vivo tests to evaluate material biocompatibility. 6. Understand regulations and standards that dictate biomaterial testing. Credits: 3.00

BME 32001 - Biomolecules And Biomaterials Laboratory

Credit Hours: 1.00. Introductory laboratory experience focused on engineering concepts and practices in the analysis of biomolecules and cells. Topics include fundamental quantitative techniques of analysis, methods of isolation, identification, and quantification of biomolecules and cells, and analysis of integrated biosystems. Concludes with student-driven design project.

Learning Outcomes: 1. Independently describe the theoretical basis of, and put into practice, fundamental analytical tools and techniques used in the isolation, characterization, and quantification of biomolecules and cells. 2. Collect, record, process, statistically analyze and report experimental data related to the analysis of biomolecules and cells in an accurate and understandable manner. 3. Conceptually design a simple analytical method and/or tool for solving a medically-relevant problem based upon detection/analysis of a specific biomolecular or cellular related abnormality. Credits: 1.00

BME 32200 - Probability, Statistics, And Applications In Biomedical Engineering

Credit Hours: 3.00. Probability theory and statistical methods are developed for life science applications. Analytical tools such as hypothesis testing, estimation of moments, sampling theory, correlation and spectral analysis are developed and applied to identifying underlying processes in biological systems, developing realistic models of physiological processes, designing experiments, and interpreting biological data.

Learning Outcomes: 1. Solve probability problems with biomedical engineering applications using the basic axioms of probability (1). 2. Describe the fundamental properties of probability density functions with applications to single and multivariate random variables (1,6). 3. Describe the functional characteristics of probability density function frequently encountered in life-science research such as the Binomial, Uniform, Gaussian, and Poisson (1,6). 4. Calculate confidence intervals and levels of statistical significance using fundamental measures of expectation and variance for a given biological data set (6). 5. Quantify the correlation between sets of random processes for given mathematical functions and biological data sets (1,6). 6. Identify the distribution function underlying a given biological process or medical application (1,6). 7. Model and describe behavior of biological systems by means of random processes (1,3). 8. Apply basic statistical concepts including descriptive statistics, Bayes Theorem, statistical inference, and hypothesis testing to biological and medical systems (1). 9. Design a statistical experiment using appropriate control and test conditions (1,6). 10. Apply statistical tools (e.g. Student's t-test) to interpret experimental results (1,6). 11. Apply statistics testing to the evaluation and acceptance of medical processes, devices, and systems (1). Credits: 3.00

BME 33000 - Bioelectricity

Credit Hours: 3.00. Fundamentals of bioelectricity of the

mammalian nervous system and other excitable tissues. Passive and active forms of electric signals in both the single cell and cell-cell communication, tissue and systematic bioelectricity, mathematical analysis including Nernst equation, Goldman equation, linear cable theory, and Hodgkin-Huxley Model of action potential generation and propagation.

Learning Outcomes: 1. Examine, describe, and solve membrane models underlying bioelectrical function and physiology. This includes but is not limited to ion-channel dynamics, membrane filtering, sub-threshold signaling, action-potential generation and propagation, chemical signaling, and basic neural circuit dynamics. 2. Formulate and appreciate the intricate similarities between silicon circuits and biological circuits. Specifically, by interfacing the two in simple recording and stimulation experiments. Furthermore, this objective will also introduce the students to instrumentation techniques to map currents and voltages from cells. 3. Solidify basic quantitative techniques in solving bioelectrical dynamics. This includes but is not limited to the use of ODE's and PDE's in solving signal propagation, Hodgkin-Huxley dynamics, and neural circuit dynamics. Overall, this will provide a sound theoretical framework to begin exploring electrophysiological devices with biomedical engineering applications.

Credits: 3.00

BME 33100 - Biosignals And Systems

Credit Hours: 3.00. This course applies mathematical analysis tools to biological signals and systems. Frequency analysis, Fourier and Laplace transforms, and state equations are used to represent and analyze continuous and discrete-time biosignals. Classic feedback analysis tools are applied to biological systems that rely on negative feedback for control and homeostasis.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Write correctly and clearly in forms and styles appropriate for communications professions and audiences.

Credits: 3.00

BME 33400 - Biomedical Computing

Credit Hours: 3.00. This course explores computational approaches to analyzing biological data and solving biological problems. Students will fit and interpret biological data, apply probabilistic and differential equation modeling techniques to biological processes, and assess numerical tools for biomedical applications. Special attention is given to the built-in analysis functions of MATLAB.

Credits: 3.00

BME 35200 - Cell And Tissue Mechanics

Credit Hours: 3.00. This course will explore the biological principles of cellular/tissue behaviors and properties. Topics include: fundamental concepts of cellular structure and tissue organization, biomolecular elements and their properties, cell shape, cell adhesion and migration, mechanotransduction, pattern formation in embryos, and stem cell and tissue regeneration.

Credits: 3.00

BME 35400 - Cell And Tissue Laboratory

Credit Hours: 1.00. This course develops quantitative biomechanical methods to analyze cell/tissue behavior and properties and to solve biomechanical engineering problems. Topics include: bio viscoelasticity, failure, filament dynamics, membrane dynamics, biofluid dynamics, cellular dynamics, and tissue dynamics.

Credits: 1.00

BME 35600 - Mathematical Models And Methods In Physiology

Credit Hours: 3.00. This course uses real-world engineering problems to introduce advanced analytical tools and concepts relevant to biomedical engineering design. Each topic is briefly introduced, and students work in small teams to investigate physical mechanisms involving human anatomy and physiology using mathematical models and methods. Group work is done during scheduled class periods and other times by arrangement. Topics include brain concussions and protective helmets, origin of the electrocardiogram and bi-ventricular pacing, and deep brain stimulation for Parkinson's disease. Mathematical methods include coupled linear and nonlinear differential equations, finite element analysis, and simulated annealing. Creation of custom computer code is required. Students prepare extensive and detailed written technical reports. A midterm and a final examination encourage individual accountability and understanding.

Learning Outcomes: 1. Accurately describe, with proper use and pronunciation of medical

terms, the anatomy of a selected body organ or system, and a related disease process after independently conducting research using resources from various sources including the Internet. 2. Create a useful biomechanical model of a body organ or tissue, describing the function of the body organ system in terms of algebra, calculus, and/or governing differential equations, evaluating constants in mathematical models on the basis standard normal physiology and routine medical observations. 3. Write full length technical research progress reports and discuss the strengths and limitations of a particular mathematical model, with graphs and charts and a comprehensive bibliography of relevant research literature. 4. Correctly solve equations, including second order, linear differential equations, and systems of equations, including coupled linear or nonlinear differential equations, by the method of undetermined coefficients, via programming in MATLAB or a suitable computational engine including the use of arrays and subroutines. 5. Effectively work in diverse teams, both face-to-face and online, to enhance productivity and eliminate errors, while reconciling theoretical calculations with experimental observations and validating mathematical models by comparison with known analytical solutions. Credits: 3.00

BME 35700 - Foundations Of Biomedical Data Science

Credit Hours: 3.00. This course presents foundational data science methods for analysis of complex biological datasets encountered in biomedical engineering research and applications. After a brief (1-2 weeks) introduction and review of mathematical concepts necessary for data science, the course will cover representative areas of regression, supervised machine learning, unsupervised machine learning, model evaluation, and uncertainty quantification. Assignments and exams will focus on practical examples spanning basic science, engineering, and medical applications.

Learning Outcomes: 1. Identify the appropriate statistical tests to analyze data fitting a given probability distribution. 2. Propose an analysis plan for large datasets that tests a hypothesis or answers an exploratory analysis question. 3. Implement the appropriate computational model for their analysis plan and interpret the model results with appropriate consideration of uncertainty. Credits: 3.00

BME 36000 - Introduction To Biomedical Imaging

Credit Hours: 3.00. The main focus of this course is on basic principles and modes of major bioimaging modalities. This course covers image characterization, interactions of electromagnetic radiation with tissue, fundamental principles in imaging and detection, and modes of imaging modalities (e.g., reflection, transmission, absorption, and emission). Conventional bioimaging modalities will be used to teach the topics. This course is particularly aimed at students in science and engineering interested in gaining a conceptual understanding of several critical biological and biomedical imaging methods, including optical microscopy, ultrasound, X-ray imaging, computed tomography, nuclear medicine, magnetic resonance imaging, and mobile health. Overall, this course provides a conceptual framework for biomedical imaging in a reasonably concise and understandable format (with minimal mathematical approaches).

Learning Outcomes: 1. Explain the principles of conventional Bioimaging modalities. 2. Distinguish advantages and disadvantages of each modality. 3. Describe utilizations of imaging in biological and medical fields. 4. Determine appropriate bioimaging methods for particular studies and applications. Credits: 3.00

BME 38000 - Professionalization In Biomedical Engineering

Credit Hours: 2.00. This active learning course covers standards of practice, regulatory and legal requirements, and moral and ethical issues; increases awareness of career paths; and addresses current and emerging trends and challenges at the frontiers of the field of biomedical engineering. Most class sessions will consist of a short introduction to a topic followed by a breakout session for active investigation of the topic. During the breakout sessions, course instructors will be available to guide discussion and answer questions.

Learning Outcomes: 1. Recognize and describe professional and ethical codes of conduct, and ethical dilemmas which pertain to a practicing biomedical engineer. 2. Use basic technical writing skills to clearly and concisely synthesize relevant technical information, data, and ideas from multiple sources. 3. Generate personal

statements, curriculum vitae and other professional documents that are used in choses career pathways that are available to biomedical engineers. 4. Describe contemporary issues in biomedical engineering and understand their impact on personal and public health. 5. Identify skills and opportunities that enhance professional career development. Credits: 2.00

BME 38100 - Implantable Materials And Biological Response

Credit Hours: 3.00. BME 381 combines biomaterials, their biological response, and interactions between implantable materials and biological systems. Materials science of implantable materials; overview of implantable biomaterials and interactions between implants and biosystem; in vitro and in vivo biocompatibility tests; and specific examples on implant-tissue interactions, biocompatibility, and evaluation tools are presented.

Credits: 3.00

BME 38300 - Implantable Materials Laboratory

Credit Hours: 1.00. BME 38300 is a corequisite course to BME 38100, supplementing the basic science of BME 38100 with quantitative, analytical examples and problems related to fundamental engineering principles in implantable materials. Topics include: microstructure, phase transformation, processing and design issues related to major engineering materials used for implantation purposes.

Credits: 1.00

BME 38800 - Applied Biomaterials

Credit Hours: 3.00. This course covers foundational knowledge in the fields of materials science and engineering. Emphasis is placed on the materials used in biomedical applications and the relationship between material properties and the performance of these biomaterials.

Learning Outcomes: 1. Describe the structure-function relationship between chemical and bulk properties of materials. 2. Provide examples of biomedical applications for different classes of materials. 3. Identify material properties that are critical for the proper function of metallic, polymeric, ceramic, and composite biomaterials. 4. Interpret phase diagrams for single- and multiple-component materials. 5. Describe corrosion of metals and degradation of polymers and identify the possible consequences of each. 6. Select appropriate biomaterials for specific applications, considering function, biocompatibility, and relevant engineering constraints. 7. Propose appropriate processing techniques for improving material properties for specific biomaterial applications. 8. Identify the important biomaterial design criteria for specific biomedical applications. 9. Communicate effectively, both in oral and written formats, with regards to biomaterials science and engineering. Credits: 3.00

BME 38900 - Junior Experimental Design Laboratory

Credit Hours: 2.00. Practical experience with engineering design principles is presented through inquiry-based modules. Each module contains computer simulation, experimental design, implementation, and data analysis. Modules address biomedical applications in different areas of BME.

Learning Outcomes: 1. Use theoretical equations from fluid, heat, and mass transport to describe, model, analyze, and explain biomedical data. 2. Design experiments to investigate biomedical transport phenomena, collect relevant data, and compile a comprehensive report that clearly demonstrates the findings and implications of the data. 3. Work in a term to simulate and experimentally model biomedical transport, and use peer-and self-reviews to describe how each team member contributed to group efforts. Credits: 2.00

BME 39000 - Professional Development And Design In Biomedical Engineering

Credit Hours: 2.00. Introduction to a diverse spectrum of current topics relevant to the technical, professional, and career aspects of Biomedical Engineers. The course topics will focus on the early stages of the design process (e.g. need identification, problem formulation, innovation and idea generation), professional communication skills (e.g. written and oral reporting and documentation), and ethics of biomedical design and research (e.g. ethical codes and decision making, animal care and use in research and testing, authorship and intellectual property, social and environmental impact of design).

Learning Outcomes: 1. Able to identify medical needs relevant to Biomedical Engineering

solutions, an understanding of realistic constraints which impact biomedical engineering design 2. Understand ethical and professional responsibilities which impact design 3. Understand the need for a multidisciplinary team to solve biomedical engineering design projects. 4. Able to independently acquire knowledge from a variety of sources including biology and medicine as well as other engineering disciplines. 5. Able to communicate effectively in written form and evaluate written reports 6. Able to identify a career development pathway that is relevant to their personal identity and training as Biomedical Engineers. Credits: 2.00

BME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

BME 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

BME 40100 - Mathematical & Computational Analysis Of Complex System Dynamics In Biology, Medicine, & Healthcare

Credit Hours: 3.00. An introduction to analysis of complex system dynamics that appear in biology, medicine, and healthcare. Key topics include nonlinear dynamical concepts associated with phase plane, bifurcation, stability diagram, oscillation, and chaotic systems along with concepts from discrete systems and stochastic processes. These topics are taught within the context of mathematical and computational models related to both non-communicable diseases (i.e. cancer) and communicable diseases (i.e. HIV/AIDS). Courses projects are drawn from recent literature.

Learning Outcomes: 1. Graphically, analytically, and numerically analyze nonlinear dynamical models and numerically analyze discrete-event and stochastic models of biological, medical, or

healthcare systems. 2. Describe possible behaviors of a given system, including how a system may be manipulated within the inherent boundaries. 3. Present, in oral and written format, an analysis and critique of the application of dynamical modeling of a biological system to solve or understand an engineering problem. Credits: 3.00

BME 40500 - Biomedical Engineering Design Project

Credit Hours: 4.00. Design and management of biomedical engineering projects. Teams design and implement a solution to a biomedical engineering problem utilizing skills gained in previous course work. Oral and written presentation of design and demonstration of function are required.

Credits: 4.00

BME 41100 - Quantitative Physiology

Credit Hours: 3.00. This course applies systems theory and explores feed forward and feedback control in the context of physiological systems. Control, frequency response, and linear systems concepts are applied to action potential generation, motor control, heart rate regulation, and other physiological processes.

Credits: 3.00

BME 41101 - Quantitative Physiology In Biomedical Engineering

Credit Hours: 4.00. This course is an introductory course in physiological systems and an introductory course in classical feedback control theory for biomedical engineers. It aims to apply systems theory and classical feedforward and feedback control in the context of physiological. Control, frequency response, and linear systems concepts are applied to action potential generation, motor control, heart rate regulation, and other physiological processes. Approximately a third of the course will be devoted to physiological systems, a third to classical control theory and a third to the application of classical control and systems theory to physiological systems.

Learning Outcomes: 1. Describe major physiological features the neuromuscular, cardiac, pulmonary, and renal systems. 2. Analyze, reduce and implement a dynamic in-silico model of a Plant (standard engineering systems and physiological systems) using linear systems theory descriptors in the frequency and state-space domains. 3. Analyze the characteristics of the linearized Plant model and design a classical feedback controller . 4. Define specifications of the normal operation of a system in nominal operation. 5. Analyze the system stability of a Plant. 6. Analyze frequency response and construct Bode plots. 7. Work in teams to understand and implement a model of a physiological system. 8. Group project work and reporting. Credits: 4.00

BME 41400 - Computational Mechanics In Biomedical Engineering

Credit Hours: 3.00. Teaches modeling methods for biomedical engineering problems with focus on fluid/solid mechanics. Students are introduced to the most common numerical techniques in biomedical engineering and will learn the applications of these techniques to biomechanical problems at various length scales, such as cardiac contraction and blood flow. The first half of this course focuses on modeling based on ordinary differential equation (ODE) and partial differential equation (PDE) as well as on how we integrate these equations analytically or numerically using software packages such as MATLAB. The other half focuses on fundamentals of fluid/solid mechanics and also on the application of COMSOL or similar software to solving relevant biomechanical problems.

Learning Outcomes: 1. Solve biomechanical problems involved with physical situations of real biomedical systems by formulating ordinary and partial differential equations and solving the equations via MATLAB. 2. Investigate complicated fluid flows observed in biomedical systems by applying knowledge in fluid mechanics and using COMSOL. 3. Analyze stress and strain of biomedical materials by applying continuum mechanics and using COMSOL. Credits: 3.00

BME 43000 - Introduction To Bioimaging

Credit Hours: 3.00. Provides a conceptual framework for understanding the theory and technical principles behind major Bioimaging modalities. The main focus is on basic principles and modes of imaging involving interactions of electromagnetic radiation with biological tissue. Main concepts include imaging and detection, modes of imaging modalities (e.g. reflection, transmission, absorption, and emission), and basic image characterizations. Applications include several critical biological and biomedical imaging methods, such as optical microscopy, ultrasound, X-ray imaging, computed tomography, positron emission tomography, and magnetic resonance imaging. Demonstrations of conventional Bioimaging modalities are used to teach the topics.

Credits: 3.00

BME 43100 - Neural Engineering

Credit Hours: 3.00. An introduction to Neural Engineering - an emerging field of developing and applying engineering solutions to research or translational problems concerning the brain. The course will cover a broad range of topics about neural sensing, modeling, stimulation, interface, and prosthetics. Course projects are drawn from real-world problems and experimental data.

Learning Outcomes: 1. Analyze neural signals in various spatial and temporal scales. 2. Examine relationships between neural activity and sensation/behavior. 3. Identify existing ways and mechanisms to modulate neural circuit functions. 4. Identify existing applications of neural prosthetics, implants, and robotics. 5. Identify, formulate, and solve engineering problems in brain research. 6. Apply knowledge of mathematics, science and engineering to neural data. Credits: 3.00

BME 44200 - Biofluid Mechanics

Credit Hours: 3.00. This course explores fluid mechanics in the context of the human circulatory system. Principal equations are derived from differential analysis of fluid flow, and models of characteristic flow conditions are fully analyzed. Biofluid mechanics, vessel biomechanics, and hemodynamic analysis of the circulation system will also be discussed.

Credits: 3.00

BME 45000 - Deep Learning For Medical Imaging

Credit Hours: 3.00. Teaches the foundation of neural network (aka Deep Learning) approaches and applications to medical imaging: or how to create computable models of biological neural systems, in particular large-scale neural networks, for processing medical images and data. Drawing inspiration from neuroscience and statistics, Deep Learning introduces the basic background on neural networks, presents computable neuron models and extends to large networks of neurons. Students study deep learning with both real and artificial neural networks, along with methods of deep learning about the environment by applying back propagation, Boltzmann machines, auto-encoders, convolutional neural networks and recurrent neural networks. Students will explore how Deep Learning is impacting our understanding of intelligence and contributing to the practical design of automatic medical imaging tools that are able to augment expert medical personnel, enhance diagnosis accuracy and speed, and lower health-care costs.

Learning Outcomes: 1. Understand and simulate a large biological neural network with several million of neurons. 2. Design and use a bio-inspired deep-learning network for application in medical imaging. 3. Write algorithms that learn to segment, track, categorize, and classify objects of interest. Credits: 3.00

BME 46000 - Cardiovascular Mechanical Support And Devices

Credit Hours: 3.00. Designed to expose students to state-of-the-art medical technologies being utilized in the treatment of patients with cardiovascular diseases, the course emphasizes the role of the biomedical engineer in the design, development and implementation of these technologies for therapeutic impact. Students completing this course will have an understanding of the role of biomedical engineers in clinical engineering and clinical research. The three components of the course, didactic presentations and discussions, laboratory dissections, and clinical shadowing are integrated throughout to teach concepts such as cardiovascular physiology, heart failure and vascular disease, treatments and treatment complications, and future directions. Clinical experts in cardiovascular diagnosis and treatment are frequent guest lecturers.

Learning Outcomes: 1. Identify key anatomical and physiological features of the cardiovascular system. They will learn this by dissecting mice and pig hearts, viewing illustrations, and both reading research articles and the textbook focused on EKGs. 2. Identify unmet clinical needs and practice brainstorming possible solutions by writing an in depth report and giving an oral presentation based on both the course material and their clinical experiences. 3. Recognize fundamental engineering concepts used to design and utilize cardiovascular medical devices by writing shadow reports based on their immersion within a clinical setting. 4. Describe and diagnose various cardiac and vascular diseases by completing a mid semester and final examination covering the course material. 5. Explain the role of a biomedical engineer in the development and implementation of cardiovascular disease treatment in healthcare by interacting with multiple health care professionals during and after their guest lectures. Credits: 3.00

BME 46100 - Transport Processes In Biomedical Engineering

Credit Hours: 3.00. This course explores engineering principles in mass and other transport processes in biological systems. Topics covered include diffusion, convection, reaction kinetics, transport in porous and fluid mediums, etc. Mathematical models of transport are developed and applied to biomedical problems and physiological systems such as the kidney/renal and oxygen/arterial systems.

Credits: 3.00

BME 47000 - Biomolecular Engineering

Credit Hours: 3.00. The course covers key chemical concepts one needs in order to modify existing biomolecules, link biomolecules with other (bio)molecules, link biomolecules with inorganic entities, create composite (bio)structures, modify specific properties of biomolecules, alter/enhance biomolecule functionality. Taken together, the rational application of these biological, chemical, and engineering tools can be used to; engineer new biomolecules, design sensors for molecular detection, create diagnostic tests, develop new imaging modalities, and design and test novel biomaterials, to name a few examples.

Learning Outcomes: 1. Describe and discuss the physiochemical properties of biomolecules. 2. Design new molecules to perform new functions. 3. Able to critically analyze literature on biomolecular engineering. Credits: 3.00

BME 48900 - Senior Design Project Lab

Credit Hours: 2.00. The biomedical engineering design process is completed starting from a preliminary system design. Student will work with their teammates to implement (e.g. build, test, iterate and evaluate) a solution to address a biomedical engineering problem statement and meet the technical specifications set forth. The resulting project design is presented and evaluated through an oral presentation, laboratory demonstration, and a final written document.

Learning Outcomes: Students will have demonstrated the ability to: 1. Integrate and apply knowledge and skills obtained in earlier work with new concepts and practices essential to the design and testing of a system or device to meet desired needs. 2. Implement the engineering design process and project management within the context of relevant design constraints. 3. Effectively communicate skills in oral and written form, both individually and as part of a team. 4. Explain/discuss realistic design constraints, including regulatory issues, societal influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. Credits: 2.00

BME 48901 - Senior Design Project Lab

Credit Hours: 3.00. The biomedical engineering design process is completed starting from a preparatory design course, BME 39000, through a preliminary system design, build and test in Senior Design Project Lab. Students will work with their teammates to implement (e.g. build, test, iterate and evaluate) a solution to address a biomedical engineering problem statement and meet the technical specifications set forth. The resulting project design is presented and evaluated through an oral presentation, laboratory demonstration, and a final written document.

Learning Outcomes: 1. Demonstrate ability to integrate and apply knowledge and skills obtained in earlier course work with new concepts and practices essential to the design and testing of a system or device to meet desired needs. 2. Implement the engineering design process and project management within the context of relevant design constraints. 3. Effectively communicate skills in oral and written form, both individually and as part of a team. 4. Explain/discuss realistic design constraints, including regulatory issues, societal influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. Credits: 3.00

BME 49000 - Professional Elements Of Design

Credit Hours: 1.00. This course advances and enhances design tools, concepts, and knowledge relevant to biomedical engineering design. Students work individually and in small teams to investigate the topic within the context of their specific senior design project in preparation for their lab. Topics include project management, human and animal subjects, ethics, regulatory affairs, literature and patent searching, and entrepreneurship.

Learning Outcomes: 1. Effectively communicate skills in oral and written form, both individually

and as part of a team. 2. Explain/discuss realistic design constraints, including regulatory issues, social influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. 3. Generate and justify solutions to a medical and/or biological problems that addresses customer needs and realistic constraints. Credits: 1.00

BME 49100 - Biomedical Engineering Design I

Credit Hours: 3.00. This course prepares students for engineering practice through a major design experience, encompassing conceptualization, requirements generation, and system and detailed design. Essential design constraints will be reviewed and applied including: safety, economics, and manufacturability. The course encompasses lectures, case studies, team formation, project assignments and generation of initial design.

Credits: 3.00

BME 49101 - Biomedical Engineering Design

Credit Hours: 2.00. This course prepares students for engineering practice through a major design experience, encompassing conceptualization, requirement generation, and system and detailed design. Essential design constraints will be reviewed and applied including: safety, economics, and manufacturability. The course encompasses lectures, case studies, team formation, project assignments and generation of initial design.

Learning Outcomes: 1. Identify and formulate the design problem, including bringing precision to the problem statement through a requirements specification. 2. Use critical thinking in the design process. 3. Conduct design using an organized design process, including planning, literature search, requirements specification, consideration of alternative approaches, determination of strategies, and design reviews. 4. Conduct design using design principles. 5. Apply engineering principles, mathematics, and science in engineering design, including methods, tools and techniques. 6. Apply technical knowledge to design, including methods, tools and techniques. 7. Analyze and interpret data. 8. Apply analytical tools and techniques to solve a design problem at the interface of engineering and biology. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a progress report, adhering to the specified format using an appropriate writing style, grammar, and spelling. Credits: 2.00

BME 49200 - Biomedical Engineering Design II

Credit Hours: 3.00. This course continues the design experience from BME 491 with verification, validation, and re-design of student projects. Regulatory and ethical design constraints will be discussed. Oral presentation and report writing are required.

Learning Outcomes: 1. Use critical thinking in the testing and redesign process. 2. Make appropriate measurements necessary for testing the design, addressing the problems associated with the interaction between living and nonliving systems. 3. Apply engineering principles, mathematics, and science in engineering redesign, including methods, tools and techniques. 4. Apply technical knowledge to testing and redesign, including methods, tools and techniques. 5. Analyze and interpret testing and verification data. 6. Discuss ethical issues in engineering design for biological and medical applications. 7. Determine ways to test a design to determine its functionality (success of the design). 8. Apply knowledge of regulatory constraints to engineering design. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a final report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 11. Make an oral presentation using effective visual aids. Credits: 3.00

BME 49500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient student interest to justify the formalized teaching of a course. Permission of instructor

required.

Credits: 1.00 to 4.00

BME 49800 - Biomedical Engineering Projects

Credit Hours: 1.00 to 4.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report is required. Permission of instructor required.

Credits: 1.00 to 4.00

BME 50000 - Biomedical Engineering Graduate Seminar

Credit Hours: 0.00. A -0- credit hour graduate seminar course consisting of weekly, one hour technical presentations by Department of Biomedical Engineering and other engineering faculty at IUPUI, researchers from local and national academia, representatives from industry and peer graduate students in the BME Department. These seminars introduce graduate BME students to a wide variety of bioengineering related topics in academic research and commercial industries. The students are exposed to research questions, methodologies and technical developments both inside and outside of their topical concentration areas. Through open inquiry, discourse and application of the Socratic method the course moderator helps the BME graduate students enhance and refine their critical thinking and technical presentation skills. Permission of department required.

Credits: 0.00

BME 50100 - Multivariate Analyses In Biostatistics

Credit Hours: 3.00. This course focuses on fundamental principles of multivariate statistical analyses in biostatistics, including multiple linear regression, multiple logistic regression, analysis of variance, and basic epidemiology. The fundamental theories are applied to analyze various biomedical applications ranging from laboratory data to large-scale epidemiological data.

Learning Outcomes: 1. Understand fundamental concepts in multivariate regression analyses. 2. Translate research questions into suitable multivariate frameworks. 3. Design studies with appropriate statistical power. 4. Compute and interpret appropriate statistical estimates from multivariate analyses. 5. Use a major statistical software package (e.g. STATA, SAS, SPSS, and R) to perform large-size data analyses.

Credits: 3.00

BME 51000 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BME 51100 - Biomedical Signal Processing

Credit Hours: 3.00. An introduction to the application of digital signal processing to practical problems involving biomedical signals and systems. Topics include: overview of biomedical signals; filtering to remove artifacts; event detection; analysis of waveshape and waveform complexity; frequency domain characterization; modeling biomedical signal-generating systems; analysis of non-stationary signals; pattern classification and diagnostic decisions, MATLAB is used throughout to apply the theory and techniques discussed to biomedical signals.

Learning Outcomes: 1. Understand practical problems faced in objective analyses of biomedical signals. 2. Understand the underlying physiological and anatomical factors that are relevant for numerous types of biomedical signals. 3. Understand the theoretical background underlying the use of digital signal processing for biomedical applications. 4. Understand the practical benefits and limitations of various digital signal

processing approaches and identify the best solution for specific problems. 5. Implement appropriate signal processing algorithms for practical problems involving biomedical signals and systems 6. Propose, carry out, orally present, and write up in a conference proceedings format a biomedical-research mini project using- signal processing algorithms. Credits: 3.00

BME 51500 - Practical MRI And Applications

Credit Hours: 1.00. This course covers basic theory and practical training for magnetic resonance imaging (MRI). Weekly labs allow students to directly train on an MRI system within the Purdue MRI Facility. Weekly lectures are provided on a broad range of applied and relevant topics, including image formation and contrast, pulse sequence basics, artifacts, advanced sequences, and safety. The course is ideally designed for students who want to make use of MRI to advance their research.

Learning Outcomes: 1. Describe the fundamentals of magnetic resonance imaging. 2. Understand safety concerns associated with operating an MRI system. 3. Demonstrate proficiency in the operation of one of the MRI systems on campus. Credits: 1.00

BME 52100 - Biosensors: Fundamentals And Applications

Credit Hours: 3.00. (ABE 56000) An introduction to the field of biosensors and an in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and biosecurity applications.

Credits: 3.00

BME 52500 - Neural Engineering

Credit Hours: 3.00. Neural engineering is an emerging engineering discipline that combines the various disciplines of engineering with the biological, physical and material sciences to find the means to access, understand, manipulate, and perhaps enhance the nervous system and the information it contains. The aim of this course is to provide an introduction to the field of neural engineering and will start with the introduction of the neuron, the bioelectric phenomenon and the neural/electronic interfaces placed in the extracellular space on the peripheral nervous system. These topics will be reinforced through hands-on practical experiments using electrodes for stimulation and recording.

Credits: 3.00

BME 52600 - Cardiac Electrophysiology

Credit Hours: 3.00. This course will introduce the basic principles of cardiac-generated bioelectricity as measured at cellular, extracellular and body surfaces. The generation, detection and classification of abnormal cardiac rhythms will be emphasized. Clinical and engineering principles of relevant electro-therapies will also be studied including cardiac pacemakers, defibrillators and ablation therapies involving cardiac mapping and a variety of ablative energy sources. Modern signal processing methods as applied to electrocardiography will also be presented. Permission of department required.

Credits: 3.00

BME 52700 - Implantable Systems

Credit Hours: 3.00. The course material and lectures will focus upon how the anatomy and physiology of the target organ system impacts the design specifications for biomedical and implants and the biosensors that can be part of the command and control strategy for the implant. The course material is roughly organized according to motor (skeletal, cardiac) and sensory (vision, audition, olfaction, touch) and visceral (lungs) organ systems. For each topic area there will be a brief introduction to the physiology and neuroanatomy of the target organ system or biological environment (e.g. subcutaneous implants). Each topic area will have companion lectures demonstrating the extent to which biomedical engineers have been able to fabricate functional replacement (prosthetic) or assistive (orthotic) devices and tissue interfaces (electrodes). For example, issues related to performance, powering, communications, command control and user interfaces for auditory and visual neuroprosthesis are presented immediately following lecture materials describing these organ systems. Although not central to the course content, tissue and cellular responses to materials will be stressed throughout the semester. Topics will include normal wound healing processes, host response to implants and general biocompatibility. Lectures will emphasize fundamental principles of bioengineering as related to the design of implantable systems and will require student participation in classroom discussions. Permission of instructor required. Permission of department required.

Credits: 3.00

BME 52800 - Measurement And Stimulation Of The Nervous System

Credit Hours: 3.00. (ECE 52800) Engineering principles addressing questions of clinical significance in the nervous system: neuroanatomy, fundamental properties of excitable tissues, hearing, vision, motor function, electrical and magnetic stimulation, functional neuroimaging, disorders of the nervous system, development and refinement of sensory prostheses.

Learning Outcomes: 1. The ability to design and utilize models of neural systems to explain or predict physiologic behavior. 2. The ability to

verbally present information related to measurement of the nervous system. 3. A systems-level understanding of the organization and operation of vision, audition, and motor function. Credits: 3.00

BME 53000 - Imaging Diagnostic Technologies For Medical And Biological Applications

Credit Hours: 3.00. This gateway course teaches the physics, engineering techniques associated with modern imaging and diagnostic tools for biological and medical applications. The course covers fundamental principles of radiology, optics, contrast generation (including genetically encoded probes and physiological indicators), image formation, detection, and analysis. The specific biomedical imaging modalities covered include: x-ray, computed tomography, nuclear medicine imaging, ultrasound, optical microscopy and tomography, and MRI. The specific biological microscopy modalities covered include: phase contrast, DIC, confocal microscopy, two-photon microscopy and super-resolution microscopy. The course also teaches the principle concepts of adaptive optics, light sheet microscopy, 4Pi microscopy, and modern super-resolution microscopy techniques (PALM/STORM, STED and ISM). To bridge the technology and physics with the latest diagnostic advances and biomedical discoveries, research progresses in specific biomedical applications are presented by leading experts in their respective biomedical field such as OCT, ultrasound, MRI, fluorescence microscopy, electron microscopy, concurrent MRI and optical functional imaging, and super-resolution fluorescence microscopy. This course also includes a crash sub-course on MATLAB programming including both introductory content and contents of MATLAB-C API and MATLAB-C-CUDA (GPU computing).

Learning Outcomes: 1. Describe fundamental principles, such as atomic structure, particle and tissue interactions, light and sound propagation, Huygen's principle, refraction, interference, diffraction and abbe's fundamental resolution limit, wave propagation of light and sound, Fresnel and Fraunhofer diffraction principles. 2. Describe the general concept of signal detection, principles of detectors, noise sources and leading development trend of detectors such as APD, PMT, CCD, CMOS, EMCCD and sCMOS. 3. Describe physical principles and considerations of instrumentation design in planar radiography, fluoroscopy, computed tomography (CT), positron emission tomography (PET), single photon emission computed tomography, ultrasound imaging and magnetic resonance imaging. 4. Understand, design and draw basic optical sketches for a simplified imaging system in either wide-field, or focused optical geometry. These imaging systems includes: Widefield, Phase Contrast, DIC, Confocal, Two photon, Adaptive optics (AO) two photon, 4Pi, I5M, SIM, RESOLFT, STED and PALM/STORM microscopy techniques. Credits: 3.00

BME 53700 - Experimental Methods In Biomedical Engineering

Credit Hours: 3.00. A 3-credit graduate level engineering course that covers issues related to general laboratory practice, techniques, instrumentation and analysis methods utilized by Biomedical Engineering researchers working in the life sciences. Both theoretical and practical aspects of experimental design and data analysis are covered using select examples from BME life science researchers here on the IUPUI campus. Most topic areas are presented from a decidedly analytical and engineering viewpoint. Students should have successfully completed courses in elementary analog electronic circuits and ordinary differential equations, and should be prepared to solve related homework problems using any available software programming tools (e.g. Matlab, Maple, Visual C, Visual Basic, etc.). No prior knowledge of the biological sciences is required although participants would benefit from having taken a first year undergraduate course in Chemistry and/or Biology. Permission of instructor required. Permission of department required.

Credits: 3.00

BME 54000 - Biomechanics

Credit Hours: 3.00. Application of engineering mechanics to the study of normal and diseased musculoskeletal systems, including bone and soft tissue biology, musculoskeletal statics and dynamics, mechanical properties of biological tissues, and structural analysis of bone-implant systems. Permission of instructor required.

Learning Outcomes: 1. Explain how concepts in continuum mechanics and constitutive models apply to tissue biomechanics. 2. Solve basic biomechanics problems related to health and disease in bone and soft musculoskeletal tissues. 3. Investigate appropriate constitutive models based on tissue structure, physiology, and relevant assumptions. 4. Design a simplified computational biomechanics model of a tissue system of biomedical relevance.

Credits: 3.00

BME 54200 - Cell & Tissue Mechanics

Credit Hours: 3.00. This course develops and applies scaling approaches and simplified models to biomechanical phenomena at molecular, cellular, and tissue level. Topics include: Molecular forces; Viscous drag; Brownian motion; Diffusion; Polymer mechanics; Polymer dynamics; Molecular motors; Cytoskeleton; Viscoelasticity; Membrane; Cell migration; Cell adhesion; Mechanobiology; Mechanotransduction; Elastic, viscoelastic. and poroelastic behavior or tissues & Cell-matrix interaction.

Learning Outcomes: 1. Solve analytically basic biomechanics problems or estimate their approximate solutions. 2. Utilize gained knowledge to interpret experimental results related to biomechanics and characterize them in the form of equations. 3. Develop computational models for biological systems or design experiments. Credits: 3.00

BME 54400 - Musculoskeletal Biology And Mechanics

Credit Hours: 3.00. This course will cover topics relevant to skeletal tissues (bone, tendon, ligament, cartilage and meniscus, muscle) including skeletal morphology, physiology, cell biology, development, adult osteogenesis, tissue mechanics, mechanical adaptation, failure (fracture) and fracture fixation. Students will gain a working understanding of tissue biology and physiology and mechanical principles governing tissue formation, maintenance and adaptation and failure. Prerequisites: BME 24100 or comparable mechanics course. Note: Students with advanced math backgrounds as well as biochemistry and cell biology may be prepared to take this course at the discretion of the instructor. Permission of instructor required.

Credits: 3.00

BME 54500 - Orthopaedic Tissue Mechanics

Credit Hours: 3.00. Orthopaedic tissues, such as bone, cartilage, tendon and ligament, serve functions that are largely mechanical in nature and that are critical for our health. This course is structured around classical topics in mechanics of materials and their applications in biomechanics and musculoskeletal tissues. Primary emphasis will be on the mechanical behavior of tissues, including elastic and failure properties as well as more advanced topics such as anisotropy, nonlinearity, viscoelasticity, poroelasticity, damage, and fatigue. Importantly, the theories used to describe these mechanical properties were originally developed for advanced engineering materials such as fiber composites, polymers, elastomers, hydrogels, etc. Thus, while the theories will be presented in the context of biological materials, potential applications are much broader. Tissue microstructure and its importance to the material properties will be covered. Mechanics of whole bones and implants (composite and asymmetric beam theories) and the mechanical function of native and artificial joints (contact mechanics, lubrication and wear) may also be discussed, time permitting. Some homework assignments will emphasize the use of experimental data to develop and test theoretical models via nonlinear curve fitting and optimization using Matlab. Students will receive an introduction to tissue mechanics literature to better understand how the concepts presented in class are used in the research setting. Permission of department required.

Credits: 3.00

BME 55100 - Tissue Engineering

Credit Hours: 3.00. (BMS 52300) Integrates the principles and methods of engineering and life sciences toward the fundamental understanding of structure-function relationships in normal and pathological mammalian tissues, especially as they relate to the development of biological substitutes to restore, maintain, or improve tissue/organ function. Current concepts and strategies, including drug delivery, tissue and cell transplantation, bioartificial organs, and in vivo tissue regeneration are introduced, as well as their respective clinical applications. Permission of instructor required.

Credits: 3.00

BME 55300 - Biomedical Optics

Credit Hours: 3.00. Optical methods applied to address biological and biomedical problems. The course includes two parts: fundamentals of optical microscopy and advanced techniques that are currently used to probe and/or manipulate cell and tissue samples. Permission of instructor required.

Credits: 3.00

BME 55500 - Magnetic Resonance Imaging Theory

Credit Hours: 3.00. This course covers fundamental aspects of magnetic resonance imaging systems with an emphasis on theory, methodology, and instrumentation. Key principles are derived from the Bloch equations and Maxwell's equations. Topics include pulse sequences, signal acquisition, spatial encoding in k-space, image reconstruction, and tissue contrast. Major components of an MRI scanner are examined, including the static magnet, gradient and shim coils, transmit and receive chains, and radiofrequency coils and arrays. Learning outcomes are assessed by solving problem sets integrating theory with practical applications. As a final research project, students survey recent literature to identify a specialized topic of interest and deliver a peer-evaluated presentation to the class.

Learning Outcomes: 1. Formulate and solve MRI spin and relaxation problems using the Bloch Equations. 2. Formulate and solve MRI magnetic field problems using Maxwell's Equations. 3. Analyze radiofrequency coils with sources and passive elements. 4. Synthesize

research knowledge from recent MRI literature. 5. Communicate a specialized topic related to MRI to an audience. Credits: 3.00

BME 55600 - Introduction To Clinical Medicine For Engineering Solutions

Credit Hours: 3.00. This course introduces students to the physiology and medicine underlying major human diseases likely to become research targets in biomedical engineering and medical device development. It encourages students to upgrade research target selection to include projects that promise to improve patient care, with a major emphasis on pathophysiology and disease mechanisms. The information and intellectual approach offered will help students recognize needs for engineering solutions to current challenges in medicine. The course also previews the intellectual content of medical school, including rigor and level of detail, for engineering students considering designing medical solutions or translational engineering research as a career, emphasizing the key "11-points" necessary for practical understanding of any disease: definition of the condition, causes, functional abnormalities, structural abnormalities, early signs, history and physical findings, differential diagnosis, special studies (lab, imaging, etc.), treatment strategy, specific steps of treatment, and follow up, as well as current clinical needs for innovation and research opportunities for the future. To avoid possible redundancy with the Weldon School undergraduate curriculum, focal areas of the course include topics and body systems not covered in BME 25600, including infectious diseases, cardiopulmonary diseases, hematology-oncology, and gastrointestinal diseases.

Learning Outcomes: 1. Describe the pathogenesis of selected diseases, including causes, abnormal anatomy, and abnormal physiology. 2. Describe the diagnosis of selected diseases, including the history, physical findings, laboratory workup, imaging, and special procedures. 3. Describe the treatment for selected diseases, including strategy, specific steps, drugs, surgery, and follow-up. Credits: 3.00

BME 56100 - Preclinical And Clinical Study Design

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly regulated environment. This course concerns the preclinical and clinical study design processes for obtaining FDA marketing approval for biomedical devices. Prior to marketing a medical device in the US, specific governmental approval is required dependent on the type of device and the risk associated. This course is part of a three-course series dealing with various aspect of regulatory science. Regulatory science considers the scientific and technical foundations that support the practical testing and regulations that ensure the safety and effectiveness of medical devices. This course covers the responsible conduct of clinical and preclinical research, including evaluation of device tissue interactions and how they may be studied with preclinical animal models to predict safety and performance in human clinical trials that are necessary to gain regulatory approval for marketing. In the section on ethics we will cover several topics related to responsible conduct of clinical and preclinical research, including informed consent, risk assessment and ethical decisions, IRB oversight and ethical study design.

Learning Outcomes: 1. Understand and apply the various considerations and perspectives in designing and implementing a preclinical and clinical study strategy that will successfully lead to the marketing approval by a regulatory authority (e.g. FDA). 2. Follow a structured, iterative decision-making process for moral reasoning to reach a supported-conclusion regarding ethical dilemmas in engineering design and testing. Credits: 3.00

BME 56200 - Regulatory Issues Surrounding Approval Of Biomedical Devices

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly-regulated environment. This course primarily concerns the processes for obtaining FDA marketing approval or clearance for biomedical devices. Prior to marketing a medical device in the US, a specific governmental approval or clearance is required depending on the type of device and the risk associated with the device. This course is part of a three-course series dealing with various aspects of regulatory science. Regulatory processes for class I, II, and III devices, including combination devices, are covered with specific focus on 510(k) and PMA requirements. Approval requirements in the EU, Japan and other countries will also be briefly considered. Throughout the course, emphasis will be placed on regulatory science, regulatory strategy and principles of interacting with regulatory agencies.

Learning Outcomes: 1. Use the appropriate regulatory classification and pathway for any medical device in the U.S. 2. Describe the significance of each major component of a 510(k) submission. 3. Describe the significance of each major component of a PMA submission. 4. Develop awareness for the need to seek country-specific expertise to prepare submissions for countries outside the U.S. 5. Select the appropriate messages and clearly

present, in both oral and written communication, in a mock FDA meeting. 6. Identify contents of a CER and know the strategy for writing a CER. Credits: 3.00

BME 56300 - Quality Systems For Regulatory Compliance

Credit Hours: 3.00. Medical devices are developed and manufactured in a highly regulated environment. This course will provide an introduction, overview, and systematic study of the intent and impact of the major federal laws and regulations governing the development, manufacturing, distribution, and marketing of medical devices. Focus is on understanding the critical elements of regulatory science and quality compliance from a design control perspective. Instruction and mentoring in regulatory science skills is provided by academics and industry representatives with expertise in their fields. This course is part of a three-course series.

Learning Outcomes: 1. Demonstrate a functional understanding of regulatory compliance for biomedical devices. 2. Use the main tools within the quality craft (Ex: confidence interval, control chart, difference between a T-test and F-test). 3. Demonstrate understanding of how the FDA approaches control. Credits: 3.00

BME 56400 - Ethical Engineering Of Medical Technologies

Credit Hours: 3.00. This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice.

Learning Outcomes: 1. Recognize and analyze personal and systemic ethical issues and challenges to ethical reasoning and social responsibility. 2. Engage in empathy building activities to enhance their abilities to understand and value the perspectives of other stakeholders. 3. Use a structured, iterative, and collaborative decision-making process that considers the perspectives of multiple stakeholders in optimizing a design decision when facing an engineering problem in design and development of medical devices or assistive technologies that are ethical and socially responsible. Credits: 3.00

BME 57100 - Drug Delivery

Credit Hours: 3.00. This course explores the principles, techniques, and applications for therapeutic drug delivery and administration. This course will start with the fundamentals of drug administration: engineering principles such as diffusion and mass transport, with specific emphasis on transport in biological systems and barriers, pharmacokinetics, and drug distribution. We will examine the existing state of art in drug delivery systems: controlled release, biomaterials, and polymer-based delivery systems. Finally, we will also discuss the current field of biotechnology and biopharmaceutical: identification of novel drug targets, latest development in drug discovery, development, clinical trials, and product development, going from research to market using the latest examples from the pharmaceutical industry. Prerequisites: Basic mass transport background. Permission of instructor required.

Credits: 3.00

BME 58100 - Bio-Micro-Electro-Mechanical Systems (BioMEMS) & Biomedical Microsystems

Credit Hours: 3.00. This course covers key topics in bio-micro-electro-mechanical systems (BioMEMS) and micro-integrated systems. Properties of useful materials will be discussed in context to BioMEMS. Micro-electronics process modules used in the design and fabrication of BioMEMS and micro-integrated systems will be presented. Applications of these systems in a variety of medical practices will be discussed in detail.

Learning Outcomes: 1. Apply advanced engineering principles to model, solve, or analyze biomedical engineering problems. 2. Formulate appropriate and quantitative design specifications and evaluate potential design solutions in terms of realistic constraints. 3. Describe the challenges associated with interactions between bio-MEMS devices/strategies and living biology to address current unmet clinical needs. Credits: 3.00

BME 58200 - Advanced Biomedical Polymers

Credit Hours: 3.00. This is an advanced polymer course that provides the most recent development of biomedical polymers and their applications and covers a variety of biomedical areas such as in cardiovascular, dental, orthopedic, ophthalmologic and wound healing research. Drug, cellular and gene delivery are also covered. This course is designed for all the graduate students (M.S. and Ph.D. level) in biomedical areas. Permission of instructor required.

Credits: 3.00

BME 58300 - Biomaterials

Credit Hours: 3.00. Discussion of principles of biomaterial design, synthesis, and evaluation for various tissues/organs of the body, including orthopaedic/dental, cardiovascular, kidney, liver, lung, skin, nerve, and brain. Topics include fundamentals of materials science and engineering integrated into biology for the better regeneration of tissue. Offered in alternate years. Permission of instructor required.

Credits: 3.00

BME 59500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 60000 - Mentoring For Combined Degree (MD/PhD) Students In BME

Credit Hours: 0.00. Specialized course for M.D./Ph.D. students that is intended to maintain communication and orientation to the BME graduate program during the first two years of the combined degree program when students are completing medical school requirements on the Indianapolis campus. Requirements include attendance at one or more BME seminars on the West Lafayette campus; at least two research planning sessions with BME faculty members, BME graduate program coordinator, or assistant head; and participation in one additional graduate program activity. Permission of department required. Prerequisite is admissions to the Combined MD/PhD Degree program.

Credits: 0.00

BME 64600 - Deep Learning - Theory And Practice Of Deep Neural Networks

Credit Hours: 3.00. This course teaches the theory and practice of deep neural networks from basic principles through state-of-the-art methods. The class blends hands-on programming, using a variety of state-of-the-art programming frameworks, with theoretical treatment based on current literature. Implementation will emphasize the use of the Pytorch language and the use of dynamic computational graphs. Some previous experience with optimization techniques is important for success in the course.

Learning Outcomes: 1. Understand how to design a neural network architecture that is appropriate for a wide range of specific applications. 2. Create an efficient implementation of a wide range of standard neural network architectures in Pytorch. 3. Use neural networks to solve applications problems in classification, regression and data generation. 4. Understand how the fundamental theory of optimization can be used to efficiently train neural networks. 5. Understand the trade-offs between optimization techniques and how these techniques can be selected to achieve the best neural network training. 6. Understand and use current theory of neural network performance. 7. Understand the limitation of existing neural network theory and the likely directions of future research. Credits: 3.00

BME 65500 - Multiscale Modeling In Biomedical Engineering

Credit Hours: 3.00. This is a 600-level course that will focus on current frontiers in modeling multiscale phenomena. The course is intended for graduate students interested in advanced computational modeling. Traditional modeling approaches focus on one scale, e.g. macroscale continuum models or microscale molecular dynamics models, population scale epidemiology, whole host biology, or single cell signaling dynamics. These models are remarkably successful in engineering applications where the smaller scales can be modeled by relatively simple constitutive relations or in analyses of microscopic behavior where it can be assumed that the process is homogeneous at larger scales. This one-scale approach, however, is not well suited for problems with complex hierarchy of spatial and time scales or with population heterogeneity, such as those common in biomedical engineering. For example, there are disparate time scales in the progression of an atherosclerotic plaque or a range of spatial scales affecting the functions and treatment of biological tissues and organs. The course will introduce state-of-the-art modeling techniques, address their limitations and review emergent papers that attempt to address multiscale modeling. Examples of biomedical problems involving disparate scales in time and space will be discussed. The course will discuss the following topics specifically for multi-scale models: multiscale model construction, coupling solutions at disparate scales, data integration, sensitivity and uncertainty analyses, and model verification.

Learning Outcomes: 1. Identify and articulate multi-scale phenomena in biomedical systems. 2. Analyze and discuss a variety of multi-scale modeling techniques. 3. Identify and implement appropriate multi-scale techniques for a defined biomedical system. 4. Quantitatively evaluate multi-scale model results (uncertainty quantification, sensitivity analysis, verification and validation). Credits: 3.00

BME 68300 - Polymers In Biomedical And

Pharmaceutical Systems

Credit Hours: 3.00. This course is designed to provide backgrounds in basic polymer chemistry, synthesis, characterization, solution properties, and recent advances in polymers for applications in drug delivery, biomedical devices, tissue engineering, biotechnology, and nanotechnology.

Learning Outcomes: 1. Understand polymer synthesis and characterization techniques. 2. Utilize Flory-Huggins theory of solutions to describe the polymer free entropy and enthalpy. 3. Use thermodynamics to describe the design of smart polymer systems. 4. Describe the properties that make a material biocompatible. 5. Understand how to design drug delivery systems. 6. Design experiments to characterize nano-scale polymeric platforms. Credits: 3.00

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

BME 69500 - Advanced Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of an advanced course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 69600 - Advanced Biomedical Engineering Projects

Credit Hours: 1.00 to 6.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report is required. Permission of instructor required.

Credits: 1.00 to 6.00

BME 69699 - Biomedical Engineering Professional Practice Graduate Internship

Credit Hours: 0.00. Graduate-level internship course in Biomedical Engineering providing training in the professional skills that lead to career success in the biomedical field. Permission of instructor required.

Learning Outcomes: 1. Integrate theory, skills and principles taught in the core biomedical engineering curriculum with professional skills, awareness, and methodologies learned during the on-site internship. 2. Apply these integrated skills and principles to solve real-world problems. Credits: 0.00

BME 69700 - Directed Reading In Biomedical Engineering

Credit Hours: 1.00 to 3.00. Individualized reading course supervised by an appropriate faculty member. Approval for each reading course must be obtained from the department prior to registration. Permission of instructor required.

Credits: 1.00 to 3.00

BME 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BME 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Botany and Plant Pathology

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

BTNY 20800 - Introduction To Plant Science Research

Credit Hours: 1.00. The course is designed to expose students to the diversity of Plant Science research at Purdue and help students to get started in research and in the fantastic world of scientific discovery. Students will learn the importance of Plant Science research in society and how to become active participants of Purdue research discoveries. Students will learn about the scientific method and how discoveries are made to find answers to world problems. The students will explore department and campus resources to identify areas of research interest, learn how to search and apply for research/internship opportunities and find faculty that can serve as professional models and mentors. We will provide opportunities for students to interact and network with faculty members, professionals from industry and students involved in diverse research areas.

Learning Outcomes: 1. Recognize the importance of plant science research and its

contribution to society. 2. Define ""scientific method"" and outline the process of scientific discovery. 3. Recognize the value of publishing/communicating scientific knowledge. 4. Critically evaluate claims in both scientific and popular media publications. 5. Identify possible research and internships experiences. 6. Identify necessary skills for specific careers in Plant Sciences. Credits: 1.00

BTNY 26200 - Plant Structure And Tissue Biology

Credit Hours: 3.00. This course focuses on fundamental knowledge of the internal structure of plants, including distinct cell types, tissues, tissue systems, and organs that make up a plant. Lectures and laboratories will cover the structural parts that comprise the plant body including three major vegetative organs (roots, stems, and leaves) and a set of reproductive organs (flowers, fruits, and seeds). The goal of this course is to understand the internal organization of plants, to learn multiple lab techniques critical for plant science research, and to develop critical thinking and problem solving skills.

Learning Outcomes: 1. Describe the internal structure of plants. 2. Perform lab techniques, such as fresh sectioning and microscopy, for plant science research. 3. Critically evaluate plant cell, tissue, and organ structures. Credits: 3.00

BTNY 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first-and second-year students. Courses offered must be approved by department or program faculty, and College of Agriculture Honors Committee. Permission of department required.

Learning Outcomes: 1. Learning Outcomes will be determined by the instructor to meet a level of academic rigor consistent with the honors level given the specific course content and may also include: Critical Thinking, Communication, Cultural Understanding, Civic Responsibilities, Professional Preparation, Scientific Principles, Social Science Principles, and/or Teamwork. Credits: 1.00 to 4.00

BTNY 28500 - Plants And Civilization (UCC: STS)

Credit Hours: 3.00. This course, intended primarily for non-majors, covers the history of agriculture, with focus on the centers of origin of our major food, fiber, and medicinal plants, and their historical, cultural, and economic relevance. The course also surveys the biology of crop plants, with respect to taxonomy, anatomy, cell structure, physiology, development, and genetics. Discussions also center on the roles plant biotechnology may play in sustainable agriculture and in helping to alleviate problems caused by overpopulation and ecological stress.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Professional preparation, scientific principles, critical thinking, cultural understanding, social science principles and lifelong learning. Credits: 3.00

BTNY 29800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research for freshmen and sophomore undergraduate students. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at

a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

BTNY 35700 - The Intoxicated Botanist - Flora Of Indiana

Credit Hours: 1.00. Over millions of years, plants have evolved the ability to biosynthesize thousands of compounds. In only the last few thousand years, humans have cultivated plants for their ability to feed, heal, intoxicate and even poison-depending upon the plant and the compounds they produce. The objective of this course is to learn and apply plant taxonomy to identify and study the regional flora of Indiana with a focus on flora used in the production 'intoxicants'. Individuals must be 21 years of age no later than the first day of class. Permission of instructor required.

Learning Outcomes: 1. Identify important plant orders and families used in the making of spirits, wine and beer. 2. Recall the vegetative

and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Use plant identification keys to quickly determine the scientific name of any plant. 4. Describe the properties of plants and fungi and relate them to their abilities and their contributions to human society, namely intoxication. 5. Develop an appreciation (connoisseurship) that plants provide in the form of wine, beer, and spirits and learn about their role in human civilization, past and present. Credits: 1.00

BTNY 35710 - The Intoxicated Botanist - Study Abroad

Credit Hours: 3.00. Over millions of years, plants have evolved the ability to biosynthesize thousands of compounds. In only the last few thousand years, humans have cultivated plants for their ability to feed, heal, intoxicate and even poison-depending upon the plant and the compounds they produce. The objective of this course is to learn and apply plant taxonomy to identify and study the flora of Slovenia with a focus on flora used in the production 'intoxicants'. Permission of instructor required.

Learning Outcomes: 1. Identify important plant orders and families used in the making of spirits, wine and beer. 2. Recall the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Use plant identification keys to quickly determine the scientific name of any plant. 4. Describe the properties of plants and fungi and relate them to their abilities and their contributions to human society, namely intoxication. 5. Develop an appreciation (connoisseurship) that plants provide in the form of wine, beer, and spirits and learn about their role in human civilization, past and present. Credits: 3.00

BTNY 39000 - Selected Topics In Plant Science

Credit Hours: 1.00 to 3.00. This course deals with special topics in botany not covered in regular undergraduate coursework. Credit depends upon work done. May be repeated once for credit. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 40000 - Botany And Plant Pathology Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

BTNY 43100 - Planning For International Engagement Methods

Credit Hours: 1.00. A team-based laboratory course for students who seek experience working with international partners to plan and conduct quality service-learning projects. Using established partner relationships, students will work with international partners to address hands-on, real-world, identified challenges to learn the principles of extension methodology and sustainable community development by integrating their discipline knowledge and technical skills from previous courses. Students will also learn the intercultural communication, market analysis, project design and planning, entrepreneurial business planning for micro-credit loans and business ventures, and cultural factors affecting community food security while they work in bi-national teams to determine how best to apply their classroom knowledge and experience to respond to partners' needs and local resource constraints.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their economic and social

challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and emotional intelligence in evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate the ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

BTNY 43110 - International Engagement Methods

Credit Hours: 1.00 to 3.00. Using established partner relationships, students will travel to and live in Cap Haitien for 8-10 days and work with Haitian partners and students to learn the principles of extension methodology, sustainable community development, and how to most effectively work with local leaders. Students will also learn the intercultural communication, entrepreneurial business planning, and cultural factors affecting community food security status while they work bi-national teams to determine how best to apply their classroom knowledge and experience.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate personal growth in cultural worldview and self-awareness to confidently address specific food security-related challenges and belief in their personal ability to succeed in a particular situation. 4. Demonstrate critical thinking, intercultural curiosity, and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 5. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 6. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 7. Demonstrate intercultural openness, empathy, flexibility, and open-mindedness to work constructively as part of a bi-national problem-solving team. Credits: 1.00 to 3.00

BTNY 43120 - Evaluating International Engagement Methods

Credit Hours: 1.00. Designed for students who have just returned from the Engagement Methods for Int'l Food Security course or have previous experience working with our partners. In order to 1) fully comprehend the impact of the experience and 2) foster true long-term relationships with and service to our partners, it is required to work on our projects when we return. Matt McGregor, Former Exec. Dir. of Timmy Global Health, told us that "it's not really about the trip". It is essential that we accomplish: 1) Closure of trip experiences with partners and contacts - thank you's and complete follow-up; 2) Reflection of Purdue student experiences and personal goals/follow-up actions; 3) Promotion of food insecurity realities and opportunities for support; and 4) Planning, recommendations, and promotion of future service learning courses.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the

ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

BTNY 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third-and fourth-year students. Courses offered must be approved by department or program faculty, and College of Agriculture Honors Committee. Permission of department required.

Learning Outcomes: 1. Learning Outcomes will be determined by the instructor to meet a level of academic rigor consistent with the honors level given the specific course content and may also include: Critical Thinking, Communication, Cultural Understanding, Civic Responsibilities, Professional Preparation, Scientific Principles, Social Science Principles, and/or Teamwork. Credits: 1.00 to 4.00

BTNY 49700 - Undergraduate Research Capstone

Credit Hours: 1.00. Professional preparation of a presentation related to the student's undergraduate research experience (BTNY 49800). Students will prepare a presentation to summarize their work and present at an academic research event. Other subjects covered: graduate school and/or career preparation, resume production/refinement, interpreting scientific data, public presenting. Students must have completed BTNY 49800 prior to registering for BTNY 49700.

Learning Outcomes: 1. Define and explain the scientific method as it applies to the student's individual research project. 2. Synthesize their undergraduate research project in the form of a scientific poster. 3. Master communication skills for engaging a broad audience on scientific principles related to the student's unique research. Credits: 1.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

BTNY 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. Thesis research. Admission to the honors program. Permission of instructor required.

Credits: 1.00 to 6.00

BTNY 50400 - Advanced Weed Science

Credit Hours: 3.00. Emphasizes the mode and mechanism of herbicide action and herbicide interaction with plants, and the biology and ecology of weedy plants. Offered in odd-numbered years.

Learning Outcomes: 1. Understand the physical, biological, biochemical, and physiological parameters that influence herbicide efficacy from the start to the end of the herbicide mode of action process in plants. 2. Demonstrate the unique differences in the practical use and plant activity of the major herbicide mode of action groups used in the United States. 3. Explain the development of herbicide-resistant crops, the evolution of herbicide-resistant weeds, and apply this knowledge to describe how these factors influence modern weed management practices. 4. Provide a technical analysis comparing the mode of action for herbicides, insecticides, and fungicides and the factors involved with management of pest resistance for these different pesticide groups. Credits: 3.00

BTNY 50500 - Advanced Biology Of Weeds

Credit Hours: 3.00. Principles of weed biology and ecology, with focus on reproduction and ecophysiology, population dynamics, community ecology, and ecosystem level phenomena. Instruction will emphasize the development and refinement of critical thinking skills.

Learning Outcomes: 1. Develop as a scholar by creating a scholarly review paper on a topic or issue related to weed biology. 2. Be able to understand and analyze peer-reviewed scientific literature so that you can engage in

informed discussions about weed science. 3. Gain knowledge about key topics in weed biology, including seed and seed bank ecology, effects of biotic and abiotic factors on weed growth, and key theories related to plant invasions. Credits: 3.00

BTNY 52500 - Intermediate Plant Pathology

Credit Hours: 3.00. Examines the biological and pathological characteristics of major causal agents; concepts of epidemiology and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions; disease management practices; and methods of disease diagnosis.

Learning Outcomes: 1. Understand concepts of disease and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions. 2. Understand the current state of knowledge in plant pathology from applied to molecular plant pathogen interactions. 3. Understand importance of plant disease in food security. 4. Understand plant pathogens and how they cause diseases; the biological and pathological characteristics of major pathogens; Understand pathogenesis of bacterial, fungal, nematode and viral diseases. 5. Understand plant disease resistance pathways, genetic resistance mechanisms starting form gene for gene interactions. 6. Understand resistance to necrotrophic plant pathogens. 7. Understand biotechnological approaches to plant diseases resistance. 8. Identify and describe an economically important plant disease. Credits: 3.00

BTNY 53500 - Plant Disease Epidemiology

Credit Hours: 3.00. Plant disease epidemics occur due to the suitable combination of various elements of the agroecosystem. Many plant pathogens and diseases have increased their geographic distribution and intensity in the U.S. and the world. A lack of epidemiological understanding can exacerbate problems and significantly challenge the management of diseases at the field level. This course is an introduction to the epidemiological basis of disease management strategies. The course includes concepts in botanical epidemiology, disease assessment and measurement, disease modeling, epidemics comparison, and a revision of the traditional plant disease control principles. *Plant Disease Epidemiology* is an upper-level course for students interested in plant pathology, agronomy, data-driven Ag, national or international agriculture, or closely related areas. Although some pathosystems are used as model systems, *Plant Disease Epidemiology* is not a "how-to" course on controlling specific plant diseases.

Learning Outcomes: 1. Standardize terminology used in epidemiology for disease management purposes. 2. Analyze the accuracy and precision of data. 3. Use models to describe plant disease epidemics. 4. Explain how epidemiology is used to evaluate disease management options. Credits: 3.00

BTNY 55000 - Biology Of Fungi

Credit Hours: 3.00. Lectures cover general features of fungi, unique characteristics of major fungal groups, fungal interactions with other organisms, and principles of fungal genetics. Lab exercises include examination of representative species from major groups of fungi and classical and molecular manipulations of fungi.

Learning Outcomes: 1. Demonstrate the understanding of fungal structures and development. 2. Identify different fungal groups. 3. Understand unique features of fungal genetics. 4. Demonstrate the ability to culture and observe different fungi. Credits: 3.00

BTNY 55101 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the

ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

BTNY 55200 - Molecular Approaches In Plant Biology

Credit Hours: 3.00. This is mainly a laboratory exercise course designed to help students to be more familiar with common molecular techniques used in plant pathology studies. Techniques will include DNA/RNA isolation, hybridization, sequence analyses, various PCR reactions, library construction and screening, protein isolation, and plant transformation. Lectures will cover basic principles and applied aspects of molecular studies in plant pathology, and recent advances in genomics and proteomics techniques.

Learning Outcomes: 1. To understand the basic principles of common molecular and genomic techniques. 2. To become familiar with the application of common molecular and genomic approaches in the field of plant biology/pathology.3)To obtain laboratory experience of performing common techniques used in molecular biology. Credits: 3.00

BTNY 55300 - Plant Growth And Development

Credit Hours: 3.00. Topics include seed dormancy, cell expansion and plant growth, pattern formation, phase transition, flowering, pollination and fertilization, seed development, fruit development, and senescence. This course is the second in a series of team-taught courses in the core curriculum of the Purdue Plant Biology Program.

Credits: 3.00

BTNY 55800 - Pathogens Of Plants

Credit Hours: 3.00. Plant pathology is the science of plant diseases and of the microorganisms that cause them and of our attempts to manage plant diseases. The ultimate goal of plant pathologists is to reduce the losses caused by diseases, thereby, increasing both the quality and quantity of the world food supply. Plant diseases are caused by the same types of microorganisms that cause disease in animals and humans and, as such, many of the principles that apply to human and animal medicine apply to plant diseases. It is the objective of this course to introduce students to the major types of plant pathogens (plant pathogenic bacteria, viruses, nematodes, and fungi), their basic biology and examples of the types of diseases they cause. It will be expected that students have knowledge in plant pathology.

Learning Outcomes: 1. Describe the characteristics of plant pathogenic bacteria, fungi, viruses, and nematodes and to distinguish between these pathogens. 2. Describe the methods that each pathogen group utilizes for reproduction, spread, infection of hosts, disease induction in hosts, and long term survival. 3. Classify plant pathogens in current taxonomic schemes. 4. Describe the disease cycles for plant pathogens covered in the course. Credits: 3.00

BTNY 56200 - Plant Hormone Biology

Credit Hours: 3.00. This course will provide a broad and integrated overview of the current status of plant hormone research. All aspects of plant hormones including biosynthesis, metabolism, transport, signal transduction will be discussed in relation to the role of hormones in plant growth and developmental processes. Cross-talk between hormones and how plants use hormones to integrate developmental or environmental signals to regulate plant growth will be included. In addition, practical aspects of hormones in the agriculture, horticulture, and pathogen responses will be covered to demonstrate the impacts of basic plant science to a modern agriculture. The course will consist of lecture and discussion of primary research papers. Upon completion of the course, the students will acquire a comprehensive knowledge of the action of plant hormones as growth regulators, critical thinking skills, and ethical research.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 3.00

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 60500 - Diagnosis Of Plant Diseases

Credit Hours: 2.00. Symptomatology and diagnosis of diseases of field crop, vegetable, fruit, ornamental, and tree plants. Emphasis is on the collection and study of diseases in field, greenhouse, and storage. Prerequisite: BTNY 30100.

Credits: 2.00

BTNY 61300 - Advanced Plant Pathology

Credit Hours: 3.00. This course makes an exhaustive attempt to dissect the nature of plant disease and resistance mechanisms in plants. Special emphasis is placed on emerging concepts and paradigms that underlie a wide variety of plant-pathogen interactions, and how the knowledge gleaned from

these studies is being used to devise effective and environmentally safe strategies of plant protection. It is expected that students have knowledge in genetics, molecular biology, biochemistry, and plant pathology.

Learning Outcomes: Students will become well versed in both the fundamental and contemporary aspects of plant pathology. They will learn about the most recent developments and trends in the field of plant-pathogen interactions and how these advances impact ideas and approaches for designing sustainable plant protection strategies. Science students will be required to prepare and lead discussions on papers that establish key milestones in plant pathology, this course will help arouse curiosity in them and stimulate critical thinking. In addition, they will be able to apply to their own research the concepts/paradigms they learn in the class. Credits: 3.00

BTNY 62000 - Plant Disease Management

Credit Hours: 3.00. Plant diseases cause billions of dollars in crop losses worldwide and play a large role in food security and the viable production of agronomic and horticulture crops. This course will center on the various aspects of managing these diseases. Specific focus areas include the effect of cultural practices and planting decisions (i.e., crop rotation, fertility, host resistance), pesticide delivery formulation, chemistry and mode of action, and integrated systems of organic and hybrid disease management. Prerequisite: BTNY 30100 or equivalent.

Learning Outcomes: 1. Understand fundamental principles of plant disease management. 2. Know the mode of action and classification of plant pesticide groups (fungicide, nematicide, antibiotics, & biocontrols) and best use practices for integration into a disease management program. 3. Understand disease resistance development and methods for prevention. 4. Be familiar with traditional and modern aspects of pesticide delivery, discovery, and regulation. 5. Learn to develop an integrated plan for a cropping system by incorporating various tools for disease management. Credits: 3.00

BTNY 66000 - Scientific Writing

Credit Hours: 3.00. This is a course on coping with publication in professional journals. It covers the full range of activities involved in carrying a piece of original research to completion as a primary research article in a refereed journal. Emphasis is on principles of clear and concise technical reporting. Topics include: research and writing goals; journals' policies; data presentations; effective style; organizing, writing, revising, and processing manuscripts; proofreading; peer review; ethics; and grant proposals. Students will use their own data to prepare a manuscript as if for publication. Permission of instructor required.

Learning Outcomes: 1. Convey scientific results and concepts to a broad range of audiences effectively and clearly. 2. Order ideas such that they make logical sense to readers. 3. Understand the distinct requirements of different audiences. 4. Understand the differing requirements of review articles, research reports, and grant proposals. 5. Cite scientific literature effectively. Credits: 3.00

BTNY 69100 - Skills For Success In Grad School

Credit Hours: 1.00. This course is aimed at first year graduate students in the Botany department. Its purpose is to introduce the students to the department, teach them what it takes to be a successful graduate students, and to help them develop effective written and oral communication skills.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 1.00

BTNY 69200 - Graduate Professional Practice

Credit Hours: 0.00 to 3.00. An internship experience with a for-profit, non-profit, or governmental entity to complement the student's academic coursework. The student must present a letter from the proposed employer documenting the work and expectations expected to be undertaken and must find a Botany and Plant Pathology faculty advisor/instructor to oversee the experience. Course may be taken in successive semesters. Must be enrolled in a Master's or PhD degree program in Botany and Plant Pathology and in good academic standing (cumulative GPA greater than 3.00). Permission of instructor required.

Learning Outcomes: 1. Experience applying knowledge and skills learned from prior coursework and reading the scientific literature to solve current problems and/or address current issues. 2. Develop skills for networking

and establishing professional connections outside of Purdue University. Credits: 0 to 3

BTNY 69700 - Departmental Seminar Series - Botany And Plant Pathology

Credit Hours: 1.00. This is a weekly seminar course that features both external and Purdue speakers. Exposure to research topics outside of a student's immediate research area is an important part of graduate student education. The goal of the seminar series course is to provide opportunities for graduate students to learn about the latest research advances plant biology, plant pathology, and weed science and to interact with visiting seminar speakers.

Learning Outcomes: 1. Learn about recent research advances in Plant Biology, Plant Pathology, and Weed Science. 2. Learn best practices for asking questions and interacting with seminar speakers. 3. Acquire new ideas for giving effective oral presentations by active listening to seminar presentations. Credits: 1.00

BTNY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Acquire training in the signature areas of the department of Botany and Plant pathology: plant biology, plant pathology, and weed science, and their subdisciplines. 2. Understand applied and molecular plant pathology. 3. Learn plant biology from cell biology to evolutionary and developmental biology, ecology. 4. Learn weed control and management, weed biology and related areas. 5. Learn how to communicate scientific ideas in written and oral form. 6. Learn best practices for asking research questions and working as part of a scientific team. Credits: 1.00 to 18.00

BTNY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Acquire training in the signature areas of the department of Botany and Plant pathology- Plant biology, plant pathology, and weed science, and their subdisciplines. 2. Understand applied and molecular plant pathology. 3. Learn plant biology from cell biology to evolutionary and developmental biology, ecology. 4. Learn weed control and management, weed biology and related areas. 5. Learn how to communicate scientific ideas in written and oral form. 6. Learn best practices for asking research questions and working as part of a scientific team. Credits: 1.00 to 18.00

Chemical Engineering

CHE 20000 - Chemical Engineering Seminar

Credit Hours: 1.00. An orientation course to inform students of the various areas in chemical engineering, to assist them in selection of electives suited to their particular abilities and interest, and to instill a sense of professional ethics and responsibility. Lectures drawn from all fields of chemical engineering.

Learning Outcomes: 1. Demonstrate an understanding of the need for academic and professional integrity and ethical behavior. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Demonstrate an appreciation of the need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 20100 - Cooperative Seminar I

Credit Hours: 0.00. Lectures by faculty and students on subjects that relate the academic work and the industrial experience. Written reports on the industrial experience are required and will include a documentation of the student's success in finding application of specified academic activities. For students returning from the first and second work periods.

Credits: 0.00

CHE 20500 - Chemical Engineering Calculations

Credit Hours: 4.00. Quantitative applications of steady-state mass and energy balances to solve problems involving multi-component systems and multi-unit chemical processes. Single-component and multi-component phase equilibria, single-reaction and multiple-reaction stoichiometry, coupled mass and energy balances, chemical processes involving bypass and recycle streams.

Learning Outcomes: 1. Estimate physical properties of real chemical systems. 2. Evaluate

introductory single-component and multi-component phase equilibria and incorporate these concepts into solutions of mass and energy balance problems. 3. Solve steady state and transient mass and energy balance problems for both reacting and non-reacting systems with or without recycle using analytical and computational methods. 4. Work professionally and ethically in teams to solve new mass and energy balance problems. 5. Identify contemporary chemical engineering problems, including their societal, environmental, and global impacts. Credits: 4.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CHE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 30000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 20000. Lectures to acquaint the junior students with professional ethics, career choices, including graduate studies, and services of professional societies.

Learning Outcomes: 1. Identify the wide range of career opportunities offered by the Bachelor in Chemical Engineering degree. 2. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the professional practice of chemical engineering. 3. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 4. Demonstrate an appreciation of the

need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 30100 - Cooperative Seminar II

Credit Hours: 0.00. Continuation of CHE 20100 . For students returning from the third and fourth work periods.

Credits: 0.00

CHE 30600 - Design Of Staged Separation Processes

Credit Hours: 3.00. The application of equilibria and mass and energy balances for the design of staged separation processes. Use of various equilibrium data and thermodynamic principles for the design of batch and continuous distillation, absorption, stripping, and extraction systems. Stagewise calculations and graphical methods for design of binary systems. Design of multicomponent separators. Determination of stage efficiency and column size.

Learning Outcomes: 1. Utilize the concepts and relations of phase equilibria, particularly VLE, in the analysis, design, and simulation of separation processes. 2. Use mass and energy balances in the analysis of separation processes. 3. Use the McCabe-Thiele diagram for the solution of problems in binary separations. 4. Use reflux and multi-stage cascades to increase separation of a given component. 5. Use process simulators for binary and multi-component systems to solve, understand, and design separation processes. 6. Apply the basic principles of distillation, absorption/stripping, extraction and other unit operations for the solution of problems in separations. 7. Identify the safety aspects of various separation processes. 8. Communicate effectively the results of a designed separation process in writing. Credits: 3.00

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

CHE 33000 - Principles Of Molecular Engineering

Credit Hours: 3.00. Application of concepts of atomic and molecular bonding, solid microstructure, phase equilibria, and rate processes to the design of solid materials for specific engineering objectives.

Credits: 3.00

CHE 34800 - Chemical Reaction Engineering

Credit Hours: 4.00. Application of kinetic rate equations, mass balances and energy balances to the analysis and design of chemical reactors involving homogeneous and heterogeneous chemical reactions. Chemical equilibria, kinetic rate equations for homogeneous and heterogeneously catalyzed reactions, design of ideal isothermal reactors, effects of non-isothermal operation, effects of diffusion in porous catalysts and non-ideal mixing in continuous flow reactors.

Learning Outcomes: 1. Apply fundamental material balances to derive the design equations for CSTR, PFR, PBR, and batch reactors. 2. Derive rate expressions from both elementary steps and reaction kinetics data for both homogeneous and heterogeneous reactions. 3. Use material and energy balances with kinetic data for both single and multiple reactions to design and analyze the behavior of isothermal and non-isothermal reactors. 4. Utilize effectiveness factors governing the coupling of reaction and diffusion in the description of heterogeneously catalyzed reactions. 5. Work professionally and ethically in teams to conduct reaction-based laboratory

experiments. 6. Effectively report results in written form and practice safety as an integral part of laboratory work. 7. Apply appropriate computational tools for the solution of chemical reaction engineering problems. Credits: 4.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CHE 37800 - Heat And Mass Transfer

Credit Hours: 4.00. Macroscopic and differential energy balances. Heat transfer coefficients for free and forced convection and phase change. Conductive and radiative heat transfer. Applications to heat transfer equipment design and compressible fluid flow. Macroscopic and differential species balances. Mass transfer coefficients and analogies. Mass transfer with and without chemical reaction. Mass transfer equipment design.

Learning Outcomes: 1. Identify and explain the three mechanisms of heat transfer: conduction, convection, and radiation. 2. Apply microscopic and macroscopic thermal energy balances incorporating Fourier's Law for the solution of problems describing steady-state and transient conduction, including convective heat transfer. 3. Utilize mass and thermal energy balances for the design of heat transfer equipment and the analysis of its operation. 4. Identify and explain the two main mechanisms of mass transfer: convection and diffusion. 5. Apply microscopic and macroscopic species mass balances incorporating Fick's Law for the solution of problems describing steady-state and transient diffusion, including relevant rate equations and convective mass transfer. 6. Identify and apply the analogies between momentum, heat, and mass transfer. 7. Utilize mass balances and appropriate phase equilibrium relations for the design of continuous mass transfer equipment and the analysis of its operation. 8. Work professionally and ethically in teams to conduct heat and mass transfer-based laboratory experiments. 9. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CHE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Develop oral and written

presentation skills. 2. Expand knowledge of the engineering profession. 3. Receive feedback from the instructor and seminar participants. 4. Continue professional development. Credits: 0.00

CHE 38499 - Professional Practice Cooperative IV

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Varies due to students academic work sessions. Credits: 0.00

CHE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 40000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 30000. Lectures to acquaint the senior students with professional ethics, services of professional societies, and help them in the transition from being an undergraduate student to becoming a successful professional or graduate student.

Learning Outcomes: 1. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the professional practice of chemical engineering. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Identify the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 4. Demonstrate an appreciation of for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 40100 - Cooperative Seminar III

Credit Hours: 1.00 to 3.00. Continuation of CHE 30100. For senior students returning from the last work period.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the chemical engineering profession. 3. Receive

feedback from the instructor and seminar participants. 4. Continue professional development. Credits: 1.00 to 3.00

CHE 41100 - ChE Undergraduate Research

Credit Hours: 1.00 to 4.00. Experience in chemical engineering science research or development; either directed or independent work that can be experimental or theoretical. Permission of instructor required.

Learning Outcomes: 1. Gain skills and experiences through independent research projects in Chemical Engineering. Credits: 1.00 to 4.00

CHE 41200 - Chemical Engineering Design Research Problems

Credit Hours: 1.00 to 4.00. Experience in chemical engineering design research or development; either directed or independent work that can be experimental or theoretical. Permission of instructor required.

Credits: 1.00 to 4.00

CHE 42000 - Process Safety Management And Analysis

Credit Hours: 3.00. Develop knowledge of process safety management and analysis in the process industries, including hazard identification, hazard analysis and risk management.

Learning Outcomes: 1. Demonstrate knowledge and understanding of the elements of process safety management. 2. Apply the techniques, analytical skills, and modern computational tools necessary for performing process safety calculations in the design of safety. 3. Demonstrate an understanding and appreciation of the need for professional integrity and ethical decision making to promote safety in the workplace. 4. Be able to pro-actively identify and analyze safety hazards. 5. Demonstrate an understanding of the detrimental effects of the unsafe operation of chemical facilities on environmental, health, and safety issues and other public interests. Our graduate will be aware of the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 6. Demonstrate knowledge and understanding of risk management tools, programs and processes associated with process safety. Credits: 3.00

CHE 43500 - Chemical Engineering Laboratory

Credit Hours: 4.00. Quantitative experimental study of projects involving problems in fluid mechanics and heat and mass transfer or operation and evaluation of equipment; projects include analysis and data-based design of operations involving mass transfer such as distillation, absorption, drying, humidification, etc; study of rates and equilibria in simple chemical reaction systems; study of chemical processes; application of methods of data analysis in practice; some library work; emphasis on group work, report writing, and oral communication.

Learning Outcomes: 1. Determine the intrinsic performance data required to complete the design of a given process or process equipment. 2. Design and conduct an experimental program to determine the required performance data. 3. Use the requisite performance data to obtain a technically feasible and economical design to meet desired needs. 4. Effectively report experimental results, performance data analyses and process designs both orally and in writing. 5. Use appropriate analytical and computational tools for the analysis and design of experiments. 6. Work effectively as a member of an engineering team in a professional and ethical manner, including different team roles. 7. Practice appropriate experimental safety measures. Credits: 4.00

CHE 44200 - Chemistry And Engineering Of High Polymers

Credit Hours: 3.00. Introduction to basic principles of polymer engineering, including the chemical structure and use of a variety of industrial polymers, polymerization mechanisms and kinetics, techniques for molecular and morphological characterization, polymer processing, and a variety of engineering properties.

Credits: 3.00

CHE 45000 - Design And Analysis Of Processing Systems

Credit Hours: 4.00. Use of process synthesis methods and concepts; detailed design of unit operation equipment, the economics of chemical plants and flow sheet optimization methods. Synthesize, develop, and evaluate a preliminary design of a chemical process that meets market requirements

for a specific product. Analysis of design alternatives using case studies and optimization methods.

Learning Outcomes: 1. Apply systematic strategies for synthesizing chemical process designs that involve conventional unit operations. 2. Describe both the difference between steady state and batch chemical processes and the implications on their design and operation. 3. Demonstrate the ability to obtain reliable information on industrial chemical processes, process operating parameters, equipment costs, cost of chemicals and materials, and associated safety and environmental hazards. 4. Describe the role of physical property estimates on process design and be able to use appropriate physical property estimation methods in unit operations design. 5. Estimate the capital and operating cost of a process and to assess its profitability. 6. Use process simulators and other tools to perform detailed analyses for the successful design of a chemical plant. 7. Communicate effectively project progress and final results in a professional manner both orally and in writing. 8. Work effectively in a team to execute open-ended design projects with time-bound deliverables in a professional and ethical manner, including different team roles. Credits: 4.00

CHE 45600 - Process Dynamics And Control

Credit Hours: 3.00. Dynamic response and control of chemical processing equipment, such as heat exchangers, chemical reactors, and absorption towers. Use is made of fundamental techniques of servomechanism theory, such as block diagrams, transfer functions, and frequency response. Introduction to advanced control techniques.

Learning Outcomes: 1. Develop a physically relevant mathematical model as a surrogate for a chemical process. 2. Apply appropriate analytical and computer packages for analyzing the process control behavior based on the developed model. 3. Design, model, and test a hierarchical control system on a complex process. 4. Describe the role of process control in meeting stringent safety, economic, environmental, societal, and corporate goals. 5. Describe the building blocks of process control and their synthesis for providing complete process control solutions. 6. Work effectively in a team to execute process control computer-based assignments in a professional and ethical manner. Credits: 3.00

CHE 46100 - Biomedical Engineering

Credit Hours: 1.00. An introduction to the field of biomedical engineering, with particular stress on the chemical engineer's role.

Credits: 1.00

CHE 46300 - Applications Of Chemical Engineering Principles

Credit Hours: 3.00. Team-based design projects in materials transport, heat transfer, mass transfer, separations, chemical reactors. Emphasis on team operation and decision-making. Consideration of current technical challenges, societal and economic issues.

Learning Outcomes: 1. Demonstrate ability to apply principles of chemical engineering to design practical systems. 2. Participate in team-based projects to understand team operation and decision-making. 3. Gain experience in and appreciation of the need for individual learning about new systems, equipment, etc. 4. Understand the role of the engineer in promoting safe operation and consideration of environmental issues in technical decisions. 5. Develop an appreciation of current issues and challenges which you may well be addressing as professionals. Credits: 3.00

CHE 49500 - Chemical Engineering Study Abroad

Credit Hours: 1.00 to 3.00. Short term study abroad experience to expose chemical engineering undergraduate students to the academic and industrial environments across the globe. Each experience location play an important economic role and offer good examples of industrial and engineering development, as well as allow for interaction with Purdue alumni, and cultural aspects through immersion during their time abroad.

Learning Outcomes: 1. Demonstrate an awareness of cultural diversity, personal growth

and intercultural competency while also gaining career readiness and leadership skills that are relevant for a global world. Credits: 1.00 to 3.00

CHE 49700 - Special Topics In Chemical Engineering

Credit Hours: 1.00 to 4.00. Primarily designed for subject areas for which there is no specific course offered. Areas of study will deal with topics that have enough student interest to justify the teaching of specialized courses on a trial basis. The course can be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 1.00 to 4.00

CHE 49800 - Undergraduate Thesis Research I

Credit Hours: 3.00. Individual research projects for students completing an undergraduate thesis. Requires prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Credits: 3.00

CHE 49900 - Undergraduate Thesis Research II

Credit Hours: 3.00. Individual research projects for students completing an undergraduate thesis. Continuation of CHE 49800. Includes submission of written thesis and public oral presentation. Permission of instructor required.

Credits: 3.00

CHE 50100 - Medical Devices - Development And Clinical Application

Credit Hours: 3.00. This course is an introduction to the medical device field, with emphasis on the ways in which chemical engineering processes provide the foundation for many device-related therapies. The course involves the application of several fundamental chemical engineering principles, including those related to mass transfer, separations, and fluid flow, to devices used for extracorporeal therapies and other treatments. The first part of the course addresses the relevant physiology and pathophysiology serving as a foundation for subsequent clinical material. With the focus on extracorporeal devices, the interactions between blood and biomaterials in a general sense are also explored. The second part of the course assesses the extracorporeal treatment of kidney failure by dialysis, which is highlighted as the only long-term, device-based replacement therapy for terminal organ failure (end-stage renal disease). This analysis will not only consider the evolution of dialysis therapy from a technology perspective but also the forces that have shaped its development into a market generating annual revenue of nearly $100 billion on a global basis. In addition, extracorporeal support therapies used clinically not only for failure of other organs (namely the heart, liver, and lungs) but also systemic inflammation secondary to severe infection (sepsis) will be presented. The third segment of the course addresses industry-focused concepts pertaining to medical device development, including verification/validation, lean manufacturing, project management, and regulatory issues. Providing a real-world perspective based on broad experience in the medical device field, Ms. Michelle Chutka (see below) will lead this third part of the course. Permission of instructor required.

Learning Outcomes: 1. Assess the mechanisms of blood-surface interactions defining the biocompatibility of an extracorporeal device. 2. Evaluate the influence of extracorporeal membrane structure and material on transport properties (diffusion, convection, and ultrafiltration) and the overall effect on device. 3. Analyze device-related and patient-related (physiologic) parameters required for kinetic modeling of different dialysis therapies. 4. Apply fundamental chemical engineering principles to provide a quantitative basis for treatments of specific clinical disorders, including end-stage renal disease (ESRD), acute kidney injury (AKI), sepsis, cardiac failure, and respiratory failure. 5. Characterize the major components of a medical device company and the manner in which these different functions interact during the pre-market and post-market phases of product development. 6. Apply important principles of project management, verification/validation, and lean manufacturing to medical device development. Credits: 3.00

CHE 50200 - Analytical Approach To Healthcare Delivery

Credit Hours: 3.00. This course provides a "real world" overview of healthcare delivery in the United States (US). The major medical technology segments (pharmaceutical compounds and medical devices) are a significant focus, including their research and development processes, regulatory framework, and market approaches. Another highlight of the course is an assessment of a series of critical medical conditions having the highest impact on the US healthcare system. Clinical cases illustrating these conditions along with case studies designed to provide practical examples of healthcare developments and challenges are included. A number of emerging healthcare developments, including precision medicine, artificial intelligence, digital health, and value-based care, are addressed. In addition, the numerous ways in which the COVID-19 pandemic has affected patients and the manner in which they receive healthcare are discussed. Permission of instructor required.

Learning Outcomes: 1. Evaluate the impact of the following conditions, from both a clinical and resource utilization (cost) perspective: coronary artery disease, heart failure, diabetes, cancer, obesity, Alzheimer's disease, chronic kidney disease, stroke, arthritis, sepsis, and acute kidney injury. 2. Analyze the major segments of medical products (pharmaceutical/biotechnology compounds and medical devices) along with the regulatory framework applying to each of these segments. 3. For the biopharmaceutical industry, determine the major components of the drug development process and the manner in which drug pricing factors into the risk/reward equation. 4. Assess US health economics by identifying the major cost drivers in the healthcare system (hospital care; physician costs; drugs and other medical products). 5. Formulate a basic understanding of the sources of health insurance coverage in the US, including the differences between government-based (Medicare/Medicaid) and commercial payers. 6. Explain several evolving trends which have the potential to influence healthcare substantially in the future, including precision medicine, artificial intelligence, digital health, and value-based care. 7. Characterize (for COVID-19) the important clinical aspects and its profound impact on the US healthcare system. Credits: 3.00

CHE 52100 - Principles Of Tissue Engineering

Credit Hours: 3.00. This course is designed to provide background for the application of engineering principles with the life sciences to facilitate understanding of normal and pathological mammalian tissues. Applications of drug delivery, tissue and cell transplantation, bioartificial organs, tissue regeneration, disease models, and applications in clinical practice will be explored.

Learning Outcomes: 1. Understand the importance of cell sources, material properties, and mass transport on tissue structure and function. 2. Design a rational experiment and have improved understanding for how to characterize and analyze tissue engineered constructs. 3. Improve their ability to present new concepts and ideas to a group of students and potential investors. Credits: 3.00

CHE 52300 - Engineering Applications Of Biological Molecules

Credit Hours: 3.00. This course introduces the applications of biological molecules in different engineering fields. The first part of the course will provide a general overview of fundamental molecular and cell biology, biophysics and biomechanics. The second part of the course will focus on three specific areas, namely 1) biopolymer, 2) nanobiotechnology and 3) genetic engineering. For each focus area, a general overview will be provided followed by in-class discussions of seminal papers of the field and team-based case studies. The goal of the course is to introduce the recent advances in the interface of biology and engineering to our students and prepare them for research and development work in interdisciplinary environments.

Learning Outcomes: 1. Learn fundamental molecular and cell biology, biophysics and biomechanics. 2. Focus on three specific areas, namely 1) biopolymer, 2) nanobiotechnology and 3) genetic engineering. For each focus area, a general overview will be provided followed by in-class discussions of seminal papers of the field and team-based case studies. 3. Work a 3-4 person to group to develop case studies and make a class presentation on state-of-the-art biotechnology. 4. Develop an individual project on recent progresses in a specific bioengineering field. An oral and final report will be required. Credits: 3.00

CHE 52500 - Biochemical Engineering

Credit Hours: 3.00. Enzyme kinetics, mathematical models of microbial growth, bioreactor design and operation, genetic and metabolic engineering, plant and animal cell culture, and purification of biological products.

Credits: 3.00

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 54300 - Polymerization Reaction Engineering And Reactor Analysis

Credit Hours: 3.00. Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, copolymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, Z-transforms, batch, CSTR and tubular reactors, stability analysis, computer control, separation, and drying.

Credits: 3.00

CHE 54400 - Structure And Physical Behavior Of Polymer Systems

Credit Hours: 3.00. Statistical mechanics of chain molecules, thermodynamics of polymer solutions, phase separations, experimental methods of molecular weight determination, crystallization of polymers, polymer physics, rubber elasticity, viscoelasticity.

Credits: 3.00

CHE 55100 - Principles Of Pharmaceutical Engineering

Credit Hours: 3.00. This course is designed to provide engineering, science and pharmacy students with an understanding of the structure, economic and regulatory context, product discovery and development pipeline dynamics, intellectual property considerations and common manufacturing technology of the global pharmaceutical industry.

Learning Outcomes: 1. Develop a "big picture" view of the Pharmaceutical Industry: its structure and key players; economic and regulatory context; international trends and markets; product pipeline dynamics; current manufacturing technology, strengths and limitations. 2. Develop a working vocabulary of domain concepts. 3. Develop an appreciation of technical challenges and opportunities over the life cycle of a pharmaceutical product. 4. Develop an appreciation of the important role of intellectual property law and the strategies used in maintaining and challenging product patents. 5. Enhance skills in critical review of topics involving the interplay of technology and economics and in succinctly reporting the most important conclusions in written and oral form. 6. Acquire the technical and economic context for more detailed follow-up courses in ChE, ME and IPPH. Credits: 3.00

CHE 55300 - Pharmaceutical Process, Development And Design

Credit Hours: 3.00. This course introduces the engineering methodologies involved in translating a laboratory recipe for a drug compound produced via synthetic organic chemistry methods to an industrial process. The basic features of common unit operations used in the pharmaceutical industry will be reviewed, including batch reaction, solid-liquid separation, crystallization, drying, mixing, batch distillation and other separation systems. Both dedicated and multi-product production system design and batch and semi-continuous operating modes will be covered.

Learning Outcomes: 1. Develop knowledge and skills in the thermodynamic, reaction and transport phenomena arising in the typical batch unit operations used in the pharma and specialty chemicals industries, including batch reaction, crystallization, solid-liquid separation, mixing, distillation, drying and liquid-liquid extraction. 2. Develop knowledge and skills in the use experimental data and relevant models to design and predict the performance of these units. 3. Develop knowledge and skills in the use of engineering software to conduct studies of these operations and interpret and critically assess the results such software produces. 4. Understand different modes of operation for batch processes and their scheduling. 5. Understand aspects of the design of batch process in which the set of batch operations are integrated. 6. Develop knowledge and skills in the use of planning/scheduling software to conduct design and operational studies of integrated process. 7. Enhance skills in succinctly reporting the most important conclusions of team projects in written and oral form. Credits: 3.00

CHE 55400 - Smart Manufacturing In Process Industries

Credit Hours: 3.00. This course surveys the tools and techniques, which are relevant to support the multiple levels of technical decisions that arise in modern integrated operation of manufacturing facilities in the chemical related process industries. The linkage of these decisions levels and sharing of associated data and knowledge via effective IT methodology is currently termed Smart Manufacturing in the US and Industry

4.0 in Europe. The topics covered in the course include the structure of the operations decision hierarchy, role of online process measurements, elements of sensor network design, information systems to support process operations, plant data reconciliation, detection and diagnosis of process faults, plant wide control, real time process optimization, production planning and scheduling, and supply chain management. Each topic will be addressed by first summarizing the basic role and scope of that component, then discussing the structure of the decision problem, and then will outline some representative tools available to address that decision problem. Each major topic will include a lecture given by an industrial practitioner who will offer a perspective on the state of industrial practice. Permission of instructor required.

Learning Outcomes: 1. Explain the function, information requirements and main decisions made at each level of the operational hierarchy of an integrated processing system. 2. Understand the design requirements of a sensor network, that insures that all variables which must be managed are observable. 3. Explain that process data storage requirements are and how these requirements are met in integrated process systems. 4. Know how to use data reconciliation methods to obtain the maximum likelihood estimate of the state of process. 5. Explain why exceptional events are important to process operations. 6. Use multivariate statistic methods to determine whether and when an exceptional event has occurred. 7. Explain what fault diagnosis is, why it is needed and what general types of methods are available for effective diagnosis. 8. Understand the role of plant-wide control and how it relates to individual unit operations control. 9. Test, evaluate and improve a specific plant wide control systems design using a process simulation model. 10. Explain the role of real time process operations and the differences between steady state and dynamic RTO. 11. Implement and solve a steady state RTO problem based on material balances. 12. Explain the differences and relationship between process planning and scheduling. 13. Represent a process planning problem by formulating a linear programming model and solving it using standard LP tools. 14. Explain the main decision variables of a process scheduling application and understand the underlying computational complexity of scheduling problems. 15. Represent a scheduling problem using a state task network and solve it using a commercial solver. 16. Explain how supply chain management relates to the operational planning of individual processes. 17. Understand the main components and operational decision variables of a supply chain optimization problem. 18. Explain the information requirements for effective supply chain management. 19. Understand where the sources of uncertainty arise in supply chain planning and what strategies can be used to accommodate to these uncertainties. Credits: 3.00

CHE 55500 - Computer Integrated Process Operations

Credit Hours: 3.00. Introduction to computer-aided process operations management. Topics include: process monitoring, regulatory control, data reconciliation, unit and plant-wide optimization, process fault diagnosis, supervisory control, planning, and scheduling. A design project involving a unified application of the presented methodologies is taken from a published industrial benchmark problem.

Credits: 3.00

CHE 55800 - Rate-Controlled Separation Processes

Credit Hours: 3.00. Rate-controlled separation processes based on solute movement (adsorption, chromatography and ion exchange), membranes (reverse osmosis, ultrafiltration, and gas permeation), and crystallization.

Credits: 3.00

CHE 56000 - Introduction To Energy Storage Systems

Credit Hours: 3.00. Energy Storage Systems Laboratory course is designed to introduce fundamentals of electrochemistry and electrochemical engineering of rechargeable lithium ion batteries (LIBs) to undergraduate and graduate students. The course will be reviewing working principles of LIBs, hands-on experience on their assembly, charge-discharge testing, data analysis and related safety aspects. Strong emphasis will be given on the Li-ion battery technology, nanotechnology implementation and the materials design. Beyond conventional

Li-ion systems and Pb-acid batteries, next generation Na-ion, K-ion and Li-S batteries will be discussed and designed. Students will be fabricating and testing high energy density batteries utilizing engineered electrodes, electrolytes and separators. Broader perspectives on sustainable, cost effective, longer lasting battery manufacturing will be provided.

Learning Outcomes: 1. Understand the basic physical concepts involved in electrochemical energy storage and engineering aspects. 2. Critically evaluate the utility and viability of technological claims in popular and scientific literature. 3. Understand the need of new electrode/electrolyte materials development for the efficient energy storage. Credits: 3.00

CHE 56200 - Battery Systems

Credit Hours: 3.00. This course is designed to introduce fundamentals of electrochemistry and electrochemical engineering of primary and rechargeable lithium ion batteries (LIBs) to undergraduate and graduate students. The course will be reviewing working principles of LIBs. Strong emphasis will be given on the Li-ion battery technology, primary batteries, nanotechnology implementation and the materials design. Beyond conventional Li-ion systems and Pb-acid batteries, next generation Na-ion, K-ion and Li-S batteries will be discussed. Students will be understanding energy density calculations, fabrication and testing mechanism of batteries utilizing engineered electrodes, electrolytes and separators. Broader perspectives on sustainable, cost effective, longer lasting battery manufacturing will be provided.

Learning Outcomes: 1. Learn Introduction to Energy Storage Systems: Overview, history, market, theory, thermodynamics, kinetics, definitions, and safety. 2. Learn challenges of Li-ion Battery Technology, Selection criteria for commercial batteries. 3. Learn Experimental techniques, Promising Cathode Materials, Anode Materials, Electrolytes, current distribution and related issues. 4. Learn electrode slurry preparation, lamination, drying, pressing, manufacturing of batteries and testing. 5. Learn Battery types and Chemistry: Cell charging, Cell discharge testing, Electrochemical impedance spectroscopy (EIS). 6. Learn Kinetics and thermodynamics of electrochemical reactions. 7. Learn Beyond Li-ion Battery Technologies, next generation Li-S batteries, Sodium ion batteries, K-ion batteries will be reviewed. Credits: 3.00

CHE 56400 - Organic Electronic Materials And Devices

Credit Hours: 3.00. This course introduces the synthesis, optoelectronic properties, transport physics, and device operation of organic and hybrid electronic materials and devices. This course will review how the molecular architecture of small molecule and polymer semiconductors can be tuned to alter the optoelectronic properties of the materials in solution and in the solid state. A number of relevant materials interactions will be covered, including: photoexcitation and recombination, intermolecular charge transport mechanisms, and energy transfer processes. Additionally, we will observe how these processes are relevant to applications such as organic field-effect transistors (OFETs), organic light-emitting diodes (OLEDs), organic photovoltaic (OPV) devices, and organic memory elements. Finally, a new type of organic-inorganic hybrid material called hybrid halide perovskite will be introduced.

Learning Outcomes: 1. Identify common mechanisms for the synthesis of small molecule and polymer semiconductors. 2. Describe the mechanism of controlled polymerization techniques for macromolecular semiconductors. 3. Interpret spectroscopic, chromatographic, and molecular characterization data in order to predict the structure of the organic semiconductor. 4. Explain how the molecular structure of an organic semiconductor will affect its thermal, structural, and optoelectronic properties. 5. Explain how x-ray and neutron scattering can be utilized to determine the Angstrom and nanometer length scale structural features of the organic semiconductors. 6. Apply principles of electron microscopy to comprehend how to image soft materials. 7. Determine the domain spacing and microstructural architecture of organic semiconductors given a scattering pattern. 8. Explain how molecular orbital levels are related to the optoelectronic properties of organic semiconductors. 9. Distinguish between different models for charge transport in organic semiconductors. 10. Describe clearly the

difference between charge generation and transport in organic and inorganic semiconductors. 11. Explain how organic electronic devices operate and how apply known equations to evaluate device performance. 12. Critique the potential for organic electronic materials to supplement or replace inorganic semiconducting devices. Credits: 3.00

CHE 57500 - Industrial Catalytic Processes

Credit Hours: 3.00. A survey course on the process design of major catalytic processes in the refining and petrochemical industries for production of transportation fuels and commodity chemicals.

Learning Outcomes: 1. Understand and analyze the historical, current and potential future roles that hydrocarbons play in the economy for energy, fuels, and chemicals. 2. Understand and compare the ways that energy is used in society, especially the breakdown between electricity/power and fuels. Understand the basic fuel properties of liquid transportation fuels (LPG/LNG, gasoline, diesel and jet). 3. Understand the regulatory requirements, technical specifications and molecular composition of fuels and chemicals. 4. Understand the major refining and petrochemical processes by which hydrocarbons are produced. Additionally, understand the reaction chemistry and role of the catalyst in these chemical transformations. 5. Understand the chemical principles and industrial processes for catalyst manufacture. 6. Understand the structure of the catalytically active site and methods for its determination. 7. Understand the future demands for fuels and chemicals and potential opportunities for changes to the current processes. Credits: 3.00

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 60000 - Approaches To Graduate Research In Chemical Engineering

Credit Hours: 3.00. This course is designed to prepare and enable students to make a rapid start on their research. Additionally, key skills in critical analysis of the literature, technical writing and delivery of oral presentations are included.

Learning Outcomes: 1. Search the scientific literature efficiently. 2. Review the literature. 3. Write for scientific publication. 4. Create a hypothesis and propose how to test it. 5. Make effective technical oral presentations. Credits: 3.00

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 61100 - Molecular Thermodynamics

Credit Hours: 3.00. This course aims at providing a systematic treatment of the microscopic foundation of thermodynamics as well as a working knowledge of the statistical formalism needed to predict microscopic properties from molecular interactions. Topics covered include kinetic theory of gases, statistical-mechanical ensembles and their correspondence with thermodynamics, ideal and imperfect gases, distribution function theory of liquids, lattice models of liquid and polymer solutions, and molecular simulation methods. Offered in alternating years. Prerequisite: CHE 61000 .

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 62100 - Advanced Transport Phenomena II

Credit Hours: 3.00. Topics included are momentum transfer with interfacial effects, transport in porous and multiphase media, transport in dispersed phase systems, heat transfer, and multicomponent mass transfer. Prerequisite: CHE 62000

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order

reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 63200 - Linear Operator Methods In Chemical Engineering

Credit Hours: 3.00. Application of the spectral theory of linear self-adjoint and non-self-adjoint operators on abstract Hilbert spaces to problems in chemical engineering. Symmetrizable non-self-adjoint problems in finite and infinite dimensional spaces with applications to physical and chemical rate processes in homogeneous and composite media. Solution of transport equations governing heat and mass transfer in deforming and chemically reacting media. Introduction to non-self-adjoint problems in chemical engineering. Offered in alternate years. Prerequisite: CHE 63000 .

Credits: 3.00

CHE 63300 - Probabilistic Methods In Chemical Engineering

Credit Hours: 3.00. Introduction to probability, random variables, and stochastic processes. Ito calculus and stochastic differential equations. Brownian dynamics and Bridge processes. Applications to chemical engineering systems. Master equations and system size expansion concepts to nonequilibrium processes. Stochastic point processes and population balance. Theory of fluctuations. Prerequisite: CHE 63000 .

Credits: 3.00

CHE 65500 - Safety In Chemical Engineering

Credit Hours: 1.00. This course will provide you with necessary safety information to comply with Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. The course will cover general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. The course will provide valuable information on how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc.

Learning Outcomes: 1. Understand necessary safety information to comply with the Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. 2. Understand general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. 3. Understand how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc. Credits: 1.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 66200 - Catalysis

Credit Hours: 3.00. Analysis of the kinetics of heterogeneous catalytic reactions, including the application of collision and transition state theories to the estimation of rate constants and calculation of rates over energetically nonuniform surfaces. Discussion of the chemical and physical properties of solid surfaces that influence catalytic reactions, and illustration of concepts of catalytic behavior with specific examples from catalytic cracking, reforming, oxidation, and hydrodesulfurization. Offered in alternate years. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 66600 - Methods In Catalysis

Credit Hours: 3.00. Various spectroscopic and other techniques for characterizing catalysts and for probing the chemistry of solid surfaces and their interactions with adsorbing and reacting gases are discussed. Topics include infrared, X-ray

photoelectron, Mossbauer, and secondary ion mass spectroscopies. Emphasis is on understanding the principles underlying each method and gaining an awareness of the kind of information each can provide in a broad spectrum of research problems. Offered in alternate years.

Credits: 3.00

CHE 66800 - Colloidal And Interfacial Phenomena

Credit Hours: 3.00. Preparation, characterization, and stability of emulsions, aerosols, and other multiphase dispersions. Interparticle forces, electrokinetics, thermodynamics and kinetics of coagulation. Techniques for determining size, shape, orientation, and charge of particles. Capillary and wetting phenomena. Thermodynamics of interfacial tension and adsorption. Applications to surfactants, polymers, biodispersions, flotation, separations, oil recovery, etc. Offered in alternate years.

Credits: 3.00

CHE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (ENE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

CHE 69000 - Seminar In Chemical Engineering

Credit Hours: 0.00. Required of all graduate students.

Credits: 0.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Chemistry

CHM 10000 - Preparation For General Chemistry

Credit Hours: 3.00. An introduction to the basic ideas and laboratory techniques of chemistry, together with relevant parts of algebra and elementary physics. Intended for those whose background does not permit them to proceed directly with a general chemistry course. Not available for credit toward graduation in the School of Science.

Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world

issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11500 - General Chemistry (UCC: SCI)

Credit Hours: 4.00. Stoichiometry; atomic structure; periodic properties; ionic and covalent bonding; molecular geometry; gases, liquids, and solids; crystal structure; thermochemistry; descriptive chemistry of metals and non-metals. Required of students majoring in science and students in engineering who are not in CHM 12300. One year of high school chemistry or one semester of college chemistry required. CTL:IPS 1721 General Chemistry I w/lab

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations

in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11600 - General Chemistry (UCC: SCI)

Credit Hours: 4.00. A continuation of CHM 11500 . Solutions; quantitative equilibria in aqueous solution; introductory thermodynamics; oxidation-reduction and electrochemistry; chemical kinetics; qualitative analysis; further descriptive chemistry of metals and nonmetals. CTL:IPS 1722 General Chemistry II w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual

Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 13600 - General Chemistry Honors (UCC: SCI)

Credit Hours: 4.00. A sophisticated treatment of the principles of chemistry. Atomic structure and bonding, spectroscopy, equilibria, thermodynamics and kinetics. Includes weekly laboratory experiments. Two years of high school chemistry recommended. Students with a grade of C or better in CHM 13600 who need 8 hours of credit in general chemistry may request credit for CHM 11500.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 4.00

CHM 18300 - Cooperative Work Experience I

Credit Hours: 0.00. Cooperative Work Experience. Must be accepted for the program by the Cooperative Education Program coordinator.

Credits: 0.00

CHM 18400 - Cooperative Work Experience II

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 19700 - Chemistry Freshman Honors Research

Credit Hours: 1.00. Supervised individual research performed by student.

Credits: 1.00

CHM 20000 - Fundamentals Of Chemistry

Credit Hours: 2.00. Integrative study of core concepts in chemistry that play a major role in governing the physical world. These core concepts are taught within the framework of important societal issues, such as atmospheric chemistry and nutrition. The pedagogy of this course is designed to provide reflective, interactive and hands-on-learning experiences that will assist elementary education majors to develop useful instructional strategies for their own classrooms. Required of students in elementary education program in the School of Education. Not available for credit toward graduation in the School of Science.

Credits: 2.00

CHM 22400 - Introductory Quantitative Analysis

Credit Hours: 4.00. Introduction to titrimetric, gravimetric, and instrumental methods of analysis; principles of separation processes, including chromatography; recognition and evaluation of possible sources of error. Required of students majoring in biology who do not take CHM 32100 .

Credits: 4.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and

methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of

organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical

principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of

data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 28400 - Cooperative Work Experience III

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 29000 - Selected Topics In Chemistry For Lower-Division Students

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

CHM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles

and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

CHM 33300 - Principles Of Biochemistry

Credit Hours: 3.00. Structure and function of biologically important molecules. Intended for students in life sciences.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to have a molecular understanding of chemical reactivity in biochemical systems. 3. Able to carry out calculations related to Biochemistry. 4. Able to understand energetics and kinetics of biochemical transformations. 5. Able to apply concepts of general chemistry and organic chemistry to biochemical systems. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based

on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

CHM 37000 - Topics In Physical Chemistry

Credit Hours: 3.00. Kinetic theory of gases; statistical thermodynamics; quantum mechanics; atomic and molecular structure and spectroscopy; properties of ionic phases. May not be used to satisfy requirements for graduation in chemistry.

Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to

understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

CHM 37409 - Professional Practice I

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Industrial practice fee is attached to this course.

Credits: 0.00

CHM 37509 - Professional Practice II

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Industrial Practice fee is attached to this course.

Credits: 0.00

CHM 38600 - Cooperative Work Experience IV

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of

department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39500 - Chemistry Honors Seminar

Credit Hours: 1.00. Seminar for junior honors students.

Credits: 1.00

CHM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate depth in major. Credits: 0.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and

carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

CHM 44400 - Cosmochemistry

Credit Hours: 3.00. Stellar evolution, nucleosyntheses, and chemical abundances. Origin, composition, and structure of the solar system and objects in it. Cosmochronology with particular emphasis on meteorites. Emphasis upon recent developments in planetology. Offered in alternate years.

Credits: 3.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

CHM 47509 - Professional Practice III

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Industrial Practice fee is attached to this course.

Credits: 0.00

CHM 48100 - Environmental Chemistry

Credit Hours: 3.00. Survey of chemical aspects of environmental problems and the application of chemistry to their solution. Topics will include atmospheric pollution problems, groundwater pollution and waste disposal problems, inorganic water pollutants, and the occurrence and fate of toxic organic compounds and other substances in the environment.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to understand the connections of different courses/subdisciplines in chemistry. 4. Able to understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 3.00

CHM 48700 - Cooperative Work Experience V

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 49000 - Selected Topics In Chemistry For Upper-Division Students

Credit Hours: 1.00 to 4.00. Topics vary.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral

and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 50200 - Modern Chemistry In The High School

Credit Hours: 3.00. A critical discussion of the means by which the fundamentals of modern chemistry can best be introduced at the high school level. The laboratory will deal with the manufacture and use of lecture demonstration equipment, the use of films and film strips, and the problems involved in organizing and running a high school chemical laboratory.

Credits: 3.00

CHM 51300 - Chemical Literature

Credit Hours: 1.00. Types of information in technical publications; exercises in finding, assembling, and using such data.

Credits: 1.00

CHM 53300 - Introductory Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry.

Credits: 3.00

CHM 53800 - Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins.

Credits: 3.00

CHM 54800 - Radiochemistry

Credit Hours: 3.00. Nuclear properties, structure, and reactions; radioactive decay; interaction of radiation with matter; radioactivity in the environment; nuclear applications in chemistry.

Credits: 3.00

CHM 56000 - Organic Spectroscopic Analysis

Credit Hours: 3.00. Identification of organic compounds and characteristic groups by the use of mass spectrometry, infrared, nuclear magnetic resonance, and ultraviolet spectroscopy.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

CHM 58100 - Atmospheric Chemistry

Credit Hours: 3.00. (EAPS 52100) An introduction to the chemistry of the earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

CHM 59900 - Special Assignments

Credit Hours: 1.00 to 4.00. Directed reading or special work not included in other courses. Permission of instructor required.

Credits: 1.00 to 4.00

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

CHM 61000 - Topics In Chemical Education

Credit Hours: 2.00 or 3.00. A variable topics course for graduate students in chemistry, chemical engineering, medicinal chemistry, and biochemistry. This course provides an overview of the literature in one of the areas of chemical education, such as: chemistry misconceptions and conceptual change; theories of learning, from Piaget and Vygotsky to radical constructivism; distributed cognition; and developing and assessing instructional materials. Offered in alternate years.

Credits: 2.00 or 3.00

CHM 61100 - Formulas For Successful Teaching

Credit Hours: 2.00. An introduction to the issues of successful teaching of chemistry at the college/university level for graduate students in chemistry, chemical engineering, medicinal chemistry, and biochemistry who are interested in academic careers. Offered in alternate years.

Credits: 2.00

CHM 61500 - Principles Of NMR Spectroscopy

Credit Hours: 3.00. The course is intended to provide in-depth coverage of fundamental concepts in modern NMR spectroscopy. Included are the vector model of spin resonance, topics in signal processing, product operator formalism, discussion of important 2D experiments, Redfield relaxation theory, and methods for molecular structure determination. The emphasis is on general spectroscopic concepts, also used

outside spin resonance spectroscopy. Spectrometer operation and data processing are also demonstrated. Prerequisite: Undergraduate degree or completed advanced coursework in chemistry, physics, biology, or engineering. Basic knowledge of NMR is expected, but not required.

Credits: 3.00

CHM 61600 - Advanced Experimental Nuclear Magnetic Resonance Spectroscopy

Credit Hours: 2.00. The theory and practice of multidimensional nuclear magnetic resonance spectroscopy and advanced NMR techniques. Prerequisite: CHM 56000 , CHM 61500 .

Credits: 2.00

CHM 62000 - Spectrochemical Instrumentation

Credit Hours: 3.00. A critical review of instrumental methods of analysis, with particular emphasis on spectroscopic techniques. Topics include: methods of measurement; analog and digital electronics; optics and spectrophotometric modules; and instrumental methods in UV-visible, infrared, and NMR spectroscopies. Prerequisite: introductory analytical and two semesters of physical chemistry.

Credits: 3.00

CHM 62100 - Advanced Analytical Chemistry

Credit Hours: 3.00. A critical survey of recent developments in chemical and instrumental methods of analysis. Prerequisite: CHM 32100 , CHM 42400 .

Credits: 3.00

CHM 62200 - Chemical Aspects Of Mass Spectrometry

Credit Hours: 3.00. A graduate-level treatment of chemical aspects of mass spectrometry. No prior knowledge in mass spectrometry is required. Prerequisite: Bachelor's degree in Chemistry.

Credits: 3.00

CHM 62400 - Particle Spectroscopy

Credit Hours: 3.00. Introduction to the application of ion and electron beams in the chemical analysis of gases and of surfaces. Emphasis is on the unity of the phenomena that underlie the preparation, manipulation, and analysis of ion and electron beams and on the analogies between inelastic reactions of ions and electrons, including those with both gaseous and solid targets. Mass spectrometry is covered in some depth, and a number of newer aspects of particle spectroscopy are treated, including ion scattering spectrometry, Rutherford scattering, energy loss spectrometry (ion and electron), ion kinetic energy spectrometry, ion cyclotron resonance and Auger spectrometry. Applications of these techniques feature structural analysis (compositions of mixtures, molecular structure of organics, electronic state assignment in simple ions), chemical preparations (ion implantation), and isotopic analysis. The underlying chemistry is explored, particularly in considering the kinetics and dynamics of unimolecular fragmentation and in terms of the factors that affect the cross-sections of inelastic collisions. Offered in alternate years. Prerequisite: CHM 42400 .

Credits: 3.00

CHM 62900 - Chromatographic Methods Of Analysis

Credit Hours: 3.00. Principles underlying chemical separations are discussed, including mechanisms of selective transport and zone broadening. Relations are shown between chromatography and electrophoresis, as well as other separation methods. Current applications and current research activity in the field of chemical separations are included. Prerequisite: CHM 42400. Permission of department required.

Credits: 3.00

CHM 63100 - Magnetic Resonance Spectroscopy

Credit Hours: 2.00. Theory, experimental practice, and current applications to biological systems of nuclear magnetic resonance spectroscopy and, to a lesser extent, electron paramagnetic resonance spectroscopy. Offered in alternate years. Prerequisite: CHM 53300, 56100, 57700, 57800.

Credits: 2.00

CHM 63200 - Membranes: Structure And Function

Credit Hours: 3.00. The structure and molecular properties of biological membranes and appropriate model systems. Offered in alternate years.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 63500 - Biochemistry: Dynamic Aspects

Credit Hours: 3.00. Enzymes, metabolism, and protein and nucleic acid biosynthesis. Prerequisite: CHM 63400 .

Credits: 3.00

CHM 63800 - Biophysical Chemistry

Credit Hours: 3.00. Applications of the principles and methods of physical chemistry in biochemistry with emphasis on the behavior of macromolecules in solution. Protein engineering. Offered in alternate years. Prerequisite: CHM 57800, CHM 63400 .

Credits: 3.00

CHM 64100 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Survey of main group and transition metal chemistry. Main group special topics, bonding and structure of boron hydrides. Coordination chemistry, bonding models in coordination compounds. Transition metal organometallic chemistry, ligand types and reactivity patterns. Survey of inorganic NMR spectroscopy. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64200 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Physical inorganic chemistry. Applications of group theory to chemistry and spectroscopy, especially vibrational and electronic spectra of transition metal complexes. Molecular orbital theory and theoretical bases for reactivity. Magnetic properties and electron paramagnetic resonance (EPR) spectroscopy of inorganic materials. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64400 - Solid State Chemistry

Credit Hours: 3.00. The chemistry of solids, including a discussion of ionic crystals, metals, alloys, and binary compounds, and their characterizations by various physical methods. Description of chemical reactions, phase changes, and catalysis in terms of current theories of the solid state. Prerequisite: CHM 34200 , CHM 37400 .

Credits: 3.00

CHM 64600 - Kinetics And Mechanisms Of Inorganic Reactions

Credit Hours: 3.00. Chemical kinetics, reaction orders, mechanisms and rate expressions; experimental techniques; transition state theory; reactions in solution; complex mechanisms; linear free-energy relationships; acid-base catalysis and proton-transfer reactions; redox reactions (electron and atom transfer, oxidative addition-reductive elimination); substitution reactions of metal ion and organometallic complexes; homogeneous catalysis; and heterogeneous reactions. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64700 - Transition Metal And Organometallic Chemistry

Credit Hours: 3.00. A study of the chemistry and physical properties of compounds of the transition metals. Halides, oxides, and oxy-salts; transition metal carbonyls and derivatives; pi-bonded organometallic compounds; catalysis; spectral and magnetic properties of compounds. Prerequisite:CHM 64100 .

Credits: 3.00

CHM 64800 - Bioinorganic Chemistry

Credit Hours: 3.00. Provides a detailed perspective on the roles of metals in biology. Emphasis is placed upon principles guiding the field. The basics of biochemistry and inorganic chemistry are provided such that students from diverse backgrounds may participate. Readings are from the research literature. Offered in alternate years.

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 65200 - Synthetic Organic Chemistry

Credit Hours: 3.00. An advanced treatment of methods for preparing major types of organic functionalities and bonds, stressing stereochemical control and involving mechanisms for understanding the reactions employed. Prerequisite: CHM 65100 .

Credits: 3.00

CHM 66800 - Physical Organic Chemistry

Credit Hours: 3.00. The theoretical and mechanistic bases for structure and reactivity in organic chemistry is discussed. Individual topics include kinetics and thermodynamics, molecular orbital theory, stereochemistry and reactive intermediates as applied to the mechanisms of organic reactions. Prerequisite: CHM 56300 or 65100.

Credits: 3.00

CHM 67100 - Advanced Physical Chemistry

Credit Hours: 3.00. Selected topics, including atomic and molecular structure and modern theories underlying thermodynamics and chemical kinetics. Prerequisite: CHM 57800.

Credits: 3.00

CHM 67200 - Quantum Chemistry

Credit Hours: 3.00. Basic principles of classical and quantum mechanics, exact solutions for simple systems, approximation methods, atomic structure, spectroscopy, application of group theory, theory of molecular binding. Prerequisite: CHM 67100 .

Credits: 3.00

CHM 67300 - Computational Quantum Chemistry

Credit Hours: 3.00. Semiempirical and molecular-mechanics treatments of large molecules, ab initio methods, modern density functional theory, Green's functions, multichannel quantum defect theory, global optimization methods. Prerequisite: CHM 67100 .

Credits: 3.00

CHM 67500 - Chemical Kinetics

Credit Hours: 2.00 or 3.00. Experimental and theoretical consideration of chemical reaction rates and mechanisms.

Credits: 2.00 or 3.00

CHM 67605 - Molecular Spectroscopy

Credit Hours: 3.00. Theoretical and experimental fundamentals of the interactions between molecules and electromagnetic waves. Topics include electronic, vibrational, and rotational spectroscopies, and laser-based methods. Prerequisites: CHM 67100 .

Learning Outcomes: 1. Possess a firm working knowledge of the interactions of light with molecules and be able to explain molecular spectroscopy concepts to other scientists. 2. Able to analyze molecular rotational, vibrational,

and electronic spectra, extracting information about the shapes, bond distances, vibrational motions/frequencies, and electronic excited states from the spectra. 3. Able to read and understand key aspects of the current literature in molecular spectroscopy, including advanced, laser-based methods. 4. Able to use group theory to identify the point group of a molecule and assign molecular rotational, vibrational, and electronic states to symmetry species. Credits: 3.00

CHM 67900 - Chemical Thermodynamics

Credit Hours: 3.00. Advanced thermodynamics of chemical and phase equilibria, of electrolytic and nonelectrolytic solutions, and of imperfect gases. Prerequisite: CHM 57800.

Credits: 3.00

CHM 68200 - Statistical Thermodynamics

Credit Hours: 3.00. Application of statistical mechanics to the description of imperfect gases, liquids, and solutions; to order-disorder phenomena in solids and surfaces; and to absolute reaction rate theory. Prerequisite: CHM 67100 , CHM 67900 .

Credits: 3.00

CHM 69500 - Seminar

Credit Hours: 0.00 or 1.00. Groups meeting for review and discussion of important current literature in analytical, biological, inorganic, organic, and physical chemistry. Each graduate student is required to attend the seminar of his or her major subject.

Credits: 0.00 or 1.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of current interest.

Credits: 1.00 to 3.00

CHM 69699 - Chemistry Graduate Internship

Credit Hours: 0.00. Graduate internship experience. Students submit final work report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. The student should have a meaningful industrial experience, and learn the skills and requirements of contributing to an industrial project or projects at a technical level appropriate to graduate study in chemistry. 2. The student should grow in their understanding of industrial work in a way that helps inform their career goals and pathways. Credits: 0.00

CHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Chinese

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof.

Credits: 4.00

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple

statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 4.00

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 4.00

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 30100 - Chinese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 30200 - Chinese Level VI (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources with stronger emphasis on authentic texts, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 39900 - Special Study Abroad Credit In Chinese

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Chinese earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

CHNS 40100 - Chinese Level VII (UCC: HUM)

Credit Hours: 3.00. Continued development of Mandarin Chinese speaking, listening, reading, and writing skills. Emphasis will be upon modern, everyday language and culture (with some introduction to traditional culture) using various sources such as textbooks, newspapers, and literary works.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 40200 - Chinese Level VIII (UCC: HUM)

Credit Hours: 3.00. Further development of Mandarin Chinese speaking, listening, reading, and writing skills. Materials will include advanced textbooks and original texts such as newspapers and literary works.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

Civil Engineering

CE 19100 - Civil Engineering Practice I

Credit Hours: 0.00. Practice in industry and written reports of this practice. For cooperative program students only.

Credits: 0.00

CE 20300 - Principles And Practice Of Geomatics

Credit Hours: 4.00. This course provides a broad overview of geomatics engineering including fundamental principles required for practical geomatics applications. This course includes subjects in traditional surveying, GPS surveying, remote sensing, photogrammetry, laser scanning, and Geographic Information Systems (GIS). Basic concepts on these subjects are applied to solve practical problems in various civil engineering applications; including computations for engineering project control and construction layout; theory of error propagation; fundamental concepts of horizontal and vertical curves; topographic mapping using various geospatial data acquisition technologies from ground, air, and space; GIS for visualization and analysis of geospatial data.

Learning Outcomes: 1. Design and execute a leveling survey. 2. Design and execute a traverse survey. 3. Use survey data to produce a topographic map. 4. Perform horizontal and vertical curve computations. 5. Collect GPS/RTK/RTN data with survey grade accuracy. 6. Perform remote sensing image classification. 7. Measure digital photographs and perform camera calibration. 8. Use

software to generate 3D point cloud from digital imagery. 9. Perform multi-image bundle block adjustment. 10. Manipulate 3D point cloud data from a laser scanner, and extract engineering parameters. 11. Select appropriate geodetic references and map projections for geomatics applications. 12. Collect and register geospatial data from multiple sources for engineering applications. 13. Map and visualize collected geospatial data. Credits: 4.00

CE 21101 - Thermal And Energy Sciences

Credit Hours: 3.00. This course includes applications of thermal science and energy fundamentals to civil engineering topics. Emphasis is placed on fundamental concepts of properties of materials, work, heat, internal energy, entropy, equilibrium, and relations derived from the first and second laws of thermodynamics. Example applications include: power plants; fluid flow in ducts/pipes; thermal properties of building/construction materials and processes; geothermal systems; heating, ventilation, and air conditioning (HVAC) processes; energy balances in buildings; refrigeration; hydroelectric power; contaminant transport in air, water, and soil; climate change; the urban heat island effect; and energy use in the transportation sector.

Learning Outcomes: 1. Explain the principles of mass and energy conservation and their use in civil engineering applications. 2. Evaluate thermodynamic systems and several forms of work, energy, and heat transfer. 3. Apply conservation of mass and energy for closed systems and control volume processes. 4. Explain the second law of thermodynamics, entropy changes, and device efficiencies. Credits: 3.00

CE 22200 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. The objective of this course is to introduce concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity of construction equipment as well as the costs associated with construction equipment and construction labor. 4. Calculate the peak financial requirement for a given project based on project revenue and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

CE 27000 - Introductory Structural Mechanics

Credit Hours: 4.00. Loads; structural forms; analysis of axially loaded members, flexural members, torsional members; combined loading conditions; buckling. Basic behavioral characteristics of structural elements and systems illustrated by laboratory experiments.

Credits: 4.00

CE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29202 - Contemporary Issues In Civil Engineering

Credit Hours: 2.00. This course provides a forum on issues in the civil engineering profession in a contemporary context. Topics include professionalism and ethics, entrepreneurship, cultural differences, and collaborating globally. Students have interactions with engineering faculty and professionals outside the University. Guidance on the preparation of individual plans of study and information on civil engineering career options are provided. Students learn and apply fundamental aspects of written communication in professional settings. Emphasis is placed on delivery of technical and managerial content. Students will compile a professional portfolio of communication

assignments, including lab reports prepared in other CE courses.

Learning Outcomes: 1. Ability to communicate effectively. 2. Ability to understand the impact of engineering solutions in a global and societal context. 3. Knowledge of contemporary issues, particularly with respect to nuclear topics. 4. Understanding of professional and ethical responsibility. Credits: 2.00

CE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

CE 29900 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Topics vary. Projects, special topics, or supplemental instruction. Arrange Hours and Credit. Permission of instructor required.

Credits: 0.00 to 18.00

CE 31100 - Architectural Engineering

Credit Hours: 3.00. This course introduces energy efficiency, thermal comfort, indoor environmental quality and green building design concepts. The course covers engineering fundamentals required for the design and analysis of building systems such as thermodynamics, fluid mechanics, heat and mass transfer, light and sound transmission. The course presents engineering principles and selected applications related to hydrothermal analysis of building enclosures, air conditioning processes in heating, ventilating and air conditioning systems, building illumination, and building acoustics.

Learning Outcomes: 1. Identify and analyze the characteristics of building environmental loads, building construction, and building operations as they define the requirements for a comfortable and healthy indoor environment. 2. Demonstrate knowledge of thermodynamics , fluid mechanics, heat and mass transfer, photometric quantities and sound transmission for use in building design. 3. Identify, formulate and solve realistic Architectural Engineering problems related to hygrothermal analysis of building enclosures, air conditioning processes in Heating Ventilating and Air Conditioning Systems, pipe and duct flow, building illumination and building acoustics. 4. Demonstrate an understanding of building systems integration to achieve efficient operation. Credits: 3.00

CE 32201 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. The objective of this course is to continue an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed faculties. Building on the broad framework introduced in the prerequisite course, this course develops further ability with analytical tools and extends the basic foundation for advanced topics in construction engineering and management. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Demonstrate an ability

to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Demonstrate an ability to design a process to meet desired needs within realistic constraints. Credits: 3.00

CE 33100 - Engineering Materials II

Credit Hours: 3.00. A continuation of CE 23100.

Credits: 3.00

CE 33500 - Civil Engineering Materials

Credit Hours: 4.00. An introduction to the relationships between fundamental structure of materials and their properties presented through a combination of materials science and engineering approaches. Emphasis on materials of particular interest for civil engineering applications, including metals, aggregates, portland cement concrete, bituminous materials, asphalt binders, asphalt mixtures, wood, polymers, composites, and masonry. Laboratory exercises illustrate atomic structure, elastic and inelastic properties, and demonstrate applications of selected principle of mechanics, testing of aggregates, as well as designing and testing of asphalt and concrete mixtures.

Learning Outcomes: 1. Formulate equations that describe the properties of composite materials based on boundary conditions, assumptions and constituent properties. 2. Design and conduct experiments, as well as to analyze and interpret data. 3. Use non-destructive tests to estimate material properties. 4. Use non-destructive test to locate flaws in engineering systems. 5. Compare and contrast strength of materials and fracture mechanics solutions. 6. Use mathematics, science and engineering principles to estimate the influence of cracks on the mechanical response of engineering materials. 7. Use scientific and engineering principles to predict the elastic and viscoelastic of a material. 8. Interpret engineering properties from test data. 9. Use standardized test procedures to describe the properties of engineering materials. 10. Use mathematical, scientific and engineering principles to compute the influence of material proportions on the structure property relationships for concrete materials. 11. Design the proportions for a concrete mixture. 12. Explain the relationship between the properties of an asphalt mixture and its performance. 13. Select engineering materials for specific applications. 14. Communicate effectively using graphs. 15. Communicate effectively using an executive summary. 16. Communicate effectively using an engineering report. 17. Communicate the expected accuracy obtained from engineering data. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to

describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

CE 36100 - Transportation Engineering

Credit Hours: 3.00. Transportation functions; transportation systems, including land, air, and marine modes; transportation system elements, including traveled way, vehicle, controls, and terminals; techniques of transportation system planning, design, and operation.

Credits: 3.00

CE 37100 - Structural Analysis I

Credit Hours: 3.00. Stress resultants (reactions, axial forces, shear forces, and bending moments) for beams and framed structures. Deflections of beams and frames by geometric methods (moment-area theorems and applications; conjugate beam analogy). Analysis of statically indeterminate beams and frames by classical stiffness methods; slope deflection and moment distribution. Influence functions and their applications.

Credits: 3.00

CE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

CE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

CE 38300 - Geotechnical Engineering I

Credit Hours: 3.00. Introduction to the nature and origin of soils and rocks; engineering significance of geologic landforms and soil deposits; identification and engineering classification of soils; engineering behavior and properties of soils; permeability, compressibility, shearing resistance; soil compaction.

Credits: 3.00

CE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

CE 39201 - Technical Communication In Civil Engineering

Credit Hours: 2.00. This course will build upon the technical

communication components of CE 29202 , adding instruction in oral communication, projects, and working in teams. This course involves both individual and team assignments intended to offer students the opportunity to practice preparing and delivering written correspondence and reports, as well as oral presentations. These activities may be coordinated with other CE courses being taken by students in CE 39201.

Learning Outcomes: 1. Know the value of clear and concise communication. 2. Understand the audience and structuring of communications. 3. Employ the forms of arguments/reasoning. 4. Apply knowledge of scientific vocabulary and technical data-driven communication. 5. Work effectively in teams. 6. Employ issue analysis to plan team project work. 7. Understanding of good listening; oral communications. 8. Employ PowerPoint and visual communications effectively. 9. Deliver team technical presentations. 10. Develop and present lab reports. 11. Knowledge to prepare ""How-To"" video project. 12. Conduct meetings; running brainstorming sessions. 13. Develop persuasive presentations. 14. Prepare effective resumes, cover letters, and job searches. 15. Employ job interview skills. Credits: 2.00

CE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39500 - Fundamentals Of Innovation Theory And Practice

Credit Hours: 3.00. This course is designed to provide students with initial exposure to the fundamental patterns, mindsets, behaviors, attributes, tools, and methods employed in the innovative activity of individuals and organizations. Emphasis is placed on understanding and effectively utilizing techniques to systematically drive innovation that are drawn from the fields of business, design, problem-solving, engineering, and the social sciences. Lecture, in-class small group activities, and individual and team assignments are employed across an array of contemporary socio-technical challenges to provide students with the opportunity to apply conveyed theory and methods to rigorously structure problems, understand involved stakeholders, utilize innovation motifs and analogical reasoning to develop robust views of potential solutions spaces, tailor solution design to stakeholder context, consider the full suite of functional, social, and emotional dimensions that could influence solution prioritization, and document and systematically assess underlying solution assumptions to iterate toward a viable and sustainable forward-looking plan that could achieve target outcomes. This course counts toward, serves as a required entry course for, the College of Engineering Minor in Innovation and Transformational Change.

Learning Outcomes: 1. Develop working knowledge of established innovation forms and motifs. 2. Demonstrate ability to link innovation motifs to specific classes of problems. 3. Understand, and be able to pursue, the core aspects of an end-to-end innovation process. 4. Recognize the mental models, mindsets and behaviors of innovators. 5. Gain awareness of the approaches various forms of organizations take to systematically innovate. 6. Acquire leadership and communication skills through teamwork, oral presentations, and written deliverables. Credits: 3.00

CE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

CE 39700 - Undergraduate Professional Internship

Credit Hours: 0.00. Professional experience in Civil Engineering. This internship experience is intended to complement the student's academic coursework and help prepare the student for a career as a practicing engineer. Program coordinated by school with cooperating employers. A written report is required. Permission of department required.

Credits: 0.00

CE 39800 - Introduction To Civil Engineering Systems Design

Credit Hours: 3.00. An introduction to engineering economy and systems analysis. A systematic approach to the engineering method of design and problem solving.

Credits: 3.00

CE 41300 - Building Envelope Design And Thermal Loads

Credit Hours: 3.00. This course discusses the basic thermal processes in buildings and presents comprehensive methods for thermal design of envelope assemblies in commercial and residential buildings. The first part of the course includes steady-state transient conduction through envelope assemblies, convection and radiation heat transfer in buildings, solar radiation and solar gains, thermal performance of windows, internal gains, ventilation and infiltration. The second part of the course considers surface and room energy balance equations and presents analytical and computational models for calculation of hourly heating and cooling loads throughout the year. Climate-based standards, passive solar design, advanced energy guides, and innovative technologies for high performance buildings are discussed. The course also includes a design project on analytical heating/cooling load calculations for a commercial building.

Learning Outcomes: 1. Calculate heat transfer through envelope assemblies for commercial and residential buildings. 2. Solve energy balance equations for building surfaces and room air. 3. Calculate solar and internal gains and predict transient hourly heating and cooling loads for a building throughout the year using analytical and computational models. 4. Design building envelopes according to national standards. 5. Understand principles of passive solar design and the application of innovative envelope technologies. Credits: 3.00

CE 41400 - Building Mechanical And Electrical System Design

Credit Hours: 3.00. This course covers the design of building mechanical and electrical systems. In the first part of the course students learn principles of designing and integrating heating, ventilation, and air conditioning systems into building air delivery systems, mechanical cooling and heating technologies, duct design and layout, blower and pump selection, and hydronic systems. They also learn to design heating, ventilation, and air conditioning systems within the constraint of achieving satisfactory occupant thermal comfort in buildings. The second part of the course covers design concepts related to building electrical systems; including, single and three-phase power systems, motors, transformers, switching, and relays. The course includes a design project related to mechanical and electrical systems for a commercial building.

Learning Outcomes: 1. Utilize building thermal load information together with a knowledge of industry standards and numerical methods to design and integrate efficient heating, ventilation, and air conditioning systems into commercial and residential buildings. 2. Understand the benefits and drawbacks of conventional and innovative mechanical systems, and identify appropriate opportunities for the selection and integration of both. 3. Evaluate the performance and estimate energy consumption of common mechanical systems and components. 4. Understand the operating characteristics and appropriately size the components that are integrated into building

electrical systems. Credits: 3.00

CE 44000 - Urban Hydraulics

Credit Hours: 3.00. Sources and distribution of water in urban environment, including surface reservoir requirements, utilization of groundwater, and distribution systems. Analysis of sewer systems and drainage courses for the disposal of both wastewater and storm water. Pumps and lift stations. Urban planning and storm drainage practice.

Credits: 3.00

CE 44200 - Introduction To Hydrology

Credit Hours: 3.00. Description, measurement, and analysis of hydrologic processes: precipitation, evapotranspiration, infiltration, and runoff. Hydrograph analysis: unit and synthetic unit hydrographs and flood routing. Statistical analysis of hydrologic data. Fundamentals, budget, and yield analysis of groundwater flows; well hydraulics. Case studies illustrating the application of principles in both surface and groundwater flows.

Credits: 3.00

CE 44300 - Introductory Environmental Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluid flow. Differential equations for environmental fluid flows, including effects of variable density and rotation. Ideal fluid flow; boundary layer approximation; turbulence; water waves.

Credits: 3.00

CE 45600 - Wastewater Treatment Processes

Credit Hours: 3.00. (EEE 45600) Fundamental design principles and practice of wastewater treatment to prepare students for designing wastewater treatment systems. The major topics include design and construction process, preliminary treatment of wastewater, primary treatment, wastewater microbiology, secondary treatment, nitrogen removal, phosphorus removal, attached microbial growth, secondary settling, disinfection and post-aeration, tertiary treatment, and wastewater plant residuals management.

Learning Outcomes: 1. Understand design principles and practice of wastewater treatment. 2. Apply the knowledge to select the best process to treat wastewater. 3. Design a wastewater treatment component or process to meet water quality goals. 4. Critically review relevant literature or contemporary issues in wastewater treatment. Credits: 3.00

CE 45700 - Air Pollution Control And Design

Credit Hours: 3.00. Fundamental concepts and design procedures for the removal of particulates, gases, and toxic air pollutants from waste gas streams. Problem assessment; characterization of exhaust gas streams; fan characteristics.

Credits: 3.00

CE 46100 - Roadway And Pavement Design

Credit Hours: 3.00. Design of highway and airport pavement systems, subgrades, subbases and bases, soil stabilization, flexible and rigid pavements; cost analysis and pavement selection; quality control; drainage; earthwork; pavement evaluation and maintenance.

Credits: 3.00

CE 46300 - Highway Transportation Characteristics

Credit Hours: 3.00. Analysis of basic characteristics of highway transportation systems and the elements influencing these characteristics: drivers, vehicles, pedestrians, flow, density, speed, travel time, delay, stream flow, intersection performance, capacity, accidents, traffic demand, and parking. Techniques used include experimental observation, deterministic and probabilistic queueing theory, probability and statistics, and graphical analysis.

Credits: 3.00

CE 47000 - Structural Steel Design

Credit Hours: 3.00. The elements of structural steel design, including tension members and their connections; structural connections, including welding, and high-strength bolts; compression members; rolled and built-up flexural members; and combined axial and flexural loading effects.

Credits: 3.00

CE 47300 - Reinforced Concrete Design

Credit Hours: 4.00. Design and behavior of reinforced concrete beams, one-way slabs, and columns.

Credits: 4.00

CE 47400 - Structural Analysis II

Credit Hours: 3.00. Determination of deflections by the method of virtual work; analysis of trusses, continuous beams, and frames by direct stiffness method; approximate methods of analysis.

Credits: 3.00

CE 47900 - Design Of Building Components And Systems

Credit Hours: 3.00. Design of simple floor and roof systems and load bearing walls; uses of building materials; fundamentals of design of metal form decking, steel joists, masonry (beams, columns and load bearing walls), and timber (beams, trusses, and mechanical connections).

Credits: 3.00

CE 48300 - Geotechnical Engineering II

Credit Hours: 3.00. Subsurface investigations and techniques for sampling soils, lateral earth pressures, and stability of retaining structures; stability of earth slopes; shallow and deep foundations design.

Credits: 3.00

CE 49700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Topics vary. Permission of

instructor required.

Credits: 0.00 to 18.00

CE 49800 - Civil Engineering Design Project

Credit Hours: 3.00. Planning, design, and analysis of a civil project; an integrated and realistic group project involves as much as possible all major aspects of the civil engineering profession.

Credits: 3.00

CE 49900 - Research In Civil Engineering

Credit Hours: 0.00 to 18.00. Credit arranged. Permission of instructor required.

Credits: 0.00 to 18.00

CE 50101 - Map Projection And Geometric Geodesy

Credit Hours: 3.00. The course will cover topics necessary for the modern "3D surveyor": it will give an overview of coordinate frames used in geodesy, surveying and mapping. What are the relationships between the various (3D) coordinate frames? How are the results of 1D/2D/3D surveys being mapped to a 2D, not necessarily flat, surface? Mapping models (projecting equations) and their characteristics will be discussed, based on the fundamentals of differential geometry and curvilinear coordinates. (Differential) Geometry and Multivariate Calculus: Cartesian, Spherical and Ellipsoidal coordinates and transformations between them. Radius of curvature. Jacobian and Metric Matrices. Geometric Geodesy: Earth-fixed frames. Geocentric, topocentric and local frames. Radius of curvature in the meridian and the prime vertical. [Differential coordinate transformations. Commutative diagram.] Reference sphere. Shortest distance over the sphere/ellipsoid. Reference ellipsoid. Reductions to the ellipsoid. Map projections: Basics of mapping. Conformal mapping. Mercator, Lambert, Stereographic. State Plane Coordinate Systems. Intro to Physical Geodesy: Shape of the Earth. Earth rotation. Inertial frames. Precession, Nutation, Polar Motion, Length of Day. Time Systems. Gravity and Gravitation. Potential Energy. Equipotential surfaces. Geoid. Height differences and the flow of water. Orthometric heights. Geodetic Reference Datums/Frames/Systems: NAD27, NGVD29, IGSN71, WGS72, GRS80, NAD83, WGS84, NAVD88, IERS Standards 1992, HARNs, GEOID90, GEOID93, GEOID96, GEOID99, GEOID2003, GEOID2009.

Learning Outcomes: 1. Solve most 1D/2D/3D survey problems based on rigorous 1D-, 2D-, 3D-modelling. 2. Perform coordinate transformations. 3. Assess mapping characteristics based on principles of differential geometry. 4. Develop mapping dedicated to any engineering project. 5. Generate novel engineering solutions to newly presented survey problems. 6. Evaluate 1D-, 2D-, 3D-models, the coordinate frames used for these and their interrelationships. 7. Model the physical reality underlying most geometry-based models, in earth-fixed as well in inertial space. Credits: 3.00

CE 50301 - Digital Photogrammetric Systems

Credit Hours: 3.00. This course deals with various aspects related to 3D reconstruction from 2D imagery. The course starts with comprehensive coverage of data acquisition systems while focusing on different factors that affect the quality of image measurements. Then, the course focuses on the mathematical details for deriving 3D information from imagery including 2D/3D rotation, collinearity equations, projective transformation, direct linear transformation, theory of orientation, bundle adjustment, image resampling according to epipolar geometry, image matching, and orthophoto generation. The course also covers the similarities/differences between photogrammetric and computer vision approaches toward 3D reconstruction.

Learning Outcomes: 1. Define photogrammetric mapping and its possible applications. 2. Explain basic definitions related to electromagnetic radiation. 3. Define basic optical principles, film development steps, and operational principles of digital cameras. 4. Derive photogrammetric formulas for vertical photography. 5. Explain image coordinate measurements and reduction/refinement. 6. Explain/derive mathematical and geometric principles. 7. Explain the theory and procedures of photogrammetric orientation. 8. Describe the different options for photogrammetric georeferencing. 9. Describe the principles of digital image matching. 10. Explain the steps for digital orthophoto generation. Credits: 3.00

CE 50401 - Laser Scanning

Credit Hours: 3.00. This course covers laser scanning data acquisition and processing activities. The first half of the course deals with the operational principles of laser scanning including laser light generation, laser scanning patterns, georeferencing, point positioning equation, impact of random and systematic errors on derived point clouds, and system calibration. The second half deals with point cloud data processing including characterization, data structures, segmentation, quality control, and product delivery. The course also covers the similarities/differences between photogrammetric and laser scanning approaches for 3D reconstruction.

Learning Outcomes: 1. Explain the latest

development in environmental biotechnology and select appropriate biotechnology for contaminant removal and public health protection. 2. Analyze and assess relevant literature on selected topics in environmental biotechnology and identify areas for improvement. 3. Develop and deliver effective presentations. 4. Write clearly and ethically. Credits: 3.00

CE 50501 - UAS-Based Mapping: Basic Principles

Credit Hours: 1.00. This module covers the fundamentals of UAS-based mapping from imaging and ranging systems - including system integration, calibration strategies, and 3D reconstruction techniques.

Learning Outcomes: 1. Identify the key components of a UAS-based mapping system. 2. Explain the principles of image-based and LiDAR-based mapping. 3. Describe different coordinate systems and georeferencing alternatives. Credits: 1.00

CE 50502 - UAS-Based Photogrammetric Mapping

Credit Hours: 1.00. This module covers the principles and mathematical details of photogrammetric 3D reconstruction from imaging systems onboard UAVs.

Learning Outcomes: 1. Explain the principles of image-based mapping. 2. Identify/select systems/sensors/platforms and design flight plan to meet the needs of a specific application. 3. Conduct a UAS-based mapping project using an imaging system. 4. Evaluate the quality of UAS-based photogrammetric products. Credits: 1.00

CE 50503 - UAS-Based LiDAR Mapping

Credit Hours: 1.00. This module covers the principles and mathematical details of laser scanning-based 3D reconstruction using ranging sensors onboard UAVs.

Learning Outcomes: 1. Explain the principles of LiDAR-based mapping. 2. Identify/select systems/sensors/platforms and design flight plan to meet the needs of a specific application. 3. Conduct a UAS-based mapping project using a LiDAR system. 4. Evaluate the quality of UAS-based ranging products. Credits: 1.00

CE 50601 - Adjustment Of Geospatial Observations

Credit Hours: 3.00. This course presents a thorough and comprehensive look at the topic of fitting data to a mathematical model. The techniques presented will free the scientist or engineer from dependence on restrictive software applications, and allow customization of solutions using weighting, constraints, parameter dependencies, and robust techniques which minimize the influence of blunders. Example applications include 2D/3D ranging, 2D/3D triangulation, curve and surface fitting, coordinate transformations, leveling, and image triangulation. Pre-analysis and design techniques permit the precision of unknown parameters to be determined in advance, prior to expending time and effort in field measurements.

Learning Outcomes: 1. Perform error/covariance propagation to make quantitative statements about uncertainties of the results, and to evaluate statistical hypothesis tests. 2. Become conversant with both linear and nonlinear models as well as sequential estimation. Credits: 3.00

CE 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to

achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

CE 51200 - Urban Planning And Analysis

Credit Hours: 3.00. An introductory course that provides a framework for better understanding of the current urban planning process. Concepts and emerging trends are covered as well as an elementary description of planning methods and techniques. For planning majors and those in related design, development, and socioeconomic disciplines.

Credits: 3.00

CE 51300 - Lighting In Buildings

Credit Hours: 3.00. This course focuses on the design of illumination systems in buildings (electric and natural lighting) in order to achieve energy efficiency and visual comfort. The first part of the course includes analytical lighting calculation techniques, visual perception, radiative transfer, lamp characteristics, electric lighting system design and control for calculation of required indoor illuminance levels. The second part of the course covers daylighting (natural lighting) systems, including state-of-the-art daylighting prediction models as well as design and control of such devices and advanced metrics. The course also has a lab section, in which the students learn how to work with lighting and daylighting tools and build their own computational transient lighting models in open programming languages, in order to design illumination systems and predict electricity consumption and potential energy savings.

Learning Outcomes: 1. Understand fundamental illumination concepts. 2. Design and assess the performance of electric and natural lighting systems in buildings. 3. Calculate fundamental illuminance, non-point sources, radiant energy, lamp types, lighting controls, interior lighting design, daylight prediction models, optical properties of windows, advanced metrics and shading devices. 4. Build and solve lighting and daylighting models using advanced software and programming techniques to design lighting systems and calculate energy savings from the use of natural light and lighting controls. 5. Design a project, submit a project report and make an oral presentation (only individual projects are allowed). The project themes cover a wide variety of lighting/daylighting design and control such as: daylighting and lighting design of commercial buildings, measurements/monitoring of lighting levels in laboratory settings, prediction of protentional energy savings, impact of shading design and control, and advanced daylighting system modeling. Credits: 3.00

CE 51401 - Building Controls

Credit Hours: 3.00. This course is designed to provide students with the knowledge of fundamentals, design, and analysis for building control systems. It primarily consists of three parts. The first part covers basic concepts, terminology, procedures and computations of control systems including block diagrams & transfer function, open-loop & closed-loop control, control system modeling, time response, root locus techniques, design via root locus, and digital control systems. The second part focuses on issues surrounding the building controls: interfacing components such as sensors and actuators, problems encountered, and state-of-the-art solutions for building energy efficiency and thermal comfort. The third part aims to develop students' ability to convert control system concepts into real building control sytems. The course provides a hand-on opportunity for students to complete three projects associated with the three primary components during the semester: indoor environmental quality assessment, building HVAC system commissioning and its control analysis, and new control algorithm development for building energy efficiency, occupant health, and individual productivity.

Learning Outcomes: 1. Demonstrate basic HVAC processes and explain the function, layout, and operation of commercial HVAC systems. 2. Analyze the function, operating characteristics, and appropriate applications of basic control loops and control modes as found in direct digital, analog electronic, electronic and pneumatic commercial control systems. 3. Understand and program a sequence of control, lay out a control system logic diagram and

program it into a DDC controller. 4. Understand the function of network devices and network protocols such as a bridge, router, gateway, hub, firewall, Ethernet, TCP/IP, BacNet, and Lon Talk. 5. Use general-purpose and specific building automation software to monitor and control a building HVAC system. 6. Numerically model a building to define the key control parameters for thermal comfort. 7. Develop and program alternative control algorithms for building HVAC systems in order to enable sustainable buildings. Credits: 3.00

CE 51501 - Building Energy Audits

Credit Hours: 3.00. This course is designed to provide students with the necessary skills to perform an energy audit on commercial and residential buildings. Energy accounting procedures for all major building subsystems are covered in detail, along with operational cost analysis of these systems. Students learn fundamental techniques for auditing the building envelope; electrical and lighting systems; heating, ventilation, and air conditioning systems; internal thermal loads; and building maintenance and operation procedures. Students also learn to analyze electric and natural gas utility tariffs and rate structures and apply their findings to the energy auditing process.

Learning Outcomes: 1. Analyze utility tariffs and rate structures for electricity and natural gas, and use the information to help guide energy audits. 2. Perform an energy audit of all major building subsystems, including the building envelope, electrical and lighting systems, heating, ventilation, and air conditioning systems, internal thermal loads, and building maintenance and operation procedures. 3. Numerically model the energy consumption of each of the building subsystems, and run parametric studies to determine and recommend appropriate energy conservation measures. Credits: 3.00

CE 51601 - Indoor Air Quality

Credit Hours: 3.00. The course covers the fundamentals of indoor air pollutant dynamics in buildings and their heating, ventilation, and air conditioning systems.

Learning Outcomes: 1. Evaluate mechanistically pollutant transport dynamics in buildings through application of material balance models. 2. Apply fundamental principles of aerosol physics to characterize the behavior of indoor aerosols from several nanometers to tens of micrometers in size. 3. Evaluate human exposure to indoor aerosols and analyze the effectiveness of engineering control strategies for indoor air pollution. 4. Read and critically analyze papers in the technical literature on indoor air quality and aerosols. 5. Gain additional insight regarding specific topics related to indoor air quality and aerosols through a rigorous course project. 6. Analyze, and discuss in a group-setting, contemporary indoor air quality issues facing our global society. 7. Prepare and review written and oral technical communication. Credits: 3.00

CE 51901 - Building Information Modeling For High Performance Buildings

Credit Hours: 3.00. The objectives of this course are: (1.) to introduce fundamental concepts of architectural engineering design to develop a deeper understanding of what constitutes our built environment; (2.) future of designing buildings: introduction to Building Information Modeling (BIM), BIM as a process, benefits and problems with a focus on interoperability and building performance-based simulations; (3.) to learn how to apply architectural engineering design and BIM principles towards obtaining high-performance buildings.

Learning Outcomes: 1. Understand architectural engineering design principles and their impact on choice of building systems, such as: form, space, organization, circulation, proportion, and scale. 2. Apply knowledge of BIM concepts and applications, BIM software (REVIT), and usage of BIM tools in architectural engineering. 3. Identify how BIM can support and improve multi-criteria assessment of high-performance buildings. 4. Evaluate the interoperability between BIM-based model and Building Performance Simulations (BPS). 5. Become conversant with language used by architects and BIM modelers to enhance collaboration and improve technical communication within large project teams in industry. Credits: 3.00

CE 52000 - Construction Project Control Systems

Credit Hours: 3.00. Techniques used for planning and scheduling, estimating, and cost control for construction projects. The interface of cost control with the financial management at the company level will be considered. Work breakdown structure as a method of control will be developed.

Credits: 3.00

CE 52100 - Construction Business Management

Credit Hours: 3.00. Develops students' understanding of the fundamental theories and applied principles of management of U.S. construction companies. Exposes students to the present and future practice of business management at the construction company level. Provides insight into basic construction business operations including strategic planning, organizational structure, marketing, accounting, financing, risk analysis, quality, and international construction business practice.

Credits: 3.00

CE 52200 - Computer Applications In Construction

Credit Hours: 3.00. A study of current computer usage in the construction industry; basic computer hardware and software concepts; computer applications in construction; commercially available software applications.

Credits: 3.00

CE 52300 - Selection And Utilization Of Construction Equipment

Credit Hours: 3.00. A study of economics and functional applications for major categories of construction equipment. Operational characteristics are identified for selected equipment items and are applied to typical construction situations.

Credits: 3.00

CE 52501 - Built Environment Modeling

Credit Hours: 3.00. A study of computational tools to model, analyze, and manage the built environment, specifically, the civil infrastructure from a life cycle and system's perspective. Such computational tools include geospatial technologies, engineering sensing technologies, engineering database, building information modeling, object-oriented modeling, and spatial analytics.

Learning Outcomes: 1. Integrate geographic information system (GIS) and building information modeling (BIM) into a digital twin. 2. Explain the fundamental concepts and theories in BIM to more effectively use it as a tool in infrastructure life cycle management. 3. Apply BIM tools to design infrastructure, estimate cost, and plan its construction process. 4. Reason the necessity to incorporate GIS in supplementing BIM in infrastructure engineering. 5. Explain the fundamental concepts and theories in GIS in order to identify the right tools for given tasks. 6. Apply GIS tools to model infrastructure and its surroundings. 7. Apply object-oriented modeling approach in both GIS and BIM to identify the common ground for integration. 8. Design an object-oriented model to integrate GIS and BIM. 9. Use modeling tools to model the civil infrastructure and its spatial context from a life cycle perspective. 10. Identify the data needs and functionality requirements in life cycle infrastructure engineering. 11. Select and apply sensing technologies to collect data. 12. Design geospatial database to store and manage infrastructure data 13. Design a system to use geospatial database for varying tasks throughout the infrastructure life cycle. 14. Develop a digital twin to solve a selected infrastructure engineering problem. 15. Identify and articulate an infrastructure engineering problem. Propose a methodology to address the problem. Work as a team to implement the proposed method. Communicate and present the findings. Credits: 3.00

CE 52900 - Smart Construction

Credit Hours: 3.00. Technologies are embedded throughout all communities, and the boundaries between humans and technologies are shrinking considerably. As a result, the construction industry is also changing rapidly. The questions are: Are we ready for this change? What skills are required to be better prepared as a future workforce? This course covers how these smart and advanced technologies are set to revolutionize the construction industry to achieve specific mission objectives (e.g., improving safety, quality, and productivity). This course will give students the opportunity to learn conceptual and practical foundations for designing and developing systems while also learning to harness technology to ensure a new generation of technologies would include humans in the loop. This course will be project-based, and students learn by actively engaging in various real-world case studies. Other topics include challenges in human-computer interaction, the internet of things, human behavior modeling, VR/AR/MR, wearable sensors, machine learning and artificial intelligence, trust in human-robot interaction, and ethics and fairness in the emerging smart technologies in the construction industry. This course follows Bloom's taxonomy to increase knowledge

(cognitive domain), develop skills (psychomotor domain), or develop emotional aptitude (affective domain). The instructor will incorporate various techniques in each of the course concepts to facilitate higher-order thinking in their students by building up from lower-level cognitive skills. Each concept will be taught in five phases: 1) Knowledge (i.e., Lecture, podcasts, readings before class); 2) Understanding (i.e., presentations, peer review, discussion); 3) Application (i.e., case studies, problem-solving demonstration); 4) Analyzing and Evaluating (i.e., simulation, discussion); 5) Creating, Reflecting, and Debriefing (i.e., group presentations, case studies, discussion, reflection).

Learning Outcomes: 1. Explain conceptual and practical foundations for designing and developing sensing and monitoring technologies. 2. Apply the knowledge and problem-solving skills to real-world case studies. 3. Identify the advantages and challenges of the state-of-the-art technologies to outline gaps in knowledge and the necessity for research in the construction industry. 4. Integrate effective scholarly writing and teamwork strategies as reflect the environment and communication in a professional civil engineering/construction setting. Credits: 3.00

CE 53000 - Properties And Production Of Concrete

Credit Hours: 3.00. Basic properties of hydraulic cements and mineral aggregates and their interactions in concrete. Properties of plastic and hardened concrete. Modifications through admixtures. Production, handling, and placement problems. Specifications; quality control and acceptance testing; lightweight, heavyweight, and other special concretes. A one-day field trip is required.

Learning Outcomes: 1. Learn the course's topics (see "Topics" in the syllabus or see learning objectives related to Outcome 1), acquiring and remember the knowledge explained and have a general vision of the most important technical aspects of one of the most used construction material in the world: Concrete. [Foundational Knowledge] 2. Develop or enhance the student's ability to find autonomously the right sources to learn more about a topic, summarize and analyze the current information, discuss the current knowledge and find the gaps. [Learning How to Learn] 3. Develop the ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics. [Foundational Knowledge & Application] 4. Be able to communicate effectively with a range of audiences the new knowledge you learned in the course. [Human Dimension] 5. Develop or enhance the students' ability to self-evaluate themselves and to evaluate others in a respectful and constructive manner. [Human Dimension, Caring] Credits: 3.00

CE 53101 - Nanotechnology For Civil And Environmental Applications

Credit Hours: 3.00. This course will introduce students to the field of nanotechnology with a special emphasis on nanomaterials synthesis, characterizations and their applications in civil and environmental engineering. The specific applications will include, but not limited to, tailoring mechanical property, durability, self-cleaning, self-sealing, self-sensing, energy harvesting and other multi-functionality. It integrates the fields of materials science, civil engineering and electrical engineering. The basic concepts will be discussed including nano-scale effect, process-structure-property relationship, nano- and micro-structure property characterizations, multi-functional materials, nano-device fabrication and their applications for energy harvesting, water infiltrations and environmental sensing. lab will be provided to students enrolled in the course to learn nano and micro-structure characterizations skills.

Learning Outcomes: 1. Be familiar with terminology and basic concepts of nanomaterials, nanomanufacturing and nanotechnologies. 2. Understand common techniques for nano-structure synthesis and fabrication. 3. Understand basic knowledge of carrier transport mechanism in nanoscales. 4. Understand basic properties of nanomaterials including: mechanical, electrical, thermal, sensing and their characterization techniques. 5. Understand working mechanisms of using nanotechnology to develop multi-functionality of infrastructure materials. 6. Understand underlying mechanisms of thermoelectricity, state-of-the-art thermoelectric materials,

devices and their applications. 7. Understand fundamental knowledge of piezoelectricity, state-of-the-art piezoelectric materials, devices and their applications. 8. Understand working mechanisms of various infrastructure sensing and monitoring technologies, their applications and limitations. Credits: 3.00

CE 53500 - Bituminous Materials And Mixtures

Credit Hours: 3.00. Consideration of major types of bituminous materials-asphalt cements, cutback asphalts, asphalt emulsions, and tars. Influence of chemical composition upon physical properties. Desirable aggregate characteristics for bituminous mixtures. Construction techniques. Current practices for determining optimum asphalt contents. Two one-day field trips are required.

Learning Outcomes: 1. Describe the origins of various bituminous materials, along with their advantages and disadvantages. 2. Describe basic asphalt, emulsion, cutback and aggregate production techniques. 3. Describe standard asphalt, emulsion, cutback and aggregate specification and test methods, along with advantages and disadvantages of each system. 4. Select the proper asphalt product for a given application. 5. Combine aggregates into blends to meet specifications. 6. Derive and correctly apply asphalt mixture volumetric equations. 7. Develop asphalt mixtures based on sound volumetric principles. 8. Complete asphalt mixture designs, including choosing the proper binder content for a given aggregate blend. 9. Explain the behavior of asphalt materials incorporated into pavement structures. 10. Describe the asphalt mixture production, placement, and compaction processes. 11. Evaluate alternatives, using appropriate measures of merit. 12. Demonstrate the capacity for critical thought. Credits: 3.00

CE 53600 - Non-destructive Testing And Sensing For Civil Infrastructures

Credit Hours: 3.00. This course will equip students with necessary fundamental knowledge related to the Non-Destructive Testing methods. The topics will be discussed including fundamental materials mechanical properties and linear fracture mechanics of materials, testing procedures of commonly used civil materials and structures. The content such as, elasticity, fracture mechanics, and wave propagation, will be covered. Various case studies will be discussed to help students understand and apply the knowledge to field inspection or monitoring of civil materials and structures.

Learning Outcomes: 1. Be familiar with terminology and basic concepts of materials and structure failure mode, and failure mechanisms. 2. Understand basic principles of various NDT techniques including stress wave, magnetic, electrical, radar and fiber optics-based methods. 3. Be familiar with typical data acquisition and signal processing involved in NDT methods. 4. Be familiar with equipment and testing procedures of common NDT methods used for civil infrastructure materials and structures. 5. Understand working mechanisms of various infrastructure sensing and monitoring technologies, their applications and limitations. 6. Identify and apply appropriate NDT methods for materials and structural health monitoring and sensing. 7. Perform hands on testing and make decisions after data processing. 8. Report the NDT testing results professionally in both oral and written format. Credits: 3.00

CE 53800 - Experimental Methods In Construction Materials Research

Credit Hours: 3.00. This course will introduce the student to the fundamental aspects of the computer control of experimental equipment. Emphasis is placed on the difficulties of interfacing computers and instruments. Experimental techniques for measuring important properties of construction materials are discussed. For example, techniques involving the use of strain gages, optical measurements, and measurement of properties such as pore structure and surface area are considered. Emphasis is placed on the effects of experimental techniques on the resulting measurements.

Credits: 3.00

CE 54000 - Open Channel Hydraulics

Credit Hours: 3.00. Energy and momentum principles, design of open channels for uniform and nonuniform flow, boundary layer and roughness effects, flow over spillways, energy dissipation, flow in channels of nonlinear alignment and nonprismatic section.

Credits: 3.00

CE 54200 - Hydrology

Credit Hours: 3.00. Meteorology; precipitation; stream flow, evaporation, and transpiration; subsurface flows, well hydraulics; runoff relations and hydrographs; elements of stream flow routing, frequency and duration studies; extreme values statistics applied to flood and drought forecasting; application of hydrologic techniques.

Credits: 3.00

CE 54300 - Coastal Engineering

Credit Hours: 3.00. An introduction to coastal engineering with emphasis on the interaction between oceanic dynamic processes (waves, currents, and tides) and coastal regions (beaches, harbors, structures, and estuaries) and on the engineering approaches necessary to prevent adverse effects caused by this interaction.

Credits: 3.00

CE 54400 - Subsurface Hydrology

Credit Hours: 3.00. Basic principles of fluid flow in saturated and unsaturated materials. Darcy's law, well hydraulics, determination of hydraulic properties of aquifers. Infiltration theory. Discussions of artificial recharge, land subsidence, saltwater intrusion, ground water quality and contamination.

Credits: 3.00

CE 54500 - Sediment Transport Engineering

Credit Hours: 3.00. Sediment properties and the mechanics of sediment transport. Threshold of movement. Riverbed load and suspended load theories. Regime theory and stable channel design. River diversion problems. Erosion. Geomorphologic and water quality aspects.

Credits: 3.00

CE 54700 - Transport Processes In Surface Waters

Credit Hours: 3.00. Four main topics are covered: (1) density-stratified two-layer systems in lakes and channels, with applications to mixed-layer growth, oil-spill containment, salinity intrusions, (2) advection-diffusion modeling in channels, including analytical solutions to steady and unsteady, one- and two-dimensional problems, (3) mechanisms of diffusional transport, including turbulence in channels and longitudinal shear dispersion, and (4) near-field analysis of discharges, including similarity analyses of jets and plumes.

Credits: 3.00

CE 54900 - Computational Watershed Hydrology

Credit Hours: 3.00. Use of professional computer programs for the calculation of the runoff from complex basins. Generation of unit hydrographs. Calculation of losses, channel and reservoir routing, parameter optimization, and application of Kinematic wave technique to urban catchments. Offered in alternate years.

Credits: 3.00

CE 55000 - Physico-Chemical Processes In Environmental Engineering I

Credit Hours: 3.00. This is the first of a two-course sequence and covers physico-chemical processes as applied in water and wastewater treatment. Topics include: reactor theory, mixing, gravity separation, centrifugation, adsorption, ion exchange, disinfection kinetics, acid/base chemistry, neutralization, precipitation, and corrosion.

Learning Outcomes: 1. Learn fundamental principles of physico/chemical processes that are commonly used by Environmental Engineers with an emphasis on water treatment. 2. Understand principles that have a broad application in Environmental Engineering and other disciplines. 3. Focus on fundamental concepts so as to prompt application in a wide range of settings and to promote creativity.

Credits: 3.00

CE 55201 - Environmental Biotechnology

Credit Hours: 3.00. This course focuses on fundamental of molecular biology and biotechnology for environmental applications. The major topics include activated sludge processes, stoichiometry, bioenergetics, anaerobic digestion, biological nitrogen and phosphorus removal, molecular microbiology tools, biofouling, antibiotic resistance, viruses and biofuels.

Learning Outcomes: 1. Understand the latest development in environmental biotechnology and their applications in contaminant removal and public health protection. 2. Review relevant literature critically on selected topics in environmental biotechnology and identify areas for improvement. 3. Deliver effective presentations. 4. Write clearly and ethically.

Credits: 3.00

CE 55401 - Water Chemistry For Environmental And Ecological Engineering

Credit Hours: 3.00. Principles of chemistry applied to the analysis and distribution of the chemical composition of natural waters and engineered water systems. Course topics include acid/base, complexation, precipitation/dissolution, sorption and redox reactions in the context of environmental and ecological engineering. Case studies focus on water chemistry in research and practice, such as lead in drinking water, recovery of valuable products from wastewater, chemistry of engineered carbon dioxide capture, and engineered treatment of surface waters. Case studies vary each year.

Learning Outcomes: 1. Describe the unique properties of water, and the relevance to natural

and engineered systems. 2. Explain fundamental principles of chemical equilibrium and kinetics, and apply principles to calculations and solving contemporary challenges in water chemistry systems. 3. Classify chemical reactions and mass transfer, and deduce which categories are present in a particular system. 4. Evaluate and formulate technological approaches to reduce environmental impacts of anthropogenic activities, based on water chemistry principles. Credits: 3.00

CE 55700 - Air Quality Management

Credit Hours: 3.00. Discussion of fugitive, mobile, and point sources of air pollution with attendant effects on materials, plants, and humans. Development and status of state and federal regulations with emphasis on the development and use of mathematical dispersion models including meteorological fundamentals and atmospheric transport. Discussion of concepts for ambient air quality control strategies including urban planning and transportation considerations.

Credits: 3.00

CE 56000 - Public Mass Transportation

Credit Hours: 3.00. Public mass transportation system technologies, design, operation, and planning including vehicle characteristics, bus transit, light rail and rail rapid transit, schedules and networks, capacity, passenger characteristics, and paratransit.

Credits: 3.00

CE 56100 - Transportation Systems Evaluation

Credit Hours: 3.00. Concepts and principles of transportation economic analysis, transportation costs and benefits, user and nonuser consequences, needs studies, finance and taxation, methods of evaluation of plans and projects, cost-effectiveness, environmental impact assessment.

Credits: 3.00

CE 56200 - Geometric Design Of Highways

Credit Hours: 3.00. Development and applications of concepts of geometric design for rural and urban highways. Design controls and criteria, elements of design including sight distance and horizontal and vertical alignment, cross-section elements, highway types, intersection design elements, types of interchanges and interchange design elements, grade separations and clearance.

Credits: 3.00

CE 56201 - Vehicular Cyber-Physical Systems

Credit Hours: 3.00. Cyber-physical systems (CPS) are a new frontier for computational systems that transform the way people interact with engineered systems, which benefit applications in fields like transportation, aerospace, manufacturing, and health care. This course introduces students to the theoretical and practical foundations of CPS, with an emphasis on their usage in connected and automated vehicles (CAV).

Learning Outcomes: 1. Obtain the basic knowledge of CPS and CAV. 2. Know how to develop an autonomous system to be applied to the transportation system. Credits: 3.00

CE 56300 - Airport Design

Credit Hours: 3.00. Airport design requirements derived from using aircraft design parameters and operational characteristics; airport configuration; runway length and orientation; geometric design of taxiways, exits, and runways; apron design; airspace obstacles; effects of air traffic control; lighting and marking; asphalt pavement and rigid concrete pavement design; pavement overlays; evaluation of runway pavement; drainage; earthwork; and project management. A field trip is required.

Credits: 3.00

CE 56401 - Data Science For Smart Cities

Credit Hours: 3.00. The availability of low-cost and ubiquitous sensors in city infrastructure provides high granular data at unprecedented spatiotemporal scales. "Smart Cities" is a concept to utilize this data to provide a healthy, happy and sustainable urban ecosystem by integrating the information and communication technology, Internet of things, and citizen participation to effectively manage and utilize city's infrastructure and services. 'Data science' is an interdisciplinary field of scientific methods, processes, algorithms, and systems to extract knowledge from data in various forms. This course will introduce techniques that will allow the analysis, inference, and prediction of large-scale data (e.g., GPS trajectories, individual social networks, etc.) that are present in urban networks. The course will focus both on the methods and their application to smart city problems. Python will be used to demonstrate the application of each method on datasets available to the instructor. Examples of applications that will be discussed as an example of applications of data science for smart city applications include: ridesharing platforms, energy modeling, smart and energy-efficient buildings, evacuation modeling, decision-making during extreme events, and urban resilience.

Learning Outcomes: 1. Understand the different types of data generated by smart cities. 2. Understand the basics of various data mining techniques. 3. Understand what type of data mining analysis is appropriate for various smart city applications. 4. Gain basic knowledge of using Python for data analytics and results visualization. 5. Apply the methods and techniques learned in this course to an applied smart city project. Credits: 3.00

CE 56500 - Traffic Engineering: Operations And

Controls

Credit Hours: 3.00. Traffic laws and ordinances; design and application of signs, markings, and signals; timing of isolated and interconnected signals; speed regulation; one-way streets; pedestrian, bicycle, and mass transit considerations; traffic engineering administration.

Credits: 3.00

CE 56600 - Transportation Planning

Credit Hours: 3.00. Fundamentals of transportation planning. Historical development and current status of techniques used in travel demand forecasting: trip generation, trip distribution, mode choice, traffic assignment. Data collection and use of surveys. Applications to passenger and freight movement in urban and statewide contexts. Implications for policy formulation and analysis.

Credits: 3.00

CE 56601 - Network Models For Connected And Autonomous Vehicles

Credit Hours: 3.00. This course provides an introduction to mathematical foundations of the analysis of transportation networks. The course will be divided into two main sections. Section 1 will introduce the basic foundations of network routing problems including user equilibrium (selfish routing) and system optimal games on networks. Various optimization-based formulations, algorithms and extensions will be discussed. A particular emphasis will be on devising efficient algorithms and computation on city networks. Students will be expected to know how to design efficient algorithms for network analysis and implement them on various datasets. The second half of the course will tailor the network models learned in the first half to understanding the impacts of connected and autonomous vehicles (CAVs). This will be done by taking specific example problems such as autonomous intersection control, parking design, network design for CAVs, etc. Recent research papers will form the basis for developing these models. Extensive use of intuitive arguments, counterintuitive phenomenon (paradoxes) and network structures will be utilized to illustrate many situations graphically. In addition, computing the solutions efficiently using various network algorithms will be discussed. The course is research based and students in addition to learning the concepts will extend the concepts to a research project to be finished within the semester.

Learning Outcomes: 1. Analyze transportation systems using game theory and optimization by drawing on analogies between the interactions of supply and demand in economic markets. Define selfish routing (user equilibrium) and system optimal problems; Develop solution algorithms for large scale networks. 2. Apply specialized network structures to solve selfish routing games efficiently. 3. Formulate and apply various extensions of the selfish routing game rigorously - traffic assignment with elasticity, stochastic user equilibrium, network design and OD estimation. 4. Understand the basic concepts of Connected and Autonomous vehicles (CAVs). 5. Apply the static network models to CAV planning and operations problems. 6. Use software to analyze various large-scale transportation networks and understand issues from real-world practitioners.

Credits: 3.00

CE 56700 - Highway Traffic And Safety Analysis

Credit Hours: 3.00. Traffic and safety studies including: traffic and safety impact studies, control and geometry improvements, hazard and countermeasures identification, predicting safety benefits, before-and-after studies; data collection and computer tools for highway traffic and safety evaluation.

Credits: 3.00

CE 56800 - Highway Infrastructure Management Systems

Credit Hours: 3.00. Processes and techniques of managing rehabilitation and maintenance of highway infrastructure facilities including roads and bridges. Three management systems are examined: pavement, bridge, and roadway maintenance. The primary emphasis is on data collection, life cycle cost analysis, priority setting and optimization, program development strategies, and institutional issues.

Credits: 3.00

CE 56901 - Smart Logistics

Credit Hours: 3.00. This course provides a foundation of analytical tools, methods and applications of logistics systems in the context of planning and operations of integrated supply chain systems. The material is useful for students interested in managing supply chain systems providing a background on where and how specific methods can be used for improving overall performance of the supply chain. The course is broadly divided into two parts: (1) Science of Logistics which provides an introduction to unique characteristics of supply chain management; demand forecasting, planning and management; inventory control and planning; operational transportation issues such as vehicle routing and supply chain contracts and network design. (2) Business of Logistics which discusses the applications of the science to real-world logistics systems. Real-world case studies from past problems will be the basis for discussion and will include the nature of costs in supply chain networks, operational issues, vehicle routing problems, interactions of carriers and shippers using auctions and yield management. The course will use intuitive arguments and mathematical optimization tools will be used to illustrate many situations in a rigorous fashion.

Learning Outcomes: 1. Reinforce the integrated nature of logistics systems from tactical, operational and strategic perspectives, different actors in this system and the role of logistics systems as an economic driver. 2. Understand the basics concepts and models of demand prediction, inventory management, operational and tactical planning in supply chain management. 3. Demonstrate the ability to develop appropriate quantitative tools for planning and logistics problems using optimization techniques and solve them using appropriate solution algorithms, techniques and software. 4. Apply the science of logistics systems to improve the cost and overall efficiency of real-world logistics problems.

Credits: 3.00

CE 57000 - Advanced Structural Mechanics

Credit Hours: 3.00. Studies of stress and strain, failure theories, and yield criteria; flexure and torsion theories for solid and thin-walled members; and energy methods.

Credits: 3.00

CE 57100 - Earthquake Engineering

Credit Hours: 3.00. The objectives of the course are to: (1) expose the fundamentals of structural design in earthquake regions; (2) explain the functions of linear, nonlinear, and limit analyses with respect to design; (3) describe the complex relationships between ground motion models and structural response models in the linear and nonlinear response ranges; and (4) provide the students perspectives about the behavior of building structures in the earthquake environment.

Credits: 3.00

CE 57200 - Prestressed Concrete Design

Credit Hours: 3.00. Behavior and design of prestressed concrete structures, prestress losses, composite construction, flexure and shear design, deflections, and special topics.

Credits: 3.00

CE 57300 - Structural Dynamics

Credit Hours: 3.00. Analysis of structural members and systems subject to dynamic loads such as wind and earthquake loads; basic theory for single-degree-of-freedom and multi-degree-of-freedom analytical models of civil engineering structures; free vibration, harmonic and transient excitation, foundation motion, resonance spectrum, Lagrange's equation, modal analysis, lumped parameter methods, computer methods.

Credits: 3.00

CE 57401 - Introduction To Applied Computer Vision To Civil Engineering

Credit Hours: 3.00. This course is an introduction to fundamental topics within applied computer vision-based sensing for management and condition assessment of civil infrastructure systems. Some of the topics covered in this course include basic concepts in digital image processing, pattern recognition, and computer vision that are applicable for segmentation, clustering, 3D reconstruction of civil infrastructure elements, strain and displacement measurement, defect detection and structural health monitoring. Upon successful completion of this course the student shall be able to understand and utilize fundamental concepts in computer vision, image processing and machine learning to analyze images, stitch images, reconstruct the 3D scene, classify and recognize objects/damage, and quantify and track changes.

Learning Outcomes: 1. Understand and utilize fundamental concepts in computer vision, image processing and machine learning to analyze data (discrete, time history, images, and videos). 2. Preprocess and filter data, stitch images, reconstruct the 3D scene, classify and recognize objects/damage, and quantify and track changes. 3. Utilize and implement deep learning techniques including deep neural networks, convolutional neural networks, autoencoders, etc. for their research projects.

Credits: 3.00

CE 57500 - Experimental Methods In Structural Engineering

Credit Hours: 3.00. Theory, methods, and techniques for experimental studies of structural members and systems. Measurements fundamentals; transducers for measuring strain, displacements, force and torque, pressure, and temperature. Physical modeling principles: similitude, materials and their properties, and loading systems for application to studies of elastic and inelastic models. Case studies. Individual project required of each student. Permission of instructor required.

Credits: 3.00

CE 57600 - Advanced Reinforced Concrete Design

Credit Hours: 3.00. Design and behavior of columns, two-way slab and slab-beam floor systems, and beam-column joints; strut-and-tie models.

Credits: 3.00

CE 57900 - Structural Stability

Credit Hours: 3.00. Bending of structural members subjected to axial and lateral loads; buckling of compression members and frames in elastic and inelastic ranges, local buckling, lateral

buckling of beams, design criteria.

Credits: 3.00

CE 58000 - Advanced Geotechnical Engineering

Credit Hours: 3.00. Advanced treatment of topics in geotechnical engineering, including the engineering response to loading, soil properties, earth pressures, shear strength, soil compaction and fabric, permeability, and consolidation and settlement analysis.

Credits: 3.00

CE 58300 - Slopes And Retaining Structures

Credit Hours: 3.00. Selected topics in soil response and technology needed in conventional geotechnical analysis and design; shearing behavior in clays; subsurface investigation; lateral earth pressures, retaining walls, and sheet pile walls; stability of slopes.

Credits: 3.00

CE 58400 - Foundation Analysis And Design

Credit Hours: 3.00. Design of shallow foundations (isolated, combined, and strip footings), with specific attention to issues of mutual concern and interest to geotechnical and structural engineers. Review of factors that serve as the basis for selection of foundation type. Interpretation of subsurface exploration results. Settlement analyses and limit bearing capacity analyses. Communications and interaction between geotechnical and structural engineers. Structure and contents of a geotechnical report. Detailed treatment of geotechnical/structural design criteria and methodologies for various types of shallow and deep foundations.

Credits: 3.00

CE 58700 - Soil Dynamics

Credit Hours: 3.00. Vibration of elementary systems, foundation vibratory theory, foundation design for vibratory loads, foundation isolation, wave propagation theory, response of soils to dynamic loading, dynamic soil properties, dynamic behavior of waste materials, field and laboratory methods for evaluation of dynamic soil properties, liquefaction of sands, vibratory compaction of granular materials.

Credits: 3.00

CE 59100 - Advanced Structural Steel Design

Credit Hours: 3.00. Design and behavior of plate girders; design of composite beam and column members; behavior and design of bolted and welded connections, including moment-resistant connections, seated connections, and gusset-plate connections.

Credits: 3.00

CE 59400 - Transportation Systems Analysis

Credit Hours: 3.00. Identifies concepts fundamental to the planning, design, operation, and management of transportation systems. Aims to impart a systems perspective to transportation problems. Incorporates concepts from economics, engineering, operations research, management, psychology, and public policy analysis. Topics include supply-demand microeconomic framework, analysis of transportation demand, system performance, network equilibrium, and associated case studies.

Credits: 3.00

CE 59500 - Finite Elements In Elasticity

Credit Hours: 3.00. Fundamentals of theory of elasticity; variational principles; one-, two-, and three-dimensional elasticity finite elements; interpolation methods; numerical integration; convergence criteria; stress interpretation.

Credits: 3.00

CE 59601 - Entrepreneurship And Business Strategy In Engineering

Credit Hours: 3.00. This course offers students the opportunity to learn and apply the core skills required to build and grow engineering- and technology-based businesses through lecture, case discussions, and weekly activities tied to a semester-long team project. Course content includes market analysis techniques to link technology attributes to opportunity and vice versa, combinatorial business design and planning methods, strategic innovation theories, competitive analysis, methods of emergent strategy and risk mitigation, as well as examination of team building, firm influence and navigation, and organizational design principles. Emphasis throughout is placed on the implications of research and development uncertainty, long-lifecycle economics, and the management of subcontracts and multi-disciplinary teams often encountered when developing and delivering complex engineering outputs. Case studies are used to contrast the challenges faced when creating new businesses (entrepreneurial) with those encountered in attempts to grow an existing enterprise (intrapreneurial). Coursework and project activities also facilitate development of business acumen, and skill building in conceptual thinking, synthesis, and persuasive communication. This course is particularly relevant for engineering students intending to progress into managerial roles in technology or R&D driven organizations. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Articulate the similarities and differences between entrepreneurship and intrapreneurship. 2. Employ open-ended problem solving techniques to identify opportunities to grow or transform new or existing organizations and/or commercialize new technologies. 3. Utilize and interpret qualitative and quantitative issue and market analysis methods to understand and/or quantify the level of market interest in an idea. 4. Understand and apply theories of innovation to

define competitive market entry strategies. 5. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 6. Employ principles of risk mitigation and emergent strategy to define the assumptions underlying new ideas and explore paths to capture market value. 7. Perform and interpret financial evaluations of new ideas and businesses. 8. Interpret the tradeoffs of varying legal and management structures for a new enterprise. 9. Recognize influence paths in an organization and/or market ecosystem and tailor oral and written communications accordingly. Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

CE 59800 - Graduate Professional Internship

Credit Hours: 0.00. Professional experience in Civil Engineering. This internship experience is intended to complement the student's academic coursework and help prepare the student for a career as a practicing engineer. Program coordinated by school with cooperating employers. Must complete one academic year in Civil Engineering. A written report is required. (May be repeated but may not be taken in successive semesters.) Permission of instructor required.

Credits: 0.00

CE 59801 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multidisciplinary student teams directly apply cumulative learning to address a real-world complex societal challenge in close collaboration with a partner organization in an experiential learning format. The course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation. Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversation methodologies and role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion and retention of new solutions. Credits: 3.00

CE 61400 - Statistical And Econometric Methods I

Credit Hours: 3.00. Basic and advanced statistical and econometric methods as applied to engineering-related problems. Introduction to ordinary least squares regression, count-data models including Poisson and Negative binomial regressions and their extensions, simultaneous equations models, multinomial logit models, ordered probability models, joint discrete/continuous models, and hazard-based duration models. Prerequisites: STAT 51100 .

Credits: 3.00

CE 63100 - Advanced Concrete And Aggregates

Credit Hours: 3.00. Microstructure of concrete. Physicochemical properties of cements and their hydration. Nature of hardened cement paste. Properties of aggregates. Workability, strength, shrinkage, creep, and fracture of concrete.

Durability, freezing and thawing, air-entertainment, reactions of aggregates, chemical attack. Influence of microstructure on engineering properties of concrete. Prerequisite: CE 53000 .

Credits: 3.00

CE 65000 - Photochemical Reactors: Theory, Methods, And Applications Of Ultraviolet Radiation

Credit Hours: 3.00. This course provides comprehensive coverage of the foundational principles of photochemistry and fundamental photochemical reactor theory. Contemporary analytical and numerical methods used to simulate and design photochemical reactors are also presented, along with detailed presentations of several common and emerging applications of these devices. Prerequisite: CE 55000 or graduate status.

Learning Outcomes: 1. Demonstrate fundamental understanding of the principles of photochemistry: mechanisms of photochemical reactions, factors that affect photochemical kinetics, rates of photochemical reactions in various settings. 2. Demonstrate fundamental understanding of photochemical reactor theory: the concept of the dose (fluence) distribution, factors that affect the dose distribution, methods used to simulate reactor dynamics. 3. Articulate fundamental physics that govern the behavior of UV radiation sources: incandescence, metal/halide vapor lamps, LEDs, excimer lamps, lasers, upconversion. 4. Demonstrate fundamental understanding of empirical methods used to characterize and quantify photochemical reactor dynamics: collimated beams, biodosimetry, chemical actinometry, relevant methods in microbiology. 5. Demonstrate fundamental understanding of numerical methods used to characterize and quantify photochemical reactor dynamics: fluence rate field models, computational fluid dynamics (CFD), integrated CFD/fluence rate field models. 6. Apply contemporary methods for analysis and design of UV disinfection systems for aqueous media: drinking water production, municipal wastewater, wastewater reuse. 7. Apply contemporary methods for analysis and design of UV-based processes for alteration of solution chemistry: direct photolysis, advanced oxidation processes, advanced, reduction processes. 8. Apply contemporary methods for analysis and design of systems used to disinfect gas-phase and solid-phase media: disinfection of air and surfaces. Credits: 3.00

CE 66100 - Algorithms In Transportation

Credit Hours: 3.00. Modeling and analysis of transportation network problems through the design, analysis, and implementation of algorithms. Emphasis on the use of quantitative techniques of operations research to model system performance. Covers fundamental data structures, complexity analysis, memory management, recursive programs, application of graph theory and network analysis to transportation problems, analytical formulations and solution algorithms for traffic assignment problems, and dynamic traffic assignment. Prerequisite: CE 59600 or IE 50100.

Credits: 3.00

CE 67100 - Behavior Of Metal Structures

Credit Hours: 3.00. Study of the behavior of metal structural components and metal structural systems. The performance of civil engineering type metal structures in various loading environments is examined, and correlations between behavioral characteristics and various design specification requirements are reviewed. Primary emphasis is placed on the behavior of steel structures, although other metal systems also are discussed. Specific topics include material behavior, manufacturing processes, fatigue and fracture, bolting and welding procedures, and repair and retrofit techniques. Course material is augmented with a number of case studies. Prerequisite: CE 59100 .

Credits: 3.00

CE 67200 - Advanced Topics In Structural Engineering

Credit Hours: 1.00 to 3.00. A series of minicourses on special topics offered as CE 67000, CE 67200, etc. These special topic minicourses provide an opportunity for introducing students to topics of contemporary importance or special interest which fall outside the scope of the regular structural courses. Information about current offerings may be obtained from the schedule of classes or the structural engineering.

Credits: 1.00 to 3.00

CE 67401 - Bridge Engineering

Credit Hours: 3.00. This course reviews a number of fundamental topics related to the structural design of highway bridges. Some of the key features include bridge types, aesthetics, structural analysis methods, vehicle load distribution, deck design and detailing, steel girder design, concrete girder design, integral abutment design, bearings, and construction. Concurrent prerequisites: CE 57200 and CE 59100 .

Learning Outcomes: 1. To solidify students' understanding of the material taught and introduce them to fundamental aspects involved in the design and construction of bridges. 2. Students should be able to understand critical aspects of AASHTO (American Association of State Highway and Transportation Officials) bridge design requirements for steel and concrete superstructures and bridge decks.

Credits: 3.00

CE 67500 - Finite Element Analysis

Credit Hours: 3.00. Theoretical basis of the finite element method; elements for use in the solution of two- and three-dimensional stress problems, plate-bending problems and shell problems; static and dynamic loadings; vibration and stability problems; geometrical or material nonlinearities; flow problems. Prerequisite: CE 57700 or 57800.

Credits: 3.00

CE 67600 - Behavior Of Reinforced Concrete Members

Credit Hours: 3.00. Studies of the behavior and strength of reinforced concrete members, behavior of beam-columns, deflections, shear, bond, and cracking. Review of research and pertinent literature. Emphasis is placed on the background, use, and limitations of present design specifications. Prerequisite: CE 57600 .

Credits: 3.00

CE 68100 - Engineering Properties Of Soils

Credit Hours: 3.00. Engineering properties of soils, including compaction phenomena, with emphasis on strength and compressibility. Experiments to examine the nature and validity of strength and compressibility theories and their application to stability and settlement analysis. Measures of soil fabric; behavior of waste/marginal materials. Prerequisite: CE 48300 .

Credits: 3.00

CE 68200 - Ground Water And Seepage

Credit Hours: 3.00. Hydromechanics of confined and unconfined flow of water through soils, potential theory, conformal mapping transient flow. Applications to design of earth dams. Prerequisite: CE 483000.

Credits: 3.00

CE 68400 - Geological Engineering

Credit Hours: 3.00. Principles describing the mechanical response of geomaterials subjected to disturbance by man. Relation between geology and engineering. Weathering and hydrothermal alteration of rock masses. Weathered rocks, problem soils, and transitional materials. Soluble rock terrain (karst). Applied geomorphology. Civil engineering design factors and case histories that relate to the behavior of rocks and sediments. Characterization of geomaterials behavior, exploration and measurement of their engineering properties. The focus of the course is on theoretical and practical solution of engineering problems. Prerequisite: CE 483000.

Credits: 3.00

CE 68500 - Rock Mechanics

Credit Hours: 3.00. Mechanical properties governing rock behavior, from intact rock to fractured rock masses. Laboratory experiments and field tests. Failure criteria. Linear Elastic Fracture Mechanics. Rock mass deformability. Analytical and empirical approaches for the design and construction of civil engineering structures in rock masses. Slope stability. Bearing capacity of shallow and deep foundations. Prerequisite: CE 48300.

Credits: 3.00

CE 68600 - Underground Construction

Credit Hours: 3.00. Planning, analysis, design, and construction of underground structures in soft ground and rock. Ground structure interaction. Static and seismic stresses on tunnel support. Relative stiffness method. Ground deformations. Construction methods, types of support, and their effects on the surrounding ground. The focus of the course is on the understanding of the interaction between ground and structure. Prerequisite: CE 48300.

Credits: 3.00

CE 68901 - Plasticity Theory

Credit Hours: 3.00. The course covers stress analysis, strains analysis, elastic and inelastic constitutive relations, with emphasis on plasticity, and the solution of plastic boundary-value problems for a wide range of materials, including metals, soils and alloys of various types. Specific topics covered by the course include: tensors, stress analysis, strain analysis, laws of thermodynamics, basic concepts from elasticity, viscoplasticity as an extension of viscoelastic concepts, classical plasticity, principle of maximum plastic dissipation, Drucker's inequality, yield function and yield surface, flow rule, hardening rule, classical models (Tresca, Von Mises, Mohr-Coulomb, Drucker-Prager), bounding-surface plasticity, thermodynamics and constitutive models, causes of plasticity at the microstructural level, noncoaxial plasticity, limit analysis, method of characteristics (slipline method) and cavity expansion analysis. Prerequisite: AAE 55300 or ME 61200.

Credits: 3.00

CE 69100 - Civil Engineering Seminar

Credit Hours: 0.00. An interdisciplinary seminar which provides a forum for invited speakers and staff to discuss new developments in practice and current research in civil engineering.

Credits: 0.00

CE 69500 - Probabilistic Methods In Geotechnical Engineering

Credit Hours: 3.00. Examines the nature of particulate media

and their description and characteristics. Compares deterministic and probabilistic approaches to the action and reaction of structures of, on, or in soil when subjected to loadings. Considers uncertainties in material parameters and their effect on designs. Stability is assessed in terms of reliability as well as customary factors of safety. Prerequisite: CE 58000 .

Credits: 3.00

CE 69700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

CE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Classics

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

CLCS 22000 - Topics In Classical Literature

Credit Hours: 3.00. Selected topics in Greek and Roman literature. All readings in English translation.

Learning Outcomes: 1. Gain a detailed historical understanding of the development of a specific genre or topic within ancient Greek and Roman literature. 2. Ability to appreciate and intelligently discuss major themes in ancient Greek and Roman literature through close reading of representative texts. 3. Ability to identify specific examples of the influence of the ancient Greek and Roman literature on the literature of the later western world. Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CLCS 23300 - Comparative Mythology (UCC: HUM)

Credit Hours: 3.00. Comparative study of the myths of major ancient cultures, with emphasis on shared typological features.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have a detailed grasp of principal characters, narratives, and themes in the myths of a number of representative ancient world cultures (Mesopotamian, Egyptian, Celtic, Aztec, Mayan, East Asian, African); 2. Be able to appreciate the many functions of myths within ancient societies, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify recurrent patterns and themes in the myths of historically disparate ancient and modern cultures. Credits: 3.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their disciplines. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23600 - Ancient World Onscreen

Credit Hours: 3.00. How film represents ancient Mediterranean civilizations and retells ancient myths; how cinematic renderings of ancient history shape views of the past and how these are affected by contemporary sensibilities. No knowledge of Greek or Latin required.

Learning Outcomes: 1. Have a detailed historical grasp of the ways in which the ancient Greek and Roman worlds have found expression in modern cinema; 2. Be able to appreciate how ancient texts fare when translated into the radically different artistic medium of film; and 3. Be able to discuss intelligently what forces influence how we choose to see and represent the ancient western world. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative

authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the influence of ancient Greek tragedy on the drama of the later western world. Credits: 3.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 33700 - The Ancient Epic

Credit Hours: 3.00. Study of the epic in four ancient cultures, with emphasis on its structure, nature, and social functions. Readings may include Gilgamesh, Iliad, Odyssey, Aeneid, Beowulf, Tain, Mahabharata, and others.

Learning Outcomes: 1. Gain an enhanced understanding of the nature and development of the genre of epic through close reading of representative samples of the genre from different ancient cultures. 2. Ability to appreciate and intelligently discuss major themes in epic as they relate to both ancient and modern views of the heroic. 3. Ability to identify specific examples of the influence of ancient epic on the literature of the later western world. Credits: 3.00

CLCS 38000 - Alexander The Great And Hellenistic World (UCC: HUM)

Credit Hours: 3.00. Course examines the career of Alexander the Great and the rise of Macedonia in the Hellenistic Era. Topics include the emergence of Macedonia under Philip II; the achievements of Alexander the Great; and the wars of succession following his demise.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical

profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice.

Credits: 3.00

CLCS 38600 - Ancient Greek Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Greece, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the ancient Greek world from the Mycenaean to the Hellenistic period. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 48000 - Potters And Society In Antiquity

Credit Hours: 3.00. Course covers the range of eastern Mediterranean ceramics encountered in Rough Cilicia Archaeological Survey Project from the Bronze Age to the Later Roman Empire. Course also explores strategies employed by archaeologists and historians to exploit ceramics as research materials.

Credits: 3.00

CLCS 48100 - Culture And Society In The Age Of Pericles

Credit Hours: 3.00. Course explores interrelationships between the emergence of Greek democracy and the cultural, political, social, and economic rise of Athens in the fifth century BCE. More broadly, course surveys history of the Greek world from the Late Bronze Age to 362 BCE.

Credits: 3.00

CLCS 48300 - Republican Rome

Credit Hours: 3.00. Course examines the military, political, economic, and social developments that enabled the Roman people to expand from an Italian city-state to a trans-Mediterranean empire, and the consequences that initiated the decline and transition in their republican form of government.

Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

Clinical Pharmacy

CLPH 43500 - Pediatric Pharmacotherapy

Credit Hours: 2.00. This elective course will focus on the pharmacotherapeutics and pathophysiology of the more common disorders that apply to the pediatric population. The purpose of the course is to discuss the relevant differences between the adult and pediatric population in regards to the diagnosis, treatment options, desired therapeutic outcomes and therapeutic drug monitoring parameters. Instruction will be provided through a combination of lectures, case discussions, homework assignments, and group presentations.

Credits: 2.00

CLPH 44800 - Therapeutic Case Studies

Credit Hours: 2.00. This course is intended to complement instruction of other courses in the second professional year of the Doctor of Pharmacy curriculum and to review many of the topics previously addressed in the Integrated Pharmacotherapy courses and Professional Program Laboratories. It is hoped that students who elect this course will enhance their development of a strong foundation of knowledge, clinical skills and abilities in order to meet the school's professional outcome abilities. Team-based problem-solving methodology will be utilized to discuss patient cases related to topics covered in the IP sequence.

Learning Outcomes: 1. Demonstrate knowledge, skills, and attitudes about drug therapy monitoring and intervention, interpretation of patient and laboratory data, patient interviewing, and interpretation/resolution of drug interactions. 2. Apply material from previous and current course work in the curriculum to cases and scenarios involving patients from a variety of patient care settings. 3. Demonstrate clinical decision making skills related to the generation of treatment algorithms for disease-based management and pharmaceutical care plans for individual patients. 4. Demonstrate verbal communication skills with both patients and other health care professionals through class discussions, role playing, and group interaction. 5. Describe and demonstrate basic physical assessment skills necessary to monitor drug therapy. 6. Exhibit knowledge of generic names, brand names, and dosing of commonly used drug products. 7. Describe the professional role of the pharmacist in providing pharmaceutical care to a diverse patient population with a variety of patient care needs in different settings. Credits: 2.00

CLPH 44900 - Introduction To Psychiatric Pharmacy Practice

Credit Hours: 1.00. This course that provides an overview of psychiatric pharmacy practice, introduction to stigma and diversity issues in mental illness, and disease state overviews in a lecture format. In one class period, the students are able to interact with 4th year pharmacy students and/or pharmacy residents who have worked or are working in the area of psychiatric pharmacy. Four of the class periods also provide live presentations and interactions with persons living with severe mental illness and mental health workers who work with them. Mental Health America of Tippecanoe County works with the instructor to schedule these live presentations. Students are assessed for attendance and participation and also for a reflection written about each class period.

Credits: 1.00

CLPH 45000 - Formulary Dossier Management

Credit Hours: 1.00. This course will focus on preparing students for competing in the annual Academy of Managed Care Pharmacy (AMCP) P&T Competition and is intended to give students a variety of experiences that will enhance their knowledge in analyzing complex therapeutic and pharmacoeconomic data, research and public presentation. The course offers an opportunity for students to engage in simulated formulary management by utilizing comparative studies andcost-effectiveness analysis to make real-life decisions on whether or not to add a drug to hospital or health plan formulary. Students will be paired into teams with each team consisting of 4 students. Each team will work independently to analyze the product dossier and prepare a monograph and presentation for the local and/or national competition. Course lectures will focus on information needed to accurately and adequately prepare students in completing the above noted tasks. Class participation is expected, and students will need to be able to engage in selfdirected learning outside of class to complete the project in a timely manner. All students are welcome. This course is not intended to focus on students from a specific professional year.

Learning Outcomes: 1. Demonstrate the ability to accurately and reliably analyze drug information sources. 2. Demonstrate understanding of basic statistical methodologies used in clinical trials and research design. 3. Demonstrate the ability to accurately interpret pharmacoeconomic data with respect to its impact on new medical treatments. 4. Demonstrate effective written communication

skills with regards to monograph composition and presentation. 5. Demonstrate effective public speaking and presentation skills by conduction a PowerPoint presentation in a confident, organized and engaging manner. 6. Demonstrate the ability to reliably critique journal articles and clinical research trials based on design, methodology and results and to accurately assess statistical and clinical significance. Credits: 1.00

CLPH 45100 - Pharmacy Practical Training

Credit Hours: 1.00. Course allows students to gain practice-related employment experience in a pharmacy setting. Pre-approval of enrollment through ISS is required prior to employment experience. Permission of instructor required.

Learning Outcomes: 1. Ensure pharmacy students receive early exposure to the most common career paths taken by today's graduates and gain a first-hand perspective of pharmacists' responsibilities and activities in their roles. This contributes to a foundation for gaining appreciation of strategies for continually evolving patient care roles in practice. 2. Provide pharmacy students with early observation of pharmacists providing pharmacy services that particularly address the following Professional Program (Pharm.D.) Outcome Ability Goals: Integrative (Practice-related) Competence, Critical Thinking and Decision Making Abilities, Communication Skills and Abilities, Responsible Use of Professional Values and Ethical Principles, Social Awareness and Social Responsibility, Professional Abilities and Habits, and Group Interaction and Citizenship. See the ""Student Handbook"" for specific descriptions of the components of these outcome abilities. 3. Provide pharmacy students with early practice exposure that illustrates the reasons that pharmacists need in-depth learning of the basic and applied sciences and a commitment to lifelong learning for professional effectiveness. 4. Provide pharmacy students with experiences and learning in care-giving that is essential to evolving a patient-centered care role. 5. Contribute to pharmacy student development of a personal practice philosophy (professionalization) as well as a vision and motivation to become a positive practice change agent. 6. Broaden students' perspectives on career pathways and foster initiatives to enhance career planning. Credits: 1.00

CLPH 45300 - Advanced Primary Literature Evaluation: A Focus On Therapeutic Issues

Credit Hours: 2.00. The purpose of this elective course is to enhance the primary literature evaluation skills of the student prior to clerkship rotations. The course is designed to meet the needs of students with an interest in pursuing post-graduate training programs to enhance their ability to discuss the medical literature. Instruction is provided through a combination of lectures and class discussions of recently published literature articles with a cardiovascular focus.

Learning Outcomes: 1. At the completion of this course, the student will be able to: 2. Discuss the basic fundamentals of clinical research. 3. Understand and interpret statistical data in the published literature. 4. Evaluate published literature as it pertains to study design, validity of results and application to treatment of specific patients and practice. 5. Explain research outcomes from a clinical, economic and humanistic standpoint. 6. Discuss the strengths/weaknesses of published current primary literature. 7. Present a journal club and debate current primary literature. Credits: 2.00

CLPH 45400 - Advanced Practice In Psychiatric Pharmacy

Credit Hours: 2.00. The purpose of this course is to provide the student with knowledge and insight regarding the use of medications in persons with mental illness. Instruction will be provided in the following areas (but not limited to): (1) psychiatric disease states; (2) psychiatric medications - usual dosing, adverse effects, drug interactions; (3) clinical use of psychiatric medications in psychiatric pharmacy practice; (4) useful and appropriate monitoring parameters; (5) the interaction of medical illness in the treatment of psychiatric disorders; (6) strategies to improve medication adherence and minimize adverse events; (7) utilization of recognized treatment guidelines in clinical care. Case-based learning will be utilized to

emphasize important points in clinical use and monitoring of psychiatric medications and disorders. Permission of instructor required.

Learning Outcomes: 1. Define and understand the DSM-IV, TR diagnostic criteria for selected psychiatric disorders. 2. Recognize significant co-morbid psychiatric and medical disorders common in the psychiatric population. 3. Classify psychiatric medications based upon FDA-approved and evidence-based reasons for use. 4. Characterize psychiatric medications based upon common reason for use, neuropharmacology and mechanism of action, significant adverse events & warnings for use, drug interactions, dosage forms, and usual dose ranges. 5. Develop techniques for the critical evaluation of psychiatric literature. 6. Apply the psychiatric literature to the clinical treatment of psychiatric disorders. 7. Identify applicable treatment guidelines and develop strategies for implementing guidelines in clinical practice. 8. Discuss the impact of substance dependence upon the treatment of psychiatric illness. 9. Identify drug interactions and adverse events related to complicated psychiatric medication regimens and make sound recommendations for drug therapy. 10. Identify potential medication adherence issues and made recommendations to improve medication use and patient outcomes in clinical practice. 11. Develop an understanding of the psychiatric treatment team and the role of the pharmacist. 12. Apply knowledge learned to clinical case examples. 13. Proactively participate and interact during in-class case discussions.

Credits: 2.00

CLPH 45700 - Pharmaceutical Care In Developing Countries

Credit Hours: 2.00. This elective will emphasize the major disease states, rational drug selection, especially with a limited medication formulary, desired therapeutic outcomes, and the provision of complete pharmaceutical care to patients in developing countries. The impact of drug therapy on health care, economics, and quality of life for diverse populations will be emphasized. Students will prepare to provide care in a cross-cultural environment in which resources are limited. Instruction is provided through a combination of lectures, discussions, and presentations. Enrollment is limited to Doctor of Pharmacy students (068) DP-C status or by consent of course coordinator.

Credits: 2.00

CLPH 45900 - International Advanced Pharmacy Practice Experience Preparation

Credit Hours: 1.00. This course is designed to help students who are participating in rotations based in London, Wales, Kenya or Colombia be prepared to practice upon arrival into your specified country. The course content will include intercultural learning, travel preparation and practice site knowledge. Permission of department and instructor permission required.

Learning Outcomes: 1. Develop an understanding of local culture and the impact on patient care and travel in London/Colombia/Wales/Kenya. 2. Recognize the patient care process in the setting (UK, Kenya, Colombia) and how this will be utilized to care for patients and provide pharmaceutical care. 3. Identify the appropriate steps of the travel preparation process. 4. Describe the four core competencies associated with intercultural learning. 5. Recognize learning styles, communications styles and Hofstede's continua in the context of international experiences and pharmacy practice. 6. Recognize conflict styles and how this may relate to working abroad. 7. Recognize empathy, compassion, openness and their role in healthcare. Credits: 1.00

CLPH 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course to be used to relate to, and supplement, an existing course. Subject matter and method of approach individually directed by instructor. Permission of instructor required.

Credits: 1.00 to 3.00

CLPH 63500 - Principles Of Pharmacokinetics And Pharmacodynamics

Credit Hours: 3.00. The goal of this is to provide students a comprehensive knowledge of concepts related to drug absorption, distribution, metabolism, excretion and action and the relationship to pharmacokinetics parameters such as bioavailability, clearance, volume of distribution, and half-life; and physiological and pharmacological factors affecting these parameters. At the end of the course, students are expected to

communicate effectively, establish a basic understanding at a clinical utility skill level of fundamental PK and PD terminology and principles. Provide a working-knowledge level understanding of the mathematics of PK and PD. Clearly distinguish and characterize the use of PK/PD as tools in Research (Discovery), Drug Development (Characterize PK/PD), and Clinical Therapeutics (TDM, Drug Interactions). Provide participants with the basic skills of PK/PD providing an understanding of the scope, complexity and critical importance these disciplines to their use in Research, Drug Development, and Clinical Therapeutics. Permission of instructor required.

Learning Outcomes: 1. Develop the vocabulary of PK and PD and be able to understand and grasp the significance of using PK/PD tools in drug discovery, development, clinical use, and research. 2. Understand and apply the fundamental mathematical relationships of PK/PD. 3. Design, conduct, and analyze research studies in animals or human subjects that employ the research tools of pharmacokinetics and/or pharmacodynamics to describe the properties of drugs or compounds under research investigation using standard techniques. 4. Understand the significance of key relationships in PK and PD and be able to apply that understanding to other drugs and circumstances. Credits: 3.00

CLPH 65100 - Internship In Pharmacy Industry

Credit Hours: 0.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques learned in the graduate program to a professional work experience in the pharmaceutical industry or government agency. The internship is to be representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Permission of instructor required.

Learning Outcomes: 1. Examine issues rationally and logically; shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make logical, safe, and ethical decisions in both familiar and unfamiliar contexts. 2. Read, write, speak, listen, and use appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 3. Acquire knowledge of leadership traits and skills through curricular and co-curricular activities and develop skills and abilities that will enable him/her to lead or actively contribute to organizational improvement. 4. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. Credits: 0.00

CLPH 65101 - Internship In Pharmaceutical Industry

Credit Hours: 1.00 to 3.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques learned in the graduate program to a professional work experience in the pharmaceutical industry or government agency. The internship is to be representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Permission of instructor required.

Learning Outcomes: 1. Examine issues rationally and logically; shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make logical, safe, and ethical decisions in both familiar and unfamiliar contexts. 2. Read, write, speak, listen, and use appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 3. Acquire knowledge of leadership traits and skills through curricular and co-curricular activities and develop skills and abilities that will enable him/her to lead or actively contribute to organizational improvement. 4. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. Credits: 1.00 to 3.00

CLPH 69000 - Special Problems

Credit Hours: 1.00 to 3.00. Individual research topics pertaining to the practice of clinical pharmacy in institutions and the community. Permission of instructor required.

Credits: 1.00 to 3.00

CLPH 69600 - Seminar In Pharmacy

Credit Hours: 1.00. Designed to provide the student with experience in the oral and written presentation of special topics

of interest to clinical pharmacists and researchers. Discussion of current problems relating to the clinical practice of pharmacy.

Credits: 1.00

College Health and Human Sciences

HHS 10100 - Introduction To Health And Human Sciences

Credit Hours: 1.00. This course is intended to introduce the various programs, majors and academic units within the College of Health and Human Sciences (HHS). In addition to providing an overview of each academic unit and the majors contained within, the course content is also structured to introduce students to career pathways within each respective unit.

Learning Outcomes: 1. Describe the majors and academic units within the College of Health and Human Sciences, and their various specializations. 2. Identify the various career paths, professions, and post-baccalaureate educational opportunities available to students in each major. 3. Describe resources available to students to help establish a strong foundation for success at Purdue. Credits: 1.00

HHS 30000 - Peer Mentoring In The Health And Human Sciences

Credit Hours: 1.00. This course will explore mentoring through training, practice, and reflection. Sophomores, juniors, and seniors in the College of Health and Human Sciences must be selected as HHS mentors prior to taking this course. Student mentors will actively participate in peer mentoring in one-on-one and group settings, use knowledge and skills gained in training and reflect on their experiences. Permission of instructor required.

Learning Outcomes: 1. Use skills and knowledge developed through training, course participation, and their own experiences to mentor first-year students for college success. 2. Recognize and reflect on how mentoring knowledge, relationships and skills align with and impact their future personal and professional goals. Credits: 1.00

HHS 30100 - Peer Mentoring Leadership In The Health And Human Sciences

Credit Hours: 2.00. This course will explore mentoring and leadership through training, practice, and reflection. Juniors and seniors in the College of Health and Human Sciences must be selected as HHS Core Leadership Team mentors prior to taking this course. Student mentors will actively participate in peer mentoring in one-on-one and group settings, develop activities for their peers, use knowledge and skills gained in training, and reflect on their experiences. Permission of instructor required.

Learning Outcomes: 1. Use skills and knowledge developed through training, course participation, and their own experiences to mentor 1 first-year student for college success and 5-8 undergraduate peer mentors for mentoring success. 2. Plan, lead, and execute group mentor/mentee engagement activities. 3. Recognize and reflect on how mentoring knowledge, relationships and skills align with and impact their future personal and professional goals. Credits: 2.00

HHS 40000 - Intercultural Learning In Health And Human Sciences - Lived Experiences

Credit Hours: 1.00 to 6.00. This course focuses on intercultural learning in health and human sciences through direct experiences in a foreign country, whose culture is unique as a whole yet diverse across its different regions. Students will be guided in cognitive and affective learning through observing the destination's culture and society and interacting with its people. By direct exposure to the local customs, health conditions, history, human relations, lifestyle, and religion as they travel across the foreign destination, students are expected to develop a deeper appreciation and empathy for cultural values and traditions that are different from their own. The course will emphasize the students' understanding of how individuals and communities can benefit from learning about others in improving their quality of life. Permission of instructor required.

Learning Outcomes: 1. Report an increase in their intercultural openness and willingness to interact with people who are culturally different from themselves through daily program activities. 2. Describe their own growing cultural self-awareness and report on cultural norms that shape their identity and biases. 3. Demonstrate curiosity about other cultures in relation to health conditions and human relations and begin to describe deeper interest in learning about additional cultures. 4. Exhibit an appreciation of a sense of place defined by cultural values, traditions, customs, and history that are different from their own through hands-on and interactive activities in the settings of health and human sciences. 5. Discover the

impacts of political, economic, and environmental factors on the physical and subjective well-being of the local people as well as their overall quality of life. 6. Identify and explain the key elements of interdependence required for the co-existence and human relations among peoples of different cultural backgrounds. 7. Identify how biases, stereotypes, and perceptions are formed with regard to other cultural groups. 8. Demonstrate self-confidence, travel-related skills, and a deeper appreciation for the increasingly interconnected world of many cultures. Credits: 1.00 to 6.00

HHS 59000 - Special Topics In Health And Human Sciences

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. 2. Outcomes will be required to meet the expectations laid out for 500-level courses. Credits: 0.00 to 9.00

Communication

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)

Credits: 3.00

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 26099 - Professional Practice Parallel Co-Op Summer I

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic

year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 26100 - Introduction To Digital Video Production

Credit Hours: 3.00. Basic production principles and practices. Emphasis on preplanning and conceptualizing skills in addition to practical production techniques. Required for admission to all television production courses. Permission of department required.

Credits: 3.00

COM 27100 - Podcasting

Credit Hours: 3.00. This directed study is designed as an introduction to podcasting. Students in the course will learn about the structure and development of podcasting campaigns, then create their own weekly recording. Recording begins in the third week of classes, giving students 14 opportunities to develop their program.

Learning Outcomes: 1. Develop an idea for a podcast. 2. Write a treatment for a podcast. 3. Pitch the idea for a podcast to an audience. 4. Create a production outline. 5. Produce a budget for the work produced and identify potential funding sources for the project. 6. Execute an advertising campaign for a podcast. 7. Coordinate a schedule for a podcast recording. 8. Evaluate the finished production and the experience of creating that work. Credits: 3.00

COM 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

COM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team

work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

COM 30301 - Mentored Intercultural Communication Experience

Credit Hours: 1.00 to 3.00. This class is intended as a companion to a study abroad or international internship experience. Through a series of guided assignments that integrate experiential activities embedded in the host community with reflective writing that solicits feedback from both peers and an intercultural mentor, students will be challenged to develop intercultural competencies while living in a different culture.

Learning Outcomes: 1. Demonstrate awareness of their own cultural rules and biases by explicitly articulating in reflections and discussions how their experiences have shaped their attitudes and behaviors. 2. Exhibit understanding of cultural differences in verbal and nonverbal communication by successfully completing tasks with team members from other cultural and linguistic backgrounds. 3. Interpret experiences from more than one perspective by seeking out answers to questions about another culture, suspending judgement about another system of values and norms for behavior, and expressing empathy for another point of view. 4. Present effective arguments about their development of intercultural competencies during their study abroad by setting and assessing the achievement of intercultural learning goals and constructing a narrative that illustrates their new skills to prospective employers. Credits: 1.00 to 3.00

COM 30390 - Intercultural Dialogue Facilitator Training

Credit Hours: 1.00. This theoretical and practical training introduces students to intercultural peer dialogue methodology and effective facilitation techniques. Students will engage in scaffolded dialogue experiences first as participants and then as co-leaders, building skills through reflection and guidance from a mentor. Permission from the Instructor is required.

Learning Outcomes: 1. Articulate theories and models of effective intercultural dialogue. 2. Engage in dialogue to experience models of facilitation. 3. Identify developmental needs as an intercultural dialogue leader. 4. Practice co-leading dialogue with a mentor. 5. Reflect on facilitation experiences. Credits: 1.00

COM 30399 - Intercultural Dialogue Facilitation Practicum

Credit Hours: 1.00. In an internship model, students apply the training they received in the Intercultural Dialogue Facilitator Training course. The aim of this course is to provide students with opportunities to hone their leadership and communication skills by facilitating peer dialogues. Each student taking this course is paired with a mentor who provides feedback to students and guides their goal-setting and reflection. The course may be repeated with other dialogue topics and/or participants for additional credit.

Learning Outcomes: 1. Apply theories and models of effective intercultural dialogue in facilitation in order to support student groups and serve the larger campus community. 2. Demonstrate communication skills (listening and observing, summarizing and distilling information, verbal and nonverbal expression) in leading intercultural dialogue. 3. Respond to contextual factors in dialogues to meet the needs of participants. 4. Engage in continuous learning by reflecting on facilitation experiences. 5. Identify areas for continued growth as a dialogue leader, and setting and accomplishing individualized goals for facilitation skill development. Credits: 1.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 31200 - Rhetoric In The Western World

Credit Hours: 3.00. An explanation of major theoretical and philosophical concepts concerning rhetoric; the relationships between rhetoric and political, social, and personal decisions are explored. Ancient and modern authors will be read.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 32800 - Diversity At Work: A Rhetorical Approach

Credit Hours: 3.00. Introduces students to theories and experiences related to issues dealing with both diversity in the workplace and diversity at work to change or influence the world.

Credits: 3.00

COM 33000 - Theories Of Mass Communication

Credit Hours: 3.00. An examination of mass communication theories and theorists. Readings and discussion of McLuhan, Lippman, De Fleur, Lazarsfeld, Schramm, Stephenson, and other significant contributors.

Credits: 3.00

COM 33200 - Television Production

Credit Hours: 3.00. Basic principles of producing, writing, and directing for television. Treats program types and television criticism, and explores creative treatment of visual, artistic, and nonverbal elements of communication in television. Permission of department required.

Learning Outcomes: 1. Utilize the terminology used in studio production settings. 2. Conceptualize a studio production. 3. Script a studio production using correct industry format. 4. Develop critical viewing/listening skills and analytical abilities necessary to evaluate the content of video productions. 5. Demonstrate the proper operation of studio production equipment. 6. Work constructively as a member of a production team. 7. Produce a television studio program. 8. Direct a television studio

program from a prewritten script. Credits: 3.00

COM 33600 - Advertising Media Strategy

Credit Hours: 3.00. Theory and practice of advertising as applied to advertising media strategy. Students build on a foundation of integrated marketing communication to develop digital advertising campaigns.

Learning Outcomes: 1. Explain how practitioners develop advertising campaigns. 2. Design and execute digital marketing plans. 3. Offer suggestions and feedback to classmates in a constructive manner. Credits: 3.00

COM 33701 - Producing Digital Advertising

Credit Hours: 3.00. This course is designed as an advanced level production course. Through lectures, discussions, critiques, screenings, and various exercises, you will gain experience designing video advertisements. You will develop and refine critical viewing/listening abilities to effectively analyze video content for aesthetic elements and overall message. Additionally, you will apply production techniques pertaining to producing, directing, shooting and editing in the creation of projects for real clients. The coursework consists of three major video projects, and a series of assignments organized under the corporate role that would be performing those tasks.

Learning Outcomes: 1. Work with a client in the development of a digital media advertisement. 2. Develop the concept for a digital media advertisement. 3. Pitch the idea for a digital media advertisement. 4. Write the script for a digital media advertisement. 5. Coordinate the production schedule for a digital media advertisement project. 6. Supervise videography for a digital media advertisement. 7. Complete post-production for a digital media advertisement. 8. Critique the final edit of a digital media advertisement. Credits: 3.00

COM 35100 - Mass Communication Ethics

Credit Hours: 3.00. A survey of various ethical approaches applied to situations confronting contemporary mass communicators, including misrepresentation in newsgathering, protection of sources, suppression of information, reporting of terror and violence, pressure from management and advertisers, and reporter bias.

Credits: 3.00

COM 35200 - Mass Communication Law

Credit Hours: 3.00. Study of Anglo-American traditions and trends as well as current American conditions of the laws of libel, privacy, fair comment and criticism, privilege, property rights, and copyright as such factors affect the print journalist and the broadcaster. Emphasis is on existing state and federal regulations and precedents.

Credits: 3.00

COM 35300 - Problems In Public Relations

Credit Hours: 3.00. Approaches to problems in public relations as they occur in industry, government, education, social agencies, and other institutions.

Learning Outcomes: 1. Develop an attitude of professionalism and tact. 2. Expand existing knowledge about theories in the practice of public relations. 3. Gain a greater understanding of the use of the tools of public relations practice. 4. Recognize types of public relations challenges and how to address them. 5. Work effectively and efficiently as a strong team member. 6. Write and edit well, and know how to improve at both. 7. Feel an increase in self-confidence and professionalism that will help with career advancement. Credits: 3.00

COM 35600 - Problems In Advertising

Credit Hours: 3.00. Approaches to problems in advertising as they involve the planning, creation, and evaluation of commercial messages.

Credits: 3.00

COM 36000 - Forensics Practicum

Credit Hours: 1.00. Forensics is the study and practice of evidence-based argumentation. This course cultivates skills associated with researching and constructing arguments - and then applies these skills to contemporary societal, national, and global issues with an eye turned toward generating practicable solutions. Students will be required to move beyond passively consuming information to critically appraising information related to broadly general as well as highly specific and technical topics. The course also emphasizes the development of advanced argumentation and communication skills, as well as the application and adaptation of these skills to diverse audiences. Permission of instructor required.

Learning Outcomes: 1. Explain technical aspects of argumentation and public speaking. 2. Locate, interpret, and explain arguments from

texts in different disciplines. 3. Formulate original arguments and objections. 4. Speak in a public setting following best practices. Credits: 1.00

COM 36001 - Mock Trial Practicum

Credit Hours: 1.00. This course prepares students to represent Purdue University in American Mock Trial Association competitions by focusing on legal reasoning, argumentation, and advocacy. Mock Trial students will become familiar with the United States' legal system and conduct a trial over a fictional civil or criminal case. Students develop and deliver opening statements, introduce and examine testimonial, physical, and demonstrative evidence, examine and cross examine witnesses, and develop and deliver closing statements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the underlying theory and content of specific laws through class discussions and exercises. 2. Locate, interpret, and explain information contained within the American Mock Trial Association's (AMTA's) annual case by reading assigned texts and participating in class discussion and exercises. 3. Formulate original arguments, objections, and replies within a legal setting by participating in class discussion and exercises, and through written assignments. 4. Deliver oral arguments, objections, and replies in accord with courtroom procedures by participating in mock trial exercises inside and outside of class. Credits: 1.00

COM 36099 - Professional Practice Parallel Co-Op Summer II

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

COM 36199 - Professional Practice Parallel Co-Op Semester I

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status.

During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 36200 - Broadcast Performance

Credit Hours: 3.00. This course will immerse students in both the foundational concepts of broadcasting and nuanced performance techniques necessary to take the craft to the next level as on-camera/on-air presenters. Through hands-on, experiential learning, students will refine existing journalistic and creative skills (such as prior reporting, video production, hosting, anchoring, or online media experience) and also develop new talents and portfolio pieces.

Learning Outcomes: 1. Produce on-camera segments that tell stories via studio, field, and social media. 2. Apply technical and creative skills necessary to produce and air basic broadcast programming by completing assigned class projects. 3. Comprehend, define, and analyze essential studio and broadcasting concepts by writing scripts to use in class practicals. Credits: 3.00

COM 36299 - Professional Practice Parallel Co-Op Semester II

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American English in African American speech communities and the U.S. culture at large.

Learning Outcomes: 1. Distinguish descriptive from prescriptive linguistics. 2. Explain how the history of the slave trade affected the development of African American English. 3. Compare and contrast features of African American English with other varieties of English and other Creole languages. 4. Describe features of African American English using tools from the linguist's toolbox (syntax, phonology, semantics, dialectology). 5. Provide examples of important legal cases concerning the education of African American children. 6. Explain how African American culture has helped shape modern American English. 7. Identify language prejudice in popular media. Credits: 3.00

COM 37200 - Communication In Relationships

Credit Hours: 3.00. An examination of communication in personal relationships (including dating and marital relationships, friendships, and families) and professional relationships (including co-worker and supervisor-supervisee relationships and relationships in specific professions, such as doctor-patient and attorney-client).

Credits: 3.00

COM 37400 - Social Interaction Skills: Assessment And Development

Credit Hours: 3.00. An examination of several major communication skills and procedures for their development. Focus is on skill measurement, methods of enhancement, assessment of training programs, and personal skill development. Skills examined include those for conversing, managing conflict, providing support, and influencing.

Credits: 3.00

COM 37600 - Communication And Gender

Credit Hours: 3.00. Course is based on the assumption that studies of gender and communication are intertwined. Focus is on communication processes that create symbols of gender and how those processes recreate the meanings of gender in the lives of individuals and groups.

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 38100 - Gender And Feminist Studies In Communication

Credit Hours: 3.00. This course examines the ways in which communication constructs and maintains our conceptions of gender. It explores different approaches to the study of gender and feminist issues in public, organizational, and mass communication.

Credits: 3.00

COM 38399 - Professional Practice Cooperative Education III

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. The program is coordinated by the Office of Professional Practice with cooperation of participating employers. Students submit a written summary report of their experience and evaluations of the company and their performance. Permission of instructor required.

Credits: 0.00

COM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 40800 - News Magazine Production

Credit Hours: 3.00. Students plan, write and produce a weekly video news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts. 4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 40900 - Video Journalism

Credit Hours: 3.00. Students plan, write and produce a weekly news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts. 4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

COM 41600 - United States Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the U.S.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Able to create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Able to write correctly and

clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 42300 - Leadership, Communication And Organizations

Credit Hours: 3.00. This course explores leadership from a communication perspective. It examines topics such as leadership styles, leading change, influencing others, emotional intelligence, burnout, and engagement. Permission of instructor required.

Learning Outcomes: 1. Able to assess leadership styles. 2. Examine the relationship between leaders and followers in organizations. 3. Critique the literature in the area of communication and leadership. Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

COM 44400 - Introduction To Communication And Social Entrepreneurship

Credit Hours: 3.00. This class introduces students to the roles that communication and innovation play in social entrepreneurship. It explores activities of entrepreneurs, ethics and skill development at the individual and organizational levels, and communication functions in not-for-profit and social venture space.

Learning Outcomes: 1. Identify the major components of communication and social change. 2. Describe the social economy. 3. Articulate how both social entrepreneurship and social innovation benefit society. 4. Describe the difference between nonprofit organizations (NPs), social action efforts, NGOs and social enterprises, as well as traditional entrepreneurship, social entrepreneurship, social intrapreneurship and social innovation. 5. Explain how social enterprises function in different sectors and regions, of various sizes, with vastly different missions. 6. Articulate the challenges social entrepreneurs face as they startup, develop, and communicate with various publics. 7. Identify the best approaches and communication tools that can be deployed to assist in ""getting out the message"" about NP goals and objectives. Credits: 3.00

COM 44700 - The Television Documentary

Credit Hours: 3.00. Study and application of principles of documentary television formats. Students will research an appropriate topic for documentary treatment and produce that program during the semester. Documentary formats examined include news, biographical, ethnographic, and documentary drama.

Credits: 3.00

COM 44900 - Media Management

Credit Hours: 3.00. An introduction to management for mass media outlets. The course will explore management styles and techniques in a variety of media situations, including radio, television, and internet-based business models. Topics such as business structure, advertising and promotion, programming, and leadership style will be included in the discussion. This class is designed as both a philosophical and practical model. Students will discover the theories and principles behind the structure of media businesses, as well as put those ideas into practice in real world situations. Students in the course will be responsible for the programming and promotion of the Brian Lamb School of Communication's channel space on Boiler TV. A mini internship experience is introduced in the second half of the semester, giving the student an opportunity to sample what these opportunities are like.

Learning Outcomes: 1. Define the roles of a media manager. 2. Program a media outlet's weekly schedule. 3. Promote a media outlet's programming to a target audience. 4. Produce a case study of an active media outlet. 5. Identify the characteristics of an effective media

manager. 6. Work constructively as a member of a management team. 7. Create a long-range plan of operation for a media outlet. 8. Present findings from a media case study. 9. Conduct a programming and promotion meeting with a team. Credits: 3.00

COM 45100 - Feature Writing

Credit Hours: 3.00. Examination of magazine staff organization, market analysis, and editorial content. Study of, and practice in, the writing of a variety of nonfiction materials for magazines. Emphasis is on the adaptation of topics and presentations to editorial policies and reader groups.

Learning Outcomes: 1. Understand the stylistic, formatting and structural differences between a typical media article and a feature. 2. Research and produce long-form feature articles for newspapers/magazines, newsletters and other communication platforms. 3. Manage interviews for long-form features - what to seek from the interviewee and what to look for beyond. 4. Write different kinds of features: Informational, instructional and promotional. Credits: 3.00

COM 45600 - Advertising Writing

Credit Hours: 3.00. The theory and practice of copy writing in various advertising contexts.

Credits: 3.00

COM 46099 - Professional Practice Parallel Co-Op Summer III

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 46399 - Professional Practice Parallel Co-Op Semester III

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism,

political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

COM 46499 - Professional Practice Parallel Co-Op Semester IV

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

COM 48900 - Research Experience In Communication

Credit Hours: 1.00 to 3.00. This course grants credit to students who participate in structured research projects within the Brian Lamb School of Communication. Permission of instructor required.

Learning Outcomes: 1. Students will gain understanding of how communication research is conducted. 2. Students will receive hands-on experience in areas such as data collection, data analysis, interpretive skills, or research writing. 3. Students considering graduate studies will gain insight into whether or not they want to pursue such a direction. 4. Students will develop relationships with faculty members that might lead to mentoring, advice, and/or letters of recommendation. 5. Students will gain

experience that might enhance their prospects for graduate studies. Credits: 1.00 to 3.00

COM 49000 - Internship In Communication

Credit Hours: 1.00 to 6.00. Experiential, supervised training in public relations, journalism, telecommunication, oral interpretation, speech education, organizational communication, or public communication. Usually given in junior or senior year. Usually gives two credits per internship experience. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to apply concepts learned in the classroom to real-world working environments and to develop a realistic view of the workplace through internships. Credits: 1.00 to 6.00

COM 49100 - Special Topics In Communication

Credit Hours: 1.00 to 3.00. Intensive study of selected topics, varying from semester to semester, from the literature or practice of communication. Course content will be drawn from areas not dealt with in the regular curriculum and may include such topics as photojournalism, economic reporting, and campaign communication. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of a specialized area of communication and its common applications. Credits: 1.00 to 3.00

COM 49101 - Boiler Communication

Credit Hours: 1.00. This course provides a practical, hands-on approach to public relations by working in student-led teams to produce comprehensive, strategic communication campaigns for actual clients. The course also includes many opportunities for professional development and portfolio building.

Learning Outcomes: 1. Experience a real public relations campaign. 2. Develop professionally to be able to start a public relations career. 3. Use creativity and critical thinking to help clients with public relations needs while engaging in social responsibility. Credits: 1.00

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 49501 - Sports Media Relations

Credit Hours: 3.00. This course examines the role of public relations and mass media in sports communication. It provides an understanding of the operation of sports media and communication and how sports information departments perform their functions. Emphasis is on written communication from athletics communication perspective.

Learning Outcomes: 1. Develop a clear understanding of the day to day responsibilities of sports public relations professionals. 2. Develop attention-grabbing writing skills that reflect an understanding of news judgment. 3. Learn about press box and game-management operations at a sports event, including news conference set-up and execution, coordination of interview requests, quote-gathering, and information and statistics updates and distribution. 4. Create promotional, multimedia content at a sports event, including written features, press releases, social media, video and infographics. 5. Explore communication strategies used by sports media relations professionals in breaking-news situations. 6. Study the evolution of the relationship between media and sports organizations. 7. Learn about the scope of responsibilities of sports media relations professionals, including the coordination of managed news events and special events, the production of media guides, the execution of publicity campaigns, and crisis communications. 8. Understand the effects of evolving technology and social media on sports media relations. Credits: 3.00

COM 49502 - Travel Writing

Credit Hours: 3.00. Travel writing is writing about places, persons, and things in other places-also writing about how to travel, when to travel, and advice on traveling-all with the reader in mind. It's about relaying your travel experiences to others so that they may emulate them or at the very least not make the same mistakes you did. And it's writing about things in your own back yard that are exotic to everyone else-a local farmer's market, historic site, restaurant, museum. In this class, you will explore the various ways travel writers can excite and assist readers.

Learning Outcomes: 1. Gain experience in writing effectively. 2. Identify typical features of travel writing genres. 3. Use research and observation as building blocks for travel writing.

4. Produce a variety of articles within this genre. 5. Understand the "business" of travel writing. Credits: 3.00

COM 49503 - Public Relations For Social Change

Credit Hours: 3.00. The overarching goal of this course is for students to work cooperatively with a community partner to identify, define and address that organization's PR problems and opportunities from a long-term, in-house perspective, building on the work of previous students and incorporating social change theory from a relationship management perspective of PR. The applied work of this course will have the dual benefit of providing students the opportunity to gain contextualized, real-world experience at PR problem-solving and advancing the mission of a nonprofit organization that is important to the wellbeing of the Greater Lafayette community as a whole.

Learning Outcomes: 1. Construct and devise a strategic and mission-focused PR plan and critically evaluate its effects. 2. Explain and demonstrate how storytelling and community relations PR strategies can be used as tools for social change. 3. Describe how their own PR skillsets can be means for future civic engagement. 4. Develop an increased sense of efficacy when it comes to matters of civic engagement and PR practice. 5. Develop a broader view of how PR as a discipline can be applied within a community. Credits: 3.00

COM 49504 - Social Media For Social Good

Credit Hours: 3.00. Nonprofit organizations advance their missions through communication. This course is designed to introduce students to the use of social media by nonprofit organizations to create their brand and reach stakeholders. It will focus on best practices and critically assess local nonprofits return on social media investment.

Learning Outcomes: 1. Discuss the importance of social media to nonprofits for communicating, marketing, public relations, and fundraising. 2. Discuss the measurement of social media effectiveness in communicating messages and in fundraising. 3. Conduct a social media audit. 4. Develop a nonprofit social media strategy. Credits: 3.00

COM 49505 - Sports Communication

Credit Hours: 3.00. This class will help students learn to think critically about sports communication, but it will also help students learn to do sports communication. Through the use of sports books and movies, guest speakers, field trips, and case studies, students will learn not only about sports communication as a field of study and a profession, but also how they can be more thoughtful consumers of sports communication in its various forms.

Learning Outcomes: 1. Describe multiple ways that sports communication constructs and maintains culture. 2. Explain changes in sports communication related to race and gender. 3. List five key events in the last 100 years of sports communication. 4. List and analyze issues related to naming in sports. 5. Create a basic sports crisis communication plan. 6. Frame labor-management sports communication issues from both perspectives. Credits: 3.00

COM 49507 - Executive Communication

Credit Hours: 3.00. This course defines executive communication, offers a rationale for its importance, provides a catalog of deliverables (or tactics) involved in the practice, teaches students how to create those deliverables, and provides students with the tools to serve as strategic advisors to senior leaders. The ultimate goal of the course is to help students become more well-rounded and successful communication professionals.

Learning Outcomes: 1. Describe the breadth, depth and nuance of executive communication. 2. Create various internal and external executive communication deliverables. 3. Conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis of an executive's communication. 4. Define and execute the role of serving as a strategic communication advisor to an executive. 5. Learn from and connect with established communication professionals. Credits: 3.00

COM 49600 - Special Topics In Corporate Communication

Credit Hours: 3.00. This course offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments on current issue in corporate communication. Topics may include diversity in the workplace, organizational assessments, or spirituality in organizations. Permission of instructor required.

Credits: 3.00

COM 49700 - Special Topics In Mass

Communication

Credit Hours: 3.00. Offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments, a current topic or trend in Media, Technology and Society. Possible offerings include Media and Social Change, Online Communities, and Technology and International Communication.

Credits: 3.00

COM 49701 - Live Sports Broadcasting Summer

Credit Hours: 1.00. In this experiential Live Sports Broadcasting course in partnership with the Lafayette Aviators, students will have the opportunity to work in the studio at Loeb Stadium in Lafayette, operate cameras on the field, produce promotional material to be used before, during, and after games, and interview players for segments on The Purdue Channel. The class spans the home season of the Aviators. Students are expected to register for all 3 1-credit modules in a summer. Permission of instructor required.

Learning Outcomes: 1. Demonstrate live sports broadcasting techniques including: studio operation, camera operation, play-by-play and commentary. 2. Interview athletes and staff for broadcast. 3. Develop promotional videos for The Purdue Channel and/or the Aviators. Credits: 1.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

COM 50000 - Introduction To Graduate Studies In Communication

Credit Hours: 3.00. Introduces basic conventions of the principles and procedures of scholarly research, surveys research methods utilized in the communication discipline, applies research methods to various subjects, and offers an overview of degree requirements. Course restricted to graduate students only.

Learning Outcomes: 1. Demonstrate an understanding of the breadth of the discipline of communication and the diversity of topics and approaches included therein. 2. Apply the full range of library research in communication (e.g., electronic resources, databases, and periodical collections). 3. Chart humanistic and social scientific approaches to scholarly endeavor. 4. Demonstrate competence in using the two acceptable writing style forms in the Department of Communication: The American Psychological Association (APA) and the Modern Language Association (MLA). 5. Evaluate published research from diverse perspectives. 6. Develop and write a research proposal and literature reviews as well as deliver an oral presentation from a specific disciplinary perspective. 7. Demonstrate an understanding of the culminating degree requirements for the master's degree in Professional Communication. Credits: 3.00

COM 50200 - Classroom Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communicative behavior in the classroom. The primary focus is on the study and application of principles of effective classroom communication through personal inquiry. Among topics discussed are components of classroom communication, systematic observation as a method of studying classroom communication, and applications of systematic observation in a variety of classroom communication settings. Department permission required.

Learning Outcomes: 1. Describe the nature of communication pedagogy. 2. Identify and discuss multiple moral and civic values for higher education. 3. Develop a specific lesson plan for a COM 11400 unit. 4. Deliver an effective lecture. 5. Facilitate a classroom discussion. 6. Develop appropriate classroom activities and assignments for a COM 11400 unit. Credits: 3.00

COM 50300 - Cross Cultural Communication

Credit Hours: 3.00. In this course, we examine the scholarly

history of intercultural and cross-cultural communication along with conceptual and empirical challenges in doing this type of inquiry. Several contexts will be studied from the point of view of forms of cultural wisdom and variation in practices. Larger questions of idenity, diversity, and intercultural competence will be explored, especially through filters of globalization and ethical issues in intercultural relations. Students will have regular reading assignments, short reaction papers, give oral presentations, and write a final research paper or proposal, depending on their stage in their programs.

Learning Outcomes: 1. Discuss and exemplify how culture is a multimodal, multilayered set of practices, attitudes, and belief. 2. Analyze intercultural communication problems, illustrating the historical, cultural, economic, and political differences that affect their solutions. 3. Recognize a range factors impacting human cultural life, including, but not limited to, class, gender, nation, ethnicity. 4. Develop research ideas and methods to address current problematics in cross-cultural communication. 5. Develop, create, determine how to engage audiences around a global problem. 6. Practice using self-awareness, research, discussion, and peer review to explore cross-cultural challenges. Credits: 3.00

COM 50700 - Introduction To Semiotics

Credit Hours: 3.00. (ANTH 51900, AUSL 58900, ENGL 57000, LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena, which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Learning Outcomes: 1. Describe and apply semiotic theories. 2. Apply semiotic theory and practice to everyday life. 3. Apply semiotic theory to different socio-cultural contexts. 4. Describe the semiotic theory behind the social construction of reality. 5. Analyze sign systems within their socio-cultural milieus. Credits: 3.00

COM 50800 - Nonverbal Communication In Human Interaction

Credit Hours: 3.00. An examination of theoretical writings and critical studies in selected areas of nonverbal communication, e.g., the environmental influences, space and territory relationships, physical appearance and dress, physical behavior, and vocal cues. One unit will deal specifically with measurement, recording, or transcription methods used in nonverbal study.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 52000 - Small Group Communication

Credit Hours: 3.00. Survey and critical evaluation of theoretical and empirical literature dealing with human communication within small group settings.

Learning Outcomes: 1. Explain theories of small group communication including theories about cohesion, conflict, power, leadership, decision-making, norms, and deviance. 2. Apply small group communication concepts and theories to their lived experience. 3. Analyze their own and others' behaviors in groups and its impact on small group communication. 4. Compose a case study analysis of a bona fide group. Credits: 3.00

COM 52700 - Introduction To Cultural Studies In Communication

Credit Hours: 3.00. An examination of selected cultural studies perspectives on mass communication. Covers cultural studies philosophies, theories, and/or approaches to the study of cultural artifacts and practices that may include some of the following: postmodernism, deconstruction, feminism, and postcolonialism, and privileging context as a means of understanding culture.

Learning Outcomes: 1. Describe multiple cultural theory approaches to cultural artifacts and practices. 2. Explain the evolution of cultural studies as a theoretical movement. 3. Apply multiple theoretical lenses to analyze cultural artifacts and practices. 4. Critically critique power relations within the production and consumption of cultural artifacts. Credits:

3.00

COM 53100 - Special Topics In Mass Communication

Credit Hours: 3.00. Critical analysis and evaluation of current and continuing problems in both commercial and public mass communication.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

COM 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, AUSL 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 58200 - Descriptive/Experimental Research In Communication

Credit Hours: 3.00. Introduction to the fundamental tools of quantitative research in communication, including data analysis, statistical design and methods, basic measurement concepts, and designs for descriptive and experimental research. Individual and/or group research projects are planned, conducted, and reported. Permission of instructor required.

Learning Outcomes: 1. You will be able to understand and critically evaluate published research; 2. Be able to make appropriate choices regarding research design which fit within the assumptions of the proposed hypotheses or research questions; 3. You will be able to use basic statistical analysis procedures; 4. You will be able to utilize four research methods; 5. You will be able to write an effective literature review; 6. You will be able to communicate your results via the web. Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 3.00. Directed study of special problems. Permission of instructor required.

Credits: 1.00 to 3.00

COM 59700 - Special Topics In Communication

Credit Hours: 3.00. Seminar of current topics of interest within the discipline of communication.

Learning Outcomes: 1. Explain, in depth, the topic of the variable topic course. 2. Describe

the topic's relevance to the communication discipline. 3. Develop an appropriate topic for analysis. Credits: 3.00

COM 60000 - Foundations Of Human Communication Inquiry I

Credit Hours: 3.00. Introduces doctoral students to major and emerging approaches to understanding human communication and provides them with the theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims.

Credits: 3.00

COM 60100 - Foundations Of Human Communication Inquiry II

Credit Hours: 3.00. Following COM 60000 , this course continues to introduce doctoral students to major and emerging approaches to understanding human communication and provides theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims. Prerequisite: COM 60000 .

Credits: 3.00

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60211 - Seminar In Global Strategic Communication

Credit Hours: 3.00. This course provides students with a global perspective in strategic communication and provides knowledge and understanding of how to address communication issues with international audiences. This class emphasizes such questions as how strategic communication plans can be successfully implemented in other countries and how plans can be measured and evaluated. Prerequisites: Graduate student in communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Understand the role of theory in international strategic communication. 2. Understand the unique role of ethics when implementing or evaluating strategic communication programs in international contexts. 3. Understand the specific role of strategic communication across a sample of nation states. 4. Understand the unique challenges presented by developing strategic communication plans globally. 5. Evaluate global strategic communication programs. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students

in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

COM 60511 - Strategic Communication And Professional Writing

Credit Hours: 3.00. This graduate course covers topics related to professional writing and strategic communication. Topics include grammar basics, audience considerations, credibility and ethics, and documentation style. In addition, writing will be discussed in a variety of contexts such as media, public relations, advertising, and business communication. Permission of department required.

Learning Outcomes: 1. Demonstrate mastery of writing, grammar, and style as well as various guidelines for academic and professional writing. 2. Articulate the role of credibility and ethics in professional writing. 3. Explain the importance of research and audience analysis in professional writing. 4. Analyze the unique challenges of writing in different contexts (e.g., advertising, public relations, media, business communication, print and online). 5. Evaluate strengths and weaknesses of various forms of written communication. 6. Produce various types of documents related to strategic communication. Credits: 3.00

COM 60611 - Seminar In Financial And Investor Relations

Credit Hours: 3.00. This course will provide students with a theoretical and practical overview of theory and practice in financial and investor relations. Student will learn about how the potential investors in public companies are and how to reach them. An emphasis will be placed on communicating with investors to facilitate informed investor decision-making. Prerequisite: COM 60111 Permission of department required.

Learning Outcomes: 1. Articulate the functions of investor relations. 2. Explain major theoretical concepts informing communication approaches to financial and investor relations. 3. Analyze and critique a corporation's investor relations strategy. 4. Develop an investor and financial relations strategy. 5. Evaluate key metrics for determining the effectiveness of an investor relations strategy. 6. Assess various relationship management strategies with various publics/stakeholders associated with investor relations communication. Credits: 3.00

COM 60711 - Strategic Communication And Fundraising Management

Credit Hours: 3.00. This graduate course serves as an introduction to the concepts, elements, and best practices of fundraising. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of communication theory related to fundraising management. 2. Identify best practices of fundraising. 3. Analyze the importance of message design and mediums when creating fundraising campaigns. 4. Assess the implications of an organization's relationships with multiple publics/stakeholder groups for fundraising. 5. Evaluate case studies of fundraising in light of theory and best practices. Credits: 3.00

COM 60811 - Leadership And Global Strategic Communication

Credit Hours: 3.00. Over the last decade, the field of strategic communication has grown rapidly. The work of strategic communication professionals requires coordinated responses between distinct organizational units that are often separated by time and space. These conditions necessitate effective leadership. Further complicating leadership in these contexts is the fact that the work of strategic communication has increasingly become global in nature. This course provides students with theoretical background in leadership and global strategic communication, as well as the opportunity to apply what they learn to strategic communication cases and to their own professional experiences. It also encourages them to think proactively about leadership challenges in these contexts and to articulate theoretically-informed analyses and evaluations of leadership in action. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of

theories related to leadership and to strategic communication in global contexts. 2. Articulate the relationship between theory and the practice of leadership as it relates to global strategic communication, and apply theoretical concepts and principles to real world contexts. 3. Explain the role of leadership and culture in global strategic communication. 4. Compare and contrast notions of leadership, corporate social responsibility, and negotiation across cultural contexts. 5. Identify the unique challenges experienced when leaders engage in strategic communication practices globally. 6. Evaluate the current knowledge base and "best practices" in global strategic communication. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

COM 61011 - Strategic Communication And Ethics

Credit Hours: 3.00. This graduate course introduces the application of ethical principles and decision making. In this course, students will study both philosophical and practical ethical questions related to strategic communication. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of diverse philosophical perspectives on ethics. 2. Compare and contrast insights offered by different perspectives when applied to concrete dilemmas encountered in students' own work experience. 3. Synthesize ethical principles embedded in professional codes of ethics, and their implications for the practice of strategic communication. 4. Highlight ethical principles pertaining to working in organizational teams. 5. Evaluate ethical guidelines for gathering, analyzing, and presenting research data. 6. Identify challenges that occur when evaluating what constitutes ethical strategic communication across cultures. 7. Articulate possible relationships between ethical and effective strategic communication. 8. Evaluate new ethical questions about the practice of strategic communication arising from the emergence of new social media. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of

communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 62211 - Social Media And Artificial Intelligence

Credit Hours: 3.00. This course provides an overview of the use of artificial intelligence and machine learning technologies in contemporary social media campaign development and management. Students will learn about the technologies, AI tools, theories, issues, challenges, ethical considerations, and best practices that inform the planning and implementation of successful social media communication and audience engagement. Throughout the course, students may engage in experiential learning, case studies, and group projects to apply their knowledge and gain hands-on experience in using AI for social media management.

Learning Outcomes: 1. Explain the basics of AI and its current and potential future applications in social media management. 2. Demonstrate how AI is used to collect and analyze social media data for insights and decision-making. 3. Evaluate how AI should not be used to create original social media content (text, audio, and video). 4. Articulate the importance and challenges of creating social media content that has a consistent (brand) voice but is tailored to fit specific social media platforms. 5. Review the potential use of AI-driven chatbots for customer support and interaction. 6. Assess the challenges and ethical concerns about AI-powered content moderation on social media. 7. Understand and explain the importance of making underlying AI algorithms transparent and explainable to social media users and managers. 8. Analyze the role of credibility and ethics in the use of AI in social media management. 9. Identify the importance of research and audience analysis in social media management. 10. Demonstrate the ability to use AI to complete key social media management tasks. Credits: 3.00

COM 62300 - Artificial Intelligence & Social Media

Credit Hours: 3.00. This course provides an overview of the use of artificial intelligence and machine learning technologies in contemporary social media campaign development and management. Students will learn about the technologies, AI tools, theories, issues, challenges, ethical considerations, and best practices that inform the planning and implementation of successful social media communication and audience engagement. Throughout the course, students may engage in experiential learning, case studies, and group projects to apply their knowledge and gain hands-on experience in using AI for social media management.

Learning Outcomes: 1. Analyze the Role of AI in Social Media Communication: Critically evaluate how AI technologies are transforming social media marketing, content personalization, and user-engagement strategies. 2. Apply AI Tools for Social Media Campaigns: Integrate AI tools such as chatbots, sentiment analysis, and predictive analytics into the design and execution of effective social media campaigns. 3. Navigate AI in Social Media Practices: Assess the ethical implications of AI usage in social media, including issues related to privacy, bias, PII, data collection, and transparency, and propose solutions to mitigate these challenges. 4. Measure AI-Driven Social Media Outcomes: Use analytics to measure the effect of AI-enhanced social media strategies on brand awareness, audience engagement, and conversion rates. 5. Understand how artificial intelligence (AI) and machine learning (ML) technologies are used in social media management. 6. Investigate, understand and analyze how AI is leveraged to create personalized content and automate content

generation, and the ethical/legal issues involved. 7. Explore and understand how AI is used to collect and analyze social media data for insights and decision-making. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

COM 64011 - Seminar In Advertising

Credit Hours: 3.00. This course provides an overview of the strategic planning process for advertising including identifying the target audience, determining a positioning strategy and developing a communication media strategy. The course will provide information on theory and best practices that inform the planning and implementation process for successful advertising campaigns.

Learning Outcomes: 1. Create a strategic advertising plan. 2. Identify key aspects of a target audience. 3. Develop a positioning strategy. 4. Articulate communication objectives. 5. Determine a media strategy. Credits: 3.00

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique

IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

COM 64400 - Strategic Personal Branding

Credit Hours: 3.00. This graduate course will examine the theories and processes of personal brand development and self-marketing. The course will examine best practices, trends, and creative strategies used in contemporary personal branding. An emphasis will be placed on experiential learning, self-awareness, image and perceptual management, career development, self-promotion, brainstorming, and effective communication.

Learning Outcomes: 1. Convey deep understanding of personal mission, vision, values, personality, skills, and other key attributes and differentiators. 2. Develop a strong conceptual foundation for formulating distinctive, professional, and effective personal brands. 3. Demonstrate an understanding of various personal branding principles, theories, tools, techniques, and models. 4. Critique real-world personal brands for their authenticity, impact, and effectiveness. 5. Develop and present a personal branding and self-marketing campaign. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 64600 - Strategic Corporate Branding

Credit Hours: 3.00. This graduate course will survey the theories and processes of business brand design, development, and implementation. The course will examine best practices, trends, and creative strategies used in contemporary business branding. An emphasis will be placed on experiential learning, case study analysis, and the application of relevant theory to provide an in-depth understanding of the development, planning, execution, and evaluation of business brands.

Learning Outcomes: 1. Develop a strong conceptual foundation for formulating creative, meaningful, and effective business brands. 2. Apply strategic branding concepts to a variety of business needs and applications. 3. Demonstrate an understanding of various branding principles, theories, tools, techniques, and models. 4. Critique real-world brands for their efficacy, impact, and creativity. 5. Develop and present a business branding campaign. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make

recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

COM 65200 - Communication Education And Training

Credit Hours: 3.00. This course is designed to introduce fundamental concepts related to learning theory and learning design as applied to training and educational settings. The course will examine best practices and strategies with a focus on assessing and enhancing communication-related skills.

Learning Outcomes: 1. Define key communication skills and vocabulary. 2. Understand and apply the basic tenets of learning theory. 3. Design, develop, and evaluate an effective educational workshop or course. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 66111 - Sports Communications

Credit Hours: 3.00. This course provides students a strategic and holistic sports communication approach and framework to solve for communications challenges. The course focuses on understanding the ever-increasingly competitive athletic landscape - collegiate and professional (though the lines are blurring) -- to aid the sports communicator in crafting a strategic communication plan based on quantifiable objectives and desired outcomes. Special topics include crisis and reputation management, leveraging social media, the emergence of AI, and athletes and culture.

Learning Outcomes: 1. Develop a strategic sports communication plan. 2. Integrate social media and AI into strategic communication planning. 3. Apply effective strategies to engage productively with collegiate and professional sports media. 4. Analyze a crisis event to develop strategies for advancing organizational reputation. 5. Articulate the role of sports in culture. Credits: 3.00

COM 66211 - Strategic Sports Media Relations

Credit Hours: 3.00. This course explores how to navigate a media landscape that is evolving at light-speed both in collegiate and professional sports. The course offers students the tools to engage productively with media members and places particular emphasis on the communicator/media relationship, how media prefer to receive content and the role of the communications leader. Strategic Sports Media Relations also delves into media interaction during crisis events and the rise of AI.

Learning Outcomes: 1. Articulate how sports media relations have evolved across print, radio, TV, online and social media. 2. Explain the roles of collegiate and professional athletics communicators. 3. Demonstrate the ability to

facilitate interviews and pitch/write in the sports media relations setting. 4. Respond to crisis and reputation management events. 5. Discuss sports media relations ethics/law and AI's impacts. Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

COM 69500 - Curricular Practical Training

Credit Hours: 1.00 to 3.00. Internship providing practical field experience under professional supervision in selected situations related to the student's area of specialization. Good standing in the graduate program of the Department of Communication and an approved plan of study including the internship. Permission of instructor required.

Learning Outcomes: 1. Apply communication concepts to industry or sector-specific communication problems and projects. 2. Develop communication skills specific to work in a specific sector or industry. 3. Gain valuable experience working alongside communication and industry leaders in the workplace. Credits: 1.00 to 3.00

COM 69800 - Research MA Or MS Thesis

Credit Hours: 1.00 to 18.00. Research MA Or MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

COM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Comparative Literature

CMPL 23000 - Crossing Borders: Introduction To Comparative Literature

Credit Hours: 3.00. (LC 23000) Foundations for comparison of works in different languages, thematic (philosophical, sociological, psychological), and structural (genre, composition, use of linguistic devises); parallel interrelation of theme and structure in works of different literatures. The importance of literary norms and systems of genres. Examination of crosscurrents in different literatures during successive periods of development.

Learning Outcomes: 1. Provide familiarity with the original languages that lie behind English translations of world literature. 2. Relate a particular culture to the larger patterns of world literature to gain an appreciative of cultural diversity and global awareness of class, ethnicity, gender, and race. 3. Provide practical experience in oral communication through class presentations and reports and projects. 4. Provide practical experience in oral communication through class presentations and reports and projects. 5. Provide appropriate level practice in information literacy related to the study of comparative literature, including researching source materials, research methodologies, and intellectual approaches. Credits: 3.00

CMPL 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (LC 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major

political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

CMPL 26600 - World Literature: From The Beginnings To 1700 A D (UCC: HUM)

Credit Hours: 3.00. (ENGL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

CMPL 26700 - World Literature: From 1700 A D To The Present (UCC: HUM)

Credit Hours: 3.00. (ENGL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

CMPL 33000 - International Cinema

Credit Hours: 3.00. This course is designed to develop students' seeing, reading, speaking, writing, and critical thinking skills, and especially to improve visual competency, awareness of visual culture, and knowledge of selected international cinema. All films will be shown with English subtitles.

Learning Outcomes: 1. Explain and assess different ways of seeing as an introduction to understanding visual theory. 2. Demonstrate understanding of the concepts and techniques of cinematography, processing, and reading images and film. 3. Recognize, select, and justify choices for seeing and interpreting the visual. 4. Identify and analyze culturally-conditioned references. Credits: 3.00

CMPL 49000 - Special Topics In Comparative Literature

Credit Hours: 3.00. Topics vary from section to section.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 3.00

CMPL 59000 - Directed Reading In Comparative Literature

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Individual conferences. No class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

CMPL 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (LC 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study.

Credits: 3.00

CMPL 65000 - Seminar In Comparative Literature

Credit Hours: 3.00. (LC 63900) Exploration of a significant topic in comparative literature, e. g. the arts of translation, thematology, genre studies, literary movements, literary relations among countries.

Credits: 3.00

CMPL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Comparative Pathobiology

CPB 25500 - Clinical Pathology-VN

Credit Hours: 4.00. Basic instruction in clinical pathology, including theory and techniques of hematology, clinical chemistry, urinalysis, cytology, and specimen handling.

Learning Outcomes: 1. Have a clinically relevant working knowledge and mastery of laboratory skills related to erythrocytes (red blood cells) of common domestic and exotic

species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of RBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal RBCs; C. Define anemia and classify anemia by mechanisms and RBC indices; D. Accurately perform laboratory analysis of blood samples to produce relevant erythrocyte data for an erythrogram. 2. Have a clinically relevant working knowledge and mastery of laboratory skills related to leukocytes (white blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of WBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal WBCs; C. Accurately describe abnormal leukograms using proper medical terminology and categorize the clinical significance of these abnormalities (e.g., inflammation, stress, excitement, neoplasia, etc.); D. Accurately perform laboratory analysis of blood samples to produce relevant leukocyte data for a leukogram. 3. Have a clinically relevant working knowledge and mastery of laboratory skills related to platelets (thrombocytes) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe or identify from questions features of platelet production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal platelets/thrombocytes; C. Define thrombocytopenia and thrombocytosis and describe major mechanisms for each; D. Accurately perform laboratory analysis of blood samples to provide accurate estimates of platelet numbers. 4. Have a clinically relevant working knowledge and mastery of laboratory skills related to analysis of urine. This includes the ability to: A. Accurately perform a complete urinalysis including the physical, chemical and sediment examination; B. Identify normal and abnormal urine elements by microscopy, gross visual examination and photographs. 5. Have a clinically relevant working knowledge and mastery of laboratory skills related to diagnostic cytology. This includes the ability to: A. Collect and process fluids, skin and subcutaneous samples, and vaginal cytologic preparations; B. Correctly classify cytologic preparations as normal, malignant or inflammatory; C. Recognize and describe normal and abnormal leukocytes in cytologic preps. This includes visual recognition and/or description of the following features: macrophage activation, neutrophil degeneration, lymphocyte reactivity; D. Recognize and distinguish between bacteria & fungal organisms; E. Classify stages of the reproductive cycle based on vaginal cytology from dogs and cats. 6. Correctly associate specific clinical chemistry tests with their primary organ of involvement (e.g., kidney, liver, etc.), process (e.g., acid-base) or class of analyte (e.g., electrolytes). 7. Have a clinically relevant working knowledge and mastery of the physiology of hemostasis and how that relates to common laboratory tests for hemostasis disorders. This includes the ability to: A. Correctly categorize the role of key elements of hemostasis into primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis; B. Select appropriate tests to assess disorders of primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis. 8. Have a

clinically relevant working knowledge and mastery of in-house serologic testing. Credits: 4.00

CPB 35100 - Microbiology-VN

Credit Hours: 2.00. Biology and laboratory identification of bacteria and fungi that cause infectious diseases in animals. Emphasis will be placed on the collection of specimens for culture, the isolation and identification of pathogenic organisms, and antibiotic susceptibility testing. Procedures and commercial systems available to veterinary practices will be utilized.

Learning Outcomes: 1. Select appropriate samples for laboratory diagnostics of infectious disease. 2. Perform basic microbiological techniques used in the laboratory setting of a veterinary hospital. (for example: Gram stain, catalase test, oxidase test, inoculate an agar plate for isolated colonies, Kirby Bauer test). 3. Identify organisms from an "unknown sample" using a variety of tests. 4. Create a shortlist of differential diagnoses for infectious disease cases. 5. Implement biosafety protocols (for example: personal protective equipment, isolation of animals). 6. Differentiate the biology of bacteria, viruses, and fungi. 7. Prevent and control the spread or introduction of infectious diseases. 8. Explain zoonotic diseases to laypeople. Credits: 2.00

CPB 35200 - Parasitology-VN

Credit Hours: 2.00. Biology and life cycles of selected protozoan, helminth, and arthropod parasites of veterinary importance. Emphasis will be placed on laboratory procedures for the identification of common parasites of domestic and laboratory animals.

Learning Outcomes: 1. Identify gross and microscopic parasite stages that help in disease diagnosis. 2. Select and perform the appropriate assays used in laboratory diagnosis of parasitic infections. 3. Summarize parasite life cycle, pathogenesis and clinical signs of various parasitic diseases. 4. Advocate the methods of parasite control and prevention. 5. Create a safety plan to prevent zoonotic disease transmission. Credits: 2.00

CPB 46400 - Clinical Toxicology-VN

Credit Hours: 2.00. The common toxicants and advanced topics on the drugs most commonly encountered in veterinary medicine. Emphasis is on mechanisms, indications, contraindications, and proper applications and handling of these drugs. Permission of department required.

Learning Outcomes: 1. Appropriately use and understand common terminology used in toxicology and clinical toxicology. 2. Describe the medical rationale and specific drugs used as emetics, cathartics, and other compounds used to decrease animal exposure to ingested toxicants. 3. Ask the appropriate questions during a history to help better identify toxicosis cases and to identify potential sources for intoxication. 4. Describe the mechanism of action for commonly encountered drug toxicants, herbal/diet supplement intoxications, household toxicants, insecticides, rodenticides, herbicides, toxic plants, and toxic animal envenomation. 5. Describe the general presenting clinical appearance and any key clinical signs characteristic of common veterinary toxicants. 6. Describe the diagnostics and treatment protocols used for common veterinary toxicants. 7. Identify means by which clients/animal owners can reduce the risk of intoxicant of animals by toxicants. Credits: 2.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of

contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

CPB 57600 - Biology And Management Of Laboratory Animals

Credit Hours: 2.00. A didactic course focusing on basic principles of the biology of laboratory animals and how they are managed in a vivarium. Covers regulatory aspects, anatomy, biological techniques, research uses, and management of mice, rats, hamsters, guinea pigs, gerbils, other rodents, rabbits, dogs, carts, ferrets, and various species of primates, reptiles, and avians in experimental applications. Offered in alternate years. Permission of department required.

Learning Outcomes: 1. Be prepared for taking the ACLAM board exam. Methods of evaluation include examinations, presenting a lecture, and discussion. Credits: 2.00

CPB 57800 - Animal Models Of Human Disease

Credit Hours: 2.00. A mixed didactic and discussion course focusing on animal models used in biomedical research. Didactic instruction on principles of model development and use will be coupled with student presentations of models currently used in various research disciplines or disease states. Advantages and limitations of research with various spontaneous and experimentally induced models of human disease, including genetically engineered models. Offered in alternate years.

Credits: 2.00

CPB 57900 - Seminar In Comparative Medicine

Credit Hours: 2.00. A discussion course focusing on current issues of laboratory animal medicine. Review of current activities, health surveillance reports, etc. Selected cases are presented in detail, including clinical presentation, interpretation of diagnostic tests, and gross and microscopic pathology. In addition, this seminar includes discussions on animal resource management; surgery; animal experimentation; current journal reports; zoonoses; and clinical animal disease diagnosis, prevention, treatment, and control, and other species and topics not formally covered in other core courses.

Credits: 2.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 59000 - Special Topics In Animal Welfare And Human-Animal Interaction

Credit Hours: 1.00 to 4.00. Individual study and directed readings in specialized areas of interest of animal welfare or human-animal interaction either for advanced undergraduate or beginning graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 60000 - Special Problems In Pathology

Credit Hours: 0.00 to 4.00. Selected problems in veterinary pathology. The topic will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 4.00

CPB 60100 - Advanced Veterinary Clinical Pathology

Credit Hours: 0.00 to 8.00. Comparative hematology, clinical chemistry, diagnostic cytology, and surgical microscopic pathology in the diagnosis of diseases of animals, including laboratory application. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.00 to 8.00

CPB 60200 - Advanced Veterinary Anatomic Pathology

Credit Hours: 0.00 to 8.00. Comparative gross and microscopic pathology in the diagnosis of diseases of animals. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.00 to 8.00

CPB 60300 - Graduate Teaching Practicum

Credit Hours: 1.00. Graduate students assist in running the laboratory sessions in a sophomore DVM course. They also grade exams and may give one lecture in or make a scholarly contribution to the course. Permission of instructor required.

Credits: 1.00

CPB 60400 - Neoplastic Diseases Of Animals

Credit Hours: 3.00. Histogenesis and structure of neoplasms of animals; consideration of clinical and pathological entities within groups of neoplasms. Prerequisite: CPB 55600.

Credits: 3.00

CPB 60500 - Pathology Of Avian Diseases

Credit Hours: 2.00. Avian diseases presented from a gross and histopathological viewpoint. Pathogenesis and differential diagnosis of avian diseases discussed. Prerequisite: DVM degree.

Credits: 2.00

CPB 61100 - Veterinary Pathology Literature Review Seminar

Credit Hours: 1.00. Understanding of principles of veterinary pathology is required. The class will provide the graduate students with in-depth knowledge in current pathology research and diagnostics. Permission of department required.

Learning Outcomes: 1. Retain new knowledge and be aware of current findings in the veterinary medicine and pathology literature. 2.

Critique and appraise data and technical approaches. 3. Formulate an evaluation of the merits of a study and to evaluate its applicability to pathology practice. Credits: 1.00

CPB 61400 - Topics In Advanced General Pathology

Credit Hours: 0.50 or 1.00. Discussion of current topics in the following areas of general pathology: cellular injury, fluid and hemodynamic alterations, inflammation, immunopathology, neoplasia, genetic and developmental disorders, pathogenesis of infectious diseases, and nutritional disorders. Class meets one hour in alternate weeks. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.50 or 1.00

CPB 61600 - Molecular Diagnostics

Credit Hours: 2.00. The purpose of this course is to enable the student to have an understanding of the impact of molecular techniques in the clinical diagnostic laboratory, the range of techniques available, how they are effectively implemented, and how they are applied for diagnostic and research purposes. Permission of department required. Prerequisites: molecular biology or biochemistry course. Offered every even year.

Learning Outcomes: 1. Understand the principles and application of molecular biology tools to clinical diagnostics. 2. Understand key features of nucleic acid amplification techniques and relative advantages and disadvantages with conventional methodologies. 3. Understand the fundamentals of PCR assay design, validation and implementation. 4. Recognize how knowledge of molecular biology can be applied to the clinical setting for patient management. 5. Retrieve DNA and protein sequences from publicly accessible databases 6. Use DNA sequences for homology searches against databases and carry out sequence alignments and translations. 7. Accurately interpret data generated in such analyses and discuss the relevance of findings. 8. Integrate theory and practice with respect to laboratory aspects of molecular microbiology and bioinformatics. 9. Analyze critically, evaluate, interpret and understand the significance of results of controlled experiments and be able to apply data obtained to solve a clinical or diagnostic problem. Credits: 2.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 61900 - Design, Conduct, And Analysis Of Clinical Trials

Credit Hours: 2.00. Reviews the various types of clinical trials that are used in medical research (e.g., therapeutic and preventive). The stages and activities in a "typical" trial are defined along with factors that influence study design. Key elements of data collection, organization, analysis, and interpretation and reporting of results are discussed and illustrated using published reports of clinical trials. Differences in the design and conduct of trials in human and veterinary medicine are considered, including the ethical concerns and costs. Prerequisite: Graduate-level coursework in Biostatistics.

Credits: 2.00

CPB 62000 - Advanced Immunology

Credit Hours: 2.00. Teaches advanced concepts in basic immunology and applications to disease prevention and therapy. Emphasis is on recent developments and experimental approaches in this rapidly evolving discipline. Topics include antigen presentation, T-cell development, signal transduction in B and T lymphocytes, immunoglobulin structure, type I hypersensitivity (asthma), neuroendocrine regulation of the immune response, immune response in viral infections (influenza and HIV), and tumor immunology. Permission of instructor required.

Credits: 2.00

CPB 62200 - Microbial Pathogenesis

Credit Hours: 2.00. Provides advanced study of the concepts of microbial pathogenesis and host-microbe interaction. The virulence factors and molecular mechanisms of infection used by bacteria, viruses, and protozoa to cause disease will be examined. Specific diseases will be studied as examples of how microbes affect animals as well as humans. Permission of instructor required.

Credits: 2.00

CPB 62400 - Advanced Laboratory Animal Medicine

Credit Hours: 0.00 to 8.00. Experiential training and practice in laboratory animal medicine. Prerequisite: DVM degree. Restriction: Only CPB graduate students in Laboratory Animal Medicine may enroll in this course.

Credits: 0.00 to 8.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 63000 - Advanced Veterinary Avian Pathology

Credit Hours: 0.00 to 8.00. Comparative gross and microscopic pathology in diagnosis of avian diseases. Prerequisites: At least one Statistics course must be taken before or during the non-thesis MS/Residency Graduate Program. See list of courses. STAT courses: CPB 61900; CPB 62500; STAT 50300; STAT 51200; STAT 51400: STAT 52400. A DVM Degree is required to enroll in the non-thesis MS/Residency Grad Program. Permission of instructor required.

Learning Outcomes: 1. Recognize avian diseases. 2. Treat and manage avian diseases. Credits: 0.00 to 8.00

CPB 63100 - Avian Immunology

Credit Hours: 2.00. The avian immune system is significantly different than the mammalian immune system. This course compares and contrasts mammalian and avian immune systems. Prerequisites: At least one graduate or undergraduate course in biology or poultry science. Permission of instructor required.

Learning Outcomes: 1. Understand the avian immune system. 2. Interpret immunodiagnostic tests and the effect of disease/injury to the immune system. Credits: 2.00

CPB 63200 - Avian Medicine

Credit Hours: 2.00. This disease-based course is designed to introduce students to poultry medicine. It covers all the major diseases and conditions that affect poultry. Permission of instructor required.

Learning Outcomes: 1. Identify major diseases of poultry. 2. Evaluate sick poultry in both backyard and commercial farms. 3. Identify proper samples/tests to use for confirmation of diagnosis. Credits: 2.00

CPB 63300 - Preventive Avian Medicine Practice

Credit Hours: 1.00. The course introduces students to issues/practice in commercial poultry production. Brief discussions will relate how these practices influence poultry health. Permission of instructor required.

Learning Outcomes: 1. Understand basic poultry production practices. 2. Understand issues facing commercial agriculture in general and the poultry industry specifically. Credits: 1.00

CPB 63400 - Diseases Of Laboratory Animals

Credit Hours: 3.00. A didactic course focusing on basic understanding of the diseases of laboratory animal medicine, and concentrating on effects of the disease on research productivity, prevention programs, and pathogenesis. Etiology, pathogenesis, gross and microscopic pathology, diagnosis, control, and research complications of diseases of rats and mice, primates, rabbits, guinea pigs, hamsters, and ferrets; and health assessment programs. Permission of department required.

Learning Outcomes: 1. Be prepared for taking the board exam. Credits: 3.00

CPB 63500 - Advanced Veterinary Diagnostic Microbiology

Credit Hours: 0.00 to 8.00. Veterinary clinical and diagnostic microbiology training. Prerequisite: DVM degree or equivalent. Permission of instructor required.

Learning Outcomes: 1. Able to identify appropriate specimens and tests to diagnose infectious disease, and ability to communicate those to clients. 2. Able to interpret lab results

and communicate results and appropriate recommendations to clients such as further testing, treatment, and management. Credits: 0.00 to 8.00

CPB 63600 - Veterinary Microbiology Seminar

Credit Hours: 0.00 to 8.00. This class will provide graduate students with in-depth knowledge in current microbiology research and clinical diagnostics. Students will review current literature related to veterinary infectious disease with the intent of explaining its application to clinical and diagnostic microbiology. Permission of instructor required.

Learning Outcomes: 1. Able to explain and apply current infectious disease/diagnostic literature. 2. Able to critically evaluate all aspects of diagnostic cases: clinical signs, sample collection, sample transport, test selection, test methods, result interpretation, and application. Credits: 0.00 to 8.00

CPB 68000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 69100 - Seminar In Veterinary Pathology

Credit Hours: 0.00 to 2.00. Discussions of selected current disease problems with emphasis on gross and microscopic tissue changes and pathogenesis. Required of all graduate students in veterinary pathology each semester in residence.

Credits: 0.00 to 2.00

CPB 69400 - Special Topics In Immunology

Credit Hours: 1.00. Understanding of principles of immunology is required. Journal club style class geared to provide graduate students with in-depth knowledge in current immunology. Faculty will participate in class to facilitate the students' understanding and discussion. Students present one-two times depending on the number of participating students. They select a research paper, recently published in the area of immunology, assigned for the semester and have it approved by the course organizer.

Credits: 1.00

CPB 69500 - Seminar In Epidemiology

Credit Hours: 1.00. Discussion of recent research in epidemiology, emphasizing study design, analysis, and public health significance. Discussion topics will be selected from the following areas: clinical epidemiology, infectious disease epidemiology, chronic disease epidemiology, and environmental epidemiology. Required of graduate students with a principal field of study in epidemiology. Prerequisite: Course work in Statistics and Epidemiology.

Credits: 1.00

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CPB 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CPB 81900 - Veterinary Toxicology

Credit Hours: 2.00. This course will provide an introduction to small and large animal toxicology. It will cover the most common toxicoses encountered in veterinary medicine with emphasis on recognizing clinical signs of toxicoses, discerning differential diagnoses for these cases, and assigning appropriate diagnostic tests. Prerequisites: Completion of first year in the DVM program.

Learning Outcomes: 1. Recognize the most common toxicoses encountered in veterinary toxicology. 2. Identify sources of exposure for the most common toxicoses encountered in veterinary toxicology. 3. Explain the mechanisms of toxicity for the most common toxicoses encountered in veterinary medicine. 4. Identify the best samples to submit for diagnostic toxicology tests. 5. Formulate differential diagnoses for toxicoses based on clinical signs, blood chemistries, and diagnostic tests through critical thinking. 6. Explain the typical treatments (symptomatic and supportive) and antidotes that can be given to animals exposed to toxins/toxicants. Credits: 2.00

CPB 83300 - Preventative Avian Medicine Practice

Credit Hours: 1.00. This course will cover practical veterinary management of commercial poultry. The first portion of the

course will concentrate on types of commercial poultry and management of large flocks. In addition, the course will include environmental impact of commercial poultry farms, waste management, and animal welfare. Management of waste and animal welfare are crucial components of veterinary and agricultural workers. The students need to appreciate the intricacies of poultry production to be able to assess the welfare, environmental, and public health regulations pertaining to the poultry industry. Introduction to the role of the poultry veterinarian in non-traditional practice will also be covered.

Learning Outcomes: 1. Identify the types of commercial flocks. 2. Create assessments of the rearing and management of all types of commercial poultry. 3. Evaluate the impact of commercial poultry on the environment. 4. Create a flock animal welfare plan. 5. Identify the various career options for poultry veterinarians in allied industry. Credits: 1.00

CPB 84000 - Use And Care Of Laboratory Animals

Credit Hours: 1.00. Topics will include the history of animal use in research; ethical thought related to animal use in research; alternatives; government regulatory requirements; statistical considerations in designing animal studies; animal models; use of the National Agricultural Library Animal Welfare Information Center; biology, husbandry, techniques, and diseases of common laboratory animal species; hygiene and occupational health; biohazard control; perioperative care and aseptic surgical techniques; anesthesia; analgesia; and euthanasia.

Learning Outcomes: 1. Understand the basics of animal research regulations. 2. Understand the difference between animal welfare vs. animal rights. 3. Know the use, important anatomy/physiology, care, and diseases of common animal species used in research. Credits: 1.00

CPB 84100 - Use And Care Of Laboratory Animals II

Credit Hours: 1.00. Priority will be given to students that have completed CPB 84000. This course teaches skills useful for the role of a laboratory animal veterinarian. Course is project-based and includes hands-on techniques in laboratory rodents.

Learning Outcomes: 1. Understand basics of rodent health monitoring, facility design and protocol review. 2. Gain hands-on experience in handling rodents and performing techniques. 3. Understand common research procedures in non-rodent species. 4. Use critical thinking to work through clinical cases. Credits: 1.00

CPB 85100 - General Pathology

Credit Hours: 3.00. An overview of the basic cellular reactions that develop in response to injurious agents. Focuses on the gross and microscopic alterations in tissues, events leading to the development of those alterations, and the consequences of those changes on the health of animals. Includes degenerative, necrotic, inflammatory, and neoplastic changes in various animal species.

Learning Outcomes: 1. Understand the events involved in the development and outcome of disease in animals. 2. Master a medical vocabulary, by using the language of medicine and pathology in both written and oral forms. 3. Recognize diseased tissue both grossly and microscopically, offer a reasonable explanation of the sequence of events that led to the development of these tissue changes, and predict the effect of these changes on the life of the host. 4. Identify the types of injury that may affect the host and describe the range of pathologic alterations that occur in response to these injuries. 5. Develop diagnostic thinking skills and learning skills. 6. Recognize the importance of a solid knowledge of pathology as a basis for veterinary medicine and surgery, and other fields of veterinary medicine. 7. Observe examples of normal and diseased organs and tissues. 8. Learn to use medical terminology (including pathologic terms) in an appropriate manner. 9. Examine examples of the histopathologic alterations discussed in lecture. 10. Use of histopathology as a basis for inquiry on various aspects of a disease or pathologic condition. 11. Correlate gross pathologic lesions with the expected microscopic alterations. (Describe the anticipated microscopic lesions, if given the gross alterations and vice versa.) Credits: 3.00

CPB 85204 - Veterinary Parasitology

Credit Hours: 3.00. Covers the important helminth, protozoal and arthropod diseases of animals. Emphasis is placed on the pathogenesis, epidemiology, clinical features, diagnosis, control,

and zoonotic implications of protozoal and arthropod infections in this semester of the course.

Learning Outcomes: 1. Master a medical terminology for parasites, by using the language of medicine, pathology and parasitology in both written and oral forms. 2. Understand general aspects of veterinary parasitology including life cycles, pathogenesis, diagnostic methods, and anthelmintic drugs. 3. Explain how the important parasites are transmitted and maintained in nature and/or domestic environments. 4. Identify the types of clinical problems and pathology caused by the various parasites and be able to explain the basic pathogenesis of these changes for the parasites. Correlate clinical and gross and microscopic pathologic findings due to these parasites. 5. For important parasites, predict the clinical presentation if given the pathologic lesions. Identify the expected pathologic lesions if given the clinical presentation. 6. Recognize important parasites grossly and/or microscopically, focusing especially on clinical parasitology diagnostics, i.e. recognition of helminth eggs, larvae, cysts, oocysts, etc. in fecal or other samples. 7. Explain the methods and rationale for treatment and control of parasitic infections. 8. Understand the zoonotic importance of certain parasites, and how they are dealt with from a veterinary public health standpoint. 9. Develop diagnostic thinking skills, computer literacy skills, and learning skills. 10. Recognize the importance of a solid knowledge of parasitology in the practice of veterinary medicine and surgery, and other fields of veterinary medicine. Credits: 3.00

CPB 85300 - Principles Of Veterinary Immunology

Credit Hours: 2.00. An overview of the fundamental concepts of immunology, with an emphasis on the immune system of domestic animals and comparative immunology. Focuses on the interactions between the host and microbial pathogens and on mechanisms that underlie hypersensitivity reactions, autoimmune diseases, and immune deficiencies. Discusses the principles of vaccination and serologic tests.

Learning Outcomes: 1. Explain the basic principles by which the immune system functions. 2. Describe the mechanisms by which the immune system protects the host against infectious diseases and can be mobilized to treat cancer. 3. Explain the role of aberrant immune responses in hypersensitivity reactions, allergies and in autoimmune diseases. 4. Outline the immunological principles of vaccines and vaccination. 5. Identify the principles of immunoassays. 6. Explain the mechanisms of action of drugs that inhibit immune responses and drugs that target specific immune mechanisms. Credits: 2.00

CPB 85400 - Principles Of Epidemiology

Credit Hours: 1.00. An introduction to the principles of epidemiology as it relates to evaluating and describing the health of human and animal populations. An emphasis is placed on the appropriate use by veterinarians of information derived from epidemiologic studies in making clinical decisions regarding the diagnosis, treatment, prognosis, and prevention of disease in individual patients. A goal is to demonstrate why epidemiology is considered by some as "a basic science for clinicians."

Credits: 1.00

CPB 85401 - Epidemiology And Evidence-Based Veterinary Medicine

Credit Hours: 2.00. The fundamentals of descriptive and analytical epidemiology will be developed as they relate to problems in veterinary and comparative medicine. A primary goal of the course is to expose future health professionals to the information and thought processes that are essential for critically evaluating the medical literature and for making decisions regarding health care for individuals and populations.

Learning Outcomes: 1. Characterize different epidemiological study designs, including experimental studies, clinical trials, and commonly used observational studies such as cross-sectional, cohort, and case-control studies. 2. Interpret basic epidemiologic measures, including prevalence and incidence measures for disease occurrence and ratio and difference measures for association. 3. Implement causal thinking by assessing

potential bias, confounding and random error. 4. Understand basic terminology of infectious disease epidemiology. 5. Understand methods of disease surveillance and their corresponding strengths and weaknesses 6. Describe the steps in an outbreak investigation. 7. Define sensitivity, specificity, false positive fraction and false negative fraction and use them to compare discriminative performance of different diagnostic tests. 8. Interpret numeric results commonly presented in journal articles such as odds ratio, 95% CI, and p-value. 9. Critically appraise evidence presented in clinical studies and scientific research articles. Credits: 2.00

CPB 85500 - Veterinary Hematology And Cytology

Credit Hours: 2.00. Provides an overview of veterinary hematology and cytology. Normal morphology and function of the cells of the hematopoietic system are reviewed. Laboratory analyses of the different cell types are discussed. The responses of the hematopoietic cells that can be seen during different disease processes are presented. Fundamentals of veterinary diagnostic cytology are introduced.

Learning Outcomes: 1. Explain the development of hematopoietic cells, their function, and control of hematopoiesis, emphasizing features and growth factors that are clinically significant. Apply these concepts, in conjunction with clinical & physical findings, to interpret laboratory data (CBC and bone marrow findings). 2. Name and explain the characteristic findings or 'patterns' anticipated on CBC and bone marrow response for common hematologic disorders in domestic animals and their etiology. 3. Discuss the characteristic features of reactive (benign) and malignant disorders of red blood cells, white blood cells, and platelets with respect to their diagnosis, etiology, and prognosis. 4. Develop microscopic skills including estimating cell density or counts and identification of normal and abnormal blood cells, morphologic changes and inclusions within these cells. 5. Demonstrate use microscope to evaluate a cytology specimen. Describe features that suggest an inflammatory, hyperplasia, versus a specific neoplasia process. Explain the type of inflammatory response seen with various infectious or non-infectious etiologies and be able to identify agents. Observe and describe general cytologic features of malignancy and of different malignant cell populations (round cell, mesenchymal, or epithelial). Credits: 2.00

CPB 85602 - Veterinary Bacteriology And Mycology

Credit Hours: 4.00. The lecture portion provides an introduction to bacterial and fungal agents of animal diseases. The taxonomy, morphology, and physiology of the organisms are discussed. Pathogenic features of the infectious agents and host responses to infection will be emphasized. Epidemiology, diagnosis, and control of the various diseases will be presented. The laboratory portion of the course covers laboratory safety, sterilization and disinfection in addition to microbiological techniques, antimicrobial susceptibility testing and interpretation, and identification of cultured bacteria and dermatophytes.

Learning Outcomes: 1. Develop basic knowledge of clinically relevant bacterial and fungal agents of disease in animals, including taxonomy, virulence factors, and pathogenesis (including transmission), with less emphasis on diagnosis and treatment (though these will be discussed). The course includes a brief introduction to antimicrobial chemotherapy and judicious use of antimicrobial agents. 2. Learn which agents are considered zoonotic or of other public health importance (e.g. foodborne pathogens, bioterrorism potential, etc.). 3. Practice basic microbiology laboratory techniques. Credits: 4.00

CPB 85603 - Veterinary Bacteriology And Mycology

Credit Hours: 3.00. An overview of bacterial and fungal pathogens of veterinary species. Topics will include discriminating features of the organisms, the pathogenesis of diseases caused by these agents, diagnostics, management and therapeutics.

Learning Outcomes: 1. Compile a list of differential diagnoses based on clinical

presentation and signalment. In other words, associate specific bacterial and fungal agents with animal species and affected body sites. 2. Evaluate the properties of organisms (Gram pos/neg; Cocci/rod; Anaerobes/aerobes, etc.) on the differential diagnoses list in order to develop a diagnostic plan. 3. Describe laboratory test methods used in diagnosis of bacterial and fungal diseases. 4. Recognize bacterial and fungal pathogens that are zoonotic or reportable. 5. Outline the pathogenesis of an organism from the host encounter, entry/multiplication/spread to damage to the host. 6. Understand basic mechanisms of action, basic spectrum of activity, and major safety and legal concerns of antibacterial and antifungal therapeutics and disinfectants. 7. Select appropriate therapy and control/prevention based on understanding of pathogens and therapeutic agents. Credits: 3.00

CPB 85700 - Veterinary Systemic Pathology

Credit Hours: 5.00. Provides coverage of system specific pathologic terminology and characteristic pathologic responses of the various body systems to injury. This is followed by presentation of representative examples of diseases of various etiologies, including, but not limited to, infectious and noninfectious diseases.

Learning Outcomes: 1. Recognize and describe diseased tissue grossly and microscopically, explain the sequence of events in the development and outcome of observed lesions, explain the interplay among different organs or tissues, and predict the effect of the response to injury on the host. 2. Correlate clinical and pathologic findings. Predict the organ/tissue site and nature of expected lesions when given the clinical presentation. Predict clinical signs when given the gross or microscopic lesions. 3. Correlate gross lesions (or lack thereof!) with histologic, cytologic, and molecular changes. 4. Categorize lesions as degeneration or necrosis, inflammation, circulatory disturbance, or disturbance of growth. Recognize that a given lesion may (and often does) fall into more than one category. 5. Formulate a logical and practical differential diagnosis based on the host signalment, the affected organ or tissue, the lesion categorization, and environmental influences (risk factors, seasonal or geographical influences, etc.). Credits: 5.00

CPB 86000 - Veterinary Virology

Credit Hours: 3.00. Principles of medical virology and discussions of important viral diseases of animals.

Learning Outcomes: 1. Know the definition of the diseases. 2. Describe brief history of the disease including current geographical distribution and importance. 3. Describe the virus as to classification, host range, important aspects of replication, and resistance to environment. 4. Outline the signs of the disease. 5. Understand pathogenesis, distribution and fate of virus, immunological responses. 6. Provide description of important gross and histological lesions that may explain pathogenesis. 7. Understand methods used to make presumptive and specific diagnoses. 8. Describe epidemiology - important methods of spread, vectors if involved, seasonality, etc. 9. Describe immunity - as it relates to vaccination, types of vaccines, and their use. 10. Recognize public health significance, if any. 11. Control of the disease including area (state, national, or international) control programs and "on the farm" control where pertinent. Credits: 3.00

CPB 86100 - Veterinary Clinical Chemistry

Credit Hours: 2.00. Laboratory techniques and interpretation of laboratory data as profiled by organ system are presented. Integration of data to explain pathophysiologic changes as an aid to diagnosis, prognosis and progression of disease is emphasized.

Learning Outcomes: 1. Organize routine tests appropriately into diagnostic profiles that best characterize abnormalities in acid-base, the urinary system, the hepatobiliary system, exocrine pancreas (pancreatitis), muscle, endocrine pancreas, adrenal gland, thyroid

gland and parathyroid gland. 2. Describe relevant physiology for each test involved in biochemical profiling, describe relevant mechanisms for alterations from normal, list differentials and prioritize differential lists based on other laboratory and clinical information. 3. Recommend follow-up testing that may lead to a definitive diagnosis where appropriate. 4. Integrate CBC data interpretations (e.g., from CPB 85500 - Veterinary Hematology & Cytology) with biochemical profiling results. 5. Characterize and diagnose disorders of hemostasis based on integration of clinical findings with hemostasis-specific and associated laboratory testing. The student will be able to: Explain the physiology of primary, secondary, & tertiary hemostasis, and anticoagulation, including the correct association of the "key elements" of hemostasis with each process; Correctly associate assays for hemostasis with the stage/process that they evaluate and interpret abnormal results. Credits: 2.00

CPB 86200 - Clinical Epidemiology For Companion Animals

Credit Hours: 1.00. Fundamentals of experimental epidemiology and clinical decision-making are explored, particularly as they relate to the practice of companion animal medicine. Methods for disease detection and prevention are emphasized in catteries and kennels. The computer laboratories illustrate the software available for problem-solving in population medicine.

Credits: 1.00

CPB 86300 - Epidemiology For Livestock Production

Credit Hours: 1.00. Study of the fundamental concepts for epidemiologic implications in livestock production, including design of epidemiologic studies in livestock populations, investigation of disease outbreaks, use of diagnostic tests, infectious disease control, and animal health economics. Rationale, strategies, and concepts of animal disease control are emphasized with examples.

Credits: 1.00

CPB 86900 - Veterinary Public Health And Zoonoses

Credit Hours: 2.00. A survey of fundamental topics on diseases that are caused by viral, bacterial, rickettsial, and parasitic agents and are known to be transmissible from animals to humans, as well as those diseases that are common to humans and animals. Topics emphasize the epidemiology and methods for prevention and control of these diseases in animal and human populations. Food safety and foodborne diseases, with particular emphasis on foods of animal origin, are discussed. Risk assessment of occupational and environmental health conditions to which veterinarians are likely to be exposed in training or the workplace also is covered.

Learning Outcomes: 1. Identify and mitigate risks to human and animal health encountered by the veterinary profession and by others through direct and indirect animal contacts (e.g., food, meat, milk). 2. Communicate about risks pertaining to environmental hazards and zoonotic diseases to professional and lay audiences. 3. Evaluate data and scientific reports related to one health critically. 4. Identify emerging and exotic diseases of animals and understand appropriate responses to them. Credits: 2.00

CPB 87000 - Diagnostic Veterinary Cytology

Credit Hours: 1.00. A combination of didactic and wet laboratory microscopic sessions are used to demonstrate applications of diagnostic cytology. Consists of weekly sessions with a brief lecture overview of the basic cytologic features of a particular organ system followed by microscopic review of collected cytology material from that particular organ system. The didactic and laboratory sessions are supplemented by Internet-based and digital-format archived images for student review.

Learning Outcomes: 1. Evaluate a cytology slide including, but not limited to, inflammatory and neoplastic lesions. 2. Describe the features of the slide in such a way as to clearly convey thoughts and justify provided interpretation. 3. Understand the limitations of cytology and provide medically sound comments to advance the case. Credits: 1.00

CPB 88300 - Public Health

Credit Hours: 3.00. This course is designed for senior veterinary students to fulfill their interests in public health and preventive veterinary medicine. There will be a classroom and field component, focusing on topics including epidemiology, food safety, infectious diseases, environmental health and health communications. Visits to various agencies will complement the course material by offering inside views of the

day to day operations of the facilities as well as the career experiences of the employees working in them. Students will also gain field experience in actual or devised research projects that will include activities such as study design, questionnaire development, collecting epidemiologic data, date input, analysis, and interpretation. Students will be asked to design a study, produce an information brochure, and prepare a verbal presentation for elementary school children about topics relating to being safe with your pets. Total clinic hours 129.

Learning Outcomes: 1. Understand the varied roles veterinarians play in the physical, mental and social well being of people. 2. Know the state and federal agencies involved in the U.S. public health system. 3. Use their epidemiological skills to investigate disease outbreaks and critically evaluate epidemiological studies. 4. Assess disease risks resulting from animal exposure in targeted human populations. 5. Assess disease risks resulting from food production and drinking water systems. 6. Understand the role of the veterinarian in biosecurity and responding to animal emergencies resulting from natural or man-made disasters. 7. Know how to communicate effectively with the public and media. Credits: 3.00

CPB 88400 - Laboratory Animal Medicine

Credit Hours: 3.00. Students will participate in laboratory animal medicine practice which can include facility inspections, protocol review, preventative medicine, monitoring disease status, and diagnosis and treatment of spontaneous diseases in laboratory animals. Total clinic hours 129.

Learning Outcomes: 1. Understand the role the laboratory animal veterinarian has within the research facility. 2. Understand how a research facility is run by working with management, animal care staff, regulatory staff, and veterinary staff. 3. Understand animal husbandry of common laboratory species such as rodents, pigs, and dogs. 4. Understand colony health monitoring and research protocol review. 5. Review and critique recent literature. Credits: 3.00

CPB 88501 - Necropsy I

Credit Hours: 1.00. This is one of three concurrent courses (CPB 88501, CPB 88502, CPB 88503) in which senior veterinary students will be enrolled. Students will actively participate in the diagnostic necropsy service within the ADDL. The student is expected to gain basic clinical experience and training in necropsy and diagnostic pathology as they contribute to and support the practice of veterinary medicine. Students are expected to actively assist faculty in performing necropsies, discuss pathophysiology of cases and submit reports of their observation. Total clinic hours 43.

Credits: 1.00

CPB 88502 - Microbiology I

Credit Hours: 1.00. This is one of three concurrent courses (CPB 88501, CPB 88502, CPB 88503) in which senior veterinary students will be enrolled. This course is designed for senior veterinary students to gain additional training in diagnostic microbiology (bacteriology, mycology, virology and molecular diagnostics) in relation to clinical diseases. Students will actively participate in self study and discussion of selected diagnostic microbiology cases as well as hands-on logistically approached laboratory procedures for culture and isolation of microbial agents. The students are expected to be proficient and competent in veterinary diagnostic microbiology at the end of rotation. Total clinic hours 43.

Credits: 1.00

CPB 88503 - Clinical Pathology I

Credit Hours: 1.00. This is one of three concurrent courses (CPB 88501, CPB 88502, CPB 88503) in which senior veterinary students will be enrolled. In addition to clinical pathology, students must be enrolled in microbiology and diagnostic pathology (necropsy). The main goal of this rotation is to insure that each participant is at a level of competency that every graduating senior should have attained. Through a combination of self study and small group periods in a classroom as well as on a multi-headed microscope, a set of core objectives will be explored. These objectives have been chosen as a representation of basic clinical pathology skills that students should have mastered to practice veterinary medicine competently. In addition, an approved journal article or comparable piece of literature will be evaluated and summarized. An objective examination at the end of the rotation will test the student's knowledge of the objectives. Total clinic hours 43.

Credits: 1.00

CPB 88600 - Diagnostic Pathology

Credit Hours: 3.00. Advanced training in diagnostic approaches to identification of the causes and pathogenesis of disease in mammals. Total clinic hours 129.

Credits: 3.00

CPB 88700 - Avian Medicine

Credit Hours: 3.00. This course is designed for senior veterinary students to receive advanced training in avian disease diagnosis and health management in commercial poultry flocks. Critical poultry infectious and non-infectious

diseases will be discussed. The student will visit production facilities for layers, broilers, turkeys, or ducks. Vaccination and medication programs for these species will be discussed. Necropsy experience will be gained from poultry, game bird, and pet bird accessions to the Animal Disease Diagnostic Laboratory (ADDL). Total clinic hours 129.

Credits: 3.00

CPB 88800 - Microbiology II

Credit Hours: 3.00. This course is designed for senior veterinary students to gain advanced training in clinical microbiology in relation to clinical diseases. Microbial diseases of veterinary importance and zoonotic significance will be addressed. Students will actively pursue selected microbiology accessions to the Animal Disease Diagnostic Laboratory (ADDL) in depth by applying problem-based learning approach, using correct laboratory procedures, and searching related literature to reach microbiological diagnosis and conclude the cases. Written reports, oral presentations, case discussion will be highlighted in the rotation to enrich the learning experience and insure the proficiency and competency in veterinary clinical microbiology. Total clinic hours 129.

Credits: 3.00

CPB 88900 - Clinical Pathology II

Credit Hours: 3.00. This advanced clinical pathology rotation is designed to take the core skills mastered in CPB 88503 and expand on them. Through daily interaction to the consulting office on clinical cases, students will learn to critically evaluate cytologic and hematologic specimens as well as laboratory data. Activities that the student will engage in include the resident's journal club, weekly clinical pathology rounds, large animal clinical pathology rounds and other small group sessions with residents and pathologists. The goal for the rotation is to begin building a broad base of experience to continue building on in the future. Total clinic hours 129.

Credits: 3.00

Computer and Information Technology

CIT 20200 - Networking Fundamentals

Credit Hours: 3.00. This course will provide students with the fundamental skills necessary to design, implement, troubleshoot and manage a small to medium sized Local Area Network. Students will gain hands-on experiences in a lab environment, configuring a client server network, working with connectivity devices, troubleshooting hardware and software issues. Students will explore topics including network performance, network management and network security.

Credits: 3.00

CIT 20300 - Information Security Fundamentals

Credit Hours: 3.00. This course provides students with an overview of the field of Information Security and Assurance. Students will explore current encryption, hardware, software and managerial controls needed to operate networks and computer systems in a safe and secure manner. In addition, students will participate in a semester project to re-enforce key concepts such as policy development and business contingency planning.

Credits: 3.00

CIT 20700 - Data Communications

Credit Hours: 3.00. This course provides the foundation for the understanding of data communication systems and computer networks. Topics include information representation and transmission, medium types and configuration, telephony, error handling, TCP/IP and internetworking, and diagnostic techniques.

Credits: 3.00

CIT 21200 - Web Site Design

Credit Hours: 3.00. This course is designed to give students an introduction to web site design and site creation. The course involves learning current standard XHTML fundamentals, CSS and design concepts. The proper design approach for constructing Web site and related techniques will also be covered.

Credits: 3.00

CIT 21300 - Systems Analysis And Design

Credit Hours: 3.00. This course provides students with the concepts, processes, and tools of system analysis and systems design. Object-oriented methods and tools are utilized with a focus on developing web-based interfaces and prototypes.

Credits: 3.00

CIT 21400 - Introduction To Data Management

Credit Hours: 3.00. Introduction to basic database development concepts. Extensive exploration of data manipulation using a relational DBMS and SQL. Students develop database applications using the most current database technologies.

Credits: 3.00

CIT 21500 - Web Programming

Credit Hours: 3.00. This course will provide students with the knowledge and techniques of introductory web programming.

Credits: 3.00

CIT 22000 - Quantitative Analysis II

Credit Hours: 3.00. A continued investigation into the problem solving tools and techniques that focus on both hardware systems and quantitative data analysis. The course is designed for CIT majors in their second full year of study.

Credits: 3.00

CIT 24200 - Introduction To ASP.Net Programming

Credit Hours: 3.00. This course will provide students with the tools and techniques to build dynamic Web sites using the ASP.Net programming environment. Students gain hands-on experience building a database-driven Web site.

Credits: 3.00

CIT 27000 - Java Programming I

Credit Hours: 3.00. This course is an introduction to the Java

Programming language. Students will learn the syntax of the language, how to use objects, classes, and methods, and will perform programming exercises that illustrate how Java is used in stand alone applications and applets.

Credits: 3.00

CIT 30400 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation using programmatic extensions to Structured Query Language (SQL). Topics include advanced data manipulation, stored procedures, triggers, and query optimization.

Credits: 3.00

CIT 30900 - Cybersecurity And Network Programming

Credit Hours: 3.00. Course teaches students skills necessary to develop programs and scripts to solve cybersecurity and networking problems such as automating manual tasks, parsing data, and data analysis. Students gain hands-on experience, combining the theory and practice of relevant tools, techniques, and programming technologies used in daily real-world cybersecurity and networking profession.

Credits: 3.00

CIT 31300 - Commercial Web Site Development

Credit Hours: 3.00. This project-based course will have students develop a data driven web site to support business processes. Students will utilize both client and server side languages in developing the site.

Credits: 3.00

CIT 32000 - Quantitative Analysis III

Credit Hours: 3.00. A continuation of statistical inference introduced in Quantitative Analysis II with emphasis on confidence intervals, hypothesis testing, analysis of variance, forecasting including linear regression and correlation, and quality control as they apply to information technology.

Credits: 3.00

CIT 32700 - Wireless Communication

Credit Hours: 3.00. Students will learn about the growing range of wireless technologies and their applications. The course will explore the fundamentals of each wireless technology from basic signaling properties to current and future market uses. Students will have the opportunity to gain hands-on experience with various wireless technologies.

Credits: 3.00

CIT 34400 - Database Security

Credit Hours: 3.00. This course will cover fundamentals of database security, data auditing, basic security models, and best practices. Topics may include security architecture, access control policies, auditing and monitoring. The course combines lectures with hands-on activities through lab sessions and an application oriented project using a database system such as Oracle or SQL Server.

Credits: 3.00

CIT 35600 - Network Operating Systems Administration

Credit Hours: 3.00. Design and administration of network servers and workstations. Focus on basic network concepts such as user account administration, resource allocation, security issues and internet service management.

Credits: 3.00

CIT 37300 - Visual Design For Software

Credit Hours: 3.00. Examination of best practices in software interface development for a variety of platforms. A study of the integration of visual elements into the systems analysis and design process, based on business and technical requirements. Topics include study of common design patterns, a review of prototyping tools, multi-modal design concepts, navigation strategies, and user acceptance testing.

Credits: 3.00

CIT 37400 - Systems And Database Analysis

Credit Hours: 3.00. Intensive exploration of application and database analysis in a synergistic environment. Students engage in collaborative, project-based activities to learn about project management, requirements analysis, modeling, prototyping, employing problem solving, and team-building skills. Object-oriented and data modeling tools are used to apply class concepts.

Credits: 3.00

CIT 38100 - Unix Programming And Administration

Credit Hours: 3.00. This course will teach students to effectively administer and develop applications in Linux/Unix. Emphasis will be on the ability to read, write, and debug shell script programs. An exploration of Windows scripting languages will also be covered.

Credits: 3.00

CIT 40200 - Design And Implementation Of Local Area Networks

Credit Hours: 3.00. The design, implementation, and configuration of local area networks. Students install the necessary hardware and software to set up a LAN server with several clients. Students will explore topics including "inter-networking", network management, network performance, and security.

Credits: 3.00

CIT 40600 - Advanced Network Security

Credit Hours: 3.00. This course provides students with the in-depth study and practice of advanced concepts in applied systems and networking security, including security policies, access controls, IP security, authentication mechanisms and intrusion detection and protection.

Credits: 3.00

CIT 41500 - Advanced Network Administration

Credit Hours: 3.00. In this course, students will learn advanced concepts for installing, configuring and securing various types of network servers including enterprise, web and mail servers. The course also covers the documentation of network systems infrastructure and the testing of hardware and software network components.

Credits: 3.00

CIT 41800 - Native Android Application Development

Credit Hours: 3.00. This advanced programming course gives students hands-on experience developing applications for Google mobile computing devices running the Android operating system. Students will build data-driven and location-aware applications using object-oriented software design patterns common to mobile application development. A variety of data storage and remote datasource-driven applications will be introduced.

Credits: 3.00

CIT 42100 - Big Data Analytics

Credit Hours: 3.00. This course will cover both the fundamentals and concepts of data analytics. The focus is on emerging advanced data analytics techniques and their applications to practical problems for different disciplines, such as IT, health care, and economics. Machine learning algorithms and distributed computing environments will be explored. Students will apply these advanced techniques in labs and a project to resolve an applied problem and identify scientific findings by using public data sets. A project report is required at the end of the course.

Credits: 3.00

CIT 43100 - Applied Secure Protocols

Credit Hours: 3.00. This course will emphasize the applied facets of cryptography for the information assurance and security professional. By the end of the course students will be able to apply important cryptographic principles and tools to allow networks to communicate securely.

Credits: 3.00

CIT 44400 - Advanced Database Design

Credit Hours: 3.00. This course addresses enterprise data management and logical database design concepts with an emphasis on needs determination and data modeling skills from an organizational perspective. Students will create data models and apply forward and reverse engineering techniques and will work through the full life cycle of the development of a software application. A project-based learning approach is used in this course.

Credits: 3.00

CIT 45100 - IT Security Risk Assessment

Credit Hours: 3.00. Students will learn the basic tools of security risk assessment and risk management. Students will be able to identify and assess security risk, conduct information asset valuation, and apply risk control strategies. Other topics discussed will be: security policies, NIST Security Models, and training education and awareness. At the end of the course students will be able to assess vulnerabilities and document them according to published assessment standard.

Credits: 3.00

CIT 47900 - Database Implementation And Administration

Credit Hours: 3.00. Extends knowledge of database concepts. Topics include physical database design, client/server implementation and database administration. Given a logical database design, students develop physical database structures and implement a database application. Students carry out database design, construction, administration, and programming activities using client/server technology.

Credits: 3.00

CIT 48500 - The Living Lab

Credit Hours: 1.00 to 6.00. The Living Lab allows students to apply networking, security, database, website, and application development concepts and techniques learned from prior CIT courses to internal and/or external projects. The Living Lab emulates an industry IT department in which students work on one or more projects as part of an IT team. Permission of instructor required.

Credits: 1.00 to 6.00

CIT 50700 - Measurement And Evaluation In Industry And Technology

Credit Hours: 3.00. This course is an introduction to measurement strategies and evaluation of data in industry and technology within the context of research design and implementation. Students will learn not only basic statistics in this course but will also learn about the research process by designing, conducting, and analyzing the data for a small empirical research project using real world data. The material in this course is directly relevant to student professional development. Data collection and interpretation are key day-to-day aspects of social and behavioral science, humanities, communication, economics, physical science, biological and medical science, technology, education, psychology, business, environmental science, education and government. In addition, the ability to use computers and other technologies around data has become a critical element in most professional decision-making processes.

Credits: 3.00

CIT 51102 - Android Mobile Application Development

Credit Hours: 3.00. This advanced programming course teaches students to create data-driven, location-aware mobile applications for the Android platform. Students will learn common mobile app design patterns and will integrate cloud computing services into their applications. Prerequisite: Any programming course equivalent to 300-level programming; any relational database.

Credits: 3.00

CIT 51600 - Database Security

Credit Hours: 3.00. This course provides a strong foundation in database security and auditing. It will cover topics on security, profiles, password policies, privileges and roles, Virtual Private Databases, and auditing. The course also covers advanced topics such as SQL injection, database management security issues such as securing the DBMS, enforcing access controls, and related issues. Permission of instructor required.

Credits: 3.00

CIT 52600 - Applied Data Analytics

Credit Hours: 3.00. This course will cover both the fundamentals and concepts of the data analytics and the advanced data analytics techniques. The focus is on emerging advanced data analytics techniques and their applications to practical problems for different disciplines, such as IT, health care, and economics. Both advanced supervised learning and unsupervised learning algorithms will be explored along with data visualization techniques. Students will apply these advanced techniques in labs and a research project to resolve an applied research problem and identify scientific findings by using public data sets. A research project report is required at the end of the course and the quality of the research report is expected to align with the requirements of IEEE or ACM international conferences.

Credits: 3.00

CIT 52800 - Information Security Risk Assessment

Credit Hours: 3.00. (CNIT 52800) Covers information security risk assessment, including the following topics: steps in performing information security risk assessment, threats to information security, technical, managerial, and operational vulnerabilities, methods for analyzing controls, methods for determining likelihood of and impact from an information security breach, and methods for determining risk. Emphasizes the development and utilization of security metrics in the risk assessment process.

Credits: 3.00

CIT 53200 - Wireless Security And Technology

Credit Hours: 3.00. This course will provide in-depth coverage of wireless communications and security. Fundamentals and state of the art developments in the wireless security area will be covered, including advances in cellular, personal communications systems (PCS), wireless LANs, and fixed wireless networks. Significant details of wireless devices and corresponding security issues will be addressed. Emerging challenges and solutions in wireless vulnerabilities, attacks, and solutions at various layers of the protocol stack, spanning the stack from aspects of physical communication to application and service security issues, will also be covered.

Credits: 3.00

CIT 58100 - Topics In Computer Information Technology

Credit Hours: 1.00 to 6.00. Advanced study of technical and professional topics relating to computer and information technology. Emphasis is on the cutting edge technologies and new developments relating to advanced information technologies. Permission of instructor required.

Credits: 1.00 to 6.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm

development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 16100 - Introduction To Programming And Data Management For Smart Manufacturing

Credit Hours: 3.00. This course introduces a programming language and provides an overview of coding, data analysis and data manipulation in a database. Topics include fundamentals of programming, introduction to data manipulation and analysis, and an introduction to relational databases and the Structured Query Language (SQL).

Learning Outcomes: 1. Understand, write, modify and debug computer programs to solve small to intermediate business problems in the Smart Manufacturing Domain. 2. Use built-in tools and data structure in the programming language to perform indexing, dropping entries, sorting, and filtering the data. 3. Use built-in methods and SQL query capabilities to access, manipulate and analyze manufacturing or supply chain data. Credits: 3.00

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 18101 - Topics In Computer Information Technology I

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

CNIT 19900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter arranged by staff. Individual study under directed leadership of professor. Primarily for students with special aptitudes. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CNIT 24000 - Data Communications And Networking

Credit Hours: 3.00. This course provides a comprehensive introduction to data communications and networks. Topics include communication standards and concepts, protocols, the Open Systems Interconnect (OSI) model, point-to-point communication, and local area networks. Business issues from both provider and user perspectives are discussed. Current technology and trends in each architectural element are reviewed.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving

the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

CNIT 27100 - Cybersecurity Fundamentals II

Credit Hours: 3.00. Course will investigate additional foundational ideas in cybersecurity and serves as a survey course in the field. The course provides extended exposure to utilizing tools to secure/harden aspects of info systems such as mandatory access control, wireless security, hardware security, cloud security and others.

Learning Outcomes: 1. Generate policy and governance decisions for high-risk information systems. 2. Implement technical controls to mitigate threats and vulnerabilities in modern networks and systems. 3. Analyze information systems to determine appropriate secure provisioning actions. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

CNIT 28101 - Topics In Computer Information Technology II

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 28500 - Topics In Programming Languages

Credit Hours: 3.00. A programming course in one or more programming languages not covered in other CPT courses. Application of structured or event-driven program design, construction, debugging, testing, and documentation techniques. Topics, projects, and languages vary with course offering.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 29900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 6.00. Hours and subject matter to be arranged by staff. Individual study under directed leadership of professor. Primarily for students with special aptitudes. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

CNIT 30600 - Game Development I: Core Skills And Technologies

Credit Hours: 3.00. (CGT 24500) This course introduces students to the fundamental technologies and skill sets required to develop video games. Students will be taught agile development methodologies in a team-based environment.

Learning Outcomes: 1. Demonstrate a

moderate level of individual skill with a commercial game engine. 2. Demonstrate the ability to observe game mechanics and reproduce them. 3. Acquire competency in each of the following domains: 3D and 2D level creation, basic art asset creation, visual programming basics, implementing game mechanics. 4. Demonstrate the ability to complete a market-ready video game in a team-based production environment. 5. Demonstrate the ability to implement agile production techniques. Credits: 3.00

CNIT 30800 - Game Development II: Design And Psychology

Credit Hours: 3.00. (CGT 25500) This course examines video game design, theory, and development from aesthetic, psychological, and technical perspectives. Students will gain experience with a commercial game development platform. Advanced game development techniques will be taught in this course.

Learning Outcomes: 1. Deconstruct and analyze an existing game and define its essential elements as per various theories of game design. 2. Identify major psychological paradigms and how they are applied in video game experiences. 3. Demonstrate proficiency in applying behavior modification principles in video games. 4. Demonstrate individual technical proficiency with a commercial game engine. 5. Complete a market-ready video game in a team-based production environment. 6. Implement agile production techniques. Credits: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 32200 - Research Methodology And Design

Credit Hours: 3.00. This course will discuss scientific research versus pseudoscience, experimental vs. quasi-experimental designs, different research controls and validity issues, and how study designs are used to answer research questions. Students will gain hands-on experience conducting observational and experimental research designs, and the process of writing a formal research paper.

Learning Outcomes: 1. Describe and produce ethical research. 2. Identify distinguishing features of good science vs. pseudoscience. 3. Critically evaluate different research

methodologies and designs. 4. Present and interpret research data in a formal research paper. Credits: 3.00

CNIT 32300 - Basic Cyberforensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyberforensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyberforensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

CNIT 34000 - UNIX Administration

Credit Hours: 3.00. This course focuses on the tasks and issues involved in the administration of UNIX systems. Topics include installation, networking, software management, scripting, and user management. In the laboratory portion of the course, students implement and maintain UNIX systems.

Learning Outcomes: 1. Understand the theory and practice of administering UNIX based operating systems. 2. Install and maintain UNIX operating systems. 3. Implement and maintain basic UNIX services including file sharing, e-mail, and X-Windows. 4. Secure UNIX operating systems. 5. Write and maintain UNIX shell scripts. 6. Integrate UNIX and Windows systems. Credits: 3.00

CNIT 34010 - UNIX Fundamentals

Credit Hours: 1.00. This course focuses on the use and basic administration of UNIX systems. Topics include installation, networking, software management, user management, and security of UNIX systems.

Learning Outcomes: 1. Describe and utilize basic UNIX system commands. 2. Install and maintain UNIX operating systems. 3. Secure UNIX systems. Credits: 1.00

CNIT 34210 - Storage Area Networking

Credit Hours: 2.00. This course introduces storage area network (SAN) technologies. Storage area networking concepts, architectures, protocols, and best practice implementation techniques are examined. Techniques for remotely booting systems over a SAN are covered. Students implement and maintain an industry standard SAN and network booting solutions.

Learning Outcomes: 1. Compare and contrast various enterprise storage architectures. 2. Implement and maintain storage area network services. 3. Utilize storage area network services from different client operating systems. 4. Install and configure a network boot environment for multiple operating systems. Credits: 2.00

CNIT 34220 - Network Administration

Credit Hours: 2.00 or 3.00. This course focuses on the tasks and issues involved in the installation and administration of distributed computing systems. Topics include the administration of network operating systems and network system interoperability. Students will implement and maintain a comprehensive network service infrastructure.

Learning Outcomes: 1. Understand, implement, and maintain network services such as DNS, PKI, e-mail, and web. 2. Research and solve hardware and software implementation problems in laboratory projects. 3. Produce written reports that document project work performed in the laboratory. 4. Work cooperatively as a team to implement solutions. Credits: 2.00 or 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 34500 - Internetwork Design And Implementation

Credit Hours: 3.00 or 4.00. This is an advanced course in network architecture. Students learn to design and implement local and wide area networks capable of simultaneous transport of real-time traffic and multiprotocol data over packet-switched and circuit-switched networks. An emphasis is placed on the integration of diverse communications technologies, while considering the effects of engineering decisions on overall performance, from both business and technology perspectives.

Learning Outcomes: 1. Understand the operation of shortest path spanning trees in internetworks. 2. Perform IP subnetworking to correctly size and allocate addressing to network devices. 3. Perform IP supernetworking to correctly size and allocate addressing to network devices. 4. Identify the correct network architecture to deploy a given set of requirements. 5. Deploy dynamic routing protocols. 6. Design, deploy, test, and maintain enterprise-class internetworks. 7. Demonstrate an understanding of medium characteristics, modulation and multiplexing techniques, physical layer framing structures used in data networks. Credits: 3.00 or 4.00

CNIT 34600 - Wireless Networks

Credit Hours: 3.00 or 4.00. This course introduces wireless networking. Topics include fundamental wireless communication concepts, wireless local area networks (LANs), and cellular systems. Wireless specific protocol elements are addressed in typical application environments. Data communications in multiple wireless environments are emphasized. In the laboratory section, students implement wireless solutions and integrate them into wired LAN environments.

Learning Outcomes: 1. Create and troubleshoot 802.11 wireless networks, as well as demonstrating integration into wired networks, devices and infrastructure. 2. Explain RF fundamentals, measurements and propagation theory. 3. Differentiate pertinent wireless networking standards, particularly those within the scope of the IEEE 802.11 standard. 4. Understand the underlying principles of the 802.11 MAC and how it relates to the upper and lower layers of the OSI model. 5. Implement wireless network security solutions and standards. Credits: 3.00 or 4.00

CNIT 35500 - Mobile Programming

Credit Hours: 3.00. This is an advanced programming course that teaches students the skills necessary to develop applications for mobile computing devices (e.g. Smartphones and tablet computers). Combining theory and practice, this course gives students hands-on experience with the latest technologies, tools and techniques used to develop mobile software solutions for business and entertainment.

Learning Outcomes: 1. List the popular mobile device platforms and market share. 2. Understand the difference between developing apps for mobile devices and developing apps

for PCs and servers. 3. Understand user interface design concepts specific to mobile devices. 4. Demonstrate how to persist app data to a mobile device. 5. Develop casual games that use essential game programming concepts. 6. Demonstrate how to use graphics programming techniques for drawing shapes, text, and sprites. 7. Develop apps that use more than one processing thread. 8. Develop apps that communicate with code running on a server. Credits: 3.00

CNIT 37000 - Introduction To Cryptography

Credit Hours: 3.00. Cryptography is an essential component to protect information in cyber systems. This course introduces the inner workings of cryptographic primitives and how to correctly use them. Specifically, the course covers cryptographic algorithms, protocols and techniques. The algorithms illustrate the art of encryption and secure hashing. The cryptographic protocols will expose the students to the world of building trust in an untrusted environment. Cryptographic techniques used in key management and algorithm choice will be explored.

Learning Outcomes: 1. Identify important real-world applications associated with cryptography. 2. Describe the major components of encryption techniques within symmetric and asymmetric cryptography. 3. Describe the major components of integrity protection and related properties. 4. Choose and apply appropriate cryptographic techniques to a plausible real-world security problem. Credits: 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

CNIT 38000 - Advanced Analysis And Design

Credit Hours: 3.00. This course is an advanced study of system analysis and design methods and techniques used by systems analysts to develop information systems. Object-oriented tools and the Unified Modeling Language (UML) will be used for describing object structure and behavior, and use cases will be used for modeling functional processes. Topics include rapid development concepts, application architecture and system design, transition from object-oriented analysis and models to components and services, graphical user interface design, web interface design, prototyping, and commercial software package integration. Emphasis is also placed on the use of an object-oriented CASE tool. This course surveys other important skills for the systems analyst, such as fact-finding (requirements discovery), communications, project management, and cost-benefit analysis.

Learning Outcomes: 1. Identify appropriate tools for modeling and implementing various systems aspects. 2. Apply use case and object modeling

using Unified Modeling Language (UML) to a systems project. 3. Understand the Systems Development Life Cycle (SDLC) as an analytical problem solving approach to systems development. 4. Apply systems development tools and techniques during various stages of systems development. 5. Develop a system concept based on a given set of system requirements. Credits: 3.00

CNIT 38101 - Topics In Computer Information Technology III

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 38301 - Packaged Application Software Solutions

Credit Hours: 3.00. This course introduces knowledge, skills, tools, and techniques used to select and implement packaged application software solutions, both small and large (including ERP). Topics will include the make-verses-buy decision, critical success factors for packages, economic analysis, requirements analysis, identifying vendors and products, request for proposals, analysis of vendor proposals, decision analysis, implementation service providers, contracting for software and service, implementation project planning, life-cycle architecture, software installation and configuration, business process redesign organizational change management, integration with legacy system, customization verses adaptation, data conversion, system and application testing, training and support, system cutover and post go-live considerations. The course will focus on best practices, and consequences of less than best practices. This course will benefit students with career aspirations as systems analysts, business analysts, consultants, data and database administrators, and IT managers.

Learning Outcomes: 1. Describe holistically, in intelligent conversation, the make-versus-buy decision, criteria, implications, and implementation process differences. 2. Analyze and revise a Request for Proposal (RFP) more maximum efficiency and effectiveness. 3. Score a set of condensed software package proposals and submit a recommendation for the "best fit" for an organization. 4. Develop a checklist for analyzing a set of contracts for a software license and its implementation services. 5. Develop a project plan for the implementation of software packages. Credits: 3.00

CNIT 38501 - Advanced Systems Design And Integration

Credit Hours: 3.00. A continuation of CNIT 38000 with an emphasis on knowledge, skills, tools, and techniques that systems analysts and architects use to translate functional systems requirements into design specifications that can be subsequently implemented. Students will learn methods for developing specifications that fulfill desired quality properties such as performance, scalability, maintainability, security, privacy, and protection of corporate property, interoperability, and usability, to name a few. Special emphasis is placed on integrating new systems with older systems, as well as with business processes. This course takes a holistic view of design and integration that specifies a complete information technology or information systems solution from the perspectives of different stakeholders, and from different systemic viewpoints and perspectives. Increasingly, the result of design and integration is referred to as a solution's architecture.

Learning Outcomes: 1. Describe holistically, in intelligent conversation, the design and architecture of information technology solutions. 2. Identify and evaluate current and emerging technologies and assess their applicability to address an IT solution's needs. 3. Apply a comprehensive framework for IT solution architecture to an approved problem domain. 4. Document accurately system representations of multiple architectural and design "concerns" of an IT solution, from the perspectives of different stakeholders. 5. Work effectively in teams and communicate effectively with various stakeholders of an architectural description of an IT solution. Credits: 3.00

CNIT 39000 - Supervised Practicum

Credit Hours: 1.00 to 3.00. An instructor-directed practicum designed to combine University study with work experience directly related to the student's plan of study. Designed to be scheduled during a regular semester. Credit awarded upon the completion of department-approved project. Maximum of three credit hours may be applied to the CIT bachelor degree.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured

and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

CNIT 39900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 4.00. Hours and subject matter to be arranged by staff. Primarily for students with special aptitudes.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 4.00

CNIT 40500 - Software Development Methodologies

Credit Hours: 3.00. This course explores methodologies and practices commonly used in contemporary software development projects. Topics include programming standards, code ownership and accountability, source code management and version control, productivity and quality metrics, software testing, and software process maturity models.

Learning Outcomes: 1. Demonstrate a level of proficiency in software development process and project topics. 2. Understand what is needed to work in and lead a team developing comprehensive software projects. 3. Understand the advantages and disadvantages of software development process models. 4. Understand the ramifications of in house vs. outsourcing of software development projects. 5. Analyze and evaluate the various software development methodologies available. 6. Understand and be able to implement requirements traceability to software modules. 7. Understand and be able to implement software testing procedures. 8. Identify, monitor, and document risks involved with software and software development. 9. Produce reports detailing the proper implementation of a software development methodology or technology. 10. Understand change management as applied to software. 11. Understand software project, process and product metrics. 12. Understand software quality concepts and the processes required to ensure software quality. 13. Understand the issues of accountability, responsibility, and certification as they apply to software professionals. 14. Understand intellectual property rights as applied to software. Credits: 3.00

CNIT 41500 - Advanced Coding Security

Credit Hours: 3.00. This course allows students to gain proficiency in secure coding principles. Security risks from common coding errors are examined. Techniques for integrating secure coding practices into the development process is detailed with an emphasis on ensuring that applications are designed and implemented with proper security requirements.

Learning Outcomes: 1. Analyze and apply secure coding standards and practices. 2. Understand common programming errors that lead to software vulnerabilities. 3. Demonstrate independent critical thinking and problem solving skills for effective mitigation strategies of security flaws. 4. Understand and apply systems development methodologies. Credits: 3.00

CNIT 41700 - Critical Infrastructure Security

Credit Hours: 3.00. In the socio-political context of nation state sponsored threat actors and cyber cold wars, critical infrastructure (such as water supply and power generation) is a strategic target for attackers. This course investigates the current threat landscape and vulnerabilities in critical infrastructure. Students then investigate system and network architectural solutions to the problem. Students build a model industrial system and will implement these protections in their model environment.

Learning Outcomes: 1. Assess system architectures of industrial control networks to identify sources of vulnerability. 2. Analyze the threat landscape associated with industrial control environments. 3. Build and validate controls in a model industrial control network.

Credits: 3.00

CNIT 42000 - Basic Cyber Forensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyber forensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyber forensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 42100 - Mobile Forensics

Credit Hours: 3.00. This course will help students understand the issues, techniques, and vulnerabilities of small scale digital device forensics. Emphasis will be placed on the forensically sound acquisition, preservation, analysis and presentation of small scale digital devices as evidence. Specific investigations will cover devices such as Personal Digital Assistants (PDA's), Cell Phones, and Smart Phones.

Learning Outcomes: 1. Identify various mobile devices. 2. Compare the characteristics of mobile devices. 3. Distinguish potential evidence found on mobile devices and ubiquitous systems. 4. Inspect forensically sound evidence from mobile devices and ubiquitous systems. 5. Produce a report for a courtroom presentation. Credits: 3.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 42300 - Advanced Cyberforensics

Credit Hours: 3.00. This course covers specialized and advanced content in digital forensics discipline. The focus of the course is on advancing and expanding the knowledge of the students regarding digital forensics investigation process particularly on emerging and contemporary technologies. Application of best practices in cyberforensics are emphasized in this course.

Learning Outcomes: 1. Identify components and sources of digital evidence in emerging technologies. 2. Apply digital forensics best practices to preserve, acquire, examine, analyze, and report digital evidence. 3. Correlating digital evidence collected from various devices for an investigation. 4. Present and communicate the digital forensics process for an investigation. Credits: 3.00

CNIT 42500 - Advanced Mobile Programming

Credit Hours: 3.00. This programming course teaches students the skills necessary to develop complex applications for mobile computing devices (e.g. smartphones and tablet computers). This course gives students hands-on experience developing mobile applications that use advanced features found on the latest mobile computing devices.

Learning Outcomes: 1. Develop applications for mobile devices that use advance features of mobile devices. 2. Develop apps that use more than one processing thread. 3. Develop apps that communicate with code running on a server. 4. Understand ways to earn money from a mobile application. Credits: 3.00

CNIT 43500 - Advanced Network Services

Credit Hours: 3.00. This course covers the concepts and technologies required to deploy advanced network services such as telephony and television over modern data networks. The underlying network structure and enabling services will be detailed along with a comprehensive analysis of protocols and services required to deploy such services.

Learning Outcomes: 1. Determine the relevant critical business and technical needs in order to

develop a IP Telephony design framework. 2. Describe the technologies used in Voice over IP and select the appropriate hardware and software components to support a proposed IP telephony design. 3. Install, configure, and secure an IP Telephony solution. 4. Describe effective troubleshooting methods to resolve issues in IP Telephony Networks. Credits: 3.00

CNIT 44500 - Advanced Internetwork Routing And Switching

Credit Hours: 3.00. This course extends routing and switching knowledge with specific attention given to emerging trends. This course focuses on the concepts of traffic shaping, advanced exterior gateway routing protocols, label switching technologies, and quality of service. The necessary perspectives of integration of these topics into enterprise networks are addressed in both lecture and laboratory.

Credits: 3.00

CNIT 44600 - Advanced Wireless Networks

Credit Hours: 3.00. This course is an advanced course in wireless networking. Building on knowledge gained from the introductory wireless local area network course, this course addresses wireless network design and implementation on a large scale. Topics include mesh networking, broadband wireless access, backhauling, WiMAX and cellular systems. The laboratory portion of the course includes implementing and simulating these technologies in an outdoor setting.

Learning Outcomes: 1. Understand current WLAN, WMAN and WWAN design and implementation strategies. 2. Understand the increasing roles that WLANs, WMANs, WWANs are playing to increase mobility and augment wire line high throughout technologies. 3. Design and configure Metropolitan and Wide Area scaled wireless networks based on a given business scenario or problem. 4. Understand wireless data and telecommunications terminology and jargon. 5. Understand the basic underpinnings of important wireless technologies and wireless internet provider management issues. 6. Conduct successful outdoor site surveys with different equipment and standards. 7. Be able to discuss wireless data and telecommunication issues with professionals in an informed and intelligent manner. 8. Formulate a checklist regarding existing and/or new wireless data/telecommunication systems and infrastructure. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 46000 - High Performance Computing Systems

Credit Hours: 3.00. This course provides an introduction to high performance, cluster, and grid computing from a systems perspective. The driving outcome for this course is for students to understand and apply high performance computing concepts, architectures, and software components to develop and operate

a high performance computing environment. Topics include: high performance computer architectures, network architectures for High Performance Computing (HPC), commodity and open-source cluster architectures, and software systems.

Learning Outcomes: 1. Understand factors that motivate the use and development of high performance computers and supercomputing systems. 2. Demonstrate skill in developing high performance computing systems. 3. Understand the continuum of high performance computing architectures. 4. Understand appropriateness of each architecture type to problem solving for a wide variety of applications. 5. Understand the effects of communications architecture and performance characteristics on application performance. 6. Demonstrate the use of commodity components in high performance computing and the trends and forces that motivate their use. 7. Demonstrate the use of tools and techniques of cluster and high performance computing. Credits: 3.00

CNIT 46100 - Parallel Data Systems

Credit Hours: 3.00. This course provides an introduction to the techniques and technologies used in high performance computing for developing, using and managing high performance data systems. Topics covered in this course will focus on aspects of the design, implementation, and use of high performance storage systems progressively from the hardware layer through the operating system up to the application level. Topics will include: commodity hardware and novel architectural storage components; the architecture and use of parallel file systems, including PVFS2 and Lustre; reliability and scheduling; virtualization and fault tolerant strategies for Petascale computing; system architectures for data intensive computing and workflows; parallel I/O systems; and grid and cloud computing architectures. The driving outcome for this course is for students to understand and apply advanced high performance computing concepts, architectures, and software components to develop and operate a high performance computing environment.

Learning Outcomes: 1. Understand the factors that motivate the use and development of high performance parallel storage systems. 2. Understand the importance of fast data rates to the efficient use of HPC systems and processors, and the effects of poor I/O on application performance. 3. Develop a high performance storage system by building, benchmarking and optimizing a small commodity-based storage system based on the Linux operating system and other open source software packages. 4. Understand the storage hierarchy, and the speeds, feeds, and costs at each level. 5. Understand the technological characteristics of components at each level of the storage hierarchy, and the effects of these technologies on reliability and performance. 6. Understand the range of interconnection technologies available for parallel data systems, and the effects of these technologies on storage performance. 7. Understand the range of storage technologies available and the design of high performance storage systems that are cost effective and reliable. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

CNIT 47200 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using a variety of methods. Students will have "hands-on" opportunities using tools to assist in these efforts. Permission from instructor required.

Learning Outcomes: 1. Examine key data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision-making purposes. 3. Evaluate the effectiveness of extracted knowledge and insights on decision-making. Credits: 3.00

CNIT 47700 - Blockchain

Credit Hours: 3.00. This course focuses on blockchain technologies. As IT practitioners and cybersecurity professionals, knowing the inner workings of blockchain technology is necessary for career preparation and development. This course aims to demystify blockchain technology by looking into its fundamental aspects, such as data structure, network consensus, economic incentives, security and privacy, applications, and regulations.

Learning Outcomes: 1. Identify enabling techniques for blockchain technology. 2. Describe the data structure and network layer of the Bitcoin blockchain. 3. Describe major components of blockchain, such as consensus, incentivization, and smart contracts. 4. Classify and analyze the security and legal issues of blockchain and cryptocurrency. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 48101 - Topics In Computer Information Technology IV

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 48200 - Six Sigma Data Quality For Continuous Improvement

Credit Hours: 3.00. A study of data quality for Six Sigma level of improvement, applying a Six Sigma DMAIC (Define, Measure, Analyze, Improve and Control) improvement methodology, utilizing information tools and techniques. The course addresses advanced topics in statistical based continuous improvement, data quality; and Big Data Analytics concepts, as pertains to systematic problems. An embedded certificate in SS is included in the body of knowledge.

Learning Outcomes: 1. Explain how Six Sigma principles are used for continuous improvement. 2. Apply the DMAIC and Big Data approach in solving team based, project based problems. 3. Demonstrate understanding of data quality principles as applied to compelling business cases. Credits: 3.00

CNIT 48300 - Applied Machine Learning

Credit Hours: 3.00. In the past decade, we have observed the expeditious evolution and tremendous applications of machine learning, such as unmanned vehicle, autonomous language translation, and smart healthcare. This course will introduce both the fundamental knowledge and design/application insights of machine learning techniques via a series of hands-on real-world examples. The overall aim is to provide the students with a good understanding of machine learning technologies,

building machine learning models, and applying machine-learning technologies to address real-world problems. In this course, students will also have an opportunity to explore the cutting-edge machine learning technologies, such as deep learning, adversarial attacks, and meta learning, and develop their own machine learning-based solutions.

Learning Outcomes: 1. Demonstrate both the fundamental knowledge and design/application insights of the state-of-the-art machine learning techniques. 2. Implement machine learning models. 3. Apply machine learning techniques to solve real-world problems. Credits: 3.00

CNIT 48400 - Applications In Data Science

Credit Hours: 3.00. Students investigate practical applications of Data Science and evaluate their effectiveness in guiding decision making. Students will employ tools to assist in these efforts.

Learning Outcomes: 1. Extract knowledge and insights from a variety of datasets. 2. Evaluate the effectiveness of extracted knowledge and insights. 3. Examine the ethical and social implications of data-driven decision making and policies and one's own ethical and social responsibilities when working with data. Credits: 3.00

CNIT 48700 - Database Administration

Credit Hours: 3.00. This course explores tools and techniques for managing an organization's database technology. Topics include database architecture, database technology installation, database creation and maintenance, Database Management System (DBMS) operation and troubleshooting, and database performance tuning. In the laboratory, students engage in activities performed by a typical database administrator.

Learning Outcomes: 1. Describe the architecture of a database management system. 2. Perform the roles of a database administrator including storage and user management, and data persistence. 3. Apply the principles and methods of performance tuning on a database management system. Credits: 3.00

CNIT 48900 - Advanced Topics In Database Technology

Credit Hours: 3.00. This course will provide students with a chance to explore contemporary issues in the database arena. These issues may be related to new or breakthrough concepts, technologies, and techniques.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 49000 - Senior Project

Credit Hours: 1.00 to 3.00. Team industrial experience for seniors who undertake a significant controlled project experience for an actual client and problem. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CNIT 49800 - Undergraduate Research

Credit Hours: 0.00 to 3.00. This course is used for tracking undergraduate research credits. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 3.00

CNIT 49900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Possible individual study under directed leadership of professor. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CNIT 51000 - Data Literacy

Credit Hours: 3.00. This course examines concepts, models, and methods useful for applying data analytics in business environments. Focusing on hypothesis generation, the capturing, storage and expression of data, analysis for research and visualizations.

Learning Outcomes: 1. Apply critical thinking abilities and analytical thought. 2. Recognize diverse range of data types/storage strategies and demonstrate the ability to analyze and debate the applications of each proficiently. 3. Examine aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 4. Analyze a set of data yielding actionable insights that can be applied to research or business. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include:

characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 51900 - Natural Language Technologies

Credit Hours: 3.00. This course serves as an introduction to natural language processing with the focus on current and emerging technologies and applications. The topics will review the state of the art of natural language processing, discuss their advantages and disadvantages for computational language processing, and look at some case studies. The assignments will range from pen and paper analysis to actual computational implementations.

Learning Outcomes: 1. Apply information systems solutions. 2. Understand the purpose of natural language understanding applications. 3. Analyze high-level tools and emerging technologies. 4. Describe functions, components and interaction of devices used in natural language applications. 5. Identify and evaluate individual application and existing and emerging technologies. 6. Demonstrate independent critical thinking and problem solving skills. 7. Apply critical thinking and creative problem solving to improve existing solutions. 8. Apply systems development methodologies. 9. Use appropriate techniques to plan, analyze, design and construct natural language based system. 10. Analyze which method is appropriate for given data characteristics. 11. Describe and analyze algorithms employed in applications. 12. Develop programs addressing various needs of natural language communications. 13. Employ effective testing methodologies. Credits: 3.00

CNIT 52300 - File System Forensics

Credit Hours: 3.00. The plethora of strategies to store information in different formats continues to expand. This course examines the various media and strategies of storing information and the processes of documenting the collection, imaging, and processing of forensic evidence. Topics include file formats, file systems, hardware, and software involved in forensic investigation. The overall pattern of forensic evidence in file systems will be examine along with the acquisition, analysis, and reporting of evidence artifacts found in file systems.

Learning Outcomes: 1. Identify and repair corrupted file systems. 2. Examine and analyze file systems using a multiple-tool approach. 3. Demonstrate how to locate deleted and hidden data. 4. Report and explain their findings and conclusions in a digital investigation. 5. Present and communicate the digital forensics process for an investigation. Credits: 3.00

CNIT 52500 - Mobile And Embedded Device Forensics

Credit Hours: 3.00. Consumer technologies are rapidly moving

forward with items integrating processing, storage, and transmission into their base functionality. The enterprise issues with the trend of "bring your own device" has rapidly expanded requirements on forensics investigators to address a plethora of mobile device types. Whether it is the automobile black box or a home thermostat, there are various elements of interesting evidence possible to be gained. The embedded and consumer device pantheon is developing as an important area of forensic science. This course explores techniques for conducting forensic analyses on a wide variety of mobile and embedded devices.

Learning Outcomes: 1. Identify components and sources of mobile and embedded device evidence. 2. Demonstrate how to preserve and acquire digital evidence while following the rules of evidence and the chain of custody. 3. Examine and analyze digital evidence using a multiple-tool approach for validation of the integrity of evidence. 4. Report and explain their findings and conclusions in a digital investigation. 5. Present and communicate the mobile forensics process for an investigation. Credits: 3.00

CNIT 53000 - Information Technology Business Analysis

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that business analysts use to solve business problems related to information technology projects. Special emphasis is placed on learning and applying the concepts of enterprise analysis, business analysis planning, stakeholder management, requirements management, and solution evaluation. Permission of department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for IT business analyst skillsets in information technology projects. 2. Research and assess the various means to construct a business case and business analysis plan to justify the execution of a project and then plan the business analyst's activities on the project. 3. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 4. Select, defend and utilize business analysis tools and techniques in the context of information technology projects. 5. Research and contribute to the business analysis body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 53100 - Information Technology Requirements Analysis And Modeling

Credit Hours: 3.00. This course introduces and develops the skills that business analysts will need to solve business problems and effectively model and analyze stakeholder requirements in order to define workable solutions and effective communicate customer needs. Permission of department required.

Learning Outcomes: 1. Apply business and requirements modeling techniques to solicit and support business analysis and problem solving. 2. Categorize, select and use specific visual modeling techniques to elicit, understand and communicate business requirements. 3. Research and analyze, then discuss in intelligent conversation, the techniques and tools used for modeling to support business requirements. 4. Perform general modeling techniques in combination with Visual Modeling learned from the resources provided for analyzing requirements and creating a requirements toolbox for a proposed solution. Credits: 3.00

CNIT 53200 - IT Enterprise Analysis

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that enterprise level business analyst use to create accurate requirements statements, organization level needs analysis and accurate business cases which assist the project team in developing schedules and budgets as well as strategic management teams in selecting the right projects to execute. Special emphasis is placed on learning and applying the concepts of innovation driven management. Permission of Department required.

Learning Outcomes: 1. Research in order to identify and define enterprise level business needs mostly represented in a strategic plan and discover opportunities for improvement. 2. Develop the ability to assess and build an accurate informative assessable business case for proposed projects. 3. Apply the process to consistently and accurately capture project

metrics to assess its success or failure at meeting customer stated goals. 4. Research, analyze, and demonstrate how to build a mature, Innovation-Driven business analysis practice or center of excellence within an enterprise. Credits: 3.00

CNIT 53500 - Advanced Topics In IT Business Analysis

Credit Hours: 3.00. The course explores the topics and tools used by today's information system professionals to lead the requirements gathering, estimating, developing, and delivery efforts of custom software applications. Course emphasis focuses on agile methodologies. Emphasis is also placed on requirements gathering and estimating technics commonly used with agile teams. Permission of Department required.

Learning Outcomes: 1. Research and analyze, then discuss then in intelligent discourse, the applications of an agile mindset to your life. 2. Research and demonstrate an understanding of an Agile methodology. 3. Research and analyze, then discuss in intelligent discourse, commonalities and detail differences between common Agile frameworks. 4. Research and analyze requirements elicitation and management practices using an agile methodology. 5. Research and apply user experience and user interface techniques, and agile estimating techniques. 6. Research and analyze, then discuss then in intelligent discourse, enterprise agile frameworks. 7. Research and analyze, then discuss then in intelligent discourse, tools that can aide in the organization of teams and project information. 8. Research and analyze, then discuss then in intelligent discourse, Business Analysis certifications, their value and purpose. Credits: 3.00

CNIT 53600 - IT Policy, Law, And Ethics

Credit Hours: 3.00. This course examines the policy, legal, and ethical aspects of information technology. Issues covered include ethical decision making, policy development, professionalism, privacy, freedom of expression, intellectual property, liability, and social responsibility. Included will be the philosophical ethical theories that underpin ethical decision making in the context of executing IT based projects.

Learning Outcomes: 1. Research and assess current related legislation affecting IT and IT based projects (SOX, HIPAA, etc.). 2. Research and assess the importance of Intellectual Property and Copyrights. 3. Research and analyze the key components of process improvement and product quality as related to ethical software development. 4. Research and assess the importance of employee and organizational liability. 5. Discuss the pros and cons in intelligent discourse concerning ethics and acting ethically for both individuals and organizations. 6. Discuss, in intelligent discourse, personal and societal impact of information privacy issues. Credits: 3.00

CNIT 53700 - Professional Research And Communication

Credit Hours: 1.00. This course explores aspects of research and communications that pertains to technology-based projects and professions as well as informed changes in business process. Specifically, the methods involved in objective driven research within and across technology and business domains, as well as the use of rationale for a concisely written summary of research methods and findings for a working professional.

Learning Outcomes: 1. Explore and discuss in intelligent discourse, the rationale and challenges in contemporary research and communications. 2. Develop, describe, and utilize a research/assessment methodology and understand the techniques used in technical based industrial research and communications. 3. Apply concepts and techniques common to current employer's practices with emphasis on concise technical writing and formatting. Credits: 1.00

CNIT 54100 - Cyberlearning Research And Development

Credit Hours: 3.00. This design-based research course explores and applies methodological and theoretical perspectives to the research, design, and evaluation of learning experiences and environments that integrate computational thinking or cyberlearning within a certain STEM discipline. Design-based research seeks to shape and even engineer learning environments and experiences "in the wild." Is

a series of approaches with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings.

Learning Outcomes: 1. Identify the theoretical foundations for the design of cyberlearning environments that enable learners to use their bodies and minds to learn through making, programming, experimenting, constructing, and inventing, so that the interaction results in deeper and authentic learning in STEM. 2. Design a learning experience, environment, or assessment tool that explores a particular pedagogical method, learning strategy, or other theoretical framework that conveys or assess STEM related concepts or that uses cyberlearning as an affordance to access of knowledge or new knowledge development in a specific STEM discipline. 3. Apply design-based research as a methodological perspective to the design and investigation of learning experiences and environments that integrate cyberlearning. Credits: 3.00

CNIT 54200 - Design-Based Research Applications

Credit Hours: 3.00. The course provides an opportunity for students to study and apply design-based research to evaluate and improve learning environments. Specifically, the course focuses on using design-based research as a methodological approach to combine instructional design and research in a cyclical and interdependent manner. Students are expected to apply this approach with the goal of simultaneously solving practical problems and developing a sharable theory by connecting design features to valued outcomes. Students should have prior knowledge of educational research methods, have an educational project to work on or a dataset ready to be analyzed. (added last statement from proposed restrictions)

Learning Outcomes: 1. Describe the purposes and characteristics of design-based research. 2. Analyze and synthesize literature describing and evidencing design based research in terms of their contexts, frameworks, processes, methods and outputs. 3. Apply conjecture mapping as a technique to operationalize specific educational related phenomena to be explored through design research cycles. 4. Apply field-based investigation methods to gather information, strategies for validity for ensuring rigor in DBR, and techniques for reporting evidence-based findings in DBR. 5. Offer constructive feedback on peers' work and incorporate feedback into one's own work. Credits: 3.00

CNIT 54300 - Human-Computer Interaction Applied To Games And Education

Credit Hours: 3.00. This course will explore Human-Computer Interaction (HCI) as applied to both the field of education and games. Students will engage in reading in these three fields. Specifically, they will develop a foundational understanding of common approaches in studying HCI, as well as current broad intersections with education and gaming. The course will be heavily focused on a semester-long research project in which students will participate in HCI, games, and education research. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of research in HCI, games, and education. 2. Develop understanding of approaches to experimental design. 3. Develop understanding of common approaches to data analysis. 4. Develop research abilities through taking part in an individual research project. Credits: 3.00

CNIT 54600 - The Internet Of Things For Information Technology

Credit Hours: 3.00. This course will explore the emergence of technologies and vertical solutions in the Internet of Things (IoT) domain. The course explores the top-level problems that IoT promises to solve, the business drivers, the attributes of IoT-enabled enterprise and consumer markets, and how IoT is different from the contemporary Internet. The course will discuss and apply IoT components such as the "things", the data, the people, and the processes, as well as vertical markets. Emphasis will be placed on types of architecture, reference models, and standards (both open and proprietary), underlying technologies, commercial products, issues (such as security), and research efforts in the Internet of Things. The lab component will focus on the complete IoT ecosystem (sensors, actuators, networks, etc.), but will specifically emphasize the functionality of IoT cloud platforms. Permission of instructor is required.

Learning Outcomes: 1. Explain and demonstrate the main functions of a complete Internet of Things (IoT) system. 2. Research and explain a specific student area of interest in the IoT realm. 3. Analyze and discuss current

topics, problems and research related to IoT. Credits: 3.00

CNIT 54900 - Internet Of Things Security

Credit Hours: 3.00. This course will introduce students to Internet of Things (IoT) fundamentals and investigate IoT security threats, vulnerabilities, and countermeasures. It will also include cloud-enabled IoT components, which is integration of cloud computing and IoT, and relevant security issues in this domain. Students will learn about the state-of-art IoT technology, platforms and services, protocols, and advanced topics (e.g., Machine/Deep Learning (ML) and Artificial Intelligence (AI)) in IoT security. This course will provide extended knowledge and exposure to students on IoT attacks, security policies, access control models, ML/AI models for IoT security and framework. The course will also explore data privacy issues associated with IoT and its components and key technologies. Students will gain knowledge and skills through hands-on project and research experience on real-world IoT devices and applications, real-world cloud computing platforms, and will work on specific IoT application domains, such as smart homes, smart health (medical IoT devices) and wearable IoT. Permission of instructor required.

Learning Outcomes: 1. Apply the Internet of Things (IoT) fundamentals, including IoT architectures, protocols, and platforms, to design different IoT use cases. 2. Identify security risks, threats and vulnerabilities in different IoT application domains (e.g., smart homes, smart health, smart transportation). 3. Analyze security requirements for IoT application domains to determine appropriate secure provisioning actions in smart connected systems and communities. 4. Implement security models and technical controls to mitigate security threats and vulnerabilities in real-world IoT use cases. Credits: 3.00

CNIT 55000 - Organizational Impact Of Information Technology

Credit Hours: 3.00. An enterprise view of the organizational impact of information technology as the most effective means for achieving "better, faster, cheaper operations" in today's highly competitive business environment. Examines how information technology has enabled new organizational forms and changes in business processes, products, markets, delivery systems, ways of working, and people management issues and challenges. Permission of instructor required.

Learning Outcomes: 1. Articulate methods and algorithms in network security. 2. Evaluate the strengths and weaknesses of different networking security approaches. 3. Describe how to deploy encryption techniques to secure data at rest and in transit. 4. Compare, contrast and critique existing applied research in network security. 5. Propose new ideas/technologies in network security and systematically assess your proposed work. Credits: 3.00

CNIT 55100 - Information Technology Economics

Credit Hours: 3.00. Examines the economics of information systems and information technology as it relates to business performance. Topics include strategic information technology planning, alignment with business planning, value assessment, and performance measurement. Special emphasis is placed on issues relevant to strategic information technology infrastructure management, both for the information technology unit as well as the business as a whole. Permission of instructor required.

Credits: 3.00

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

CNIT 55300 - Quality Management In Information Technology

Credit Hours: 3.00. This course explores quality and productivity models used to ensure quality in information technology systems development processes. Special emphasis is on learning and understanding process metrics and measurement, as well as initiatives such as Total Quality Management, Continuous Process Improvement, Six Sigma, and the Software Engineering Institute Capability Maturity Model. Permission of instructor required.

Learning Outcomes: 1. Use and apply information technology solutions. 2. Understand and apply high-level tools and emerging technologies. 3. Demonstrate independent critical thinking and problem solving skills. 4. Understand and apply information technology

application methodologies. 5. Communicate effectively with customers, supervisors and peers, both orally and in writing. 6. Understand the expectations of an information technology professional. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CNIT 55501 - Social Engineering Mitigation In Information Technology

Credit Hours: 3.00. Human vulnerability is currently one of the biggest threats to cybersecurity. Social engineering is one of the primary tools used to take advantage of this vulnerability. In this course, students will learn about some techniques used in social engineering, the psychology harnessed to carry out social engineering attacks, and learn to identify possible avenues of attack and procedures to prevent and mitigate specific risks. Permission of instructor required.

Learning Outcomes: 1. Identify and describe the techniques of social engineering. 2. Explain the psychological principles underlying social engineering techniques. 3. Apply some basic social engineering tools. 4. Design strategies to prevent or mitigate social engineering attacks. 5. Apply ethical standards to the practice of social engineering. Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science. Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

CNIT 55800 - Bioinformatics Computing And Systems Integration

Credit Hours: 3.00. This is a graduate-level course for students interested in the application of computational methods and information technology in the pharmaceutical, biotechnology, and life sciences arena. An overall understanding of information technology and systems is assumed, as well as an in-depth knowledge of one or more areas of information technology. Permission of instructor required.

Credits: 3.00

CNIT 55900 - Data Warehousing

Credit Hours: 3.00. The design and implementation of data warehouses (including data marts and operational data stores) are studied using current database technologies. Topics include data modeling for warehouses, data warehousing infrastructure and tool selection, data exploration, data synthesis and reduction, organizational metadata, data warehouse administration, and other contemporary issues. Preference is given to students having graduate status in the College of Technology with a CIT concentration. Permission of instructor required.

Credits: 3.00

CNIT 56000 - Advanced High Performance

Computing Systems

Credit Hours: 3.00. This course is a graduate level course that covers advanced topics in high performance, cluster, and grid computing in detail from a systems perspective. Topics covered in this course will focus on aspects of the design, implementation, and use of high performance computing systems at each level of the system, including: commodity hardware and novel architectural components, such as graphics processing units; operating systems for HPC systems, including low-noise OS and light-weight kernels; system reliability and job scheduling; virtualization systems and fault tolerance for HPC; data intensive computing and workflows; parallel I/O systems; and grid and cloud computing architectures. Experience in Linux systems administration is a prerequisite for this course.

Learning Outcomes: 1. Understand the impact of performance, cost, reliability, and usability on the design and deployment of high performance computing systems based on mixture of commodity and special purpose components and software. 2. Demonstrate skill in finding a balance among these factors by designing, building, benchmarking, and optimizing a small commodity-based cluster computer based on the Linux operating system and other open source software packages. 3. Demonstrate ability to analyze problems inherent in cluster computing and to design new solutions to those problems based on the development and integration of new technologies, such as GPUs, parallel data systems, and workflow systems. 4. Demonstrate understanding and knowledge of the core concepts of high performance computing, which include: The continuum of high performance computing architectures, and the appropriateness of each architecture type to problem solving for a wide variety of applications; The effects of communications architecture and performance characteristics on application performance; The effects of component reliability and operating systems on Petascale computing; The use of commodity components in high performance computing, and the trends and forces that motivate their use; The design of high performance computing systems to meet specific application needs and resource constraints; tools and techniques of cluster and high performance computing, such as scheduler configuration and use, benchmarking tools and techniques, queuing and reliability models. Credits: 3.00

CNIT 56100 - Advanced Parallel Data Systems

Credit Hours: 3.00. This course is a graduate level course that covers advanced topics in high performance, cluster, and grid computing in detail from a systems perspective. Topics covered in this course will focus on aspects of the design, implementation, and use of high performance storage systems progressively from the hardware layer through the operating system up to the application level. Topics will include: commodity hardware and novel architectural storage components; the architecture and use of parallel file systems, including PVFS2 and Lustre; reliability and scheduling; virtualization and fault tolerant strategies for Petascale computing; system architectures for data intensive computing and workflows; parallel I/O systems; and grid and cloud computing architectures. Experience in Linux systems administration is a prerequisite for this course.

Learning Outcomes: 1. Understand the impact of performance, cost, reliability, and usability on the design and deployment of high performance computing systems based on mixture of commodity and special purpose components and software. 2. Demonstrate skill in finding a balance among these factors by designing, building, benchmarking, and optimizing a small commodity-based cluster computer based on the Linux operating system and other open source software packages. 3. Demonstrate ability to analyze problems inherent in cluster computing and to design new solutions to those problems based on the development and integration of new technologies, such as GPUs, parallel data systems, and workflow systems. 4. Demonstrate understanding and knowledge of the core concepts of high performance computing, which include: The continuum of high performance computing architectures, and the appropriateness of each architecture type to problem solving for a wide variety of applications; The effects of communications architecture and performance characteristics on

application performance; The effects of component reliability and operating systems on Petascale computing; The use of commodity components in high performance computing, and the trends and forces that motivate their use; The design of high performance computing systems to meet specific application needs and resource constraints; tools and techniques of cluster and high performance computing, such as scheduler configuration and use, benchmarking tools and techniques, queuing and reliability models. Credits: 3.00

CNIT 56200 - Six Sigma Black Belt For Operations Excellence

Credit Hours: 3.00. A study of the Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. This course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Six Sigma methodology; and provides an opportunity to earn a for Six Sigma Black Belt. Permission of instructor required.

Learning Outcomes: 1. Explain Six Sigma principles and benefits. 2. Apply Six Sigma techniques and tools to solve technical problems. 3. Apply the Six Sigma DMAIC methodology in team-based projects for continuous improvement. Credits: 3.00

CNIT 56300 - Software Design And Development For Robotics

Credit Hours: 3.00. The purpose of this graduate-level course is to provide students with hands-on experience in designing, implementing, programming, and debugging robotic software systems. The course begins with an introduction to fundamental concepts and skills in robotics, encompassing both hardware and software components. Students will gain proficiency in working with embedded processors such as Arduino and Raspberry Pi, and they will have the opportunity to construct their robots using a dedicated robotic development platform. Subsequently, students will explore programming tools such as Matlab and Simulink, along with robot simulators, to acquire a deep understanding of the principles and best practices in software design and development within the field of robotics. Additionally, students will actively engage in discussions and debates, gain insights from guest speakers within the robotics field, and collaborate on team projects. Through hands-on involvement in a project, students will gain valuable experience in addressing real, non-trivial challenges. This course equips students with the skills and knowledge needed to excel in the dynamic and rapidly evolving field of robotics, fostering a strong foundation in both theoretical concepts and practical application.

Learning Outcomes: 1. Demonstrate an understanding of the key topics and trends in software design and development in robotics areas. 2. Identify principles of robotic programming in robotics and practice of robot components. 3. Demonstrate practical skills necessary to design, implement, test, and deploy robotic system. 4. Develop proficiency in delivering effective oral presentations and written communication, effectively addressing research problems, methodologies, and findings within the context of software design and development in robotics. Credits: 3.00

CNIT 56400 - Assistive Technology And Robotics

Credit Hours: 3.00. The purpose of this graduate-level course is to equip students with the practical skills required to engage in effective and impactful research within the realm of assistive technologies and assistive robotics. The course encompasses a comprehensive exploration of key topics and research areas in assistive robotics and related technology fields, including mobility, vision, hearing, speech, and cognitive aids. Throughout the course, students will acquire a strong foundation in the essential components of conducting research in these domains. This includes conducting needs assessments, conducting comprehensive literature reviews, implementing user testing and iterative solution development processes, evaluating solutions, and engaging in prototyping activities. Emphasizing a holistic approach to learning, students will actively participate in dynamic discussions and debates, engage in insightful site visits, interact with guest speakers, and collaborate on both team and individual projects. A pivotal aspect of the course involves the practical application of acquired knowledge in a research project. Students will have the opportunity to design, implement, and/or evaluate assistive technologies or robots tailored to address specific challenges faced by individuals with disabilities and the elderly. This hands-on experience will enable students to put theory into practice and contribute meaningfully to the advancement of assistive technology solutions.

Learning Outcomes: 1. Demonstrate an understanding of the key topics and trends in assistive robotics and technology areas. 2. Demonstrate the ability to access and analyze current literature relevant to assistive technology and robotics, and identify ways in

which computing and robotic technology can positively impact the lives of individuals with disabilities. 3. Identify the essential components of research, including conducting needs assessments, conducting thorough literature reviews, engaging in iterative design and development processes, conducting user testing and evaluation, and proficiently creating prototypes. 4. Develop proficiency in delivering effective oral presentations and written communication, effectively addressing research problems, methodologies, and findings. Credits: 3.00

CNIT 56500 - Information Security Management

Credit Hours: 3.00. Information Security Management explores the issues surrounding the alignment of business and information security. More precisely, once the context of information security is understood in terms of the business and the problems with the current state of Information Security Management are identified, the course pursues solutions to those problems in terms of people, policy, process, procedures, and technology. The product produced as a result of this pursuit is an Enterprise Security Architecture, mapping business needs to technology implementation. The enterprise security architecture produced is dynamic and maintainable, thereby assuring traceability and accountability. Permission of instructor required.

Learning Outcomes: 1. Develop a multi-layer enterprise security architecture. 2. Prepare a Risk Assessment. 3. Identify and employ appropriate information security metrics and standards. 4. Employ appropriate tools and methodologies to balance business and security considerations. Credits: 3.00

CNIT 56600 - Interactive Systems And Web Development

Credit Hours: 3.00. This is a graduate-level course designed to immerse students in the design, development, and evaluation of web-based interactive systems. Through a blend of theoretical understanding and hands-on projects, the course emphasizes the latest in human-computer interaction, full-stack web development, and human-AI interfaces, preparing students to innovate in the digital landscape while addressing real-world problems.

Learning Outcomes: 1. Analyze and articulate the complexities of designing interactive systems, emphasizing a deep understanding of user needs and system functionalities within digital environments. 2. Synthesize diverse user requirements and technological capabilities to develop innovative web-based interactive platforms that are responsive to evolving digital interaction landscapes. 3. Evaluate the effectiveness of various web development frameworks and tools in the creation of robust, user-centered applications, assessing their utility in real-world scenarios. 4. Apply advanced design principles and development techniques to construct, test, and refine interactive web applications, focusing on both front-end and back-end functionalities. 5. Communicate research findings effectively, using structured academic writing and presentations to disseminate insights and implications of studies in interactive system development. Credits: 3.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

CNIT 57100 - Responsible Data Science

Credit Hours: 3.00. This course examines advanced topics relating to algorithmic fairness, transparency, and interpretability of data-driven decision-making systems. Topics include the data

science lifecycle, data quality, algorithmic bias, debugging and mitigating bias, and transparency of data and algorithms.

Learning Outcomes: 1. Recognize current issues related to the transparency and fairness of decisions made by data-driven decision-making systems. 2. Examine sources of unexpected and discriminatory behavior of data-driven decision-making systems. 3. Contrast existing methods and design novel techniques to mitigate undesired system decisions. Credits: 3.00

CNIT 57500 - Data Analysis

Credit Hours: 3.00. This course will teach students how data analysis can inform decision-making. Students will develop analytical skills and focus is placed on predictive analysis to evaluate business decision. Students will develop logical reasoning and communication skills related to quantitative outputs. This course will also develop the ability to collect large datasets, organize, and combine them using Tableau software.

Learning Outcomes: 1. Recognize the pervasiveness and breadth of data collection options available in today's world. 2. Discern and defend ethical applications of how collected data can be used for marketing. 3. Discuss how to find, download, clean and combine data sets. 4. Identify and evaluate trends in data sets. 5. Build models to make predictions about future events based upon historic data. Credits: 3.00

CNIT 58000 - Advanced Topics In Information Technology Project Management

Credit Hours: 3.00. The course explores and applies the advanced concepts, skills, knowledge, techniques, and tools required to successfully initiate, plan, manage, execute, control, and report on information technology projects. Special emphasis is placed on applying the PM BOK in a real life business case study as well as researching and learning concepts, techniques, and processes experienced project and program managers employ to successfully plan and manage projects. This course enables the student to learn project management through the application of project approaches in a team based setting. Through the application of project methodologies, tools and templates, the student learns the project life-cycle approach as demonstrated through actual and simulated project situations. Permission of Department required.

Learning Outcomes: 1. Explain and apply the processes and Weekly Assignments, Live, and artifacts prescribed by the PMBOK. 2. Assess the objectives of a project management office and how organizations implement them based on their organizational structure and culture. 3. Research and analyze methodologies, tools, and techniques used by today's experienced IT project managers. 4. Research and analyze current business and technology conditions that affect project managers of today. 5. Describe and evaluate the competencies that are required to be an effective project manager. 6. Research innovative methods and techniques for performing IT project management. Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

CNIT 58200 - IT Project Estimating, Control And Scheduling

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to create and manage time and cost estimates, as well as the creation of accurate schedules with dependencies. The course reviews research of best practices in schedule management and budget management. Students will apply these skills and techniques to business problems. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for creation of IT project estimates and budgets into IT projects. 2. Understand and be able to apply current techniques and methodologies used to build cost and time estimates for IT projects including Function Points, COCOMO, and others. 3. Discuss, in intelligent discourse, the types of schedules (Work Breakdown Structures) needed to run IT projects today including traditional lifecycles and Agile approaches. 4. Accurately conduct analysis of network schedule dependencies including calculation of slack, Critical Path Analysis and Critical Chain Scheduling. 5. Discuss, in intelligent discourse,

the role corporate politics and negotiation skills play in building project budgets and successfully executing the project. 6. Understand and be able to apply time and cost monitoring and control techniques including Earned Value Management (EVM). Credits: 3.00

CNIT 58300 - IT Program And Portfolio Management

Credit Hours: 3.00. Program and Portfolio Management deliver benefits to organizations by enhancing current abilities or developing new capabilities for the organization to use. This CNIT Graduate course will provide a detailed understanding of Program and Portfolio Management and its relationship to Project management and will present concepts that promote efficient and effective management and communications among various groups. This course curriculum is consistent with the Project Management Body of Knowledge (PM BOK) and related Standards for Program and Portfolio Management published by the Project Management Institute. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the differences between portfolio, program and project management. 2. Understand and articulate the importance of project governance within the company and associated portfolio, program, and project processes. 3. Understand the possible compositions and value of the Project Management Office (PMO) and strategies for implementation. 4. Understand and discuss in intelligent discourse the importance of project planning, change management and communication within the company to foster Project, Program and Portfolio management success. 5. Discuss, in intelligent discourse, the role corporate politics and negotiation skills play in building project budgets and successfully executing the project. 6. Understand and be able to apply time and cost monitoring and control techniques including Earned Value Management (EVM). Credits: 3.00

CNIT 58500 - Organizational Change Management For IT Projects

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to manage the "people" side of organizational change that results from IT projects that implement new technologies, systems, services, and products into the workplace. This is sometimes called stakeholder management. The course reviews research of best practices in change management and their impact on project metrics such as schedule, budget, scope, stakeholder satisfaction. Students also learn how to identify and document the organizational and people impacts of new information technology solutions, and then develop a formal project plan to manage the organizational change. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for organizational change management into information technology projects. 2. Pro-actively apply an organizational change management framework and principles to a business situation, ideally an information technology project. 3. Discuss, in intelligent discourse, the types of disruptive organizational change and how they can be caused by information technology projects. 4. Accurately document, and communicate IT-enabled changes to existing business processes. 5. Select, defend and utilize organizational change management tools and techniques in the context of information technology projects and management. 6. For residential, thesis students, research and contribute to the organizational change management body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 58600 - IT Requirements Management

Credit Hours: 3.00. The course explores the approaches used by today's information system professionals to conduct and manage the requirements development process. Course emphasis focuses on contemporary techniques for requirements elicitation, requirements analysis, requirements specification, requirements validation and verification. Emphasis is also placed on identifying stakeholders through the use of formal stakeholder analysis techniques, the use of formal change control, requirements traceability and the use of requirements management tools. The course is designed based on the principles and competencies prescribed by the Project Management institute's PM BOK (Project Management Body of Knowledge) and Business Analyst Guide as well as the International Institute of Business Analysis's BABOK (Business

Analysis Body of Knowledge). Permission of Department required.

Learning Outcomes: 1. Research and analyze in order to discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for requirements management into information technology projects. 2. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 3. Accurately document, and communicate business requirements for an IT project. 4. Select, defend and utilize requirements management tools and techniques in the context of information technology projects and management. 5. For residential, thesis students, research and contribute to the requirements management body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 59000 - Special Problems In Computer Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Design, plan, and execute a structured cybersecurity research project, applying appropriate methodologies and critically analyzing relevant literature to identify and address gaps in current knowledge. 2. Apply advanced cybersecurity tools and techniques to develop innovative solutions to research challenges, demonstrating technical proficiency and creative problem-solving within the field. 3. Communicate effectively research findings in written and oral formats suitable for academic and professional audiences, while adhering to ethical standards in cybersecurity research, including data privacy and responsible disclosure. Credits: 1.00 to 6.00

CNIT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1.

Varies due to nature of the course. Credits: 1.00 to 3.00

CNIT 60100 - Applied Statistics In Information Technology

Credit Hours: 3.00. This course will survey the field of applied statistics in information technology. Students will gain hands-on experience running statistical analyses on samples from a variety of populations. Students will learn the process of data cleaning, data transforming/coding, identifying the appropriate statistical analyses (descriptive and inferential), as well as writing and interpreting the results. Specifically, this course will survey the following statistical approaches: correlations, t-test, analysis of variance, analysis of co-variance, factorial ANOVA, simple regression, multiple regression, logistic regression, chi-square analysis, factor analysis, and nonparametric tests. In this course, students will be able to differentiate statistical analyses and identify appropriate statistical analyses depending on the research question and variables of interest. Permission of instructor required.

Learning Outcomes: 1. Analyze data with different statistical procedure using SPSS. 2. Differentiate between different types of statistical analyses. 3. Evaluate the statistical procedures and results in published journal articles. Credits: 3.00

CNIT 61700 - Cyberphysical Security Seminar: Research Topics In Cyberphysical Security

Credit Hours: 3.00. This course meets the requirements of a research seminar for the CIT graduate program. Students focusing on homeland security and related research areas are encouraged to take this course to expand their knowledge of the field in general and in their specific research areas. The students will present their research to one another to gain knowledge of topics in the subject area. The student numbers will include PHSI student research assistants, interns, and students focused on homeland security research topics. The creation of this course will provide these students more structure for engagement, learning and research. Students taking the course will construct a research paper formatted for publication in a homeland security research journal. This course will also promote the interdisciplinary nature of homeland security from information technology to public policy generation and agent-based computer modeling. Permission of Instructor required.

Learning Outcomes: 1. Develop research papers. 2. Develop research that can be used

as a chapter in students' research. 3. Learn appropriate format for publication. 4. Identify sources. 5. Identify topics. 6. Develop a research presentation. 7. Prepare for thesis proposal/defense. 8. Share student research with students of similar interest. Credits: 3.00

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

CNIT 62500 - Research Methods In Computing

Credit Hours: 3.00. The goal of this course is to provide you with the tools necessary to not only understand how to create your own research study on cyber-physical systems, but how to critically assess the different methodologies and components in various research designs used in applied information technology. In this course, you will learn about the landscape of research in information technology. You will learn to differentiate between different research methodologies used in IT, identify threats to validity, learn specific protocols for commonly used methods in IT, and synthesize empirical literature and theory in order to design a scientific research study. The end product of this course will be the ability to design and report on an IT-related research project. Permission of instructor required. Prerequisites: STAT 50100 or STAT 51100 or other statistics course; 6 credits of CNIT at the 500 level.

Learning Outcomes: 1. Understand the landscape of research related to applied cyber-physical systems. 2. Evaluate the quality and salience of research related to cyber-physical systems. 3. Differentiate between research methodologies used in IT and design a research study using appropriate methods. 4. Formulate discipline-appropriate research questions. 5. Synthesize empirical literature and theory and write various types of research reports appropriate to their sub-discipline. 6. Identify different research philosophies and paradigms used in Information Technology and their impact on research designs and outcomes. Credits: 3.00

CNIT 64000 - Advanced Research Topics In Blockchain Technology

Credit Hours: 3.00. Blockchain is gaining momentum and of increasing interest to both academia and industry. The underlying distributed ledger technology was first introduced in the cryptocurrency Bitcoin by Satoshi Nakamoto and its adoption will dramatically reshape the landscape of IT infrastructure of a diverse range of sectors, such as manufacturing, finance, government, healthcare, and insurance, from centralized control to decentralized cooperation. Under the hood, cryptography, distributed consensus, economic incentives, and autonomous management/computation are consolidated to support Blockchain technology. In this research-focused course, we will explore a variety of active research areas in the evolving Blockchain technology, identify the challenges of the current development and attempt to answer open questions. Permission of instructor required.

Learning Outcomes: 1. Compare permissionless and permissioned blockchain network. 2. Discuss the corresponding countermeasures for addressing the scalability issue of the current blockchain implementation. 3. Describe the on-chain data protection and privacy-preserving technology. 4. Describe the smart contracts, the related vulnerabilities, and mitigations. 5. Explain the blockchain incentivization and related attacks. 6. Analyze and evaluate blockchain-based applications. 7. Investigate the selected research topics and propose innovative solutions. Credits: 3.00

CNIT 69100 - Natural Language In Information Assurance, Security, And Privacy

Credit Hours: 3.00. This course will serve as seminar in natural language applications with the emphasis in information assurance, security, and privacy. The topics will review the state of the art of general information assurance, security, and privacy with the focus on natural language text and information received from and implied in it. The course will focus in a wide range of papers describing various techniques and applications, with identifiable advantages and disadvantages. The assignments will range in class paper presentations to group projects and written reports.

Learning Outcomes: 1. Illustrate the purpose and goals of natural language-based information assurance, security and privacy applications. 2. Identify and evaluate individual applications for a particular need. 3. Apply critical thinking and creative problem solving to improve existing solutions. 4. Explain advantages and disadvantages of natural

language processing techniques applied to security-related applications. 5. Develop reports on new and existing methods and applications following Purdue University Ethics Policies. Credits: 3.00

CNIT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 18.00

CNIT 69900 - Research PhD Dissertation

Credit Hours: 1.00 to 18.00. Dissertation-level research (for CIT PhD degree). Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Outcomes will be agreed upon by the instructor and the student. Credits: 1.00 to18.00

Computer Graphics Technology

CGT 10100 - Introduction To Computer Graphics Technology

Credit Hours: 3.00. This course introduces students to the Computer Graphics Technology program, and prepares them for the program curriculum. It serves both as the Freshman Experience course, and the fundamental introduction to Computer Graphics. In addition to academic career planning and utilization of institutional resources, students also investigate the definitions and applications for Computer Graphics, the history and knowledge base for Computer Graphics, and critically examine potential Computer Graphics career pathways.

Learning Outcomes: 1. Demonstrate comprehension of the basic principles of CGT. 2. Engage practicing professionals, current students, faculty, counselors, and alumni to discover opportunities within the department, college, and university to develop and validate a CGT plan of study. 3. Identify and utilize basic strategies for team building, planning, investigation and presentation. 4. Identify and utilize opportunities to participate in activities focused on critical thinking, teamwork, project management, potential social impact, ethics and communication. 5. Evaluate current technical skill level and demonstrate investigation into or competent entry skill in a CGT area of interest. Credits: 3.00

CGT 10101 - Foundations Of Computer Graphics Technology

Credit Hours: 2.00. This course provides a foundational overview of computer graphics. The topics include the applications of computer graphics in today's world, basic technical elements of computer graphics, a review of current and future career opportunities in the field, and areas of potential research and study in computer graphics technology.

Learning Outcomes: 1. Demonstrate comprehension of the basic principles of CGT. 2. Engage practicing professionals, current students, faculty, counselors and alumni to discover opportunities within the department, college and university to develop and validate a CGT plan of study. 3. Identify and utilize basic strategies for team building, planning, investigating and presentation. 4. Identify and utilize opportunities to participate in activities focused on critical thinking, teamwork, project management, potential social impact, ethics and communication. 5. Evaluate current technical skill level and demonstrate investigation into or competent entry skill in a CGT area of interest. Credits: 2.00

CGT 10501 - Introduction To Games (UCC: STS)

Credit Hours: 3.00. Students learn the history of computer game design. Students engage in learning activities that help them remember basic game design principles. These principles are then applied using simple exercises within game engine technology.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recall key facts about computer game design history. 2. Understand principles of computer game design. 3. Apply computer game design principles in exercises on paper and in game engine technology. 4. Analyze computer games via written critiques. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

CGT 11100 - Designing For Visualization And Communication

Credit Hours: 3.00. An introductory design course for computer graphics majors. Students develop an understanding of the basic design elements and principles, composition, and typography through exercises and projects. The focus is on visual thinking, exploring the relationship between type and image, and developing multiple solutions to a given problem.

Learning Outcomes: 1. Distinguish the elements and principles of visual design and composition. 2. Describe the foundational principles of Color Theory. 3. Describe the relationship between type and image. 4. Critique visual communications and design solutions. Credits: 3.00

CGT 11200 - Sketching For Visualization And Communication

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication, and creativity within a sketching metaphor. Exercises and projects in graphic theory, problem solving, and sketching skill development provide students with activities that focus on further development within the discipline. A variety of sketching techniques are used to gather critical information and transform data into effective communication instruments.

Learning Outcomes: 1. Awaken creativity and problem-solving through the means of sketching. 2. Develop fine motor skills: Becoming a artisan. 3. Explore Aesthetics as it pertains to sketching. 4. Learn and practice professional methods of look development. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11505 - Scripting And Computational Thinking

Credit Hours: 3.00. This course introduces the students to computer programming, computational thinking, and the mathematics of graphics programming. The act of programming is viewed through the lenses of Decomposition, Pattern Matching, Abstraction and Algorithms and then applied to writing some simple games in current scripting languages. No prior programming experience is required. The principal objective of the course is to provide a working knowledge of programming fundamentals to game designers and artists as well as to prepare game programmers for more advanced game programming coursework. As computer programming is an applied discipline, this course uses an active learning approach that combines lecture time with extensive lab assignments.

Learning Outcomes: 1. Apply the elements of computational thinking to programming tasks. 2. Use scripting languages in a well-structured way to implement math-based graphical solutions. 3. Use scripting languages to create gameplay within a game engine. 4. Use the mathematics of 2D and 3D graphics programming. Credits: 3.00

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11700 - Illustrating For Visualization And Communication

Credit Hours: 3.00. This foundation course stresses the use of pictorial illustration for visualization and communication. Various projection systems are introduced with discussion focusing on the appropriate use of view and system utilized to accentuate and provide clear communication. A variety of digital tools are used to construct, extract and render pictorial views using vector and raster tools.

Credits: 3.00

CGT 11800 - Fundamentals Of Imaging

Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 12300 - Animation Foundations

Credit Hours: 3.00. In this course, students are introduced to the core concepts and principles of animated motion. The course includes an overview of animation history and the evolution of animation technology. Principles of animation production are explored through practical exercises executed in a range of animation software types. These exercises will familiarize students with different approaches to creating animated motion, with a focus on keyframed digital animation.

Learning Outcomes: 1. Identify the sequence of major milestones in the history of animation technology, style and industry. 2. Demonstrate fundamental animation skills and principles including anticipation, squash & stretch, timing, easing and motion arcs. 3. Create animated images of objects and characters in digital animation software that communicate believable motion. 4. Arrange and manipulate geometric objects and systems in digital animation software, creating a range of defined outputs including still images and image sequences suitable for animation workflows. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 14700 - Visual Effects Introduction

Credit Hours: 3.00. This course introduces students to the visual effects techniques using common methodologies and tools. Topics include procedural frameworks, 3D pipeline implementation, vector operations, and simulating physical phenomena for entertainment graphics. Special emphasis is placed on achieving aesthetically please entertainment-grade graphics using visual effects techniques.

Learning Outcomes: 1. Describe visual effects pipeline. 2. Implement simple simulations using common visual effects tools and techniques. 3. Explore options for visual effects career pathways. 4. Create aesthetically pleasing visual effects using production tools and techniques. Credits: 3.00

CGT 17207 - User Experience Design Experience Studio I

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students learn about the roles they can pursue and build foundational collaboration and project management skills. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Participate actively and contribute to team activities. 2. Identify and use project management tools. 3. Explore areas of UX specialization. 4. Explain project objectives in a professional manner. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Conduct basic analysis

of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 20100 - Portfolio Presentation

Credit Hours: 2.00. This course has been designed to introduce students to the standard practices used in business and industry to identify potential employees in graphics related positions. Lectures will cover professional conduct when searching for employment and graphics standards expected in a professionally developed portfolio.

Learning Outcomes: 1. Demonstrate how to systematically identify, evaluate, and select individual pieces of the student's own work to be included in a professional looking portfolio. 2. Demonstrate an ability to evaluate and select the appropriate technology to create an online portfolio with appropriate domain name which can be sent to potential employers during position internship and job searches. 3. Explain the value in lifelong learning and ongoing professional development in their chosen field and how this goal may be accomplished. 4. Identify internship opportunities, both locally and nationally. Credits: 2.00

CGT 20200 - Motion And Video I

Credit Hours: 3.00. The movement of graphics and incorporation of video is become ever prevalent within commercial production. No longer are these elements done solely by the Hollywood elite or used strictly within the film industry. Professionals are utilizing all kinds of tools in digital video, audio, graphic design and animation to create moving elements that tell a story and communicate concepts to solve communication problems. Students will learn basics in the production process, framing and movement, key framing, and design principles. Students will also learn basics in client relationship and business etiquette. Initial projects will focus on commercial creation and the utilization of typography as it relates to storytelling.

Credits: 3.00

CGT 20400 - Introduction To Themed Attraction Design

Credit Hours: 3.00. An introduction to immersive attraction; including the consideration of operations, graphics, engineering, technology and design. Students will apply their knowledge in narration and graphic principles to concept projects in immersive spaces.

Credits: 3.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 21100 - Raster Imaging For Computer Graphics

Credit Hours: 3.00. Digital images are produced using a variety of computer technologies. Advanced color theory, surface rendering, and light control are emphasized in relation to technical illustration, hardware characteristics, and software capabilities.

Learning Outcomes: 1. Demonstrate understanding of the primary attributes and differences between vector and raster graphics and their application to various communicative products and tasks. 2. Demonstrate understanding of analog and digital data forms and the conversion processes relating to digital imaging. 3. Appropriately use common imaging application features such as layers, channels, paths, filters, color adjustment and correction tools, histograms, color mode tools, and calibration tools. 4. Demonstrate understanding of input, manipulation, and output technologies related to raster graphics. 5. Demonstrate understanding of color theory, color models, color systems, and the physiological and psychological effects of color in raster imaging. 6. Demonstrate understanding of miscellaneous raster graphics issues such as file formats, compression technologies, vector to raster conversion methods and the legal implications of copyrights, trademarks, licenses, and releases. 7. Demonstrate skill and proficiency in creating professional raster graphics for all

types of output including: textures for use in 3D environments, photographic reproduction, digital illustration, web delivery, CD-ROM multimedia, and self-promotion. Credits: 3.00

CGT 21500 - Computer Graphics Programming I

Credit Hours: 3.00. This course focuses on programming fundamentals, logic, and problem solving necessary for advancement into upper level CGT courses. A cross-section of languages and technologies will be introduced and demonstrated.

Learning Outcomes: 1. Understand basic programming concepts such as variables, data types, selection and repetition control structures, arrays, files, and methods and functions. 2. Create simple object-oriented applications. 3. Demonstrate an understanding of the similarities between several different programming or scripting languages. 4. Demonstrate the ability to apply knowledge to different computer graphics software applications. Credits: 3.00

CGT 21600 - Vector Imaging For Computer Graphics

Credit Hours: 3.00. Full-color vector illustrations for a variety of uses are produced using computer methods. Color theory, surface analysis, and rendering techniques are emphasized as they apply to vector-based illustrations.

Learning Outcomes: 1. Have completed all assignments associated with this course and earned a passing grade. 2. Have reviewed all lectures online, attended all meeting sessions, and have participated in class discussions on a weekly basis. 3. Be able to demonstrate their knowledge in all the areas listed within the course outcomes. 4. Master the principles of creativity as they pertain to graphics design. 5. Demonstrate their techniques for effective ideation and creative brainstorming. 6. Execute design projects established in current multimedia technologies and best practices. 7. Use appropriate design vocabulary utilizing the concepts of visual grammar and marketing language. 8. Explain and demonstrate the importance of deadlines in a multimedia production schedule. 9. Produce quality pieces for their student portfolios. Credits: 3.00

CGT 21801 - Open Studio - Interactive Art And 3D Animation

Credit Hours: 3.00. This interdisciplinary course invites Purdue students to reflect on global culture, location and society, while simultaneously learning practical knowledge in programming, interactive visualization, locative media, 3D modeling and animation. The class integrates field trips, brainstorming sessions and technical training to create context-based interactive art.

Learning Outcomes: 1. Design and create interactive and multimedia works for display. 2. Investigate cultural differences in a globalized context. 3. Identify properties of teamwork as a tool for the creation of new multimedia projects. 4. Demonstrate technical knowledge through the development of 3D models and animations. 5. Synthesize graphics programming fundamentals. Credits: 3.00

CGT 22000 - Prop Asset Creation

Credit Hours: 3.00. This course prepares students to become skilled environmental prop artists, focusing on the creation of 3D assets that enhance and contribute to the overall depth and atmosphere of digital environments. Students will learn to design and model various digital props, such as products, weapons, vehicles, rides, furniture, foliage, and other objects that populate and bring life to digital worlds. Additionally, the course will cover the creation of physical 3D printed assets, allowing students to bring their digital designs into the physical world. Through the use of visual references and concept art, students will develop 3D models while adhering to specific technical constraints.

Learning Outcomes: 1. Develop 3D prop assets that effectively enhance digital and physical environments functionality, reinforcing they contribute to immersive experiences that resonate with the audience and leave a lasting impression. 2. Apply best practices in polygonal modeling, with a strong focus on maintaining optimal topology and adhering to polygon count constraints for efficient asset creation. 3. Identify effective methods for sourcing high quality visual references, maintaining the quality and relevance of reference images and concept art before the modeling and texturing stages. 4.

Develop Level of Detail (LOD) props, taking into account the proximity of the 3D prop to the digital camera and how this influences the polygon count and texture resolution applied to the asset. Credits: 3.00

CGT 24100 - Introduction To Computer Animation

Credit Hours: 3.00. This course introduces the knowledge base on which digital animation and spatial graphics technology are founded and developed. Emphasis will be placed on developing a working knowledge of the mechanics of 3D geometric formats, spline-based modeling with polygon mesh & NURBS, procedural mapping of raster images, simplified polygon modeling, rendering methods, hierarchical linking, and kinematic fundamentals.

Learning Outcomes: 1. Explain the basic concepts of animating objects over a specific amount of time. 2. Apply appropriate design parameters to achieve a pre-defined animation outcome. 3. Define and explain clearly production timeline needs associated with animation projects. 4. Create animation along a timeline using various techniques such as anticipation, follow through, squash & stretch, balance, gravity, etc. for desired motion. Credits: 3.00

CGT 24500 - Game Development I: Core Skills And Technologies

Credit Hours: 3.00. (CNIT 30600) This course introduces students to the fundamental technologies and skill sets required to develop video games. Students will be taught agile development methodologies in a team-based environment.

Learning Outcomes: 1. Demonstrate a moderate level of individual skill with a commercial game engine. 2. Demonstrate the ability to observe game mechanics and reproduce them. 3. Acquire competency in each of the following domains: 3D and 2D level creation, basic art asset creation, visual programming basics, implementing game mechanics. 4. Demonstrate the ability to complete a market-ready video game in a team-based production environment. 5. Demonstrate the ability to implement agile production techniques. Credits: 3.00

CGT 24600 - Compositing I

Credit Hours: 3.00. This course focuses on applying node-based video compositing techniques as applied to 3D visual effects and animation. Students explore the major areas of video compositing, including node-based workflows, integration with 3D animation and visual effects tools, image tracking, rotoscoping, and chroma keying. Special emphasis is placed on creating aesthetically pleasing video composites using production tools and techniques.

Learning Outcomes: 1. Implement video composite using node-based compositing tools. 2. Apply color correcting techniques. 3. Given a multichannel render, properly composite it into a final product. 4. Apply common compositing techniques. 5. Integrate 3D renders and video in an aesthetically pleasing manner. Credits: 3.00

CGT 24700 - Visual Effects - Particles And Procedural Effects

Credit Hours: 3.00. This course focuses on simulating and rendering particles. Special emphasis is placed on volumes, sparks, dust, and smoke effects. Techniques for minimizing render times and meeting production requirements are explored. Emphasis is placed on the use of production tools and techniques to create aesthetically pleasing graphics.

Learning Outcomes: 1. Create efficient particle simulations. 2. Render particle simulations properly. 3. Apply approved mathematical formulas to create simulations for entertainment graphics. 4. Optimize simulations based on time and production project parameters. 5. Implement common visual effects. Credits: 3.00

CGT 24800 - Visual Effects - Pyrotechnics And Destruction Effects

Credit Hours: 3.00. This course focuses on the application of visual effects methodology to create effects based on destruction techniques and pyrotechnics. Students implement projects using methods for simulating destruction, fire, and smoke. Emphasis is placed on using production tools and techniques to produce realistic and aesthetically pleasing graphics.

Learning Outcomes: 1. Implement destruction simulations using production tools and techniques. 2. Implement fire and smoke simulations using production tools and techniques. 3. Integrate destruction and fire simulations to meet the needs of 3rd party video compositing team. 4. Render simulations

realistically within the provided time and computational constraints. Credits: 3.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 25100 - Principles Of Creative Design

Credit Hours: 3.00. This course is an exploration of conceptualization and problem-solving using the integration of type and image as both visual and verbal communication. Topics such as systems of organization, visual hierarchy, creativity, typography, color, and navigation are introduced and explored.

Credits: 3.00

CGT 25300 - Front-End Web Development

Credit Hours: 3.00. This is a course in Front-End Web Development that emphasizes the importance of JavaScript, its libraries, and other front-end technologies in crafting engaging and interactive user interfaces. The JavaScript programming language has been the backbone of modern front-end web development. It enables developers to create dynamic content that enriches the user experience and interaction on websites. This course will cover the fundamental ideas of JavaScript. Students will learn to use the Document Object Model (DOM) in JavaScript to make web pages that can update and change in real-time. Students will also explore various JavaScript libraries or other front-end technologies that help streamline the development process and allow for the creation of complex user interfaces with less code.

Learning Outcomes: 1. Develop skills and proficiency in creating professional interactive components using HTML, JavaScript, JavaScript libraries, and CSS. 2. Demonstrate understanding of front-end programming. 3. Create interactive front-end user interfaces for websites. 4. Systematically develop content for the Web, from concept to implementation. 5. Further enhance cognitive skills in problem-solving, debugging, and programming. Credits: 3.00

CGT 25500 - Game Development II: Design And Psychology

Credit Hours: 3.00. (CNIT 30800) This course examines video game design, theory, and development from aesthetic, psychological, and technical perspectives. Students will gain experience with a commercial game development platform. Advanced game development techniques will be taught in this course.

Learning Outcomes: 1. Deconstruct and analyze an existing game and define its essential elements as per various theories of game design. 2. Identify major psychological paradigms and how they are applied in video game experiences. 3. Demonstrate proficiency in applying behavior modification principles in video games. 4. Demonstrate individual technical proficiency with a commercial game engine. 5. Complete a market-ready video game in a team-based production environment. 6. Implement agile production techniques. Credits: 3.00

CGT 25600 - Principles Of User Experience Design

Credit Hours: 3.00. This course introduces students to the process of user-centered design of computer systems humans interact with. Students learn how to draw upon principles of usability and user interface design rooted in human psychology and user research in order to conceptualize, prototype, and evaluate computer systems. Topics include processes such as user research, conceptual design, prototyping, and evaluation and concepts such as visual hierarchy, usability, information architecture, navigation, and more. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Apply the user-centered design process (UCDP) to create visual digital interfaces. 2. Demonstrate the user-centered design approach. 3. Apply the design process to create computer interfaces. 4. Apply visual

principles to interface design. 5. Apply usability principles to interface design. 6. Conduct usability research. Credits: 3.00

CGT 26505 - Video Game Level, Mission, And World Design

Credit Hours: 3.00. This course teaches the techniques required to make game environments and levels from a game level design perspective. Students learn the process of designing play spaces through a structured process of paper design, blockout, and iteration. Architectural principles are discussed, in addition to case studies from published games. Environment art and lighting techniques are discussed and implemented, all with the goal of enhancing the interactivity of the given play space.

Learning Outcomes: 1. Analyze game levels and environments using concepts from architecture. 2. Plan game levels by using design documentation. 3. Construct a complete game level or environment. 4. Assemble compelling action-gameplay experiences using industry best practices. 5. Apply principles from cinematography to video game environments. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 27001 - Topics In Data Visualization

Credit Hours: 1.00. This course provides students with first-hand knowledge about the field of data visualization and explore a collection of competencies that will help students think through, think about, and think with visual representation of data. Students will explore and examine current careers in data visualization and learn what skills they should work to refine in preparation for future internships and jobs. This course will provide insight into current data visualization literacy requirements in today's data driven world.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 1.00

CGT 27108 - User Experience Design Studio II: Screen

Credit Hours: 3.00. Intermediate exploration of various approaches to human-centered design. Students learn intermediate research and design methods and create high-fidelity prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct intermediate analysis of situations, clients, and problems using multiple approaches to problem framing. 2. Create a variety of concepts that address the issues in the problem statement. 3. Use intermediate data gathering and analysis techniques to inform design decisions. 4. Demonstrate intermediate application of principles of visual and interaction design to create high-fidelity prototypes. 5. Distinguish among major approaches to user-centered design. 6. Compare and contrast the core values of various approaches to user-centered design. Credits: 3.00

CGT 27207 - User Experience Design Experience Studio II

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students continue to develop their abilities and contribute significantly to projects.

Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 3.00

CGT 27208 - User Experience Design Studio III: Cross-Channel

Credit Hours: 3.00. Advanced exploration of cross-channel approaches to human-centered design such as service design that span digital and physical experiences. Students utilize principles of usability and user experience to create and evaluate physical prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct advanced analysis. 2. Create a variety of concepts that address the issues of situations, clients, and problems that demonstrate an awareness of multiple user touchpoints. 3. Use physically-based techniques for data gathering and analysis to inform design decisions. 4. Demonstrate application of human factors principles to create physical prototypes. 5. Distinguish among popular processes and methodologies for UX. 6. Explain how design philosophy impacts design practice. Credits: 3.00

CGT 27500 - Data Visualization II

Credit Hours: 3.00. This course provides a practical introduction to exploratory data analysis and data mining to better inform data visualization applications. The course introduces a practical approach for making sense out of data. Students are introduced to issues inherent to the data analysis process or data mining projects. The course covers: (1) how to ***prepare*** data prior to analysis, (2) how to ***generate*** summaries of the data, (3) how to ***identify*** non-trivial facts, patterns and relationships in the data and (4) how to ***create*** models from the data to better understand the data and make predictions. After data is analyzed students will use the data visualization process and techniques to ***visually represent*** the data. The course will also introduce the use of high-level programming languages for data analysis and data visualization.

Learning Outcomes: 1. Prepare data prior to analysis. 2. Identify patterns and relationships in the data. 3. Use programming languages for visualizing data at an introductory level. Credits: 3.00

CGT 28500 - Cross Cultural Game Development

Credit Hours: 3.00. This course presents current methods of design and development of digital games for extra-cultural audiences. Students are instructed using an experiential learning model in which multi-cultural student teams lead independent game development projects targeted at a non-native cultural audience. Topics include: dimensions of cultural, game engine scripting, art asset utilization, ethnographic data collection methods, cross-cultural team building, cultural observation, and project management. This course is taught in the US but is co-taught as a distance learning course with a foreign partner institution. Students who take 28500 may not also take 28510 (the study abroad version of the course).

Learning Outcomes: 1. Create an engaging game for culturally non-native audience using a 3D game engine. 2. Identify cultural dimensions using ethnographic methods. 3. Collaborate effectively within a multi-cultural team. 4. Present a finished game and supporting research to a non-native culture. 5. Synthesize cultural experiences into a set of functional guidelines. Credits: 3.00

CGT 29000 - Computer Graphics

Credit Hours: 1.00 to 3.00. Course topics will be determined by the CGT faculty. Hours and subject matter shall be arranged by the instructor and approved by the CGT curriculum committee. This course will not be used for independent study.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 29900 - Selected Topics In Computer Graphics

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff.

Credits: 1.00 to 3.00

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content.

Credits: 0.00

CGT 30800 - Prepress Production And Design

Credit Hours: 3.00. This course focuses on the process of designing, creating, and preparing documents for commercial printing. Students will develop proficiency with publishing software. Topics include page layout, font and image management, color, printing processes, papers, bindings and proofing methods. Projects emphasize designing single and multi-page documents for business and advertising such as identities, flyers, brochures, forms, catalogs, newsletters and booklets.

Learning Outcomes: 1. Create sketches and roughs for conception and planning of print documents. 2. Apply design principles to the creation of original print documents and content elements. 3. Manage all content elements and prepare documents for printing. 4. Demonstrate proficiency laying out documents and applying effects using a prevailing computer based page layout package. 5. Discuss the different types of print documents as well as their components and purposes. 6. Discuss the issues related to color processes and color printing. 7. Demonstrate knowledge of papers, inks, and bindings. 8. Create print products that show an understanding of the principles of page design and organization. Credits: 3.00

CGT 30900 - Internship In Computer Graphics Technology

Credit Hours: 2.00 or 3.00. Internship course in computer graphics technology. Practical experience totaling at least 240 hours in computer graphics technology. Permission of department required.

Learning Outcomes: 1. Vary by course offering. Credits: 2.00 or 3.00

CGT 31300 - Digital Painting I For Computer Graphics

Credit Hours: 3.00. This course introduces students to digital painting techniques for graphical visualization and communication. Topics include industry standard practices and instruction in digital brush creation, digital mark making, value under painting, color palettes, and lighting and rendering to produce various computer graphics.

Credits: 3.00

CGT 31400 - Advanced Motion Design

Credit Hours: 3.00. This course builds on the basic principles of motion design. Students will learn advanced techniques in visual storytelling, puppetry/rigging and integration of 3D elements into the design environment. Advanced design principles will also be discussed as sell as post-production techniques for animators with a focus on commercial production.

Credits: 3.00

CGT 31500 - Computer Graphics Programming II

Credit Hours: 3.00. A continuation of the study of computer graphics programming concepts with an emphasis on interactive graphics and application development. Topics include polygon tessellation, vector imaging, interactive programming techniques, application development, and game development.

Learning Outcomes: 1. Demonstrate proficiency in using Modern C++ (14/17) relative to Classic C++. 2. Demonstrate working knowledge of the shader-based programmable graphics pipeline. 3. Demonstrate ability to extend the functionality of a game engine using C++. 4. Work on a team to research an advanced topic related to computer graphics. 5. Deliver a content lesson based on team research that includes a presentation with learning exercises. Credits: 3.00

CGT 31700 - Planning And Communicating Themed Attraction Design

Credit Hours: 3.00. Building on students knowledge of narrative creation and design, students will learn about the fundamentals of operations, graphics, engineering, technology and design to create theme-based immersive attractions. This course will focus on design concepts, technical design, management and creation of immersive experiences.

Credits: 3.00

CGT 31800 - Animation Preproduction

Credit Hours: 3.00. This course introduces students to industry standard practices of preproduction for animation, and demonstrates how these processes relate to the creation of large-scale graphics productions.

Learning Outcomes: 1. Identify, evaluate, and solve written problems using visual techniques. 2. Demonstrate an understanding of the different animation preproduction processes. 3. Demonstrate the ability to perform animation preproduction research and development. 4. Develop the successful conceptualization and design of background environments. 5. Develop the successful conceptualization and design of story characters. 6. Identify, evaluate, and

understand the impact of storytelling through cameras and cinematography principles. 7. Develop a completed storyboard sequence. 8. Develop a completed color script. 9. Identify, evaluate, and utilize industry standard graphics software. Credits: 3.00

CGT 31901 - Experience Lab

Credit Hours: 3.00. This course provides students with hands-on experience in a student-run design studio environment. Students will work on real-world projects, including paid project work from corporate sponsors, collaborating with clients and peers to develop professional design solutions as well as have the opportunity to apply for internship credit. The course emphasizes project management, client communication, and the application of design principles in a practical setting. Additionally, students will have the opportunity to enter their work in design competitions when possible/available.

Learning Outcomes: 1. Analyze client needs and project requirements to develop comprehensive project briefs and timelines. 2. Create innovative design solutions that effectively address client objectives and constraints. 3. Evaluate design concepts through peer reviews and feedback sessions to refine and improve final deliverables. 4. Apply project management tools and techniques to successfully execute and deliver design projects on time. Credits: 3.00

CGT 32101 - Digital Illustration

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication and creativity using a painting metaphor. Exercises and projects in graphic theory, problem solving and painting skill development provides students with projects that focus on further development within the digital illustration discipline. A variety of traditional digital drawing and painting techniques are used to transform concepts into communicative visual artifacts.

Learning Outcomes: 1. Design a workflow for creative project research. 2. Identify visual styles and techniques of illustration 3. Exhibit advanced conceptual and technical imaging skills. 4. Create concept art for environments. 5. Apply concepts of perspective, anatomy and lighting to create realistic digital paintings. 6. Create evocative illustrations for physical and digital outputs. 7. Analyze entrepreneurial aspects of digital art marketing and promotion through public exhibits and other venues. Credits: 3.00

CGT 32500 - Animation For Games

Credit Hours: 3.00. In game industry, computer animation is the foundation giving life to human-like virtual characters. A thorough understanding of the motion capture and interactive computer animation is a requisite element of the game development process. This course introduces students to the fundamental techniques and skills required to develop animations for video games using a modern motion capture device and software packages. Students are taught using lectures and lab sessions. The focus of this course is primarily on the technical, artistic, and functional dimensions of animation for games, prioritizing the required technical skills. Production of user controller interactive virtual characters is required.

Learning Outcomes: 1. Demonstrate a moderate level of motion capture animation and animation programming with a commercial game engine. 2. Demonstrate the ability to develop character animations and multi-character interaction for games. 3. Acquire competency in each of the following domains: motion capture, motion retargeting, motion cleaning, footskate removal, character controller implementation. 4. Demonstrate the ability to complete an interactive multi-character story. 5. Demonstrate the ability to develop highly realistic animation for video game using a motion capture system. Credits: 3.00

CGT 32505 - Player-Centered Approaches To Designing Games

Credit Hours: 3.00. This course is designed for students interested in games user research to deepen their understanding of designing engaging games, through feedback from real players and evaluation of design decisions. The course is divided into two sections: The first half of the semester focuses on the fundamentals of player-centered research approaches, that explain the role of games user research and play testing in the game development process, mental models for player-centered design approaches and designing experiments to measure behavioral and experiential metrics for design impact. The second half of the course is dedicated to case studies of design failures in games. Students will be involved in design exercises that use an iterative data-driven approach to enhance game design elements.

Learning Outcomes: 1. Describe the core concepts of games user research and explain

how it can improve player experiences. 2. Identify the appropriate research method based on different design needs, plan and execute games user research studies on live game development projects. 3. Identify design problems and effectively communicate research results to game development team. 4. Demonstrate data-driven approaches to iteratively enhance design elements for better player experience. 5. Apply cross-cultural design approaches in game design process for enhancing end-user experience. Credits: 3.00

CGT 32600 - Graphics Standards For Product Definition

Credit Hours: 3.00. Introduction to product data exchange and interoperability standards, ANSI and NIST product documentation standards, product modeling standards, methodologies for technology selection, implementation, and evaluation. This course supports the product archival and communication processes in a PLM environment.

Credits: 3.00

CGT 32800 - Business Of Themed Entertainment

Credit Hours: 3.00. This course provides an insider's look at the skills needed to succeed in themed entertainment industry as well as provide an overview of the experience economy. Students will get an insider understanding of the project process, working with outside vendors, team communication, common constraints and budgeting.

Credits: 3.00

CGT 33300 - Modeling For Entertainment Graphics

Credit Hours: 3.00. This course offers students a chance to comprehensively explore Polygon Modeling, with consideration of how choices made in modeling can affect all other aspects of the animation pipeline.

Learning Outcomes: 1. Evaluate polygon models based on topology and polygon budget. 2. Build polygon models appropriate for level of detail sculpting and detailing. 3. Unwrap polygon models with minimal UV shells, maximizing texture space. 4. Texture and detail polygon models with appropriate shaders, achieving a desired result. 5. Render polygon models in a format appropriate for demo reel review. 6. Correct topological errors in conversion from NURBS to Polygons. 7. Identify challenges in conversion of two-dimensional drawings to three-dimensional models. Credits: 3.00

CGT 33500 - Game Scripting

Credit Hours: 3.00. Students gain a deeper understanding into video game scripting. Utilizing a common project, students use scripted objects to customize and enhance a small existing game. While the projects are individualized for the student, they are trained to utilize best practices for team based, industry applications of their work. Permission of department required.

Learning Outcomes: 1. Create reusable game objects that perform useful functions in standard video game genres. 2. Reinforce proper techniques in scripting. 3. Achieve mastery of Unreal blueprint scripting and visual scripting generally. 4. Learn how to drive gameplay with imported data. 5. Achieve a rudimentary baseline of C++ scripting. 6. Become familiar with Visual Studio. Credits: 3.00

CGT 34000 - Digital Lighting And Rendering For Computer Animation

Credit Hours: 3.00. The development of a working knowledge of perspective display of three-dimensional models and the resulting effects of projected light sources on shade, shadow, color, texture, and atmospheric effects in architecture, product illustration, and animation. Emphasis will be placed on lighting design, analysis, and photorealistic simulation for commercial graphic applications.

Learning Outcomes: 1. Complete guided exercises to learn the basic concepts of lighting & compositing. 2. Observe, photograph and paint reference imagery of real-world lighting scenarios. 3. Analyze professional examples of lighting to understand the desired outcomes. 4. Understand how to use state-of-the-art Shading, Lighting, Compositing and Animation packages. 5. Assemble and texture scenes for lighting. 6. Plan and execute a creative vision by art directing an original lighting sequence. Credits: 3.00

CGT 34100 - Motion For Computer Animation

Credit Hours: 3.00. An applied course covering three-dimensional computer graphic animation for graphics specialists and professionals involved in the use of technical design, time and motion study, surface texture mapping, digital lighting, color, and the technology required to produce computer

animations for commercial applications in manufacturing design, marketing, and training.

Learning Outcomes: 1. Complete all the assigned readings, assignments, and any other quizzes or tests associated with this course and earned a passing grade. 2. Review all lectures online, attended all meeting sessions, and have participated in class discussions on a weekly basis. 3. Able to demonstrate their knowledge in all the area listed within the General Goals of the course. Credits: 3.00

CGT 34505 - Environment Modeling For Games

Credit Hours: 3.00. This course teaches the techniques and principles needed to create realistic three-dimensional virtual environments rendered in game engines. This course will examine design, modeling, material creation and lighting of environments displayed in a real-time game engine environment. Amongst the topics that will be covered is: Direct input modeling, procedural modeling, digital sculpting, material authoring and real-time lighting using current 3D tools.

Learning Outcomes: 1. Explore and practice methods for environment creation by means of 3D modeling. 2. Develop fine motor skills: Refining the digital artisan's skillset in modeling. 3. Explore Aesthetics as it pertains to environment design. 4. Learn and practice professional methods. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 34600 - Digital Video And Audio

Credit Hours: 3.00. Covers the use of digital technologies for video and audio in multimedia, hypermedia, and animation products. Students examine the methods for creating, sampling, and storing digital video and digital audio and the constraints placed on these media assets when used for media-based products. Emphasis is placed upon the technology of digital video and audio, including formats, data rates, compressors, and the advantages and disadvantages of the different technologies.

Learning Outcomes: 1. Demonstrate understanding of the principles editing. 2. Solve video compositing problem by using masking, tracking, color correcting, and animation. 3. Properly compress a digital video when given a set of constraints. 4. Author interactive video disks (Blue-ray) using standard authoring tools. 5. Set up a solution to stream video. Credits: 3.00

CGT 34800 - Photorealistic Shaders

Credit Hours: 3.00. This course focuses on the creation and application of photorealistic custom shaders to visual effect problems. Students learn to tender common material photorealistically using common industry tools and techniques. Emphasis is placed on meeting specified aesthetic and photorealistic requirements within computationally constrained environments.

Learning Outcomes: 1. Create custom shaders for common platforms. 2. Create photorealistic shaders when given photographic references. 3. Optimize shaders within the constraints of available resources. 4. Create shaders to meet aesthetic requirements. Credits: 3.00

CGT 35000 - Experiential Branding And Storytelling

Credit Hours: 3.00. This course explores the role of branding and storytelling in creating memorable user experiences. Students will learn how to develop brand narratives and design cohesive brand experiences across multiple touchpoints, including advertising, social media, and emerging technologies. The course will also cover storytelling techniques, empathy, and measuring campaign effectiveness using key performance indicators.

Learning Outcomes: 1. Develop compelling brand narratives that resonate with target audiences. 2. Design cohesive brand experiences across digital and physical spaces, including spatial computing and immersive technology. 3. Apply storytelling frameworks to create engaging and immersive user experiences. 4. Measure the effectiveness of campaigns using key performance indicators. 5. Create prototypes of branded experiences for evaluation, incorporating empathy and emotional journey mapping, while maximizing accessibility and universal design. Credits: 3.00

CGT 35100 - Interactive Multimedia Design

Credit Hours: 3.00. This course introduces the many facets of interactive multimedia design and production. Students are introduced to authoring programs used for information delivery, with special attention focused on the integration of various media assets for communication. There is also concentration on the storage, management, and retrieval of media assets in a production environment. Considerable time is spent on the

systematic design of interactive media products to meet specified goals of communication.

Credits: 3.00

CGT 35300 - Principles Of Interactive And Dynamic Media

Credit Hours: 3.00. This course explores the development of interactive and dynamic media components for web and interactive media products. The course examines the design, creation and integration of 2D animation, 2D games, text, sound, video, programming, and databases for use in web and other interactive media.

Learning Outcomes: 1. Develop skills and proficiency in creating interactive components using HTML5, JavaScript libraries, and CSS. 2. Demonstrate understanding of JavaScript programming. 3. Develop beginning to moderately complex front-end designs. 4. Understand the emerging capabilities of delivering Web content. 5. Extend the ability to systematically develop content for the Web, from concept to implementation. Credits: 3.00

CGT 35400 - Design Management

Credit Hours: 3.00. This course focuses on the development and management of design systems, project management, and collaboration within design teams. Students will learn how to create and implement effective design systems, manage projects, and lead design teams. The course will cover techniques for collaboration, communication, and the use of AI tools in prototyping and project management. Through the creation of high-fidelity prototypes, students will gain practical experience in applying these management and design system skills.

Learning Outcomes: 1. Understand the principles of design systems and their implementation. 2. Apply project management techniques to design projects. 3. Collaborate effectively within design teams. 4. Utilize modern tools for prototyping and project management. 5. Evaluate to refine design systems based on user feedback and testing. Credits: 3.00

CGT 35500 - Character Creation For Photorealism And Stylism

Credit Hours: 3.00. This course explores both the artistic and technical aspects of 3D character modeling and texturing, providing a comprehensive foundation in digital character creation. Students will begin with an in-depth study of anatomy and proportion, critical for the accurate construction of characters in a digital environment. Emphasis will be placed on developing strong anatomical knowledge and topology skills, which are essential for producing high-quality characters that achieve both photorealism and stylization for various entertainment and practical applications. Mastery of these traditional concepts and techniques will enable students to create portfolio quality character models that align with industry standards.

Learning Outcomes: 1. Analyze the principles of correct anatomical proportions essential for the creation of both bipedal and quadrupedal characters, maintaining anatomical accuracy in digital character design. 2. Apply optimal topology techniques in character construction, optimizing the model for efficient rigging and animation processes. 3. Utilize reference photographs and concept sketches to create accurate photorealistic and stylistic character models, preserving accuracy to visual references and artistic intent. 4. Create stylized characters by strategically exaggerating realistic caricatured body features, achieving consistency with the character's visual style and environment. Credits: 3.00

CGT 35600 - Web Programming, Development And Data Integration

Credit Hours: 3.00. A course focusing on the development of dynamic content and applications to facilitate information distribution. The course stresses development strategies for managing the rapidly changing information of corporations and organizations for just-in-time distribution, using authoring programs to create interactive multimedia products that utilize database management systems, file systems, and XML to provide a method for visualizing and manipulating that data. Significant time is spent on intermediate to advanced programming and scripting.

Learning Outcomes: 1. Demonstrate an understanding of how to use server-side technology to develop dynamic database-driven websites and personalize content for users. 2. Integrate server-side and client-side technology in developing web applications. 3. Demonstrate an understanding of the logic behind web applications. 4. Create projects using server-side technologies to be used in a database-

driven Web project. 5. Show understanding of basic database design, theory, and application. Credits: 3.00

CGT 36500 - Game Development Practicum

Credit Hours: 3.00. This course provides an opportunity for teams of game developers to focus on a project without distraction by competing course deliverables. Students propose a game project and spend the entire semester working only on that project. Course instructors will function as facilitators, producers, and supervisors, helping each student team scaffold their work such that all course goals are met.

Learning Outcomes: 1. Decompose a large term game development project into an actionable sequence of smaller development tasks. 2. Face emergent open-ended development challenges and either solve them or adapt to them as project goals require. 3. Set short-term game production goals and consistently meet them. 4. Self-evaluate completed work and iterate as necessary to ensure it meets the project's quality goals. 5. Accept and incorporate criticism regarding one's work and use it to improve one's craft. 6. Deliver criticism constructively that is in service to meeting project quality goals. 7. Maintain group cohesion and morale across a physically separated accordance with industry best productions practices. 8. Internalize and structure individual work habits in accordance with industry best production practices. Credits: 3.00

CGT 36700 - Previsualization In Themed Entertainment

Credit Hours: 3.00. This course provides an overview of themed entertainment development from concept to previsualization and communication. Students will have the opportunity to take initial concepts for themed experiences and visualize them to communicate to multiple external audiences.

Credits: 3.00

CGT 37000 - Interactive Data Visualization

Credit Hours: 3.00. Data visualization is the art and science of putting quantitative numbers into pictorial or graphical format that are easy for users to understand, use, and take action upon the data. In this course, we will learn basic data visualization design principles, theories, data management skills, and fundamental web technologies to design and develop web based interactive date visualizations. The students will be able to design the proper visual representations of the data based on the data's characteristics, business needs, and prospective users.

Learning Outcomes: 1. Demonstrate understating of different types of data, their characteristics, relations, and business purpose. 2. Compare and choose proper visualization methods to represent the data based on the characteristic and purpose. 3. Apply perception theories and design principles in visualization design. 4. Utilize web toolkits and technologies to develop simple data visualization. 5. Develop an interaction information visualization system to represent data from different aspects. Credits: 3.00

CGT 37108 - User Experience Design Studio IV: Strategy

Credit Hours: 3.00. Advanced exploration of strategic human-centered design that aligns user experience with organizational strategy and business goals, using approaches such as agile, waterfall, and lean UX. Students utilize visual, information, and usability principles as well as various approaches and methods of human-centered design to create interactive digital prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using advanced data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems that aligns with the client organizational strategy and business goals. 3. Demonstrate fluent application and evaluation of visual and interaction design principles by using advanced prototyping techniques to create interactive prototypes. 4. Demonstrate the ability to make recommendations for appropriate major design approaches and methodologies that fit a particular design situation and team. 5. Articulate their design identity and personal design philosophy. Credits: 3.00

CGT 37207 - User Experience Design Experience Studio III

Credit Hours: 3.00. This course provides students with opportunities to explore opportunities in a company-like environment. Students are knowledgeable project members and beginning to transition into subject matter experts and managers. Projects utilize human-centered design principles to provide a rich user experience.

Learning Outcomes: 1. Create and manage teams, resources, and activities. 2. Create and manage project strategy. 3. Demonstrate depth in one or more UX specializations. 4. Champion UX approaches to diverse stakeholders in a professional manner. Credits: 3.00

CGT 37208 - User Experience Design Studio V: Specialization

Credit Hours: 3.00. This course prepares students to lead complex and strategic design projects. Students become proficient in the most advanced approaches, methods and techniques of human-centered design. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using expert data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems to advance stakeholder strategies and goals. 3. Demonstrate advanced application and evaluation of visual and interaction design principles by using advanced prototyping techniques to create working interactive digital prototypes. 4. Demonstrate the ability to lead UX teams through the user-centered design processes, employing appropriate approaches, processes and methodologies. 5. Practice human-centered design in concordance with their personal design philosophy. Credits: 3.00

CGT 37500 - Game Audio

Credit Hours: 3.00. Students learn the basics of audio production as it relates to game development. Students edit and create audio effects using off-the-shelf tools and implement these sounds in a game engine. Microphones, digital audio workstations, and sound effect libraries are utilized in a framework that focuses on direct implementation into interactive media.

Learning Outcomes: 1. Analyze existing audio library sounds effects and edit them according to a project's requirements. 2. Identify game audio scripting techniques and translate these into their own work. 3. Analyze and explain the theory of implementing music into games and interactive media. 4. Develop techniques for using software and equipment for the creation of game audio effects. 5. Implement audio effects and music into a commercial game engine. Credits: 3.00

CGT 37700 - Scientific Visualization

Credit Hours: 3.00. This course is an introduction to the use of computer graphics to help user gain insight into scientific datasets. Applications from atmospheric science, medicine and physics will be explored. Topics will include the fundamental approaches to scalar-valued data (volume rendering, iso-surface extraction), vector-valued data (glyphs, streamlines), and tenors-valued data (ellipsoidal, quadric and super quadric glyphs).

Learning Outcomes: 1. Describe sources of scalar-, vector-, and tensor-valued data and the properties of the data. 2. Assess the effectiveness of given visualization techniques. 3. Explain the differences between multiple approaches to visualization. 4. Create effective scientific visualizations using the vTk library, or tools based on vTk. Credits: 3.00

CGT 38500 - Game Production

Credit Hours: 3.00. This course uses intensive project-based, student-led learning in game development to cultivate skills in quality assurance, leadership, communication, time management, contingency planning, technology integration, autonomy and accountability. Students act in an executive role with students in other project-oriented classes and in so doing cultivate supervisory production experience. Each student must engage with instructors and students to hone real-world hard and soft skills through situated experiences and student-led teaching opportunities. Student producers must develop a functioning development pipeline, meet regularly with their teams, and maintain industry-standard documentation and project management processes. Permission of Instructor required.

Learning Outcomes: 1. Lead a team of novice developers to achieve all production goals for their semester project. 2. Build a functional asset pipeline that accommodates team needs while maintaining steady output. 3. Implement and document game development processes according to industry-accepted standards. 4.

Maintain group cohesion and morale while motivating all team members to produce their best work. 5. Implement agile production techniques in a small-group game development project. Credits: 3.00

CGT 39000 - Computer Graphics

Credit Hours: 1.00 to 3.00. Course topics will be determined by the CGT faculty. Hours and subject matter will be arranged by the instructor and approved by the CGT curriculum committee.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 40100 - Immersive Virtual Realities

Credit Hours: 3.00. This practical production course serves as the culmination of the knowledge and skills acquired throughout the degree program. Students will apply their expertise in immersive media by developing a comprehensive production project that demonstrates proficiency in virtual world building, prop creation, and animation. Projects may be undertaken individually or collaboratively and can range from photorealistic to stylistic in design. The final deliverable may take various forms, including virtual reality experiences, online social environments, or other innovative mediums. This course emphasizes creativity, technical execution, and conceptual depth, allowing students to showcase their unique artistic and technical vision.

Learning Outcomes: 1. Produce an immersive reality project that exemplifies both artistic creativity and technical proficiency, incorporating advanced principles of design, animation, and interactive media. 2. Implement concepts and techniques acquired throughout the degree program into a fully developed project, demonstrating expertise in an individual and collaborative production. 3. Analyze instructor feedback and implement revisions to enhance the quality, effectiveness, and coherence of the project. 4. Design immersive worlds, assets, characters, and animations, integrating all essential components to craft a unified and engaging experience customized to a target audience. Credits: 3.00

CGT 40200 - Motion And Video II

Credit Hours: 3.00. This course builds on the principles of motion design and video production. Students will learn advanced techniques in effects and integration of video and motion elements with the goal of creating realistic production and animation to be used in commercial production.

Learning Outcomes: 1. Identify two ways that video and motion graphics can be utilized within the same project. 2. Demonstrate a working knowledge of motion paths within a project. 3. Demonstrate effective techniques for working with a client. 4. Provide examples of professional and non-professional motion and video productions. 5. Develop a video reel for professional use. Credits: 3.00

CGT 40400 - Self Promotion For Computer Graphics

Credit Hours: 3.00. This course has been designed to introduce students to the professional practice of branding oneself as commonly used in industry. Students will learn how to critique their own work, and the work being done by peers in the industry.

Credits: 3.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 40700 - Current And Future Trends In Themed Attraction Design

Credit Hours: 3.00. Students will learn about current trends in immersive attractions. Current technologies will be explored that can be used to enhance the narrative in a themed immersive space. Students will explore technologies, narrative techniques and integration of engineering.

Credits: 3.00

CGT 41100 - Contemporary Problems In Applied Computer Graphics

Credit Hours: 3.00. Groups will identify, design, qualify, manage, create, and present a final project relative to existing or emerging issues within applied computer graphics. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. The course concludes with faculty, peers, and practicing professionals evaluating oral, written, and media presentations of final projects.

Credits: 3.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in

conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 41600 - Senior Design Project

Credit Hours: 3.00. This capstone course requires students to engage in a substantive endeavor directed at solving problems related to computer graphics. Activities include the creation and management of graphic systems and media assets per the requirements of the senior design proposal. Students are required to demonstrate professional attitudes and attributes in the timely completion and presentation of their project.

Credits: 3.00

CGT 42500 - Game Design

Credit Hours: 3.00. This course is about the discovery, summarization, application, analysis, and synthesis of novel game design techniques. Discovery and summarization are done through research and in-class presentations. These presentations are then used to create prototypes in the game engine of the student's choice. Students are expected to collect data on these prototypes. This data is then used to iterate on the prototypes throughout the semester. The course culminates in a polished prototype that is published on any valid public gaming platform or student portfolio. This is an advanced course that assumes the student has existing skills in game creation (particularly game scripting, game art, and game design). Permission of instructor required.

Learning Outcomes: 1. Discover novel game design techniques. 2. Demonstrate new game design ideas by creating functional prototypes in a game engine. 3. Discover and apply current game design theory. 4. Recognize current game design trends in modern games. 5. Communicate complex game design ideas to an audience. 6. Synthesize new ideas from concepts learned from research and collaborative work in class. 7. Collect and evaluate playtesting data. 8. Publish a small game prototype on a gaming platform. Credits: 3.00

CGT 42600 - Industry Applications Of Simulation And Visualization

Credit Hours: 3.00. This course focuses on developing mathematically accurate physical-visual simulations of mechanisms, systems, and assemblies. Topics include physical system analysis; coordinate systems; inverse kinematics; linear, rotational, and reciprocating motion. Simulations will be created using modeling technology, programmed scripting, and diverse software.

Credits: 3.00

CGT 43500 - Virtual Reality And 3D User Interfaces

Credit Hours: 3.00. The purpose of this course is twofold: (a) to provide students with a deep understanding of the fundamentals of virtual reality environments and 3D user interfaces and (b) to offer students practical experience with consumer-grade virtual reality systems. Students will explore the challenges of developing and analyzing virtual reality systems and 3D user interfaces that are effective and comfortable, motivated by design goals and constrained by the real world. We will also explore the relationship of virtual reality to entertainment, medical, and manufacturing domains.

Learning Outcomes: 1. Discover novel virtual reality interaction techniques. This is

accomplished via student research, instructor presentations, and student presentations. 2. Demonstrate new virtual reality design ideas by creating functional prototypes in a game engine. 3. Apply theory to create virtual reality experiences that will generate intuitive interactions and believable experiences for the user. 4. Apply programming knowledge to create interactive experiences in virtual reality environments. 5. Communicate complex virtual reality design ideas to an audience. 6. Synthesize new ideas from concepts learned from research and collaborative work in class. 7. Collect and analyze user experience data. Credits: 3.00

CGT 44200 - Production For Computer Animation

Credit Hours: 3.00. An applied course covering advanced spline modeling techniques, lighting techniques, applied shading, motion dynamics and controllers, particle systems, application customization programming, and pre-production development and planning. Study of emerging advancements in computer animation and spatial graphic technologies will be included.

Learning Outcomes: 1. Identify career opportunities in computer graphics and related industries. 2. Assess, classify and critique peer and professional-level portfolios in relation to industry roles 3. Define major project outcomes that align with specific career pathways. 4. Develop and manage production plans for a major entertainment graphics project. 5. Manage teams or individual tasks to execute defined goals within entertainment graphics projects. 6. Create professional portfolio or showreel pieces that demonstrate industry relevant skills. Credits: 3.00

CGT 44201 - Advanced Portfolio Development For Digital Media Careers

Credit Hours: 3.00. This course is designed to provide students the opportunity to complete self-driven projects to enhance and showcase their skills to potential employers. Students will learn about professional expectations of a variety of jobs in computer graphics and digital media, including but not limited to Animation, Games, Visual Effects, and Interactive Design. They will develop the skills to receive and provide feedback, refine expertise in their chosen area of specialization by proposing and executing relevant projects, culminating in the creation of job application materials and an online portfolio which displays the completed works.

Learning Outcomes: 1. Explore Digital Media career opportunities and determine a path that best fits one's goals. 2. Create new materials and curate a strong portfolio showcasing individual skills and interests. 3. Evaluate peer projects to train one's critical eye. 4. Develop a plan and vision for pursuing one's desired career path. 5. Understand the recruiting process and the expectations of the industry to prepare strong, tailored application materials. Credits: 3.00

CGT 44400 - The History And Technique Of Visual Effects In Film

Credit Hours: 3.00. This lecture-based course presents the history and technique of special or visual effects in film from the 19th Century (George Me'lie's) to the current digital age of visual effects. Emphasis is placed on the use of effects in fantasy, science fiction, and horror genres. These effects can range from the recreation of historical venues, to fictional characters and to worlds not yet seen. This course serves not only to address this facet of the history of film and cinema, but also the techniques and technology of visual effects including practical effects, miniatures, stop-motion, makeup, mechanical effects, optical effects, motion control, and the digital realm.

Credits: 3.00

CGT 44500 - Procedural Methods For Game Development

Credit Hours: 3.00. This course teaches a procedural approach to game development ranging from geometric modeling techniques, crowd simulation, particle systems, fluid simulation and flame simulation. The course will examine procedural nondestructive workflows that can be translated into real-time assets for game development. Students will learn how to set up nodal and parameter based graphs that carry the ability to be interactively updated and changed, thus having the flexibility expected in an industry pipeline.

Learning Outcomes: 1. Implement non-destructive procedurally modeled and aesthetically pleasing assets while demonstrating an understanding of scalable UVs. 2. Implement assets within game engine environment, harnessing the advanced procedural production in an optimized real-time

setting. 3. Create asset movement through implementation of simple expressions to drive procedural animations. 4. Create finished and refined renders for use in visualization and sequenced flipbook animations. 5. Demonstrate knowledge of pre-rendered particle systems and an understanding of transference to real-time applications. 6. Demonstrate mastery of rigid body dynamics to create in-game destruction sequence. Credits: 3.00

CGT 44600 - Post-Production And Special Effects For Computer Animation

Credit Hours: 3.00. A variety of commercial applications of technical animation and spatial graphics are analyzed and produced, with special emphasis upon client development, design, organization, scripting, storyboarding, technical production, management, and evaluation.

Learning Outcomes: 1. Describe the business model of film and animation production. 2. Understand script development and analysis as they relate to production. 3. Demonstrate image acquisition in the production environment. 4. Demonstrate an understanding of final finishing and distribution processes. Credits: 3.00

CGT 45000 - Professional Practices

Credit Hours: 3.00. This course prepares students for professional employment in Computer Graphics related professions. Topics include ethical and legal issues, contracts, copyright, and freelancing as well as portfolio planning, design, preparation, and presentation.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 45100 - Multimedia Application Development

Credit Hours: 3.00. This course focuses on the development of applications that manipulate media assets. Significant time is spent on intermediate to advanced programming and scripting as well as the synchronization of aural and graphical components. Students are required to plan, design, and implement a major project, and a final presentation is required.

Credits: 3.00

CGT 45300 - Multisensory Experience Design

Credit Hours: 3.00. This course examines the design of experiences that engage multiple senses. Students will explore how to create immersive environments that utilize sound, touch, and other sensory inputs to enhance user interaction. The course will also cover the integration of physical technology, such as microcontroller-driven physical computing, with digital screens.

Learning Outcomes: 1. Understand the principles of multisensory experience design. 2. Design environments that engage multiple senses. 3. Incorporate sound, touch, and other sensory inputs into designs. 4. Evaluate the impact of multisensory elements on user experience. 5. Create prototypes of multisensory experiences for testing, blending physical technology with digital screens. 6. Ensure accessibility by designing UX experiences that accommodate users with disabilities, incorporating assistive features and inclusive design principles. Credits: 3.00

CGT 45400 - Innovative Experience Design

Credit Hours: 3.00. This course explores advanced design techniques for creating impactful experiences studying various fields such as sports, gaming, social media, charitable causes, fintech, and healthcare. Students will learn to incorporate empathy, accessibility, and AI into their designs to address human-centered challenges. The course will also focus on collaboration, engaging with clients, improving communication skills and confidence, and evaluation of created work.

Learning Outcomes: 1. Apply innovative design techniques to create impactful experience through design efficiency and effectiveness. 2. Integrate empathy and accessibility into design processes. 3. Study and develop solutions for human-centered challenges in a variety of emerging fields. 4. Collaborate with clients, engage effectively, and improve communication

skills. 5. Evaluate and test user experiences to gather feedback and improve designs. Credits: 3.00

CGT 45600 - Advanced Web Programming, Development And Data Integration

Credit Hours: 3.00. This course presents the advanced technologies available for use on the World Wide Web and within corporate intranet environments. Emphasis and discussion is focused on the advantages and disadvantages of these technologies as well as on implementation to create unique solutions for business and industry. Strategies for planning, development, and implementation will be discussed and demonstrated. Significant time is spent on advanced programming and scripting as well as manipulation and visualization of data from various sources, including robust database management systems. Students are required to plan, design and implement a major project.

Learning Outcomes: 1. Demonstrate understanding of ASP.NET, C#, and the .NET Framework. 2. Create and compile advanced dynamic web projects using ASP.NET technology. 3. Demonstrate understanding of advanced database applications and SQL. 4. Show understanding of the logic behind advanced web applications. 5. Integrate front-end and back-end technologies in developing professional web applications. Credits: 3.00

CGT 47000 - Data Visualization Studio

Credit Hours: 3.00. This course will teach students design and develop interactive data visualization systems to communicate and analyze complicated datasets. Students will learn interaction and visual design principles, draw from human perception and cognition theories, and focus on hands-on practice of developing interactive data visualization systems that enable users to see, understand, and analyze complex data and relations. At the end of the class, students will apply the design principles and use proper technologies to create a comprehensive interactive visualization system for data analysis.

Learning Outcomes: 1. Demonstrate understanding of design principles from perspectives of human perception, cognition, and design. 2. Choose the correct visual format based on the data, relations, and data usage. 3. Recognize the common problems in information visualization dashboard design. 4. Demonstrate the ability to process, filter, and transform data for visualization. 5. Utilize proper visual forms, visual analysis techniques, and practices for analyzing basic types of data and data relationships. 6. Develop complex interactive information visualizations system with multiple visualizations for communication and data analysis. Credits: 3.00

CGT 47407 - UXD Experience Studio VI Management

Credit Hours: 3.00. This is an advanced-level course where students are project managers in a company-like environment within the Purdue Experience Studios. Students learn about management expectations within a UX design company as they work with multi-level teams on corporate-sponsored projects. Projects utilize a human-centered design approach with an emphasis on designing for the user experience. Students learn how to manage team leadership, including training project owners by planning, organizing, and running training and mentoring workshops. Permission of instructor required.

Learning Outcomes: 1. Participate in setting up multiple teams with the goal of creating balanced and successful teams. 2. Conduct effective 1on1 meetings to manage junior student's personal growth plan. 3. Implement team-building skills with structured activities and workshops. 4. Solve teamworking conflicts in a fair and effective manner. 5. Demonstrate depth in UX management by documenting your skill development and growth throughout the semester in a written reflection document. 6. Create an activity log of the process, goals, and outcomes to train new student managers. 7. Train junior students how to communicate UX approaches to diverse stakeholders in a professional manner. 8. Teach successful meeting etiquette, including agendas, action items, and follow-ups to junior students. Credits: 3.00

CGT 47500 - Applied Games Research

Credit Hours: 3.00. This course teaches fundamental concepts in scientific methodology, such as hypothesis formation, experimental design, methodology, data collection and analysis, reporting of findings, quantitative and qualitative methods, sampling, ethical research practices, and regulatory compliance. It also teaches practical skills such as manuscript preparation, publication, and funding strategies. Though the course is

oriented toward applying these concepts and skills in a Games context, the lessons are broadly applicable, and students from other areas within the department are welcome to enroll with instructor permission.

Learning Outcomes: 1. Construct original manuscripts and research proposals that integrate quantitative and qualitative methodologies, applying the scientific method to investigate complex topics. 2. Assess peer manuscripts and published scientific papers for clarity, logic, writing quality, and the validity of conclusions, providing constructive critiques. 3. Implement research, writing, and analytical techniques to address problem scenarios, recommend appropriate methodologies, and complete exercises, quizzes, and exams. 4. Design a collaborative research study by integrating course concepts, planning, and preparing for an independent team project. Credits: 3.00

CGT 48500 - Honors Game Production

Credit Hours: 3.00. This course provides an opportunity for students to acquire real-world experience working as a game studio producer for one or more student Career Project (capstone) teams. Students may enroll in this course via invitation only. As this is an Honors course, students are expected to bear greater individual responsibility and produce very high quality results. Students should be capable of working with a high degree of autonomy and be prepared to adapt to open-ended problems and deliverables expectations that may shift according to project needs. Student producers will coordinate development efforts and logistics between Career Project teams (CGT 365) and the various Outsourcer courses that the Career Project teams depend upon. Students must function as leaders and accept responsibility for their team's results. This course fulfills the requirement for work experience as defined by the CGT department. Permission of instructor required.

Learning Outcomes: 1. Negotiate and manage relationships between multiple clients and providers. 2. Create actionable, sustainable development plans with their teams. 3. Master industry-standard project management groupware to track and assign work items to their teams. 4. Solve or adapt to emergent open-ended production challenges. 5. Identify production blockages and proactively foresee future blocks. 6. Accept and incorporate criticism regarding one's work and use it to improve their craft. 7. Deliver criticism constructively toward meeting project quality goals. 8. Reflect on one's own work and evaluate how their experience contributed to the overall project and articulate how the experience helped them grow in their discipline. 9. Maintain group cohesion and morale while motivating all team members to produce their best work. 10. Implement agile production techniques in multiple small-group game development projects. Credits: 3.00

CGT 49000 - Computer Graphics

Credit Hours: 1.00 to 3.00. Senior-level course topics will be determined by the CGT faculty. Hours and subject matter shall be arranged by the instructor and approved by the CGT curriculum committee. This course will not be used for independent study.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 49100 - Special Topics In Computer Graphics

Credit Hours: 1.00 to 6.00. A variable title, variable content course pertaining to problems and research in graphical methods and representation. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

CGT 49800 - Undergraduate Research In Computer Graphics Technology

Credit Hours: 1.00 to 3.00. Students will conduct research in the area of computer graphics technology with a primary investigator. The primary focus of the course is to contribute to ongoing research, while learning current research techniques. Contributing to research design, analyzing data, determining courses of action, developing critical thinking, and presenting results are emphasized. Requires prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Learning Outcomes: 1. Demonstrate subject-matter competency, integrating appropriate theoretical and conceptual frameworks. 2. Conduct research using generally accepted methods appropriate for the research question. 3. Demonstrate critical thinking skills. 4. Evaluate, synthesize, and apply ethical issues

facing researchers. Credits: 1.00 to 3.00

CGT 49900 - Selected Tropics in Computer Graphics

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff.

Credits: 1.00 to 3.00

CGT 50100 - Seminar In Computer Graphics Technology

Credit Hours: 0.00 to 3.00. A variable topics course that addresses contemporary problems and issues related to M.S. students in Computer Graphics Technology. Permission of instructor required.

Learning Outcomes: 1. Understand the transition from undergraduate to graduate study (course approaches, studying, research, assistantship responsibilities). 2. Understand and apply ethics in research and writing. 3. Understand the grant process and agencies that offer grants. 4. Understand the publishing process relative to articles and proceedings. 5. Understand the various publishing formats and methods of citations (APA, Chicago, and MLA versus organizational approaches). 6. Understand the IRB process and method of research approval. 7. Develop a plan of study. 8. Establish a graduate committee. 9. Understand the process for obtaining the MS. 10. Accept grand challenges in Computer Graphics Technology. Credits: 0.00 to 3.00

CGT 51100 - The Development Of Graphics In Technology

Credit Hours: 3.00. An introduction to the historical development of visual science in western civilization and its effect on computer graphics techniques and practices. Topics include the historical, contemporary, and future developments in computer graphics. Emphasizes the study of visual science and the significance of computer graphics as a communications medium.

Learning Outcomes: 1. Apply the principles attained from course material. Lectures, readings and discussions will be structured around developments and shifts in the selected computer graphics topics. 2. Provide an understanding in research methodologies that are related to different areas in computer graphics. 3. Understand key concepts and techniques of computer graphics. 4. Design and conduct academic research in computer graphics. Credits: 3.00

CGT 51200 - Foundational Readings Of User Experience Design

Credit Hours: 3.00. This course provides an overview of the field of human-computer interaction (HCI) and user experience (UX) design. Students will explore the main themes, paradigms, and theories of HCI and UX from its inception to the present. The course takes a broad, chronological approach, examining the history and evolution of HCI and UX, including its major intellectual shifts, successes and failures, and its dynamic relationship to other fields. Students will read seminal works from leading researchers. This course is intended to provide a solid foundation for further research. No specific technical or programming experience is required.

Learning Outcomes: 1. Engage with major theories, paradigms, and themes throughout the history of HCI and UX. 2. Identify, describe, and assess strengths and limitations of various methods and approaches with HCI and UX. 3. Critically evaluate existing research in the field and develop their scholarly and intellectual skills in preparation for future research. Credits: 3.00

CGT 51300 - Interactive Multimedia Development And Research

Credit Hours: 3.00. A survey of the interactive multimedia development process, knowledge base, and applications in business and industry. Particular attention is paid to research issues surrounding theoretical, technological, and interactive techniques, and validating those approaches through applied research. Emphasis is placed on the interdisciplinary nature of the development of new media tools.

Learning Outcomes: 1. Become familiar with a range of projects that consider data as a primary material and learn to contextualize recent creative data visualization projects within the history of electronic media, the interactive arts, and visual design. 2. Develop proficiency at programming using the main contemporary software frameworks for data visualization and interactive content creation. 3. Gain experience working on a larger project, including collaborating with others on interactive software, authoring a conference-style write-up to

describe the project, and documenting project code in an open-source repo. Credits: 3.00

CGT 51500 - Virtual Environments

Credit Hours: 3.00. This course provides deep exposure to the most prominent and important research within the fields of virtual reality, games, and any application area where virtual environments are constructed or inhabited. Students will study experiential, cultural, and phenomenological aspects of habitation within virtual environments as well as become familiar with technical aspects involved in virtual environment creation. Students will generate original research data and analysis, prepare a publishable manuscript, and build their own virtual worlds as applicable.

Learning Outcomes: 1. Conduct a thorough literature review of a chosen topic related to virtual environments and/or their development. 2. Analyze scientific research and present the results of the analysis. 3. Conduct a sound, logical study in the area of virtual environments. 4. Create a virtual environment using a game or virtual reality engine. 5. Prepare a human subjects research application (IRB) that meets all regulatory regulations required to conduct ethical human research. 6. Write a publishable research manuscript using the LaTeX scripting language. Credits: 3.00

CGT 51600 - Collaborative Virtual And Augmented Environments

Credit Hours: 3.00. A study of the field of collaborative virtual and augmented environments in shared, multi-user, same-site and multi-site immersive environments. Students will gain knowledge in the following research areas: multi-user interaction, collaborative virtual and augmented environments, and latest software and hardware tools. In this collaborative environment, students not only interact within the same virtual environment but collaborate between physically different environments through distributed environments. Knowledge of 3D computer graphics fundamentals, openGL, and C/C++, or consent of instructor.

Learning Outcomes: 1. Understand the principles and theory of collaborative shared virtual and augmented environments. 2. Apply the principals of graphics programming in designing virtual and collaborative space. 3. Describe and explain the use of, and advantages and disadvantages of, current VR and AR collaborative technologies. 4. Describe human interaction issues in 3D collaborative virtual and augmented environments. Credits: 3.00

CGT 51800 - Augmented Reality

Credit Hours: 3.00. Augmented Reality, a form of presenting virtual information within a perspective of the real world. This course instructs students in the foundations, practice and use of AR (Augmented Reality) as well as the technology required to produce an AR visualization. The concepts covered in this class include: physical tracking systems, computer vision, image processing techniques, 3D virtual environment visualization and calibration, display systems for AR and usage of AR in multimedia & tech culture. Some experience in Unity 3D preferred.

Learning Outcomes: 1. Comprehend the fundamentals of Augmented Reality and the technologies required to produce an AR context. 2. Harness the power of image processing to implement tracking with and without fiducial markers. 3. Produce an AR application for use in entertainment, instruction, research or training as a final project (requiring instructor approval). 4. Present concepts of AR and how they are used in research and industry as it relates to their class final project. 5. Demonstrate knowledge of the history of AR and its social-cultural impact as well as the evolution of the technology used in advancing AR display and tracking techniques. Credits: 3.00

CGT 51900 - Projects In Graphics

Credit Hours: 3.00. This course instructs students in current methods of conducting research on computer graphics and the content development process. Topics covered in the course include biofeedback, user experience, measurement and analysis, development pipelines, publication strategies and methodologies. LaTeX document preparation, simulation, and qualitative approaches to conducting research in the field of computer graphics.

Learning Outcomes: 1. Conduct a thorough literature review of a chosen topic related to computer graphics and/or the content development process. 2. Present to the class an analysis of an academic paper or set of papers. 3. Conduct a sound, logical study in the area of computer graphics. 4. Prepare a human

subjects research application (IRB) that meets all regulatory regulations required to conduct ethical human research. 5. Conduct a research study. 6. Analyze the results of a completed research study. 7. Write a complete publishable manuscript using the LaTeX scripting language. Credits: 3.00

CGT 52000 - Computer Graphics Programming

Credit Hours: 3.00. This course provides a working knowledge of computer graphics fundamentals, such as using transformation matrices, writing programmable shaders, implementing a lighting model and texture mapping using a modern graphics API. Coursework focuses on creating real-time interactive applications using a low-level programming language.

Learning Outcomes: 1. Understand the graphics pipeline exposed by modern graphics APIs. 2. Understand and use transformation matrices and coordinate frames. 3. Implement the Phong lighting model using programmable shaders. 4. Understand and use texture mapping and texture state such as filtering and wrapping modes. 5. Understand and implement interaction techniques using mouse, keyboard and user interface. Credits: 3.00

CGT 52100 - Advanced Real-Time Computer Graphics

Credit Hours: 3.00. This course focuses on a working knowledge of real-time rendering and shaders using a modern graphics API. Students will learn the performance implications of program design choices with respect to the highly parallelized nature of the GPU and the characteristics of the GPU memory hierarchy. Students will learn about optional specialized programmable shader stages, as well as advanced techniques such as physically-based lighting and shadowing techniques.

Learning Outcomes: 1. Understand the graphics pipeline exposed by modern graphics APIs. 2. Understand and apply modern GPU features. 3. Understand and use buffers efficiently for data access in shaders 4. Understand and use techniques such as tangent-space bumpmapping or shadow mapping which require the use of additional coordinate frames and transformation matrices. 5. Implement a physically-based lighting model using programmable shaders. Credits: 3.00

CGT 52200 - UX Design Graduate Studio I: Fundamentals

Credit Hours: 3.00. This course is an introduction to the fundamental components of human-centered design, focusing on interactive computing systems. Students learn basic tenets and methods of user-centered design, including usability and visual design principles, user research, low-fidelity prototyping, and high-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct analysis of situations, clients and problems, articulate problem statements, and create concepts that address issues in the problem statement. 2. Identify and use data gathering and analysis techniques to inform design decisions. 3. Demonstrate application of principles of visual and interaction design to create prototypes. 4. Explain and apply the fundamental components of user-centered design. 5. Synthesize and articulate the core values of user-centered design. Credits: 3.00

CGT 52300 - Intelligent Virtual Agents

Credit Hours: 3.00. Intelligent Virtual Agents (IVAs) are interactive virtual characters that exhibit human-like qualities, including communicating using natural human modalities such as facial expressions, speech, and gesture. They are capable of real-time perception, cognition, emotion, and action that allow them to participate in dynamic social environments. This course introduces students to the interdisciplinary research on the design, application, and evaluation of IVAs. Students will be taught theory, methodologies, and algorithms, which they will then apply to individual projects. These individual projects will provide students with a common base for authoring IVAs for various application domains, including virtual assistants, pedagogical agents, human-agent task/problem co-solving, human-agent collaboration, and more. Prior background in virtual reality or technical animation is assumed, as the course will provide students the opportunity to further develop these competencies through hands-on assignments within a commercial game engine. The focus of this course is primarily on the computational and functional dimensions of IVAs; however, design and creativity are also important aspects of all projects. This course uses an active learning approach that involves lab assignments, presentations, independent research, and group ideation and collaboration.

Learning Outcomes: 1. Define notions of expressiveness of intelligent virtual agents. 2.

Create domain-specific IVAs using artificial intelligence techniques. 3. Identify application domains and simulate IVAs' behaviors. 4. Develop communication strategies that enable human-IVA interaction based on artificial intelligence techniques. 5. Apply the theory and programming knowledge covered in class to concrete exercises using a commercial game engine. 6. Compare and contrast the constraints and affordances for expressiveness in physical vs. virtual intelligent agents and human-like vs. non-humanoid agents. Credits: 3.00

CGT 52500 - Virtual Reality

Credit Hours: 3.00. This course introduces students to the hardware, software, and cognitive underpinnings necessary for creating cutting-edge virtual reality (VR) applications with a strong emphasis on immersive and interactive experiences, allowing students to explore and innovate within the realm of VR. Students will engage with various topics throughout the course, including computer graphics, human-computer interaction, applied perception, optics, and display technologies. Practical experience with consumer-grade virtual reality systems will empower students to design, develop, and analyze VR applications that are effective and comfortable for the user. This course aims to explore the vast potential of VR beyond traditional applications, highlighting its impact on entertainment, healthcare, education, and various other industrial domains. Through a combination of lectures, hands-on projects, and assignments, students will tackle the challenges of VR development, guided by design principles and real-world constraints. By the end of this course, students will be equipped with both knowledge and practical skills needed to design and develop VR experiences that push the boundaries of immersion and interactivity.

Learning Outcomes: 1. Discover novel virtual reality interaction techniques. This is accomplished via student research, instructor presentations, and student presentations. 2. Demonstrate new virtual reality design ideas by creating functional prototypes in a game engine. 3. Apply theory to create virtual reality experiences that will generate intuitive interactions and believable experiences for the user. 4. Develop interactive experiences in virtual reality environments. 5. Communicate complex virtual reality design ideas to an audience. 6. Synthesize new ideas from concepts learned from research and collaborative work in-class. 7. Collect and analyze user experience data. Credits: 3.00

CGT 53200 - UX Design Graduate Studio II: Cross-Channel

Credit Hours: 3.00. This course is an advanced exploration of cross-channel approaches to human-centered design, such as service design, that span digital and physical experiences. Students utilize principles of usability and user experience to create and evaluate physical prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct advanced analysis of various situations using appropriate processes and methodologies for UX. 2. Select and apply appropriate user research methods. 3. Prioritize design requirements based on user research. 4. Identify and frame perceived and real problems. 5. Distinguish among popular processes and methodologies for UX. 6. Create design concepts that address the issues of situations, clients, and problems that demonstrate an awareness of multiple user touchpoints. 8. Distinguish among methods for representing design ideas and processes. 9. Apply contextually appropriate methods for representing design ideas and processes. 10. Justify appropriateness of chosen methods. 11. Prototype multi-channel experiences that incorporate physical computing systems and other advanced technologies. 12. Apply human factors principles in the creation of physical prototypes. 13. Apply appropriate methods to evaluate multi-channel experiences. 14. Demonstrate technical competence with physical computing systems and other advanced technologies. 15. Design holistic experiences that integrate multiple channels cohesively. 16. Explain how design philosophy impacts design practice. 17. escribe how underlying assumptions and perspectives influence practice. 18. Identify key components of a design philosophy. 19. Articulate personal

design philosophy. 20. Apply advanced UX theory in the design and evaluation of interactive experiences. 21. Distinguish among relevant theoretical frameworks and constructs. 22. Utilize theoretical frameworks in the design of interactive experiences. 23. Analyze existing experiences using appropriate theoretical frameworks. Credits: 3.00

CGT 53700 - Applied Artificial Intelligence For Computer Graphics

Credit Hours: 3.00. This graduate-level survey course offers a comprehensive exploration of how AI technologies are revolutionizing computer graphics and applications, including animation, augmented reality (AR), virtual reality (VR), digital media, and interaction techniques. With a focus on both the theoretical foundations and practical applications of AI, the curriculum delves into machine learning, deep learning, neural networks, and their specific uses in creating visual content and interactive digital media applications. Students will engage in hands-on projects, ranging from individual experiments to collaborative efforts, designed to demonstrate AI's transformative potential in enhancing both the visual and interactive dimensions of computational media. By the end of this course, students will not only understand the current landscape of AI in computational media but also possess the technical, analytical, and creative skills needed to contribute meaningfully to this rapidly evolving field.

Learning Outcomes: 1. Design conceptually and prototype computer graphics applications that effectively incorporate AI technologies, demonstrating an understanding of how AI can enrich the content, enhance interaction, and increase realism within these applications. 2. Apply appropriate AI techniques and machine learning algorithms for tasks like object recognition, content generation, and natural user interfaces across a variety of computer graphics applications, including animation, virtual reality (VR), and augmented reality (AR). 3. Assess critically the ethical, societal, and technical implications of using AI in computational media, including considerations around data privacy, bias in AI models, and the broader impact of AI-generated graphics on industry and society. Credits: 3.00

CGT 54000 - Current Topics In 3D Animation

Credit Hours: 3.00. This course addresses recent research and development in 3D animation. Permission of instructor required.

Learning Outcomes: 1. Demonstrate an understanding of the latest research contributions in the field of 3D animation. 2. Discuss advanced/emerging 3D animation technologies and suggest improvements and alternatives. 3. Develop research, presentation, and writing skills related to technical content. 4. Effectively set up for animation (rig) realistic/fantasy creatures and objects. 5. Animate realistic/fantasy creatures and objects in a believable way. 6. Create physically accurate animations using rigid body and soft body dynamics, particle systems, cloth and hair. 7. Apply advanced/emerging animation methods and techniques to development of original animation-based productions. Credits: 3.00

CGT 54300 - Experimental Animation

Credit Hours: 3.00. This course introduces key theoretical and applied concepts of experimental animation. Evolving technology consistently provides new opportunities for experimental practices in animation production. In this course, students will engage with experimental creative practices including abductive reasoning, abstraction, generative animation, motion graphics, simulations, glitch and mixed digital media. These experimental animations are suitable for a wide range of outputs including experimental short film, installation, projection mapping and a range of online platforms.

Learning Outcomes: 1. Identify key examples of experimental digital animation and explain the relationship between experimental practices and technology. 2. Evaluate process and outcomes of experiments with digital graphics technology used to produce images and animation. 3. Appraise aesthetic or communication opportunities arising from new experimental production, linking these to contemporary image culture. 4. Create new experimental animated works for public display, screening or installation or for online dissemination. Credits: 3.00

CGT 54400 - Animation History, Technology And

Technique

Credit Hours: 3.00. This course traces the history of animation by reviewing the evolution of animation technology and the nexus between these technologies, production practices and crafts and the resulting styles, movements and genres of animation. The course reviews major technological developments of the 20th century that have impacted commercial animation production, as well as lesser known independent studios and artists, fringe technologies and sub genres. The course culminates with a consideration of current animation technology and the limits and opportunities it creates.

Learning Outcomes: 1. Identify important developments in animation production technology throughout the history of the medium. 2. Analyze examples of animation from the 20th and 21st century and assess correlations between technology, cultural history and animation production. 3. Evaluate and recommend animation tools based on aesthetic goals and project parameters. 4. Create animation projects utilizing a range of techniques and technologies that explore the limits and potentials of historical and contemporary animation methods. Credits: 3.00

CGT 54500 - Game Development I

Credit Hours: 3.00. In both research and industry game engines are the foundation for nearly all graphics-intensive interactive applications. A thorough understanding of how game engines work is therefore a requisite element of the game development process and lever for research in most domains involving interactive simulations and games. As game engine development, research, and application is a large and complex topic, the course is split into two semesters of study. The two courses are structured similarly but cover different aspects of development on and within game engines. This course introduces students to the fundamental technologies and skills required to develop video games using a modern game engine. Students are taught using a student-led, active-learning pedagogy in which students co-develop and present lectures, demonstrations, and assignments for their peers, with facilitation by the course instructor. The focus of this course is primarily on the technical, functional, and theoretical dimensions of game development, prioritizing technical soundness over design and creativity (which are covered more explicitly in a separate course). As research in this field continues to rapidly iterate, the latest findings are incorporated into each new offering of the course, refreshing its content as the technology evolves in its implementation and theoretical underpinnings. Production of original research focused upon an aspect of game development or game engine design is required.

Learning Outcomes: 1. Reproduce game mechanics observed in an existing game. 2. Present to a classroom the theory and implementation within a scientific paper or set of papers that relate to an aspect of game development and lead a subsequent discussion surrounding said implementation. 3. Extract practicable production information from papers, books, vendor documentation and ad hoc sources to solve open-ended technical problems. 4. Create a technically sound video game prototype within a team-based production environment. 5. Generate and test a research hypotheses related to games, game technology, or game development processes. Credits: 3.00

CGT 55400 - Configuration Management In The Digital Enterprise

Credit Hours: 3.00. This course will cover Configuration Management (CM) in the context of the digital enterprise and Product Lifecycle Management (PLM). Configuration Management applies processes, resources and controls to establish and maintain consistency between product configuration information and the product. Configuration information includes product requirements and changes to the product. This course provides preparation for IpX CM2 Certification at the Application Specialist level.

Learning Outcomes: 1. Learn how an organization is driven by requirements and why configuration management is essentially requirements management. 2. Learn how to use physical item hierarchies as a framework to subdivide complex configurations into manageable increments. 3. Learn how to use a similar administrative hierarchy to manage the requirements for the business enterprise. 4. Learn the difference between corrective action and real improvements and how to eliminate the need for intervention resources. Credits: 3.00

CGT 55500 - Game Development II

Credit Hours: 3.00. This course introduces students to the advanced concepts, technologies, skills that enable the creation of sophisticated video games, simulations, and game systems. Students are taught using student-led, active-learning pedagogy in which students co-develop and present lectures, demonstrations, and assignments for their peers, with the

facilitation of the course instructor. A thorough understanding of how game engines work is therefore a requisite element of the game development process and lever for research in most domains involving interactive simulations and games. As game engine development, research, and application is a large and complex topic, the course material is distributed across two semesters. In addition to the continuation of technical topics this course also emphasizes the experiential, conceptual, and aesthetic dimensions of game development, prioritizing implementation completeness with creative, aesthetically-pleasing implementations that are informed by current research. As research in this field continues to rapidly iterate, the latest findings are incorporated into each new offering of the course, refreshing its content as the technology evolves in its implementation and theoretical underpinnings. Production of original research focused upon an aspect of game development or game engine design is required. Permission of instructor required.

Learning Outcomes: 1. Interpret, describe, and present the theory and implementation of an advanced game development topic via student-led in-class lecture. 2. Present to a classroom the theory and implementation within a scientific paper or set of papers that relate to an aspect of game development and lead a subsequent discussion surrounding said implementation. 3. Extract practicable production/development information from papers, books, vendor documentation and ad hoc sources to solve open-ended technical problems. 4. Create (or extend from the previous course) a technically sound video game prototype within a team-based production environment. 5. Generate and test a research hypotheses related to games, game technology, or game development processes. Credits: 3.00

CGT 56200 - Cognition And Human-Computer Interaction

Credit Hours: 3.00. This course provides an overview of the role of human cognition in the use of interactive digital technologies. Students will learn fundamental theories and concepts of cognitive science that are relevant to interactive technology. The course takes a broad chronological approach, examining the history and development of cognitive theories and models in the field of human computer-interaction (HCI). Students will read seminal works from leading researchers in cognitive science and HCI. The course covers older well-established theories and models as well as newer speculative ones. Students will develop a sound understanding of the origins, development, and future directions of cognition research in HCI. Topics covered include: classical cognition; the cognitive revolution; mediated cognition; activity theory; situated action; embodied cognition; distributed, external, and extended cognition; enactive cognition; thinking and epistemic coping; make-believe and imagination; scaffolding and cognitive offloading; internal and external representations. Students are encouraged to make appropriate connections to their own research areas. No specific technical or programming experiences is required.

Learning Outcomes: 1. Critically assess the role of cognition in the use of interactive digital technologies. 2. Explain the history and development of cognition research in the field of human computer-interaction, including major theories and seminal works. 3. Apply concepts from the course in their own personal research. Credits: 3.00

CGT 57000 - Information Visualization

Credit Hours: 3.00. This course provides a systematic, comprehensive framework to study principles, design choices, and development toolkits on information visualization design and development. It focuses on creating innovative and intuitive visualization solutions to provide users with peripheral awareness of meaningful information from a complex data set. Employing a user-centric approach, this course studies and analyzes visualization design and development from data, tasks, and visualization and interactions. The students will learn perception theories on visualization and use visual elements such as space and color to encode data, compare, evaluate, choose among different visualization forms and interaction methods. Through a project-based learning approach, students will conduct case studies on various visualization designs, analyze the user, data, tasks, and design choices in the visualizations, and finally design and develop information visualization solutions as course projects. Students should have finished their undergraduate study in domains that are closely related to one or more of the following: business analysis, statistics, knowledge management, computer science, software engineering, interaction design, human-centered computing, scientific visualization or information visualization. Permission of department required.

Learning Outcomes: 1. Describe the purposes of visualization and the process of design and developing visualizations. 2. Explain visual encoding channels, visualization design rules, and design principles using scientific theories on visual perception. 3. Apply popular visualization forms to represent different types of data. 4. Analyze visualization designs to

differentiate the functions and purposes of visual elements and channels 5. Evaluate different visualization forms, arrangements, and interactions about their pro and cons, purposes, and suitable contexts. 6. Design, develop, and evaluate an innovative visualization system with interlinked multiple views to represent a large complex dataset. Credits: 3.00

CGT 57200 - Special Topics In Human-Centered Design And Development

Credit Hours: 3.00. This course offers students the opportunity to explore current topics in human-centered design and development of systems with graphical user interfaces in-depth through readings, discussions, design projects and design critiques. Topics vary by semester. Possible offerings include Critical Design, Design for Behavior Change, Participatory Design, Design for Social Good, Service Design, Social Interaction Design.

Learning Outcomes: 1. Describe, explain, and compare processes, methods and techniques of human-centered data. 2. Create deliverables such as, but not limited to: interactive prototypes, research reports, usability evaluation reports, scholarly research papers using HCDD processes, methods and techniques. 3. Critique HCDD processes, methods and techniques. 4. Evaluate HCDD deliverables using HCDD methods such as cognitive walkthrough, usability testing, focus groups, etc. 5. Lead teams through HCDD iterative processes used for creating. 6. Solve specific design problems using the appropriate HCDD processes, methods and techniques. Credits: 3.00

CGT 57207 - UX Design Graduate Experience Studio

Credit Hours: 3.00. This course immerses students in a company-like environment where they work on semester-long design projects that are sponsored by industry partners. Students learn about the various roles within a UX environment as they build collaboration and project management skills. Projects utilize a human-centered design approach with an emphasis on designing for the user experience. Students will engage in substantial research and evaluation activities, informed by seminal literature in the field, along with their design work. Students are expected to take responsibility for project deliverables and mentor junior students. Permission of department required.

Learning Outcomes: 1. Implement team-building skills and manage collaboration between teammates. Solve conflicts in a fair and effective manner that is a "lead by example" process. Organize and lead team retrospectives. Measure your UX role and your teammates, then determine growth plans (e.g., create team member growth plans; retrospective reflections; peer team evaluations; ...). 2. Develop a project strategy with tasks and deliverables based on project goals and team dynamics. Execute project management plan with milestones, and team member tasks. Champion the development of a UX project proposal that will clearly explain the project vision, direction, goals, stakeholders, deliverables, timeline, and tasks (e.g., identification, planning, and completion of project milestones; ...). 3. Demonstrate depth in one or more UX specializations and critique strengths and weaknesses. Teach UXD specialization tasks and process to team members. Educate team members about the roles and careers of UX designers. Document your educational path of UXD skill development in a written reflection (e.g., activity log of specialization goals and outcomes; guide to job searching; ...). 4. Communicate UX approaches to diverse stakeholders in a professional manner. Champion the final project written design documentation, including the executive summary. Enhance portfolio, conduct job search, and mentor junior students (e.g., sponsor-facing reports; executive summaries; lead presentation and documentation; ...). 5. Conduct advanced primary and secondary research in tandem with ongoing client communication and team design work. Write up research and evaluation findings in a formal paper. Credits: 3.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

CGT 58100 - Workshop In Computer Graphics Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 8.00

CGT 59000 - Special Problems In Computer Graphics Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

CGT 59700 - Directed MS Capstone

Credit Hours: 3.00 to 6.00. An original investigation of a particular problem under the guidance of the instructor(s). The resulting product is a substantial project report with an evaluation or research component. Not applicable to a thesis option plan of study. Enrollment for a total of six credits is required. Permission of department required.

Learning Outcomes: 1. Independently identify a problem or opportunity and conduct a substantial project relevant to the student's focus area. 2. Iteratively evaluate project outcomes using appropriate research methods. 3. Communicate project process, outcomes, and relevant forms of evaluation through written and oral outputs. Credits: 3.00 to 6.00

CGT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 61000 - Visual Intelligence And Perception

Credit Hours: 3.00. This course focuses on the fundamentals of perception and cognition relative to vision and its implications to the field of computer graphics technology and the creation of graphics. Students will examine the foundations of human perception of form, shape, color, and motion, developing an understanding of why and how humans perceive visual information. Permission of instructor required.

Learning Outcomes: 1. Discover the history of investigations into visual perception. 2. Understand how the human vision system constructs an understanding of the 3D world. 3. Know the visual rules that govern the interpretation of form, shape, color and motion. 4. Understand the clinical aspects relative to vision and perception. 5. Learn to apply visual rules in the planning, creation and evaluation of all graphics. Credits: 3.00

CGT 62000 - Graphics Processing Unit Computing

Credit Hours: 3.00. This course provides a working knowledge of general-purpose graphics processing unit computing (GPGPU) using CUDA, OpenCL, and C++. OpenCL and CUDA are the platform independent industrial standard API and leading edge technology for GPGPU. The course focuses on utilizing, GPU for advanced tasks of scientific computing on parallelization of creating real-time and interactive applications and is structured into several blocks; parallel programming and synchronization tasks, GPU architecture, CUDA programming model, the OpenCL programming model. Permission of instructor required.

Learning Outcomes: 1. Understand the Graphics Processing Unit Computing models. 2. Understand the modern Graphic Processing

Units. 3. Parallelize sequential tasks and apply them to the Graphics Processing Unit Computing model. Credits: 3.00

CGT 62100 - Compute Shader Programming

Credit Hours: 3.00. Compute shaders allow graphics programmers to leverage the parallel processing power of the GPU for tasks besides rendering. Kinematics and other simulations, collision detection and image processing are common applications. In this class we will use several different shading languages to implement a variety of algorithms in both stand-alone applications and in game engines. Pre-Requisite: CGT 52000 (Concurrent Pre-Requisite) or CGT 52100 (Concurrent Pre-Requisite) or instructor permission.

Learning Outcomes: 1. Describe the capabilities and limitations of compute shaders. 2. Decompose problems into sequences of common parallel programming patterns (e.g., map, reduce, scan). 3. Implement efficient compute shaders with respect to computational and memory constraints. 4. Assess the efficiency of compute shaders. Credits: 3.00

CGT 63700 - Creative AI: Machine Learning For Creativity And Design

Credit Hours: 3.00. This graduate seminar offers an in-depth exploration into the creative and innovative intersections of artificial intelligence (AI) and machine learning with arts and design. As we witness a surge of breakthroughs in AI, this course aims to uncover the creative potential of new interaction techniques and art forms within these technological advances. Students will delve into how machine learning reshapes disciplines such as computational design, media arts, music, gaming, human-computer interaction, virtual reality, and graphics. The seminar has a dual focus: firstly, surveying the landscape of contemporary creative applications of deep learning across various fields; and secondly, empowering students to conceive and execute their own creative projects that leverage AI technologies. Coursework will be organized around the development of creative AI projects, to be completed either individually or collaboratively in small groups. Prerequisite: CGT 53700 or by permission of instructor.

Learning Outcomes: 1. Apply AI and machine learning techniques for creative purposes in fields such as animation, art, graphic design, digital media, and visual effects. 2. Contextualize and categorize creative AI projects within the history of electronic media, interactive arts, and visual design. 3. Devise and develop a series of creative projects using generative AI/ML programming techniques within contemporary software frameworks. 4. Evaluate the creativity, ethical considerations, and societal impacts of creative AI projects, as well as the creative potential of AI techniques and tools. Credits: 3.00

CGT 64500 - Games Research

Credit Hours: 3.00. This course instructs students in current methods of conducting research on digital games, ludology, and the game development process. The most current or impactful research in the field is presented, analyzed, and extrapolated upon. The course surveys a wide variety of specific topics that shift as new research findings are published. Previous topics have included: biofeedback, user experience evaluation in games, gameplay measurement and analysis, development pipelines, mathematical modeling of game design, publication strategies and methodologies, scientific document preparation, and simulation. Quantitative and qualitative approaches to conducting research in the field of digital and traditional games. Production of original research focused upon an aspect of games, ludology, game development, or simulation is required.

Learning Outcomes: 1. Conduct a thorough literature review of a chosen topic related to digital games and/or their development. 2. Present to a classroom a critical analysis of a scientific paper or set of papers and lead a discussion surrounding said research. 3. Prepare a human subjects research application (IRB) that meets all regulatory regulations required to conduct ethical human research. 4. Design and conduct a sound, logical study in the area of games. 5. Complete a publishable-quality scientific manuscript and submit it for publication. Credits: 3.00

CGT 67000 - Applications In Visual Analytics

Credit Hours: 3.00. Visual Analytics (VA) provides a fast way for people to make sense of large number of data, and has applications in many sectors. This course will introduce Visual Analytics through foundational theories and a broad range of techniques and tools, focusing on using visualization methods to reason and solve complex problems in a wide variety of applications. Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces that synthesize human and computational ability to attack large complex problems. It is concerned with analytical reasoning, interaction, data transformations, data visualization, analytic reporting, and technology transition. While the different visual

analytics applications share common theories and strategies, each of them has its unique data composition, visual representations, and analytical needs and strategies. Through survey and study a broad range of visual analytics applications, students will be able to apply visual analytics on their own applications, analyze and break down a complex analytical problem into proper components and steps, evaluate different visual analytic techniques and strategies, and finally design and develop an effective visual analytics solution toward the problem.

Learning Outcomes: 1. Describe the purposes, foundational theories, research components, and process of visual analytics. 2. Select proper visualization forms from visual analytics tools to answer specific reasoning questions. 3. Apply information visualization and visual analytics approaches to analyze complex problems from data processing, transformation, to visualization, and analysis. 4. Compare, analyze and assess different visual analytics approaches from various aspects such as effectiveness, efficiency, scalability, learnability, and user experience. 5. Develop a visual analytics solution and evaluate its efficacy in solving a complex domain problem. Credits: 3.00

CGT 69400 - CGT Graduate Seminar

Credit Hours: 0.00. The CGT Graduate Seminar is designed to provide opportunities for students to experience the breadth and depth of academic inquiry, raising their awareness of key challenges and opportunities for graduate research within the field of the department. Through participation in a series of interactive sessions and presentations, students will gain valuable insights into the diverse research areas within the department, discover potential research avenues, and become aware of critical issues in the fields.

Learning Outcomes: 1. Describe the range of research topics covered by CGT faculty. 2. Distinguish the various research methods and approaches used in CGT-related disciplines. 3. Identify research opportunities in CGT-related disciplines. Credits: 0.00

CGT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 18.00

Computer Sciences

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the

link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.

Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 18300 - Professional Practice I

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 18400 - Professional Practice II

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 19000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 19100 - Freshman Resources Seminar

Credit Hours: 1.00. This course is intended to integrate freshman majors in computer sciences into the department, help them adjust to university life, and assist them in developing academic and intellectual survival skills. Weekly recitation sections enable the students to work in teams. Strongly recommended for freshmen. The credit may be used only toward free electives.

Credits: 1.00

CS 19300 - Tools

Credit Hours: 1.00. This course is designed to introduce new Computer Science students to various programming tools which will aid them in their Computer Science classes, personal projects, and software development job experiences.

Learning Outcomes: 1. Understand Unix/Linux commands for navigating directories and files and manipulating files and folders. 2. Understand terminal commands for searching and input/output redirection. 3. Understand shells such as sh, csh, ksh, tcsh, bash, zsh. 4. Understand debugging via print statements and general debugger concepts. 5. Understand version control via Git and Github, source control, workflow, commit, collaboration, pull, push, create and pushing a new repository, cloning, branches, merging, and conflicts. 6. Understand vim including mouseless navigation, normal/insert mode, copy/paste, search/replace, and saving/quitting. Credits: 1.00

CS 19700 - Freshman Honors Seminar

Credit Hours: 1.00. A seminar dealing with the history, context, and future of computer science. Open only to students in the Computer Sciences Honors Program. The credit may be used only toward free electives.

Credits: 1.00

CS 21100 - Competitive Programming I

Credit Hours: 2.00. CP1 teaches applied algorithmic ideas and problem solving techniques to solve programming interview and competitive programming questions including usage of basic data structures such as [array, set, map, stack, queue, deque, priority queue], the four main algorithm paradigms: [complete search, greedy, divide and conquer, dynamic programming], other algorithmic ideas including [binary search the answer/bisection, meet-in-the-middle, prefix sum and difference arrays, two pointers, sliding window], and basic graph algorithms covering [strongly/connected components, floodfill, topological sort, shortest paths].

Learning Outcomes: 1. Differentiate between categories of problems in computer science including complete search, greedy, divide and conquer, dynamic programming, and various types of graph problems, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to all major categories of problems in computer science (listed in LO1). 3. Use new/novel algorithms to solve problems. 4. Recognize key characteristics of certain problem types listed in LO1. 5. Classify a problem by those key characteristics. 6. Deconstruct a problem into subproblems that can be solved individually. 7. Assemble those subproblems into a complete solution. 8. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 9. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the

problem. 10. Reflect on how one came up with a solution to a problem to better recognize patterns in problem types. 11. Debug programs by generating custom test cases based on problem constraints. Credits: 2.00

CS 23500 - Introduction To Organizational Computing

Credit Hours: 3.00. People and organizations, decision-making, information systems, telecommunications, desktop systems, integration tools, collaboration and groupware, multimedia, authoring multimedia documents, emerging technologies. May not be taken for credit by Computer Science majors.

Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

CS 24300 - Artificial Intelligence Basics

Credit Hours: 3.00. This course provides an introduction to foundational areas of artificial intelligence and current techniques for building intelligent systems. As an entry-level course for Artificial Intelligence, the primary goals of this course are: Teach fundamental building blocks of an intelligent system, namely, knowledge representation; learning; model validation, diagnosis, and visualization; reasoning and decision-making; probabilities and uncertainty in AI. Provide students with first-hand experiences in building a working machine learning and an automated reasoning system. Provide an overview of current state-of-the-art technologies in multiple domains of artificial intelligence. Broaden the students' horizon and spark their interests via learning about exciting applications of artificial intelligence in many aspects of human society.

Learning Outcomes: 1. Use data processing and implement learning and reasoning algorithms using Python. 2. Determine how to represent knowledge in an AI system. 3. Build a first-hand machine learning system. Know and be able to build all basic components of the entire machine learning pipeline, including data collection, wrangling, cleaning, model selection, training, cross-validation, and diagnosis. 4. Master the mathematical theory behind linear regressors and classifiers. 5. Build a first-hand automated reasoning system, learn how to formulate real-world problems as constraint programs, solve reasoning problems and make complex decisions using AI. 6. Produce a reasoning system using depth-first search. 7. Demonstrate basic knowledge of the full landscape of AI: game playing, causality, fairness/bias/ethics, uncertainty handling, reinforcement learning. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and

bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

CS 28400 - Professional Practice III

Credit Hours: 0.00. Professional Practice. Permission of instruction required.

Credits: 0.00

CS 28401 - Professional Practice Part-Time

Credit Hours: 0.00. Professional Practice Part-Time. The instructor determines the adequacy of the student's preparation for the work assignment proposed by the prospective employer for the student. Permission of Instructor required.

Credits: 0.00

CS 29000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 29100 - Sophomore Development Seminar

Credit Hours: 1.00. Presentations by corporate partners about careers in computer science. Presentations by faculty about careers in academia and research. Students learn about upper-division courses, tour research laboratories, and attend job fairs.

Credits: 1.00

CS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database

model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35100 - Cloud Computing

Credit Hours: 3.00. Introduction to cloud computing. Cloud data center infrastructure, public and private clouds, servers and virtualized servers, data center networks and virtualized networks, virtualized disk, file, and object storage, the concept of scale-out, algorithms and programming systems used in the design and implementation of cloud-native software, especially using containers and orchestration systems, microservices, serverless designs, controller-based designs, edge and fog computing, security in a cloud environment, programming models.

Learning Outcomes: 1. Describe physical facilities and virtualized technologies used in a cloud data center. 2. Understand major algorithms and programming paradigms used to build cloud-native software. 3. Design and deploy containerized software in a cloud environment. 4. Demonstrate orchestration of container software. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 36100 - Great Issues In Computer Science

Credit Hours: 3.00. This course provides an overview of current and essential professional and ethical issues in computing and their impact on society. Topics specialize in the impact of computing, including algorithmic bias, motives behind design

decisions, data ethics, privacy and security, and legal issues. The goal of this course is to equip students with the framework and context necessary to think critically about the impact of computing. Discussions and readings will include current events.

Learning Outcomes: 1. Identify the causes behind some contemporary ethical concerns in computing. 2. Apply critical thinking and analytical abilities to a conversation around the impact of computing on society. 3. Apply reasoning to real-world case studies to analyze the ramifications of unethical practices. 4. Appreciate the importance of diverse experiences, thoughts, and backgrounds in Computer Science, both in academia and industry. 5. Understand some legal issues, privacy impacts, social issues, and other topics as they apply to computing. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 38001 - C++ Programming

Credit Hours: 1.00. This course builds on the CS 24000 (Programming In C) course to teach C++ extensions. This 5-week one-credit course teaches C++ programming and helps students improve their understanding of object-oriented programming. It also teaches how to use an Integrated Development Environment (IDE) when programming in C++.

Learning Outcomes: 1. Understand how to program in C++. 2. Understand how to program in object-oriented languages in general. 3. Understand how to implement some basic Software Patterns in C++. 4. Understand how to use an IDE when programming in C++. Credits: 1.00

CS 38002 - Advanced Java Programming

Credit Hours: 1.00. This course builds on the Java course CS 18000 (Problem Solving And Object Oriented Programming) to teach advanced topics in Java. This 5-week one-credit course will teach advanced topics such as Network Programming in Java, JDBC, JNI, and J2EE to write web applications in Java. You will also improve your understanding of Object Oriented Programming.

Learning Outcomes: 1. Understand advanced features such as Network Programming in Java, J2EE, JDBC, Java Swing, and JNI. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that

illustrate time-space trade-offs of algorithms.

Credits: 3.00

CS 38600 - Professional Practice IV

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 39000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 39100 - Junior Resources Seminar

Credit Hours: 1.00. This seminar course engages a number of outside speakers who typically present information on the role of research in computer science, how the research components of computer science relate to each other, approaches to software development in industry, different types of application development paradigms, technological trends, and societal, ethical, and legal issues. The credit may be used only toward free electives.

Credits: 1.00

CS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Identify the practices, protocols, and key skills used for various positions of a particular organization and/or industry in which they are working. 2. Reflect on their professional growth, personal development, and the practical application of theoretical knowledge within their chosen field. 3. Refine and reassess their own career goals as a result of the experience. Credits: 0.00

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 40700 - Software Engineering Senior Project

Credit Hours: 3.00. A capstone course combining all the concepts students have learned in the Software Engineering Track: software and software engineering, working as a team leader and as a team member, Agile Software Development, Scrum Software Development, Version Control, basing software development on reusable technology, developing requirements

(User Stories and Use Cases), modelling with classes, design patterns, focusing on users, modelling interactions and behavior, architecting and designing software, testing and inspecting, managing the software development process. This is a project course. Students are organized into 4-6 student teams. Each team completes a full-semester software engineering project. Each team creates a Project Charter, Product Backlog, Design, and for 3 Sprints -- Planning Document, Demo, Retrospective Document. The final demo is a formal presentation.

Learning Outcomes: 1. Understand the software development process. 2. Understand the best methods to plan, analyze, design, test, measure, and manage software projects. 3. Understand agile methodologies in general and specifically Scrum. 4. Understand how to use version control systems in a team software engineering project. 5. Understand that good people are one of, if not the most important, requirements for successful projects. 6. Understand how to work on a team project as a team leader and/or team member. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including

HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

CS 43400 - Advanced Computer Graphics

Credit Hours: 3.00. Advanced concepts and techniques of computer graphics. The course covers, in complete detail, going from a scene representation to a raster image without using OpenGL or other graphics packages. The course develops a complete graphics implementation in which the students implement every aspect of the graphics pipeline. This involves a substantial software project in C/C++.

Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 44100 - Data Science Capstone

Credit Hours: 3.00. The Capstone course aims at providing students with an opportunity to integrate their accumulated knowledge and technical and social skills in order to identify and solve realistic or real-world data science problem, with an emphasis on the application domain. Capstone projects are

often sponsored by corporate partners or by academic or non-academic research groups. The Capstone course serves as preparation for students entering into the profession of Data Science. Students will conduct a team-based project through the entire data science pipeline, by following the six phases of the CRISP-DM (Cross-Industry Standard Process for Data Mining) methodology. Students get experience in working as teams, participating in project planning, writing reports, and giving presentations.

Learning Outcomes: 1. Identify the business objectives in a complex problem. 2. Develop appropriate data science goals and project plan. 3. Implement the appropriate data pre-processing and analysis models. 4. Evaluate the above models and interpret results with respect to the "business" objectives. 5. Present the project outcomes through written reports and digital/oral presentations. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-

solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues

in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 48700 - Professional Practice V

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded projects; working in teams. CS 35200 (Compilers) and CS 35400 (Operating Systems) are recommended, but not required.

Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

CS 50010 - Foundational Principles Of Information Security

Credit Hours: 3.00. This course covers foundational principles relevant to information security including data structures,

algorithm design, computational complexity, probability theory, number theory, and basics of cryptography. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Professionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Identify and explain the basic data structures. 2. Identify and explain algorithm design techniques. 3. Explain computational complexity and decidability concepts and their relevance to information security. 4. Apply basic probability tools to analyze problems involving uncertainty and randomness. 5. Explain basic concepts of modular arithmetic and their application to cryptography. Credits: 3.00

CS 50011 - Introduction To Systems For Information Security

Credit Hours: 3.00. The course covers computer systems principles relevant to information security and it serves as a prerequisite for the later courses in the MS in IS program. The material includes features in the C/C++ programming languages for understanding security-critical software vulnerabilities, basic knowledge in computer architecture and assembly languages, knowledge of the compiling process, operating systems, networking, databases, and web applications relevant to information security. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Processionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Understand C/C++ code with security-relevant features such as pointers, string operations, function pointers, dynamic memory allocation, etc., laying the foundations for understanding software vulnerabilities in C/C++. 2. Explain common programming errors in C/C++ programs. 3. Explain how C/C++ programs are compiled into assembly and how call stack works in function calls, laying the foundation for understanding stack based buffer overflow. 4. Explain basic concepts in computer architecture, such as instruction set, assembly code, CPU modes, registers, MMU, paging. 5. Explain basic concepts in operating systems, such as processes, system calls, virtual memory, file system structure. 6. Explain basic concepts in networking, databases, and web applications. Credits: 3.00

CS 50023 - Data Engineering I

Credit Hours: 1.00. The course introduces students to the fundamentals of Data Engineering with a focus on tools and computational techniques to gather, construct, manipulate, summarize, and visualize data sets as a means to extract knowledge from the underlying data. Python and Python libraries are used. Completion of the course will allow learners to perform basic data analysis on data sets. Experience in Python Programming and Linear Algebra is required. The course also prepares learners for additional instruction in the courses Data Engineering II and Foundations of Decision Making.

Learning Outcomes: 1. Identify key file types (TXT, CSV, HTML) and their characteristics. Using Python, read data in these formats. 2. Create and execute Python scripts to parse, select, transform, summarize, and visualize data. 3. Explain how to identify and fill in missing values in data values. 4. Create informative visualizations from given data and recognize the key qualities of good visualizations. 5. Apply Pandas functions to slice, dice, and summarize datasets. 6. Apply the process of sampling data and sample probabilistically. 7. Demonstrate how to transform and construct features (e.g., standardization, distances). 8. Compute summary statistics from data (e.g., covariance, correlation). 9. Explain how to solve simple data analysis problems. Credits: 1.00

CS 50024 - Data Engineering II

Credit Hours: 1.00. This course introduces students to the fundamentals of database management systems (DBMS) from

a user's perspective. The principles of modeling an enterprise using Entity-Relationship diagrams and transforming the model into a relational or NoSQL database are illustrated through a range of examples. The SQL language is used to create, query, aggregate, and update a relational database. NOSQL databases and the related data models (column, graph, and document-based) are introduced. Experience in Python Programming is required.

Learning Outcomes: 1. Carry out database design steps from conceptual to logical to physical design. 2. Use SQL commands to define the structure of a relational database, populate, update and delete data in the database, retrieve data having specified characteristics, and specify access control. 3. Explain the differences, advantages, and disadvantages of relational and NOSQL databases. 4. Describe features of relational databases not needed in big data applications. 5. Create a document-based, NOSQL database like mongoDB and movie data from an SQL to a NOSQL database. 6. Understand the benefits and downsides of creating index structures on query performance for relational, and NOSQL databases. 7. Explain the difference between hash indices and B-tree indices. 8. Analyze large data sets created from piecing together multiple data files through the application of SQL queries. Credits: 1.00

CS 50025 - Foundations Of Decision Making

Credit Hours: 1.00. This course provides an overview of data science methods used for data-driven discovery, extraction of knowledge, and informed decision making. The course covers fundamental computational methods and statistical techniques used to correctly reason about uncertainty, conduct hypothesis tests, infer causal relationships, and apply and evaluate predictive models. The course highlights how sampling biases can impact fairness in decision making. Throughout, students get hands-on experience on how to make correct and explainable inferences from data. Experience in Python Progamming, Probability, Statistics and Linear Algebra is required.

Learning Outcomes: 1. Support and justify claims with evidence from data and discuss how human biases can impact interpretations. 2. Recognize the basic approach to formulating statistical hypothesis tests and apply parametric hypothesis tests for both discrete and continuous data. 3. Interpret p-values and apply them effectively to support claims about data. 4. Formulate and test conjectures with controlled experiments, including A/B testing. 5. Recognize the types of errors encountered when conducting multiple hypothesis tests. 6. Use computational approaches based on randomization for hypothesis testing and uncertainty quantification. 7. Discuss ethical issues such as privacy and fairness that can be associated with automating decisions based on machine learning methods. 8. Apply the basic components of classification methods using Python libraries. 9. Evaluate the performance of learned models with learning curves and k-fold cross validation and assess significance with hypothesis tests. Credits: 1.00

CS 50100 - Computing For Science And Engineering

Credit Hours: 3.00. Credit in this course may not be used toward a graduate degree in Computer Sciences. Computational concepts, tools, and skills for computational science and engineering scripting for numerical computing, scripting for file processing, high performance computing, and software development. Project may be required.

Learning Outcomes: 1. To prepare graduate students outside Computer Science to write computer programs in support of their studies and research. Credits: 3.00

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in

the compiler front-end and back-end. Credits: 3.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election, group communication, and replication. Permission of department required.

Credits: 3.00

CS 51000 - Software Engineering

Credit Hours: 3.00. Software life cycles, requirements engineering, software design, design of distributed systems, verification and validation, software architecture, process metrics and models, and research methods in software engineering.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 51501 - Parallelism In Numerical Linear Algebra

Credit Hours: 3.00. This course examines both theoretical and practical aspects of numerical algorithm design and implementation on parallel computing platforms. In particular, it provides an understanding of the tradeoff between arithmetic complexity and management of hierarchical memory structures, roundoff characteristics if different from the sequential schemes, and performance evaluation and enhancement. Applications are derived from a variety of computational science and engineering areas.

Learning Outcomes: 1. Become quite knowledgeable in handling these parallel numerical linear algebra algorithms that arise in computational science and engineering. 2. Acquire problem-solving skills in this field. 3. Communicate their solution strategies and the performance realized on parallel computing platforms. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices

can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security

properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 53100 - Computational Geometry

Credit Hours: 3.00. Computational geometry studies how to compute with and reason about geometric objects. The subject is playing an increasingly important role in computer graphics, game software, geometric modeling, geographic information systems, and many other applications. Course topics include convex hull, segment manipulations, triangulations, range searching, Voronoi diagrams, window queries, Delaunay triangulation, and duality. Some key algorithms are implemented. Questions of floating-point accuracy and robust algorithm design are considered throughout the course.

Credits: 3.00

CS 53200 - Geometric Modeling Algorithms

Credit Hours: 3.00. The geometric modeling course will first introduce computational and mathematical concepts needed for 3D shapes, such as points, vectors, linear combinations, metrics, continuity, differentiability, and transformations. Then, it will describe mathematical descriptions of shapes and their implementations, starting from curves to free-form and subdivision surfaces, meshes and their simplifications, volumetric structures such as meshes, and constructive solid geometry. It will also provide knowledge of the fundamentals of procedural modeling (fractals, L-systems, terrain, and vegetation modeling). This course will also discuss modern AI-oriented methods for 3D shape generation.

Learning Outcomes: 1. Learn foundations of geometric modeling including geometry and topology. 2. Learn basic geometric objects, their representations, and operations including line, plane, and volume. 3. Learn algorithms and Data Structures for Geometric Modeling. 4. Learn curves including derivative, curvature, osculating circle, and continuity. 5. Learn surfaces including differential properties and special surfaces. 6. Learn volumes including space enumeration and constructive solid geometry. 7. Learn advanced shape representations including meshes. 8. Learn procedural models including fractals, chaos, and noise. 9. Learn AI-based generative models. Credits: 3.00

CS 53400 - Motion Planning

Credit Hours: 3.00. This course introduces the fundamental concepts of motion planning in robotics and autonomous systems. It will cover classical algorithms, basic kinematics, sampling-based approaches, and an introduction to multi-agent planning. The course is designed for graduate students with little or no prior background in motion planning. Practical applications and hands-on projects will be used to solidify the concepts learned.

Learning Outcomes: 1. Comprehend the essential problems in motion planning for autonomous systems, including pathfinding, navigation, and collision avoidance. 2. Articulate the challenges faced by robots in different environments, such as static, dynamic, and complex terrains. 3. Implement and apply classical graph-based search algorithms (e.g., A*, Dijkstra's) to solve planning problems in robotic systems. 4. Analyze the trade-offs between different algorithms with respect to computational complexity, optimality, and real-time performance in grid-based and continuous environments. 5. Grasp the concepts behind sampling-based planning methods such as Probabilistic Roadmaps (PRM) and Rapidly-exploring Random Trees (RRT). 6. Design and implement basic versions of these algorithms in simulation environments, understanding their practical application in high-dimensional configuration spaces. 7. Implement collision detection algorithms and integrate them into planning frameworks to ensure safe navigation in complex and cluttered environments. 8. Develop an understanding of geometric representations used in collision detection and their limitations in real-world applications. 9. Understand kinodynamic constraints (e.g., velocity, acceleration) and incorporate them into motion planning to ensure feasible trajectories for robots. 10. Apply basic control and trajectory optimization techniques to produce smooth and dynamic motions in robotics systems. 11. Understand the challenges and strategies in multi-agent motion planning, focusing on collision avoidance, path coordination, and reciprocal interactions. 12. Implement simple multi-agent planning algorithms, such as Reciprocal Velocity Obstacles (RVO), in a dynamic multi-agent scenario. 13. Gain hands-on experience using Robot Operating System (ROS) and other standard robotics frameworks to apply motion planning algorithms in simulation and real-world settings. 14. Demonstrate the ability to prototype, test, and debug planning algorithms in simulated robotic systems. 15. Understand the role of optimization in motion planning and apply basic optimization-based techniques for trajectory generation and path smoothing. 16. Analyze

how optimization techniques improve the efficiency and feasibility of motion planning in constrained environments. Credits: 3.00

CS 53500 - Interactive Computer Graphics

Credit Hours: 3.00. The principles of computer graphics and interactive graphical methods for problem solving. Emphasis placed on both development and use of graphical tools for various display devices. Several classes of graphics hardware considered in detail. Topics include pen plotting, storage tubes, refresh, dynamic techniques, three dimensions, color, modeling of geometry, and hidden surface removal. Part of the laboratory involves use of an interactive minicomputer graphics system. Knowledge of programming required.

Learning Outcomes: 1. Learn the algorithms underlying the interactive graphics pipeline, including algorithms for geometric modeling, projection, rasterization, shading, lighting, texture mapping, projective texture mapping, shadow mapping, and environment mapping. 2. Gain experience implementing the interactive graphics pipeline through projects. 3. Gain initial experience programming Graphics Processing units through shaders. 4. Learn and implement algorithms for advanced rendering techniques. Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 53900 - Extended Reality: Principles And Applications

Credit Hours: 3.00. The course covers the computer science foundations of XR in geometric modeling, computer graphics, computer vision, computer animation, human-computer interaction, virtual reality, mixed reality, and augmented reality, as well as applications of XR in education, healthcare. The course will cover principles, design, implementation, and evaluation of XR applications.

Learning Outcomes: 1. Apply computer science, computer graphics, computer visualization, computer vision, and human-computer interaction concepts and principles to implement an extended reality (XR) application. 2. Apply statistics and human-computer interaction concepts and principles to design, implement, and analyze a user study to evaluate an XR application. 3. Demonstrate knowledge of the potential implications of XR technologies in the real-world context. 4. Demonstrate knowledge of the capabilities and limitations of the state of the art in XR. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 54300 - Introduction To Simulation And Modeling Of Computer Systems

Credit Hours: 3.00. Simulation: discrete event simulation, process oriented simulation, generating random numbers, simulation languages, simulation examples of complex systems. Nondeterministic models: random variables, Poisson process, moment generating functions, statistical inference and data analysis. Modeling: elementary queuing models, networks of queues, applications to performance evaluation of computer systems.

Credits: 3.00

CS 54701 - Information Retrieval

Credit Hours: 3.00. Basic principles and practical algorithms used for information retrieval and text mining: statistical characteristics of text, several important retrieval models, text categorization, recommendation system, clustering, federated text search, link analysis, etc.

Learning Outcomes: 1. Learn the theories and techniques behind Web search engines, E-commerce recommendation systems, etc. 2. Get hands on project experience by developing real-world applications, such as intelligent tools for improving search accuracy from user feedback, email spam detection, recommendation system, or scientific literature organization and mining. 3. Learn tools and techniques to do cutting-edge research in the area of information retrieval or text mining. Credits: 3.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage, communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3. Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

CS 55800 - Introduction To Robot Learning

Credit Hours: 3.00. Introduction To Robot Learning

Learning Outcomes: 1. Formulate the robot motion planning and control problems and solve them using standard tools. (W, P, E) 2. Identify

the robot constraints, define their degree of freedom, and formulate their dynamical models for control. (W, P, E) 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. (W, P, E) 4. Identify limitations in existing classical robot algorithms and understand how to avoid the musing Machine Learning. (W, P) 5. Understand and apply Deep Reinforcement Learning approaches to complex robot systems. (W, P, E) 6. Evaluate and assess current best practices and mechanisms for robot programming. (W, P) 7. Develop a skill for robot programming from perception to low-level control using state-of-the art methods. (W, P) Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 57100 - Artificial Intelligence

Credit Hours: 3.00. Artificial Intelligence (AI) systems are increasingly being deployed in many real-world tasks. This course provides an introduction to the fundamental principles and applications of AI. The course covers classic material including search-based methods, probabilistic reasoning, game playing, decision making, exact and approximate inference, causal learning, and reinforcement learning as well as selected advanced topics. The focus of the course is on foundational methods and current techniques for building AI systems that exhibit 'intelligent' behavior and can 'learn' from experience. The course assumes students are familiar with basic concepts in analysis, linear algebra, optimization, discrete mathematics, elementary probability, statistics, data structures, and algorithms. Students are expected to have good programming and software development skills and have a working knowledge of Python and Java.

Learning Outcomes: 1. Assess and explain the applicability, strengths, and weaknesses of the basic knowledge representation, problem-solving, and learning methods in solving a particular problem. (E,W) 2. Predict the

behavior and estimate the cost (in time and space) of different heuristic and optimal search methods, and choose the appropriate method for particular problems. (W,P) 3. Develop small logic-based, rule-based, and search-based systems; be able to predict performance characteristics. (P) 4. Predict the behavior of basic machine-learning methods, and choose the appropriate method for particular problems. (W,P) 5. Communicate critical key issues in AI-related to knowledge representation, problem-solving, and learning for a specific problem. (W) 6. Propose, evaluate, and implement effective solutions to problems requiring AI techniques. (P) 7. Articulate key problems, both technical and philosophical, in the development of artificial intelligence systems. (E,W) Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

CS 57900 - Bioinformatics Algorithms

Credit Hours: 3.00. Review of Genomes, DNA, RNA, proteins, proteomes. Biological Sequences: dynamic programming; pairwise global, local, and semi-global alignments of genes and proteins; constant, affine, and general gap penalties; RNA alignments; BLOSUM and PAM scoring matrices. Multiple alignment of proteins: approximation algorithms; iterative and progressive alignment methods. Database search for sequences: BLAST and variants. Phylogenetic Trees: distance-based methods, ultrametric and additive distance functions; parsimony, and maximum likelihood methods. Whole Genome Alignment: suffix trees and suffix arrays. Systems Biology: Module discovery in biological networks, spectral algorithms for graph clustering. Network alignment: quadratic programming formulations and graph matching. Genetic Variation: haplotype inference, the perfect phylogeny problem and chordal graphs. Additional topics such as next-generation sequencing, analysis of multidimensional data from flow cytometry, and gene

expression data, if time permits.

Learning Outcomes: 1. Students will learn how to design algorithms. 2. Students will learn how to solve computational problems from the new biology, the data-rich field that biological sciences is becoming. Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 58100 - Algorithmic Game Theory

Credit Hours: 3.00. The field of algorithmic game theory (also known as economics and computation) has been expanding at a rapid pace in recent years, with computational reasoning playing a crucial role in transforming classical economics. An increasing number of real-world systems require careful design of algorithms where the inputs are provided by agents with different preferences. Applications include Google's ad auctions, spectrum auctions, Bitcoin, matching markets, and allocation of vaccines. This has inspired new models and algorithms and led to deep connections with machine learning through multi-agent learning and computational complexity. This course will introduce the area of Algorithmic Game Theory by studying games, solution concepts, complexity of equilibria, mechanism design, auction theory, fair division, social choice, learning dynamics, and markets. It will include both classical results and recent developments.

Learning Outcomes: 1. Analyze and solve games (zero-sum, general-sum, potential games), identify stable solutions, and design algorithms for computing them where applicable. 2. Design and analyze mechanisms that work well when the participants are strategic, for various problems including selling goods (auctions). 3. Design and analyze algorithms with provable fairness guarantees. 4. Explain concepts of social choice used in specific domains, e.g., elections. 5. Analyze markets and design algorithms that market participants can use to achieve desirable outcomes in both static and repeated settings. 6. Analyze multi-agent learning settings, where agents learn together in some environment but have different incentives, which influence their interactions. Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 58500 - Theoretical Computer Science Toolkit

Credit Hours: 3.00. This course covers fundamental techniques and a range of mathematical tools that underlie today's research in theoretical computer science. The course material is essential for research in theoretical computer science as well as machine learning theory. The course is targeted at students who plan to pursue research in these areas. Topics will be chosen from four core areas: Convex Analysis and Optimization, Spectral Methods, Concentration Inequalities, and Discrete Fourier Analysis. Depending on student and instructor interest, additional topics will be chosen and may include applied analysis, coding theory, probabilistic proofs, and more advanced topics in discrete Fourier analysis. Students will read papers in theoretical computer science and machine learning theory using, exploring and extending the covered techniques and tools. Students are expected to be proficient in probability theory, have the maturity to follow and carry out basic analysis proofs, and have completed courses in calculus, linear algebra, discrete mathematics, and analysis of algorithms. More specifically, the course expects mastery of the material covered in Calculus III, Linear Algebra, Probability, Foundations of CS, and Analysis of Algorithms.

Learning Outcomes: 1. Explain and justify the merits and limitations of convex optimization algorithms. 2. Describe the characteristics and the role of convexity in optimization. 3. Formulate mathematically problems that have solutions based on convex optimization or matric analysis tools and analyze them effectively. 4. Predict typicality of the outcome in experiments. 5. Explain how to use and apply concentration bounds, including Chernoff-Hoeffding Bound, Martingales and Azuma's

Inequality, and applications of the Talagrand inequality. 6. Develop precise mathematical formulation of problems and analyze using frameworks related to concentration of measure. 7. Apply Discrete Fourier Transform to determine properties of functions. 8. Explain why Fourier Analysis of Boolean Functions is a major tool in theoretical CS and describe application scenarios including property testing, cryptography, complexity, learning theory, pseudorandomness, hardness of approximation, and random graph theory. 9. Identify properties of functions based on the properties of their spectrum. 10. Explain the basic ideas underlying the tradeoff between the amount of redundancy used and the number of errors that can be corrected by a code. 11. Describe achieving the optimal tradeoff between redundancy and error correction for codes that come equipped with efficient encoding and decoding. 12. Illustrate how and why concatenated codes support the construction of asymptotically good codes. Credits: 3.00

CS 58700 - Foundations Of Deep Learning

Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning.

Learning Outcomes: 1. Understand statistical Foundations of Deep Learning. 2. Understand feedforward Networks. 3. Understand stochastic optimization of neural network models. 4. Understand Bayesian Neural Networks. 5. Understand invariant & Equivariant Representation Learning. 6. Understand task-invariant representations. 7. Understand meta Learning. 8. Understand multi-task Learning. 9. Understand transfer Learning. 10. Understand implicit generative models (probabilistic models without explicit likelihoods). 11. Understand variational Auto-Encoders. 12. Understand generative Adversarial Networks. 13. Understand stable Diffusion Generative models. 14. Understand how to evaluate the performance of neural networks, as well as

formulate and test hypotheses. 15. Understand how theory and algorithmic elements interact to impact performance. Credits: 3.00

CS 58800 - Randomized Algorithms

Credit Hours: 3.00. The area of randomized algorithms has grown from being a tool in computational number theory to finding widespread application in algorithms in all areas of computer science. Two practical benefits of randomization are its simplicity and speed. Deep and important computational complexity connections have been developed, from bridging the gap between discrete and continuous optimization, bypassing deterministic barriers in online settings, summarizing massive data in polylogarithmic space, probabilistically checkable proofs, privacy enhancing techniques, modeling the web and other large networks, and sparsifying and compressing complicated combinatorial structures such as graphs. Randomization is an essential key ingredient in the algorithmic breakthroughs today and in the future. This course presents the basic concepts in the design and analysis of randomized algorithms and shows how to apply them to algorithms for a wide range of problems. The course covers a broad range of problems benefitting from randomized computation including data structures, graph algorithms, online algorithms, geometric algorithms, streaming algorithms, derandomization techniques, and tools for probabilistic analysis of algorithms.

Learning Outcomes: 1. Describe the main principles underlying the design and analysis of a randomized algorithm. 2. Explain concepts of randomized algorithms used in specific domains; e.g., graph-theory, number theory, and linear algebra problems. 3. Apply measure concentration results from probability theory to analyze a given randomized algorithm. 4. Determine the running times, failure probabilities, and accuracy guarantees of a randomized algorithm. 5. Apply learned design techniques and analysis tools to design and analyze new randomized algorithms. 6. Explain material from published research in the area of randomized algorithms using field-specific language. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

CS 59100 - Seminar

Credit Hours: 1.00. A weekly seminar presented by faculty and invited speakers, normally in a specific area.

Credits: 1.00

CS 59200 - Computer Science Seminar

Credit Hours: 3.00. A seminar course for in-depth exploration of a specific topic. Topics vary. Classes consist of both instructor and student presentations. Students read, present and discuss research papers, and may complete and present a research project in the area. For each offering, inclusion on a plan of study is determined by the CS Graduate Study Committee. If approved, may be included on a CS MS or PhD plan of study according to relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

CS 59300 - New Topics In CS

Credit Hours: 3.00. A variable title course for topics not currently covered in the CS graduate curriculum. Each offering follows a traditional course structure with textbook(s), assignments, exams, and week-by-week content synopsis described in a syllabus. A CS 59300 offering does not imply that a course is intended to become, or will become, a regular course in the CS graduate curriculum. May be included on a CS MS or PhD plan of study according to the relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

CS 59799 - Graduate Professional Practice

Credit Hours: 0.00. Internship experience to complement the student's academic coursework and help prepare the student for employment in computer science. The student must present a letter from the proposed employer describing to a reasonable extent the work to be undertaken and find a member of the Computer Science Graduate Faculty to be the instructor. The student must have completed at least one semester as a computer science graduate student at Purdue, West Lafayette. May not be taken in successive semesters. Permission of instructor required.

Learning Outcomes: 1. Experience applying knowledge and skills learned in courses. Credits: 0.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 63500 - Capturing And Rendering Real-World Scenes

Credit Hours: 3.00. Advanced techniques for automated modeling and visualization of complex environments, such as rooms, buildings, urban scenes, and landscapes. Topics covered are at the confluence of computer graphics, computer vision and engineering, and include: capture technologies, acquisition device calibration, view registration, panoramic images, 3D reconstruction from images, view morphing, 3D image warping, lightfield modeling and rendering, visual hulls, point-based modeling and rendering, view dependent texture mapping, and application development issues and examples. Prerequisite: CS 58000 , CS 53500 or a solid foundation in computer graphics, programming proficiency in C or C++ and basic linear algebra.

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 63800 - Multimedia Networking And Operating Systems

Credit Hours: 3.00. For graduate students in computer sciences who have a background in networking and operating systems and are interested in research in networked multimedia systems. The course consists of a selection of networking and operating system topics for realizing high performance, predictable, scalable, flexible, and secure multimedia systems. Topics may vary to reflect timely research issues and the current interests of the instructor(s). Students are expected to complete a term project. Presentations also may be required. Undergraduate background in computer science required. Prerequisite: CS 53600 or CS 50300 .

Credits: 3.00

CS 64100 - Multimedia Database Systems

Credit Hours: 3.00. Prepares students for research in multimedia database systems. Students are exposed to a variety of emerging innovative techniques to store, manipulate, communicate, visualize, and reason with multimedia systems. Prerequisite: CS 54100 or CS 54200 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 66200 - Pattern Recognition And Decision-Making Processes

Credit Hours: 3.00. (ECE 66200) Introduction to the basic concepts and various approaches of pattern recognition and decision-making processes. Topics include various classifier designs, evaluation of classifiability, learning machines, feature extraction, and modeling. Prerequisite: ECE 30200 .

Credits: 3.00

CS 69000 - Seminar On Topics In Computer Sciences

Credit Hours: 0.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 5.00

CS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. The student is expected to follow safe research practices, to follow ethical research practices, to maintain communication with the instructor, to formulate a set of reasonable semester research progress milestones with instructor, optionally in writing. Permission of instructor required.

Credits: 1.00 to 18.00

CS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. The student is expected to follow safe research practices, to follow ethical research practices, to maintain communication with the instructor, to formulate a set of reasonable semester research progress milestones with instructor, optionally in writing. Permission of instructor required.

Credits: 1.00 to 18.00

CSCI 23000 - Computing I

Credit Hours: 4.00. The context of computing in history and society, information representation in digital computers, introduction to programming in a modern high-level language,

introduction to algorithms and data structures, their implementation as programs.

Credits: 4.00

CSCI 24000 - Computing II

Credit Hours: 4.00. Continues the introduction of programming begun in CSCI 23000, with a particular focus on the ideas of data abstraction and object oriented programming. Topics include programming paradigms, principles of language design, object-oriented programming, programming and debugging tools, documentation, recursion, linked data structures, and an introduction to language translation.

Credits: 4.00

CSCI 24100 - Introduction To Web Design

Credit Hours: 3.00. Introduction to writing content for the Internet and World Wide Web. Emphasis on servers, hand-coded HTML, Cascading Style Sheets and extending HTML with other Web technologies.

Credits: 3.00

CSCI 31100 - Advanced Database Programming, Oracle

Credit Hours: 3.00. Focus on the concepts and skills required for database programming and client server development. Concepts will apply to any modern distributed database management system. Emphasis on developing Oracle SQLPlus scripts, PL/SQL server side programming, and Oracle database architecture. Students with programming experience in ODBC compliant languages will be able to practice connecting such languages to an Oracle database. Lecture and laboratory.

Credits: 3.00

CSCI 34000 - Discrete Computational Structures

Credit Hours: 3.00. Theory and application of discrete mathematics structures and their relationship to computer science. Topics include mathematical logic, sets, relations, functions, permutations, combinatorics, graphs, Boolean algebra, digital logic, recurrence relations, and finite-state automata.

Credits: 3.00

CSCI 36200 - Data Structures

Credit Hours: 3.00. A study of the design and analysis of data structures and algorithms. Abstract data types: arrays, stacks, queues, lists, trees, graphs, etc. Algorithms: sorting, searching, hashing. File structures: organization and access methods.

Credits: 3.00

CSCI 36300 - Principles Of Software Design

Credit Hours: 3.00. (ECE 37200) This course is designed to teach students best practices in designing and implementing object-oriented systems of high quality. To accomplish this task, we start with an overview of software design patterns and their role in developing high-quality software. We then begin surveying different design-level software design patterns, such as the Bridge, Strategy, Wrapper Facade, and Visitor software design patterns. Next, we touch on software design patterns for building distributed systems. Finally, we finish the course by surveying software anti-patterns, which are common design mistakes that negatively impact system quality, such as degrading performance as the system scales in size and complexity. Students will have the opportunity to apply learned techniques on several programming projects throughout the semester.

Learning Outcomes: 1. Understand and define the purpose of software design patterns. 2. Identify and describe the design goal and intent of different design patterns. 3. Know what software design pattern to apply to a particular problem. 4. Apply techniques for implementing and debugging object-oriented software systems. 5. Apply techniques for identifying design flaws that negatively impact system quality. Credits: 3.00

CSCI 40300 - Introduction To Operating Systems

Credit Hours: 3.00. Operating system concepts; history, evolution and philosophy of operating systems. Concurrent processes, process coordination and synchronization, CPU scheduling, deadlocks, memory management, virtual memory, secondary storage and file management, device management, security and protection, networking, distributed and real-time systems.

Learning Outcomes: 1. Learn computer systems structures. 2. Learn operating systems structures. 3. Study processes & threads. 4. Perform CPU scheduling. Credits: 3.00

CSCI 41400 - Numerical Methods

Credit Hours: 3.00. Error analysis, solution of nonlinear equations, direct and iterative methods for solving linear systems, approximation of functions, numerical differentiation and integration, numerical solution of ordinary differential equations. Not open to students with credit in CSCI 512.

Credits: 3.00

CSCI 43200 - Security In Computing

Credit Hours: 3.00. An introduction to computing security to include Cryptography; Identity and authentication; Software security; Operating system security; Trusted operating system design and evaluation; Network threats and defenses; Security management; legal aspects of security; Privacy and ethics.

Learning Outcomes: 1. Learn about cryptography, identity, and authentication. 2. Identify different types of software security, operating system security, trusted operating system design. 3. Discuss the legal aspects of security, privacy, and ethics. Credits: 3.00

CSCI 44300 - Database Systems

Credit Hours: 3.00. Relational database systems: architecture, theory, and application. Relational data structure, integrity rules, mathematical description, data manipulation. Standard SQL and its data manipulation language, engineering aspects of database design in industry, introduction to non-relational database systems.

Credits: 3.00

CSCI 44800 - Biometric Computing

Credit Hours: 3.00. Biometrics is capturing and using physiological or behavioral characteristics for personal identification. It is set to become the successor to the PIN. This course will introduce computational methods for the implementation of various biometric technologies including face and voice recognition, finger print and iris identification, and DNA matching.

Learning Outcomes: 1. Learn behavioral characteristics for biometric identification. 2. Discuss biometric traits and theories. 3. Implement real-world biometric technologies.

Credits: 3.00

CSCI 45000 - Principles Of Software Engineering

Credit Hours: 3.00. Tools and techniques used in software development. Lifecycle concepts applied to program specification, development, and maintenance. Topics include overall design principles in software development; the use of structured programming techniques in writing large programs; formal methods of program verification; techniques and software tools for program testing, maintenance, and documentation.

Credits: 3.00

CSCI 48400 - Theory Of Computation

Credit Hours: 3.00. Introduction to formal languages and automata theory; finite automata, regular expressions, regular languages, context-free languages and pushdown automata, context sensitive languages, Turing machines, undecidability, P and NP. Design and analysis techniques for divide-and-conquer algorithms, greedy algorithms, dynamic programing, amortized analysis.

Credits: 3.00

CSCI 48900 - Data Science

Credit Hours: 3.00. The course will cover data manipulation, analysis, and visualization. Statistical modeling, dimension reduction and techniques of supervised and unsupervised learning. Introduction to software technologies used in data science and applications in science, government and industry.

Learning Outcomes: 1. Understand and describe various aspects of machine learning, statistics and soft engineering skills used in industrial and academic data science. 2. Demonstrate and apply knowledge through class competitions, blog assignment and a final project. 3. Communicate data analyses effectively through written reporting and oral presentations. Credits: 3.00

CSCI 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields.

Credits: 1.00 to 5.00

CSCI 49500 - Explorations In Applied Computing

Credit Hours: 1.00 to 6.00. Explorations in Applied Computing is an undergraduate capstone experience. Students will work in teams, advised by faculty and external liaisons, to solve real-world computing problems. This hands-on experience will cultivate technical expertise, utilization of analytical thinking, quantitative reasoning, project management skills, and communication skills.

Credits: 1.00 to 6.00

CSCI 49600 - Computer Science Internship Capstone

Credit Hours: 3.00. A professional experience providing students the opportunity to incorporate material learned in CSCI coursework in a supervised internship position. The approved internship position will cultivate technical expertise, utilization of analytical thinking, quantitative reasoning, project management skills, and communication skills.

Credits: 3.00

Construction Engineering and Management

CEM 18000 - Construction Engineering Pre-Professional Development

Credit Hours: 1.00. Online course consisting of 8 sessions and 1 module (10 hour OSHA training) is intended to be completed before the student's first work session (internship) in order to prepare the student in the form of oral and written communication that will assist them in being successful in their experiential learning opportunities within industry. This course will also introduce the students to the construction industry relative to office and field requirements and introduce the student to professional skills that will be needed for their experiential learning opportunities including but not limited to: verbiage and acronyms, tools, software platforms, and general business etiquette and ethics.

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an understanding of professional and ethical responsibility. 3. Demonstrate ability to

communicate effectively. 4. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 6. Demonstrate knowledge of contemporary issues. Credits: 1.00

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

CEM 28000 - Construction Engineering Professional Development I

Credit Hours: 1.00. This course will prepare the student for professional practice in construction engineering including information on careers and issues in construction industries; History and Culture of the U.S. Construction Industry; Engineering Ethics and Preparation for Leadership. Information and assistance is also provided related to minors and selections associated with the plan of study; student's organizations; opportunities for construction research and community outreach at Purdue. Guest speakers with be utilized to enhance the experience. The guest speakers include industry partners as well as faculty and staff. There will be an emphasis on written and oral communication.

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to function on multidisciplinary teams. 4. Demonstrate an ability to identify, formulate, and solve engineering problems. 5. Demonstrate an understanding of professional and ethical responsibility. 6. Demonstrate ability to communicate effectively. 7. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 8. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 9. Demonstrate knowledge of contemporary issues. 10. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

CEM 29100 - Construction Internship II

Credit Hours: 0.00. Second of three internship periods and a continuation of that described. Typically, experience emphasizes the office-based activities of the sponsor.

Credits: 0.00

CEM 29199 - Experiential Learning Session I

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating

a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 29299 - Experiential Learning Session II

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to

ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 29700 - Experimental Course

Credit Hours: 1.00 to 6.00. This course is required to assist in the development and testing of new courses for either residential or online delivery. Initially, there may be more residential courses than online due to faculty availability and/or workload.

Learning Outcomes: 1. Introduce students to essential elements of engineering theories, practices, and applications in the field of construction engineering. Courses may address two or more ABET outcomes. 2. Able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. 3. Able to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 4. Able to communicate effectively with a range of audiences. 5. Able to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 6. Able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 7. Able to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. 8. Able to acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00 to 6.00

CEM 30100 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. This course continues an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed facilities. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Able to

design a process to meet desired needs within realistic constraints. Credits: 3.00

CEM 32100 - Construction Engineering Materials Lab

Credit Hours: 1.00. The nature and performance of materials under load stress. Important engineering materials for evaluation of physical and mechanical properties include ferrous and nonferrous metals, plastics, bituminous materials, Portland cement, aggregates, concrete, timber, and particulate systems.

Learning Outcomes: 1. Evaluate the behavior and properties of engineering materials. 2. Assess the nature and performance of materials under load: Theory vs. Reality. 3. Facilitate the understanding of the strength and weakness of major construction engineering materials and their application. 4. Design and conduct experiments, and analyze and interpret data. Credits: 1.00

CEM 32400 - Human Resource Management In Construction

Credit Hours: 3.00. Introduce a broad set of fundamental topics regarding management of people in engineering and construction organizations in the U.S. Subjects include labor-management relations (laws, regulations and practices affecting construction workers and organizations); worker motivation, productivity, and training; roles and practices of managers; construction safety; management of quality.

Learning Outcomes: 1. Understand managerial aspects of the engineering and construction industry. 2. Know the background and the principal laws and practices concerning labor-management relations for the union and nonunion jobs. 3. Know current management practices involving worker supply and demand, workforce training, EEO and workforce diversity, professional ethics and construction safety. 4. Gain basic knowledge to help you become an effective manager in engineering and construction organizations. 5. Enhance communication skills. Credits: 3.00

CEM 35100 - Foundations Of Architectural Design (UCC: HUM)

Credit Hours: 3.00. Contemporary humans spend most of our time directly engaging with architecture; it is the context in which we live our lives. This course introduces the demands ('tasks') and methods ('tools') inherent to the practice of architectural design. In other words, the problems architects address through design and the ways in which they do so. These two sets of topics are presented in tandem through historical and contemporary examples, along with selected case-studies and readings. Success in the course will provide a foundation for richly experiencing, critically assessing, and productively engaging the development of our built environment.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify features exhibiting distinct qualities (historical, cultural, technical, etc.) in built examples. 2. Explain how an architectural design may have developed as it did. 3. Demonstrate how ideas from one source can be applied to the analysis of another. 4. Distinguish how a case study example exhibits specific traits. Credits: 3.00

CEM 38000 - Construction Engineering Professional Development II

Credit Hours: 1.00. This course will build upon the topics discussed in CEM 28000 to further prepare students for their work in the construction industry. A focus of this class will be on presentation skills. By utilizing the first or last hour of CEM 42500 - Construction Practice Project, the students of CEM 38000 will have the opportunity to present and also participate as an audience and active participant in CEM 42500 Construction Practice Project. The presentations of CEM 38000 will consist of their required Summer Internship Reports, which are a compilation of the work they have completed and skills they have learned in their first two internships (CEM 19100 and CEM 29100).

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to identify, formulate, and solve engineering problems. 4. Demonstrate an understanding of professional and ethical responsibility. 5. Demonstrate an ability to communicate effectively. 6. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and

societal context. 7. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 8. Demonstrate knowledge of contemporary issues. Credits: 1.00

CEM 39100 - Construction Internship III

Credit Hours: 0.00. Third, and last, of required internships. It typically emphasizes the project management activities of the sponsor. Actual assignments to a student may vary from sponsor to sponsor.

Credits: 0.00

CEM 39399 - Experiential Learning Session III

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in Construction Engineering and Management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CEM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in Construction Engineering and Management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CEM 39700 - Experimental Course

Credit Hours: 1.00 to 6.00. This course is required to assist in the development and testing of new courses for either residential or online delivery. Initially, there may be more residential courses than online due to faculty availability and/or workload.

Learning Outcomes: 1. Introduce students to essential elements of engineering theories, practices, and applications in the field of construction engineering. Courses may address two or more ABET outcomes. 2. Able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics. 3. Able to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 4. Able to communicate effectively with a range of audiences. 5. Able to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 6. Able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 7. Able to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. 8. Able to acquire and apply knowledge as needed using appropriate learning strategies. Credits: 1.00 to 6.00

CEM 40100 - Critical Thinking In Construction Engineering

Credit Hours: 3.00. This course introduces the concepts of critical thinking and why acting in our 'comfort zone' can result in discomfort. Students will explore a number of simulated and actual problems that challenge understanding of the situation and require additional investigation or analysis. Problems will cover the entire building life-cycle from development of a project plan, through design, project risk analysis for bidding, controlling the project, project recovery, and project handover. Guest speakers will present examples of projects where critical thinking was applied to resolve project issues or avoid a significant error.

Learning Outcomes: 1. Understand the complex nature of construction through the schematic nature of design and the physical realities of construction sequences and processes. 2. Explore different approaches to accomplishing the same goal. 3. Learn from several case studies where solutions may appear obvious but where the better solution is less obvious. Professional writing and presentation skills are required. 4. Evaluate a specific construction case in depth and report on their findings and recommended approach. Credits: 3.00

CEM 42501 - Construction Engineering Capstone I

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students

use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design. Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and in construction internships.

Learning Outcomes: 1. Know phases and aspects of construction project planning, engineering, and management at the project level. 2. Know complexities and uncertainties of planning and decision-making in a realistic environment. 3. Know how construction activities by the constructor are influenced by owner needs and project design basis and features. 4. Demonstrate methods and skills of oral and written communication. 5. Demonstrate methods, techniques and experience of working in teams. Credits: 2.00

CEM 42502 - Construction Engineering Capstone II

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design. Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and in construction internships.

Learning Outcomes: 1. Able to read a contract and determine the scope of work to be provided and under what terms. 2. Able to assemble a schematic design and design development set of plans & specifications representative of the schedule and budget. 3. Able to create appropriate types of schedules based on work composition using various scheduling programs. 4. Able to select the appropriate equipment, labor resources, and materials including temporary structure to perform the work. 5. Able to develop an estimate and budget based on plans and specifications. Credits: 2.00

CEM 43100 - Introduction To Facility Engineering And Management

Credit Hours: 3.00. This course introduces students to the field of facility engineering and management, the operation of constructed facilities to ensure efficient operation, meet stakeholder needs, and preserve the facility for its intended life. The course is a technical elective for Construction Engineering and Management students who are familiar with the delivery of capital construction projects and provides an owner/operator perspective of capital construction and ongoing operations. The course focuses on the different capital construction types (buildings, roads, bridges, tunnels, water treatment facilities, and industrial facilities). Guest speakers will be used to present the challenges specific to individual facility types. Methods and tools to develop the needed management and annual operational plans for facilities will be used. Case studies will be used to demonstrate the application of methods and tools.

Learning Outcomes: 1. Understand what is required to operate and manage a constructed facility. 2. Describe what resources are needed to operate and manage facilities of different types. 3. Examine the needs of individual facility types to ensure successful operation. 4. Analyze a facility to determine what is required for planning purposes. Credits: 3.00

CEM 45100 - Integrative Building Design

Credit Hours: 3.00. This course introduces the architectural and constructive challenges of comprehensive, integrated building design. In lectures, the range of constituent systems (active and passive) that combine to produce contemporary buildings will be presented with particular attention to the specific parameters and metrics that drive their functionality and performance. The central project is an extended exercise in design modeling: applying iterative refinements to introduce additional layers of systemic complexity and to respond to specific analytical measures of building performance. Success in this course will support the ability to productively contribute to building and construction projects from a variety of specific roles.

Learning Outcomes: 1. Understand building systems fundamentals. 2. Apply knowledge of building systems to a model case. 3. Compare the outcomes of different design/system application choices. 4. Develop a design solution based on a range of input parameters. 5. Communicate project outcomes clearly and effectively. Credits: 3.00

CEM 45500 - Temporary Structures In

Construction

Credit Hours: 3.00. This course will cover the design and construction of various temporary structures and systems used in building and transportation construction. The course describes not only design issues of temporary structures such as formwork, falsework, bracing, earth retention systems, scaffolding, cofferdams, and so forth by providing lectures and design examples, but it also covers business aspects associated with the design and construction of temporary structures in the real world such as business practice, legal aspects, and design philosophy.

Learning Outcomes: 1. Develop an understanding of design and performance of various systems. 2. Develop an understanding of the importance and value of these systems and the responsibilities that will be carried into a professional career. Credits: 3.00

CEM 45600 - Design-Build Project Delivery Method For Engineers

Credit Hours: 3.00. This course presents traditional project delivery methods and contrasts them with design-build project delivery. The course focuses on the principles, tools, and procedures used in the design-build project delivery method. It provides students with sufficient education to become certified (following additional examination) by the Design Build Institute of America as an Associate Member and dependent on employment experience, a full Member. Traditional project delivery methods, Design-Bid-Build, Construction Manager as Agent, 'Fast Track', and other 'rip and read' methods are losing popularity to project delivery methods that take a more collaborative approach. Collaboration requires a different way of thinking about a capital construction project and working with others in project delivery. Constructors must move from a transactional, arms-length relationship where the project is viewed as a low-price commodity to a full-suite delivery of services resulting in a high-value product. This requires collaboration with the Owner and other members of the project delivery process, something that has been missing from traditional project delivery methods. Active student participation is required. Student participation will be facilitated through assigned presentations, in-class projects, field trips to local projects, and guest lectures. Students who complete the course and achieve DBIA's minimum requirements (Fundamentals of Project Delivery, Principles of Design-Building Project Delivery, Post Award, and Contracts & Risk Management) will be eligible for recognition by DBIA.

Credits: 3.00

CEM 45700 - Inland Navigation Engineering

Credit Hours: 3.00. This course teaches detailed elements of Inland Navigation Structures, primarily in the United States. Students will become familiar with how waterways are conceived, planned, designed and constructed. Engineering Design Manuals for Locks and Dams will be reviewed. A primary focus will be on a new Corps of Engineers Lock and Dam currently under construction. The students will thoroughly review the Plans and Specifications as well as Construction Photos and Videos taken during construction. Various marine construction equipment and techniques will be presented.

Learning Outcomes: 1. Describe the attributes of all major project delivery methods, procurement methodologies, and contracting approaches. 2. Identify the appropriate project delivery method based on owner requirements. 3. Evaluate the attributes of design-build project delivery. 4. Assess the critical elements of the request for qualifications/request for proposals (RFQ/RFP) process and overall project management for design-build projects. 5. Understand the risk management and contract implications of a design-build project versus other project delivery methods. 6. Apply the attributes learned in this course to case studies. 7. Be prepared to be a meaningful participant on a real design-build project. Credits: 3.00

CEM 48500 - Legal Aspects Of Construction Engineering

Credit Hours: 3.00. This course will cover legal principles and landmark cases relevant to civil and construction engineering. Specific subjects covered include contracts, torts, agency, professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties and ethics.

Learning Outcomes: 1. Read, comprehend and interpret construction contract plans and specifications for lock and dam facilities and other inland navigation structures. Through detailed study of project plans and specs as well as construction photos, students will be taken through the process of building these facilities from planning through construction. 2. Understand how a lock and dam facility functions. 3. Identify various components of lock and dam structures. 4. Understand various types of marine equipment necessary to construct a navigation facility in the dry or wet. Credits: 3.00

CEM 49700 - Construction Engineering Projects

Credit Hours: 0.00 to 4.00. Topics vary. Permission of

department required.

Credits: 0.00 to 4.00

CEM 50100 - Leadership And Advanced Project Management

Credit Hours: 3.00. This course will focus on the first ten years of the student's professional career. It will introduce concepts relating to development of the leader-manager, advanced project management techniques that will assist the student towards success in the construction industry, and developing a business plan on starting a small engineering or construction company. Guest speakers provide learning from entrepreneurs who got their start utilizing the systems taught in the course.

Learning Outcomes: 1. Recognize the importance of their personal values, attitudes, and communication skills in developing the leader-manager within. 2. Understand that modern leadership is "Taking people from where they are to where they have never been" and that "Leaders build leaders". 3. Work within a team atmosphere and understand conflict management. 4. Develop their planning skills with specific focus on Lean Construction and story boarding & resource leveling techniques. 5. Understand the importance and impact that marketing and relationship development can have on the individual construction company's success and survival. 6. Expand their financial and cash management skills, including real estate development. 7. Develop business plans for an emerging engineering or construction business. Credits: 3.00

CEM 53100 - Facilities Engineering And Management

Credit Hours: 3.00. This course provides the student with an understanding of the issues related to facilities management for owner organizations. The course is oriented toward upper class and graduate students familiar with the delivery of capital construction projects and provides an owner's perspective of capital construction and ongoing operation. The course will focus on the total life-cycle cost of a capital construction project beginning with planning, business rationale, economic analysis, and programmatic specifications. The owner's perspective on annual operating costs will be examined including calculation of daily, weekly, monthly, and annual operating costs. The implications of stewardship and customer service will be reviewed and analyzed including the implications on total life-cycle costs. The human resources implications of operating a facility will be reviewed including determination of staffing requirements to meet various levels of service as well as tools and techniques to determine and manage contracted services. Numerous case studies will be described and discussed which will demonstrate the importance of careful planning and budgeting of annual and periodic maintenance. Issues of sustainability, regulations, and other legal factors will be discussed and examined.

Learning Outcomes: 1. Gain an understanding of the cost implications associated with the decision to construct a new facility via a total cost of ownership perspective as well as understanding the service delivery expectations. 2. Learn methods for formulating and analyzing costs of operations including capital renewal. 3. Learn concepts of management of facilities (institutional, commercial, residential, and manufacturing). 4. Learn external factors related to owning and/or operating facilities of various sizes. 5. Learn prioritization, stewardship, management and decision making for capital projects. Credits: 3.00

CEM 53200 - Infrastructure Planning

Credit Hours: 3.00. This course provides the student with an in depth understanding of the issues related to infrastructure planning, engineering, and economics. The focus will be on the prioritization, stewardship, management and decision-making roles within the engineering division of a large public works agency. Various infrastructure planning concepts will be reviewed and discussed. Numerous case studies will be described and discussed, which will demonstrate that in order to plan and implement a successful public works project, many controversial issues must be faced and difficult problems must be solved. Decision-making at agency and other levels of government will be discussed with respect to reports prepared by planners covering engineering feasibility, environmental and social impact assessments, and financial and economic analyses. Evolving modern planning issues will be introduced and discussed, including sustainability; environmental economics; environmental justice; uncertainty and risk-benefit analysis; partnerships with private entities versus total privatization; and the optimum staff-mix utilization in-house versus outsourcing.

Learning Outcomes: 1. Learn methods for formulating and analyzing infrastructure projects. 2. Learn concepts of management of public works planning and implementation. 3. Learn principal methodologies of the interdisciplinary analyses of infrastructure

projects. 4. Learn prioritization, stewardship, management and decision making for public works projects. Credits: 3.00

CEM 53300 - Infrastructure Analytics

Credit Hours: 3.00. This course investigates the data sources and numerical tools required to assess the status of constructed facilities and to make informed decisions from the data. The course is oriented toward upper class and graduate students familiar with the delivery of capital construction projects (buildings, roads, bridges, earthworks, utilities, rail/transit, ports, and canals) and includes numerical analysis techniques. The course will focus on data sources, either direct or indirect, and analysis methods to identify the current condition or project future conditions of built infrastructure. Course format will be highly interactive with discussion about recent infrastructure projects in both instructor, guest speaker, and student-led discussions. Issues of sustainability, regulations, and other factors will be discussed and examined.

Learning Outcomes: 1. Learn Identification of metrics for analysis. 2. Learn data gathering techniques and tools. 3. Learn management of infrastructure data. 4. Learn techniques to resolve missing or non-existent data. 5. Learn numerical methods, limitations and accuracy. Credits: 3.00

CEM 58500 - Temporary Structures

Credit Hours: 1.00. This class will provide construction and design professionals the skills to understand construction loads and their combinations, wind loads and their impacts, timber design, bracing and guying design, designing vertical forming systems, and shoring analysis for vertical construction.

Learning Outcomes: 1. Know the possible types and magnitudes of loads experienced by temporary structures. 2. Design bracing and guying systems needed and used in vertical construction. 3. Design vertical forming systems. 4. Design vertical shoring systems. 5. Coordinate construction interfaces with design. Credits: 1.00

CEM 58600 - Development Of Underground Space

Credit Hours: 3.00. This course has been designed to support students with civil engineering and construction engineering and management background. New underground construction projects are planned all over the world, and the course equips students to contribute to these exciting developments. This course includes an overview of the application for tunneling and underground space as well as construction methods. The course will cover various sizes of underground opening from small diameters built by micro-tunneling to common tunnels used in civil and mining applications to large caverns, often found in different end uses such as storage or hydropower construction.

Learning Outcomes: 1. Critique concepts for the future use of underground space and innovative methods of construction. 2. Describe and classify underground works according to type, use and construction methods. 3. Recognize the diversity and complexity of underground excavations and associated works. 4. Improve oral and written communication skills, including effective presentation. Credits: 3.00

CEM 58700 - Underground Infrastructure Asset Management

Credit Hours: 3.00. Most of the U.S. water and wastewater conveyance infrastructure was installed during the first half of the 20th century and is coming to an end of its useful life. "Out of sight, out of mind" describes the awareness and significance that has been placed on these underground lifeline systems which support societies' quality of life, public health, economic development and living standard. Historically, management of these systems has been described as "crises management." They only get attention when there is a failure. It has been determined that a reactive management approach is not sustainable. The Environmental Protection Agency (EPA) has been instrumental in assisting utilities transition from reactive management practices to proactive practices. This approach involves the principles and practices of Asset Management (AM). AM is a comprehensive approach which involves every aspect of the organization to develop and implement best business practices to address: (a) the current state of the assets, (b) levels of service, (c) critical assets, (d) life-cycle costing, and (e) funding. This course prepares students to utilize sound engineering judgment and principles for managing the construction, repair, rehabilitation, and maintenance of buried infrastructure systems including pipes, tunnels, chambers, etc.

Learning Outcomes: 1. Understand how utilities (owners of underground infrastructure) are organized and operate. 2. Understand rates of deterioration, failure mechanisms, evaluation/inspection technologies, rehabilitation and repair methods of the buried infrastructure systems including pipes, tunnels, and chambers. 3. Develop strategic, tactical and operational plans to achieve the mission and objectives for developing and implementing

asset management programs for buried infrastructure. 4. Improve oral and written communication skills, including effective presentation. Credits: 3.00

CEM 59700 - Experimental Masters Course

Credit Hours: 1.00 to 3.00. This course will allow CEM to develop and test new courses for graduate level delivery. Possible courses include: Robotics in Construction; Tunneling; Process Plant Construction; Waterway Engineering; Construction Visualization; Remote Monitoring and Inspection; Cost/Benefits of Planning Details; Heavy Construction Innovation; Site Pollutant Reduction & Control; Statistical Methods in Construction; Infrastructure Decay Mechanisms; Time Buffers and Task Durations; BIM Tools and Applications; Sustainable Construction Methods; Construction Operations & Productivity; Construction Accounting; and Construction Leadership.

Learning Outcomes: 1. Varies with each course however, the goal will be to provide either high-demand subject matter or to tailor courses to a manageable size. Credits: 1.00 to 3.00

Construction Management

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

CM 15000 - Construction Management Fundamentals

Credit Hours: 6.00. This introductory course focuses on construction materials, methods, and contracts for basic commercial and residential projects. Students will develop essential skills in quantity estimating, construction plan reading, and project documentation. Students will participate in hands-on lab exercises that aim to connect theory with practice. The course includes OSHA 10-hour instruction, with students earning OSHA 10-hour certification cards upon completion, further emphasizing the importance of safety in construction practices.

Learning Outcomes: 1. Identify materials, means, and methods for a construction project throughout the entire project lifecycle. 2. Recognize project controls required during the pre-construction and construction phases of a construction project. 3. Explain project planning tasks relevant to a construction project. 4. Comprehend project administration on a construction project and the required documentation and technology available within the current construction industry. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 16000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Learning Outcomes: 1. Understand fundamentals of surveying including the theory and practice of surveying. 2. Perform surveying computations of grade, direction, traverse adjustment, area, and horizontal and vertical curve geometry. 3. Perform field measurements using basic and modern surveying equipment. 4. Perform tasks within a group effectively and efficiently. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

CM 20002 - Intermediate Pre-Construction Management

Credit Hours: 4.00. A project course covering intermediate level commercial, residential, heavy/civil, and industrial construction projects. Students will expand their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Calculate design components of a construction project during the pre-construction phase. 2. Produce project controls required during the pre-construction phase of a construction project. 3. Construct pre-planning documents relevant to beginning a construction project. 4. Apply project administration to a construction project utilizing the required documentation and technology available within the current construction industry. Credits: 4.00

CM 21500 - Mechanical Construction

Credit Hours: 3.00. Principles of code, design, methods, and materials are applied to plumbing, heating, ventilation, and air conditioning systems for buildings. The comprehension of mechanical construction plans and specifications is emphasized through exercises in mechanical estimating.

Learning Outcomes: 1. Relate materials, means, & methods for the MEP scope to a construction project throughout the project lifecycle. Prepare a list of CSI Divisions for the MEP scope and outline the MEP scope of work for a construction project; Propose sustainability concepts to the materials, means, and methods for the MEP scope of a construction project; Schedule work sequence for the MEP scope of construction phases of a project; Apply QA/QC documents and procedures required for the MEP scope during the construction phase. 2. Apply company management concepts to the MEP scope of a construction project during the construction phase. Create financial management plan required to complete the MEP scope of a construction project; Demonstrate interpersonal relations related to the MEP scope on a construction project; Integrating technology use on the MEP scope of a construction project during the construction phase. 3. Show professionalism by applying proper communication, team work, rules & regulations, and level of detail required within a construction company and on a construction jobsite. Demonstrate leadership skills within a team-based project; Utilize management skills required to complete tasks within a construction project; Practice teamwork utilizing the strengths of the individuals within the team; Apply oral and written communication skill

required within a construction project; Use ethics in all decision making and daily activities in a construction project. Credits: 3.00

CM 21601 - Electrical Construction

Credit Hours: 2.00. Principles of code and basic concepts in electrical theory, materials, methods, design and estimating are applied to electrical systems for buildings. Comprehension of electrical construction plans and specifications as well as installation exercises are emphasized through lab experiences.

Learning Outcomes: 1. Demonstrate thorough knowledge of all documents normally used in the electrical construction process including plans and specifications. 2. Recognize the applications of commonly used types of electrical materials required in building construction. 3. Interpret and evaluate materials selection, installation methods, and proper sizing and installation techniques using the National Electrical Code. 4. Illustrate the ability to effectively interact with building construction professionals regarding electrical construction. 5. Recall the names, nicknames, applications and rules for commonly used materials in the electrical contracting industry. 6. Construct proper electrical systems schematics. 7. Assemble the correct components and arrange them correctly to demonstrate basic electrical circuit knowledge. 8. Inspect electrical installations and identify rudimentary National Electrical Code violations. Credits: 2.00

CM 23301 - Mechanical, Electrical And Piping Systems In The Built Environment

Credit Hours: 3.00. An introductory course dealing with construction materials and methods related to building systems, focusing on mechanical, electrical, and piping (MEP) systems. Students will acquire fundamental skills in MEP construction plan reading, quantity estimating, basic systems' design and construction execution through lectures, laboratories and integrated project team exercises.

Learning Outcomes: 1. Recognize the basic principles and components of mechanical, electrical and piping (MEP) systems. 2. Explain the components of a given MEP system based on reading plan and specifications information. 3. Demonstrate the ability to understand conceptual cost and schedule of MEP systems. 4. Trace basic MEP systems lines, such as piping, lighting, and mechanical ducts. 5. Show an understanding of professionalism by applying proper communication, teamwork, rules & regulations, and level of detail required within a built environment business and on a construction jobsite. Credits: 3.00

CM 26000 - BIM I: Arch Modeling & Presentation Development

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers (IVCM) with essential skills in Building Information Modeling (BIM) for architectural design and marketing. Students will learn to create detailed, accurate 3D models and immersive visualizations that enhance construction workflows and serve as powerful marketing tools. By integrating BIM with project management, students will gain the technical and creative skills needed to transform complex construction data into persuasive visual content for clients and stakeholders.

Learning Outcomes: 1. Create accurate and detailed architectural Building Information Models, integrating design intent and construction data, while coordinating with other disciplines. 2. Demonstrate proficiency in creating high-quality visualizations, including renderings, animations, and walkthroughs, to develop professional presentations that clearly and persuasively communicate design concepts, project details, and potential construction impacts to stakeholders and clients. 3. Incorporate project management data, such as material quantities, cost estimates, and timelines, into models, preparing students for decision-making roles in construction management. 4. Develop the ability to manage BIM models throughout the project lifecycle, ensuring accuracy, version control, and alignment with evolving project objectives, while preparing professional-grade presentations tailored to client needs. Credits: 3.00

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems

conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

CM 27000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Learning Outcomes: 1. Analyze force systems acting at a single point. 2. Analyze force systems that are non-concurrent. 3. Analyze/design cable systems. 4. Analyze/design trusses by graphical and numerical methods. 5. Analyze/design pinned frames. 6. Analyze/design 3-hinged arches. 7. Trace the live and dead loads throughout a building structure. Credits: 3.00

CM 30002 - Advanced Pre-Construction Management

Credit Hours: 4.00. A project course covering advanced level commercial, residential, heavy/civil, and industrial construction projects. Students will further develop their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Select design systems for a construction project during the pre-construction phase. 2. Illustrate project controls required during the pre-construction phase of a construction project. 3. Analyze pre-planning tasks relevant to beginning a construction project. 4. Differentiate project administration on a construction project utilizing the required documentation and technology available within the current construction industry. 5. Demonstrate professionalism by analyzing proper communication, teamwork, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 4.00

CM 30101 - Introduction To Construction Company Financial Management

Credit Hours: 2.00. An introduction to methods for recognizing revenue for long-term construction contracts and each method's impact on financial statements. Includes introduction to analysis of financial statements and their use in developing company budgets, projecting cash needs, pricing construction projects, and forecasting the impact of business decisions on construction company profit.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction contractor. 2. Identify the unique accounts required for percentage of completion revenue recognition, describe what the account represents, and indicate on which statement the account is found. 3. Interpret the outcomes of line-item analysis, vertical analysis, horizontal analysis, and cost-volume-profit analysis utilizing construction company financial statement data. 4. Perform a profit center analysis of an income statement. 5. Prepare an annual budget for a construction company given source documents. 6. Analyze the impact of various decisions on company profits by applying the cost-volume-profit financial analysis technique. 7. Select the appropriate overhead and profit allocation technique given example company cost structures and compute minimum company overhead and profit mark-up rates. 8. Prepare a monthly company budget given the annual budget and other appropriate information. 9. Compare the monthly budget prepared to actual data. 10. Compare and contrast profit and cash flow for the construction company. 11. Prepare

a cash flow projection by applying the company monthly budget. Credits: 2.00

CM 31000 - Equipment And Field Operations

Credit Hours: 3.00. Study of heavy equipment used in construction operations with an emphasis on equipment selection, application, cost, productivity, safety, and economics.

Learning Outcomes: 1. Understand each of the construction equipment functions and applications for construction operations. 2. Use the technique and method presented in class to: analyze ownership and operating costs; analyze earthwork volume, mass diagram, and hauling distance; analyze compaction operations; analyze power requirements; analyze dozer operation; analyze scraper operation; analyze excavator operation; analyze hauling operation; understand asphalt mix production and placement; understand concrete and concrete equipment operation; understand crane operation. Credits: 3.00

CM 31500 - Applied Construction Practice I

Credit Hours: 3.00. This course provides a supervised pre-professional learning experience, enabling students to apply their skills and knowledge while gaining practical, on-the-job training. It's designed to offer students an exciting hands-on progressive learning experience while helping employers shape and prepare their future workforce. Students are required to maintain full-time documented employment with an approved employer for the duration of the course. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficient use of construction management skills and concepts to successfully perform duties as assigned by direct supervisor. 2. Work cooperatively as a team member on construction projects. 3. Demonstrate oral and written communication skills to facilitate project delivery. 4. Demonstrate professionalism. 5. Develop independent planning and organizational skills. Credits: 3.00

CM 32500 - Applied Construction Practice II

Credit Hours: 3.00. This course provides a supervised pre-professional learning experience, enabling students to apply their skills and knowledge while gaining practical, on-the-job training. It's designed to offer students an exciting hands-on progressive learning experience while helping employers shape and prepare their future workforce. Students are required to maintain full-time documented employment with an approved employer for the duration of the course.

Learning Outcomes: 1. Demonstrate proficient use of construction management skills and concepts to successfully perform duties as assigned by direct supervisor. 2. Work cooperatively as a team member on construction projects. 3. Demonstrate oral and written communication skills to facilitate project delivery. 4. Demonstrate professionalism. 5. Develop independent planning and organizational skills. Credits: 3.00

CM 33000 - Design And Construction I

Credit Hours: 6.00. A course which introduces students to projects and the design information of the built environment as communication tools representing space and proportion. Through a blend of lectures and studio work, students obtain working knowledge of the traditions, documents and standards utilized in the planning for a built structure. Students will also experience how design decisions and programing are influenced by a multitude of outside influences.

Learning Outcomes: 1. Develop basic projects, sketches and pre-projects related to the built environment using appropriate design conventions. 2. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics and technical demands into consideration at the same time. 3. Analyze relevant precedents in order to make informed design choices. 4. Explain the feasibility analysis, supervision and coordination of integrated projects. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

CM 33100 - Design And Construction II

Credit Hours: 6.00. A course where students exert criticism and evaluation of existing design through a blend of lectures and studio work. Students will be exposed to typical impediments to the design of the built environment as they demonstrate integrative decision making in creating an aesthetic and functional design program that meet the needs of society in a resource efficient and sustainable manner. Students will

regularly critique the work of others and have their work critiqued as they seek to shape and implement informed design decisions.

Learning Outcomes: 1. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics, cost, schedule, safety and technical demands into consideration at the same time. 2. Identify sustainability, efficiencies and resource conservation principles to be applied in the built environment. 3. Elaborate sketches, two-dimension drawings or three-dimension models using standard design conventions to aid in the design and construction coordination. 4. Demonstrate the skills associated with making integrated decisions across multiple systems and variables in the completion of a design project. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

CM 33200 - Architectural Design, Construction Techniques And Society

Credit Hours: 3.00. A course in which students will be exposed to the evolution of architecture and building techniques that influenced the western built environment. Emphasis will be given to the use of appropriate vocabulary and also how social and cultural factors have influenced the design of the built environment throughout the centuries. The course will survey topics from XVII century to recent times.

Learning Outcomes: 1. Recognize architectural and technical traditions of the Western culture. 2. Identify relationships between cultural patterns and social responsibilities of designers. 3. Recognize ways that history or related arts, humanities and technologies influence the built environment. 4. Use appropriate architectural and technical vocabulary. Credits: 3.00

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-making throughout the project lifecycle. Credits: 3.00

CM 36200 - Construction Competition

Credit Hours: 2.00. This is a multi-disciplinary course where students from several majors work together as a team, developing a proposal for a construction of development project, which is presented at a student competition. Topics include a variety of project types, including land development, design/build, residential, commercial and heavy highway. Permission of instructor required.

Learning Outcomes: 1. Write competition required documents and/or presentation. 2. Collaborate successfully in groups. 3. Demonstrate professional communication towards stakeholders involved in the competition they participate (team mates, competition organizers and/or instructors). Credits: 2.00

CM 36400 - Jobsite Management

Credit Hours: 3.00. Examination of construction project management on the jobsite. Topics include, submittals, record

keeping, jobsite layout, meetings, negotiations, dispute resolution, labor relations, safety, subcontracting, quality, cost control, waste management, changes, claims, progress payments, and project closeout.

Learning Outcomes: 1. Understand and explain the fundamentals of project management. 2. Understand and explain the project team. 3. Understand and explain the use of construction documents on the jobsite. 4. Understand and explain submittals, samples, and shop drawings. 5. Understand and explain documentation and record keeping at the jobsite. 6. Understand and explain meetings, negotiations, and dispute resolution. 7. Understand and explain jobsite labor relations and control. 8. Understand and explain personnel and safety management. 9. Understand and explain subcontracting and purchasing. 10. Understand and explain project quality management. 11. Understand and explain time and cost controls. 12. Understand and explain waste and environmental management and sustainable construction practices. 13. Understand and explain computerized project administration. 14. Understand and explain building information modeling (BIM). 15. Understand and explain changes and claims. 16. Understand and explain progress payments. 17. Understand and explain project closeout. Credits: 3.00

CM 36500 - BIM For Project Managers And Field Supervision

Credit Hours: 2.00. One of the most important components of the construction industry is to visualize the project during its design, construction and over entire life cycle of structure, enabling invested parties to change/adjust the project. A construction project manager' job description is a person who can plan and oversee a construction project from initiation to close with the help of software, technology, resources and a reasonable budget. BIM has delivered a significant impact all aspects and types of AEC projects in terms of economic as well as technical viability. BIM plays a vital role in the management of the project. A project manager can leverage the capability of BIM to deliver a successful construction project and BIM reduces the burden on the project manager of manually calculating and managing tasks. It seems clear that for a construction project to be successful today, project managers would do well to adopt BIM technology. This course is the start that seeks to better understand & address student needs as a on job-site project manager utilizing advanced technologies coupled with Building Information Modeling to produce a form of Building Information Management. It will be given across the multiple disciplines/curricula in anticipation of integrating said new technologies extracted from BIM. Permission of instructor required.

Learning Outcomes: 1. Identify key components of BIM used in Field office. 2. Identify key aspects of LOD (and what trades are most beneficial) needed in BIM for field office operations. 3. Improve Field and Office processes (and communication) utilizing BIM. 4. Facilitate and improve Coordination of discipline models. 5. Introducing the engineering design process in a quick, easy, and visible way. 6. Bridging the physical and digital model within field office. 7. Integrating hands-on experience with technology utilized in field. Credits: 2.00

CM 36800 - Reinforced Concrete And Steel Construction And Design

Credit Hours: 3.00. This course examines the design and behavior of reinforced concrete and steel structures, with a focus on analyzing concrete members under moments, shear, and axial forces. Students will explore the influence of material properties on structural performance and study the design of reinforced concrete components (beams, columns, slabs) and steel members, applying industry codes and standards. The course integrates theoretical, experimental, and practical aspects of structural design, equipping students with the skills to proportion and understand concrete and steel elements for real-world construction management applications.

Learning Outcomes: 1. Explain the influence of material properties (e.g., concrete strength, steel yield stress) on the structural performance and behavior of reinforced concrete and steel elements under different loading conditions. 2. Analyze reinforced concrete and steel structural elements subjected to different types of loads (moment, shear, axial forces) and determine their strength, stability, and serviceability. 3. Assess the effectiveness of design solutions for reinforced concrete and steel structures critically considering factors such as cost,

material selection, and long-term performance. 4. Develop comprehensive structural designs for reinforced concrete and steel members, integrating theoretical principles with practical design constraints to ensure safety, economy, and efficiency. 5. Communicate complex structural design concepts and calculations effectively through technical drawings, reports, and presentations to clients, contractors, and other stakeholders. Credits: 3.00

CM 37000 - Heavy Civil Construction Management

Credit Hours: 3.00. This course will focus on the construction of roads, bridges, and other major transportation-related infrastructure. Topics include construction of concrete pavements, asphalt pavements, deep foundations, and underground utilities. Management of traffic, road construction safety, quality and master planning will also be covered.

Learning Outcomes: 1. Explain terminology and construction requirements for embankments and aggregate bases. 2. Develop a plan for highway construction equipment. 3. Compare the procedures and techniques for construction, rehabilitation, and maintenance of asphalt and concrete pavements. 4. Apply quality control techniques in highway construction. Credits: 3.00

CM 37100 - Industrial Construction Management

Credit Hours: 3.00. This course will focus on the design and construction of industrial systems and processes including Infrastructure for energy, chemical, and water/wastewater systems. Topics studied include piping, welding, heavy lift cranes, and high voltage systems.

Learning Outcomes: 1. Explain the construction procedures for large industrial processes and contracting methods. 2. Calculate forces from heavy crane lifts and multi-crane lifts. 3. Analyze work procedures related to piping, welding, and high voltage electrical installation. Credits: 3.00

CM 37200 - Planning, Design, And Construction Process For The Healthcare Built Environment

Credit Hours: 3.00. This course will focus on the construction of healthcare facilities including hospitals, clinics, nursing homes and laboratories. The course will emphasize the interrelationship of planning, design, and construction.

Learning Outcomes: 1. Identify the key market segments of the healthcare built environment. 2. Classify the unique requirements for healthcare planning, design, and construction. 3. Analyze job opportunities within healthcare for construction management students. Credits: 3.00

CM 37300 - Healthcare Construction Management - Systems, Occupied Space Work, And Related Industries

Credit Hours: 3.00. This course will focus on the construction of healthcare facilities and include topics related to infectious materials control, disruption avoidance, rapid technology changes, emergency routes, and advanced mechanical and electrical systems.

Learning Outcomes: 1. Analyze building systems in healthcare construction. 2. Define the processes required to work within occupied spaces. 3. Identify the related industries in healthcare other than traditional hospitals. Credits: 3.00

CM 37400 - Mechanical And Electrical Construction Management I

Credit Hours: 3.00. This course will focus on the process of analyzing the elements of mechanical, electrical, and plumbing (MEP) construction inherent in producing a MEP construction estimate. Topics include using work product documentation to present and shape the proposal, establishing a conceptual framework of the estimating process, examining commercial/industrial methods and materials, symbol identification, equipment application, and studying the estimating process sequence from project overview to final pricing.

Learning Outcomes: 1. Interpret MEP construction drawings, specifications and bid documents. 2. Describe the estimating process, including the concepts of labor, material, profit, and overhead. 3. Prepare a final bid summary, including quantity takeoff and required pricing. Credits: 3.00

CM 37500 - Mechanical And Electrical Construction Management II

Credit Hours: 3.00. This course will focus on an in-depth investigation of the elements of mechanical, electrical, and plumbing (MEP) construction on real-world projects. The student will be involved in investigating the equipment and

components for the MEP systems and selecting the optimum project delivery method. Estimating will include topics such as solar arrays, EV charging, electrical vehicle charging station projects, smart grids, and energy conservative strategies and equipment. Cost saving strategies will also be examined for MEP system installations utilizing Building Information Modeling (BIM), pre-fabrication, and value engineering.

Learning Outcomes: 1. Interpret MEP construction drawings and specifications at an MEP contractor level of competency. 2. Evaluate the design and provide value engineering options. 3. Explore value engineering methods to reduce labor and material costs and increase profit. 4. Research technology projects to review the latest technology trends in MEP installations. Credits: 3.00

CM 37600 - Residential Construction Management-Green Construction And Sustainability

Credit Hours: 3.00. A study of the best building practices in residential construction, based upon the National Green Building Standard and other national green/sustainable building practices.

Learning Outcomes: 1. Explain the goals of green and sustainable construction guidelines as it pertains to residential structures. 2. Describe the potential benefit of building green for both building professionals and their customers. 3. Explain the relationship between building science and the disciplines of green building and remodeling. 4. Describe different green building programs and incentives for different states. 5. Apply green buildings practices and principles to existing residential construction. Credits: 3.00

CM 37700 - Residential Construction Management Design-Build

Credit Hours: 3.00. A study of the design-build project delivery system for residential construction, including home design fundamentals, construction methods, disability code requirements, building code requirements, and aging-in-place design coupled with best practices of universal design.

Learning Outcomes: 1. Describe concepts relating to universal design-build and aging in place when designing residential construction. 2. Describe specific design solutions for various client requirements including but not limited to ADA, Aging in Place, etc. 3. Identify special considerations for estimating and scheduling a design-build project. 4. Identify considerations and recommendations for executing the job while the client is in residence. 5. Discuss common design-build business challenges and practical tips and tools to overcome them. Credits: 3.00

CM 37800 - Wood And Timber Construction And Design

Credit Hours: 3.00. This course focuses on designing and constructing wood and timber structures, combining historical techniques and modern innovations. Students will study traditional timber framing methods alongside contemporary practices such as cross-laminated timber, glulam beams, and other engineered wood products. The course emphasizes analyzing, designing, and constructing safe, efficient, and sustainable timber structures, preparing students to integrate classic craftsmanship and cutting-edge technologies in construction projects. Practical design assignments and case studies will provide real-world timber construction exposure.

Learning Outcomes: 1. Evaluate the load-bearing capacities of different types of timber materials and structures using appropriate engineering calculations and software tools. 2. Apply principles of timber construction design to determine the most appropriate materials and techniques for specific construction projects based on structural requirements, cost-efficiency, aesthetics, and environmental impact such as resource sustainability, energy use, and lifecycle carbon footprints in timber materials and designs. 3. Analyze case studies of successful timber structures to identify key design principles, safety considerations, and sustainability practices used in their construction. 4. Design innovative timber structures that integrate traditional craftsmanship with modern technologies, ensuring both functionality and aesthetic appeal. 5. Communicate timber construction ideas and designs effectively through clear

technical drawings, reports, and presentations to peers, instructors, and industry professionals. Credits: 3.00

CM 38000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Learning Outcomes: 1. Understand, apply, and analyze fundamentals of geotechnical engineering and construction techniques associated with various types of soil conditions. 2. Conduct various soil lab testing and create lab reports. 3. Use the knowledge of soils and foundation engineering and applications to: create lab reports as written communication; analyze engineering properties of soils; analyze different soil types and field exploration; analyze soil compaction; analyze permeability of water in soils; analyze subsurface stress, consolidation, and shear strength of soil; analyze shallow and deep foundation load, design, and construction; analyze lateral earth pressure and retaining wall structure. Credits: 3.00

CM 38800 - Temporary Structures In Construction

Credit Hours: 3.00. This course provides an in-depth exploration of temporary structures used to support construction operations. Topics include the design, application, and removal or integration of systems such as concrete formwork, scaffolding, shoring, cofferdams, underpinning, slurry walls, and construction dewatering systems. Students will study the technical aspects of these structures, which are either dismantled once permanent works are self-supporting or are incorporated into the finished project. The course emphasizes practical knowledge and safety considerations for the use of temporary structures in the construction industry.

Learning Outcomes: 1. Analyze the potential risks associated with the use of temporary structures and evaluate the effectiveness of safety measures for mitigating these risks. 2. Evaluate different methods for designing and constructing temporary structures, considering factors like material properties, load-bearing capacity, and site conditions. 3. Design a temporary structure for a construction project, incorporating technical specifications, safety considerations, and cost-effectiveness. 4. Demonstrate the ability to integrate temporary structures into a larger construction project, ensuring minimal disruption and maximum safety during the build process. 5. Propose an integrated solution for managing temporary structures throughout a construction project, from design and installation to removal or incorporation into the finished project. Credits: 3.00

CM 40000 - Construction Capstone I

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of pre-construction management into a capstone project.

Learning Outcomes: 1. Design systems for a construction project during the pre-construction phase. 2. Create project controls required during the pre-construction phase of a construction project. 3. Evaluate pre-planning tasks relevant to be beginning a construction project. 4. Generate project administration for a construction project utilizing the required documentation and technology available within the current construction industry. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 43300 - Risk Management And Legal Issues In Design And Construction Integration

Credit Hours: 2.00. An advanced course dealing with risk management and legal issues as they pertain to the interaction of designers, contractors, and owners. Students will learn to identify and mitigate potential risks that may affect the multiple stakeholders and the business organizations they represent during design and construction activity. The course will also deal with trust and teamwork issues within collaborative processes in the built environment.

Learning Outcomes: 1. Identify potential risks

for designers, contractors, and owners in a collaborative construction industry environment. 2. Understand potential trust issues that inhibit collaboration within the architecture, engineering, and construction (AEC) industry. 3. Develop mitigation measures to reduce risk and increase collaboration within architecture, engineering, and construction interactions. 4. Use clear and precise questions and consider diverse points of views when reasoning. 5. Demonstrate ability to gather, assess, record, and compare relevant information in order to support conclusions and related consequences. Credits: 2.00

CM 45000 - Construction Capstone II

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. 4. Design site planning for a construction project throughout the construction lifecycle. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 45001 - Construction Capstone II

Credit Hours: 3.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. Credits: 3.00

CM 45701 - Construction Safety

Credit Hours: 3.00. This course will examine the impact of safety on the construction industry, including in-depth discussions on the application of the Occupational Safety & Health Administration (OSHA) Safety and Health Standards for the construction industry. The emphasis of this course is to provide training for job sited supervisory personnel. This course will also fulfill the requirements for the OSHA 30-Hour Card.

Learning Outcomes: 1. Identify the role of OSHA in the construction industry and examine current issues related to safety. 2. Acquire knowledge of jobsite safety management and company safety risk management. 3. Identify and evaluate jobsite hazards, including abatement strategies and procedures. 4. Complete the requirements for an OSHA 30-hour card in Construction Safety & Health Administration. Credits: 3.00

CM 46000 - BIM IV: Model Creation & Management Utilizing Cloud

Credit Hours: 3.00. This course explores the impact of cloud-based technologies on managing construction projects with Building Information Modeling (BIM), emphasizing remote collaboration and real-time data access. Students will gain hands-on experience with industry-leading platforms like Autodesk Construction Cloud, learning to manage 3D discipline-specific models, coordinate teams, and oversee project workflows from any location. By integrating cloud-based management with BIM, the course prepares students to lead modern, digitally connected construction projects.

Learning Outcomes: 1. Manage construction projects using cloud-based BIM tools, enabling real-time collaboration, data sharing, and communication among group members as well as sponsors. 2. Coordinate multidisciplinary teams remotely, integrating project data from design to construction while ensuring seamless collaboration. 3. Master cloud-based technology to leverage data analytics that optimize construction workflows, which allow them to make informed decisions, and automate project processes for improved efficiency and

reduced risk generating automated reports, and track key metrics such as timelines, budgets, and safety. 4. Apply best practices in data management within cloud-based BIM platforms, ensuring secure storage, version control, and efficient risk management through clash detection and issue resolution. Credits: 3.00

CM 46200 - Applications Of Construction Documentation II

Credit Hours: 3.00. Creating, archiving, integrating, qualifying and utilizing computer-generated, three-dimensional architectural models in a light commercial construction enterprise. Topics include components of MEP, fire protection, blueprint reading and 4D BIM scheduling. Credit cannot be obtained for both CM 36000 and CM 46200.

Learning Outcomes: 1. Learn, decipher, and apply parametric and geometric technologies to AEC problems. 2. Explain where new and emerging software technologies can be applied in the industry. 3. Program database-driven parametric objects for use in various projects. 4. Explain how parametric technologies can benefit the production homebuilder. 5. Develop leadership and life-long learning skills applicable to the construction industry. 6. Incorporate renderings and 3D models into drawing sets for effective communication. 7. Prepare effective marketing materials for residential and commercial industry. Credits: 3.00

CM 46500 - BIM V-Capstone

Credit Hours: 3.00. This capstone course offers an immersive, hands-on experience in integrating emerging technologies with Building Information Modeling (BIM) to transform construction project management into Integrated Virtual Construction Management. Students will use and manipulate tools like drones, IoT, 3D scanning, robotics, AR/VR, and AI-driven analytics to develop innovative solutions, enhancing project planning, monitoring, and execution through real-world simulations. By the end, students will demonstrate mastery in leveraging these technologies, culminating in a capstone project that showcases their ability to solve complex construction challenges.

Learning Outcomes: 1. Integrate emerging technologies such as IoT, drones, 3D scanning, AR/VR, and robotics into BIM workflows to enhance project planning, monitoring, and execution. 2. Develop end-to-end BIM models incorporating cost estimation, scheduling, site management, and real-time data integration using advanced tools and technologies. 3. Manage construction projects using cloud-based BIM tools for collaboration, coordination, and communication among multi-disciplinary teams. 4. Apply data analytics, AI, machine learning, and sustainability practices within BIM to optimize project performance, predict risks, and enhance safety and operational efficiency throughout the construction lifecycle. 5. Experiment with cutting-edge construction technologies, gaining hands-on experience in real-world research and development (R&D) practices as they explore innovative solutions to complex construction management challenges. Credits: 3.00

CM 47500 - Construction Costs

Credit Hours: 2.00. A study of construction costs, including analysis of field records, job cost accounting, job cost control, and determination of unit prices.

Learning Outcomes: 1. Define the underlying concepts of construction cost control. 2. Prepare a construction project cash flow forecast using the project budget and time schedule. 3. Calculate construction project cost performance by measuring costs to-date, projecting remaining costs, and calculating variances at completion in terms of materials, subcontracts, general conditions, and project equipment. 4. Analyze construction labor cost performance using earned value, trending, and variance analysis. 5. Make capital acquisition decisions using time value of money concepts. Credits: 2.00

CM 49000 - Construction Work Experience II

Credit Hours: 1.00. This course completes a student's required 800 hours of work experience within the construction industry. Students will be required to share their experiences with faculty and other construction management students. Permission of department required.

Learning Outcomes: 1. Create an oral presentation sharing experience(s) acquired within the construction industry. 2. Write a formal paper summarizing knowledge gained through the requirement of work experience. 3. Critique fellow students on their written and oral communications of experiences. Credits: 1.00

CM 49900 - Special Topics In Construction

Credit Hours: 0.00 to 4.00. Variable title, variable credit course (Independent Study). Hours, subject matter, and credit to be arranged by staff. Permission of Instructor required.

Learning Outcomes: 1. Develop an increased knowledge in select topics related design and/or construction management. Credits: 0.00 to 4.00

CM 50500 - Construction Finance And Company Management

Credit Hours: 3.00. This course provides students with knowledge and research training to construction finance and company management.

Learning Outcomes: 1. Learn about concepts, principles, and practices of construction finance. 2. Learn about company marketing, customer relationship and trust development. 3. Learn about the methods, technologies and statistical approaches used for construction finance and company management. 4. Apply the accounting knowledge to prepare and analyze financial statements. 5. Become a critical thinker of current company management practices and apply what they have learnt to identify and solve challenges of construction management. Credits: 3.00

CM 50800 - Human Factors In Construction And Transportation

Credit Hours: 3.00. This course provides students with knowledge and research training to identify and solve design problems and safety issues of human factors specifically in construction and transportation.

Learning Outcomes: 1. Learn the concepts, theories, methods and technologies of human factors (HF), human information processing, and cognitive psychology. 2. Apply the HF knowledge to study and discuss HF issues in the design and safety of construction and transportation. 3. Develop critical thinking ability to identify HF issues and factors in research and real world. 4. Apply HF knowledge to explore, research and solve the problems in the areas of their interests in construction and transportation. 5. Communicate the design and safety from HF perspective. Credits: 3.00

CM 51000 - Topics In Environmentally Sustainable Construction, Design And Development

Credit Hours: 3.00. This course explores environmental sustainability in all its forms, starting with the historical and theoretical basis and continuing through an understanding of sustainable building construction, design, development, and renewable energy strategies/management tools and how these can be applied in practice.

Learning Outcomes: 1. Recognize human population trends and their effects on associated resource demands. 2. Identify and evaluate energy use trends, including status quo, business-as-usual (BAU) and alternative production and delivery approaches. 3. Interpret and analyze regional and global climate trends and implications, including policy alternatives. 4. Illustrate economic and social drivers, including triple bottom line business practices. 5. Discuss trends and management alternatives in land and ocean ecosystems. 6. Examine food and water security issues including production, management, and distribution alternatives. 7. Distinguish behavior psychology including examination of constraints and opportunities for sustainable practices. 8. Compare market and other incentives designed to stimulate best practices for building design and community planning. 9. Demonstrate knowledge of the conceptual history and controversies involving sustainability. 10. Apply current sustainability principles. 11. Debate common sustainability issues from multiple perspectives. 12. Recognize uncertainty envelopes and constraints on predictive knowledge. 13. Apply best practices in sustainability to their specific

field of interest. 14. Employ interdisciplinary approaches to sustainability outside of their own field. 15. Recognize the challenges and opportunities of applying science and technology to governance. 16. Formulate messaging skills needed to deliver scientific information to popular audiences. 17. Practice abstract theoretical evaluation of sustainability challenges and solutions. 18. Employ critical reading and writing skills within scientific, policy and popular media. 19. Prepare action research projects to transform sector-specific practices for sustainability. 20. Construct a broad range of delivery and assessment strategies to support change for sustainability. Credits: 3.00

CM 51100 - Energy Conserving Building Retrofit

Credit Hours: 3.00. This course introduces energy related reconstruction of buildings with an emphasis on light commercial buildings. Retrofit topics include: Basic thermodynamics, Energy conserving technologies, Impact of site characteristics, Indoor air quality, Water conservation measures, Measuring and benchmarking energy performance, Cost/Benefit Analysis, Financing energy improvements, as well as Building operation and management to reduce energy and water use.

Learning Outcomes: 1. Identify and describe opportunities for energy conservation in existing light commercial buildings through energy related reconstruction activities, commissioning, onsite power generation, as well as building operation and management strategies. 2. Apply basic thermodynamics to energy related retrofit strategies. 3. Identify, classify, and describe techniques and technologies that can be utilized in building envelop, building site, or HVAC systems for energy or water conservation. 4. Apply problem solving and decision making for cost vs. benefit analysis of retrofit strategies. 5. Apply basic energy measurement and benchmarking simulation models. 6. Identify the ways indoor air quality is impacted by vent. Credits: 3.00

CM 51800 - Building Information Modeling And Sustainability

Credit Hours: 3.00. This course explores environmental sustainability in all its forms, starting with the historical and theoretical basis and continuing through an understanding of sustainable building construction, design, development, and renewable energy strategies/management tools. In this course students explore Building Information modeling technology to assess and compare the design impact on the environment.

Learning Outcomes: 1. Explain and apply LEED Principles. 2. Explain and apply Life Cycle Analysis principles. 3. Compare design alternatives. 4. Solve a real construction problem. Credits: 3.00

CM 52000 - Preconstruction Project Management

Credit Hours: 3.00. Management and control of projects from authorization to start of construction. Project success factors, conceptual and parametric estimating, design planning and management constructability review techniques and value engineering methods. Real estate transactions. Land zoning, platting, development and pro forma calculations.

Learning Outcomes: 1. Appreciate the real estate site selection process. 2. Understand the zoning and platting process. 3. Develop an understanding of the real estate transaction process. 4. Compare and contrast project delivery systems. 5. Understand the design process. 6. Identify project success factors. 7. Utilize value engineering and constructability concepts. 8. Understand the role of preconstruction in the project life cycle. 9. Employ early estimating techniques. 10. Analyze projects from a time-value of money perspective. 11. Evaluate the viability of a construction project before authorization. 12. Appreciate roles played by the various participants in the preconstruction process. 13. Ensure adequate risk management measures have been employed. 14. Apply real estate development rules and consider regulatory issues. Credits: 3.00

CM 52500 - Managing Construction Quality And Production

Credit Hours: 3.00. Advanced techniques for assessing the success of construction project management including schedule cost, safety and quality measurements. Impacts of pre planning, human factors, and communication systems on quality and productivity. Statistical methods for analysis of construction

operations.

Learning Outcomes: 1. Define construction productivity and quality. 2. Understand the project owner's role, the designer's role, and the construction firm's role in construction, productivity and quality. 3. Demonstrate the ability to manage productivity at the following enterprise levels - company, project, and construction site. 4. Demonstrate the ability to manage construction labor productivity, equipment productivity, and subcontractor productivity. 5. Measure construction labor productivity. 6. Understand the impact that changes have on productivity. 7. Quantify lost productivity. 8. Implement a Total Quality Management (TQM) system. Credits: 3.00

CM 52600 - Value Engineering - Functional Analysis Of Systems And Techniques

Credit Hours: 3.00. This course applies value engineering principles and life cycle costs to the built environment with particular focus on the effect of the decisions made in the design, construction, operation and maintenance of the built environment on the quality and cost.

Learning Outcomes: 1. Synthesize and articulate the core principles of life cycle cost and apply engineering economics principles to calculate costs. 2. Synthesize and articulate the core principles of functional analysis of systems and techniques (FAST) methodology. 3. Conduct analysis of systems, articulate client needs and problems, define problem statements, compare design alternatives, and suggest solutions that address the issues in the problem statement. 4. Develop weighting criteria for decision making to meet problem statement and demonstrate advantages of proposed solution in comparison with initial design. Credits: 3.00

CM 53000 - Construction Operations And Strategic Management

Credit Hours: 3.00. Principles of construction company business management for U.S. companies. Executive-level construction functions including strategic planning, organizational structure, and ownership structure including succession planning.

Learning Outcomes: 1. Undertake company strategic planning. 2. Prepare a company business plan. 3. Create organizational structure. 4. Develop policies and procedures. 5. Manage change. 6. Manage equipment utilization. 7. Ensure contract profitability. 8. Identify and manage other operational concerns. 9. Develop succession plans. 10. Implement succession plans. Credits: 3.00

CM 53100 - Facilities Contract Management

Credit Hours: 3.00. This course will teach you the basics of contracts for use in management of facilities. The purpose of the course is not to teach you how to write contracts. Instead, you will learn key principles of contract law so that you can better understand how an agreement is made and what terms become part of that agreement. Knowledge from this course will help the facility manager navigate the contractual process, from negotiating terms to dealing with potential disputes. Areas of focus will include real estate contracts, negotiations, managing risks and disputes, and the uniform commercial code. An emphasis will also be placed on contracts related to construction projects.

Learning Outcomes: 1. Interpret the phases of facility management from design/acquisition to final disposition using principles of acquisition, installation, operations, maintenance, outsourcing, renovation and disposition of building systems, structure, interiors, exterior and grounds. 2. Identify the skills needed to strategically lead process, the organization, stakeholders and technologies in an ethically responsible way. 3. Interpret corporate real estate finance, management and transactional execution. 4. Integrate written, oral, aural, and graphic communication skills through repetitive assessment and evaluation of industry appropriate genre. Credits: 3.00

CM 53400 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology. Permission of instructor required.

Learning Outcomes: 1. Understand the history of quality and apply those concepts to contemporary quality issues. 2. Analyze internal and external organization customer needs in terms of contemporary quality concepts. 3. Synthesize the balance between cultural and technological organizational transformation. 4. Analyze the role of Lean, Six Sigma and TPS in modern process design and optimization and contemporary quality management. 5. Synthesize Lean and Six-Sigma roles and responsibilities. 6. Utilize Lean and Six Sigma philosophies, methodologies and tools; statistical analysis tools; quality assurance auditing techniques; and quality training concepts. 7. Design materials for present basic Lean Six Sigma training aids. Credits: 3.00

CM 53500 - Construction Accounting And Financial Management

Credit Hours: 3.00. Accounting techniques, financial methods, and financial management for construction firm management. Analysis techniques for contemporary construction company accounting and finance practice with an emphasis on cash flow analysis and cash management.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction company. 2. Explain the progress billing terms retainage and front loading and discuss the reasons for and against such practice. 3. Identify the accounts applied and their use when the percentage of completion method of accounting is applied. 4. Explain the difference between underbilling and overbilling, discuss why they occur and their impact on cash flow. 5. Apply the following financial analysis techniques to financial statements: line-item analysis, horizontal analysis, vertical analysis, use-source analysis, ratio analysis, cost-volume-profit analysis, and profit center analysis. 6. Prepare the budgeted income statement and develop rates for overhead and profit mark-up, exercise control over company cost, and prepare a cash plan. 7. Apply time value of money principles to various decision making tools when seeking company and project financing and the acquisition of capital assets. Credits: 3.00

CM 53600 - Highway Construction And Quality Control

Credit Hours: 3.00. This course provides students with knowledge of methods, materials, equipment, and procedures in construction of highways. Students will acquire the concepts and applications of quality control and quality assurance in construction of highways. Students will learn to design appropriate work zones to improve efficiency and safety of highway construction. This course will provide graduate students with a much-needed venue to gain the theory, technology, and practice of highway construction, rehabilitation, maintenance, and quality control.

Learning Outcomes: 1. Acquire the characteristics of various types of highway materials and highway designs and highway construction specifications. 2. Acquire the quality control and assurance principles, and techniques, and methods. 3. Determine the optimal strategy for pavement preservation. 4. Apply quality control and safety improvement techniques in highway construction. 5. Design work zones to improve efficiency and safety of highway construction. Credits: 3.00

CM 53800 - Roadway Infrastructure Management

Credit Hours: 3.00. This course provides students with theories and practices of managing roadways to achieve maximum benefit in the system and network level with limited available funds and resources. Students will learn the concepts of roadway performance measures in terms of physical conditions, service levels, and safety. As a graduate level course, this course will introduce basic methods to find optimal solutions for real-world problems and provide graduate students analytical and mathematical tools for effectively conducting research related to problem formulation, optimal decision-making, and maximizing benefits/effectiveness and minimizing costs.

Learning Outcomes: 1. Acquire roadway systems and performance measures. 2. Acquire the frameworks and principles of management systems. 3. Conduct data analysis and establish condition prediction models. 4. Perform life cycle benefit/cost analysis of infrastructure projects. 5. Create decision-making models to maximize benefit of infrastructure systems with

limited resources. Credits: 3.00

CM 54000 - Law For Construction Managers

Credit Hours: 3.00. A study of the legal system and its impact on the construction process. The focus is on the legal obligations, rights and remedies pertaining to the construction company. Topics include bidding, contracts, and construction changes.

Learning Outcomes: 1. Describe agency relationships, contracts, torts, professional liability, risk management, indemnification, risk sharing and surety bonds. 2. Explain the concept of the design professional as judge. 3. Recognize the procedures for legally terminating a construction contract. 4. Plan the project with a contract law viewpoint. 5. Comply with the legal requirements for competitive bidding. 6. Create as well as to comply with the rights & duties of the construction contract. 7. Demonstrate the ability to apply construction law concepts to subcontracting, changes, payments, performance problems, defects, subsurface problems, time and claims. Credits: 3.00

CM 54500 - Construction Management Training And Development

Credit Hours: 3.00. Identification, training and development of future company leaders. Mentorship as a required, managerial activity, effective delegation of responsibility, and empowerment of subordinates to take initiative.

Learning Outcomes: 1. Interpret the role of the training department in meeting an organization's strategic goals. 2. Analyze the broader organizational context and business environment in order to ensure that training meets business needs and achieves stakeholder support. 3. Use effective investigative and analytical methods to advise and assist clients in identifying needs, at organizational levels, to which training is the most appropriate response. 4. Work with stakeholders to design training events (including formal programs) that are grounded in the principles of learning, are accessible, effective and make timely use of available resources. 5. Incorporate new technology as appropriate into both training and learning processes, and the effective management of the training and development function. 6. Carry out appropriate monitoring and evaluation of training programs, and coordinate with stakeholders on any necessary changes to training provision and practice. 7. Explore models and research relating to the core competencies and behavioral characteristics of effective trainers. Credits: 3.00

CM 54700 - Collaborative Project Delivery Models And Practices

Credit Hours: 3.00. A project-focused course covering advanced topics on collaborative project delivery models such as Integrated Project Delivery (IPD), Design-Build (DB), and Partnering. Collaborative project delivery methodologies aim to integrate project teams, stakeholders, systems, business structures, and practices to facilitate collaboration at all levels within a project and to produce the most optimal project outcomes. Students will develop and expand their interdisciplinary collaborative team working skills, communication, and understanding of essential elements underlying collaborative project delivery models.

Learning Outcomes: 1. Describe, analyze, and select the most appropriate delivery method for a project. 2. Engage in team-building processes and analyses that are intended to establish collaborative working environments. 3. Analyze case study documents including RFP's, RFQ's, contracts, and other managerial documents used in collaborative project delivery practices. 4. Research and analyze construction management processes to develop collaborative project teams and collaborative work environments. Credits: 3.00

CM 54900 - Advanced Topics In Mechanical And Electrical Construction

Credit Hours: 3.00. A project-focused course covering advanced topics on mechanical and electrical construction installation practices and processes. This course teaches the student how to plan, organize, and execute mechanical and electrical construction operations. Students will develop and expand their knowledge about mechanical and electrical work sequencing, coordination, commissioning, and relationship to facility operations and management.

Learning Outcomes: 1. Describe and analyze mechanical and electrical scopes of work. 2. Engage in team-building processes and analyses that involve developing work sequencing and coordination. 3. Analyze case study documents including construction schedules to determine best practices and recommendations for improvement. 4. Research and analyze commissioning programs to develop key performance indicators and implementation strategies. Credits: 3.00

CM 55000 - Risk Management In Construction

Credit Hours: 3.00. Analysis of the depth and breadth of risk in construction. Defining key terms and concepts used in various risk management arenas - legal statutes, precedent and case studies relevant to construction risk management, insurance, and surety bonding. Subjects include: contracts, torts, insurance, surety, safety laws, quality, and risk management models. Analysis of case studies to utilize risk management tools and identify issues and possible approaches. Project risk control including management of foreseeable hazards as well as unforeseen conditions.

Learning Outcomes: 1. Overview of risk fundamentals - and how liability drives outcomes. 2. Understand the relationships between insurance, sureties, contractual risk transfer and risk financing. 3. Understand how safety covers direct employees, other parties, and member of the public. 4. Understand the role of incident investigation, and management of claims of various types. 5. Understand quality and how to deliver acceptable project results. 6. Understand the value of Business Continuity Planning and other Crisis Management methods and tools. 7. Understand the value of corporate compliance programs for satisfaction of regulatory and other legal requirements. 8. Understand standards of care, and their evolutionary nature, compelling "compliance as you go." 9. Ability to critically evaluate existing risk management approaches, and apply risk management models to promote successful project outcomes. Credits: 3.00

CM 55500 - Construction Leadership And Marketing

Credit Hours: 3.00. Analysis of organizational leadership at the executive level. The goals of this course are to introduce and stimulate thought and discussion of leadership theories, characteristics and behaviors of successful leaders, contextual factors affecting leader effectiveness, dynamics of leader-follower relationships, communication, decision-making and contemporary challenges confronting organizational leaders as well as marketing theory, marketing vs. business development, the marketing process, and an introduction to a construction marketing dashboard.

Learning Outcomes: 1. Understand the essential principles of leadership theories and apply the theories in construction management. 2. Comprehend the characteristics and behaviors of successful leaders in the field of construction. 3. Grasp the main contextual factors affecting leader effectiveness. 4. Apply the dynamics of leader-follower relationships in daily operations. 5. Acquire communication, decision-making and other key leadership skills. 6. Recognize the contemporary challenges confronting organizational leaders. 7. Understand the marketing theory, the market process, and marketing vs. business development. 8. Understand and utilize construction marketing dashboard. Credits: 3.00

CM 55800 - Advanced Construction Management For Disaster Recovery

Credit Hours: 3.00. Prepares construction project professionals to better plan and deliver post-disaster built environment and infrastructure restoration and reconstruction services. Emphasizes differences between conventional construction and disaster recovery work, considering projects of larger scope and including international concerns. Technical facets of restoration processes introduced to advise comprehensive management. Includes executive-level management case study with team solution. Permission from department required.

Learning Outcomes: 1. Explain the special environmental and personal conditions and concerns that often confront construction project professionals performing disaster recovery. 2. Improve planning for major disaster recovery projects. 3. Explain how to execute major disaster recovery projects. 4. Select appropriate restorative, demolition, and waste disposal

techniques for common recovery projects. Credits: 3.00

CM 56000 - Academic Writing Seminar I

Credit Hours: 1.00. Analysis of the requirements of research reports. Emphasis on research methods and concepts, identifying major issues, academic literature reviews, data collection and presentation methods, and selecting a research topic.

Learning Outcomes: "1. Increase the student's skills related to research and academic writing through the introduction of resources available through the Purdue Library System and the Purdue Online Writing Lab (OWL). 2. Demonstrate appropriate samples of academic writing through sample reports on the Purdue College of Technology EPubs. 3. Develop the student's knowledge and application of PAP version 6 formatting. 4. Advance the student's expectations of academic writing. Credits: 1.00

CM 56500 - Academic Writing Seminar II

Credit Hours: 1.00. Provides a higher level understanding of scholarly writing as it is applied to the individual student's research. Students also learn to present his or her technical work to an audience in a clear, easily understandable form.

Learning Outcomes: 1. Demonstrate develop of the student's skills related to academic writing through individual and group exercises related to their individual research. 2. Demonstrate appropriate samples of academic writing through sample reports on the Purdue College of Technology Epubs. 3. Appropriate student knowledge and application of APA version 6 formatting. 4. Advance the student's expectations of academic writing. 5. Increase the rate of successful completion of the masters program scholarly writing requirements. Credits: 1.00

CM 57000 - Analysis Of Research In Construction

Credit Hours: 4.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of business research procedures including fundamental statistical methods in the solution of a construction industry relevant problem.

Learning Outcomes: 1. Acquire research knowledge and skills required to produce scholarly work for the construction industry. 2. Adapt the scientific research model to solve problems in a construction company. 3. Demonstrate proficiency at library usage, EndNote, and citing references using APA format. 4. Demonstrate related academic writing through individual and group exercises suitable to their individual research. 5. Demonstrate appropriate samples of academic writing though sample reports on the Purdue College of Technology Epubs. 6. Advance expectations of academic writing. Credits: 4.00

CM 58100 - Workshop In Building Construction Management Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 8.00

CM 59000 - Special Problems In Building Construction Management Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required

Learning Outcomes: 1. Develop an increased knowledge in select topics related design and/or construction management. Credits: 1.00 to 6.00

CM 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 3.00

CM 59900 - Facilities Management Directed Project

Credit Hours: 1.00 to 3.00. The Directed Project is defined as an applied research project that is more extensive and sophisticated than a graduate-level independent study and less formal than a master's thesis. The overall objective of the requirement is to engage in a facilities management related study focused in industry, business or education. The focus is to be placed on a topic with practical implications rather than

original research.

Learning Outcomes: 1. Identify a business or industry relevant solution to a technology related problem. 2. Define and/or validate a business or industry relevant problem. 3. Address a technological problem in a systematic and replicable manner. 4. Use technical/professional research and/or development procedures effectively. 5. Identify criteria for success/solution of the problem. 6. Gather information appropriate to the problem by employing business research procedures. 7. Document the research and development activity in a manner that permits replication and assessment of key decisions and alternatives. 8. Write effectively in a form customary to business and industry, using APA format. 9. Prepare and deliver a presentation in a form customary to business and industry. Credits: 1.00 to 3.00

CM 61000 - Urban Built Environment

Credit Hours: 3.00. This provides students with advanced theories and applications of analyzing multiple performance indicators in urban built environments. Students will learn the concepts of energy, environment, human comfort, and mobility performance in urban built environments. This course will offer an overview of various analysis techniques using Geographic Information System, Building Energy Modeling and Simulation, and Spatial Analytics using a programming language. Graduate students will learn problem-solving skills through project-based learning, and how to apply the skills to effectively conduct research related to urban built environment planning, design, and development. Prerequisite: CM 51000.

Learning Outcomes: 1. Apply GIS techniques to understand geographical patterns and spatial variables. 2. Apply building energy modeling and analyze environmental, design, and construction parameters affecting energy demand. 3. Evaluate spatial networks in urban built environments in various measures. 4. Evaluate multiple performance of urban built form. 5. Create a decision-support framework to better inform the performance of urban built forms and optimize urban built. Credits: 3.00

CM 62500 - Smart Infrastructure System

Credit Hours: 3.00. Applying advanced cutting-edge technologies to the civil and construction industry to address traditional infrastructure problems is becoming more popular. One of the very hot areas is developing smart infrastructure. How to make our civil infrastructures smarter and more resilient plays a vital role for our society. The first half of this course will cover the fundamental knowledge of some cutting-edge technologies and smart infrastructure including sensing, signal processing, data collection and transmission, and closed-loop control. The second half of this course will focus on smart infrastructure applications including smart bridges, smart grid, smart building and smart railways. This advanced-level course will provide advanced knowledge of cutting-edge technologies to develop smart infrastructure systems. Through this course, student will polish their research skills in different aspects including: conducting literature review, developing their own research idea, implementing their ideas, presenting their work and publishing their results. In addition, at the end of this course, students will be able to implement various types of systems, create smart infrastructure systems and check their performance. Prerequisite: CM 58100.

Learning Outcomes: 1. Differentiate design and performance of smart infrastructure system over traditional infrastructure system. 2. Organize and identify major components of smart infrastructure systems for practical application. 3. Plan the operation and maintenance of smart infrastructure systems for long-term operation. 4. Create and design smart infrastructure systems based on different purposes. 5. Implement smart infrastructure system to address the critical needs and evaluate smart infrastructure system performance. Credits: 3.00

CM 63500 - Advanced Facilities Management

Credit Hours: 3.00. This course provides advanced facilities management (FM) practices in the life cycle of the built environment, including core competencies, compliance and standards, operations & maintenance, risk management, sustainability, health & safety, real estate and financial management, human resources management, and workplace and utility management. In addition, FM practices include emergency preparedness, business continuity, leadership, contracts, capital and maintenance planning, outsourcing, procurement, space planning, occupant comfort and productivity, and energy management. The role of the facilities manager in hard (space and infrastructure) and soft services (grounds, custodial, waste management, pest control, parking, workspace management, catering) will be analyzed with case studies emphasizing the need for their integration in the design and construction process. The students will be able to interpret

and analyze critical management principles in the operations phase of the built environment by identifying the fundamentals of facilities management theory and practice. Prerequisite: CM 52600.

Learning Outcomes: 1. Differentiate the essential services in facilities management (FM). 2. Analyze the hard and soft services in FM with short business cases. 3. Organize the critical components of FM in architecture, engineering, and construction processes. 4. Evaluate the current research trends in FM from an applied and practical perspective. 5. Implement the fundamentals of FM from a managerial perspective in a business case. 6. Describe the role of the facility manager in various organizational settings. Credits: 3.00

CM 63600 - Future-Proof Construction And Infrastructure

Credit Hours: 3.00. The course provides advanced tools and methods to optimize the maintainability, resilience, flexibility and responsiveness of infrastructure and construction so to ensure that these provide an adequate level of service under uncertain future conditions. This includes methods to rigorously quantify the level of service, model the uncertainty over variable parameters, identify maintainable, resilience flexible and responsive design solutions, run simulations to estimate their impact (i.e., costs of interventions and risk on the service) and identify the optimal balance with the costs of construction. Prerequisite: CM 51000.

Learning Outcomes: 1. Explain the concept of future-proof design. 2. Measure rigorously and orthogonally the service provided by an infrastructure. 3. Optimize the intervention strategies based on the predicted deterioration of objects. 4. Evaluate resilience of construction and infrastructure to ensure that the extra cost invested in resiliency are justified by the risk saved in the phase of operation and management. 5. Evaluate flexibility of construction and infrastructure to ensure that the extra cost invested in flexibility are justified by the risk saved in the phase of operation and management. 6. Develop team-building skills. Credits: 3.00

CM 63700 - Computer Vision Application For Smart Infrastructure Management

Credit Hours: 3.00. This graduate-level course is for students who major in Construction Management Technology, Construction Engineering and Management, Civil Engineering, and other related majors in the architecture, engineering, and construction domain. Computer vision (CV) technology can play a critical role in constructing and managing built environments (infrastructure systems and facilities). It promises to become even more critical in the next few decades as technologies are more efficient and effective for infrastructure inspection and maintenance. The CV technologies include the principles and utilization of object detection, action recognition, and 3D reconstruction technologies. This course will offer the students the advanced knowledge and ability to come up with a solution for infrastructure and facility management challenges by evaluating current computer vision technologies. After this course, the students can evaluate appropriate computer vision algorithms and develop frameworks for various infrastructure management problems by creating their own training data sets and models.

Learning Outcomes: 1. Master theories and methods of computer vision by critically reviewing and assessing scientific literature. 2. Identify and formulate computer vision and 3D modeling-related problems in the smart construction and infrastructure management field. 3. Apply, evaluate, and examine various computer vision algorithms, tools, equipment, and methods to support the construction and facility management research domains. 4. Communicate effectively and work in teams to develop working computer vision systems for smart construction and infrastructure management. 5. Design and develop practical and innovative computer vision applications or systems applicable to construction and infrastructure management. Credits: 3.00

CM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 18.00

CMGT 12000 - Materials And Methods

Credit Hours: 3.00. Introduction to common construction terminology, materials, methodologies, building codes, structural fundamentals, and contract documents related to buildings, industrial facilities, and infrastructure. Field trips to production / fabrication facilities for each type of material (wood, steel,

concrete, and masonry).

Credits: 3.00

CMGT 15000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Credits: 3.00

CMGT 21000 - Quantity Take-Off

Credit Hours: 3.00. Study of methods to estimate material quantities for construction projects. Topics include, interpreting construction drawings, fundamental construction technology, quantity take-offs. Excel and take-off software are used.

Credits: 3.00

CMGT 25000 - Mechanical And Electrical Systems

Credit Hours: 3.00. Methods for design, construction and inspection of mechanical and electrical systems for buildings. Emphasis on heating and cooling loads, equipment selection, duct and pipe sizing, codes, safety installation, inspection, commissioning, and estimating. Responsibilities of the general contractor for HVAC (heating, ventilating, and air-conditioning), electrical and plumbing work.

Credits: 3.00

CMGT 26000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Credits: 3.00

CMGT 31000 - Cost Estimating

Credit Hours: 3.00. Study of methods to estimate quantities and costs for material, labor and equipment; establishing direct overhead and markups including indirect overhead and profit for a construction project; software applications for estimating; conceptual estimating procedures; and subcontractor qualifications and scope of work.

Credits: 3.00

CMGT 32000 - Scheduling And Project Control

Credit Hours: 3.00. A study of the planning and control of construction schedules. Topics include Gantt charts, critical path method (CPM) network scheduling, and monitoring and controlling the schedule. Lab work includes the application of MS Project for creating, presenting, revising, updating and controlling construction schedules.

Credits: 3.00

CMGT 33000 - Contract Administration And Specifications

Credit Hours: 3.00. Study of the contractual organization and administration of a construction project. Topics include, analysis of delivery systems, working with contracts, general and special conditions of the contract, specifications, project communication, payment applications, change orders and close out. Project management software is used.

Credits: 3.00

CMGT 35000 - Materials Testing

Credit Hours: 2.00. Laboratory and field testing of structural materials to determine their mechanical properties and behavior under load. Materials included are steel, aluminum, concrete, wood, and asphalt.

Credits: 2.00

CMGT 36000 - Strength Of Materials

Credit Hours: 3.00. Stress-strain relationships of construction materials. Consideration of strength issues related to major classes of engineering materials including steel, concrete, and wood. Composite analysis; shear forces and bending moments in beams. Introduction to analysis and design of steel and wood beams and columns, beam deflections.

Credits: 3.00

CMGT 38000 - Infrastructure Planning, Engineering, And Economics

Credit Hours: 3.00. Introduction to the planning and analysis of infrastructure projects. The focus will be on the prioritization, stewardship, management and decision-making roles within the division of a large public works agency. This course will cover municipal infrastructure system, infrastructure alternatives, financial and economic analyses, environmental and social impact assessment, uncertainty and risk-benefit analysis, sustainability, and public-private partnerships including numerous case studies.

Credits: 3.00

CMGT 39000 - Construction Experience III

Credit Hours: 1.00. Supervised pre-professional learning experience that allows students to apply their skills and knowledge in a professional setting. This experience is designed to enhance the student's preparedness for an intended career in the construction profession. A minimum of 400 work-hours is required.

Credits: 1.00

CMGT 41000 - Equipment And Field Operations

Credit Hours: 3.00. Study of heavy equipment used in construction operations with an emphasis on equipment selection, application, cost, productivity, safety, and economics.

Credits: 3.00

CMGT 42000 - Safety And Inspection

Credit Hours: 3.00. Study of safety regulations, practices,

policies, and procedures required for construction projects. Topics include, accident investigation, record keeping, OSHA reporting requirements, inspections, and hazards. Included is an OSHA safety card.

Credits: 3.00

CMGT 43000 - Jobsite Management

Credit Hours: 3.00. Examination of construction project management on the jobsite. Topics include, submittals, record keeping, jobsite layout, meetings, negotiations, dispute resolution, labor relations, safety, subcontracting, quality, cost control, waste management, changes, claims, progress payments, and project closeout.

Credits: 3.00

CMGT 44000 - Project Management Capstone

Credit Hours: 3.00. Students apply the knowledge and skills, acquired during their construction management program of study, to simulate the construction management process on an actual construction project. Includes role playing and a formal oral presentation.

Credits: 3.00

CMGT 45000 - Structural Systems And Analysis

Credit Hours: 3.00. Analysis of the structural characteristics of common construction materials, including: wood, steel, concrete, masonry, and light gauge metal in order to integrate structural elements into complete structural systems in the construction of modern buildings and structures to withstand gravity, wind, earthquake, and other environmental forces.

Credits: 3.00

CMGT 46000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Credits: 3.00

Consumer Science

CSCI 31700 - Computation For Scientific Applications

Credit Hours: 3.00. Prerequisite: N207 or equivalent. This course gives a survey and overview of popular computational software used in multiple scientific domains to support data processing and scientific research. This class focuses on teaching how to use software to efficiently process data in terms of modeling, simulating, visualizing and data-mining. Fundamental concepts related to scientific computing are introduced briefly.

Credits: 3.00

CSCI 36100 - Fundamentals Of Software Project Management

Credit Hours: 3.00. Tools and techniques used to manage software projects to successful completion. Problem solving focus to learn specification development and management, program success metrics, UML modeling techniques, code design and review principles, testing procedures, usability measures, release and revision processes, and project archival.

Credits: 3.00

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources

and advice when necessary. Credits: 3.00

CSR 12800 - Introduction To Apparel Design

Credit Hours: 3.00. This course introduces the fundamentals of the Apparel industry, design, and assembly through lectures, discussions, readings and application in an Apparel laboratory. The student will learn the proper operation of industrial garment production equipment. Further, the course will introduce the manufacturing standards of apparel assembly through garment construction, principles of fit and fiber, and fabric performance.

Learning Outcomes: 1. Explain the basics of the nature, materials, producers, and markets of and for fashion and the apparel industry. 2. Identify basic apparel assembly and design techniques, principles of fit, and fiber and fabric performance characteristics within specific types of garments. 3. Operate garment production equipment in a safe and appropriate manner. Credits: 3.00

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

CSR 20100 - Introduction To Professional Sales

Credit Hours: 3.00. Introduction to sales process, business to business communication strategies, and expectations of a sales professional.

Learning Outcomes: 1. Describe the operationalization of sales and the purchasing function within a business. 2. Define the variety of sales roles and determine best fit. 3. Demonstrate the skills necessary to succeed in a sales role. 4. Apply sales process to a role play sales call. Credits: 3.00

CSR 20900 - Introduction To Retail Management

Credit Hours: 3.00. Retail career paths, management training, merchandise control, organization and service structure, and a comparison of store types.

Credits: 3.00

CSR 21500 - Textile Industry

Credit Hours: 3.00. Fundamentals of the textile industry addressing the lifecycle of textile products beginning with the source and properties of textile fibers to the steps in the production of textile products and their impact on product performance and consumer satisfaction. Generate an awareness of the global textile industry as it relates to the impact on the environmental and social communities. Emphasis on retail, apparel, and interior design applications.

Learning Outcomes: 1. Predict fabric performance and end-use based on knowledge of fibers, yarns, fabric constructions, and finishes. 2. Possess a working knowledge of the many facets of processing textiles from raw materials to the finished product, including laws and requirements that regulate textile labeling. 3. Generate awareness of the scope and complexity of the global textile industry as well as the challenges it faces, environmentally and socially. 4. Assess the impact of consumer buying behavior, use, care and disposal decisions on textiles and related industries. Credits: 3.00

CSR 22000 - Apparel Design I

Credit Hours: 3.00. Introductory course that deals with the evolution of apparel design through the principles of flat pattern design, three-dimensional draping, and computer-aided design (CAD for pattern design). Fundamentals for apparel design. Students create designs for a basic, sleeveless, collarless top.

Learning Outcomes: 1. Recognize and apply the creative process: inspiration, designer's resources, visual consumer, garment engineering, and fashion sketching. 2. Recognize, name, and use pattern making tools, equipment, and terminology. 3. Produce and apply the use of a croquis (sketch/design/inspiration) book. 4. Create and continuously add personal designs and

inspirations of design to a croquis book. 5. Understand and apply proper use of fabric grain in pattern making and draping. 6. Drape a set of basic block patterns to properly fit an industrial model form: bodices, skirts and sleeves. 7. Understand and apply the use of design principles #1 dart manipulation, and other patternmaking design details. 8. Create and sketch an original design, complete the patterns, and complete the assembly of: a sleeveless/collarless garment to fit the upper torso only or both upper and lower torso.

Credits: 3.00

CSR 22100 - Apparel Design II

Credit Hours: 3.00. Continued development of apparel design from concept to finished product through the application of flat pattern design, draping, and computer-aided design. Building on the introductory course to create apparel wear design that includes sleeves, collars, blouses/shirts, dresses, pants, and skirts. Introduction to pattern grading manually and through CAD, and marker for apparel production.

Learning Outcomes: 1. List, define, and apply sewn products industry and patternmaking terminology as related to apparel design. 2. Measure the human figure and industrial model form for the development and drafting of patterns for apparel. 3. Identify and appropriately make sure of various patternmaking / drafting tools. 4. Apply principles of flat pattern drafting to the production of patterns for original design apparel items of pants, collars, sleeves, and skirts. 5. Apply the principles of draping to the production of patterns for original design apparel items of skirt, pants, collars, sleeves, and torso. 6. Render presentation boards for color story, design inspirations / sketches, target customer profile, item selection of line or collection, fabric trim selection, and technical sketches (flats or production drawings). 7. Create, render, and continuously add personal designs and inspirations of design to a croquis book. 8. Create original design garments from conception of design through rendering to drafted patterns to assembled garment. Credits: 3.00

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

CSR 30000 - Field Experience In Retail Management

Credit Hours: 1.00. Approved in-service training, a total of 140 hours; development of activities plan; and report of activities. Recommended for semesters 3,4,5, or 6. Advance approval of director and employer and attendance at pre- and post-organizational meeting is required. Permission of instructor required.

Credits: 1.00

CSR 30700 - Field Experience In Selling And Sales Management

Credit Hours: 1.00. Approved in-service training and supervised work experience in selling and sales management. Total of 140 hours required with in-depth report and analysis of activities. Permission of department required.

Learning Outcomes: 1. Provide exposure to career options in a real world setting through direct practice or by observation and interaction with colleague at the internship site. 2. Apply theory and relevant coursework in a professional setting, where the student will combine academic and work site assignments. 3. Advance skills and professional experience to enhance the student's career development.

Credits: 1.00

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied

solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 31000 - Buying Of Merchandise

Credit Hours: 3.00. Principles of volume buying applicable to department, chain, specialty, and independent stores.

Learning Outcomes: 1. Demonstrate knowledge of the buying and merchandising functions, and their role in a retail organization. 2. Describe definitions and concepts of terminology related to merchandising math. 3. Apply basic mathematical concepts to solve typical merchandising problems and make decisions. 4. Use data to analyze and evaluate the performance of merchandising strategies. Credits: 3.00

CSR 31500 - Relationship Selling

Credit Hours: 3.00. This course focuses on long-term relationship selling. The course is organized around a seven-step selling process which has proven to be effective. The course adds to this process some principles of marketing and business strategy. The elements are necessary for the success of professional salesperson both in successful prospecting and making strategic choices as to how to allocate their time within the territory. Important to the learning process is actually practice of principles. Students will do various exercises of principles such as prospecting and negotiation. At the end of the semester, students will hone the skills learned through the semester with a series of role plays designed to put them in position of both seller and buyer.

Learning Outcomes: 1. Recognize that selling is a process which can be taught versus an innate trait. 2. Have an organized approach to the process of selling which can be applied to any industry. 3. Know principles of marketing and strategy which students can apply to the selling process. 4. Know principles of negotiation and handling objections both through class assignments and role playing. 5. Know how to do effective product presentation and frame benefits to the clients through a series of role play scenarios. Credits: 3.00

CSR 32300 - Visual Merchandising

Credit Hours: 3.00. Creative experimentation, production, and analysis of promotional formats for merchandising of product in a retail setting. Study of the elements and principles of design and their application for promotion of retail merchandise and/or services.

Credits: 3.00

CSR 32800 - Apparel Art And Design

Credit Hours: 3.00. Exploration and experimentation of creative rendering of apparel design through the use of various media. Opportunity for the students to develop their own unique style of illustrating fashion.

Credits: 3.00

CSR 33100 - Consumer Behavior

Credit Hours: 3.00. An interdisciplinary survey of consumer behavior theory focused on psychological, sociological, and cultural influences on consumer choice and use of products and services. Credit will not be given for both CSR 33100.

Credits: 3.00

CSR 33200 - Cross-Cultural Marketing And International Retailing

Credit Hours: 3.00. Examination of marketing/retail practices used to target domestic and global consumer market segments. Development of successful retail and marketing strategies is stressed.

Credits: 3.00

CSR 34100 - Luxury Brand Management

Credit Hours: 3.00. Students examine the innovation and creativity that foster the development of luxury brands in the current business environment. A key facet of this course is the opportunity to develop unique brand strategies that generate social, aesthetic, quality, and emotional value for luxury consumers. Students learn the ways brands tailor services, products, and experiences to achieve these goals.

Learning Outcomes: 1. Define the psychological and cultural elements of luxury brand experiences. 2. Explain the connections between service excellence, craftsmanship, and creative direction within the management of luxury brands. 3. Analyze social, economic, and technological trends within the luxury market. 4. Describe the ethical and social challenges of managing luxury brands. 5. Develop strategies that create brand prestige and generate value for luxury consumers. Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

CSR 34400 - Fundamentals Of Negotiations

Credit Hours: 3.00. This course is designed to be relevant to the broad spectrum of bargaining "problems" that are traditionally faced by the manager, sales personnel and financial advisors. The course explores the processes of bargaining and negotiation as social and managerial activities. Special emphasis will be given to the areas of interpersonal and interpersonal and intergroup conflict, in addition to the interpersonal influence techniques and the tactics and strategies involved with improved bargaining and negotiation. The major purpose of the course is for each student to gain insight into his or her own negotiating style and to become a more effective negotiator, as well as a more astute observer of social process. The course will involve extensive use of cases, role-plays, and related participative activities, enhanced by rigorous self-review and introspection.

Learning Outcomes: 1. Explore the major concepts and theories of the psychology of bargaining and negotiation. 2. Understand the dynamics of interpersonal and intergroup conflict and its resolution. 3. Help develop the sophistication to analyze bargaining and conflict relationships. 4. Learn about your own individual "bargaining" style. 5. Development appropriate negotiation strategies and tactics for specific situations. Credits: 3.00

CSR 35700 - Retail Technology: Merchandise Planning And Allocation

Credit Hours: 3.00. The application of software technology in retail merchandising, planning and allocation systems. Builds on basic knowledge of buying functions utilizing industry software, to develop skills needed in higher-order planning and allocation of merchandise. Students apply knowledge and skills through simulations with real-world data.

Learning Outcomes: 1. Explain the relationship between planning and buying merchandise. 2. Explain the relationship between allocation and supply chain. 3. Evaluate the effects of planning/allocation on revenue & profit. 4. Demonstrate analytical skills through the application of industry software, to make effective merchandising decisions. Credits: 3.00

CSR 36300 - Retail Technology: Category Management

Credit Hours: 3.00. Category management is used by retailers and consumer products companies to reduce costs and increase revenue, based on consumer behavior. Technology to implement category management is used at all levels of the value chain, from producer to procurement to the retail store. Students in this course learn about the theory behind category management from both sales and retail perspectives, then apply that knowledge using industry software to create and analyze visual and data sales plans.

Learning Outcomes: 1. Demonstrate via discussion and examination, concepts of space planning and category management. 2. Create planograms using space planning knowledge and skills. 3. Develop a sales plan utilizing category management process and sales data. 4. Analyze effects on profit and revenue based on category management applications and planogram sales data. 5. Design a retail space that includes: consumer purchasing decisions, coordinates product selection and supply, shelf merchandising, promotion and pricing. Credits: 3.00

CSR 38600 - Risk Management

Credit Hours: 3.00. The course includes principles of insurance, analysis and evaluation of risk exposures, legal aspects of insurance, insurance needs and analysis, policy selection, and insurance company selection and due diligence. Types of insurance that are studied include: property and casualty, health, life, long-term care, disability and general business liability.

Credits: 3.00

CSR 39000 - Undergraduate Special Problems

Credit Hours: 1.00 to 6.00. Individual participation, supervised reading, laboratory or field experiments, or research in special areas of the field. Permission of instructor required.

Credits: 1.00 to 6.00

CSR 39500 - Special Projects

Credit Hours: 1.00 to 6.00. Individual participation in supervised undergraduate project. Open to qualified upperclassmen. Permission of department required.

Credits: 1.00 to 6.00

CSR 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for CFS Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Credits: 1.00 to 3.00

CSR 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an International experience that is recognized by the University. Permission of department required.

Credits: 1.00 to 6.00

CSR 39900 - Undergraduate Special Topics In CSR

Credit Hours: 1.00 to 6.00. Various topics that may change from semester to semester are presented by CSR faculty. Permission of department required.

Credits: 1.00 to 6.00

CSR 40300 - Retail Management Internship

Credit Hours: 3.00. A supervised full-time internship in retail and related industries. This experience will enable students to further develop their professional interests and skills. Prior field experience and completion of application and pre-approval of internship by internship director and attendance at pre- and post-organization meetings is required. Permission of department required.

Credits: 3.00

CSR 40400 - Strategic Management For Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. Through the analysis of internal and external forces, students develop strategies to help an organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of an organization. The course is structured to enhance students' analytical, critical thinking, and verbal skills by integrating academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Demonstrate through effective written and oral communication, the ability to conduct a strategic situational analysis of a service organization. 2. Develop a business strategy for a service organization. 3. Integrate and apply prior knowledge areas from your major to propose a functional strategy that aligns with the strategic vision of your service organization. Credits: 3.00

CSR 40600 - E-Retailing

Credit Hours: 3.00. To provide understanding of the technological and retail infrastructure that underlines doing retailing over the internet. Build an understanding of business strategies over the net. To identify management issues and consumer issues in e-retailing.

Learning Outcomes: 1. Understand the technological and retail infrastructure that underlies doing retailing over the Internet. 2. Learn the vocabulary to discuss e-retailing. 3. Build and understand business strategies over the Internet. 4. Acquire power to exploit any business opportunities that jump out your way. 5. Provide the ability to get your hands dirty and use some of the most important net marketing tools. 6. Understand the "business case" for Internet commerce in retailing (or other business). 7. Identify management issues in e-retailing. 8. Understand the consumer issues in e-retailing. 9. Acquire skill sets that allow a competitive market advantage in interviews, jobs and careers. Credits: 3.00

CSR 41500 - Sales Force Management

Credit Hours: 3.00. An introduction to sales force management. An examination of the sales force management process, including principles of recruiting and selecting, training, compensation, motivation, supervision, and evaluation. Planning skills, including sales force deployment and the role of the sales force in sales forecasting, are also covered.

Learning Outcomes: 1. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues and activities. Credits: 3.00

CSR 41600 - Retail Supply Chain Management

Credit Hours: 3.00. Supply chain management is a set of approaches utilized to efficiently integrate all parties of the supply chain to fulfill a request from a customer. Companies like Amazon, Zara, Walmart, Toyota, Dell, and Procter & Gamble are proof that excellence in supply chain management is a must to achieve industry leadership. With increasing competition around the globe, supply chain management is both a challenge and an opportunity for companies. The main goal of this course is to introduce you to the key concepts and techniques that will allow you to analyze, manage and improve supply chain processes for different industries. The course is a combination of lectures, case studies, in-class exercises, and games with the goal of defining key tradeoffs that managers need to understand and evaluate to successfully manage complex supply chains. Quantitative tools designed to evaluate these tradeoffs will be studied and used extensively throughout the course. Topics that will be covered in this course include: Managing inventory, forecasting in supply chains, the optimal design of the supply chain, transportation and distribution, bullwhip effects and dealing with uncertainty, sourcing and supply contracts.

Learning Outcomes: 1. Develop an

understanding of how supply chain management can improve operations efficiency and market responsiveness under uncertainty. 2. Utilize and apply theories, concepts, and optimization techniques in analyzing, managing and improving supply chain processes for various industries. 3. Obtain skills to assess supply chain performance and make recommendations to enhance supply chain competitiveness in today's business environment. 4. Identify current issues and trends in global supply chain management such as sustainability, consumer health, and national security. Credits: 3.00

CSR 41800 - Selling And Sales Management Capstone

Credit Hours: 3.00. A capstone course in advanced professional selling taught in a seminar format and designed to prepare students for the transition from student to professional. Students are introduced to practitioner-focused issues involved in long-term, major B2B account sales and an emphasis is placed on professional presentation skills. Students will complete a senior group research project and a major account sales project. Professional dress code from business-casual to full-business attire required based on the scheduled day-to-day activity.

Learning Outcomes: 1. Construct a complete selling and sales management program (term project). 2. Demonstrate the ability to analyze selling and sales management situations, and apply skills to solving selling and sales management problems and developing effective selling strategies (exams; quizzes; class exercises). 3. Identify how diversity, ethical, global, and multicultural considerations affect the selling and sales management decision-making processes (exams; class exercises). 4. Demonstrate effectively communication skills by the presentation of a research project in an oral presentation and in a written paper (term project presentations and project updates). Credits: 3.00

CSR 42100 - Apparel Design III

Credit Hours: 3.00. Creation of apparel product line or collection from concept to consumer. Application of principles of apparel design from rendering, technical sketches, pattern design, pattern grading, marker making, and construction of several apparel garments from the line or collection.

Credits: 3.00

CSR 48000 - Financial Counseling And Planning Internship

Credit Hours: 1.00. Supervised internship in the financial services industry. The experience will enable students to develop their professional interest and skills. Attendance at a pre-planning meeting required. Permission of department required.

Credits: 1.00

CSR 48100 - Ethics And Behaviors In Financial Planning

Credit Hours: 3.00. As research in behavioral finance makes increasingly clear, understanding the psychology of financial behaviors is a critical skill for financial planners. Simultaneously, understanding ethical challenges to financial planners' own behaviors, and complying with new and ever more complex regulations, is a key requirement of successful and relevant financial planning and advice-giving. The course will enable students to be better financial planners by reviewing rules of behaviors for financial planners, improving students' capacity to provide fiduciary advice, and enhance their ability to integrate psychological insights into customers' financial behavior throughout the financial planning process.

Learning Outcomes: 1. Identify ethical issues and compliance matters in the field of financial counseling and planning. 2. Evaluate client and planner attitudes, values, biases, behaviors, and their impact on the financial planning relationship. 3. Demonstrate understanding of The CFP Board's Code of Ethics and Professional Responsibility and Rules of Conduct; Disciplinary Rules and Procedures, and Financial Planning Practice Standards. 4. Apply basic knowledge of behavioral finance and its impacts on clients' financial needs (including in times of crisis). Credits: 3.00

CSR 48400 - Consumer Investment And Savings Decisions

Credit Hours: 3.00. A survey of consumer investment alternatives, with emphasis on financial assets.

Learning Outcomes: 1. Analyze investment decisions and investment risk management through portfolio management, capital market equilibrium and asset pricing theories. Credits:

3.00

CSR 48500 - Case Studies In Financial Planning

Credit Hours: 3.00. Financial planning principles and practice. Course utilizes a case study approach toward financial planning for upper- and middle-income households. Business calculator required.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the content found within the Financial Planning curriculum and effectively apply and integrate this information in the formulation of a financial plan. 2. Effectively communicate the financial plan, both orally and in writing, including information based on research, peer, colleague or simulated client interaction and/or results emanating from synthesis of material. 3. Collect all necessary and relevant qualitative and quantitative information required to develop a financial plan. 4. Analyze personal financial situations, evaluating clients' objectives, needs, and values to develop an appropriate strategy within the financial plan. 5. Demonstrate logic and reasoning to identify the strengths and weaknesses of various approaches to a specific problem. 6. Evaluate the impact of economic, political, and regulatory issues with regard to the financial plan. 7. Apply the CFP Board Financial Planning Practice Standards to the financial planning process. Credits: 3.00

CSR 48600 - Retirement Planning And Employee Benefits

Credit Hours: 3.00. Analysis of employee benefit plans, retirement needs analysis, and types of retirement plans including employer-sponsored plans and participant-directed plans.

Learning Outcomes: 1. Evaluate a client's retirement income and savings need. 2. Explain important provisions of Social Security, The Affordable Care Act and Medicare. 3. Differentiate between individual Retirement Arrangements including those used by individuals and small businesses. 4. Know the rules relating to qualified retirement plans. 5. Conduct an in-depth analysis of qualified plans (e.g. defined benefit, profit sharing, 401(k) plans, stock bonus plans, and ESOPs). 6. Employ rules and strategies for appropriate retirement decumulation. 7. Understand deferred compensation plans, stock option plans, and planning for executive compensation. Credits: 3.00

CSR 49000 - Independent Study

Credit Hours: 1.00 to 4.00. Independent study. Permission of instructor required.

Credits: 1.00 to 4.00

CSR 49700 - Honors Research Project

Credit Hours: 1.00 to 4.00. The completion of the independent honors research project for CFS Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Credits: 1.00 to 4.00

CSR 50300 - EXPIRED - Transitional Health Disparities: Research, Practice, And Policy

Credit Hours: 3.00. This course will provide an overview of quantitative and qualitative research methods, measurement models, and research skills relevant to translational health science and the transfer/translation of knowledge from the research setting to applied practice settings. Course material will place special emphasis on research skills for developing health disparities translational researchers and strategies for being culturally competent, and career-minded in the mediation, cultivation, and development of translational research skills, and the implementation of evidence-based practices. Emphasis is placed on service needs of marginalized populations.

Learning Outcomes: 1. Identify and describe quantitative and qualitative research methods relevant to translational research in health disparities; be able to discuss measurement models and demonstrate skills of research relevant to translational research in health disparities. 2. Distinguish between core principles of implementation science and the transfer/translation of knowledge from the research setting to clinical practice settings in health disparities. 3. Discuss definitions and terms related to evidence-based practice (EBP), the history and progression of EBP, and the importance of empirically supported knowledge transfer from research settings to clinical settings and policy initiatives in health

disparities. 4. Evaluate the importance of and need for culturally competent clinical and services research and the development of culturally adapted EBP's in health disparities. 5. Summarize ethical principles in clinical and services research in health disparities. Credits: 3.00

CSR 59000 - Special Problems In Consumer Sciences And Retailing

Credit Hours: 1.00 to 4.00. Credit variable. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

CSR 62300 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (HK 67500) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

CSR 63100 - Consumer Behavior Theories

Credit Hours: 3.00. An examination of research methods, principles, and theories of social science as they apply to the study of consumer behavior and marketing sciences. Prerequisite: STAT 50100 , STAT 50200 , or PSY 60000 , PSY 60100 .

Credits: 3.00

CSR 68100 - Consumption Theories

Credit Hours: 3.00. Analysis of theories of consumption with emphasis on their relation to current practices and to the history of economic thought. Permission of instructor required.

Credits: 3.00

CSR 69000 - Independent Study In Consumer Sciences And Retailing

Credit Hours: 1.00 to 6.00. Topic and credit to be arranged. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 6.00

CSR 69700 - Final Non-Thesis Paper

Credit Hours: 1.00 to 3.00. The curriculum of consumer behavior and family and consumer economics has evolved in the past decades with the changing market trend to currently encompassing specializations for meeting the diverse and integrated needs of individual consumers, their families, and communities. The non-thesis option is called to respond to the increasing market demand for professionals who are able to solve practical issues in the field in addition to mere epistemological pursuits. This proposed new course is designed for the students from this option to organize their learnings in the option in a way that provides propositions and strategies for addressing their topics of interest. Hence, this course should be taken during the last semester of the student's Master's program. The students will work with their major advisors for the topic and design of the study. Prerequisites: The students should take this course during the last semester of their non-thesis master's program. It is preferably taken after the students have completed the recommended core courses. Permission of Instructor required.

Learning Outcomes: 1. Be prepared for the workforce in business, nonprofit organizations, and public services. 2. Cultivate critical and analytical thinking, written communication, problem solving, and technology. Credits: 1.00 to 3.00

CSR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 18.00

CSR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 18.00

Critical Disability Studies

CDIS 23900 - Introduction To Disability Studies

Credit Hours: 3.00. Introduces students to the principles of and debates within disability studies. Topics explored include ideas of normalcy; the social model of disability; history of eugenics and its current manifestations; relations between disability and other identity categories; issues of social and physical access; cultural representations of disabled people.

Learning Outcomes: 1. Identify different models of understanding disability. 2. Understand the ways normalcy is socially constructed. 3. Distinguish between impairment and disability. 4. Offer informed opinions on current eugenic practices. 5. Compare and contrast disability to other identity categories such as race, gender, and sexuality. 6. Identify exclusionary practices that marginalize disabled people. Credits: 3.00

CDIS 29000 - Special Topics In Critical Disability Studies

Credit Hours: 3.00. Various topics in critical disability studies, changing from semester to semester as presented by different instructors.

Learning Outcomes: 1. Vary due to variable nature of course. Credits: 3.00

Dance

DANC 10100 - Modern Dance Technique I

Credit Hours: 2.00. An introduction to the techniques and principles of modern dance.

Learning Outcomes: 1. Demonstrate elementary level performance of skills and principles of Modern Dance technique. 2. Perform basic dance movement with personal expression. 3. Demonstrate fundamental bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 10200 - Ballet I

Credit Hours: 2.00. An introduction to the techniques and principles of classical ballet.

Learning Outcomes: 1. Demonstrate essential ballet skills, principles and techniques used in ballet. 2. Demonstrate correct use of ballet terminology. 3. Recognize and define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor. Credits: 2.00

DANC 10300 - Jazz Dance I

Credit Hours: 2.00. An introduction to the principles of jazz dance techniques: alignment, isolations, rhythmic patterns, and basic locomotion.

Learning Outcomes: 1. Perform basic skills of the body including coordination, proper alignment, and musicality through movement phrases and exercises aligned with Jazz Dance Techniques. 2. Demonstrate an elementary understanding of core principles, techniques and histories under the broad umbrella of Jazz Dance Technique. 3. Demonstrate a fundamental understanding of Jazz Dance vocabulary and basic body anatomy. Credits: 2.00

DANC 10400 - Hip Hop I

Credit Hours: 2.00. This is an introductory-level course where students will explore the different styles, vocabularies, and grooves of dance styles under the Hip Hop umbrella. Students will learn elements of choreography, freestyling (also known as improvisation), and grooves of varying Hip Hop dance genres.

Learning Outcomes: 1. Identify the pioneers and "Five Elements of Hip Hop" dance and culture. 2. Integrate the movement vocabulary from class into freestyle and choreography. 3. Develop bodily and spatial awareness, mobility, and strength. 4. Demonstrate understanding of foundational movements through freestyle practices, choreography, and movement vocabulary. Credits: 2.00

DANC 20100 - Modern Dance Technique II

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 10100.

Learning Outcomes: 1. Demonstrate confident performance of skills and principles of Modern Dance technique. 2. Perform dance movement with personal expression and artistry. 3. Demonstrate increased bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 20200 - Ballet II

Credit Hours: 2.00. A continuation of the principles and techniques of classical ballet addressed in DANC 10200.

Learning Outcomes: 1. Demonstrate advanced ballet skills, principles and techniques used in ballet, with focus on increased strength and coordination. 2. Demonstrate correct use of ballet terminology. 3. Define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor, as well as various ballet variations. Credits: 2.00

DANC 20300 - Jazz Dance II

Credit Hours: 2.00. A continuation and refinement of the jazz dance concepts and movement vocabulary addressed in DANC 10300.

Credits: 2.00

DANC 23000 - Biomechanics Of Dance, Movement And Strength

Credit Hours: 2.00. This course will provide conceptual and experiential understanding of biomechanical approaches to dance technique. Through studio, lecture, movement exercises and assignments, the students will learn to perform all types of dance and movement with ease, strength and economy of motion.

Learning Outcomes: 1. Integrate movement patterns that are efficient, stable and mobile. 2. Develop the ability to identify problem areas in dance and movement technique. 3. Know tools for developing successful skills. Credits: 2.00

DANC 24000 - Dance Composition

Credit Hours: 3.00. An introduction to the theory and practice of the principles and utilization of choreographic tools; movement exploration, manipulation of basic dance elements, development of movement themes, and application of compositional dance forms.

Learning Outcomes: 1. Learn the systematic application of choreographic tools which will allow them to create a coherent dance composition. 2. Increase awareness for dance composition and understand its value and meaning as both a creator and observer. 3. Learn to discuss and critique dance choreography. Credits: 3.00

DANC 24500 - Practicum In Dance Performance And Production

Credit Hours: 1.00 to 2.00. Open through audition. The study and practice of dance rehearsal, performance and basic concert production techniques, culminating in a main-stage dance concert. Permission of instructor required.

Learning Outcomes: 1. Demonstrate understanding of professional dance company member responsibilities and processes by learning choreography as assigned and performing at the highest standard. 2. Demonstrate personal artistry as a dancer and dependability as an ensemble member through rehearsals, technical preparations and performances. 3. Demonstrate interpersonal collaboration skills in creative process. Credits: 1.00 to 2.00

DANC 26000 - Dance Improvisation

Credit Hours: 3.00. In this course students explore a variety of techniques for creating movement. While physically researching concepts from a broad spectrum of improvisational artists, students expand their boundaries and definitions of dance, art and creativity. Important concepts include choice making, moving from internal motivations, and ensemble collaboration. All backgrounds in dance and movement are welcome, and will benefit from this course.

Learning Outcomes: 1. Demonstrate multiple approaches to create unique dance movement spontaneously. 2. Formulate and participate in improvised solo and group dance performances. 3. Generate qualities of movement and elements of dance composition through improvisation. 4. Evaluate the many critical roles of improvisation in the art of dance. Credits: 3.00

DANC 26100 - Contact Improvisation

Credit Hours: 3.00. This course is both a physical practice and philosophical exploration of the techniques and underlying premise of this contemporary partner dance form. CI training involves a practice of movement improvisation while developing the body's ability to attend to the effects of gravity, muscle tone, and anatomical structures on dancing solo and in partnership. While increasing their body awareness, respect, sensitivity and connection, students learn about collaborative community creativity, which can be applied in other settings including design, performance, and social activism. DANC 26000 is a good preparation for this course, but not required. Course may be repeated for credit.

Learning Outcomes: 1. Demonstrate basic skills

of solo movement in group dance setting. 2. Demonstrate basic skills of partnering using weight sharing and touch. 3. Model nonverbal communication with a partner. 4. Improve awareness and perception of the body. Credits: 3.00

DANC 30000 - Performance Production

Credit Hours: 3.00. This course teaches many aspects of producing a performance, from backstage to onstage. Students will learn the technical aspects of creating a professional performance by both observing performance production and developing an actual performance, which this semester is the Xperimental 2024 Concert. Students may participate in the production in a variety of active roles; however, they will be exposed to all aspects through observation, participation, and discussion. Production roles include: director and assistant director, choreographer, performer, lighting design and staging, sound design and technical support, and stage crew (stage manager, house manager, ticket manager, setup and strike support). Occasional class sessions cover skills to enhance your knowledge of some areas of production such as sound design, and lighting technology. For many students who are at the university level, the art of performance is defined almost totally by the act of being on stage performing, in studios or on stages. This course is designed to invite students to learn about all the activities that are done behind the scenes in order for live performances to be presented to an audience. We will discuss what is involved in both large institutional performance spaces, and compare this to our university performance. Then we will discuss what this scenario looks like for performance professionals after college. This course will greatly enhance students' ability to produce their own events in the future, and develop greater appreciation for the collaborative nature of live performance as art form.

Learning Outcomes: 1. Plan and create a small live performance production. 2. Identify the necessary components of a production of a professional performance and explain the key collaborative interactions among them. 3. Practice basic skills for working performers and producers including those relating to technology and business. Credits: 3.00

DANC 30100 - Modern Dance Techniques III

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 20100. Emphasis placed on expressive qualities of movement.

Learning Outcomes: 1. Demonstrate strong performance of skills and principles of Modern Dance technique. 2. Perform complex movement with personal expression and artistry. 3. Evaluate the art of Modern Dance and examine its value and meaning as both a creator and observer. Credits: 2.00

DANC 34500 - Choreography

Credit Hours: 3.00. This course focuses on methods and practices of choreographing contemporary dance works. It teaches the choreographic process: how to create original movement and expand and build both solo and group dance works. Basic compositional elements of exploring and manipulating movement and structuring choreographed material are utilized. The development of production elements are taught to support choreographic intent. Highly recommended before enrolling in this course: DANC 24500 and DANC 30100.

Learning Outcomes: 1. Identify and apply choreographic tools to create a coherent dance composition. 2. Analyze dance composition and understand its value and meaning as both a creator and observer. 3. Express individual artistry through dance composition. Credits: 3.00

DANC 34600 - Intermediate Choreography

Credit Hours: 1.00 or 2.00. A study of selected principles underlying the design of group performance in modern dance. Permission of instructor required.

Learning Outcomes: 1. Analyze and research methods for constructing and choreographing a group dance work. 2. Demonstrate ability to craft, edit and stage a piece of choreography for a professional-level dance performance. 3. Demonstrate growth in interpersonal and leadership skills while working with the group of dancers cast in their dance work. Credits: 1.00 or 2.00

DANC 35000 - Dance For The Camera

Credit Hours: 3.00. An introduction to technical and aesthetic techniques to create screendance or dance film, with an emphasis on camera use, editing techniques, development and production of choreographic projects designed specifically for film format.

Learning Outcomes: 1. Demonstrate how to use a camera and capture dance footage. 2. Demonstrate basic skills in non-linear digital video editing with attention to motion and action editing in dance. 3. Analyze the art of screendance and examine its value and

meaning as both a creator and observer. 4. Create a sense of personal expression and artistry through crafting dance film projects. Credits: 3.00

DANC 35100 - Intermedia Dance Technology

Credit Hours: 3.00. An introduction to dance and intermedia within the choreographic process. Integration of movement and various forms of technology which might involve digital images, film, animation, programming, sensors, sound, lighting and/or robotics.

Learning Outcomes: 1. Demonstrate new approaches to choreography by integrating intermedia technology into the dance-making process. 2. Apply basic skills for creating or implementing film, digital media, sound editing, and/or programming. 3. Analyze intermedia dance technology works. 4. Develop awareness of dance intermedia technology art and examine its value and meaning as both a creator and observer. 5. Build a sense of personal expression and artistry through the composition of intermedia dance technology works. Credits: 3.00

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

DANC 37800 - Survey Of Concert Dance History (UCC: HUM)

Credit Hours: 3.00. This course is a broad survey of concert dance history predominately in the 20th and 21st century in Western cultures. The direct relationship and influence of the culture, training, choreographic, and performative records of dance practices, to socio-political ideologies of gender, race, sexuality, and national identities will be the area of investigation. Students will read, watch, research and actively participate in discussion regarding important dance figures, movements, eras, and their social and cultural reverberations. Dance's relationship to other art practices throughout history will also be a subject of lecture and discussion.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate understanding of the foundational underpinnings of concert dance history. 2. Identify specific choreographers and their works of art in oral and written communication. 3. Recognize concert dance contexts in order to speak and write clearly about them. 4. Demonstrate an awareness of the relationships and interactions between dance and culture. Credits: 3.00

DANC 37900 - The Art Of Protest: An Examination Of The Role Of Arts, Artists, Activism, & Social Transformation

Credit Hours: 3.00. Throughout history, art has been used to advocate for political movements and provoke social action and transformation. This course examines the role of the arts and the artist and their relationship to activism throughout history and beyond. We will investigate how art has been used as a tool to transform cultural perspectives, alter policies, and promote social change. We will explore a range of artists whose methodologies, materials and approach challenge the cultural norms. From printmakers to musicians, to choreographers, to performance artists, students will engage and evaluate the act of art-making as a tactic of resistance and the responses to those acts. We will investigate readings that argue for and against the need for artists to make work that politically challenge their society. Once a foundation of knowledge has been laid, we will turn to the creative process through an investigation of materials and practices - performance, mixed media, and photography. Students will research, watch, discuss, create, and perform their own projects that promote social transformation.

Learning Outcomes: 1. Demonstrate effective oral and written communication in formal assignments, critical analysis, and class presentations. 2. Demonstrate through creative projects how art, culture, and activism have a direct and interactive relationship. 3. Investigate and critically engage with artists whose work transform cultural perspectives, alter policies, provide socio-political commentary, and promote social change. 4. Analyze seminal art and historical and philosophical texts that articulate the role and

importance of political art. Credits: 3.00

DANC 49000 - Special Problems In Dance

Credit Hours: 1.00 to 3.00. Individual readings, topics, or projects in dance. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the topic. Credits: 1.00 to 3.00

Earth Atmospheric and Planetary Sciences

EAPS 10000 - Planet Earth (UCC: STS)

Credit Hours: 3.00. An introduction to the Geosciences-Earth science, oceanography, atmospheric science and astronomy. The course emphasizes topics (earthquakes, volcanoes, ocean pollution, climate change, severe weather, etc.) that are of general interest and relevance, and the interconnections between various Earth processes. CTL:IPS 1730 Earth Science

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

EAPS 10400 - Oceanography (UCC: STS)

Credit Hours: 3.00. Origin of the oceans and marine life. Seafloor spreading and marine geology; currents, waves, and tides; marine organisms and ecology; beaches and nearshore life. Man's use and abuse of the sea, including contemporary problems and future opportunities. The role of oceans in climate and evolution of the biosphere.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand ocean and coastal processes. 2. Understand potential future impacts of ocean and other environmental changes. Credits: 3.00

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space.

Credits: 3.00

EAPS 10600 - Geosciences In The Cinema (UCC: STS)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about natural hazards based on the depictions of such hazards in movies. Topics include earthquakes, tsunamis, volcanoes, tornadoes, hurricanes, climate change, asteroid impacts, space exploration, and wildfires. The course focuses on the accuracy of the depiction of natural hazards in the movies, the underlying processes that control their formation and the dangers they represent, how they influence society, and how students can prepare for them and keep themselves safe.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how scientists explore natural hazards, make observations, and develop theories. 2. Explain the processes that control natural hazards and where and when they are likely to occur. 3. Know the natural hazards inherent to a student's location and be able to plan how to keep themselves safe in the event of such an occurrence. 4. Critically assess the reasonableness of depictions of natural hazards in the media. Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history

from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

EAPS 11600 - Earthquakes And Volcanoes (UCC: SCI)

Credit Hours: 3.00. A survey class on earthquakes and volcanoes. Topics include earthquake hazards and forecasting, the use of seismic waves to investigate the earth's interior, volcanoes and tectonics, volcanic hazards, and the influence of volcanoes on climate. Examples of recent and historic earthquakes and volcanic eruptions are presented.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

EAPS 11700 - Introduction To Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. The weather/climate system. Solar variability and Milankovitch Theory. Atmospheric scales of motion. Chemistry of greenhouse gases and aerosols. Fundamental laws of meteorological dynamics and radiation. Weather systems, air masses and fronts. Severe storms, hurricanes and tornadoes. (Required for atmospheric sciences majors.).

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Appreciate the temporal and spatial scales of climate change, from Milankovitch Theory and glacial/interglacial regions, to the anthropogenic effects of greenhouse gases (GHG's). 2. Appreciation of how weather events collectively and cumulatively, lead to the establishment of climate. 3. Understand the basic scales of atmospheric motion (space and time) and the classification of weather events into these scales (planetary, synoptic, mesoscale and microscale). 4. Understand the definition of aerosols and GHG's and their relation to weather and climate. 5. Understand the four basic laws of radiation (beginning with Planck's Law). 6. Understand the fundamental laws of atmospheric motion, and some general principles of weather prediction. 7. Understand the basic principles of cloud physics, from CCN to cloud formation and precipitation. 8. Understand the First Law of Thermodynamics, and the general concepts of thermal convection, including lapse rates and the concept of latent heat release. 9. Understand the behavior, including simulation and differences, of geophysical columnar vortices, from dust devils to tornadoes to hurricanes. 10. Understand the broad context of atmospheric science, from solar physics and space weather, to meteorology and lower atmosphere weather phenomena. 11. Understand how the planetary atmospheric circulation establishes a jet stream and the semi-permanent pattern of wind and pressure belts (e.g., the trade winds and the westerlies). 12. Understand the formation and movement of air masses and fronts, including the formation of Extratropical Cyclones. 13. Understand the formation of thunderstorms, including severs thunderstorms, hail and tornadoes. 14. Understand tornado climatology in the USA, the tornado intensity scale, taxonomy and climate considerations such as ENSO pattern of El Nino and La Nina. 15. Understand weather hazards in the field of aviation, particularly thunderstorm phenomena (such as hail and downburst winds). 16. Understand a basic review of weather/climate and energy (from wind farms to climate changes). Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12900 - Earth System Dynamics (UCC: SCI/STS)

Credit Hours: 3.00. Provides foundational knowledge and critical thinking skills to discuss the Earth's changing climate and environment and their impacts. Introduces how the components of the Earth system - atmosphere, hydrosphere, lithosphere, and biota -- interact with each other in response to various forcings. Course is designed to enhance learners' geospatial-temporal thinking skills and geoscience literacy, as well as analyze some of the 'what if' scenarios using a 'systems approach'.

University Core Curriculum (UCC): (UCC: SCI/STS) Learning Outcomes: 1. Describe the various sub-systems inside the Earth system and conceptualize how they interact. 2. Apply facts and concepts about geospatial-temporal phenomena when relevant events arise in real life. 3. Develop the ability to analyze the Earth system from personal, community to global scales. 4. Connect available evidence in real life to climate change impacts for decision- and policy-making. Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

EAPS 13800 - Thunderstorms And Tornadoes (UCC: SCI)

Credit Hours: 3.00. Not open to juniors and seniors majoring in atmospheric science. An elementary treatment of the physical

structure of the atmosphere and the dynamical conditions that lead to the development of convective clouds, thunderstorms, and severe weather (including tornadoes, hail, wind, rain, lightning, and flash floods). This course will also focus on storm climatology, the socioeconomic impact of severe weather, as well as prediction, detection, warnings, and safety procedures. Analysis of severe weather events will include tornado movies and case studies of ground/aerial surveys of storm damage.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

EAPS 19100 - Introductory Topics In Earth And Atmospheric Science

Credit Hours: 1.00 to 3.00. Introductory special topics in earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

EAPS 20500 - Fundamentals Of Planetary Science

Credit Hours: 3.00. This course provides a quantitative understanding of the fundamental principles that govern the behavior of planetary systems, including their atmospheres, surfaces, interiors, and orbital dynamics. This course is intended to be a quantitative follow-on to EAPS 10500, and aims to provide students with hands-on experience with physics-based problem solving, scientific programming, and developing research projects. Lecture periods will include lectures as well as group work on problems, and lab periods will focus on programming projects in Python. By the end of the course, students will have a strong foundation in the principles and techniques of planetary science and be well-prepared to engage in upper-year courses and conduct planetary science research. It is recommended that students have completed EAPS 10500 The Planets, PHYS 17200 Modern Mechanics or equivalent, and have some previous programming experience (preferably in Python).

Learning Outcomes: 1. Apply principles of classical physics to investigations of planetary orbital dynamics, surfaces, interiors, and atmospheres. 2. Write and debug basic data analysis, graphical display, and numeric computation code in Python. 3. Come up with a science question, conduct a literature review, test hypotheses using real data or models, and present an informed assessment. Credits: 3.00

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC:

SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

EAPS 23000 - Laboratory In Atmospheric Science

Credit Hours: 2.00. A laboratory course that introduces the fundamentals of atmospheric science through quantitative exercises. The theoretical exercises include the vertical structure of the atmosphere, the Earth's energy budget, atmospheric moisture, saturation and stability, clouds and precipitation and atmospheric motion. Data and map analysis exercises include mid-latitude cyclones, thunderstorms and tornadoes, hurricanes and controls of climate. Prior or current course work in introductory atmospheric science is required. This course may not be taken for credit by students in the atmospheric science option of the Department of Earth and Atmospheric Sciences.

Credits: 2.00

EAPS 23001 - Laboratory In Atmospheric Science: Introduction To Weather And Climate Datasets

Credit Hours: 2.00. This course is a Python-based introduction to the array of weather and climate datasets freely available on the internet in an online computational laboratory setting. The course will emphasize the importance of having data be freely available and "FAIR" (Findable, Accessible, Interoperable, Reusable) from the point of view of the philosophy of science, from a data science perspective, and from a practical "how to do it" perspective.

Learning Outcomes: 1. Write Python code to read in, plot, and perform simple analyses using a wide range of weather and climate datasets (observations, numerical weather forecasts, reanalysis, climate models) in different formats that are publicly available on the internet. 2. Visualize weather and climate data in maps and graphs. 3. Communicate weather and climate information clearly and concisely to non-experts using weather and climate data visualizations. Credits: 2.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in

meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 24400 - Earth Materials II

Credit Hours: 4.00. The study of common igneous, sedimentary, and metamorphic rocks. The origin and occurrence of rocks, weathering, and alteration processes. Prior course work in earth materials or mineralogy is required.

Credits: 4.00

EAPS 30100 - Oil!

Credit Hours: 3.00. Petroleum is a common thread that interweaves Geoscience with the Political-Economic history of the 20th century. Its dominance in current society has major repercussions on our current and future society and environment. The unequal distribution of petroleum and natural gas, coupled with innovative geologists and engineers, has set the stage for the modern geo-political world. This course is a unique survey into the multitude of aspects of petroleum -- from its formation to "resource wars".

Learning Outcomes: 1. Enlighten and enable self-discovery of this major past, present and future issue in human civilization. 2. Understand the selected major oil-gas basins. 3. Learn Technical writing. 4. Examine case examples of past unethical corporate or private behaviors and how these were eventually resolved or remain a concern (e.g., monopoly building and later bread-up of Standard Oil; Ecuador pollution cases;; CIA involvement with Iranian government overthrow in 1950s to restore oil company monopoly; corruption in African and other ""oil-cursed"" nations; atmospheric pollution of cities; major oil spills; etc.). 5. Learn exactly how a hydrogen-fuel car would function, including engineering costs; or exactly how ozone is produced in car-dominated cities in the summer. This multidisciplinary course also includes aspect of social change, role of oil-gas in national politics, climate effects, and the petrochemical industry products. 6. Understand petroleum basins and the importance of hydrocarbons in history/society/climate is essential. This OIL! Course is unique in placing the geological aspects into the broader context of social, international and environmental concerns. Credits: 3.00

EAPS 30900 - Computer-Aided Analysis For Geosciences

Credit Hours: 3.00. Application of computer analysis techniques including error analysis, line and surface fitting, spatial and temporal correlations, contouring, interpolation, and map projections. These methods are discussed in terms of specific geologic applications. All exercises and examples are developed using commercial mathematical software package. A three-hour-per-week computer laboratory tutorial provides hands-on experience with the techniques discussed in class. Prior course work in computer programming is required.

Learning Outcomes: 1. Carry out computational solutions to a given range of data analysis problems. 2. Select the appropriate analysis and visualization approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong

assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

EAPS 31500 - Biogeochemistry

Credit Hours: 3.00. The course examines the main element cycles of Earth: carbon, oxygen/hydrogen, nitrogen, sulfur, phosphorous, and trace metals, and how they are interconnected from terrestrial, aquatic/ocean, and atmospheric perspectives. General chemistry concepts such as equilibrium, free energy, electrochemistry are used to understand the energetics of the cycles. Connection between the cycles and environmental problems, such as climate change and air pollution will be emphasized.

Learning Outcomes: 1. Construct a mental model of the Earth system and the flow of elements among different parts of the system. 2. Examine modern problems caused by human perturbation of the main biogeochemical cycles. 3. Perform basic research tasks and present scientific findings. Credits: 3.00

EAPS 31900 - Exploring Earth Through Time

Credit Hours: 3.00. The course will explore the history of the Earth from its beginning 4.5 billion years ago to the present. Our understanding and insight into the history of the Earth has greatly expanded during the last several decades. Emphasis will be placed on the relationships of tectonic processes that shaped the surface of the Earth and the evolution of the Earth's biosphere. The course will also examine how the role of evolution of life has played in the history of the atmosphere and oceans.

Credits: 3.00

EAPS 32500 - Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who have an interest in topics in meteorology applied to aviation operations with emphasis on meteorological hazards for instrument flight. Topics covered include obtaining and evaluating weather data, review of synoptic meteorology, map analysis, the ICAO standard atmosphere, pressure and altimetry, atmospheric thermodynamics, moisture and stability, low-IFR operations, aircraft icing, turbulence, thunderstorms and associated hazards, and interpretation and use of radar and satellite imagery. Prior course work in introductory atmospheric science and pre-calculus is required.

Credits: 3.00

EAPS 32700 - Climate, Science And Society

Credit Hours: 3.00. This course will examine the broad problems of climate change by examining the relationship between science, politics, and society by using climate change as a lens through which to examine larger issues. Students will be encouraged to identify similar themes in their own experiences as emerging scientists, engineers and global leaders. Adequate preparation to write essays and perform basic arithmetic calculations needed. Prior knowledge of climate change science is not necessary.

Learning Outcomes: 1. Able to think logically and creatively. 2. Able to apply knowledge to practical situations. 3. Able to respond flexibly as situation changes. 4. Understand ethical issues, particularly in Science. 5. Appreciate diverse experiences, thoughts, backgrounds. 6. Understand and appreciate Science in the world environment. Credits: 3.00

EAPS 34400 - Igneous And Metamorphic Petrology

Credit Hours: 4.00. This course provides an overview of igneous

and metamorphic petrology including, but not limited to, the following topics: experimental petrology and phase diagrams, melting of the Earth's interior, understanding the relationship between mineralogy, chemical composition, and physical conditions, relating magmatism and metamorphism to different tectonic environments, and exploring the similarities, and differences, between magmatism on Earth and other planetary bodies. The lectures and labs emphasize developing a basic understanding of petrology and petrologic processes, rather than the simple memorization of terms, definition, and facts.

Learning Outcomes: 1. Understand how petrologists determine the origin of common igneous and metamorphic rocks and the data that supports current interpretations. 2. Describe the types of igneous and metamorphic rocks that would be found in different tectonic settings. 3. Interpret and understand phase diagrams and how they are constructed. 4. Link mineralogy to chemical compositions and understand how compositions can change during melting, fractional crystallization, or open-system metamorphism. 5. Understand how metamorphic rocks can be utilized to quantitatively constrain the physical conditions that a rock experienced. 6. Gain confidence in understanding and using scientific methods and information to interpret igneous and metamorphic rocks. Credits: 4.00

EAPS 35200 - Structural Geology

Credit Hours: 3.00. This course deals with the nature and evolution of structures in rock deformed naturally by flow and fracture, as deduced from experimental, theoretical and field studies. Specific topics include: structures in three dimensions using descriptive geometry and stereonets, field measurements of rock geometry, tensors, strain and stress, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop, the structure and mechanics of mountain belts. Students will be expected to show competency with using a general set skills, techniques, and tools commonly used by professional geoscientists.

Learning Outcomes: 1. Interpret geologic structures in three dimensions using descriptive geometry, stereonets, and field measurements of rock geometry. 2. Evaluate quantitatively observations of the deformation in the crust using basic stress and strain theory, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop. 3. Recognize the structures and give a mechanical explanation for the development of mountain belts. 4. Apply these skills in the field. Credits: 3.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to

geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

EAPS 36000 - Great Issues In Climate Change And Society

Credit Hours: 3.00. This course develops basic skills and knowledge critical to analyze issues of energy use, climate change, and sustainability that incorporate both societal and scientific perspectives. The goal of this course is not to arrive at particular consensus solutions to the problems associated with these issues but instead to foster an informed (through information literacy) debate that will ultimately be waged as solutions are sought. Working in teams the students work throughout the semester to complete a capstone teamwork project and a group presentation. Counts for Great Issues course in College of Science.

Learning Outcomes: 1. Understand/interpret the complex issues related to energy (production and use) policy and climate change. 2. Recognize the basic ethical, technological, political, and economic issues influencing the production of renewable and fossil energy. 3. Identify, distinguish, and use credible/factual information sources to establish a defensible viewpoint on these issues. Credits: 3.00

EAPS 36400 - Natural Hazards: Science And Society

Credit Hours: 3.00. This course will investigate the role of data and science in policy and decision-making as it relates to natural hazard resiliency. The scientific fundamentals of specific hazards will be introduced along with an explanation of how available data, various policies, programs, and real-time decisions can impact a community's response and recovery from disasters. Guest speakers describe their role in specific disasters, and in framing the policies and decisions made in the aftermath of the natural hazards. This course counts as a Great Issues course in the College of Science for Juniors and Seniors.

Learning Outcomes: 1. Demonstrate the ability to write knowledgeably and persuasively about the issues examined. 2. Use statistics and data ethically in the discussion of great issues. 3. Work as an active and contributing member of a team. 4. Transmit accumulated knowledge in effective written and oral presentations. Credits: 3.00

EAPS 36700 - Survey Of Planetary Atmospheres

Credit Hours: 3.00. This course is intended to serve as an introduction to the diversity of planetary atmospheres in our solar system and beyond for those without an atmospheric science background. Topics to be covered in this class include: The basic structure and properties of an atmosphere, how planetary atmospheres form / are eroded, the balance of radiation and its effect on atmospheric motions, the presence and formation of hazes, clouds, and aerosols, fundamental atmospheric compositions and chemistry, the connections between planetary interiors, surfaces, and atmospheres, and how we measure and interpret observations of exoplanet atmospheres. To achieve this, we will learn about Earth's atmosphere and us our terrestrial template to compare, contrast, and explore the atmospheres of other astronomical bodies.

Learning Outcomes: 1. Gain familiarity with the different types of planetary bodies and the atmospheres that are present on them. 2. Recall the main properties of planetary atmospheres in our solar system. 3. Identify and apply the general properties of the atmospheres. 4. Understand the effect of radiation and distribution of energy in an atmosphere. 5. Recognize the importance of chemical reactions and pathways. 6. Identify the ways in which atmospheres are formed, lost, and evolved. 7. Make simple predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. Credits: 3.00

EAPS 37500 - Great Issues - Fossil Fuels, Energy And Society

Credit Hours: 3.00. Prosperity of the 20th century was based on abundant and cheap energy; during the 21st century we will be faced with difficult challenges. Our society will face higher energy prices, decline of petroleum based fuels supplies,

increased environmental effects of fossil fuels usage, and the challenge of solving the technological problems of developing alternative fuels. This course will review the structure, economics, and geopolitical issues faced by fossil fuel industries and the mitigation strategies that will be needed to change to low fossil fuel use society based on low polluting renewable energy sources. Counts for Great Issues course in College of Science for Juniors and Seniors.

Credits: 3.00

EAPS 38500 - Principles Of Engineering Geology

Credit Hours: 3.00. Application of geology to evaluation of design and construction problems relating to dams, highways, tunnels, and reservoirs; review of construction material sources and their utilization. A field investigation is required. Prior course work in mineralogy, petrology or geology for engineers is required.

Credits: 3.00

EAPS 39000 - Geologic Field Methods

Credit Hours: 3.00. Introduction to geologic mapping principles on quadrangle (7 1/2 min., 15 min., 1:250,000 scales) maps. Application of aerial photography, GPS, and GIS techniques. Emphasis on construction of cross sections, measurement of stratigraphic sections, and preparation of geologic reports. Several weekend field exercises will be required.

Credits: 3.00

EAPS 39100 - Topics In Earth And Atmospheric Sciences

Credit Hours: 1.00 to 4.00. Intermediate special topics in the earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 4.00

EAPS 39500 - Astrobiology

Credit Hours: 3.00. Course explores current ideas on how life originated on Earth and may have originated elsewhere in the universe. Lectures will cover zones of habitability in stellar systems, planetary surface and atmosphere evolution and the environment of the early Earth. Topics include how life on Earth functions and its earliest evolution, SETI, planetary quarantine, panspermia, mass extinctions and the potential for life elsewhere in our own solar system.

Learning Outcomes: 1. Know the outlines of how life developed on the Earth, the principal requirements for life to originate and persist, what features makes a planet (in our system or around other stars) habitable for life. 2. Understand how extrasolar planets are found and what limitations exist in our knowledge of those planets. 3. Understand how NASA is seeking for life on Mars and elsewhere in the solar system, why we are concerned about quarantining spacecraft and returned samples. 4. Acquainted with the rationale and methods of the SETI search for intelligent life in the universe. Credits: 3.00

EAPS 40000 - Planetary Sciences Senior Capstone

Credit Hours: 3.00. In this course, students will use the knowledge they have gained as part of their education at Purdue to develop a comprehensive science-driven planetary exploration strategy. First, students will review the history of planetary exploration. Next, students will understand the current landscape for planetary exploration including missions and instruments which will soon fly. Throughout the course, student-led research and presentation exercises will build to the development of a mission concept for planetary exploration.

Learning Outcomes: 1. Understand of the history of planetary exploration and the major science questions that influenced the designs of historical, ongoing, and proposed spacecraft missions. 2. Make effective and engaging scientific presentations and posters using the Assertion-Evidence model. 3. Understand how the grant proposal writing and evaluation process works within the NASA ROSES grant proposal system, including knowing how to: 4. Write proposals for competitive grant programs, such as NASA ROSES. 5. Evaluate grant proposals to determine their scientific merit. 6. Participate in a proposal peer review panel discussion. 7. Learn to write proposal evaluation peer review reports in a style consistent with NASA ROSES proposal peer review panel guidelines. 8. Become an effective team member in a science-driven spacecraft mission proposal design study. Credits: 3.00

EAPS 40700 - Earth And Planetary System Science

Credit Hours: 3.00. This class will explore the major components of the Earth System-the atmosphere, the hydrosphere (ocean + cryosphere), the biosphere, and the solid Earth-and their interactions, both today and through time. Topics include (1) the evolution of earth's climate system, from global glaciation to ice-free states in the past to future anthropogenic climate change scenarios; (2) how the circulation of the atmosphere, ocean, and solid earth shape the distribution

of chemicals and life through time; (3) how life has transformed Earth's surface environments; and (4) the interplay between atmospheres, oceans, geology, and life on other worlds.

Learning Outcomes: 1. Describe the components of the Earth System and their interactions. 2. Discuss how the Earth system has evolved from its formation to present-day. 3. Understand the role of humans in the Earth System and scenarios for future Earth System evolution. 4. Consider how other planetary systems may resemble or differ from the Earth System. Credits: 3.00

EAPS 41900 - Internship In Environmental Geosciences

Credit Hours: 1.00 to 6.00. This course provides students with an opportunity to gain practical work experience in environmental geoscience. The student works with a faculty advisor to set up an internship consisting of the equivalent of at least six weeks of full-time employment with a government agency, business, or consulting company. Internships typically involve field, laboratory, and office work. A portion of the internship may be part-time work during a regular semester, but at least three consecutive weeks must be full-time work. One credit hour per week of unpaid internship. Six week internship. Prior course work in upper level EAPS courses is required. Permission of department required.

Credits: 1.00 to 6.00

EAPS 42000 - Global Change Modeling

Credit Hours: 3.00. Understanding, monitoring, and modeling global environmental change. Each session examines the response of the interrelated earth systems to different geological, ecological, atmospheric, oceanic, or societal impacts. Topics include global warming, major biogeochemical cycles, atmospheric ozone, coevolution of life and climate, asteroid impacts, and ecological disruptions. The laboratory uses object-oriented modeling software and current NASA satellite data. No prior knowledge of computer programming is required.

Credits: 3.00

EAPS 42100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (AGRY 43100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in introductory atmospheric science, second semester physics or thermodynamics is required.

Credits: 3.00

EAPS 42200 - Atmospheric Dynamics I

Credit Hours: 3.00. (AGRY 43200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations, thermal wind relationships; circulation, vorticity, divergence, and vertical motion. Prior course work in atmospheric thermodynamics and differential equations is required.

Credits: 3.00

EAPS 42300 - Atmospheric Dynamics II

Credit Hours: 3.00. (AGRY 43300) An extension of EAPS 42200, with emphasis on perturbation theory and hydrodynamics stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

EAPS 42501 - Physics Of Climate

Credit Hours: 3.00. To understand climate we describe and synthesize physical processes in the atmosphere and their coupling to the ocean, ice, and land. We quantitatively explore climatology with an equal balance of physical principles and scrutiny of available modern data. Topics include: visualization of atmospheric/land surface/oceanographic climatological data sets; theories of climate dynamics; and climate change. Beginning with radiative balance and simple energy balance models, the course progresses toward understanding the effects of radiative-convective forcing and rotation on the fluid envelopes. Analysis of data in an interactive computer-enabled environment is an important part of the course. By the end of this course, the student should know how the Earth System behaves at large scales and grasp the physical understandings of why.

Learning Outcomes: 1. Quantitatively describe climatology, climate variability, and climate change through physical principles and modern climate data. 2. Use radiative equilibrium, radiative-convective equilibrium, and energy balance models to make predictions of climate change and compare with observations. 3. Describe and synthesize atmosphere and ocean dynamics, large-scale circulation patterns, and interactions with ice and land surfaces. 4. Analyze major contemporary atmospheric science problems and phenomena, such as global warming, ozone hole, El Nino, etc., and the information provided by past climates on Earth. Credits: 3.00

EAPS 43100 - Synoptic Laboratory I

Credit Hours: 1.00. (AGRY 44100) Analysis of vertical distributions of temperature and moisture with applications to adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in atmospheric thermodynamics is required.

Credits: 1.00

EAPS 43200 - Synoptic Laboratory II

Credit Hours: 1.00. Analysis of horizontal distributions of pressure, temperature, wind, vorticity, and vertical motions. Applications to synoptic-scale wave propagation. Prior course work in atmospheric thermodynamics and synoptic lab I is required.

Credits: 1.00

EAPS 43300 - Synoptic Lab III

Credit Hours: 1.00. (AGRY 44300) Diagnoses of midtropospheric wave propagation and growth. Analysis of surface pressure fields and fronts and their relationships to upper air features. Extensive use is made of teletype and facsimile weather information. Prior course work in atmospheric dynamics and synoptic lab II is required.

Credits: 1.00

EAPS 43400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (AGRY 44400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

EAPS 43500 - Severe Storms Field Work

Credit Hours: 3.00. This four-week summer course will focus on prediction, instrumented field observations, and case study analysis of severe storms. Students will receive instruction in severe storm forecasting, real-time radar interpretation, safe observation of severe storms, teamwork, and careers in research meteorology. During a field trip, students will deploy meteorological instrumentation in support of the instructors' research efforts. Students are required to deliver weather briefings and evaluate their forecasts. Permission of instructor required.

Learning Outcomes: 1. Lead the group (in pairs) in a complete day of atmospheric science field program activities. 2. Evaluate the quality of your severe weather forecast. 3. Expand your knowledge of paths and skills necessary for a successful career in meteorology. Credits: 3.00

EAPS 44500 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the planetary sciences curriculum. Components include analysis methods for preliminary design, development of an initial spacecraft and mission concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with science operation, science objectives, and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Learn how to generate a Science Traceability Matrix. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

EAPS 44600 - Geochemistry

Credit Hours: 3.00. This course provides an overview of the processes controlling the distribution of elements within the solid Earth as well as the hydrosphere and atmosphere.

Learning Outcomes: 1. Describe the distribution of elements in our Solar System and throughout the Earth. 2. Explain the distribution of elements as a function of their physical properties and chemical affinities. 3. Use principles of thermodynamics to explain why particular reactions or phase assemblages are expected at different equilibrium conditions. 4. Develop simple models to explain the exchange of elements between different Earth reservoirs and the chemical evolution of these reservoirs through time. 5. Describe applications of geochemistry to big picture research questions in Earth, atmospheric, and planetary science. Credits: 3.00

EAPS 45000 - Physics And Chemistry Of Solid Earth

Credit Hours: 4.00. Physics of the earth's interior, including seismic velocity and density structure, seismic wave propagation, and gravitational and magnetic fields. Thermal history of the earth. Chemical and mineralogical composition of the earth, radioactivity, isotopes, and geochronology. Magma generation, crustal evolution, and tectonic models. Prior course work in chemistry, physics, calculus, earth materials, and plate

tectonics is required.

Credits: 4.00

EAPS 47400 - Sedimentary Geology

Credit Hours: 4.00. Systematic study of continental and marine depositional environments. Interpretation of sedimentary facies, structures, and microfacies. Principles and applications of stratigraphy, including applications of paleontology, field relations, paleomagnetism, well logs, seismic reflections, and chemistry. Field investigations may be required. Prior course work in earth materials, mineralogy and petrology is required.

Learning Outcomes: 1. Understand core areas of sedimentary geology, and interpret a wide range of earth processes on different temporal and spatial scales. 2. Develop proficiency interpreting depositional processes and environments of ancient sedimentary strata through bedrock exposures, well logs, and drill cores. 3. Demonstrate skills of interpretive analysis and critical thinking with respect to geological problems involving temporal and spatial relationships. 4. Develop writing abilities through scientific reports that will be written individually, revised based on instructor and peer feedback, and subsequently integrated into a comprehensive basin analysis report. 5. Demonstrate competence in collecting scientific data, including field observations and field and analytical measurements. Specifically, demonstrate competency in collecting the following field datasets from outcrops: paleocurrent indicators, lithofacies associations, stratigraphic sections, and facies architectures. 6. Conduct effective independent and collaborative investigations. Specifically, develop your ability to work both independently and collaboratively during acquisition, analysis, and dissemination of scientific datasets as part of basin analysis project. Credits: 4.00

EAPS 47500 - Geology And Geophysics Field Camp - Wasatch-Uinta Field Camp

Credit Hours: 6.00. The Wasatch-Uinta Field Camp is a six-week capstone course designed to prepare students for successful careers in the geosciences. This course emphasizes scientific methodology and traditional techniques that provide a strong foundation for the broad range of modern technologies used by today's industry, academic, government and private workforces. Students learn to develop research strategies, collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, and construct geologic maps and cross sections. Field exercises are located in geologically ideal locations in the Wasatch and Uinta mountains of Utah, the San Rafael Swell of southeastern Utah, Grand Teton National Park in Wyoming, and the Carlin-type gold deposits of Nevada. The Wasatch-Uinta Field Camp was established in 1967 by the University of Minnesota. The camp is operated by a consortium that currently includes Purdue University, the University of Minnesota-Duluth, University of Wisconsin-Madison, the University of Nebraska, and the University of Illinois.

Learning Outcomes: 1. Learn how to make systematic geological observations and also collect relevant data using a Brunton compass. This includes the ability to identify rock types and minerals and primary and secondary geological structures and require skills and information learned in mineralogy, petrology (igneous, metamorphic, and sedimentary), structural geology, and stratigraphy. 2. Collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, which will be used to construct geologic maps and cross sections. 3. Navigate in the field using topographic maps, and compasses. Proficiency in field navigation is crucial for locating and completing field studies. 4. Develop skills in interpreting geological history, including the sequence of events and the geological evolution of an area based on field observations. 5. Deal with incomplete or ambiguous data and will be required to formulate hypotheses, make educated inferences, and solve geological problems based on limited information. 6. Enhance their ability to work effectively in a team, collaborating with peers on field projects, and communicating geological findings through clear and concise field notes, maps, and reports. 7. Learn to conduct geological fieldwork safely is paramount. Students should be able to

identify potential hazards in the field, adhere to ethical and legal guidelines for collecting samples, and understand the importance of preserving natural landscapes. Learn best practices for safely conducting a field study. Credits: 6.00

EAPS 47700 - Earth And Planetary GIS

Credit Hours: 3.00. In this course, students will learn to display and analyze Earth and planetary data using geographic information systems (GIS). Students will learn how to find and work with data from various sources, including satellites and spacecraft missions. Using a variety of spatial data, students will make maps and visualizations of data, perform analyses using a range of toolboxes, and implement workflows in geoprocessing.

Learning Outcomes: 1. Communicate applications of GIS in the real world. 2. Locate geospatially relevant datasets in online repositories. 3. Organize and manage files (and their appropriate formats) used within GIS software. 4. Identify limitations and gaps in remote sensing datasets. 5. Design and implement a workflow to analyze remote sensing data. 6. Create maps and figures that visualize products within a geospatial analysis workflow. 7. Describe a goal (i.e., hypothesis being tested) that geospatial analysis can address, as well as the data inputs, steps in the workflow, and outcome (i.e., results) of the analysis in the form of a webpost that can be shared with employers and other GIS users. Credits: 3.00

EAPS 49000 - Field Geology In Rocky Mountains

Credit Hours: 6.00. Field studies in sedimentary, igneous, and metamorphic terrains. Studies may involve geologic mapping, stratigraphic section measuring, structural analysis and interpretation, geomorphic interpretation, and interpretation of geologic history. Field excursions include visits to several classical geologic localities in the Colorado Plateau, Great Basin, and Rocky Mountains with discussions and interpretations of features observed. Transportation fee plus room and board at field station required. Rigorous field work requires physical conditioning. Six-week session, including field excursion. Prior course work in earth materials, surface processes, and plate tectonics is required. Permission of instructor required.

Learning Outcomes: 1. Maintain a professional notebook where observations are recorded as primary data such as rock descriptions and sketches. 2. Write well-structured, professional unit descriptions from provided rock description data sheets, or from virtual images, virtual microscope. 3. Plan an efficient field check for a mapping area, address areas of uncertainty and plan pathways through field. 4. Record and organize observations into interpretations through geologic sketches from outcrop-to field-area-scale. 5. Use unit descriptions to interpret geologic history. 6. Extrapolate from discrete observations to fully mapped terrains, using geologic principles to guide decision making. 7. Interpret and project geologic data mapped on the surface into the subsurface through cross-sectional development. 8. Synthesize notes and sketches, mapped geologic data and cross-cutting relationships to determine relative chronology and geologic history. 9. Synthesize observations and interpretations in notes, maps, and cross-sections into a written geologic report. 10. Work more effectively in a team. Credits: 6.00

EAPS 49700 - Earth And Atmospheric Sciences Undergraduate Readings And Research

Credit Hours: 1.00 to 6.00. Supervised reading and/or research in various fields. Permission of instructor required.

Credits: 1.00 to 6.00

EAPS 50300 - Mars Seminar

Credit Hours: 3.00. This seminar course will introduce students to the origin and evolution of Mars through reading classic papers on the geology, atmosphere, and Interior of Mars, as well as in-class lectures, discussions, and a final paper.

Learning Outcomes: 1. Understand Mars as a planet. 2. Understand the limits of human knowledge about the Red Planet, its potential for life, and its potential for sustaining humans in the future. 3. Gain a basic understanding of the process of Mars exploration including landing site selection. 4. Gain proficiency in reading scientific papers and in presenting scientific ideas in oral and written format.

Credits: 3.00

EAPS 50400 - Geologic Dating Methods

Credit Hours: 3.00. This course covers general theory and applications of geochronology and thermochronology to questions in Earth and planetary science.

Learning Outcomes: 1. Explain the basic physical processes underlying the most commonly used dating methods. 2. Calculate geochronological dates from raw geochemical datasets or other kinds of observations for the most commonly used dating methods. 3. Use physical and numerical models to interpret the significance of geochronological dates. 4. Evaluate which geochronological method, if any, is most appropriate for answering a particular scientific question in Earth and planetary science. 5. Discuss the contribution of geo/thermochronology to big questions in Earth and planetary science. Credits: 3.00

EAPS 50600 - Cosmochemistry And Geochemistry

Credit Hours: 3.00. The course focuses on the chemical processes involved in the formation and evolution of our solar system and our planet. The course includes discussion of nucleosynthesis and chemical abundances, the origin and composition of various planetary objects and their constituent materials, and the distribution and cycling of elements within and between different Earth systems, including the solid Earth, atmosphere, and oceans.

Learning Outcomes: 1. Understand the cosmochemical model for solar system formation. 2. Become familiar with the inventory of planetary materials in our solar system and understand their characteristics. 3. Understand what causes the first order distribution of elements in different parts of the Earth and other planetary bodies. 4. Apply principles of thermodynamics and reaction kinetics to predict the physical and chemical characteristics of Earth and planetary materials. 5. Understand how chemical exchange between the solid earth, biosphere, and ocean-atmosphere affect the evolution of the Earth system. 6. Analyze laboratory data to gain insight geochemical and cosmochemical processes. 7. Identify outstanding questions in the primary cosmochemistry and geochemistry literature and propose what new observations, data, and/or models could be used to address these questions. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open-source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

EAPS 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real-world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on

both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

EAPS 50900 - Data Analysis Techniques In Earth And Atmospheric Sciences

Credit Hours: 3.00. Application of statistical techniques to analyze and interpret data containing substantial information about the dynamics of our planet Earth. Emphasis on fundamentals with elements of atmospheric/climate time series analysis and weather and climate extremes (necessary for understanding current research) interwoven with computer-intensive bootstrap methods (which work for complex data sets typical in geosciences). Offered Spring.

Learning Outcomes: 1. Gain a solid basis for practical application of statistical methods to data analysis in geosciences. 2. Gain exposure to atmospheric and climate time series analysis including weather and climate extremes, necessary for understanding current topics in weather and climate research. 3. Experience computer-intensive methods to handle complex data sets without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. Credits: 3.00

EAPS 51000 - Climate Time Series Analysis

Credit Hours: 3.00. This course in time series analysis combines traditionally taught basics with topics of central importance in current weather and climate research, including long memory, extremes, nonlinear time series, chaos and complexity.

Learning Outcomes: 1. Understand concepts and methods of classical time series analysis. 2. Get hands on experience in resampling methods for time series analysis, which work for complex data sets without having to rely on strong assumptions common in classical time series analysis but rarely met in geosciences. 3. Learn how to match a time series methods to a particular geosciences data set or question. 4. Develop skills in writing programs in R to analyze geosciences data and interpret results. 5. Learn basics of advanced topics instrumental in geosciences: long memory, extremes, nonlinear time series, chaos and complexity. 6. Improve their critical thinking and oral communication skills via giving presentations on their research projects involving topics covered in the course. Credits: 3.00

EAPS 51201 - Planetary Origins

Credit Hours: 3.00. The goal of this course is to introduce students to our current understanding of how planetary systems form and evolve. We will focus on the physical theories describing how the structures of planetary systems develop and how planets, moons, and other heavenly bodies form. We will also consider the relationship between these theories and observations (astronomical, geophysical, cosmochemical) of the Solar System and extrasolar planetary systems. This will include some discussion how the Solar System fits into our understanding of the veritable menagerie of planetary systems.

Learning Outcomes: 1. Understand the physical processes that produce and sculpt planetary systems. 2. Develop ability to read and critically examine scientific papers. 3. Provide and receive constructive criticism to and from colleagues. 3. Learn how to formulate a research question and conduct a literature review or design and conduct some original research on that topic. 4. Learn how to present scientific ideas in oral and written format. Credits: 3.00

EAPS 51400 - Glacial And Quaternary Geology

Credit Hours: 3.00. Formation, dynamics, and regimen of glaciers. Erosional and depositional processes and landforms developed by alpine and continental glaciation. Glaciation of North America during the Ice Age, with emphasis on stratigraphy, soils, climates, biology, and physical changes resulting from glacial processes and environments. Application of glacial studies to agronomy, life sciences, climatology, oceanographic studies, and engineering problems. A one-day field investigation is required.

Credits: 3.00

EAPS 51500 - Geodata Science

Credit Hours: 3.00. Course covers a range of topics with applications of mathematical, statistical, numerical, and distributed parallel computing methods for modeling and understanding complex and large spatio-temporal geoscience datasets in the formats common to in-situ observations, asynoptic remote sensing data, volumetric gridded analysis, etc.

Learning Outcomes: 1. Identify and load into R the relevant data to solve a specific geoscience problem. 2. Design effective data import, tidying, and transformation procedures using geoscience knowledge. 3. Determine what and how to plot large geoscience datasets to guide each step in the workflow. 4. Judge whether model assumptions are reasonable and if the chosen models fit the data using geoscience domain knowledge. 5. Appraise and conclude the results of a geodata-science project professionally. Credits: 3.00

EAPS 51600 - Stable Isotope Applications In Earth Science And Ecology

Credit Hours: 3.00. This course examines stable isotopes as tools to study biogeochemical cycles, hydrological processes, carbon cycle, ecology, geology, and anthropology. Primary systems studied will include H, C, N, O, and S. The goal is to explore both theoretical and applied aspects of stable light isotope biogeochemistry so that students can: 1) understand and critically evaluate research articles containing stable isotopic data, and 2) see how isotopes might be used as primary tools or to enhance their own research. Every effort will be made to cover the isotopic systems of each student's research field. Theoretical principles, isotope fractionation, mixing models, and variation of isotopes in the natural world, and uncertainty quantification in applications will be presented and discussed. Course assignments will include homework sets, exams, a journal-club style discussion of relevant literature, and a final paper in the form of a review article or scientific proposal.

Learning Outcomes: 1. Apply a theoretical understanding of light stable isotopes to research applications in biogeochemistry, hydrology, ecology, geology, and/or anthropology. 2. Read and evaluate research articles containing stable isotopic data. 3. Demonstrate an understanding of how isotopic measurement techniques work, sampling preparation considerations, and data workup. 4. Analyze, plot, and interpret stable isotope data to answer a research question of the student's choosing. Credits: 3.00

EAPS 51700 - Lunar Exploration

Credit Hours: 3.00. In this course we will review the history of the scientific exploration of the Moon since the dawn of the space age. Our focus will be on the science problems that motivated researchers in their scientific investigations of the Moon and the results that they obtained. The course will then transition to modern theory and the fringes of our understanding related to Moon formation and evolution. Here the course will make extensive use of primary peer-reviewed literature, and facilitate open discussion intended to cultivate original thought or new testable hypotheses aimed at advancing outstanding issues in lunar science. Part of this course will also be devoted to understanding the technical language and terminology used in lunar science, as well as general strategies for reading and understanding scientific literature.

Learning Outcomes: 1. Appreciate the immense body of scientific knowledge enabled by the exploration of the Moon. 2. Identify scientifically important lunar geographical features through daily readings, in-class discussions, and quizzes. 3. Understand the constraints on our current models for the origin and evolution of the Moon. 4. Identify the knowledge gaps in our current models for the origin and evolution of the Moon and how future missions could be designed to close those gaps. 5. Apply learned skills and strategies for reading, comprehending, and assessing primary scientific literature. Credits: 3.00

EAPS 51800 - Soil Biogeochemistry

Credit Hours: 3.00. This course will provide an introduction to the physical and microbial processes governing the cycling of photosynthetically-produced organic matter on land and in streams and rivers. Organic geochemical transformations in the soil and litter will be highlighted along with methods of characterization of the organic constituents. Biogeochemical concepts of stabilization and destabilization of soil organic matter and stress response of terrestrial ecosystems will be reinforced through manipulation of actual data sets.

Learning Outcomes: 1. Understand the basic mineral and organic chemistry of soils. 2. Understand the range of soil types and capacities to store organic matter. 3. Understand the natural and man-made stressors of soil organic matter and the range of

impacts. 4. Understand the common analytical tools used to assess chemistry and health state of soils. 5. Understand how to structure and write and NSF-style proposal. 6. Understand the need for hypothesis generation in developing a research proposal. 7. Be able to work in teams to analyze large data sets and develop and hone hypotheses. 8. Understand the mechanisms of soil stabilization and destabilization. 9. Understand the comparative role of different groups of microbes in the decay of plant-derived litter. Credits: 3.00

EAPS 52000 - Theory Of Climate

Credit Hours: 3.00. A general introduction to the theory of climate at an intermediate level. A brief survey of physical climatology and paleoclimates. Theoretical development of climate models. Theories of climatic stability and climatic change.

Learning Outcomes: 1. Describe in a quantitative fashion the processes that determine past and present climates, as well the qualitative patterns associated with those changes. Apply this fundamental theoretical knowledge using the tools of modeling to understand and predict climate changes and changes in modes of climatic variability. 2. Identify, calculate, and explain the various thresholds, non-linearities, and 'tipping point' mechanisms in the climate system as a complex dynamical system both from the theoretical and observational points of view. 3. Define the appropriate type of model or quantitative framework for answering a climate, paleoclimate, or future climate question and know how to utilize this model through comparison with appropriate data or theoretical predictions. Credits: 3.00

EAPS 52100 - Atmospheric Chemistry

Credit Hours: 3.00. An introduction to the chemistry of the earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

EAPS 52300 - Radar Meteorology

Credit Hours: 3.00. Origin and evolution of radar. Modern weather radar systems and their component parts. Propagation of microwave energy in the atmosphere. Rayleigh and Mie scattering theory, with application to scattering by precipitation. Utilization of radar systems in forecasting quantitative analyses and cloud physics research. Recent refinement and future potential. Prior coursework in synoptic meteorology labs and atmospheric physics is required.

Credits: 3.00

EAPS 52400 - Laboratory Analysis

Credit Hours: 3.00. This course focuses on becoming familiar with various laboratory techniques used in the analysis of earth and planetary materials and understanding what questions data products from these techniques can answer. This course will include discussion of the instruments and how they operate, as well as provide hands-on experience working in the lab and processing data.

Learning Outcomes: 1. Become familiar with common laboratory analytical techniques used in earth and planetary science. 2. Gain experience working with analytical instruments and the associated laboratory data. 3. Propose a research topic, conduct a literature review, and design an original research project requiring use of coordinated analytical techniques. Credits: 3.00

EAPS 52500 - Boundary Layer Meteorology

Credit Hours: 3.00. (AGRY 53500) A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

EAPS 52600 - Introductory Geofluid Dynamics

Credit Hours: 3.00. Provides a fluid dynamics background for graduate students interested in atmospheric sciences, oceanography, mantle convection, hydrology, turbulence, or pollution. Topics covered include: basic assumptions and deviations of Navier Stokes equations, conservation laws, vorticity, divergence, waves, and applications in atmosphere, ocean, and geophysics.

Learning Outcomes: 1. Provide students a rigorous foundation in geofluid dynamics as well as the connections among math, physics, and real natural phenomena. 2. Students will become accustomed to applying the physical

equations to real phenomena, and to presenting them in a concise way. 3. Understand the basic equations and physics in existing models which provides a broader and deeper understanding of the earth sciences. Credits: 3.00

EAPS 52700 - Principles Of Terrestrial Ecosystem Ecology

Credit Hours: 3.00. The objective of this course is to build a conceptual model of terrestrial ecosystems and to provide students with the state-of-the-art mechanisms by which terrestrial ecosystems work. Topics include ecosystem concept, Earth's climate system, geology and soils, terrestrial water and energy balance, terrestrial production processes, terrestrial decomposition, terrestrial plant nutrient use and cycling, biogeochemical pathways, and ecosystem temporal and spatial dynamics. Permission of instructor required.

Learning Outcomes: 1. Learn what key variables to be observed for ecosystem studies. 2. Understand the feedbacks between the atmosphere and terrestrial biosphere. Credits: 3.00

EAPS 52900 - Modeling Ecosystems And Biogeochemical Cycles

Credit Hours: 3.00. Process-based models are powerful tools for studying ecosystem dynamics and geochemical cycles in Earth System Sciences. In this course, we will explore how various components of ecosystems can be modeled following principles of biology, physics, and chemistry. We will also examine techniques for using modeling to study: 1) responses of the structure and functioning of ecosystems to changing climate, atmospheric composition, environmental conditions, and human activities; and 2) exchanges of major greenhouse gases (e.g., CO2, CH4, and N2O) between the atmosphere and the biosphere. During the course, we will go through the whole cycle of system modeling approach including model conceptualization, formulation, parameterization, sensitivity and uncertainty analysis, verification, and application.

Learning Outcomes: 1. Learn the whole cycle of system modeling approach including model conceptualization, formulation, parameterization, sensitivity and uncertainty analysis, verification, and application. 2. Learn how to model the key element cycles (e.g., C and N) between the atmosphere and terrestrial biosphere. Credits: 3.00

EAPS 53000 - Extreme Weather And Climate: Science And Risk

Credit Hours: 3.00. This project-oriented course introduces students to the real-world analysis of weather and climate risk, including under climate change. Course will provide a risk-relevant introduction to different types of impactful weather (e.g., hurricanes, drought) and how the climate system can cause them to vary on monthly (e.g., Madden-Julian Oscillation), seasonal (e.g., El Nino and La Nina), and longer timescales (e.g., climate change). The course will further connect this intrinsic uncertainty in weather outcomes to uncertainties in real-world applications (e.g., crop yields) across a variety of economic sectors - "risk". Students will be introduced to basic methods in probability and statistics for analyzing data required to help someone make real-world decisions that depend on weather/climate. The principal course outcome is a semester-long "start-to-finish" project where students define a hypothetical real-world decision that is weather-dependent, find and analyze data to guide that decision-maker, write a concise report on their findings, and concisely present their results orally to the class.

Learning Outcomes: 1. Explain the meaning of "risk" in weather/climate and impacts. 2. Describe the basics of various types of impactful weather. 3. Describe how modes of climate variability cause weather to vary on monthly, seasonal, and longer time scales. 4. Explain how weather and climate variability translates to risk in a wide range of applications and economic sectors. 5. Analyze weather/climate data to find real-world solutions to weather risk problems. 6. Gain experience working as a hypothetical weather/climate science consultant in a team setting. 7. Summarize research in a succinct and compelling technical report. 8. Summarize research in a succinct and compelling oral presentation. 9. Use data to help someone find a solution to a real-world problem that depends on the weather/climate. Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems

quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

EAPS 53300 - Atmospheric Physics II

Credit Hours: 3.00. A continuation of EAPS 53200 , covering the following selected advanced topics in atmospheric physics: gaseous absorption, Mie scattering, the equation of transfer, and radiative transfer in cloudy and hazy atmospheres. The application of radiative transfer in active and passive remote sensing. Advanced topics in atmospheric thermodynamics, such as heterogeneous systems, kinetic theory of gases, and planetary atmospheres. Basic ozone photochemistry applied to stratospheric and tropospheric pollution.

Credits: 3.00

EAPS 53400 - Tropical Meteorology

Credit Hours: 3.00. This course tackles the observed structure of the Earth's tropical atmosphere and the core theories that explain this structure and its variability. Topics include the 3D annual and seasonal mean state, the energy budget, the Hadley cell, monsoons, the Walker cell, equatorial waves, ENSO, convective aggregation, easterly waves, and tropical cyclones.

Learning Outcomes: 1. Visualize and identify the most important features of the tropical atmosphere and describe them in terms that can be understood by a non-expert. 2. Explain how the Sun shining on a rotating rock with an overlying water ocean provides the necessary ingredients for the many different forms of variability in the tropical atmosphere. 3. Develop testable hypotheses about any aspect of the tropical atmosphere of interest. 4. Perform experiments using simple physical computational models to test hypotheses. 5. Use real-world historical data (e.g., reanalysis) to test hypotheses. Credits: 3.00

EAPS 53500 - Atmospheric Observations And Measurements

Credit Hours: 3.00. A course that introduces students to direct and remotely sensed observations of the atmosphere. Directly measured quantities discussed include temperature, pressure, moisture, wind, solar radiation, chemical properties of the atmosphere, etc. Remote sensing of cloud, precipitation, and air motion by weather radars, satellites, profilers, lidars, and other emerging technologies is reviewed. Students will gain experience in observation techniques and data interpretation, and will learn uncertainty and error assessment. Prior course work in atmospheric science and statistics is required.

Credits: 3.00

EAPS 53600 - Introduction To General Circulation

Credit Hours: 3.00. This course provides an overview of the general circulation of the atmosphere and oceans. Topics include: global energy balance, hydrological cycle, atmospheric general circulation and climate, ocean general circulation and climate, history and evolution of Earth's climate, climate sensitivity and feedback mechanisms, global climate models, natural climate change and anthropogenic climate change.

Learning Outcomes: 1. Understand the energy balance of the Earth and the atmosphere. 2. Grasp the general circulation of the atmosphere and ocean and their energy. 3. Gain a scientific understanding of the climate's natural variability and human-induced change. 4. Learn about global climate models. Credits: 3.00

EAPS 53900 - Mesoscale Meteorology

Credit Hours: 3.00. Review of the theories applied in mesoscale meteorology, including semi-geostrophic systems and frontogenesis, symmetric instability, rainbands and inertia-gravity waves, sea-breeze, terrain effects, mountain waves, lee-vortices and cyclogenesis, convection, convective instability, low-level jets, drylines, and squall lines. Prior course work in synoptic labs and vector calculus is required.

Credits: 3.00

EAPS 54000 - Introduction To Geodesy

Credit Hours: 3.00. Course offers an introduction and overview of theory, techniques, data sources, and applications of geodesy. Provides understanding of how various geodetic techniques work and how they can be used to investigate a number of geological, atmospheric, and related problems. Evaluation of the robustness and quality of data as well as assessment of models and conclusions derived from geodetic methods.

Learning Outcomes: 1. Explain essential theory behind various geodetic techniques. 2. Describe how geodetic techniques and datasets can be used to investigate geological problems. 3. Identify and break down contributing sources to complex data signals. 4. Assess which data and model types are most appropriate for a

particular problem. 5. Devise an original research project topic and develop hypothesis and a methodology for its evaluation. 6. Analyze and critique scientific journal articles. 7. Summarize main research results in a clear, concise manner in both written and oral form.

Credits: 3.00

EAPS 54100 - Geodetic Data And Applications

Credit Hours: 3.00. This course will provide students with hands-on experience in the selection, processing, and analysis of geodetic data sets, particularly InSAR and GPS. Students will learn how to select data, evaluate its strengths and weaknesses, process and analyze the data, and apply it to the investigation of geological problems.

Learning Outcomes: 1. Explain essential theory behind processing geodetic data. 2. Describe various processing parameters and how they influence data analysis. 3. Evaluate quality of various datasets and determine most appropriate analysis strategies for desired application. 4. Interpret analyzed datasets in the context of geological problems. 5. Judge whether models fit data and if model parameters are compatible with available non-geodetic data sources. 6. Devise an original research project topic and develop hypothesis and a methodology for its evaluation. 7. Summarize main research results in a clear, concise manner in both written and oral form.

Credits: 3.00

EAPS 54200 - Economic Geology: Petroleum

Credit Hours: 3.00. Fundamental principles of the origin, migration, accumulation, exploration, and development of petroleum. Study of reservoir fluids, reservoir mechanics, and primary and secondary production techniques. Methods of prospect and leasehold evaluation and economic appraisal. Offered in alternate years.

Credits: 3.00

EAPS 54500 - Planetary Spacecraft Instrumentation

Credit Hours: 3.00. This course will educate students on the basic design and operation of planetary science instruments in space. Instrumentation covers many different techniques over many different portions of the optical spectrum, detection of particles and fields, and sample handling techniques on planetary bodies. Topics for defining instruments and their capabilities within a given mission, such as traceability matrices and proposal techniques, will also be discussed. In-class lectures and discussion will be important components of this course. All students will be expected to read several papers per week and respond to discussion or quiz questions. Each student will participate in giving a lecture and lead a discussion on two to three topics, based on assigned papers. Based on the information presented in class, there will be an individual project to define an instrument, with an option to learn one of several software tools for designing a scientific instrument for space.

Learning Outcomes: 1. Be exposed to the various types of instrumentation used in planetary exploration. 2. Gain a basic understanding of how various types of planetary instruments work. 3. Learn and experience how instrument parameters are defined and selected based on scientific objectives of the mission. 4. Learn about design optimization packages for photon and ion optics, and neutron and charged particle trajectories. 5. Gain proficiency in reading instrumentation papers and in presenting instrument and spacecraft details.

Credits: 3.00

EAPS 55000 - Advanced Geophysical Field Studies.

Credit Hours: 1.00 to 3.00. Individual geophysical field investigations including organizing, conducting and reducing, and interpreting data under the guidance of a staff member. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 55501 - Numerical Modeling Of Planetary Orbits

Credit Hours: 3.00. The goal of the course is twofold. First, you will develop quantitative skills to understand the orbital motions of planets and minor bodies in planetary systems, both in our solar system and in exosolar systems. Second, you will develop practical skills and techniques for using computers to solve scientific problems. We will begin with classical analyses of the two-body and N-body problems. We will then learn about modern, powerful, analytical and numerical techniques. We will then see how these techniques are applied to solving real problems in understanding the origin and evolution of planetary systems. These problems will include understanding planet formation, planet migration, resonance dynamics and resonance capture, tidal evolution of planets and natural satellites, and the collisional evolution of small body populations. Permission from instructor required.

Learning Outcomes: 1. Demonstrate proficiency with modern numerical methods and tools. 2.

Demonstrate proficiency with methods of analysis and theory related to the dynamics of solar system bodies. Credits: 3.00

EAPS 55600 - Planetary Surface Processes

Credit Hours: 3.00. The application of petrology and structural geology to other planets. Topics include: theories of star and solar system formation, orbital dynamics and Kepler's laws, petrology and geochemistry of meteorites, age dating techniques, structure and composition of the terrestrial, giant, and icy planets, planetary surfaces, planetary atmospheres, and theories of the formation of the moon. Offered in alternate years. Prior course work in earth materials is required.

Learning Outcomes: 1. Understand the physical and chemical principles behind processes that modify planetary surfaces. 2. Identify planetary surface features in orbital imagery and use observational evidence to postulate their origin and modification histories. 3. Gain field experience with planetary surface processes and landforms at local planetary analog sites. 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic. Credits: 3.00

EAPS 55700 - Introduction To Seismology

Credit Hours: 3.00. Theory of propagation to seismic waves in elastic media. Solution of wave equations for compressional, shear, and surface waves. Analysis of travel-times, amplitudes, and attenuation of seismic waves in terms of ray and wave theory. Principles of the seismograph. Structure of the earth as determined by seismological studies. Investigation of the causes, effects, distribution, and characteristics of earthquakes. Earthquake prediction.

Credits: 3.00

EAPS 55800 - Physical Properties Of Earth And Planetary Materials

Credit Hours: 3.00. This course includes a survey of the physical properties of earth materials: solids, liquids, and porous materials relevant to a range of geophysical and engineering concerns broadly within the domain of the growing field of Rock Physics. The variety of rock materials with particular emphasis on the aspects of composition, texture, and pore structure is first overviewed. Standard petrophysical characteristics such as mineralogic composition, density, and porosity are defined and the methods used to determine them both directly in the laboratory and indirectly from borehole measurements studied. With this background, students then explore how the intrinsic characteristics of pore structure, fluid content, and composition together with conditions of in situ temperature and pressure control the bulk material's electrical conductivity, dielectric permittivity, elasticity, and strength. These properties are viewed from perspectives of many scales of observation from the laboratory through geophysical logging from boreholes to larger scale geophysical surface measurements and high pressure and temperature laboratory measurements. More advanced issues related to frequency dependence, anisotropy, and stress measurement are discussed. Depending on their level, students will complete assignments or carry out literature reviews and a final research project. The research project may be designed to complement the student's own research needs.

Learning Outcomes: 1. Be aware of the various physical properties of rocks and particularly link these to geophysical observations. 2. Gain an appreciation of various methods to model these various physical properties and what the practical limitations of these various models are. Credits: 3.00

EAPS 55900 - Topics In Seismology

Credit Hours: 1.00 to 3.00. This course covers current topics in seismology. Recent topics have included seismic structure of the crust and mantle, seismic anisotropy, and earthquake sources. Professor Nowack. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 56700 - Planetary Atmospheres

Credit Hours: 3.00. This course is intended to for upper-level undergraduates and graduate students and will provide an in-depth look into the to the diversity of planetary atmospheres in our solar system and beyond. Topics to be covered in this class include: The processes by which atmospheres are constructed and eroded over plants lifetime, radiative balance, general circulation, the formation of hazes, clouds, and aerosols, atmospheric compositions and chemistry, the link between planetary interiors, surfaces, and atmospheres, how we measure and interpret observations of exoplanet atmospheres, and much more. To achieve this, we will briefly introduce the properties and components of an atmosphere, visit the planetary atmospheres in our solar system to learn more, and finally explore exoplanetary atmospheres.

Learning Outcomes: 1. Differentiate between different types of planetary bodies and the atmospheres that are present on them. 2. Recall the main properties of planetary atmospheres in our solar system. 3. Derive underlying physical properties for an atmosphere. 4. Understand and evaluate how atmospheric composition and planet type affect these physical properties. 5. Compare the effect of radiation and the subsequent dynamical

motions with the distribution of energy in an atmosphere as a function of stellar type and atmospheric composition. 6. Distinguish the importance of different chemical reactions and pathways (such as those for an oxidizing vs. reducing atmosphere). 7. Examine the ways in which atmospheres are formed, lost, and evolved, and how this results in the atmospheres we see today. 8. Make detailed predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. 9. Summarize and differentiate between techniques for observing and sampling the planetary atmospheres of our solar system and beyond. Credits: 3.00

EAPS 57300 - Basin Analysis

Credit Hours: 3.00. Advanced study of tectonic evolution and stratigraphic history of sedimentary basins. Topics include formative mechanisms of different sedimentary basins; tectonic, eustatic, and climatic controls on basin stratigraphy; relationship of depositional systems to basin types; subsidence and thermal histories; and application of basin analysis to petroleum reservoir and ground water aquifer assessment. Required field trips. Offered in alternate years. Prior course work in sedimentology and stratigraphy is required.

Credits: 3.00

EAPS 57700 - Remote Sensing Of The Planets

Credit Hours: 3.00. Introduction to key planetary and Earth science satellite remote sensing datasets, including visible and thermal imagery, visible through mid-infrared spectroscopy, radar, gamma ray and neutron spectroscopy, and laser altimetry. Students will receive hands-on-experience with data acquisition, image processing in IDL, spectral analysis in ENVI and Davinci, crater counting, and geologic mapping in GIS programs. Includes 1-2 full-day field trips. Junior, Senior, or Graduate status required. Recommended minimum background for undergraduates: Introductory knowledge of Earth or planetary surface processes and basic programming skills.

Learning Outcomes: 1. Understand the underlying physical principles behind the interpretation of remote sensing data. 2. Gain proficiency in the acquisition, processing, and analysis of remote sensing data. 3. Gain field experience with using and ground truthing remote sensing data at planetary analog sites. 4. Propose a research topic, conduct a literature review, and design and complete an original research project. Credits: 3.00

EAPS 58000 - Geodynamics

Credit Hours: 3.00. This course will provide students with a first order understanding of geophysical processes by developing analytical solutions to a variety of geophysical and planetary thermo-mechanical problems. Topics will include stress and strain, rheology, elasticity and flexure, faulting, and conductive heat transfer, and fluid mechanics. We will develop governing analytical equations based on first order principles, such as the conservation of mass, energy, and momentum, and solve these equations for a number of boundary conditions.

Learning Outcomes: 1. Solve first-order analytical thermo-mechanical problems in geophysics and planetary science. 2. Understand the basis for more complex numerical solutions of thermo-mechanical problems in geophysics and planetary science. 3. Investigate the factors that control a variety of thermo-mechanical geophysical and planetary processes. Credits: 3.00

EAPS 58300 - Geology Of Landfills

Credit Hours: 3.00. This course consists of the application of the geological sciences to the siting, exploration and site evaluation for solid waste disposal landfills, plus the evaluation of existing landfill facilities as they pertain to soils, bedrock, stratigraphy, landforms, geologic processes, and hydrogeology. Included are soil and rock exploration, laboratory testing, installation of ground water monitoring devices, and evaluation of contaminant transport. Both attenuation and confinement landfill systems are considered. Geological aspects of solid waste disposal regulations are reviewed and compared to those for hazardous waste disposal. Classroom discussions include evaluation of specific landfill examples and a semester project on a landfill evaluation. A one-day field investigation is required.

Credits: 3.00

EAPS 58400 - Hydrogeology

Credit Hours: 3.00. Investigates the qualitative and quantitative aspects of ground water location, occurrence, movement, evaluation, and development, and the influence of man upon this resource. Geologic and engineering aspects of ground water systems are discussed. Classroom teaching is complemented by problem sets and field trips.

Credits: 3.00

EAPS 58801 - Impact Cratering

Credit Hours: 3.00. Impact cratering is arguably the most pervasive geologic process in the solar system. In this course, we will study the physical process of impact cratering and its place in planetary science. The course will take a process-

oriented approach to understanding impact cratering with firm foundations in geologic observation and impact experiments. To explore the extreme process of impact cratering, we will use continuum/rock mechanics, thermodynamics, numerical modeling, experiments, and observations. Principal topics will include the formation of craters from contact of the projectile to final crater morphology; shock metamorphism; impact ejecta and products; cratered terrains; impacts and planetary evolution; and impact hazards.

Learning Outcomes: 1. Understand the physical principles of impact cratering. 2. Understand how impacts affect target materials. 3. Calculate the effects of the impact (size of crater, volume of melt, etc.). 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic.

Credits: 3.00

EAPS 59000 - Field Geology North America

Credit Hours: 2.00. Advanced study of tectonic evolution and stratigraphic history of specific geologic provinces. Particular emphasis on the relationship between tectonics, basin development, and sedimentation. Field component deals with application of field techniques used in basin analysis and structural studies. A 10-day field trip is required. Permission of instructor required.

Credits: 2.00

EAPS 59100 - Advanced Topics In Earth And Atmospheric Sciences

Credit Hours: 0.00 to 18.00. Specialized study offered on an individual basis or through specially arranged courses. Permission of instructor required.

Credits: 0.00 to 18.00

EAPS 59500 - Planetary Habitability

Credit Hours: 3.00. This class will explore the origin and evolution of habitable environments on Earth, habitable environments in our Solar System (e.g., early Mars, Europa's ocean), and the diversity of potentially habitable environments on exoplanets. Topics include consideration of how stellar properties, orbital dynamics, and geological phenomena influence habitability. We will additionally consider how we can remotely characterize habitable environments beyond the solar system from the comfort of Earth.

Learning Outcomes: 1. Synthesize information from several scientific disciplines to construct a holistic view of the most promising environments for the origin and long-term survival of life in the Universe. 2. Read primary literature critically and distinguish between facts, assumptions, and speculations relating to habitability. 3. Present and defend arguments for whether a particular world may or may not host habitable environments. 4. Pose well-formulated questions and testable hypotheses relating to habitability. Credits: 3.00

EAPS 60000 - Writing Successful Science Proposals

Credit Hours: 3.00. This course is designed to teach graduate students the skills necessary to successfully garner extramural graduate, postdoctoral, and project funding. Topics will include identification of funding sources and development of research objectives and strategies. Emphasis will be on writing concise fellowships and full NSF-type research proposals. Class meetings will be interactive with an emphasis on peer review. Each student will complete a quality research proposal based upon their own research. Any graduate student with a nascent idea for a science or engineering project is encouraged to enroll. We have found that this course works especially well to help newer MS or PhD graduate students develop a research project, improve communication with their advisor, and organize their research priorities regardless of whether they use this course to submit a proposal.

Learning Outcomes: 1. Develop an understanding of their own research significance, novelty, and plan, be able to communicate these concepts both in the written from (proposal) and be able to orally communicate these ideas to their peers.

Credits: 3.00

EAPS 60200 - New Graduate Student Seminar

Credit Hours: 3.00. This course will provide students with the tools to succeed as a graduate student in the Department of Earth, Atmospheric, and Planetary Sciences, which include good communication with their advisors, graduate fellowship proposal writing, giving good talks and posters, giving and receiving critical reviews, an understanding of regulations and graduate timelines, formulating a plan of study, and resources available to help graduate students succeed. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively with their adviser. 2. Understand how to develop a compelling research question. 3. Organize their planned research into a graduate fellowship proposal. 4. Provide and receive constructive criticism to and from colleagues, including understanding peer review. 5. Understand how to give well-organized talks

and eye-catching posters for department seminars and national meetings. 6. Assemble an advisory committee, formulate a plan of study, and know the department regulations and what is required to graduate in a timely manner. Credits: 3.00

EAPS 62000 - Aerosols, Clouds And Climate

Credit Hours: 3.00. An exploration of the complex relationships between aerosols, clouds and climate, including the so-called "direct effect" of aerosol on the radiation balance and their numerous influences upon relevant cloud properties called "indirect effects", the impact of different cloud types upon incoming solar radiation and outgoing longwave radiation, the effects of anthropogenic aerosol and climate change on precipitation efficiency, and the representation of aerosol, clouds and cloud processes in climate models.

Learning Outcomes: 1. Students will add to their base knowledge regarding the interaction of aerosols, clouds and climate. 2. Students will also develop their critical thinking skills and written communication skills. 3. Students will also improve their oral communication skills. Credits: 3.00

EAPS 65000 - Advanced Topics In Geophysics

Credit Hours: 3.00. Specialized topics in geophysics such as heat flow, rock magnetism, and marine geophysics; varied depending on interest. Permission of instructor required.

Credits: 3.00

EAPS 65200 - Folding Of Rocks

Credit Hours: 3.00. Theory and application of finite strain to the study of folded rocks, with numerous illustrations from literature. Presentation of modern theories of folding and density instability of single- and multi-layered rocks, with special emphasis on basic folding mechanisms. Treatment of linear viscous and power-law fluids. Second- and third-order analysis of causes of basic fold forms, such as concentric, chevron and kink folds, and mullion structure. Causes of drag folds and reverse drag folds. Offered in alternate years.

Credits: 3.00

EAPS 65300 - Fracturing Of Rocks

Credit Hours: 3.00. Description and analysis of joints and faults from the point of view of field geology and fracture mechanics. Three basic modes of fracture and their analogs in the Earth's crust. Also examined are structures, such as folds, pressure solution surfaces, basins, and mountain ranges associated with faults. Offered in alternate years. Prerequisite: differential equations.

Credits: 3.00

EAPS 65700 - Geophysical Inverse Theory

Credit Hours: 3.00. Investigates problems of determining physical parameters of the earth from remote observations of wave and potential fields. The theoretical topics include spectral and singular value decompositions, maximum likelihood and stochastic inversion, Backus and Gilbert theory, Green's function and linear operators, and the physics of layered media. Geophysical applications include seismic tomography, deconvolution, gravity and magnetics, earthquake sources, geodetics, and remote sensing. Offered in alternate years. Prior course work in advanced differential equations, physics, and chemistry of the earth is required.

Credits: 3.00

EAPS 68000 - Contaminant Hydrogeology

Credit Hours: 3.00. Covers the basic theory and applications of problem-solving exercises in hydrogeology, fluid mechanics, and chemistry of contaminated sites; flow and transport equations and models; investigational methods; remediation methods; case studies; and pertinent environmental laws. Prior course work in chemistry, computer programming, differential equations, and hydrogeology is required.

Credits: 3.00

EAPS 69100 - Colloquium In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. This course is intended to expose students to the wide range of topics studied throughout the Department of Earth, Atmospheric, and Planetary Sciences, allows for interactions with outside experts and networking, and provides the opportunity for students to synthesize high level topics that may not be directly related to their scientific endeavors.

Learning Outcomes: 1. Gain exposure to new scientific topics. 2. Summarize and discuss potentially new and unfamiliar scientific topics. 3. Identify relevant information from scientific talks and presentations. 4. Engage with the important questions that stimulate discussion and debate in EAPS fields. 5. Listen attentively and actively. 6. Use critical thinking and questioning. Credits: 1.00

EAPS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EAPS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Economics

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ECON 21900 - Economics For Future Elementary Teachers

Credit Hours: 3.00. A principles of economics course designed for future elementary and social studies teachers. The purpose of this course is to: 1) introduce the future teacher to basic economic concepts required by the Indiana Academic Standards for Social Studies, K-6, 2) learn methods for teaching these concepts in the K-6 curriculum, and 3) develop a catalog of curriculum materials appropriate for teaching economics in grades K-6. No credit for management students.

Learning Outcomes: 1. Identify and understand the basic concepts and principles of economics in order to teach at the elementary school level. 2. Develop an `Economic Way of Thinking? that can be utilized to make more efficient choices as consumers, and as voters. 3. Identify supplementary materials (DVDs, online and app-based resources, simulations, curriculum materials, etc.) that can be used in K-6 teaching or as a supplement in K-6 classrooms. 4. Apply this 'Economic Way of Thinking' in the analysis existing curriculum in K-6 economics, and of everyday current events. 5. Utilize the basic concepts and principles of economics to design and develop new K-6 curriculum. Credits: 3.00

ECON 21910 - Economics For Future Secondary Teachers

Credit Hours: 3.00. Upon completion of this course students will be able to analyze economic events in order to make more intelligent choices as consumers, workers, and voting citizens; identify and understand the basic concepts and principles of economics in order to meet standards at the secondary school level; identify supplemental materials and programs from variety of sources used in your teaching major, minor or as supplements in your classrooms; and review and organize lessons that teach economic concepts. No credit for management students. The course content is principles-level economics and is designed for social studies education students who are beginning their sequence of required economics courses. The course is designed to be taken before upper-division economic content courses.

Learning Outcomes: 1. Analyze economic events so that you will be able to make more intelligent choices as a consumer, worker, and voting citizen 2. Identify and understand the basic concepts and principles of economics in order to teach at the secondary school level. 3. Identify supplementary materials and programs (CD's, video tapes, simulations, curriculum materials, etc.) from a variety of sources that can be used in your teaching major, minor or as supplements in your classroom. 4. Review and organize lessons that teach economic concepts in your chosen Social Studies area. 5. Assist course instructor in improving the course to better fit your needs. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

ECON 28600 - Economics Scholars

Credit Hours: 1.00. This course explores the concept of human capital investment in higher education. For each course meeting you will be assigned readings. You must complete the assigned readings before the scheduled discussion and come prepared to discuss them. Class will consist of a discussion of the ideas in the readings, not a lecture, with grades based on your participation in addition to one writing assignment at the end of the semester. The instructor will suggest questions to get the discussion started and will maintain the queue that determines speaking order. Permission of instructor required.

Learning Outcomes: 1. Read essays on higher education investment and be able to explain and evaluate their arguments. 2. Discuss and write about how the concept human capital investment theory applies to higher education policy today. Credits: 1.00

ECON 29000 - Sophomore Level Problems In Economics

Credit Hours: 1.00 to 4.00. Arrange with instructor before enrolling. Investigation in a specific economics field. Permission of instructor required.

Learning Outcomes: 1. Vary by course topic. Credits: 1.00 to 4.00

ECON 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

ECON 32200 - Economics Of Public Policy

Credit Hours: 3.00. The examination and analysis of public finance practices and problems in the federal fiscal system. Government activities that involve spending and taxation are analyzed applying basic principles of economics. Topics include public education, social security, healthcare, environment and tax systems. State and local government issues are also addressed.

Learning Outcomes: 1. Explain how the provision of government goods and services through political institutions differs from market provision of goods and services. 2. Examine and analyze taxes and subsidies with and without market failure. 3. Examine and analyze various types of government expenditures on public education, health care, social security, income assistance, unemployment compensation, etc. 4. Explain how cost-benefit analysis can be used to help government choose among alternative investment projects. 5. Examine and analyze the impact of various types of taxes on the economy. Credits: 3.00

ECON 32500 - Economics Of Sports

Credit Hours: 3.00. This class applies economic principles to the professional sports entertainment industry and its derivative input markets. The class begins by examining the microeconomics of demand for (by fans) and supply of (by teams) sports entertainment. The labor markets for the primary input, athletic talent, receive significant attention. Coordination among economic agents, taking the forms of leagues, players' unions, and government, is considered at the end of the class, with an emphasis on how they affect the efficiency of the markets related to sports entertainment. Quantitative empirical

analysis is emphasized throughout the class. This is not a sports trivia or fantasy sports strategy class.

Learning Outcomes: 1. Solve models of how fans, teams, and players behave. 2. Describe and evaluate the structures of the markets for sports outputs and inputs, e.g., players. 3. Explain information presented in quantitative forms, e.g., equations, graphs, tables. 4. Analyze the effects of leagues' or governmental polices on market efficiency. 5. Communicate conclusions about sports output and input markets in numerical, graphical, tabular, and written forms. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms,

including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 36200 - Health Economics

Credit Hours: 3.00. This course is designed to introduce upper level undergraduate students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues using tools from intermediate microeconomic theory. The course begins with an analysis of health care as a commodity and why health is different from other consumer goods. The course then examines the demand for and the production of health and health care, and the behavior and organization of health care providers. The discussion then switches to information asymmetries and the functioning of health insurance markets. Afterwards, the course turns to the analysis of government involvement in the health care system. The class concludes with an examination of medical care systems around the world, paying particular attention to the U.S. health care system.

Learning Outcomes: 1. Describe the main economic theories relating to health and health care markets. 2. Apply economic theory to the analysis of health care policy and institutions. 3. Construct a detailed demand and supply model of the health insurance market. 4. Critically evaluate key policy issues in health and health care from an economic perspective. Credits: 3.00

ECON 36500 - History Of Economic Thought

Credit Hours: 3.00. The course traces the development of theories of value and economic growth from the seventeenth century to Karl Marx. Among the authors studied are the mercantilists, Hume, Smith, Ricardo, and Marx. Excerpts from the original works are read and evaluated in light of modern theory.

Credits: 3.00

ECON 36700 - Law And Economics

Credit Hours: 3.00. It has become increasingly clear to economists, legal scholars and political scientists that it is impossible to understand economic institutions without first having an understanding of the legal framework within which they operate. Similarly, it is impossible to understand the impact of law on society without first having an understanding of economic principles. This problem is further complicated by the fact that there are often ambiguities in the written law that lead to significant differences between what the law appears to say and how the law is interpreted in the courts. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions.

Learning Outcomes: 1. Understand better the relationship of Law and Economics, two different disciplines that both directly impact the business climate. 2. Learn how the concepts taught in this class apply in a real world setting. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

ECON 37200 - Experimental Economics

Credit Hours: 3.00. This course will explore how experiments are used in economics to test economic theory, understand behavior, and evaluate new policies. Focusing on recent research, we read research papers on a variety of policy topics including labor market discrimination, payday lending, organ transplantation, media censorship, and voting. Applying the concepts from class, students will identify their own original research questions and design new experiments.

Learning Outcomes: 1. Understand why

experiments are the gold standard for causal inference. 2. Identify the key elements of any economic experiment and evaluate design choices. 3. Generate original research questions that can be answered with an experiment. 4. Design novel experiments to test hypotheses. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 37600 - Economics Of The European Union

Credit Hours: 3.00. Current economic structure of the European Union, and the economic challenges it is now facing.

Learning Outcomes: 1. Understand the background and current economic structure of the European Union, as well as the economic challenges it is now facing. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 38500 - Labor Economics

Credit Hours: 3.00. The purpose of this course is to introduce important topics, theories, institutions, and policy issues relating to the functioning of labor markets. Topics to be considered include labor supply decisions, investments in human capital, compensating wage differentials, labor contract theory, unions, compensation programs, signaling in labor markets, the economics of unemployment, and government employment, retirement, and workplace safety.

Learning Outcomes: 1. Distinguish the major determinants of labor market participation and hours worked. 2. Analyze how welfare programs and business cycles affect labor supply. 3. Derive the short and long term demand for labor. 4. Construct a detailed demand and supply model of the labor market. 5. Find the equilibrium labor market outcomes in the context of the neoclassical model 6. Analyze the role played by jobs' and workers' characteristics in generating wage differentials. 7. Develop a schooling model that explains human capital investment. 8. Distinguish factors that affect earnings inequality and labor market discrimination. Credits: 3.00

ECON 39000 - Junior Level Problems In Economics

Credit Hours: 1.00 to 4.00. Investigation into a specific topic area of economics. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 39040 - Economics Internship

Credit Hours: 1.00. An Economics-related work experience. This internship experience is intended to complement the student's academic plan-of-study and help prepare him/her for his/her future role in Economics. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job description may be requested before registration will be permitted. Permission of instructor required.

Learning Outcomes: 1. Internship experience. Credits: 1.00

ECON 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 43200 - Economics Of Growth & Innovation

Credit Hours: 3.00. Part one: we focus on this fact: the richest countries in the world have incomes nearly 200 times greater than the poorest, with profound consequences for the lives (and deaths) of their citizens. Why nations are poor and how they can become rich is one of the most important questions in Economics. We will look at the role of investment, schooling, population growth and technology. Part two: we explore how globalization affects productivity and innovation. This includes how international trade and domestic policies affect allocative efficiency, accelerate structural change, and discipline competitive behaviors by domestic firms. We explore how firms grow on global markets, how technology is embodied in traded inputs, and how international markets for ideas and the possibility of imitation can lead to explosive growth. Part three: we explore a rapidly growing literature on the economics of innovation. We'll wrestle with the questions of: where new ideas come from, and whether it is becoming more difficult to innovate; how cities become hotbeds of innovation and how this will be affected by remote work; and how innovation can be shaped by choices of firms and by government policies.

Learning Outcomes: 1. Analyze income levels and growth rates across countries using economic models to understand and assess the underlying factors driving disparities in economic development, including investment, population growth, schooling, and technology; quantitatively assess these factors and make cross-country comparisons to build capabilities for engaging in economic reasoning through data; use economic models and research evidence to evaluate the causal drivers of, and impact of policy decisions on, innovation at the level of individuals, institutions, and places. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic

interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 45600 - Urban Economics

Credit Hours: 3.00. Examines the market forces that lead to the development, growth, and size of cities. In addition, this course covers the theory of location and land use, principles of local public finance, policy problems in the areas of urban housing, transportation, crime, and pollution.

Credits: 3.00

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

ECON 46600 - International Economics

Credit Hours: 3.00. Analyzes topics in international economics, using more advantage techniques and more detailed treatment than in ECON 37000 or 37100. While coverage varies somewhat with instructor, some topics could include: economic growth, innovation and technology transfer, and the role of multinational corporations.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade and finances. 2. Understand the perspective provided by economic analysis regarding the interaction between economic growth and international trade. 3. Identify insights economics analysis provides concerning the benefits and costs of technology transfer and the role of multinational corporations. Credits: 3.00

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 48500 - Economics Of Racial And Gender Discrimination

Credit Hours: 3.00. This course focuses on quantifying the extent of, and determining the underlying causes of racial and gender disparities in the labor market. Topics include the impact of prejudice on labor market outcomes, statistical discrimination, early childhood factors and differences in environment, and fertility and reproductive technology.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize the differences and importance of disparities that control and do not control for observable factors. 3. Understand the difference between prejudice and discrimination, and the extent to which prejudice can cause discrimination. 4. Assess how discrimination can occur even in the absence of prejudice. 5. Evaluate the impact of policies designed to reduce disparities, such as affirmative action. Credits: 3.00

ECON 49000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Open only to a limited number of seniors with superior records in previous courses. Permission of instructor required.

Learning Outcomes: 1. Vary by course topic. Credits: 1.00 to 4.00

ECON 49900 - Economics Capstone Research

Credit Hours: 3.00. The course combines experiential learning with a hands-on research project that unfolds over the course of a semester, serving as a culminating experience at the end of their degree program. The overarching objective of the capstone project is for students to understand how business problems can be addressed with empirical methods. This course is designed to help students develop a more comprehensive and integrative understanding of the major, apply their knowledge to develop and execute a methodologically rigorous research a project, and demonstrate their mastery of critical thinking and research skills they have acquired throughout their time in the major. In addition to a paper, completion of the research project may involve the presentation of the findings in a seminar or workshop setting.

Learning Outcomes: 1. Complete a high quality research paper that applies Economic analysis to a topic of particular interest to the student. 2. Develop a deep understanding of the roles that Economic theory and/or empirical analysis (Econometrics) play in creating high-quality economic analysis. 3. Identify the economics literature (journals, books, monographs, etc.) that relates to the research topic considered. Credits: 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to

apply tools to explain events. Credits: 2.00

ECON 51100 - Intermediate Economics I

Credit Hours: 3.00. Consumer behavior and demand, production and cost, factor demand, market structure, general equilibrium and welfare. Emphasis on the tools used to analyze the behavior of individual economic units. Not open to students with credit in ECON 34000 .

Credits: 3.00

ECON 51200 - Intermediate Economics II

Credit Hours: 3.00. Course content includes money and banking, national income and aggregative economics; the analysis of the determination of national income, employment, the price level, and the balance of payments. Consideration of both theory and economic policy. Not open to students with credit in ECON 35200 .

Credits: 3.00

ECON 51302 - Fundamentals Of Macroeconomics

Credit Hours: 2.00. This course examines how the US economy functions and develops a theoretical framework permitting an analysis of the forces affecting national income, employment, unemployment, interest rates, and the rate of inflation. Throughout the semester we will discuss both the theory and the empirical evidence on aggregate macroeconomic measures; consumption, savings, and investment; labor supply and demand; employment and unemployment; economic growth; money and banking; and macroeconomic stabilization techniques.

Learning Outcomes: 1. Describe the macroeconomy using aggregate measures. 2. Identify and describe the drivers of households' consumption and savings decisions. 3. Demonstrate an understanding of the factors that affect business investment decisions. 4. Derive the short-run demand for labor. 5. Distinguish the major determinants of labor market participation and hours worked. 6. Recognize the different measures, causes and effects of unemployment. 7. Identify and describe the causes of long-run economic growth. 8. Recognize the causes and effects of inflation. 9. Assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 2.00

ECON 51400 - Microeconomics (UCC: BSS)

Credit Hours: 2.00. An introduction to microeconomic theory. Analysis of consumer demand, output and input decisions of firms, price determination, economic efficiency, market structures, and market failure.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate the efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 2.00

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 51600 - Introduction To Mathematics For Economics

Credit Hours: 2.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. The content covers a review of algebra, univariate and multivariate calculus, and constrained optimization methods, e.g., LaGrange multipliers. Mastering these methods is instrumental to preparing for ECON 51100 & 51200 (micro and macro theory).

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3.

Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

ECON 53300 - Econometrics

Credit Hours: 2.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economic data. The course examines the statistical techniques used in testing economic theories, estimating causal effects, and making predictions. Emphasis is placed on estimating a single equation and the problems associated with such estimation. In addition to multivariate OLS regression, students will be introduced to other regression methods including: instrumental variables estimation, time series estimation, and panel data methods. As part of the course, students will use Stata, a statistical software package.

Learning Outcomes: 1. Understand the theoretical foundations of linear regression methods. 2. Estimate linear regression model parameters and perform basic tests using Stata. 3. Interpret regression results and identify the sources of estimation bias. Credits: 2.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and

health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 53800 - International Economics

Credit Hours: 2.00 or 3.00. The course covers selected topics in international trade with a focus on real world applications.

Learning Outcomes: 1. Identify the effects of international trade on wages, prices or products and welfare of nations. 2. Develop models as well as a diverse set of academic papers to discuss current policy debates. Credits: 2.00 or 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities. 3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 54100 - Managerial Economics & Business Strategy

Credit Hours: 1.00. The course covers topics such as monopolies (price discrimination, optimal pricing strategies), advanced strategic decision-making and imperfect competition (optimal pricing and production), new product introductions, product variety offered on the market, and entry deterrence strategies. The main goal of this course is to provide a basis for a good understanding of the logical mechanics, and to provide a good intuition in managerial economics and business decision-making processes that facilitate the understanding of daily business problems.

Learning Outcomes: 1. Identify and explain logical mechanics that determine individuals' choices and decisions. 2. Evaluate managerial economic problems to better identify daily business problems. 3. Apply key aspects such as marginal concepts and countervailing effects when proposing solutions. 4. Illustrate main mechanisms using graphs and apply basic knowledge of algebra and calculus to business problems. Credits: 1.00

ECON 55000 - Personnel Economics

Credit Hours: 2.00. Personnel Economics applies micro- and macroeconomic theory to the workings of the labor market while maintaining a focus on incentives in the workplace. The course will investigate the determination of wages and compensation (based on a study of labor demand and supply) and the differences in these forms of payment for labor services across workers within an occupation, across occupations, and across cultures. Other topics to be considered include the connection between investments in education and training and labor market outcomes and estimates of the costs and benefits of immigration and employee turnover and discuss the impact of unions, as well as discrimination in the labor market issues. Permission of department required.

Learning Outcomes: 1. Students will have the tools of economic logic that allow them to evaluate proposals for labor policies on a firm-specific level and on a national level. Credits: 2.00

ECON 55400 - Business Cycles & Macroeconomic Policy

Credit Hours: 1.00. This course examines how the US economy functions and develops a theoretical framework permitting an analysis of the forces behind short-term fluctuations in the level of economic activity and the corresponding macroeconomic stabilization techniques. Topics covered include comprehending the origins and characteristics of business cycles, assessing the impact of government fiscal and monetary policies in fostering stable economic growth and prices, and evaluating the causes and consequences of unemployment.

Learning Outcomes: 1. Categorize and describe the causes and properties of business cycles. 2. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 3. Use theoretical and empirical models to predict and evaluate the effects of economic policies on macroeconomic variables. 4. Assess economic information contained in

news reports, policymakers' statements, and specialized publications. Credits: 1.00

ECON 55500 - Economic Forecasting

Credit Hours: 2.00. This course provides an introduction to forecasting methods of current interest in economics. The goal is to equip students with a working knowledge of state-of-the-art techniques that are useful for forecasting macroeconomic variables. The strengths and weaknesses of the techniques will be analyzed and their empirical relevance will be demonstrated through a variety of applications to real data sets. The topics will include univariate prediction models, vector autoregressions, forecasting with large data sets, forecast combinations and forecast evaluation. Particular emphasis will be placed on applications and the issues involved with implementation of the various methods in practice.

Learning Outcomes: 1. Identify the statistical issues involved in forecasting economic data. 2. Analyze the strengths and weaknesses of a variety of forecasting techniques commonly used in economics. 3. Demonstrate the empirical relevance of each forecasting approach through applications to real-world data sets. Credits: 2.00

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 56400 - Advanced Quantitative Economics With Python

Credit Hours: 1.00. The main goal of this course is to extend the computational and programming toolkit developed in Quantitative Economics with Python. In particular, we will cover advanced methods for working with, visualizing and analyzing data in Python. In addition, we will consider more advanced programming techniques including stochastic optimization and infinite-horizon dynamic programming. Throughout the course we will consider a number of applications related to microeconomics, macroeconomics, and econometrics covered in the MS Econ program curriculum.

Learning Outcomes: 1. Have working knowledge of programming techniques in Python. 2. Have the ability to use scientific computing packages to analyze economic data. 3. Have an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 1.00

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 56700 - Managerial Economics And Business Strategy

Credit Hours: 1.00 to 4.00. This course studies optimal decision-making processes made by managers and policymakers within firms and other organizations. The course is based on microeconomics and applies advanced microeconomics-related concepts with an emphasis on pricing strategies. The course covers topics such as monopolies (price discrimination, optimal pricing strategies), advanced strategic decision-making and imperfect competition (optimal pricing and production), new product introductions, product variety offered on the market, and entry deterrence strategies. We use a variety of examples and applications, and operate with modern tools (Game Theory) that facilitate the decision-making process for individuals, policymakers and managers. The main goal of this course is to provide a basis for a good understanding of the logical mechanics, and to provide a good intuition in managerial economics and business decision-making processes that facilitate the understanding of daily business problems. Permission of instructor required.

Learning Outcomes: 1. Identify and explain logical mechanics that determine individuals' choices and decisions. 2. Evaluate managerial economic problems to better identify daily business problems. 3. Apply key aspects such as marginal concepts and countervailing effects when proposing solutions. 4. Illustrate main mechanisms using graphs and apply basic

knowledge of algebra and calculus to business problems. Credits: 1.00 to 4.00

ECON 57200 - Econometrics II

Credit Hours: 2.00. This course reviews basic concepts in probability, mathematical statistics and linear algebra in order to obtain a more rigorous understanding of the linear regression model, its representation and assumptions, procedures for estimation and properties associated with the OLS estimator. We move on and apply what we have learned to the linear regression model. We discuss estimation and prediction, establish properties such as efficiency, unbiasedness, consistency and convergence in mean square. We conclude by considering a few nonlinear models appropriate for modeling binary outcomes. Permission of department required.

Learning Outcomes: 1. A student will be able to apply Econometric analysis to specific economic questions using MATLAB. Credits: 2.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 58400 - Experimental Economics

Credit Hours: 2.00 or 3.00. This course introduces you to the experimental methods used by economists to study human behavior. These methods analyze data collected in controlled laboratory experiments. Throughout the course, we will discuss different types of experiments that have been extensively researched by experimental economists. To help introduce and motivate each topic, you will participate in weekly synchronous experiments with your classmates over the internet. You will then complete an assignment analyzing the data generated by your class in the online experiment. The following lecture will provide an overview of the theoretical framework and experimental predictions. We will also discuss commonly observed behavior and any relevant explanations for such behavior.

Learning Outcomes: 1. Demonstrate an understanding of the experimental methodology used by economists to study human behavior. 2. Evaluate economic behavior by analyzing and interpreting experimental data and its relationship to common economic models. 3. Identify and explain common insights that experiments provide regarding people's behavior in strategic situations. Credits: 2.00 or 3.00

ECON 58500 - Behavioral Economics

Credit Hours: 2.00 or 3.00. This course explores human economic behavior, with a strong emphasis on laboratory and field experiment methodology used in behavioral economics research. Topics considered include behavior in markets for financial assets and auction markets, and behavior in social dilemmas that arise when people try to provide public goods voluntarily or increase economic surplus through trust. Students will also study how people bargain with and exhibit social preferences towards others. Decision-making and anomalies for risky uncertain choices will also be covered.

Credits: 2.00 or 3.00

ECON 58700 - Advanced Quantitative Economics With Python

Credit Hours: 3.00. The main goal of this course is to extend the computational and programming toolkit developed in Quantitative Economics with Python course. In particular, we will cover advanced methods for working with, visualizing and analyzing data in Python. In addition, we will consider more advanced programming techniques including stochastic optimization and dynamic programming. Throughout the course, we will consider a number of applications related to microeconomics, macroeconomics, and econometrics covered in the MS Econ program curriculum.

Learning Outcomes: 1. Gain working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Understand numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 59100 - Financial Valuation And Decision Making

Credit Hours: 2.00 or 3.00. A comprehensive introduction to finance. The object of this course is to provide the computational framework necessary to appreciate and understand how to make decisions based on sound financial reasoning.

Learning Outcomes: 1. Develop skills in investment decisions and financing decisions. Credits: 2.00 or 3.00

ECON 60000 - Teaching Economics

Credit Hours: 1.00 to 3.00. This course traces the development of economic theory from the Mercantilist writers through the contributions of J. S. Mill and Karl Marx. Topics covered include the development of value theory (especially labor theories of value), theories of economic growth and business cycles, the classical debate over the meaning and validity of Say's Law, and changing views regarding the appropriate role of government in the marketplace. In each case, the contributions of the authors considered are evaluated in light of our modern understanding of economic theory.

Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

ECON 60700 - Microeconomics II

Credit Hours: 1.00 to 3.00. Building on Microeconomics I, more advanced consumer and producer theory using support functions, risk/uncertainty and information, and basic game theory and oligopoly. Prerequisite: ECON 60600 .

Credits: 1.00 to 3.00

ECON 60800 - Macroeconomic Theory I

Credit Hours: 2.00 or 3.00. An introduction to general equilibrium macroeconomic models in both deterministic and stochastic settings. Topics studied include: static neoclassical models, social planner problems, dynamic programming, growth and capital accumulation, stochastic economies, asset pricing, and overlapping generations models.

Credits: 2.00 or 3.00

ECON 60900 - Microeconomics III

Credit Hours: 1.00 to 3.00. An advanced course in game theory and general equilibrium theory. Among the topics covered are: games in strategic form, games in extensive form, games of incomplete information, cooperative games with side payments, mechanism design, consumer choice theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of microeconomic topics, including extensions in game theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. 2. Identify insights game theory provides in translating informal descriptions of multi-person decision situations into formal game-theoretic problems, including the class of games in which the players are tasked to simultaneously distribute limited resources over several objects. 3. Understand the perspective provided by general equilibrium analysis contrasted with particle equilibrium theory. Credits: 1.00 to 3.00

ECON 61000 - Advanced Game Theory

Credit Hours: 1.00 to 3.00. An advanced course in game theory and its applications. Among the topics covered are: extensive form games, normal form games, Nash equilibrium, mixed strategies equilibrium, subgame perfect equilibrium, learning and equilibrium, games with incomplete information, repeated games, cooperative games, noncooperative bargaining, and auctions. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of game theory and strategic thinking, including concepts such as dominance, backward induction, equilibrium, commitment, extensive form games, and asymmetric information. 2. Understand the perspective provided by game theory for a variety of games played in economic and political settings. 3. Identify insights game theory provides in translating an informal description of a multi-person decision situation into a formal game-theoretic problem. Credits: 1.00 to 3.00

ECON 61100 - Macroeconomic Theory II

Credit Hours: 2.00 or 3.00. An introduction to selected topics in macroeconomics, including theories of business cycles, economic growth, microfoundations of labor markets and some miscellaneous issues. Topics covered include: theories of business cycles (real business cycles, information imperfections, coordination failures), economics of growth (neoclassical model, human capital model, endogenous growth), microfoundations of labor markets (recursive competitive equilibrium models, search and matching models, efficiency wages, implicit contracts, insider-outsider model), miscellaneous issues including monetary economics (cash-in-advance constraint models), the Lucas critique, time inconsistency, and endogenous cycles. Prerequisite: ECON 60800 .

Credits: 2.00 or 3.00

ECON 61200 - Macroeconomic Theory III

Credit Hours: 1.00 to 3.00. Selected topics in contemporary research in macroeconomic theory. Emphasis on the implications of uncertainty in macroeconomic theory, including such topics as search theory, asset selection under uncertainty, stochastic optimal control, and asymmetric information.

Learning Outcomes: 1. Understand and define equilibrium in various models. 2. Identify the sources of inefficiencies in a competitive equilibrium. 3. Develop foundations in macroeconomic models necessary to pursue research in economics. Credits: 1.00 to 3.00

ECON 61400 - Economics Of Information

Credit Hours: 1.00 to 3.00. An introduction to the economics of information. Key topics considered are nonexpected utility theory and the various implications of asymmetric information-either hidden action(s) and/or hidden types, including extensions of the basic principal-agent model as well adverse selection issues, mechanism design, and screening/signaling models. Other topics that may be considered include the value of information/real option theory, herd behavior, capital asset pricing models, stochastic calculus and options pricing models, organizational decision making, search theory and price dispersion models, and herd behavior. Prerequisite: ECON 60600 .

Credits: 1.00 to 3.00

ECON 61500 - Mathematical Analysis For Economists

Credit Hours: 2.00 or 3.00. Topics include constrained optimization, comparative statics, and elementary topics in mathematical analysis. Students should be familiar with calculus, linear algebra, basic probability, and have a grasp of microeconomic theory (such as the material covered in ECON 51100).

Learning Outcomes: 1. Master key mathematical concepts used in advanced (PhD level) Economics courses. 2. Gain the ability to

analyze Economics problems using higher level mathematical tools. Credits: 2.00 or 3.00

ECON 61800 - Advanced Topics In Economics

Credit Hours: 3.00. Macro/international theory workshop. Topics on macroeconomics and international economics are presented by departmental and external speakers.

Learning Outcomes: 1. Gain awareness of the latest research in Economics across a variety of fields in Economics. 2. Identify ways to effectively communicate new research in Economics to others. 3. Understand how the development of new formal theoretic models and/or the execution of rigorous novel empirical research using the latest Econometric methods provide insights for current policy discussion. Credits: 3.00

ECON 62000 - Industrial Organization

Credit Hours: 1.00 to 3.00. A survey of some of the major theoretical issues in the field of industrial organization. Topics include: the welfare economics of competition and monopoly, static and dynamic oligopoly theory, differentiated products models, and entry deterrence.

Credits: 1.00 to 3.00

ECON 62100 - Applied Industrial Organization

Credit Hours: 1.00 to 3.00. A continuation of ECON 62000, with emphasis on empirical analysis and the application of theory to real-world situations. Topics covered include: empirical estimation of market structure, empirical tests of market conduct, the effect of anti-competitive behavior on economic performance, antitrust practice, regulation theory and practice, and experimental industrial economics. The material is selected from current journal articles. Prerequisite: ECON 62000.

Learning Outcomes: 1. Understand methodological developments in the area of empirical Industrial Organization. 2. Establish empirical models and test hypotheses derived from theory. 3. Gain insights in data evaluation and apply statistical software. 4. Derive, estimate, and interpret economic concepts such as market power, economies of scale and scope, price elasticities of demand, etc. Credits: 1.00 to 3.00

ECON 62400 - Estimating Game Theoretic Models

Credit Hours: 2.00 or 3.00. This course examines topics in empirical industrial organization (I.O.), which aims to use data to draw conclusions about how market and firm structure, firm conduct, and market performance interact in imperfectly competitive markets. We will take a "structural" approach, focusing on estimating the parameters of game theoretic models using real industry data, and then simulating those same models to generate predictions under alternative ("counterfactual") scenarios. We will cover theory only to the extent that it provides intuition or testable conclusions. The course is divided into two unequal parts. In the first part, we will learn about static games in the context of mergers, market power, and entry. In the second part, we will focus on the estimation of dynamic games, after first understanding how to solve and estimate dynamic single-agent problems.

Learning Outcomes: 1. Know about several important empirical methods, and you will understand why we use them. 2. Apply some of those methods to real data, generating your own usable code for implementing them. 3. Highlight the advantages and shortcomings of any given method by pointing to scholarly work that applies that method to real industry data. 4. Have the kind of in-depth knowledge (for at least one of these methods) that makes you an expert (and resource) among your peers. 5. Have practiced your presentation skills. 6. Have thought creatively about the challenges facing the forefront of empirical I.O. Credits: 2.00 or 3.00

ECON 63200 - Labor Economics

Credit Hours: 1.00 to 3.00. An area seminar. Theoretical and empirical research on the financial markets.

Credits: 1.00 to 3.00

ECON 63400 - International Trade

Credit Hours: 1.00 to 3.00. Application of microeconomic techniques to international trade. Topics include: classical, neoclassical, and modern theories of international trade; the theory of tariffs and commercial policy, (including aspects of political economy), welfare aspects of trade and tariff theory, and related topics. The material is selected from current journal articles. Prerequisite: ECON 60700.

Learning Outcomes: 1. Acquire the important building blocks for conducting both theoretical and empirical research in international trade. 2. Develop a keen understanding of the state of current research in trade and labor-market outcome. 3. Refine your skills in critical thinking and nourish your ability to initiate and execute

independent inquiries. Credits: 1.00 to 3.00

ECON 63600 - Topics And Research In International Trade

Credit Hours: 1.00 to 3.00. A course in international trade theory and empirics, with emphasis on surveying the recent developments in the field-including empirical applications of material covered in ECON 634. While specific subject matter may vary from year to year, likely topics include: theory and empirics on trade and wages, trade and the environment, trade in the presence of multinational firms and vertical specialization, empirical evaluation of the positive theories of trade (especially factor endowment and variety models), and the identification and measurement of trade barriers and their effects. Material is selected from current journal articles. Prerequisite: ECON 60700.

Learning Outcomes: 1. Identify the evolution & applications of general equilibrium modeling with heterogeneous firms and industries. 2. Outline theory and simulation techniques to modeling frameworks to questions in international trade. 3. Demonstrate knowledge & analysis of New Trade Theory applications through preparation of a 20-30 minute in class presentation. Credits: 1.00 to 3.00

ECON 64100 - Agent-Based Computational Economics

Credit Hours: 2.00 or 3.00. Computational study of economic systems involving interacting agents who do not necessarily possess perfect rationality and information. In addition to equilibrium analysis, agent-based models focus on out-of-equilibrium dynamics that may or may not lead to equilibrium in the long run,

Learning Outcomes: 1. Provide foundation for implementing agent-based simulations in Python. 2. Use agent-based approach to explain and/or complement findings from studies that use human subject experiments. Credits: 2.00 or 3.00

ECON 64200 - Computational Economics

Credit Hours: 2.00 or 3.00. The purpose of this class is to give you a computational toolbox you can apply to economic questions. We will introduce and use numerical methods on computationally tractable problems. The goal of the course is to encourage Ph.D. students to apply these techniques to their own research. Our in-class applications
will primarily be public policy and macro-oriented, by solving and simulating the problems of microeconomic agents and aggregating the results.

Learning Outcomes: 1. Use a computational toolbox that you can apply to economic questions. 2. Solve policy functions of Bellman equations and simulating agent behavior. 3. Solve and simulate the problems of microeconomic agents and aggregating the results. Credits: 2.00 or 3.00

ECON 64300 - Search Theory And Applications In Macroeconomics

Credit Hours: 2.00. This course will employ both self-prepared notes on foundational and current topics in the research area as well as recommended/required texts. Often, students will be required to read, understand and summarize a number of published research papers in this area of study. Methods of assessment will include frequent problem sets that require analysis of data / theoretical analysis of key topics and a capstone course project. Students will develop mastery of frequently used-models and techniques in the literature, including the classic Diamond-Mortensen-Pissarides model of the labor market and Kiyotaki-Wright/Lagos-Wright model of monetary economies. Prerequisite: ECON 61100.

Learning Outcomes: 1. Identify, formulate, and solve general equilibrium search models. 2. Use search models to interpret empirical regularities and assess policy. 3. Discuss and evaluate papers in the literature. 4. Identify topics for future research that can be studied with the tools of search theory. Credits: 2.00

ECON 64500 - International Macroeconomics

Credit Hours: 2.00. One of the challenging and interesting areas of economic research seeks to integrate three intimately related dimensions of economic activity and the choices underlying them: who, when, what, and where? In a nutshell, the main objective of this course is to develop a better understanding of what I will call DS2GE models - Dynamic Stochastic Spatial General Equilibrium models. The strategy will be to take different paths through the research literature while maintaining focus on the who, what, when and where in each reading.

Learning Outcomes: 1. Have a deep understanding of the key theoretical models in use in the field. 2. Understand how the model is both shaped by empirical observation and estimated or tested using real-world data. 3. Solve some small-scale models or sub-parts of models. 4. Use computer algorithms to formulate, calibrate, estimate and simulate a

small-scale Dynamics Stochastic General Equilibrium model of an open economy. 5. Read, understand and assess (i.e., write a professional referee report) peer-reviewed publications in the field of international macroeconomics and trade. 6. Present a research paper clearly and with insight. 7. Develop a preliminary research paper proposal as might fit into a dissertation proposal. Credits: 2.00

ECON 64700 - Urban Economics I

Credit Hours: 2.00. This course explores topics related to current research at the intersection of labor and urban economics. There is significant overlap with industrial organization and trade in topics and methods.

Learning Outcomes: 1. Understand the unique economics of cities and regions. 2. Improve technical knowledge of relevant empirical and structural approaches and their appropriate applications. 3. Evaluate existing research critically. 4. Gain maturity in communicating your own research ideas. Credits: 2.00

ECON 64800 - Urban Economics II

Credit Hours: 2.00. This course is the second part in the sequence Urban Economics. It is aimed at second and third-year PhD students in Economics. This course visits selected topics related to internal migration, regional development and government policies, roles of transportation infrastructure, and urbanization in developing countries. This course aims at familiarizing students with the field's important questions, workhorse models, and key empirical methods. As part of the course, students will start developing their independent research.

Learning Outcomes: 1. Be familiar with recent literature in topics related to urban and regional economics, including regional development policies, residential sorting and its consequences, infrastructure, and the housing market. 2. Use workhorse models and empirical methods in their own original research. 3. Work with spatial data using Python or R. 4. Formulate a research idea, collect data, conduct initial investigation, and present preliminary findings. Credits: 2.00

ECON 64900 - Advanced Topics In Panel Data & Spatial Econometrics

Credit Hours: 2.00. This course covers selected topics in panel data and spatial econometrics with an emphasis on developing a clear understanding of the methodological issues involved as well as identifying a set of substantive issues where such methods can be applied. Familiarity with a matrix-oriented programming language is essential. Considerable emphasis will be placed on the replication of simulation and empirical results from published papers. Prerequisite: ECON 67200.

Learning Outcomes: 1. Understand concepts for characterizing panel and spatial data. 2. Estimate panel and spatial models and conduct inferences. 3. Apply to real economic panel and spatial data. Credits: 2.00

ECON 65000 - Applied Microeconometrics

Credit Hours: 1.00 to 3.00. Topics in labor economics. While the specific subject matter varies from year to year, recent seminars have examined such topics as dynamic labor demand and supply analysis, human capital theory, screening and signaling theories, contract theory, efficiency wages, job matching, search, unions, and internal labor markets. Material is selected from current journal articles.

Learning Outcomes: 1. Understand the background and motivation for various microeconometric model. 2. Recognize the assumptions or conditions that provide identification of the treatment effect in each model. 3. Use Stata to estimate policy-relevant treatment effect using non-experimental data. 4. Demonstrate how to read and understand economic journal articles that use the methods introduced in this course. 5. Perform PhD-level empirical research using microeconometric methods. Credits: 1.00 to 3.00

ECON 65300 - Topics In Early Childhood Development

Credit Hours: 2.00 or 3.00. This course is the second in the Ph.D. Labor Economics sequence. We will focus on the economics of skill formation and its consequences on later outcomes like schooling choices, health, social behaviors and labor market variables. We will do this, by analyzing both static and dynamic settings, in which we recognize that skill formation is a process where early inputs affect the productivity of later ones. This course will be econometrically intense, covering from reduced form techniques to structural ones. We will pay special attention to econometric identification of effects and the analysis of skills as unobserved heterogeneity, its consequences on

empirical estimation and models to address it. This course will emphasize the connection between theory and practice.

Learning Outcomes: 1. Understand the role played by the endogeneity caused by the unobserved heterogeneity in econometric estimation. 2. Understand and use advanced methodologies that allow the correct estimation of econometric models in non-standard settings, like in the presence of self-selection and unobserved heterogeneity. 3. Understand the economic theory and evidence that allow us to claim that early childhood development is one of the most important investment a person can do. 4. Know the relevant literature regarding early childhood development, skill formation and econometric estimation techniques employed in these subareas of labor economics. 5. Understand why and how skills evolve over time. Credits: 2.00 or 3.00

ECON 65400 - Topics In Empirical Labor & Public Economics

Credit Hours: 2.00. Provide an introduction to the baseline models of labor supply, including static and dynamic model of labot supply. Introduce students to several seminal and new papers on labor supply. Provide students with the conceptual understanding and computational tools (Stata and Matlab) required to adapt and apply the models presented in the course to address new research questions in labor and public economics. Provide students with an basic understanding of the Current Population Survey (CPS). Motivate and illustrate simulation-assisted estimation as a method for estimating structural models of labor supply.

Learning Outcomes: 1. Understand baseline models of labor supply, including static and dynamic model of labor supply. 2. Understand concepts and use of computational tools (Stata and Matlab). 3. Basic understanding of the Current Population Survey (CPS). 4. Illustrate simulation-assisted estimation as a method for estimating structural models of labor supply. Credits: 2.00

ECON 65500 - Public Economics

Credit Hours: 2.00 to 3.00. Knowledge of various types of government programs, public policies and program administration. Prerequisite: ECON 65000.

Learning Outcomes: 1. Gain a working knowledge of various types of government programs. 2. Understand the application of reduced form methods for studying public policy. 3. Assemble a portfolio of potential study topics related to public economics. 4. Gain experience in presenting and discussing research. Credits: 2.00 to 3.00

ECON 65600 - Labor Economics II

Credit Hours: 2.00. This course is the third in the PhD Labor Economics sequence. This course is designed to be primarily a "topics" course. Class will focus on some of the most popular open questions in labor economics, however, we will take a long view to these questions in order to understand the progress that has been made over the last half-century.

Learning Outcomes: 1. Cover many of the theoretical underpinnings across topics in labor economics. 2. Understand these tools for quality dissertation writing in labor economics. Credits: 2.00

ECON 65700 - Search Theory & Applications

Credit Hours: 2.00. This course provides an overview to the tools and applications of search theory, which has been a very active area of research. The aim of this course is to provide students with a solid understanding of the search approach and to get started on engaging in research. The first part of the class will cover topics in labor economics, while the second part turns to applications in monetary economics. It is also worth noting that search models have also been successfully applied in other contexts (e.g., housing, marriage and household formation, over-the-counter markets, international trade, industrial organization, just to name a few). Graduate students with broad interests in applied theory, labor economics, macroeconomics, and trade are encouraged to take this class.

Learning Outcomes: 1. Formulate and solve general equilibrium search models. 2. Use search models to interpret empirical regularities and assess policy. 3. Discuss and evaluate papers critically in the literature. 4. Identify topics for future research that can be studied with the tools of search theory. Credits: 2.00

ECON 65800 - Public Economics II

Credit Hours: 2.00. This course explores the operations of government in society and the economy. Using real-world policy examples, motivations for intervention and policy alternatives are explored. A strong emphasis is placed on causal inference and seminal papers in the field of public economics.

Learning Outcomes: 1. Identify and describe the most common types of government programs.

2. Evaluate empirical methods used in public economics literature. 3. Suggest research projects related to public policy. 4. Provide valuable feedback to peers (identify and articulate) on research ideas. 5. Present research in a clear and concise way to an audience. Credits: 2.00

ECON 66200 - Game Theory

Credit Hours: 2.00 or 3.00. In this course, we will examine some of the basic elements of Game Theory. Game Theory studies strategic environments in which each individual's payoff depends upon both their own actions as well as the actions of others. Game Theory attempts to develop an understanding of such situations and to provide a formal framework and solution concepts for making better strategic choices.

Learning Outcomes: 1. Apply game-theoretic reasoning to real-world problems in a range of environments, including: (i) static (normal-form) games with complete or incomplete information, (ii) dynamic (extensive-form) games with complete or incomplete information, and (iii) repeated games. Credits: 2.00 or 3.00

ECON 66800 - Topics In Applied Economics

Credit Hours: 3.00. Applied micro workshop. Topics on applied macroeconomics are presented by departmental and external speakers.

Credits: 3.00

ECON 67000 - Probability And Statistics

Credit Hours: 2.00 or 3.00. An introduction to probability theory and the basic statistical estimation methods. Topics include: axiomatic development of probability theory, counting methods, conditional probability and Bayes' theorem, random variables and distributions, expectation, variance, covariance and correlation, special distributions, statistical inference, maximum likelihood estimators, unbiased estimation, and testing hypotheses. Prerequisite: ECON 61500.

Learning Outcomes: 1. Identify important statistical issues of interest in practical scenarios. 2. Demonstrate the application of state of the art statistical methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. Credits: 2.00 or 3.00

ECON 67100 - Econometrics I

Credit Hours: 1.00 to 3.00. An introduction to the modern techniques of econometrics and their applications. Topics include: the classical linear regression model (specification, estimation, inference, and prediction), specification analysis, functional form, heteroscedasticity, and autocorrelation. Prerequisite: ECON 67000.

Learning Outcomes: 1. Investigate the properties of econometric estimators under a variety of conditions. 2. Explain econometric techniques for estimating causal effects. 3. Explain the principles and purpose of Monte Carlo simulation methods. 4. Conduct basic empirical analyses of cross sectional data. Credits: 1.00 to 3.00

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 67300 - Time Series Econometrics

Credit Hours: 1.00 to 3.00. This advanced course gives an up-to-date and comprehensive treatment of modern time series analysis and empirical macroeconomics. Topics include: ARIMA processes, spectral analysis, forecasting, covariance-stationary vector processes, vector autoregressions, state space representations in the Kalman filter, non-stationary time series and fractional integrated processes, and time series models of heteroscedasticity. Prerequisite: ECON 67200 .

Credits: 1.00 to 3.00

ECON 67400 - Microeconometrics

Credit Hours: 1.00 to 3.00. This advanced course covers the econometrics and statistical methods needed to study data on individual agents in general qualitative response models and models of limited dependent variables. Special emphasis is placed on applying the alternate estimation and inference techniques to actual or simulated datasets. Topics include: univariate binary models, multinomial and multivariate qualitative response models, choice based sampling, distribution-free estimation methods, and Tobit models. Prerequisite: ECON 67200 .

Credits: 1.00 to 3.00

ECON 67800 - Search Theory And Applications

Credit Hours: 2.00 or 3.00. This course provides an overview to the tools and applications of search theory, which has been a very active area of research. The aim of this course is to provide students with a solid understanding of the search approach and to get started on engaging in research.

Learning Outcomes: 1. Formulate and solve general equilibrium search models. 2. Use search models to interpret empirical regularities and assess policy. 3. Critically discuss and evaluate papers in the literature. 4. Identify topics for future research that can be studied with the tools of search theory. Credits: 2.00 or 3.00

ECON 68500 - Experimental Economics I

Credit Hours: 1.00 to 3.00. An overview of seminal and recent developments in experimental economic research. Provides practical training in designing and conducting experiments and the analysis of experimental data. Content varies from year to year. Applications include: industrial organization, game theory, finance, international trade, information economics, and monetary economics. Course readings are primarily from journal articles. Prerequisite: ECON 60700 . ECON 61000 .

Credits: 1.00 to 3.00

ECON 68600 - Experimental Economics II

Credit Hours: 2.00 or 3.00. Covers topics different from ECON 685, and they vary from year to year. May be taken prior to ECON 685. Course readings are primarily from journal articles. Prerequisite: ECON 60700. 61000.

Learning Outcomes: 1. Identify research questions that are suitable for answering using economics experiments. 2. Develop you own experimental designs to address specific research questions and hypotheses. 3. Criticize and evaluate experimental research published in leading economics journals. Credits: 2.00 or 3.00

ECON 68900 - Experimental And Behavioral Economics

Credit Hours: 2.00. The course will cover: (i) experimental methodology; (ii) statistical considerations in experiments; (iii) behavioral game theory (including psychological games and boundedly rational thinking in games); (iv) loss aversion and reference points (including prospect theory, expectations-based reference points, and goal setting); and (v) experiments on gender. We will also discuss how to develop good research ideas in experimental economics, and how to write papers in a way that appeals to top journals in the field.

Learning Outcomes: 1. Develop the skills to design experiments that test cleanly predictions from economic theory. 2. Understand what statistical techniques are appropriate for different types of experimental designs. 3. Become familiar with cutting-edge research in the field of experimental and behavioral economics. 4. Gain experience in how to present research effectively. 5. Learn how to write research papers that will appeal to the top journals in the field. Credits: 2.00

ECON 69000 - Advanced Problems In Economics

Credit Hours: 1.00 to 4.00. Advanced individual reading and investigation in a specific economic field at the graduate level. Open to individual students with superior records. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 69100 - Advanced Topics In Panel Data

Credit Hours: 2.00 or 3.00. This course covers selected topics in the econometrics of panel data with an emphasis on developing a clear understanding of the methodological issues involved as well as identifying a set of substantive empirical issues where such methods can be applied. Prerequisite: ECON 67100 and ECON 67200.

Learning Outcomes: 1. Organize data into an easy to interrupt manner. 2. Understand the role of factor models as a tool for dimension reduction in the analysis of large-dimensional data as well as a device for modeling cross-sectional correlation in panel data analysis when the cross-sectional and time series dimensions are comparable in magnitude. Credits: 2.00 or 3.00

ECON 69200 - Advanced Topics In Time Series

Credit Hours: 2.00 or 3.00. This course covers a set of selected topics of current interest in eco-nomic forecasting. It is designed for students interested in conducting theoretical research related to the development and evaluation of new forecasting techniques as well as those inclined towards the application of state-of-the-art techniques to economic data.

Learning Outcomes: 1. Organize data into an easy to interpret manner. 2. Understand the role of factor models as a tool for dimension reduction in the analysis of large-dimensional data as well as a device for modeling cross-sectional correlation in panel data analysis when the cross-sectional and time series

dimensions are comparable in magnitude. Credits: 2.00 or 3.00

ECON 69300 - Bayesian Econometrics I

Credit Hours: 2.00 or 3.00. This is a first course in Bayesian Econometrics. The overarching goal of the course is to expose students to the Bayesian perspective and get them up-to-speed with modern Bayesian simulation methods.

Learning Outcomes: 1. Explain the Bayesian approach to estimation and inference. 2. Develop posterior simulators to estimate commonly-used models. Credits: 2.00 or 3.00

ECON 69400 - Bayesian Econometrics II

Credit Hours: 2.00 or 3.00. This is a second course in Bayesian Econometrics. After completion student should be able to conduct research in Bayesian econometrics using state-of-the-art models and techniques. Pre-requisite: ECON 69300.

Learning Outcomes: 1. Use state-of-the-art Bayesian models and methods in research. Credits: 2.00 or 3.00

ECON 69700 - Research Methods In Economics

Credit Hours: 2.00 or 3.00. The first steps in doing a thesis research paper, proposal/idea, growing the proposal/idea. Developing a set of critical professional skills. Pre-requisite: ECON 60700 and ECON 60800.

Learning Outcomes: 1. Write a serious term paper, and present it in class in the proposal and final stages. Credits: 2.00 or 3.00

ECON 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Education-Curriculum and Instruction

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. (EDCI 20002) This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a

minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works well with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 20700 - Construction And Textile Lab Management

Credit Hours: 3.00. A lecture/lab course which provides clothing construction and textile science content to be applied in the secondary family and consumer sciences classroom.

Learning Outcomes: 1. Demonstrate clothing construction concepts. 2. Apply basic textile science to fabric and clothing selection. 3. Manage a clothing and/or textile lab within a secondary family and consumer sciences classroom. Credits: 3.00

EDCI 21000 - Education Scholars Program I

Credit Hours: 1.00 to 3.00. EDCI 21000 is the first course in a two course, introductory sequence for College of Education students enrolled in the Honors College and/or DeVito Program scholarship recipients. In this course, we will examine key concepts and ideas in educational thought and research, understand what research is, and begin to explore individual students' research interests.

Learning Outcomes: 1. Introduced to key concepts and ideas in educational thought, e.g. democracy; diversity; equity; teaching, learning, and testing; creativity; and technology. 2. Examine how educational researchers conceptualize and conduct research. 3. Explore research interests in education, and how to access resources to further develop those interests. 4. Introduced to campus-based academic resources. 5. Complete multiple writing assignments to develop scholarly writing skills. Credits: 1.00 to 3.00

EDCI 21100 - Education Scholars II

Credit Hours: 1.00 to 3.00. This is the second course in a two course, introductory sequence for College of Education students enrolled in the Honors College and/or DeVito Program scholarship recipients. In this course, students will work on a research project with a faculty mentor, will participate in reflection and discussion of that research experience, will participate in seminars with faculty to read and discuss research, and continue to explore their own research interests and campus resources.

Learning Outcomes: 1. Participate in a semester-long research project with a faculty mentor for 3-4 hours per week. 2. Participate in structured written and oral reflection on their semester-long research experiences. 3. Interact with faculty in the College of Education through 3-4 seminars focused on discussion of their research and scholarship. 4. Explore their research interests, and campus resources. 5. Present their research projects during a public presentation session at the end of the semester. Credits: 1.00 to 3.00

EDCI 21510 - Language & Literacy Foundations For Teachers

Credit Hours: 1.00. The goal of the course is to provide background information in language and literacy necessary for success in literacy methods courses. The course will address basic linguistics and phonetic patterns of English, as well as the structures of literature and literary terms.

Learning Outcomes: 1. Compare and contrast levels of language structure: phoneme, morpheme, root, affix, phrase, sentence. 2. Differentiate graphic from phonological

elements of language (e.g., grapheme vs phoneme). 3. Compare and contrast vocabulary terms (e.g. synonym, homonym, homograph). 4. Define and articulate written elements (e.g. digraphs, consonant clusters, long/short vowels). 5. Identify morpho-syntactic structures and phonological patters in written and spoken language. 6. Compare and contrast literary genres (e.g. narrative, non-narrative, fiction, nonfiction). 7. Distinguish the organizational structures of fictional genres from those of nonfictional genres. 8. Identify literary terms in context (e.g. alliteration, character traits, plot, stanza). Credits: 1.00

EDCI 21610 - Teaching History: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching history in powerful, exciting and innovative ways through a topical study (e.g., American Civil Rights Movement) approach. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national history standards. 2. Use research and theory about how grades 5-12 students learn history. 3. Merge historical content and processes with pedagogy to forge pedagogical content knowledge. 4. Employ appropriate history-specific academic language in history lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful and purposeful history teaching and learning grades 5-12. Credits: 1.00

EDCI 21710 - Teaching Geography: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching geography in powerful, exciting and innovative ways through a study of geographic concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national geography standards. 2. Use research and theory about how secondary students learn geography. 3. Merge geographical content and process with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful geography lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary geography teaching and learning. Credits: 1.00

EDCI 21810 - Teaching Civics And Government: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching civics and government in powerful, exciting and innovative ways through a study of civics and political science concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national civics and government standards. 2. Use research and theory about how secondary students learn civics and government. 3. Merge political science content and processes with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful civics and government-oriented lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary civics and government teaching and learning. Credits: 1.00

EDCI 21910 - Teaching For Economic Literacy: Developing An Economic Way Of Thinking

Credit Hours: 1.00. Course focuses on preparing students in the social studies education licensure program to teach high school economics and to integrate economics into other middle and/or high school social studies courses. Course addresses issues of economic pedagogy. It will address economic content/concepts specifically and only in a way to illustrate/expand on the teaching ideas, resources, methods, and assessment.

Learning Outcomes: 1. Develop a rationale for teaching high school economics. 2. Identify state and national standards addressing economic content. 3. Explore methods for active teaching/learning in economics. 4. Identify resources appropriate for the active teaching/learning of economics. Credits: 1.00

EDCI 22200 - Knowing The World Through Mathematics (UCC: QR)

Credit Hours: 3.00. In this course, *Knowing the World Through*

Mathematics, students will connect their situated experiences to larger trends in equity and social justice around the globe through mathematical investigations embedded in the context of the United Nations 2030 Agenda (United Nations, 2015). Students in this course will make use of mathematics and global policy documents to critically interpret, model, and represent world phenomena. Students will collaboratively analyze quantitative information gathered through trustworthy, globally representative data sets and individual survey and questionnaire items to investigate local experiences in relation to students' area(s) of interest. Students will learn about and utilize the GAISE Framework for Statistical Problem Solving (Franklin, et al., 2005) and the Four Dimensions of Equity in Mathematics Education (Gutiérrez, 2012) to ground their discussions and deliverables for *Knowing the World Through Mathematics*.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use a critical mathematics perspective to interpret world patterns, situations, and events. 2. Create mathematical models of world phenomena. 3. Use multiple mathematical representations to present global issues. 4. Identify and implement appropriate mathematical strategies to investigate world phenomena. 5. Express mathematical arguments related to world phenomena. 6. Use mathematics to explore global policy documents. 7. Explore world phenomena through quantitative (and qualitative) methods. Credits: 3.00

EDCI 22222 - Integrated Health And Physical Education For Elementary Teachers

Credit Hours: 3.00. This course provides elementary education majors with a comprehensive understanding of the critical role health and physical education play in the overall development of young learners. Students will explore how physical activity and health education contribute to cognitive, social, emotional, and physical growth. The course emphasizes the importance of integrating movement and health topics such as personal safety, nutrition, and emotional health into the elementary classroom to enhance academic performance, promote wellness, and develop lifelong healthy habits. Through a blend of theory, practical strategies, and hands-on activities, students will learn to design inclusive, developmentally appropriate physical education lessons and comprehensive school health education (CSHE) plans that cater to diverse learners. By the end of the course, students will be equipped to create engaging, safe, and supportive environments that foster both physical well-being and academic success.

Learning Outcomes: 1. Understand health-related fitness concepts and principles related to physical activity and wellness. 2. Promote physical, emotional, and social well-being in elementary students. 3. Understand and teach proper nutrition, including the relationship between healthy eating, physical activity, and overall wellness. 4. Promote mental and emotional health by teaching coping strategies, stress management, and emotional regulation. 5. Teach personal safety and injury prevention, including strategies for safe play, accident prevention, and emergency response. 6. Integrate physical activity into daily classroom activities, promoting active learning and encouraging students to develop positive attitudes toward physical activity. 7. Develop inclusive and developmentally appropriate physical education lessons, ensuring students of all abilities can participate in and benefit from physical education. Credits: 3.00

EDCI 22550 - Mathematics Education Seminar

Credit Hours: 1.00. In this course, students will be introduced to many aspects of mathematics education, including pedagogies, professional organizations, standards, research, lesson planning, technology, etc. In addition, they will have opportunities to get to know others in their major earlier in their program.

Learning Outcomes: 1. Examine critically current pedagogical practices used in secondary mathematics classrooms. 2. Explore alternative pedagogies to enhance student engagement and conceptions of the relevance of mathematics. 3. Become familiar with technologies available for use in mathematics teaching and learning, mathematics education research, and professional organizations and standards. Credits: 1.00

EDCI 25000 - Professional Development In Family And Consumer Sciences Education

Credit Hours: 0.00 to 2.00. This course focuses on students' professional development as family and consumer sciences educators. Characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; the Purdue Family and Consumer Sciences Education program; and expectations for

Indiana FCS teacher-licensure are emphasized. Includes participation in professional organizations and meetings.

Learning Outcomes: 1. Formulate and implement plans for building and documenting one's professional identity, competence, and career development as a family and consumer sciences educator. 2. Examine characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; coursework and field-based experiences in the Purdue Family and Consumer Sciences Education (FCSE) program; and licensure requirements and standards for teachers of family and consumer sciences. Credits: 0.00 to 2.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 28500 - Multiculturalism And Education (UCC: BSS)

Credit Hours: 2.00 to 3.00. This course integrates an understanding of multiculturalism with principles of democratic education. Historical, sociological, cultural, political, philosophical, and pedagogical foundations of multiculturalism are explored and related to issues of pedagogy in a pluralistic society.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Develop awareness of issues and concerns related to multicultural education. 2. Develop knowledge of how multiculturalism impacts teachers, schools, classrooms, and society. 3. Develop skills of critical thinking and reflection that will enable educators to contribute to meeting the needs of students in a multicultural and global world. Credits: 2.00 to 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDCI 30101 - Inquiry Into Teaching And Learning

In K-2

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the K-2 classroom. Admission to Teacher Education required. Cannot be taken concurrently with EDCI 30002.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach, assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6. Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 30102 - Inquiry Into Teaching And Learning In 3-6

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the 3-6 classroom. Admission to Teacher Education is required. Cannot be taken concurrently with EDCI 30101.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6. Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 31100 - Media For Children

Credit Hours: 3.00. Books and other resources designed for children and adolescents are studied and evaluated in terms of literary theory and aesthetic appreciation. Emphasis is placed on literature and its place in the child's world.

Credits: 3.00

EDCI 31101 - Integrating Media In The K-2 Classroom

Credit Hours: 2.00. The goal of the course is for teacher candidates to understand how to choose and evaluate children's literature and media to use in K-2 classroom, develop ways to integrate literature and understanding of literature and media using a variety of methods, select appropriate materials for individual student's needs, and assess student's learning. Admission to Teacher Education is required.

Learning Outcomes: 1. Evaluate both fiction and nonfiction resources for the use in classroom including identifying media which is broadly representative of the world in which we live using a variety of rubrics and evaluation forms. 2. Determine cross-curricular connections, teaching ideas, and assessment methods of

individual titles for use in the K-2 classroom. 3. Develop materials (i.e., graphic organizers, vocabulary activities, comprehension supports) to use with literature which may be differentiated for individual learner's needs. Credits: 2.00

EDCI 31102 - Integrating Media In The 3-6 Classroom

Credit Hours: 1.00. The goal of the course is for teacher candidates to understand how to choose and evaluate children's literature and media to use in the 3-6 classroom, develop ways to integrate literature and media throughout the curriculum, support students' understanding of literature and media using a variety of methods, select appropriate materials for individual student's needs, and assess students' learning.

Learning Outcomes: 1. Evaluate both fiction and nonfiction resources for use in the classroom including identifying media which is broadly representative of the world in which we live. 2. Determine cross-curricular connections, teaching ideas, and assessment methods of individual titles for use in the 3-6 classroom. 3. Develop materials (i.e., graphic organizers, vocabulary activities, comprehension supports) to use with literature which may be differentiated for individual learner's needs. 4. Research and develop a rationale for including social justice topics at part of the 3-6 curriculum. Credits: 1.00

EDCI 31103 - Integrating Media In The K-6 Classroom

Credit Hours: 3.00. This course prepares teacher candidates to select, evaluate, and integrate children's literature and media in K-6 classrooms. Focusing on high-quality, diverse texts and media, candidates will learn to choose materials that are developmentally appropriate and reflect the diversity of the world in which we live. Emphasis will be placed on the critical role literature and media play in fostering vocabulary development, enhancing critical thinking skills, and supporting literacy development across subjects. The course will focus on how K-6 students learn to use comprehension strategies independently and efficiently as they progress through elementary school fostering both their academic growth and their ability to engage with diverse texts.

Learning Outcomes: 1. Integrate literature and media into content area lessons to enhance vocabulary (including academic language skills), critical thinking, and comprehension. 2. Select and evaluate three trade books to read aloud during a math, a social studies, and a science lesson. 3. Identify instructional strategies supported by the Science of Reading that teach k-6 students' academic language skills, vocabulary knowledge, and reading and listening comprehension. Credits: 3.00

EDCI 31950 - Approaches To English Learner Education

Credit Hours: 3.00. This course addresses English language instruction and content instruction for English Learning students in mainstream classrooms. The purpose of this course is to provide information necessary to the design of materials and instructional strategies for English Language Learners in K-12 context. In this course, we will focus on current issues and techniques in instruction for ELL students who are at different stages of English language acquisition in the K-12 school context. The course will also consider the nature of immigrants' experiences of a new country and school context. Practical field experiences integrated into the course will provide students with the opportunity to apply and demonstrate principles and strategies presented in the course.

Learning Outcomes: 1. Use essential techniques for instruction of ELLs across various grade levels. 2. Evaluate the language used in resources for ELL content instruction. 3. Examine the role of visual and verbal language in ELL instruction. 4. Analyze the ways in which students use literacy as writing, drawing, and talk. 5. Describe the language characteristics of important school genres. 6. Apply the teaching and learning cycle in the genre approach to lesson planning. 7. Implement and reflect on a multimodal, content area ELL lesson. 8. Discuss the role of home language and culture in ELL instruction. 9. Apply an understanding of the role of culture and family background in the student's experience of the classroom. Credits: 3.00

EDCI 32250 - Physical Education In The Elementary School

Credit Hours: 2.00. Current conceptions of elementary school physical education, with a particular emphasis on curriculum implementation.

Learning Outcomes: 1. Competence in

instructional and organizational strategies appropriate for effective elementary gymnasium practice. 2. Ability to develop and implement warm-up, concept-based fitness, skill-based, and culminating activity instructional episodes. 3. Ability to provide developmentally appropriate assessment for skill-based physical education lessons. Credits: 2.00

EDCI 32500 - Literacy In The Early Childhood Classroom

Credit Hours: 3.00. Students will study how children's oral language develops, how children learn to read and write in early childhood/K3 settings, and the teacher's role in this process. Students will learn how phonemic awareness, phonics, fluency, vocabulary and comprehension influence children's literacy development. Students will learn how to select appropriate instructional materials; employ teaching strategies to meet the cognitive and affective literacy needs of all children; and collect, interpret, and use data from various types of assessments to inform literacy teaching and learning processes.

Learning Outcomes: 1. Develop a sound background in theory and research about children's language and literacy development and learning in grades K-3. 2. Learn how literacy learning, teaching, and assessment in phonemic awareness, phonics, fluency, vocabulary, comprehension and writing can be effectively and systematically integrated and diversified to meet individual or group needs in grades K-3. 3. Design and implement developmentally appropriate instruction for K-3 grade students. Credits: 3.00

EDCI 32501 - Teaching Literacy In K-2

Credit Hours: 2.00. Students will study how children's oral language develops, how children learn to read and write in primary grade settings, and the teacher's role in this process. Students will learn how phonemic awareness, phonics, fluency, vocabulary and comprehension influence children's literacy development. Students will learn how to select appropriate instructional materials; employ teaching strategies to meet the cognitive and affective literacy needs of all children, and collect, interpret, and use data from various types of assessments to inform literacy teaching and learning processes.

Learning Outcomes: 1. Develop a sound background in theory and research about children's language and literacy development and learning. 2. Learn how literacy learning, teaching, and assessment in phonemic awareness, phonics, fluency, vocabulary, comprehension and writing can be effectively and systematically integrated and diversified to meet individual or group needs. 3. Design and implement developmentally appropriate instruction for primary grade students. Credits: 2.00

EDCI 32600 - Literacy In The Intermediate Classroom

Credit Hours: 3.00. This course includes a field-based component. Students will build on material learned in EDCI 32500 . They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children; and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Develop a sound understanding of student literacy needs in the intermediate grades with a focus on comprehension strategies, strategic reading, vocabulary development, literary analysis, content area reading, and the writing process. 2. Assess student's learning and use this information to design and implement developmentally and culturally appropriate instruction in literacy and social studies. 3. Learn how literacy learning, teaching, and assessment can be effectively and systematically integrated and diversified to meet individual or group needs. Credits: 3.00

EDCI 32602 - Teaching Literacy In 3-6

Credit Hours: 2.00. Students will build on material learned in EDCI 32501. They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children, and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Demonstrate an understanding of theoretical and evidence-

based foundations that guide reading, writing processes, and instruction. 2. Design developmentally appropriate instruction that addresses the needs of all learners. 3. Teach developmentally appropriate lessons/units in the school setting. 4. Assess student learning by designing/using/adjusting formative and summative assessments for your group of students, and pre-assessments. 5. Reflect and analyze your own teaching. Credits: 2.00

EDCI 32650 - Introduction To Linguistics And Language Acquisition In Education

Credit Hours: 3.00. This course addresses foundational knowledge in language and linguistics for pre-service teachers and educational researchers. The purpose of this course is to survey linguistics, the study of the science of language. In this course, we will focus on phonetics, phonology, morphology, syntax, and semantics. These topics will be discussed in terms of theory, as well as in the context of ESL classroom instruction, materials development, and assessment.

Learning Outcomes: 1. Understand and describe core concepts and terminology of descriptive linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics. 2. Apply course concepts to analyze linguistic data and gain a fuller understanding of the systematic nature of language. 3. Apply descriptive linguistic concepts to instruction to support the four domains of speaking, listening, reading, and writing. 4. Research and describe the biological, social, and cultural dimensions of linguistics, including pragmatics, discourse, dialects, bilingualism, and language in education. 5. Discuss the role of home language and culture in ELL instruction. 6. Apply an understanding of the role of culture and family background in the student's experience of the classroom. Credits: 3.00

EDCI 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00. Given the needs of struggling/striving readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine a number of reading models and instructional approaches designed to ensure all students have access to effective, research-based literacy instruction. The goal is to ensure students complete the semester with a range of essential tools for working with this population.

Learning Outcomes: 1. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 2. Implement Tier 1 and Tier 2 reading practices in a classroom. 3. Establish an understanding of reading difficulties/disabilities. 4. Extend knowledge of unique needs of struggling readers. Credits: 2.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c)

future career opportunities. Credits: 1.00 to 3.00

EDCI 35001 - Tanzania Seminar

Credit Hours: 2.00. In this course, we will prepare for the Maymester in Tanzania study abroad program in a variety of ways, including investigating the history and culture of Tanzania, beginning to learn Kiswahili, conceptualizing service learning experiences, and collaborating on a plan for program logistics.

Learning Outcomes: 1. Critically explore common conceptions of Africa. 2. Investigate the history and culture of Tanzania. 3. Describe the educational system of Tanzania. 4. Read, write, and speak basic phrases and sentences in Kiswahili. 5. Conceptualize and engage in service learning experiences. Credits: 2.00

EDCI 35002 - International Comparative Education

Credit Hours: 3.00. In this course, students will explore the education system in an international context and compare particular aspects of the system (e.g., equity, funding, language, accessibility) to their own experiences with, and knowledge of, education in the United States. Students will consider the range of schools and policies in both countries in terms of issues of social justice (e.g., redistribution, recognition, representation).

Learning Outcomes: 1. Experience, first-hand, the educational system of Tanzania and read accounts of this system from a range of perspectives which draw attention to its strengths and challenges. 2. Investigate issues of social justice (e.g., redistribution, recognition, representation) in education systems. Credits: 3.00

EDCI 35003 - Knowing Africa Through Literature

Credit Hours: 3.00. Through a set of texts, this course will offer opportunities to understand, broaden and question a new (to you) and significantly different culture and your experiences in that culture. You will read a variety of African literature, including short stories, novels, and poetry, in order to investigate perspectives on African history, culture, language and education. You will then draw upon your personal encounters and activities while in Tanzania to extend your learning.

Learning Outcomes: 1. Investigate "growing up" cultural, and traveling experiences in Africa from a range of perspectives. 2. Extend understanding of Africa through the study of literature, including short stories, novels, and poetry. Credits: 3.00

EDCI 35004 - History, Culture, And Language In Tanzania

Credit Hours: 3.00. This course is a component of the Maymester in Tanzania study abroad program. In this course, students will study the history, culture, and language of Tanzania through experiences in local schools and the community, supplemented by course readings, assignments, discussions, and service learning projects.

Learning Outcomes: 1. Explore the history of Tanzania, including its identification as the cradle of mankind, colonization, independence, and the impacts of socialism and capitalism. 2. Engage in cultural and linguistic immersion in a rural Tanzanian village and schools. 3. Experience, first-hand, the educational system of Tanzania and read accounts of this system from a range of perspectives which draw attention to its strengths and challenges. 4. Collaborate with Tanzanian residents on developing and implementing service learning projects in the community. Credits: 3.00

EDCI 35600 - Career Education In Family And Consumer Sciences

Credit Hours: 3.00. Examination of middle and high school career education accomplished through family and consumer sciences, including (1) life and career exploration and planning; (2) analysis of career paths and opportunities in family and consumer sciences; and (3) career preparation through laboratory and cooperative education programs. Historical and contemporary foundations for career education in family and consumer sciences is also are addressed. Includes observations and interactions with students and teachers in career-education programs and participation in professional meetings.

Learning Outcomes: 1. Examine purposes, curriculum, and implementation strategies for career education accomplished through family and consumer sciences, including FCS careers, FCS supporting content, and FCS life and career foundations. 2. Examine the structure and delivery of career and technical education in the United States and Indiana, state and federal laws and regulations pertaining to career and technical education, and important events and developments in the history of career and technical education and family and consumer

sciences education. 3. Engage in ethical professional practice professional development, and outreach in family and consumer sciences education, including advocacy and working with local advisory committees. 4. Analyze instructional strategies and procedures for career education in family and consumer sciences, including integration of career and technical student organizations, particularly the Family, Career and Community Leaders of America (FCCLA) and coordination of students' work-based learning experiences through in-school laboratories and community-based placements. Credits: 3.00

EDCI 35950 - Content Area Instruction For English Learners

Credit Hours: 3.00. This course identifies the linguistic challenges faced by English language learners (ELLs) in the content areas of English language arts, mathematics, science, and the social studies. Participants will learn to describe how language varies in the way it presents knowledge in different content areas. The course links these challenges to English language instruction and subject-matter instruction in English for ELLs who are in general education classrooms. The course emphasizes assessment tools designed to assess content knowledge and links these students' English language development. Participants will describe academic tasks that require advanced levels of reading and writing and the expectations for the development of academic literacy as ELLs move from elementary to secondary "literacy" contexts, or the kinds of meaning-making typical of secondary and postsecondary education.

Learning Outcomes: 1. Evaluate the linguistic challenges of academic language in the English language arts, mathematics, science, and the social studies for ELLs. 2. Assess the development of academic literacy as ELLs move from elementary into secondary and postsecondary education. 3. Evaluate how standardized tests pose challenges for ELLs. 4. Analyze how various issues of assessment affect ELL student learning. 5. Create standards-based ESL and content instruction in a supportive learning environment for ELLs with different Limited English Proficiency (LEP) levels. 6. Implement a variety of standards-based teaching strategies, tools, and techniques for developing and integrating the four skills and for assessing the grade-level curriculum. 7. Apply academic tasks that require advanced levels of reading and writing. Credits: 3.00

EDCI 36000 - Curriculum And Instruction In Family And Consumer Sciences: Middle School

Credit Hours: 3.00. Instructional program development for family and consumer sciences. Developmental needs and issues of early adolescents; study of adolescent literacy; and curriculum integration of language arts, math, and other content areas are emphasized. Development of a comprehensive unit of instruction that incorporates standard-based curriculum, assessment, and instruction for family and consumer sciences is a major component of the course. Includes observations and interactions with family and consumer sciences teachers and students and participation in professional meetings.

Learning Outcomes: 1. Utilize middle school philosophy/perspectives, state-level resources, and community assets to guide curriculum development in Family & Consumer Sciences that is challenging, exploratory, integrative, and diverse, and which fosters learning that is active, purposeful, and democratic. (FCS TEd 7) 2. Integrate professional knowledge/behaviors supportive of middle-level education learner development (physical, cognitive, socio-emotional, psychological) into FCS curricula/practices, attentive to the health, wellness, and social-emotional competence of learners. (FCS TEd 8) 3. Employ professional and other resources to develop a "literary" classroom environment that reflects all students. (FCS TEd 11) 4. Identify and collect resources, references, and other materials that support the identity, intellect, skill, and criticality development of students across FCS content. (FCS-Ted) 5. Create student-centered learning experiences in blended and online settings using UDL principles that are culturally responsive (TIBOT competency 3; FCS-Ted 7, 8, 11) 6. Review and critique FCS curriculum

materials and practices for alignment with best practices for inclusion, access, equity, and diversity. (FCS-TEd 7, 8) 7. Relate family and consumer sciences programs to broader educational program goals and to community assets and needs. 8. Integrate foundational FCS perspectives (historical lens, Body of Knowledge, Critical Science approach) into professional schema. (FCS-TEd 12) 9. Develop and reflect on personal/professional characteristics that shape optimal middle school/FCS educator practice. (FCS-TEd 12) Credits: 3.00

EDCI 36100 - Social Studies In The Elementary School

Credit Hours: 3.00. Provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to elementary school children. Encourages participants to reflect on social studies knowledge, skills and dispositions, how students learn these most effectively, and how best to teach social studies. Includes a field-based experiential component. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Students will work to identify the most important social studies knowledge, skills and dispositions. 2. Investigate how students learn most effectively. 3. Utilize their new understandings to draw conclusions about what constitutes powerful teaching in the social studies. Credits: 3.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36102 - Teaching Social Studies In 3-6

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practices strategies for teaching social studies to children in the 3-6 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how 3-6 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the 3-6 grades.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the 3-6 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the 3-6 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the 3-6 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36300 - Literacy In The Elementary School II

Credit Hours: 3.00. Focuses on teaching children who experience difficulty acquiring literacy. Assessments of children's strengths and needs are used to plan and evaluate instruction. Strategies for helping children develop more mature literacy understandings are applied in weekly small-group instructional sessions. Includes a field-based experiential component. Taken concurrently with EDPS 43000.

Learning Outcomes: 1. Know the literacy processes so that they are able to make decisions about the use of appropriate assessment measures and instructional strategies for children who are experiencing difficulty learning to read and write. Credits: 3.00

EDCI 36303 - Literacy Teaching And Assessment In K-6

Credit Hours: 2.00 to 3.00. This course is an undergraduate, elementary education course designed to provide preservice teachers with classroom and practicum experiences focused on literacy instruction for children experiencing difficulty learning to read and write. Students learn to administer and analyze individual assessments to determine the strengths and needs of a struggling reader/writer and set intervention goals based on these results. Application of appropriate research-based reading instructional strategies for developing (structured literacy instruction) phonological awareness, phonics, comprehension, vocabulary, and fluency is the focus of weekly literacy teaching in local elementary schools.

Learning Outcomes: 1. Demonstrate the importance of providing instruction to meet the needs of all children through their teaching. 2. Implement a framework for assessment and instruction that allows the teacher to evaluate and adjust for an optimal match between the reader/writer, the text and the literacy context. 3. Translate assessment findings into a plan for instructional support that is realistic in view of the child's needs and the available resources. 4. Use assessment as an ongoing guide to instructional decisions. 5. Become skillful in observing, planning, implementing, and evaluating literacy lessons. 6. Demonstrate knowledge of materials, procedures, and strategies for individual and group literacy instruction. 7. Examine a range of assessment and evaluation tools and strategies. 8. Report to others their assessments of students' literacy learning. 9. Work as a team with peers and school personnel. Credits: 2.00 to 3.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using children's ideas, beliefs, and experiences as primary resources. Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 36402 - Teaching Mathematics In Grades 3-6

Credit Hours: 2.00. Focuses on teaching mathematics in the elementary school grades 3-6. Students learn what it means to teach mathematics interactionally using children's ideas, beliefs, and experiences as primary resources. Mathematical reasoning, problem solving, communication, and connections are foci.

Learning Outcomes: 1. Develop, apply, analyze, and evaluate strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Know and analyze methods of assessing and responding to the needs of mathematics learners labeled in schools. 3. Analyze and apply student's mathematical conceptual understanding and procedural knowledge to the development of problem-solving based mathematics lessons. 4. Create and analyze instructional activities drawing from student's conceptual understanding and procedural knowledge as primary resources. Credits: 2.00

EDCI 36404 - Mathematics In The Elementary School

Credit Hours: 4.00. Focuses on teaching mathematics in the elementary school. Students learn what it means to teach mathematics when reasoning, problem solving, communication, and connections are the foci. Includes a field-based experiential component.

Learning Outcomes: 1. Learn, practice, and reflect on strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Gain skill in assessing, evaluating, and responding to the needs of diverse learners in mathematics. 3. Understand

ways to assess students mathematical understanding and learning. 4. Plan and carry out problem-solving mathematics instruction with a focus on students conceptual and procedural understanding. Credits: 4.00

EDCI 36500 - Science In The Elementary School

Credit Hours: 3.00. Investigates ways children learn science as a basis for planning, enacting, and assessing science curriculum and instruction. State and national standards, teaching cases, and science lab experiences are used as tools for reflecting on practice. Includes a field-based experiential component. Taken concurrently with EDCI 36400 and EDCI 37000.

Learning Outcomes: 1. Explore the instruction of elementary science through pedagogically appropriate methods. Lesson design will follow the learning cycle (5 E format) and lessons will be designed in a discovery/inquiry fashion using hands-on instruction. 2. Study in-depth teacher/student and student/student interactions in the classroom and to better understand how knowledge of children can inform the teaching-learning process, especially in science instruction. 3. Explore planning processes in several subject areas to learn to integrate science into other curricular areas, as well as developing both weekly and daily lesson plans. 4. Examine the nature of teaching and teacher growth through reflection. 5. Demonstrate through the planning and teaching of lessons, that you possess the subject matter knowledge necessary to provide quality educational experiences for children in grades K-6. 6. Examine management routines, teacher rationale for those routines, procedures, and management in the classroom. 7. Examine methods of evaluation, including anecdotal records, alternative assessments, performance assessments, general record keeping, and grading. 8. Examine the school as a community of diverse learners. 9. Examine your philosophy of education throughout this field experience. Credits: 3.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are committed to social justice and education of all the children of all the people - especially in the

area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDCI 36502 - Teaching Science Through Design In Grades 3-6

Credit Hours: 2.00. The aim of this course is to prepare students to teach science, engineering, and computational thinking with grade 3-6 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade 3 through 6 learners. At least 9 credits of science content courses are required.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 2.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDCI 38100 - Teaching For Social Justice: Culturally And Linguistically Diverse Learners

Credit Hours: 3.00. This course builds on the content of EDCI 28500 (Multicultural Education) with specific attention to issues of social justice related to literacy and linguistic diversity. Within this framework, students will learn strategies for teaching English language learners, deconstruct deficit perspectives of dialectical differences, and consider approaches to classroom management. Additionally, a field experience component with an ELL teacher will be included in the course.

Learning Outcomes: 1. Engage with the following concepts via reading, analysis/critique, and consideration of how they might apply in future classrooms: culturally relevant pedagogy and culturally sustaining pedagogy, code switching and code meshing, restorative justice. 2. Learn pedagogical strategies for working with ELLs in secondary English classrooms. 3. Understand the school-to-prison pipeline phenomenon and develop classroom management principles accordingly. 4. Participate in a field experience that requires interaction with culturally and linguistically diverse students in a local ELL classroom. Credits: 3.00

EDCI 42100 - The Teaching Of Biology In Secondary Schools

Credit Hours: 3.00. The rationale, objectives, methods, and materials of teaching biology and life science in junior and senior high schools. Extensive use of multimedia resources in planning specifically for the student teaching experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Have a conceptual understanding of science, how to develop a learning community within a classroom, and an understanding of and strategies to implement educational equity in a classroom. 2. Learn how to carry out the practical activities of science teaching, develop worksheets, hold class

discussions, develop and grade tests, and use textbooks. 3. Learn about the nature of scientific understanding and classroom communities, and how to use theoretical knowledge of learners & communities to guide their teaching. Credits: 3.00

EDCI 42200 - The Teaching Of English In Secondary Schools

Credit Hours: 3.00. Explores a wide variety of instructional practices suitable for teaching middle and high school English including language, literature, and writing - addressing specific pedagogical issues such as teaching diverse learners and developing cohesive units of instruction.

Learning Outcomes: 1. Explore different philosophical and instructional applications for secondary English teaching. 2. Examine diverse issues affecting teaching and learning in the secondary English classrooms. 3. Develop the reflective and critical thinking skills necessary for secondary English teachers. 4. Increase pedagogical competency in diverse aspects of teaching and learning, including classroom instruction, student interaction, and teacher development. Credits: 3.00

EDCI 42300 - The Teaching Of Social Studies In Secondary Schools

Credit Hours: 3.00. The purpose of this course is the development of a theoretical framework and pedagogical skills necessary to teach social studies to middle and high school students. Students are introduced to the general issues involved in planning and organizing a social studies curriculum.

Learning Outcomes: 1. Develop theoretical understanding and pedagogical skills necessary to teach social studies to middle and high school students. 2. Develop understanding of cross collaboration, communication, and the characteristics of the community, school, and classroom. 3. Develop specific and relevant understanding of student characteristics, approaches to learning, or skills and prior learning. 4. Learn general issues involved in planning and organizing a social studies curriculum. 5. Obtain the knowledge, skills, and attitudes necessary to become a reflective and skilled social studies teacher. Credits: 3.00

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population. Credits: 3.00

EDCI 42500 - Teaching Of Secondary Mathematics - Methods I

Credit Hours: 3.00. This is the first of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, curriculum, teaching, learning, assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's principles and standards, as well as the content and process standards included in Indiana Academic Standards for Mathematics, and pedagogical strategies for teaching these in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 42600 - Teaching Of Secondary Mathematics - Methods II

Credit Hours: 3.00. This is the second of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, mathematical task design, classroom discourse, classroom environment assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's Professional Standards as well as the content and process standards included in Indiana Academic Standards for Mathematics and pedagogical strategies for teaching in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences. Credits: 3.00

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9.

Gain skills to collaborate in a team of teachers. Credits: 2.00

EDCI 43300 - Advanced Social Studies Methods

Credit Hours: 2.00. Foundations of social studies; methods, techniques, strategies of teaching, and activities - with special attention to skills of planning, questioning, and testing. Includes observation, participation, and microteaching in social studies classrooms. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Develop knowledge of social studies content, appropriate state and national standards, and social studies specific pedagogy. 2. Develop and apply knowledge of middle level learners' academic needs and interests. 3. Utilize their new understandings to draw conclusions about what constitutes powerful social studies teaching and learning in middle school. Credits: 2.00

EDCI 43400 - Literacy Teaching And Learning In Secondary Schools

Credit Hours: 2.00. Exploration and development of various instructional methods and materials appropriate for supporting adolescent literacy in secondary English (i.e., middle and high school English Language Arts), including the teaching of reading. Content-area literacy methods and materials are also addressed. Includes a field experience of up to 20 hours in a secondary English school setting.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of secondary English literacy. 2. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 3. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary English. Credits: 2.00

EDCI 44400 - Methods For Teaching Family And Consumer Sciences

Credit Hours: 4.00. The culminating on-campus teacher-education course for the Purdue University Family and Consumer Sciences program. The course builds and consolidates teacher-candidates' knowledge and skills for teaching family and consumer sciences. Emphasis placed on standards-based instructional planning and materials; instructional strategies, including laboratories, assessment of student learning, and classroom management. Course includes field experiences. Program content requirements should be completed previous to or concurrent with this course.

Learning Outcomes: 1. Establish a comprehensive knowledge base of standards in a range of family and consumer sciences content areas, with a corresponding knowledge base for integrating standards in other areas such as financial literacy, technology, English Language Arts, and mathematics. 2. Design and implement standards-based curriculum, teaching/learning strategies, and assessment of student learning to meet the needs of diverse learners. 3. Apply knowledge of student behavior, organizational skills, and classroom and laboratory management skills to create a safe, supportive, and productive learning environment. 4. Enable student learning of family and consumer sciences concepts and skills through instructional strategies and laboratory experiences that build student capacities for self-directed learning, critical-thinking, problem-solving, decision-making, leadership, and managent. Credits: 4.00

EDCI 44600 - Directed Observation For Family And Consumer Sciences

Credit Hours: 1.00 to 4.00. Field-based experience in a middle or high school, a Cooperative Extension setting, or other applicable career setting for family and consumer sciences educators. Build professional capacity through focused, participatory experiences that include interactions with family and consumer sciences educators, other school/agency personnel, and students/clients. Thirty-five hours of documented experience in approved setting needed for one credit.

Learning Outcomes: 1. Develop knowledge and awareness of family and consumer sciences education professional setting, including purposes, structures, day-to-day activities, and interactions among participants. 2. Examine professional responsibilities of family and consumer sciences educators, and corresponding knowledge, skills, and capacities for professional effectiveness. 3. Build professional experiences and capacity as a

family and consumer sciences educator. 4. Assess personal competence, goals, and areas for continued professional growth as a family and consumer sciences educator. Credits: 1.00 to 4.00

EDCI 45200 - Global Studies Seminar

Credit Hours: 1.00. (EDPS 45200) The course builds on students' international cross-cultural experiences, particularly Study Abroad. The course is required for those wishing to complete the Global Studies minor in the College of Education.

Learning Outcomes: 1. Discuss economic, social, and cultural diversity within a global context. 2. Describe the cultural, social and historical dynamics that influence individuals and groups. 3. Explain the perspective of the culture of another country through the study of world languages, arts, spiritual traditions, mythology/literature, and/or through study abroad. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. 5. Clearly communicate a central message with the supporting materials. Credits: 1.00

EDCI 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDCI 49200 - Honors Scholarly Project Capstone

Credit Hours: 1.00 to 6.00. This course is designed to provide students with an introduction to designing and writing a proposal for the Honors Scholarly Project.

Learning Outcomes: 1. Identify a research question for the Honors Scholarly Project. 2. Learn how to review relevant literature, identify a methodology/approach forthe research, design the research study (or equivalent scholarly project) and identify an appropriate mentor. 3. Write, present, and submit a proposal for approval for the Honors Scholarly Project. Credits: 1.00 to 6.00

EDCI 49600 - Student Teaching In The Elementary School (UCC: OC)

Credit Hours: 6.00 to 16.00. Full-time elementary classroom teaching experiences and a student teaching seminar under the mentorship of the classroom teacher and a University supervisor.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each child's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each child's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDCI 49601 - Elementary Education Expanded Student Teaching

Credit Hours: 1.00 to 8.00. This course is the initial residency experience that precedes a full semester of student teaching. The seminar and field experience focus on induction into the broader elementary school context and building mentoring relationships as both a mentee and mentor. Students will develop their identity as a professional educator who advocates for the profession, themselves, and their students. Includes a field experience. Admission to Teacher Education required.

Learning Outcomes: 1. Integrate their learning from Foundations and Methods courses into their teaching experiences in the classroom. 2. Design and deliver instruction that meets learner needs, continually assess student learning, and use assessment to drive instruction. 3. Develop their skills and professional identity as an educator through self-reflection, analysis of student learning, and analysis of feedback. 4. Use observation, academic and personal engagement, and assessment data to develop an understanding of their students as learners at the individual and group level. Credits: 1.00 to 8.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and

address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

EDCI 50600 - Environmental Education

Credit Hours: 3.00. Synthesis of philosophies, scientific principles and methods for environmental education programs in forests, camps, and schools. Students conduct and summarize literature research on scientific and educational principles. In interdisciplinary teams, they develop, implement, and evaluate curricula for schools, nature centers, interpretive and outdoor education programs.

Learning Outcomes: 1. Become knowledgeable of national environmental educational programs and curriculum. 2. Develop the knowledge and skills to plan, implement, and evaluate environmental education programs, curriculum and materials. 3. Develop an understanding about learners and pedagogical methods for teaching about the environment and assessing learners. Credits: 3.00

EDCI 51000 - Colloquium In Science And Mathematics Education

Credit Hours: 1.00. Weekly colloquia on individual research topics of interest to science and mathematics education faculty and graduate students. Colloquia will describe research programs in education. Course will be required of first-year graduate students.

Credits: 1.00

EDCI 51200 - Mathematics In The Secondary School

Credit Hours: 3.00. Models of mathematics learning, current curriculum trends and practices with emphasis on laboratory and individualized systems; designing instructional materials.

Learning Outcomes: 1. Develop lesson plans promoting students' development of conceptual and procedural understanding of mathematics. 2. Develop understanding of student learning and development in mathematics by engaging in tasks similar to those that might be given to students. 3. Develop understanding of curriculum in context through teaching and working on mathematical problems from a variety of texts. 4. Develop understanding of the scope and significance of secondary school mathematics through examinations of standards and mathematics education research. 5. Develop professionally through the demonstration of professional attitudes and work habits as well as the identification of professional organizations and resources available locally and nationally. Credits: 3.00

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 51600 - Seminar In Environmental Education

Credit Hours: 3.00. The seminar covers current research and literature in environmental education, focusing on teaching children and adults about the environment. Topics vary by

semester and student interest.

Learning Outcomes: 1. Develop an understanding of the research literature in environmental education pertaining to the topic of study. 2. Develop critical thinking and analysis skills for evaluating environmental education research, programs, and curriculum. 3. Develop an understanding of environmental issues. Credits: 3.00

EDCI 51700 - Survey Of Science Education

Credit Hours: 3.00. Introduction to current issues and research in science education, broadly organized under themes of learning, teaching, and science curriculum.

Credits: 3.00

EDCI 51800 - The Nature Of Science In Science Teaching

Credit Hours: 3.00. Explores philosophical issues related to the scientific enterprise, such as the production and validation of scientific knowledge; the role of the scientific community; and the influence of gender and culture on doing science. Also examines the implications of these issues for science teaching and learning, as well as for research in science education.

Learning Outcomes: 1. Develop an understanding of various philosophical positions on the nature of science. 2. Develop an understanding of your own views of the nature of science. 3. Develop an understanding of the roles of scientists, the greater society, culture, and gender in the creation and validation of scientific knowledge. 4. Develop an understanding of students' and teachers' ideas about the nature of science. 5. Develop an understanding of the implications of various perspectives on the nature of science teaching and learning. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

EDCI 52001 - Curriculum And Instruction Online MS Seminar I

Credit Hours: 1.00. This boot camp is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Curriculum and Instruction program. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn about various learning strategies and online resources that you can utilize in your courses. In this seminar, you will be responsible for completing all assignments on time over the course of the semester. Read the guidelines for each week and complete the assignments. NOTE: This course is a core course in the C&I online masters program. A grade of B- or better is required (if a lower grade is received, the course must be retaken). Permission of department required.

Learning Outcomes: 1. Exhibit knowledge of academic integrity by completing plagiarism, statement of commitment, and APA tutorials. 2. Effectively explain your professional goals for the program by writing an initial reflection. 3. Identify essential components of the Curriculum and Instruction Handbook, including what is required for the final portfolio. 4. Develop and apply group project skills and management techniques to make you successful in future courses and your career. 5. Demonstrate digital skills and competence with various digital tools (i.e., blogs, screencasting, Google docs, file sharing). 6. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 1.00

EDCI 52002 - Curriculum And Instruction Online MS Seminar II

Credit Hours: 1.00. This seminar is designed to help you to understand the knowledge and skills necessary for your success throughout the Curriculum and Instruction program. In addition to providing you with information that will help you succeed in the program, you are also asked to think about ways to make yourself more marketable to current and future employers. Permission of department required.

Learning Outcomes: 1. Investigate the skills and knowledge needed to be successful in a

relevant career within the C&I field. 2. Describe program and career goals. 3. Apply research skills required to compose an annotated bibliography. 4. Create the foundation of a C&I portfolio displaying programmatic achievements and course competencies. Credits: 1.00

EDCI 52003 - Theories And Trends In Curriculum And Instruction

Credit Hours: 3.00. This course focuses on current theories and trends influencing curriculum and instruction. A theory is a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena. It is a belief, policy, or procedure proposed or followed as the basis of action. A trend, on the other hand, is a pattern of gradual change in a condition, output, or process. It reflects a general tendency of a series of moves in a certain direction over time. We will focus on understanding sources of current theories and trends and how they may influence work in curriculum and instruction. Permission of department required.

Learning Outcomes: 1. Examine and clarify the educational beliefs, values, and knowledge guiding your curricular and instructional decisions. 2. Utilize and evaluate multiple appropriate sources in researching current curriculum and instruction trends and issues. 3. Interpret, critique, and synthesize relevant research related to current curriculum and instruction trends. 4. Assess the implications of research relative to your curricular and instructional practices. 5. Interpret, critique, and synthesize relevant educational theories related to current curriculum and instruction trends. 6. Assess the implications of educational theories relative to your curricular and instructional practices. 7. Interpret, critique, and synthesize relevant state and national policy decisions related to current curriculum and instruction trends. 8. Assess the implications of state and national policy decisions relative to your curricular and instructional practices. 9. Communicate effectively in oral and written formats. 10. Demonstrate the disposition for life-long learning and continuous professional development. 11. Identify communities of practice within discipline and participate within these communities according to the ethical standards of the discipline. 12. Examine and clarify how your educational beliefs, values, and knowledge guide your curricular and instructional decisions address the diversity of students, schools, and communities. 13. Advocate for values of diversity, inclusivity, and social justice. Credits: 3.00

EDCI 52004 - Teachers As Leaders

Credit Hours: 3.00. This course focuses on teacher leadership in instruction. Participants will examine the history of teacher leadership. Instructional coaching models will be examined and compared. Students will identify the various theories that support each coaching model and examine what is most present in their school contexts. Permission of department required.

Learning Outcomes: 1. Investigate the construct of school leadership. 2. Evaluate potential leadership roles in classrooms, schools, or other organizations. 3. Research teacher leadership praxis to impact future praxis. 4. Synthesize leadership research in conjunction with theories of social justice and equity. 5. Analyze the skills of effective teacher leadership through collaboration and inquiry. 6. Explore the critical role teachers play in creating conditions for continuous and systematic improvements in education. Credits: 3.00

EDCI 52301 - Foundations Of Bilingual Education

Credit Hours: 3.00. This course builds foundational and practical knowledge of children's bilingual development and the sociocultural, cognitive, philosophical, and educational basis for high-quality dual language and other bilingual education programs. It focuses on research and current issues related to the bilingual development of emergent bilinguals in K-12 contexts. It is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify the various dimensions of bilingualism, bilingual language use, and bilingual language ability. 2. Outline

the dimensions of language proficiency and the challenges of measuring bilingualism. 3. Describe development processes and types of early and late development of bilingualism. 4. Describe the role of translanguaging in bilingual language development and use, and the connections between identity and bilingualism. 5. Describe the role of languages in society, including factors that contribute to language maintenance and loss. 6. Describe the cognitive aspects bilingualism. 7. Identify the features of various models of bilingual education and the theories that guide their implementation. 8. Describe historical and current policies, court decisions, and legislation that have shaped bilingual education. 9. Identify the essential features of strong bilingual programs that lead to high levels of bilingualism and biliteracy. 10. Explore the findings of specific research studies that provide evidence of the effectiveness of well-designed bilingual education programs. 11. Describe the ways bilingual education programs can address the needs of a all bilingual students, including students with exceptionalities and special needs. Credits: 3.00

EDCI 52401 - Teaching Methods In Bilingual Education

Credit Hours: 3.00. Application of theory, research, and guiding principles to providing high-quality instruction in dual language and other bilingual education programs in K-12 education. This course includes a specific focus on both program-level design of effective dual language programs, and effective language and literacy instruction for emergent bilingual students leading to high levels of bilingualism, biliteracy, and academic achievement. This course is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify and describe the principles and key aspects of the structure and curriculum of dual language bilingual education programs. 2. Define biliteracy and the key components of the Literacy Squared model. 3. Identify and describe the principles and key aspects of effective oral language instruction and the development of metalinguistic skills. 4. Identify and describe the principles and key aspects of effective reading instruction across two languages. 5. Identify and describe the principles and key aspects of effective writing instruction across two languages. 6. Identify and describe the principles and key aspects of effective assessment practices across two languages. 7. Develop effective lesson plans for bilingual and biliteracy development. 8. Identify and describe the principles and key aspects of whole school considerations in supporting effective dual language bilingual education programs. Credits: 3.00

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

EDCI 53300 - Teaching And Learning Number And Operations

Credit Hours: 3.00. This course is designed to provide opportunities for mathematics educators to develop understanding of teaching and learning in the domain of number and operation. Central to this work is the construction of models of learners' understanding of number and operation and the use of those models to build and select curriculum. While curricular efforts have historically taken as central a formal view of mathematics and its construction, more recently curriculum has been written to engage learners and to build from knowledge of learners' understanding. In this course we will develop models of learner's understandings of different facets of number and operation and then use those models and our emerging understanding of curriculum to explore challenges in teaching and learning.

Learning Outcomes: 1. Develop models of learner's understandings of number and operation. 2. Use models of learner's understandings of number and operation to design and select appropriate and productive learning opportunities. 3. Develop knowledge of

key curricular development in mathematics education in the United States. 4. Associate teaching and curriculum with understandings of number and operation they might generate. 5. Use technology to support the development of ideas in number and operation. 6. Synthesize existing research to support inquiry in the teaching and learning of number operation. Credits: 3.00

EDCI 53400 - Teaching And Learning Geometry And Measurement

Credit Hours: 3.00. This course is designed to provide opportunities for mathematics educators to develop understanding of teaching and learning in the related domains of geometry and measurement. Central to this work is the construction of models of learners' understandings of geometry and measurement and the use of models to design instruction. Geometry, as a discipline in school mathematics, has historically and more currently been debated. In this course we will explore research in the teaching and learning of geometry and measurement. A synthesis of select literature will inform our efforts to develop models of learners' geometric reasoning and understanding of measurement. We will move past the development of models to the design of instruction meant to support understandings of concepts that utilizes technology.

Learning Outcomes: 1. Develop models of learner's understanding of measurement and concepts in geometry. 2. Use models of learner's understanding to design and select appropriate and productive learning opportunities. 3. Develop knowledge of the history of geometry as a school mathematics subject in the United States. 4. Develop and articulate a perspective on teaching and learning geometry and measurement with technology. 5. Synthesize existing research to support inquiry in the teaching and learning of geometry and measurement. Credits: 3.00

EDCI 53500 - Teaching And Learning Algebra And Functions

Credit Hours: 3.00. This is a course for current or prospective mathematics teachers wishing to explore ways of teaching algebra with a focus on addressing concerns related to student performance in algebra and increasing algebraic reasoning skills in the classroom. The course includes experiences with inquiry-based learning by engaging participants in algebra activities from two secondary National Council of Teachers of Mathematics (NCTM) standards-based curricula. The course will provide opportunities for participants to collaborate on the development of algebraic thinking in mathematics classrooms and will address pedagogical approaches to students' learning of algebra.

Learning Outcomes: 1. Content and pedagogical knowledge for teaching algebra. 2. Familiarity with NCTM standards-based mathematics curricular. 3. Disposition that values students' contributions and desires to motivate students to learn algebra using a variety of strategies, including engaging them in making sense of algebraic concepts and making use of their life experiences to find relevant contexts for algebra. Credits: 3.00

EDCI 53600 - Teaching And Learning Data Analysis And Probability

Credit Hours: 3.00. This course will provide opportunities for the growth of middle school mathematics teachers understanding of data analysis and probability as a means to help analyze and interpret experienced events. The course will address the following: selecting and using appropriate statistical methods to analyze data, developing and evaluating inferences and predictions that are based on data, and understanding and applying the basic concepts of probability. This course will also address pedagogical approaches to students' learning of data analysis and probability.

Learning Outcomes: 1. Employ research-based instructional strategies to develop statistical understanding in middle, secondary and tertiary settings, and for teacher professional development. 2. Develop tasks, questions, and lessons that can be used to assess as well as further develop students' understanding of statistics and probability. 3. Read and interpret research results and classroom-based articles that describe students' statistical and probabilistic reasoning. 4. Reflect on course readings and their practical teaching experience to consider how to best teach statistical and probability concepts. Credits: 3.00

EDCI 53900 - Introduction To K-12 Integrated Science, Technology, Engineering And Mathematics (STEM) Education

Credit Hours: 3.00. This course will provide students with a conceptual understanding of integrated K-12 Science,

Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 54100 - Contemporary Issues In Career And Technical Education

Credit Hours: 3.00. Identification, analysis, synthesis, and implications of current issues and problems in career and technical education at the elementary, secondary, postsecondary, and adult levels; policy and literature review; formulation of alternatives and solutions.

Learning Outcomes: 1. Identify and analyze existing policy and programmatic problems and issues in career and technical education and related disciplines and fields. 2. Synthesize and summarize contemporary literature relating to problems and issues. 3. Formulate alternatives and solutions to existing problems and issues. 4. Examine the implications and potential impact (short- and long-range) of problems and issues in career and technical education for society and education in general. Credits: 3.00

EDCI 54300 - Instruction In Career And Technical Education

Credit Hours: 3.00. Contemporary trends and methods in teaching career and technical programs, learning styles and teaching styles, and a variety of creative instructional strategies for different educational contexts will be identified and analyzed.

Learning Outcomes: 1. Develop an understanding of the instructional process and learning theory in career and technical education and business and industry training. 2. Provide an overview of the major influences on learning and learning environments. 3. Acquire skills in instructional planning, implementation, and evaluation. 4. Analyze a variety of instructional strategies and resources in career and technical education and training. 5. Review and analyze instructional literature and research in career and technical education. 6. Gain experience in instructional planning and delivery. Credits: 3.00

EDCI 54400 - Career And Technical Education For Special Needs Learners

Credit Hours: 3.00. Legislative initiatives; identification of special needs learners at the elementary, secondary, postsecondary, and adult levels; learning characteristics; assessment; individualized planning; instructional adaptations; school and community resources; exemplary program models; research, trends, and issues; and evaluation.

Learning Outcomes: 1. Describe the major historical and contemporary legislative provisions affecting the delivery of career and technical education to special needs learners. 2. Identify and describe the educational characteristics of special needs learners, including students with disabilities, disadvantaged students, gifted and talented learners, non-traditional learners, and limited-English proficient speakers. 3. Describe and use appropriate strategies for assessment of the career needs, learning styles, and progress of special needs learners. 4. Develop and evaluate individualized education, career, and transition plans for a special needs learner. 5. Select and use appropriate instructional strategies, procedures, and materials. 6. Identify and select appropriate community, business, industry, school, governmental agency, occupational, and professional resources. 7. Compare and contrast various exemplary program models for special needs learners. 8.

Evaluate the major professional trends, issues, and implications for career and technical education programs for special needs learners. Credits: 3.00

EDCI 54500 - Planning In Career And Technical Education

Credit Hours: 3.00. Principles and strategies in planning new and improving existing career and technical education programs, strategic planning, needs assessment, community and workforce market research, information and data analysis, program improvement. Permission of Department required.

Learning Outcomes: 1. Develop an understanding of the principles and strategies in planning CTE and workforce education programs. 2. Provide an overview of the CTE district program plan. 3. Review Federal CTE and workforce education legislative planning regulations and guidelines. 4. Examine State CTE and workforce education legislative planning regulations and guidelines. 5. Critique various strategic planning models, strategies, and procedures. 6. Describe strategies for advocating for diversity and access and equity for special needs populations in CTE program planning policy and practice. 7. Evaluate local and CTE district planning factors and considerations. 8. Discuss community needs assessment and workforce market research, information and data analysis, and use of findings in decision-making. 9. Describe strategies for organizing and collaborating with program advisory committees. 10. Explain continuous program evaluation and improvement. Credits: 3.00

EDCI 54501 - Teaching STEM Through Agriculture, Food, And Natural Resources

Credit Hours: 3.00. The course focuses on the background and history of STEM movement and agricultural education, contemporary models, strategies, and justification for incorporation of science, technology, engineering and mathematics (STEM) concepts and practices into K-12 formal and non-formal agricultural education programs. Consider and develop the best practices for STEM teaching and learning and enhancement of STEM content in agriculture, food and natural resources (AFNR) context. The goal of the course is to help students develop knowledge about STEM integration and equip them with teaching knowledge and skills for designing K-12 lesson plans by using integrated STEM through AFNR. Students will learn strategies that promote engagement in integrated STEM through AFNR activities. At the end of the course, students should be able to design and implement research-based integrated STEM through AFNR lesson plans and assessment plans.

Learning Outcomes: 1. Analyze integrated models of STEM learning, and justify how a selected model informs best practices for science and agriculture, food, and/or natural resources teaching and learning. 2. Evaluate current national and state standards that help design lesson plans in non formal, and formal educational contexts. 3. Develop lesson plans by using agriculture, food, and/or natural resources as context to teach STEM content and concepts. 4. Describe life and 21st century skills that are relevant in agriculture, food, and/or natural resources contexts and demonstrate how these skills can be integrated into lesson plans. 5. Create an assessment plan to evaluate learning outcomes. 6. Apply learner-centered teaching strategies, such as inquiry-based learning, to teach the lesson plans. 7. Create a manuscript that can be used to disseminate the integrated STEM lesson to professional audiences. Credits: 3.00

EDCI 54800 - Teaching Mathematics To Diverse Learners

Credit Hours: 3.00. This course is designed to provide opportunities for in-service teachers to engage around issues of equity in mathematics education. Equity here is used as a broad construct intended to help us think about how to provide meaningful opportunities to learn for all the students in our mathematics classrooms. The notion of "diverse" here is also taken broadly. All students have special needs, but it is sometimes helpful to think about the needs of particular groups of students while at the same time avoiding reducing differences among students to stereotypes. Issues of diversity here include, but are not limited to race, culture, gender, disabilities, language, SES, and sexual orientation.

Learning Outcomes: 1. Increased awareness of diverse learners' challenges in mathematics education. 2. Developed discourse for equity

issues in mathematics education. 3. Knowledge of strategies to facilitate diverse learners' mathematical learning. Credits: 3.00

EDCI 54900 - Assessment In STEM Education

Credit Hours: 3.00. This course is designed to help teachers of STEM recognize the link between productive assessment and productive instruction, using the STEM education standards for teacher competence in educational assessment. This course is designed to help teachers meet those professional standards and understand the public pressure as well as instructional need for effective formative and summative assessment.

Learning Outcomes: 1. Choose appropriate assessment methods. 2. Develop appropriate assessment methods. 3. Administer scoring and interpreting assessment results. 4. Use assessment results to make decisions about individual students, plan teaching and develop curriculum. 5. Communicate assessment results to students, parents, and other educators. 6. Recognize inappropriate assessment methods and uses of assessment information. Credits: 3.00

EDCI 55000 - Career Education

Credit Hours: 3.00. An overview of contemporary legislation, educational reform, trends, and issues; career education program models; vocational and technical education, technology prep, and school-to-work systems; partnerships; foundations of career education; career development; curriculum; career guidance and counseling; career assessment; career planning practices; learning styles and instructional strategies; career information sources and resources; exemplary programs; and special needs populations and practices.

Learning Outcomes: 1. Describe the major legislative provisions and educational reforms affecting the delivery of career education. 2. Evaluate significant trends in career education, and professional and social issues. 3. Identify and adapt (a) career education model(s). 4. Describe the Career and Technical Education, Tech Prep, Career Pathways, and School-to-Career delivery systems. 5. Discuss effective partnerships between and among the school, the community, and business and industry. 6. Describe the foundations of career education. 7. Explain the career development process. 8. Identify the roles of elementary, middle, high school, postsecondary, and adult education; and business and industry in career education. 9. Develop career education curriculum; career clusters and pathways; and occupational, job, and task analysis. 10. Apply career guidance and counseling practices and procedures. 11. Utilize career assessment strategies. 12. Implement career planning practices and procedures. 13. Adapt appropriate learning styles and instructional strategies for individual learners. 14. Locate and use career information sources. 15. Identify, select, and utilize appropriate career information resources related to the school, community, governmental agency, occupational, and professional resources. 16. Identify, compare, contrast, and adapt exemplary career education programs. 17. Identify special needs populations and effective practices. Credits: 3.00

EDCI 55100 - Young Adult Literature

Credit Hours: 3.00. This course is a survey of classic and contemporary young adult texts. Students are introduced to the genre through reading notable young adult texts, applying relevant literary criticism, and investigating effective pedagogical strategies.

Learning Outcomes: 1. Read and respond to selected young adult texts in writing and in class discussion. 2. Explore the extent to which young adult texts portray the complex challenges of teenage life. 3. Explore the extent to which young adult texts, as imaginative narratives, affect teenage identity development. 4. Create a final project synthesizing young adult texts, theories of reading and response, and theories of adolescent development. Credits: 3.00

EDCI 55200 - Generalizable Skills Instruction In Career And Technical Education

Credit Hours: 3.00. Curriculum, assessment, planning, implementation, and evaluation relating to generalizable skills (also known as generic, transferable, or workplace skills) in career and technical education, other content areas, and special education programs; philosophical, historical, social, economic, political, and educational influencing factors; analysis and synthesis of current research and conceptual models; practical

applications for programs; instructional strategies; resources and support services, interdisciplinary collaboration approaches; applications for special needs learners; learning styles and characteristics.

Learning Outcomes: 1. Identify and analyze the philosophical, historical, social, economic, political, and educational factors influencing generalizable skills instruction in career and technical education programs. 2. Locate, analyze, and synthesize contemporary generalizable skills literature and research and its application in career and technical programs. 3. Identify, analyze, and apply a conceptual model for generalizable skills instruction regarding curriculum, assessment, planning, implementation, and evaluation. 4. Identify generalizable skills curriculum. 5. Examine and apply methods of generalizable skills curriculum development and revision. 6. Review and analyze functional, curriculum-based assessment, instruments, strategies, and procedures. 7. Describe and use procedures for using generalizable skills assessment data/information in individualized educational planning. 8. Identify the individual learning styles and characteristics of, and apply appropriate instructional approaches for, individual students in career and technical programs. 9. Identify, locate, select, and evaluate instructional resource materials and support services useful in generalizable skills instruction. 10. Identify, adapt, and develop methods for teaching generalizable skills in career and technical programs. 11. Develop and implement interagency collaboration strategies among career and technical education, special education, support/remedial services, and content related (e.g., mathematics, reading) school personnel. 12. Identify and select appropriate evaluation methods and procedures for determining the adequacy, quality, and effectiveness of generalizable skills instruction and support services in career and technical education programs. Credits: 3.00

EDCI 55201 - AI Integration In Education

Credit Hours: 3.00. This course aims to provide students with the knowledge and skills needed to understand and utilize Generative AI in education. Students will acquire fundamental coding skills and develop technical expertise in using and comprehending AI. By engaging in hands-on activities and analyzing real-world case studies, students will design and create their own AI applications using Google Teachable Machine to solve a specific problem of their choosing. Additionally, the course will examine ethical issues related to AI/GenAI, allowing students to establish guidelines for the meaningful integration of AI/GenAI in teaching and learning.

Learning Outcomes: 1. Define AI/GenAI and discuss its potential integration into education. 2. Create an innovative AI/Gen application using Google Teachable Machine. 3. Develop a learning activity using GenAI that caters to different learning preferences and needs. 4. Analyze and discuss the ethical issues surrounding the use of AI, specifically GenAI, in education from the perspectives of both learners and educators. Credits: 3.00

EDCI 55300 - Leadership Development In Career And Technical Education

Credit Hours: 3.00. Design, development, implementation, and evaluation of systems and strategies for enhancing the skills and knowledge of personnel seeking to become leaders in the field of Career and Technical Education (CTE); research related to critical and emerging leadership issues, strategies, policies, and resources are examined and applied to program improvement initiatives in schools, the workplace, agencies, and other organizations that serve a wide variety of youth, adolescents, young adults, and adults.

Learning Outcomes: 1. Identify and adapt models of staff development, in-service education, and program improvement. 2. Use organizational, adult learning, motivational, leadership, and social systems therapy in staff development and school-or agency-based program improvement activities. 3. Develop and implement organizational communications and group-related interactions effectively. 4. Evaluate the principles related to leadership style; organizational development, initiation and management of change, needs analysis, and

consultation strategies; and program improvement activities. 5. Locate current and emerging funding sources, as well as effective procedures for developing grant seeking and project management strategies. 6. Implement comprehensive strategies for developing assessing and improving programs, policies, practices, and services related to career and technical education programs. 7. Design and implement effective interagency collaboration initiatives. Credits: 3.00

EDCI 55600 - Educational Video Game Design

Credit Hours: 3.00. Designed to provide an introduction to the design of educational video games. The focus of the course is on two areas: 1) the learning, instructional design, and game design theories which can inform the design of effective and engage in educational video games, and 2) how to apply those theories within practical settings.

Learning Outcomes: 1. Become comfortable with the history, concepts, terminology, culture, and classification of educational video and computer games. 2. Explore current research on educational computer and video games. 3. Examine learning, instructional design, and game design theories for relevance to the design of educational computer and video games. 4. Apply theory be designing, developing, and implementing a prototype of an educational computer or video game as teams. Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDCI 55850 - Introduction To Teaching Engineering And Technology Design In The Context Of K-12 Integrated STEM

Credit Hours: 3.00. Engineering and technology design has gained considerable traction in many K-12 schools. In this

course, we will examine principals of engineering design and technology as well as where and how engineering and technology design best fits in a K-12 integrated STEM curriculum. Course participants will engage in authentic engineering and technology design experiences. Course participants will also design, develop, deliver integrated lessons that help K-12 students develop the knowledge, skills, and practices of engineering and technology design.

Learning Outcomes: 1. Demonstrate a broad understanding of engineering and technology education disciplines and concepts. 2. Scaffold engineering practices that support diverse learners and describe conceptual understanding and content knowledge of engineering and technology design skills through problem-based learning in i-STEM environments. 3. Comprehend and elaborate data-driven decision-making skills as practiced by engineering and technology professionals to develop solutions to design briefs that support K-12 learning in diverse learning environments. 4. Examine and evaluate the engineering design process in the context of integrated STEM education at the K-12 learning. 5. Collaborate and prepare pedagogical practices in integrated engineering and technology design through integrated STEM that support K-12 learning for a diverse group of learners. Credits: 3.00

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

EDCI 55950 - Engineering And Technology Design Practicum

Credit Hours: 3.00. EPICS is a service-learning design course in which teams of students from across campus work together on long- term projects that benefit the community. Project work centers around the engineering, technology, and computing needs of a community partner, but interdisciplinary team interaction is an integral element for project success. Students may participate in EPICS multiple semesters and participation for multiple consecutive semesters on a project team is encouraged. Teams are composed of first year students through seniors.

Most EPICS projects last at least one-year, though partnership with the community organization continues for several years. Projects are intended to solve real problems, are defined in partnership with their community partners, and span the complete design process cycle [problem identification - specification development - conceptual design - detailed design - delivery - service/maintenance - retirement].

You receive academic credit for participating in EPICS. How academic credits are applied to your major depends on your degree program and is determined by your department and/or advisor. See https://engineering.purdue.edu/EPICS/purdue/epics-purdue/credit.

Learning Outcomes: 1. Apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Be aware of the customer. 5. Function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Communicate effectively both orally and written with widely-varying backgrounds. 7. Be aware of professional ethics and responsibility. 8. Have an appreciation of the role that their discipline can play in social contexts. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training

environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56500 - Principles Of Adult Education

Credit Hours: 3.00. (ASEC 56500) Principles of adult education applied to helping adults learn, evaluating their performance, and determining their needs. Examines history, philosophy, and research of adult education. Explores techniques required in design and delivery of instruction for adults.

Learning Outcomes: 1. Examine principles and techniques for educating adults, including the history, philosophy, and research field. 2. Develop an individual philosophy of continuing and adult education for a wide variety of situations. 3. Apply principles, techniques, philosophy and research in development and design of adult education programs. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 56700 - Action Research In Science Education

Credit Hours: 3.00. An introduction to various models and conceptions of teacher action research in science education. Students review literature on action research, participate in small research cohorts, and plan and conduct action research within their respective educational situations.

Learning Outcomes: 1. Develop an understanding of what action research is, how it is conducted, and what role it plays in the construction of teacher knowledge in science

education. 2. Plan and conduct action research within your respective educational situation. 3. Examine various models for action research in pre-service, in-service, and independent projects in science education. 4. Gain insight into the role action research plays in science education and science teacher education. Credits: 3.00

EDCI 56800 - Partnering With Web-Based Tools For Learner Centered Environments

Credit Hours: 3.00. Provides an in-depth look at Web-based digital tools for teaching and learning, with a focus on learner-centered activities and environments. Emphasis is given to applying the knowledge and skills necessary to create a Web-based, student-centered lesson/unit that provides diverse learners with opportunities for formal and informal learning. Course content is applicable to both independent and collaborative learning, as well as use of the Web as the sole educational delivery system or in combination with other approaches, including traditional classroom instruction.

Learning Outcomes: 1. Create a personal vision of 21st century schools or workplace and a personal definition of a 21st century learner. 2. Examine, in depth, a specific student-centered approach (e.g. project-based learning, problem-based learning, inquiry learning, authentic instruction, etc.) and discuss the similarities and differences among different approaches. 3. Create a video tutorial that teaches others how to use a specific Web 2.0 tool. 4. Design a learner-centered lesson that incorporates relevant Web 2.0 tools for the purpose of broadening and/or deepening students' understanding of specific curricular content. 5. Develop an implementation plan and create appropriate assessment measures to determine student learning in your own learner-centered lesson. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 57300 - Instructional Development Practicum

Credit Hours: 2.00 or 3.00. Provides supervised field experience in programs involving instructional design development activities. Students participate in ongoing projects in the design, development, and evaluation of instructional materials and training programs in business and industry, medical facilities, or other settings deemed appropriate. Recommended prerequisites: EDCI 56900, EDCI 57200, and EDCI 67200. Permission of instructor required.

Learning Outcomes: 1. Design, develop, and evaluate a major instructional design project within a professional work setting/environment. 2. Create and manage an instructional design project within a professional setting following a specific timeline. Management of the process may require collaboration with supervisors,

subject matter experts, and others to complete the project in the most effective manner. Credits: 2.00 or 3.00

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 58600 - Topics In Educational Reform

Credit Hours: 3.00. (EDFA 58600) Explore important and timely issues related to educational reform and restructuring. Topics include: school choice, curriculum reform, assessment, technology, and influences on the reform process.

Learning Outcomes: 1. Explore and develop awareness of important and timely issues related to educational reform and change. 2. Increase knowledge of important and timely

topics in educational reform theory and practice. 3. Develop skills of critical thinking and reflection in relationship to important and timely topics in educational reform theory and practice. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 59400 - Concluding Secondary Transition To Teaching Seminar

Credit Hours: 2.00. This seminar course offers a conclusion to the program, as well as a review of general educational concerns and issues applicable to all content area instruction at the middle and high school levels. It is often the last course taken in the TTT program by program participants. The course centers on discussions of educational issues, theories, and approaches that the students who are seeking licensure in any of the secondary areas available at Purdue will find helpful. Additionally, the course helps students prepare to obtain their teaching license and enter the teaching community as a secondary teacher. Permission of instructor required.

Learning Outcomes: 1. Reflect upon transition from being "student" to becoming "teacher". 2. Write a draft of current teaching philosophy/personal pedagogy. 3. Present to colleagues about a professional experience or accomplishment. 4. Find, evaluate, and explore uses for technology and web resources in content area. 5. Critically reflect upon year(s) in the TTT/STEM program, what was learned? What goals are set for future professional development as a teacher? Credits: 2.00

EDCI 59600 - Pedagogy I: Introductory Methods For Secondary Education Transition To Teaching Program

Credit Hours: 3.00. This course is the introductory seminar for the secondary Transition to Teaching (TTT) programs across disciplines. Students who enroll in this course will be seeking teaching licensure in one of the secondary program areas available at Purdue University. Therefore, instruction in the course will revolve around general educational concerns and issues that are applicable to all content area instruction at the middle and high school levels. Admission to the Transition to Teaching program required. Permission of department required.

Learning Outcomes: 1. Situate themselves philosophically within (or against) cultural-historical paradigms in education. 2. Demonstrate familiarity with practitioner-oriented journals, conferences, and resources available through at least one content-specific professional organization in their field. 3. Articulate their understanding of current education issues related to social justice, technology, and classroom management. 4. Apply backward design when planning courses, units, and lessons. 5. Select instructional strategies that promote active learning and deep understanding. 6. Explain how literacy pertains to their content area. 7. Describe appropriate modifications and interventions for diverse learners in their future classrooms. 8. Navigate program and licensing information and

processes from the Office of Clinical Practice and Teacher Education Licensure. Credits: 3.00

EDCI 59650 - Practical Pedagogy: Tools, Techniques, And Technology

Credit Hours: 3.00. This course is designed to help with inquiry into practical pedagogical practices. The course is based on individual experiences - where, who, what, and how you're teaching, and provides space for all to investigate and explore the aspects of teaching you want to know more about. The course is grounded in theory, yet focused on the practical and everyday tasks and aspects of teaching, including: tools, techniques, and technology related to community building, grading, trauma-informed practices, lesson planning, etc. Learning Outcomes: 1. Use an inquiry stance and reflect on their teaching practices. 2. Identify and inquire into tools, techniques, and technologies that will allow them to grow as teachers in their content area. 3. Discuss the realities of everyday teaching scenarios and find resources that help them solve pedagogical problems. 4. Research, discuss, and give presentations on pedagogical tools, techniques, and technologies that they are planning to incorporate into their own teaching, explaining how and why. 5. Use an asset-based lens toward their diverse student populations. 6. Build community, establish class routines and structures, select appropriate technological tools, and develop grading practices that are best suited for them and their students. Credits: 3.00

EDCI 59700 - Pedagogy II: Advanced Methods For Secondary Education Transition To Teaching Program

Credit Hours: 3.00. This sixteen-week course is the capstone methods course for the online Transition to Teaching (TTT) program. Students who enroll in this course will be seeking teaching licensure in one of the secondary program areas available at Purdue University. Therefore, instruction in the course will revolve around general educational concerns and effective teaching approaches that are applicable to all content area instruction at the middle and high school levels. This course extends engagement with the pedagogical principles of practice introduced in *Transition to Teaching: Pedagogy I*. The course also includes a fifty-hour field experience component. Admission to Transition to Teaching program required. Permission of department required. Learning Outcomes: 1. Plan learner-centered instruction and classroom management techniques that reflect cultural competency; are responsive to the characteristics, strengths, experiences, and needs of each student; and promote all student's development and learning. 2. Develop effective lesson and unit plans in short- and long-range instructional planning. 3. Describe project-based learning experiences that guide students to analyze the complexities of an issue and use creative thinking and innovative approaches to solve problems. 4. Identify skills and strategies for creating a safe, healthy, supportive, and inclusive learning environment that encourages all student's engagement, collaboration, and sense of belonging. 5. Identify skills and strategies for establishing a culture of learning that emphasizes high expectations for all students, promotes self-motivation, and encourages students' sense of responsibility for their own learning. 6. Use a variety of assessment results and data sources to evaluate and monitor student learning and progress; establish learning goals; and plan, differentiate, and continuously adjust instruction for individuals, groups, and classes. 7. Compare characteristics and benefits of virtual learning environments, online environments, face-to-face environments, and hybrid environments, and the strategies to work effectively in different types of environments to ensure student learning and growth. 8. Evaluate key areas for growth and goal setting after reviewing procedures for teacher evaluations and administrator expectations for professional teachers. 9. Reflect on field experience lesson planning, instructional delivery and student interactions. 10. Anticipate the requirements for edTPA and teacher certification. Credits: 3.00

EDCI 59900 - Research And Instructional

Coaching

Credit Hours: 3.00. This independent study, field-based course is designed to teach you about field-based research, instruction, and coaching in teacher education and elementary schools. You will have the opportunity to apply what you learn by developing and executing a mini-inquiry project including research questions, data collection, analysis, and findings for publication and/or program materials development.

Learning Outcomes: 1. Explore and identify research interests, sites, and projects then create and execute an attainable semester-long plan for research/inquiry. 2. Learn about, plan, teach & film exemplary critical literacy/interdisciplinary read aloud lessons and related activities for K-5. 3. Observe and/or coach PSTs through a DEI lens: coaching requires 22+ hours of K-5 US classroom teaching experience equivalent to EDCI363 or classroom teaching. Credits: 3.00

EDCI 60001 - Intro To Demonstrating Professional Competencies In LDT

Credit Hours: 1.00. This course is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Learning Design and Technology program, with a focus on the process of earning digital badges aligned with professional competencies. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn and apply the process of both earning digital badges within the program and evaluating your peers' work as part of the badge earning process.

Learning Outcomes: 1. Students will learn the specifics of the LDT Master's program and its requirements familiarize yourself with resources, review targeted learning competencies, and program requirements. 2. Students will examine skills and approaches to obtain competency badges critical to your success as a student in the online program, including peer review, self-editing, effective time management, avoiding plagiarism, utilizing proper online etiquette and incorporating a positive disposition in your interactions with peer students, faculty and staff. 3. Students will become familiar with the badge earning process in LDT and progress in earning your first digital badges. Credits: 1.00

EDCI 60003 - LDT Professional Competencies Portfolio

Credit Hours: 1.00. This course will focus on completion of the competency portfolio reflecting on the depth and breadth of your educational growth since entering the Master's program. The purpose of the LDT competency portfolio is to demonstrate that you have mastered the graduate competencies. The portfolio will contain student evidence aligned with LDT competencies and will be reviewed by your committee. The completed competency portfolio is a requirement for graduation from the LDT Master's program. Prerequisites: EDCI 60001 and 60002.

Learning Outcomes: 1. Finalize students' competency-based portfolio. 2. Compose reflective narratives on Professional Foundations of LDT, Planning and Analysis, Design and Development, and Evaluation and Implementation. 3. Update and finalize resume or vita suitable for job searching. Credits: 1.00

EDCI 60400 - Social Studies In The Elementary School

Credit Hours: 3.00. Social Studies-content and place in the modern elementary education curriculum. Materials, instruction techniques, evaluation procedures, and understanding the syntax of the structure of social studies. Prerequisite: EDCI 36100 .

Credits: 3.00

EDCI 60500 - Teaching Integrated Science, Technology, Engineering And Math

Credit Hours: 3.00. Analysis of historical developments and present trends in science education; the designing, implementation, and evaluation of science programs; the role of research in present and future developments.

Learning Outcomes: 1. Identify, describe, and explain the fundamental tenets of different constructivist learning theories and their relevancy to STEM education. 2. Clarify and refine beliefs about teaching and learning in STEM education. 3. Identify and characterize students' ideas about STEM and how they influence learning. 4. Explore students' thinking and understanding of STEM through multiple strategies. 5. Describe ways to assess student learning in STEM. 6. Identify, practice, and reflect upon teaching strategies commensurate with teaching beliefs and knowledge about how

students learn STEM through an integrated approach. 7. Compare and evaluate curriculum resources for integrating STEM instruction. 8. Devise a comprehensive lesson plan for integrating STEM instruction based on science and engineering practices and teaching for all learners. 9. Teach and reflect upon an integrated STEM lesson employing multiple instructional strategies. 10. Evaluate student learning in the context of an integrated STEM lesson. Credits: 3.00

EDCI 61200 - Seminar In Literacy

Credit Hours: 3.00. Recent trends and research in literacy. Topics provide in-depth study of literacy acquisition in educational settings.

Learning Outcomes: 1. Investigate a specific topic of interest through readings, written work, and discussion. 2. Develop understandings of a new topic area relevant to the study of literacy and language. Credits: 3.00

EDCI 61300 - Seminar In The English Language Arts

Credit Hours: 3.00. Problems in the teaching of English: literature, language, rhetoric. Attention to recent scholarship and to its application in the public schools.

Learning Outcomes: 1. Think critically about historical and/or contemporary research and theory central to the field of English education. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions which encourage critical thought and personal engagement. Credits: 3.00

EDCI 61450 - Seminar In Bilingualism And Multilingualism

Credit Hours: 3.00. This course examines theories, research and educational practices in bilingualism and multilingualism. Students will become familiar with major conceptual and methodological issues in research about the use and acquisition of two or more languages in bi/multilingual societal and educational contexts. Individual and societal dimensions will be considered through the examination of a wide range of approaches. Accordingly, the course is transdisciplinary in nature, bringing together work from anthropology, education, psychology, and (socio)linguistics.

Learning Outcomes: 1. An understanding of the complex developmental history of literacy, including the role of visual literacy. 2. Familiarity with relevant research, and the ability to critically evaluate and discuss this literature. 3. Development of the professional skills of analytic and integrative thinking, discussion, and questioning. 4. A critical understanding of the role of classroom experience-both in terms of its social and political value and in terms of available resources and materials -- in the development of young children's literacy. Credits: 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns

involved in qualitative inquiry at an advanced level. Credits: 3.00

EDCI 61800 - Gender And Culture In Science Education

Credit Hours: 3.00. An examination of the different perspectives on issues of gender, culture, and science. Major topics include feminist critiques of scientific theories and methods, the work of women and minorities in science, the role science has played in the construction of race and gender, and topics in science education, such as girls' learning in science and the potential of inclusive practices in the science classroom. Prerequisite: EDCI 51800 or EDCI 58500 .

Learning Outcomes: 1. Develop an in-depth understanding of the role of gender and culture in science and science education. 2. Examine feminist and cross-cultural studies in science and science education. 3. Apply feminist and critical frameworks of analysis to various studies in science education. 4. Identify and evaluate the strengths and limitations of feminist and cultural critiques of science. 5. Synthesize related literature in an effort to gain in-depth knowledge about one or more areas of gender and culture in science and science education. Credits: 3.00

EDCI 61900 - Learning Science

Credit Hours: 3.00. The course provides a holistic study of how children and adults learn science; how the learner's ideas, ways of thinking, abilities to do science, and their attitudes towards and beliefs about science learning influence how they learn science.

Learning Outcomes: 1. Develop an increased understanding of the research literature in science education as it pertains to science learners. 2. Gain an appreciation of science learners and the different perspectives about how individuals learn science. 3. Apply science education research about science learners to instructional, curricular, and assessment development. Credits: 3.00

EDCI 62000 - Seminar In Mathematics Education

Credit Hours: 1.00 to 6.00. Selected topics in mathematics education. Typical topics considered are: (1) problem solving; (2) instructional strategies; (3) cognitive structure; (4) current curriculum; (5) current research. Permission of instructor required.

Learning Outcomes: 1. Examine, synthesize, and communicate a view of the state of mathematics education and situate one's research in it. 2. Create knowledge for the field of mathematics education and communicate findings to the professional community. 3. Communicate and act upon professional feedback in the processes of designing and conducting research and writing conference proposals and research reports. 4. Report on various stages and types of research (e.g., project design, data analysis, findings). Credits: 1.00 to 6.00

EDCI 62100 - Technology For Qualitative Research

Credit Hours: 3.00. Exploration of the effective use of technology to facilitate data collection, organization, and analysis. Emphasis on application of theoretically-based methodologies for handling and analyzing qualitative data through the use of qualitative research software. Course also includes attention to other hardware or software relevant to the collection, organization and analysis of qualitative data. Prerequisites: EDCI 61500.

Learning Outcomes: 1. Explore and practice the application of theoretically-based methodologies for handling and analyzing qualitative data through the use of qualitative research software (NVivo). 2. Explore and practice the following mobile applications that may be used for data collection and other research purposes: digital photo, audio, and video recording and editing apps; document scanning apps (Scanner Pro); notetaking apps (e.g., Evernote, Notability); Adobe Acrobat .pdf file management and mark-up apps (Notability); and the integration of these apps with NVivo. Credits: 3.00

EDCI 62200 - Seminar In Science Education

Credit Hours: 1.00 to 3.00. Current issues in science education. Typical topics considered are: (1) science curriculum; (2) concept learning; (3) teacher education; (4) intellectual developments; (5) current research. Prerequisite: EDCI 51700 , EDCI 51800 .

Credits: 1.00 to 3.00

EDCI 62400 - Seminar In Social Studies Education

Credit Hours: 3.00. An investigation of various aspects of the teaching of the social studies. One topic is dealt with in each enrollment. Master's candidates are expected to complete the first three topics. Areas include: (1) philosophic concepts used in the social studies; (2) curricular analysis and examination of new social studies materials; (3) methods of inquiry in the social studies; (4) research methodology in the social studies.

Credits: 3.00

EDCI 62700 - Current Topics In Learning Design And Technology

Credit Hours: 3.00. A critical analysis of problems, trends, issues, and programs related to the area of learning design and technology. Prerequisite: EDCI 51300 .

Learning Outcomes: 1. Critically analyze current issues and trends in the field related to a given topic. 2. Identify and discuss advantages and limitations to implementing specific emerging tools, strategies, and /or approaches. 3. Identify strategies for examining the effectiveness of specific emerging tools and strategies. Credits: 3.00

EDCI 62800 - Curriculum And Instruction Doctoral Seminar I

Credit Hours: 1.00. An examination of current issues and concerns related to doctoral study in Curriculum and Instruction. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year of doctoral study.

Learning Outcomes: 1. Reflect on the roles and responsibilities of faculty members. 2. Identify steps to develop personally and professionally. 3. Describe major milestones of doctoral study in the department. 4. Identify ethical standards in the field of education. 5. Practice ethical conduct of research. 6. Identify research topics of personal interest and locate. 7. Locate and begin to review literature relevant to those topics. Credits: 1.00

EDCI 63300 - Instructional Design Project Management

Credit Hours: 3.00. This course focuses on the application of project management ideas, concepts, and strategies in instructional design settings. Students will be asked to consider the relationship between instructional design and project management, tools that can assist with managing instructional design projects, and factors influencing the instructional design project management process. Students will explore these topics by creating deliverables for instructional design cases and other interactive assignments.

Learning Outcomes: 1. Explain and reflect upon common project management terminology's role in instructional design projects. 2. Analyze and articulate the relationship between project management and instructional design. 3. Propose and/or develop relevant intervention strategies (instructional design and project management) to real-world instructional design issues that are consistent with arguments and evidence presented. 4. Integrate project management technologies and tools in the development of instructional design project management. 5. Interpret the role of interpersonal skills in and factors impacting project management instructional design initiatives. Credits: 3.00

EDCI 63500 - Content And Goals In Mathematics Education

Credit Hours: 3.00. Examines conceptions of what mathematics is and how those conceptions have influenced the mathematics curriculum over the course of American history. Prerequisite: Master's student standing or higher and enrolled in Mathematics Education.

Learning Outcomes: 1. Develop perspectives on and communicate various theories or theoretical frameworks related to mathematics curriculum. 2. Investigate and communicate a research based perspective on the underlying nature of curriculum. 3. Develop and communicate a historical perspective on evolution of mathematics curriculum. 4. Synthesize seminal and current research describing curriculum and curricular relationships in mathematics education. Credits: 3.00

EDCI 63600 - The Learning Of Mathematics: Insights And Issues

Credit Hours: 3.00. Examines research related to the learning of mathematics and to the relationships of social and cultural factors to the learning of mathematics. Prerequisite: Master's student standing or higher and enrolled in Mathematics Education.

Learning Outcomes: 1. Develop perspectives on and communicate orally and in writing various

theories or theoretical frameworks for learning mathematics. 2. Investigate and communicate orally and in writing core ideas and beliefs that form the thinking and research efforts in the learning of mathematics. 3. Critically reflect on and synthesize seminal and current research in mathematics learning. Credits: 3.00

EDCI 63700 - The Teaching Of Mathematics: Insights And Issues

Credit Hours: 3.00. Examines research related to mathematics teaching, including research on characteristics of mathematics teachers, the features of effective mathematics teaching, and the professional preparation and development of mathematics teachers. Prerequisite: Master's student standing or higher and enrolled in Mathematics Education.

Learning Outcomes: 1. Develop perspectives on and communicate orally and in writing various theories or theoretical frameworks related to teaching mathematics. 2. Investigate and communicate orally and in writing theoretical and empirical foundations of the research literature related to mathematics teaching, teacher education, and/or professional development. 3. Critically reflect on and synthesize seminal and current research in mathematics teaching, teacher education, and/or professional development. Credits: 3.00

EDCI 63800 - Curriculum And Instruction Doctoral Seminar II

Credit Hours: 1.00. This course consists of an examination of current educational research. EDCI and other faculty will present and lead discussions of their research. Students will be exposed to research within multiple paradigms and perspectives. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year to doctoral study. Permission of instructor required.

Learning Outcomes: 1. Identify and understand contemporary education research concerns. 2. Identify and understand research within multiple paradigms and perspectives. 3. Interact with Purdue faculty about their current research interests. 4. Grow and develop as a professional. Credits: 1.00

EDCI 64400 - Legal Issues In Career And Technical Education

Credit Hours: 3.00. Comprehensive examination of contemporary federal, state, and local legislation; rules, policy, regulations, provisions, guidelines, and initiatives affecting the nature, establishment, and implementation of state and local programs at the secondary and postsecondary levels in career and technical education; need for legislation and initiatives and the reauthorization of existing legislation; social, political, and economic aspects of legislation; advocacy for legislation; and public policy and policy development. Approval of Department required.

Learning Outcomes: 1. Discuss the importance and impact of statutory law on the development and nature of career and technical education in the United States. 2. Describe and contrast the legislative process and policies at the national and state levels. 3. Review, articulate, and analyze critically the history of CTE and related legislation from 1862 to the present. 4. Explain and apply the major provisions of the current CTE and workforce federal legislation. 5. Relate and apply the content of the current Indiana State Plan for CTE to the provisions, requirements, and legal interpretation of Federal CTE legislation. 6. Examine critically and apply Indiana legislation and initiatives that provide authority, support, structure, and administration for CTE in the State. 7. Refine conceptual, analysis, synthesis, and evaluation skills. 8. Enhance their written and oral communication skills. Credits: 3.00

EDCI 64500 - Organization And Administration Of Career And Technical Education

Credit Hours: 3.00. Organizational structure and delivery systems at the national, regional, state, and local levels; program areas and services; legislative initiatives; federal, state, and local planning; administrative functions and practices; leadership development; trends; and issues.

Learning Outcomes: 1. Develop an understanding of the organizational structure and delivery systems at the national, regional, state, and local levels in career and technical education (CTE). 2. Provide an overview of the CTE program areas, career clusters, career pathways, and services and their relationships

to academic and special education. 3. Review federal and state legislation related to CTE. 4. Examine federal, state, regional, and local planning and funding activities. 5. Analyze administrative functions and practices and management systems. 6. Critique leadership and staff development initiatives in CTE. 7. Evaluate current trends and issues in the field. Credits: 3.00

EDCI 64600 - Supervision In Career And Technical Education

Credit Hours: 3.00. Purposes, principles, strategies, and procedures of supervision and management in career and technical education and related workforce education and development contexts: theory and practice: human resource development: environment, education, and management. Approval of Department required.

Learning Outcomes: 1. Define and describe contemporary supervision concepts. 2. Identify and explain principles of educational supervision. 3. Relate and analyze critically emerging concepts in supervision to social, political, economic, and cultural factors. 4. Describe and discuss a sequence of (clinical) experiences that provide optimum opportunity for developing educator competencies. 5. Identify and apply best practices experiences that have potential for practica, internships, and other work-based learning programs. 6. Identify and describe the stages of supervision. 7. Identify, evaluate, select, and apply techniques and strategies appropriate to the implementation of each stage of supervision. 8. Implement methods of supervision in pre-observation, conference, observation, analysis and strategy, conference, and post-conference contexts. 9. Develop awareness and participate in professional development opportunities in CTE and education. Credits: 3.00

EDCI 64700 - Research In Career And Technical Education

Credit Hours: 3.00. Rationale for and history of research in career and technical education; analysis of the research process and research methods; examination of the environment and support required for research; proposal development, and strategies for dissemination and utilization of research. Offered in alternate years.

Learning Outcomes: 1. Develop a rationale for disciplined inquiry in career and technical education. 2. Examine the history of research in career and technical education. 3. Analyze the research process and research methods. 4. Identify the environment and support required for research. 5. Describe strategies for the dissemination, utilization, and evaluation of research. Credits: 3.00

EDCI 64800 - Curriculum In Career And Technical Education

Credit Hours: 3.00. Overview of curriculum in career and technical education programs; business and industry training programs; curriculum planning, development, implementation, and evaluation; review and analysis of curriculum models.

Learning Outcomes: 1. Develop an understanding of curriculum and its relationship to other instructional phases in career and technical education and training. 2. Provide an overview of curriculum processes and procedures in career and technical education and business and industry training programs. 3. Review and analyze curriculum development research in career and technical education. 4. Acquire skills in curriculum needs assessment, planning, implementation, and evaluation. 5. Explore the theoretical, ethical, political, social, and economic factors related to curriculum development in career and technical education and training. 6. Gain experience in designing a curriculum plan and curriculum development. Credits: 3.00

EDCI 64900 - Assessment In Career And Technical Education

Credit Hours: 3.00. Goals and rationale for evaluation in education and work training contexts; assessment and measurement methods, techniques, and procedures; reliability, validity, and accuracy; construction and selection of instruments; data and information collection, analysis, and interpretation; meta evaluation; adaptations and modifications for special needs populations; and using assessment data and information.

Learning Outcomes: 1. Provide an overview of assessment in career and technical education and training programs. 2. Identify goals and a rationale for evaluation. 3. Explore contemporary assessment trends and practices. 4. Develop an understanding of career assessment and measurement methods, techniques, and procedures in career and technical education and training. 5. Examine several methods for estimating instrument reliability, validity, and accuracy. 6. Develop skills in the construction, analysis, and selection of assessment and measurement instruments and procedures in career and technical education and training programs. 7. Explore the ethical, psychological, political, social, economic, and educational issues related to assessment in career and technical education and training. 8. Gain experience in the collection and analysis of assessment data and information. 9. Develop skills in the evaluation of assessment and measurement instruments. 10. Explore a variety of appropriate procedures to interpret, disseminate, and use assessment data and information in career and technical education and training programs. Credits: 3.00

EDCI 65000 - Program Evaluation In Career And Technical Education

Credit Hours: 3.00. Goals and objectives of, and criteria for, program evaluation in career and technical education; evaluation models and methods; design and planning; issues; development and selection of instruments and procedures; data and information collection and analysis; preparing program evaluation reports; and using program evaluation results for program improvement.

Learning Outcomes: 1. Provide an overview of program evaluation. 2. Develop an understanding of the major concepts, principles, models, theories, and techniques of evaluation. 3. Acquire knowledge and skills in designing and planning program evaluations. 4. Explore the ethical, political, social, and economic issues related to evaluation. 5. Experience implementing the methods, procedures, and activities of a program evaluation plan. 6. Participate in the reporting, dissemination, and use of findings of program evaluations. Credits: 3.00

EDCI 65200 - Seminar In Family And Consumer Sciences Education

Credit Hours: 2.00 to 6.00. A critical analysis of current problems, trends, issues, and programs in family and consumer sciences education. Prerequisite: 12 credit hours in Education or equivalent professional training. Permission of instructor required.

Credits: 2.00 to 6.00

EDCI 65300 - Seminar In Career And Technical Education

Credit Hours: 1.00 to 9.00. Current trends, theory, and practices related to educational contexts and careers.

Learning Outcomes: 1. Review, synthesize, analyze, and critique current research in education, career and technical education, and related fields and disciplines. 2. Identify significant research problem areas and researchable problems in education. 3. Examine and evaluate research methods used and applicable in education fields and related disciplines. 4. Explore various research dissemination strategies. 5. Network with researchers in education and related fields. Credits: 1.00 to 9.00

EDCI 66000 - Learning Design And Technology Seminar

Credit Hours: 1.00. This course is an investigation of trends, developments, and issues in learning design and technology with a focus on current practices, problems, and research. This one-credit seminar is designed to help students learn about applications of instructional design and educational technology in various settings and to interact with faculty and guest speakers about topics related to the field and the LDT program.

Learning Outcomes: 1. Become familiar with resources available to support progression through your LDT graduate program. 2. Learn the specifics of the program and its requirements, including reviewing targeted learning competencies, portfolio requirements, program faculty, and the graduate handbook. 3.

Identify and work towards fulfilling short and long-term professional goals. 4. Identify a career pathway that is appropriate for you including the skills, knowledge, and attitudes you will need to be successful. 5. Gain real-world insights into LDT field. Credits: 1.00

EDCI 67000 - Learning Design And Technology Portfolio

Credit Hours: 1.00 to 2.00. This course was created to help guide LDT students near completion of their coursework to develop their competency portfolio. The competency portfolio is a requirement for graduation from the traditional LDT Master's program.

Learning Outcomes: 1. Develop an electronic version of your competency portfolio based on artifacts as evidence. 2. Compose narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00 or 2.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of learning systems design to real-world educational situations through the in-depth consideration of key instructional design processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

EDCI 67300 - Issues And Methods In Learning Systems Design Research

Credit Hours: 3.00. Provides preparation to conduct independent research in the field of learning design and technology through direct participation in the research process: critically reviewing research, designing and conducting a research study, synthesizing and presenting results in written and oral formats. Prerequisites: EDPS 53300, EDCI 67600, EDCI 67700.

Learning Outcomes: 1. Describe the role of research in the field of Learning Design and Technology. 2. Design a research study to investigate a problem relevant to the field of Learning Design and Technology. 3. Conduct a research study in an applied (school, hospital, community agency) or experimental (lab, designed) setting. 4. Analyze, interpret, and discuss various sets of data. 5. Write a research report according to APA guidelines. 6. Present the results of a research study according to professional guidelines. Credits: 3.00

EDCI 67400 - Advanced Instructional Design Theory

Credit Hours: 3.00. Examines the impact of both psychological learning theories and instructional applications upon the development of various instructional design theories. Emphasis is on theory construction, influence of learning and educational principles, and the current and future possibilities of instructional design theory. Prerequisite: EDCI 53100 and 57200.

Learning Outcomes: 1. Identify and consider the key principles and underlying assumptions from several prominent Instructional Design Theories and articulate relationships across these areas. 2. Determine when, why, how, and under what conditions specific ID theoretical principles can be applied to resolve applied learning problems. 3. Assess the effectiveness of specific ID theories, explain their individual strengths and weaknesses, and propose alternative viewpoints, guidelines, and perspectives to enhance learning given specific situations. 4. Develop effective methods for analyzing and articulating sound and logical arguments regarding theoretical, instructional, and

technological relationships, positions, and conceptualizations. Credits: 3.00

EDCI 67500 - Instructional Strategies

Credit Hours: 3.00. Examines and applies the cognitive strategies and tactics that can be used by an instructional designer to improve human learning. Applications of various instructional strategies for specific cognitive tasks (e.g., concepts, mental models, problem solving) will to be covered. Additionally, best practices for a diverse range of instructional methods will be considered, as well as, the strategies for the entire instructional experience. Prerequisite: EDCI 57200. Permission of instructor required.

Learning Outcomes: 1. Identify, synthesize, and summarize practical, research based guidelines that facilitate the development of quality instructional results. 2. Identify, describe, and select relevant cognitive techniques/strategies (e.g., analogies, metaphors, imagery and mnemonics) and cite relevant research to indicate their appropriate use and effectiveness. 3. Identify, describe, and select relevant instructional methods (e.g., case-based instruction, cooperative learning, discussion, simulation, peer mentoring, reciprocal teaching, and discovery) and cite relevant research to indicate their appropriate use and effectiveness. 4. Identify, describe, and select relevant motivational strategies that can be incorporated to increase learner effort in a learning task and cite relevant research to indicate their appropriate use and effectiveness. 5. Given a task to evaluate instructional materials for specific content, identify the type of learning involved, select the appropriate set of instructional techniques, methods and strategies, and utilize those to design and propose an effective instructional outcome. Credits: 3.00

EDCI 67600 - Unpacking Research: Writing Literature Reviews In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the learner to the process of analyzing and preparing literature reviews on topics relevant to the field of Learning Design and Technology. Emphasis is placed on helping the learner to understand, critique, and synthesize the research literature in order to apply it to their own personal research agenda. Course activities and assignments are designed to help the learner develop the knowledge, tools, and strategies needed to become thoughtful consumers and producers of research and to use this knowledge to inform their practice. Learning experiences revolve around two major themes: 1) the examination and thoughtful critique of current research and 2) preparation of a thorough literature review that provides a rationale for continued study. Permission of instructor required.

Learning Outcomes: 1. Formulate a driving question about a specific topic in Learning Design and Technology. 2. Locate published literature (scholarly work) that supports the importance of the question. 3. Critically evaluate published research. 4. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 5. Analyze and provide feedback to peers through a collaborative learning experience. Credits: 2.00

EDCI 67700 - Unpacking Research: Writing Research Proposals In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the novice researcher to the process of developing a research problem statement supported by literature resulting in a professional organization conference proposal and a proposal for a funding agency in the field of Learning Design and Technology. Permission of instructor required. Prerequisite: EDCI 67600.

Learning Outcomes: 1. Discuss current research in the LDT field. 2. Formulate a problem statement, purpose statement, and research questions to drive a potential research study. 3. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 4. Analyze and provide feedback to peers through a collaborative learning experience. 5. Develop a research proposal that is ready to be put into place. 6. Identify areas for improvement in the research proposal writing process. Credits: 2.00

EDCI 67800 - Unpacking Research: Writing For Scholarly Publications In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the novice researcher to the process of publishing research in the field of Learning Design and Technology. Emphasis is placed on practical aspects of the publishing process as well as familiarizing students with the role that editors and reviewers play in that process. Prerequisite courses include: EDCI 67600 Writing Literature Reviews and EDCI 67700 Writing Research Proposals. Students must bring a draft manuscript completed through the methods portion into the course, and students must have completed research and collected data to facilitate completion of a research-based manuscript for publication during the course. Permission of instructor required.

Learning Outcomes: 1. Discuss current research in the LDT field. 2. Formulate a problem statement, purpose statement, and research questions to drive a potential research study. 3. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 4. Analyze and provide feedback to peers through a collaborative learning experience. 5. Develop a research proposal that is ready to be put into place. 6. Identify areas for improvement in the research proposal writing process. Credits: 2.00

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders. Credits: 3.00

EDCI 68000 - Curriculum & Instruction MS Portfolio

Credit Hours: 1.00. This course was created to help guide C&I students near completion of their coursework to develop their competency portfolio. A competency portfolio reflects the depth and breadth of a student's educational growth since entering the graduate program. The purpose of the C&I competency portfolio is to demonstrate that students have mastered the graduate competencies for the C&I online Master's program. The portfolio will contain student projects aligned with C&I competencies and will be reviewed by committee members. The competencies are based on the Curriculum & Instruction departmental competencies and several program-specific competencies. The competency portfolio is a requirement for graduation from the C&I Master's program. (Multiple media are welcome.) Permission of department required.

Learning Outcomes: 1. Develop an online version of your competency portfolio based on artifacts as evidence. 2. Compose reflective narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00

EDCI 68200 - Contemporary Curriculum Theory

Credit Hours: 3.00. Critical examination of contemporary concepts of curriculum theory. Rational/technical curriculum, social needs/child centered curriculum. Socio-political curriculum theory; curriculum as existential, aesthetic, and phenomenological. Implications for current practice, school reform, and educational research.

Learning Outcomes: 1. Develop an understanding of the social theories and philosophies that inform contemporary curriculum theorizing. 2. Articulate the role of curriculum theorizing in defining and analyzing educational phenomena. 3. To utilize curriculum theory toward the development of educative responses to issues of ethics, equity, power,

and privilege. 4. To synthesize the complexity and tensions of various curriculum theories into frameworks for educational research. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

EDCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EDCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Educational and Psychological Studies

EDPS 10101 - Learning In Context-An Introduction To The Learning Sciences

Credit Hours: 3.00. This introductory course is designed to acquaint first year Learning Science students with the core concepts, principles, and research findings of the learning sciences as they apply to a wide range of formal and informal educational contexts. The course provides students with opportunities to interact with and learn about the scholarship of College of Education faculty who conduct research within the framework of the learning sciences. Students will learn about faculty projects that exemplify key features of the Learning Sciences such as attention to the complexity of learning environments, the study of social and cultural as well as individual dimensions of learning, and the cross-disciplinary nature of the field.

Learning Outcomes: 1. Identify the features of education as a design discipline. 2. Identify core principles, questions, and challenges, that define educational research and practice from a Learning Sciences perspective. 3. Identify the varied sources of cross-disciplinary knowledge that contribute to the design and study of effective learning environments. Credits: 3.00

EDPS 10500 - Academic And Career Planning (UCC: IL)

Credit Hours: 3.00. Builds understanding of career interests and personality characteristics related to academic and career decisions. Expands knowledge of Purdue academic programs and of the world of work. Introduces decision-making strategies.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe and explain multiple facets of your identity. 2. Identify and analyze potential academic majors. 3. Identify and analyze potential careers. 4. Evaluate potential majors and careers in relation to yourself. Credits: 3.00

EDPS 10600 - Mapping Your Career

Credit Hours: 1.00. A course designed to help students explore professional development and create an individualized career plan toward their career goals. Students can use this career plan while meeting educational goals at Purdue.

Learning Outcomes: 1. Describe your interests, skills, values, and motivations. 2. Identify and research potential career opportunities that match your career goals. 3. Develop verbal, written, and physical ("body language") communication skills. 4. Expand your knowledge of what a career is and plan for life beyond college. 5. Create a portfolio of professional tools you can use in the real world. Credits: 1.00

EDPS 17700 - Learning And Regulation Strategies For College Success

Credit Hours: 3.00. This course is designed to help students improve their college academic success by studying more

efficiently and effectively, through strategic engagement, learning, and performance. We examine and apply evidence-based learning, motivation, and regulation strategies beneficial for college and lifelong learning. Educational psychology provides the theoretical framework for practical application of intentional and informed learning, cognition, motivation and behavior regulation.

Learning Outcomes: 1. Integrate evidence-based strategies to strengthen learning across environment and disciplines. 2. Apply self-regulation techniques to strengthen learning. 3. Develop confidence in implementing learning strategies for college success, including working in groups. Credits: 3.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current

special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral, social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 24000 - Children With Gifts, Creativity, And Talents

Credit Hours: 1.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted

children youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). Cannot be taken concurrently with EDPS 24800.

Learning Outcomes: 1. Understand who gifted, creative and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something

new every day. Cannot be taken concurrently with EDPS 24000.

Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 26500 - The Inclusive Classroom

Credit Hours: 3.00. Characteristics of students with special needs/talents; strategies for helping students learn and develop in general educational settings. Emphasis placed upon research evidence, case studies, problem-based learning, and development of a plan for an inclusive classroom. A field-based component is included.

Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 27001 - Characteristics Of Individuals With Mild Disabilities

Credit Hours: 3.00. This course addresses the characteristics of students with mild disabilities and the social, legal, and ethical issues that surround their academic and social-emotional concerns, educational experiences, implications and life-long outcomes. This course has a shared field experience with EDPS 36201.

Learning Outcomes: 1. Engage in legal discourse involving students with mild disabilities. 2. Demonstrate knowledge and understanding of mild disabilities. 3. Engage in data-driven decision making regarding lesson plan development. 4. Design a lesson plan that meets the needs of target learner with a mild disability. Credits: 3.00

EDPS 30000 - Student Leadership Development

Credit Hours: 1.00 to 3.00. Leadership in students is developed through lectures and experiential activities. Topic areas include

leadership styles; campus organizational structures; program planning; social and intellectual activities; human relations and cultural differences; motivation; team building; public relations. Permission of instructor required.

Credits: 1.00 to 3.00

EDPS 30100 - Peer Counseling Training

Credit Hours: 1.00 to 3.00. Students are trained to help peers deal with their problems and concerns. Training modules are used to build knowledge and skills in the duties of peer helpers; student development, communication, goal setting, and use of community resources are stressed. (EDPS 30100 and 30100 are for Horizon students only.) Permission of instructor required.

Credits: 1.00 to 3.00

EDPS 30101 - Motivation To Learn

Credit Hours: 3.00. This course introduces students to current social-cognitive and sociocultural theories of motivation for learning and academic achievement, and research framed by those theories. Both individual-level and contextual factors associated with motivation will be considered. The course will also address applications of theory in educational settings, including motivational interventions.

Learning Outcomes: 1. Be familiar with predominant social-cognitive theories of motivation and their related constructs. 2. Understand how social-cognitive and socio-cultural approaches to studying motivation differ conceptually, methodologically, and empirically. 3. Be familiar with a range of methodologies that are used to measure student motivation, and strengths and weaknesses of each. 4. Understand and think critically about research design issues in motivation research, including descriptive correlational, quasi-experimental, and design research. 5. Understand the implications of motivation for student learning and achievement, and how this association is affected by affective, behavioral, and cognitive engagement. 6. Be familiar with proximal and distal contextual factors that are associated with motivation, and reasons for those associations. 7. Be familiar with ways that teaching and learning practices can facilitate or impede optimal student motivation. Credits: 3.00

EDPS 30102 - Social-Emotional Aspects Of Learning In Diverse Environments

Credit Hours: 3.00. The course examines the role of social emotional competence in learning and builds understandings of the inter-relationships between theory, empirical evidence, and instructional practice. It takes the perspective that experiences across different learning contexts are interrelated and may influence each other in reciprocal ways. The course views social-emotional dimensions of learning as: embedded in person-environment transactions; tied to specific instructional (formal and/or informal) contexts over time; co-evolving with cognition and language; critical to psychological, behavioral, and learning outcomes. The focus is on intersection of social-emotional competence, learning, and instruction. The course is intended to provide the foundations (theoretical and empirical) that can help those interested in formal and informal instructional environments make informed educational decisions by considering the social-emotional dimensions of learning.

Learning Outcomes: 1. Students will develop familiarity with major theoretical perspectives that inform social and emotional development in learning contexts. 2. Students will be able to define and distinguish core theoretical principles and connect them to empirical evidence and instructional practices in formal and informal learning contexts. 3. Students will be able to think critically about and evaluate the characteristics of different learning environments (and the instructional practices within these environments) and their relationship to learner development. 4. Students will develop familiarity with research methods for studying and assessing social development in different contexts. 5. Students will be familiar with key dimensions of social-emotional competence. 6. Students will develop the ability to think critically about the dimensions of social-emotional competence and their links to learner development in different contexts. 7. Students will be familiar with the social processes that operate in key contexts. Credits: 3.00

EDPS 30200 - Adolescents Classroom Teacher

Credit Hours: 3.00. Students will develop understanding of physical, intellectual, emotional and social development of learners. Emphasis on individual differences and behavior patterns that influence the establishment of an orderly, healthy learning environment, and upon the teacher as an influence of the learning environment.

Credits: 3.00

EDPS 30400 - Assessment And Transition (Data-Based Decision-Making)

Credit Hours: 3.00. This course addresses assessment techniques and transition planning in special education, with applications to curriculum. It includes norm-referenced and curriculum-based measurement, error analyses, observational ratings, data-based decision-making, and transition planning from early intervention to post-secondary settings.

Learning Outcomes: 1. Apply their understanding of specialized curricula to inform their programmatic and instructional decisions for individuals with exceptionalities across a variety of contexts and the continuum of placement options (CEC 3.2) 2. Develop, select, administer, analyze, and interpret multiple measures of student learning, behavior, and the classroom environment to evaluate and support classroom and school-based systems of intervention for students with and without exceptionalities (CEC 4.1). 3. Develop, select, and administer multiple, formal and informal, culturally and linguistically appropriate measures and procedures that are valid and reliable, to contribute to eligibility determination for special education services CEC 4.2). 4. Assess, collaboratively analyze, interpret, and communicate students' progress toward measurable outcomes, using technology as appropriate, to inform both short and long-term planning, and make ongoing adjustments to instruction (CEC 4.3). 5. Utilize appropriate progress monitoring skills in order to develop individualized education plans (IEPs) for students. Credits: 3.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 30900 - Systematic And Explicit Instruction

Credit Hours: 3.00. Students will learn evidence based instructional strategies for students with disabilities. The key components of systematic and explicit instruction will be explored. Students will learn how to use explicit instructional strategies to foster engagement and motivation. Methods for implementing systematic instruction across academic, functional, communication, social, and behavior goals will be addressed. Additionally, implementation in a variety of settings including 1:1, small group, and large group settings will be explored. Planning for generalization and maintenance of skills will also be addressed.

Learning Outcomes: 1. Contrast and compare a range of pedagogical models (e.g. Constructivist, Cognitive, Behavioral, etc) in special education. 2. Use formative and summative assessment to identify students current level of performance and inform instructional planning and decision making. 3. Identify instructional strategies necessary for promoting engagement, motivation, and opportunities to respond. 4. Identify components of systematic instruction. 5. Identify and implement a variety of strategies necessary for preparing the setting to support learning. 6. Demonstrate understanding of how to use flexible grouping to meet individual and large group needs. Credits: 3.00

EDPS 31001 - Characteristics Of Individuals With Disability Who Require Intense Intervention

Credit Hours: 3.00. This course addresses the characteristics of individuals who require intense intervention and how learning, behavioral, social-emotional, and communicative needs impact their lives. This course will also explore the cultural differences, legal and ethical guidelines, family impact, transition to adulthood, and wraparound services. A field experience will provide opportunities to observe and participate in a school setting (early childhood through age 21).

Learning Outcomes: 1. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students requiring intense intervention. 2. Understand how language, culture, family background, and environment impact the education and development of individuals requiring intense intervention. 3. Investigate services within the school and community based on the individual target learner and his/her family needs. 4. Demonstrate ability to assess and address individual academic, social, communication, daily living, and employment goals EC-21. Credits: 3.00

EDPS 31100 - Supporting Exceptional Learners: Foundations And Mathematics

Credit Hours: 3.00. Teaching students with special needs requires the ability to locate evidence-based interventions, implement those interventions with fidelity, and track student performance over time. Mathematics is a content area in which success or failure yields major ramifications for postsecondary success. This course will cover the common math interventions employed for mild to severe disabilities across grade levels K-12.

Learning Outcomes: 1. Develop standards-based lesson plans for math that consider individual abilities, interests, learning environments, and cultural and linguistic factors. 2. Use technologies to support instructional assessment, planning, and delivery of mathematics for individuals with exceptionalities. 3. Identify strategies for teaching to mastery and promote generalization of learning in mathematics for both fluency and world problem solving. 4. Produce standards-based lesson plans for numeracy that incorporate evidence-based practices, classroom resources (e.g. peer and paraprofessional), and technological supports for use with students who have diverse learning needs. Credits: 3.00

EDPS 31200 - Inclusive Practices In Cross-Content Curriculum

Credit Hours: 3.00. This course aims to teach best practices for cross-content integration in an inclusive or self-contained classroom. It develops pre-service teacher understanding of core curricula along with how to integrate the curricula across subject areas. This course will also cover curricula to implement a well-rounded education (e.g., visual arts, dance, theater, music, etc.), provide methods for inclusive practices within the content, and discuss the implementation of collaborative approaches to cross-content planning and delivery.

Learning Outcomes: 1. Apply understanding of curricula across curricular content areas to develop integrated units of study which provide a well-rounded education. 2. Develop curricular content knowledge in order to develop learning progressions for individuals with exceptionalities. 3. Select appropriate curricula for individuals with exceptionalities across multiple content areas. 4. Teach cross-disciplinary knowledge and skills (e.g., critical and creative thinking, problem-solving) through integrated lesson planning and curricular units of study. 5. Implement cross-content curriculum across a wide range of settings through collaborative practices. Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how

interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

EDPS 31600 - Collaborative Leadership: Cross-Cultural Settings (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the cultural nuances of leadership in the United States as well as around the world. This course will include impact of globalism as a context for leadership, conflict resolution in a global environment, and other important factors that impact culturally diverse or global teams.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Better understand what a culture is, broadly defined, and how it functions. 2. Better understand the importance of culturally aware, knowledgeable, and skillful leaders. 3. Increase professional and personal self-awareness in relation to leadership in diverse settings. 4. Better understand the importance of making cultural issues central for constructive conflict management. 5. Understand the complexity of leader-other interaction and impact of psycho-social variables on this interaction. Credits: 3.00

EDPS 31700 - Collaborative Leadership: Mentoring

Credit Hours: 3.00. The purpose of this course is to provide a theoretical and experiential overview of the basic elements of mentoring as a key aspect of effective collaborative leadership. The hallmark of this course is the inclusion of a service-learning component in which students will be paired with undergraduate mentees and required to participate in weekly mentoring meetings for the duration of the semester. This learning experience is designed to promote development of the knowledge, skills, and dispositions required for competent mentorship. Emphasis on peer mentoring.

Learning Outcomes: 1. Differenitate among various types, purposes, roles of mentoring/mentors. 2. Identify the essential elements of effective mentoring relationships. 3. Examine and discuss the ethical considerations involved in mentoring. 4. Acquire knowledge regarding how issues of diversity interact with the process of mentoring. 5. Evaluate empirical findings associated with mentoring. 6. Consider various approaches to evaluating mentoring and the outcomes of mentoring programs. Credits: 3.00

EDPS 32000 - Happiness And Well-Being: Introduction To Positive Psychology

Credit Hours: 3.00. Happiness and Well-Being: An Introduction to Positive Psychology is an undergraduate course designed to provide students with an introduction to the field of positive psychology while also learning valuable, impactful life skills that can improve individual well-being, resilience, flow, happiness, and mindfulness for those enrolled. The course is designed in such a way time is devoted to both lecture and discussion based learning as well as experiential activities in the classroom designed to expose students to positive psychology constructs. Students will be exposed to strength oriented approaches to understanding human behavior, the instillation of hope and optimism, and multiple other positive psychology concepts that augment understanding of psychology. Students should be willing to participate in experiential exercises using positive psychology methods designed to promote self-awareness and growth. Though this course derives material from psychology, applications of the material can be made across fields and majors; thus, all students will benefit from better understanding human behavior, happiness, and well-being from an inclusive, positive psychology perspective. This class introduces the student to the major topics of the growing area of positive psychology. Students will learn theories, techniques and research associated with methods that promote happiness and psychological well-being. This introductory class will begin the journey into positive psychology and provides a foundation for further study of applied psychology and counseling at the graduate level.

Learning Outcomes: 1. Understand the importance of balancing psychological understanding by integrating positive psychology concepts and positive assets/characteristics into conceptualization of deficit and difficulty most often found in psychology. 2. Develop an understanding of positive psychology concepts and their practical implications. 3. Identify the impact that positive psychology concepts can have in your specific

fields and future careers. 4. Understand human social behavior from a lens that incorporates understanding of the positive assets with individuals, communities, and systems. 5. Develop the ability to implement positive psychology concepts in your own life with the hope of improving well-being and happiness. Credits: 3.00

EDPS 32600 - Health, Wellness, And Adaptive Physical Education

Credit Hours: 3.00. Through a blend of theoretical knowledge and practical application, students will acquire the skills necessary to design and implement effective programs that promote overall student wellness. Students will gain a comprehensive understanding of health, wellness, and physical education of school-aged children with and without disabilities: emphasizing the importance of inclusive instruction. Additionally, students in this course will examine the responsibilities and opportunities for teachers in supporting and enhancing student health, with an emphasis on developing effective strategies for creating a healthy and safe learning environment for everyone.

Learning Outcomes: 1. Identify and explain how nutrition and common diseases promote health-related fitness and are associated with disease and injury prevention, for students with and without disabilities. 2. Identify and explain how, basic functions and structures of human body systems, including human growth and development, basic motor skills, movement patterns, and physical activities, promote participation and responsible behaviors and safety in various physical activities for students with and without disabilities. 3. Identify and describe the influence of family, peers, culture, media, technology, as well as student interpersonal relationships and communication, have on various health behaviors for students with and without disabilities. 4. Assess, design, and perform evidence-based health, wellness, and physical education instruction, for students with and without disabilities in promoting their overall health and physical well-being. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00 to 3.00. Given the needs of variety of needs of readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine evidence-based science of reading approaches designed to ensure all students have access to effective, researched-based literacy instruction.

Learning Outcomes: 1. Establish an understanding of P-12 science of reading principles and practices. 2. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 3. Understand how to implement Tier 1 and Tier 2 reading practices in a classroom. 4. Establish an understanding of reading difficulties/disabilities. 5. Extend knowledge of unique needs of struggling readers. Credits: 2.00 to 3.00

EDPS 34100 - Introduction To Philosophical Underpinnings And Concepts Of Applied Behavior Analysis

Credit Hours: 3.00. This course is the first of four courses in the Applied Behavior Analysis pathway for undergraduates in

teacher licensure programs and is also part of the course content required to become a Board Certified Assistant Behavior Analyst (BCaBA). The course will provide an introduction into the primary concepts and principles of applied behavior analysis. Students will be introduce to the fundamental knowledge and experiences for understanding Applied Behavior Analysis principles, concepts, and techniques, including operant behavior, reinforcement, punishment, choice, antecedent stimulus control, and verbal behavior. Students learn concepts and principles to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. This course includes a field placement.

Learning Outcomes: 1. Define and provide examples of behavior, response, and response class. 2. Define and provide examples of stimulus and stimulus class. 3. Define and provide examples of respondent and operant conditioning. 4. Define and provide examples of positive and negative reinforcement contingencies. 5. Define and provide examples of schedules of reinforcement. 6. Define and provide examples of positive and negative punishment contingencies. 7. Define and provide examples of automatic and socially mediated contingencies. 8. Define and provide examples of unconditioned, conditioned, and generalized reinforces and punishers. 9. Define and provide examples of operant extinction. 10. Define and provide examples of stimulus control. 11. Define and provide examples of discrimination, generalization, and maintenance. 12. Define and provide examples of motivating operations. 13. Define and provide examples of rule-governed and contingency-shaped behavior. 14. Define and provide examples of verbal operants. Credits: 3.00

EDPS 34200 - Applied Behavior Analysis - Assessment And Intervention

Credit Hours: 3.00. This course is one of four courses in the Applied Behavior Analysis pathway for undergraduates in teacher licensure programs and is also part of the course content required to become a Board Certified Assistant Behavior Analyst (BCaBA). This course offers the interventionist with the techniques for designing, implementing, and evaluating instructional and behavioral interventions grounded in the theories of applied behavior analysis. Specifically, the learner will be exposed to techniques for measuring target academic, behavior, social and adaptive skills, as well as methods for displaying and interpreting data. Additionally, learners will design interventions, and monitor progress and will be exposed to the foundational concepts and methods of ABA including defining behaviors, collecting data, and understanding the three-term contingency of behavior. This course includes a field placement.

Learning Outcomes: 1. Identify and define the basic concepts of applied behavior analysis including the foundations of ABA, interrelated domains, and dimensions of ABA. 2. Identify factors to consider when selecting target goals including client and environmental factors. 3. Define target skills utilizing observable and measurable terms including all components of an appropriate learning goal. 4. Identify measurable dimensions of behavior and appropriate measurement procedures, including advantages and disadvantages of each. 5. Demonstrate knowledge about the various single subject research designs and variations of each, including advantages and disadvantages of each, including those most appropriate for practice and ongoing documentation. 6. Identify potential interventions based on assessment results as well as client/student preferences and current repertoires. 7. Use stimulus prompts and fading (e.g., errorless, most-to-least, least-to-most, prompt delay, stimulus fading). 8. Describe the role of imitation and modeling in learning and demonstrate procedures for implementation. 9. Define stimulus control and strategies for establishing. 10. Describe and implement discrete trial and naturalistic teaching arrangement. Credits: 3.00

EDPS 34201 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to curricular materials, curriculum development, and programs for gifted, creative, and talented (GCT) students. It serves the needs of pre-service teachers who are preparing to teach gifted students in mixed-ability, general education or specialized classrooms. Students will be exposed to established program and curriculum

models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students. Major assignments will assess students' understanding and application of foundational concepts related to the education of students with gifts, creativity, and talent. Permission of instructor required.

Learning Outcomes: 1. Determine the degree of alignment between a gifted program's stated goals, continuum of services, and curriculum resources. [NAGC-CEC Standards (2013): 2.4, 3.1, 3.3, -4.4, 4.5, 5.1-5.3, 5.5, 6.1, 7.3] 2. Describe the most widely used curriculum and program models in gifted education. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] 3. Determine which curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. You may conclude that particular models "fit" different grade levels better than others. [NAGC-CEC Standards (2013): 3.1, 3.4, 4.4, 5.1, 5.2, 6.1]. 4. Justify the use of differentiation to meet the academic needs of gifted students. [NAGC-CEC Standards (2013): 3.2-3.4, 4.2, 4.4, 5.1] 5. Evaluate educational materials and practices to assess their suitability for use with high-ability students. [NAGC-CEC Standards (2013): 2.4,3.3, 4.1-4.4, 5.1-5.3, 6.1] 6. Practice designing and revising lessons to incorporate instructional strategies well-suited for high-ability students. [NAGC-CEC Standards (2013): 2.1-2.4, 3.1-3.4, 4.2, 4.4, 4.5,5.1-5.5] Credits: 3.00

EDPS 34501 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students and provides you with knowledge and skills needed to effectively support healthy psychosocial development through your work with gifted students. As well as providing an overview of the characteristics and needs of gifted students, we will also discuss special populations of gifted learners, diversity issues, family and peer relationships, and current educational approaches and counseling interventions, including considerations for career development for gifted students. Permission of instructor required.

Learning Outcomes: 1. Recognize the social and affective characteristics and needs of high-ability students; describe and apply research-based practices to support their affective developments across home, school, and community. [NAGC-CEC Standards: 1.1, 1.2, 2.1] 2. Practice designing products that incorporate meaningful and engaging social and affective components that promote social-emotional well-being, including coping skills, proactive, adaptive behaviors, performance skills, and social skills. [NAGC-CEC Standards: 2.1-2.3, 3.1, 3.4, 4.5, 5.1] 3. Discuss characteristics and needs of subpopulations of high-ability learners and the implications for academic instruction, ethical leadership development, and/or counseling interventions. [NAGC-CEC Standards: 2.1-2.3, 4.1-4.5, 6.1, 6.3] 4. Increase knowledge and experience through regular participation in class discussion boards, interaction with gifted students and their parents, and completion of an in-depth, original affective case study of a high-ability students K-12. [NAGC-CEC Standards: 3.1, 4.3, 4.5, 7.1-7.2] Credits: 3.00

EDPS 36100 - Use Of Assessment Techniques In Special Education

Credit Hours: 3.00. Assessment techniques for the exceptional child, with applications to curriculum. Includes norm-referenced and curriculum-based measurement, error analyses, and observational ratings. Admission to Teacher Education Program, passage of Gate A.

Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4.

Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDPS 36300 - Psychoeducational, Medical, And Physical Aspects Of Individuals With Disabilities

Credit Hours: 3.00. Introduction to characteristics of individuals with mild and severe intellectual disabilities: defining characteristics, etiological factors, assessment, social, legal and educational issues, and basic physical or medical disability management issues and techniques. Admission to Teacher Education Program, passage of Gates A required.

Learning Outcomes: 1. Demonstrate the knowledge of the roles and responsibilities of the educational team. 2. Demonstrate the knowledge of instructional strategies needed to promote independence. 3. Demonstrate the knowledge of motor tone and motor patterns. 4. Demonstrate the knowledge of proper positioning, lifting, and handling techniques. 5. Demonstrate the knowledge of feeding and toileting techniques. 6. Demonstrate the knowledge of infection control. 7. Demonstrate the knowledge of assessment and monitoring techniques of major health conditions. Credits: 3.00

EDPS 40099 - Topics In Design Based Research, Assessment And Evaluation

Credit Hours: 3.00. Design-Based Research (DBR) is inquiry that is driven by educational practice- the desire to understand and improve the practice of teaching and learning. Learning scientist employ DBR in order to implement innovative designs for teaching and learning in a variety of formal and informal educational settings (e.g., schools, museums, and extramural clubs) and to conduct research no teaching and learning that occurs in the context of their design innovations. The focus of this course is to help students develop a set of core competencies for systemically studying the teaching and learning of science in designed environments.

Learning Outcomes: 1. Understand the various forms of design-based research that are conducted in education. 2. Critically evaluate the strengths and limitations of examples of design-based research in the literature on science teaching and learning. 3. Develop a proposal for a design-based research study and present this proposal, both orally and in writing to a review panel of peers (classmates). Credits: 3.00

EDPS 40200 - P-12 Reading Methods For Exceptional Learners

Credit Hours: 2.00 to 3.00. This course is designed to meet the expectations of CEC, NCTQ, IDA and REPA 3 and prepare students in the science of reading for exceptional learners (including students with dyslexia and those with intensive needs) in Tiers 2 and 3. This course will provide implementation details on Response to Intervention (RTI) and Multi-tiered Systems of Support (MTSS). The course will present strategies and programs used in strategic and intensive intervention efforts for those learners needing additional, unique, and/or more focused remediation efforts. Topics will include understanding reading intervention research, the behavior analytic and learning sciences' contributions to understanding the reading process, the sequence of learning to read (systematic instruction), reading to learn, and the five components of reading instruction for P-12 learners. This course will specifically address the REPA 3 Standard: Focused work using (interventions that are direct, explicit, and multi-sensory) as a component of scientifically-based reading.

Learning Outcomes: 1. Review the five components of effective reading instruction for those in P-3 and those in grades 4-12. 2. Explain the models for remediation of prereading/reading difficulties and describe how they function: RTI, MTSS. 3. Describe and demonstrate how to use various screeners and progress monitoring assessments for P-12 students in Tiers 2 and 3. 4. Describe the meaning of direct and systematic instruction. 5. Demonstrate mastery of Corrective Reading sounds. 6. Demonstrate methods of increasing student engagement. 7. Discuss strategies to enhance content area reading performance. 8. Illustrate a scope and sequence for reading remediation for readers needing strategic and intensive intervention. 9. Explain how reading

instruction can be made more explicit for those needing more focused efforts 10. Demonstrate how to provide systematic and explicit small group/one-on-one reading instruction. 11. Describe Big Direct Instruction and published scientifically-based programs that are designed based on the science of reading instruction and demonstrate how they are implemented. 12. Describe the use of Universal Design for Learning and assistive technology approaches to increase access to reading materials and/or improve reading skills. Credits: 2.00 to 3.00

EDPS 40300 - Individual Social, Emotional, Behavioral Supports

Credit Hours: 3.00. This course is designed to prepare students with advanced knowledge and skills in designing and delivering individualized social-emotional and behavioral supports for learners. Emphasis will be placed on functional behavior assessment and function-based interventions and supports.

Learning Outcomes: 1. Identify the advanced principles of behavior and provide classroom examples. 2. Articulate the connection between social-emotional skills and challenging behavior. 3. Define learner behaviors. 4. Select an appropriate behavior measurement system for learner outcomes. 5. Measure and graph learner behavior. 6. Conduct a functional behavior assessment. 7. Develop and implement a behavior support plan. 8. Analyze learner data to guide educational programming decisions. Credits: 3.00

EDPS 41001 - Collaboration And Transition Practices For Individuals With Disabilities

Credit Hours: 3.00. This course addresses the professional collaborative practices for special educators, who work with school age students with disabilities. The topics of this course include collaboration with professionals, ancillary personnel, agencies, and families, problem-solving and dealing with conflict, co-teaching, and transition planning from early intervention to post-secondary settings. The possible products from this course include community resources, transition plans, co-teaching plans, and family interviews. No undergraduate student may be enrolled in this undergraduate course until they have been admitted to the teacher education program and passed Gates A and B.

Learning Outcomes: 1. Become familiar with the legal requirements of IDEA and other related laws, both federal and state as they relate to collaboration and transition. 2. Demonstrate proficiency in writing and interpreting transition plans. 3. Demonstrate knowledge in the use of both formal and informal assessments in determining student transition needs and supports. 4. Develop comprehensive plans for community-based instruction (including ecological inventories, site analyses, site development, instructional strategies, behavior management plans, data collection). 5. Demonstrate knowledge of interagency collaboration, professional development, and community resource development for the purpose of providing effective transition services. 6. Demonstrate a basic understanding of the government benefits (e.g., SSI, AFDC) for which persons with disabilities may be eligible. They will be familiar with the impact of work or other financial resources on maintaining these benefits. 7. Know about accessing and implementing information related to school and post-school private resources for persons with disabilities in the areas of government benefits, vocational services, estate planning, independent living, social and recreational services, transportation services, community integration and related services. 8. Demonstrate an understanding of the issues and barriers encountered by students, parents, and service providers as students with disabilities transition between grade and school levels. 9. Identify solutions to issues and barriers for all parties as individuals with disabilities transition through grade and school levels. Credits: 3.00

EDPS 41700 - Special Education Knowledge And Skills For General Educators

Credit Hours: 3.00. This course is the capstone course for the Special Education certificate and pathway. This course is designed to expose students to innovative strategies and best practices for promoting inclusive education. Students in this course will develop the habits of ongoing training and

professional development to support the variety of student needs in inclusive general education classes.

Learning Outcomes: 1. Describe shared instructional responsibility and the roles of school personnel who support the educational needs of students with disabilities. 2. Provide equitable access to and participation in the general curriculum for students with disabilities. 3. Know where to access current educational research that informs practice in the field. 4. Understand their responsibility for implementing IEP's. 5. Understand school policies regarding special education including those regarding referral, assessment, eligibility, and services for students with disabilities. 6. Understand when to consult with others who possess specialized expertise. 7. Understand students who have disabilities within the broader context of their families, cultural backgrounds, socioeconomic classes, languages, communities and peer/social groups. 8. Reflect on practices. Credits: 3.00

EDPS 42100 - Supporting Exceptional Learners: Social Studies And Science

Credit Hours: 3.00. This course is designed to prepare special educators to deliver social studies and science content to children and adolescents with disabilities across PK-12 settings. It will also prepare special educators to make programmatic and instructional decisions related to least restrictive environment, appropriate educational supports, assistive technology, accommodations, and modification specific to science and social studies instruction. This course includes assignments that will be linked to EDPS 46100 the Special Education Student Teaching Residency.

Learning Outcomes: 1. Use knowledge of general and specialized social studies curricula to individualize learning for individuals with exceptionalities. 2. Use knowledge of general and specialized science curricula to individualize learning for individuals with exceptionalities. 3. Use strategies to enhance language development and communication skills of individuals with exceptionalities across social studies and science content area. Credits: 3.00

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal

philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 44100 - Introduction To Ethics And Practice Of Applied Behavior Analysis

Credit Hours: 3.00. This course is the final course in the Applied Behavior Analysis pathway for undergraduates in teacher licensure programs and is also part of the course content required to become a Board Certified Assistant Behavior Analyst (BCaBA). This course will address the professional and ethical responsibilities of behavior analysts. Key issues of responsible conduct as it relates to areas such as confidentiality, consent, consultation, treatment planning, and research will be discussed and applied through case studies. Learners will be able to consider ABA techniques within the bounds of both legal and ethical frameworks.

Learning Outcomes: 1. Demonstrate understanding of BACB guidelines for the responsible conduct of applied behavior analysis. 2. Discuss scenarios involving ethical issues and describe appropriate solutions using BACB guidelines. 3. Identify appropriate ethical practices in ABA research. 4. Demonstrate understanding of empirically validated practices vs pseudoscience and non-validated practices within the context of service delivery. Credits: 3.00

EDPS 44200 - Advanced Intervention In Applied Behavior Analysis

Credit Hours: 3.00. This course is one of four courses in the Applied Behavior Analysis pathway for undergraduates in teacher licensure programs and is also part of the course content required to become a Board certified Assistant Behavior Analyst (BCaBA). This course will provide fundamental knowledge and experiences for understanding instructional and behavior interventions grounded in the principles of Applied behavior Analysis including a pivotal response training, functional communication training, video modeling, self-management, social skills training, and augmentative and alternative communication (AAC). Students learn procedures to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. Students will also learn strategies for consultation with other service providers as well as practices for effective supervision of others such as paraeducators.

Learning Outcomes: 1. Identify, distinguish between, and provide examples of core (basic and advanced) concepts and principles in the field of behavior analysis. 2. Describe the concepts of motivating operations and stimulus control and demonstrate application to instruction. 3. Demonstrate procedures for implementing functional communication training and describe the principles of ABA involved. 4. Describe processes and demonstrate procedures for implementing a variety of instructional strategies including pivotal response training, peer mediating learning, video modeling, augmentative and alternative communication, social skills training. 5. Describe strategies and procedures for implementing group contingencies. 6. Describe and demonstrate how to implement self-management programs. 7. Synthesize procedures for supervising implementors (e.g. paraeducators) through implementation of ABA strategies including behavior skills training. 8. Discuss strategies for consulting with other school and community-based providers including parents. Credits: 3.00

EDPS 45200 - Global Studies Seminar

Credit Hours: 1.00. (EDCI 45200) The course builds on students' international cross-cultural experiences, particularly Study Abroad. The course is required for those wishing to complete the Global Studies minor in the College of Education.

Learning Outcomes: 1. Discuss economic, social, and cultural diversity within a global context. 2. Describe the cultural, social and historical dynamics that influence individuals and groups. 3. Explain the perspective of the culture of another country through the study of

world languages, arts, spiritual traditions, mythology/literature, and/or through study abroad. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. 5. Clearly communicate a central message with the supporting materials. Credits: 1.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

EDPS 45901 - Assistive Technology (UCC: STS)

Credit Hours: 1.00. This course explores the use of Universal Design for Learning as a framework for Differentiated Instruction. Additionally, this course addresses the use of Augmentative and Alternative Communication and Assistive Technology by individuals with disability requiring mild, moderate, and intense intervention.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the principals of UDL as a framework for differentiated instruction. 2. Understand the legal and ethical issues regarding UDL, Differentiated Instruction, AAC, and AT. 3. Assess individuals with disability for appropriate technology services and devices. 4. Demonstrate data-based decision-making to differentiate instruction and/or identify appropriate technology of a target learner requiring mild, moderate, or intense intervention. Credits: 1.00

EDPS 46000 - Strategies For Teaching Individuals With Mild And Moderate Disabilities Primary & Elementary Grades

Credit Hours: 3.00. This course is designed to prepare future special educators to plan and provide content area instruction in the core content areas to primary and elementary students with mild and moderate disabilities. Course content will include information on assessment, instructional design, and development of individualized education programs, research-based practices for promoting academic and behavioral growth, and content area literacy and numeracy, and your professional role as a teacher of students with mild disabilities. This course has a required concurrent enrollment in EDPS 46100.

Learning Outcomes: 1. Identify the legal requirements of academic goals and learning supports within individualized education plans (IEPs) and demonstrate understanding of assessment and monitoring procedures necessary to evaluate student progress. 2. Identify the principal instructional arrangements common to P-6 settings for students with mild disabilities, how the arrangement impacts classroom organization, and how to modify the arrangement to meet individual student needs. 3. Identify the common characteristics of evidence-based behavioral and instructional strategies implemented in P-6. These include class-wide (Tier 1) and targeted (Tier II) interventions. 4. Produce standards-based lesson plans for literacy and numeracy that incorporate evidence-based practices, classroom resources (e.g., peer and paraprofessional), and technological supports for use with students who have diverse learning differences. 5. Distinguish between accommodations, modifications, and interventions within the assessment, teaching and IEP development process. Credits: 3.00

EDPS 46100 - Practicum In Strategies For Teaching Individuals With Disabilities

Credit Hours: 1.00 to 6.00. Practicum experience in assessment and teaching of individuals with disabilities. Experience in design, delivery, implementation, and evaluation of instruction. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A and B.

Learning Outcomes: 1. Provide instruction that is responsive to student differences and

promotes development and learning for all students. 2. Match expectations to the unique characteristics, abilities, developmental levels, and behavior of students. 3. Identify characteristics of students with disabilities and design classroom accommodations. 4. Adjust instruction according to student needs and performances. 5. Use a variety of evidence-based instructional strategies. 6. Plan and deliver standards-based, data-driven differentiated instruction that actively engages students in the learning process. 7. Demonstrate an appreciation and concern for students as individuals and interact with them in positive ways that encourage and teach appropriate behavior. 8. Model effective use of language. 9. Demonstrate effective classroom and behavior management and establish a positive, productive, and safe learning environment with high expectations for all students. 10. Integrate instructional technology by creating instructional materials, delivering instruction using technology, or encouraging student use of technology in assignments. 11. Reflect on practices. 12. Engage in professional development activities to remain current with best practices. 13. Collaborate effectively with colleagues, parents, and others to increase the effectiveness of instruction and engage in professional growth. Credits: 1.00 to 6.00

EDPS 46300 - Teaching Individuals With Severe Disabilities

Credit Hours: 3.00. Education of individuals with severe or multiple disabilities. Application of innovative technology, design of individual educational programs, strategies and methods for instruction, evaluation of instruction, community-based instruction, generalization and maintenance of skills. Admission to Teacher Education Program, passage of Gate A required.

Learning Outcomes: 1. Demonstrate the knowledge of the various aspects of trial management. 2. Demonstrate the knowledge of the ability to record, graph, and interpret ongoing data of student performance. 3. Demonstrate the knowledge of the ability to apply the principles of learning and strategies of instruction. 4. Demonstrate the knowledge of the components of community referenced curriculum and community-based instruction. 5. Demonstrate the knowledge of the inclusionary/collaborative strategies for students with severe disabilities. Credits: 3.00

EDPS 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDPS 49100 - Topics And Issues In Education

Credit Hours: 1.00 to 3.00. Provides student with opportunity to strengthen preparation through study of selected educational topics and issues based upon individual needs and interests. One topic is considered in each enrollment.

Credits: 1.00 to 3.00

EDPS 49500 - Practicum In Gifted Education

Credit Hours: 3.00. The Practicum in Gifted, Creative, and Talented (GCT) Education is designed to be the culminating experience for those who are pursuing the GCT pathway as part of their teacher education undergraduate licensure program, with or without Indiana licensure. The overall goal of the course is derived from Standard 6 of the NAGC-CEC Teacher Preparation Standards in Gifted and Talented Education. Includes experiential learning. Required for those seeking GCT pathway in teacher education.

Learning Outcomes: 1. Develop as reflective practitioners who set and evaluate their progress toward personal goals for professional growth. 2. Create professional networks that can be sustained beyond the practicum experience. 3. Practice continuous improvement in teaching gifted, creative, and talented students. 4. Demonstrate the key ideas, standards, guiding principles, theories, models, and instructional strategies learned in EDPS 24000, 24800, 54200, & 54500. 5. Formalize philosophies of and personal identities as practitioners of GCT education. Credits: 3.00

EDPS 49800 - Supervised Teaching- Special Education (UCC: OC)

Credit Hours: 1.00 to 16.00. A student planning to enroll in EDCI 49600, EDCI 49800, EDCI 49900; EDPS 49800, EDPS 49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A, B, and C.

University Core Curriculum (UCC): (UCC: OC)

Credits: 1.00 to 16.00

EDPS 49900 - Supervised Teaching Or Practicum In Endorsement Area

Credit Hours: 3.00 to 9.00. A student planning to enroll in EDCI 49600 , EDCI 49800 , EDCI 49900; EDPS 49800 , EDPS 49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in an endorsement area in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. completion of education courses required for the endorsement area and admittance to teacher education program.

Credits: 3.00 to 9.00

EDPS 50000 - Group Counseling Theories And Techniques

Credit Hours: 3.00. Theoretical and experiential overview of fundamental elements of group work and group counseling processes. Broad topics include purposes and types of groups, therapeutic factors and stages of leadership skills, and multicultural, ethical, and legal aspects of group counseling.

Learning Outcomes: 1. Differentiate among various types and purposes groups and specializations in group work. 2. Identify the essential group dynamics involved in understanding group interactions. 3. Develop an understanding of the principles and challenges associated with planning a group intervention. 4. Develop an understanding of the principles and challenges associated with implementing a group intervention such as recruitment, therapeutic factors, and developmental stages of group. 5. Compare and contrast different perspectives on group leadership. 6. Examine and discuss the ethical considerations unique to group work. 7. Acquire knowledge regarding diversity-competent group practice. 8. Evaluate empirical findings associated with group work. 9. Consider various approaches to evaluating group processes (e.g., program evaluation) and the outcome of group work. Credits: 3.00

EDPS 50001 - Foundations Of Online Learning

Credit Hours: 1.00. This course is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Online MSEd in Special Education program, with a focus on the process of completing University and Program specific requirements. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies.

Learning Outcomes: 1. Learn the specifics of the Online MSEd in Special Education program and its requirements. 2. Familiarize themselves with resources, review targeted learning competencies, and program requirements.

Credits: 1.00

EDPS 50002 - Foundations Of Licensure

Credit Hours: 1.00. This course is designed to guide candidates to complete required documents needed to determine appropriate clinical practice placement(s) for candidates within unique employment situations. This course includes two process applications required of all employed candidates: 1) Clinical Practice Pre-Application Process and 2) Clinical Practice Application Process.

Learning Outcomes: 1. Participate in specific Online MSEd in Special Education Program Clinical Practice Placement requirements.

Credits: 1.00

EDPS 50100 - Introduction To School Counseling

Credit Hours: 3.00. Presents an overview of counseling in elementary, middle, and secondary schools. Treats the history

of school counseling, developmental characteristics and problems of students, and counseling program elements and issues.

Learning Outcomes: 1. Articulate fundamentals of counseling in general and school counseling in particular, as well as skills and role of the school counselor. 2. Articulate basic history and current trends in school counseling. 3. Identify ways for school counselors to serve as change agents in the school culture and climate, as well as incorporate multicultural understandings into conceptualizing school counseling programs. Credits: 3.00

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 50700 - Counseling Multicultural And Diverse Populations

Credit Hours: 3.00. Counseling strategies for multicultural and diverse populations encountered by helping professionals. Among the populations considered are ethnic and cultural minorities, older persons, the gifted, and the disabled.

Learning Outcomes: 1. Examine how social and cultural factors influence the counseling relationship and are reflected in counseling theory and practice. 2. Develop strategies for working with diverse individuals, couples, families, groups, and communities. 3. Develop an awareness of multicultural and pluralistic trends, including characteristics and concerns of specific socially and culturally diverse groups. 4. Examine ethical and legal issues related to counseling diverse populations. Credits: 3.00

EDPS 50701 - Foundational Techniques For Telemental Health Providers

Credit Hours: 3.00. The purpose of this course is to provide a broad overview of individual therapy with adults via telemental health using a videoconferencing platform. Within this course, students will develop general, foundational knowledge related to pre-screening adults for individual therapy, conducting intakes with adult clients, engaging in individual therapy sessions with adult clients, terminating with adult clients, and managing risk with adult clients. Additionally, this course offers a brief overview of telemental health therapy with children, couples, families, and groups. This course is taught in an asynchronous manner and uses various strategies to facilitate student learning, which include: discussion boards, case studies, role plays, self-assessment papers, and pre-recorded lectures with associated PowerPoint slides. Access to necessary technology resources which includes but is not limited to: stable internet access, Brightspace, a telemental health or associated platform, and a computer, is required to complete the course.

Learning Outcomes: 1. Acquire basic knowledge for telemental health technologies/platforms. 2. Learn the basic function and operations of telemental health technologies/platforms. 3. Obtain an understanding of telemental health technologies' strengths and limitations. 4. Become familiar with the primary ethical considerations for telemental health practice. 5. Learn ethical considerations associated with telemental health practice. 6. Identify ethical considerations that are unique to telemental health practice as compared to in-person, face-to-face clinical practice. 7. Be encouraged to research and learn basic telemental health practice guidelines and laws for their associated profession and state-of-practice, respectively. 8. Learn about effective utilization of telemental health technologies/platforms for individual therapy with adults. 9. Acquire foundational

knowledge in conducting an effective pre-screening appointment for potential individual therapy clients with telemental health. 10. Become knowledgeable in how to use basic clinical skills within individual therapy via telemental health. 11. Learn about the termination and referral processes when working within telemental health. 12. Know how to address unexpected and unique issues associated with telemental health (e.g., loss of connectivity). 13. Able to successfully implement essential, foundational clinical skills within a telemental health technology/platform. 14. Engage in active discussion via online discussion boards regarding the application of clinical skills within telemental health. 15. Engage in active practice and application of foundational clinical skills as related to telemental health (i.e., role plays). 16. Foster self-awareness of their strengths and areas of growth regarding telemental health practice. 17. Work to identify their strengths and areas of growth regarding telemental health prior to learning course material. 18. Work to identify their newfound strengths and continued areas of growth regarding telemental health near completion of the course. 19. Learn risk management with adults via telemental health. 20. Learn how to address suicidality and homicidality in adults with telemental health practice. 21. Obtain introductory knowledge and skills in telemental health practice with couples, families, groups, and children. 22. Be provided with cursory knowledge regarding therapy with couples, families, groups, and children using a telemental health platform. Credits: 3.00

EDPS 50702 - Addressing Demographic Health Disparities In Telehealth

Credit Hours: 3.00. The practice of tele-mental health is expanding rapidly. This expansion reflects both increased opportunities afforded by technological advances within the healthcare field, as well as pressing needs to resolve persistent healthcare disparities associated with in-person services. As part of the Certificate in Telemental Health Counseling, this course will prepare students to take a systematic view of the challenges and opportunities of transitioning live practices to telehealth, by preparing students to Identify demographic telemental health disparities at local, national, and international levels; describe key barriers that produce demographic telemental health disparities; generate a telemental health access toolkit to address demographic disparities within a specific practice and/or field.

Learning Outcomes: 1. Identify demographic telemental health disparities at local, national, and international levels. 2. Explain the historical intersections across the fields of mental health, technology, and social justice. 3. Describe key barriers that produce demographic telemental health disparities. 4. Generate a telemental health access toolkit to address demographic disparities within your practice and field.

Credits: 3.00

EDPS 50703 - Introduction To Telemental Health Assessment And Intervention

Credit Hours: 3.00. As part of the Certificate in Telemental Health, this course will prepare students to take a systematic view of the challenges and opportunities of transitioning live practices to telehealth, by preparing students to apply intervention skills within a telehealth framework; identify key differences in telehealth procedures compared to in-person practice; apply skills for working with individuals, groups and families via telemental health processes and practices.

Learning Outcomes: 1. Consider and explain barriers and strengths of implementing various evidence-based practices in telemental health. 2. Effectively use strategies for implementing therapies via telemental health platforms. 3. Understand and utilize cognitive and behavioral interventions via telemental health platforms. 4. Understand the nuance of and deliver adherent

psychological assessment measures via telemental health platforms. Credits: 3.00

EDPS 50800 - Cultural And Linguistic Diversity In Special Education Programs

Credit Hours: 3.00. Living in a diverse society provides special education teachers and support personnel the opportunity to encounter a wide array of cultures in their educational settings. The course, designed for special education stakeholders (i.e., teachers, staff, support personnel, administrators), considers issues of human diversity, broadly defined to include ability, ethnicity, culture, gender identity, linguistic background, race, religion, socioeconomic status, and sexual orientation. This course challenges biased assumptions that influence the provision of educational services, and examines issues related to promoting equal learning opportunities in the classroom and other educational settings. It is designed to facilitate student examination of how diversity and diverse experiences shape systems that affect individuals, families, communities, and society. It allows students to explore their own cultures and the biases and internalized messages about those who are different from themselves. Students will be introduced to specific approaches to practice, and frameworks for equity, advocacy, and empowerment to support students who receive special education and/or applied behavior analysis (ABA) service, as well as their families. The course also includes information and discussion topics pertaining to the culturo-behavior science (CBS) specialization of the Association for Behavior Analysis International (ABAI) and to interpersonal communication skills - to include speaking, listening, reading, and writing - and their effect on students and families. Permission of instructor required.

Learning Outcomes: 1. Demonstrate a conscious awareness and working knowledge of diverse populations within education settings. 2. Demonstrate the knowledge to create safe, inclusive, culturally responsive learning environments and classroom management systems. 3. Demonstrate the ability to identify funds of knowledge and how they interact to form meaningful relationships with students and families. 4. Engage with others around identity and difference, and apply self-awareness to identify and manage the influence of personal biases and values in working in diverse settings. 5. Analyze and interpret historical and contemporary dynamics of privilege and oppression in society that lead to inequalities in access to educational resources. 6. Analyze, evaluate, and propose solutions to contemporary social problems found in schools, school districts, and ABA settings (E.g., culturally responsive PB IS, restorative justice, etc. 7. Implement strategies that encourage students' to value their own heritage; value richness of cultural diversity and commonality; respect diverse cultural groups; and reduce stereotyping. Credits: 3.00

EDPS 51500 - Foundations Of Applied Behavioral Analysis In School Settings

Credit Hours: 3.00. Application of learning theory, measurement procedures, verification of functional relationships, and developing knowledge of current significant research in applied behavior analysis.

Learning Outcomes: 1. Introduced to specific methods and teaching strategies for working with children with emotional and behavioral disabilities. 2. Prepared to systematically monitor student performance. 3. Prepare teachers to devise and implement usable functional behavior analysis and behavior management plans for students with emotional and behavioral disabilities. Credits: 3.00

EDPS 52000 - Characteristics Of Students With Intense Intervention Needs

Credit Hours: 3.00. EDPS 52000 will explore typical and atypical human development, characteristics and etiologies, as well as the influence of cultural, linguistic, and socioeconomic factors of students with intense intervention needs. Candidates will study medical conditions, physical and health needs, common medications, and the importance of transition plans, health-care plans, and behavioral and academic intervention plans designed to help students with intense intervention needs achieve desired positive learning outcomes. Candidates will be introduced to AAC systems, technology, materials, and other resources to support and enhance the communication skills of students with intense intervention and English learning needs. This course will also explore strategies for using digital tools and resources to communicate and collaborate with students, families, general education teachers, related service providers, paraprofessionals, community agencies, and other stakeholders to help students with mild disabilities achieve desired positive learning outcomes. In addition, candidates will analyze relationships across theory and practice, multiple perspectives and trends, and the application of these relationships within educational settings.

Candidates will explore major theories and concepts related to

online learning, virtual instruction, twenty-first-century skills, information literacy skills, and the diverse perspectives of online students and develop strategies for effectively integrating technologies into teaching and learning, discuss the benefits and challenges of technologies as educational tools, and apply technologies to meet a variety of learning purposes and needs. Learning Outcomes: 1. Recognize typical and atypical human development, characteristics and etiologies in order to address the educational needs of individuals with intense disabilities. 2. Apply knowledge of the effects of medical conditions, physical and health needs, and common medications (e.g., stimulant, antidepressant, antiepileptic) on students with intense exceptional needs. 3. Analyze the impact of disability on the multiple aspects (education, career, vocation, social relationships, recreation, and adult life) of the life of an individual with intense intervention needs, including the knowledge of the family's role in supporting learning and development. 4. Explain the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals with intense intervention needs from diverse groups. 5. Maintain a safe and healthy learning environment by utilizing universal precautions, applying appropriate body mechanics to ensure safety in transferring, lifting, positioning, and seating, and implementing specialized health-care interventions for students with intense physical and health needs. 6. Apply appropriate techniques for physical positioning, and maintain educational and assistive technologies to facilitate the learning of students with intense intervention needs. Credits: 3.00

EDPS 52400 - Effective Instruction For Students With Significant Reading Difficulties

Credit Hours: 3.00. This course will explore significant reading difficulties, such as dyslexia, and essential components of effective reading instruction. This course will investigate scientifically-based reading research (SBRR), evidence-based and developmentally appropriate reading instruction and interventions to support students with exceptionalities. Learning Outcomes: 1. Identify the foundations of language acquisition and literacy development, including cognitive, linguistic, cultural, social, and motivational factors that affect language acquisition and literacy development; and major components of reading development, including phonemic awareness, phonics, fluency, vocabulary, and text comprehension. 2. Explore the history, origins, and underlying causes of significant reading difficulties, including dyslexia. 3. Synthesize principles of scientifically based reading research (SBRR) and evidence-based reading instruction and intervention, such as applying data-based decision making, setting individual student learning goals, and using instruction grounded in SBRR. 4. Explain key concepts of phonemic awareness: the critical role of phonemic awareness in learning to read an alphabetic language; the distinction between phonological awareness (i.e., the awareness that oral language is composed of smaller units, such as spoken words and syllables) and phonemic awareness (i.e., a specific type of phonological awareness involving the ability to distinguish the separate phonemes in spoken words); and knowledge of the continuum of phonological- and phonemic-awareness skills development. 5. Summarize key concepts of phonics in developing accurate decoding and automaticity in word recognition; the importance of sequencing phonics instruction according to the increasing complexity of linguistic units; the reciprocity between decoding and encoding; and the continuum of phonics skills. 6. Create SBRR-based, evidence-based, and developmentally appropriate assessment, instruction, intervention, or extension lesson plan, and ongoing progress monitoring in phonemic awareness, phonics, fluency, vocabulary and academic language,

comprehension and analysis of informational, persuasive, and literary texts, including response to literature. Credits: 3.00

EDPS 52700 - Literacy Curricula For Learners With Exceptionalities

Credit Hours: 3.00. This course will explore research-supported general and specialized literacy curricula to prepare candidates to design and/or adapt instructional lessons and materials to meet the needs of students with exceptionalities.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 2. Evaluate research-supported instructional strategies and materials appropriate to the strengths, needs, and characteristics of students with exceptionalities within the areas of literacy development, reading fluency, concepts of vocabulary and academic language, and comprehension and analysis of informational, persuasive, and literary text. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and the students' learning environment. 4. Create lesson plans, based on national, state, and/or local curricula standards and the scope and sequence of grade-level/chronologically-aged appropriate general education content-area curriculum that incorporate UDL, research-supported instructional strategies and materials, and provide meaning-filled learning opportunities. 5. Design lesson plans that incorporate UDL and apply research-supported strategies to provide specially designed reading and writing instruction, including strategies for providing explicit and systematic instruction and strategies for using technology to support various aspects of the reading and writing process and include instructional and assistive strategies to teach students to monitor errors in reading comprehension and writing. 6. Evaluate instruction, monitor progress, and make instructional changes to support student learning. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53100 - Introduction To Measurement And

Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

EDPS 53600 - Achievement Motivation And Performance

Credit Hours: 3.00. Study of current theory and research on the nature and development of achievement motivation. Motivation for intellectual and academic performance will be emphasized. Applications of theory in educational settings will be considered.

Credits: 3.00

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54100 - Identification And Evaluation In Gifted Education

Credit Hours: 3.00. This course provides an introduction to the instruments and procedures for identifying gifted, creative, and talented students, as well as the issues and procedures for evaluating gifted programs and individual student progress.

Learning Outcomes: 1. Demonstrate skills in assessing the evaluability of a gifted program. 2. Develop an evaluation plan that reflects understanding of key issues in gifted program evaluation. 3. Develop a figted program evaluation plan that demonstrates a utilization focus. 4. Demonstrate scholarly behaviors in exploring an interest linked to course content. 5.

Analyze key issues in selecting a student for gifted program participation and monitoring growth. Credits: 3.00

EDPS 54200 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to the curriculum development and program design for meeting the needs of gifted, creative, and talented students. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students.

Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 54700 - Foundations And Principles Of Applied Behavior Analysis

Credit Hours: 3.00. This course will provide a historical perspective of Applied Behavior Analysis as well as the core principles of ABA. The learner will be exposed to the foundational concepts and methods of ABA including defining behaviors, collecting data, and understanding the three-term contingency of behavior. Permission of instructor required.

Learning Outcomes: 1. Identify and define the basic concepts of applied behavior analysis including the foundations of ABA, interrelated domains, and dimensions of ABA. 2. Identify factors to consider when selecting target goals including client and environmental factors. 3. Define behavior utilizing observable and measurable terms including all components of an appropriate behavior goal. 4. Identify measurable dimensions of behavior and appropriate measurement procedures, including advantages and disadvantages of each. 5. Construct and interpret graphic displays of behavioral data. 6. Describe the key components of visual analysis and a strong experimental design including interobserver agreement and treatment fidelity. 7. Define reinforcement and punishment including application procedures, schedules of delivery, and key considerations. 8. Identify the types of preference assessments including similarity and differences in procedures. Credits: 3.00

EDPS 54800 - Ethics And Professional Practice Of Applied Behavior Analysis

Credit Hours: 3.00. This course will address the professional and ethical responsibilities of behavior analysts. Key issues of responsible conduct as it relates to areas such as confidentiality, consent, consultation, treatment planning, and research will be discussed and applied through case studies. Learners will be able to apply ABA techniques within the bounds of both legal and ethical frameworks. Permission of instructor required.

Learning Outcomes: 1. Demonstrate understanding of BACB guidelines for the

responsible conduct of applied behavior analysis. 2. Discuss scenarios involving ethical issues and describe appropriate solutions using BACB guidelines. 3. Identify appropriate ethical practices in ABA research. 4. Demonstrate and describe methods used to protect client/student confidentiality. 5. Demonstrate understanding of empirically validated practices vs. pseudoscience and non- validated practices within the context of service delivery. Credits: 3.00

EDPS 54900 - Verbal Behavior And Social Communication

Credit Hours: 3.00. This course will explore the development of verbal and social behavior as explained through tenets of applied behavior analysis. Students will identify the similarities and differences between verbal operants as well as appropriate function-based interventions to develop each including augmentative communication systems and functional communication training. Measurement and intervention for more complex social-communication skills will also be addressed. Permission of instructor required.

Learning Outcomes: 1. Understand and describe the historical perspective of Verbal Behavior in relation to Applied Behavior Analysis including differences between structural and functional approaches. 2. Describe verbal behavior in terms of the three term contingencies. 3. Define, describe, and differentiate the basic verbal operants. 4. Assess, interpret results and develop appropriate treatment plan to address target skills utilizing the VB-MAPP. 5. Identify and describe evidence-based practices for addressing communication for individuals with complex communication needs 6. Identify and describe evidence-based practices for increasing social-communication skills including intraverbal and listener behaviors. 7. Summarize and critically evaluate research on verbal and communication interventions for individuals with disabilities. Credits: 3.00

EDPS 55000 - Behavioral Consultation And Systems Change

Credit Hours: 3.00. This course will address the provision of behavioral analytic services through consultation within an implementation science framework. Application of ABA principles to evaluate and address system change will be explored including application of behavioral skills training. Techniques for program evaluation, collaborative planning, and progress monitoring will be discussed. Permission of instructor required.

Learning Outcomes: 1. Develop an understanding of implementation science frameworks and stages. 2. Describe, analyze, synthesize, evaluate and discuss factors that influence implementation of evidence-based practices. 3. Understand consultation theory and its application for decision-making in educational and family contexts. 4. Apply problem-solving techniques in collaborating with professional colleagues, parents and related personnel to provide for students' learning needs. 5. Articulate key principles of behavioral skills training and coaching. 6. Communicate the principles of behavior analysis in nontechnical language. Credits: 3.00

EDPS 55100 - Practicum In Applied Behavior Analysis

Credit Hours: 3.00. University-supervised fieldwork in applied behavior analysis. This practicum will facilitate development and fluency of essential professional and ethical skills necessary for the delivery of high-quality ABA services. Permission of instructor required.

Learning Outcomes: 1. Conduct assessment to determine the need for ABA services and guide intervention decision-making. 2. Design, implement, and monitor applied behavior interventions designed to increase or reduce target behaviors. 3. Explain, both verbally and in writing, behavioral analytic techniques, in technical and non-technical language appropriate for the audience. 4. Consult with and provide behavior skills training for behavior-change agents responsible for carrying out ABA program. 5. Demonstrate ability to analyze the incorporate findings from research into applied settings. Credits: 3.00

EDPS 55200 - Basic Concepts Of Applied

Behavior Analysis

Credit Hours: 3.00. This course is the first in a sequence of courses for the Applied Behavior Analysis Certificate Program. This course, in combination with the other courses, will provide fundamental knowledge and experiences for understanding Applied Behavior Analysis principles, concepts, and techniques, including observational analysis, data-based instruction, and social validity to increase students' social and task related behavior. Students learn procedures to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. Permission of instructor required.

Learning Outcomes: 1. Identify the goals of behavior analysis as a science (i.e., description, prediction, control) (A-1). 2. Explain the philosophical assumptions underlying the science of behavior analysis (e.g., selectionism, determinism, empiricism, parsimony, pragmatism) (A-2). 3. Describe and explain behavior from the perspective of radical behaviorism (A-3). 4. Distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis (A-4). 5. Describe and define the dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968) (A-5). 6. Define and provide examples of behavior, response, and response class (B-1). 7. Define and provide examples of stimulus and stimulus class (B-2). 8. Define and provide examples of respondent and operant conditioning (B-3). 9. Define and provide examples of positive and negative reinforcement contingencies (B-4). 10. Define and provide examples of schedules of reinforcement (B-5). 11. Define and provide examples of positive and negative punishment contingencies (B-6). 12. Define and provide examples of automatic and socially mediated contingencies (B-7). 13. Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers (B-8). 14. Define and provide examples of operant extinction (B-9). 15. Define and provide examples of stimulus control (B-10). 16. Define and provide examples of discrimination, generalization, and maintenance (B-11). 17. Define and provide examples of motivating operations (B-12). 18. Define and provide examples of rule-governed and contingency-shaped behavior (B-13). 19. Define and provide examples of the verbal operants (B-14). 20. Define and provide examples of derived stimulus relations (B-15). Credits: 3.00

EDPS 55300 - Application Of Applied Behavior Analysis To Manage And Support Personnel

Credit Hours: 3.00. This course will teach students how to use applied behavior analysis to maximize the potential of an organization. Students will learn the role of a Behavior Analyst in implementing principles of applied behavior analysis to motivate employees, intervene with challenges in the organization, evaluate the program, and collect and deliver ongoing performance feedback. Permission of instructor required.

Learning Outcomes: 1. Define Organizational Behavior Management (OBM) and explain how it differs from other management approaches. 2. State three specialty areas of application of OBM. 3. Define Pinpoint and state the four components of behavior pinpointing. 4. Describe methods and tools for measurement in OBM. 5. Describe types of analysis in OBM. 6. State common intervention procedures used in organizations. 7. Apply OBM knowledge to assess targeted concern(s) and provide recommendations within an organization. 8. State characteristics of effective feedback. 9. Describe steps for evaluating reinforcers and delivering reinforcers. 10. Describe tools for evaluating performance change. Credits: 3.00

EDPS 55400 - Positive Learning Environments And Classroom Management

Credit Hours: 3.00. This course will focus on classroom PBIS practices to create positive learning environments (online and face-to-face), establish classroom expectations, and develop academic and behavioral routines to meet the social, emotional, and behavioral needs of students with exceptionalities. EDPS 55400 will support candidates as they develop classroom practices that are positive and preventative in nature and align to larger school and district positive behavioral supports.

Learning Outcomes: 1. Identify types, characteristics, strengths, limitations, and evaluate theoretical approaches and research-based models of behavior intervention, motivation, and reinforcement techniques used with students with exceptionalities. 2. Analyze how teacher attitudes and behaviors can affect students with and without disabilities and the ability to apply strategies for developing and maintaining rapport with all students. 3. Evaluate strategies for creating a safe, positive, equitable, and supportive classroom climate and apply those strategies to plan, manage, and modify the learning environment, including effective classroom routines. 4. Evaluate strategies to encourage students' active participation, meaningful engagement, and independent in individual and group activities, across learning environments. 5. Analyze barriers to accessibility (e.g., physical, technological) and apply strategies for adapting the environment to meet individual needs. 6. Create a plan to incorporate the use of paraeducators, volunteers, and/or tutors within the classroom environment. Credits: 3.00

EDPS 55500 - Differentiating Curriculum & Instruction

Credit Hours: 3.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online class meetings and discussions, case studies, differentiated instruction examples, direct application, and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative, and summative assessments to inform instructional decision-making; and c) flexible grouping; addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn and are motivated; understanding that the process of differentiation involves modifying content, process, product, learning environment, and/or affect; incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development; understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (RTI), and Multi-Tiered System of Support (MTSS).

Learning Outcomes: 1. Deconstruct the concept of differentiation as a response to the readiness levels; interests; learning preferences and strengths; and academic, social, emotional needs of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Assess students' readiness, interests, and learning profiles to create differentiated lessons that utilize instructional strategies and technologies that motivate and engage students in learning, including those from special populations. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and your plan to implement differentiation knowledge and skills gained in this course. Credits: 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to

analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills by taking advanced quantitative methods courses. Credits: 3.00

EDPS 55800 - Transition Education And Services

Credit Hours: 3.00. This course will explore a variety of resources, strategies, and techniques for promoting successful life transitions for students with mild and intense intervention needs before and throughout the school years and into postsecondary and adult settings.

Learning Outcomes: 1. Apply ethical guidelines, state and federal transition laws and policies (REPA 9.6, 9.7; CEC Int 1.1, 2.3: CEC Adv 2.2, 2.3, 3.3, 4.1, 5.1, 5.2, 6.1) 2. Evaluate state, school, and private resources (e.g. Individual Family Service Plans, Medicaid Waivers, Vocational Rehabilitation, Special Needs Trusts, Issues of Guardianship, Bureau of Developmental Disability Services) that promote successful life transitions (REPA 9.6, 9.7; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 3. Examine the rights, roles, and responsibilities of stakeholders and organizational resources concerning the transition process of students with exceptionalities (REPA 1.3, 1.4, 1.5, 9.6, 9.7; CEC Int. 1.1, 2.2, 2.3; CEC Adv 2.2, 2.3, 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 4. Create a transition-related lesson/activity to support positive, life-long transition outcomes (REPA 3.9, 9.2, 9.4, 9.5; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 5. Apply strategies to collaborate effectively with general education teachers, support staff, families and community/organizational resources to identify services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and promote positive transition outcomes. (REPA 4.6, 4.8, 9.3, 9.4, 9.5; CEC Int 1.1, 1.2, 2.3, 3.2, 4.2, 4.3, 5.2, 7.1, 7.2, 7.3; CEC Adv 1.1, 2.3, 3.2, 3.3, 4.2, 5.1, 5.2, 5.3, 6.2, 6.3, 7.1, 7.2, 7.3). 6. Apply strategies to support students with exceptionalities to develop and strengthen self-determination skills (REPA 7.8; CEC Int 1.1, 1.2, 2.1, 2.2, 2.3, 3.2, 5.2, 5.6, 6.1, 6.2; CEC Adv 1.1, 2.3, 3.2, 3.3,

3.4, 4.2, 5.1, 5.2, 6.2, 6.3). Credits: 3.00

EDPS 55900 - Introduction To The Experimental Analysis Of Behavior

Credit Hours: 3.00. This course introduces students to the theories, principles, and research conducted in experimental analysis of behavior (EAB). EAB began with highly controlled animal studies and has expanded to translational work with humans. Applied Behavior Analysis (ABA), the study of human behavior and the application of behavioral principles on socially significant behavior has evolved from EAB. Permission of instructor required.

Learning Outcomes: 1. Identify and analyze the major conceptual frameworks from the Experimental Analysis of Behavior (EAB). 2. Analyze areas of overlap between EAB and applied behavior analysis. 3. Apply the process of reading and extracting critical information from peer-reviewed empirical and conceptual papers in EAB. 4. Differentiate among the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. 5. Evaluate research methods used in EAB and how these are utilized to examine environmental determinants of behavior under experimental conditions. Credits: 3.00

EDPS 56010 - Clinical Practice I Experience: Practicum

Credit Hours: 1.00 to 6.00. This is a supervised clinical practice experience across two (2) special education settings, one at the elementary level (K-6) and a second experience at the secondary level (5-12) serving students with Mild and/or Intense Intervention Needs. These experiences take place over the course of 8-16 weeks depending upon availability and individual agreements with our partner district. These experiences are a coordinated effort between the Clinical Practice Coordinator, University Supervisor, and highly qualified, practicing Cooperating Teachers from both the elementary and secondary placements. Candidates assess, design and deliver lessons, manage student needs and behaviors, develop IEPs, integrate technology to support learning outcomes, collaborate with families and colleagues, and analyze the experience of facilitation a classroom and caseload of students. In addition, candidates will analyze relationships across theory and practice, multiple perspectives and trends, and the application of these relationships within educational settings. Candidates will explore major theories and concepts related to online learning, virtual instruction, twenty-first-century skills, informative literacy skills, and the diverse perspectives of online students and develop strategies for effectively integrating technologies into teaching and learning, discuss the benefits and challenges of technologies as educational tools, and apply technologies to meet a variety of learning purposes and needs.

Learning Outcomes: 1. Apply knowledge of instructional design to develop a series 3-5 lessons that include: observable and measurable instructional objectives, baseline assessment data, and plans that are incrementally appropriate to the learner and his/her ability to master the given content. 2. Apply knowledge and skills to develop an Individualized Education Program that is student centered, based on data, and collaborative. 3. Apply knowledge regarding principles of human behavior to analyze the ""function"" or the reason(s) behavior occurs and identify strategies to decrease inappropriate behaviors and increase appropriate behaviors. Credits: 1.00 to 6.00

EDPS 56300 - Data-Based Decision Making For Learners With Exceptionalities

Credit Hours: 3.00. Advanced procedures for educational assessment of exceptional individuals: norm-referenced and curriculum-based measurement, error analyses, and observational ratings. Adaptations and selections of tests for sensory impairments, behavioral styles, different intelligence levels and ages.

Learning Outcomes: 1. Apply terminology, theory, and the implications of measurement theory to select, administer, and score and interpret formal, informal, and/or curriculum-based assessment results for key stakeholders to make data-based decisions. 2. Apply principles of UDL to make decisions regarding selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 3. Apply knowledge of the referral and classification procedures and interpret, report, and communicate results to stakeholders via paper and/or digitally. 4. Evaluate eligibility (including students from culturally and/or linguistically

diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and evaluating individualized learning objectives), and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with exceptionalities. 5. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth. Credits: 3.00

EDPS 56400 - Mild Mental Handicaps: Historical Perspectives, Etiology, And Characteristics

Credit Hours: 3.00. Advanced study of persons with varying disabilities. Topics include: historical development; theoretical models; etiological factors; characteristics; assessment and intervention.

Credits: 3.00

EDPS 56500 - Math Curricula For Learners With Exceptionalities

Credit Hours: 3.00. This course will explore research-supported general and specialized math curricula to prepare candidates to design and/or adapt math lessons and instructional materials to meet the math needs of students with exceptionalities.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying math assessments to accommodate student(s) with exceptionalities, including students who are nonverbal, have intense intervention needs, or are English Learners. 2. Evaluate research-supported math instructional strategies and materials appropriate to the strength, needs, and characteristics of students with exceptionalities. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate students' math learning and the students' learning environment. 4. Create math lesson plans, based on national, state and/or local math curricula standards, and the scope of sequence of grade-level/chronologically-aged appropriate general education math curriculum that incorporate UDL, research-supported math instructional strategies and materials, and provide meaning-filled math learning opportunities that facilitate student's ability to make connections (e.g., learning mathematics in the context of cooking and art). 5. Create math lesson plans that incorporate UDL and apply research-supported strategies to provide specially designed mathematics instruction, including strategies for problems and meaning-filled math learning opportunities that facilitate students' ability to make connections (e.g., learning mathematics in the context of cooking and art). 6. Evaluate math instruction, monitor progress, and make instructional changes to support students' math learning. Credits: 3.00

EDPS 56510 - Collaboration And Transition Practices In Special Education

Credit Hours: 3.00. Three modules related to collaboration and transition practices in special education are addressed. Included are theoretical frameworks and assessment for consultation and collaboration involving paraeducators and families.

Learning Outcomes: 1. Understand consultation theory and its application for decision-making in special and general education contexts. 2. Recognize conditions that strengthen or inhibit effective use of collaborative consultation. 3. Exhibit self-understanding and constructive use of individual differences for school-based collaboration in culturally diverse settings. 4. Demonstrate skills in facilitating family partnerships with schools to serve student needs. 5. Apply communication skills of effective verbal and non-verbal communication,

listening, avoiding communication roadblocks, dealing with resistance, being appropriately assertive, and resolving conflicts. 6. Use problem-solving techniques in collaborating with professional colleagues, parents and related and ancillary personnel to provide for students' learning needs. 7. Develop self-assessment techniques and tools for evaluating and improving consultation, collaboration, and co-teaching skills. 8. Formulate strategies for co-planning and co-teaching to serve students' special needs. 9. Explain responsibilities and strategies for supervising and planning with paraeducators, and for initiating involvement of school administrators in collaborative efforts. 10. Demonstrate awareness of need for organizing interrelated agencies in their roles as providers of the array of services required for students' special needs. 11. Cite key legislation that has impacted career and transition programs and services for youth and adults with disabilities. (Standard 2) 12. Explain theories and stages of life-long career development and how they impact the career decision-making process for individuals with disabilities. (Standard 2) 13. Identify methods, strategies, and materials used for instruction to facilitate career education, including participation in the IEP process. (Standard 2) 14. Explain theoretical models on which family intervention is predicated. (Standard 2) 15. Demonstrate an understanding of the impact a child with a disability has on the family, family dynamics, coping strategies, finances, and family communication and interaction patterns (Standards 1, 2) 16. Identify and define issues and strategies related to empowerment, and self-advocacy that are crucial to the successful career development of individuals with disabilities. (Standards 2, 3) 17. Develop an awareness of community resources available in career transition planning for students with disabilities at the elementary, middle, and secondary levels. (Standard 2) 18. Discuss issues related to parental involvement in career development and the educational process for youth and adults with disabilities. (Standards 1, 3) 19. Identify and describe services, supports, and resources available in post-secondary and employment settings for youth and adults with disabilities. (Standard 2) 20. Identify and define the issues related to interagency collaboration in the career and transition planning process for youth and adults with disabilities. (Standard 2)

Credits: 3.00

EDPS 56600 - Graduate Supervised Teaching Special Education

Credit Hours: 1.00 to 16.00. Demonstration of ability to function independently in special education setting by appropriately planning for student needs, implementing and evaluating plans, establishing appropriate classroom discipline, and interacting professionally with staff and parents. Permission of instructor required.

Credits: 1.00 to 16.00

EDPS 56601 - Clinical Practice Experience II (Student Teaching)

Credit Hours: 1.00 to 6.00. This course is a supervised 16-week teaching experience in special education. Candidates assess, design and deliver lessons, manage student needs and behaviors, develop IEPs, integrate technology to enhance learning outcomes and communication, collaborate with families and colleagues, and analyze the experience of facilitating a classroom and caseload of students.

Learning Outcomes: 1. Create lesson plans that apply research-supported strategies for providing specially designed written language including strategies for providing explicit and systematic instruction and strategies for using technology to support various aspects of the writing process and include instructional and assistive strategies to teach students to monitor for errors in their written language in order to produce legible documents. 2. Create lesson plans that apply research-supported strategies for providing specially designed mathematics instruction, including strategies for providing

explicit and systematic instruction and strategies for using technology to engage students in solving authentic, real-world problems. 3. Create lesson plans that apply research-supported strategies for providing specially designed science and social studies instruction, including strategies for providing explicit and systematic instruction, strategies for using technology to support students' learning, and strategies for incorporating inquiry-based instruction. 4. Create and implement lesson plans that include essential components of effective reading instruction, including explicit explanation, teacher modeling, guided practice, and independent practice. 5. Create and implement lesson plans that incorporate instructional practices, approaches, and methods for eliciting students' engagement in and motivation for reading. 6. Evaluate SBRR-based, evidence-based, and developmentally appropriate assessment, instruction, intervention, extension, and ongoing progress monitoring in the phonemic awareness, phonics, fluency, vocabulary and academic language, comprehension and analysis of informational, persuasive, and literary texts, including response to literature. 7. Apply principles of universal design for learning (UDL) and adaptive and assistive technologies. 8. Conduct functional behavioral assessments and use the results to develop and implement behavioral support plans for students with mild/intense exceptional needs coordinating the implementation among stakeholders and identify strategies and procedures for crisis prevention and intervention to ensure the safety of all. 9. Apply strategies, Council for Exceptional Children (CEC) Code of Ethics, federal and state laws, and other standards of the profession for using digital tools and resources to communicate and collaborate with students with mild/intense exceptional needs and their families, general education teachers, related services providers, other school staff members, representatives of community agencies, and other stakeholders to help students achieve desired learning outcomes, including students from diverse cultural, linguistic, and socioeconomic backgrounds and students who are chronically or terminally ill. 10. Supervise and communicate with paraeducators, volunteers, and tutors. 11. Analyze self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth. Credits: 1.00 to 6.00

EDPS 56800 - Social, Legal, And Ethical Issues Across The Lifespan

Credit Hours: 3.00. Survey of difference and similarities of children with exceptionality, including their nature and characteristics related to their developmental and educational needs. Analysis and practical application of social, legal, and ethical issues in the field of special education.

Learning Outcomes: 1. Explain the historical perspectives and foundations of general and special education policy, current issues, and research (REPA 1.1, 1.2; CEC Int. 1.1; CEC Adv. 3.3, 4.2, 6.1). 2. Apply ethical guidelines, state and federal laws and policies, and utilize the rights, roles, and responsibilities of stakeholders and organizations concerning the education of students with exceptionalities (REPA 1.3, 1.4, 1.5; CEC Int. 1.1, 2.2; CEC Adv 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 3. Evaluate the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals from diverse groups. (REPA 2.8.; CEC Int. 1.2, 2.2; CEC Adv. 2.3, 3.2, 4.2, 5.2). 4. Examine the roles and responsibilities of team members (RtI,

multidisciplinary, Case Conference Committee (CCC), families, student) to facilitate in developing, implementing, monitoring, and amending individualized programs for students with exceptionalities (IEPs, transition plans, health-care plans, and behavioral and academic intervention plans) setting goals, and monitoring progress toward goal each grading period. (REPA 4.3, 4.4, 4.5; CEC Int. 2.1, 2.2, 2.3, 7.1; CEC Adv. 4.2, 5.3). 5. Evaluate eligibility (including students from culturally and/or linguistically diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and evaluating individualized learning objectives), and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with mild and/or intense exceptional needs. (REPA 4.1, 4.2, 4.7; CEC Int. 1.1, 1.2, 2.1, 2.3, 3.1, 3.2; CEC Adv 4.2, 5.1, 5.2). 6. Engage in professional development activities and professional organizations relevant to teaching students with exceptional needs, and knowledge of professional resources, organizations, and publications for enhancing one's professional skills and for engaging in lifelong professional development (REPA 10.4/10.5; CEC Int 1.2; CEC Adv. 5.4, 5.5, 6.4, 6.5). 7. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth (REPA 10.6/10.7; CEC Int 2.2, 2.3, 4.2, 5.1; CEC Adv. 6.3, 7.1). Credits: 3.00

EDPS 57100 - Advanced Assistive Technology

Credit Hours: 3.00. Introduction and overview of assistive technology for communication, education, employment, recreation, and daily living activities.

Learning Outcomes: 1. To learn about assistive technology for students with disabilities. 2. To learn about the integration of technology into teaching and learning within the field of special education. Credits: 3.00

EDPS 57300 - Medical And Physical Management Of Learners With Disability Or Chronic Illness

Credit Hours: 3.00. This course will explore instructional programs, interventions, services, and implications specific to independent living, career, education, and medical self-management procedures that support students with intense medical, physical, or chronic health care needs.

Learning Outcomes: 1. Apply knowledge of the effects of medical conditions, physical and health needs, and common medications (e.g., stimulant, antidepressant, antiepileptic) on students with exceptionalities. 2. Create a safe and healthy learning environment by utilizing universal precautions, applying appropriate body mechanics to ensure safety in the transferring, lifting, positioning, and seating, and implementing specialized healthcare interventions for students with physical and health needs. 3. Apply appropriate techniques for physical positioning and maintain educational and assistive technologies for facilitating student learning. 4. Apply knowledge of resources (model career, vocational, and transition programs), strategies, and techniques to promote positive life-long transition outcomes (school, postsecondary, adulthood) and self-management procedures for students with exceptionalities. Credits: 3.00

EDPS 57600 - Curricula For Learners With Intense Intervention Needs

Credit Hours: 3.00. This course will explore research-supported general and specialized content-area (reading, Math, Writing, Science, Social Studies) curricula as well as functional and independent skill curricula to prepare candidates to design and/or adapt instructional lessons and materials to meet the

needs of students with intense intervention needs.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying assessments to accommodate student(s) with intense intervention needs, including students who are nonverbal or English Learners. 2. Evaluate research-supported instructional strategies and materials appropriate to the strengths, needs, and characteristics of students with intense exceptional needs. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition, assessments, and assistive technology that facilitate student learning and the students' learning environment. 4. Create lesson plans, based on national, state, and/or local curricula standards and the scope and sequence of grade-level/chronologically-aged appropriate general education content-area curriculum (Reading, Math, Writing, Science, Social Studies) that incorporate UDL, research-supported instructional strategies and material, and provide meaning-filled learning opportunities that facilitate students' ability to make connections and generalize across settings. 5. Create lesson plant to provide specially designed functional skill instruction (explicit and systematic), that incorporates UDL, research-supported instructional strategies and materials, and provides meaning-filled learning opportunities to facilitate generalization across settings. 6. Evaluate instruction, monitor progress, and make instructional changes to support student learning. 7. Analyze a variety of language and communication strategies (AAC/Assistive Technologies) to increase functional communication. Credits: 3.00

EDPS 57701 - Development Of Learners With Mild Intervention Needs

Credit Hours: 3.00. This course will explore the 4 areas of child development and the milestones associated with Cognitive, Social/Emotional, Language and Communication, and Movement and Physical development. This foundation in typical development will allow candidates to better understand atypical development in relation to characteristics and etiologies of mild disabilities. Candidates will investigate the multiple impacts systems have on individuals with mild disabilities and their families.

Learning Outcomes: 1. Describe typical and atypical human development, characteristics and etiologies in order to address the educational needs of individuals with mild disabilities. 2. Apply knowledge of the effects of medical conditions, physical and health needs, and common medications (e.g., stimulant, antidepressant, antiepileptic) on students with mild exceptional needs. 3. Analyze the impact of disability on the multiple aspects (education, career, vocation, social relationships, recreation, and adult life) of the life of an individual with mile intervention needs, including the knowledge of the family's role in supporting learning development. 4. Explain the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals with mild intervention needs from diverse groups. 5. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with mild exceptional needs and their families to improve instruction, and to determine personal goals for professional growth. Credits: 3.00

EDPS 58900 - Special Topics For Teachers

Credit Hours: 1.00 to 4.00. Consideration of appropriate professional problems of experienced educational personnel in workshops or in-service programs.

Credits: 1.00 to 4.00

EDPS 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work.

Permission of instructor required.

Credits: 1.00 to 6.00

EDPS 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDPS 59200 - Principles & Philosophy Of Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to provide students with a working understanding of the conceptual framework of behavior analysis and the underlying theoretical and philosophical foundation of behavior analysis. The course will provide advanced coverage of the history, philosophical underpinnings, and advanced concepts and principles of behaviorism and behavior analysis. Permission of instructor required.

Learning Outcomes: 1. Identify and evaluate the goals of behavior analysis as a science. 2. Synthesize the philosophical assumptions underlying the science of behavior analysis. 3. Analyze behavior from the perspective of radical behaviorism. 4. Differentiate among the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. 5. Distinguish the dimensions of applied behavior analysis. Credits: 3.00

EDPS 60000 - Counseling Theories And Techniques

Credit Hours: 3.00. Examination of major counseling theories and counseling techniques, professional and ethical issues. Permission of instructor required.

Learning Outcomes: 1. Utilize theoretical approaches to individual personality, behavior, decision, and life difficulties in clinical settings with clients. 2. Develop and write case conceptualization through active application. 3. Ascertain how counseling theory informs counseling techniques. 4. Theoretically conceptualize client presentations based on the context of diversity-related strengths and limitations of counseling theory (i.e. age, ethnicity, disabilities, language, national origin, race, religion, sexual orientation, and SES).

Credits: 3.00

EDPS 60100 - Counseling Theories And Techniques Laboratory

Credit Hours: 3.00. Use of counseling techniques in a supervised laboratory; application of theories and techniques within varying employment settings. Concurrent Prerequisite: EDPS 60000 .

Learning Outcomes: 1. Identify counselor behaviors and characteristics that influence the helping process, including age, gender, ethnic differences, verbal and nonverbal behaviors, and personal characteristics, orientations, and skills. 2. Demonstrate essential interviewing and counseling skills, establishing appropriate counseling goals, designing intervention strategies, evaluating client outcomes, and successfully terminating the counselor-client relationship. Credits: 3.00

EDPS 60400 - Advanced Counseling Theories And Techniques

Credit Hours: 3.00. Integration of counseling theory, practice, and research. Emphasis on integrating counseling knowledge and skills with major counseling theories and interventions. Prerequisite: EDPS 60000 . Permission of instructor required.

Learning Outcomes: 1. Obtain knowledge of personality theories/concepts for conceptualizing client issues and designing interventions. 2. Understand the context and development of theories. Credits: 3.00

EDPS 60700 - Mixed Methods Research Designs And Applications

Credit Hours: 3.00. This course provides an overview of mixed methods research designs within social science and educational research. The focus of the course will emphasize the philosophical pragmatism embedded in enacting mixed methods research. Further, the course will demonstrate the utility and plausibility of integrating quantitative and qualitative data into a single study. This demonstration will be accomplished through reviewing the historical context of qualitative and quantitative research in social sciences and students' application of mixed methods research within their respective fields of study. Prerequisites: EDPS 53300, EDPS 55600, and EDPS 55700 and an introductory qualitative methods course (one of COM 58500, EDCI 61500, SOC 68600).

Learning Outcomes: 1. Understand the historical context of mixed methods research with specific attention to the epistemological

tenets of pragmatic research. 2. Recognize the use of mixed methods as researchers in your discipline implement these designs. 3. Describe the various mixed methods designs and explain how they are unique with respect to the timing of data collection, the prioritization (or lack thereof) of the phases in a mixed methods study, and the means of integrating data. 4. Comprehend the role of rigor in all phases of mixed methods research and critically digest mixed methods articles in the literature. 5. Develop skills to plan and conduct a mixed methods study in addition to writing a mixed methods study in the space limitations of academic journals. Credits: 3.00

EDPS 61000 - School Counseling Practicum

Credit Hours: 3.00. EDPS 61000 is a field experience for first year master's students in school counseling, consisting of a minimum of 100 hours in a school, under the supervision of both a site supervisor and a campus supervisor. Permission of instructor required. Prerequisites: EDPS 60000 and EDPS 60100 . Permission of instructor required.

Learning Outcomes: 1. Develop counseling competencies related to individual, small-group, and large-group interventions. 2. Increase knowledge of school settings, including organizational structure, processes, and mission. 3. Increase competence regarding articulating the role of the school counselor. 4. Increase awareness of legal and ethical concerns related to school counseling and to increase competence in ethical decision-making. Credits: 3.00

EDPS 61100 - School Counseling Seminar

Credit Hours: 3.00. Attention given to current topics, such as special education, gifted education, data management, grant writing, crisis intervention, service learning, K-12 career development, and systemic change. Prerequisite: EDPS 50100 . Permission of instructor required.

Learning Outcomes: 1. Understand and apply concepts from special education to their own field experiences. 2. Articulate a vision and mission for a comprehensive school counseling program. 3. Develop a program appropriate for their targeted setting and identify potential funding sources for that program. Credits: 3.00

EDPS 61200 - Advanced Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to expand knowledge and understanding of advanced applied behavior analytic theories and interventions. Specifically, this course will focus on interventions aimed at developing new skills as well as increasing and decreasing behaviors. Procedures for identifying and designing function based interventions will be addressed. Prerequisite: EDPS 36200 or 51500 and EDPS 58800.

Learning Outcomes: 1. Demonstrate knowledge of methods for increasing and decreasing behaviors such as antecedent and consequence-based interventions and group contingencies. 2. Demonstrate knowledge and skill in developing new behaviors through advanced techniques such as shaping, chaining, and differential reinforcement procedures. 3. Demonstrate knowledge and skill in procedures for assessing the function of behaviors including function based assessment and functional analysis. 4. Demonstrate knowledge of guiding principles and procedures to program for maintenance and generalization of behaviors. Credits: 3.00

EDPS 61400 - Advanced Counseling Practicum

Credit Hours: 3.00. Supervised use of personal and career counseling techniques applied to complex and difficult client situations. Permission of instructor required.

Learning Outcomes: 1. Display readiness to continue in practicum through exhibiting progress in: professionalism, reflective practice/self-assessment, scientific knowledge and methods, relationships, individual and cultural diversity, ethical and legal standards and policy, interdisciplinary systems, assessment, interventions, research/evaluation, supervision, management-administrative tasks, advocacy. Credits: 3.00

EDPS 61500 - Theories Of Counseling Supervision

Credit Hours: 3.00. Critical analysis of the theories and counseling supervision. Experiential exercises may be included. Prerequisite: EDPS 61400 . Permission of instructor required.

Learning Outcomes: 1. Develop knowledge of theories, methods, and problems in supervision. 2. Learn to think like a supervisor. 3. Understand individual and cultural differences in supervision. Credits: 3.00

EDPS 61700 - Professional Issues, Ethics, And History Of Counseling Psychology

Credit Hours: 3.00. Three primary areas in counseling psychology: 1) historical development within psychology; 2) American Psychological Association ethics, professional, and legal issues; and 3) the scientist-practitioner training model in counseling psychology identity. Permission of instructor required.

Learning Outcomes: 1. Understand counselling psychology's (a) history, (b) position within the psychology discipline and profession and (c) ethical, legal, and professional standards. 2. Gain a sense of how psychology and counselling psychology are embedded within and influenced by context (i.e., historical, societal, cultural, and economic factors). 3. Begin socialization into (a) the attitudes, values, skills, and activities of a counselling psychologist; and (b) the Purdue Counselling Psychology program. Credits: 3.00

EDPS 61801 - Intellectual & Neuropsychological Assessment

Credit Hours: 4.00. This course is designed to expose students to the theory and practice of intellectual and neuropsychological assessment. Students will receive instruction on the theoretical, psychometric, and best practice foundations of these types of assessment in the context of a lecture component, which will be followed by laboratory time in which students will gain experience in administering and scoring relevant tests. Although the WAIS-IV and WISC-IV will be the primary foci of this course, other tests of achievement, cognitive ability, and neuropsychological functioning will be covered. Students will also (a) gain experience in preparing written reports of their interpretations of assessment results, (b) develop an understanding of the history and development of cognitive ability and neuropsychological tests, and (c) explore implications for intellectual and neuropsychological assessment with diverse populations. Permission of instructor required. Prerequisite: EDPS 53300, B-.

Learning Outcomes: 1. Develop an understanding of the theoretical, historical, and psychometric foundations of intellectual and neuropsychological assessment. 2. Develop advanced knowledge of the administration, scoring, and interpretation of the major tests of cognitive ability (i.e., WAIS-IV, WISC-IV), and identify strengths and weaknesses of each. 3. Develop understanding of the ethical and multicultural issues associated with intellectual and neuropsychological assessment. 4. Demonstrate ability to select assessment tools appropriate to examinees' developmental and ability levels. 5. Demonstrate competence in reporting results and interpretation of assessment results in written form. Credits: 4.00

EDPS 61900 - Counseling Psychology Research Practicum

Credit Hours: 3.00. Application of qualitative and quantitative research designs in counseling psychology. Concurrent prerequisite: EDPS 61800(Inactive at PWL) and (PSY 60100 or STAT 50200) and Doctoral student standing enrolled in the Counseling Psychology Program.

Learning Outcomes: 1. Gain knowledge of research methodologies in counseling psychology. 2. Develop the ability to provide an evidentially based rationale for research, including consideration of multicultural issues. 3. Display awareness of counseling psychology research. 4. Demonstrate self-initiative and personal investment (a) in the research process and (b) in efforts to find and use relevant sources of information. 5. Apply the scientific method in critiquing and generating research studies. 6. Present research results in a manuscript that uses APA professional style. 7. Enhance oral and written communication skills through presentation of material in a clear, organized, grammatically correct, and engaging manner. 8. Develop professional writing and editing skills to prepare for careers as a counseling psychologist (e.g., scholarly contribution, reports). Credits: 3.00

EDPS 62000 - Counseling Seminar

Credit Hours: 1.00 to 4.00. Recent investigation and research in (1) counselor supervision; (2) professional issues; (3) counseling theories; (4) education of counselors and student

personnel workers; (5) counseling methodology; (6) vocational development; (7) elementary school counseling; (8) counselor consultation; and (9) other relevant topics. One topic is dealt with in each enrollment. Prerequisite: Open to graduate students who have successfully completed 12 credit hours of previous counseling personnel services courses.

Credits: 1.00 to 4.00

EDPS 62100 - Advanced Multicultural Counseling Theory And Practice

Credit Hours: 3.00. Advanced study and clinical application of racial and cultural theories in counseling. Knowledge and practicum components are integrated to facilitate development of awareness and skill competencies central to "Guidelines on Multicultural Education, Training, Research, Practice and Organizational Change for Psychologists" of the American Psychological Association. Prerequisite: EDPS 50700 . Permission of instructor required.

Learning Outcomes: 1. Increase understanding of ICD dimensions, and their intersection within persons, in relation to psycho-social development. 2. Identify and address institutional and social barriers that impede access, equity, and well-being for diverse populations. 3. Develop advanced skill in discussing ICD, comfortably and appropriately, in interpersonal and professional relationships. 4. Demonstrate awareness of potential interactions between cultural beliefs and attitudes and cognitive and affective experiences. Credits: 3.00

EDPS 62200 - Systems Concepts In Counseling And Development

Credit Hours: 3.00. Introduction to the use of systems concepts in the counseling professions. Individuals' development within relationships and family matrix, contemporary person-environment issues, and constructs for research and preventive, developmental, and remedial practice. Prerequisite: EDPS 61700 .

Learning Outcomes: 1. Obtain knowledge of terms, concepts, and principles of systems thinking. 2. Learn to develop systems hypotheses and evaluate their evidence. 3. Understand that the person exists within and is influenced by the socio-economic-historical context. Credits: 3.00

EDPS 62300 - Personality Assessment

Credit Hours: 3.00. Applied introduction to methods of administration, scoring, and interpretation of primarily objective personality assessments. Emphasis is placed on assessment of normative population with attention given to personal strengths, developmental factors, and issues of diversity.

Learning Outcomes: 1. Select appropriate batteries of personality measures based on particular referral situations and/or questions. 2. Administer, score, and interpret results of personality assessments. 3. Incorporate clinical interview and behavioral observation data into their interpretations of personality assessment results. 4. Interpret personality assessment results from developmental and multicultural perspectives. Credits: 3.00

EDPS 62400 - Advanced Off-Site Counseling Practicum And Supervision Theory

Credit Hours: 3.00. Supervised use of personal and/or career counseling and assessment applied to complex and difficult client situations. Critical analysis of counseling supervision theories. Prerequisite: EDPS 61400 . Permission of instructor required.

Learning Outcomes: 1. Demonstrate appropriate professional and ethical behavior in their interactions with agency clients and staff. 2. Design treatment plans that are based on appropriate assessment and conceptualization of client problems. 3. Develop the conceptual and critical thinking skills that are required of a scientist-practitioner, such as the ability to formulate and test hypotheses regarding the bases of client behavior. 4. Utilize interventions that are rooted in theory and research in counselling/psychotherapy, human development, and personality. 5. Demonstrate understanding and respect for clients' cultural values, identities (e.g., racial, gender), and desires for self-determined growth. 6. Demonstrate an increased awareness of clinical strengths as well as areas of growth and professional development. 7. Demonstrate ability to effectively use individual and group supervision. Credits: 3.00

EDPS 62500 - Human Growth And Development

Credit Hours: 3.00. An overview of lifespan development. Study

of major development theories of childhood, adolescence, and adulthood. Prerequisite: EDPS 60000 .

Learning Outcomes: 1. Demonstrate knowledge of the nature and needs of individuals at all developmental levels across the life span, including theories of individual and family development and transition. 2. Demonstrate knowledge of major theories of learning and personality development. 3. Demonstrate knowledge of cognitive and emotional aspects of growth, including learning, intellectual, and moral development. Credits: 3.00

EDPS 62800 - The Behavior Analyst As Supervisor

Credit Hours: 0.00 to 3.00. This course will address the provision of supervision of behavior analysis trainees and technicians utilizing principles and procedures of applied behavior analysis. Application of goal development, behavioral skills training, and progress monitoring within a behavioral analytic framework will be explored. Must be enrolled in ABA Certificate or Masters Program. Pre-requisite: EDPS 61200. Permission of instructor required.

Learning Outcomes: 1. Describe reasons for effective evidence-based supervision and outcomes of ineffective supervision. 2. Describe necessary components of the supervisory relationship. 3. Assess and select performance expectations for the supervisee and supervisor. 4. Describe components of behavioral skills training. 5. Apply supervision skills to teach assessment and intervention procedures as relevant to task list competencies. 6. State features of performance monitoring and performance feedback . 7. Evaluate supervisor effectiveness. 8. Describe ethics of and methods for providing ongoing professional development. Credits: 0.00 to 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDPS 63100 - Applied Educational Research Design Seminar

Credit Hours: 1.00 to 3.00. This seminar seeks to promote professionalism, research and scholarly productivity and collegial support among graduate students in gifted, creative (GCT), and talented studies, associated graduate students, visiting scholars, and interested others. A secondary purpose involves assisting GCT students, COE students, and associates with successful study and career preparation by focusing on research, grants, thesis preparation, graduate writing, proposal development, professional development, and degree completion. Finally, seminar offers students the opportunity to discuss, learn and "mess" around with current issues in the field and of personal interest. Seminar creates time and incentive for students to become more productive with their scholarship efforts, and offers students credit for work completed and formal support for the professional development and scholarship processes. In this course students should expect to attend, contribute, and participate. A variety of formats will be used, including, but not limited to: discussion, simulations, group work, lecture, guest speakers, and peer feedback. Prerequisite: EDPS 63000 and one graduate course in Statistics.

Learning Outcomes: 1. Engage with IRB process. 2. Write for publication. 3. Critically review and revise writing. 4. Engage in research. 5. Develop a professional vita. 6. Write conference proposals. 7. Create professional presentations. 8. Review relevant literature. Credits: 1.00 to 3.00

EDPS 63200 - Seminar In Research Procedures In Education

Credit Hours: 1.00 to 3.00. Experimental, field study, scientific survey, and prediction study methods in education. Internal and external validity, identification and development of research problems, criteria development, common methodological errors, strategies of analysis, and sources of acceptable educational

research literature will be reviewed. Critical analyses of the research methodology of educational research reports in the student's field. Prerequisite: EDPS 63000 or 53300 and course work in Statistics.

Learning Outcomes: 1. Develop specific advanced methodological skills and knowledge that are applicable to education research and practice. Credits: 1.00 to 3.00

EDPS 63300 - Seminar In Educational Psychology

Credit Hours: 1.00 to 3.00. Recent investigations and research in educational psychology. One topic is dealt with in each enrollment. The topics provide an in-depth study of those areas of psychological investigation in educational settings and problems. These areas include: (1) instructional technology and design; (2) individual differences and educational growth; (3) school learning: theory and research; (4) classroom behavior and social processes; (5) educational assessment; and (6) other relevant topics. Prerequisite: EDPS 53000 .

Credits: 1.00 to 3.00

EDPS 63500 - Psychometric Theory And Application

Credit Hours: 3.00. Advanced classical test theory and application of psychometric methods to study technical properties of tests. Prerequisite: (EDPS 53100 and STAT 50200), or (PSY 60100 or PSY 51200) or consent of Instructor.

Learning Outcomes: 1. Demonstrate an understanding of mathematical and statistical concepts in various measurements principles. 2. Apply understanding of reliability and validity in both classical and modern measurement theory frameworks to solve practical measurement problems. 3. Demonstrate knowledge of psychometric theories in scale development. 4. Read the literature related to psychometrics in their own substantive areas more critically. 5. Use measurement or scales more intelligently in research. 6. Explain different models of modern test theory. Credits: 3.00

EDPS 63600 - Item Response Theory

Credit Hours: 3.00. Models and model-data fit, estimation of ability and item parameters, item and test information, test construction, obtaining evidence of test reliability and validity, differential item functioning, norming, and equating. Prerequisite: EDPS 53100 , (PSY 60100 or STAT 50200 or STAT 51200).

Learning Outcomes: 1. Explain fundamental item response theory concepts and terminology. 2. Distinguish and select from among 1-, 2-, and 3- parameter item response models for dichotomous data in practical situations. 3. Demonstrate familiarity with the graded response and partial credit item response models for polytomous data, and multidimensional item response models. 4. Use item response models for testing applications, such as item calibration during instrument/item pool development, estimation of person parameters and conditional standard errors of measurement, investigation of differential item functions, and score linking. 5. Conduct item response modeling with specialized software and interpret the results. Credits: 3.00

EDPS 63800 - Factor Analytic Procedures

Credit Hours: 3.00. Introduction to exploratory and confirmatory factor analysis techniques and examination of the use of factor analysis in social sciences. Emphasis on application of methods. Students will develop skills to conduct factor analytic research and critically review use of factor analysis in research. Prerequisite: STAT 51200 , STAT 52400 .

Credits: 3.00

EDPS 65000 - Systematic Literature Review

Credit Hours: 3.00. This course is designed for advanced graduate students in special education and related disciplines. The goals of this course are: (a) Understand the principles and methodologies of conducting a systematic literature review. (b) Develop skills in identifying, evaluating, and synthesizing literature in education/special education; (c) Critically review and evaluate education/special education literature and research, and (d) Write a professional, scholarly review of research on a current issue or critical topic in education/special education.

Learning Outcomes: 1. Understand the principles and methodologies of conducting a systematic literature review. 2. Develop skills in identifying, evaluating, and synthesizing relevant literature. 3. Review and evaluate education / special education literature and research critically. 4. Apply the knowledge and write a professional, scholarly review of research on a current issue or critical topic in education/special education. Credits: 3.00

EDPS 65300 - Collaborative Learning

Credit Hours: 3.00. Techniques for fostering productive

collaboration in classrooms will be discussed along with the evidence for their educational effectiveness. The course will be research focused. Truth-wins, most -competent-member, and average-member models for comparing group performance to individual performance will be described. The goal will be to have students learn how to implement successful collaborative activities in classrooms while also developing the ability to further research in the field. In addition to course readings and class participation, students will be expected to propose a research study related to collaborative learning with emphasis on the literature review.

Learning Outcomes: 1. Implement successful collaborative activities in their classrooms while also developing the ability to further our understanding of the field. 2. Propose a research study related to collaborative learning with emphasis on the literature review. Credits: 3.00

EDPS 66100 - Seminal Research In Special Education

Credit Hours: 3.00. This course is designed to focus on the investigation and research in the field of special education, particularly research and articles that are considered seminal to the field of special education in general as well as various topics of study within special education. The course is meant to be an overview of critical pieces of research and literature in the field to provide students with a breadth view, and how the seminal articles have shaped the field of special education including special education laws and policies.

Learning Outcomes: 1. Comprehend seminal articles/research that have shaped the field of special education. 2. Analyze the impact of seminal research and its relevance to special education laws, policies, and practices. 3. Develop a comprehensive understanding of the field and its implications for educating students with special/diverse needs. 4. Identify and comprehend emerging seminal research in the field of special education/education. 5. Gain an understanding of the range of research conducted by faculty in the special education and related programs. 6. Develop skills in investigating and conducting research in special education. Credits: 3.00

EDPS 66300 - Organization And Administration Of Special Education

Credit Hours: 3.00. (EDST 66300) A comprehensive course in the organization and administration of special education including the organizational arrangements, identification, placement and service delivery, tests and assessments, program evaluation, personnel, and school/community relations.

Learning Outcomes: 1. Examine, discuss, and gain an understanding of the role of the special education director. 2. Apply the federal and state rules and regulations for special education in school settings. 3. Understand the role of litigation in the field of special education. 4. Understand special education funding options, identify budget preparation strategies and fund management. 5. Demonstrate ways to ensure parent involvement. 6. Discuss current trends and issues in educating children with disabilities, including ethnic and cultural diversity, discipline, suspension and expulsion. Credits: 3.00

EDPS 66400 - Seminar In Special Education

Credit Hours: 1.00 to 4.00. This seminar is for doctoral students in special education. Its purpose is to contribute to the development of student's professional competencies, including conducting and writing scholarly research, grant writing, university-level teaching, and professional engagement. To facilitate this growth each seminar will culminate in a scholarly product related to the seminar's focus.

Learning Outcomes: 1. Formulate clear and concise research questions and generate one idea for a research project. 2. Develop a comprehensive research plan for their ideas based on a review of the literature. 3. Produce a detailed research project proposal or carry out a research project that aligns with their own research interests. 4. Apply their knowledge in evidence-based practice and lead a session on academic intervention (e.g., reading, math, science, social studies) to effectively support students with diverse needs. Credits: 1.00 to 4.00

EDPS 68800 - Single Subject Research Design

Credit Hours: 0.00 to 3.00. Designed to introduce advanced level students to single subject research methodology in context of a science of human behavior, including design theory and application, measurement, experimental validity, applied behavior analysis, and data analysis procedures.

Learning Outcomes: 1. Demonstrate knowledge about the various single subject research designs and variations of each. 2. Demonstrate the ability to conduct reliable visual analysis, understand value of effect size for single subject design, and calculate effect size. 3. Demonstrate knowledge of the criteria for designing and evaluating high-quality, rigorous single subject design studies. 4. Demonstrate knowledge of the application of single subject research methodology in clinical and educational settings including designing, conducting, and analyzing a single subject study. Credits: 0.00 to 3.00

EDPS 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Learning Outcomes: 1. Measure and evaluate one's professional growth and case conceptualization skills through use of audio tapes and case notes. 2. Demonstrate respect, understanding, and tolerance of multicultural and diversity issues as they relate to clients' need and concerns. 3. Demonstrate ethical and professional behavior in accord with the ACA Code of Ethics. Credits: 1.00 to 10.00

EDPS 69600 - Internship In Counseling Psychology

Credit Hours: 0.00. A special course in the practice activities of counseling psychology. Provides field experience under the supervision of a licensed psychologist. Permission of instructor required.

Learning Outcomes: 1. Learn advanced skills in psychotherapy. 2. Increase knowledge of psychological assessment. 3. Learn advanced skills in consultation and outreach activities. 4. Increase knowledge of administrative and professional issues. Credits: 0.00

EDPS 69700 - Education Specialist Project-Research

Credit Hours: 0.00 to 18.00. Educational Specialist project research. Permission of instructor required.

Credits: 0.00 to 18.00

EDPS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EDPS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Educational Leadership and Cultural Foundations

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDST 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDST 49100 - Topics And Issues In Education

Credit Hours: 1.00. Provides student with opportunity to strengthen preparation through study of selected educational topics and issues based upon individual needs and interests. One topic is considered in each enrollment.

Credits: 1.00

EDST 51200 - Foundations Of Educational Policy

Credit Hours: 3.00. (EDFA 51200) An examination of the relationship between policy, values, and social change in education, including the roles of local, state, and federal government in educational policymaking and the effects of

educational policies on societal issues such as equity, cultural diversity, and opportunity.

Learning Outcomes: 1. Understand the policy-making process at different levels of government. 2. Understand underlying values and theories of education behind different policy initiatives. 3. Understand the relationship between educational policy and social issues. Credits: 3.00

EDST 51300 - Educational Facilities Planning

Credit Hours: 3.00. (EDFA 51300) The course utilizes a systems approach as a basis for planning, construction, and utilization of school facilities. The primary audience for which the course is designed is aspiring school superintendents and central office leaders. Emphasis is placed on gaining the performances, dispositions, and knowledge necessary for successfully providing facilities to enhance the teaching/learning processes in meeting the educational needs of diverse learners. It is intended as a practical course oriented toward "tools" and school facilities in the state of Indiana. Permission of instructor required.

Learning Outcomes: 1. Describe the political and economic dimensions associated with the development and acquisition of facilities in Indiana. 2. Describe the various ways to finance renovation and /or new school construction in Indiana. 3. Identify and describe the required procedures for new school construction in Indiana. 4. Describe the involvement of professionals outside of education in the planning and construction of school facilities. 5. Understand terminology related to construction and maintenance of school facilities in Indiana. Credits: 3.00

EDST 51400 - Economics Of Education

Credit Hours: 3.00. A general course in financing education, including current economic theories, sources of revenues, and trends in fiscal structure and operations in education.

Learning Outcomes: 1. Develop and understand the goals of public education, why states invest in education, and the legal basis for financing public education. 2. Develop and understand the sources of revenues for public education and the approaches used to raise and distribute funds for school district operations. 3. Develop and understand the concepts of equity and adequacy and how these ideas are reflected in current state education policy and educational leadership practices. 4. Develop and understand budgeting strategies and procedures used by educational leaders to influence student achievement outcomes and realize other school-based goals. Credits: 3.00

EDST 51600 - School-Community Relations

Credit Hours: 3.00. (EDFA 51600) This course will stress concepts and principles relevant to school-community interaction. It will focus on the new roles of the public in education and will deal with problems encountered by educators in communicating with the public.

Learning Outcomes: 1. Design their commitment to build stronger family and community relationships with schools. 2. Understand important analytical, policy-relevant, and practice-oriented perspectives on family and community involvement in education 3. Develop skills and strategies for fostering mutually beneficial family and community connections with schools. Credits: 3.00

EDST 52000 - Educational Leadership, Governance, And Policy

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of contemporary PK-22 education leadership, administration, and governance. This course will cover the foundational administrative knowledge and skills necessary for transformational leadership at the modern primary, secondary, and post-secondary educational settings. The scope of this course seeks to cultivate an understanding of the functionality of educational systems as organizations within the context of a technologically, socially, and culturally changing world.

Learning Outcomes: 1. Analyze a variety of literature on PK-22 educational leadership, integrating relevant literature from the fields and disciplines of higher education, leadership, business, political science, and sociology. 2. Apply skillfully foundational PK-22 leadership knowledge and skills necessary for middle management and senior-level educational leadership in the context of a rapidly changing, culturally diversifying, technologically dynamic

global education field. 3. Understand sustainable transformational education leadership by repeatedly engaging in activities and assignments that: Require a comprehensive analysis and understanding of how the following interface: institutional finance and budgeting, strategic planning and assessment, organizational structure and culture, existing and emerging education policy, and the current social and political climate; Require an understanding and analysis of the common day-to-day and long-term challenges that contemporary PK-22 education administrators face in strategic decision-making; Require an evaluation of structural and cultural practices and norms in PK-22 education administration for the sake of comparative analysis. Credits: 3.00

EDST 52100 - Foundations In PK-XXII Educational Systems

Credit Hours: 3.00. This survey course broadly explores the complex foundations of U.S. educational systems from pre-kindergarten (PK) through the doctoral level of education (PK-22). Through the lenses of culture, history, politics, and society, this course seeks to examine factors that impact the policies and practices of PK-22 educational systems. From theoretical knowledge to philosophical orientations, the course interrogates the ways schools transform society and ways society transforms schools. The course incorporates a variety of engaged learning activities including discussion prompts, reflective journaling of course readings, and literature review and research writing. As such, this course challenges students to: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems; 2. Examine the interrelationships of culture, politics, and social structures related to educational systems; 3. Analyze and evaluate current issues in PK-22 education systems; 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies.

Learning Outcomes: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems. 2. Examine the interrelationships of culture, politics, and social structures related to educational systems. 3. Analyze and evaluate current issues in PK-22 education systems. 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies. Credits: 3.00

EDST 52200 - Culture And Social Issues In PK-XXII Education

Credit Hours: 3.00. The aim of this course is to engage students in the critical examination of cultural and social issues impacting PK-22 education at the local, state, and federal levels. This course will review the evolving functional role of PK-22 education in a diversifying global society. By way of critical intercultural and intracultural examination and reflection, this course seeks to cultivate a deeper understanding of the ways that education influences and is influenced by issues related to cultural and social change and conflict.

Learning Outcomes: 1. Analyze a variety of literature on cultural and social issues, integrating relevant literature from the fields and disciplines of education, anthropology, sociology, and political science. 2. Examine and evaluate the past and present activity /role of PK-22 entities during periods of social and cultural changes and conflict. 3. Reflect critically on intercultural and intracultural biases, perspectives, and positions, and the way that they might influence day-to-day interactions in educational environments. 4. Apply acquired knowledge and understanding of the corresponding relationship between culture/social issues and PK-22 education, to create comprehensive proposals and recommendations for PK-22 entities to engage with and address issues on diversity. Credits: 3.00

EDST 58900 - Special Topics For Teachers

Credit Hours: 1.00 to 4.00. (EDFA 58900) Consideration of appropriate professional problems of experienced educational personnel in workshops or in-service programs.

Credits: 1.00 to 4.00

EDST 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. (EDFA 59000) Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDST 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. (EDFA 59100) Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

EDST 60000 - Seminar In The Foundations Of Education

Credit Hours: 3.00. Recommended for those who have had a prior foundations course. Specialized studies in such areas as educational history, educational philosophy, educational sociology, religion and public education, current educational issues, and classical literature of education.

Credits: 3.00

EDST 60200 - Seminar: The School Principalship

Credit Hours: 3.00. Individual exploration in depth of selected aspects of the school principalship and critical analysis of related issues. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the students acquiring proficiency in: Leadership, Supervision, Vision and Mission, Change, Staff Recruitment & Selection, Staff Evaluation, Staff/Administrative Relations, Curriculum Leadership and Management, Student Discipline, Pupil Personnel Services, Professional Development, Ethics, Decision Making, Planning, Time Management and Teaching and Learning. Credits: 3.00

EDST 60700 - Administration Of Educational Systems

Credit Hours: 3.00. An examination of administrative function, process, structure, and practice. Special emphasis given to theory development in administration. Exploration of system analysis applications to educational administration. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana Standards focused on students acquiring proficiency in organizational and resource management, including using data to identify needs and priorities within the organization; identifying and addressing organizational barriers to student achievement; using technological tools to manage information and support effective management of the organization; and using practices for the safe, efficient and effective operation of school's physical plant, equipment and auxiliary services. Credits: 3.00

EDST 60800 - Business Management In Education

Credit Hours: 3.00. (EDFA 60800) This course explores the management and operation of the school business environment, the critical trends and issues in the field, and the internal and external determinants of school fiscal policy. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51400 .

Learning Outcomes: 1. Know the success of managing the organization, operations, and resources of a district in a way that promotes a safe, efficient, and effective learning environment. 2. Act with integrity, fairly, and in an ethical manner. 3. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 60900 - Legal Aspects Of American Education

Credit Hours: 3.00. (EDFA 60900) Legal foundations of education as established by constitutional provisions, court decisions, opinions of attorney generals, administrative rulings, and executive directives. Emphasis on legal theory and

principles currently in state of change. Stress of case study method of investigation into educational law. Prerequisite: 9 credit hours in Education.

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the student acquiring proficiency in human resource management; equity and access to educational programs, curricula and available supports; behavior management systems; school safety and emergency preparedness; student safety and welfare; and the rights and responsibilities of students, families, and school staff. Credits: 3.00

EDST 61000 - Supervision Of Instruction And Instructional Personnel

Credit Hours: 3.00. (EDFA 61000) A comprehensive approach to supervision and instruction that develops the knowledge, interpersonal, and leadership skills, which are then applied in a school setting for the purpose of instructional improvement. Models of supervision, leadership and evaluation will be examined to gain knowledge in order to apply effective strategies for diverse situations. The study of transformational change in today's schools will guide leadership knowledge to the task of direct assistance, collegiality, collaboration, culture of trust, professional development, dialectic inquiry, curriculum development and action research. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Recognize the temper of diverse situations within their instructional leadership role and appropriately apply strategies that will address the situations. 2. Use the understanding and experience of instructional supervision concepts explored throughout this course and apply supervisory principles to the daily functions and responsibilities of an education administrator. 3. Demonstrate the ability to correctly apply various leadership concepts to various fact-based situations and formulate a plan of action to address each situation. 4. Accurately interpret the characteristics of a healthy organization (campus, district, etc.). 5. Evaluate the results of teacher and administrator interviews regarding system and recommend a teacher appraisal system that may improve the equality of observations and appraisals. Credits: 3.00

EDST 61200 - Seminar In Educational Administration And Curriculum

Credit Hours: 3.00. An analysis of current research and theory related to selected topics in educational administration and curriculum. One topic is studied in each enrollment. Permission of instructor required.

Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

EDST 61400 - Leadership For Community Collaboration And Development

Credit Hours: 3.00. In this course, we will consider how school leaders can help develop and strengthen relationships between districts/corporations and their publics, for the mutual benefit of students, schools, families, and communities. Throughout selected core and supplemental district level educator standards of the Indiana Standards for School Leaders and the National Policy Board for Educational Administration are addressed. Emphasis is on the integration of theory and practice. Permission of instructor required.

Learning Outcomes: 1. Acquire knowledge and ability to foster mutually beneficial family and community connections with school districts. 2. Acquire knowledge and ability to understand needs of diverse families and communities. 3. Acquire knowledge and ability to assess research on school partnerships to identify best practices in their contexts. Credits: 3.00

EDST 61500 - Educational Policy And Decision Making

Credit Hours: 3.00. This course explores a variety of current legal, political, social, cultural and economic issues as they relate to educational policy and decision making. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders and ELCC/NPBEA standards are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Act with integrity, fairly, and in an ethical manner. 2. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 61600 - Analytical Techniques In Educational Management

Credit Hours: 3.00. This course is a mix of theory and practice concerning planning and implementation of the fiscal responsibilities that a superintendent of schools would engage in at the district level. The course exposes students to some of the key processes and activities related to planning for and implementing the school budget and related activities. The course examines such planning concepts as goal definition, decision-making, and evaluation of planning as it relates to the fiscal issues of a school corporation. A feature of the course is an emphasis on the process of dealing with the elements of change and planning for such as it relates to fiscal issues in educational organizations. Prerequisite: EDST 51400 or EDST 60800 .

Learning Outcomes: 1. Describe various functions of the school district business office. 2. Identify methods of decision making involved in allocating fiscal resources. 3. Identify various methods of budgeting. 4. Demonstrate an understanding of elementary accounting concepts. 5. Demonstrate an understanding of calculations and functions related to Indiana public school corporation funds. 6. Summarize the ways in which Indiana public school corporations are funded and the most recent legislation that will impact funding. 7. Demonstrate an understanding of the role of business with regard to insurance, transportation, food service, and maintenance. 8. Summarize the balance among expenditures, revenues, and the educational plan. Credits: 3.00

EDST 64000 - Higher Education Law

Credit Hours: 3.00. This course explores the legal framework within which institutions of higher education operate. Course materials, activities, and assignments will give students a deep understanding of how state and federal legislative bodies and courts operate. Students will read statutory materials and case law on legal issues related to higher education, including: free speech, religion, academic freedom, searches and seizures, due process rights, equal protection issues, individuals with disabilities, contracts and employment, torts and university liability. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize case law, and statutory and administrative law materials to create and share a robust understanding of how the varied sources of law inform all interactions at institutions of higher education. 3. Create new knowledge by synthesizing, applying, and communicating how the law can and should be applied in higher education institutions. 4. Learn and apply legal research skills that will empower them to contribute to legal scholarship. 5. Become more fluent in communicating complex legal concepts to stakeholders at different levels (students, peers, administrators, etc.). Credits: 3.00

EDST 64100 - Organization And Adminstration In Higher Education

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of organization and administration in higher education. To do so, the course will have a dual focus: organization, which includes forms, structures, systems, roles, and functions; and administration, including the three "Ps" - processes, products, and "players." The scope of the course seeks to create an appreciation for the complexity of the higher education system, specifically of colleges and universities as ecosystems, through exploration of these systems both horizontally across institutions and institutional types and vertically within the individual, single institution. Throughout the semester students will engage in a variety of analytic and critical perspectives through course readings, discussions, and assignments that encourage a multifaceted perspective. The course intends to provide an organizational framework and serve as the foundation for the courses in the Higher Education program of study.

Learning Outcomes: 1. Explore a variety of literature on organizational theory, integrating literature from the field of higher education as well outside disciplines of business, political science, & sociology. 2. Gain an applied knowledge of the complexity of higher education institutions as organizations by understanding: the different internal "players" involved in higher education administration and governance; a variety of external influences and factors that

may impact higher education institutions; the critical issues that impact the cultures and norms both within and across institutions; identify and apply organizational theory through analysis of critical issues facing higher education institutions. 3. Examine complex cultural, political, social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using different organizational theory and frameworks. 4. Develop skills to succinctly and professionally articulate analysis and synthesis of relevant empirical research and literature. 5. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. Credits: 3.00

EDST 64200 - Cultural Engagement In Higher Education Communities

Credit Hours: 3.00. The influence of culture is of particular import with issues facing the world today and Higher Education institutions (HEIs) are not immune to this reality. HEIs often serve as an institutional base for communities and have a vested interest in meaningful engagement with the communities that surround their campuses. This course is designed to enable learners to confidently communicate, build relationships, and work effectively in culturally diverse communities. Through exploration of a variety of intercultural theories, students will become aware of and be able to navigate the cultural influences in local, state, regional, national, and international higher education communities. As part of the course, students will engage in their communities through experiential, real-world, case study, and project management methods. Permission of instructor required.

Learning Outcomes: 1. Deepen their thinking and practice of community engagement and the positionality of the institution within its community. 2. Demonstrate that as a complex organization, Higher education functions as both a personal and a societal (public and private) benefit. 3. Demonstrate consistent critical attention and critical thinking to their own and others positionality including cultural identities, social and organizational power and privilege, and intercultural competence. 4. Formulate skills to better recognize, prevent, and resolve cross-cultural conflicts. 5. Construct effective cross-cultural relationships and work in an intercultural group setting. 6. Evaluate and summarize intercultural theories as applied to their individual/institutional contexts. 7. Describe a context for examining the organization of knowledge and institutions of higher education in relation to community-based problem solving. 8. Examine complex social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using a variety of community engagement and cultural frameworks. 9. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. 10. Apply theory to practice in a final community engagement research project. Credits: 3.00

EDST 64300 - Higher Education Economics And Finance

Credit Hours: 3.00. This course provides students with an overview of financial issues related to higher education. Students will discuss and evaluate topics such as the public versus private financial benefits of higher education, the financial relationship between institutions of higher education and both state and federal governments, and issues related to labor economics. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize, create, and communicate knowledge. 3. Engage in professional development. 4. Participate actively in the profession. Credits: 3.00

EDST 64400 - Policy And Politics In Higher Education

Credit Hours: 3.00. In this course, focused on historic and contemporary issues, research, and theories that shape public policy in higher education, students will critically examine the policy issues facing higher education today. The course will interrogate the ways politics and policy are leveraged to address issues of access and college success for all, dismantle systemic oppression, and improve upon higher education's ability to carry out its mission, vision, and purpose. Three main foci will be reviewed and applied throughout the course: The policymaking process: Students will gain a foundational knowledge of policy formation and implementation process at the federal, state, tribal/local levels; Methods of policy analysis: methods of analyzing, interpreting, and evaluating policy/policy issues; Policy research: multiple theoretical lenses and research trends

focused on continued improvement and development of higher education institutions, programs, and services. Permission of instructor required.

Learning Outcomes: 1. Gain and deepen foundational knowledge of HE politics and policy, including the reciprocity (or lack thereof) between federal, state, tribal/local policy, policy formation and implementation, and contemporary issues shaping HE politics and policymaking today. 2. Evaluate and apply public policy theoretical and conceptual frameworks as applied to their individual/institutional contexts. 3. Investigate the ways cultural/social/political contexts affect creation and implementation of public policy. 4. Explore how policy interacts with higher education's ability to deconstruct/level systemic oppression while creating opportunity for equity and access. 5. Examine issues of power, privilege and oppression in public policy by asking: who has power, resources, influence; how "they" use the power, resources, and influence; and whose perspectives, identities, and interests are represented in current policies. 6. Evaluate how policy effects the lived experiences of the higher education community - students, faculty, staff, administration and communities. 7. Examine complex cultural, political, and social issues from different perspectives - specifically the ability to conduct research and analysis using public policy frameworks. 8. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. 9. Apply theory to practice through policy analysis and a final research proposal. Credits: 3.00

EDST 64500 - Higher Education Leadership And Management

Credit Hours: 3.00. This is the second in the series of courses on the Higher Education Organization. The aim of this course is to provide an overview of leadership and management of higher education institutions in the U.S. from relationship-rich and cultural lenses. The scope of the course seeks to create an appreciation for the complexity of the higher education system, specifically of colleges and universities as ecosystems, through exploration of the leadership and management types, systems and structures both horizontally across institutions and institutional types and vertically within the individual, single institution. The course will examine leadership and management from the presidency to managers at all levels in both academic and administrative units. Permission of instructor required. Prerequisite: EDST 64000.

Learning Outcomes: 1. Explore a variety of literature on HEI leadership and management, integrating literature from the field of higher education as well outside disciplines of business, political science, & sociology. 2. Gain an applied knowledge of the complexity of higher education institutions leadership and management by understanding; the different internal roles involved in higher education administration and governance; a variety of external influences and factors that may impact higher education institutions; the critical issues that impact the leadership and management cultures and norms both within and across institutions. 3. Analyze and reflect on their personal leadership styles based on HE theory, frameworks, and perspectives. 4. Identify and apply HEI leadership and management theory through analysis of critical issues facing higher education institutions. 5. Examine complex leadership and management issues from cultural, political and organizational perspectives - specifically the ability to conduct research and analysis using different HEI leadership and management theory and frameworks. 6. Develop skills to succinctly and professionally articulate analysis and synthesis of relevant empirical research and literature. 7. Formulate and articulate rational arguments through discussions, peer review, presentation, and reflective and research writing. 8. Apply theory to practice in a final leadership/management manuscript publication project. Credits: 3.00

EDST 64600 - Assessment And Evaluation In

Higher Education

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of assessment and evaluation within higher education systems, including but not limited to student learning, academic programs, student support services, and administrative services. The scope of the course seeks to create a practical understanding of assessment and evaluation, whereby we examine the foundations of assessment planning and development, explore various assessment techniques, explicate and develop a comprehensive assessment plan, and explain how approaches to data collection work in concert and separately to assess both student learning outcomes and program effectiveness.

Learning Outcomes: 1. Apply fundamental principles of assessment and evaluation. 2. Synthesize knowledge and skills of assessment essentials to create a comprehensive assessment plan. 3. Analyze various data collection methods as it relates to assessment and evaluation. 4. Evaluate findings from assessment plans and translate into practical actions that inform practice, policy, and institutional effectiveness. 5. Apply course content to problem-solving, program effectiveness, and the generating of interventions and services to enhance student experiences in higher education. Credits: 3.00

EDST 64700 - History Of American Higher Education

Credit Hours: 3.00. This course engages students to better understand the history of higher education in the United States from the Colonial era to the present. Upon completion, students will have an appreciation for how higher education institutions (HEIs) were (and continue to be) developed, as well as an understanding of who had access to these institutions over the past 200+ years, and who did not, from a social justice perspective.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize, create, and communicate knowledge. 3. Engage in professional development. 4. Participate actively in the profession. Credits: 3.00

EDST 64800 - International And Intercultural Higher Education

Credit Hours: 3.00. This doctoral-level course critically examines the interconnected and interdependent world of international higher education through an intercultural lens. The course will employ a variety of critical theoretical perspectives (post-development, feminist, & equity frameworks as well as organizational/institutional models) to examine both the historical and contemporary developments in higher education throughout the globe. Topics will vary based on current issues but will center on the influences cultural, economic, political, & social factors have had on national and international higher education development. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the interwoven concepts related to internationalization, globalization, and intercultural higher education. 2. Explore a variety of literature on international and intercultural higher education, integrating literature from the field of higher education as well outside disciplines of business, political science, & sociology. 3. Analyze a HEI's internationalization plans, intercultural activities/strategies and various influences on these based on HE theory, frameworks, and perspectives. 4. Examine complex internationalization and intercultural issues from cultural, political and organizational perspectives - specifically the ability to conduct research and analysis using equity, feminist, post-colonialist and/or an organizational theory or framework. 5. Develop skills to succinctly and professionally articulate analysis and synthesis of relevant empirical research and literature. 6. Formulate and articulate rational arguments through discussions, peer discussion, and reflective and research writing. 7. Apply theory to practice in a final internationalization case study project. Credits: 3.00

EDST 66300 - Organization And Administration Of Special Education

Credit Hours: 3.00. (EDPS 66300) A comprehensive course in the organization and administration of special education including the organizational arrangements, identification, placement and service delivery, tests and assessments, program evaluation, personnel, and school/community relations.

Learning Outcomes: 1. Examine, discuss, and gain an understanding of the role of the special education director. 2. Apply the federal and state rules and regulations for special education

in school settings. 3. Understand the role of litigation in the field of special education. 4. Understand special education funding options, identify budget preparation strategies and fund management. 5. Demonstrate ways to ensure parent involvement. 6. Discuss current trends and issues in educating children with disabilities, including ethnic and cultural diversity, discipline, suspension and expulsion. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

EDST 69700 - EdS Project-Research

Credit Hours: 0.00 to 18.00. Educational Specialist project in research. Permission of instructor required.

Credits: 0.00 to 18.00

EDST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electrical and Computer Engineering

ECE 19595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to

linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ECE 20008 - Electrical Engineering Fundamentals II Lab

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20002 Electrical Engineering Fundamentals II; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

Learning Outcomes: 1. Ability to competently select, use, and automate electronic measurement instruments. 2. Design, wire, and troubleshoot electronic circuits. 3. Ability to simulate electronic circuits. 4. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 5. Demonstrate knowledge of laboratory safety precautions. 6. Maintain laboratory notes and create professional experiment reports. Credits: 1.00

ECE 20200 - Linear Circuit Analysis II

Credit Hours: 3.00. Continuation of ECE 20100. Use of Laplace Transform techniques to analyze linear circuits with and without initial conditions. Characterization of circuits based upon impedance, admittance, and transfer function parameters. Determination of frequency response via analysis of poles and zeros in the complex plane. Relationship between the transfer function and the impulse response of a circuit. Use of continuous time convolution to determine time domain responses. Properties and practical uses of resonant circuits and transformers. Input - output characterization of a circuit as a two-port. Low and high-pass filter design.

Learning Outcomes: 1. Able to compute impedances and admittances of components and circuits. 2. Able to compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Able to compute responses to linear circuits using transfer function and convolution techniques. 4. Able to analyze and compute responses of linear circuits containing mutually couples inductors and ideal transformers in the s-domain. 5. Able to analyze basic two port circuits using the various types of two port parameters and be able to construct such parameters from a given circuit. 6. Able to analyze and design basic LP, BP, HP and resonant circuits in the s-domain. Credits: 3.00

ECE 20400 - Introduction To Electrical And Electronic Circuits

Credit Hours: 4.00. Students will learn basics of electrical and electronic circuits including introduction to analog and digital electronic circuits. Measurement of electrical signals using meters, probes, and oscilloscopes are covered in the laboratory component of the course. Circuits are designed for minimum

hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

Credits: 4.00

ECE 20700 - Electronic Measurement Techniques

Credit Hours: 1.00. Experimental exercises in the use of laboratory instruments. Voltage, current, impedance, frequency, and wave form measurements. Frequency and transient response. Elements of circuit modeling and design.

Credits: 1.00

ECE 20800 - Electronic Devices And Design Laboratory

Credit Hours: 1.00. Laboratory experiments in the measurement of electronic device characteristics. Design of biasing networks, small signal amplifiers, and switching circuits.

Credits: 1.00

ECE 20869 - Discrete Math For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Learning Outcomes: 1. Define, reason about, and operate on sets using basic set operations and Recursive definition. [1,7] 2. Represent and verify entailment arguments in predicate logic, both syntactically and semantically. [1,3,7] 3. Argue carefully using a variety of informal proof techniques, including mathematical induction. [1,3,7] 4. Count in a wide range of settings including permutations, combinations, countable infinities, and recurrence equations. [1,7] 5. Define and reason about functions and binary relations and work with their useful properties. [1] 6. Have an ability to define finite-state automata and regular expressions for languages, and relate these formalisms using non-determinism. [1,7] 7. Formulate algorithmic problems as decision problems and reason about their decidability and scalable solvability. [1,7] Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

ECE 21000 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE and BSCmpE degree requirements, and professional development.

Credits: 1.00

ECE 25500 - Introduction To Electronic Analysis And Design

Credit Hours: 3.00. Diode, bipolar transistor, and FET circuit models for the design and analysis of electronic circuits. Single and multistage analysis and design; introduction to digital circuits. Computer-aided design calculations, amplifier operating point design, and frequency response of single and multistage amplifiers. High-frequency and low-frequency designs are emphasized.

Learning Outcomes: 1. Able to identify and correctly utilize the external lead structure and basic electrical characteristics of common semiconductor devices (pn junctions, MOSFETs, ad BJTs). 2. Able to analyze and design d.c. bias circuits. 3. Able to utilize d.c. and a.c. models of semiconductor devices in both analysis and design. 4. Able to analyze and design single and multistage amplifiers at low, mid and high frequencies. 5. Able to use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course.

Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 28200 - UNIX Programming For Engineers

Credit Hours: 1.00. Introduction to the UNIX operating system, including the UNIX file system, UNIX tools, and utilities. Introduction to Shell programming. The emphasis will be on how these tools/utilities are utilized in the Computing Engineering field.

Credits: 1.00

ECE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29401 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree requirements, professional writing and multicultural and professional development.

Learning Outcomes: 1. Knowledge of the ECE educational objectives and required outcomes. 2. Knowledge of the BSEE and/or BSCmpE degree requirements. 3. Ability to prepare a satisfactory plan-of-study. 4. Ability to write effectively in the English language. 5. Appreciation for ethical, professional and academic conduct. Credits: 1.00

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an

ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 29600 - Electrical And Computer Engineering Projects

Credit Hours: 0.00 to 18.00. Projects in Electrical and Computer Engineering. Permission of Department required.

Learning Outcomes: 1. Ability to apply knowledge of mathematics, science, and engineering. 2. Recognition of the need for, and an ability, to engage in life-long learning. 3. Ability to use techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 0.00 to 18.00

ECE 30010 - Introduction To Machine Learning And Pattern Recognition

Credit Hours: 3.00. Intelligent information processing, search and retrieval, classification, recognition, prediction and optimization with machine learning and pattern recognition algorithms such as neural networks, support vector machines, decision trees and data mining methods, current models and architectures, implementation topics especially in software, applications in areas such as information processing, search and retrieval of internet data, forecasting (prediction), classification, signal/image processing, pattern recognition, optimization, simulation, system identification, communications, control, management and finance. Topics covered will also be illustrated with the software package MATLAB and related toolboxes. Permission of instructor required.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multi-disciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. 7. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. Credits: 3.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-

term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

ECE 30411 - Electromagnetics I

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic waves and transmission lines, which is continued in ECE 30412.

Learning Outcomes: 1. Work with electrostatic fields and find electric and potential fields from charge distributions including the presence of dielectric materials. 2. Work with magnetostatic fields and find magnetic fields from current distributions including the presence of magnetic materials. 3. Work with time varying fields including wave propagation. 4. Work with transmission lines in the time and frequency domains. Credits: 3.00

ECE 30412 - Electromagnetics II

Credit Hours: 3.00. Electromagnetics II builds on Electromagnetics I (ECE 31100) and emphasizes time-varying electromagnetic fields. Both fundamental understanding and an appreciation for applications that span all technologies related to electrical and computer engineering are emphasized. The topics covered include: Maxwell's equations, plane waves, transmission lines, waveguides and cavities, and antennas and radiation. Applications addressed relate to photonics, communications, and imaging and sensing. More generally, illustrations cover the basic principles on which devices and systems used every day operate.

Learning Outcomes: 1. Understand time-varying fields and Maxwell's equations. 2. Understand plane electromagnetic waves. 3. Understand the theory and application of transmission lines. 4. Understand waveguides and cavity resonators. 5. Understand antennas and radiating systems. Credits: 3.00

ECE 30414 - Elements Of Fiber Optics, Lasers And Optoelectronics

Credit Hours: 3.00. Fundamental of photonics, guided-wave optics, optical fibers, lasers, photon detectors, integrated optical components, optical information processing, devices in communication and sensor applications. Topics include generation, transformation, modulation and detection of laser beams and their applications.

Learning Outcomes: 1. Analyze simple optical systems including dielectric slabs, thin lenses, reflectors, and optical resonators. 2. Analyze optical waveguides, examine fiber modes and waveguide properties. 3. Know the operations of gas lasers, semiconductor lasers and light emitting diodes. 4. Know the operational principles of optical detectors, including various optical detection schemes. 5. Understand of the key components of optical fiber communication systems. 6. Understand of novel concepts in photonics, including ultrafast optics, photonic crystals, optical interconnects, metal optics, and metamaterials. Credits: 3.00

ECE 30415 - Fiber Optics And Lasers Laboratory

Credit Hours: 1.00. This laboratory course exercises in lasers, modulation of laser beams, fiber components and systems. It covers some simple optical measurements like Power and beam spot measurement of Gaussian beams. Students learn about lens-pinhole spatial filters and beam expanders. Fourier transform, convolution and correlation are covered. Characteristics of LEDs and ILDs are shown. Students become familiar with optical fibers related experiments like Fiber-optic microbend intensity sensors, Electrooptic modulation, Fiber optic Mach-Zehnder interferometer etc. Students also learn how to build laser systems based on the knowledge acquired from previous labs and with some simple set up. Finally there is a final project where students can design a practical optical instrument based on their knowledge from the lab.

Learning Outcomes: 1. Handle basic optical components and equipment properly. 2. Assemble and align necessary optical components to perform simple optical experiments. 3. Design and test simple fiber communication systems. Credits: 1.00

ECE 30416 - Basics Of Engineering Optics

Credit Hours: 3.00. Fundamental of photonics, guided-wave optics, optical fibers, lasers, photon detectors, integrated optical components, optical information processing, devices in communication and sensor applications. Topics include generation, transformation, modulation and detection of laser beams and their applications.

Learning Outcomes: 1. Analyze simple optical

systems including dielectric slabs, thin lenses, and reflectors. 2. Model Gaussian beams and the transformation of beams. 3. Analyze and design polarization systems, including polarizers and wave plates. 4. Know of optical interferometers and the operations of interferometers such as the Michelson, Fabry-Perot and double-slit. 5. Analyze diffraction patterns. Credits: 3.00

ECE 30417 - Engineering Optics Laboratory

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and basic applications of geometrical optics, beams, polarization optics, wave optics and Fourier optics. Permission of instructor required.

Learning Outcomes: 1. Handle basic optical components and equipment properly. 2. Assemble a set of optical components to perform simple optical measurements. 3. Design and test simple free-space optical measurements and instruments. Credits: 1.00

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 30600 - Electronic Circuits And Systems Laboratory

Credit Hours: 1.00. Experiments in electronic circuits and systems, including spectral analysis techniques, sampling, distortion measurements, random signals, signal-to-noise ratio and correlation.

Credits: 1.00

ECE 30653 - Introduction To Nanotechnology And Quantum Science & Technology

Credit Hours: 3.00. This interdisciplinary course offers an introduction to nanotechnology and quantum science and technology for undergraduate students in science and engineering. The students will develop understanding of interdisciplinary nature of these fields and utilize concepts in physics, chemistry and mechanics to describe and analyze unique properties of quantum and nanoscale objects. The course will provide the opportunity to get exposed to highly interdisciplinary nature of today's most active and rapidly expanding fields of research and technologies.

Learning Outcomes: 1. Define major types of nanoparticles and their sources. 2. Illustrate by simple calculations unique physical properties of nanoscale objects, e.g. calculate de Broglie wavelength, surface energy, melting point. 3. Describe basic nanostructure measurement methods. 4. Give examples of economic benefits of nano and quantum technology. 5. Describe approaches for managing security, health and environmental risks. Credits: 3.00

ECE 30700 - Electromagnetic Fields And Waves Laboratory

Credit Hours: 1.00. Experimental exercises illustrating concepts in electric and magnetic fields, transmission lines, electromagnetic fields, simple waveguides, and antennas.

Credits: 1.00

ECE 30800 - Systems Simulation And Control Laboratory

Credit Hours: 1.00. Instruction and laboratory exercises in the solution of differential equations that arise in the modeling of physical systems. Instruction in the principles of operation and design of linear control systems.

Credits: 1.00

ECE 30834 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. Permission of department required.

Learning Outcomes: 1. An understanding of the design issues for creating raster graphics. 2. An ability to apply rendering techniques to an actual computer graphics problem and associated datasets. 3. An understanding of object transformations, representations, transformations and perspective projections. 4. An understanding of color, illumination, and shading techniques. 5. An understanding of the rendering and rasterization techniques. 6. An understanding of the application of computer graphics techniques to visualization, animation,

and computer aided design. Credits: 3.00

ECE 30861 - Software Engineering

Credit Hours: 3.00. Introduction to the technical and social aspects of software engineering principles, with special emphasis on the process, methods, and tools needed to develop and test quality software products and systems.

Learning Outcomes: 1. Conduct object-oriented design and use unified modeling language. 2. Understand different models of software development processes. 3. Analyze requirements and write project specifications. 4. Develop a team software project on time and meet the specifications successfully. Credits: 3.00

ECE 30862 - Object-Oriented Programming In C++ And Java

Credit Hours: 3.00. C++ and Java programming languages, including classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function, overloading and overriding, function name overload resolution, container classes, and template classes.

Learning Outcomes: 1. An understanding of the concepts of inheritance and polymorphism. 2. An ability to overload operators in C++. 3. An understanding of the difference between function overloading and function overriding. 4. An ability to incorporate exception handling in object-oriented programs. 5. An ability to use template classes and the STL Library in C++. 6. An ability to write object-oriented programs of moderate complexity in Java. 7. An ability to write programs with multiple threads and use synchronization among threads. Credits: 3.00

ECE 30864 - Software Engineering Tools

Credit Hours: 1.00. This course will acquaint students with the toolkit of the modern software engineer. Students will learn the tools surrounding the software application itself, e.g., tools for software process, software construction, and software deployment. Examples include: integrated development editors (IDEs), version control systems, project management, bug tracking, scripting languages, testing aids, deployment technologies.

Learning Outcomes: 1. Use orchestration languages to manipulate diverse software systems. 2. Understand testing tools to assess software reliability and correctness. 3. Use software management tools. 4. Have an awareness of software deployment technologies and tradeoffs. Credits: 1.00

ECE 31032 - Power Systems Engineering

Credit Hours: 3.00. Introduction to the economic operation of power systems, three-phase circuit analysis, modeling of transformers and transmission lines, steady-state network analysis using a power flow, analysis during faults and state estimation.

Learning Outcomes: 1. Understand the function of the main components in a power system, and the basis of their circuit models. 2. Build a system representation from components' circuit models and to apply solution techniques to certain operational needs. Credits: 3.00

ECE 31033 - Power Electronics

Credit Hours: 3.00. Introduction to the fundamental operating principles of power conditioning circuits that are currently being used to effect power flow from AC to DC and vice versa. Emphasis is on the relationship between form and function of these circuits. Circuits discussed will include AC/DC line-commutated converters, DC/DC converters, DC/variable frequency converters, resonant converters, and AC/AC converters. Computer simulations will be used as a part of the coursework.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a microcontroller-based digital system. 2. Understand the engineering design process. 3. Function on a multidisciplinary team. 4. Be aware of professional and ethical responsibility. 5. Communicate effectively, in both oral and written form. Credits: 3.00

ECE 31100 - Electric And Magnetic Fields

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credits: 3.00

ECE 31500 - Fundamentals Of Electrical Energy Engineering

Credit Hours: 3.00. Resistive circuit analysis with controlled sources. Sinusoidal frequency response, filters and Bode plots. Complex power in AC circuits, ideal transformers and three-

phase power. Power electronic circuits including diodes, transistor switches, rectifiers and AC-DC converters. Magnetic circuits, magnetic materials and B-H curves. Transformer equivalent circuit models. No credit will be given for ECE majors.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering. 2. Design and construct experiments, as well as to analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, societal, political, ethical, health and safety, manufacturability, and sustainability. 4. Function on multi-disciplinary teams. 5. Identify, formulate, and solve engineering problems. 6. Understanding of professional and ethical responsibility. 7. Communicate effectively. Credits: 3.00

ECE 32100 - Electromechanical Motion Devices

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Learning Outcomes: 1. Analyze/design electromagnetic circuits/devices. 2. Understand the concepts and principles of electromagnetic energy conversion. 3. Understand the concept of time-varying transformations in the analysis of time-varying systems. 4. Analyze dc machines. 5. Understand converters for dc drives. 6. Analyze brushless dc machines. 7. Analyze induction machines. Credits: 3.00

ECE 32300 - Electromechanical Motion Devices And Systems Laboratory

Credit Hours: 1.00. Experiments closely coordinated with ECE 32100 involving measurement of fundamental parameters of various electromechanical devices using modern instrumentation techniques. Computer simulation is used to predict steady-state and dynamic operating characteristics. Comparison of predicted and measured performance is emphasized.

Learning Outcomes: N/A Credits: 1.00

ECE 32600 - Engineering Project Management

Credit Hours: 3.00. (ME 32600) Project management is an important skill that is needed in the private and public sectors as well as specialty businesses. This course will explore the challenges facing today's project managers and will provide a broad understanding of the project management environment focused on multiple aspects of the project.

Learning Outcomes: 1. Use library resources and internet resources to find information necessary for the project. 2. Use critical thinking in its design process. 3. Use creative approaches when necessary to obtain project objectives. 4. Analyze and interpret data. 5. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 6. Write a project report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 7. Make an oral presentation using effective visual aids. 8. An understanding of professional and ethical responsibility. 9. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 10. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ECE 32700 - Engineering Economics

Credit Hours: 3.00. (ME 32700) Engineering Economics is designed as an overview of economics with a focus on how it relates to the practice of engineering. Topics include interest formulas, rate of return, life cost analysis, depreciation, taxes, and cash flow.

Learning Outcomes: 1. Understand the terminology used in engineering economic analysis. 2. Understand time-value-of-money concepts such as net present worth analysis, equivalent uniform annual worth analysis, benefit/cost analysis, internal rate of return analysis, loans, leveraging, and fixed-income investment analysis. 3. Understand the criteria for making economic-based decisions. 4. Analyze before-tax and after-tax cash flows. 5. Understand economic risk analysis techniques. 6. Conduct minimum life cycle cost tradeoffs between initial and repair costs. 7. Formulate economic solutions to real-world case study

problems. 8.Demonstrate capability to use Excel spreadsheet analysis in solving economic problems. 9. Experience working in a project team to solve an economic problem and make a presentation of the solution using PowerPoint. 10. Write a project report, adhering to the specified format for business reports using appropriate writing style, grammar, and spelling. 11. Learn how to estimate costs and perform an economic analysis in support of capstone design and other term projects. 12. Develop cash flow analysis problem solving techniques for passing exams including the Engineering Economics portions of the EIT exam. Credits: 3.00

ECE 33700 - ASIC Design Laboratory

Credit Hours: 2.00. Introduction to standard cell design of Application Specific Integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and verification.

Learning Outcomes: 1. Design combinational and sequential logic in a variety of styles and awareness of resource usage. 2. Use, modify, create scripts to control logic synthesis. 3. Create a test bench and use it to verify a design that incorporates multiple sequential blocks. 4. Place, route, and verify timing of an ASIC design. 5. Determine the RTL architecture implied by HDL code of moderate complexity. 6. Explain the difference between various ASIC and digital system design approaches - standard cell, full custom, and programmable device. Credits: 2.00

ECE 34000 - Simulation, Modeling, and Identification

Credit Hours: 3.00. Investigation and evaluation of design problems through simulation of systems described by ordinary differential and difference equations. Development of simulation models from physical parameters and from experimental data. Topics include continuous, discrete, and hybrid models of electrical, mechanical, and biological systems. Laboratory experiences demonstrate concepts studied in text and lecture.

Credits: 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system. Credits: 4.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

ECE 36900 - Discrete Mathematics For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Credits: 3.00

ECE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 38200 - Feedback System Analysis And Design

Credit Hours: 3.00. In this course, classical concepts of feedback system analysis and associated compensation techniques are presented. In particular, the root locus, Bode diagram, and Nyquist criterion are used as determinants of stability.

Credits: 3.00

ECE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39401 - Professional Communications And Diversity

Credit Hours: 1.00. This course provides ECE students with practice in relevant aspects of communication. Topics include: successfully seeking employment, working effectively in teams, delivering engaging presentations, and leveraging the advantages and challenges of diversity and inclusion.

Learning Outcomes: 1. Ability to function effectively on a team whose members create a collaborative and inclusive environment, plan tasks, and meet objectives. 2. Communicate effectively with a range of audiences. 3. Develop and explain solutions to engineering problems, taking public health and cultural factors into consideration. Credits: 1.00

ECE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39600 - Industrial Practice Seminar I

Credit Hours: 1.00. A special seminar for cooperative education and curricular practical training students. Permission of instructor required.

Learning Outcomes: 1. Understanding of how an engineering internship or co-op work experience benefits academic and career goals. Credits: 1.00

ECE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 40020 - Sound Reinforcement System Design

Credit Hours: 3.00. An introduction to computational tools used in the measurement and analysis of electro-acoustic systems, and their application to sound reinforcement system engineering. Service learning based projects, serving the needs of community clients, provide the context for application of sound reinforcement system design principles and practices.

Learning Outcomes: 1. An ability to apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design a sound reinforcement system. 2. An understanding of the engineering design process. 3. An ability to function on a multidisciplinary team. 4. An awareness of professional and ethical responsibility. 5. An ability to communicate effectively, in both oral and written form. Credits: 3.00

ECE 40100 - Engineering Ethics and Professionalism

Credit Hours: 1.00. Some ethical, social, political, legal, and ecological issues that practicing engineers may encounter. (ECE 401 and ME 401 are cross-listed courses; students may not get credit for both ECE 401 and ME 401.)

Credits: 1.00

ECE 40400 - Introduction To Computer Security

Credit Hours: 3.00. Introduction to security issues related to the operation of computers and the workings of computer networks. Topics covered include introduction to cryptography, authentication protocols, digital signature algorithms, internet vulnerabilities, worms and virus propagation, denial of service attacks, etc. The students will also learn how to design firewalls to protect a system against unwanted intrusions. Permission of department required.

Credits: 3.00

ECE 40655 - Digital Integrated Circuit Analysis And Design

Credit Hours: 3.00. As applied to digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential, and dynamic logic circuits are considered. While the focus of the course is on CMOS technology, bipolar, nMOS, and BiCMOS circuits are introduced as well. SPICE is used as both an analysis and design tool. Semiconductor memory circuits are also discussed.

Learning Outcomes: 1. Demonstrate a basic knowledge of CMOS IC processing and layout. 2. Demonstrate an understanding of CMOS inverter operation, both static and dynamic. 3. Demonstrate an understanding of CMOS combinational logic circuit design and analysis. 4. Demonstrate an understanding of basic CMOS arithmetic circuits. 5. Demonstrate an understanding of CMOS digital array design. 6. Demonstrate an understanding of basic CMOS sequential logic analysis. 7. Demonstrate an understanding of memory technologies and designs. 8. Demonstrate an ability to design, and analyze and simulate a CMOS digital circuit. Credits: 3.00

ECE 40656 - CMOS Analog And Mixed Signal Integrated Circuits

Credit Hours: 3.00. This course is a review of technology and modeling of CMOS transistors; Analysis, and design of CMOS monolithic integrated circuits for analog and mixed-signal applications. Consideration of amplifier circuit design, and fabrication techniques with circuit simulation using Cadence. Simple and advanced CMOS operational amplifiers, comparators, sample and hold circuits, switch capacitor circuits and data converters; Design of analog and mixed-signal circuit building blocks.

Learning Outcomes: 1. Design a simple single-stage amplifier in a standard CMOS technology and verify the design using simulation. 2.

Design a simple CMOS operational amplifier and verify the design using simulation. 3. Design an advanced operational amplifier in a standard CMOS technology and verify the design using simulation. 4. Analyze a voltage comparator in a standard CMOS technology and verify the design using simulation. 5. Analyze a sample and hold circuit and perform simulations. 6. Analyze a switched capacitor circuit and perform simulations. 7. Analyze a data-convertor circuit. Credits: 3.00

ECE 40801 - Introduction To Computer Vision

Credit Hours: 3.00. This course is an introduction to computer vision. The course will cover both classical and deep-learning approaches to recognizing objects in images and activities in video. Topics to be covered include scene classification, object localization, segmentation, and activity recognition. The course will cover both the theory behind methods to solve these problems as well as how they are implemented in systems like PyTorch. Permission of department required.

Learning Outcomes: 1. Construct and train a neural network. 2. Construct and train an object detector. 3. Construct and train an activity classifier. 4. Work in a team to construct a solution to a computer vision problem. Credits: 3.00

ECE 40802 - Introduction To Natural Language Processing

Credit Hours: 3.00. This course is an introduction to modern natural language processing and computational linguistics. This course covers morphological, syntactic, semantic, and pragmatic processing as well as applications such as information extraction, question answering, and machine translation. This course will cover fundamental topics as well as recent advances from the literature.

Learning Outcomes: 1. Design and implement a natural language parser. 2. Construct a semantic representation from natural-language input. 3. Train and use a neural network for NLP. 4. Use natural-language technology to construct and demo a new application. Credits: 3.00

ECE 40862 - Software For Embedded Systems

Credit Hours: 3.00. This course provides an introduction to software design for embedded computing systems. Major topics covered include the importance of time and timing in embedded systems, embedded software organization (FSM-based program design, polled loop systems, foreground-background systems, event driven architectures, multi-tasking, etc.), real-time scheduling and real-time operating systems, wired/wireless networked embedded systems, debugging techniques for embedded software, and advanced topics such as memory-safe programming, implementing reentrant functions, and minimizing code space, memory usage, and power consumption. The course features a series of integrated assignments using state-of-the-art embedded hardware platforms, embedded software design tools, and real-time operating systems that reinforce the concepts taught in the lectures.

Learning Outcomes: 1. Understand the embedded software design process and tools used. 2. Understand various software architectures for embedded systems. 3. Apply advanced debugging techniques to embedded software. 4. Analyze and implement real-time embedded applications. 5. Design and implement distributed applications for networked embedded systems. Credits: 3.00

ECE 40875 - Data Mining Basic Concepts And Techniques

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, such as the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering, classification, anomaly detection, recommendation and graph analysis. The applications of these techniques in real-world decision making in various domains, such as science, business, biology, health care, transportation, will be discussed.

Learning Outcomes: 1. Describe and explain the process of data mining. 2. Formulate problems in real-world applications into data mining tasks and solve the problems using data mining techniques. 3. Implement software programs that conduct data mining and evaluate the output of data mining programs. 4. Work in a team and present data mining solutions to people in scientific or other disciplines. Credits: 3.00

ECE 41015 - Introduction To Smart Grid

Credit Hours: 3.00. This course is an introduction to the concepts of data communications, cybersecurity, and information privacy on a smart-grid environment. Understanding the differences between power grid employed worldwide since the end of the 19th century and the new power grid system with

distributed energy sources, this course outlines the key issues involved in enhancing: the distribution system, engaging electricity demand and utility regulation. Students will learn the main challenges and solutions to mitigate the issues associated with the integration of variable energy resources, transmission expansion and the impact of distributed generation and electric vehicles.

Learning Outcomes: 1. Describe the operation of conventional power grid systems including its generation, transmission and distribution, and the new power grid system with distributed energy sources along the transmission and distribution lines. 2. Develop simplified models to describe different components on both traditional and the smart grid. 3. Design and specify renewable energy systems (e.g., solar and wind energy sources) as well as storage devices (e.g., batteries) connected to the smart grid. 4. Develop load flow analysis of power grids. 5. Understand the main data communications standards. 6. Classify the cybersecurity vulnerabilities and understand the risks of an attack on the grid. Credits: 3.00

ECE 41023 - Electromechanical Motion Control

Credit Hours: 3.00. The operation, analysis, and control of electromechanical systems are covered, including a treatment of electromechanical devices, power electronics, and control systems. Sample applications include servo-systems, propulsion drives, and variable-speed rotational equipment.

Learning Outcomes: 1. Understand the structure, design, and operating characteristics of dc drive systems including dc/dc converters, associated switching strategies, dynamic-average-value models, and speed/position/trajectory motion control systems. 2. Understand the structure, design and operating characteristics of brushless dc drive systems including dc/ac inverters, associated switching strategies, dynamic-average-value models, and speed/position/trajectory motion control systems. 3. Understand the operating principles and control of stepper motors including the design of optimum acceleration/deceleration profiles. 4. Understand the operating principles and control of field-oriented induction motor drives. 5. Understand the structure, operating characteristics, and modeling of switched reluctance motor drive systems. Credits: 3.00

ECE 41200 - Introduction To Engineering Optics

Credit Hours: 3.00. The control and characteristics of optical radiation are covered. Applications to optical instrumentation, thin films, holography, and polarizing optics are discussed.

Learning Outcomes: 1. Analyze simple optical systems (dielectric slabs, thin lenses, reflectors). 2. Model Gaussian beams and the transformation of beams. 3. Analyze and design polarization systems, including polarizers and wave plates. 4. Know optical interferometers and the operations of interferometers such as the Michelson, Fabry-Perot and double-slit. 5. Analyze diffraction patterns. Credits: 3.00

ECE 41300 - Introduction To Optics Laboratory

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and applications of geometrical optics, polarization optics, wave optics, and Fourier optics.

Learning Outcomes: 1. Design, construct, and test a simple optical system by assembling a set of optical components. 2. Test the operation of simple interferometers. 3. Make holograms using lab equipment. 4. Design practical optical system (e.g.; barcode scanner, laser microphone, etc.) and analyze its performance. Credits: 1.00

ECE 41400 - Elements Of Electro And Fiber Optics

Credit Hours: 3.00. Introduction to the use of lasers, fiber and integrated optical components and devices in communication and sensory applications. Topics include generation, transformation, modulation, deflection, and detection of laser beams, and their applications in fiber communication sensory systems.

Credits: 3.00

ECE 41500 - Electro- And Fiber Optics Laboratory

Credit Hours: 1.00. Laboratory exercises in lasers, hologram, modulation and deflection of laser beams, fiber components, and systems.

Credits: 1.00

ECE 43200 - Elements Of Power System

Engineering

Credit Hours: 3.00. Fundamental concepts of power system analysis, transmission line parameters, basic system models, steady-state performance, network calculations, power flow solutions, fault studies, symmetrical components, operating strategies, and control.

Learning Outcomes: 1. Understand the function of the main components in a power system, and the basis of their circuit models. 2. Able to build a system representation from components' circuit models and to apply solution techniques to certain operational needs. Credits: 3.00

ECE 43201 - Elementary Power Systems Engineering

Credit Hours: 3.00. Fundamental concepts of power systems analysis, transmission line parameters, basic system models, steady state performance, network calculations, power flow solutions, fault studies, symmetrical components, operating strategies and control.

Learning Outcomes: 1. Understand the functions of the main components in a power system, and the basis of their circuit models. 2. Build a system representation from components' circuit models and to apply solution techniques to certain operational needs. Credits: 3.00

ECE 43500 - Object-Oriented Design Using C++ And Java

Credit Hours: 3.00. Review of OO design with C++ and Java. Difficulties caused by multiple inheritances in C++. Taking advantage of Run-Time Identification in C++. Multi-threading, AWT, and Network Programming in Java. Discussion of Java applets, beans, and servlets. Unified modeling language. Use-case analysis. Constructing conceptual models. System sequence diagrams. "Gang of Four" design patterns. Case studies. Permission of instructor required.

Credits: 3.00

ECE 43700 - Computer Design And Prototyping

Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, datapath design, control strategies, pipelining, memory hierarchy, and I/O interface design.

Credits: 4.00

ECE 43800 - Digital Signal Processing With Applications

Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; short-time spectral analysis and synthesis; linear predictive coding. Image processing: two-dimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credits: 4.00

ECE 44000 - Transmission Of Information

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Learning Outcomes: 1. Recognize and analyze in the time and frequency domain the performance of amplitude and frequency modulated analog communications systems in the presence of noise. 2. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of analog systems, which include bandwidth and signal to noise ratio. 3. Recognize and analyze in the time and frequency domains the performance of various digital modulation formats, including ASK, QAM, PSK, and FSK in the presence of noise. 4. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of digital systems which include bandwidth and hit error probability. 5. Understand the basics of information theory and error control codes including the effect of error control codes on the bandwidth and bit error probability of digital systems. Credits: 4.00

ECE 44100 - Distributed Parameter Systems

Credit Hours: 3.00. Transient and steady-state behavior of transmission lines, wave guides, antennas, propagation, noise, microwave sources, and system design.

Credits: 3.00

ECE 45300 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the

key concepts developed in the last 25 years which constitute the fundamentals of nanoelectronics and mesoscopic physics, assuming a minimal set of prerequisites. Topics covered include the new Ohm's law, conductance quantization, the nanotransistor, spin valves, thermoelectricity, quantum systems and the non-equilibrium Green's function (NEGF) method.

Learning Outcomes: 1. Ability to perform semiclassical analysis of charge flow in nanoelectonic devices. 2. Ability to perform semiclassical analysis of spin flow and heat flow in nanoelectronic devices. 3. Ability to perform quantum analysis of nanoelectonic devices.

Credits: 3.00

ECE 45500 - Integrated Circuit Engineering

Credit Hours: 3.00. Analysis, design, and fabrication of silicon bipolar and MOSFET monolithic integrated circuits. Consideration of amplifier circuit design and fabrication techniques with circuit simulation using Spice-2. Integrated operational amplifiers with difference amplifiers, current sources, active loads, and voltage references. Design of IC analog circuit building blocks.

Credits: 3.00

ECE 45600 - Digital Integrated Circuit Analysis And Design

Credit Hours: 3.00. As applied t digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential, and dynamic logic circuits are considered. While the focus of the course is on CMOS technology, bipolar, nMOS, and BiCMOS circuits are introduced as well. SPICE is used as both an analysis and design tool. Semiconductor memory circuits are also discussed.

Credits: 3.00

ECE 45700 - Electronic Design Laboratory

Credit Hours: 1.00. Laboratory exercises illustrating the design and application of electronic circuits. Case studies of circuits presently in existing instruments, such as the color television receiver sampling oscilloscope, are used as a basis for the circuits investigated or designed. Pulse and analog circuits studied, as well as high voltage and power supplies. Signal processing, modulation, and sampling are used to demonstrate the circuits as interconnected into a complete system.

Credits: 1.00

ECE 46300 - Introduction To Computer Communication Networks

Credit Hours: 3.00. An introduction to the design and implementation of computer communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet success. Topics include: digital transmission and multiplexing, protocols, MAC layer design (Ethernet/802.11), LAN interconnects and switching, congestion/flow/error control, routing, addressing, performance evaluation, internetworking (Internet) including TCP/IP, HTTP, DNS etc. This course will include one or more programming projects.

Learning Outcomes: 1. An understanding of the fundamental principles underlying packet switching networks, and different Local Area Network technologies. 2. An ability to implement network protocols using network socket programming. 3. An understanding of the key principles behind retransmission protocols, congestion control algorithms, and TCP. 4. An understanding of the basic concepts of routing.

Credits: 3.00

ECE 46800 - Introduction To Compilers And Translation Engineering

Credit Hours: 4.00. The design and construction of compilers and other translators. Topics include compilation goals, organization of a translator, grammars and languages, symbol tables, lexical analysis, syntax analysis (parsing), error handling, intermediate and final code generation, assemblers, interpreters, and an introduction to optimization. Emphasis is on engineering a compiler or interpreter for a small programming language - typically a C or Pascal subset. Projects involve the stepwise implementation (and documentation) of such a system. Department permission required.

Credits: 4.00

ECE 46900 - Operating Systems Engineering

Credit Hours: 4.00. The design and construction of operating systems for both individual computers and distributed (networked) systems. Basic concepts and methods for managing processor, main memory, block-structured storage, and network resources are covered. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked versions of UNIX. These techniques are applied to design improvements of portions of a simplified, networked, UNIX-based operating system; the improvements are implemented and their performance is evaluated in laboratory experiments.

Credits: 4.00

ECE 47000 - Curricular Practical Training

Credit Hours: 0.00. An electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan of study and help prepare him/her for his/her future role as a practicing engineer. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job minimum period of employment is required. This course may not be taken in successive semesters. Permission of department required.

Credits: 0.00

ECE 47001 - Part-Time Curricular Practical Training

Credit Hours: 0.00. A part-time electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan of study and help prepare him/her for his/her future role as a practicing engineer. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Build skills realted to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 47100 - Embedded Microcontroller, Microprocessor, and DSP-Based Systems

Credit Hours: 3.00. A structured approach to the development and integration of embedded microcontroller/microprocessor/DSP-based systems. The course provides students with design experience of embedded systems. The course covers the microprocessor selection, the configuration of peripheral components, and the hardware abstraction techniques. The course also covers the C programming techniques for embedded systems and using a fixed point microprocessor for floating point calculations.

Credits: 3.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

ECE 47700 - Digital Systems Senior Project

Credit Hours: 4.00. A structured approach to the development and integration of embedded microcontroller hardware and software that provides senior-level students with significant design experience applying microcontrollers to a wide range of embedded systems (e.g., instrumentation, process control, telecommunications, and intelligent devices). The primary objective is to provide practical experience developing integrated hardware and software for embedded microcontroller systems in an environment that models one which students will most likely encounter in industry. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a microcontroller-based digital system. 2. Understand the engineering design process. 3. Function on a multidisciplinary team. 4. Be aware of professional and ethical responsibility. 5. Communicate effectively, in both oral and written form. Credits: 4.00

ECE 48300 - Digital Control Systems Analysis And Design

Credit Hours: 3.00. The course introduces feedback computer controlled systems, the components of digital control systems, and system models on the z-domain (z-transfer functions) and on the time domain (state variable representations.) The objectives for system design and evaluation of system performance are considered. Various discrete-time controllers are designed including PID-controllers, state and output feedback controllers, and reconstruction of states using observers. The systems with the designated controllers are tested by simulations.

Learning Outcomes: 1. Understand digital feedback control systems. 2. Know constructing discrete-time mathematical model system. 3, Know the analyzing system behavior using discrete-time model and evaluating the system performance. 4. Know to use controller design techniques to make the system behavior satisfy specified design objectives. 5. Evaluate and test the system performance using digital simulations. Credits: 3.00

ECE 49022 - Electrical Engineering Senior Design Projects

Credit Hours: 4.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics). Lectures require use of the I-Clicker system.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain

new knowledge necessary to design and test a system, component, or process to meet desired needs. 2. Understand the engineering design process. 3. Function on an interdisciplinary team. 4. Acquire an awareness of professional and ethical responsibility. 5. Develop effective communication skills, both oral and written. Credits: 4.00

ECE 49401 - Professional Communication Capstone

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and plans for professional growth.

Learning Outcomes: 1. Communicate effectively with a range of audiences. 2. Function effectively on a team whose members together create a collaborative and inclusive environment, plan tasks, and meet objectives. 3. Ability to make informed judgments based ethical and professional responsibilities in engineering situations, giving consideration to global, economic, environmental, and/or societal contexts. Credits: 1.00

ECE 49500 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

Credits: 1.00 to 4.00

ECE 49595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 49600 - Electrical And Computer Engineering Projects

Credit Hours: 0.00 to 18.00. Arrange Hours and Credit. Topics vary. Permission of department required.

Learning Outcomes: 1. Apply fundamental laws of electrical and electronic circuits to analyze systems and circuits. 2. Assemble and test circuits (virtual and real), measuring electrical quantities using standard instrumentation. 3. Decompose a system into functional blocks; and in some applications, blocks into circuits. 4. Utilize technology to control electronic circuit actions. 5. Utilize structured problem solving techniques to analyze fundamental applications in electronics. 6. Demonstrate knowledge of and apply electrical safety. Credits: 0.00 to 18.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement,

debug, and execute basic machine learning algorithms on computers. Credits: 3.00

ECE 50435 - Introduction To Quantum Science And Technology

Credit Hours: 3.00. This course introduces engineering students with no background in quantum mechanics to the fundamental concepts of quantum physics and how these principles are being used to create revolutionary quantum information technologies. The course aims to develop an understanding of quantum phenomena and identify engineering challenges and opportunities of various quantum information technologies. Topics covered include the fundamentals of quantum mechanics, the quantization of electrical circuits and electromagnetic fields, and the interactions between (artificial) atoms and electromagnetic fields. These topics are discussed in the context of popular hardware platforms and how they can be harnessed to create quantum computers, quantum communication systems, and quantum sensing systems.

Learning Outcomes: 1. Apply fundamental quantum mechanical principles to analyze simple quantum systems. 2. Analyze the properties of quantum electrical circuits and electromagnetic fields. 3. Analyze the interactions between (artificial) atoms and classical and quantum electromagnetic fields. 4. Use engineering judgement to assess the capabilities and challenges of revolutionary quantum technologies. Credits: 3.00

ECE 50616 - Physics And Manufacturing Of Solar Cells

Credit Hours: 3.00. This course introduces the electronic, optical and material properties and the manufacturing of photovoltaic devices. Topics include electronic charge separation, transportation and recombination; optical concentration, trapping and confinement; material preparations in photovoltaic systems; bulk crystal, thin-film and organic photovoltaic device configurations; energy storage; as well as emerging concepts in photovoltaics. Discussions also involve the process and equipment for the manufacturing of various photovoltaic modules, with special emphasis on driving down the cost of photovoltaic systems.

Learning Outcomes: 1. Understand different market segments for photovoltaics and their key requirements. 2. Understanding of p-n junctions, drift and diffusion of charges, LUMO and HOMO. 3. Extract efficiency from i-v characteristics of photovoltaic cells. Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance and the two Landauer formulas. Credits: 1.00

ECE 50632 - Introduction To Quantum Transport

Credit Hours: 1.00. This course introduces the Schrödinger equation, uses the tight-binding method to discuss the concept of bandstructure and E(k) relations, along with simple quantum transport problems. No prior background in quantum mechanics or statistical mechanics is assumed.

Learning Outcomes: 1. Explain tight-binding model, reciprocal lattice and evaluate dispersion relation. 2. Explain NEGF equations, dephasing, quantum point contact and evaluate quantities like the transmission, the self-energy and spectral functions. 3. Use Pauli spin matrices and evaluate quantities like spin density. Credits: 1.00

ECE 50633 - Boltzmann Law: Physics To Computing

Credit Hours: 1.00. This course introduces the key concepts of equilibrium statistical mechanics leading to the celebrated Boltzmann law and how it leads to Boltzmann machines and related concepts in modern machine learning. No prior background in statistical mechanics is assumed.

Learning Outcomes: 1. Explain the law of equilibrium and entropy. 2. Understand the operation of Boltzmann machines. 3. Understand the operation of quantum circuits. Credits: 1.00

ECE 50635 - An Introduction To Data Analysis, Design Of Experiment, And Machine Learning

Credit Hours: 1.00. This course will provide the conceptual foundation so that a student can use modern statistical concepts and tools to analyze data generated by experiments or numerical simulations. We will also discuss the principles of the design of experiments so that the data generated by experiments/simulations are statistically relevant and useful. We will conclude with a discussion of analytical tools for machine learning and principal component analysis. At the end of the course, a student will be able to use a broad range of tools embedded in MATLAB and Excel to analyze and interpret their data.

Learning Outcomes: 1. Analyze data taken from variety of sources. 2. Design randomized experiments and analyze the results. 3. Understand key machine learning algorithms and use them in illustrative examples. Credits: 1.00

ECE 50641 - Semiconductor Fundamentals

Credit Hours: 1.00. This course about semiconductors is designed to provide a foundation to understand the operation of devices such as transistors, diodes, solar cells, light-emitting devices, etc. The course does not discuss devices - it prepares students to understand the operation of semiconductor devices. The treatment is physical and intuitive, and not heavily mathematical. Technology users will gain an understanding of the semiconductor physics that is the basis for devices. Semiconductor technology developers may find it a useful starting point for diving deeper into condensed matter physics, statistical mechanics, thermodynamics, and materials science. The course presents an electrical engineering perspective on semiconductors, but those in other fields may find it a useful introduction to the approach that has guided the development of semiconductor technology for the past 50+ years. Topics include semiconductor fundamentals such as energy bands, bandgaps, effective masses, electrons and holes, and elements of quantum mechanics. The Fermi function, doping, and carrier densities are then discussed. Carrier transport and generation-recombination are examined along with the important concept of quasi-Fermi levels. The course concludes with the "semiconductor equations," which provide a complete, mathematical description of electrons and holes in semiconductors (subject to some important simplifying assumptions) and ends with a discussion of how energy band diagrams provide a qualitative solution to these equations.

Learning Outcomes: 1. Be familiar with computing basic semiconductor quantities such as electron and hole drift and diffusion currents, recombination-generation rates, and quasi-Fermi levels. 2. Simplify and apply the semiconductor equations to specific semiconductor problems. 3. Draw and interpret energy band diagrams for specific semiconductor problems. Credits: 1.00

ECE 50642 - Fundamental Of Transistors

Credit Hours: 1.00. This course is designed for anyone seeking a sound, physical, intuitive understanding of how modern transistors operate. Important technology considerations and applications of transistors are also discussed. The focus is on MOSFETs for digital logic, but other types of transistors are briefly considered. The course is broadly accessible to students with only a very basic knowledge of semiconductor physics and electronic circuits and should be useful for advanced undergraduates, beginning graduate students, as well as practicing engineers and scientists. Topics include device metrics for digital and analog circuits, traditional MOSFET theory, the virtual source model, 1D and 2D electrostatics, Landauer/transmission approach to nanotransistors, the limits of MOSFETs, as well as a quick look at HEMTs, bipolar transistors, and compact circuit models.

Learning Outcomes: 1. Understand MOSFET IV characteristics and device metrics and be able to analyze measured transistors characteristics and extract key device parameters. 2. Have a sound understanding of the physical operation of transistors and be acquainted with the traditional theory of the MOSFET. 3. Be familiar with 1D/2D/3D MOS electrostatics and appreciate the need for advanced MOSFET structures such as the FinFET. 4. Understand modern transport theory (the transmission approach) and its application to nanoscale MOSFETs. 5. Be introduced to other barrier-controlled transistors, such as HEMTs and bipolar transistors. 6. Know what a physics-based compact model is and the role they play in electronics. Credits: 1.00

ECE 50650 - Applied Quantum Computing I - Fundamentals

Credit Hours: 1.00. This fundamentals course is part 1 of the series of quantum computing courses and covers aspects from fundamentals to present-day hardware platforms to quantum software and programming. This course provides the essential foundations required to understand computing models built from the principles of quantum mechanics. This course requires a minimal set of engineering and science prerequisites but will allow students to develop a physical and intuitive understanding of the topics.

Learning Outcomes: 1. Learn the fundamental postulates of quantum mechanics and how they

can be mapped onto present-day quantum information processing models. Credits: 1.00

ECE 50651 - Applied Quantum computing II - Hardware

Credit Hours: 1.00. This course is part 2 of the series of Quantum computing courses, which covers aspects from fundamentals to present-day hardware platforms to quantum software and programming. The goal of part 2 is to provide the essential understanding of how the fundamental quantum phenomena discussed in part 1 can be realized in various material platforms and the underlying challenges faced by each platform. To this end, we will focus on how quantum bits (qubits, the building block of quantum information processing) can be defined in each platform, how such qubits are manipulated and interconnected to form larger systems, and the sources of errors in each platform. With an emphasis on present-day leading candidates, we will discuss the following specific quantum material platforms: 1) Superconductor-based and 2) Atom/ion traps-based. The material will appeal to engineering students, natural sciences students, and professionals whose interests are in using and developing quantum information processing technologies.

Learning Outcomes: 1. Understand domain-specific quantum algorithms and how to run them on present-day quantum hardware. Credits: 1.00

ECE 50652 - Applied Quantum Computing III - Software and Algorithm

Credit Hours: 1.00. This course is part III of the series of Quantum computing courses, which covers aspects from fundamentals to present-day hardware platforms to quantum software and programming. The goal of part III is to discuss some of the key domain-specific algorithms that are developed by exploiting the fundamental quantum phenomena (e.g. entanglement) and computing models discussed in part I. We will begin by discussing classic examples of quantum Fourier transform and search algorithms, along with its application for factorization (the famous Shor's algorithm). Next, we will focus on the more recently developed algorithms focusing on applications to optimization, quantum simulation, quantum chemistry, machine learning, and data science. A particularly exciting recent development has been the emergence of near-intermediate scale quantum (NISQ) computers. We will also discuss how these machines are driving new algorithmic development. A key aspect of the course is to provide hands-on training for running (few qubit instances of) the quantum algorithms on present-day quantum hardware. For this purpose, we will take advantage of the availability of cloud-based access to quantum computers and quantum software. The material will appeal to engineering students, natural sciences students, and professionals whose interests are in using as well as developing quantum technologies.

Learning Outcomes: 1. Understand how present-day material platforms are built to perform quantum information processing tasks. Credits: 1.00

ECE 50653 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. The modern smartphone is enabled by a billion-plus nano-transistors, each having an active region that is barely a few hundred atoms long. Interestingly the same amazing technology has also led to a deeper understanding of the nature of current flow on an atomic scale. The aim of this course is to make the fundamentals of nanoelectronics accessible to anyone in any branch of science or engineering, assuming very little background beyond linear algebra and differential equations, although we will be discussing advanced concepts in non-equilibrium statistical mechanics that should be of interest even to specialists. We first introduce a new perspective connecting the quantized conductance of short ballistic conductors to the familiar Ohm's law of long diffusive conductors, along with a brief description of the modern nano-transistor. We then address fundamental conceptual issues related to the meaning of resistance on an atomic scale, the interconversion of electricity and heat, the second law of thermodynamics and the fuel value of information. Finally we introduce the concepts of quantum transport as applied to modern nanoscale electronic devices.

Learning Outcomes: 1. Perform semi-classical analysis of charge flow in nanoelectronic devices. 2. Perform semi-classical analysis of the interconversion of heat and electricity in nanoelectronic devices. 3. Perform quantum analysis of nanoelectronic devices. Credits: 3.00

ECE 50836 - Introduction To Data Mining

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, i.e., the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering, classification, anomaly detection, recommendation and graph analysis. Students are expected to gain the skills to formulate data mining problems, solve the problems using data mining techniques and interpret the output.

Learning Outcomes: 1. Describe and explain the process of data mining. 2. Formulate problems in real-world applications into data mining tasks and solve the problems using data mining techniques. 3. Implement software programs that conduct data mining and evaluate the output of data mining programs. 4.

Present data mining solutions to people in scientific and other disciplines. Credits: 3.00

ECE 50863 - Computer Network Systems

Credit Hours: 3.00. The goal of this course is to provide students with a proper grounding in the basic concepts and seminal work in computer network protocols and systems, and to introduce students to research in the field. The course will cover classical concepts such as network architecture, switching, routing, congestion control, and quality-of-service, and discuss recent developments in these areas. The course will also cover new developments in networking such as network measurements, network management, overlay networking and peer-to-peer systems, network security, and new network architectures. The course will emphasize a system-oriented and empirical view of internet architecture. Graduate standing or consent of instructor.

Learning Outcomes: 1. Understand the architectural principles underlying internet design. 2. Understand LAN interconnects, routing algorithms, and congestion control algorithms. 3. Identify, formulate, and solve problems encountered in the design of networks. 4. Implement networking systems and rigorously evaluate them using systematic empirical methods. Credits: 3.00

ECE 51000 - Introduction To Biometrics

Credit Hours: 3.00. Biometrics is an emerging technology for automatic human identification and verification using unique biological traits. Compared to traditional identification and verification methods, biometrics is more convenient for users, reduces fraud, and is more secure. It is becoming an important ally of security, intelligence, law enforcement, and e-commerce. The principle of various biometric technologies and systems is introduced. Especially, students analyze and design fingerprint recognition, face recognition, iris recognition, voice recognition, and multimodal biometric systems. Students have hands-on experience in designing and analyzing biometric systems.

Credits: 3.00

ECE 51012 - Electromechanics

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of dc, induction, brushless dc, and stepper motors used in control applications are presented. Prerequisite by Topic: Basic circuit analysis; Elementary electromagnetics; Elementary mechanics.

Learning Outcomes: 1. Acquire knowledge of magnetics and magnetic materials as it relates to electromechanical devices. 2. Understand the energy conversion process including field energy, co-energy, force and torque production. 3. Be familiar with the use in reference frame theory in the analysis of rotational electromechanical devices. 4. Understand the operation of rotating electric machines including stepper motors, permanent magnet ac machine, and induction machines. 5. Understand the acceptable and unacceptable practice with regard to taking exams, working on homework, working on the project, and the implications of unacceptable practices. Credits: 3.00

ECE 51018 - Hybrid Electric Vehicles

Credit Hours: 3.00. Introduction to architectures and technologies associated with electric and hybrid electric vehicles including their constituent components. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization. Prerequisite by Topic: Energy conversion and power electronics.

Learning Outcomes: 1. Understand the principal architectures of electric and hybrid electric vehicles. 2. Analyze performance characteristics and understand limitations of each architecture. 3. Understand the principal components of an HEV including the energy storage, conversion, transmission, and control subsystems. 4. Integrate disparate subsystem models to form end-to-end vehicle model. Credits: 3.00

ECE 51032 - Computational Methods For Power System Analysis

Credit Hours: 3.00. System modeling of power networks. Description of modern electricity markets. Analysis of the economic dispatch problem using optimality conditions. Planning of distributed energy resources. Smart grid applications. Machine learning applications to power systems (forecasting, demand-side management, and fault detection). Assigned projects will involve implementing some of the methods using realistic power system models.

Learning Outcomes: 1. Explain how electricity markets work and how various computational methods are used in power system operations and planning. 2. Understand formulation and solution techniques applied to normal operation

of large power systems. 3. Implement existing optimization packages to solve power system problems. 4. Use machine learning methods to answer questions about power system operations. Credits: 3.00

ECE 51100 - Psychophysics

Credit Hours: 3.00. (PSY 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of department required.

Credits: 3.00

ECE 51214 - CMOS Analog IC Design

Credit Hours: 3.00. The course covers general topics in CMOS analog IC design; biasing, noise, single stage amplifiers, differential amplifiers, OP-Amp, OTA, frequency domain analysis, and active filters. While the focus of the course is on CMOS IC design, design in bipolar andBi CMOS technologies are introduced as well. A design project is a key component of the course. The students conduct group or individual design projects. Process Design *Kit* and EDA tools are provided for the design projects.

Learning Outcomes: 1. Have basic knowledge of bias circuits. 2. Have basic knowledge of noise analysis. 3. Understand single-stage amplifiers and their applications. 4. Understand differential Op-amp, OTA, and practical design skills. 5. Understand feedback circuits. 6. Understand basic active filters, practical design skills, and applications. Credits: 3.00

ECE 51216 - Digital Systems Design Automation

Credit Hours: 3.00. This course will provide an introduction to the tools used to design and analyze circuits at the logic level of abstraction (where circuits are composed of gates and flip-flops). Most digital chips used in computing and electronic systems (including microprocessors, graphics processors, chips used in network routers, cell phones, digital audio/video appliances, automotive electronics) are entirely or largely designed using EDA tools. This course will focus on the foundations of logic-level EDA tools, including the design of exact and heuristic algorithms that form the basis for VLSI Computer-Aided Design. Topics covered include an overview of the IC design flow and levels of abstraction, synthesis of two-level (AND-OR / PLA) circuits, multi-level logic synthesis and technology mapping, sequential circuit synthesis, Logic-level verification using Boolean Satisfiability and BDDs, Timing Analysis, Power analysis and Reduction, and design techniques for emerging nanoscale technologies.

Learning Outcomes: 1. Design minimal combinational logic circuits. 2. Design minimal finite-state machines. Credits: 3.00

ECE 51220 - Applied Algorithms

Credit Hours: 3.00. Solving large-scale problems typically rely on many clever data structures and algorithms. This course aims to cover many such useful algorithms for solving large-scale problems. These algorithms include greedy algorithms, dynamic programming and more advanced graph algorithms. The course also aims to demonstrate how such algorithms can be applied to solve optimization problems encountered in engineering applications. In particular, applications in the design of VLSI (very large scale integration) at circuit, layout, or system level will be used to demonstrate how an engineering problem can be formulated as a tree/graph problem and solved using established tree/graph algorithms.

Learning Outcomes: 1. Demonstrate an understanding of greedy algorithms and dynamic programming (ABET outcome 1). 2. Demonstrate an n understanding of advanced graph algorithms (ABET outcome 1). 3. Demonstrate an ability to design and implement appropriate data structures and algorithms for engineering applications (ABET outcomes 1 and 2). Credits: 3.00

ECE 51300 - Diffraction, Fourier Optics, And Imaging

Credit Hours: 3.00. Modern theories of diffraction and Fourier optics for imaging, optical communications, and networking. Imaging techniques involving diffraction and/or Fourier analysis with application to tomography, magnetic resonance imaging, synthetic aperture radar, and confocal microscopy. Additional topics in optical communications and networking, including wave propagation in free space, fiber, integrated optics, and related design issues. Simulation studies, using Matlab and other software packages for analysis and design. Offered odd years.

Learning Outcomes: 1. A knowledge of a number of important technologies based on wave propagation such as digital diffractive imaging techniques and devices involving the principles of diffraction and/or Fourier analysis and synthesis techniques. 2. A knowledge of developments in the areas of device fabrication and computer technology for the fabrication of optical components and implementation of imaging/focusing modalities not possible until

recently. 3. An ability to deal with the analysis of imaging and focusing techniques involving diffraction. 4. A knowledge of a number of other topics, such as dense wavelength division multiplexing (DWDM) systems and devices, micro/nano systems in need of rigorous diffraction theory, image and phase recovery involving Fourier analysis and Fourier iterative optimization techniques, focusing of wave energy and daylighting. 5. An ability to utilize the theoretical analysis of such topics based on Fourier analysis and synthesis for system and device fabrications. Credits: 3.00

ECE 51500 - Software Engineering For Embedded Systems

Credit Hours: 3.00. This course teaches the object-oriented system analysis and design for embedded systems. Unified modeling language and Shlaer/Mellor methodology are studied. Assigned project will lead students through the cycles of information gathering, problem analysis, model design, and model implementation for software development.

Credits: 3.00

ECE 51501 - Smart Grid

Credit Hours: 3.00. The course analyzes the history of the U.S. power grid and to the basic concepts on the current electric power system. The main challenges on the transition of the traditional power system with unidirectional power flow to the new and complex system connected to renewable sources and bidirectional power flow capability is also presented in this course. In addition, the impact of distributed generation and electric vehicles is discussed along with cybersecurity and information privacy issues inherent in this new power grid.

Credits: 3.00

ECE 52301 - Nanosystems Principles

Credit Hours: 3.00. (ME 52301) This is the introductory course in the nanosystems area. It introduces students to the principles and applications of nanosystems. The course begins with an introduction to the nanometer scale phenomena. It then introduces students to the basic elements resulting in nanosystems: nanoscale materials, processes, and devices. It also provides students with a basic understanding of the tools and approaches that are used for the measurement and characterization of nanosystems, and their modeling and simulation. Moreover, the course covers the applications of nanosystems in a wide range of industries, including information technology, energy, medicine, and consumer goods. The course concludes with a discussion of the societal and economical significance of these applications, including benefits and potential risks.

Credits: 3.00

ECE 52600 - Fundamentals Of MEMS And Micro-Integrated Systems

Credit Hours: 3.00. (BME 58100) Key topics in micro-electro-mechanical systems (MEMS) and biological micro-integrated systems; properties of materials for MEMS; microelectronic process modules for design and fabrication. Students will prepare a project report on the design of a biomedical MEMS-based micro-integrated system. Offered in alternate years. Permission of department required.

Credits: 3.00

ECE 52601 - Integrated Nanosystems Processes And Devices

Credit Hours: 3.00. (ME 52601) This course covers processes and devices associated with integrated nanosystems. Integrated nanosystems refer to systems which consist of integrated micro-, meso-, and/or macro-scale parts, and their core components are realized by nano-scale materials, processes, and devices. The course, while covering processes which result in integrated nanosystems, will focus on the theory and operation of select electronic, electromechanical, and biomedical devices which are used for information technology, sensing, medical, and other applications. The lectures will be complemented by hands-on laboratory experience. Permission of instructor required.

Credits: 3.00

ECE 52702 - Advanced Power Electronics Converters

Credit Hours: 3.00. The course introduces students to advanced power electronics converters dealing with ac voltage. The power electronics topologies considered in this course are sorted into two groups: multilevel configurations and back-to-back converters. The multilevel configurations presented are: a) neutral-point-clamped, b) cascade, c) flying capacitor, and d) non-conventional multilevel configurations. The back-to-back converters presented are: a) three-phase to three-phase, b) single-phase to three-phase, c) single-phase to single-phase ac-dc-ac converters. A new methodology will be employed to present comprehensively multilevel and back-to-back converters topologies. The main applications of those converters are in renewable energy systems, active power filters, energy efficiency devices and motor drive systems. Permission of instructor required.

Credits: 3.00

ECE 52800 - Measurement And Stimulation Of The Nervous System

Credit Hours: 3.00. (BME 52800) Engineering principles addressing questions of clinical significance in the nervous system: neuroanatomy, fundamental properties of excitable tissues, hearing, vision, motor function, electrical and magnetic stimulation, functional neuroimaging, disorders of the nervous system, development and refinement of sensory prostheses.

Credits: 3.00

ECE 53301 - Wireless And Multimedia Computing

Credit Hours: 3.00. A treatment of Voice and Video over IP and wireless communication algorithms, protocols, standards, and implementation using multicore digital signal processors and communications processor modules. Discussion of voice over IP and wireless communication algorithms, protocols and standards, and advanced wireless and voice over IP applications.

Credits: 3.00

ECE 53401 - Embedded Autonomous Systems In Automotive Platforms

Credit Hours: 3.00. A treatment of Embedded and Autonomous Systems: Motor Control, Image Vision, Sensors, Security, Neural Networks, SLAM, Machine and Deep Learning, Protocols, Standards and Implementation using Multiprocessors, Multicores, ISP, Bluebox and APEX.

Credits: 3.00

ECE 53600 - Introduction To Computational Intelligence

Credit Hours: 3.00. Basic concepts in theory and paradigms for neural networks, evolutionary computation, and fuzzy logic; algorithms and applications for hybrids of these tools known as computational intelligence are explored. Topics include artificial neural networks, fuzzy systems, and evolutionary computation. Implementations of a number of paradigms are presented, including particle swarm optimization. Applications to various areas, such as biomedical engineering and nonlinear control, are examined.

Credits: 3.00

ECE 53700 - Multimedia Applications

Credit Hours: 3.00. Treatment of multimedia algorithms and implementation using high-speed multimedia processors. Detailed discussion of entropy coding, transform coding, speech compression, image compression, video compression, and architecture, addressing modes, and instruction set of multimedia processors.

Credits: 3.00

ECE 53800 - Digital Signal Processing I

Credit Hours: 3.00. Theory and algorithms for processing of deterministic and stochastic signals. Topics include discrete signals, systems, and transforms, linear filtering, fast Fourier transform, nonlinear filtering, spectrum estimation, linear prediction, adaptive filtering, and array signal processing.

Learning Outcomes: 1. Understand the autocorrelation and covariance methods of estimating the correlation matrix. 2. Know the Discrete Time Fourier Transform (DTFT) and its relationship to the Discrete Fourier Transform (DFT). 3. Comprehend of parametric methods of spectrum estimation, including autoregressive modeling, minimum variance, linear prediction, and eigendecomposition-based methods. 4. Understand nonparametric methods of spectrum estimation, including the periodogram and the correlogram. 5. Understand of linear filters, including the Wiener filter, as applied stochastic to signals. 6. Introduce to adaptive filters, including the method of steepest descent and the least-mean-square (LMS) algorithms. Credits: 3.00

ECE 53801 - Discreet Event Dynamic Systems

Credit Hours: 3.00. This course introduces discrete event dynamic systems with their applications in system modeling, analysis, and control. Models such as automata, Petri nets, Markov chain, and queueing systems are introduced, along with analysis of their dynamics. Discrete event simulation methods are included. Examples from various engineering applications are given. Permission of instructor required.

Credits: 3.00

ECE 53900 - Foundations Of Advanced Engineering I

Credit Hours: 3.00. Several mathematical tools applied in the engineering discipline are discussed. Statistical methods, including construction of confidence interval and hypothesis testing, as well as regression and regression analysis, are discussed. Discrete tools are discussed; these include logic and mathematical reasoning, combinatorics, groups and finite fields. Applications of some of these tools in engineering problems are introduced. Decision Theory including Bayes Theorem and applying Bayes Theorem to form decision problems. Permission of instructor required.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 54700 - Introduction To Computer Communication Networks

Credit Hours: 3.00. A qualitative and quantitative study of the issues in design, analysis, and operation of computer

communication and telecommunication networks as they evolve toward the integrated networks of the future, employing both packet and circuit switching technology. The course covers packet and circuit switching, the OSI standards architecture and protocols, elementary queuing theory for performance evaluation, random access techniques, local area networks, reliability and error recovery, and integrated networks.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental principles underlying computer communication networks. [1,3,4;a,e] 2. Demonstrate an ability to obtain mathematical models of networking systems. [1,2,4;a,e] 3. Demonstrate an ability to perform queueing analysis of simpler queueing networks, convergence analysis of routing protocols, and stability analysis of random access mechanisms. [1,2,4;a,e,k] 4. Demonstrate an ability to solve simple network design and optimization problems to meet specifications in though put and delay. [1,4;a,c,e,k] 5. Demonstrate an ability to use simulation tools for network analysis and design. [1,3,4;a,c,e,k] Credits: 3.00

ECE 54800 - Introduction To 2D And 3D Digital Image Processing

Credit Hours: 3.00. An introduction to 2D and 3D image processing. Lecture and projects covering a wide range of topics including 2D and 3D image analysis, image segmentation; color image processing, image sharpening, linear and filtering, image restoration, and image registration. Permission of instructor required.

Credits: 3.00

ECE 55200 - Introduction To Lasers

Credit Hours: 3.00. An introduction to lasers and laser applications which does not require a knowledge of quantum mechanics as a prerequisite. Topics include: the theory of laser operation; some specific laser systems; nonlinear optics; optical detection; and applications to optical communications, holography, laser-driven fusion, and integrated optics.

Credits: 3.00

ECE 55400 - Electronic Instrumentation And Control Circuits

Credit Hours: 3.00. Analysis and design of special amplifiers, pulse circuits, operational circuits, DC amplifiers, and transducers used in instrumentation, control, and computation.

Credits: 3.00

ECE 55700 - Integrated Circuit Fabrication Laboratory

Credit Hours: 3.00. Laboratory exercises in the fabrication and testing of silicon integrated circuits. Both bipolar and MOS integrated circuit test chips are fabricated and tested. Laboratory technique, the technology of integrated circuit fabrication, and electrical characterization are emphasized. Permission of department required.

Credits: 3.00

ECE 55801 - Advanced Systems On A Chip (SoC) Designs For Image Processing Using FPGAs

Credit Hours: 3.00. This class covers advanced concepts in using Field Programmable Gate Arrays (FGPAs) designed with and HDL (VHDL for example: Very High Speed IC Hardware Description Language). The students will learn complex interface design, advanced hardware and embedded system design and parallel processing. Projects and lessons will focus on application in Digital Imaging Systems. Lecture and projects covering topics including: VHDL mapped to FPGA for state machine design, hardware and software VGA control, image filtering, data transfer to bus, and embedded controller integration. Permission of instructor required.

Credits: 3.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

ECE 56300 - Programming Parallel Machines

Credit Hours: 3.00. This course presents methods and techniques for programming parallel computers, such as multicore and high-end parallel architectures. Various parallel algorithms will be presented to demonstrate different techniques for identifying parallel tasks and mapping them onto parallel machines. Realistic science/engineering applications and their characteristics will be discussed. Parallel architectures to be considered are shared-memory and distributed-memory multiprocessor systems. Programming paradigms for these

machines will be compared, including directive-based (OpenMP), message passing (MPI) and thread-based (Posix threads) methods. Methodologies for analyzing and improving the performance of parallel programs will be discussed. There will be a class project in which each student parallelizes and tunes the performance of a large computation application or develops/improves a tool that helps this process. Each student will prepare one lecture for a selected topic. Offered during odd years.

Credits: 3.00

ECE 56401 - Computer Security

Credit Hours: 3.00. In this course the discussion will include the following topics: (not necessarily in this order) security policies, confidential policies, integrity policies, security models, security design, access control, cryptography, key management, authentication, program and software, security, malicious logic, intrusion detection, network security, security attacks and countermeasures, operation system security, smartcard tamper-resistant devices, phishing, legal and ethical issues in computer security, and selected topics.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 56601 - Real-Time Operating Systems And Applications

Credit Hours: 3.00. This course introduces students to the principles of modern operation systems focusing on real-time operation systems and embedded operation systems and their applications. Permission of instructor required.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 56810 - Design With Embedded Systems

Credit Hours: 3.00. This course provides an overview of the architectures, design considerations, features and applications of embedded processors with digital signal processing capabilities. The course emphasizes design consideration for embedded systems. Different applications such as Internet of Things, Voiceover IP, Machine to Machine, Wearable Devices, Smart Homes, Medical Devices, Drones and Wireless Systems, are considered.

Credits: 3.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57101 - System Modeling And Design For Smart Devices

Credit Hours: 3.00. Introduction to the mobile computing and the principles to design and implement application system for a smart device, including mobile computing architecture, mobile and pervasive computing environments, applications and services, context-aware computing, and human-computer interaction. Permission of instructor required.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECE 57700 - Engineering Aspects Of Remote Sensing

Credit Hours: 3.00. Introduction to the concepts of multispectral image data generation and analysis. Basic principles of optical radiation, reflection, and measurement in natural scenes. Fundamentals of multispectral sensor design and data analysis for complex scenes. Application of signal processing and signal design principles and of statistical pattern recognition to these problems. Spatial image processing methods and algorithms as appropriate to land scene data. Practice with analysis of actual aircraft and spacecraft data in a cross-disciplinary environment. Offered even years.

Learning Outcomes: 1. Knowledge of a number of important technologies based on multispectral/hyperspectral remote sensing and related image processing techniques. 2. Knowledge of machine learning techniques such as deep learning for remote sensing technologies. 3. Knowledge of developments in the areas of statistical analysis for remote sensing. 4. Knowledge of a number of other topics, such as MATLAB and Python for remote sensing algorithms. 5. Ability to utilize the theoretical analysis of topics based statistical pattern recognition and machine learning for various system designs. Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 58500 - Automotive Control

Credit Hours: 3.00. Basic engine operation; Air-Fuel Ratio control, Idle Speed control, Knock control,Fuel injection timing control, Ignition control of SI engines; Engine fault diagnosis; Driveline modeling and control, Clutch phasing control; Hybrid Electric Vehicle and its control; Wheel model and complete vehicle model; Observers, Friction coefficient estimators, Tire contact patch force estimators; Anti-lock brake control, Traction control, Yaw stability control, Drive-By-Wire systems.

Credits: 3.00

ECE 58900 - State Estimation And Parameter Identification Of Stochastic Systems

Credit Hours: 3.00. Introduction to point estimation, least squares, Bayes risk, and maximum likelihood. Optimum mean-square recursive estimation for nondynamic stochastic systems. State estimation for discrete-time and continuous-time dynamic systems. Parameter identification of stochastic systems using maximum likelihood. Stochastic approximation, least squares, and random search algorithms. Offered in alternate years.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60004 - Communication For Engineering Leaders

Credit Hours: 1.00. The goal of this course is to upskill talented engineers' communication abilities. By the end of the course,

you should have new adeptness at creating and delivering powerful presentations on a short deadline, as well as strategies for leading others effectively.

Learning Outcomes: 1. Create engaging, effective presentations and documents. 2. Design plans for valuable, productive workplace and team interactions. 3. Develop a leadership or mentoring plan tailored to your specific workplace. Credits: 1.00

ECE 60022 - Wireless Communication Networks

Credit Hours: 3.00. This course will cover fundamental concepts in mobile wireless systems such as propagation and fading, cellular systems, channel assignment, power control, handoff, mobility management. It will also cover system and standards issues including second-generation circuit switched and third-generation packet switched networks, wireless LANs, mobile IP, and ad hoc networks. Besides providing an overview of current technologies, the emphasis on the course will be to identify the challenges that face the engineers of wireless communications networks. Prerequisites: ECE 54700. Prerequisite by Topic: Students are expected to enter the course with an introductory graduate-level understanding of networking, as well as a basic understanding of probability obtained from a typical undergraduate EE program. Permission of instructor required.

Learning Outcomes: 1. Acquire a solid understand of the fundamental principles of wireless communication networks. 2. Use basic analytical tools to study the performance of cellular and ad hoc wireless networks. 3. Present results through written communication. 4. Identify the key challenges facing future wireless networks. Credits: 3.00

ECE 60141 - Foundations Of Computational Imaging

Credit Hours: 3.00. This class presents a collection of mathematical and statistical methods that form the foundation of modern computational imaging research and applications. Computational imaging seeks to form images from sensor data and is widely used in applications including consumer imaging, scientific imaging, industrial inspection, and security imaging. This class provides an advanced treatment of computational imaging based on an inverse-problems framework and blends perspectives from applied math, statistics, physics, and applications. The topics covered include stochastic modeling of images, Bayesian estimation, inverse methods, optimization, convexity, majorization techniques, constrained optimization and proximal methods, plug-and-play methods for advance prior models, the EM algorithm, Bayesian networks, Markov chains, hidden Markov models, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 60146 - Deep Learning - Theory And Practice Of Deep Neural Networks

Credit Hours: 3.00. This course teaches the theory and practice of deep neural networks from basic principles through state-of-the-art methods. The class blends hands-on programming, using a variety of state-of-the-art programming frameworks, with theoretical treatment based on current literature. Implementation will emphasize the use of the Pytorch language and the use of dynamic computational graphs. Some previous experience with optimization techniques is important for success in the course.

Learning Outcomes: 1. Understand how to design a neural network architecture that is appropriate for a wide range of specific applications. 2. Create an efficient implementation of a wide range of standard neural network architectures in Pytorch. 3. Use neural networks to solve applications problems in classification, regression and data generation. 4. Understand how the fundamental theory of optimization can be used to efficiently train neural networks. 5. Understand the trade-offs between optimization techniques and how these techniques can be selected to achieve the best neural network training. 6. Understand and use current theory of neural network performance. 7. Understand the limitation of existing neural network theory and the likely directions of future research. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60270 - Structure And Dynamics Of Large-Scale Networks

Credit Hours: 3.00. Large-scale networks are prevalent in both engineered systems (e.g., the Internet, the power grid, industrial control networks, large robotic swarms and sensor networks) and in natural systems (e.g., genetic networks, ecological networks, social and economic networks). While the specific details of such networks will depend on the application, the last few decades have seen the emergence of an underlying "science" of networks, comprised of a common language (graph theory) for representing large-scale networks, along with mathematical models and analytical techniques for studying structure and dynamics. This course will provide a detailed introduction to the field of network science. It will develop common mathematical representations of networks, metrics for identifying important features of networks, generative mechanisms for networks (including both random-graph and strategic network formation perspectives), and tools for studying dynamical processes on networks (such as information cascades, opinion dynamics and interconnected dynamical systems). This is an introductory course that establishes several of the fundamental tools and concepts in network science, and requires only an undergraduate background in probability and linear algebra.

Learning Outcomes: 1. Characterize networks based on degree distributions, clustering coefficients, diameter, etc. 2. Identify influential nodes via centrality metrics. 3. Analyze random and strategic (game-theoretic) models for large-scale networks. 4. Analyze dynamical processes and stability of interconnected dynamical systems on networks. Credits: 3.00

ECE 60281 - Intro To Mathematical Fundamentals For Systems And Control

Credit Hours: 1.00. This course serves as background for ECE 60200 Lumped System Theory, ECE 69500 Epidemic Processes over Networks, and ECE 69500 Structure and Dynamics of Large-Scale Networks, and other similar courses. The course will make the necessary mathematical background for the aforementioned courses accessible by decomposing and illustrating difficult concepts with a number of real-world examples and problems for students to work out. Namely, the course consists of five modules: 1) Linear Algebra, 2) Basic Graph Theory, 3) Basic Control Theory, 4) Probability, and 5) Optimization. Prerequisite: Linear Algebra (MA 26500 or MA 26200) or equivalent, ECE 30200 or equivalent.

Learning Outcomes: 1. Analyze equations involving matrices by applying algebraic concepts such as rank, null space, linear independence, and eigenvalues. 2. Define graph properties such as diameter, degrees, and connectivity, and apply them to analyze networked systems. 3. Define properties of linear systems, including controllability, observability, and stability, and apply them to design state estimators and feedback controllers. 4. Define probability distributions and moments of random variables and characterize the long-term behavior of stochastic processes. 5. Specify the fundamental optimality conditions for optimization problems and implement basic algorithms to find the optimizers. Credits: 1.00

ECE 60282 - Epidemic Processes

Credit Hours: 1.00. This course provides a control theory and data science approach to traditional epidemic models. Traditional epidemiological ideas will be explored and combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn from data, and design mitigation techniques. Namely, the course consists of four modules: 1) Virus Models, 2) Limiting Behavior, 3) Parameter Identification, and 4) Mitigation Algorithms. Prerequisite: ECE 60281.

Learning Outcomes: 1. Differentiate between distinct compartmental models for epidemics (SI, SIS, SIR, etc.) and identify the best model for a given scenario. 2. Analyze the limiting behavior of models for epidemic processes by identifying the different possible equilibria of the models and specifying conditions for converging to different equilibria. 3. Estimate model parameters from data for the different epidemic models. 4. Employ the estimated model parameters to forecast the impact of an outbreak. 5. Choose the best model for a given

scenario/dataset by employing their knowledge of the epidemic models and by comparing the fit from the estimated parameters and the forecast accuracy. 6. Develop and implement mitigation algorithms for the different models of epidemic processes. Credits: 1.00

ECE 60283 - Epidemic Processes Over Networks

Credit Hours: 1.00. This course presents a class of epidemic models from a network science, control theoretic, and data science perspective. Networked epidemiological ideas will be explored combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn the behavior from data, and design mitigation techniques. Namely, the course consists of three modules: 1) Networked Virus Models, 2) Limiting Behavior of Networked Virus Models, and 3) Parameter Identification & Mitigation Algorithms. Prerequisites: ECE 60281 and ECE 60282.

Learning Outcomes: 1. Differentiate between distinct networked compartmental models for epidemics (SI, SIS, SIR, etc.) in order to identify the best model for a given scenario. 2. Analyze the limiting behavior of networked models for epidemic processes by identifying the different possible equilibria of the models and specifying conditions for converging to different equilibria. 3. Estimate model parameters from data for the different networked epidemic models. 4. Employ the estimated model parameters to forecast the spread of an outbreak. 5. Choose the best networked model for a given scenario/dataset by employing their knowledge of the epidemic models and by comparing the fit from the estimated parameters and the forecast accuracy. 6. Develop and implement mitigation algorithms for the different models of epidemic processes. 7. Leverage the advantages and disadvantages of using networked models of epidemics processes versus group models in a given situation. Credits: 1.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60419 - Numerical Simulations Of Electro-Optic Energy Systems

Credit Hours: 3.00. Introduction to computational techniques employed in research on energy systems involving quantum electronics and electromagnetics. You will learn the strengths and weaknesses of each approach; what types of problem call for which one; and how your simulation will perform. Techniques include eigenvalue problems, fast Fourier transforms, band structure calculations, rigorous-coupled wave analysis, beam-propagation methods, finite-difference time-domain, and finite element methods. Applications include nanophotonics, photovoltaics, thermal management, radiative control, and nonlinear optics. Prerequisite by Topic: Elect/Magn Interactions (ECE 60400 or equivalent); Programming For Engineers (C, MATLAB, or similar); Linear Algebra; Ordinary Differ. Equatn; and Signals and Systems.

Learning Outcomes: 1. Explain strengths and weaknesses of computational techniques for electro-optic systems. 2. Calculate computational complexity of a given algorithm. 3. Perform conventional and Fast Fourier transforms, based on existing codes. 4. Solve for eigenvalues and eigenvectors, for both standard and generalized eigenproblems. Credits: 3.00

ECE 60420 - Radio Frequency Integrated Circuits

Credit Hours: 3.00. This course aims at analysis and design of CMOS integrated radio frequency (RF), microwave and mm-wave circuits. Various modules of an RF transceiver are discussed including low noise amplifiers, mixers, oscillators, frequency synthesizers and power amplifiers. A term project on design of an RF to mm-wave module is also required.

Learning Outcomes: 1. Know various wireless standards, modulation techniques and CMOS technology. 2. Know matching network, transmission line effects, scattering parameters. 3. Know analysis and design of CMOS low noise amplifiers from RF to mm-wave frequencies. Credits: 3.00

ECE 60421 - Nanophotonics And Metamaterials

Credit Hours: 3.00. The course will cover nanoscale processes and devices and their applications for manipulating light on the nanoscale. The following topics will be covered: Fundamentals, Maxwell's equations, light-matter interaction, dispersion, EM

properties of nanostructures; Photonic crystals and photonic crystal fibers; Photonic and plasmonic nanocircuits; Silicon nanophotonics; Metal optics; Manipulating light with plasmonic nanostructures; Plasmonic nano-sensors; Near-field optics; Metamaterials: artificial magnetism and negative refractive index; Metamaterials: superlens and hyperlens; Transformation optics and cloaking; Nanolasers; Tunable and active plasmonic materials; Refractory plasmonics; Plasmonics for energy conversion, data storage and biomed applications; Metasurfaces; Intro to quantum photonics. Prerequisites by Topic: Basic knowledge of electromagnetism and solid state materials, Maxwell equations and band structure of solids.

Learning Outcomes: 1. Derive, calculate and analyze the optical properties of metals including plasma frequency, relaxation time, dielectric constant, reflection and transmission coefficients. 2. Derive and analyze the optical properties of nanophotonic systems including color centers in solids, metallic nanoparticles, metal-dielectric slabs, thin metal films, metamaterial slabs with negative refraction. 3. Analyze surface plasmon polariton waveguides and waveguide properties. 4. Articulate the fundamentals of optics of structured media. 5. Demonstrate an understanding of novel concepts in photonics, including photonic crystals, metamaterials, nanoscale interconnects, metal optics, transformation optics, nanolasers, nanosensors, super- and hyperlens and quantum nanophotonics. Credits: 3.00

ECE 60422 - Primer On RF Design

Credit Hours: 1.00. This course covers the fundamentals of RF design. It is designed as a first course for students or engineers with limited background in high-frequency electronics. Engineers that need to understand the 'RF language' and gain working knowledge of critical RF concepts will benefit from taking this course. Students in this class will learn the basic RF tools and design principles. By the end of this class students will be able to understand important RF concepts and how these are related to the design of practical RF blocks.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF systems and modules. 2. Use common tools and techniques in the RF design space. Credits: 1.00

ECE 60423 - RF System Design

Credit Hours: 1.00. Following the 'Primer on RF Design' course, this class focuses on system-level issues. We discuss several important design considerations including noise, non-linearity, distortion, sensitivity and dynamic range and their impact in selecting the appropriate system architecture. The course also covers common receiver architectures including superheterodyne and direct-conversion receivers.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF modules and transceivers. 2. Describe and articulate common transceiver architectures. 3. Use tools and analysis techniques to estimate the impact of non-linear effects, noise and interferences on transceivers. Credits: 1.00

ECE 60424 - RF Design: Passive And Active Components

Credit Hours: 1.00. Following the 'Primer on RF Design' course, this class focuses on passive and active components. We use the techniques learnt in the previous course, to design advanced RF devices including couplers, filters and amplifiers. Current research topics are discussed as appropriate.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF passive and active components. 2. Design RF couplers, filters and amplifiers. 3. Use tools and analysis techniques to support the design of RF filters and amplifiers. Credits: 1.00

ECE 60432 - Nanophotonic Modeling

Credit Hours: 1.00. This course is an introduction to photonic materials and devices structured on the wavelength scale. Generally, these systems will be characterized as having critical dimensions at the nanometer scale. These can include nanophotonic, plasmonic, and metamaterials components and systems. Co-requisite: ECE 60400 or equivalent.

Learning Outcomes: 1. Write down photonic modes using Bloch's theorem. 2. Calculate standing wave modes at the band edge of a 1D periodic photonic crystal. 3. Calculate TE and TM modes at the band edge of a 2D square-periodic photonic crystal. 4. Draw the irreducible Brillouin zone for a 2D triangular lattice photonic crystal. 5. Calculate the band structure of a 2D triangular lattice photonic crystal for the lowest 8 bands using MIT Photonic Bands. 6. Identify the lowest-energy photonic bandgap in TE and TM polarizations associated with a 2D triangular lattice photonic crystal. 7. Use a ray-optics

transfer matrix to calculate the reflection and transmission associated with multiple optical elements. 8. Use a wave-optics T-matrix to calculate transmission and reflection through several dielectric layers arranged in a 1D stack. 9. Use a wave-optics S-matrix to calculate transmission and reflection through several dielectric layers arranged in a 1D stack. 10. Use Singular Value Decomposition in CAMFR to calculate the eigenmodes associated with a photonic crystal waveguide structure consisting of a row of defects. 11. Calculate the quality factor of a resonant mode using the FDTD method. 12. Calculate the band structure of a 2D periodic structure using the FDTD method. 13. Calculate the relative enhancement in the local density of photonic states associated with a defect in a 2D photonic crystal using the FDTD method. 14. Calculate a transmission spectrum using the Finite Element Method. 15. Calculate a transmission spectrum for a waveguide using the Beam Propagation Method. 16. Calculate the emission spectrum of a photonic emitter using the Finite Element Method. Credits: 1.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60614 - Reliability Physics Of Nanoelectronic Transistors

Credit Hours: 3.00. This course will focus on the physics of reliability of small semiconductor devices. In traditional courses on device physics, the students learn how to compute current through a device in response to applied voltage. However, as transistors are turned on and off trillions of times during the years of operation, gradually defects accumulate within the device so that at some point the transistor does not work anymore. The course will explore the physics and mathematics regarding how and when things break a topic of great interest to semiconductor device engineers. Prerequisites: ECE 60600 required; ECE 61200 and ECE 55800 are recommended.

Learning Outcomes: 1. Acquire a deep understanding regarding a topic of broad interest to academic community and to the industry. 2. Think critically related to broad range of topics involving various aspects of reliability physics. Credits: 3.00

ECE 60645 - High-speed Semiconductor Devices

Credit Hours: 3.00. As semiconductor device geometry miniaturizes, the device becomes faster and some devices move into the quantum-effect region. These high-speed devices are the key components for future electronic systems in communications, computers, control, and consumer applications. This course covers the physics and operational principles of these devices to meet the needs of microelectronics in the 21st century. This course emphasizes the integration of the state-of-the-art technologies such as high-k dielectrics, SiGe, SiC and GaN devices. This course is intended for graduate students in science and engineering who are either i) interested in pursuing research in semiconductor materials, structures or devices, or ii) seeking the broad device background on the state-of-the-art technologies for a future R&D career in the microelectronic industry. Co-requisite: ECE 60600.

Learning Outcomes: 1. Produce homework and presentations at the course that use appropriate formats, knowledge of electronic materials and devices, and documentation styles while controlling the right technical terms, writing skills including grammar and spelling. 2. Demonstrate an understanding of technical contents of the course and writing reports as a process that includes multiple drafts, collaboration, feedback, and reflection. 3. Examine critically, summarize, apply, analyze, and synthesize information as the basis for developing original ideas and claims. 4. Demonstrate proficiency in identifying, reading, evaluating, analyzing, and using reliable sources of technical contents of this course. Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching,

sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 60827 - Programmable Accelerator Architectures

Credit Hours: 3.00. Programmable hardware accelerators seek to fulfill the promise of continued performance and energy-efficiency gains in the era of a slowing Moore's law, larger problem sizes and an increased focused on energy-efficiency. These factors have caused hardware acceleration to become ubiquitous in today's computing world and critically important in computing's future. This class will introduce students to the architectures of programmable accelerators. We will delve deeply into the architectures of modern massively parallel accelerators like GPUs, culminating in a course project. General topics in hardware acceleration will be discussed, including but not limited to GPGPU and massively parallel computing, approximate accelerators, reconfigurable hardware and programmable hardware for machine learning. Pre-requisite: ECE 43700 or equivalent and ECE 56500.

Learning Outcomes: 1. Learn knowledge and scholarship. 2. Learn communication. 3. Learn critical thinking. 4. Learn ethical and responsible research. 5. Have professionalism. Credits: 3.00

ECE 60872 - Reliable And Secure Computer Systems

Credit Hours: 3.00. The course provides an introduction to the hardware and software methodologies for specifying, modeling and designing fault-tolerant systems supported by case studies of real systems. The material presents a broad spectrum of hardware and software error detection and recovery techniques that can be used to build reliable networked systems. The lectures discuss how the hardware and software techniques interplay, what techniques can be provided in COTS hardware, what can be embedded into operating system and network communication layers, and what can be provided via a distributed software layer and in the application itself. Prerequisite by Topic: Any one high level programming language experience; A basic background in probability.

Learning Outcomes: 1. Formulate design principles for dependable systems. 2. Analyze mathematically a system for its dependability properties. 3. Understand and apply hardware dependability techniques. 4. Understand and apply software dependability techniques. 5. Understand and apply networking dependability techniques. 6. Design, develop, and present an innovative project on dependable systems. Credits: 3.00

ECE 60874 - Mobile Computing Systems

Credit Hours: 3.00. This course will introduce the technologies of mobile computing systems for various applications, including multimedia, cloud services, location-based services, data collections and privacy. This course will include both hands-on assignments writing mobile applications as well as reading recently published papers on the technologies. The students will design mobile services and present their projects.

Learning Outcomes: 1. Examine recent technologies in mobile computing. 2. Design mobile services and present their projects. 3. Plan for data collection and respect users' privacy. Credits: 3.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 61010 - Time Domain Simulation And Optimization For Design

Credit Hours: 1.00. This is a skills course that teaches time domain simulation and multi-objective design optimization. This course will serve the needs of students in power and energy system and component design, but is widely applicable to all areas of engineering and does not require domain specific knowledge.

Learning Outcomes: 1. Code accurate and computationally efficient simulation models. 2. Comprehend the theory of single- and multi-objective optimization. 3. Utilize single-and multi-objective optimization effectively/efficiently. Credits: 1.00

ECE 61014 - Electromagnetic And Electromechanical Component Design

Credit Hours: 3.00. This course focuses on the design of electromagnetic and electromechanical systems, with power applications. The course includes optimization methods, modeling techniques for design (as opposed to for simulation), and the formulation of design problems as optimization problems. Prerequisite by Topic: Knowledge of the use of field and co-energy techniques to calculate force/torque, Understanding of theory of operation of permanent magnet ac machines (brushless dc machines), basic knowledge of electromagnetic fields.

Learning Outcomes: 1. Understand multi-objective design techniques as they relate to the design of power magnetic devices. 2. Understand the use of computationally efficient methods of solving field problem including analytical methods and magnetic equivalent circuits. 3. Understand loss mechanisms in power magnet devices including hysteresis, eddy current, and resistive losses. 4. Understand design of distributed conductors systems such as rotating electric machinery. 5. Understand working practices on homework, exams, and projects. 6. Understand how to compete component architectures in a rigorous and meaningful way. Credits: 3.00

ECE 61016 - Power Electronic Converters And Systems

Credit Hours: 3.00. The objective of this course is to educate students in the operation, detailed modeling, average-value modeling, and control design of power electronics converters and systems of converters. Prerequisite by Topic: Basic knowledge of ordinary differential equations, solution of ODEs using numerical methods, state-space system representation, basic feedback control design with frequency domain methods, reference frame theory, some knowledge of rotating electric machinery. Permission of instructor required. Prerequisites: ECE 61010. Concurrent prerequisites: ECE 61000 and ECE 38200. Concurrent prerequisites by topic: synchronous machines (wound rotor and permanent magnet), reference frame theory, three-phase inverters, basic frequency domain control techniques, state-space representation of systems.

Learning Outcomes: 1. Understand switched circuits. 2. Understand average-value analysis techniques. 3. Understand feedforward/feedback control of power electronic converters. 4. Understand waveform level and average-value simulation techniques for switched systems. 5. Understand several ac-dc, dc-ac, and dc-dc power conversion topologies. 6. Understand inverter modulation techniques. 7. Understand ethical homework and project practices, and implication of failure to adhere to these. 8. Understand how to effectively present project results. Credits: 3.00

ECE 61020 - Operation Of Modern Power Systems

Credit Hours: 3.00. Overview of modern power system operations. Economic dispatch of assets as a constrained optimization problem, and solution methods. The unit commitment problem formulation, and solution methods. Power flow solution methods. Security-constrained economic dispatch and unit commitment. The optimal power flow. Automatic generation control. Operation of power markets. Prerequisites: ECE 43200. Co-Requisites: ECE 58000.

Learning Outcomes: 1. Read and communicate the findings of the latest power system operations, control, and economics literature. 2. Write software to perform various modern power system functions, such as: security-constrained economic dispatch and unit commitment, dc or ac power flow analysis, and optimal power flow. 3. Appreciate the computational challenges related to large-scale electric power systems analysis. Credits: 3.00

ECE 61025 - Finite Element Analysis Of Electric Machines

Credit Hours: 3.00. Application of advanced numerical methods for the characterization of the steady-state and dynamic characteristics of electromechanical energy conversion devices including solenoids, synchronous, induction, and permanent-magnet machines.

Learning Outcomes: 1. Apply basic concepts of vector calculus to quantify and correlate the physical variables of electromagnetic fields. 2. Interpret Maxwell's equations in the context of electric machinery. 3. Recognize how variational calculus can be used to reformulate the partial differential equations governing the magnetic field. 4. Solve linear and nonlinear quasi-magnetostatic problems of electromechanical energy conversion devices

numerically using the finite element method. 5. Develop custom-made software for conducting finite element analysis of electric machinery. Credits: 3.00

ECE 61200 - Advanced VLSI Devices

Credit Hours: 3.00. Device physics of advanced transistors. Process, device, circuit, and systems considerations affecting development of new integrated circuit technologies. Review of metal oxide semiconductor (MOS) fundamentals along with key process and circuit concepts. Short channel effects in sub-micron channel length metal oxide semiconductor field-effect transistors (MOSFETs) including device scaling considerations. Device physics and technology issues for sub-100 nm (nanoscale) MOSFETs. Limits of silicon device technology and key issues in the continuing miniaturization of devices. Alternative device structures to replace bulk MOSFET. Computer simulation employed throughout the course to examine device issues and prototype new device technologies. Offered in alternate years. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 61220 - Advanced VLSI Design

Credit Hours: 3.00. The objective of this course is to train the students with advanced digital circuit design techniques that can be instrumental in achieving higher energy efficiency and resilience to process variations in scaled technologies. Prerequisite: ECE 55900 or equivalent.

Learning Outcomes: 1. Design challenges associated with scaled MOSFETs, including short channel effects, leakage mechanisms, process variations, reliability issues and interconnect parasitics. 2. Understand advantages and disadvantages of emerging technologies and circuit design challenges. 3. Understand adaptive design techniques to increase resilience to process variations. 4. Understand low power/ultra-low power design in near-threshold/sub-threshold region. 5. Understand advanced SRAM design. 6. Understand memory design in emerging technologies. 7. Understand Computing-in-Memory. 8. Understand Device-Circuit Co-design in Advanced Technologies. Credits: 3.00

ECE 61500 - Nonlinear Optics

Credit Hours: 3.00. An in-depth study of nonlinear optics. After a review of linear effects, several nonlinear optical processes and applications are discussed. These include electro-optic switches and modulators, harmonic light generators, sum and difference frequency mixing, parametric amplifiers and oscillators, and phase conjugate mirrors. Discussions of nonlinear spectroscopy include topics such as two-photon absorption, saturation spectroscopy, Raman spectroscopy and double-optical resonance measurements. Photonechoes and other transient effects, and surface effects are also discussed. Offered in alternate years. Prerequisite: ECE 55200 , ECE 60400 .

Credits: 3.00

ECE 61600 - Ultrafast Optics

Credit Hours: 3.00. A study of the physics, technology, and applications of ultrashort laser pulses. Topics covered include the following: methods for generating and measuring ultrafast laser pulses; basic physical processes affecting ultrashort pulses; devices for manipulating ultrashort pulses; ultrafast nonlinear optics, including nonlinear optics in fibers, nonlinear refractive index effects, pulse compression, solitons, and all-optical switching; time-resolved spectroscopy of ultrafast materials processes; and applications to ultrafast optoelectronics. In addition, each student will select a specific topic for in-depth study. Offered in alternate years. Prerequisite: ECE 55200 .

Credits: 3.00

ECE 61700 - Antennas: Design And Applications

Credit Hours: 3.00. Electrically small antennas; arrays; wire antennas and feeding arrangements; aperture antennas such as slots, horns, and parabolic reflectors; antennas for multiple frequencies including log-periodic and other frequency independent types; receiving antennas and the concept of antenna temperature; antenna measurements and evaluation. Prerequisite: ECE 44100 and concurrent prerequisite: ECE 60400 .

Credits: 3.00

ECE 61800 - Numerical Electromagnetics

Credit Hours: 3.00. The numerical solution of Maxwell's equations is studied. Numerical methods such as the Finite Element Method and the Finite Difference Method are presented for the solution of both differential and integral equations. Applications studied include: waveguides (microstrip, VLSI interconnects, optical, discontinuities), scattering (frequency selective surfaces, arbitrary scatterers), antennas, magnetics, semiconductor devices, and inverse scattering. Papers in the current literature are used. Offered every third semester. Prerequisite: ECE 60400 .

Credits: 3.00

ECE 62000 - Introduction To Biomedical Imaging Systems

Credit Hours: 3.00. (BME 63000) Overview of biomedical imaging systems and analysis. Examination of various imaging modalities, including X-ray, ultrasound, nuclear, and MRI. Microscopy including how images are formed and what types of information they provide. Image analysis techniques, including analysis of cardiac ultrasound, mammography, and MRI functional imagery. Offered in alternate years. Concurrent

prerequisite: ECE 63700.

Credits: 3.00

ECE 62400 - Multimedia Systems

Credit Hours: 3.00. Provides a general coverage of three major areas that include multimedia data management (logical and physical modeling), broadband network architectures and protocols for distributed multimedia communication, and user interface environments. Various models and specification methodologies in these areas are introduced. The discussion is augmented with various case studies. Prerequisite: ECE 54700 , ECE 56200 .

Credits: 3.00

ECE 62500 - Analysis Of Electromechanical Systems II

Credit Hours: 3.00. Extension of ECE 525. Electric propulsion systems including presentation of cycloconverter and rectifier-inverter drive systems. Dynamic and steady-state analysis of machine performance with series controlled rectifiers in the stator or rotor phases. MMF space harmonic analysis. Prerequisite: ECE 62500.

Credits: 3.00

ECE 62700 - Introduction To Cryptography And Secure Communication

Credit Hours: 3.00. Introduces the basic concepts of cryptography. Various cipher systems are presented, including transposition and substitution systems, Block ciphers, RSA, and Knapsack. Methods used to attack ciphers are discussed with emphasis on complexity. Case studies of the use of cryptographic methods in communication systems are presented with some consideration given to privacy issues. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 62900 - Introduction To Neural Networks

Credit Hours: 3.00. Information processing with neural networks, biological and engineering implications, learning algorithms, current neural network models and architectures, implementational topics, applications in areas such as signal/image processing, pattern recognition, optimization, simulation, system identification, nonlinear prediction, communications, and control. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63300 - Modeling And Simulation Of Power System Components

Credit Hours: 3.00. Recommended for those interested in learning to use computer simulation to investigate the dynamic and controlled behavior of electrical power components. Beginning with an introduction to MATLAB/SIMULINK, the course goes through the key steps of modeling, implementing and verifying the simulation of single and three-phase transformers, single and three-phase induction machines, three-phase wound field synchronous machines and permanent magnet machines useful in power applications, each case amply illustrated in projects around some interesting topics. Students are expected to implement and verify about 10 simulation projects and also discuss observed behaviors on topics such as inrush current in transformers, motoring, generating and braking operation of machines, and pulsating torque from subsynchronous resonance. Prerequisite: ECE 43200 .

Credits: 3.00

ECE 63400 - Digital Video Systems

Credit Hours: 3.00. Digital video systems. Characteristics of basic analog video systems, including bandwidth constraints, color encoding, and composite signal formation. Digital video concepts with emphasis on processing of time-varying images. Topics include: filtering, enhancement, restoration, and motion estimation and prediction. Digital video compression techniques, including intraframe coding approaches, with particular emphasis on JPEG. MPEG1 and MPEG2 video compression standards. Low bit rate approaches, including H.261, H.263, and MPEG4. Applications include: video servers, transmission systems, high definition television, multimedia systems, and videoconferencing systems. Offered in alternate years. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 63800 - Principles Of Digital Color Imaging Systems

Credit Hours: 3.00. Basic principles of color science: physiology of the human eye, trichromatic and color opponent models for color, and uniform color spaces. Color reproduction in electronic imaging systems: color models for input and output devices, color imaging system calibration, color quantization and halftoning, and color printing. Color appearance and computational color: color appearance models, models for color constancy, and physics-based models for color. Offered in alternate years. Prerequisite: 51100 and Master's student standing or higher.

Credits: 3.00

ECE 63900 - Error Control Coding

Credit Hours: 3.00. The theory and practice of error control coding is examined. The study includes the arithmetic of Galois fields as well as linear block, cyclic, and convolutional codes. Some applications of codes in digital communication systems

and in computer systems are presented. Offered every third semester. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63901 - Error Correction Coding And Secret Sharing

Credit Hours: 3.00. The theory and practice of error control coding is examined. The study includes the arithmetic of Galois fields as well as linear block, cyclic, and convolution codes. Some applications of codes in digital communication systems and in computer systems are presented. The dual of error coding, secret sharing is also discussed. Several secret sharing schemes will be presented. Applications of secret sharing are discussed. Permission of instructor required.

Credits: 3.00

ECE 64100 - Model Based Image And Signal Processing

Credit Hours: 3.00. An advanced treatment of the methods in model-based signal and image processing including stochastic modeling of multidimensional signals, Bayesian estimation, inverse methods, doubly stochastic models, regularized inversion, the EM algorithm, Bayesian networks, Markov chains, optimization, convexity, majorization techniques, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation. Prerequisite: ECE 60000, 63700.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 64200 - Information Theory And Source Coding

Credit Hours: 3.00. A treatment of the basic concepts of information theory. Determination of channel capacity and its relation to actual communication systems. Rate distortion theory is introduced, and the performance of various source codes is presented. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 64500 - Estimation Theory

Credit Hours: 3.00. This course presents the basics of estimation and detection theory that are commonly applied in communications and signal processing systems. Applications in communications and signal processing will be considered throughout. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 64700 - Convex And Stochastic Optimization And Applications

Credit Hours: 3.00. Convex optimization and dynamic programming with application to various disciplines in ECE, including wireless and wireline communications, networks, electrical systems, and machine learning. The goal is to model a research problem as an optimization problem, and use the insights from the optimization algorithms to design implementable protocols and solutions that are tailored to the needs of the applications (e.g., operating in decentralized settings and under stochastic uncertainty). The instructor may tailor the content to reflect current trends and goals of research. Examples of relevant topics are: convex sets and functions, convex program, Lagrange duality, primal and dual decomposition, proximal optimizations, stochastic approximation, Markov decision processes, dynamic programming and approximate dynamic programming. The exposition of the theory will be connected to various ECE applications, such as congestion control, wireless power control and opportunistic scheduling, cross-layer design, demand response, renewable integration, spectrum sharing and cognitive radio, machine learning, optimization of UAV (unmanned aerial vehicles) aided communications. Prerequisite: ECE 60000.

Learning Outcomes: 1. Be equipped with the basic theory of convex optimization, Markov decision processes, (approximate) dynamic algorithms, and be able to apply these tools to research problems. Credits: 3.00

ECE 64800 - Wavelet, Time-Frequency, And Multirate Signal Processing

Credit Hours: 3.00. Advanced topics in signal processing, including time-frequency analysis, multiscale edge detection, wavelet bases and filter banks, and techniques for approximation, estimation, and compression using wavelets. Offered in alternate years. Prerequisite: ECE 53800 .

Credits: 3.00

ECE 65000 - Topics In Solid-State Devices And Materials

Credit Hours: 1.00 to 3.00. An introductory treatment of selected device and materials related topics. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes solid state microwave devices, optoelectronics, laser-quantum electronics, magnetics, noise in semiconductor devices, acoustic wave devices, energy conversion, device fabrication, electroceramics, MOS devices, thin-film devices, and memory devices.

Credits: 1.00 to 3.00

ECE 65400 - Solid State Devices II

Credit Hours: 3.00. Introduction to advanced concepts in semiconductor devices as an extension and continuation of ECE 60600 . Topics include charge storage and transfer in deep depletion MOS devices (CCDs and DRAMs); negative differential mobility and transit time effects in microwave oscillators (Gunn and IMPATT diodes); spontaneous and stimulated emission, quantum efficiency, and charge confinement in photonic devices (LEDs and double heterojunction lasers); and quantum efficiency and spectral response in conventional and avalanche photodiodes. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 65600 - Electronic Transport In Semiconductors

Credit Hours: 3.00. A treatment of the microscopic and phenomenological physics of carrier transport in bulk semiconductors and in semiconductor devices. The Boltzmann transport equation is introduced as are techniques for solving it analytically and numerically. The physics of carrier scattering in common semiconductors is explored. Theoretical treatments of low and high field transport are compared with measured results. Balance equations are derived as moments of the Boltzmann Transport Equation and are applied to the analysis of sub-micron semiconductor devices. Students are expected to be able to apply elementary concepts of quantum mechanics and solid state physics. Offered every third semester. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 65800 - Semiconductor Material And Device Characterization

Credit Hours: 3.00. A comprehensive survey of modern characterization techniques routinely used to determine solid-state material and device parameters. Concepts and theory underlying the techniques are examined, and sample experimental results are presented. The coverage includes electrical, optical, chemical, and physical characterization methods. Offered in alternate years. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 65900 - Quantum Phenomena In Semiconductors

Credit Hours: 3.00. This course is designed for graduate students familiar with semiconductor fundamentals, with engineering electromagnetics and with linear algebra, but having no significant acquaintance with either quantum mechanics or statistical mechanics. The purpose of the course is to introduce the relevant concepts of quantum mechanics and nonequilibrium statistical mechanics as possible using device-related examples. Topics include: preliminary concepts, equilibrium, restoration of equilibrium, transport, effective mass equation, optical properties, advanced concepts. Offered every third semester. Prerequisite: ECE 60600, MA 51100.

Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECE 66200 - Pattern Recognition And Decision-Making Processes

Credit Hours: 3.00. (CS 66200) Introduction to the basic concepts and various approaches of pattern recognition and decision-making processes. The topics include various classifier designs, evaluation of classifiability, learning machines, feature extraction and modeling. Prerequisite: ECE 30200 .

Credits: 3.00

ECE 66300 - Advanced Compilation And Automatic Programming

Credit Hours: 3.00. This course presents the concepts needed to design and implement production quality code generators for any of the more popular languages and families of computer architecture (including various pipelined, superscalar, and macro-parallel machines). Flow analysis and concurrency detection, as well as optimizations and loop and irregular code parallelizations, are covered in detail. Using C on ECN UNIX, each student will complete a project implementing a simple optimizer/parallelizer. Prerequisite: ECE 56500 , CS 50200 or ECE 46800 or ECE 57300 .

Learning Outcomes: 1. Apply automated reasoning techniques and tools to analyze and verify programs and reactive systems. 2. Explain and implement program synthesis algorithms and methodologies. 3. Apply program synthesis techniques to automate programming tasks in an application domain.

Credits: 3.00

ECE 66400 - Formal Languages, Computability, And Complexity

Credit Hours: 3.00. Topics in computability theory and formal languages include recursive function theory, the equivalence of various generic programming languages for numeric calculations and string manipulations, regular languages and finite state automata, and context-free and context-sensitive languages. In complexity theory, emphasis is on the theory of NP-completeness, including proof methods, the distinctions

between strong- and weak-sense NP-completeness, NP-hardness, and performance-guaranteed approximation algorithms. Offered in alternate years. Prerequisite: ECE 60800 .

Credits: 3.00

ECE 66600 - Advanced Computer Systems

Credit Hours: 3.00. The study of theoretical aspects of advanced computer systems where multiprocessing is used. Topics include the design, architecture, and performance evaluation of multiprocessor memories, interconnection networks, and computational pipelines. Also included are the topics of scheduling, synchronization, resource allocation, load-balancing, partitioning and deadlock avoidance in multiprocessors. Also covered are the design and analysis of parallel algorithms, programming languages and automatic approaches to parallelism detection/exploitation for concurrent computation. Prerequisite: ECE 56500 , ECE 60800 .

Credits: 3.00

ECE 67000 - Modeling And Optimization Of High-Performance Interconnects

Credit Hours: 3.00. RLC extraction of VLSI interconnects. Modeling of interconnects as RLC trees or networks. Elmore delay model. Reduced-order modeling: moment matching, Pade approximation, and Krylov-subspace methods. Device modeling with consideration of resistive shielding in the interconnection load. Delay calculation with consideration of devices and interconnects. Repeater insertion and planning at floorplanning. Timing-driven placement: zero-slack algorithm for delay budgeting, net-based placement, and path-based placement. High-performance clock synthesis: zero-skew routing, bounded-skew routing, and useful-skew routing. Term projects investigating interconnect-related issues are assigned. Prerequisite: ECE 55900 .

Credits: 3.00

ECE 67300 - Distributed Computing Systems

Credit Hours: 3.00. Discussions of the design issues of distributed computing systems (DCS). The general theory of distributed transaction management, reliability, and resource management is discussed. Various algorithms and specification methodologies for DCS are introduced. A general coverage of the three major areas of DCS, namely: distributed operating systems, distributed databases, and distributed AI is provided. The discussion is augmented with various case studies. Prerequisite: ECE 46900 or introductory course in operating systems.

Credits: 3.00

ECE 67500 - Introduction To Analysis Of Nonlinear Systems

Credit Hours: 3.00. An introduction to modeling of dynamic control systems. State plane and numerical methods for solving modeling equations. Linearization and describing function techniques. Stability concepts. Controller and state estimator design for nonlinear systems. Variable structure sliding mode control. Vector field techniques. Introduction to chaos. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 67600 - Academic Oral Communication For International Research Students

Credit Hours: 0.00. Discussions of and activities related to such topics as appropriate nonverbal communication; learning styles; strategies for effective speech and listening; and speech acts for the classroom, office, and laboratory. Individual weekly tutoring sessions to improve speech comprehension. Prerequisite: Master's student standing or higher and Electrical & Computer Engineering majors only. Permission of department required.

Credits: 0.00

ECE 67700 - Communication Aspects Of Academic Research

Credit Hours: 0.00. Topics relevant to oral and written communication needs of Ph.D. students. Three papers are written: a journal article review, a literature review, and the choice of a thesis proposal, conference paper, or a journal article. Library and Internet research strategies and resources; research/writing ethics; citing sources; citation styles; and academic language. Oral presentations based on the written projects. Extensive peer revision and editing and out-of-class writing conferences with the instructor. Prerequisite: Master's student standing or higher and Electrical & Computer Engineering majors only. Permission of department required.

Credits: 0.00

ECE 67800 - Radar Engineering

Credit Hours: 3.00. An introduction to the system aspects of modern radar engineering. The theoretical basis for radar performance analysis is developed and applied to radars designed for a variety of different applications. Consideration is given to system parameters such as receiver noise, antenna characteristics, operating frequency, target characteristics, transmitted signal modulation, and methods of detection. Attention is given to radars for special purposes, such as automatic range and angle tracking, moving target indication, and resolution enhancement through synthetic aperture techniques. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 67900 - Advanced Digital Communications

Credit Hours: 3.00. Provides a detailed examination of optimum digital communication principles and introduces three advanced topics critical to the design of digital communication systems: system synchronization; techniques for communication in nonideal channels (equalization); and communication over fading/multipath channels. Theoretical principles and practical implementations are considered. Prerequisite: ECE 54400 , ECE 60000 .

Credits: 3.00

ECE 68000 - Modern Automatic Control

Credit Hours: 3.00. Theoretical methods in optimal control theory. Topics include the calculus of variations and the Pontryagin minimum principle with applications to minimum energy problems. Geometric methods will be applied to the solution of minimum time problems. Computational methods, singular problems, observer theory, and sufficient conditions for existence of solutions are also discussed. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 68400 - Linear Multivariable Control

Credit Hours: 3.00. A state space investigation of multi-input, multi-output control design problems from the geometric perspective. The course will detail the theory and design algorithms needed for a solution to the state feedback eigenvalue assignment problem, the disturbance decoupling problem with and without internal stability, the output stabilization problem, and the tracking (or regulator) problem with internal stability. Offered in alternate years.

Credits: 3.00

ECE 68800 - VLSI Testing And Verification

Credit Hours: 3.00. Discusses different aspects of VLSI testing and formal verification of designs. Design and manufacturing defect models are introduced along with test generation and fault simulation algorithms targeting the different fault models. Both combinational and sequential logic testing are covered, and different synthesis for testability schemes such as BIST (Built-In-Self-Test), scan path design, etc., are introduced. Other new and emerging test and verification techniques also are discussed. Offered every third semester. Prerequisite: ECE 55900 .

Credits: 3.00

ECE 69200 - Introduction To Graduate Research

Credit Hours: 1.00 to 3.00. Research-related activities supervised by an ECE faculty member to introduce newly admitted ECE graduate students to the methods and culture of doing research. Possible activities might include, but are not limited to, participation in group research meetings, association with an advanced graduate student, and individualized reading or project work. A description of the activity, approved by the faculty supervisor, must be filed with the ECE Graduate Office. Permission of instructor required.

Learning Outcomes: 1. Develop knowledge and scholarship (thesis/non-thesis). 2. Develop communication (thesis/non-thesis). 3. Develop critical thinking (thesis/non-thesis). 4. Develop ethical and responsible research (thesis) or professional and ethical responsibility (non-thesis). Credits: 1.00 to 3.00

ECE 69300 - Advanced Intern Project

Credit Hours: 1.00. Graduate-level project course in ECE based on off-campus intern position. Individual research projects are approved by the supervising Purdue ECE faculty member before registering for the course. An approved written report must be filed before credit is accepted. This course cannot be used to satisfy the minimum course requirements for the master's or Ph.D. degrees. Permission of instructor required.

Credits: 1.00

ECE 69311 - Advanced Internship

Credit Hours: 1.00 to 3.00. Graduate-level Internship based course, in an off-campus internship position. Internship must be in the area of Electrical & Computer Engineering. Individual Internship must be preapproved by the supervising ECE faculty member before the student can register for the course. A written report must be submitted and approved by the faculty before credit is accepted. This course cannot be used to satisfy the minimum course requirements for the Master's or Ph.D. degrees. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

ECE 69401 - Electrical And Computer Engineering Graduate Seminar

Credit Hours: 0.00. Seminar presentations by members of the faculty of the Department of Electrical and Computer Engineering, staff and other faculty of IUPUI, researchers from academia, and representatives from industry. The presentations introduce the student to a wide variety of current topics relevant to the technical, educational and career aspects of electrical and computer engineering. This course cannot be used to satisfy the PhD seminar requirement. Permission of department required.

Credits: 0.00

ECE 69409 - Electrical And Computer Engineering PhD Student IUPUI Residency Course

Credit Hours: 1.00. This course is for ECE PhD students who are required to be enrolled at Purdue West Lafayette for their PhD program although research instruction and all related activities occur at the IUPUI Campus.

Credits: 1.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69600 - Advanced Electrical Engineering Projects

Credit Hours: 0.00 to 18.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report must be filed before credit is accepted. Permission of instructor required.

Credits: 0.00 to 18.00

ECE 69700 - Directed Reading In Electrical Engineering

Credit Hours: 1.00 to 3.00. Individualized reading course supervised by an appropriate faculty member and pertaining to a topic not intended for a subsequent project or thesis done by that student. Approval for each reading course must be obtained from the department prior to registration. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ECE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electrical and Computer Engineering Technology

ECET 11600 - Electrical Circuits

Credit Hours: 3.00 or 4.00. This course covers circuit components, R, L, C; voltage; current; power; Ohm;s law, Kirchhoff' laws; series and parallel circuits; electrical measurements; sinusoidal voltages; currents; impedances; transformers; motors; polyphase systems, and the National Electrical Code. This course is a service course for non-ECET majors.

Learning Outcomes: 1. Identify and recognize electrical safety practices. 2. Identify the terminology associated with current, voltage, and dc circuits. 3. Convert from one unit of measure to another. 4. Draw schematic circuits of batteries, and calculate the total voltage and current available for different series, parallel, and series-parallel cell and battery connections. 5. Accurately read resistor color code and verily & the results with an ohm meter. 6. Compute total resistance for series, parallel, and series-parallel circuits. 7. Measure total resistance for series, parallel, and series-parallel circuits. 8. Solve problems involving power, current and voltage. 9. Solve unknown values in series, parallel, and series-parallel dc circuits. 10. Identify the terminology associated with magnetism inductance and capacitance. 11. Demonstrate how capacitance reacts in a circuit. 12. Identify the terminology associated with alternating current. 13. Setup an Oscilloscope and accurately measure. 14. Describe and accurately measure RMS, peak, and peak-to-peak voltages. 15. Explain the effects of capacitor and inductors in AC circuits. 16. Solve for capacitive and inductive reactance in AC circuits. 17. Demonstrate the characteristics of a series RC Network. 18. Work with others in laboratory problem solving.

Credits: 3.00 or 4.00

ECET 15500 - Digital Fundamentals II

Credit Hours: 3.00. A continuation of ECET 10900. Sequential logic circuits, flip-flops, counters, finite state machines, programmable logic devices, shift registers, logic families, and introductory computer concepts.

Credits: 3.00

ECET 15700 - Electronics Circuit Analysis

Credit Hours: 4.00. Capacitors, inductors, switching circuits, transformers, rectifiers, linear regulators, dependent sources, operational amplifiers, BJT- & MOSFET-based small-signal amplifiers, waveform generation, and programmable analog devices are studied. Circuit fundamentals such as Kirchhoff's laws are utilized in analysis and design of circuits. Computer simulation is used.

Credits: 4.00

ECET 16400 - Applied Object-Oriented Programming

Credit Hours: 3.00. Problem solving and computing with emphasis on electrical engineering technology applications. Introduction to an object programming language as applied to solving electrical technology problems.

Credits: 3.00

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 20700 - AC Electronics Circuit Analysis

Credit Hours: 4.00. AC circuits including the j operator, phasors, reactance and impedance are studied. Circuit laws, network theorems, and the fundamental concepts of Fourier analysis are applied and used in the study of topics such as passive filters, IC filters, amplifiers, resonant circuits, single-phase and three-phase circuits. Computer aided analysis of circuits is used.

Credits: 4.00

ECET 20900 - Introduction To Microcontrollers

Credit Hours: 4.00. This course is an introduction to microcontroller hardware and software, focusing on embedded control applications. Interconnections of components, peripheral devices, bus timing relationships, structured C-language programming, debugging, input/output techniques, and use of PC based software development tools are studied.

Credits: 4.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of

circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

ECET 23110 - Electrical Machines

Credit Hours: 3.00. An introduction to the fundamental concepts and applications of transformers, induction motors, and single-phase and three-phase power systems. Design and optimization of power systems based on National Electrical Code guidelines. Laboratory experiments in the design, operation, and measurement of electromechanical systems.

Learning Outcomes: 1. State and practice the principles of electrical safety. 2. Apply the principles of circuit analysis to calculate real, reactive, and apparent power in single and three-phase circuits. 3. Explain the operating principles of electric machines and transformers. 4. Use mathematical models to solve engineering technology power problems. 5. Design basic power and motor circuits in accordance with applicable standards (NEC, etc.), including sizing wires, circuit breakers or fuses, and overload protection. 6. Understand the application of NEC Chapter 2 Wiring and Protection, Article 230 (see Figure 1) and Chapter 4 Equipment for General Use, Article 430 (see Figure 2). 7. Use Joint International Congress (JIC) standard drafting practices and symbols to construct a ladder diagram. 8. Understand how to properly size the components for a defined application. 9. Understand and compare the characteristics of electric motors. 10. Understand the ethical consideration of the elimination of PCB's as transformer and cooling liquid. Credits: 3.00

ECET 23120 - Industrial Controls

Credit Hours: 3.00. An introduction to Industrial Controls with a focus on relay logic and PLC logic. Design and optimization of control systems based on National Electrical Code guidelines and methods for development of schematics and coding for industrial controls. Laboratory experiments in the design, coding, operation, and documentation of industrial control systems.

Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 28400 - Computer Communications

Credit Hours: 4.00. An introductory course in data communication systems. The hardware and software issues in computer communications are studied. Emphasis on hands-on experience in computer communications, such as cabling, use of communication devices and media, choice of networking topologies, protocols, and platforms.

Credits: 4.00

ECET 28404 - Contemporary Communication System

Credit Hours: 4.00. An introductory course in communications that introduces and evaluate basic concepts and principle of contemporary communication systems. The hardware and

software issues in contemporary communications are studied. Emphasis is given on experiential experience in the signals and systems used in contemporary communications such as types of signals and systems use of communication devices and media choice of networking technologies protocols and platforms. Permission of department required.

Learning Outcomes: 1. Describe communication systems and their basic underlying characteristics. 2. Analyze signals in the time and frequency domains. 3. Explain the necessity and the concept of modulation in communication systems. 4. Explain the concept and the use of signal-to-noise ratio and its importance to communication systems. 5. State the relationship between bandwidth and information rate for a given communication system. 6. Describe and contrast different types of modulation schemes. 7. Solve problems that demonstrate the overall concept of computer communications and networking technologies. 8. Describe and explain various types of computer networks, network topologies. 9. Describe the basis of data communications and computer networking, such as: digital signals, serial and parallel transmission, communication modes, digital encoding and error detection methods used in networking. 10. Describe and explain the function of each layer in the OSI Reference Model. 11. Describe and explain how local area networks are configured and specified. 12. Describe and explain how data is transmitted through interconnected networks from both hardware and software aspects. 13. Describe the TCP / IP protocol used for transporting Internet messages. 14. Describe the application of multiplexer, de-multiplexer, types of multiplexing accesses, and switching technology. 15. Describe and explain the applications of networking interconnection devices such as repeaters, bridges, routers, and gateways. 16. Explain the Internet architecture, TCP / IP, IP, Ipv6, and contemporary interconnect models. 17. Describe and explain how WAN and some special types of interconnected networks, such as industrial networks are setup. 18. Demonstrate skills for life-long learning through term project presentation by locating, evaluating and applying relevant information using external resources such as the Internet, data books, trade publications and library resources. Credits: 4.00

ECET 29801 - Laboratory Teaching Aide In Electrical Engineering Technology

Credit Hours: 1.00 to 3.00. This course allows a student to serve as an undergraduate teaching aide in the laboratory. The student will work with and support a course instructor in the undergraduate teaching labs. Hours, subject matter, and credit to be arranged by faculty. Course content applies toward the EET Professional Experience requirement. Department and Instructor permission required.

Learning Outcomes: 1. Explain and communicate lab steps clearly. 2. Recognize problems and implement troubleshooting techniques. 3. Demonstrate operation and use of test equipment. Credits: 1.00 to 3.00

ECET 29900 - Selected Electrical Engineering Technology Subjects

Credit Hours: 0.00 to 6.00. Hours and subject matter to be arranged by staff. Permission of instructor required.

Learning Outcomes: 1. Vary due to the content of the project and will be approved by the EET curriculum subcommittee. Credits: 0.00 to 6.00

ECET 30200 - Introduction To Control Systems

Credit Hours: 4.00. This first course in industrial controls is applications oriented and includes on-off type open- and closed-loop control systems, and analog-based systems. Major topics include relay and programmable controller-based systems.

Credits: 4.00

ECET 30201 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices and common practices associated with control systems with a primary focus on industrial implementations. Additionally, the course provides a hierarchical examination of the implantation of control theory. Programmable logic controllers serve as the primary platform for presenting applications in interfacing and control of electromechanical and pneumatic devices. Electrical industrial safety standards are presented and emphasized throughout the course.

Learning Outcomes: 1. Demonstrate an

understanding of common electrical, pneumatic, and mechanical safety standards and practices. 2. Identify, describe, and compute the parameters of key functional blocks of a basic control system. 3. Describe, interpret and implement control scenarios in ladder logic, flow chart and programmatic forms. 4. Construct, program and trouble shoot basic control circuits and systems using programmable logic controllers. Credits: 3.00

ECET 30700 - Analog Network Signal Processing

Credit Hours: 4.00. This is an advanced course in network analysis that stresses network theorems and solutions of time- and frequency-domain problems. Transform circuit and signal analysis using Laplace and Fourier techniques are developed, culmination in active filter design applications. Software techniques, such as MATLAB(r) and LabVIEW(tm), to solve mathematical problems are employed.

Credits: 4.00

ECET 30903 - Advanced Embedded Microcontrollers

Credit Hours: 3.00. This course emphasizes advanced applications of embedded microcontrollers, included are microcontroller architecture, use of advanced programmable counter/timer arrays, interrupts, multi-tasking, analog interfaces, hardware abstraction and their peripherals. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Designate and setup a linker to specify memory spaces for code, data, constants, and I/O. 2. Use a real-time high-level code debugger to test and debug programs including instruction stepping, setting up breakpoints and examining variables. 3. Use standard C-language coding conventions. 4. Manipulate I/O bits (clear and set) using C language logic instructions and bit-fields. Credits: 3.00

ECET 31800 - Foundations Of Audio Electronics

Credit Hours: 3.00. The design, fabrication, and testing of the electronics that comprise audio signal transduction, transmission, processing, amplification and delivery to a loudspeaker are studied at an introductory level. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Quantify and measure sound and signal levels in terms of dB. 2. Convert dB, crest factor, THD, and frequency cut-off specifications into circuit design parameters. 3. Interface circuitry to microphones and loud speakers. 4. Design, build, and test a small audio system containing differential transmitters, differential amplifiers, simple active filters summers/mixers, class AB and class D power and bridged audio power amplifiers. Credits: 3.00

ECET 32100 - Introduction To Nanotechnology

Credit Hours: 3.00. This course explores the downsizing of electronic and mechanical devices and introduces the field of nanotechnology. Properties of nanomaterials and the tools of nanotechnology are studied. Interdisciplinary research and commercial applications are reviewed. The course involves participation in research seminars and hands-on laboratory experiences with nanotechnology instrumentation.

Learning Outcomes: 1. Identify the basic concepts behind nanotechnology. 2. Describe the tools of nanotechnology. 3. Develop a model of the Scanning Probe Microscope. Credits: 3.00

ECET 32300 - Introduction To Electric Vehicle Systems

Credit Hours: 3.00. The course is an introduction to electric vehicle (EV) technology analysis and configuration. The course explores the integrated mechanical and electrical power and control systems including the management of integrated power and control systems within an electric vehicle. Students perform detailed analysis of and develop design approaches for electrically powered vehicles.

Learning Outcomes: 1. Calculate horsepower requirements for various electric vehicle configurations. 2. Calculate efficiency of an electric vehicle. 3. Compare and contrast the various types of motors/controllers and their associated benefits and limitations. 4. Compare and contrast the various battery technologies related to electric vehicles. Credits: 3.00

ECET 32700 - Instrumentation And Data Acquisition Design

Credit Hours: 3.00. This course builds upon the prerequisite knowledge and covers implementation of electric systems to measure and record mechanical, electrical, and biological parameters. Signal characteristics, transducer specification and selection, signal conditioning and transmission design, data conversion, software, and an overall system error budget are developed.

Learning Outcomes: 1. Differentiate appropriate transducers for sensing various signals, including mechanical, biological, and electrical. 2. Design, simulate and verify signal conditioning circuits. 3. Implement analog-to-digital converters and examine conditioned data for sampling and quantization effects. 4. Create software programs to interface with analog-to-digital converters, process data, and display or utilize the results. 5. Evaluate common sources of errors in instrumentation systems. Credits: 3.00

ECET 32900 - Advanced Embedded Digital Systems

Credit Hours: 3.00. This course focuses on the study and application of real-time embedded systems. Real-time operating systems (RTOS) are introduced and applied. Students learn and use programming and scripting languages to discover the advantages and limitations of RTOS application in the lab.

Learning Outcomes: 1. Define, compare and contrast embedded systems terms and the concepts of soft and hard real time. 2. Identify and explain real time operating system operational concepts. 3. Demonstrate the application of software design, documentation, and version control tools. 4. Demonstrate the application of an RTOS application programming interface and testing techniques to evaluate embedded system functional correctness and performance. Credits: 3.00

ECET 33300 - Power Electronics In Energy Systems

Credit Hours: 3.00. A study of fundamentals and applications of switch-mode DC-DC and DC-AC power electronic converters. The emphasis is given to hardware development aspects. Students will learn how to safely work with high power and high voltage circuits.

Learning Outcomes: 1. Describe how power electronics enable energy efficiency in various applications such as energy conservation, renewable energy, and transportation. 2. Design and build switch mode DC-DC and DC-AC converters using commercially available components. 3. Develop closed loop control circuits for DC-DC converters using voltage mode and peak-current mode methods. 4. Simulate power electronic circuits. Credits: 3.00

ECET 33400 - Embedded Cross-Platform Interface And Communication

Credit Hours: 3.00. Project-oriented, hands-on study of embedded communication protocols, advanced OOP targeted for hand-held devices and low power embedded systems interface. A PC based OS with cross-platform development environments designing system solutions targeted for device platforms and interfacing with microcontroller systems. Topics include microcontrollers, SoC, various OS platforms, RTOS, embedded IoT protocols.

Learning Outcomes: 1. Use cross-platform development tools to design embedded solutions for low-power devices. [Problem Solver: ABET 3-1] 2. Be able to interface, and analyze sensors and actuator wired and wireless embedded communication protocols. [Problem Solver: ABET 3-4] 3. Be able to work in project teams to design, test, and implement robotic (low power device) control across multiple platforms. [Innovator: ABET 3-2 and Communicator: 3-5] Credits: 3.00

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory

measurements and simulations. Credits: 3.00

ECET 33900 - Digital Signal Processing

Credit Hours: 3.00. The course introduces students to the fundamental principles associated with processing discrete time signals. The architecture, instruction set and hardware and software development tools associated with a fixed point general purpose VLSI digital signal processor are examined. Some common real-time applications are implemented such as digital filters and DFT-based spectral estimation on a typical fixed point digital signal processor.

Learning Outcomes: 1. Describe the architectural features of a DSP and relate these to the DSP kernel equation. 2. Manipulate different binary number formats associated with a fixed point DSP. 3. Develop and debug simple programs that involve SOPs, modulo addressing, scaling and extraction of result, and common DSP program structures. 4. Describe the consequences and limitations of sampling baseband signals including the Nyquist rate and bandwidth, quantization noise, aliasing, frequency folding, reconstruction, spectrum of sampled baseband signals. 5. Express a sampled deterministic analog signal in closed mathematical form and expanded form using the unit sample. 6. Express a sampled signal in terms of the Z transform, in expanded and closed form. 7. Describe the relationship between the transfer function and impulse response in an LTI system. 8. Describe the operation of convolution and its implementation using hand calculations, mathematical software packages, and a fixed-point DSP. 9. Design and analyze FIR filters with the aid of a mathematical software package such as MATLAB. Credits: 3.00

ECET 34900 - Advanced Digital Systems

Credit Hours: 3.00. This course investigates complex digital systems that are implemented with field programmable gate arrays (FPGAs) using concurrent and sequential digital design techniques. Applications will include interfacing with analog signals and memory systems.

Learning Outcomes: 1. Design FPGA solutions for given digital design problems using a hardware description language (HDL). 2. Design FPGA solutions for given digital problems using a high-level sequential programming language for embedded processors. 3. Design FPGA solutions by decomposing a system into concurrent and sequential functional blocks and using hierarchical system development techniques. 4. Verify digital designs using simulation and hardware prototyping. 5. Analyze and design memory subsystems. 6. Apply ADC and DAC circuits to interface digital systems with analog devices/systems. Credits: 3.00

ECET 35100 - Instrumentation Applications For Technology

Credit Hours: 3.00 or 4.00. Introduction to the basic concepts and terminology of instruments. This course covers the procedures and techniques essential to measurement of physical quantities (such as pressure, flow, temperature, and level measurements) and analysis of that data. Students will use data acquisition systems and computer control software to complete laboratory exercises.

Credits: 3.00 to 4.00

ECET 35901 - Computer Based Data Acquisition Applications

Credit Hours: 3.00. This course focuses on the study and application of computer based data acquisition (DAQ) systems. Concepts of high resolution and high throughput data acquisition are introduced and applied. Students learn and use programming and scripting languages to discover the interfacing, advantages and limitations of computer based (DAQ) systems.

Learning Outcomes: 1. Define, compare and contrast common data acquisition terms. 2. Analyze the advantages and limitations of DAQ systems. 3. Demonstrate proficiency with software tools and computer based data acquisition. 4. Develop user-friendly applications for the purpose of DAQ system control. 5. Collect, analyze, and reduce data from a system for the purpose of written and oral reporting. Credits: 3.00

ECET 36400 - Fundamentals Of Electromagnetics

Credit Hours: 3.00. This course introduces the fundamentals of electromagnetics in both theory and application. Wave propagation, transmission lines, port parameters, antenna

theory, and antenna design are studied. Other topics include Maxwell's equations, propagation losses, RF signal measurement, impedance matching, and Smith chart applications.

Learning Outcomes: 1. Demonstrate knowledge of transmission line theory and application. 2. Apply and analyze transmission line systems using Smith carts. 3. Demonstrate the fundamentals and use of port parameters. 4. Design impedance matching networks using analytical methods and Smith charts. 5. Demonstrate and apply electromagnetic theory. 6. Describe and apply the fundamentals of electromagnetic wave propagation. 7. Design, simulate and analyze antennas. 8. Use RF simulation software for the analysis and design of RF circuits. 9. Demonstrate the use of RF laboratory equipment including the vector network analyzer, spectrum analyzer and RF generator. Credits: 3.00

ECET 36900 - Applied Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course provides fundamental knowledge of integrated computer imaging or vision systems for sensing, quality control and automation applications. Fundamental basis of optics, illumination, camera types with associated technologies, and image acquisition to develop a customized computer imaging or vision systems will be covered. Algorithms for image processing, image analysis and pattern recognition will also be covered. Emerging technologies-based integrated computer vision or imaging system for sensor system, inspection, quality control and automation in different sectors (medical, manufacturing, security, construction etc.) will be examined. Parallel laboratory hands-on experience will allow the students to apply and validate the concepts learned in the lecture.

Learning Outcomes: 1. Identify different components of a computer vision/imaging system and their needs. 2. Identify and specify different components of a computer imaging system for selected different applications. 3. Interpret and implement different operations related to image processing, image analysis and image understanding. 4. Evaluate different real-world case studies to learn from successes and failures related to computer imaging system-based devices or components. 5. Formulate or create tentative solution for selected real world applications. Credits: 3.00

ECET 37100 - Automation, Instrumentation, and Process Control

Credit Hours: 3.00 or 4.00. A project-oriented course combining key areas of automation, instrumentation and process control. The course covers automatic testing, computer interfacing, data collection, robotic controls, programmable logic controllers, and graphical process control software. A final project is an integrated system.

Credits: 3.00 or 4.00

ECET 37201 - Continuous Control Electronics

Credit Hours: 3.00. A study of the electronic design of the elements of closed-loop analog and digital systems. Topics include characteristics of process and servo systems, analysis and design of the electronics used to acquire the process variable; condition, transmit, and receive the signal; implement a single loop control algorithm, and provide proportional power. Several sensor types and interpretation of their static and dynamic specifications are included. Controllers employed include student designed analog, and embedded microprocessor, and commercial single loop controllers. Software is used to model components and analyze open and closed-loop systems.

Learning Outcomes: 1. Evaluate the performance of a closed loop system. 2. Use simulation software to analyze a control system. 3. Select sensors to meet given performance parameters. 4. Design, implement, and analyze the electronic circuits necessary to interface with sensors, covert-transmit-receive-scale signals, produce control signals, and apply continuous power to actuators. 5. Select, install, document, tune, and troubleshoot SISO (single input-single output) closed-loop systems. Credits: 3.00

ECET 37300 - Applied Electronic Drives

Credit Hours: 3.00. This course covers operational principles and application development consideration of all subsystems that make up electric drives: electric machines, power-electric based converters, mechanical system requirements, feedback controller design, and the interaction of drives with the utility grid. State of the art drive development tools are introduced through hands-on activities.

Learning Outcomes: 1. Describe the structure of electronic drive systems and their role in various applications such as flexible production

systems, energy conservation, renewable energy, and transportation, making electric drives an enabling technology. 2. Understand the basic principles of power electronics in drives using switch-mode converters and pulse width modulation to synthesize the voltages in dc and ac motor drives. 3. Understand the operation of DC, AC, and brushless DC motors. 4. Construct and test traditional and electronic drive circuit for above motors. 5. Analyze various signals present in electric drive to evaluate drive performance. 6. Learn speed control of the above machines. Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.

Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide. Credits: 3.00

ECET 38001 - Global Professional Issues In Engineering Technology

Credit Hours: 3.00. This course addresses professional ethics, legal issues, professional development, technology transfer, and corporate culture as they relate to EET graduates and our global society. Information relating to personal job and career choices, resumes, and interviews are included.

Learning Outcomes: 1. Demonstrate awareness in areas of intercultural knowledge and effectiveness. 2. Demonstrate awareness in areas of ethical reasoning. 3. Demonstrate awareness in areas of global citizenship and social awareness. 4. Identify applications of professional and ethical responsibilities including respect for diversity. 5. Demonstrate the ability to engage in self-directed continuing professional development. 6. Demonstrate knowledge of the impact of engineering technology solutions in a societal and global context. Credits: 3.00

ECET 38100 - Electrical Distribution Systems

Credit Hours: 4.00. A study of the design and operation of electric distribution systems including estimated demand, demand calculations, energy conservation, faults on power systems, power quality, power factor improvement, electric rates, voltage drops, protective devices, illumination, and the applicable portions of the National Electric Code (NEC). Both new facilities and additions to existing facilities are included.

Credits: 4.00

ECET 38404 - Fundamentals Of Contemporary Signal Of Processing

Credit Hours: 4.00. Fundamentals of processing techniques applied to signals and systems in both time and frequency domains are studies. Both continuous-time and discrete-time linear systems are introduced. Analysis methods such as: Fourier series, Fourier transform, bilateral Laplace transform, difference equations, discrete-Time Fourier transform, bilateral 7-Transform are introduced. Common applications such as waveform generation, FIR and IIR digital filtering, DFT and FFT based spectral analysis and filtering are covered. Use of software tools is emphasized throughout the course. Department permission required.

Learning Outcomes: 1. Classify various types of signals and systems. 2. Determine the impulse response of a differential or difference equation. 3. Determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms. 5. Compute the transforms and inverse transforms of basic examples. 6. Determine the response of linear

systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain. 7. Adhere to Nyquist sampling principles when developing a signal processing problem solution. 8. Calculate coefficients for FIR filter and IIR filter. Explain the fundamental source of the equations used. 9. Write programs to implement FIR filter and IIR filter. 10. Use a software simulation package to analyze system stability. 11. Convert a z-transform equation into a difference equation and implement it in software. 12. Generate the equivalent time-domain signal of a z-transform. 13. Generate the DFT of a number sequence. 14. Explain the output of a DFT based on the number of samples and sampling frequency. 15. Demonstrate self-learning ability by presenting a paper on any signal processing application to explain the application and its relevance. Credits: 4.00

ECET 38502 - Introduction To Automotive Electronics Laboratory

Credit Hours: 1.00. This course is a laboratory study of automotive electronics components and systems. The main topics are electronic circuit fundamentals, sensor characterization and signal conditioning, and actuator control.

Credits: 1.00

ECET 38600 - Building Electrical Codes And Standard Practices

Credit Hours: 3.00. A course in the design of building wiring, machine wiring and electrical control systems using relevant codes and standards to layout commercial and industrial facilities and manufacturing processes.

Learning Outcomes: 1. Identify codes and standards that pertain to the design and installation of building electrical systems. 2. Choose proper components for a wiring application. 3. Use commercial power system analysis software to assist in the design of an electrical distribution system. 4. Design lighting for office, industrial, and other areas. 5. Apply the appropriate standards to provide proper protection for electoral circuits. 6. Calculate balanced, three-phase short-circuit currents for a distribution system in accordance with applicable standards. Credits: 3.00

ECET 38800 - Analog IC Applications

Credit Hours: 3.00. This course is a study of the applications of analog integrated circuits. Topics include linear amplifiers, IC specifications, linear regulators, waveform generation, linear and switched-capacitor active filters, and nonlinear circuit applications. Computer aided analysis of these circuits is also presented.

Learning Outcomes: 1. Analyze and design a wide variety of digitally controlled analog circuits, selecting among several alternative configurations, accounting for the non-ideal IC behavior, and selecting appropriate devices. 2. Evaluate the performance of a variety of analog circuits, using appropriate standard laboratory measurement procedures, and simulations. Credits: 3.00

ECET 39000 - Lab Assistant In Electrical Engineering Technology

Credit Hours: 0.00 to 3.00. This course allows a student to serve like an employee as an undergraduate teaching assistant in the laboratory, lab exercise/apparatus developer, or undergraduate researcher. Hours, subject matter, and credit to be arranged by faculty. Course content applies toward the EET Professional Experience requirement. Permission of instructor required.

Learning Outcomes: 1. Meet the expectations of an employer. 2. Behave professionally in employer/ employee relationship. 3. Behave professionally in employee/client relationship. 4. Manage time and resources to meet expectations. Credits: 0.00 to 3.00

ECET 41500 - Digital Hardware Modeling Using Hardware Description Languages (HDL)

Credit Hours: 3.00. This course introduces students to various contemporary Hardware Description Languages (HDL) for modern digital logic systems. The course will emphasize on Verilog HDL. It covers logic-synthesis and high-level-synthesis in the context of HDL coding constructs for platform-independent and dependent technologies applicable to modern semiconductor industry testing. Students are also exposed to the subset of HDL that may be used for synthesis of custom logic for edge devices. HDL simulation and synthesis labs and projects are performed using commercial and/or academic VLSI CAD tools.

Learning Outcomes: 1. Gain proficiency in

popular HDL for modeling digital systems. 2. Use CAD tools to synthesize HDL code. 3. Verify/validate results through simulation and testing. 4. Identify effective HDL constructs for reconfigurable programmable logic vs. custom logic. 5. Apply HDL in real-world projects, including the development of complex digital systems for emerging technologies. Credits: 3.00

ECET 42301 - Electrical Vehicle Integration And Fabrication

Credit Hours: 3.00. This course requires students to develop a detailed design, develop a time/action plan, perform research on existing electronic vehicle systems, develop a procurement plan for electronic vehicle components, design and fabricate custom electric vehicle components, and construct an electric vehicle. The completed electric vehicle is extensively tested for safety, performance, and energy efficiency.

Learning Outcomes: 1. Design and fabricate custom electrical vehicle components. 2. Execute the construction of an electrical vehicle. 3. Measure energy efficiency of an electrical vehicle. 4. Implement appropriate electric vehicle instrumentation for various electric vehicle configurations. 5. Optimize an electric vehicle configuration for maximum efficiency. Credits: 3.00

ECET 42800 - Audio Electronics-Selected Topics

Credit Hours: 3.00. Define, implement, and evaluate the performance of the electronic elements in a professional audio system such as preamplifiers, signal encoding and transmission, signal reception and decoding, mixers, post processors, power amplifiers, limiting and protection, and intelligent power supplies. Both analog and digital signal processing may be implemented in each of the electronic elements.

Learning Outcomes: 1. Define parameters used to specify the performance of the electronic elements of a professional grade audio system. 2. Specify the electronic elements in a professional grade audio system to satisfy a given set of parameters. 3. Design, implement, and evaluate the electronic elements in a professional grade audio system. Credits: 3.00

ECET 42801 - Advanced Acoustics And Audio Engineering Technologies

Credit Hours: 3.00. This course introduces topics on acoustics and audio features/elements from hardware and/or software perspectives. Topics covered include the preparation and augmentation of audio data and designing, implementing, and evaluating the audio data using AI machine learning. This course also investigates electro-acoustic applications, their hardware element details, and their contributions to the system. This will pave students' understanding of the state-of-the-art technology in the acoustic and audio engineering technology field.

Learning Outcomes: 1. Define sound features that are both speaker-independent and -dependent. 2. Analyze acoustic/audio signals using AI machine learning. 3. Investigate electro-acoustic transducers and applications. 4. Review and evaluate acoustics/audio-related state-of-arts technology. Credits: 3.00

ECET 43000 - Electrical And Electronic Product And Program Management

Credit Hours: 3.00. This course deals with the planning of electrical and electronic products and projects. Research methods are studied to support new product development including customer needs and the development of engineering requirements. Formal techniques such as functional decomposition, top-down and bottom-up design techniques are studied. Planning and design alternatives to meet cost, performance, and user-interface foals are emphasized. Technical topics are revisited with emphasis on new applications. The various types and levels of new product system tests are studied. New product planning, scheduling, and management techniques are studied, along with the usage of software tools for project scheduling and management. Creativity is stressed, and the different approaches taken by the designers are compared and discussed.

Learning Outcomes: 1. Apply the engineering design lifecycle process. 2. Evaluate customer needs as part of the definition of the solution to a problem. 3. Evaluate alternative designs to solve a problem and then decide on the most appropriate design to pursue. 4. Define a workable plan to create a design to solve a product development problem. 5. Plan and construct a Gantt chart to be followed during senior design. 6. Write a formal technical proposal to be carried through in senior design. Credits: 3.00

ECET 43100 - International Capstone Project

Planning And Design

Credit Hours: 3.00. The course deals with the planning and execution of an industry sponsored senior capstone project carried out jointly with students from a foreign academic institution. Project management and systems engineering methods are studied to support the development of solutions to open-ended problems proposed by industry. Formal techniques such as functional decomposition, top-down and bottom-up, requirement matrix, analysis of alternatives are studied and applied to the projects. Project planning techniques including work breakdown structures, Gantt charts and resource planning are studied and applied to meet cost, performance and project goals. The various types and levels of new system tests are studied and applied. Electronic and internet communication tools shall be used to maintain team and project progress. Foreign travel shall be required for at least one face to face team meeting during the execution of the project. Permission of Instructor required.

Learning Outcomes: 1. Apply the engineering design lifecycle process. 2. Evaluate customer requirements and constraints as part of problem definition. 3. Evaluate multiple design solutions and quantitatively select optimal solution. 4. Define a workable design plan to solve the industry problem. 5. Plan and construct a Gantt chart to be followed during the project. 6. Produce appropriate project documentation. 7. Interact appropriately regarding international cultural diversity particularly in project planning and execution. Credits: 3.00

ECET 43400 - PC Systems II

Credit Hours: 4.00. Real-time PC-based operating systems. Programming Graphical User Interface in C++. Embedded PC hardware, busses, and peripheral programming. Writing and integrating device drivers.

Learning Outcomes: 1. Write GUI programs using an object-oriented language. 2. Write programs that require multiple threads. 3. Write a server-client data transfer program using TCP/IP calls. 4. Write a program that handles interrupts in an OS environment. 5. Write a program that transfers data on a Serial Port. 6. Write a program that controls a peripheral using the I2C bus. 7. Write programs that generate time intervals using timers. 8. Examine communications via typical device busses. Credits: 4.00

ECET 43600 - Electrical Power Transmissions, Distribution, And Smart Control

Credit Hours: 3.00. A course on the simple modeling and simulation of the power grid systems, power flow analysis, and advanced meter infrastructure (AMI). The fundamentals learned in this course will be useful in the study of the effects of distributed energy resources and storage in Smart Grid environment.

Learning Outcomes: 1. Explain the role of components of electrical power transmission and distribution network. 2. Identify characteristics of DC and AC transmission lines and cable systems. 3. Identify the characteristics of various power system loads and power quality issues. 4. Calculate and simulate power flow in a power systems network. 5. Explain how to stabilize power systems. 6. Apply Advanced Meter Infrastructure (AMI) as it is used in Smart Grid applications. Credits: 3.00

ECET 43900 - Advanced Digital Signal Processing

Credit Hours: 3.00. The course builds on the basic principles and applications of Digital Signal Processing with a view to implementing advanced DSP techniques. These techniques are chosen to form some of the building blocks that are used in specialization areas such as the biomedical, communications and energy management fields.

Learning Outcomes: 1. Write and debug basic DSP applications on a VLSI DSP 2. Write and debug advanced DSP techniques and applications drawn from areas such as communications and biomedical signal processing. 3. Embed software modules from DSP libraries into specific applications. Credits: 3.00

ECET 44200 - Programming Robots With ROS

Credit Hours: 3.00. Robot Operating Systems (ROS) will be used as a programming platform to explore the topics of computer vision, SLAM (Simultaneous Localization and Mapping), path planning, grasping, and social interaction in robotic systems, as well as programming large systems for physical interaction with the world. Self-contained implementation projects are core to the class. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of matrices is assumed.

Learning Outcomes: 1. Apply software versioning techniques to the programming of large software projects with hardware in-the-loop. 2. Build ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 3. Apply basic software engineering techniques to designing and documenting software. 4. Apply and evaluate computer vision techniques based on templates to track objects in 2-D. 5. Synthesize 3-D computer vision techniques for 3-D sensors from 2-D algorithms. 6. Analyze and evaluate hardware sensors with respect to specific software task needs. 7. Apply SLAM methods to real-world scenes to interpret the world on real hardware in real-time. 8. Analyze execution times and evaluate trade-offs in computational hardware performance with respect to sensor data throughput. 9. Implement feedback controllers and tune for specific hardware characteristics. 10. Apply manual path planning techniques to 2-D and 3-D maps extracted from SLAM algorithms. 11. Apply automatic path planning tools and software to 2-D and 3-D maps extracted from SLAM algorithms. Credits: 3.00

ECET 44400 - Wireless Systems: Design And Measurement

Credit Hours: 3.00. In this course wireless RF signals and microwave circuit designs are studied. Topics include signal analysis, RF signal measurement, microstrip design and analysis, Smith chart applications, RF circuit design, s-parameters, power dividers and couplers, filter design, and advanced RF PCB layout.

Learning Outcomes: 1. Apply knowledge of RF component non-idealities. 2. Design, simulate and test RF amplifiers, filters, and power dividers. 3. Apply RF test methods and procedures to RF components, circuits and systems. 4. Demonstrate microstrip and stripline analysis and design. 5. Apply RF simulation software for the analysis and design of RF circuits. 6. Demonstrate printed circuit board layout techniques for high frequency applications. 7. Demonstrate the use of RF laboratory equipment including the vector network analyzer, spectrum analyzer and RF generator. Credits: 3.00

ECET 46000 - Project Design And Development

Credit Hours: 3.00. An extensive individual or small group design project is carried out with guidance from a faculty advisor. This course includes determining customer requirements, considering design alternatives, prototyping, project integration, and testing. The project is completed as a robust prototype. The course concludes with a formal written report and a presentation of the project to faculty and invited industrial guests.

Learning Outcomes: 1. From a formal project proposal, create a functional prototype to solve the given problem. 2. Utilize a software scheduling package to plan and track the progress of a project. 3. Weigh design alternatives for customer requirements, efficiency, reliability, and cost. 4. Apply formal test procedures to the developed prototype. 5. Analyze the data acquired during testing of the prototype. 6. Present a project orally to a specific audience. 7. Write a technical report including conclusions and recommendations for further work. Credits: 3.00

ECET 46100 - International Capstone Project Execution

Credit Hours: 3.00. This course completes the development and execution of an international industry sponsored senior capstone project carried out jointly with students from a foreign academic institution. Project management and systems engineering methods are applied in the development of solutions to open-ended problems proposed by industry. Design tools including failure mode and effects analysis and configuration management are studied and applied. A manufacturing plan supported by both in process and validation test plans are developed and applied to demonstrate compliance to project requirements. The project is completed with the generation of a proof of concept demonstration that satisfies project requirements. The course concludes with a formal written report and presentation. Electronic and internet communication tools shall be used to maintain team and project progress. Foreign travel shall be required for at least one face to face team meeting during the execution of the project. Permission of Instructor required.

Learning Outcomes: 1. Create a functional proof of concept (POC) to solve the given problem. 2. Plan and track progress on the project utilizing a software scheduling package. 3. Apply formal test procedures to the developed proof of concept. 4. Analyze test data and draw valid conclusions on the POC compliance to project requirements. 5. Present a project to an industrial sponsor and faculty audience. 6. Write a technical report. 7. Interact appropriately regarding international cultural diversity particularly in project planning and execution. Credits: 3.00

ECET 47600 - Smart Grid Technology And Applications

Credit Hours: 3.00. This smart-grid (SG) technology and applications is designed to introduce new topics related to distributed generation, micro-grids, renewable energy sources, and smart home applications. Topics covered include design, modeling, control, and analysis of smart-grid systems. Concepts dealing with computational intelligence, decision support systems, smart metering, optimization, and energy storage are addressed. The laboratory component will provide students with hands-on experience in the utilization of smart-grid technologies and applications.

Learning Outcomes: 1. Identify fundamental elements and structure of smart grids and microgrids including communication networks. 2. Model, simulate, and analyze various distributed energy resources. 3. Interpret and implement smart grids computational techniques using decision support tools and optimization. 4. Evaluate different real-world case studies for smart grids applications. 5. Develop effective solutions for real-world applications considering environmental issues, standards, and regulations related to smart grids. Credits: 3.00

ECET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

ECET 48400 - Digital Wireless Systems

Credit Hours: 3.00. This course investigates the theory and implementation of digital wireless systems for current and next generation communication systems. Cognitive radio systems and technologies will be studied and implemented.

Credits: 3.00

ECET 48404 - Emerging Information, Communication And Technologies

Credit Hours: 4.00. An advanced course in the Computer Engineering Technology program that introduces and evaluates emerging systems, services and applications in information, communication, and technologies (ICT) areas. In the laboratory, students use utilities to evaluate and analyze various emerging subjects so that certain level of mastery f the subjects can be demonstrated. Permission of department required.

Learning Outcomes: 1. Facilitating students' critical thinking ability on the emerging subjects of the internet, internet protocols and the delivery of communication services using the internet by focusing on the fundamentals of these systems and applications. 2. Developing competence in analysis and application of technologies in computer networking. 3. Developing competence in analysis and application of technologies in telecommunications and wireless communications. 4. Understanding the operations and development trends of emerging technologies in ICT areas. Credits: 4.00

ECET 49000 - Senior Design Project Phase I

Credit Hours: 1.00 or 2.00. An extensive individual design and/or analytical project performed in consultation with one or more faculty advisors. Collaboration with representatives of industry, government agency, or community institutions is encouraged. Evidence of extensive and thorough laboratory performance is required. PHASE I includes, but is not limited to, faculty acceptance of project proposal, defining and limiting project objectives, initial research and source contacts,

procurement of materials, and periodic progress reports.

Credits: 1.00 or 2.00

ECET 49100 - Senior Design Project Phase II

Credit Hours: 2.00 to 5.00. PHASE II includes, but is not limited to, continued research and finalized design, oral presentation to faculty and other interested parties, and a written technical report.

Learning Outcomes: 1. Demonstrate the elements of System Design Principles. 2. Apply principles of Electrical Engineering Technology theory, problem solving techniques, and practical laboratory knowledge to design, implement, test, and bring to completion of a working project. 3. Demonstrate sufficient written communications skills. 4. Demonstrate sufficient oral communication skills. Credits: 2.00 to 5.00

ECET 49300 - Ethics And Professionalism In Technology

Credit Hours: 1.00. Factors involved in the ethical decision making in engineering and technology professions on both a local and global scale will be presented. Workplace issues such as socio-economic and cultural differences, professionalism, ethical codes, employee and community safety, whistle blowing, diversity and sexual harassment will be discussed. Case studies will guide student activities.

Credits: 1.00

ECET 49900 - Electrical Engineering Technology

Credit Hours: 1.00 to 9.00. Hours and subject matter to be arranged by staff. Cannot be used to replace EET 48000, 49600, or 49700. Permission of instructor required.

Learning Outcomes: 1. Vary with the project, and are subject to EET curriculum subcommittee approval. Credits: 1.00 to 9.00

ECET 52400 - Applied Electromagnetics

Credit Hours: 1.00 to 3.00. This course provides an advanced treatment of electromagnetics and applications at the graduate level for engineering technology students. Electric and magnetic field theory is presented, including Maxwell's equations. Topics include vector analysis, electric and magnetic fields, Maxwell's equations, electromagnetic wave radiation, and propagation. A semester-long project based on applied electromagnetics is required for each student. Knowledge of RF measurement equipment, such as spectrum analyzers and vector network analyzers is required.

Learning Outcomes: 1. Perform electromagnetic analysis, using vectors and differential and integral vector operations. 2. Perform electrostatic analysis and calculation in Cartesian, cylindrical and spherical coordinate systems. 3. Calculate the electric charge and electric and magnetic fields using Coulomb's Law, Gauss's Law, and Ampere's law. 4. Use Maxwell's equations in integral form and differential form to solve boundary value problems. 5. Derive and calculate the electromagnetic plane waves propagation in two and three dimensional space. 6. Determine and calculate the electromagnetic fields in rectangular and cylindrical waveguides. 7. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 1.00 to 3.00

ECET 53500 - Energy Sustainability

Credit Hours: 3.00. A study of energy auditing, energy saving opportunities of commercial and industrial systems, utility rate structures, economic evaluation of investments, potential energy saving retrofits, maintenance considerations, and cogeneration opportunities. Data analysis and report writing are practiced using data from a real world energy audit.

Learning Outcomes: 1. Identify and describe the energy conservation opportunities in industrial and commercial systems. 2. Apply energy auditing techniques. 3. Apply electrical and mechanical engineering principles to improve energy efficiency of systems. 4. Determine energy cost and consumption indexes using energy rate structures. 5. Examine the economic evaluation of energy conservation solutions. 6. Use DOE energy assessment tools. 7. Evaluate existing systems for energy recovery and cogeneration opportunities. 8. Use web-based and published material in energy analysis. 8. Evaluate existing systems for Smart Grid opportunities with smart utility meters. Credits: 3.00

ECET 53600 - Embedded Systems Security

Credit Hours: 3.00. This course focuses on the implementation and application of cryptographic algorithms and protocols in embedded systems. An overview of the security problem and the science of cryptography and cryptanalysis is presented. The notion of the security perimeter in terms of physical access to

assets in embedded hardware subsystems is studied. Students implement and apply various ciphers on 8-bit to 32-bit embedded platforms, comparing and contrasting computational and data throughout performance. Permission of instructor required.

Learning Outcomes: 1. Identify and describe cryptography, cryptanalysis, and security perimeters of embedded systems. 2. Identify and describe key performance issues and tradeoffs in the design and application of cryptographic algorithms and protocols in embedded systems. 3. Identify and describe the main areas of research focus in embedded system security and whey they are important. 4. Identify, describe, and apply tools used in cryptographic analysis and performance characterization of embedded systems. 5. Identify, describe, analyze and apply cryptographic algorithms and protocols including but not limited random number and key generators, private-key and public-key ciphers and protocols, and one-way hash functions. Credits: 3.00

ECET 54100 - Robotics And Cyber-Physical Systems Seminar

Credit Hours: 0.00 to 1.00. This course is a series of lectures from eminent local, national, and international researchers in the field of robotics, cyber-physical systems, and related areas (such as computer vision, autonomy, wearables, etc.).

Learning Outcomes: 1. Understand the state-of-the-art of research and practice in robotics and cyber-physical systems. Credits: 0.00 to 1.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies).

Credits: 3.00

ECET 58100 - Workshop In Electrical And Computer Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 8.00

ECET 59000 - Special Problems In Electrical And Computer Engineering Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

ECET 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Varies by students research topic. Credits: 1.00 to 3.00

ECET 63800 - Selected Topics In Sensor Networks

Credit Hours: 3.00. This course examines general sensor network concepts, with a focus on a particular area of research and development. Current applications are studied, culminating with the analysis, characterization and/or examination of a sensor network. Permission of instructor required.

Learning Outcomes: 1. Identify and describe sensor network applications. 2. Identify and describe key performance issues and tradeoffs in the design and application of sensor networks. 3. Identify and describe the main areas of research focus in sensor networks and whey they are important. 4. Identify, describe, and apply tools used in sensor network analysis, simulation, characterization, control, and information retrieval. 5. Analyze, calculate and simulate or measure critical performance metrics of sensor networks and their components (nodes, gateways, etc.). Credits: 3.00

ECET 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies by student research topic. Credits: 1.00 to 18.00

Engineering

ENGR 10000 - First-Year Engineering Lectures

Credit Hours: 0.00 or 1.00. An introduction to the engineering profession.

Credits: 0.00 or 1.00

ENGR 10300 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small group seminars led by faculty designed to introduce a specific topic, problem, or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or to assist in their decision of an engineering degree program.

Credits: 1.00

ENGR 10301 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small seminars led by faculty designed to introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or assist in their decision of an engineering degree. Permission of department required.

Learning Outcomes: 1. Introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Credits: 1.00

ENGR 10351 - Space Engineering Seminar

Credit Hours: 1.00. The purpose of this course is to help you see and appreciate the multi-disciplinary nature of space engineering, to give you an awareness that will aid you in developing your career. Space engineering includes a vast number of topics where expertise is needed by industry and NASA and a good understanding of this if vital to finding opportunities for your own interest and expertise to start you on a career.

Learning Outcomes: 1. Identify multiple career paths pursued by people in aerospace with various degrees; including those of people still working in aerospace and those of people who used their aerospace engineering degree as a basis for a career in a different field. 2. Recognize the broad range of products, topics, applications and systems on which aerospace engineers work. 3. Understand the variety of

topical expertise needed for space commerce and exploration. 4. Have an awareness of issues related to inclusion and intercultural teams. Credits: 1.00

ENGR 10400 - Introduction To Engineering And Purdue

Credit Hours: 1.00. Weekly small group seminars led by upper-class engineering students, enabling a broader understanding of engineering disciplines at Purdue, covering skills and techniques for academic success, and offering instruction and practice in career preparation and employment-finding skills.

Learning Outcomes: 1. Successfully transition to Purdue by balancing academic and personal life. 2. Develop life skills it takes to succeed as an engineering student. 3. Understand the academic and career opportunities within the different fields of engineering. 4. Develop a mentor-mentee relationship with your Peer Mentors. 5. Develop a network of classmates with whom to study and socially interact. 6. Learn about Purdue University resources. 7. Learn more about the fields of engineering you want to study and with which you may work. Credits: 1.00

ENGR 10500 - First-Year Engineering Seminar

Credit Hours: 1.00. A selection of invited lectures, participation exercises, and lab tours designed to acquaint exceptionally well-motivated students with opportunities to enhance their undergraduate engineering education through independent study, special research projects, overseas study, and other opportunities that may be available for students who are inclined to seek extraordinary challenges.

Credits: 1.00

ENGR 11700 - First-Year Engineering Honors Seminar

Credit Hours: 3.00. A course in computer programming, covering fundamentals of the C programming language. Other language(s) or materials will be covered to prepare Honors students to do the best possible work in their professional school courses. Students will be introduced to structured problem-solving and top-down programming techniques. Laboratory exercises will accelerate learning of fundamental materials through supervised repetitive practice, while more traditional individual and team projects will provide practice in the decomposition and solution of larger problems.

Credits: 3.00

ENGR 12600 - Engineering Problem Solving And Computer Tools

Credit Hours: 3.00. Introduction to the solving of open-ended engineering problems and the use and of computer software, including UNIXTM, computer communications, spreadsheets, and MATLAB. Explicit model-development activities are utilized, and students are expected to develop skill at working in teams. This is emphasized both in laboratories and on projects.

Credits: 3.00

ENGR 13000 - Transforming Ideas Into Innovations (UCC: IL)

Credit Hours: 4.00. This introductory course to engineering teaches skills in managing complex problems related to design, systems analysis with computational tools, and academic professional development. Through multiple experiences, students will learn effective methods to design and analyze behaviors of complex engineering systems with an eye for innovation. These experiences will develop their skills in teaming, project management, logical reasoning, sustainability, coupled with oral, written and visual communication for multiple audiences. This course also develops students ability to build computational tools (e.g., Python, MATLAB and Excel) to analyze the performance of systems using fundamental concepts associated with physical science and data science (e.g., mathematical modeling, data processing, numerical modeling, statistics). Professional identify development is critical to preparing students for making an informed decision in their choice of major and the development of professional skills to succeed in that major. Therefore, the course includes learning experiences to help them gather and process information about all the engineering academic pathways they could choose at Purdue. Permission of instructor required.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 4.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13300 - Transforming Ideas To Innovation, EPICS/VIP (UCC: IL)

Credit Hours: 2.00. Introduces students to the engineering professions using multidisciplinary, societally relevant content. Students will develop engineering approaches to systems, generate and explore creative ideas, and use quantitative methods to support design decisions. Students will experience the process of design and analysis in engineering including how to work effectively in teams, and will develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB). An emphasis will be placed on computing logic development and builds upon the co-requisite experience of the students in the EPICS class.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Examine and analyze career information from various resources to make informed decisions about which engineering discipline to pursue. 2. Develop metacognitive skills in evaluating own teamwork and leadership abilities, recognizing how own

behavior impact the whole team, and make team process adjustments when necessary. 3. Explain critical and diverse use of modeling in engineering to understand problems, represent solutions, compare alternatives, make predications, etc. 4. Use multiple models, estimation, and logic to triangulate and evaluate information coming from various data sources. 5. Collect, analyze, and represent data to make informative explanations and persuasive arguments. 6. Develop a logical problem solving process which includes sequential structures, conditional structures, and repetition structures for fundamental engineering problems. 7. Solve fundamental engineering problems using computer tools. 8. Perform basic file management tasks using an appropriate computer tool. 9. Work effectively and ethically as a member of a technical team. 10. Develop a work ethic appropriate for the engineering profession. 11. Reflect on personal and team performance to achieve continuous improvement. Credits: 2.00

ENGR 14100 - Honors Creativity And Innovation In Engineering Design I (UCC: IL)

Credit Hours: 3.50. This course introduces students to the engineering professions using multidisciplinary, societally relevant content. Students develop engineering approaches to systems, generate and explore creative and innovative ideas, and use of computational methods to support design decisions. Design challenges and projects engage students in innovative thinking across the engineering disciplines at Purdue. Students experience the process of design and analysis in engineering including how to work effectively in teams. Students also develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel®, LabView®, MATLAB®, and Python).

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Understand and apply engineering fundamentals and basic engineering science concepts to model, analyze, predict build, and evaluate an object of engineering interest using a design process. 3. Develop the ability to evaluate complex systems. 4. Develop strategies to facilitate generating creative ideas for complex design challenges. 5. Show how the engineering problem solving is related to the design process. 6. Use the engineering problem solving process to translate written problem statement into a mathematical model that is suitable for algorithmic development. 7. Communicate technical information to justify decision made during a problem solving situations (e.g. design, troubleshoot, or product selection). 8. Develop a logical and systematic problem solving process and use that process for software development, which includes sequential structures, conditional structures, and repetition structures. 9. Implement simple algorithmic forms of engineering models/problems using the most appropriate computer tool (LabVIEW, MATLAB, and Python). 10. Perform basic file management tasks using an appropriate computer tool. 11. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 12. Develop skills for cross-cultural communication. 13. Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

ENGR 14200 - Honors Creativity And Innovation In Engineering Design II

Credit Hours: 3.50. This course continues building on the foundation developed in ENGR 14100 . Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students extend and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., C, Excel®, LabView®, MATLAB®, and Python).

Learning Outcomes: 1. Describe, in greater depth, the engineering disciplines at Purdue

and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a mathematical model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Further development of strategies to facilitate generating creative ideas for complex design challenges. 8. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 9. Implement complex algorithmic solutions to engineering problems/designs using the most appropriate computer tool (C , Excel, LABVIEW, MATLAB, and Python) and be able to explain your rationale for your choice. 10. Apply a systems approach in solving engineering problems and in undertaking design projects. 11. Synthesize your knowledge of effective and ethical membership on a technical team (i.e., teaming skills) to appropriately behavior. 12 Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

ENGR 16100 - Honors Introduction To Innovation And The Physical Science Of Engineering Design I (UCC: IL/SCI)

Credit Hours: 4.00. This course introduces students to the engineering profession using physics-based, multidisciplinary, societally relevant content. Students develop engineering approaches to systems, generate and explore creative and innovative ideas, and use of computational methods to support design decisions. In particular, the students will develop the ability to model and investigate physical systems at the microscopic and macroscopic levels with a focus on vectors analysis, linear momentum, angular momentum, work-energy, and solid material interactions. Design challenges and projects will explore a wide range of natural phenomena experimentally and computationally (utilizing MATLAB and Python) and engage students in innovative thinking across the engineering disciplines at Purdue. They will learn the basics of descriptive statistics, data analysis, sensitivity analysis, and decision-making. Students experience the process of design and analysis in engineering including how to work effectively in teams. Students also develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Discuss the engineering education process, courses, and options, explain and compare engineering job functions and roles, and use this information to prepare a moderately well-informed course of study for academic and career success (3). 2. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and demonstrating a personal growth mindset to thoughtfully pursue course activities and the course as a whole (2). 3. Plan and implement systematic design processes using formal engineering management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (6). 4. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 5. Describe a wide range of physical phenomena using a few fundamental physical laws (12). 6. Learn how to implement a unified approach that relates microscopic behavior to macroscopic behavior. These include mechanical theories based on particle, spring, and material models (10). 7. Model natural phenomena using computer simulations

(5). 8. Demonstrate professional communication skills in the areas of technical writing to produce engineering reports, in presentations to convey engineering evidence and findings verbally and graphically to audiences, and in interpersonal communication to work with other members of the class (2). 9. Work alongside individuals with diverse backgrounds, utilizing the team environment to learn interdependently, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 10. Evaluate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (5). 11. Incorporate the consideration of engineering ethics, including social, safety, and sustainability issues into instances of engineering thinking and engineering problem solving so that the broader impacts of engineering work are evaluated and accounted for (3). 12. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, visualization, significant digits, and the problem presentation method to engineering applications (2). 13. Display proficiency in the applications of engineering content knowledge including basic statistics (5). Credits: 4.00

ENGR 16200 - Honors Introduction To Innovation And The Physical Science Of Engineering Design II (UCC: IL/SCI)

Credit Hours: 4.00. Students will take an in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. The students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g. MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control in an effort to identify and characterize physical material systems.

*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Utilize knowledge of the engineering education process, courses, and options, and engineering job functions and roles to prepare a final course of study for academic and career success (3). 2. Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories (10). 3. Apply the unified approach to material interactions to a broad array of applications including asteroids, black holes, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity (7). 4. Model natural phenomena using computer simulations (7). 5. Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem solving to ensure that the broader impacts of engineering work are consistently evaluated and accounted for (3). 6. Display proficiency in the applications of engineering content knowledge including statistics, statics, mechanics of materials, the universal accounting equation, electrical theory, and design of experiments (8). 7. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole (2). 8. Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and House of

Quality to design innovative products and systems (2). 9. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 10. Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms (5). 11. Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class (3). 12. Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 13. Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (3). 14. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering challenges (2). Credits: 4.00

ENGR 17600 - Professional Internship I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by department with cooperation of participating employers. Students submit a summary report.

Credits: 0.00

ENGR 18000 - Minorities In Engineering Seminar

Credit Hours: 1.00. Explores the challenges that minority engineering students have in making a smooth and informed transition to college from high school. The content and activities may be of particular interest to engineering students from underrepresented groups as they adjust to the University's environment. The course provides a setting for entering students to explore career opportunities in the various fields of engineering. Open to all entering engineering students.

Credits: 1.00

ENGR 18500 - Engineering Career Planning

Credit Hours: 1.00. An engineering-oriented course designed to assist students in planning for their educational, career, and personal development. Individual and group projects, computer-aided guidance. Course will incorporate autobiographies, resumes, and academic and career planning exercises. Interest inventories and personal appraisal surveys will be utilized. Computer-based guidance systems will be utilized, including ESCAPE (Engineering Specific Career Advisory Problem-solving Environment). (Eight-week session)

Credits: 1.00

ENGR 19400 - Women In Engineering Seminar

Credit Hours: 1.00. An overview of the career opportunities for women in engineering. The content and activities of the course may be of particular interest to women. Speakers from a variety of engineering organizations discuss their career paths and share their strategies for success. Students also meet weekly in small groups led by engineering seniors for additional information, interaction, and support from their peers in engineering. Open to all entering engineering students.

Credits: 1.00

ENGR 19500 - First-Year Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ENGR 19700 - Introduction To Programming Concepts

Credit Hours: 2.00. Basic concepts and applications of software programming for solving engineering problems. Topics include techniques for developing structured algorithms, data input and output, conditional statements, loops, recursion, functions, arrays, and elementary concepts in mathematical programming. Examples, homework, and applications of programming concepts make extensive use of the C programming language.

Credits: 2.00

ENGR 20000 - Cooperative Education Practice I

Credit Hours: 1.00. A semester or summer of external, full time, related career experiences designed to enhance the student's preparedness for an intended career with business, industry or government agency. A comprehensive written report on the internship practice is required. A minimum of 10 weeks and 200 hours are required for credit.

Credits: 1.00

ENGR 20010 - Engineering Career Enrichment Internship I

Credit Hours: 1.00. Semester of external career related experiences designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit.

Credits: 1.00

ENGR 23099 - Cooperative Education Seminar I

Credit Hours: 1.00 or 2.00. (PSY 23099) This seminar course is optional for Co-Op students when they are on campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least one Co-Op work term. May be repeated once after the second work term. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Learn from the experiences of other participants and apply that knowledge to the situation. Credits: 1.00 or 2.00

ENGR 25000 - Cooperative Education Practice II

Credit Hours: 1.00. A semester or summer of external, full time, related career experiences designed to enhance the student's preparedness for an intended career with business, industry or government agency. A comprehensive written report on the internship practice is required. A minimum of 10 weeks and 200 hours are required for credit.

Credits: 1.00

ENGR 25010 - Engineering Career Enrichment Internship II

Credit Hours: 1.00. Semester of external career related experiences designed to enhance the student's preparedness for entering and initial or second career.

Credits: 1.00

ENGR 26099 - Learning While Working Full-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 27199 - Professional Practice Flex Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience. Credits: 0.00

ENGR 27299 - Professional Practice Flex Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session,

the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience. Credits: 0.00

ENGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29600 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the freshmen/sophomore level on a temporary basis to test the viability of offering the course on a permanent basis.

Learning Outcomes: n/a Credits: 0.00 to 6.00

ENGR 29701 - Global Engineering Orientation

Credit Hours: 1.00. Forum in preparation of study and work abroad. Understanding of cultural differences and collaborating across cultural boundaries, professionalism and ethics in foreign work and academic environments, leadership and teamwork options in foreign environments. Permission of instructor required.

Learning Outcomes: 1. Be provided with foundation in global engineering communication skills. 2. Outline teamwork and leadership opportunities available through participation in the global engineering community. 3. Be provided with globally diverse and multicultural experiences and discuss case studies to prepare them for upcoming international internships and semester study abroad. 4. Identify resources available for academic studies and industrial work experience abroad. 5. Develop a strong ethical framework and cultural sensitivity to prepare for the global professional workplace. Credits: 1.00

ENGR 30301 - Business Essentials Executive Forum

Credit Hours: 2.00. This course will provide undergraduate engineering students access to Purdue Engineering alumni working in the C-suite, as well as basic knowledge regarding the understanding of corporate financial statements. The forum is a lecture-discussion course featuring executives from engineering firms, tech companies, and other organizations. Emphasis is placed on the actual practice of leadership in corporate America, on career selection and mobility, on styles of leadership, and on other business topics not normally covered in undergraduate engineering courses.

Learning Outcomes: 1. Have a fundamental understanding of basic financial statements, ratios, and methods used to make business decisions. 2. Understand the backgrounds, traits, qualities, and mindsets of Purdue undergraduate engineering alumni at the executive level. 3. Acquire up-to-date knowledge of business essentials needed for corporate leadership. 4. Discover career opportunities for engineers in the business function of organizations. Credits: 2.00

ENGR 30500 - Fundamentals Of Innovation Theory And Practice

Credit Hours: 3.00. This course is designed to provide students with initial exposure to the fundamental patterns, mindsets, behaviors, attributes, tools, and methods employed in the innovative activity of individuals and organizations. Emphasis is placed on understanding and effectively utilizing techniques to

systematically drive innovation that are drawn from the fields of business, design, problem-solving, engineering, and the social sciences. Lecture, in-class small group activities, and individual and team assignments are employed across an array of contemporary socio-technical challenges to provide students with the opportunity to apply conveyed theory and methods to rigorously structure problems, understand involved stakeholders, utilize innovation motifs and analogical reasoning to develop robust views of potential solutions spaces, tailor solution design to stakeholder context, consider the full suite of functional, social, and emotional dimensions that could influence solution prioritization, and document and systematically assess underlying solution assumptions to iterate toward a viable and sustainable forward-looking plan that could achieve target outcomes. This course counts toward, serves as a required entry course for, the College of Engineering Minor in Innovation and Transformational Change.

Learning Outcomes: 1. Develop working knowledge of established innovation forms and motifs. 2. Demonstrate ability to link innovation motifs to specific classes of problems. 3. Understand, and be able to pursue, the core aspects of an end-to-end innovation process. 4. Recognize the mental models, mindsets and behaviors of innovators. 5. Gain awareness of the approaches various forms of organizations take to systematically innovate. 6. Acquire leadership and communication skills through teamwork, oral presentations, and written deliverables. Credits: 3.00

ENGR 31000 - Engineering In Global Context (UCC: STS)

Credit Hours: 3.00. This course provides students with opportunities to study how engineering is intertwined with larger economic, social, cultural, and technological dynamics in an era of intensified globalization. Its major goals are to help students understand and appreciate what engineering is, how engineers are trained, what engineers do, and how engineering and society interact. The course approaches these themes through discussion of: the relation and interaction of engineering, science, technology, and society; the historical origins and development of engineering as a profession; diversity issues in engineering and other STEM fields; engineering in cross-national/cultural contexts; and contemporary challenges related to globalization, ethics, and sustainability. In summary, the course is designed to help students understand what it means to identify as, and/or work with, engineers. Recitation sections and/or independent projects (at the instructor's discretion) provide further opportunities for students to expand their knowledge and improve their skills in relation to course themes.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe and evaluate the specific kinds of knowledge and methods typically employed by engineers, including in comparison with other professional fields. 2. Understand the historical development of engineering education and the engineering profession in the United States. 3. Recognize how national differences are important in engineering work, including by comparing and contrasting different national cultures and styles of engineering. 4. Explain the significance of diversity in engineering education and professional practice, including by evaluating competing perspectives on diversity in different historical and sociocultural contexts. 5. Understand contemporary trends and issues related to globalization, ethics, social responsibility, and sustainability, and interpret their significance in relation to engineering education and practice. 6. Demonstrate written communication capabilities at the level of emerging or higher (as defined by the Purdue Core Curriculum guidelines). Credits: 3.00

ENGR 33099 - Cooperative Education Seminar II

Credit Hours: 1.00 or 2.00. This seminar is optional for Co-Op students when they are on campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least two Co-Op work terms. May be repeated once after the fourth work term. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Receive feedback from the instructor and seminar participants. 4. Continue professional development. Credits: 1.00 or 2.00

ENGR 35000 - Cooperative Education Practice IV

Credit Hours: 1.00. A semester or summer of external, full time, related career experiences designed to enhance the student's preparedness for an intended career with business, industry or

government agency. A comprehensive written report on the internship practice is required.

Credits: 1.00

ENGR 36099 - Learning While Working Full-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36199 - Learning While Working Part-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36299 - Learning While Working Part-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 37399 - Professional Practice Flex Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the

student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience.

Credits: 0.00

ENGR 37499 - Professional Practice Flex Co-Op IV

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience.

Credits: 0.00

ENGR 37599 - Professional Practice Flex Co-Op V

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience.

Credits: 0.00

ENGR 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report

Credits: 0.00

ENGR 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report

Credits: 0.00

ENGR 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in Engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b)

assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report

Credits: 0.00

ENGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39501 - Breakthrough Thinking Complex Challenges

Credit Hours: 3.00. This course is intended to help students understand and effectively employ the principles underlying breakthrough thinking. Students will participate in cross-disciplinary teams to design solutions to a complex societal challenge in conjunction with a partner organization, in an experiential learning setting. Case discussions of historical breakthroughs will be used to introduce techniques for the identification of opportunities, the design of solutions, and the launch, test, and iteration of such solutions. Emphasis will be placed on the effective use of techniques from various fields, such as business, design, problem-solving, engineering, and the social sciences.

Credits: 3.00

ENGR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39600 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the junior level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 0.00 to 6.00

ENGR 39602 - Undergraduate Experiential Training - Research

Credit Hours: 0.00. This course is meant to promote meaningful reflection on the different experiential learning research environments a student may participate in such as Summer Undergraduate Research Fellowship and Research for Pay internship. Additional data will be collected on each student's experience regarding pay, project, position, etc. Assignments will include goal setting, goal evaluation, reflection, and resume writing. Guidance will be provided within the Brightspace page and throughout the pre/post-experience survey assignments. Permission of instructor required.

Learning Outcomes: 1. Have enhanced critical thinking, problem-solving skills, and intellectual growth. 2. Gain practical skills, research methodologies, and confidence in their abilities. 3. Be better prepared for graduate studies.

Credits: 0.00

ENGR 39603 - Undergraduate Experiential Training - Semiconductors

Credit Hours: 0.00. This course is meant to promote meaningful reflection on the different experiential learning environments a student may participate in which focus on workforce development and the acquisition and practice of technical skills.

This course will supplement the Summer Training Awareness & Readiness for Semiconductions (STARS) program. Additional data will be collected on each student's experience regarding pay, project, position, etc. Assignments will include goal setting, goal evaluation, reflection, public speaking as it relates to the workforce domain, and resume writing in addition to industry/sector-specific technical training. Guidance will be provided within the Brightspace page and throughout the pre/post-experience survey assignments. Permission of instructor required.

Learning Outcomes: 1. Have enhanced critical thinking, problem-solving skills, and intellectual growth. 2. Gain practical skills, research methodologies, and confidence in their abilities. 3. Be better prepared for the semiconductor sector-specific technical training. Credits: 0.00

ENGR 39697 - Global Engineering Projects

Credit Hours: 1.00 to 3.00. Students will work in teams to formulate solutions to engineering problems. Project topics will focus on a problem outside the U.S. and/or incorporate teammates from international universities. International teams may work remotely with the possibility for international travel and in-person collaboration. Permission of instructor required.

Learning Outcomes: 1. Obtain practical skills through engagement in a real-life project utilizing engineering principles. 2. Enhance communication and teamwork skills through experience working on a diverse team. Credits: 1.00 to 3.00

ENGR 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report Credits: 0.00

ENGR 39700 - Global Engineering Experience

Credit Hours: 1.00. Forum for students participating in an international internship or study abroad experience. Students will complete weekly guided writing assignments during the first 15 weeks of their international experience. Assignments will aid students with integration into the host community. Students will demonstrate increased awareness of the nature and complexities of intercultural communication by applying various theories to their lived experiences. To be taken concurrently with international internship/study abroad experience. Permission of instructor is required.

Learning Outcomes: 1. Apply cultural theories to their personal experiences. 2. Deepen understanding of cultural differences, inter-cultural communication and their cultural competency. 3. Develop strategies to bridge cultural gaps and the ability to identify, manage, communicate and apply emotions effectively and appropriately. 4. Understand challenges of studying or working in a foreign country and develop a strong ethical framework and cultural sensitivity to succeed in a global workplace. Credits: 1.00

ENGR 39799 - GEARE Domestic Internship

Credit Hours: 0.00. Domestic internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with domestic employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the GEARE program requirements b) assess course outcomes via student evaluation of work sessions and work session technical report Credits: 0.00

ENGR 39899 - GEARE Global Internship

Credit Hours: 0.00. Global internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with global employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the

GEARE program requirements b) assess course outcomes via student evaluation of work sessions and work session technical report Credits: 0.00

ENGR 40400 - Instruction, Mentorship And Leadership

Credit Hours: 1.00. This course provides students with valuable mentorship, leadership, and instructional opportunities through participation in the College of Engineering mentorship programs. The weekly seminar will feature a combination of student-led discussions, guest speakers, and practical team-building skills.

Learning Outcomes: 1. Articulate the core tenets of their own philosophy of mentorship. 2. Apply effective mentoring strategies to overcome the challenges of mentorship. 3. Evaluate their own mentorship ability and style, as well as evaluate their own mentorship needs. 4. Build effective relationships with mentees. Credits: 1.00

ENGR 40600 - Engineering Ambassador Leadership Seminar

Credit Hours: 1.00. Students will engage in a weekly seminar that includes topics such as leadership, professional skills, teamwork, and Purdue culture. Students will utilize these skills while representing Purdue College of Engineering to current and prospective students, alumni, donors, legislators, and other supporters of Purdue College of Engineering. Student must be selected as a College of Engineering Ambassador; be currently enrolled full-time in the College of Engineering; have completed no less than three academic semesters at Purdue; have a cumulative GPA of 2.8 or higher. Permission of department required.

Learning Outcomes: 1. Provide students with theoretical and experiential basis from which they may acquire and enhance their knowledge and skills in the areas of: Leadership principles and models; Purdue structure, culture, and engineering education opportunities; Personal/professional effectiveness, including teamwork and public speaking. 2. Provide students with the opportunity to develop a personal philosophy of leadership that includes an understanding of self, others, and community. Credits: 1.00

ENGR 43099 - Cooperative Education Seminar III

Credit Hours: 1.00 or 2.00. This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least three Co-Op work terms. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Learn for the experiences of other participants and apply that knowledge to the situation. Credits: 1.00 or 2.00

ENGR 46099 - Learning While Working Full-Time Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46399 - Learning While Working Part-Time Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering,

polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46499 - Learning While Working Part-Time Co-Op IV

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 49001 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multi-disciplinary student teams directly apply cumulative learning to address selected parts of a real-world complex societal challenge in close collaboration with a partner organization, in an experiential learning format. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation. Permission of instructor required.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually-exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services, and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversion methodologies and the role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Understand combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying

new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion, and retention of new solutions. Credits: 3.00

ENGR 49400 - Women In Engineering Senior Seminar: Gender In The Workplace

Credit Hours: 1.00. This course provides junior and senior engineering students an opportunity to maximize their earning potential, promotion opportunities, and retention within engineering or related fields. Enrolled students will 1) become aware of and discuss solutions for internal and external barriers which can prevent women from reaching their greatest potential in the workforce; 2) enhance professional development and transition skills required to move successfully from an academic to professional environment; and 3) acquire skills and knowledge to serve as engineering role models/ambassadors for diverse populations. The content and activities of the course may be of particular interest to women. Permission by instructor required.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 1.00

ENGR 49600 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the senior level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 0.00 to 6.00

ENGR 49700 - Global Engineering Capstone

Credit Hours: 1.00. Forum for students returning from international internship and/or study abroad experience. Students will explore personal development resulting from the international experience as it relates to changes in world-view, understanding of culture, interpersonal skills and career aspirations. They will learn to highlight international experiences on resumes and in interviews. Students will apply and share their cultural knowledge through structured activities and summarize their entire global experience through a poster presentation. To be taken in semester following international internship/study abroad experience. Permission of instructor is required.

Learning Outcomes: 1. Identify skills gained through the international experience. 2. Able to highlight experiences on resumes and in interviews. 3. Apply skills to current and future inter-cultural situations and develop a strong ethical framework and cultural sensitivity to succeed in a global workplace. Credits: 1.00

ENGR 50000 - Global Design Team V

Credit Hours: 0.00 to 3.00. Global Design Team brings together undergraduate and graduate students from different disciplines, inside and outside of the College of Engineering to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic and GPA. Permission of department required.

Learning Outcomes: 1. An awareness of varying regulations, codes of practice, standards, technical specifications testing/inspection procedures, environmental regulations, and systems of measurement between countries and regions. 2. Familiarity with the concept of a "global product platform". 3. Ability to apply familiar concepts to unfamiliar, real-world problems. 4. Ability to use design tools to solve engineering problems. 5. Ability to adapt to cultural norms in a professional arena and act appropriately. 6. Ability to make ethical and socially responsible decisions in the context of a culture divergent from my own. 7. Ability to analyze problems from a different cultural frame of reference. 8. Ability to communicate professionally in a culturally-appropriate manner. 9. Ability to practice social and cultural responsibility, e.g. resource sustainability. 10. Proficiency in a second language. 11. Ability to be cross-culturally adaptable/flexible. 12. Ability

to contribute to a culturally-diverse team. Credits: 0.00 to 3.00

ENGR 50100 - Engineering Management Graduate Program Seminar

Credit Hours: 1.00. Seminar focused on graduate-level development for Interdisciplinary Engineering (IDE) professional master's students in key professional skill areas including technical management, engineering industry awareness, networking, and methods for obtaining a professional position after graduation. Permission of instructor required.

Learning Outcomes: 1. Function in a technical manager role by engaging with industry partners. 2. Construct an attractive professional brand by applying the characteristics of an effective online presence. 3. Enhance knowledge about successfully transitioning to industry by directly communicating with program graduates. 4. Write an effective resume and cover letter by implementing tangible connections between professional development assessment results and university resources. 5. Execute job search activities strategically by comparing engineering job markets, both domestically and internationally, regarding employment requirements, job growth, and salary range. 6. Develop a skills-based functional resume by synthesizing engineering course backgrounds with industry job requirements. 7. Generate graduate-level interview skills by participating in engineering industry mock interviews. Credits: 1.00

ENGR 50200 - Engineering Leadership

Credit Hours: 3.00. Engineering leadership is the ability to inspire and guide engineering and technology-focused teams and organizations to achieve strategic outcomes. The successful engineering leader creates value at the intersection of technical systems and human systems. This course introduces students to evidence-based, practice-proven frameworks and tools related to (1) leadership presence, (2) cognitive diversity and psychological safety in teams, and (3) designing and transforming organizations and ecosystems.

Learning Outcomes: 1. Describe characteristics of effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

ENGR 59600 - Special Topics

Credit Hours: 0.00 to 6.00. Special topic courses for projects or special interest in Engineering.

Learning Outcomes: 1. Will vary by course. Credits: 0.00 to 6.00

ENGR 60100 - Doctor Of Engineering Fundamentals

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations as part of the Doctor of Engineering (D.Eng.) program. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. The course will also detail the differences between a professional doctorate (D.Eng) and a PhD program. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives. As the foundational course for the Doctor of Engineering program, students are expected to take this course during their first year of the program.

Learning Outcomes: 1. Create an individual development plan (IDE). 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow and plan for your studies. 4. Critique your individual development plan. 5. Establish professional and academic connections with students and faculty in the D.Eng. program. 6. Identify and engage with potential faculty advisor(s) and dissertation committee members. Credits: 1.00

ENGR 60200 - Engineering Research Fundamentals

Credit Hours: 3.00. This course is designed to teach students basic research fundamentals, including critical analysis of scientific literature, scientific communication, hypothesis development and basics of scientific writing. At the course's end, students will be able to critically review literature and present their scientific thoughts and findings in both written and

oral forms. Students will also have opportunities to implement writing, presentation, and networking strategies that are key to success beyond graduate school. An introduction to ethical research practices will also be provided. Finally, students are expected to provide feedback to peers and improve their scientific writing and editing skills through weekly writing sessions. Through self-guided reading and online discussions, students will master the art of analyzing scientific literature, communicating their arguments, and offering peer feedback to colleagues.

Learning Outcomes: 1. Understand and comprehend the basics in research methodology and applying them in research/ project work. 2. Find literature relevant to a research problem, analyze research and retain and retrieve its content for future use. 3. Apply research guidelines regarding record keeping. 4. Apply approaches for the development and formulation of research questions, objectives, and hypotheses. 5. Apply approaches to good writing for research proposals, papers, and theses. 6. Communicate research plans to peers and non-expert audiences, including oral and poster presentations. 7. Identify common ethical issues in research. Credits: 3.00

ENGR 60300 - Doctor Of Engineering Seminar

Credit Hours: 1.00. The graduate seminar is designed to provide students with the opportunity to explore and engage with current research topics, trends, and developments within engineering. The seminar will feature a different guest speaker each week. Here are the benefits of participating in the seminar: Knowledge expansion: You will gain insights into cutting-edge research; Exposure to diverse research areas: You will be exposed to a broader range of topics and research areas. This exposure will help you gain a more comprehensive understanding of current cutting-edge research topics and techniques. It can also inspire new research ideas and perspectives that you may not have considered previously; Developing critical thinking skills: You will refine your critical thinking by asking questions and participating in discussions during the seminars; Developing presentation skills: You will observe different presentation styles and effective communication techniques that you can use as examples to develop your own; Networking: You will be able to interact with professors, researchers, and peers from within and outside your program.

Learning Outcomes: 1. List critical areas and topics being investigated across a variety of engineering disciplines and areas. 2. Summarize a research presentation. 3. Identify improvements for current research practices. 4. Identify effective presentation styles and effective communication techniques. 5. Network with your peers and provide feedback. Credits: 1.00

ENGR 69199 - Professional Practice Graduate Co-Op I

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required.

Credits: 0.00

ENGR 69299 - Professional Practice Graduate Co-Op II

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required. Prerequisite: ENGR 69199.

Credits: 0.00

ENGR 69399 - Professional Practice Graduate Co-Op III

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required. Prerequisite: ENGR 69299.

Credits: 0.00

ENGR 69499 - Professional Practice Graduate Co-Op IV

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required. Prerequisite: ENGR 69399.

Credits: 0.00

ENGR 69699 - Professional Practice Graduate Internship

Credit Hours: 0.00. Graduate internship experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required.

Credits: 0.00

ENGR 69810 - Engineering Research

Credit Hours: 1.00 to 18.00. Designed for online engineering graduate students to participate in a mentored research experience. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 18.00

ENGR 69900 - Doctor Of Engineering Research

Credit Hours: 1.00 to 18.00. This research dissertation course will reflect the student's work to prepare and pass the preliminary examination, prepare and pass the dissertation proposal and successfully defend and pass the Doctor of Engineering dissertation. Research expectations will be determined by the instructor and student. Permission of instructor is required.

Learning Outcomes: 1. Vary due to research expectations. Credits: 1.00 to18.00

Engineering Education

ENE 49800 - Undergraduate Research In Engineering Education

Credit Hours: 1.00 to 3.00. Individual research projects for students with the approval of their academic advisors. Requires prior approval of, and arrangement with, a faculty research advisor in the Department of Engineering Education. Written and oral final reports are required. Permission of instructor required.

Credits: 1.00 to 3.00

ENE 50100 - Professional Development In Engineering Education

Credit Hours: 1.00. This course provides beginning engineering education graduate students opportunities to define themselves with the engineering education department and within the field of engineering education. Students, faculty, and outside speakers present research topics, academic opportunities, and other information that will enhance students' graduate experiences. Permission of instructor required.

Learning Outcomes: 1. Develop a plan for completing a professional engineering education portfolio. (Students will demonstrate an ability to reflect critically upon their learning goals and articulate learning plan.) 2. Identify and interact with members of the engineering education community at local and national levels. (Students will develop and enhance their communication skills and other professional development skills.) 3. Identify and utilize resources that will help students to complete their doctoral program and to transition into the professional engineering education community. (Students will obtain knowledge of academic and professional resources in engineering education.) Credits: 1.00

ENE 50101 - Foundations Of Engineering Education

Credit Hours: 3.00. In this course, new doctoral students in engineering education explore their roles within the field of engineering education, create a learning plan that maps to program requirements, and develop habits of mind to support their ongoing professional development. Students learn to write clearly and coherently in an academic context. Students examine research trends and faculty interests so they can make informed choices about advising and program opportunities. Permission of instructor required.

Learning Outcomes: 1. Critically reflect upon personal learning goals, and articulate a learning plan that will eventually result in a professional portfolio. 2. Develop skills in academic writing. 3. Understand the research interests of local faculty members. 4. Identify resources that will facilitate the student's transition into the engineering education community. Credits: 3.00

ENE 50200 - History And Philosophy Of Engineering Education

Credit Hours: 3.00. Examines the history and philosophy of engineering education by: (1) exploring the history of engineering education through archival research and historical documents (critical moments, tensions, issues); (2) investigating philosophies of education and the philosophies that have guided engineering as a profession; and (3) critiquing the evolution of engineering education, identifying alternative scenarios, and imagining a future role in engineering education. This course introduces students to the field of engineering education while broadening their views of the roles of interrelationships between teaching and research. Open to students in Engineering Education. Permission of instructor required.

Learning Outcomes: 1. Develop a culture of critical reflection, engagement, and collaborative learning. 2. Provide opportunities for students to identify and understand tools to inquire into the history and philosophy of engineering education and develop the skills for using these tools. 3. Provide opportunities for students to use these inquiry tools to form persuasive arguments about the nature of

engineering education. Credits: 3.00

ENE 50300 - Engineering Education Inquiry

Credit Hours: 3.00. This course is conceived as a bridge between beginning graduate students' knowledge of technical research and modes of inquiry appropriate to the new field of engineering education. It is designed as the entryway to required research method courses taken as part of the students' plan of study. By the end of this survey course, students will be able to critique research in terms of the quality of the authors' argument based on their chain of reasoning, and will recognize that the articulation of a research question, the significance of the question, the choice of methods in regards to the research goals, and the transparency of the explanation of the methodology are all the parts of the chain of reasoning. Permission of instructor required.

Learning Outcomes: 1. Provides a pathway into the discipline that characterizes the diversity of approaches to engineering education research and research topics. 2. Create opportunities to discuss the need for rigorous engineering education research. 3. Develop critical understanding of relationships between research problem, method, and design. 4. Foster community development and collaborative efforts among students and engineering education researchers. 5. Help students identify conceptual hurdles and individual pathways into research activities. 6. Support students' identity development as an engineering education researcher. Credits: 3.00

ENE 50400 - Leadership, Policy, And Change In Science, Technology, Engineering, And Mathematics (STEM) Education

Credit Hours: 3.00. This course provides a foundation for examining historical and current perspectives of STEM education programs and policy at the secondary and postsecondary levels. Focusing on the relationships among education policy, leadership theories, and models of systemic change, this course will enable students to situate and envision their potential role in shaping engineering education within the context of the larger education landscape. Students will synthesize course readings, examine education policy, and reflect on leadership theories and change, as well as explore how they can influence leadership, policy, and /or organizational change in STEM education through a semester project.

Learning Outcomes: 1. Evaluate leadership theories and the leadership process. 2. Identify and evaluate factors that contribute to effective leadership within organizations. 3. Analyze education policy at local, state, and national levels with a focus on STEM education. 4. Evaluate models of systemic change and diffusion of innovative processes. 5. Understand key aspects, strategies, and applications of systemic change in education. 6. Generate strategies to implement change within STEM education environments. Credits: 3.00

ENE 50500 - Theories Of Development And Engineering Thinking

Credit Hours: 3.00. This course examines theories of human development, learning and epistemology in the context of Engineering Education. A broad survey of readings guides an in-depth study of fundamental theories of development and knowledge generation as it relates to pedagogy and research. A rich body of theoretical literature will be studied in order to explore its relation to engineering education. Work in the course aims to construct answers to the following three questions: (1) How do theories of human learning, development, and epistemology help us think about engineering? (2) How do they relate to engineering education? (3) How do they inform research method and practice in engineering education? No restrictions. It is helpful, however, for students to have engaged in prior reading-and writing- intensive courses that required them to synthesize large amounts of information. For this reason, it is recommended that students are enrolled currently in a graduate program at Purdue University. Permission of department required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design

Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 55400 - Globalization And Engineering

Credit Hours: 3.00. The focus is on the multifaceted dynamics of globalization, and its impact on engineering practice and the lives and education of engineers. The course emphasizes engineering and globalization from the perspectives of the emerging Asian economies and Europe, as well as the United States. This course is designed for practicing engineers and engineering educators. It is taught within a learner-centric, highly interactive, collaborative learning environment in which students are expected to learn from the experiences and thinking of each other, as well as from the instructor, and other course resources. The course places emphasis on reading, writing, web-based research, and discussion. Students are recommended (but not required) to have a minimum of two years work experience as a practicing engineer and strong communication skills (self-assessed). Permission of instructor is required.

Learning Outcomes: 1. Have increased global awareness. 2. Have knowledge of the dynamics of globalization as an economic and social process including contrasting theories and interpretations of events. 3. Have knowledge of how globalization is studied and characterized by economists, political scientists, and sociologists. 4. Able to interpret studies and research on globalization. 5. Understand the nature and roles of engineering education and life-long learning within the globalization dynamic. 6. Understand the innovation process within a global enterprise including contrasting theories and the ability to analyze specific cases. 7. Able to lead and innovate within a rapidly globalizing profession. 8. Know the engineering profession, engineering education, and globalization from the perspectives of countries beyond the United States, particularly perspectives from Europe and the emerging economies of Asia. Credits: 3.00

ENE 58600 - Exploring Alternative Career Paths As An Engineering Educator

Credit Hours: 3.00. This course is designed for graduate students in engineering or closely related fields who want to be involved in educating current or future engineering students or practicing engineers or in communicating technical material to others, including teachers, the public, or policymakers - but are not currently interested in a tenure-track faculty position. It explores a wide range of positions in formal education, informal education (e.g., museums, foundations), industry, and government and offers an opportunity to learn and practice some skills typically required for success in those positions.

Learning Outcomes: 1. Describe non-tenure-track positions of interest to them and where to look for those types of positions. 2. Build and maintain networks with people who have similar interests. 3. Prepare a professional development plan to develop and polish the skills they need in their current or future position. 4. Write an effective proposal seeking funding for a project of interest. Credits: 3.00

ENE 59000 - Special Problems In Engineering Education

Credit Hours: 1.00 to 6.00. Project or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum. Interested students should seek a faculty advisor by meeting individual

faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken and expected outcomes and deliverables. An individual project must be approved by the faculty member supervising the project and the student's advisor before registering for the course. An approved written report is required. Permission of instructor required.

Learning Outcomes: 1. Objectives vary based on course topics. Credits: 1.00 to 6.00

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 62000 - Design, Cognition And Learning

Credit Hours: 3.00. Design is central to engineering: it is an integral part of the engineering profession and how we educate future professionals. Design cognition and learning is an area of engineering education research that seeks to understand what designers know and how they learn, and what tools best support design activity (e.g. collaboration, innovation, etc.). This research draws from many perspectives including cognitive psychology and the learning sciences, organizational learning, engineering and product design, architecture, human-centered interaction, and creativity and innovation. Themes in the course include (1) design knowledge, (2) what theories help understand design knowing and learning, (3) what are ways to study designers and design activity, and (4) how may design research inform design education and practice? Permission of instructor required.

Learning Outcomes: 1. Explore and critique multiple perspectives on design cognition and learning, some of which are synergistic and some of which conflict, to develop a more sophisticated understanding that acknowledges and builds on different perspectives. 2. Stretch, broaden, and challenge perspectives. 3. Share and clarify ideas through writing and discussion. 4. Develop a landscape view of cognition knowing and learning that may also reveal gaps in knowledge. 5. Critique and discuss a variety of ways people study design to better understand what methods are appropriate for what kinds of research goals. 6. Examine data drawn from a variety of methods (e.g., verbal protocol analysis, sketches, surveys, debrief interviews and reports). 7. Experience different resources across disciplinary communities. 8. Identify central resources for finding information. 9. Develop an awareness of differences across diverse design communities (e.g., differences in language, values, approaches). 10. Experience and reflect on design through in class activities. 11. Examine other designers (peers as well as existing design data) to develop skills of noticing and seeing that may be used to guide personal reflections on a design philosophy, to develop a research proposal, or to develop an awareness of the kinds of challenges learners experience about design knowing. 12. Synthesize ideas through class discussion, activities, and out-of-class reflection blog posts. 13. Give and receive feedback on the final course project at multiple points in the term. 14. Develop an application of research on design knowing and learning (a philosophy statement, a research proposal, an education proposal, a synthesis to identify gaps). Credits: 3.00

ENE 63000 - Cognitive Devices In Science, Technology, Engineering And Mathematics Learning Environments

Credit Hours: 3.00. This course explores the nature of technologies we use to assist in thinking, learning and teaching. Specific focus is on cognitive tools associated with engineering activities and how to blend these tools with science and mathematical knowledge. These will range from representational tools, computational tools and cognitive tools for supporting individual and group thinking and learning. Participants in this course will be able to evaluate various learning technologies relative to specific learning goals and outcomes and will design a technological tool to support thinking, learning and/or teaching about concepts in science, engineering, mathematics and technology. Participants will also be able to identify assessment methods that indicate cognitive change in learners as a measure of the effectiveness of a device/tool in context of an activity.

Learning Outcomes: 1. Evaluate various learning technologies relative to specific

learning goals and outcomes and will design a technological tool to support thinking, learning, and/or teaching about concepts in science, engineering, mathematics and technology. 2. Identify assessment methods that indicate cognitive change in learners as a measure of the effectiveness of a device/tool in context of an activity. Credits: 3.00

ENE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (CHE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Student must be admitted into a Ph.D. program in Engineering or other technical discipline (Finished with MS or MS-bypass). Not open to students who have taken PSY 69500/EDPS 63400. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 68700 - Mentored Teaching In Engineering

Credit Hours: 1.00 or 3.00. Mentored experience in the teaching of engineering, with structured opportunities for individual reflection. All students create a scholarly teaching portfolio. Students who register for three credits conduct a scholarship of teaching and learning project. Prerequisites: Significant concurrent responsibility for teaching an engineering course. Registration in or completion of ENE 50600 (Content, Assessment And Pedagogy) or ENE 68500 (Educational Methods In Engineering); or instructor permission required.

Learning Outcomes: 1. Think critically about the relationships between your teaching experiences and the readings in this course and the prerequisite courses. 2. Use reflection, mentoring, and student feedback to learn from teaching experiences. 3. Explain the reasons for choices of teaching methods. 4. Analyze evidence of student learning. 5. Identify and address ethical issues in teaching situations. 6. Plan and carry out a scholarly investigation of teaching and learning through the SoTL project. Credits: 1.00 or 3.00

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

ENE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Make satisfactory progress on Master's research. Credits: 1.00 to 18.00

ENE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Engineering Projects in Community

Service

EPCS 10100 - First Year Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS 10100 gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's sophomores, juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. May be repeated for credit.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 10200 - First Year Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Participants in EPCS 10200 gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Working with team's sophomores, juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 10200 is offered for two credits and is intended for students who have exhibited significant achievement in EPCS 10100 and desire the level of responsibility that is appropriate for two credits. May be repeated for credit. Permission of department required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 11100 - First Year Participation In EPICS I (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one-year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as

a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

EPCS 12100 - First Year Participation In EPICS II (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and educational organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project for two or more semesters. First-year students participating in EPICS gain insight into the specific project, and more generally, into the design and development process. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Ability to apply material from their discipline to the design of community-based projects. 2. Understanding of design as a start-to-finish process. 3. Ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Awareness of the customer. 5. Ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Ability to communicate effectively with audiences with widely-varying backgrounds. 7. Awareness of professional ethics and responsibility. 8. Appreciation of the role that their discipline can play in social contexts. Credits: 1.00

EPCS 20100 - Sophomore Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). Sophomores participating in EPCS 20100 gain insight into the specific project, and, more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 20100 is offered for one credit.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 20200 - Sophomore Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Sophomores participating in EPCS 20100 gain insight into the specific project, and, more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 20200 is offered for two credits. Permission of instructor required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for

the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 30100 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 40100 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100/EPCS 40200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 40100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively

with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 40200 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100 /40200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 40200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 41100 - Senior Design Participation In EPICS

Credit Hours: 1.00. Continuation of EPICS courses. Seniors using EPCS 41100 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41200 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to

function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 49000 - EPICS Special Topics Course

Credit Hours: 1.00 to 3.00. Projects of special interest outside the scope and structure of the standard EPICS courses. Interested students seek a faculty advisor in their area of special interest and together prepare a brief description of the work to be undertaken. Permission of instructor required.

Credits: 1.00 to 3.00

Engineering Technology

ENGT 10200 - Industrial Technology Aerospace Studies

Credit Hours: 3.00. This course introduces students to the world of aeronautics, flight, and engineering. Students apply scientific and engineering concepts to design materials and processes that measure, repair, improves, and extend aeronautical systems.

Learning Outcomes: 1. Explain the principles of atmospheric and space flight. 2. Apply concepts of orbital mechanics, using industry-standard software. 3. Explore career opportunities in aerospace engineering and technology. Credits: 3.00

ENGT 10300 - Industrial Technology Exploring Civil Engineering And Architecture

Credit Hours: 3.00. Students learn various aspects of civil engineering and architecture, apply their knowledge to designing and development of a commercial property. Students learn about documenting their project, problem-solving, and communications in the civil engineering community.

Learning Outcomes: 1. Apply aspects of building and site design for commercial projects. 2. Use industry-standard 3-D architectural software to document work. 3. Compare/contrast the roles of architects and civil engineers. 4. Explore various career opportunities in civil engineering and architecture. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

ENGT 10600 - Industrial Technology Digital Electronics

Credit Hours: 3.00. This course is the study of applied digital logic. Students will study the application of electronic logic circuits and apply Boolean logic to the solution of problems. Students will design circuits, export their design to a printed program that generates printed circuit boards, and construct the design using electronic components.

Learning Outcomes: 1. Design digital electronic circuits. 2. Apply various number systems and logic gates. 3. Design combinational and sequential circuits. 4. Use industry-standard software to design/simulate digital circuits. Credits: 3.00

ENGT 10700 - Industrial Technology Principles Of Engineering

Credit Hours: 3.00. This course explores various engineering systems and manufacturing processes. Students examine how the field of engineering technology addresses social and political consequences of technological change.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Explain mechanical systems, including simple/compound machines, mechanisms, and motion. 3. Design basic electrical circuits. 4. Explore applications of robotics and automation in engineering. Credits: 3.00

ENGT 10800 - Industrial Technology Computer-Integrated Manufacturing

Credit Hours: 3.00. This course builds on students' solid modeling skills to develop manufactured products. Students evaluate products using mass property analysis, make appropriate modifications, and use prototyping equipment to produce three-dimensional models of the solutions.

Learning Outcomes: 1. Use computer-aided

design and computer-aided manufacturing software to optimize production workflows. 2. Use computer numerical control machines to transform digital designs into physical products. 3. Integrate robotic systems to improve efficiency and precision. 4. Analyze economic aspects of manufacturing. Credits: 3.00

ENGT 10900 - Industrial Technology Engineering Design And Development

Credit Hours: 3.00. In this capstone course students work in teams to design and construct a solution to an engineering problem, applying the knowledge and skills previously developed. Students maintain a portfolio of their design and development activities. Teams are responsible for making final presentations of the solution to an engineering review panel.

Learning Outcomes: 1. Apply the engineering design process. 2. Conduct research to support design decisions. 3. Present and defend design decisions. 4. Explore the societal, ethical, and environmental impacts of engineering. Credits: 3.00

ENGT 18000 - Engineering Technology Foundations

Credit Hours: 3.00. This course introduces School of Engineering Technology students to resources and skills that will help them to be successful in their studies and ultimately in their careers. The skills needed to define and solve technical problems in engineering technology are developed. Instruction is given in analytical and computational problem-solving techniques. Application of software for analysis and communication is emphasized. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Select the most appropriate degree program. 2. Apply algebraic and trigonometric skills to solve engineering technology problems. 3. Apply computational tools to address engineering technology problems. 4. Identify professional issues in engineering technology. 5. Plan and execute a strategy for success in a chosen degree program. Credits: 3.00

ENGT 18100 - Engineering Technology Applications

Credit Hours: 1.00. Basic electrical, electronics, mechanical, and process laboratory skills are introduced, including simple troubleshooting techniques and safety practice. Relevant engineering technology projects are emphasized.

Learning Outcomes: 1. Operate safely in a lab environment. 2. Use standard lab instrumentation to take measurements accurately. 3. Communicate relevant experimental results. 4. Complete an engineering technology team project. Credits: 1.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

ENGT 22670 - Sustainable Energy Technologies: An International Perspective

Credit Hours: 3.00. This course is a survey of sustainable energy technologies taught at Ostfalia University in Wolfenbuttel, Germany during the two-week International Summer University Program. Wind, Solar, Hydro-electric, Hydrogen Fuel Cell, Biomass, and other technologies are studied along with the future of Nuclear and Coal powered generation. The economic aspects of shifting to renewable energy sources by Germany are presented. Field trips to energy-related industries and historic cities occur nearly every day. Permission of instructor required.

Learning Outcomes: 1. Increase intercultural

awareness. 2. Identify various sustainable energy technologies. 3. Describe technological issues associated with each generation method. 4. Explain economic issues associated with implementation of sustainable energy. 5. Identify events in history that shaped the German culture. Credits: 3.00

ENGT 29000 - Special Topics In ENGT

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of engineering technology is provided by SOET faculty, subject to SOET curriculum subcommittee approval. Hours, subject matter, and credit to be arranged by faculty. Permission of department required.

Learning Outcomes: 1. Learning outcomes will match the course content and are subject to SOET curriculum subcommittee approval. Credits: 1.00 to 3.00

ENGT 29900 - Engineering Technology Project

Credit Hours: 1.00 to 3.00. Independent project or study of a special topics is conducted under the supervision of appropriate SOET faculty. Hours and subject matter must be arranged with the instructor and approved by the SOET curriculum subcommittee before enrolling in the course. Permission of department required.

Learning Outcomes: 1. Learning outcomes will depend on the content of the project and will be approved by the SOET curriculum subcommittee. Credits: 1.00 to 3.00

ENGT 39000 - Special Topics In Engineering Technology

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of engineering technology is provided by SOET faculty, subject to SOET curriculum subcommittee approval. Hours, subject matter, and credit to be arranged by faculty. Permission of department required.

Learning Outcomes: 1. Learning outcomes will be reviewed by the SOET CC subcommittee as part of the course proposal. Credits: 1.00 to 3.00

ENGT 39900 - Engineering Technology Project

Credit Hours: 1.00 to 6.00. Independent project or study of a special topic is conducted under the supervision of appropriate SOET faculty. Hours and subject matter must be arranged with the instructor and approved by the SOET curriculum subcommittee before enrolling in the course. Permission of department required.

Learning Outcomes: 1. Learning outcomes vary, and will be approved by the SOET curriculum subcommittee. Credits: 1.00 to 6.00

ENGT 48000 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

ENGT 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify

limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

ENGT 49000 - Special Topics In Engineering Technology

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of engineering technology is provided by SOET faculty, subject to SOET curriculum subcommittee approval. Hours, subject, matter, and credit to be arranged by faculty. Permission of department required.

Learning Outcomes: 1. Learning outcomes will vary, and are subject to SOET curriculum subcommittee approval. Credits: 1.00 to 3.00

ENGT 49900 - Engineering Technology Project

Credit Hours: 1.00 to 6.00. Independent project or study of a special topic is conducted under the supervision of appropriate SOET faculty. Hours and subject matter must be arranged with the instructor and approved by the SOET curriculum subcommittee before enrolling in the course. Permission of department required.

Learning Outcomes: 1. Learning outcomes will vary with the project, and are subject to SOET curriculum subcommittee approval. Credits: 1.00 to 6.00

ENGT 50100 - Graduate Research Seminar

Credit Hours: 0.00 or 1.00. This course is intended to orient new graduate students to the Engineering Technology (ET) program and faculty. This includes PhD students and students pursuing a Master's degree through a thesis or directed project option. This does not include students pursuing a Master's degree with coursework only. Research activities within ET and throughout Purdue University are discussed. Student resources and opportunities are reviewed to give the students the tools they need to be successful. In addition, this course provides a way to develop a natural cohort of graduate students. This course is a graduate seminar course focused on the ET program. Graduate status or upper-division undergraduate. Permission of department required.

Learning Outcomes: 1. Summarize research interests of ET graduate faculty. 2. Interpret Purdue University research activities and resources and apply this knowledge to their particular research plan. 3. Generate MS or PhD preliminary documents based on ET specific requirements. 4. Implement effective use of library resources and ability to write scholarly information in accepted format styles. Credits: 0.00 or 1.00

ENGT 50200 - Developmental Testing And Innovation Seminar

Credit Hours: 0.50 or 1.00. The course introduces Engineering Technology and the requirements to fulfill the master's and/or Ph.D. Technology degrees. The seminar can include graduate faculty from the SoET, the NAVY, and other Engineering and Technology related disciplines from the Purdue Polytechnic, College of Engineering, and other STEM-related disciplines across campus.

Learning Outcomes: 1. Interpret Purdue University and Navy research activities and resources applying the knowledge to their particular research plan. 2. Generate M.S. or Ph.D. preliminary documents based on Engineering Technology or NAVY-specific research requirements. 3. Implement effective intellectual use of Purdue library and Navy resources for the ability to write scholarly information in accepted university and/or Navy format styles. Credits: 0.50 or 1.00

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

ENGT 50900 - Applied Computational Methods

Credit Hours: 1.00 to 3.00. This class covers the mathematics

typically needed for research in engineering technology and is especially suited to the needs of ENGT student. The class includes basic calculus, introductory numerical methods, implemented in MATLAB, and elementary linear algebra. It uses relevant, practical problems to teach concepts and provides the students with actionable information. The starting point is graphical and numerical solutions of systems of non-linear algebraic equations. The class progresses to simple ordinary differential equations. Prerequisite: Six credits of undergraduate classes in technical mathematics, focusing on calculus.

Learning Outcomes: 1. Working understanding of algebra. 2. Solve systems of linear and nonlinear equations. 3. Calculate eigenvalues. 4. Working understanding of basic calculus. 5. Find derivatives and integrals of basic functions analytically. 6. Show graphical representations of integrals and derivatives. 7. Working knowledge of basic numerical methods. 8. Approximate derivatives using finite differences. 9. Find roots of nonlinear equations. 10. Implement a numerical algorithm using MATLAB. 11. Working knowledge of simple differential equations. 12. Solve an ordinary differential equation (ODE) using finite differences. 13. Solve an ODE numerically in MATLAB. Credits: 1.00 to 3.00

ENGT 51000 - Internet Of Things And Cybersecurity For Engineering And Technology

Credit Hours: 3.00. The internet has brought about the ability to embed computing into everyday devices to allow them to send and receive information. These devices, known as the Internet of Things (IoT), will require management at all levels to understand the inherent security risks due to the interconnection via the internet. Illegally accessing (hacking) IoT is increasingly becoming the most pervasive form of industrial espionage in use today. Understanding the threats aimed at IoT and how to protect IoT will be the key to keeping sensitive corporate information and secrets secure and private, and will require everyone's participation, not just the IT department. For this course students will learn the basics of research of and into cybersecurity, and the techniques used to commit industrial related crimes; how to detect these potentially catastrophic crimes; and the means to protect one of the company's most important assets...its systems and data.

Learning Outcomes: 1. Analyze security regulations relevant to their industry. 2. Apply a cybersecurity framework based upon industry regulations. 3. Analyze privacy issues with Internet of Things. 4. Analyze the difference between threats, vulnerabilities and risks as it relates to Internet of Things. 5. Apply techniques to mitigate risk to Internet of Things. 6. Evaluate the inherent benefits of using IoT, potential risks to IoT, and how to use a cybersecurity framework to help mitigate risk to IoT. Credits: 3.00

ENGT 54000 - Change Management For Enterprise Sustainability

Credit Hours: 3.00. Change management is at the core of an engineering organization's processes and data, and it affects every member of the enterprise. Change management provides a method for identifying, analyzing, preparing, implementing, validating, and documenting engineering changes throughout a product's lifecycle, to ensure everyone in the organization is working from the same product record and changes are communicated in real-time. In this course, the core elements, data structures, stakeholders, and workflows of change management and their role as enablers of the digital thread and the digital enterprise are discussed. The application of the industry standard CM2 methodology is emphasized as a strategy to provide control, maintain data integrity, and improve visibility and traceability of changes.

Learning Outcomes: 1. Summarize the challenges that engineering and manufacturing organizations face when managing quality, options, and variants throughout a product lifecycle. 2. Construct and justify a product hierarchy and its associated datasets. 3. Estimate the magnitude of corrective action for a given change and compare it to the application of conformance measurements. 4. Assess the impact of an engineering change. 5. Evaluate and interpret the CM2 model, an industry-standard closed-loop change management process. 6. Differentiate and prepare the main change objects for authorizing and managing work. 7. Summarize the challenges and complexities of lifecycle sustainment and assess how they differ from those in product development. 8. Prepare a detailed change implementation plan. Credits: 3.00

ENGT 54200 - Cyber-Animal Systems I:

Technology-Enhanced Animal Welfare

Credit Hours: 3.00. Cyber-Animal Systems is an interdisciplinary course involving hardware science, software science, and animal science students, who will study the interaction of animals and computer-controlled systems. The course addresses recent advances in robotics, data science, and animal husbandry that combine to create collaborative robots, wearable devices, and biological and environmental sensing systems that improve the practice of precision animal agriculture. Topics include case studies of technology adoption in animal agriculture, impacts of animal welfare on farm production and climate, and the importance of animal societies, confounding variables in animal studies, and animal anxiety on the design of experiments for technology integration. All students will learn mentoring techniques for tutoring other students from different disciplines so they develop skills in "lifelong teaching".

Learning Outcomes: 1. Explain the needs of farmers and technologists related to agricultural animal welfare. 2. Create and apply mentoring plans to support peers who are not familiar with your area of expertise. 3. Define animal welfare and apply the procedures of a basic animal welfare assessment. 4. Critically evaluate sensors, processing techniques and systems used to monitor and measure animal welfare and production. 5. Analyze measurement systems for data integrity and availability in a networked environment. 6. Apply design-of-experiments techniques that balance data requirements with the ethics of animal use and animals' needs. 7. Synthesize critiques from reviewing contemporary animal science and IoT literature. Credits: 3.00

ENGT 55000 - Manufacturing System Design For Sustainability

Credit Hours: 3.00. This course prepares manufacturing and information technology leaders to design and analyze manufacturing processes to achieve manufacturing system objectives that meet internal and external customers quality, cost and delivery requirements within a safe environment. The course project covers major aspects of manufacturing system design and Industry 4.0 in the context of meeting customer needs. Technology leaders and entrepreneurs learn how to work with others to develop the design of manufacturing systems that are sustainable (business, ecological, social, technological) for the long term. When to use lean and six-sigma techniques in the context of the manufacturing enterprise system design to meet customer needs will be assessed from a system design perspective, through analytical and computer simulation techniques, and through the use of physical modeling tools.

Learning Outcomes: 1. Relate why and how the design of manufacturing processes/equipment that support manufacturing system requirements enables lower cost, high quality, on-time delivery, volume and mix flexibility, sustainability, and continuous improvement. 2. Determine why our tone affects the ability to make systems improvements; realize that the origin of at least 90 percent of all issues is due to the system design and implementation and not the people. 3. Apply a structured approach and language to identify, describe, and relate system design thinking to implementation structure and work - i.e. Lean is an outcome of effective system design. 4. Align performance measures to reinforce manufacturing system design requirements with the knowledge that total cost results from the system design. 5. Design a manufacturing system and the included manufacturing processes to establish product flow, part families and takt time -- time per unit (average pace of customer demand). 6. Create a controllable, robust system design, i.e., a manufacturing system that meets customer quality and delivery expectations in spite of disruptions. 7. Reduce the 5 Delays that increase manufacturing lead time by using manufacturing system design. 8. Apply methods to evaluate and develop Manufacturing Systems, including the Manufacturing System Design Decomposition (MSDD), Capability Maturity Model Integration (CMMI), Six Sigma (DMAIC) Process. 9. Describe why Tone, Plan Do Check Act (PDCA), Standard Work, Takt Time and a Robust / Controllable System Design are necessary for continuous improvement and sustainability. 10. Develop an organizational structure to sustain and improve the manufacturing system. Credits: 3.00

ENGT 56100 - Metrology Concepts And Applications

Credit Hours: 3.00. Metrology is a fundamental concept required for obtaining scientific data and understanding instrumentation. This course introduces the concepts of metrology associated with measurement systems: sensors, signal conditioning, data acquisition and analysis, as well as the error propagation. System and environmental noise are investigated along with methods to mitigate influences of noise. Standards and calibration of instrumentation are also studied. Concepts of metrology for the seven basic units of measurements are described from the macro to nano-scale.

Learning Outcomes: 1. Classify instrumentation necessary to make measurements of interest. 2. Summarize standards and calibration associated with measurements. 3. Implement various methods of reducing system and environmental noise. 4. Calculate errors budgets and adjust instrumentation to meet error budgets. 5. Identify ethical and international aspects of measurement science.

Credits: 3.00

ENGT 57100 - Applied Nanotechnology

Credit Hours: 3.00. The emerging field of nanotechnology introduces new challenges and opportunities in a variety of career fields. This course introduces students to the concepts of nanotechnology including electronics/mechanics, materials, tools and applications. The experience allows students to move beyond the boundaries of standard application of mechanical and electrical systems into the next generation or dimension of their chosen fields. The course incorporates experiential instruction to reinforce the concepts learned in the lecture. Permission of department required.

Learning Outcomes: 1. Summarize the basic concepts behind nanotechnology. 2. Design nanoelectronic devices. 3. Characterize materials at the nano regime. 4. Extrapolate nanoelectronic applications. 5. Identify ethical and international aspects of nanotechnology.

Credits: 3.00

ENGT 58100 - Workshop In Engineering Technology

Credit Hours: 1.00 to 21.00. This course number is used to pilot and develop new graduate level courses. Each 58100 course number is followed by either a unique alphabetic suffix (e.g., ABC) or numeric suffix (e.g., 123) and is given a unique title and course description. These courses can be included in a graduate plan of study with the usual condition that they must be approved by the student's graduate committee. Accordingly, it is important to discuss these courses with your faculty advisor and committee prior to registration. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering.

Credits: 1.00 to 21.00

ENGT 58300 - Applied Engineering Statistics For Industry

Credit Hours: 3.00. The purpose of this course is to teach the practitioner how to use and make better-informed decisions as a manager for making optimum process, business, or personnel decisions. Emphasis will be placed on Verification, Validation in R&D, Manufacturing, QA/QC, basic probability, Summarizing Data, Basic Tools (flowcharts, fishbone diagrams, Pareto charts), Process Capability - Cp/Cpk. Upper and lower control limits/charts, Use of Control Charts for Continual Improvement, Six Sigma, Design of Experiments, Taguchi Methodology and Data Analytics will also be covered.

Learning Outcomes: 1. Demonstrate the importance of the Central Limit Theorem and its application. 2. Evaluate the capability of a process using the process capability index (CPI). 3. Analyze variation reduction in relation to process capability and design of experiments. 4. Articulate how single-piece flow, standard work, and continuous improvement processes enable variation reduction. 5. Determine the expected number of defects from a given process. 6. Explain the statistical meaning of Six Sigma. 7. Differentiate between Type I and Type II errors. 8. Calculate the sample size based on specified Type I and Type II Error. 9. Calculate a confidence interval. 10. Define direct run rate I first time through and its calculation. 11. Develop a hypothesis test. 12. Calculate regression and correlation of data and distinguish between correlation and causation. 13. Select and evaluate the test statistic for different kinds of hypothesis tests and make statistical inference decisions. 14. Construct and evaluate an ANOVA table and make statistical inference decisions. 15. Differentiate among different types of experimental designs and design an experiment. 16. Demonstrate the Taguchi quality loss function and how to make

quality loss calculations. 17. Classify the procedural errors that can occur in experimental design, such as confirmation bias. 18. Explain data mining and Big Data and their role in the future of experimental design. Credits: 3.00

ENGT 59000 - Special Problems In Engineering Technology

Credit Hours: 1.00 to 3.00. The ENGT 59000 course code is intended primarily for students to undertake targeted study or projects to develop depth in an area related to their area of research, where no other comparable course is available at Purdue or conveniently elsewhere. You may take up to 9 credits of ENGT 59000 as part of your Plan of Study. Requests to extend the number of credits must be decided within your graduate committee and documented with the Graduate Chair. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

ENGT 60500 - Engineering Technology Research Writing Strategies

Credit Hours: 2.00 to 3.00. The stated Master of Science in Engineering Technology graduate course teaches research literature mining and analysis found in Purdue licensed databases. Focuses on detail, a measurable topic, literature review, reporting, citation, data visualization using APA. Requires research paper writing aligned with ARWE specifications for in-depth research preparation and reporting. Students will research a topic relevant to a workplace problem in their industry. For example, a new technology, a process (Giga Casting for example), a material, supply chain, digitization, industry 4/5.0, sustainability, workforce diversity, aging workforce, ethics in the workplace, offshoring vs. onshoring, direct part marking, inventory/project management, cybersecurity risks, facility management, energy management, patents/intellectual property or environmental compliance. Keep in mind, Before You Start, that whichever topic you choose, the problem must be measurable. Measurable either from a quantitative or qualitative statistic perspective. Your topic will have to be tied to a global grand engineering challenge we face as a society and/or industry.

Learning Outcomes: 1. Evaluate the data you collected by completing the Workplace Information Literacy Strategies (WILS) activity to determine your research topic. 2. Analyze research topic/focus gained from the WILS, correlate a measurable research problem statement, and relate it to one of the 14 global, grand engineering challenges. 3. Create an Introduction to the problem statement. 4. Synthesize collected data by writing a review of the literature which supports the research problem topic. 5. Evaluate different research measures for the problem, choosing one to assess the problem. 6. Analyze the research measure(s) by using ChatGPT to help determine optimum research measure to write up. 7. Create a research methodology by writing a detailed script on how you intend to measure the research problem. 8. Submit expected deliverables in a timely manner after evaluating your final analysis report, synthesizing the introduction, research problem statement, review of literature, and research measure. 9. Present a compelling oration of your research topic and significance as to why the topic should be pursued or funded. The creation of a three-minute video debriefing is not an exercise in "watering down" research but forcing you to consolidate your ideas and concisely explain your research discoveries for senior leadership approval and funding. 10. Complete written assignments using APA format and NO passive wording or adverbs. Adhere to the MET 527 Academic Research Writing Expectations (ARWE) handout document. Failure to not read and follow the ARWE document will prove to be an unsuccessful assignment/course experience. 11. Perform individually AND not fall into the plagiarism trap. Credits: 2.00 to 3.00

English

ENGL 10400 - English Composition I

Credit Hours: 3.00. Emphasis on the organization of the expository theme. Directed writings of themes based on personal experience, on the relationship between experience and language, and on the relationship between experience and ideas.

Credits: 3.00

ENGL 10500 - English Composition II

Credit Hours: 3.00. The second half of the basic composition sequence. Extensive practice in writing clear and effective prose. Instruction in logic, structure, and style.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 19500 - Introducing English

Credit Hours: 1.00. This introductory seminar familiarizes students with the different majors in English as well as potential career opportunities, introduces them to departmental and College of Liberal Arts resources, and promotes community through participation in English Department activities. These include visits to the Writing Lab (English) and the Career Center (CLA); common read book discussions; & more.

Learning Outcomes: 1. Define the different majors and concentrations within English. 2. Identify important resources in the English Department and College of Liberal Arts. 3. Articulate key concepts related to the Department's annual common read. 4. Produce well-reasoned written essays about assigned the reading and activities. Credits: 1.00

ENGL 20102 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods through critical inquiry. 4. Create a process for developing and completing a digital project.

Credits: 3.00

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking, reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

ENGL 20300 - Introduction To Research For Professional Writers

Credit Hours: 3.00. Introduction to research sources and methods useful for professional writers, including electronic resources. Focus on collecting print and online information, interviewing, surveying, and conducting observations; and on evaluating, summarizing, analyzing, and reporting research.

Credits: 3.00

ENGL 20400 - Special Topics In Writing

Credit Hours: 3.00. A course in writing, with the special topic selected by the instructor.

Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 20700 - Introduction To Rhetoric & Argument

Credit Hours: 3.00. Introduces the art, science, and practical applications of rhetoric through ancient, contemporary, and transcultural concepts. Helps students gain a grounded understanding of rhetoric and its application in everyday life and professional contexts. This course will feature the application of persuasion in diverse fields and for diverse purposes. Students will learn to apply rhetorical principles to written, visual, and multimodal forms.

Learning Outcomes: 1. Articulate a comprehensive understanding of the evolution of rhetoric, from ancient to contemporary theorists. 2. Summarize the role of proofs in human communication and evaluate how rhetorical strategies can be used in persuasive messaging. 3. Develop and apply skills in identifying, analyzing, and employing rhetorical frameworks to enhance persuasive communication strategies. 4. Select rhetorical strategies appropriate for written, visual, and multimodal forms. Credits: 3.00

ENGL 21500 - Inventing Languages

Credit Hours: 3.00. "Invented languages" include linguistic systems created for fictional worlds, such as Dothraki (Game of Thrones), Na'vi (Avatar), Elvish (Lord of the Rings) and Klingon (Star Trek), as well as languages invented for international communication by real speakers, such as Esperanto. In this course, you will study these systems, learn the major properties of natural human languages, and construct your own rudimentary languages.

Learning Outcomes: 1. Understand the characteristics and goals of various invented languages from linguistic, cultural, and historical perspectives. 2. Show mastery of basic concepts of language structure and language typology. 3. Elucidate mastery of basic concepts of sociolinguistics, historical linguistics, and linguistic anthropology. 4. Explain how natural languages has influenced the development of invented languages. 5. Construct a rudimentary language system and create a back story, dictionary, grammar, and sample text. Credits: 3.00

ENGL 21700 - Figures Of Myth And Legend I: Monsters (UCC: HUM)

Credit Hours: 3.00. This course traces specific monster case studies across a variety of genres and media from the ancient to the modern period. It explores the way monsters define and police the boundaries of what it means to be human, and provide a common language for crystallizing specific social, ethnic, and national practices.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the relationship

between monsters and nationalism/national identity. 2. Explain disability theory and the cultural coding of unusual bodies. 3. Produce written, verbal, and visual communication that demonstrates critical thinking, creative problem solving, empathy, and visual literacy. 4. Apply historical and global awareness. Credits: 3.00

ENGL 21800 - Figures Of Myth And Legends II: Heroes And Villains (UCC: HUM)

Credit Hours: 3.00. This class offers in-depth explorations of the larger-than-life leaders (on the side of good, and sometimes evil, too) who have become models for how we think of heroism, charisma, and what it means to seek and wield power over others. From the chivalric Knights of the Round Table to the frightening energy of the Viking comitatus bands, it will show that no models of mythic leadership come without their complications--or admirable qualities.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Compare legal and cultural ethical codes across different cultures. 2. Define models of leadership to understand different versions of heroism, villainy, manliness, and gender coding of behavior. 3. Demonstrate knowledge of how the past influences present social modes and mores. 4. Argue through textual evidence across a variety of media. Credits: 3.00

ENGL 21900 - Figures Of Myth And Legend III: Magic And Marvels (UCC: HUM)

Credit Hours: 3.00. This course surveys stories of elves, fairies, wizards, witches, etc., and explores the allure of all things marvelous, strange, and magical. It considers how language itself constitutes a kind of magic; examines magic as technology and vice versa, since, as Arthur C. Clarke famously declared: "Any sufficiently advanced technology is indistinguishable from magic"; and seeks to understand how people across history have used stories of magic to reinforce (mystify) or upend (defamiliarize) the status quo.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Compare a variety of imaginative texts from Anglophone and other cultures, and be able to analyze them critically. 2. Define how both magic and science are not fixed but rather variable and culturally specific. 3. Demonstrate knowledge of how stories code difference, and either reinforce (mystify) or upend (defamiliarize) the status quo. 4. Argue through textual evidence across a variety of media. Credits: 3.00

ENGL 22002 - Technology And Play

Credit Hours: 3.00. This course introduces students to games, as well as investigating innovations and controversies in the gaming industry. It will explore theories of play, how technological innovations and business practices in both digital and analog gaming (through board games, video games, tabletop games, and esports) mediate or structure the experience of play. It will also survey the rise of myriad gaming subcultures, including celebrity streamers and esports.

Learning Outcomes: 1. Identify important categories of games. 2. Demonstrate critical thinking skills of observation, explanation, and interpretation to assess sociological and cultural trends in the different spaces of gaming. 3. Produce original work using logic, creativity, and interpretive skills examining different games and industry practices. Credits: 3.00

ENGL 22300 - Literature And Technology (UCC: STS)

Credit Hours: 3.00. This class uses literature to explore how technological innovation both enables and constrains creativity. It also explores how technology has been represented in literature, and examines the relationship between literature and new media.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Define technology and its implications. 2. Employ multiple approaches to critical thinking well-suited to cultural complexities. 3. Demonstrate written, visual, and technological literacies while working with diverse media. 4. Demonstrate creativity through remediation (moving information from one medium to another) and iteration. 5. Explain the relationship between information and digital media production. 6. Explain and employ multiple critical approaches to narrative and storytelling. Credits: 3.00

ENGL 22400 - Literature, Money, And Markets

Credit Hours: 3.00. This course explores the interconnections among markets, business and its management, and literature. It examines representations of traditional markets (industry, finance, and global trade) as well as alternative markets (the market in bodies, the black market, and the digital marketplace

economy). The course will present a wide-ranging survey of canonical texts, orienting the reader as to how classics from Chaucer to Dickens are engaged in the business of thinking about business. But it will also engage with alternative viewpoints and contemporary concerns about business practices, literature, and individual consciousness in the techno-digital age.

Learning Outcomes: 1. Define "market". 2. Apply historical knowledge to explain current business systems. 3. Explain literature's power to inform economic practices. 4. Apply traditional and visual literacy to produce market analysis. Credits: 3.00

ENGL 22500 - Literature, Inequality, And Injustice (UCC: HUM)

Credit Hours: 3.00. This course introduces students to literature addressing inequality and social justice. Questions will include: What is social justice? How do literary works reproduce or resist dominant ideologies? How does literature provide tools to map social and economic formations? What role have literary works played in emancipatory and egalitarian political movements? Readings and comparison of these texts will help examine how literature maintains a variety of communities.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. State knowledge about diversity and inclusion (including, but not limited to, histories of race, gender, and class). 2. Produce effective written and verbal communication that demonstrates critical thinking, creative problem solving, and empathy. 3. Access and analyze information across a range of media. Credits: 3.00

ENGL 22600 - Narrative Medicine (UCC: STS)

Credit Hours: 3.00. "Narrative Medicine" encompasses stories about the interior lives of doctors and medical professionals, the complexities of medicine past and present, and health-care for patients and their families. Ultimately, this course emphasizes the essential role of rhetoric and storytelling in the face of medical crisis and uses stories about illness and disability to explore the human condition.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Explain medicine from a humanistic perspective. 2. Explain contemporary health issues. 3. Define storytelling as an intellectual and empathic discourse. 4. Analyze fictional and factual narratives (stories). Credits: 3.00

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ENGL 22800 - Language And Social Identity

Credit Hours: 3.00. This course introduces linguistic diversity, including regional, cultural, and stylistic variation within a single language, code-switching in bilingual communities, and colonial, immigrant, Creole, indigenous, and sign languages. It also explores the role of language in supporting various types of social identity (e.g., age, gender, social class, race, ethnicity) as well as power structures that enable discrimination against less powerful groups.

Learning Outcomes: 1. Distinguish empirically-grounded facts about linguistic diversity and language use from popular attitudes and opinions that are not based in facts. 2. Recognize the legitimacy and systematic structure of all language varieties. 3. Describe the phonetic, lexical, grammatical, and pragmatic features as found in the language of different groups, through close analysis of primary linguistic data. 4. Show how individuals use linguistic features to help construct their social identities, through the close examination of case studies. 5. Recognize forms of linguistic discrimination as depicted in the popular media and as enacted in the education system, the workplace, the judicial system, and daily life. Credits: 3.00

ENGL 22900 - Creole Languages And Cultures

Credit Hours: 3.00. This course introduces the concept of pidgin and creole languages across the world, with a focus on English-based pidgins and creoles. It addresses their geographical distribution and some of their cultural manifestations such as music, food and literature on both sides of the Atlantic. The course presents a general view of the historical events that led to the formation of creole languages and to the development of the African diaspora. We will consider different varieties of creole languages and (their) cultures including English-based creoles in West Africa such as Kru (Liberia and Sierra Leone), Nigerian Pidgin and Cameroonian Pidgin; in the Caribbean such as Jamaican, San

Andreas, Nicaraguan and Limonense, contrasting them with the Spanish-based creole Palenquero; and the three most predominant creoles in the U.S. Louisiana Creole, Gullah and Hawaii Creole, to understand their characteristics and their history. We will explore the ways in which the languages manifest in the music and literature of the contexts where they are spoken. Finally, we will consider the African diaspora as a fundamental thread that ties (English-based) creole languages and peoples together. In exploring these issues, the course will draw on a variety of theoretical concepts and traditions from sociolinguistics, creole studies and African American studies.

Learning Outcomes: 1. Identify the cultural and linguistic legitimacy and importance of creole languages in the world. 2. Describe general historical events that led to the development and origin of creole languages. 3. Distinguish general cultural and grammatical features in creole languages that differ from non-creole languages. 4. Show how individuals use creole languages in literature and music. 5. Identify attitudes towards creole languages, the language's relationship to the African diaspora, and its relationship to linguistic diversity in North America. Credits: 3.00

ENGL 23000 - Great Narrative Works (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of great narratives from Homer's Odyssey to the present, considering works from a variety of cultures and time periods in order to develop an understanding of their ideas, structures, styles, and cultural values.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ENGL 23100 - Introduction To Literature

Credit Hours: 3.00. Reading and discussion of great works of various types to develop an understanding of their ideas, structures, and styles. Includes poetry, drama, biography, essay, and prose fiction. CTL:IEL 1270 Appreciation Of Literature

Credits: 3.00

ENGL 23200 - Thematic Studies In Literature

Credit Hours: 3.00. Examination of a particular theme, such as the hero, death, or the city, and the techniques by which it is treated in various literary works, usually in more than one genre. Current offerings available from counselors.

Credits: 3.00

ENGL 23400 - Literature And The Environment (UCC: STS)

Credit Hours: 3.00. Literary study of nature writing; writing from the natural sciences; and canonical poetry, fiction, and essays through an ecological lens. Introduces students to ecocritical thought and environmental literary history.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and discursive conventions of literature about the environment. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 23700 - Introduction To Poetry (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of poetry from different periods aimed at enhancing the student's understanding of genre, form, and style; how poetry grows out of and speaks to its historical moment; and how poetry addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of poetry. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 23800 - Introduction To Fiction (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of fiction from different periods aimed at enhancing the student's understanding of genre, form, and style; how fiction grows out of and speaks to its historical moment; and how fiction addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of fiction. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature

they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 24000 - British Literature Before 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the medieval to the Romantic period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Romantic period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Romantic literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 24100 - British Literature After 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the Romantic period on.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the Romantic period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about literature from the Romantic period to the present based on appropriate use of textual evidence. Credits: 3.00

ENGL 24900 - Great British Books

Credit Hours: 3.00. Why are British books so compelling? This course examines the dynamic history of British literature and explores how canonical and contemporary texts shaped the cultural landscape of Britain, the British Empire, and the world.

Learning Outcomes: 1. Identify and make convincing arguments about major genres of British literature, including essays, journals, autobiographies, poetry, drama, and fiction. 2. Identify the diversity of peoples, interests, and ideologies within British literature and culture, and the texts that define them. 3. Define and analyze how literary texts both reflect and produce culture. 4. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

ENGL 25000 - Great American Books (UCC: HUM)

Credit Hours: 3.00. What makes great American books so compelling? This course examines the dynamic history of American literature and explores how canonical and contemporary books have shaped the cultural landscape of the U.S. and the world.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions related to great American books. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American books based on appropriate use of textual evidence. Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 26200 - Greek And Roman Classics In Translation

Credit Hours: 3.00. Study of important works of Greek and Roman literature, their intrinsic literary values, and their influence on later European and American writing and thinking.

Credits: 3.00

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including

argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26700 - World Literature: From 1700 A.D. To The Present (UCC: HUM)

Credit Hours: 3.00. (CMPL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. Typically offered Summer Fall Spring. CCN: IEL 1251 World Literature 2

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 27600 - Shakespeare On Film (UCC: HUM)

Credit Hours: 3.00. Considers the relation of the written text of five or six Shakespeare plays to multiple film versions from a wide variety of times and cultures, e.g., the United States, England, France, Italy, Japan, Denmark, India, and Russia. Typically offered Fall Spring Summer.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explore a selected set of Shakespeare's plays through a comparative analytical lens. 2. Compare and contrast various film versions of Shakespeare's plays in their respective contexts. 3. Respond to the films and written texts through reflective and critical writings and discussions. Credits: 3.00

ENGL 27900 - The American Short Story In Print And Film

Credit Hours: 3.00. Analysis of American short stories of the nineteenth and twentieth centuries, their filmed versions, their printed scenarios, and critical writings about the tales and their adaptations.

Credits: 3.00

ENGL 28000 - Games, Narrative, Culture

Credit Hours: 3.00. This is an introduction to the field of game studies, and to games as narrative and cultural media. We will look at the stories games tell; the way their narrative elements or plot devices intersect with the culture around the games and gaming itself; and how all these things come together to affect game design, meaning, and play.

Learning Outcomes: 1. Demonstrate knowledge of key concepts in both game studies and narrative theory in order to critique a game's systems and narrative elements. 2. Articulate how a game's narrative and the industry's workplace practices are situated in specific historical and cultural contexts. 3. Demonstrate critical thinking skills suited to cultural and historical complexities. 4. Articulate concise, coherent arguments about the effects of writing, narrative, and workplace practices and policies on the video game industry and a game's audience. Credits: 3.00

ENGL 28600 - The Movies (UCC: HUM)

Credit Hours: 3.00. Introduction to the movies from classic to contemporary films. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to classic and contemporary films. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic

contexts. 3. Produce well-reasoned written arguments about classic and contemporary films based on appropriate use of evidence. Credits: 3.00

ENGL 30100 - Ways Of Reading

Credit Hours: 3.00. Introduction to literary theory and practice. Close reading of and significant writing about selected literary texts informed by a variety of critical and/or theoretical perspectives.

Learning Outcomes: 1. Identify various theoretical approaches to literature, and then apply them to literary texts. 2. Define important literary terms, genres, and conventions within their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned arguments about literary texts based on appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 30600 - Introduction To Professional Writing

Credit Hours: 3.00. Development of skill in analyzing rhetorical situations in the workplace. Practice in planning, writing, evaluating, and revising a variety of documents typical of those used in the arts and industry.

Learning Outcomes: 1. Understand the basic rhetorical theories that underlie professional and technical writing. 2. Explore issues and challenges in professional writing in a variety of professional and technical contexts. 3. Produce critical writing on rhetorical issues in the field. 4. Solve workplace or organizational problems using writing. Credits: 3.00

ENGL 30900 - Digital Design And Production

Credit Hours: 3.00. The development of the ability to write and design documents using electronic publishing technologies. Students will receive instruction in writing, graphics, and publishing software and will write, design, produce, and critique a number of publications.

Learning Outcomes: 1. Understand the foundational principles of document design and gain practical experience with contemporary design tools. 2. Build portfolio pieces that employ a design thinking approach, both in content and execution 3. Apply theories of document design to a variety of different genres directed to different audiences and rhetorical purposes. Credits: 3.00

ENGL 31600 - Craft Of Fiction From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of fiction with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of fiction, statements of aesthetics and craft, and various fictional forms.

Learning Outcomes: 1. Analyze published fiction by applying terms of fiction craft. 2. Identify the effects of fiction forms by articulating their differences and/or similarities. 3. Analyze their own fiction by applying the terms of fiction craft. Credits: 3.00

ENGL 31700 - Craft Of Poetry From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of poetry with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of poetry, statements of aesthetics and craft, and various poetic

forms.

Learning Outcomes: 1. Analyze published poetry by applying terms of poetry craft. 2. Identify the effects of poetry forms by articulating their differences and/or similarities. 3. Analyze their own poetry by applying the terms of poetic craft. Credits: 3.00

ENGL 32001 - Rhetoric, Artificial Intelligence, And Technology

Credit Hours: 3.00. This course examines the relationships between rhetoric and generative artificial intelligence (AI) using classical and contemporary rhetorical theory. While exploring how AI can support writing, students will gain insights into the challenges posed by AI, including issues of ethics, freedom, privacy, and sustainability. Includes application of rhetorical principles to the design and critique of new technologies.

Learning Outcomes: 1. Use knowledge of rhetorical history and contemporary rhetorical theory to evaluate the emergence of generative artificial intelligence (AI). 2. Write and design workplace documents by engaging common elements of AI tools, such as prompts and training data. 3. Integrate AI tools with other writing tools to create persuasive and informative content in diverse media. 4. Develop ethical approaches to using AI in research, persuasion, and critique. Credits: 3.00

ENGL 32101 - Content Strategy & Rhetoric

Credit Hours: 3.00. This course explores common methods for intentionally auditing, developing, and managing content across multiple media. Students will consider how different audiences and purposes shape how content is structured and delivered in varying rhetorical contexts and diverse media. Emphasizes both analytical and technical elements of content strategy.

Learning Outcomes: 1. Create and implement content strategies aligned with organizational goals and tailored to specific audiences, contexts, and purposes. 2. Perform content audits and inventories using common approaches such as lifecycle development and user testing. 3. Articulate how specific needs influence the structure and delivery of content across multiple media. 4. Use tools such as content management systems to engage and inform relevant stakeholders and contributors. Credits: 3.00

ENGL 32200 - Word, Image, Media (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the study of images, their relationship to language, and their functions in media. From decoding advertising messages to analyzing digital journalism, students will learn how images and their viewers make meaning in a variety of media contexts.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze images using multiple critical methods. 2. Explain how images and their viewers make meaning. 3. Explain what role images play (or have played) in our cultures. 4. Explain what it means to negotiate so many images in our daily lives. 5. Produce effective written, verbal, and visual communication that demonstrates critical thinking, creative problem solving, empathy, and visual literacy. 6. Access and analyze information. Credits: 3.00

ENGL 32700 - English Language I: History And Development

Credit Hours: 3.00. Introduction to the history of the English language, its sounds, inflections, words, and sentence structures. Cultural and historical events affecting this history, and the interplay between language and literature.

Credits: 3.00

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 .

Credits: 3.00

ENGL 32900 - English Language III: Sound And Form

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on phonology and morphology. Implications of recent theory to the teaching of English.

Credits: 3.00

ENGL 33000 - Games And Diversity

Credit Hours: 3.00. This course looks critically at diversity in games, game development, and in the larger mainstream games community. Students will analyze and play games that related to women, minorities, members of the LGBTQ community, and/or those who lack access because of disability.

Learning Outcomes: 1. Analyze a game's

narrative based on a specific frame of diversity (i.e. gender, ethnicity, sexuality, and/or disability). 2. Explain how video games relate to contemporary cultural issues. 3. Use evidence-based arguments to defend a position related to video games and diversity. Credits: 3.00

ENGL 33200 - Games And User Experience (UX)

Credit Hours: 3.00. This course connects gamers and their experiences with games by developing ways to harvest gaming experiences for the improvement of games. We aim to prepare you to better understand gaming experiences, use those understandings to improve games in development, and be able to think and write critically about those experiences.

Learning Outcomes: 1. Identify and address the variables affecting usability investigation. 2. Articulate and employ methods for collecting and processing usability/user experience information about games. 3. Practice evidence-based arguments on game development and improvements. Credits: 3.00

ENGL 34100 - Topics In Science, Literature, And Culture

Credit Hours: 3.00. This course focuses on issues in and representation of science and technology in various texts, including literature, film, science, and theory. May be repeated for credit only under a different topic.

Credits: 3.00

ENGL 34200 - Legal Fictions

Credit Hours: 3.00. This course explores legal conflicts through literature. It uses the narratives created by the cat-and-mouse of procedural dramas, emotionally charged trial scenes, and dramatic courtroom struggles, to introduce different schools of jurisprudence, and to critically examine the decisions made by those with social and legal governing power.

Learning Outcomes: 1. Explain the intersections of legal and literary practice. 2. Define different schools or theories of jurisprudence. 3. Explain and analyze legal and cultural complexities. 4. Construct sustained and persuasive arguments based on textual evidence. Credits: 3.00

ENGL 34300 - Labor And Literature

Credit Hours: 3.00. This course introduces its students to the transformative synergy between the labor of literature and labor within literature. In contrast to accepting the marketplace as a societal monolith, the readings illustrate the role of labor in creation. This course will examine labor taken in its broadest sense, from the labor of self-fashioning to the labor of industries; the labor of life and the labor of destruction and the implications of the laboring body from market creation to market collapse. Diverse readings range from traditional literary staples to modern representations of the labor market.

Learning Outcomes: 1. Explain who is allowed to participate in, and who is excluded from financial, economic, and other markets, and why. 2. Explain both individual and institutional roles in the labor market. 3. Define diverse worldviews of what constitutes labor. 4. Write reasoned arguments about labor and its connections to literature. Credits: 3.00

ENGL 34400 - Environmental Ethics, Policy, And Sustainability

Credit Hours: 3.00. Environmental Ethics, Policy and Sustainability is an interdisciplinary course designed to open new pathways into ethical and eco-critical inquiry in the Anthropocene age. The course analyzes disciplinary differences in approaching the ethical, the human, and environmental problems such as sustainability, development, biodiversity, global security, and climate change. Students will explore what it means to be ethical in and through an interrogation of our contemporary conceptions of what it means to be human. These interrogations in turn will prompt us to reconsider human creations such as knowledge, culture, and technology, which will push us to genuinely think how humans as a species situate their creations within the realm of what they call Nature. Students will be introduced to the history of environmental studies in the discipline, to the rise of what is now known as "postcolonial ecocriticism" to theoretical inquiry into modern technology, and to other recent developments in the fields of environmental studies.

Learning Outcomes: 1. Learn, describe, and relate key developments in environmental ethics. 2. Distinguish and translate different perspectives concerning ethical challenges. 3. Comprehend the efficacies of environmental positions, and learn to push the boundaries of different disciplinary approaches to environmental dilemmas. 4. Evaluate the limitations of positions and the complex frameworks surrounding ethical problems in order to offer more imaginative and resilient solutions. Credits: 3.00

ENGL 34500 - Games And World Building

Credit Hours: 3.00. Every game designer and gamer knows that there is more to narrative than just words on a page and more to worldbuilding than images on a screen. This course

looks at the ways that narrative worlds get built-in games. We will begin by looking at the narrative elements in analog games that have been the foundation of many digital games and move on to look at the elements in digital games that come together to form the worlds.

Learning Outcomes: 1. Comprehend theoretical texts about game design and world building and demonstrate this by discussing them in class and with written assignments. 2. Analyze digital and analog games for specific world building techniques and strategies and demonstrate this via class discussion and written assignments. 3. Synthesize what they have learned about world building from theoretical texts and gameplay and demonstrate this by applying it to a final project in which they design their own game worlds. Credits: 3.00

ENGL 35000 - American Literature Before 1865 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from European colonization to the U.S. Civil War. CTL:IEL 1210 American Literature I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Civil War period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35100 - American Literature After 1865 (UCC: HUM)

Credit Hours: 3.00. A survey of American literature from the Civil War to the present. CTL:IEL 1211 American Literature II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the post-Civil War period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 36000 - Gender And Literature (UCC: HUM)

Credit Hours: 3.00. An introduction to feminist approaches to the study of literature, including poetry, drama, fiction, and/or autobiography. Examines how gender intersects with race, ethnicity, sexual orientation, and class in shaping authorship, reading, and representation.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ENGL 36500 - Literature And Imperialism (UCC: HUM)

Credit Hours: 3.00. A study through cultural and theoretical works of the impact of imperialism on the ruling nations.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism/colonialism. 2. Develop a foundational knowledge of the historical contexts of and theoretical approaches to literary texts: gain an introductory knowledge of

postcolonial literary theory. 3. Improve close reading and textual analysis skills. 4. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.

Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 36700 - Mystery And Detective Fiction (UCC: HUM)

Credit Hours: 3.00. An introduction to the detective genre, examining its origins, its characteristics, and its intersections with empiricism, forensic science, race, class, gender, sex, and empire.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Be familiar with the generic conventions of, and theoretical approaches to, the detective genre. 2. Use detective fiction to improve students' historical, cultural, and global awareness. 3. Practice analyzing, interpreting, and synthesizing information within and across texts and other media. 4. Practice successful academic writing, including a debatable thesis, as well as appropriately-selected and presented evidence. Credits: 3.00

ENGL 37300 - Science Fiction And Fantasy (UCC: HUM)

Credit Hours: 3.00. Representative works of science fiction and fantasy examined in relation to both mainstream and popular literature. Emphasis is on technique, theme, and form.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ENGL 37401 - Studies In British Literary History

Credit Hours: 3.00. This class focuses on one of several important British literary-historical periods, ranging from medieval English to modern British literature. In it, students will examine individual authors and texts while also gaining a wider understanding of their historical context. Students will also engage with a variety of genres and practice numerous critical approaches to literature.

Learning Outcomes: 1. Identify and construct arguments about genres of, and theoretical approaches to, historical literature. 2. Explain the diversity of peoples, interests, and ideologies with specific British literacy-historical periods. 3. Show how literary artifacts are both agents and reflections of culture. 4. Construct written arguments that demonstrate historical, cultural, and global awareness. 5. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

ENGL 37700 - Modern And Contemporary Poetry

Credit Hours: 3.00. A study of poetry in English from the twentieth century to the present.

Learning Outcomes: 1. Identify the form and analyze the significances of modern and contemporary poems. 2. Discuss modern and contemporary poems in relation to their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned and written arguments about modern and contemporary poems. Credits: 3.00

ENGL 37800 - Studies In American Literary History

Credit Hours: 3.00. This class focuses on one of several important American literary-historical periods: colonial, nineteenth-, or twentieth- and twenty-first-century literature. In it, students examine individual authors and texts while also gaining a wider understanding of their historical context. Students also will engage with a variety of genres and practice numerous critical approaches to literature.

Learning Outcomes: 1. Identify and construct arguments about genres of, and theoretical approaches to, historical literature. 2. Explain the diversity of peoples, interests, and ideologies with specific American literary-historical periods. 3. Show how literary artifacts are both agents and reflections of culture. 4. Construct written arguments that demonstrate historical, cultural, and global awareness. 5. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

ENGL 37900 - The Short Story

Credit Hours: 3.00. A study of the development and features of the short story genre.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and literary conventions related to the short story genre. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about short stories based on appropriate use of textual evidence. Credits: 3.00

ENGL 38000 - Issues In Rhetoric And Public Life (UCC: IL/WC)

Credit Hours: 3.00. Study of how language and media create belief and change. Examines ancient and contemporary rhetorical theory as it applies to public discourse, media, and technology.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate knowledge of a range rhetorical techniques and practices in the public realm, past and/or present. 2. Discuss those techniques and practices in relation to their diverse historical, cultural, and technological contexts. 3. Produce well-reasoned written arguments about the rhetorical techniques and practices they study using appropriate forms of research and evidence. Credits: 3.00

ENGL 38100 - The British Novel (UCC: HUM)

Credit Hours: 3.00. Survey of British novels ranging from the eighteenth- to the twenty-first centuries.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and literary conventions related to the British novel. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about British novels based on appropriate use of textual evidence. Credits: 3.00

ENGL 38200 - The American Novel (UCC: HUM)

Credit Hours: 3.00. A survey of American novels ranging from the eighteenth century to the twenty-first-centuries.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and literary conventions related to the American novel. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American novels based on appropriate use of textual evidence. Credits: 3.00

ENGL 38600 - History Of Film To 1950

Credit Hours: 3.00. This survey crosses the divide between the silent film era and the "talkies" to explore narrative, experimental, and documentary styles of feature films from the 1890s to 1950.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to film from its origins through the mid-twentieth century. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-1950 films based on appropriate use of

evidence. Credits: 3.00

ENGL 38700 - History Of Film Since 1950

Credit Hours: 3.00. A survey of narrative, experimental, and documentary styles of feature films from the mid-twentieth century to the present.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to films from the mid-twentieth century. 2. Identify and articulate connections among these topics and conventions as they relate to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 38900 - Literature For Children (UCC: HUM)

Credit Hours: 3.00. This course surveys eighteenth, nineteenth-century, and early-twentieth-century literature for children, including the so-called "golden age" of children's myth, fairy tales, and fantasy, as well as domestic fiction for girls and adventure books for boys.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Know important genres of children's literature as well as their historical, cultural, and aesthetic contexts. 2. Know important theoretic approaches to the study of children's literature as well as debates about the ethics of writing for children. 3. Empathize through considering perspectives on childhood from authors whose life experiences are different from students' own. 4. Write clearly and produce elements of academic writing, including a thesis, as well as appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

ENGL 39000 - Practicum In Tutoring Writing

Credit Hours: 1.00 to 3.00. A practicum to teach undergraduates to teach writing in the one-to-one setting of a writing lab.

Credits: 1.00 to 3.00

ENGL 39100 - Composition For English Teachers

Credit Hours: 3.00. Exploration of the theory, research, and pedagogy of teaching writing at the secondary level. Topics include the development of writing assignments and related activities, the study of writing process models, and the evaluation of student work in a variety of genres.

Learning Outcomes: 1. Design lesson plans for secondary writing instruction. 2. Incorporate writing-process strategies into assignments and activities. 3. Develop prompts for student writing in a variety of genres. 4. Map instructional activities to formal state or national curricular standards. 5. Reflect on differentiating lessons for diverse learners. Credits: 3.00

ENGL 39200 - Young Adult Literature

Credit Hours: 3.00. This course examines the construct of Young Adult Literature as a genre crafted specifically for adolescents. Using both classic and contemporary novels, as well as relevant theoretical and research texts, this course explores how YA literature is defined, what it offers to adolescent readers, and how it is situated in the literary landscape.

Learning Outcomes: 1. Read, respond to, and analyze selected works of Young Adult literature in order to think critically about various concepts and issues connected to the genre. 2. Explore, analyze, and critique the extent to which selected Young Adult literature affects and reflects teenage life. Credits: 3.00

ENGL 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ANTH 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish, paraphrase, and translate different disciplinary perspectives on these key environmental and sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary

approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

ENGL 39600 - Studies In Literature And Language

Credit Hours: 1.00 to 3.00. A course in the study of a special topic directed by an instructor in whose particular field of specialization the content of the course falls.

Learning Outcomes: 1. Students will think critically about course content. 2. Students will read and write reflectively and critically about course content. 3. Students will engage in course discussions, either online or face-to-face, which encourage critical thought and personal engagement. Credits: 1.00 to 3.00

ENGL 39900 - Beyond English

Credit Hours: 3.00. This class is designed for third- and fourth-year English majors. It will help students translate the worth of English and the humanities to the world beyond the university, providing them with tools to articulate their achievements and prepare for their professional and adult lives.

Learning Outcomes: 1. Be familiar with economic, scientific, and humanistic arguments for the value of English and the humanities. 2. Practice speaking clearly, writing persuasively, and collaborating effectively. 3. Enhance career preparation and professionalization. Credits: 3.00

ENGL 40600 - Review Writing

Credit Hours: 3.00. Intensive practice in the writing of book, film, and theatre criticism, as well as reviews of musical programs and art exhibits. Readings in critics to serve as possible models. Audience analysis of newspapers and periodicals that would be potential markets.

Credits: 3.00

ENGL 40700 - Intermediate Poetry Writing

Credit Hours: 3.00. Study and practice of methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems by using effective imagery, line breaks, stanzas, compression, and linguistic playfulness; 2. Produce a portfolio of poems by revising according to suggestions received in workshop and in individual conferences with the instructor. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary poetry. Credits: 3.00

ENGL 40800 - Creative Writing Capstone

Credit Hours: 3.00. This course will focus on the writing and revision of the capstone thesis in Creative Writing, consisting of a substantial portfolio of either fiction or poetry with an introductory essay. Workshop, discussion of published writing, and individual conferences will form the center of the course with readings, lecture, and discussion of various literary topics. Permission of instructor required.

Learning Outcomes: 1. Master specific topic on either poetry or fiction writing by giving a formal in-class presentation. 2. Master either poetry or fiction writing by producing a portfolio of their own creative work. 3. Understand their aesthetic by producing a formal essay which analyzes their creative writing. Credits: 3.00

ENGL 40900 - Intermediate Fiction Writing

Credit Hours: 3.00. Study and practice of methods of composing fiction, with a primary emphasis on the student's own work. Workshop criticism and discussion of published fiction.

Learning Outcomes: 1. Write and revise fiction by using effective character development, plot and scene. 2. Produce a polished fiction by revising according to suggestions received in workshop. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary fiction. Credits: 3.00

ENGL 41100 - Studies In Major Authors

Credit Hours: 3.00. A study of the literary, critical, or cinematic works of one or two influential authors or directors. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of the works of a particular author. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a

substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41200 - Studies In Genre

Credit Hours: 3.00. A study of literary or cinematic works that share distinctive formal features. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate detailed knowledge of a single literary genre. 2. Discuss that genre in relation to its diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41300 - Studies In Literature And History

Credit Hours: 3.00. A study of literature or film produced during a well-defined historical period from the view of its social, political, religious, and economic contexts. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of a particular period in history. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41400 - Studies In Literature And Culture

Credit Hours: 3.00. A study of literature or film from the perspective of the cultural norms and values it expresses, celebrates, and challenges. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of the relationship between literary texts and their culture. 2. Discuss those relationships in light of texts' diverse historical and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

ENGL 43201 - Editing And Publishing

Credit Hours: 3.00. Editing and Publishing is a professional writing workshop that teaches students how to proofread, copyedit, substantive edit, and global edit documents. Students will learn how to navigate the publishing industry and work with authors on print, electronic, online, and multimedia documents.

Learning Outcomes: 1. Understand how the publishing industry operates, especially from an editor's perspective. 2. Apply the four levels of edit (global editing, substantive editing, copyediting, and proofreading) in an editorial project. 3. Work collaboratively with authors to produce clearly written and persuasive documents. 4. Edit document design and graphics in a document. 5. Interact with publishers to bring a text from manuscript form into a published manuscript. Credits: 3.00

ENGL 43300 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants is a professional writing workshop that teaches students to write workplace proposals and grants in for-profit and not-for-profit companies and organizations. Students will also learn how to write business plans, a specialized form of proposal.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Generate new ideas for businesses, products, and services. 3. Organize proposals and grants using various proposal genres. 4. Write in a plain and persuasive style that is appropriate to readers. 5. Design documents in ways that make information accessible. 6. Edit and revise proposals and grants. 7. Work with authors, customers, and funding agencies to

sharpen the message of a proposal or grant. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

ENGL 43900 - Topics In Disability Studies

Credit Hours: 3.00. Explores cultural, social, and political meanings and effects of disability in relation to literature and/or rhetoric. Specific topics will vary.

Learning Outcomes: 1. Discuss the strengths and weaknesses of different models for understanding disability. 2. Understand ways normalcy is socially constructed. 3. Identify cultural practices that exclude disabled people. 4. Compare and contrast disability with other identity categories such as race, gender, and sexuality. 5. Discuss ways in which culture defines disability as impairing one's subjectivity and even humanity. 6. Analyze literary representations of disabled characters. 7. Examine the role of disability in literary works more broadly. Credits: 3.00

ENGL 44200 - Shakespeare

Credit Hours: 3.00. Shakespeare's dramatic craftsmanship, poetry, humor, characterization, psychology, and modern pertinence illustrated in representative tragedies, comedies, and history plays.

Credits: 3.00

ENGL 44300 - Craft Seminar

Credit Hours: 3.00. Study of fiction, poetry, creative nonfiction, storytelling, and/or hybrid form theory and techniques, both in published texts and student manuscripts. Students produce multiple texts and drafts. Workshop criticism. Can be taken up to three times for credit.

Learning Outcomes: 1. Develop a greater understanding of the form and theory of fiction, poetry, creative nonfiction, storytelling, and/or hybrid texts. 2. Read published creative texts, including very recent texts, in order to understand the conventions of and current practices within the field. 3. Read, discuss, and offer feedback on other students' drafts. 4. Draft and revise multiple pieces to produce high-quality, polished work suitable for submission to creative publications. Credits: 3.00

ENGL 46000 - Studies In Women's Literature

Credit Hours: 3.00. A study of literary works by women according to a specific theme, historical period, genre, or culture, e.g., Nineteenth-Century Women Novelists, Madness in Women's Writing, Caribbean Women Writers. May be repeated only with different topic.

Credits: 3.00

ENGL 46200 - The Bible As Literature: The Old Testament

Credit Hours: 3.00. A study of the Old Testament - Pentateuch, Prophets, and other books such as Psalms, Proverbs, Job, and Ecclesiastes - with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 46300 - The Bible As Literature: The New Testament

Credit Hours: 3.00. A study of the New Testament, with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 47000 - Advanced Topics In Rhetorical Studies

Credit Hours: 3.00. Study of rhetorical theories and practices past and present. Includes readings in primary texts in the history and theory of rhetoric. May be repeated for credit with a different topic.

Learning Outcomes: 1. Demonstrate advanced understanding of rhetorical concepts, theories, and practices. 2. Analyze and assess rhetorical situations from which arguments are generated; evaluate arguments and their public, institutional, or organizational success; produce arguments in a variety of genres and forms. 3.

Demonstrate understanding of how and why rhetoric accomplishes its work from a variety of perspectives across the humanities and sciences. Credits: 3.00

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

ENGL 49000 - Worksite Internship Practicum

Credit Hours: 1.00 to 3.00. Course facilitates the transition between an English undergraduate degree and the workplace or professional life. The course has two components: a professor-guided component and a practicum component in a chosen area. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 49200 - Literature In The Secondary Schools

Credit Hours: 3.00. Exploration of the theory, research and pedagogy supporting the teaching of literature at the secondary level. Topics include text selection, instructional strategies, adolescent literacy, student engagement and the use of alternative texts.

Credits: 3.00

ENGL 49400 - Research Practicum For Undergraduates

Credit Hours: 2.00 or 3.00. This course introduces students to research techniques and trains them to participate in a research laboratory or a professor-sponsored research project. Permission of instructor required.

Credits: 2.00 or 3.00

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

ENGL 50200 - Practicum In Teaching College Composition

Credit Hours: 1.00. Reading professional literature, preparing syllabi; evaluating student papers, leading discussions. Required of all teaching assistants in their initial semesters.

Credits: 1.00

ENGL 50500 - Approaches To Teaching College English

Credit Hours: 3.00. Reading professional literature on the teaching of writing, linguistics, and ESL. Studies of methodologies, issues of assessment, and the relationship between theory and pedagogy. This course is not part of the degree requirement. Open only to teaching assistants in the Department of English. Permission of instructor required.

Credits: 3.00

ENGL 50600 - Introduction To English And General Linguistics

Credit Hours: 3.00. General study of language and linguistic theory with emphasis on English. Problems and methods in phonology, morphology, syntax, and semantics. Current techniques of linguistics analysis.

Credits: 3.00

ENGL 50700 - Advanced Poetry Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems, using all the skills from ENGL 40700 but at a more proficient level. 2. Produce a portfolio of poems revised according to suggestions received in workshop and in individual conferences with the instructor. 3. Acquire a broader knowledge of the context of contemporary poetry by reading and discussing several volumes by contemporary poets.

Credits: 3.00

ENGL 50900 - Advanced Fiction Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing fiction, with the primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise fiction, using all the skills from English 40900 but at a more proficient level. 2. Produce polished fiction revised according to suggestions received in workshop and feedback from the instructor. 3. Acquire a broader knowledge of the context of contemporary fiction by reading and discussing work by several contemporary fiction writers.

Credits: 3.00

ENGL 51100 - Semantics

Credit Hours: 3.00. An introduction to and survey of current semantic theories and methods with an emphasis on English. Basic concepts of linguistic semantics and its relation to the other semantics. Compositional (transformational), model-

theoretical (truth-conditional), pragmatic, and contextual semantics.

Credits: 3.00

ENGL 51200 - English Syntax And Syntactic Theory

Credit Hours: 3.00. Introduction to English syntactic structure, syntactic argumentation, and syntactic theory. Emphasis on one current theory as the primary theoretical framework, with other theories considered.

Credits: 3.00

ENGL 51300 - English Phonology

Credit Hours: 3.00. Introduction to current phonological theory, with applications to descriptions of American and British English. Articulatory description of English phonological structure and contrastive analysis of phonetic variation across dialects. Evolution of the stress system of English and its utilization by poets writing metrical verse.

Credits: 3.00

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

ENGL 51600 - Teaching English As A Second Language: Theoretical Foundations

Credit Hours: 3.00. Survey of theories of learning and teaching English as a second/foreign/international language. Focus is on current theories and their implications for practice.

Learning Outcomes: 1. Demonstrate an understanding of current theories of second-language learning and teaching and their implications. Credits: 3.00

ENGL 51800 - Teaching English As A Second Language: Principles And Practices

Credit Hours: 3.00. Studies of issues and principles in ESL/EFL program development. Emphasis is on practical application of theory in a variety of English learning and teaching contexts in the U.S. and abroad.

Credits: 3.00

ENGL 52000 - Eighteenth-And Nineteenth-Century Literature

Credit Hours: 3.00. Study of key texts and movements in literature from the 18th and 19th centuries, with emphasis on historical, cultural, and theoretical contexts. Literary movements may include (but are not limited to): Neoclassicism, Sentimentalism, Romanticism, Victorianism, Realism, and Naturalism. Genres may include (but are not limited to): poetry, drama, the essay, autobiography/memoir, travel narratives, various forms of the novel, and short fiction. Critical concerns may include (but are not limited to) close textual studies, reception studies, the relation of literature to social and technological change, and the relation of literature to other artistic and cultural modalities. Additional topics include (but are not limited to) the history of critical interpretation, contemporary theoretical frameworks, and research methods and practices.

Learning Outcomes: 1. Explain the historical, cultural, and theoretical contexts shaping key works of 18th- and 19th-century literature. 2. Analyze literary texts using contemporary critical and theoretical frameworks. 3. Compare and contrast the ways in which 18th- and 19th-century literature engages with themes including individualism, democracy, and industrialization. 4. Assess the influence of historical and cultural events on the development of literary styles and genres. Credits: 3.00

ENGL 52100 - Medieval Language And Literature

Credit Hours: 3.00. This course offers an in-depth exploration of key texts and themes from medieval English literature, focusing on the period roughly from the 9th to the 15th century. With an emphasis on texts' historical, cultural, and literary contexts, this course examines genres such as epic, romance, religious allegory, and early drama. Key topics include the nature of early English heroism as derived from the Germanic/Norse traditions, the development of chivalric and romance literature from the French tradition, the role of women in medieval narratives, the development of the English language, and the intersection of secular and religious thought.

Learning Outcomes: 1. Identify and recall key works of medieval literature along with their authors, historical contexts, and major themes. 2. Demonstrate an understanding of the major literary genres and forms in medieval literature and will explain their cultural and historical significance. 3. Apply critical concepts and methodologies in medieval literary studies to interpret and analyze primary texts within their historical and social contexts. 4. Analyze the representation of key themes in medieval literature and will compare these representations across different works and traditions. 5. Evaluate scholarly interpretations of medieval texts, critically assessing different

critical approaches and methodologies, and developing informed, evidence-based arguments. Credits: 3.00

ENGL 52200 - Renaissance Literature

Credit Hours: 3.00. This course is an intensive survey of the major genres (epic, drama, lyric, prose) and writers of the English Renaissance (1400-1700) within the context of England's history and the European Renaissance primarily. Key themes include the rediscovery of classical antiquity, the emergence of individualism, the influence of religion and science, and the changing conceptions of gender and power. Critical readings and research activities will demonstrate the significant role of English Literature in the development of world literature and globalization.

Learning Outcomes: 1. Identify various theoretical approaches to literature and then apply them to Renaissance literary texts. 2. Define important literary terms, genres, and conventions within their cultural, and aesthetic contexts in relation to the specific era of the Renaissance, 1300-1700. 3. Produce clear oral communication and written text, especially well-reasoned arguments about literary texts and their interaction with the Renaissance era and the era's reception, based on appropriately selected, evaluated, and presented textual evidence. 4. Practice, employ, and begin developing primary research activities associated with literary studies, especially those most applicable to the Renaissance era.

Credits: 3.00

ENGL 53200 - The English Novel In The Nineteenth Century

Credit Hours: 3.00. A survey of fiction up to about 1880, including such novelists as Scott, Dickens, Thackeray, the Brontes, Eliot, and Meredith.

Credits: 3.00

ENGL 54100 - Studies In Chaucer's Canterbury Tales

Credit Hours: 3.00. Critical reading of The Canterbury Tales and related works in Middle English, with attention to the literary and cultural background and to secondary studies.

Credits: 3.00

ENGL 54300 - Shakespeare In Critical Perspective

Credit Hours: 3.00. Shakespeare's plays read in context of historical and contemporary literary theory and criticism, considering such issues and approaches as structuralism, Marxism, deconstruction, new historicism, colonialism, sexuality, race, and gender.

Credits: 3.00

ENGL 54700 - British Romanticism

Credit Hours: 3.00. Readings from among the works of the High Romantics and other figures; discussion of historical, philosophical, cultural debates of the era, with attention to current critical and theoretical developments in the field.

Credits: 3.00

ENGL 54800 - Victorian Literature

Credit Hours: 3.00. A study of selected English poetry and prose, largely nonfiction, from circa 1830-1900. Includes readings from such figures as Arnold, Barrett, Bronte, Browning, Carlyle, Mill, Rosetti, Ruskin, and Tennyson.

Credits: 3.00

ENGL 55200 - Studies In Major American Authors

Credit Hours: 3.00. A study of the works of one or two influential American authors.

Credits: 3.00

ENGL 55300 - Colonial And Early American Literature

Credit Hours: 3.00. A survey of American literature to about 1820. Texts of major and minor authors, such as Bradford, Bradstreet, Rowlandson, and Cooper, are viewed within their cultural context.

Credits: 3.00

ENGL 56000 - Modern American Poetry

Credit Hours: 3.00. A survey of modern American poetry. Emphasis will be on major writers such as Eliot, Pound, Frost, Stevens, and Lowell, but attention will be paid to lesser figures.

Credits: 3.00

ENGL 56002 - Twentieth- And Twenty-First Century Literature

Credit Hours: 3.00. Study of key texts and movements in literature from the 20th and 21st centuries, with emphasis on historical, cultural, and theoretical contexts. Topics may include modernism, postmodernism, global literatures, postcolonial studies, environmental writing, and evolving narrative forms in response to technological and social change. Focus on critical interpretation, research methodologies, and contemporary theoretical frameworks.

Learning Outcomes: 1. Explain the historical, cultural, and theoretical contexts shaping key works of 20th- and 21st-century literature. 2. Analyze literary texts using contemporary critical and theoretical frameworks, such as

formalism, disability studies, postmodernism, postcolonialism, and ecocriticism. 3. Compare and contrast the ways in which 20th- and 21st-century literature engages with themes such as identity, politics, technology, and globalization. 4. Assess the influence of historical and cultural events (such as World War I, the Cold War, and 9/11) on the development of literary styles and genres. Credits: 3.00

ENGL 56300 - Historical Linguistics

Credit Hours: 3.00. (ANTH 56300, LC 56300) A survey of mechanisms and motivations of linguistic change. Topics include: phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

ENGL 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, LC 56500, LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ENGL 56900 - Contemporary Criticism And Theory

Credit Hours: 3.00. Study of contemporary criticism and theory generally focused on such schools and movements as structuralism, psychoanalysis, poststructuralism, feminism, new historicism, cultural studies, and gay and lesbian studies.

Credits: 3.00

ENGL 57000 - Introduction To Semiotics

Credit Hours: 3.00. The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ENGL 57900 - Modern British Fiction

Credit Hours: 3.00. Critical study of twentieth-century novels, mainly before World War II, by such writers as Conrad, Lawrence, Forster, Joyce, and Woolf.

Credits: 3.00

ENGL 58500 - Creative Nonfiction Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing creative nonfiction, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing. Learning Outcomes: 1. Write and revise sophisticated creative nonfiction through the study and practice of techniques unique to the genre. 2. Produce polished creative nonfiction revised according to suggestions received in workshop and feedback from the instructor. 3. Acquire a broader knowledge of the context of contemporary creative nonfiction by reading and discussing work by several contemporary fiction writers. Credits: 3.00

ENGL 58900 - Directed Writing

Credit Hours: 1.00 to 3.00. Writing (creative, popularly technical, biographical, historical, philosophical) on subjects of the student's choice. Individual conferences only; no class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 59000 - Directed Reading

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 59100 - Introduction To Composition Theory

Credit Hours: 3.00. A survey of major contemporary theories of invention and style, including such topics as heuristics; the aims and modes of discourse; stylistics; readability theories; sentence-combining; error analysis; audience; and evaluation. Applications to teaching will be made.

Credits: 3.00

ENGL 59200 - Postcolonial Studies

Credit Hours: 3.00. Study of works from once colonized cultures in Africa, Asia, and the Caribbean, and/or postcolonial diasporas. Individual sections will focus on one or more of the following: literature, women's literature, film, or feminist and cultural theory.

Credits: 3.00

ENGL 59400 - Contemporary Poetry

Credit Hours: 3.00. Study of poetry of the past two or three decades, both American and foreign, and their interaction. Attention to influences, "schools," and little magazines, as well as to conventional sources.

Credits: 3.00

ENGL 59500 - Contemporary American Fiction

Credit Hours: 3.00. Intensive study of contemporary and postmodern American fiction within various formal, theoretical, and cultural contexts, including multiculturalism, poststructuralism, and gender analysis, among others.

Credits: 3.00

ENGL 59600 - Advanced Studies In Literature Or Language

Credit Hours: 3.00. Advanced study of a topic within the instructor's fields of specialization. Emphasis on scholarly analysis and research.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

ENGL 59700 - Contemporary Black Feminist Literature

Credit Hours: 3.00. An intense examination of recent literary works by black women along with various critical theories constructed about black women's literature, beginning with the premise that black feminism is a "sign to be interrogated, a locus of contradictions."

Credits: 3.00

ENGL 59900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (EDCI 55900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and postsecondary education. Credits: 3.00

ENGL 60100 - Teaching Literature At The College Level

Credit Hours: 3.00. Focuses on the practical and theoretical issues related to teaching literature at the college level. Topics include course design, literary canons and text selection, teaching and learning styles, close reading, writing about literature, assessment, and professional ethics. Prerequisite: ENGL 50100 or consent of department. Restricted to graduate students in the Department of English.

Learning Outcomes: 1. Understand practical and theoretical issues of teaching literature to undergraduates. 2. Demonstrate familiarity with a variety of methods for teaching literature of various genres and encouraging active learning. 3. Design effective writing assignments and assess them effectively. 4. Understand the rights and responsibilities of students and instructors. Credits: 3.00

ENGL 60111 - Introduction To Scientific, Technical, Medical, And Healthcare Writing

Credit Hours: 3.00. Introduction to Scientific, Technical, Medical, and Healthcare Writing offers an overview of the genres, conventions, and strategies that these professional fields have in common. This course is the gateway course into the online Professional Certificate and Masters in Scientific, Technical, and Medical Communication. Permission of department required.

Learning Outcomes: 1. Identify the written, spoken, and media genres that are common to scientific, technical, medical, and healthcare industries. 2. Explain how genres and conventions are used in professional workplaces within a variety of industries. 3. Demonstrate how common communication strategies can allow a writer, speaker, or media user to explain scientific, technical, medical, and healthcare concepts and to persuade others. 4. Develop a common genre set that is applicable to the needs of a particular workplace within a broader scientific, technical, medical, and healthcare industry. 5. Evaluate existing communication practices at a workplace or within an industry and make recommendations for improvements. Credits: 3.00

ENGL 60211 - Science Writing

Credit Hours: 3.00. This course teaches students how to use the various writing styles and rhetorical strategies that are common in popular science and the scientific workplace. More specifically, they learn how to analyze, prepare, and edit technical and professional documents needed to effectively communicate within scientific professions, with specialized focus on reporting science news, conducting interviews with scientists, and identifying and explaining current debates in

science. Permission of department required.

Learning Outcomes: 1. Describe, analyze, and understand the particular written genres that are needed in the field of science writing. 2. Explain and translate scientific information to scientists, policy makers, and the public 3. Understand and demonstrate the ways in which rhetorical choices construct meaning in scientific contexts. 4. Analyze audiences for various forms of science writing, predict their needs, and craft writing that is audience appropriate. 5. Conduct professional interviews with scientists and other stakeholders in scientific issues in order to clearly articulate the findings of those interviews in a written format. Credits: 3.00

ENGL 60311 - Medical And Healthcare Writing

Credit Hours: 3.00. This course helps students master various genres, writing styles, and rhetorical strategies common in medical and healthcare contexts. More specifically, you will learn how to analyze, prepare, and edit documents that are used to communicate within and about the healthcare industry (i.e., protocols, patient educational materials, and proposals). Permission of department required.

Learning Outcomes: 1. Identify and understand the written genres that are common in healthcare and medical fields. 2. Analyze audiences for medical and healthcare documents and understand their needs. 3. Generate and translate health complex medical information to both healthcare professionals and the public. 4. Organize information in a way that is accessible and useful in healthcare workplaces. 5. Develop and design professional quality medical documents such as protocols, patient educational materials, and proposals. Credits: 3.00

ENGL 60411 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants teaches students how to analyze requests for proposals, analyze problems, devise project plans, and write proposals for for-profit corporations and non-profit organizations. Permission of department required.

Learning Outcomes: 1. Interpret and analyze a request for proposals (RFP). 2. Identify the ""problem"" that initiated the RFP by determining its causes and effects. 3. Develop clear objectives, outcomes, and deliverables that will make a project attractive to a client. 4. Propose a project plan that meets the client's needs and expectations. 5. Demonstrate why your company or organization is uniquely qualified to take on the project. 6. Compare the costs and benefits for readers of accepting a project proposal or grant proposal. 7. Present a proposal orally or in video form to decision-makers. Credits: 3.00

ENGL 60500 - Computers In Language And Rhetoric

Credit Hours: 3.00. Seminar that investigates how computers figure in contemporary theories of text and text making. Typical topics: critiques of technology, hypertext, cyberspace, computer-mediated communication, Internet, electronic writing, online research, pedagogy, and publishing.

Credits: 3.00

ENGL 60511 - Editing And Publishing

Credit Hours: 3.00. The purpose of this course is to show you how to use professional editing techniques to produce high-quality and publishable documents. Students learn how to work as a professional editor at four "levels of edit," which include proofreading, copyediting, substantive editing, and development editing. Permission of department required.

Learning Outcomes: 1. Apply editing techniques at the four levels of edit (proofreading, copyediting, substantive editing, and development editing). 2. Demonstrate effective decisions about the kinds of editing needed and expected for a task or a piece of writing. 3. Employ editing and publishing terminology and knowledge to a variety of documents in a variety of situations. 4. Demonstrate the use of proofreading and copyediting marks as used in print-based and electronic documents. 5. Employ strategies for doing substantive editing on larger documents in scientific, technical, medical, and healthcare professional settings. Credits: 3.00

ENGL 60600 - Seminar In Poetry Writing

Credit Hours: 3.00. An advanced course in the writing of poetry. Workshop criticism. Study of the work of established writers. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Enhance active reading skills through the close examination and critique of the poetry, notebooks, and letters of established poets. 2. Enhance feedback skills through thoughtful, frank, tactful, and intelligent critiques of your classmates' poems. 3. Enhance writing skills through intensive writing of original poetry and through structure exercises. Credits: 3.00

ENGL 60611 - Technical Communication

Credit Hours: 3.00. The purpose of this course is to show students how to write technical documentation and produce high-quality and reader-centered documents. They learn to write documents in several modalities, including print, electronic, audio, and video. Permission of department required.

Learning Outcomes: 1. Apply technical concepts, processes, and terms effectively for the purposes of informing and persuading. 2. Identify, analyze, and understand the particular written genres and conventions of various workplaces so that they can be shaped to fit one's professional needs. 3. Classify and identify audiences for specific technical documents. 4. Demonstrate an understanding audience needs by crafting writing, designing documents, and producing audio-visual texts that address and take those needs into consideration. 5. Produce and manage common professional documents in collaboration with others. Credits: 3.00

ENGL 60700 - The Theory And Craft Of Creative Writing

Credit Hours: 3.00. A study of the craft of poetry, fiction, or drama with some consideration of underlying theories. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Develop reading and analysis skills of the techniques used in other authors' writing. 2. Apply analysis skills learned from other authors' writing to your own writing through imitation and adaptation. 3. Develop skills in the teaching of writing through peer review, discussion, and presentations. Credits: 3.00

ENGL 60711 - Designing Documents, Interfaces, And Graphics

Credit Hours: 3.00. The purpose of this course is to introduce students to visual rhetoric principles that are commonly used to design documents and interfaces, as well as show them how to use multimedia tools for designing visual texts. Students also learn how to create effective visuals, such as graphs, charts, and tables. Permission of department required.

Learning Outcomes: 1. Recognize gestalt principles of design and how they operate in documents and interfaces. 2. Critique the design of documents and interfaces to determine whether they are working properly and determine how they can be improved. 3. Utilize computer-based design tools for designing documents and multimedia texts. 4. Create effective graphs, charts, and tables that complement written text. 5. Explain how design, typography, and color work together to make documents and interfaces intuitive, accessible, and attractive. 6. Develop a reliable design process that governs the visual design of individual and team-based projects. Credits: 3.00

ENGL 60811 - Entrepreneurship Communication

Credit Hours: 3.00. The purpose of this class is to teach students how to use design thinking and information experience (IX) strategies to be innovative and generate new ideas for products and services. Students will learn how to write a business model and pitch that business model to investors or their supervisors. Permission of department required.

Learning Outcomes: 1. Identify and use written genres that are common in business start-ups. 2. Use design thinking principles to envision new products and services, empathize with users, and ideate with new technology. 3. Analyze a market for your business and its products and services. 4. Develop a marketing strategy for raising awareness of your business. 5. Propose a new business concept by writing a business plan or model. Credits: 3.00

ENGL 60900 - Seminar In Fiction Writing

Credit Hours: 3.00. An advanced course in the writing of fiction. Workshop critiques. Prerequisite: Admission to the creative writing program.

Learning Outcomes: 1. Enhance reading skills

through close examination of other writers, including classmates and professional writers. 2. Enhance vocabulary for the creative writing discourse community. 3. Enhance feedback skills through thoughtful, frank, tactful, and intelligent discussion of your classmates stories and novel chapters. 4. Expand reading and writing aesthetics, and understanding of what literature is and can be, that will guide your reading and writing in the future. 5. Produce fiction benefitting a third-year thesis. Credits: 3.00

ENGL 60911 - User Experience And Design Thinking

Credit Hours: 3.00. The purpose of this courses is to show students how to employ User Experience (UX) principles to design documents, interfaces, and products for scientific, technical, healthcare, and medical situations, making those interactions intuitive, easy, and even pleasurable. Design thinking broadens out the focus, using design as a systematic way of understanding a company's customers, defining their problems and needs, ideating to create new solutions with emerging technologies, and prototyping those solutions. Permission of department required.

Learning Outcomes: 1. Critique the design of interfaces and documents through user experience (UX) principles. 2. Assess UX situations and anticipate the needs and problems that users, customers, and clients are try to solve. 3. Select UX strategies for designing interfaces and documents that users find useful and even pleasurable to interact with. 4. Demonstrate the use of design principles that can be used across media and platforms to design products, interfaces, and documents. 5. Develop a sense of empathy for users that allows product and document designers to see situations from the users perspective. 6. Learn how to ideate in ways that reframe existing problems, enhance creativity, and open new pathways for designing products and services. Credits: 3.00

ENGL 61400 - Middle English Literature

Credit Hours: 3.00. Study of representative works in the major literary traditions and genres of Middle English literature (exclusive of Chaucer): lyric, romance, satire, and allegory. Detailed examination of major works, such as Sir Gawain and the Green Knight, Piers Plowman, and Pearl.

Credits: 3.00

ENGL 62000 - Classroom Communication In ESL For Teaching Assistants

Credit Hours: 5.00. Student must be enrolled in the Graduate School and a non-native speaker of English. Permission of department required.

Credits: 5.00

ENGL 62100 - Written Communication For International Graduate Students

Credit Hours: 3.00. A course in English composition for non-native English-speaking graduate students.

Credits: 3.00

ENGL 62200 - Issues In Composition Studies: Classical Period To The Renaissance

Credit Hours: 3.00. The course historicizes issues in composition studies from the sophists to the Renaissance. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62400 - Issues In Composition Studies: Modern Period

Credit Hours: 3.00. The course historicizes issues in composition studies from the eighteenth century to the mid-twentieth century. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62600 - Postmodernism And Issues In Composition Studies

Credit Hours: 3.00. The course historicizes how various postmodern theories and practices (cultural, political, ethical, philosophical, technological, aesthetic) influence the study and teaching of written discourse. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62700 - Seminar In Linguistics

Credit Hours: 3.00. Investigation of a topic in advanced linguistics research.

Credits: 3.00

ENGL 62800 - Natural Language Processing

Credit Hours: 3.00. (ECE 66900) This course focuses on

keyword-driven question answering systems; transition networks; parsing procedures for context-free grammars; theory of transformational grammars; implementation of recursive transition networks; implementation of augmented transition networks; representation of conceptual dependencies; surface semantic conceptual analysis; conceptual dependency parsing; generating natural language from a conceptual base; scripts, plans, and goals; building conversationalist programs. Prerequisite: ENGL 50600 or ECE 57000 .

Credits: 3.00

ENGL 62900 - Seminar In English As A Second Language

Credit Hours: 3.00. In-depth study of variable subjects relating to the nature of English as a second/foreign/international language and its learning and teaching. Prerequisite: ENGL 51600 .

Credits: 3.00

ENGL 63000 - Seminar In Second Language Writing

Credit Hours: 3.00. An overview and examination of major issues in the theory, research, and practice of writing in English as a second language. Prerequisite: ENGL 51600 or ENGL 59100 .

Credits: 3.00

ENGL 63100 - World Englishes

Credit Hours: 3.00. Investigation of the use, spread, and development of English as an international language. Topics include: non-native varieties, language contact and change, new English literatures, and the teaching of English as an international language. Prerequisite: ENGL 50600 .

Credits: 3.00

ENGL 66800 - Seminar In Interpretation And Cultural Theory

Credit Hours: 3.00. Examination of selected developments in social, cultural, and hermeneutical theories from the eighteenth century to the present.

Credits: 3.00

ENGL 66900 - Introduction To Visual Theory And Visual Culture

Credit Hours: 3.00. Visual studies is the multidisciplinary study of images, viewers, and vision. Students will be provided with an overview of the theories, practices, and histories of the visual from a variety of disciplinary perspectives and historical periods. The seminar will be organized around a series of basic questions (such as "What is an image?" "How do images produce meaning?" "What do images do?" "What is vision?") whose responses have come to constitute the field as well as its transdisciplinarity. Readings will be drawn from seminal works in visual theory, cultural semiotics, cultural theory, intermediality, art history, media studies as well as the psychology, philosophy, and science of vision.

Learning Outcomes: 1. Demonstrate knowledge of the theories, practices, and histories of the visual from a variety of disciplinary perspectives and historical periods (including what is an images are and how they produce meaning). 2. Produce a finished conference paper and abstract. 3. Produce a finished undergraduate syllabus on a topic related to the course and student expertise. Credits: 3.00

ENGL 67400 - Seminar In Language Testing

Credit Hours: 3.00. An introduction to the techniques, practices, and history of language testing. Introduces the basic tenets of measurement and the issues and controversies related to the measurement of language ability.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 68100 - Hutton Lectures In Rhetoric And Composition

Credit Hours: 3.00. Reading and discussion of the work of contemporary scholarship in rhetoric and composition, accompanied by lectures by visiting scholars.

Credits: 3.00

ENGL 69000 - Internship In Second Language Studies/ESL

Credit Hours: 1.00 to 3.00. Part-time or full-time practical work experience in selected situations related to the student's field of study. The internship must be located at an off-campus site unless a special exception is granted by the Graduate School. Permission of instructor required.

Learning Outcomes: 1. Students will have acquired knowledge of how various institutions function and gained competence in the specific area (e.g., testing/test construction, teaching/teacher education, materials and curriculum design) and will have critically reflected upon the experience. Credits: 1.00 to 3.00

ENGL 69200 - Scholarly Writing And Publishing

Credit Hours: 3.00. Guides graduate students through preparing an essay for journal publication. Activities include

selecting appropriate venues, daily revision, outlining, workshopping, and hearing guest speakers. At the end of the course, students will formally submit their essay publication. Prerequisites: ENGL 50100 or instructor permission. Students must have an essay draft in hand that they wish to work on revising.

Learning Outcomes: 1. Produce and publish high-quality research in peer-reviewed journals. 2. Understand the hows and whys of publishing. 3. Demonstrate general professionalization of graduate students. 4. Assess and edit writing of self and others. 5. Demonstrate ethical professional behavior. Credits: 3.00

ENGL 69600 - Seminar In Literature

Credit Hours: 3.00. Advanced study of special subjects.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

ENGL 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Or MFA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ENGL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Entomology

ENTM 10100 - Insect Biology And Societal Grand Challenges

Credit Hours: 1.00. An introduction to the roles of insect biologists in addressing societal grand challenges.

Learning Outcomes: 1. Appreciate the scope of societal grand challenges. 2. Understand and demonstrate where Insect Biology and grand challenges intersect. 3. Evaluate and critique popular literature and media surrounding these issues. 4. Identify gaps in our current knowledge and understand future needs. Credits: 1.00

ENTM 10200 - The Practice Of Science

Credit Hours: 2.00. A critical examination of science, best practices for conducting science, the contribution of research to knowledge accumulation, and the ethical obligations of scientists.

Learning Outcomes: 1. Understand and practice the fundamental components of conducting scientific investigations (observation, explanation, and investigation). 2. Understand the concept of falsifiable hypotheses and their role in the practice of science. 3. Understand concepts underlying approaches to the quantitative analysis of data. 4. Appreciate the importance of accuracy, precision, and the identification and mitigation of sources of error in data collection and analysis. 5. Understand the ethical expectations of peers, sponsors, and the general public in the practice of science. 6. Understand the distinction between science and pseudoscience, and be able to recognize each. Credits: 2.00

ENTM 10500 - Insects: Friend And Foe (UCC: SCI/STS)

Credit Hours: 3.00. A one-semester course for nonscience students who want to know more about insects - the most numerous organisms on earth. An introduction to insects and their relationship with humankind, including interesting aspects of insect biology; insects in music, decoration, history; use of insects in teaching at the elementary school level; their use in art, photography, and drawing; insects as human food.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 3.00

ENTM 12800 - Investigating Forensic Science (UCC: STS)

Credit Hours: 3.00. Designed for both forensic science majors and non-majors, this course will provide an overview of the issues affecting the study and practice of forensic science as defined by the National Academy of Science 2009 report: "Strengthening Forensic Science". Using a mixture of popular media (film, television, news articles) as well as more conventional academic peer-reviewed articles, students will learn how the scientific method is applied to forensic investigations including; identifying pseudoscience, crime lab procedures, DNA evidence, errors in thinking and problem-solving, types of fraud, and the influence of the "CSI Effect".

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recognize basic phases of science and the procedural steps of the scientific method and explain the difference

between the two. 2. Recognize the difference between science and pseudoscience and how poor forensic science impacts the application of law. 3. Understand how basic procedural issues affect crime labs. 4. Recognize how a need for confidence in measurement impacts the scientific method and how this need shapes the current paradigm in forensic science. 5. Recall basic tenants of DNA evidence. 6. Understand the primacy of DNA evidence under the current paradigm of forensic science compared to other forensic science disciplines. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

ENTM 21000 - Introduction To Insect Behavior (UCC: SCI)

Credit Hours: 3.00. Description and introductory analysis of innate and learned insect behavior, including basic orientations and movements, behavioral periodicity, communication, chemical and structural defenses, host selection and feeding, reproduction, and insect societies. General biology and introductory entomology are desirable, but not essential.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ENTM 22810 - Forensic Investigation (UCC: SCI)

Credit Hours: 4.00. Forensic science investigation, crime scene management and field data collection techniques. Includes crime scene recognition and the documentation, collection, preservation, and processing of crime scene evidence. Emphasizes the place of field data collection as the first step in a sequence that takes evidence from scene to the lab for analysis and finally into the court of law.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. Credits: 4.00

ENTM 22820 - Forensic Analysis (UCC: SCI)

Credit Hours: 4.00. Forensic science evidence analysis, crime lab evidence management and data analysis techniques. Focuses on the accuracy, precision and integrity in evidence analysis for a survey of forensic disciplines. Emphasizes the place of forensic analysis as a necessary second step in a sequence that takes evidence from scene, to the lab for analysis and finally into the court of law.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Appreciate the scope of science in forensic analysis. 2. Develop an understanding of the scientific method in the context of the law. 3. Develop an understanding of the particulars for each forensic sub-discipline. 4. Experience the basic techniques employed by the sub-disciplines reviewed. Credits: 4.00

ENTM 22830 - Forensic Testimony And Ethics

Credit Hours: 3.00. The final course in the forensic science program core, focuses on the legal ramifications that arise when forensic science is applied at the crime scene, in the crime lab and in the courtroom. Students are introduced to ethical issues that form the basis of all scientific investigations and the role of scientists as expert witnesses in maintaining the moral integrity

of our justice system.

Learning Outcomes: 1. Recognize how science and the legal system interact throughout a case life history, and the role played in presenting scientific conclusions at trial. 2. Identify the ethical issues associated with scientific investigations at the scene, including the ability to avoid bias and correct for problems before a case is compromised. 3. Identify the ethical issues associated with scientific investigations at the lab, including the ability to avoid bias and correct for problems before a case is compromised. 4. Identify the ethical issues associated with avoiding bias, correcting for errors and providing testimony as an expert scientific witness. Credits: 3.00

ENTM 22840 - Forensic Entomology Principles

Credit Hours: 2.00. An overview to the four disciplines of forensic entomology. An introduction to stored products, urban, medical/veterinary, and medico-legal entomology.

Learning Outcomes: 1. Understand the broad field of forensic entomology coverage. 2. Define each discipline within forensic entomology. 3. Explain the depth of human and insect interactions. 4. Discuss the role an entomologist can play in a forensic context. 5. Develop an understanding of and explain what each discipline of forensic entomology handles. 6. Categorize the insects that are important to and used in each discipline. 7. Compare and contrast the context that each discipline deals with. 8. Describe the historical impact insects have played within each discipline. Credits: 2.00

ENTM 22841 - Forensic Entomology Principles Lab

Credit Hours: 1.00. An optional laboratory component to Principles of Forensic Entomology. Insects of importance in the fields of stored products, urban, medical/veterinary, and medico-legal will be covered, including morphological identifications and an assessment of their biology and damage.

Learning Outcomes: 1. Experience the basic techniques and skills employed by each of the four main disciplines reviewed. 2. Classify and identify insects within each discipline using morphological characteristics. 3. Develop appropriate collecting and rearing techniques for each type of insect. 4. Evaluate an entomological scenario and create guidelines on how to best handle the situation. Credits: 1.00

ENTM 24200 - Data Science

Credit Hours: 3.00. Develop a data science skill set that complements coursework in mathematics, statistics, and experimental design. Data Science facilitates research by developing skills in data sourcing, formatting and using different types of data, and hypothesis generation. Mathematical communication skills are developed through data graphics, animation, and delivery of results through multiple platforms including interactive simulations on webpages.

Learning Outcomes: 1. Source different types of data and know what analyses are appropriate for each type. 2. Transform and format data for analyses. 3. Detect trends in data as part of hypothesis generation. 4. Communicate findings to different audiences through appropriate graphics and animations, including through web pages. 5. Write R scripts to accomplish all of the above. Credits: 3.00

ENTM 25300 - Insect Physiology And Biochemistry

Credit Hours: 4.00. Introductory course in insect cell biology, biochemistry, and physiology including structures and functions of insect internal and external tissues and organs. A year of college biology or equivalent knowledge is expected.

Learning Outcomes: 1. Understand (i) the structure and functions of insect cells, the major internal organ systems of insects, the insect integument, and homeostatic mechanisms; (ii) insect development and reproduction, and their endocrine control; and (iii) the neural mechanisms that underlie the interactions of insects with their environment and coordinated behavior. 2. Understand the physical and chemical principles underpinning animal physiology. 3. Understand the dependence of function on structure in physiology and biochemistry. 4. Acquire familiarity with commonly used experimental procedures for research in insect physiology and biochemistry.

Credits: 4.00

ENTM 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first and second-year students. Courses offered must be approved by departmental or program faculty, and the College of Agriculture Honors Committee. Must be enrolled in an Honors program. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and a professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29400 - Topics In Forensic Sciences

Credit Hours: 1.00 to 4.00. This course will address the needs for our students to have current information about important emerging areas of Forensic Science and will provide a mechanism for recording such studies on their transcript.

Learning Outcomes: 1. The series is intended to develop content knowledge and critical thinking skills and allow students to demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 29410 - Laboratory Topics In Forensic Science

Credit Hours: 1.00 to 4.00. This course provides students with combined lecture and laboratory experience in important emerging areas of Forensic Science.

Credits: 1.00 to 4.00

ENTM 29500 - Topics In Entomology

Credit Hours: 1.00 to 4.00. Special topics in entomology not available in other entomology courses.

Credits: 1.00 to 4.00

ENTM 29510 - Laboratory Topics In Entomology

Credit Hours: 1.00 to 4.00. Special topics in entomology not available in other entomology courses that include laboratory.

Credits: 1.00 to 4.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

ENTM 31100 - Insect Ecology

Credit Hours: 3.00. Insect ecology investigates the fundamental concepts of ecology as they relate to insects, including insect interactions, other insects and their environment. Topics include population and community ecology, plant-insect interactions, insect biodiversity and biogeography, and theoretical and applied ecology. Examples from current entomological and ecological studies are used. Completion of college biology or an introductory course in entomology is recommended.

Learning Outcomes: 1. Comprehend ecological principles at different scales of biological

organization, from the individual to the population to the community to the ecosystem. 2. Understand the mechanisms that mediate interactions of insects with their biotic and abiotic environments. 3. Appreciate the importance of insects as stabilizing and destabilizing components of food webs. 4. Recognize the value and application of insect ecology n solving real-world problems. 5. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 3.00

ENTM 31200 - Plant-Insect Chemical Ecology

Credit Hours: 3.00. An overview of the structure and function of natural and synthetic chemical products in insect ecology. One year of college biology. One year of college chemistry strongly recommended.

Learning Outcomes: 1. Appreciate the history and scope of chemical ecology as a discipline. 2. Understand the role of chemistry in the biology/ecology of plants and animals. 3. Appreciate how chemical products influence processes at various levels of biological integration - from genes to ecosystems. 4. Evaluate and critique primary literature on chemical ecology. 5. Recognize the application of insect chemical ecology in solving grand challenges in entomology. Credits: 3.00

ENTM 32810 - Practical Molecular Biology

Credit Hours: 3.00. Students explore molecular technology commonly used in population genetics and diagnostics and apply them to questions in Insect Biology and Forensics.

Learning Outcomes: 1. Appreciate the scope and application of modern Forensic Biology and Insect Biology. 2. Appreciate the scope, diversity and utility of a variety of modern molecular typing techniques as they are used to address Grad Challenges. 3. Perform the primary techniques used in current entomological and forensic molecular data generation: DNA extraction and quantification, PCR, gel electrophoresis and sample purification. 4. Perform molecular data generation analysis. Credits: 3.00

ENTM 32820 - Medico-Legal Entomology

Credit Hours: 3.00. This course explores the main topics covered under medico-legal entomology (MLE). Specifically, the course will focus on the role that insects play in abuse, neglect, and death investigations. Students will experience rearing and identifying the major forensically important insect groups associated with medico-legal investigations. Finally, students will gain an appreciation of the scope of MLE through the analysis of two mock cases.

Learning Outcomes: 1. Establish an understanding of how insects are in used in legal investigations. 2. Define and defend the types of insect evidence presented in abuse & neglect cases. 3. Define and defend the types of insect evidence presented in death investigations. 4. Explain how insects are used to answer various questions in legal investigations. 5. Collect, rear and identify forensically important specimens. 6. Identify forensically important specimens down to family, genus or species level. 7. Demonstrate and explain proper collection techniques from decomposing remains. 8. Demonstrate and explain proper rearing techniques for forensically important insects. 9. Experience medico-legal entomology. 10. Compare and explain the life cycle of forensically important flies. 11. Analyze two medico-legal scenes. 12. Compose forensic entomology case reports. Credits: 3.00

ENTM 33500 - Introduction To Insect Identification

Credit Hours: 4.00. This class is designed for learning more about the collection and identification of adult insects. Emphasis will be placed on collection and sampling techniques, the preparation of specimens for future study, and identification.

Learning Outcomes: 1. Use keys and other published resources to identify unknown insects to the correct family and by-sight identification. 2. Collect a diversity of insects and related arthropods and to prepare specimens to professional standards. 3. State the scientific names, critical taxonomic characters, natural history and biology, unique or interesting

behaviors, ecological role, taxonomic relationships and impacts on human activities of selected families. Credits: 4.00

ENTM 35300 - Insecticides And Environment

Credit Hours: 3.00. Insecticides, their interactions with biological organisms and the environment, regulatory policies, environmental and human health outcomes, and current controversies. A year of college biology and college chemistry or equivalent knowledge is expected.

Learning Outcomes: 1. Communicate to the public about insecticide issues including risk, best practices for management and use. 2. Apply principles of toxicology including dose response, target sites, differential toxicity, and resistance. 3. Evaluate environmental hazards, their management and mitigation. 4. Interpret and implement insecticide label instructions. 5. Explain how Risk Assessment and Management is implemented in the U.S. to protect human health and safety balance economic and environmental risks. Credits: 3.00

ENTM 39000 - Professional Experience Programs In Entomology

Credit Hours: 0.00. Supervised professional experiences in entomology, integrated pest management, or urban/industrial pest control. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of instructor required.

Credits: 0.00

ENTM 39100 - Professional Experience Programs In Forensic Sciences

Credit Hours: 0.00 to 8.00. The course provides a mechanism for students to record unpaid internships and appropriate professional experiences in Forensic Science on their transcript. Permission of department required.

Learning Outcomes: 1. Experiential learning through interactions with professionals. Credits: 0.00 to 8.00

ENTM 39300 - Insect Biology Practicum

Credit Hours: 1.00. Imbedded programmatic experiences for undergraduate students in Insect Biology including focused reflection on the knowledge, skills, and values necessary for contributions in the discipline. Permission of instructor required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of Insect Biology. 2. Be able to make relevant connections to their own academic, professional and personal motivations and goals in Insect Biology. 3. Understand procedures and approaches useful for research, teaching and extension in Insect Biology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

ENTM 39310 - Insect Biology Practicum II

Credit Hours: 1.00. This course provides imbedded programmatic experiences for undergraduate students. It introduces students to the breadth of the discipline of entomology by engaging them at a programmatic level. This is accomplished by incorporating students into laboratory meetings, research, extension or teaching activities and through discussions with the faculty instructor about the goals and motivations driving their weekly research, extension or teaching activities and how these activities address societal grand challenges. All students enrolled in ENTM 39310 will be required at the end of each of the 8-week sessions and provide a recorded presentation overviewing some aspect of the mentor's program and its linkage to societal grand challenges. Permission of department required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of entomology. 2. Provide students with an opportunity to make relevant connections to their own academic, professional and personal motivations and goals in entomology. 3. Understand procedures and approaches useful for research, teaching and extension in entomology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

ENTM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry

principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 40000 - Entomology Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ENTM 40100 - Addressing Grand Challenges Through Insect Biology

Credit Hours: 1.00. This course engages students in an examination of societal grand challenges by identifying the problems, understanding the current state of knowledge, identifying knowledge gaps, and implementing possible solutions. Permission of department required.

Learning Outcomes: 1. Explain how the accumulated knowledge and experiences of Insect Biology majors can be applied to address Grand Challenges. 2. Demonstrate where capstone projects and grand challenges intersect. 3. Explain roles insect biologists play in addressing grand challenges, and the relationship to future career options. 4. Demonstrate skills in communication, critical thinking and teamwork. Credits: 1.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and

understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 42820 - Carrion Ecology

Credit Hours: 3.00. This course explores how carrion interact with the environment and other organisms during the decomposition process. Focus will be given to an understanding of the process itself, how investigators collect information about the process, and how research is conducted into the process of decomposition. Students will carry out an experiment and write their results up in the format of a peer reviewed article.

Learning Outcomes: 1. Explain the process of decomposition. 2. Describe and distinguish the stages of vertebrate decomposition, including when those stages begin and end and what variables define a given stage. 3. Describe and explain the abiotic factors that influence decomposition. 4. Describe and explain the biotic factors that influence decomposition. 5. Explain the nutrient flow through a carrion resource, including how various living organisms take advantage of such resources. 6. Experience carrion ecology field techniques. 7. Measure the abiotic factors that influence decomposition. 8. Measure the biotic factors that influence decomposition. 9. Evaluate a decomposition scene and strategize site data collection. 10. Identify the species the animals that frequent a carrion source. 11. Develop and implement a research project. 12. Plan, propose and defend a scientific research project related to carrion ecology. 13. Build a budget for a research project. 14. Build a collection strategy SOP for a research project. 15. Conduct a proposed research project. 16. Analyze the results of a research project. 17. Write-up, print and submit a research paper on your project, using the format for INSTARS or JPUR. Credits: 3.00

ENTM 42890 - Forensic Science Teaching

Credit Hours: 3.00. This course provides an opportunity for students who have completed forensic science courses to assist in that course previously taken, reinforcing the skills, expanding their mastery of the scientific method and how it pertains to forensic science as well as introducing basic pedagogical tools for instruction to the student. Permission of Instructor required.

Learning Outcomes: 1. Display mastery in the scientific method in the context of the law. 2. Demonstrate appropriate presentation skills. 3. Demonstrate appropriate assessment and pedagogical skills. Credits: 3.00

ENTM 43100 - Human-Wildlife Conflicts

Credit Hours: 3.00. Exploration of conflicts between human interests and wildlife and the regulations policies and legislation used to minimize conflicts. Negative interactions may be real or perceived, economic or aesthetic, social or political, and may pose risks to human health and safety. Emphasis on the causes of conflict and resolutions that seek to balance protection or conservation of wildlife with protection of other public resources and individual property owners. Prior knowledge of college-level general biology and ecology is expected.

Learning Outcomes: 1. Identify common causes of human-wildlife conflicts. 2. Evaluate the impacts of the conflict damage/threat. 3. Prescribe options for resolving the conflict. 4. Measure effectiveness of applied mitigation strategies. Credits: 3.00

ENTM 47500 - Honors Course-Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third and fourth-year students. Courses offered must be approved by departmental or program faculty, and the College of Agriculture Honors Committee. Must be enrolled in an Honors program. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and a professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49310 - Insect Biology Capstone Experience

Credit Hours: 2.00 or 4.00. Insect Biology majors complete a

capstone project under the guidance of a faculty mentor. Permission of instructor required.

Learning Outcomes: 1. Conduct a capstone project and analyze and interpret the information generated. Credits: 2.00 or 4.00

ENTM 49320 - Insect Biology Capstone Experience II

Credit Hours: 2.00 to 4.00. This course is an experiential meant to familiarize students with the options and procedures associated with the Entomology capstone experience and provide students with an avenue for fulfilling their capstone requirement by conducting a capstone project. Students may use a research, extension or teaching project to meet this requirement. Although the capstone project may build on or extend a previously conducted undergraduate research project, independent study, or study abroad, students enrolled in ENTM 49320 must conduct their capstone project in a manner that is independent from any other project for which credit will be awarded or for which they will be paid as an employee. Students may enroll in ENTM 49320 and conduct the capstone project at any time during the last 2 years of study. Permission of department required.

Learning Outcomes: 1. Demonstrate their ability to integrate their accumulated knowledge and technical and social skills in order to identify and solve a problem relevant to Entomology. 2. Conduct a capstone project and analyze or interpret the information generated. Credits: 2.00 to 4.00

ENTM 49390 - Insect Biology Capstone Forum

Credit Hours: 1.00. Students apply their accumulated knowledge to grand challenges and careers in insect biology. Permission of department required.

Learning Outcomes: 1. Demonstrate ability to integrate accumulated knowledge, technical and social skills to identify and solve a problem relevant to Insect Biology. 2. Communicate the results the Capstone mentored research project through oral and written presentations. Credits: 1.00

ENTM 49400 - Advanced Topics In Forensic Sciences

Credit Hours: 1.00 to 4.00. This course will provide an avenue for students to pursue knowledge in emerging advanced areas of Forensic Science. Permission of department required.

Learning Outcomes: 1. The series is intended to develop content knowledge and critical thinking skills and allow students to demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49410 - Advanced Laboratory Topics In Forensic Science

Credit Hours: 1.00 to 4.00. This course will provide an avenue for students to pursue laboratory techniques in emerging advanced areas of Forensic Science. Permission of Department required.

Credits: 1.00 to 4.00

ENTM 49500 - Advanced Topics In Entomology

Credit Hours: 1.00 to 4.00. Special topics in entomology at upper division level not available in other entomology courses. Permission of department required.

Learning Outcomes: 1. Learn information about important emerging areas of entomology including but not limited to new invasive species, advance in biotechnology, advances in insect science and topics that prepare students to address emerging problems at the state, national and global levels. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49510 - Advanced Laboratories In Entomology

Credit Hours: 1.00 to 4.00. Special laboratories in entomology at upper division level not available in other entomology courses. Permission of department required.

Credits: 1.00 to 4.00

ENTM 49700 - Special Problems In Forensic Science

Credit Hours: 1.00 to 4.00. This course will provide an opportunity for qualified sophomores, juniors and seniors to engage in the study of special Forensic Science problems not covered in regular coursework. It will also provide a mechanism for recording these independent studies on their transcript. Permission of department required.

Learning Outcomes: 1. To develop content knowledge and critical thinking skills and allow students an opportunity to demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49800 - Special Problems In Entomology

Credit Hours: 1.00 to 4.00. Open to qualified sophomores, juniors, and seniors who want to study special problems in entomology not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 4.00

ENTM 50800 - Integrative Insect Taxonomy

Credit Hours: 4.00. A multisource approach to understanding insect taxonomy, morphology, and evolution. We will compare traditional classification schemes with new hypotheses of insect evolutionary relationships based on an array of data sources. Students learn the importance of natural history collections and how to prepare insect specimens for permanent storage. We will explore insect diversity through hands-on laboratory exercises and field research.

Learning Outcomes: 1. Identify insects to family by to sight. 2. Implement field techniques for collecting insect specimens. 3. Demonstrate proper insect collection preparation and curation. 4. Understand the principles of insect morphology, classification, and nomenclature. 5. Understand phylogenetic hypotheses and their implementation in insect taxonomy. 6. Integrate skills through a final class project on insect evolution. Credits: 4.00

ENTM 52500 - Medical And Veterinary Entomology

Credit Hours: 3.00. Introduction to the biology and control of arthropods of medical and veterinary importance, and coverage of the natural history and abatement of selected arthropod-related diseases, including arboviral encephalitis, filariasis, leishmaniasis, Lyme disease, malaria, plague, spotted fever, trypanosomiasis, and myasis. Offered in odd-numbered years.

Credits: 3.00

ENTM 59500 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. May be repeated for credit if the course topic is not repeated. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

ENTM 60000 - Graduate Student Orientation

Credit Hours: 1.00. Introduction and orientation to the requirements and culture of the Department of Entomology, the College of Agriculture, and Purdue University. Intended for graduate students in their first year.

Learning Outcomes: 1. Know the administrative regulations and procedures of Entomology and the Graduate School. 2. Know the history of Entomology. 3. Know the land grant mission and the role of Entomology. 4. Know the University hierarchy. 5. Know the roles, rules and expectations of the apprentice and mentors. 6. Begin creation of a career plan. 7. Develop strategies for effective networking. 8. Learn how to communicate within the discipline through oral and poster presentations. 9. Participate in independent activities. Credits: 1.00

ENTM 60200 - Insect Biology

Credit Hours: 3.00. A comprehensive course in entomology, for graduate students with little entomological background, that introduces students broadly to insect structure, function, behavior, ecology, pest management, and systematics. Students apply broad knowledge in each of the topic areas to a specific insect and are expected to be able to read and critically evaluate primary literature and summarize it in written and oral presentations. One year of college biology is strongly recommended.

Learning Outcomes: 1. Become conversant with entomology terms and definitions. 2. Be proficient in search techniques for the primary literature, to read, evaluate and discuss the primarily literature, and be able to extract information from primary sources and apply it to their own area of research. Credits: 3.00

ENTM 60900 - Science Writing

Credit Hours: 1.00. This course is designed for graduate students (MS or PhD) at any stage in their professional career who are seeking formal training in manuscript and grant writing for a scientific audience. Students will be required to attend class and prepare for in-class group discussions and writing activities by reading assigned sections of the text or associated papers. Students will also be required to prepare a written assignment (manuscript or grant) over the course of the semester, which they will use to practice and hone newly acquired skills, as well as participating in peer evaluation of one another's writing. Permission of department required.

Learning Outcomes: 1. Utilize resources and approaches (e.g. online tools, peer-writing groups, time management skills) to develop regular writing habits. 2. Perform critiques of scientific manuscripts and research proposals. 3. Provide constructive criticism to fellow students on writing assignments. 4. Learn steps and basic principles (e.g. language, narrative

structure, revision Revised: 08/11/21 process) used to write clear and concise scientific papers for a variety of audiences. 5. Apply principles of science writing to develop a complete draft of a specific section(s) of the MS/PhD research proposal, critical literature review, manuscript or other academic work (with instructor permission). Credits: 1.00

ENTM 61000 - Current Trends In Insect Pest Management

Credit Hours: 3.00. Concepts of pest management and dynamics of pest populations, with emphasis on population regulation in theory and practice. The principles of applied ecology that pertain to insects and agricultural crops and systems. Identification, biology, behavior, and relationships of pests of forage, fiber, and vegetable crops. A knowledge of introductory entomology is recommended. Offered in even-numbered years.

Learning Outcomes: 1. Identify key insects in economically important IPM systems. 2. Design a pest management plan that includes preventive practices, sampling and economic thresholds. 3. Identify gaps in management techniques and propose new research directions. 4. Discuss key IPM concepts. Credits: 3.00

ENTM 61100 - Toxicology Of Insecticides

Credit Hours: 3.00. The chemistry, mode of action, and metabolism of insecticides and related compounds in both insect and vertebrate systems. Evaluation of toxic action, principles of selective toxicity, insecticide resistance, and environmental effects are also discussed. A minimal knowledge of entomology is required. Knowledge of biochemistry and neurobiology is useful. Offered in even-numbered years.

Credits: 3.00

ENTM 64200 - Analysis Of Ecological Data

Credit Hours: 3.00. Intermediate course in analysis options for biological and ecological data. Topics include: univariate, multivariate, parametric and non-parametric analysis and their basis; advanced graphical techniques; basic mapping with and without geographical information systems; simulation modeling; associated coding for open source platforms. A previous graduate-level course in statistics is required. Working knowledge of ANOVA, t-tests, linear regression, and assumptions and distributions of test statistics for these is assumed.

Learning Outcomes: 1. Know data and analysis requirements when planning experiments and observational studies. 2. Apply several univariate and multivariate statistical analyses. 3. Model or simulate simple biological or ecological systems. 4. Use several different graphing techniques including mapping, three-dimensional plots, and animations. 5. Write code to accomplish 1-4 within open-source software. 6. Develop critical thinking skills. 7. Foster creativity by finding alternative solutions to analytical challenges. 8. Develop both the written and the technical side of communication skills. Credits: 3.00

ENTM 69100 - Special Problems

Credit Hours: 1.00 to 12.00. Special research topics of interest to graduate students and not included in assigned coursework. Permission of instructor required.

Credits: 1.00 to 12.00

ENTM 69200 - Special Topics

Credit Hours: 1.00 to 4.00. Advanced topics in specialties of department members such as, but not limited to: biochemistry and physiology; biological control; insect pest management; veterinary entomology; nematode systematics; pathology; systematics. The field in which work is offered will appear on the student's record. Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 4.00

ENTM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ENTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Entrepreneurship

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2.

Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

ENTR 31500 - Business Planning For Social Entrepreneurship

Credit Hours: 3.00. This course builds on entrepreneurship concepts and skills developed in ENTR 20000 (prerequisite course) to understand the differences, benefits, and opportunities associated with social impact business models. Students work in teams on experiential activities including gathering customer feedback, creating forecasts, developing a strategy, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Develop convincing social enterprise business models. 2. Conduct feasibility analysis. 3. Create pro-forma financial statements. 4. Understand legal, regulatory, and ethical issues social entrepreneurs face. 5. Understand the process of recruiting, hiring, and developing a new venture team. 6. Identify sources of funding and investor needs. 7. Persuade potential investors to support a social impact venture. 8. Participate effectively as a team member or leader. Credits: 3.00

ENTR 32500 - Global Entrepreneurship And Innovation

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course), to provide students with a comprehensive understanding of entrepreneurship in a global context. It explores the differences, challenges, and opportunities associated with developing international ventures and expanding into overseas markets. Through topic lectures, case studies, and experiential team projects, students will gain insight into global trends, cultural nuances, business models, strategies, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify economic, political, technological, ethical, and cultural factors influencing entrepreneurship in global settings. 2. Develop cross-cultural awareness to navigate diverse business environments. 3. Conduct feasibility analysis for international venture establishment and expansion. 4. Recognize critical aspects of global supply chains and associated business implications. 5. Describe international funding sources and currency considerations. 6. Explore global entrepreneurship and innovation ecosystems as scalability engines. 7. Understand the process of recruiting, hiring, and developing a global team. 8. Participate effectively as a team member or leader. Credits: 3.00

ENTR 39000 - Special Topics In Entrepreneurship And Innovation

Credit Hours: 1.00 to 3.00. The requested course will provide the opportunity to develop courses which fulfill the "option" course requirement for the Certificate in Entrepreneurship and Innovation Program. Option courses are designed to provide depth in certain disciplines related to entrepreneurship and innovation, and/or entrepreneurship and innovation in relation to specific industries or markets.

Credits: 1.00 to 3.00

ENTR 39699 - Internship And Research Experiences

Credit Hours: 0.00. Interns for Indiana internships work experience with participating employers. Students submit a summary report and company evaluation. Through a mutual selection process, students may be placed as interns with entrepreneurial companies. Placements are determined through a screening process based upon students' skills and experiences gained through their major fields of study. Fulfills a capstone requirement for the Certificate in Entrepreneurship and Innovation Program. Contact the Office of Professional Practice. Permission of instructor required. Discovery Park Undergraduate Research Internships. Check the DURI website for further information. https://www.purdue.edu/discoverypark/duri/.

Learning Outcomes: 1. Gain skills and experiences through their major fields of study. Credits: 0.00

ENTR 46000 - Internship And Career Preparation Seminar

Credit Hours: 1.00. This course is a distance option course for the Certificate in Entrepreneurship and Innovation. It equips students with professional skills based on entrepreneurship competencies. Students develop resources to illustrate their skills, talents, abilities, and goals to increase career preparedness. They learn what it takes to successfully transfer academic skills to a workplace setting and develop an entrepreneurial mindset that sets them apart from other job seekers.

Learning Outcomes: 1. Improve self-awareness of professional skills development through assessments and reflection. 2. Create a professional brand through an improved LinkedIn profile, resume review, interviewing, and networking skills. 3. Showcase educational and professional skills in an e-portfolio or website. Credits: 1.00

ENTR 47000 - Gender, Diversity And Leadership

Credit Hours: 3.00. This course serves as an option course for the Certificate in Entrepreneurship and Innovation. It provides a social and historical perspective of gender and diversity in leadership and entrepreneurship, as well as practical skills students can use to develop their own leadership abilities. This highly interactive course provides the opportunity for students to meet with diverse leaders from a variety of organizations. Topics of social, political, and economic interest are covered, as are discussions of current issues and research relevant to leadership success.

Learning Outcomes: 1. Define the social, cultural, organizational, and historical dimensions of gender and leadership. 2. Identify contemporary gender and leadership issues. 3. Practice communication, negotiation, and other skills relevant to leadership success. Credits: 3.00

ENTR 48000 - Entrepreneurial Leadership And Careers

Credit Hours: 3.00. This course prepares students for entrepreneurial careers by requiring them to apply the knowledge and skills learned in prerequisite entrepreneurship courses to the development of their professional goals and networks. Students explore how they can use their entrepreneurial talents, skills, and interests in a variety of ways, including launching startups, joining family businesses, or being intrapreneurs in established organizations. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify unique personal entrepreneurial strengths to help shape career decisions. 2. Understand the practical application of team building and leadership. 3. Explore different types of entrepreneurial careers in startups and large organizations. 4. Research and interview entrepreneurs about career pathways. 5. Use secondary research to assess potential employers and their alignment with personal goals. 6. Explore options for using entrepreneurial skills within existing organizations. 7. Understand key elements of personal financial planning and management. 8. Build a personal brand and use social media platforms to expand professional networks. 9. Create a personal business plan. Credits: 3.00

ENTR 48100 - Consulting For Emerging Enterprises

Credit Hours: 3.00. This course is an experiential course that requires students to apply the knowledge and skills learned in

prerequisite entrepreneurship courses to a real-world consulting project for a startup, small business, or non-profit organization. Student teams use a three-stage consulting model to guide project contracting, data gathering, and value creation for the client. In-class time focuses on developing consulting knowledge and competencies that are applied directly to client interactions and project execution. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation. Class size is limited. Permission of the instructor is required.

Learning Outcomes: 1. Develop consulting skills through a hands-on consulting engagement. 2. Think strategically about a small business in a complex and changing environment. 3. Practice leadership and organization skills by establishing priorities, setting expectations, and completing objectives within a team. 4. Effectively use consulting tools and practices to analyze operations establish priorities for improving effectiveness and growing the business. 5. Collaborate with clients by establishing positive relationships, building trust, sharing information, educating, learning, and solving problems. 6. Create value for a consulting client through tangible deliverables including new methods, processes, systems, products and services that will have a lasting impact on the long-term growth of the business. 7. Network with entrepreneurs and service providers from a variety of disciplines. Credits: 3.00

ENTR 48200 - Venture Planning Studio

Credit Hours: 3.00. This course is an experiential course that brings students through the process of creating a startup company as they would in a real-world business incubator or venture studio. They apply knowledge and methodologies related to design thinking, lean startup, financial planning, and fundraising to develop robust business models. Students can bring their own ideas to the course or contribute to one that will be identified. The purpose of this course is to develop in students the confidence and competence to transform a venture idea into a viable startup company. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Use design thinking to generate new ideas for to solve stakeholder problems. 2. Employ Customer Forces and Jobs to Be Done models and methodologies to inform a Lean Canvas. 3. Create unique value propositions and concepts for new products, technologies, or services. 4. Conduct customer interviews to identify market opportunities and risks. 5. Define cost structure, pricing, and go-to-market strategy. 6. Develop pro-forma financial statements. 7. Build a minimal viable product (if appropriate). 8. Present a persuasive investor pitch deck. Credits: 3.00

ENTR 49000 - Senior Level Special Topics In Entrepreneurship And Innovation

Credit Hours: 1.00 to 3.00. The requested course will provide the opportunity to develop capstone courses for the Certificate in Entrepreneurship and Innovation Program. Capstone courses are designed to provide students with the opportunity to apply the knowledge acquired in Certificate Program "core" and "option" courses to hands-on, real world activities related to entrepreneurship and innovation.

Credits: 1.00 to 3.00

ENTR 50000 - Technology Commercialization Seminar

Credit Hours: 2.00. This course is a seminar that focuses on topics related to technology realization, commercialization, and entrepreneurship. Topics pertaining to these areas are covered through readings, class discussion, and presentations by invited speakers.

Learning Outcomes: 1. Evaluate a new technology in terms of its value proposition and product/market fit. 2. Document how to conduct market analysis and customer development. 3. Give examples of why intellectual property protection, legal business formation, and contracts are important to startup companies. 4. Describe why raising money is essential for technology entrepreneurship. 5. Differentiate the various resources supporting entrepreneurs in the community. Credits: 2.00

ENTR 50100 - Technology Commercialization Practicum

Credit Hours: 2.00. This course introduces a variety of cross-disciplinary topics to develop the skills needed to realize technology. Each week, students learn specific methodologies and techniques and apply these through case studies and class projects.

Learning Outcomes: 1. Conduct market research for a new technology. 2. Define market

segments through market analysis. 3. Evaluate business models for a new technology. 4. Develop a go-to-market strategy for a new venture. 5. Create and deliver an investor pitch for a new venture. Credits: 2.00

ENTR 59000 - Graduate Level Special Topics In Entrepreneurship And Innovation

Credit Hours: 1.00 to 3.00. The requested course will provide the opportunity for graduate students to participate in entrepreneurship courses focused on the skills and knowledge necessary to launch and lead new business ventures, the examination of the feasibility and market potential of new technologies, and/or the development of business plans.

Learning Outcomes: 1. Acquisition of the skills and knowledge necessary to launch and lead new ventures. 2. Examination of the feasibility and market potential of new products or technologies. 3. The development of business plans for new ventures. Credits: 1.00 to 3.00

Environmental and Ecological Engineering

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering design proposal. Credits: 3.00

EEE 25000 - Environmental, Ecological, And Engineering Systems

Credit Hours: 3.00. An overview of systems thinking and examples, and applications to environmental, ecological, and engineering systems. Students will develop an understanding of complex and global systems, along with the tools and analysis methods required to deal with them. Basic environmental and ecological science concepts are also included.

Learning Outcomes: 1. Understand the types of relationships and dynamics common in complex systems, including environmental systems, ecological systems, and engineering systems. 2. Able to apply fundamental systems tools and modeling approaches to a wide variety of engineering, environmental, and ecological problems. 3. Understand the foundational concepts and vocabulary of global environment and ecological systems. 4. Appreciate the complexity of contemporary issues related to society and EEE, including and understanding of the roles and responsibilities of stakeholders. Credits: 3.00

EEE 29001 - Introduction To Environmental & Ecological Engineering Seminar

Credit Hours: 2.00. Guest presenters, peer panelists, and small group discussions introduce students to the knowledge, skills, and abilities needed in order to exhibit the highest levels of professionalism & stewardship expected of an Environmental and Ecological Engineering graduate. Topics include planning a course of study; internship, research, study abroad opportunities; career planning and placement skills; professional responsibility and ethics; and functioning as a professional.

Learning Outcomes: 1. Communicate

professionally in both formal and informal settings. 2. Create career documents (e.g., resumes, cover letters, LinkedIn Profiles) that demonstrate professionalism and critical thinking. 3. Understand how their actions and/or inactions are perceived in professional settings. 4. Identify and justify their curricular path at Purdue University. 5. Identify a variety of curricular, extra-curricular, and professional opportunities that will best support the achievement of their career goals. Credits: 2.00

EEE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29500 - Experimental Course

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 36000 - Environmental And Ecological Engineering Laboratory

Credit Hours: 1.00 to 3.00. An introduction to laboratory methods of analysis of Environmental and Ecological Engineering systems. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes experimental design, treatment of data, the analytical determination of chemical and biological constituents in water, soil, and air; analysis of environmental and ecological engineering processes; analysis of life-cycle characteristics and impacts of consumer products and commodities; methods of prevention and remediation of manufacturing waste streams.

Learning Outcomes: 1. Ability to acquire experimental data and evaluate experimental error and variability. 2. Understanding of data reduction, analysis and presentation. 3. Ability to produce professional technical communication of experimental conclusions. 4. Ability to summarize results of quantitative analysis to propose management strategies for environmental problems. Credits: 1.00 to 3.00

EEE 36001 - Water Quality And Treatment Laboratory

Credit Hours: 3.00. Laboratory procedures are described and performed that examine chemical, physical, and biological properties and constituent concentrations of natural waters. In addition, water treatment process experiments are performed to show how constituent concentrations can be altered during water treatment processes. Procedures include the analytical determination of several chemical and biological constituents in water by titrimetric, colorimetric, or chromatographic methods, whereas treatment processes include reactor design, pH adjustment, ion exchange, lime softening, coagulation, and disinfection.

Learning Outcomes: 1. Apply physical, chemical, and biological principles to each experimental procedure or measurement technique. 2. Conduct laboratory experiments, making quantitative measurements to assess water quality and water treatment process performance. 3. Organize, report, and graphically display experimental data in common software packages. 4. Analyze and evaluate experimental data on its quality and significance (i.e., usefulness). 5. Identify issues (i.e., problems) with data collection and data uses. Credits: 3.00

EEE 36002 - Environmental Sustainability For Industry, Laboratory

Credit Hours: 3.00. This lab course provides an opportunity for students to gain hands-on experience with the physical and analytical tools of industrial sustainability. These include experimental methods for product testing and air quality measurement; design and planning of experiments; statistical interpretation of experimental data; design and environmental

assessment of building energy use, combustion systems, and electrical circuits; and life-cycle management of electronic equipment and other household products. Students are encouraged to complete their statistics requirement.

Learning Outcomes: 1. Develop a hypothesis and design experiments to test the hypothesis. 2. Conduct/interpret statistical analysis of experimental results. 3. Describe power and energy demand in multiple contexts including electricity, combustion, and heat transfer. 4. Propose energy efficiency solutions and evaluate their economic and environmental consequences. 5. Design and measure the material and environmental impacts of a product's life cycle, including production, waste handling, and end-of-life scenarios. 6. Produce technical reports that clearly communicate methods, results, and conclusions for a professional audience. Credits: 3.00

EEE 38000 - Environmental Chemodynamics

Credit Hours: 3.00. Introduction to chemical thermodynamics and general equilibrium processes in environmental and ecological engineering systems. Introduction to the first and second laws of thermodynamics; properties of pure substances; ideal and real gases; thermodynamic cycles and processes; heat transfer and combustion; and chemical equilibrium in aquatic solutions, including equilibria between phases and reaction equilibria. Emphasis is on understanding and conceptualizing important processes, and competency in thermodynamic calculations.

Learning Outcomes: 1. Apply the First and Second Laws of thermodynamics to closed and open systems. 2. Understand, identify, and quantify the environmental impacts of closed and open systems, based on mass and energy transfer. 3. Analyze full-scale systems, and compare actual and theoretical operation. 4. Understand the structure and reactivity of environmentally relevant organic compounds. 5. Calculate concentrations of different components in equilibrium and non-equilibrium environmental systems. Credits: 3.00

EEE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in Environmental and Ecological Engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (AGRY 38500) Designed as an upper-level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 4.00

EEE 39000 - Environmental And Ecological Engineering Professional Practice Seminar

Credit Hours: 1.00. Seminar lectures and discussions to

introduce students to aspects of professional practice within Environmental and Ecological Engineering. Topics include career planning and placement skills, professional responsibility and ethics, functioning as a professional, and other current important topics in the profession. Students will interact with several practicing Environmental and Ecological Engineers.

Learning Outcomes: 1. Develop professional skills that will allow them to enter into the professional Environmental and Ecological Engineering field. 2. Gain an understanding of major professional issues. 3. Begin development of a personal approach to ethical professionalism. 4. Gain experience in professional communication. 5. Gain knowledge of the range of opportunities available in the profession. Credits: 1.00

EEE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39500 - Experimental Course

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credits. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39699 - Professional Practice Internship

Credit Hours: 0.00. One-session professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 43000 - Industrial Ecology And Life Cycle Analysis

Credit Hours: 3.00. The outputs and processes associated with industrial systems are examined, with special emphasis placed on interactions of these systems with environmental and ecological systems. A full product life cycle perspective is stresses, including energy and material flows, processes used to produce materials and realize products, and the management of end-of-life products.

Learning Outcomes: 1. An understanding of the

principles of industrial ecology and an ability to apply these principles to specific engineering and manufacturing systems in order to create designs with reduced environmental and ecological impact. 2. Knowledge of life cycle analysis (LCA), its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. The ability to perform a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 4. An understanding of the complex interactions between industrial and environmental systems. Credits: 3.00

EEE 45600 - Wastewater Treatment Processes

Credit Hours: 3.00. (CE 45600) Fundamental design principles and practice of wastewater treatment to prepare students for designing wastewater treatment systems. The major topics include design and construction process, preliminary treatment of wastewater, primary treatment, wastewater microbiology, secondary treatment, nitrogen removal, phosphorus removal, attached microbial growth, secondary settling, disinfection and post-aeration, tertiary treatment, and wastewater plant residuals management.

Learning Outcomes: 1. Understand design principles and practice of wastewater treatment. 2. Apply the knowledge to select the best process to treat wastewater. 3. Design a wastewater treatment component or process to meet water quality goals. 4. Critically review relevant literature or contemporary issues in wastewater treatment. Credits: 3.00

EEE 47200 - Community-Engaged Engineering & Design

Credit Hours: 3.00. Utilizing a transdisciplinary approach in a real-world, client-based service-learning design experience, students will lead the design and implementation of community-engaged sustainability projects integrating not only their discipline-specific knowledge, but community partner and stakeholder knowledge as well. This course will require travel outside of class to community partner sites to collaborate in the design process. Sustainability projects to improve the health and wellness of communities will be implemented at multiple sites. The complex and dynamic relationships between social, economic, environmental, and political sectors in such community-engaged projects will be investigated.

Learning Outcomes: 1. Display social responsibility, civic engagement, and leadership in addressing sustainability issues: evaluate and apply diverse perspectives from multiple stakeholders to site-specific design solutions; connect and extend academic knowledge to improve the health and wellness of communities; take informed, responsible action to address ethical, social, and environmental challenges related to sustainability at partner sites; communicate project efforts in a creative, well-organized, and logical manner. 2. Design novel, context-appropriate solutions to sustainability issues using a transdisciplinary knowledge production model: describe the interconnectivity between environmental, social, political, and economic issues surrounding technical solutions; apply a transdisciplinary knowledge production model; propose solutions to open-ended design problems that demonstrate a deep comprehension of the issues. 3. Engage in the complexities of a negotiated design process occurring between multiple stakeholders in a professional and ethical manner: demonstrate empathy and adaptability in working with teammates and stakeholders with varied skills, talents, abilities, and work strategies; create project deliverables that demonstrate cohesive stakeholder functionality; critically evaluate personal and others' contributions to the overall success of the projects. Credits: 3.00

EEE 48000 - Environmental And Ecological Engineering Senior Design

Credit Hours: 1.00 to 3.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems. Permission of department required.

Learning Outcomes: 1. An ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. An understanding of the complete design

process and an ability to perform the process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An ability to function on multidisciplinary teams. 5. An ability to communicate professional design and design decisions effectively. 6. An awareness of professional ethics and responsibility of engineers. 7. An appreciation of the role of engineering and of EEE in social contexts. Credits: 1.00 to 3.00

EEE 48001 - Environmental And Ecological Engineering Senior Design I

Credit Hours: 1.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems. Permission of department required.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Have an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 1.00

EEE 48002 - Environmental And Ecological Engineering Senior Design II

Credit Hours: 2.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Gain an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 2.00

EEE 48100 - Reflective Practitioner

Description: Credit Hours: 1.00. Reflective practice is a term coined by Donald Schon in The Reflective Practitioner (1983). Reflective practice is the capacity to reflect on action to engage in a process of continuous learning. Reflective practice can be an important tool in practice-based professional learning settings where people learn from their own professional experiences, rather than from formal learning or knowledge transfer. It may be the most important source of personal professional development and improvement. It is also an important way to bring together theory and practice. A person who reflects throughout their practice is not just looking back on past actions and events, but is taking a conscious look at emotions, experiences, actions, and responses, and using that information to add to their existing knowledge base and reach a higher level of understanding. Critical reflection as part of experiential education generates, deepens, and documents learning. As a result of this course, you will be able to articulate the value of your experiential education opportunities toward marketing yourself for potential job opportunities and develop the skills needed to become a reflective practitioner for promotional growth in your future career. Permission of department required.

Learning Outcomes: 1. Reflect on experiential education experiences; Identify knowledge and skills gained from experiences; Identify connections between experiences and disciplinary knowledge. 2. Apply theories and concepts to practical sustainability problems; Identify ways in which individual actions within experiences contributed to improving sustainability; Identify ways to individually contribute to improving sustainability in future professional practice. 3. Synthesize experiential education experiences into a career development plan; Articulate strengths and weaknesses observed within experiences; Develop a self-improvement plan for future

professional practice; Identify a potential career path; Synthesize knowledge and skills gained into high-quality LinkedIn page and Strengths Statement. Credits: 1.00

EEE 49500 - Experimental Course

Credit Hours: 0.00 to 6.00. Topics Vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 49800 - Environmental And Ecological Engineering Projects

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credits. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 51601 - Indoor Air Quality

Credit Hours: 3.00. The course covers the fundamentals of indoor air pollutant dynamics in buildings and their heating, ventilation, and air conditioning systems.

Learning Outcomes: 1. Evaluate mechanistically pollutant transport dynamics in buildings through application of material balance models. 2. Apply fundamental principles of aerosol physics to characterize the behavior of indoor aerosols from several nanometers to tens of micrometers in size. 3. Evaluate human exposure to indoor aerosols and analyze the effectiveness of engineering control strategies for indoor air pollution. 4. Read and critically analyze papers in the technical literature on indoor air quality and aerosols. 5. Gain additional insight regarding specific topics related to indoor air quality and aerosols through a rigorous course project. 6. Analyze, and discuss in a group-setting, contemporary indoor air quality issues facing our global society. 7. Prepare and review written and oral technical communication. Credits: 3.00

EEE 53000 - Life Cycle Assessment: Principles And Applications

Credit Hours: 3.00. This course covers the basic concept of life cycle thinking, framework and computational structure of process and economic input-output based life cycle assessment (LCA), state-of-the-art LCA software tools, industrial case studies, and recent advances in LCA methodology. Students are required to complete a group project that could potentially facilitate the adaptation of LCA tools in engineering research, education, or practice.

Learning Outcomes: 1. Conduct an LCA study using state-of-the-art software tools and databases according to ISO I4040 standards. 2. Identify the limitations and weakness of an existing LCA study. 3. Develop customized inventory dataset using information available in literature and current inventory databases. 4. Develop a simplified yet functional LCA software tool tailored for an enterprise or organization. 5. Combine LCA results with economic and social impact analysis to support decision making. Credits: 3.00

EEE 54400 - Environmental Organic Chemistry

Credit Hours: 3.00. (AGRY 54400) The fundamental properties and processes responsible for the fate of organic chemicals in the environment, with emphasis on soil and water chemistry. Areas to be addressed will include both conceptual and theoretical aspects of processes relevant to environmental fate of contaminants; measurement, estimation, correlation, and application of the parameters most commonly used to assess various chemodynamic properties in soil-water systems.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in surface and subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-base speciation and reactivity. 3. Quantify chemical distribution between soil-water, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 3.00

EEE 55000 - Physico-Chemical Processes In Environmental Engineering I

Credit Hours: 3.00. Theory and principles of design for processes used in environmental engineering, with emphasis on water and wastewater treatment. Processes include: coagulation, flocculation, sedimentation, centrifugation, filtration, disinfection, adsorption, and gas/liquid transfer.

Learning Outcomes: 1. Learn fundamental principles of physico/chemical processes that are commonly used by Environmental Engineers with an emphasis on water treatment. 2. Understand principles that have a broad application in Environmental Engineering and other disciplines. 3. Focus on fundamental concepts so as to prompt application in a wide range of settings and to promote creativity. Credits: 3.00

EEE 55201 - Environmental Biotechnology

Credit Hours: 3.00. This course focuses on fundamentals of molecular biology and biotechnology for environmental applications. The major topics include activated sludge processes, stoichiometry, kinetics, anaerobic digestion, biological nitrogen and phosphorus removal, emerging contaminants, molecular microbiology tools, biofouling, antibiotic resistance, and biofuels.

Learning Outcomes: 1. Understand the latest development in environmental biotechnology and their applications in contaminant removal and public health protection. 2. Critically review relevant literature on selected topics in environmental biotechnology and identify areas for improvement. 3. Deliver effective presentations. 4. Write clearly and ethically. Credits: 3.00

EEE 55401 - Water Chemistry For Environmental And Ecological Engineering

Credit Hours: 3.00. Principles of chemistry applied to the analysis and distribution of the chemical composition of natural waters and engineered water systems. Course topics include acid/base, complexation, precipitation/dissolution, sorption and redox reactions in the context of environmental and ecological engineering. Case studies focus on water chemistry in research and practice, such as lead in drinking water, recovery of valuable products from wastewater, chemistry of engineered carbon dioxide capture, and engineered treatment of surface waters. Case studies vary each year.

Learning Outcomes: 1. Describe the unique properties of water, and the relevance to natural and engineered systems. 2. Explain fundamental principles of chemical equilibrium and kinetics, and apply principles to calculations and solving contemporary challenges in water chemistry systems. 3. Classify chemical reactions and mass transfer, and deduce which categories are present in a particular system. 4. Evaluate and formulate technological approaches to reduce environmental impacts of anthropogenic activities, based on water chemistry principles. Credits: 3.00

EEE 56000 - Environmental And Ecological Engineering In-Context

Credit Hours: 0.50 to 3.00. An introduction to current challenges and issues in Environmental and Ecological Engineering (EEE) applications. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes current events, emerging challenges, adaptations to new regulations, innovative environmental and ecological engineering processes, life-cycle impacts of manufactured products, and sustainable management of industrial waste streams.

Learning Outcomes: 1. Design experiments and evaluate experimental data, error and variability. 2. Understand environmental systems and processes. 3. Communicate professionally to the public about complex technical issues. 4. Develop management strategies for environmental problems. Credits: 1.00 to 3.00

EEE 57000 - Solid And Hazardous Waste Management

Credit Hours: 3.00. Students will be introduced to the regulation of solid and hazardous wastes; engineering design, planning and analysis of solid and hazardous waste management facilities.

Learning Outcomes: 1. Solve basic problems related to pollutant generation, waste collection and composition, recycling, and thermal conversion processes. 2. Apply knowledge of topics from chemistry such as stoichiometry, kinetics, and equilibrium to gas generation, and waste composition. 3. Understand the role of an engineer involving regulations, ethics, professionalism, engineering practice and

registration. 4. Demonstrate an ability to communicate effectively. 5. Solve environmental and public health problems associated with man-made and natural disasters. Credits: 3.00

EEE 59500 - Environmental And Ecological Engineering Projects

Credit Hours: 0.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 59800 - Environmental And Ecological Engineering Projects

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 69000 - Environmental And Ecological Engineering Graduate Seminar

Credit Hours: 0.00. Combination of invited speakers (outside and inside Purdue) including graduate students. Topics will range across environmental and ecological engineering with an emphasis on current topics.

Learning Outcomes: 1. Increased understanding of academic and research topics in Environmental and Ecological Engineering (EEE). 2. Improve ability of EEE graduate students to think critically about research and presentation skills of others. 3. Increased ability to critique his or her own work. Credits: 0.00

EEE 69199 - Professional Practice Graduate Co-Op I

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Understand of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69299 - Professional Practice Graduate Co-Op II

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69399 - Professional Practice Graduate Co-Op III

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69500 - Experimental Courses

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 69699 - Professional Practice Internship

Credit Hours: 0.00. One-session professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance

skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Learning objectives vary per student. Credits: 1.00 to 18.00

EEE 69900 - Research PhD Dissertation

Credit Hours: 1.00 to 18.00. Research PhD Dissertation. Permission of instructor required.

Learning Outcomes: 1. Learning objectives are student dependent. Credits: 1.00 to 18.00

Film and Video

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

FLM 29100 - Special Topics In Film/Video Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Objectives vary per topic. Credits: 1.00 to 4.00

FLM 29102 - Special Topics In Live Production

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29105 - Special Topics In Screenwriting

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29106 - Special Topics In Cinematography

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29107 - Special Topics In Editing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 32100 - Live Production I: Theater/Music/Arts

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as narrative development.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 32200 - Live Production I: Fall/Winter Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and

equipment as well as the art and storytelling of the craft. Potential Men's and Women's Fall/Winter sports include Cross Country, Soccer, Volleyball, Football, Swimming & Diving, Wrestling, Basketball, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 32300 - Live Production I: Winter/Spring Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Winter/Spring sports include Swimming & Diving, Wrestling, Basketball, Baseball, Softball, Tennis, Golf, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 33000 - International Cinema

Credit Hours: 3.00. This course is designed to develop students' seeing, reading, speaking, writing, and critical thinking skills, and especially to improve visual competency, awareness of visual culture, and knowledge of selected international cinema. All films will be shown with English subtitles.

Learning Outcomes: 1. Explain and assess different ways of seeing as an introduction to understanding visual theory. 2. Demonstrate understanding of the concepts and techniques of cinematography, processing, and reading images and film. 3. Recognize, select, and justify choices for seeing and interpreting the visual. 4. Identify and analyze culturally conditioned references. Credits: 3.00

FLM 35100 - Screenwriting

Credit Hours: 3.00. Students will gain a working knowledge of basic narrative elements and how these elements work to form a story. Writing and re-writing a three-act outline and an original screenplay will give you an understanding of script language and process.

Learning Outcomes: 1. Identify Aristotelian Three-Act Structure as applied to the screenplay. 2. Develop a specific technique of writing based on the course teachings. 4. Critique the work of self and others, including proper and professional screenplay formatting. 5. Determine methods to assess success or failure of writer's intent. Credits: 3.00

FLM 36100 - Cinematography

Credit Hours: 3.00. This intermediate course in Cinematography will further prepare the student to use the technology of the camera as a basis for the art and visual storytelling of motion pictures. The student will also receive the basic background needed for understanding the skills and processes of a single camera production environment.

Learning Outcomes: 1. Discuss production techniques in film and video using the vocabulary of the industry. 2. Explore the production process for single camera environments. 3. Demonstrate an understanding of basic shot types and execute examples of these shots. 4. Demonstrate an understanding of the technology of capturing the moving image. 5. Identify career options and job types within film and video production. Credits: 3.00

FLM 37100 - Editing I

Credit Hours: 3.00. The course introduces students to the principles of film and video editing. Projects, discussions, demonstrations, and hands-on exercises expose students to the technical and artistic aspects of the editing process.

Learning Outcomes: 1. Summarize the basic concepts involved in the editing process. 2. Compare and contrast historical and modern approaches to film and video editing. 3. Develop proficiency with industry standard software. 4. Execute an example of the editing process under strict time constraints. Credits: 3.00

FLM 37200 - Editing II

Credit Hours: 3.00. This course instructs students in advanced principles of film and video editing and color grading. Projects, discussions, demonstrations, and hands-on exercises expose students to the technical and artistic aspects of the editing

process.

Learning Outcomes: 1. Develop an increased understanding of the art, technique, and philosophies of the editing process 2. Examine the concepts involved in the color grading process and visual effects. 3. Demonstrate techniques for basic color grading and visual effects. 4. Develop further proficiency with industry standard software. Credits: 3.00

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

FLM 42200 - Live Production II: Fall/Winter Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of Producing and Directing live sports video and television. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Fall/Winter sports include Cross Country, Soccer, Volleyball, Football, Swimming & Diving, Wrestling, Basketball, or Track & Field. Permission of instructor required.

Learning Outcomes: 1. Identify career options and job types within live event production. 2. Operate the core components of a live video system, including a switcher, replay system, and advanced broadcast graphics. 3. Create examples of visual storytelling using live, multi-camera, production techniques. Credits: 1.00 to 4.00

FLM 42300 - Live Production II: Winter/Spring Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of Producing and Directing live sports video and television. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Winter/Spring sports include Swimming & Diving, Wrestling, Basketball, Baseball, Softball, Tennis, Golf, or Track & Field. Permission of instructor required.

Learning Outcomes: 1. Identify career options and job types within live event production. 2. Operate the core components of a live video system, including a switcher, replay system, and advanced broadcast graphics. 3. Create examples of visual storytelling using live, multi-camera, production techniques. Credits: 1.00 to 4.00

FLM 44200 - Directing The Narrative Short Film

Credit Hours: 3.00. Students will gain knowledge of all phases of film production in the course of completing multiple short films. This class will emulate standard film industry practices and guidelines.

Learning Outcomes: 1. Summarize the overall film production process. 2. Create examples of each stage of the production process. 3. Construct multiple complete films, in the roles of Director and/or Assistant Director, using professional and industry standard techniques based upon the production process. 4. Evaluate completed films for content and technique. Credits: 3.00

FLM 44600 - Producing Non-Fiction Video

Credit Hours: 3.00. This advanced course builds on previous knowledge and exposes students to the role of an independent video producer. By working with real-world clients on real-world projects, students will gain valuable experience in guiding productions from start to finish. Additionally, students will learn basic fundamentals of entrepreneurship and business skills designed to begin to prepare students to form their own video production business.

Learning Outcomes: 1. Summarize an understanding of the art, technique, philosophies, and business of the video production. 2. Construct budgets and business plans. 3. Organize, plan, and create video productions simulating professional processes and techniques. 4. Develop and produce multiple unique projects by working closely with real-world clients. Credits: 3.00

FLM 49100 - Special Topics In Film/Video Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Varies due to nature of course. Credits: 1.00 to 4.00

FLM 49102 - Special Topics In Live Production

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49105 - Special Topics In Screenwriting

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49106 - Special Topics In Cinematography

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49107 - Special Topics In Editing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49900 - Capstone In Film/Video/Media Production

Credit Hours: 2.00 or 4.00. The Capstone in Film/Video/Media Production is intended to be the culminating experience of the Film/Video Studies or Film/Video and Theatre Production major. Each student Students will create a project of their own design. Students will pitch their project ideas to the program director and/or faculty and should develop a project based around their future career goals. Example areas include narrative/fiction cinema, documentary/non-fiction filmmaking, television production, live event production, etc. Students will fulfill the role of Writer/Producer/Director for their project (and potentially Director of Photography, Editor, etc.). This creative work will culminate in a presentation to an audience. Permission of instructor required.

Learning Outcomes: 1. Develop a complete and significant project idea/vision/creative work. 2. Plan out the execution of the creative work. 3. Assemble a team with which to craft the developed vision. 4. Complete the work to a professional level of quality. 5. Present the work to an audience with a Q&A session. Credits: 2.00 or 4.00

Food Science

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

FS 16200 - Introduction To Food Processing

Credit Hours: 1.00. Application of introductory food science principles (e.g., food chemistry, food microbiology, and unit operations) to food processing; emphasis will be placed on food formulation, pilot-scale process design, and resulting food quality. May require class trips.

Credits: 1.00

FS 16300 - Introduction To Fermentation Sciences

Credit Hours: 3.00. This course will provide an overview of the use of microorganisms in the food, pharmaceutical and chemical industries. The course will introduce fundamental concepts associated to the microbiological transformation of various substrates to produce desirable products such as foods, beverages, pharmaceuticals or chemical compounds. As an introductory course, the scientific principles of fermentation processes will be gradually introduced through the analysis of familiar fermented food products, such as bread, cheese, beer, wine, cocoa, coffee, etc. Once the fundamental concepts are learned, examples of advanced fermentation technology for production of pharmaceutical products and fine chemicals will be presented.

Learning Outcomes: 1. Explain the role of microorganisms in the transformation of various substrates into desirable products. 2. Identify

the type of microorganism (bacteria, yeast or mold) involved in the production of various fermented foods and beverages. 3. Explain the impact of environmental processing conditions (T, pH, aw, O2) on microbial growth. 4. Recognize the similarities across a wide variety of products made through fermentation. Credits: 3.00

FS 24500 - Food Packaging

Credit Hours: 1.00. Elements of packaging science and technology applied to preservation, distribution, and marketing of food products; packaging materials; principles of diffusion and permeability; procedures for developing, evaluating, and testing food packages; packaging requirements for specific types of foods; other special topics of current interest.

Learning Outcomes: 1. Appreciate the important role that packaging plays in today's sophisticated food processing operations, its effect on final product quality and self-life, and its influence on distribution methods and marketing related decisions. 2. Understand the basic packaging materials and the technology to produce food packages. 3. Understand basic concepts of diffusion, permeation, and migration, especially as they relate to package properties, food quality, and product shelf-life. 4. Develop general guidelines for selecting appropriate packaging materials to fit the needs of specific food products. 5. Have a general appreciation of the methods used to test and evaluate packaging materials for specific properties and whole containers for integrity, suitability, and overall performance. 6. Intelligently discuss current food packaging related topics (i.e. package degradability/recyclability, tamper evident/proof packaging, modified atmosphere packaging, aseptic packaging, microwaveable packaging, etc.) Credits: 1.00

FS 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by instructor and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

FS 29100 - Special Assignments

Credit Hours: 1.00 to 3.00. Open to primarily freshmen and sophomores who desire to study special problems in science not covered in regular coursework. May be repeated for credit with instructor permission. Permission of instructor required.

Credits: 1.00 to 3.00

FS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29800 - Sophomore Seminar

Credit Hours: 1.00. Current food science issues will be discussed by students, staff, and guest speakers. Career planning and improvement of communication skills will be emphasized.

Learning Outcomes: 1. Construct a professional resume that includes educational background and experience. 2. Construct a professional cover letter in reference to a job posting. 3. Demonstrate the ability to professionally answer interview questions in an interview setting. 4. Demonstrate the ability to present information with PowerPoint software. 5. Identify your Myers Briggs personality profile. 6. Explore some current issues in the food industry. 7. Plan your coursework for each semester through graduation. Credits: 1.00

FS 34000 - Introduction To Food Law And Regulations

Credit Hours: 1.00. This course will cover basic knowledge and familiarity of the principal law and regulations governing raw and processed foods. Class meets during weeks 1-5.

Learning Outcomes: 1. To gain a basic knowledge and familiarity of the principal laws and regulations governing raw and processed foods. 2. To develop an understanding of the law's core - adulteration and misbranding. 3. To learn basic food labeling and health claim regulations. 4. To obtain a working knowledge of US food law and promulgated regulations, current issues concerning food regulations, and how to obtain further information for specific regulatory problems. Credits: 1.00

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.

Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3. Identify the conditions under which important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 34200 - Food Processing I Laboratory

Credit Hours: 1.00. This laboratory course applies food engineering principles and thermal processing methods for production of safe and high-quality foods. The course will include applications of mathematics and physics principles in food processing operations, engineering problem-solving exercises and laboratory demonstrations. Engineering concepts such as heat transfer, fluid flow, mass and energy balances applied to various food systems will be a major portion of this laboratory.

Learning Outcomes: 1. Apply mathematical principles to food processing application. 2. Demonstrate an understanding of energy, heat transfer and fluid flow principles. 3. Apply engineering principles to thermal processing of foods. 4. Identify conditions under which microorganisms are commonly inactivated, killed, or made harmless in foods including pasteurization, sterilization, and aseptic processing. 5. Demonstrate use mass and energy balances for a food process. Credits: 1.00

FS 36100 - Food Plant Sanitation

Credit Hours: 1.00. Relation of food-plant sanitation to good manufacturing practices and regulations affecting sanitation; organization of a food-plant sanitation program; sanitary building and equipment construction; selection of cleaning, sanitizing, and pesticidal compounds; water, air, and waste treatment; food storage and transportation.

Credits: 1.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 36300 - Food Microbiology Laboratory

Credit Hours: 2.00. Classic and molecular methods for enumerating, isolating, and identifying spoilage, fermentative, and pathogenic food microorganisms in food systems.

Learning Outcomes: 1. Perform proper aseptic technique. 2. Sample foods for microbial analyses. 3. Test food products for common microorganism. 4. Interpret data obtained from microbiological analysis. 4. Understand basic molecular techniques used to identify foodborne pathogens. Credits: 2.00

FS 37200 - Fermentation Microbiology

Credit Hours: 3.00. This course explores the principles underlying the design of microbes for their use in biotechnological applications. This project-based course will teach students fundamental molecular biology techniques, important parameters for strain selection and genetic engineering, and reactor design and operation in bioprocessing. Additionally, this course will cover today's diverse bioengineering goals and tools and the role of microbial biotechnology in society.

Learning Outcomes: 1. Articulate the concept of microbial cell factories and the relationship of microorganisms to food and industrial fermentations. 2. Identify genetic and environmental approaches to control the products, rate, and yield of bioconversion. 3. Understand microbial metabolic pathways and how they are engineered. 4. Design genetic strategies to engineer microbes. 5. Read primary literature relevant to fermentation biotechnology. Credits: 3.00

FS 37300 - Fermentation Microbiology Laboratory

Credit Hours: 1.00. The course provides a laboratory-based experiential learning experience with the learning of fundamental aspects of genetic, physiological and substrate manipulation to achieve product formation in industrial microbes.

Learning Outcomes: 1. Understand the genetic manipulation and physiological factors involved in successful fermentation approaches. 2. Apply various methods of monitoring growth of various bioreactor formats. 3. Manipulate and correlate growth with yield of organisms and products. 4. Identify the basic problems which cause fermentation processes to fail and understand the reasons for failure. 5. Create and troubleshoot a simple fermentation process. Credits: 1.00

FS 38000 - Fermented Food Products

Credit Hours: 1.00. This course will allow students to learn and integrate concepts from microbiology, biochemistry, and processing used in the production of representative fermented food products. Students will learn how to design and make specific fermented foods.

Learning Outcomes: 1. Explain the role of specific microorganisms (lactic acid bacteria, yeasts) in the transformation of specific substrates into fermented food products. 2. Explain the chemical and biochemical changes whereby specific substrates are converted into fermented foods. 3. Understand the interdisciplinary nature of fermentative processes by integrating food safety, nutrition, microbiology, economic, and regulatory considerations in process design. 4. Design a laboratory scale process to produce a fermented food product of their choice. Credits: 1.00

FS 38100 - Industrial Fermentation Products

Credit Hours: 1.00. Industrial Fermentation Products introduces students to microbial fermentations employed in the biofuels and fine chemicals industry and their role in the larger bioeconomy. Students will be introduced to diverse final products, technical challenges in the sector, and the individuals and companies working to solve them. We end our five-week module with a field trip to a local biorefinery plant.

Learning Outcomes: 1. Identify the key products of industrial fermentations and their markets. 2. Articulate the major technical and economic challenges facing the industrial fermentations sector. 3. Research and understand fermentation production processes for a specific molecule of interest. 4. Interact with fermentation scientists in the biofuels, biochemicals, and polymers sector. Credits: 1.00

FS 38300 - Fermented Beverage Products

Credit Hours: 1.00. This course will allow students to learn and integrate concepts from microbiology, biochemistry, and processing used in the production of representative fermented beverages. Students will learn how to design and make specific fermented beverages. Must be 21 years of age or older. Permission of department required.

Learning Outcomes: 1. Explain the role of specific microorganisms (lactic acid bacteria, yeasts) in the transformation of specific substrates into fermented beverages. 2. Explain the chemical and biochemical changes whereby specific substrates are converted into fermented beverages. 3. Understand the interdisciplinary nature of fermentative processes by integrating food safety, nutrition, microbiology, economic, and regulatory considerations in process design. 4. Design a laboratory scale process to produce a fermented beverage of their choice. Credits: 1.00

FS 39000 - Food Science Cooperative Work Experience

Credit Hours: 0.00. Supervised professional experiences in the food science industry. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of department required.

Credits: 0.00

FS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 40000 - Food Science Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned

through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

FS 40100 - Fermentation Processing

Credit Hours: 2.00. The Integration of fermentation core concepts; the application of bioprocess engineering principles to biological systems; topics covering enzyme kinetics, fermentation, downstream processing, and integrated bioprocesses important to industries.

Learning Outcomes: 1. Understand applications and solve problems relating to the use of enzymes for industrial bioprocessing. 2. Apply engineering principles to address issues in fermentation processes. 3. Analyze and identify limiting factors in a bioprocess. 4. Explain and solve problems relating to mass and energy balances in biological reactors. 5. Explain how fermentation processing is used in various fields. Credits: 2.00

FS 40200 - Fermentation Processing Laboratory

Credit Hours: 1.00. The essential concepts of industrial bioprocessing with a focus on the physiology of fermentation; a series of laboratory experiments that follow value-adding processes from conception to completion.

Learning Outcomes: 1. Learn laboratory techniques, to design and conduct experiments, and to analyze and interpret data. 2. Design appropriate bioreactor models based upon bioproducts and other process criteria. 3. Conduct fermentation experiments with process optimization and scale-up. 4. Model the growth of microorganisms in batch, fed-batch, and continuous flow processes. 5. Gain an overview of the fermentation industry. Credits: 1.00

FS 43500 - Sensory Science

Credit Hours: 1.00. Introduction to the fundamental concepts and practices of sensory analysis of food products. Technical aspects of planning and conducting human sensory panels on food products including analysis and interpretation of collected data. Course meets weeks 1-8.

Learning Outcomes: 1. Solve typical sensory problems occurring in the food industry. 2. Conduct sensory testes, analyze and interpret the results. 3. Write a report and executive summary of the findings. Credits: 1.00

FS 44200 - Food Processing II

Credit Hours: 2.00. Study of food processing and preservation methods based on the integrated knowledge of microbiology, chemistry, and food engineering; emphasis will be on temperature reduction, water activity, concentration, dehydration, irradiation, and extrusion.

Learning Outcomes: 1. Have sufficient knowledge of food chemistry to control reactions in foods. 2. Understand the major chemical reactions that limit shelf-life of foods. 3. Identify the conditions under which the important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Understand the principles involving food preservation via fermentation processes. 5. Be able to identify the conditions, including sanitation practices under which the important pathogens and spoilage microorganisms are commonly inactivated, killed, or made harmless in foods. 6. Explain the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage. 7. Understand the principles that make a food product safe for consumption. 8. Be able to use mass and energy balances for a given food process. 9. Explain the unit operation required to produce a given food product. 10.Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality. 11.Be able to apply and incorporate the principles of food science in practical, real-world situations. 12.Define a problem, identify causes and possible solutions, and make thoughtful recommendations. 13.Work effectively on a team project. Credits: 2.00

FS 44300 - Food Product Design (Capstone)

Credit Hours: 3.00. Teams develop a new product from concept through marketing. Final case study defense is presented to faculty and peers. Classes include guest lectures from the food industry.

Learning Outcomes: 1. Apply fundamental aspects of food chemistry, microbiology, food safety, nutrition, processing and packaging in the design and develop a new product from

market concepts to practical prototype. 2. Apply knowledge food ingredient sourcing and functionality to the product development process. 3. Understand the basics of project management in the context of group projects. 4. Develop insight into bench top to pilot scale prototyping of food products. 5. Apply statistical principles through process control, experimental design and assessment of experimental data. 6. Have an appreciation for factors impacting product shelf-life and methods to control spoilage. 7. Intelligently discuss current topics in food science and trends that impact the food industry. Credits: 3.00

FS 44400 - Statistical Process Control

Credit Hours: 1.00. Basic concepts and techniques of solving quality problems and assuring the quality of production processes; emphasis is on quality improvement programs, problem-solving tools, control charts for variables and attributes, process capability analysis, and sampling methods. Course meets during weeks 6-10.

Credits: 1.00

FS 44700 - Food Processing II Laboratory

Credit Hours: 1.00. This lab is designed to build upon fundamental concepts associated with the preservation and processing of various food products. Concepts to be covered include water activity, dehydration (drum, spray and freeze drying), frying, high pressure, microwave and ohmic heating. The focus of this lab will be hands-on production of various food products and the demonstration of fundamental food processing unit operations and calculations related to each preservation method.

Learning Outcomes: 1. Perform experiments using appropriate food processing unit operations to create various food products. 2. Write a lab report that includes analysis and interpretation of the results. 3. Work on a project team to duplicate a commercial food product and present the finding of the project in an oral and written report. Credits: 1.00

FS 45300 - Food Chemistry

Credit Hours: 3.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Understand the importance of food chemistry and the relationship of food chemistry to other food science areas. 2. Understand the structures and functions of major food components, including water, proteins, carbohydrates, lipids, vitamins, and minerals. 3. Understand major reactions occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 4. Identify the major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 5. Be able to describe types and uses of basic sensory tests. 6. Be able to identify functions of most or all ingredients listed on the ingredient label of a food product. 7. Be able to discuss alternative ingredient choices for food products. 8. Be able to write a scientific abstract using IFT formatting. Credits: 3.00

FS 45400 - Food Chemistry Laboratory

Credit Hours: 1.00. Laboratory to demonstrate application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Performance of the students' progress will be evaluated by 7 lab reports and 3 in-class problem solving activities. Credits: 1.00

FS 45500 - Cereal Chemistry And Processing

Credit Hours: 1.00. Cereal grain structure, chemical and functional properties, and nutritional aspects related to grain milling and processing. Cereal processing covers dry and wet milling, brewing, baked products, pasta, breakfast cereals, snack foods, and traditional cereal foods from other countries. (Offered in even-numbered years.)

Learning Outcomes: 1. To gain a fundamental knowledge and familiarity of the chemistry of cereal grain components and the major cereals processed to consumer products. 2. Have a working knowledge of the relationship between chemical structures, interactions and processing. Credits: 1.00

FS 46700 - Food Analysis

Credit Hours: 3.00. Application of quantitative and qualitative physical, chemical, and instrumental methods of analysis to the examination of food products; evaluation of methods for specific applications.

Learning Outcomes: 1. Describe the principles of the official and rapid methods of analysis for the following food components: moisture, ash, fat, and protein. 2. Select and justify the use of: (for any given food product) a) an official method, and b) a rapid method of analysis for the following food components: moisture, ash, fat, and protein. 3. Describe the principles of the method(s) of analysis for the following food components or properties: individual sugars, starch, total dietary fiber, individual minerals, oxygen demand, texture, color, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional quality, protein functional properties. 4. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy, spectrometry, immune-based assays, enzymatic assays, animal assays. 5. Identify government regulations that dictate industrial standard practices of food analysis. Credits: 3.00

FS 46900 - Food Analysis Laboratory

Credit Hours: 2.00. Practical laboratory applications of food analysis, including relevant calculations using data gathered and interpretation of data. (Intended for upper-division students.)

Learning Outcomes: 1. Demonstrate practical proficiency in a food analysis laboratory, including relevant calculations using data gathered. Credits: 2.00

FS 47000 - Wine Appreciation

Credit Hours: 3.00. A study of wine production and marketing principles with an emphasis upon consumption responsibility. Historical perspectives form the foundations for wine classification systems and traditional serving procedures. Cardinal scale sensory evaluations are conducted in relationship to various food pairings. Must be 21 years of age or older to register for this course. Permission of department required.

Learning Outcomes: 1. Understand the nature of wine - its production, history, uses and related responsibilities. 2. Develop the ability to recognize different classes, types, and origins of wines. 3. Learn proper etiquette and tasting techniques. 4. Gain direct experience, both individually and as part of a team, in adopting these manners and methods. Credits: 3.00

FS 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by instructor and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

FS 48200 - Food Science Senior Seminar

Credit Hours: 1.00. Oral and written reports on selected food science topics.

Credits: 1.00

FS 48300 - Fermentation Capstone

Credit Hours: 3.00. The development of value-added fermentation processes requires a complex blend of technoeconomic and market awareness, resource gathering, strain selection and engineering, reactor optimization and operation, product recovery, and project management skills. Keeping these diverse aspects in balance while managing project timelines is essential to a successful fermentation process - that is, one that is both technically and economically successful. This course is organized to develop your knowledge of the diverse inputs into design of microbial fermentation and your ability to apply concepts learned in prior fermentation classes to the design of a fermentation process, integrating microbiology, chemistry, and processing with basic marketing and business concepts. Students will be organized into project teams for the semester and challenged to design, market, develop, prototype, and scale up a new fermentation. Classes will include guest lectures from experts in the fermentation industry and academia. Project teams will be organized and project leaders selected to manage communication between individual groups and the instructors. Final product concepts will be presented to faculty and peers for evaluation.

Learning Outcomes: 1. Apply and practically integrate fundamental aspect of fermentation microbiology, chemistry, and processing in the design and development of a new value-added

process. 2. Understand and navigate the challenges associated with scaling up a benchtop fermentation process. 3. Apply knowledge of factors impacting fermentation design, productivity, yield, and stability to optimize economic value of a process. 4. Generate an ""elevator speech"" to spur project investment. 5. Manage projects in group contexts. 6. Apply statistical principles in experimental design and assessment of experimental data as it relates to process control and product assessment. 7. Discuss current topics in fermentation science competently. Credits: 3.00

FS 49100 - Special Assignments In Food Science

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who desire to study special problems in science not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 3.00

FS 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For honors students doing independent research. Permission of instructor required.

Credits: 1.00 to 6.00

FS 50200 - Sustainable Food Manufacturing Technologies

Credit Hours: 3.00. This comprehensive course covers the principles and practices fundamental to manufacturing and storage of foods. It provides an in-depth look at common unit operations-mechanical, thermal, mass transfer, and nonthermal-used in commercial food manufacturing to ensure consistent quality, safety, and supply chain sustainability. Students will also learn about by-product and waste handling and processing. Concepts are explored through digital lectures and virtual laboratory sessions.

Learning Outcomes: 1. Describe the unit operations used in food processing and their relationship to food safety, including principles and mechanisms of action. 2. Build and explain process flow diagrams and identify appropriate processing equipment used to manufacture various food products. 3. Apply thermal calculations and perform mass and heat balances to food manufacturing processes. 4. Identify and discuss critical current issues in food processing, emerging technologies, and waste handling/processing. 5. Communicate effectively on critical issues related to food processing. 6. Conduct specific tests to assess product quality and process data (in virtual labs). 7. Perform lab- and pilot-scale basic unit operations (in virtual labs). Credits: 3.00

FS 53000 - Food Ingredient Technology

Credit Hours: 1.00. Identifies functions of ingredients listed on ingredient labels of food products and discusses alternative ingredient choices for food products.

Credits: 1.00

FS 53100 - Science Of Experimental Cuisine

Credit Hours: 3.00. This course brings together culinary arts and the application of food chemistry and ingredient technology principles. Emphasis will be placed on food construction and deconstruction, using common food preparation and molecular gastronomy techniques.

Learning Outcomes: 1. Develop and use the vocabulary of a professional chef. 2. Understand and intelligently discuss how cooking works. 3. Demonstrate practical proficiency in food preparation skills. 4. Understand and experience food from farm to fork. 5. Compare and contrast home, culinary/food service, and large food industry food production practices. 6. Use common food preparation and molecular gastronomy techniques to manipulate the structure of food ingredients and finished food products. 7. Describe the fundamental structure-function relationships of food ingredients and how each of the applied techniques alters the ingredient structure and/or function. 8. Explore and control common food-related reactions/interactions including: emulsification, Maillard browning, caramelization, gelatinization, gelation, denaturation. 9. Exemplify the scientific process and inquiry driven research by designing, implementing, and analyzing experiments related to food construction and deconstruction. 10. Design and create food textures and products by manipulating fundamental structure-function relationships of food

ingredients, and explain the science of how the foods were constructed. Credits: 3.00

FS 53500 - Aseptic Processing Technologies

Credit Hours: 1.00. Overview of aseptic processing and packaging systems; thermal processing and fluid flow in continuous heat exchangers; food microbiology, chemistry, and packaging as applied to aseptic processing. Establishing processes for aseptic processing of liquid and particulate foods.

Learning Outcomes: 1. Describe the chemical reactions that most affect the quality, including how to control and monitor these. 2. Describe the microbiological concerns, and use this knowledge in problem solving. 3. Select appropriate packages and package integrity tests. 4. Understand the heat transfer principles, and calculate thermal processes, lethality flow rate characteristics, and residence time distribution. Credits: 1.00

FS 54100 - Postharvest Technology Of Fruits And Vegetables

Credit Hours: 1.00. (HORT 54100) Theoretical and applied aspects of methods being used for enhancing the quality and shelf life of harvested fruits and vegetables. Factors that affect the longevity of produce and technology used to control these factors and reduce deterioration of produce between harvest and consumption/processing will be emphasized. Meets during weeks 11-15.

Credits: 1.00

FS 55001 - Food Chemistry

Credit Hours: 1.00. Principles and concepts of the effects of heat, light, oxygen, and water activity on chemical reactions and physical events involved in processing, storage, and preparation of food products and their relationships to nutritional quality, organoleptic quality, stability, and safety. Class meets for 5 weeks.

Learning Outcomes: Students are expected to have a working knowledge of the following topics: 1. Structures and functions of major food components, including water, proteins, carbohydrates, and lipids; Major chemical reactions or structural changes occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 2. Major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 3. Examples of the effects of processing on food constituents and end product quality; Basic principles of dispersed systems: colloids, gels, emulsions, foams; Problem solving using basic food chemistry knowledge. Credits: 1.00

FS 55101 - Food Analysis

Credit Hours: 1.00. Principles and applications of chemical, physical, and sensory techniques to analyze foods. Class meets for 5 weeks.

Learning Outcomes: 1. Identify government regulations that dictate industrial standard practices of food analysis. 2. Describe the principles of the official and rapid methods of analysis of the following food components: moisture, ash, fat, protein. 3. For any given food product, select and justify the use of 1) an official, and 2) a rapid method of analysis for the following food components: moisture, ash, fat, protein. 4. Describe the principles of the methods of analysis for the following food components/properties: individual sugars, starch, total dietary fiber, vitamins, individual minerals, oxygen demand, texture, color, sensory evaluation, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional and functional properties. 5. Relate the various analyses discussed in class to quality assurance of specific food products. 6. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy (including mass spectroscopy and MALDI), enzymatic assays, immuno-based assays. Credits: 1.00

FS 55201 - Nutritional Sciences

Credit Hours: 1.00. Study of perspectives on established nutrition knowledge, concepts, and principles pertinent to the field of food science. Contemporary information about diet as it relates to health and safety issues. Controversies regarding nutrients and functional foods. Class meets 5 weeks.

Learning Outcomes: Students will learn about

the scientific principle relevant to: 1. Newly released dietary guideline for Americans 2010, & components in diets and foods. 2. Digestion, absorption and metabolism of macro-nutrients. 3. Digestion, absorption and metabolism of vitamins and minerals frequently used in food processing. 4. Influence of food components on energy balance and body weight management. Credits: 1.00

FS 55301 - Food Microbiology

Credit Hours: 1.00. Principles and applications of the microbiology of foods. Focuses on many of the important conditions that may lead to foodborne illness and food spoilage. Structured in three main sections related to foodborne hazards: 1) identification, 2) control and prevention, and 3) detection. Class meets weeks 1-5.

Learning Outcomes: 1. Identify the major components of food that affect microbial growth. 2. Explain major foodborne pathogens and under what conditions they thrive. 3. Use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 1.00

FS 55401 - Food Processing And Packaging

Credit Hours: 2.00. Covers relevant basic engineering concepts and their applications to solve food processing and packaging problems. Key unit operations and regulations or recommended practices for manufacture of a variety of foods also will be covered. Students work in teams on a project and present their findings to the entire class. Class meets weeks 6-15.

Learning Outcomes: 1. Understand the rationale and principle of operation behind common food processing operations. 2. Identify and explain the unit operations involved in the manufacture of specific food products. 3. Explain how processing parameters will affect quality and safety of processed products. 4. Communicate effectively with food technologists and engineers. Credits: 2.00

FS 55402 - Food Processing

Credit Hours: 1.00. The Food Processing course will present an overview of the basic food engineering concepts and unit operations involved in the manufacture of various food products. Students will be able to understand the food processing literature and to effectively communicate with food technologists and engineers. Topics to be covered include: physical properties of foods, unit operations commonly found in the food industry, and processing equipment. Permission of department required.

Learning Outcomes: 1. Understand the rationale and principle of operation behind common food processing operations. 2. Identify and explain the unit operations involved in the manufacture of specific food products. 3. Explain how processing parameters will affect quality and safety of processed products. 4. Communicate effectively with food technologists and engineers. 5. Work effectively with team members with various backgrounds. Credits: 1.00

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

FS 56000 - Food Science Graduate Cooperative Work Experience

Credit Hours: 0.00. Supervised professional experiences in the food science industry. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of department required.

Learning Outcomes: 1. Think critically, creatively to solve problems in their field of study. Credits: 0.00

FS 56400 - Commercial Food And Beverage Fermentations

Credit Hours: 2.00. This course will provide a study of the

principles and practices of international food and beverage fermentations with emphasis on the microbiology, biochemistry and processing techniques used in commercial fermentations that utilize fruits, vegetables, grains, dairy, and meats. Instructional Format: This is a two-credit lecture that can be linked to a separate optional one credit hour laboratory combination. Students must be 21 years of age with ID check for proof of age. Permission of department required.

Learning Outcomes: 1. To gain a fundamental understanding of the principles and practices of traditional and novel fermentation techniques in the international food and beverage industries. 2. To acquire an advanced scientific knowledge in food microbiology, safety, biochemistry and processing. 3. To gain a learning experience with both production and sensory aspects of applied food and beverage fermentations. Credits: 2.00

FS 56500 - Microbial Foodborne Pathogens

Credit Hours: 3.00. The primary focus is to study the microbial pathogens involved with foodborne diseases. Course emphasis is on molecular and genetic basis of virulence of foodborne pathogens and host-parasite interactions. Topics include incidence and source of pathogens, immune response to infection, virulence factors, and mechanism of pathogenesis of specific infectious and intoxicating foodborne bacteria, mycotoxins, viruses and parasites. Typically offered odd years.

Credits: 3.00

FS 56600 - Microbial Techniques For Food Pathogens

Credit Hours: 2.00. Molecular biology, immunochemistry and tissue culture-based rapid and automated techniques currently used for detection and identification of foodborne pathogens. The techniques include metabolic fingerprinting identification system, enzyme immunoassay and dot blotting, lateral flow assay, polymerase chain reaction, genomic fingerprinting, cytotoxicity assays, and selected biosensor tools. Laboratory experiments are scheduled for four hours, with up to two additional hours of arranged time. Offered in even-numbered years. (Weeks 6-16).

Credits: 2.00

FS 58000 - Food And The Environment

Credit Hours: 1.00. This course is to provide information for students to understand the radical increase in food production and the associated environmental issues it has created. This course gives theoretical coverage of Life Cycle Assessment (LCA) methodology that will assist students in finding ways to evaluate the environmental sustainability of different food systems throughout their entire supply chains at local, national and global levels.

Learning Outcomes: 1. Understand the relationship between the food product life cycle and resource use and emissions generated. 2. Explain the principles of LCA and describe its content and purpose of each analytical step. 3. Interpret and evaluate food LCA studies and understand their strengths, weaknesses and appropriate use. 4. Perform a complete LCA to assess the environmental impact of a food product/system using publicly available data and software. 5. Identify the key factors impacting the environmental sustainability of food systems from farm-to-fork. Credits: 1.00

FS 58100 - Microbial Genomics And Metabolism

Credit Hours: 3.00. Microbial genomics and metabolism will introduce students to how genomes are assembled, how microbial functional predictions are made, and how systems biology techniques are used to query microbial function in diverse ecosystems. Students will participate in activities including classroom lecture, group discussion, reading of primary literature, hands-on computational assignments, exams, and student projects. Basic knowledge of microbiology and molecular biology is expected. Permission of department required.

Learning Outcomes: 1. Run various sequence and genome analysis programs from the command line. 2. Identify the important properties of sequencing technology and genome organization that underlie the genomics of bacteria, archaea, and microbial eukaryotes. 3. Predict gene function using bioinformatic tools and genome properties to annotate and curate microbial genomes. 4. Analyze genomes to predict metabolic pathways and compare related genomes to identify differences in microbial potential function. 5. Present and defend genome-based predictions of organismal metabolism both orally or in scientific writing. Credits: 3.00

FS 58200 - Emerging Food Technologies

Credit Hours: 1.00. This online multi-institutional course provides a broad perspective of innovation as applied to food engineering. The course constitutes weekly presentations from 12 speakers on topics in three thematic areas selected using a student survey (from 18 institutions), aiming to develop a

student-centered course. This course (1) provides a broad perspective of innovation as applied to food engineering; (2) provides a general overview and case studies of current and emerging research areas in food and agricultural engineering and processing by different research groups in the nation; and (3) demonstrates the efforts among food engineers and scientists in the nation to advance engineering knowledge and technologies for the purpose of improving food safety, quality and security, and enhance health benefits of food products through extensive research in focused areas. Permission of department required.

Learning Outcomes: 1. Become familiar with advances in thermal processing of food and biomaterials. 2. Become familiar with advances in nonthermal processing of food and biomaterials. 3. Learn recent developments in understanding and sensing food quality and safety. 4. Apply the insights gained from observing faculty presentations to improve writing and presentation skills. Credits: 1.00

FS 59000 - Special Problems

Credit Hours: 1.00 to 5.00. Specialized study in research laboratories, libraries, or computer laboratories for problems related to food science that are not taught in regular courses. Permission of instructor required.

Credits: 1.00 to 5.00

FS 59100 - Special Topics

Credit Hours: 1.00 to 3.00. Specialized topics not covered in other courses will be offered as one-credit minicourses. Topics, requirements, and credits will be determined yearly. Permission of instructor required.

Credits: 1.00 to 3.00

FS 62000 - Scientific Writing In Food Science

Credit Hours: 2.00. This course covers the essential elements of publishing original research at professional meetings (oral presentations and papers) and in peer-reviewed journals (original research manuscripts). Topics include: ethics in writing, effective reading of the literature, organizing research data, choosing a journal, writing the manuscript (results, materials and methods, introduction, discussion, title, abstract, references), publication process, revising and reviewing, poster presentation, and short oral presentations. Each student will write a paper, prepare a 12-minute oral presentation, and prepare a poster, based on data from his/her graduate research project. Permission of instructor required.

Credits: 2.00

FS 63000 - Carbohydrates

Credit Hours: 3.00. (NUTR 63000) Carbohydrates with an emphasis on those of low molecular weight in foods. Structures, reactions, and properties of mono- and oligosaccharides. Introduction to polysaccharides and food gums. Offered in alternate years. Prerequisite: 6 credit hours in Organic Chemistry. Prerequisite: Nine credits of chemistry.

Credits: 3.00

FS 66000 - Intestinal Microbiology And Immunology

Credit Hours: 1.00. (ANSC 66000) Discussion and critique of recent journal articles related to intestinal microbiology/immunology. The specific areas covered under this forum are: (1) intestinal microbiology, (2) food microbiology as it relates to gastrointestinal diseases, (3) probiotics and prebiotics-related to intestinal health or pathogen control, and (4) mucosal immunity with major emphasis on intestinal immunology.

Learning Outcomes: 1. Demonstrate effective oral and written communication skills. This includes such skills as writing technical reports and making formal presentations. 2. Apply critical thinking skills to new situations including critical evaluation of published papers. 3. Research independently: scientific and nonscientific information and use library resource. Credits: 1.00

FS 68400 - Food Science Seminar

Credit Hours: 1.00. Current topics in food science.

Credits: 1.00

FS 68500 - Food Science Seminar

Credit Hours: 0.00. Observe and critically evaluate presented content and presentation skills of graduate students that are offering seminars. Students will attend seminars during the course time by joining the online content that is simultaneously streamed during the seminar.

Learning Outcomes: 1. Describe science-based problems and technological solutions that are relevant to Food Industry and human nutrition. 2. Gain observational knowledge on valuable presentation practices. Credits: 0.00

FS 69000 - Special Topics In Food Science

Credit Hours: 1.00 to 3.00. Individual study of specialized materials. Permission of instructor required.

Credits: 1.00 to 3.00

FS 69700 - Supervised University Teaching In Food Science

Credit Hours: 1.00. Students assist a faculty member in teaching a food science course to obtain training and experience in various aspects of classroom and laboratory teaching. Permission of instructor required.

Credits: 1.00

FS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

FS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Forestry and Natural Resources

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 15000 - The Nature Of Wild Things

Credit Hours: 1.00. This is the core course for "The Nature of Wild Things" learning community. The course focuses on the majors offered in the Department of Forestry and Natural Resources (FNR), and new student integration into the University and department. This course expands knowledge of academic programs and career options in FNR, and resources available on campus to facilitate student success in the first year. Permission of department required.

Learning Outcomes: 1. Understand the importance of being engaged in FNR as a new student. 2. Be familiar with many of the faculty and some of the staff in FNR. 3. Be familiar with many of the available resources offered by Purdue University, the College of Agriculture, and FNR that facilitate student success in the first year on campus. 4. Understand proper classroom etiquette, and how to conduct oneself appropriately when interacting with faculty, academic advisors, graduate students, upperclassmen, and other members of the campus community. 5. Feel a sense of community with others in his/her cohort. Credits: 1.00

FNR 19800 - Introductory Topics In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 3.00

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political

system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 24000 - Wildlife In America (UCC: STS)

Credit Hours: 3.00. History of the occurrence, exploitation, and management of North America's wildlife resources. Life histories, habitat relationships, and human impacts on selected species. Current conservation practices and future prospects.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify and describe the diversity of North American wildlife and their habitats in order to improve their ecological study and aid in their management and conservation. 2. Describe and explain fundamental concepts and theories in the field of ecology in order to inform different wildlife conservation and management strategies. 3. Compare and contrast the various anthropogenic threats to wildlife in order to synthesize and evaluate their impacts on wildlife. 4. Explain and apply approaches and tools used in wildlife conservation and management in order to address anthropogenic threats to wildlife. 5. Evaluate primary literature in order to analyze the merits and weaknesses of current research in the fields of ecology, conservation, and management as they relate to major wildlife groups. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and

ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 0.00 to 4.00. The class will be used primarily for lower-level undergraduate research projects and for the development of new and/or temporary courses for lower-division students. The course also offered for 0 credit for training opportunities (e.g., first aid for undergraduates attending summer practicum).

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 4.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 30200 - Global Sustainability Issues

Credit Hours: 2.00. This course explores global sustainability issues in natural resources with emphasis on forestry, wood products manufacturing, conservation, water management, energy and their impact on the targeted geographic location (such as Central America, Eastern Europe) and the rest of the world. The purpose of this course is to present students, regardless of their disciplinary background, with an overview of the interdisciplinary aspects of sustainable natural resource management. This colloquium course will examine global sustainable natural resources and related issues (including population, poverty, pollution, climate change, deforestation, invasive species, urbanization, habitat loss, cultural traditions, water management, energy, education, technology, and international collaboration).

Learning Outcomes: 1. Appraise the impact of natural resources in developing and developed economies. 2. Understand the most important factors that threaten natural resources in developing and developed economies. 3. Understand how developments in natural resources in foreign countries relate to similar developments in Indiana and the United States. 4. Comprehend the complexity of global natural resource issues and the role of sustainable natural resource management in sustainable development. Credits: 2.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural

characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

FNR 31300 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (HORT 31110) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in Western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of postharvest food storage and pest management. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 14. Be able to handle multiple tasks and deadline pressures. 15. Be able to work effectively with individuals from diverse cultures. 16. Have strong professional ethics and integrity. 17. Understand the importance of developing leadership skills. 18. Be able to work effectively in teams. 19. Have a working knowledge of SI (metric) units. Credits: 1.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 33350 - Applied Fire Ecology

Credit Hours: 3.00. Fire, either as a natural disturbance or anthropogenically mediated disturbance, has been a feature of almost every major terrestrial ecosystem in North America. In this era of climate change, land management agencies are increasingly using fire both to manage terrestrial ecosystems

and to actively contain wildfire. This class will provide basic understanding to both fire behavior and its ecological impacts on terrestrial ecosystems, focusing on systems common to the Central Hardwood Region. Students will get experience conducting prescribed fire and take Firefighter Type II (FFT2) online training modules, in partial fulfillment of requirements of an Incident Qualification Card (i.e., "red card"). Students will learn how to develop a burn plan for a given property, including assessment of risks, prediction of fire behavior (i.e., BEHAVE model), and estimation of burn effects.

Learning Outcomes: 1. Explain the role of fire in the development of North American ecosystems. 2. Describe fire as a physical and ecological process. 3. Demonstrate the ability to utilize prescribed fire safely. 4. Develop a burn plan to complete a prescribed fire safely and effectively. 5. Evaluate the role of fire as a contemporary management tool. Credits: 3.00

FNR 33800 - Introduction To Silviculture

Credit Hours: 3.00. This course introduces the common silvicultural systems used in North American forests for forestry and wildlife habitat management objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures present theoretical concepts in order to allow students to understand forest management practices, while the recitation portion of this course reviews these concepts in light of wildlife habitat management, biodiversity, and other non-timber resources. The recitation is writing-intensive requiring several reflection papers on assigned readings and a semester-ending term paper on a subject of the student's choosing. Credit cannot be earned for both FNR 33800 and FNR 43900. Permission of department required.

Learning Outcomes: 1. Be familiar with technical silvicultural terminology. 2. Describe the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices affect soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Locate, summarize and evaluate primary and selected secondary literature sources in regards to silvicultural effects on non-timber resources. Credits: 3.00

FNR 34100 - Wildlife Habitat Management

Credit Hours: 3.00. Principles, practices, and justification of the habitat management approach to the manipulation of wildlife populations.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 34800 - Wildlife Investigational Techniques

Credit Hours: 3.00. An introduction to current wildlife research techniques that are used in managing populations and habitats. Laboratory and field exercises are used to gather and analyze data; basic data analysis and written dissemination of results is emphasized.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35100 - Aquatic Sampling Techniques

Credit Hours: 3.00. An introduction to laboratory and field sampling methods in aquaculture, limnology, and fisheries biology. Emphasis will be placed on the proper use of laboratory equipment and sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35110 - Aquatic Sampling Techniques I

Credit Hours: 2.00. This course presents an introduction to field sampling methods used in aquaculture, aquatic ecology, and fisheries biology. The course emphasizes the proper care and

use of field sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with assessing physical habitat, lower trophic levels, and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including basic data analysis and decision-making as it pertains to the sampling and management of aquatic ecosystems. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

FNR 35150 - Aquatic Sampling Techniques II

Credit Hours: 2.00. This course presents an introduction to laboratory and field sampling methods used in aquaculture, limnology, and fisheries biology. The course emphasizes the proper care and use of laboratory equipment and field sampling gears, as well as the analyses and reporting of fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with hatchery and freshwater and marine fish culture systems and assessment of fish health, fish diet and age, physical habitat, water quality and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including data analysis, reporting, and decision-making as it pertains to the sampling and management of fish culture systems and aquatic ecosystems. 3. Advance critical thinking and written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale

problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37100 - Fisheries And Aquatic Sciences Practicum

Credit Hours: 5.00. Specific field instruction in fisheries and aquatic sciences. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Develop knowledge in the principles and techniques associated with sampling and assessing fish populations, aquatic habitats, and lower trophic levels (e.g.. zooplankton. benthic invertebrates, etc.) in stream/river (i.e.. lotic) and pond/lake (i.e.. lentic) ecosystems. 2. Develop practical, hands-on experience in aquatic resource assessment, data analysis, reporting, and decision-making as it pertains to sampling and management of aquatic ecosystems. 3. Sharpen critical thinking, written and oral communication, and

professional skills relative to fisheries and aquatic sciences as they apply to both basic and applied science. Credits: 5.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

FNR 37300 - Wildlife Practicum

Credit Hours: 4.00. Specific field instruction in wildlife science and management. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Able to identify the common birds seen and heard on the campus of Covenant Point and surrounding areas. 2. Able to set up mist nets, remove birds safely from the nets and take down and store the equipment properly. 3. Able to safely handle and measure birds, mark them with leg bands and record appropriate data. 4. Create and maintain a field notebook of their observations and activities during the week. 5. Able to lay out a small mammal trapping grid and properly place traps. 6. Able to remove small mammals from live traps, mark those animals, measure them for identification and release them. 7. Able

to operate a telemetry to receiver to estimate the location of a radio collar via triangulation and use homing technique to find that transmitter. 8. Able to identify bat roosting habitat, use acoustic recorders to detect bats and use software to identify bat species from recorded calls. 9. Able to track small mammals using both spool and line and fluorescent powder techniques. 10. Able to develop a null hypothesis about habitat selection and use a chi square test for independence to accept or reject that null hypothesis. 11. Perform current techniques for sampling herpetofanua and macroinvertebrates. 12. Describe and perform herpetofanual marking techniques. 13. Identify anuran species by call. 14. Identify and dissect larval amphibians. 15. Identify macroinvertebrate species in lentic and lotic habitats. 16. Describe common diseases of amphibians. Credits: 4.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 37700 - Optimize Student Conference Attendance

Credit Hours: 1.00. Participation in this course will formalize the experience of attending a professional conference by training students to optimize their experience. Students will then attend a professional conference with mentoring from the course instructors. Permission of instructor required.

Learning Outcomes: 1. Attend a profession conference. 2. Gained an understanding of how to plan a personal conference schedule and maximize networking opportunities to gain the most out of the experience. 3. Develop critical evaluation skills that allow for assessment of the quality of research and what to expect from a conference presentation based on an abstract. 4. Broaden their understanding of career options available in their chose field and the training and experience necessary to be qualified for those careers. Credits: 1.00

FNR 37800 - Marine Biology Practicum

Credit Hours: 3.00. This course presents students with expanded opportunities to use field techniques to sample and report on marine habitats and organisms. The course emphasizes the proper care and use of field sampling gear and identification of fish and invertebrates samples from exposed shore, lagoon, and estuary habitats. A trip to the coast of either the Atlantic Ocean or Gulf of Mexico is a central component of this course; a course fee is required to cover the expenses of the trip.

Learning Outcomes: 1. Demonstrate enhanced knowledge of the basic principles and techniques associated with sampling organisms in coastal environments. 2. Demonstrate practical knowledge and skills in sampling, handling, identifying, and reporting on marine biological communities characteristic of several costal habitat types. 3. Demonstrate improved

critical thinking, written and oral communication, and professional skills related to marine biology. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

FNR 38500 - Fish Biology And Ecology

Credit Hours: 4.00. Advanced study of the biology and ecology of fishes. In particular, the course covers aspects of the morphology, physiology, development, behavior, evolution, and diversity of fishes throughout the world. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems will be explored. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual, population, community structure, and anthropogenic effects.

Learning Outcomes: 1. Know key primitive fish groups and understand how modern fishes evolved through time. 2. Develop skills in fish taxonomy and scientific nomenclature, including identification of a wide range of fish specimens. 3. Understand fish diversity in terms of morphology, behavior, feeding, reproduction and habitats. 4. Build fish laboratory skills, including fish dissection, data collection and data analysis. 5. Understand the broad ecological roles of fishes in freshwater and marine systems. 6. Understand the principles of fish population dynamics and how populations respond to various biotic and abiotic factors. 7. Develop an understanding of the scientific method and demonstrate the ability to solve. problems, think critically and write scientific reports. Credits: 4.00

FNR 39000 - Cooperative Professional Program

Credit Hours: 0.00. Supervised professional experience in forestry. Programs must be preplanned and conducted under the direction of a forestry faculty coordinator with the cooperation of an employer. Students must submit a summary report. Admission to forestry Co-op program.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00

FNR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry

principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 40000 - Forestry And Natural Resources Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 8.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (AGEC 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the

future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

FNR 41800 - Properties Of Wood Related To Manufacturing

Credit Hours: 3.00. Orthotopic nature of wood, grain, texture, moisture content, shrinking, swelling, specific gravity, machining, thermal properties, electrical properties, elastic properties, strength properties, vibration properties, bending, natural characteristics affecting mechanical properties, effect of manufacturing and service environment on mechanical properties, changing quality of available resources and implications of wood quality changes for manufacturing.

Learning Outcomes: 1. Familiarize the student with the basic physical, mechanical, and working properties of wood and wood composites. 2. Understand the effect of manufacturing and service environment on mechanical properties, changing quality of available resources, and implications of wood quality changes for manufacturing. Credits: 3.00

FNR 41910 - Furniture Product Development And Strength Design

Credit Hours: 3.00. Qualitative and quantitative principles of furniture construction, product development methodology and strength design principles, furniture performance testing, product sustainability and end of life options (LCA, computer-based applications and solutions). Course features laboratory evaluating, furniture joints and furniture structures.

Learning Outcomes: 1. Identify and specify appropriate furniture constructions. 2. Determine whether furniture has adequate strength, stiffness, and durability. 3. Determine whether furniture will meet existing performance standards. 4. Determine product sustainability. Credits: 3.00

FNR 42500 - Secondary Wood Products Manufacturing

Credit Hours: 3.00. Secondary wood products manufacturing; structure of the industry, organization of a furniture factory, raw materials, rough mill, finish mill, assembly, finishing, machinery, wood machining, plant layout, production methods, modern industrial engineering concepts; includes visits to manufacturing operations. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Familiarize the student with the basics of secondary hardwood products manufacturing: organization, raw materials, machinery, plant layout, production methods, machining, finishing, and CNC router operation. Credits: 3.00

FNR 43200 - Human-Wildlife Conflicts

Credit Hours: 3.00. Exploration of conflicts between human interests and wildlife and the regulations policies and legislation used to minimize conflicts. Negative interactions may be real or perceived, economic or aesthetic, social or political, and may pose risks to human health and safety. Emphasis on the causes of conflict and resolutions that seek to balance protection or conservation of wildlife with protection of other public resources and individual property owners. Prior knowledge of college-level general biology and ecology is expected.

Learning Outcomes: 1. Identify common causes of human-wildlife conflicts. 2. Evaluate the impacts of the conflict damage/threat. 3. Prescribe options for resolving the conflict. 4. Measure effectiveness of applied mitigation strategies. Credits: 3.00

FNR 43300 - Grand Challenges In Forest Management

Credit Hours: 3.00. This course will guide students through readings, discussions, and presentations of the grand challenges that face the field of forest management. These topics will vary with each iteration of the class but may include topics such as climate change, invasive species, pressure on forest lands from a growing population, altered disturbance regimes, development of new silvicultural techniques, economic pressure at multiple scales, and shifting public perceptions on the management of forests. Students will examine and discuss these challenges from the vantage points of multiple stakeholders to gain insight into their complexity and importance. Students will read and discuss on average 2-4 research or review articles, book chapters, or other sources per week.

Learning Outcomes: 1. Identify and discuss major challenges facing the field of forest management. 2. Describe how these challenges interact and develop an understanding of how these interactions may result in amplified effects on forests. 3. Understand how these challenges may be viewed from a variety of perspectives by different stakeholders. 4. Identify how forest management may be used to mitigate some of

the effects of these challenges. 5. Organize and present an oral and written case study of a forest management scenario that is linked to multiple challenges discussed in class. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

FNR 44400 - Arboricultural Practices

Credit Hours: 4.00. Course covers a broad spectrum of arboriculture principles and techniques, including pruning, transplanting, fertilization, climbing, rigging, removal, cabling, bracing, lightning protection, hazard tree evaluation, tree appraisal, and street tree inventory.

Learning Outcomes: 1. Recognize and explain the various arboricultural practices that enhance the sustainability of trees in the built environment. 2. Apply essential plant health care practices and arboricultural practices used in the cultivation and management of trees and other woody plants in the built environment including planting, pruning and pest management. Credits: 4.00

FNR 44500 - Urban Forest Issues

Credit Hours: 3.00. This course presents an array of topics germane to the management of trees in the urban environment. This includes the benefits of trees and general tree care, tree appraisal, tree ordinances, tree inventory and management plans, and tree preservation and construction.

Learning Outcomes: 1. Understand sustainable urban & community forestry and why it is important. 2. Recognize the numerous benefits of urban/community forests to society, and the ecosystem services provided. 3. Identify common issues, challenges and pressures which threaten the urban forest. 4. Recognize the unique features of urban forest systems and how to apply the principles of urban forest management to real-world cases. 5. Acquire an understanding of sustainability as it pertains to urban forests and urban forestry programs in

metropolitan regions, cities, towns, communities and neighborhoods. Credits: 3.00

FNR 44700 - Vertebrate Population Dynamics

Credit Hours: 4.00. Estimation and analysis of populations; computer modeling of sampling methods, population dynamics, population and habitat management. Knowledge of computer programming not required.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 4.00

FNR 45200 - Aquaculture

Credit Hours: 3.00. Historical perspectives and current practices in aquaculture, including production systems, feeds, water quality requirements, and diseases of commercially important species.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45300 - Fish Physiology

Credit Hours: 3.00. Presentation and discussion of physiological mechanisms exhibited by freshwater and marine invertebrates and vertebrates. Primary materials used for class presentation and discussions will be examples from primary research literature. Topics include respiration, osmoregulation, stress physiology, absorption and metabolism of compounds, and hormonal control of selected physiological mechanisms. Offered in odd-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45500 - Fish Ecology

Credit Hours: 3.00. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual and population adaptation, community structure, and anthropogenic effects. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45600 - Fish And Marine Population Dynamics

Credit Hours: 4.00. Theory of population dynamics of animal populations in freshwater and marine environments. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, marine and freshwater invertebrates, sport and commercial fish populations, and aquatic communities. Human resource users and non-users are considered.

Learning Outcomes: 1. Quantitatively assess the status of a fish population and develop considerations for management. 2. Practice and develop critical thinking skills through in-class discussions and a group research project. 3. Learn to interpret the scientific literature through reading of the primary literature. 4. Broaden understanding of fisheries and natural resource management. Credits: 4.00

FNR 45700 - Practical Fisheries Management

Credit Hours: 2.00. Theory and practice of fisheries management, with emphasis on strategies utilized for the management of freshwater and marine fisheries. Course content will include hands-on assessment of fish populations, as well as development of management plans and the setting of appropriate goals and objectives for effective, science-based management.

Learning Outcomes: 1. Develop understanding of the practical management of fisheries. 2.

Compare and contrast a variety of fisheries management techniques with an emphasis on local fisheries. 3. Demonstrate quantitative skills in population modeling and the writing of fisheries management plans. Credits: 2.00

FNR 45800 - Advanced Marine Biology

Credit Hours: 3.00. Focus is placed on the structure and function of major marine ecosystems, including estuarine, mangrove, coastal, coral reef, open ocean, and deep ocean environments. Course content will include rigorous treatment of the biogeochemical processes that support these ecosystems, as well as the biology and ecology of characteristic flora and fauna.

Learning Outcomes: 1. Demonstrate in-depth understanding of the structure and function of key marine ecosystems of the world. 2. Demonstrate thorough understanding of the major groups of organisms characteristic of key marine ecosystems of the world. 3. Demonstrate thorough understanding of the biogeochemical processes that sustain key marine ecosystems and their constituent taxa. 4. Understand major threats to sustainability of key marine ecosystems of the world. 5. Demonstrate improved critical thinking and scientific writing skills. Credits: 3.00

FNR 46000 - International Natural Resources Summer Program

Credit Hours: 3.00. A four-week, intensive program examining the management and conservation of natural resources in Europe and the United States. Jointly taught with faculty and students from the Swedish University of Agricultural Sciences. The program topic and venue change each year, but emphasis is placed on student interaction and internationalization as well as on cross-cultural communication skills within a natural resources framework. Offered in even-numbered years at Purdue University and in odd-numbered years at the Swedish University of Agricultural Sciences in Sweden.

Learning Outcomes: 1. Explain cultural differences in managing natural resources sustainably. 2. Evaluate natural resource use alternatives and policies. 3. Evaluate the sustainability of various landscapes and uses of natural resources. Credits: 3.00

FNR 46500 - History And Role Of Hunting In North American Wildlife Conservation

Credit Hours: 1.00. Introduction to the social, economic and wildlife management importance of hunting and how it relates to North American wildlife conservation. History of hunting and the North American Model of wildlife conservation, contrasted with those of European nations. Students will be required to participate in or observe hunting-related activities outside of class. This exercise is conducted off-campus on local Purdue-maintained properties.

Learning Outcomes: 1. Understand the history and role of hunting in North America. 2. Understand the economic impacts of hunting to wildlife conservation. 3. Examine how hunting influences wildlife management. 4. Examine the relationship of hunter demographics, ethics, public perception, and animal rights issues to hunting. 5. Apply the tenets of the North American Model of Wildlife Conservation to management and conservation challenges. 6. Experience hunting through first-hand activities. 7. Articulate the impacts of hunting to peers and constituents. Credits: 1.00

FNR 46600 - Costa Rica Natural History Study

Credit Hours: 2.00. This course is intended to introduce students to the natural history, ecology, and people of Costa Rica. Our purpose is to explore the region's diversity and contrast it with that of the United States. The course consists of excursions, field lectures, and discussions in a variety of ecosystems throughout the country. We will stay in facilities that allow close observation of a wide variety of Costa Rican fauna and flora.

Learning Outcomes: 1. Identify a wide variety of Costa Rican plants and animals with an appreciation of the biological diversity of the tropics. 2. Describe how conservation research and field implementation are done and appreciate common pitfalls in designing research on targets of conservation interest. 3. Appreciate Costa Rican attitudes and priorities regarding natural resources within a socio-economic framework specific to this society. 4. Weigh the balance between conservation and other priorities in land management, societal goals, and socio-political systems. Credits: 2.00

FNR 47100 - Environmental Sensors And Data

Credit Hours: 1.00. Environmental sensors and the data these devices generate are becoming increasingly central to routine

ecological and environmental science research and monitoring. This course introduces students to the function of a range of environmental sensors, operation of microcontrollers that control these sensors, and application of data produced by these sensors. This class emphasizes a practical approach with hands-on work with programming sensors and analyzing data.

Learning Outcomes: 1. Learn how to apply environmental sensors to research and monitoring efforts. 2. Visualize and model environmental data from sensors available on live streaming data portals. 3. Use embedded microcontrollers to collect data and stream those data to the web. 4. Learn how to problem solve using online resources and discussion forums (including Slack and Stackoverflow). Credits: 1.00

FNR 48410 - Sustainable Wood Products, Furniture Design And Manufacturing

Credit Hours: 3.00. This project-based course explains principles of product development, furniture construction, strength design, performance testing, and product sustainability (life cycle analysis and end-of-life options). The course familiarizes students with methods such as Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), Computer Numerical Control (CNC) router operation, rapid prototyping, and basics of secondary wood products manufacturing, to build an actual product.

Learning Outcomes: 1. Understand Computer Aided Design (CAD). 2. Understand Computer Aided Manufacturing (CAM). 3. Understand CNC router operation. 4. Understand rapid prototyping. 5. Understand the basics of secondary wood products manufacturing. 6. Understand the principles of sustainable product development. Credits: 3.00

FNR 49800 - Special Assignments

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. 2. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

FNR 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Learning Outcomes: 1. Write a research proposal describing a research initiative and explaining the scientific value in conducting the research. 2. Conduct research including forming the project scope, initiating and conducting the research, analyzing data and summarizing the results. 3. Present a summary of the research's findings in either oral or written format. Credits: 1.00 to 6.00

FNR 50600 - Theory And Application Of Natural Resource Extension Programming

Credit Hours: 1.00. This course will provide an opportunity for students to develop and implement extension activities based on their research interests. The course will focus on important natural resources issues, identify common target audiences, provide examples of extension programming, discuss outputs developed from various extension programs, and outline metrics used to evaluate program impact.

Learning Outcomes: 1. Be familiar with the breadth of natural resource extension programs. 2. Create a logic model based on student research and extension interests. 3. Develop a plan that outlines student extension goals. 4. Communicate technical information to non-scientific audiences. Credits: 1.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians,

birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 53500 - Forest Regeneration And Restoration

Credit Hours: 3.00. An overview of the dynamics associated with the regeneration of forestlands in North America. Topics include: seed collection and handling, forest tree nursery operations, seedling quality, managing for environmental stresses, planting operations, early stand management, and natural regeneration. Permission of instructor required. Offered in odd-numbered years.

Learning Outcomes: 1. Apply the following activities common in forest regeneration and restoration projects: artificial and natural regeneration, tree seed, site preparation, seedling quality and assessment, seedling storage and handling, planting operations, vegetation management, managing stresses in the regeneration environment, early stand management, and regeneration planning. Credits: 3.00

FNR 53600 - Ecology Of Disturbance

Credit Hours: 2.00. Advanced lecture- and discussion-based class examining how disturbance shapes the composition and structure of communities and landscapes across major terrestrial biomes. Students will examine and discuss the relationships between disturbance intensity, frequency, and spatial extent and how these characteristics affect ecological processes and ecologically-based management of forest and grassland ecosystems. The class will also examine the synergistic effects of multiple disturbances and the restoration of endemic disturbance regimes in contemporary ecosystems. Course is reading intensive; students will read and discuss on average 3-8 journal articles per week.

Learning Outcomes: 1. Describe how disturbance shapes community composition and structure for several major terrestrial biomes. 2.

Understand how disturbance regulates biological diversity across terrestrial and aquatic ecosystems. 3. Understand the relationship between disturbance intensity, frequency, and spatial extent and how those factors affect management of forest and grassland ecosystems. 4. Describe the synergistic nature of disturbance and identify how disturbance factors interact across a landscape. 5. Describe how contemporary and restored disturbance regimes may facilitate or suppress the spread of invasive species. 6. Understand how management activities can mimic endemic disturbance regimes to promote biodiversity and sustainability. Credits: 2.00

FNR 53601 - Ecology Of Disturbance Practicum

Credit Hours: 1.00. This course is the practicum for FNR 53600 , hence enrollment is contingent upon enrollment in FNR 53600 . Course consists of a one or two-week long field trip to a remote site; prior trips have been taken to the Great Smokey National Park over spring break. Course requires an additional travel fee, depending on location visited.

Learning Outcomes: 1. How disturbance shapes community composition and the distribution of species across landscapes. 2. How alterations to endemic disturbance regimes affect the composition, structure, and function of ecosystems. 3. How interactions between natural disturbance and invasion of exotic species influence forest community development. 4. Management that uses natural disturbance to restore and maintain biotic communities and ecosystems. Credits: 1.00

FNR 54300 - Conservation Biology I

Credit Hours: 3.00. Introduction to conservation biology, including population dynamics and genetic structure of rare organisms. Recovery planning, restoration ecology, environmental policy making, and sustainable developments are considered, as is ethics in conservation of biological diversity. Offered in odd-numbered years. Permission of instructor required.

Learning Outcomes: 1. Read and interpret the scientific literature on conservation of natural resources with an awareness of the current status of what is known about biodiversity, endangered species and ecosystems, biological invasions, and the effects of climate change on natural communities. 2. Explain how conservation research is carried out, and appreciate common pitfalls in designing research for goals of conservation interest. 3. Consider and evaluate the balance between conservation goals and other priorities in land management, societal and economic goals, and socio-political systems. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

FNR 56010 - Digital Data Acquisition Camp - UAS Field Operations

Credit Hours: 1.00. This class is the first course (of four) within the Digital Data Acquisition Camp (DDAC), a 3-week long intensive, in-person program. Students in this course learn best practice approaches concerning UAS operations and mapping missions, with both safety and effective data collection strategies in mind. Piloting, mission planning, and crew resource management fundamentals will have a primary focus in the curriculum. Other key foci will effectively apply core remote sensing, geospatial, and thermographic concepts to UAS workflows. Students learn how to effectively design and implement a safe and effective UAS operation through linking FAA policy toward Standard Operating Procedures, Crew Resource Management, and an overall Safety Management

System. Throughout the course, core geospatial concepts are applied to a UAS data strategy that stresses data collection from start to finish. Where weather conditions allow, the student will gather data using UAS platforms and sensors. Students should already have their FAA Part 107 license before enrolling in the class. Permission from the Department is required.

Learning Outcomes: 1. Identify, define, and relate FAA Part 107 Policies toward UAS data collection approaches. 2. Demonstrate an ability to create a Safety and Crew Resource Management System within a UAS operation effectively. 3. Identify and define best practices in UAS data acquisition in a forested environment. 4. Develop and engage in UAS mapping missions and effectively gather UAS imagery data in a forested environment. Credits: 1.00

FNR 56030 - Digital Data Acquisition Camp - LiDAR Mapping

Credit Hour: 1.00. This class is the third sequential course (of four) within the Digital Data Acquisition Camp, a 3 week-long intensive, in-person program. This class will cover the basic principles of deriving 3D information from LiDAR systems with special attention to acquired point clouds by LiDAR systems onboard UAS over forest environments. The concepts of laser ranging, LiDAR georeferencing, point cloud generation, data structuring, point cloud processing/visualization, and qualitative/quantitative evaluation of derived products will be explained. Theoretical aspects will be emphasized through the analysis of derived products from images of forest stand acquired during both leaf-on and leaf-off conditions. Permission from the Department is required.

Learning Outcomes: 1. Describe the principles of deriving 3D information from LiDAR systems. 2. Demonstrate LiDAR system calibration and describe its impact on derived point clouds. 3. Explain the concept of LiDAR georeferencing using navigation units onboard UAS. 4. Describe and apply the principles of LiDAR point cloud data processing. 5. Design a mission plan for a UAV-LiDAR system and process acquired data for forest inventory. Credits: 1.00

FNR 56040 - Digital Data Acquisition Camp - Sensor Arrays

Credit Hours: 1.00. This class is the last course (of four) within the Digital Data Acquisition Camp, a 3 week-long intensive, in-person program. Students will learn: the operating principles behind common environmental sensors, how to configure and deploy sensors, and practices for cleaning, processing, and analyzing sensor time series data. Learners will gain hands-on experience collecting data with environmental sensors. Students will work with large datasets to learn best practices for quality control. After processing their datasets, students will use common data processing and modeling techniques to extract meaningful information from sensor data streams. This course emphasizes both in situ and remote sensing techniques for analyzing soil, water, and air chemistry and physical properties and forestry and wildlife applications. Permission from the Department is required.

Learning Outcomes: 1. Understand and evaluate different sensor technology platforms and networks. 2. Deploy, calibrate and maintain sensor networks. 3. Process, clean and manage data collected from sensor networks. 4. Analyze simple data streams from sensor networks. Credits: 1.00

FNR 56600 - Digital Natural Resources Capstone

Credit Hours: 1.00 to 6.00. This course is the capstone project for the Digital Natural Resources Masters of Forestry program. The content will include one or more of the following phases of the project: 1) the proposal development, 2) data acquisition, 3) data analysis and synthesis, and/or 4) project presentation and defense. The course may be repeated for credit. Course will be an independently directed course designed for specific students. Permission of instructor is required.

Learning Outcomes: 1. Recognize attributes and objectives that may be addressed with digital tools and technologies. 2. Plan and conduct a data acquisition mission with digital tools and technologies. 3. Clean, proof, and analyze collected data to achieve mission objectives. 4. Archive data in appropriate formats and structures. 5. Synthesize results into both written and oral formats for further decision-making. Credits: 1.00 to 6.00

FNR 56700 - Advanced Mammalogy

Credit Hours: 3.00. The class explores approaches to mammalian research and wildlife management through readings, discussions, field, and laboratory exercises. Topics such as mammalian behavior, ecology, phylogeny, taxonomy, and conservation are emphasized. The intention of this class is to help students who have a sincere interest in mammalian research and management to progress beyond identification in their understanding of mammals.

Learning Outcomes: 1. Understand the diversity

of topics currently being examined using wild mammal populations and communities. 2. Integrate the results of published research into the design and exploration of research topics in which the students are interested. 3. Exhibit improved abilities in critical thinking, writing, and oral communication in discussing mammalian research and management topics. Credits: 3.00

FNR 57000 - Amphibian Ecology And Conservation

Credit Hours: 3.00. This course will address the ecology and conservation of amphibians at the global scale. Lectures will cover diversity and natural history, phylogenetic relationships, basic biology and ecology, and conservation concerns and strategies. Class materials come from a text and primary literature. Labs will focus on important characteristics of species, families and orders of amphibians, including both North American and non-North American species. Class will also discuss and debate conservation issues. Course will include guest lectures, potential field trips or a class project. Permission of department required.

Learning Outcomes: 1. Be familiar with the diversity and natural history of amphibians. 2. Know the basic biology of amphibians. 3. Be familiar with studies of behavior and community ecology. 4. Analyze research critically in amphibian ecology and conservation. 5. Be familiar with the current threats to amphibian populations as well as global conservation efforts. Credits: 3.00

FNR 57100 - Advanced Ornithology

Credit Hours: 3.00. Study of current avian research topics and techniques. Class discussion of recent scientific literature; field and laboratory exercises to illustrate approaches to ornithological research. One weekend field trip is offered. (Offered in even-numbered years.)

Learning Outcomes: 1. Read the scientific literature on birds with a greater awareness of the current status of what is known about birds. 2. Describe how avian research is done and appreciate common pitfalls in designing research on birds. 3. Understand the conservation and management implications of current avian knowledge. Credits: 3.00

FNR 57400 - Big Data, AI, And Forests

Credit Hours: 3.00. This course is focused on introductory big data analysis, artificial intelligence, and associated applications in large-scale forest research. The lecture will cover the challenges we encounter in big data ecological research, and the approaches to overcome these challenges. Real-time forest inventory and wildlife survey data at national and continental levels will be utilized in this course, and actual high-impact research projects will be introduced as case studies to inform students of the state-of-the-art in this subject area. High-performance computing clusters will be utilized for big data analysis. This course is also open to non-forestry majors. We will introduce basic machine learning techniques that are applicable to other subject areas. Guest lectures may cover big data analyses in different fields, internet-of-things, and/or data management and optimization/decimation for collaborative Virtual Reality experiences. The class will be evaluated through a final project, for which students will work independently or in a group setting to develop a 'mini' research manuscript with a title of their own selection. All the groups are encouraged to submit their manuscript for publication at peer-reviewed journals, and those whose manuscripts have passed the initial journal screening will get extra bonus points.

Learning Outcomes: 1. Equip themselves with critical thinking skills to evaluate big-data research topics and their potential alignment with top-tier journals such as Science, Nature, and PNAS. 2. Equip themselves with general problem-solving skills to overcome practical big-data challenges. 3. Equip themselves with a synthetic understanding of the strength and weakness of various big data tools and machine learning algorithms. Credits: 3.00

FNR 58000 - Research Methods For Natural Resource Social Science

Credit Hours: 3.00. This class covers basic elements of research design for social scientists, with an emphasis on issues pertinent to natural resource management. Topics to be covered include the role of theories and paradigms in designing sound research, writing research questions and hypotheses, and the importance of validity and reliability in research design. Qualitative, quantitative, and mixed methods designs are presented and discussed.

Learning Outcomes: 1. Understand fundamental concepts such as theories and paradigms that are essential precursors to designing sound research. 2. Able to articulate clear research questions and testable hypotheses. 3. Differentiate between different research designs and know which are appropriate under which circumstances. 4 Understand overarching

issues such as validity and reliability. 5. Know under which circumstances qualitative, quantitative or mixed methods are appropriate. 6. Demonstrate knowledge of a variety of commonly-used research methods. 7. Articulate basic steps involved in analyzing qualitative and quantitative data. 8. Demonstrate the ability to write a research proposal. Credits: 3.00

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

FNR 58700 - Advanced Spatial Ecology And GIS

Credit Hours: 3.00. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales. The lab will focus on the use and application of these databases that are common in natural resource management settings.

Learning Outcomes: 1. Apply the principles of landscape ecology to the analysis of spatial change in urban, agricultural and forested landscapes for the purposes of natural resource management. 2. Calculate change in landscape patterns using a variety of geospatial tools such as geographic information systems, spatial models, and geostatistics. 3. Prepare reports using the traditional scientific journal article format, on the analysis of landscape-scale change, focusing on problems common to watershed management. 4. Compare and contrast the ways that biodiversity can be calculated using standard indices of organismal diversity. 5. Calculate ecological footprints and evaluate why these vary across geopolitical and/or ecological units. Credits: 3.00

FNR 59000 - Introduction To Teaching In Natural Resources

Credit Hours: 1.00. This applied course introduces topics related to teaching science courses to facilitate and support the success of teaching assistants in Forestry and Natural Resources. Students will read and review assigned readings and then participate in a discussion at a weekly class meeting. Students also will have an opportunity to practice and apply concepts through development and presentation of a lesson plan. Permission of instructor required.

Learning Outcomes: 1. Learn evaluated and applied methods to effectively engage and support diverse student populations in formal and informal classrooms. 2. Develop skills to communicate effectively while teaching natural resource topics. 3. Connect ethical teaching practices to teaching actions. 4. Develop a personal teaching philosophy and an associated formal statement. 5. Create materials for a 50 min lecture period lesson plan on a topic of their choice that incorporates concepts from the semester. Credits: 1.00

FNR 59100 - Teaching In Natural Resources Practicum

Credit Hours: 1.00 or 2.00. This practicum course provides students with an opportunity to gain teaching experience in natural resource courses. This course is only open to students that are not being paid as teaching assistants. Permission of Instructor required.

Learning Outcomes: 1. Gain classroom and or laboratory experience teaching, engaging, and supporting students in lecture and/or laboratory classrooms. 2. Improve their communication skills while teaching natural resource topics. Credits: 1.00 or 2.00

FNR 59800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

FNR 64700 - Quantitative Methods For Ecologists

Credit Hours: 3.00. Examines the assumptions and utility of statistical and other data analytic techniques that are encountered commonly or increasingly being used in ecological research. Emphasis is placed on the potential applications of these quantitative methods in an ecological context. Topics include traditional multivariate methods (cluster analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling, correspondence analysis), generalized linear models (logistic Poisson, and ordinal regression and derivatives), randomization methods, information-theoretic model selection and inference, and hierarchical models. An introduction to Bayesian analysis is provided for generalized linear (and mixed) models, with applications to (meta) population and (meta) community ecology. Prerequisite: BIOL 58210 or ENTM 64200 or STAT 51200 , or consent of instructor. Knowledge of linear algebra and experience with R is desirable but not essential.

Learning Outcomes: 1. Determine the appropriate statistical tool to use when confronted with most questions and data types. 2. Be familiar with the assumptions underlying these methods. 3. Have some familiarity with software required to apply the methods. 4. Offer a basic interpretation of results provided. Credits: 3.00

FNR 65000 - Individual-Based Ecology And Modelling

Credit Hours: 3.00. This course will provide graduate students with the opportunity to learn about the techniques and approaches used for individual-based modeling in ecological studies. Students will find relevant supplementary literature and lead class discussions on those topics as well as chapters from the course textbook and present case study examples of existing individual-based models (IBM) to the class. Students will develop individual-based models based on their own research project(s).

Learning Outcomes: 1. Explore the role that individual-based models (IBMs) can play in ecological research. 2. Develop a working knowledge of the nature of IBMs, their strengths, and weaknesses. 3. Become familiar with IBM programming concepts and NetLogo software. 4. Become able to incorporate individual-based modeling in the student's own research. Credits: 3.00

FNR 69100 - Topical Problems In Forestry

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Analyze contemporary challenges in forestry critically; may include habitat loss, climate change, species conservation or management, ecosystem health, analysis methods, or new applying new conservation or management strategies. 2. Develop proficiency in the application of concepts, methods, or analyses related to forestry research. 3. Communicate complex scientific concepts related to forestry through

written reports, presentations, extension/outreach products, or other media formats. Credits: 1.00 to 3.00

FNR 69300 - Topical Problems In Wildlife Biology

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Analyze contemporary challenges in wildlife biology critically; may include habitat loss, climate change, species conservation or management, ecosystem health, analysis methods, or new applying new conservation or management strategies. 2. Develop proficiency in the application of concepts, methods, or analyses related to wildlife research. 3. Communicate complex scientific concepts related to wildlife biology through written reports, presentations, extension/outreach products, or other media formats. Credits: 1.00 to 3.00

FNR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Integrate and synthesize relevant literature, theories, methods from their field of study into a cohesive thesis or manuscript framework that showcases their understanding of existing research and identifying gaps that would benefit from future studies or research. 2. Construct and articulate clear, coherent research objectives, hypotheses, and/or predictions and develop methods that will address these. 3. Conduct research and collect data on thesis topic. Credits: 1.00 to 18.00

FNR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Integrate and synthesize relevant literature, theories, methods from their field of study into a cohesive dissertation or manuscript framework that showcases their understanding of existing research and identifying gaps that would benefit from future studies or research. 2. Construct and articulate clear, coherent research objectives, hypotheses, and/or predictions and develop methods that will address these. 3. Conduct research and collect data on dissertation topic. Credits: 1.00 to 18.00

French

FR 10100 - French Level I (UCC: HUM)

Credit Hours: 3.00. A beginning French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. Permission of department required. CTL:IWL 1901 French Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain and produce biographical information about themselves and others in the French language. 2. Identify necessary information by asking questions about people and things in the French language. 3. Solve a simple survival situation such as ordering food and beverages in the French language. 4. Compose with language by combining learned elements in the French language. Credits: 3.00

FR 10200 - French Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 10100 . CTL:IWL 1902 French Level II

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 10500 - Accelerated Basic French (UCC: HUM)

Credit Hours: 3.00. This is an accelerated beginning-level course designed to develop language proficiency in French. The course will help students progress toward competence in speaking, listening, reading, and writing, as well as toward knowledge of French and Francophone cultures. The course focuses on active language use. Students will interact meaningfully with classmates and develop communicative strategies. Course will be taught in French. Permission of Department required.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify appropriate use of French language in specific contexts by reading French texts. 2. Identify appropriate use of French language in specific contexts by listening to audio recordings and watching

videos of spoken French. 3. Compose French sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken French in the form of dialogues and presentations. Credits: 3.00

FR 11200 - Elementary French Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice to enhance communicative competence. Small group discussions in French on practical topics.

Learning Outcomes: 1. Develop elementary listening skills and improve oral French proficiency. 2. Acquire elementary vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in French. Credits: 1.00

FR 20100 - French Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1903 French Level III

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 20200 - French Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 20100 . CTL:IWL 1904 French Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 20500 - Accelerated Intermediate French (UCC: HUM)

Credit Hours: 3.00. This course is an accelerated intermediate-level course designed to develop language proficiency in French. The course will help students progress toward competence in speaking, listening, reading and writing, as well as toward knowledge of French and Francophone cultures. The course focuses on active language use. Students will interact meaningfully with classmates and develop communicative strategies. Course will be taught in French.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of French language in specific contexts by reading French texts. 2. Identify appropriate use of French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken French in the form of dialogues and presentations. Credits: 3.00

FR 21200 - Intermediate French Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in French on practical topics. Not open to students enrolled in or having credit for FR 30100 or above.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral French proficiency. 2. Acquire intermediate vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in French. Credits: 1.00

FR 22400 - Professional French I

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills will be developed toward use of French for business purposes. Course materials cover daily business dealings as well as national and international trade.

Learning Outcomes: 1. Discuss the main aspects of the French professional world (hierarchy, professional versus personal relationships, etc.). 2. Accomplish simple administrative tasks in French such as give/answer a phone call, make an appointment. 3. Behave appropriately in a French professional context. Credits: 3.00

FR 23000 - French Literature In Translation

Credit Hours: 3.00. Reading and analysis of selected French writers and their works, with particular emphasis on the social, political, and intellectual climate of their times. The course content will change from semester to semester. Knowledge of French not required.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.

Credits: 3.00

FR 28000 - Second-Year French: Special Topics
Credit Hours: 3.00. Selected topics on the civilization, culture, and literature of France. Lectures and readings primarily in English, but knowledge of French at the first-year level necessary.

Credits: 3.00

FR 30100 - French Level V (UCC: HUM)
Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)
Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 31200 - Advanced French Conversation
Credit Hours: 1.00. One credit hour advanced French conversation focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative competence. Discussions in French on various topics. Course may be taken concurrently with FR 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral French proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in French.

Credits: 1.00

FR 32300 - French For Engineering
Credit Hours: 3.00. This course is an intermediate/advanced French course emphasizing vocabulary and structures necessary for communication within the context of the working world. In this course, students will further develop their speaking, listening, reading, and writing abilities through the study of specialized vocabulary from the engineering and technology sciences. Conducted in French.

Learning Outcomes: 1. Understand, explain, and apply a broad range of vocabulary related to engineering and technology. 2. Read, understand, and analyze specific engineering and technical topics in French. 3. Describe particular engineering problems in simple terms.

Credits: 3.00

FR 32400 - Professional French II
Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

FR 33000 - French Cinema (UCC: HUM)
Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 34100 - French Literature I: From The Middle Ages To The Enlightenment
Credit Hours: 3.00. Reading of selected poetry, prose, and theatre of France from the Middle Ages through the Enlightenment in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 34200 - French Literature II: The 19th And 20th Centuries

Credit Hours: 3.00. Reading of selected French poetry, novels, theatre, and short fiction of the 19th and 20th centuries in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 39400 - Special Topics In French Literature

Credit Hours: 3.00. Studies a particular aspect in French literature (e.g., theme, device, character type, motif, place) by reading a varied selection of works of different genres, styles and/or periods. Readings, discussion, and papers in French.

Credits: 3.00

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 39900 - Special Study Abroad Credit In French

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in French earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

FR 40100 - French Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of French speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 40200 - French Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in French. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 41200 - Advanced French Conversation II

Credit Hours: 1.00. This course is designed to help students build advanced listening skills and oral proficiency in French through classroom discussions. Students will be expected to actively participate in classroom discussions, prepare for class, and utilize the target language only. No textbook is needed.

Learning Outcomes: 1. Build French speaking and comprehension skills through classroom discussions. 2. Explain and assess relevant texts and audio materials in the target language. 3. Formulate ideas based on texts and audio materials as expressed in written and oral French. Credits: 1.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 44300 - Introduction To Francophone Literature

Credit Hours: 3.00. The study of the most representative Francophone poets, playwrights, and novelists from various countries, such as Leopold Senghor, Aime Cesaire, Jacques Romain, Gabrielle Roy, Michel Tremblay, Mohamed Dib.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 49100 - Special Topics In French

Credit Hours: 1.00 to 4.00. This course will be offered as a guided reading or independent study course on a topic of mutual interest in French or Francophone literature, culture, film, or linguistics, to the student and faculty. Permission of instructor required.

Learning Outcomes: 1. Learning objectives will vary due to the nature of the course. Credits: 1.00 to 4.00

FR 51900 - Teaching College French

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of department required.

Credits: 3.00

FR 52700 - Etudes de Style

Credit Hours: 3.00. Study of the expression of affective and artistic values in literary French. Detailed grammatical analyses and study of stylistic procedures. Comparison with English usage. Introduction to explication de texte as an approach to literature. Permission of department required.

Credits: 3.00

FR 54100 - Renaissance French Literature

Credit Hours: 3.00. Major works in verse and prose of the sixteenth century. Marot, du Bellay, Ronsard, Rabelais, Montaigne. Permission of department required.

Credits: 3.00

FR 54900 - French Literature And Film

Credit Hours: 3.00. An examination of the interrelationships of contemporary French literature and film. Discussion of the potential of each medium as an art form, problems of visual transposition of literary works, and extension of literary concepts such as Dadaism and Surrealism into cinema. Permission of department required.

Credits: 3.00

FR 55800 - French Novel Of The Twentieth Century

Credit Hours: 3.00. Consideration of the character, aesthetics, and evolution of the twentieth-century French novel. Readings from such representative novelists as Proust, Gide, Bernanos, Giono, Malraux, Camus, Robbe-Grillet, Saporta. Permission of department required.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

FR 59000 - Directed Reading In French

Credit Hours: 1.00 to 4.00. Directed readings in French. Permission of instructor required.

Credits: 1.00 to 4.00

FR 59400 - Special Topics In French Literature

Credit Hours: 1.00 to 4.00. Special topics in French Literature. Permission of instructor required.

Credits: 1.00 to 4.00

FR 59600 - Special Topics In French Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

FR 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research: the basic concepts and terminology of literary criticism. Required of all MA candidates in French.

Credits: 3.00

FR 65900 - Seminar In French Literature

Credit Hours: 3.00. Advanced study of special subjects. Topics to be announced in advance. Permission of instructor required.

Credits: 3.00

FR 67900 - Seminar In French Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in French linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

FR 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

FR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

General Science

SCI 10000 - Multicultural Leadership Seminar

Credit Hours: 1.00. Exposes students to career opportunities via presentations from corporate and academic representatives; provides an opportunity for minority science students to share concerns and to become aware of existing academic and non-academic support systems on campus. Provides an overview of the significant contributions to the sciences by minority groups; reinforces good study habits for academic success.

Credits: 1.00

SCI 19100 - Part-Time Curricular Practical Training

Credit Hours: 0.00. A part-time scientific work experience for Science majors. This internship experience is intended to complement the student's academic plan of study and help prepare for a future role as a practicing scientist. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job description must be provided to the Dean of Science's office for approval before registration will be permitted. A minimum period of employment is required. Permission of department required.

Credits: 0.00

SCI 19500 - Special Topics In Science

Credit Hours: 0.00 to 3.00. This is a special projects course that will be used for special circumstances with individual study or for experimental courses, pointed toward students who are first- or second-year students.

Credits: 0.00 to 3.00

SCI 20100 - Special Topics: Integrated Science And Engineering Learning Community

Credit Hours: 1.00. This course will expose students to interdisciplinary problems scientists and engineers routinely need to solve. Students will gain an appreciation for working with individuals from diverse disciplines and backgrounds. Participation in hands-on activities is a key component of the course.

Credits: 1.00

SCI 21000 - Teaming Principles

Credit Hours: 1.00. College of Science students will learn the principles and concepts involved in teaming, such as recognizing different learning styles, developing shared goals, addressing conflict, utilizing collaborative problem solving and utilizing strengths of team members. These foundations will allow students to enter collaborative situations, such as lab groups and study sections, fully prepared to maximize the value of their educational experiences as well as develop positive working relationships with their fellow students.

Learning Outcomes: 1. Demonstrate the ability to work on a team. 2. Learn the concepts involved in team building and collaboration, such as leadership, developing shared goals, and utilizing strengths of team members. These foundations will allow students to enter collaborative situations, such as lab groups, study sections and work environments, fully prepared to maximize the value of their educational experiences as well as develop positive working relationships with their fellow students. Credits: 1.00

SCI 29000 - Special Topics In Science

Credit Hours: 3.00. Introductory, integrated science course for engineering and science students. Beginning lectures will cover the basic chemistry of life, the organization of cells. This will be followed by more advanced topics such as photosynthesis. Each topic will emphasize how understanding the biological system requires concepts and tools from other disciplines such as chemistry and physics. Permission of instructor required.

Credits: 3.00

SCI 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29500 - Intercultural Leadership Seminar

Credit Hours: 0.00 to 3.00. This is a special projects course that will be used for special circumstances with individual study or for experimental courses, pointed toward students who are first- or second-year students. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 3.00

SCI 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39500 - Special Topics In Science

Credit Hours: 0.00 to 3.00. This is a special topics course that will be used for special circumstances with individual study or for experimental courses.

Credits: 0.00 to 3.00

SCI 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 49000 - Topics In Science For Undergraduates

Credit Hours: 1.00 to 5.00. Selected interdisciplinary topics. Offered as a scheduled course when appropriate. Also available for supervised reading and reports of an interdisciplinary nature. Permission of instructor required.

Learning Outcomes: 1. Demonstrate the ability to communicate well, both orally and in writing. 2. Demonstrate the ability to work on a team.

Credits: 1.00 to 5.00

General Studies

GS 11900 - Introduction To Academic Programs At Purdue

Credit Hours: 1.00. To provide a comprehensive program describing each of the baccalaureate degree-granting schools at Purdue. The course is designed to assist students in the clarification of their degree objectives. Not open to students who have completed GS 115.

Credits: 1.00

GS 12000 - Summer Beginners Seminar I

Credit Hours: 1.00. Early Start students, as incoming freshmen, will learn the ins and outs of higher education - more specifically of Purdue University - and how to effectively manage their time and create successful personal habits. Whether it is learning the university course management system, understanding the bus routes, or navigating the world of financial aid, this seminar will prepare incoming students for success at Purdue's campus. Additionally, students will go through a series of lectures focused on creating successful habits, including, but not limited to: time management, study skills, cultural awareness, goal setting, and interpersonal communication.

Learning Outcomes: 1. Identify how to utilize extra- and co-curricular campus resources as related to personal and academic success. 2. Compare the unique nuances of the culture of a collegiate environment vs. high school environment. 3. Demonstrate effective communication skills with faculty, staff and peers. 4. Select strategies to aid in increasing their comfort as they navigate the transition between the cultures of a collegiate environment vs. high school environment.

Credits: 1.00

GS 12001 - Summer Beginners Seminar II

Credit Hours: 1.00. This seminar course is designed for students to reflect on the hopes, assumptions, and questions they bring with them as they begin their college experience at Purdue University. The class will support student success by introducing students to campus resources, establishing connections with the campus community, expanding study skills learned during high school, and implementing appropriate time management strategies.

Learning Outcomes: 1. Create and strengthen connections with the Purdue University community. 2. Describe appropriate study skills and time management strategies related to academic success. 3. Outline areas of growth in relation to student development. 4. Identify appropriate campus resources to support timely graduation. Credits: 1.00

GS 17500 - Information Strategies

Credit Hours: 0.00 or 1.00. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Organization and use of electronic and print tools will be explained through discussion, hands-on exercises, and homework assignments.

Credits: 0.00 or 1.00

GS 19501 - Preparing For Your Undergraduate Research Experience

Credit Hours: 1.00. This course is for prospective Purdue undergraduate researchers who are interested in conducting undergraduate research or creative endeavors. Purdue students who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs. Throughout the course, students will develop components for a final application packet to submit to a research team or program they choose.

Learning Outcomes: 1. Identify professional and personal goals sought from an undergraduate research experience. 2. Learn research skills such as assessing literature credibility and compiling a review of the topic important to all fields. 3. Utilize online and in person resources and programs to assist in locating and applying to undergraduate research experiences. 4. Evaluate research programs/projects to determine how they fit within personal and professional goals. 5. Create and submit an application/proposal including a resume and personal statement for research programs/projects. Credits: 1.00

GS 19505 - Introduction Of Research Essentials - Getting Started

Credit Hours: 1.00. This course is for prospective Purdue undergraduate researchers who are within their first two years at Purdue who are interested in conducting undergraduate research or creative endeavors. New Purdue Boilermakers who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs to prepare for a project in the following semester. Throughout the course, students will develop components for a final application packet to submit to a

research team or program they choose while focusing on the transition to college expectations regarding research-related topics. Must be a first-year or second-year student. Permission of instructor required.

Learning Outcomes: 1. Learn about the nature of research and how it can expand your undergraduate experience. 2. Develop a community of first-year and second-year Boilermakers interested in conducting research or creative endeavors. 3. Explore research opportunities available to undergraduate students by connecting with research faculty, professional staff, and active student researchers. 4. Learn research skills important to all disciplines such as accessing and assessing literature, recording research efforts, conducting ethical research, and communicating research. 5. Evaluate research programs/projects to determine how they fit within personal and professional goals. 6. Create and submit an application/proposal including a resume and personal statement for research programs/projects. 7. Present your research interests and an oral presentation. Credits: 1.00

GS 19700 - Purdue Promise First-Year Experience Course

Credit Hours: 1.00. A combined lecture and experiential seminar course for new Purdue Opportunity Awards scholars. The course will focus on the transition issues for these first-year students. Permission of instructor required.

Learning Outcomes: 1. Be introduced to Purdue resources such as MyPurdue, Blackboard, and Purdue University policies. 2. Learn and discuss topics pertaining to becoming a college student/young professional, such as email communication habits, appropriate class demeanor, and how to work best with instructors and advisors. 3. Learn about the available resources at Purdue, such as the Division of Financial Aid, Office of the Dean of Students, Writing Lab, Center for Career Opportunities, Student Wellness Office, etc. via presentations from the respective offices to become more confident in self-efficacy and self-advocacy as college students. Credits: 1.00

GS 19900 - Strategies For A Successful First Year

Credit Hours: 3.00. This course focuses on student adjustment to university life and development skills. Content includes testing to determine skills, attitudes, and interests; group activities to foster student adjustment; and training in computer usage, time management, and University policies. Open to Horizons students only.

Credits: 3.00

GS 20000 - Preparing Tomorrow's Leaders: Purpose And Connection

Credit Hours: 1.00. A one-credit course designed to provide Purdue Promise students with skills and connections to be successful at Purdue and post graduation. This course will provide Purdue Promise students in their second year with a foundation in leadership and career development skills.

Learning Outcomes: 1. Research/write and implement an academic and career plan. 2. Learn about emotional intelligence; thus taking greater responsibility for their own behaviors and learning. 3. Be exposed to and encouraged to Purdue avenues of leadership with the university. 4. Learn about work and internship opportunities. 5. Refine job search skills (resume, cover letters) and register with CCO Express. 6. Continue to explore and make connections with campus multicultural and diversity programs. Credits: 1.00

GS 21000 - Leadership Development Seminar

Credit Hours: 1.00. A one-credit course designed to provide Orientation Programs students with skills and connections to be successful leaders at Purdue and beyond. This course will provide students a foundation in leadership skills. Students must be selected as a Team Supervisor for Orientation Programs, and have permission of instructor, to enter the course.

Learning Outcomes: 1. Explore and identify leadership styles and competencies of successful college students and student leaders. 2. Analyze personal values and leadership styles to understand a student's growth and behavior as a leader. 3. Develop and enhance life skills, self-awareness, and personal strengths to become productive

individuals. 4. Recognize backgrounds and cultures different from their own and identify techniques for interaction. 5. Enhance preparation for the role as a Team Supervisor for Boiler Gold Rush. Credits: 1.00

GS 22000 - Summer Session Special Topics

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of topics that stress interdisciplinary understanding, creative thought, and group discussion. Topics vary by semester. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 6.00

GS 29000 - Study Skills Seminar

Credit Hours: 2.00 or 3.00. Designed to help students improve their college grades by learning to study more efficiently and effectively. Deals with improving study habits, such as time scheduling, attitudes, and specific study skills, such as note-taking, listening, test-taking, memory techniques, and reading skills.

Learning Outcomes: 1. Develop self-regulation skills around learning strategies. 2. Develop critical and creative skills. 3. Learn to apply strategies to other courses. Credits: 2.00 or 3.00

GS 29001 - Academics Success Skills

Credit Hours: 1.00. Designed to help students improve their college grades by learning to study more effectively.

Learning Outcomes: 1. Develop self-regulation skills around learning strategies. 2. Develop study habits and specific study skills. 3. Learn to apply strategies to other courses. Credits: 1.00

GS 29501 - Understanding Your Undergraduate Research Experience I

Credit Hours: 1.00. This course is for Purdue undergraduates who are part of an active research project and/or creative endeavor. Students will hone skills necessary for reflecting on and completing these experiences. During this course, students will utilize their research experience to apply skills including but not limited to: managing time with a research project, communicating research findings, using Purdue Libraries' resources, and providing constructive feedback to peer researchers. Students will deliver elevator pitches on their own research projects and critique pitches from their peers.

Learning Outcomes: 1. Communicate research to various audiences with an oral research elevator pitch and a written research abstract. 2. Provide constructive feedback, interact with peers, and incorporate feedback in your work. 3. Define skills and attributes you have developed and expanded as a result of your involvement in an undergraduate research experience. 4. Develop and expand your network of peer researchers within and across disciplines. 5. Reflect on and apply transferable skills necessary to be a successful undergraduate researcher. Credits: 1.00

GS 39501 - Understanding Your Undergraduate Research Experience II

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build upon the previous course and focus on research data collection, analysis, and communication for current Purdue undergraduate researchers. During this course, students will learn and discuss various forms of data and collection practices. Students will develop their own academic poster to present their research project's data and implications.

Learning Outcomes: 1. Learn about quantitative and qualitative research methods and discuss how to utilize both in a research project. 2. Create and present an academic poster applying data visualization best practices. 3. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

GS 39505 - Research Peer Mentoring Training

Credit Hours: 1.00. This course is for current or past Purdue undergraduate researchers who want to learn how to serve as peer mentors to undergraduate researchers early in their careers. This course will train students on how to create mutually beneficial and productive mentorships. This course will provide research-based best practices for mentoring newer student researchers while developing as a cohort of new research mentors. This course is especially useful for those students who enjoy supporting peer researchers or plan to continue into more formal mentorship roles as a senior undergraduate researcher, graduate student, or research supervisor in academia or industry. Permission of instructor required.

Learning Outcomes: 1. Explore multiple strategies for effective mentoring with case studies, discussions, and readings. 2. Learn how to transition from a researcher to a peer mentor. 3. Create a mentoring philosophy statement and present your philosophy with

peers. 4. Develop preparatory steps for effective mentorship dissolution. Credits: 1.00

GS 40400 - Horizons Advanced Career Preparation

Credit Hours: 1.00. Horizons Advanced Career Preparation is designed to assist students in beginning their transition from college to the workforce or graduate school. The emphasis of the course is placed on self-exploration, career search skills, graduate school preparation, professional conduct, and financial planning.

Learning Outcomes: 1. Understand self-authorship through evaluation of strengths and talents. 2 Navigate a process of personal exploration focused on future career objectives. 3. Develop and refine resume or curriculum vitae. 4. Enhance skills as they relate to ongoing job search or graduate school preparation. 5. Educate navigating a professional setting. 6. Develop financial literacy as it relates to budgeting, loans, and savings. Credits: 1.00

GS 40500 - Advancing Tomorrow's Leaders: Preparing For Employment And Life After College

Credit Hours: 1.00. A one-credit course designed to prepare Purdue Promise students for the next chapter of their professional journey through the reflection of past experiences and the acquisition of new knowledge, expectations, and skills necessary to be successful citizens and employees post-graduation. This course is only for students in the Purdue Promise program. Permission of instructor required.

Learning Outcomes: 1. Identify expectations of post-graduation life. 2. Be informed of benefits, insurance, paycheck, and tax information. 3. Learn how to navigate their new positions and organizations-cultures, co-workers, supervisors, and workplace challenges. 4. Learn how to maintain marketability in the job market. 5. Learn the necessary life skills of living in a new town, with transitions, new financial obligations, and new responsibilities. 6. Reflect upon their college experience and how it has prepared them for their transition out of college. Credits: 1.00

GS 41000 - Advancing Tomorrow's Scholars: Graduate And Professional School Preparation

Credit Hours: 1.00. A one-credit course designed to prepare Purdue Promise students for a smooth transition into graduate or professional school. This course will inform Purdue Promise students of the necessary preparation, required paperwork, and skills needed to be successful in post-baccalaureate education. This course is only for students participating in the Purdue Promise program. Permission of instructor required.

Learning Outcomes: 1. Be informed of graduate school timelines, checklists, and necessary steps to apply. 2. Learn how to select a good graduate program for themselves. 3. Write a personal statement. 4. Learn ways to finance graduate school prior to starting and once in graduate school. 5. Learn the necessary life skills of living in a new town, with new transitions, and new responsibilities. 6. Reflect upon their college experience and how it has prepared them for their transition out of college. Credits: 1.00

GS 49000 - Directed Reading In General Studies

Credit Hours: 1.00 to 4.00. Reading to be done under the direction of the instructor in the particular field of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

GS 49501 - Beyond Undergraduate Research

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build on the previous courses (GS 29501, 39501) and focus on continuing their education in graduate or professional school. During this course, students will learn and discuss the various phases of identifying, selecting, applying to and funding graduate or professional school programs. Students will also gain a deeper comprehension of the qualities and skills that make research mentors effective while developing skills they will need to be successful mentees and peer mentors. Students will conduct research to identify potential programs of interest and develop a statement of purpose.

Learning Outcomes: 1. Categorize graduate or professional school qualities that fit skills and meet professional needs. 2. Identify qualities and skills necessary to act effectively as a research mentor and as a research mentee to a future graduate/professional advisor. 3. Create a statement of purpose to include in graduate/professional school applications. 4. Reflect on and apply transferable skills of an

undergraduate researcher for future success. Credits: 1.00

German

GER 10100 - German Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in German reserved exclusively for students who have had less than two years of German at the ninth-grade level or above. Students with two years or more of previous German study may not take this course for credit. Permission of department required. CTL:IWL 1920 German Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos of spoken German. 4. Compose German sentences by focusing on the set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 10200 - German Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 10100 . CTL:IWL 1921 German Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 10500 - Accelerated Basic German (UCC: HUM)

Credit Hours: 4.00. This course is a first-year course in German, which covers two semesters in one. The course is appropriate for students who would like to accelerate the process of learning German, including GEARE students, graduate students, and others. The course will be conducted primarily in German and will use all modes of communication: interpersonal, presentational, and interpretive. The course book facilitates learning in context through the use of an integrated video program. The students are trained in the audio-visual interpretive mode of communication that is essential to carry out daily activities in Germany, and to be able to read and react to a variety of German texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading a variety of German texts and by listening to audio recordings of spoken German. 2. Identify German cultural aspects by watching videos in spoken German language integrated in the book. 3. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken German in the form of dialogues and presentations and respond appropriately to questions and statements related to everyday life. Credits: 4.00

GER 11200 - Elementary German Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in German on various topics.

Learning Outcomes: 1. Develop listening skills and improve oral German proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language. Credits: 1.00

GER 20100 - German Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate German course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts, and listening to audio recordings, and watching videos of spoken German. 2. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 3. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 20200 - German Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 20100 . CTL:IWL 1923 German Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 20500 - Accelerated Intermediate German (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate level course in

German designed to achieve second year language proficiency in German. The course is appropriate for students who would like to accelerate the process of learning German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading a variety of German texts. 2. Identify German cultural aspects by watching videos in spoken German language integrated in the book. 3. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 4. Compose grammatically correct German sentences by observing the norms and standards of the language. 5. Produce sentences in spoken German in the form of dialogues and presentations and respond appropriately to questions and statements related to everyday life. Credits: 4.00

GER 21200 - Intermediate German Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in German conversation to enhance communicative competence. Small group discussions in German on various topics. Not open to students enrolled in or having credit for GER 30100 or above.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral German proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen, and discuss relevant intermediate texts in the target language. Credits: 1.00

GER 22300 - German Level IV: Science And Engineering

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills, directed toward use of German in science and technology. Work on grammar as needed. Use of materials from recent publications in science and technology. Introduction to general and technical vocabulary. Conducted primarily in German. Credit will not be given for both GER 20200 and 22300.

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts about science, engineering, and business. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings about science, engineering, and business in spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos about science, engineering, and business in spoken German. 4. Compose German sentences about science, engineering, and business by focusing on a set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations that deal with science, engineering, and business. Credits: 3.00

GER 22400 - German Level IV: Business German

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed toward use of German for business purposes. Work on grammar as needed. Course materials cover daily business dealings as well as national and international trade, living conditions, environmental and social problems.

Credits: 3.00

GER 23000 - German Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Reading and analysis of selected German writers and their works, with particular emphasis on the social, political, and intellectual climate of the times. The course content will change from semester to semester. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.

Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as

symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts. Credits: 3.00

GER 28000 - German Special Topics

Credit Hours: 3.00. Selected topics on the civilization and culture of German speaking countries. Lectures and readings all in English. No knowledge of German necessary.

Learning Outcomes: 1. Students will explore in depth a particular aspect of life in German-speaking countries, leading to their increased understanding not only of those cultures, but also, by comparison, of their own culture. Credits: 3.00

GER 28100 - Beer And Brewing In German Culture

Credit Hours: 3.00. Course about beer and brewing and its role as a cultural product in shaping the identity of regional areas in Germany, Austria, and Switzerland, and its influence on science, religion, economics, politics, and history. The course will give students an overview of the relationship between beer and brewing to other disciplines, allowing them to connect the topics covered to their own fields of study. Conducted in English.

Learning Outcomes: 1. Demonstrate an understanding of the central importance of beer and brewing in German-speaking culture and its relation to other fields of study. 2. Examine the representation of beer in German texts (in English) and other forms of art. 3. Analyze how beer and brewing contribute to the creation of national identities. 4. Identify historical, political, religious, societal, and economic issues as they pertain to beer and brewing in German-speaking culture. Credits: 3.00

GER 30100 - German Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of German speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Germany from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 30200 - German Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in German on the basis of materials dealing with the ideas and events that have shaped present-day Germany. Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 31200 - Advanced German Conversation

Credit Hours: 1.00. One credit hour advanced German conversation course focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative competence. Discussions in German on various topics. Course may be taken concurrently with GER 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral German proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen, and discuss relevant intermediate texts in the target language. Credits: 1.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

GER 33000 - German Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of major German contributions to the cinema from the earliest period to the present. Emphasis on relevant aesthetic theories and on the schools of literature and painting that served as sources. Evaluation of the German film on the basis of social, artistic, and political criteria. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify and describe the major movements and trends of German film

history of the 20th and 21st centuries. 2. Analyze the cinematography of representative German films. 3. Interpret the explicit and implicit meanings of representative German films. Credits: 3.00

GER 34100 - German Literature I: From The Middle Ages To The 18th Century

Credit Hours: 3.00. Reading and discussion of selected texts (poetry, prose, dramatic texts, cultural documents, and artworks) in German from the Middle Ages to the Eighteenth Century.

Credits: 3.00

GER 34200 - German Literature II: From The 18th Century To The 21st Century

Credit Hours: 3.00. Reading and discussion of selected texts in German with the dual context of literary movements and historical developments between the 18th and 21st centuries.

Credits: 3.00

GER 39900 - Special Study Abroad Credit In German

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in German earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

GER 40100 - German Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of German speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Germany. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

GER 40200 - German Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in German. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Compose essays in German after reading authentic German articles and books. 2. Discuss current events in German based on print and media sources from German-speaking countries. 3. Formulate arguments during debate in German through group discussion. 4. State their opinions in German on recordings, television shows, and texts. 5. Describe information in German from graphs, charts, diagrams, and pictures. Credits: 3.00

GER 42400 - Business German

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Learn and practice vocabulary and cultural knowledge that is applicable to business situations in German-speaking countries. 2. Compare business practices in German-speaking countries with those in the United States, and will be able to discuss the similarities and differences in German. Credits: 3.00

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 49800 - Advanced Topics In German

Credit Hours: 3.00. Special topics on literature, linguistics and culture of contemporary German-speaking countries. Conducted in German.

Credits: 3.00

GER 51900 - Teaching College German

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

GER 52400 - German For International Trade

Credit Hours: 3.00. A broad spectrum of business and cultural materials to prepare students for work in international firms. Intensive study of technical terminology used in business transactions; stylistics in business correspondence and report writing; training for accurate oral expression in business negotiations.

Credits: 3.00

GER 54200 - German Classicism

Credit Hours: 3.00. The study of the classical period in German literature as revealed in the works of Goethe and Schiller.

Credits: 3.00

GER 54300 - The Age Of Enlightenment And The Storm And Stress Movement

Credit Hours: 3.00. A study of the literature of the Age of Enlightenment, the cult of feeling, and the Storm and Stress works of Goethe and Schiller.

Credits: 3.00

GER 54400 - German Romanticism

Credit Hours: 3.00. A study of the rise and degeneration of the romantic ideal in German literature. Particular attention is paid to aesthetics, literary criticism, and the revival of a national heritage.

Credits: 3.00

GER 54500 - German Prose From Naturalism To The Present

Credit Hours: 3.00. Development of the novel and short story of the period, with special emphasis on the major authors.

Credits: 3.00

GER 54600 - German Literature Since 1945

Credit Hours: 3.00. Major literary movements and tendencies in East and West Germany, Austria, and Switzerland since 1945. Involves the close reading of literary texts, investigation of major problems addressed by literary criticism, and discussion of historical context.

Credits: 3.00

GER 55100 - Lyric Poetry From Romanticism To The Present

Credit Hours: 3.00. A study of the German lyric from Romanticism to the present. The study of motif, form, and style as reflections of the aesthetic ideals of their age.

Credits: 3.00

GER 55400 - German Drama Before Naturalism

Credit Hours: 3.00. German drama from its beginnings up to the advent of Naturalism. A study of the most significant German dramatists of the first part of the nineteenth century and earlier periods.

Learning Outcomes: 1. Students will be familiarized with drama theory, including the Aristotelian approach and the 18th century dramas that were created in response to it. 2. Students will learn about aesthetics and ethics in cultural history, explore the differences between such movements as Storm and Stress and Weimar Classicism, the Bourgeois play and the Brechtian drama and variations in between. 3. This course will enhance reading, writing, and speaking skills in the target language of German and will provide cultural knowledge and improve students' global competency. Credits: 3.00

GER 55500 - German Drama From Naturalism To The Present

Credit Hours: 3.00. Developments of the drama through the various literary movements of the period, including consideration of the underlying social and ideological forces.

Credits: 3.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 57500 - Theories Of German Language Acquisition

Credit Hours: 3.00. Advanced course designed to provide an overview of major theoretical issues in German language acquisition research. Permission of instructor required.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

GER 59000 - Directed Reading In German

Credit Hours: 1.00 to 4.00. Directed readings in German. Permission of instructor required.

Credits: 1.00 to 4.00

GER 59400 - Special Topics In German Literature

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor

required.

Credits: 1.00 to 4.00

GER 59600 - Special Topics In German Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

GER 60100 - First Course To Establish Reading Knowledge

Credit Hours: 3.00. First Course To Establish Reading Knowledge.

Credits: 3.00

GER 60300 - Second Course To Establish Reading Knowledge

Credit Hours: 3.00. Second Course To Establish Reading Knowledge. For those in the physical sciences, mathematics, and engineering. Prerequisite: GER 60100 .

Credits: 3.00

GER 60500 - Second Course To Establish Reading Knowledge

Credit Hours: 3.00. Second Course To Establish Reading Knowledge. For those in the humanities and social sciences. Prerequisite: GER 60100 .

Credits: 3.00

GER 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in German.

Credits: 3.00

GER 64400 - Seminar In German Expressionism

Credit Hours: 3.00. The prose, drama, and poetry from 1910-1925. Will also examine selected political-literary essays as they relate to this artistic avant-garde generation.

Credits: 3.00

GER 65900 - Seminar In German Literature

Credit Hours: 3.00. Advanced study of special subjects. Topics to be announced in advance. Permission of instructor required.

Credits: 3.00

GER 66400 - Middle High German

Credit Hours: 3.00. This course introduces students to the Middle High German language, the language of medieval literary texts written in German between 1050 and 1350. The language of this period is significantly different in spelling, vocabulary, and grammar when compared to Modern Standard German. The course also provides an introduction to various genres of medieval German literary texts from this period. Many of the foundational works in the German tradition come from this period, including those of the so-called "golden age" of medieval German literature from 1170 to 1230.

Learning Outcomes: 1. Compare Middle High German vocabulary and grammar with Modern German. 2. Analyze Middle High German grammatical forms as they appear in literary texts. 3. Identify linguistic variation in Middle High German. 4. Apply linguistic knowledge by translating Middle High German texts. 5. Identify distinctions between genres of Middle High German literary texts. 6. Recognize major themes in Middle High German literary texts. 7. Write a paper that synthesizes information from class on genres and cultural/historical themes in Middle High German literary texts. Credits: 3.00

GER 67900 - Seminar In German Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in German linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

GER 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GER 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Global Engineering Program

GEP 10000 - Global Design Team I

Credit Hours: 1.00. Global Design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 1.00

GEP 20000 - Global Design Team II

Credit Hours: 0.00 to 2.00. Global Design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 0.00 to 2.00

GEP 30000 - Global Design Team III

Credit Hours: 1.00 to 3.00. Global Design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 1.00 to 3.00

GEP 40000 - Global Design Team IV

Credit Hours: 1.00 to 3.00. Global design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 1.00 to 3.00

Global Studies Liberal Arts

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

GSLA 39100 - Special Topics In Global Studies

Credit Hours: 3.00. This variable title course deals with topics that explore a range of experiences and analytical perspectives clustered around the contemporary global experience. The course will vary in subject matter but focus on the challenges and rewards of a globalized world as articulated through topics such as cross-border histories, music, gender, racial formations,

film, and economic development. Content will vary with the instructors teaching the course.

Learning Outcomes: 1. Understand, by definition but also by analytical variation, the range of lived experiences and critical perspectives that encompass the contemporary global experience. 2. Recognize the cultural, economic, and political characteristics that define contemporary globalization. 3. Think and write analytically about contemporary globalization through topics such as national or regional histories, music, gender and/or racial formations, film, literature, politics, and economics. Credits: 3.00

GSLA 48000 - Senior Interdisciplinary Capstone Project In Global Studies I

Credit Hours: 3.00. The senior capstone course for Global Studies majors is designed to give students the chance to define and complete a research project of personal interest, and to integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001. The capstone courses are offered to students in their senior year to be completed the final two semesters of their major. Students will assemble a committee of two or more faculty members willing to direct their work. The Director of Global Studies will be an ex-officio member of the committee. Students will incorporate their prior coursework (including foreign language training), study abroad, and/or internships into their final project. The capstone may be, but is not limited to, a senior honors project, a multimedia project, service learning, or directed research. Timeline for a successful capstone project: Spring of Sophomore year: After three semesters of coursework, the student will start defining an area of interest or passion that will form the basis of their capstone research. Junior Year: The student will select courses in their interest area. They will also start speaking to faculty members in the field in order to assemble their committee. Spring of Junior Year: Students will finalize their faculty committee to direct their research. Fall of Senior Year: Research Semester, as directed by the committee. GSLA 48000. Spring of Senior Year: Complete project. GSLA 48001.

Learning Outcomes: 1. Demonstrate an awareness of Global issues through academic inquiry and extracurricular engagement. 2. Critically apply multi-perspective research frameworks to a concrete problem or case. 3. Recognize historic roots of Global inequality. 4. Develop intercultural competence and demonstrate empathy for difference. Credits: 3.00

GSLA 48001 - Senior Interdisciplinary Capstone Project In Global Studies II

Credit Hours: 3.00. The senior capstone is a year-long course for which Global Studies majors enroll in consecutive semesters. Its primary goal is for students to define and complete a research project of personal, academic, and/or professional interest, as they integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001 in order to complete the Global Studies major.

Learning Outcomes: 1. Varies per student project/ capstone. Credits: 3.00

Graduate Studies

GRAD 50100 - PULSe Scientific Communications

Credit Hours: 1.00. To begin to create an atmosphere in which students learn to communicate across disciplinary lines by providing the opportunity to develop skills in presenting and evaluating research results. Students will develop short scientific presentations, an abstract, and a poster and learn to present their findings to others and to ask and answer questions from their peers. Permission of department required.

Learning Outcomes: 1. To improve your ability to organize and present research presentation. 2. To gain experience with the skills required to prepare material for presentation. 3. To learn more about the faculty and students in PULSe. Credits: 1.00

GRAD 50200 - Interdisciplinary AI Fundamentals: Bridging Knowledge

Credit Hours: 1.00. This course provides foundational concepts for AI for those in both MSAI majors. This course covers the history of AI, the foundations of artificial reasoning and knowledge, and practical skills for communicating about AI technology, projects, and workflow. This graduate course, designed to be accessible to learners with diverse backgrounds, serves as a foundational introduction to the field of AI. Whether you come from a technical or non-technical background, this course will provide you with a solid grasp of AI concepts, principles, and their real-world applications. To be successful in this course, we encourage students to know math (e.g., algebra and calculus) and a basic understanding of programming (e.g., R, Python, or Java).

Learning Outcomes: 1. Describe the foundations of artificial reasoning, knowledge, and trace the historical development of AI. 2. Explain the basic concepts, terminologies, and applications of different AI algorithms,

developing a problem-solving mindset applicable to various domains. 3. Examine the diverse range of AI applications across varied industries. 4. Explain the role human factors and social context play in the development of artificial intelligence. Credits: 1.00

GRAD 50300 - AI Essentials: A Non-Technical Introduction

Credit Hours: 2.00. This course provides students on the translator track a foundation in the principles and methodologies of Artificial Intelligence (AI) to empower them to actively engage in interdisciplinary collaborations. With a focus on the essentials of AI, machine learning, and natural language processing, students will gain the knowledge and skills needed to bridge the gap between language and technology. Students will leverage AI tools and techniques to enhance translation efficiency, accuracy, and engagement in the ever-evolving digital landscape. Students will have a foundation in the methodology so they can effectively participate in interdisciplinary collaborations, serving as a valuable resource for industries where language and technology converge.

Learning Outcomes: 1. Explain the basic concepts and applications of different AI algorithms and how they apply for specific fields for application or research purposes. 2. Describe the types of data inputs and outputs used in different AI applications. 3. Define a project and apply basic AI approaches in a programming environment. 4. Communicate methods and results of an AI project to specialists and non-specialists. Credits: 2.00

GRAD 50400 - Advanced AI Fundamentals For Technical Professional

Credit Hours: 2.00. Artificial Intelligence (AI) is the driving force behind the transformation of industries, research, and technology. For students with a highly technical background, this 2-credit hour graduate course offers a deep dive into the fundamental principles, theories, and applications of AI. Specifically, this course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focus on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation. To be successful in this course students should have experience with programming such as Python and R and have a background that includes calculus, linear algebra, algorithms, and probability theory.

Learning Outcomes: 1. Identify key elements of Artificial Intelligence (AI) and Machine Learning (ML) algorithms. 2. Understand how to choose AI/ML algorithms for different analysis tasks. 3. Analyze data in both an exploratory and targeted manner using AI and ML approaches. 4. Implement and apply basic AI/ML algorithms for supervised and unsupervised learning. 5. Accurately evaluate the performance of AI/ML algorithms, as well as formulate and test hypotheses. Credits: 2.00

GRAD 50500 - Foundations In Data Science

Credit Hours: 3.00. This course is the inaugural course in the Master of Science in Data Science program. Tailored for students with a technical background, this course provides a comprehensive introduction to key concepts, statistical techniques, and tools foundational to the field of data science. The syllabus integrates hands-on experience, ethical considerations, programming refresher, and agile project management principles to equip students with a robust foundation for their data science journey.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of core data science concepts and articulate the significance of data in various domains. 2. Acquire skills to perform exploratory data analysis, identify patterns, and make informed decisions based on statistical inference. 3. Analyze ethical dilemmas arising in data-driven contexts, apply ethical decision-making models, and navigate the legal implications of data handling and analysis. 4. Demonstrate a comprehensive understanding of programming fundamentals and the application of agile methodologies to manage and execute data science projects. 5. Access, navigate, and employ Purdue's computing resources available through Purdue's Rosen Center for Advanced Computing (RCAC). Credits: 3.00

GRAD 50600 - Big Data Tools And Technologies

Credit Hours: 3.00. This course is designed to equip students with the essential skills to handle big data effectively. It covers proficiency in big data technologies, scalable data processing techniques, and the integration of big data tools into data

science workflows.

Learning Outcomes: 1. Demonstrate proficiency in big data technologies. 2. Apply scalable data processing techniques to handle large datasets. 3. Integrate big data tools into comprehensive data science workflows. 4. Demonstrate proficiency with cloud computing. Credits: 3.00

GRAD 50700 - Cross Domain Data Communication And Visualization

Credit Hours: 3.00. This course focuses on the proficient use of data communication strategies and competencies. The course will focus on identifying data narratives, generating stories from data, illustrating with powerful and self-explanatory visualization, and basic principles of ethical use of non-data narrative frames for data communication. Designed for students with a technical background pursuing a Master of Science in Data Science, this course aims to enhance students' ability to extract and communicate meaning and narratives from raw data and visually represent it.

Learning Outcomes: 1. Create effective and aesthetically pleasing data visualizations. 2. Communicate complex data findings clearly to diverse audiences. 3. Utilize interactive visualization techniques for dynamic exploration of datasets. 4. Develop the ability to integrate ethics and data privacy considerations effectively when communicating with data. Credits: 3.00

GRAD 50800 - Data Analytics

Credit Hours: 3.00. This course provides an in-depth exploration of advanced data analysis techniques, predictive modeling, ensemble methods, and proficiency in data manipulation and transformation. It is designed for students with a technical background pursuing a Master of Science in Data Science.

Learning Outcomes: 1. Apply advanced data analysis techniques to extract meaningful insights from complex datasets. 2. Implement predictive modeling and ensemble methods for accurate data-driven predictions. 3. Demonstrate proficiency in data manipulation and transformation techniques. Credits: 3.00

GRAD 50900 - Applied Machine Learning: From Foundations To Latest Advances

Credit Hours: 3.00. This course provides an in-depth exploration of machine learning algorithms and data mining techniques, building on the foundational concepts introduced in the Foundations of Data Science course. Students will develop a comprehensive understanding of various machine learning algorithms, focusing on practical applications and hands-on experience. Additionally, the course will cover data mining techniques for dimension reduction and pattern discovery.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of popular machine learning algorithms, including supervised and unsupervised learning techniques. 2. Demonstrate the ability to analyze mathematical foundations and principles behind machine learning models. 3. Understand the nuances of applying various machine learning models, emphasizing the trade-offs between performance, computational complexity, and interpretability. 4. Students will actively explore unsupervised learning techniques, emphasizing clustering algorithms, and recognizing their vital role in solving real-world challenges. 5. Demonstrate proficiency into the fundamental principles of deep learning and investigate recent advancements, such as optimization using diffusion models, learning from unlabeled data using consistency models, and decentralized data processing through federated learning. Credits: 3.00

GRAD 51000 - ESE Colloquium/Seminar I

Credit Hours: 2.00. This 2-semester sequence (2 credits in fall and 1 credit in spring) is a first-year requirement of all ESE IGP students. The series is designed to build critical and resilience thinking skills, and improve oral and written communication through critique writing, panel forums, and mini, oral presentations while promoting camaraderie among the ESE IGP.

Learning Outcomes: 1. Identify your dogmas and recognize your biases towards learning how to remove your biases and learn how to minimize filtering readings and others' opinions through your own dogmas. 2. Gain a breadth of understanding on topics around sustainability and environmental challenges and different disciplinary approaches to a problem. 3. Increase your critical thinking skills, your ability to synthesize material, and improve your written

communication skills. 4. Increase your oral communication ability, your ability to process others' opinions, and build camaraderie. 5. Improve your ability to think independently, to re-evaluate your assessment through input of others, and the process for approaching complex problems. Credits: 2.00

GRAD 51100 - ESE Colloquium/Seminar II

Credit Hours: 1.00. This 2-semester sequence (2 credits in fall and 1 credit in spring) is a first-year requirement of all ESE IGP students. The series is designed to build critical and resilience thinking skills, and improve oral and written communication through critique writing, panel forums, and mini, oral presentations while promoting camaraderie among the ESE IGP.

Learning Outcomes: 1. Increase your ability to work together, synthesize information, and present orally as a team. 2. Increase your ability to work with others towards consensus, facilitate discussion towards a common goal, and to approach the challenges from marketing to implementation of a symposium event. Credits: 1.00

GRAD 55000 - Fellowship And Grant Application Writing

Credit Hours: 2.00. Fellowship Application Writing is open to any graduate student who is interested in applying for fellowships and other grant opportunities. Graduate students will be taught how to write personal statements, research statements, and extended research plans that they can submit for fellowship applications. Organization of research background, methods, and significance will be emphasized. Writing mechanics and addressing grant agency requirements and procedures will also be covered. Additionally, fellowship and grant opportunities will be discussed along with professional communication skills.

Learning Outcomes: 1. Analyze the different types of fellowship opportunities currently available to them as well as form broad knowledge of postdoc and faculty grants. 2. Practice and evaluate proofreading skills to gain experience in editing fellowship application writings and be able to apply advanced proofreading skills to future writing projects. 3. Compose persuasive documents using a grant proposal writing style with appropriate formatting and organization and analyze their writing with grant agency criteria. 4. Synthesize and refine competitive personal statements, research plans, and statements of previous research to use for various fellowship applications. Credits: 2.00

GRAD 58800 - Online Master Of Science In Data Science-Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a real-world data science problem, with an emphasis on the application domain. The capstone course for the OMSDS provides students with practical experience applying the collective set of skills developed through the OMSDS program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams of 3-5 students each, will work with a product owner to scope out the project via a project charter that will include a timeline, milestones, and metrics that will yield benefits and a strategy for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using data science that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

GRAD 58900 - Master Of Science In Artificial Intelligence Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a realistic or real-world artificial intelligence problem, with an emphasis on the application domain. The capstone course for the MSAI provides students with practical experience applying the collective set of skills developed through the MSAI program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams, will select a target beneficiary, arrange a consultation, develop a problem statement, a project plan that will yield benefits, and a strategy

for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using AI that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

GRAD 59500 - Independent Study

Credit Hours: 1.00 to 6.00. This course provides a means of independent study of a special problem or research topic. Although not required, it is likely that a major result of the course will be a conference or journal publication. This course does not substitute for master's research credit on the plan of study. Permission of instructor required.

Learning Outcomes: 1. Outcomes will depend upon the agreed deliverables for the course. Credits: 1.00 to 6.00

GRAD 59800 - MS Non-Thesis Research

Credit Hours: 1.00 to 18.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Permission of instructor required.

Learning Outcomes: 1. Outcomes defined at the time of offering. Credits: 1.00 to 18.00

GRAD 60000 - Mentoring Intercultural Growth: Theory And Application

Credit Hours: 3.00. The ability to mentor intercultural competence, the capacity to interact effectively across differences of many kinds is a key expectation of today's leaders. This course supports your ability to mentor others' intercultural development by building your own and by engaging in experiential learning, reflective practices, and knowledge acquisition. Topics explored include mentorship, learning theories, facilitation, assessment, and frameworks for intercultural competence and diversity, equity, and inclusion.

Learning Outcomes: 1. Articulate new self-awareness (e.g., of your own cultural identity and habitual behaviors) as an intercultural mentor, noting areas for potential growth. 2. Demonstrate foundational knowledge of models, frameworks, and practical approaches to bridging differences from the intercultural/global and diversity/inclusion realms. 3. Design and implement learning interventions for the development of intercultural competence. 4. Utilize appropriate formative and summative methods of assessing learners' intercultural development. Credits: 3.00

GRAD 60200 - Peer To Peer Mentoring For ESE IGP Students

Credit Hours: 1.00. This Peer-to-Peer (P2P) mentor experience is geared to enhance the professional development of our ESE students and foster enhanced success and professional development for our first year students. The P2P mentors meet once a week with Independent of GRAD 59000 and also meet with GRAD 59000 . P2P mentors have to shape the syllabus for each semester including identifying readings; develop, lead, and facilitate classroom activities through both traditional and innovative and creative strategies; and provide verbal and written input on weekly student critiques. Permission of instructor required.

Learning Outcomes: 1. Learning to develop creative and innovative teaching strategies. 2. Develop skills for fostering student written and oral communication. 3. Develop skills for fostering an inclusive and safe environment. 4. Develops skills for selecting course materials, planning course activities, and grading student performance. Credits: 1.00

GRAD 61000 - Grant Training Program I

Credit Hours: 1.00 to 3.00. This variable topic course is designed to be used by any department at WL needing to offer a training program associated with research grants such as those required by certain NIH, NSF or other grant agencies or programs. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will

be required to meet the expectations laid out for 600-level courses. Credits: 1.00 to 3.00

GRAD 61100 - Grant Training Program II

Credit Hours: 1.00. This variable topic course is designed to be used by any department at WL needing to offer a training program associated with research grants such as those required by certain NIH, NSF or other grant agencies or programs. Instructor permission required. Prerequisite: GRAD 61000.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid out for 600-level courses. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 68900 - Special Seminars

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. For use in interdisciplinary seminars and in other cases where general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 0.00 to 18.00

GRAD 69000 - Special Topics

Credit Hours: 1.00 to 8.00. This variable topic course focuses on advanced study of technical and professional research topics, primarily for doctoral students.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. 2. Outcomes will be require to meet the expectations laid our for 600-level courses. Credits: 1.00 to 8.00

GRAD 69300 - Interdisciplinary Internship/Practicum

Credit Hours: 0.00 to 18.00. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 0.00 to 18.00

GRAD 69500 - Doctoral Independent Study

Credit Hours: 1.00 to 6.00. This course provides a means of independent study of a special problem under the guidance of a graduate faculty member who holds a terminal degree. It is assumed that projects in this course are research projects independent of one's doctoral research. Although not required, it is likely that a major result of the course will be a conference or journal publication. This course does not substitute for dissertation research credit on the plan of study. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes will be dependent on the content of the course. Credits: 1.00 to 6.00

GRAD 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Outcomes defined at the time of offering. Credits: 1.00 to 18.00

GRAD 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Greek

GREK 10100 - Ancient Greek Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to the grammar of Attic Greek of the Classical period, and first forays into the reading of connected prose. Emphasis on accidence, syntax, and vocabulary building.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain foundational Ancient Greek grammar and demonstrate familiarity with core vocabulary. 2. Bring together their knowledge of Ancient Greek grammar and vocabulary, creating clear English translations by analyzing basic texts adapted from Ancient Greek literature. 3. Apply this knowledge of grammar and vocabulary to writing simple sentences in Ancient Greek, and translating from English to Ancient Greek.

Credits: 3.00

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn basics of reading and translating ancient Greek, completing their

introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 10500 - Accelerated Introductory Ancient Greek

Credit Hours: 4.00. This course is an accelerated beginning-level course designed to develop language proficiency in Ancient Greek. The course will help students progress toward competence in reading and writing, as well as toward knowledge of Ancient Greek culture. The course focuses on developing deep understanding of Greek syntax and morphology and building strategies for fluent and accurate reading of ancient texts. Primary language of instruction is English.

Learning Outcomes: 1. Differentiate the syntactic structures used in Ancient Greek sentences and longer texts based on the study of model sentences. 2. Compose sentences in Ancient Greek by focusing on a set of grammatical rules and standards in the language. 3. Recite Ancient Greek aloud with accuracy and fluency and demonstrate their ability in in-class text readings and recordings. 4. Infer the meaning of unknown vocabulary in context by reading stories. 5. Identify and analyze grammatical forms in the Greek contexts in which they are used. 6. Generate smooth-flowing and elegant English translations of the Greek, attending to inherent differences in style and structure. Credits: 4.00

GREK 20100 - Ancient Greek Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in New Testament Greek, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn how to apply foundational knowledge of ancient Greek grammar and syntax to readings in the New Testament. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 34400 - Greek Epic

Credit Hours: 3.00. Readings and discussion of the Greek epic, including selected passages from Homer and Hesiod.

Credits: 3.00

GREK 35300 - Greek Tragedy

Credit Hours: 3.00. Reading and discussion of selected Greek tragedies of the 5th century BCE.

Credits: 3.00

GREK 35400 - Greek Comedy

Credit Hours: 3.00. Readings and discussion of selected Greek comedies of the 4th and 5th centuries BCE.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical historians in the original Greek.

Credits: 3.00

GREK 49000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

GREK 59000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 4.00. Directed Reading In Classical

Greek. Permission of instructor required.

Credits: 1.00 to 4.00

Health and Kinesiology

HK 10000 - Foundations Of Kinesiology

Credit Hours: 3.00. This course will provide an introduction to the physical and behavioral sciences underlying kinesiology, the study of human movement. The course will cover foundational concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. The course will take an interdisciplinary perspective, exploring both key concepts in each of these sub-areas of kinesiology, and how they are integrated to understand problems in human movement, exercise, physical activity, sport, and healthy lifestyles.

Learning Outcomes: 1. Explain basic concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. 2. Apply and integrate concepts from the sub-disciplines of kinesiology to better understand human behavior. Credits: 3.00

HK 13500 - Introduction To Health And Kinesiology

Credit Hours: 1.00. Overviews the disciplines of health and kinesiology. Students explore skills and academic interests in theses areas. Describes career opportunities and options for graduate study. Provides strategies for professional and portfolio development. Students complete five hours of community service per semester. Permission of instructor required.

Credits: 1.00

HK 21000 - History And Philosophy Of Physical Education

Credit Hours: 2.00. Introduction to the history and philosophy of physical education to prospective teachers. Emphasis is placed on the impact of societal history on physical education and the role of philosophic thinking in curricular activities. For majors and minors only.

Credits: 2.00

HK 21300 - Clinical Field Experience In Health And Fitness

Credit Hours: 0.00 to 3.00. This course is a coordinated clinical/professional experience designed to expose students to various positions within the wellness community and how clinical interactions are embedded within fitness centers. In addition to weekly in-person class meetings, students will observe and practice professional and foundational skills at different clinical sites. Professional communication, interdisciplinary interactions, and self-reflection are key skills developed in this practicum.

Learning Outcomes: 1. Describe effective and critically assess client-provider interactions, including professionalism in physical presentation and verbal/written communication. 2. Demonstrate the following personal/professional competencies needed in future clinical roles: communication skills, teamwork, customer service, leadership, independence, and initiative. 3. Professionally carry out all expected duties/responsibilities and identify individual strengths and areas for improved growth. 4. Develop a personalized health, fitness, and wellness philosophy, based on interactions with individual clients. Credits: 0.00 to 3.00

HK 22200 - Foundations For The Health And Fitness Professional

Credit Hours: 3.00. Designed to introduce the emerging Health and Fitness professional to current trends in health and physical activity and provide effective hands-on methodology for implementation of physical activity and exercise in different settings. Students will be able to identify the role of a clinician, coach, trainer, etc. Students will obtain skills in client consultation, program design and strategies for implementing programs to the general population. Students will also be introduced to the skills and knowledge required for working with clinical populations. This course is designed to help students prepare for future clinical practice and certification.

Learning Outcomes: 1. Review current national health and physical activity status, guidelines, and implications. 2. Learn basic health screenings and fitness assessments. 3. Discover effective interaction and consultation skills with patients/clients in different settings. 4. Establish a knowledge base for basic cardiorespiratory fitness and muscular conditioning exercise prescription. 5. Assess, instruct, evaluate, and apply various exercise techniques. 6. Develop comprehensive exercise programs for general population and begin developing a working framework to modify exercise programs for clinical population. 7. Establish and practice basic instruction /coaching skills to implement as a clinician. 8.

Obtain knowledge and skills related to methodologies and practices for alter professional application. Credits: 3.00

HK 25300 - Principles Of Motor Development

Credit Hours: 3.00. This course provides an introduction to motor development from a life-span perspective. Students will learn how infants develop from mainly reflexive beings into children and adults that are capable of interacting with the world in a goal-directed manner. This course specifically examines how changes in physical growth, aging, and maturation of the central nervous system influence motor performance. Finally, the decline of motor skills associated with advanced age is discussed.

Learning Outcomes: 1. Students will be able to describe how motor skills develop in children and decline in older adults. 2. Students will be able to apply the principles of motor development to clinical, education, and sport sciences settings. Credits: 3.00

HK 25800 - Foundations Of Motor Skill Learning

Credit Hours: 3.00. Concepts and principles of motor skill learning, with emphasis on the acquisition and retention of gross movement and sport skills.

Credits: 3.00

HK 26300 - Biomechanical Foundations Of Motor Skills

Credit Hours: 3.00. Fundamental anatomical and mechanical concepts and procedures for analyzing motor skills, with particular reference to sport, dance, and aquatic activities.

Learning Outcomes: 1. Describe motion with mechanical and anatomical terminology. 2. Quantify linear and angular characteristics of motion. 3. Describe and quantify the cause and effect relationship between force and motion. 4. Collect, analyze and interpret biomechanical measures of human movement. Credits: 3.00

HK 26400 - Principles Of Motor Learning, Development, And Biomechanics

Credit Hours: 3.00. This course surveys the fundamental processes and variables related to motor development, motor learning, and biomechanics. Students will be exposed to concepts relevant to teaching motor skills and critical issues to increase knowledge of human movement.

Learning Outcomes: 1. Describe motion with mechanical and anatomical terminology. 2. Describe the linear and angular characteristics of motion. 3. Describe the relationship between force and motion. 4. Define terms of motor control. 5. Define the optimal conditions for learning new skills. 6. Describe how factors related to the individual, task, and environment affect the learning of skills movement. 7. Define terms of development, growth, and maturation. 8. Describe reflexes and motor milestones. 9. Describe the development of body control, reaching and locomotion. Credits: 3.00

HK 28500 - Fieldwork In Athletic Training - Collegiate

Credit Hours: 1.00. Students will learn about and explore the athletic training profession through classroom and experiential learning in an intercollegiate setting. Under supervision of the certified athletic trainer, students will observe facility operations and duties of the athletic trainer. Topics of instruction include history of athletic training, governance, and professional foundation and ethics.

Learning Outcomes: 1. Define athletic training and the athletic training profession. 2. Know the location of athletic facilities, athletic training supplies and equipment. 3. Demonstrate proper opening and closing procedures of the Purdue athletic training rooms. 4. Properly perform cleaning and maintenance of facility athletic training room equipment. 5. Learn proper inventory and equipment check-out procedures. 6. Articulate the history of the profession and important milestones and prominent individuals who shaped the profession. 7. Describe the governance of the profession and the advantages and disadvantages associated with the current governance structure. Credits: 1.00

HK 28600 - Fieldwork In Athletic Training - Secondary School

Credit Hours: 1.00. Students will learn about and explore the athletic training profession through classroom and experiential learning in secondary school setting. Under supervision of the certified athletic trainer, students will observe facility operation and duties of the athletic trainer. Topics of instruction include basics of taping and wrapping, selection and fitting of protective equipment, and principles of risk management.

Learning Outcomes: 1. Discuss the differences in wound care techniques. 2. Select the appropriate technique to dress and care for a

wound. 3. Select and apply basic taping and wrapping procedures commonly used in athletic training on a simulated patient. 4. Discuss the legal principles of equipment liability. 5. Select and apply protective equipment commonly used by patients in contact-collision sports. Credits: 1.00

HK 28700 - Fieldwork In Athletic Training - Clinic/Industry

Credit Hours: 1.00. Students will learn about and explore the athletic training profession through classroom and experiential learning in an emerging athletic training setting. Under supervision of the certified athletic trainer, students will observe facility operations and duties of the athletic trainer. Topics of instruction include basics of wound care, setup and operation of therapeutic modalities, and basic rehabilitation principles.

Learning Outcomes: 1. Define risk management and discuss how it applies to athletic training settings. 2. Inventory an athletic training facility and appraise the risk management strategies used. 3. State the differences between different methods of stretching. 4. Demonstrate proper flexibility and stretching techniques. 5. Match the appropriate stretching technique to a patient condition or injury. 6. Discuss correct application techniques for basic cryotherapy and thermotherapy modalities. 7. Administer a simulated treatment for a patient using the appropriate modality. Credits: 1.00

HK 30200 - Applied Clinical Anatomy

Credit Hours: 3.00. An introduction to the regional anatomical study of the human body for undergraduate allied health students. Lectures will be supplemented by observation and demonstration of prosected cadaver material, radiographs, osteology, and surface anatomy.

Credits: 3.00

HK 30500 - Injury Assessment I

Credit Hours: 4.00. A guided lecture and laboratory experience designed to teach the student injury assessment techniques normally required of an athletic trainer. Topics include splinting and transportation, equipment fitting and fabrication, lower extremity injury evaluation, taping and bracing.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the lower extremities and spine. 2. Identify different methods of prevention for many injuries commonly seen in the lower extremities and spine. 3. Identify common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Explain gender differences in the musculoskeletal system and the impact on injury management for the lower extremities. 5. Identify anatomical growth and development characteristics of males and females in the following stages: pre-adolescent and adolescent. 6. Demonstrate general treatment and rehabilitation protocols to use with injuries in the lower extremities. 7. Demonstrate general treatment and rehabilitation protocols to use with injuries in the spine. 8. Identify the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of injuries/illness commonly seen in the upper extremities and spine. 9. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity and spinal conditions. 10. Explain the different psychomotor test characteristics - validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 11. Synthesize test psychometric data to select appropriate tests and measures during assessment. 12. Formulate a clinical question and perform a literature search to answer the question. Credits: 4.00

HK 30800 - Athletic Health Care

Credit Hours: 3.00. Provides students with foundational knowledge and skills for the prevention, recognition, and management of common athletic injuries and illnesses, as well as emergency conditions encountered by sports medicine professionals.

Learning Outcomes: 1. Identify basic components of an athletic injury/illness prevention program. 2. Acquire knowledge related to athletic protective equipment and

prophylactic braces. 3. Develop an understanding of the physiological effects of injury in order to provide proper treatment and care. 4. Develop practical knowledge of the mechanisms, signs, and associative anatomy for common athletic injuries associated with the upper extremity, lower extremity, head, spine, and thorax. 5. Develop practical knowledge related to the recognition and treatment of environmental conditions. This will include an understanding of appropriate hydration requirements for physical activity. 6. Develop an understanding of the acute care and emergency management of athletic injuries. Credits: 3.00

HK 31300 - Clinical Field Experience In Healthcare

Credit Hours: 3.00. This course will provide students with observation in various clinical settings. Students will establish a mentor with at least 1 site. Students may choose to pursue observations in various patient care environments, such as, physical therapy, occupational therapy, physician clinics, cardiac rehab, etc. Permission of department required.

Learning Outcomes: 1. Observe patient/practitioner interactions and patient centered care. 2. Demonstrate basic skills related to medical practices in the field (i.e., therapy techniques, treatment modalities, medical procedures, patient assessment/screening, etc.). 3. Describe how skills and content learned in previous courses can be applied to a clinical setting. 4. Explain current best practices and scope of care necessary in their clinical setting. 5. Model the behaviors and skills appropriate to the profession and clinical setting. Credits: 3.00

HK 31500 - Group Fitness Leadership

Credit Hours: 2.00. This course is designed to provide students with an overview of the educational concepts, program design, and instruction/leadership skills needed to design and teach instructor-led exercise programs for small (2-3 individuals) and large (10+) groups with and without music. The course will include basic analysis and application of safe and effective exercise procedures for all fitness levels. Students will be expected to lead group classes throughout the semester as assigned by the course instructor. Preparedness and ability to execute will be assessed. This course is designed to help students prepare of future clinical practice and certification as an ACSM Certified Clinical Exercise Physiologist.

Learning Outcomes: 1. Develop an appropriate sequence of movement in an instructor-led exercise program: to include methods of linear transitions, combination techniques, and building sequence development. 2. Modify instructor-led exercise programs for special health and physical concerns. 3. Develop, design and implement group based muscle conditioning programs for healthy adults. 4. Develop the ability to lead/coach components of a group physical activity sessions. Credits: 2.00

HK 31600 - Foundations Of Strength And Conditioning

Credit Hours: 2.00. This course will provide students with an in-depth analysis of strength and conditioning principles, and application strategies to cardiorespiratory conditioning, strength training, and flexible exercise. Students will assess the foundational application of anatomy, physiology, and biomechanics to various forms of exercise training based on standards of the American College of Sports Medicine, National Strength and Conditioning Association, and the National Academy of Sports Medicine. A major focus of this class will also prepare students to instruct and coach on an individual level to ensure proper mechanics, engagement, and execution of exercise movement. This course is designed to help students prepare for future clinical practice and certification as an ACSM Certified Clinical Exercise Physiologist.

Learning Outcomes: 1. Identify and define skeletal and muscle anatomy, physiology, and biomechanics as related to cardiorespiratory activity, resistance training, and flexibility. 2. Identify and define the Human Movement System and causes of dysfunction/impairment that can effect exercise outcomes. 3. Perform, assess, and instruct various resistance training exercises. 4. Develop a program for cardiorespiratory health, strength and flexibility. Credits: 2.00

HK 31800 - Strength And Conditioning And Exercise Instruction Across The Lifespan

Credit Hours: 3.00. This course is designed to provide students with an overview of educational concepts, program design and instructional/leadership skills for designing and instructing exercise programs. Students will obtain hands-on experience conducting exercise programs for strength and conditioning,

cardiorespiratory fitness, and flexibility throughout the semester. Students will learn to work with a variety of populations throughout the semester. Students will be evaluated on their effectiveness in designing and instruction exercise sessions for both individual and group-led scenarios. This course is designed to help students prepare for future clinical practice and certifications, such as the ACSM Certified Clinical Exercise Physiologist. Must have CPR/AED, First Aid certifications.

Learning Outcomes: 1. Describe musculoskeletal anatomy, physiology and biomechanics related to exercise and the effects of resistance training, cardiorespiratory training and flexibility. 2. Perform fitness assessments and client intake interviews to acquire clients' baseline fitness, health history, exercise background and goals, to allow for proper exercise program development. 3. Develop and administer group exercise and/or group personal training classes incorporating muscle conditioning, aerobic training, HIIT, circuit training, etc. 4. Develop and implement resistance training programs for client/s based upon initial assessment data and intake information, and adjust the program throughout the semester. 5. Describe modifications and appropriate precautions required when developing and instructing exercise programs for populations with special health/physical concerns. Credits: 3.00

HK 32700 - Introduction To Sports Management

Credit Hours: 3.00. This course introduces the foundations and principles of sport management, focusing on the leadership, administration, business practices, and operation of sport organizations at all levels. This course offers students the opportunity to gain information and an understanding of the various practices and procedures associated with sport management and the sport industry. Students are presented with an overview of the business of sport, including a variety of different career opportunities in a multitude of sport settings as they explore the value of professional management within sport organizations. Finally, this course uses a semester-long major project that allows students to use the skills and knowledge gained from lectures, readings, and discussions to develop a comprehensive business plan integrating the various modules and topics from the semester into a cohesive administrative plan.

Learning Outcomes: 1. Describe the career possibilities in sport management, as well as the skills and strategies necessary to be successful in the field. 2. Explain the development of the sport business industry and the defining characteristics of the modern sport business industry. 3. Identify concepts of management theory and how these concepts help managers and sport organizations succeed. 4. Explain the central role that leadership plays in sport organizations and how leadership theories apply to management. 5. Identify the characteristics, similarities, and differences among various sport management sites (community, interscholastic), intercollegiate, professional, and international sport). 6. Recognize the unique characteristics of sport marketing and how a marketing plan is linked to an organization's mission, values, and strategy. 7. Recognize the necessary steps in managing a facility and a corresponding risk management plan. 8. Demonstrate the components and workings of sport media and its interaction with the sport industry, including the increasing influence of social media and the internet within the sport industry. 9. Describe the basic principles of economics as they pertain to the sport industry and be able to describe the business structure of sport organizations. 10. Discuss the social and cultural significance of sport in our society. Credits: 3.00

HK 32800 - Business Of Professional Sports

Credit Hours: 3.00. This course examines the rise and growth of professional sport into a multibillion-dollar industry worldwide that is both an economic giant as well as a pop cultural phenomenon. The course takes a look at the historical development of professional sport while also examining current trends that continue to shape the industry. Students learn the basics of how pro leagues and teams operate by participating in an interactive and engaging fantasy sports simulation that sees them create their own league and manage and operate their own team. In the simulation, students deal with issues real-life pro sports managers have to address every day, including roster construction and management, pricing their product, and marketing and branding their franchise and league overall.

Learning Outcomes: 1. Explain fundamental economic concepts, particularly as these concepts relate to the sports industry. 2. Analyze differences in organizational structure across the major American sports leagues, such as the generation and distribution of revenues, restrictions on player salaries, and the promotion of competitive balance. 3. Discuss the interplay between sports leagues and antitrust policy and the seminal court cases that have led to full and/or partial exemptions to federal antitrust laws for certain leagues. 4. Compare and contrast the various funding mechanisms state and local municipalities have used to attract and/or keep a sports franchise as well as critically analyze the economic benefits of a sports franchise to a city. 5. Explain the labor market in professional sports, particularly the determination of player salaries and key disputes between player unions and league management. Credits: 3.00

HK 34500 - The Coaching Of Interscholastic Sports

Credit Hours: 2.00. Discussion and practical experience in organizing, training, and coaching interscholastic athletes in a selected sport. A partial list of sports that may be selected: baseball, basketball, football, gymnastics, soccer, swimming, track/field/cross country, volleyball, and wrestling.

Credits: 2.00

HK 34600 - Field Experience In Coaching

Credit Hours: 2.00. Students will be assigned to assist in coaching a team in a public-, parochial-, or selected university-sponsored program. A partial list of sports available: baseball, basketball, football, gymnastics, soccer, swimming, track/field/cross country, volleyball, and wrestling. Permission of instructor required.

Credits: 2.00

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

HK 37200 - Sport And Exercise Psychology I

Credit Hours: 3.00. This course focuses on social and psychological factors related to participation in sport, exercise, and physical activity. The class explores both (a) how social and psychological factors influence participation and performance in physical activity, and (b) how sport, exercise, and physical activity participation affects psychological well-being. Topics include personality, socialization, learning and feedback, stress and coping, self-perceptions, motivation, and psychological methods for enhancing personal development and physical performance.

Learning Outcomes: 1. Develop an understanding of social and psychological processes that operate in physical activity. 2. Acquire the knowledge to successfully apply social psychological principles within a variety of physical activity settings. Credits: 3.00

HK 37600 - History Of Sport

Credit Hours: 3.00. A prior course in American or world history is recommended but not required. A survey of historical events that have shaped classical and modern sport, with a focus on recent history of American sport.

Learning Outcomes: 1. Examine the historical themes, factors, and particular events influencing the nature of sport within the larger context of United States history and culture. 2. Describe how sport shaped aspects of American culture and identify the critical place of sport in the emergence of American culture. 3. Investigate the ways gender, race, ethnicity, and class have influenced sporting experiences in the past and present, and determine the cultural and human diversity within sports in the United States. Credits: 3.00

HK 40900 - Seminar In Sports Medicine

Credit Hours: 3.00. A review of selected medical aspects of sports. Liberal use of guest medical professionals. A broad look at the field of sports medicine.

Learning Outcomes: 1. Explain the various professional disciplines within the sports medicine profession and those healthcare providers that interact with athletic training. 2. Explore current trends at the state, district and national level in athletic training involving clinical practice or education. 3. Develop athletic training students' understanding of contemporary medical information required in different sports medicine practice settings.

Credits: 3.00

HK 41500 - Exercise As Medicine

Credit Hours: 3.00. Provide students with the concepts, techniques, and skills to investigate the scientific evidence on physical activity and health; and to design and implement interventions to make physical activity a part of daily campus culture. Permission of instructor required.

Learning Outcomes: 1. Recognize and describe the consequences of regular physical activity (PA) and inactivity on individual and community health. 2. Recognize and describe the causes of and solutions for health disparities in communities. 3. Develop activities to promote physical activity on campus. 4. Develop activities to promote physical activity through social media and online content. 5. Evaluate the success of activities promoting physical activity. Credits: 3.00

HK 42100 - Health Screening And Fitness Evaluation And Design

Credit Hours: 3.00. This course provides the learner with the knowledge and skills to successfully administer and interpret the results of health evaluations and fitness assessments for the purposes of analysis and the development of individualized exercise programs.

Learning Outcomes: 1. Apply specific physiological principles to individual physical health prescription: Cardiovascular Health, Body Composition, Posture, Muscular Strength, Muscular Endurance, Flexibility, ROM. 2. Explain verbally identified fitness assessment tests as would to a client indicating what, why, and how they are each performed. 3. Administer pre-exercise screening questionnaire/informed consent and identify needs for a medical clearance. 4. Administer accurately identified fitness assessment tests to a client and classify results. Credits: 3.00

HK 42200 - Basic Concepts In Exercise Program Design

Credit Hours: 3.00. Introduces basic program design concepts and rationale to design fitness programs for healthy adults emphasizing cardiovascular training, strength training, flexibility training, and balance.

Learning Outcomes: 1. Design and implement a safe and effective warm up and cool down protocol specific to the individual. 2. Create and implement well-planned, individualized, and progressive resistance training programs. 3. Develop progressive and individualized cardiovascular training programs. 4. Describe the role of exercise in healthy weight management. 5. Apply the scientific concepts to design exercise programs to improve athletic performance and optimize fitness in non-athlete healthy persons. Credits: 3.00

HK 42700 - Sports Marketing

Credit Hours: 3.00. This course introduces and examines marketing within various levels of the sport industry, with an emphasis on consumer behavior, branding, and sponsorship. This course first introduces students to the marketing of sport services, sport teams, and sport programs by examining basic marketing strategies as they relate specifically to sport settings. Second, the course examines key consumer behaviors regarding sport fans and sport fan communities. Finally, the course enables students to formulate original and creative sport marketing mixes to provide students with the hands-on practice necessary to become an effective sport marketer.

Learning Outcomes: 1. Explain the unique characteristics of sport marketing. 2. Recognize what motivates individuals to engage in sport-related consumer behavior. 3. Identify practices for developing and socializing sport fans and sport fan communities. 4. Interpret data sources for segmenting, targeting, and positioning strategies within sport. 5. Synthesize existing marketing ideas in original ways. 6. Formulate and analyze sponsorship proposals. 7. Design and implement sport marketing strategies characterized by high degrees of innovation, divergent thinking, and risk-taking. Credits: 3.00

HK 42800 - Sports Facility And Event Management

Credit Hours: 3.00. This course is meant to introduce students to the foundations and principles of effective facility and event management. Sport facilities and the types of events they can host are essential components to understanding the field of sport management. In this course, we will explore the concepts of facility design, planning, systems, risk management, marketing, and ownership. In terms of event management, we will explore the concepts of event creation, impact on hosts, marketing/sponsorship, and the potential positive and negative

outcomes of sport events.

Learning Outcomes: 1. Define and apply key facility and event management terminology and concepts to the sport and recreation industry. 2. Engage critically with facility and event management sites and evaluate the potential positive and negative outcomes associated with sport facility and/or sport event development. 3. Display the ability to organize, coordinate, and execute operational plans for various sizes of facilities and events. Credits: 3.00

HK 44300 - Neuroscience Of Movement

Credit Hours: 3.00. In this course students will learn about the neuroscience behind the control, sensation and perception of human movement. The course is divided into five sections. In the first section, students learn about the sensory systems with human movement. In the second section, students learn about the basic CNS building blocks underlying movement control and perception. In the third section, the control of balance and locomotion is the central topic. In the fourth section, students learn about the higher brain functions involved in cognition. The final section of the class examines issues regarding learning, development, and brain plasticity.

Learning Outcomes: 1. Able to describe basic principles of the neuroscience behind the control of human movement. 2. Able to apply principles of the neuroscience of movement to clinical, educational, research, and sports science setting using specialized laboratory equipment. Credits: 3.00

HK 44400 - Balance Rehab In Older Adults

Credit Hours: 3.00. In this course, students learn about the decline in motor function that occurs in older adults and techniques to improve motor function in an older population. Topics include decreased balance control, loss of muscle strength, and declines in adaptive locomotion as a function of age. Students enrolled in this class also participate in an off-campus lab. In the lab, students are paired with an older adult and use the knowledge gained in lecture to improve the motor function of the older adult. This class provides students with a unique opportunity to gain hands-on experience working with an older population. Permission of instructor required.

Learning Outcomes: 1. Describe the declines in motor function that occur in older adults. 2. Critically assess intervention research with aims to improve motor function in older adults. 3. Describe and evaluate types of interventions and their effectiveness. 4. Use quantitative equipment to assess balance and mobility of younger and older adults. Credits: 3.00

HK 45300 - Motor Coordination And Development

Credit Hours: 3.00. An advanced undergraduate motor development course that examines the processes and coordination principles related to motor behavior development across the life span. Material and concepts are concentrated around specific skills areas and SPAN a broad range of ages and theoretical approaches.

Learning Outcomes: 1. Describe how motor abilities develop in infancy and childhood both in typically developing and clinical populations. 2. Apply basic research designs in motor developments to clinical populations. Credits: 3.00

HK 45800 - Principles Of Motor Control And Learning

Credit Hours: 3.00. Discussion of the principles of motor learning and control. Relevant research literature will be surveyed with an historical perspective. Students will be expected to design and/or conduct a mini research project.

Credits: 3.00

HK 46300 - Analysis Of Human Motion

Credit Hours: 3.00. An analytic approach to the mechanical analysis of human motion, including modeling procedures and computer-generated display techniques.

Credits: 3.00

HK 46500 - Research Methods

Credit Hours: 3.00. This course will be conducted in a lecture/lab format. The lectures will introduce the basic knowledge necessary to understanding the entire research process as it is found in health and kinesiology. The laboratories will be designed to give students practice in discovering research questions, preparing research proposals, evaluating existing research, and applying research to practical problems.

Learning Outcomes: 1. Describe the nature of research and the scientific method. 2. Describe the different types of research conducted within health and kinesiology, and the value of each type of research. 3. Provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating research in basic and applied settings. 4. Identify a potential topic/issue to examine and conduct a review of the existing

research literature and summarize and critically evaluate a research article. 5. Describe the steps involved in developing a research proposal, collecting and analyzing data, and reporting the results of a research project.

Credits: 3.00

HK 46800 - Advanced Exercise Physiology II

Credit Hours: 3.00. An advanced undergraduate course in the area of exercise and human performance. Further examination of the physiological mechanisms and theories involved in the exercise response.

Credits: 3.00

HK 46900 - Exercise Testing And Prescription In Special Populations

Credit Hours: 3.00. Examines responses to exercise testing and prescription in healthy adults compared to exercise responses and special considerations for individuals with chronic diseases and conditions and issues of concern to pregnant women, children, and older adults, among others.

Learning Outcomes: 1. Identify the difference in testing and prescription for individuals with chronic conditions. 2. Evaluate critically the risks and benefits associated with exercise participation. 3. Apply appropriate emergency procedures in various exercise settings. 4. Deliver unique exercise programs to special populations. Credits: 3.00

HK 47200 - Sport And Exercise Psychology II

Credit Hours: 3.00. Course presents topics not covered in PE 37200 and emphasizes application of psychological principles in sport and exercise settings. Topics include group dynamics, psychological benefits of exercise; exercise addiction; body image; leadership and communication; and performance enhancement principles and techniques.

Learning Outcomes: 1. Describe the basic principles of the psychological processes in sport and exercise contexts. 2. Synthesize and apply theoretical and empirical knowledge in sport and exercise psychology through active learning processes and interaction with fellow students. 3. Apply critical thinking, group interaction, public speaking, research, and writing skills. Credits: 3.00

HK 47600 - Olympic Games: Ancient And Modern

Credit Hours: 3.00. A historical study of the nature and significance of the ancient and modern Olympic Games. Topics include genesis of the games; evolution of events; the amateur ideal; social, economic, and commercial influences; politics; modern controversies; and various reform movements.

Credits: 3.00

HK 47700 - Sport And Exercise Psychophysiology

Credit Hours: 3.00. The purpose of this course is to give students an understanding of the psychological, behavioral, and social processes as related to and revealed through physiological principles and events underlying human movements in the context of sport and exercise. This course will utilize traditional lectures combined with student-led group discussions to examine topics including, but not limited to, the following: (1) introduction, principles, and measurements of psychophysiology, (2) psychophysiological characteristics of optimal mental state and superior performance, (3) biofeedback and neurofeedback training in performance enhancement, and (4) acute and chronic effects of sport and exercise participation on cognition and emotion.

Learning Outcomes: 1. Describe and explain the study of psychophysiological processes that operate in the context of human movements in sport and exercise. 2. Describe and explain the methods and theories in the study of sport and exercise psychophysiology. 3. Evaluate major sport and exercise psychophysiology studies on topics such as enhancements in athletic performance, cognition, and emotion in terms of their methods, results, conclusions, and implications. 4. Analyze and synthesize concepts and theories across topics, readings, and discussions. 5. Communicate ideas in writing and group discussion in a clear, coherent, and logical style. 6. Acquire the knowledge to apply psychophysiological principles within sport and exercise settings.

Credits: 3.00

HK 49000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for undergraduate students. Permission of instructor required.

Credits: 1.00 to 3.00

HK 49100 - Research Experience In Health & Kinesiology

Credit Hours: 1.00 to 3.00. Individualized activities related to a

faculty member's research in health and kinesiology appropriate for undergraduate students; no project presentation required. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 3.00

HK 49500 - International Special Topics

Credit Hours: 1.00 to 3.00. Course taken during an international experience that is recognized by the university. Permission of department required.

Credits: 1.00 to 3.00

HK 49600 - Mentored Research In Kinesiology

Credit Hours: 1.00 to 3.00. Students are engaged in a research project under the guidance of a faculty member in one of the areas of inquiry in the kinesiology major. Permission of instructor required.

Credits: 1.00 to 3.00

HK 50000 - Introduction To Athletic Training Practice

Credit Hours: 3.00. This course covering the roles and responsibilities of an athletic trainer as well as the history, governance structure, and regulation of the athletic training profession. Instruction and practical application of taping, wrapping, bracing techniques, and protective equipment is also included. Permission of department required.

Learning Outcomes: 1. Identify and evaluate the role of the NATA, BOC, CAATE, Foundation, and state practice acts in athletic training governance and practice regulation. 2. Compare and differentiate the role of a certified athletic trainer and other professionals in the health care of patients and in the broader health care system. 3. Describe and critique safe athletic training practices (e.g. OSHA standards). 4. Evaluate the fundamental role of evidence-based practice as it relates to athletic training and its use in the clinical decision making process. 5. Explain the theoretical foundation of clinical outcomes assessment (e.g., disablement, health related quality of life) and apply common methods of outcomes assessment in athletic training clinical practice (generic, disease-specific, region-specific, and dimension-specific outcomes instruments). 6. Analyze mechanisms of injury/etiology, recognition, and treatment associated with common injuries and illnesses. 7. Develop skills in adhesive taping and acute injury management. 8. Develop skills in protective pad fabrication and implementation. 9. Develop technical skills in the appropriate management of athletic medical emergencies. 10. Have a working understanding of athletic and medical protective equipment/materials and be able to evaluate patient needs in athletic medical situations. 11. Construct a preparticipation examination as it pertain to the prevention of injuries. Credits: 3.00

HK 50600 - Evidence Based Practice In Athletic Training

Credit Hours: 2.00. Introduction to research methodology, and qualitative and quantitative data analysis as related to evidence-based practice of athletic training. The course addresses formulating clinical questions; searching, reading and appraising research; understanding levels of evidence; and citing and referencing works to become consumers of and designers of evidence. The course introduces students to the selection, application, and interpretation of basic descriptive, correlational, and interferential statistics. Permission of department required.

Learning Outcomes: 1. Understand and compare the types of research commonly undertaken by researchers within the field of athletic training. 2. Appreciate and understand the ethical considerations within the research process. 3. Conduct a review of literature on the research topic allowing the student to organize and interpret the findings while writing of the review of literature of a paper for publication. 4. Consider the mechanics of designing the research process which allows the student to begin writing an introduction of a paper for publication. 5. Evaluate the concepts of internal and external validity of research design. 6. Weigh the importance of reliable and valid measurements in athletic training research. 7. Distinguish between experimental and non-experimental research designs and the advantages and disadvantages with each type of design. 8. Critique the typical measures utilized by athletic training researchers to report strength, proprioception and kinesthesia,

balance, stability, range of motion, etc. results in athletic training research. 9. Create all the different components of the research design concluding with the writing of a methods section of a paper for publication. 10. Understand and apply basic statistical measures such as: descriptive, inferential and probability statistics. 11. Understand and apply the common applied statistical decision making techniques in athletic training research analysis of variance, repeated measures analysis of variance, and correlation analysis, etc. 12. Organize and construct the results section of the research project for both thesis chapter and manuscript formats. 13. Understand the importance of and methods associated with obtaining research funding through grant writing and other mechanisms. Credits: 2.00

HK 51100 - Electrocardiogram And Exercise Testing

Credit Hours: 3.00. This course is designed to provide students with competencies related to electrocardiogram and exercise testing. Students will develop skills to interpret a 12-lead ECG, prep and execute a resting 12-lead ECG, complete appropriate pre-screening for graded exercise testing and develop an understanding and initial skills for administering a diagnostic exercise test. Additionally, students will explore various cardiac, pulmonary and/or metabolic testing common to the clinical exercise testing setting. The course is designed to help students prepare for future clinical practice and certifications, such as the ACSM clinical exercise physiologist certification.

Learning Outcomes: 1. Explain the application of ECG and rationale of its utilization in preventative, diagnostic and prognostic settings. 2. Establish fundamental knowledge of ECG interpretation, identification of abnormalities, and the clinical significance of findings. 3. Utilize critical thinking skills to identify anatomical and physiological reasons for ECG changes and potential diagnoses. 4. Demonstrate abilities to execute a resting 12-lead ECG and ECG with stress testing and communicate results (recognizing both normal and abnormal responses to exercise). 5. Explore and differentiate various assessments/tests common to the clinical exercise testing setting. 6. Appraise different test characteristics - reliability, validity, sensitivity, specificity, etc., and its relevance with test selection. 7. Synthesize knowledge obtained from pre-screening information and test characteristics to select appropriate assessments/tests and protocol. 8. Display proficient application of various exercise test protocols, their utilization and associated best practices. Credits: 3.00

HK 51500 - Emergency Medical Management In Athletic Training

Credit Hours: 4.00. This course is designed to teach management concepts and skills used by athletic trainers in emergency situations. Topics addressing prevention, recognition, and management of life-threatening and/or severe injury and illness are included. Application of skills that include the environment, CPR/AED, airway management, immobilization, bleeding control and sudden illness management are also addressed. Students will become certified in CPR/AED. Permission of department required.

Learning Outcomes: 1. Analyze typical administrative policies and procedures that govern first aid and emergency care. 2. Distinguish the different hospital trauma levels and the role of the system in the transportation decision making process. 3. Perform a primary and secondary patient assessment, as well as an assessment of the scene. 4. Obtain and interpret vital signs including pulse, respirations, blood pressure, core body temperature, and oxygen saturation. 5. Distinguish the different types of airway adjuncts and demonstrate airway management skills. 6. Evaluate the indications, application, and treatment parameters for supplemental oxygen administration for emergency situations, and be able to administer supplemental oxygen. 7. Apply proper management strategies for external hemorrhage. 8. Compare different proper positioning, immobilization and transfer techniques for a patient using a spine board. 9. Evaluate and select proper techniques for

removing equipment and clothing to access an airway or evaluate an injured part. 10. Evaluate and choose techniques to immobilize injuries to the extremities. 11. Explain and demonstrate the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 12. Recommend strategies to manage environmental emergencies. 13. Distinguish and recommend techniques for infectious control regulations including Universal Precautions. 14. Attain Basic Life Support for Healthcare Providers certification. Credits: 4.00

HK 51700 - Governance In Sport

Credit Hours: 3.00. This course is an examination of sport organizations focused both on professional and amateur governance structures and processes, with a focus on the NCAA. The study of policy in educational, non-profit, professional and international sport venues will also be addressed.

Learning Outcomes: 1. Identify governing bodies in professional and amateur sport. 2. Recognize policy components and processes in major sport governing bodies. 3. Recognize the influence of governmental bodies and commissions on sports. 4. Identify the organizational structure of various sport governing bodies. 5. Assess the authority and functions of various sport governing bodies. 6. Identify the membership requirements of various sport governing bodies. 7. Identify the sanctions and appeal processes utilized by sport governing bodies. 8. Understand American sport policy and governance in comparative and international context. 9. Understand different forms of sport policy and governance internationally. Credits: 3.00

HK 51800 - Analytics And Technology In Sport

Credit Hours: 3.00. This course is designed to acquire the fundamentals of sports performance analytics. It provides a basic understanding of the different key performance indicators within sports performance analytics including load management, injury prevention, drafting and scouting. The course also provides an understanding of how business analytics can drive decisions in the sport world.

Learning Outcomes: 1. Apply data science principles to sports performance, referred to as sports analytics. 2. Apply measurement and statistical modeling to professional athletes in sports. 3. Examine professional athletes' performance and implication of injuries on market value. 4. Present data to different pro sports industry audiences: players, coaches, and front office management. 5. Apply the processes that take place from the inception of a research question, identification of key performance indicators, data collection, statistical analyses, and data visualization, also termed the sports science data protocol. Credits: 3.00

HK 52000 - Evaluation And Management Of The Lower Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the lower extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the lower extremities. 2. Apply different methods of prevention for many injuries commonly seen in the lower extremities. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the lower extremities. 5. Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the lower extremities. 7. Summarize the role and function

of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the lower extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 52100 - Sport Administration

Credit Hours: 3.00. This course is designed to provide students with a deeper understanding of variety of areas within Sport Management. Students will learn about youth, college and professional sport and the various ancillary roles and departments that are attached to each. Students will also engage in a focused book reading and current event reading to further understand the roles in sport.

Learning Outcomes: 1. Develop group leadership skills through discussions and presentations. 2. Acknowledge the historical ramification of the creation of the NCAA and of professional leagues how this impacts today's sport setting. 3. Recognize the management functions that exist in a contemporary sport organization. 4. Understand the major factors affecting today's world of professional, collegiate, and amateur sport. 5. Develop a personal philosophy regarding organizations within the sport industry. 6. Develop a greater knowledge of intercollegiate athletics administration. 7. Acknowledge the historical, socio-cultural, and ethical factors facing today's college and professional sport. Credits: 3.00

HK 52200 - Sport Law And Ethics

Credit Hours: 3.00. This course explores legal problems facing sport. Students will learn fundamental legal principles including employment law, ADA requirements, hazing, sexual harassment, and Title IX application. Both past and current legal cases related to sport, recreation and fitness industries are examined. Concerns and problem-solving for issues of risk management are also explored.

Learning Outcomes: 1. Develop an understanding of the history and development of the American legal system and courts. 2. Analyze and apply ethical and legal literature in case law, statutes, periodicals, and texts. 3. Explain the basic understanding of terminology and procedures used in legal proceedings. 4. Discuss legal aspects most important to sport management including tort law, contract law, physical activity situations, constitutional law, Title VII and Title IX. 5. Create a comprehensive understanding of risk management and other legal theories to minimize or avoid legal liability in sport settings. 6. Gain a deeper understanding of the ethical reasoning/decision-making process and develop the knowledge, skills, and abilities to apply moral reasoning in dealing with ethical dilemmas in sport. Credits: 3.00

HK 52400 - Managing Health, Fitness, And Sports Organizations

Credit Hours: 3.00. An overview of the major principles, considerations, and techniques involved in managing health, fitness, and sports (HFS) organizations. Emphasizes the skills and competencies involved in the planning, organization, and control of opportunities, resources, and facilities in HFS settings. Permission of instructor required.

Credits: 3.00

HK 52500 - Marketing And Promotion In Health, Fitness, And Sports Organizations

Credit Hours: 3.00. An overview of marketing and promotion in health, fitness, and sports organizations. Emphasizes the skills necessary to develop marketing and promotion plans and to develop materials and approaches for carrying out these plans in health, fitness, and sports settings. Permission of instructor required.

Credits: 3.00

HK 52600 - Communication And Media In Sport

Credit Hours: 3.00. This course is designed to provide students with a deep understanding of the unique role and importance of internal and external communications in relation to sport. Furthermore, it examines the important role the media plays in the sport universe. The intermingling of sport organization and sport media is also examined, especially within the context of

the changing nature of the relationship in the 21st century.

Learning Outcomes: 1. Explain why it is essential to learn about technology today and discuss several ways technology has been integrated into our business and personal lives. 2. Discuss the organizational and societal impact of implementing technology; including some benefits and risks related to the prominence of computerized technology in our society. 3. Explain the impact of computerized communications (blogs, podcasting, viral marketing, etc.) on businesses, personal lives, and the sports Industry. 4. Describe social networking (including some computerized elements) and how it can be used to enhance and expand customer relationships for businesses and the sports Industry. 5. Define web-based multimedia and list some of the advantages and disadvantages of using multimedia and demonstrate how to utilize web-based media to create Marketing and Public Relations products; some examples include (a) newsletter, (b) press release, (c) podcast, (d) web pages, interactive training presentation, and (f) social media. Credits: 3.00

HK 52800 - Sport Event Management And Operations

Credit Hours: 3.00. Introduces students to the planning and management of national and international sport events through the strategic and systematic process of event management, exploring the phases and structural domains associated with the model.

Learning Outcomes: 1. Apply the event management process to sport events. 2. Develop sustainable sport events. 3. Create risk management solutions to minimize, transfer, avoid, or accept risks for sport events. 4. Respond appropriately to managerial challenges facing sport event managers. Credits: 3.00

HK 52900 - Venue Management

Credit Hours: 3.00. This course will examine all aspects of the management of sport facilities, including development, planning, staffing, operations, and evaluation. Students will study the relationships between the respective parties in terms of ownership, management, and the event.

Learning Outcomes: 1. Develop a basic understanding of the managerial issues (e.g., building planning, hospitality, employee and event recruitment, selection, and negotiating) that are specific to sport event and facility management. 2. Schedule, promote, market, and maintain events and facilities. 3. Develop an appreciation of the legal liability associated with events and facilities management and emergency crowd control. 4. Understand the basic principles of facility design and construction. 5. Seek to discuss issues centered on preventive maintenance, facility planning, event administration, box office management, concessions, house and ground management, systems management, marketing, finance, and personnel administration. Credits: 3.00

HK 52950 - Sport Practicum

Credit Hours: 1.00 to 3.00. This course is designed to provide students with a deeper understanding of the variety of different areas within Sport Management. Students will learn through practical experience in the field. Students will also engage in a focused book reading and current event reading to further understand the roles in sport.

Learning Outcomes: 1. Apply classroom experiences to the real world through specific projects and experiences. 2. Examine how the practice of various activities varies from the ideal taught in a classroom. 3. Lead others in moving a project from start to conclusion. 4. Present to faculty and students in the classroom how the real-world experience improved their understanding of necessary skills. Credits: 1.00 to 3.00

HK 53000 - Evaluation And Management Of The Upper Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the upper extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and

management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the upper extremities. 2. Apply different methods of prevention for many injuries commonly seen in the upper extremities. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the upper extremities. 5. Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the upper extremities. 7. Summarize the role and function of commonly used prescription and non prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the upper extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of upper extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 53200 - Musculoskeletal Adaptations

Credit Hours: 3.00. This course will utilize traditional lecture combined with small group, student-lead learning to study the impact of acute and chronic exercise on skeletal muscle and tendon. Topics covered will include muscle growth, muscle metabolism, structural and functional changes in skeletal muscle and tendon, the impact of age and sex on exercise adaptations, and the impact of exogenous agents on skeletal muscle and tendon adaptations to exercise. Other topics may include the impact of unloading (e.g., bedrest) and spinal injury on skeletal muscle and tendon. This course will be relevant to those interested in exercise physiology, athletic training, physical therapy, occupational therapy, medical school, nutrition science, engineering, and similar programs of study. Permission of department required.

Learning Outcomes: 1. Analyze and synthesize research in the area of musculoskeletal adaptations to exercise - including the effects of exercise on skeletal muscle, tendon, and bone - and how aging, sex, and lack of activity influence exercise adaptations. 2. Critically evaluate research data in the context of exercise, human health, and rehabilitation. 3. Develop a strong base knowledge of the current state of the literature regarding musculoskeletal adaptations to exercise. 4. Gain experience presenting research findings in oral and written format. Credits: 3.00

HK 53500 - Athletic Training Interventions

Credit Hours: 3.00. This course is designed to provide the student with the foundational theory and techniques related to injury and illness intervention. Included are topics addressing tissue healing, theories of pain and pain control, concepts of kinetic chain stability and mobility, as well as principles related to the use of therapeutic medications. Students will discover how to plan and implement a comprehensive reconditioning program for injuries and conditions sustained by physically active individuals. Permission of department required.

Learning Outcomes: 1. Distinguish the role and types of clinical outcome assessments/measures utilized in clinical practice to determine patient progress. 2. Compare the phases of tissue healing and its implications on intervention design, implementation and progress. 3. Compare common pain control theories and evaluate methods to control pain. 4. Evaluate common indications and contraindications to common therapeutic interventions. 5. Compose a comprehensive rehabilitation program including: determination of therapeutic goals and objectives, selection of therapeutic modalities and exercise, methods of evaluation and documenting rehabilitation progress, and development of criteria for progression and

return to activity. 6. Demonstrate and instruct therapeutic exercises and implement a rehabilitation plan. 7. Analyze local, state, and federal standards/law for the safe application of therapeutic modalities, rehabilitation equipment and medications. 8. Generalize concepts related to the administration of therapeutic administration of medication. 9. Use peer reviewed resources to examine a common condition presented to a rehabilitation professional and construct an evidence based injury rehabilitation protocol for return to competitive activities. 10. Perform a professional oral presentation using professional communication skills. Credits: 3.00

HK 53600 - Cardiopulmonary Physiology

Credit Hours: 3.00. This course will provide a comprehensive overview of the characteristics and regulatory mechanisms underlying the cardiorespiratory adjustments to exercise. The effects of chronic diseases, including chronic obstructive pulmonary disease, peripheral artery disease and chronic heart failure, on the cardiovascular and respiratory responses to exercise will also be discussed in detail. Permission of department required.

Learning Outcomes: 1. Describe and compare the cardiovascular and respiratory responses to incremental, submaximal and prolonged exercise. 2. Define and analyze the role of muscle afferents and central command on the regulation of cardiovascular and respiratory adjustments to exercise. 3. Delineate and evaluate the effects of exercise training on the cardiovascular and respiratory systems. 4. Synthesize recent research findings on the consequences of chronic disease on the cardiovascular and respiratory adjustments to exercise. Credits: 3.00

HK 54000 - Evaluation And Management Of The Spine And Head

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the spine and head, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the spine and head. 2. Apply different methods of prevention for many injuries commonly seen in the spine and head. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the spine and head. 5. Consider anatomical growth and development characteristics of males and females in the following stages: pre-adolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the spine and head. 7. Summarize the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the spine and head. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics -validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 54100 - Athletic Training Practicum I

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 17. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 18. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 19. Demonstrate the ability to evaluate a patient with an emergency injury or condition. Credits: 2.00

HK 54200 - Athletic Training Practicum II

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further

examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Educate others using relevant and effective teaching methods. 20. Produce quality documentation in a timely manner to support the delivery of athletic training services. 21. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 22. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 23. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 24. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 25. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 54300 - Athletic Training Practicum III

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely

manner to support the delivery of athletic training services. 23. Collect and analyzes data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 29. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 30. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 54500 - Therapeutic Modalities

Credit Hours: 3.00. Course covering the physiological effects, indications, contraindications, and precautions of contemporary therapeutic modalities. Students will design and plan therapeutic interventions. Focus will be on the application of therapeutic modalities according to evidence-based protocols. Included in this course will be the role of equipment safety and maintenance of therapeutic modalities. Permission of department required.

Learning Outcomes: 1. Explain the inflammatory response to acute and chronic injury. 2. Select the appropriate modality according to treatment goals and objectives. 3. Compare the prevailing pain control theories and associated rationale for the selection and use of therapeutic modalities for the control of acute and chronic pain. 4. Evaluate the physical properties, biophysics, set-up, indications, contraindications, and specific physiological effects associated with the application of superficial cold and heat; stimulating electrical currents; diathermy; therapeutic ultrasound; intermittent compression units; iontophoresis; traction; massage; biofeedback; and LASER. 5. Administer contemporary therapeutic modalities to a patient using clinically acceptable procedures including patient preparation, set-up, determination of dosage, and operational procedures according to established guidelines. 6. Inspect therapeutic equipment and the treatment environment. 7. Identify various standards that influence the approval, operation, inspection, maintenance and safe application of therapeutic equipment. 8. Use a systemic approach to create and answer a clinical question. 9. Summarize differences between narrative reviews, systematic reviews, and meta-analysis. 10. Search for, find, and document the best evidence to support a problem or clinical problem. 11. Develop a Critically Appraised Topic (CAT) that includes a PICO, creating a search strategy (search terms), using databases to find evidence, appraising evidence, determining levels of evidence, analyzing and synthesizing evidence, and determining a clinical bottom line. 12. Present a Critically Appraised Topic using professional communication skills. Credits: 3.00

HK 54600 - Lifestyle Medicine

Credit Hours: 3.00. This graduate-level course reviews the principles and practices of lifestyle medicine. Students will explore the evidence-based application of lifestyle medicine in

preventing, managing, and treating chronic disease. Students will learn about the application of all six pillars of lifestyle medicine: physical activity, nutrition, sleep, stress management, substance avoidance, and health relationships / social well-being. Students in this course will obtain knowledge, skills, and tools via lectures, research reviews, group discussions, and experiential learning. Throughout the course, students will learn to comprehensively apply lifestyle medicine to healthy individuals and those with chronic diseases across the community. Upon completing the course, students will be empowered to promote healthy lifestyle change with clients/patients in their future healthcare professions. This course can be taken as part of a course series that will prepare students for a health coaching certification and the potential to sit for the National Board of Health and Wellness Coaching (NBHWC) health coaching certification exam.

Learning Outcomes: 1. Explore the application of evidence-based lifestyle medicine and its effectiveness in long-term health outcomes. 2. Assess the six pillars of lifestyle medicine and the impact and potential benefits of optimizing different variables, such as physical activity/exercise, nutrition, stress management, sleep, emotional well-being, social connectivity, etc. 3. Evaluate literature in lifestyle medicine critically and assess the utilization of different disease prevention and management strategies. 4. Appraise various health conditions and the power of lifestyle medicine on disease management and quality of life. 5. Integrate lifestyle medicine concepts into behavior change models and coaching techniques, such as the transtheoretical model, motivational interviewing, appreciative inquiry, strengths-based approach, goal setting, and more. 6. Explore the importance and impact of self-care and positivity for health and wellness professionals. Credits: 3.00

HK 54700 - Principles Of Health And Wellness Coaching

Credit Hours: 3.00. This is a graduate-level course that will assist students in refining patient/client communications and applying lifestyle behavior change strategies in practice. This course provides a comprehensive introduction to health and wellness coaching principles, practices, and theories. Topics include core components and scope of health coaching, behavior change models and theories, coaching structure, screening and assessment, building rapport, motivational interviewing, and more. This course is part of a series that will prepare students for a health coaching certification and the potential to sit for the National Board of Health and Wellness Coaching (NBHWC) health coaching certification exam.

Learning Outcomes: 1. Explain the role and scope of the health coach professional and core coaching competencies. 2. Explore and understand the theoretical foundations of coaching psychology, behavior change models & theories. 3. Establish fundamental knowledge within coaching applications and techniques, such as motivational interviewing, cognitive behavioral coaching, appreciative inquiry, and SMART goals techniques. 4. Evaluate current literature and research in the field of health and wellness coaching. 5. Demonstrate understanding of different assessments, screening tools, and health coaching techniques implemented through observation and peer-to-peer practice. Credits: 3.00

HK 54800 - Advanced Concepts And Application Of Health And Wellness Coaching

Credit Hours: 3.00. This course is a graduate-level skills-based course designed to provide practical applications of health and wellness coaching. Topics include advanced theories in health and wellness coaching, the application of effective coach-to-client communication techniques, legal considerations of the profession, and a health coach's professional scope of practice. Students in this course will complete peer-mentored coaching sessions and practical skills evaluations. This course is part of a series that will prepare students for a health coaching certification and the potential to sit for the National Board of Health and Wellness Coaching (NBHWC) health coaching certification exam.

Learning Outcomes: 1. Explore and practice behavior change models & theories. 2. Utilize evidence-based coaching techniques in practice. 3. Demonstrate efficiency in reviewing assessments and screening tools in the health coaching practice. 4. Display understanding and application of the core components of a coaching session, as well as the techniques and skills employed for successful sessions. 5. Synthesize knowledge from various coaching practices and techniques learned and

demonstrate skill in implementing these within coaching sessions. 6. Apply ethical principles and guidelines in the practice of health and wellness coaching. Credits: 3.00

HK 54900 - Health Coaching Practicum

Credit Hours: 1.00 to 3.00. This graduate-level practicum course affords students who have completed the two health and wellness courses (HWC), Principles of Health and Wellness Coaching (HK 54700) & Advanced Concepts and Application of Health and Wellness Coaching (HK 54800), pragmatic application of health coaching skills through ongoing coach-client interactions. Students will gain experiential mastery of communication, building client rapport, motivational interviewing, goal development, and other health coaching skills learned in HK 54700 & HK 54800. Students will work with a mentor(s) to complete health coaching hours through their identified site(s). Students will predominantly complete coaching sessions at the Purdue Recreation and Wellness and The AH Ismail Center. The class is designed to help students complete the 50 health coaching sessions required before applying to sit for the National Health and Wellness Coaching Board exam. Students in the HWC course series can complete required coaching sessions independently or by taking this practicum to obtain the coaching hours.

Learning Outcomes: 1. Demonstrate proficiency in the application and practice of health coaching techniques and skills. 2. Explore the utilization of motivational interviewing, cognitive behavior coaching, behavior change, and SMART goals techniques. 3. Administer and interpret health assessments and screenings in the health coaching practice. 4. Demonstrate an understanding of common conditions (cardiovascular disease, diabetes, hypertension, cancer, obesity, arthritis, etc.), the implications of lifestyle behavior on these conditions, and synthesize this understanding into health coaching practice. 5. Recognize signs/symptoms of mental health conditions (i.e., depression, anxiety, etc.) and when a referral is recommended. 6. Evaluate their coaching presence, the effectiveness of sessions administered, and implement practices to enable continued growth and 'mastery'. Credits: 1.00 to 3.00

HK 55000 - Evaluation And Management Of Medical Conditions

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the thorax and abdomen, including the cardiovascular, digestive, urinary, reproductive, endocrine, and lymphatic systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering injury assessment techniques of common illnesses and disease most often encountered by allied healthcare professionals will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the thorax and abdomen. 2. Apply different methods of prevention for many injuries commonly seen in the thorax and abdomen. 3. Differentiate general treatment and rehabilitation protocols to use with injuries in the thorax and abdomen. 4. Identify the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the thorax and abdomen. 5. Demonstrate through low fidelity simulation sound evaluation techniques of the thorax and abdomen. 6. Explain modifiable and non-modifiable risk factors pertaining to general medical conditions across the life span in the physically active and special populations. 7. Explain and identify the etiology, prevention, recognition and management of conditions leading to sudden death. 8. Explain and identify the etiology, prevention, recognition and management of general medical conditions associated with the systems of the body across the life span in the physically active and special populations. 9. Demonstrate the ability to assess and interpret findings in the evaluation of general medical conditions, using diagnostic accuracy and clinical prediction rules, associated with the systems of the body. 10. Explain the general therapeutic strategy, including drug categories for the treatment of

general medical conditions. 11. Use available resources to identify indications, contraindications, precautions, and adverse reactions of prescription and non-prescription medications. 12. Develop a clinical question, search for, assess, and synthesize evidence related to general medication conditions and pharmacology. Credits: 3.00

HK 55500 - Principles Of Manual Medicine

Credit Hours: 2.00. This course will provide students with the theory, skills, and clinical application of manual medicine. The emphasis will be placed on passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. All skills will be introduced through onsite demonstration and hands-on practice. Permission of department required.

Learning Outcomes: 1. Describe the basic theories and principles of various types of manual medicine. 2. Evaluate the patient indications and contraindications, treatment efficacy, and clinical applications of each kind of manual medicine technique. 3. Summarize and select appropriate manual medicine techniques to match injury pathophysiology. 4. Choose and apply manual medicine treatment techniques, including passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. 5. Create a plan of care including manual medicine in preparation for exercise and recovery from exercise. 6. Compare the role of manual medicine in a multi-disciplinary approach to treatment of soft tissue injuries. Credits: 2.00

HK 56000 - Advanced Procedures In Athletic Training

Credit Hours: 2.00. This course aims to provide students with advanced psychomotor skills in athletic training, such as wound closure, orthopedic casting, orthotic fabrication, biometrics and other emerging techniques and technologies. Skill integration into practice will be considered and practice act concerns will be discussed. Permission of department required.

Learning Outcomes: 1. Recognize different types of wounds and which require advanced management, including wound closure. 2. Compare wound closure techniques to determine appropriate applications. 3. Summarize the differences between casting methods. 4. Evaluate casting techniques relative to patient indications and pathology present. 5. Explain the purpose of foot orthotics as related to the pathomechanical model. 6. Apply wound closure techniques, orthopedic castings, and fabricate orthotics in simulated patients. 7. Consider and summarize emerging technologies and practices in athletic training, such as the use of biometrics to determine use and efficacy in a clinical setting. Credits: 2.00

HK 56300 - Business Of Sport

Credit Hours: 3.00. This course focuses on the application of financial management tools used to assist managers in the sport industry. Financial concepts will be examined as they relate to management decision-making. Emphasis will be on interpreting financial data and communicating results to operation managers.

Learning Outcomes: 1. Apply finance and business concepts effectively in a sport or entertainment setting. 2. Analyze financial data and make recommendations to management concerning financial position and produce a budget for your department or organization. 3. Explain in detail key public sources of finance for sport organizations and the advantages and disadvantages of each. 4. Explain in detail how sporting events create an economic impact for various locals. 5. Appreciate the current financial status of diverse segments of the sport industry. Credits: 3.00

HK 56700 - Epidemiology For Public Health Practice

Credit Hours: 3.00. This course presents the fundamental principles, methods, and applications of epidemiology, including the quantification of morbidity, mortality, and disease risk. Epidemiologic study designs and the use of public health vital statistics, disease transmission evidence, and risk assessment data are explored. Historically significant epidemiological cases

provide a framework for the application of ethical principles to epidemiologic research. This course meets the epidemiology core competency requirement for the Master's in Public Health (MPH) degree.

Credits: 3.00

HK 56800 - Advanced Exercise Physiology

Credit Hours: 3.00. The study of selected concepts and principles of physiology as they relate to the exercising human.

Credits: 3.00

HK 57400 - Advanced Exercise Psychology

Credit Hours: 3.00. This course is designed to examine psychological issues and theories related to exercise, the promotion of regular physical activity and active lifestyles. Emphasis is placed on the factors related to physical activity, health behavior theories, and the psychological and emotional consequences of exercise and physical activity. Key methodological considerations in behavioral health research will also be highlighted.

Learning Outcomes: 1. Discuss the feasibility, utility, and challenges of using theories in exercise psychology. 2. Compare and contrast several prominent health behavior theories, especially those with relevance to encouraging physical activity behaviors. 3. Identify research methodology criteria for evaluating the quality of exercise psychology and behavioral medicine studies, and appraise the quality of the research literature based on these criteria. 4. Acquire knowledge of the research literature and be able to have an informed and critical discussion of current perspectives and challenges in exercise psychology. 5. Design and develop their own questionnaire to assess health behaviors and psychological constructs for a given population. 6. Understand how psychological principles and theories are applied in exercise and physical activity contexts. 7. Develop graduate-level writing and oral presentation skills through course assignments. Credits: 3.00

HK 57600 - Diversity And Health

Credit Hours: 3.00. This course is designed to examine the health status and the politics of representation of the U.S. ethnic minorities (e.g., African Americans, Latinos, Asian Americans, Native Americans, Alaskans, etc.). Emphasis is placed on factors that influence health and health-related behaviors. The course is intended to provide students with an overview of historical, political, social, and cultural factors related to the health behavior and status of minority groups in American society.

Credits: 3.00

HK 57700 - Marketing, Branding, And Sales In Sport

Credit Hours: 3.00. This course is designed to provide students with (1) a deep understanding of theories and concepts in sport marketing, (2) an up-to-date understanding of them as they are currently being applied to solve marketing problems and issues in various sport business contexts, (3) strategies of making effective decisions concerning the marketing of sport products and brands, (4) a foundation for advanced study and work in marketing, consumer behavior, and related fields.

Learning Outcomes: 1. Articulate the factors that make sport marketing a unique enterprise. 2. Demonstrate an understanding of various research methodologies utilized in sport marketing. 3. Assess the value of segmentation in sport marketing. 4. Design, implement, and evaluate a sport marketing research plan. 5. Appreciate the elements of the sport product that contribute to its uniqueness in the marketplace. 6. Analyze the growth in importance of licensing, brand equity, and fan identification in sport marketing. 7. Differentiate among the unique factors that impact sport product pricing strategies. 8. Understand and evaluate the effectiveness of the key components of effective promotional programs and campaigns within the sport market. 9. Devise a promotional and sales plan within the sport marketplace. 10. Understand the scope and nature of sponsorship and the rationale for their use by corporations and the sport enterprise. 11. Analyze the importance of public relations and its unique role in the marketing mix within the context of sport. 12. Consider the future directions of sport marketing, giving special attention to the growth of electronic media and its parts. Credits: 3.00

HK 57800 - Organizational Behavior And Leadership In Sport

Credit Hours: 3.00. This course is an introduction to the basic concepts and topics in organizational behavior (OB) and

leadership. The course focuses on OB at three levels: individual, interpersonal, and collective. We will cover decision-making, relationships, motivation, personality, influence, and groups. Permission of department required.

Learning Outcomes: 1. Learn of and develop an understanding of the fundamental theories and principles of employee and organizational behavior in the context of professional, college, and amateur sports by reading the assigned textbook and related articles, listening to lectures, videos, and engaging in other course materials. 2. Identify and apply learned theories and approaches to address and resolve organizational and personnel issues encountered by management in sports organizations by analyzing and problem-solving weekly case studies based on real-life organizational behavior examples in sports settings. 3. Demonstrate knowledge of the principles and practices associated with the following areas of organizational behavior in sports including leadership, organizational culture, internal and external organizational conflict, and diversity and inclusion. 4. Apply the information learned in weekly modules and through the completion of individual personality assessments in class to understand students' individual work styles and create a personal plan to employ work traits in a practical manner as future employees. 5. Develop personal growth through assessment activities where students have the opportunity to reflect on their own style of work in light of the course material as it aligns with their career goals. Credits: 3.00

HK 57900 - Strategic Case Reviews: Lessons From The Sport Management Field

Credit Hours: 3.00. The focus of this course is to merge the application of leadership and management theory to various issues arising in Sport Management including organizational behavior, strategic planning, and human resources management. This course will utilize case studies based on true events and connect theoretical ideas with practical experience and outcomes. Permission of department required.

Learning Outcomes: 1. Learn of and develop an understanding of the fundamental theories and principles of employee and organizational behavior in the context of sports by reading the assigned textbook chapters and related articles, listening to lectures, and fully engaging in all course materials and assignments. 2. Identify and apply learned theories and approaches to address issues encountered by management in organizations by analyzing and problem-solving weekly case studies based on real-life examples in a variety of sports settings. 3. Demonstrate knowledge of the principles and practices associated with organizational behavior in sports including leadership, organizational culture, and internal and external conflict. 4. Using information learned in weekly case studies, and through the completion of individual personality assessments, gain a better understanding of individual leadership and work styles. 5. Develop personal growth through a variety of assessment activities whereby students reflect on their own leadership style. Credits: 3.00

HK 58300 - Patient Care Simulation In Athletic Training I

Credit Hours: 2.00. This course is designed to refine psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care decisions. Permission of department required.

Learning Outcomes: 1. Evaluate a patient and then select and apply appropriate taping applications for injury reduction and prevention. 2. Select and apply protective equipment for use by active individuals participating in sport. 3. Apply specialty taping procedures in response to patient indications and treatment goals. 4. Perform a primary and secondary patient assessment for a patient in an emergency situation. 5. Obtain and evaluate

vital signs including pulse, respirations, blood pressure, core body temperature, and oxygen saturation. 6. Differentiate and select from the different types of airway adjuncts to demonstrate airway management. 7. Use the indications and treatment parameters in an emergency situation to determine appropriateness of supplemental oxygen administration. 8. Administer supplemental oxygen to patients in an emergency situation. 9. Create a management plan of external hemorrhage and apply this emergent and non-emergent situations. 10. Consider and select proper immobilization and transfer techniques for a patient using a spine board. 11. Evaluate techniques for removing equipment and clothing to access an airway or evaluate an injured part and select the most appropriate for a given situation. 12. Apply corrective intervention techniques for the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 13. Analyze patients and institute a management plan for patients in an environmental emergency. Credits: 2.00

HK 59000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for graduate students. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes vary due to special topics nature of course. Credits: 1.00 to 3.00

HK 60000 - Individual Research And Study

Credit Hours: 1.00 to 3.00. Each student studies a problem of interest related to physical education, health, or recreation. Permission of instructor required.

Credits: 1.00 to 3.00

HK 60100 - HK PhD Seminar

Credit Hours: 2.00. This course is the first of a required two-course sequence for first-year health and kinesiology doctoral students. The course is designed to socialize students into the worlds of science, graduate education, and health and kinesiology research and practice. Particular emphasis is placed on the responsible conduct of research, shared and unique expectations of graduate students and mentors across various health and kinesiology subdisciplines, professional development, and the nurturing of academic community. Prerequisite: Incoming health and kinesiology doctoral students qualify for and are required to complete this course. Permission of department required.

Learning Outcomes: 1. Develop an appreciation for philosophical and scientific issues of relevance to all health and kinesiology scholars. 2. Develop an understanding of successful and less successful approaches to graduate education, department citizenship, pursuit of scholarly endeavors, and professional development. 3. Develop an understanding of how to obtain effective mentoring. 4. Become an active member of the HK intellectual and professional community. Credits: 2.00

HK 60200 - HK PhD Seminar II

Credit Hours: 2.00. This course is the second of a required two-course sequence for first-year health and kinesiology doctoral students. The course is designed to expose students to classic works in health and kinesiology subdisciplines, address professional development issues, and help students formulate a curricular and research program to structure the doctoral experience. Particular emphasis is placed on the interdisciplinary nature of health and kinesiology and becoming an active member of the research community. Permission of department required.

Credits: 2.00

HK 61000 - Research Methods In Health, Physical Education, And Recreation

Credit Hours: 3.00. Application of research methodology to problems in health, physical education, and recreation. Prerequisite: 3 credit hours in Statistics. Permission of instructor required.

Credits: 3.00

HK 61100 - Data Analysis In Health And Kinesiology

Credit Hours: 3.00. This student-driven course addresses a variety of data analysis issues in health, kinesiology, and related fields (e.g., education, psychology). The course will overview the types of data prominent in health and kinesiology research, how these data are obtained and handled by researchers, measurement/evaluation issues, and ways to present and analyze data. Heavy emphasis is placed on matching research questions and conceptualization with data analysis techniques, obtaining familiarity with widely-used data analysis software, analyzing multivariate data sets, and constructing high-quality

results sections in journal manuscript format. Prerequisites: STAT 50100 , STAT 50200 and access to a data set pertaining to one's area of research are expected. Permission of instructor required.

Credits: 3.00

HK 63000 - Administration Of Athletic Training Programs

Credit Hours: 2.00. Course covering management and supervision of personnel, financial resources, as well as the preparation in planning, designing, developing, organizing, implementing, directing, and evaluating an athletic training health care program and facility. Legal concerns, risk management, insurance, and reimbursement will be discussed. Prerequisites: Completion of HK 50000 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Summarize the components associated with professional development and regulation of athletic trainers. 2. Distinguish the roles and responsibilities of health care professionals in the field of sports medicine. 3. Compare the current initiatives, missions, objectives, and professional activities of other allied health and medical organizations and professions. 4. Analyze the major elements of the National Athletic Trainers Association (NATA) Code of Ethics against published case report. 5. Recognize the importance and complexity of the ethical and legal issues associated with medical information, authorization to participate, record keeping, and confidentiality. 6. Appraise and recommend medical and professional liability insurance policies. 7. Develop administrative policy and procedures for operation of an athletic medical facility. 8. Develop a system of records for athletes and general facility operations. 9. Develop a comprehensive pre-participation medical exam. 10. Develop a basic architectural design of an athletic medical facility that is safe and efficient. 11. Develop a budget for operation of an athletic medical facility. Credits: 2.00

HK 63500 - Injury Prevention And Health Promotion

Credit Hours: 3.00. This course emphasizes theory and strategies for behavioral change relating to healthy lifestyles and specific health conditions. Analyses of major injury problems affecting patients in the workplace, community, at home, and in activity along with basic principles of nutrition and exercise as they pertain to individual health and activity are included. Prerequisite: HK 53500 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Develop and implement strategies to mitigate the risk for long-term health conditions across the lifespan. 2. Develop, implement, and assess the effectiveness of programs to reduce injury risk. 3. Plan and implement a comprehensive pre-participation examination process to affect health outcomes. 4. Develop, implement, and supervise comprehensive programs to maximize sport performance that are safe and specific to the clients activity. 5. Educate and make recommendations to clients/patients on fluids and nutrients to ingest prior to activity, during activity, and during recovery for a variety of activities and environmental conditions. 6. Educate clients/patients about the effects, participation consequences, and risks of misuse and abuse of alcohol, tobacco, performance-enhancing drugs/substances, and over-the-counter, prescription, and recreational drugs. Credits: 3.00

HK 64000 - Leadership In Athletic Training

Credit Hours: 2.00. This course is designed to prepare students to embark on paths of personal leadership development. The course will examine leadership theory and research and emphasize the development of leadership and interpersonal skills. Understanding various methods of bringing about change will be provided and researched by learners, and then discussed in our time together. Students in this course will apply foundational business concepts in athletic training through self-assessment case studies and professional experiential exercises. Permission of department required. Prerequisite: HK 63000 with B- or better.

Learning Outcomes: 1. Compare key organizational behavior theories and concepts related to leadership and management. 2. Evaluate the unique of structures, processes, and interactions in health care organizations as they relate to leadership, management and policy. 3. Distinguish the different roles and

specific challenges for leadership and management in health care. 4. Differentiate personal leadership orientation, styles and strengths. 5. Practice, hone, and demonstrate teamwork skills (e.g., leadership, collaboration, communication, etc.) in consulting team assignments and case analyses. 6. Develop a professional development plan for long term development as a professional. 7. Evaluate the value model to develop a business case to supply athletic training services. Credits: 2.00

HK 64100 - Athletic Training Practicum IV

Credit Hours: 8.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required. Prerequisite: HK 54300.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to screen a medical

record(s) or an individual or group of individuals to allow for safe physical activity and make appropriate recommendation and/or referrals as necessary. 29. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 30. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 31. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 32. Locate community-based resources for psychosocial intervention. 33 Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 34. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 8.00

HK 64200 - Athletic Training Practicum V

Credit Hours: 6.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management. 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to

a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 29. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 30. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 31. Locate community-based resources for psychosocial intervention. 32. Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 33. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 6.00

HK 64500 - Psychosocial Interventions In Athletic Training

Credit Hours: 2.00. The focus of this course is on identification, referral, and treatment options for patients with organic and non-organic mental health conditions commonly seen in athletic training. The course will also address cultural competence in patient care and the role of various mental healthcare providers that comprise the mental health referral network. Permission of department required. Prerequisite: HK 535 with B- or better.

Learning Outcomes: 1. Explain the theoretical background of psychological and emotional response to injury and forced inactivity. 2. Identify and select psychosocial techniques into a patients treatment or rehabilitation program. 3. Evaluate which psychosocial techniques are appropriate for a patient in a given clinical scenario. 4. Identify at-risk individuals with psychosocial disorders and/or mental health emergencies. 5. Distinguish appropriate patients requiring referral to mental health care providers. 6. Develop a management plan for at-risk individuals. 7. Explain and demonstrate processes of effective interpersonal and cross-cultural communication. 8. Construct psychological techniques and interventions that are used to facilitate and motivate the patient for return to play. 9. Summarize the importance of Cultural Competence when providing healthcare. 10. Evaluate how psychosocial considerations affect clinical decision-making related to return to activity or participation. Credits: 2.00

HK 65000 - Seminar In Athletic Training

Credit Hours: 3.00. This course is a culminating experience in athletic training that will provide the student with a comprehensive review of athletic training foundational and specific knowledge regarding the Domains of Athletic Training. This course will help the student to prepare for athletic training practice. Permission of department required. Prerequisite: HK 53000 with B- or better.

Learning Outcomes: 1. Access, analyze, and differentiate between the essential documents of the national governing and regulatory bodies, including, but not limited to, the NATA Athletic Training Educational Competencies, BOC Standards of Professional Practice, the NATA Code of Ethics, and the BOC Role Delineation Study/Practice Analysis. 2. Produce a self-assessment of professional competence and create a professional development plan to maintain necessary credentials and promote life-long learning. 3. Summarize the tasks required for entry-level proficiency of athletic

trainers within the five domains of the BOC Role Delineation Study/Practice Analysis. 4. Evaluate the recommendations found in the NATA Position Statements, Official Statements, and Consensus Statements against current practice patterns. 5. Appraise current trends at the state, district and national level in athletic training involving clinical practice and education. Credits: 3.00

HK 66000 - Diagnostic Imaging In Athletic Training

Credit Hours: 1.00. This course provides students with an intensive study of radiology. Students will understand the types of diagnostic images commonly used in sports medicine, as well as basic interpretive techniques used in radiology. The course will emphasize the systematic approach for diagnostic images and interpretation of various diagnostic reports. Permission of department required. Prerequisite: HK 58000 with B- or better.

Learning Outcomes: 1. Understand the importance of imaging technology used in musculoskeletal care. 2. Evaluate the differences and capabilities of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 3. Understand the importance of communicating with other healthcare providers regarding radiological studies. 4. Describe a radiological report and evaluate the findings related to a rehabilitative plan of care. 5. Use terms commonly found in diagnostic radiography, MRI, CT, bone scintigraphy, and ultrasonography. 6. Summarize the fundamental physical principles of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 7. Categorize basic positions utilized for radiography. 8. Identify basic anatomy in routine radiography, MRI, CT, bone scintigraphy, and ultrasonography. 9. Compare the three types of densities usually seen on a radiograph and their significance. 10. Discuss the importance of correlating the study with the patient's history and physical exam. 11. Describe and then compare the different patterns of pathologic processes; including fractures, sprains, strains, effusions, stress reactions, DVT. 12. Differentiate the genetic anomalies commonly seen on radiographs. 13. Interpret routine radiographs and identify abnormalities. Credits: 1.00

HK 66800 - Seminar In Exercise Physiology

Credit Hours: 3.00. Review of literature; design and conduct of research in an area of current interest in exercise physiology. Permission of instructor required.

Credits: 3.00

HK 66900 - Exercise Metabolism And Biochemistry

Credit Hours: 3.00. This course is designed to provide students with practice using basic laboratory skills which can then be applied to more sophisticated techniques in biochemical analysis. The course is a laboratory-based class and will provide considerable "hands-on" experience. Lectures will focus on laboratory procedures, calculations, common lab problems and solutions, and laboratory safety procedures. Most of these measures will be made using an exercise context, i.e., standard exercise physiology tests (VO2 max, Wingate tests, etc.) will be performed to allow us to acquire blood samples for analysis. Prerequisites: HK 56800 or permission of the instructor.

Learning Outcomes: 1. Accurately weigh, measure and make calculations for mixing, diluting, and preparing solutions and buffers for use in the laboratory. 2. Safely perform hemoglobin, creatine kinase, cholesterol, glucose, lactate, mononuclear cell isolation, glycerol and citrate synthase assays. Credits: 3.00

HK 67000 - Advanced Topics In Motor Control

Credit Hours: 3.00. Selected topics in motor control. The subject matter will be data-based and drawn from research literature encompassing behavioral and physiological experimental paradigms. Students will critically evaluate and synthesize research to better understand the integration of individual systems in sensorimotor processing. Permission of instructor required.

Credits: 3.00

HK 67200 - Stress And Coping In Sport, Exercise And Physical Activity

Credit Hours: 3.00. This course examines stress, coping, and emotional processes as they relate to sport, exercise, physical activity, and the physical self. We will explore theoretical perspectives on stress and coping processes, examine the empirical evidence related to sport/exercise/physical activity/rehabilitation/physical self, and discuss applications of this knowledge. Course readings will cover topics including the

history and conceptual issues of psychosocial stress, conceptual and methodological issues of coping, individual differences in stress and coping, the influence of sociocultural and contextual factors, and vulnerability and resilience. Prerequisite: HK 57400 .

Learning Outcomes: 1. Be able to understand and explain major theories of stress, coping, and emotional processes, and how individual and contextual factors influence these process as they related to physical activity and the physical self. 2. Be able to critically evaluate research articles on stress, coping and emotion related to physical activity and the physical self. 3. Propose applications based on theoretical and empirical knowledge of stress/coping/emotion in physical activity settings. 4. Develop and refine critical thinking, writing, oral communication, and group facilitation skills. Credits: 3.00

HK 67400 - Special Topics In Sport And Exercise Psychology

Credit Hours: 3.00. An in-depth analysis of specific areas of theoretical and empirical work in sport or exercise psychology. Emphasis is placed on the critique, integration, and application of the literature reviewed. Rotating topics. Prerequisite: HK 57400 .

Credits: 3.00

HK 67800 - Motivational Processes In Sport And Exercise

Credit Hours: 3.00. Seminar focused on motivation in sport and exercise settings. Antecedents and consequences of motivated behavior are examined from theoretical, research, and application perspectives. Topics include participation motivation in sport, intrinsic/extrinsic orientations, achievement goals, causal attributions, group processes, and exercise motivation. Prerequisite: HK 57400 .

Credits: 3.00

HK 68300 - Patient Care Simulation In Athletic Training II

Credit Hours: 3.00. This course is designed to refine psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care decisions. Permission of department required. Prerequisite: HK 56300 with a B- or higher.

Learning Outcomes: 1. Evaluate common orthopedic conditions of the axial and appendicular skeleton, formulate a differential diagnosis, and recommend appropriate treatment strategies. 2. Evaluate patients with medical conditions involving the cardiovascular system, gastrointestinal system, dermatological system, endocrine system and determine a differential diagnosis with appropriate interventions, including potential for referral. 3. Evaluate general medical conditions and common non-orthopedic conditions of the head and face and determine a differential diagnosis with appropriate interventions, including potential for referral. 4. Screen a patients' general health and wellness, fitness, nutrition, gait, posture, and movement to address deficiencies in order to develop treatment strategies and referrals (where indicated). 5. Design an overall program to include fitness and wellness, nutrition, and general injury prevention strategies (including ergonomics). 6. Use baseline evaluation data of mobility, stability, strength, and balance to compose a therapeutic exercise program to address known deficits. 7. Select and incorporate therapeutic modalities into the rehabilitation plan of care. 8. Formulate a progressive rehabilitation plan using evidence-based interventions for common musculoskeletal injuries and conditions. 9. Instruct a patient in corrective exercise and a home exercise program. 10. Use patient and clinician oriented outcomes to make clinical decisions, including recommended interventions, activity progressions, and return to play decisions. 11. Educate and instruct a patient on general health and wellness behaviors and in the program to address deficiencies identified on a comprehensive fitness evaluation. 12. Communicate patient care status with stakeholders involved on the

healthcare team (other providers, parents, coaches, administrators). Credits: 3.00

HK 68600 - Theories And Concepts Of Stress Management

Credit Hours: 3.00. Development of a conceptual understanding of stress and stress management. A seminar focused on the review of literature regarding psychophysiology of stress, relationship between stress and disease, and methods of preventing/relieving stress, models of stress research, and issues surrounding stress research methodology. Prerequisite: BIOL 20300 , BIOL 20400 . Permission of instructor required.

Credits: 3.00

HK 69000 - Advanced Studies

Credit Hours: 1.00 to 6.00. Topic and credit to be arranged. Individual study for the doctoral student. Permission of instructor required.

Credits: 1.00 to 6.00

HK 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HK 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Health Sciences

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 11000 - Careers And Research In Occupational And Environmental Health

Credit Hours: 1.00. The goal of this course is to familiarize students to the variety of research and careers available within the broad field of environmental and occupational health. The course will focus on two areas: current research in occupational and environmental health and careers in occupational and environmental health. This content will be delivered through interactive lectures and discussions with a variety of guest speakers as well as HSCI faculty. Advice and guidance on applying for internships/jobs in the field will also be provided. A highlight of the event is a student/professional networking event which will be coordinated towards the end of the program.

Learning Outcomes: 1. Understand and apply key terms within occupational and environmental health. 2. Describe current research in occupational and environmental health. 3. Describe the extent and variety of careers available in occupational and environmental health. 4. Deliver an oral presentation about a contemporary issue in occupational and environmental health. Credits: 1.00

HSCI 13000 - Introduction To Medical Laboratory Science

Credit Hours: 1.00. An introduction to career opportunities in medical technology. Preprofessional and professional requirements. A survey of the major clinical laboratory departments and their applications to patient care and management. Discussion and interpretation of some of the major diagnostic tests, i.e., for cardiac enzymes, cholesterol, blood cells, diabetes, and drug monitoring.

Learning Outcomes: 1. Have a clearer and more in depth understanding of the field of medical laboratory science. 2. Have an appreciation for the diverse disciplines and thus career opportunities within this field. 3. Have an opportunity to engage in and contribute to your own knowledge gain. 4. Have the ability to translate a simple job description into an exciting professional career. Credits: 1.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 19000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for

freshmen students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 19501 - School Of Health Sciences Freshman Honors Seminar

Credit Hours: 1.00. This course is for Freshman students in the School of Health Sciences Honors Program. This course consists of a 50-minute weekly seminar meeting designed to orient and familiarize Freshman HSCI Honors students with the School of Health Sciences including research areas and current topics in public health and biomedical research. Students will interact with guest speakers and expand their knowledge base in health science research. In addition to the seminar, students will be matched to a faculty mentor in a research area of their interest during the fall semester. Students will develop and design a research project with their faculty mentor (to be conducted in HSCI 19601 during the spring semester). In the spring semester, students will enroll in the seminar series (HSCI 19501) and in the research project course (HSCI 19601) to complete their project. Each student will be responsible for presenting and reporting on their research project during the spring seminar series. Permission of departmental required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Learn basic research skills such as how to do a literature search and report research findings. 3. Learn how to give and evaluate a research presentation. Credits: 1.00

HSCI 19601 - School Of Health Sciences Freshman Honors Project

Credit Hours: 1.00. This course is for Freshman students in the School of Health Sciences Honors Program. In this course students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students enroll in this course during the spring semester concurrently with HSCI 19501 . During the fall semester in HSCI 19501 , students will be matched to a faculty mentor in the research area of their choice and complete a Project Description Form based upon the work to be completed during this course. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least weekly or biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Some students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict

management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

HSCI 26000 - Clinical Urinalysis And Body Fluid

Credit Hours: 1.00 to 10.00. Clinical Urinalysis And Body Fluid.

Credits: 1.00 to 10.00

HSCI 29000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for sophomore students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 29501 - School Of Health Sciences Sophomore Honors Seminar

Credit Hours: 1.00. This course is for sophomore students in the School of Health Sciences Honors Program. This course consists of a 50-minute weekly seminar meeting to discuss current topics in health science, public health, and biomedical research. Students will interact with guest speakers and expand their knowledge base in health sciences research. In addition, each student will be responsible for presenting and reporting on their ongoing honors research project. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Build on the skill to give and evaluate a research presentation. Credits: 1.00

HSCI 29601 - School Of Health Sciences Sophomore Honors Project

Credit Hours: 1.00. This course is for Sophomore students in the School of Health Sciences Honors Program. In this course, students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students enroll in this course in both fall and spring semesters (concurrently with HSCI 29501 in the spring semester). An updated Project Description Form will be due at the beginning of each semester based on the progress and any changes to the research plan. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least weekly or biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Some students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

HSCI 30500 - Basics Of Oncology

Credit Hours: 3.00. This course will introduce the student to the biology of cancer and some basics of oncology. Focus will be placed on what makes cancer different from normal tissues and how those differences can be leveraged for diagnostic and treatment purposes. This course will touch on topics of epidemiology, cancer biology, common therapeutic and diagnostic approaches, and other considerations of cancer care.

Learning Outcomes: 1. Identify the major risk factors of cancer. 2. Understand the difference between cancer and normal tissue. 3. Enumerate the major hallmarks of cancer. 4. Explain the link between cancer biology and diagnostic imaging. 5. Describe how cancer therapies target the hallmarks of cancer. Credits: 3.00

HSCI 31000 - Imaging In Medicine

Credit Hours: 3.00. This course will introduce students to develop essential understandings of all primary medical imaging techniques utilized in hospitals such as Computer tomography, X-ray imaging, MRI, Ultrasound and Nuclear medicine imaging modalities. The course will cover basic scientific principles of each modality and introduce their underlying clinical requirements and applications. In addition, this course introduces the student to human anatomy as seen in the transverse, coronal, and sagittal planes. Anatomy of the brain, thorax, abdomen, and pelvis will be studies using CT and MRI images. Normal anatomy, anatomic variants, and selected pathologies will be discussed in the various body regions.

Learning Outcomes: 1. Understand (at an elementary level) the physical basis and limitations of diagnostic imaging techniques and correctly distinguish between the following imaging techniques: plain X-rays, CT scans, MRI scans, PET scans and ultrasound. 2. Differentiate major anatomical regions and identify major anatomical structures in the transverse, coronal, and sagittal plane. 3.

Acquire basic knowledge of the fundamental principles and techniques of all the major imagine modalities including, CT, MRI, Ultrasound and nuclear medicine (PET and SPECT). 4. Understand basic sectional (transverse, sagittal and coronal) anatomy in medical imaging. Credits: 3.00

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 33300 - Introduction To Immunology

Credit Hours: 3.00. Introduction to Immunology will meet twice weekly and provide an overview of this evolving field of science with an emphasis on the clinical implications and application of learned knowledge. The immunologic mechanisms associated with the normal and abnormal immune response will be discussed and students will put this knowledge into practice by directing their own case study. In addition, a number of common clinical concerns with respect to immunity will be reviewed. Furthermore, we will explore the critical role our knowledge of this branch of science plays in patient diagnosis, treatment and care both now and in the future.

Learning Outcomes: 1. Have solid understanding of the science of Immunology and the Immune Response. 2. Have an appreciation for the complexity of the immune system, its cellular components, its regulation and implications of its dysfunction. 3. Have a clearer understanding of the clinical applications and implications of the immune response. 4. Have enhanced knowledge of the course material. 5. Have the ability to transfer the written word into practical application of its principles. Credits: 3.00

HSCI 33400 - Lung Physiology And Medicine

Credit Hours: 2.00. This course will explore the normal functioning of the respiratory system, along with a variety of diseases and disorders affecting this system. Special emphasis will be placed upon diseases which result from, or are aggravated by, environmental pollutants. The course will begin with discussing the anatomy and physiology of the respiratory system. Individual lung disorders will then be discussed with consideration of the sources of air pollution contaminants and

the interaction of those contaminants with normal lung tissue.

Learning Outcomes: 1. Describe the normal anatomy and physiology of the respiratory system. 2. Identify the lung volumes and how lung volumes relate to lung capacities. 3. Describe the pathophysiology of major types of lung disorders. 4. Relate lung disorders to air pollution contaminants. Credits: 2.00

HSCI 33500 - Heart Physiology And Medicine

Credit Hours: 2.00. This course will provide a discussion about diseases affecting the heart and cardiovascular system. The normal anatomy and physiology of the heart and blood vessels with be discussed. Various diseases of the heart and vasculature, including atherosclerosis, cardiomyopathies, valvular heart disease, hypertension, and stroke will be explored. Included in the discussion of each disease process will be environmental agents, which are associated with disease development and progression.

Learning Outcomes: 1. Describe the normal anatomy of the hear. 2. Discuss the cardiac steps of the cardiac cycle. 3. Describe disease processes of the heart and blood vessels. 4. Identify environmental exposures associated with an increased risk of heart disease. Credits: 2.00

HSCI 33600 - Eye Physiology And Disease

Credit Hours: 2.00. This course will cover the fundamental structure and function of the eye and visual nervous system. Brief review lectures will be provided on basic cell biology and neuroscience to provide a strong foundation for topics such as phototransduction, retinal neural circuit function, and disease etiology. The first half of the course will be focused on the normal and healthy anatomy and physiology of the eye. The second half the course will be focused on eye and visual diseases and their associated pathophysiology and clinical manifestations. This part of the course will include lessons on eye imaging techniques and cutting-edge treatments used for detection and treatment of eye diseases. This course will be beneficial for any student interest in clinical or medical research, and highly recommended for those interested in optometry, ophthalmology, and visual research careers. Permission of department required.

Learning Outcomes: 1. Describe the normal anatomy of the eye and visual pathways in the brain. 2. Discuss neural circuit and cell signaling pathways in phototransduction. 3. Describe the cellular etiology of ocular disease processes. 4. Understand the basic approaches to studying and assessing eye function. Credits: 2.00

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

HSCI 34600 - Industrial Hygiene Engineering Control

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Describe/understand different approaches for controlling exposures in the occupational environment, and give hypothetical and real situations in terms of the

best control methods. 2. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a complete ventilation system. 3. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 4. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to prevent it in the workplace. 5. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 6. Synthesize and apply knowledge of the IH paradigm (AREC) in analyzing practical industrial hygiene/occupational health problems. Credits: 4.00

HSCI 34800 - Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. Sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Explain the rationale of the sampling strategy. 2. Perform basic sampling procedures for certain gases, vapors, particulates, noise, and heat, including proper selection, set-up, and operation of equipment. 3. Summarize the basic principles of the sampling procedures and explain why they function as they do. 4. Describe the limitations of sampling and analysis in real-world situations and how to deal with them. 5. Collect, analyze, interpret, and summarize laboratory data into a well-written report. 6. Describe the advantages as well as the difficulties of working together on a team. Credits: 3.00

HSCI 35300 - Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and frontline employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the frontline employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the frontline employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the frontline employees and upper management together in their vision of a safe and healthy workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. 6. Demonstrate group and team building strategies as it relates to health and safety. Credits: 3.00

HSCI 36000 - Everyday Toxicology: Poisonings From Clinics To Courtrooms

Credit Hours: 2.00. Exposure to chemicals happens every day in human life through the living environment and diet; yet the health impact and toxicological consequences of these exposures are often unknown to general populations. This 300-level course examines basic concepts of toxicology in human health as they apply to the exposure of environmental agents, e.g., chemicals, metals, and poisons in daily life and attempted poisoning in criminal cases and political assassins. With an emphasis on historical accounts of poisonings and case analyses, the course describes commonly encountered chemicals and poisons, their symptoms, clinical diagnosis, basic toxicological mechanisms, and medical interventions. Students will also learn some of the large-scale environmental and occupational incidents that have led to legal actions, and the role of toxicology in forensic investigation of purposed poisoning. The course is ideal to students who are inspired to become a future healthcare professional in any of the health-oriented pre-professional programs or students with majors in

biomedical health sciences, environmental and occupational health sciences, medical laboratory science, and/or public health.

Learning Outcomes: 1. Define the concepts of poisoning, forensics, and toxicology. 2. Describe the dose-response relationship and routes of exposure for common chemicals. 3. Discuss common poisons from a historical perspective. 4. Explain signs and symptoms, diagnosis, and treatments related to typical poisons. 5. Illustrate basic biological mechanisms leading to adverse health outcomes. 6. Understand professions and duties involved in the field of clinical toxicology. Credits: 2.00

HSCI 39000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for junior students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 39501 - School Of Health Sciences Junior Honors Seminar

Credit Hours: 1.00. This course is for Junior students in the School of Health Sciences Honors Program. This course consists of a 50-minute weekly seminar meeting to discuss current topics in health science, public health, and biomedical research. Students will interact with guest speakers and expand their knowledge base in health sciences research. In addition, each student will be responsible for presenting and reporting on their ongoing honors research project. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Build on the skill to give and evaluate a research presentation. Credits: 1.00

HSCI 39601 - School Of Health Sciences Junior Honors Project

Credit Hours: 1.00. This course is for Junior students in the School of Health Sciences Honors Program. In this course, students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students enroll in this course in both the fall and spring semesters (and concurrently with HSCI 39501 in the spring semester). An updated Project Description Form will be due at the beginning of each semester based on the progress and any changes to the research plan. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Some students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of departmental required.

Learning Outcomes: 1. Gain an understanding of the research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

HSCI 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

HSCI 40000 - International Special Topics

Credit Hours: 1.00 to 8.00. Courses taken during an International experience that is recognized by the University. Permission of Department required.

Credits: 1.00 to 8.00

HSCI 41500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. The course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the state and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. Group exercises and simulations in applied nuclear security scenarios will complement lectures. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. Obtain a broad picture of nuclear security components and their interconnections, and of the planning of nuclear security activities at the state and facility level. 2. Learn the basic concept of nuclear security. 3. Learn the basics of nuclear security planning

at the facility and state level. 4. Learn proliferation efforts, framing them within the historical and security-related context. 5. Create a foundational understanding of relevent security, safeguards and nonproliferation treaties and agreements. 6. Leverage existing technical knowledge in coming to policy conclusions. 7. Develop both a regime and state specific knowledge base. 8. Illustrate understanding through technical and policy oriented exercises. 9. Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts. Credits: 3.00

HSCI 42000 - Applied Anatomy For Medicine

Credit Hours: 4.00. With a focus on preparing students to be practitioners of health sciences, Applied Anatomy for Medicine (HSCI 42000) will build upon the foundational knowledge of form and function obtained in prerequisite courses through enhancement of the relationship between bony structures, musculature, innervation, vascular perfusion, and interconnectedness with respect to human health. The significance of regional anatomy and important anatomical landmarks from a clinical perspective will be learned. The incorporation of student driven dissection will promote a more comprehensive understanding of the correlation between structure, function, dysfunction and disease signalments. The integration of clinical application and case study investigation will facilitate the transition from learner to practitioner.

Learning Outcomes: 1. Identify the bones, associated bony prominences, muscles, innervation, action and vascular perfusion. 2. Identify and demonstrate the relationship between superficial and deep structures including dermatome maps. 3. Identify regional anatomy and important clinical landmarks, and aid in deciphering imaging diagnostics. 4. Identify anatomical design both in health as well as modifications due to disease. 5. Understand the critical role anatomical design plays in the maintenance of health, development and manifestation of disease, diagnostic assessment, intervention and treatment. Credits: 4.00

HSCI 44400 - Exposure Assessment In OEHS

Credit Hours: 3.00. Exposure assessment is an essential component of Environmental Health Science and industrial hygiene. This course provides students basic scientific knowledge of exposure assessment, with emphasis on practical aspects of exposure science, including study design, data and measurement collection, data analysis, and results interpretation and presentation. Course topics include major exposure media and pathways (air, water, food, soil, etc.) and important exposure routes (inhalation, ingestion, dermal absorption); exposure measurement and assessment; strengths and weaknesses of various exposure assessment techniques, how to link exposure assessment with environmental health, and human subject research in exposure studies. The course includes case studies and group projects. Students are expected to develop entry-level skills for designing exposure studies applicable to human exposure monitoring, epidemiologic investigations and health risk assessment.

Learning Outcomes: 1. Describe basic components of exposure assessment studies. 2. Design a study to conduct basic assessments of exposure to chemical hazards at workplace or in a community setting. 3. Obtain and analyze existing data, collect and analyze measurement data, prepare technical reports, and present results. 4. Discuss ethical and professional responsibilities in exposure studies. 5. Function effectively on a team that identify, evaluate and solve problems related to exposures in occupational and environmental settings. Credits: 3.00

HSCI 44500 - Industrial Hygiene Internship

Credit Hours: 2.00. Discussion class based on applied work experience as an industrial hygiene assistant or technician at an industrial, consulting, hospital, government, or education and research institution. Topics covered also include professional and ethical aspects derived from students' work experiences. Written and oral reports as well as other classroom assignments. Restricted to industrial hygiene majors who have completed an acceptable industrial hygiene work experience.

Credits: 2.00

HSCI 44600 - Applied Industrial Hygiene

Credit Hours: 3.00. This course allows the student to synthesize his or her basic industrial hygiene fundamentals to understand how they apply in the real world. Issues faced by industrial hygienists will be addressed by a variety of guest speakers. Class projects add to the diversity of this senior capstone course.

Credits: 3.00

HSCI 44700 - Global Workplace Health

Credit Hours: 2.00. This course will examine health and safety

issues, particularly those which occur in the work setting, in various countries around the world. A particular focus will be toward developing countries in which the regulatory environment and resources to control hazards are less than those of more developed countries. Students will participate through an established professional organization. They will virtually work on specific projects in various countries, with the goal of improving the health and safety environment.

Learning Outcomes: 1. Identify exposures to harmful environmental agents which may adversely affect human health. 2. Apply their knowledge and skills of occupational health to recommend methods to reduce exposure to harmful environmental agents. 3. Be able to function as part of team to address issues involving human health. 4. Be able to describe the differences in exposure to hazardous agents for different parts of the world. 5. Obtain a knowledge of current events and identify how the events relate to disparities in human health across different cultures and countries. 6. Obtain an understanding of professional ethics in relation to differing health and safety policies.

Credits: 2.00

HSCI 45100 - Clinical Biochemistry

Credit Hours: 1.00 to 10.00. This course is designed to provide principles of biochemistry for clinical application for medical technologists. The course encompasses an introduction to carbohydrate, amino acid, and lipid metabolism. Also included are lectures on basic endocrinology, enzymes, and biosynthesis of steroid hormones. Physiological principles are stressed with respect to liver, lung, and kidney function. Special emphasis is placed on correlation of the theoretical and clinical areas.

Credits: 1.00 to 10.00

HSCI 45200 - Clinical Chemistry

Credit Hours: 1.00 to 10.00. This course is designed to provide the medical technologist with the principles and application of clinical chemistry. Methods of instrumental analysis include a variety of automated procedures, electrophoresis, immunoelectrophoresis, immunodiffusion, radioisotopes, steroids, hormone assay, and toxicology. Quality control for clinical chemistry is included. Supervised clinical laboratory experience is offered, with students rotating through the various areas of clinical chemistry on a sequential rotational basis.

Credits: 1.00 to 10.00

HSCI 45300 - Clinical Hematology

Credit Hours: 1.00 to 10.00. Study of the functions, maturation, and morphology of blood cells. Blood cells, platelets, and reticulocyte counting procedure. Experiences in the study of cellular content of other body fluids are offered. Lectures and laboratory are designed to teach techniques of sedimentation rates, hematocrits, corpuscular indices, hemoglobin red cell fragility, and special staining procedures. Also, routine and special coagulation studies are taught. Supervised experience in clinical hematology offers opportunities for study in routine and special hematology and coagulation procedures.

Credits: 1.00 to 10.00

HSCI 45400 - Clinical Immunohematology

Credit Hours: 1.00 to 10.00. A review of serologic principles and technical fundamentals of transfusion practice; a comprehensive consideration of all blood groups, with emphasis on ABO and Rh-Hr blood group systems. Extensive practice is gained in pre-transfusion techniques and antibody identification in the laboratory. Other blood types and antigen-antibody relationships are taught in laboratory and lectures. Also included are blood donor room procedures; preparation of blood components; correlation of blood component therapy with disease states; quality control of all reagents, procedures, and equipment used; and laboratory safety measures, all of which offer the best patient care and protection of laboratory personnel.

Credits: 1.00 to 10.00

HSCI 45500 - Clinical Microbiology

Credit Hours: 1.00 to 10.00. Lectures and clinical laboratory experience in diagnostic procedures as aids to the diagnosis of human disease. Proper selection of techniques for the isolation and identification of medically important bacteria. Special emphasis is placed on newer methods for anaerobic bacteria identification. Also includes lectures and laboratory identification in the fields of mycology and microbacteriology, with emphasis on isolation and identification. Practical applications of fluorescent antibody tests are performed.

Credits: 1.00 to 10.00

HSCI 45700 - Clinical Parasitology

Credit Hours: 1.00 to 10.00. Techniques of specimen examination, identification of cysts and ova, life cycles of parasites.

Credits: 1.00 to 10.00

HSCI 45800 - Clinical Serology

Credit Hours: 1.00 to 10.00. Lectures and a laboratory experience in serology, including the preparation of antigen, flocculation tests for syphilis, heterophile antibody tests, creative proteins, RA test, FTA, rubella testing. Also included are lectures in immunology that include classifications of immunoglobulins; mechanism of antibody formation; immune response; types of antigen-antibody reactions; and theories of radioimmunoassay.

Credits: 1.00 to 10.00

HSCI 46000 - Clinical Urinalysis

Credit Hours: 1.00 to 10.00. Routine analysis, chemical tests, sediment identification, renal function tests, pregnancy tests.

Credits: 1.00 to 10.00

HSCI 46500 - Introduction To Laboratory Education And Management

Credit Hours: 1.00 to 3.00. A study of the principles and techniques of clinical instruction, and inservice and continuing education as well as administration and supervision.

Credits: 1.00 to 3.00

HSCI 48500 - Health Physics Internship

Credit Hours: 1.00 to 8.00. Applied work experience as a health physics assistant or technician at a nuclear power generating station, government laboratory, hospital, or education and research institution. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 49000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for senior students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 49200 - Professional Experience In Health Sciences Internship

Credit Hours: 0.00 to 3.00. Professional experience in Health Sciences. This experiential offering is coordinated by Health Sciences in cooperation with participating employers. Students will submit company evaluations related to the experience or summary reports and assignments related to professional development in Occupational, Environmental or other Health Sciences areas. Permission of department is required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in a professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase knowledge of the application of occupational, environmental or other areas of health sciences in a professional capacity.

Credits: 0.00 to 3.00

HSCI 49501 - School Of Health Sciences Senior Honors Seminar

Credit Hours: 1.00. This course is for Senior students in the School of Health Sciences Program. This course consists of a 50-minute weekly seminar meeting to discuss current topics in health science, public health, and biomedical research. Students will interact with guest speakers and expand their knowledge base in health sciences research. In addition, each student will be responsible for presenting and reporting on their ongoing honors research project. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Build on the skill to give and evaluate a research presentation. Credits: 1.00

HSCI 49601 - School Of Health Sciences Senior Honors Project

Credit Hours: 1.00. This course is for Senior students in the School of Health Sciences Honors Program. In this course, students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students will enroll in this course in both fall and spring semesters (and concurrently with HSCI 49501 in the spring semester). An updated Project Description Form will be at the beginning of each semester based on the progress and any changes to the research plan. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least weekly or biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 51500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. This course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the State and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. The integration of safety and security and the use of alternative technologies will also be

covered. Group exercises and simulations in applied nuclear security scenarios will complement lectures given by a number of national and international experts. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. To introduce students to the basic concept of nuclear security. 2. To introduce students to the basics of nuclear security planning at the facility and state level. 3. Introduce students to proliferation efforts, framing them within the historical and security-related context. 4. Create a foundational understanding of relevant security, safeguards and nonproliferation treaties and agreements. 5. Leverage existing technical knowledge in coming to policy conclusions. 6. Develop both a regime and state specific knowledge base. 7. Illustrate understanding through technical and policy oriented exercises. 8. Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts. Credits: 3.00

HSCI 51600 - Molecular Imaging-Nuclear Medicine

Credit Hours: 2.00. This course is related to molecular imaging by SPECT (single-photon emission computed tomography) and/or PET (positron emission tomography). This course is particularly useful for graduate and senior undergraduate students in the medical physics programs. It has been offered to MP and HP graduate students over the last 4 years (2014 - 2018) as a part of the 3-credit molecular imaging course with magnetic resonance spectroscopy (MRS: 1-credit) taught by Dr. Ulrike Dydak, computed tomography (CT: 1-credit) taught by Dr. Keith Stantz, and nuclear medicine (NM: 1-credit) taught by Dr. Shuang Liu. In the future, it will be expanded the "Nuclear Medicine" section as a 2-credit course on the basis on the previous lectures. This course focuses on recent development in nuclear medicine techniques for noninvasive imaging of brain diseases, cancer, and heart diseases. This course is delivered as 50-min lectures twice a week. Students are expected to spend more time for homework and literature reading.

Learning Outcomes: 1. Understand the basic concept of molecular imaging, techniques for isotope production, and the use of radiolabeled biomolecules (e.g. antibodies and small biomolecules) for diagnosis of brain diseases, cancer and heart diseases, and for target-specific radiotherapy with the receptor-based radiotracers. Credits: 2.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based

analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 54100 - Human Sectional Anatomy

Credit Hours: 2.00. This course connects anatomy and physiology with medical imaging. The primary focus is on anatomic imaging methods such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) but includes Positron Emission Tomography (PET) and Ultrasound (US) images when applicable or are in common use as part of clinical care.

Learning Outcomes: 1. Identify and label the anatomy associated with the topical outline in diagnostic CT/MRI images. 2. Critique CT/MRI images for the presence or absence of anatomy and pathology to decide whether the image is appropriately positioned and diagnostic for radiological assessment. 3. Locate anatomical systems and possible pathology based on background knowledge of typical anatomical locations and identify normal course of system function for appropriate positioning, patient instructions, and CT/MRI imaging. Credits: 2.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure

assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 4.00

HSCI 54601 - Advanced Industrial Hygiene Control Technology Project

Credit Hours: 1.00. Students study the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Permission of instructor required.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating recognition, evaluation and control of occupational hazards in the workplace. Credits: 1.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models

of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies.

Credits: 3.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system.

Credits: 3.00

HSCI 54801 - Advanced Industrial Hygiene Instrumentation Techniques Project

Credit Hours: 1.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data. Permission of instructor required.

Learning Outcomes: 1. Understand the limitations of sampling and analysis in real world situations and learn how to deal with them. 2. Collect, analyze interpret and summarize laboratory data into a well-written report. 3. Appreciate the advantages as well as the difficulties of working together on a team.

Credits: 1.00

HSCI 55100 - Physical Agents In Environmental Health

Credit Hours: 3.00. Physical characterization and biological interactions of non-ionizing radiation with emphasis on the adverse effects of human exposure. Topics include source characterization, environmental exposure assessment, measurement instrumentation, toxicological and epidemiological findings, control strategies.

Credits: 3.00

HSCI 55200 - Introduction To Aerosol Science

Credit Hours: 3.00. The principles of aerosol behavior and sampling, with particular emphasis on applications in the health sciences. Topics include aerosol aerodynamics, aerosol filtration, pulmonary deposition of aerosols, methods of environmental sampling, and generation of laboratory aerosols.

Credits: 3.00

HSCI 55300 - Advanced Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization, protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often

forms a bridge between upper management and front line employees. As such, the successful health and safety manager needs to skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the front line employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the front line employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the front line employees and upper management together in their vision of a safe and health workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. Credits: 3.00

HSCI 55301 - Advanced Occupational Safety Management And Culture Project

Credit Hours: 1.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front-line employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. Permission of instructor required.

Learning Outcomes: 1. Identify, review, and critically evaluate current literature in the field of occupational safety management and culture. 2. Collaborate the peers on a group project to review a real safety management program. Credits: 1.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 56200 - Analytical Toxicology And Pathology

Credit Hours: 3.00. Historically, toxicology has been defined as the study of the adverse effects of xenobiotics. Today, toxicology encompasses much broader areas, including the study of endogenous compounds, physical agents, and even using toxicants as research tools. Basic and introductory toxicology courses cover the principles of toxicant metabolism and target organ toxicity. This course, Analytical Toxicology and Toxicologic Pathology is focused on the research and clinical applications of these principles. Two major areas will be covered: (1) principles of toxicant detection in biological matrices and (2) the assessment of pathological effects caused by toxicant exposure in biological systems. Laboratory sessions associated with each major topic allow students to have hands-on experience in these advanced analytical and pathological technologies. This course provides a unique opportunity for students to learn techniques that research and clinical toxicologists use daily in scientific or clinical laboratories. The course is suitable to both graduate and upper-class undergraduate students who are interested in toxicology, forensic science, veterinary medicine, environmental and occupational health, food toxicity, pharmaceutical drug testing, medical laboratory science, and general human and children's health.

Learning Outcomes: 1. Have a basic understanding of how to measure toxicant levels. 2. Have essential knowledge in evaluating histopathological alterations of major organs and tissues upon exposure to typical toxicants. 3. Be able to assess and interpret the adverse effects of toxicants in mammalian systems. Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57100 - Basics Of Magnetic Resonance Spectroscopy

Credit Hours: 3.00. Students will learn the basics of Magnetic Resonance Spectroscopy (MRS), practicalities of the MRS exam including hands-on experience, as well as examples of several clinical and research applications of MRS. The course teaches theory, practical aspects and applications of MRS and

is intended for graduate students who either specialize in the field of medical imaging, or who would like to use MRS as a tool for their research. A thorough basis will be provided to understand signal generation and signal processing in MRS with particular emphasis on current techniques used in human in vivo MRS. Students will become familiar with the most relevant metabolites and their physiological functions detectable by MRS in the brain and other organs (mostly liver, kidney, muscle, prostate, breast). Further, students will learn different approaches for analysis and quantification of MRS data and become familiar with several different analysis tools available. Permission of instructor required.

Learning Outcomes: 1. Describe the basics of signal generation and detection in MRS. 2. Distinguish between several localization techniques and when to apply each. 3. Implement and apply MRS parameters and protocols for specific applications. 4. Compare and contrast the similarities and differences of different nuclei used in MRS (1H, 31P, 23Na). 5. Implement and apply several MRS processing tools. 6. Summarize the techniques and challenges of MRS signal quantification. 7. Compare and contrast the advantages and limitations of MRS to other imaging modalities. 8. Implement and apply several MRS analysis tools (e.g. LCModel). 9. Set up and acquire human subject MRS data (using a 3T Siemens Prisma scanner). Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the

risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

HSCI 58000 - Occupational Biomechanics And Ergonomics

Credit Hours: 2.00. Occupational safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. Occupational ergonomics is a branch of science that focuses on optimizing the relationships between workers and their work environment. This course focuses on the principles and applications of safety and ergonomics as it applies to workers. The first part of the course will consist of lectures on the fundamentals of safety standards and liability and the development of work-related musculoskeletal disorders, ergonomic risk factors including work practices, tools and workstation design. The last part will consist of identification and use of safety and ergonomic controls to reduce and prevent work-related fatalities, injuries, and musculoskeletal disorders.

Learning Outcomes: 1. Describe ergonomic risk factors in the workplace. 2. Analyze work stations and identify ergonomic risk factors. 3. Develop solutions to minimize identified ergonomic risk factors. 4. Describe cumulative trauma disorders which may occur due to exposure to poor ergonomic conditions. 5. Explain how people perceive & understand information, and use this knowledge to improve work flow. Credits: 2.00

HSCI 58001 - Occupational Biomechanics And Ergonomics Laboratory

Credit Hours: 1.00. This course will be the laboratory component for HSCI 58000. Occupational Biomechanics and Ergonomics. Laboratory exercises will accompany and illustrate each topic discussed during the lecture course. An ergonomic project will allow the students to evaluate an individual performing a job and provide ergonomic recommendations to improve the work situation. The course will also emphasize report writing, teamwork, and communication skills.

Learning Outcomes: 1. Evaluate scientific literature to identify the strengths & weaknesses of study designs, interpretation of results, and implications for the future. 2. Display techniques for performing ergonomic measurements. 3. Evaluate ergonomic hazards of the workplace and make recommendations to correct the identified hazards. 4. Write professional quality reports summarizing laboratory procedures, clearly display experiment results, and interpret those results in the context of the principles learned in the HSCI 58000 lectures. Credits: 1.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including

networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

HSCI 67100 - Biochemical Toxicology

Credit Hours: 2.00. Toxicologists in all fields are concerned with mechanism of action or how a specific toxicant or class of toxicants produces toxicity. Introductory toxicology courses typically focus on the adverse effects exerted by a specific compound, with some examination of mechanisms. The entire focus of this upper-level graduate course is on the "how" and the "why", or a detailed examination of biochemical mechanism of toxicity. There will be some lectures, but the majority of the course will consist of student-led discussions on specific mechanisms of action. Further, students will write a review-style article on a chosen mechanism of action. Prerequisite: HSCI 56000 .

Learning Outcomes: 1. Orally describe mechanisms of action for major classes of toxicants. 2. Draft a written manuscript that critically assesses data on a specific mechanism of action. Credits: 2.00

HSCI 67200 - MRI Quality Assurance Internship I

Credit Hours: 3.00. This internship course provides didactic training and practical experience in clinical diagnostic medical physics. Students will spend 3-4 hours per week learning the responsibilities of a medical physicist in MRI quality assurance (QA) such as MRI system performance testing, setting up weekly MRI QA procedures, analysis of MRI QA data, and annual clinical system evaluations. In Part I students will observe and review the weekly MRI QA tests performed by the MR Technologists on clinical MRI scanners and be involved with data analysis of these tests (image quality assessment, reporting). Annual MRI system performance evaluations of different clinical scanners will be observed and discussed. This includes assessing magnetic field homogeneity, slice position accuracy and slice thickness accuracy, and performance of radio frequency coil tests on the various coils available at different clinical MRI sites in the Indianapolis area. Students will also work as a team with the instructors on a course project to develop and evaluate advanced MR QA methods and procedures. Prerequisites: HSCI 57000. Having documented experience in running an MRI scanner, e.g., having primary operator status on one of the research scanners at Purdue or IU. Level II MRI Safety Training: http://www.indiana.edu/~mri/safety_nonIU/safety.html. Permission of instructor required.

Learning Outcomes: 1. Understand the basic elements and clinical rationale in the QA program for MRI scanners. 2. Understand the significance of frequency and transmitter gain stability, geometric accuracy, slice position accuracy, high contrast resolution, low contrast detectability and artifacts, etc. 3. Understand the requirements for weekly and annual QA tests as required by ACR. Credits: 3.00

HSCI 67300 - MRI Quality Assurance Internship II

Credit Hours: 3.00. This internship course provides didactic training and practical experience in clinical diagnostic medical physics. Students will spend 3-4 hours per week learning the responsibilities of a medical physicist in MRI quality assurance (QA) such as MRI system performance testing, setting up weekly MRI QA procedures, analysis of MRI QA data, and annual clinical system evaluations. In Part II of the course, MRI system performance evaluations of different clinical scanners will be performed by the students independently following the ACR guidelines. This includes assessing magnetic field homogeneity, slice position accuracy and slice thickness accuracy, and performance of radio frequency coil tests on the various coils available at different clinical MRI sites in the Indianapolis area. Students will also work as a team with the instructors on a course project to develop and evaluate advanced MR QA methods and procedures. Prerequisites: HSCI 67200. (This course provides the theoretical basis and opportunity to observe MRI QA on clinical scanners, and forms the basis for this course, Part II). Permission of instructor required.

Learning Outcomes: 1. Understand the requirements for weekly and annual QA tests as required by ACR. 2. Become proficient at performing weekly and annual MRI QA

procedures. Credits: 3.00

HSCI 67400 - Radiological Diagnostic Imaging Internship

Credit Hours: 3.00. This internship course provides the student with hands-on experience with clinical imaging equipment, lectures on the fundamental operation of the equipment, and quality assurance/control methods/assessment of this equipment. Students will learn the safety and imaging performance of flat panel digital x-ray system, fluoroscopy, CT scanner, Ultrasound system, and MRI scanner. Lectures will provide fundamental physics and operation of each system, perform quality assurance methods employed by board certified Medical Physics, and subsequent analysis of these methods. This course is to be delivered as a 50-minute lecture, a 150-minute lab, which includes additional time for image analysis (computational lab). The goal of this course is to provide the necessary information as part of CAMPEP/ABR and ACVR. Prerequisite: HSCI 570 Introduction to Medical Imaging.

Learning Outcomes: 1. Communicate results to the faculty in charge, both verbally and in writing through their lab report. 2. Develop procedures that will provide the required measurement. The protocol they implement will require careful consideration and have a physical understanding of the result. 3. Understanding the quality of the measurements and potential procedural errors. 4. Synthesize many forms of information to understand image artifacts, characterize the cause of these artifacts, and a means to remediate them. 5. Resolve problems, requiring research and ultimately improvements in procedure or protocol. Credits: 3.00

HSCI 67600 - Radiation Therapy Clinical Competencies I

Credit Hours: 3.00. The course is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue-Indiana University School of Medicine joint CAMPEP accredited program. Students will spend approximately 4 hours in the clinic on a weekly basis for 10 weeks. Prerequisite: HSCI 57200.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology clinic. 2. Perform specific quality assurance tasks with limited supervision. 3. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

HSCI 67700 - Radiation Therapy Clinical Competencies II

Credit Hours: 3.00. This is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue CAMPEP accredited program. Students enrolled in this course will participate in the Radiation Oncology clinic, which will provide similar experiences as junior medical physicists in training. Students will meet with the course instructor prior to spending time in the clinic to be assigned mentors and to arrange schedules. Students will spend approximately 3 hours in the clinic on a weekly basis. Absences/vacations are allowed but must be arranged with approved by the mentor with sufficient notice. Prerequisite: HSCI 67600.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology clinic. 2. Perform quality assurance tasks with limited supervision. 3. Understand the roles of other professionals in the Radiation Oncology clinic. 4. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

HSCI 69000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

HSCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HSCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Health, Services, Outcomes & Policy

HSOP 45200 - Social Aspects Of Pharmacy Practice

Credit Hours: 2.00. A survey of selected social and behavioral models and related issues that affect the contemporary practice of pharmacy. Special emphasis is given to the interdependent roles of the patient, the pharmacist, and the physician.

Credits: 2.00

HSOP 46800 - Community Pharmacy Management

Credit Hours: 3.00. Principles, practices, and case studies

related to the organization, operation, and control of community pharmacies.

Credits: 3.00

HSOP 48200 - Marketing Pharmaceutical Products

Credit Hours: 2.00. Examination of the channels of distribution for pharmaceutical products, including research-intensive and generic manufacturers, drug wholesalers, independent and chain community pharmacies, non-pharmacy retailers, prescription benefit managers, and third-party payers. Areas of special emphasis include new product development, product distribution, advertising and promotion, Rx-to-OTC switching, and product pricing and payment policies.

Credits: 2.00

HSOP 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Credits: 1.00 to 3.00

HSOP 50100 - Food And Drug Law I

Credit Hours: 3.00. A systematic study of the structure and function of the major federal (USA) laws and regulations governing the manufacturing, distribution, and marketing of foods, drugs, cosmetics, and devices. Permission of instructor required.

Credits: 3.00

HSOP 50200 - Food And Drug Law II

Credit Hours: 3.00. Detailed study of statutes and regulations applied to discovery, development, and marketing pharmaceutical and devices in the United States.

Credits: 3.00

HSOP 55600 - Healthcare Economics And Public Policy

Credit Hours: 3.00. Principles and theories of healthcare economics applied in analysis of the U.S. healthcare system. Perspectives are presented on the differential roles of economic analysis and policy analysis. Topics include medical care as an input to health, pharmaceutical service market, adequacy of health manpower supply, health associations and demand for legislation. Healthcare reform, the pharmaceutical industry, and social values that guide policy are explored.

Credits: 3.00

HSOP 69000 - Special Problems

Credit Hours: 0.50 to 3.00. Individual investigations in pharmacy marketing, retailing, and management. Permission of instructor required.

Credits: 0.50 to 3.00

HSOP 69600 - Seminar In Pharmacy Administration

Credit Hours: 1.00. Selected topics on current research, teaching methods, and contemporary problems in management and marketing.

Credits: 1.00

Healthcare Engineering Technology Management

HETM 22500 - Healthcare Technology Diagnostics And Repair

Credit Hours: 3.00. This course will explore fundamental repair theory and applications of technology used in the clinical setting, switching logic and controls, and systems repair in medical devices.

Credits: 3.00

HETM 24000 - The Technology Of Patient Care

Credit Hours: 3.00. This course provides an overview of medical equipment used in the hospital and other medical environments to diagnose and treat patients. Sensors and physiological signals will be explained. Equipment found in various hospital departments and medical specialties will also be discussed. Patient safety and regulations will be emphasized.

Credits: 3.00

HETM 31500 - Introduction To Imaging Modalities

Credit Hours: 3.00. The fundamentals of diagnostic imaging equipment will be explored. The principles of x-ray based systems will be explored. Components and features of MRI, ultrasound, PET, and nuclear medicine will be discussed. Image storage and communication protocols will be presented.

Credits: 3.00

HETM 40200 - Healthcare Device System Security

Credit Hours: 3.00. Students explore the clinical applications of computer networks, integrated medical devices, interoperability, and electronic medical records. Special emphasis will be on security and HIPAA compliance associated with physiological data. Hands-on learning will involve campus-area hospitals.

Credits: 3.00

HETM 44000 - Codes, Regulations And Patient Safety

Credit Hours: 3.00. This course explores applicable NFPA 99, JCAHO, CLIA, FDA and other regulatory agencies and their regulations governing medical equipment in the clinical environment. Case studies will be used to provide examples of interpretation and application.

Credits: 3.00

HETM 46000 - Systems Engineering Technology For Healthcare

Credit Hours: 3.00. Participants will gain insight into the analysis of multiple-entity clinical systems involving healthcare technology. Focus will include process analysis and improvement to satisfy clinical customer needs. Course content will explore the interdisciplinary efforts related to support the development, verification, deployment, integration, operations and user training of complex systems involving healthcare technology, as well as the creation of information about system performance associated with management decision making.

Credits: 3.00

HETM 49000 - Project Planning And Design

Credit Hours: 1.00. Students are expected to prepare an individual design in collaboration with industry and/or the clinical setting. This course will introduce the applications of project management to the student's design. Topics include project scope, scheduling, resource limitations, stakeholder interactions, delivery and quality assurance.

Credits: 1.00

HETM 49300 - Healthcare Engineering Technology Management Ethics And Professionalism

Credit Hours: 1.00. Students will explore ethical, social, political, legal and ecological issues that practicing BMET's may encounter. Particular emphasis will be placed on patient safety and privacy issues.

Credits: 1.00

Hebrew

HEBR 10100 - Modern Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to Modern Hebrew: the writing and sound systems, and systematic presentation of basic structures. All language skills - reading, writing, speaking, and comprehension - are emphasized. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 10200 - Modern Hebrew II (UCC: HUM)

Credit Hours: 3.00. Continuation and extension of the first semester. The course aims to develop fluency in reading, comprehension, and spoken language. Knowledge of grammar and vocabulary is expanded.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 12100 - Biblical Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. The first semester of biblical Hebrew will present the basic elements of the language, including alphabet, vocabulary, and grammar. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 12200 - Biblical Hebrew Level II (UCC: HUM)

Credit Hours: 3.00. The second semester of biblical Hebrew will continue the study of reading, vocabulary and grammar, based on selections from the Hebrew Bible.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 20100 - Modern Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading both in the modern language.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 20200 - Modern Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading in the modern language.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 22100 - Biblical Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. The third semester of biblical Hebrew focuses on reading and translation of extended passages form the Pentateuch and the use of textual criticism.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 22200 - Biblical Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. The fourth semester of biblical Hebrew exposes the student to both narrative and poetic sections of the Bible.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 28400 - Ancient Near Eastern History And Culture

Credit Hours: 3.00. This course is a survey of the development of the ancient Near East, from its pre-history to Alexander the Great. It emphasizes the evolutions of various Near Eastern cultures in their many manifestations; art, government, agriculture, economics, philosophy, religion, ethics, and science. Taught in English.

Learning Outcomes: 1. Understand the difference between pre-history and history. 2.

Understand various ancient and modern ideas of the purpose of writing history. 3. Understand how the invention of writing and the origins of cities were coordinate developments. 4. Understand something of the flow of empires that succeeded each other, eventually displaced by the empire of Alexander the Great, whose conquests shaped the contours of the world much as we know it. 5. Become aware how art reflects the development of thought and idealism; how ideas of human government evolved; how religion, science, agriculture, and much else developed as empires built onto those they displaced. Credits: 3.00

HEBR 38000 - Israel And The Modern World: Cinema, Literature, History And Politics (UCC: HUM)

Credit Hours: 3.00. Critical survey/exploration of major traits of Israeli culture through a variety of media: literature, film and music, in the larger context of Judaism, Zionism, as well as the creation of a new state and culture. Conducted in English; no knowledge of Hebrew is necessary.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand the depth of Modern Israel cultural, political and historical complexity. 2. Understand the richness of Israeli culture. 3. Understand Israeli political-social problems and its influence on world affairs. 4. Development of modern Israeli cinema and literature in reference to their historical and political groundings. 5. Mastery of major historical events, major films, major literary figures, and major social/political problems. Credits: 3.00

HEBR 38300 - Kabbalah And Jewish Mysticism: Secret Knowledge In Judaism

Credit Hours: 3.00. This course critically explores the roots, history, symbolism and major characteristics of the Jewish mystical tradition known as Kabbalah.

Learning Outcomes: 1. Identify and describe the key terms, concepts, texts, and figures in Jewish mysticism. 2. Consider the case of Jewish mysticism in the general context of religious mysticism and evaluate the applicability of general concepts to specific, tradition-based examples, and vice versa. 3. Gain insight into the inner world of esoteric religiosity and its texts. 4. Learn the crucial influence of Jewish mysticism on Christianity, Islam and on European history as well as on the evolvement of Western civilization. 5. Become familiar with the symbolic, phenomenological approach to mystical texts and experiences as practiced in the academic study of religions. 6. Learn the art of hermeneutics: interpretation and unpacking of original, historical and hagiographical texts, and the dramatic ramifications of reading these kinds of texts in translation. 7. Develop critical thinking and oral communication skills through course readings and class discussions, presentations and through work on directed individual projects. 8. Develop writing and research skills by writing weekly papers and a research paper. Credits: 3.00

HEBR 38500 - The Holocaust In Modern Hebrew Literature

Credit Hours: 3.00. This course critically examines the Holocaust and the ways in which it has influenced modern Hebrew literature, the role it plays, and how it is represented in modern Hebrew literature. Conducted in English; no knowledge of Hebrew is necessary.

Credits: 3.00

History

HIST 10001 - Issues In African-American History

Credit Hours: 3.00. Study and analysis of selected historical issues and problems of general import. Topics will vary from semester to semester but will usually be broad subjects that cut across fields, regions, and periods. May be repeated with different topics for a maximum of 9 credit hours.

Credits: 3.00

HIST 10300 - Introduction To The Medieval World (UCC: HUM)

Credit Hours: 3.00. Barbarians, kings, queens, peasants, witches, saints, teachers, students, heretics, Moslems, Jews, Christians, love, death, monks, farm life, city life, ordinary men, women, and children as Europe develops from A.D. 500 to 1500.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 12300 - History At Work

Credit Hours: 1.00. Students will learn how history majors' distinctive skills and expertise can help them achieve success in many different careers. Participants will explore the value of historical thinking in daily life, including causality, contingency, and contextualization, and will refine practical reading, thinking, and communication skills crucial to career success. Permission of department required.

Learning Outcomes: 1. Summarize the arguments of a historical journal article (secondary source) and apply their understanding of how historical research is produced and evaluated to an analysis of that source's significance to the discipline. 2. Identify professional opportunities such as jobs, internships, and calls for conferences, prizes, and article proposals. 3. Create CVs/resumes and cover letters/personal statements that highlight their skills and accomplishments, and that are tailored to the professional opportunities for which they are applying. 4. Investigate different career paths available to history majors, and assess their own strengths and interests in relation to those career options. 5. Discuss and advocate for the importance of historical thinking in the workplace and in daily life. Credits: 1.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 20100 - Special Topics In History

Credit Hours: 3.00. This variable title course deals with broad historical topics that transcend and telescope traditional analytical, chronological, and geographical boundaries. Content will vary with the instructors teaching the class.

Credits: 3.00

HIST 21000 - The Making Of Modern Africa (UCC: HUM)

Credit Hours: 3.00. This course provides students with a comprehensive introduction to modern African history from 1800 to the present. Using a variety of films, novels and scholarly resources, we will examine the major historical forces that have shaped African lives over the last two centuries. Emphasis will be placed on African experiences of slavery, colonialism, liberation struggles, and post-independence national building. Students will also learn to analyze contemporary African issues within a larger historical context.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand modern African history and the state of Africa today. 2. Learn how to interpret historical texts from a number of different epistemic positions (i.e. paying attention to race, class, gender, sexuality, nation and other axes of ""difference""). 3. Expect to develop stronger writing skills, as well as to improve on critical thinking and oral articulation. Credits: 3.00

HIST 21100 - The Global Field: World Soccer And Global History (UCC: HUM)

Credit Hours: 3.00. This is an introductory course to the history of soccer, on and off of the pitch. It studies the history of the game itself as well as the international economic, political,

social, and cultural trends that shaped it.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand a major global phenomenon and its relationship with nations and societies around the world. 2. Learn how to look critically at the same problem (soccer) from the perspective of more than one discipline. 3. Develop communication, writing skills and critical thinking. Credits: 3.00

HIST 22100 - History Behind The Headlines

Credit Hours: 3.00. This course introduces undergraduate students to the study of history and provides an overview of the various ways history is communicated outside the academy in narrative nonfiction, journalism, museum exhibitions, policy documents, political speeches, advertising, podcasts, television, film, and social media.

Learning Outcomes: 1. Identify and assess the ways in which history is presented to the public. 2. Produce a compelling historical argument based on a thorough assessment of primary and secondary sources. 3. Design a history communication project for public and non-expert audiences. Credits: 3.00

HIST 22800 - English History To 1688

Credit Hours: 3.00. This course is designed to survey the growth and development of English society from its beginning through the seventeenth century. Emphasis is put upon those institutions and events that influenced the establishments of the English legal system.

Credits: 3.00

HIST 22900 - English History Since 1688

Credit Hours: 3.00. A continuation of HIST 22800 . Emphasis is placed upon Great Britain as a world and imperial power. Attention is given particularly to the industrial revolution, the growth and achievements of democratic institutions, and the role Britain has played in Western civilization in recent times.

Credits: 3.00

HIST 23005 - Hitler's Europe

Credit Hours: 3.00. This course will examine the rise, seizure, and consolidation of power by the Nazi Party and will trace the development of Adolf Hitler from a provincial Austrian to dictator of Nazi Germany.

Learning Outcomes: 1. Explain how and why Adolf Hitler and the Nazis seized and exercised power, and the consequences for Germany and Europe. 2. Distinguish between secondary and primary sources and critically read both types of sources; synthesize information and arguments from both types of sources. 3. Evaluate biography as a historical genre; engage in independent historical interpretation with the use of primary and secondary sources. 4. Compose analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. Credits: 3.00

HIST 23800 - History Of Russia From Medieval Times To 1861 (UCC: HUM)

Credit Hours: 3.00. This course explores the main characteristics of early Russian society, culture and politics. Topics include: the Kievan principalities, Orthodox Christianity, the Mongols, the rise of Moscow, the Petrine reforms, peasant and national rebellions, revolutionary movements, and the Tsarist empire to the Crimean War.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major geographical features of the Russian homeland, the Baltics, Belarus, Ukraine, the Caucuses, Central Asia, the Volga-Urais, Siberia, and the Far East. 2. Trace and describe the main historical characteristics of Russian culture, social structure, and political life from the earliest origins under the Viking conquests to the emancipation of the serfs in 1861. 3. Analyze what the Russians both gave and took from the hundreds of Caucuses, Siberian, Central Asian, and European peoples, whom they gathered into the all-Russian state. 4. Understand the sources of Russia's triumphs and tragedies through the empire's consolidation of autocracy and serfdom. 5. Create a game-style simulation on the topic Russia's Circular Frontier and the Rise of Muscovy. Credits: 3.00

HIST 23900 - History Of Russia From 1861 To The Present (UCC: HUM)

Credit Hours: 3.00. This course surveys the paths of the Russian empire through economic modernization, social transformation, and World War I; the revolutionary regimes of Bolshevism, Leninism, and Stalinism; World War II and the Cold War; the collapse of the USSR; and the new Eurasian states.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify the major geographical features of the Russian land empire from its European borders, through the Caucasus and Central Asian frontiers, to the steppes and forests of Asia. 2. Trace and describe the main historical characteristics of Russian culture, social structure, and political life from the Great Reforms of the late empire (1861) to the present regime. 3. Analyze why, twice in recent times (1917 and 1991), the state collapsed under the weight of its own contradictions, driven in part by the pace of European and American modernization. 4. Understand how Russian history is a metaphor for global history, a study of the crises posed by the world revolution of western values. 5. Create a game-style simulation of the topic The Genesis and Structure of the Stalinist State. Credits: 3.00

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24300 - South Asian History And Civilizations (UCC: HUM)

Credit Hours: 3.00. Survey history of India, Pakistan, and Bangladesh, from the origins of South Asian civilization to the present. Topics include ancient India, the Mughal Empire, the colonial experience, the independence movement, and conflict and popular culture.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24600 - Modern Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course explores the political, social, and cultural factors that have contributed to the formation of the modern Middle East. Course includes short stories and a selection of documentary films from the region.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 25000 - United States Relations With The Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course examines US relations with the Middle East and North Africa since World War II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gained a deeper understanding of the patterns and processes shaping US relations with the Middle East and North Africa. 2. Thought historically and critically about approaches to the study of US relations with the Middle East and North Africa. 3. Used primary source evidence to analyze fundamental issues in US relations with the Middle East and North Africa. 4. Sharpened critical reading, thinking, writing, and discussion skills in order to defend an independent argument. Credits: 3.00

HIST 27100 - Introduction To Colonial Latin American History (1492-1810) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the principle historical themes of Latin America during the colonial period (roughly, from 1492 to 1810). No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate a grasp of the historical forces that in many ways laid the foundation for present-day Latin America. 2. Express understanding of how these major political, social, economic, and cultural issues unfolded in different ways in Latin America, with respect to region, time, and culture. Credits: 3.00

HIST 27200 - Introduction To Modern Latin American History (1810 To The Present) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the study of the major economic,

political, social, and cultural processes that shaped modern Latin American nations since independence. No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a broad understanding of the modern history of Latin America. 2. Become familiar with the major economic, political, social, and cultural processes that shaped the nations of the continent. Credits: 3.00

HIST 27800 - Money, Trade, And Power: The History Of Capitalism

Credit Hours: 3.00. This course examines the origins of capitalist institutions and their changes over time, including banks, joint-stock companies, and modern corporations -- all viewed with respect to their impact on industrialization, colonial expansion, business cycles, and the emergence of a global economy.

Learning Outcomes: 1. Explain the history of capitalism based on a combination of readings, course lectures, and course discussions. 2. Develop compelling historical arguments and demonstrate your understanding of the course material through examinations. 3. Write clear and concise analytical papers based on templates and feedback supplied by the professor. Credits: 3.00

HIST 28000 - Science And Society In Western Civilization I (UCC: HUM/STS)

Credit Hours: 3.00. A survey of the main lines in the development of science and society in Western civilization from earliest times to Newton's discovery of gravitation. Beginning with prehistory and Egyptian and Mesopotamian civilizations, the course treats in more detail the Greeks and Romans. The course then considers science during the Middle Ages, examining the transmissions of ancient science and its incorporation into the body of Christian doctrines. The course concludes with the new efforts of physicians and astronomers to free their studies from the influence of the Church and antiquity, and the new accommodations between science and society during the Scientific Revolution.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 28100 - Science And Society In Western Civilization II (UCC: HUM/STS)

Credit Hours: 3.00. This course considers Western science and society from the time of Newton to the present. Beginning with Copernicus to Newton, topics next include biological classification, modern chemistry, and the onset of the industrial revolution. For the nineteenth century the course stresses the maturation of biology. Darwinian evolution, the dynamic synthesis and electromagnetic studies, and the second industrial revolution. In the twentieth century, the course covers modern physics, the life sciences, the understanding of the universe, and the interaction between pure and applied science. The course concludes with some of the modern social and political problems which science caused by its success.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and

explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 28200 - Science And Society In The Twentieth Century World (UCC: HUM/STS)

Credit Hours: 3.00. An introductory survey emphasizing cultural contexts, relationships with other institutions, and the lives of major figures. Covering selected major achievements as well as the problems these generate. Neither science nor engineering background is required.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society during the Twentieth Century. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society during the Twentieth Century. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contributions of different social groups in science and society during the Twentieth Century. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science during the Twentieth Century. Credits: 3.00

HIST 28400 - The Computer Age From Babbage To The Blockchain

Credit Hours: 3.00. In this course we will explore the history of computing-from the pre-electronic days through the computer's ascent in the twentieth century to the various electronic computing and communications technologies that surround us today. This course will investigate why there was a desire to create computing machines in the first place, the economic and political arrangements that brought computers into existence, the debates over what computers could (and should) be used for, the development of the IT profession, and the gradual shift from computers being room-sized specialty machines to everyday objects that people carry around in their pockets.

Learning Outcomes: 1. Identify social, economic, political, and historic factors that have shaped the development and application of computer technology. 2. Describe the history of computing and its relevance for the world today. 3. Locate primary source materials, critically analyze those sources by considering their context and the reasons for their creation. 4. Examine work produced by, and arguments made by, historians. 5. Discuss the role that computers play in everyday life with an expansive view of the wide breadth of computerized systems that surround us. Credits: 3.00

HIST 30000 - Eve Of Destruction: Global Crises And World Organization In The 20th Century (UCC: HUM)

Credit Hours: 3.00. Using a variety of case studies, this course considers 20th-century turning points -- often violent and disastrous ones -- in an emerging global conversation about urgent world problems and their possible solutions.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 30105 - Big History: Time And Scale

Credit Hours: 3.00. This course explores Big History, a new form of world / global history. Like all forms of world history, Big History transcends the limitations of nation-centered perspectives. Drawing on the history of science and environmental history, Big History considers the many forces (physical, biological, environmental, social, and political) that drive change across time.

Learning Outcomes: 1. Examine, interpret, and explain trends in Big History / World History at multiple scales. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to Big History. 3. Identify and explain the major themes of Big History. 4. Write about the role of Big History and social implications of science. Credits: 3.00

HIST 30200 - Historical Topics

Credit Hours: 3.00. This variable-title course deals with broad historical topics that transcend and collapse traditional analytical, chronological, and geographic boundaries. Content

will vary with faculty member teaching the class.

Learning Outcomes: 1. Students will acquire a perspective on and basic understanding of the course content. 2. Students will engage in integrative learning as they examine the course content that transcends and collapses traditional analytical, chronological, and geographic boundaries. 3. Students will develop their creative and critical thinking skills. 4. Students will strengthen their information literacy and improve their writing skills. Credits: 3.00

HIST 30305 - Food In Modern America (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the kitchen as an architectural space, a place of labor and food production, and an arena for technological innovation in modern American history. Cooking and eating reflect cultural sentiments about modernity, progress, ethnicity, and family, and the politics of how society nourishes bodies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Think historically and critically about the cultural consequences of technologies related to eating and food preparation. 2. Think historically and critically about approaches to the study of national identify and culture expressed through food. 3. Appreciate the circumstances and history of kitchen design in relation to raced and gendered identities, home space, and food preparation. 4. Understand and recognize how assumptions about food production during the late 19th and 20th centuries in the United States reflected notions about labor, modernity, and progress. 5. Understand the difference between secondary and primary sources. Students will analyze and interpret primary documents related to kitchens, cooking, and food preparation. They also will understand the competing and conflicting nature of historical interpretation. 6. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 30400 - America In The 1960s (UCC: HUM)

Credit Hours: 3.00. Surveys the turbulent history of the 1960s America. Topics include: the Kennedy, Johnson, and Nixon presidencies; postwar liberalism and conservatism; insurgent political and social movements; the counterculture; the sexual revolution; rock 'n roll; and the Vietnam War.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 30505 - The United States In The World 1898-Present (UCC: HUM)

Credit Hours: 3.00. This course explores the central issues and themes of American foreign relations during the twentieth century with a primary focus on the expansion of American political military, economic, and cultural power.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand how and why the United States transformed from a relatively minor regional power in the nineteenth century into the global power we recognize today. 2. Understand innovative ways in which historians are expanding our understanding of Americans' role in the world. 3. Understand the often competing and conflicting nature of historical interpretation and encourage assessment of various forms of primary source evidence to form conclusions about the United States' place and experience in the world. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5.

Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

HIST 30701 - History Of Artificial Intelligence: Minds And Machines

Credit Hours: 3.00. This course examines the long history of efforts in automating human cognition. Historically, the attempts to automate human cognitive functions - from the mere reckoning of numbers to complex decision-making have been entangled with heated debates about what counts as good, proper, and desirable thinking; whose thinking machines should emulate; and whether the thinking of some humans is inferior to that of machines. In this course, we will examine how the invention of calculating machines - analogue and then digital - has developed in tandem with philosophical and scientific theories of human thinking and intelligence. In their turn, the latter developed as a response to changing social, political, and economic currents.

Learning Outcomes: 1. Critique the epistemological foundations and ethical implications of past and present approaches to the automation of human cognition. 2. Use primary sources to make arguments about the role of social, political, economic, and cultural currents that have historically provided the impulses for research and development in the automation of human cognition. 3. Assess historical scholarly arguments about social, economic, and political power asymmetries surrounding artificial intelligences. 4. Create websites to use text, imagery, and video content and effectively communicate how social factors have historically shaped the development of artificial intelligence. Credits: 3.00

HIST 30705 - History Of Data: How Data Became Big

Credit Hours: 3.00. This course offers a long history of Big Data. The first module focuses on how states collected data from the 16th to 19th centuries. Here we will focus on mortality bills, census, statistics, and accounting tables. In the second model, we will pay special attention to data collection and privacy in the 20th century. In the third module, students will explore how previous developments in data collection were applied to the new developments in analog and digital computing. The final weeks of the course will focus on present-day artificial intelligence, big data, their technical limitations, and the ways they often amplify, exploit, and contribute to a wide array of social problems.

Learning Outcomes: 1. Understand a variety of historical contexts that have shaped how we use, collect, and analyze data in the 21st century. 2. Assess historical arguments about the place of data in the growth of state bureaucracies, colonialism, eugenics, national security, warfare, and scientific research made in scholarly secondary sources. 3. Use primary sources to make arguments about the historical contingency of the ways practitioners have been using data to solve state problems. 4. Develop critical thinking about data-empowered algorithms and envision a human-centered and ethical way of creating and implementing data technologies. Credits: 3.00

HIST 30801 - American Eugenics

Credit Hours: 3.00. This course explores the pre-history and history of American eugenics, as well as its afterlives. It analyzes how Americans have used scientific ideas to grapple with questions of heredity and human worth from the Early Republic to the present. We will explore the social and political uses of phrenology, physiognomy, and eugenics, and consider how those scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering.

Learning Outcomes: 1. Read and discuss primary sources. 2. Interpret how scientific knowledge has been applied in human lives and society from the 18th century to the present. 3. Analyze major themes in the history of eugenics. 4. Investigate how and why specific ideas about human value and genetic worth arise in specific historical contexts. 5. Critique the extent to which scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering. Credits: 3.00

HIST 30805 - History Of Life Sciences

Credit Hours: 3.00. This course will examine the development of life sciences from 1750 to the present, introducing students to critical problems related to biology and society through the study of primary and secondary sources. The "life sciences" include all the sciences that deal with life as an organic entity. A prominent

theme in this historical treatment is the impact of social and political ideas on the life sciences. Topics will include theories of life, the origin of life, taxonomy and classification, theories of development, natural selection, genetics, eugenics, science and religion, the evolutionary synthesis, biodiversity, ecology and environmentalism, sociobiology, the discovery of DNA, cognition and the brain, and gender in science. Students will develop crucial skills in the interpretation of primary and secondary sources, research, analysis, and presentation.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical material. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 30902 - History Of Biotechnology

Credit Hours: 3.00. This class examines historical intersections between engineering and biology in the Western world. The course begins by considering several possible meanings of "biotechnology." It examines how and why different biotechnologies from the life sciences, biology, and medicine have arisen in specific historical contexts, changed over time, and affected society from the late 19th century to the present. We will study vaccines and beer-making in the 19th century, cell culture, birth control pills, and DNA sequencing in the 20th century, and 21st-century genome editing and synthetic biology, for example. Overall, this course argues that biotechnologies have always forced human beings to consider whether living and non-living entities are made up of the same fundamental "stuff," the implications of manipulating living things, and the nature of life itself.

Learning Outcomes: 1. Identify and describe examples of biotechnologies. 2. Describe the role of biotechnology in history and its relevance for society today. 3. Explain major themes in the history of biotechnology, such as how biotechnologies have changed through time and impacted society by way of their interactions with (for example) ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class. 4. Investigate the history and social impacts of a biotechnology of their choosing that has not been discussed in depth in this class. 5. Explain how and why this biotechnology arose in a specific historical context, changed over time, and impacted (or impacts) society (using historical methods). Credits: 3.00

HIST 30905 - History Of Environmental Science

Credit Hours: 3.00. This course introduces students to various approaches to environmental science through time. It considers critical problems related to the environment and society. The "environmental sciences" include all the sciences that deal with the Earth's physical and organic environments.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical materials. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 31000 - Historical Geography

Credit Hours: 3.00. Survey of historical geography.

Learning Outcomes: 1. Analyze geographical sources for historical information, and historical sources for geographical information. 2. Explain how historical processes act across space. 3. Synthesize temporal and spatial information into original conclusions about history. Credits: 3.00

HIST 31005 - The Civil War And Reconstruction, 1850 To 1877 (UCC: HUM)

Credit Hours: 3.00. A survey of the American Civil War and Reconstruction, covering the intense sectional conflict of the 1850s; the military, social, economic, and political aspects of the war; and the political and economic reconstruction that followed.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify and explain the causes, fighting, and outcomes of the American Civil War and Reconstruction. 2. Understand, analyze, and evaluate different interpretations of the war. Credits: 3.00

HIST 31205 - The Arab-Israeli Conflict

Credit Hours: 3.00. This class traces the emergence of political fault lines in Ottoman Palestine, the immigration of European

Jews in the Interwar Era and after World War II, the divisive policies of the British Mandate, the establishment of a Jewish state and the subsequent wars between Israel and surrounding Arab countries. In the end, students study religion as one part of a complex struggle for control over regional resources.

Learning Outcomes: 1. Increase understandings of the political, economic and cultural forces that acted as a catalyst for the Arab-Israeli conflict and continue to underpin and stir them. 2. Reflect on the symbols (monuments, songs, literature, film, language) of Israeli and Palestinian nationalism in order to understand culture productions within conflict. 3. Assess narratives of the Arab-Israeli conflict in film, memoir and other documents in order to develop the skills necessary to read and argue about the past, particularly in a conflict in which historical interpretation itself can be skewed due to political aims. 4. Improve written and oral communication skills while improving analytical skills pertaining to complex issues. 5. Increase global fluency, or student knowledge about diverse cultures. Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2. Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 31405 - Science, Technology, Engineering And Mathematics (STEM) And Gender (UCC: HUM/STS)

Credit Hours: 3.00. Scientific and technological innovation has been a cornerstone of American identity. How science and technology matters to gender, and gender matters to science and technology, will be explored through studying amateur and professional scientists and engineers, industrialization, education, sexual division of labor, and home and work spaces in twentieth-century America. Examining technological, scientific, and engineering innovation through the lens of gender reveals changing relationships between men and women in modern America.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to gender. 2. Understand and recognize how assumptions about gender may influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 31505 - American Beauty (UCC: HUM)

Credit Hours: 3.00. This course explores twentieth-century gender history in the United States through the concept of beauty. Ideals about beauty intersect with politics, economics, technological developments, medical innovations, and nation building. A critical examination of beauty as seen through advertising, pageants, and material culture, yields insight about modern womanhood, everyday life, and identify formation in the twentieth-century United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Appreciate the ways that beauty has been pursued by individuals, health practitioners, corporations, and media cultures since 1900. 2. Understand and recognize how assumptions about gender have influenced the

way that beauty is constructed and experienced at different places and times. 3. Think historically and critically about the culture consequences of technologies related to beauty. 4. Think historically and critically about approaches to the study of beauty in modern American history. 5. Understand the difference between secondary and primary sources. 6. Analyze and interpret primary documents related to beauty cultures. 7. Understand the competing and conflicting nature of historical interpretation. 8. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 31700 - A History Of The Christian Church And The Expansion Of Christianity I

Credit Hours: 3.00. A history of the emergence of Christianity, the development of the Christian church, and the impact of Christian thought and institutions upon western Europe prior to the Reformation.

Credits: 3.00

HIST 31905 - Christianity In The Global Age

Credit Hours: 3.00. This course examines the social, cultural, economic, legal, and religious dynamics of global Christianity in its emerging centers of Latin America, Asia, and Africa during the 20th and 21st centuries.

Learning Outcomes: 1. Understand key issues in the global Christianity in 20th and 21st centuries. 2. Distinguish between secondary and primary sources, and be able to critically read both types of sources. 3. Synthesize information and arguments from both types of sources. 4. Engage in independent historical analysis with the use of primary and secondary sources. 5. Write analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. 6. Research a contemporary topic using a variety of international sources and write a report analyzing the issue in the context of longer historical developments. Credits: 3.00

HIST 32105 - Spain: The First Global Empire, 1469-1713

Credit Hours: 3.00. This course examines the history of Spain's global empire from the unification of the kingdoms of Castile and Aragon to the War of the Spanish Succession. Topics include Spain's European possessions, overseas empire, ruling dynasty, society, and culture.

Learning Outcomes: 1. Assess the mechanisms that made the Spanish imperial system successful and, likewise, appraise its inherit weaknesses. 2. Distinguish the different stages in the development of the Spanish empire. 3. Judge the extent of the Spanish empire's impact on international politics and regional histories. 4. Evaluate the substantial cultural output of the period. Credits: 3.00

HIST 32300 - German History (UCC: HUM)

Credit Hours: 3.00. A survey of German history from the earliest times until the present. After a brief description of the medieval empire, we will turn to the Germany of Bismarck and Hitler and its successor states. A recurring theme will be the struggle between forces of liberalism and democracy and those of authoritarianism and militarism.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 32400 - Modern France (UCC: HUM)

Credit Hours: 3.00. A survey of modern France since 1789, including political, social, industrial, and institutional development. Emphasis is also placed upon the colonial and international aspects of French history.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 32501 - Twentieth Century Europe Through Autobiography

Credit Hours: 3.00. Merits and limitations of autobiographies as sources for 20th-century European history.

Credits: 3.00

HIST 32900 - History Of Women In Modern Europe (UCC: HUM)

Credit Hours: 3.00. This course examines women's experiences and constructions of femininity in Europe from 1789 to the present, including women in revolutions, state intervention in the family, changing ideas of sexuality, women's movements, women in socialism and fascism, and women in war.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will understand the history of women in modern Europe from 1789 to the present by analyzing women's experiences and the social and cultural constructions of femininity as well as the

different contexts of class, ethnicity, and nationality in the history of European women. 2. They will think historically and critically about women's participation in revolutions; state interventions in the family; working lives of women; ideals and practices of sexuality; the middle-class model of domesticity and women's responses to it; the role of women and femininity in imperialism; women in socialism, under fascism, and in the transition from communism to capitalism; women's experiences of two world wars; and the rise of feminist movements and contemporary feminisms in Europe. 3. Students will understand the difference between secondary and primary sources. They will read and interpret primary source materials, including fiction, autobiography, and other historical documents including those written by women. 4. Students will develop their critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 33205 - The Nuclear Age (UCC: HUM/STS)

Credit Hours: 3.00. Once seen as a revolutionary and exceptional, nuclear technologies have become central to many aspects of life in the U.S. This course uses the history of nuclear technologies to trace how American society has grappled with technological change.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Write a persuasive essay evaluating nuclear energy as a source of power, using primary and secondary historical sources to support your claims. 2. Create a compelling argument about how societies cope with technological change, using the history of nuclear technologies as a central example. 3. Summarize the importance of nuclear technologies in US history, drawing on primary and secondary historical sources introduced in the course. Credits: 3.00

HIST 33505 - Nationalism And Socialism In East Central Europe

Credit Hours: 3.00. This course examines how the peoples of East Central Europe engaged and coped with the most influential ideologies of the 20th century; with special attention to the weaknesses of the interwar and postwar regimes, strategies of modernization, survival, and dissent.

Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities which have shaped modern east central European society, culture, and politics. 2. Think historically and critically about approaches to the study of East Central European history, including the outcomes of ideological experimentation, and perspectives on how this region fits into a broader global context. 3. Use primary source evidence to analyze fundamental problems in modern East Central European history in individual writing and group work. 4. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 33605 - Global LGBTQ History

Credit Hours: 3.00. This course will examine sexual and gender diversity during the last two centuries of accelerating global interconnectivity. Although the US-derived framework of LGBTQ+ identities has become increasingly popular, people around the world have and continue to understand themselves in a multitude of ways that extend beyond this current acronym. This course will discuss the rich complexity of sexual cultures across the world as well as how they connect through global processes, such as colonialism, warfare, and migration, that have defined the nineteenth and twentieth centuries.

Learning Outcomes: 1. Identify ways different societies under examination have understood gender and sexual diversity in the past. 2. Differentiate lines of scholarly analysis in the field of LGBTQ+ history. 3. Apply queer theory to primary source analysis. 4. Develop original research projects based in/relating to existing scholarship. 5. Connect contemporary concerns to historical study. 6. Develop research projects for a public audience. Credits: 3.00

HIST 33700 - Europe Since 1945

Credit Hours: 3.00. This course traces the history of Europe, west and east, from 1945 to the present. Once viewed as a success story, culminating in the collapse of eastern European communism, developments after 1990 - such as the breakup of Yugoslavia, the European debt crisis, and the War in Ukraine - call this simplistic narrative into question. This course will consider Cold War division, decolonization, and political

protest alongside democratization and economic recovery.

Learning Outcomes: 1. Explain broad themes in postwar European history, including the Cold War as geopolitical process and a historical framework, the role of decolonization in shaping European politics, the impact of social movements, and the distinctions and overlaps between different economic systems. 2. Read historical scholarship for arguments, evidence, and contributions to the field and assess their effectiveness in these areas. 3. Craft a persuasive argument supported by primary and secondary source evidence that makes an intervention into the historical literature on a chosen topic. 4. Interpret a diverse range of historical sources and assess their utility in understanding the past, paying attention to form, perspective, and limitations. 5. Present historical research clearly and accessibly to different audiences using a variety of media formats. Credits: 3.00

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world. Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34400 - History Of Modern Japan (UCC: HUM)

Credit Hours: 3.00. A survey of Japanese history from the nineteenth century to the present, including Japan's response to Western expansionism, the formation of the modern state, political parties, industrialization, the Pacific War, the American Occupation, the postwar "economic miracle," and Japan today.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34505 - Arabs in American Eyes

Credit Hours: 3.00. This course explores Arab-American relations over the past 300 years, using American writings on the Middle East and North Africa as a prism for viewing evolving conceptions of national identity and global power in the United States.

Learning Outcomes: 1. This course will improve students' ability to communicate their ideas in a small classroom setting. 2. The assigned course materials will encourage them to think more broadly in terms of primary sources, for students will be required to analyze classic works of literature, films and art. 3. Their writing skills will improve, because students will be required to synthesize and analyze assigned course materials in thematic essay questions

designed to improve their ability to define a thesis statement and also to defend it. Credits: 3.00

HIST 34705 - History Of Religion In America

Credit Hours: 3.00. This course examines the history of religion in the United States from the colonial period to the present. It traces the evolution of religious life in America and religion's influence on American politics, society, and culture.

Learning Outcomes: 1. Summarize and compare American religious movements and analyze their significance in American history and society. 2. Distinguish between secondary and primary sources and critically read both types of sources; synthesize information and arguments from both types of sources. 3. Engage in independent historical interpretation with the use of primary and secondary sources; research an historical religious figure, movement or event, and evaluate its influence on American religious history. 4. Compose analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. Credits: 3.00

HIST 34901 - The First World War (UCC: HUM)

Credit Hours: 3.00. This course is designed to explore the origins, course, meaning, and lasting legacy of World War I.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students are expected to understand the origins, course, and results of World War I. 2. Students are expected to understand the consequences that the war had on today's world. Credits: 3.00

HIST 35100 - The Second World War (UCC: HUM)

Credit Hours: 3.00. A study of the diplomacy, economic mobilization, and military operations of World War II, 1939-1945.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 35205 - Death, Disease And Medicine In Twentieth Century American History (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of disease, dying, and medicine in the United States in the 20th century.

University Core Curriculum (UCC): (UCC: HUM/STS)

Learning Outcomes: 1. Identify and explain the relationship between science and culture and interdisciplinarity. 2. Analyze texts and cultural artifacts about medicine. 3. Identify medical practice and how it is informed by context and culture. Credits: 3.00

HIST 35305 - Sports In America

Credit Hours: 3.00. Today sports virtually dominate American culture. From fantasy leagues and 24-hour a day news shows to business decisions and off-the-field troubles to the games themselves, sports entertain Americans at the same time as they define American culture and social norms. This course will look at the growth of the sport industry in the 20th Century. It will examine the lives and importance of Babe Ruth, Joe Louis, Jackie Robinson, Muhammad Ali, and other athletes, as well as the economic, social, and medical impact of the games we watch.

Learning Outcomes: 1. Comprehend the role that sports has played in American society. 2. Analyze the centrality of race in sports and in America more broadly. 3. Apply their course knowledge to a range of professions in one of the largest industries in America; namely, in television and other media, marketing, management, etc. 4. Hone their active writing skills for effective professional application. Credits: 3.00

HIST 35500 - History Of American Military Affairs (UCC: HUM)

Credit Hours: 3.00. Surveys American military policy from the colonial militia to the atomic age. Covers major wars and limited wars. The course also investigates the peacetime military functions, i.e., the Navy's role in diplomacy and the Army's involvement in Indian affairs.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 35900 - Gender In East Asian History (UCC: HUM)

Credit Hours: 3.00. Examination of the construction of tradition and modernity in East Asia through the lens of gender. Topics include the influence of "Confucian" ethics; gender and imperialism, nationalism and revolution; and social change in the aftermath of war and decolonization.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 36105 - History Of Science, Technology, And Environment In Pre-Modern East Asia

Credit Hours: 3.00. This course explores developments in scientific, technological, and ecological history specifically in Pre-modern East Asia. In this class, we will read basic theories and methods in the history of science and technology, as well as basic debates and questions that challenge scholars studying the history of science, technology, and the environment in a non-western pre-modern context. We will explore how society, culture, and politics affect knowledge production and people's engagement with nature, and how these interactions, in turn, shaped society, culture, and politics. All readings are in English. No prior knowledge of East Asia is necessary.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society in pre-modern East Asia. 2. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 3. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 4. Investigate the diversity of human experience in pre-modern East Asia, explain how social factors such as ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, have shaped the development or application of science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. 5. Identify and explain the major themes of the history of science, technology, and environment, write about the role of science in society, and describe ethical implications of technological and scientific developments. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S. University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 36405 - Patient Voices In The History Of Medicine

Credit Hours: 3.00. This course examines the history of medicine in the United States from the early twentieth century to the present by starting with patient voices, which provide a glimpse into the experience of illness. Using patient reflections as the primary lens through which to examine the history of medicine, topics covered include historical changes and historical decision making related to the diagnostic process, therapeutic interventions, access to care, and medical institutions. The course also examines how assumptions about gender, race, and class have shaped differential health outcomes such as mortality rates, time to diagnosis, and determination of treatment approach and efficacy.

Learning Outcomes: 1. Identify in written and oral communication key features of the U.S. medical system by examining how patient experiences have changed over time and in different contexts. 2. Analyze how assumptions about race, gender, and class can affect the experience of illness, access to care, and health outcomes. 3. Engage with primary sources such as journal entries, memoirs, newspaper articles, artwork, and audiovisual material to identify patient perspectives and place them in historical context, and to illustrate how social, cultural, political, and economic factors have shaped the practice of medicine. 4. Reflect on the ethical issues that have arisen in medicine using patient voices as a lens to examine the impact of technology on the illness experience. 5. Examine patient experiences to make an argument about the history of medical practice, such as the diagnostic process or therapeutic approaches, using historical methods. Credits:

3.00

HIST 37005 - Queens And Empresses In Early Modern Europe

Credit Hours: 3.00. This course explores the lives and legacies of queens and empresses in early modern Europe within the wider context of gender, political authority, culture, and monarchy. Students will be introduced to new scholarly approaches to the study of female rulership.

Learning Outcomes: 1. Compare the legal, cultural, and symbolic aspects of queenly authority across monarchies and centuries applying the relevant vocabulary and conceptual frameworks. 2. Evaluate the political intervention of various individual queens and empresses taking into account the many variables that shaped their rule. 3. Distinguish the ways in which queens and empresses shaped national histories as well as European international politics and culture. Credits: 3.00

HIST 37100 - Society, Culture, And Rock And Roll (UCC: HUM)

Credit Hours: 3.00. Surveys American society and culture through the prism of rock and roll music. Looks at politics, gender, race, and class in the postwar era to examine and explain the social, economic, and technological forces that shaped rock and roll.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37200 - History Of The American West

Credit Hours: 3.00. This course explores the history of the trans-Mississippi and Pacific west from the early 17th century to the late 19th century. The diverse experiences of the inhabitants and the environmental transformations are the central themes of the course.

Learning Outcomes: 1. Understand the environmental and human history of the American west. 2. Be aware of the complicated and overlapping experiences of the inhabitants of the west including, but not limited to, the diverse indigenous population and the myriad groups of settlers from Asia, South and Central America, Europe, and the US. 3. Gain a new appreciation of how diverse populations interacted with multiple environments of the American west and the ongoing impact of that legacy on our modern times. 4. Build upon and improve skills as critical thinkers and readers. 5. Enhance skills in oral communication and analytical writing. Credits: 3.00

HIST 37500 - Women In America Since 1870 (UCC: HUM)

Credit Hours: 3.00. A survey of the history of women in the United States from 1870 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37600 - History Of Indiana

Credit Hours: 3.00. Economic, political, and social history of Indiana from the state's earliest beginnings as a part of the old Northwest Territory to the present.

Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37901 - The Corporation In East Asia, 1600-Present

Credit Hours: 3.00. This course explores the rise of major corporations in modern East Asia, including China, Japan, Korea, Taiwan, and Vietnam, from 1600 to the present. Students will develop skills in contextualizing primary sources and scholarly works to form their own insights into the interactions between corporations, society, and the state. This course provides invaluable insights into the intersections of economic power, political authority, and social change in the modern era.

Learning Outcomes: 1. Examine case studies of major East Asian corporations, to understand their role in shaping regional economies and global markets. 2. Analyze the historical trajectory of corporations, their socio-economic impact and political ramifications in East Asia, from 1600 to the present. 3. Evaluate the complex relationships between corporations, society, and state in East Asia critically, considering factors such as industrialization, colonialism, and globalization. 4. Develop advanced skills in source evaluation, analytical

thinking, and academic writing through choosing appropriate primary sources and scholarly literature. Credits: 3.00

HIST 37902 - The Silk Road And Pre-Modern Commerce

Credit Hours: 3.00. This course introduces the history of the Silk Road - a complex network of trade routes that connected China with the rest of Eurasia over land and sea - and its role in fostering cultural and material exchanges between the peoples it connected. It will revisit key moments of the Silk Road in pre-modern history to understand how Eurasia was connected through vast networks of traders and caravans, and will situate temporally and geographically the main states, actors, objects, religions, and ideas that have populated the roads, oasis towns, and steppe territories constituting the Silk Road.

Learning Outcomes: 1. Demonstrate a basic understanding of historical contexts, major concepts, and theoretical perspectives in the history of pre-modern Silk Road trading routes across time and place. 2. Identify diverse historical groups, cultures, and commercial interests on Silk Road networks. 3. Compare and contrast the strengths and weaknesses of contending scholarly interpretations of the conflicts and connections along the Silk Road. 4. Develop advanced skills through source evaluation, analytical thinking, and academic writing through choosing appropriate primary sources and scholarly literature. 5. Evaluate how historical knowledge informs and can shape global decisions and responsibilities in today's world. Credits: 3.00

HIST 38001 - History Of United States Agriculture (UCC: HUM/STS)

Credit Hours: 3.00. This course surveys the main development in North American agricultural history, emphasizing the continental United States. Topics include early American agriculture, the plantation system, land policy, scientific and technological change, agrarian politics, water rights, migrant labor, and agricultural policy.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain a broad understanding of the major economic, social, political, scientific and technological development in the history of American agriculture. 2. Analyze the causes, consequences, and significance of the major events and issues that have influenced the agricultural history of the United States. Credits: 3.00

HIST 38105 - American Indians And Film

Credit Hours: 3.00. This course investigates ways that Hollywood filmmakers influenced public perceptions of Native American history and culture through feature films. Students explore issues of race, gender, class, ethnicity, ideology, and nature, as well as the work of indigenous filmmakers.

Learning Outcomes: 1. Recognize aesthetic and narrative practices in modern film through discussion and written analysis. 2. Recognize and understand the genesis and impact of stereotypes of Native Americans perpetuated through film in classroom discussions and written assignments. 3. Articulate key trends in American filmmaking and the evolving representations of Native Americans through in-class presentations. 4. Investigate and critically analyze films produced by non-Native and Native filmmakers in a research essay. Credits: 3.00

HIST 38200 - American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Survey of the fundamental principles of American constitutionalism and dominant trends in judicial interpretation, from the creation of the Constitution to the period of the New Deal.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38300 - Recent American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Intensive study of constitutional questions and Supreme Court answers from the period of the Warren Court to present. Particularly emphasized are the areas of segregation, civil rights, and civil liberties and guarantees for personal rights.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38505 - Media, Politics And Popular Culture (UCC: HUM)

Credit Hours: 3.00. This class examines the relationship of media, politics, and popular culture over the course of the twentieth century in American history. Students trace how new media shaped political institutions and practices and afforded opportunities for political change.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the historical development in American political, cultural, economic, and social structures by examining primary and secondary sources. 2. Analyze primary and secondary sources to explain how and why these historical developments happened. 3. Pursue original primary research about a specific topic in American history and synthesize primary and secondary materials to advance on original arguments about the roots, shape, and implications of a historical moment. 4. Interrogate modern media myths with an analysis of primary sources that will allow students to go beyond popular narratives of history and understand a more complicated historical reality. 5. Recognize the historical roots of contemporary political debates. 6. Understand the relationship between politics and popular culture in ways that will allow students to navigate the contours of the mass media, entertainment, and the American political process more effectively. Credits: 3.00

HIST 38605 - Land Of The Indians: Native Americans In Indiana

Credit Hours: 3.00. This course offers a survey of Native American and Indigenous history and culture in the historic region encompassing the modern state of Indiana. The course opens in the pre-Columbian era and is organized chronologically to the present day.

Learning Outcomes: 1. Read, analyze, and synthesize archeological data and research through written analyses and discussions. 2. Read, analyze, and synthesize primary historical documents and research through written analyses and discussions. 3. Demonstrate increased knowledge and cultural awareness of the significance of Native Americans in Indiana's history through examination and written analyses. 4. Critique both scholarly and popular accounts of the history of indigenous people in the region and state and express those ideas through oral presentations and classroom discussion. Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 39400 - Environmental History Of The United States (UCC: HUM)

Credit Hours: 3.00. This is a mid-level survey designed to provide students of environmental science with historical background and students of history with the unique perspective of environmental history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance

their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 39800 - African American History Since 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history from 1877 that focus on Black Americans' struggle to overcome social, economic, and political oppression and to win basic civil and human rights while making valuable contributions to American society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 40000 - Great Books And The Search For Meaning

Credit Hours: 3.00. This intellectual-history course discusses the meanings of the Great Books within their particular historical contexts and the universal quest for self-understanding, focusing on good and evil; mystery and reason; the nature of power; and what it means to be human.

Learning Outcomes: 1. Read and think critically about a wide variety of texts that are significant in the history of civilization. 2. Write and speak with intelligence and eloquence. 3. Gain a greater understanding of history, of their humanity, and of social and political relationships. 4. Become culturally literate, better able to understand the varied cultural models of their world, and better prepared to meet the needs of global citizenship. Credits: 3.00

HIST 40300 - Europe In The Reformation

Credit Hours: 3.00. A study of decay and renewal in European society, 1300 to 1650. Concentrates on the Protestant and Catholic Reformation and religious wars, but also covers the Northern Renaissance, the New Monarchies, and the discovery and exploration of the New World.

Credits: 3.00

HIST 40500 - The French Revolution And Napoleon

Credit Hours: 3.00. A study of revolutionary France from the fall of the ancient regime to the Congress of Vienna. Divided in emphasis between the period of the revolution and the era of Napoleon, the course stresses social, political, ideological, and institutional developments.

Credits: 3.00

HIST 40600 - Rebels And Romantics: Europe 1815-1870

Credit Hours: 3.00. Examines the dramatic social, cultural, and political developments in Europe following the defeat of Napoleon through various rebellious and romantic personalities, as well as figures who supported conservative or reformist solutions to the upheavals of industrialization, revolution, and nationalism.

Credits: 3.00

HIST 40700 - Road To World War I: Europe 1870-1919

Credit Hours: 3.00. Studies the increase in Europe's wealth and power through conquest, industrialization, and nation-state rivalries, along with the social stress and cultural anxiety that culminated in World War I; examines the war from the perspectives of both combatants and civilians.

Credits: 3.00

HIST 40800 - Dictatorship And Democracy:

Europe 1919-1945

Credit Hours: 3.00. This course examines the fleeting triumph of democracy across Europe. Followed by the rise of fascism, communism, and Nazism. Emphasis will be placed on broad economic, social, and cultural transformations as well as individual choices to resist or conform.

Credits: 3.00

HIST 41005 - History Of The American Presidency (UCC: HUM)

Credit Hours: 3.00. Using a historical perspective, examines the shifting role of the presidency in the American imagination and the cultural, social, and economic changes that have wrought political developments in public functions and expectations of the modern presidency.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the historical development in American political, cultural, economic, and social structures by examining primary and secondary sources. 2. Analyze primary and secondary sources to explain how and why these historical developments happened. 3. Pursue original primary research about a specific topic in American history and synthesize primary and secondary materials to advance an original argument about the roots, shape, and implications of a historical moment. 4. Interrogate the role of the modern American presidency in American political life with an analysis of primary sources that will allow students to go beyond popular biographies of presidents and understand a more complicated historical reality of the debate about the responsibilities and nature of the office. 5. Recognize the historical roots of contemporary political debates about the presidency and the constitutional authority of the institution. 6. Understand the modern American presidency in ways that will allow students to better navigate the American political process more effectively. Credits: 3.00

HIST 41300 - Modern European Imperialism: Repression And Resistance

Credit Hours: 3.00. This course examines the expansion, transformation and collapse of 19th and 20th-century European empires, focusing on colonial encounters and relationships. Students should come to the course familiar with major developments, events and themes in modern European and/or global history.

Learning Outcomes: 1. Contextualize and compare important events and moments in the history of European imperialism and decolonization. 2. Analyze and evaluate how historians interpret the past, and examine how this past continues to shape the present. 3. Analyze an array of historical sources and types of evidence, historical narratives, first-person accounts and commentaries, scholarly interpretations, visual imagery and fictional portrayals, as well as the setting in which these sources were produced. 4. Craft original arguments supported by historical and textual evidence in class discussions and weekly writing assignments. Credits: 3.00

HIST 41505 - Gender And Politics In Early Modern Europe

Credit Hours: 3.00. This course explores the role of gender (its discourse as well as its practice) in the emergence, consolidation, and centralization of European political systems from the Renaissance to the French Revolution, such as princely courts, republics and monarchies.

Learning Outcomes: 1. Appraise the role of men, women, and gender discourse in the evolution of the main political systems of early modern Europe from the fifteenth to the eighteenth centuries. 2. Evaluate the mechanisms and power structures that included or excluded early modern women and men in the political process. 3. Apply the conceptual framework of gender and politics to a specific case study in 10-12-page analytical paper. Credits: 3.00

HIST 42100 - Honors Historical Methods

Credit Hours: 3.00. Designed as a prequel to Honors Thesis; this course introduces the Honors students to various advanced interpretative approaches to history and methods of historical research. Students also choose their topic for their Honors Thesis and begin research.

Credits: 3.00

HIST 42200 - Honors Thesis In Historical Research

Credit Hours: 3.00. Designed as a sequel to HIST 42100 (Honors Historical Methods); this course is intended as the culminating academic experience for students in the Department of History Honors Program. It will require the completion of an undergraduate thesis in history. Permission of instructor required.

Credits: 3.00

HIST 42300 - Advanced Topics In Modern Germany

Credit Hours: 3.00. This course offers a reading-intensive study of a specific period or theme in modern German history. Semester-long topics might include Imperial Germany; Weimar Germany; Divided Germany (1945-1990); or thematic studies on culture, religion, or military affairs.

Learning Outcomes: 1. Convey an understanding of the course material. 2. Designed to improve students' ability to communicate their ideas in a small classroom setting. 3. Enhance students' ability to analyze historical monographs critically. 4. Teach students to synthesize a semester's worth of reading in thematic essay questions. Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

HIST 44100 - Africa In The Twentieth Century

Credit Hours: 3.00. A problem-oriented course in the modern history of Africa from 1880 to 1975. It analyzes origins of African nationalism, European colonialism, racial conflict, and war leading to the independence revolution of the 1960s and 1970s.

Credits: 3.00

HIST 45000 - The English Landscape:Integrating History, Horticulture & Landscape Architect

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Permission of instructor required.

Credits: 3.00

HIST 46000 - American Colonial History

Credit Hours: 3.00. An investigation of the foundation of the American colonies, their place in the British imperial structure, and the eventual conflict of imperial exigencies with colonial self-interest and national feeling.

Credits: 3.00

HIST 46100 - The Revolutionary Era, 1763 To 1800

Credit Hours: 3.00. An analysis of the origins, nature, and consequences of the American Revolution; of the achievements and difficulties of the new nation under the Articles of Confederation; of the drafting and adoption of the Constitution; and of the initial political, economic, and social progress of the United States under the Federalists.

Credits: 3.00

HIST 46700 - The Emergence Of Modern America

Credit Hours: 3.00. Examines the changes in American society between 1877 and 1932. The course covers such issues as the rise of industry, the growth of consumerism, the shift to a multi-ethnic society, imperialism, Populism, Progressivism, World War I, and the 1920s.

Credits: 3.00

HIST 46800 - Recent American History

Credit Hours: 3.00. Examines the issues that shaped American society, politics, foreign policy, and culture from 1932 to the present. Covers the Great Depression, World War II, the Cold War, and the Vietnam War as well as the social, cultural, and economic impact of those events.

Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

HIST 47300 - History Of The South

Credit Hours: 3.00. Geographic, economic, cultural, social, and political aspects of the South. The significance of such figures

as Jefferson, Jackson, Calhoun, Jefferson Davis, and Woodrow Wilson. The emphasis is on the evolution of the intellectual climate.

Credits: 3.00

HIST 47600 - The Civil War In Myth And Memory

Credit Hours: 3.00. This seminar will explore how the Civil War has been celebrated and/or remembered from 1865-present.

Credits: 3.00

HIST 47700 - Native American Women's History

Credit Hours: 3.00. This course studies the history of indigenous women in North America from pre-contact to the present era, examining their roles through the experience of colonization and decolonization underscoring issues of sovereignty, identity, activism, kinship, public images, and stereotypes.

Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

HIST 48500 - Topics In American Political History

Credit Hours: 3.00. This course deals with broad thematic and chronologically defined topics in American political history from the Revolutionary Era to the late twentieth century. Content will vary with the faculty member teaching the class.

Credits: 3.00

HIST 48800 - History Of Sexual Regulation In The United States

Credit Hours: 3.00. This course will illuminate broad themes in the historical regulation of sexual violence, consensual sex, and homosexuality. Student will understand and analyze how cultural, social, religious, and moral ideologies have influenced conceptions of deviant and normative sexuality in the United States.

Learning Outcomes: 1. Students will be able to articulate verbally and in writing what they have learned about the nineteenth and twentieth century history of sexual regulation. 2. Students will be able to identify and analyze the cultural and religious values which informed sexual regulation. 3. Students will develop a deeper understanding of how regulations and reform worked by conducting primary source research and synthesizing it into written arguments.

Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49400 - Science And Society In American Civilization

Credit Hours: 3.00. This course examines the development of science in the United States from colonial times to the present. Emphasis in the earlier periods is placed on comparison and contrast of the American scene with that of Europe. Subsequent treatment deals with industrialization, and maturation of the American scientific community, and the increasing social effects of science. Among those considered are the forces making for urbanization, for greater interdependence among science, industry and government, and for repercussions in intellectual affairs.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical

methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49900 - History Internship

Credit Hours: 1.00 to 3.00. This course allows students to earn credit for internships. Examples of qualified internships would include work with museums, historical societies, and various units of government. Credit and course requirements arranged with the instructor. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

HIST 51200 - England Under The Stuarts

Credit Hours: 3.00. This intensive study of seventeenth-century England focuses on the political, religious, and economic tensions under the early Stuarts; the Civil War; Cromwell's Protectorate; and The Glorious Revolution. Topics discussed include parliament, puritanism, radicalism, the Restoration, and the Whig Oligarchy.

Credits: 3.00

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 57700 - Contemporary Latin America

Credit Hours: 3.00. A topical and regional approach to recent political, social, and economic movements in Latin America.

Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

HIST 60100 - Reading Seminar In European History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields of topics in European history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 60200 - Seminar In European History

Credit Hours: 3.00. Individual and group study of topics in European history from the medieval period to the modern era. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students

write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

HIST 64100 - Reading Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64200 - Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 65000 - Teaching The History Survey Course

Credit Hours: 3.00. This course provides an introduction to the literature on teaching history at the college level, especially the literature on pedagogy, theory, and conceptualization needed for the undergraduate survey course. Students will become familiar with the professional literature, develop their own syllabus for the survey course, and produce an extensive historiographical essay supporting and justifying the contents of the syllabus. Class discussions will expose students to a number of teaching strategies, concepts, and exercises. Prerequisite: Master's student standing. Permission of instructor required.

Learning Outcomes: 1. Have effective communication through written and oral modes. 2. Have critical and creative thinking skills in acquiring a broad base of knowledge and applying it to complex issues. 3. Have competence in a major area of study. 4. Have appreciation for and understanding of an expanded world perspective by engaging respectfully with a diverse range of individuals, communities and viewpoints. Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 65200 - Seminar In American History

Credit Hours: 3.00. Individual and group study of topics in American history from the colonial period to the present. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 67000 - Seminar In Latin American History

Credit Hours: 3.00. Research or reading seminar in Latin American History on a selected topic in colonial or national

period of Latin American History. Topics vary. It may be repeated once with change of topic. Students must have been admitted into M.A. or Ph.D. history programs or any other graduate program at Purdue. Also, adequate knowledge of languages pertinent to research topic is expected. No prior knowledge of Latin American History is required.

Learning Outcomes: 1. Become familiarized with the historical process in Latin America from 1492 to the present. 2. Understand the complexities of doing research in the area (e.g., the type of documentation, archives, and scholarly community that exist in Latin America). 3. Develop critical thinking and research abilities. Credits: 3.00

HIST 68000 - Entering The History Profession

Credit Hours: 3.00. This seminar is for advanced graduate students who are in the final two years of the program. In your earlier courses, you have become proficient in various methodological approaches and have gotten well acquainted with the historiography in various fields of study. You also have pursued original research and have navigated the classroom challenges. Now is the time to prepare for the job market, thinking critically about the skills you have acquired during graduate school and discerning strategies to communicate your credentials to a hiring committee. During this seminar, we will focus on how to structure a curriculum vitae, write a cover letter, create a teaching portfolio, craft a diversity statement, and select writing samples. We will also hold mock interviews to prepare you to orally communicate your skills, experiences, and expertise. Graduate students will also meet with professionals outside academia to learn about navigating the world of business, journalism, politics, non-profits, and public history. Permission of department required. Prerequisites: HIST 61000 and HIST 61100.

Learning Outcomes: 1. Gain a deeper understanding of the job market, inside and outside academia. 2. Foster stronger writing skills to present their research and qualifications. 3. Gain stronger oral communication skills and gain interview experiences. 4. Expand their professional networks by meeting with professionals inside and outside academia. 5. Create a research and teaching portfolio. Credits: 3.00

HIST 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HIST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Honors

HONR 12000 - Introduction To Research

Credit Hours: 3.00. In this course you will take an idea and blow it up. You will "blow it up" to better understand its elements, and its connections to various ways of creating knowledge. Then you will take the resultant pieces and use them to construct a research plan that's inclusive of at least two forms of inquiry.

Learning Outcomes: 1. Create a research proposal from some idea, observation, or problem that interests you, so that you can implement the plan as you launch your undergraduate academic journey. Credits: 3.00

HONR 19900 - Interdisciplinary Honors - Introductory Seminar

Credit Hours: 1.00 to 6.00. These introductory topic seminars are designed to open intellectual horizons and allow opportunities for learning by inquiry in a collaborative environment. Courses are limited to 20 participants or less, may be team-taught, and emphasize close interaction between the professor(s) and the students.

Learning Outcomes: 1. Sharpen critical thinking skills and interdisciplinary understanding. 2. Learn project-based inquiry, research thinking, and collaborative skills. Credits: 1.00 to 6.00

HONR 19901 - Honors First Yr Experience I

Credit Hours: 1.00. All JMHC students take this 1 credit course each semester (fall and spring) of their first year. This "Honors First Year Experience" is designed to introduce students to college-level honors education. Learning outcomes include how to be flexible thinkers, inclusive collaborators, and ethical leaders. In fall, students explore interdisciplinary topics in small seminars with dedicated faculty and work in groups with JMHC student mentors in "world readiness" labs.

Learning Outcomes: 1. Identify and analyze complex and global issues/events/perspectives. 2. Identify approaches to interdisciplinary scholarship. 3. Evaluate and summarize literature from multiple disciplines. 4. Practice strategies for inclusive and equitable engagement across differences through in-class discussions and group activities. 5. Recognize the mission of the JMHC - what the college stands for, what it offers to students, and what

students can offer the JMHC community. 6. Develop inclusive and equitable collaborative and teamwork skills. Credits: 1.00

HONR 19902 - Honors First Yr Experience II

Credit Hours: 1.00. All JMHC students take this course each semester (fall and spring) of their first year. This course is designed to introduce students to college-level honors education. Learning outcomes include how to be flexible thinkers, inclusive collaborators, and ethical leaders. This course is the second half of the required course sequence taken by all students entering the Honors College. Restricted to Honors College students.

Learning Outcomes: 1. Identify and analyze complex and global issues/events/perspectives. 2. Identify approaches to interdisciplinary scholarship. 3. Evaluate and summarize literature from multiple disciplines. 4. Practice strategies for inclusive and equitable engagement across differences through in-class discussions and group activities. 5. Recognize the mission of the JMHC - what the college stands for, what it offers to students, and what students can offer the JMHC community. 6. Develop inclusive and equitable collaborative and teamwork skills. Credits: 1.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

HONR 22000 - Community Of Inquiry

Credit Hours: 2.00. This course is for new members of the Honors College community, who entered as continuing Purdue students or transferred to Purdue. It, being your first or one of your first courses in the Honors College, is designed to help you hone some of the fundamental learning outcomes of an honors education: interdisciplinary thinking, critical thinking, problem-solving, research thinking, collaboration, and global awareness. You will also engage with the pillars of the Honors College and develop community within the Honors College. To accomplish these objectives, the course is simultaneously project-based and experiential. You will work in multi-disciplinary teams on applied research that emphasizes critical and multi-dimensional thinking about real-world problems. Through project-based learning, you will move your skills beyond identifying and understanding a problem to identifying and formulating solutions to that problem. The problem addressed in the course is local or global in scope and has social, economic, political, and/or environmental implications for our local and/or global community as well as begs a multi-disciplinary, innovative solution. Continuing in the vein of experiential learning and of building your honors ethos, you will attend events (some as a class, others individually) and participate in programs in the Honors College and across campus that embody the Honors College's pillars: Community and Global Engagement, Leadership, Research, and Interdisciplinary Academics. You will curate a schedule of events that take place during the semester and reflect on these experiences. Permission of department required.

Learning Outcomes: 1. Develop interdisciplinary thinking, critical thinking, problem solving, research thinking, collaboration, and global awareness. Credits: 2.00

HONR 22100 - Exploring Place (UCC: BSS)

Credit Hours: 3.00. "Exploring Place" is an examination of the cultural, social and historical dynamics that influence communities and relationships of a site. Blending independent study and distance learning, in this experiential learning course, the student and the instructor work together to design an individualized, in-depth study of the place in which the student is located. This study will be attentive to the social, cultural, political, economic, and other forces that have shaped this place historically and today, while also focusing on community life and the relationships between residents, institutions, organizations, and others. Exploring Place offers students the opportunity to better understand the people and places around them, expand their worldviews, and increase their self-awareness as they engage within these spaces and understand their place in them.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Create a plan of study that will serve as a guide for all of your activities in this course. 2. Identify and distinguish among different worldviews that shape how individuals or groups behave or perceive the world. 3. Identify and develop another intercultural competency for which you would like to accomplish personal growth. 4. Synthesize pertinent scholarly literature in order to establish a theoretical framework for understanding selected topic. 5. Collect and analyze primary data in order to describe and explain relationships among groups and culture of a place. Credits: 3.00

HONR 22200 - Solutions Lab Global

Credit Hours: 2.00. In this course, students from Purdue University (West Lafayette, Indiana) and at universities abroad will collaborate virtually in interdisciplinary teams to identify solutions to a major global challenge. Each semester, the theme of the global challenge changes. At the start of the course, students at both universities will meet together as a class to learn about the topic from a range of disciplinary perspectives through guest lectures, assigned readings, and class discussions. Students will then be divided into interdisciplinary teams with members from both universities and provided a prompt related to the semester's theme. Teams will spend several weeks of the course focused on researching, developing, and packaging their solutions, before presenting them publicly at the end of the term. In addition to increasing knowledge of the topic and improving teamwork skills, students in this course will advance in intercultural knowledge, skills, and attitudes through their international collaborative experience.

Learning Outcomes: 1. Increase basic knowledge of global pandemics and their effects on societies. 2. Gain new perspectives on the social implications of design emerging from multiple academic disciplines. 3. Analyze global issues and challenges, as well as potential solutions, from multiple cultural perspectives and the positions of multiple stakeholders around the world. 4. Advance research and teamwork skills through the completion of a group project and presentation addressing real-world problems. 5. Practice intercultural communication skills and other intercultural competencies through in-class activities and discussions, and through group work completed in international, cross-cultural teams. 6. Develop deeper intercultural self-awareness through reflective thinking and journaling. Credits: 2.00

HONR 29500 - Interdisciplinary Honors - Independent Experience

Credit Hours: 1.00 to 3.00. Individual experiential projects undertaken with faculty supervision. Permission of instructor required.

Credits: 1.00 to 3.00

HONR 29900 - Interdisciplinary Honors - Experiential Learning

Credit Hours: 1.00 to 6.00. These interdisciplinary topics seminars are designed to offer experiential learning on campus, in the community, and around the world. Courses are limited to 20 participants or fewer, may be team-taught, and emphasize close interaction between the professor(s) and the students. Students will participate in active learning exercises that may include study away and study abroad, workshops, research and creative skill building, community collaboration, and/or service learning. Seminar topics will vary from semester to semester.

Credits: 1.00 to 6.00

HONR 29901 - Interdisciplinary Honors - Honors Mentors

Credit Hours: 2.00. This hands-on course provides leadership training to the continuing Honors College students selected to work as mentors for the required, first-year honors course. Students work closely with a faculty instructor. Restricted to Honors College students. Department permission required.

Learning Outcomes: 1. Demonstrate self-understanding and continuous learning. 2. Demonstrate communication skills. 3. Demonstrate systems thinking, planning, and solving. 4. Demonstrate teamwork and collaboration. 5. Demonstrate ethics and personal responsibility. Credits: 2.00

HONR 31000 - Space-Time!

Credit Hours: 3.00. In Space-time!, we will explore how our relationship to space and time has changed over human history. We will focus primarily on the last two centuries and how interconnected changes in science, technology, and culture altered our sense of the scope, age, and nature of the reality around us. The ideas around space and time offer us an occasion to see how arts, philosophy, sciences, and our own experiences shape the way we see the world. Students, too, will explore the cross-influences of arts, philosophy, and sciences, as they write their own creative works, engage complex ideas from new perspectives, and expand their imaginations.

Learning Outcomes: 1. Develop an appreciation for how the progression of science is intertwined with culture and how certain creative genres -- like science fiction -- explore, interrogate, and even progress scientific ideas. 2. Develop skills for exploring new ideas, engaging multiple perspectives, and synthesizing diverse ideas to create more a complex or nuanced understanding of the world around them. 3. Develop skills for raising novel questions, exploring multiple perspectives, and synthesizing divergent ideas. Credits: 3.00

HONR 31100 - Replicants

Credit Hours: 3.00. From ancient mythology to Blade Runner 2049, the creation of artificial bodies has captured the human imagination. This course asks: how do the materials we use to re-create the human body affect the way that we construct our humanity? We will examine the different materials people have used to replicate the body throughout history. The course is organized thematically by materials such as wood, wax, silicone, and digital media. This course emphasizes hands-on learning; we will cast wax masks, sculpt clay figurines, and create automata, among other experiential activities. The types of replicants we will study in this course range from voodoo dolls to Real Dolls, death masks to Deep Fakes, and statues to cyborgs. For the final project, you will choose a case study of a replicant to write about in an exploratory paper.

Learning Outcomes: 1. Understand core concepts of materiality theory, including the material turn and theories of the body, and compare how these concepts are used by multiple scholarly disciplines. 2. Apply these concepts to your own academic discipline and interests. 3. Evaluate and apply diverse cultural and historical practices of material use and reproduction of the human form across cultures and over time. 4. Have developed your own imaginative and complex perspective on the course material. 5. Have developed critical reading, analytical, and communication skills through engagement with scholarly writing, group discussion, small group work, leading discussion, and writing assignments. Credits: 3.00

HONR 31200 - Jazz

Credit Hours: 3.00. Jazz artists "speak to each other in the language of music." In Jazz, we will explore the nature of this artistic conversation with many of its cultural influences, geographical variations, and temporal iterations. Throughout our time together we will interrogate varying facets of the social impact such a conversation facilitates. Furthermore, we will explore the musical language of jazz with its power to make collective performance stronger. And we will investigate the ways in which this artists' talk became the "talk of the town" and country as a medium through which people could break from dominant cultures. We will make sense of and process our journey by creating our own jazz ensemble, featuring the layered textures of our lives as inspiration for the note and lyric.

Learning Outcomes: 1. Articulate jazz conceptually. 2. Create connections between jazz and a democratic community. 3. Represent jazz creatively. Credits: 3.00

HONR 31300 - Science, Technology, & Society (UCC: STS)

Credit Hours: 3.00. Science and technology are deeply intertwined with the distribution of costs and benefits in human society, underscoring the need for critical perspectives. This project-based course will examine the social and ethical implications of science and technology using interdisciplinary methodologies/approaches. Students will have the opportunity to address questions such as: How have particular scientific discoveries and technologies emerged or evolved? How have they shaped society, and how has society shaped science and technology? How have science and technology compounded social inequalities (race, class, gender), and how can they be changed to reduce inequalities? Topics that will be explored will vary each semester.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 2. Describe ethical implications of technological and scientific developments. 3. Explain how social factors have shaped the development and application of science. 4. Explain how social factors have shaped the development science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. Credits: 3.00

HONR 31400 - The Human Epoch (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the entangled relations between humanity and the environment

from multiple social contexts and time periods. Throughout the class, students will read, analyze, and discuss interdisciplinary scholarship from the social and behavioral sciences. Classroom activities will take the form of discussion, projects and group assignments, and writing assignments, with an emphasis on peer-to-peer learning. Students will create a project aimed at a public audience that demonstrates knowledge about key course topics and communicates connections between social/behavioral knowledge and personal, civic, ethical, or global decisions and policies. As a result of taking this course, students will be able to understand and evaluate critical questions about humanity and its ecologies, recognize the importance of those questions for various audiences, and draw connections between course materials and their own perspectives about the world.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Demonstrate knowledge of major concepts, theoretical perspectives, empirical patterns, and/or historical contexts within a given social or behavioral domain. 2. Identify the strengths and weaknesses of contending explanations or interpretations for social, behavioral, or historical phenomena. 3. Recognize the extent and impact of diversity among individuals, cultures, or societies in contemporary or historical contexts. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. Credits: 3.00

HONR 31500 - Across Differences (UCC: HUM)

Credit Hours: 3.00. To understand and combat systemic injustices, our students must be equipped to engage with the historical and present-day racial and ethnic "reckonings" that define the United States, and large parts of the globe. This course offers students an opportunity to focus on cultural landscapes/contexts, to learn how race and ethnicity permeate cultural texts, genres, and industries. The course trains students to recognize how race-and-ethnicity-based inequities intersect with issues of class, gender, and/or sexuality, and how these intersections articulate themselves in/through culture. Students will grapple with the colonial, national, transatlantic, trans-cultural, and diasporic underpinnings of culture. Topics that will be explored will vary each semester, but to attend to the diverse ways in which students learn and demonstrate their learning, all sections will use interdisciplinary materials like songs, films, video games, sporting events, poems, neighborhood maps, photographs, fine art pieces, oral histories, interviews, and newspapers, in addition to traditional/scholarly publications.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize and describe humanistic, historical, or artistic works or problems and patterns of the human experience, especially those related to matters of race, ethnicity, and difference. 2. Apply disciplinary methodologies, epistemologies, and traditions of the humanities and the arts to better engage with historical and present-day debates about race and ethnicity. 3. Analyze and evaluate texts, works, objects, events, or ideas in their cultural, intellectual, or historical contexts to recognize how race and ethnicity-based inequities intersect with issues of class, gender, and/or sexuality. 4. Create, interpret, or reinterpret artistic and/or humanistic works through performance, analysis or criticism to grapple with how difference is inscribed onto cultural landscapes and contexts. 5. Analyze diverse narratives and evidence in order to explore the complexity of colonial, national, transatlantic, trans-cultural, and diasporic human experiences across space and time. Credits: 3.00

HONR 39500 - Interdisciplinary Honors - Independent Study

Credit Hours: 1.00 to 3.00. Individualized course of study undertaken with faculty supervision. Permission of instructor required.

Credits: 1.00 to 3.00

HONR 39900 - Interdisciplinary Honors - Special Topics Seminar

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of honors seminars that stress interdisciplinary understanding, intellectual flexibility, creative thought, and group discussion. Topics vary by semester. Open to students at all levels.

Credits: 1.00 to 6.00

HONR 46000 - Technological Justice (UCC: STS)

Credit Hours: 3.00. In this course, students will study interdisciplinary approaches to technology ethics for responding to today's pressing technological dilemmas in a range of contexts, from healthcare, mass incarceration, and airport security to social media, smart cities, and space travel. Students will grapple with how historical and present-day inequalities,

institutional environments, decision-making cultures, and regulatory systems impact the technological design process and distribution of technology's risks and rewards in society. We will ask ourselves how relations of power inform the ways technologies are designed and experienced, as well as how power shapes dominant and insurgent approaches to achieving technological justice. The primary deliverable in this class is for you to conceive of and carry out your own "Technological Justice" Project, based on your interests, passions, and personal and/or professional goals.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Gain an interdisciplinary understanding of critical interventions into tech ethics from both scholarly and popular culture perspectives. 2. Recognize and critically analyze how values, goals, assumptions, and ideas of social differences are embedded in technological designs and shape ethics discourse (with particularly attention to race, gender, class, and ability). 3. Analyze and reflect critically on the societal impacts of technologies in a variety of contexts. 4. Conceive, conduct, and present an original interdisciplinary research project that demonstrates a sophisticated understanding of the relationship between technology, social issues, and justice. Credits: 3.00

HONR 46100 - Well-Being

Credit Hours: 3.00. Copenhagen, Zurich, Helsinki, Stockholm, and Tokyo are the five most livable cities in the world according to MONOCLE's 2021 Quality of Life Index. They are the highest-ranking cities when using metrics to measure crime, emergency services' response time, transportation networks, cycling culture, food, drink, retail, and the number of independent bookshops. MONOCLE's Quality of Life survey is one among the many that exist to rank the world's best cities, but wealth is one theme that emerges from among the varying indices and their respective results. The metrics, indeed the participants responding to the metrics, represent populations of people with high levels of discretionary income. How might the metrics reflect different values if these indices include a different kind of participant, such as the urban poor?

Learning Outcomes: 1. Investigate indicators of community well-being related to quality of life with urban poor communities. Credits: 3.00

HONR 46200 - Protein Design With FoldIt

Credit Hours: 3.00. The protein folding problem is a grand challenge in biology. How does a protein's amino acid sequence dictate its three-dimensional structure? FoldIt is an online game in which players determine the most stable folded structure of hypothetical proteins that have been predicted by unique computer algorithms to perform specific functions in the cell. Students in this course will be introduced to the mechanics of the FoldIt software to fold computer-predicted proteins into their native structures as well as design novel proteins that can bind and deactivate the COVID-19 spike protein.

Learning Outcomes: 1. Demonstrate knowledge of the fundamental principles underlying protein folding and design. 2. Demonstrate knowledge of the protein structure prediction and design problems. 3. Design novel 3D protein structures using the FoldIt software. 4. Develop responsible and ethical research practices. 5. Read, summarize, and analyze scientific research articles. 6. Construct a literature review. 7. Create, present, and evaluate scientific research posters. 8. Develop strategies to translate research to the general public. 9. Critically reflect upon and articulate their learning and growth as a researcher. Credits: 3.00

HONR 46300 - Research Thinking Portfolio

Credit Hours: 2.00. This course establishes a new pathway for Honors completion through a critical engagement with the Undergraduate Research pillar of the college. This course will empower Honors students to leverage their research, scholarly, and creative experiences in curricular as well as co- and extra-curricular experiences toward completing the HC curriculum. Our course will combine workshops, hands-on laboratories, group discussion, and one-on-one meetings. The major assignment is a reflective portfolio, which will serve as a record of your past experiences and an opportunity to reflect on the ways in which your time as an Honors College student has shaped your research thinking and helped prepare you for life beyond the university. Successful completion of the course fulfills the scholarly project requirement of the HC curriculum.

Learning Outcomes: 1. Understand the place of research in institutions of higher education and society. 2. Identify a question, the answer to which makes a contribution to an existing body of knowledge or creative practice. 3. Read, analyze, and synthesize information from scholarly literature and/or traditions of creative practice. 4. Demonstrate knowledge of disciplinary and/or interdisciplinary skills,

methods, and abilities appropriate for the research/creative question. 5. Recognize and respond to ethical responsibilities of their research projects. 6. Communicate their findings in both oral and/or written formats. Credits: 2.00

HONR 46400 - Scholarly Project

Credit Hours: 3.00. This course fulfills the scholarly project requirement of the Honors College curriculum. Students will engage in original research projects that produce new knowledge.

Learning Outcomes: 1. Identify a question, the answer to which makes a contribution to an existing body of knowledge or creative practice. 2. Read, analyze, and synthesize information from scholarly literature and/or traditions of creative practice. 3. Demonstrate knowledge of disciplinary and/or interdisciplinary skills, methods, and abilities appropriate for their research/creative question. 4. Evaluate and interpret their findings. 5. Recognize and respond to ethical responsibilities of their research/creative projects. 6. Communicate their findings in both oral and/or written formats. Credits: 3.00

HONR 49500 - Honors Independent Research

Credit Hours: 1.00 to 6.00. Individualized research under faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Improve research skills. 2. Develop research thinking. 3. Create new knowledge. Credits: 1.00 to 6.00

HONR 49900 - Honors Research Project

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of faculty-led collaborative research projects. Topics will vary by semester. Permission of department required.

Credits: 1.00 to 6.00

HONR 59901 - Research Mentorship Development Program

Credit Hours: 3.00. The Research Mentorship Development Program is designed for Purdue based on a nationally recognized curriculum and prepares graduate students or postdocs to mentor undergraduates in research. Effective mentoring of undergraduate researchers requires specific skillsets and approaches. Implementation of these strategies can lead to a productive and mutually beneficial experience for both students and their mentors. The course is designed for graduate students who plan to work with new researchers in their labs or research groups and who plan to enter academia or pursue careers in which they will mentor others in scholarship or research. Graduate students or postdocs selected for the program are matched with honors students who are interested in research. Permission of department required.

Learning Outcomes: 1. Communicate more effectively with mentees. 2. Align mentor and mentee expectations. 3. Assess their mentee's understanding of core concepts and technical skills in the research field. 4. Foster their mentee's confidence and ability to conduct independent research. 5. Implement concrete strategies for addressing issues of diversity. 6. Articulate and constructively review their own approach to mentoring. 7. Cultivate research ethics with their mentees. 8. Promote professional development of their mentees. 9. Build a community of practice with other mentees. Credits: 3.00

Horticulture

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great

activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 12100 - Medicine In The Garden (UCC: STS)

Credit Hours: 1.00. A survey of the uses and properties of horticultural plants for human health and well-being. Topics will focus on the close relationships between plants and human physiology, nutrition, medicines, mind-altering drugs, poisons, and beverages.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

HORT 21200 - Greenhouse And Landscape Fundamentals For Educators

Credit Hours: 3.00. (ASEC 21200) This course will prepare future educators in using a greenhouse and landscape as teaching tools. The key focus will be preparing students to apply greenhouse and landscape management fundamentals in order to teach these concepts in the classroom. Laboratories will explore how to identify and produce both woody and herbaceous plants while safely maintaining and operating greenhouse technologies. Students will also explore how to implement landscape design technologies and identify tools, equipment, and landscape plants. Permission of instructor required.

Learning Outcomes: 1. Identify and apply basic propagation techniques. 2. Identify and describe plant species specific to greenhouse and landscape plantings. 3. Interpret funding for greenhouses, greenhouse technologies, and landscape design equipment. 4. Apply IPM,

irrigation, and propagation techniques while safely maintaining and operating a greenhouse. 5. Analyze and utilize landscape design software and tools to design a landscape. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

HORT 27000 - Floral Design And Interior Plant Management

Credit Hours: 3.00. Elements and principles of floral design, as well as the identification, culture, and propagation of indoor plants. Topics in the art of floral design from both the florist's and the consumer's perspective, as well as information on growing houseplants. A variety of creative, hands-on lab projects include fresh flowers & foliage, silk, and dried materials.

Learning Outcomes: 1. Recognize and use the elements and principles of design as they apply to the art of arranging flowers. 2. Develop the skills necessary to create floral designs. 3. Correctly select and use flowers, containers, and color harmonies. 4. Properly condition cut flowers and greens for use in everyday flower arrangements. 5. Identify indoor foliage plants and flowers and problems of interior plants. 6. Better understand the factors involved in growing and maintaining plants. 7. Know the cultural requirements of 30 popular interior plants. 8. Properly manage interior plants and floral arrangements. 9. Properly evaluate floral designs used for decorating and gift giving. 10. Receive greater enjoyment from plants and flowers and increased awareness of their design qualities. Credits: 3.00

HORT 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

HORT 29100 - Selected Topics In Horticulture

Credit Hours: 1.00 to 3.00. This variable-credit, lower-level selected topics course will be used for lower-division undergraduate research projects, for development of new lower-division courses and for temporary courses for lower-division students. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking,

problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 30600 - History Of Horticulture (UCC: STS)

Credit Hours: 3.00. The origins and development of agriculture, with specific emphasis on horticulture from prehistory to the present in relation to civilization and modern culture.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HORT 31110 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (FNR 31300) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of post harvest food storage and pest management. Credits: 1.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural

crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 31900 - Controlled Environment Production Of Horticultural Crops

Credit Hours: 3.00. This course combines production principles with environmental concepts and advances in technology to provide a comprehensive training in sustainable production of herbaceous ornamentals and vegetables in controlled environment systems. The laboratory instruction provides hands-on experience with the practice of growing crops under controlled environments by combining the learning from lab prep with the use of technology to control environment during production.

Learning Outcomes: 1. Become familiar with best management practices for growing herbaceous ornamentals and vegetables that improve sustainability in controlled environments. 2. Learn how above and below ground environments interact with crop production. 3. Learn basics about the state-of-the-art technologies used in controlled environment agricultural production to monitor and control environments. 4. Interact with industry professionals to gain first-hand knowledge about careers and development in commercial horticulture. 5. Gain sufficient background in science, technology and regulations required to become entrepreneurs, next generation growers and researchers in the controlled environment agriculture industry. Credits: 3.00

HORT 32100 - Hydroponics Systems

Credit Hours: 3.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in controlled environment agriculture (CEA). This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

Learning Outcomes: 1. Describe essential components of single-pass and recirculating hydroponic systems. 2. Compare different substrates and hydroponic system designs. 3. Interpret water quality analysis results and recommend corrections. 4. Create nutrient solutions using salts or mixed fertilizers. 5. Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponics. 6. Select hydroponic systems for production of leafy greens, herbs, and vegetable crops. 7. Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

HORT 37000 - Professional Floral Design

Credit Hours: 3.00. Principles and techniques of commercial-scale floral design for weddings, funerals, hospitals, personal, and parties. Design construction for fresh, dried, and silk materials. Survey of retail florist management. Permission of department required.

Credits: 3.00

HORT 39000 - Cooperative Program In Horticulture

Credit Hours: 0.00. Supervised work experience in horticultural industry. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of department required.

Credits: 0.00

HORT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 40000 - Horticulture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

HORT 40300 - Tropical Horticulture

Credit Hours: 3.00. An introduction to the agriculture of the tropics and subtropics, emphasizing horticultural crops. Offered in even-numbered years.

Credits: 3.00

HORT 42700 - Horticulture Capstone

Credit Hours: 1.00. Based on an approved work or internship experience, or case study, or mentored research experience, or production activity, students will collect information and develop a written analytical exploration of the commercial enterprise, internship institution, or research or production activity. The written analysis will be appropriate to the student's area of concentration. In addition, a summary oral presentation based on specific aspects of their experience will be made by each student. Prerequisite: Completion of an approved work or internship experience or mentored research experience.

Learning Outcomes: 1. Describe the structure and operation of a horticultural enterprise, public horticultural institution or the methodology for hypothesis testing in research. 2. Give examples of strengths and weaknesses of a horticultural enterprise, public horticultural institution or the methodology used in the research project. 3. Apply principles learned in coursework to evaluation of the observed horticultural enterprise, public horticultural institution or the methodology used in the research project including the management, operational, or horticultural setting and strategies. 4. Formulate proposals for ways in which the observed horticultural enterprise, public horticultural institution or the research

activity might improve. Credits: 1.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

HORT 45000 - In The English Landscape: Integrating History, Horticulture, And Landscape Architecture

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Offered in even-numbered years. Permission of instructor required.

Credits: 3.00

HORT 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For students doing individualized research on horticultural problems; report required. Arrange with academic advisor and honors research advisor before registering. Admission to the honors program. Permission of instructor required.

Credits: 1.00 to 6.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 51400 - Sensors And Automation For Horticultural Crop Production

Credit Hours: 3.00. This course is designed to provide undergraduate (senior level) and graduate students with the knowledge of a wide range of environmental and plant sensors and automation devices for horticultural crop production, especially controlled environment production. Lectures will focus on the theory and application of different plant and environmental sensors, electronic devices and computer programming for automation and environmental control using sensors while the laboratory activities provide hands-on experience on the application of sensors and automation devices to control below and above-ground environment during production.

Learning Outcomes: 1. Examine theory associated with different environmental and plant sensor measurements. 2. Implement methods to interface sensors to measurement devices such as dataloggers and micro-controllers and program them for automated and continuous sensor measurements. 3. Examine digital sensing technologies based on image analysis. 4. Demonstrate knowledge and practice hands-on experience with precision

environmental control using datalogger and microcontrollers. Credits: 3.00

HORT 52500 - The Plant Microbiome

Credit Hours: 3.00. Students will learn about the latest methods to collect and analyze root and shoot exudates, quantify the composition and activity of microbes associating with plants, and determine how these associations influence plant health and productivity. Critical reviews of the primary literature and development of a research proposal will help students acquire the skills needed to conduct research on this rapidly emerging topic.

Learning Outcomes: 1. Describe basic processes regulating plant-microbial interactions in the rhizosphere and phyllosphere, and the implications of these interactions on plant and environmental health. 2. Critically evaluate and discuss primary literature in the field. 3. Compare and contrast methods used to study processes mediating plant-microbial relationships. 4. Identify questions that remain unanswered in the field and develop a research proposal to address one of these questions. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

HORT 54100 - Postharvest Technology Of Fruits And Vegetables

Credit Hours: 1.00. (FS 54100) Theoretical and applied aspects of methods being used for enhancing the quality and shelf life of harvested fruits and vegetables. Factors that affect the longevity of produce and technology used to control these factors and reduce deterioration of produce between harvest and consumption/processing will be emphasized. Weeks 11-15.

Credits: 1.00

HORT 55100 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles.

2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

HORT 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Demonstrate knowledge of a variety of participatory and facilitation techniques. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

HORT 59000 - Special Studies In Horticulture

Credit Hours: 1.00 to 3.00. Special studies in horticulture not covered in regular coursework. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60200 - Horticulture Research Seminar

Credit Hours: 1.00. Weekly attendance at the Horticulture and Landscape Architecture Departmental seminars to help graduate students develop an appreciation for attending seminars and learning appropriate and effective presentation skills. HORT 602 compliments HORT 60100 and HORT 60300 by extending the presentation and project development approaches learned, so that students are better ready to prepare and defend their project proposals in HORT 60300. Prerequisite: BCHM 56100.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

HORT 69500 - Horticulture Seminar

Credit Hours: 0.00. Topics of current interest to staff and students.

Credits: 0.00

HORT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HORT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Hospitality and Tourism Management

HTM 10010 - Exploring Transformational Experiences In Hospitality And Tourism

Credit Hours: 1.00. In an age where experiences have become the new currency, businesses must adapt and thrive in the experience economy to succeed. This course introduces students to the concept of transformational experiences within the experience economy, providing them with the knowledge and skills needed to navigate this dynamic landscape. Students will gain a better understanding of where their passions lie within the broader scope of hospitality and tourism, preparing them for academic and career-related success.

Learning Outcomes: 1. Describe transformational experiences that drive business success in the experience economy. 2. Outline current and trending transformational experiences in hospitality, tourism, and affiliated industries. 3. Identify potential career paths within hospitality, tourism, and affiliated industries. Credits: 1.00

HTM 10100 - Hospitality And Tourism Student Seminar

Credit Hours: 1.00. Course assists the student new to Purdue to become acquainted with the Purdue system and with the HTM department and program. Information presented to assist students with developing strategies for academic and career-related success at Purdue.

Learning Outcomes: 1. Describe the curriculum of the Hospitality and Tourism Management Department; the Purdue University registration process and apply that knowledge to plan their academic program and develop a schedule each semester at Purdue. 2. Use the principles of time management in planning their time commitments. 3. Demonstrate individual skills and interests related to career choice. 4. Define and apply civic engagement principles in the local community in service to a non-profit hospiitality or tourism related business. 5. Create a professional resume and understand the interview process in searching for employment. Credits: 1.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

HTM 16200 - Introduction To Event And Meeting Planning Industry

Credit Hours: 3.00. Upon completion of this course, students will have a comprehensive overview of the event and meeting industry. Topics will include the supply and demand side of event and meeting management, the basic planning process needed for any event or meeting, sustainability, business ethics, and keeping pace with current industry trends through guest lectures from event and meeting planners.

Learning Outcomes: 1. Develop a comprehensive overview of the essential supply and demand components of the event industry including corporations, associations, and the government in terms of organization, type, decision makers, attendees, and marketing efforts. 2. Compare and contrast the advantages and disadvantages of major venues of hotels, convention centers, conference centers, cruise ships, and unusual venues to those who demand and plan events. 3. Identify the key players and pioneers of the event planning industry. 4. Identify the basic needs of

event planners and consumers. 5. Identify the basic principles and concepts of sustainability as applied to the event management industry. 6. Summarize the major characteristics of event planning with respect to planning, directing, organizing, controlling and assessing events. 7. Identify ethical business practices associated with the event industry. Credits: 3.00

HTM 17300 - Tourism Systems

Credit Hours: 3.00. Tourism is a global phenomenon impacting destination communities, incorporating a range of hospitality-related businesses and organizations, and enriching the lives of tourists and residents alike. This course examines key elements of tourism systems, how these elements interact to deliver unique travel experiences, and how destination stakeholders can use tourism for sustainable development. The course will strengthen students' understanding of tourism systems while preparing them to successfully engage in it for a variety of career options in tourism and hospitality industries.

Learning Outcomes: 1. Explain the tourism system including the roles of travelers, tourism businesses and destinations, and other tourism system components. 2. Describe the impacts of tourism and the basic components of sustainable tourism practices. 3. Identify the key principles of destination marketing and management. 4. Describe key factors that influence consumer travel behavior including personal, interpersonal, and environmental factors. 5. Describe how to apply experience design principles to develop tourism products, services, and experiences. Credits: 3.00

HTM 18000 - Hospitality Operations

Credit Hours: 3.00. Hospitality leaders require a deep understanding of the fundamental principles and practical aspects of managing operations within the dynamic and fast-paced hospitality industry to effectively run a business. This course will address topics including principles of management, organizational structures, managerial decision-making, hospitality metrics, and the responsibilities of managers. Through these topics, the course will strengthen students' understanding of the hospitality industry as it exists today while preparing them for the industry of the future.

Learning Outcomes: 1. Describe the key principles of management. 2. Identify organizational structures, including brands, management, and ownership. 3. Compute key hospitality metrics. 4. Explain how work groups in major types of hospitality businesses interconnect. 5. Understand the responsibilities of leaders in hospitality operations. Credits: 3.00

HTM 18100 - Introduction To Lodging Management

Credit Hours: 3.00. History, features, operation procedures and management of lodging facilities both in the United States and in other parts of the world. The course involves an experiential learning component.

Learning Outcomes: 1. Describe the evolution of the lodging sector in the United States (U.S.) and around the world. 2. Identify hotel types, brands as well as management and ownership structures in 21st century lodging business. 3. Describe how work is organized in hotels. 4. State the duties and responsibilities of positions within lodging business. 5. Describe and critically evaluate front office and housekeeping procedures in hotels. 6. Identify internal and external reports (such as the STR Report) commonly used in lodging business. 7. Compute basic key performance indicators (KPIs) (such as occupancy percent, ADR, RevPar). 8. Discuss some of the latest technological advances in lodging business. 9. Describe common unethical practices and innovative strategies in reducing such practices in lodging business. 10. Describe other tourism business sectors that interconnect with lodging. Credits: 3.00

HTM 18101 - The Union Club Hotel Experience

Credit Hours: 1.00. Hospitality businesses are complex operations requiring unique managerial approaches to deliver exceptional guest and employee experiences. The Union Club Hotel is ideally positioned to expose students to managerial roles in a multi-million-dollar asset. Students will shadow managers who oversee hotel departments and interact with corporate leaders through this experiential course while learning how managers ensure an exceptional guest experience, provide a positive employee experience, and execute efficient hospitality operations. The knowledge gained in this course is transferable to all hospitality businesses, making this course valuable for all.

Learning Outcomes: 1. Identify principles of

management as demonstrated by managers of a hospitality operation. 2. Describe how various departments of a hospitality business interconnect to deliver the guest experience. 3. Describe the importance of fostering a positive work environment for hospitality employees. Credits: 1.00

HTM 19100 - Sanitation And Health In Foodservice, Lodging, And Tourism

Credit Hours: 3.00. This course introduces students to the foodservice component of the Hospitality and Tourism industry and explores food safety and other health-related issues. Application of sanitation principles in restaurants, hospitals, schools, hotels, cruise ships, airlines, and international travel are covered. Students must pass a National Sanitation Certification Examination to receive credit.

Learning Outcomes: 1. Identify the causative agents, symptoms, contributing factors to foodborne illnesses, and the processes used to prevent foodborne illnesses from occurring. 2. Describe how food should be safely handled from purchasing through service to the customer. 3. Describe the role and responsibilities of federal and state governments, local regulatory agencies, and foodservice managers in promoting and maintaining consumer food safety. 4. Describe the overall foodservice inspection system, how inspections are conducted, and how managers should use inspections to improve their food safety. 5. Describe additional health issues relevant to the foodservice, lodging and travel industries and what these industries should do in regards to these health issues. 6. Describe how to effectively communicate with government agencies and the general public as part of normal operations and during crisis management. 7. Describe what and how food safety training of employees should be done. Credits: 3.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

HTM 20200 - Hospitality And Tourism Work Experience

Credit Hours: 1.00. This course is a supervised paid industry work experience in the hospitality and tourism industry. Students are required to present a signed agreement from their employer prior to initiating employment. Students are also required to prepare a series of work and reflective reports. A minimum of 320 work hours is required for completion during either a summer or semester period. Permission of department required.

Learning Outcomes: 1. Develop skills necessary to seek their first positions in a hospitality organization. 2. Develop skills to analyze issues in a hospitality organization through the use of various required work experience reports. 3. Analyze the culture and work environment in an organization and determine its strengths and weaknesses. 4. Identify the functions of the various departments within the specific type of operation in which they work. 5. To be able to distinguish between engaged employees and those employees who are disengaged. 6.

Describe effective customer service encounters versus those which were not handled properly by their organization. Credits: 1.00

HTM 21200 - Leading For Success In Service Industries

Credit Hours: 3.00. Effective leaders possess knowledge of organizational behavior and skills which provide the capacity to enhance organizational performance. Drawing upon leadership and organizational behavior theories, this course will provide students with the tools necessary to lead teams in service industries. Areas of focus include understanding individual differences and team dynamics, motivating and developing employees, effective decision-making, communication, influence, diversity, and leading change. This course will include preparation for a leadership development certificate, such as the Dale Carnegie Leadership certificate, to be earned upon successful completion of the course.

Learning Outcomes: 1. Describe the roles of managers and leaders in hospitality and tourism and the concepts of organizational efficiency and effectiveness. 2. Identify and explain basic management principles of planning, organizing, directing and controlling as applied to the hospitality and tourism business. 3. Identify basic leadership skills that effective managers in the hospitality and tourism industry possess, including business communication, motivation, decision making, and change management. 4. Identify contemporary management and leadership issues facing the hospitality and tourism industry. 5. Explain the basics of human behavior in organizations, including individual behavior and team dynamics. 6. Discriminate between ethical and non-ethical behaviors on the part of individuals inside and outside the organization. 7. Analyze the impacts of culture and diversity on organizations. Credits: 3.00

HTM 21800 - Creating Experiences For A Diverse Society

Credit Hours: 3.00. This course will provide students with knowledge and skills related to diversity, equity, and inclusion (DEI), and provide students an opportunity to actively increase their cultural competence to help them work with others effectively in professional settings. The course provides frameworks, terminology, and tools for engaging in productive conversations around difficult topics related to DEI. Students use critical and reflective thinking, as well as effective problem solving to create inclusive experiences for all stakeholders.

Learning Outcomes: 1. Define and apply terminology and concepts related to diversity, equity, and inclusion (DEI). 2. Develop awareness and knowledge of DEI best practices to create inclusive experiences for all stakeholders. 3. Demonstrate an understanding of issues related to DEI within the White Lodging-J.W. Marriott, Jr. School of Hospitality and Tourism Management disciplines. 4. Engage in inclusive and interdisciplinary collaborations. 5. Apply best practices to address and propose solutions to current DEI topics within students' academic disciplines. 6. Demonstrate effective oral, written, and visual communication. Credits: 3.00

HTM 23100 - Marketing In Service Industries

Credit Hours: 3.00. Marketing plays a crucial role in service industries, addressing unique service challenges. Its importance lies in engaging customers, establishing trust and credibility, distinguishing from competitors, boosting revenue, and fostering sustainable growth and success. This course equips students with a customer-centric approach to service industry marketing, emphasizing the integral role of marketing in a service organization's strategic planning. The course exposes students to service marketing principles, components, and marketing practices.

Learning Outcomes: 1. Explain the unique challenges in marketing and managing services. 2. Describe the role of marketing in supporting the strategic direction of a service organization. 3. Evaluate the role of the service marketing mix in solving marketing related problems and promoting the overall success for service organizations. Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial

statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

HTM 25500 - Advanced Spreadsheet Techniques For Hospitality And Tourism Management

Credit Hours: 2.00. This course builds upon information and skills obtained in an entry-level-computing course. It will take students to the next level by introducing them to more advanced techniques used in Hospitality, Tourism, Retail, and Sales Management.

Learning Outcomes: 1. Demonstrate proper utilization of spreadsheet techniques to effectively organize and analyze data for management presentations. 2. Explain the purpose of selected spreadsheet techniques and describe how they are used in Hospitality, Tourism, Retail, and Sales Management. 3. Demonstrate advanced spreadsheet techniques, such as: Advanced Spreadsheet Formulas; Statistical Analysis; Validating Data Entry; Conditional Formatting; Advanced Charting Techniques; Pivot Tables; Spreadsheet Dashboards; Recording and Using Spreadsheet Macros; Power Query; Advanced Cell/Column/Row/Table Formatting; Creating Templates. Credits: 2.00

HTM 25501 - Fundamentals Of Excel And Data Analytics In Service Industries

Credit Hours: 3.00. The proper application of data analytics is important for optimizing the performance of service enterprises. Spreadsheet programs make it easy to manage and visualize data as well as perform basic data analyses. Microsoft Excel is one of the primary tools used for business reporting and decision-making tasks. In this course, students will receive hands-on training in a wide range of Excel functionalities including using functions and formulas, working with tables, creating charts, and analyzing data using PivotTables. This course will use practical, real-world applications to train students how to make business decisions.

Learning Outcomes: 1. Apply built-in Excel functions and create formulas necessary to analyze data. 2. Apply data visualization techniques to identify and communicate business issues. 3. Demonstrate proficiency using Excel to formulate and solve business problems. Credits: 3.00

HTM 26200 - Festivals And Special Events

Credit Hours: 3.00. This course offers a comprehensive overview of the theory and procedures associated with the coordination of festivals and special events. Essential topics will include the conceptualization, planning, coordination, sponsorship, marketing, funding, staffing, legal issues, and assessment of festivals and special events. Students will gain hands-on experience by volunteering to work a minimum of six hours to set up, help coordinate, or tear down a large-scale festival or special event.

Learning Outcomes: 1. Classify the types and purpose of festivals and special events. 2. Compare and contrast traditional events and meetings to festivals and special events. 3. Develop a basic understanding of the size and scope and the employment potential of festivals and special events. 4. Describe the key steps necessary to plan, manage, staff, organize, and assess the stated objectives of a festival or special event. 5. Knowledge of economic, financial, and accounting principles and practices of festivals and special events. 6. Apply the principles of sustainability to festivals and special events. 7. Read relevant research and apply it to festival and special events management. 8. Differentiate between ethical and non-ethical business practices. Credits: 3.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology,

processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

HTM 29102 - Introduction To Foodservice Management

Credit Hours: 3.00. An introduction to food preparation methods and service techniques in quantity food settings. Students become familiar with ingredients and culinary terminology, and learn to read, write and evaluate menus. Recipe conversion, inventory and costing skills are developed. Production methods, equipment, and product flow are examined. Front-of-the-house service techniques as well as front-and-back-of-the-house interactions will be studied.

Learning Outcomes: 1. Describe kitchen operations including culinary terminology, basic cooking methods, equipment and technology, and basic food handling skills, such as food preparation, safety, and quality. 2. Describe service techniques including a la carte and buffet setup and service, cycle of service (ordering through payment), tableside cooking and service recovery. 3. Describe and demonstrate proper kitchen management systems, such as cost control, inventory control, sales history, and menu development. 4. Explain the importance of timing and quality production in regards to the distribution of goods and services. 5. Describe the relationship between international foods and factors, such as geography, climate, and culture. 6. Identify current foodservice trends, such as: healthy food, menu labelling, and sustainability. 7. Discriminate between ethical and non-ethical behavior on the part of individuals and organizations. Credits: 3.00

HTM 29700 - Introduction To Honors Research

Credit Hours: 1.00. Introduces students to the design and implementation of an honors research project.

Credits: 1.00

HTM 30000 - Semester Internship Experience In Hospitality And Tourism

Credit Hours: 0.00. Mechanism to recognize students in the Purdue system the semester they are off campus participating in an approved semester internship program with a hospitality company. Permission of department required.

Credits: 0.00

HTM 30200 - Hospitality And Tourism Industry Internship I

Credit Hours: 1.00 or 2.00. Opportunities for learning through professional work experience that is practical, meaningful, and aligned with career aspirations are important for career development, planning, and goal setting. As part of the professional development curriculum, this internship course provides students with entry-level experience within the hospitality and tourism industry, broadening their exposure and understanding of the industry to explore potential career paths. Guided by the Ray Kavanagh Career Center and the National Association of Colleges and Employers (NACE) Career Readiness Competencies, students apply what they are learning in the classroom to the workplace.

Learning Outcomes: 1. Develop and apply interviewing and negotiating skills during the

process of seeking and being hired into an internship. 2. Recall and explain the strengths and weaknesses of departments and work units from the hospitality operation in which they interned. 3. Describe and explain interactions with the hospitality operation's guests and the development of a positive service oriented attitude. 4. Compare and contrast the differences and similarities of management styles and leadership skill of the supervisors they worked with; evaluate the effectiveness of supervisor or manager; analyze which type of style or skill fits best with their style. 5. Identify new and different experiences encountered during the internship; distinguish the positive and negative aspects of the experience, and appraise these experiences as to their value to their future Hospitality management career. 6. Recall coursework related knowledge and apply and demonstrate this knowledge in areas of Human Resource Management, Finance, Management, Law, and other applicable areas in a hospitality organization. 7. Synthesize the total internship learning experience by completing comprehensive management reports. Credits: 1.00 or 2.00

HTM 31100 - Procurement Management For Foodservice

Credit Hours: 3.00. Identifies and describes food, supplies, and related merchandise used in the foodservice industry. Provides methods and criteria for recognizing quality, evaluating, specifying, purchasing, and inspecting these products. Discusses the use of technology in the purchasing component of the foodservice industry.

Learning Outcomes: 1. Explain foodservice procurement principles such as steps in the procurement process, procurement-menu relationship, quality standards, and vendor relations. 2. Explain factors impacting procurement decisions such as ethics, government regulations, global economic conditions, sustainability, distribution sales channels, technology, competitors, consumer behavior, and skills and knowledge of buyers. 3. Apply foodservice procurement principles, factors, and data analysis to formulate decisions related to product, quantity, price, supplier/producer/manufacturer, and inventory management. Credits: 3.00

HTM 31200 - Talent Management For Service Industries

Credit Hours: 3.00. Service organizations are labor-intensive, requiring effective talent management to be successful. Managers must be able to attract, develop, motivate, and retain employees to deliver exceptional service. Building on leadership skills and management principles, this course will emphasize the strategic role of human resource management with topics that span the lifecycle of a job (e.g., recruitment, selection, training, performance management, compensation, etc.). Students will explore the science behind effective talent management, developing knowledge and skills that will prepare them to manage a growing and diverse workforce.

Learning Outcomes: 1. Explain the importance of the various elements of strategic human resource management and their contribution to organizational performance. 2. Critique human resource practices by applying theories and research. 3. Create solutions that would address current human resource issues in service industries such as associate engagement, diversity, ethics, and employee well-being. Credits: 3.00

HTM 31400 - Franchising

Credit Hours: 3.00. The study of franchise administration, operations, and marketing, with a special emphasis on hospitality-related franchises. Includes a study of the legal regulation of franchises, the franchisee-franchisor relationship, and unique problems in operating a franchise.

Credits: 3.00

HTM 31500 - Club Management And Operations

Credit Hours: 3.00. A study of the organization, administration, operation, and opportunities within the private club industry, with emphasis on the manager's duties.

Learning Outcomes: 1. Describe the various types of clubs, and the job of a club manager, including attributes of successful club managers. 2. Describe the career prospects in managing clubs; the issues facing clubs today and prospects for the future of the club industry.

3. Explain the fundamentals of good human resource management as it applies to clubs. 4. List issues that are unique or particularly significant to clubs, including legal, technological and financial issues. 5. Explain the differences and similarities between clubs and public hospitality operations. 6. Describe and discuss the products, activities and services in the club industry and how a manager works toward identifying, understanding and improving these in their club. Credits: 3.00

HTM 31700 - Business Etiquette For Managers

Credit Hours: 1.00. A review of contemporary standards of human interaction in the workplace. How manners, etiquette and style affect and enhance everyday dealings with others.

Credits: 1.00

HTM 32200 - Hospitality Facilities Management

Credit Hours: 3.00. Technical and managerial issues relating to the operation and maintenance of the physical plant and equipment in hospitality industry facilities.

Learning Outcomes: 1. Develop systematic solutions to a wide range of facility management problems and evaluate those potential solutions to ensure they are fiscally sound. 2. Explain how systems within a facility function, and what is involved in keeping them functioning properly. 3. Describe what's involved in operating a maintenance department and evaluate their efforts. 4. Describe how to make facilities more sustainable reduce its negative environment impact both during construction and operation. 5. Describe the different regulatory requirements that apply to hospitality facilities such as building codes, licensing, and permit requirements and state the importance of compliance with those requirements. Credits: 3.00

HTM 33100 - Hospitality And Tourism Sales And Service

Credit Hours: 3.00. Application of sales and customer service methods used to generate revenues for hospitality and tourism businesses. Emphasis is placed on a hands-on assignment which requires students to identify a product that they will market and sell, as well as participate in a sales blitz.

Learning Outcomes: 1. Develop systematic solutions to a wide range of facility management problems. 2. Explain how systems within a facility function, and what is involved in keeping them functioning properly. 3. Describe what's involved in operating a maintenance department and evaluate their efforts. 4. Describe the functions of the major pieces of food service equipment and how to purchase each. 5. Describe how operations can conserve utilities and the basic criteria for LEED certification. 1. Apply marketing principles to the sales process in hospitality and tourism industry. 2. Distinguish between ethical and non-ethical behaviors on the part of sales professionals. 3. Identify the buying style of the customer and adapt sales pitch and pace to maximize sales potential. 4. Design a strategy to work with others to accomplish sales goals. 5. Identify, market, and sell a tangible product to the general public. 6. Apply professionalism and customer service principles to the sales process. 7. Apply fundamental accounting skills to formulate, monitor, and accomplish self-imposed sales goals. 8. Apply sales techniques in an actual hospitality and tourism business setting. Credits: 3.00

HTM 34100 - Operations Control And Analysis In The Hospitality Industry

Credit Hours: 3.00. Applications of the control process and quantitative analysis to effectively manage an efficient and profitable hospitality business. The emphasis is on planning budgets, controlling operational activities, and evaluating performance.

Learning Outcomes: 1. Explain the importance of control process to the success of an operation. 2. Describe behavior of costs and evaluate their effects on the operating income in the hospitality industry. 3. Analyze and interpret financial statements. 4. Establish appropriate cost standards and procedures in each state of the product cycle. 5. Construct a labor schedule that will satisfy customer demand, meet

employee requests, and keep labor cost down. 6. Apply regression, moving average, and exponential smoothing to forecasting revenue and customer counts. 7. Identify and eliminate excessive food and beverage costs and describe how to eliminate them. 8. Develop an operating budget based on revenue and expense forecasts. 9. Apply revenue management concepts to create demand and maximize revenue for the given demand in restaurants. 10. Prepare visual representations of operational and financial data. Credits: 3.00

HTM 34200 - Financial Management For Service Industries

Credit Hours: 3.00. To create value for owners, managers need to understand the implications of long-term investment and the importance of securing finance to ensure sustainable growth. The primary purpose of this course is to understand the role of financial management, to learn analytic concepts and managerial tools for making capital investment decisions and to become familiar with major financial instruments and concepts such as time value of money, risk-return, capital budgeting, cost of capital, and capital structure.

Learning Outcomes: 1. Identify financial management roles and describe the agency problem in hospitality and tourism businesses. 2. Demonstrate proficiency in using Excel to model cash flows and calculate returns in the capital budgeting process. 3. Explain how the risk-return relationship affects cost of capital and stocks/bonds valuation. 4. Explain how capital structure affects firm value and dividend decisions. Credits: 3.00

HTM 35700 - Disruption And Innovation In Hospitality & Tourism

Credit Hours: 3.00. Hospitality and tourism businesses face unprecedented industry shifts requiring proactive leaders. Through this course students will develop an innovative mindset, rethink the status quo, and amplify their creative thinking in designing solutions to current and future business challenges.

Learning Outcomes: 1. Describe innovation theories and trends. 2. Explain how building and sustaining a culture of innovation is a competitive advantage. 3. Describe the core aspects of an end-to-end innovation process. 4. Develop and evaluate innovative solutions to product and service challenges. Credits: 3.00

HTM 36200 - Event And Meeting Management

Credit Hours: 3.00. The principles and practices of event and meeting management will be covered in this course, including: strategic event planning process, project management, risk management, financial management, human resources, stakeholder management, meeting or event design, site location and management, marketing, professionalism, and ethics. Students will gain hands-on experience planning, directing, organizing and controlling a small-scale event.

Learning Outcomes: 1. Determine the purpose of a meeting and identify the relationship of a meeting to organizational strategy. 2. Develop and manage a budget for a meeting/event. 3. Develop the complete plan to meet the goals and objectives of the event (such as reserving rooms, securing meeting space, transportation, and food and beverage). 4. Review the event to determine if the goals and objectives were met. 5. Differentiate between ethical and non-ethical business practices. 6. Work with a team to plan, direct, organize and control a small scale event. Credits: 3.00

HTM 37000 - Sustainable Tourism And Responsible Travel

Credit Hours: 3.00. This course will examine issues associated with sustainability in the hospitality and tourism industry. It will examine how principles of sustainable development and the triple bottom line (economic, social and environmental) are applied to hospitality and tourism. The course will address sustainability across a variety of tourism sectors including destination management, lodging, restaurants and meetings. The course will also examine consumer issues associated with sustainability.

Learning Outcomes: 1. Define sustainability and describe its applications in the tourism and hospitality system. 2. Explain the relationship between tourism and the UN Sustainable Development Goals/Grand Challenges. 3. Describe the components of sustainability programs in tourism and hospitality organizations. 4. Analyze sustainability programs in various tourism sectors to determine their effectiveness in achieving social

and environmental goals. 5. Apply and evaluate environmental performance programs in the hospitality industry. 6. Explain the major consumer issues associated with sustainability in the tourism and hospitality industry. 7. Identify and explain principles of ethics as applied to the tourism industry. 8. Identify career opportunities associated with sustainability in tourism and hospitality. Credits: 3.00

HTM 37200 - Global Tourism Geography (UCC: BSS)

Credit Hours: 3.00. Introduction and analysis of specific world travel destinations, including the exploration of geographic features, customs and tradition, population centers, visitor attractions, political, religious, language and other cultural differences as these relate to the hospitality and travel industry. The course is designed to teach students specific geographic knowledge and develop a deeper understanding and empathy for cultural values and traditions that exist outside their own culture.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain the interactions of tourism with the culture, economy, and environment of global destinations. 2. Identify international travel patterns and explain their impact on tourism management in promoting cultural understanding and global peace. 3. Locate various countries, major cities, natural wonders, historic sites and other tourism attractions, both man-made and natural. 4. Describe how the physical environment in specific geographic regions affects the ability of humans to live there and influences inbound and outbound travel. 5. Explain how political, economic, and environmental factors affect travel both positively and negatively. 6. Explain international travel patterns and identify the major travel generating and travel receiving areas. 7. Compare and contrast different cultures throughout the world with your home culture. Identify and explain key differences and their influence on travel. 8. Identify and explain the key elements of interdependence required for the existence of modern day world travel. Credits: 3.00

HTM 38110 - Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management plays a vital role in guiding service businesses to allocate resources efficiently, understand customer behavior, stay competitive, and achieve long-term sustainability and profitability. This course provides students with the theoretical foundation and practical applications of revenue management in service industries. The course cultivates students' revenue optimization mindset and analytical skills. Students will have the opportunity to earn an industry-recognized certification.

Learning Outcomes: 1. Describe the evolution of revenue management in lodging business. 2. Explain commonly used terms in revenue management. 3. Describe the duties and responsibilities of the hotel revenue manager. 4. Demonstrate knowledge of common revenue management activities. 5. Apply the concepts of constrained capacity, market segmentation, and differential pricing when setting prices. 6. Forecast demand. 7. Explain the trade-off between dilution and spoilage when allocating capacity. 8. Set Booking limits with overbooking policies. 9. Explain the role of distribution channels in market competition. 10. Apply revenue management fundamentals to other areas of lodging business such as to food and beverage and meeting and events in hotels. 11. Differentiate between ethical and unethical practices in revenue management. 12. Identify latest technologies used in revenue management. 13. Discuss contemporary issues affecting revenue management." Credits: 3.00

HTM 38600 - Fundamentals Of Hotel Asset Management

Credit Hours: 3.00. The value of a hotel is based on both its operation and the real estate holding. A successful manager needs to understand the relationship between operations and the management of the real estate asset. Hotel asset management involves overseeing operating performance and real estate planning with the goal of achieving long-term profitability and enhancing the value of the hotel property. This course will introduce students to the principles and practices of hotel asset management including real estate management,

contracts, as well as the planning and execution of hotel investments. Students with an interest in hospitality finance and real estate investment are encouraged to take graduate-level courses in this area and explore the finance and real estate minors following the successful completion of this course.

Learning Outcomes: 1. Explain the foundations and process of asset management. 2. Identify the key issues related to planning and managing real estate and physical assets. 3. Analyze the effects of contracts on hotel operations and asset value. 4. Apply financial theories and concepts in planning and executing hotel investments. Credits: 3.00

HTM 39000 - Undergraduate Special Problems

Credit Hours: 0.00 to 6.00. Individual or group participation in supervised reading, laboratory experiences, field experiences, or research in special areas of the field. Permission of instructor required.

Credits: 0.00 to 6.00

HTM 39001 - Undergraduate Research In Hospitality And Tourism Management

Credit Hours: 1.00 to 3.00. This course allows undergraduate students to gain valuable experience and knowledge through research in the hospitality and tourism industry. Permission of instructor required.

Learning Outcomes: 1. Demonstrate a basic understanding of research by participating in a research project under the supervision and guidance of a HTM faculty member. Credits: 1.00 to 3.00

HTM 39200 - Classical Cuisine

Credit Hours: 1.00. Supervised hands-on cooking experience to enhance competencies needed in professional cooking. Permission of instructor required.

Credits: 1.00

HTM 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for CFS Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Credits: 1.00 to 3.00

HTM 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an international experience that is recognized by the University.

Credits: 1.00 to 6.00

HTM 39900 - Special Topics In HTM

Credit Hours: 1.00 to 6.00. Various topics that may change from semester to semester are presented by HTM faculty.

Credits: 1.00 to 6.00

HTM 40000 - Career Mastery: Navigating Your Career And Professional Development Seminar

Credit Hours: 1.00. Successful professionals possess a strong sense of self and the ability to observe the world around them, reflecting, synthesizing, and responding effectively. As the capstone to the professional development curriculum, students have the ability to refine these skills through discussion and reflection in this seminar-style course. Guided by the National Association of Colleges and Employers (NACE) Career Readiness Competencies, this course focuses on honing various aspects of personal and professional development, with a focus on contemporary issues in the workplace, ensuring students are prepared to be effective leaders. Students will be confident, proactive, and well-prepared professionals with a mindset required to successfully transition into the professional world.

Learning Outcomes: 1. Demonstrate a strong sense of professional self-awareness, leadership competencies, and areas for future development. 2. Refine personal brand that best positions self in the competitive job market. 3. Critique complex workplace issues to formulate effective leadership strategies. 4. Formulate a career plan trajectory to achieve identified career goals post-graduation. Credits: 1.00

HTM 40200 - Hospitality And Tourism Industry Internship II

Credit Hours: 1.00. Career development is an ongoing process of refinement and reflection of professional aspirations as one moves along their career path accumulating work experience. As part of the professional development curriculum, and building on the HTM 30200 entry-level internship experience, this course provides students with a graduate-ready experience in their chosen field, focusing on leadership skill development. Through hands-on experiences and guided learning, students gain real-world professional experience while refining their leadership abilities. Students reflect on their performance to foster personal growth in preparedness for careers post-graduation.

Learning Outcomes: 1. Apply theoretical knowledge gained in the classroom to the workplace. 2. Practice career readiness competencies as defined by National Association of Colleges and Employers (NACE) to entry-level management experience. 3. Demonstrate proficiency in effective leadership skills and styles relevant to an entry-level management position. 4. Assess leadership skill

development and strengths through self-reflection. Credits: 1.00

HTM 41100 - Hospitality And Tourism Law

Credit Hours: 3.00. Legal issues can damage or even destroy businesses. The primary goal of this course is to educate students to identify behaviors and situations that are likely to result in legal liability for themselves and their operation. By identifying potential legal liabilities, students will be able to develop strategies to reduce their exposure and better determine when to involve a lawyer. Topics include court procedures, civil rights, contracts, negligence, legal and ethical relationships with patrons, employment law, real estate law, ethics, and risk management. Students will use critical thinking and effective problem-solving to analyze cases and determine potential ways to reduce the likelihood of similar legal problems in the future.

Learning Outcomes: 1. Discuss the framework of the legal system and how a case progresses. 2. Analyze legal and ethical standards for hospitality and tourism enterprises including interactions with guests, other patrons, tenants, suppliers, and employees to determine potential consequences if they have not been met. 3. Analyze torts impacting hospitality and tourism enterprises and describe their legal impacts. 4. Describe the dynamics of risk management and develop strategies to mitigate losses. Credits: 3.00

HTM 42200 - Hospitality Facilities Design And Management

Credit Hours: 3.00. The facility is the largest asset for most hospitality operations and profoundly impacts guest experience. How it is designed and managed can be the difference between operational success and failure. The primary goal of this course is to foster student understanding of facility design and physical plant maintenance. Students will learn standard language and concepts along with problem-solving and project management techniques to enable cost-effective decisions in creating a physical environment that maximizes the guest experience.

Learning Outcomes: 1. Explain how systems within a facility function and are maintained in a cost-effective, environmentally friendly manner that meets regulatory requirements and promotes a welcoming, safe environment for employees and guests. 2. Analyze a wide range of facility design and physical plant problems and improvement opportunities to develop cost-effective solutions using systematic problem-solving techniques. 3. Apply standard project management tools and techniques to design a hospitality facility space, including physical plant elements, that promotes a positive guest experience that is ergonomically friendly to guests and employees. Credits: 3.00

HTM 43600 - Customer-Centric Service Design And Management

Credit Hours: 3.00. This course explores and informs the design, management, and innovative strategies of customer-centric firms through the theoretical and empirical services management literature. The course uses conceptual frameworks and cases from a variety of industry sectors.

Learning Outcomes: 1. Describe and apply basic service management principles. 2. Identify strategies that satisfy both customer needs and business performance. 3. Create a service blueprint and use it to inform service design or redesign. 4. Explain how service management differs from customer service. 5. Perform a service audit. 6. Design service strategies. 7. Describe how to develop a service centric culture. 8. Develop strategies that optimize tangible and intangible returns on service excellence. Credits: 3.00

HTM 44100 - Financial Management For The Hospitality Industry

Credit Hours: 3.00. This course deals with subjects and issues facing a financial manager in the hospitality and tourism industry. The primary purposes of this course are to understand the role of financial management, to learn analytic concepts and managerial tools for making capital investment decisions and to become familiar with major financial instruments and concepts such as time value of money, risk-return, capital budgeting, cost of capital, capital structure.

Learning Outcomes: 1. Identify financial management roles and describe the agency problem in hospitality and tourism businesses. 2. Explain financial statements and perform financial statement analysis. 3. Utilize financial concepts/tools such as the time value of money. 4. Apply applicable capital budgeting techniques to the hospitality and tourism industry. Determine initial investment cash flows. 5.

Explain the concepts of risk/return, and risk preference, investment portfolio, and the Capital Asset Pricing Model (CAPM). 6. Explain the cost of capital concept, cost of debt and stock, weighted average cost of capital, and marginal cost and investment decisions. 7. Explain a firm's capital structure and describe how to choose optimal capital structure. 8. Explain dividend fundamentals and describe factors affecting dividend policy. 9. Describe interest rates, bond valuation, and stock valuation.
Credits: 3.00

HTM 44300 - Hospitality Operations Control And Analysis

Credit Hours: 3.00. To be successful, a business must maximize revenue and efficiently control costs. This course will equip students with the knowledge and skills needed to plan, analyze, and control service operations. Students will learn essential managerial skills such as establishing operational standards, forecasting sales, budgeting, controlling, and evaluating performance throughout the product cycle.

Learning Outcomes: 1. Identify and monitor operational standards at each stage of the product cycle. 2. Analyze financial statements to identify the strengths and weaknesses of a business. 3. Make business decisions based on the cost structure and business environment. 4. Forecast future demand based on historical and advanced booking data. 5. Develop operational plans and incorporate in operations budgeting.
Credits: 3.00

HTM 46200 - Advanced Event And Meeting Management

Credit Hours: 3.00. Advanced aspects of meeting and event management principles and practices will be covered in this course. A focus is placed on: strategic planning, project management, finance and risk management, event design, site management, and ethics.

Learning Outcomes: 1. Formulate mission, goals and objectives to ensure effective meeting management and monitor and evaluate activities to ensure they meet desired outcomes and contribute to event effectiveness and sustainability. 2. Management meeting or event to achieve mission, goals and quality standards within the meeting's scope, time and budget. 3. Prepare and determine program components and sequence; development selection criteria for, negotiate and execute contracts for speakers; determine food and beverage requirements; design environment (themes and decor) and requirements for staging and technical equipment and production; develop admittance credential systems and related crowd management control systems. 4. Develop, monitor and revise project budget; monitor revenue streams and cash flow; make ongoing effective decisions and wise resource allocations; manage registration processes. 5. Identify and analyze risks for a specific meeting. 6. Develop and implement risk management plans to reduce the probability and impact of undesirable situations. 7. Differentiate between ethical and non-ethical business practices.
Credits: 3.00

HTM 49000 - Independent Study

Credit Hours: 1.00 to 4.00. Independent study. Permission of instructor required.

Credits: 1.00 to 4.00

HTM 49110 - Wine Sommelier Certification

Credit Hours: 1.00. This course involves the application of previously learned information about the principles of wine including vine growing, wine production, sensory evaluation of wine and practices involved in selection and sales of wine in a foodservice establishment. Students are immersed in the analysis and application of the principles and practices of the Guild of the Master Sommelier Program including Level one Certification. Student must be at least 21 years of age.

Learning Outcomes: 1. Describe the historical role of the wine sommelier and the purpose of the International Guild of the Master Sommelier. 2. Identify the major global wine producing regions in terms of Terroir, wine grape growing and wine making practices and traditions specifying whether the region is an Old World or New World area. 3. Identify wine production methods, quality standards, merchandising and pairing with food items for any given wine product. 4. Identify, describe and apply the

Guild of the Master Sommelier Wine Evaluation process to specific wine types. 5. Identify and describe (given a specific wine producing region) the quality control system for that region or area and the wine production factors that are controlled through those regulations; a representative wine for each specific wine producing sub-region and/or district of that region, and specific production steps and wine production terms for the wine produced there. Credits: 1.00

HTM 49111 - Beverage Operation Management

Credit Hours: 1.00. This course teaches students the historical background and modern day principles and management practices regarding the production, selection, purchasing, storage, and service of beverage alcohol in all aspects of the hospitality industry. Students must pass the ServSafe Responsible Service of Alcohol certification examination to earn course credit.

Learning Outcomes: 1. Describe the historical role of alcoholic beverages and the beverage operation in our society. 2. Describe and explain the strategies involved in management of a modern day operation selling beverage alcohol including the design and layout of the operation. 3. Identify the components necessary to manage a successful beverage operation, including purchasing, distribution, and security of beverage alcohol; cost control and pricing strategies; maintaining and controlling inventory. 4. Identify and describe how legal, ethical and social responsibilities impact the management of a beverage alcohol operation. 5. Identify, describe and apply the principles, policies and actions necessary to serve beverage alcohol in a responsible manner. 6. Identify the role of marketing and merchandising in the overall management of a beverage operation. Credits: 1.00

HTM 49112 - Management And Service Of Beverage Alcohol

Credit Hours: 2.00. This course introduces the principles and practices associated with the production of beverage alcohol in the hospitality industry. Lectures and structured tastings will guide students in identifying and describing the unique characteristics of fermented beverages commonly found in the hospitality industry. Course fee. Students will be tasting alcohol as part of this course, they need to be at least 21 years of age to do so legally. Department permission required.

Learning Outcomes: 1. Identify and describe the categories of beverage alcohols including spirits, wine, beer, and ale including the factors involved in the fermentation and distillation of beverage alcohols. 2. Describe and explain the major global wine producing regions and production practices, product varieties, characteristic flavors, service styles, and appropriate food pairings associated with wine. 3. Identify and describe the agricultural principles associated with viticulture, such as geography, climate, harvesting, and dominant grape varietals, and their impact on wine production. 4. Describe and explain regional differences in the labeling of wine. 5. Identify and describe the specific factors unique to wine, through structured tastings. 6. Describe and explain the production methods, styles and characteristics associated with the production of beers, ciders, ales, and distilled beverage alcohols. 7. Identify and describe the specific factors unique to beer, ciders and ales, through structured tastings. 8. Identify and describe the specific factors unique to distilled beverage alcohols, through structured tastings. Credits: 2.00

HTM 49200 - Advanced Foodservice Management

Credit Hours: 4.00. Utilize managerial skills and techniques with planning, organizing, directing and controlling a full-service restaurant operation. Management teams of two to three students develop, market, and operate a restaurant that is open to the public. Emphasis is placed on utilizing effective management skills to create a high-quality, profitable operation with well planned systems and highly motivated, organized employees.

Learning Outcomes: 1. Identify and apply the principles of idea generation and brainstorming in the development of a restaurant concept; demonstrate the ability to design a menu and

marketing campaign responsive to the economic and aesthetic requirements of the concept. 2. Demonstrate the ability to forecast production schedules and staffing needs; explain and demonstrate the ability to work cohesively in a team environment, and demonstrate an appropriate level of professional supervision of a restaurant concept. 3. Apply principles of production flow and timing; demonstrate facility and equipment operation and maintenance and demonstrate competency in utilizing a POS system in the current restaurant concept. 4. Apply principles of purchasing and selection of materials; product storage and rotation and service quality appropriate to the current restaurant concept. 5. Demonstrate the ability to analyze and effectively decrease food costs and increase contribution margins to the current restaurant concept. 6. Identify and apply principles of safety and sanitation (in accordance with Indiana law), and principles of quality food production and wine service to the current restaurant concept. 7. Describe and apply an appropriate ethical standard of conduct in dealings with customers, staff, fellow students and instructors in all parts of the lab and classroom experience. Credits: 4.00

HTM 49201 - Hospitality Operation Management And Leadership

Credit Hours: 4.00. Students apply managerial skills and techniques in organizing, directing and controlling a full-service restaurant operation as they rotate through a variety of managerial positions. Students will also participate in lectures, assignments, and projects on topics related to leadership, such as interpersonal communications (emphasis on culture, gender and age differences), ethical leadership (emphasis on integrity and credibility), public speaking, teamwork and critical thinking. Permission of department required.

Learning Outcomes: 1. Design and implement a marketing campaign targeting one or more of the food service operations. 2. Work cohesively in a team environment, and demonstrate an appropriate level of professional supervision of a restaurant. 3. Coordinate production flow and sequence of service to maximize service quality. 4. Demonstrate facility and equipment operation and maintenance in the restaurant. 5. Apply principles of purchasing and selection of materials, product storage, and rotation appropriate to the restaurant. 6. Identify and apply principles of food safety and sanitation, responsible alcohol service, and quality food production in the restaurant. 7. Describe and apply appropriate ethical standards in dealings with customers, staff, fellow students and instructors in all parts of the lab and classroom experience. 8. Demonstrate the ability to analyze and effectively decrease food costs and increase contribution margins to the current restaurant concept. 9. Compare and contrast issues associated with leading employees from different cultures, ages and genders. 10. Practice interpersonal communication skills by delegating, coaching, and presenting feedback. 11. Evaluate leadership issues in terms of ethics, integrity, and credibility. Credits: 4.00

HTM 49700 - Honors Research Project

Credit Hours: 1.00 to 4.00. The completion of the independent honors research project for CFS Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Credits: 1.00 to 4.00

HTM 49900 - Feasibility Studies And Business Development In Hospitality And Tourism

Credit Hours: 3.00. The study of business development. The course will cover all stages in the feasibility and development process. Emphasis will be on strategic planning, design of systems, models and problem analysis, leading to the opening of a successful hospitality or tourism business.

Learning Outcomes: 1. Review, prepare and present the various components that are involved in a feasibility study. 2. Assess the various aspects of and create a situational/operational analysis for a hospitality or tourism operation. 3. Explain the various perspectives and operations philosophies. 4. Assess various management and operations

philosophies. 5. Analyze and evaluate project planning and project management activities from conceptualization to completion. 6. Evaluate between ethical and unethical behaviors on the parts of individuals when preparing and presenting feasibility studies to potential investors and interested others. Credits: 3.00

HTM 49901 - Strategic Management In Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. By analyzing internal and external forces, students develop strategies to help a service organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy development and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of a service organization. The course is structured to enhance students' analytical, critical thinking, and communication skills by integrating their academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Integrate and apply prior knowledge areas from the HTM curriculum in developing a business. 2. Develop and analyze the feasibility, situational, and operational aspects of a hospitality and tourism business. 3. Select and implement an appropriate business model in development of a business plan. 4. Describe the characteristics of a successful business and apply that knowledge to mitigate situational and operational risks. 5. Evaluate between ethical and unethical behaviors on the parts of individuals when preparing and presenting a business development plan to potential stakeholders. 6. Prepare and present a business development plan. Credits: 3.00

HTM 50100 - Research Methods In Hospitality And Tourism

Credit Hours: 3.00. Introduction to behavioral and economic research design, and the development of research proposals.

Credits: 3.00

HTM 50101 - Statistical Laboratory

Credit Hours: 1.00. Introduction to the use of software used in behavioral research projects.

Credits: 1.00

HTM 50200 - Management Information Systems For The Hospitality Industry

Credit Hours: 3.00. Analysis and design of management information systems for hotels, restaurants, and the travel industry. Topics include cost and value information, data management, local area and wide area networks, implementation of system and impact of information systems on hospitality organizations.

Credits: 3.00

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating customer satisfaction, engagement, and enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

HTM 50500 - Hotel Asset Management & Investment

Credit Hours: 3.00. Asset management is an indispensable discipline in the hospitality industry, aimed at maximizing the value of hotel properties in alignment with the owners' and investors' strategic objectives. A competent manager in the industry needs to possess basic understanding of asset management principles and practices for operational and strategic decisions. This course exposes students to the multifaceted world of representing ownership interests in managing hotel investments, and helps students to establish a

robust corporate finance foundation to become a competent manager in the industry. Through this course, students develop a nuanced understanding of the intricate interplay among operational issues, real estate management, and financial decisions, and effectively apply the learned knowledge to hotel real estate investment and operation strategies.

Learning Outcomes: 1. Describe the role of an asset manager in the dynamic relationships among various hotel investment stakeholders. 2. Analyze the impacts of operational decisions, such as revenue management, leases, management contract, and franchise agreement, on asset valuation. 3. Explain the effects of development and management of physical assets on hotel operations and valuation. 4. Compare and apply various hotel valuation approaches. 5. Evaluate the effects of capital structure decisions on hotel investment returns. Credits: 3.00

HTM 50600 - Leading People In Service Industries

Credit Hours: 3.00. Leadership requires an understanding of human behavior, organizational culture, and strategy. In this class, students are exposed to leadership theory through the extant literature. Facilitated by readings and class discussion, students develop critical and analytical understanding of how theory informs and connects to practice. The course topics include human resources functions, organizational and human behavior, human values and motivations, team dynamics, decision-making, and change management. This course takes an interdisciplinary approach, with student learning drawn from different fields.

Learning Outcomes: 1. Understand the role of leadership in successful organizations. 2. Explain how human resource practices contribute to organizational effectiveness. 3. Analyze theories and practices in human resources, organizational behaviors, and leadership. 4. Connect leadership theories to organizational practices. 5. Synthesize different theoretical perspectives within/across service industries. Credits: 3.00

HTM 50700 - Integrated Marketing Communications For Service Industries

Credit Hours: 3.00. This course addresses the unique challenges and opportunities in marketing the intangible, inseparable, variable, and perishable service products. Balancing theoretical research and practical applications, this course provides a systematic review of key components and processes for an effective integrated marketing communication for service industries. Students will learn how to leverage both long-standing and emerging marketing communication approaches (e.g., strategic marketing and promotion, branding, public relations, digital marketing, social media, influencer marketing and artificial intelligence application) to create customer awareness, manage customer expectations, build customer relationships, and ensure customer satisfaction and loyalty.

Learning Outcomes: 1. Evaluate the role of marketing communications in achieving success for service organizations. 2. Identify critical metrics to understand customer expectations and manage customer perceptions. 3. Apply customer-centric approach to leverage various marketing communication methods and tools to meet customer needs, wants and demands. 4. Develop, promote, and manage service promises through both external and internal marketing. Credits: 3.00

HTM 50800 - Cultivating A Service Excellence Mindset

Credit Hours: 3.00. Understanding the fundamental principles of service management is essential to successfully manage service organizations in a complex market environment. This course utilizes major theoretical frameworks, such as Service-Dominant Logic, to address key issues in managing service organizations, including creating service culture, motivating a service-minded workforce, co-creating service value, and achieving service excellence. Students develop managerial skills through a thorough understanding of service strategies, systems, and processes to optimize service value.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the service experience. 2. Explain the critical role of managing the employee-customer interface in the service delivery process. 3. Evaluate various service management strategies to enhance service excellence. 4. Construct key service management systems and processes to solve issues in complex service environments. Credits: 3.00

HTM 50900 - Service Experience Design

Credit Hours: 3.00. The success of service organizations requires well-planned design of the service environment and customer experience journey to enhance operational efficiency

and excellence, drive customer satisfaction and loyalty, and differentiate from competitors. Addressing the importance of developing and providing optimal customer experience in service industries, this course aims to inspire a design-thinking approach to create contemporary customer experiences in various service settings. By gaining insights from the service design theories, students will gain knowledge to effectively manage the physical environment, service interactions, and service delivery processes to enhance the overall service experience quality. Learning by practice, students will apply the learned design tools to envisage, blueprint, and devise innovative service experience solutions.

Learning Outcomes: 1. Articulate the role of service experience design for the strategic success of service organizations in the marketplace. 2. Conduct critical quantitative and qualitative analyses of customer service experience. 3. Design service experiences for customers by utilizing various experience design tools. 4. Communicate the service design process to service industry professionals and relevant stakeholders. Credits: 3.00

HTM 51000 - Strategic Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management is a vital strategic tool enabling decision-makers to coordinate various functions leading to company-wide profit maximization. This course empowers students with analytical tools to generate optimal revenue solutions in a competitive marketplace. In the course, students learn economics of pricing and market competition, models and algorithms for capacity allocation, overbooking, and forecasting through a variety of real-world contexts.

Learning Outcomes: 1. Solve for optimal prices given capacity constraints and market segmentation. 2. Calculate optimal protection and overbooking levels. 3. Forecast demand based on time series models and advanced booking models. 4. Formulate strategies to manage consumer responses to revenue management practices across various service industries. 5. Address challenges in revenue management implementation in service industries. Credits: 3.00

HTM 51100 - Hospitality Business Law And Risk Management

Credit Hours: 3.00. This course provides an overview and analysis of the legal aspects of managing a hospitality and tourism business. Risk management principles will be utilized to develop liability mitigation plans. Discussion board and case studies will be utilized to facilitate students' understanding and application of legal concepts for managing and owning businesses. Topics covered include: the rights and responsibilities of hospitality businesses and owners in the areas of civil rights, employment law, negligence, contract law, relationships with guests and others, licensing, real estate law, and product liability; the principles of risk management; and the fundamentals of business insurance.

Learning Outcomes: 1. Apply basic legal principles to evaluate a situation and determine the most likely legal outcome then use the principles of risk management to create a corrective plan to reduce liability. 2. Describe legal and ethical relationships standards for interactions with guests, other patrons, tenants, suppliers, and employees. 3. Determine if legal and ethical relationship standards have been breached and what liability if any is faced by each party. 4. Utilize the dynamics of risk management to develop a comprehensive risk management plan for a hospitality and tourism operation. 5. Describe and define the different types of insurance options available to hospitality and tourism operations and define why and how certain insurance options are applicable to specific operations. Credits: 3.00

HTM 51200 - EXPIRED - Leadership In Hospitality And Tourism

Credit Hours: 3.00. This course will focus on the knowledge and skills required for effective leadership. Topics will draw upon an extensive body of research on leadership theory and practice and cover organizational behavior and team dynamics, business communication, decision-making, motivation and change management. In addition, specific skill development in the areas of problem-solving, written and oral communications, leading teams and goal setting, it will include models for examining personal career paths, ethical decision-making and the role or organizational change agents. This course will take an interdisciplinary approach and analyze leadership through different lenses and how leadership insights can be effectively applied to hospitality organizations. Students will examine leadership examples where individuals moved an organization from normal to exceptional functioning and extraordinary results.

Learning Outcomes: 1. Apply knowledge of organization behavior, including the impacts of

personality, motivation, and emotional intelligence, to leadership situations in a hospitality business. 2. Evaluate and apply leadership theories and approaches to business situations. 3. Practice effective team building within hospitality organizations. 4. Prepare and deliver effective business communication in a variety of settings (written and oral). 5. Implement change processes within organizations and lead change management. 6. Explain how leadership values and ethics effect the overall functioning of the organization, and perform an ethical evaluation of leaders' behaviors. 7. Apply self-analysis techniques to develop a personal leadership development plan to guide them throughout their careers. Credits: 3.00

HTM 51300 - Strategy In Service Industries

Credit Hours: 3.00. Strategic management plays a pivotal role in helping industry leaders gain a competitive advantage and accomplish business goals in an ever-changing marketplace. This course centers on the exploration of various theories, frameworks, and models to understand contemporary issues and challenges in service industries. Through the application of strategic management principles and strategy-oriented tasks, students comprehend essential topics in strategic management, including environmental and competitor analysis, strategic planning, strategy formulation, strategy execution, and strategic evaluation and control.

Learning Outcomes: 1. Articulate the theoretical principles and tactical practices in strategy management. 2. Analyze external and internal factors to effectively manage service organizations. 3. Evaluate the strategic planning process for service organizations. 4. Apply strategic theories, frameworks, and models to management practices in service organizations. Credits: 3.00

HTM 51400 - Business Analytics For Service Industries

Credit Hours: 3.00. In today's highly dynamic business environment, decision-makers often encounter problems that are complex and data intensive. This course focuses on a variety of techniques from the field of business statistics and exposes students to statistical and decision analytics to solve data-driven decision-making problems. The course adopts a practical spreadsheet-based approach to facilitate decision-making and explores the practical applications of these techniques across various functional fields, with a specific focus on service industries.

Learning Outcomes: 1. Identify and evaluate managerial problems requiring data-based decision-making. 2. Apply quantitative methods to model and analyze real-world situations. 3. Employ analytic software tools to solve problems from various functional fields. 4. Communicate solutions and managerial implications across different stakeholders. Credits: 3.00

HTM 53100 - Hospitality And Tourism Marketing II

Credit Hours: 3.00. This course will examine marketing strategy in tourism and hospitality organizations. Students will actively engage in the application, analysis, and evaluation of marketing principles as they are applied to tourism and hospitality.

Learning Outcomes: 1. Define marketing strategy and describe its use in the hospitality industry. 2. Detail the components of marketing strategy and marketing plan for a hospitality and tourism organization. 3. Evaluate the strengths and weaknesses of hospitality or tourism organization's marketing strategy and plan. 4. Evaluate metrics designed to measure marketing strategy effectiveness. 5. Explain the major market trends in the hospitality industry. 6. Distinguish between major marketing research techniques and explain their advantages and disadvantages. Credits: 3.00

HTM 53600 - EXPIRED - Advanced Service Management In Hospitality And Tourism

Credit Hours: 3.00. Approximately two-thirds of U.S. economic activity resides in the service sector. Subsequently, service firms' foci on the needs of their customers are rewarded by positive customer outcomes such as behavioral loyalty and positive word of mouth. This course explores and informs the design, management, and innovative service strategies of firms who operate in the service sector through the theoretical and empirical services management literature.

Learning Outcomes: 1. Describe and apply basic service management principles. 2. Understand how to determine customer needs and simultaneously manage business

performance. 3. Create a service blueprint and use it to inform service design or redesign. 4. Identify excellence in service from a variety of sectors across the globe. 5. Describe and apply basic service management principles. 6. Distinguish service management from customer service principles. 7. Perform a service audit for an organization. 8. Design sustainable service strategies and approaches. 9. Understand the mechanisms necessary in developing a service culture. 10. Craft the necessary elements in funding service excellence. Credits: 3.00

HTM 54100 - Advanced Hospitality Accounting And Finance Systems

Credit Hours: 3.00. Specialized accounting and finance systems as related to the hospitality industries. Applications of budgeting and pricing models, performance evaluations and incentives systems, and short-term asset management are discussed, as well as other current subjects.

Learning Outcomes: 1. Interpret and analyze financial statements. 2. Calculate present value and future value of multiple cash flows. 3. Value assets based on the discounted cash flow method. 4. Utilize capital budgeting techniques. 5. Understand the concepts of risk, return, and cost of capital. 6. Describe capital structure theories. 7. Describe the relationship between economy and hospitality businesses. 8. Explain the concept of diversification. 9. Calculate the present value of a franchise and a leasing contract. Credits: 3.00

HTM 55300 - Cultivating A Service Excellence Mindset For Healthcare Professionals

Credit Hours: 3.00. Notwithstanding the importance for healthcare services to prioritize clinical outcomes for patients, there is a growing need to think about the patient experience beyond science-driven, evidence-based practices. The healthcare sector is being transformed by consumerism and transparency that demands a more holistic approach to managing the patient experience. In order to promote patient engagement and to enhance their experience, an intentional strategic intent, as reflected in a service excellence mindset, is required. This course seeks to establish the foundation of this mindset for healthcare professionals that are driven to make a difference in their patients' lives. The aim of the course is for students to develop a greater appreciation for the complexity of providing excellent service in the healthcare industry. The course will stimulate students to think differently and more deeply about the patient experience through a service management lens. In doing so they will develop the necessary skills to make effective decisions in the constantly changing patient experience landscape. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the patient experience (patient expectations, drivers of satisfaction, service quality measurement, creating a service culture). 2. Examine the critical role of managing the employee-patient interface in delivering patient-centric services. 3. Recognize and evaluate various service management practices to enhance the patient experience. 4. Recommend key service management systems and practices to improve or solve problems in the complex healthcare environment. Credits: 3.00

HTM 55400 - Designing The Patient Experience For Contemporary Healthcare Systems

Credit Hours: 3.00. In the rapidly evolving healthcare industry, optimizing the patient experience remains a fundamental focus of practice. Addressing the practical challenge and complexity of providing excellent healthcare services, this class aims to inspire a design-thinking approach to reimagine and reinvent the patient experience in the contemporary healthcare systems. Learning by practice, students will apply the design tools to envisage, blueprint, and devise a patient experience solution. Gaining insights on experience-centric innovations in the healthcare domain, students will develop capabilities to better manage the service interactions, facility, and processes to enhance the quality of the patient experience and ease the stress of a hospital stay. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the role of experience design for healthcare organizations' strategic success in the contemporary market environment. 2. Conduct critical quantitative and qualitative analysis of the healthcare service experience. 3. Apply various experience design tools to innovatively design healthcare service experiences for the relevant stakeholders (e.g., patients, service providers). 4. Communicate

effectively the design product in both written and verbal manners to healthcare professionals. Credits: 3.00

HTM 55500 - Investing In Healthcare Human Capital

Credit Hours: 3.00. The modern work environment is increasingly focused on working with people in teams - working with people and for people. In seeking to motivate and lead people, it is imperative to acknowledge individuals have different backgrounds, perspectives, and viewpoints. In successfully balancing the challenges of working with people in the labor intensive, diverse and high-stakes nature of the healthcare industry, this class seeks to provide knowledge on organizational behavior concepts (e.g., employee performance, satisfaction, engagement, and motivation; group behavior, teamwork; emotional labor, stress, work-life balance) and the skills to practice this knowledge as a healthcare professional. This course will provide students with the foundational building blocks to adapt to the changing landscape of the work environment, applying theories and exercising critical thinking skills to realize a transformative healthcare workforce experience. Permission of the department required.

Learning Outcomes: 1. Demonstrate an understanding of knowledge, skills, and abilities (KSA's) needed by successful leaders in the healthcare industry. 2. Apply organizational behavior theories and the role of managers in the context of the healthcare work environment. 3. Evaluate the role of leadership and management of personnel - individuals, groups, and teams - within the healthcare industry. 4. Recommend various leadership and management practices to improve and provide solutions for issues in today's healthcare workforce. Credits: 3.00

HTM 57100 - Economics Of Travel And Tourism

Credit Hours: 3.00. This course includes the asset theory of tourism, cost-benefit analysis, tax policy impacts, and other economic and statistical aspects of tourism. The course will examine research designed to determine economic impacts of the hospitality and tourism industries.

Learning Outcomes: 1. Acquire an understanding of the economic aspects of tourism, including the definitions of tourism and the size, persuasiveness, and data available on the industry, both internationally and domestically. 2. Develop an understanding of the importance and impacts of tourism and the marketing segmentation, supply, demand, and monetary exchange rates that impact the economies of tourism destinations. 3. Develop working knowledge of the various issues, problems, forecasts and types of research common in the tourism industry to include economic impact analysis such as input output analysis and multipliers, forecasting models and other tools used to analyze the tourism industry. Credits: 3.00

HTM 58100 - Advanced Hotel Management

Credit Hours: 3.00. A study of current service management theories as they apply to hotel management. Theory topics include strategic planning, hotel organization and communication, organizational leadership, and control systems. Topics will be discussed from the viewpoint of the hotel's general manager.

Credits: 3.00

HTM 59000 - Problems In Hospitality And Tourism

Credit Hours: 1.00 to 4.00. Individual study in advanced subject areas. A course plan must be submitted to the supervising professor. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 4.00

HTM 59001 - Graduate Professional Industry Internship

Credit Hours: 1.00. The Graduate Professional Industry Internship allows graduate students to gain valuable experience through paid employment with a company in the hospitality and tourism industry or a related industry. In addition, each student will research an issue and provide a potential solution to a problem faced by the employer. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from Graduate Professional Industry Internship Coordinator is required to enroll in this course. Permission of instructor required.

Learning Outcomes: 1. Understand how to effectively manage a service industry business. 2. Develop critical thinking, creativity, and problem solving skills. Credits: 1.00

HTM 59002 - Graduate Professional Industry Research

Credit Hours: 3.00. The primary emphasis of the Graduate

Professional Industry Research is research on a relevant issue within the hospitality and tourism industry. To enhance the research project, it is anticipated that the research will typically be linked to a paid employment experience in the hospitality and tourism industry or a related industry. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 credit hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from the Graduate Professional Industry Research Coordinator is required to enroll in this course. Permission of department required.

Learning Outcomes: 1. Gain industry experience while applying research skills and techniques to address hospitality and tourism industry issues. Credits: 3.00

HTM 59100 - Research Issues In Food Service Management

Credit Hours: 3.00. The course will focus on research issues related to the food service industry and their short- and long-term implications. Topics will include essential issues in food safety, product development, food service consumer interests, food production, and waste management. Exposure to quantity food production and purchasing.

Credits: 3.00

HTM 60100 - Research Development And Design

Credit Hours: 3.00. This course will equip doctoral students to think like a scholar and develop the ability to design rigorous research. Students will learn research philosophy, research idea development, and the development and evaluation of research processes and methods. Emphases are placed on developing students' confidence in conceptualizing, developing, designing, and writing empirical and theoretical research.

Learning Outcomes: 1. Demonstrate an understanding of theoretical, methodological, and ethical issues inherent in conducting research. 2. Evaluate various research processes, methodologies, and recent trends. 3. Develop rigorous research ideas, translate ideas into theory-supported research questions, and formulate analytical strategies to best address research questions. Credits: 3.00

HTM 60200 - PhD Professional Development Seminar

Credit Hours: 1.00. The goals of this course are to (1) introduce and provide professional development resources, practices, and current trends in the areas of research, learning, and engagement, and (2) empower graduate students to pursue an academic career by developing a continuous growth mindset. Open to PhD students. No pre-requisite.

Learning Outcomes: 1. Explain the expectations for university faculty in research, learning, and engagement. 2. Create a career plan for the first five years as a university faculty. 3. List the resources and skills needed for a successful academic career in the long term. Credits: 1.00

HTM 61200 - HTM Management Challenge Analysis

Credit Hours: 3.00. A course designed to discuss specific management problems in the hospitality and tourism industries. Through the use of case studies, students study current challenges, management analysis, the process of decision-making, and the impacts of corporate decisions. Prerequisite: basic management organization class.

Learning Outcomes: 1. Gain exposure and knowledge of strategic management topics in preparation for graduate coursework, applied projects, and future research. 2. Critically consider and assess the merits and weaknesses of specific strategic management concepts and theories. 3. Develop analytical skills through tasks such as critical analysis and discussion of cases. Credits: 3.00

HTM 61400 - Theory Of The Consumer

Credit Hours: 3.00. This course will examine concepts and theories that have been developed for understanding consumer choices and behaviors in society and marketplaces. Students will learn classic and modern consumer theories, such as behavioral economics and applied psychological and sociological theories. It will discuss how these theories can help explain consumer tendencies such as preferences, choices, and other consumption-related behaviors.

Learning Outcomes: 1. Demonstrate an understanding of the scope of consumer theory literature. 2. Evaluate the consumer theories and their implications in society and marketplaces. 3. Apply theories of consumer behavior to research. Credits: 3.00

HTM 61500 - Theory Of The Firm

Credit Hours: 3.00. In this course, students examine concepts, models, and theories developed for the understanding of firm and organizational behavior. This course equips students with knowledge of classic and contemporary theories, such as those related to managerial economics, pricing and price

discrimination, organizational structure and culture, employee productivity, firm financial behaviors, marketing management, and operations management.

Learning Outcomes: 1. Demonstrate a foundational understanding of the scope of firm-theory literature. 2. Apply firm theory to research. 3. Analyze and synthesize firm theories with other leading or discipline-specific theories. Credits: 3.00

HTM 63100 - Strategic Marketing In Hospitality And Tourism

Credit Hours: 3.00. Evaluates the role of marketing strategy within overall corporate strategic planning. Segmentation theory, brand segmentation, niche marketing, program life cycles, and positioning approaches are discussed. Emerging concepts, such as visioning, relationship marketing, strategic alliances, and database marketing are studied. Prerequisite: HTM 53100 .

Credits: 3.00

HTM 64200 - Advanced Personnel Systems In Restaurants, Hotels, And Institutions

Credit Hours: 3.00. Examination of the philosophical and operational alternatives related to establishing and directing human resource systems in complex restaurant, hotel, and institutional organizations. Prerequisite: HTM 34100, 41100; 6 credit hours at the upper division undergraduate level in Business, Management, Marketing.

Learning Outcomes: 1. List leading issues impacting human resource management in hospitality businesses nationally and globally. 2. Suggest appropriate business responses to those HR issues. 3. Explain the role of the human resource office at the corporate level in multi-unit hospitality companies. 4. Craft strategies that would successfully recruit, select, train, develop, compensate and manage the performance of assignees working in multi-unit hospitality businesses. 5. Develop strategies that would sustain a hospitality business' corporate culture across national and international borders. 6. Describe ways used by large multi-unit hospitality companies to effectively communicate and engage its subsidiaries. Credits: 3.00

HTM 68100 - Seminar On Hospitality And Service Business Research

Credit Hours: 3.00. This seminar focuses on contemporary topics in hospitality and service business research and guides students to produce work that meets the standards of top-tier journals. Key topics include corporate strategy, consumer behavior, branding, marketing, human resource management, and the application of big data and technology. Through classroom discussions and research project development, students will critique existing literature, formulate research problems, and develop a theoretically robust and methodologically sound research, with a focus on solving real-world problems in hospitality and service industries.

Learning Outcomes: 1. Identify research gaps in the hospitality and service business literature and formulate research questions to address these gaps. 2. Evaluate various quantitative and qualitative research methodologies to determine their appropriateness for addressing the research questions. 3. Compile insights from corporate strategy, consumer behavior, and technology applications to develop comprehensive research frameworks. 4. Create a research project that is theoretically robust and methodologically sound to meet the standards of top-tier journals. Credits: 3.00

HTM 69000 - Hospitality And Tourism Research Problems

Credit Hours: 1.00 to 4.00. Development of an individual research project for doctoral students. Projects are designed to broaden understanding of specific research techniques or to add to subject matter knowledge necessary for completion of the doctoral thesis. A paper worthy of submission to a refereed journal is expected upon project completion. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 4.00

HTM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

HTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

Human Development and Family Science

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 22500 - Human Development Across Cultures

Credit Hours: 3.00. This course provides a basis for interdisciplinary exploration of cross-cultural human development and family relations throughout the lifespan. Key topics include international variation in cultural understandings of parent-child relationships, gender roles, education, work, social relationships, and health/wellness. Students will explore professional applications in an increasingly globalized world.

Learning Outcomes: 1. Understand and respect the diversity of children, youth and families around the world. 2. Identify how family values and traditions vary across cultures and how these variations have emerged within broader ecologies (e.g., economics, treaties, history) of the culture. 3. Articulate processes of intergenerational transmission of culture with a particular focus on parent-child relationships. 4. Compare and contrast various cultural responses to issues important to children and families, such as conceptions of childhood, gender roles, education, and work-family relationships. 5. Describe how individual characteristics such as friendship, altruism, leadership, academic achievement, delinquency, conflict management, aggression, and morality vary across cultures. 6. Analyze the reasons for migration and immigration and their impacts on children and families. 7. Develop skills for working across cultures,

including cross-cultural communication and adapting to culture contrasts when interacting with those from a culture different from one's own. Credits: 3.00

HDFS 26000 - Young Children With Exceptional Needs

Credit Hours: 3.00. A broad overview of learner characteristics and service delivery models for young children (birth-8 years) who are at-risk or have identified disabilities. Students gain understanding of disabilities in young children, of laws relating to persons with disabilities, and roles of special and general educators in providing services to students with identified disabilities.

Learning Outcomes: 1. The student will demonstrate knowledge of: (a) Philosophical, historical, and legal foundations of special education. (b) How principles of development, motivation, behavioral and cognitive learning theories are related to learner differences. (c) Characteristics of learners with exceptionalities, including individual and group diversity that may impact learning. (d) Issues related to environmental and personal barriers that hinder accessibility and acceptance of persons with disabilities and their families. (e) Applicable laws, rules and regulations, and procedural safeguards regarding the planning and implementation of early children special education interventions, including management of behaviors, of children with special learning needs. (f) Issues related to teacher professionalism and ethical practice. 2. The student will demonstrate skills to: (a) Articulate current issues in special education. (b) Define and describe and characteristics of learners with exceptionalities. 3. The student will demonstrate appropriate dispositions regarding: (a) The right of all children through the age of 21 to receive a free and appropriate public education. (b) Access to the natural environment and to the general curriculum as the starting point for special education and early intervention services. Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 30500 - Biosocial Foundations Of The Family

Credit Hours: 3.00. Family ties and family processes in the promotion of individual health and management of disease across the life course are covered. Course reviews research on families and health from multiple disciplinary perspectives.

Learning Outcomes: 1. Describe evolutionary and biosocial theory as the basis of development, using a life course perspective from conception through old age. 2. Identify the key biological systems involved in behavior, and how they are measured in biosocial research. 3. Explain the direct implications for biological and environmental interactions for families, children, adolescents, and adults. Credits: 3.00

HDFS 31000 - Guidance In Early Childhood

Credit Hours: 3.00. This course presents a developmental, child-centered approach to the guidance and discipline of young children, including children with disabilities. Influential theories, relevant research, and effective guidance methods for the early childhood teachers and other professionals working with young children and families, including families from different cultural and economic backgrounds, are discussed. Admitted to Gate B.

Learning Outcomes: 1. Understand the primary components of child guidance at different developmental stages. 2. Plan and implement developmentally appropriate methods of child

guidance and discipline. 3. Understand the influential theoretical perspectives of child guidance/discipline. 4. Modify expectations and guidance strategies appropriately for children with diverse abilities, family demographic characteristics, and cultural backgrounds. 5. Promote and create environments and lessons that prevent challenging behaviors. 6. Demonstrate desirable modeling of behavior. 7. Increase understanding and skills surrounding effective communication with children and parents about child guidance. 8. Gain critical knowledge of the importance of understanding diverse family and community characteristics and how they influence child behavior. 9. Increase understanding and skills for engaging with families, other educators,
and practitioners on child guidance. 10. Demonstrate growth in professionalism as early childhood educators. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

HDFS 31200 - Adult Development

Credit Hours: 3.00. An in-depth study of developmental processes from the transition to adulthood through old age. Particular emphasis is placed on understanding the influence of contexts on adult development.

Learning Outcomes: 1. Identify biological, psychological, social, and demographic aspects of adult development and how they interact over time. 2. Identify theoretical perspectives on human development, and apply them in understanding life trajectories. 3. Understand and apply the process of doing research in adult development. 4. Communicate academic ideas clearly and effectively. Credits: 3.00

HDFS 31300 - Adolescent Development

Credit Hours: 3.00. An overview of the normative developmental changes that occur during adolescence, with specific attention to individual and relational adjustment.

Learning Outcomes: 1. Critically evaluate popular conceptions of adolescence and adolescents. 2. Compare and contrast theoretical perspectives on normative development during adolescence. 3. Identify the diversity in the developmental pathways during adolescence. 4. Acquire a framework for assessing the connections between interpersonal development and the larger social context. Credits: 3.00

HDFS 31400 - Atypical Child Development

Credit Hours: 3.00. Atypical child development from conception to adolescence can emerge from genetic, medical/health, educational, psychological, and/or contextual factors. This course will survey factors (e.g., premature birth, obesity, neurodevelopmental disorders, learning difficulties, child abuse, and war) that contribute to atypical child development. It will assess how and when typical and atypical developmental trajectories diverge and the roles of measurement and intervention.

Learning Outcomes: 1. Describe at least three theories of atypical child development. 2. Differentiate typical and atypical child development and describe the roles measurement/assessment may play in this

distinction. 3. Identify biological and contextual factors that may promote resilience or atypical development during the following developmental periods: prenatal, infancy, early to middle childhood, and adolescence. Credits: 3.00

HDFS 31801 - Developmental Assessment

Credit Hours: 3.00. This course provides an introduction to the variety and characteristics of developmental assessments for young children, birth to age 8. Students learn formal and informal strategies for documenting individual development and learning; linking assessment and instruction; and, the use of assessment for determining eligibility for early intervention/early childhood special education. Students learn partnering with families, other professionals, as well as cultural and ethical issues in assessment.

Learning Outcomes: 1. Explain appropriate uses of assessment with young children, birth - 8 years of age, for instruction and intervention. 2. Describe the appropriate use of standardized and non-standardized approaches to assessment with young children, including family-centered assessment strategies. 3. Describe and be able to apply the linked systems of assessment, intervention, and evaluation, including in the context of IEP/IFSP development, progress monitoring, and program evaluation. 4. Conduct assessments, accurately interpret results, and critically evaluate assessment data. 5. Explain approaches to inclusion of family members in assessments, including identification of resources and priorities, and strategies for communicating assessment results to families. 6. Describe ethical considerations in assessment as well as cultural, language, and developmental differences that effect assessment implementation and outcomes. 7. Exhibit growth in professional behavior related to assessment of young children and for the field of early childhood education / early childhood special education. Credits: 3.00

HDFS 32500 - Health And Health Care For Children And Families

Credit Hours: 3.00. This course discusses leading causes of child health problems as well as examines the child and family reactions and adjustment to illness and disability. A developmental perspective on coping with health problems from early childhood through adolescence is presented. An overview on global child health disparities is also addressed.

Learning Outcomes: 1. Discuss the impact of illness on children, adolescents, and families. 2. Examine and analyze the leading causes of child and adolescent health. 3. Examine and compare health disparities among national and international children. 4. Determine the complexities and implications of health care policy and barriers to access to care on children, adolescents and families. 5. Determine the importance of implementing family centered care and interdisciplinary collaboration while providing care for children and adolescents. 6. Identify professional opportunities in child and family health. Credits: 3.00

HDFS 33000 - Sexuality And Family Life

Credit Hours: 3.00. Provides the student with a basic knowledge of human sexuality as it pertains to individuals, couples and families. The course is designed to be helpful to students who will become family life educators as well as to be helpful to students as individuals, spouses, and parents.

Learning Outcomes: 1. Construct a basic knowledge of human sexuality as it pertains to family relations in the personal and professional settings. 2. Compare and describe social, cultural, historical, and technological trends and the interrelationships between these trends and their impact on sexuality, family relations, and personal values and attitudes. 3. Differentiate and examine the many different aspects of sexuality including biological, developmental, medical, cultural, historical, and interpersonal. 4. Demonstrate knowledge that helps to develop a better understanding of students' own feelings and attitudes related to sexuality and how those attitudes and feelings influence their beliefs about individuals, couples, and families. Credits: 3.00

HDFS 33100 - Skills For Helping Professionals In

Individual, Family And Group Settings

Credit Hours: 3.00. This course is an introduction to skills commonly used in helping professions, including relationship-building skills, beginning interviewing skills, and group process skills. Attention is paid to cultural competence and professional ethics. This course includes a weekly lab experience involving practice of the helping skills, as well as a service-learning project in which helping skills are used in a community setting.

Learning Outcomes: 1. Use basic helping skills effectively in both individual and group contexts. 2. Evaluate your own helping interactions and those of others, including making constructive suggestions for improvement. 3. Design, implement, and reflect on a service-learning project that uses helping skills in a community setting. 4. Contribute to your team's successful service-learning project and provide leadership to the team as appropriate. 5. Reflect on your experiences in the course through your writing and use those reflections to promote development toward your own professional goals. Credits: 3.00

HDFS 33200 - Stress And Coping In Contemporary Families

Credit Hours: 3.00. Examines theoretical perspectives related to family stress and resilience in multicultural and diverse family settings, and connects these perspectives to empirical work on family dynamics, coping, and dysfunction across the lifespan. Topics such as economic stress and poverty, immigrant families, single-parent families, homeless families, adoption, military families, maltreatment, and families coping with illness are explored. The class focuses on environmental, cultural, as well as biological contributions to both risk and resilience processes in individuals and families.

Learning Outcomes: 1. Describe theory and research concerning family stress, coping and social support. 2. Understand how an individual's or family's context plays a role in his/her exposure to and coping with stressors. 3. Explain how individual, familial and environmental processes contribute to risk and resilience in individuals and families. 4. Apply the principles of Family Stress Theory and Risk and Resilience Theory to case studies of families. 5. Demonstrate an ability to understand and empathize with total life experiences (physical. psychological, social) of others by identifying possible motivations/explanations for individual and family behavior. Credits: 3.00

HDFS 34100 - Working With Parents

Credit Hours: 3.00. This course focuses on developing and maintaining effective relationships between parents and professionals working with children, within the context of family-centered practices. Issues related to cultural, linguistic, economic, and developmental differences that affect relations between families and professionals are examined.

Learning Outcomes: 1. Demonstrate an understanding of the development tasks and concerns of parents across the life course. 2. Demonstrate an understanding of the content and design of innovative professional practices and program strategies that seek to promote positive parenting outcomes or reduce/prevent unhealthy parenting outcomes in each developmental stage of parenting. 3. Demonstrate an understanding of how diverse family characteristics and circumstances shape the developmental tasks, concerns, and needs of parents. 4. Demonstrate an understanding of the implications of diverse family characteristics and circumstances for professional practices and program strategies aimed at supporting parents. 5. Demonstrate an understanding of how to creatively work with students colleagues to develop an original program idea that supports parents during a particular developmental stage. Credits: 3.00

HDFS 34300 - Assessment And Case Management

Credit Hours: 3.00. This course is an introduction to case management as a service delivery approach for helping individuals and families in need. This course provides opportunities to practice basic helping and case management skills such as building rapport, assessing client needs, developing intervention plans, professional ethics, and professional writing.

Learning Outcomes: 1. Explain the case management approach to addressing the health and human service needs of children, adults, and families. 2. Differentiate among the various

phases and task responsibilities of case management. 3. Analyze how individual differences in human development and motivation for change influence case management work. 4. Apply basic assessment and case management skills in practice interviews with individuals and families. 5. Demonstrate professional documentation and writing ability through the preparation of assessment reports, case notes, and intervention plans. 6. Demonstrate professional helping capacities such as ethical behavior and reflective practice. Credits: 3.00

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop the basic knowledge and skills needed to understand the research process, including generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present research studies and findings to a group. Credits: 3.00

HDFS 34800 - Administration Of Social Service Not-For-Profit Organizations

Credit Hours: 3.00. This course introduces students to aspects of not-for-profit management identified as keys by leaders in existing agencies. Students will prepare themselves for specifically establishing, building, working in and leading not-for-profit organizations.

Learning Outcomes: 1. Demonstrate knowledge, comprehension, analysis and application supporting competence in the defining features of nonprofit management by interactively thinking critically and creatively to develop a board of directors; design a strategic plan; write a corresponding operations plan; diagram an evaluation logic model; prepare a budget; making a fund raising ask; write a fund raising letter; write a grant proposal; write a press release; and make oral presentations. 2. Demonstrate knowledge, comprehension, application, analysis and synthesis by interactively solving an administrative problem in a nonprofit agency case study and presenting the solution. Credits: 3.00

HDFS 39000 - Special Topics In HDFS

Credit Hours: 1.00 to 6.00. Supervised readings, discussion, lectures and/or research on special topics in family and individual development. Permission of instructor required.

Credits: 1.00 to 6.00

HDFS 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an international experience that is recognized by the University.

Credits: 1.00 to 6.00

HDFS 40000 - Social Studies In Preschool And Primary Grades

Credit Hours: 2.00. This course focuses on teaching social studies in preschool and primary grade classrooms. It covers

the developmental foundations and curriculum applications of social studies teaching in pre-kindergarten and of social studies in primary grades and includes ways to plan, implement and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of social studies in early childhood, including supporting children's understanding of themselves and the diverse nature of their communities, history, economics, citizenship, leadership, and civics and government. 2. Explain appropriate strategies for facilitating children's development of social studies skills. 3. Plan, implement, and evaluate developmentally appropriate instruction in social studies, including responding to the needs of diverse learners. 4. Demonstrate an understanding of Indiana State Standards for social studies for children from birth-3rd grade. 5. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 2.00

HDFS 40500 - Language, Literacy, And Social Studies In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching language, literacy and social studies in preschool and primary-grade classrooms. It covers the developmental foundations and curriculum applications of language, literacy and social studies teaching in pre-kindergarten and of social studies in primary grades and includes ways to plan, implement and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English.

Learning Outcomes: 1. Understand the purposes and importance of reading and writing in early childhood classrooms and homes, including the importance of supporting children's vocabulary, language comprehension, alphabet knowledge, phonemic awareness, and concept and functional use of print. 2. Understand the purposes and importance of social studies in early childhood, including supporting children's understanding of themselves and the diverse nature of their communities, history, economics, citizenship, leadership, and civics and government. 3. Understand strategies for facilitating children's development of language, literacy, and social studies skills. 4. Plan, implement, and evaluate developmentally appropriate instruction in language, literacy, and social studies, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for literacy and social studies for children from birth-3rd grade (www.doe.in.gov/primetime/foundations and http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml). 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus. Credits: 3.00

HDFS 40510 - Literacy In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching literacy in preschool and primary-grade classrooms. It covers the developmental foundations and curriculum applications of literacy teaching in pre-kindergarten and primary grades and includes ways to plan, implement, and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of reading and writing in early childhood classrooms and homes, including the importance of supporting children's vocabulary, language comprehension, alphabet knowledge, phonemic awareness, and concept and functional use of print. 2. Explain the science of reading, particularly the current state of reading research and implications of research for reading instruction. 3. Practice strategies for facilitating children's development of literacy skills. 4. Plan, implement, and evaluate developmentally appropriate instruction in literacy including responding to the needs of diverse learners. 5. Describe the importance and demonstrate the use of Indiana State

Standards for literacy for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus. Credits: 3.00

HDFS 40600 - Mathematics In Preschool And Primary Grades

Credit Hours: 4.00. This course focuses on teaching mathematics in preschool and primary grade classrooms. It covers the developmental foundations and curriculum applications of mathematics teaching and includes ways to plan, implement and evaluate developmentally appropriate mathematics instructions for children with and without disabilities and children who are learning English. Field-based experiences in preschool or primary-grade classrooms are included.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching mathematics. 2. Demonstrate an understanding of how children think about mathematical concepts. 3. Identify key mathematics knowledge that children need to learn during the early childhood and primary years 4. Critically and creatively plan, implement, and evaluate developmentally appropriate instruction in mathematics, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Mathematics for children from birth-3rd grade (www.in.doe.gov/primetime/foundations.html and http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml). 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Note: A 3 hour/week field experience provides students the opportunity to apply knowledge to practice as reflected in objectives 4-6 above. Credits: 4.00

HDFS 40800 - Early Intervention / Early Childhood Special Education: Issues And Professional Practices

Credit Hours: 4.00. An introduction to the field of early intervention / early childhood special education including its origin, services, and practices in working with young children ages birth through eight with or at risk for developmental delays and disabilities and their families. Designing curriculum, environments, and services where all children are included, have equal opportunity for access and engagement, and feel a sense of belonging is addressed. For Early Childhood Education and Exceptional Needs majors only. A field experience in preschool or primary-grade classrooms is included.

Learning Outcomes: 1. Discuss origins of early intervention / early childhood special education including key legislation affecting young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 2. Describe the value of and process for fostering family participation and professional-family collaboration in order to plan and implement family concerns, priorities, and access resources in intervention and education of young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 3. Explain considerations including individualized and culturally / linguistically appropriate service delivery models, assessment, and curriculum for designing and organizing learning environments and experiences for young children (0-8) who have or are at risk for developmental delays and disabilities. 4. Evaluate, select, implement, and reflect on individually and culturally/linguistically appropriate evidence-based instructional strategies and interventions for young children (0-8) who have or are at risk for developmental delays and disabilities. 5. Utilize appropriate teaming and collaboration models, skills, processes, and strategies to engage with families and other professionals in the development of individualized intervention and transition plans. 6. Discuss current issues in providing effective early intervention / early childhood special education services for young children

and their families. 7. Exhibit growth in professional behavior related to the field of early intervention / early childhood special education. Credits: 4.00

HDFS 40900 - Science In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching science in preschool and primary grade classrooms. Developmental foundations and curriculum applications of science teaching including ways to plan, implement and evaluate developmentally appropriate science instruction for young children with and without disabilities and those who are learning English.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching science. 2. Demonstrate an understanding of how children think about science concepts at developmental levels between birth and 8 years. 3. Demonstrate understanding of critical approaches to scientific thinking. 4. Understand key science knowledge and skills that children need to learn from Pre-K to Grade 3 as represented in current science education standards. 5. Assess children's science knowledge, skills, and dispositions, and use the assessment data to plan science education activities. 6. Plan, implement, and evaluate developmentally appropriate classroom science activities, including responding to the needs of diverse learners. 7. Demonstrate positive dispositions and skills of an early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

HDFS 41200 - Professionalism And Music And Movement In Early Childhood

Credit Hours: 3.00. This course focuses on foundations of professionalism in early childhood education and early childhood special education. Additionally, this course discusses music and movement in early learning environments. It covers the developmental foundation and curriculum applications of music and movement activities and includes ways to plan, implement and evaluate developmentally appropriate music and movement instruction for children with and without disabilities and children who are learning English.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the ethical and professional standards in early childhood education, including the importance of maintaining confidentiality, respecting diversity, teaming will colleagues, and upholding the well-being of children and families. 2. Describe principles of developmentally appropriate early childhood education and intervention as they relate to music and movement in early childhood and primary grades. 3. Demonstrate an understanding of children's development of creative expression through music and movement. 4. Plan, implement, and evaluate developmentally appropriate visual music and movement instruction, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Physical Education and Health and Music for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

HDFS 41500 - Approaches To Early Childhood Education

Credit Hours: 3.00. The historical and theoretical basis for early childhood education and early intervention is emphasized. Relations between theory and practice are examined and illustrated with model early childhood programs. Addresses cultural/developmental diversity, ethics, and standards in early childhood education and intervention.

Learning Outcomes: 1. Discuss recommended practices in early childhood education and early intervention, including historical and theoretical sources and reasons for these practices with young children. 2. Describe, evaluate, and apply ideas from influential early childhood curriculum models while incorporating cultural and developmental diversity among young children, families, and the profession. 3. Clearly articulate to others your theoretical assumptions, goals, and practices as an early childhood professional. 4. Describe ethical guidelines and

best practice recommendations for early childhood teachers and early interventionists and be able to apply those principles to everyday problems in early childhood education and early intervention. 5. Read, think, speak, and write about the course material, demonstrating your development as a professional, with increased confidence that what you do every day as a teacher is grounded in theory, recommended best practices, cultural sensitivity, and research-based knowledge. Credits: 3.00

HDFS 41800 - Understanding Autism

Credit Hours: 3.00. (PSY 41800, SLHS 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associated with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

HDFS 42000 - Developmental Foundations Of Infant And Toddler Curriculum

Credit Hours: 3.00. Study of typical and atypical development in infants and toddlers as well as implication for practice. Focuses on infant toddler developmental assessment and designing and implementing learning activities in all developmental areas and enhancing parent/professional relationships. Includes a practicum experience with infants and toddlers.

Learning Outcomes: 1. Acquire knowledge of the needs, normal development patterns, and important variations in development (including delays and disabilities) of children from prenatal period to 3 years. 2. Acquire skills in designing, maintaining, and evaluating safe, supportive, stimulating environments for infants and toddlers. 3. Acquire knowledge and skills in implementing developmentally-appropriate and culturally-appropriate assessment and programming for infants and toddlers. 4. Acquire skills providing basic care, education, and guidance for children under 3 years that may be applied in child care settings, family homes, or health care settings. 5. Acquire skills in developing supportive caregiving relationships with infants and toddlers. 6. Acquire skills in collaborating with key adults in infants' and toddlers' lives, including parents, other family members, and allied professionals. Credits: 3.00

HDFS 43030 - Human Development And Family Studies Student Mentors

Credit Hours: 1.00 to 3.00. Advanced undergraduate students selected for this opportunity to serve as mentors to beginning and prospective HDFS students in the department's orientation course (HDFS 10000). Mentors will be matched with a small group of students with similar major/career interests. Mentors will lead small group discussions, provide guidance and feedback, and otherwise serve as a role model to the students. Mentors will receive support and training to be effective in this role. Permission of instructor required.

Learning Outcomes: 1. Develop and communicate a thorough understanding of what

they have done to achieve success throughtout their college career. 2. Act as role models to beginning and prospective HDFS students. Credits: 1.00 to 3.00

HDFS 44000 - Expanded ECEEN Student Teaching

Credit Hours: 1.00 to 3.00. This is a full semester of supervised expansion of student teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will occur the semester prior to full-time student teaching and be supervised by an HDFS faculty member and the classroom cooperating teacher. Monthly HDFS sponsored professional development seminars will also be required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Division for Early Childhood of the Council for Exceptional Children. 3. Engage in developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. Credits: 1.00 to 3.00

HDFS 45000 - Supervised Teaching In Inclusive Programs For Young Children (UCC: OC)

Credit Hours: **16.00.** This is 16 full-time weeks of supervised teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will be supervised by a HDFS faculty member and the classroom cooperating teacher. Monthly HDFS-sponsored professional development seminars and additional teacher education meetings will also be required. This will partially fulfill requirements for the Indiana Early Childhood Education and the Early Childhood Special Education teaching license. Admission to Student Teaching required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Council for Exceptional Children. 3. Design developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the student teaching environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. 5. Create and conduct one-to-one, small group and/or large group instruction, guidance, intervention, and developmental activities in the student teaching environment. 6. Design and implement appropriate child assessment and evaluation procedures that influence the teaching and learning process. 7. Evaluate their own teaching practices through self-reflection and the analysis of child learning Credits: 16.00

HDFS 45010 - Supervised Teaching In Inclusive Programs For Young Children

Credit Hours: 12.00. This is 16 full-time weeks of supervised teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will be supervised by a HDFS faculty member and the classroom cooperating teacher. Monthly HDFS-sponsored professional development seminars and additional teacher education meetings will also be required. This will partially fulfill requirements for the Indiana Early Childhood Education and the Early Childhood Special Education teaching license. Admission to Student Teaching required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Council for Exceptional Children. 3. Design developmentally appropriate

instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the student teaching environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. 5. Create and conduct one-to-one, small group and/or large group instruction, guidance, intervention, and developmental activities in the student teaching environment. 6. Design and implement appropriate child assessment and evaluation procedures that influence the teaching and learning process. 7. Evaluate their own teaching practices through self-reflection and the analysis of child learning. Credits: 12.00

HDFS 45100 - Internship & Career Preparation For Human Services

Credit Hours: 2.00. This course includes an overview of HDFS-related professions, self-evaluation, career search skills, exploration of internship opportunities, and professional development. Students will complete arrangements for their field placement.

Learning Outcomes: 1. Assess career interests and identify potential internship sites. 2. Create a professional cover letter and resume. 3. Identify how resources available at the Purdue Center for Career Opportunities (CCO) and its website (myCCO) can be used in the job/internship search. 4. Develop skills and strategies for conducting an effective job/internship. 5. Develop and apply professional interview skills. 6. Demonstrate professional behavior through the successful and timely completion of course assignments. 7. Demonstrate preparation for the transition from student to intern. Credits: 2.00

HDFS 45400 - Internship & Career Preparation For Developmental And Family Science

Credit Hours: 2.00. This course includes an overview of HDFS-related professions, self-evaluation, career search skills, exploration of internship opportunities, and professional development. Students will complete arrangements for their field placement.

Learning Outcomes: 1. Assess career interests and identify potential internship sites. 2. Create a professional cover letter and resume. 3. Identify how resources available at the Purdue Center for Career Opportunities (CCO) and its website (myCCO) can be used in the job/internship search. 4. Develop skills and strategies for conducting an effective job/internship search. 5. Develop and apply professional interviewing skills. 6. Demonstrate professional behavior through the successful and timely completion of course assignments. 7. Demonstrate preparation for the transition from student to intern. Credits: 2.00

HDFS 45500 - Human Services Capstone Internship

Credit Hours: 6.00 or 12.00. Supervised full-time or half-time internship in human services, doing work typical of an entry-level bachelor-degreed professional. Students will integrate and build upon knowledge developed during their studies in human services. Students will use and enhance their skills in direct service to client or indirect service. Students will work in the placement setting secured during HDFS 45400. Example field placement sites include: government or community agencies; social service agencies; hospitals; and recreational settings. Permission of Department required. Must be a student in good academic standing during the internship semester.

Learning Outcomes: 1. Synthesize previously acquired and new knowledge about individual development, family processes, and broader social contexts and apply it to their responsibilities in their internship setting. 2. Demonstrate skills in direct service to children, adults, and/or families in the planning, evaluation, management, or support of human services programs. 3. Exhibit professional work attitudes and behavior. Credits: 6.00 or 12.00

HDFS 45800 - Development And Family Science Capstone Internship

Credit Hours: 6.00. Supervised internship for the Developmental & Family Science major, doing work typical of an entry-level bachelor-degreed professional. Students will integrate and build upon knowledge developed during their studies in developmental and family science. Students will use and enhance their skills in child development, family and community health, or another area related to developmental and

family science. Students will work in the placement setting secured during HDFS 45400. Must be a student in good academic standing during the internship semester. Permission of Department required.

Learning Outcomes: 1. Synthesize previously acquired and new knowledge about individual development, family processes, and broader social contexts and apply it to responsibilities in the internship setting. 2. Demonstrate relevant workplace skills including direct service to clients, program development and evaluation, and/or other appropriate tasks. 3. Exhibit professional work attitudes and behavior. Credits: 6.00

HDFS 49000 - Independent Study

Credit Hours: 1.00 to 4.00. Independent study. Permission of instructor required.

Credits: 1.00 to 4.00

HDFS 49101 - Mentored Research In Human Development And Family Studies I

Credit Hours: 3.00. Independent study in which student engages in research under the supervision of a faculty member. Involves developing a research proposal, beginning the project, and submitting a summary of the project plan and progress. First semester of a two-semester sequence to fulfill the requirements of the capstone thesis for the Developmental & Family Science major. Permission of instructor required.

Learning Outcomes: 1. Critically and creatively synthesize knowledge and skills gained as a DVFS major, using them in a research project of the student's interest. 2. Synthesize and apply previously acquired and new knowledge of the HDFS field through in-depth exploration of a topic of interest. 3. Observe and participate in the research process, including generating a written report of the project. 4. Work collaboratively with a research mentor and/or research team. 5. Make decisions using the logic of the scientific method. Credits: 3.00

HDFS 49102 - Mentored Research In Human Development And Family Studies II

Credit Hours: 3.00. Independent study in which student engages in research under the supervision of a faculty member. Involves completing a research project, writing up the results, and presenting the results to a new audience. Second semester of a two-semester sequence to fulfill the requirements of the capstone thesis for the Developmental & Family Science major. Permission of instructor required.

Learning Outcomes: 1. Critically and creatively synthesize knowledge and skills gained as a DVFS major, using them in a research project of the student's interest. 2. Synthesize and apply previously acquired and new knowledge of the HDFS field through in depth exploration of a topic of interest. 3. Observe and participate in the research process, including generating a written report of the project. 4. Work collaboratively with a research mentor and/or research team. 5. Make decisions using the logic of the scientific method. Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 60000 - Families And Health Across The Life Course

Credit Hours: 3.00. Interpersonal processes of family members and close others in the promotion of individual health choices and management of disease across the life course are covered. Course topics include involvement of family and close others in: health promotion and disease prevention; disease management; interactions with healthcare providers; and informal caregiving in the family context.

Learning Outcomes: 1. Evaluate research linking family ties with individual health and well-being across the life course. 2. Examine how interpersonal processes contribute to promoting health and managing illness of individuals across the life course. 3. Understand the role of family members in interactions with the healthcare system. 4. Differentiate diverse disciplinary approaches to families and health research across the life course. Credits: 3.00

HDFS 60100 - Advanced Child Development

Credit Hours: 3.00. This course provides an overview of foundational and current developmental research on changes that occur within the individual throughout infancy, childhood, and early adolescence. Emphasis is given to processes and mechanisms that have been proposed to explain developmental changes. This course includes attention to social and cultural contexts within which individuals develop. Prerequisite: Graduate-level coursework in Child Development or

Psychology.

Credits: 3.00

HDFS 60200 - Advanced Family Science

Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

Learning Outcomes: 1. Describe and critique classic and emerging theoretical and conceptual frameworks in family science, with attention to refinements over time. 2. Demonstrate critical thinking skills through exploring and discussing diverse theoretical viewpoints and recent research in family science. 3. Apply theoretical and conceptual frameworks when developing empirical research in family science. Credits: 3.00

HDFS 60400 - Developmental And Family Approaches To Diversity And Oppression

Credit Hours: 3.00. In this course, we will utilize an intersectional lens throughout the course to critically examine the development of individuals oppressed due to their minority status in the United States. We will review current research and literature across disciplines to: 1) understand the origin, meaning, and purpose of race and racism; 2) learn about the history of oppression and resilience of minoritized groups; 3) analyze systems of discrimination; 4) introduce theoretical frameworks for studying the unique, intersectional experiences of minoritized populations and examples of their application to empirical research, and 5) discuss how research can be used to advance social justice. Permission of department required.

Learning Outcomes: 1. Define concepts such as discrimination, race, racism, gender (beyond binary definitions), cissexism, heterosexism, neurodiversity, and ableism as they pertain to diverse populations in the U.S. 2. Present their own intersectionality and demonstrate how personal intersections can inform bias and actions. 3. Discuss the diversity that exists in the US and identify systemic factors that interact with this diversity (including but not limited to socioeconomic factors). 4. Explain the major concerns regarding minoritized groups' experiences and the factors that promote positive outcomes for marginalized individuals and families. 5. Evaluate critically the theoretical foundation of empirical studies conducted with diverse individuals/families and apply diversity-focused theory to student research content areas of interest. Credits: 3.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to diversity in developmental influences and trajectories, including atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to

evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

HDFS 61700 - Quantitative Methods II: Regression

Credit Hours: 4.00. This course has two primary goals: 1) provide students with foundational knowledge related to linear regression statistical analyses, and 2) provide students with the opportunity to practice writing, interpreting, and presenting regression analyses for the purposes of dissemination. Prerequisite: HDFS 61300 or PUBH 60100 or STAT 50100 or PSY 64600. Permission of instructor required.

Learning Outcomes: 1. Understand the foundations of linear regression statistical analyses, including multiple regression. 2. Understand mediation and moderation hypotheses and associated testing in linear regression. 3. Derive research questions and hypotheses testable in linear regression. 4. Analyze data using linear regression modeling and statistical software. 5. Properly interpret the statistical estimates and tests covered in the course. 6. Apply regression modeling to your research questions using empirical data. 7. Produce written communication of analytic methods and interpretation of results. Credits: 4.00

HDFS 61900 - Adolescent And Youth Development In Context

Credit Hours: 3.00. This graduate-level course examines the major developmental issues of adolescents and youth with attention to their familial, cultural, and socio-economic backgrounds. Topics include health and well-being; biological, socio-emotional, and cognitive development; sexual and racial/ethnic identity; risks and resilience; peer and family relationships; civic engagement and activism; positive youth development; and the transition to adulthood. Course readings focus primarily on adolescents and youth in the United States, although international contexts are also incorporated across the class.

Learning Outcomes: 1. Evaluate empirical studies assessing the major developmental themes of adolescence and the transition to adulthood. 2. Apply and understand major theoretical perspectives relevant to adolescent and youth development. 3. Demonstrate understanding of the contexts that impact development during adolescence and the transition to adulthood. 4. Demonstrate accurate knowledge of physical, cognitive, social, and psychological development of adolescents and youths. 5. Understand how adolescent and youth development is impacted by diverse backgrounds and experiences. Credits: 3.00

HDFS 62000 - Current Issues In Early Childhood Education

Credit Hours: 3.00. Emphasis on current issues in early childhood education as they are affected by contemporary social change with observation and analysis of a variety of programs for young children. Prerequisite: HDFS 60100 .

Credits: 3.00

HDFS 62200 - Child Development Within The Family Context

Credit Hours: 3.00. This course provides an overview of (1) foundational and current child development theories and (2) research on typical individual change throughout infancy and childhood within the family context. Emphasis is given to milestones, and to the processes and mechanisms proposed to explain developmental change. The course takes a chronological age-approach to study development within the family context and covers the following stages: prenatal and infancy, early childhood, and middle childhood. Initially the course places the individual within the larger family context and then delineates development/growth within the realms of physical growth, brain, motor, sensation, perception, language, social, cognitive, feeding/eating, sleep, self-regulation, attachment, and temperament/personality development. Across

these realms diversity and historical standards around typical development expectations will also be incorporated. Permission of instructor required.

Learning Outcomes: 1. Demonstrate an understanding of basic tenets of influential child development theories. This foundational knowledge will include (but is not limited to) life-history theory, genetics, developmental neuroscience, attachment theory, bioecological theory, social domains theory, and Piaget. 2. Analyze, discuss, and critique information about child development theories and research using empirical evidence. 3. Demonstrate an understanding of the normative developmental progression (from fetus to middle childhood) in the domains of: Physical growth, brain maturation, language, social, cognitive, feeding/eating, sleep, self-regulation, attachment, and temperament/personality development. 4. Think critically about how historic patterns of research, family systems, and isms (e.g., racism, weightism, ableism) influence our standards of typical/normative development for developmental domains. 5. Demonstrate an understanding of the family factors that influence variability in typical developmental trajectories. Family factors will include (but are not limited to) individual characteristics (e.g., child gender, innate capacities, and age), dyadic features (e.g., marital conflict / union dissolution, contingent responsivity), and contextual elements (e.g., socioeconomic resources, culture). Credits: 3.00

HDFS 62500 - Child And Family Social Policy

Credit Hours: 3.00. An examination of selected issues related to child and family policy relevant to scholars of CDFS. These issues include: (1) influences of research on children and families on the policy process; (2) the role of child and family specialists as advocates and analysts; (3) policy formulation, enactment, and evaluation; and (4) child and family policy in cross-national perspective. Prerequisite: HDFS 60100 and HDFS 60200 .

Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and

estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

HDFS 62900 - Interventions Across Developmental And Family Contexts

Credit Hours: 3.00. This course will focus on the scientific foundations of designing and conducting interventions for improving the human condition across diverse developmental and family contexts. A particular emphasis in this course will be on experimental and quasi-experimental designs for making causal inferences and understanding mechanisms of intervention effects. Students will gain specific knowledge of intervention design, implementation and fidelity, and scale-up of interventions, as well as how to evaluate proposed or existing interventions. Co-design processes with intervention users and qualitative methods for understanding intervention needs and implementation will also be examined. Prerequisite: none.

Learning Outcomes: 1. Read and critique the literature on interventions across developmental and family topical areas. 2. Acquire skills in understanding culture, diversity, equity, and bias as they apply to intervention design, implementation, and evaluation. 3. Identify, critique, and communicate about methods to design, implement, evaluate, and scale up interventions. 4. Understand strengths and limitations of interventions relative to the mechanisms of change, implementation processes, fidelity of implementation, and contextual (both setting and population) factors that may affect intervention success. 5. Demonstrate understanding of methods and limits of causal inference using interventions. 6. Acquire skills to obtain external funding by practicing grant writing and reviewing. Credits: 3.00

HDFS 64400 - Biosocial Processes In Developmental And Family Research

Credit Hours: 3.00. In this course we discuss theoretical models and empirical research regarding the interplay between biology and context in development, focusing on the unique interactions that occur within families. Prerequisite: HDFS 60100 and HDFS 60200 .

Learning Outcomes: 1. Identify basic genetic, neuroanatomical, and neuroendocrine processes involved in major aspects of physiological regulation (e.g. the stress response). 2. Describe the dynamic interaction between physiology and the environment. 3. Explain implications of normative and non-normative experiences for physiological regulation. 4. Critically evaluate biosocial research. Credits: 3.00

HDFS 64900 - Multidisciplinary Gerontology

Credit Hours: 3.00. A multidisciplinary overview of aging that provides a background for graduate studies on aging. An examination of sociological, psychological, and biological theory and research in the field of aging. The aging process from cells to social security will be covered. Projects will assist students in developing appropriate professional skills in their field of study. Students are expected to have basic research and writing skills in their field of study. The course serves as a graduate-level introduction to the field of gerontology. There are several options for course projects.

Learning Outcomes: 1. Describe and critique major theoretical and empirical foundations and advances in gerontological research. 2. Examine and discuss the ways influences at different levels of function (e.g., biological, social) and from different academic disciplines (e.g., psychology, sociology) interact to shape the aging process and related outcomes. 3. Use existing literature to construct and support novel research ideas. 4. Practice and produce cogent, compelling writing. Credits: 3.00

HDFS 65800 - Attachment Relationships

Credit Hours: 3.00. This graduate course studies child-parent relationships theory and research from the respective of Attachment Theory. Prerequisite: CDFS 60300. Permission of instructor required. Prerequisite: HDFS 60100 and a basic graduate-level statistic course.

Learning Outcomes: 1. Identify the history and the historic context in which attachment theory was proposed. 2. Identify and analyze the central characteristics and constructs of attachment theory, and the model of

development (4 phases) that Bowlby proposed. 3. Describe and analyze the empirical evidence provided by Ainsworth in support of attachment theory. 4. Analyze and critique the literature on the context sensitivity of attachment relationships (e.g., influence of quality of care, infant/child temperament, family characteristics, socio-economic conditions, and culture). 5. Identify and critique the relations between infant security and later socialization outcomes. 6. Survey and analyze the research literature on child-parent attachment relationships during early and middle childhood, adolescence, and adulthood. 7. Critique the hypothesis concerning the intergenerational transmission of attachment patterns from parents to offspring. 8. Identify, analyze, and critique age appropriate methodologies in the study of offspring-parent attachment relationships. 9. Develop and present (orally and in writing) a 10-page research proposal on attachment relationships.

Credits: 3.00

HDFS 67900 - Qualitative Research On Families

Credit Hours: 3.00. Provides an introduction to qualitative research theory and methods and prepares graduate students to conduct and evaluate qualitative family research. Students conduct observations, interviews, and basic data analysis. Prerequisite: a course in research methods.

Credits: 3.00

HDFS 68000 - Professional Issues For Child And Family Specialists

Credit Hours: 3.00. Professional issues involved in working with children and families. Questions of ethics, legal relationships, and value problems may be pursued, as may such pragmatic inquiries as the role of professional organizations and labor unions in these fields.

Credits: 3.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

HDFS 68501 - Developmental Seminar

Credit Hours: 1.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00

HDFS 69000 - Directed Research In HDFS

Credit Hours: 1.00 to 4.00. Directed research and supervised research on a topic in student's area of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

HDFS 69700 - Graduate Student Colloquium

Credit Hours: 1.00. Research presentations by faculty members, graduate students, and invited speakers. Includes attention to: (1) the responsible conduct of research, (2) professional/scholarly and teaching development, and (3) diversity, equity, and inclusion.

Learning Outcomes: 1. Expose students to a wide swath of HDFS-related research across the life course. 2. Provide a rotation of professional development trainings (e. g., vita, job talk, and conference presentation development). 3. Foster teaching development through presentations, workshops, or trainings. 4. Generate internal and external networking opportunities for graduate students. 5. Address issues of diversity, equity, and inclusion (DEI) in HDFS by (a) providing a platform for increased representation in presenters, (b) critically considering how research in HDFS serves diverse (i. e., underrepresented/underserved/historically marginalized) populations, and (c) increasing our competencies related to DEI as part of professional development. Credits: 1.00

HDFS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HDFS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Industrial and Molecular Pharmaceutics

IMPH 10000 - Pharmaceutical Sciences Orientation

Credit Hours: 1.00. An orientation course for incoming freshmen or CODO students enrolled in the Bachelor of Sciences in the Pharmaceutical Sciences program. Provides an introduction to the scope of the program, the career opportunities for graduates, the curriculum rationale, and the faculty and staff support structure.

Credits: 1.00

IMPH 45100 - Industrial Practical Training

Credit Hours: 1.00. Course allows students to gain practice-related employment experience in industrial pharmacy. Students receive credit for practical experience in the session when they participate in the practical experience and complete the course paper requirement. Pre-approval of enrollment through ISS is required prior to employment experience. Permission of instructor required.

Learning Outcomes: 1. Ensure pharmaceutical science students receive early exposure to the most common career paths taken by today's graduates and gain a first-hand perspective of industry responsibilities and activities in their roles. This contributes to a foundation for gaining appreciation of the strategies for continually evolving requirements and skills in industry. 2. Provides pharmaceutical science students with opportunities to have early in their program observation of scientists providing services, particularly those that address Pharmaceutical Science Outcome Ability Goals. These include Conceptual Competence, Scientific Comprehension, Mathematical Competence, Integrative Competence, Critical Thinking and Decision Making Abilities, Communication Skills and Abilities, Responsible Use of Professional Values and Ethical Principles, Social Awareness and Social Responsibility, Professional Abilities and Habits, and Group Interaction and Citizenship. See the ""Student Handbook"" for specific descriptions of the components of these outcome abilities. 3. Provide pharmaceutical science students with early industry exposure that illustrates the reasons they need in-depth learning of the basic and applied sciences and a commitment to lifelong learning for professional effectiveness. 4. Provide pharmaceutical science students with experiences and learning in applications that are essential to evolving professional responsibilities in an industrial setting. 5. Contribute to pharmaceutical science student development as well as providing the vision and motivation to become a positive scientific influence or change agent. 6. Broaden students' perspectives on career pathways and foster initiatives to enhance career planning. Credits: 1.00

IMPH 49000 - Special Topics

Credit Hours: 1.00 to 6.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest, utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 6.00

IMPH 56200 - Introduction To Pharmaceutical Manufacturing Processes

Credit Hours: 4.00. A course intended to provide the student with basic understanding of both the theoretical and practical aspects of pharmaceutical manufacturing by combining a thorough classroom treatment of the underlying principles of each pharmaceutical unit operation with hands-on execution of these activities in the laboratory. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to effectively communicate their field of study. 2. Demonstrate ability to conduct research in an ethical and responsible manner. 3. Demonstrate ability to think critically, creatively, and solve problems in their field of study. 4. Demonstrate ability to identify and conduct original research, scholarship, and creative endeavors. Credits: 4.00

IMPH 57400 - Pharmaceutical Biotechnology

Credit Hours: 3.00. Pharmaceutical biotechnology is the array of scientific and engineering principles used to develop, manufacture, and regulate biologic drugs. Biologic drugs - also known as "biologics", "biopharmaceuticals", or "large molecule drugs" - are medicinal agents derived from living systems, in contrast to more conventional "small molecule drugs" produced by organic chemical synthesis. Since the approval of the first recombinant human insulin in 1982, biologics have grown from niche products to occupy a prominent place in the

pharmaceutical armamentarium. Today, biologics provide innovative treatments for a host of previously intractable diseases, including cancers, autoimmune disorders, and diabetes. The global biologics market was more than $300 billion in 2019, accounting for 20-25% of all pharmaceutical sales. This course introduces students to pharmaceutical biotechnology. The five didactic sections of the course present: (i) the biotech drug market, (ii) cellular and molecular biology foundations, (iii) formulation and stability of biotech drug products, (iv) analytical methods for quality assurance, and (v) manufacturing methods. In the sixth and final section of the course, students will present case studies on currently approved biotech drugs, integrating and applying what they've learned. The course is intended for beginning graduate students in the Departments of Industrial and Physical Pharmacy, Chemical Engineering, and Biomedical Engineering. The course may also be suitable for well-qualified upper-division undergraduates. Permission of department required.

Learning Outcomes: 1. Understand and be able to describe the current state of the biopharmaceutical industry, including major drug classes, top-selling biotech drugs, innovative biotech drugs under development, and leading pharma biotech companies. 2. Understand and be able to describe the fundamental cellular and molecular biology principles and interrelationships that undergird pharmaceutical biotechnology, including (e.g.) the roles of cells as protein factories, drug targets, and vehicles for gene delivery; the roles of viral vectors as drug delivery and cell transfection agents; the roles of proteins as drugs, drug targets, and products of mRNA vaccines. 3. Understand and be able to describe the mechanisms of chemical and physical degradation of peptide/protein and nucleotide therapeutics. Be able to suggest formulation strategies to control various types of degradation. 4. Understand and be able to describe various chromatographic and electrophoretic methods used to analyze biologics. Be familiar with other types of chemical and biophysical methods used for these drugs. 5. Understand and be able to describe the manufacturing methods used for different classes of biologics, with a more detailed understanding of the methods used for recombinant proteins. 6. Develop a detailed knowledge of one current biotech drug product, including methods of manufacturing, analytical methods for quality control and assurance, formulation approaches and any instabilities, indications, and current market. Credits: 3.00

IMPH 58000 - Physical Chemical Principles

Credit Hours: 3.00. Applications of physical chemical principles to pharmaceutical systems.

Credits: 3.00

IMPH 58300 - Advanced Biopharmaceutics

Credit Hours: 3.00. A comprehensive course dealing with the interaction of biological and physicochemical considerations relating to drug effectiveness and dosage form design.

Credits: 3.00

IMPH 58700 - Pharmaceutical Solids

Credit Hours: 2.00. Provides students with the ability to identify and characterize polymorphs and hydrates and to understand their behavior in the presence of water. Both classical methods and new techniques for the study of pharmaceutical solids and their interaction with water are included. Scientific principles are blended with practical examples to provide a conceptual basis for understanding particular problems.

Credits: 2.00

IMPH 59000 - Special Topics In Industrial And Molecular Pharmaceutics

Credit Hours: 1.00 to 6.00. Special topics in selected areas of industrial and molecular pharmaceutics. Permission of instructor required.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 6.00

IMPH 68000 - Pharmacokinetics And Biopharmaceutics

Credit Hours: 3.00. Pharmacokinetics (PK) is the study of the time course of the absorption, distribution, metabolism and excretion (ADME) of a drug, compound or new chemical entity (NCE) after its administration to the body. Biopharmaceutics examines the relationship between the physical/chemical nature of a drug, the dosage form and the route of administration on the rate and extent of systemic drug absorption. Knowledge of the pharmacokinetic and biopharmaceutics properties of an NCE are critical to its selection as a lead candidate in a drug discovery program, its use as a functional research tool, and its use as a therapeutic agent. This course will be an overview of the development of pharmacokinetic principles, including guidelines for conducting clinical studies, and equations required to characterize the disposition of drugs and their metabolite(s). Students will develop the ability to probe the mechanisms and physiological processes responsible for

ADME. Pharmacodynamics, the relationship between drug concentration and effect, and the issues surrounding stereospecific PK will presented. Prerequisites: Admission to the IMPH graduate program and at least one course in pharmacology and one course in mammalian or human physiology. Permission of instructor required.

Learning Outcomes: 1. Probe the mechanisms and physiological processes responsible for ADME. Credits: 3.00

IMPH 69000 - Special Problems

Credit Hours: 0.50 to 6.00. Individual research topics selected from the areas of industrial pharmacy, physical pharmacy, or biopharmaceutics. Permission of instructor required.

Learning Outcomes: 1. Vary by topic. Credits: 0.50 to 6.00

IMPH 69600 - Seminar In Industrial And Physical Pharmacy

Credit Hours: 0.00 or 1.00. Discussion of recent research developments in physical pharmacy, industrial pharmacy, and biopharmaceutics related to the physicochemical properties, availability, effectiveness, and safety of drugs and drug products. Topics are presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

IMPH 69699 - IMPH Professional Practice Internship

Credit Hours: 0.00. A one-semester course for graduate students going out for Professional Internships to register to keep their graduate student status. Permission from department is required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional setting related to their research context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and practice of ethical responsibility in professional work. Credits: 0.00

IMPH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Industrial Engineering

IE 20000 - Industrial Engineering Seminar

Credit Hours: 0.00. An orientation course to inform students of the major options in the industrial engineering program, assistance in selection of appropriate electives to meet career objectives, introduction to the faculty, and selection of an academic advisor.

Credits: 0.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 30000 - Honors Program Seminar

Credit Hours: 0.00. An orientation course intended for juniors who have demonstrated exceptional academic ability and desire to conduct meaningful independent research or solve unique engineering design projects during their senior year of study.

Credits: 0.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and

experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

IE 33200 - Computing In Industrial Engineering

Credit Hours: 3.00. Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Credits: 3.00

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

IE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional practice with qualified employers in industry, government, or small business and a comprehensive written report of this practice. Professional Practice students only. Permission of department required.

Credits: 0.00

IE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional practice with qualified employers in industry, government, or small business and a comprehensive written report of this practice. Professional Practice students only. Permission of department required.

Credits: 0.00

IE 38300 - Integrated Production Systems I

Credit Hours: 3.00. Basic concepts in the design and operational control of integrated production systems. Includes topics on facility layout and material handling, material flow and information flow, resource and capacity planning, and shop floor control and scheduling.

Credits: 3.00

IE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional practice with qualified employers in industry, government, or small business and a comprehensive written report of this practice. Professional Practice students only. Permission of department required.

Credits: 0.00

IE 38600 - Work Analysis And Design I

Credit Hours: 3.00. Fundamentals of work methods and measurement. Applications of engineering, psychological, and physiological principles to the analysis and design of human work systems.

Credits: 3.00

IE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business and a comprehensive written report of this practice. Permission of department required.

Credits: 0.00

IE 43100 - Industrial Engineering Design

Credit Hours: 3.00. Capstone design experience for industrial engineering students involving analysis and synthesis of unstructured problems in practical settings. Students work in teams to formulate issues, propose solutions, and communicate results in formal written and oral presentations. Prerequisite: all 30000-level industrial engineering courses required for the BS IE degree.

Credits: 3.00

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

IE 47200 - Imagine, Model, Make

Credit Hours: 3.00. This course develops a holistic view of an initial competency in engineering design by conceiving, designing, manufacturing, and optimizing a system component such as a complex structural part. Activities include hand sketching, CAD modeling, and operation of CNC machining equipment for rapid prototyping. Tolerance requirements will be verified and optimized prior to the fabrication of the part in the laboratory using rapid prototyping techniques. The focus is on the design process itself as well as the complementary roles of human creativity and computational methods and tools.

Learning Outcomes: 1. Create any object using 3D CAD design software (modeling, texturing, and animation). 2. Evaluate and optimize 3D designs for different manufacturing processes and materials. 3. Apply the principles of engineering tolerance to 3D CAD design. 4. Use rapid prototyping techniques (laser cutting, laser engraving, injection molding, and 3D printing) to manufacture 3D CAD designs. Credits: 3.00

IE 47400 - Industrial Control Systems

Credit Hours: 3.00. Introduction to automatic controls with reference to automation of industrial machines and processes, including linear dynamic systems, feedback control, and elements of systems analysis. Introduction to digital control.

Learning Outcomes: 1. Able to design basic control systems using block diagrams. 2. Able to determine the feedback equation of block diagrams. 3. Able to interpret state-space models. 4. Able to compute state-spaced equations. 5. Able to conduct basic dynamic modeling of a control system. 6. Able to classify a linear time-invariant system into known classes. 7. Able to compute the dynamic

response of a control system. Credits: 3.00

IE 48100 - Introduction To System Simulation

Credit Hours: 3.00. The course presents a general introduction to simulation concept and methodology. It covers simulation modeling in specialized simulation environments. Practical application of simulation to diverse systems will be discussed. Proper design and analysis of the simulation experiment is emphasized. Permission of department required.

Learning Outcomes: 1. Construct discrete-event simulation models using a representative simulation software package. 2. Identify different types of simulation models and determine scenarios where each would be appropriate. 3. Perform analysis of data for the development of input models. 4. Design simulation experiments and conduct statistical analysis. 5. Verify and validate a simulation model. Credits: 3.00

IE 48400 - Integrated Production Systems II

Credit Hours: 3.00. Extensions of topics on the design and operational control of integrated production systems. Includes production databases, facility layout, material handling, advanced control and scheduling, and physical distribution. Case studies, lab assignments, and projects.

Credits: 3.00

IE 48600 - Work Analysis And Design II

Credit Hours: 3.00. Continuation of IE 38600 . Applications of engineering, computer sciences, information sciences, and psychological principles and methods to the analysis and design of human work systems.

Credits: 3.00

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.

Credits: 1.00 to 6.00

IE 49500 - Industrial Practices Seminar

Credit Hours: 1.00. Solution of industrial engineering problems, with particular emphasis on current industrial experience obtained through the cooperative engineering education program. For cooperative program students only.

Credits: 1.00

IE 49900 - Research In Industrial Engineering

Credit Hours: 1.00 to 6.00. Individual research projects for students with honors standing, or other students with the approval of their advisors. Permission of instructor required.

Credits: 1.00 to 6.00

IE 52500 - Healthcare Delivery Systems

Credit Hours: 3.00. This course is to introduce the interconnected sectors in the complex U.S. healthcare delivery systems, including in-patient care, emergency departments, surgical services, out-patient clinics, long-term care, pharmacies, laboratories, as well as supporting industries such as insurance, food services, information technologies, etc. The course focuses on the management of healthcare services by the industrial engineering principles and quantitative decision-making methodologies.

Learning Outcomes: 1. Understand current performance assessment for healthcare. 2. Develop skills in decision making and problem solving by quantitative analytical tools and system/process modeling. 3. Develop proficiency in selecting analytical methods that are appropriate for addressing specific problems for healthcare providers. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 53300 - Industrial Applications Of Statistics

Credit Hours: 3.00. The application of statistics to the effective design and analysis of industrial studies relating to manufacturing and human factors engineering in order to optimize the utilization of equipment and resources. Emphasis on conducting these studies at the least cost.

Credits: 3.00

IE 53500 - Linear Programming

Credit Hours: 3.00. Optimization of linear objective functions subject to linear constraints. Development of theory and algorithmic strategies for solving linear programming problems.

Credits: 3.00

IE 53600 - Stochastic Models In Operations Research I

Credit Hours: 3.00. An introduction to techniques for modeling random processes used in operations research. Markov chains, continuous time Markov processes, Markovian queues, reliability and inventory models.

Credits: 3.00

IE 53700 - Discrete Optimization Models And Algorithms

Credit Hours: 3.00. An introduction to classic models and algorithms for discrete optimization. Basic theory and computational strategies for exact and heuristic solution of integer, combinational, and network problems in the context of classic models.

Credits: 3.00

IE 53800 - Nonlinear Optimization Algorithms And Models

Credit Hours: 3.00. Survey of computational tools for solving constrained and unconstrained nonlinear optimization problems. Emphasis on algorithmic strategies and characteristic structures of nonlinear problems.

Credits: 3.00

IE 54100 - Nature-Inspired Computation

Credit Hours: 3.00. This course is about algorithms that are inspired by naturally occurring phenomena and applying them to optimization, design and learning problems. The focus is on the process of abstracting algorithms from the observed phenomenon, their outcome analysis and comparison as well as their "science". This will be done primarily through the lens of evolutionary computation, swarm intelligence (ant colony and particle-based methods) and neural networks.

Learning Outcomes: 1. Describe the natural phenomena that motivate the discussed algorithms. 2. Understand the strengths, weaknesses and appropriateness of nature-inspired algorithms. 3. Apply nature-inspired algorithms to optimization, design and learning problems. 4. Understand fundamental concepts of NP-hardness and computational complexity. 5. Prove algorithm convergence rates using probabilistic arguments. 6. Perform appropriate analyses on and between the outputs of stochastic algorithms. 7. Analyze search space structure using statistical and information theoretic measures and explain its impact on algorithm behavior and output. Credits: 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

IE 54900 - Machine Vision In Intelligent Robotic Systems

Credit Hours: 3.00. Introduction to machine vision and learning algorithms from a human-machine interaction standpoint, and application of machine vision techniques to the design of human-integrated cybernetic systems, such as, robotic systems, flexible automation, and wearable electronics.

Learning Outcomes: 1. Analyze and write computer programs to analyze images for tasks such as filtering, edge detection, segmentation, object recognition, and template matching. 2. Describe and use image filtering methods for image processing. 3. Describe and use edge detection methods for image processing. 4. Use morphological operations to perform shape recognition and template matching. 5. Use optical flow methods to study motion. 6. Apply techniques for object tracking and motion detection to analyze multiple images or video. 7. Apply learning methods such as neural networks, clustering, and linear regression for object recognition. 8. Apply a computer vision technique to the control of a robotic arm. 9. Plan and develop a working prototype machine vision interface. Credits: 3.00

IE 55600 - Job Design

Credit Hours: 3.00. (PSY 55600) Task analysis, personnel selection and training, job and organization design, and criteria development and use. Human factors related to job design in order to increase job satisfaction and productivity.

Credits: 3.00

IE 55800 - Safety Engineering

Credit Hours: 3.00. Application of human factors and engineering practice in accident prevention and the reduction of

health hazards are presented. The objective of this course is to provide an understanding of the safety and health practices which fall within the responsibilities of the engineer in industry. Special attention is devoted to the detection and correction of hazards and to contemporary laws and enforcement on occupational safety and health.

Credits: 3.00

IE 55900 - Cognitive Engineering Of Interactive Software

Credit Hours: 3.00. Theory and applications of software design to improve productivity and job satisfaction on information processing and cognitive tasks in the workplace. Human information processing models and cognitive theories will be used to provide a theoretical basis for how to choose and display information to the user. Other topics include user-friendly displays and empirical approaches to software design. Applications of the design theory are stressed by class projects.

Credits: 3.00

IE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (AAE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems.

Credits: 3.00

IE 56600 - Production Management Control

Credit Hours: 3.00. Background and development of production management, plus current concepts and controls applicable to production management functions. Not open to Industrial Engineering students with a minor in management.

Credits: 3.00

IE 57000 - Manufacturing Process Engineering

Credit Hours: 3.00. Theories and applications of materials forming and removal processes in manufacturing, including product properties, process capabilities, processing equipment design, and economics. A systems approach to all aspects of manufacturing process engineering.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

IE 57800 - Applied Ergonomics

Credit Hours: 3.00. Analysis, modeling, and design of jobs and systems to be consistent with human factors and ergonomic principles.

Learning Outcomes: 1. Analyze and design work to fit human anthropometric requirements. 2. Analyze and design work to meet human physiological limitations, including lifting tasks. 3. Conduct time studies and use predetermined time system modeling. 4. Perform task analysis and process mapping. 5. Analyze and design work to meet human cognitive limitations. 6. Determine function allocation between automation and human tasks. 7. Model basic human performance at movement, detection, and control tasks. 8. Identify common human errors and perform human reliability analysis. 9. Design displays that meet basic human-computer interaction principles. 10. Write technical reports describing the results of human factors analysis. 11. Present technical material describing the results of human factors analysis. Credits: 3.00

IE 57900 - Design And Control Of Production And Manufacturing Systems

Credit Hours: 3.00. Design and control of discrete part manufacturing systems in contemporary production environments, with emphasis on flexible, demand-driven, product-based manufacturing. Currently used planning and control methodologies, such as MRP, OPT, and JIT are reviewed and integrated with appropriate facility design methodologies, including cellular design algorithms. Introduction to Computer Integrated Manufacturing (CIM) architecture and reference models and relevant control procedures, including

basis approaches to appropriate data management methodologies.

Credits: 3.00

IE 58000 - Systems Simulation

Credit Hours: 3.00. Philosophy and elements of digital simulation language. Practical application of simulation to diverse systems. Computer simulation exercises and applications are required.

Credits: 3.00

IE 58100 - Simulation Design And Analysis

Credit Hours: 3.00. An introduction to simulation of stochastic systems on digital computers. Emphasis is on the fundamentals of simulation as a statistical experiment. Topics include uniform random numbers, input modeling, random variate generation, output analysis, variance reduction, and optimization.

Credits: 3.00

IE 58200 - Advanced Facilities Design

Credit Hours: 3.00. Study of the theoretical and applied aspects of manufacturing systems layout. Emphasis on contemporary manufacturing, including the layout of cellular systems, automated material handling systems, and storage systems.

Credits: 3.00

IE 58300 - Design And Evaluation Of Material Handling Systems

Credit Hours: 3.00. Analysis for design and evaluation of material handling systems with emphasis on material flow control and storage. Analytic models and simulation used. Economic justification models for material handling systems.

Credits: 3.00

IE 58800 - e-Work And e-Service

Credit Hours: 3.00. e-Work is defined as the collaborative, computer-and-communication-supported work in highly distributed organizations of humans/robots/autonomous systems. This course is devoted to learning the basic principles, theories, and applications for the design of effective e-Work and e-Service systems. Relevant discoveries at Purdue and elsewhere are also presented.

Learning Outcomes: 1. Understand fully the theory and design principles of collaborative e-Work and e-Service systems. 2. Model correctly workflow, protocols and agents for e-Work and e-Service systems. 3. Design, specify, evaluate and optimize e-Work and e-Service applications correctly. 4. Discuss benefits, limitations, and emerging trends of e-Work and e-Service systems critically and correctly. Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

IE 63000 - Multiple Objective Optimization

Credit Hours: 3.00. Theory and applications of multiple objective optimization and multiple criteria decision making. Existence and specification of single and multiple attributive value and utility functions. Risk aversion. Characterization and generation of efficient (Pareto optimal) solutions to vector optimization problems. Domination cones. Interactive algorithms. Prerequisite: IE 53500 .

Credits: 3.00

IE 63200 - Scheduling Models

Credit Hours: 3.00. Development and discussion of mathematical and simulation models for scheduling and sequencing the flow of jobs or activities in manufacturing environments. Techniques include dynamic programming, branch and bound, linear and integer programming, heuristics and stochastic network simulation. Prerequisite: IE 57900 ; IE 53500 or IE 53700 .

Credits: 3.00

IE 63300 - Dynamic Programming

Credit Hours: 3.00. Theory and applications of finite and infinite stage sequential decision processes, including Markovian decision problems, efficient computational methods, and computer software package. Prerequisite: IE 53500 , IE 53600 .

Credits: 3.00

IE 63400 - Integer Programming

Credit Hours: 3.00. An advanced course on theory and algorithms for integer and mixed integer optimization problems. Convergence of integer programming algorithms, dual relaxations, Benders decomposition, cutting plane theory, group theory of integer programs, and linear diophantine equations. Prerequisite: IE 53500 , IE 53700 .

Credits: 3.00

IE 63500 - Theoretical Foundations Of Optimization

Credit Hours: 3.00. An advanced course in theoretical foundations of mathematical programming. Convex analysis, global and local duality and optimality, general algorithmic convergence. Offered in alternate years. Prerequisite: IE 53500 .

Credits: 3.00

IE 63900 - Combinatorial Optimization

Credit Hours: 3.00. An advanced course in combinatorial optimization. Emphasis on the theory and strategies of combinatorial algorithms including complexity theory, advance issues in network flows, matching, matroids, and combinatorial polyhedra. Prerequisite: IE 53500 .

Credits: 3.00

IE 64600 - Advanced Decision Theory

Credit Hours: 3.00. An advanced course on the theory and models of decision-making and rationality. Material includes advanced topics in decision analysis, models of probabilistic reasoning, decision-making in competitive situations, and models of human and computer reasoning (including artificial intelligence). Prerequisite: IE 54600 .

Credits: 3.00

IE 65600 - Research Seminar In Human Factors

Credit Hours: 3.00. An in-depth study of topics of special interest in human factors. A variable title course where topics change from semester to semester. Possible topics include cognitive engineering in expert systems, human resource management, skills acquisition and retention, knowledge elicitation, and knowledge representation. Permission of instructor required.

Credits: 3.00

IE 65900 - Human Aspects In Computing

Credit Hours: 3.00. Advanced topics in ergonomic, cognitive, and social aspects of using computerized systems are discussed with regard to comfort and user satisfaction, ease and productive use of computerized systems, and effective implementation of computerized technologies in the workplace. Prerequisite: IE 55900 .

Credits: 3.00

IE 67000 - Advanced Topics In Manufacturing Engineering

Credit Hours: 3.00. Advanced research topics and approaches in manufacturing engineering, including processes and equipment. Research methodology, nontraditional processes, manufacturing systems, and competitive aspects of manufacturing. Prerequisite: IE 57000 .

Credits: 3.00

IE 67400 - Cyber Methods For Advanced Production Control

Credit Hours: 3.00. The study of the theoretical foundation and relevance of advanced cyber methods in the planning and control of intelligent production operations; manufacturing operating systems; synchronization in decentralized systems; recovery in decentralized systems; parallel processing; distributed databases; factory networks; reasoning and logic for production control. Prerequisite: IE 57400 or 57500 or 57900.

Learning Outcomes: 1. Know theoretical foundation and relevance of advanced cyber, real-time control, computing, communication, and brain models for robotics. 2. Know automation of planning and decisions in distributed production and supply installations, global supply, logistics, and service systems/networks. 3. Know the current and emerging functions, algorithms, protocols, and models and how to apply them to research projects and presentations in the field. Credits: 3.00

IE 68000 - Advanced Simulation Design And Analysis

Credit Hours: 3.00. An introduction to the literature of simulating stochastic systems, with emphasis on probabilistic and statistical aspects. Prerequisite: IE 58100 .

Learning Outcomes: 1. Gain in-depth understanding of simulation for use in research or in preparation for conducting research in the area of simulation methodology. Credits: 3.00

IE 69000 - Advanced Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Advanced study in various fields of industrial engineering for graduate students. Credits and hours to be arranged. Permission of instructor required.

Credits: 1.00 to 6.00

IE 69600 - Graduate Professional Practice

Credit Hours: 0.00. Practice in industry and comprehensive written reports of this practice. Permission of instructor required.

Credits: 0.00

IE 69700 - Seminar

Credit Hours: 0.00. Industrial engineering problems with particular emphasis on current research.

Credits: 0.00

IE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

IE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Industrial Engineering Technology

IET 10400 - Industrial Organization

Credit Hours: 3.00. A detailed survey of organizational structures, operational, financial, marketing, and accounting activities; duties of management, planning, control, personnel, safety, wages, policy, and human factors necessary for effective management. Not open to students taking, or with credit in, IE 36600.

Credits: 3.00

IET 11100 - Introduction To Manufacturing And Supply Chain Systems

Credit Hours: 3.00. A survey of organizational units and their function within an enterprise, including a brief history of

organizations. The course emphasizes a systems perspective and how decisions in one area impact the entire system. Topics include operations, financial, marketing, planning, quality control, process strategy, logistics, and safety.

Learning Outcomes: 1. Explain the purpose and function of various organizational units within an enterprise. 2. Describe how the enterprise is a system of interrelated parts. 3. Explain the impact of risk on the enterprise system. 4. Critically analyze current processes to identify areas of improvement. 5. Predict how a suggested change impacts the system. Credits: 3.00

IET 15000 - Quantitative Methods For Technology

Credit Hours: 3.00. Application of statistical techniques to typical problems in technology. Topics include data collection, descriptive statistics calculation, hypothesis testing, sampling, continuous and discrete distribution, probability, ANOVA, and related topics. The course also introduces the use of spreadsheet and other software to solve statistical calculations. Introduction to SPC is included. Basic metrology, concepts of gage and meter calibration calculations, instrument linearity, repeatability, reproducibility, sensitivity, precision, and instrument control are included.

Credits: 3.00

IET 19000 - Topics In Industrial Technology

Credit Hours: 1.00 to 3.00. Hours, credit, and subject matter to be arranged by staff. This is not for independent study. Permission of instructor required.

Credits: 1.00 to 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 28100 - Industrial Safety

Credit Hours: 3.00. A course designed to develop understanding of, and insight into, the basic aspects of accident prevention and safety. Specific attention will be given to (1) the psychological aspects of accident prevention; (2) the principles of accident prevention; (3) the practical aspects of planning, implementing, and maintaining a safe environment; and (4) standards, current laws, and regulations. Field trips may be required.

Credits: 3.00

IET 31300 - Technology Innovation And Integration: Bar Codes To Biometrics

Credit Hours: 3.00. This course provides the foundation for automatically capturing data in a system. The content covers an introduction to technology used in automatic identification and data capture systems, including: bar codes; radio frequency identification; smart cards, and biometrics. Topics also include an immersive semester project that examines the integration of these technologies, as well as advanced problem-solving.

Learning Outcomes: 1. Describe the essential components of an AIDC system. 2. Evaluate and propose solutions to AIDC system-related problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles of integrating and managing AIDC systems. 5. Identify opportunities for system improvement. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33100 - Advanced Industrial Safety And Health Management

Credit Hours: 3.00. An introduction to OSHA and standards development for occupational health in general industry. Special emphasis is on fire protection and egress, flammable and combustible liquids, electrical, personal protective equipment, machine guarding, industrial hygiene/blood-borne pathogens, ergonomics, and ISO 9000/14000 integration.

Learning Outcomes: 1. Explain the purpose of the Occupational Safety and Health Administration (OSHA). 2. Describe the fundamental requirements of each of the General Industry Regulations in 29 CFR 1910. 3. Apply the General Industry Regulations in real-life scenarios within the workplace. 4. Explain how to prepare for the OHSA workplace inspection. 5. Create an adequate training plan for workplace employees. 6. Identify readily available resources for creating a workplace free from recognized hazards. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

IET 33520 - Human Factors For Technology Systems

Credit Hours: 3.00. This course provides the foundation for examining the intersection of people, technology, policy, and work across technology systems. Topics include the evaluation, analysis, and design recommendations for improving the safety and efficiency of human-technology interactions.

Learning Outcomes: 1. Describe the relationship between human factors and technology systems. 2. Solve human-machine interaction problems, using appropriate human factors principles. 3. Recommend actions to correct safety deficiencies in existing environments. 4. Apply principles of innovation to design, conduct, and document a human factors study. Credits: 3.00

IET 33610 - Risk Analysis And Assessment

Credit Hours: 3.00. This course introduces the tools for identifying and analyzing inherent risks associated with the decision-making process. The challenges of quantitative risk assessment are introduced using decision trees, influence diagrams, and probability models. The concepts of risk index, options, avoidance, prevention, and reduction are discussed in the context of technology systems.

Learning Outcomes: 1. Identify and characterize organizational threats. 2. Assess the vulnerability of critical assets to specific threats. 3. Determine the probability and consequences of events. 4. Identify methods to reduce risks. 5. Prioritize risk reduction measures. Credits: 3.00

IET 33620 - Total Productive Maintenance

Credit Hours: 3.00. This course emphasizes the importance of effective maintenance planning and execution for efficient and economical operation of service or technology systems. A systems approach to maintenance planning is taken. Maintenance activities are discussed from reliability and productivity perspectives in the context of technology systems. Semester-long, team-based research project is typically

required.

Learning Outcomes: 1. Differentiate among the various types of maintenance activities. 2. Calculate failure rate, mean time between failures, reliability, and maintenance cost versus profit. 3. Identify various state-of-the-art technologies and applications in PM and PDM maintenance management. 4. Evaluate maintenance management philosophies, organization, and practices of a manufacturing entity. 5. Articulate maintenance management philosophies and practices for manufacturing entities. Credits: 3.00

IET 34200 - Warehouse And Inventory Management

Credit Hours: 3.00. A course designed to develop understanding of types of warehouses, methods of organizing the warehouse environment, and determining efficient inventory control procedures. Technology applications related to the management of warehouse and inventory stock-keeping units (SKU) are investigated. Storage of inventory, placement of inventory, picking, packing, shipping, and other internal logistics management topics will be explored.

Learning Outcomes: 1. Identify activities associated with inventory and warehouse management. 2. Explain the relationship of inventory and warehouse management to supply chain management with other various functional areas, including corporate strategy. 3. Design various warehouse activities under given circumstances. 4. Describe material/distribution requirements planning (MRP/DRP) systems. Credits: 3.00

IET 34250 - Purchasing And Contract Management

Credit Hours: 3.00. This course examines the processes by which goods and services are acquired through purchasing and contract management. Topics include procurement, contract strategies, source selection, identifying contract type, product liability and risk, the bid process and response evaluation; contract risk assessment, contract negotiation, and contract law.

Learning Outcomes: 1. Classify key components of the purchasing and contract processes. 2. Explain product and service selection methods. 3. Identify key documents used in the purchasing and contract processes. 4. Explain negotiation roles and processes. 5. Describe key legal and ethical considerations for purchase orders and contracts. Credits: 3.00

IET 34300 - Technical And Service Selling

Credit Hours: 3.00. A study of sales models and techniques for technical and service sales in business-to-business environments, including development of channel relationships, long-term sales agreements, customer relationship management efforts, total cost of ownership tools and complex sales presentations. Covers critical sales skills such as e-economy sales and marketing, lead management, building credibility, consultative selling, ethical negotiations, and sustainable product management.

Learning Outcomes: 1. Explain the roles of technical and service sales in business to business channels. 2. Describe the relationship between personal selling and marketing. 3. Describe critical influencing factors on organizational buyer behavior. 4. Describe various types of buying situations and typical sales agreements. 5. Demonstrate a personal selling communication model. 6. Describe customer relationship management. Credits: 3.00

IET 34350 - Business To Business Sales Management

Credit Hours: 3.00. This course covers key topics in sales management while emphasizing customer relationship management, sales productivity, and the effects of technology on the sales function. Topics include analyzing multiple channel models; establishing sales plans; incentivizing and motivating the sales force; and evaluating, monitoring, and managing the effectiveness of the sales force.

Learning Outcomes: 1. Describe the responsibilities and challenges of sales in the management role. 2. Describe strategic sales planning; supporting sales recruitment, hiring, and training, evaluation and performance feedback. 3. Demonstrate a variety of data analytic techniques to forecast sales, establish sales goals, and create budgets. 4. Explain sales productivity measures used to establish and manage sales territories. 5. Describe the appropriate use of technology in managing sales. Credits: 3.00

IET 35000 - Engineering Economy

Credit Hours: 3.00. Examines the concepts and techniques of analysis useful in evaluating the worth of systems, products, and services in relation to their cost. The objective is to help students grasp the significance of the economic aspects of engineering and to become proficient in the evaluation of engineering proposals in terms of worth and cost. Project analysis will require computer proficiency. Not open to students who have credit for IET 25000.

Credits: 3.00

IET 36400 - Total Quality Control

Credit Hours: 3.00. This course is aimed at determining customer needs and wants and interpreting these into design during production, follow-up on field performance, and feeding back quality information to further improve the quality system.

Credits: 3.00

IET 41100 - Applications Of Lean And Six Sigma Methodologies

Credit Hours: 3.00. This hands-on course focuses on emerging business practices that are geared toward making an organization more effective and efficient. Highlighted topics will include use of lean and six sigma methodologies in today's business environments. These methods are used for achieving long term profits through customer satisfaction, waste elimination, and elevation of employee skills to eliminate waste and defects at the source. Application of these methods in various environments such as service, health care and manufacturing organizations will be explored. Students are expected to work in teams to apply systematic problem solving processes to solve case studies and/or real-world issues. Supporting concepts such as implementation of new business practices and culture change will also be explored.

Credits: 3.00

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model; total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 43540 - Facilities Planning And Material Handling

Credit Hours: 3.00. This course takes a systematic approach to design of facilities and material handling systems for effective and lean production of goods and services. An array of qualitative and quantitative tools and techniques are introduced and utilized, emphasizing lean principles, waste reduction, and overall efficiency of operations. Flow analysis and optimization tools, including computer simulation, are introduced. Strong emphasis is placed on a comprehensive semester-long team project as an integral component of this course.

Learning Outcomes: 1. Calculate various elements of time study and Takt time. 2. Apply various flow analysis tools. 3. Apply the principles of line balancing. 4. Calculate the efficiency of an assembly line. 5. Calculate facility space requirements. 6. Develop a systematic approach to layout and resource planning, incorporating basic material handling systems. Credits: 3.00

IET 43630 - Design Of Experiments

Credit Hours: 3.00. Introduction to statistical design of experiments. The course examines the difference between

single, multivariate, and factorial experimental designs. Concepts of optimization and response surface methodologies are introduced. The course focuses on interpreting and communicating experimental results.

Learning Outcomes: 1. Formulate null and alternate hypotheses. 2. Apply appropriate statistical tests. 3. Design an appropriate experiment to test a hypothesis. 4. Differentiate between main effects and interaction effects. 5. Distinguish between factorial and fractional factorial designs. 6. Apply response surface methodology. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

IET 44275 - Global Transportation And Logistics Management

Credit Hours: 3.00. A study of the various aspects of logistics. The development, implementation, and control of physical transportation systems, product distribution, warehousing, and inventory policy models will be emphasized. A working knowledge of third and fourth-party logistics and transportation strategies will be analyzed. The impact of logistics and transportation in the global environment will be discussed.

Learning Outcomes: 1. Describe the role of logistics and its relationship to other functional areas of business within a single firm and within the supply chain. 2. Explain various management and control techniques in logistics. 3. Apply statistical principles to evaluate the relative worth of cost-savings initiatives in the logistics industry. 4. Describe how enterprise resource planning (ERP) systems are used to manage logistics and transportation functions. Credits: 3.00

IET 44500 - Strategic Supply Chain Management

Credit Hours: 3.00. A course designed to build upon previous courses with subjects related to managing a distribution enterprise. Modules in sales management, financial analysis, strategic planning, logistics, purchasing, and the legalities of distributor and manufacturer relationships will be combined with case studies to provide students with practice in establishing policy and making decisions from the manager's point of view. Field trips may be required.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision making. Credits: 3.00

IET 45400 - Statistical Process Control

Credit Hours: 3.00. Online process control including design and analysis of process control charts and sampling plans.

Learning Outcomes: 1. Know Operating Characteristics and Average Run Length curves. 2. Apply advanced control chart methods like short run, EWMA, CUSUM and DNOM charts. 3. Determine process capability indices, Cp, Cpk, Pp, Ppk, and Cpm. 4. Apply Taguchi loss function. 5. Apply design of experiments methodology. 6. Have knowledge of statistical tolerancing. Credits: 3.00

IET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology

problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

IET 48390 - Industrial Engineering Technology Capstone I: Problem Identification And Analysis

Credit Hours: 3.00. This is the first semester of a two-semester capstone sequence, which focuses on an industry-based, team approach to problem-solving. An array of qualitative and quantitative tools is used to identify and analyze an industrial or business process. Data collection, process maps, flow analysis, Pareto chart, computer simulation, and other optimization tools will be used to identify problem areas and possible solutions.

Learning Outcomes: 1. Use appropriate research/design processes to identify problems or areas for improvement. 2. Participate effectively in teams. 3. Collect sufficient data to qualitatively and quantitatively describe/evaluate the problem. 4. Identify learning needs/knowledge gaps needed in order to complete projects(s). 5. Propose and properly document a potential design solution or process improvement. 6. Demonstrate ethical conduct, describing societal, environmental, and economic implications of proposed solutions. Credits: 3.00

IET 48395 - Industrial Engineering Technology Capstone II: Project Design

Credit Hours: 3.00. This is the second course of two-semester capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution to the project/problem.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final design recommendations. Credits: 3.00

IET 48490 - Supply Chain Management Technology Capstone I: Strategic Planning

Credit Hours: 3.00. This course is the first of two integrative capstone courses for senior-level students. The focus is on how firms formulate, implement, and evaluate strategies. Teams of students will integrate program knowledge, coupled with strategic-management techniques learned, to make decisions and help chart the future of different organizations. The major responsibility of students in the capstone courses is to make objective strategic decisions and to justify them through oral and written communication.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision making. Credits: 3.00

IET 48495 - Supply Change Management Technology Capstone II: Strategic Analytics

Credit Hours: 3.00. This course is the second of two integrative capstone courses for senior-level students. Students will continue working in teams using a variety of planning and decision-making models to work with organizations to solve problems and make sound decisions. The major responsibility of students in the capstone courses is to make objective strategic decisions and to justify them through oral and written communication.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision-making. Credits: 3.00

IET 49000 - Special Topics In Industrial Engineering Technology

Credit Hours: 1.00 to 3.00. Supervised individual research in industrial engineering technology topics. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes will vary for each instance the course is offered.

Credits: 1.00 to 3.00

IET 49900 - Industrial Engineering Technology

Credit Hours: 1.00 to 9.00. Hours and subject matter to be arranged by staff. Course may be repeated for credit.

Credits: 1.00 to 9.00

IET 50700 - Measurement And Evaluation In Industry And Technology

Credit Hours: 3.00. An introduction to measurement strategies in industrial, technical, and human resource development environments. The evaluation of measurement outcomes will be the primary focus of the course.

Credits: 3.00

IET 50800 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology.

Credits: 3.00

IET 53410 - Implementation And Advanced Topics Of Enterprise Six Sigma

Credit Hours: 3.00. This course is designed to expose master's and doctoral students to the theory behind implementation of Six Sigma at the Enterprise level. Students will develop their own research with regard to the future of the discipline through particular assessments. Topics include structure and methodology of Six Sigma deployment, including: systems thinking, change management, business process management, competitive intelligence through international standards, and the future of the discipline. Students will learn the methodology of Six Sigma at the project level for technical skill building in addition to practices of implementing and managing Six Sigma at an organizational level. Permission of Instructor required.

Learning Outcomes: 1. Define Six Sigma by describing the various technical aspects of the DMAIC methodology. 2. Have a knowledge basis suitable to pass an external Six Sigma certification exam. 3. Have the ability to recognize the organizational opportunity for the implementation and management of Six Sigma at the enterprise level. 4. Exhibition of knowledge needed to introduce and champion Six Sigma strategically to the organization. 5. Conduct applied or use inspired research in Six Sigma discipline by identifying current boundaries of the discipline, identify novel applications, and appraise the standardization of the body of knowledge. Credits: 3.00

IET 54500 - Global Supply Chain Management

Credit Hours: 3.00. The objective of this course is to provide in-depth knowledge of global supply chain management and its application in industries. This course explores supply chain management, expanding beyond the linkage between producer and distributor to include other enterprises in the product life cycle, beginning with concept design and ending in disposal. Learning methodologies include lecture, case study, and collaborative student group activities in applied research. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of supply chain management terminology, issues, and models. 2. Construct supply chain models and identify advantages and limitations. 3. Critically evaluate supply chain management techniques in applied case studies. 4. Independently develop in-depth knowledge of a supply chain and present the findings in a coherent and informative manner. Credits: 3.00

IET 58100 - Workshop In Industrial Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Mastery of diverse topics related to Industrial Engineering Technology. 2. Integrate the concepts from various topics related to Industrial Engineering Technology. Credits: 0.00 to 8.00

IET 59000 - Special Problems In Industrial Engineering Technologies

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in Industrial Engineering Technology. A faculty sponsor is required for this course. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

IET 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of Instructor required.

Learning Outcomes: 1. Identify a business or

industry relevant solution to a technology related problem 2. Define and/or validate a business or industry relevant problem. 3. Address a technological problem in a systematic and replicable manner. 4. Effectively use technical/professional research and/or development procedures. 5. Identify criteria for success/solution of the problem. 6. Gather information appropriate to the problem by employing business research procedures. 7. Document the research and development activity in a manner that permits replication and assessment of key decisions and alternatives. 8. Write effectively in a form customary to business and industry, using APA format. 9. Prepare and deliver a presentation in a form customary to business and industry. Credits: 1.00 to 3.00

IET 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering due to individual research topics. Credits: 1.00 to 18.00

Industrial Technology

IT 54000 - Biometric Performance And Usability Analysis

Credit Hours: 3.00. An introduction of test methodologies from disciplines outside of biometrics, which include: usability, ergonomics, human factors, and human-computer interaction, in order to demonstrate how biometric data analysis can benefit from understanding how humans interact with biometric sensors during the testing and evaluation of biometric systems. The course explores test methods, case studies, and prior biometric testing reports in order to develop a test methodology that includes information on how users interact with biometric systems. Permission of department required.

Learning Outcomes: 1. Understand the operation of biometric systems. 2. Understand how people use biometric systems in operational settings (both controlled and uncontrolled). 3. Understand traditional technology, scenario, and operational testing methodologies. 4. Understand traditional ergonomic and usability testing methodologies. 5. Understand and analyze the limitations of biometric systems. 6. Understand basics of quantitative and qualitative research. 7. Evaluate the issues in designing a biometric system, including but not limited to: the impact of language and culture (instructions and symbols), ergonomics and anthropometrics (heights-angles, positioning), training and habituation or accessibility, affordance, and perception. 8. Interpret results from reports on: biometric technologies evaluation methods, ergonomic and usability methods, and statistical methods. 9. Appraise and critically evaluate prior scenario and operational test reports and case studies of biometric technologies to examine where the application of Human-Biometric Sensor Interaction principles, such as usability, human factors, and ergonomics could have provided additional data on system performance. 10. Transfer knowledge and understanding of usability, ergonomic, and usability evaluation methodologies to the testing and evaluate biometric devices and systems. 11. Establish a test methodology and collect data using a Human-Biometric Sensor Interaction based methodology (usability, ergonomic, human factors) to investigate a current problem facing industry. 12. Perform the appropriate data analysis and report findings in a report. 13. Students will produce final reports, conference papers, etc., based on their course project. Credits: 3.00

IT 54500 - Biometrics Technology And Applications

Credit Hours: 3.00. Examines biometrics technology as it relates to security, access control, and the authentication of individuals. The course will examine biometric technologies including iris, face, finger, hand geometry, dynamic signature verification, skin print analysis, and voice recognition. Permission of instructor required.

Credits: 3.00

IT 57100 - Project Management In Industry And

Technology

Credit Hours: 3.00. The factors influencing decisions during the initiation, implementation, and termination of industrial and manufacturing projects are examined. Students work as project teams, using project management tools to develop implementation strategies. Permission of instructor required.

Learning Outcomes: 1. Understand and learn latest tools and techniques used in projects. 2. Develop a system perspective for understanding projects. 3. Align projects with strategic objectives. 4. Develop and think analytically in order to successfully apply knowledge and technical expertise to the solution of real business problems. Credits: 3.00

IT 59000 - Special Problems In Industrial Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Credits: 1.00 to 6.00

IT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of department required.

Credits: 1.00 to 3.00

Information and Library Science

ILS 10000 - Introduction To Information Studies

Credit Hours: 3.00. This course will provide a foundation for navigating and engaging with the information-rich world. Students will define and assess information in order to address real-world situations; map their information landscape and effectively engage with information systems as well as human sources of information; develop a practice of critical and ethical information use; and conceptualize, apply, and examine the strategies for information and knowledge management, production, and dissemination. Students will examine the societal impact and implications of information and information privilege to explore the applications and consequences of information, in addition to examining data practices and methods. This will provide students with an opportunity to strengthen their research and information literacy skills, reflect in an informed and critical manner, and give them the tools to successfully make ethical, evidence-based decisions in the academic and professional context.

Learning Outcomes: 1. Identify different types of primary and secondary information formats and how they are created. 2. Analyze the societal, historical, and political significance of information. 3. Identify and explain different types of information-seeking behaviors. 4. Demonstrate ethical attribution of sources in their own information production. 5. Critically evaluate information. 6. Synthesize information in order to make ethical and evidence-based decisions. 7. Identify interested parties, such as scholars, experts, archives, organizations, governments, and industries, who might produce or house information about a topic and then determine how to access that information. 8. Match information needs and search strategies to appropriate search tools. 9. Design and refine needs and search strategies. 10. Understand how information systems (i.e., collections of recorded information) are organized in order to access relevant information. 11. Understand how and why information is selected for long-term preservation and access. 12. Organize information in situationally relevant ways. 13. Explain different forms of information dissemination. 14. Explore different professional pathways and career options in relation to information. 15. Analyze and criticize forms of preservation. Credits: 3.00

ILS 10300 - Introduction To Data Lifecycle Management

Credit Hours: 1.00. Introduces concepts of the management of data throughout its lifecycle. Understanding different types of data and their functions. Managing data in the context of a particular discipline or profession. Finding and evaluating data purposefully. Using data ethically and responsibly. Creating and sharing data for reuse, accountability, and enhancement. Making decisions and communicating using data, including data analysis and visualization. Protecting and archiving data.

Learning Outcomes: 1. Describe the data lifecycle and types of data that are used in their discipline or profession. 2. Discuss the ethical and responsible use of data. 3. Locate and evaluate datasets for reuse that are relevant to

their research or work. 4. Apply a variety of introductory data collection, analysis, and visualization techniques. 5. Understand the basics of securing, archiving, and sharing data. Credits: 1.00

ILS 13200 - Introduction To Museums And Archives

Credit Hours: 3.00. This course is an introduction to the structures, history, theories, and professional practices in museums and archives. In addition to providing an overview, this course provides students with career exploration in museums and archives through analyzing opportunities in various professional tracks. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Explain the historical foundations of museums and archives. 2. Identify basic organizational structures and career paths of museums, galleries, archives, and special collections libraries. 3. Analyze the value and educational mission of museums, galleries, archives, and special collections across multiple disciplines. 4. Interpret contemporary theories and practices within museums, galleries, archives, and special collections. 5. Apply learning to future opportunities in chosen specialties, majors, and career fields. Credits: 3.00

ILS 17500 - Information Strategies For Hospitality & Tourism Management (UCC: IL)

Credit Hours: 1.00. This course will provide students with a framework of information search skills and problem-solving they can utilize in their area of study and in everyday life. It will also incorporate technology literacy components with active learning. Class sessions will consist of lecture, group discussion, demonstrations, and in-class activities and out-of-class activities. The course is intended for first-semester freshman students. Department permission required.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Develop the ability to access information and determine what different sources are needed for problem solving. 2. Develop a foundation in problem-solving to use discovered information effectively and efficiently. 3. Develop a knowledge-base into the full array of information available (scholarly articles, market reports, quality websites, and other types of information). 4. Learn to prioritize sources based on credibility and relevance. 5. Accurately cite the information you find. 6. Use retrieved information to accomplish a specific purpose and present information clearly and persuasively using a range of technology tools and media. Credits: 1.00

ILS 18000 - Preparing For Your Undergraduate Research Experience

Credit Hours: 1.00. This course is for prospective Purdue undergraduate researchers who are interested in conducting undergraduate research or creative endeavors. Purdue students who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs. Throughout the course, students will develop components for a final application packet to submit to a research team or program they choose. Department permission required.

Learning Outcomes: 1. Identity the professional and personal goals sought from an undergraduate research experience. 2. Learn research skills such as assessing literature credibility and compiling a review of the topic important to all fields. 3. Utilize online and in-person resources and programs to assist in locating and applying to undergraduate research experiences. 4. Evaluate research programs/projects to determine how they fit within personal and professional goals. 5. Create and submit an application/proposal including a resume' and personal statement for research programs/projects. Credits: 1.00

ILS 19500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics from the practice of information and data science, varying from semester to semester. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of department required.

Learning Outcomes: 1. Examine critically and apply information and data science to various disciplines. 2. Develop practical skills and apply

them to their disciplinary research. Credits: 1.00 to 4.00

ILS 20100 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work. Permission of instructor required.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods through critical inquiry. 4. Create a process for developing and completing a digital project. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

ILS 23500 - SPIRaL, Part I: Commencing Information Literacy Research

Credit Hours: 2.00. Over the course of a year-long research experience, SPIRaL undergraduate researchers engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. In the first half of the semester, SPIRaL students will explore the information literacy literature to build a foundation for our research this year. In this early part of the semester, students will be introduced to the different views scholars have of information literacy, the various research approaches they employ, and the range of real-world information challenges information literacy researchers attend to with their research. Students will use the insights from the existing information literacy and information challenges research to inform the research study they will carry out over the year. In second part of the fall semester, students will commence original research that addresses a need or gap in the literature. Students will apply data collection methods and reflect on the affordances of qualitative research approaches in pursuing knowledge about information literacy's role in addressing information challenges. Across this year-long research experience, the SPIRaL research team will aim to: 1. expand what is known about the role information literacy can play in addressing significant information challenges in the world, and 2. enrich the information literacy research community by welcoming new and passionate undergraduate researchers into this work.

Learning Outcomes: 1. Analyze the range of scholarly perspectives, research approaches, and real-world information challenges information literacy researchers attend to with their research. 2. Use insights from information literacy research to conduct a qualitative research study investigating the role information literacy may play in addressing various information challenges. 3. Apply qualitative research methods to collect data for our research study that will investigate the role information literacy may play in addressing various information challenges. 4. Employ a practice of reflection and act upon reflective insights to operate effectively on team-based research. Credits: 2.00

ILS 23600 - SPIRaL, Part II: Conducting Information Literacy Research

Credit Hours: 1.00. Over the course of a year-long research experience, SPIRaL undergraduate researchers engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. The second

semester of SPIRaL builds upon the work completed in the previous semester. We will spend the first half of the semester analyzing the data collected last semester. We will then present our research approach, findings, and implications in various scholarly venues.

Learning Outcomes: 1. Analyze data collected in semester 1 to investigate the role information literacy may play in addressing various information challenges. 2. Present information literacy research (including methods/processes, findings, and insights) to diverse audiences and stakeholders (the SPIRaL research group, ILS researchers, Purdue campus). 3. Employ a practice of reflection and act upon reflective insights to operate effectively on team-based research. 4. Recognize the value of information literacy research in addressing information challenges that impact society. Credits: 1.00

ILS 24900 - Collections Management In Museums And Archives

Credit Hours: 3.00. This course provides discussion and application of collections management in museums and archives. Students will learn the systems, organizational methods, descriptive processes, ethical/legal considerations, and administration best practices within these cultural heritage institutions. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Understand application of collections systems within their fields. 2. Identify current issues in collections management. 3. Compare and contrast collections management between archives and museums. 4. Demonstrate standards and best practices in collections management. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ILS 28000 - Understanding Your Undergraduate Research Experience I

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to hone skills necessary for successfully reflecting on and completing the experience. During this course, students will utilize their research experience to apply skills such as managing time with a research project, communicating your research, utilizing Purdue Libraries' resources, and providing feedback to peer researchers. Students will deliver research pitches about their own project and provide critiques to others' pitches. Department permission required.

Learning Outcomes: 1. Communicate research to various audiences with a research pitch and a research abstract. 2. Provide constructive feedback and interact with peers and apply comments to your work. 3. Define skills/attributes from your undergraduate research experience. 4. Develop and expand a network of researchers within your unit and among other peer researchers. 5. Reflect on and apply transferable skills necessary to be a successful undergraduate researcher. Credits: 1.00

ILS 29000 - Independent Study In Information Science

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue. Plan of Study and assessment method are agreed upon by faculty and student prior to course registration.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

ILS 29500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and

organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 30000 - Information, Culture, And Society

Credit Hours: 3.00. Information and information systems shape our beliefs, influence decision-making, define our collective knowledge, and are integral to being an informed, responsible, and engaged citizen in our modern world. This course will examine the intricate relationship between information and society to better understand how information ecosystems, constituted by various technologies and practices, shape and are shaped by individual identities, structures of power, and ethical considerations/human values. Using an interdisciplinary and team-based approach, students will gain essential skills to navigate their information-rich world.

Learning Outcomes: 1. Identify and apply frameworks to critically evaluate the impact of information and technology on cultural norms, values, and societal structures. 2. Explore the concept of information identity, including how individuals and communities construct their identities through information consumption and production, and critically analyze the impact of information identity on culture and society. 3. Explain the components of information ecosystems, including producers, consumers, intermediaries, and technologies, and how they interact within different cultural and societal contexts. 4. Analyze the power structures in information ecosystems, including the privileged access and control of certain individuals or groups, and explain how these power dynamics intersect with social constructs like race, gender, class, and ethnicity to shape cultural and societal dynamics. 5. Articulate ethical principles related to information ownership, privacy, censorship, transparency, and research in various contexts. Credits: 3.00

ILS 30100 - Data Foundations, Tools, And Applications

Credit Hours: 3.00. Data are everywhere. Data permeates every aspect of our lives, from journalistic reporting to workplace projects to artificial intelligence applications. This course covers the basics of the data research lifecycle, including locating and managing datasets, along with applying different methods and tools a to craft compelling stories about data. Students will learn the difference between data and information and how to transform raw data into information to be communicated to a wider audience. This course offers unique skills for students from any discipline who want to discover the world of data.

Learning Outcomes: 1. Understand the differences between data and information. 2. Navigate the basics of data management, ethics, and analysis. 3. Explore different datasets and their lifecycles. 4. Apply fundamental methods--and tools--of data location, analysis, cleaning, and visualization. 5. Create an original data story with and about data. Credits: 3.00

ILS 33000 - The Age Of Mis/Dis/Malinformation

Credit Hours: 3.00. In our current moment, often known colloquially as the "Information Age," the veracity of information is of incredible importance, yet we see the viral spread and consumption of "bad" information: misinformation, disinformation, and malinformation. These three forms of information are spread globally regarding every event. Even though more people have access to information sources than ever before, we still are living in the age of mis/dis/malinformation.

Learning Outcomes: 1. Apply theoretical frameworks to think critically about our information ecosystems. 2. Respond critically, thoughtfully, and empathetically to the problematic of mis/dis/malinformation. 3. Reflect on the impact of mis/dis/malinformation on everyday people, nations, and information ecosystems. 4. Engage philosophical and critical debates about information from a range of disciplines. 5. Recognize the various ways in which prominent social-media platforms facilitate the spread of mis/dis/malinformation. Credits: 3.00

ILS 33100 - Conspiracy Theories

Credit Hours: 3.00. In the information age, we have witnessed a dramatic resurgence of paranoia and violence, fueled by the very technologies meant to provide access to knowledge and

information. In this course, we will uncover conspiracies together, seeking to understand how such strange ideas originate and spread.

Learning Outcomes: 1. Apply theoretical frameworks to think critically about conspiracy theories within American culture. 2. Respond critically, thoughtfully, and empathetically to the problematic of American conspiracism. 3. Reflect on the impact of conspiracy theories on the American public sphere, families, and information ecosystems. 4. Engage philosophical and critical debates about conspiracy theories from a range of disciplines. 5. Recognize the various ways in which prominent social media platforms facilitate the spread of conspiracy theories. Credits: 3.00

ILS 33500 - SPIRaL, Part I: Commencing Information Literacy Research

Credit Hours: 2.00. Over the course of a year-long research experience, you will engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. In the first half of the semester, you will explore the information literacy literature to build a foundation for our research this year. In this early part of the semester, you will be introduced to the different views scholars have of information literacy, the various research approaches they employ, and the range of real-world information challenges information literacy researchers attend to with their research. You will use the insights from the existing information literacy and information challenges research to inform the research study you will carry out over the year. In the second part of the fall semester, you will commence original research (IRB #) that addresses a need or gap in the literature. You will apply data collection methods and reflect on the affordances of qualitative research approaches in pursuing knowledge about information literacy's role in addressing information challenges. Across this year-long research experience, the SPIRaL research team will aim to: 1. expand what is known about the role information literacy can play in addressing significant information challenges in the world, and 2. enrich the information literacy research community by welcoming new and passionate undergraduate researchers into this work. Permission of department required.

Learning Outcomes: 1. Analyze the range of scholarly perspectives, research approaches, and real-world information challenges information literacy researchers attend to with their research. 2. Use insights from information literacy research to conduct a qualitative research study investigating the role information literacy may play in addressing various information challenges. 3. Apply qualitative research methods to collect data for our research study that will investigate the role information literacy may play in addressing various information challenges. 4. Employ a practice of reflection and act upon reflective insights to operate effectively on team-based research. Credits: 2.00

ILS 33600 - SPIRaL, Part II: Conducting Information Literacy Research

Credit Hours: 1.00. Over the course of a year-long research experience, SPIRaL undergraduate researchers engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. The second semester of SPIRaL builds upon the work completed in the previous semester. We will spend the first half of the semester analyzing the data collected last semester (IRB 2024-84). We will then present our research approach, findings, and implications in various scholarly venues. Across this year-long research experience, the SPIRaL research team will aim to: 1. expand what is known about the role information literacy can play in addressing significant information challenges in the world, and 2. enrich the information literacy research community by welcoming new and passionate undergraduate researchers into this work. Permission of department required.

Learning Outcomes: 1. Analyze data collected in semester 1 to investigate the role information literacy may play in addressing various information challenges. 2. Effectively present information literacy research (including methods/processes, findings, and insights) to diverse audiences and stakeholders (the SPIRaL research group, ILS researchers, Purdue campus). 3. Employ a practice of reflection and act upon reflective insights to operate effectively on team-based research. 4. Recognize the value of information literacy research in addressing information challenges that impact society. Credits: 1.00

ILS 38000 - Understanding Your Undergraduate Research Experience II

Credit Hours: 1.00. This course is for current Purdue

undergraduate researchers to build upon the previous course and focus on research data collection, presentation, and communication for current Purdue undergraduate researchers. During this course, students will learn and discuss various forms of data and collection practices. Students will develop their own academic poster to present their research project's data and implications. Students are encouraged to present their poster at one of Purdue's undergraduate research conferences near the end of the semester. This course is the second course taken as undergraduate researchers and introduces material at this advanced level. This higher-division course is normally scheduled for juniors and seniors. Department permission required.

Learning Outcomes: 1. Learn about quantitative and qualitative research methods and discuss how to utilize both in a research project. 2. Create and present an academic poster applying data visualization best practices. 3. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

ILS 39500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digitals scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Department approval required.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 48000 - Beyond Undergraduate Research

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build on previous courses and focus on continuing their education in graduate or professional school. During this course, students will learn and discuss the various phases of identifying, selecting, applying to and funding graduate or professional school programs. Students will also gain a deeper comprehension of the qualities and skills that make research mentors effective while developing skills they will need to be successful mentees and peer mentors. Students will conduct research to identify potential programs of interest and develop a statement of purpose. Department permission required.

Learning Outcomes: 1. Categorize graduate or professional school qualities that fit skills and meet professional needs. 2. Identify qualities and skills necessary to act effectively as a research mentor and as a research mentee to a future graduate/professional advisor. 3. Create a statement of purpose to include in graduate/professional school applications. 4. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

ILS 49000 - Independent Study In Information Science

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue. Plan of Study and assessment method are agreed upon by faculty and student prior to course registration.

Learning Outcomes: 1. Variable but agreed upon by faculty and student prior to course registration. Credits: 1.00 to 3.00

ILS 49500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 51200 - Information Strategies For Science, Technology, And Engineering Research

Credit Hours: 1.00. This course focuses on information strategies for successful research in science, engineering, and technology disciplines. Students will learn about how scholarly information and discipline relevant grey literature (e.g., patents, technical standards) are created, organized, disseminated, retrieved, and managed. In addition, students will learn strategies to critically evaluate information and present their research effectively and ethically.

Learning Outcomes: 1. Compare and contrast various modes and models of publication relevant to science, engineering, and technology disciplines. 2. Construct and apply

search strategies to retrieve relevant information on science, engineering, and technology related topics, using information resources appropriate to the given task and the type(s) of information sought. 3. Critique information to judge whether it is appropriate and applicable to the task at hand. 4. Synthesize information from multiple sources in order to produce a clear and effective presentation, citing sources where appropriate. Credits: 1.00

ILS 51400 - Information Skills For Health Professionals

Credit Hours: 1.00. This course is designed to help you develop essential information skills to support your professional goals and prepare you to succeed in graduate or professional school in the health sciences. Learn how to navigate PubMed and other subject-specific databases, and differentiate between various types of research articles. Become adept at saving, organizing, and annotating articles so you can easily locate them, "cite while you write," and share them with your classmates or research group. Prepare for writing for publication. And avail yourself of the resources and services academic libraries provide, beyond books and journals, to support your coursework and research.

Learning Outcomes: 1. Plan for comprehensive literature searches by clearly defining your information need and mapping search terms to those concepts. 2. Find information relevant to your information needs using appropriate subject database(s), including the use of keywords or prescribed vocabulary, and available search facets. 3. Evaluate the level of evidence presented by research reports on the basis of their methodologies. 4. Save, organize, and use materials in multiple formats (journal articles, books, book chapters, web sites) using a citation management system. 5. Explain what evidence-based practice means to you in the context of your career goals. Credits: 1.00

ILS 52000 - Introduction To Systematic Review For The Health Sciences

Credit Hours: 3.00. This course will introduce systematic review methodology of published health sciences literature. Students will learn to form research questions, develop inclusion and exclusion criteria, search for evidence, manage data, and assess the risk of bias.

Learning Outcomes: 1. Analyze and articulate the sequential steps encompassing the systematic review process. 2. Construct and refine a reproducible and systematic search strategy tailored to specific research inquiries. 3. Execute the management of citation data to support systematic review processes. 4. Design a systematic review protocol adhering to established guidelines and standards. Credits: 3.00

ILS 54000 - Critical GIS: Theory And Applications

Credit Hours: 3.00. This course will provide students with a critical overview of the role power, culture, justice and injustice, and oppression have played in the practice and history of cartography. In this hands-on course students will learn the basic GIS skills and techniques that will help them understand place and space through critical theories of race, gender, sexuality, indigeneity, class, ability, colonialism, and the State. We will engage theoretical texts on mapping and social justice to identify how GIS and maps can expose and resist oppression and inequality. Students will apply critical theory through the practice of critical cartography to analyze a course-related topic of their choosing and use GIS tools to create an original project. Students will move away from the traditional research paper and engage with a digital research platform that enhances research impact and scholarship reach while applying such tools to interrogate the power dynamics contained within them. It provides the opportunity to serve as a tool for community collaborations in social activism as a shareable document. This class is designed to offer an interdisciplinary approach to place-based research and its connections to social justice.

Learning Outcomes: 1. Engage theoretical texts related to GIS, mapping, and critical theory. 2. Critique the role of GIS in resisting or reinforcing power structures. 3. Implement GIS and mapping techniques to respond to important sociopolitical issues. 4. Create original maps related to topics discussed in the course. Credits: 3.00

ILS 59000 - Independent Study In Information Sciences

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue University. Plan of study and assessment is agreed upon by faculty and student before registration. Permission of department required. Permission of

instructor required.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

ILS 63100 - Digital And Analog Archives

Credit Hours: 3.00. Digital and Analog Archives provides an overview of archival theory and practice, including archival arrangement and description, preservation, and digitization best practices. Lab components incorporate archival research, digital reformatting, metadata creation, the creation of digital archives, and presentation of archives to users.

Learning Outcomes: 1. Analyze and think critically about archives. 2. Arrange, describe, preserve archival materials. 3. Conduct archival research; Communicate and defend a research argument. 4. Utilize digital humanities tools to create a digital archives project. Credits: 3.00

ILS 65000 - Introduction To Computational Text Analysis

Credit Hours: 3.00. This course provides an introduction to the methods, debates, and tools of computational text analysis, specifically crafted for the humanities and social science graduate students.

Learning Outcomes: 1. Recognize and assess the possibilities for computational text analysis for research. 2. Find and implement code for text analysis projects. 3. Experiment with both existing and original code. 4. Appraise and critique the limits of computational text analysis for research. 5. Design original projects using course lessons. Credits: 3.00

ILS 65100 - Introduction To Natural Language Processing

Credit Hours: 3.00. This course provides a comprehensive overview of the fundamental concepts, techniques, and applications in the field of natural language processing. Using Python programming, students will learn to implement NLP tasks from basic text processing to advanced techniques, including sentiment analysis to discern emotions from text and topic modeling to uncover latent themes within large datasets. Additionally, students will explore emerging technologies such as generative AI and Large Language Models (LLMs) and their implications for NLP. By the end of this course, students will emerge with a solid understanding of NLP principles, proficiency in Python programming for NLP tasks, and the ability to apply these skills to address diverse NLP challenges.

Learning Outcomes: 1. Describe Natural Language Processing (NLP) and its applications. 2. Apply Python programming to Natural Language Processing tasks. 3. Implement text analysis to extract information from text data. 4. Create solutions for sentiment analysis problems. 5. Build solutions for topic modeling tasks. 6. Describe generative AI and Large Language Models (LLMs) and their use

cases. Credits: 3.00

ILS 69000 - Independent Study In Information Sciences

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue University. Plan of study and assessment is agreed upon by faculty and student before registration. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

ILS 69500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

Interdisciplinary Engineering

IDE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply

probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IDE 38199 - Professional Practice Three-Session Coop I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

IDE 38299 - Professional Practice Three-Session Coop II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

IDE 38399 - Professional Practice Three-Session Coop III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

IDE 38500 - Design Methodologies For Diverse Stakeholders

Credit Hours: 3.00. This course focuses on engineering design methodologies with a concern for the needs of diverse stakeholders. The course brings together topics drawn from a variety of disciplines (including anthropology, education, psychology, human-computer interaction and engineering) to introduce interdisciplinary engineering approaches to: (1) design tools, systems, and/or environments to support cognitive processes and (2) engage in human-centered and learner-centered design. The semester design project provides a context for students to apply these methods. Permission of Instructor required.

Learning Outcomes: 1. Learn about cognitive processes (including learning processes), how to design products, processes and environments to support cognition. 2. Learn methodologies and develop skills to be able to apply human-centered principles in the design of interfaces, every-day products and learning environments, whether in industrial or academic settings. 3. Engage in reflective practices to connect the course material to previous learning experiences as well as personal learning goals, with a goal of furthering their life-long learning skills. Credits: 3.00

IDE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39699 - Professional Practice Internship

Credit Hours: 0.00. Internship experience in multidisciplinary engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

IDE 48000 - Engineering Ethics In Interdisciplinary Contexts

Credit Hours: 3.00. The purpose of this course is to provide students with tools and strategies to reason through situations with ethical issues that they may encounter as engineering students and in their future careers. To this end, this course seeks to enhance students' awareness of ethical issues in interdisciplinary engineering contexts, ability to reason through ethical challenges in diverse engineering contexts, courage to respond to ethical issues in their future practice, ability to work effectively on teams, and the ability to communicate with others.

Learning Outcomes: 1. Identify ethical issues affecting ethical engineering practice in interdisciplinary engineering contexts. 2. Apply a consistent reasoning process toward ethical issues in an engineering context and formulate appropriate courses of action to respond to the issue. 3. Feel prepared to respond to ethical issues they may encounter in their future work. 4. Collaborate on interdisciplinary teams while considering and responding to challenging ethical scenarios. 5. Communicate ethical considerations to their peers and other key stakeholders. Credits: 3.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and

verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 49500 - Special Topics In Interdisciplinary Engineering

Credit Hours: 1.00 to 4.00. Primarily designed for interdisciplinary engineering subject areas for which there is no specific course offered, but for which there is sufficient student interest to justify teaching a specialized course on a trial basis. May be repeated for credit as long as the topic being taught is not repeated.

Credits: 1.00 to 4.00

Interdisciplinary Studies

IDIS 20100 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods through critical inquiry. 4. Create a process for developing and completing a digital project. Credits: 3.00

IDIS 29000 - Interdisciplinary Topics

Credit Hours: 0.00 to 6.00. Course topics and patterns will vary.

Credits: 0.00 to 6.00

IDIS 49000 - Directed Reading In Interdisciplinary Studies

Credit Hours: 1.00 to 3.00. Reading under the direction of the instructor in a particular field of study. Permission of instructor required.

Credits: 1.00 to 3.00

IDIS 49100 - Special Topics In Interdisciplinary Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of the instructor in a particular field of specialization.

Learning Outcomes: 1. Formulate significant research questions and conduct research relevant to those questions. 2. Consider a topic from multiple perspectives. 3. Demonstrate

critical thinking and problem-solving abilities. 4. Demonstrate effective communication skills.

Credits: 1.00 to 4.00

IDIS 59000 - Directed Reading In Interdisciplinary Studies

Credit Hours: 1.00 to 3.00. Reading under the direction of the instructor in a particular field of study. Permission of instructor required.

Credits: 1.00 to 3.00

IDIS 59100 - Selected Topics In Interdisciplinary Studies

Credit Hours: 3.00. A study of selected topics, taught by an instructor in whose particular field of specialization the content of the course falls.

Credits: 3.00

Interior Architecture

INT 10300 - Introduction To Interior Design

Credit Hours: 3.00. An overview of the field of interior design, its history, and theory. An application of the principles and elements of interior design. Basic hand drafting. This course is for those who are seeking or considering a degree in Interior Design.

Credits: 3.00

INT 12400 - Space Planning For Interiors

Credit Hours: 3.00. Introduction to the fundamentals of design for human activity, standards for space, programming, and graphic communication. Requirements for ADA and Universal Design will be included.

Credits: 3.00

INT 12500 - Color And Lighting Of Interiors

Credit Hours: 3.00. Exploration of the physiological, psychological, and phenomenal aspects of color and light in interior spaces. Application includes specification and selection of lighting fixtures and light sources.

Credits: 3.00

INT 15100 - Textiles For Interiors

Credit Hours: 3.00. An extensive study of textiles: fiber types, yarn production, fabric construction, finishing, coloring, and printing. Application of textiles for use in residential and commercial interiors.

Credits: 3.00

INT 20200 - Interior Materials And Applications

Credit Hours: 3.00. Analyzes information related to use of surfacing materials applied as interior finishes in interior design projects. The role of green design is introduced, and ecological issues are integrated into each category of materials analyzed.

Credits: 3.00

INT 20400 - History Of Interiors And Furniture I

Credit Hours: 3.00. A survey of historical development of interiors, furniture and decorative arts from early history to 1800 (early neoclassic). Emphasis on design motifs, ornamentation and furniture styles.

Credits: 3.00

INT 22400 - Residential Interior Design Studio

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered. The course will utilize computer-aided drafting and design (CAD).

Credits: 3.00

INT 22600 - Commercial Interiors I

Credit Hours: 3.00. This studio course emphasizes the elements used by designers in the development of nonresidential space. Studies include technological and building requirements; building and life-safety codes; square footage and space planning standards. Organizational, ergonomic, technical, spatial and environmental factors will be considered.

Credits: 3.00

INT 30200 - Three-Dimensional Design

Credit Hours: 3.00. This studio class examines the fundamentals of three-dimensional design, detailing and documentation, along with 3D thinking and visualization of design solutions sensitive to functional, ergonomic and aesthetic objectives.

Credits: 3.00

INT 30400 - History Of Interiors And Furniture II

Credit Hours: 3.00. The continuation of a survey of historical development of interiors, furniture, and decorative arts beginning with 1650 Colonial America through the 20th century. Emphasis is on design motifs, ornamentation, and furniture styles. Adaptation and use of period styles within contemporary design are included.

Credits: 3.00

INT 32400 - Residential II: Housing Design

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered.

Credits: 3.00

INT 32600 - Commercial Interior Design Studio II

Credit Hours: 3.00. This studio course emphasizes the elements used in development of nonresidential space. Studies include technological and building requirements; building and life-safety codes, ADA guidelines, square footage and space planning standards.

Credits: 3.00

INT 42600 - Evidence-Based Design

Credit Hours: 3.00. This studio-based course emphasizes the principles of evidence-based design in modern practice. Students will acquire working knowledge of best practices with

relation to healthcare or similar environments based on empirical data.

Credits: 3.00

INT 42800 - Interior Design Capstone Design Project

Credit Hours: 3.00. In this B.S. Capstone course the designer tackles a semester long advanced design problem by applying the design process from project obtainment through construction documents. This class is team-taught and must be taken in conjunction with INTR 48000.

Credits: 3.00

INT 45200 - Interior Building Systems

Credit Hours: 3.00. A survey course of building systems that covers the design implications of heating, air-conditioning, plumbing and electrical systems of both residential and commercial buildings. Sustainable technologies such as solar energy for heating, cooling, or hot water heating, day-lighting, and recycling systems will be included.

Credits: 3.00

INT 45300 - Business Practices Of Interior Design

Credit Hours: 3.00. Business principles and practices as they relate to the interior design profession. Includes business formation and management, professional ethics and organization, certification and licensing issues, design liability, and project management.

Credits: 3.00

INT 48000 - Senior Portfolio

Credit Hours: 3.00. This course will assist the student with developing a professional level portfolio and related materials which may be used in interviewing for an Interior Design position, and provides an opportunity to showcase all academic work created at this institution. Topics and activities include branding, resume preparation, website design, social media management, interviewing, and the creation of various related portfolio materials.

Credits: 3.00

INT 49500 - Sustainable Design In Engineering And Technology

Credit Hours: 3.00. In this multidisciplinary course students will create industrial ecological solutions within their unique disciplines. A theoretical framework on Green Design is used to identify and apply green concepts while working on multidisciplinary teams. Environmental concerns for better air quality and global environmental issues are explored.

Credits: 3.00

Italian

ITAL 10100 - Italian Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Italian course with emphasis on communicative skills (listening and speaking), literacy (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize familiar words and very basic phrases. 2. Speak and write simple phrases and sentences. 3. Interact in a basic way, provided the other person is prepared to repeat or rephrase things at a slower rate of speech and help the student to formulate the intended thought. 4. Ask and answer simple questions in areas of immediate need or on very familiar topics. Credits: 3.00

ITAL 10200 - Italian Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of ITAL 10100.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Speak a series of simple phrases and sentences to describe commonly discussed topics. 2. Develop a basic understanding of simple social exchanges. 3. Write short, simple sentences related to areas of immediate needs. 4. Read short, simple texts, by identifying predictable information. Credits: 3.00

ITAL 10500 - Accelerated Basic Italian (UCC: HUM)

Credit Hours: 3.00. An accelerated basic Italian course that substitutes for ITAL 10100 and ITAL 10200 . Knowledge of a foreign language required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 11200 - Elementary Italian Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in Italian on various topics.

Learning Outcomes: 1. Develop listening skills and improve oral Italian proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language. Credits: 1.00

ITAL 20100 - Italian Level III (UCC: HUM)

Credit Hours: 3.00. A continuation of ITAL 10200 .

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 20200 - Italian Level IV (UCC: HUM)

Credit Hours: 3.00. An intermediate Italian course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 20500 - Accelerated Intermediate Italian (UCC: HUM)

Credit Hours: 3.00. An accelerated second-year Italian course with focus on furthering the development of listening, reading, speaking and writing abilities at the intermediate level.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 21200 - Intermediate Italian Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in Italian conversation to enhance communicative competence. Small group discussions in Italian on various topics. Not open to students enrolled in or having credit for ITAL 30100 or above.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral Italian proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language. Credits: 1.00

ITAL 23100 - Dante's Divine Comedy

Credit Hours: 3.00. Reading and discussion of Dante's Divine Comedy. The major critical approaches to Dante's masterpiece will be reviewed. All readings, papers, and examinations will be in English.

Credits: 3.00

ITAL 28000 - Italian Culture And Civilization (UCC: HUM)

Credit Hours: 3.00. Course focuses on salient aspects of Italian culture and civilization from the Middle Ages to the present. In English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of Italian culture and its legacy in the world. 2. Identify crucial developments of Italian society and culture of the time studied. 3. Situate the arts, literature, and music of Italy in their historical context. 4. Become aware of the political and national struggles that Italy faced throughout the centuries. 5. Be introduced to key figures from different fields of studies whose work, inventions, and discoveries changed and are still changing our world perspectives. Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

ITAL 28500 - Intercultural Migration To Italy In Film, Literature, And Art (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the complexities of recent migrations to Italy through the perspectives of film, literature, and art. The course covers a wide range of topics, from a historical and geographical overview of migrations to Italy, to the hotly debated issues of immigration policies, Italian citizenship law, human rights and social justice, and the process of reimagining the Italian identity in more diverse and inclusive terms. Course taught in English. No Italian knowledge required.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Define the historical context, geographical routes, and reasons of migration to Italy. 2. Explain the impact of migration on Italian demographics, economy, and Italian identity ("Italianità"). 3. Compare diverse cultural representations of migration to Italy with diverse representations of migration in their own cultural contexts. 4. Outline the

intersections between migration and the issues of citizenship, human rights, and social justice in Italian and their own cultural context. 5. Reflect on their intercultural learning in the domain of curiosity, openness, empathy, and global awareness. Credits: 3.00

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 31200 - Advanced Italian Conversation

Credit Hours: 1.00. One credit hour advanced Italian conversation course focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative competence. Discussions in Italian on various topics. Course may be taken concurrently with ITAL 30100, 30200, 34100 and 34200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in Italian. Credits: 1.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and

Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

ITAL 39300 - Special Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will focus on particular aspects of Italian literature, cinema or culture. No knowledge of Italian required.

Credits: 3.00

ITAL 39400 - Special Topics In Italian Literature

Credit Hours: 3.00. This course studies a particular aspect in Italian literature (e.g., a theme, device, character type, motif, place) by reading a varied selection of works of different genres, styles, and/or periods. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 39900 - Special Study Abroad Credit It Italian

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Italian earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

ITAL 49300 - Advanced Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will analyze in depth particular aspects of Italian literature, cinema or culture. No knowledge of Italian necessary.

Credits: 3.00

ITAL 59000 - Directed Reading In Italian

Credit Hours: 1.00 to 4.00. Directed readings in Italian. Permission of instructor required.

Credits: 1.00 to 4.00

Japanese

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3. Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

JPNS 23000 - Japanese Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected texts from major writers and genres. The course provides a broad survey of the Japanese literary tradition and its cultural and historical background. Emphasis may vary from year to year. Knowledge of Japanese not required.

Credits: 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used

in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 39900 - Special Study Abroad Credit In Japanese

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Japanese earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 40200 - Japanese Level VIII (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of Fourth Year Japanese I. It continues work on the acquisition of advanced-level proficiency in speaking, listening, reading and writing. Students are given opportunities to understand the main ideas of extended discourse, to read texts which are linguistically complex, and to write about a variety of topics.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 44200 - Manga And Anime

Credit Hours: 3.00. In this class, students will study the globally popular art forms of Japanese comic books, known as manga, and cartoons, known as anime, from an academic perspective. We will approach the study of these media via the disciplines of literary studies, art history, visual culture studies, and the study of popular culture. While examining manga and anime as visual and literary media, we will consider topics including Japanese history, the environment, war, gender, sexuality, family, tradition, religion, philosophy, Japan's relationship to the globe, and genres of popular literature such as fantasy, horror, and science fiction. Materials to be covered include historical illustrated fiction of the 18th and 19th centuries (the prehistory of manga), foundational manga from the post-WWII era, manga by women writers, contemporary popular manga, anime films that ignited the global anime phenomenon, and anime films by the latest major directors.

Learning Outcomes: 1. Identify major writers, directors, texts, themes, and artistic traditions within the media of manga and anime. They will establish a foundation on which to support future study of Japanese culture, literature, art, and society, as well as other global traditions of literature and the arts. 2. Assess formal structures, aesthetic values, social practices, worldviews, points of emphasis, and gaps or omissions in the texts that they read. They will also learn the practice of visual analysis, or the ability to carefully describe and interpret visual details and information. 3. Compose, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 4. Identify the ways in which text and image are combined to create meaning in visual-verbal narratives through the study of primary materials and academic articles. 5. Read manga in Japanese, which will introduce students to various forms of colloquial, formal, and informal linguistic registers. Practice listening to spoken Japanese by watching animated films. (Optional: For those with advanced language skills) Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

JPNS 49000 - Special Topics In Japanese

Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 52100 - Teaching Japanese As A Foreign Language

Credit Hours: 3.00. Introduces a wide range of techniques used in teaching Japanese as a foreign language. Discusses theoretical issues concerned with the learning and teaching of Japanese. Permission of instructor required.

Credits: 3.00

JPNS 56000 - Survey Of Japanese Linguistics

Credit Hours: 3.00. This course is intended to provide the student with a systematic overview of the Japanese language. It covers most major areas of linguistics, from phonetics to pragmatics. Conducted in Japanese.

Credits: 3.00

JPNS 57500 - Theories Of Japanese Language Acquisition

Credit Hours: 3.00. Advanced course designed to provide an overview of major theoretical issues in Japanese language acquisition research. Permission of instructor required.

Credits: 3.00

JPNS 59000 - Directed Reading In Japanese

Credit Hours: 1.00 to 4.00. Directed readings in Japanese. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59600 - Special Topics In Japanese Linguistics.

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 67900 - Seminar In Japanese Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in Japanese linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

JPNS 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Jewish Studies

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JWST 59000 - Directed Readings In Jewish Studies

Credit Hours: 3.00. A reading course in aspects of Judaica directed by the instructor in whose particular field of specialization the content of the reading falls. Permission of Instructor required.

Learning Outcomes: 1. Deepen the knowledge of select topics in Judaica. Credits: 3.00

Korean

KOR 10100 - Korean Level I (UCC: HUM)

Credit Hours: 4.00. This course is the first half of the Elementary Korean language sequence. It is designed for those who have no prior (or very limited) knowledge of Korean. Lecture will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Emphasis is placed on the fundamentals of listening, speaking, reading, and writing. In addition, students will be exposed to everyday life contexts (e.g., language use, culture, etc.) likely to be encountered in contemporary Korean society.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Assess the meaning of limited vocabulary and some simple questions or statements auditorily and visually in the context of everyday events, such as greetings, introductions, giving directions, expressing needs, and making requests in Korean. 2. Construct short statements and ask simple questions by combining grammatical and lexical items using spoken Korean in a limited number of content areas, particularly if strongly supported by the situational context. 3. Identify meanings communicated in written Hangul, a Korean writing system, related to basic language use and immediate needs, such as

prices in stores, dates on schedules, and short letters, messages, or memos relating information relevant to various aspects of student life. 4. Construct simple fixed expressions and limited memorized material by combining grammatical and lexical items in written form using Hangul. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, pop lyrics, or traditional grams. Credits: 4.00

KOR 10200 - Korean Level II

Credit Hours: 4.00. This course is the second half of the elementary Korean language sequence. As a continuation of KOR 10100, the main purpose of this course is to expand on the study of the Korean language and culture. The class will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Students continue to learn vocabulary, pronunciation, grammar, and the writing system by practicing Korean to achieve Novice High level of speaking, listening, reading, and writing.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of recombinations of learned elements applied to a limited number of contexts, such as organizing a party, shopping, placing orders, making telephone calls, describing symptoms of illness and scheduling appointments. 2. Solve communicative problems related to uncomplicated, basic communicative tasks and social situations, such as making an apology, accepting and declining invitations, and making polite requests and suggestions by identifying linguistic meanings and producing new linguistic content. 3. Identify meanings expressed in written materials with emphasis on survival and immediate needs, such as memos, messages, postcards, journal entries, brief narratives, and short letters relating information relevant to various aspects of student life. 4. Produce simple texts of a few paragraphs such as skit, messages, short letters, and brief narratives by recombining learned material in Korean. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

KOR 20100 - Korean Level III

Credit Hours: 4.00. This course is the first half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Low proficiency level. Some class meetings are conducted entirely in Korean. Students practice reading and listening comprehension, grammar, vocabulary building, and conversations that require a variety of styles, pragmatic considerations, and knowledge of Korean cultural topics. Skills for simple narration and written report will be enhanced. Students rely on authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of a sufficient amount of vocabulary and expressions to communicate in a variety of situations covered in the course. 2. Apply basic components of Korean grammatical structures to construct standard Korean sentences to express creative ideas and to make comparisons. 3. Solve communicative problems related to a variety of uncomplicated social situations by asking and answering questions. 4. Compose written language in Korean to meet practical writing needs, such as short personal letters and journals. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The course provides students with further conversational and grammatical skills. Students practice reading comprehension,

grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 28000 - Special Topics In Korean Language

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on Korean language topics such as history of Korean language, Korean linguistics, Korean dialects, Korean sociolinguistic studies, applied linguistic foci in Korean language, etc.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 30100 - Korean Level V

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas-speaking, listening, reading, and writing-in Korean at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. Emphasis will be on the appropriate use of Korean in a variety of situations including schools, companies, and formal/informal meetings. This course also enables students to understand Korean culture and history and to develop cross-cultural insights by comparing Korean society with US society. Korean history, image of Korea, and current social trends in Korea will be discussed for a solid understanding of Korean culture in which Korean language is embedded.

Learning Outcomes: 1. Obtain knowledge about linguistic structures and language-related cultures through linguistic and cultural analysis and synthesis of various types of data. 2. Apply their linguistic and cultural knowledge to

comprehend (reading and listening) and produce (writing and speaking) language. 3. Assess paragraph-length texts and oral discourse to comprehend provided texts and dialogue in the classroom. 4. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 5. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 6. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 7. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 3.00

KOR 30200 - Korean Level VI

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas-speaking, listening, reading, and writing-in Korean at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. Emphasis will be on the appropriate use of Korean in a variety of situations including schools, companies, and formal/informal meetings. This course also enables students to understand Korean culture and history and to develop cross-cultural insights by comparing Korean society with US society. Korean history, image of Korea, and current social trends in Korea will be discussed for a solid understanding of Korean culture in which Korean language is embedded.

Learning Outcomes: 1. Obtain knowledge about linguistic structures and language-related cultures through linguistic and cultural analysis and synthesis of various types of data. 2. Apply their linguistic and cultural knowledge to comprehend (reading and listening) and produce (writing and speaking) language. 3. Assess paragraph-length texts and oral discourse to comprehend provided texts and dialogue in the classroom. 4. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 4. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 5. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 6. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding

the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

KOR 40100 - Korean Level VII

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas (speaking, listening, reading, and writing) at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. By dealing with various topics on authentic materials including news, articles on websites, and short stories, this course enables students to enhance linguistics knowledge and skills and also helps them to understand Korean culture, history, and current issues in Korea. It is expected that students will be able to discuss various topics and express opinions fluently in both spoken and written language.

Learning Outcomes: 1. Assess discourse-length texts to comprehend provided texts and dialogue in the classroom. 2. Explain the main ideas and most supporting details in connected discourse of paragraphs on a variety of general interest topics in written and spoken Korean. 3. Analyze, learn, and produce forms in informal and formal settings, provide lengthy and coherent narrations, present opinions on a number of issues, and provide structured arguments to support them. 4. Compose written language in Korean to demonstrate the ability to write about various topics with good control of frequently used structures and vocabulary, by using paraphrasing and elaboration to provide clarity. 5. Describe facts and evidence related to Korean history, culture, and society through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional games. Credits: 3.00

KOR 48000 - Special Topics In Korean Studies

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on topics related to contemporary Korean culture, arts, literature, etc. Or an internship totaling approximately 100-120 hours per semester or summer in Korea may also be credited through this course.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

Landscape Architecture

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

LA 10600 - Accelerated Foundations Studio

Credit Hours: 6.00. Conceptualizing, recording, and presenting site design ideas through problem-solving projects. Introduction to design and to presentation techniques fundamental to landscape architecture. Short projects give students exposure to a variety of design topics and presentation materials (pencil, ink, pastel, paper and board) and freehand lettering through two- and three-dimensional creative projects. Materials used are purchased by the student.

Learning Outcomes: 1. Demonstrate/understand fundamental tools and processes of design: spatial organizations and

relationships, analytical tools and ordering principles. 2. Demonstrate/understand basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate/understand investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Demonstrate/understand effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Demonstrate/understand roles, contributions and responsibilities of Landscape Architecture to society and to environmental health. 6. Demonstrate/understand how to be a design student: time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 6.00

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

LA 11700 - Graphic Communication In Design II

Credit Hours: 3.00. A course in graphic communication theory focusing on digital skills and processes. Project-based instruction will be used to simulate design office procedures through 2D and 3D exercises using raster and vector software.

Learning Outcomes: 1. Prepare students for internship and professional practice through office-ready digital workflows. 2. Develop and refine a personal graphic style along with a critical ""designer's eye"" through formal presentation and discussion. 3. Analyze a problem and determine the best tool(s) for the task while pursuing graphic innovation by knowing the ""why"" and ""how"" of digital tools. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession.

The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

LA 22600 - Studio II: Site Analysis And Design

Credit Hours: 4.00. Methods, principles and the process of designing in the built environment. Basic principles of site organization and composition are presented and applied in a series of exercises and studio projects. Role of the design process is reinforced both as a problem-solving tool and as a means of creativity and ideation.

Learning Outcomes: 1. Recognize and discuss theoretical design principles, identify those principles in well-designed sites, and apply those principles to their own design work. 2. Apply a robust design process to solve increasingly complex site design problems. 3. Ideate and assess appropriate program elements based on client and site needs and investigate the impact of alternate program elements on successful site design. 4. Analyze natural systems and apply that understanding to determine the appropriate design of sites. 5. Apply knowledge of the functional requirements of landscape elements to locate, size, and use these elements in the landscape. Credits: 4.00

LA 22700 - Planting I: Creating Ecologically Connected Landscapes

Credit Hours: 3.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants in fall.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 3.00

LA 22704 - Studio III: Planting Design

Credit Hours: 4.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design

material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 4.00

LA 24600 - Site Engineering: Earthwork And Stormwater

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation, and nomenclature. Methods for calculating volumes of cut and fill.

Learning Outcomes: 1. Understand three-dimensional forms in the built environment and how these forms are represented using standard graphic conventions. 2. Visualize and manipulate geomorphic and manmade terrains. 3. Articulate, utilize, and specify methods for landscape architecture earthwork manipulation and stormwater management. 4. Demonstrate an understanding of circulation systems design, including rationale, safety, and proper documentation for construction through the design of circulation systems. 5. Apply knowledge of hydrology and traditional and sustainable stormwater management techniques to the design of site-specific stormwater systems. Credits: 4.00

LA 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

LA 29000 - Special Topics In Landscape Architecture

Credit Hours: 1.00 to 4.00. Special topics in landscape architecture are explored. Topic selection is based on student interest. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge of the presented topic to the larger framework of landscape architecture projects, products, and practices. 2. Communicate effectively, using written, graphic, or oral communication, including delivering effective presentations where required. 3. Apply methods of investigation and inquiry that are appropriate to the subject and desired product, including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. Credits: 1.00 to 4.00

LA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 30900 - Co-Op Preparation

Credit Hours: 1.00. The material presented in this course consists of a broad overview of the employment opportunities in the professional practice of landscape architecture and the ways to secure an internship. It provides the student with information about career choices in landscape architecture and an appropriate knowledge base with which to make informed internship choices. Students prepare written and graphic documents for seeking employment. Students prepare for interviews and communications leading to employment as an intern in landscape architecture. Course meets during weeks 1-8.

Learning Outcomes: 1. Prepare and critique application materials in pursuit of gaining a co-op internship. 2. Practice interview skills and research firms available for co-op internships. Credits: 1.00

LA 31600 - Studio IV: Park And Open Space Design

Credit Hours: 4.00. Design theory and meaning in landscape architecture. Past, current and emerging design theories are investigated via lectures, research assignments and studio projects. Projects gain in size, complexity and depth of meaning. Emphasis on the role theory plays both as a stabilizing force and as a catalyst for change.

Learning Outcomes: 1. Access available landscape data to summarize critical natural resource needs at the site scale and translate this into fundamental ecological design principles for parks and open spaces. 2. Analyze the activities people participate in using available community parks and open space, categorize the landscape elements necessary to support current and projected future activities, and develop a parks program recommendation based on these social conditions. 3. Design public spaces that support multi-functional landscapes that fulfill recreation, education, and conservation program goals. Credits: 4.00

LA 32500 - Ecological Landscape Performance And Planting

Credit Hours: 3.00. Study of plants and their integration with other site features (e.g., water, landform) to increase sustainability. Plants will not only be studied for their aesthetic and spatial uses in the landscape, but also their ecological functions and temporal dynamics. The relationship of plants to site planning, ecosystems, and human use will be explored. Various scales, sustainable practices, and landscape performance will be considered. Class trip may be required. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Be familiar with and able to use design principles and elements in the development of planting designs and understand the implications of plants as living things. 2. Understand the relationship of planting design, ecological functions, social factors, and sustainability. 3. Have a clear understanding of the concept and measurement methods of landscape performance. 4. Set smart and measurable sustainable goals and be able to select suitable plant material and create effective compositions appropriate for a variety of site conditions. 5. Know how to observe plants from multiple perspectives (plant needs & site/environmental conditions; human spatial needs; aesthetic responses; ecological implications) and be able to integrate these perspectives into functional designs. Credits: 3.00

LA 32600 - Studio V: Community Design And Planning

Credit Hours: 4.00. Community planning and design. Past, current and emerging planning theories are investigated via lectures, research assignments and studio projects. The interrelationship of land use, circulation, and open space are explored using environmental and sustainable principles within a framework of traditional neighborhood design.

Learning Outcomes: 1. Understand the fundamental terminologies, design strategies, and workflow of master plan community planning. 2. Distinguish the attributes and characteristics of different residential types. 3. Articulate, utilize and specify methods for spatial layout and resource Integration (open space, transportation, parking and facilities, and building blocks) in different community planning projects. 4. Develop well-reasoned design concept and defensible design decisions that best respond to site constraints and planning regulations. 5. Apply knowledge of stormwater management and sustainable practices to community design. 6. Improve the abilities to research, critical thinking, collaboration, model making (hand and digital), verbal representation, and digital rendering techniques. Credits: 4.00

LA 34600 - Site Systems II

Credit Hours: 3.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Credits: 3.00

LA 34604 - Site Engineering: Materials And Construction

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Learning Outcomes: 1. Demonstrate an understanding of common landscape construction materials and their application in the built environment. 2. Demonstrate an understanding of structural qualities and limitations of construction materials and systems. 3. Demonstrate an understanding of basic construction documentation. 4. Demonstrate the ability to access, evaluate, and document a variety of materials and construction systems commonly found in landscape construction. Credits: 4.00

LA 35600 - Site Engineering: Construction Documents And Advanced Systems

Credit Hours: 4.00. Methods and standards of construction documentation using current technology. Preparation and packaging of site-related technical drawings and bid packages. Methods for site layout and dimensioning. Organization and composition of planting plans, plant lists, grading plans, lighting plans, and associated detail sheets. Standards and sequence of site-related specification documents.

Learning Outcomes: 1. Develop office-ready documentation techniques toward the efficient and complete generation of legally binding CD drawings. 2. Understand and demonstrate CAD drawing standards. 3. Understand and capable of developing construction details and technical specifications to describe all project components. 4. Demonstrate a preliminary understanding of on-site construction observation work. Credits: 4.00

LA 39000 - Professional Cooperative Programs In Landscape Architecture

Credit Hours: 0.00. Supervised work experiences in landscape architectural offices and in the landscape construction or maintenance industry. Programs must be preplanned and conducted under the direction of the cooperative educational coordinator in cooperation with an employer. Students must submit a summary report of the work experience. Consent of cooperative program coordinator required. Department permission required. Additionally, student must have a C- or better average in all LA courses taken to date.

Credits: 0.00

LA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical

responsibility in professional work. Credits: 0.00

LA 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 40000 - Landscape Architecture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

LA 41600 - Studio VI: Urban Design

Credit Hours: 4.00. An intensive design studio focusing on urban issues, including environmental, social, and economic approaches to the built environment. Exploration of development history, regulatory structures, local and regional demographics, economies, and environmental systems will be expressed through detailed design proposals, case study, and presentation critiques.

Learning Outcomes: 1. Explore spatial, social, and economic issues of design in an urban context. 2. Create design proposals dealing with urban populations and systems including urban ecology and demographics. 3. Analyze existing built works and design theories for lessons learned to inform innovative design solutions. Credits: 4.00

LA 42600 - Studio VII: Landscape Architecture Capstone

Credit Hours: 4.00. This course will focus on the integration and application of accumulated knowledge of landscape architecture from the student's previous coursework and internship experience. Students will be challenged to identify and solve problems in community-based projects. The students will also communicate, through reports and presentations, their results and plan to community audiences, faculty, and other students. Students will also do directed readings and then discuss topics related to the current and future practices of landscape architecture and environmental design.

Learning Outcomes: 1. Apply a meaningful and exhaustive process of investigation along with analysis that codifies modeling and testing of design hypotheses and expression. 2. Address all critical issues in the development of the project including challenges and limitations. 3. Develop clear and precise concepts defining theoretical and practical solutions to project issues, including aesthetics; site/environmental factors; and behavioral, historic, contextual and technological elements during the process of design. Credits: 4.00

LA 45000 - In The English Landscape:Integrating History, Horticulture, and Landscape Architecture

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Offered in even-numbered years. Permission of instructor required.

Credits: 3.00

LA 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

LA 47600 - Professional Practice Of Landscape Architecture

Credit Hours: 2.00. A study of the principles and practice of landscape architecture in private and public offices. The course covers project acquisition, office management, and project implementation procedures. Preparation of a professional compendium is required.

Credits: 2.00

LA 48100 - Special Topics In Landscape Architecture

Credit Hours: 1.00 to 3.00. This variable-credit, special topics course will be used for rotating topics dealing with skills, knowledge, and experiences related to landscape architectural theory, expression, and practice. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand and relate information about significant examples of landscape architecture in North America which illustrate key principles and concepts of physical design and the organization of space for functional and aesthetic purposes. 2. Demonstrate that important historical landscape design is the product of both the broad cultural context (social, political, economic, and philosophical trends) and, of environmental factors such as climate and topography.

Credits: 1.00 to 3.00

LA 48200 - Contemporary Issues In Landscape Architecture

Credit Hours: 2.00. Rotating topics that explore focused issues in landscape architecture theory and practice. Analysis and experience of contemporary issues, designs, and designers explored through presentation, discussion, critique, and practice of thematic content. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Analyze and evaluate focused topics in landscape architecture. 2. Understand and apply contemporary issues and theories in landscape architecture towards design studio, theory, and technology projects.

Credits: 2.00

LA 49000 - Special Problems In Landscape Architecture

Credit Hours: 1.00 to 6.00. Independent in-depth study and presentation of specific research or design problems selected by the student in consultation with the instructor. Open only to advanced students. Permission of instructor required.

Credits: 1.00 to 6.00

LA 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For students doing individualized research on landscape architecture; report required. Arrange with academic advisor and honors research advisor before registering. Admission to the honors program required. Permission of instructor required.

Credits: 1.00 to 6.00

LA 50100 - Research Methods For Design Applications

Credit Hours: 1.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 1.00

LA 50102 - Research Methods For Design Applications

Credit Hours: 2.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 2.00

LA 58100 - Special Topics In Landscape Architecture

Credit Hours: 1.00 to 3.00. Rotating topics dealing with skills, knowledge, and experiences related to landscape architectural theory, expression, and practice.

Learning Outcomes: 1. Learning outcomes vary due to nature of special topics course. Credits: 1.00 to 3.00

LA 58200 - Contemporary Issues - Landscape Architecture

Credit Hours: 2.00. Rotating topics that explore focused issues in landscape architecture theory and practice. Analysis and experience of contemporary issues, designs, and designers explored through presentation, discussion, critique, and practice of thematic content. Permission of instructor.

Learning Outcomes: 1. Learning outcomes vary due to nature of special topics course. Credits: 2.00

Languages and Cultures

LC 10100 - Special Topics in Languages and Cultures I

Credit Hours: 0.00 to 5.00. Special topics in Foreign Languages. Permission of department required.

Learning Outcomes: 1. Varies due to nature of course. Credits: 0.00 to 5.00

LC 10200 - Special Topics In Foreign Languages II

Credit Hours: 0.00 to 4.00. Topics vary. Permission of department required.

Credits: 0.00 to 4.00

LC 20100 - Special Topics In Foreign Languages III

Credit Hours: 0.00 to 4.00. Topics vary. Permission of department required.

Credits: 0.00 to 4.00

LC 20200 - Special Topics In Foreign Languages IV

Credit Hours: 0.00 to 4.00. Special Topics in Foreign Languages IV. Permission of department required.

Credits: 0.00 to 4.00

LC 23000 - Crossing Borders: Introduction To Comparative Literature

Credit Hours: 3.00. (CMPL 23000) Foundations for comparison of works in different languages, thematic (philosophical, sociological, psychological) and structural (genre, composition, use of linguistic devices); parallel interrelation of theme and structure in works of different literatures. The importance of literary norms and systems of genres. Examination of crosscurrents in different literatures during successive periods of development.

Learning Outcomes: 1. Provide familiarity with the original languages that lie behind English translations of world literature. 2. Relate a particular culture to the larger patterns of world literature to gain an appreciative of cultural diversity and global awareness of class, ethnicity, gender, and race. 3. Provide practical experience in oral communication through class presentations and reports and projects. 4. Provide practical experience in oral communication through class presentations and reports and projects. 5. Provide appropriate

level practice in information literacy related to the study of comparative literature, including researching source materials, research methodologies, and intellectual approaches. Credits: 3.00

LC 23100 - Fairytale, Folktale, Fable

Credit Hours: 3.00. This course provides an overview of fairytale, folklore, and fable traditions across various cultures and historical periods, as well as an examination of their ongoing influence on contemporary cultures. Taught in English.

Learning Outcomes: 1. Gain an intercultural knowledge of human cultures as well as global citizenship and awareness. 2. Make comparisons and connections about the interplay and the importance of such traditional tales among various cultures of the world. 3. Enable students to develop both their written communication and their oral communication skills. 4. Develop critical thinking, creative thinking, and in some instances, ethical reasoning. 5. Develop information literacy skills and the integrative knowledge, not only through classwork, but also through assignments and projects. Credits: 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

LC 23900 - Women Writers In Translation (UCC: HUM)

Credit Hours: 3.00. An examination of international female writers' literary creativity in the context of women's studies and feminist theory, as articulated in their specific cultural and geographical milieu. Course content will vary in terms of cultural focus. In English.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop skills in writing, reading, critical thinking, and oral expression. 2. Gain knowledge of female literary traditions in different geographical milieu and time periods. 3. Increase awareness of the ways in which women writers reflect upon and resist stereotypes of women in literature, and how this process may differ across cultures. 4. Understand fundamental concepts in women's gender and sexuality studies. Credits: 3.00

LC 26100 - Introduction To The Linguistic Study Of Foreign Languages (UCC: BSS)

Credit Hours: 3.00. Overview of linguistics and the role of language in society; fundamental concepts of linguistic analysis. The course focuses on linguistic phenomena found in French, German, Russian, and Spanish, with material, examples, and assignments drawn primarily from those languages whenever appropriate.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

LC 26300 - Introduction To Computational Linguistics

Credit Hours: 3.00. This course introduces students to computational linguistics, a subfield of linguistics that studies natural languages from a computational perspective. The course covers both the theoretical and engineering topics ranging from aspects of formal linguistic structure to tools of language technology. The course will provide an understanding

of the essential characteristics and differences between fields of inquiry such as computational linguistics, natural language processing (NLP), machine learning, and artificial intelligence (A.I.). There are no prerequisites and students are not expected to have any previous programming background, although the course introduces students to Python 3 programming language. Python is the ideal choice for NLP and AI due to its robust capabilities, strong community support, flexibility, and readability. It is a requirement for all NLP practitioners.

Learning Outcomes: 1. Identify and describe key concepts of and common methods in computational linguistics. 2. Explain the role of computational linguistics in the broader context of linguistics and artificial intelligence. 3. Implement computational linguistics tasks with robust Pythonic code using state-of-the-art NLP libraries such as natural language processing toolkit (NLTK) and spaCy. 4. Acquire the ability to write programming projects in Python. 5. Analyze linguistic patterns in a natural language using Pythonic coding skills. Credits: 3.00

LC 26500 - Introduction To Neurohumanities

Credit Hours: 3.00. This course introduces students to the main developments in the neurohumanities particularly since the 1990s, with focus on cognitive literary and cultural studies. The course emphasizes not only the role of psychology, neuroscience, evolutionary biology, and other STEM and social scientific fields in interpreting cultural artifacts, but also how literary and cultural studies contribute significantly to those fields. Students will learn skills which will enable them to consider and interpret works of art, broadly defined, through a highly interdisciplinary cognitive-studies lens as they explore how the humanities are intricately intertwined with the sciences.

Learning Outcomes: 1. Identify the main focal points of cognitive literary and cultural studies and trace their developments over the past four decades. 2. Analyze the reciprocal influence of humanistic cognitive studies and scientific fields. 3. Explain the primary debates within and surrounding cognitive studies in the humanities. 4. Implement one or more approaches from cognitive studies to analyze a literary work, film, or other cultural artifact. Credits: 3.00

LC 26600 - World Literature: From The Beginnings to 1700 A D

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

LC 26700 - World Literature: From 1700 A D To The Present

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

LC 28000 - Special Topics In Languages And Cultures

Credit Hours: 3.00. Special topics relating to world languages and cultures.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

LC 28100 - Introduction To World Food Cultures (UCC: HUM)

Credit Hours: 3.00. This course introduces students to global food culture and world gastronomy. It covers different aspects of food studies such as food representations in art and literature, national identity, culinary traditions, and world trade and migration in respect to food. This course will give students a broad overview of the relation between food and many other disciplines, allowing them to connect the topics addressed to their own fields of study. Conducted in English. No prerequisites.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize the central importance of food in every culture and its relation to other fields of study. 2. Compare food representations in literary texts and other

forms of art. 3. Analyze how food contributes to the creation of national identities. 4. Recognize the main challenges of global food production, circulation, and consumption. 5. Examine the food heritage and impact of different cultures in the United States. Credits: 3.00

LC 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 30000 - World Literature Through The Photographic Lens

Credit Hours: 3.00. The course critically explores the photographic characteristics of modern world literature. It examines the deep, dynamical, and fascinating relationship between photography and literature.

Learning Outcomes: 1. Demonstrate critical understanding of the ways and manners literary works interact with photographic images. 2. Comprehend the relationship between the sense of vision, language and thought. 3. Demonstrate ability to critically appraise cultural differences, social problems and historical changes. 4. Identify, analyze, and evaluate literary theories, art criticism, historical analysis and philosophical musings. 5. Create, develop and hone a sense of aesthetics as well as a personal writing style while engaging in literary and art criticism. Credits: 3.00

LC 32300 - Global Sustainable Engineering

Credit Hours: 1.00 or 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 or 3.00

LC 33100 - Comparative Literature In Translation

Credit Hours: 3.00. A course in the study of a special topic related to works in several foreign literatures, directed by an instructor whose particular field of specialization will be highlighted.

Credits: 3.00

LC 33200 - Global Horror Cinema (UCC: HUM)

Credit Hours: 3.00. The course introduces horror cinema across the globe, through the technical and thematic analysis of different subgenres and domestic trends. In addition to building

analytical skills regarding film concepts and theories, the course is designed to implement critical skills in film studies, cultural studies, and global studies.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply film studies-related terms for technical and thematic analysis of film sequences. 2. Demonstrate a deeper knowledge of horror film industries across the globe. 3. Analyze the domestic and international contexts in which films are released (history, politics, social movements). 4. Investigate intersectional questions of gender, race, and class in connection with film analysis and film production. 5. Develop critical approaches to a variety of horror subgenres.

Credits: 3.00

LC 33300 - The Middle Ages On Film (UCC: HUM)

Credit Hours: 3.00. Introduction to the Middle Ages through films in various languages and genres from the beginning of film history to the present. Reading literary, historical, legal, and film theory texts in conjunction with the films, students critically analyze representations of the Middle Ages and the cultural context from which these emerge.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LC 33800 - Language Through Films

Credit Hours: 3.00. The course critically explores language(s) via the medium of cinema where language plays a key role in the film. It is intended to introduce students to the fundamental place language occupies within human experience, to advance knowledge of some of the features of the system of language, develop a sharper ear for language, a better understanding of its nature, and a livelier interest in all its manifestations. The course will be taught in English and films will be shown with subtitles.

Learning Outcomes: 1. Identify the main building blocks of language. 2. Examine the universal characteristics of the many languages humans speak. 3. Appraise the relationship between language, cognition, emotion and world view. 4. Re-evaluate their thinking regarding the acquisition of a second language. 5. Access the significant position language plays within societies and cultures. Credits: 3.00

LC 36100 - Sound And Form In Language

Credit Hours: 3.00. Examination of the nature of sound systems (phonology) and form systems (morphology) of language, as well as techniques of phonological and morphological analysis, using material from various languages. Central focus on phonetic and phonological structure, and on inflectional and derivational morphology.

Credits: 3.00

LC 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American English in African American speech communities and the U.S. culture at large.

Credits: 3.00

LC 37100 - Phonetics Of Foreign Languages

Credit Hours: 3.00. Introduction to articulatory phonetics for students of foreign languages. Mechanisms of production of speech sounds. Production and discrimination of sounds of other languages; contrast with English sounds; practice in pronunciation and phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be awarded for more than one of SLHS 30600 , LING 31500 , and LC 37100.

Credits: 3.00

LC 38500 - The Holocaust In World Literature And Film

Credit Hours: 3.00. This course explores the representation of the Holocaust through a wide range of literary and historical texts and films. The course provides sociohistorical context for these works, while also grappling with philosophical questions of representation such as how - or even should - the atrocities of genocide be represented aesthetically and fictionally? Drawing on both primary and secondary sources, the course gives students a nuanced understanding of the difficulties of representations that are based in part on fallible human memory, but also of the crucial importance of giving voice to those who experienced the trauma of the Holocaust. Students will further develop their critical thinking skills by analyzing literature and film that documents a variety of ways in which this watershed event of the 20th century has been represented and interpreted.

Learning Outcomes: 1. Analyze filmic and literary representations of the Holocaust in respect to themes, historical context, and narrative and filmic strategies of representation. 2. Demonstrate knowledge of the historical events surrounding the Holocaust. 3. Discuss the Holocaust from nuanced ethical and moral perspectives, with consideration of the vantage points of its victims, traumatized survivors, perpetrators, passive bystanders, and resistance fighters. 4. Evaluate the roles of

memory, first-person and eyewitness testimony, and other types of documentation of the Holocaust, reflecting on the challenges of representing these tragic events and the implications for historiography. Credits: 3.00

LC 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 39900 - Special Study Abroad Credit In Foreign Languages

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in foreign languages earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4. Recognize how theories of individual and collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

LC 49000 - Special Topics In Foreign Languages And Literatures

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

LC 49900 - Research In Foreign Languages

Credit Hours: 1.00 to 3.00. Undergraduate research into a topic in foreign languages. Permission of instructor required.

Credits: 1.00 to 3.00

LC 51900 - Teaching Of Foreign Languages

Credit Hours: 3.00. A basic course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

LC 56300 - Historical Linguistics

Credit Hours: 3.00. (ANTH 56300, ENGL 56300) A survey of mechanisms and motivations of linguistic change. Topics include phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

LC 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, ENGL 56500, LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

LC 57000 - Introduction To Semiotics

Credit Hours: 3.00. (ANTH 51900, SLHS 58900, COM 50700, ENGL 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena that can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

LC 57300 - Methods Of Experimental Research In Linguistics

Credit Hours: 3.00. The course is an overview of experimental methods used in linguistic research. The goal of the course is to introduce basic concepts, terminology, and procedures associated with experimental research in general, and to survey the types of experiments typically conducted in several major subfields of linguistics, including the associated experiment designs and approaches to data analysis. The course will focus mainly on designing and conducting the experiment, rather than on data analysis, although the data analysis techniques appropriate to the types of data will be briefly discussed whenever possible. The course will also cover additional topics such as ethics of experimental research (preparing an IRB protocol), doing background research, getting funding, choosing the right conference for presenting the results, writing a conference abstract, creating and delivering a conference presentation/poster, and writing up the results for publication.

Learning Outcomes: 1. Define experimental research and explain its differences from other types of research. 2. Explain best practices in developing research questions, hypotheses, and designing experiments. 3. Distinguish different types of data and measurement levels and select the appropriate type of data analysis for a given type of data. 4. Design and implement experimental studies independently to test hypotheses in linguistics, including determining the necessary equipment, software, facilities, and subject pool, preparing IRB protocols, and obtaining funding. 5. Summarize and present experimental results effectively both orally and in writing and in appropriate presenting and publishing outlets. Credits: 3.00

LC 57500 - Theories Of Foreign Language Acquisition

Credit Hours: 3.00. An advanced course designed to provide an overview of major theoretical issues in foreign language acquisition research. Provides a broad historical introduction to theories of acquisition that underlie these different perspectives. This course also provides an understanding of skills assessment and selection of instructional materials. Permission of instructor required.

Credits: 3.00

LC 57700 - Acoustic Analysis Of Speech

Credit Hours: 3.00. This course is an introduction to those aspects of acoustics most pertinent to understanding speech production and perception. It covers sound waves and their properties, digital signal processing, hearing and loudness, sound recording, and details of the acoustics of specific speech sounds such as vowels, plosives, fricatives, and nasals. The course includes a prominent practicum component aimed at learning to use software tools, specifically Praat, for analyzing acoustic properties of speech sounds.

Learning Outcomes: 1. Define the physical parameters of sound waves; explain how sound waves are created and how they propagate through a medium. 2. Explain the concepts of resonance and filtering as applied to speech production. 3. Explain digital signal processing as applied to the analysis of speech. 4. Use their understanding of acoustics to explain aspects of hearing and perception of speech, including the perception of loudness; explain

and apply standard methods of measuring loudness. 5. Use the tools of acoustic analysis to measure acoustic properties of speech sounds, such as duration, loudness, fundamental frequency, and other spectral properties; communicate the results effectively orally and in writing. Credits: 3.00

LC 59000 - Directed Reading In Foreign Languages

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

LC 59300 - Special Topics In Literature

Credit Hours: 1.00 to 4.00. Special topics in Literature. Permission of instructor required.

Credits: 1.00 to 4.00

LC 59600 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Special topics in Linguistics. Permission of instructor required.

Credits: 1.00 to 4.00

LC 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (CMPL 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study. Required of all students in the Comparative Literature Program.

Credits: 3.00

LC 63900 - Seminar In Comparative Literature

Credit Hours: 3.00. (CMPL 65000) Exploration of a significant topic in comparative literature, e.g., the arts of translation, thematology, genre studies, literary movements, literary relations between countries. (See Comparative Literature.) Prerequisite: ENGL 66000 or LC 63000 .

Credits: 3.00

LC 65000 - Topics In Theory

Credit Hours: 3.00. Study of theoretical approaches to literature, the arts, or general culture (e.g., cognitive science, deconstruction, feminism, hermeneutics, postmodernism, postcolonial studies, reader response, semiotics). Examines methodologies and confronts them with literary texts. Permission of instructor required.

Credits: 3.00

LC 65900 - Seminar In Literature And Culture Of The African Diaspora

Credit Hours: 3.00. An examination of the African Diaspora through the study of literatures and cultures of Latin America and the Caribbean. Prerequisites: Experience working with literatures of the African Diaspora and critical theory. Learning Outcomes: 1. Acquire knowledge of the historical shifts that affected the formation of the literary movements. 2. Use theory in their interpretation of the texts. 3. Demonstrate ability to apply literary theories in order to analyze the literature read. Credits: 3.00

LC 67900 - Seminar In Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

LC 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

LC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Latin

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

LATN 10500 - Accelerated Basic Latin

Credit Hours: 4.00. Foundational Latin grammar course designed to prepare students to read classical and post-classical Latin in a single intensive semester. Focus on grammar, syntax, vocabulary, and elementary readings. The accelerated Latin course assumes *no* previous knowledge of Latin and makes it possible for the diligent student to be able to read *any* Latin prose or poetry (with a dictionary) after a single semester. (Upon completion students will be prepared to enroll in Latin 201.)

Learning Outcomes: 1. Recite Latin texts aloud (with accurate pronunciation, meaningful phrase grouping, and appropriate voice inflection) by imitating models they have heard in class. 2. Analyze Latin texts by identifying and describing the basic elements of Latin grammar, sentence structure, and style. 3. Translate intermediate level un-adapted Latin texts into English. 4. Compose complex sentences while writing a short story in Latin. Credits: 4.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.

Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from

Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts.

Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LATN 49000 - Directed Reading In Latin

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

LATN 59000 - Directed Reading In Latin

Credit Hours: 1.00 to 4.00. Directed reading of selected texts in classical and/or medieval Latin. Permission of instructor required.

Credits: 1.00 to 4.00

Latina American and Latino Studies

LALS 25000 - Introduction To Latin American And Latino Studies

Credit Hours: 3.00. Interdisciplinary and integrative presentation and examination of the historical, political, economic, and cultural processes of Latin America, from independence to the present followed by an analysis of scholarly works that include theoretical models, methodological strategies, and analytical approaches to learning about US Latinos. Special emphasis is placed on the immigrant experience and its role in the incorporation of Latinos into the US society.

Credits: 3.00

LALS 26000 - U S Latino Culture

Credit Hours: 3.00. This course uses an interdisciplinary approach to study Latino culture in the United States through art, film, literature, music and theater.

Credits: 3.00

LALS 30100 - Latin American Literary And Cultural Studies

Credit Hours: 3.00. Focuses on Latin American literatures and cultural products, such as film, music, and/or art. As a variable-topics course, individual sections may variously focus on South

and/or Central America, Mexico, the Caribbean, U.S. Latina/o populations, or any combination of the above. Individual sections may also examine major cultural and historical movements, and/or canonical and emerging authors and artists. May be repeated for credit.

Credits: 3.00

LALS 30300 - Latin American Languages And Linguistics

Credit Hours: 3.00. Focuses on the languages and linguistic practices of Latin American and/or U.S. Latina/o populations, also including the Caribbean. As a variable-topics course, individual sections may variously focus on the nature and structure of specific languages, as well as the study of their dialects, semantics, and histories; the history, structure, uses, and educational concerns of Latin American indigenous, Caribbean Creole and/or U.S. Latina/o speech communities; or any combination of the above. May be repeated for credit.

Credits: 3.00

LALS 34700 - Latin American Politics

Credit Hours: 3.00. Focuses on major aspects of Latin American and/or U.S. Latina/o politics and development. As a variable-topics course, individual sections may variously focus on U.S. foreign policy toward countries in Latin America, the U.S.'s historical role in the politics of the Western hemisphere, the impact of the military on political development, the dynamics of Latin American industrialization, Latin America's changing international role, Latinas/os's political participation in the United States, or any combination of the above. Individual sections may also Latin American political thought from the colonial period through the present day.

Credits: 3.00

LALS 35500 - Political Economy Of Latin America

Credit Hours: 3.00. Examines the salient issues of the 21st century in the political economy of Latin America. The first part introduces students to the historical evolution of the region's economy and its socio-economic and political determinants. Then it focuses on topical inquiry, analyzing key policy areas, frameworks and choices at the core of the current political economy of the region's countries: fiscal and industrial policies, monetary and financial policies and policies on trade, migration and inequality, energy and the environment.

Credits: 3.00

LALS 40100 - Special Topics In Latin American/Latino Studies

Credit Hours: 3.00. Investigation of a special topic in Latin American or US Latina/o studies. The topic will vary from semester to semester.

Credits: 3.00

LALS 40200 - Directed Reading In Latin American/Latino Studies

Credit Hours: 1.00 to 6.00. Directs the reading of students with special interests in Latin American or U.S. Latina/o studies. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 6.00

Library and Information Science

ILS 55200 - Research Data Management For Quantitative Data

Credit Hours: 3.00. This course will provide students working with quantitative data an overview of major issues in quantitative data management such as data set organization; data versioning, backup, and archiving; computer file and directory organization; data quality control, exploration, visualization and analysis; and data sharing, publication, copyright and ownership. Students will be introduced to a wide range of public databases to serve as examples of data organization, sources of reusable research data, and possible platforms for data publication. Recent trends and emerging issues in data and information science will be discussed, but the primary focus will be on encouraging students to apply critical thinking so they can develop practical strategies to their own research data issues. Accordingly, the course places a strong emphasis on active learning with theoretical lectures and discussions reinforced by applied lab sessions using tools such as Excel, R, Unix, Git, and parallel computing. Permission of department required.

Learning Outcomes: 1. Demonstrate mastery of using a computer as their primary data management tool through online labs, a data management notebook, and discussions. 2. Demonstrate mastery of efficient use of Excel, R, and Git through the online lab exercises and data management notebook. 3. Demonstrate use of public data repositories in their discipline through written assignments and the final data management project. 4. Demonstrate preparing dataset for publication through the online lab exercises and the final data management project. 5. Demonstrate creation of a data management plan through completing a written data management plan for a specific data set.

Credits: 3.00

Linguistics

LING 20100 - Introduction To Linguistics (UCC: BSS)

Credit Hours: 3.00. Basic concepts of linguistics and methods of analysis of language; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax, and semantics, and to problem-solving techniques, with

material drawn from a variety of languages.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

LING 31100 - Fundamentals Of Phonology And Morphology

Credit Hours: 3.00. Basic concepts and tools of phonological and morphological analysis viewed through the material of American English. Current theoretical approaches to phonology and morphology, including word-formation processes and applications.

Credits: 3.00

LING 31500 - Elements Of Phonetics

Credit Hours: 3.00. Introduction to articulatory phonetics. Mechanisms of production of speech sounds. Sounds of languages of the world, ear training for discriminating speech sounds, and practice in broad and narrow phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be given for both LING 31500 and SLHS 30600.

Credits: 3.00

LING 32100 - Foundations Of Syntax And Semantics

Credit Hours: 3.00. Introduction to syntactic and semantic analysis based on American English and its dialects. Underlying structure and its relation to meaning. Analysis of parts of speech, constituent phrases, sentence structure, representations, ambiguity, and applications of current theory. Credit will not be given for both LING 32100 and ENGL 32800 .

Credits: 3.00

LING 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American English in African American speech communities and the United States culture at large.

Credits: 3.00

LING 39800 - Special Topics In Linguistics I

Credit Hours: 3.00. Investigation of a special topic in linguistics. The topic will vary from semester to semester. Permission of instructor required.

Credits: 3.00

LING 47000 - TENL Practicum

Credit Hours: 3.00. As the final course of the TENL program, the Practicum builds on participants' knowledge and skills of teaching multilingual learners by revisiting previous learning in the TENL program. This course requires participants to demonstrate mastery and application of concepts covered in previous courses (e.g., oral language progression, literacy development, test construction, domains/subsystems of language, language teaching methodologies, etc.) and assesses what participants currently know and believe about English language instruction, literacy acquisition, and approaches to professional development. Experiential learning or fieldwork in a classroom setting is required. In order to qualify for TENL certification, students must obtain a grade of C or higher in all TENL courses.

Credits: 3.00

LING 49000 - Directed Reading In Linguistics

Credit Hours: 1.00 to 4.00. Independent study and reading on a topic in linguistics directed by a faculty member. Permission of instructor required.

Credits: 1.00 to 4.00

LING 49800 - Special Topics In Linguistics II

Credit Hours: 3.00. Investigation of a special topic in linguistics. The topic will vary from semester to semester. Permission of instructor required.

Credits: 3.00

LING 49900 - Research In Linguistics

Credit Hours: 1.00 to 3.00. Undergraduate research into a designated topic in linguistics. Permission of instructor required.

Credits: 1.00 to 3.00

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

LING 50100 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual development.

Learning Outcomes: 1. Learn how languages are acquired and developmental stages of main linguistic components. 2. Know major concepts and issues relative to child language development. 3. Know major concepts and issues relative to bilingual first language acquisition. 4. Know main sociocultural constructs related to language development. 5.

Become familiar with main issues relative to methodological issues in language acquisition. 6. Know main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

LING 51100 - Phonology I: Descriptive Analysis

Credit Hours: 3.00. Foundations of phonological analysis. Development of concepts and methods for the analysis of phonological data and the phonological structures of natural languages within the framework of generative phonology. Focuses on problem solving and linguistic argumentation. Offered in conjunction with ENGL 51300 .

Credits: 3.00

LING 51101 - Methods And Materials In Tesol I

Credit Hours: 3.00. This course provides an overview and critical discussion on the profile of English language learners (ELLs), their cultural and linguistic backgrounds, features of academic language, the main language teaching theories and methods and how they inform current practices in various contexts, as well as US education policy on ELLs. The course also has an emphasis on the teaching of listening and speaking. The students are given ample opportunities to understand the integration of implicit and explicit instruction on various language concerns, e.g., phoneme-awareness, word augmentation, sentence structure, listening comprehension, oral fluency etc. Students will also apply the principles of teaching to a mini-teaching task, where they can put theories into practice, observe and share feedback. In order to qualify for TENL certification, students must obtain a grade of C or higher in all TENL courses.

Credits: 3.00

LING 51200 - Phonology II: Theoretical Approaches

Credit Hours: 3.00. Examination, comparison, and evaluation of contemporary phonological theories, with focus on the contribution of each theory to our understanding of representations and operations in phonological analysis. Primary emphasis is on autosegmental phonology, metrical phonology, lexical phonology, and optimality theory.

Credits: 3.00

LING 51201 - Methods And Materials In TESOL II

Credit Hours: 3.00. This course aims at broadening course participants' understanding of principles and practices of course & lesson planning, assessment, and materials development for English as a new or foreign language (ENL/EFL) instruction. Building on topics covered in Methods and Materials for TESOL I, we will examine explicit instructional approaches and strategies with an emphasis on developing reading and writing skills in the English language for culturally and linguistically diverse learners. While there is an emphasis on literacy instruction in this course, participants should keep in mind that all of the 4 language skills (reading, writing, listening, and speaking) are integrated and evidence of this integration is expected in the design of lesson plans. Throughout the semester, we will explore 5 major interrelated topics, which are guided by and embedded in philosophies and theories of education, language, second language acquisition (SLA), teaching, and learning: standards, curriculum, pedagogy, culture, and literacy acquisition. This course involves pre-professional education/training. Experiential learning or fieldwork in a classroom setting is required. In order to qualify for TENL certification, students must obtain a grade of C or higher in all TENL courses.

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

LING 52200 - Syntax II: Issues In Syntax

Credit Hours: 3.00. Deeper examination of a wider range of syntactic phenomena and evaluation of competing theoretical analyses proposed to account for them. Constructing theoretical analyses and evaluating their explanatory adequacy for Universal Grammar. Topics include LF phenomena, functional projections, and structural representations.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 54100 - Historical Linguistics And Language Change

Credit Hours: 3.00. A general examination of the ways in which languages and their subsystems change over time and of the forces that produce change. The comparative method; internal reconstruction; geographical variation; and social variation. Overview of world language families and genetic relationships.

Offered in conjunction with ENGL 56300 or LC 56300 .

Credits: 3.00

LING 56000 - Service Learning In Languages And Linguistics

Credit Hours: 1.00 to 4.00. This course aims to introduce the student to critical reflective thinking and experiential learning that address local and global needs and foster civic responsibility. This service learning course is a multifaceted method of teaching and learning that enriches a students' academic life and real life learning by engaging her/him in meaningful hands-on service to the community while gaining valuable knowledge and skills that integrate with course objectives.

Learning Outcomes: 1. Participated in socially responsible activities that would have a positive impact not only on her/his local and global community. 2. Acquired skills that are transferable to her/his future work environments. 3. Reflected on how to maximize her/his personal and academic development to help her/him achieve her/his goals in life. 4. Gained knowledge and insights that will prepare her/him for active civic engagement. Credits: 1.00 to 4.00

LING 56300 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual develpment.

Learning Outcomes: 1. Understand how languages are acquired and developmental stages of main linguistic components. 2. Understand major concepts and issues relative to child language development. 3. Understand major concepts and issues relative to bilingual first-language acquisition. 4. Understand knowledge of main sociocultural constructs related to language development. 5. Understand main issues relative to methodological issues in language acquisition. 6. Understand main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

LING 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Learning Outcomes: 1. Able to discuss the relationship between language and society and identify the roles of language in its social and cultural context. 2. Able to critique current theories in sociolinguistics using data sets provided in course texts. 3. Able to identify the major models for sociolinguistic analysis and suggest reformulations and refinements necessary for various societies and cultures. 4. Able to recognize the sociolinguist's responsibility in the ethical treatment of human subjects and collected data. Credits: 3.00

LING 57000 - Field Methods In Linguistics

Credit Hours: 4.00. This course deals with the basic techniques for collecting language data, and is designed to reproduce and explore the conditions and methods of linguistic fieldwork in a classroom. The course also addresses questions related to the ethics of retrieving linguistic data, the relations between the linguist and the speaking communities, and the use of the collected data. A non-Indoeuropean lesser-studied language will be examined with the help of a native speaker of the language. The main area of its grammar will be covered: phonetic and phonological system, inflectional and derivational morphology, basic syntactic structures and basic semantic phenomena. The final goal is to obtain a basic grammatical description of the language. Lab sessions will be directed towards the training in the software and audio and video tools used for the trade.

Learning Outcomes: 1. Identify the key parts of the grammar of language. 2. Formulate questions about the language that (a) can reveal the structure of language and (b) can be answered by a speaker with no knowledge of linguistics. 3. Use the tools of the trade (software, equipment, etc.) 4. Develop methodologies based on a Participatory Action Research approach. 5. Develop sensitivity about what is of relevance to the speaking

community and how to interact with the community in general and the speakers in particular. 6. Develop skills on how to transfer newly discovered scientific knowledge of the language back to the speaking community. Credits: 4.00

LING 57600 - Latin American Indigenous Languages And Cultures

Credit Hours: 3.00. This course will help students to learn the importance of understanding the diversity of Latin American indigenous languages and cultures as well as the intercultural understandings gained when these indigenous languages are valued within the global context. Moreover, this course will provide a general cultural and linguistic framework to understand the sociolinguistic status of the language within the context where it exists. In this course, students will deepen their knowledge of Latin American indigenous cultures and their historics, as a means to achieving a greater understanding of both a shared humanity and the variety of human experiences. Learning Outcomes: 1. Acquire in-depth knowledge in a chosen, specific indigenous people while demonstrating panoramic understanding of Latin American indigenous groups. 2. Explain the brief history of US interaction with a particular Latin American country of this course topic. 3. Show basic oral and auditory competency in the language; will demonstrate how to express and understand basic statements, greetings, requests for directions, for food, and general courtesy interactions in the particular language. 4. Identify the particular complex interactions of the indigenous language within the context of the dominant colonial language. 5. Identify the linguistic position of the language within the context of indigenous languages of the Americas. 6. Identify basic cultural characteristics associated with the language speaking community. Credits: 3.00

LING 59000 - Directed Reading In Linguistics

Credit Hours: 1.00 to 4.00. Independent study and reading on a topic in linguistics directed by a faculty member. Permission of instructor required.

Credits: 1.00 to 4.00

LING 59100 - Special Topics In Phonology

Credit Hours: 3.00. Investigation of an advanced topic in phonology. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59300 - Special Topics In Semantics

Credit Hours: 3.00. Investigation of an advanced topic in semantics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59400 - Special Topics In Historical Linguistics

Credit Hours: 3.00. Investigation of an advanced topic in historical linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59800 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Investigation of an advanced topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 1.00 to 4.00

LING 61900 - Seminar In Phonology

Credit Hours: 3.00. Intensive study and research on a selected topic in phonology. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 62900 - Seminar In Syntax

Credit Hours: 3.00. Intensive study and research on a selected topic in syntax. Topic varies from semester to semester.

Credits: 3.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 69000 - Individual Seminar

Credit Hours: 1.00 to 3.00. Under the individual guidance and supervision of a faculty member, students will select and investigate a topic and will produce a paper of professional caliber on the subject. Prerequisite: Doctoral student standing and Linguistics majors only. Permission of instructor required.

Credits: 1.00 to 3.00

LING 69800 - Research MA Thesis

Credit Hours: 1.00 to 12.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 12.00

LING 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Management

MGMT 10000 - Introduction To Management

Credit Hours: 1.00. An introduction to and survey of the field of management. Exposure to the different functional areas of management will be stressed. Focus will be on the individual development of the student in regard not only to future professional employment but also to his or her educational planning. Required for freshman management students.

Learning Outcomes: 1. Understand the fundamental vocabulary of Business. 2. Analyze and rank different main areas of business in accordance with individual interests. 3. Apply appropriate strategies to maximize the possibility of getting the desired grade. 4. Develop a working knowledge of the many offerings that Krannert provides. 5. Become acquainted with numerous people associated with Krannert's past, current, and future endeavors. Credits: 1.00

MGMT 11000 - Introduction To Management And Information Strategies

Credit Hours: 2.00. An introduction to and survey of the field of business. Exposure to the different functional areas of management will be stressed. Focus will be on the individual development of the student in regard not only to future professional employment but also to his or her educational planning. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Students apply their knowledge of business in a Case Competition. Required for freshman Krannert Leaders Academy students.

Learning Outcomes: 1. Learn how to manage themselves. 2. Identify various professional development options available to them. 3. Reflect upon what type of Krannert student they would like to be. 4. Learn strategies and tactics to help them transition to college life 5. Analyze and rank different main areas of business in accordance with individual interests. 6. Learn how to manage teams. 7. Reflect upon their behavior within a group. 8. Learn how to manage a small team to be efficient 9. Compete in a freshmen case competition to explore further how to practice teamwork in a case environment. 10. Use information and fundamentals of business to make decisions 11. Understand the fundamental vocabulary of business. 12. Become aware of various resources that are available to them through the library. 13. Break down problems into segments. 14. Use information to make decisions in groups. 15. Become acquainted with numerous people associated with Krannert's past, current, and future endeavors. Credits: 2.00

MGMT 17300 - Data Mining Lab

Credit Hours: 1.00. The Data Mining Lab provides a guided Experiential Learning environment for School of Business', especially BS BAIM's, freshman and sophomore students to learn the basics of business data variety, how they are organized, and what insights may be mined for. Students will have hands-on experience to get familiar with a specific data mining tool, R, for carrying out some data mining experiments. Completion of this course will not only enable students to see how the prerequisite or accompanying foundational courses are relate to their major studies but also help them better preparing for successes in their multiple upper division course studies.

Learning Outcomes: 1. Recall examples of business data and data driven decisions. 2. Exemplify the concepts of structured business data and enterprise data management infrastructure. 3. Differentiate business applications of supervised and unsupervised data mining methods. 4. Explain data mining framework that consists of data understanding, insights derivation, and analytical result communication. 5. Use a data mining tool, R, for simple data mining related tasks. Credits: 1.00

MGMT 17500 - Information Strategies For Management (UCC: IL)

Credit Hours: 1.00. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Organization and use of electronic and print tools will be explained through discussion, hands-on exercises, and homework assignments. Permission of instructor required.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Ability to access information and determine what different sources are needed for problem solving. 2.

Develop a foundation in problem-solving to use discovered information effectively and efficiently. 3. Develop a knowledge base into the full array of information available (scholarly articles, market reports, quality websites, and other types of information). 4. Prioritize sources based on credibility and relevance. 5. Accurately cite the information you find. 6. Use retrieved information to accomplish a specific purpose and present information clearly and persuasively using a range of technology tools and media. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

MGMT 19000 - Freshman Level Problems In Management

Credit Hours: 1.00 to 4.00. Investigation into a specific topic area of Management. Arrange with instructor before enrolling.

Credits: 1.00 to 4.00

MGMT 19700 - Careers In Accounting & Finance

Credit Hours: 1.00. This course explores the various career opportunities available to accounting majors, as well as opportunities available to non-accounting majors who have a strong background in accounting. While most students believe public/private accounting are the only career options for accounting majors, we examine other avenues such as hedge funds, private equity and consulting, among others.

Learning Outcomes: 1. Identify potential career paths for both accounting and non-accounting majors with a strong accounting background. 2. Demonstrate an understanding of the various tasks employees perform in several distinct careers. 3. Develop the attributes necessary to succeed in various careers designed for individuals with an accounting major or a strong understanding of accounting (for non-accounting majors). Credits: 1.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4.

Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 22000 - Making The Business Case

Credit Hours: 3.00. This course develops one's ability to address situations faced by managers. This involves collecting information, analyzing that information to determine what decision or action is required and then selling the recommended decision or action to the management team. Selling this is done using one's persuasive skills in both telling a story and illustrating that story.

Learning Outcomes: 1. Differentiate whether a situation calls for making a decision or solve a problem. 2. Identify important facts in case studies. 3. Organize facts found in case studies into issues that factor in the analysis of alternatives. 4. Evaluate alternative solutions to a decision in terms of how they address issues. 5. Recommend an alternative solution. 6. Create a plan of action that will put the recommendation in place. 7. Create presentations that have a story line flowing through them. 8. Create a slide deck that supports the story line of the presentation. 9. Demonstrate effective speaking and body language when making presentations. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and

implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 24200 - Contemporary Problems In Personal Finance For Minorities

Credit Hours: 3.00. This course is designed to allow students to make informed decisions regarding their current and future financial position. Utilizing basic tools such as financial statements and budgets, the students can learn how to plan effectively for continuous financial stability. Students also are able to acquire a basic understanding of different saving instruments, investments, and retirement planning methods, as well as the benefits of purchasing real assets and accumulating wealth to allow stability. Students also have the opportunity to explore other interesting topics of personal finance through presentations and voluntary participation in class discussion. Permission of instructor required.

Learning Outcomes: 1. Create a personal spending, saving, and investment plan for immediately after college. 2. Invest in desired stocks based on popular statistical measures. 3. Obtain a general understanding of careers in financial services. 4. Understand the financial impact of taxes, debt, and health. Credits: 3.00

MGMT 24300 - Contemporary Thought Of Minorities In Management

Credit Hours: 3.00. The basic goal of this course is to introduce the minority student to the vast opportunities that are available in the field of management. The logic of a business education for the minority student is a reflection of the phenomenon that many corporations today are actively seeking minorities for managerial positions. Each semester, approximately 15 Fortune 500 companies are invited to the class to give presentations about entry-level opportunities with their firms. Other topics include the interview, resume writing, dual-career couples, the work force, affirmative action, minorities in the corporate world, etc. Each student is required to give a class presentation covering a business area of interest followed by class discussion over the topic.

Learning Outcomes: 1. Develop job search strategies tailored to your career of choice. 2. Understand the largest challenges facing minority employees within corporate America. 3. Demonstrate an ability to work on a team to analyze data and provide a recommendation to a business case. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 25300 - Finance Industry Exploration

Credit Hours: 2.00. Finance Industry Exploration will introduce students to various sectors of the financial services industry through lectures, guest lectures by financial market participants and regular reading of financial publications (Wall Street Journal, Financial Times, etc.). Students will understand potential career paths, how specific financial markets operate, career success factors, employment differentiation, industry vernacular and suggested future coursework. Topics covered may include (subject to speaker availability) - Investment Banking, Mergers and Acquisitions, Corporate Finance, Corporate Development, Public Finance, Commercial Banking, Sales and Trading, Wealth Management, Asset Management, Private Equity and Private Credit, Venture Capital, Investor Relations and FinTech.

Learning Outcomes: 1. Analyze and explain the commercial landscape of the finance industry, including key firms, influential personalities, and the challenges and opportunities each face. 2. Develop and evaluate a tailored career strategy by identifying one or two industry sectors, multiple companies, and specific roles of interest, and designing a curricular and extracurricular pathway to enhance competitiveness in the job market. 3. Identify and interpret the success factors of various industry sectors and evaluate how specific roles generate value for their company and clients. 4. Demonstrate the ability to discuss industry

topics with professionals by using appropriate terminology and providing relevant historical and company-specific examples. Credits: 2.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 25600 - Technology Landscape

Credit Hours: 1.00. Success in business requires an understanding of today's rapidly evolving technological landscape. This course provides students with an overview of emerging technologies that are shaping the future of business. Weekly meetings feature forums with technology experts and business practitioners, giving students insights into the latest technological advancements and their practical applications in diverse business contexts.

Learning Outcomes: 1. Identify and evaluate new and emerging technologies, including those associated with Computing, Digital Transformation, Automation, Biotechnology, Nanotechnology & Advanced Materials, Technology Management. 2. Integrate new and emerging technologies to promote business growth, competitiveness, and sustainability. 3. Conceive and describe applications of new and emerging technologies to tackle the challenges facing businesses over the next decade. 4. Conceive and describe applications of new and emerging technologies for a sustainable local, national, and global society. 5. Describe the political, legal, and ethical challenges resulting from the development and application of new and emerging technologies. 6. Create and deliver clear, effective, and engaging written assignments appropriate for both technical and non-technical audiences. Credits: 1.00

MGMT 26100 - Introduction To Supply Chain Management

Credit Hours: 3.00. This course seeks to introduce general concepts in supply chain management, including procurement, supply planning, demand planning, and logistics. This course is designed around a corporate partnership to provide students with the opportunity to collaborate on solving a large-scale supply chain challenge. In the first five weeks of the semester, students will be introduced to basics of SCM through lectures, cases, and assignments. Beginning in the sixth week, students will form teams to work on a real-world case presented by the corporate partner, a complex problem broken down into six learning areas, each with a corresponding deliverable.

Learning Outcomes: 1. Define, measure, and recommend improvements to an organization's supply chain. 2. Gain experience in applying these skills to a real-world business problem. 3. Learn about the different aspects of supply chain management. Credits: 3.00

MGMT 28800 - Programming For Business Applications

Credit Hours: 3.00. This course will cover the fundamentals of business rules and logic in a business application development context. Students will acquire these skills using computer programming. A modern programming language will be used to learn and reinforce logical concepts, including abstraction, process flow, variable assignment, and control structures, as well as proper programming and application development

practices, including documentation.

Learning Outcomes: 1. Understand and apply basic technical knowledge to managerial problems. 2. Successfully write, test, and run computer programs designed to address managerial problems. Credits: 3.00

MGMT 28900 - Doster Leadership Conference Board Experiential Course

Credit Hours: 1.00. This experiential course focuses on developing leadership and managerial skills through the planning and execution of the Doster Leadership Conference. The course is designed for students currently in a leadership role related to the Doster Leadership Conference. The material is developed to offer evidence-based approaches to tasks and issues you will face in your role as a board member for the Doster Leadership Conference. In this course, you'll learn to tackle real-world challenges, improve communication, and foster effective teamwork. You'll also gain insights into event logistics, budgeting, and stakeholder engagement while honing your problem-solving abilities. By actively participating in the conference's development, you'll grow as a leader, event organizer, and team member and be better prepared for leadership and project management roles in the future. Ultimately, you will become a stronger, more thoughtful, more organized, and more creative board member and board committee as a whole. Permission of instructor required.

Learning Outcomes: 1. Make evidence-based decisions to address managerial issues. 2. Develop a systematic approach to fulfilling board member responsibilities and obligations. 3. Embrace a growth mindset as individuals and as a collective board. 4. Identify and address opportunities for improvement to deliver a high-quality conference. Credits: 1.00

MGMT 29000 - Problems In Management

Credit Hours: 0.00 to 4.00. Arrange with instructor before enrolling. Investigation in a specific management field. Permission of instructor required.

Credits: 0.00 to 4.00

MGMT 29050 - Professional Internship

Credit Hours: 0.00. Students should be pursuing an internship complementing their academic plans-of-study (majors, minors, and concentrations within the Krannert School of Management). The intended purpose of the internship experience is to help students clarify career interests and prepare for future roles in Accounting; Analytical Consulting; Economics; Finance; Human Resources (OBHR); Industrial Management; International Business; Management; Management Information Systems; Marketing; Supply Chain, Manufacturing, and Operations Management; Quantitative Methods; or Strategic Management. Students must be seeking a Bachelor of Science degree in the School of Management. Employment must be related to the students major, minor, or area of academic concentration. May not be taken for more than five (5) semesters. Permission of instructor required.

Learning Outcomes: 1. Identify skills, values and interests that ultimately help determine career fit and gain career preparedness. Credits: 0.00

MGMT 29110 - Integrated Business & Engineering Seminar I

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 29120 - Integrated Business & Engineering Seminar II

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation.

Credits: 1.00

MGMT 29130 - Integrated Business & Engineering Seminar III

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 29140 - Integrated Business & Engineering Seminar IV

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 29150 - IBE Professional Development

Credit Hours: 0.00. This course is meant to promote meaningful reflection on multiple experiential learning opportunities offered to IBE cohort members as 2nd Year/Sophomores & 3rd Year/Juniors. The course will be required each semester during the 2nd and 3rd Years of the IBE program cohort experience. Assignments will include a reflection quiz or paper based on each event experience. Students will be required to complete at a minimum, 3 experiential learning experiences and corresponding reflections. All questions for surveys will be available on the Brightspace page.

Learning Outcomes: 1. Reflect upon learning experiences that allow you to connect these opportunities in an academic, professional, and social context. 2. Determine how curricular, co-curricular, and industry-based experiences affect your goals and professional development. Credits: 0.00

MGMT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29300 - Diversity In The Workplace

Credit Hours: 3.00. Diversity can be defined as real or perceived differences among people with regards to race, ethnicity, sexual orientation, religion, age, physical and mental ability, and family status that affect an individual's treatment, opportunities and outcomes. As demonstrated in the workplace,

diversity is the numerous ways that employees are viewed as being similar or different. Through this course, students will examine the historical context and the emergence of diversity in the workplace including bias, meritocracy, privilege, social identity frameworks, organizational culture, allyship and advocacy.

Learning Outcomes: 1. Demonstrate knowledge of historical policy and employment regulations that drive current workplace decisions. 2. Demonstrate awareness of social identities, values, and biases of self and of others. 3. Demonstrate perspective and skills to effectively navigate workplace groups and relationships. Credits: 3.00

MGMT 29400 - Navigating Gender In The Workplace

Credit Hours: 3.00. This course has four objectives: (1) To Increase self-awareness and understand its value in managing careers; (2) To learn how gender culture and implicit bias may affect workplace experiences; (3) To develop strategies to deal with gender related challenges; and (4) To develop competencies in leading effective, gender-aware teams. By exploring these areas, students will develop new insights for managing their careers, and they will learn new leadership strategies to help their teams achieve higher levels of performance.

Learning Outcomes: 1. Through self-assessment, increase understanding of your strengths, core values and work styles. 2. Practice behaviors that demonstrate your confidence and leadership skills. 3. Learn how men and women might behave differently in certain work situations, based on research. 4. Understand implicit bias and its potential impact on talent assessment and advancement. 5. Learn effective strategies and skills to handle common gender-related work challenges - as an individual, as a team member and as a leader. Credits: 3.00

MGMT 29450 - Women In Leadership

Credit Hours: 1.00. Ready to grow your confidence in leadership? In this one-credit course, we will explore how to develop and grow your talents, strengths and leadership while also making an impact at the school of business. We'll also explore what leadership looks like in different contexts, tools you need, and how to be a more inclusive leader.

Learning Outcomes: 1. Explore leadership theories and apply them to your experiences. 2. Develop a leadership plan for your personal leadership development and growth. 4. Assess how your MyStrengths talents make you uniquely qualified to lead. 5. Reflect on past success as you build a plan for personal leadership growth. Credits: 1.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in

corporate finance. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 31200 - Challenge X: Discovering Meaningful Problems Worth Solving

Credit Hours: 3.00. Venture creation drives progress by solving complex challenges, addressing pressing problems, and unlocking new opportunities. It begins with a deep understanding of stakeholder needs, customer pain points, and systemic challenges through rigorous observation and direct engagement. This course helps students lay that foundation by identifying a problem space they care about and embarking on a discovery journey. By the end, they will define their Challenge X?a clear, high-impact problem or opportunity that could inspire a new venture. Permission from Instructor is required.

Learning Outcomes: 1. Generate innovative venture ideas and critically evaluate their attractiveness and alignment with emerging market opportunities. [Idea Generation and Evaluation] 2. Conduct effective customer discovery processes - including secondary research, interviews and surveys - to validate problem hypotheses and refine business concepts. [Customer Discovery Skills] 3. Develop a strong understanding of problem-framing dynamics by synthesizing customer feedback into actionable insights that guide iteration and improvement of venture ideas. [Problem Framing] 4. Analyze target customers and markets using tools and frameworks to estimate market size, identify key segments, and assess competitive landscapes. [Market Analysis Competence] 5. Create and deliver persuasive presentations that effectively communicate validated business opportunities and demonstrate readiness for further entrepreneurial development. [Entrepreneurial Communication] Credits: 3.00

MGMT 31300 - Solution X - Designing And Building The Product To Address Challenge X

Credit Hours: 3.00. Once a validated problem is identified, how do we transform deep insights into impactful solutions? Building on Venture X1, this course focuses on designing, testing, and refining the right solution through rapid prototyping, business model innovation, and stakeholder engagement. Students will explore multiple solutions, iterate based on real-world feedback, and prioritize those that leverage existing technologies for maximum impact. By the end, they will have their Solution X-a validated prototype and model ready for further development and eventual venture creation. Permission of instructor required.

Learning Outcomes: 1. Design and build a Minimum Viable Product (MVP) that addresses a validated problem, and test it iteratively with customers to gather actionable feedback. [MVP Development and Testing] 2. Identify, prioritize, and validate critical assumptions about the desirability, feasibility, and viability of a business

idea through structured experimentation. [Critical Assumption Testing] 3. Develop a comprehensive business model that integrates key components such as value proposition, customer segments, revenue streams, and cost structures. [Business Model Design] 4. Formulate and evaluate a go-to-market strategy that aligns with the product offering, target customers, and competitive landscape. [Go-to-Market Strategy] 5. Deliver a compelling presentation that effectively communicates the MVP, business model, and validated assumptions to potential investors or stakeholders. [Pitching and Stakeholder Communication] Credits: 3.00

MGMT 31400 - MODEL X - Assembling And Attracting Resources For Launch

Credit Hours: 3.00. This course helps students transition from a validated solution to a scalable venture by focusing on assembling the critical resources needed for launch and long-term success. Building on X1 and X2, it shifts from solution development to securing the right team, customer traction, strategic partnerships, and sustainable funding. Through hands-on engagement with potential customers, investors, and partners, students refine their model and identify the best pathway-whether as a startup, business unit, or product extension. Over the summer, they will receive financial support, collaborate in a shared environment, and ultimately pitch their venture to attract the necessary resources for launch. Permission of instructor required.

Learning Outcomes: 1. Develop and refine a customer-validated business model with a clear value proposition that resonates with a specific cohort of paying customers. [Customer-Validated Business Model] 2. Form and manage a purpose-built co-founding team, leveraging partnerships with mentors, advisors, and subject matter experts to strengthen the venture. [Team Building and Leadership] 3. Identify and establish key partnerships with organizations and stakeholders to enhance business growth and scalability. [Strategic Partnerships] 4. Create and deliver an investor pitch that clearly communicates the value proposition, business model, and traction, while targeting the right investors for the venture. [Pitching and Fundraising] 5. Work effectively in a co-located team environment, learning from peers and leveraging the local network in downtown Indianapolis to solve real-world entrepreneurial challenges. [Collaborative Problem Solving] Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 33100 - Development And Impact of Equal Employment Law

Credit Hours: 3.00. This class will delve into the legal issues that affect women and men with regard to gender discrimination,

equality under the law, sexual harassment, the wage gap, the glass ceiling, affirmative action, family law, and more. The class will be lead through a variety of teaching formats including lectures, activities, presentations, and more. Through this course students will learn about these important areas and, in the process, develop strategies that will assist them as they pursue careers in business and management. Students will have the opportunity to delve deeply into areas that interest them and will impact their future careers. They will do this through a research topic and presentation. Sophomores and juniors are encouraged to enroll. The content may be of particular interest to women, but the course is open to all students.

Learning Outcomes: 1. Learn about the law as it relates to women in business and other areas. 2. Learn the theory related to law and women in business. 3. Practice through experiential exercises approaches to legal situations women confront in the business context. 4. Conduct research and make presentations related to class topics. Credits: 3.00

MGMT 33200 - Business World Problem Solving

Credit Hours: 3.00. The class engages students to work in cross-functional teams to analyze business problems,develop recommendations, and persuade decision makers through the presentation of compelling solutions. In the classroom students will work together in teams to solve problems that are difficult for firms to outsource and are usually solved in-house without the opportunity to engage a consultant.

Learning Outcomes: 1. Identify the critical elements of a business decision. 2. Develop a solution as a team. 3. Prepare and present a professional presentation of a business solution. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 33900 - Krannert Mentoring & Leadership Program

Credit Hours: 2.00. This course will help students learn mentoring best practices and qualities of an effective mentor while practicing and developing these qualities in themselves as they mentor incoming Krannert first-year students. Additional topics include: 1) how to implement and assess mentoring programs in companies, 2) how mentoring builds ethics and leadership skills, and 3) how to be a better cross-cultural mentor.

Learning Outcomes: 1. Learn best business mentoring practices and how to implement them. 2. Grow your awareness of your mentoring and leadership skills and challenges. 3. Develop formal mentoring relationships with

assigned mentees and informal mentoring relationships with other mentors and mentees. 4. Acclimate mentees to Krannert, college life, and business opportunities. 5. Facilitate your professional and personal growth (to mentor you) as you develop your mentees. Credits: 2.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 35000 - Intermediate Accounting I

Credit Hours: 3.00. Financial reporting for interested external parties. Emphasis on asset valuation, income measurement, and preparation of financial statements, and on appreciation of discretion available to preparers.

Learning Outcomes: 1. Understand the objectives of financial reporting. 2. Explain and apply the basic principles of accounting. 3. Describe how to prepare and analyze an income statement, balance sheet, statement of cash flows and statement of retained earnings under generally acceptable accounting principles (GAAP). 4. Understand the tradeoffs involved in standard setting, the limitations of current accounting standards, and the effects that these tradeoffs and limitations have on the quality and content of financial statements. 5. Gain an appreciation of firms' ability and incentives to choose from a wide variety of alternative measurement bases and accounting procedures and the effects that those choices have on readers of firms' financial statements. Credits: 3.00

MGMT 35100 - Intermediate Accounting II

Credit Hours: 3.00. Continuation of Intermediate Accounting I. An examination of additional problems in financial reporting, including long-term assets, liabilities, owners' equity, income taxes, earnings per share, leases, and pensions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants

(i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

MGMT 35500 - Consulting Tools And Skills

Credit Hours: 3.00. This novel course will provide an opportunity for motivated students to gain exposure to the skills and tools necessary to succeed in the consulting industry. There will be a chance to work in small teams to define client problems, collect and analyze data, develop solution proposals, and implement recommendations. Students will also be given an insider's look into the history of consulting, common types of consulting, and professional standards in this specialized area of management. Honing skills in project management, presentation delivery, storytelling, and stakeholder engagement will form the foundation of the tools used to solve client challenges.

Learning Outcomes: 1. Effectively and confidently use specific consulting business language. 2. Critically analyze resumes and case interviews. 3. Effectively research businesses and unfamiliar industries. 4. Use a consulting approach to problem solving. 5. Present a professional, engaging, and authentic persona. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 37000 - Real Estate Fundamentals

Credit Hours: 3.00. This course introduces the basic concepts, principles, and analytic methods applied in the field of real estate. The course covers topics including legal, financial, economic and marketing concepts related to real estate. The goal of the course is to expose students to the field of real estate and prepare them for more advanced real estate courses.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Describe titles to the conveyance of real estate. 3. Review land economic principles as they relate to real estate values. 4. Identify all quantitative issues required to complete effective real estate transactions. 5. Discuss the aspects of city planning and zoning on real estate values. 6. Understand basic methods for real estate valuation. 7. Understand basic issues in real estate development. Credits: 3.00

MGMT 37300 - Accounting Information Systems & Data Analytics

Credit Hours: 3.00. Learn how to manage the design, control and operation of accounting information systems. The emphasis is on identifying the information needs of decision makers and developing appropriate business process control in the design of accounting information systems. Gain an understanding and appreciation of the accounting information system and how it is used to successfully manage, audit and develop processes to support today's evolving business environment.

Learning Outcomes: 1. Understand and apply basic tools necessary for diagrammatically analyzing and documenting organizational data flows and business processes including data modeling and flowcharting. 2. Gain an understanding of the various business processes necessary for an enterprise to successfully operate, the key controls for maintaining successful business processes, and application of the methodology for evaluating risks and controls within the given business process. 3. Explain, justify and evaluate the

components of organizational governance and associated effective internal control systems. 4. Develop a basic understanding of data analytics and emerging technologies in accounting information systems. 5. Explain and justify AIS auditing, computer fraud, and security techniques. Credits: 3.00

MGMT 37500 - Real Estate Law

Credit Hours: 3.00. The course provides an overview of real estate law and its influence on various aspects of the real estate industry. The course examines the legal issues surrounding the nature of real property, types of ownership and possession, real estate contracts, escrow and title and insurance, zoning, financing, landlord and tenant, land use regulations, environments law and regulations, and agency ethics.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Understand how the right to use land is conveyed. 3. Understand the limitations and requirements of land ownership. 4. Understand how the state controls and influences the use of property. 5. Describe the various ways of acquiring the title of real property. 6. Interpret the regulations on real estate contracts. 7. Evaluate various types of real estate ownership and financing techniques. 8. Understand the limitations which can be imposed on real property based on environmental concerns. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

MGMT 38900 - Using R For Business Analytics

Credit Hours: 3.00. The main purpose of this course is to introduce and familiarize undergraduate students to RStudio and the R programming language as tools for business data analytics. Students will develop a small portfolio of projects that demonstrate fundamental knowledge of programming, exploratory data analysis, data visualization, and basic predictive modeling techniques using R. The emphasis of the course will be on hands-on applied projects in R in which students will be able to appreciate and visualize statistical and machine learning concepts tailored to real world business applications.

Learning Outcomes: 1. Process data using R and RStudio. 2. Apply statistical and machine learning principles using R and RStudio. 3. Produce meaningful data visualization outputs using R and RStudio. 4. Examine the interaction between business principles and data analytics. Credits: 3.00

MGMT 39000 - Junior Level Problems In Management

Credit Hours: 0.00 to 4.00. The Accounting Internship provides work experience in businesses or other institutions. Permission of instructor required.

Credits: 0.00 to 4.00

MGMT 39100 - Strategic Thinking And Decision-Making

Credit Hours: 3.00. This course focuses on how to think strategically and make good business decisions. By the end of the class, you will be able to do the following: (1) Recognize biases in how people process information, conducting user tests

and interviews to gain insights from prototypes to make business development decisions; (2) Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas; (3) Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas; (4) Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas. 3. Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas. 4. Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

MGMT 39200 - Optimizing Personal Brand And Image

Credit Hours: 3.00. This course will focus on four areas: personal branding, social and digital media strategies, financial literacy and philanthropy. You'll gain an understanding of how to convey your image to an external audience, evaluate the proper channels to maximize and monetize that image responsibly, select advisors to help negotiate contracts and invest your money, and establish charities and events that support your personal causes. You'll learn which media and financial landmines to avoid while staying true to your personal principles and philosophies, and you'll gain leading-edge information about the technologies to keep you ahead in the game of life.

Learning Outcomes: 1. Outline the basics of developing your brand and convey your image to an external audience. 2. Evaluate the proper channels to maximize and monetize that image responsibly. 3. Explain basic financial concepts and compare advisors to negotiate contracts and invest your money responsibly. 4. Demonstrate how to establish philanthropies and events that align with your personal causes and brand. Credits: 3.00

MGMT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39699 - Professional Practice Internship

Credit Hours: 0.00 to 1.00. Professional experience in Management. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit reflective summaries and receive company evaluation. Permission of Instructor required.

Learning Outcomes: 1. Identify the practices, protocols, and key skills used for various positions of a particular organization and/or industry in which they are working. 2. Reflect on their professional growth, personal development, and the practical application of theoretical knowledge within their chosen field. 3. Refine and reassess their own career goals as a result of the experience. Credits: 0.00 to 1.00

MGMT 39799 - Professional Internship

Credit Hours: 1.00 to 3.00. Professional experience in Management. The internship must be for a minimum of 11 weeks and credit hours are determined based on worked hours per week and total hours worked. Program coordinated by the Office of Professional Practice in collaboration with Business Careers Services in the Mitch Daniels School of Business. Surveys are required to gather information on each student's experience, including details about compensation, location, and position. Along with completing work experience surveys, students are also evaluated by their supervisors. At the completion of the internship course, students are required to submit their updated resume which reflects their internship experiences. Other assignments may be required depending on the number of credits assigned to the course. Permission of instructor required.

Learning Outcomes: 1. Identify the practices, protocols, and key skills used for various positions of a particular organization and/or industry in which they are working. 2. Reflect on their professional growth, personal development, and the practical application of theoretical knowledge within their chosen field. 3. Refine and reassess their own career goals as a result of the experience. Credits: 1.00 to 3.00

MGMT 39800 - Using R For Business Analytics

Credit Hours: 3.00. The main purpose of this course is to introduce and familiarize undergraduate students to RStudio and the R programming language as tools for business data analytics. Students will develop a small portfolio of projects that demonstrate fundamental knowledge of programming, exploratory data analysis, data visualization, and basic predictive modeling techniques using R. The emphasis of the course will be on hands-on applied projects in R in which students will be able to appreciate and visualize statistical and machine learning concepts tailored to real world business applications.

Learning Outcomes: 1. Process data using R and RStudio. 2. Apply statistical and machine learning principles using R and RStudio. 3. Produce meaningful data visualization outputs using R and RStudio. 4. Examine the interaction between business principles and data analytics. Credits: 3.00

MGMT 40100 - Executive Forum

Credit Hours: 1.00. A lecture-discussion course featuring executives from business firms and other organizations. Emphasis is placed on the actual practice of management in corporate America, on career selection and mobility, on styles of management, and on other topics not normally covered in undergraduate courses.

Learning Outcomes: 1. Learn from a diverse set of speakers from a variety of institutions. 2. Understand problems and solutions and opportunities. 3. Gain the need for educational preparation of future business leaders. 4. Understand themselves, their responsibilities and their relationships with each other. 5. Understand the executive suite. Credits: 1.00

MGMT 40500 - Six Sigma And Quality Analytics

Credit Hours: 3.00. The course is an undergraduate elective offered as part of the Center for Manufacturing Management Enterprises (CMME) quality initiatives. Provides an overview of various tools and methods for total quality management.

Learning Outcomes: 1. Make data driven conclusions and decisions for quality management operations through working on various business cases. 2. Apply previously gained statistical knowledge to understand and to analyze data. 3. Gain some advanced analytical technics such as Analysis of Variances (ANOVA) and Design of Experiment (DOE) to optimize obtaining data and learnings.

4. Master a simple yet powerful MINITAB software to carry out complex tasks. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

MGMT 41200 - Financial Institutions And Markets

Credit Hours: 3.00. Introduction to financial markets and management of financial institutions. Emphasis on determinants of interest rates, and measurement and management of financial risk. Concentration on management of depository firms such as banks and savings and loans.

Learning Outcomes: 1. Students will be introduced to financial markets and management of financial institutions through learning about determinants of interest rates, and measurement and management of financial risk, with particular attention on management of depository firms such as banks and savings and loans. Credits: 3.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

MGMT 41250 - Fixed Income Securities

Credit Hours: 3.00. This course includes examination of fixed income securities institutions that invest, roles in institution, portfolios and math associated with assessing characteristics of fixed income securities.

Learning Outcomes: 1. Examine management of fixed income securities. 2. Examine portfolios and risk management strategies. 3. Demonstrate use of simulation models for risk assessment. Credits: 3.00

MGMT 41300 - Corporate Finance

Credit Hours: 3.00. The course provides the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending, or investment banking setting. Topics include corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition, and mergers/acquisition.

Learning Outcomes: 1. Know the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending or investment banking system through study of topics including

corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition and mergers/acquisition. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

MGMT 41350 - Venture Capital And Entrepreneurial Finance

Credit Hours: 3.00. This course includes descriptions of markets for start-up businesses, venture capital financial structures, valuation of start-ups, role of venture capital in economic development and business growth strategies.

Learning Outcomes: 1. Evaluate start-up ventures and understand the markets for early-stage businesses. 2. Value these companies using Discounted Cash Flow models, markets multipliers and other industry-specific valuation methods. Credits: 3.00

MGMT 41500 - International Financial Management

Credit Hours: 3.00. The course explores financial decision making in an international framework from the perspective of the management of a multinational corporation. Topics covered include the international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations.

Learning Outcomes: 1. Students will learn about financial decision making in an international framework from the perspective of the management of a multinational corporation through topics such as international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations. Credits: 3.00

MGMT 41601 - Corporate Mergers And Acquisitions

Credit Hours: 3.00. The financial analysis of corporate acquisitions, mergers, and reorganizations including asset acquisitions, joint ventures, spin-offs, sell-offs, equity carve-outs, bankruptcy proceedings and reorganizations, and corporate governance. The course uses a combination of lectures, readings, and case analysis.

Learning Outcomes: 1. Understand the processes of valuation, negotiation, and financial outcomes of transactions involving mergers and acquisitions. Credits: 3.00

MGMT 41650 - Financial Engineering

Credit Hours: 3.00. The objective of this course is to develop necessary skills to value and hedge a wide variety of derivative contracts traded in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous time. Some basic knowledge of stochastic processes would be helpful, but not essential: what needed will be covered in class. The analytic valuation and hedging of derivatives using the modern martingale methods will be the main focus of the course. Applications will include forwards, futures, and options on stocks, bonds and foreign currencies. The numerical methods such as parameter estimation, Monte Carlo simulations, discretization schemes as well as the conditional volatility estimation techniques will also be addressed. In addition to the valuation and hedging derivatives, course also covers Value-at-Risk, credit risk, modeling the term structure of interest rates and the construction of the VIX index using the S&P 500 index options obtained from the IvyDB OptionMetric database.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Outline and design new financial derivatives. 3. Develop the VIX index using options data. Credits: 3.00

MGMT 42000 - Consumer Analytics

Credit Hours: 3.00. Many firms possess extensive information about customers, their transactions, and their relationships with the firms, necessitating expertise for intelligent utilization. The objective of this course is to equip you with a scientific approach to customer marketing, featuring hands-on use of databases, analytics, and computing to collect, analyze, and act on customer information for various industries. This course specifically focuses on customer relationship analytics, including identifying promising prospects and customer acquisition, customer development through up-selling, cross-selling, and personalization, as well as managing customer attrition, retention, and evaluating customer lifetime value. It also explores advanced analytics models such as conjoint analysis, purchase forecasting, and perception analysis.

Learning Outcomes: 1. Use data analytics to improve customer engagement and elevate the overall customer experience. 2. Clarify the role of analytical customer relationship management in achieving strategic marketing goals across various industries. 3. Carry out analytical skills through practical experience with customer datasets. 4. Recognize advanced modeling techniques commonly employed in the field. 5. Summarize the financial advantages of adopting marketing strategies based on the concept of 'Customer Lifetime Value'. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 42120 - Data & AI-Driven Marketing

Credit Hours: 3.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course offers an immersive exploration into the intersection of data science, artificial intelligence, and marketing strategies, providing students with the knowledge and skills to thrive in the digital era. It will discuss uses of data science tools and AI algorithms in marketing applications, such as personalized marketing, sentiment analysis, and ad campaign optimization. Students will also gain hands-on experience on applying the methods to real-world data.

Learning Outcomes: 1. Identify modern statistical & machine learning methods required for marketing using big data. 2. Carry out applying statistical and machine learning methods to improve major marketing decisions. 3. Implement statistical and machine learning methods in Python using real-world data. Credits: 3.00

MGMT 42130 - Consumer Behavior

Credit Hours: 3.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, economics and sociology to learn why consumers behave in the ways that they do. The course focuses on three general topics. 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision-making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior.

Learning Outcomes: 1. Organize, explain and predict consumers judgements and choices using social science multiple concepts, frameworks and theories. 2. Identify & analyze consumer behavior issues and apply relevant theories to aid in managerial decision-making. 3. Generate basic applied experiments in consumer behavior to test relevant theories with real consumers. Credits: 3.00

MGMT 42210 - International Marketing

Credit Hours: 3.00. Most U.S. businesses, large and small, are becoming deeply involved in international business. The trend is going to grow even stronger because of the influence of World Trade Organization and regional trade blocks. Under these circumstances, it is imperative that business managers possess the skill sets to adapt their marketing strategies to the needs of international markets. This course will cover the concepts and theories pertaining to international marketing. It is aimed to

provide students with skills in formulating a marketing plan for foreign market entry and conducting business in a foreign country.

Learning Outcomes: 1. Understand the issues involved in formulating and evaluating international marketing strategies. 2. Learn about global market entry, expansion, and sustainment. 3. Be exposed to the appropriate theories, models, and other tools to make better marketing decisions in cross-cultural business settings. 4. Obtain insights into how profitable global marketing strategies can be created. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

MGMT 42410 - Retail Management

Credit Hours: 3.00. Understanding and executing effective sales and retail strategies are essential for achieving overall business success, impacting growth, customer relationships, and competitiveness in the market. This course combines theoretical foundations with practical applications, guiding students in integrating sales and retail management principles into comprehensive business decision-making processes.

Learning Outcomes: 1. Apply market analysis techniques to identifying customer segments, analyze sales techniques and create a strategic sales plan. 2. Demonstrate an understanding of the principles of inventory management, merchandising strategies and their impact on customer experience and profitability. 3. Analyze the alignment of sales and retail strategies with broader business objectives. 4. Apply sales and retail management concepts to diverse business scenarios. Credits: 3.00

MGMT 42420 - Sales Management

Credit Hours: 3.00. An introduction to sales force management, this course offers a comprehensive examination of the salesforce management process. Key topics include the principles and best practices of recruiting, selecting, training, compensating, and motivating sales personnel. Additionally, the course will cover strategies for effective supervision and evaluation of a sales team to ensure optimal performance.

Learning Outcomes: 1. Explain the different components/skills of relationship sales management and apply them through course assignments. 2. Compare and contrast different sales management strategies through cases and simulations. 3. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues, and activities. Credits: 3.00

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

MGMT 42610 - Brand Management

Credit Hours: 3.00. This course is designed to provide an understanding of how to manage a brand, product, or product category. The course concerns issues related to customer behavior and customer decision making, with an emphasis on

how to utilize such customer-oriented knowledge for building and maintaining brand equity. This course builds on concepts and topics covered in the core marketing course.

Learning Outcomes: 1. Increase understanding of the important issues in planning and evaluating brand strategies. 2. Provide appropriate theories, models, and other tools to make better brand management decisions. 3. Provide students with insights into how profitable brand strategies can be created. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 42910 - Experiential Marketing

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet regularly with the faculty supervisor and also the project sponsor to review project progress and discuss the next steps towards meeting project requirements. Projects are done in teams, although evaluation is individual. Permission of instructor required.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the project analysis and information gathered into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Experience challenges of working in teams to achieve projects goals. Credits: 3.00

MGMT 42930 - Labor Relations

Credit Hours: 3.00. The course focuses on employee-employer relations. Attention is given to topics in legal aspects of union organizing and collective bargaining, labor unions history and structure in the United States, labor management negotiations, dispute resolution procedures, international labor relations, and labor-management cooperation.

Learning Outcomes: 1. Summarize what unions do and why workers join labor unions. 2. Explain how management can react when its workers decide to form a union. 3. Execute the process of collective bargaining and summarize information typically contained in a collective bargaining agreement. 4. Differentiate how disputes are resolved through mediation, arbitration, and other methods. 5. Compare how labor-management relations in the USA are versus similar relationships in other countries around the world. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to

the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

MGMT 43700 - Social Media Marketing

Credit Hours: 3.00. This course is deigned to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class. The deliverables for this project will be a slide presentation (no more than 10 pages, excluding appendices) to showcase what you have learned. This may be included as a part of your resume to show your potential employers. These are some of the basic knowledge of useful skills in web crawling, data mining, and statistical analyses, so you may leverage your portfolio when seeking entry/junior level marketing analyst positions.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 3.00

MGMT 43800 - Pricing Strategies

Credit Hours: 3.00. In the era of Big Data, where extensive information is available at the customer level, managers benefit from an increased ability to learn from their customers' behavior. In this scenario pricing becomes a crucial lever for increasing the relationship with the customer and maximizing profits and shareholder value. In this course, students will learn how to systematically approach pricing decisions, taking the perspective of the marketing manager. The course will use a combination of lectures, case discussions and in-class exercises to leverage micro-level transaction data for pricing decisions.

Learning Outcomes: 1. Become familiar with the concepts, theory, and latest thinking bearing on the key issues in pricing, taking the perspective of the marketing manager. 2. Apply concepts and theory to the solution of real pricing problems in marketing settings. 3. Develop your business communication skills and receive feedback from your peers and the instructor. Credits: 3.00

MGMT 43901 - Real Estate Investment & Development

Credit Hours: 3.00. The course will cover two main topics: real estate development and real state investment. For real estate development, we will discuss the process of the real estate development process, including the basics of the idea conception, feasibility, planning, financing, market analysis, contract negotiation, risk management, marketing, and asset management. For real estate investment, we will discuss the process and techniques of analyzing real property investment, and the effects of market conditions, government policies, and other factors on real estate investment.

Learning Outcomes: 1. Understand the nature of real estate markets and how value is determined. 2. Understand the process of developing real estate properties. 3. Understand the basic methods for evaluating financial and other risks associated with a real estate development project. 4. Understand and utilize the underlying theory in the analysis of income-producing real estate as an investment medium. 5. Use the net present value and internal rate of return and traditional measures of investment analysis of a real estate investment. 6. Understand the basic principles in structuring real estate investments. Credits: 3.00

MGMT 43902 - Real Estate Capital Markets

Credit Hours: 3.00. In this course, students explore the world of real estate finance and capital markets from the perspectives of investors, lenders, fund managers, and other capital allocators. Diving into essential topics like deal structuring, waterfall analysis, debt management, real estate private equity, taxation and regulation, public incentives, mortgage-backed securities (MBS), and Real Estate Investment Trusts (REITs). Through hands-on experience, they will learn to model before-tax and after-tax cash flows, price various securities and deal structures, and develop strategies for managing risk and distress at both

project and fund levels. With a strong focus on case study analysis, this course will equip students with practical insights and skills to succeed in real estate finance.

Learning Outcomes: 1. Demonstrate a deep understanding of the history and composition of both debt and equity components of real estate capital markets. 2. Understand the main drivers of real estate capital flows and capital pricing. 3. Describe the structure of residential and commercial mortgage-backed securities. 4. Perform a comprehensive valuation of a REIT. 5. Structure the capitalization for a given project type. Credits: 3.00

MGMT 43905 - Real Estate Industry Project

Credit Hours: 3.00. This course gives students opportunities of working on real-world projects provided by commercial corporations or organizations. Through the experiential learning experience, students have the opportunities to develop knowledge and skills in managing real estate projects. Depending on the available projects, students will work on topics related to real estate investment and development, facility design and renovation, asset management and other issues. The focus is on developing students' ability in applying what they've learned to solve real-world challenges and receiving coaching and feedback from industry experts.

Learning Outcomes: 1. Learn how to organize your investment or development project by analyzing key characteristics and external constraints that affect schedule, budget, and outcomes. 2. Plan and manage financial and physical resources by a well-planned schedule with appropriate tasks. 3. Monitor project progress and make necessary adjustments to the project schedule manpower and costs. 4. Develop team leadership and communication skills. Credits: 3.00

MGMT 43907 - Advanced Topics In Real Estate

Credit Hours: 3.00. This course covers selected and timely topics in real estate that are not covered in other regular courses. The topics are determined by the instructor offering the course. The instructor may also include advanced analytical techniques for real estate investment decisions, real estate valuation, and other analyses. Cases and research reports may be used in this course.

Learning Outcomes: 1. Recognize and understand issues and their impacts on the real estate industry. 2. Assess the impacts of certain issues on a company. 3. Understand and apply advanced analytical methods in real estate decisions. 4. Develop a life-long learning ability for future issues in real estate. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

MGMT 44310 - China, America And Artificial Intelligence

Credit Hours: 3.00. The key to business success is to read broadly and to understand how culture, economics, history, and politics converge. Through frequent writing assignments, close readings of personal accounts, and daily class discussions, students will gain insights into how culture, economics, history, and politics intersect to influence human behavior and worldviews. Case studies and examples will be drawn from the United States, China, and Taiwan. Finally, we will apply what we have learned to the practice of global cultural dexterity. Students will identify cultural nuances and subtleties in order to share examples of how each student has adapted or failed to adapt to different cultural dynamics.

Learning Outcomes: 1. Identify and to analyze cultural, economic, historical, political, and social variables. 2. Understand how culture, economics, history, politics and society converge to influence human behavior and worldviews. 3. Gain knowledge of cultural worldview frameworks. 4. Acquire an attitude of openness. Credits: 3.00

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing

world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

MGMT 44363 - Confident Transitions And Leadership

Credit Hours: 1.00. In this course offered by the Brock Wilson Center for Women in Management, graduating senior women will prepare for a confident transition from student to professional. Students will focus on common issues for new employees as well as be paired with an alumni mentor. They will develop a personal plan for their transition from college student to successful professional through reading and discussing key business leadership books. Through this course, each student will build a plan for the first six months of their job and decide what a successful transition looks like for them. Permission of instructor required.

Learning Outcomes: 1. Understand the core principles of successful professionals and how they apply to a first job. 2. Explain and reflect on best practices for launching a successful career. 3. Formulate a plan for the first six months of your new position and what success will look like. 4. Utilize your unique MyStrengths as part of your plan for a Confident Transition. Credits: 1.00

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44429 - Talent Management

Credit Hours: 3.00. This course focuses on the employer-employee relationship at work, and how managers work with employees to improve employee performance. Attention is given to the history of labor relations and performance management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing employee performance.

Learning Outcomes: 1. Identify and understand the tools and techniques of contemporary employee relations at work. 2. Identify and understand the tools and techniques of contemporary performance management at work. 3. Ability to apply these techniques. Credits: 3.00

MGMT 44430 - Staffing: Talent Acquisition

Credit Hours: 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. It will also prepare students to evaluate methods for job analysis and selection. Students will learn how to design and ask interview questions that are behaviorally anchored and focused on

organization-person fit and person-job fit, both of which are important for successful adaptation and effective performance on the job. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Describe workforce planning implementation issues and the importance of continuous refinement of the plan. 2. Define talent acquisition and differentiate between recruiting and selection processes. 3. Understand the various talent acquisition organization models. 4. Use tangible and intangible data to build a business case for effective talent acquisition. 5. Articulate the steps in a common talent analysis and translate the analysis into selection criteria and methods. 6. Conduct a job-fit and organization-fit analysis and translate the analysis into selection criteria and methods. 7. Develop behavior-based and situation-based interview questions derived from job analysis and conduct a professional interview. 8. Design a process for final candidate evaluation. 9. Highlight various strategies to orient and onboard new acquired talent. 10. Articulate an employer's legal responsibilities in the talent acquisition process. Credits: 3.00

MGMT 44431 - Compensation: Total Rewards

Credit Hours: 3.00. This course examines the tangible and intangible aspects of compensation, through the lens of a total reward philosophy of an organization in order to attract, motivate, and retain their Human Capital. It also provides an overview of the considerations necessary to develop a compensation system that is internally and externally equitable and fiscally responsible, including the use of job evaluation and salary surveys.

Learning Outcomes: 1. Evaluate the difference Total Rewards programs can make in organizations. 2. Distinguish between total rewards and compensation and identify compensation and non-compensation elements of total rewards. 3. Recognize various reward systems, their relationship and connection to a total compensation and benefits philosophy, and how they impact the quality of work life and productivity organizations. 4. Assess the practical issues in compensation and employee benefits in light of a company's management philosophy and human resources strategies. 5. Define job evaluation and its use to develop internally equitable compensation systems. 6. Identify the implications of using salary surveys to ensure externally equitable and fiscally responsible compensation systems. 7. Explain the concepts of salary administration and application of compensation programs in the business environment. 8. Better understand effective salary and wage structures in organizations today. 9. Explain the relationship between performance evaluation methods and reward systems. 10. Discuss the legal aspects of compensation, benefits and performance appraisals. Credits: 3.00

MGMT 44433 - Leading And Working In Teams

Credit Hours: 3.00. This course will explore the forces that affect behavior in teams, and the factors that lead to team success. We will use a variety of readings, cases, activities, and class discussions to build concrete skills related to leading and working in teams. The course will explore the specific challenges associated with leading teams, some of which include: building and designing teams, managing information exchange within and across teams, structuring effective group decision processes, igniting creative thinking, enabling complex problem solving, managing team diversity and conflict, and managing systems of teams. Permission of instructor required.

Learning Outcomes: 1. Identify and define concepts related to team functioning and effectiveness. 2. Apply those concepts to understand and diagnose issues associated with team effectiveness. 3. Develop a course of action to improve team functioning. Credits: 3.00

MGMT 44434 - Human Resources Analytics

Credit Hours: 3.00. This course introduces concepts, tools, and methods used in collecting, interpreting, and presenting HR data. Students will learn how to gain new insights, solve problems, and drive performance through HR analytics. A central focus of this course is the ethics of HR analytics. This course teaches students how to ask the right questions in order to intelligently use HR analytics and metrics for business

decisions. It discusses the implications of internet AI, business AI, perception AI, and autonomous AI for HR. This course will cover applications including the intelligent use of analytics related to employee engagement, healthcare expenditure, learning and development, performance management, and safety.

Learning Outcomes: 1. Gain an understanding of the different analytical approaches used by HR Professionals to solve real business problems. 2. Examine actual business cases and apply problem solving and critical thinking skills through group case studies. 3. Learn how to make impact with data by using effective storytelling techniques. 4. Build on presentation skills and demonstrate the ability to work effectively in teams. Credits: 3.00

MGMT 44630 - Innovation Management

Credit Hours: 3.00. In this course you learn why organizations struggle to innovate, how to successfully analyze and implement an innovation strategy, and you learn to manage the innovation process. The course consists of two pillars (or 'walls') that enable a company to become innovative (Innovation Strategy and Organization Design) and the innovation process itself. The innovation process contains how to generate, select, implement, protect, experiment, scale, and diffuse ideas. Consequently, this course will provide you the skills and knowledge to manage innovations. Permission of department required.

Learning Outcomes: 1. Analyze the potential and implication of ideas and innovations for an organization and environment. 2. Formulate an innovation strategy. 3. Develop an innovation process. 4. Distinguish the different approaches to designing an innovative organization. Credits: 3.00

MGMT 44670 - The Great Leaders Book Club

Credit Hours: 3.00. One way to learn about leadership and being an effective leader is to learn from other leaders past and present. Numerous articles and books have been written about leadership and/or profile one or more leaders. We will study leaders through historical and contemporary review and analysis of selected books that illustrate important leadership principles and situations. Course readings will typically include books that one would find on bookshelves of top-level leaders in organizations and institutions. Each week students and instructor meet to discuss the assigned readings and identify key leadership lessons and takeaways. These discussions are reinforced through role play and in-class exercises. Students are expected to be active co-participants and will be challenged to ask curious questions and develop critical thinking skills. This class is designed for high potential leaders who take leadership seriously and wish to develop their leadership capability to its fullest. Permission of instructor required.

Learning Outcomes: 1. Identify what leadership is and what it is not. 2. Summarize key differences between effective and ineffective leaders. 3. Deconstruct and differentiate leader attributes and behaviors that contribute to leader outcomes. 4. Identify and use influence techniques to influence others. 5. Recognize differences in situations that may call for different leadership approaches. Credits: 3.00

MGMT 44671 - Corporate Conscience

Credit Hours: 3.00. Is there a moral component to leadership? Does a moral person translate to a moral manager? What does leading ethically entail? Where have organizations and their leaders failed to act in a way that advances the interests of their employees and society at large? This course takes a case study approach to understanding ethical leadership. We look inside organizations, through case study, to evaluate an organization's corporate conscience, defined here as the extent to which a company or organization prioritizes ethics and demonstrates ethical behavior or unethical behavior. We examine the drivers of ethical decision making and the qualities of what it means to be a servant leader. Permission of instructor required.

Learning Outcomes: 1. Identify the components of ethical behavior. 2. Summarize ways of thinking about ethics. 3. Differentiate ""means"" based ethics and ""ends"" based ethics. 4. Create a personal code of ethics. 5. Identify behaviors that define what it means to be a servant leader. 6. Integrate ethical concepts in analysis of real world, organization-based case studies. Credits: 3.00

MGMT 44672 - Transformational Leadership Development Immersion Experience

Credit Hours: 1.00 to 4.00. Courses involve leadership immersion trips to develop one's leadership acumen and enable one to reflect on one's guiding principles. Immersion learning takes place in novel, inspiring settings where real leadership is/was required. Permission of instructor required.

Learning Outcomes: 1. Generate a list of strategic leadership advantages; finding the "high ground" and positioning for success. 2. Carry out communication with others and influence them for strategic advantage. 3. Differentiate both the rational and emotional

components of being a transformational leader. 4. Reflect on how transformational leadership can be utilized for strategic advantage. 5. Identify the traits and characteristics of some of history's greatest leaders during the Civil War and Battle of Gettysburg and apply their leadership principles to today's challenges, whether they be in your family, community, school, or organization. 6. Deconstruct how leadership, discipline, trust and teamwork drove many of the successes in the early history of NASA. 7. Summarize factors in an organization or team that can derail the team and lead to sub-optimal outcomes including issues of structure, process, conflict, power, politics and differing perceptions of risk. 8. Identify the root causes of failure and develop successful interventions for leading in VUCA (volatile, uncertain, complex, ambiguous) environments. 9. Differentiate the relationship between vulnerability, humility, trust, control, and credibility. 10. Use skills that will create the confidence to lead a team in novel, stressful, difficult situations. 11. Reflect on the inspirational power and natural beauty of Yosemite and appreciate how the magnificence of nature contributes to developing one's personal humility. 12. Identify team roles and use one's understanding of roles to lead by example. 13. Carry out teaming skills that develop willingness to be vulnerable to others in uncertain, challenging situations. 14. Differentiate transformational and pseudo-transformational leadership. 15. Generate a set of ethical leadership principles and compare to the actions of historical and contemporary leaders. 16. Reflect on their own leadership guiding principles and the impact a good or bad leader can have, not just on a team or organization, but civilization. 17. Summarize the principles of power and influence; Recognize the conditions under which a population (e.g., nation) could be vulnerable to and be transformed by the false promises of a highly charismatic leader. 18. Reflect upon and attempt to find inspiration in the stories of courage and sacrifice that won WWII for the Allies in Europe. Credits: 1.00 to 4.00

MGMT 44673 - Intensive Leadership Sprint

Credit Hours: 1.00. Intensives are rapid leadership development experiences condensed over a weekend, with topics focused on self-leadership, teambuilding, conflict resolution, decision-making, communication, influence, and visioning. Permission of instructor required.

Learning Outcomes: 1. Identify the connection between personality and leadership. 2. Identify the qualities of effective teaming and what it means to be a team-player. 3. Carry out effective teaming behaviors and recognize how individual personality and communication style differences affect team success. 4. Design/develop strategies that will motivate self and others. 5. Summarize the ways people resolve conflict. 6. Determine one's own conflict resolution style and its implications for leadership. 7. Differentiate the ways we get people to go along and their implications on organizational outcomes. 8. Create new ways demonstrate influence tactics and apply them to influence other team members. 9. Contribute more effectively to a team. 10. Recognize and avoid costly team mistakes that plague many teams. 11. Create a crisis management plan for an organization. 12. Use their problem solving and decision-making skills to solve team challenges and problems. 13. Deconstruct the leader's role in leading a team to effective decision-making. 14. Identify their own personal ""why"" or leader purpose. 15. Reflect upon and summarize one's own limitations and strengths as a leader. 16. Deconstruct the role of vision and strategic decision-making at various levels of leadership in an organization. 17. Create a vision for themselves and other

organizations. Credits: 1.00

MGMT 44680 - Experiential Learning And Team Consulting Projects

Credit Hours: 1.00 to 4.00. This course is for independent team experiential consulting projects. Students work on solving a real-world problem. Projects will typically involve an external corporate or alumni partner that sponsors a project and provides a problem to be solved. Student teams will work with the client to define the scope of engagement, develop a project plan, conduct a needs assessment, provide benchmark data and market analysis, solve problems, make decisions and present recommendations. In addition, students will develop professionalism skills in communicating and interacting with corporate clients through written and oral communication, including a final presentation to corporate stakeholders. Permission of instructor required.

Learning Outcomes: 1. Develop professionalism through written and verbal communication. 2. Develop teamwork skills by working in a cross-functional team. 3. Use and apply consulting methodologies and frameworks. 4. Analyze and assess current client situation. 5. Apply management tools such as SWOT analysis. 6. Conduct internal and external research and benchmarking. 7. Provide recommendations to solve real-world business problems. Credits: 1.00 to 4.00

MGMT 44690 - Negotiation And Decision Making

Credit Hours: 3.00. The purpose of this course is to understand the theory and processes of negotiation so that you can negotiate successfully in organizational and management settings. This course covers a wide variety of negotiation problems faced by business people. In addition, models of effective and ineffective decision-making are introduced and students will have the opportunity to make decisions at both the individual and group levels.

Learning Outcomes: 1. Improve ability to effectively negotiate. 2. Recognize and analyze negotiation situations. 3. Gain confidence negotiating. 4. Improve decision-making knowledge and skills. Credits: 3.00

MGMT 44710 - Competitive Strategy

Credit Hours: 3.00. This course focuses on the dynamics between a firm and the marketplace including interaction with competition. Strategy implementation occurs over multiple periods and is highly dependent on choices and behavior of competition. The course material covers how these dynamics and expectations of competitor response will shape the decisions of managers. This is inclusive of signaling intent to competitors and mutual forbearance to avoid negative sum gain competition.

Learning Outcomes: 1. Improve ability at market and competitive analysis. 2. Recognize opportunities and problems for market entry that may follow from market and competitive analysis. 3. Improve decision making knowledge and skills. Credits: 3.00

MGMT 44810 - Technology Strategy

Credit Hours: 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage.

Learning Outcomes: 1. Improve ability to assess technology and innovation from a competitive perspective. 2. Learn about disruptive innovation and its effects on incumbents and new firms. 3. Consider internal processes for innovation management in existing firms. 4. Improve decision-making and skills with respect to technology and innovation. Credits: 3.00

MGMT 45200 - Manufacturing Strategy And Process Innovation

Credit Hours: 3.00. This course examines the management challenges posed by the growth in worldwide manufacturing capabilities, markets, and competition and by rapid advances in technology and the concomitant decline in product life cycles. The manufacturing function is considered within a broader context encompassing design, engineering, purchasing, marketing, and customer service in an effort to assess the degree to which existing management structures successfully meet the challenges arising from the changing manufacturing environment.

Learning Outcomes: 1. Identify the tradeoffs made between operations flexibility and cost. 2. Identify proper alignment between manufacturing strategy and business strategy. 3. Identify the pros and cons of different types of plant network strategies. 4. Identify the behavioral issues associated with

implementation of rigid project management tools. 5. Identify the potential long term implications of outsourcing on the development of competition. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 45600 - Legal Foundations For Business II

Credit Hours: 3.00. A study of commercial law as prescribed by the Uniform Commercial Code, including the law of sales, documents of title, negotiable instruments, and the law relating to security interests. Additional material is presented covering the legal aspects of real estate transactions and personal property transfer.

Learning Outcomes: 1. Have a good basic understanding of the structure of the U.S. legal system. 2. Be able to understand and apply basic legal terms and concepts in almost every area of the law. 3. Be able to recognize common legal and ethical issues which will arise in the course of doing business. 4. Demonstrate your knowledge in classroom discussion and through the four (4) exams given during the semester. 5. Have the ability to more effectively communicate with and assist counsel on legal matters in your future business career. Credits: 3.00

MGMT 45900 - International Management

Credit Hours: 3.00. This course focuses on the challenges top managers face in developing strategies and management policies in multinational corporations (MNCs). Major topics usually covered include foreign market entry strategies, motivations and organizational challenges of internationalization, analyzing global industries, managing MNC/host government relations, building competitive advantage in global industries, international alliances and acquisitions, structuring and controlling MNCs, risk management, and the country manager role.

Learning Outcomes: 1. Understand the range of competitive opportunities and challenges companies and managers face in creating value worldwide. 2. Appreciate the complexities of national institutions and the dynamics of industry competition. 3. Deal with a company's multiple stakeholders including its internal constituents. 4. Integrate the concepts, principles, skills, and knowledge acquired in functional courses. Credits: 3.00

MGMT 46200 - Advanced Manufacturing Planning And Control Systems

Credit Hours: 3.00. The course examines key concepts in the planning, control, and improvement of processes in manufacturing and service operations. Specific topics covered in the course include: (i) Product/service characteristics that provide value to customers and competitive priorities, (ii) Role of processes and key operations choices to support the competitive priorities, (iii) Process analysis and scheduling, (iv) Throughput principles to deal with adverse impacts of process uncertainties and bottlenecks, (v) Managing capacity and lead times, (vi) Throughput principles to deal with wastes and errors, including the Toyota Production System and Lean Operations, and (vii) Coordinating material/order flows in supply chain - MRP, and Resources and Production Planning - Aggregate Production Planning. The class uses a combination of lectures, cases, simulations, outside speakers, experiential exercises, and student presentations. An important component of the course is a hands-on exercise where students in teams of seven or eight design and run a production process to meet demand for a quality-conscious customer. The teams then present the lessons learned to the class.

Learning Outcomes: 1. Learn the details of production planning, master scheduling, materials planning, short range capacity planning, production floor execution, and quality control. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 46400 - Logistics: Concepts And Models

Credit Hours: 3.00. The course familiarizes students with main concepts and models of business logistics management. Through the course, students develop an ability to design, improve, and manage logistics operations such as Inventory, Transportation, Warehousing, and Logistics Network Design. Since logistics decisions often require certain trade-offs to be made, students develop necessary quantitative and qualitative analytical skills to improve their decision-making. At the end of the course, students should be able to analyze logistics strategy of a firm, identify problems and tradeoffs in different logistics functions, formulate the corresponding models, identify quantitative methods to solve it, obtain results and interpret them for small-size problems using standard spreadsheet software, communicate the results to a broader audience using business language, discuss issues and challenges in same-day delivery, humanitarian logistics, physical internet.

Learning Outcomes: 1. Know vocabulary of Logistics, and Supply Chain. 2. Design, improve and manage processes by learning decision making tools. 3. Become familiar with the key issues and problems facing an operations manager. Credits: 3.00

MGMT 46501 - Strategic Sourcing And Procurement Operations Analytics

Credit Hours: 3.00. This elective course will serve as an important complement to the existing OM modules (e.g., MGMT 36100 Operations Management) to introduce more in-depth knowledge about supply chain management to undergraduate students, especially those major in SC&OM, focusing on strategic sourcing and procurement operations which are the building blocks for supply chain operations. More specifically, this course will introduce procure-to-pay process, category management, supplier selection and evaluation, supplier relationship management, vertical integration, global sourcing, outsourcing, auctioning, supply contract design and negotiation, business ethics, legal and compliance issues, etc. Sourcing and procurement is the major job title for supply chain operations jobs in the industry and our course can also help students to get the professional certificate of sourcing and procurement. Hence, it may also help senior students prepare for the job placements.

Learning Outcomes: 1. Master the working knowledge and vocabulary of strategic sourcing and procurement. 2. Know how to design and manage the business process in sourcing operations. 3. Know how to align sourcing strategies with corporate strategies. 4. Know how to model the key decision-making process of sourcing operations. 5. Apply data analytics techniques to develop sourcing strategies. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

MGMT 46700 - Big Data & Cloud Computing

Credit Hours: 3.00. Cloud computing and big data technologies are rapidly enhancing an organization's business intelligence ecosystem. Two modules of the course are specially designed for students to gain valuable hands-on experience in collecting, cleaning, formatting, integrating, and storing massive amounts of data that may be structured or unstructured, archived, or streaming in a cloud platform. The first module will introduce cloud computing fundamentals, its enabling technologies, main building blocks, and hands-on experience through projects utilizing Google Cloud Platform (GCP). The second module will cover processes for creating data pipelines in GCP so that the student will be able to curate big data for training, analysis, and prediction using AI/ML and other data science techniques.

Learning Outcomes: 1. Configure rapidly GCP to meet any analytics related challenge. 2. Build Data Lakes and Data Warehouses for big data analytics. 3. Use BigQuery and related services for advanced, real-time analytics. 4. Use BigQuery ML for classification and regression.

5. Build complex data pipelines using GCP's Dataflow, Cloud pub/sub, and Cloud Function to prepare data for machine learning algorithms. Credits: 3.00

MGMT 46800 - Supply Chain Technology

Credit Hours: 3.00. The course will introduce the major SCM information systems and technologies utilized by industry leaders to integrate SCM operations and achieve coordination within and across various business functions. The students will learn how to manage SCM operations, including: sales & distribution, materials management, production planning and control, warehouse management, retail operations. The course will provide students the opportunity to study, analyze, and observe the information systems and technology tools. Topics include Enterprise Resource Planning Systems (ERP), Blockchain, Warehouse Management System (WMS), Transportation Management Systems (TMS), Internet of Things (IOT) in retail. The students will learn how to use the SAP software to execute SCM operations. The course will review the technology implementation process and how such projects should be organized and managed.

Learning Outcomes: 1. Learn how to manage SCM operations, including: sales & distribution, materials management, production planning and control, warehouse management, retail operations. Methods of Evaluation: HWs, Quizzes. 2. Study, analyze, and observe the information systems and technology tools. Methods of Evaluation: Case studies, lab sessions, online discussions. 3. Learn how to use the SAP software to execute SCM operations. Methods of Evaluation: Lab exercises, team workshop, games. Credits: 3.00

MGMT 46900 - Supply Chain & Operations Analytics Consulting

Credit Hours: 3.00. This supply chain experiential learning course aims to provide students opportunities to apply theories and methods learned from supply chain and operations management courses to tackle real-world supply chain problems. A salient feature of this course is that it consists of two pillars. The first pillar is the partnerships with leading companies (e.g., Wabash, Corteva and Rolls Royce) to offer project opportunities and assign internal experts to advise student teams. Students will have opportunities to visit company sites, interact with domain experts, and present their findings to leadership teams. The second pillar is the partnership with a group of Purdue alumni to leverage their extensive supply chain consulting and corporate leadership experiences to advise students the consultation approach to problem-solving: how to approach problems, engage stakeholders, and professionally manage project delivery processes as internal or external consultants for business organizations.

Learning Outcomes: 1. Apply knowledge and skills learned in classes to real-world supply chain and operations problems. 2. Identify and approach real-world supply chain problems. 3. Collect, process and analyze real-world data. 4. Communicate and interact with supply chain executives. 5. Manage supply chain projects as a consultant. Credits: 3.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on

descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 47500 - Machine Learning For Business

Credit Hours: 3.00. This course concerns the latest techniques in machine learning, focusing on deep learning and reinforcement learning, with applications to computer vision, natural language understanding, speech recognition, news recommendation, and others. The course plans to cover Neural Nets, Backpropagation, Convolutional neural network, Recurrent Networks, Autoencoders and other architectures in Deep Learning in the rst half. Next, the course plans to cover multi-armed bandits, Contextual bandits, Markov decision process, and Policy gradient methods in Reinforcement Learning.

Learning Outcomes: 1. Perceive the scope and importance of machine learning. 2. Understand and evaluate modern machine learning algorithms. 3. Apply appropriate programming skills to administer a machine learning algorithm in a real-world problem. 4. Communicate the machine learning results in an appropriate level of detail for an intended audience. Credits: 3.00

MGMT 47600 - Employment Law For Business

Credit Hours: 3.00. Employment Law for Business is designed to help students navigate the complex legal challenges businesses face in employment. Students will explore key topics like defining the employment relationship, addressing discrimination and harassment, and managing technology and privacy issues in the workplace. Through real-world examples, students will learn about critical regulations, including the Fair Labor Standards Act, FMLA, OSHA, and laws governing employee benefits. By the end of the course, students will develop the skills to approach employment law issues with confidence, applying legal, managerial, and ethical perspectives to solve problems effectively.

Learning Outcomes: 1. Analyze and apply legal principles and legislation to evaluate employment decisions in business scenarios. 2. Explain and evaluate the legal protections and responsibilities of managers in various business contexts. 3. Identify and assess the fundamental components of litigation and analyze the financial and reputational costs of HR law violations. 4. Apply best practices in management, ethical frameworks, and legal mandates to resolve employment law issues effectively. 5. Develop and apply communication, analytical, and logical reasoning skills through case studies and writing exercises, demonstrating proficiency in at least three key areas. 6. Analyze the impact of public policy changes on legal frameworks, with examples of recent legislative shifts. Credits: 3.00

MGMT 47700 - Accenture Innovating Industry

Credit Hours: 3.00. Delve into the transformative role of innovation in driving industry growth and competitiveness. Students will explore how businesses can harness emerging technologies, evolving market dynamics, and disruptive business models to reshape industries. Through a combination of case studies, business world examples, and hands-on projects, the course emphasizes the importance of strategic thinking, design thinking, and creative problem-solving in identifying opportunities for innovation across sectors.

Learning Outcomes: 1. Analyze key drivers of

innovation within different industries. 2. Apply innovation frameworks to solve business world challenges. 3. Design and prototype new business models that address tech-driven industries. 4. Lead initiatives that use technology to help businesses grow by creating relevance with their customers. 5. Evaluate the impact of technological and social trends on industry evolution. 6. Deliver a solution to a corporate partner that satisfies their needs in an agile fashion. Credits: 3.00

MGMT 47800 - Experiential Project In Analytics

Credit Hours: 3.00. Most degree programs offer students an opportunity to apply the knowledge learned from their studies in an applicable area via a thesis, a research project, or capstone. This course provides such an opportunity and is designed specifically for Business Analytics & Information Management undergraduate students that will pursue analytical-type careers (e.g., Data/OR Analyst, Data Scientist, Decision Scientist, Consultant, Developer, etc.). This course is designed to polish and integrate the knowledge, skills, and abilities you have developed from your coursework by successfully developing an analytics solution with an industry partner in a structured fashion. Thus, most of your time will be devoted to working with your project teammates to provide the answers and deliverables specified by the partner over the course of many sprints. Every project team will be provided with a project description, data dictionary, and access to the dataset (or directions in where to find the necessary data), as well as an NDA to read, understand, sign, and return to your professor before you can gain access to the data. These are tasks that might be required of you to perform when you work on a new project or have a new client. Students are expected to be familiar with at least one programming language (e.g., Python, R). Permission of instructor required.

Learning Outcomes: 1. Formulate a business problem into an analytical problem. 2. Deliver an analytical solution to stakeholders in an agile fashion in programming languages. 3. Communicate effectively with stakeholders. 4. Work effectively in a team. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

MGMT 48400 - Management Of Entrepreneurial Ventures

Credit Hours: 3.00. This course teaches skills required to become an entrepreneur, succeed in a start-up venture, work in venture capital, join a family business, or develop a franchise operation. Students will learn about how to identify and shape emerging market opportunities, innovate new business models, prepare and evaluate business plans, raise capital, build a skilled founding team, network for resources, and grow an initial market.

Learning Outcomes: 1. Identify and shape emerging market opportunities. 2. Innovate new business models. 3. Prepare and evaluate business plans. 4. Raise capital. 5. Build a skilled founding team, network for resources, and grow an initial market. Credits: 3.00

MGMT 48800 - Data-Driven Decisions In Digital Markets

Credit Hours: 3.00. This course analyzes the changes in business models that have been enabled by Internet technologies, and exposes students to hands-on data analyses to quantify the impact these technologies and business models have on firms, economies, and people. A programming course such as MGMT 28800 Programming for Business Applications or MGMT 38800 Python for Business or CS 17600 Data Engineering in Python or CS 17700 Programming with Multimedia Objects or CNIT 17500 Visual Programming or CS 18000 Problem Solving & Object Oriented Programming and a

statistics course such as STAT 30301 Probability & Statistics for Business or MGMT 30500 Business Statistics is highly recommended.

Learning Outcomes: 1. Recognize the role of business models and data-driven decisions in digital markets. 2. Measure, evaluate, and improve online technology usage, advertisement campaigns, and product pricing to meet specific business objective like better serving customers, customer acquisition, quantifying network effects, etc. 3. Analyze the sheer amount of data ("traces") collected by businesses from different touch points - Google Glass, Apple Watch, smart phones, or simple computing devices - and make critical business decisions. Credits: 3.00

MGMT 49000 - Problems In Industrial Management

Credit Hours: 1.00 to 4.00. Investigation in a specific management field. Arrange with instructor before enrolling. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 49200 - Intellectual Property Management

Credit Hours: 2.00. Intellectual property (IP) has become a strategic opportunity for creating value for the firm. Firms are tasked with understanding how to utilize intellectual property as a competitive advantage in multiple market contexts. In the current economic environment, intellectual assets can be the largest portion of a firm's total wealth. Strategic management of these assets is very critical. Managing intellectual property is about transforming a firm's ideas, know-how, etc., into learning, products, and ultimately cash flow. In Managing Intellectual Property, we examine this topic by viewing intellectual property as both a legal asset (property ownership) and business asset (value-adding). The focus of Managing Intellectual Property is on the integration of IP generation, IP protection, and strategizing functions of the firm in creating value with an IP portfolio. Concepts and frameworks discussed/developed in lecture are exercised in case studies from multiple contexts.

Learning Outcomes: 1. Understand key elements in intellectual property management. 2. Aware of the different types/forms of intellectual property. 3. Understand how the difference in the types of intellectual property provides strategic opportunities. 4. Confidence in your own abilities to manage intellectual property. 5. Aware of the role of multiple functions in creating an intellectual property portfolio (e.g. R&D, Marketing, Legal, Merger & Acquisition, Business Development, Human Resources, Finance). Credits: 2.00

MGMT 49300 - Storytelling With Data

Credit Hours: 2.00. Business students are trained to be experts in turning data into information. With a strong focus on data visualization, the purpose of this course (Storytelling with Data) is to help students take the next step: Turning that information into action. This course will provide you with helpful frameworks for understanding your audience, insights about how people perceive information best, and effective skills to express your ideas in ways that connect.

Learning Outcomes: 1. Understand the importance of communication context, elements of good storytelling, and basic principles of human information processing as related to data visualization. 2. Apply this understanding to the communication of complex (i.e., data-driven) information. 3. Analyze data visualization design choices. 4. Evaluate the effectiveness of data communication. 5. Create a compelling story using data with the tools and skills taught in this course. Credits: 2.00

MGMT 49400 - IBE Capstone

Credit Hours: 3.00. The objective of the IBE Capstone course is to provide students with the opportunity to apply and integrate what they have learned from prior courses in "Real World" settings. There are no traditional classes. Rather, students will work in self-managed teams of 5-6 on projects that have both business and engineering elements with the support of a mentor; in many cases the mentor will be from a sponsoring company. The role of the company mentor is to provide advice and guidance to the student team as well as to expose the students to the approaches and processes used in industrial and commercial organizations. The course instructors will also meet with the student teams on a weekly basis to assess progress and provide guidance. Possible options for the projects include: 'Product Design' and 'Business Solution'. The Product Design projects would be focused on the marketing, technical, and economic feasibility of a new product concept. The Business Solution projects would be focused on technical issues in a business context and developing solutions to a "real world" problem presented by a sponsoring company. Examples of these projects might include use of 3-D printing for spare and replacement parts or incorporation of autonomous transportation into a company's operations and supply chain.

Learning Outcomes: 1. Exhibit integrity, accept responsibility, take initiative, and provide

leadership necessary to ensure project success. 2. Produce product designs or business solutions that meet important performance requirements while satisfying relevant societal, legal/regulatory, and professional constraints. 3. Establish relationships and implement practices with team members, advisors, and other stakeholders that support high performance and continuous improvement. 4. Plan, monitor, and manage project schedule, resources, and work assignments to ensure successful project completion. 5. Utilize and synthesize prior knowledge, independent research, published information, and original ideas in addressing problems and generating solutions. 6. Make decisions based on customer and user needs, product design or business solution requirements, resource availability, and associated risks. 7. Demonstrate effective use of contemporary tools for engineering and business analysis. 8. Test and defend performance of a product design or business solution with respect to key requirements. 9. Use formal and informal communications with team, advisor, and other stakeholders to document and facilitate progress and to enhance impact of design products. Credits: 3.00

MGMT 49600 - Management Consulting Practicum

Credit Hours: 3.00. Management Consulting Practicum is an elective course consisting of consulting engagements with clients and projects from the Purdue Foundry and other sources. This course uses class time for students working in teams to receive timely guidance on applying a wide range of consulting skills and tools to supplement the client engagements.

Learning Outcomes: 1. Apply core consulting skills in solving real-life problems. 2. Collaborate and build relationships with business clients. 3. Analyze and identify various sources of data, prepare deliverables, and report results. Credits: 3.00

MGMT 49700 - The Science Of Working Well

Credit Hours: 3.00. What does it truly mean to "work well"? From burnout and physical exhaustion to lack of motivation and meaning in their work, to not feeling socially connected to others-there are many factors that can influence the extent to which employees feel like they are able to thrive at work and at home. In this course, we will explore individual; relational/dyadic; organizational; and community influences on working well by diving into the common challenges employees' face in their daily work, both in managing their well-being and the well-being of others as leaders, coworkers, and community members. Together we will work towards identifying solutions to challenges that influence our ability to work well based on the scientific evidence.

Learning Outcomes: 1. Identify key definitions and theories of well-being at work and at home. 2. Distinguish antecedents of well-being at work and home stemming from individual, relational, organizational, and community-level factors. 3. Analyze data for "intervention points" to help offer improved support and programs for employees' well-being. 4. Plan habits or routines that promote your well-being at work and at home. Credits: 3.00

MGMT 50300 - Advanced Accounting

Credit Hours: 3.00. Advanced course in financial accounting. A range of contemporary issues in financial reporting, such as business combinations, investments, consolidations, inflation, multinationals, and tax allocation are covered. Both technical proficiency and user applications are emphasized.

Learning Outcomes: 1. Develop a conceptual understanding of and appreciation for the significant accounting and reporting requirements pertaining to consolidated or affiliated enterprises, foreign currency transactions and translation and other topics listed in the schedule below. 2. Provide you with the technical skills and knowledge to produce financial information that can be used by management, shareholders and stakeholders. 3. Improve your ability to interpret and use such financial reports. 4. Enhance the students' communication skills. 5. Contribute to the requisite background required for professional examinations such as CPA or CMA. However, it is not the primary goal to memorize 2019

standards or regulations, but rather to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 50400 - Tax Accounting

Credit Hours: 3.00. Basic tax course designed to provide an understanding of the various federal taxes, including income, gift, estate, excise, federal insurance contribution, self-employment, and unemployment taxes.

Learning Outcomes: 1. Calculate the income tax liability for individuals, understand basic tax planning strategies, and prepare individual tax returns. 2. Understand broadly how different business entities are taxed including formation, operations, distributions, and liquidations. 3. Calculate the income tax liability for C Corporations, understand basic tax planning strategies, and prepare basic C Corporation tax returns. 4. Report the results from operations for partnerships and S Corporations. 5. Understand broadly the tax treatment of property transactions encountered by individuals and business entities. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50900 - International Accounting

Credit Hours: 3.00. Provides insight into and an understanding of the many accounting problems and issues faced in an international business environment. The material is approached from two compatible and overlapping perspectives: the perspective of accounting or financial management in a U.S. multinational corporation and the perspective of an investor interested in understanding the international business environment.

Learning Outcomes: 1. Learn about the development of international accounting movements and implications in a globalized financial market. 2. Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS) 3. Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event. 4. Learn to cope with differences in financial measurement, recognition and reporting practices when performing international financial statement analyses. 5. Enhance the students' communication and presentation skills. 6. Contribute to the requisite background required for professional examinations such as CPA and to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 51099 - Practicum In Taxation Compliance And Consulting

Credit Hours: 1.00 to 3.00. This is an experiential course to provide real-world experience and significant community service through volunteer tax compliance and consulting. The course partners with the Internal Revenue Service Volunteer Income Tax Assistance Program to provide significant free tax preparation and consulting services to low- and middle-income families in the Greater Lafayette community with an additional focus on providing these services to international students at Purdue. Learning outcomes include technical tax abilities as well as soft skills in a professional services environment.

Learning Outcomes: 1. Develop technical tax

preparation skills and apply those skills using tax software. 2. Interact positively with clients through sometimes difficult situations. 3. Explain complex tax issues in an understandable way to clients. 4. Discuss relevant tax and client issues with other students and coordinators. 5. Learn from constructive feedback to improve your tax preparation and client interaction skills. 6. Adapt your role at the site extemporaneously to help mitigate stressful situations. 7. Serve the community through accounting knowledge. Credits: 1.00 to 3.00

MGMT 51100 - Fixed Income Securities

Credit Hours: 2.00. Introduction to fixed income securities. Discusses a variety of contracts-starting with pure discount bonds, coupon bonds, and callable bonds. Continues with options on bonds, caps, floors, and interest rate swaps. Introduces the theory of the term structure and present models for pricing fixed income securities. Topics include: spot and forward markets for debt instruments, simple models for interest rate risk management, duration, convexity, organized exchange-traded interest rate contracts, interest rate swaps, pricing relationships and the theory of the term structure, and single factor models for pricing interest rate claims.

Learning Outcomes: 1. Identify how to value and hedge commonly traded fixed income securities. 2. Demonstrate understanding of underlying economic determinants and behavior of fixed income securities. 3. Outline and structure such securities. Credits: 2.00

MGMT 51300 - Student Managed Investment Fund

Credit Hours: 0.00 to 3.00. This course provides undergraduate and graduate students with hands-on portfolio management experience by investing a $300,000 (as of 2017) portfolio in the stock market. This student-managed fund is a large time commitment, and this course is a way to give students class credit for their experiential learning through SMIF.

Learning Outcomes: 1. Gain knowledge about investing through experiential learning by managing real money. 2. Learn how to analyze stocks and create buy or sell recommendations through team meetings and presentations. 3. Gain teamwork experience and in-depth knowledge by working with industry-specific teams for stock research. Credits: 0.00 to 3.00

MGMT 51400 - Volunteer Income Tax Assistance (VITA): Practicum In Taxation

Credit Hours: 3.00. This is a one-semester experiential course where students prepare individual income tax returns for low- and moderate-income taxpayers in the Greater Lafayette community. In addition to providing a valuable service to the community, students develop their professional skills and client service skills as well as proficiency with a professional tax preparation software product and a deeper understanding of technical tax issues.

Learning Outcomes: 1. Demonstrate and apply technical tax preparation skills using tax software to accurately complete tax returns. 2. Practice and refine positive client interaction skills to handle challenging situations effectively. 3. Explain complex tax issues clearly and accurately in a manner clients can understand. 4. Engage in discussions about relevant tax and client issues with peers and coordinators to enhance collaborative problem-solving. 5. Incorporate constructive feedback to improve technical tax preparation and client interaction skills. 6. Adapt and respond effectively to changing roles and stressful situations at the site to ensure smooth operations. 7. Contribute to the community by applying accounting knowledge to provide meaningful tax preparation services. Credits: 3.00

MGMT 52020 - Analytics For Marketing Managers

Credit Hours: 2.00 or 3.00. The purpose of this course is to learn tools, technologies, applications and practices used to collect, integrate, analyze, and present raw data in order to create insightful visualization and actionable marketing information. It will cover conceptual understanding of marketing performance based on data and statistical methods. Once conceptual understanding is familiarized, students will learn common tools and techniques for marketing managers in today's industry.

Learning Outcomes: 1. Learn how to collect and analyze basic analytical concepts and tools. 2. Gain experience in understanding the importance of visualizations. 3. Learn to become a marketing manager who can provide marketing insights based on analytics. 4. Be

exposed to the challenges of resent online platforms of visualization for user interactivities. Credits: 2.00 or 3.00

MGMT 52100 - Brand Management

Credit Hours: 2.00. This course exposes students to the issues and activities in brand management. Topics include developing the brand marketing plan, design and execution of integrated marketing communications, testing, launching, and repositioning of brands, creating and managing brand equity, formulating strategies for leveraging and defending brands, product line and category management.

Learning Outcomes: 1. Identify the components of a firm's brand equity, based on weekly discussions of "Best Practice" cases assigned in the course. 2. Demonstrate an understanding of how a firm formulates, develops, and executes a firm's branding strategy. 3. Demonstrate an understanding of the key components of a firm's branding strategy. 4. Develop an understanding of how a firm manages the issues of building brand equity, measuring brand equity, and understanding how to grow a firm's brands. Credits: 2.00

MGMT 52200 - New Product Development

Credit Hours: 2.00. The course covers new product development issues including idea generation, concept testing, prototype development, patent protection, and product launch. Student teams generate a new product idea, test the idea with target customers, and develop a product launch strategy.

Learning Outcomes: 1. Understand New Product Development Process. 2. Analyze New Product Development Cases. 3. Develop and Test a New Product Idea. Credits: 2.00

MGMT 52300 - Digital Marketing Strategy

Credit Hours: 2.00. This course enables students to rethink marketing in the evolving digital age and develop capabilities in developing, implementing, and evaluating digital marketing strategies. Topics include: digital marketing strategy framework, search engine marketing, social media marketing, and location based marketing (mobile).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital and social media age. 2. Understand how digital and social media marketing strategies fit with companies' overall marketing strategy. 3. Learn to develop, implement, and evaluate digital and social media marketing plan. 4. Understand the major tools of digital and social media marketing: online ads, search engine optimization, paid search ads, organic social media, social media ads, web analytics, and social media analytics, and others. 5. Explore the future development of digital marketing. Credits: 2.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

MGMT 52610 - Data And AI-Driven Marketing

Credit Hours: 2.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course introduces modern statistical methods and AI algorithms for marketing using big data. It discusses marketing applications for which we may use statistical and machine learning methods to improve and optimize decisions. Students will use Python to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis.

Learning Outcomes: 1. Apply appropriate modern statistical and machine learning methods required for marketing using big data. 2. Implement the methods in Python using real-

world data. Credits: 2.00

MGMT 52710 - Digital Marketing Applications

Credit Hours: 2.00. Companies today expect their marketing professionals to understand what it takes to develop, implement, and evaluate digital marketing strategies and campaigns. The best way for marketing professionals to gain such expertise is for them to actually build and execute specific digital marketing programs/campaigns using various digital and social media platforms for a real world client. This course offers students a unique hands-on learning opportunity with an online marketing project, each student team is given a budget up to $300 to promote a chosen business or non-profit organization via digital advertising platforms including Google AdWords, Bing Ads, Facebook Business, LinkedIn Sponsored Ads, and Twitter Ads. Students are given flexibility in selecting projects of interest. All students are also expected to pass Google Analytics certification and Google AdWords certification.

Learning Outcomes: 1. Gain practical knowledge in web analytics, display advertising, search engine marketing (search engine optimization and pay per click), content marketing, and social media advertising. 2. Gain experience in designing, implementing, and evaluating a consistent digital marketing and social media marketing strategy through the online marketing campaign. 3. Learn how to communicate with clients, how to present an online marketing strategy, and how to deliver the outcome of an online marketing campaign. 4. Exposed to the challenges of working in teams to achieve marketing campaign goals in real world situations. Credits: 2.00

MGMT 52800 - Customer Analytics

Credit Hours: 2.00. Customer Relationship Management (CRM) refers to the selection or identification, acquisition, growth and retention of desired customers to maximize profit. CRM requires a shift in mindset from product-centric to customer-centric management and a new set of tools for understanding and predicting the behavior of current customers. This course focuses on analytical CRM: identifying good prospects and customer acquisition, customer development via up-selling, cross-selling and personalization, customer attrition, retention, and customer lifetime value. While traditional marketing relied on the three pillars of segmentation, targeting and positioning (STP), technological advances have made it possible to obtain customer-level transaction data, and also to target individual customers with a customized marketing mix that is designed to maximize individual customer value. Important strategic questions arise from such a radical shift in marketing mix options, questions such as: How to allocate resources to customer acquisition and to customer retention? Are loyal customers more profitable for firms? Related to these strategic questions are important conceptual and computational issues, such as: What metrics are best used to measure customer profitability? What techniques can be used to identify most profitable customers? How to target profitable customers with customized price, promotion, product, place? This course will equip you with the skills and tools you need to answer such strategic, conceptual and computational questions related to customer relationship management (CRM). Permission of instructor required.

Learning Outcomes: 1. Build your knowledge of a rapidly emerging marketing arena - customer-centric marketing. 2. Develop basic analysis skills using a statistical software package. 3. Increase your analytical skills and expose you to several commonly used advanced modeling techniques. Credits: 2.00

MGMT 52850 - Consumer Behavior And Marketing

Credit Hours: 2.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, behavior economics and other fields to learn why consumers behave in the ways that they do. The course focuses on three general topics: 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior. Consumer behavior is an applied discipline rooted in other social sciences, and you will therefore learn multiple concepts, frameworks and theories. Your job is to master those concepts and use them to organize, explain, and predict consumers' judgments and choices. Ultimately you should be able to identify a consumer behavior issue, select a relevant theory to examine and explain the issue, and apply the theory properly to aid in a managerial decision. You will also learn how to run basic applied experiments in consumer behavior to test your theories with real consumers.

Learning Outcomes: 1. Master multiple concepts and use them to organize, explain, and predict consumers' judgments and choices. 2. Identify a consumer behavior issue, select a relevant theory to examine and explain the

issue, and apply the theory properly to aid in a managerial decision. 3. Run basic applied experiments in consumer behavior to test your theories with real consumers. Credits: 2.00

MGMT 52900 - Marketing Consulting Projects

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet once a week to review project progress and discuss the next steps generally in the presence of the faculty supervisor. Projects are done in teams, although evaluation is individual.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the findings from a project analysis into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Exposed to the challenges of working in teams to achieve project goals. Credits: 3.00

MGMT 53000 - Financial Statement Analysis

Credit Hours: 3.00. The course is designed to help students: (a) understand the content of corporate financial reports and analyze the information therein, (b) use the information for evaluating the financial health, operating performance, and growth prospects of corporation-type companies, and (c) learn the various models available and estimate the value of such a company using those models and the information abstracted from the financial reports. The topics to be covered include the corporate financial statements and their relationships, ratio analysis for profitability and risk evaluation, assets/liabilities/owners' equality analysis, intercompany investments, forecasting financial statements, and company valuation models.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions: Students will be able to demonstrate their ability to incorporate financial statement information into commonly used firm valuation models that are widely used in business decision-making. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will be able to demonstrate their ability to use spreadsheet in developing valuation models and will demonstrate their ability to retrieve financial information from Internet and evaluate its quality. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class assignments and the writing and presentation of a group project. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment. Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a group project. 5. Develop awareness and understanding of global issues relating to financial reporting, tax accounting and business decisions. Students will demonstrate their ability to value multinational corporations and interpret their financial statements through homework assignments, examinations and a group project. 6. Achieve depth of understanding applications of financial reporting. Students will demonstrate their ability to understand and interpret financial statements and accounting choices through homework assignments, examinations and a group project. Credits: 3.00

MGMT 53100 - Government/Not-For-Profit Accounting

Credit Hours: 3.00. This course is designed to provide students with a solid understanding of the financial reporting and accounting principles used in the preparation of governmental and not-for-profit entities. Topics include, but are not limited to, fund accounting, city government accounting, state government

accounting, special funds, budgetary accounting for the general and special revenue funds, fiduciary funds and government-wide statements, university accounting, accounting for community foundations, not-for-profit accounting, and auditing not-for-profit entities.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions: Students will be able to demonstrate their understanding of generally accepted accounting Principles for government and not-for-profit entities and how accounting information is used in decision-making for those organizations through the completion of multiple projects. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate their understanding of ethics in reporting through team projects that analyze a government or not-for-profit's accounting system. They will also be able to demonstrate their understanding of how to properly account for fiduciary (trust) funds. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate oral and written communication skills through class participation and the writing and presentation of team projects. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environmental: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present team projects. 5. Achieve their understanding of generally accepted accounting principles for government and not-for-profit entities through team projects and examination(s). Credits: 3.00

MGMT 53200 - Forensic Accounting And Fraud Examination

Credit Hours: 3.00. This course is designed to help students apply their accounting, auditing, information systems and communication skills to detect financial fraud and unauthorized reporting acts to prepare and present a fraud case for criminal proceedings or civil litigation. These skills are highly valued in the rapidly growing field of forensic accounting. Upon completing this course, students will understand the role of forensic accountants in examining financial records for fraud and detecting insurance fraud; in providing litigation support; and in capturing digital evidence. This course will also review material related to the Certified Fraud Examiner (CFE) exam. Throughout the course, students will have opportunities to improve their written and oral communication skills, particularly as they relate to communication in the legal settings associated with investigating accounting.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate their understanding of business functional areas through homework assignments, examinations and team projects that require analysis or development of fraud detection plans and litigation support. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will be able to demonstrate their understanding of how people in organizations use common technology and software to commit fraud through homework assignments, examinations and team projects. They will also be able to demonstrate their ability to use software to detect fraud and other irregular transactions. 3. Become familiar with the ethical issues that individuals face in organizations: Ethical behavior is a key factor in preventing fraud. Students will be able to demonstrate their ability to identify signs of unethical behavior and how it manifests itself in financial fraud through homework assignments, examinations and team projects. 4. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class participation and the writing and presentation of team projects. 5. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present team projects. 6. Achieve

depth of understanding and applications of financial reporting. Students will demonstrate their understanding of accounting systems through homework assignments, examinations and team projects that require a deep understanding of accounting rules and procedures and the technology that individuals use to keep financial records. Credits: 3.00

MGMT 53600 - Employment & Diversity Law For Managers

Credit Hours: 2.00. Managers, regardless of your industry, will routinely face HR and employment issues that collide with the law. In this course, we will examine many laws and the practical ways you can stay on the right side of the law. Don't worry, you aren't in a law school class and I don't expect you to become employment attorneys. However, I will help you gain a working knowledge of employment laws including: The Civil Rights Act, ADA, ADEA, FMLA, FLSA, and a host of alphabet soup. We will also apply these laws from posting a job description to recruiting to hiring to employee reviews to terminating an employee. While I can't guarantee you will never be sued by a disgruntled current or former employee, I can help you put yourself and your company in the best possible position to defend that suit. And don't worry: we will look at lots of quick case studies (less than a page) to give you context you can easily remember.

Learning Outcomes: 1. Know about the law of the employment process. 2. Know the global principles that apply to corporate managers in the legal context. 3. Know about specific human resource management techniques (or methodologies), and apply some to the techniques. 4. Know about the importance of legal principles as applied to the employment process. Credits: 2.00

MGMT 53700 - Persuasive Communications

Credit Hours: 2.00. The purpose of this course is to work with you to improve your professional communications specifically as those communications relate to client and external communications. We will focus on oral and written communications theory, techniques, and practice.

Learning Outcomes: 1. Acquire skills in writing professional business documents including business memos, business letters, group papers, and PowerPoint slides. 2. Develop and present elevator pitches for their career development. 3. Gain skills to research and craft an intensive analysis regarding a marketing plan for Fortune 500 companies. 4. Enhance personal presentation skills via elevator pitches, impromptus, and group presentations. Credits: 2.00

MGMT 53900 - Analytics For Social Media Marketing

Credit Hours: 2.00 or 3.00. The objective of this course is to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Be exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 2.00 or 3.00

MGMT 54000 - Computing For Analytics

Credit Hours: 2.00 or 3.00. The main goal of this course is to introduce students to algorithmic thinking and computational tools for data analytics. The course will focus on challenges associated with large data sets and how algorithms and data structures can aid in resolving some of those challenges. The course will introduce relevant programming techniques in Python. Permission of department required.

Learning Outcomes: 1. Categorize problems according to their computational complexity. 2. Employ algorithmic techniques to obtain insights about data. 3. Develop algorithms to new problems. 4. Implement the algorithms and methodologies in python. Credits: 2.00 or 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data

security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 54500 - Systems Development

Credit Hours: 3.00. Focuses on information systems development theories, practices, and tools for rapid adaptation and management of leading-edge as well as emerging computing paradigms. MGMT 54400 Database Management is highly recommended. Permission of department required.

Learning Outcomes: 1. Define the essential processes involved in information systems development. 2. Analyze and represent business processes. 3. Develop and validate systems models and design specifications for an information system application. 4. Understand database concepts and design relational databases based on data models. 5. Effectively use and maintain databases through hands-on experience with Structured Query Language (SQL). 6. Work effectively on a team to successfully complete team projects. 7. Proficiently use various tools used in systems analysis and design. Credits: 3.00

MGMT 54700 - Computer Communications Systems

Credit Hours: 3.00. Explores the convergence of telecommunications and computer technology, framed in terms of their strategic impact in the business environment. Components of computer communication systems are surveyed. Major design and analysis issues in the development, implementation, and management of computer communication systems are examined. Relevant emerging trends are highlighted. The course is devoted to technical issues, applications, and case studies covering telecommunication systems used in business.

Learning Outcomes: 1. Learn the infrastructure of telecommunication systems. 2. Learn how telecommunications systems work. 3. Learn applications of telecommunication systems. 4. Learn how to create strategic advantage by using telecommunication systems. Credits: 3.00

MGMT 55200 - Mentoring And Socialization

Credit Hours: 2.00. Students learn about the employee socialization process through case studies, discussion, and presentations. In addition, students receive practical experience through participation in a mentoring program for new students. Class discussions and presentations evolve from students' mentoring experiences, and guest speakers provide real-world perspective on new employee programs. The course helps students develop skills in mediation, leadership, conflict management, and communication.

Learning Outcomes: 1. Learn strategies to develop individual mentoring and leadership skills. 2. Assist students in their transition to Krannert, the graduate school environment, and the community. 3. Learn top mentoring practices, theories, and ways to implement these for individual development. 4. Provide opportunity for students to practice professional mentoring skills. Credits: 2.00

MGMT 55360 - Industrial Relations I

Credit Hours: 2.00. An in-depth examination of human resource management in the context of union-management relations. Emphasis is on understanding how and why unions form, the legal context, and changing competitive environment for labor management relations. Covers the dynamics of the collective bargaining process, including the determinants of bargaining power, preparation of labor contract demands, and negotiation tactics. The course culminates with an extended mock negotiation exercise.

Learning Outcomes: 1. Provide you with a sense of US labor history and acquaint you with labor laws essential for managers in multinational corporations. 2. Understand power dynamics not only between unions and management, but between managers and

subordinates in everyday situations, in any organization. 3. Familiarize you with the union organizing process and help you understand its relevance for managers in non-unionized firms. 4. Engage you in a mock contract negotiation so that you may experience the dynamics of collective bargaining and negotiation. 5. Improve your conflict management skills. Credits: 2.00

MGMT 55400 - Leading Global Organizations And People Across Cultures

Credit Hours: 2.00 or 3.00. This course focuses on the opportunities and challenges of managing a global multicultural workforce and implementing global organizational people strategies. The overall goal of this class is to help you become a more effective professional and leader in a global world on and off the job by providing information, tools and multicultural opportunities to increase conceptual and practical understanding of how national cultures shape employment settings and its implications for your own behavior as a global business professional and leader who implements human capital and organizational strategies, policies, and practices in a cross-national context. This course will also increase knowledge of and ability to implement current global human capital, international HRM, and organizational strategies for MNES and domestically. To achieve these goals, student engagement in class sessions, and willingness to share perspectives and opinions, and application of course readings and materials, are critical to the success of this course. A range of participative learning methods are used to facilitate an active classroom environment, including learning log journaling, case analysis, experiential exercises, small group projects, break out discussions, company guest speakers, and self-assessments. The role of the instructor in this course is not always to provide "the" answer, but to create an environment where you can collectively explore, examine and experiment with students' own ideas and share ideas and perspectives on working and managing global firms.

Learning Outcomes: 1. Use cross-cultural leadership and organizational abilities to understand on how cultural differences shape workplace interactions so you can better implement organizational and people strategies to achieve business goals in a global environment. 2. Identify and avoid cultural mishaps and identify how your own national cultural values and assumptions about managing people and organizations shape your effectiveness in managing people, diversity, and systems in a global or cross-cultural firm. 3. Understand the challenges of adapting HRM policies and organizational people strategies when adapting HR and employment systems as organizations "go global" and develop a global workforce. 4. Understand the pros and cons of different multicultural strategies (cultural minimization, accommodation, cultural integration) for successfully implementing human capital strategies and HR practices in multicultural contexts. 5. Develop the core competencies needed by business leaders to work in multicultural teams contexts, including cultural intelligence, the ability to work in cross-cultural teams, develop clear and concise non country biased written communication, the ability to give effective presentations virtually and face to face, and the ability to engage in strategic cross-cultural thinking to implement global HR. 6. Understand and be able to apply core concepts in global HR/OB from 1)Global HR planning and organizational design; 2) Merger and Acquisition with a focus on linkages to successful people and organizational strategies; 3) Global talent management; 4) Development, reward, and performance management of global leaders; 5) Managing Global Teams, diversity, and cross-cultural communication; and 6) Implementing global change and improving organizational effectiveness. Credits: 2.00 or 3.00

MGMT 55410 - Training And Development

Credit Hours: 0.00 to 3.00. This course prepares students to design training and develop training programs and to identify principles, practices and methods of staff training and career development. Students will learn and practice how to deliver and evaluate said programs for return on investment (ROI). Emphasis is placed on the application of principles related to adult learning instructional design and program development, evaluation and learning technologies. Specific objectives include topics related to communication, diversity, generational differences and group dynamics.

Learning Outcomes: 1. Master training and

development principles and terminology. 2. Understand the linkage between strategies and training and development. 3. Understand how training and development can be a competitive advantage. 4. Conduct a needs assessment and SWOT analysis. 5. Apply the ADDIE model and learning styles. 6. Link Performance and Career Development needs to training. 7. Conduct, Evaluate, and Calculate the ROI of training. 8. Develop, Implement, and evaluate a training and development project. Credits: 0.00 to 3.00

MGMT 55500 - Leading Management Of Diversity And Inclusion In Organizations

Credit Hours: 2.00 or 3.00. This course is designed to help participants learn to effectively manage self, peers, teams, clients, and firms in diverse organizational settings and to lead organizational change to foster inclusion, equality, and productive workplaces. The class is designed to develop your skills in leading diversity and inclusion from a multi-level view in the workplace: employee, leader, team member, organizational, and institutional/societal levels. Its goal is to a) improve your ability to work in diverse teams, as well as b) develop your ability to design, and implement strategies to foster cultural and structural change to support the management of an increasingly diverse workforce toward enhanced organizational effectiveness to benefit business, employees, and society. People and leaders in organizations are constantly working with members of different backgrounds, social identities, and experiences, often across distributed and/or digitally connected environments, fostering increased attention to diversity equity and inclusion in transforming employment settings. When understood, supported and leveraged effectively, these differences in social identities, difference and values can help attract and retain talent, strengthen societal and community economic equality, support organizational and team effectiveness; but when overlooked, or mismanaged, these differences can increase turnover, conflict, stress, talent under-utilization, and harm career and work-life wellbeing, health, and productivity. We will focus on advancing understanding of how intersecting organizational and institutional structures and cultures and their relation to strategies for creating diversity; an inclusive culture and positive climate for inclusion and talent management; and developing and retaining diverse talent to foster innovation and organizational effectiveness across multiple levels of intervention. We discuss how to conduct an organizational diagnosis of the current diversity climate and barriers and facilitators for creating a multicultural workplace and a flexible environment supportive of many identities, and how assumptions of "ideal workers" may vary across industry and cultural contexts. You as a leader will be better able to articulate your own DEI vision and develop understanding of strategies that move from description to evidence-based diagnosis to action strategies and implementation in order to move aspirations into organizational change realities. From an individual leadership perspective, we tackle the question: "Why does diversity, equity and inclusion matter in employing organizations and business, what is the state-of-the-art evidence-based knowledge, and what does it mean to me personally in my career and my leadership beliefs?" Specifically, we focus on the business and social science processes - including attitudes toward in-groups and out-groups, stereotyping, identity, privilege, and power, intersectionality, discrimination, bias, influence opportunity, bystander awareness, allyship, difficult conversations, and perspective taking - these topics relate to how members of different social groups perceive and interact with one another. Since managing social identity increasingly involves managing work-life boundaries and work and non-work public and private selves, we will also learn about authenticity choices and social and public/professional identity boundary management. Further, the opportunity to experience higher well-being and work-life balance is increasingly linked to job and life opportunities reflecting growing work-life inequality in society. From an organizational and group perspective, we address the questions: "What are best practices for successful management of diversity and inclusion? And why does it matter to me as a future leader personally and in business and in the communities and world in which I live."

Learning Outcomes: 1. Evaluate the aspects of your identity and personal experiences that shape how you interact and engage with others and how they interact and engage with you in organizations. 2. Explain how issues of power, privilege, discrimination, bias, equality, and equity influence opportunity and effectiveness in organizations operating both in local, domestic and global contexts. 3. Propose ways to make relationships across cultural and cross-cultural and gender differences in organizations more effective. 4. Describe current perspectives on the relationships among diversity, inclusion, creativity, and innovation in domestic and global organizations. 5. Analyze a company's current approach to leading diversity and use content from this course to propose ways to enhance learning and effectiveness in that company. Credits: 2.00 or 3.00

MGMT 56000 - Manufacturing Planning And

Control

Credit Hours: 2.00 or 3.00. An advanced course in manufacturing planning and control systems, emphasizing the integration of demand forecasting, inventory control, production scheduling, and production control. Topics are linked through case studies and an elaborate manufacturing computer simulation game.

Learning Outcomes: 1. Master the major concepts, techniques and models of process design and analysis, and the ability to apply them to contexts beyond manufacturing. 2. Master the major tools for conformance quality control and performance quality improvement. 3. Understand the trend in manufacturing management and the advanced skills needed. 4. Acquire the analytical capabilities to uncover problems and improvement opportunities in manufacturing management. Credits: 2.00 or 3.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 56300 - Machine Learning For Business Analytics

Credit Hours: 2.00. With the rise in big data, Machine Learning has experienced rapid growth over the last ten years with major advances in its subfields of Deep Learning, Reinforcement Learning, Natural Language Processing, Computer Vision, Robotics, and other subfields. The purpose of this course is to provide the students with a systematic introduction to the recent developments in machine learning through the coverage of modern machine learning concepts and practical business applications, as well as hands-on experience with modern machine learning frameworks. The course plans to cover neural nets, convolutional neural networks, recurrent networks, deep generative models, deep reinforcement learning, and the trustworthy AI framework with the properties of safety, robustness, privacy, and fairness.

Learning Outcomes: 1. Understand the foundations of machine learning concepts and methods. 2. Receive a deep understanding of modern ML -- deep learning, and different deep neural. 3. Network architectures and their state-of-the-art applications. 4. Understand the caveats of real-world data. 5. Receive hands-on practice to apply ML methods to solve business problems. Credits: 2.00

MGMT 56400 - Management Of Service Operations

Credit Hours: 2.00. Special characteristics of services require an interdisciplinary approach to analyzing operations. This course draws upon concepts from accounting, management science, and marketing. Differences and similarities between the service and manufacturing organizations are analyzed. Case studies of service organizations are used extensively. Prerequisite: MGMT 66000 (if Graduate student status) or else MGMT 36100 (if Undergraduate student status).

Credits: 2.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good

understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

MGMT 56700 - Deep Learning For Business Analytics

Credit Hours: 2.00. With the rise in big data, Machine Learning has experienced rapid growth over the last ten years with major advances in its subfields of Deep Learning, Reinforcement Learning, Natural Language Processing, Computer Vision, Robotics, and other subfields. The purpose of this course is to provide the students with a systematic introduction to the recent developments in deep learning through the coverage of modern machine learning concepts and practical business applications, as well as hands-on experience with modern machine learning frameworks. The course plans to cover neural nets, convolutional neural networks, recurrent networks, deep generative models and deep reinforcement learning.

Learning Outcomes: 1. Identify the deep learning algorithms and design deep neural networks which are more appropriate for various types of learning tasks in various domains. 2. Perform regularization and hyperparameter selections of different deep learning models and evaluate their performance. 3. Implement deep learning algorithms in Python using the Keras library. 4. Apply the algorithms to a real-world problem and report the performance achieved by the models. Credits: 2.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain.

Credits: 2.00

MGMT 56900 - Ethical And Sustainable Supply Chain Management

Credit Hours: 2.00 or 3.00. This course provides students with knowledge and skills for building and analyzing ethical and sustainable practices in supply chains, taking a holistic view of the interaction between businesses, the environment, and society.

Learning Outcomes: 1. Run life-cycle analysis (LCA) and interpret findings. 2. Analyze product and process performance through life-cycle thinking. 3. Understand the Tragedy of the Commons in the business context and identify the underlying reasons. 4. Assess pros and cons of various solutions to the Tragedy of the Commons problem in business context. 5. Identify and explain various product stewardship practices and their pros and cons. 6. Identify innovative business models, such as Servicizing, based on sustainable use of products and services. 7. Compare and contrast traditional supply chain with closed-loop supply chain. 8. Compare and contrast different types of contracts and practices for incentivizing compliance with ethical and sustainable conduct throughout the supply chain. 9. Identify and analyze opportunities and constraints in building ethical and sustainable supply chains. 10. Compare and contrast alternative ways of complying with environmental and social regulations such as carbon trading. Credits: 2.00 or 3.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work. Credits: 2.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 57200 - Six Sigma And Quality Management

Credit Hours: 2.00. Establishes the link between quality and productivity design and improvement and variance reduction. The course examines some of the more traditional views on quality, as well as those today, which are gaining greater credibility and influence under the umbrella of TQM. It also covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations.

Credits: 2.00

MGMT 57300 - Optimization Modeling With Spreadsheets

Credit Hours: 2.00. The course emphasizes applications of optimization through cases and computer exercises. The applications are chosen to provide insights into business and economics. Areas covered include linear, network, integer, and nonlinear optimization. At the end of the course, the students should have the ability to model optimization problems work with software to solve optimization problems relate to optimization theory in a variety of application settings develop optimization insights into applications in marketing, finance, and operations and get some basic exposure to EXCEL automation. Prerequisites: Students are expected to have taken a basic MBA (core) course in business analytics (such as the masters core MGMT 67000).

Learning Outcomes: 1. Train the students to

write mathematical formulations of business problems and use solvers in excel spreadsheets to solve the problems. It requires critical thinking via the presentation of case assignments. Credits: 2.00

MGMT 57400 - Frontiers In Manufacturing Technology

Credit Hours: 1.00. This course will explore various types of technologies used in manufacturing today and the implication for future uses and applications. These modules will provide background, applications, and current use cases of the various tools. Students will also conduct weekly research on various technology applications.

Learning Outcomes: 1. Gain an understanding of the various technologies (17 types will be discussed). 2. Gain an understanding and be able to apply these tools to within the manufacturing sector. 3. Work independently and improve their ability to stay on task. 4. Be exposed to the history and how these technologies have evolved. 5. Gain an understanding of the future technological trends. Credits: 1.00

MGMT 57500 - Supply Chain Technology

Credit Hours: 2.00. This course will emphasize the use of supply chain technology for planning and control of dynamic manufacturing systems. This requires the simulation of plans and required changes over time. Therefore, the course will revolve around active learning computer simulations in SAP.

Learning Outcomes: 1. Execute end-to-end business scenarios, including Procure-to-Pay, Forecast to Delivery, and Order to Cash, in an Enterprise Resource Planning (ERP) system. 2. Choose among several planning methods and develop initial parameters based on supply chain and production capabilities and market intelligence. 3. Modify system parameters as necessary to address events such as material shortages, lack of cash flow, changes in supply availability, and market changes. 4. Access and analyze operational data from the ERP system. 5. Design a manufacturing planning and control strategy to maximize company value. Credits: 2.00

MGMT 58100 - Big Data Technologies

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn visualization techniques using Tableau to query large datasets and gain insights from it. 2. Learn to deploy big data technologies such as Cloudera Hadoop on Virtual Box. 3. Learn to collect data using open APIs to access streaming data from sites like Twitter, Quandl, Buzzfeed, etc. 4. Learn to architect a big data platform for analysis. Credits: 2.00

MGMT 58200 - Management Of Organizational Data

Credit Hours: 2.00. Provides the basic concepts and skills needed to analyze and organize business data, as well as to utilize the organized data to answer a variety of business queries. After successful completion, students will have an understanding of why database management is important and what it entails, how to analyze the data requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams, translate an ER diagram into normalized relations for a relational database management system, write simple and relatively complex data retrieval commands in the SQL language for an Oracle database, use Microsoft Access as a front end to a server database in Oracle, be familiar with several selected topics of current interest in the data management arena.

Credits: 2.00

MGMT 58500 - Information Technology Project

Management

Credit Hours: 2.00. The purpose of this class is to provide students with a basic understanding of the tasks and challenges facing IT and analytics project managers. Students learn about projects, roles and responsibilities of project managers. We start by discussing the skills and approaches commonly used in creating and monitoring project plans and braking complex projects down into manageable segments. We also discuss important areas defined in PMI's PMBOK, like scope, time, cost and quality management. Next we look at how IT projects have traditionally been managed, and move on to the study of agile methods. We go through some of the most important aspects of agile project management, such as user stories, agile teams an agile planning, execution and tracking. In learning these tools and techniques, we take a hands-on approach wherever possible and use project management software, exercises and case studies.

Learning Outcomes: 1. Acquire a good understanding of the most important aspects of general project management such as cost and time management. 2. Define the essential processes involved in information systems development. 3. Work effectively on a team to successfully complete team projects. 4. Understand and explain various approaches to manage IT projects. 5. Use project management tools, MS Project and Atlassian Jira. 6. Explain what agile is and how it is different from waterfall. 7. Work on a team as a scrum master or product owner. 8. Think about and describe how agile could be applied in various contexts. Credits: 2.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

MGMT 58800 - VBA Programming

Credit Hours: 0.00 to 3.00. This course takes a variety of business topics and implements with state-of-the-art spreadsheet models. Students will gain hands-on experience with a wide range of business problems and databases in finance, marketing, operations, and so on. The focus of this course is to learn Visual Basic for Applications (VBA) to design functions and macros that will enhance spreadsheet models. Students will also have exposure to basics and other advanced topics of spreadsheet modeling. In addition to in-classroom time, this course will also meet in computer-based labs for hands-on instructions and implementation.

Learning Outcomes: 1. Learn the basic concepts, components, and elements of the Visual Basic language. 2. Learn the macro

programming environment in Excel. 3. Apply the basics of macro programming in organizing, summarizing, and visualizing data. 4. Develop the ability to use the techniques to analyze real-world data and draw scientific or managerial implications. Credits: 0.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 59100 - Launching Global Leaders

Credit Hours: 0.00 to 2.00. Capitalizing on the unique personal and professional backgrounds of each student in our program, the Launching Global Leaders course provides a comprehensive and customizable leadership development curriculum. In this year long course, students will engage in a 360 assessment of strategically identified professional competencies critical to success in the contemporary workforce. Using these target areas as a guide, students will then customize their leadership development experience by selectively engaging in a variety of program offerings, including: interactive industry simulations, personal and team performance enhancement tools, professional coaching, interactive learning sessions with industry leaders, and workshops in developing intercultural competency, personal branding and career management.

Learning Outcomes: 1. Comprehensively assess their individual leadership strengths and areas of development along the Launching Global Leaders competency model. 2. Gain exposure to a variety of leadership styles and strategies from successful industry leaders. 3. Gain an awareness of contemporary issues facing leaders of global organizations, and strategies for future. 4. Gain exposure to tools and concepts currently utilized in industry that inspire continuous self-improvement. Credits: 0.00 to 2.00

MGMT 59200 - Contracts For Managers

Credit Hours: 3.00. Purpose of the course is to provide the student with an understanding of the contract legal environment as it pertains to profit and non-profit organizations and of the ethical considerations and social and political influences that affect such organizations. Students will examine a wide range of substantive rules of public law, which will provide a framework for a discussion of the ways in which managerial decision making affects and is affected by the legal environment.

Learning Outcomes: 1. Demonstrate a high-level of understanding of the law governing the formation of contracts. 2. Demonstrate the ability to identify and apply concepts of the law governing contractual interpretation and construction. 3. Demonstrate the ability to identify and apply concepts of the law governing contractual performance and breach. 4. Demonstrate the ability to identify and apply concepts of the law governing remedies for contract breach. 5. Demonstrate the ability to identify and apply concepts of the law governing the assignment of contractual rights and the delegation of contractual duties. 6. Demonstrate the ability to identify and apply concepts of the law governing third party beneficiaries to contracts. 7. Demonstrate their ability to do legal research and a publishable level. Credits: 3.00

MGMT 59699 - MS Internship

Credit Hours: 0.00. This course is required as part of the U.S. student visa regulation for international masters who are interning in the U.S. and want to use Curricular Practical Training (CPT). Even if a student is not being paid, they must sign up for the class unless the organization where the internship is being done is a non-profit. Students will be required to receive the necessary CPT permissions prior to enrolling in the course as well as complete paperwork from the Business Career Services office in Rawls Hall 3029. Course can also be taken by students that wish to have an internship transcripted. This course does not apply towards graduation. Does not count towards graduation. Permission of instructor required.

Learning Outcomes: 1. Experience internship. Credits: 0.00

MGMT 59800 - Analyzing Unstructured Data

Credit Hours: 2.00. This course prepares master students with the advanced and frontier technique for analyzing unstructured data that is built on the prerequisite of basic data analysis on structured data (e.g., data mining using python). Upon completion, students are expected to be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and TensorFlow); students should at least be proficient to design and lead industry-level practical projects conceptually when

working with data scientist. We take text and image as examples for illustration and cover applications of: Text mining and feature extraction (e.g., sentiment, topic, readability, etc.); Image classification (e.g., recognition, etc.); Advanced applications (e.g., translations, chatbot, image expression, etc.) The course is formatted as a combination of seminars and hands-on coding practices in class. Students are expected to code (and debug) in the class. The main method topics covered include: Crawling unstructured data using scrapy. Representation and embedding of text and image. Unsupervised learning for unstructured data (e.g., LDA topic modeling, clustering, etc.) Supervised learning for unstructured data (e.g., classic ML models, A/D/C/RNN, LSTM, etc.). Permission of instructor required.

Learning Outcomes: 1. Be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and TensorFlow). 2. Design and lead industry-level practical projects in joint with data scientist. Credits: 2.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 60100 - Managerial Accounting

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (North Central). Oriented to managers, the course examines the firm's internal systems for costing products or services and their interpretation. A variety of manufacturing and service industries are studies to demonstrate design of flexible cost systems to match the firm's technological, competitive and/or multinational environments. Applications to budgeting, variance analysis, pricing models, performance evaluation and incentives are demonstrated. Case discussion and analytical "what if" modes of instruction are used to enhance managerial skills of students. Design and use of accounting data are linked to other subjects in the program core and to ethical aspects of accounting policy issues. Prerequisite: MGMT 60000 .

Learning Outcomes: 1. Master basic service and product costing methods. 2. Develop analytic skills to help businesses use the different types of costing information to make better business decisions and to formulate better business models. 3. To understand and analyze the variety and the use of accounting performance evaluation methods and the role of incentives in a business environment. Credits: 2.00 to 4.00

MGMT 60200 - Valuation And Financial Statement Analysis

Credit Hours: 2.00. Establishes how to use accounting information to make business and investment decisions. Internally, the information is used to assess performance of units, to evaluate performance of upper-level management, to monitor the firm's investment and financing decisions, and for comparison purposes with the firm's rivals. Externally, accounting information is used by financial analysts, investors and (potential) acquirers to assess the value of the firm, by creditors to assess its credit-worthiness, and by regulators. Prerequisite: MGMT 60000 , MGMT 60100 .

Learning Outcomes: 1. Demonstrate ability to understand financial statements and related information. 2. Practice communicating decisions and ideas through written and oral communication. Credits: 2.00

MGMT 60600 - Seminar In External Reporting I

Credit Hours: 2.00 to 4.00. Seminar examines research issues on the production, dissemination, and use of financial accounting information for economic decisions by external users. The materials covered are primarily empirically oriented. The aim is to expose students to these issues as they are covered in the accounting and related literature. Prerequisite: ECON 60000 .

Credits: 2.00 to 4.00

MGMT 60700 - Seminar In Internal Accounting

Credit Hours: 2.00 to 4.00. Development of a conceptual framework for evaluating information system alternatives. The seminar examines insights into information value provided by the literature. Both the decision-facilitating and contracting-facilitating roles of information are considered. Topics also include auditing issues. Prerequisite: ECON 60700 , ECON 61500 .

Credits: 2.00 to 4.00

MGMT 60900 - Seminar In External Reporting II

Credit Hours: 2.00 to 4.00. Selective investigation of analytical research of informational and incentive issues in accounting. Emphasis is on the role of externally reported accounting information in asset pricing in financial markets. Prerequisite:

ECON 60700 , ECON 61000 , ECON 61500 .

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 61100 - Advanced Corporate Finance

Credit Hours: 2.00 to 4.00 (West Lafayette, Calumet) 3.00 (North Central). Long-term capital structure planning, capital budgeting, treatment of uncertainty in investment decisions, security underwriting, dividend policies, and mergers. Prerequisite: MGMT 61000.

Learning Outcomes: 1. Outline and describe Corporate Financial Policies and understand their potential impact of firm value. 2. Value real options in capital budgeting projects using the Black Scholes, the risk-neutral probability and the duplicating portfolio models. 3. Understand the use of and characteristics of various alternatives to corporate finance including leasing, convertible bonds, and structured finance. Credits: 2.00 to 4.00

MGMT 61400 - Investments

Credit Hours: 2.00 to 4.00. Examination of the process of asset valuation. Emphasis on portfolio analysis, security selection, risk-return relationships, and performance evaluation. Additional topics considered include security analysis, option pricing and analysis, futures contracts, and security market operations.

Learning Outcomes: 1. Develop a sound foundation for the main concepts in investment management and portfolio theory. 2. Understand how stock, bond, and option prices are determined. 3. Learn the analytical tools and financial theory necessary to understand how financial assets are used for investment decisions. 4. Take a critical look at the process of investing and relate the topics covered to current real-world problems relevant to practitioners. 5. Prepare students for more advanced courses in investments, portfolio management, and corporate finance. Credits: 2.00 to 4.00

MGMT 61500 - International Financial Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Integrative course dealing with the management of firms doing business internationally. Emphasis on decision making. Will draw upon, and adapt, managerial decision models developed for domestic operations, as well as cover appropriate international institutional material. Particular focus on finance and strategic management. Prerequisites: ECON 51500.

Learning Outcomes: 1. Evaluate how changes in the exchange rates affect a firm's cash flows and value. 2. Evaluate how international capital budgeting decisions are affected by the complications due to currency considerations. 3. Evaluate how international capital budgeting decisions are affected by the complications due to tax considerations. 4. Evaluate how international capital budgeting decisions are affected by the complications due to country risk considerations. Credits: 2.00 to 4.00

MGMT 61601 - Seminar In Capital Markets I

Credit Hours: 2.00. This is the first in a sequence of four PhD level finance courses that cover theoretical and empirical research in capital markets. Offered in alternate years.

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in capital markets. 2. Be able to show ability to conduct research in an ethical and

responsible manner. 3. Be able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61602 - Seminar In Capital Markets II

Credit Hours: 2.00. This is the second in a sequence of four PhD level finance courses that cover theoretical and empirical research in capital markets. Offered in alternate years. Prerequisite: MGMT 61601 .

Learning Outcomes: 1. Critical Thinking: Students demonstrate ability to think creatively and critically while solving problems in capital markets. 2. Ethical and Responsible Research: Students will be able to show ability to conduct research in an ethical and responsible manner. 3. Communication: Students will be able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61701 - Seminar In Capital Markets III

Credit Hours: 2.00. This is the third in a sequence of four PhD level finance courses that cover theoretical empirical research in capital markets. Offered in alternate years. Prerequisite: MGMT 61602 .

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in capital markets. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61702 - Seminar In Capital Markets IV

Credit Hours: 2.00. This is the fourth in a sequence of four PhD level finance courses that cover theoretical empirical research in capital markets. Offered in alternate years. Prerequisite: MGMT 61701 .

Learning Outcomes: 1. Able to think creatively and critically while solving problems in capital markets. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61801 - Seminar In Managerial Finance I

Credit Hours: 2.00. This is the first in a sequence of four PhD level finance courses that cover theoretical empirical research in managerial finance. Offered in alternate years.

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of managerial markets. Credits: 2.00

MGMT 61802 - Seminar In Managerial Finance II

Credit Hours: 2.00. This is the second in a sequence of four PhD level finance courses that cover theoretical empirical research in managerial finance. Offered in alternate years. Prerequisite: MGMT 61801 .

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of managerial markets. Credits: 2.00

MGMT 61901 - Seminar In Managerial Finance III

Credit Hours: 2.00. This is the third in a sequence of four PhD level finance courses that cover theoretical empirical research in managerial finance. Offered in alternate years. Prerequisite: MGMT 61802 .

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of managerial markets. Credits: 2.00

MGMT 61902 - Seminar In Managerial Finance IV

Credit Hours: 2.00. This is the fourth in a sequence of four PhD level finance courses that cover theoretical and empirical research in managerial finance. Prerequisite: MGMT 61901 .

Learning Outcomes: 1. Critical Thinking: Students demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Ethical and Responsible Research: Students will be able to show ability to conduct research in an ethical and responsible manner. 3. Communication: Students will be able to effectively communicate knowledge of managerial finance. Credits: 2.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00

(North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 62300 - Business Marketing

Credit Hours: 2.00 to 4.00. This course deals with the challenges of marketing to commercial enterprises, government organizations, and non-profit institutions. It covers topics including organizational buying behavior, launching and management of new high tech products, beta testing, customer relationship management, and the importance of manufacturing-marketing coordination. Prerequisite: MGMT 62000.

Credits: 2.00 to 4.00

MGMT 62500 - Marketing Research

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Application of statistical and other quantitative concepts to marketing management problems. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62600 - Seminar In Marketing Models

Credit Hours: 2.00 to 4.00. Treatment of theoretical marketing models. Study of marketing models in research setting. Prerequisite: MGMT 62000, 67200.

Learning Outcomes: 1. Understand the main research areas associated with quantitative methods in marketing. 2. Acquaint with the basic research techniques, approaches and key findings in the realm of empirical quantitative models in marketing. 3. Learn to develop and estimate the econometric models on consumer choices and firm interactions. 4. Prepare research ideas and the skills to implement the ideas. Credits: 2.00 to 4.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 63150 - Accounting For Private Equity

Credit Hours: 2.00 or 3.00. The course offers students with knowledge of private equity services that accounting firms provide to clients. It covers investment banking, buy- and sell-side due diligence, M&A tax services, business valuations, etc.

Learning Outcomes: 1. Gain practical knowledge and skills regarding tools accounting firms use to service Private Equity clients. 2. Improve technical presentation skills, both verbal and written. 3. Simulate the business environment and team approach. Credits: 2.00 or 3.00

MGMT 63250 - Advanced International Accounting

Credit Hours: 2.00 or 3.00. This course is designed to help students a) Learn about the development of international accounting movements and implications in a globalized financial market; b) Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS); c) Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event; d) Learn to cope with differences in financial measurement, recognition, and reporting practices;

and e) Enhance the students' communication skills. The course should also contribute to the requisite background required for professional examinations such as CPA and to become prepared for a long-range successful accounting, auditing, and/or managerial career.

Learning Outcomes: 1. Learn about the development of international accounting movements and implications in a globalized financial market. 2. Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS). 3. Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event. 4. Learn to cope with differences in financial measurement, recognition, and reporting practices. 5. Enhance the students' communication skills. Credits: 2.00 or 3.00

MGMT 63350 - Accounting Data Analytics

Credit Hours: 2.00 or 3.00. The skill set that accountants have needed to perform math and to keep order has evolved from pencil and paper, to calculators, and then to spreadsheets and accounting software. A new skill set that is becoming more important for nearly every aspect of business is that of big data analytics: managing large amounts of data in the database, analyzing them and finding actionable insights and visualizing the results. This course is designed to help accounting students develop an analytical mindset and prepare them to use data analytic programming languages and software like Python, SQL, and Tableau.

Learning Outcomes: 1. Understand the basic syntax and semantics of the Python language. 2. Understand the primitive data types build into Python. 3. Understand the key data visualization principles and techniques. 4. Apply data visualization principles and techniques to real-world business problems. 5. Critically evaluate the design and presentation of complex data or concept. 6. Design innovative static and interactive visualizations to effectively present information and enable data exploration. 7. Analyze a business situation to determine information management needs. 8. Design a database to address those needs. 9. Write SQL queries to retrieve information from a relational database. Credits: 2.00 or 3.00

MGMT 63400 - Business Law For Accountants

Credit Hours: 2.00 or 3.00. This course is designed to help prepare students for their professional careers by familiarizing them with aspects of the law that are directly relevant to the practice of accounting. These topics are not only at work every day in business but are also tested on professional examinations such as the Uniform Certified Public Accounting (CPA) Exam. Specific topics include, but are not limited to, contract law, relevant provisions of the Uniform Commercial Code, bankruptcy, and the legal liability of accountants. The course will be taught through a mixture of lectures and class discussions. Students are expected to come to class having completed the assigned readings and ready to participate in class discussions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate the ability to apply legal rules and principles to business transactions and the accounting for them. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of business ethics and social responsibility as it relates to the legal aspects of business transactions and reporting. 3. Develop awareness and understanding of global issues relating to financial reporting, tax accounting and business decisions: Students will be able to demonstrate an understanding of international business law and cyber law, both of which affect financial reporting and tax accounting. 4. Develop effective written and oral communication skills: Students will be able to demonstrate effective oral communication skills through class participation and effective written communication skills through the development and writing of a research paper. Credits: 2.00 or 3.00

MGMT 63410 - Communications For Accountants

Credit Hours: 2.00. Accountants spend much of their time

designing and writing reports, memos, etc. and explaining those communications to others. They communicate regularly with external investors and creditors, regulators, clients and fellow professionals. This course is designed to help accounting students prepare for their professional careers by helping them develop their written and oral communication skills. The course begins with an overview of the writing process and then moves to document organization and design and how to write with conciseness and clarity. The last half of the course focuses on specific forms of written communication (e.g., letters, memos, reports, email, essays on professional exams) and oral presentations.

Learning Outcomes: 1. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of ethical communication as it relates to accounting-related issues. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will study the appropriate and professional use of social media and electronic and written communication mediums in a business setting. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class assignments and the writing and presentation of a team paper. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a report on a pre-specifies accounting topic. Credits: 2.00

MGMT 63450 - Financial Statement Analysis And Valuation

Credit Hours: 2.00 to 3.00. This course is designed to prepare students to become intelligent financial statement users. Understanding how market participants use financial statements will assist professionals in their primary tasks of creating and communicating financial information to these individuals.

Learning Outcomes: 1. Identify certain adjustments that are required by financial analysts when assessing firms. 2. Demonstrate an adequate understanding of complex financial statement analysis and valuations procedures. 3. Develop reports that discuss the adjustments necessary to provide an accurate assessment of firms' income-generating abilities, as well as reports that encompass various valuation techniques commonly used in practice. Credits: 2.00 to 3.00

MGMT 63550 - Accounting Consulting For Entrepreneurship

Credit Hours: 2.00 or 3.00. This course is an experiential learning experience that is part of the Experiential Learning Initiative in the Krannert School of Management. The main goal of the course is to provide various accounting services to STEM start-up companies which are based on Purdue's innovations (www.purduefoundry.com) and to established companies in the bigger corporate world. At the same time, we also would like to give our students the opportunity to apply their acquired classroom knowledge and have them exposed to some real-world accounting problems that start-up or established companies typically experience. Our students are expected to provide various accounting support services that are related to financial accounting & reporting, managerial accounting, business planning, and/or tax issues. The format of the course is very open. The first four weeks will be spent in a classroom setting, with presentations on how to professionally manage a client relationship and how to successfully tackle projects in a challenging STEM start-up and/or established corporate environment. Each project will be completed by teams of 3-5 students, which will be formed at the beginning of the semester. After the initial classroom sessions, the project teams will be on their own, with faculty guidance, running the engagement. The teams will meet with the clients to determine their needs and expectations. The students will do the work and deliver the output including a final presentation to the client.

Learning Outcomes: 1. Provide various accounting services to STEM start-up companies which are based on Purdue's innovations (www.purduefoundry.com) and to established companies in the bigger corporate world. Credits: 2.00 or 3.00

MGMT 63610 - Business Ethics

Credit Hours: 2.00. This course is designed to move past a surface-level understanding that we need to act ethically in the business environment to wrestling with what does that look like and what frameworks can help us do just that. I also firmly believe that we have to prethink our decisions before we are confronted with opportunities to compromise ethically. We will incorporate current headlines to our evaluation of major ethical lapses of the past.

Learning Outcomes: 1. Describe, list, differentiate, and utilize a set of frameworks/theoretical approaches to ethics and apply those approaches to concrete problems/cases. 2. Assemble the ethical concepts through effectively writing and speaking about business ethics by paraphrasing and describing the concepts in your own words. 3. Respond to questions in online discussions to develop and integrate business ethics in real-world cases. 4. Develop your ability to effectively write and speak about business ethics by paraphrasing and describing the concepts in your own words. 5. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 6. Use business ethics and apply to real-world cases by thinking critically about our own responsibilities as economic agents (as workers, managers and consumers) and as citizens. 7. Summarize and use a set of frameworks/theoretical approaches to ethics and apply those approaches to concrete problems/cases. 8. Summarize Crisis Communications and integrate ethics into related case studies. Credits: 2.00

MGMT 63650 - Accounting Ethics

Credit Hours: 3.00. This course is designed to introduce students to the foundational elements underlying ethics and ethical behavior, with an emphasis on ethical issues facing professional accountants. The course will provide students with a framework of ethical reasoning, professional values and attitudes for exercising professional skepticism, and other behavior that is in the best interest of the public and accounting profession. The course will also review the core values of integrity, objectivity, and independence as well as rules of professional conduct. This course uses real-world case studies and practical hands-on applications in order to enhance the student's ability to recognize ethical dilemmas and overcome them with sound ethical decision-making. Illinois Board of Examiners ethics course required to apply for taking the Uniform CPA Examination.

Learning Outcomes: 1. Summarize the importance of ethics and ethical reasoning to professional accountants through explaining various ethical models. 2. Paraphrase and implement the core values of integrity, objectivity and independence, the backbone of the accounting profession. 3. Implement the rules of professional conduct included in the AICPA Code of Professional Conduct and TSBPA ethics rules to various case studies from a CPA Exam perspective. 4. Identify situations that might be unethical or a violation of professional standards, perform research and consultations as appropriate, and determine the appropriate action. 5. Recognize potentially unethical behavior of clients and determine the impact on the services being performed. Credits: 3.00

MGMT 63750 - Advanced Taxation

Credit Hours: 2.00 or 3.00. This course is directed at students who wish to learn more about the taxation of business entities beyond the basic principles taught in MGMT 504 Introductory Tax Accounting or an equivalent course. The course will cover broad topics such as tax law sources and tax research; the tax advantages and disadvantages of various business entities as well as how entrepreneurs may choose the optimal entity for tax purposes; taxable and nontaxable methods of mergers, acquisitions, and divestitures; fundamental concepts of consolidated tax returns for C Corporations; and the accounting for income taxes under ASC 740.

Learning Outcomes: 1. Describe various tax planning procedures. 2. Identify the tax law sources and assess the authoritative weight of each. 3. Conduct basic tax research using RIA Checkpoint and communicate results. 4. Understand the basic tax treatment of major operational events for sole proprietorships, partnerships, S Corporations, and C Corporations. 5. Identify the optimal business entity for tax purposes. 6. Understand the basic types of taxable acquisitions of C Corporations and tax planning ideas. 7. Understand the basic types of nontaxable acquisitions of C Corporations and tax planning ideas. 8. Understand the basic types of corporate divestitures and tax planning ideas. 9.

Understand fundamental concepts of consolidated tax returns for C Corporations. 10. Calculate a corporation's income tax provision under ASC 740 and understand how to prepare the required financial statement disclosures. Credits: 2.00 or 3.00

MGMT 63800 - Pricing Strategies And Algorithms

Credit Hours: 2.00. The course enables participants to formulate a systematic framework for approaching the problem of pricing a product, and more generally, a product line. The concepts and analytical methods necessary to develop such a framework are explored and incorporate marketing, competitive, and legal aspects. The course will use a combination of lectures, case discussions and exercises. Prerequisite: MGMT 62000.

Learning Outcomes: 1. Adopt a systematic framework to approach the problem of pricing a product or service. 2. Understand various approaches to estimate value of a product or service to users. 3. Understand the tradeoff between price and sales volume and its relation to price elasticity. 4. Understand segmented pricing and psychological aspects of pricing. 5. Understand the implications of pricing in a competitive environment and the importance of price policy. 6. Appreciate pricing issues when selling through an intermediary. 7. Be introduced to legal aspects of pricing. Credits: 2.00

MGMT 63850 - Public Company Reporting And Regulation

Credit Hours: 2.00 or 3.00. This course introduces students to the Securities and Exchange Commission's (SEC) rules and regulations as they apply to U.S. companies and their auditors. Requirements for frequently encountered annual reporting responsibilities (e.g., Forms 10-K, 10-Q, 8-K, proxy statements, etc.) and registration statements are explored and analyzed. Actual SEC filings provide real-world applications and interpretation of the SEC's rules. Rules imposed by the primary U.S.-based stock exchanges are introduced as is the history of the SEC and current trends affecting this rule-making body. Additionally, this course encompasses the enforcement power of the SEC and its implications to companies, their officers, and accountants.

Learning Outcomes: 1. Identify the structure, mission, and limitations of the SEC and key securities laws and statutes impacting U.S. companies and their external auditors. 2. Demonstrate an understanding of the Securities Acts of 1933 and 1934 and The Public Company Accounting Reform and Investor Protection Act of 2002 by identifying required disclosures and associating them with the specific rule requirements. 3. Research specific topics including emerging issues by using online resources supported by the SEC and the stock exchanges. Credits: 2.00 or 3.00

MGMT 63900 - Advanced Auditing And Audit Analytics

Credit Hours: 3.00. This course is designed to help students prepare for their professional careers by strengthening their understanding of the CPA's attest function and familiarizing them with current assurance issues. After finishing the course, students should understand the current state of the Enterprise Risk Management and tools for risk evaluation, be able to identify best practices related to external audit, be prepared to manage an audit group, understand the key aspects of being an audit consultant and be able to work with all levels of internal and external audit professionals. Throughout the course, students will have opportunities to improve their written and oral communication skills, particularly as they relate to communication in the audit setting. The course will also emphasize the impact of recent and current regulatory actions, including the Sarbanes-Oxley Act of 2002, on the audit profession. Prerequisite: MGMT 50600 with a minimum grade of C.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate an understanding of how U.S. audit and securities market regulations affect an audit. They will also use their statistical training in audit planning and evaluation as well as risk assessment. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of ethics as it relates to audit and external reporting. 3. Develop current business technologies and use common business technology and software in essential tasks: Students will use spreadsheets and auditing software in case analyses and assignments. 4.

Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class participation and the writing and presentation of a team paper. They will also demonstrate effective written communication skills through case write-ups. 5. Achieve depth of understanding and applications of financial reporting: By deepening their understanding of the audit process and techniques and by working through case studies focused on particular reporting and auditing issues, students will develop and demonstrate a deep understanding of reporting regulations and rules. 6. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a research paper on business and audit risks in a specific sector. Credits: 3.00

MGMT 63901 - London Trip For IASB

Credit Hours: 2.00 or 3.00. This is an experiential study abroad class with workshops held at the International Accounting Standards Board (IASB) as well as at one of the leading universities in the UK. In addition, students will visit public multinational companies and/or accounting firms in the Greater London area, UK.

Learning Outcomes: 1. Understand the IASB institution, its role, and its relationship to national standard-setting bodies. 2. Understand the IFRS standard-setting process, and be able to develop a new standard based on the IFRS conceptual framework. 3. Understand how standards are applied by multinational companies and be able to interpret standards given more complex situations and events. 4. Understand the enforcement process related to international accounting standards. 5. Gain a deeper understanding of the political impact on accounting standard-setting. Credits: 2.00 or 3.00

MGMT 63902 - Accounting And Public Policy

Credit Hours: 1.00 or 2.00. This course offers students an intensive, distinctive, personal and professional development experience, addressing critical public policy institutions, issues, and trends affecting the profession of accounting. Over 3 days in Washington, D.C., participants meet with and gain a greater understanding of the role of regulatory agencies such as the Public Company Accounting Oversight Board and the Securities and Exchange Commission. Participants also have meetings and discussions with organizations governing the accounting profession, such as the American Institute of Certified Public Accountants and the Center for Audit Quality, as well as more informal but important organizations such as trade associations and think tanks. The course often includes visits with members and staff from Congress and officials from the Executive Branch to understand their institutional roles in governing the profession. These meetings include discussions of the relevant tax, securities, commodities, and oversight committees in Congress, for example. Within the Executive Branch, discussions typically include the operations of forensic accounting and compliance within agencies such as the U.S. Treasury and Internal Revenues Service and the Federal Bureau of Investigation. Participants also gain practical insights into the strategic role of government relations, as well as the role of public policy lobbying and advocacy by the overall profession and individual firms, regarding issues that affect them and their clients. Other topical sessions often include discussions of cybersecurity policy, tax policy, and other topics relevant to the profession and key clients.

Learning Outcomes: 1. Will provide students an intensive, distinctive, personal and professional development experience, addressing critical public policy institutions, issues, and trends affecting the profession of accounting. Credits: 1.00 or 2.00

MGMT 63910 - Accounting For Managers

Credit Hours: 0.00 or 1.00. Accounting is the language of business. Understanding financial accounting enables professionals inside the firm to communicate with external users. In this course you will be introduced to financial accounting, which focuses on the reports that are generated to provide external users information about a firm's financial position and operational effectiveness.

Learning Outcomes: 1. Describe the financial statements and the parties involved in the production and use of financial statements. 2. Analyze the key principles used in financial accounting. 3. Analyze the process of preparing financial statements. 4. Evaluate how managers' choices and estimates shape

financial statements. Credits: 0.00 or 1.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel. The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial applications. Credits: 2.00 or 3.00

MGMT 64100 - Options And Futures

Credit Hours: 2.00 to 4.00. Rigorous and applied coverage of the pricing and hedging of options and futures contracts with applications. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64200 - Portfolio Management

Credit Hours: 2.00 to 4.00. Methods of analysis of common stocks and bonds for individual and institutional portfolios. Review of the empirical evidence of security market efficiency, and implications of that evidence for various methods of security analysis. Team projects to analyze the economy, the particular industry or sector, and selected firms within the industry or sector, and to make specific buy-hold-sell recommendations for the stocks and bonds of those firms. Prerequisite:MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64300 - Financial Risk Management

Credit Hours: 2.00 to 4.00. Provides a foundation for understanding ways in which financial institutions and industrial firms can optimally manage financial risks. Concentrates on various "functional" risk measurement problems related to interest rate risk, default risk, exchange rates, and commodity prices. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64400 - Venture Capital And Investment Banking

Credit Hours: 2.00 to 4.00. Examines the process of corporate value creation through financial policy choices. The sequence of topics roughly parallels the life cycle of a typical corporation. Begins by studying the financing of entrepreneurial companies. Then studies the investment banking and capital acquisition process employed for public securities issues. Also examines capital acquisition and reorganization decisions, such as the use of hybrid securities like convertible debt and PIPEs, project financing bankruptcy reorganizations, and equity structurings. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64500 - Mergers, Acquisitions, And Corporate Control

Credit Hours: 2.00 to 4.00. Focuses on firms' internal governance structures and on pressure from the external market for corporate control, including executive compensation, board of directors' composition, shareholder activism, mergers, and takeovers. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64700 - Financial Engineering

Credit Hours: 2.00 or 3.00. The objective of this course is to provide students with the necessary skills to value and hedge a wide variety of derivatives contracts used in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous-time. Some basic knowledge of stochastic processes would be helpful, but not essential: we will cover what we need in class. The course covers valuation of securities using modern martingale methods as well as the necessary parameter estimation and numerical methods such as Monte Carlo simulations. Applications will include derivatives such as options on stocks, bonds and currencies, as well as valuation of defaultable securities, and modeling the term structure of interest rates and risk management with Value-at-Risk. Prerequisites: MGMT 61400, or similar coursework with instructor permission.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Understand the underlying economic determination and behavior of financial derivatives. 3. Design and structure such financial derivatives. Credits: 2.00 or 3.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65200 - Entrepreneurship

Credit Hours: 0.00 to 3.00. Examines entrepreneurship with a focus on the start-up process for high growth new ventures.

Cases will be used, and students will conduct a feasibility analysis of a new venture concept. Prerequisites: MGMT 61000 and MGMT 62000. Concurrent Prerequisites: MGMT 65000.

Learning Outcomes: 1. Learn how to sketch out a possible business idea and "pitch it" to gain team members and participants. 2. Develop a business model and learn the advantages of bootstrap financing vs venture capital financing for new ventures. 3. Describe a value proposition of a business plan and show the current valuation. 4. Learn how to write a Business Plan. Credits: 0.00 to 3.00

MGMT 65210 - Organizational Development And Consulting Rewards

Credit Hours: 2.00. The course will describe techniques for diagnosing organizations and interventions for improving organizations. Specific interventions will be examined in detail including structural interventions (e.g., organizational design, job design), interpersonal process interventions (e.g., process consultation, team building), and human resource interventions (e.g., performance management, career development). The course will attempt to both build knowledge and provide practice in the various techniques.

Learning Outcomes: 1. Understand the basics principles of the theory and practice of OD. 2. Gain familiarity with the different types of OD interventions, including detailed real-world examples. 3. Introduce the specific OD techniques (or methodologies) and get practice applying some of the techniques. 4. Appreciate the importance of an OD practitioner perspective in understanding and implementing OD. Credits: 2.00

MGMT 65310 - Human Resource Systems

Credit Hours: 3.00. An overview of selected human resource activities/systems for the future human resource professional. Emphasis will be placed on building skills in areas that will provide a foundation for future coursework in human resources management. Topics covered include planning and forecasting human resource needs, job analysis, design and evaluation of training systems, design of performance appraisal systems, and safety and health in the workplace.

Learning Outcomes: 1. Develop a strong value for HRM knowledge generated from research (i.e., "evidence-based management") and its potential for contributing to improving the quality of contemporary human resource management activities. 2. Develop an appreciation for the organizational environment in which HRM activities occur, and an understanding of the effects of that environment on such activities. 3. Demonstrate an understanding of relevant professional and legal standards in developing, implementing, and evaluating HRM functions. 4. Understand and apply fundamental principles and techniques related to HRM activities. 5. Evaluate the strengths and weaknesses of the primary tools and principles employed in HRM. 6. Improve writing, critical thinking, and discussion skills through course activities. Credits: 3.00

MGMT 65330 - HR Strategy

Credit Hours: 2.00 to 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Learning Outcomes: 1. Understand the history of human resource management and how it has evolved to the strategic level. 2. Understand what strategic Human Resource Management means and entails. 3. Understand and complete a Human Resource Management Strategic plan. 4. Make yourself an invaluable resource to upper level management and the CEO by demonstrating the extreme importance and value of Strategic Human Resource management. Credits: 2.00 to 3.00

MGMT 65340 - Staffing Tools

Credit Hours: 2.00. Provides an in-depth analysis of the methods used in staffing and selection processes. Methods used to evaluate individuals as well as methods used to evaluate selection and promotion tools will be studied. Emphasis on the processes of designing, administering, revising, and evaluating selection programs that comply with government regulation as well as add value to the organization. This course is designed for the future HR professional. Concurrent Prerequisite: MGMT 65310 or STAT 51200 .

Learning Outcomes: 1. Understand the staffing systems at both practical and theoretical levels, including the basic scientific concepts. 2. Gain familiarity with the common methods, tools, and

techniques in staffing. 3. Develop hands-on skills in using some of these staffing methods and tools. Credits: 2.00

MGMT 65350 - Staffing Systems

Credit Hours: 2.00. Examines all aspects of the staffing process beginning with applicant recruitment and ending with termination and outplacement. Emphasis on building skills that the general manager will need to evaluate, design, and implement these activities. Designed for the future manager, as well as the future HR professional. Topics will be addressed from an individual perspective, as well as an organizational perspective. Prerequisite: OBHR 63100 or OBHR 63300 or MGMT 65310.

Learning Outcomes: 1. Understand the staffing systems at both practical and theoretical levels. 2. Gain familiarity with the common methods, tools, techniques, and strategies in staffing. 3. Develop hands-on skills in using some of these staffing methods and tools. Credits: 2.00

MGMT 65370 - Industrial Relations II

Credit Hours: 2.00. An examination of union-management relations topics that build on material addressed in OBHR 640. Topics include causes of strikes, impasse resolution techniques, grievance and arbitration procedures, public sector labor relations, labor-management cooperation, and international labor-management relations. Emphasis is on how changes in the competitive environment have created the need for changes in the traditional union-management relationship. Films, cases, exercises, and guest speakers are utilized. Prerequisite: OBHR 64000 or MGMT 65360.

Learning Outcomes: 1. Identify the various forms of alternative dispute resolution techniques, such as mediation, arbitration, and peer review, as utilized in both the private and public sectors. 2. Demonstrate understanding of key concepts from the course such as why workers join unions, the usefulness of the strike, how industrial relations works in the unionized sector versus in the employment at will sector of the economy, etc. 3. Outline the labor management relationship in a major industry such as airlines, health care, entertainment, etc. showing understanding of the past, present and future of industrial relations in that sector. 4. Develop the ability to think critically about the major issues that face unions and management as we move into the middle part of the century. 5. Develop the ability to critically evaluate the positions of labor and management on key issue such as recent Supreme Court decisions like Janus, the factors that should be utilized in making promotion decisions, just cause for discharge, etc. Credits: 2.00

MGMT 65380 - Compensation And Reward Systems

Credit Hours: 3.00. The first course in a two-course master's-level sequence focusing on the use of rewards to achieve organizational objectives. Special emphasis is given to compensation as a particularly salient reward. Designed for HR professionals, the course examines the relationship between rewards and organizational characteristics to achieve effective reward practices. Lectures, discussions, case studies, and guest speakers are used to build competence in job evaluation, skill-based pay, and setting pay levels. Prerequisite: OBHR 63100 or OBHR 63300 or MGMT 65310, MGMT 67100 or STAT 51200.

Learning Outcomes: 1. Learn the current state of compensation decision-making. 2. Develop knowledge and skills in making evidence based compensation decisions. 3. Learn how compensation systems relate to business strategies, human resources systems, and other organizational processes. 4. Build competence in measuring and valuing work, the design of pay structures, and market-pricing systems. Credits: 3.00

MGMT 65390 - HR Analytics

Credit Hours: 2.00 to 3.00. This course provides an introduction to the field of HR analytics. HR Analytics is an advanced set of data analysis methodologies, tools and metrics for comprehensive workforce performance measurement and improvement. The objective of HR analytics is to drive evidence-based decisions and action in the workplace. In addition to your instructor, you may hear from expert practitioners and corporate leaders who have "been there and done that" leveraging a myriad of HR analytics along the way. We will also review (and hopefully expand) your understanding of handling data including conceptualizing models, identifying key metrics, collecting data, analyzing data, and presenting data in ways that tell a powerful story. Throughout our course, I will infuse consulting concepts, methodologies, and lessons learned that combined with your analytic skills will help you to effectively serve as an HR Business Partner (internal HR consultant).

Learning Outcomes: 1. Understand how organizations use HR analytics to address

business problems, support business decision making and drive business outcomes. 2. Become familiar with methods and processes to design, define and execute workforce research projects in a consulting capacity leveraging consulting models and methodologies and enhancing project management capabilities. 3. Learn how to approach and apply HR analytics methodology. 4. Understand current HR analytics practices, tools and emerging trends. Credits: 2.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

MGMT 65450 - Human Capital Consulting

Credit Hours: 2.00 or 4.00. Working in a team setting, this course provides real-life experience consulting with an organization to solve a real business problem. The focus is on human capital or human resource-related problems. Students

work with a client to define the scope of their engagement, identify needs, conduct outside research (benchmark, market analysis), develop solutions, and identify key deliverables. The project culminates with an executive summary presentation with tangible recommendations to the client's senior leadership. This experience prepares students to serve as an HR Business Partner (HRBP).

Learning Outcomes: 1. Identify problems and generate & offer solutions to problems. 2. Conduct benchmarking and other external market analysis. 3. Develop the professionalism and influence skills needed to credibility influence an executive audience. 4. Demonstrate credibility through written and oral presentations. Credits: 2.00 or 4.00

MGMT 65460 - Talent Acquisition

Credit Hours: 2.00 to 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions, and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Design a talent acquisition program in order for an organization's talent to be its competitive advantage. 2. Design a workforce implementation plan and a process to identify issues and continuous refinement of the plan. 3. Create a Recruiting plan that is focused on both external and internal candidates. 4. Design a process for final candidate evaluation. 5. Develop strategies to orient and onboard newly acquired talent. Credits: 2.00 to 3.00

MGMT 65470 - Talent Management

Credit Hours: 2.00 to 3.00. This course focuses on the employer-employee relationship and how managers work with employees to improve their performance. Attention is given to Talent, Talent Management, and Performance Management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing talent. Various definitions of Employee Engagement will be explored, along with how it is, measured, and why it is so important to your organization. Finally, various methods to engage employees in the organization will be studied.

Learning Outcomes: 1. Define talent and talent management. 2. Determine talent management strategies to support an organization's objectives and goals. 3. Evaluate talent management models to address organizational needs. 4. Develop and integrate a talent management system into organizations. 5. Define critical elements of a successful performance management system. 6. Identify methods to promote and maintain an engaged workforce. Credits: 2.00 to 3.00

MGMT 65480 - Total Rewards

Credit Hours: 2.00. This course examines how organizations can optimize financial and relational returns to gain and sustain a competitive advantage in a global environment. We will use theory and cases to develop a sound understanding of the compensation system.

Learning Outcomes: 1. Understand compensation systems and how they can be a catalyst for change and to help organizations execute their business strategies. 2. Know how to attract, engage, and retain top talent effectively. 3. Apply practical management tools for sustaining competitive advantage. 4. Develop technical compensation skills to design pay structures and market pricing systems. 5. Comprehend the importance of rational returns for employees and the role it plays in employee development. Credits: 2.00

MGMT 65500 - Competitive Strategy

Credit Hours: 2.00 or 3.00. Examines how firms obtain and sustain superior returns through the development and implementation of a competitive strategy at the business-unit level. Focus is on strategies that develop and exploit two sources of superior returns: unique value-creating resources (e.g., patents, brand equity, operational capabilities), and powerful positions in markets and supply chains. Participants are expected to be familiar with basic competitive strategy concepts and tools, such as "five-forces analysis", the value chain, and generic strategies. Presents a more analytical perspective of strategy, drawing from game theory. Prerequisites: MGMT 65000.

Learning Outcomes: 1. Learn how to analyze differential competitive positions. Establish the source of advantage in terms of competitive position and resources firms may have. Use

case analysis and discussion to do so. 2. Identify the means of disrupting incumbent positions with entry or deter entry through pre-emption of competitive position or key resources by incumbents. Also consider mechanisms for incumbents to reduce the success of entrants by adopting some aspects of entrants offering. Project scenarios in which entrants can be successful and also identify scenarios in which incumbents will respond aggressively. Project pricing and financial outcomes of these choices for entrant and incumbent. 3. Understand the competitive dynamics of business ecosystems. Identify the drivers of success in these ecosystems by articulating the network effects associated with different offerings within an ecosystem. Credits: 2.00 or 3.00

MGMT 65700 - Manufacturing Strategy And Process Innovation

Credit Hours: 2.00. In recent years many firms have rediscovered manufacturing and operations as a potential source of strategic advantage. In general, these firms have sought to develop capabilities in operations which provide a sustainable advantage in the marketplace. In addition, successful firms have developed processes for understanding the cross-functional implications of product and process choices. In this course, we will seek to understand the circumstances under which particular operating capabilities are most beneficial and how such capabilities can be developed so that operations can be exploited for competitive advantage. Concurrent Prerequisite: MGMT 61000, 65000, 66000.

Learning Outcomes: 1. Identify a fit between Competitive Priorities and Operational Choices by showing how such a fit is accomplished in case analysis and write-ups and understanding pressures to change competitive priorities or operational choices. 2. Establish how capabilities emerge over time and enable a trajectory of competitive advantage by showing how capabilities create options to change tradeoffs in competitive priorities in case analysis and write-ups and identifying financial implications of pursuing one competitive priority vs another. 3. Use financial analysis and discussion of capabilities to argue for investment choices in case analysis. 4. Understand benefits of different approaches to supplier alliances. Consider tradeoffs in governance cost, production cost, long term efficiency and responsiveness in arms length, vertically integrated, and third way supplier partnerships in case analysis. Credits: 2.00

MGMT 65730 - Technology Strategy

Credit Hours: 2.00 or 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage. We take an in-depth look at how technological innovation affects the competitive dynamics of markets, how firms can strategically manage these dynamics, and how firms can create and implement strategies to maximize their likelihood of success. The course introduces tools, concepts, and analytical frameworks that will enhance your ability to define and analyze strategic problems that stem from innovation and technological change, and to identify sources of competitive advantage from both an industry and firm-level perspective. Permission of department required.

Learning Outcomes: 1. Assess the degree to which a firm or industry is subject to technological factors. 2. Evaluate the temporal dynamics of an industry, lifecycles and s-curves from both a technological maturity and adoption (installed customer base) perspective. 3. Design firm strategies to capitalize on internal technological capabilities and external opportunities. 4. Formulate collaboration strategies and strategies for protecting innovation. Credits: 2.00 or 3.00

MGMT 65810 - Corporate Consulting Experiential Learning

Credit Hours: 1.00 to 4.00. This course is an engagement with an external firm to solve challenges within the business. Students work together on project teams that require a cross-functional and interdisciplinary perspective. Student mix is

determined by project needs and qualifications. Projects are typically sponsored at a senior level of the organization and address enterprise-level issues and challenges of strategic importance. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in use of consulting skills. 2. Manage client meetings and expectations. 3. Set-up and manage project using project management skills and tracking. 4. Critique peer contributions and have the ability to discriminate between good and better performers. Credits: 1.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 66100 - Management Of Operating Systems

Credit Hours: 1.00 to 4.00. A project course in which students are exposed to a variety of operations problems as they arise in a real world setting. The focus of the course is problem formulation, analysis, and proposal(s) of an implementable scheme for their resolution. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Gain an increased ability to identify and analyze issues in operations management. 2. Develop implementable solutions. 3. Enhance understanding of how specific projects relate to larger business goals. 4. Improve professional skills, including teamwork, client communication, and project management. Credits: 1.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 67200 - Advanced Business Analytics

Credit Hours: 2.00. Quantitative decision procedures under uncertainty applied to business problems. Basic concepts in econometrics and multivariate analysis are studied. Several managerial-oriented case studies are used to illustrate estimation, testing, and regression procedures. Master's student standing and Management majors only.

Learning Outcomes: 1. Review of Multiple Linear Regression. 2. Analysis of Variance (ANOVA): A Regression Approach. 3. Qualitative Independent Variables. 4. Qualitative or Discrete Dependent Variables. 5. Univariate Time Series Models for the Mean. 6. Univariate Time Series Models for Volatility. Credits: 2.00

MGMT 67620 - Optimization For Data Analysis And Decisions

Credit Hours: 2.00 or 3.00. This course covers optimization theory and algorithms for data analysis and decision-making. The topics covered include polyhedral analysis, duality, first-order methods, relaxation techniques, and computational aspects of optimization. The course will use business applications to demonstrate usefulness of the methods.

Learning Outcomes: 1. Understand convex optimization theory. 2. Understand the use of optimization techniques with data analysis. 3. Code optimization algorithms. 4. Perform polyhedral analysis. 5. Utilize modern solvers

and modeling paradigms to solve optimization problems. 6. Develop relaxations for nonconvex optimization problems. Credits: 2.00 or 3.00

MGMT 67700 - Seminar In Quantitative Methods In Management Research

Credit Hours: 3.00. Applications of quantitative methods of analysis to research problems in financial, marketing, and production management. Data processing and statistical inference in management research. Prerequisite: MGMT 67000, 67100, 67200.

Credits: 3.00

MGMT 68000 - Economic Analysis Of Technology Markets

Credit Hours: 0.00 to 3.00. The core models of microeconomics are fundamental to day-to-day management decisions. This course will cover economic models that describe firm production, pricing, entry/exit decisions, market efficiency, and welfare. Such economic models will be applied to the analyses of a variety of market conditions, including monopoly, oligopoly, and monopolistic competition. It will provide students with an understanding of the implications of economic theory on technology products, firms, markets, and consumers.

Learning Outcomes: 1. Be able to use economic models to analyze technology markets and make optimal managerial decisions. Credits: 0.00 to 3.00

MGMT 68200 - Digital Product Design

Credit Hours: 2.00. This course is a comprehensive exploration of designing digital products that can improve the quality of people's daily lives. It covers value creation with technology and a human-centered design process including improv brainstorming, storyboarding, interviewing, sketches, and selling. Students will learn how to ideate and how to iteratively refine ideas with real users. Students will consider factors driving technology product design decisions such as the unique economic characteristics of today's technology-intensive markets and their impact on strategic interactions among firms and consumers. Students will also learn to discover unmet user needs, reframe problematic situations, envision multiple possible product concepts, and assess their feasibility, viability, and desirability. The course culminates in the creation of a business model, a product sketch, and a plan for taking the product to market.

Learning Outcomes: 1. Apply digital business methods and digital information strategies. Credits: 2.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 68700 - AI For Business Decisions

Credit Hours: 1.00 to 3.00. Leading-edge companies in every industry are relying on data and AI to replace intuition and guesswork in their decision-making. This course prepares students to understand how AI can be utilized to create value and a sustainable competitive advantage. It teaches the scientific process of using AI to transform data into predictions and insights for making better business decisions in a real-world setting. Upon completion, students should be able to identify and evaluate value propositions of AI advances, conduct successful AI implementations, and manage AI-driven digital

transformations.

Learning Outcomes: 1. Design and present as a part of the project engagements that take into consideration human instincts and biases. 2. Understand and identify human instincts and biases that are useful for design considerations. 3. Break apart engagements into three parts: mechanics, dynamics, and aesthetics. Credits: 1.00 to 3.00

MGMT 68800 - Developing A Global Business Strategy

Credit Hours: 2.00 to 4.00. Provides an introduction regarding the business and strategy challenges faced by managers in our global economy, regardless of whether the firm is a small domestic company or a large multi-national. Major topics for the course include motivations and challenges of internationalization, international business fundamentals, foreign market entry strategies, organizing across countries, analyzing global industries, building competitive advantage in global industries, and the influence of culture and institutions. Prerequisite: MGMT 65000.

Learning Outcomes: 1. Understand the three foundation characteristics related to foreign market entry - firm, industry, and institutional factors. 2. Analyze country choice for entry and the factors involved in choosing a country. 3. Develop the essential skills to identify and pursue global business opportunities, with a focus on the different modes of entry. 4. Acquire the skills to resolve management decision problems in global markets, and analyze multi-country organizational structures. Credits: 2.00 to 4.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

MGMT 69100 - Special Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level. For students in the master's programs in management who are registered in the master's program summer session. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 69199 - Graduate Co-Op I

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by Business Career Services with cooperation from academic disciplines and participating employers. Permission of department required.

Learning Outcomes: 1. Have an increased ability to identify and analyze issues in operations management to develop implementable solutions. 2. Understand how specific projects relate to larger business goals. 3. Have improved professional skills, including teamwork, client communication, and project management. Credits: 0.00

MGMT 69200 - Managerial Communication Skills

Credit Hours: 1.00. Enhances student professionalism in managerial contexts by improving oral communication skills by developing strong oral presentation techniques.

Credits: 1.00

MGMT 69299 - Graduate Co-Op II

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by Business Career Services with cooperation from academic disciplines and participating employers. Permission of department required.

Learning Outcomes: 1. Have an increased ability to identify and analyze issues in operations management to develop implementable solutions. 2. Understand how specific projects relate to larger business goals. 3. Have improved professional skills, including teamwork, client communication, and project management. Credits: 0.00

MGMT 69399 - Graduate Co-Op III

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by Business Career Services with cooperation from academic disciplines and participating employers. Permission of department required.

Learning Outcomes: 1. Have an increased ability to identify and analyze issues in operations management to develop implementable solutions. 2. Understand how specific projects relate to larger business goals. 3. Have improved professional skills, including teamwork, client communication, and project management. Credits: 0.00

MGMT 69410 - Communication And Persuasion

Credit Hours: 2.00. Business students are trained to be experts in turning data into information. With a strong focus on data visualization, the purpose of this course is to help students take

the next step: Turning that information into action. This course will provide you with helpful frameworks for understanding your audience, insights about how people perceive information best, and practical skills to express your ideas in ways that connect. Permission from department required. Co-requisite: MGMT 69000 - Industry Practicum

Learning Outcomes: 1. Articulate personal brand via writing, speaking and interacting. 2. Explain data and analyses in ways that are concise and clearly understood by laymen without losing meaningful context or content (content delivery). 3. Demonstrate mastery at being data-driven by (a) translating data and analyses into a narrative that provides context for your message (storytelling) AND (b) creating informative, clutter-free data visualizations to support your message (content organization). 4. Make persuasive recommendations that convince decision-makers to adopt a particular belief or take a course of action. 5. Identify ethics and inclusion considerations in communication and persuasion. Credits: 2.00

MGMT 69600 - Theoretical Principles For Deep Learning

Credit Hours: 2.00 or 3.00. This course aims to expose you to one of the most active contemporary research directions within machine learning: theoretical principles for deep learning. Despite its undisputedly useful empirical breakthroughs, their understanding is still in many ways nascent. This course provides the latest theoretical aspects of deep learning and representation learning, accompanied by a mixture of reading group sessions and student projects. This is an advanced graduate course designed for master's and Ph.D.-level students and assumes a substantial degree of quantitative research background.

Learning Outcomes: 1. Demonstrate the deep learning algorithms and design deep neural networks which are more appropriate for various types of learning tasks in various domains. 2. Understand representation power and generalization of deep models, regularization, and hyperparameter selections. 3. Identify optimization for deep learning algorithms with observations on the landscape and explain the role of overparameterization. 4. Perform nonlinear feature selections in deep architectures. 5. Leverage your deeper theoretical understanding to produce rigorous solutions to real-world applications. Credits: 2.00 or 3.00

MGMT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Manufacturing Engineering Technology

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

MFET 11301 - Product Data Management

Credit Hours: 3.00. This course provides an understanding of the types of data generated and used in the product lifecycle, the current tools and methodologies in the management of that data, and system analysis and implementation techniques for using PDM as the backbone supporting a company's product development and implementation activities. Interaction between various enterprise systems is discussed.

Learning Outcomes: 1. Develop a significant understanding of concepts, applications, and procedures involved in the controlling, protecting, and accessing product definition data. 2. Understand and apply Product Data

Management (PDM) technologies and methods in a Product Lifecycle Management (PLM) environment. 3. Use a PDM system from the end-user perspective, simulating various workflows. 4. Understand basic principles of project management. 5. Understand the creation and importance of object metadata. 6. Describe the relevance of PDM in model-based enterprises. Credits: 3.00

MFET 15900 - Introduction To The Smart Manufacturing Enterprise

Credit Hours: 1.00. This course serves as an introduction to modern smart manufacturing methods and processes. The course explores the manufacturing enterprise in different industry contexts to illustrate multiple, varied paths to inform students of multiple career opportunities.

Learning Outcomes: 1. Define the multiple areas that rely on the manufacturing process and connected enterprise. (Case studies, guest speakers) 2. Demonstrate understanding of the fundamentals of historical technology evolution and potential future trends of manufacturing through Industry 1.0, Industry 2.0, Industry 3.0, Industry 4.0, etc. 3. Identify potential manufacturing methods and processes in modern smart manufacturing. (Case studies, guest speakers) 4. Apply knowledge of different manufacturing methods to design a prototype of a manufacturing process. (prototyping and presentation) Credits: 1.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MFET 20301 - Model-Based Definition

Credit Hours: 3.00. This course provides experience in the development of model-based product definition through the use of contemporary modeling tools and the application of ASME dimensional standards. This course also covers product data exchange and interoperability standards from the perspective of neutral and proprietary data formats and models. Long-term archival concepts are also covered.

Learning Outcomes: 1. Explain the significance of 2D and 3D CAD model standards relative to industrial practice. 2. Describe the elements and process of 3D model-based definition. 3. Incorporate model-based definition techniques into the CAD model database and technical documentation when creating geometry. 4. Implement modeling techniques that support long-term archival of product data. 5. Develop standard parts libraries which incorporate industrial standard parts specifications. 6. Select appropriate file format(s) for the communication of CAD data through different toolsets and data exchange media. 7. Develop basic literacy in interpreting technical documentation. Credits: 3.00

MFET 20401 - Data Capture, Collection, Analysis, And Visualization In Smart Manufacturing

Credit Hours: 3.00. This course provides an introduction as well as hands-on experience in data analysis and visualization in the Smart Manufacturing environment. It introduces students to the role of data in a Smart Manufacturing Enterprise, concepts and techniques of data analytics, and design principles for creating effective data visualization to facilitate managerial decision-making. This course is part of Smart Manufacturing Enterprise Fundamentals and should be taken after completing Introduction to the Smart Manufacturing Enterprise course.

Learning Outcomes: 1. Describe the types of data existing in a Smart Manufacturing

Enterprise, and how data are used to support strategic, tactical, and operational decisions in smart manufacturers. 2. Perform descriptive, diagnostics, and predictive analytics on a manufacturing/supply chain dataset. 3. Solve a small manufacturing/supply chain optimization problem with Excel Solver. 4. Explain what visual qualities are important to convey data and apply design principles in creating visualizations. 5. Combine data analytics and visualization to provide insights into manufacturing/supply chain datasets. Credits: 3.00

MFET 21301 - Simulation And Visualization Applications

Credit Hours: 3.00. This course provides an investigation of predictive and documentary capabilities of engineering simulation and visualization tools. The course is based on concepts derived from theoretical computer graphics and related industrial standards, as well as the use of the geometric model-based product definition.

Learning Outcomes: 1. Describe the processes of simulation and visualization methods and tools. 2. Select and use appropriate simulation and visualization tools for specific PLM tasks. 3. Describe the role of product data models to enhance the processes of engineering design optimization and verification. 4. Develop skills of communication and project management through written assignments, individual, and group projects. 5. Define and apply the fundamentals of technical simulation and visualization with CAx tools in a PLM environment. Credits: 3.00

MFET 23000 - Industrial Internet Of Things, Networks, And Systems I

Credit Hours: 3.00. This course provides an introduction to Industrial Internet of Things (IIoT) devices, networks, and standards in the context of converged information technology (IT) and operations technology (OT) industrial automation systems. Course topics include an examination of IT and OT networks, hardware, architecture, protocols, standards, and security practices in the context of industrial applications.

Learning Outcomes: 1. Explain the concept of Industrial Internet of Things (IIoT) and the enabling technologies. 2. Describe IT and OT development and detail differences in priorities and capabilities. 3. Design, implement, and analyze an integrated industrial network. 4. Configure host-level and network-level technical security controls in IT and OT systems. 5. Apply industry standards and reference architectures to ensure best practices in the selection, deployment, and operation of IIoT devices. Credits: 3.00

MFET 23100 - Industrial Internet Of Things, Networks, And Systems II

Credit Hours: 3.00. This course offers a practical exploration of Industrial Internet of Things (IIoT) in converged information and operations technology (IT/OT) industrial automation systems. Course topics include IT and OT reference architectures, industrial network convergence, standards, and security practices in the context of Edge, hybrid, and Cloud-based industrial applications. Specific focus is given to integrating and securing networked industrial devices with local and cloud-based IT systems in greenfield and brownfield scenarios.

Learning Outcomes: 1. Apply industry standards to develop a basic industrial network for converged IT/OT smart manufacturing systems. 2. Demonstrate the implementation of key security components required for converged IT/OT industrial networks. 3 Describe the role, characteristics, and requirements of safety systems in smart manufacturing. 4. Implement batch and real-time computation and basic machine learning models in an automated system. Credits: 3.00

MFET 24100 - Automatic Control Systems

Credit Hours: 3.00. This course provides students with a comprehensive understanding of feedback control systems and their practical implementation. Students will learn modeling and simulations of linear/linearized dynamic systems, stability study, time domain analysis, frequency domain analysis, root-locus method, design of PID control, compensators, derivation of control law, and system performance analysis through hands-on exercises and simulations. The curriculum emphasizes applications of mechatronics, robotics, and mechanical/electrical engineering technology fields.

Learning Outcomes: 1. Utilize the fundamental concepts for feedback control system design. 2. Create mathematical models of dynamic

systems. 3. Analyze the performance of control systems through simulations. 4. Optimize controller parameters for desired system behavior. 5. Apply control theory to real-world engineering problems. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MFET 25000 - Smart Manufacturing Cloud Computing Applications

Credit Hours: 3.00. This course introduces concepts and principles of cloud computing and the virtualization of computing resources and services for smart manufacturing applications. The fundamental topics of cloud computing will be addressed, including virtually processing, storing, modeling and analyzing of data in the cloud environment. Fundamental concepts about cloud tools, applications, and services from a production and manufacturing perspective will be presented.

Learning Outcomes: 1. State the challenges and advantages of cloud computing in smart manufacturing. 2. Explain the concepts and principles of cloud computing such as a scalability, elasticity, agility, fault tolerance, disaster recovery and networking. 3. Recognize the models, tools, and service types offered by the different cloud platforms for smart manufacturing applications. 4. Select strategies for managing and optimizing cloud computing resources for different manufacturing applications. 5. Apply techniques in clouding computing to model and manage manufacturing data. 6. Build manufacturing apps using cloud based platform tools and services. Credits: 3.00

MFET 29000 - Special Topics In Manufacturing Engineering Technology

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of Manufacturing Engineering Technology is provided by Technology faculty, subject to MFET curriculum subcommittee approval.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

MFET 29200 - Projects In Automation, Robotics And Mechatronics

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Course is for supervised project development, subject to MFET curriculum subcommittee approval. Intended for lower division students. Permission of instructor required.

Learning Outcomes: 1. Successfully complete a project of limited scope. 2. Document and manage a project using accepted project management principles. 3. Demonstrate effective oral and written communication skills. Credits: 1.00 to 3.00

MFET 29900 - Manufacturing Engineering Technology Independent Project

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by instructor and approved by the MFET curriculum committee. Primarily for third- and fourth-semester students with special interests. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

MFET 30301 - Digital Manufacturing

Credit Hours: 3.00. This course investigates digital manufacturing methods, tools, and processes. Topics include additive and subtractive production techniques, CNC tools, geometric dimensioning and tolerance, model-based definition, measurement instruments and metrology, and scanning techniques for geometry validation.

Learning Outcomes: 1. Describe the differences between additive and subtractive manufacturing. 2. Create a simple CNC program to drive a desktop mill, lathe, and cutter. 3. Understand the basic steps to moving CAD data through a CAM system to drive a machine. 4. Use measurement techniques and model-based data to inspect a manufactured part. 5. Use 3D scanning technology to validate a manufactured part. Credits: 3.00

MFET 31301 - The Business Of Managing Digital Product Data

Credit Hours: 3.00. This course provides experience in the business-related aspects of PLM tools and methods. Topics include identifying specifications and roles for system users within an organization, creating database models for digital product information, workflows, virtual machine installation and configuration of PLM systems, budgeting, and benchmarking.

Learning Outcomes: 1. Identify specifications and requirements for users of PLM systems. 2. Identify user roles and create them with appropriate permissions in a PLM system. 3. Install and configure a PLM system to be used by student teams. 4. Develop the product data model consistent with user requirements. 5. Conduct basic benchmarking and budgeting activities for a PLM deployment. Credits: 3.00

MFET 32100 - Nature-Inspired Design And Materials

Credit Hours: 3.00. In this course, students will work at the intersection of nature, design, materials, and devices. We will begin by exploring structures in nature, from the microscale to the macroscale. Inspired by nature, teams will design structures, objects, tools, machines, or sensors that incorporate aesthetic elements inspired by their exploration and observation of nature. These designs will then be realized through 3-D printing and will be realized in a proof-of-concept device.

Learning Outcomes: 1. Differentiate among general multi-physics engineering principles. 2. Design 3D structures creatively, using nature inspiration, art, and engineering software. 3. Evaluate 3D structures from the aesthetic and engineering perspective. 4. Fabricate sensors and other electrical devices, implementing nature-inspired structures. 5. Develop teamwork ethics, especially from diversified backgrounds. Credits: 3.00

MFET 34100 - Process And Continuous Control Applications

Credit Hours: 3.00. An examination of devices, algorithms, strategies, and standards used in smart manufacturing continuous process and control serves as the basis of this course. Concepts include Proportional, Integral, & Derivative Control (P&ID), loop modeling, transfer functions, PID design, implementation and tuning. Course laboratories focus on implementing and tuning systems using industry-grade hardware and devices.

Learning Outcomes: 1. Explain the importance of control systems in the management of a continuous process. 2. Apply fundamental control theory concepts and models to a process or continuous control scenario. 3. Document process control applications, using recognized standards and symbology. 4. Apply controller algorithms and tuning methods to refine the performance of control loops. 5. Determine appropriate control architecture and hardware for single and multiple loop systems. Credits: 3.00

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 34800 - Introduction To Robot Kinematics

Credit Hours: 3.00. This course introduces the fundamentals of robotics with an emphasis on solutions to the kinematics problems of serial robotic manipulators. It covers robot modeling and simulation, forward kinematics, inverse kinematics, analysis of robot motion and static forces, and trajectory planning.

Learning Outcomes: 1. Create the kinematics model of a robotic manipulator. 2. Solve forward and inverse kinematics problems of a robotic manipulator. 3. Analyze the motion and static forces of a robotic manipulator. 4. Plan trajectories of a robotic manipulator. Credits: 3.00

MFET 35000 - Smart Manufacturing Systems Modeling & Simulation

Credit Hours: 3.00. This course addresses application of industrial internet of things (IIoT) for modeling and simulation of smart manufacturing assets, processes, and operations. Emphasis is on synchronizing modeling/simulation with real-time data to develop innovative services, create efficiencies, and enable productivity improvement in smart factories.

Learning Outcomes: 1. Describe the

convergence of the physical and digital worlds, technology, and standards of IIoT-aided modeling and simulation. 2. Implement process data modeling and application to various types of plant data (drives, pumps, production lines) using real-time, historical, and event-based data. 3. Develop digital/virtual-cloud representation models to be mirrored onto physical manufacturing systems. 4. Create digital twin (DT) models using data from IIoT devices for monitoring and automating control of smart connected assets. 5. Construct DT-oriented simulation model for IoT-aided manufacturing system for applications in productivity, reliability, efficiency, and predictive maintenance operations. 6. Develop application of augmented reality and manufacturing model proxies in diagnostic and troubleshooting operations. Credits: 3.00

MFET 35100 - Mixed Reality Smart Manufacturing Applications & Design

Credit Hours: 3.00. The course investigates development strategies, use cases, and mixed reality (MR) application in industrial IoT (IIoT)-based smart manufacturing systems. Emphasis is on superimposing digital content onto physical systems, integrating data from smart and connected manufacturing production operations, processes, and machines.

Learning Outcomes: 1. Outline the benefits and applications of mixed reality (MR) offers in smart manufacturing environments. 2. Link the MR concepts, industrial IoT (IIoT) technologies, and development approaches with smart manufacturing applications. 3. Develop proficiency in using hardware, software tools and technologies to design and prototype effective MR applications for manufacturing. 4. Design and develop MR user interfaces and interaction techniques for augmented human-machine systems. Credits: 3.00

MFET 35200 - Smart Manufacturing Production Information Systems

Credit Hours: 3.00. An examination of smart manufacturing information systems with particular focus on applications for horizontal- and vertically-integrated manufacturing organizations. Topics include cloud-based integrated information systems to provide connectivity, visibility, and analytics of production and shop-floor execution systems and integrating manufacturing execution, manufacturing operations management, and enterprise resource planning (ERP) systems.

Learning Outcomes: 1. Apply ISA-95 standards for horizontal and vertically integrated smart manufacturing operations using Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and Enterprise Resource Planning (ERP) systems. 2. Apply cloud infrastructure and data concepts for storing, distributing, and accessing manufacturing enterprise data for planning, scheduling, management, and production control. 3. Implement real-time, batch, and streaming data processing techniques for visualization and analytics of production data. 4. Apply cloud-based Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and ERP for creating efficiency, optimization, and control of production operations. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

MFET 36300 - Intelligent Manufacturing Systems I

Credit Hours: 3.00. This course investigates how artificial intelligence, industrial IoT, and big data are used to enable predictive analytics with machine learning. Emphasis is on optimizing production processes, improving productivity, quality, efficiency, and integrating predictive maintenance applications in smart manufacturing operations.

Learning Outcomes: 1. Apply appropriate machine learning algorithms for improving and optimizing manufacturing operations. 2. Enable predictive analytics with machine learning for maintenance operations. 3. Evaluate manufacturing processes using machine learning. 4. Identify and solve manufacturing problems using machine learning and root cause analysis. 5. Describe how data- and knowledge-based systems are used in product and design lifecycles. Credits: 3.00

MFET 36400 - Intelligent Manufacturing Systems II

Credit Hours: 3.00. Artificial intelligence (AI), machine learning (ML), industrial IoT (IIoT), and big data are applied to enable predictive analytics with machine learning for optimizing processes and operations in a horizontally-integrated smart manufacturing value-chain network.

Learning Outcomes: 1. Integrate cloud platforms with industrial big data, advanced analytics, AI/ML, and IIoT in a horizontally integrated supply chain network. 2. Implement data, analytics, and machine learning to create insights and drive decision-making in a horizontally integrated value chain network. 3. Describe how intelligent systems are connected to physical assets via IIoT infrastructure to automate inventory, and asset management across a manufacturing value chain network. 4. Apply predictive modeling, analytics, and AI/ML techniques to optimize material management, production planning, scheduling, and supply operations across a manufacturing value chain network. Credits: 3.00

MFET 37100 - Introduction To Precision Machine Design

Credit Hours: 3.00. This is a multidisciplinary course focusing on engineering techniques that are employed to design and develop high-precision automation products equipped with precision mechanisms. Fine mechanisms and precision instruments will be used to illustrate the concepts and applications. Topics covered include design strategy, high-precision mechanical components, sensors and measurement, servo control, design for controllability, control software development, controller hardware as well as automated error detection and recovery.

Learning Outcomes: 1. Utilize principles of precision machine and mechanism design for smart and precision machinery. 2. Design electromechanical components and systems using multidisciplinary techniques. 3. Design smart machinery with sensing, transmission, actuation technologies, and machine control strategies. 4. Perform product value analysis and product life performance analysis of precision machines. Credits: 3.00

MFET 37400 - Manufacturing Integration I

Credit Hours: 3.00. The fundamentals of data communications and local area networks are taught in order to show students how to integrate modern manufacturing systems. Emphasis is on the various levels of communications between shop floor computers, PLCs, robots, and automatic identification equipment. Database technology is used as an integration tool. This course prepares students for the MFET capstone course.

Learning Outcomes: 1. Achieve communications between various types of controls and devices. 2. Interface various peripheral manufacturing devices using networking and serial communications. Credits: 3.00

MFET 39200 - Advanced Projects In Automation, Robotics, And Mechatronics

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Course is for supervised project development, subject to MFET curriculum subcommittee approval. Intended for upper division students. Instructor of permission required.

Learning Outcomes: 1. Successfully complete a project of limited scope. 2. Document and manage a project using accepted project management principles. 3. Demonstrate effective oral and written communication skills. Credits: 1.00 to 3.00

MFET 39500 - Smart Manufacturing Enterprise

Organization And Operations

Credit Hours: 3.00. This course provides an introduction and overview of dealing with organizational change management needed to address existing cultures within organizations dealing with the digital transformation required to implement a Smart Manufacturing Enterprise. It introduces students to the cultural and organizational barriers that exist and the theories, tools, and best practices used to overcome them.

Learning Outcomes: 1. Summarize the barriers to organizational change management. 2. Describe the tools, techniques and theories that are employed to overcome organizational and cultural barriers within and organization. 3. Describe the impact that AI will have on the workforce and SMART manufacturing. 4. Provide examples of the drivers, enablers and compelling forces for Industry 4.0's advancement. 5. Define the Industry 4.0 framework and be able to outline the various systems used and their role in SMART Manufacturing organizations. 6. Illustrate the role and importance of IT+OT, Cyber Physical Systems, analytics, and BIG Data driving decisions in SMART manufacturing organizations. 7. Identify the integration points of Machine-, Factory, and Enterprise-level activities using MES, FEMS, ERP, QMS, & PLM for connecting people, process, and machines across the manufacturing value chain. Credits: 3.00

MFET 41000 - Introduction To Additive Manufacturing

Credit Hours: 3.00. This course covers topics in additive manufacturing (AM) technologies. Topics include the AM benefits and drawbacks of additive as compared to subtractive manufacturing, additive manufacturing process and material selection, design for additive manufacturing, support structure generation, printing process planning, and quality control techniques, such as monitoring, inspection, and surface modification.

Learning Outcomes: 1. Describe the concepts, benefits, and application of additive manufacturing. 2. Select appropriate additive manufacturing processes and material for producing parts. 3. Design 3D objects for additive manufacturing considering the process requirements. 4. Develop strategies and practices incorporating appropriate quality control techniques. Credits: 3.00

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3. Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

MFET 44100 - Robotics and IoT Seminar

Credit Hours: 0.00 or 1.00. The Robotics Seminar is a series of lectures from eminent local, national and international researchers in the field of robotics and the internet of things (IoT) and related areas, such as computer vision, autonomy, cyber-physical systems, wearables, etc.

Learning Outcomes: 1. Conduct a search of published papers, articles and materials on the web of relevance to a seminar topic. 2. Analyze a presentation in the context of prior published papers and materials on the web. 3. Evaluate the claims of a presentation with respect to researched material. Credits: 0.00 or 1.00

MFET 44200 - Programming Robots With ROS

Credit Hours: 3.00. Robot Operating Systems (ROS) will be used as a programming platform to explore the topics of

computer vision, SLAM (Simultaneous Localization and Mapping), path planning, grasping, and social interaction in robotic systems, as well as programming large systems for physical interaction with the world. Self-contained implementation projects are core to the class. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of matrices is assumed.

Learning Outcomes: 1. Apply software versioning techniques to the programming of large software projects with hardware in-the-loop. 2. Build ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 3. Apply basic software engineering techniques to designing and documenting software. 4. Apply and evaluate computer vision techniques based on templates to track objects in 2-D. 5. Synthesize 3-D computer vision techniques for 3-D sensors from 2-D algorithms. 6. Analyze and evaluate hardware sensors with respect to specific software task needs. 7. Apply SLAM methods to real-world scenes to interpret the world on real hardware in real-time. 8. Analyze execution times and evaluate trade-offs in computational hardware performance with respect to sensor data throughput. 9. Implement feedback controllers and tune for specific hardware characteristics. 10. Apply manual path planning techniques to 2-D and 3-D maps extracted from SLAM algorithms. 11. Apply automatic path planning tools and software to 2-D and 3-D maps extracted from SLAM algorithms. Credits: 3.00

MFET 47100 - Electric Machines

Credit Hours: 3.00. This course provides a comprehensive introduction to electrical machines fundamentals, three-phase circuits, electromagnetic principles, AC and DC motors, transformers, magnetism in motors, energy conversion in electric machines as well as their industrial and commercial applications.

Learning Outcomes: 1. Utilize working principles of electric machinery for design and performance analysis. 2. Master application of three-phase circuits, transformers, electromagnetic field analysis, electrical/mechanical energy conversion and efficiency, and interaction between motors and power systems. 3. Develop teamwork and problem-solving skills through electric machine projects. 4. Select and integrate electric machines in multidisciplinary systems. Credits: 3.00

MFET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 48002 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 48003 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and

develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 48004 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 48005 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 49000 - Special Topics In Manufacturing Engineering Technology

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of Manufacturing Engineering Technology is provided by Technology faculty, subject to MFET curriculum subcommittee approval.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

MFET 49900 - Manufacturing Engineering Technology Independent Project

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by instructor and approved by MFET curriculum committee. Primarily for seventh- and eighth-semester students with special interests. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

MFET 51400 - Product Lifecycle Management

Credit Hours: 3.00. A survey of the graphical knowledge base with business and industry applications that support the product lifecycle management process is presented. Graphical applications used in the development of a product from an initial concept through its disposal are covered. Current and past application topics are reviewed in both theoretical and technological aspects and are validated through applied research. Emphasis is placed on the interdisciplinary nature of product lifecycle management through industrial case studies.

Learning Outcomes: 1. Develop fluency and awareness of the elements of product lifecycle management in the contemporary sense. 2. Describe the basic elements of a PLM environment. 3. Identify organizational barriers to implementing PLM. 4. Describe the various roles in the organization and their relationship to PLM. 5. Describe the concept of the Digital Thread and how it relates to product lifecycle management. 6. Identify potential organizational impacts of PLM. 7. Work within a team to design and deploy a product data management solution that supports PLM and the Digital Thread. 8. Complete a research/white paper targeted at an industry or academic conference and/or publication covering the efforts of the project undertaken during the semester. Credits: 3.00

MFET 51700 - Product Development Using Virtual Environments

Credit Hours: 3.00. This course presents the concepts of

product development using virtual reality and haptic devices in the development and manufacture of products. Students learn how this technology is currently being used in industry and anticipated technological advancements. Some of the major topic areas covered are: virtual reality technologies, product design and development processes, virtual environments and virtual prototyping, 3D modeling, design analysis and visualization, simulation visualization, multimodal user interface in virtual environments, and real-world applications of product development. Knowledge of 3D computer graphics fundamentals.

Learning Outcomes: 1. Understand the theory of engineering and product design for virtual environments. 2. Apply the principles of engineering and design in developing 3D models for virtual space. 3. Apply current VR and engineering CAD tools to product development and display scenarios. 4. Describe challenges and issues regarding 3D engineering design in virtual space. Credits: 3.00

MFET 52400 - Model-Based Definition In The Digital Enterprise

Credit Hours: 3.00. This course will explore Model-based definition (MBD), an emerging industry technique that uses 3D CAD models with annotations to communicate information between people and equipment instead of using drawings. This technique results in reduced variability during data translation, more accurate product definition information and wider dissemination of product data through an increasingly digital corporate enterprise.

Learning Outcomes: 1. Understand how MBD is beneficial to the modern manufacturing environment of organizations, along with the use of PLM tools and methods. 2. Author Product Manufacturing Information (PMI) in the selected CAD system. 3. Understand the challenges and opportunities where MBD data can be re-used throughout the lifecycle of the product. Credits: 3.00

MFET 53400 - Technical Documentation In The Digital Enterprise

Credit Hours: 3.00. This course will explore the different ways technical documentation manifests itself within the enterprise to support the digital thread. We will use various industry applications to create and modify technical documentation and explore the processes and applications that facilitate the creation, storage, and configuration of technical documentation.

Learning Outcomes: 1. Provide a history of the evolution of Technical Documentation. 2. Provide an overview and background of the emerging use of Technical Documentation in the context of the Digital Enterprise. 3. Explain and demonstrate how to generate various forms of Technical Documentation for manufacturing. 4. Expose students to the opportunities and uses of Technical Documentation throughout the supply chain. Credits: 3.00

MFET 55700 - Smart Manufacturing Enterprise: Exploring The Applied Technologies

Credit Hours: 3.00. The core foundations of digital transformation in manufacturing for making all things digital, making all things smart, and making all things connected to drive business value.

Learning Outcomes: 1. Analyze how the nine enabling technologies of Industry 4.0 is transforming the manufacturing industry. 2. Demonstrate understanding of the socio-economic impact of Industrial IoT and cyber-physical manufacturing systems will have on human workforce and the manufacturing industry alike. 3. Demonstrate how digital and data assisted systems in manufacturing is used for decision making and augmenting human capabilities in manufacturing. 4. Analyze how information is acquired, exchanged, managed, and leveraged across manufacturing value chain. Credits: 3.00

MFET 55800 - Smart Manufacturing & Global Supply Chain

Credit Hours: 3.00. Progressive manufacturing uses innovative technology to improve products or processes through the Internet of Things. Smart manufacturing is not limited to emerging technologies; rather, it is composed of efficient, productive, highly integrated, tightly controlled processes across a spectrum of globally competitive U.S. manufacturers and suppliers, including the facilities themselves. The course will examine the selection, characteristics, and optimization of materials, processes, big data, cloud analysis of design data, control and adaptive theories, and personnel in a production environment. Examining global manufacturing issues through a variety of business examples, you will study the framework that explains the characteristics and challenges surrounding global supply chain management and investigate the impact on

suppliers, manufacturers, and customers.

Learning Outcomes: 1. Evaluate and design automation and control strategies in manufacturing operations. 2. Assess data collection, analysis, and sharing attributes of manufacturing systems and subsystems. 3. Plan and apply strategies for managing data from multiple sources. 4. Analyze and appraise variables significant for global supply chain management. Credits: 3.00

MFET 63400 - Automation Of Digital Product Development Processes

Credit Hours: 3.00. This course introduces students to advanced computer programming techniques in the context of Computer-Aided Design and Manufacturing by focusing on automation and customization procedures of 3D solid modeling, design, and management tasks. The course emphasizes problem-solving skills and creative thinking by developing solutions to manipulate CAD applications, files and PDM systems programmatically. By the end of the semester, students should be able to identify characteristics and common patterns in tasks that lend themselves to automation and select and evaluate the most appropriate mechanisms to implement different levels of automation. Pre-Requisite: CGT 52000 or equivalent.

Learning Outcomes: 1. Demonstrate expertise in manipulating CAD applications and files programmatically. 2. Analyze how CAD systems can be customized to suit unique purposes. 3. Devise algorithms to automate design work and speed CAD/CAM processes. 4. Develop functionality that expands and builds on the capabilities of CAD software. 5. Create complete applications for engineering and design both inside and outside the CAD environment. 6. Improve productivity by reducing the time required to perform repetitive tasks. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

Materials Engineering

MSE 19000 - Introduction To Materials Engineering

Credit Hours: 1.00. An introduction to materials science and engineering. Emphasis on the "processing, structure, properties, performance" relationships that lead to the development of materials for society's needs. Examples drawn from the major materials classes.

Learning Outcomes: 1. Recognize and give examples of the "processing, structure, properties, performance" relationships for the major materials classes. Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning

outcomes. Credits: 3.00

MSE 23500 - Second Year Materials Engineering Laboratory

Credit Hours: 3.00. Laboratory experiments using standard equipment to measure material properties, characterize material structure and composition, and explore processing methods to form functional shapes, and modify properties of the formed shapes. Experiments are carried out with metal, ceramic, and polymeric materials to illustrate property-structure-processing relationships.

Learning Outcomes: 1. Identify and properly utilize primary sources and online databases to find information about material structures, properties, and processing techniques. 2. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 3. Apply characterization techniques appropriate for the class of material analyzed. 4. Assess validity of experimental data and recognize experimental factors affecting data. 5. Accurately and clearly report engineering data using figures, graphs, and tables and proper statistical methods. 6. Display effective written communication in technical reports. Credits: 3.00

MSE 25000 - Physical Properties In Engineering Systems

Credit Hours: 3.00. Class connects math, science and engineering practice and applications. Presents foundational aspects of engineering problem solving, use of computer math tools for engineering problem solving, basic engineering statics, dynamics and mechanics, group problem solving approaches, and introductory aspects of design and materials selection.

Credits: 3.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics;

Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

MSE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 33000 - Processing And Properties Of Materials

Credit Hours: 3.00. An introduction to the relationships between the processing of materials and their properties. Heat treating, forming, casting, consolidation, and other more material-specific manufacturing processes. Elucidation of the role of phenomena such as heat flow, mass diffusion, nucleation, interfacial tension, elastic and plastic deformation, precipitation, grain growth.

Credits: 3.00

MSE 33500 - Materials Characterization Laboratory

Credit Hours: 3.00. The principles of analytical methods for characterization of materials for structure and composition; optical microscopy, scanning electron microscopy, X-ray spectroscopy and diffraction, atomic absorption, emission spectroscopy, and mass spectrometry. Laboratory experiments in X-ray spectroscopy, X-ray diffraction, optical microscopy, and scanning electron microscopy.

Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and

momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

MSE 36700 - Materials Processing Laboratory

Credit Hours: 3.00. This laboratory is intended as an intensive experience in processing techniques used for ceramics, metals, and polymers. Sintering of a ceramic, casting and post-processing (work hardening, heat treatment, etc.) of a metal, and preparation and extrusion of a polymer are the suggested processes. The measurements (e.g., powder size, compaction force, temperature, grain size, molecular weight) applicable to the successful processing of the material and the final properties (e.g., hardness, ductility, strength, stiffness) will be emphasized.

Learning Outcomes: 1. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 2. Demonstrate effective written communication in lab reports. 3. Demonstrate effective oral communication in final project presentation. 4. Characterize the physical mechanisms that underlie the basic interactions between macroscopic shaping processes and microstructure development for the core bulk processing routes of each of the main classes of materials and how they relate to properties. 5. Assess validity of experimental data and recognize experimental factors affecting data. 6. Identify specific processing capabilities and limitations for the main classes of materials.

Credits: 3.00

MSE 37000 - Electrical, Optical, And Magnetic Properties Of Materials

Credit Hours: 3.00. An introductory course to provide basic background on the behavior of materials; electronic band structure, electronic and ionic conduction, electronic processes in semiconductors, dielectric, optical, and magnetic properties, and superconductivity; emphasis is on the relation between the properties and the structural aspects of materials.

Credits: 3.00

MSE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain practice with qualified employers within industry, government, or small business. Permission of Department required.

Credits: 0.00

MSE 38200 - Mechanical Response Of Materials

Credit Hours: 3.00. This course encompasses deformation-based microscopic mechanisms, including dislocation motion, diffusion, and viscoplasticity. Macroscopic mechanical response of metals, ceramics, polymers, and composites will be related to elasticity and plasticity concepts for single crystal, polycrystalline, and amorphous materials. Practical design considerations for deformation will be included as well as an introduction to fracture mechanisms.

Learning Outcomes: 1. Conversant with conventional nomenclature, units and notation of mechanical behavior. Examples: Stress, strain, yield strength, fracture strength; yield criteria, flow rules, creep, fracture. 2. Estimate relative ranges and values for important properties of common engineering materials. Examples: Young's modulus at room temperature for steels versus most polymers; yield strength ranges for ductile metals. 3. Recognize mechanisms for important mechanical behaviors. Examples: Plastic deformation by dislocation glide; plastic deformation by molecular rearrangement; dilatant deformation processes; strengthening mechanisms in crystalline solids. 4. Predict mechanical responses based on given information. Examples: Will yielding occur given a stress state and properties? Will fracture occur given a stress state and properties? How will the material change shape for the applied deformation? Which slip system(s) will be operative? 5. Explain the fundamental basis for important deformation mechanisms or processes. Examples: Dislocation glide, cross-slip, dislocation climb, precipitation strengthening; molecular orientation; Nabarro-Herring creep; plane strain fracture. 6. Apply the mechanisms of deformation to component design or alloy design. Credits: 3.00

MSE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain practice with qualified employers within industry, government, or small business. Permission of Department required.

Credits: 0.00

MSE 38399 - Professional Practice Co-Op III
Credit Hours: 0.00. To obtain practice with qualified employers within industry, government, or small business. Permission of Department required.

Credits: 0.00

MSE 39000 - Materials Engineering Seminar
Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MSE 39399 - Cooperative Experience III
Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39499 - Extensive Cooperative Experience IV
Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39599 - Extensive Cooperative Experience V
Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39699 - Professional Practice Internship
Credit Hours: 0.00. Professional experience in Materials Engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Develop the ability to function on multi-disciplinary teams and receive the broad education necessary to understand the impact of engineering solutions in global, economics, environmental and societal context. Credits: 0.00

MSE 42000 - Structure And Properties Of Organic Materials
Credit Hours: 3.00. This course presents information on the chemical and physical structure and basic material properties of organic materials, including synthetic plastics and specialty polymers and surfactants as well as select natural materials (e.g., proteins, carbohydrates, lipids). Fundamental concepts from organic chemistry will be presented along with descriptions of how the chemical and physical structures of organic molecules directly impact the properties of bulk materials over multiple length scales, from the molecular-level to the macroscale. This course will prepare students to be successful in higher-level polymer and soft material elective courses in materials engineering.

Learning Outcomes: 1. Describe atomic-scale bonding and identify common hydrocarbon units in organic molecules and describe common organic reactions involving those units. 2. Select the appropriate characterization techniques for chemical structures, physical structures, and bulk material properties and interpret basic data from selected techniques. 3. Explain how macromolecules are synthesized and outline the most common synthesis reactions. 4. Distinguish between chemical and physical structures or organic materials and classify

different structures into appropriate material length scales. 5. Explain important structure-property relationships over multiple length scales. Credits: 3.00

MSE 43000 - Materials Processing And Design I

Credit Hours: 3.00. Experience in the initiation and execution of a specific materials project or study involving research, processing, and design; a written proposal on the project prepared by the student under the supervision of an individual faculty member; oral progress report at the end of the semester.

Learning Outcomes: 1. Ability to apply knowledge of mathematics, science, & engineering to problems in materials engineering. 2. Ability to exhibit effective oral and written communication skills. 3. Recognition of the need for, and an ability to engage in life-long learning. 4. A knowledge of contemporary issues, particularly as they relate to materials engineering. Credits: 3.00

MSE 44000 - Materials Processing And Design II

Credit Hours: 3.00. Continuation and completion of the materials project or study initiated in MSE 43000 and presentation of a written dissertation on the results and conclusions. Competence in technical writing is emphasized in the preparation of the dissertation.

Learning Outcomes: 1. Exhibit effective oral and written communication. 2. Become aware of the complexity of working in teams to achieve goals, including issues related to the importance of individual ownership of project assignments, communication, leadership roles, establishing goals, and recognizing a diversity of talents among group members. 3. Have a basic understanding of different ethical systems, including legal positivism, ethical egoism, utilitarianism, deontological, etc. 4. Understand consequences of unethical behavior in the profession. 5. Understand and apply the basic tools of engineering design. 6. Draw simple logic diagrams that relate the important precedent relationships for tasks required to complete an engineering program. 7. Develop and learn necessary modelling, processing and characterization tools needed to successfully execute the project. 8. Use statistical analysis to infer conclusions from experiments. Credits: 3.00

MSE 44500 - Materials Engineering Systems Analysis And Design

Credit Hours: 3.00. Integration of materials engineering core coursework with statistical, economic and environmental considerations for analysis and design of systems. Analysis of primary materials processing operations using mathematical and statistical models for predicting interactive effects and process optimization. Specification of materials and processes for mechanical designs, incorporating properties assessment and tradeoffs, cost analysis, and performance optimization with multiple constraints.

Learning Outcomes: 1. Translate performance attributes in a given design to the corresponding nominal material properties. 2. Derive and apply material indices to materials selection for single- and multi-objective designs using the CES materials database and software tools. 3. Specify manufacturing processes for a given component design (material, shape, production rate) using basic cost modeling. 4. Apply a computational model for simulating a materials production and/or processing operation. 5. Quantify material properties, processing and performance variability using statistical methods. Examples: error analysis, probability distributions, sampling theory, statistic intervals and statistical process control charts. 6. Perform basic calculations for engineering cost analysis and use those results to make choices among trade-offs in product design or process operation. 7. Locate and evaluate design information for specific materials and processes. Examples: testing standards, processing specifications, commercial data and patents. 8. Apply quantitative trade-off strategies in selection of materials for designs with conflicting objectives. 9. Apply computational models for materials production and/or processing operations to predict interactive effects of inputs on material quality,

production rates, cost minimization, and environmental impact. 10. Optimize material and process selection simultaneously, based on refined functional relationships between processing, properties and costs. Credits: 3.00

MSE 48900 - Ethics In Engineering Practice

Credit Hours: 3.00. Presentation and discussion of common ethical theories, including ethical egoism, legal positivism, utilitarianism, duties and rights, and virtue ethics. Application of these theories to the practice of engineering, including professionalism, codes of ethics, trust and loyalty, confidentiality, whistle blowing, respect for legitimate authority, risk and reliability, and fraud. Examples of application of ethical theory and case studies drawn from across the engineering profession and include discussion of the interrelated technical and ethical issues.

Learning Outcomes: 1. Identify and discuss common ethical theories. 2. Describe how these theories apply these theories to the practice of engineering. 3. Analyze case studies of failures of engineering products and organizations.

Credits: 3.00

MSE 49000 - Directed Studies In Materials Engineering

Credit Hours: 1.00 to 3.00. Supplementary individual instruction for students from other engineering schools enrolled in 30000-50000 level MSE courses. Permission of instructor required.

Credits: 1.00 to 3.00

MSE 49700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 49900 - Research In Materials Engineering

Credit Hours: 0.00 to 18.00. Available upon prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 50200 - Defects In Solids

Credit Hours: 3.00. Structures and interactions of point, line, and planar defects in solids, with emphasis on properties of defects. Generic basis of defect energies and interactions, with reference to specific materials and material classes as examples. Types of point defects found in crystals, their origins, interactions, and motion. Overview of dislocation theory and point-defect/dislocation interactions. Structural aspects of surfaces and interfaces, including point and line defect interactions.

Credits: 3.00

MSE 50800 - Phase Transformations In Solids

Credit Hours: 3.00. Description of stress effects on transforming systems. Development of classical models for nucleation and growth and spinodal decomposition. Application of models to discontinuous precipitation, bainite formation, and martensitic transformations.

Credits: 3.00

MSE 51000 - Microstructural Characterization Techniques

Credit Hours: 3.00. A broad variety of analytical tools will be presented. The intent is to allow the student to make an educated selection of characterization techniques, or critical analysis of published data, for materials and defect analysis. The techniques will be assessed in terms of the probe type and material response, of what device and specimen requirements are typical, and of what data can or cannot be derived from each type of analysis.

Credits: 3.00

MSE 51200 - Powder Processing

Credit Hours: 3.00. Processing of engineering materials from powders. Synthesis of metals, ceramics, and polymers in powder form. Characteristics of particulates. Behavior of collections of particles; surface forces, particle agglomeration and dispersion, gelation, particle packing. Consolidation of powders; mechanics of dry flow and compaction, slurry rheology, shaping processes. Densification and microstructural development; geometry, thermodynamics, and kinetics of sintering, liquid-phase sintering, reaction densification, infiltration. Powder processing of composites.

Learning Outcomes: 1. Describe a powder fabrication process from starting reagent to finished powder. interpret a particle size distribution and estimate mean particle size and specific surface area from the data. 2. Review an ASTM standard for particulate materials characterization. 3. Describe the role of van der Waals interactions in determining structure on the colloidal and macroscopic length scales. 4. Differentiate between processing routes more favorable for processing bulk materials versus routes geared towards processing thin films. 5. Describe when it is appropriate to process dry powders versus processing powders suspended in a liquid medium. 6. Calculate the packing density of bimodal particle size distributions and describe the difference between calculated values and what one might expect to observe in

experimental measurements. 7. Describe the effects of particle agglomeration on interparticle forces and the packing density of powder compacts. 8. Calculate the particle size at which gravitational segregation becomes significant during aqueous colloidal processing. 9. Describe how segregation effects may be minimized during aqueous colloidal processing and any advantages and disadvantages associated with the modified process. 10. Describe the effects of interparticle forces on powder compact homogeneity and subsequent effects on compact densification. 11. Describe the effects of furnace atmosphere on the density, the specific surface area, and the microstructure of a powder compact. Credits: 3.00

MSE 51700 - Materials For Hypersonics

Credit Hours: 3.00. This course will include a brief history of hypersonic flight and design, along with a description of the aerothermal environment, to provide motivation for the use of ceramic materials as thermal protection systems and window materials. The classroom approach is to develop a fundamental understanding of materials structure, forming and sintering, and properties (mechanical and thermal) of ceramics, and then apply that knowledge for hypersonic applications such as ultra-high temperature ceramics (UHTCs including ZrB2), ceramic matrix composites (including Cf/SiC, SiCf/SiC, and Carbon/Carbon), and materials requirements for RF and IR radomes and windows. Permission of instructor required.

Learning Outcomes: 1. Become familiar with the aerothermal environment expected during hypersonic flight. 2. Learn how to process high-temperature ceramic materials, from colloidal design to forming methods such as additive manufacturing. 3. Understand flexure testing and Weibull statistics interpretation of ceramic materials. 4. Know how bonding and microstructure affect thermal properties. 5. Understand the basic material requirements for radar frequency and infrared frequency windows for hypersonic flight. 6. Articulate the assumptions of various thermodynamic models used to estimate heat flux and surface temperatures during hypersonic flight. 7. Differentiate the advantages and disadvantages of different additive manufacturing techniques used for ceramics. 8. Calculate sample strengths for different-sized flexure specimens. 9. Make assessments of the thermal shock resistance of materials based on mechanical and thermal properties. 10. Calculate the thicknesses of random materials based on the frequency of interest for different RF window concepts. Credits: 3.00

MSE 51800 - Failure Analysis

Credit Hours: 3.00. Introduction to failure analysis and prevention. Concepts of materials failure, root cause analysis, manufacturing aspects of failure, techniques for identifying failure, fracture, corrosion, wear, and case studies. Also includes business and entrepreneurship aspects.

Learning Outcomes: 1. Become familiar with and be able to identify the categories of failure. 2. Recognize types of failure based on microstructural and post-mortem characterization 3. Relate failure to stressors driving failure (mechanical, thermal, electrical, etc.) 4. Communicate results of a failure analysis clearly to professional audiences 5. Estimate stressors driving failure in relationship to materials properties, service conditions, and design constraints. 6. Use or select appropriate characterization tools for failure analysis. 7. Select appropriate inspection criteria to prevent failure. 8. Recommend improvements in design, service or inspection to prevent failure. Credits: 3.00

MSE 52000 - Steel And Aluminum Alloys: Processing, Structure And Properties

Credit Hours: 3.00. Steel and aluminum alloy processing will be studied to provide fundamental understanding of how the final properties are influenced by processing from the extraction of metal from ore, through shaping by casting, hot-working and cold-working, and heat treatment for control of microstructure. This understanding will enable the student to go beyond comparisons of standard handbook values and recognize the fundamental metallurgical phenomena leading to differences in performance among the main alloy classifications. By examining the relationships among processing, microstructure, and properties, the course will provide the "know-how" for specifying,

designing, and manufacturing with steels and aluminum alloys.

Learning Outcomes: 1. Describe current practice of steel and aluminum production in terms of the thermochemical unit processes. 2. Understand the differences between the main classes of commercial metal shaping processes and their intrinsic effects on microstructure. 3. Relate alloy microstructure to properties as measured in standard mechanical testing. 4. Interpret standards and specifications for processing and properties of different steel and aluminum alloy classifications. 5. Identify processing defects and predict their effect on material performance. 6. Specify alloy and processing route to achieve desired properties sets for particular applications. 7. Explain properties variability in terms commercial practice constraints. 8. Analyze critically the state of research on a particular current topic in steel or aluminum metallurgy. Credits: 3.00

MSE 52300 - Physical Ceramics

Credit Hours: 3.00. Physical and chemical processes responsible for microstructure development in modern ceramic materials, and the relationship between microstructures and physical properties. The material covered is divided into three parts: solid state processes, including structural defects, diffusion, sintering and grain growth, reaction rates, nucleation and growth, and microstructure development; mechanical and thermal behavior, including deformation, strength, thermal properties, and thermal and compositional stresses; and electrical and magnetic behavior, including electrical conductivity, dielectric properties, and magnetic properties. Offered in alternate years.

Credits: 3.00

MSE 52400 - Mechanical Behavior Of Polymers

Credit Hours: 3.00. This course will focus on the mechanical properties and behaviors of polymeric materials. The course will utilize fundamental solid and fluid mechanics to understand the response of bulk polymers (solid and liquid, above and below T_g). The impact of deformation rate and temperature on the mechanical response of polymers will be covered in detail. The course will start with an overview of linear elastic mechanics, move to rubber elasticity, and then viscoelasticity (concentrating on time-temperature superposition). We will also cover fluid dynamics and the rheology of non-Newtonian fluids. We will conclude with a section on deformation, yield, and fracture mechanisms (focusing on those phenomena that are unique to polymers such as rubber cavitation, drawing, and crazing).

Learning Outcomes: 1. Demonstrate fundamental understanding of solid mechanics: draw a free body diagram and employ the correct equations of state to solve two- and three-dimensional statics and solids problems. 2. Articulate in rubber elasticity. 3. Utilize time-temperature superposition to generate a master curve to fully describe the mechanical response of a viscoelastic material. Apply "spring and dashpot" models to describe nonlinear materials responses. 4. Describe a rheology experiment of a non-Newtonian fluid: interpret and analyze raw rheology data, identify key phase transitions. 5. Solve simple fracture mechanics problems. 6. Demonstrate an understanding of polymer deformation mechanisms. 7. Apply polymer yield criteria to predict failure resulting from a given loading scenario. Credits: 3.00

MSE 52500 - Struct-Property Relationships Of Engineering Polymers

Credit Hours: 3.00. Structure-property relationships developed for commodity and engineering resins. Focus on connecting bonding and polymer structure (i.e., molecular weight, tacticity, crystallinity as it regards spherulites) to mechanical (yield phenomena and fracture) and thermomechanical behavior (viscoelasticity). Thermal characterization techniques, including DSC, TGA, TMA, and DMTA. Flow of polymer melts related to common melt processing techniques (i.e., extrusion and injection molding). Offered in alternate years.

Learning Outcomes: 1. Identify microstructural differences between thermoplastic, thermosetting, and elastomeric polymers and how these affect thermal and mechanical properties. 2. Discuss the crystalline structures of thermoplastic polymers, including nucleation and growth of spherulitic structures and how molecular weight, tacticity, and cooling rate affect the morphology of the crystals. 3. Discuss entropy elasticity as it relates to elastomeric behavior. 4. Compare and contrast the yield and fracture behavior of polymers with metallic and ceramics materials. 5. Explain viscoelasticity from a microstructural viewpoint, and its manifestations in polymeric mechanical

behavior, including mathematical modeling of creep and stress relaxation behaviors of simple and complex systems. 6. Interpret the results from common thermal characterization (TGA, DSC, DMA) techniques and relate them to polymer structure. 7. Discuss polymer melt-processing techniques of extrusion and injection molding, and how polymer chain morphology affects processing. Credits: 3.00

MSE 52700 - Introduction To Biomaterials

Credit Hours: 3.00. This course aims to introduce students to Biomaterials concepts: structure, properties, and applications. The class will cover the main classes of materials: metals, ceramics and polymers in the context of their use in medicine as implant materials, drug delivery vehicles, and as tissue engineering scaffolds. Permission of instructor required.

Learning Outcomes: 1. Be familiar with the main concepts of Biomaterials principles: biocompatibility, structure-property-applications relationships, mechanical response of natural tissues, cellular pathways for tissue-material ingrowth. 2. Understand the requirements for metals and alloys, as well as ceramic materials to be used in load bearing implants (corrosion concepts, stress shielding, mechanical properties, composition). 3. Understand what properties of polymers impact their use in medicine (leaching and swelling, creep and stress relaxation). 4. Understand the tissue response to biomaterials: cytotoxicity, carcinogenicity, immune reactions. 5. Be able to expand the understanding of materials concepts to drug delivery applications (polymer degradation, encapsulation) and tissue engineering (scaffold porosity, diffusion of nutrients, mechanical properties). Credits: 3.00

MSE 53000 - Materials Processing In Manufacturing

Credit Hours: 3.00. Examination of the production/synthesis of engineering materials and the subsequent processing steps required to obtain a desired shape and microstructure. The course covers four major categories of materials processing: primary processing or materials synthesis, solidification processing, deformation processing, and powder processing, and provides specific examples from the processing of polymers, metals, and ceramics. The goal is to connect fundamental principles of materials processing to manufacturing processes. Credit will not be given for both MSE 5300 and MSE 36700 .

Credits: 3.00

MSE 53100 - Quantitative Analysis Of Microstructure

Credit Hours: 3.00. A review will be presented of basic probability theory and statistical analysis, with particular emphasis on terms and definitions of a microstructure. The properties accessible to quantification, the basic stereological relationships and the mathematical foundations, and the microstructural tools needed to quantify the structure will be emphasized. The last one-third of the course will cover applications of quantitative metallography to problems in failure analysis, solidification, heat treatment, phase equilibria, and deformation behavior. Offered in alternate years.

Credits: 3.00

MSE 53500 - Lean Manufacturing Of Materials

Credit Hours: 3.00. This course provides perspectives on materials processing and product innovation with an economic lens on efficiency and elimination of waste. It includes an historical perspective of manufacturing via the transition from mass to lean production in the automotive industry; and extends manufacturing and product development in context of emerging trends in automation (e.g., control and PAT, I4.0), modular design, supply chain, and sustainability. The class covers lean tools, focusing on value stream analyses and optimization using simulations. As an elective, the course accommodates a range of student interest profiles. It includes both individual and interest-based group assignments. The mix of students adds to the effectiveness of group exercises. A term paper enables individuals to do a deeper dive into specific interests. Overall, the course has shown to be adaptable over a broad range of students representing a variety of departments and professional backgrounds.

Learning Outcomes: 1. Understand the distinction between Mass Production and Lean Manufacturing and to analyze a facility's progress in the transition from Mass to Lean. 2. Articulate a case for Lean. Students will be able to present an argument on why Lean is a superior environment to Mass. 3. Compare and contrast the culture, organizational structure and leadership in Mass and Lean environments. 4. List and describe the Types of Waste and why waste elimination is a core component of Lean Manufacturing. 5. List and describe lean functionality (i.e., quality, continuous flow, pull

systems, 5S, Visual Control, Task Planning, etc.). 6. Articulate why the "Rules in Use" were a breakthrough in understanding the Toyota Production System. 7. Develop a Value Stream Map of a manufacturing process, and explore optimization thereof using simulations and economic models, including options to mitigate changing conditions or uncertainty. 8. Understand A3 methodology and create an A3 proposal having economic justifications. 9. Understand the similarities and differences between Lean Manufacturing and Product Development. 10. Complete a Matrix exercise. An individual deep-dive survey of a specific interest selected by each student, and a group exercise to synthesize and present elements of individual surveys clustered by topical area. Credits: 3.00

MSE 53600 - Solidification Of Castings

Credit Hours: 3.00. A study of solidification of metal in molds involving the characteristics of liquid-solid phase transformations, sand and metal thermal behavior, macroscopic structures, mechanical properties, and casting defects.

Learning Outcomes: 1. Analyze and understand the heat flow in different casting processes and alloy effects. 2. Analyze and understand the thermodynamics of solid-liquid phase change and effects of pressure, capillarity, and chemistry. 3. Analyze and understand the kinetics of solidification including crystal nucleation, growth, and glass transition temperature. 4. Analyze and understand microstructural development during processing and the causes for morphological instability and dendritic growth. 5. Recognize effective gating and risering practice in metal casting and predict the microstructure and casting defects given an alloy and process. 6. Become familiar with the current solidification science and practices within the archival literature. Credits: 3.00

MSE 54700 - Introduction To Surface Science

Credit Hours: 3.00. Classical thermodynamics of surfaces: surface tension, surface excess properties, and surface segregation. Atomic structure of surfaces and surface reconstruction. Electronic structure of surfaces, surface states, and the electronic structure/properties of interfaces. Adsorption, surface diffusion, and clustering of adsorbates. Chemical reactions at surfaces. Offered in alternate years.

Credits: 3.00

MSE 54800 - Deposition Processing Of Thin Films And Coatings

Credit Hours: 3.00. Processing and microstructural development of thin films and layered structures. Includes vapor, liquid, and reactive processing, as well as layer modification by annealing and beam techniques. Offered in alternate years.

Learning Outcomes: 1. List the detailed sequence of steps required for CVD (or sputter or MBE) film deposition and quantify the parametric dependence of these steps. 2. Explain the process and film requirements for an epitaxial (or columnar or amorphous) film. 3. Discuss the differences between different evaporation processes. 4. Compare the advantages and disadvantages of techniques used to suppress reactivity (a) of the materials during deposition and (b) of the material with the substrate. 5. Explain the importance of materials and process parameters during laser annealing. 6. List material and process critical factors for specific films in at least three different functional classes of film applications. 7. Communicate in detail the importance, use, and production method of a particular functional film in a manner understandable by other students. 8. Explain the importance and critical issues involved in the following film deposition processes: CVD, PVD, Electrochemical, thermal spray, lithography. 9. Explain the broad issues involved in processing each different type of material class: metals, ceramics, polymers, semiconductors, composites, and functionally graded materials. Credits: 3.00

MSE 55000 - Properties Of Solids

Credit Hours: 3.00. Critical examination of fundamental concepts of physical properties of solids and the relation of these properties to thermal and mechanical treatments.

Approach is atomistic rather than electronic, and an emphasis is made to connect the fundamental knowledge of solid state physics to actual processing of materials and to a qualitative understanding of current research in the area of materials science. Offered in alternate years.

Credits: 3.00

MSE 55500 - Deformation Mechanisms In Crystalline Solids

Credit Hours: 3.00. Focuses on the mechanisms for deformation and fracture of metal, intermetallic, and ceramic materials, with particular emphasis on high temperature properties. The industrial success of superalloys, dispersion-strengthened alloys, stainless steels, composites, and thermal barrier coatings will serve as the basis for exploring the relationship between composition, microstructure, and component application in high temperature performance. Topics included are alloying effects on dislocation climb and glide, grain boundary and lattice diffusion, and dynamic recrystallization. The interactions between environment and thermal and mechanical cycling also will be considered. Design tools for prediction and evaluation of component life will be investigated in detail, including an exploration of deformation mechanism maps. Offered in alternate years.

Learning Outcomes: 1. Understand dislocation plasticity: nucleation, motion, multiplication and interactions of dislocations. 2. Understand diffusion-based creep and stress relaxation: time-dependent dislocation motion, dislocation climb, Nabarro-Herring Creep, Coble Creep, Harper-Dorn Creep. 3. Recognize mapping strategies for design using deformation mechanism maps. 4. Describe effects of processing and microstructure on deformation mechanisms. Credits: 3.00

MSE 55600 - Fracture Of Materials

Credit Hours: 3.00. The failure and fracture of materials under applied stress are the focal points of this course, with particular emphasis on the material characteristics that influence fracture. The initial subjects covered in this course will include introductions to linear elastic fracture mechanics (LEFM) and elastic plastic fracture mechanics (EPFM). Subsequently, the strength and toughness of metals, ceramics, and polymers will be explored with regard to processing property relationships and microstructure. Special topics will include fracture mechanism maps, Weibull statistics, toughening mechanisms, and failure analysis. This course is distinct from a course on fracture mechanics in that the fundamental materials aspects of fracture are of paramount importance. Offered in alternate years.

Learning Outcomes: 1. Recognize and understand the significance of stress concentration; fracture mode (I, II, III); process or plastic zone; plane strain fracture toughness, KIC; plane stress fracture; crack tip opening displacement, CTOD; J-Integral. 2. Recognize how the shear and dilatant character of a deformation process plays in role in fracture resistance. 3. Recognize how specimen geometry and size influences fracture toughness and strength compared to applications. 4. Be conversant in at least one research area related to fracture and failure. 5. Be able to critique experimental fracture data relative to models or mechanisms reported for those materials. 6. Understand how post-mortem analysis can be used to assess failed components. Credits: 3.00

MSE 55900 - Phase Equilibria In Multicomponent Systems

Credit Hours: 3.00. A detailed examination of the thermodynamics of phase equilibria in multicomponent systems, experimental methods of determining these equilibria by measurements of thermodynamic activity and graphical method of representing the equilibria. This is followed by an examination of theoretical models of the behavior of solutions and an examination of the extent to which observed phenomena can be understood and predicted in terms of the models. Offered in alternate years.

Credits: 3.00

MSE 56000 - The Production Of Inorganic Materials

Credit Hours: 3.00. Examination of the production of inorganic materials of engineering importance (metals, ceramics, and glasses) from ore concentrates, raw materials, and recycled materials. Individual stages in the extraction, refining, and syntheses processes are examined from the viewpoints of thermodynamics and kinetics, and alternative production routes are compared and contrasted. Topics covered include carbothermic and metallothermic reduction of oxide concentrates, smelting and conversion of sulfide mattes, electrolysis and electrowinning from aqueous solutions and molten salts, distillation and vacuum refining, glass-forming, and the synthesis of carbide and nitride ceramics. Offered in alternate years.

Credits: 3.00

MSE 56200 - Soft Materials

Credit Hours: 3.00. Soft materials are an important and diverse class of materials that share the common trait of being easily deformable by external stresses, electric or magnetic fields or

even thermal fluctuations. These materials are the foundation of important technologies that are used in everyday life including ceramic and pharmaceutical processing (tablet formation), cosmetics (hand creams), cleaning products, foods (milk, mayonnaise) and bio-technologies (drug delivery). The aim of this class is to gain a fundamental understanding of the physical and chemical underpinnings of common soft materials systems and how they are used to engineer technologically relevant materials and structures.

Learning Outcomes: 1. Analyze the applicability of research techniques based on concepts learned in class. 2. Perform calculations to quantify molecular and colloidal properties. 3. Determine the feasibility of a scientific/engineering idea using fundamental concepts and performing calculations. 4. Find the optimal conditions for the fabrication of soft materials. 5. Process images and/or data to characterize soft materials. Credits: 3.00

MSE 56700 - Polymer Synthesis

Credit Hours: 3.00. Analyze properties of polymers and correlate them to chemical structure. Apply methods and mechanisms of polymer chemistry to industrial and laboratory synthesis. Examine the kinetic and design factors that control polymer structures. Offered in alternate years.

Learning Outcomes: 1. Student will understand, predict and design polymer properties based on polymer structure and how and why certain reactions take place through mechanistic means. 2. Be able to produce a polymer structure based on known reactants and retrosynthetically design a chemical route to a variety of polymer structures. 3. Intuitively grasp the kinetic factors involved to predict such things as molecular weight, polydispersity, and others. 3. Understand polymer chemistry in relation to everyday materials and why industrial practice is as is. Credits: 3.00

MSE 56800 - Additive Manufacturing Of Materials

Credit Hours: 3.00. The course takes an MSE approach to additive manufacturing, integrating deposition processing, powder processing, and solidification processing principles in the full range of AM process configurations and kinematics. The overarching goal is to learn how microstructure development, and thus the resulting material properties, are controlled by the interaction of physical, chemical, thermal and mechanical phenomena in the shaping of materials by additive processing. All the main classes of materials and AM processes are covered. Additional objectives are to quantitatively analyze the capabilities and limitations of AM relative to established commercial shaping processes; and to critically analyze the AM research literature.

Learning Outcomes: dentify the generic elements of any additive manufacturing process. 2. Identify and understand the main unit materials process involved and be able to predict how processing parameter will change resulting material structure and properties. 3. Relate additive processing to characteristic microstructure features and defects. 4. Interpret standards and specifications for processing and properties produced by the different additive manufacturing processes. 5. Distinguish quantitatively between the different additive manufacturing processes in terms of their shaping capability compared to traditional bulk shaping processes. 6. Identify AM processing defects and their origins in particular processing parameters 7. Specify an optimum AM process for a particular material, component and service conditions. 8. Explain properties variability and anisotropy in AM products in terms of processing constraints. 9. Analyze critically the state of research on a particular current topic in additive manufacturing. Credits: 3.00

MSE 57000 - Introduction To Materials Modeling And Informatics

Credit Hours: 3.00. This course provides an introduction at the graduate level to theory and methods for simulating the structure and properties of materials. The course will provide a broad initial overview of many atomistic modeling techniques, followed by a detailed study of density functional theory (DFT) over several weeks, then a few lectures on classical molecular dynamics (MD) and Monte Carlo (MC) simulations, and finishing with an introduction to materials informatics techniques which rely on learning from materials data. Students will obtain an essential understanding of quantum and classical theory and become acquainted with practical methods for running DFT, MD and MC simulations, as well as combining such simulations with simple machine learning and data science methods for materials design. Existing and new tools on nanoHUB, access to open-source simulation software, and writing simple Python code will be utilized for all necessary coursework and exercises. Permission of department required.

Learning Outcomes: 1. Design, execute and analyze simple simulations using techniques appropriate for the problem at hand. 2. Recognize the approximations and level of accuracy associated with each modeling technique. 3. Establish a foundation for exploring materials modeling techniques in greater depth and applying them to their own research projects. 4. Recognize the importance of machine learning and data science, and identify when to apply such techniques for materials datasets. Credits: 3.00

MSE 57400 - Sports Engineering And Entrepreneurship

Credit Hours: 3.00. This course provides an introduction at the graduate level to sports engineering and entrepreneurship. Students will be immersed in the state-of-the-art of industry and interact with renown experts in the field. This course is a comprehensive exploration of the key areas of sports engineering (digitalization, equipment and apparel, fan experience, data, etc.) with an emphasis on the future of the industry. The course includes the development of a business plan for a start-up in sports engineering, encouraging students to critically think about where they see opportunities for innovation based on knowledge gained in the course. This is not only for students looking to start their own business, but for any student interested in working in sports engineering field. Permission of instructor required.

Learning Outcomes: 1. Analyze the emerging technologies related to performance, sports equipment, apparel, facilities and events. 2. Evaluate the underlying technologies and market for a specific sport and its societal impact. 3. Create a business plan that captures the needs and trends of the next generation of sports. 4. Evaluate understanding of the different influencing factors in the decision process during the development of sports equipment, apparel, facilities and events. Credits: 3.00

MSE 57500 - Transport Phenomena In Solids

Credit Hours: 3.00. Energetics and kinetics of phase changes in metals and alloys. Nucleation and growth models, with special emphasis on the role of crystal defects. Selected topics in multicomponent diffusion. Offered in alternate years.

Credits: 3.00

MSE 57600 - Corrosion

Credit Hours: 3.00. Rate-controlling steps in electrode processes; activation, ohmic, and concentration polarization; passivation; potentiostatic studies and alloy design; applications to engineering systems. Offered in alternate years.

Credits: 3.00

MSE 57700 - Materials Science Of Rechargeable Batteries

Credit Hours: 3.00. This course is aimed at junior/senior undergraduate and graduate students interested on developing an understanding on the Materials Science of Rechargeable Batteries. The focus is on electrochemical materials, its non-idealities (e.g., transport limitations, failure mechanisms), and its application to energy storage devices, such as batteries and fuel cells, particularly for portable electronics and hybrid/electric vehicles. This course will deliver an introduction to basic electrochemistry, principles of electrochemical devices, and electroactive materials as used in such systems. Current trends and directions in the field of battery technology will be outlined. Permission of department required.

Learning Outcomes: 1. Become familiar with lingo, language, units and quantities associated to modern battery technology. 2. Read the scientific literature on rechargeable batteries. 3. Relate properties to performance (power, energy, charge, health, life, etc.). 4. Communicate results of battery technology to professional audiences. 5. Make simple battery designs that maximize performance. 6. Develop a basic understanding of the most widely used battery simulation software. 7. Make simple battery designs that maximize reliability. Credits: 3.00

MSE 58500 - Magnetic Materials: Physical Properties And Applications

Credit Hours: 3.00. This course provides an introduction of the basic physical and structural properties that determine the functionality of magnetic materials and devices. Starting from basic concepts on the physics of magnetism, materials synthesis and device fabrication, the functional requirements of magnetic materials for diverse applications will be discussed. Magnetic material properties depend on the electronic structure of the constituent elements and their electronic interactions. These interactions are controlled by their atomic arrangement, microstructure, defects, and strain fields that distort the local atomic order. Furthermore, the role of reduced dimensionality on the physical and functional properties of nanoscale materials will be discussed.

Learning Outcomes: 1. Understand the physical

origins of magnetism and magnetic material properties. 2. Establish the correlation between materials magnetic properties and their crystalline order, microstructure, the role of defects and secondary phases. 3. Explain how synthesis and post-processing techniques are used to design and optimize magnetic materials. 4. Apply the course learnings to optimize magnetic material properties and functionality for diverse applications. Credits: 3.00

MSE 58600 - Experimental Characterization Of Advanced Composite Materials

Credit Hours: 3.00. The characterization of advanced composite materials is a combined lecture/laboratory course in which polymeric composite laminates will be fabricated of carbon fiber epoxy and subjected to classical test methods appropriate to the determination of the anisotropic, thermoelastic properties. Properties measured will include thermal expansion coefficients, anisotropic elastic constants, biaxial strength properties and interlaminar fracture strengths. The autoclave processing of composite laminates will be discussed and the consolidation, degree of cure and glass transition temperature of the polymeric matrix will be modeled. Microscopic analysis of the composite will be carried out to observe microstructure and measure composition fractions. Lectures will precede each experiment.

Learning Outcomes: 1. Be familiar with test methods for advanced composite materials. 2. Carry out these tests to produce property data for a specific material system including fabrication of test specimens, fiber volume fraction, lamina longitudinal tensile tests, lamina shear test, lamina off-axis tensile test, lamina flexural test, lamina thermoelastic test, laminate tensile test, laminate thermoelastic test, laminate notch strength test, mode I interlaminar fracture test, mode II interlaminar fracture test. Credits: 3.00

MSE 58900 - Archaeology And Materials

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course will focus on the analysis and interpretation of archaeological artifacts and provide opportunities for hands-on learning. Permission of department required.

Learning Outcomes: 1. Make a reasoned argument about historical development of anthropological and archaeological approaches to the study of technology, and the role of materials science in archaeological research. 2. Demonstrate a nuanced understanding of, and appreciation for, ancient and contemporary technologies and the materials properties which led to their fabrication and use in specific ways. 3. Demonstrate the ability to write a research proposal, design educational material, or design and conduct a research experiment that incorporates materials science in the investigation of past (ancient, historic, or potentially more recent) technology. 4. Understand the relationship between Culture and Technology and communicate concepts about the impact of this relationship on the environment and issues of sustainability. 5. Understand critical questions about a set of journal articles focused on specific topics and lead the class in a systematic discussion of the articles and the questions they raise. 6. Select and discuss written information from journal articles, books, the class textbooks, and class lectures to produce a comprehensive picture of specific anthropology, archaeology, and materials science concepts and approaches to the study of materials and culture. 7. Compare and contrast the information that different materials characterization techniques can provide about the way historical artifacts were made and used, including the materials from which they are constructed. Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 60000 - Materials Engineering Fundamentals

Credit Hours: 3.00. Fundamental relationships between the internal structure, properties and processing in all classes of engineering materials. Comprehensive coverage spanning

physical, chemical, thermal, mechanical, electrical, magnetic, and optical responses. The course is intended for materials researchers from all backgrounds, as well as engineers working in product design, development and manufacturing who seek a deeper understanding of the full spectrum of engineering materials.

Learning Outcomes: 1. Perform calculations to quantify material properties and microstructural characteristics. Example: Calculate the interplanar spacing of a family of atomic planes given a x-ray diffraction pattern. 2. Recognize the effect of composition and microstructure on material properties. Example: The effect of dislocation density on yield strength and electrical conductivity. 3. Take information from a known situation and apply it to a new situation. Example: Effect of temperature and applied stress on the peak positions in a XRD pattern. 4. Predict property response or microstructural changes based on imposed conditions. Example: Effects of temperature and alloying on the resistivity of metals. 5. Assess the interplay of two or more material properties. Example: Assess the effect of atomic bond strength on Young's modulus, coefficient of thermal expansion and melting temperature. Credits: 3.00

MSE 64000 - Transmission Electron Microscopy And Crystal Imperfections

Credit Hours: 3.00. Theory and application of TEM to problems in materials science and engineering. Principles of electron diffraction and microscopy are reviewed with the emphasis on the relationship between real and reciprocal space. Diffraction theory of imperfect crystals will be introduced. A primary part of the course will be a discussion of image contrasts in terms of atomistic structures of key crystal imperfections, including dislocations and grain boundaries. Experimental applications and image simulations will be included to amplify theoretical concepts. Offered in alternate years. Permission of instructor required.

Credits: 3.00

MSE 67000 - Atomistic View of Materials: Theory, Modeling And Simulations

Credit Hours: 3.00. In this course students will be introduced to the fundamental physics required to describe materials in terms of electrons and atoms, learn how these processes relate to macroscopic behavior and become familiar with advanced modeling and simulation techniques that enable quantitative predictions. Students will gain hands-on experience with several simulation tools, including ab initio calculations using density functional theory, molecular dynamics simulations and other advanced modeling techniques. Pre-Requisites: BS degree in materials, mechanical, chemical, electrical or aerospace engineering or in physics or chemistry. Permission of department and instructor required.

Learning Outcomes: 1. Become familiar with the principles of quantum, classical and statistical mechanics required for predictive materials science. 2. Extract materials properties from the simulations. 3. Recognize the approximations and estimate the level of accuracy to be expected from each modeling technique. 4. Design, perform and analyze computer experiments using electronic and atomistic simulation techniques appropriate for the problem at hand. 5. Read critically the current scientific literature on computational modeling and simulation of materials. Credits: 3.00

MSE 69000 - Seminar In Materials Engineering

Credit Hours: 0.00. Required of all MSE graduate students.

Learning Outcomes: 1. Students would demonstrate application of academic comprehension in industrial context. Credits: 0.00

MSE 69600 - Graduate Professional Practice

Credit Hours: 0.00. Professional practice in Industry. Restrictions: MSE graduate students only. Permission of instructor required.

Credits: 0.00

MSE 69700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Prerequisite: two upper-division mathematics courses: one on linear algebra and one on abstract algebra. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

MSE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Mathematics

MA 10800 - Mathematics As A Profession And A Discipline

Credit Hours: 1.00. A seminar course for undergraduate students interested in majoring in an area of mathematics at Purdue. The purpose is to build prospective mathematics majors' awareness of opportunities to enhance their experiences at Purdue and of career paths available for graduates with a good mathematical background. The format of most classes is a presentation and discussion with an invited speaker/guest, including experts on a different aspect of mathematics in our world today. This course is recommended for undergraduates in their first or second year at Purdue.

Credits: 1.00

MA 11100 - Algebra

Credit Hours: 3.00. This is an algebra review course for students not prepared for MA 15200, 15300, or 15900. Topics covered: real numbers, linear functions, solving linear equations and systems of linear equations, absolute value equations and inequalities, rational expressions, complex numbers, proportions, solving quadratic equations.

Learning Outcomes: 1. Use qualitative graphs to describe situations. 2. Graph linear equations. 3. Find the slope of a line. 4. Interpret the meaning of slope for equations, graphs, and tables. 5. Find and use linear equations. 6. Identify linear functions. 7. Use function notation to make predictions. 8. Interpret and apply slope as a rate of change. 9. Use graphs, tables, substitution, and elimination to solve systems. 10. Use linear inequalities in one variable to make predictions. 11. Apply properties of exponents. 12. Simplify expressions that have rational exponents. 13. Add, subtract and multiply polynomial expressions and functions. 14. Factor trinomials of the form x2 + bx + c; factor out the GCF. 15. Factor polynomials and special binomials. 16. Use factoring to solve polynomial equations. 17. Solve quadratic equations by using the square root property and by completing the square. 18. Find the domains of rational functions and simplify rational expressions. 19. Add, subtract, multiply, and divide rational expressions. 20. Solve rational equations. 21. Simplify radical expressions. 22. Add, subtract, and multiply radical expressions. 23. Solve radical equations.

Credits: 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability,

including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

MA 13900 - Mathematics For Elementary Teachers III

Credit Hours: 3.00. Geometric, measurement and spatial reasoning in one, two and three dimensions as the basis for elementary school geometry. Metric and non-metric geometry, transformation geometry. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Differentiate between various polygons based on number of sides and measures of angles. 2. Find the sum of the measures of the interior angles of a polygon. 3. Draw nets for polyhedra. 4. Differentiate between various types of polyhedra including all regular polyhedra. 5. Determine number of lines of symmetry for a plane figure and orders of rotational symmetry. 6. Determine number of planes of symmetry for a solid figure as well as axes of rotational symmetry. 7. Recognize and draw shapes that tessellate the plane and solid figures that tessellate space. 8. Determine dimensions of similar planar figures. 9. Determine surface area and volume of similar solid figures. 10. Construct perpendicular bisectors and parallel lines using a compass and straightedge. 11. Recognize and draw rigid motions of shapes including translations, reflections and rotations. 12. Determine area of plane figures and surface area and volume of solid figures. 13. Use the Pythagorean Theorem to determine diagonals of solid figures. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15400 - Trigonometry (UCC: QR)

Credit Hours: 3.00. While MA 15400 is a continuation of MA 15300, the course MA 15300 is not a prerequisite. It is suggested that students have a C- or better in MA 15300 or a B- or better in MA 15200. Topics covered include the trigonometric functions, analytic geometry, laws of sines and cosines, vectors, dot product, conic sections, and rational functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the College of Science.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand and be able to use trigonometric functions, inverse trigonometric functions, analytic geometry, laws of sines and cosines, vectors and the dot product to solve application problems. 2. Learn about conic sections (ellipses, hyperbolas and parabolas) and rational functions. Credits: 3.00

MA 15555 - Quantitative Reasoning (UCC: QR)

Credit Hours: 3.00. This course will cover important mathematical ideas, including proportion, weighted averages, linear models, exponential models, basic probability and statistics, and some algebra, by using concrete real-world problems. It will not be a prerequisite for any other mathematics course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn proportion and how to apply it to unit conversions, percentage, sales tax and discounts, and inflation. 2. Learn weighted averages and how they apply to the consumer price index and other examples. 3. Learn paradoxes involving weighted averages. 4. Learn linear models and how they apply to electricity bills, income taxes, and climate change. 5. Learn exponential growth and how it applies to compound interest and other financial issues. 6. Learn basic probability theory and how it applies to insurance and games of chance. 7. Learn how algebra is related to the other things learned. Credits: 3.00

MA 15800 - Precalculus - Functions And

Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 15900 - Precalculus

Credit Hours: 5.00. Algebra and trigonometry topics designed to prepare students for calculus. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Understand the basic properties of linear functions, including their graphs and applications. 2. Model physical and economic situations using exponential functions and solve problems related to the model. 3. Have a computational facility and conceptual understanding of functions, including compositions of functions, inverse functions, and graphs of functions. 4 Use logarithms to solve exponential equations and to solve problems using exponential models. 5. Understand the basic properties of polynomial functions, including their graphs and applications, with a special emphasis on quadratic functions. 6. Understand the unit circle definition of sine and cosine and be able to generate formulas for general sinusoidal functions. 7. Solve trigonometric equations and applied problems using inverse trigonometric functions. 8. Understand the ways in which a trigonometric expression can be represented and have the facility converting between these representations. 9. Determine geometric and algebraic properties of conic sections. Credits: 5.00

MA 15910 - Introduction To Calculus

Credit Hours: 3.00. A survey of differential and integral calculus. Applications to the agricultural, life, managerial, and social sciences. Not available for credit toward graduation in the School of Science.

Learning Outcomes: 1. To create functional models. 2. To create and simplify difference quotients. 3. To compute basic limits of functions and to apply limit laws. 4. To compute derivatives and to apply basic rules of differentiation. 5. To use derivatives in graphing and solving basic optimization problems. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem

of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16019 - Applied Calculus I For Technology

Credit Hours: 4.00. This course develops topics from analytical geometry and introduces differentiation and integration.

Learning Outcomes: 1. Demonstrate ability to calculate derivatives of polynomial, power, and rational functions and their compositions. 2. Demonstrate ability to apply derivatives to solve technology-related problems. 3. Demonstrate ability to compute integrals of polynomials, power, and rational functions and their compositions. 4. Demonstrate ability to apply integrals to solve technology-related problems. Credits: 4.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16290 - Data Science Labs: Calculus

Credit hours: 1.00. This course consists of weekly computer

laboratories which apply concepts learned in Calculus I and II to data science problems. Main topics covered include function sampling and approximation, numerical differentiation, numerical integration, Jupyter notebooks, introductory Python programming, object oriented programming, and data acquisition with microcontrollers and sensors.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python 2. 4. Acquire basic object oriented programming skills. 5. Acquire and interpret sensor data. Credits: 1.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 17000 - Introduction To Actuarial Science

Credit Hours: 2.00. (STAT 17000) An introduction to actuarial science from the point of view of practicing actuaries from life insurance, casualty insurance and consulting; introduction to insurance and the mathematical theory of interest; application of spreadsheets to problems related to actuarial science.

Learning Outcomes: 1. Describe different expressions of interest rates. Calculate an equivalent rate given another rate. 2. Calculate the present value of a set of cash flows. 3. Apply basic probability principles. 4. Describe and apply different types of probabilities used by actuaries. 5. Calculate the expected present value of a set of cash flows. 6. Describe basic types of insurance and their characteristics. 7. Define and apply basic components of insurance. Examples: premium, claim, deductible, coverage, limit, coinsurance, insured, owner. 8. Describe the ratemaking process. Calculate the rate of a simple insurance product. 9. Describe the pricing process. Calculate the price of a simple insurance product. 10. Describe different accounting regimes and their purposes. 11. Define a policy reserve. Calculate a simple policy reserve. 12. Define a loss reserve. Calculate a simple loss reserve. 13. Demonstrate a basic level of knowledge by applying Excel to solve problems. Credits: 2.00

MA 18300 - Professional Practicum I

Credit Hours: 0.00. Professional Practicum. For Cooperative Education students only; must be accepted for the program by the cooperative program coordinator. Permission of department required.

Credits: 0.00

MA 19000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Learn about mathematical thinking and practice. Credits: 1.00 to 5.00

MA 25000 - Problem Solving In Probability

Credit Hours: 2.00. (STAT 25000) This course is designed to teach techniques for solving problems in probability theory which are relevant to the actuarial sciences. It is intended to help actuarial students prepare for the Society of Actuaries and Casualty Actuarial Society Exam P/1. Credit of Examination is not available for this course.

Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26190 - Data Science Labs: Multivariate Calculus

Credit Hours: 1.00. This course consists of weekly computer laboratories which apply concepts learned in Multivariate Calculus (Calculus III) to data science problems. The students will also practice programming in Python and use sensors and microprocessors to acquire data. Topics covered include representation and perception of color, motion detection in videos, and construction of a planimeter based on Green's theorem.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python. 4. Acquire and interpret sensor data. Credits: 1.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

MA 27300 - Introduction To Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some of the fundamental concepts of financial mathematics and their application to business situations and basic risk management. Includes discussions of interest rates, discount rates, annuity valuation, bond valuation, cash flow valuation, spot rates, forward rates, Macaulay duration, modified duration, convexity, immunization, and asset-liability management. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Credits: 3.00

MA 27900 - Modern Mathematics In Science And Society

Credit Hours: 3.00. The course covers topics in combinatorics and probability applied to real life situations such as the paradoxa of democracy, weighted voting, fair division, apportionment, traveling salesmen, the mathematics of networks, Fibonacci numbers, golden ratio, growth patterns in nature, mathematics of money, symmetry, fractals, censuses and surveys, random sampling, sample spaces, permutations and uniform probability spaces.

Learning Outcomes: 1. The students will gain knowledge, overview, and understanding in

several fundamental mathematical subdisciplines which fall into four basic categories: voting and apportionment; growth; management of networks; data analysis. 2. Students will assimilate these mathematical ideas while applying them to practical everyday questions, and in turn gain an understanding how real-life programs give rise to development of mathematical theories. Credits: 3.00

MA 29000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

MA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 30100 - An Introduction To Proof Through Real Analysis

Credit Hours: 3.00. An introduction to abstract reasoning in the context of real analysis. Topics may include axioms for the real numbers, mathematical induction, formal definition of limits, density, decimal representations, convergence of sequences and series, continuity, differentiability, the extreme value, mean value and intermediate value theorems, and cardinality. The emphasis, however, is more on the concept of proof than on any one given topic.

Credits: 3.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 32500 - History Of Mathematics

Credit Hours: 3.00. The purpose of this course is to help students understand and appreciate the growth and development of mathematical ideas across various cultures. Students will study the achievements of people who have made significant contributions to the development of both ancient and modern mathematical concepts.

Learning Outcomes: 1. Gain an appreciation for mathematics as a central human pursuit, driven by both curiosity and practical applications. 2. Analyze the biographical details of key mathematical figures, understanding their contributions to the field. 3. Establish connections between mathematics and diverse academic disciplines, contemporary events, and the interrelationships among different branches of mathematics. 4. Explore the historical and

contemporary development of mathematics across societal, cultural, and geographic boundaries. 5. Understand the evolving significance of mathematics within various global cultures and societies. Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 34990 - Data Science Labs: Signals And Systems

Credit Hours: 1.00. This course consists in weekly computer laboratories. The laboratories introduce students to the application of concepts learned in Signals and Systems or Fourier Analysis course to Data Science problems. The courses also provide opportunities to practice programming in Python and use sensors and microprocessors to acquire and manipulate data.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python. 4. Acquire and interpret sensor data. Credits: 1.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which

takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem,

formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 38600 - Professional Practicum IV

Credit Hours: 0.00. Professional Practicum. Permission of department required.

Credits: 0.00

MA 39000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 41690 - Data Science Labs: Probability

Credit Hours: 1.00. This course consists in weekly computer laboratories. The laboratories introduce students to the application of concepts learned in an introductory Probability course to Data Science problems. This course also provides opportunities to practice programming in Python and use sensors and microprocessors to acquire and manipulate data.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python. 4. Acquire and interpret sensor data. Credits: 1.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the

theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

MA 45401 - Galois Theory Honors

Credit Hours: 3.00. This course will give a thorough introduction to Galois theory. Galois theory is a fundamental tool in many areas of mathematics, including number theory and algebraic geometry. This course will increase students' mathematical maturity and prepare them for graduate school. Topics include finite extension fields and their symmetries, ruler and compass constructions, complex roots of unity, solvable groups, and the solvability of polynomial equations by arithmetic and radical operations. This course is intended for third- or fourth-year students who have taken MA 45000 (Algebra Honors) or MA 45300 (Elements of Algebra I).

Learning Outcomes: 1. Know the historical background of Galois theory. 2. Know the classical version which addresses questions

about roots of polynomials and the modern formulation in terms of abstract algebra. 3. Know about finite extension fields and their symmetries. 4. Know how Galois theory answers ancient questions about ruler and compass constructions. 5. Know about cyclotomic fields generated by complex roots of unity. 6. Know how Galois theory answers questions about the solvability of polynomial equations by arithmetic and radical operations. Credits: 3.00

MA 46000 - Geometry

Credit Hours: 3.00. This course begins at the high-school level and then moves quickly to intermediate and advanced topics including an introduction to non-Euclidean geometry. Emphasis on proofs.

Learning Outcomes: 1. Learn geometry topics included in the Indiana state standards. 2. Learn to solve a wide range of geometry problems. 3. Learn the meaning of definition, axiom, theorem, and proof, and use these words correctly. 4. Learn the proofs in book I of Euclid's elements. 5. Learn some basic ideas of non-Euclidean geometry. Credits: 3.00

MA 46200 - Elementary Differential Geometry

Credit Hours: 3.00. The geometry of curves and surfaces based on familiar parts of calculus and linear algebra. An introduction to the study of differentiable manifolds and Riemannian geometry.

Credits: 3.00

MA 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

MA 48100 - Advanced Problem-Solving Seminar

Credit Hours: 3.00. Seminar intended to prepare students for the national Putnam examination in mathematics. There is no formal prerequisite, but students should be familiar with basic elements of Linear Algebra, Analysis, Geometry and Trigonometry.

Learning Outcomes: 1. Learn about various, more advanced techniques of how to approach Olympiad undergraduate type problems within areas such as number theory, combinatorics, algebra, analysis and geometry. 2. Learn various angles of approaching a proof and how to properly conceptualize it. 3. Learn how to properly write (justify) the arguments within a mathematical proof at a high rigor level imposed by the Putnam contest. Credits: 3.00

MA 48200 - Advanced Short Term Actuarial Mathematics

Credit Hours: 3.00. This course provides comprehensive coverage of a wide range of advanced short-term actuarial analysis techniques including severity and aggregate models, parametric models' estimation and selection, parametric and empirical credibility, and reserving, pricing for short-term insurance coverages. This course prepares actuarial students for the SOA Exam ASTAM: Advanced Short-Term Actuarial Mathematics.

Learning Outcomes: 1. Understand and apply methods for modeling severity and aggregate loss distributions, including creating new distributions and comparing tail behaviors. 2. Analyze the impact of coverage modifications and inflation on loss modeling in insurance. 3. Estimate parameters using the maximum likelihood method and assess the asymptotic normality of the maximum likelihood estimator for a function of parameters. 4. Select models based on graphical and score-based approaches and perform goodness-of-fit tests. 5. Evaluate credibility concepts, including limited fluctuation credibility, Bayesian credibility with conjugate priors, and Bühlmann and

Bühlmann-Straub models. 6. Apply techniques for estimating unpaid losses, incurred but not reported (IBNR) losses, and project losses using trend analysis, as well as calculate overall average rates, rate changes, and risk classification differential changes. Credits: 3.00

MA 48400 - Seminar On Teaching College Algebra And Trigonometry

Credit Hours: 3.00. This course is a seminar on the teaching of mathematics for our best undergraduate mathematics education students. It provides supervised teaching experience along with a chance for the students to perfect their knowledge of algebra before going on to be high school teachers. Students who take this class will also teach a section of MA 15300. Permission of instructor required.

Credits: 3.00

MA 48700 - Professional Practicum V

Credit Hours: 0.00 or 1.00. Professional Practicum. Permission of department required.

Credits: 0.00 or 1.00

MA 49000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 6.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 6.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 50300 - Abstract Algebra

Credit Hours: 3.00. Group theory: definitions, examples, subgroups, quotient groups, homomorphisms, and isomorphism theorems. Ring theory: definitions, examples, homomorphisms, ideals, quotient rings, fraction fields, polynomial rings, Euclidean domains, and unique factorization domains. Field theory: algebraic field extensions, straightedge and compass constructions.

Credits: 3.00

MA 50400 - Real Analysis

Credit Hours: 3.00. Completeness of the real number system, basic topological properties, compactness, sequences and series, absolute convergence of series, rearrangement of series, properties of continuous functions, the Riemann-Stieltjes integral, sequences and series of functions, uniform convergence, the Stone-Weierstrass theorem, equicontinuity, and the Arzela-Ascoli theorem.

Credits: 3.00

MA 51000 - Vector Calculus

Credit Hours: 3.00. Calculus of functions of several variables and of vector fields in orthogonal coordinate systems. Optimization problems, implicit function theorem, Green's theorem, Stokes' theorem, divergence theorems. Applications to engineering and the physical sciences. Not open to students with credit in MA 36200 or MA 41000.

Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

MA 51900 - Introduction To Probability

Credit Hours: 3.00. (STAT 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

MA 52000 - Boundary Value Problems Of Differential Equations

Credit Hours: 3.00. Separation of variables; Fourier series; boundary value problems; Fourier transforms; Bessel functions; Legendre polynomials.

Credits: 3.00

MA 52100 - Introduction To Optimization Problems

Credit Hours: 3.00. Necessary and sufficient conditions for local extrema in programming problems and in the calculus of variations. Control problems; statement of maximum principles and applications. Discrete control problems.

Credits: 3.00

MA 52300 - Introduction To Partial Differential Equations

Credit Hours: 3.00. First order quasi-linear equations and their applications to physical and social sciences; the Cauchy-Kovalevsky theorem; characteristics, classification and canonical forms of linear equations; equations of mathematical physics; study of Laplace, wave and heat equations; methods of solution.

Credits: 3.00

MA 52500 - Introduction To Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; applications. Not open to students with credit in MA 42500.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations.

Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory.

Credits: 3.00

MA 53000 - Functions Of A Complex Variable I

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; special topics. More mathematically rigorous than MA 52500.

Credits: 3.00

MA 53100 - Functions Of A Complex Variable II

Credit Hours: 3.00. Advanced topics.

Credits: 3.00

MA 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (STAT 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

MA 53800 - Probability Theory I

Credit Hours: 3.00. (STAT 53800) Mathematically rigorous, measure-theoretic introduction to probability spaces, random variables, independence, weak and strong laws of large numbers, conditional expectations, and martingales.

Credits: 3.00

MA 53900 - Probability Theory II

Credit Hours: 3.00. (STAT 53900) Convergence of probability laws; characteristic functions; convergence to the normal law; infinitely divisible and stable laws; Brownian motion and the invariance principle.

Credits: 3.00

MA 54200 - Theory Of Distributions And Applications

Credit Hours: 3.00. Definition and basic properties of distributions; convolution and Fourier transforms; applications to partial differential equations; Sobolev spaces.

Credits: 3.00

MA 54300 - Ordinary Differential Equations And Dynamical Systems

Credit Hours: 3.00. This course focuses on the theory of ordinary differential equations and methods of proof for developing this theory. Topics include basic results for linear systems, the local theory for nonlinear systems (existence and uniqueness, dependence on parameters, flows and linearization, stable manifold theorem) and the global theory for nonlinear systems (global existence, limit sets and periodic orbits, Poincare maps). Permission of instructor required.

Learning Outcomes: 1. Know and understand

the central results and methods of proof in the theory of ordinary Differential Equations. 2. Gain deeper understanding of mathematical analysis more generally. 3. Gain facility in constructing, writing and presenting proofs. Credits: 3.00

MA 54400 - Real Analysis And Measure Theory

Credit Hours: 3.00. Metric space topology; continuity, convergence; equicontinuity; compactness; bounded variation, Helly selection theorem; Riemann-Stieltjes integral; Lebesgue measure; abstract measure spaces; LP-spaces; Holder and Minkowski inequalities; Riesz-Fischer theorem.

Credits: 3.00

MA 54500 - Functions Of Several Variables And Related Topics

Credit Hours: 3.00. Differentiation of functions; Besicovitch covering theorem; differentiation of one measure with respect to another; Hardy-Littlewood maximal function; functions of several variables; Sobolev spaces.

Credits: 3.00

MA 54600 - Introduction To Functional Analysis

Credit Hours: 3.00. Fundamentals of functional analysis. Banach spaces, Hahn-Banach theorem. Principle of uniform boundedness. Closed graph and open mapping theorems. Applications. Hilbert spaces. Orthonormal sets. Spectral theorem for Hermitian operators and compact operators.

Credits: 3.00

MA 55300 - Introduction To Abstract Algebra

Credit Hours: 3.00. Group theory: Sylow theorems, Jordan Holder theorem, solvable groups. Ring theory: unique factorization in polynomial rings and principal ideal domains. Field theory: ruler and compass constructions, roots of unity, finite fields, Galois theory, solvability of equations by radicals.

Credits: 3.00

MA 55400 - Linear Algebra

Credit Hours: 3.00. Review of basics: vector spaces, dimension, linear maps, matrices determinants, linear equations. Bilinear forms; inner product spaces; spectral theory; eigenvalues. Modules over a principal ideal domain; finitely generated abelian groups; Jordan and rational canonical forms for a linear transformation.

Credits: 3.00

MA 55600 - Introduction To The Theory Of Numbers

Credit Hours: 3.00. Divisibility, congruences, quadratic residues, Diophantine equations, the sequence of primes.

Credits: 3.00

MA 55700 - Abstract Algebra I

Credit Hours: 3.00. Review of fundamental structures of algebra (groups, rings, fields, modules, algebras); Jordan-Holder and Sylow theorems; Galois theory; bilinear forms; modules over principal ideal domains; Artinian rings and semisimple modules. Polynomial and power series rings; Noetherian rings and modules; localization; integral dependence; rudiments of algebraic geometry and algebraic number theory; ramification theory.

Credits: 3.00

MA 55800 - Abstract Algebra II

Credit Hours: 3.00. A continuation of MA 55700.

Credits: 3.00

MA 56000 - Fundamental Concepts Of Geometry

Credit Hours: 3.00. Foundations of Euclidean geometry, including a critique of Euclid's "Elements" and a detailed study of an axiom system such as that of Hilbert. Independence of the parallel axiom and introduction to non-Euclidean geometry.

Credits: 3.00

MA 56200 - Introduction To Differential Geometry And Topology

Credit Hours: 3.00. Smooth manifolds; tangent vectors; inverse and implicit function theorems; submanifolds; vector fields; integral curves; differential forms; the exterior derivative; DeRham cohomology groups; surfaces in E3., Gaussian curvature; two dimensional Riemannian geometry; Gauss-Bonnet and Poincare theorems on vector fields.

Credits: 3.00

MA 57100 - Elementary Topology

Credit Hours: 3.00. Fundamentals of point set topology with a brief introduction to the fundamental group and related topics, topological and metric spaces, compactness, connectedness, separation properties, local compactness, introduction to function spaces, basic notions involving deformations of continuous paths.

Credits: 3.00

MA 57200 - Introduction In Algebraic Topology

Credit Hours: 3.00. Singular homology theory; Eilenberg-Steenrod axioms; simplicial and cell complexes; elementary homotopy theory; Lefschetz fixed point theorem.

Credits: 3.00

MA 57300 - Numerical Solution Of Ordinary Differential Equations

Credit Hours: 3.00. Numerical solution of initial-value problems by Runge-Kutta methods, general one-step methods, and multistep methods; analysis of truncation error, discretization error, and rounding error; stability of multistep methods; numerical solution of boundary- and eigen-value problems by initial-value techniques and finite difference methods.

Learning Outcomes: 1. Learn general one-step methods for numerical solution of initial-value problems. 2. Learn explicit and implicit Runge-Kutta and multistep methods, convergence and stability. 3. Learn iterative methods for solving

large systems of equations. 4. Learn numerical methods for stochastic differential equations and Monte Carlo methods. 5. Learn the Fast Fourier Transform and spectral methods. 6. Learn to use software tools such as visualization and specialized computing packages. Credits: 3.00

MA 57400 - Numerical Optimization

Credit Hours: 3.00. Convex optimization algorithms using modern large-scale algorithms for convex optimization, with a heavy emphasis on analysis including monotone operator, fixed point iteration and duality in splitting methods. The course will cover and focus on the following three parts: smooth optimization algorithms, nonsmooth convex optimization algorithms, and stochastic and randomized algorithms. Permission of department required. Prerequisites: MA 51100 and MA 50400.

Learning Outcomes: 1. Learn standard convergence results for gradient descent method and Newton's method and their generalizations for smooth problems. 2. Learn convergence results for subgradient method and proximal point method for nonsmooth convex problems. 3. Learn about popular splitting methods and the proof of their convergence by using monotone operators and fixed-point iteration. 4. Learn about convergence of stochastic algorithms such as randomized coordinate descent, stochastic gradient descent and Langevin dynamics. Credits: 3.00

MA 57500 - Graph Theory

Credit Hours: 3.00. Introduction to graph theory with applications.

Credits: 3.00

MA 58400 - Algebraic Number Theory

Credit Hours: 3.00. Dedekind domains, norm, discriminant, different, finiteness of class number, Dirichlet unit theorem, quadratic and cyclotomic extensions, quadratic reciprocity, decomposition and inertia groups, completions and local fields.

Credits: 3.00

MA 58500 - Mathematical Logic I

Credit Hours: 3.00. Propositional and predicate calculus; the Gdel completeness and compactness theorem, primitive recursive and recursive functions; the Gdel incompleteness theorem; Tarski's theorem; Church's theorem; recursive undecidability; special topics such as nonstandard analysis. Credits: 3.00

MA 59000 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 59500 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Special topics courses including dual-level special topics. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 59800 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

MA 61100 - Methods Of Applied Mathematics I

Credit Hours: 3.00. Banach and Hilbert spaces; linear operators; spectral theory of compact linear operators; applications to linear integral equations and to regular Sturm-Liouville problems for ordinary differential equations. Prerequisite: MA 51100, MA 54400.

Credits: 3.00

MA 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (CS 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicholson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: MA 51400, MA 52300.

Credits: 3.00

MA 62000 - Mathematical Theory Of Optimal Control

Credit Hours: 3.00. Existence theorems; the maximum principle; relationship to the calculus of variations; linear systems with quadratic criteria; applications. Offered in alternate years. Prerequisite: MA 54400.

Credits: 3.00

MA 63100 - Several Complex Variables

Credit Hours: 3.00. Power series, holomorphic functions, representation by integrals, extension of functions, holomorphically convex domains. Local theory of analytic sets (Weierstrass preparation theorem and consequences). Functions and sets in the projective space Pn (theorems of Weierstrass and Chow and their extensions). Prerequisite: MA

53000.

Credits: 3.00

MA 63800 - Stochastic Processes I

Credit Hours: 3.00. (STAT 63800) Advanced topics in probability theory which may include stationary processes, independent increment processes, Gaussian processes; martingales, Markov processes, ergodic theory. Prerequisite: MA 53900.

Credits: 3.00

MA 63900 - Stochastic Process II

Credit Hours: 3.00. (STAT 63900) Continuation of MA 63800.

Credits: 3.00

MA 64200 - Methods Of Linear And Nonlinear Partial Differential Equations I

Credit Hours: 3.00. Second order elliptic equations including maximum principles, Harnack inequality, Schauder estimates, and Sobolev estimates. Applications of linear theory to nonlinear equations. Prerequisite: MA 52300.

Credits: 3.00

MA 64300 - Methods Of Partial Differential Equations II

Credit Hours: 3.00. Continuation of MA 64200. Topics to be covered are Lp theory for solutions of elliptic equations, including Moser's estimates, Aleksandrov maximum principle, and the Calderon-Zygmund theory. Introduction to evolution problems for parabolic and hyperbolic equations, including Galerkin approximation and semigroup methods. Applications to nonlinear problems. Prerequisite: MA 64200.

Credits: 3.00

MA 64400 - Calculus Of Variations

Credit Hours: 3.00. Direct methods; necessary and sufficient conditions for lower semicontinuity of multiple integrals; existence theorems and connections with optimal control theory. Prerequisite: MA 54400.

Credits: 3.00

MA 65000 - Commutative Algebra

Credit Hours: 3.00. The study of those rings of importance in algebraic and analytic geometry and algebraic number theory. Prerequisite: MA 55800.

Credits: 3.00

MA 66100 - Modern Differential Geometry

Credit Hours: 3.00. Topics chosen by the instructor. Prerequisite: MA 55400.

Credits: 3.00

MA 66300 - Algebraic Curves And Functions I

Credit Hours: 3.00. Algebraic functions of one variable from the geometric, algebraic, or function-theoretic points of view. Riemann-Roch theorem, differentials. Prerequisite: MA 55800.

Credits: 3.00

MA 66400 - Algebraic Curves And Functions II

Credit Hours: 3.00. Continuation of MA 66300. Topics chosen by the instructor. Prerequisite: MA 66300.

Credits: 3.00

MA 66500 - Algebraic Geometry

Credit Hours: 3.00. Topics of current interest will be chosen by the instructor. Prerequisite: MA 65000 or MA 66300.

Credits: 3.00

MA 68400 - Class Field Theory

Credit Hours: 3.00. Ideles, adeles, L-functions, Artin symbol, reciprocity, local and global class fields, Kronecker-Weber Theorem. Prerequisite: MA 58400.

Credits: 3.00

MA 69000 - Topics In Algebra

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69200 - Topics Applied Math

Credit Hours: 1.00 to 3.00. Topics in applied math. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69300 - Topics In Analysis

Credit Hours: 1.00 to 3.00. Topics in analysis. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69400 - Topics In Differential Equations

Credit Hours: 1.00 to 3.00. Topics In Differential Equations. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69600 - Topics In Geometry

Credit Hours: 1.00 to 3.00. Topics in geometry. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69700 - Topics In Topology

Credit Hours: 1.00 to 3.00. Topics in topology. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Mechanical Engineering

ME 16400 - Geometric And Annotation Modeling

Credit Hours: 3.00. This course focuses on CAD-based modeling and engineering graphics standards (national - ANSI/ASME and international - ISO), including coordinate and geometric dimensioning and tolerancing practices. It covers principles and techniques of three-dimensional surface and solid modeling. This course teaches students how to model real-world engineering objects and assemblies using the capabilities

of commercial CAD systems. Conceptual, preliminary and detailed part and assembly models are assigned as exercises to reinforce the classroom lectures. This course teaches the graphics language and standards necessary for engineering students to read, understand, and sign off engineering drawings and documents. Students are required to detail (create engineering drawings) their CAD models, demonstrating their ability to both read and apply graphic standards.

Learning Outcomes: 1. Improve sketching. 2. Understand wireframe, surface and solid modeling techniques found in a modern commercial CAD package. [3] 3. Create CAD models of basic machine components and assemblies. [2] 4. Design and create CAD models of average to complex mechanical components. [2] 5. Understand the approaches and processes used in component and assembly modeling, i.e., top-down and bottom-up design. [2] 6. Read and understand engineering drawings composed of multiple views with standard dimensioning and tolerancing nomenclature. [3] 7. Read and understand engineering drawings that contain geometric dimensioning and tolerancing symbols. [3] 8. Use of standards for geometric modeling, dimensioning, and tolerancing. [2] 9. Work in collaboration with fellow teammates to accomplish both the learning of the CAD tool and the executing of the modeling projects. [5] Credits: 3.00

ME 19800 - PMEA Leadership Program

Credit Hours: 1.00. A weekly seminar that includes topics such as leadership, professional skills, teamwork, and the Mechanical Engineering culture. Students will utilize these skills while representing Mechanical Engineering to current and prospective students, alumni, donors, and other visitors to the school.

Learning Outcomes: 1. Able to function effectively with a student run team whose members create a collaborative and inclusive environment, plan events, and meet the objectives of the ME Undergraduate Program. 2. Communicate effectively with a range of audiences. 3. Develop a personal philosophy of leadership that includes an understanding of self, others, and community. Credits: 1.00

ME 19900 - How Stuff Works

Credit Hours: 1.00. An introduction to Mechanical Engineering for First-Year Engineering students interested in exploring a career in ME. The course is student led and involves a mix of presentations from successful mechanical engineers about their chosen careers coupled with fun hands-on experiences related to better understand how everyday products work from a mechanical engineering perspective. A variety of common products are disassembled, evaluated, and reassembled to understand the underlying engineering design and fabrication fundamentals. Little or no mechanical experience is required.

Learning Outcomes: 1. Learn from successful alumni about their career paths and common products that they have helped to design and market. 2. Become familiar with common products and how they work. 3. Gain hands-on experience and develop your mechanical aptitude by dissecting products, studying the basic engineering and operation of the products and reassembling the products. 4. Become familiar with common engineering terminology used in describing the various parts and assemblies of products. Credits: 1.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ME 22001 - Fundamentals Of Energy Materials

Credit Hours: 3.00. This course examines the chemistry and structure of materials and their correlation with various electrochemical properties including their suitability for use in conversion and storage of electrochemical energy, energy related materials, and chemical and renewable energy sources.

Credits: 3.00

ME 22501 - Mechanical Engineering Laboratory I

Credit Hours: 1.00. Experiments in thermodynamics, parametric design and component fabrication.

Credits: 1.00

ME 22510 - Energy Engineering Laboratory I

Credit Hours: 1.00. Experiments on testing of thermodynamics, parametric design and electrochemistry.

Credits: 1.00

ME 23900 - Introduction To Data Science For Mechanical Engineers

Credit Hours: 1.00. Introduction to data science for sophomore mechanical engineers with no prior knowledge of the topic; Overview of Python basics using Jupyter notebooks; review of probability theory as the language of uncertainty, Monte Carlo sampling for uncertainty propagation; basics of supervised (Bayesian generalized linear regression, logistic regression, deep neural networks, convolutional neural networks), and unsupervised learning (k-means clustering, principal component analysis, Gaussian mixtures).

Learning Outcomes: 1. Represent uncertainty in parameters in engineering or scientific models using probability theory. 2. Propagate uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Solve basic supervised learning tasks, such as regression and classification. 4. Solve basic unsupervised learning tasks, such as clustering, dimensionality reduction, and density estimation. 5. Develop and apply various Python coding skills. 6. Load and visualize data sets in Jupyter notebooks. 7. Visualize uncertainty in Jupyter notebooks. 8. Recognize basic Python software (e.g., Pandas, numpy, scipy, scikit-learn) and advanced Python software (e.g., pytorch, pyrho, Tensorflow) commonly used in data analytics. Credits: 1.00

ME 24000 - Basic Engineering Mechanics

Credit Hours: 4.00. This course is an introductory mechanics course in energy engineering, covers force systems and couples, equilibrium, centroids, friction, kinematics, kinetics of particles & rigid body, Newton's second law, energy, and momentum methods; equations of motions, and application to machine elements. Permission of department required.

Credits: 4.00

ME 25001 - Mechanical Engineering Laboratory II

Credit Hours: 1.00. Experiments on data analysis, hands-on programming with devices and fabrication.

Credits: 1.00

ME 25010 - Energy Engineering Laboratory II

Credit Hours: 1.00. Experiments on testing of thermodynamics, parametric design and electrochemistry.

Credits: 1.00

ME 26000 - Sustainable Energy

Credit Hours: 3.00. The objective of this course is to familiarize the students with various forms of available energy. The concept of these energies in terms of efficiency, raw material, safety, economy and environmental impact will be introduced. Permission of department required.

Credits: 3.00

ME 26201 - Design, Ethics, And Entrepreneurship

Credit Hours: 2.00. Basic concepts of the design process. Innovative engineering design of real life applications. Engineering ethics topics. Fundamentals of Entrepreneurship. Design projects focus on open-ended problems. Design modeling, simulation, documentation and communication. Implementation and use of modern computer tools in solving design problems and completing team design projects in the area of Energy Engineering.

Credits: 2.00

ME 26300 - Introduction To Mechanical Engineering Design, Innovation And Entrepreneurship

Credit Hours: 3.00. The product design process. Development of product design specifications using customer inputs, benchmarking, product/market research and patent review. Concept generation and evaluation using brainstorming, functional decomposition, modeling and decision matrices. Detailed product design including assembly, economic analysis, CAD, and bill of materials. Oral and written design reviews. Key skills developed include teamwork, communication, project planning, innovation, design, and entrepreneurship.

Learning Outcomes: 1. Instill the philosophy that real engineering design problems are open-ended and multifaceted. 2. Teach a systemic design methodology. 3. Provide guidance in applying engineering principles to open-ended problems. 4. Develop the ability to mathematically model and analyze engineering systems. 5. Sharpen skills in leadership, teamwork, communication, project planning, innovation, design and entrepreneurship. 6. Instill a philosophy of professional and ethical behavior. 7. Provide a foundation for the rest of the mechanical engineering curriculum and future careers. Credits: 3.00

ME 26400 - Introduction To Manufacturing For Mechanical Design

Credit Hours: 3.00. Introduction to manufacturing processes for typical engineering materials. Basics of material properties and

behavior for manufacturing processes. Material selection and manufacturing process selection for mechanical design. Hands-on projects in the lab reinforce the knowledge of manufacturing processes.

Learning Outcomes: 1. Understand material properties and behavior for design and manufacturing. 2. Gain a fundamental knowledge of manufacturing processes. 3. Gain knowledge of the practice of measurements and manufacturing processes through laboratory experiments. 4. Enhance knowledge on the selection of materials and manufacturing processes for product design. 5. Enhance technical communication skills through short technical lab reports. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 27200 - Mechanics Of Materials

Credit Hours: 3.00. Kinematic and dynamic analysis of linkages and mechanical systems. Analytical and graphical approaches to analysis. Vector loop and relative velocity/acceleration solutions. Design and analysis of cams and gears. Static and dynamic balancing. Design for strength of various machine components. Reliability principles. Design documentation and communication. Laboratory experiments on mechanical design and strength.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

ME 28500 - Industrial Practice I

Credit Hours: 0.00. Professional practice of engineering in industry. Comprehensive written report of this experience required. For cooperative program students only.

Credits: 0.00

ME 28600 - Industrial Practice II

Credit Hours: 0.00. Professional practice of engineering in industry. Comprehensive written report of this experience required. For cooperative program students only.

Credits: 0.00

ME 29000 - Global Engineering Professional Seminar (UCC: STS)

Credit Hours: 1.00. Forum on contemporary issues in the global profession of mechanical engineering. Professionalism and ethics. Interactions with engineering faculty and with professionals outside the University. Quizzes on assigned readings in the areas of globalization, cultural difference and collaborating across cultural boundaries. Individually developed professional profiles describe technical interests and convey awareness of ethical responsibilities in global context.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Provide a solid foundation in global engineering skills. 2. Introduce the in global engineering community and encourage active involvement with professional associations such as ASME and SAE to develop teamwork and leadership skills. 3. Explore the ME Curriculum and identify resources available for planning a academic program including global literacies (language and area studies) and for obtaining diverse industrial experience appropriate for developing global competencies. 4. Support the development of a strong ethical framework for global professional workplace, including an appreciation for cultural differences, as a responsible member of the global engineering community. Credits: 1.00

ME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29500 - Engineering Topics

Credit Hours: 1.00 to 5.00. Topics of contemporary importance of special interest that are outside the scope of the standard undergraduate curriculum can be offered temporarily under the selected topics category until the course receives a permanent number. Typically offered Summer Fall Spring.

Credits: 1.00 to 5.00

ME 29601 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the freshman or sophomore level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 0.00 to 6.00

ME 29700 - Mechanical Engineering Sophomore Projects

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest. Students submit a summary report. Permission of instructor required.

Credits: 0.00 to 6.00

ME 30000 - Thermodynamics II

Credit Hours: 3.00. Properties of gas mixtures, air-vapor mixtures, applications. Thermodynamics of combustion processes, equilibrium. Energy conversion, power, and refrigeration systems.

Credits: 3.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and fundamental concepts to measuring and analyzing fluid systems and flows. 3. Learn a laboratory design project on a flow system reinforces the design process. Credits: 1.00

ME 31002 - Fundamentals Of Fluid Mechanics

Credit Hours: 3.00. Continua, velocity fields, fluid statics, basic conservation laws for systems and control volumes, dimensional analysis. Euler and Bernoulli equations, viscous flows, boundary layers, flows in channels and around submerged bodies, and one-dimensional gas dynamics.

Credits: 3.00

ME 31401 - Fundamentals Of Heat And Mass Transfer

Credit Hours: 3.00. Fundamental principles of heat transfer by conduction, convection, and radiation; mass transfer by diffusion and convection. Application to engineering situations.

Credits: 3.00

ME 31500 - Heat And Mass Transfer

Credit Hours: 4.00. Fundamentals of heat transfer by conduction, convection, and radiation; mass transfer by convection. Relevance to engineering applications.

Learning Outcomes: 1. Develop the ability to identify the relevant transport processes (heat, momentum and energy) when confronted with a particular problem. [1, 7] 2. Develop the ability to model and analyze heat and mass transfer processes. [1, 2, 3, 5, 7] 3. Augment the ability to design and conduct experiments to solve open-ended engineering problems. [2, 3, 5, 6, 7] 4. Reinforce technical written and oral communication skills through a formal project report. [3, 4, 5] Credits: 4.00

ME 31600 - Fluid Mechanics

Credit Hours: 3.00. Continua, velocity fields, fluid statics, basic conservation laws for systems and control volumes, dimensional analysis. Euler and Bernouilli equations, viscous flows, boundary layers, flows in channels and around submerged bodies, and one-dimensional gas dynamics.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

ME 32301 - Mechanics Of Materials Laboratory

Credit Hours: 1.00. Experimental methods and techniques employed for the measurement of mechanical properties and evaluation of mechanical structures. Application of mechanics of materials and fundamental concepts to measuring and analyzing mechanical structures. A laboratory design project on mechanical structures.

Learning Outcomes: 1. Conduct simple experiments and analyze data. 2. Enhance systematic problem-solving skills and sharpen written-communication skills through short technical laboratory memos. 3. Complete a design project on a mechanical structure. Credits: 1.00

ME 32500 - Dynamics Of Physical Systems

Credit Hours: 3.00. Development and solution of linear models; translational and rotational mechanical systems, electrical systems, electromechanical systems, thermal systems, hydraulic systems. The Laplace transform, transfer functions, and Bode plots, state variable representation and solutions. Computer analysis and simulation.

Learning Outcomes: 1. Develop a mathematical model generally consisting of ordinary differential equations for a given system. 2. Determine the equilibrium conditions, and where appropriate, obtain a linearized model for a nonlinear system. 3. Rearrange the equations that make up the system model in a new form suitable for an analytical solution and use them to build and simplify block diagrams. 4. Solution for a first order system by the method of time domain response. 5. Use Laplace transform method to find the time response, to determine the role of the transfer function on the system response, and where appropriate, to find the time constraints, damping ratios, and undamped natural frequencies. 6. Use a suitable software (i.e. Simulink - Matlab) to simulate and analyze the behavior of the dynamic systems. 7. Use block diagrams and computer simulations as aids in modeling and analysis of dynamic systems. Credits: 3.00

ME 32501 - Mechanical Engineering Laboratory III

Credit Hours: 1.00. Experiments on testing of Mechanics of Materials and Fluid Mechanics.

Credits: 1.00

ME 32510 - Energy Engineering Laboratory III

Credit Hours: 1.00. Experiments on testing of Fluids Mechanics and energy engineering.

Credits: 1.00

ME 32600 - Engineering Project Management

Credit Hours: 3.00. (ECE 32600) Project management is an important skill that is needed in the private and public sectors as well as specialty businesses. This course will explore the challenges facing today's project managers and will provide a broad understanding of the project management environment focused on multiple aspects of the project.

Learning Outcomes: Upon successful completion of the course, students should be able to 1. Use library resources and internet

resources to find information necessary for the project. 2. Use critical thinking in its design process. 3. Use creative approaches when necessary to obtain project objectives. 4. Analyze and interpret data. 5. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 6. Write a project report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 7. Make an oral presentation using effective visual aids. 8. An understanding of professional and ethical responsibility. 9. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 10. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ME 32700 - Engineering Economics

Credit Hours: 3.00. (ECE 32700) Engineering Economics is designed as an overview of economics with a focus on how it relates to the practice of engineering. Topics include interest formulas, rate of return, life cost analysis, depreciation, taxes, and cash flow.

Credits: 3.00

ME 33000 - Modeling And Analysis Of Dynamic Systems

Credit Hours: 3.00. Introduction to dynamic engineering systems; electrical, mechanical, fluid, and thermal components; linear system response; Fourier series and Laplace transform.

Credits: 3.00

ME 33010 - Modeling And Measurements Of Dynamic Systems

Credit Hours: 3.00. This course will cover the fundamentals of instrumentation, measurement, and dynamic systems modeling. Design, selection, and usage of the instrumentation systems and the interpretation of experimental results are also introduced. Basic concepts of measurements methods, measurement system response, assessment, uncertainty analysis of measured data, sensors, signal conditioning, recording / display devices, digital techniques, instrument interface, and measurement theories on stress and strain, temperature, pressure, fluid flow and velocity will also be covered. Additionally, fundamentals of dynamic systems including mechanical, electrical, and electromechanical systems will be introduced. Laplace transform, block diagram, transient and frequency response of linear first and second order system will be covered as well.

Credits: 3.00

ME 34001 - Instrumentation And Measurement Systems

Credit Hours: 2.00. Modeling and formulation of differential equations for dynamic systems, including mechanical vibratory systems, thermal systems, fluid systems, electrical systems, and instrumentation systems. Analysis of dynamic systems and measuring devices including transient response and frequency response techniques, mechanical systems, transducers, and operational amplifiers. Consideration of readout devices and their responses to constant, transient, and steady-state sinusoidal phenomena. Calibration and data analysis techniques are introduced. Both analog and digital computation are included.

Credits: 2.00

ME 34400 - Introduction To Engineering Materials

Credit Hours: 3.00. Introduction to the structure and properties of engineering materials, including metals, alloys, ceramics, plastics, and composites. Characteristics and processing affecting behavior of materials in service.

Credits: 3.00

ME 34600 - Renewable Energy Systems And Design

Credit Hours: 3.00. This course is designed to introduce the system and design of energy conversion and storage devices for renewable energy sources. Students will first learn about energy sources available on earth including kinetic, solar, and chemical. Next, the course will provide students with a review of the thermodynamic concepts behind energy constant and energy transfer via an energy conversion device. Finally, this course will tie together concepts of renewable energy sources and thermodynamics teaching students about design elements for energy conversion and storage devices, in which renewable energy sources are converted and stored. Permission of Instructor required.

Credits: 3.00

ME 35001 - Mechanical Engineering Laboratory IV

Credit Hours: 1.00. Experiments on testing of Dynamic Systems, Heat & Mass transfer, and Materials.

Credits: 1.00

ME 35010 - Energy Engineering Laboratory IV

Credit Hours: 1.00. Experiments on testing of heat and mass transfer, and energy engineering.

Credits: 1.00

ME 35200 - Machine Design I

Credit Hours: 4.00. Introduction to the principles of design and analysis of machines and machine components. Design for

functionality, motion, force, strength, and reliability. Review of fatigue failure theories and analysis of fatigue stresses. Laboratory experience provides open-ended projects to reinforce the design process.

Credits: 4.00

ME 35400 - Machine Design

Credit Hours: 3.00. Design, analysis, and selection of machine components for fluctuating loading. Application of design fundamentals to mechanical components and integration of components to form systems. Open-ended design projects reinforce the design process.

Learning Outcomes: 1. Apply Statics, Dynamics, and Strength of Materials to the realization of machine components. 2. Understand fatigue failure mechanisms 3. Apply fatigue failure theories to create reliable mechanical components. 4. Select standard machine components and materials. 5. Enhance problem-solving and communication skills through design projects. Credits: 3.00

ME 35401 - Machine Design Laboratory

Credit Hours: 1.00. Physical experiments on static and fatigue failure of mechanical parts. Application of failure theories to design of mechanical components and systems. Open-ended design projects to reinforce the design process.

Learning Outcomes: 1. Experiment on static and fatigue failure. 2. Compare theory with physical experiments and simulation. 3. Apply failure theories to design of machines. 4. Learn open ended design projects. Credits: 1.00

ME 36300 - Principles And Practices Of Manufacturing Processes

Credit Hours: 3.00. Manufacturing processes for engineering materials, both metallic and non-metallic. Fundamentals of manufacturing processes with a "hands-on" laboratory sequence. Analysis and design of processes for various engineering materials and their link to engineering design. Hands-on experiences through laboratory experiments and demonstrations. Not open to students with credit in IE 37000.

Credits: 3.00

ME 36400 - Systematic Engineering Design

Credit Hours: 3.00. The engineering design process including planning and clarification, conceptual design, embodiment design, and detail design. Identification of customer requirements and development of engineering specifications. Concept generation and selection. Rules and guidelines for embodiment design. Design considerations including quality, modularity, manufacturing, assembly, and economics. Detail design to support manufacturing.

Learning Outcomes: 1. Understand and apply a systematic design method. 2. Understand customer needs and translate needs to engineering specifications. 3. Generate concepts and use ideation techniques. 4. Develop layouts using embodiment design techniques. 5. Generate designs that are manufacturable. 6. Communicate design effectively to various stakeholders. 7. Work effectively in a team environment. 8. Acquire and apply new knowledge and tools to support the design process. Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 37200 - Design Of Mechanisms

Credit Hours: 3.00. Kinematic and dynamic analysis of linkages and mechanical systems. Analytical and graphical approaches to analysis. Vector loop and relative velocity/acceleration solutions. Design and analysis of cams and gears. Static and dynamic balancing. Design documentation report writing and communication.

Credits: 3.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

ME 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

ME 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

ME 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

ME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39600 - Professional Internship II

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit a summary report.

Credits: 0.00

ME 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ME 39700 - Selected Topics In Mechanical Engineering

Credit Hours: 0.00 to 6.00. Topics of contemporary importance or of special interest in Mechanical Engineering. Permission of instructor required.

Credits: 0.00 to 6.00

ME 40600 - Robust Design, Standards And Contemporary Issues

Credit Hours: 1.00. The role of standards, robust design and lifelong learning in engineering design. Application to contemporary issues.

Credits: 1.00

ME 40700 - HVAC Design

Credit Hours: 3.00. The fundamentals required to design and analyze HVAC systems used in buildings. This includes the fundamentals of the thermodynamics of HVAC systems and buildings, the thermodynamics of moist air (psychometrics), calculating building heating / cooling loads, application of HVAC equipment to buildings, HVAC component analysis, energy reduction strategies. Application to real building designs.

Credits: 3.00

ME 41200 - Additive Manufacturing: Fundamentals, Equipment, And Applications

Credit Hours: 3.00. Introduction to additive manufacturing through lecture and project-based learning. The focus is additive process fundamentals, materials, characterization, and testing. Students will develop and understanding of processes and equipment for additive manufacturing; design for additive manufacturing; Implementation of Additive Manufacturing for Product Applications.

Learning Outcomes: 1. Understand the fundamentals of materials, properties, and testing for additive manufacturing. 2. Develop understanding of processes and equipment for additive manufacturing. 3. Understand design(s) for additive manufacturing with material(s) and process(es) for application specific functionality. 4. Complete a project based on product innovation or novel research. Credits: 3.00

ME 41300 - Noise Control

Credit Hours: 3.00. Fundamentals of acoustic waves. Psychoacoustics and theories of hearing. Environmental and building acoustics. Measurement methods and common instrumentation. Noise control methods. Machinery noise. Community reaction. Legal aspects. Design-oriented semester project. Course work in differential equations.

Credits: 3.00

ME 41400 - Thermal-Fluid Systems Design

Credit Hours: 3.00. Application of basic heat transfer and fluid flow concepts to design of thermal-fluid systems. Emphasis on design theory and methodology. Design experience in thermal-fluid area such as piping systems, heat exchangers, HVAC, and energy systems. Design projects are selected from industrial applications and conducted by teams.

Credits: 3.00

ME 41500 - Energy Systems Engineering

Credit Hours: 3.00. Application of Thermodynamics, fluid mechanics, and heat transfer fundamentals to the design of energy systems. Applications include thermal regulation in buildings, electronic equipment, energy generation, conversion, and storage, manufacturing processes, and combustion processes. Beyond the fundamentals, this course will focus on design and analysis techniques, including analysis of energy costs, economics, and environmental issues.

Credits: 3.00

ME 41800 - Engineering Of Environmental Systems And Equipment

Credit Hours: 3.00. Design and analysis of systems and equipment used in conditioning buildings. Review of fundamentals in thermodynamics, heat transfer, fluid mechanics, economics, non-linear equation solving, optimization. Analysis of building heating and cooling requirements for design and annual energy use. Design and selection of equipment.

Credits: 3.00

ME 42301 - Introduction To Nanotechnology

Credit Hours: 3.00. The course introduces students to the scale of nanotechnology, materials used in nanotechnology, forces acting in nanomaterials, electronic and mechanical behaviors on the nanometer scale, and applications in industries and life sciences. Nano-versus micro-technology in the evaluation of potential risks and benefits will be covered with emphasis on their impact on society.

Learning Outcomes: 1. Describe the status of nanotechnology infrastructure and products in the USA in instrumentation, devices, materials, and applications. 2. Compare nanotechnology to micro-technology issues. 3. Demonstrate knowledge of nanotechnology standards, tools, and Nano-manufacturing. 4. Explain the features of nanoscale electronics. 5. Communicate team project or team research term paper work through oral presentation and technical report. Credits: 3.00

ME 42501 - Mechanical Engineering Laboratory V

Credit Hours: 1.00. Experiments on testing of Mechanical Measurements and Control Systems.

Credits: 1.00

ME 42510 - Energy Engineering Laboratory V

Credit Hours: 1.00. Experiments on testing of mechanical measurements, control systems and alternative energy systems.

Credits: 1.00

ME 43000 - Power Engineering

Credit Hours: 3.00. Rankine cycle analysis, fossil-fuel steam generators, energy balances, fans, pumps, cooling towers,

steam turbines, availability (second law) analysis of power systems, energy management systems, and rate analysis.

Credits: 3.00

ME 43300 - Principles Of Turbomachinery

Credit Hours: 3.00. Unified treatment of principles underlying fluid mechanic design of hydraulic pumps, turbines and gas compressors. Similarity and scaling laws. Cavitation. Analysis of radial and axial flow machines. Blade element performance. Radial equilibrium theory. Centrifugal pump design. Axial compressor design.

Learning Outcomes: 1. Understand principles of operation of pumps, fans, compressors and turbines. 2. Develop the ability to size and select turbomachinery for a specific application. 3. Develop the ability to analyze the performance of turbomachinery. 4. Master the concepts of classic mean-line and quazi-3D design methods. Credits: 3.00

ME 43400 - Gas Turbines For Power And Propulsion

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet, turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component matching and off-design performance. Coursework in thermodynamics and fluid mechanics.

Learning Outcomes: 1. Apply basic performance characteristics of shaft power gas turbine engines. 2. Apply basic performance characteristics of gas turbines for aircraft propulsion. 3. Apply cycle analysis. 4. Apply component performance analysis. 5. Apply design and off-design operation. Credits: 3.00

ME 43500 - Dynamical Systems

Credit Hours: 1.00. This course introduces the modeling and analysis of dynamical systems providing the tools for problem-solving of complex mechanical, electromechanical, and aerospace systems. The course focuses on providing a unified approach to derive equations of motion of diverse linear systems the solution of which can be obtained in generic fashion. The course is designed to draw from differential equations, dynamics, and control systems courses, thereby unifying seemingly diverse concepts and tools under the dynamical systems umbrella.

Learning Outcomes: 1. Gain familiarization with energy-based methods for equations of motion derivation. 2. Understand derivation and analysis of linear dynamical systems via canonical forms of equations of motion. 3. Gain familiarization with general solution approaches to linear dynamical systems. Credits: 1.00

ME 44000 - Automotive Prime Movers: Green Engines And Clean Fuel

Credit Hours: 3.00. Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics- engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics- different components of hybrid engines and the powertrain design. FCE topics- fundamentals of fuel cells and automotive applications. Clean fuel topics- biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels.

Learning Outcomes: 1. Relate processes in automotive prime movers to engineering fundamentals. 2. Study low-carbon emitting, and LEV, ULEV, SULEV, PZEV, and ZEV prime mover designs. 3. Study prime mover designs that are alternative to conventional combustion engines. 4. Study cleaner alternatives to conventional fossil fuels. 5. Carry out analysis of prime mover designs and fuel alternatives to identify cost and energy tradeoffs. Credits: 3.00

ME 44400 - Computer-Aided Design And Prototyping

Credit Hours: 3.00. Introduction to advanced computer-aided design (CAD) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional and marketable product. Projects include use of the advanced design tools to produce a working prototype that is manufacturable. Application to design, manufacturing, and analysis.

Credits: 3.00

ME 44700 - Compressible Flow And Renewable Kinetic Energy

Credit Hours: 3.00. This course is designed to introduce compressible flow, turbomachines and design of kinetic energy conversion and storage devices for wind, wave and tidal renewable energy sources. Students will first learn about compressible flow, turbomachines concepts and kinetic energy sources available on earth. Next, the course will provide students with analysis, design parameters and control renewable kinetic energies.

Credits: 3.00

ME 45500 - Vehicle Design And Fabrication

Credit Hours: 3.00. Open-ended project course to design and build competitive prototype vehicles. Integration of design concept formulation, engineering analysis and testing, and prototype fabrication. Product development activities in a hands-on setting. Design constraints imposed by manufacturing limitations, funding constraints and market competition. Permission of instructor required.

Learning Outcomes: 1. Apply the design process to the design of a vehicle. 2. Apply engineering fundamentals to evaluate the design of a vehicle. 3. Apply team-work skills to management of the Mini-Baja or Formula SAE teams. 4. Learn the effect of design choices by building and testing students' designs. Credits: 3.00

ME 45900 - Mechanism And Machine Theory

Credit Hours: 3.00. Introduction to the principles of the analysis and design of mechanisms and machinery. Design for functionality, motion constraints, inertia force effects, and static and dynamic balancing.

Learning Outcomes: 1. An understanding of the kinematics of mechanisms. 2. An understanding of the kinetics and dynamics of machines. 3. Enhance problem-solving techniques in mechanism and machine theory. 4. Appreciation of the design of different types of machinery. Credits: 3.00

ME 46200 - Capstone Design

Credit Hours: 3.00. Concurrent engineering design concept is introduced. Application of the design is emphasized. Design problems from all areas of mechanical engineering are considered.

Credits: 3.00

ME 46300 - Engineering Design

Credit Hours: 3.00. Application of the design process to the design of various engineering components and systems. Mathematical modeling in design is emphasized. Design problems from all areas of mechanical engineering are considered.

Learning Outcomes: 1. Reinforce the philosophy that engineering design problems are open-ended and multifaceted. [1, 2, 3, 5] 2. Exercise a collaborative design methodology. [2, 3, 4, 5, 6, 7] 3. Broaden skills in leadership, teamwork, communication, project planning, innovation, design, and entrepreneurship. [3, 5] 4. Experience the application of core course materials, engineering design methods, and testing to practical open-ended design problems. [1, 2, 6] 5. Reinforce a philosophy of professional and ethical behavior. [4] 6. Provide a practical foundation for knowledge acquisition and continued learning as needed in students' future careers. [7] Credits: 3.00

ME 47500 - Automatic Control Systems

Credit Hours: 3.00. Controller design in frequency domain with introduction to digital systems and control.

Credits: 3.00

ME 48200 - Control System Analysis And Design

Credit Hours: 3.00. (MSTE 36000) Classical feedback concepts, root locus, Bode and Nyquist techniques, state-space formulation, stability, design applications. Students may not receive credit for both ECE 38200 and ME 48200.

Credits: 3.00

ME 48900 - Introduction To Finite Element Analysis

Credit Hours: 3.00. Introduction to finite element analysis with focus on linear elasticity and heat transfer. Matrix analysis and assembly of solutions. Strong form and weak form as a general solution process for differential equations.

Learning Outcomes: 1. Introduce concepts of finite element analysis. 2. Learn the use of matrix methods for solution of truss structures. 3. Learn strong and weak form for the solution of differential equations. 4. Learn how to define finite elements and finite element approximations. 5. Learn how to solve weak form formultions as a finite element approximation. 6. Apply these concepts to linear elastic and heat transfer problems. 7. Apply a commercial finite element code to linear elastic and heat transfer problems. 8. Understand the use of the Finite Element Analysis in engineering practice. Credits: 3.00

ME 49200 - Technology And Values

Credit Hours: 3.00. The impact of science and technology on personal and societal value systems. The special responsibility of engineers. Practical methods for using human values to guide future technological developments. Societal problems considered: warfare, energy, overpopulation, resource depletion, and environmental degradation. Interdisciplinary

approaches stressed. Offered in alternate years.

Credits: 3.00

ME 49601 - Experimental Courses

Credit Hours: 1.00 to 6.00. Experimental classes offered at the junior or senior level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 1.00 to 6.00

ME 49700 - Mechanical Engineering Projects

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest outside the scope of the standard undergraduate curriculum. Interested students seek a faculty advisor in their area of special interest and together prepare a brief description of the work to be undertaken. Permission of instructor required.

Credits: 1.00 to 6.00

ME 49800 - Research In Mechanical Engineering I

Credit Hours: 0.00 to 6.00. Individual research projects for students with honors classification. Requires prior approval of, and arrangement with, a faculty research advisor. Honors classification. Permission of instructor required.

Credits: 0.00 to 6.00

ME 49900 - Research In Mechanical Engineering II

Credit Hours: 0.00 to 6.00. Continuation of ME 49800. Requires submission of a written thesis, public presentation, and oral defense of the research project. Honors Classification. Permission of instructor required.

Credits: 0.00 to 6.00

ME 50000 - Advanced Thermodynamics

Credit Hours: 3.00. The empirical, physical basis of the laws of thermodynamics. Availability/exergy concepts and applications. Properties and relations between properties in homogeneous and heterogeneous systems. The criteria of equilibrium. Application to a variety of systems and problems, including phase and reaction equilibrium. Offered in alternate years.

Credits: 3.00

ME 50100 - Statistical Thermodynamics

Credit Hours: 3.00. The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Introduction to quantum mechanics and molecular spectroscopy. The Maxwell-Boltzmann formulation of statistical mechanics and applications to ideal gases, solids, radiation, and laser diagnostics. The Gibbs formulation of statistical mechanics and application to real gases. Kinetic theory and applications to transport properties and chemical kinetics. Offered in alternate years.

Learning Outcomes: 1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena. 2. Apply concepts and calculate thermodynamic and transport properties of ideal gases. 3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements. Credits: 3.00

ME 50101 - Energy Assessment Of Industrial Processes

Credit Hours: 3.00. The course provides and analyzes methodologies for improving energy efficiency in the manufacturing sector. The manufacturing equipment and processes will be analyzed in terms of energy consumption and optimization. It provides the technical and analytical foundation for students on assessing industrial processes to evaluate measures for optimizing energy efficiency in industrial, electrical, motor drive, compressed air, process heating, process cooling, lighting, space conditioning, combined heat and power systems. This course is designed for students who are interested in energy efficiency. Permission of instructor required.

Credits: 3.00

ME 50102 - Energy Management Principles

Credit Hours: 3.00. This course provides energy management principles for industrial applications. Various energy management methods, commitments, and strategies for continuous improvement as well as international standards will be analyzed and integrated. This course emphasizes real world applications including: critiquing utility rates structure and assessing costs; characterizing and quantifying energy saving opportunities at industrial facilities; determining investment payback scenarios and considerations. Permission of instructor required.

Credits: 3.00

ME 50103 - Industrial Energy Assessment: Tools And Applications

Credit Hours: 3.00. This course synthesizes advanced energy efficiency, energy auditing, and energy assessment methods and practices. Several types of industrial audits will be analyzed with respect to the methods, tools (hand and software), and industrial application. Topics include: the audit process for energy, industrial productivity, and waste stream audits; audit components: energy bill analysis and economic analysis: audit system mechanics related to building envelop, electrical system, HVAC system, waste heat recovery, lighting, cogeneration, and other prevalent industrial systems; and measurement instrumentation issues for each industrial system. Students will enhance learning from a class project, which requires completion of an industrial scale energy audit. Permission of instructor required.

Credits: 3.00

ME 50104 - Powertrain Integration

Credit Hours: 3.00. The holistic view of powertrain development

that includes engine, transmission, and driveline is now well accepted. Current trends indicate an increasing range of engines and transmissions in the future with, consequently, a greater diversity of combinations. This course discusses engines, transmissions, and drivelines in relation to their interfaces with chassis systems. This course also explores various aspects of powertrain integration. Novel concepts relating, for example, to continuously variable transmissions (CVTs) and hybridization as well as approaches to modeling, analysis, and simulation will be discussed. Permission of instructor required

Credits: 3.00

ME 50105 - Hybrid And Electric Transportation

Credit Hours: 3.00. This course will cover fundamentals of hybrid electric and battery electric transportation systems with particular emphasis on automotive vehicles. It will cover powertrain configurations of Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), and Battery Electric Vehicle (BEV). The principal element of the powertrain of these vehicles will be discussed: Battery, Electric Motor, Engine, Transmission. This course will cover design concepts for HEV / PHEV and BEV powertrain. Optimal methods of component sizing via appropriate modeling and analysis methodologies will also be introduced. An introduction to power electronic components and microprocessor based controllers for these powertrains will also be given. An in-depth coverage, including optimal energy management, will be given on the energy and power management of HEV / PHEV and BEV powertrain once the design is complete. Introduction of various concepts and terminologies, the state of the art development, energy conversion and storage options, modeling, analysis, system integration and basic principles of vehicle controls will be covered as well. Upon completion of this course, students should be able to follow the literature on these subjects and perform modeling, design, analysis and development work in this field. A field demonstration of a PHEV will be used to further enhance the learning experience in this course. Permission of department reqjuired. Prerequisite: ME 48200/ECE 38200.

Credits: 3.00

ME 50106 - Industrial Energy Audit

Credit Hours: 1.00 or 2.00. Students enrolled in this course will investigate, evaluate, conjecture, formulate and author during their participation in professional energy audits at multiple manufacturing sites. Students earn one credit during the fall semester and two credit hours during the spring semester of this two-part course. Permission of instructor required.

Credits: 1.00 or 2.00

ME 50300 - Micro-And-Nano-Scale Energy Transfer Processes

Credit Hours: 3.00. Transport of energy in natural and fabricated micro- and nano-scale structures. Physical nature of energy transport by three carriers-electrons, phonons, and photons. Bulk material properties (e.g., thermal/electrical conductivity) are derived from statistical particle transport theories. Effects of spatial confinement on bulk properties are quantified. Contemporary interdisciplinary engineering applications.

Learning Outcomes: 1. Gain an understanding of the fundamental elements of solid-state physics. 2. Develop skills to derive continuum physical properties from sub-continuum principles. 3. Apply statistical and physical principles to describe energy transport in modern small-scale materials and devices.

Credits: 3.00

ME 50400 - Automotive Control

Credit Hours: 3.00. Basic engine operation; lambda control, speed control, knock control, fuel injection timing control, ignition control of SI engines; driveline modeling, automatic transmission control, clutch phasing control; wheel model, complete vehicle model; observers, friction coefficient estimators, tire contact patch force estimators; anti-lock brake control, traction control, yaw stability control; drive-by-wire systems. The distance offering of this course originates from the IUPUI campus, is offered through streaming video via ProEd, and may be made available at the West Lafayette campus.

Credits: 3.00

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 50601 - Design Optimization Methods

Credit Hours: 3.00. In this course, the general theory of optimization, concepts and problem statement are presented. Methods for minimization of a function of one or n-variables with and without constraints are discussed. Response surface methods and design of experiments are shown to significantly reduce analysis time. Applications using a commercial software package to solve typical engineering design optimization problems are demonstrated. Uncertainty in the design process is introduced. In addition to engineering, the methods studied can be applied to a variety of diverse disciplines such as finance, investment portfolio management, and life sciences. Permission of instructor required.

Credits: 3.00

ME 50700 - Laser Processing

Credit Hours: 3.00. Introduces background knowledge in laser science and laser technology and fundamentals involved in laser processing and manufacturing. The following topics are discussed: laser fundamentals, industrial laser systems and processes, and the laser-induced thermal, thermo-mechanical, and thermo-acoustic effects. The course also discusses emerging areas of laser applications, such as microscale laser processing, ultrafast laser processing, and the related energy transport analyses. Laboratory and video demonstration sessions are used to enhance the overall understanding of the course materials. Offered in alternate years.

Credits: 3.00

ME 50800 - Heat Trans In Biological Systems

Credit Hours: 3.00. Introduction to applications of heat transfer in living systems to students who have general interests in biomedical engineering. Fundamental concepts of biology and engineering involved in these applications are introduced. Regulation of blood flow under external thermal stimuli and its effect on heat transfer are discussed. Clinical applications of heat transfer, including cancer therapy and gene therapy. Prerequisite: first course in fluid or aerodynamics. Offered in alternate years.

Credits: 3.00

ME 50801 - Orthopaedic Tissue Mechanics

Credit Hours: 3.00. Orthopaedic tissues, such as bone, cartilage, tendon and ligament, serve functions that are largely mechanical in nature and that are critical for our health. This course is structure around classical topics in mechanics of materials and their applications in biomechanics and musculoskeletal tissues. Primary emphasis will be on the mechanical behavior of tissues, including elastic and failure properties as well as more advanced topics such as anisotropy, nonlinearity, viscoelasticity, poroelasticity, damage and fatigue. Importantly, the theories used to describe these mechanical properties were originally developed for advanced engineering materials such as fiber composites, polymers, elastomers, hydrogels, etc. Thus, while the theories will be presented in the context of biological materials, potential applications are much broader. Tissue microstructure and its importance to the material properties will be covered. Mechanics of whole bones and implants (composite and asymmetric beam theories) and the mechanical function of native and artificial joints (contact mechanics, lubrication and wear) may also be discussed, time permitting. Some homework assignments will emphasize the use of experimental data to develop and test theoretical models via nonlinear curve fitting and optimization using Matlab. Students will receive an introduction to tissue mechanics literature to better understand how the concepts presented in class are used in the research setting.

Credits: 3.00

ME 50900 - Intermediate Fluid Mechanics

Credit Hours: 3.00. Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

Learning Outcomes: 1. State basic laws for a control volume in different coordinate systems. 2. Derive the kinematics of fluid flow in problem solving. 3. Derive the equations for frictionless and incompressible flows. 4. Derive the basic equations of motion of viscous flows. 5. Find standard exact solutions of viscous-flow equations and apply them. 6. Derive and solve basic equations of boundary-layer theory. 7. Find lift and drag forces on immersed bodies with simple shapes. 8. Understand concepts of incompressible turbulent flows and wall turbulence. Credits: 3.00

ME 51000 - Gas Dynamics

Credit Hours: 3.00. Flow of compressible fluids. One-dimensional flows including basic concepts, isentropic flow, normal and oblique shock waves, Rayleigh line, Fanno line, and simple waves. Multidimensional flows including general concepts, small perturbation theory for linearized flows and method of characteristics for nonlinear flows. Prerequisite: first course in fluid or aerodynamics.

Credits: 3.00

ME 51100 - Heat Transfer In Electronic Systems

Credit Hours: 3.00. This course covers both traditional and more innovative methods for heat extraction in electronic systems and the effectiveness and applicability of these methods over a wide range of scales. Special emphasis is given to industry-related applications with experts often attending and presenting material as part of class instruction.

Learning Outcomes: 1. Introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practicing engineers. 2. Provide an appreciation for the applications of first principles to electronics cooling and packaging problems in industry. 3. Provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge. Credits: 3.00

ME 51201 - Energy Storage Devices And Systems

Credit Hours: 3.00. The basic concepts and components of primary and rechargeable batteries; Faraday's Law: electrode process and kinetics; electric double layer; electroanalytical techniques; battery standard, operation, and other considerations; materials for Li-ion batteries; next generation high energy rechargeable lithium batteries; batteries for electric vehicles and hybrid electric vehicles; and battery for the electrodes, electrolytes, temperature range and operation of different types of batteries. Permission of instructor required.

Credits: 3.00

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

ME 51400 - Fundamentals Of Wind Energy

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet, turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component machine and off-design performance. Inspection trip to industrial plan required.

Learning Outcomes: 1. Introduce students to the technology and economics of converting wind energy to electricity. 2. Inform students to the environmental concerns of wind energy. 3. Understand principles of wind turbine aerodynamics. 4. Develop the ability to design optimum blading. 5. Develop the ability to evaluate a potential site in terms of wind energy. 6. Understand wind turbine structural dynamics issues. Credits: 3.00

ME 51800 - Analysis Of Thermal Systems

Credit Hours: 3.00. Modeling and optimization of thermal systems with a focus on heat-pumping equipment, such as vapor compression, absorption, and some advanced heat-pumping cycles. Students combine the use of thermodynamics, heat transfer, fluid mechanics, and numerical methods to develop and apply mathematical models for the analysis and optimization of specific equipment. Offered in alternate years.

Learning Outcomes: 1. Develop a comprehensive understanding of the fundamentals of thermal systems' modeling and analysis. 2. Develop a detailed understanding of vapor compression systems, absorption systems, and other advanced heat pumping equipment. Credits: 3.00

ME 52000 - Imaging-Based Computational Hemodynamics For Cardiovascular Assessment

Credit Hours: 3.00. Image-based computational hemodynamics is a newly-emerged computational technique for non-invasive and patient-specific assessment of cardiovascular diseases based on medical imaging data. In this course, students will learn (1) concepts and principles of cardiovascular circulation in the human body and imaging modalities for cardiovascular diseases; (2) image-based computational modeling methods for quantification of hemodynamics (velocity, pressure, and wall-shear stress) in human vessels based on CT/MRI and Doppler ultrasound imaging data; and (3) computational analysis to assess the severity of cardiovascular diseases. Team projects to non-invasively assess the severity of arterial stenosis in renal, iliac, and coronary arteries via quantification of trans-stenotic pressure gradient and/or fractional flow reserve will provide first-hand experience of how computational modeling and analysis can contribute to medical innovation and advanced precision medicine.

Credits: 3.00

ME 52200 - Indoor Environmental Analysis And

Design

Credit Hours: 3.00. Review of current trend of building and indoor environment design. Theory of thermal comfort, indoor air quality, visual comfort, and acoustic comfort. Introduction of experimental techniques and advanced computer tools for indoor environment analysis and design.

Learning Outcomes: 1. Provide an introduction into and practical examples of indoor environment. 2. Present the basic theory of thermal comfort, indoor air quality, visual comfort, acoustics comfort and HVAC systems. 3. Introduce advanced tool to analyze and design indoor environment and energy use in buildings. 4. Conduct indoor environment analysis and design for a challenging problem. Credits: 3.00

ME 52301 - Nanosystems Principles

Credit Hours: 3.00. (ECE 52301) This is the introductory course in the nanosystems area. It introduces students to the principles and applications of nanosystems. The course begins with an introduction to the nanometer scale phenomena. It then introduces students to the basic elements resulting in nanosystems: nanoscale materials, processes, and devices. It also provides students with a basic understanding of the tools and approaches that are used for the measurement and characterization of nanosystems, and their modeling and simulation. Moreover, the course covers the applications of nanosystems in a wide range of industries, including information technology, energy, medicine, and consumer goods. The course concludes with a discussion of the societal and economical significance of these applications, including benefits and potential risks.

Credits: 3.00

ME 52500 - Combustion

Credit Hours: 3.00. Physical and chemical aspects of basic combustion phenomena. Chemical energetics and equilibrium. Basic chemical kinetics, chain reactions, and explosions. Chain and thermal ignition. Homogeneous combustion models. Detonations and deflagrations. Laminar flame speed and flame extinction. The Shvab-Zeldovich formulation of the multicomponent conservation equations. Diffusion flames and droplet combustion. Introduction to turbulent combustion.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8) spray drying. Offered in alternate years.

Credits: 3.00

ME 52601 - Integrated Nanosystems Processes And Devices

Credit Hours: 3.00. (ECE 52601) This course covers processes and devices associated with integrated nanosystems. Integrated nanosystems refer to systems which consist of integrated micro-, meso-, and/or macro-scale parts, and their core components are realized by nano-scale materials, processes, and devices. The course, while covering processes which result in integrated nanosystems, will focus on the theory and operation of select electronic, electromechanical, and biomedical devices which are used for information technology, sensing, medical, and other applications. The lectures will be complemented by hands-on laboratory experience. Permission of instructor required.

Credits: 3.00

ME 52900 - Sustainable Energy Options And Analysis

Credit Hours: 3.00. This course develops an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. A range of different technologies and approaches are presented for meeting future energy needs. Students learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics and gain experience in assessing different energy technologies for specific case studies.

Learning Outcomes: 1. Gain an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. 2. Gain an understanding of alternative technologies for meeting future energy needs. 3. Learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics. 4. Gain experience in assessing different energy technologies. Credits: 3.00

ME 53100 - Characteristics Of Particles, Powders, And Compacts

Credit Hours: 3.00. Familiarize students with the properties and methods used to characterize the mechanical behavior of particles, powders, and compacts, with the intention of using these properties for process and performance design. Students work with a subset of the measurement methods in a laboratory setting. Students successfully completing the course will be able to define and describe the significant properties of particles,

powders, and compacts; describe and demonstrate techniques used to measure these properties; and demonstrate how these properties are useful in product and manufacturing performance. Offered alternate years.

Learning Outcomes: 1. Define and describe the significant properties of particles, powders, and compacts. 2. Describe and demonstrate techniques used to measure these properties. 3. Demonstrate how these properties are useful in product and manufacturing performance. 4. Pursue further studies on particle and powder characterization. Credits: 3.00

ME 53101 - Particle, Powder, And Compact Characterization

Credit Hours: 2.00. The goal of this course is to familiarize students with the properties and methods used to characterize the physical and mechanical behavior of particles, granules, and compacts with the intention of using these properties for process and performance design.

Learning Outcomes: 1. Define and describe the significant properties of particles, granules, powders, and compacts. 2. Explain how these properties are measured. 3. Illustrate how these properties influence the performance of particle-based products and manufacturing processes. 4. Create a computational or web-based tool that demonstrates or implements concepts from the course. Credits: 2.00

ME 53102 - Particle, Powder, And Compact Characterization Laboratory

Credit Hours: 1.00. The goal of this laboratory course is to train students on state-of-the-art laboratory equipment used to measure the mechanical properties of particles, granules, powders, and compacts.

Learning Outcomes: 1. Follow laboratory safety guidelines. 2. Operate common laboratory equipment and follow standard operating procedures used to measure the mechanical properties of particles, granules, powders, and compacts. 3. Plan and perform measurements as part of a team, analyze results, and summarize the results in a written report. Credits: 1.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and recognize the technologies available for each component. 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

ME 53501 - Introduction To Systems Engineering

Credit Hours: 3.00. This course offers an examination of the principles of systems engineering and their application across the system life cycle. Special emphasis is given to concept exploration, requirements analysis and development, analysis of alternatives, preliminary design, integration, verification, and system validation. The students will use the international space station (on-orbit modules) for practical application of the principles introduced in this course. This is the first of two courses in systems engineering and is a prerequisite to the Systems & Specialty Engineering course. Both courses use the same text book and have a 15% overlap of the text material. Permission of instructor required.

Credits: 3.00

ME 53502 - Systems And Specialty Engineering

Credit Hours: 3.00. This course offers an examination of the

interaction between the principles of systems engineering and the design for specialty engineering areas. The focus of their interactions is viewed across the system life cycle. Special emphasis is given to contributions of the specialties to the essential knowledge development needed for concept exploration, requirements analysis and development, trade-offs and decisions with uncertainty, preliminary design, system integration, verification, and system validation. Students will use the international space station and its support systems for practical application of the principles introduced in this course. Permission of instructor required.

Credits: 3.00

ME 53503 - Model-Based Systems Engineering

Credit Hours: 3.00. This course focuses MBSE or Model-Based Systems Engineering (i.e. the model-based version of Systems Engineering) with an emphasis on its intelligent implementation using SysML graphical language for systems representation. The other two pillars for implementing MBSE are also covered: a methodology (OOSEM) and a tool (Cameo Systems Modeler). The coursework incorporates theoretical concepts learned in earlier systems engineering classes and is structured around the Object Modeling Group's SysML which is used in modeling systems. SysML's application to real-life projects and businesses to define, track and visualize various aspects of a system is investigated. Case studies from a variety of disciplines - including engineering and healthcare - are used as teaching tools.

Credits: 3.00

ME 53504 - Systems Driven Product Development

Credit Hours: 3.00. Integrated Model-Based Systems Driven Product (and Process) Development, or SDPD (Systems Driven Product Development) is a methodology and framework for integrating system behavioral modeling with downstream design and manufacturing practices to plan multi-domain, complex, systems. SDPD is an implementation of MBE (Model-based Engineering) which integrates MBSE (Model-based Systems Engineering) and PLM (Product Lifecycle Management) to create the "Digital Twin" of a product/process and support the digital transformation resulting in the digital enterprise of Industry 4.0 (4th Industrial Revolution). The course covers key concepts and definitions pertaining to SDPD including MBSE, PLM, Digital Manufacturing, Digital Twin, Digital Thread, Industry 4.0, Interoperability, Traceability, Validation/Verification, Optimization, and Predictive Analytics. State-of-the-art engineering software tools are taught and used by students to design, optimize and verify multi-domain complex products (or systems) following the SDPD methodology. The graduate level project consists of a comprehensive implementation of SDPD methodology in real-life/industry relevant design and optimization of complex (multi-domain) systems.

Credits: 3.00

ME 53700 - Complex Fluids

Credit Hours: 3.00. The aim of the course is to provide a basic foundation in the fluid mechanics of viscous flows and complex fluids. Students completing this course are expected to understand the physics underlying the constitutive equations for these materials and be able to model them.

Learning Outcomes: 1. Develop a thorough understanding of complex fluids and relevant flow physics. 2. Define and describe significant properties of complex fluids. 3. Explain how properties of complex fluids are measured. 4. Understand the physics underlying the constitutive equations for complex fluids. 5. Enable continued study in advanced topics in fluid mechanics. 6. Develop the ability to critically evaluate the scientific literature on complex fluids. 7. Develop skills for scientific presentations. Credits: 3.00

ME 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (AAE 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, and nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

ME 54000 - Internal Combustion Engines

Credit Hours: 3.00. Spark-ignition and compression-ignition engine processes. Study of the fundamentals of turbulence, boundary, layers, liquid atomization, sprays, combustion, and pollutant formation as applied to engines. Engine after treatment. Modeling of engine flows, sprays, combustion, and pollutants. Offered in alternate years.

Learning Outcomes: 1. Study the fundamentals of turbulence, boundary layers, liquid atomization, sprays, combustion, and pollutant formation as applied to internal combustion engines. 2. Study the modeling of engine flows, sprays, combustion, and pollutant formation in internal combustion engines. Credits: 3.00

ME 54100 - Engineering Design: A Decision-Based Perspective

Credit Hours: 3.00. Multi-objective decision making under risk and uncertainty; Group decision making; Sequential decision making; Model-based and data-driven decision making; Heuristics and biases in design decision making. Applications to engineering design including estimation of customer preferences, simulation-based design, and sustainable design.

Learning Outcomes: 1. Formulate design decisions under risk and uncertainty. 2. Apply multi-attribute utility theory to make decisions in engineering design. 3. Evaluate the assumptions and limitations of commonly used decision-making methods. 4. Identify heuristics and biases in design decision making. 5. Adopt an interdisciplinary approach to design across engineering economics and social sciences. Credits: 3.00

ME 54200 - Introduction To Renewable Energy

Credit Hours: 3.00. An introductory course on renewable energy. Students will learn the fundamental principles of the various renewable energy options and their applications and costs. After taking this course, students will be familiar with the economic and societal impact of renewable energy systems, and be able to participate in the design or selection of renewable energy systems.

Credits: 3.00

ME 54255 - Motorsports Vehicle Dynamics Fundamentals

Credit Hours: 3.00. Vehicle dynamics is the study of behavior of vehicles in motion. The study is one of the most important activities in the Vehicle design and development cycle to design vehicles which drive well and are comfortable to ride in. The course focuses on the development of advanced mathematical engineering models that represent the behavior of automotive vehicles and vehicle subsystems. Topical emphasis is focused on rectilinear performance, steady state handling behavior, tire models and suspension models.

Learning Outcomes: 1. Evaluate the solution to the race car and vehicle design as applied to motorsports vehicles. 2. Investigate the concept of the suspension design process and optimization techniques including concepts of kinematics and vibration isolation used in industry by race engineers. 3. Implement concepts of tire and mechanism of load generation and industry standards. 4. Critique suspension geometry design, wheel and steering angles, suspension travel, anti-features, roll centre, camber change rate and elastokinematics. 5. Develop modeling and dynamic simulation. 6. Formulate mechanism of traction force generation in Braking and accelerating and explanation of working of Anti-lock brake systems as an industry tool in motorsports design. Credits: 3.00

ME 54355 - Motorsports Vehicle Vibration Dynamics

Credit Hours: 3.00. An investigation into advanced topics in the field of vehicle dynamics. This course covers the principles and applications of vehicle handling dynamics from an advanced perspective in depth. The methods required to analyze and optimize vehicle handling dynamics are presented, including tire compound dynamics, vehicle planar dynamics, vehicle roll dynamics, full vehicle dynamics, and in-wheel motor vehicle dynamics. The provided vehicle dynamic model is capable of investigating drift, sliding, and other over-limit vehicle maneuvers. This is an ideal course for postgraduate and research students and engineers in motorsports, mechanical, automotive, transportation, and ground vehicle engineering.

Learning Outcomes: 1. Evaluate the rectilinear performance simulation program based on the modelling equations adapted to the race car and vehicle design as applied to motorsports vehicles. 2. Investigate the concept of the transient vehicle handling model used in industry by race engineers. 3. Implement concepts of the vehicle ride model and apply known vehicle parameters to understand

vehicle performance and industry standards. 4. Develop advanced modeling and dynamic simulation. Credits: 3.00

ME 54455 - Motorsports Aerodynamics Fundamentals

Credit Hours: 3.00. A study and adaptation of fluid flow and aerodynamics as applied to motorsports design and performance optimization. This course is designed to reinforce student's understanding of aerodynamics as it pertains to a race car. This course breaks down the differences between actual air flow while driving / racing versus air flow within a wind tunnel, and how these flows are different. It discusses how to evaluate those flows, and determine if they need to be improved. It discusses ways to improve the aero on race cars.

Learning Outcomes: 1. Evaluate the solution to the aerodynamic analysis and design as applied to motorsports vehicles. 2. Investigate the concept of the aerodynamic optimization techniques used in industry by race engineers. 3. Implement concepts of wind tunnel technology and industry standards. 4. Critique aerodynamic flow regimes (continuum, slip, and transition) and their verifications in different regimes. 5. Develop modeling and fluid simulation. 6. Formulate and conduct direct Computational Fluid Dynamics simulations as an industry tool in motorsports design. Credits: 3.00

ME 54555 - Advanced Applications Of Motorsports Aerodynamics

Credit Hours: 3.00. This advanced course is designed to adapt the secrets of the rapidly developing field of high-speed vehicle design. From F1 to Indy Car, Advanced drag simulation and Sedan racing, this course provides clear advanced explanations for students and engineers who want to improve their design skills and to interpret how their favorite race cars aerodynamics is designed. It differentiates how aerodynamics win races, why downforce is more important than streamlining and drag reduction, designing wings and venturis, plus wind tunnel designs and more. Appraises the development process of advanced motorsports aerodynamics engineering. Extensive use of CFD in the development of race car aerodynamics.

Learning Outcomes: 1. Incorporate the design of aerodynamic bodywork and components using numerical techniques. 2. Evaluate aerodynamic optimization techniques used in industry by race engineers. 3. Implement race car engine/frame integration including wake mechanics. 4. Implement the process by which race vehicles are designed with regards the addition and optimization of aerodynamic multidisciplinary platform. 5. Determination of facilities to develop high-resolution nonintrusive instrumentation such and wind tunnels with acoustic lining. Credits: 3.00

ME 54600 - CAD/CAM Theory And Advanced Applications

Credit Hours: 3.00. Theory of CAD/CAM. Geometric modeling for seamless CAD/CAM integration. Solid modeling data structure design/manipulation. CAD and CAM tools with a focus on product development integration and automation. Machining theory, automated CNC machining, and process control. CAD/CAM applications using programming languages and open architecture kernel for modeling. Projects involve CAD/CAM aspects for advanced engineering.

Credits: 3.00

ME 54655 - Composite Materials For Automotive Applications

Credit Hours: 3.00. This course focuses on development of low-cost carbon fiber for automotive applications, mechanical properties of advanced composites, automotive composite structures for crashworthiness, crashworthiness analysis of composite, hybrid structures consisting of sheet metal and fiber reinforced plastics for structural automotive and design solutions to improve crash-box impact efficiency for racing applications.

Learning Outcomes: 1. Incorporate the design of low-cost carbon fiber for automotive and motorsports applications using analytical and numerical techniques. 2. Investigate structural optimization techniques used in industry. 3. Evaluate race car chassis integration including monocoque. 4. Formulate the process by which the crash-box impact efficiency for racing applications is optimized using multidisciplinary platforms. 5. Execution of green composites for automotive applications. Credits: 3.00

ME 54755 - Design And Analysis Of Materials And Structures In Lightweight Vehicles

Credit Hours: 3.00. The materials for the construction of automobiles are changing from mostly low carbon steels to a combination of steels, light alloys, such as aluminum and magnesium alloys, and polymer matrix composites. Many of these materials are already used in today's vehicles, albeit in smaller volumes. Future vehicles, which will have to be much

lighter in weight for improved fuel economy and reduced environmental pollution, will contain much larger volumes of these materials. The selection of materials will not only be influenced by their weight reduction potential, but also by factors such as safety, durability, processing, joining, recycling and cost. This course focuses on materials, their properties, processing technology and design and materials selection issues pertinent to designing lightweight vehicles. It will provide first-hand knowledge and experience of working with these advanced materials. It starts with a broad review of the materials scenario and design considerations for lightweight automotive structures. It is then divided into two major parts: materials, and design and manufacturing. The materials part contains topics on advanced steels, aluminum alloys, magnesium alloys and polymer matrix composites. It will provide information on material properties, processing characteristics and application examples. The design and manufacturing part contains information on manufacturing processes for light alloys, joining, crash worthiness considerations, recycling and life-cycle issues.

Learning Outcomes: 1. Evaluate the material selection from advanced steels, aluminum alloys, Magnesium alloys and thermoplastics and thermoplastic-matrix composites for lightweight automotive structures. 2. Investigate the techniques for joining of thermoplastic matrix composites. 3. Investigate design allowables and use of MIL-HDBK-5. 4. Critique execution plans for fatigue analysis of materials and structures. 5. Develop models for design and analysis of symmetric and asymmetric beams. 6. Formulate shear stresses in single and multi-cell beams subjected to bending and/or torsional loadings in monocoque. 7. Execute simulations for structural configurations of modern automobile. Credits: 3.00

ME 54800 - Fuel Cell Science And Engineering

Credit Hours: 3.00. Fundamental principles of fuel cell science and engineering (fuel cell reactions, charge and mass transport in fuel cells, water transport management, and materials development in the fuel cells, fuel cell system designs and integrations), current state-of-the-art fuel cell technology and the current technical challenges on the development of fuel cells, codes and standards for safe handling of fuel cells. Permission of instructor required.

Credits: 3.00

ME 54855 - Motorsports Vehicle Simulations

Credit Hours: 3.00. A course on mathematical modeling and computer simulation of mechanical systems offering a complete tool for modeling and simulation of integrated and complex systems for use within automotive and motorsports applications. Complex multi-disciplinary systems modeling and analysis problems will be solved, using a modeling and simulation environment for complex systems analysis such as Dymola's Modelica simulation technology. Dymola is a complete environment for model creation, testing, simulation and post-processing. Equal emphasis is placed on model development and simulation via Dymola GUI interface. Models range from simple spring-mass-damper system to whole vehicle models will be covered.

Learning Outcomes: 1. Evaluate the solution to the race car and vehicle design as applied to motorsports vehicles. 2. Investigate the techniques to build robust models for adaptation and reuse. 3. Implement and identify the placement of simulations in motorsports within the larger context of simulations as a field of study. 4. Critique execution plans and methods for verification and validation of motorsports simulations. 5. Develop Modelica language and Dymola interface to design components for models. 6. Formulate existing Dymola and Modelica library components to complete models of mechanical, electrical, fluid, and thermal systems for study in simulation. 7. Execute simulations and process results to answer questions about the behavior of a system. Credits: 3.00

ME 55000 - Advanced Stress Analysis

Credit Hours: 3.00. Studies of stresses and strains in three-dimensional problems. Failure theories and yield criteria. Stress function approach to two-dimensional problems. Bending of nonhomogeneous asymmetric curved beams. Torsion of bars with noncircular cross sections. Energy methods. Elastic stability. Introduction to plates. Students may not receive credit for both ME 55000 and CE 57000.

Credits: 3.00

ME 55100 - Finite Element Analysis

Credit Hours: 3.00. An introduction to the basic principles of finite element method. Weak variational form of boundary-value problems. Finite element formulation of one- and two-dimensional boundary-value problems. Time-dependent problems. Computer implementation. Examples are chosen from heat transfer, solid mechanics, and fluid mechanics areas.

Credits: 3.00

ME 55200 - Advanced Applications of Finite Element Method

Credit Hours: 3.00. Various algorithms for nonlinear and time-dependent problems in two and three dimensions. Emphasis on advanced applications with problems chosen from fluid dynamics, heat transfer, and solid mechanics areas. Independent project required.

Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 55400 - Intellectual Property For Engineers

Credit Hours: 1.00. Survey of the law of patents, trade secrets, trademarks, and copyrights, with special emphasis on the process of defining inventions broadly and diversely. Obtaining, registering, licensing, and litigation of intellectual property.

Credits: 1.00

ME 55401 - Design For IP Protection And Commercialization

Credit Hours: 3.00. Present topics of intellectual property (IP) such as copyright, trademark, and trade secret, topics directed to patents including a through introduction to subject matter eligibility, novelty, and non-obviousness as well as topics related to enablement and written description requirements of a patent and how each of these concepts can affect design choices. Learn how to navigate patent databases. Develop patentable designs, as well as designs that do not infringe on existing IP. Learn about technology commercialization from an IP perspective.

Credits: 3.00

ME 55600 - Lubrication, Friction & Wear

Credit Hours: 3.00. Science, technology, and application of lubricated interacting surfaces in relative motion. Advanced analysis techniques and hands-on exposure to modern experimental methods provide an enhanced understanding of fundamental principles of lubrication, friction, and wear. Basics of design and analysis of machine components operating in the presence of air and liquid lubricants. Rolling fatigue, friction and wear models, and measurement techniques. Offered in alternate years.

Credits: 3.00

ME 55700 - Design For Manufacturability

Credit Hours: 3.00. Introduction to manufacturing concerns, such as efficient design, producibility, and quality, which must be considered early in the engineering design process. Topics include the product development cycle, manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, Taguchi's robust design methodology, life cycle engineering, and reliability. Laboratory projects in the area of tolerancing, assembly, and manufacturability are included along with a project from industry in which the students can disassemble, analyze, and redesign a product while obtaining feedback from industry concerning manufacturability.

Credits: 3.00

ME 55800 - Composite Materials

Credit Hours: 3.00. Portential applications of composite materials. Basic concepts of fiber reinforced composites. Manufacturing, micro- and macro-mechanics, and static analysis of composite laminates. Performance (fatigue and fracture) and their application to engineering design.

Credits: 3.00

ME 55801 - Composite Materials For Automotive Applications

Credit Hours: 3.00. This course focuses on development of low-cost carbon fiber for automotive applications, mechanical properties of advanced pore morphology foam composites, automotive composite structures for crashworthiness, crashworthiness analysis of composite, hybrid structures consisting of sheet metal and fiber reinforced plastics for structural automotive and design solutions to improve crash-box impact efficiency for racing applications.

Credits: 3.00

ME 55802 - Design And Analysis Of Materials And Structures In Lightweight Vehicles

Credit Hours: 3.00. This course focuses on materials, their properties, processing technology and design and materials selection issues pertinent to designing lightweight vehicles. It will provide first-hand knowledge and experience of working with these advanced materials. It starts with a broad review of the materials scenario and design considerations for lightweight automotive structures. It is then divided into to major parts: materials, and design and manufacturing.

Credits: 3.00

ME 55900 - Micromechanics Of Materials

Credit Hours: 3.00. Prediction of the macroscopie behavior of materials from their microstructure and the design of new materials. Microstructure-property relationships between the macroscopie material behavior and microscopic structure. Application to traditional structure as well as to new engineering materials. Adapting emerging constitutive relations into structure analyses. Introduction of this new approach to materials, its

applications in predictive analysis tools, and its importance in simulation-based engineering.

Credits: 3.00

ME 56000 - Kinematics

Credit Hours: 3.00. Geometry of constrained plane motion with applications to linkage design. Type and number synthesis, size synthesis. Path curvature, inflection circle, cubic of stationary curvature. Finite displacements, three and four separated positions. Graphical, analytical, and computer techniques.

Credits: 3.00

ME 56200 - Advanced Dynamics

Credit Hours: 3.00. Dynamics of multi-degrees-of-freedom mechanical systems. Holonomic and nonholonomic constraints. Lagrange's equations of motion. Hamilton's principle for holonomic systems. Kinematics and kinetics of rigid body motion, including momentum and energy methods. Linearized equations of motion. Classification of vibratory systems - gyroscopic, circulatory forces. Stability of linear systems - divergence and flutter. Applications to gyroscopes, satellite dynamics, etc.

Learning Outcomes: 1. Develop an understanding of the principles governing the motion of mechanical systems modeled as rigid bodies. 2. Develop an ability to analyze rigid-body kinematics in stationary as well as moving frames of reference. 3. Develop an ability to use Newton-Euler laws of rigid body motion. 4. Develop an understanding of the fundamental concepts in analytical dynamics, and the ability to use them to formulate the equations of motion for rigid bodies and systems. Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 56500 - Vehicle Dynamics

Credit Hours: 3.00. Modeling of wheeled vehicles to predict performance, handling, and ride. Effects of vehicle center of mass, tire characteristics, traction and slip, engine characteristics, and gear ratios on performance. Suspension design. Steady state and transient handling models of four-wheeled vehicles and car-trailer systems to determine oversteer and understeer characteristics, critical speeds, and stability. Multi-degree-of-freedom ride models, including tire and suspension compliance. Computer simulations. Current research topics in vehicle vibration isolation.

Learning Outcomes: 1. Mature in application of modeling techniques to predict the dynamic behavior of highway vehicles. 2. Develop an understanding of the relationships between vehicle design variables and vehicle dynamic behavior (acceleration, braking, handling, and ride). Credits: 3.00

ME 56802 - Ceramic Materials

Credit Hours: 3.00. Fundamental concepts of ceramic materials. Atomic structure, bonding the transport of charged defects and their relationships to conductivity in ceramics, phase diagrams and glasses. Solid state processes, including sintering and grain growth. Physical properties including mechanical, thermal, magnetic, dielectric, and optical properties. Application to energy and biomedical applications.

Credits: 3.00

ME 56900 - Mechanical Behavior Of Materials

Credit Hours: 3.00. A study of load and environmental conditions that influence the behavior of materials in service. Elastic and plastic behavior, fracture, fatigue, low and high temperature behavior. Fracture mechanics. Failure analysis case studies emphasis on design.

Credits: 3.00

ME 57000 - Machine Design

Credit Hours: 3.00. Analysis of stresses and deflections due to complicated loading. Investigation of specific design problems through application of theory of elasticity, failure criteria, energy approach, and numerical methods. Individual design project.

Learning Outcomes: 1. Understand complicated 3-D state of stress for both determinate and indeterminate problems. 2. Learn advance theory of elasticity. 3. Gain fundamental knowledge of bodies in contact. 4. Solution methods for torsion of prismatic section and bending of asymmetric cross section. 5. Apply energy method to solve problems for linear and nonlinear materials. Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 57101 - Probabilistic Engineering Design

Credit Hours: 3.00. This course presents probabilistic methodologies for engineering design under uncertainty. It is intended for students who are interested in statistical/probabilistic methods for engineering analysis and design. The outcomes of the course are 1) an ability to model uncertainties in engineering applications, 2) an ability to performance basic statistics, risk, and reliability analyses, and 3) an ability to integrate probabilistic design with simulations, optimization, Design for Six Sigma, and Design of Experiments. The course is lecture and project based.

Credits: 3.00

ME 57200 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. Introduction to the analysis and design of robotic manipulators. Topics include: kinematic configurations, forward and inverse position solution, velocity and acceleration, path planning, workspace analysis, force and torque solutions, rigid body dynamics, motors and actuators, robot design, sensors and controls, computer simulation, and graphical animation.

Learning Outcomes: 1. Analysis of manipulator motion and forces. 2. Manipulator design including actuator, drive, and sensor issues. 3. Computer simulation to predict motion and forces. Credits: 3.00

ME 57201 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. The basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematics of manipulator arms; velocity and force-torque relations; dynamic equations using Euler-Lagrange formulation; motion planning; obstacle avoidance; controller design using torque method; and classical controllers for manipulators. Permission of instructor required.

Credits: 3.00

ME 57301 - Air Pollution And Emission Control

Credit Hours: 3.00. This course is designed to integrate the real-world problem solving experience into the course curriculum through project / lab environment. Students will study the air pollution sources and fundamental mechanisms of their impact on the environment and human health, and how automotive emission can be measured and controlled. In particular, measurement of particulate emission deposited in a diesel particulate filter will be studied. Here the students will have a chance to optimally design the sensor components. The course topics are chosen in this context so that they align with the local industry / lab well. Topics in emission control technologies, including sensors, control mechanisms, remedial systems will be taught and combined into the course projects that students will complete over the course of a semester.

Credits: 3.00

ME 57401 - Additive Manufacturing

Credit Hours: 3.00. During this course, students evaluate the engineering aspects and physical principles of available AM technologies (binder and material jetting, sheet lamination, vat photopolymerization, directed energy deposition, powder bed fusion, and material extrusion technologies) as well as these technologies' most relevant applications and criteria in order to successfully select the AM technology that is best suited for the embodiment of a particular design (material compatibility, interface issues, strength requirements). The topics of this course are grouped into three modules: (1) AM Technologies (2) Design for AM (3) AM Process Planning. During the first module (50% of the course), the historical development of AM is examined and then the underlying physical principles of current AM technologies are evaluated. The second module (25% of the course) focuses on investigating the mathematical principles and technical aspects of design optimization methods for AM (including topology optimization). The third module (25% of the course) incorporates product evaluation (mechanical properties and dimensional accuracy), process optimization, and applications. Students taking this course will create original products using CAD/CAE systems and topology optimization tools. Students will hone skills on image post-processing, segmentation, vectorization, and generation of STL files. Students also will execute tasks using several 3D printers and manipulate different AM technologies including material extrusion, vat photopolymerization, and powder-bed fusion. They will also have the opportunity to visit local industries in the areas of manufacturing, design, and materials.

Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with

emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57600 - Computer Control Of Manufacturing Processes

Credit Hours: 3.00. Fundamental elements for manufacturing process control are presented with advanced control theories, modeling and analysis of actuators, controller architecture, interfacing and programming. Emphasis is on computer integrated manufacturing with computer numerical control of machine tools, automation via programmable logic controllers, motion control, process control examples, and manufacturing process monitoring. Hands-on experience is attained through laboratory experiments with state-of-the-art equipment.

Credits: 3.00

ME 57700 - Human Motion Kinetics

Credit Hours: 3.00. Study of kinetics related to human motion. Review of human anatomy and anthropometric data. Planar and three-dimensional kinematic analysis of gross human motion. Detailed kinematic studies of human joints. Newton-Euler and Lagrangian methods for joint torques. Muscle force and power analysis. Studies on walking, jumping, cycling, and throwing exercises.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 57900 - Fourier Methods In Digital Signal Processing

Credit Hours: 3.00. Fundamentals of signal processing associated with Fourier analyzer systems are presented. Emphasis is on amplitude accuracy and frequency resolution properties necessary for reliable experimental methodologies in system identification, spectrum estimation, and correlation analysis. Deterministic, as well as random, data analyses are presented. Students are required to develop algorithms that significantly expand the utility of Fourier analyzer systems.

Credits: 3.00

ME 58000 - Nonlinear Engineering Systems

Credit Hours: 3.00. Methods of analysis for nonlinear ordinary differential equations arising in engineering systems. Review of linear systems. Stability concepts. Phase plane methods. Perturbation and averaging methods of analysis. Self-excited and parametrically-excited systems. Relaxation oscillations. Systems with more than one degree of freedom.

Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

ME 58400 - System Identification

Credit Hours: 3.00. Theory and application of System Identification methods. Connecting the world of mathematical models to experimental data - least squares methods and difference equation models. Background in probability and analysis: algebra of random variables, law of large numbers, central limit theorem. The ARMA family of models; mapping physics models to generalized ARMAX forms (linear and nonlinear); mapping the parameter estimation problem to the least squares problem (batch and recursive), and numerical solution techniques. Model (in)validation, optimal identification criteria, experiment design and data preprocessing considerations. Issues of signal-to-noise ratio, persistency of excitation, sampling frequency, data accuracy and data sizes.

Learning Outcomes: 1. Interpret data probabilistically and ability to calculate uncertainty propagation. 2. Fit backbox models to data; convert physics models to identifiable forms for least squares formulations. 3. Construction of numerical codes for solving least squares problems and use of MATLAB System ID toolbox. 4. Construct informative experiments for dynamic systems with suitable precision of and accuracy of sensing, data

length, persistency of excitation, and sampling frequency. Credits: 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58700 - Engineering Optics

Credit Hours: 3.00. Fundamentals of geometrical and physical optics as related to problems in engineering design and research. Characteristics of imaging systems; properties of light sources; optical properties of materials. Diffraction, interference, polarization, and scattering phenomena as related to optical measurement techniques. Introduction to lasers and holography. (Laboratory work can be undertaken for additional credit by special arrangement.).

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 58901 - Optimal Design Of Mechatronic Systems: Robots And Interactive Structures

Credit Hours: 3.00. This course will introduce the fundamentals of transformation of knowledge from art/design to engineering/technology applications. Different variant forms of free form design, in relation to various structural topologies common in engineering and technology applications and related optimization techniques will be discussed. This course will utilize the epistemology of studio practice implicit in the artistic process in order to acquire embodied knowledge. Reasoning innovative process can be taught through the crafting of mechanical structures while experiencing bodily interactions with the nature of materials and tools. Thus, this course introduces a range of design principles and critical studio practice methodologies while working with a range of variable materials and aims to help students grow in their creative thinking. It will integrate mechatronic modeling / simulation, optimal design, and hands-on fabrication of robotic systems (sensors, actuators, electric circuits, and embedded controllers) and interactive structures in a makerspace environment. Permission of instructor required.

Credits: 3.00

ME 59100 - Mechanical Engineering Project

Credit Hours: 1.00 to 3.00. Individual advanced study in various fields of mechanical engineering. May be repeated for up to 6 credit hours. Students registered for this course must have weekly meeting with the instructor for at least an hour. Permission of department required.

Credits: 1.00 to 3.00

ME 59300 - Solid Mechanics I

Credit Hours: 3.00. The design of modern engineering structures is intrinsically linked to the understanding and analysis of materials and structures. This course is a foundational course on graduate-level knowledge in this area of engineering. Course will cover Elements of linear elasticity, Kinematics of deformation, equilibrium conditions, and constitutive relationship of materials. Classical problems in elastostatics and general solutions for field equations in elasticity. Anisotropic elasticity, thermal elasticity.

Learning Outcomes: 1. Comprehend mechanics concepts of key classes engineering materials (elasticity, thermoelasticity), and be able to relate mechanics principles to real-world engineering applications in design. 2. Comprehend the methods for the analysis and prediction of deformation, strain and stress in engineering structures. 3. Identify elasticity and thermoelasticity in the context of static and dynamic loading. 4. Develop the ability to deal with elastic and thermal boundary conditions. 5. Develop the skill to analyze problems of stability. 6. Use solid mechanics principles to interpret and analyze the mechanical behavior of advanced engineering structures. Credits: 3.00

ME 59500 - Special-Topic Minicourses

Credit Hours: 1.00. A series of one-credit-hour courses on special topics offered as ME 59500, 59500, etc. These special-topic minicourses will provide an opportunity for introducing students to topics of contemporary importance or special interest that fall outside the scope of the curriculum. Information about current offerings may be obtained from the schedule of classes or the mechanical engineering registration deputy.

Credits: 1.00

ME 59600 - Solid Mechanics II

Credit Hours: 3.00. The design of modern engineering structures is intrinsically linked to the understanding and analysis of materials and structures. This course is a

foundational course on graduate-level knowledge in this area of engineering.

Learning Outcomes: 1. Select the most appropriate theory for modeling a particular material and structure in a given application and outline the variables and general parameters needed, as well as limitations of the chosen theory. 2. Formulate and evaluate the stress-strain response of a (i) hyperelastic material, (ii) a viscoelastic material, (iii) a plastic material; Formulate and evaluate the internal resultant versus kinematic variable response of (i) beams, (ii) plates, and (iii) shells; Formulate and evaluate the contact force (pressure) between (i) smooth non-conforming deformable surfaces (e.g., spherical objects), (ii) a rigid object on a deformable substrate (e.g., indentation), (iii) fluid-solid interfaces, for elastic solids (and/or rate-dependent solids and/or plastic solids). 3. Use solid mechanics principles to interpret and analyze the mechanical behavior of advanced engineering structures. Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 59800 - Mechanical Engineering Graduate Seminar

Credit Hours: 0.00. Acquaint graduate students with a broad spectrum of research in various areas of mechanical engineering. Weekly seminars by invitees/researchers from academia, national labs, or industry. Seminar topics provide a mix of subjects, areas and disciplines, and can involve considerable technical depth, a broad overview and/or historical perspectives. Permission of department required.

Credits: 0.00

ME 59999 - PMP Professional Development

Credit Hours: 0.00 to 3.00. Projects or special topics in professional development as it relates to ME. Permission of department required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 0.00 to 3.00

ME 60101 - Computational Modeling Of Turbulence

Credit Hours: 3.00. This course consists of three parts. The first part is on the fundamentals of turbulence inlcuding turbulence concepts, statistical description, and Kolmogorov hypothesis. The second part covers major practical modeling concepts and formulations such as direct numerical simulation (DNS), large eddy numercial simulation (LES), and Reynolds averaged Navier-stokes simulation (RANS). The third part is team project related to turbulence computation with applications in environment, industry, biomechanics for visualizing and experiencing turbulence. Prerequisite: Intermediate Fluid Mechanics (ME 50900) or consent of instructor.

Credits: 3.00

ME 60500 - Convection Of Heat And Mass

Credit Hours: 3.00. Heat and mass transfer in moving fluid media; free, forced, and mixed convection for internal and external flows; differential and integral treatments of boundary layer problems; convection analogies for heat, mass, and momentum transfer; combined heat and mass transfer with chemical reactions; special topics and applications to electronic cooling, materials processing, transpiration and film cooling. Prerequisite: ME 31500 .

Credits: 3.00

ME 60600 - Radiation Heat Transfer

Credit Hours: 3.00. Thermodynamics and physics of radiation and its interaction with interfaces and matter; radiation characteristics of surfaces and radiation properties of solids, liquids, and gases; analysis of radiation exchange between real and idealized surfaces; fundamentals of radiation transfer in absorbing, emitting, and scattering media; interaction of radiation with conduction and convection; remote temperature sensing and applications to selected problems involving combined energy transfer mechanisms. Offered in alternate years. Prerequisite: ME 31500 .

Credits: 3.00

ME 60601 - Optimal Design Of Complex Mechanical Systems

Credit Hours: 3.00. The objective of this research course is to prepare students to address mechanical systems design and innovation challenges through appropriate advanced optimal design methodologies. This course will focus on current design approaches, which are rapidly expanding in research and industrial applications, but are not commonly included in engineering curricula. The course also focuses on the theoretical aspects of multi-objective optimization, global approximation methods (metamodel-based optimization), and applications in mechanical engineering systems. Students of this research course will acquire an understanding of state-of-

the-art analysis and optimization tools through hands-on experience and the involvement in research projects. The research experiential learning will prepare students to design innovative mechanical systems and to increase their problem solving capabilities through the use of effective design methodologies. Pre-requisite or co-requisite: ME 50601. Permission of instructor required.

Credits: 3.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

ME 61000 - Boundary Layer Theory

Credit Hours: 3.00. Fundamentals of continuum fluid mechanics; Navier-Stokes equations. Laminar flow; boundary-layer concept; similarity solutions; transformation methods; integral and finite difference solution techniques for general pressure gradients. Should be preceded by intermediate fluid mechanics.

Credits: 3.00

ME 61100 - Principles Of Turbulence

Credit Hours: 3.00. Methods of description and basic equations for turbulent flows. Isotropic and homogeneous turbulence, energy spectra, and correlations. Introduction to measurements. Transition theory and experimental evidence. Wall turbulence, engineering calculations of turbulent boundary layers. Free turbulent jets and wakes. Prerequisite: ME 61000 .

Learning Outcomes: 1. Develop the ability (from first principles) to describe the physics of turbulent flows. 2. Comprehend the methods of analysis used in turbulence study. 3. Understand the principles of turbulence simulation and the associated modeling problems. Credits: 3.00

ME 61200 - Continuum Mechanics

Credit Hours: 3.00. A unified and exact mathematical treatment of the mechanics of solids and fluids. Cartesian tensor algebra and calculus; stress tensor, principle stresses and invariants; material and spatial coordinates, deformation gradient, strain and stretch tensors; balance of mass, momentum, and energy; constitutive equations of elasticity, hyperelasticity, viscous fluids and viscoelasticity.

Credits: 3.00

ME 61201 - Continuum Mechanics

Credit Hours: 3.00. This course will cover the formal, consistent and unified mathematical treatment of the mechanics of continuous solids and fluids. Topics covered include the kinematics of deformation, the concept of stress, and the conservation laws for mass, momentum and energy. This is followed by an introduction to constitutive theory with applications to well-established models for viscous fluids and elastic solids. The concepts are illustrated through the solution of tractable initial boundary-value problems.

Credits: 3.00

ME 61300 - Advanced Engineering Acoustics

Credit Hours: 3.00. An extension of ME 51300 . Sound transmission between two media. Acoustic resonators and application to muffler theory. Structural radiation and sound. Acoustical measurements and signal processing: sound intensity, surface intensity, coherence and cepstral techniques. Numerical acoustics: finite element analysis, boundary integral equation analysis and statistical energy analysis. Advanced topics. Prerequisite: ME 51300 .

Credits: 3.00

ME 61400 - Computational Fluid Dynamics

Credit Hours: 3.00. Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solution of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Prerequisite: ME 50900 or ME 58100 .

Credits: 3.00

ME 61500 - Aeroacoustics

Credit Hours: 3.00. (AAE 61500) Quantitative measures of sound (decibel scales, spectra, energetics of acoustic motions, and measurement techniques). The wave theory of sound (basic equations and properties, sound propagation in homogeneous and inhomogeneous media, one-, two- and three-dimensional sound fields and distributed sources). Effects of source movement. Aerodynamic noise generation - acoustic analogy (Lighthill's equation and Ffowcs Williams-Hawkings equation). Introduction to Computational Aeroacoustics (CAA). Noise from turbulent shear flows (jet noise, cavity noise, and noise from flow over objects). Noise from turbomachinery, propellers, and rotors. Prerequisite: ME 30900 or ME 51300 or AAE 51100.

Credits: 3.00

ME 61700 - Applied Thermal Physics And Molecular Spectroscopy

Credit Hours: 3.00. The fundamentals of statistical mechanics, kinetic theory, and molecular spectroscopy will be taught in order to predict and characterize the behavior of non-equilibrium gases using optical and laser diagnostics. This material will be taught within the context of applications involving combustion,

plasmas, propulsion, energetic materials, shock waves and laser radiation. Pre-requisite: Thermodynamics I, ME 20000 or Heat Transfer 1, ME 31500 or Chemistry 1, CHM 12500.

Learning Outcomes: 1. Model and experimentally characterize the dynamic behavior of non-equilibrium gases as they transition from one equilibrium state to another (e.g., due to chemical ignition, shock heating/compression, and laser radiation). 2. Calculate how energy is distributed (i.e., partitioned) on the molecular level and how many molecules or atoms exist in a given quantum state. 3. Determine the viable mechanisms for transferring energy and inducing chemical reactions via collisions and to calculate how quickly these processes occur and how they evolve in time. 4. Calculate absorption and emission spectra of atoms and molecules and to convert laboratory measurements of said spectra to thermodynamic properties of the test gas (e.g., temperature, pressure, species concentration, velocity). Credits: 3.00

ME 62000 - Combustion Of Energetic Materials

Credit Hours: 3.00. Students will learn the concepts of how to approach research in the area of Energetic Materials (EM) based on an understanding of the fundamental principles. Students will learn how energetic materials are fabricated, safety used, as well as understand life cycle issues, homogeneous & heterogenous combustion, and advanced energetic material concepts. Multiphase combustion phenomena will be introduced and emphasized. They will apply these concepts to a literature review and group research project, as well as that includes applying thermochemistry and chemical kinetic software. In addition, six hands-on labs are performed. This material will be covered in the context of real-world applications, with an emphasis on energetic materials, combustion, propulsion, explosives, pyrotechnics, and detonation phenomenon. Pre-requisite: ME 52500 or AAE 53900 or consent of instructor.

Learning Outcomes: 1. Become familiar with the basic terminology, material science, physics & chemistry of energetic materials. 2. Learn how to safely work with energetic materials. 3. Learn how to experimentally or computationally approach research. 4. Learn how to approach literature reviews and form hypotheses for future research. 5. Learn the knowledge and experience needed to understand, model, develop, and experimentally characterize energetic materials, and well as numerous related fields. Credits: 3.00

ME 62500 - Advanced Combustion

Credit Hours: 3.00. Coupling of the energy, species, and mass conservation equations with the momentum equation. Statistical treatment of turbulence and the problems of interactions of turbulence with chemistry, radiation, and two-phase flows. Critical study of at least 10 seminal and recent contributions in the combustion literature. Offered in alternate years. Prerequisite: ME 52500 .

Credits: 3.00

ME 64000 - Structural Acoustics

Credit Hours: 3.00. Waves in fluids and structures, dispersion relations, sound radiation from structures, radiation efficiency, radiation from concentrated forces, effect of fluid loading on wave propagation, transmission of sound through barriers, effect of panel lining, enclosures, acoustically induced vibration of structures and numerical calculation of fluid-structure interaction. Offered in alternate years. Prerequisite: ME 51300 , ME 56300 .

Credits: 3.00

ME 65000 - Computational Fracture Mechanics

Credit Hours: 3.00. Advanced concepts of methods for the analysis of cracks, of crack propagation and damage evolution. Prediction of the macroscopic behavior of structures as it emerges from the presence of defects such as cracks, voids, or delamination. Linear elastic and nonlinear fracture problems. Rate independent and rate dependent problems. Methods in computational fracture mechanics where material separation emerges as an outcome of the boundary value problem. Demonstrations of how mechanical design can take advantage of the methods of computational fracture mechanics by introducing such concepts into structural analyses. Applications of computations in predictive analysis and its importance in simulation-based engineering. Prerequisites: AAE 55800 or ME 48900, or similar courses in finite element analysis or ME 57000 or ME 61200 or AAE 55300, or similar courses on advanced solid mechanics. Recommended but not required: CEE 597-109 or AAE 65400.

Learning Outcomes: 1. Introduce concepts of computational methods for material damage, fracture and fatigue. 2. Learn continuum mechanics concepts for description of material failure. 3. Learn about advanced constitutive equations for bulk and interface failure. 4. Learn how model material failure processes. 5. Learn

how to develop and apply computational mechanics methods. 6. Apply these concepts to analysis of failure at the macro, micro and Nano scale. Credits: 3.00

ME 65100 - Advanced Finite Element Method For Solids

Credit Hours: 3.00. This course is designed to teach students advanced finite element techniques for solid mechanics stress and heat transfer analysis. Those include: techniques for modeling beams, plates and 2D/3D continua with material non-linearity, material plasticity and geometric non-linearity; heat transfer; modeling thermos-mechanical systems; frequency domain, time domain and quasi-static solutions; modeling of frictional contact; modeling rigid-bodies. Applications of the modeling techniques taught in this course will be introduced, including: modal analysis; stress-analysis with material and geometric non-linearity; structural dynamics with material and geometric non-linearity; frictional contact problems; metal forming and crash analysis. Prerequisites: ME 55100 and ME 58100. Graduate Standing. Permission of instruction required.

Credits: 3.00

ME 65500 - Computational Mechanics Of Materials

Credit Hours: 3.00. Prediction of the mechanical behaviors of engineering materials employing computational methods, at atomistic, discrete, and continuum levels. Continuum and discrete models for material deformation in brittle and ductile materials. Atomistic models for fracture in nanomaterials. Applications to engineering structures on the macro-micro and nanoscale.

Credits: 3.00

ME 66400 - Vibrations Of Continuous Systems

Credit Hours: 3.00. Theory of small oscillations of continuous systems. Love's equations for thin shells, reduction to special cases of shallow shells, plates, beams, etc. Initial stresses; influence of shear; thermal excitation. Initial value problems; forced vibrations; structural damping. The dynamic Green's function, impedance concepts; variational approaches. Experimental procedures, scaling, composite, and stiffened shells. Prerequisite: knowledge of one degree of freedom system vibrations.

Credits: 3.00

ME 67500 - Multivariable Control System Designs

Credit Hours: 3.00. Fundamentals of the frequency response loop shaping methodology for the analysis and design of robust multivariable control systems will be presented. Emphasis is on suitable extensions of the classical Bode-Nyquist design techniques to systems with not only uncertain parameters but also multiple inputs and outputs. Instrument and environmental signal level constraints on the performance of control systems will be critically evaluated. Students are required to develop ability to handle open-ended design issues involving significant multiobjective performance trade-offs. Prerequisite: ME 57500 .

Credits: 3.00

ME 67700 - Nonlinear Feedback Controller Design

Credit Hours: 3.00. Controller design and analysis of nonlinear feedback systems. Topics include the design of linear/nonlinear feedback controllers. Describing Function (DF) techniques for design, Popov and Generalized Circle Criterion for closed-loop stability, functional analysis and Volterra series approaches, and introduction to existing nonlinear controller design tools. Offered in alternate years. Prerequisite: ME 67500 .

Credits: 3.00

ME 68000 - Bifurcations And Chaos

Credit Hours: 3.00. Basic concepts in stability of systems, nonlinear dynamical systems, and bifurcation theory. Algebraic and geometric techniques for local bifurcation analysis. Models governed by difference, ordinary, and particle differential equations. Examples from mechanical, structural, chemical, and electrical systems. Models of chaotic behavior. Techniques for prediction of chaos. Routes to chaos. Offered in alternate years. Prerequisite: ME 58000 .

Credits: 3.00

ME 68100 - Finite And Boundary Element Methods

Credit Hours: 3.00. The solution of problems in mechanical engineering using the generalized numerical techniques; the finite element method and the boundary element method. Topics include reformulation of partial differential equations into appropriate form for each method. The development and implementation of code and solution of problems. Applications include: acoustics, fluid dynamics, heat transfer, design, mechanics and biomechanics. Prerequisite: ME 58100 .

Credits: 3.00

ME 68700 - Laser Diagnostics For Reacting Flows

Credit Hours: 3.00. The principles of spectroscopic laser diagnostics including absorption, fluorescence, and Raman scattering techniques. Theory of the interaction of laser radiation with atomic and molecular resonances. Lasers and detectors for optical diagnostics. Offered in alternate years. Prerequisite: ME 50100 .

Credits: 3.00

ME 68900 - Adaptive Control

Credit Hours: 3.00. Theory and application of adaptive control of linear systems in both continuous and discrete time domain. Real-time parameter estimation algorithms, direct and indirect adaptive methods, deterministic self-tuning regulators, Lyapunov stability theory, input-output stability, model-reference adaptive control, stability and convergence of adaptive

algorithms, robustness, and implementation issues, with laboratory experiments and demonstrations. Offered in alternate years. Prerequisite: ME 57500 .

Credits: 3.00

ME 69000 - Individual Study In Mechanical Engineering

Credit Hours: 0.00 to 18.00. Individual study in advanced areas not currently available through formal course offerings within the University. Course plan must be approved by professor in charge prior to registering for the course. Written report and presentation of a departmental seminar based on material studied are required at the end of the semester. Permission of instructor required.

Credits: 0.00 to 18.00

ME 69100 - Mechanical Engineering Graduate Seminar

Credit Hours: 0.00. Acquaint graduate students with a broad spectrum of research in various areas of mechanical engineering. Weekly seminars by invitees/researchers from academia, national labs, or industry. Seminar topics provide a mix of subjects, areas and disciplines, and can involve considerable technical depth, a broad overview and/or historical perspectives.

Learning Outcomes: 1. Develop an understanding of the field of Mechanical Engineering in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued where Mechanical Engineering has the potential to provide leadership. Credits: 0.00

ME 69600 - Advanced Professional Internship

Credit Hours: 0.00. Advanced professional experience in mechanical engineering. The program is coordinated by the school with cooperation of participating employers. Students submit a summary report. Prerequisite: Master's student standing.

Credits: 0.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

ME 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ME 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Mechanical Engineering Technology

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 11300 - Mechanics Applications

Credit Hours: 1.00. Concepts of mechanics are applied to structures, machine components, and frames. Stresses and deformations resulting from axial, shear, torsional, and flexural loads are considered. Kinematics and kinetics of motion are introduced.

Learning Outcomes: 1. Solve linear and rotational kinematics problems that are based on constant or linearly-varying acceleration. 2. Apply the principles of dynamic equilibrium to

solve linear particle and rotational kinetics problems. 3. Calculate axial stress, shear stress, bearing stress, torsional stress, and flexural stress. 4. Use material properties and design factors to confirm simple loading of machines, frames, beams, and columns. Credits: 1.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

MET 16000 - Analytical And Computational Tools In MET

Credit Hours: 3.00. The skills needed to solve technical problems in mechanical engineering technology are developed. Instruction is given in analytical and computational problem-solving techniques. The electronic calculator, the factor-label method of unit conversions, engineering graphs, and the computer are used to solve problems. Computer emphasis is on spreadsheet analysis, graphics, and generation of technical reports through the integrated use of software packages. Credit will not be granted for MET 16000 and MET 16200 or MET 16300.

Credits: 3.00

MET 16200 - Computational Analysis Tools In MET

Credit Hours: 1.00. Instruction is given in analytical and computational problem-solving techniques. The electronic calculator, the factor-label method of unit conversions, and engineering graphs are used to solve technical problems in mechanical engineering technology. Credit will not be granted for both MET 16000 and 16200.

Learning Outcomes: 1. Demonstrate algebraic techniques for solving systems of equations. 2. Demonstrate geometric understanding related to areas and volumes of shapes. 3. Demonstrate trigonometry techniques of basic trigonometric functions, theorems, and laws. 4. Apply U.S. Customary and S.I. units in calculations. 5. Apply linear interpolations of tabular data. 6. Draw graphs using software. Credits: 1.00

MET 16400 - Computing In Engineering Technology

Credit Hours: 3.00. Fundamental programming concepts are introduced using an interpreted high level programming language. Programming topics such as variable types, arrays, input/output tasks, and conditional and repetition executions will be applied to address technical problems seen in the first two years of engineering technology curricula.

Learning Outcomes: 1. Write programs to perform calculations. 2. Apply conditional and repetition logic to produce intended results. 3. Obtain input data for program manipulation. 4. Produce output data for subsequent use. Credits: 3.00

MET 20400 - Production Drawing

Credit Hours: 3.00. Application of principles of engineering drawing to design layout, detail, and assembly. A 2D PC CAD-centered laboratory.

Credits: 3.00

MET 21100 - Applied Strength Of Materials

Credit Hours: 4.00. The principles of strength, stiffness, and stability are introduced and applied primarily to mechanical components.

Learning Outcomes: 1. Find internal shear and internal bending moment within a structure due to the external loading. 2. Undertsand basic mechanical properties of materials and cross-sectional/area properties of structures and apply them. 3. Identify and calculate the stress present due to internal loads. 4. Identify potential maximum stress locations and calculate the principle stresses and the maximum shear stress. 5. Calculate deflection in statically determinate structures. Credits: 4.00

MET 21102 - Applied Strength Materials Lab

Credit Hours: 1.00. This laboratory course focuses on testing of materials to determine their physical and mechanical properties. Students will verify physical testing through computer analysis using appropriate computer application and prepare reports from data secured from such tests and analysis.

Learning Outcomes: 1. Demonstrate an understanding of the basic principles of Strength of Materials. 2. Apply previous analytical skills from mathematics and MET prerequisite courses to new areas of application. Therefore, demonstrate proficiency in performing strength of materials experimentation. 3. Show understanding of "Stress and Strain Transformation." 4. Demonstrate proficiency in determination of Combined Stresses and beam deflection. 5. Conduct experiments involving equipment compliant with industry standards and perform calculations on experimental results to assist in analyzing data. 6. Draw conclusions concerning material behavior under various testing and/or loading conditions and prepare lab reports using a structured approach. Credits: 1.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

MET 21400 - Machine Elements

Credit Hours: 3.00. The methods developed in statics, dynamics, and strength of materials are applied to the selection of basic machine components. The fundamental principles required for the selection of individual elements that compose a machine are developed. Selected course topics are included as computer exercises.

Learning Outcomes: 1. Apply principles and methods from statics, dynamics, and strength of materials to the selection of machine components. 2. Develop skill in using, reading, and interpreting necessary materials such as tables, charts, graphs, and industrial catalogs as part of appropriate problem solution. 3. Use the underlying concepts and theories of machine elements to select appropriate solution methods for specific problem solutions. Credits: 3.00

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

MET 22010 - Heat-Power Laboratory

Credit Hours: 1.00. Laboratory course that introduces the principles of thermodynamics and heat transfer through energy

systems. Permission of department required.

Learning Outcomes: 1. Apply the First Law of Thermodynamics and conversation of mass to analyze when testing fixed mass (closed) and steady flow control volume (open) systems and devices. 2. Understand the fundamental concepts of the Second Law of Thermodynamics and their application. Apply them to conversations between heat and work and to thermal efficiency. 3. Test thermodynamic systems involving cycles such as Otto, Diesel, Rankine, and refrigeration cycles. 4. Identify and operate laboratory equipment typically used in measurement and analysis of thermal systems. 5. Use application software for analyzing, documenting, and presenting the results of technical work. Credits: 1.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

MET 29000 - Special Topics In MET

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of Mechanical Engineering Technology is provided by MET faculty, subject to MET curriculum subcommittee approval.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

MET 29900 - Mechanical Engineering Technology

Credit Hours: 1.00 to 3.00. Independent project or laboratory work is conducted under the supervision of appropriate MET faculty. Hours and subject matter must be arranged by instructor and approved by MET curriculum subcommittee. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

MET 30200 - CAD In The Enterprise

Credit Hours: 3.00. Theory and practice of management, use and integration of computer-aided design systems, and related

engineering tools and practices are studied as they are applied in the industrial enterprise. Emphasis is on course projects.

Learning Outcomes: 1. Operate a variety of CAD software packages to create models, assemblies, and fully annotated mechanical and electrical drawings that adhere to accepted drafting standards. 2. Appropriately apply GD&T, fits and tolerances to complex mechanical assemblies. 3. Develop practical system designs and part designs that are capable of being manufactured, including visual, calculated, and simulated analysis to assure design validity. 4. Transfer CAD files of various file formats to CAM software and set up simple tool path operations for machining. Credits: 3.00

MET 31000 - Computer-Aided Machine Design

Credit Hours: 3.00. Introduction to the use of specialized programs to analyze machine components such as shafts, linkages, springs, and cams. Use of finite element analysis to analyze mechanical systems.

Credits: 3.00

MET 31100 - Experimental Strength Of Materials

Credit Hours: 3.00. Selected advanced topics from the areas of mechanics of materials, structures, stress analysis, and strain measurements are considered. Basic electronic strain gage circuits and instrumentation are presented, with emphasis on transducer applications.

Learning Outcomes: 1. Calculate principal stresses, maximum shear stress, and principal direction in a plane when given the loading condition. 2. Select, locate and mount strain gages for the measurement of strain in an experimental structure. 3. Analyze the stress in a structure based on the strain data when given appropriate material information. 4. Perform an open-ended experimental investigation in solid mechanics using strain gages or other experimental stress methods. Credits: 3.00

MET 31300 - Applied Fluid Mechanics

Credit Hours: 3.00. The fundamental principles of fluid mechanics are developed, including properties of fluid, pressure, hydrostatics, dynamics of fluid flow, friction losses, and sizing of pipes. Emphasis is on problem solving.

Learning Outcomes: 1. Apply hydrostatic equations to static and dynamic fluid problems. 2. Solve problems involving flow over immersed bodies. 3. Analyze piping systems for closed conduit flow. 4. Select pumps to optimize open and closed loop flow systems. Credits: 3.00

MET 31400 - Applications Of Machine Elements

Credit Hours: 3.00. The methods developed in statics, dynamics, and strength of materials are applied to the selection of basic machine components (gears, shafts, bearings, chain and belt drives, clutches and brakes, and motors).

Learning Outcomes: 1. Analyze and design chain and belt drive systems. 2. Analyze, design, and select appropriate gears for a machine. 3. Identify motors that are appropriate to use in a machine with specific components and loading criteria. 4. Analyze a machine to select rolling element bearings based on loading and life requirements. 5. Design clutches and brakes that store and/or transfer rotational energy. Credits: 3.00

MET 31500 - Applied Mechanism Kinematics And Dynamics

Credit Hours: 3.00. Displacements, velocities, and accelerations are determined using graphical, semi-graphical, and numerical analyses of rotational and translational motions of common mechanisms such as linkages, cams, gears, screws, and chains as well as their loading.

Learning Outcomes: 1. Categorize and model common mechanisms, including their degrees of freedom. 2. Determine the displacements, velocities, and accelerations in common linkages. 3. Analyze and synthesize common mechanisms (e.g., linkages, cams, gears, screws, belts, chains, shafts). 4. Use software in kinematic analysis and synthesis. Credits: 3.00

MET 31601 - Mechanics Of Machine Design

Credit Hours: 3.00. Concepts of stress and strain analysis under combined loadings are introduced. Analyses emphasize use of von Mises stress, Mohr's circle, static failure theories, and fatigue failure criteria. Structural joints and buckling are also analyzed.

Learning Outcomes: 1. Analyze stresses in mechanical bodies and structures subjected to combined loadings. 2. Apply static failure criteria in the analysis and design of mechanical bodies. 3. Apply fatigue assessment methods in

the analysis and design of mechanical bodies subjected cyclic loadings. 4. Perform buckling analysis in columns. 5. Analyze structural joints. Credits: 3.00

MET 31700 - Machine Diagnostics

Credit Hours: 3.00. A broad spectrum of equipment behavior is introduced through the study of four major operating parameters: vibration, noise, temperature, and lubrication. Emphasis is placed on measurement and analysis of data using diagnostic instrumentation and techniques found in modern process and manufacturing plants.

Learning Outcomes: 1. Determine the equation of motion for a single degree of freedom vibrating system. 2. Experimentally determine system vibration characteristics. 3. Understand and apply the principles for condition-based maintenance to diagnose machinery problems. 4. Develop and complete an open-ended diagnostics project. Credits: 3.00

MET 31800 - Applied Room Acoustics

Credit Hours: 3.00. Concepts of acoustics are applied to rooms, automotive applications, speakers, musical instruments, audio electronics, and other areas of interest. Modeling and design skills are developed through applied labs and a semester project. Lectures and mathematical exercises are combined with hands-on labs and a semester project to link abstract and physical concepts. As part of the semester project, a special fee will be assessed to be used towards materials for the semester project.

Learning Outcomes: 1. Analyze sound in terms of amplitude and frequency content. 2. Analyze the signal chain in a sound system (course will use a typical commercial sound system as a basis for discussion). 3. Describe the basic types of room treatments for different acoustical environments. 4. Describe the basic function of filters. 5. Analyze acoustic spaces using modeling software. 6. Design the acoustic performance of an enclosed space given representative physical and economic requirements. Credits: 3.00

MET 32000 - Applied Thermodynamics

Credit Hours: 3.00. Following a review of fundamental concepts, advanced power and refrigeration cycles are analyzed. Applications such as gas mixtures, air-vapor mixtures, and chemical reactions of combustion processes are presented.

Learning Outcomes: 1. Use thermodynamic properties of gases and vapors in system analysis. 2. Apply the first and second laws of thermodynamics to real and ideal systems. 3. Analyze thermodynamic cycles (e.g., Otto, Diesel, Brayton, Rankine, vapor compression). 4. Compute properties of gas mixtures. Credits: 3.00

MET 32800 - CAD/CAM For Mechanical Design Drafting

Credit Hours: 3.00. Basic operation of mechanical design-drafting. A PC CAD (2D and 3D) laboratory-centered course introducing the basic steps involved in the geometric design of mechanical parts. This class provides an overview and continues into a detailed investigation of parametric modeling. Parametric modeling concepts will be applied to problems using standard industrial practices. Students must possess a solid background in engineering or technical graphics.

Credits: 3.00

MET 33400 - Advanced Fluid Power

Credit Hours: 3.00. Hydraulic and pneumatic circuits and their steady state and time-variant behavior as it affects the selection and design of components and systems used in fluid power transmission and motion control are studied. Emphasis is placed on industrial and mobile applications, but the principles also apply to aerospace, marine, and other fluid power systems.

Learning Outcomes: 1. Utilize the applicable laws of fluid mechanics to compute the requirements of fluid power systems. 2. Utilize computer software to evaluate starting and stopping transient behaviors in hydraulic systems. 3. Design motion control strategies with various actuators and valves to accomplish a specified task with hydraulic and pneumatic systems. 4. Analyze the performance of various pumps and compressors and specify the appropriate pump or compressor for a hydraulic or pneumatic system. Credits: 3.00

MET 33800 - Manufacturing Processes

Credit Hours: 4.00. Course covers basic fabrication and material removal manufacturing processes. Areas studied include casting, forging, material joining, forming, basic metal removal mechanisms, automated manufacturing processes, dimensional metrology for quality control and manufacturing process planning. The course emphasizes the selection and application of the various manufacturing processes. Permission of department required.

Credits: 4.00

MET 34500 - Welding Processes

Credit Hours: 3.00. Welding processes, equipment, and weldments are studied. An in-depth look is taken into welding processes, welding problems, quality control, inspection methods, welding filler metals, welding equipment, and weldment design.

Learning Outcomes: 1. Understand welding variables and processes. 2. Specify appropriate welding processes, equipment, and consumables for various welding operations. 3. Perform cost estimations for different weldments. 4. Write basic weld procedure specifications. Credits: 3.00

MET 34600 - Advanced Materials In Manufacturing

Credit Hours: 3.00. Metals, polymers, ceramic, and composite materials are studied. Crystal structure, molecular behavior, and the effects of various processes on material properties are considered. Course emphasizes the development and control of material properties to meet engineering requirements and specifications.

Learning Outcomes: 1. Describe common materials and major manufacturing processes. 2. Understand the process-property interaction for materials and manufacturing processes, including the major processes in strengthening materials. 3. Describe methods for measuring material properties. 4. Describe microstructure evolution of materials during casting, hot working, cold working, and heat treating processes. 5. Use appropriate tools for materials design and selection. Credits: 3.00

MET 34800 - Engineering Materials

Credit Hours: 4.00. An overview of structures, properties and applications of metals, polymers, ceramics, and composite materials is presented. Problem-solving skills are developed in material selection, evaluation, measurement, and testing. Laboratory activities include testing various properties of different materials, and the selection of materials for engineering application. Permission of department required.

Credits: 4.00

MET 34900 - Stringed Instrument Design And Manufacture

Credit Hours: 3.00. Concepts, knowledge, and skills in experimental mechanics, production processes, and design are integrated to manufacture a working musical instrument. Production concerns such as fixture design, process variability, and validation testing comprise key course elements.

Learning Outcomes: 1. Demonstrate understanding of the product development process. 2. Manage project and time to complete individual and team goals. 3. Synthesize design, manufacturing, and testing constraints, resulting in a working product. Credits: 3.00

MET 35000 - Applied Fluid Mechanics

Credit Hours: 3.00. The fundamentals of fluid mechanics including properties of fluid, pressure, hydrostatic force on submerged areas; kinematics and dynamics of fluid flow; friction losses and sizing of pipe.

Credits: 3.00

MET 36000 - Heating, Ventilating, And Air-Conditioning

Credit Hours: 3.00. A study of heat losses, heat-producing equipment, and cooling equipment in addition to the design of the direct systems. Includes controls and cost estimating for commercial, industrial, and residential systems. Codes and standards are emphasized throughout the course.

Credits: 3.00

MET 37900 - Introduction To Aerospace Technology

Credit Hours: 3.00. An overview of flight vehicle design is introduced through designing and making radio controlled model flight vehicles. Aerodynamic forces, dynamics and longitudinal stability are studied. Students will make airframes, integrate the controls, and test fly the resulting vehicles.

Learning Outcomes: 1. Evaluate minimum and maximum speed, climb rate, and power requirements for a flight vehicle. 2. Summarize stability parameters for a flight vehicle. 3. Explain basic performance characteristics of turbine and rocket engines. 4. Estimate performance of a flight vehicle using analysis or a simulation software package. 5. Prototype a model flight vehicle. Credits: 3.00

MET 38200 - Controls And Instrumentation For Automation

Credit Hours: 3.00. Study of the procedures and techniques essential to industrial measurement and transmission of data is provided in the areas of microprocessor control, process control, and automated testing. Concepts of hysteresis, repeatability, weighted signals, span, suppression, range, and closed loop control are emphasized.

Learning Outcomes: 1. Evaluate and select sensors for a given application based on relevant specifications. 2. Select a data acquisition system based on the requirements of a given application. 3. Explain how process gain, dead band, and lag affect the performance of a closed loop control system. 4. Tune a closed loop PID controller. Credits: 3.00

MET 39200 - Laboratory Assistant In Engineering Technology

Credit Hours: 0.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Intended for upper division students. Course content meets the MET Professional Experience requirement. Permission of department and instructor required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 0.00 to 3.00

MET 40100 - Capstone Projects I

Credit Hours: 3.00. This course deals with the planning for capstone projects. Methods to develop engineering requirements to meet project needs and formal design techniques are studied. Planning and design alternatives to meet cost, performance, and user-interface goals are emphasized. System tests and measurements are considered. Project planning, scheduling, and management techniques are studied. Different design approaches are compared.

Learning Outcomes: 1. Apply the engineering design lifecycle process. 2. Evaluate customer needs when defining a solution. 3. Evaluate design alternatives to determine the most appropriate design to pursue. 4. Define a plan for project development. 5. Propose a solution to a technical problem. Credits: 3.00

MET 40200 - Capstone Projects II

Credit Hours: 3.00. This is the second of two courses in a capstone project sequence. Project management and system engineering methods are applied to solving an engineering problem. Permission of instructor required.

Learning Outcomes: 1. Create a functional prototype. 2. Weigh design alternatives for requirements, efficiency, reliability, and cost. 3. Apply formal test procedures, including data analysis. 4. Present project results orally and in writing. Credits: 3.00

MET 41100 - Introduction To The Finite Element Method

Credit Hours: 3.00. The finite element method is introduced, with emphasis on modeling and interpretation of results. Linear static problems are solved using commercial FEA software, and FEA results are verified through laboratory tests and/or theoretical calculations. Topics include trusses, frames, plane stress/strain, torsion, 3D structures, buckling, and natural frequency/mode shape analyses.

Learning Outcomes: 1. Select and use the appropriate element type in the construction of FEA models for linear static, buckling, and frequency and mode shape analyses. 2. Demonstrate knowledge of meshing, symmetry, and the application of loads and constraints in the construction of FEA models. 3. Understand and demonstrate the use of mechanical testing, analytical calculation, and verification problems as a check on FEA solution accuracy. 4. Perform and open-ended design problem involving the application of FEA in a linear static or thermal problem. Credits: 3.00

MET 41400 - Design Of Mechanical Projects

Credit Hours: 3.00. Application of the fundamental principles of mechanical, hydraulic, and electrical technology to the design of mechanical systems. Discussion of the design process and continuation of topics in the design of machine elements. A semester design project is required.

Credits: 3.00

MET 42100 - Air Conditioning And Refrigeration

Credit Hours: 3.00. Heat gains and losses, heat-producing equipment, cooling, and refrigeration equipment are studied. System design is presented, including controls and instrumentation for commercial, industrial, and residential systems.

Learning Outcomes: 1. Recognize and explain the operation of common refrigeration and air conditioning equipment. 2. Evaluate the performance of refrigeration and air conditioning equipment. 3. Use appropriate instrumentation for accurate measurements of HVAC&R equipment performance. 4. Identify equipment, operating strategies, or management practices that encourage energy conservation and sustainable buildings. 5. Apply standard industry practices to the design of HVAC&R systems. Credits: 3.00

MET 42200 - Power Plants And Energy Conversion

Credit Hours: 3.00. The theories and skills learned from prerequisite coursework are applied to the analysis and design of power plants and their systems and to selected technologies of energy conversion. Industrial procedures and methods are emphasized.

Learning Outcomes: 1. Identify the efficiency of power cycles. 2. Detect and locate major components in power generation circuits and renewable power generating systems. 3. Evaluate turbines and cooling water systems. 4. Identify various types of fuel available in the utility industry and renewable energy sources. 5. Describe typical power plant pollutants. 6. Identify current technologies and policies that impact the development of new power plants. Credits: 3.00

MET 42600 - Internal Combustion Engines

Credit Hours: 3.00. Introduces the operating principles of internal combustion engines with emphasis on performance, efficiency, and emissions. Students will evaluate engine performance through geometric, kinematic, and thermodynamic analysis. Introduces advanced thermodynamic cycles and trends in internal combustion engine technology.

Learning Outcomes: 1. Describe the principles of internal combustion engine operation. 2. Calculate engine geometric and operating parameters. 3. Analyze engine performance through kinematic, kinetic, and thermodynamic calculations. 4. Evaluate advanced engine technologies and explain their impact on emissions and performance. 5. Describe the social and environmental impact of internal combustion engines from historical and contemporary perspectives. 6. Design an internal combustion engine for use in an on-road or off-road vehicle system. Credits: 3.00

MET 43200 - Hydraulic Motion Control Systems

Credit Hours: 3.00. Hydraulic feedback motion control systems, types, and applications are studied. Simulation and performance of closed loop control systems with single and multiple signal paths are emphasized. Dynamic system performance is predicted and evaluated. System parameters including accuracy, response speed, fluid compressibility effects, load disturbances, and nonlinear behavior of the components are studied.

Learning Outcomes: 1. Identify the origins, development and applications of servo mechanisms. 2. Explain hydraulic system and component nonlinearities such as friction, deadband, backlash, and hysteresis. 3. Recognize control terms, definitions, and fluid power components of a hydraulic system. 4. Evaluate transfer functions and their use in predicting the performance of a system. 5. Utilize computer software simulation tools to investigate the dynamic performance of simple control loops. 6. Develop methods for improving hydraulic system stability through the use of simulation tools. Credits: 3.00

MET 43600 - Pneumatic Motion Control Systems

Credit Hours: 3.00. The application of pneumatic motion control systems to industrial motion control and robotics is studied. Circuit design with control logic of both fluid and electronic types is stressed, as applied to pneumatic point-to-point and proportional controls. Control designs are implemented, tested, and evaluated in the laboratory.

Learning Outcomes: 1. Identify the internal parts and the operation of pneumatic components. 2. Design pneumatic systems integrating electronic input/output controls. 3. Construct single and multiple pneumatic cylinder/motor systems utilizing directional control valve technology. 4. Evaluate pneumatic control systems using simulation software. 5. Estimate the power loss due to air leakage in a pneumatic system. 6. Design closed loop control systems used in diverse pneumatic applications. Credits: 3.00

MET 44200 - Plastics Manufacturing Systems

Credit Hours: 3.00. Basic control theory, heat transfer, machine design principles, and basic polymer science are applied to analysis and design of polymer manufacturing systems. Emphasis is placed on thermoplastics processes such as extrusion and injection molding. Projects include design of new machinery, major renovations of existing processes, and automation of processes.

Learning Outcomes: 1. Understand the terms and principles of mold and pattern design for plastics manufacturing. 2. Develop a solid understanding of factors that drive plastics manufacturing processes. 3. Use simulation

software for pre manufacturing analysis and compare to the actual part once manufactured. 4. Explain how to conduct a design of experiments process to make basic recommendations related to product and/or process design which would allow more efficient manufacturing. 5. Develop an understanding of the common polymers and appropriate application for different manufacturing processes. Credits: 3.00

MET 44301 - Joining Processes

Credit Hours: 3.00. Topics cover joining technologies such as fastening, welding, brazing/soldering, adhesive, and diffusion bonding processes of metals, ceramics, plastics, and composites. The materials, processes, destructive and non-destructive evaluation, and design aspects of these technologies as well as current production practices will be presented. Emphasis will be placed on identification and optimization of key processing parameters. Students will be exposed to commonly used technologies, equipment, and methods for joint design, formation, testing, and optimization to better understand key parameters and process variables, and their influence on optimum joint designs.

Learning Outcomes: 1. Understand the operating principles, advantages and limitations of commonly used joining processes, including application to optimize joint design. 2. Develop a solid understanding of the response of materials to joining processes and joint functionality. 3. Identify the key parameters of major joining processes and their optimization in various production and product design scenarios. 4. Apply common techniques for quality measurement and control to joining processes. 5. Recommend changes to product and/or process design for more efficient manufacturing. Credits: 3.00

MET 44400 - Applied Metallurgy

Credit Hours: 3.00. Metals used in common engineering applications are studied to determine how their properties are achieved. Photomicrographic and other methods are employed to investigate the alloying, hotworking, coldworking, and heat treating processes of these metals. Detection, identification, and diagnosis of metal failure are included.

Learning Outcomes: 1. Understand common metallurgical processes and their effects on the microstructures and mechanical properties of alloys. 2. Identify phases in alloys using microscopes. 3. Correlate phases to the deformation and failure of alloys. 4. Apply knowledge that has been learned in the class to solve real world problems. Credits: 3.00

MET 44500 - Applied Metalcasting

Credit Hours: 3.00. This course applies metalcasting principles from concept through final product. Students design and optimize essential elements of casting systems using both simulation and fabrication methods and testing.

Learning Outcomes: 1. Apply sound design and manufacturing principles in the production of metal-cast products. 2. Design effective and efficient molds for multiple metal-cast products. 3. Apply methods to effectively identify, prevent and correct common product defects. 4. Demonstrate effective use of applicable software optimization tools. 5. Safely demonstrate metalcasting production techniques and practices. Credits: 3.00

MET 45100 - Manufacturing Quality Control

Credit Hours: 3.00. (MFET 45100) Quality control practices used in manufacturing industries; management, statistical control charts, reliability, sampling plans, economics, computer methods, and test equipment are presented and applied. Credit will not be granted for both MET 45100 and MFET 45100.

Learning Outcomes: 1. Apply the theory, principles, and applications of various quality management philosophes. 2. Measure and collect data in a variety of manners using technical standards related to sampling plans and quality process documentation. 3. Work in teams to conduct measurement system analysis and statistical process control (SPC). 4. Develop a solid understanding of how to utilize common quality management tools. 5. Conduct quality control experiments commonly used in industry for different manufacturing processes. Credits: 3.00

MET 45200 - Advanced GD&T Concepts Applied To Product Quality

Credit Hours: 3.00. This course explores the theory and application of Geometric Dimensioning and Tolerance (GD&T) to measurement systems and the programming necessary to

insure product quality.

Learning Outcomes: 1. Develop a comprehensive understanding of GD&T standards and callouts and how they apply to product quality. 2. Develop and demonstrate a comprehensive understanding of the critical components, capabilities, and software of CMMs and similar product measurement systems. 3. Apply uncertainty principles to measurement data to determine critical parameters associated with CD&T controls of product quality. Credits: 3.00

MET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MET 48200 - Mechatronics

Credit Hours: 3.00. Fundamental concepts and applications of practical mechatronics are presented, with emphasis on product design, systems integration, and functional relationships between mechanical structure, sensor data, precision actuators, power resources, embedded microcontrollers, control logic, and drives. Students gain hands-on experience with mechatronics components and measurement equipment which is applied in a team-based design-build mechatronics system project.

Learning Outcomes: 1. Describe the design and operation of mechatronics. 2. Demonstrate input/output characteristics of microcontroller and its interfacing. 3. Create a mechatronic system solution to a given problem. 4. Explain programming and interfacing issues involved in the design of mechatronic system. Credits: 3.00

MET 49000 - Special Topics In MET

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of mechanical engineering technology is provided by MET faculty, subject to MET curriculum subcommittee approval. Hours, subject matter, and credit to be arranged by faculty.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00 to 3.00

MET 49900 - Mechanical Engineering Technology

Credit Hours: 1.00 to 6.00. Independent project or study of a special topic is conducted under the supervision of appropriate MET faculty. Hours and subject matter must be arranged with the instructor and approved by the MET curriculum subcommittee before enrolling in the course. Permission of instructor required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00 to 6.00

MET 50300 - Applied Optimization

Credit Hours: 3.00. This course will introduce technology graduate students and senior undergraduates to the basic concepts of optimization methods with particular emphasis on applications in product and process design. Unconstrained nonlinear problems will be presented and solved using steepest descent and conjugate directions. Constrained problems will be solved using exterior penalty functions. Permission of department required.

Learning Outcomes: 1. Recognize optimization problems and cast them in standard form. 2. Identify objective functions and constraints. 3. Use commercial software to solve formal optimization problems. 4. Correctly identify global and local optimum solutions. 5. Use basic calculus concepts to calculate design sensitivities. 6. Understand the geometric concept of design space and be able to plot design space for a constrained problem with two design variables. Credits: 3.00

MET 51500 - Mechanics For Engineering And Technology

Credit Hours: 2.00. Evaluation of static and dynamic systems through the application of mechanics principles. Course will focus on aircraft applications and associated human factors. Topics to be covered include analysis of force equilibrium, kinematics with constant and varying acceleration, kinetics, work, energy, impulse and momentum.

Learning Outcomes: 1. Analyze systems in static equilibrium to determine applied and/or reaction forces necessary for system design and evaluation. 2. Analyze particles or systems of particles to determine acceleration, velocity

and/or position using the principles of dynamics for linear and rotational motion (such as kinematics, force, acceleration, work, energy, impulse and/or momentum). 3. Analyze extended rigid bodies or systems of bodies to determine acceleration, velocity and/or position using the principles of dynamics for translational, rotational and general plane motion (such as kinematics, force, acceleration, work, energy, impulse and/or momentum). 4. Devise relationships between the user and the aircraft to determine applied forces (both pilot to aircraft, and aircraft to pilot or passenger). Credits: 2.00

MET 51800 - Propulsion Mechanics And Electronic Systems

Credit Hours: 3.00. The course provides an in-depth exploration of propulsion systems driven by electro-mechanical technologies, with applications in aerospace, automotive, and industrial sectors. The course will cover the principles of electromechanical energy conversion and its integration with propulsion systems, focusing on electric motors, actuators, and power electronics used in propulsion mechanisms. Emphasis will be placed on the application of modern control systems, thermal management, and the efficiency optimization of electro-mechanical propulsion systems. Students can engage in hands-on projects, using simulation tools to design, analyze, and optimize propulsion systems for performance, durability, and sustainability.

Learning Outcomes: 1. Analyze and design electro-mechanical propulsion systems for various applications. 2. Evaluate power electronics and control systems to optimize propulsion performance. 3. Create outputs from simulation tools for propulsion system analysis. 4. Evaluate the environmental and efficiency impacts of electro-mechanical propulsion technologies. 5. Analyze potential future propulsion technologies strategic applications and scenarios. Credits: 3.00

MET 52700 - Technology From A Global Perspective

Credit Hours: 3.00. Introduction to the challenges faced by the practicing technologist when working and interacting with international technical personnel, both here and abroad, including history, standards, education, and practice of technology outside the United States. Permission of department required.

Learning Outcomes: 1. Awareness and comprehension of cross-cultural factors necessary for international professional practice in technology. 2. Effective research strategies that access what is known about technology development, usage and impact from a global perspective. 3. Knowledge and skill in researching and reporting cultural factors affecting business practices in a variety of independent nation states. 4. Knowledge of procedures, regulations and practices regarding international business. 5. Research skills to identify the natural and technology resources of countries. 6. An ability to contrast the impact of technology infrastructure and use of technology in developed countries to what occurs in underdeveloped countries. 7. Knowledge of the concept and application of ""Appropriate Technology"". 8. Knowledge of the historical development of technology in various modern nations. 9. Informed judgments regarding the influences of cultural and political environments of countries and their technological development. 10. Awareness of the major changes related to current and/or emerging technology in the leading industrial nations of the world. 11. Understanding of the methodologies employed for the effective introduction of technologies into new country or cultural settings. 12. Knowledge of selected International Technology Standards and organizations. Credits: 3.00

MET 53000 - Facilities Engineering Technology

Credit Hours: 3.00. A study of the application of the engineering sciences and technology to the solution of problems associated with mechanical and electrical systems in buildings. Emphasizes commercial and industrial facilities. Identifying energy conservation measures for both mechanical and electrical systems and evaluating their economic impact are an important focus of the course.

Learning Outcomes: 1. Explain building energy trends and related policy. 2. Explain the

organizations and personnel supporting the built environment. 3. Use building automation systems to monitor and control building operation. 4. Quantify energy use in building systems. 5. Use accepted professional practice for technical computations and writing. 6. Calculate the economic impact of energy and resource conservation measures for buildings. 7. Compute the impact of solar energy use for a building. 8. Apply strategies for maintaining Indoor Air Quality in buildings. 9. Evaluate the performance of mechanical or electrical systems in buildings. Credits: 3.00

MET 53500 - Optimization Of Metalcasting Design

Credit Hours: 3.00. The course focuses on optimal design of metalcastings to fit structural requirements (applied loads) and to assure sound manufacturability (castability). Students are expected to learn the general principles of design optimization through hands-on laboratory exercises based on the application of finite element and computational fluid dynamics software.

Learning Outcomes: 1. Analyze and apply advanced principles of metalcasting design to create efficient, high-quality castings with minimal defects and optimal performance characteristics. 2. Utilize modern simulation tools and techniques to predict and mitigate potential casting issues, optimize gating and riser systems, and ensure cost-effective production methods. 3. Develop and implement strategies for material selection, waste reduction, and energy efficiency, ensuring sustainable practices in metalcasting design and production. Credits: 3.00

MET 54600 - Industrial Applications Of Computer Integrated Manufacturing

Credit Hours: 3.00. A study of the development of CIM (computer integrated manufacturing) from the application of basic automation to a fully integrated system for the operation of the business enterprise. Emphasis is placed on the technology, systems, and human resources, which are integrated to accomplish the objectives of the company. Permission of instructor required.

Credits: 3.00

MET 58100 - Workshop In Mechanical Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 0.00 to 8.00

MET 59000 - Special Problems In Mechanical Engineering Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

MET 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Varies by course offering due to individual research topics. Credits: 1.00 to 3.00

MET 64500 - Design And Control Of Rehabilitation And Assistive Robots

Credit Hours: 3.00. This course focuses on studying the fundamentals of the design and control of rehabilitation and assistive robots and evaluating their performances. Topics in multiple areas, including robotics, biomechanics, controls, and mechatronics, are included in this course. Specifically, the students study various applicable control methods, including impedance control for the physical interaction of humans and robots. Additionally, the students conduct gait experiments and analyze the data to determine the gait parameters relevant to the design of lower leg assistive and rehabilitation robots, including human joint impedance. Supportive topics such as user intent recognition and relevant instrumentation are also discussed. Prerequisites: MFET 44200 or ECE 56900 or ME 57200.

Learning Outcomes: 1. Evaluate the needs of target populations, technologists, and ethical and regulatory restrictions related to human well-being, especially improved mobility. 2. Analyze the biomechanics considerations in the evaluation of the design and control of rehabilitation robots. 3. Analyze the data of the performed gait experiments. 4. Design an impedance controller for an assistive robot. 5.

Create a system of wearable sensors to analyze gait parameters in an unstructured environment. Credits: 3.00

MET 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies by courses due to individual research topics. Credits: 1.00 to 18.00

Medicinal Chemistry and Molecular Pharmacology

MCMP 49000 - Special Topics

Credit Hours: 1.00 to 3.00. A course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest, utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Credits: 1.00 to 3.00

MCMP 51400 - Biomolecular Interactions: Theory And Practice

Credit Hours: 1.00 to 4.00. Theory and applications of biophysical and bioanalytical methods for the identification and qualification of biological and pharmaceutical samples. Methods to be discussed include chromatography, electrophoresis, optical spectroscopy, mass spectrometry, electrochemical methods, radiochemical analysis, ultracentrifugation, calorimetry and surface plasmon resonance. Physical measurements, such as binding equilibrium, kinetics and macromolecular structure will be discussed. While fundamentals of each technique will be discussed, a major focus will be on the application and integration of presented methods for the analysis of biological problems. The course will be organized into four general topic areas around the theme of medicinal analysis, and variable credit will be available based on a student's interest in the four topic areas (i.e., 1 credit per topic area). Students should register for 1 credit hour, and the variable credit option will be discussed and determined at the first class period. Permission of instructor required.

Credits: 1.00 to 4.00

MCMP 54400 - Drug Classes And Mechanisms

Credit Hours: 3.00. The course will integrate basic principles of medicinal chemistry and pharmacology to achieve an understanding of drug mechanisms as applied to autonomic/endocrine, cardiovascular/renal, CNS, and chemotherapy/infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease.

Learning Outcomes: 1. Knowledge and understanding of the major drug classes. 2. Knowledge of the relationships between mechanism of action with drug interactions and adverse reactions. 3. Development of an introductory-level ability to critically evaluate primary literature. 4. An appreciation for the relevant research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. 5. A broad knowledge of pharmaceutical and related sciences. 6. An understanding of drug discovery, development, and commercialization. 7. Effective written and oral communication skills. 8. An ability to integrate and apply knowledge to solve problems. Credits: 3.00

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

MCMP 57100 - Discovery And Development Of Therapeutic Agents

Credit Hours: 3.00. Detailed description of drug discovery and development that integrates multiple scientific disciplines. Topics include Drug Disposition and Toxicology, Identification, Qualification, and Validation of Molecular Targets, Lead Discovery and Optimization, and New Drug Modalities and Advanced Medicinal Products. These topics assume prior student mastery of basic chemical principles of biological action that are taught in MCMP 57000.

Learning Outcomes: 1. Demonstrate an advanced understanding of the process for identifying and developing new candidate agents. 2. Evaluate pharmaceutical candidates for therapeutic efficacy, safety, and potential improvement of candidates for clinical development. 3. Design traditional and cutting-edge drug discovery workflows for identifying therapeutic targets and pharmaceutical candidates. 4. Understand the breadth of the drug discovery process and be conversant with

the interdisciplinary nature and disciplines involved in the drug discovery industry. Credits: 3.00

MCMP 59800 - Introduction To Research

Credit Hours: 1.00 to 3.00. Introduction to research in synthetic and analytical medicinal chemistry, pharmacognosy, and natural products under the direction of a member of the graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

MCMP 61700 - Molecular Targets: Neuro Function And Dysfunction

Credit Hours: 2.00. The application of basic scientific principles from medicinal chemistry and molecular pharmacology, and new discoveries in biology, to the development of new drugs to treat psychiatric disorders and diseases of the central nervous system. Important examples of drug targets, and small molecules (either currently approved drugs or those under investigation) that target them, are discussed. Classes of drug target examples discussed include: G protein-coupled receptors, neurotransmitter transporter proteins, and ion channels. Processes of neurosecretion and neurodegenerative processes will also be discussed, as well as target validation and examples of the use of genetic models to identify CNS targets. Prerequisites: MCMP 57000 . This course is offered even numbered years.

Learning Outcomes: 1. Understand completely modern approaches to assessing the nature and relevance of the various targets for CNS drugs and CNS drug discovery. 2. Demonstrate full comprehension and satisfactory presentation of CNS drug discovery findings from the current literature. 3. Demonstrate satisfactory critical evaluation of the primary literature. 4. Demonstrate a synthesis of knowledge acquired/demonstrated through the first three outcomes, to achieve a full understanding of a specific area of CNS drug discovery, and generate a satisfactory original research proposal in that area. Credits: 2.00

MCMP 61800 - Molecular Targets: Cancer

Credit Hours: 2.00. The application of basic scientific principles from medicinal chemistry and molecular pharmacology, and new discoveries in biology, to the development of new anti-cancer drugs. Important examples of drug targets and small molecules (either currently approved drugs or those under investigation) that target them, are discussed. Classes of drug targets discussed include: kinases, small monomeric G proteins, prenyltransferases, transcription factors, nuclear receptors, cell cycle proteins, cytoskeletal proteins, and topoisomerases. Prerequisites: MCMP 57000 .

Learning Outcomes: 1. Understand completely modern approaches to anti-cancer drug discovery. 2. Demonstrate full comprehension and satisfactory presentation of anti-cancer drug discovery findings from the current literature. 3. Demonstrate satisfactory critical evaluation of the primary literature. 4. Demonstrate a synthesis of knowledge acquired/demonstrated through the first three outcomes, to achieve a full understanding of an area of anti-cancer drug discovery, and generate a satisfactory original research proposal in that area. Credits: 2.00

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

MCMP 69000 - Special Topics In Medicinal Chemistry And Molecular Pharmacology

Credit Hours: 0.00 to 6.00. Special topics, projects, or laboratory exercises in selected areas of medicinal chemistry and molecular pharmacology. Permission of instructor required.

Credits: 0.00 to 6.00

MCMP 69600 - Seminar In Medicinal Chemistry And Molecular Pharmacology

Credit Hours: 0.00 or 1.00. Faculty and student participation in discussion of current research and developments in synthetic medicinal products, quality control, instrumentation, biosynthesis, and structure elucidation of natural products.

Credits: 0.00 or 1.00

MCMP 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

MCMP 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Medieval and Renaissance Studies

MARS 22000 - Introduction To Medieval And Renaissance Studies

Credit Hours: 3.00. An introduction to the interdisciplinary study of the Middle Ages and Renaissance.

Credits: 3.00

Military Science and Leadership

MSL 10100 - Introduction To The Army

Credit Hours: 1.00 to 2.00. An introduction to the army, the profession of arms, and basic soldier skills. Students learn what it means to be a professional in the U.S. Army. The overall focus is introducing them to the Army Leadership Requirements Model and the Reserve Officers' Training Corps (ROTC) program, its purpose in the Army, and its advantages for the student. Other topics include map reading, land navigation, fieldcraft, first aid, and individual/team movement techniques.

Learning Outcomes: 1. Demonstrate proficiency in mission command philosophy. 2. Demonstrate proficiency in mission command leader and commander tasks. 3. Demonstrate proficiency in mission command staff tasks. 4. Demonstrate proficiency in mission command systems. 5. Demonstrate capacity in creative critical thinking. 6. Demonstrate proficiency in communications skills. 7. Demonstrate proficiency in cultural awareness, cross cultural competencies in the strategic environment of 2025 and beyond. 8. Pursue Comprehensive Fitness / Resiliency Skills and Performance Enhancement Skills. 9. Pursue lifelong learning, self-assessment, and goal setting. 10. Demonstrate proficiency in Army and Joint doctrine. 11. Support Army policies, programs, and processes. 12. Demonstrate technical and tactical competency. Credits: 1.00 to 2.00

MSL 10200 - Foundations Of Leadership

Credit Hours: 1.00 to 2.00. An introduction to the personal challenges and competencies that are critical for effective leadership. Topics include critical thinking, time management, goal setting, and communication. The course emphasizes the communications process and the importance for leaders to develop essential skills to effectively communicate in the Army. Basic squad-level tactics will be reinforced.

Learning Outcomes: 1. Apply critical thinking and problem-solving, using troop-leading procedures (TLP). 2. Demonstrate map reading and land navigation skills. 3. Explain the value of diversity and the officer's role in leading change. 4. Describe the fundamentals of the Army as a profession. Credits: 1.00 to 2.00

MSL 20100 - Leadership And Ethics

Credit Hours: 2.00 to 3.00. An examination of leadership and ethics through the study and analysis of famous leaders. Army values and ethics and their relationship to the Law of Land Warfare is stressed. Emphasizes the philosophy of military service and how military leaders can apply values and ethics to a variety of situations they might encounter in the Army.

Learning Outcomes: 1. Apply Army core values and ethics to different situations that officers may encounter as a leader. 2. Explain the relationship between Army Values, the Law of Land Warfare, and the philosophy of military service. 3. Develop a personal leadership philosophy and style. Credits: 2.00 to 3.00

MSL 20200 - Army Doctrine And Decision Making

Credit Hours: 2.00 to 3.00. The course explores using analytical techniques, creative-thinking skills, and the Army problem-solving process to help with situational decision making. Troop-leading procedures (TLP) and operational orders (OPORD) are used to explain Army Doctrine and symbology. Topics include using unified land operations, offensive operations, and defensive operations in squad-level tactics.

Learning Outcomes: 1. Apply analytical techniques, creative-thinking skills, and the Army problem-solving process. 2. Explain Army doctrine and symbology, using TLPs and OPORDs. 3. Explain how squad tactics are used in unified land operations, offensive operations, and defensive operations. Credits: 2.00 to 3.00

MSL 30100 - Training Management And The Warfighting Function

Credit Hours: 3.00 to 4.00. Examines how the Army operates through warfighting functions. Emphasizes planning, preparing, and executing training for small-unit tactics.

Learning Outcomes: 1. Describe the fundamentals of training management. 2. Explain how the Army operates through the warfighting functions. 3. Plan, prepare, and execute training for a squad conducting small-unit tactics. Credits: 3.00 to 4.00

MSL 30200 - Applied Leadership In Small Unit Operations

Credit Hours: 3.00 to 4.00. An examination of the fundamentals

of direct-level leadership and small-unit tactics at the platoon level in preparation for Cadet Summer Training Advance Camp. Emphasizes the planning, coordinating, navigating, motivating, and leading a platoon to execute a mission.

Learning Outcomes: 1. Describe the fundamentals of direct-level leadership and small unit tactics at the platoon level. 2. Explain how the Army operates through the warfighting functions. 3. Plan, coordinate, and lead a platoon to execute a mission. Credits: 3.00 to 4.00

MSL 40100 - The Army Officer

Credit Hours: 3.00 to 4.00. An examination of Army officer development to include planning, resourcing, and assessing training at the small-unit level. Topics include counseling subordinates, evaluating performance, values and ethics, career planning, legal responsibilities, and programs that support Army officers in these endeavors.

Learning Outcomes: 1. Describe Army programs that support counseling subordinates and evaluating performance, values and ethics, career planning, and legal responsibilities. 2. Explain how to plan, prepare, execute, and continuously assess training at the company level. Credits: 3.00 to 4.00

MSL 40200 - Company Grade Leadership

Credit Hours: 3.00 to 4.00. This course explores the roles and responsibilities of company-grade Army officers with respect to unified land operations. Emphasizes the knowledge, skills and abilities required of junior officers in preparation for commissioning.

Learning Outcomes: 1. Describe company grade officer roles and responsibilities pertaining to unified land operations. 2. Demonstrate officership as it pertains to a U.S. Army Second Lieutenant. Credits: 3.00 to 4.00

MSL 49000 - Directed Studies In Military Science

Credit Hours: 1.00 to 3.00. Individual readings, topics, or projects in military science appropriate for advanced undergraduate students. Permission of instructor required.

Credits: 1.00 to 3.00

Motorsports Engineering

MSPE 29000 - Motorsports Engineering Seminar

Credit Hours: 1.00. An overview of the motorsports industry including types of vehicles, types of competition, careers available, historical perspective, development of pertinent technologies, and brief discussions of engineering related topics that will be covered in more detail in future classes. Interactions with motorsport and mechanical engineering faculty along with motorsports engineers currently working in the industry. Professionalism and ethics are discussed along with topical discussions as related to the motorsports industry in the areas of globalization, cultural differences, and collaboration across cultural boundaries.

Learning Outcomes: 1. Demonstrate knowledge of the motorsports industry and recognize techniques, skills and modern tools of the motorsports industry. 2. Apply current knowledge and solve introductory problems relevant to the motorsports industry. 3. Possess a general knowledge of the history and evolution of motor racing nationally and internationally. 4. Develop technical writing skills beyond those learned in first-year engineering. 5. Recognize professional, ethical, and societal responsibilities in the context of the motorsports industry. Credits: 1.00

MSPE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 29701 - Computer Modeling For Motorsports

Credit Hours: 2.00. An introductory course detailing methods for designing and modeling motorsports components using Computer Aided Design (CAD) software.

Learning Outcomes: 1. Understand Bottom-up Design of systems and components. 2. Utilize modern engineering tools to model components as solid models in 3 dimensions. 3. Utilize modern engineering tools to generate detail two-dimensional detail drawings of components. 4. Utilize modern engineering tools to model and constrain component assemblies in 3 dimensions. 5. Communicate thoughts and ideas. Credits: 2.00

MSPE 29800 - Programming And Computer Modeling For Motorsports

Credit Hours: 2.00. Introductory course detailing methods for creating virtual models of vehicle systems for design, analysis and optimization. Virtualization methods include object-oriented programming techniques for creating mathematical models in Excel, Matlab and Python. Students will learn the basics of data regression consistent with the analysis methods conducted in the motorsports industry. The methods introduced through this course lay the foundation for advanced courses in vehicle design, simulation, and analysis.

Learning Outcomes: 1. Introductory understanding of Object-Oriented Programming using Excel VBA and C#. Credits: 2.00

MSPE 31201 - Business of Motorsports

Credit Hours: 0.00 or 3.00. This course covers the unique aspects of the motorsports industry, especially race teams, including organizations, budgeting, marketing, and sponsorships through an examination of literature and guest speakers.

Credits: 0.00 or 3.00

MSPE 31700 - Motorsports Practicum I

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a professional motorsports organization.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team. 10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 32000 - Motorsports Design I

Credit Hours: 3.00. Introduction to the principles of design and analysis of vehicle subsystems and components within those subsystems. Vehicle subsystems are reviewed and evaluated for functionality, and reliability with emphasis on the utilization of analytical tools in design. Analytical methods developed in vehicle dynamics are utilized to support the understanding of forward and reverse engineering principles.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to solution of design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively. Credits: 3.00

MSPE 33000 - Systems Engineering For Motorsports

Credit Hours: 3.00. Systems engineering encompasses the engineering knowledge to specify, design, program and analyze the electrical systems of a motorsports vehicle. The course will explore those systems to provide the engineering foundation in instrumentation, data analysis, data reduction, and system programming. Project work will supplement the learning outcomes through direct engagement of designing and specifying a data system for a motorsports vehicle, manufacturing a motorsports vehicle sensor loom, and programming the communication pathways between different vehicle electrical systems.

Learning Outcomes: 1. Understand the fundamentals of the data acquisition systems

installation, operation, software, and maintenance, while appreciating the importance of data integrity 2. Understand the implications of design decisions when designing the data acquisition system or designing around the data acquisition system. 3. Understand the limitations and possibilities of the data acquisition system. 4. Utilize data acquisition analysis tools to properly import and display data signals. 5. Understanding on how to write math channels to interpret and analyze data. 6. Initial understanding of how recorded data represents vehicle and driver performance. 7. Utilize motorsports wiring tools to manufacture a motorsports sensor harness. 8. Understand the basics of digital car communication including the math associated with communicating digital signals throughout the vehicle. Credits: 3.00

MSPE 33001 - Data Acquisition For Motorsports I

Credit Hours: 2.00. This course introduces students to motorsports data acquisition systems and the associated hardware and software that are comprised therein. A hands-on lab component is included int he class where in students learn how to specify a motorsports data system, understand vehicle network communication and build a motorsport industry standard data acquisition wiring harness.

Credits: 2.00

MSPE 33100 - Data Acquisition For Motorsports II

Credit Hours: 3.00. This course explores the appliaction of vehicle dynamics principles to motorsport vehicles. Students will utilize engineering software tools to develop motorsport engineering worksbooks for vehicle performance analysis. Driver performance analysis and race strategy topics are introduced to provide the student with the full fundamentals of race engineering.

Credits: 3.00

MSPE 34000 - Dynamic Signals And Systems

Credit Hours: 3.00. Introduction to dynamic engineering systems and continuous-time and discrete-time signals, mechanical electromechanical components, linear system response, Fourier and Laplace Transforms. The course is designed to teach the student the basic concept for modeling the behavior of dynamic systems.

Credits: 3.00

MSPE 35000 - Computer Aided Design And Manufacturing

Credit Hours: 3.00. This course provides the basis for the computer-aided engineering and analysis skills needed in the Motorsports Industry. The ability to visualize and conceptualize a real part in the physical world and produce graphical representations of it in 2D and 3D in Solidworks or an equivalent is a primary objective. Further skills to be developed include the ability to produce large assemblies of such parts with appropriate tolerancing, free form surfacing, casting shapes and casting machining, 2D drawings for use in 3D sheet metal fabrication including shrink and stretch, use of 3D models to facilitate Finite Element Analysis, Conversation of CAD model to programming of CAM machining.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to problems involving the design and manufacturing of components and systems. 2. Design a system, component, or process to meet desired needs. 3. Identify, formulate, and solve engineering problems involving the design and manufacturing of components and systems. 4. Use the techniques, skill, and modern engineering tools necessary for engineering practice. Credits: 3.00

MSPE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

MSPE 41400 - Motorsports Design II

Credit Hours: 3.00. This is the culminating course in the Motorsports Engineering Plan of Study, tying together concepts from all the other courses in the curriculum, and requires a capstone design project representative of a real world project with the Motorsports Industry.

Learning Outcomes: 1. Apply knowledge of mathematics, science and engineering to the solution of complex and comprehensive design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs pertinent to the motorsports industry. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively in written reports and oral presentations. 7. Use the technique, skill, and modern engineering tools necessary for engineering practice in the motorsports industry. Credits: 3.00

MSPE 41700 - Motorsports Practicum II

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a race team in the motorsports industry. Students will be expected to show mastery of at least 12 of the 12 skills outlined in the Course Objectives.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team. 10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 42600 - Internal Combustion Engines

Credit Hours: 3.00. This course will cover fundamentals of hybrid electric and battery electric transportation systems with particular emphasis on high performance vehicles. It will cover powertrain configurations of Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), and Battery Electric Vehicle (BEV). Component sizing and energy management topics will also be covered.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools needed for design and analysis of engines. 2. Apply current knowledge and adapt to emerging applications in engine development. 3. Conduct, analyze and interpret experiments and apply results to improve processes. 4. Function effectively on teams. 5. Identify, analyze and solve technical problems. 6. Communicate effectively. Credits:

3.00

MSPE 43100 - Race Engineering

Credit Hours: 3.00. Motorsports engineering knowledge obtained throughout the curriculum are brought together to create foundational knowledge in the discipline. Analytical tools in Excel or Matlab along with data analysis tools from Cosworth or Motec are utilized to guide the application of motorsports engineering principles to vehicle performance optimization. Race strategy topics are investigated to provide foundational knowledge beyond vehicle system.

Learning Outcomes: 1. Utilize Excel or Matlab to analyze vehicle systems and performance. 2. Utilize Cosworth Toolbox or Motec i2 software to analyze vehicle systems and performance. 3. Calculate fuel error and its impact on race strategy. 4. Understand tire degradation principles and its impact on race strategy. 5. Write technical reports to disseminate the technical information in a clear and concise manner. Credits: 3.00

MSPE 47200 - Vehicle Dynamics

Credit Hours: 3.00. Analytical and mathematical model development of the automotive and motorsports vehicles to understand how key vehicle parameters influence vehicle performance. Areas of focus include rectilinear motion, lateral motion, suspension kinematics, tire dynamics and drivetrain modeling.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools necessary for analysis of vehicle dynamics and design of vehicle systems. 2. Apply current knowledge and adapt to emerging applications appropriate to the topic of vehicle dynamics. 3. Conduct, analyze and interpret experiments and apply experimental results to improve processes. 4. Apply creativity in the design of systems, components or processes appropriate to program objectives. 5. Function effectively on teams. 6. Identify, analyze and solve technical problems. 7. Communicate effectively. Credits: 3.00

MSPE 48200 - Motorsports Aerodynamics

Credit Hours: 3.00. A focused introductory course into the study of aerodynamics principles as applied to automotive and motorsports vehicles. Broad range of topics introduce students to the complexity of fluid flow in and around the vehicle. Analytical methods including Computational Fluid Dynamics are utilized to emphasize key aerodynamics principles taught in the course.

Learning Outcomes: 1. Students will understand the basics of aerodynamic analysis and design as applied to motorsports vehicles. 2. Students will be able to apply Computational Fluid Dynamics modeling and analysis techniques to motorsports design. 3. Students will be able to integrate the various aspects of motorsports modeling and design. Credits: 3.00

MSPE 49000 - Motorsports Engineering Independent Study

Credit Hours: 1.00 to 3.00. This is an independent study course for students wishing to pursue advanced studies under the direction of a faculty advisor. Permission of instructor required.

Credits: 1.00 to 3.00

MSPE 49700 - Motorsports Design Project

Credit Hours: 3.00. This is an independent study version of the MSPE 41400 culminating course in the Motorsports Engineering Plan of Study, tying together concepts from all the other courses in the curriculum, and requires a capstone design project representative of a real world project within the Motorsports Industry. Permission of instructor required.

Credits: 3.00

MSPE 49900 - Motorsports Engineering Special Topics

Credit Hours: 1.00 to 3.00. This is a special topics course for students wishing to pursue advanced studies under the direction of a faculty advisor. Permission of instructor required.

Credits: 1.00 to 3.00

Music History and Theory

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 11200 - Fundamentals Of Music (UCC: HUM)

Credit Hours: 3.00. Fundamentals of music notation, ear training, and music reading.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand music notation, rhythmic structure, meter, scales, blues form, chords, basic musicianship and ear training, and fundamentals of songwriting. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 17100 - Jazz Improvisation I

Credit Hours: 2.00. This course is an introduction to the development of beginning jazz improvisational and theoretical skills for all instrumentalists and vocalists. Fundamentals theoretical and musicianship skills are addressed through practical application, guided listening, dictation, transcription, harmonic and rhythmic analysis, and performance of standard jazz repertoire.

Learning Outcomes: 1. Explain the fundamentals of jazz theory and musicianship. 2. Write or transcribe a jazz solo from a recording. 3. Explain and notate jazz harmonies and voicings using established forms of analysis. 4. Describe various jazz styles in performance. 5. Perform selected jazz repertoire. 6. Perform an improvised jazz solo. Credits: 2.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural

elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 23300 - Music Theory IV: Contemporary Music

Credit Hours: 3.00. A study of music theory from the late Romantic era through current practice. Students may be asked to compose works in a variety of styles that include late Romanticism, Impressionism, Neoclassicism, Atonality, Pointillism, Minimalism, Sound-Mass Composition, Indeterminacy, Ambient music, Graphic Notation and Neoromanticism.

Learning Outcomes: 1. Demonstrate a theoretical understanding of harmonic practice from the Late Romantic Era through the contemporary period. 2. Analyze the structural elements of music from the Late Romantic Era through the contemporary period. 3. Produce original compositions in the styles associated with the Late Romantic Era through the contemporary period. Credits: 3.00

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 27100 - Jazz Improvisation II

Credit Hours: 2.00. This course is a continuation of MUS 17100, Jazz Improvisation I. Students will continue to develop their jazz improvisation skills that include scale development, pattern playing, guided listening, dictation, transcription skills, harmonic, melodic and rhythmic studies as well as performing standard jazz repertoire. Students should have at least two years of previous experience in band, orchestra, choir, or piano study prior to enrolling in this course. Students will be required to perform in class. Prerequisites for this class are MUS 13200, Music Theory I and MUS 17100, Jazz Improvisation I or consent of the department.

Learning Outcomes: 1. Define common terminology and techniques used in jazz. 2. Explain common chord progressions found in jazz. 3. Demonstrate common linear approaches to jazz improvisation. 4. Explain similarities and differences between various jazz styles and how they impact improvisation. 5. Perform effective jazz solos. Credits: 2.00

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

MUS 32100 - Songwriting

Credit Hours: 3.00. This course is an introduction to contemporary songwriting. Topics covered will include the study of contemporary chord progressions, melodic development, essential songwriting forms and lyric writing. Students will analyze and compose original songs that will cover a wide range of musical styles and genres including folk, country, pop, rock, jazz and hip-hop. Students interested in Art Song composition should take MUS 34100 or 34200, Composition I-II. Prerequisites include MUS 13200, Music Theory I and MUS 27000, Computer Skills in Music or consent of department.

Learning Outcomes: 1. Demonstrate a theoretical and practical understanding of contemporary songwriting. 2. Explain traditional

and contemporary harmonic and melodic practice in songwriting. 3. Define common terms such as verse, chorus, bridge, refrain and hook. 4. Analyze and compose works in simple forms such as binary, ternary, AABA and blues forms. 5. Explain and demonstrate common features of various beats and styles associated with songwriting: samba, bossa nova, swing, bop, funk, hip-hop. 6. Analyze and write effective lyrics. 7. Create original songs. Credits: 3.00

MUS 32400 - Teaching Music In The Elementary School

Credit Hours: 3.00. Develops basic musicianship through singing, playing instruments, reading and writing music, listening and moving to music. Surveys music teaching methods and materials. Includes lesson planning, experiences in teaching, and observation of children in music classes.

Learning Outcomes: 1. Advocate for the importance of music's inclusion (or exclusion, if desired) in the elementary classroom. 2. Develop curricula that appropriately advances the musical abilities, appreciation, and understanding of children. 3. Perform by singing and playing instruments both alone and in a group. 4. Synthesize appropriate terms to describe musical performance and recording. 5. Connect music to a variety of societal, cultural, and historical contexts. Credits: 3.00

MUS 32800 - Jazz Theory, Composition And Arranging

Credit Hours: 3.00. This course is an introduction to contemporary jazz theory, composition and arranging practices. Topics covered will include the study of chord and scale constructions, substitutions, analyzing and building harmonic progressions, modal functions, identifying various styles and idioms, and writing for combo and big band. Students will learn how to compose in various jazz styles and score their works for small and large ensembles. Prerequisites: MUS 13300, Music Theory II and MUS 27000, Computer Skills in Music or consent of instructor.

Learning Outcomes: 1. Explain common chords, scales and modes used in contemporary jazz music. 2. Define common terms used in jazz arranging and composition. 3. Explain and demonstrate common features of various jazz styles. 4. Create original jazz compositions and arrangements. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 34500 - History Of Rock Music

Credit Hours: 3.00. This course is a survey of the major trends, styles, and genres of rock music from the earliest recordings to the present day. It focuses on the work of the artists and groups who have proven to have the most enduring significance.

Learning Outcomes: 1. Analyze song form as well as instrumentation. 2. Describe and distinguish between various rock genres and their chronological development in history. 3. Describe rock music's influence on society and culture. 4. Demonstrate fluency in the fundamentals of music. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire.

4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

MUS 36000 - Singing For The Theatrical Stage

Credit Hours: 2.00. A workshop/lab in which students explore how to sing musical theater repertoire for the stage. Students will learn about musical theater auditioning, character analysis and development through song, and performance on stage as a singing actor. The course will have both in-class and out-of-class performance opportunities as well as research experiences that use performance-based methods to explore oneself in social contexts (autoethnography). It is recommended that students have at least two years of singing experience prior to taking this course. Exceptions may be made with instructor's approval. The course may be repeated.

Learning Outcomes: 1. Incorporate and explain musical and theatrical decisions through the singing of musical theater repertoire. 2. Develop and perform a repertoire of appropriate materials for musical theater auditions. 3. Create new art through performance-based research and musical media that can be disseminated on stage and online. 4. Evaluate and describe one's own performance as well as others through reflection and criticism. 5. Analyze musical theater performances, characters, and scripts to better perform as a singing actor. Credits: 2.00

MUS 37000 - Introduction To Instrumental And Choral Conducting

Credit Hours: 3.00. This course is an introduction to instrumental and choral conducting. Topics covered will include the study of essential skills necessary to lead vocal and instrumental ensembles that will involve warmup techniques, choral and instrumental tone production, baton and directing patterns, ensemble organizational leadership and score analysis. Prerequisites include MUS 13300, Music Theory II or consent of the department.

Learning Outcomes: 1. Define common terms used in musical scores. 2. Demonstrate a wide variety of conducting hand and baton patterns. 3. Explain how musical analysis can influence conducting. 4. Explain standard organizational and leadership approaches in conducting musical groups. 5. Explain frequent errors made by conductors. Credits: 3.00

MUS 37500 - Selected Topics In Music

Credit Hours: 3.00. A study of a specific genre in music (symphony, opera, chamber music, etc.) or the works of a single composer.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 3.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

MUS 38400 - Digital Record And Production II

Credit Hours: 3.00. This course is a continuation of MUS 38300, Digital Audio Recording and Production I. Topics covered will include advanced musical sequencing, multitrack audio recording, audio signal processing, mixing, mastering and advanced audio and digital production. Students will be required to develop music recording and production projects.

Learning Outcomes: 1. Explain and demonstrate multitrack recording, mixing, analog and digital effects processing, sampling, use of specialized filters and audio tools such as vocoders and other electronic instruments to shape and edit sound. 2. Explain and demonstrate advanced musical sequencing and digital audio editing. 3. Explain and demonstrate issues and techniques used when combining digital sound with acoustic instruments and voices. 4. Create professional mixes that use reverb, compression, and special effects, etc. 5. Explain and demonstrate techniques used in combining sound and music to video and film productions. Credits: 3.00

MUS 49000 - Guided Reading In Music

Credit Hours: 1.00 to 6.00. For students with specialized needs and interests in the field. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 6.00

MUS 59000 - Special Problems In Music

Credit Hours: 1.00 to 4.00. An individualized and intensive study of any aspect of music required by the student's plan of study. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

Natural Resources and Environmental Science

NRES 12100 - Stepping Stones To Environmental Science

Credit Hours: 1.00. Intended to expose first-year students to emerging environmental problems and innovative solutions, to support their transition to Purdue through a sense of community and increased engagement, and to provide students access to faculty in the environmental sciences in a small group setting. Activities include field trips, hands-on learning, study halls, and meals together. Enrollment is restricted to members of the environmental science learning community. Department permission required.

Learning Outcomes: 1. Recognize environmental service and awareness groups on campus and in the local community. 2. Identify local environmental challenges. 3. Increase knowledge of potential solutions for increasing food-water-energy sustainability. Credits: 1.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 23000 - Survey Of Meteorology (UCC: SCI)

Credit Hours: 3.00. (EAPS 22100) An introductory course for both science and non-science students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate, ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

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Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00 Credits: 1.00

NRES 33700 - Environmental Hydrology

Credit Hours: 3.00. (AGRY 33700) This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Learning Outcomes: 1. Become familiar with hydrological processes, interactions and their representations over scales from point to ""continental"" and times from seconds to years. The major emphasis is on surface and near surface phenomenon. 2. Gain qualitative and quantitative understanding of land surface water budgets and how they respond to environmental change. 3. Develop problem solving abilities on topics related to surface water hydrology. Credits: 3.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological

hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

NRES 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (AGRY 38500) Designed as an upper level introductory course covering environmental soil chemistry concepts in the framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or mathematics background.

Credits: 4.00

NRES 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Credits: 3.00

NRES 40000 - Natural Resources And Environmental Science Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

NRES 41000 - Research In Natural Resources And Environmental Science

Credit Hours: 1.00 to 3.00. Supervised individual research. NRES 41000 provides the opportunity to participate in independent undergraduate research with the goal of learning how to design, execute, and report research. Students will properly and permanently record their information in a timely fashion and learn how to examine, analyze, and interpret their results. One credit hour corresponds to one how of laboratory preparation and three hours of laboratory research. Total credits in NRES 41000 and NRES 41100 may not exceed six credits. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00 to 3.00

NRES 42000 - Environmental Internship

Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (AGRY 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Credits: 3.00

NRES 48000 - Hazardous Waste Certification Renewal

Credit Hours: 0.00. Upon completion of this course, students will be able to 1) analyze a response scene to stop the release or potential releases of hazardous substances, and 2) connect knowledge and awareness to meet OSHA requirements (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. Students successfully completing all requirements will receive their 40-hour HAZWOPER Certification.

Learning Outcomes: 1. Receive 40-hour HAZWOPER Certification Renewal upon completion of this course. Credits: 0.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems.

Credits: 2.00

NRES 49800 - Individual Studies In Environmental Science

Credit Hours: 1.00 to 3.00. An opportunity for upper-level undergraduates to focus their interests and knowledge on an environmentally related problem. Arrangements must be made with a Natural Resources and Environmental Science Program faculty member before registration. Permission of instructor required.

Credits: 1.00 to 3.00

NRES 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Discuss the complexity of involving stakeholders in decisions about landscape management. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

Naval Science

NS 11000 - Introduction To Naval Science

Credit Hours: 3.00. This course is a general introduction to the USN and USMC that emphasizes organizational structure, warfare components and assigned roles/missions of USN/USMC. It covers all aspects of naval service from its relative position within the DoD to the specific warfare community/career paths and includes basic elements of leadership and USN and USMC core values. The course provides students with initial exposure to many elements of naval culture and provides the conceptual framework/working vocabulary for students to use on summer cruise.

Learning Outcomes: 1. Demonstrate proficiency in USN and USMC customs, such as the hand salute, uniform preparation, and flag etiquette. 2. Describe the departmental organizations of the USN and USMC. 3. Define the various watch-standing roles of shipboard personnel. 4. Describe the general career path of the various unrestricted line communities in the Navy and Marine Corps. 5. Describe all rank insignia of the armed forces. 6. Explain institutional values and ethics of the Department of the Navy. Credits: 3.00

NS 20200 - Naval Science Laboratory

Credit Hours: 2.00. This lab is designed to develop students morally, mentally, and physically and to imbue in them the highest ideals of duty, honor, and loyalty. Topics shall cover general Navy/Marine Corps mission and policies, force protection, operational security, watch standing, physical fitness, nutrition, stress management, and other professional development subjects not normally included in the curriculum of the Naval Science Courses. Laboratory periods may also be used on an occasional basis to supplement the Naval Science Courses and provide additional time for projects, such as navigation chart work. Open to Naval ROTC students only.

Learning Outcomes: 1. Complete the Navy or Marine Corps physical fitness tests with passing scores. 2. Demonstrate proficiency in close-order drill. 3. Complete a dress uniform inspection with a passing score. 4. Demonstrate proper military courtesies. 5. Describe the basics of military customs, ceremonies, and traditions. 6. Demonstrate exemplary personal and professional behavior in accordance with standards of conduct expected of a professional military officer. 7. Demonstrate the basic principles of the Navy and Marine Corps' Warrior Toughness program. Credits: 2.00

NS 21200 - Naval Ships Systems II (Weapons)

Credit Hours: 3.00. This course outlines the theory and employment of weapons systems. Students explore the processes of detection, evaluation, threat analysis, weapon selection, delivery, guidance, and explosives. Fire control systems and major weapons types are discussed, including capabilities and limitations. The physical aspects of radar and underwater sound are described. Facets of command, control, communications, computers, and intelligence are explored as a means of weapons system integration. The tactical and strategic significance of command and control warfare and information warfare is discussed.

Learning Outcomes: 1. Explain the choice of weapon, given the defined threat's capabilities. 2. Define the capabilities and limitations of Naval Ship weaponry. 3. Identify, visually, a ship's array of antennae and communication components. 4. Describe the importance of command and control warfare. 5. Analyze the

moral and ethical responsibilities of leaders and their use of firepower. Credits: 3.00

NS 21300 - Sea Power And Maritime Affairs

Credit Hours: 3.00. This course is a study of the U.S. Navy and sea power's influence on history and the political process. Students will explore the major events, attitudes, personalities, and circumstances that have imbued the U.S. Navy with its proud history and rich tradition. It deals with issues of national imperatives in peacetime, as well as war, varying maritime philosophies that were interpreted into naval strategies/doctrines, budgetary concerns that shaped force realities, and the pursuit of American diplomatic objectives. It concludes with a discussion of the Navy's strategic and structural changes at the end of the Cold War and its new focus, mission, and strategy in the post-September 11, 2001 world.

Learning Outcomes: 1. Describe the impact and significance of geography and Sea Lines of Communication on maritime strategy and naval operations. 2. State the mission and basic organization of the Navy and Marine Corps. 3. Describe the current organization of the Department of the Navy. 4. Describe significant events in U.S. naval history. 5. Describe the evolution of the Navy and Marine Corps including the origins. 6. Describe the importance of power projection by seaborne forces and cite historical examples. 7. Describe the significant historical developments of naval weapons systems, platforms, tactics, techniques, and procedures. Credits: 3.00

NS 21400 - Naval Leadership And Management

Credit Hours: 3.00. Introduces the student to many of the fundamental concepts of leading Sailors and Marines, which shall be expanded upon during the continuum of leadership development throughout NROTC. It develops the elements of leadership vital to the effectiveness of Navy/Marine Corps officers by reviewing the theories and parameters of leadership and management within and outside of the Naval Service and progressing through values development, interpersonal skills, management skills, and application theory. Practical applications are explored through the use of experiential exercises, readings, case studies, and laboratory discussions.

Learning Outcomes: 1. Explain the differences between management and leadership. 2. Describe sources of leader power and related influence tactics. 3. Describe the interaction between the leader, the followers, and the situation. 4. Describe the building blocks of leadership skills and how they impact a leader's effectiveness. 5. Perform a leadership personality analysis and interpret its results. 6. Describe rational and emotional approaches to organizational changes. 7. Apply leadership concepts to a written analysis of a real-world leader. Credits: 3.00

NS 31000 - Naval Navigation

Credit Hours: 3.00. This course is an in-depth study of the theory, principles, procedures, and application of plotting, piloting, and electronic navigation, as well as an introduction to maneuvering boards. Students learn piloting techniques, the use of charts, the use of visual and electronic aids, and the theory of operation of both magnetic and gyrocompasses. Students develop practical skills in plotting and electronic navigation. Other topics include tides, currents, effects of wind/weather, voyage planning, and an application and introduction to the international/inland rules of navigation.

Learning Outcomes: 1. Explain the theory and practice of navigation at sea. 2. Describe the environmental weather factors affecting naval operations. 3. Describe the sources of environmental products/predictions, forecasts available to naval units underway. 4. Demonstrate relative motion and the capability to solve problems associated with relative motion using maneuvering boards. 5. Demonstrate proper use of the Rules of the Road preventing collisions at sea. Credits: 3.00

NS 31100 - Naval Operations And Seamanship

Credit Hours: 3.00. This course is a continued study of relative motion, formation tactics, and ship employment. It includes introductions to naval operations and operations analysis, ship behavior and characteristics in maneuvering, applied aspects of ship handling, afloat communications, naval command and control, naval warfare areas, and joint warfare.

Learning Outcomes: 1. Explain the theory of relative motion as it applies to vessels at sea. 2. Describe the fundamentals of the U.S. Navy's systems of communications used on sea-going vessels. 3. Demonstrate proper use of the Rules of the Road preventing collisions at sea. 4. Discuss the many issues relating to ship handling and Naval Officers' responsibility. 5.

Demonstrate relative motion and the capability to solve problems associated with relative motion using maneuvering boards. 6. Perform the proper use of Standard Commands during Conning Officer Virtual Environment (COVE) lab. 7. Explain the doctrines of Naval Warfare, Command and Control, and Joint Operations. Credits: 3.00

NS 33000 - Evolution Of Warfare

Credit Hours: 3.00. The purpose of Evolution of Warfare is to imbue students with an understanding of the origins of modern warfighting theory through an analysis of historical philosophies, domains, tactics and technology. Through a study of military history, students explore the timeless fundamentals of armed conflict as well as the central role of innovation. They will apply these fundamental warfighting concepts to historic amphibious and expeditionary operations through guided analysis and decision games.

Learning Outcomes: 1. State the major cultural, technological, organizational, and doctrinal transformations in warfare. 2. State the operational history of amphibious and expeditionary warfare. 3. Recite the warrior ethos. 4. Describe the relationship between the tactical, operational, and strategic level of warfare. 5. Describe the origins of current USMC and Joint doctrine, especially MCDP 1 and MCDP 1-0. 6. Apply symmetric and asymmetric principles across all warfighting domains. 7. Apply knowledge from historical conflicts to modern and future challenges. 8. Demonstrate fundamental writing and speaking skills required of a marine officer. 9. Demonstrate a tactical mindset and effective decision-making. Credits: 3.00

NS 35000 - Naval Ship Systems-Engineering

Credit Hours: 3.00. In this course, students learn detailed ship design, hydrodynamic forces, stability, propulsion, electrical theory and distribution, hydraulic theory and ship control, and damage control. The course includes basic concepts of theory/design of steam, gas turbine, diesel, and nuclear propulsion.

Learning Outcomes: 1. Explain the first and second laws of thermodynamics and how they apply to naval ship systems. 2. Understand the difference between thermal and mechanical energy and how to transfer between the two to produce propulsion. 3. Explain how energy is stored onboard US naval vessels and the ways that stored energy is converted into propulsion. 4. Describe each step of a thermodynamic cycle and be able to apply them to various heat engines. 5. Draw the steam cycle on a temperature/entropy graph and describe each process. 6. Describe the role of various auxiliary equipment in a propulsion plant. 7. Describe the basic damage control process and the initial ship-wide response to fire and flooding. Credits: 3.00

NS 41300 - Naval Leadership And Ethics

Credit Hours: 3.00. This course completes the final preparations of ensigns and second lieutenants for service in the Navy and Marine Corps. The course integrates an intellectual exploration of Western moral traditions and ethical philosophy with a variety of topics, such as military leadership, core values, professional ethics, the UCMJ and Navy regulations, and discussions relating to the roles of enlisted members, junior and senior officers, command relationships, and the conduct of warfare. The course provides midshipmen with a foundation of moral traditions, combined with a discussion of actual current and historical events in the Navy and Marine Corps, to prepare them for the roles and responsibilities of leadership in the Naval Service of the 21st century. Permission of instructor required.

Learning Outcomes: 1. Explain the role of commissioned officers as members of the U.S. Armed Forces and the obligations and responsibilities assumed by taking the oath of office, including the constitutional requirement for civilian control. 2. Explain the naval officer's roles and responsibilities as a member of the profession of arms. 3. Explain the significance of special trust and confidence vested in commissioned officers. 4. Explain the Uniform Code of Military Justice (UCMJ), the practice of military law, and the applications of regulations as they may involve a junior officer in the performance of duties. 5. Explain the purpose, scope, and constitutional basis of Navy regulations and the UCMJ, relating them to

personal conduct in the military service. 6. Explain the professional, moral, and ethical responsibilities of the naval officer. 7. Explain the relationship of integrity, moral courage, and ethical behavior to authority, responsibility, and accountability. 8. Demonstrate, by personal example, the professional attributes and behaviors of a naval officer. 9. Describe how leadership by example influences an officer's ability to effectively lead in an organization. Credits: 3.00

NS 44000 - Fundamentals Of Maneuver Warfare

Credit Hours: 3.00. The purpose of this course is to introduce the student to the foundational concepts and history of the USMC as the premier maneuver warfighting organization. It is a theoretical class that utilizes both historical examples from previous military operations as well as current doctrine, developing an individual who is both a critical thinker and scholar in the profession of arms. The goal is to educate the student to read military history analytically.

Learning Outcomes: 1. Describe the role of the United States Marine Corps as a premier amphibious warfare fighting institution. 2. Describe specific successful amphibious-based maneuver warfare operations throughout Marine Corps history. 3. Describe how amphibious warfare ties into general warfare, serving as a subset of total warfare. 4. Perform an analysis of historical influences upon current tactical, operational and strategic implications of maneuver warfare practices used in current and future operations. 5. Recite a basic understanding of Marine Corps doctrine that facilitates successful sea-based operations, requiring ship-to-shore movements. Credits: 3.00

Nuclear Engineering

NUCL 11000 - Introduction To Energy Engineering

Credit Hours: 1.00. This course, designed for first-semester freshmen, reviews and discusses the history of energy use by the world, the relation between energy usage and quality of life, the social impact of energy use, and the environmental constraints on energy usage. In particular, the role that engineering disciplines play in solving energy problems will be discussed. The full impact that the various energy alternatives have on economic and environmental issues will be reviewed in order to provide a rational basis for energy choices for the future.

Credits: 1.00

NUCL 12000 - Freshman Research Project

Credit Hours: 1.00. In this course, the student performs a small independent project in nuclear engineering under direct faculty supervision.

Credits: 1.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications.

Credits: 3.00

NUCL 20500 - Nuclear Engineering Undergraduate Laboratory I

Credit Hours: 2.00. A laboratory course designed for the study of the properties of radiation, radioactive material, and radiation detectors. The hazards of radiation and safe handling techniques are emphasized.

Credits: 2.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

NUCL 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29800 - Sophomore Seminar

Credit Hours: 0.00. Career areas in nuclear engineering, job opportunities, areas of related study, topics of current interest, orientation, professional ethics, and responsibility.

Credits: 0.00

NUCL 30000 - Nuclear Structure And Radiation Interactions

Credit Hours: 3.00. Review of atomic properties and introduction to nuclear models. Discussion of radioactive decay and the interaction of nuclear radiation and reaction products with matter. Energetics and cross-sections of nuclear reactions with applications to problems typical of nuclear engineering.

Credits: 3.00

NUCL 30500 - Nuclear Engineering Undergraduate Laboratory II

Credit Hours: 2.00. Continuation of NUCL 20500 . Experiments with scintillation detectors, multichannel analyzers, neutron detectors, the subcritical pile, and the reactor will be performed. Measurements will be made to demonstrate neutron activation analysis techniques, neutron slowing down, neutron flux distributions, and the effects of control rods on neutron fluxes.

Credits: 2.00

NUCL 31000 - Introduction To Neutron Physics

Credit Hours: 3.00. Development of diffusion theory for neutrons. Neutron interactions and development of one-group neutron diffusion theory with point, plane, and fission sources. Application to one- and two-region reactors. Introduction to buckling, multiplication constants, critical size, neutron slowing down, and resonance capture. Applications using two-group theory.

Credits: 3.00

NUCL 32000 - Introduction To Materials For Nuclear Applications

Credit Hours: 3.00. Nuclear environments and materials selection for nuclear applications, bonding, crystal structure and symmetry, defects and irradiation, chemical thermodynamics, phase equilibria, phase transformations, and corrosion in nuclear systems and design.

Credits: 3.00

NUCL 32500 - Nuclear Materials Laboratory

Credit Hours: 3.00. Nuclear materials laboratory that evaluates various characterization techniques and technologies, tensile properties, hardness, fracture toughness, microstructures, X-ray diffraction, electron microscopy, mechanical properties of thin-films, NDE techniques and data acquisition in materials characterization techniques.

Learning Outcomes: 1. Understanding of what materials are, and how they perform and fail. 2. Understand the conceptual tools dealing with materials phenomena. 3. Be able to communicate with professionals about materials problems. 4. Be able to address the limitations of materials in design, and improve them.

Credits: 3.00

NUCL 35000 - Nuclear Thermal-Hydraulics I

Credit Hours: 3.00. The first of an integrated two-course sequence introducing the concepts of nuclear reactor thermal transport and associated hydraulics with applications to design and safety. Macroscopic balances, dimensional analysis, and flow measurement. Fluid behavior, momentum transfer, and applications to reactor systems and design.

Credits: 3.00

NUCL 35100 - Nuclear Thermal-Hydraulics II

Credit Hours: 3.00. Emphasis is given to the fluid transport of heat from reactor fuel elements. Heat transfer in fluids, analogies, and applications to reactor coolant channel analysis. Two-phase flow and convective boiling. Radiative heat transfer. Applications to safety analysis and reactor design.

Credits: 3.00

NUCL 35500 - Nuclear Thermohydraulics Laboratory

Credit Hours: 3.00. Laboratory course corresponding to NUCL 35000 and NUCL 35100 . Various fluid flow and heat transfer phenomena applied to nuclear reactor systems and design.

Credits: 3.00

NUCL 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

NUCL 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

NUCL 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

NUCL 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

NUCL 39800 - Junior Seminar

Credit Hours: 0.00. Continuation of NUCL 29800 .

Credits: 0.00

NUCL 40200 - Engineering Of Nuclear Power Systems

Credit Hours: 3.00. Principles and practice of power plant systems with design applications; thermal cycles, heat transport, mechanical designs, control, safety analysis, shielding analysis, fuel cycles; resources, optimization, options, waste management. Fusion and alternate energy sources.

Credits: 3.00

NUCL 41000 - Introduction To Reactor Theory And Applications

Credit Hours: 3.00. Intermediate treatment of reactor theory and its relevance to routine design engineering calculations, including introduction to transport theory, criticality evaluation, multi-group theory, isotopic depletion, and concludes with short overview of multi-level reactor design calculations, critical experiments, and treatment of neutronic uncertainties. List of Topics: Derivation of Boltzmann transport equation, and its reduction to steady state and time dependent diffusion equation. Introduction to multi-group theory, and evaluation of group

parameters in both wide and narrow resonance approximations. Introduction to homogenization theory, and evaluation of lattice parameters. Evaluation of criticality condition for bare and reflected reactor geometries. Development of discretization techniques for the time-dependent multi-group diffusion theory equation. Reactor kinetics, reactivity coefficients and reactivity balance equation. Flowchart of multi-level reactor design calculations. Introduction to critical experiments and startup reactor physics test. Sources and treatment of uncertainties in reactor calculations.

Learning Outcomes: 1. Develop an understanding of reactor physics value for engineering design calculations, and to learn how it is applied to make engineering design decision regarding material choice, composition, type, and operating conditions to sustain and control chain reactor over reactor operating horizon. 2. Learn how to develop a computer code to solve a reactor physics problem.

Credits: 3.00

NUCL 42001 - Radiation Interaction With Materials And Applications

Credit Hours: 3.00. Fundamental of radiation interaction with materials and applications, types of radiation and radiation sources, physical mechanisms of radiation interaction with solids, radiation damage, ion mixing, applications in nuclear fission and fusion reactors, applications in materials synthesis.

Learning Outcomes: 1. Learn the types and sources of radiation. 2. Understand the physical mechanisms of radiation interaction with materials and model these interactions quantitatively. 3. Understand and model the phenomenon of radiation damage to bulk, surfaces and interfaces. 4. Relate the concepts of radiation damage to neutron interaction with solids in both fission and fusion reactors. 5. Understand the technological applications of radiation interaction with materials. Credits: 3.00

NUCL 44900 - Senior Design Proposal

Credit Hours: 1.00. The course outcome is the writing and presentation of a proposal for the senior design project, NUCL 45000 . The tasks include the selection of project design topics (various nuclear engineering components and systems designs), the selection of teams, introduction to design process, team management, communication, and engineering ethics, literature and patents survey, initiation of design activities and familiarization with design tools (for example software).

Credits: 1.00

NUCL 45000 - Design In Nuclear Engineering

Credit Hours: 3.00. Application of the design process to the project design topics identified in NUCL 44900 . The design process usually includes, but not limited to, mathematical modeling in design, neutronic, thermal-hydraulics and safety studies, risk assessment, economics, policy and regulation, environmental impact.

Credits: 3.00

NUCL 46000 - Introduction To Controlled Thermonuclear Fusion

Credit Hours: 3.00. Energy resources and the potential role of nuclear fusion. Ignition and breakeven conditions for fusion power plants. Particle and energy confinement in linear and toroidal magnetic fields. Review of magnetic and inertial confinement experiments and conceptual reactor configurations.

Credits: 3.00

NUCL 47000 - Fuel Cell Engineering

Credit Hours: 3.00. The principles of electromechanical energy conversion for a single fuel cell, fuel cell stack, process engineering in the fuel and oxidizer supply systems. Principles, components, operation and performance for alkaline, phosphoric acid, solid polymer, molten carbonate and solid oxide fuel cells. Provides broad insight into science, technology, system design, and safety concerns in design and operation of fuel cells.

Credits: 3.00

NUCL 48000 - Nuclear Engineering Technical Communications

Credit Hours: 3.00. This course makes students aware of the importance of communication skills-written, oral, graphical and interpersonal-in a successful nuclear engineering career and gives them the opportunity to develop and practice those skills. Students will learn how to access, evaluate, use and synthesize relevant technical literature. In addition, through the writing and speaking assignments, students develop team work skills, gain an understanding of professional and ethical responsibilities of engineering, learn to write a simple propose and learn about selected contemporary global economic, social and political issues, particularly with respect to nuclear topics.

Learning Outcomes: 1. Ability to communicate effectively. 2. The ability to understand the impact of engineering solutions in a global and societal context. 3. A knowledge of contemporary issues, particularly with respect to nuclear topics. 4. An understanding of professional and ethical responsibility. Credits: 3.00

NUCL 49000 - Independent Study In Nuclear

Engineering

Credit Hours: 1.00 to 6.00. Projects or research of contemporary importance or special interest. Interested students seek a faculty advisor in their area of special interest and together prepare a brief description of the work to be undertaken. May be taken for 1-6 credits in Fall, Spring, or Summer. May be repeated as many times as desired, but only 6 credits may be counted for the technical elective requirement. Permission of instructor required.

Learning Outcomes: 1. Learning objectives vary based on varying coursework. Credits: 1.00 to 6.00

NUCL 49700 - Selected Topics In Nuclear Engineering

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Learning Outcomes: 1. Learning objectives will vary with coursework. Credits: 1.00 to 3.00

NUCL 49800 - Senior Seminar

Credit Hours: 0.00. Lectures to acquaint the senior students with professional ethics, job opportunities, graduate schools, continuing study, and services of professional societies.

Credits: 0.00

NUCL 50100 - Nuclear Engineering Principles

Credit Hours: 3.00. A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science or engineering. The course is structured in four parts: (1) Nuclear structure and radiation, biological effects and medical applications of radiation. (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality. (3) Nuclear materials and waste. (4) Reactor systems and safety.

Credits: 3.00

NUCL 50200 - Nuclear Engineering Systems

Credit Hours: 3.00. Engineering aspects of nuclear power. Materials of construction; fuel and fuel cycles; heat removal; radiation shielding; economics; and nuclear power systems. Permission of instructor required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to solve typical nuclear reactor calculations. 3. Develop a quantitative foundation of nuclear reactor safety, radiation protection and shielding. 4. Apply knowledge of mathematics and physics to the design of nuclear power reactor systems. 5. Able to design a reactor system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 6. Model engineering issues in nuclear reactor safety, radiation protection and shielding quantitatively and draw appropriate inferences. 7. Able to use the techniques, skills, and modern engineering tools necessary for nuclear reactor systems through a project. Credits: 3.00

NUCL 50300 - Radioactive Waste Management

Credit Hours: 3.00. Will familiarize students with the nature of the risks associated with radioactive waste and the history, regulations, and worldwide status for the safe storage of various types of radioactive waste. The sources, characteristics, and magnitudes of radioactive wastes are described, and the current and proposed engineered waste management systems are examined along with the analysis of their associated risks.

Credits: 3.00

NUCL 50400 - Nuclear Engineering Experiments

Credit Hours: 3.00. A laboratory course that, when coupled with NUCL 50100 , produces a sequence that contains both the theoretical and engineering aspects of nuclear engineering. Topics include radiation detection and analysis, neutronics, and nuclear reactor experiments.

Credits: 3.00

NUCL 51000 - Nuclear Reactor Theory I

Credit Hours: 3.00. Methodologies of neutron flux calculations, diffusion and slowing down theory, flux separation, material buckling, resonance absorption, Doppler effect, 2-group and multi-group theories, and reactivity balances for design and operation. Introduction to reactor kinetics, delayed neutrons, point reactor kinetics, transient behavior, load changes, reactivity feedback, and safety implications.

Credits: 3.00

NUCL 51100 - Reactor Theory And Kinetics

Credit Hours: 3.00. Advanced methodologies for neutron flux calculation, nodal methods, introduction to transport theory, transport correction, multigroup theory, and introduction to the generation of group constants. Reactor kinetics, perturbation theory, adjoint fluxes, reactivity calculation from perturbation theory, reactivity coefficients due to Doppler effect, temperature and density changes, void coefficient, and energy and power coefficients. Microkinetics, theory of reactivity measurements, approximate methods: prompt jump approximation, and prompt kinetics. Transients with feedback, safety implications, and spatial kinetics.

Credits: 3.00

NUCL 51200 - Computers In Reactor Analysis

Credit Hours: 3.00. The application of computational methods in reactor systems analysis. Theory behind modern numerical methods (e.g. SOR, Conugate Gradient, etc.) for solving large,

sparse systems on linear equations that result from the discretization of elliptical and parabolic partial differential equations. Applications include the multigroup, multi-dimensional neutron transport equation and two-phase flow fluid dynamics. Extensive use of MATLAB, FORTRAN, and UNIX(tm). No written exams, and the majority of problem sets are performed as group projects. Knowledge of FORTRAN required.

Credits: 3.00

NUCL 52000 - Radiation Effects And Reactor Materials

Credit Hours: 3.00. Introduction to radiation effects in solids and a survey of nuclear reactor materials. Radiation interaction mechanisms and effects on properties. Reactor material characteristics, selection criteria, testing, and economic considerations.

Credits: 3.00

NUCL 55100 - Mass, Momentum, And Energy Transfer In Energy Systems

Credit Hours: 3.00. Formulations for analyzing complicated thermal-hydraulic phenomena in energy systems. Derivation of two-phase flow field equations and constitutive relations. Thermal-hydraulic modeling of nuclear reactor systems. Analyses of nuclear reactor safety related phenomena based on conservation principles.

Credits: 3.00

NUCL 55200 - Thermal-Hydraulics And Reactor Safety

Credit Hours: 3.00. Applications of thermal-sciences to nuclear reactor safety design and risk assessment. Emphasis on illustrating the use of basic principles in quantitative safety assessments of practical and current interest. The basic topics revolve around multiphase transients and applications which include study of accident analysis and its applications to licensing for light water reactor systems and for liquid metal fast breeder reactor.

Credits: 3.00

NUCL 55300 - Nano-Macro Scale Applications Of Nuclear Technology

Credit Hours: 3.00. Introduction of the principles of nuclear science and engineering for addressing industrial and scientific issues ranging from sub-nano-to-macro scales. Areas to be covered include: propulsion, high-energy density materials, supercooling, medical applications, sonoluminescence, novel detection systems for special nuclear and contraband materials, and advanced nuclear fusion power systems.

Credits: 3.00

NUCL 55500 - Thermal Hydraulics Measurement And Instrumentation

Credit Hours: 3.00. Measurement techniques in fluid flow, heat transfer, and multi-phase flow. The principle and practice of measurement of temperature, flow, level, pressure, and void fraction (in two-phase flow systems) as applied to nuclear reactor systems. Instrument error and measurement errors, and data acquisition system using PC. Hands-on experience in the laboratory with instruments.

Learning Outcomes: 1. Demonstrate an understanding of the principles of instruments. 2. Demonstrate an ability to design an application of the instrument in fluid system. 3. Understand design concepts, design evaluation and application of a measurement system to practical systems. Credits: 3.00

NUCL 56000 - Introduction To Fusion Technology

Credit Hours: 3.00. Introduction to electricity and magnetism, magneto-fluid-mechanics and plasma physics. Thermonuclear reactions, power balances, macroscopic and microscopic instabilities. Principles of operation and conceptual design of Tokamaks, Mirror, Theta-Pinch, and Laser-Driven fusion reactors.

Credits: 3.00

NUCL 56300 - Direct Energy Conversion

Credit Hours: 3.00. Review of energy sources and study of the basic processes of direct energy conversion and their applications to energy utilization, based on both conventional and nuclear energy conversion schemes. Conventional schemes include thermoelectric, photovoltaic, thermionic, magnetohydrodynamic generators, fuel cell systems, etc.; and nuclear energy conversion schemes correspond to nuclear radiation and fusion energy conversion. Permission of instructor required.

Credits: 3.00

NUCL 57000 - Fuzzy Approaches In Engineering

Credit Hours: 3.00. Presentation of the mathematical fundamentals of fuzzy logic theory and a survey of engineering applications. Fuzzy sets; the extension principle; fuzzy numbers; fuzzy relations and composition; linguistic descriptions; implication operators and fuzzy algorithms are formally developed. Applications emphasize the engineering utilization of approximate reasoning to diagnostics, control, safety, and decision-making problems.

Credits: 3.00

NUCL 57500 - Neural Computing In Engineering

Credit Hours: 3.00. Mathematical fundamentals of computing with neural networks. Survey of engineering applications. Computational metaphors from biological neurons. Artificial neural networks modeling of complex, nonlinear and ill-posed problems. Emphasizes engineering utilization of neural computing to diagnostics, control, safety, and decision-making problems.

Credits: 3.00

NUCL 58001 - Essential Communication Skills For Nuclear Engineering

Credit Hours: 3.00. Essential communications skills for engineers with emphasis on communicating subject matter specific to the nuclear engineering field. Includes instruction, practice, and detailed feedback on written, oral, and graphical communications. Students learn to access, evaluate, and synthesize technical literature and practice skills necessary to prepare a literature review. Ethics and professional responsibilities, along with contemporary global economic, social and political issues are among the topics discussed. The only prerequisite is admission to the graduate program in Nuclear Engineering.

Learning Outcomes: 1. Understand importance of developing strong communications skills. 2. Know and routinely practice effective written, oral and graphical communication skills. 3. Access, use and synthesize relevant technical literature. 4. Work effectively in a team. 5. Understand professional and ethical responsibilities. 6. Be aware of contemporary global economic, social, and political issues. Credits: 3.00

NUCL 59000 - Independent Study In Nuclear Engineering I

Credit Hours: 1.00 to 6.00. Independent study projects. Interested students seek a faculty instructor in their area of special interest and prepare a brief description of the independent project to be undertaken. May be taken for 1-6 credits in Fall, Spring, or Summer. May be repeated as many times as desired, but only a maximum of 6 credits may be counted for the degree program requirement. Permission of instructor required.

Learning Outcomes: 1. Vary due to coursework. Credits: 1.00 to 6.00

NUCL 59700 - Selected Topics In Nuclear Engineering I

Credit Hours: 1.00 to 3.00. Development of individual research and study projects. Permission of instructor required.

Learning Outcomes: 1. Vary with coursework. Credits: 1.00 to 3.00

NUCL 61000 - Nuclear Reactor Theory II

Credit Hours: 3.00. This course covers advanced reactor physics topics including the neutron transport theory, slowing down and resonance escape, and generalized perturbation theory. The neutron transport theory is the fundamental theory describing the neutron flux behaviors in nuclear systems. The slowing down and resonance escape calculations are essential for generating the multi-group cross sections required in the whole-core neutron transport calculations. The generalized perturbation theory is a powerful method for determining the changes in response parameters due to the variations in nuclide densities and microscopic cross sections. Prerequisites: NUCL 51000 and advanced engineering mathematics covering complex analysis, partial differential equations, and integral equations.

Learning Outcomes: 1. Demonstrate knowledge on advanced reactor physics topics (neutron transport theory, slowing down and resonance escape, and generalized perturbation). 2. Use computational methods to determine information regarding the aforementioned reactor physics topics. Credits: 3.00

NUCL 61200 - Applied Reactor Analysis

Credit Hours: 3.00. Reactor physics analysis of existing reactors and critical experiments through the use of digital computers and reactor programs. One-, two-, and three-dimensional solutions of the diffusion and transport equations. Calculation methods for lifetime effects on excess reactivity, power distribution, breeding ratio, and temperature, void, and Doppler coefficients of reactivity. Fuel shuffling and safety calculations for fuel handling and storage. Concurrent Prerequisite: NUCL 61000 .

Credits: 3.00

NUCL 62000 - Advanced Topics In Radiation Damage

Credit Hours: 3.00. Materials phenomena unique to nuclear reactor environments are examined quantitatively. The relation between these phenomena and the structure and properties of engineering materials is discussed. Coupled phenomena are considered in relation to materials modeling codes. Prerequisite: NUCL 42000 and NUCL 52000 (or other related/similar courses).

Learning Outcomes: 1. Learn performance of nuclear materials in reactor environments. 2. Learn the effects of various radiations on materials damage and lifetime. 3. Learn methods and techniques to extend the lifetime, safety, and reliability of reactor components. Credits: 3.00

NUCL 64000 - Fast Reactor Theory

Credit Hours: 3.00. Course is designed to teach reactor physics specific to fast spectrum reactors and the associated computational methods. Topics include breeding and actinide burning capabilities, core design implications, and reactivity feedback mechanisms. Computational methods will be specific to fast reactor physics analysis and include the fast neutron

spectrum calculation, group constant generation and reactivity feedback calculations for Doppler, thermal expansions, and sodium void. Prerequisites: NUCL 51100 and advanced engineering mathematics covering complex analysis, partial differential equations, and integral equations.

Learning Outcomes: 1. Demonstrate essential knowledge of fast reactor theory. 2. Demonstrate working knowledge of the associated computational methods and codes. Credits: 3.00

NUCL 65000 - Thermal Hydraulics For Nuclear Reactor Safety

Credit Hours: 3.00. Safety philosophy, levels and goals of safety. Approaches used for nuclear reactor safety for the protection of public health. Design basis accidents. Engineered safeguards and inherent safety features. Fundamentals of safety related thermal-hydraulic phenomena and their integration into a methodology for containment assessment. Prerequisite: ME 50500 .

Credits: 3.00

NUCL 65100 - Dynamics Of Nuclear Thermal-Hydraulics System

Credit Hours: 3.00. This course discusses and analyzes various two-phase flow instabilities important for nuclear reactor systems. For the interfacial stabilities, Kelvin-Helmholtz and Rayleigh-Taylor instabilities as well as flooding and flow reversal instabilities are addressed. For the static instabilities, flow excursion instability that can reach the critical heat flux condition is analyzed relative to fast reactor and high flux research reactors. For the dynamic instabilities the density wave instabilities are discussed in detail. The characteristic equation is obtained and how to determine the stability of the system is discussed. Both the encirclement theory and the D-Partition stability boundary theory are explained. In addition, each student's research is studied through presentations, questions and discussions. Permission of instructor required. Prerequisites: NUCL 55100 and NUCL 55200.

Learning Outcomes: 1. Understand the Physics and Analytical Method to Solve Interfacial Instabilities in Two-phase Flow, Static Instabilities, Flow Excursion and Flow Reversal Dynamic Instability caused by Kinematic Waves. 2. Understand the implications in Interfacial Structures in Coolant in Nuclear Reactors, Sodium Cooled Fast Reactor, Safety High Flux Research Reactor and Isotope Production Reactors, Boiling Water Reactor Designs, and Natural Circulation Passively Safe Reactors. 3. Learn about Small Perturbation Method, Characteristic Equation, Response Function, Encirclement Theory, D-Partition Method and Stability Map. 4. Learn how to present research progress and analyze and discuss it. Credits: 3.00

NUCL 65500 - Two-Phase Flow Computational Fluid Dynamics Applications

Credit Hours: 3.00. The course guides the student to two-fluid model solutions using computational fluid dynamics (CFD). Topics include: review of the two-fluid model, review of elliptic and parabolic partial differential equations, description of numerical algorithms, and two-phase flow channel and jet flows. Prerequisite: NUCL 56000 .

Learning Outcomes: 1. Understand basic principles of hyperbolic and parabolic partial differential equations applied to the equations of fluid dynamics. 2. Use finite differences to solve partial differential equations of fluid dynamics. 3. Apply principles in 1 and 2 to simulations with Navier Stokes and Two Fluid Model Equations. 4. Employ stability theory to analyze the Two Fluid Model. Credits: 3.00

NUCL 66000 - Magnetic Confinement Fusion

Credit Hours: 3.00. Applications of plasma physics for analysis and design of plasma configurations in fusion reactors. Topics include beam-driven fusion systems, plasma heating and ignition via neutral beams and RF wave heating, plasma waves, kinetic and fluid descriptions of plasmas, and energy transport; blanket neutronics for tritium breeding, energy conversion, and reactor design considerations. Prerequisite: NUCL 56000 .

Credits: 3.00

NUCL 66100 - Inertial Confinement Fusion Technology

Credit Hours: 3.00. Inertially confined thermonuclear fusion reactions and energy gains; laser-plasma interactions; hydrodynamic compression; energy transports including electron thermal conduction and radiation transport; beam transport and instabilities; driver energy deposition and the driver development for lasers, particle beams and accelerators; and target designs. Approval of Instructor required. Prerequisite: NUCL 56000 or equivalent.

Learning Outcomes: 1. Understand the physics of inertial confinement fusion. 2. Explore the engineering issues associated with the concepts and applications of beam drivers, targets, and chambers leading to target ignition

and energy conversions. Credits: 3.00

NUCL 69000 - Independent Study In Nuclear Engineering II

Credit Hours: 1.00 to 6.00. Independent research projects. Interested students seek a faculty instructor in their area of special interest and prepare a brief description of the independent project to be undertaken. May be taken for 1-6 credits in Fall, Spring, or Summer. May be repeated as many times as desired, but only maximum of 6 credits may be counted for the degree program requirement. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes will vary based on coursework. Credits: 1.00 to 6.00

NUCL 69600 - Nuclear Engineering Seminar

Credit Hours: 0.00. Discussion by graduate students and invited speakers of their research projects and topics of interest in nuclear engineering. Prerequisite: Master's student standing and Nuclear Engineering majors only.

Credits: 0.00

NUCL 69700 - Selected Topics In Nuclear Engineering II

Credit Hours: 1.00 to 3.00. Courses on topics of contemporary importance or special interest in nuclear engineering. Hours and credits to be arranged. Permission of instructor required.

Learning Outcomes: 1. Vary based on coursework. Credits: 1.00 to 3.00

NUCL 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

NUCL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Nuclear Pharmacy

NUPH 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Credits: 1.00 to 3.00

NUPH 49100 - Introduction To Nuclear Pharmacy

Credit Hours: 1.00. This course will serve as an introduction to nuclear pharmacy practice and serve as the first course in the nuclear pharmacy elective series. Successful completion of the nuclear pharmacy series can be used to meet the 200 hour didactic training requirement set forth by the Nuclear Regulatory Commission (NRC) towards achieving Authorized User status. This course will provide basic information about the profession of nuclear pharmacy, as well as an introduction to radioactive material and radiation safety concepts. The course will conclude with guest lectures from practitioners in several different areas of nuclear pharmacy practice to provide information about the different areas of practice available to nuclear pharmacists.

Learning Outcomes: 1. Describe nuclear pharmacy and nuclear medicine and the role of these areas of practice. 2. Review the history of nuclear pharmacy practice. 3. Understand concepts relating to the medical use of ionizing radiation. 4. Identify methods used to monitor and minimize radiation exposure. 5. Recognize basic principles of radiation biology and how radiation interacts with humans. 6. Understand the role of radiation monitoring in nuclear pharmacy practice. 7. Review basic regulatory oversight for nuclear pharmacy and PET pharmacy practice. 8. Describe the role of nuclear pharmacists in various practice settings. Credits: 1.00

NUPH 49200 - Basics Of Nuclear Pharmacy Practice

Credit Hours: 1.00. This course emphasizes some of the daily tasks performed by nuclear pharmacists when working in the nuclear pharmacy.

Learning Outcomes: 1. Understand the fundamentals of radiation and radiation safety. 2. Know the principles of instrumentation used in nuclear pharmacy and understand the use of these instruments as related to daily practice. 3. Understand the theoretical foundations of the profession of nuclear pharmacy. 4. Meld theory and abilities in the practice setting. 5. Develop a basic knowledge base to enable a student to practice the profession (ex. summer internships). Credits: 1.00

NUPH 49300 - Regulatory Considerations For Nuclear Pharmacy Practice

Credit Hours: 2.00. This is the second course in the nuclear pharmacy series, with an emphasis on the regulatory oversight of nuclear pharmacy practice. While the previous course dealt with radiation safety issues, this course outlines how these safety skills relate to the regulatory requirements set forth by the various regulatory agencies.

Learning Outcomes: 1. Provide a basic overview of the various regulatory agencies that oversee nuclear pharmacy practice. 2. Relate practical radiation safety skills and tasks to their regulatory requirements. 3. Utilize clinical reasoning skills to address practical related problems. Credits: 2.00

NUPH 49400 - Clinical Aspects Of Nuclear Pharmacy Practice

Credit Hours: 2.00. This course will be offered as a lecture course with some interactive discussion and problem solving applications. In addition, students will be required to complete several distance learning activities that relate to/enhance the materials that will be covered in the lecture period. This course is the final course in the NUPH series that can be used to count toward the 200 hours of didactic training required for Authorized Nuclear pharmacist (ANP) status.

Learning Outcomes: 1. Understand the principles of drug design, radiopharmaceutical chemistry, product compounding and clinical applications as they apply to the currently available radiopharmaceutical products. 2. Understand the differences between SPECT and PET radiopharmaceuticals. 3. Understand the role of nuclear medicine procedures in the diagnostic and therapeutic workup of patients with certain clinical conditions. Credits: 2.00

NUPH 49500 - Applied Nuclear Pharmacy

Credit Hours: 2.00. This is an elective course that consists of lecture, laboratory, and distance education components which will count as part of the 200 hours of didactic training required for Authorized Nuclear Pharmacist (ANP) status. This course focuses on the preparation, dispensing and clinical applications of radiopharmaceutical products.

Learning Outcomes: 1. Understand the preparation of a variety of radiopharmaceutical products. 2. Enhance skills in kit selection, product specific compounding requirements, radiochemical purity testing and dispensing of final doses for patient use. 3. Utilize practical pharmaceutical compounding skills including sterile product preparation guidelines as they apply to radiopharmaceutical preparation. 4. Identify clinical applications of products being prepared in the nuclear pharmacy laboratory. 5. Identify and problem solve clinical issues related to various radiopharmaceuticals. Credits: 2.00

NUPH 49600 - Case Studies In Clinical Nuclear Medicine

Credit Hours: 1.00 or 2.00. Introduction to the clinical applications of radiopharmaceutical drug products and the associated practice of nuclear medicine, through analysis of a series of current clinical case studies. Factors examined include: patient medical history, with emphasis on recent diagnostic procedures and pharmacotherapy; radiopharmaceutical selection, dosage, and preparation; possible contraindications for the nuclear medicine procedure and associated interventional agents; diagnostic findings; and the impact of study outcome on subsequent patient treatment. Permission of instructor required.

Credits: 1.00 or 2.00

NUPH 69000 - Special Problems

Credit Hours: 0.00 to 18.00. Individual investigations in the applications of radionuclides to research and nuclear pharmacy. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

NUPH 69600 - Seminar In Nuclear Pharmacy

Credit Hours: 0.00 or 1.00. Selected topics in nuclear pharmacy, radiopharmaceutical chemistry, health physics, and radiation biology, presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Nursing

NUR 10800 - Introduction To Nursing

Credit Hours: 1.00. Introduce students entering the nursing profession to foundations of the baccalaureate nursing curriculum, including concepts, competencies, mandatory requirements and responsibilities within the profession. Students are introduced to the rigor of the curriculum and begin to build a sense of community within the Purdue School of Nursing.

Learning Outcomes: 1. Explain the relationship between the Essentials of Baccalaureate Education for Professional Nursing Practice document and Purdue's baccalaureate nursing curriculum. 2. Describe the roles of the professional nurse in the healthcare delivery system. 3. Describe individuals, families, communities, and populations as consumers of nursing care. 4. Reflect upon personal and professional responsibilities in relation to the

nursing profession. 5. Communicate in oral and written form at a professional level. 6. Identify personal behaviors necessary for success in an academic and professional career. 7. Engage in student and/or nursing organizations as an aspect of professional growth and development. Credits: 1.00

NUR 10900 - Introduction To Nursing II

Credit Hours: 1.00. Using knowledge acquired in NUR 10800 students will examine the profession of nursing and their role and responsibilities within the profession. Topics to be discussed include informatics and technology, the importance of professional communication in oral and written form, the global image of nursing, wellness and self-care, and preparation for progression into the sophomore year. Permission of department required.

Learning Outcomes: 1. Demonstrate the ability to communicate in oral and written form at a professional level. 2. Explore the roles of the professional nurse in both domestic and global healthcare delivery systems. 3. Examine the role of social media and its impact on healthcare. 4. Identify components of effective and ineffective communication in the healthcare environment. 5. Discuss the use of informatics in documenting the management of patient care. 6. Identify skills and personal behaviors necessary for success in an academic and professional career. Credits: 1.00

NUR 21801 - Health Assessment And Essentials Of Nursing Practice I

Credit Hours: 5.00. Focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client centered safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients from the healthy to chronically ill populations. 2. Develop critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 3. Discuss the impact of evidence based nursing research in guiding practice. 4. Identify the effect of personal values and beliefs on professional practice. 5. Develop basic physical and psychosocial clinical assessment skills for the client across the lifespan, including interviewing techniques, and comprehensive history and physical exam. 6. Employ basic principles of documentation to describe clinical findings. 7. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 8. Use informatics appropriately in simulation and in the clinical setting. 9. Identify methods and resources for personal and professional growth. Credits: 5.00

NUR 21901 - Pathopharmacology I

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort and the pharmacotherapies utilized as treatment for alterations and disease states. This introductory knowledge provides the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe primary regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations in body structure and function affecting homeostasis; metabolic processes; immune response; circulation; renal elimination; fluid/electrolyte and acid/base balance; sensory perception and comfort. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and comfort. 4. Idenify major drug classifications and pharmacokinetic processes utilized in the

prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contraindications, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22001 - Essentials Of Nursing Practice II

Credit Hours: 5.00. Continues to expand on the professional nursing role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients in the clinical setting. 2. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 3. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 4. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 5. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 6. Identify client adaption and coping strategies when adjusting to changes along the health-wellness continuum. Credits: 5.00

NUR 22101 - Pathopharmocology II

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function and the pharmacotherapies utilized as treatment for alterations and disease states. This course builds on the learning objectives from Pathopharmacology I to provide the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe the primary regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 4. Identify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contradictions, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into the overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3.

Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

NUR 22301 - Foundations Of Research And Evidence-Based Practice (UCC: IL)

Credit Hours: 3.00. Students gain foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. Students learn the principles of research process and identify strengths and limitations of research articles in relation to EBP in nursing and healthcare.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently to Information Literacy Competency Standards for Higher Education. 3. Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical practice. 5. Examine economic, legal and ethical issues related to conducting research. Credits: 3.00

NUR 22401 - Nursing Practice Foundations I: Health Assessment

Credit Hours: 4.00. Designed for second degree students, this course focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical experience, learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client-centered, safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Develop beginning critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 2. Discuss the impact of evidence based nursing research in guiding practice. 3. Identify the effect of personal values and beliefs on professional practice. 4. Develop basic physical and psychosocial clinical assessment skills for the client across the lifespan including interviewing techniques, and comprehensive history and physical exam. 5. Employ basic principles of documentation to describe clinical findings. 6. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 7. Use informatics appropriately in simulation and in the clinical setting. 8. Identify methods and resources for personal and professional growth. Credits: 4.00

NUR 22501 - Nursing Practice Foundations II: Fundamentals

Credit Hours: 4.00. Designed for second degree students, this course continues to expand on the professional nurse role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients representing healthy to chronically ill populations. 2. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients

in the clinical setting. 3. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 4. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 5. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 6. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 7. Identify client adaptation and coping strategies when adjusting to changes along the health-wellness continuum. Credits: 4.00

NUR 22601 - Topics In Nursing Research And Evidence-Based Practice

Credit Hours: 3.00. Introduces foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. The principles of research process and strengths and limitations of research articles in relation to EBP in nursing and healthcare are identified.

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently according to Information Literacy Competency Standards for Higher Education. 3. Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical research. 5. Examine economic, legal, and ethical issues related to conduction research. 6. Discuss the process of translating research evidence into practice. 7. Demonstrate the characteristics of an innovator that are necessary for EBP, which include leadership, a sense of inquiry, flexibility to change, awareness of self and of the environment, effective communication, critical thinking, lifelong learning, and professionalism. Credits: 3.00

NUR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 31401 - Health Alterations In Adults I

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of well-being as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in tissue integrity related to surgical interventions, cellular division, reproductive function, elimination, nutrition and sensory function that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision-making when caring for diverse populations of adults experiencing selected illnesses. 2. Utilize

the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related (including gerontologic) pathophysiology when providing care to diverse populations of adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence- based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to client, client's family, and other members of the healthcare team. 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes. 10. Utilize patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31501 - Nursing Of Childbearing Families

Credit Hours: 5.00. Promotes the development of nursing skills when caring for families and their newborns during uncomplicated and/or complicated childbearing experiences within a variety of clinical settings. Emphasizes the study and application of the nursing process, integrating evidence based practice while meeting the health and safety needs of diverse childbearing families.

Learning Outcomes: 1. Integrate theory and evidence to guide nursing practice and clinical decision-making throughout the care of childbearing families. 2. Incorporate childbearing family participation throughout health promotion, disease prevention, and risk reduction processes. 3. Address the childbearing family's developmental, physiologic, and psychological needs. 4. Assess ethical, legal, and sociocultural influences on resource utilization and compassionate maternal-child health care delivery. 5. Design targeted plans of care via a partnership with childbearing families, intra- and interprofessional teams, professional organizations, and institutions. 6. Utilize information technology to enhance learning, practice, and communication. Credits: 5.00

NUR 31601 - Integration Seminar I

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and obstetrical diagnoses. Through the course activities the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medical-surgical and obstetrical populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

NUR 31701 - Health Alterations In Adults II

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of wellbeing as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in health related to oxygenation, circulatory dynamics, endocrine regulation, neurological regulation, immune regulation and musculoskeletal dynamics that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to

inform practice and influence clinical decision making when caring for diverse populations of adults experiencing selected illnesses. 2. Demonstrate appropriate use of the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related pathophysiology when providing care to adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence-based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to the client, client's family, and other members of the health care team 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes that emphasize client safety and evidence-based practice. 10. Use patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31801 - Psychiatric And Mental Health Nursing

Credit Hours: 5.00. Focuses on providing nursing care that supports mental health and the care of persons with mental illness while providing a conceptual integration of the nursing process, theories, and research from the biopsychosocial sciences and humanities. Demonstrates the relevance of psychiatric-mental health nursing concepts to all areas of professional practice.

Learning Outcomes: 1. Examine the effects of myths, stereotypes, stigma, values, beliefs and culture on the practice of psychiatric nursing. 2. Compare past, current, and projected systems in delivery of evidence based mental health care and its social implications. 3. Identify legal and ethical implications involved in the practice of psychiatric mental health nursing. 4. Utilize the nursing process in the phases ofthe therapeutic nurse-client relationship to delineate the complex needs of clients with psychiatric disorders.. 5. Identify the principles of communication and therapeutic relationships in the care of clients with psychiatric disorders. 6. Determine specific nursing care interventions for acute and serious behavioral health issues that demonstrate developmentally and culturally appropriate strategies. 7. Utilize the ANA Standards of Psychiatric and Mental Health Nursing Practice as a basis for safe and competent care. 8. Incorporate theory, research and evidence from the psychobiological sciences, biological sciences, and humanities into an evidenced based practice approach to psychiatric nursing care. 9. Utilize client care technologies, information systems, and communication resources to access, organize and communicate information in a professional manner. 10. Establish therapeutic, collaborative relationships with members of the interdisciplinary treatment team. 11. Demonstrate personal and professional growth and skill development when providing evidence-based nursing care to clients with psychiatric disorders. Credits: 5.00

NUR 31901 - Integration Seminar II

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and psychiatric diagnoses. Through the course activities, the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes

in one's nursing practice with medically and psychologically unstable populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

NUR 33001 - Nursing Peer Mentors

Credit Hours: 2.00. Peer mentorship role to assist students entering the nursing profession to develop an understanding of the foundations of the baccalaureate nursing curriculum, including concepts, competencies, mandatory requirements, and responsibilities within the profession. To help students acclimate to college and begin to build a sense of campus community and community within the Purdue School of Nursing. Important attributes of a peer mentor are the desire to develop and help others, an openness to spending time with diverse individuals who may not share a common background, values, or goals, and a willingness to share failures and personal experiences to provide valuable opportunities for learning. A peer mentor should have a growth mindset and learning attitude, skill in developing others through active listening, asking open-ended questions, self-reflection, and providing feedback, and the ability to commit time and energy to the mentoring relationship. Permission of department required.

Learning Outcomes: 1. Actively create supportive, intentional relationships with mentees based on mutual trust, respect, and accountability that create a safe space for mentees to work towards personal learning goals. 2. Provide objective guidance and feedback to mentees based on personal experiences navigating the University and School of Nursing environment. 3. Facilitate reflective thinking by asking thought-provoking questions that seek deeper meaning and help the mentee become more self-aware of strength and growth opportunities. 4. Serve as a role model for personal growth and learning by employing practices of goal setting, seeking feedback, and reflection for one's own development during the mentoring relationship. Credits: 2.00

NUR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry

principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39699 - Professional Practice Internship

Credit Hours: 0.00. Program coordinated by Nursing with cooperation of participating employers and the Office of Professional Practice. Students will submit summary reports and company evaluations related to the experience. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional nursing context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Incorporate knowledge of the nursing profession and practice, basic nursing principles, and principles and practice of ethical responsibilities in professional work. Credits: 0.00

NUR 39801 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an international experience that is recognized by the University. Permission of department required.

Learning Outcomes: 1. Course outcomes will vary depending upon specific study abroad experience in which the student participates. Credits: 1.00 to 6.00

NUR 39900 - Special Topics

Credit Hours: 0.00 to 3.00. Hours, credit, and subject matter to be arranged by faculty.

Credits: 0.00 to 3.00

NUR 41001 - Issues In Professional Nursing

Credit Hours: 2.00. Promotes the use of critical thinking, clinical reasoning, and active learning to analyze contemporary issues related to professional nursing practice. Issues and key trends surrounding social determinants of health policy and economics, regulatory agencies, political action, cultural diversity, practice competency, nursing informatics and ethics are used as a framework. Permission of department required.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Evaluate historical components and current nursing practice that impact healthcare systems. 3. Demonstrate understanding of the impact of local, state, national and global regulations on healthcare trends and healthcare policy. 4. Evaluate the impact that economic, political, cultural, and social concerns have on the role of professional nursing and the healthcare delivery system. 5. Articulate the value of pursuing practice excellence, life-long learning, engagement, self care, and resilience in professional nursing practice. 6. Utilize inquiry, analysis, information literacy, nursing informatics to address practice issues, ambiguity, and unpredictability in the healthcare systems. Credits: 2.00

NUR 41401 - Pediatric Nursing

Credit Hours: 5.00. Explores factors influencing the health and wellness of children and families. Students will apply principles, concepts and research from the health and human sciences to the care of children and families across the health-illness continuum. A structured clinical component focuses on clinical reasoning and evidence based practice. Students will provide family centered care to healthy, at risk and ill children across a variety of clinical settings.

Learning Outcomes: 1. Integrate family theories; growth and development; genomics; environmental and psychosocial factors in the care of children across the health-illness continuum. 2. Integrate nursing concepts into evidence based nursing practice for children and families across a variety of health care settings. 3. Apply knowledge of information technologies to improve health outcomes of children and families. 4. Evaluate environmental and psychosocial risk factors for children and families. 5. Adapt nursing care to families, recognizing their diverse needs, ethnicity, culture, and values. 6. Evaluate the collaborative role of the nurse with other health care disciplines in the provision of comprehensive nursing care for healthy, at risk, and ill children. 7. Demonstrate a spirit of inquiry, responsibility and accountability within legal, ethical, professional and organizational parameters. Credits: 5.00

NUR 41501 - Public Health Nursing

Credit Hours: 5.00. Utilize health promotion, maintenance,

education and disease prevention in coordinating and providing population-focused care to individuals, families and aggregates in the community. A variety of clinical settings are used to offer students a broad, comprehensive perspective of public health nursing, a field that synthesizes content from nursing, social and public health sciences. Collaboration with the community and implementation of population-focused interventions foster critical thinking and independent decision making in the delivery of nursing care.

Learning Outcomes: 1. Synthesize concepts, theories, knowledge and practice from nursing, social and public health sciences. 2. Examine the structure, function, and influence of historical, political, social, environmental, cultural, and ethical factors to the health of individuals, families, and communities. 3. Collaborate with interdisciplinary healthcare and human service providers to address the health needs of individuals, families, and communities. 4. Utilize principles, concepts, models, theories and research to guide culturally sensitive nursing care and public health practice of individuals, families, and communities. 5. Explore the delivery of public health nursing services to diverse and vulnerable populations. 6. Formulate client teaching strategies that address the principles of disease prevention and health promotion to clients across the lifespan. 7. Evaluate interventions implemented using community and family resources to address mutually identified health needs of clients. 8. Use principles of caseload management, in the delivery of safe, quality public health nursing services that reflect legal, ethical, and professional standards. 9. Apply national health objectives in planning interventions to meet the individual, system, and community level needs of diverse populations. 10.Utilize health care technology to improve health outcomes of individuals, families, and communities. 11.Integrate the role of advocacy into the delivery of care to individuals, families, and communities. Credits: 5.00

NUR 41701 - Leadership In Nursing

Credit Hours: 3.00. Studies the components of nursing leadership and management functions with an emphasis on critical thinking, problem solving, communication, and team building within the context of experiential problem-based group projects. This course will provide specific practice and evaluation of strategic and financial planning, conflict management, delegation, and complex change. Competencies to be gained, at a novice level, include professional communication, sound ethical and legal judgments within personal and organizational frameworks, leadership skills in the management and evaluation of others, and an understanding of the drivers of healthcare change and finances.

Learning Outcomes: 1. Synthesize concepts of nursing leadership and management in relation to the role of the professional nurse, nurse leader, and manager in promoting safe and quality care. 2. Organize a quality improvement project by utilizing project management strategies, quality improvement principles, and evidence-based practices to promote system changes in healthcare delivery. 3. Utilize concepts of professional communication, delegation, and evaluation of healthcare team members with an awareness of ethical, professional, social, and legal issues implicit to nursing leadership and management. 4. Describes economic, policy, social, and organizational factors that influence the professional nurse and healthcare systems. 5. Evaluate the impact of professional and unprofessional behaviors on healthcare delivery and professional interactions and presentations through knowledge of nursing standards of excellence. Credits: 3.00

NUR 41901 - Professional Nursing: Evolution As A Clinician And Leader

Credit Hours: 3.00. Incorporate the use of critical thinking, clinical reasoning, and active learning in analyzing contemporary issues related to professional nursing practice and obtaining professional nursing licensure. Issues surrounding political action, socio-legal concerns, cultural diversity and ethics in nursing practice are used as a framework.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Articulate the

value of pursuing practice excellence, life-long learning, and engagement in professional nursing practice including membership in professional organization, completion of continuing education, and specialty certifications. 3. Integrate principles of evidence-based practice, ethical decision-making, inter-professional communication, and advocacy to answer complex questions related to the practice setting. 4. Evaluate the impact of local, state, national and global health policy on the healthcare system. 5. Differentiate the professional nurse's role in health policy development and implementation. 6. Apply effective study habits and test taking strategies to enhance performance on the NCLEX-RN exam. Credits: 3.00

NUR 42001 - Transition To Professional Nursing Practice

Credit Hours: 4.00. This course challenges students to use critical thinking and clinical reasoning to identify, prioritize and evaluate nursing interventions for clients with complex healthcare issues. Students interact with members of the healthcare team and clinical faculty to practice effective leadership, delegation and supervision of nursing students in clinical environments.

Learning Outcomes: 1. Apply sound clinical judgment, professional behavior, communication, collaboration and integration of best practice in clinical settings. Demonstrate/apply professional behavior, communication, collaboration and sound clinical judgment by integrating best practice in clinical settings. 2. Utilize the nursing process when caring for clients with complex healthcare needs. 3. Articulate the value of pursuing practice excellence, life-long learning, patient advocacy and engagement in professional nursing practice. 4. Demonstrate effective leadership, delegation and supervision when collaborating with members of the healthcare team. 5. Assume personal responsibility for professional growth. 6. Analyze system barriers that effect quality healthcare delivery in patients affected by complex conditions. Credits: 4.00

NUR 43001 - NCLEX Review

Credit Hours: 2.00. The NCLEX-Prep is a pre-graduation comprehensive review of nursing content implemented in the senior year. The course is utilized as supplemental to assist with overall content review. Students will use their ATI account to access the content and will be assigned an ATI educator. The course is used to assist students to prepare for the ATI Comprehensive Predictor (Program Exit Exam), and NCLEX (National Council Licensure Examination).

Learning Outcomes: 1. Demonstrate an increased understanding of nursing content related to NCLEX. 2. Develop a study base for post-graduate RN content review. 3. Improve test-taking strategies specifically for NCLEX. 4. Increase individual awareness of content deficits. 5. Recognize the need for continued preparation after graduation. Credits: 2.00

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50100 - Foundations Of Advanced Practice In Nursing

Credit Hours: 2.00. This course builds on the knowledge and experiences that students possess when beginning their advanced practice in nursing education. Students explore their assumptions about advanced practice in nursing, its historical context and definitions of the various advanced practice roles, conceptual underpinnings and role competencies. Students develop an appreciation for how evidence based practice influences advanced practice in nursing. They develop skills that include using information communication technologies, identifying problems, posing questions that lead to evidence sources, searching and differentiating among various sources and types of evidence.

Credits: 2.00

NUR 50200 - Pharmacotherapeutics For Advanced Practice Nursing

Credit Hours: 3.00. Course includes pharmacodynamics, pharmacokinetics, and pharmacotherapeutics of broad categories of pharmacologic agents. Students apply these principles and also consider the role of best available evidence and patient preferences as a basis for managing pharmacologic regimens. Students review regulations relevant to prescriptive authority for advanced practice nurses.

Credits: 3.00

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 50700 - Physiologic Concepts For Advanced Practice Nursing

Credit Hours: 4.00. Students examine the principles of physiologic function at all levels of organization from cells to organ systems as they affect human function. The course uses homeostasis as a model to account for regulatory and compensatory functions in health. Students develop the necessary theoretical and empirical foundation for subsequent understanding of the diagnosis and management of human responses to disease and non-disease based etiologies.

Credits: 4.00

NUR 51000 - Research And Evidence Based Nursing Practice

Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 51100 - Health Promotion For Advanced Practice In Nursing

Credit Hours: 2.00 to 3.00. Students analyze health promotion/disease prevention, and health education frameworks combined with best available evidence as a foundation for advanced practice in nursing. Students promote the health of diverse client populations by incorporating the Healthy People goals, clinical practice guidelines, risk assessment, epidemiological data and evidence based screening tools into nursing practice. In collaboration with selected clients and/or families, students implement health coaching/teaching through the integration of family, health promotion and health literacy theories.

Credits: 2.00 to 3.00

NUR 51200 - Clinical Applications In Pharmacotherapeutics

Credit Hours: 1.00. This course applies information from NUR 50200 to the care of clients through the use of case studies. Emphasis is placed on incorporating information from pharmacology, physiology, and physical assessment.

Credits: 1.00

NUR 51300 - Health Promotion In Special Populations

Credit Hours: 3.00. Examination of wellness and health promotion issues unique to three special populations: clients in rural areas, women, and adolescents. Legal and ethical issues related to practice with special populations is addressed. Evidence-based standards will be utilized.

Credits: 3.00

NUR 51400 - Clinical Application In Pharmacotherapeutics For Pediatric Nurse Practitioners

Credit Hours: 1.00. Applies information from NUR 50200 , Pharmacotherapeutics in Primary Care, to the care of infants, children, and adolescents through the use of case studies. Emphasis is placed on incorporating information from pharmacology, physiology, and physical assessment.

Credits: 1.00

NUR 51500 - Health Promotion In Pediatric Populations

Credit Hours: 3.00. Examines wellness and health promotion issues unique to children from birth through adolescence. Concepts of growth and development are integrated into health promotion activities. Legal and ethical issues related to practice with children and adolescents are addressed. Evidence-based practice standards will be utilized.

Credits: 3.00

NUR 51601 - Clinical Applications In

Pharmacology Family Nurse Practitioner

Credit Hours: 1.00. This course applies information from Pharmacotherapeutics in primary care (NUR 50200) to the care of infants, children, adolescents and adults through the use of case studies. Emphasis is on incorporating from pharmacology, physiology and physical assessment.

Credits: 1.00

NUR 51700 - Doctor Of Nursing Project Seminar, Doctor Of Nursing Practice

Credit Hours: 0.00. This seminar will allow the student to begin contemplating and organizing their thoughts in developing the DNP project. In this seminar, the student will be introduced to the requirements for the DNP project and begin to cultivate feasible project questions that have an impact in clinical care, obtain feedback and network with peers.

Credits: 0.00

NUR 52200 - Psychopharmacology Across The Lifespan

Credit Hours: 2.00. Signs and symptoms of all major psychiatric disorders and the medications used to treat them across the life-span are discussed. Classes of psychiatric medications are considered; including indications, therapeutic uses, neurophysiological mechanism of action and side effects.

Credits: 2.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 52800 - Acute Illness: Pediatric Health Practice

Credit Hours: 3.00. A developmentally organized course to provide knowledge and experience to care for acute episodic illnesses of children and adolescents in primary healthcare settings. Examines pathophysiological alterations and clinical management. Students will synthesize knowledge of developmental, physiological, psychological, and sociocultural factors in the assessment and management of acute illness. The focus is on differential diagnosis, clinical management, and child and family education within the context of primary care. Health promotion models, and biopsychosocial, developmental, and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed.

Credits: 3.00

NUR 52900 - Acute Illness: Pediatric Health Preceptorship

Credit Hours: 3.00. Assists students to develop and broaden clinical judgment and skills. Content includes the study of primary health care of children and adolescents with acute conditions and the impact of those conditions on family members. The focus is on growth and development, assessment, differential diagnosis, clinical decision making, management, and patient and family education within the context of primary care. Professional issues, collaboration and scope of practice, and advocacy are emphasized. Clinical seminars focus on variations of child health in the context of health promotion and advanced assessment.

Credits: 3.00

NUR 53200 - Acute Illness: Adult Health Practice

Credit Hours: 3.00. Examination of pathophysiological alterations and clinical management of acute conditions in adolescents and adults. Students will synthesize knowledge of physiological, psychological, and sociocultural factors in the assessment and management of acute illness. Focus is on the differential diagnosis, clinical management, patient and family education within the context of primary care. Health promotion models, as well as biopsychosocial and cultural theories are integrated throughout the course. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions.

Credits: 3.00

NUR 53300 - Acute Illness: Adult Health Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of adolescents and adults with acute conditions and the impact of those conditions on family members. Focus is on assessment, deferential diagnosis, clinical decision making and management, as well as patient and family education within the context of primary care. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions. Professional issues, collaboration and scope of practice, and advocacy are emphasized.

Credits: 3.00

NUR 53800 - Psychiatric Mental Health Nurse Practitioner Roles And Psychotherapeutic Framework And Modalities

Credit Hours: 2.00. Scope and standards of practice for psychiatric mental health advanced practice nursing is set forth in this course. Content includes Psychiatric Mental Health Nurse Practitioner (PMHNP) functioning based on the state practice act as well as additional functions of the PMHNP including providing integrative therapy interventions, community interventions, case management, consultation and liaison services, clinical supervision, and policy development. Students will explore principles of evidence-based psychotherapy interventions including individual and group therapy, family and play therapy, and demonstrate competency in two forms of psychotherapeutic interventions.

Credits: 2.00

NUR 53900 - Psychiatric Mental Health Nurse Practitioner Roles And Therapeutic Modalities Preceptorship

Credit Hours: 2.00. Psychotherapeutic frameworks and modalities are analyzed within the role of the PMHNP. Students participate in the application of individual and group psychotherapeutic interventions in a clinical setting by a PMHNP or therapist/clinical social worker.

Credits: 2.00

NUR 54200 - Chronic And Commonly Recurring Conditions: Adult Health Practice

Credit Hours: 3.00. Examination of pathophysiological alterations and clinical management of chronic conditions and illnesses in adolescents and adults. Students will synthesize knowledge of physiological, psychological, and sociocultural factors in the assessment and management of chronic conditions. Focus is on the differential diagnosis, clinical management, and patient and family education within the context of primary care. Chronic illness and health promotion models, as well as biopsychosocial and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions.

Credits: 3.00

NUR 54300 - Chronic Illness: Adult Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of chronic illness and recurring conditions in adolescents and adults and the impact of those conditions on family members. Focus is on the differential diagnosis, clinical decision making and management, as well as patient and family education within the context of primary care. The adult nurse practitioner role is analyzed in the context of caring for persons with chronic conditions. Professional issues, collaboration, scope of practice and advocacy are emphasized.

Credits: 3.00

NUR 54400 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan

Credit Hours: 3.00. Evidence-based treatment methods including principals of psychopharmacology and psychotherapeutic modalities across the life span are examined, evaluated and implemented in clinical practice. Factors, such as culture, neurobiology, developmental level and gender that impact disease expression, therapeutic approaches and treatment response are explored. Mental health assessment including standardized psychiatric assessment tools, including Mental Status Exam, Mood Disorder Questionnaire, Patient Health Questionnaire (PHQ-9), Columbia-Suicide Severity Rating Scale (C-SSRS), DSM V and ICD is presented. In addition, developmental and functional level, and cultural influences are included. Substance use assessment skills and substance use interventions will be examined including how substance use impacts psychiatric symptom expression and response to treatment. Legal and ethical implications of care will be discussed.

Credits: 3.00

NUR 54500 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan I Preceptorship

Credit Hours: 3.00. Students engage in the PMHNP role in a clinical setting under the supervision of a Psychiatric Mental Health Nurse Practitioner (PMHNP) or MD. Students implement and evaluate mental health assessment skills, evidenced based treatment interventions and evaluate effectiveness integrating principals of neurobiology, culture, developmental and functional abilities.

Credits: 3.00

NUR 55200 - Chronic Illness And Commonly Recurring Conditions: Pediatric Health Practice

Credit Hours: 3.00. Examines pathophysiological alterations and clinical management of chronic conditions and illnesses in children and adolescents. Students will synthesize knowledge of developmental, physiological, psychological, and sociocultural factors in the assessment and management of chronic conditions. The focus is on the differential diagnosis, clinical management, and child and family education within the context of primary health care. Chronic illness and health promotion models, as well as biopsychosocial, developmental, and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed.

Credits: 3.00

NUR 55300 - Chronic Illness And Commonly Recurring Conditions: Pediatric Health Preceptorship

Credit Hours: 3.00. Assists students to develop and broaden clinical judgment and skills. Content includes the study of chronic illness and recurring conditions in children and adolescents and the impact of those conditions on family members. The focus is on growth and development, differential diagnosis, clinical decision making and management, and child and family education within the context of primary care. The pediatric nurse practitioner role is analyzed in the context of caring for children with chronic conditions. Professional issues, collaboration, scope of practice, and advocacy are emphasized.

Credits: 3.00

NUR 57600 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan II

Credit Hours: 3.00. The practice of Psychiatric Mental Health Nurse Practitioner (PMHNP) is further expanded to include identification and management of the complex patient across the life span. Explore how co-morbid health conditions impact psychiatric disorders and treatment response. Differentiate

psychiatric diagnoses, personality disorders, social, family and cultural influences, developmental disorders and how these factors impact treatment. Apply a variety of approaches including inter-and intra-professional resources, and psychopharmacological interventions to the management of complex patients. Legal and ethical implications of care are discussed.

Credits: 3.00

NUR 57700 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan II Preceptorship

Credit Hours: 3.00. Students engage in the Psychiatric Mental Health Nurse Practitioner (PMHNP) role in a clinical setting under the supervision of a PMHNP or Medical Doctor. Students continue to develop and broaden clinical judgment, psychiatric assessment skills, and evidenced-based treatment interventions while considering cultural influences, and developmental and functional abilities. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of mental health.

Credits: 3.00

NUR 59800 - Master's Capstone

Credit Hours: 1.00 or 3.00. Students apply research principles through problem identification, proposal development, implementation, and evaluation of a clinical problem. Students synthesize principles of health assessment and advanced practice nursing through a clinical research project. The project may be an evaluation study or part of an ongoing faculty research project.

Credits: 1.00 or 3.00

NUR 59900 - Special Topics/Independent Study In Nursing

Credit Hours: 0.00 to 6.00 (West Lafayette, Calumet) 1.00 to 6.00 (Fort Wayne). Special topics in nursing are critically examined. Hours, credit, and subject matter are determined by the staff. Permission of instructor required.

Credits: 0.00 to 6.00

NUR 60400 - PhD Seminar

Credit Hours: 0.00. This seminar is taken by Ph.D. nursing students each semester to integrate themselves to the academic and professional roles of the Ph.D. prepared nurse. This seminar will facilitate students to share their research ideas and progress through networking and collegial discourse. It also provides a low-stake forum where students can give and receive feedback on each other's research. Seminar goals include improving students' presentation and writing skills, teaching how to give constructive criticism, and advising on the academic and professional job market.

Credits: 0.00

NUR 61100 - Primary Care Of The Young Family

Credit Hours: 3.00. Prepares family nurse practitioner students to assume responsibility for the coordination and delivery of culturally appropriate health services to childbearing and childrearing families. Students apply theory and research to the management of pregnancy, well-child care, stable chronic conditions, and acute episodic illnesses commonly encountered in primary care settings. The course emphasizes a sound conceptual basis for practice and an appreciation for evidence-based care. Students continue to integrate health promotion and health maintenance into the primary care of young families.

Credits: 3.00

NUR 61300 - Primary Care Of The Young Family Practicum

Credit Hours: 3.00. Students progress in their ability to master the competencies of the family nurse practitioner, using critical thinking and diagnostic reasoning skills. Students apply knowledge of clinical research, pharmacology, physiology, and conceptual frameworks to the primary care of childbearing and childrearing clients and families. Prerequisite: NUR 50000 , NUR 51100 .

Credits: 3.00

NUR 61500 - Primary Care Of The Young Family Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of the young family with acute and chronic conditions, and the impact of those conditions on family members. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. The Family Nurse Practitioner role is analyzed in the context of caring for the young family with acute and chronic conditions. Professional issues, collaboration and scope of practice, advocacy are emphasized. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 61100.

Credits: 3.00

NUR 62200 - Primary Care Of The Aging Family

Credit Hours: 3.00. Prepares family nurse practitioner students to assume responsibility for the coordination and delivery of culturally appropriate health services to middle-aged and older families. Students learn to manage stable chronic conditions and acute episodic illnesses commonly encountered in primary care settings. The course emphasizes the conceptual basis for practice and an appreciation for evidence-based care. Students continue to integrate health promotion and health maintenance into the primary care of older clients and their families.

Credits: 3.00

NUR 62300 - Primary Care Of The Aging Family Practicum

Credit Hours: 3.00. Students progress in their ability to master the competencies of the family nurse practitioner, using critical thinking and diagnostic reasoning skills. Students apply knowledge of clinical research, pharmacology, physiology, and

conceptual frameworks to the primary care of middle-aged and older clients and families. Prerequisite: NUR 61300 .

Credits: 3.00

NUR 62400 - Evidence-Based Practice

Credit Hours: 3.00. This course focuses on discovery and utilization of evidence-based care to produce the best outcomes for patients. The student develops a problem statement, performs a comprehensive literature search, and critically evaluates the evidence to determine best practice and formulate recommendations. The implementation of evidence-based practice (EBP) practical strategies, and analysis of components of EBP are examined throughout the course. Prerequisite: and either an undergraduate or graduate statistics course within the last five years. is recommended.

Credits: 3.00

NUR 62500 - History, Ethics, And Innovations In Health-Care Delivery Systems

Credit Hours: 3.00. Broadens and refines the student's view of the current health-care delivery system by providing an analysis from an historical perspective, of the forces that have shaped the system, including scientific discoveries, technological advances, social justice issues and the development of health professions and institutions. Nursing knowledge is influenced by these multiple factors; thus, the course provides students with tools to lead others in meeting the many challenges the health-care system brings. A chronological and topical format is used, which investigates policy and societal trends affecting health care, the nursing and medical professions, and professional practice. Changes in the roles of health-care providers and consumers are assessed from economic, social, organizational, political, ethical, legal, and technological perspectives.

Credits: 3.00

NUR 62600 - Applied Biostatistics For Outcome Evaluation

Credit Hours: 3.00. This course applied biostatistical methods commonly used in epidemiologic research to large data sets. Students learn to use statistical software to compute descriptive, bivariate, and multivariate statistics. Students translate statistical findings into conclusions relevant to the delivery of health care. Prerequisites: NUR 51000 and an undergraduate statistics course within the last five years.

Credits: 3.00

NUR 62700 - Primary Care Of The Aging Family Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of the aging family with acute and chronic conditions and the impact of those conditions on family members. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. The Family Nurse Practitioner role is analyzed in the context of caring for the aging family with acute and chronic conditions. Professional issues, collaboration and scope of practice, advocacy are emphasized. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 62200.

Credits: 3.00

NUR 63100 - Family Nurse Practitioner Preceptorship Clinical Synthesis

Credit Hours: 2.00 to 3.00. This course assists students to integrate clinical knowledge and skills from prior course work when providing care to patients across the lifespan. The Family Nurse Practitioner role is analyzed in the context of caring for patients of all ages with acute and chronic conditions. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 61100 and NUR 61500 and NUR 62200 and NUR 62700.

Credits: 2.00 to 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 64000 - Human Factors In Healthcare Engineering

Credit Hours: 3.00. This course provides an introduction to human factors and ergonomics with a focus on healthcare applications. Fundamental principles will be introduced including the cognitive, physical, and social considerations that comprise human factors engineering. By course completion, students should be able to formulate studies of and/or evaluate the healthcare domain using these fundamentals principles of human factors engineering. Permission of instructor required. Prerequisites: NUR 51000 or equivalent and Undergraduate Statistics course within the past five years.

Learning Outcomes: 1. Identify human factors relevant to healthcare engineering. 2. Describe ergonomic concepts applicable to healthcare engineering. 3. Interpret research applicable to human factors and engineering. 4. Apply the fundamental physical, cognitive, and organizational principles to the healthcare

setting. Credits: 3.00

NUR 64100 - Principles Of Epidemiology

Credit Hours: 3.00. This course will provide the student with an introduction to epidemiology - the study of the distribution and determinants of health status. This course focuses on application of epidemiologic descriptive and analytic study as it relates to the distribution and determinants of health status. Topics will include the scope and history of epidemiology, basic quantitative methods and measures used in the field, and an introduction to the design and implementation of epidemiological studies. The course will also include the examination of cases from infectious disease, various forms of applied epidemiology (e.g., clinical and field epidemiology), surveillance/screening tests, types of epidemiological studies, concepts of disease transmission, and causality. Prerequisites: At least one undergraduate or graduate level statistics course. Permission of department required.

Credits: 3.00

NUR 64200 - Systems Approaches In Healthcare

Credit Hours: 3.00. Students are introduced to the fundamentals of systems engineering tools and approaches through hands-on problem-solving exercises. Systems Engineering tools/methods are applied to a clinical problem. Upon completion of this course, the participants will have had exposure to system engineering tools and approaches such as process mapping, bottle-neck analysis, queuing, lean engineering, simulation, optimization, dealing with uncertainty, what-if analysis, quality control and performance monitoring techniques. Permission of instructor required.

Learning Outcomes: 1. Discuss the applicability of systems engineering in a healthcare setting. 2. Develop familiarity with systems engineering tools and approaches. 3. Recognize opportunities for improvement where systems engineering can be employed. 4. Identify a specific clinical problem in a real-world setting that can be analyzed using systems engineering. 5. Conduct an in-depth analysis of a clinical problem using one of the tools/approaches presented. Credits: 3.00

NUR 65500 - Advanced Practice In Nursing Seminar

Credit Hours: 1.00. Students analyze movements and trends that influence advanced practice in nursing. Students dialogue with peers on issues related to advanced practice, nursing as a profession and discipline, healthcare and other related topics of interest. Prerequisite: NUR 60100, NUR 60300, NUR 61300 .

Credits: 1.00

NUR 65600 - Healthcare Organization, Policy And Economics

Credit Hours: 3.00. Students use theories to understand the various models that influence health care policy and organize health care delivery. Students investigate the processes of analyzing and forming health policy. The reciprocal relationship between evidence-based practice and health care policy is explored. Students examine health care economics from a micro and macro perspective and their impact on health care delivery systems. Students also explore issues such access to health care, health care quality, and cost. Prerequisite: NUR 50100 .

Credits: 3.00

NUR 65700 - FNP Practicum: Clinical Synthesis

Credit Hours: 2.00. This is the final clinical capstone course in a sequence of clinical courses designed to prepare graduate nursing students for FNP practice. Students synthesize and apply theoretical and empirical knowledge in primary-care settings with culturally diverse clients and families. Emphasis is given to the clinical management of a wider spectrum of clients and to the more complex, co-morbid conditions seen in family practice. Prerequisite: NUR 62300 .Corequisite: NUR 65500 , NUR 65600 .

Credits: 2.00

NUR 67300 - DNP Health Policy Residency

Credit Hours: 2.00. This residency course provides an opportunity for students to gain greater understanding of how public policy affects state, national, and international health-care delivery systems and resources. Students will interact with top policy makers at the local, state, national, and/or international level to explore the many forces, including political, economic, social, and technological, that influence current policy and the policy-making process. Prerequisite: NUR 65600.

Credits: 2.00

NUR 67400 - Quality Initiatives, Leadership And Advanced Practice Nursing

Credit Hours: 2.00. This course develops concepts of the guiding principles of quality, system and leadership initiatives in the Nurse Practitioner Role. The students explore principles and techniques of health coaching, interprofessional team work, delegation and prioritization that can be used in various healthcare settings. Potential quality initiatives will be identified and an improvement plan will be developed using various quality initiatives modalities in the healthcare system to improve quality care, safety and patient outcomes. Permission of department required.

Credits: 2.00

NUR 67500 - Role Transition And Synthesis

Credit Hours: 2.00. This course provides an integration of core, cognate, and specialty knowledge, with an emphasis on role transition and synthesis. Focuses on internal and external healthcare organizational factors at the local, state, national, and international levels. Seminars explore role issues, licensure, credentialing, finances, legislation, healthcare policy, legal

issues, ethics, cultural diversity, evidence-based practice, emerging trends in the management of acute and chronic conditions of adults, and independent and collaborative practice. Prerequisite: NUR 53200 , NUR 53300 . Corequisite: NUR 54200 , NUR 54300 , NUR 59800 .

Credits: 2.00

NUR 67800 - Healthcare Economics And Finance

Credit Hours: 3.00. This class will provide an introduction to the application of health economics principles as it relates to various health care systems, health care stakeholders and health policy issues in the United States. The course will explore the allocation and distribution of resources in the health care industry and the nature of the constantly changing relationship between health care and its major constituencies. Topics include the demand for health care, access to care, health care parity, health care reimbursement, economic evaluation, health care delivery models, and health care professionals' services.

Credits: 3.00

NUR 68000 - DNP Cognate Residency: Direct Practice/Systems Management I

Credit Hours: 3.00. This is the first in a series of two courses that applies knowledge and skill to improve healthcare outcomes in systems. The emphasis is the application of engineering principles to health care including human factors, systems analysis and design, and optimal use of information technology and simulation. Residency activities provide students with opportunities to participate in professional service activities, attend institutes and conferences to expand their area of research or clinical interest and/or develop significant scholarly pursuits. The focus is on creating change in the healthcare system through analysis, synthesis, critique, and application of evidence-based practice to support accessible high quality, safe, efficient, and effective health care. Prerequisites: NUR 68700 .

Credits: 3.00

NUR 68001 - PhD Cognate Residency

Credit Hours: 3.00. The PhD Cognate includes experiential learning that provides preliminary preparation for conducting the PhD Dissertation Proposal. The course will incorporate guidelines for ethical conduct of human studies, research-based studies, and evaluation of evidence-based literature for study design. The course will assist students to develop the project reflective of previous courses, evidence, project feasibility, theoretical frameworks, appropriate methodology and data analysis.

Learning Outcomes: 1. Use communication information technology to advance the scholarship of discovery as a nurse scientist. 2. Analyze emerging clinical patterns and problems within a practice setting, healthcare organization, community, or system. 3. Integrate nurse-led care strategies that meet current and future healthcare needs based on scientific findings in nursing, organizational, political, economic, and other related sciences. 4. Employ consultative and leadership skills with transdisciplinary teams to generate new knowledge to improve healthcare. 5. Evaluate existing knowledge to develop a research plan to guide the generation of new knowledge and ideas to improve health. 6. Interact with diverse organizational cultures and populations, such as stakeholders of a specific topic, health system leaders, research participants, and interdisciplinary team members. Credits: 3.00

NUR 68100 - DNP Cognate Residency: Direct Practice/Systems Management II

Credit Hours: 3.00. This is a second in a series of two courses that applies knowledge and skill to improve healthcare outcomes in systems. The emphasis is the advanced application of engineering principles to health care including human factors, systems analysis and design, and optimal use of information technology and simulation. Students assume a leadership role in the application process utilizing skills acquired in DNP Residency: Direct Practice Management I. Residency activities provide students with opportunities to participate in professional service activities, attend institutes and conferences to expand their area of research or clinical interest and/or develop significant scholarly pursuits. The focus is on providing leadership in creating change in the healthcare system through analysis, synthesis, critique, and application of evidence-based practice to support accessible high quality, safe, efficient, and effective health care and systematic evaluation of outcomes. Clinical sites for the DNP Residency may include collaboration with experts in local, state, national, and international healthcare agencies. Residency activities are selected by the student under the guidance of the faculty advisor and preceptor, DNP program director, and approved by the director of graduate programs in nursing. Prerequisite: NUR 68700 .

Credits: 3.00

NUR 68300 - DNP Cognate Residency: Public Health/Homeland Security Practice I

Credit Hours: 3.00. This is the first in a series of two courses that provides an opportunity to explore a public health topic of interest under the direction of a faculty member. The focus is on implementation of an evidence-based practice model and evaluation of their effectiveness in improving community health outcomes. Residency activities provide opportunities to utilize research and evidence-based practice to expand the knowledge base needed for the development, implementation, and

evaluation of programs to meet the public health needs of specific communities with risk assessment analysis. Students will assess, plan, and evaluate the preparedness and response to mass casualty disasters or other public health concerns. Prerequisites: NUR 51000 and NUR 63200 . Concurrent Prerequisites: NUR 62400 and NUR 62600 .

Credits: 3.00

NUR 68500 - DNP Cognate Residence: Public Health/Homeland Security Practice II

Credit Hours: 3.00. This is the second in a series of two courses that provides an opportunity to further explore a public health topic of interest under the direction of a faculty member. The focus is on implementation of an evidence-based practice model and advanced application of evaluation techniques in establishing their effectiveness in improving community health outcomes. Residency activities provide ongoing opportunities to refine research and evidence-based practice to expand the knowledge base needed for the development, implementation, and evaluation of programs to meet the public health needs of the community and systems of care. Emphasis is on providing leadership in incorporating assessment of health needs of specific communities with risk assessment analysis to implement models to improve community outcomes. Students assume a leadership role as they assess, plan, and evaluate the preparedness and response to mass casualty disasters or other public health concerns. Residency sites may be local, state, national, and/or international settings. Residency activities are selected by the students under the guidance of the faculty advisor and preceptor, DNP program director, and approved by the director of graduate programs in Nursing. Prerequisite: NUR 68300 .

Credits: 3.00

NUR 68700 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice I

Credit Hours: 3.00. This course is first of a two part series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 51000 , NUR 62600 , NUR 62400 and Cognate Residencies.

Credits: 3.00

NUR 68900 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice II

Credit Hours: 3.00. This course is second in the series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 68700 and Cognate Residencies.

Credits: 3.00

NUR 69010 - Research Seminar

Credit Hours: 1.00. The Seminar in Nursing Research is a discussion-based course intended to socialize the nursing student to the role of an independent scholar. Discussion concentrates upon current topics and issues in nursing research, with an emphasis on targeting the most supportive trajectories for individual student research foci. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69020 - Leadership Seminar

Credit Hours: 1.00. The nurse as leader is deconstructed and reconstructed within the realms of scientific knowledge, theory, education, and healthcare delivery. Nurse leaders as members of collaborative teams and the influence of nursing intelligence on research teams are examined. Historical and societal influences affecting nurse leaders are examined, including media portrayals of nursing, transformational leadership, critical theory and feminist theory. Models of leadership are explored within the context of scientific work; the student is challenged to evaluate themselves as present and future leaders and members of nursing's academe. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69030 - Communication Seminar

Credit Hours: 1.00. Original research findings, using a global framework, are analyzed. The effectiveness of communication to implement and evaluate programs designed to promote innovative change in healthcare is critiqued. Communication as a mechanism to develop pathways to ensure accuracy of scientific information transfer, and as a necessary component of policy and major public health events is appraised. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69040 - Collaboration Seminar

Credit Hours: 1.00. Principles of collaboration to generate scientific knowledge, which is used to improve nursing and healthcare practice, education, policy, and outcomes, are discussed. Evidence generated from transdisciplinary teams is analyzed with attention given to specific professions contributions and roles. The specific role of the nurse scientist and the value of nursing intelligence within the context of

collaborative projects are discussed. Best practices in collaboration as exemplified by select research teams are presented. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69050 - Implementing Theory In Healthcare Research

Credit Hours: 3.00. Historical and contemporary social, ethical, educational, scientific, and professional influences on the development of theoretical knowledge in nursing and health research are analyzed. Various methods of theory development are reviewed. Selected biological/physiological, behavioral, and health service theories that form the basis of nursing science are critically evaluated. Skills needed for theory analysis and theory development are emphasized. The role of theoretical knowledge to innovation in nursing science and healthcare is presented. Scientific bridges between theoretical frameworks and research methods are appraised. Selected nursing and healthcare scientists communicate the theoretical aspects of their programs of research with an emphasis on collaboration between disciplines. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 3.00

NUR 69060 - Innovative Care/Innovations In Healthcare Delivery

Credit Hours: 3.00. Historical, ethical, financial, and social influences on contemporary innovations in healthcare practices and delivery systems are analyzed. The genesis and diffusion of both micro- and macro-level innovations are reconstructed with the use of theories, organizational and transdisciplinary factors, and effective processes. Quality of care issues are synthesized utilizing innovations in care and health delivery systems as a framework. With innovative care and innovations in healthcare delivery systems as frameworks, quality of care issues are appraised. Selected exemplars of successful innovations, with an emphasis on strategies to evaluate dissemination and impact, are analyzed. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 3.00

NUR 69100 - Health Care Research Methods

Credit Hours: 3.00. This course advances knowledge and skill in quantitative research methods for health program evaluation, population health, healthcare quality improvement, and other healthcare research applications. Topics include design of experimental, quasi-experimental, and observational studies; primary data collection through surveys and other techniques; use of clinical, administrative, and other secondary data sources; and data analysis strategies appropriate to each design and type of data. The course addresses basic issues of sampling, measurement, and validity and reliability, as well as practical issues that arise in healthcare research.

Credits: 3.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

NUR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Nutrition Science

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10600 - Introduction To The Profession Of Dietetics

Credit Hours: 1.00. Overview of the dietetics profession, including standards, ethics, educational and employment opportunities, and professional credentialing. Spring semester offered only through distance learning.

Learning Outcomes: 1. Describe the profession of dietetics and future trends. 2. Recognize the education preparation needed to pursue careers in dietetics including different education models of becoming an entry-level dietitian. 3. Demonstrate knowledge of the supervised practice experience application process. 4.

Identify the credentialing of dietetic practitioners. 5. Recognize the major professional organizations in dietetics such as the Academy of Nutrition and Dietetics, state affiliates and district dietetic associations, and dietetic practice groups and the roles of each. 6. Demonstrate the ability to develop a professional development portfolio, resume, and cover letter. 7. Develop an understanding of professionalism related to dietetics including interviewing skills, professional etiquette, professional ethics, and professional practice standards. 8. Develop skills for planning a career in dietetics such as self-assessment, goal setting, networking, job search strategies, and timeline establishment. Credits: 1.00

NUTR 10700 - Introduction To Nutrition Science

Credit Hours: 1.00. An overview of professional opportunities for nutrition scientists. Introduces tools and resources available for becoming a nutrition scientist.

Learning Outcomes: 1. To identify and describe the current professional opportunities for nutrition scientists. 2. To comprehend the educational preparation necessary to pursue a career as a nutrition scientist. 3. To name and become knowledgeable about the functions of, and advantages of belonging to, major professional organizations in nutrition science such as the American Society of Nutrition. 4. To apply modern information technology to the problem of discovering scientifically valid nutrition science information. Credits: 1.00

NUTR 12500 - Food Safety Certification And Career Development

Credit Hours: 1.00. Training in ServSafe food safety certification program.

Learning Outcomes: 1. Select appropriate food safety and sanitation practices according to ServSafe guidelines. 2. Assess professional development using resume and student portfolio. Credits: 1.00

NUTR 20200 - Principles Of Food Preparation And Nutrition

Credit Hours: 4.00. Chemical, physical, microbiological, and nutritional principles of food preparation. Functions and sources of nutrients, their relationship to a healthy lifestyle and incorporating the benefits into marketing of foodservice.

Credits: 4.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 24500 - Rookie Experience In Sports Nutrition

Credit Hours: 1.00. For students without prior experience within the specialty dietetics practice of sports nutrition, this course provides traditional and experience-based learning in a Division I Collegiate sports setting. Guest speakers will present on various aspects of the athletics work setting. Basics of sports nutrition are taught and students must pass an exam to progress to NUTR 34500 , Continuing Experience In Sports Nutrition. Written application and interview process required prior to instructor approval. Permission of Instructor required.

Learning Outcomes: 1. Describe healthful and performance-enhancing nutrition habits of student-athletes through active participation in project groups. 2. Recognize well-established scientific concepts, controversies, experts and resources in the field of sports nutrition. 3. Demonstrate work-enhancing skills/qualities like initiative, leadership, creativity, communication, cooperation, commitment and enthusiasm. 4. Apply information-literacy skills to accomplish goals of project groups. Credits: 1.00

NUTR 29700 - Introduction To Honors Research

Credit Hours: **2.00.** Introduces students to the design and implementation of an honors research project.

Learning Outcomes: 1. Identify the requirements for graduation with honors from Nutrition Science. 2. Define specific goals for

completion of their Honors Project. 3. Recognize the benefits of graduating with honors. 4. Discuss research currently being done in Nutrition Science. 5. Identify faculty interested in serving as mentors for students pursuing Honors Research Projects in Nutrition Science. 6. Locate and obtain research articles relevant to their research project. 7. Write appropriate citations for research articles. 8. Explain the scientific method and research ethics. Credits: 2.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate

understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 34000 - Field Experience In Nutrition, Fitness And Health

Credit Hours: 1.00 to 3.00. Field experience in NFH-related setting that provides an opportunity for the application of the classroom experience. For NFH majors only. The student secures his/her own field experience, which must be approved by the NFH program coordinator in order to receive academic credit.

Credits: 1.00 to 3.00

NUTR 34500 - Continuing Experience In Sports Nutrition

Credit Hours: 1.00. Traditional and experience-based learning within the specialty dietetics practice of sports nutrition in a Division I Collegiate sports setting. Guest speakers will present on various aspects of the athletics work setting. Students must pass an exam given in NUTR 24500 , Rookie Experience In Sports Medicine, to enroll. Permission of Instructor required.

Learning Outcomes: 1. Describe healthful and performance-enhancing nutrition habits of student-athletes through active participation in project groups. 2. Recognize well-established scientific concepts, controversies, experts and resources in the field of sports nutrition. 3. Demonstrate work-enhancing skills/qualities like initiative, leadership, creativity, communication, cooperation, commitment and enthusiasm. 4. Apply information-literacy skills to accomplish goals of project groups. Credits: 1.00

NUTR 35000 - Dietetics Practicum In Quantity Food Production

Credit Hours: 1.00 to 3.00. Supervised on-the-job experience related to the food service management in health care facilities, schools, community programs, etc. Student is responsible for arrangement and approval of the experience through the supervising food service manager or dietitian and the course instructor. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge gained from coursework to actual work situations. 2. Develop skills related to management of food service. 3. Design and complete a project appropriate for a food service operation. Credits: 1.00 to 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 37500 - Foods And Nutrition Internship

Credit Hours: 1.00 to 4.00. Food science or nutrition professionally related work experience in industry, institutions, or business. Permission of instructor required.

Credits: 1.00 to 4.00

NUTR 39000 - Independent Undergraduate Research

Credit Hours: 1.00 to 3.00. Individual research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven

research projects. Credits: 1.00 to 3.00

NUTR 39100 - Independent Study

Credit Hours: 1.00 to 3.00. Independent scholarly activity undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Increase knowledge base and/or application in nutrition science. Credits: 1.00 to 3.00

NUTR 39200 - Undergraduate Instruction In Nutrition

Credit Hours: 1.00 to 5.00. Problems dealing with various aspects of nutrition. Permission of instructor required.

Learning Outcomes: 1. Develop extensive knowledge base and/or application in nutrition science. Credits: 1.00 to 5.00

NUTR 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for Honors College and Department of Nutrition Science Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 39800 - International Special Topics

Credit Hours: 1.00 to 3.00. Course taken during an international experience that is recognized by the University.

Credits: 1.00 to 3.00

NUTR 40000 - Executive In The Classroom

Credit Hours: 1.00. Lecture and discussion, featuring industrial and business executives in food-related areas. Emphasis is placed on careers in the food industry.

Credits: 1.00

NUTR 41100 - Dietetics Career Planning

Credit Hours: 1.00. This course will prepare students to successfully apply and interview for dietetics supervised practice experience, jobs and graduate programs.

Learning Outcomes: 1. Students will prepare resumes, personal statements, and sample applications. 2. Students will use available resources to develop skills in interviewing. 3. Students will identify the steps and deadlines for applying to graduate school and supervised practice programs. Credits: 1.00

NUTR 41500 - Practicum In Nutrition, Fitness, And Health

Credit Hours: 2.00. Application of nutrition and exercise knowledge and skills by performing assessments, interpreting data, designing and implementing programs, documenting progress, and counseling of an adult client.

Learning Outcomes: 1. Collect, analyze, and interpret nutrition and fitness assessment data. 2. Organize aspects of interaction with the client (educational materials, short- and long-term planning, etc.). 3. Use critical thinking and counseling skills to elicit pertinent client information, evaluate client feedback, and guide the client toward positive changes. 4. Accurately and concisely document interactions with client. 5. Creatively apply nutrition and fitness knowledge. 6. Communication effectively with the client. 7. Evaluate effectiveness of intervention; make necessary changes. 8. Develop critical thinking skills and professional judgment to recognize and manage the"" gray"" areas of one-on-one wellness counseling/coaching. 9. Utilize information technology and other methods of inquiry to accomplish all of the above. Credits: 2.00

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the

public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 42600 - Laboratory In Community Nutrition

Credit Hours: 3.00. Application of previous knowledge and communication skills in nutrition of community settings, such as school nutrition, health facilities, and federal or state nutrition programs.

Learning Outcomes: 1. Perform as a community nutritionist and complete the competencies as outlined in the Learning Outcomes for Supervised Practice Form. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 44200 - Foodservice Systems Management

Credit Hours: 3.00. Systems approach to foodservice management. Foodservice operations based on nutritional goals of the target market. Food sanitation and safety, management of human resources, and supervision. Emphasis on applications to health-care facilities.

Learning Outcomes: 1. Identify and describe the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 2. Apply management and business theories and principles to the development, marketing and delivery of programs or services. 3. Determine costs of services or operations, prepare a budget and interpret financial data. 4. Apply the principles of human resource management to different situations. 5. Apply safety principles related to food, personnel and consumers. Credits: 3.00

NUTR 44300 - Laboratory In Foodservice Systems Management

Credit Hours: 9.00. Application of knowledge relating to foodservice. Responsibilities may include communication skills and tasks equivalent to supervising foodservice operations.

Learning Outcomes: 1. Prepare you for an entry-level job in food service management, and to introduce you to the fundamentals of management required for the competent practice in other areas of dietetics. Credits: 9.00

NUTR 45300 - Food Chemistry

Credit Hours: 4.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Recognize and predict how chemical structures and reactions influence sensory and analytical properties of food. 3. Explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives, and evaluate the validity of health controversies related to these ingredients. 5. Design, execute, and explain (via oral and written reports) a food experiment using the scientific method. Credits: 4.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

NUTR 46100 - Laboratory In Medical Nutrition Therapy

Credit Hours: 10.00. Application of previous knowledge and communication skills of medical nutrition therapy in the hospital/patient care setting to ultimately include responsibilities equivalent to staff relief.

Learning Outcomes: 1. Perform as a clinical nutritionist and complete the competencies as outlined in the Learning Outcomes for Supervised Practice Form. Credits: 10.00

NUTR 46500 - Laboratory In Engagement

Credit Hours: 3.00. Culminating experiences in community nutrition, foodservice, medical nutrition therapy, public health, research and/or nutrition related business. Placements will be arranged based on individual student's preferred track in long-term care facilities, hospitals, public health or community agencies, and/or business and industry.

Learning Outcomes: 1. Perform at entry level as dietician and in placements arranged based on individual student's preferred track in long-term care facilities, hospitals, public health or community agencies, and/or business and industry. Credits: 3.00

NUTR 48000 - Medical Nutrition Therapy I

Credit Hours: 4.00. Nutrition assessment in humans and introduction to the nutrition care process. Application of the nutrition care process to various disease states.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical evidence-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify nutrition-related problems for medical nutrition therapy. Credits: 4.00

NUTR 48100 - Medical Nutrition Therapy II

Credit Hours: 3.00. Application of the Nutrition Care Process in various disease states and conditions to prepare students for supervised practice programs.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify nutrition-related problems for medical nutrition

therapy. Credits: 3.00

NUTR 48800 - Topics In Nutrition, Fitness, And Health

Credit Hours: 3.00. This course critically evaluates the interrelationships between nutrition and exercise and their impact on physical performance and health. Concepts combining nutritional sciences and exercise physiology will be presented. Emerging science and controversies in the current literature will be discussed.

Learning Outcomes: 1. Value the integration of nutrition and exercise for human health promotion, especially related to dietary macronutrients and energy. 2. Discuss current controversial topics in nutrition and fitness and special topics. 3. Practice scientific literature searching, critical evaluation and interpretation of research, technical and scientific writing, and oral communication skills. Credits: 3.00

NUTR 49000 - Independent Undergraduate Research

Credit Hours: 1.00 to 4.00. Independent research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 4.00

NUTR 49100 - Independent Study

Credit Hours: 1.00 to 4.00. Independent scholarly activity undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Increase knowledge and/or application in nutrition science. Credits: 1.00 to 4.00

NUTR 49200 - Undergraduate Instruction In Nutrition

Credit Hours: 1.00 to 5.00. Problems dealing with various aspects of nutrition. Permission of instructor required.

Learning Outcomes: 1. Develop extensive knowledge base and/or application in nutrition science. Credits: 1.00 to 5.00

NUTR 49500 - Undergraduate Seminar In Foods And Nutrition

Credit Hours: 1.00. Instruction and application of concepts for effective oral presentations in the field of nutrition sciences.

Learning Outcomes: 1. To enhance your critical thinking skills. 2. To develop and enhance your oral communication skills. 3. To enhance your ability to make effective visuals for presentations. Credits: 1.00

NUTR 49600 - Evaluation Of Nutrition Science Research

Credit Hours: 3.00. Evaluation of nutrition science research as it relates to health and disease.

Learning Outcomes: 1. Distinguish between data and interpretation through the practice of reading, analyzing, critiquing, and discussing nutrition science research articles. 2. Access and integrate the contribution of multiple research studies to an area of nutrition science rresearch and its impact on health and disease. 3. Explain, orally and in writing, the evaluation of nutrition science research. 4. Identify and assess the validity of sensational nutrition science research presented in media. Credits: 3.00

NUTR 49700 - Honors Research Project

Credit Hours: 1.00 to 3.00. The completion of the independent honors research project for Honors College and Department of Nutrition Science Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Learning Outcomes: 1. Demonstrate critical thinking skills in nutrition science. 2. Present and defend hypothesis-driven research project. Credits: 1.00 to 3.00

NUTR 51100 - Applied Nutrition Counseling

Credit Hours: 3.00. Field experience in one-on-one nutrition counseling that requires application of prior learning of theory, knowledge and skills.

Credits: 3.00

NUTR 51200 - Dietary Supplements

Credit Hours: 2.00. Provides advanced training to evaluate concepts and issues of dietary supplement use in various populations. Students develop critical thinking skills through activities such as case studies to make appropriate recommendations for nutrition supplementation.

Credits: 2.00

NUTR 51300 - Food Chemistry

Credit Hours: 2.00. Application of fundamental laws and concepts of chemistry, physics, and biology to foods and the sensory and analytical properties of food. Evaluation of the validity of health controversies related to food ingredients.

Completion of a food additive assessment.

Credits: 2.00

NUTR 51400 - Food Chemistry Laboratory

Credit Hours: 2.00. Application of fundamental laws and concepts of chemistry, physics, and biology to foods and eating. Experiments with food will be designed, reported and critiqued using the scientific method.

Credits: 2.00

NUTR 51500 - Nutrition Pathophysiology

Credit Hours: 2.00. A review of the underlying nutritional components and pathophysiology of common human diseases/disorders and current approaches for the prevention, management, and treatment of nutrition-related diseases. Building upon previous coursework in micronutrient and macronutrient metabolism, the focus is on the metabolic disturbances occurring with diseases such as diabetes, GI diseases, obesity kidney diseases, cardiovascular disease, and anemia.

Learning Outcomes: 1. Explain the underlying nutritional aspects of several common diseases. 2. Use current information technologies to locate and apply evidence-based guidelines and protocols. 3. Use principles of pathophysiology to explain the nutritional aspects of diseases, identify nutrition-related problems and determine and evaluate nutrition interventions; this will include the integration of multiple disciplines (e.g., biochemistry, genetics, microbiology, pharmacology, physiology). 4. Have knowledge of prevention theories and guidelines for nutrition-related diseases.

Credits: 2.00

NUTR 51600 - Eating Disorders And Healthy Weight Management

Credit Hours: 3.00. An evidence-based, application-focused exploration of the continuum of healthy eating to eating disorders and the factors that influence body weight. This includes review of each eating disorder diagnosis from an interdisciplinary perspective with emphasis on the role of the registered dietitian nutritionist in prevention, identification, treatment, and recovery.

Learning Outcomes: 1. Describe the prevalence of and relevant biological, environmental, social, and psychological factors associated with the development of overweight, obesity, and eating disorders. 2. Identify the diagnostic characteristics of and understand tailored treatment interventions for anorexia nervosa, bulimia nervosa, binge eating disorder and avoidant/restrictive feeding intake disorder, as well as discuss other specified feeding and eating disorders presentation and treatment. 3. Appreciate the role of the interdisciplinary support/treatment team and various levels of care in eating disorder support and treatment while developing knowledge and aptitude in a range of nutrition therapy interventions. 4. Identify the benefits, potential risks, appropriate target population(s), and medical nutrition therapy components of diet-based, medication-based, and surgical weight management interventions. 5. Understand and be able to apply mindful and intuitive eating and health at every size approach in patient/client care as a method of preventing disordered eating, weight stigma, and body negativity and to support wellbeing and recovery. Credits: 3.00

NUTR 52100 - Advanced Medical Nutrition Therapy

Credit Hours: 3.00. Application of the Nutrition Care Process in various disease states and conditions to prepare students for supervised practice.

Credits: 3.00

NUTR 52200 - Advanced Nutrition Communications

Credit Hours: 3.00. Provides advanced training and skill development to effectively implement and evaluate food and nutrition communication to lay and professional audiences through oral, written, and mass media channels. Permission of department required.

Credits: 3.00

NUTR 52300 - Trends In Nutrition & Dietetics

Credit Hours: 2.00. Analysis and discussion of current trends in dietetics practice and nutrition including such topics as nutrigenomics, informatics, sustainability, agricultural practices, food policies, and global health. Permission of department required.

Credits: 2.00

NUTR 52900 - Basic Bone Biology

Credit Hours: 3.00. This course is designed to present the fundamentals of bone biology. The course objectives are designed to provide learners with a solid framework for understanding mechanisms, diseases, and treatments

associated with the musculoskeletal system as they advance in their education and training.

- Approximately 45 hours of lecture will help the learner achieve the objectives outlined. Lectures will be given to present information and tie into information learners have acquired or will acquire in other courses (e.g. biomechanics, physiology, molecular biology, etc.) to assist them in combining all of their courses and research experiences together into one interdisciplinary learning experience.
- Directors will attend and supervise the scheduled lecture sessions if they are not providing the lecture content, and they will be available during these times to answer questions. However, it is expected that students take additional time outside of scheduled class time to further learning.
- Materials for the learners will be posted on the course's website. These materials will include:
- Lecture notes and PowerPoints: Each lecturer will post his/her lecture notes and associated PowerPoint slides prior to the lecture.
- Additional information: As the course progresses, instructors may come across additional information that they may find useful for student learning of the material. These materials will be posted for students to utilize as they see fit.

** Materials found on other sites (e.g. social networking sites) will not be official course materials, so use at your own risk.*
** Course offered every other spring*

Credits: 3.00

NUTR 53100 - Ethical Practice And Professionalism In Dietetics

Credit Hours: 1.00. Evaluation of concepts and issues of ethical practice in the dietetics profession and the application of the Scope/ Standards of Practice for Nutrition and Dietetics Practitioners and the Code of Ethics for the Nutrition and Dietetics Profession. Permission of department required.

Credits: 1.00

NUTR 53200 - World Food Problems

Credit Hours: 3.00. (AGEC 53200) This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Credits: 3.00

NUTR 53300 - Community Nutrition Experience

Credit Hours: 3.00. Application of previous knowledge and communication skills in nutrition of community settings, such as school nutrition, health facilities, and federal or state nutrition programs.

Credits: 3.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

NUTR 53500 - Leadership In Dietetics

Credit Hours: 1.00. Evaluation of concepts and development of skills relevant to leadership in dietetics including staff development, budgeting, strategic planning, quality improvement, regulatory compliance and embracing human diversity.

Learning Outcomes: 1. Apply change management strategies to achieve desired outcomes. 2. Apply management theories to the development of programs or services. 3. Evaluate a budget/financial management plan and interpret financial data. 4. Demonstrate an understanding of the regulation system related to billing and coding, what services are reimbursable by third party payers and how reimbursement may be obtained. 5. Apply the principles of human resource management to different situations. 6. Evaluate data to be used in decision-making for continuous quality improvement. 7. Analyze quality, financial and productivity data for use in planning. 8. Practice resolving differences or dealing with conflicts. 9. Promote team involvement and recognize the skills of each member. Credits: 1.00

NUTR 53900 - Foodservice Systems

Management Experience

Credit Hours: 4.00. Application of previous knowledge and communication skills in foodservice facilities. Student's performance will ultimately include responsibilities equivalent to staff relief. Must have ServSafe Certification (manager level) prior to enrollment.

Credits: 4.00

NUTR 54100 - Food Policy And Nutrition

Credit Hours: 3.00. We will explore the nature of contemporary United States food policy and key events throughout history that have shaped what it is today. We will investigate and discuss the roles individuals, corporations, and federal, state, and other government agencies play in creating food policy, and how these stakeholders as well as complex sociological and economic factors influence the way Americans eat. These questions will lead us to consider the future of food and food policy in the United States. Can Americans develop food policy that supports the agricultural economy AND promotes the consumption of healthy foods? Could our agricultural system support this? We will learn about and explore these questions with class discussions, debate, research, guest lectures, relevant documentary films, and thought-provoking readings that present a variety of viewpoints. You will explore current, real-life problems and have an opportunity to develop potential solutions.

Credits: 3.00

NUTR 54200 - Engagement Experience

Credit Hours: 3.00. Application of previously acquired knowledge and communication skills in a culminating supervised practice experience in one of seven engagement tracks. Placements at professional sites incorporate individual student's preferred track in foodservice, industry, nutrition-fitness-wellness-energy balance, community/public health, long-term care, medical nutrition therapy or research. Students complete a major project demonstrating readiness to practice as an entry-level dietitian.

Credits: 3.00

NUTR 54300 - Medical Nutrition Therapy Experience

Credit Hours: 4.00. Application of previous knowledge and communication skills of medical nutrition therapy in the hospital/patient care setting to ultimately include responsibilities equivalent to staff relief.

Credits: 4.00

NUTR 54400 - Advanced Medical Nutrition Therapy For Special Populations

Credit Hours: 1.00. Application of Medical Nutrition Therapy for special populations including enhanced skills for the practice of dietetics. Lectures and laboratory activities supplement training in various diagnoses and conditions not routinely encountered during supervised practice experiences in NUTR 54300 Medical Nutrition Therapy Experience. Permission of department required.

Learning Outcomes: 1. Apply evidence-based guidelines, systematic reviews and scientific literature. 2. Evaluate emerging research for application in nutrition and dietetics practice. 3. Incorporate critical-thinking skills in overall practice. 4. Practice in compliance with current federal regulations and state statutes and rules, as applicable, and in accordance with accreditation standards and the Scope of Nutrition and Dietetics Practice and Code of Ethics for the Profession of Nutrition and Dietetics. 5. Function as a member of interprofessional teams. 6. Perform the Nutrition Care Process and use standardized nutrition language for individuals, groups and populations of differing ages and health status, in a variety of settings. 7. Practice routine health screening assessments, including measuring blood pressure and conducting waived point-of-care laboratory testing (such as blood glucose or cholesterol). 8. Perform routing health screening assessments including measuring blood pressure, conducting waived point of care laboratory testing (such as blood glucose or cholesterol), initiating pharmacotherapy plans (such as insulin management), and administering vaccine injections (such as flu shots). 9. Provide instruction for self-monitoring blood glucose, insulin administration and adjusting diabetes medication. 10. Insert nasogastric or nasoenteric feeding tubes. 11. Initiate and conduct bedside swallow

screenings. Credits: 1.00

NUTR 59000 - Special Problems In Nutrition

Credit Hours: 1.00 to 4.00. Individual problems dealing with various aspects of nutrition. Permission of instructor required.

Credits: 1.00 to 4.00

NUTR 59100 - Nutrition Science Graduate Experiential Learning/Internship

Credit Hours: 0.00 to 2.00. The objective of the course is to enhance graduate learning via facilitating graduate students to enhance research and data analysis skills through real-life experience. Permission of instructor required.

Learning Outcomes: 1. Gain real-life knowledge that strengthens a student's graduate learning. 2. Obtain research and data analysis skills that are important for a student's thesis but are not readily available on campus. 3. Conduct research with a collaborator to enhance a student's thesis. Credits: 0.00 to 2.00

NUTR 59600 - A Journey Through The GI Tract

Credit Hours: 2.00. This seminar-format course follows the production and then the fate of a meal of pizza and soda from the farm through the digestive system. Topics for in-depth consideration include cephalic phase responses, salivary, sensory and masticatory processes in the oral cavity, esophageal, gastric and intestinal (small and large) phases of digestion, as well as the brain-gut axis and microbial contributions to health and disease. The emphasis will be on organ and whole-body level physiology related to ingestive behavior and body weight. Prior coursework in biochemistry and physiology preferred or request permission from the instructor.

Learning Outcomes: 1. Understand the relationships between food properties and both food digestion and nutrient absorption/metabolism. 2. Understand feed-forward and backward signaling systems in the GI tract. 3. Understand the requirements and limits of digestive processes. 4. Improve their written and verbal communication skills. 5. Evaluate critically how perturbations in GI processes impact health. Credits: 2.00

NUTR 60500 - Nutritional Biochemistry And Physiology I

Credit Hours: 4.00. (ANSC 62500) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing interactions in bone and gut metabolism and physiology. Permission of instructor required.

Credits: 4.00

NUTR 60600 - Nutritional Biochemistry And Physiology II

Credit Hours: 2.00. (ANSC 62600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules, emphasizing integrative metabolism in liver, muscle and adipose tissues. Offered weeks 1 - 8. Prerequisite: NUTR 60500.

Credits: 2.00

NUTR 60700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (ANSC 62700) Integration of biochemical and physiological functions of nutrients in humans and animals, emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9 - 16. Prerequisite: NUTR 60600.

Credits: 2.00

NUTR 60900 - Food Lipids

Credit Hours: 1.00 to 3.00. (FS 60900) Importance of lipids in the diet and food systems with emphasis on changes occurring during processing, preparation, and storage. Nomenclature, physical attributes, and oxidation of lipids as well as properties and characteristics of antioxidants will be major components of the course. Offered in alternate years. Prerequisite: BCHM 56100; Prerequisite: NUTR 45300 or FS 45300.

Credits: 1.00 to 3.00

NUTR 61200 - Obesity: Behavior, Physiology And Policy

Credit Hours: 2.00. The topics in this course provide a firm conceptual foundation for graduate students interested in issues related to obesity. Topics include issues ranging from molecular to policy: there is a strong emphasis on interdisciplinary approaches and critical thinking as it is a goal to integrate the sophisticated analyses of the physiological, nutritional, developmental, genetic, sensory, socio-economic, and experiential determinants of food and fluid intake. In addition, topics in this course such as health implications of obesity, epidemiology of obesity, endocrine, energy metabolism/integration, and neurochemistry will provide the opportunity for greater interdisciplinary collaborations.

Credits: 2.00

NUTR 61600 - Special Topics In Ingestive Behavior

Credit Hours: 3.00. Explore, in-depth, important and current issues in ingestive behavior, enhance critical thinking skills, acquire professional skills (e.g. organizational, interpersonal), and develop rapport with scholars in the field.

Credits: 3.00

NUTR 61700 - Ingestive Behavior Seminar

Credit Hours: 1.00. (PSY 61801) Fosters an exchange of ideas and promotes greater familiarity among individuals from

different laboratories and departments with interests related to ingestive behavior, and gives students opportunities to build their communication skills and lead/mediate discussions at a high scholarly level. Typically offered in alternate years.

Credits: 1.00

NUTR 62600 - Advanced Presentation Skills

Credit Hours: 1.00. This course will teach graduate students how to synthesize information from multiple scientific studies and then communicate that information effectively to others in the form of a 40 minute long scientific seminar. The course is designed to provide students with clear guidelines for effective long-form oral communication of scientific information and then give students an opportunity to put those guidelines into practice. Prerequisites: Graduate standing past the first year. NUTR 69400 or equivalent course (determined by instructor review). For PhD students; INP Scientific Writing Course NUTR 62700. For MS students; a statement from the research mentor that the student has a clear thesis topic, that the student has completed the majority of work on the thesis, and that the student has conducted background reading on the thesis topic.

Credits: 1.00

NUTR 62700 - Scientific Writing In Nutrition Science

Credit Hours: 1.00. The goal of this course is to develop and practice skills for clear scientific writing. The course is designed to introduce and practice the building blocks of scientific writing, including word choice, sentence structure and paragraph structure. In addition, students will be introduced to components of a hypothesis testing biomedical research paper in order to communicate a storyline. In addition, the publication cycle will be discussed. Prerequisites: Graduate standing past the first year. NUTR 60500 and NUTR 60600 and NUTR 60700. Other students can be approved for entry by permission of the instructor.

Credits: 1.00

NUTR 63000 - Carbohydrates

Credit Hours: 3.00. (FS 63000) Carbohydrates with an emphasis on those of low molecular weight in foods. Structures, reactions, and properties of mono- and oligosaccharides. Introduction to polysaccharides and food gums. Offered in alternate years. Prerequisite: 6 credit hours in Organic Chemistry.

Credits: 3.00

NUTR 63200 - Lipids And Cell Function

Credit Hours: 2.00. This graduate-level course teaches advanced knowledge and critical thinking skills relevant to lipids in cell, tissue, and organismal physiology and pathophysiology. Students should have completed some graduate level biochemistry, physiology and nutrition coursework. Permission of instructor required.

Learning Outcomes: 1. Know several resources for research related to lipids including websites, professional organizations, journals, books and companies. 2. Name and classify lipids appropriately according to recommendations from LIPIDMAPs. 3. Describe different methods for detecting and analyzing a wide variety of lipids. 4. Describe how lipids (diet and endogenously derived) impact physiology and pathophysiology at the cellular, tissue, and organism levels. 5. Critique research published on lipids. Credits: 2.00

NUTR 63400 - Nutrition And Cancer Prevention

Credit Hours: 2.00. An in-depth examination of the role of nutrition in cancer prevention. Typically offered in alternate years.

Credits: 2.00

NUTR 64000 - Human Feeding

Credit Hours: 2.00. Critical review of the genetic, neural, metabolic, endocrine, sensory, cognitive, and cultural determinants of appetite, food selection, and energy balance. Offered in alternate years. Prerequisite: physiology, biochemistry. Masters student standing.

Credits: 2.00

NUTR 69000 - Interdepartmental Nutrition Program Grant Writing

Credit Hours: 1.00. Fulfillment of grant writing requirements for graduate students enrolled in the Interdepartmental Nutrition Program. Prerequisite: Interdepartmental Nutrition Program graduate students status. Permission of instructor required.

Credits: 1.00

NUTR 69400 - Introductory Presentation Skills In Nutrition Science

Credit Hours: 1.00. Introductory training and application of concepts for effective communication through oral and poster presentations in the field of nutrition science.

Credits: 1.00

NUTR 69500 - Interdepartmental Nutrition Program Seminar

Credit Hours: 0.00 or 1.00. Develop and strengthen skills in organization, preparation, and presentation of scientific information relevant to nutrition science to an audience of scientists.

Credits: 0.00 or 1.00

NUTR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

NUTR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission

of instructor required.

Credits: 1.00 to 18.00

Organizational Behavior and Human Resources

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

OBHR 49000 - Problems In Organizational Behavior

Credit Hours: 1.00 to 4.00. Supervised readings and reports in various subjects. Arrange with instructor before enrolling. Permission of instructor required.

Credits: 1.00 to 4.00

OBHR 59000 - Problems In Organizational Behavior And Human Resource Management

Credit Hours: 1.00 to 4.00. Advanced study and investigation in a field of organizational behavior and human resource management under the guidance of staff. Permission of instructor required.

Learning Outcomes: 1. Learning objectives vary due to nature of variable course content.

Credits: 1.00 to 4.00

OBHR 60500 - Research Methods I

Credit Hours: 3.00. An introduction to research methods. This seminar examines the use of research methods to develop empirical tests for theoretical and practical issues. It includes readings and discussions on the philosophy of science, reliability, validity, research design, threats to research, ethics, and other issues in research methodology. Students formulate hypotheses and an original research design to test their hypotheses.

Learning Outcomes: 1. Identify key decisions organizational researchers must make when crafting research proposals and conducting studies. 2. Demonstrate ability to generate a sound research proposal, based on course concepts and key research decisions discussed throughout the course. 3. Criticize the research methods employed in prior published works in the organizational literature, comparing and contrasting exemplary versus less-than-exemplary approaches. Credits: 3.00

OBHR 60600 - Research Practicum

Credit Hours: 2.00 or 3.00. Independent empirical research in organizational behavior and human resource management, including the submission of a written report. Prerequisite: OBHR 60500 . Permission of instructor required.

Credits: 2.00 or 3.00

OBHR 64600 - Human Resource Information Systems I

Credit Hours: 2.00. Designed to gain an understanding of and appreciation for the use of information systems as a tool for managing human resources. The course will introduce and master, and then apply to HR problems, a set of topical hardware and software solutions. The class project, an HRIS consulting assignment with a major corporation, will commence. Prerequisite: MGMT 65310 .

Credits: 2.00

OBHR 65200 - Organizational Development And Consulting

Credit Hours: 2.00. Organizational development (OD) refers to the application of behavioral sciences knowledge and techniques to improve organizational effectiveness (e.g., productivity, quality, service, employee satisfaction, etc.). The course will describe techniques for diagnosing organizations and interventions for improving organizations. Specific interventions will be examined in detail including structural interventions (e.g., organizational design, job design), interpersonal process interventions (e.g., process consultation, team building), and human resource interventions (e.g., performance management, career development). The course will attempt to both build knowledge and provide practice in the various techniques. The course will not duplicate material in other current course offerings by this professor, and it will not require prior courses in human resources.

Learning Outcomes: 1. Learn about the theory and practice of OD. 2. Learn about different types of OD interventions, including detailed real-world examples. 3. Learn about specific OD techniques (or methodologies), and get practice

applying some of the techniques. 4. Learn about the importance of an OD practitioner perspective in understanding and implementing OD. Credits: 2.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

OBHR 68300 - Individual Behavior In Organizations

Credit Hours: 1.00 to 3.00. This seminar provides an analysis of theory and research on individual and group behavior in organizations. Readings and discussion focus on motivation, attitudes and job satisfaction, employee participation and turnover, stress, leadership, group processes, and other issues.

Learning Outcomes: 1. Identify and define organizational behavior concepts. 2. Apply those concepts to improve your understanding of your own work attitudes and behaviors. 3. Apply those concepts to improve the functioning of your organizational unit. Credits: 1.00 to 3.00

OBHR 68400 - Research In Human Resource Management

Credit Hours: 1.00 to 3.00. Focuses on research methods, theories, and issues in HR management. A doctoral-level course designed for students interested in a research and teaching career in HR or organizational behavior. Objectives are to learn the primary theories and theoretical issues in each major area in HR, to learn the primary research methods and methodological issues, to attain a comprehensive reading list of the literature, to learn about publishing and the article review process, and to develop ideas for potential research projects.

Credits: 1.00 to 3.00

OBHR 69000 - Advanced Problems In Organizational Behavior And Human Resource Management

Credit Hours: 2.00 to 4.00. Advanced investigation in a specific organizational behavior or human resource field at the graduate level.

Credits: 2.00 to 4.00

OBHR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Organizational Leadership and Supervision

OLS 25200 - Human Relations In Organizations

Credit Hours: 3.00. A survey of the concepts that provide a foundation for the understanding of individual and group behavior in organizations. Special emphasis on typical interpersonal and leadership relationships.

Credits: 3.00

OLS 26300 - Ethical Decisions In Leadership

Credit Hours: 3.00. This class is for students interested in discussing and contemplating the difficult legal and ethical situations facing managers in all sizes and types of organizations. Students in this class will read and discuss a variety of writings on ethics in the workplace and also analyze both written and videotaped legal/ethical scenarios.

Credits: 3.00

OLS 27400 - Applied Leadership

Credit Hours: 3.00. Introduction to applied leadership in the context of organizational functions, structures, and operation.

Credits: 3.00

OLS 29801 - Leadership Seminar I For ET Student Leaders

Credit Hours: 0.00 or 1.00. New student peer leaders in Engineering and Technology will receive training to facilitate a mentoring relationship, lab, and/or recitation within the School of Engineering and Technology's formal and PLTL programs. Selected topics focus on leadership styles, group dynamics, facilitation techniques, collaborative learning techniques, redirecting strategies, and student motivation. Permission of department required.

Credits: 0.00 or 1.00

OLS 30200 - Leadership And Economic Aspects Of Sustainability

Credit Hours: 3.00. The main focus of this course is to learn how organizations make sustainability work in their organizations. You will learn about the triple bottom line (environment, social and economic aspects of business decisions) and how to make "sustainability" thrive in an organization. This course will look at how organizations: describe the benefits of sustainability for corporations and society; build a framework for implementing corporate sustainability; lead and design strategies for corporate sustainability; organize, perform evaluations and create reward systems for sustainability; implement social, environmental, and economic measuring systems; improve corporate processes, products, projects for sustainability; and manage reports for sustainability. This course will view various examples of sustainable practices in organizations, such as, Interface, Novartis, CEMEX, DuPont, Timberland, and Chiquita Brands,

which are making sustainable practices thrive in their organization.

Credits: 3.00

OLS 32700 - Leadership For A Global Work Force

Credit Hours: 3.00. This course is for present and future leaders interested in the increasingly diverse global workforce. The course will present a variety of leadership issues including expatriate assignments, international business strategies and their cultural and managerial impact, and a review of business practices around the world.

Credits: 3.00

OLS 33100 - Occupational Safety And Health

Credit Hours: 3.00. A presentation of the aspects of occupational safety and health that are essential to the organizational leaders. Special emphasis is placed on developing an understanding of the economic, legal, and social factors related to providing a safe and healthy work environment.

Credits: 3.00

OLS 34400 - Employee Benefits

Credit Hours: 1.00 to 3.00. This course will promote an understanding of employee benefit programs. Students will learn about the strategic importance of employee benefits and approaches to planning a benefits program while applying the legal, regulatory, and industry influences on employee benefits practices.

Credits: 1.00 to 3.00

OLS 34600 - Critical Thinking And Ethics

Credit Hours: 3.00. A course in complex problem solving and creative thinking with an emphasis on the ethical impacts of these solutions.

Learning Outcomes: 1. Define various approaches to the study of ethics in leadership. 2. Recognize and apply laws and regulations that affect ethical behavior in business and industry. 3. Work through processes to better identify what are real problems and perceived problems. 4. Use various techniques to ensure the real problem is identified and generate solutions. 5. Relate methods and concepts learned to new situations in order to solve problems. 6. Identify necessary steps to evaluate and implement solutions. 7. Develop individual problem solving and analytical skills. 8. Identify ethical, legal, and global challenges facing organizational leaders. Credits: 3.00

OLS 34800 - Human Resources Analytics

Credit Hours: 1.00 to 3.00. This course provides insight into uses of analytics in Human Resources (HR), why it is important, and how HR analytics add value to organization. Students will explore resources that will align an organization's mission and goals with key metrics and benchmarks.

Credits: 1.00 to 3.00

OLS 35100 - Innovation And Entrepreneurship

Credit Hours: 3.00. An in-depth study of innovation in existing organizations, as well as entrepreneurship in start-up businesses, franchises, family-owned firms, and other business formats.

Learning Outcomes: 1. Define the nature, skills, and spirit of entrepreneurs. 2. Conduct market research to develop innovative business model. 3. Conduct an industry analysis to identify competitors and industry trends. 4. Explain the benefits of selecting a diverse leadership team and employee pool. 5. Create and evaluate a business plan. Credits: 3.00

OLS 36800 - Employment Law

Credit Hours: 3.00. This course covers the regulatory environment of the employment relationship. Topics will include discrimination and Title VII of the Civil Rights Acts of 1964, recruitment and selection, affirmative action, rights of union and nonunion employees, Fair Labor Standards Act, Equal Pay Act, employee benefit plans, unemployment compensation, and right to discharge.

Credits: 3.00

OLS 37100 - Project Management

Credit Hours: 3.00. This course provides the basics of the project management discipline and allows the student to apply these skills in team-based situations.

Credits: 3.00

OLS 37500 - Training Methods

Credit Hours: 3.00. Principles, practices, and methods of employee training. Introduction to systematic training program design, development, and evaluation. Emphasis is on the supervisor as a trainer.

Learning Outcomes: 1. Define the role training and development plays in sustaining a competitive advantage across the full array of modern organizations. 2. Explain how training is a systemic process and how it relates to the overall leadership, supervision, and human resource management system of an organization. 3. Describe the purpose and scope of a training needs assessment and plan,

including its key components in designing training systems in leadership, supervision, and human resource management system of an organization. 4. Compare and contrast various training delivery methods, citing advantages and disadvantages of each. 5. Describe the essential principles of adult learning and intervention evaluation in developing and designing a training program in leadership, supervision, and human resource management system of an organization.

Credits: 3.00

OLS 37600 - Human Resource Issues

Credit Hours: 3.00. Analysis and discussion of case problems concerning typical leadership and personnel situations that impact upon the supervisor/manager. Emphasis directed toward development of attitude, philosophy, analytical ability, and problem-solving skills within the working environment.

Credits: 3.00

OLS 37800 - Labor And Management Relations

Credit Hours: 3.00. An introduction to, and overview of, the fundamental concepts of labor relations, collective bargaining, and dispute resolution procedures. An international comparative analysis is used to assess some of the legal, economic, and political structures of labor relations.

Credits: 3.00

OLS 38300 - Human Resource Management

Credit Hours: 3.00. This course teaches an overview of the human resource function in organizations today. Case studies are used to explore applications of human resource principles.

Credits: 3.00

OLS 38500 - Leadership Strategies For Quality And Productivity

Credit Hours: 3.00. Knowledge and applied leadership skills essential for establishing and continuously improving organizational effectiveness by forestalling and solving workplace problems.

Credits: 3.00

OLS 38600 - Leadership For Organizational Change

Credit Hours: 3.00. Introduction to and overview of fundamental concepts of leading organizational change. Topics include setting the stage for organizational change, implementing organizational change, sustaining organizational change, and the role of the change manager. Concepts and frameworks taught in this course are applicable to change at multiple scales from small enterprises and large corporations to communities and ecosystems.

Learning Outcomes: 1. Identify organizational culture and transformation readiness. 2. Apply various change management frameworks to leading organizational change. 3. Understand the role organizational culture plays in change and transformation. 4. Identify the effect of technological change on organizations, communities, and society. 5. Develop and apply a change management framework. Credits: 3.00

OLS 38800 - Leadership Through Teams

Credit Hours: 3.00. The group process, team development and exploration of dynamics that impact group and team performance.

Learning Outcomes: 1. Identify various principles and theories of group dynamics. 2. Plan and lead effective meetings. 3. Provide opportunities to become skilled participant-observers of team processes. 4. Demonstrate the behavior of the team leader and team members in molding work groups into high performance teams. 5. Demonstrate the process of human communications in small group context. 6. Use communication skills to more competently solve problems in task-oriented groups. 7. Use personal knowledge and interpersonal skills in dealing with people in all group types. 8. Analyze and comprehend why teams are functional or dysfunctional.

Credits: 3.00

OLS 39000 - Leadership Theories And Processes

Credit Hours: 3.00. This course integrates knowledge and skills from all associate level OLS courses and allows students to define, reflect upon, and improve their leadership abilities.

Credits: 3.00

OLS 39801 - Leadership Seminar II For ET Student Leaders

Credit Hours: 0.00 or 1.00. This course introduces ET student peer leaders to the knowledge, attitudes, and inner resources needed to be an effective leader. Students will utilize their first hand experiences to obtain the techniques to improve their leadership skills. Permission of department required.

Credits: 0.00 or 1.00

OLS 39900 - Special Topics

Credit Hours: 1.00 to 6.00. Hours and subject matter to be

arranged by staff.

Credits: 1.00 to 6.00

OLS 39901 - Special Topics In Project Management

Credit Hours: 3.00. Hours and subject matter to be arranged by faculty/staff. Primarily for upper-division majors with specific interests in project management. Permission of instructor required.

Learning Outcomes: 1. Vary with topic of each offering. Credits: 3.00

OLS 42300 - Green Organizations: Global Responsibility For Environmental And Economic Necessity

Credit Hours: 3.00. This course is interdisciplinary-emphasizing sustainability, engineering, manufacturing, technology, and leadership processes for the purpose of being environmentally responsible, cost effective, and socially responsible including guest lecturers, group discussions, and tours of businesses, locally or in other countries. Typically offered Summer Fall Spring.

Credits: 3.00

OLS 45000 - Advanced Project Management

Credit Hours: 3.00. An introduction to project management concepts and practices in the context of human resource development projects.

Learning Outcomes: 1. Apply the Project Management Institute's methodology to plan a project in the training and development field. 2. Apply instructional development methodology. Credits: 3.00

OLS 45400 - Gender And Diversity In Management

Credit Hours: 3.00. Today's workforce is composed of employees with a variety of individual differences, including race, gender, LGBTQ+, culture, national origin, mental and physical disabilities and age. This course will use the knowledge of diversity, equity, inclusion and ethical responsibilities to develop effective leadership.

Learning Outcomes: 1. Define managing diversity, valuing diversity and affirmative action. 2. Compare American cultural values with non-American cultural values. 3. Describe the major diversity issues, including inclusion, equity and ethical responsibilities, encountered in the workplace. 4. Explain how federal anti-discrimination laws affect the management of diversity and ethical responsibilities. 5. Describe how leaders can effectively manage diversity, inclusion, equity and ethical responsibilities. 6. List the major components of a diversity/inclusion program. Credits: 3.00

OLS 47700 - Conflict Management

Credit Hours: 3.00. A study of the methods for dealing with innerpersonal, interpersonal, and political disputes by means generally outside the traditional court system. Students will investigate the theoretical and practical aspects of conflict assessment, negotiation, problem solving, mediation, and arbitration.

Learning Outcomes: 1. Interpret and summarize major conflict management concepts. 2. Apply course conflict management concepts to new situations and real-world applications. 3. Assess conflict situations and apply appropriate methods to mitigate conflict. 4. Demonstrate ability to handle difficult people and situations. Credits: 3.00

OLS 47900 - Staffing Organizations

Credit Hours: 3.00. An applications-oriented study of key concepts in staffing organizations, including principles and issues in conducting job analysis; preparing job descriptions/specifications; and screening/selecting employees. Special emphasis on the design, validation, and operation of high-volume staffing systems.

Credits: 3.00

OLS 48400 - Leadership Strategies For Quality And Productivity

Credit Hours: 3.00. A study of how organizational leaders create an environment conducive to high levels of employee self-motivation, quality, and productivity (TQM). Actual case situations are used to illustrate the application of course content.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

OLS 48700 - Leadership Philosophy

Credit Hours: 3.00. A review of current managerial, education, and development theories and practices; discussions of fundamental social, economic, and political changes affecting business and the art of managing; implications of these changes for individual development and continued growth.

Learning Outcomes: 1. Discuss disparate texts/writings on leadership from different eras and cultures. 2. Exhibit familiarity with a philosophical approach to studying leadership. 3. Explain a personal leadership philosophy. Credits: 3.00

OLS 48900 - Digital Transformation

Credit Hours: 3.00. This course covers the role of digital transformation and what it means for companies. This course includes practicums in digital transformation, including business transformation strategies, and AI driven insight.

Learning Outcomes: 1. Describe the foundations of Industry 4.0. 2. Explain the history of digital transformation. 3. Evaluate business collaboration in the modern workplace. 4. Synthesize performance management goals and objectives. Credits: 3.00

OLS 49000 - Senior Research Project

Credit Hours: 1.00 to 6.00. Opportunity to study specific problems in the field of personnel, safety, supervision, and training under the guidance of an OLS faculty member.

Credits: 1.00 to 6.00

OLS 49100 - Internship Program

Credit Hours: 3.00 (West Lafayette and Tech Statewide); 1.00 to 3.00 (Calumet and North Central). A practicum designed to combine University study with work experience directly related to the student's plan of study. Permission of department required.

Learning Outcomes: 1. Apply organizational leadership theory in a corporate environment. Credits: 3.00 or 1.00 to 3.00

OLS 49101 - Internship Experiences

Credit Hours: 2.00. A practicum designed to combine University study with work experience directly related to the student's plan of study. Includes a design of an optimal interning experience as well as a written final paper and oral presentation covering the student's internship experience. Permission of department required.

Learning Outcomes: 1. Compare and contrast internship experiences of different types of organizations. 2. Describe the internship experience. 3. Evaluate the effectiveness of the internship experience. Credits: 2.00

OLS 49900 - Special Topics In Organizational Leadership And Supervision

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Permission of instructor required.

Credits: 1.00 to 3.00

OLS 50100 - Leadership And Ethics

Credit Hours: 3.00. This course is an examination of ethical, legal and policy issues facing business and technology leaders. Topics include perspectives on business ethics and values, ethical issues and theory, personal values in the workplace, values and heuristics, responses to ethical situations, corporate social responsibility, sustainability and the responsible corporation, ethical compliance, global and local values, globalization and international business. In particular, this course will ask students to examine, analyze and understand the concept of servant leadership as an ethical construct for leaders. This course uses various learning tools including the case study method and involves active discussion and debate in an online setting. Typically offered Fall Spring Summer.

Learning Outcomes: 1. Analyze a range of perspectives and approaches to the study of ethics in leadership. 2. Sharpen and synthesize critical thinking, communication and reasoning skills. 3. Enhance knowledge and application of laws and regulations that affect businesses and industry, scientific research, technology innovations and public policies. 4. Develop sound problem solving and analytical skills. 5. Strengthen research, writing, debate, and technology skills. 6. Analyze, create solutions for global, technological and security challenges for business leaders. 7. Read about, critically analyze and debate the concept of Servant Leadership as an ethical construct for leadership. Credits: 3.00

OLS 50701 - Quantitative Analysis And Analytics For Leaders

Credit Hours: 3.00. This course emphasizes the use of statistical analysis in critical decision making. Specifically, the course focuses on selecting data and running appropriate statistical analyses, synthesizing findings based upon the analyses, making decisions based upon the findings, and using multiple modes to present the data, the findings, and recommendation(s) for action.

Credits: 3.00

OLS 51500 - Foundations Of Human Resources

Credit Hours: 3.00. A survey course emphasizing the human resource function (and its development) in the context of the work organization. Human resource development topics include exploration of various training and development techniques, the relation of training to organizational strategies, training needs analysis, evaluation of training, and career development. The

strategic approach to human resource management also is covered, including what human resource professionals can and should do to help the organization succeed. Permission of Department required.

Credits: 3.00

OLS 51600 - Diversity, Equity, And Inclusion For Organizational Leaders

Credit Hours: 3.00. This course will assist students in identifying and understanding diversity, equity, and inclusion issues in the workplace. Students will engage with various theories and concepts related to workplace and societal diversity, equity and inclusion and apply them to organizational settings.

Credits: 3.00

OLS 53100 - Advanced Visual Technical Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of visually communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Apply effectively visual technical communication principles when designing publications, especially technical ones, which communicate both visually and with words. 2. Apply project management skills. 3. Apply group collaborative writing skills. 4. Design and refine publications for clients within specific situations. 5. Evaluate, use, and understand relevant software for creating visual technical communication. Credits: 3.00 or 4.00

OLS 53200 - Advanced Managing Document Quality

Credit Hours: 3.00 or 4.00. In this course, students will examine and apply principles of creating a technical or professional publication from start to finish Students will explore and practice publication quality management issues such as planning, researching audience and content, designing the publication, drafting, obtaining reviews, conducting usability testing, and negotiating within organizational cultures.

Learning Outcomes: 1. Explain the features that affect document quality. 2. Apply and explain the processes that lead to effective technical/professional publications. 3. Evaluate, use, and explain software tools that can aid technical communicators in managing the publication creation process. 4. Apply concepts relevant to effective processes that technical communicators need to understand. 5. Apply user-centered design principles and usability testing in the process of creating effective publications. 6. Synthesize ideas from secondary research concerning an emerging concept in the field that will be useful in professional practice. Credits: 3.00 or 4.00

OLS 53300 - Advanced Research Approaches For Technical And Professional Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of conducting applied research in technical and/or professional communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Generate effective research questions, suitable for workplace technical/professional communication research into audience, content, and communication approaches. 2. Conduct and report on results of secondary research relevant to technical/professional communication. 3. Design, conduct, and report on the results of primary research relevant to technical/professional communication. 4. Analyze reports of technical/professional communication research. 5. Explain the rationale for technical/professional research approaches, based on sound concepts and noting the capabilities and limitations of various approaches. Credits: 3.00 or 4.00

OLS 56300 - Sustainable Practices In Business And Industry In The European Union

Credit Hours: 3.00. This course examines and critically assesses sustainable practices in businesses, industries, and/or municipalities in Germany OR France. Students will spend one week in Marseille, France OR Mannheim, Germany visiting, touring, and analyzing businesses, industries or municipalities on their sustainable practices, culture and technical language skills.

Learning Outcomes: 1. Acquire knowledge of issues in sustainability (interdisciplinary area) as it relates to business and industry internationally and nationally. 2. Analyze, compare and contrast sustainable practices in German or France businesses or industries with

comparable U.S. businesses or industries. 3. Identify and describe trends and business practices in various sustainable organizations. 4. Utilize and synthesize sustainable knowledge from course to apply in life upon return to U.S. 5. Acquire knowledge and appreciation of German or French culture and some language skills. 6. Understand and analyze the interconnectivity of global concerns. Credits: 3.00

OLS 57100 - Advanced Project Management In Technology

Credit Hours: 3.00. This course helps students learn project management through applying technology project approaches in teams. Using project tools and templates, students learn the technology project life-cycle through actual and simulated situations. The course presents terms and approaches used in industry and allows students to apply methods individually and in teams.

Credits: 3.00

OLS 57200 - Integration Of Project Management For Leaders

Credit Hours: 3.00. This course emphasizes critical analysis, synthesis, and evaluation of theories and applications of project management knowledge and skills, leadership, communication, and stakeholder engagement. Students integrate theoretical and applied skills in planning, distributing, and managing communication; analyzing and interpreting project organization in context; and applying best practices in team management.

Learning Outcomes: 1. Compose and apply an appropriate communication strategy for a given situation. 2. Prepare professional documentation and presentations consistent with university and diverse workplace standards. 3. Demonstrate interpersonal skills consistent with expectations for project managers. 4. Apply critical and innovative thinking skills to improve their own, and other's decision making processes within projects. 5. Evaluate alternative strategies and implement major aspects of project management for a realistic project. 6. Model ethical sensitivity for a given situation. 7. Apply critical thinking and problem-solving skills to project knowledge areas and processes. 9. Consider and relate basic leadership principles and processes to address leadership issues and to remove obstacles in the project environment. 10. Locate, assess, and synthesize current literature on topics associated with project management competencies. 11. Facilitate the organizational change management process and encourage behavior to maximize project success. 12. Analyze power dynamics and organizational politics and suggest conflict management and negotiation techniques relevant to the project. 13. Identify, recognize, and engage both internal and external project stakeholders. 14. Demonstrate how project purpose, organizational structure, culture, roles, and knowledge management affect the ability to lead a project team. 15. Evaluate roles of team members, how they contribute to projects, and apply an understanding of self in how they relate to teams. 16. Apply knowledge of team building, operation, and behavior, considering factors that influence effectiveness for all types of teams, including those that are virtual and global. Credits: 3.00

OLS 57400 - Managerial Training and Development

Credit Hours: 3.00. Review of current managerial education and development theories and practices; discussion of fundamental social, economic, and political changes affecting business and the work of managing; implications of these changes for individual manager development and continued growth.

Credits: 3.00

OLS 57900 - Emerging World-Class Leadership Strategies

Credit Hours: 3.00. Exposes graduate students to the theoretical foundation and empirical research associated with emerging strategies and theories in the study of world-class leadership. The structure of the course is four fold: the discovery of critical leadership skills and behaviors, discovery of critical world-class leadership strategies, encouragement of self analysis, discovery of leadership strengths, and conducting research on leadership issues. Permission of instructor required.

Credits: 3.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.

Credits: 3.00

OLS 58100 - Workshop In Organizational Leadership And Supervision

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education. Course may be offered in traditional, distance, or blended format. Course format may vary, depending upon topic of course.

Credits: 0.00 to 8.00

OLS 58200 - Leadership and Organizational Change

Credit Hours: 3.00. Explores issues in leadership and organizational change. Included are change theories, utilizing resistance to change, contemporary approaches to change, the future workplace, and researching best practices in organizational change.

Learning Outcomes: 1. Attain an understanding of the major models of change theory. 2. Gain skills in managing change through pragmatic applications of change theories. 3. Complete a major change research project in which they investigate a change initiative, gather data, and make recommendations for successfully implementing the change. Credits: 3.00

OLS 58300 - Coaching And Mentoring In Organizations

Credit Hours: 3.00. This course explores issues and practices in technologically-driven organizations pertaining to the roles and functions that coaching and mentoring play in employee development. A "best practices" approach, utilizing the case method, is emphasized. Presented from the point of view of a human resource manager/leader, the focus of the course is on identifying coaching opportunities, enhancing communication skills, developing and implementing coaching and mentoring strategies, and evaluating the outcomes of these strategies. Attention is directed to facilitating personal coaching mentoring skills. Course may be offered in traditional, distance, or blended format. Permission of department required.

Credits: 3.00

OLS 59000 - Individual Research Problems In Supervision And Personnel

Credit Hours: 1.00 to 6.00. Opportunity to study specific problems in the field of supervision and personnel under the guidance of a qualified faculty member within the department. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

OLS 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Credits: 1.00 to 3.00

OLS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Pharmaceutical Science

PHSC 10000 - Introduction To Pharmacy And Pharmaceutical Sciences

Credit Hours: 1.00. This first semester pre-pharmacy course is designed to provide the pre-pharmacy student with an introduction to the profession of pharmacy and to Purdue University College of Pharmacy. The topics presented in this course will allow the pre-pharmacy students to develop informed perspectives on: pharmacy summer employment opportunities for students; pharmacy career opportunities; current pharmacy practice trends; the importance of professionalism, values, and ethics as it pertains to the profession; resume and cover letter development; the College's curriculum, admissions process, and course registration process.

Learning Outcomes: 1. Describe various pharmacy career paths and opportunities. 2. Discuss professionalism as it relates to the profession. 3. Discuss current pharmacy practices trends in various settings. 4. Develop a resume. 5. Develop a cover letter. 6. Describe the College's admissions process. Credits: 1.00

PHSC 20000 - Introduction To Pharmacy And Admissions Process

Credit Hours: 2.00. A second orientation course to provide students interested in pre-pharmacy an introduction to the profession of pharmacy and to the Purdue University College of Pharmacy. Topics include personal development, academic program and career planning, pharmacy career opportunities, professionalism and ethics, and the Pharm.D. curriculum and the pharmacy admissions process. The course builds on PHPR 10000, but students are not required to have taken that course in order to enroll in this course.

Learning Outcomes: 1. Identify personal

strengths and weaknesses and a plan to build on this knowledge. 2. Recognize the variety of traditional and non-traditional career options available in pharmacy. 3. Develop a personal plan for career development. 4. Reflect on how ethics and professionalism apply to the pharmacist's practice role. 5. Obtain information to be able to outline the content and structure of the Pharm.D. curriculum as well as to be able to explain the professional program application process. Credits: 2.00

PHSC 20100 - Bachelor Of Science In The Pharmaceutical Sciences Orientation II

Credit Hours: 1.00. This seminar course is designed to enhance the BSPS student's professional skills career exploration and prepare for post-graduation employment. It provides the academic content to link experiences in professional fields to study in Pharmaceutical Sciences as well as social, economic and intellectual forces that shape views and work experiences. The intent is to prepare the student to successfully transfer skills to workplace. Typically taken in the junior year. The course builds on IMPH 10000, but students are not required to have taken that course. The course consists of a mix of on-line modules and assignments and in-person class sessions.

Learning Outcomes: 1. Build on-the-job skills; and develop and cultivate professional skills and relationships. 2. Analyze self-assessment of performance, professional expectations and ethical issues involved with being professional. 3. Articulate how classroom-acquired knowledge applies to real-world situations. 4. Explore critical topics that will assist the transition into a professional environment. 5. Reflect on professional development goals and needs. Credits: 1.00

PHSC 20400 - Organic Chemistry I

Credit Hours: 3.00. A study of the compounds of carbon on a functional group basis, with particular emphasis on those organic compounds of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

PHSC 20401 - Organic Chemistry I Laboratory

Credit Hours: 1.00. Laboratory experiments to accompany PHSC 20400 performing laboratory experiments involving the methods of purification, reactions, and synthesis of organic compounds.

Learning Outcomes: 1. Perform lab exercises that demonstrate some of the principles studied in PHSC 20400 Organic Lecture. 2. Complete "dry lab" and "wet chemistry" experiments that directly relate to the contents that are covered in PHSC 20400 lecture. 3. Work together in groups to gather and analyze data in several lab exercises. Credits: 1.00

PHSC 20500 - Organic Chemistry II

Credit Hours: 3.00. PHSC 20500 is a continuation of PHSC 20400. You will learn the principles of organic chemistry with an emphasis on reactions of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action. You will continue to apply the fundamentals learned in general chemistry to the functional classes of compounds that are most important in pharmaceutical and biological chemistry.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning

and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

PHSC 20501 - Organic Chemistry II Lab

Credit Hours: 1.00. This course has been designed to help you apply the concepts of organic chemistry and to enhance your understanding of the subject. This lab is an extension of the PHSC 20401 laboratory, and you will continue to use the concepts and techniques that you learned in organic chemistry I.

Learning Outcomes: 1. Perform lab exercises demonstrating some of the principles studied in lecture. 2. Complete "wet chemistry" experiments directly related to the reactions that are covered in lecture. 3. Learn about and engage in several analytical and purification techniques like thin-layer chromatography and column chromatography. Credits: 1.00

PHSC 20800 - Biochemistry For Pharmaceutical Sciences

Credit Hours: 3.00. The overall objectives of this course are to increase students' biomedical understanding and knowledge and their ability to apply that understanding and knowledge. This requires the students in this course to learn and understand the facts, concepts, and formulaic processes, and to become skilled at applying what they have learned.

Learning Outcomes: 1. The student must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries: a. Basic principles of thermodynamics and kinetics and their role in defining chemical processes. b. The relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics. Credits: 3.00

PHSC 40000 - Research Methodology And Pharmacokinetic Concepts

Credit Hours: 1.00. This course is designed to provide students with a working knowledge of fundamental concepts in pharmacokinetics and research methodology. In particular, students will learn the importance of determining and deploying the pharmacokinetics of experimental therapeutic agents to appropriately design and analyze preclinical studies in drug discovery.

Learning Outcomes: 1. Define the concepts of clearance, volume of distribution, half-life, and systemic availability. 2. Define the key concepts for quantifying drug response, including ED50, EC50, Emax, IC50, and TD50. 3. Describe the key elements of hypothesis formulation and testing. 4. Define the terms specificity, selectivity, and sensitivity as they regard to experimental data. 5. Use basic concepts of experimental methodology, design a basic study to determine the pharmacokinetics of a drug in a species after intravenous administration of an experimental drug. 6. Provide EC50 data from cell studies on the effects of an experimental drug, design a study to determine the dose needed to achieve the EC50 in a given species. 7. Formulate a hypothesis and design a study to determine the effects of an experimental agent on a model disease, including measures of reproducibility and appropriate data analysis. 8. Design a basic study to assess the reproducibility of an assay. Credits: 1.00

PHSC 42200 - Immunology

Credit Hours: 3.00. This course exposes students to the basic principles of immunology, teaches students to use those principles to understand the cause of immunological disease and the basis of immunoprophylaxis and immunotherapy, and provides students with sufficient information to understand the principles and challenges of gene therapy and the application of genomics to future drug development.

Learning Outcomes: 1. The basic components of the immune system and their roles in innate and adaptive immunity. 2. The development and function of lymphocytes in adaptive immunity. 3. The molecular basis of antibody diversity. 4. How antigens are recognized by T cells. 5. How B cells develop and function in the body. 6. How T cells develop in the body and differentiate into specialized subsets. 7. How lymphocytes undergo positive and negative selection. 8. How B cells and T cells are activated and participate in adaptive immunity. 9. The basis of MHC polymorphism and the role on the immune response. 10. How the complement system is

activated and plays its role in immune responses. 11. How the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. How the body remembers a previous infection. 13. The types and causes of immunodeficiency diseases. 14. How infection with HIV affects the immune system. 15. How the immune system sometimes recognizes harmless antigens (allergic reactions). 16. How the immune system can damage healthy tissue. 17. The basis and practice of immunization. 18. How the immune system complicates organ transplantation. 19. How the immune system recognizes cancer cells and can be used to combat cancer. Credits: 3.00

PHSC 42400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy.

Learning Outcomes: 1. Understand the basic principles of pathophysiology and pharmacology. 2. Understand the basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHSC 42800 - Dosage Forms I

Credit Hours: 3.00. The purpose of this course is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Provide an understanding of the relationship between dosage forms, the design of dosage forms, including how to turn molecules into medicines, and drug delivery and the physicochemical properties and structures of drug molecules. 2. Enable students to comprehend the underlying principles of drug product quality and be able to apply them to engage in critical thinking of drug stability, formulation, and delivery. 3. Recognize the importance of physiological conditions on the design, selection, and performance of dosage forms. 4. Build up the knowledge in drug development and delivery and develop problem-solving skills. 5. Build a solid foundation for understanding the role of formulations in drug therapy. Credits: 3.00

PHSC 42900 - Dosage Forms II

Credit Hours: 2.00. The purpose of this course is to educate beginning pharmacy students to thoroughly understand the basic physical-chemical principles involved in preparing liquid and semisolid dosage forms and controlled drug delivery systems used in the practice of pharmacy.

Learning Outcomes: 1. Explain the basic scientific principles involved in the performance of liquid dosage forms, including solution, emulsion, and suspension, and their chemical and physical stability. 2. Explain the basic scientific principles involved in controlled drug delivery and nanomedicine and list examples. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including transdermal and mucosal routes. 4. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and iso-osmolality, IV bags and drip sets. 5. Explain how biopharmaceuticals including peptides, proteins, and nucleic acids are formulated and advise on their handling in clinical pharmacy setting. 6. Advise patients on the proper use and storage of dosage forms and understand the relationship of dosage form selection to clinical outcomes. 7. Explain unique properties of veterinary products. Credits: 2.00

PHSC 43600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. The overall objective of this course is to expand students' knowledge of biochemistry obtained in the prerequisite one-semester Biochemistry course to understanding advanced aspects of human biochemistry related to pharmaceutical sciences.

Learning Outcomes: 1. Apply an advanced understanding and knowledge of biochemistry to pharmaceutical sciences and the practice of pharmacy. 2. Demonstrate advanced understanding of biochemistry including integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and the development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and the advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Understand the molecular basis of many idiopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseased of aberrant molecular transport; including the mechanisms of DNA damage and repair and the mechanisms of action of antimetabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented as well as demonstrate understanding of the each content area is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHSC 44400 - Drug Classes And Mechanisms

Credit Hours: 3.00. This course provides an overview of the major therapeutic classes of pharmaceuticals. It integrates basic principles of medicinal chemistry and pharmacology in order to achieve an understanding of drug mechanisms. The major classes of drugs that are covered are those targeting the autonomic nervous, endocrine system, cardiovascular system, renal system, respiratory system and central nervous system, in addition to chemotherapy drugs and drugs targeting infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease. Lectures will focus on representative drugs to illustrate key concepts related to mechanisms of action.

Learning Outcomes: 1. Attain knowledge and understanding of the major drug classes. 2. Attain knowledge of the relationships among mechanisms of action, drug interactions, and adverse reactions. 3. Gain the ability to critically analyze primary literature. 4. Gain an appreciation for research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. Credits: 3.00

PHSC 46000 - Drug Discovery And Development I

Credit Hours: 3.00. Focuses on the strategies, current methods and technologies used in early stage pre-clinical research to

discover, validate and select lead drug candidates.

Learning Outcomes: 1. A variety of college outcomes related to: conceptual competence, scientific comprehension, integrative competence, critical thinking and decision-making abilities, communication skills and abilities, responsible use of professional values and ethical principles, and group interaction and citizenship. Credits: 3.00

PHSC 46100 - Drug Discovery And Development II

Credit Hours: 3.00. The course focuses on the process of drug development from pre-formulation to unit operations. The emphasis is on the scientific principles behind every step in moving from a drug molecule to its products.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the following theoretical foundations and apply these to basic anatomy/physiology, delivery of drugs from various dosage forms, relationship between chemical structure and dosage form selection, influences of pharmacokentics on formulation and dosage form design, unit operations of drug manufacturing. 2. Demonstrate comprehension of major scientific discoveries and methods. 3. Be able to use mathematical variables to analyze physical and pharmacokentic properties of a drug compound. 4. Meld theory and abilities in a practical setting to identify and provide solutions of related problems. 5. Examine issues rationally logically, and coherently. 6. Be able to read, write, speak, listen, use data, media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 7. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances, in particular, working together in their term-projects. Credits: 3.00

PHSC 48500 - Intercultural And Global Health Issues

Credit Hours: 2.00. This course is designed to meet the University Embedded Outcomes of Intercultural Knowledge, and Global Citizenship and Social Awareness. Students will discuss and develop presentations (verbal and written) about various intercultural and global health issues.

Learning Outcomes: 1. Examine health issues that have global and/or cross-cultural impact. 2. Identify and articulate personal insights about intercultural and global health issues. 3. Develop and present an oral and poster presentation in a seminar fashion. Credits: 2.00

Pharmacy

PHRM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 31600 - Drug Abuse/Addiction Education

Credit Hours: 1.00. An overview of alcoholism and other chemical addictions. Students are given the information and experience necessary to present a five-hour drug abuse education program to the public and specifically middle school students. Course is taught by undergraduate pharmacy students with oversight by staff.

Learning Outcomes: 1. Describe the pharmacology involved with classes and specific substances of abuse. 2. Discuss aspects (i.e., social, genetic predisposition, intervention, treatment) associated with the disease of chemical addiction. 3. Describe the role of the Pharmacist Recovery Network (PRN). 4. Present a drug abuse/addition program (5 hours) to a class of sixth grade students. Credits: 1.00

PHRM 38199 - Industrial Practice I

Credit Hours: 1.00. Professional practice of pharmaceutical sciences in industry. Comprehensive written report of this experience required. For cooperative program students only enrolled in the College of Pharmacy. Permission of Department required.

Learning Outcomes: 1. Applying fundamental principles of the pharmaceutical sciences studied in the classroom environment. 2. Learning to work effectively with others and in teams. 3. Clarifying opportunities best suited to individual aptitudes and interests. 4. Gaining confidence in the application of skills and abilities. 5. Developing foundation for transition into the job environment following graduation. Credits: 1.00

PHRM 38299 - Industrial Practice II

Credit Hours: 1.00. Professional practice of pharmaceutical sciences in industry. Comprehensive written report of this experience required. For cooperative program students only enrolled in the College of Pharmacy. Permission of Department required.

Learning Outcomes: 1. Applying fundamental principles of the pharmaceutical sciences studied in the classroom environment. 2. Learning to work effectively with others and in teams. 3. Clarifying opportunities best suited to individual aptitudes and interests. 4. Gaining confidence in the application of skills and abilities. 5. Developing foundation for transition into the job environment following graduation. Credits: 1.00

PHRM 38399 - Industrial Practice III

Credit Hours: 1.00. Professional practice of pharmaceutical sciences in industry. Comprehensive written report of this experience required. For cooperative program students only enrolled in the College of Pharmacy. Permission of Department required.

Learning Outcomes: 1. Applying fundamental principles of the pharmaceutical sciences studied in the classroom environment. 2. Learning to work effectively with others and in teams. 3. Clarifying opportunities best suited to individual aptitudes and interests. 4. Gaining confidence in the application of skills and abilities. 5. Developing foundation for transition into the job environment following graduation. Credits: 1.00

PHRM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39599 - Extensive Cooperative Experience

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Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39699 - Pharmaceutical Science Internship Experience

Credit Hours: 1.00 to 3.00. Professional practice with qualified employers within the pharmaceutical industry. Pre-approval of enrollment by the BSPS Committee is required as well as completion of a course paper. Department and instructor permission required.

Learning Outcomes: 1. Ensure pharmaceutical science students receive early exposure to the most common career paths taken by today's graduates and gain a first-hand perspective of industry responsibilities and activities in their roles. This contributes to a foundation for gaining appreciation of the strategies for continually evolving requirements and skills in industry. 2. Provide pharmaceutical science students with opportunities to have early in their program observation of scientists providing services, particularly those that address Pharmaceutical Science Outcome Ability Goals. These include Conceptual Competence, Scientific Comprehension, Mathematical Competence, Integrative Competence, Critical Thinking and Decision-Making Abilities, Communication Skills and Abilities, Responsible Use of Professional Values and Ethical Principles, Social Awareness and Social Responsibility, Professional Abilities and Habits, and Group Interaction and Citizenship. See the ""Student Handbook"" for specific descriptions of the components of these outcome abilities. 3. Provide pharmaceutical science students with early industry exposure that illustrates the reasons they need in-depth learning of the basic and applied sciences and a commitment to lifelong learning for professional effectiveness. 4. Provide pharmaceutical science students with experiences and learning in applications that are essential to evolving professional responsibilities in an industrial setting. 5. Contribute to pharmaceutical science student development as well as providing the vision and motivation to become a positive scientific influence or change agent. 6. Broaden students' perspectives on career pathways and foster initiatives to enhance career planning. Credits: 1.00 to 3.00

PHRM 40500 - Mindfulness

Credit Hours: 1.00. The goal of the course is to introduce students to intercultural development, identify stressors in life, and learn simple methods to reduce stress of pharmacy students. This introductory course comprises of class activities/discussions and assignments. *It is very important that respect is demonstrated by being considerate, courteous, and professional, and by maintaining confidentiality of others' information*. *There are no exams in this course.*

Learning Outcomes: 1. Facilitate learning through group discussion and presentation styles. 2. Enhance written, verbal, and nonverbal communication skills. 3. Increase awareness of professional and personal image in healthcare settings. 4. Develop professional and personal confidence and curiosity. Credits: 1.00

PHRM 41000 - Professional Communications

Credit Hours: 1.00. Professional communications will focus on developing verbal, written, and nonverbal communication skills. The goals of the course are to augment the students' knowledge about soft and hard communications, reinforce necessary skills for interactions and engagement in various healthcare settings, and develop professional and personal confidence. Class participation is expected and the format will be active learning with very few lectures. All pharmacy students are welcome - this course is not intended to focus on any particular group or class. This course comprises of home study and class discussions. *All*

discussions in class shall remain confidential. There are no exams in this course.

Learning Outcomes: 1. Facilitate learning through group discussion and presentation styles. 2. Enhance written, verbal, and nonverbal communication skills. 3. Increase awareness of professional and personal image in healthcare settings. 4. Develop professional and personal confidence and curiosity. Credits: 1.00

PHRM 41900 - Experiential Reflections In The Pharmaceutical Sciences

Credit Hours: 0.00. This course meets the requirement for the experiential component of the BSPS program in the College of Pharmacy. Students will be required to submit a written reflection on a practical experience of a minimum of 8 weeks duration that was accomplished in the past year. This reflection will include a description of the location, duration, and type of practical experiences. Students will provide a summary of key learning through the experience and how it has impacted their career plans. Students will also be required to submit a letter from their practical experience supervisor confirming the dates, place, and nature of the experience. Permission of department and instructor required.

Learning Outcomes: 1. Demonstrate proficiency in technical writing using clear, concise, logical progression of thought. 2. Demonstrate a general understanding of how different areas of expertise must come together in order to discover and develop pharmaceutical products. 3. Demonstrate the ability to reflect on career goals and opportunities. Credits: 0.00

PHRM 42500 - Pharmacy Leadership And Innovation Forum

Credit Hours: 1.00. This course introduces students to emerging trends and career opportunities in pharmacy and the pharmaceutical sciences through exposure to leaders in professional and corporate environments.

Learning Outcomes: 1. Principles of management and administration. 2. Synthesize information to draw logical conclusions. 3. Interact with other pharmacists, physicians, nurses, and other healthcare professionals to achieve positive patient outcomes. 4. Demonstrate values consistent with the provision of quality healthcare to all patient groups and populations. 5. Demonstrate awareness of key issues and debates in healthcare. 6. Demonstrate awareness of and ability to analyze internal and external factors that influence the practice of pharmacy and healthcare in an attempt to resolve practice-related problems. Credits: 1.00

PHRM 42700 - Conversations About Death And Dying

Credit Hours: 1.00. This course is open to all years of the professional pharmacy program or others with instructor permission. This course provides opportunity for open discussion of the topics of death and dying in the provision of healthcare.

Learning Outcomes: 1. Explore personal and professional feelings, beliefs, and attitudes regarding death and dying. 2. Reflect on your feeling and beliefs related to death and dying. 3. Discuss with another person their feelings, beliefs, and attitudes about death and dying. 4. Practice communication skills around death and dying. 5. Investigate a topic related to death and dying. 6. Explore the roles of health care professionals in E-o-L care. 7. Develop a personal end-of-life portfolio. 8. Compare and contrast different burial options. 9. Distinguish between different end-of-life documents. 10. Describe the components needed for a will. 11. Describe hospice and palliative care. 12. Identify issues around Physician-Assisted Dying. Credits: 1.00

PHRM 43600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. The overall objective of this course is to expand students' knowledge of biochemistry obtained in the prerequisite one-semester Biochemistry course to understanding advanced aspects of human biochemistry related to pharmaceutical sciences.

Learning Outcomes: 1. Apply an advanced understanding and knowledge of biochemistry to pharmaceutical sciences and the practice of pharmacy. 2. Demonstrate advanced understanding of biochemistry including integration of multiple areas of metabolism in

the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and the development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and the advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Understand the molecular basis of many idiopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseased of aberrant molecular transport; including the mechanisms of DNA damage and repair and the mechanisms of action of antimetabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented as well as demonstrate understanding of the each content area is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHRM 43900 - Vulnerable And Underserved Patient Care

Credit Hours: 2.00. The goal of this course is to increase knowledge of the challenges faced by underserved patient populations and ways healthcare providers can assist patients in overcoming these challenges. The course also provides exposure and experience in patient care provided in two rural federally qualified health centers (FQHCs). Students will be able to challenge preconceived notions that they may have about underserved populations and learn the impact that pharmacists can have in caring for these populations.

Learning Outcomes: 1. Discuss and reflect on one's individual views and cultural attitudes and beliefs regarding vulnerable and underserved populations. 2. Recognize characteristics of patients who are at increased risk for health and health care disparities. 3. Identify obstacles to medication adherence in vulnerable and underserved patients. 4. Summarize the roles of different individuals in the delivery of health care for vulnerable and underserved patients. 5. Analyze ethical and legal issues affecting vulnerable and underserved populations. 6. Examine financial barriers a patient may face in accessing social and health care services. 7. Identify barriers and challenges faced by vulnerable and underserved patients and consider these when developing and modifying patient care plans. 8. Demonstrate the role of pharmacists in caring for underserved and vulnerable populations. Credits: 2.00

PHRM 44200 - Introduction To The Pharmaceutical Industry

Credit Hours: 2.00. While providing an overview of the pharmaceutical industry, this course focuses on the drug development process, including clinical research, regulatory affairs, pharmacovigilance and marketing. Pharmaceutical company executives serve as guest lecturers and discuss their individual areas of expertise.

Learning Outcomes: 1. Acquire a working knowledge of the organizational structure in the pharmaceutical industry and the role the Food and Drug Administration (FDA) plays in the provision of drug development. 2. Know multiple divisions within a pharmaceutical company including, but not limited to: Regulatory Affairs, Clinical Trial Development, Pharmacovigilance, Medical Information, and Health Outcomes. 3. Know the types of attitudes, skills, abilities, and training that are necessary for pharmacists to possess to effectively work with a variety of other professionals in the pharmaceutical industry. 4. Build a network of professionals within the pharmaceutical industry for resources and guidance as he/she determines his/her career path. Credits: 2.00

PHRM 45600 - Pharmaceutical Care Of Diabetes

Credit Hours: 1.00. The purpose of this course is for students to obtain a comprehensive knowledge of the pharmaceutical care of diabetes. Students will participate in class discussions related to patient cases and learn about effective communication with patients with diabetes. In class discussions will expose the students to patient case scenarios in which they will gain an appreciation for the complexities involved with diabetes, construct evidence-based treatment plans, and enhance overall

understanding of effective diabetes management. This course provides a platform for shaping future pharmacists into excellent caregivers for patients with diabetes. Permission of instructor required.

Learning Outcomes: 1. Approximate the number of carbohydrates in a variety of foods. 2. Recommend: a) Diabetes oral medication initiation doses and dose adjustments; b) Insulin initiation doses and dose adjustments; c) Non-insulin injectable initiation doses and dose adjustments; d) Individualized medication recommendation changes. 3. Know the basic settings and methods for operating continuous glucose monitoring (CGM) devices. 4. Identify patients with diabetes who would benefit from CGM. 5. Initiate and titrate dosing for insulin injections and insulin pumps. 6. Educate a patient with diabetes on effective insulin pump use. 7. Know basic concepts surrounding the use of motivational interviewing for patients with diabetes. 8. Describe different opportunities for pharmacists to become involved in diabetic care and processes for becoming a Certified Diabetes Educator (CDE) or Board-Certified in Advanced Diabetes Management (BC-ADM). 9. Identify effective strategies to communicate with patients with diabetes. 10. Identify the role of APPE students in a variety of settings relevant to patients with diabetes. Credits: 1.00

PHRM 46400 - Preparing For Postgraduate Residency Program

Credit Hours: 2.00. This elective course will focus on preparing for the pharmacy residency program selection process. The purpose of this course is to discuss various aspects of the selection process, provide students with guidance regarding each step of the process, and provide feedback regarding materials such as curriculum vitaes (CVs), letters of intent, and thank you notes. This course is intended to guide the students through the process using events, which normally occur during the residency search including pre-Midyear preparation, navigating American Society of Health-System Pharmacists (ASHP) Midyear, the post-Midyear application and interview process, and the Match. Permission of instructor required.

Learning Outcomes: 1. Develop short-term and long-term professional and personal goals. 2. Discuss reasons why you want to complete a residency/post graduate training program. 3. Research residency programs and prepare a residency rank list based on professional and personal career goals. 4. List various ways in which residency program information can be obtained and evaluate programs based on your particular areas of interest. 5. Explain the general process involved in the residency search including navigation of ASHP Midyear Meeting, application and interview timeline, the Match process, and the post-Match process. 6. Identify key components of being a successful resident. 7. Revise a CV based on peer and faculty feedback and give appropriate feedback on others' CVs. 8. Create a professional, polished CV that can be continually updated. 9. Create a letter of intent appropriate for a residency program application. 10. Develop a complete residency application for multiple programs. 11. Demonstrate appropriate verbal and non-verbal interview skills. 12. Demonstrate professionalism throughout all course activities and interactions. 13. Demonstrate an inquisitive mindset by asking questions and actively seeking out answers to your inquires. Credits: 2.00

PHRM 46600 - Pharmaceutical Care In Oncology

Credit Hours: 1.00. This course aims to expand students' understanding of hematology and oncology topics. After completion, the student should be able to apply course concepts to actual patient cases. CLPH 49000 will be collaboratively taught by oncology pharmacists and residents from the greater Indianapolis area hospitals. Students will be exposed to relevant topics including current events, supportive care, bone marrow transplant, renal cell carcinoma, specialty pharmacy administration and leadership, oral chemotherapy, palliative care and career paths in oncology pharmacy.

Learning Outcomes: 1. Demonstrate critical thinking and decision making assessed through current event discussions and patient case presentations. 2. Demonstrate communication skills and abilities assessed through current event discussions and mock patient counseling

experience. 3. Demonstrate information literacy assessed through current event discussions. 4. Demonstrate professionalism and ethics assessed through current event discussions and palliative care case/discussions. 5. Demonstrate competence and social awareness assessed throughout all discussions and projects as it pertains to individuals with the diagnosis of cancer. Credits: 1.00

PHRM 46800 - Clinical Integration And Application

Credit Hours: 2.00. This is an elective class which gives participants more experience working up patient cases with multiple complications and an opportunity to make recommendations to a team. The material for each case will be derived from actual cases and topics will include continuity of care problems, typical problems/diseases seen in hospitalized patients, and a host of other chronic illnesses. During the 3-week class, students will have 1-1.5 hours to work on a patient case in class and address challenges faced in the clinical setting. The second half of class will be used for students to present their recommendations to a "medicine team" (made up of your classmates and teachers). Students will be responsible for creating a pharmacist problem list and making verbal drug therapy recommendations. The majority of the grade will come from in-class participation with other points coming from online quizzes, communication exercises, and follow-up answers from clinical questions.

Learning Outcomes: 1. Utilize the Pharmacists' Patient Care Process (PCPP) when evaluating and synthesizing patient care plans 2. Identify and prioritize medical problems for a complex patient each class period. 3. Interpret patient cases through the identification of pertinent objective and subjective data each class period. 4. Formulate and adjust a patient specific, evidence-based treatment plan for each identified medical problem daily. 5. Present audience appropriate, patient specific recommendations using evidence-based medicine as necessary. 6. Identify and apply relevant literature, including, but not limited to practice guidelines, landmark trials, and case reports to each patient case. 7. Prepare and communicate a drug information response including appropriate citations when requested. 8. Demonstrate the ability to self-assess one's performance and identify areas for continual professional development. Credits: 2.00

PHRM 49000 - Special Topics

Credit Hours: 0.00 to 3.00. Subject matter and method of approach individually directed by instructor. Permission of instructor required.

Learning Outcomes: 1. The development of professional skills and increased knowledge base of pharmaceutical subject matter. Credits: 0.00 to 3.00

PHRM 49500 - Pharmaceutical Research Special Topics

Credit Hours: 1.00 to 3.00. Ongoing involvement in pharmaceutical research. Pharmaceutical research subject matter and method of approach individually directed by instructor. Permission of instructor required.

Learning Outcomes: 1. Develop professional skills. 2. Increase knowledge base of pharmaceutical subject matter. 3. Direct research exposure and experience. Credits: 1.00 to 3.00

PHRM 50000 - Artificial Intelligence And Its Use In Clinical Care

Credit Hours: 2.00. The course comprehensively covers key topics such as the mechanisms behind how AI functions, the capabilities and limitations of current technologies, and important considerations around data privacy, bias, and health equity. Ethical issues are also explored through analyses of real-world case studies. The course equips participants with a solid foundation to thoughtfully engage with, evaluate, and contribute to the ongoing integration of AI into clinical practice and beyond.

Learning Outcomes: 1. Identify various applications and settings where AI is being utilized in healthcare today and where it will migrate to in the future. 2. Describe the technical underpinnings of how AI tools are built and function. 3. Analyze the clinical and social impacts of AI for patient care including how patients are using these tools as well as various ethical and regulatory issues. 4. Synthesize a solution to clinical cases using AI tools to improve your skills in the healthcare industry. Credits: 2.00

PHRM 69500 - Introduction To Pharmaceutical

Sciences Research

Credit Hours: 0.50. Introduction of new graduate students to graduate programs, various disciplines, and the research environment in the College of Pharmacy, and prepare them for their graduate studies at Purdue College of Pharmacy. Each meeting is expected to have ~90 minutes presentation(s) and 30 minutes student discussion. Permission of department required.

Learning Outcomes: 1. Know the graduate programs and their classmates and peers. 2. Understand pharmacy as a profession and recognize various scientific and research areas in pharmaceutical sciences. 3. Have a fundamental understanding of professionalism and research conduct. 4. Start utilization of career development tools including individual development plan (IDP). 5. Understand the general framework for conducting research that constitutes of literature search, hypothesis development, data keeping, and scientific writing. Credits: 0.50

PHRM 80000 - Integrated Pharmacotherapy I

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80100 - Integrated Pharmacotherapy II

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and

utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80200 - Integrated Pharmacotherapy III

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80300 - Integrated Pharmacotherapy IV

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various

therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80400 - Integrated Pharmacotherapy V

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80500 - Integrated Pharmacotherapy VI

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist,

regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80600 - Integrated Pharmacotherapy VII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80700 - Integrated Pharmacotherapy VIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology,

pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80800 - Integrated Pharmacotherapy VIIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health

improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80900 - Integrated Pharmacotherapy X

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 81000 - Basics Of Immunology

Credit Hours: 1.00. The goal of PHRM 81000 (Basics of Immunology) is to expose the student to the basic principles of immunology and enable the student to use these principles to understand how the immune system combats infections. This goal will be achieved through online recorded lecture and out of class reading assignments and quizzes. The student will be expected to understand basic immunological concepts and apply this knowledge to solving problems involving the integration of the various components of the immune system.

Learning Outcomes: 1. Discuss the basic components of the immune system and their roles in innate and adaptive immunity. 2. Discuss the development and function of lymphocytes in adaptive immunity. 3. Discuss the molecular basis of antibody diversity. 4. Discuss how antigens are recognized by T cells. 5. Discuss how B cells develop and function in the body. 6. Discuss how T cells develop in the body and differentiate into specialized subsets. 7. Discuss how lymphocytes undergo positive and negative selection. 8. Discuss how B cells and T cells are activated and participate in adaptive immunity. 9. Discuss the basis of MHC polymorphism and the role in the immune response. 10. Discuss how the complement system is activated and plays a its role in immune responses. 11. Discuss how the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. Discuss how the body remembers a previous

infection. Credits: 1.00

PHRM 81100 - Integrated Case Studies I

Credit Hours: 1.00. This is the first course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81200 - Integrated Case Studies II

Credit Hours: 1.00. This is the second course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes

to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81300 - Integrated Case Studies III

Credit Hours: 1.00. This is the third course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81400 - Integrated Case Studies IV

Credit Hours: 1.00. This is the fourth course in a series of five

courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81500 - Integrated Case Studies V

Credit Hours: 1.00. This is the fifth course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-

specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81600 - Introduction To Patient-Centered Care

Credit Hours: 2.00. This course teaches students the key communication principles and skills necessary to deliver direct patient care and interact with other health care professionals. This includes developing cultural self-awareness, evaluating patient comprehension, and improving personal communication skills.

Learning Outcomes: 1. Apply the steps of the PPCP to collect and analyze patient-specific information, assess the information, develop and implement a patient-centered plan, and follow-up once the plan has been implemented. 2. Identify patient-specific factors and incorporate these aspects into patient care. 3. Demonstrate effective communication skills for patients, caregivers, peers, and other healthcare providers. 4. Develop strategies to appropriately adjust behavior or communication style based on cultural and communication considerations to optimize patient care. 5. Begin to develop a structured clinical thought process when presented with a patient case. 6. Work effectively within a group of peers to evaluate a patient's case and complete clinical documentation. Credits: 2.00

PHRM 81700 - Introduction To Self-Care

Credit Hours: 2.00. This course introduces students to the principles and practices of self-care and over-the-counter (OTC) medications. Students will learn to assess and recommend appropriate self-care treatments for common conditions, considering patient-specific factors. The course covers nonprescription medications, including their pharmacology, indications, contraindications, and proper use. It also teaches techniques for evaluating patient symptoms and determining when self-care is appropriate versus when to refer to a healthcare provider. Additionally, students will explore strategies for educating patients on lifestyle modifications and preventive measures to maintain health and well-being. By the end of the course, students will be equipped with the knowledge and skills to confidently guide patients in self-care practices and make informed recommendations for OTC therapies.

Learning Outcomes: 1. Identify common self-care conditions and describe both non-therapeutic and therapeutic treatment options for non-prescription management of self-care conditions. 2. Apply therapeutic knowledge to patient care. By the end of this course, students will be able to effectively apply the Pharmacist Patient Care Process (PPCP) to gather and assess patient information, identify patient-specific factors, and make informed decisions regarding self-care and non-prescription therapies. 3. Demonstrate advanced communication and drug information skills. Credits: 2.00

PHRM 81800 - Professional Identity Formation And Leadership

Credit Hours: 1.00. This course is designed to enhance the PharmD P-1 student's professional skills, career exploration and prepare for internships, post-graduation employment or continuing education plans. It provides academic content to link experiences in professional fields to study in pharmacy as well as social, economic and intellectual attitudes that shape views and work experiences. It also introduces Professional Identity Formation (PIF), which is defined as "a complex and transformational process of internalizing a profession 's core

knowledge, skills, values and beliefs, resulting in an individual "thinking, acting and feeling" like a member of that professional community." (AACP) The course will build the student's professional skills and attitudes, with activities and experiences, intended to advance professional, personal, and career development. The topics and activities are purposely designed and implemented to ensure an array of opportunities for students to document competency of advocacy, self- awareness, leadership, and professionalism.

Learning Outcomes: 1. Prepare for a transition to a professional career setting after graduation through self-reflection, self-assessment of performance, and goal setting, while learning tools and strategies to navigate personal and professional values and interests. 2. Understand the importance of on-the-job training and experiential opportunities; and learn how to develop and cultivate professional skills and relationships. 3. Articulate professional expectations and learn how to navigate ethical issues involved with being a professional. 4. Identify personal leadership traits and skills while understanding multiple leadership and communication styles. 5. Identify career interests or goals and understand the pathways to different careers in pharmacy. Credits: 1.00

PHRM 82000 - Professional Skills Laboratory I

Credit Hours: 2.00. Experiments, computer simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82100 - Professional Skills Laboratory II

Credit Hours: 2.00. Continuation of PHRM 82000 with emphasis upon modules that provide laboratory practice experience designed to integrate basic science concepts and practice applications. Small group problem-solving methodology will be utilized as appropriate.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82200 - Pharmacy Skills And Patient Counseling

Credit Hours: 2.00. Pharmacy Skills and Patient Counseling is a two credit hour, required first professional year experiential course combining practical experience in the Purdue University Pharmacy with lecture. Students are monitored by faculty instructors, staff pharmacists and Advanced Pharmacy Practice Experience (APPE) students. Students must have a valid Social Security number the first week of class.

Learning Outcomes: 1. Recall and apply brand and generic names, common uses, strengths, doses, side effects and counseling points of commonly used medications. 2. Recall and apply federal and state laws. 3. Obtain pertinent patient information during the prescription intake process. 4. Recall and apply commonly used pharmacy abbreviations, conversions, and computer software functions. 5. Process and dispense new and refilled prescriptions according to federal and state law requirements. Credits: 2.00

PHRM 82400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy. Prerequisite: MCMP 20400, 20500, 20800, and BIOL 20300, 20400 or 30100, 30200. Departmental permission required.

Learning Outcomes: 1. Conceptual Competence: Pathophysiology, Principles of pharmacology. 2. Scientific Comprehension: Basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Critical Thinking and Decision Making Abilities: Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Communication Skills and Abilities: Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Responsible use of Professional Values and Ethical Principles: Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Professional Abilities and Habits: Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHRM 82500 - Integrated Pharmacotherapy I

Credit Hours: 6.00. This course will serve as an integrated approach to the physiology/pathophysiology, medicinal chemistry, pharmacology, pharmacokinetics/ pharmaceutics, and pharmacotherapeutics of the following topics: fluids/electrolyte pharmacotherapy, renal diseases, acid/base disorders, clinical nutrition, autonomic nervous system (ANS), pulmonary diseases, hematology, immunology, and rheumatology. The emphasis of this course is knowledge and skill development. Also in the process of completing the objectives, attitudes toward the role of the pharmacist and patient-related issues will be imparted.

Learning Outcomes: 1. Conceptual Competence: The student must demonstrate evidence-based knowledge of the following theoretical foundations of the profession and apply these to individual practice settings. Basic anatomy/physiology; Pathophysiology; Diagnostic methods and decision making; Principles of pharmacology; Relationship between chemical structure and biological activity; Delivery of drugs from various dosage forms; Pharmacotherapy; Drug interactions; Treatment guidelines. 2. Scientific Comprehension: The students must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries. Basic principles of drug design and the chemical and biochemical mechanisms of drug action; The relevance of molecular biology, biochemistry, and pharmacogenomics and apply key principles of disease states and therapeutics. 3. Mathematical Competence: The students must be able to use mathematical variables to analyze physical, biological, and socioeconomic phenomena. Perform error-free mathematical calculations with regard to drug dosing and pharmacokinetics. 4. Integrative (Practice-related) Competence: The student must be able to meld theory and abilities in the practice setting to enhance positive patient outcomes. Provide patient-centered pharmaceutical care; Promote health improvement and disease prevention; critically evaluate patient data, literature sources, and drug products; provide specific, sound, cost effective, evidence-based drug and healthcare recommendations; design, implement, and evaluate patient specific

pharmacotherapeutic regimens; select the proper drug, dose, and dosage form for a specific patient; design strategies to monitor patients' drug regimens for therapeutic and toxic effects of medications; design strategies to avoid or manage drug interactions and adverse drug events; identify and implement strategies to encourage patient adherence to therapeutic interventions. 5. Critical Thinking and Decision Making Abilities: The student must examine issues rationally, logically, and coherently; and shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar context. Synthesize information in order to draw logical conclusions; provide evidence-based support for arguments, recommendations, and solutions; demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. Credits: 6.00

PHRM 82600 - Introduction To Patient Centered Care

Credit Hours: 4.00. The introductory course teaches students the key communication principles and skills necessary to deliver patient care and interact with other health care professionals. This includes performing basic physical assessments, evaluating patient comprehension, and improving personal communication skills.

Learning Outcomes: 1. Identify and perform physical assessment techniques based on disease states. 2. Demonstrate the ability to interpret and use assessment values appropriately. 3. Demonstrate communication skills to effectively advise and counsel patients. 4. Demonstrate effective communication skills when conveying patient information or therapeutic recommendations to healthcare providers. 5. Develop strategies to appropriately adjust behavior or communication style based on cultural and communication considerations in order to optimize patient care. 6. Develop strategies to modify therapeutic regimens based on an assessment of patient readiness and motivation. 7. Develop strategies to address issues related to patient adherence to therapeutic recommendations. 8. Demonstrate skills to interview patients, evaluate medication regimens, respond to health-related needs, and develop an action plan for addressing therapeutic issues. Credits: 4.00

PHRM 82800 - Dosage Forms I

Credit Hours: 3.00. The purpose of Dosage Forms I is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Explain the basic scientific principles involved in drug delivery such as dissolution, chemical stability, physical stability, content uniformity, and bioavailability. 2. Describe the essential scientific principles involved in the design of solutions, emulsions, suspensions, as well as dermatological and ophthalmic dosage forms. 3. Evaluate the quality parameters of dosage forms that are involved in product selection. 4. Analyze and interpret the results of bioequivalence studies that are important in product selection. 5. Advise patients on the proper use and storage of liquid dosage forms. Credits: 3.00

PHRM 82900 - Dosage Forms II

Credit Hours: 2.00. Education in the use of dosage forms to deliver drugs. Collaboration with peers and other members of the health care team regarding the proper use of the various dosage forms so that the desired therapeutic objective is achieved.

Learning Outcomes: 1. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to

maintain sterility, solution isotonicity and isoosmolality, IV bags and drip sets. 2. Explain the basic scientific principles involved in the performance of solid dosage forms, including amorphous and crystalline solids, polymorphism, dissolution, diffusion, chemical and physical stability, bioequivalence and bioavailability. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including oral, buccal, rectal, subcutaneous and transdermal routes. 4. Evaluate quality parameters for solid dosage forms, as an aid to product selection. 5. Advise patients on the proper use and storage of solid dosage forms, and understand the relationship of dosage form selection to clinical outcomes. 6. Explain the factors involved in the use of generic versions of solid dosage forms and their influence on therapeutic outcomes, including the ability to identify drugs for which switching to a generic form should be approached with caution. Credits: 2.00

PHRM 83100 - Health Care Systems

Credit Hours: 2.00. This course is envisioned as a primarily didactic course whose main purpose is to provide students with an introduction to the structures and functions of the United States Health Care System. It is also designed to provide the student an opportunity to compare and contrast the methods used in other countries to address the needs of society for provision of health care to its members.

Learning Outcomes: 1. Able to meld theory and abilities in the practice setting to enhance positive patient outcomes. 2. Promote health improvement and disease prevention. 3. Identify and implement strategies to encourage patient adherence to therapeutic interventions. 4. Examine issues rationally, logically, and coherently, and shall acquire evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 5. Sythesize information in order to draw logical conclusions. 6. Provide evidence-based support for arguments, recommendations, and solutions. 7. Read, write, speak, listen, and use media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 8. Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 9. Interact with other pharmacists, physicians, nurses, and other healthcare professionals to achieve positive patient outcomes. 10. Interact with technicians and other support staff to develop and maintain a positive and productive work environment. 11. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. 12. Maintain professional competence through sound judgment, ethical behavior, adherence to legal guidelines and socioeconomic principles. 13. Demonstrate values consistent with the provision of quality healthcare to all patient groups and populations. 14. Demonstrate an understanding of self, the strengths and challenges of cultural diversity, and the historic responses of society in times of rapid change. 15. Demonstrate awareness of key issues and debates in healthcare. 16. Self-assess and satisfy learning and continuous professional development on an ongoing basis. 17. Take an active role in professional and community organizations and promote advocacy for key healthcare and professional initiatives. 18. Demonstrate awareness of and be able to analyze internal and external factors that influence the practice of pharmacy and healthcare policy in an attempt to resolve practice-related problems. 19. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances. 20. Demonstrate awareness of the roles of various

healthcare professionals in multiple healthcare environments. Credits: 2.00

PHRM 83300 - Introduction To Case Studies

Credit Hours: 1.00. This course will focus on medical terminology, discovery of different sections of a patient chart, exploration of the components of a SOAP note and other documentation types, orientation to the teaching electronic medical record (tEMR), and reinforcement of the Pharmacists' Patient Care Process (PPCP) with a focus on what is unique or different in the care provided by a pharmacist. A primarily online method for content delivery will be utilized. Multiple in person case-based sessions will be incorporated throughout the semester. Material covered is meant to supplement and augment that gained in PHRM 82600, PHRM 82500, and the PPL sequence.

Learning Outcomes: 1. Introduce students to basic medical terminology, electronic medical records and clinical documentation types. 2. Create a foundation for development of necessary case review skills incorporating the components of the PPCP. Credits: 1.00

PHRM 83400 - Pharmaceutical Calculations

Credit Hours: 1.00. Mastery of pharmaceutical calculation skills is vital and PHRM 83400 prepares students to apply calculation problem solving skills to clinical practice. PHRM 83400 prepares students to perform pharmaceutical calculations necessary for prescription/drug order preparation, compounding dosage forms, and medication dosage calculations based on patient specific factors. Pharmacists must perform error-free pharmaceutical calculations. Correct calculations contribute as much to pharmaceutical care as the newest methods/guidelines for diagnosis, treatment, and prevention. The development of problem solving skills with pharmaceutical calculations is an important component of this course. In addition, practice and repetition of problems is necessary to develop confidence as well as accuracy. Appropriate documentation of work/set up and numerical answers (including units) is required. Approaches to minimize errors and maximize accuracy with pharmaceutical calculations are emphasized.

Learning Outcomes: 1. Describe the role of pharmaceutical calculations in the provision of pharmaceutical care. 2. Perform accurate/error-free pharmaceutical calculations in an organized, clear, and appropriately documented format. 3. Express numerical answers in a clear manner which includes units and appropriate use of zeros with decimal points. 4. Interpret abbreviations and professional nomenclature in prescriptions/drug orders. 5. List the equivalents/conversion factors for the systems of measurement used in pharmacy (i.e., metric, apothecary, avoirdupois, and household). 6. Convert from one unit to another between and within the various systems of measurement used in pharmacy. 7. Calculate quantities of ingredients necessary to reduce or enlarge a pharmaceutical formula. 8. Define and appropriately utilize specific gravity in pharmaceutical calculations. 9. Define and perform pharmaceutical calculations using various expressions of concentration [i.e., percentage (i.e., W/V, V/V, W/W), ratio strength, milligram percent, parts per million] used in pharmacy. 10. Calculate a patient's body surface area (BSA) utilizing a nomogram and/or BSA formula and apply in dose determinations. 11. Calculate ideal body weight (IBW) and estimated creatinine clearance (CrCl) rates and apply in dose determinations. 12. Calculate body mass index (BMI) from a standard formula. 13. Calculate appropriate medication dosages based on patient specific factors. 14. Calculate admixed intravenous (IV) solution quantities/volumes. 15. Calculate intravenous (IV) solution flow rate. 16. Perform the calculations necessary to prepare isotonic compounded solutions. 17. Perform calculations for the preparation and use of stock solutions. 18. Perform calculations for altering product strength by dilution or concentration. 19. Solve problems associated with compounding in contemporary practice. Credits: 1.00

PHRM 83500 - Principles Of Pharmacokinetics

Credit Hours: 3.00. This course introduces the theory and concepts of pharmacokinetics and biopharmaceutics. It provides the student with a foundation for more advanced therapeutic concepts in subsequent courses. The learner will develop expertise in quantifying drug absorption, distribution and elimination from concentration vs. time data or urinary drug excretion vs. time data to estimate primary pharmacokinetic parameters. Use of these parameters is required to design and modify individual drug-dosing regimens.

Learning Outcomes: 1. Describe the general

physiological processes and factors that influence drug dissolution, absorption, distribution, metabolism and excretion. 2. Define and describe the pharmacokinetic features of parallel, sequential, and reversible first-order processes. Define and describe the pharmacokinetic features of zero-order and first-order, and Michaelis-Menten processes. 3. Anticipate the effects of altering rate and extent of absorption, clearance, volume of distribution on the amount of drug in the body following an oral dose. 4. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance dose of drugs eliminated by first-order kinetics. 5. Collect relevant patient information and relevant drug information data in order to calculate the appropriate loading and maintenance dose of a drug. 6. Design and modify dosing regimens given patient-derived information such as plasma concentration vs. time data and dosing regimen. 7. Quantitatively draw the concentration vs. time curves when clearance, volume of distribution or bioavailability changes and explain how the curves have changed. 8. Define and describe relative and absolute bioavailability the factors controlling bioavailability from various routes of administration. Determine if absorption or elimination rate-limits drug absorption kinetics. 9. Describe the pharmacokinetic parameters that determine the time course of active metabolite disposition. Determine if formation or elimination rate-limits active metabolite kinetics. 10. Describe drug disposition based upon physiological determinants in terms such as organ perfusion, unbound intrinsic clearance, free fraction in plasma and in tissue. 11. Describe, with examples, how altered physiology (e.g., renal disease, liver disease, pregnancy, advanced age) affects the disposition of drugs. Define and describe the principles of hemodialysis and how this alters the disposition of drugs. 12. Define steady-state concentration and describe the controlling factors following a constant rate intravenous infusion. Use pharmacokinetic parameters to predict drug concentrations during and after a constant rate infusion, with or without a bolus dose. 13. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance doses of drugs. Predict the rate and extent of drug accumulation for a given regimen of fixed dose and interval. 14. Define and describe the basic models used to characterize the kinetics of effect (pharmacodynamics). Credits: 3.00

PHRM 83600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. This course provides instruction in biochemistry that builds on basic knowledge by presenting content on advanced aspects of human biochemistry for students in pharmaceutical sciences. The content emphasizes the integration of biochemical knowledge and the application of biochemical understanding to medically relevant situations including disease etiology, medical diagnosis, disease research, drug discovery, drug and toxin mechanisms of action, and mechanism of drug metabolism.

Learning Outcomes: 1. Understanding and knowledge of biochemistry to an advanced level and to increase the ability to apply that understanding and knowledge to pharmaceutical sciences and the practice of pharmacy. 2. Advanced understanding of biochemistry includes integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and advanced aspects of molecular transport, membrane

function, enzyme kinetics, and the enzymology of drug metabolism. 3. Application of biochemical understanding and knowledge includes understanding the molecular basis of many idopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseases of aberrant molecular transport. It also includes the mechanisms of DNA damage and repair and the mechanisms of action of anti-metabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented in this course, as well as demonstrate understanding of the concepts in each content area presented in this course ta is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHRM 83800 - Interprofessional Education (IPE) Experience I

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Describe the role of team-based care in helping patients or clients to navigate the complexity of the healthcare system. 2. Explain roles and responsibilities of team members represented at the learning event. 3. Recognize the value of interprofessional team practice. 4. Recognize the value of actively seeking the contributions of other professions and perspectives. Credits: 0.50

PHRM 83900 - Interprofessional Education (IPE) Experience II

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Use specific communication tools and methods within a team setting. 2. Describe the roles within the team and how they relate to the team as a whole. 3. Assess their role within the team and ways to improve their contributions to the team. 4. Identify ways to improve team effectiveness and performance. Credits: 0.50

PHRM 84000 - Professional Skills Laboratory III

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as the development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84100 - Professional Skills Laboratory IV

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts form the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84200 - Community Pharmacy IPPE

Credit Hours: 3.00. A 3-credit hour required experiential course in the summer before the 2nd year of professional Doctor of Pharmacy program. Students learn community pharmacy operations and patient counseling skills.

Learning Outcomes: 1. Perform basic functions and skills in a community practice setting. 2. Document a minimum of 160 hours of performance-based experience in a community pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in community practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the community pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in community pharmacy. 12. Reflect on new information learned. 13. Describe and reflect on the community pharmacy work environment and staffing. 14. Describe and reflect on the steps involved in the prescription filling and dispensing. 15. Formulate and describe opinions on the quality of patient care. 16. Describe and reflect on common causes of medication errors and methods of prevention and apply knowledge to suggest system improvements. 17. Conduct an effective, conversational interview with a patient about medication use. 18. Review the patient's medications in relation to their condition(s) or disease(s). 19. Describe common problems/barriers patients encounter with medications. 20. Utilize pharmacy references and document sources of information. 21. Formulate an opinion on the value of pharmacists' involvement in patient care. 22. Prepare a formal recommendation letter to a healthcare provider. 23. Reflect on successes of the assignment and self-assess the need for improvement. Credits: 3.00

PHRM 84300 - Population Health Management

Credit Hours: 3.00. Pharmacists are increasingly called upon to participate in the management of large population-based programs requiring managed care principles and a basic understanding of the healthcare system models, healthcare payment models, and the principles of pharmaceutical outcome research. These activities require knowledge and skills relative to comparative effectiveness research, pharmacoepidemiology, and Pharmacoeconomics. The core content of this three-credit hour course will include managed care principles, health care disparities, health care financing, actual and potential pharmacist roles in health systems and managed care, and specialty pharmacy.

Learning Outcomes: 1. Describe the foundations of population health and the related factors influencing the health and wellness of a defined community. 2. Compare and contrast population health and public health. 3. Define and employ the terminology associated with population health. 4. Identify and stratify perspective populations used in providing healthcare. 5. Describe epidemiologic principles used in the provision of population health. 6. Compare the similarities and differences, and potential conflict in providing individual versus population health. 7. Locate, interpret, and evaluate demographic and population health data. 8. Describe the importance of population health to pharmacy and in providing healthcare to communities and within healthcare systems. 9. Identify the inequities in the provision of healthcare in the US and in certain sub-populations. 10. Describe key factors responsible for the inequities in healthcare. 11. Describe and contrast the delivery of and resources utilized in providing healthcare across the life span. 12. Describe how insurance

coverage impacts the access to healthcare in the US. 13. Analyze the link between social factors and health outcomes. 14. Describe and evaluate management strategies and tools used to provide healthcare to populations of patients. 15. Recognize and apply the theoretical foundations of Pharmacoeconomics, pharmacoepidemiology, and health outcomes research to the provision of healthcare and pharmacy services within population health. 16. Describe the importance of a robust primary care foundation in the provision of population health. 17. Describe the components and potential vulnerabilities of the pharmaceutical supply chain and the role that pharmacists play in maintaining a safe and robust supply of pharmaceutical and medical supplies to all patient groups. 18. Formulate strategies for engaging stakeholders in population health interventions. 19. Describe the principles of managed care and select those strategies most appropriate for populations of patients. 20. Discuss key components of integrated population health management and how value-based care payment models are being used to influence provider and patient behaviors. 21. Describe the role of specialty pharmacy in the provision of healthcare services. 22. Describe the role of digital innovation in the provision of population healthcare services. 23. Interpret the data set to suggest management strategies, given a scenario with population data. 24. Analyze the application of population health interventions in real-world settings. 25. Describe key leadership strategies that pharmacists and use to build teams, lead, and implement population health initiatives. Credits: 3.00

PHRM 84400 - Integrated Pharmacotherapy II

Credit Hours: 6.00. This course will provide an integrated approach to instruct the students in physiology, pathophysiology, pharmacology, medicinal chemistry, and therapeutics relevant to diseases of the endocrine and cardiovascular systems. When applicable, special emphasis will be placed on presenting the interrelationships between deficits in endocrine function and cardiovascular disease. In addition, students will study and critique current therapeutic approaches and opinions in the application of replacement therapy with natural, synthetic, or recombinant hormone preparations.

Learning Outcomes: 1. Know basic anatomy/physiology. 2. Know Pathophysiology. 3. Know diagnostic methods and decision making. 4. Know Principles of pharmacology. 5. Know relationships between chemical structure and biological activity. 6. Know delivery of drugs from various dosage forms. 7. Know Pharmacotherapy. 8. Know Drug interactions. 9. Know Treatment guidelines. 10. Know basic principles of drug design and the chemical and biochemical mechanisms of drug action. 11. Know the relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics. 12. Perform error-free mathematical calculations with regard to drug dosing and pharmacokinetics. 13. Provide patient-centered pharmaceutical care. 14. Promote health improvement and disease prevention. 15. Evaluate patient data, literature sources, and drug products. 16. Provide specific, sound, cost effective, evidenced-based drug and healthcare recommendations. 17. Design, implement, and evaluate patient specific pharmacotherapeutic regimens. 18. Select the proper drug, dose, and dosage form for a specific patient. 19. Design strategies to monitor patients' drug regimens for therapeutic and toxic effects of medications. 20. Design strategies to avoid or manage drug interactions and adverse drug events. 21. Identify and implement strategies to encourage patient adherence to therapeutic interventions. 22. Synthesize information in order to draw logical conclusions. 23. Provide evidence-based support for arguments, recommendations, and solutions. 24. Demonstrate the ability to make sound decisions given complex scenarios in a

time-constrained environment. 25. Present information to colleagues and other healthcare practitioners, and the general public, regarding drug therapy and related topics. 26. Demonstrate awareness of key issues and debates in healthcare. 27. Demonstrate cultural competence that includes awareness of the impact that cultural, social, and ethnic differences can play in the provision of healthcare and the workplace. 28. Discuss and remain open to differences of opinion and defend rational opinions that differ from those of other healthcare professionals. Credits: 6.00

PHRM 84500 - Integrated Pharmacotherapy III

Credit Hours: 6.00. This course will develop knowledge and skills regarding the physiology/ pathophysiology, medicinal chemistry, pharmacology, pharmacokinetics/pharmaceutics, and pharmacotherapy of specific cardiovascular diseases, neurology diseases, and psychiatric disorders.

Learning Outcomes: 1. Explain structure-function relationships of drugs used for the management of ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine, headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. 2. Explain the pharmacology of drugs used for the management of ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine, headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. 3. Describe the pathophysiologic processes responsible for specific disease states and integrate this knowledge into the therapeutic decision making process. 4. Evaluate various therapeutic alternatives for a given disease state in light of specific patient factors and design a patient-specific pharmacotherapeutic regimen. This will include assessing the effectiveness of therapy on the basis of clinical and laboratory parameters. 5. Describe adverse effects associated with drugs used for the management of ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine/headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. 6. Design evidence-based drug therapy treatment plans for patients with ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine/headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. Credits: 6.00

PHRM 84700 - Principles Of Pharmacogenomics

Credit Hours: 2.00. This course is designed to introduce the theory and concepts of pharmacogenetics, pharmacogenomics, and precision medicine. The course will provide the student learner broad knowledge for advanced integrated therapeutic strategy based on a patient's genetic information. The learner will develop expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized data and pharmacogenomic information. This course offers a platform for shaping next-generation pharmacists into an era of precision medicine.

Learning Outcomes: 1. Broad knowledge for advanced integrated therapeutic strategy on patient's genetic information. 2. Develop expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized

data and pharmacogenomics information. Credits: 2.00

PHRM 84800 - Principles Of Drug Information And Literature Evaluation

Credit Hours: 3.00. This course is designed to provide students with the fundamental skills needed for the provision of drug information in pharmacy practice. Emphasis is placed on the evaluation, interpretation, and practical implications of primary medical literature on the delivery of pharmaceutical care. Four recently published clinical trials will be reviewed and discussed throughout the semester to illustrate contemporary issues in the interpretation of biomedical research.

Learning Outcomes: 1. Discuss the fundamentals and importance of drug information skills for all pharmacists. 2. Demonstrate effective verbal communication skills in obtaining pertinent background and patient-specific information when receiving drug information requests. 3. Demonstrate effective written communication of drug information. 4. Demonstrate familiarity with contemporary drug information retrieval technology and the ability to conduct a thorough and systematic search of the tertiary and primary literature. 5. Demonstrate the ability to judge the reliability of various tertiary sources of drug information. 6. Demonstrate an understanding of the role of the Internet in providing accurate and timely drug information. 7. Demonstrate the ability to incorporate drug information, patient-specific factors, and other pertinent information in the delivery of pharmaceutical care. 8. Describe the hierarchy of study designs as it relates to level of evidence. 9. Explain the general principles of observational and experimental research designs used to answer drug information questions. 10. Explain fundamental regulatory and ethical principles involved in human subjects research. 11. Differentiate between internal and external validity of clinical trial results. 12. Apply the principles of literature evaluation to analyze recent clinical trial results. 13. Understand and interpret statistical tests commonly used in contemporary biomedical literature. 14. Delineate between statistical significance and clinical significance. 15. Interpret the usefulness of clinical trial data for making evidence-based practice decisions. Credits: 3.00

PHRM 84900 - Population Health Management

Credit Hours: 2.00. This two-credit hour course aims to provide students with the core knowledge and basic skills used in managing the health of populations. Core content will include managed care principles, pharmacist involvement in managed care, and program designs. The course will also provide instruction in the topic areas of pharmacoepidemiology and pharmacoeconomics.

Learning Outcomes: 1. Become prepared for work in managed care settings. 2. Understand of the concepts and computations used in pharmacoepidemiology, pharmacoeconomics, decision analysis, and comparative effectiveness research. 3. Know the tools needed to conduct new drug evaluations and formulary reviews and therapeutics committees. 4. Understand basic driving forces behind policy analysis as it relates to ongoing healthcare reform and pipeline drug products. Credits: 2.00

PHRM 85000 - Immunization Certification

Credit Hours: 1.00. The purpose of the course is to provide immunization training certification for students in the Doctor of Pharmacy program. Certification is awarded based on completion of the Pharmacy-Based Immunization Delivery program content that is provided through the American Pharmacists Association (APhA). All students will be expected to have completed immunization training as a graduation requirement.

Learning Outcomes: 1. Provide comprehensive immunization education and training. 2. Provide pharmacists with the knowledge, skills, and resources necessary to establish and promote a successful immunization service. 3. Teach student pharmacists to identify at-risk patient populations needing immunizations. 4. Teach student pharmacists to administer immunizations in compliance with legal and regulatory standards. Credits: 1.00

PHRM 85200 - Public Health Pharmacy

Credit Hours: 3.00. The course is designed to provide the

pharmacy student with a comprehensive overview of key public health and wellness principles and related to self-care and nonprescription products as they impinge upon the ability of patients to assume active roles and function effectively on their own behalf in health promotion and disease prevention, detection, and treatment.

Learning Outcomes: 1. Identify key public health issues. 2. Describe the profession of pharmacy's role in public health initiatives. 3. Retrieve information about various aspects of key public health issues. 4. Interpret information about various aspects of key public health issues. 5. Educate others about various aspects of key public health issues. Credits: 3.00

PHRM 85400 - Interprofessional Education (IPE) Experience III

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Recognize similarities and differences in the "Code of Ethics" for two or more different professions. 2. Consider how similarities and differences across professions influence caregivers' decisions and understanding of health and heath care priorities. 3. Describe health and healthcare as inclusive of people, populations, and communities. 4. Explain how everyone in the healthcare team shares accountability to improve prevention and healthcare outcomes. 5. Demonstrate effective methods of communicating with team members to clarify each person's role and responsibilities. 6. Discuss the importance of teamwork in person-centered and community-focused care. 7. Demonstrate active listening, while encouraging ideas and opinions of others. 8. Identify ways to improve team performance. Credits: 0.50

PHRM 85500 - Interprofessional Education (IPE) Experience IV

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e., medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 86000 - Professional Skills Laboratory V

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care.

Learning Outcomes: 1. Synthesize information in order to draw logical conclusions. 2. Provide evidence-based support for arguments,

recommendations, and solutions. 3. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86100 - Professional Skills Laboratory VI

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care. It serves as a one credit hour course. In accordance with university policy, this course may require up to three hours of work weekly outside of the arranged class time.

Learning Outcomes: 1. Synthesize information in order to draw logical solutions. 2. Provide evidence-based support for arguments, recommendations, and solutions. 3. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86200 - Institutional Pharmacy Introductory Pharmacy Practice Experience

Credit Hours: 2.50. A 2.5-credit hour required experiential course in the summer prior to the third year of the professional Doctor of Pharmacy program. Students learn basic institutional pharmacy operations and sterile product compounding.

Learning Outcomes: 1. Perform basic functions and skills in an actual practice setting. 2. Document a minimum of 160 hours of performance-based experience in an institutional pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on the degree of professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in institutional practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the institutional pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in institutional pharmacy. 12. Reflect on new information learned. 13. Describe the institutional pharmacy work environment and staffing. 14. Describe the steps involved in the medication order filling and dispensing process. 15. Formulate an opinion on the quality of patient care. 16. Review common causes of medication errors and methods of prevention. Credits: 2.50

PHRM 86400 - Integrated Pharmacotherapy IV

Credit Hours: 6.00. This course will develop knowledge and skills regarding the physiology, pathophysiology, medicinal chemistry, pharmacology, pharmacokinetics, pharmaceutics, and pharmacotherapeutics of oncology and hematologic malignancies, hepatic disorders, gastrointestinal disorders, and women's and men's health. This knowledge will be utilized in subsequent integrated pharmacotherapy modules, skills labs and practice experience that follow.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the theoretical foundations of the profession and apply these to individual practice settings. 2. Demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries. 3. Meld theory and abilities in the practice setting to enhance positive patient outcomes. 4. Examine issues rationally, logically, and coherently; and shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. Credits: 6.00

PHRM 86500 - Integrated Pharmacotherapy V

Credit Hours: 6.00. This course provides an integrated approach to the physiology, pathophysiology, medicinal

chemistry, pharmacology, pharmacokinetics, pharmacodynamics and pharmacotherapeutics of infectious diseases. It covers a vast array of microbiological pathogens, including bacteria, fungi, viruses, mycobacteria, parasites, protozoa and malaria.

Learning Outcomes: 1. Develop competence in basic anatomy/physiology, pathophysiology, diagnostic methods and decision making, principles of pharmacology, relationship between chemical structure and biological activity, delivery of drugs from various dosage forms, pharmacotherapy, drug interactions, and treatment guidelines. 2. Develop competence in basic principles of drug design and the chemical and biochemical mechanisms of drug action, basic principles that affect drug release from dosage form, drug absorption, distribution, metabolism, excretion, and toxicology and the impact of those properties on clinical pharmacokinetics and pharmacodynamics, and the relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics. 3. Perform error-free mathematical calculations with regard to drug dosing and pharmacokinetics. 4. Provide patient-centered pharmaceutical care. 5. Promote health improvement and disease prevention. 6. Critically evaluate patient data, literature sources, and drug products. 7. Provide specific, sound, cost-effective, evidence-based drug and healthcare recommendations. 8. Design, implement, and evaluate patient specific pharmacotherapeutic regimens. 9. Select the proper drug, dose, and dosage form for a specific patient. 10. Design strategies to monitor patients' drug regimens for therapeutic and toxic effects of medications. 11. Design strategies to avoid or manage drug interaction and adverse drug events. 12. Identify and implement strategies to encourage patient adherence to therapeutic interventions. 13. Synthesize information in order to draw logical conclusions. 14. Provide evidence-based support for arguments, recommendations, and solutions. 15. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. Credits: 6.00

PHRM 86600 - Biotech/Advanced Parenteral Dosage Forms

Credit Hours: 2.00. This course covers the different types of parenteral products derived from biotechnology. The lectures encompass the origin, chemical characteristics and therapeutic use of biopharmaceuticals. This course builds on the concepts and skills gained by the student from taking Dosage Forms II (PHRM 82900) and Professional Program Laboratory II (PHRM 82100).

Learning Outcomes: 1. List and describe the different types of biotechnology derived therapies. 2. Ability to describe the different types of pharmaceutical products in this area, their origin, and the delicate connection that exists between the proper handling and compounding of biotech based products and their therapeutic activity. 3. List and identify the advanced systems used in hospitals for the delivery of biotech products as well as parenteral products in general. Credits: 2.00

PHRM 86700 - Introduction To The Advanced Pharmacy Practice Experience

Credit Hours: 1.00. The Introduction to Advanced Pharmacy Practice Experience (APPE) course was designed to provide students with the tools needed to be successful clerkship students. Students will participate in a variety of activities, including case studies, group work, evaluations and assessment, review of therapeutic topics, and student/preceptor panel interactions. Activities will be supplemented by didactic lecturing for each topic. The activities and lecture topics were selected based on feedback from previous clerkship students, preceptors, and faculty, and are intended to de-mystify the clerkship experience. This course prepares students to enter the clerkship year with the ability to successfully submit required clerkship forms, evaluate preceptors and peers, avoid common clerkship student mistakes, document clinical interventions, review medical charts, and prepare for therapeutic and pharmacokinetic responsibilities.

Learning Outcomes: 1. Explain how to register for rotations. 2. Recall clerkship policies and procedures. 3. List the forms which should be submitted to the Office of Experiential Learning

after each rotation. 4. Critique preceptors and rotations constructively and assess peer performance on oral and written work. 5. Apply strategies to maximize the clerkship experience to each assigned rotation. 6. Cite the rotation portfolio requirements. 7. List handy drug information resources to use during rotations. 8. Explain ways to handle "tough situations" during rotations. 9. Document complete clinical interventions using Clinical Measures software. 10. Provide pharmacokinetic recommendations using provided equations and tools. 11. List ways to succeed on non-patient-care rotations. 12. List ways to prepare for post-graduate training during rotations. 13. Recall important information from common disease states encountered while on rotation. Credits: 1.00

PHRM 86800 - Patient Safety And Informatics

Credit Hours: 3.00. This course provides core knowledge and skills needed by pharmacists to promote patient safety and use the tools of healthcare informatics; understand the landscape, epidemiology and culture of patient safety data privacy and security. Case studies will address disclosure of medication errors and reporting adverse events. Informatics tools such as computer order entry, electronic medical record systems, health information exchanges, and decision support will be explained. The use of informatics tools to promote patient safety will be emphasized.

Learning Outcomes: 1. Conceptual competency. 2. Integrative competence. 3. Critical thinking and decision making. 4. Communication skills and abilities. 5. Responsible use of professional values and ethical principles. 6. Social awareness and social responsibility. 7. Professional abilities and habits. Credits: 3.00

PHRM 86900 - Practice Management And Marketing Of Professional Services

Credit Hours: 2.00. Introduces essential pharmacy practice managerial skills including personnel management, addressing conflict, CQI, change management and leadership. Builds upon these skills in the development of a business plan to implement an innovative pharmacy service.

Learning Outcomes: 1. Explain key concepts and legal stipulations related to hiring, performance assessment and communicating with work associates and employees. 2. Explain the characteristics that best describe themselves in a work setting (DiSC) and how these affect individual and team work. 3. Describe the four steps in LEAN theory and apply it to a variety of health care settings and its place in overall quality improvement measures. 4. Ascertain data and statistics about the practices and populations of a specific health care market. 5. Develop marketing materials based on a target audience(s). 6. Conceptualize and project the financial and clinical impact of a new product or service on an existing organization/system. 7. Justify and defend an innovative service or product. 8. Write a complete business plan addressing, at minimum, an executive summary, purpose, background, program description, financial projections and conclusion/summary. 9. Present on an innovative pharmacy service covering pertinent and persuasive information. 10. Justify and defend an innovative service or product. Credits: 2.00

PHRM 87000 - Health Policy Applications

Credit Hours: 1.00. This course will explore policy issues that influence health care. The course will provide students opportunities to apply material from prior courses in Health Systems, Population Health Management, and Public Health as it relates to the impact of health policy. Students will gain an understanding of how policy development must address competing interests and goals, and how policy can influence the scope of pharmacist's professional roles. Timely materials on current policy, current policy debates, and professional advocacy will be discussed.

Learning Outcomes: 1. Discuss health policy drivers that impact the current healthcare market. 2. Discuss the impact of various national and state health policies influence on how health care is organized, delivered, and financed. 3. Evaluate potential consequences of specific national, state, and local health policies on health systems, providers, and patients. 4. Identify the process and challenges regarding

pursing state legislative health policy change. 5. Analyze healthcare policies and identify opportunities to modify policy to advance the profession of pharmacy. 6. Generate and evaluate policy development strategies to affect health care access, health care quality, and health care cost. Credits: 1.00

PHRM 87100 - Jurisprudence

Credit Hours: 2.00. An in depth study of federal and Indiana laws, regulations, and rules affecting pharmacy practice. Primary emphasis is on Retail and Hospital Pharmacy settings. Lecture is supported by an instructor-created text covering the Food, Drug, and Cosmetic Act (21 USC), the Controlled Substances Act 21 CFR 1300 et. seq. and Indiana Food and Drug law IC 25-26-13 et. seq. and Indiana rules 856 IAC-1-43.

Learning Outcomes: 1. Identify acts that are covered by statute, regulation, and/or rule, and what and where those are. 2. Passing the national licensing examination on laws (MPJE "Multistate Pharmacy Jurisprudence Examination" developed, administered and graded by the National Association of Boards of Pharmacy). Credits: 2.00

PHRM 87400 - Interprofessional Education (IPE) Experience V

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 87500 - Interprofessional Education (IPE) Experience VI

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and

expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 88000 - Advanced Pharmacy Practice Experience

Credit Hours: 3.00. This final year begins in May and continues through the following April. The 36 weeks of rotation are broken down as follows: 4 weeks Hospital Operations 2, 4 weeks Community Pharmacy Operations 2, 8 weeks Ambulatory rotations, 4 weeks inpatient rotations, and 16 weeks General Electives (4 of which must be additional patient care rotation).

Learning Outcomes: 1. The purposes, uses, and effects of their medications and related therapy. 2. Achievable therapeutic outcomes with estimated time frame. 3. Drug cautions and side effects in relation to the patient's condition. 4. Medication cost issues. 5. Relevant lifestyle modifications (i.e. weight loss and smoking cessation) and non-drug therapies. 6. Use, storage, side effects, and dosage of nonprescription drugs. 7. The appropriate selection of over-the-counter medications in response to patient's condition/needs. 8. Appropriate patient's comprehension of student's counseling (i.e. final verification step). Credits: 3.00

Pharmacy Practice

PHPR 42700 - Pharmacy Leadership Seminar

Credit Hours: 2.00. This course is specifically designed to mentor enthusiastic leaders and enhance their ability to become an effective leader in the practice of pharmacy. The objective of this course is not to build a leader, rather to augment the characteristics the particular leader possesses. Students have the opportunity to partake in a variety of activities including the development of a proposal with implementation plan to address a current school-wide issue. A variety of outside speakers share their leadership experiences with the class. The course has a maximum enrollment and requires instructor approval to enroll. Students interested in enrolling in the course must submit a course application packet. Students are assessed on written reflections, oral presentation, written reports, and a group project.

Credits: 2.00

PHPR 45000 - Introduction To Institutional Pharmacy Practice

Credit Hours: 1.00. An overview of the delivery of pharmaceuticals and the provision of clinical and administrative services to patients in institutional settings is presented along with the various roles pharmacists play both within the pharmacy department and the institution. Course content focuses on the provision of services and career development rather than on drug therapy. The course features a series of presentations by practitioners from a variety of practice settings. Enrollment is limited to Doctor of Pharmacy students or by consent of course coordinator.

Credits: 1.00

PHPR 45500 - Medicare In Pharmacy Practice

Credit Hours: 1.00. Elective course providing an in-depth review of Medicare and related topics beyond that covered in the core curriculum. A service-learning component involving hands-on experience with Medicare beneficiaries is part of the course requirements.

Credits: 1.00

PHPR 48000 - Self-Care Pharmacy Practice I

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem-solving process. Course activities, readings and homework assignments will provide students with illustration of how the problem-solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Colds, Coughs, Allergies.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a

nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48200 - Self-Care Pharmacy Practice II

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem-solving process. Course activities, readings and homework assignments will provide students with illustration of how the problem-solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Gastrointestinal Disorders.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48300 - Self-Care Pharmacy Practice III

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem solving process. Course activities, readings and homework assignments will provide students with illustration of how the problem solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Dermatology.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48400 - Self-Care Pharmacy Practice IV

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem-solving process. Course activities, readings and homework

assignments will provide students with illustration of how the problem-solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Determined by students taking PHPR 48300.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48600 - Beyond Ecstasy

Credit Hours: 1.00. The goal of the course is to augment the students' knowledge about commonly used street drugs including: pharmacology and mechanisms of action; interactions and adverse effects; law enforcement and policing; available support and treatment for addiction, abuse, and misuse; and the role of pharmacists.

Learning Outcomes: 1. Explain the role of the pharmacist in the prevention, treatment, and recovery process of addiction/substance abuse. 2. Discuss treatment agreements for controlled substance use. 3. List signs and symptoms of addiction and toxicities associated with street drugs. 4. Describe community-based programs designed to treat addicts. Credits: 1.00

PHPR 48900 - Complementary And Alternative Medicine

Credit Hours: 1.00. This course is intended to expose students in health care fields to alternative health care practices used by people around the world.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the theoretical foundations of the profession and apply these to individual practice settings. 2. Meld theory and abilities in the practice setting to enhance positive patient outcomes. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 5. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. 6. Demonstrate an understanding of self, the strengths and challenges of cultural diversity, and the historic responses of society in times of rapid change. 7. Effectively self-asses and satisfy learning and continuous professional development on an ongoing basis. 8. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances. Credits: 1.00

PHPR 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course to be used to relate to, and supplement, an existing course. Subject matter and method of approach individually directed by instructor. Permission of instructor required.

Credits: 1.00 to 3.00

PHPR 59000 - Special Topics In Pharmacy Practice

Credit Hours: 1.00 to 3.00. Special topics in selected areas of pharmacy practice. Permission of instructor required.

Credits: 1.00 to 3.00

PHPR 59800 - Introduction To Research

Credit Hours: 1.00 to 3.00. Qualified students will undertake a project in an area of pharmacy practice, clinical pharmacy, or pharmacy administration under a member of the graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

PHPR 66400 - Research Techniques And Proposal Development

Credit Hours: 2.00. A consideration of current trends in pharmacy practice, clinical pharmacy, and pharmacy

administration relating to healthcare services and systems. Offered in alternate years.

Credits: 2.00

PHPR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHPR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Philosophy

PHIL 11000 - The Big Questions: Introduction To Philosophy (UCC: HUM)

Credit Hours: 3.00. The basic problems and types of philosophy, with special emphasis on the problems of knowledge and the nature of reality. CTL:ISH 1050 Introduction To Philosophy

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate familiarity with several of the basic problems of philosophy, with a special emphasis on the problems of knowledge and the nature of reality. 2. Demonstrate exposure to and knowledge of some of the central ideas from some major figures in the history of philosophy, including Plato, Descartes, and at least one ""British Empiricist."" 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 11005 - I Play, Therefore I Am: Introduction To Philosophy Through Video Games (UCC: HUM)

Credit Hours: 4.00. This course uses video games to demonstrate many of the fundamental problems of philosophy. To better understand the philosophical problems presented in text, students will watch online walkthroughs and live demonstrations of video games in class. Students will also engage with these problems through active learning by occasionally playing video games.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify historical and contemporary philosophical problems by reading assigned texts, and viewing demonstrations of or playing video games. 2. Demonstrate knowledge of the central ideas of major figures in the history of philosophy by participating in class activities and discussions, and through written assignments. 3. Explain, defend and discuss complex philosophical ideas, theories, and perspectives in assigned texts and demonstrations of video games through in class activities, presentations, and written assignments. 4. Critique and evaluate the significance of philosophical problems to the contemporary world, and potential responses to those problems, through in class activities, discussions, and written exam responses. 5. Construct sound, well-reasoned arguments, and communicate them clearly by participating in class activities and discussions, and through written assignments. Credits: 4.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate

complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 11400 - Global Moral Issues (UCC: HUM)

Credit Hours: 3.00. A systematic and representative examination of significant contemporary moral problems with a focus on global issues such as international justice, poverty and foreign aid, nationalism and patriotism, just war, population and the environment, human rights, gender equality, and national self-determination.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of a comprehensive selection of global moral issues, including the concepts and theories that are essential to understanding and discussing these issues. 2. Acquire skills in the analysis and evaluation, as well the construction, of the kind of arguments needed for justifying personal opinion on ethical issues. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 11500 - Philosophy: What Are You Going To Do With That?

Credit Hours: 1.00. This course is designed for all philosophy majors, but is open to anyone interested in minor/majoring in philosophy. The format for this course is based on three components: reading and reflection, along with in-class discussion; in-class guest speakers who will address various topics in philosophy as a field, and/or professionalization (both within and outside of academia); and short written exercises, often done in class, which are designed to build up to the final project. Most classes will begin with a guest speaker giving a brief introduction to a particular area or topic within philosophy. Students will have a short reading assigned for each class period that will be discussed with the instructor following the guest's presentation. The course readings will be, as best as possible, related to the area/topic introduced by the guest. Certain classes will be dedicated solely to career/professionalization interests and will feature guests with expertise in these areas. The professionalization experts will help students develop their career goals, identify possible internships and scholarships to pursue while a student at Purdue, and develop career goals for after they have graduated. Finally, certain classes will be dedicated to writing and the development of the final project, which will include a proposed 8-semester path of study, a polished resume/CV, and career/professionalization goals.

Learning Outcomes: 1. Devise academic and professional goals by preparing professionalization documents including a CV/resume. 2. Construct an eight semester plan of study toward completion of a degree in philosophy by listing courses of interest and forecasting future course load. 3. Identify argument structures in philosophical writing by reading assigned texts. 4. Assess and critique issues in various areas of philosophy by participating in classroom and group discussions. Credits: 1.00

PHIL 12000 - Critical Thinking (UCC: IL)

Credit Hours: 3.00. This course is designed to develop reasoning skills and analytic abilities, based on an understanding of the rules or forms as well as the content of good reasoning. This course will cover moral and scientific reasoning, in addition to ordinary problem solving. This course is intended primarily for students with nontechnical backgrounds.

University Core Curriculum (UCC): (UCC: IL) Credits: 3.00

PHIL 15000 - Principles Of Logic (UCC: QR)

Credit Hours: 3.00. A first course in formal deductive logic; mechanical and other procedures for distinguishing good arguments from bad. Truth-tables and proofs for sentential (Boolean) connectives, followed by quantificational logic with relations. Although metatheoretic topics are treated, the emphasis is on methods.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: Will add at a later date. Credits: 3.00

PHIL 20000 - Fun And Other Untimely Values

Credit Hours: 3.00. We'll explore the nature of fun, the metaphysics and value of games, and a host of related topics like play, humor, awesomeness, and happiness. We'll think about how these are related to each other, to some of the less paradigmatically fun elements of life like work, morality, striving, and idleness, and how they each might best contribute a life worth living. Philosophic discussion of what gives a life meaning or makes it worth living tend to veer into heavy, sometimes morose territory. In this class we'll go in the opposite direction.

Learning Outcomes: 1. Develop the ability to

critically think about the role of the plurality of different, sometimes competing values. 2. Synthesize and organize a variety of ideas, information, and dense prose. 3. Summarize arguments in clear and concise ways. 4. Conceptualize and explain the line of reasoning that a text is putting forth. Credits: 3.00

PHIL 20600 - Introduction To Philosophy Of Religion (UCC: HUM)

Credit Hours: 3.00. The course encourages critical reflection on traditional and contemporary views about God and other religious ideas. Topics include arguments for God's existence, the problem of evil, understanding the divine attributes, miracles, religious pluralism, and life after death. CTL:ISH 1052 Philosophy Of Religion

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate familiarity with one or more conceptions of God and with arguments for and against the coherence of such conceptions. 2. Demonstrate a familiarity with some of the arguments for and against God's existence and with some of the objections to those arguments. 3. Recognize the importance of and demonstrate familiarity with multiple religious ideas and beliefs. 4. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 5. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

PHIL 21900 - Philosophy And The Meaning Of Life (UCC: HUM)

Credit Hours: 3.00. Does life have meaning? If so, in what sense? If not, does this matter? Does the answer depend on the existence of God and an afterlife? What, if anything, makes existence worthwhile? Might the question - 'does life have meaning?' - be malformed? This course explores these and related questions, as well as answers to them, with the aim of teaching students to think critically and rigorously about matters of perennial existential importance. In previous iterations of this course, readings have been chosen from the following writers: Kierkegaard, Nietzsche, Dostoevsky, Kafka, Marcel, Heidegger, Camus, Sartre, Jaspers, de Beauvoir, Ortega, and Merleau-Ponty.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 22300 - Fate And Free Will (UCC: HUM)

Credit Hours: 3.00. This course encourages critical reflection on the nature and possibility of human freedom in a world like ours that appears to be determined by unchanging causal and physical laws. Topics include the compatibility of free will and determinism, the possibility of moral responsibility without free will, and the incentives (if any) for future planning if our future fate is already sealed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Enhance critical thinking skills. 2. Enhance ability to analyze relatively complex philosophical arguments. Credits: 3.00

PHIL 22500 - Philosophy And Gender (UCC: HUM)

Credit Hours: 3.00. An examination of the beliefs, assumptions, and values found in traditional and contemporary philosophical analyses of women. A range of feminist approaches to knowledge, values, and social issues will be introduced.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improved knowledge of human cultures, creative thinking, critical thinking, integrative learning. Credits: 3.00

PHIL 22700 - Science And Religion

Credit Hours: 3.00. Are science and religion irrelevant to each other? Or can one of them challenge, support, shape, presuppose, explain-or explain *away*-the other? This course examines how science in general, as well as specific scientific disciplines such as evolutionary biology, physical cosmology, and cognitive science, are related to religion in general, and to particular religious traditions.

Learning Outcomes: 1. Identify specific ways in which science and religion appear to be in tension and specific ways in which they appear to support one another. 2. Demonstrate familiarity both with attempts to resolve alleged tensions between science and religion and with attempts to challenge claims that science and religion support one another. 3. Present, explain, defend, and evaluate complex philosophical perspectives on the relationship between science and religion, in oral and written communication. 4. Locate, interpret, understand, and evaluate philosophical arguments encountered in complex texts on the relationship science and religion. Credits: 3.00

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 24100 - Philosophy, Politics, And Economics

Credit Hours: 3.00. Many important issues, such as environmental pollution, global poverty, and the proliferation of nuclear weapons, have philosophical, political, and economic aspects. Accordingly, his interdisciplinary course deals with issues of interest to philosophers, political scientists, and economists alike. Possible topics to be studied include: the basis for political authority, game theory and rational choice, property rights, market advantages and market failures, justice, equality, and freedom.

Learning Outcomes: 1. Develop a competent understanding of fundamental issues arising at the intersection of philosophy, politics, and economics, and to begin (or advance) the process of learning to think more clearly, deeply, and consistently about them on one's own. 2. Develop greater critical thinking skills, especially in connection with controversial social and political issues. 3. Improve one's ability to write critically, carefully, and creatively about matters of great importance. Credits: 3.00

PHIL 24200 - Philosophy, Culture, And The African American Experience (UCC: HUM)

Credit Hours: 3.00. The purpose of this course is to consider African American based or inspired conceptions of Western philosophy and new visions of what it is to do philosophy sensitive to culturally rooted diversity.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 25501 - Introduction To Cognitive Science: Minds, Brains, And Machines

Credit Hours: 3.00. This will provide an introduction to foundational topics in the philosophy of mind. We will consider the relationship between the mind and the body, and the mental to the physical more generally. We'll ask, and look at some candidate answers to, questions like "What is a mind, and what are its component parts? How does a mind work? How are minds related to brains, and to the physical bodies that they seem to animate and control? How do minds represent the world around them? What is a self? What is the nature of consciousness and subjective experience? Could other animals, aliens, computers, robots or other types of entities have minds, or be conscious? How would we know? How can empirical efforts like the cognitive sciences help shed light on these questions? Could scientific theories of the mind supplant our intuitive conceptions of the mind? If so, what would be the implications?"

Learning Outcomes: 1. Analyze the main arguments for different theories in the philosophy of mind, such as dualism, behaviorism, and functionalism. 2. Develop original arguments that apply concepts from class to real-life current events. 3. Evaluate the implications of different theories for ethical, political, and social issues. Credits: 3.00

PHIL 25601 - Philosophy And Artificial Intelligence

Credit Hours: 3.00. Just what is it to be artificially intelligent and what will be AIs impact on our future? This course tackles these questions using an interdisciplinary and historically anchored approach beginning with the development of AI to arrive at a more holistic, socially- and ethically-ensconced account of what it means to be artificially intelligent. Will AI agents change the nature of work? Can they be used to regulate individuals and their opportunities through automated algorithms and sorting software? What are the human and environmental costs of a full-throated adoption of AI? This class will arm you with the philosophical and historical background to begin to devise and weigh the creative opportunities and challenges posed by this future. We'll first consider traditional questions and issues in the philosophy of computation, epistemology, ethics and justice before turning to home onto a series of specific challenges that may include issues of AI in equity, AI and the law, AI and gender, AI and labor, AI and policy, the future of AI, and whether we can even design 'ethical' AI.

Learning Outcomes: 1. Examine the theoretical foundations of AI. 2. Identify ethical and

epistemological implications of emerging AI technologies. 3. Evaluate policy challenges posed by AI technologies. Credits: 3.00

PHIL 25701 - Moral Minds: The Nature Of Right And Wrong

Credit Hours: 3.00. This course will explore questions about the nature of morality that lie at the intersection of philosophy and psychology. Is genuine altruism possible, or is everybody selfish deep down? Is moral thinking driven by reason or emotion? Is there such a thing as moral character? Is anyone ever truly responsible for their actions? Do facts about our evolutionary history undermine objective morality? Is empathy...bad? What makes someone a jerk? We'll also think about what happens to moral psychology when it gets plugged into social media algorithms and polarized political environments.

Learning Outcomes: 1. Identify and analyze major debates in moral psychology. 2. Explain the major theories in the history of moral psychology. 3. Apply lessons from moral psychology to contemporary moral problems, such as climate change or the spread of misinformation. Credits: 3.00

PHIL 26000 - Philosophy And Law

Credit Hours: 3.00. A discussion of philosophical issues in the law: a critical examination of such basic concepts in law as property, civil liberty, punishment, right, contract, crime and responsibility; and a survey of some main philosophical theories about the nature and justification of legal systems. Readings will be drawn from both law and philosophy.

Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

PHIL 27500 - The Philosophy Of Art (UCC: HUM)

Credit Hours: 3.00. A survey of the principal theories concerning the nature, function, and value of the arts from classical times to the present.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 29300 - Selected Topics In Philosophy

Credit Hours: 1.00 to 3.00. A critical examination of some special topic or topics in philosophy. Details concerning topics selected for treatment in a given semester may be obtained in advance from the Department of Philosophy. Sections of this course may sometimes be initiated by students upon petition to the department.

Credits: 1.00 to 3.00

PHIL 30000 - Philosophy Of AI: Foundations And Theoretical Issues

Credit Hours: 3.00. This class will examine some of the underlying philosophical questions and issues that arise when we think carefully about the nature of machines that are meant to model our own minds and replicate intelligence. Topics will include the nature of computation, intelligence, deep learning, and mind design. While no technical background is assumed, some readings will include technical elements.

Learning Outcomes: 1. Explain basic topics in the philosophy of artificial intelligence. 2. Identify philosophical perspectives that contribute to understanding and explaining artificial intelligence. 3. Explain basic differences among types of artificial intelligence and machine learning systems. 4. Evaluate claims about the capabilities and limitations of artificial intelligence systems. Credits: 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of

medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30400 - Nineteenth-Century Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of the major movements and directions of nineteenth-century philosophy, including such figures as Hegel, Comte, Mach, Schopenhauer, Nietzsche, Mill, Royce and Peirce.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30600 - Twentieth-Century Philosophy

Credit Hours: 3.00. A critical examination of the main currents of contemporary philosophical thought, such as pragmatism, analytic philosophy, phenomenology, and existentialism, and other recent developments. The course will cover selected works of such philosophers as Russell, Wittgenstein, Peirce, Whitehead, Heidegger, and Sartre.

Credits: 3.00

PHIL 31000 - Classical Chinese Philosophy

Credit Hours: 3.00. In this course, we will survey the classic works of classical Chinese philosophy (c. 600-200 BCE). We will focus on seven major philosophers (and their followers): Kongzi (Confucius), Mozi, Mengzi (Mencius), Zhuangzi, Laozi, Xunzi, and Han Feizi. We will use their work to consider topics such as: the nature and value of morality, the proper role of ritual in human life, whether human nature is good or bad, how one becomes a moral person, the proper role and function of government, and more. In addition to introducing the competing traditions of Confucianism, Mohism, Daoism, and Legalism, the course will help students to develop basic philosophical skills as they develop and defend their own views on these topics. No knowledge of Chinese is expected.

Learning Outcomes: 1. Identify the central views of classical Chinese philosophers by reading primary texts. 2. Explain these views in their own words, and relate them to alternative views, by writing summaries (as part of ""position evaluation"" assignments). 3. Apply these views and arguments to questions arising in their own lives through in-class discussion of assigned reading questions. 4. Extract arguments from prose text and analyze them, both through in-class exercises and as part of ""position evaluation"" assignments. 5. Assess the value of these arguments via in-class group discussion and final papers. 6. Formulate original arguments regarding topics discussed by Chinese philosophers via in-class group discussion and final papers.e philosophers via in-class group discussion and final papers. Credits: 3.00

PHIL 31400 - Philosophy Of Artificial Intelligence: Ethical, Social, And Political Issues

Credit Hours: 3.00. This course introduces students to the fundamentals of ethical, social, and political analysis of AI. By developing critical thinking, argumentative, and philosophical skills, students will engage with questions surrounding the development, risks, responsibilities of and surrounding AI. Students will learn the tools necessary to address these issues through reasoned argument and reflection.

Learning Outcomes: 1. Identify key normative, ethical, social, and political issues raised by the development and use of AI technologies. 2. Analyze philosophical arguments about the use of AI for both empirical plausibility and ethical validity. 3. Argue for novel positions in the philosophy of AI utilizing students' own reflection and analysis. Credits: 3.00

PHIL 31500 - Philosophy Of Money

Credit Hours: 3.00. This course is primarily concerned with the nature and ethics of money-how money functions as a social fact and how we relate to money and let it affect our character. After a brief exploration of the functions of money, the course will take up the different forms of the money supply (which also includes bank deposits and credit).

Learning Outcomes: 1. Articulate and explain the nature of money. 2. Distinguish and evaluate several theories of the nature of money. 3. Apply these concepts to ethical questions regarding the role of money in our lives. Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

PHIL 32600 - Business Ethics

Credit Hours: 3.00. Philosophic examination of such topics as morality and self-interest, freedom and coercion, distributive justice, limits of the law, moral and legal rights, fair equality of opportunity, justice between nations. These topics are seen from a new perspective when they are connected to discussions of fair wages and capitalism, legal constraints on manufacturers and advertisers, affirmative-action programs, environmentalism, and multinational corporations.

Learning Outcomes: 1. Distinguish ethics from law and regulation, and relate ethics to economic systems such as markets and firms. 2. Explore classical ethical theories including virtue ethics, deontology and consequentialism. 3. Examine role responsibilities and professional ethics for agents, principals, managers, and employees. Credits: 3.00

PHIL 35000 - Philosophy And Probability

Credit Hours: 3.00. This course introduces the student to mathematical probability and its philosophical applications. Topics may include theories of probability, Hume's problem of induction, Goodman's paradox, and the foundations of scientific reasoning.

Credits: 3.00

PHIL 35501 - Major Questions In Cognitive Science

Credit Hours: 3.00. The philosophy of cognitive science uses tools from philosophy, psychology, neuroscience, linguistics, and computer science to answer foundational questions about how the mind works. In this course, we'll survey a range of contemporary debates in the philosophy of cognitive science, focusing on topics like the distinction between perception and cognition, the relationship between memory and imagination, the relationship between language and thought, whether there exist basic emotions and more.

Learning Outcomes: 1. Compare and contrast the different theoretical frameworks for the study of cognition. 2. Analyze contemporary debates in cognitive science. 3. Evaluate implications of cognitive science for ordinary psychological concepts, such as belief, memory, perception, reasoning, and emotion. Credits: 3.00

PHIL 40200 - Studies In Medieval Christian Thought

Credit Hours: 3.00. A survey of medieval (and patristic) philosophical theology. Issues include the nature and existence of God, religious language, and doctrines such as the Trinity, Incarnation, and Atonement. Readings (in English translation) will include, among others, Augustine, Boethius, Anselm, and Aquinas.

Credits: 3.00

PHIL 40300 - Moral Psychology And Climate Change

Credit Hours: 3.00. This course investigates the ethical challenges posed by climate change in conjunction with the deep cognitive and motivational factors that shape our individual and collective responses to it. Current research on human moral psychology is examined, drawing on work from a range of disciplines. Ethical theories concerning the unique moral challenges posed by a threat that spans national borders and human generations are considered. Strategies for addressing climate change that try to avoid our common cognitive foibles, and to leverage what we know about human moral capacities for collective action, are examined.

Learning Outcomes: 1. Identify the structure, thesis statement, and main lines of argumentation in written work of philosophers and psychologists, and also to analyze the arguments by breaking them down into their component parts, and formulating their own objections. 2. Discuss a wide variety of issues and sources surrounding moral psychology, from philosophers, psychologists, biologists, economists and anthropologists; they will

develop this ability by summarizing and commenting on the assigned readings in weekly blog posts. 3. Compare the threat raised by climate change to other existential threats by reporting on the way different kinds of threats are processed cognitively. 4. Appraise the strengths and weaknesses of different strategies for addressing climate change, as assessed from the point of view of the state of the art understanding of human cognition and moral motivation; they will write a research paper that assesses the pros and cons of such strategies. 5. Identify common cognitive blind spots, predictable irrationalities, and motivational hurdles, and will be able to use this to appreciate the scope of the collective action problems associated with climate change; they will develop these skills by reading academic texts devoted to these issues. Credits: 3.00

PHIL 40400 - Advanced History Of 19th Century Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in 19th-century philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of 19th-century philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 40600 - Intermediate Philosophy Of Religion

Credit Hours: 3.00. An intensive study of some important problems such as the existence of God, the problem of evil, immortality, or the nature of religion. Or the religious philosophy of some significant thinkers such as Buber, Berdyaev, Tillich, Barth, Maritain, or Chardin may form the content of the course. Subject matter may vary.

Credits: 3.00

PHIL 40700 - Advanced History Of Ancient Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in ancient philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of ancient philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 40900 - Advanced History Of Medieval Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in medieval philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of medieval philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 41000 - Mock Trial Practicum

Credit Hours: 1.00. This course prepares students to represent Purdue University in American Mock Trial Association competitions by focusing on legal reasoning, argumentation, and advocacy. Mock Trial students will become familiar with the United States' legal system and conduct a trial over a fictional civil or criminal case. Students develop and deliver opening statements, introduce and examine testimonial, physical, and demonstrative evidence, examine and cross examine witnesses, and develop and deliver closing statements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the underlying theory and content of specific laws through class discussions and exercises. 2. Locate, interpret, and explain information contained within the American Mock Trial Association's (AMTA's) annual case by reading assigned texts and participating in class discussion and exercises. 3. Formulate original arguments, objections, and replies within a legal setting by participating in class discussion and exercises, and through written assignments. 4. Deliver oral arguments, objections, and replies in accord with courtroom procedures by participating in mock trial exercises inside and outside of class. Credits: 1.00

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in

ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 41300 - Advanced History Of Modern Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in modern philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of modern philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 41400 - Advanced Topics In Philosophy Of Artificial Intelligence

Credit Hours: 3.00. This course focuses on specific issues in the philosophy of machine learning and artificial intelligence more broadly. It is primarily aimed at students (a) in the BA in AI degree, and/or (b) who have taken several other courses on the philosophy of mind, cognitive science, and AI in the department. Students will learn how to critically analyze issues from the cutting edge of AI, write about such issues with depth and insight, and apply their insights to new and emerging questions in the field.

Learning Outcomes: 1. Demonstrate understanding of cutting-edge issues in the philosophy of artificial intelligence. 2. Analyze and produce arguments in the field. 3. Evaluate proposals for the future of artificial intelligence across different theoretical and applied dimensions. Credits: 3.00

PHIL 41500 - Philosophy Practicum

Credit Hours: 1.00 to 3.00. This course is for philosophy students who are pursuing internship, research opportunities, and professional experience in various fields, industries, and sectors. The aim of this course is for students to apply concepts and skills they have gained in the philosophy curriculum to research and professional experience. The applicable skills students can bring to their internship/research/professional experience include logic, analytical reasoning, critical thinking, written and oral communication, textual analysis, and persuasive argumentation. Students can take the course up to two times for no more than 6.00 total credits. Internships and research positions can be offered remotely or on-site.

Learning Outcomes: 1. Learning objectives for this course will vary depending on the internship/professional experience aligned with the student's enrollment. Credits: 1.00 to 3.00

PHIL 41600 - Philosophy And Political Economy

Credit Hours: 3.00. An examination of the philosophical foundations of economic and political institutions and the reciprocal relationships between such institutions. Topics include foundations of systems of property and exchange; the problem of externalities; theories of the firm; constitutional design; democratic theory; public goods provision; rent-seeking and public choice; lobbying and campaign finance; the moral and legal limits of markets; public-private entanglement.

Learning Outcomes: 1. Explicate core concepts in philosophy and political economy. 2. Understand how these concepts are relevant to justifying institutions. 3. Apply these concepts to generate novel arguments and insights in original research. Credits: 3.00

PHIL 42100 - Philosophy Of Science

Credit Hours: 3.00. An examination of central issues in philosophy of science. Topics include theories of explanation, confirmation, reduction, laws, the status of theoretical entities, and the epistemological foundations of scientific theories.

Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 42500 - Metaphysics

Credit Hours: 3.00. A concentrated investigation of some of the basic problems concerning essence, existence, time, space, substance, causality, permanence, and change. Readings and discussions will center on representative metaphysical thinkers.

Credits: 3.00

PHIL 43200 - Theory Of Knowledge

Credit Hours: 3.00. An analysis of selected texts on knowledge and rationality. Topics such as the following will be considered: foundationalism, coherentism, internalism, externalism,

skepticism, contextualism, empiricism, rationalism, analyses of epistemic concepts, and the Gettier problem.

Credits: 3.00

PHIL 43500 - Philosophy Of Mind

Credit Hours: 3.00. An examination of some central issues in the philosophy of mind. Attention is given to such topics as the knowledge of other minds, the relation between mind and body, the nature of persons, and the analysis of certain relevant concepts such as action, emotion, and perception. Readings are selected primarily from the writings of contemporary philosophers.

Credits: 3.00

PHIL 44000 - Advanced Topics In Political Philosophy

Credit Hours: 3.00. An examination of central issues in political philosophy. The course will focus on topics such as theories of justice, authority, legitimacy; questions about foundational political values like freedom, equality, and community; and methodological issues concerning ideal versus non-ideal theory, contractualism versus contractarianism; political versus comprehensive liberalism; and nationalism versus cosmopolitanism.

Learning Outcomes: 1. Recognize and differentiate between competing theories of justice, legitimacy, and authority. 2. Identify and reconstruct philosophical arguments. 3. Argue philosophically about first- and second-order questions concerning political philosophy. Credits: 3.00

PHIL 45501 - Studies In Cognitive Science

Credit Hours: 3.00. The subject matter will alternate between an in-depth study of a particular aspect of cognition (e.g., memory, belief, concepts) and a study of a specific explanatory framework in the philosophy of cognitive science (e.g., the computational theory of mind, predictive processing, gene-culture co-evolution).

Learning Outcomes: 1. Analyze advanced debates in contemporary cognitive science. 2. Evaluate the distinct theoretical approaches to cognition employed in psychology, neuroscience, and computer science, respectively. 3. Construct arguments to resolve conceptual problems and move current debates forward. Credits: 3.00

PHIL 46500 - Philosophy Of Language

Credit Hours: 3.00. An examination of some of the central issues in the philosophy of language, such as meaning, reference, truth, propositions, and speech acts.

Credits: 3.00

PHIL 49000 - Advanced Topics In Philosophy

Credit Hours: 1.00 to 3.00. An advanced study of a significant topic in philosophy.

Learning Outcomes: 1. Demonstrate familiarity with several advanced problems of philosophy. 2. Develop the ability to present, explain, defend and critically evaluate advanced philosophical ideas, theories, and perspectives, in oral and written communication. 3. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 4. Develop critical thinking and writing skills. Credits: 1.00 to 3.00

PHIL 50000 - Advanced Ethics For Technology, Engineering, And Design

Credit Hours: 3.00. This graduate seminar is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen.

Learning Outcomes: 1. Recall and describe key concepts of professional and ethical responsibilities in national, international, and cross-cultural environments. 2. Apply the general ethical framework to analyze and resolve specific, concrete cases in engineering. 3. Develop a well-researched original case study that integrates professional and ethical considerations, informed by personal experiences and future aspirations in engineering. Credits: 3.00

PHIL 50100 - Studies In Greek Philosophy

Credit Hours: 3.00. The subject matter will alternate between the intensive study of some fairly specific topic in Greek philosophy (e.g., Plato's theory of knowledge, Aristotle's ethics,

etc.) and a general study of either the philosophy of Plato or the philosophy of Aristotle.

Credits: 3.00

PHIL 50200 - Studies In Medieval Philosophy

Credit Hours: 3.00. An intensive study of some central topics in the thought of major medieval philosophers. Subject matter will vary. Philosophers most often studied are Augustine, Thomas Aquinas, Duns Scotus, and Ockham.

Credits: 3.00

PHIL 50300 - Studies In Early Modern Philosophy

Credit Hours: 3.00. A detailed study of either: 1) one or more central philosophical themes or 2) one or more major figures (typically, but not restricted to, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and/or Kant) in the early modern period. Offered in alternate years.

Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the human good, the nature of God, and divine language.

Credits: 3.00

PHIL 50600 - Advanced Philosophy Of Religion

Credit Hours: 3.00. A detailed critical investigation of some central problems in a philosophical approach to religion. Readings will be selected from leading representatives of traditional theism and various contemporary schools. The thought of the representative thinkers will be analyzed, discussed, and critically evaluated. The problems discussed will be selected from the existence of God, the problem of evil, freedom and determinism, the problem of immortality, and the nature of religious language. Variable content.

Credits: 3.00

PHIL 50800 - Advanced Ethics Of Data Science

Credit Hours: 3.00. This graduate seminar is designed to examine the new and important ethical issues that are arising as the applications of data science permeate more and more aspects of our lives. Because we're entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

Learning Outcomes: 1. Explain the conceptual framework for ethical reasoning in professional settings as it applies to data science. 2. Analyze case studies to identify and evaluate ethical issues arising from the applications of data science. 3. Assess critically the ethical implications of data science applications and propose well-reasoned solutions. Credits: 3.00

PHIL 51000 - Phenomenology

Credit Hours: 3.00. A detailed, critical examination of some major issue(s) in phenomenology. Attention will be given to either the historical development or contemporary relevance of phenomenological philosophy. Readings will be drawn from the works of Husserl, Heidegger, Merleau-Ponty, and others.

Credits: 3.00

PHIL 51400 - Twentieth-Century Analytical Philosophy I

Credit Hours: 3.00. A detailed study of the origins and development of contemporary philosophical analysis, and how it was pursued in movements such as logical atomism, logical positivism, ordinary language philosophy, and others. Readings will cover a selection of the writings of Frege, Russell, Moore, Wittgenstein, Ayer, Ryle, Austin, and others. Need not be followed by PHIL 51500.

Learning Outcomes: 1. Develop an appreciation for and understanding of central problems, texts, and ideas in the history of analytic philosophy. 2. Identify and reconstruct philosophical arguments. 3. Discriminate between metaphysical and epistemological issues. Credits: 3.00

PHIL 51500 - Twentieth-Century Analytical Philosophy II

Credit Hours: 3.00. The development of philosophical analysis through logical positivism and the various forms of linguistic philosophy. An examination of some of the important writings of Moore, Ayer, Ryle, Wisdom, Austin, and the later Wittgenstein. Need not be preceded by PHIL 51400 .

Credits: 3.00

PHIL 52000 - Existentialism

Credit Hours: 3.00. A detailed exploration and examination of the existentialist movement in modern thought, including its historical roots, its philosophical formulations, and its influence and expression in and relation to art, literature, psychology, social criticism, and religion. Readings will be from at least some of the major existentialists: Kierkegaard, Nietzsche, Jaspers, Heidegger, and Sartre. In addition, texts from existentialist thinkers in other areas will be used.

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular

reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 52500 - Studies In Metaphysics

Credit Hours: 3.00. An intensive and critical examination of one or more of the basic problems of ontology and cosmology, such as substance, existence, causality, change, time, space, teleology, freedom, and universals. Variable content.

Credits: 3.00

PHIL 53200 - Studies In Theory Of Knowledge

Credit Hours: 3.00. An intensive examination of selected problems concerning the nature of human knowledge, its scope and limits, its relation to sense-perception and memory. Variable content.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 54000 - Studies In Social And Political Philosophy

Credit Hours: 3.00. A detailed study of one or more important concepts in social or political philosophy, such as natural rights, revolution, law, freedom, justice, or political obligation. Variable content.

Credits: 3.00

PHIL 55100 - Philosophy Of The Natural Sciences

Credit Hours: 3.00. A survey of issues and theories in contemporary philosophy of science. Variable content.

Credits: 3.00

PHIL 55200 - Philosophy Of The Social Sciences

Credit Hours: 3.00. An exploration of the nature of the concepts in the social sciences, and a study of the ways in which they have been and are employed.

Credits: 3.00

PHIL 55300 - Mathematical Logic

Credit Hours: 3.00. This class is an introduction to various logical foundations of mathematics as well as the basics of logical metatheory.

Learning Outcomes: 1. Understand some of the more advanced methods employed in logical analysis. 2. Explain important problems and issues in foundational mathematical logic and express them in clear and precise terms. 3. Analyze and assess foundational results in mathematical logic. 4. Explain, apply, and appraise the use of formal languages. 5. Assess and construct precise, abstract arguments using the tools of mathematical logic. (This will help students engage in better written and oral communication, in particular in circumstances where perspicuity and logicality are of special importance.) Credits: 3.00

PHIL 56100 - Reading Philosophy: Skills And Strategies

Credit Hours: 3.00. Repeatable twice for a maximum of 9 credits. Academic philosophy demands both the ability to read large amounts of texts fluently, carefully, and closely. Furthermore, the abstract nature of philosophical discourse places a large cognitive demand upon readers. This course prepares non-native English speakers philosophy students for these intensive reading demands. The course has three major learning areas: the language skills that students need to read fluently (i.e., the efficient processing of language for general comprehension of meaning); reading strategies that students can use to improve comprehension and learning; and communication about readings, as the close reading of texts is essential to communicating one's ideas both orally and in writing. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar. Permission of department required.

Learning Outcomes: 1. Read un-simplified prose more fluently (i.e., improved rate, accuracy, and expression). 2. Apply reading strategies to improve reading comprehension of philosophical texts. 3. Define and expand core vocabulary of philosophical discourse and academic discourse. 4. Identify genre, rhetorical features, and stylistic elements of philosophical texts to aid reading comprehension and fluency. 5. Discuss philosophical texts in a classroom setting. 6. Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 56200 - Reading To Argue

Credit Hours: 3.00. Repeatable twice for a maximum of 9 credits. Closely and critically reading philosophical arguments is the first step to composing your own arguments in philosophy.

In addition, developing these skills will help you to orally discuss philosophical ideas, both in classroom discussions as well as when giving presentations. This class aims to prepare students for these tasks by developing the skills of close and critical reading in philosophical discourse. All the while, students will continue improving their reading, writing, and speaking skills in the English language through specifically designed language learning components for non-native English speakers. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar. Permission of department required.

Learning Outcomes: 1. Apply core concepts of informal argument analysis to philosophical arguments. 2. Construct effective informal argument reports. 3. Identify genre and rhetorical devices of philosophical arguments to aid reading comprehension and critical reading. 4. Critically evaluate philosophical arguments. 5. Explain and discuss philosophical arguments orally in class and group conversations. 6. Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 56300 - Directed Reading: Greek Philosophy Texts And Translations

Credit Hours: 1.00. In this course we shall focus on an important Greek philosophical text in fine detail. We will be working in the original language, not from an English translation. Participants will translate the text at hand and philosophical discussion will follow. Normally a Platonic dialogue or a work of Aristotle will be selected.

Learning Outcomes: 1. Develop greater facility in comprehending the text in the original language, and on this basis will be better positioned to analyze the argumentative structure of the text at hand. 2. Improve both philological and philosophical skills. Credits: 1.00

PHIL 56400 - Walk-Along Language Lab

Credit Hours: 1.00. This course is a co-requisite, language-focused class linked to a philosophy seminar. Walk-along courses provide opportunities to shift focus from content to language form and use. Activities and projects for the course are designed to complement tasks and projects required for the seminar. Thus, the purpose of the walk-along course is to help you develop linguistic abilities required to succeed in your coursework. In addition, because of the centrality of writing for philosophy, walk-along courses will predominantly focus on developing your writing skills. Permission of department required.

Learning Outcomes: 1. Define core vocabulary of the seminar topic. 2. Identify genre and rhetorical features of the seminar topic to aid reading comprehension and fluency. 3. Compose several reaction papers for the seminar topic for a wide range of purposes, including explaining, criticizing, extending arguments, giving examples, etc. 4. Explain and discuss your written works in class as well as in individual conferences. Credits: 1.00

PHIL 56500 - Directed Reading: Political Philosophy

Credit Hours: 1.00. Participants read recent and classic work by political philosophers, political economists and political theorists. Specific topics vary by term.

Learning Outcomes: 1. Develop critical reading skills. 2. Have a better understanding of methods of argumentation in political philosophy. 3. Develop an area strength in themes in political philosophy. Credits: 1.00

PHIL 56700 - Directed Readings In Philosophy Of Mind

Credit Hours: 1.00. A reading group focused run by faculty members aimed at an in-depth exploration of some thread of research emerging in the contemporary literatures.

Learning Outcomes: 1. Get up to speed on and analyze the positions being staked out in advanced debates in contemporary philosophy of mind, cognitive science, and/or moral psychology. 2. Evaluate the distinct theoretical approaches and arguments given in support and against newly emerging views. 3. Identify opportunities to intervene on those current debates, pathways for future research, potential criticisms to develop into publishable papers. Credits: 1.00

PHIL 57100 - Writing To Learn

Credit Hours: 3.00. Repeatable twice for a maximum of 9

credits. Writing on a higher academic level can be especially challenging for non-native English-writers. Thus, this course aims to develop students' graduate-level skillsets in philosophical practices in an English language environment to help them gain confidence and become productive members of the philosophical community. Students will learn writing processes that will aid their ability to effectively compose in English, including developing a thesis statement, outlining, drafting, formatting, and editing. As all four chief skillsets in second-language proficiency development work in tandem and enhance each other, the course will rely on writing, reading, speaking, listening, and presenting work for learning and further developing these advanced language skills. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar. Permission of department required.

Learning Outcomes: 1. Construct clear and well-organized expositions of philosophical discourses. 2. Identify cases of plagiarism in writing in order to avoid plagiarism when summarizing the ideas of others. 3. Apply writing strategies to manage the writing process, including outlining, drafting, and revising. 4. Apply genre and rhetorical features of philosophical discourse to writing including: Rhetorical practices and linguistic devices used to paraphrase and summarize information, genre conventions for citing sources and organizational devices used to create coherence and cohesion in essays. 5. Present and discuss ideas and research work compellingly, thoughtfully, and respectfully. 6. Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 57200 - Writing To Argue

Credit Hours: 3.00. Repeatable twice for a maximum of 9 credits. Writing is a primary mode of communication in philosophy. This course aims to prepare students for the writing demands of philosophy by having students develop their ability to analyze, interpret, and critique philosophical arguments through written works and, in the process, construct their own philosophical arguments. Students will also learn writing processes that will aid their ability to effectively and clearly compose philosophical arguments, including outlining, drafting, and editing. Finally, the class will also pay attention to genre and rhetorical features of philosophical discourse, such as how philosophers enact criticism and write introductions to research papers. All the while, students will continue improving their writing and speaking skills in the English language through specifically designed language learning components for non-native English speakers. Students can use their course paper as a draft of a writing sample for PhD programs. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar.

Learning Outcomes: 1. Apply analytical techniques to analyze and interpret philosophical arguments in written composition. 2. Critique philosophical arguments in written composition. 3. Apply steps in the writing process, including outlining, drafting, revising, and editing. 4. Compose an argumentative research paper that responds to a current philosophical issue. 5. Formulate constructive feedback to others and revise your written assignments based upon feedback. 6. Apply genre and rhetorical features of philosophical discourse to one's writing, including: Rhetorical practices and linguistic devices used to criticize arguments and genre conventions for writing introductions, including how to create a research space for your argument. 7. Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 58000 - Proseminar In Philosophy

Credit Hours: 1.00 to 3.00. Designed primarily for majors in philosophy who have already successfully completed six hours in philosophy. Other students may be admitted to the course with the special consent of the instructor in charge. Topic to be selected by the department.

Credits: 1.00 to 3.00

PHIL 59000 - Directed Reading In Philosophy

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose particular field of specialization the content

of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

PHIL 60000 - Graduate Teaching And Pedagogy Seminar

Credit Hours: 3.00. This graduate seminar provides graduate students with a forum to discuss and enact teaching strategies. Over the course of the term, weekly meetings will be devoted to a discussion and implementation of issues in teaching, learning, and assessment. The goal of this course is to prepare and enhance the teaching portfolio of our students and to make them more effective teachers in the classroom.

Learning Outcomes: 1. Analyze and evaluate disparate strategies for effective pedagogical performance. 2. Develop strategies to foster an inclusive teaching and learning environment. 3. Compare evaluative modalities for assessing student performance. Credits: 3.00

PHIL 60100 - Special Topics In Ancient Philosophy

Credit Hours: 3.00. A detailed critical analysis of special problems or texts in ancient philosophy. Prerequisite: PHIL 50100 .

Credits: 3.00

PHIL 61000 - Seminar In Recent Continental Philosophy

Credit Hours: 3.00. An intensive, critical examination of some of the current modes of thought in recent continental philosophy, including phenomenology, critical theory, hermeneutics, deconstruction, and postmodernism. Selected writings from representative figures. Topics and texts will vary from semester to semester. Prerequisite: PHIL 51000 or PHIL 52000 .

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

PHIL 66500 - Philosophy Of Language

Credit Hours: 3.00. An introduction to some of the main concepts and problems in the philosophy of language, such as meaning, reference, and private languages, through readings in the chief contributors to the field. Prerequisite: 6 credit hours in Philosophy.

Credits: 3.00

PHIL 68000 - Seminar In Philosophy

Credit Hours: 3.00. An intensive course for graduate students majoring or minoring in philosophy. The content of the seminar will be determined in accordance with the needs and interests of the students. Prerequisite: 6 credit hours at the graduate level in Philosophy.

Credits: 3.00

PHIL 68300 - Studies In Continental Rationalism

Credit Hours: 3.00. An intensive study of Descartes, Spinoza, or Leibniz, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68400 - Studies In British Empiricism

Credit Hours: 3.00. An intensive study of Locke, Berkeley, or Hume, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68500 - The Philosophy Of Kant

Credit Hours: 3.00. This course will be concerned with the critical philosophy as a whole. Primary emphasis, however, will be on the theories of knowledge and metaphysics as developed in the Critique of Pure Reason. Lesser attention will be paid to Kant's ethics and the principles of judgment as time permits. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHIL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Physical Education Skills

PES 11100 - Lifetime Fitness

Credit Hours: 2.00. Provides students opportunities to assess levels of physical fitness, develop an exercise plan, and experience activities designed to improve cardiovascular condition, strength, and flexibility. Presents current findings and provides laboratory experiences regarding techniques of initiation, maintaining, and evaluating personal fitness. For non-H&K majors only.

Credits: 2.00

PES 11200 - Aquatic Movement Forms

Credit Hours: 1.00. Instruction and practice in aquatic movement forms. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: beginning swimming; intermediate swimming; advanced swimming; synchronized swimming.

Credits: 1.00

PES 11400 - Exercise And Conditioning

Credit Hours: 1.00. Instruction and practice in various types of exercise programs. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: body conditioning; exercise and fitness; exercise to music; jogging and running; swimnastics; relaxation techniques; weight training; exercise and principles of weight control.

Learning Outcomes: 1. Articulate the benefits of regular physical activity. 2. Explain the importance of training intensity relative to efficiency in engagement of physical activity. 3. Participate in a regular physical activity program, and reflect on what they have learned/gained throughout each session.

Credits: 1.00

PES 11500 - Individual And Dual Movement Forms I

Credit Hours: 1.00. Instruction and practice in individual and dual movement forms conducted in an indoor setting. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: badminton; billiards; bowling; fencing; judo; karate; beginning gymnastics; intermediate gymnastics; squash; racquetball; yoga; kung fu; personal defense. Special fee required.

Credits: 1.00

PES 11600 - Individualized And Dual Movement Forms II

Credit Hours: 1.00. Instruction and practice in individual and dual movement forms conducted mainly in outdoor settings. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: beginning golf; intermediate golf; advanced golf; bicycling; beginning tennis; intermediate tennis; advanced tennis; track and field. Special fee required.

Credits: 1.00

PES 11700 - Team Movement Forms

Credit Hours: 1.00. Instruction and practice in team movement forms. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: basketball; field hockey; lacrosse; softball; soccer; power volleyball I; power volleyball II.

Credits: 1.00

PES 11800 - Horseback Riding

Credit Hours: 1.00. Instruction and practice in hunter seat equitation. Class meets off campus, and students are expected to provide their own transportation. Following is a partial list of offerings: beginning; intermediate; advanced; combined training.

Credits: 1.00

PES 12000 - Officiating

Credit Hours: 1.00. Theory and practice in officiating movement forms. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: basketball; field hockey; gymnastics; swimming; softball; volleyball; track and field.

Credits: 1.00

PES 14600 - Advanced Golf Applications

Credit Hours: 1.00. Designed for the student who has either already taken PES 11600, or established themselves as a golfer by having a golf handicap, or by playing on a golf team in the past. Students learn methods to improve course management and strategies on the golf course. Students will receive intense levels of one on one instruction, utilizing video to analyze every student's swing. In addition to instruction, a league will be formed in which the students play 9 holes each week.

Learning Outcomes: 1. Play golf at an advanced level. 2. Identify dysfunctional movement. 3. Apply corrective measures to dysfunctional movement. 4. Develop course management strategies. 5. Effectively participate in team communications and competitive golf. Credits: 1.00

Physics

PHYS 10400 - First Year Physics Seminar

Credit Hours: 1.00. A one-credit course for first-year Physics majors designed to develop concepts and skills in team building, time management, and professional development that complement the students' academic and research training. Talks from a broad range of speakers are included.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths of the Physics programs.

Credits: 1.00

PHYS 15200 - Mechanics (UCC: SCI)

Credit Hours: 0.00 to 5.00. Statics, uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; hydrostatics and hydrodynamics; simple harmonic motion; wave motion and sound.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Learn the basic theories of mechanics and their application, including uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; properties of matter; simple harmonic and wave motion. Credits: 0.00 to 5.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 19000 - Special Assignments

Credit Hours: 1.00 to 4.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Learning Outcomes: 1. Understand physics and physical laws of nature by learning beyond what is offered by currently available fixed-title courses. Credits: 1.00 to 4.00

PHYS 19400 - Freshman Physics Orientation

Credit Hours: 1.00. Designed to provide incoming physics majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the Department including degree options, co-op program, undergraduate research, careers in physics, use of spreadsheet software, graphing packages, and drawing programs. Attendance and performance on assigned projects are the basis of the Pass/Not Pass requirement.

Credits: 1.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 21500 - Physics For Elementary Education (UCC: SCI)

Credit Hours: 2.00. The curriculum draws heavily on Project 2061 Benchmarks and NRC Science Education Standards for content and nature of science materials and focuses on middle school learning goals (especially those with strands at elementary level). Each learning goal was expanded to finer-grained target ideas creating more steps to make concepts more understandable and explicit. Activities were designed to enable students to develop deep conceptual understanding of each target area and the structure and sequence were guided by research on student learning. In this class social interactions are used to clarify ideas and to encourage peer teaching. The students' understandings are based on prior knowledge. The class is based on a constructivist framework where new understandings are scaffolded from partial to incomplete understandings, and those are refined over time.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

PHYS 21600 - Introduction To Science-Based Dating

Credit Hours: 3.00. An introduction to age determination techniques used in archaeology and the earth sciences. Various techniques currently in use, and their impact on our understanding of the past, will be described qualitatively. Topics covered include dating by use of Carbon 14, thermoluminescence, tree rings, and fission tracks, and surface exposure dating by use of cosmogenic nuclides.

Credits: 3.00

PHYS 21700 - Introduction To Current Physics And Forefront Research Honors

Credit Hours: 1.00. This course introduces new physics majors to current physics and the research areas of the department. There are multiple sections with each section having eight or less students meeting with a professor. The course is part seminar, part interactive discussion and questions and answers and part laboratory visits to research areas. Topics cover a wide range including the evolution of the Universe, astrophysics, elementary particle physics, nuclear physics, geophysical dating, nanoscience and imaging. Topics evolve to match current physics and the interests of the students.

Credits: 1.00

PHYS 21800 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Analyze physical circumstances according to Newton's Laws of motion properly. 2. Apply basic conservation laws and and to recognize the circumstances in which they apply. 3. Use physical terms such as energy, acceleration, momentum, impulse, velocity, etc., properly. Credits: 4.00

PHYS 21900 - General Physics II (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Learn the basic theory and application of electricity, magnetism, dc and ac circuits; geometrical and physical optics; topics in modern physics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical Sciences* PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum,

conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

PHYS 23500 - Seminar In Careers In Physics

Credit Hours: 1.00. Course is designed to help physics majors evaluate different career options. Permission of instructor required.

Credits: 1.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25100 - Heat, Electricity And Optics

Credit Hours: 5.00. Heat, kinetic theory, elementary thermodynamics, heat transfer. Electrostatics, AC/DC circuits, electromagnetism, magnetic properties of matter; geometrical and physical optics.

Learning Outcomes: 1. Compute force, field, and potential energy and combine these in a variety of rich contexts (e.g., forces on dipoles). 2. Compute electric fields due to various charge configurations. 3. Compute electric fields in matter in equilibrium. 4. Compute magnetic fields from sources. 5. Apply microscopic circuit analysis techniques. 6. Apply macroscopic circuit analysis techniques. 7. Compute forces on charges in magnetic fields. 8. Compute fields using Gauss's and Ampere's Law. 9. Compute EMF between two points in situations where flux is changing. 10. Compute radiative field from accelerating charges. 11. Compute interaction of EM Waves with matter. 12. Heat and Thermodynamics: reason about thermodynamic problems using the concepts of heat, work, temperature and thermal energy. Credits: 5.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27000 - Special Topics In Physics

Credit Hours: 1.00 to 5.00. Specialized topics in physics. Permission of department required.

Credits: 1.00 to 5.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 29000 - Special Assignments

Credit Hours: 0.00 to 3.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Credits: 0.00 to 3.00

PHYS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29500 - Outreach Assistance As Service Learning

Credit Hours: 1.00 to 3.00. Physics 29500 is a service learning class available to students willing and able to deliver physics lessons to K-12 classrooms and to other public events. Students are required to prepare and rehearse labs/activities so they are able to offer professional presentations. Students are also required to maintain a reflection journal, where they record notes about their experiences. Although efforts are made to work around students' schedules, students should have at least on open morning or afternoon each week (preferably 2-3) that allows them to visit an assigned site on a regular, consistent basis. One credit is equivalent to 32 hours of involvement in preparation and/or delivery of activities, and journaling time. Prerequisites: desire, commitment, dependability responsibility.

Credits: 1.00 to 3.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics.

The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 31700 - Special Nuclear Materials

Credit Hours: 3.00. This Great Issues course addresses the impact of science and technology of the special nuclear materials (so designated by Congress as they could be used to make nuclear weapons as well as to produce low-cost electric power) on society and the ethical issues that arise. The course is designed to be a dynamic, interactive learning experience, and topics covered range from the technical issues involved in searching, transporting, and safely utilizing these materials to social and economic impact of these activities, and to the ethical and philosophical issues presented by the flow of modernity.

Learning Outcomes: 1. Able to think and function as a scientist. 2. Demonstrate breadth of knowledge. 3. Demonstrate knowledge of a subfield of physics: The student demonstrates knowledge of the diverse applications of physical laws in fundamental physics, in various branches of science and in applied science and engineering. 4. Able to communicate well both orally and in writing. 5. Able to collaborate as part of a team. Credits: 3.00

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 32300 - Research With Big Data I

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

PHYS 32400 - Research In Big Data II

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle.

Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

PHYS 34300 - Modern Physics Laboratory

Credit Hours: 1.00. Laboratory experiments to support PHYS 34200.

Credits: 1.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34500 - Optics Laboratory I

Credit Hours: 1.00. Laboratory experiments in geometrical and physical optics and spectrometry.

Credits: 1.00

PHYS 34900 - Introduction To Quantum Computing

Credit Hours: 3.00. This is a first course in quantum information and quantum computing, for students who have already had an introduction to quantum science. Linear algebra and some probability theory will be presented and used throughout this course. The basic postulates of quantum mechanics will motivate the applications to qubits, cryptography, quantum computation, algorithms, error correction, and other current topics.

Learning Outcomes: 1. Explain the difference between classical and quantum computation. 2. Understand the essential role of quantum entanglement. 3. Appreciate the role of eigenstates in quantum cryptography. 4. Explain the historical significance of Shor's algorithm in establishing the field of quantum computing. 5. Demonstrate the ability to write a quantum computing program. Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-

Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 38199 - Professional Practice I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Credits: 0.00

PHYS 38299 - Professional Practice II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Credits: 0.00

PHYS 38399 - Professional Practice III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Credits: 0.00

PHYS 39000 - Special Assignments

Credit Hours: 1.00 to 4.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Learning Outcomes: 1. Understand physics and physical laws of nature by learning beyond what is offered by currently available fixed-title courses. Credits: 1.00 to 4.00

PHYS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 41000 - Physical Mechanics I Honors

Credit Hours: 3.00. Newtonian, Lagrangian, and Hamiltonian mechanics. Emphasis on point mass mechanics. Free, driven, and damped harmonic motion, central force problem.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical

Mechanics. Credits: 3.00

PHYS 41100 - Physical Mechanics II Honors

Credit Hours: 2.00. Continuation of mechanics in PHYS 41000 . Coupled systems, general theory of small oscillations, the vibrating string, perturbation theory. Rigid body motion. Motion of charged particles in electromagnetic fields. Elements of continuum mechanics.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 2.00

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 41610 - Thermal And Statistical Physics

Credit Hours: 3.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential; classical and quantum ideal gases; phase equilibria; critical phenomena.

Learning Outcomes: 1. Understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 43000 - Electricity And Magnetism I Honors

Credit Hours: 3.00. Electrostatics, solutions of Poisson's equation in spherical and cylindrical coordinates, macroscopic and microscopic theory of dielectrics, electrostatic energy, conduction; magnetostatics, electromagnetic induction, and magnetic properties of matter.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 3.00

PHYS 43100 - Electricity And Magnetism II Honors

Credit Hours: 2.00. A continuation of PHYS 43000 . Magnetic energy; applications of Maxwell's equations to a.c. circuits, filters, transmission lines, waveguides, and antennae; Lienard-Wiechert potentials.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 2.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 46100 - Quantum Mechanics II Honors

Credit Hours: 3.00. Angular momenta, radial equation, operators, matrices, spin, time-independent perturbation theory, electron-electromagnetic field interaction, hydrogen atom, structure of atoms, molecules, radiation; selected topics in radiative transitions, collision theory, solids, nuclei, elementary

particles and their symmetries.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 47000 - Special Topics In Physics

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Credits: 1.00 to 5.00

PHYS 49000 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, laboratory work, or research in special areas of physics. Intended for upperclass students. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

PHYS 52100 - Survey Of Classical Physics

Credit Hours: 3.00. This course is intended for first-year graduate students in the Department of Physics. It provides an intensive problem solving environment encompassing a broad survey of major topics in classical mechanics, electromagnetism, and thermal physics. The primary objective is to prepare beginning graduate students for continuing on to higher level of work in the physics graduate program.

Learning Outcomes: 1. To get the beginning graduate students ready for higher levels of physics work by consolidating the foundations in all areas of classical physics. Credits: 3.00

PHYS 52600 - Physics Of Quantum Computing And Quantum Information

Credit Hours: 3.00. An introduction to the physics of quantum information science. Starting with the concepts of quantum superposition, it defines and describes qubits (quantum bits) and their manipulation by quantum logic gates. The topics of quantum entanglement and the EPR paradox are introduced, and their importance for quantum teleportation, communication, and quantum cryptography are covered. Quantum computing is described in terms of quantum circuits of logic gates, and also in terms of quantum algorithms, such as Deutsch's algorithm, the quantum Fourier transform, Shor's prime factoring algorithm, and Grover's search algorithm. The final topic is quantum decoherence and the limits it places on practical implementations of quantum computing.

Learning Outcomes: 1. Understand the meaning of entanglement and how it distinguishes quantum from classical science. 2. Understand how the rules of quantum measurement are fundamental to quantum cryptography and quantum computing. 3. See how the basics of quantum science enable quantum computing to solve important problems otherwise inaccessible to classical computing. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include

broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 54500 - Solid-State Physics

Credit Hours: 3.00. Crystal structure; lattice vibrations and electronic band structure of crystals; electrical, optical, and thermal properties of solids; transport and other nonequilibrium phenomena in uniform and nonuniform materials.

Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

PHYS 55600 - Introductory Nuclear Physics

Credit Hours: 3.00. Theory of relativity, brief survey of systematics of nuclei and elementary particles, structure of stable nuclei, radioactivity, interaction of nuclear radiation with matter, nuclear reactions, particle accelerators, nuclear instruments, fission, nuclear reactors.

Credits: 3.00

PHYS 56000 - Stellar Evolution

Credit Hours: 3.00. (ASTR 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

PHYS 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (ASTR 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

PHYS 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (ASTR 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

PHYS 56300 - Astroparticle Physics

Credit Hours: 3.00. (ASTR 56300) An overview of an emerging research frontier in modern physics that lies at the interface of particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology, cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

PHYS 56400 - Introduction To Elements Particle Physics

Credit Hours: 3.00. This course brings students up to the current status of research in elementary particle physics. The focus of the course is the construction of the Standard Model with emphasis on the electroweak theory. The seminal experiments that confirmed the predictions of the Standard Model is presented. The solar neutrino problem, the search for nonzero neutrino masses, and the efforts to construct a theory which unifies all interactions, including gravity, is discussed.

Credits: 3.00

PHYS 56500 - Introduction To Elementary Particle Physics II

Credit Hours: 3.00. This course follows PHYS 56400 , and it continues to present current topics in elementary particle physics. It focuses on the Higgs mechanism, and it explores physics beyond the standard model. Special attention is devoted to supersymmetry and searches for new particles.

Credits: 3.00

PHYS 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (ASTR 56700) Fundamental concepts in observational astronomy, including coordinate and time systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal.

Credits: 3.00

PHYS 57000 - Selected Topics In Physics

Credit Hours: 3.00. Specialized topics in physics selected from time to time. Permission of instructor required.

Credits: 3.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

PHYS 59000 - Reading And Research

Credit Hours: 1.00 to 3.00. (Calumet, Fort Wayne) 1.00 to 6.00 (West Lafayette, IUPUI). Reading and research in Physics. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 59300 - Independent Research

Credit Hours: 1.00 to 4.00. Research in some area of modern physics (spectroscopy, nuclear physics, solid state physics, elementary particle physics, biophysics, geophysics, etc.) with student receiving individualized supervision and guidance from staff member. This course may be used to satisfy the independent project or 500-level elective requirement of the undergraduate majors in Honors and Applied Physics Honors Programs. Permission of instructor required.

Credits: 1.00 to 4.00

PHYS 59500 - Instructional Design In Physical Science

Credit Hours: 1.00 to 3.00. This course builds on collaborative interactions among current Purdue Physics or Education students, K-12 science educators, Physics and Purdue College of Science faculty, and Physics Outreach. The goal for this course is to provide opportunities and mentorship for independent work that could include the design, piloting, and assessment of instructional materials, relevant to learning and teaching topics and concepts related to the physical sciences. With a "service learning" orientation, students enrolled in this course should expect to learn and build upon the fundamental principles related to the design and implementation of instructional materials in classroom or informal learning environments, and assessment of learning. Materials developed could contribute to the repertoire of practicing teachers and/or Physics Outreach.

Learning Outcomes: 1. Learn to apply fundamental principles of instructional design and/or assessment of learning. 2. Develop creative and engaging age-appropriate opportunities to promote the learning of scientific concepts. 3. Critique and reflect upon personal insights and experiences related to non-traditional and informal science education.

Credits: 1.00 to 3.00

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

PHYS 60300 - Methods Of Theoretical Physics IIIB

Credit Hours: 3.00. Basic theory of groups and group representations. Finite groups and abelian infinite groups, with applications to atomic physics. Elements of Lie group theory. The three-dimensional rotation group. The group SU(3). Application to particle physics. Prerequisite: PHYS 60100 .

Credits: 3.00

PHYS 60500 - Pedagogical Methods For Physics Graduate Students

Credit Hours: 2.00. This course prepares physics graduate students for classroom and laboratory teaching assignments. Through 100 minutes per week of lectures and hands-on recitations, it provides an intensive survey of basic pedagogical methods, both theoretically and in practice. Students will learn and practice teaching techniques via various forms and microteaching, reading, and class discussion. A broad range of results from physics education research will be studied in detail. Additional topics include grading and assessment, responsible conduct in teaching related to issues such as gender, culture and ethnicity, students with disabilities, and ethics in academia, generally, including ethical conduct of research.

Credits: 2.00

PHYS 61000 - Advanced Theoretical Mechanics

Credit Hours: 3.00. Lagrangian and Hamiltonian mechanics; variational principles; canonical transformations; Hamilton-Jacobi theory; theory of small oscillations; Lagrangian formulation for continuous systems and fields. Prerequisite: PHYS 51000 .

Credits: 3.00

PHYS 61700 - Statistical Mechanics

Credit Hours: 3.00. Classical and quantum statistical mechanics. Prerequisite: PHYS 66000 .

Credits: 3.00

PHYS 63000 - Advanced Theory Of Electricity

And Magnetism

Credit Hours: 3.00. The experimental origins of Maxwell's equations. Electrostatics and magnetostatics; solution of boundary value problems. Quasi-static currents. Electromagnetic energy and momentum and the Maxwell stress tensor. Foundations of optics. Radiation from antennas, multi-pole expansion; waveguides. Prerequisite: PHYS 53000 , PHYS 60000 .

Credits: 3.00

PHYS 63100 - Advanced Theory Of Electricity And Magnetism

Credit Hours: 3.00. Covariant formulation of electrodynamics; Lienard-Wiechert potentials; radiation from accelerated particles; Cerenkov radiation; dynamics of relativistic particles; radiation damping; introduction to magneto-hydrodynamics. Prerequisite: PHYS 63000 .

Credits: 3.00

PHYS 64500 - Electron Theory Of Solids I

Credit Hours: 3.00. Electronic energy bands in crystalline solids; crystal symmetry and Brillouin zones, approximate methods of calculation, electrons and holes under applied fields. Lattice dynamics and thermal conductivity. Electron-lattice interactions. Transport phenomena in metals and semi-conductors. Prerequisite: PHYS 54500 , PHYS 60100 , PHYS 66100 . Permission of instructor required.

Credits: 3.00

PHYS 64600 - Electron Theory Of Solids II

Credit Hours: 3.00. Crystal imperfections, impurities and lattice defects. Magnetic properties: diamagnetic effects, paramagnetism, ferromagnetism, resonance phenomena. Ferroelectricity. Optical properties of metals and semiconductors; interband and intraband transitions, excitons, effects of crystal imperfections. Prerequisite: PHYS 64500 . Permission of instructor required.

Credits: 3.00

PHYS 66000 - Quantum Mechanics I

Credit Hours: 3.00. Origins of the quantum theory, the uncertainty and complementarity principles. The Schrodinger equation and its solutions for simple physical systems. Mathematical formulation of the quantum theory. Applications: simple harmonic oscillator, theory of angular momentum, the hydrogen atom. Time-independent and time-dependent perturbation theory. The Pauli exclusion principle. Spin of the electron. Elementary theory of scattering. Prerequisite: PHYS 53000 , PHYS 55000 , PHYS 60000 , PHYS 61000 . Corequisite: PHYS 60100 .

Credits: 3.00

PHYS 66100 - Quantum Mechanics II

Credit Hours: 3.00. Symmetry and conservation laws. The Klein-Gordon and Dirac equations. Interaction of radiation with matter. Applications of quantum mechanics to atomic structure. Scattering theory. Prerequisite: PHYS 60100 , PHYS 63000 , PHYS 66000 .

Credits: 3.00

PHYS 66200 - Quantum Field Theory I

Credit Hours: 3.00. Introduction to relativistic quantum field theory. Representations of the Lorentz and Poincare groups. Noether's theorem: symmetries and conservation laws. Canonical quantization of free Klein-Gordon, Dirac, Maxwell fields. Interacting field theory: Lehmann-Kallen representations. LSZ reduction formula. Schwinger action principle. Quantum Electrodynamics (QED): Gell-Mann Low expansion, Wick's theorem, Feynman rules for Green functions and S-matrix elements. Scattering processes in QED: cross sections in low orders of perturbation theory. Prerequisite: PHYS 66100 . Permission of instructor required.

Credits: 3.00

PHYS 66300 - Quantum Field Theory II

Credit Hours: 3.00. Concepts and techniques of relativistic quantum field theory. Quantum Electrodynamics: radiative corrections, renormalization program, infrared divergences, external field problem. Feynman path integral quantization. Global symmetries and Ward identities. Quantum effective action: effective potential, loop expansion. Non-Abelian gauge theories: quantization via Faddeev-Popov prescription, Feynman rules, BRS invariance. Quantum Chromodynamics. Callen-Symanzik equation and renormalization group. Prerequisite: PHYS 66200 . Permission of instructor required.

Credits: 3.00

PHYS 66400 - Quantum Theory Of Many-Body Systems

Credit Hours: 3.00. Practical introduction to modern quantum field theory techniques as applied to the study of many-body phenomena occurring in solid state systems. Standard perturbative-theoretic results based on zero- and finite-temperature Green's functions, with application to specific physical situations. Introduction to nonperturbative methods. PHYS 64500 and PHYS 64600 are recommended. Prerequisites: PHYS 61700 , PHYS 66000 , PHYS 66100 . Permission of instructor required.

Credits: 3.00

PHYS 67000 - Selected Topics In Physics

Credit Hours: 1.00 to 3.00. Specialized topics in physics, varied from time to time. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 67500 - General Relativity

Credit Hours: 3.00. Theoretical and experimental general relativity. The equivalence principle and its experimental basis. The Einstein field equations; classical tests of general relativity; gravitational radiation, cosmological considerations; topics to be chosen. Prerequisite: PHYS 60000 , PHYS 61000 , PHYS 63000 .

Credits: 3.00

PHYS 69600 - Introduction To Physics Research

Credit Hours: 1.00. Seminar designed to acquaint first-year physics graduate students with the research programs of the department.

Learning Outcomes: 1. Acquaint graduate students with the thesis research opportunities available in physics and to initiate conversations between students and potential major professors. Credits: 1.00

PHYS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHYS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Political Science

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

POL 20400 - Spies And Lies: Studies In Intelligence And National Security

Credit Hours: 3.00. This course examines the role that the collection, analysis, and dissemination of intelligence plays in US foreign policy and national security. We will unpack the missions and methods of the US Intelligence Community. Who does what? What are the different challenges for those engaged in the different aspects of intelligence? Why is the intelligence community configured like it is? We will also spend time with more contemporary topics in intelligence. What role does intelligence play meeting future national security and foreign policy challenges? What is the role of intelligence in modern warfare, including cyber-warfare? What role does intelligence play in a liberal democracy? What should intelligence oversight look like?

Learning Outcomes: 1. Gain a better understanding of the complexities of our intelligence community and the role it plays in protecting against threats to our nation's security and achieving foreign policy objectives. 2. Understand the structure of the US Intelligence Community and how it's changed over time. 3. Understand how intelligence is collected, analyzed, disseminated, and utilized

by policymakers. 4. Understand new threats and challenges facing the Intelligence Community. Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

POL 22900 - Emerging Problems In Political Science

Credit Hours: 1.00 to 3.00. This course focuses on problems and issues that are beginning to be recognized as worthy of public discussion or policy action, or that may be new areas of expertise and interest for our faculty members. We use it to introduce new topics and approaches, including experimental pedagogies, courses that involve travel, and the like. The content of the course varies from one offering to the next. Possible topics are Bioethics and Politics, Food Policy, and Bicycle Politics.

Credits: 1.00 to 3.00

POL 23000 - Introduction To Peace Science

Credit Hours: 3.00. This course provides an introduction to the field of peace science, the systematic study of the causes and consequences of conflict between and within states, including conflict resolution and strategies for creating sustainable peace.

Learning Outcomes: 1. Identify the elements of conflict, including the stakeholders, their motivations, and their decision-making processes. 2. Describe the complexities of why conflicts get started, how and why they escalate or de-escalate, and how and why outsiders get involved. 3. Compare and evaluate explanations for how and why conflicts end and factors that increase the likelihood of enduring peace. Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23200 - Contemporary Crises In International Relations

Credit Hours: 3.00. The focus of this course will be on major world crises, such as in the Middle East and Southern Africa, and ways in which these crises may be analyzed.

Credits: 3.00

POL 23400 - The Politics Of Terrorism

Credit Hours: 3.00. This class examines the phenomenon of terrorism and counterterrorism. Why do terrorists do what they do? What can governments do to stop them? We will begin with issues of definition, and theoretical and empirical approaches to the study of terrorism. We will then delve into the history and

evolution of the tactic (taking time to study some of the more notorious organizations). At this point in time it is critical that we look at both domestic-particularly in the United States-and transnational forms of terrorism. The study of terrorism is rife with puzzles that we will explore. Why resort to violence in the first place? How and why do groups evolve over time? How and why do some groups end, and others continue for years? Why are some individuals/groups not classified as terrorists? What are the consequences of terrorism? We will also look closely at counterterrorism policy. What are the most effective ways to respond to terrorism? What doesn't work? How do policies differ between states? To what extent is there global cooperation on counterterrorism? We will conclude the class by taking a critical look at US counterterrorism policy and the massive counterterrorism apparatus that has developed in the aftermath of the attacks of September 11, 2001. Should counterterrorism dominate US national security priorities to the degree it does?

Learning Outcomes: 1. Understand the leading theories and concepts for understanding terrorist behavior. 2. Have a greater understanding of counterterrorism strategies and their impact on terrorist organizations/lone wolfs. 3. Identify current trends and make predictions about the future of both terrorism and counterterrorism. 4. Think analytically about global threats. Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 25801 - Introduction To Tech Diplomacy In International Affairs

Credit Hours: 3.00. This course is an overview and introduction to the field of tech diplomacy in international affairs and foreign policy. It explores the risks and opportunities of emerging technology in international relations and potential strategies in governance, foreign policy, and diplomacy to address them.

Learning Outcomes: 1. Define and summarize the key features of tech diplomacy, including its principles and goals. 2. Explain the relationships between technology, globalization, international relations, and foreign policy. 3. Analyze new and ongoing challenges in international affairs posed by emerging technology and draw conclusions about how tech diplomacy approaches might address such challenges. Credits: 3.00

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL) Credits: 3.00

POL 31000 - Methods Of Philosophy, Political Science, And Economics

Credit Hours: 3.00. This course introduces students to the basic concepts, techniques, and tools used in philosophical, political, and economic analyses through the lens of rational choice theory. Starting with the foundations of rationality and individual rational choice, the course advances to examining rational choice in groups through game theory and social choice theory. The course concludes by analyzing how rational decision-making operates within institutional frameworks, such as the firm.

Learning Outcomes: 1. Explain key concepts in rational choice theory, such as Pareto efficiency, ordinal and cardinal utility, Nash equilibrium, and backwards induction. 2. Apply formal rational choice models to philosophical, political, and economic problems. 3. Translate real-world scenarios into abstract representations. 4. Assess the limitations of rational choice theories and models. Credits: 3.00

POL 31400 - The President And Policy Process

Credit Hours: 3.00. A study of presidential leadership as the embodiment of social forces and as reflective of the personality of the incumbent; the president as national leader reflecting national myths and ideologies; the growth of the presidency; issues and forces affecting the continuity of presidential leadership; the degree of institutionalization of the presidency.

Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 32930 - Topics In Global Politics And International Relations

Credit Hours: 3.00. Variable topic course that examines conflict, competition, and cooperation in global politics and international relations. Students examine the historical background of the topic and apply current political science theories to understand the institutions, participants, and outcomes. Course may be repeated for a maximum of 9 credit hours.

Learning Outcomes: 1. Identify and explain the major theories related to the course topic covered in this course. 2. Explain the emergence of the modern global system of nation-states and the position of non-state actors within the topic area of the course. 3. Evaluate how differences in political interests, identities, and material circumstances affect international cooperation and conflict related to the topic of the course. Credits: 3.00

POL 33500 - China And The Challenges Of Globalization (UCC: BSS)

Credit Hours: 3.00. Globalization is a very popular topic, resulting in a lot of loose and poorly thought-through talk and writing around the subject. The view taken in this course is that to understand current processes of globalization we need to examine it in less broad and amorphous ways by focusing on its specific manifestations. Thus, this course focuses on how China has managed the challenges of globalization. China is a particularly useful case study because it failed the challenges of globalization in the late 19th and early 20th centuries. For an ancient civilization such as China, this failure had tremendous impact on its national pride. The Chinese refer to this historical juncture as the "century of shame." Towards the end of the 20th century and the onset of the 21st, China faced again the challenges of globalization and has arisen to the tasks in a spectacular fashion, transforming a largely rural and agriculture economy into the world's second largest economic power. This amazing transformation is leading some to proclaim that the 21st century will belong to China!

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recall basic facts about China's geography, people, economy, and culture. 2. Identify key historical moments in China's engagement with globalization. 3. Demonstrate a clear grasp of the concept of globalization and contending definitions of it. 4. Apply knowledge to explain how China has dealt with challenges of globalization. Credits: 3.00

POL 34500 - West European Democracies In The Post-Industrial Era

Credit Hours: 3.00. An introduction to the political institutions and processes in West European democracies. The course focuses on the ability of Western democracy to survive the transition to the post-industrial era.

Credits: 3.00

POL 34700 - Introduction To Latin American Politics

Credit Hours: 3.00. Major aspects of Latin American politics and development. Questions such as the impact of the military on political development, the dynamics of Latin American industrialization, and Latin America's changing international role will be explored.

Credits: 3.00

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

POL 35200 - Selected Topics In Political Theory

Credit Hours: 3.00. This course is intended to provide a more narrowly focused analysis of selected problems and topics, giving special emphasis to their conceptual frameworks and their significance in the history of political philosophy. This course also will allow students to see the practical role of the political theorist by stressing the methods and criteria used in the selection, formulation, and solution of problems in political

philosophy. Course topics will be different each semester.

Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 37200 - Indiana Government And Politics (UCC: BSS)

Credit Hours: 3.00. An examination of the political and governmental organization of the state of Indiana. Includes the political and historical development of Indiana state government and comparison of policies and institutions with those of other states.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 37300 - Campaigns And Elections

Credit Hours: 3.00. This course analyzes the role of political parties, issues, candidates, media, funding, and electoral and campaign strategies in presidential, congressional, and state campaigns. Contemporary election examples will be utilized.

Credits: 3.00

POL 40200 - Topics In Political Research Methods

Credit Hours: 3.00. This variable topics course in political methodology acquaints students with the scientific process of political research by applying different research designs and methodological approaches to analyzing political data. Students must complete POL 30000 before taking this course. This variable topic course may be repeated for up to 9 credit hours.

Learning Outcomes: 1. Apply research methods to analyze data and communicate results to specialists and non-specialists. 2. Evaluate and select appropriate research methods for political science research questions. 3. Utilize commonly used software applications to analyze data. 4. Assess the benefits and limits of different research methods for making valid descriptive and causal claims, noting differences in internal and external validity. Credits: 3.00

POL 40300 - Field Experience In Political Science

Credit Hours: 1.00 to 9.00. Students are able to earn credit for internships in federal, state, and local government offices as well as with political parties, campaign organizations, nonprofit organizations, legislative bodies, and interest groups. Credit and course requirements to be arranged with the instructor. Permission of instructor required.

Credits: 1.00 to 9.00

POL 40301 - Local Partner Internship In Political Science

Credit Hours: 3.00. This course in Political Science offers experiential learning opportunities to qualified junior and senior political science majors. These competitive internships allow students to explore a political science-related field, apply classroom knowledge and skills, and gain valuable work experience for academic credit. Employers recognize that the most qualified graduates come into the workforce with a combination of strong academic preparation and practical on-the-job experience. Political science internship partners include city and county governments, non-profit agencies, political parties, and other community organizations. Public policies affect every aspect of community life, and our internship partners enable students to experience first-hand the impact of government actions on local organizations' work and the constituencies they serve. POL 403 internships provide the opportunity to develop and refine skills that are important to academic success, career readiness, and personal growth. All internships for credit must be approved by the Department of Political Science through the application process. Students can only take either POL 40301, 40302, or 40303 once for a letter grade and 3 credit hours. Students have the option to take up to 6 additional credit hours as Pass/Not Pass by enrolling in POL 40300. Internships can be paid or unpaid. Some internships require a background check. Permission of department required.

Learning Outcomes: 1. Explore a political science-related field to help discern a career path after college. 2. Develop professional skills and gain valuable on-the-job experience in preparation for the workforce and to gain a competitive edge in the job market. 3. Apply classroom knowledge and skills to societal problems in the real world. 4. Learn first-hand how political and social issues affect communities and how local governments and organizations seek to address them. 5. Recognize the versatility and value of a political science degree. Credits: 3.00

POL 40302 - Self-Initiated Internship In Political Science

Credit Hours: 3.00. This course in Political Science offers the opportunity to complete a self-initiated internship for academic credit. Employers recognize that the most qualified college graduates come into the workforce with a combination of strong academic preparation and practical on-the-job experience. Internships strengthen resumes and law and graduate school

applications. All internships for credit must be approved by the Department of Political Science through the application process. Students can only take either POL 40301, 40302, or 40303 once for a letter grade and 3 credit hours. Students have the option to take up to 6 additional credit hours as Pass/Not Pass by enrolling in POL 40300. Internships can be on-site or virtual, or a hybrid. Internships can be paid or unpaid. Some internships require a background check. Permission of department required.

Learning Outcomes: 1. Explore a political science-related field to help discern a career path after college. 2. Develop professional skills and gain valuable experience in preparation for the workforce and to gain a competitive edge in the job market. 3. Apply classroom knowledge and skills to real-world issues in a professional setting. 4. Recognize the versatility and value of a political science degree. 5. Strengthen applications to law school and graduate school. Credits: 3.00

POL 40700 - Field Experience In Undergraduate Research Collaboratory

Credit Hours: 3.00. Students earn credit for research with Department of Political Science Faculty and Advanced Graduate Students. Collaboratory members might engage in activities such as data collection and processing, survey design, and data analysis and visualization. Entry into the Collaboratory is managed by the Department of Political Science through an application process. Graded option available to students who have taken POL 300A and are pursuing the Research Intensive Concentration for Political Scientists.

Learning Outcomes: 1. Analyze research approaches and demonstrate skills in an academic research environment. 2. Identify important topics in political science research ethics and the ethical conduct of human subjects research. 3. Demonstrate communication and teamwork skills on a collaborative project. Credits: 3.00

POL 41000 - Political Parties And Politics

Credit Hours: 3.00. An analysis of the nature and functioning of U.S. political parties in terms of social and economic forces that shape our political system. Interactions among political parties, pressure groups, and formal government structures are emphasized throughout. Special attention is devoted to political leadership, nominating processes, campaign management, voting behavior, and other important aspects of American politics.

Credits: 3.00

POL 41100 - Congress: Structure And Functioning

Credit Hours: 3.00. A study of how Congress actually operates. Formal and informal power structures within both chambers and roles of the individual members of Congress are analyzed. Attention is directed to latent, as well as manifest, functions of legislative, investigative, and other major activities of Congress. The problem of bringing expertise to bear on the legislative process is considered throughout.

Credits: 3.00

POL 41300 - Analysis Of Political Attitudes And Behavior

Credit Hours: 3.00. A broad-based survey of human political attitudes and behavior and the forces that underlie them, utilizing contemporary research tools to examine and evaluate theoretical claims. Examines how people respond to information about politics, communicate about politics, form attitudes and preferences about politics, and their political interactions with other individuals, groups, and nations. Introduces survey research methodology, its uses, and its challenges in measuring political attitudes and behavior.

Learning Outcomes: 1. Compare and contrast foundational and contemporary theories that explain political attitudes and behavior. 2. Critically evaluate sources of information about public opinion and understand how to communicate, accurately, the results from survey research. 3. Synthesize course knowledge to create a theoretically-grounded analysis of political attitudes or behavior using empirical data and appropriate research methods. 4. Describe and explain to specialists and non-specialists the theories and empirical evidence of the causes and consequences of political attitudes and behavior. Credits: 3.00

POL 41500 - US Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the United States.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Create and analyze political messages in the context of

campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Write correctly and clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 42900 - Contemporary Political Problems

Credit Hours: 3.00. Contemporary political problems in the United States affecting the interpretation of democracy, human rights and welfare, social pressures, and intergovernmental relations.

Credits: 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

POL 43200 - Selected Problems In World Order

Credit Hours: 3.00. An in-depth analysis of how selected problems in international relations are treated within international organizations.

Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43500 - International Law

Credit Hours: 3.00. A study of international legal theories, principles, and practices, with an emphasis on the role and utility of law in contemporary international relations.

Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights

violations. Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

POL 45000 - Game Theory And Strategy In Political Science

Credit Hours: 3.00. This course introduces students to the basics of game theory and its applications in political science. The course will cover foundational concepts in game theory, including strategic rationality, best responses, normal and strategic form games, backward induction, and games of incomplete information. Students will complete problem sets to demonstrate mastery of these subjects. We will also apply these basic game theoretic tools to important problems in political science to better understand the dynamics of bargaining, coercion, reassurance, cooperation, and other key concepts.

Learning Outcomes: 1. Demonstrate mastery of key game theoretic concepts, including utility theory, best responses and equilibrium, backward induction, and incomplete information. 2. Solve basic game theoretic problems and derive equilibria of both normal form and strategic form games with both simultaneous and sequential moves. 3. Apply game theoretic concepts to explain actions and outcomes in important contemporary and historical cases in political science, policy, and politics. Credits: 3.00

POL 45801 - Tech Diplomacy And Emerging Technology

Credit Hours: 3.00. This course explores how emerging technologies in various sectors can disrupt global power structures and international relationships. Students will analyze case studies and apply international relations theories to understand the opportunities and risks and develop skills communicating with policy and lay audiences.

Learning Outcomes: 1. Explain the risks and opportunities of emerging technology for international relations and how they shape goals for tech diplomacy. 2. Demonstrate the key features of a policy brief, a white paper, and principles of effective communication of technical information to policy and lay audiences. 3. Analyze and communicate information about emerging threats and opportunities in fields of emerging technology. 4. Propose strategies to address emerging threats and opportunities using principles and practices of tech diplomacy. Credits: 3.00

POL 46000 - Judicial Politics

Credit Hours: 3.00. A survey of judicial processes as they operate in America. Both trial courts and appellate courts will be examined in light of the procedures with which they operate. The external social, economic, and political pressures surrounding courts and the impact courts have on society will be considered.

Credits: 3.00

POL 46100 - Constitutional Law I

Credit Hours: 3.00. A survey of selected areas of constitutional law, considering the political and social influences as well as the doctrinal forces that have produced these policies and interpretations.

Credits: 3.00

POL 46200 - Constitutional Law II

Credit Hours: 3.00. An examination of the development of individual rights and civil liberties through constitutional law and interpretation of the Bill of Rights and Civil War Amendments. Both doctrinal and political pressures will be discussed to illustrate the evolution of these rights.

Credits: 3.00

POL 46400 - Legal Writing, Ethics, And Professionalism

Credit Hours: 3.00. This class is designed to provide students with the practical skills and knowledge they will need to embark on an internship or career in the legal environment. The class will focus on legal ethics, writing and research skills.

Learning Outcomes: 1. Explain the basic principles of legal ethics and recognize common ethical issues in law practice. 2. Identify ways to address legal issues, expectations, and consequences for lawyers and their staff. 3. Draft several standard legal documents. 4. Demonstrate ability to conduct basic legal research and write a professional report.

Credits: 3.00

POL 49100 - Political Science Senior Seminar

Credit Hours: 3.00. This is a variable-title seminar focusing on contemporary issues in political science at the senior level. It is part of the "capstone" experience for political science majors.

Credits: 3.00

POL 49300 - Interdisciplinary Undergraduate Seminar

Credit Hours: 1.00 to 3.00. An undergraduate seminar devoted

to an interdisciplinary examination of social, economic, political, and intellectual movements, using the faculty resources of the participating departments. Subject matter will vary. Each offering of the seminar will be approved by a committee of department heads from the sponsoring departments. Permission of instructor required.

Credits: 1.00 to 3.00

POL 49500 - Undergraduate Research Experience

Credit Hours: 1.00 to 3.00. Students are able to earn credit by working on a research project with a faculty member. Students will become familiar with all phases of the research process. Credit and course requirements are arranged with the instructor. Permission of instructor required.

Credits: 1.00 to 3.00

POL 49505 - Undergraduate Research Experience Capstone

Credit Hours: 3.00. Students are able to earn credit by working on a research project with a faculty member to count as capstone credit on plan of study. Students will become familiar with all phases of the research process. Credit and course requirements are arranged with the instructor. Permission of department required.

Learning Outcomes: 1. Learn the systematic collection of data for quantitative and qualitative analysis. 2. Apply research methods and discuss how to utilize effectively in a research project related to the discipline. 3. Develop writing and oral communication proficiencies through completion of semester long paper and/or presentation. 4. Collaborate on research work with faculty mentor or peers. Credits: 3.00

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

POL 50601 - Data, Machine Learning, And Artificial Intelligence For The Public Sector

Credit Hours: 3.00. This course examines how machine learning algorithms and tools related to artificial intelligence can be used to advance our understanding in public sector domains. Students will develop a comprehensive understanding of how to apply AI and various machine learning algorithms, focusing on practical applications and hands-on experience. It provides an overview public sector data sources and addresses ethical and privacy issues associated with this type of data.

Learning Outcomes: 1. Identify, construct, and manipulate public data ethically and appropriately for use in AI and machine learning applications. 2. Explain privacy and ethical considerations associated with the use of public sector data, including issues that arise when combining public and private sector data. 3. Demonstrate a comprehensive understanding of popular AI and machine learning algorithms, including supervised and unsupervised learning techniques. 4. Apply AI and machine learning techniques to real-world data sets, emphasizing those techniques commonly used in government, policy, and political settings. 5. Assess, interpret, and report AI and machine learning output to audiences commonly found in government, policy, and political settings.

Credits: 3.00

POL 51700 - Applied Political Economy

Credit Hours: 3.00. An examination of the core concepts of political economy, the interaction of political institutions, markets, and economic choices, including the nature of capital and labor in the political process. Understand how political institutions and policies influence the organization of economic activity, and the role of the state and policy in shaping the domestic and global political economy since World War II.

Learning Outcomes: 1. Explain the core concepts of markets, capital, labor, and how they relate to economic and political outcomes. 2. Understand and describe why policy choices of states shape the functioning of markets, the organization of capital and labor, and economic decision-making. 3. Analyze the impact of different forms of political institutions and public policies on markets, economic behavior, and economic and political outcomes. 4. Apply political economy concepts to analyzing the context of an economic problem, identify potential solutions, and assess the likely outcome of policy interventions in light of the political economy of the state. Credits: 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political

relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 52101 - Applied Public Policy: Institutions, Processes, Practices

Credit Hours: 3.00. Applied introduction to the institutions, processes, and practices in the field of public policy. Students will examine the role of government institutions, standards organizations, corporate actors, and non-governmental organizations, policymakers, regulators, and the public in the policy process. The course will draw examples from one or more applied policy areas such as economic development, emerging technology policy, sustainability policy, energy, foreign policy, or social policy.

Learning Outcomes: 1. Summarize and describe the institutions, actors, and policy process for different political systems. 2. Compare and contrast the role of political analysis and policy analysis for analyzing the viability and success of policy. 3. Evaluate a policy area and write a policy brief describing the history of the policy, current stakeholders in the area, the current state of policy, and emerging policy challenges or prospective changes. 4. Design translational communication materials to convey policy information to different audiences including specialists and non-specialists. Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

POL 52601 - Technology, AI, And Ethics In Public Policy And Public Administration

Credit Hours: 3.00. Examines how emerging technologies like artificial intelligence (AI), automated decision systems, and digital platforms are being adopted in the public sector. It explores the benefits as well as ethical risks and challenges associated with implementing these technologies in areas like healthcare, education, child welfare, and criminal justice. Students will analyze governance strategies, policies, and administrative procedures to promote responsible technology use in government.

Learning Outcomes: 1. Summarize the main forms of digital technology and algorithmic practices (AI) that are being adopted in government operations and decision-making, including automated decision systems, digital public interfaces, and data integration platforms. 2. Analyze emerging trends and developments in the use of AI, automated decision systems, and data analytics in public agencies and governments, in the U.S., internationally, and at the local level. 3. Assess the benefits as well as risks and challenges associated with implementing these technologies in the public sector, including how the use of new technology is transforming interactions between government and citizens, impacting social welfare, and implicating issues of transparency, accountability, discretion, discrimination, and public trust. 4. Evaluate ethical concerns, biases, and risks to social welfare that may arise from the use of AI and automated decision systems in administering public programs and services and demonstrate the ability to examine issues from multiple stakeholder perspectives. 5. Propose governance strategies, policy solutions, and administrative procedures to ensure responsible and ethical use of AI and other emerging technologies in the public sector, such as best practices for procurement, implementation, auditing, and public engagement. Credits: 3.00

POL 52701 - Local To Global Governance Of Data, AI, And Emerging Technology

Credit Hours: 3.00. This course introduces students to the institutions and governing systems at the subnational, national,

supranational, and international levels that regulate emerging technology, AI, and data. Focusing on laws, standards, and best practices, students will examine comparative case studies of regulation of big tech in differing governing environments. Students will explore how social, economic, and political factors shape differences in technology regulation across the globe.

Learning Outcomes: 1. Summarize the main policy institutions, stakeholders, and regulatory actors in subnational, national, supranational, and international settings as applied to area of emerging technology, AI, and data. 2. Analyze the current state of policy and its implementation in one or more regions or states as applied to areas of emerging technology, AI, and data. 3. Develop a proposal for best practices for managing the use of AI, data resources, or other emerging technology in a private, public, or non-profit setting. 4. Compare and contrast differences in technology regulation across the globe and explain common sources for these differences. Credits: 3.00

POL 52801 - Organizational Governance Of Technology And AI

Credit Hours: 3.00. This course examines the impact of technology policy on organizations and their organizational governance strategies for AI and technology. It explores the incentives, strategies, and activities of the private and non-profit sector in governing AI, as well as the relationship between the private, public, and non-governmental sectors.

Learning Outcomes: 1. Describe and evaluate the impact of legal, regulatory, and ethical frameworks (soft laws and hard laws) on organizational governance of AI, including how legal, technological, and social factors can advance and hinder AI governance in organizations. 2. Analyze different considerations for companies using and governing AI, depending on their size and stage, industry, and jurisdiction. 3. Evaluate strategies that AI practitioners in AI governance functions of organizations have used to manage AI systems and their risks. 4. Develop and communicate strategies to advance AI governance objectives in different organizational contexts, including through policies, assessments, procurement strategies, and/or education. Credits: 3.00

POL 52901 - Applied Policy And Program Evaluation

Credit Hours: 3.00. This course introduces students to the logic of designing and implementing program evaluations to assess implemented policies and programs. The course examines research designs for different evaluation goals, the application of evaluation strategies, and strategies for reporting results to specialist and non-specialist audiences.

Learning Outcomes: 1. Describe the role and principles of evidence-based policymaking and program evaluation, including ethical considerations. 2. Explain the different aspects of evaluation, including inputs, outputs, outcomes, impacts, and processes, and identify complementary evaluation strategies. 3. Compare and contrast different methods for program impact evaluation, including ethical considerations. 4. Synthesize knowledge of program evaluation strategies to solve applied problems. 5. Communicate program evaluation results to specialists and non-specialists effectively. Credits: 3.00

POL 53100 - Terrorism And WMD Threat Assessment

Credit Hours: 3.00. "Terrorism and WMD Threat Assessment" is designed to teach students how to analyze and assess the threats terrorist organizations present in the area of nuclear and radiological security and weapons of mass destruction more generally. The goal of this class is to enable students to identify, prioritize, and assess terrorist threats and propose appropriate, proportional, and cost-effective counter-measures.

Learning Outcomes: 1. Understand the causes, motivations, strategies, and tactics of terrorist organizations, particularly regarding nuclear terrorism. 2. Understand challenges associated with implementing effective counterterrorism strategies and policies. 3. Analyze current and future nuclear proliferation threats from countries and non-state or sub-state actors and provide recommendations on how to address these security issues. 4. Define and analyze the

various types of transnational threats and targets in order to craft effective policy responses. 5. Describe nuclear weapons proliferation, including incentives and disincentives for proliferation. 6. Analyze counter-proliferation strategies. Credits: 3.00

POL 53200 - Nuclear Strategy And Proliferation

Credit Hours: 3.00. "Nuclear Strategy and Proliferation" is designed to teach students about 1) the conceptual elements and operational requirements of nuclear deterrence and 2) the historical dynamics of nuclear proliferation and nonproliferation. The goal of the class is to enable students to 1) evaluate the deterrent effects of different nuclear weapons and various configurations of nuclear arsenals and 2) analyze the technological, political and legal incentives and obstacles for acquiring nuclear weapons.

Learning Outcomes: 1. Understand the historical development of ideas about nuclear deterrence and its requirements. 2. Understand debates about the requirements for nuclear deterrence. 3. Analyze and evaluate the size and structure of the nuclear arsenals of current nuclear powers. 4. Identify and explain the main technological challenges and obstacles to acquiring nuclear weapons. 5. Evaluate potential explanations of why nations choose to acquire nuclear weapons (or refrain from doing so). Credits: 3.00

POL 54101 - Applied Foundations Of Global Development

Credit Hours: 3.00. Describes the foundational concepts of economic development and the historical emergence of global inequality, provides explanations of global inequality, and explores Western efforts to mitigate it through foreign aid. Applies concepts to analyze current trends in development and emerging practices in foreign aid.

Learning Outcomes: 1. Explain the global history of economic and human development. 2. Contrast notions of development beyond the narrow concept of economic growth. 3. Identify and critique a wide array of explanations for why some countries are developed and others are not. 4. Analyze international, domestic, and geographical constraints on economic development. 5. Describe the workings of the international aid regime. 6. Demonstrate practical skills for working in the field of development such as communication, organization, and analysis. Credits: 3.00

POL 55101 - Governance Auditing For AI - Sociotechnical Frameworks And Practices

Credit Hours: 3.00. Governance auditing of AI involves examining the sociotechnical systems that shape AI's design, deployment, and impact at the levels of individual AI systems, teams, and broader organizations. This course equips students with the skills to better understand and evaluate AI systems, their organizational context, and associated governance mechanisms through applying common industry and government frameworks.

Learning Outcomes: 1. Understand leading frameworks for AI auditing and their relevance in the socio-technical assessment of AI systems, especially at the organizational level. 2. Analyze the intersection and trade-offs associated with regulatory, ethical, organizational, and practical considerations in AI governance and governance auditing. 3. Assess critically the relationship of governance auditing of AI with other forms of auditing and evaluation, such as technical auditing and safety evaluations. 4. Conduct sociotechnical evaluations of AI systems, focusing on dimensions well-being, human rights, and organizational maturity in responsible AI. 5. Develop and communicate actionable recommendations for improving responsible AI practices in various contexts. Credits: 3.00

POL 55801 - Tech Diplomacy In International Affairs

Credit Hours: 3.00. This course provides an overview of the role of tech diplomacy in international relations and foreign policy, focusing on how emerging technologies can disrupt global power structures and create both risks and opportunities. Students will study core theories, analyze case studies, and develop skills in applied research and communication.

Learning Outcomes: 1. Define and summarize the key features of tech diplomacy, including its principles and goals. 2. Explain the relationships between emerging technology, globalization, international relations, and foreign policy. 3.

Research, analyze, and communicate information about emerging threats and opportunities in fields of emerging technology, and develop strategies for addressing them by applying the principles and practices of tech diplomacy. Credits: 3.00

POL 55901 - Emerging Technology In International Affairs

Credit Hours: 3.00. This course focuses on understanding contemporary emerging technologies and their implications for tech diplomacy, national security, and foreign policy. Students develop skills through analyzing case studies and developing applied projects that assess threats and opportunities in an area of emerging technology.

Learning Outcomes: 1. Explain and demonstrate research strategies for analyzing the strategic implications of emerging technologies for diplomacy, national security, and foreign policy. 2. Apply theoretical frameworks and grounding in principles of tech diplomacy to evaluate real-world case studies to assess threats and opportunities in an area of emerging technology and develop forward-thinking strategies to address them. 3. Assess and select strategies for communicating information about the implications of emerging technology with different types of audiences, including foreign and domestic officials, technical experts, media, and the public. Credits: 3.00

POL 59000 - Directed Reading In Political Science

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

POL 60000 - Political Science: Discipline And Profession

Credit Hours: 3.00. An exploration of the scope of political science and of its development as a profession, with a focus on what American political scientists do as disciplinary professionals. Analysis of major approaches to the study of politics and of current developments. Prerequisite: 6 credit hours in Political Science.

Credits: 3.00

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

POL 60600 - Advanced Quantitative Techniques In Political Science

Credit Hours: 3.00. This course deals with advanced quantitative techniques useful in political science research. These include multiple correlation and regression, causal modeling, dynamic (time series) analysis, dimensional analysis (Coombsean scaling, Shepard-Kruskal scaling, and factor analysis), and cross-level inference techniques. Prerequisite: POL 50100 , POL 60500 .

Learning Outcomes: 1. Understand the logic and interpretation of various models. 2. Understand the assumptions underlying various advanced quantitative techniques. 3. Analyze data using advanced quantitative techniques. 4. Learn the appropriate software to apply advanced quantitative techniques. Credits: 3.00

POL 60800 - Qualitative Methods In Political Science

Credit Hours: 3.00. This course is an introduction to the use of qualitative methods in political science. In addition to a detailed consideration of several leading qualitative approaches to political research, the course will also consider the distinctive issues of research design for qualitative research as well as the relationship of qualitative and quantitative methods. Prerequisite: POL 50100 Political Science Methodology or equivalent or consent of instructor.

Learning Outcomes: 1. Know and understand the different perspectives and epistemologies related to qualitative research. 2. Know and understand the primary components of qualitative research design. 3. Recognize and apply the common tools for the collection and analysis of qualitative data. 4. Understand the distinctive ethical issues that can arise in qualitative research. 5. Create and compose a research proposal with a substantial qualitative methods component. Credits: 3.00

POL 60900 - Advanced Applied Research Design

Credit Hours: 3.00. The main goal of this seminar is to guide

graduate students when preparing their Ph.D. dissertation proposals. The seminar aims to do two things. The first is to provide an overview of the crucial research design tools and research planning considerations that can help students plan and carry out better dissertation projects. The second is to offer a structured forum where students can present and receive feedback on their dissertation proposals. With permission from the Director of Graduate Studies, this course may be repeated and used to support the development of a grant proposal or research publication. Pre-requisite: POL 60000 with a grade B or better.

Learning Outcomes: 1. Communicate clearly a research question, its scientific merit, and broader impacts. 2. Connect a theory and its concepts to a suitable research design. 3. Estimate and describe a research project's feasibility. 4. Produce a defensible prospectus or other research product suitable for submission to an evaluative body. 5. Respond effectively to reviewer feedback in revising work. Credits: 3.00

POL 61000 - Proseminar In American Political Systems, Processes, And Behavior

Credit Hours: 3.00. An introduction to American political systems, processes, and behavior as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 61100 - Research Seminar In American Government And Politics

Credit Hours: 3.00. Topics vary. Permission of department required.

Credits: 3.00

POL 61500 - Proseminar In Electoral Behavior And Political Socialization

Credit Hours: 3.00. A reading and lecture course acquainting the student with the general literature in the field. Traces the descriptive aspects, causes, and consequences of electoral behavior and political socialization in the American polity and selected European countries. Emphasis on the processes of citizen integration into the larger political system. Both historical and comparative approaches to the material will be used.

Credits: 3.00

POL 61600 - Research Seminar In Political Behavior

Credit Hours: 3.00. Extends the work of POL 51600 (Group Politics) to the empirical study of primary groups, cliques, social groups, voluntary associations, experimental and occupational groups (insofar as they have political impacts) and of political clubs and associations, paraparties, and inchoate political movements and parties. Training will be given in the use of phenomenological observation, interaction analysis, content analysis, personality inventories, and other instruments that reveal the social structure and dynamics of groups. Students will conduct field studies of politically-relevant groups, or will conduct or participate in conducting laboratory experiments.

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

POL 62200 - Research Seminar In Public Policy And Public Administration

Credit Hours: 3.00. Investigation in depth of a substantive aspect of public policy such as energy policy or social policy, or of a theoretical topic, for example, policy formulation, enactment, implementation, impact, or evaluation. Permission of instructor required.

Credits: 3.00

POL 62300 - Research Seminar In Environmental Policy

Credit Hours: 3.00. Investigation in depth of a substantive aspect of environmental policy or a theoretical approach to environmental policy, with emphasis on student research. Permission of instructor required.

Credits: 3.00

POL 63000 - Proseminar In International Relations

Credit Hours: 3.00. An introduction to international relations as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 63100 - Research Seminar In International Relations

Credit Hours: 3.00. Topics vary. Permission of department required.

Credits: 3.00

POL 64000 - Proseminar In Comparative Political Systems

Credit Hours: 3.00. An introduction to comparative political systems, processes, and behavior as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 64100 - Research Seminar On Comparative Politics

Credit Hours: 3.00. Topics vary. Prerequisite: POL 64000 .

Credits: 3.00

POL 65000 - Proseminar In Political Theory

Credit Hours: 3.00. An introduction to political theory as a field of graduate study with special emphasis on the literature of great political thinkers. Prerequisite: Master's student standing.

Credits: 3.00

POL 65100 - Research Seminar In Political Theory

Credit Hours: 3.00. Investigation in depth into a selected area of political thought. Intensive study and close analysis of the selected topic, school, or theoretic system. Development of historic and philosophic methods applicable to the study of political thought.

Credits: 3.00

POL 66200 - Proseminar In Political Economy

Credit Hours: 3.00. An introduction to political economy as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 68500 - Professional Development Practicum

Credit Hours: 0.00 or 1.00. This course examines the ethics, norms, and expectations of the profession of political science and public policy for those engaged in doctoral level study. the course explores topics of professional development to support progress in the degree and building a successful career. Permission of department required.

Learning Outcomes: 1. Explain the expectations for professional conduct in research, teaching, and service at Purdue and in professional political science settings, including why these standards are relevant for advancing free inquiry, diversity, and creating an inclusive culture. 2. Develop a sequenced plan of professional activities to help prepare them for success in the program and the job market by their final year in the program. 3. Identify how to access resources to support professional development in the college, the university, and the discipline of political science. 4. Demonstrate an ability to independently select and participate in meaningful professional development activities. Credits: 0.00 or 1.00

POL 68600 - Career And Placement Practicum

Credit Hours: 2.00. Provide practical guidance and workshops to help students plan job searches, prepare application materials, and develop skills in public presentations such as video interviews, in-person interviews, job talks, teaching talks, and other public talks. Permission of department required.

Learning Outcomes: 1. Explain the key steps in the academic job market and the non-academic job market, and how to prepare for each. 2. Demonstrate an ability to create a professional oral and written materials for a job search towards both academic and non-academic jobs. 3. Identify how to access resources to support career planning and job searches for academic positions, post-docs, and non-academic positions. 4. Explain why diversity, equity, and inclusion is an important part of job searches, and build evidence of their work in this area for job market materials. 5. Demonstrate an ability to independently select and participate in meaningful career planning and job search activities. Credits: 2.00

POL 69300 - Interdisciplinary Seminar

Credit Hours: 3.00. Topics vary - Interdisciplinary Seminar. Permission of instructor required.

Credits: 3.00

POL 69500 - Directed Reading And Research Topics

Credit Hours: 1.00 to 3.00. Individual topics involving research by the student other than on a thesis topic. Admission and hours require the consent of instructor who will supervise the research. Approval of each topic must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

POL 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis.

Credits: 1.00 to 18.00

POL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Polytechnic

PTEC 10801 - Guided Exploration I

Credit Hours: 3.00. Part one of the first in a series of transdisciplinary, real-world, project-based work and conversations exploring the intersections of humanities and technology, social and natural sciences. Projects emphasize design thinking; collaboration; communication; hands-on prototyping; testing; assessing. Learners will engage in individual and team project work and conversations that will change in scale and scope based on the learner's experience, goals, and learning needs. Permission of department required.

Learning Outcomes: 1. Demonstrate a

developing level of understanding of issues related to the intersection of science, technology, and quantitative reasoning using project-based techniques to address unstructured, real-world problems. 2. Demonstrate a developing level of understanding and skill with individual and team based project work. 3. Demonstrate a developing level of understanding of issues related to the intersection of technology and culture using a variety of effective communication techniques. 4. Demonstrate a developing level of information literacy using a variety of effective communication techniques. Credits: 3.00

Portuguese

PTGS 10100 - Portuguese Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in Portuguese.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe themselves, their families, school, music and preferred foods using the present and preterite verb tenses. 2. Identify and locate specific characteristics of the geography of Brazil, including the north, northeast, south and southeastern regions and evaluate the impact that demographics has had on migration, religion, and culinary habits. 3. Assess the role of education in Brazil and its impact on the family and society in the country's different regions. Credits: 3.00

PTGS 10200 - Portuguese Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of PTGS 10100.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PTGS 10500 - Accelerated Portuguese (UCC: HUM)

Credit Hours: 3.00. Accelerated acquisition of basic Portuguese for speakers of Spanish or another romance language. Capitalizes on students' backgrounds in related languages to build skills in listening comprehension, reading comprehension, basic writing, and conversation. Knowledge of a romance language.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PTGS 20100 - Portuguese Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Portuguese course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Discussing personal relations and academic studies. 2. Giving and receiving directions to a destination and/or in order to complete a task. 3. Preparing short oral presentations on topics related to Portuguese and Brazilian cultures. 4. Writing short essays on specified topics. Credits: 3.00

PTGS 20200 - Portuguese Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of PTGS 20100 .

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PTGS 23500 - Luso-Brazilian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Brazilian and Portuguese literature, with an emphasis on transatlantic cultural traditions and creative responses to contemporary social challenges. Knowledge of Portuguese not required.

Learning Outcomes: 1. Identify and explain exemplary texts from Brazilian and Portuguese literature, by reading them and discussing them with classmates and the professor. 2. Identify significant aspects of Luso-Brazilian culture, through discussions of examples found in assigned readings. 3. Explain how challenges relating to racial relations, social class and everyday ethics may be addressed in different ways by another culture, through comparing their own approaches with those found in the texts. 4. Discuss how literature relates to culture and to the analysis of social challenges, because of identifying societal implications of numerous readings. 5. Explain the importance of satire as a coping mechanism and corrective for social problems, by commenting on assigned texts in a personal journal. 6. Discuss how literature relates to culture and to the analysis of social challenges, through identifying

societal implication of numerous readings. 7. Write persuasively about significant aspects of colonial and post-colonial relationships, by composing and revising essays about literary texts. Credits: 3.00

PTGS 30100 - Portuguese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Portuguese speaking, listening, reading and writing abilities, using materials dealing primarily with everyday life and civilization in the Portuguese-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Portuguese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PTGS 30200 - Portuguese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Portuguese on the basis of materials dealing primarily with the ideas and events that have shaped present-day Portuguese-speaking countries. Conducted primarily in Portuguese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

PTGS 39800 - Topics In Portuguese

Credit Hours: 3.00. Advanced studies of particular aspects of Portuguese (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussion, and papers in Portuguese.

Credits: 3.00

PTGS 39900 - Special Study Abroad Credit In Portuguese

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Portuguese earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

PTGS 49800 - Advanced Topics In Portuguese

Credit Hours: 3.00. Advanced studies of particular aspects of Portuguese (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussion, and papers in Portuguese.

Credits: 3.00

PTGS 55100 - Brazilian Poetry

Credit Hours: 3.00. A survey of the major currents and most important writers of Brazilian poetry. Readings include Gregorio de Matos, Goncalves Dias, Castro Alves, Mario de Andrade, Manuel Bandeira, and Cecilia Meireles. Permission of instructor required.

Credits: 3.00

PTGS 55500 - Brazilian Drama

Credit Hours: 3.00. A survey of the primary movements and most important works of Brazilian theatre. Readings include plays by Nelson Rodrigues, Dias Gomes, Ariano Suassuna, and Jorge Andrade. Permission of instructor required.

Credits: 3.00

PTGS 55700 - Brazilian Fiction

Credit Hours: 3.00. A survey of the development and major texts of Brazilian fiction. Readings include novels or short stories by Jose de Alencar, Machado de Assis, Graciliano Ramos, and Clarice Lispector, among others. Permission of instructor required.

Credits: 3.00

PTGS 59000 - Directed Reading In Portuguese

Credit Hours: 1.00 to 4.00. Directed readings in Portuguese. Permission of instructor required.

Credits: 1.00 to 4.00

PTGS 59400 - Special Topics In Luso-Brazilian Literature

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

Professional Practice

OPP 10100 - Changing The World With Chips

Credit Hours: 1.00. On a weekly basis, students will be exposed to semiconductor industry professionals representing some of the largest companies in the world. Students will learn about new technologies, semiconductor products and applications, and career opportunities relevant to a variety of academic disciplines. This course is a requirement for the Semiconductor and Microelectronics certificate and serves as a gateway to a variety of research and internship opportunities relevant to the semiconductor industry.

Learning Outcomes: 1. Understand what a semiconductor is and its relevance to technological advancements and the economy. 2. Understand the components of the semiconductor industry and the broad range of

companies involved in this industry. 3. Understand career paths for various academic disciplines within the semiconductor industry. 4. Learn about additional opportunities to develop skills relevant to the semiconductor industry. 5. Start building a network of industry professionals who can help you achieve your career goals. Credits: 1.00

Psychological Sciences

PSY 10000 - Introduction To The Science And Fields Of Psychology (UCC: IL)

Credit Hours: 1.00. An introduction to psychology as a science and as a profession.

University Core Curriculum (UCC): (UCC: IL) Credits: 1.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 12300 - Beyond Mental Health: The Science Of Well-Being (UCC: BSS)

Credit Hours: 3.00. This course seeks to provide a scientific and psychological account of well-being - its definition, determinants, and outcomes. We address questions such as: How do we go about measuring happiness? Can happiness enhance longevity and health? What interventions can promote happiness? What types of societies are happier? This course will engage and challenge students not only intellectually, but also experientially as we work on enhancing happiness in our lives and in the lives of others around us.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Outline the history of well-being research. 2. Identify key antecedents of well-being. 3. Explain and distinguish among different scientific theories of well-being. 4. Describe the positive outcomes of happiness for individuals and societies. 5. Discuss the scientific process of studying well-being. 6. Apply positive psychology techniques to their own their lives. 7. Identify and locate resources that promote mental health and well-being. Credits: 3.00

PSY 20000 - Introduction To Cognitive Psychology

Credit Hours: 3.00. A survey of psychology as the science of mental life, covering theories and research in perception, reading, attention, consciousness, imagery, memory and its improvement, problem solving, creativity, decision-making, and artificial intelligence.

Learning Outcomes: 1. Describe basic aspects of visual perception and visual imagery. 2. Explain the role of attention in cognition. 3. Describe basic representations and processes of memory. 4. Understand high-level cognitive functions such as reasoning, problem solving, and language. 5. Understand how cognitive neuroscience can inform cognitive psychology. Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

PSY 20300 - Introduction To Research Methods In Psychology

Credit Hours: 3.00. The use of scientific method in psychology. Lecture covers principles of collecting and interpreting data, using examples of research from many areas of psychology. In

the laboratory portion, the student uses many different techniques from various areas of psychology. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand and produce research that adheres to the highest ethical standards. 2. Identify distinguishing features of good science, bad science and junk science. 3. Critically evaluate research findings. 4. Understand how study designs are used to answer research questions. 5. Present and interpret experimental data in an APA-style paper. Credits: 3.00

PSY 22200 - Introduction To Behavioral Neuroscience

Credit Hours: 3.00. An introduction to how the nervous system controls behavior. Topics include evolution and comparative psychobiology, the neuroscience of sensation and perception, the neuroscience of motivation, neuropsychology, and cognitive neuroscience.

Learning Outcomes: 1. Describe the basic structure and function of the brain including neuroanatomy and neural communication. 2. Explain how the central nervous system processes internal and external stimuli. 3. Explain how experience influences current and future behavior. 4. Discern normal from abnormal brain function and describe its influence on behavior. Credits: 3.00

PSY 23099 - Cooperative Education Seminar I

Credit Hours: 1.00 or 2.00. (ENGR 23099) This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least one Co-Op work term. May be repeated once after the second work term. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Learn from the experiences of other participants and apply that knowledge to the situation. Credits: 1.00 or 2.00

PSY 23500 - Child Psychology

Credit Hours: 3.00. Not open to students with credit in PSY 36000. General principles of children's behavior and development, from conception to adolescence, including sensory and motor development, and basic psychological processes such as learning, motivation, and socialization.

Credits: 3.00

PSY 23900 - The Psychology Of Women

Credit Hours: 3.00. The purpose of the course is to provide an overview of the psychology of women. Topics include stereotyping, women and achievement, aggression and power, the psychological concept of androgyny, and attitudes toward feminism.

Credits: 3.00

PSY 24000 - Introduction To Social Psychology

Credit Hours: 3.00. Not open to students with credit in SOC 34000 . A broad survey in current knowledge about human social behavior. Topics covered include aggression, attraction and love, social influence, attitudes and attitude change, nonverbal communication, leadership, prejudice and discrimination, and application of social psychology to law, medicine, and other fields. CTL:ISH 1024 Social Psychology

Credits: 3.00

PSY 24400 - Introduction To Human Sexuality

Credit Hours: 3.00. This course will provide a broad survey of research on human sexuality from a psychosocial perspective. Topics covered include research methods, gender identity, sexual orientation, reproductive anatomy, typical and atypical sexual behavior, and sexual difficulties and their treatments. CTL:ISH 1022 Human Sexuality

Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

PSY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 29200 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various introductory-level topics in Psychology that may be offered on a semester-by-semester basis by Purdue Psychological Sciences faculty or by non-Purdue faculty/instructors as part of a student's study abroad program.

Learning Outcomes: 1. Provide breadth of coverage across the diverse field of Psychological Sciences. Credits: 1.00 to 3.00

PSY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

PSY 30500 - Understanding And Analyzing Psychological Data

Credit Hours: 3.00. This course is an upper level undergraduate statistics course for students in psychology and related fields who are interested in conducting or understanding quantitative research. Students should have successfully completed an introductory statistics course (e.g., PSY 20100). The course will begin with an accelerated review of fundamentals concepts (e.g., data visualization, central limit theorem, probability) and then will focus primarily on regression.

Learning Outcomes: 1. Demonstrate advanced conceptual understanding of foundational statistical principles. 2. Demonstrate ability to correctly analyze data by hand and using SPSS. 3. Demonstrate skills in managing their own data. 4. Demonstrate the ability to comprehensively analyze and interpret the results of correlation, simple regression, multiple regression, and two-way interaction models. 5. Demonstrate proper interpretation. 6. Demonstrate the ability to accurately report results of statistical analyses in APA format. Credits: 3.00

PSY 30600 - Understanding And Analyzing Experiments

Credit Hours: 3.00. This course helps to prepare students for independent research. Students (1) develop an understanding of group-based statistical analyses, such as t-tests and ANOVA; (2) formulate and present a research idea based on statistical tools covered in class; and (3) get experience using statistical software to analyze data.

Learning Outcomes: 1. Determine which statistics to use, how to use them and how to interpret their findings using data for conventional experimental designs in psychological sciences. 2. Interpret current research in psychological sciences. 3. Give oral presentations based on research. 4. Develop and advance personal research interests. Credits: 3.00

PSY 31000 - Sensory And Perceptual Processes

Credit Hours: 3.00. A survey of the study of psychological experiences caused by stimulation to the senses. Topics include theory and research in seeing, hearing, touching, smelling, and tasting as experienced by humans and other animals.

Credits: 3.00

PSY 31100 - Human Memory

Credit Hours: 3.00. A survey of theories and research about how humans remember information and why they often forget. Topics include research on amnesia, forgetting, and sensory memory systems as well as on practical issues such as how to improve memory.

Learning Outcomes: 1. Explain how the science of human and memory enriches understanding of the human mind. 2. Describe what learning and memory are, how they work, and why they work that way. 3. Critically apply the science of learning and memory to evaluate ideas presented in popular media. Credits: 3.00

PSY 31400 - Introduction To Learning

Credit Hours: 3.00. This course attempts to make clear the theoretical and practical implications of learning principles and findings. Various theories of learning are examined and the implications of these theories, and the learning approach generally, for a variety of practical problems are emphasized.

Credits: 3.00

PSY 32400 - Introduction Cognitive Neuroscience

Credit Hours: 3.00. (SLHS 30100) Introduction to the neural bases of complex human mental abilities. Emphasis on integrating research from cognitive science, brain-scanning techniques, and the lesion technique. Topics include perception, attention, memory, language, motor control, planning/decision-making and consciousness.

Credits: 3.00

PSY 32700 - Psychology Of Helping

Credit Hours: 3.00. This course is designed to provide a broad but rigorous, undergraduate-level comprehensive overview of contemporary scientific research on prosocial processes from the perspective of personality and social psychology.

Learning Outcomes: 1. Demonstrate a comprehensive mastery of the mechanisms and processes associated with prosocial behavior. 2. Demonstrate an ability to think creatively about research on prosocial processes. 3. Demonstrate an understanding of how research on prosocial behavior is planned and conducted. 4. Demonstrate how prosocial processes are integrated with more general interpersonal processes and social relations. Credits: 3.00

PSY 33099 - Cooperative Education Seminar II

Credit Hours: 1.00 or 2.00. This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Permission of instructor required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand their knowledge of professions in Psychological Sciences. 3. Learn from the experiences of other participants so that they may apply their knowledge to their situation. Credits: 1.00 or 2.00

PSY 33500 - Stereotyping And Prejudice

Credit Hours: 3.00. This course examines the topics of stereotyping, prejudice, and discrimination from a social psychological perspective. Relying on empirical findings and relevant theoretical approaches, the course moves beyond lay opinions to explore the social psychological foundations and forms of stereotyping and prejudice, and to examine various strategies for reducing intergroup biases.

Credits: 3.00

PSY 33600 - Issues In Developmental Psychology

Credit Hours: 3.00. Survey of current issues in developmental psychology and methods for studying these problems. The topics selected for intensive examination reflect contemporary developmental research issues and may involve different-aged children or adults.

Credits: 3.00

PSY 33700 - Social Cognition

Credit Hours: 3.00. A survey of theory and research on the role of thought processes in social behavior (a combination of social and cognitive psychologies). Topics include causal attribution, person perception, stereotyping, impression formation, event memory, and social judgment.

Credits: 3.00

PSY 34200 - Introduction To Psychology Of Personality

Credit Hours: 3.00. This course integrates empirical studies (observational, correlational, experimental) with classical and current personality theories. Topics include the biological foundations of personality, self-esteem, extraversion, sex role orientation, authoritarianism, and personality disorders. Minimum competence is assumed in basic experimental design and correlations.

Learning Outcomes: 1. Define personality from a scientific psychological perspective. 2. Discuss the strengths and weaknesses of the methods and sources of data for personality researchers. 3. Describe biological and trait models of personality. 4. Discuss the relationship between personality, psychopathology, personality disorders and psychotherapy. 5. Describe how culture and environment interact with personality. Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

PSY 35200 - Introduction To Neuropsychology

Credit Hours: 3.00. This course is an examination of the effects of various types of brain damage on human behavior, the methods used to assess brain damage, and evaluation of research studies on human brain damage and behavior.

Learning Outcomes: 1. Describe effects of damage to different human brain areas on behavior. 2. Discuss what effects of brain

damage teach us about brain function and organization. 3. Describe approaches used to study human brain damage. 4. Critically evaluate published research studies on human brain damage and behavior. Credits: 3.00

PSY 35400 - Close Relationships

Credit Hours: 3.00. This course introduces undergraduate college students to major topics in psychological research on intimate relationships. There are many types of close relationships. This primarily focuses on relationships that currently are, will be soon, or at one point were, romantic involvements. A goal is to educate students on current research findings concerning intimate relationships.

Learning Outcomes: 1. Navigate relevant research and demonstrate understanding and of relationship science. 2. Judge the accuracy of portrayals of relationships in the general media. 3. Describe the mechanics underlying close relationships. 4. Demonstrate the ability to read and understand published studies concerning close relationships. Credits: 3.00

PSY 36700 - Adult Development And Aging

Credit Hours: 3.00. Theory and research on adult development from young adulthood through the elderly years. Course covers biological, cognitive, personality, and social issues. Topics include vocational choice, marriage, parenthood, the empty nest, menopause, memory and aging, retirement, widowhood, longevity, and death and dying.

Credits: 3.00

PSY 37600 - Attention And Cognitive Control

Credit Hours: 3.00. This upper-level undergraduate course provides an overview of research and theory related to attention and cognitive control. The first half of the course focuses on selective attention to locations, objects, and features, as well as the role of attention in memory and skilled performance. The second half focuses on divided attention and cognitive control in multitasking situations, as well as aspects of adaptive, hierarchical, and inhibitory control. The goal of the course is to provide you with an understanding of major theoretical views, key experimental findings, and common research procedures related to attention and cognitive control.

Learning Outcomes: 1. Define selective attention to locations, objects, and features. 2. Describe the relationship between eye movements and attention. 3. Identify the limits of attention. 4. Describe the role of attention in memory and skilled performance. 5. Discuss divided attention, dual-task, task switching performance, task interruption and mind wandering. 6. Identify aspects of adaptive and hierarchical control. Credits: 3.00

PSY 38000 - Behavior Change Methods

Credit Hours: 3.00. Application of behavioral learning principles to problems in living. Self-paced learning format covers design and evaluation of behavior modification programs, with practical and ethical issues. Relevant to work with children, adults, clinical patients, athletes, etc., in schools, institutions, and everyday situations.

Credits: 3.00

PSY 39000 - Research Experience In Psychology

Credit Hours: 1.00 to 3.00. Involvement in an ongoing research project in the Department of Psychological Sciences. Up to 6 credits may be taken for a letter grade. Additional credits after 6 must be taken as Pass/No Pass. Permission of instructor required.

Learning Outcomes: 1. Apply principles of research methodology within a lab setting, as appropriate for lab role. 2. Demonstrate ethical behavior in the conduct of psychological research. 3. Demonstrate professional communication skills through interactions with principal investigators, graduate students, lab personnel, and research participants. Credits: 1.00 to 3.00

PSY 39100 - Readings In Psychology

Credit Hours: 1.00 to 3.00. In-depth reading on a specific topic in psychology under the guidance of a faculty member, often in preparation for PSY 49800. Permission of instructor required.

Credits: 1.00 to 3.00

PSY 39200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by Psychological Sciences department faculty.

Credits: 1.00 to 3.00

PSY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

PSY 39800 - Independent Research In Psychology

Credit Hours: 3.00. Students will conduct an independent research project related to research that is ongoing in the lab. Students will discuss theories and ideas related to the project, and plan and execute a thesis. Duties may include data coding and entry; participating in the planning of the research and the development of research materials; executing the research with responsibility for all aspects of data collection. Students are expected to be involved in the research project for an average of nine hours per week. Permission of instructor required.

Learning Outcomes: 1. Learn about many aspects of conducting research, such as human or animal subject issues, experimental design, interpreting results, relating results to theory, etc. 2. Learn how psychological questions can be answered through research. Credits: 3.00

PSY 40100 - Language And The Brain

Credit Hours: 3.00. (SLHS 40100) This course is an overview of the neutral systems that underlie the core components of language, including speech perception and production, reading and writing, morphology, syntax, semantics, and discourse. During the past few decades, there has been an unprecedented increase in studies on these topics, due in large part to the widespread use of highly sensitive brain mapping techniques that enable researchers to identify relationships between particular brain areas and particular language functions. The findings that have been emerged from this recent explosion of research are exciting and important for several reasons. They provide fresh insights into the nature of the uniquely human capacity for language, and they have significant implications for understanding and treating language disorders that result from brain injury.

Learning Outcomes: 1. Understand the main methods for investigating the neural substrates of language. 2. Understand the classic and progressive aphasia syndromes. 3. Basic neural underpinnings of the core aspects of language. 4. Critically evaluate research on language. 5. Critically evaluate research on language and the brain. Credits: 3.00

PSY 40300 - Psycholinguistics

Credit Hours: 3.00. (PSY 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of

language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

PSY 40400 - Honors Research Seminar I

Credit Hours: 3.00. Part one of a research series aimed at providing a structured learning experience to help students develop the basic research skills needed in order to conduct psychological research. Students will be expected to develop a research plan to be completed in concert with PSY 40500. Permission of department required.

Credits: 3.00

PSY 40500 - Honors Research Seminar II

Credit Hours: 3.00. Part two of a research series aimed at providing a structured learning experience to help students develop the basic research skills needed in order to conduct psychological research. Students will be expected to develop a research plan to be completed in concert with PSY 40400. Permission of department required.

Credits: 3.00

PSY 41800 - Understanding Autism

Credit Hours: 3.00. (HDFS 41800, SLHS 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history of ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associated with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

PSY 42100 - Alcohol Use And Disorders

Credit Hours: 3.00. The goal of this course is to provide students with a broad understanding of the biological bases of alcohol abuse and alcoholism. The course will cover neuroanatomical, neurochemical and biological systems that regulate the biological and behavioral response to alcohol. Coverage will also include discussions of the role of environment, age, gender, among other factors that influence the response to alcohol and propensity toward abuse and addiction. The course will also cover the neuroscience of treatment and relapse.

Learning Outcomes: 1. Acquire knowledge about alcohol's effects on the brain and behavior. 2. Demonstrate knowledge about the major theories of addiction. 3. Critically evaluate primary research about the neuroscience of alcohol. 4. Discuss and apply learned knowledge about the neuroscience of alcohol and theories of addiction to ""real-world"" situations. 5. Communicate proficient critical thinking skills about the neuroscience of alcohol through writing. Credits: 3.00

PSY 42200 - Genes and Behavior

Credit Hours: 3.00. An examination of genetic influences on behavior, including the mechanisms of genetic influence, methods of gene manipulation, and the role of genes in development and evolution. Genetic influences on mental illness, learning, memory, and intelligence are considered.

Credits: 3.00

PSY 42600 - Language Development

Credit Hours: 3.00. (SLHS 30900) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

Credits: 3.00

PSY 42800 - Drugs And Behavior

Credit Hours: 3.00. Discussion of the variety of drugs that affect the nervous system and behavior. Emphasis will be upon a discussion of the physiological and pharmacological bases for the use and misuse of drugs in our society.

Credits: 3.00

PSY 42900 - Hormones And Behavior

Credit Hours: 3.00. Discussion of the mechanisms and effects of endocrine hormones and brain peptides on sexual differentiation, sexual behavior, learning, response to stress, maternal behavior, and weight regulation.

Credits: 3.00

PSY 43099 - Cooperative Education Seminar III

Credit Hours: 1.00 or 2.00. This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Permission of instructor required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand their knowledge of professions in Psychological Sciences. 3. Learn from the experiences of other participants so that they may apply their knowledge to their situation. Credits: 1.00 or 2.00

PSY 43200 - Social Psychology In Film

Credit Hours: 3.00. This course examines theory and research in experimental social psychology and uses popular films to assist in provoking thought and analysis of the theory and research.

Learning Outcomes: 1. Correctly interpret research findings from experimental social psychology. 2. Apply these findings to various films. 3. Formulate written ideas about films that are grounded in social psychological theory. Credits: 3.00

PSY 43400 - Neurobiology Of Disease

Credit Hours: 3.00. This course explores the neurobiological basis of disorders of the nervous system and psychiatric disease. Students will learn various neurological disorders that affect behavior, the associated cellular and molecular mechanisms, and current treatment strategies.

Learning Outcomes: 1. Demonstrate how to search for scientific literature and compare/contrast peer-reviewed articles with news media. 2. Identify, discuss, examine, and critically evaluate the basic mechanisms and clinical features of diseases of the nervous system. 3. Describe research on the biology of various neurological and psychiatric disorders. 4. Discuss and critique research papers on ground breaking discoveries related to underlying mechanisms and treatments of various neurological and psychiatric disorders. 5. Generate analogies and craft models that represent human neurological and psychiatric diseases. Credits: 3.00

PSY 43600 - Foods And Behavior

Credit Hours: 3.00. This course examines aspects of the scientific study of eating and drinking; its effects on individual health and well-being; broader implications of psychology, culture and society on eating and drinking; the effects of food policy on food and beverage intake and well-being. Topics to be covered include physiological signals affecting hunger and satiety, social norms and influences regarding food intake, identifying sources of food and its constituents, disordered food intake, malnutrition, poverty and food, and the influence of food and agriculture industries on food choices and consumption.

Learning Outcomes: 1. Describe how the scientific method applies to questions related to ingestive behavior. 2. Discuss how constituents of food contribute to physical and emotional well-being. 3. Describe biological, social and cultural factors that influence food choice. 4. Critically evaluate how society and culture influence eating and drinking habits. Credits: 3.00

PSY 43700 - Behavioral And Neural Systems Of Learning And Memory

Credit Hours: 3.00. The purpose of this course is to integrate insights on learning and memory from behavioral and neuroscience perspectives based on animal and human research. How brain regions underlie different categories of learning will be covered. Discussions on how these types of learning contribute to clinical disorders, such as anxiety and addiction disorders.

Learning Outcomes: 1. Examine how brain regions underlie different categories of learning. 2. Discuss how types of learning contribute to clinical disorders. 3. Compare and contrast

insights on learning and memory from behavioral and neuroscience perspectives based on animal and human research. 4. Comprehend and discuss behavioral processes, brain substrates and clinical perspectives for each topic covered. Credits: 3.00

PSY 43800 - Introduction To Clinical Psychology

Credit Hours: 3.00. This course introduces students to the field of clinical psychology and will provide a broad overview of the roles and responsibilities that fall under the rubric of clinical psychology, with a particular emphasis on psychological assessment and intervention. Focus is on the professional responsibilities of a clinical psychologist (i.e., how clinical psychology is applied in practice), rather than the study of psychopathology per se.

Learning Outcomes: 1. Describe professional responsibilities of a clinical psychologist. 2. Discuss methods used by clinical psychologists to assess and diagnose disorders. 3. Describe specific types of interventions used to treat psychological disorders. 4. Discuss special concerns related to diagnosing and treating children and adolescents. Credits: 3.00

PSY 44300 - Aggression And Violence

Credit Hours: 3.00. An intensive examination of the nature of human aggression. Among the topics covered will be (1) theoretical perspectives concerning such behavior; (2) social conditions that encourage its performance; and (3) means for its prevention and control.

Credits: 3.00

PSY 46400 - Research Ethics In Psychological Sciences

Credit Hours: 3.00. Research Ethics broadly refers to the application of everyday values, such as fairness, honesty, and objectivity to scientific research. This course is designed to provide broad coverage of the ethical standards that research scientists must follow and allow exploration of various real-world ethical issues in the psychological sciences.

Credits: 3.00

PSY 47300 - Selection And Performance Appraisal In Organizations

Credit Hours: 3.00. Classic and current issues in employee selection and the appraisal of employee performance will be discussed. Topics addressed will include: Equal Employment Opportunity and unfair discrimination, developing effective selection and placement strategies, evaluating employee performance, and understanding the performance appraisal process.

Learning Outcomes: 1. Define and apply the major theories related to personnel selection and performance appraisal. 2. Describe recent research findings and apply those findings to issues related to personnel selection and performance appraisal. 3. Design and develop personnel selection and performance appraisal systems that are fair, valid, and legally appropriate. 4. Demonstrate the ability to evaluate personnel selection and performance appraisal systems with respect to their fairness, validity, and legality. 5. Perform a job analysis. Credits: 3.00

PSY 47500 - Work Motivation And Job Satisfaction

Credit Hours: 3.00. Psychological processes and current theories of work motivation and job satisfaction and their practical implications.

Credits: 3.00

PSY 48400 - The Psychology Of Consciousness

Credit Hours: 3.00. A survey of psychological experiments and theory in consciousness. An emphasis is placed on altered states of consciousness such as dreaming, hypnosis, drug-induced changes in consciousness, and meditation; and comparison with ordinary consciousness is made.

Credits: 3.00

PSY 49200 - Internship In Psychology

Credit Hours: 3.00. Experiential, supervised training in various areas of psychology-related fields including human factors, human resources, mental health-related organizations, research labs, and supervised living institutions. Usually taken in junior or senior year. Permission of instructor required.

Learning Outcomes: 1. Broaden experiences by exposure to professional settings related to psychological sciences. 2. Experience the importance and relevance of ideas learned in course work. 3. Increase repertoire of skills and experiences related to job placement or further education after graduation. 4. Develop skill working in a group/team. Credits: 3.00

PSY 49800 - Senior Research

Credit Hours: 3.00. Student conducts and writes a report on an individual research project under the guidance of a faculty member. Permission of instructor required.

Learning Outcomes: 1. Demonstrate expertise with the processes and procedures of research

in psychological sciences. 2. Design and conduct a research project related to psychological sciences. Credits: 3.00

PSY 50600 - Professional Issues And Trends In Social Psychology

Credit Hours: 3.00. This course is designed to help students acculturate to and acquire a broad knowledge of social psychological research. Topics to be covered include but are not limited to: how to apply for academic jobs, how to present your program of research, how to network at conferences, how to develop a website presence, how to approach potential collaborators, and how to structure your research questions in an appropriate manner for grant applications. Permission of department required.

Learning Outcomes: 1. Learn strategies to professionally present themselves, their interests, and their accomplishments on paper and in person. Credits: 3.00

PSY 50700 - Current Readings In Social Psychology

Credit Hours: 3.00. This course is designed to expose students to a variety of readings, discussions, and presentations. The seminar examines a diverse assortment of social psychological topics. Students benefit from exposure to current research and methods in the field. Students also benefit from becoming increasingly conversant regarding the latest empirical advances in the field. Permission of department required.

Learning Outcomes: 1. Understand and interpret a host of different designs and analyses regarding a large variety of key areas in social psychological research. Credits: 3.00

PSY 51100 - Psychophysics

Credit Hours: 3.00. (ECE 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of instructor required.

Credits: 3.00

PSY 51200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, BIOL 56200) Background in cell biology, psychobiology, physiology, or anatomy is recommended. Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Permission of instructor required.

Credits: 3.00

PSY 51300 - Introduction To Computational Cognitive Neuroscience

Credit Hours: 3.00. Computational cognitive neuroscience is a new field of study that lies at the intersection of computational neuroscience and the similar fields of machine learning, neural network theory, connectionism, and artificial intelligence. Like computational neuroscience, computational cognitive neuroscience strives for neurobiological accuracy and like connectionism, a major goal is to account for behavior. Covered topics include feature extraction / optimization, connectionism, computational neuroscience, and computational cognitive neuroscience applications. Permission of department required.

Learning Outcomes: 1. Understand critically existing computational models. 2. Master important computational modeling methods. 3. Implement and simulate computational models. Credits: 3.00

PSY 51400 - Introduction To Mathematical Psychology

Credit Hours: 3.00. This course introduces the student to the field of mathematical modeling of psychological processes. Mathematical techniques employed in modeling are learned, and a number of mathematical models and theories that have been developed and employed in various important areas of experimental psychology are explained. An introduction to problems in theory and model testability also is given.

Credits: 3.00

PSY 51500 - Neuroscience Of Consciousness

Credit Hours: 3.00. How does your brain generate your uniquely subjective experience of the world? Is it possible to identify distinct neurophysiological markers of your awareness of a particular sight, sound, taste, or touch? What is the cortical basis of your sense of being a self with a first-person point of view that is spatiotemporally grounded in a body? How does consciousness relate to attention and working memory? Does consciousness have an adaptive function? Might a person in a coma or a vegetative state still have some form of awareness? Could a computer or a robot ever have what we would consider to be genuine experiences? During the past few decades, these and other questions about the nature of consciousness have been the focus of increasing empirical and theoretical research in neuroscience and other disciplines. The main purpose of the course is to introduce students to this exciting field of inquiry by exposing them to a variety of representative books and articles in the literature. The "backbone" of the course will be Stanislas Dehaene's Consciousness and the brain: Deciphering how the brain codes our thoughts (2014). As we go through the course, we will use each successive chapter in this book as the starting point for a deeper and wider exploration of the given topic(s), bringing into our discussion relevant experimental findings and philosophical perspectives from other investigators. Requirements: Students will take turns guiding discussions and

will also write 1-2 page "response papers" to the weekly readings. Permission of department required.

Learning Outcomes: 1. Learn historically relevant and current research - both theoretical and empirical - on the neuroscience of consciousness. 2. Understand theoretical and empirical approaches used to study the neuroscience of consciousness. 3. Gain background knowledge and experience needed to understand and critically evaluate theoretical and empirical research on the neuroscience of consciousness. Credits: 3.00

PSY 52200 - An Introduction To Pediatric Psychology

Credit Hours: 1.00. This course is designed for the clinical psychologist who desires to become acquainted with the field of pediatrics as it is seen by the practicing pediatrician. The student will be introduced to common medical terminology, literature, and interrelated pediatric and psychological problems. Permission of instructor required.

Credits: 1.00

PSY 55600 - Job Design

Credit Hours: 3.00. (IE 55600) Task analysis, personnel selection and training, job and organizational design, and criteria development and use. Human factors related to job design in order to increase job satisfaction and productivity.

Credits: 3.00

PSY 57700 - Human Factors In Engineering

Credit Hours: 3.00. (IE 57700) Survey of human factors in engineering, with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments. Primarily for engineers and other non-psychology majors.

Credits: 3.00

PSY 58100 - Neuroethics

Credit Hours: 3.00. Neuroscience research has led to a better understanding of the neuronal basis of behavior. The knowledge, together with new technological approaches that can predict and even control some aspects of human behavior, can have a major impact on social and legal policies. The course explores ethical, social, and legal implications of the use of new technological and pharmacological advances in brain research. Permission of department required.

Learning Outcomes: 1. Learn some of the technology and pharmocology that is currently used to study/manipulate the human mind and behavior. 2. Critically evaluate ethical arguments/dilemmas surrounding the use of such scientific advances. 3. Research in depth a real-world topic in Neuroethics that may have social and/or legal implications at the present time. Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60300 - Psychopharmacology

Credit Hours: 3.00. This course will cover core pharmacology concepts and principles, such as neurotransmitters, receptors, drug classes, and mechanisms of drug action, while highlighting recent findings related to pharmacogenetics and sex/gender differences in psychopharmacology. There will also be a primary focus on drug therapy for major psychiatric disorders including addiction, depression, anxiety and schizophrenia. Prerequisites: (BIOL 56200 and PSY 51200) or PSY 61500 or MCMP 57000.

Learning Outcomes: 1. Acquire knowledge about the primary biological systems through which drugs act to produce changes in behavior. 2. Learn basic principles of pharmacokinetics and pharmacodynamics. 3. Learn the primary signs/symptoms of major mental disorders and how these disorders are classified with the DSM. 4. Discuss and differentiate the primary methods currently used to treat mental disorders. 5. Critically evaluate the strengths and weaknesses of primary research papers in psychopharmacology. 6. Explain the use of animal models in psychopharmacology. 7. Explain and discuss the methods used in the "drug discovery pipeline", from target identification to FDA approval and beyond and model the application

of new drugs through this pipeline.. 8. Communicate proficient knowledge about a single psychiatric disorder and its pharmacological treatment through oral presentation and writing (white-paper style). Credits: 3.00

PSY 60500 - Applied Multivariate Analysis

Credit Hours: 3.00. A survey of the most frequently employed multivariate research techniques, such as multivariate generalizations of univariate tests and analysis of variance, principal components, canonical analysis, and discriminant analysis. A central theme of the course is the general linear model, both univariate and multivariate. A multipurpose program for this model provides the student with practical experience in conducting multivariate research. Some prior exposure to elementary matrix algebra is recommended. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate

analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

PSY 61501 - Systems And Behavioral Neuroscience

Credit Hours: 4.00. This course will provide you with a broad introduction to the field of neuroscience and how it can inform our understanding of behavior. First, we will cover neuroanatomy, synaptic communication, and plasticity. Next, we will cover neuroscience research on a range of major topics relevant to behavior: emotion, motivation, attention, learning, decision-making, and social cognition. This course will also provide a brief introduction to a variety of neuroscience research methods that are commonly used in animal and human research (e.g., electroencephalography, magnetic resonance imaging), including tutorials and live demonstrations. Permission of department required.

Learning Outcomes: 1. Know general neural architecture of core systems relevant to behavior. 2. Know behavioral outcomes for each major neural system. 3. Know how brain structure and functioning are studied in animal research. 4. Know how brain structure and functioning are studied in human research. 5. Know how brain functioning undergirds cognition, affect, and social processes. 6. Translate basic neuroscience to clinical and other applied research. Credits: 4.00

PSY 61601 - Neurobiology Of Brain Disorders

Credit Hours: 4.00. This course covers cellular and molecular mechanisms associated with alterations in brain function and human behavior linked to the most common neurological and psychiatric disorders. Students will learn about genetic, pharmacological, and physiological mechanisms related to the etiology, expression, and treatment of brain disorders. Permission of department required.

Learning Outcomes: 1. Acquire knowledge of the molecular and cellular mechanisms and behavioral components of major brain disorders. 2. Acquire knowledge about the methods and models used to study brain disorders with a focus on translation. 3. Demonstrate proficiency in critically evaluating primary literature. 4. Demonstrate in-depth knowledge of the underlying mechanisms and treatments for a specific brain disorder. Credits: 4.00

PSY 62101 - Genes, Brain And Behavior

Credit Hours: 3.00. This course examines how genes regulate development and function of the brain to ultimately influence behavior. Genetics has come to be an important aspect of research in almost every field of Neuroscience and Psychology ranging from neural development to cognitive function and dysfunction. However, many students have not had the opportunity to explore this in their studies to date. Therefore, the goal of this course is to provide students with the background needed to understand and think critically about the genetic components of Neuroscience and behavioral research. Numerous questions will be explored mainly through discussion of research papers. Lectures by the professor will fill in background knowledge needed to understand the readings. The questions explored will include: What are chromosomes and genes? What do they do? How do they do it? How do genes control development of the brain? How are single genes manipulated in animals to study their effects on behavior? How can genes associated with normal or abnormal behavior be identified? What has been learned from gene-behavior studies in animals? in humans? What do these studies tell us about the nature-nurture controversy? In addition to exploring these more traditional aspects of behavioral genetics we will address the three most exciting recent developments. These include the use of transgenic primate models, selective remote control of specific neural circuits using optogenetics and chemogenetics, and epigenetics, which helps explain how environmental factors and behavior itself can change gene activity and how these changes may be transmitted from one generation to the next. Many behaviors could be used to explore the principles these questions address. The readings will be selected from papers that focus on learning & memory and mental illness. However, if students are interested in other behaviors, papers that involve those behaviors and serve our purposes can be substituted. Grading will be based mainly on informal presentations of papers and participation in discussions of these papers. Permission of department required.

Learning Outcomes: 1. Understand historically relevant and current research on how genes influence behavior. 2. Become familiar with approaches used to study how genes influence behavior. 3. Gain background knowledge and experience needed to understand and critically evaluate research on the influence of genes on behavior. Credits: 3.00

PSY 62400 - Human Learning And Memory

Credit Hours: 3.00. Selected survey of important problems in

the encoding, storage, and retrieval of laboratory and naturalistic events.

Learning Outcomes: 1. Describe the most common methods and procedures used to carry out research on human learning and memory. 2. Describe and explain foundational findings in the study of human learning and memory. 3. Describe and evaluate key concepts and theories that have been developed to understand the mental processes involved in human learning and memory. Credits: 3.00

PSY 62500 - Complex Cognitive Processes

Credit Hours: 3.00. Surveys research and theory concerned with the nature of the "higher-order" mental processes, including decision making, categorization, problem solving, and language. Fundamental questions regarding the nature of the representations that underlie conceptual and linguistic behavior will be addressed. Permission of instructor required.

Learning Outcomes: 1. Read, critically evaluate, and discuss empirical and theoretical research articles about complex cognitive processes. 2. Integrate learning of course material with their own research interests into a written proposal of a research project, demonstrating effective communication skills and critical thinking skills. Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 62800 - Perceptual Processes

Credit Hours: 3.00. This course is an advanced introduction to the psychology of perception. The course emphasizes visual and auditory perception, reviewing basic concepts, methodologies, research findings, and theoretical approaches. Theories of direct perception, constructivist perception, and computational vision are discussed in detail.

Credits: 3.00

PSY 62901 - fMRI Design And Analysis

Credit Hours: 3.00. Introduces students to the design of fMRI experiments and fMRI data analysis. Covered topics include an introduction to MR physics, block designs, rapid-event related designs, data preprocessing, and standard analyses using the general linear model. Advanced analysis techniques such as functional connectivity and multivariate pattern analysis and common pitfalls in design and analysis will also be covered. Prerequisites: Required: Basic knowledge of inferential statistics. Recommended: Familiarity with the general linear mode (GLM) and signal processing. Permission of department required.

Learning Outcomes: 1. Understand how to design fMRI experiments. 2. Perform fMRI analysis. 3. Interpret the results of fMRI data analysis. 4. Understand and avoid pitfalls related to fMRI data analysis. Credits: 3.00

PSY 63000 - Stereotyping And Prejudice

Credit Hours: 3.00. Provides an in-depth examination of issues related to stereotyping, prejudice, and discrimination. After a general introduction and historical overview, students will be exposed to a detailed study of the social psychological foundations of stereotyping and prejudice to include their impact and reduction strategies. Permission of instructor required.

Learning Outcomes: 1. Facilitate oral and written communication skills and critical thinking skills. 2. Acquire greater appreciation of research ethics, methodology, design, and data analysis. 3. Gain appreciation through careful consideration of original empirical works. Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research

design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

PSY 63600 - Self And Identity

Credit Hours: 3.00. This seminar explores many issues related to the self from a social psychological perspective. The goal is to develop a better understanding of theory and research dealing with various aspects of the self. To accomplish this goal, students will learn to critically analyze research papers addressing self-related material. Department permission required.

Learning Outcomes: 1. Identify and examine how the self is shaped by social context and social feedback mechanisms. 2. Identify and examine how people compare the self to others. 3. Identify and examine how people's own self-perceptions influence the way they think about and judge others. 4. Identify and examine what elements of the self-influence how people act in the social world, including the manner in which we present ourselves to others. Credits: 3.00

PSY 63700 - Human Information Processing

Credit Hours: 3.00. This course develops the methodological tools required for an information processing approach to human behavior. These techniques are applied to such topics as reaction time, signal detection, attention, and skilled behavior, with emphasis upon unifying empirical findings. Prerequisite: PSY 60000 , PSY 60100 .

Credits: 3.00

PSY 64000 - Survey Of Social Psychology I

Credit Hours: 3.00. An extensive survey of methods, research, and theory in social psychology.

Credits: 3.00

PSY 64200 - Social Influence

Credit Hours: 3.00. Students are immersed into the exciting sub-field of social psychology: social influence through lively discussions and readings on the subject. Students will evaluate what is meant by social influence, what it includes, what it doesn't include, as well as current trends in social influence. Permission of instructor required.

Learning Outcomes: 1. Enhance knowledge and facilitate oral and written communication skills and critical thinking skills 2. Gain a greater appreciation of ethical research (e.g., through coverage of Milgram's original research on social influence in the form of obedience to authority). 3. Gain a research methodology. Credits: 3.00

PSY 64300 - Attitudes And Attitude Change

Credit Hours: 3.00. Considers relation of attitudes to beliefs and to behaviors. Surveys major theories of attitude formation and change as well as empirical research related to these theories.

Credits: 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

PSY 64600 - Seminar In Social-Personality Psychology

Credit Hours: 3.00. A seminar covering a special topic in personality or social psychology. Specific topic varies from seminar to seminar. Permission of instructor required.

Credits: 3.00

PSY 64700 - Group Processes And Performance

Credit Hours: 3.00. Provides a survey of research concerning small group interaction and performance. Covers topics such as group problem-solving, group decision-making, group polarization, and group structure. Will also discuss group interaction and communication patterns.

Credits: 3.00

PSY 66700 - Clinical Assessment I

Credit Hours: 4.00. Presentation of general assessment principles and methods. Supervised practice in general diagnostic and treatment procedures as applied to both children and adults. Emphasis is placed on laboratory practice in the administration and interpretation of intelligence tests; behavioral

observation techniques and operant remediation procedures. Permission of instructor required.

Learning Outcomes: 1. Display knowledge of basic psychometric theory as evidenced by performance on examinations. 2. List primary instruments and their strengths and weaknesses. 3. Perform accurate administration, scoring, and interpretation of personality assessment instruments in real-time. 4. Display proficiency in writing integrative assessment reports. 5. Dialogue with professional colleagues regarding the professional practice of assessment and diagnosis. Credits: 4.00

PSY 66800 - Clinical Assessment II

Credit Hours: 4.00. Presentation of methods of clinical assessment including structured and unstructured personality tests, physiological recording, behavioral observation, and interview techniques. Emphasis is placed on laboratory practice in the administration and interpretation of personality tests and training in the basic clinical interview techniques. Permission of instructor required.

Credits: 4.00

PSY 66900 - Prosocial Behavior

Credit Hours: 3.00. This course is designed to provide a broad and rigorous, graduate-level overview of contemporary scientific research on prosocial processes from the perspective of personality and social psychology. Permission of department required.

Learning Outcomes: 1. Have a comprehensive mastery of the mechanisms and processes associated with prosocial behavior. 2. Learn how to plan and conduct research on prosocial behavior. 3. Learn to integrate prosocial processes with more general interpersonal processes and social relation research. Credits: 3.00

PSY 67000 - Principles And Techniques Of Psychological Treatment

Credit Hours: 3.00. Discussion and elaboration of the main theories and techniques of psychotherapy, the application of these techniques to the change of behavior, and the analysis of clinical cases for therapy planning.

Learning Outcomes: 1. Understand basic methodological issues related to psychotherapy research. 2. Describe the distinction between process and outcome in psychotherapy. 3. Understand the contributions of specific and common factors in psychotherapy. 4. Demonstrate basic process skills of active listening, empathic responses, and utilization of the therapeutic relationship in interactions with mock clients. 5. Demonstrate basic skills involved in motivational interviewing. 6. Demonstrate practical skills to document therapeutic interventions (progress notes) and care management (treatment planning). 7. Develop an understanding of the conceptual underpinnings of cognitive behavior therapy, including a) underlying theory of psychopathology; b) proposed mechanisms of change; c) establishment of treatment plans based on mechanisms of change; d) empirical evidence of therapy efficacy and effectiveness. 8. Demonstrate skills to implement basic evidenced-based therapeutic interventions and strategies (CBT). 9. Demonstrate an appreciation for addressing individual differences and diversity in psychotherapy. 10. Demonstrate a sense of self-awareness and ability to relate to diverse clients. Credits: 3.00

PSY 67300 - Psychology Of Behavior Disorders

Credit Hours: 3.00. Advanced abnormal psychology. Consideration will be given to research and theory of psychopathology.

Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal

articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

PSY 67510 - Research Methods In Clinical Psychological Sciences

Credit Hours: 3.00. This course provides an in-depth introduction to the fundamentals of research methods and design, including the scientific approach and its applicability to the science of psychology to the philosophy of science, the role of theory, and hypothesis testing. Philosophical and theoretical fundamentals are discussed, followed by methodological issues. The course includes content on the replication crisis in psychology, the practices that contributed to it, and the means to overcome it, as well as issues in sampling, measurement, and design. The course will examine nonexperimental research as well as experimental and quasi-experimental approaches. Permission of department required.

Learning Outcomes: 1. Understand Open Science practices, basic psychometrics, experimental design, and nonexperimental approaches and identify bad research practices in published research articles. 2. Evaluate special issues faced when studying psychopathology. 3. Evaluate the factors that contribute to replication concerns in the field (i.e., low statistical power, HARKing, p-hacking, and publication bias). 4. Evaluate correct strategies for calculating reliability and demonstrating validity of a psychological assessment. 5. Create a research study working through sampling, assessment, and design. Credits: 3.00

PSY 67800 - Seminar In Clinical Psychology

Credit Hours: 2.00. Discussion of special topics in clinical psychology. Permission of instructor required.

Credits: 2.00

PSY 67900 - Practicum In Clinical Psychology

Credit Hours: 1.00 to 6.00. This is a practicum in clinical psychology, whereby students see individuals for therapy. These cases are supervised by faculty in clinical psychology. This is a requirement for the graduate program, and students must do both adult and child practicum. Students enrolled in this program must register for this course a minimum of four times. Prerequisite: Master's student standing and Psychology majors only. Permission of instructor required.

Credits: 1.00 to 6.00

PSY 68000 - Survey Of Industrial/Organizational Psychology

Credit Hours: 3.00. This two-semester sequence extensively surveys the various areas of industrial/organizational psychology. The first semester surveys those topics generally classified as dealing with industrial psychology (e.g., selection, placement, training, performance appraisal), and the second semester surveys organizational psychology topics (e.g., job satisfaction, motivation, leadership, decision making, role making). Course provides a critical and up-to-date review of recent and classical research in these areas. Prerequisite: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Credits: 3.00

PSY 68010 - Survey Of Industrial Psychology

Credit Hours: 3.00. This seminar is designed to familiarize doctoral students with the basic areas of Industrial Psychology and Human Resource Management. The course will include a discussion and analysis of book chapters and journal articles related to key topics. The goal of this seminar is to help students develop frameworks for organizing the myriad conceptual, professional, and technical issues associated with Industrial Psychology / Human Resource Management. Development of these frameworks is requisite for effective acquisition and integration of information provided in future seminars and development of research ideas. Permission of department required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Organizational Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3. Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Organizational Psychology. Credits: 3.00

PSY 68020 - Survey Of Organizational Psychology

Credit Hours: 3.00. The main objective of this course is to introduce doctoral students in the Industrial and Organizational Psychology program (and related disciplines) to the major areas of research in the field of organizational psychology. Additionally, the course aims to provide students an opportunity to: (1) hone their analytic and information presentation skills, and (2) gain practice in developing research ideas. We will discuss classical and contemporary issues in light of both their theoretical and practical implications for the field. The course will include presentations and (synchronous and asynchronous) discussions of assigned readings. Permission of department

required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Industrial Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3. Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Industrial Psychology. Credits: 3.00

PSY 68100 - Seminar In Research Methodologies Of Industrial/Organizational Psychology

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings.

Learning Outcomes: 1. Develop an understanding of quantitative research methods employed in psychology, including their strengths and limitations in addressing validity concerns. 2. Apply quantitative research methods to your own research. 3. Have critical thinking skills and good professional judgment regarding research, theory, and methods. 4. Have written and oral skills. 5. Understand and able to apply professional and ethical values of psychology. Credits: 3.00

PSY 68110 - Research Methods In Industrial-Organizational Psychology I

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings. This course is the first part of a two-semester sequence which covers issues in research design and data analysis techniques common to I-O psychology and other applied fields. We will review the overall research process and various types of research. We will review the various threats to the validity of conclusions that can be drawn from quantitative research and how design features can help address these threats. We will spend time in class critiquing research articles. Permission of department required.

Learning Outcomes: 1. Evaluate the conceptual and methodological strengths and limitations of quantitative research in psychology. 2. Write a research proposal that effectively integrates best practices in quantitative research (e.g., scientific contribution, measurement, reliability, validity, open science). 3. Critically evaluate the rigor and reproducibility of quantitative research in psychology. 4. Run and interpret basic descriptive statistics, correlations, and linear regression models using R. Credits: 3.00

PSY 68120 - Research Methods In Industrial-Organizational Psychology II

Credit Hours: 3.00. This course is the second part of a two-semester sequence that covers core research methods in the social sciences focusing on Industrial/Organizational psychology, Organizational Behavior, and allied fields of Social and Personality psychology. This course sequence is designed for doctoral students who intend to conduct quantitative empirical research publishable in scholarly journals. This course begins with the philosophy of science, developing and evaluating theory, reviewing and summarizing relevant research. Topics include the examination of research methods applicable to survey data, multilevel data, and longitudinal data. The course concludes with a discussion of 'methods' (strategies) for publishing in scholarly journals. Permission from department required. Prerequisites: PSY 68110, Research Methods in Industrial-Organizational Psychology I (or equivalent) and Basic Statistics.

Learning Outcomes: 1. Articulate the importance of research methods for science. Method of evaluation: class discussions. 2. Develop and apply research methods to their research, including designing of studies that employ a particular method. Method of evaluation: written research proposal. 3. Identify the strengths/weaknesses of each method. Method of evaluation: weekly reading summaries. 4. Explain empirical research findings to scholars in their field. Method of evaluation: research presentation. 5. Evaluate research methods used in empirical studies. Method of evaluation: class discussions. Credits: 3.00

PSY 68200 - Advanced Seminar In Industrial Organizational Psychology

Credit Hours: 3.00. Special topics in industrial and organizational psychology are offered on a two-year rotating basis. The special topics are: work motivation, leadership, advanced selection and placement, and performance appraisal. One topic will be treated each semester.

Credits: 3.00

PSY 68300 - Seminar In Industrial/Organizational

Psychology
Credit Hours: 3.00. Topics vary. Permission of instructor required.

Credits: 3.00

PSY 68800 - Research Methods In Social Psychology
Credit Hours: 3.00. This course provides a broad and rigorous, graduate-level overview of contemporary research methodology in social psychology and personality. The course follows a discussion seminar format. Permission of department required.

Learning Outcomes: 1. Understand the specific rationale for using different methodological techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

PSY 69000 - Individual Research In Psychology
Credit Hours: 1.00 to 3.00. Involvement in research design, execution, and analysis under the guidance of a faculty member. Permission of instructor required.

Credits: 1.00 to 3.00

PSY 69100 - Readings In Psychology
Credit Hours: 1.00 to 3.00. In-depth reading into specific topic area in psychology, under the guidance of a faculty member. Permission of instructor required.

Credits: 1.00 to 3.00

PSY 69200 - Special Topics In Psychology
Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 69600 - Seminar In Neuroscience
Credit Hours: 2.00. The course is designed to expose graduate students to diverse areas of most up-to-date research and hone their skills in understanding conceptual issues and tools used to study neuroscience. The students help host speakers and introduce speakers before their colloquium talk. The students will also formally present their own research to the area faculty and students once each year, at a level appropriate to their years in the program. Lastly, each student will write a "journal club" style paper on a recently published empirical study. Permission of instructor required.

Learning Outcomes: 1. Present own research to a broad audience. 2. Evaluate and provide constructive feedback of peer's oral presentations. 3. Comprehend, summarize, and lead a discussion on current research. 4. Network and meet with external speakers and eloquently articulate your research interests. Credits: 2.00

PSY 69700 - Clinical Psychology Internship
Credit Hours: 0.00. Clinical psychology internship. Open only to Clinical Psychology students in approved internship facilities. Permission of instructor required.

Credits: 0.00

PSY 69800 - Research MS Thesis
Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PSY 69900 - Research PhD Thesis
Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Public Health

PUBH 10000 - Introduction To Public Health
Credit Hours: 1.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health and disease. 3. Understand the government's role in matters pertaining to the health of the public. 4. Explain the role of public health in medical care and identify the principal problems in the US healthcare system. 5. Achieve a basic understanding of the two major analytical methods of public health: epidemiology and biostatistics. 6. Identify the principal environmental determinants of health. 7. Understand the health challenges that confront major vulnerable populations. 8. Have knowledge of major and widespread challenges to good health: smoking, obesity, chronic disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health. 10. Describe future challenges in public health. Credits: 1.00

PUBH 10001 - Introduction To Public Health

Credit Hours: 3.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health. 3. Explain the role of public health in society. 4. Understand the government's role in matters pertaining to the health of the public. 5. Understand the role of health disparities in public health. 6. Achieve a basic understanding of the major investigative tool in public health: Epidemiology. 7. Identify the principal environmental determinants of health. 8. Know major and widespread challenges to good health: smoking, obesity, chronic disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health, including the current pandemic. Credits: 3.00

PUBH 20200 - Health In The Time Of Pandemics: An Introduction (UCC: STS)

Credit Hours: 3.00. This course will introduce students to basic concepts about health and disease through examination of the sweeping effects of pandemics. In addition to reviewing the effects directly related to human health and healthcare systems, the course will provide an interdisciplinary overview of the social, political, and economic consequences of infectious disease outbreaks and the range of local, national, and global responses to address them. The course will be taught by faculty members representing the broad diversity of disciplines within the College of Health and Human Sciences (HHS), with additional specific contributions from faculty representing other disciplines outside HHS.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Outline the historical and epidemiologic context of epidemics and pandemics. 2. Identify ethical, environmental, political, social and economic impacts of pandemics across the human lifespan. 3. Analyze the public health and social responses to pandemics at the local, national, and global levels. 4. Describe examples of scientific and technological developments, including novel vaccines, diagnostic tests, telehealth and other service delivery innovations, and the costs, benefits, and ethical implications for individuals and global society. Credits: 3.00

PUBH 20500 - Basic Public Health Studies

Credit Hours: 3.00. Examination of basic scientific concepts as applied to the problems and issues in selected areas of human health behavior with particular attention to their influence on population and individual health. Restricted to students enrolled in major degree programs for which this course is a requirement.

Learning Outcomes: 1. Discuss the nature of public health promotion and disease prevention in the US. 2. List the leading causes of death and describe leading theories of health behavior. 3. Define the components of psychological health and describe the basic traits shared by psychologically healthy people. 4. Describe the nature of stress, the physiology of the stress response, and the relationship of stress to health/disease; identify the major sources of stress in contemporary society and discuss interventions for stress management. 5. Discuss categories of drugs, routes of administration and drug interactions. 6. Describe the relationship of alcohol, tobacco and caffeine to health and disease. 7. Describe the general concepts of nutrition, list and explain the recommendations made to the public by various health agencies to decrease risk of chronic disease. 8. Describe various theories of obesity, discuss concepts of weight management, define/describe body image and the disordered eating continuum, define anorexia and bulimia nervosa, and list symptomatology and risk factors. 9. Discuss the relationship of physical activity and physical fitness to health and/or disease and provide rationale (based on evidence from exercise epidemiology) for the recommendations made

to the public concerning activity/exercise participation. 10. Describe the anatomy and basic functions of the cardiovascular system and the prevalence/incidence of heart disease, identify risk factors and describe the features of atherogenesis and other diseases of the heart and vascular system. 11. Describe the prevalence and incidence of the various types of cancer and identify cancer risk factors. 12. Describe the prevalence and incidence of diabetes and list risk factors for diabetes. Credits: 3.00

PUBH 22000 - Sexuality And Health

Credit Hours: 3.00. Deals with various aspects of human sexuality and sexual behavior and their impact upon individual health. Health concerns related to sexual behavior.

Credits: 3.00

PUBH 22500 - Contemporary Women's Health

Credit Hours: 3.00. Examines behavioral, psychological, and sociocultural aspects of women's experience in healthcare systems. Includes the influence of factors such as age, social class, and ethnicity on women's roles as recipients and providers of health care.

Credits: 3.00

PUBH 23000 - Community, Culture And Social Justice From A Public Health Perspective

Credit Hours: 3.00. The course provides an introduction to the concepts of community, culture, and social justice. The interaction between community, cultural, ethical, social, economic, environmental, political and social justice dynamics that shape health will be explored.

Learning Outcomes: 1. Identify and understand the social determinants of health. 2. Describe how community, cultural, ethical, social, economical, environmental, political and social justice shape human health both locally and globally using a social determinants of health framework. 3. Learn about theories of justice related to the field of public health. 4. Understand community developmental theoretical frameworks dimensions associated with the social change, such as empowerment, community participation, and capacity building. 5. Identify roles and responsibilities of the public health educator, other practitioners, and community members as agents of change. 6. Compare and contrast the concepts of health inequities, health disparities and health inequalities. Credits: 3.00

PUBH 23500 - Stress And Human Health

Credit Hours: 3.00. Course is designed to provide an understanding of stress and stress management, including the physiology of the stress response, the relationship between stress and disease, potential sources of stress, and methods of intervening to prevent and/or relieve stress.

Credits: 3.00

PUBH 24000 - Global Health

Credit Hours: 2.00. This course introduces students to current challenges, debates, and efforts at solutions in global public health with a focus on low-and middle-income countries. It provides an interdisciplinary overview of topics that include measures of health and disease, health disparities, communicable and non-communicable diseases, women's health, maternal and child health, food systems and nutrition, health systems, and global cooperation. It also highlights the central role of data in achieving the global health agenda. Permission of department required.

Learning Outcomes: 1. Identify major issues and trends in global health and their drivers, with a focus on low and middle-income countries. 2. Characterize the determinants of health and risk factors for conditions of importance to global health. 3. Identify key issues in health disparities between and within countries. 4. Describe the role of data in informing and driving decision-making and actions in global health. 5. Formulate evidence-based arguments for or against global health policies or interventions. Credits: 2.00

PUBH 25000 - Intercultural Development In Public Health And Human Sciences

Credit Hours: 3.00. There is a high demand for students to be prepared to work efficiently and effectively across different cultures. Whether working on sustainable and thriving communities and organizations, promoting healthy lifestyles, disease prevention, or developmental health and wellness, the need to develop cultural bridging skills is important for effectively helping individuals and their communities. The course teaches students how to develop a deeper appreciation and empathy for cultural values and traditions that are different from their own, learn how to cultivate a cultural worldview, become more aware of their own cultures, foster intercultural openness and curiosity, and how to communicate across cultures.

Learning Outcomes: 1. Identify important cultural dimensions between US and other cultures. 2. Describe mindfulness and demonstrate how it applies to both their student life on campus as well as their public health and human sciences careers. 3. Engage in mindfulness techniques for self-reflection. 4. Formulate various techniques to focus on present situations and choose the appropriate method for various healthcare situations. 5. Learn and practice how to regulate their emotions during stressful situations in public health and human sciences. 6. Construct specific techniques to question their predisposed judgments of familiar and new people, places and things. 7. Assess and interpret cultural situations in order to plan and interact with others from different cultures in healthcare and human services. 8. Reflect on their cultural interactions and identify and develop new ways to interact in future cultural interactions in health and human services (synthesis and application). Credits: 3.00

PUBH 29500 - Internship & Career Preparation

Credit Hours: 1.00. This course provides students with professional competencies in identification and development of professional resources that aid in a greater understanding and preparation for careers in public health. Upon completion of the course, students will be prepared to seek an internship and apply concepts learned to their professional development experiences.

Learning Outcomes: 1. Define and conceptualize individual areas of study as a professional discipline, including its purpose, goals, trends, professional expectations, types of settings, etc. 2. Identify procedures for internship preparation. 3. Demonstrate the ability to develop a professional cover letter and resume. Credits: 1.00

PUBH 30500 - Health Education In Elementary Schools

Credit Hours: 3.00. The problems of physical health, mental health, and safety of the school-aged child are considered, with emphasis on ways in which the elementary teacher meets his or her responsibilities and opportunities for promoting pupil health.

Learning Outcomes: 1. Define terms related to health, coordinated school health programs (CSHP), and comprehensive school health education (CSHE). (IPSB 19) 2. Describe the health status of, and health risk behaviors of, children and adolescents. (IPSB 2) 3. Describe factors related to the health status and health behaviors of children and adolescents. (IPSB 7) 4. obtain needs assessment data related to child health and learning and the health risk behaviors of adolescents. (IPSB 1, 2) 5. Describe the relationship between health risk behaviors and CSHE. (IPSB 19) 6. Describe CSHP and components of CSHP. (IPSB 8) 7. Describe interrelationships between the components of CSHP including CSHE. (IPSB 8) 8. Provide rationale for CSHP and CSHE. (IPSB 8) 9. Develop plans for promoting collaborative efforts among health and education agencies and organizations for CSHP and CSHE. (IPSB 6) 10. Use technology to retrieve resources for CSHP and CSHE. (IPSB 16) 11. Describe the role elementary and middle school teachers in CSHP and CSHE. (IPSB 9) 12. Define terms and identify concepts related health education planning, needs assessment, skills, content, methods, and assessment. (IPSB 5, 6, 10, 11, 12, 13, 18) 13. Secure, describe, and demonstrate strategies for teaching and assessing health education content and skills. (IPSB 13, 18, 20) 14. Develop a scope and sequence for elementary health education. (IPSB 3) 15. Identify and demonstrate strategies for handling sensitive health issues. (IPSB 17) 16. Secure, describe, and demonstrate strategies for involving families in CSHE. (IPSB 15) 17. Secure, describe, and demonstrate strategies for integrating health education with at least one other academic area. (IPSB 14) 18. Develop a resource kit for planning, implementing,

assessing, and evaluating instruction in CSHE (IPSB 16) Credits: 3.00

PUBH 32000 - Health Behavior And Health Promotion

Credit Hours: 3.00. Introduces health behavior theory and practice in the context of health promotion and education. Examines individual, interpersonal, and community approaches to explaining and predicting health behavior and emphasizes their application to interventions in health promotion and education.

Learning Outcomes: 1. Identify basic theories, concepts and models from a range of social and behavioral disciplines that are used in public health research and practice. 2. Apply different health behavior theories and models in the U.S. and internationally to important public health issues such as tobacco use, physical inactivity, poor diet, etc. 3. Identify the causes of social and behavioral factors that affect health of individuals and populations. 4. Describe the role of social and community factors in both the onset and solution of public health problems. 5. Specify multiple targets and levels of intervention for social and behavioral science programs and/or policies. 6. Understand theoretical constructs from an ecological perspective; Understand theories and models relevant at multiple levels of behavioral influence, including the individual, interpersonal, community, and organizational levels. Credits: 3.00

PUBH 32500 - Methods Of Health Promotion And Education

Credit Hours: 3.00. Methods and materials of health promotion and education; preparation and use of content and materials related to health concerns of target populations. A variety of strategies and media are covered with theoretical and practical applications.

Credits: 3.00

PUBH 36500 - Public Health Research Methods

Credit Hours: 3.00. The course is designed to help you (1) develop an understanding of the nature of research and the scientific method in public health, (2) acquire an appreciation for the different types of research conducted within public health, and (3) provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating public health research in basic and applied settings.

Learning Outcomes: 1. Explain and discuss the public health research process. 2. Identify or develop sound public health research questions and hypotheses, and discuss appropriate methods for testing the hypotheses. 3. Demonstrate appropriate techniques regarding data collection in public health. 4. Interpret research findings and discuss their implications relative to public health. Credits: 3.00

PUBH 38000 - Public Health Policy

Credit Hours: 3.00. This course will provide the opportunity to examine and analyze the financing, organization and delivery of health care in the U.S. and how these core elements are shaped and influenced by health care policy and decision-making.

Learning Outcomes: 1. Describe the role of policy, law and government relations in health care and public health. 2. Explain how federal, state, and local health policy is made. 3. Identify and critique the difference between population health and individual health. 4. Explain the policy interests between the public good (public health) and individual rights. 5. Explain the organization of the health care system, including principles and examples of health insurance and health care finance. 6. Describe health care policy formulation and implementation. 7. Explain and apply health policy principles to the policy topics discussed in class. Credits: 3.00

PUBH 40000 - Human Diseases And Disorders

Credit Hours: 3.00. The major communicable and noncommunicable diseases and disorders that afflict modern man, with particular emphasis upon the etiology, epidemiology, and ecology of these diseases and disorders.

Learning Outcomes: 1. Describe risk factors and modes of transmission for infectious and chronic diseases and how these diseases affect both personal and population health. 2. List the leading causes of mortality and morbidity, and health disparities among local, regional, and global populations. 3. Discuss major local,

national, and global health challenges. 4. Explain the influence that science and technology have on individual and population health. 5. Describe the multiple determinants of health. Credits: 3.00

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

PUBH 48000 - Internship For Public Health

Credit Hours: 9.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques they have mastered in the classroom to a professional work experience in the field. Each student in the Public Health Major at Purdue University is required to perform a 400 hour internship experience that meets the expectations of the student, the internship/practicum site, and the University. The internship is to be a culminating experience representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Must have completed all other major requirements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge, skills, and abilities to be applied through the practicum experience within the areas of a) Administration, b) Program Development, c) Supervising Programs, d) Agency Operations. 2. Demonstrate professional and ethical decision making skills, verbal and written communication skills, and an ability to work with various needs of diverse populations. 3. Demonstrate professional relationships that present themselves as part of the organization with staff and clientele throughout their practicum experience. 4. Assess, plan, implement, and evaluate a research or facility enhancing major project within the practicum site. Credits: 9.00

PUBH 49000 - Special Topics In Public Health

Credit Hours: 0.00 to 6.00. Various public health topics that may change from semester to semester. Department persmission required.

Learning Outcomes: 1. Outcomes vary due to nature of variable course topics. Credits: 0.00 to 6.00

PUBH 49200 - Mentored Research In Public Health

Credit Hours: 3.00. Designed to provide a research learning activity for undergraduate students majoring in Public Health. Students will gain research and presentation experience under the guidance of a supervising public health faculty member. Permission of instructor required.

Learning Outcomes: 1. Explain and discuss the research process. 2. Identify or develop sound public health research questions and hypotheses, and discuss appropriate methods for testing the hypotheses. 3. Demonstrate appropriate techniques regarding data collection in public health. 4. Interpret research findings and discuss their implications relative to public health. Credits: 3.00

PUBH 50000 - Introduction To Public Health

Credit Hours: 1.00 to 3.00. This Public Health course covers a variety of issues related to the profession of public health. The Introduction to Public Health provides the graduate student with an overview of the history, science, mission, practice and future

of public health. The core public health principles and services, and the expected competencies of the professional public health practitioner, are discussed. Current issues in public health are also presented for discussion and analysis.

Learning Outcomes: 1. Describe factors affecting the health of a community (e.g., equity, income, education, and environment). 2. Apply ethical principles in accessing, collecting, analyzing, using, maintaining, and disseminating data and information. 3. Identify current trends (e.g., health, fiscal, social, political, environmental) affecting the health of a community. 4. Communicate in writing and orally with linguistic and cultural proficiency (e.g., using age-appropriate materials, incorporating images). 5. Describe the roles of governmental public health, health care, and other partners in improving the health of a community. 6. Describe the diversity of individuals and populations in a community. 7. Describe the effects of policies, programs, and services on different populations in a community. Credits: 1.00 to 3.00

PUBH 50100 - Introduction To Health Equity

Credit Hours: 3.00. This course introduces the participants to graduate level research in health disparities and the various theoretical and analytical skills needed to be a good health disparities researcher. It will take the course participants through the axiological, ontological and epistemological questions that we are confronted within social scientific research. This course will walk the participants through the various research paradigms and the critical debates associated with it so that they can reflect and possibly make an informed choice about their own research priorities. Permission of department required.

Learning Outcomes: 1. Develop students understanding of the fundamental assumptions underlying different approaches to health disparities research and in turn how these inform the field. 2. Develop students' capacities to describe, and to compare and contrast, the prominent approaches used to understand Health Disparities. 3. Encourage the student participants to critically evaluate different research and approaches to health disparities and comment on the suitability of these in advancing health disparities research. 4. Learn to write for academic audiences. Credits: 3.00

PUBH 51100 - Foundations Of Global Health

Credit Hours: 3.00. Global disparities in the health and well-being of diverse populations, across and within borders, has never been greater. Profound and rapid changes in demographics, from population growth to urbanization, along with unprecedented shifts in patterns of disease and risks, are coupled with game-changing advances in knowledge, technology, and innovation. This course will introduce students to current challenges and efforts at solutions in global health, with a focus on low- and middle-income countries. It will provide an interdisciplinary overview of topics that include measures of health and disease, communicable diseases such as HIV/AIDS and malaria, non-communicable diseases such as diabetes and cardiovascular disease, women's health, maternal and child health, food systems and nutrition, health systems, and health care delivery. In addition to lectures, the course will include interactive discussions of case studies and specific country examples, aimed at immersing students in the debates and challenges facing global health leaders and decision makers.

Learning Outcomes: 1. Identify major shifts and trends in health patterns, burden of disease, population dynamics, and globalization. 2. Understand the historical context of global health and current evolving agendas. 3. Analyze diverse global health challenges, incorporating ethical, environmental, political, historical, and societal perspectives, with a focus on low- and middle-income countries. 4. Evaluate global health research to assess how conclusions arise from evidence and analysis. 5. Formulate evidence-based arguments for/against diverse global health policies or interventions. Credits: 3.00

PUBH 51250 - International Health Systems: A Comparative Approach

Credit Hours: 3.00. This course is an introduction to public health priorities from an international perspective, illustrating the interdependent nature of health promotion and disease prevention issues across diverse regions and populations. Coursework examines population health determinants, contrasting industrialized and developing countries and how these influence health goals established by public health institutions, such as the World Health Organization, philanthropic foundations and governmental agencies. International health care needs continue to emerge as interchanges among peoples and nations increase. To

effectively address these needs, public health leaders must understand the social, economic, environmental, and political determinants of health and be prepared to respond to challenges related to health and health care at the local, national, and global level. This course examines the historical evolution of international health challenges as well as the future trends that will continue to impact health and health systems worldwide. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Conduct a comparative analysis of international health data and trends impacting health care systems. 2. Analyze international health systems and their emphasis on the global health care market. 3. Assess the impact of health and disease on a nation. 4. Evaluate the role of government and non-government agencies in the provision and management of global health systems. 5. Develop a formal proposal to address a global health challenge. 6. Evaluate how indicators of health care spending and the quality of health service provision vary across global health care systems. Credits: 3.00

PUBH 51350 - Global Health Security And Disaster Management

Credit Hours: 3.00. This course is a contemporary examination of the growing threat and potential public health consequences of disasters and the role of climate change. Additionally, we review the variety of public health and environmental health disasters, their consequences and the role of public health agencies health care systems and practitioners in preparedness, response and recovery from a local, national and global perspective. The course is designed to develop proficiency in analyzing and evaluating the public health response to disasters, the linkage to emergency management frameworks and identifying solutions and methods for improvement. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Explore the concepts and tools of public health as it relates to minimizing the effects of disasters in a global context. 2. Compare and contrast past approaches to disease eradication with modern best practices. 3. Examine the impact of natural and man-made disasters, disease, climate change on the public health and medical response infrastructure and the capability to respond effectively in a crisis. 4. Describe public health surveillance and epidemiological forecasting. 5. Evaluate public health emergency management principles and practices that impact Global health security. 6. Analyze the global response to public health issues and crisis. 7. Demonstrate communication skills and strategies for promoting family and community health during times of disaster or public health emergencies. Credits: 3.00

PUBH 52000 - Human Sexuality And Sexual Health

Credit Hours: 3.00. This course is designed to provide students with an in-depth and applied understanding of the major theories and principles guiding human sexuality and sexual health research. Content covered will enrich an understanding of sexuality and sexual health research methods, past and present research findings, and the intersection of this field and public health practice.

Learning Outcomes: 1. Identify and assess major concepts, theories, and perspectives guiding an interdisciplinary and translational approach to understanding of human sexuality. 2. Identify and assess past and present developments in sexuality research. 3. Identify and assess multidisciplinary and mixed sexuality research methods. 4. Identify and assess how sexuality research informs public health practice and policy. Credits: 3.00

PUBH 52500 - Statistical Methods For Public Health Evaluation

Credit Hours: 3.00. This course provides an overview of the statistical methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs and the application and tailoring of these designs to evaluations. In addition, we will focus on categorical data analysis methods, which are often necessary for evaluation projects. You will collaborate with those students to conduct an evaluation, develop a report with your findings, and present your findings. The course is intended for graduate students in public health; however, it may be of

interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of department required.

Learning Outcomes: 1. Describe preferred methodological alternatives to parametric statistical methods when assumptions are not met. 2. Accurately interpret the results and limitations of nonparametric descriptive and inferential methodologies. 3. Apply appropriate descriptive and inferential methodologies according to the type of study design for answering a particular research question. 4. Collaborate with non-statisticians to complete evaluation activities. 5. Explain evaluation analyses and results to non-statisticians, including researchers, public health professionals, and community members. 6. Recognize and critically reflect upon one's own cultural biases and their impact on research design, analysis, and interpretation. Credits: 3.00

PUBH 52600 - Randomized Control Trials In Public Health

Credit Hours: 3.00. Randomized control trials provide solid evidence on whether interventions and programs "work" to improve health outcomes. In this course, students will learn how to design a randomized study, handle practical issues that arise in data collection, analyze data using appropriate methods and good statistical practice, identify limitations to statistical evidence, and interpret and communicate findings in an audience-appropriate way. This is a hands-on course in which students will work with data and build skills using SAS statistical software in preparation for careers as biostatisticians, data scientists, and researchers. Pre-requisite: A graduate level introductory statistics course that includes simple linear regression.

Learning Outcomes: 1. Identify and plan an appropriate randomized study design to answer a substantive question. 2. Identify limitations to statistical evidence that arise in study design and implementation. 3. Analyze data from randomized trials using appropriate methods and good statistical practice. 4. Interpret and communicate findings from randomized trials in an audience-appropriate way. Credits: 3.00

PUBH 53500 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

PUBH 54250 - Public Health And Nutrition

Credit Hours: 3.00. This course will emphasize development, implementation, and evaluation of nutrition intervention programs from a public health perspective. Students have an opportunity to practice setting realistic goals that produce outcomes aimed to improve health and support community and public nutrition. Students will explore changing nutritional behavior and the barriers to such change. This course is intended for graduate students interested in developing, implementing, and evaluating community-based nutrition programs The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Evaluate the impact of various nutrition-based public health programs. 2. Construct realistic goals that produce outcomes that improve health and support wellness. 3. Describe the basic elements of program planning in public health. 4. Identify methods for overcoming barriers to program implementation. 5. Describe methods for process, effect, and impact evaluation of nutrition programs. 6. Design a comprehensive community-based nutrition intervention program. Credits: 3.00

PUBH 54300 - Physical Activity And Public Health

Credit Hours: 3.00. In this course students will be exposed to epidemiological, behavioral, and public health issues relevant to effective promotion of physical activity. The course is appropriate for students training to be practitioners or researchers from a range of disciplines including exercise science, nutrition, psychology, and public health. Major topic areas will include physical activity epidemiology, determinants of physical activity in youth and adults, and current evidence for physical activity interventions ranging from individual, behavioral strategies, to environmental or policy approaches.

Learning Outcomes: 1. Differentiate between various definitions of physical activity, exercise, and physical fitness. 2. Describe and identify strengths and weaknesses of different approaches used to measure physical activity, including surveys, and objective methods using pedometers and accelerometers. 3. Discuss epidemiological evidence on relationships between physical activity and all-cause mortality, cardiovascular disease, cancers, diabetes, obesity, and overweight. 4. Describe and critically evaluate the physical activity determinants literature in children, youth, and adults, and the current determinants research focus in these populations. 5. Describe and critically evaluate physical activity intervention literature, including currently recommended approaches for children, youth, and adults (e.g., based on the Community Guide to P{Preventive Services). Credits: 3.00

PUBH 54500 - Healthcare Policy And Administration

Credit Hours: 3.00. This course will provide the opportunity to examine and analyze the financing, organization and delivery of health care in the U.S. and how these core elements are shaped and influenced by health care policy and decision-making. Additionally, we will examine the landmark healthcare reform the Patient Protection and Affordable Care Act (PPACA) of 2010 and legislation since its passing to study the transformation of healthcare to present time.

Learning Outcomes: 1. Analyze the infrastructure, payment mechanisms, and human capital of the US healthcare and public health system compared to other countries. 2. Describe the structure of federal, state, and local governments and their direct role in public health and healthcare policy. 3. Analyze the passage and implementation of the Affordable Care Act and recent healthcare policy. 4. Evaluate the US healthcare system after the passage and implementation of the Affordable Care Act. Credits: 3.00

PUBH 54600 - Child And Family Health Policy

Credit Hours: 3.00. The main goals of the course are to provide students with foundational knowledge related to research and policies that affect the health and wellbeing of children and families. Students will read and discuss policy-relevant research on current topics associated with child and family health. Students will read and discuss examples of researchers who have made an impact on child and family policies. Students will also write three papers that integrate research and policy perspectives.

Learning Outcomes: 1. Analyze and critique policy-relevant research. 2. Communicate a broad understanding of different policy issues that affect child and family health. 3. Describe the role that research plays in policymaking. 4. Write about their research interests from a policy perspective. Credits: 3.00

PUBH 54700 - Public Health Program And Policy Evaluation

Credit Hours: 3.00. This course provides an overview of the methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs, and the process for applying and tailoring these designs to program and policy evaluations. In addition, we will focus on the process of engaging communities and stakeholders in program evaluation efforts. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Create an evaluation design that considers the budget, time, data, and environmental constraints of the context to public health interventions. 2. Discuss the role of formative, process, outcome, and cost evaluation across the program lifecycle. 3. Interpret and critique the quality of evaluation research case studies and reports. 4. Explain

and defend evaluation design decisions to expert and lay audiences. 5. Recognize and critically reflect upon one's own cultural biases and their impact of evaluation design development and implementation. Credits: 3.00

PUBH 54750 - Public Health Program And Policy Evaluation

Credit Hours: 3.00. This course provides an overview of the methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs, and the process for applying and tailoring these designs to program and policy evaluations. In addition, we will focus on the process of engaging communities and stakeholders in program evaluation efforts. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Summarize the role of evaluation within the program life cycle. 2. Discuss the basics of formative, process, outcome, and cost evaluation. 3. Build a logic model to guide the evaluation plan and justify the decisions made in the logic model. 4. Interpret and critique the quality of evaluation research case studies and reports. 5. Explain the role of ethics, health equity, and social justice in evaluation planning and implementation. 6. Apply the major evaluation designs to public health interventions that consider the budget, time, data and environmental constraints of the situation. 7. Explain and defend the evaluation plan in lay language. Credits: 3.00

PUBH 54850 - Public Health Law

Credit Hours: 3.00. This course examines the role of law in promoting or impeding positive health outcomes. Students will study the authority and limitations of governments engaging in public health activities as well as the types of legal interventions available to promote public health. Students will apply legal principles to public health case studies on topics such as infectious disease, chronic disease, and violence prevention, among others. Students will also apply public health legal research methodologies to current public health issues and discuss the role of law in public health advocacy. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, law, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Understand the legal system including key definitions and institutions. 2. Discuss public health governance at the federal, state, Tribal, local, and territorial levels. 3. Describe legal interventions available to support public health. 4. Discuss the role of law in applied settings such as infectious disease, chronic disease, environmental health, etc. 5. Apply legal research methods to public health studies. 6. Strategize the role of law in public health advocacy. Credits: 3.00

PUBH 57000 - Healthcare In The United States

Credit Hours: 3.00. By the end of this course, you will have a strong foundational understanding of the American healthcare system, along with the basic financial and management skills to make better, well-informed decisions that improve the cost and quality of the healthcare you or your enterprise provides. Understanding the evolution of today's system form the foundation for subsequent learning and leadership. Landmark legislation will also be reviewed including: Hill-Burton Act, Social Security Act, HMO Act, Balanced Budget Act of 1997, PPACA, ARRA. We will focus on a range of healthcare services, including acute care, post-acute care and senior health and housing, ambulatory surgery centers, behavioral health, and medical insurance companies. Permission of instructor required.

Learning Outcomes: 1. Evaluate the current strengths and weakness of the American healthcare system. 2. Understand the evolution of healthcare during the 20th and 21st centuries. 3. Understand methods to analyze basic financial and management situations driving to improved cost and quality of healthcare. 4. Analyze landmark legislation including Hill-Burton Act, Social Security Act, HMO Act, Balanced Budget Act of 1997, PPACA, and AARA. 5. Evaluate the intersection of healthcare services including acute care, post-acute care, senior health and housing, ambulatory surgery centers, behavioral health, and medical insurance companies. Credits: 3.00

PUBH 57100 - The Business Of Healthcare

Credit Hours: 3.00. This course is designed to help you keep pace with the rapidly changing world health and healthcare. We

will (1) explore the drivers of value creation, valuation approaches, and the differences in capital structures between nonprofit and for-profit healthcare providers; (2) examine horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures, and vertical consolidation and integration between providers and payers; and (3) discuss the ethos of healthcare, disruptive innovation, and emotional intelligence.

Learning Outcomes: 1. Understand the drivers of value creation, valuation approaches, and differences in capital structures between nonprofit and for-profit healthcare providers. 2. Evaluate horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures and vertical consolidation and integrations between providers and payers. 3. Understand the ethos of healthcare and role of disruptive innovation and emotional intelligence in the advancement of healthcare delivery. 4. Analyze the role of healthcare value creation and its connection with hospital ownership and the disruptive innovation in healthcare. 5. Evaluate the intersection of public health, population health, and the business of healthcare delivery. Credits: 3.00

PUBH 57200 - International And Comparative Healthcare Systems

Credit Hours: 3.00. This course examines international and comparative healthcare systems by analyzing the roles of private, public, non-profit and civil society sectors on national policy, planning and development.

Learning Outcomes: 1. Identify strategies for the recruitment, selection, development, and retention of quality health care professionals while applying accreditation criteria to human resources practices. 2. Apply human resources management for problem solving and decision making. 3. Identify various legal issues which require managerial attention and strategy. 4. Understand the changing workforce dynamics and the issues associated with labor shortages of skilled professionals in the healthcare industry. 5. Prepare for future challenges and examining future trends in the human resource field within the industry of healthcare. 6. Understand regulatory compliance issues uniquely associated to the field of health care (such as Joint Commission) standards pertaining to safety, emergency preparedness, job analysis, performance appraisals, and employee retention. 7. Analyze employee productivity in patient-centered environments. 8. Put human resource principles, concepts, generalizations, theories and models into practice. 9. Analyze the impact human resources management has on strategy formulation and strategy implementation. Credits: 3.00

PUBH 57300 - Cultural Proficiency For Healthcare Leaders

Credit Hours: 3.00. This course meets all four criteria for being a graduate level course. Readings for this course consist of journal articles and advanced readings. Assessments are designed to require students to integrate and synthesize course concepts. Our reading list and discussion prompts consists of current articles, texts, and examples. Finally, students as part of weekly discussions are required to read and critique academic articles and case studies.

Learning Outcomes: 1. Define key terms and concepts relating to cultural competency in healthcare, including factors identified in in the literature that are necessary for the delivery of culturally competent healthcare. 2. Demonstrate an understanding of the fundamentals of cross-cultural communication. 3. Understand your current strengths and weaknesses as a leader and as a follower and develop your own personal approach to the practice of leadership. 4. Enhance your ability to think critically, to analyze complex and diverse concepts, and to use your reasoning, judgment and imagination to create new possibilities in leadership. 5. Compare and contrast leadership roles within other cultures. 6. Define the impact culture and indigenous practices have on healthcare. 7. Begin to internalize and value cultural

proficiency as an approach to leading and managing the dynamics of diversity and equity. Credits: 3.00

PUBH 57400 - Healthcare Economics, Policy And Law

Credit Hours: 3.00. This course presents an overview of legal regulations and issues related to healthcare delivery and administration in multiple settings. Topics include healthcare legislation and regulation; professional and institutional liability; medical staff credentialing; patient consent requirements; termination of care; confidentiality of medical care; and the roles of federal, state and private stakeholders.

Learning Outcomes: 1. Be able to perform basic legal research. 2. Apply the legal protections afforded to patient health information. 3. Evaluate the forms of legal action that can be brought against public and private health insurance programs. 4. Comprehend the implications of Federal ERISA law on private health insurance. 5. Identify the common organizational and theoretical laws which apply to the health care environment. 6. Identify and articulate aspects and perspectives of highly controversial subjects such as abortion, organ transplant, right to die, physician assisted suicide, informed consent etc. 7. Differentiate between torts, negligence, malpractice, abandonment, and a variety of other legally charged and ethical complex legal terms. 8. Articulate the role of ethics and compliance committees including their structure, goals, functions, and decision-making activities. 9. Analyze and identify specific issues associated with coding, regulatory compliance, and ethical actions of skilled health care professionals and medical providers. 10. Understand and articulate patient rights. 11. Understand their unique role as a health care leader in providing quality patient care. 12. Understand the demands of managing in a highly regulated, transparent and scrutinized field. 13. Identify and bridge the gap between fiscally prudent stewardship and quality patient care. 14. Understand and cultivate relationships between care givers and administration. Credits: 3.00

PUBH 57500 - Healthcare Accounting & Reimbursement

Credit Hours: 3.00. This course teaches core financial skills of accounting and financial management as they apply to healthcare management systems. Topics include analysis of financial reporting, cost management; reimburse mechanisms, CFO Responsibilities, managed care contracting and fundraising and capital investment. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Apply financial concepts to health care related issues. 2. Assess the performance of healthcare organizations. 3. Use financial data to strategically align planning methodologies to reimbursement issues. 4. Discuss the impact of healthcare reimbursement on the financial solvency of the healthcare system. 5. Explore varying healthcare setting and the differing financial aspects of each. 6. Calculate profit in capitated markets. 7. Accounts receivable and revenue cycles in patient care environments. 8. Estimate cash flows in patient care settings. 9. Identify charge master and medical record and coding. Credits: 3.00

PUBH 57600 - Workforce Management And Organizational Behavior In Healthcare

Credit Hours: 3.00. The course focuses on the relationships between healthcare administration and human resource management across various health care organizations, including hospitals, long-term care facilities, and community health organizations. Topics include personnel recruitment and training; compensation and benefits; performance evaluations; staffing plans; employee discipline; and credentialing health care professionals. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Identify strategies for the recruitment, selection, development, and retention of quality health care professionals while applying accreditation criteria to human resources practices. 2. Apply human resources management for problem solving and decision-making. 3. Identify various legal issues, which require managerial attention and strategy. 4. Understand the changing workforce dynamics

and the issues associated with labor shortages of skilled professionals in the healthcare industry. 5. Prepare for future challenges and examining future trends in the human resource field within the industry of healthcare. 6. Understand regulatory compliance issues uniquely associated to the field of health care (such as Joint Commission) standards pertaining to safety, emergency preparedness, job analysis, performance appraisals, and employee retention. 7. Analyze employee productivity in patient-centered environments. 8. Put human resource principles, concepts, generalizations, theories and models into practice 9. Analyze the impact human resources management has on strategy formulation and strategy implementation. Credits: 3.00

PUBH 57700 - Strategic Planning And Marketing For Healthcare

Credit Hours: 3.00. This course provides an introduction to the conceptualization, development and implementation of strategic planning and marketing for healthcare organizations across several practice settings. Topics covered in the course include theories of decision-making, strategic planning and resource allocation, consumer behavior and provider comparisons. This course is a core class for the "Healthcare Quality Improvement" certificate program.

Learning Outcomes: 1. Apply the strategic planning process to a health care organization. 2. Understand strategic planning and marketing theories, principles, concepts, terms, methods, tactics, and tools. 3. Integrate strategic planning with marketing. 4. Analyze applications of planning and marketing in health care. 5. Know how strategic planning guides an organization in positioning itself in its defined market. 6. Discuss and define the position of the marketing function within the overall organizational structure of a health care system. 7. Formulate a health services marketing plan. 8. Compare alternative market research methods. 9. Identify the role and responsibility of health system governance in health care marketing. Credits: 3.00

PUBH 57800 - Healthcare Quality And Risk Management

Credit Hours: 3.00. The course explores how to identify quality and complexity issues affecting healthcare organization; how to develop, implement and assess quality improvement programs and strategies in various healthcare settings. Topics include continuous quality improvement; lean management; Six Sigma; IHI Quality Improvement Program; Baldrige criteria; patient safety; and quality tools. This course is a core class for the Healthcare Quality Improvement certificate programs.

Learning Outcomes: 1. Understand the interdependence, drivers and challenges of Quality and Information Management. 2. Learn and practice key aspects of multiple change management models, quality improvement methodologies and tools. Complete a quality improvement project using a basic improvement methodology. 3. Apply health care operations and quality management skills for problem solving and decision making. 4. Integrate the professions of health care operations, quality management and health administration. 5. Understand how health care operations and quality management affect allied health professionals and others. 6. Develop and use new ways of thinking about health care operations and quality management jobs and professions. 7. Analyze the impact health care operations has on quality management strategy formulation and strategy implementation. 8. Be able to integrate health care operations and quality management with organization and performance outcomes. 9. Understand the challenges in creating a culture of safety. 10. Understand the structures and drivers in incentive programs to improve care. Credits: 3.00

PUBH 57900 - Information Powered Patient Care In The 21st Century

Credit Hours: 3.00. This course focuses on the use of computer technology and information science to identify, gather, process, and manage information to help healthcare organizations succeed. Emphasis is placed on technology-based health applications, which support clinical, administrative, research,

and educational decision-making that enhance the efficacy of health care administration.

Learning Outcomes: 1. Evaluate computer applications to aggregate and analyze data for evidence- based practice and quality improvement. 2. Describe systems theory and design as applied to health informatics. 3. Identify key trends and regulatory requirements for healthcare information systems. 4. Evaluate the strengths and weaknesses of health information systems in practice. 5. Explain the relationship among information technology, information literacy, and evidence-based practice. 6. Describe and critique taxonomic and terminology systems used in national efforts to enhance interoperability of information systems and knowledge management. 7. Articulate ethical/legal issues that arise in using, designing, and managing healthcare information systems. 8. Analyze the methods used to align a health care information management plan with the corporate and strategic goals of a health care organization. 9. Practice the principles of project management. 10. Understand security and confidentiality issues, as well as health care information management trends and risks. Credits: 3.00

PUBH 58000 - Health Economics

Credit Hours: 3.00. This course will provide an introduction to the application of health economic principles as it relates to various health care systems, healthcare stakeholders and health policy issues in the United States. Topics include access to care; healthcare parity; relationships between economic characteristics and health status; impact of economy on health services industry; demand and resources for health services; utilization, prices, costs, and health insurance. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Understand the fundamental principles, generalizations and theories of health care economics and health care policy. 2. Apply economics and policy to improve rational thinking, problem solving and decision making for health care issues. 3. Develop skills, competencies and viewpoints needed by health services administrators. 4. Know how and why health care policy is formulated, implemented, and modified (based on outcomes). 5. Relate the relevance of economics to public policy. 6. Understand the methodology and evaluation of various health programs and policies through the use of cost effectiveness and cost benefit analysis. 7. Identify how to participate in the policy-making process. 8. Communicate effectively orally and in writing with a wide range of people in varying settings. 9. Apply complex concepts, develop creative solutions, or adapt previous solutions in new ways. Credits: 3.00

PUBH 58100 - Managing Complex Healthcare Operations

Credit Hours: 3.00. This course focuses on the familiarization of production processes and service systems, and quantitative analysis of problems arising in the management of operations. We consider key performance measures of operations (productivity, flexibility, quality, and response time) as well as important concepts in the planning, design, control, and improvement of processes in healthcare contexts along these dimensions. For this course, students will also acquire the ability to learn ways to conduct operations management through data analysis. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Understand the crucial importance of operations management in the healthcare environment. 2. Enhance analytical skills and the ability to uncover problems and opportunities for improvement in healthcare as well as other production and service processes. Credits: 3.00

PUBH 58200 - Advanced Executive Healthcare Leadership Development

Credit Hours: 3.00. This course provides advanced leadership training for healthcare executive. Topics include: emotional intelligence, managing difficult conversations, successful interviewing, employee engagement, building learning environments, adaptive leadership, and creating innovative cultures. This course is a core class for the Healthcare Leadership certificate program.

Learning Outcomes: 1. Explain and utilize emotional intelligence in the healthcare workplace. 2. Be able to use multiple leadership

concepts to understand leadership situations and enhance your effectiveness in the leadership process. 3. Distinguish between leadership, coaching, and mentoring. 4. Enhance your ability to think critically, to analyze complex and diverse concepts, and to use your reasoning, judgment and imagination to create new possibilities in leadership. 5. Identify and discuss the behavioral practices (patterns of action) of effective leaders. 6. Obtain skills and the ability to engage in difficult conversations. 7. Identify and discuss the behavioral practices used by effective change leaders in multiple contexts (organizational, community, political, social/movement, and global). 8. Articulate and explain the purpose for leading change in different healthcare contexts; Obtain skills for building learning environments. 9. Identify a leader's role in change and how leaders evaluate the need for change, plan for change, initiate change, communicate the need for change, gain support of others for change, and sustain change. 10. Explore other philosophical approaches and change movements to determine relevancy and practical lessons for health administration change leaders; and to critically analyze organizational change practices and leadership in case studies from the field. Credits: 3.00

PUBH 58500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 60000 - Professional Development In Public Health Seminar

Credit Hours: 0.00. A professional development course designed to the meet the needs of MPH students in the Department of Public Health.

Learning Outcomes: 1. Explore careers in public health. 2. Network with community agencies. 3. Receive mentorship on field placements. 4. Develop a professional portfolio for the job search. Credits: 0.00

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques. Students will acquire the ability to utilize statistical software as a tool to facilitate the processing, editing, storing, displaying,

analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

PUBH 60400 - Public Health Administration

Credit Hours: 3.00. An introduction to the principals of management as applied to public health organizations, particularly local health departments. Topics include the organization of the U.S. public health system, legal and ethical obligations of public health administrators, the public health workforce and human resource issues, public health budgeting and finance, and leadership in the public health agency. The course is designed to introduce master's level students in public health to the management skills necessary to successfully implement a public health program.

Learning Outcomes: 1. Understand the transforming integrated health delivery system in the United States to build collaborative network of care providers. 2. Formulate action plans for process improvement that addresses gaps of public health service areas. 3. Appraise effectiveness of initiatives and programs to determine best practices and benchmarks for delivering public health services. Credits: 3.00

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify

grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

PUBH 60700 - Public Health Practicum

Credit Hours: 3.00. This course integrates public health theory and practice in a professional setting. Students have the opportunity to apply concepts from core and concentration courses, conduct projects, and interact with a range of professionals in the designated setting. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the 10 core program competencies. 2. Identify and describe health trends and data. 3. Evaluate and design interventions. Credits: 3.00

PUBH 60800 - Culminating Experience

Credit Hours: 3.00. The MPH degree plans of study require a culminating project to be completed in the final semester of study. The student provides evidence of competency mastery by partnering with a public health related agency, identifying a community problem, proposing an evidence-based solution, and developing an evaluation plan. The final product is in the form of a grant proposal. Guidance for proposal development is achieved through completion of a grant-writing workshop and feedback from a faculty advisor. Permission of department required.

Learning Outcomes: 1. Develop a grant proposal using components introduced. 2. Evaluate peer work, based on best practices in grant writing. 3. Strategically present a grant proposal. Credits: 3.00

PUBH 69400 - Graduate Seminar In Public Health

Credit Hours: 0.00. Seminar course covering a broad range of current research topics in public health and related fields of study. Seminar presentations by representatives from academia, industry, government, other external institutions and organizations, and members of the Purdue University community. Intensive analysis of application of various research and statistical methodologies to the study of public health.

Learning Outcomes: 1. Acquire an understanding and appreciation of research conducted on topics relevant to the field of public health. 2. Develop a working knowledge of how research topics are determined, hypotheses are formed, methodologies are designed and implemented, data are collected, and conclusions are drawn. 3. Apply knowledge of research and statistical design to student' own research projects. Credits: 0.00

PUBH 69500 - Public Health Independent Research Or Study

Credit Hours: 1.00 to 9.00. Investigation of various public health topics as determined by the interest of the individual public health graduate student and faculty mentor. Permission of department required.

Learning Outcomes: 1. Reinforce one or more of the student's graduate program competencies. Credits: 1.00 to 9.00

PUBH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis.

Learning Outcomes: 1. Develop MS level research skills in Public Health. Credits: 1.00 to 18.00

PUBH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis.

Learning Outcomes: 1. Develop doctoral level research skills in Public Health. Credits: 1.00 to 18.00

Purdue Systems Collaboratory

SYS 30000 - It's A Complex World - Addressing Global Challenges (UCC: STS)

Credit Hours: 3.00. The main goal of this course is to address grand challenges that are of global concern - such as environmental sustainability and energy use, natural and human disasters, and political and economic development - using the ideas and tools of complex adaptive systems. The course exploits the broad expertise of the four faculty members by treating these challenges from diverse disciplinary perspectives, from the biological and physical sciences, to the social sciences, to engineering. By way of a set of case studies, students will analyze the features of these challenges which make them complex, and seek to explain and find solutions to the problems that arise in each case. Their treatment of the cases will be informed by published research and computer simulation. Students will actively participate in discussions regarding these global challenges, and contribute to the progress of the class using oral and written presentations. The course will culminate with a final project completed by teams composed of students from different disciplines.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe global challenges using engineering, biological, physical, and social scientific perspectives, including attention to the interdependence of the different perspectives. 2. Explain the fundamental concepts of 'complex adaptive

systems, ' including applications to different global challenges. 3. Develop basic proficiency in applying computer modeling to represent the behavior of complex systems, with applications to the global challenges. 4. Apply the concepts and tools of complexity research to develop a group-based proposal of comprehensive policies/solutions/strategies in a new and unresolved problem area. Credits: 3.00

SYS 35000 - Systems Methods

Credit Hours: 3.00. Introduction to modeling tools and methods for understanding and designing systems. Topics include: defining the problem; defining and validating stakeholders' needs; system modeling and types of models; defining and modeling system behavior; defining and modeling functional, physical and allocated system architectures; and evaluating and modeling the tradeoffs between alternative system designs.

Learning Outcomes: 1. Emphasize patterns of systems thinking. 2. Introduce systems modeling and design processes and methods. 3. Introduce model-based systems analysis and design. 4. Provide practice in using model-based systems tools. Credits: 3.00

SYS 40000 - Systems Praxis (UCC: STS)

Credit Hours: 3.00. Engineers, social scientists, and managers frequently bring people and technology together to address complex problematic situations in an equitable way that benefits people and the environment. Multiple systems concepts and methods have been developed to address these situations, and typical courses in systems focus on a relatively small portion of the rich assortment of available approaches to addressing systems problems. This course introduces students to multiple systems concepts and methods via readings and class lecture. The students then apply these concepts and methods on team-based projects. The course will emphasize critical thinking about how the concepts and methods are applicable to the problematic situations of the projects and how well the project teams were able to perform the required activities.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn about group project team formation, operation, and evaluation. 2. Learn and apply the viable system model in a team environment. 3. Learn and apply critical systems heuristics and soft systems methodology in a team environment. 4. Learn and apply a collection of functionalist systems methods in a team environment. 5. Develop written and oral communication products to present results. Credits: 3.00

SYS 49000 - Topics In Systems

Credit Hours: 1.00 to 6.00. This is an UG Level variable title course for topics related to Systems (Systems Thinking, Systems Engineering, Systems Dynamics, etc.). UG students can enroll in this course to do independent study or individual project with the instructor. Permission of instructor required.

Learning Outcomes: 1. Outcomes will be defined by the syllabus for each proposed instance of the course. Credits: 1.00 to 6.00

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods

for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define models of the interfaces of an engineered system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 52000 - Systems Engineering Processes And Professional Competencies

Credit Hours: 3.00. This course covers life cycle processes performed by system engineers and soft skills essential to being a successful system engineer. Topics include systems engineering technical processes, technical management processes, organizational strategies and operations supporting system development, tailoring of processes to industry sectors and domains, cross-cutting systems engineering methods, specialty engineering, systems engineering competencies, and relevant soft skills. Permission of instructor required.

Learning Outcomes: 1. Identify the organization, content, and key principles of the INCOSE Systems Engineering Handbook. 2. Critique primary literature on systems engineering practices and competencies and apply these concepts to the practice of systems engineering. 3. Synthesize systems engineering life cycle processes and competencies to create tailored applications of the concepts for an industry or organization. 4. Identify key components of INCOSE systems engineering certification and create a certification application. 5. Create a professional development plan through self-assessment of systems engineering professional competencies. Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and

ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 59000 - Projects In Systems

Credit Hours: 1.00 to 6.00. This is a Graduate Level variable title course for topics related to Systems (Systems Thinking, Systems Engineering, Systems Dynamics, etc). Graduate students and seniors can enroll in this course to do independent study or individual project with the instructor. Permission of instructor required.

Learning Outcomes: 1. Outcomes will be defined by the syllabus for each proposed instance of the course. Credits: 1.00 to 6.00

Quantum Science

QSCI 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

QSCI 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

QSCI 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the

Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

QSCI 34900 - Introduction To Quantum Computing

Credit Hours: 3.00. This is a first course in quantum information and quantum computing, for students who have already had an introduction to quantum science. Linear algebra and some probability theory will be presented and used throughout this course. The basic postulates of quantum mechanics will motivate the applications to qubits, cryptography, quantum computation, algorithms, error correction, and other current topics.

Learning Outcomes: 1. Explain the difference between classical and quantum computation. 2. Understand the essential role of quantum entanglement. 3. Appreciate the role of eigenstates in quantum cryptography. 4. Explain the historical significance of Shor's algorithm in establishing the field of quantum computing. 5. Demonstrate the ability to write a quantum computing program. Credits: 3.00

QSCI 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

QSCI 52600 - Physics Of Quantum Computing And Quantum Information

Credit Hours: 3.00. An introduction to the physics of quantum information science. Starting with the concepts of quantum superposition, it defines and describes qubits (quantum bits) and their manipulation by quantum logic gates. The topics of quantum entanglement and the EPR paradox are introduced, and their importance for quantum teleportation, communication, and quantum cryptography are covered. Quantum computing is described in terms of quantum circuits of logic gates, and also in terms of quantum algorithms, such as Deutsch's algorithm, the quantum Fourier transform, Shor's prime factoring algorithm, and Grover's search algorithm. The final topic is quantum decoherence and the limits it places on practical implementations of quantum computing.

Learning Outcomes: 1. Understand the meaning of entanglement and how it distinguishes quantum from classical science. 2. Understand how the rules of quantum measurement are fundamental to quantum cryptography and quantum computing. 3. See how the basics of quantum science enable quantum computing to solve important problems otherwise inaccessible to classical computing. Credits: 3.00

Radiopharmacy & Radiopharmaceutical Manufacturing Programs

RPMP 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest utilizing the original literature as prime source material.

A laboratory project may be included. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Outcomes will be determined between the instructor and student based on specific projects. Credits: 1.00 to 3.00

RPMP 49100 - Introduction To Nuclear Pharmacy

Credit Hours: 1.00. This course will serve as an introduction to nuclear pharmacy practice and serve as the first course in the nuclear pharmacy elective series. Successful completion of the nuclear pharmacy series can be used to meet the 200 hour didactic training requirement set forth by the Nuclear Regulatory Commission (NRC) towards achieving Authorized User status. This course will provide basic information about the profession of nuclear pharmacy, as well as an introduction to radioactive material and radiation safety concepts. The course will conclude with guest lectures from practitioners in several different areas of nuclear pharmacy practice to provide information about the different areas of practice available to nuclear pharmacists.

Learning Outcomes: 1. Describe nuclear pharmacy and nuclear medicine and the role of these areas of practice. 2. Review the history of nuclear pharmacy practice. 3. Understand concepts relating to the medical use of ionizing radiation. 4. Identify methods used to monitor and minimize radiation exposure. 5. Recognize basic principles of radiation biology and how radiation interacts with humans. 6. Understand the role of radiation monitoring in nuclear pharmacy practice. 7. Review basic regulatory oversight for nuclear pharmacy and PET pharmacy practice. 8. Describe the role of nuclear pharmacists in various practice settings. Credits: 1.00

RPMP 49200 - Basics Of Nuclear Pharmacy Practice

Credit Hours: 2.00. This course emphasizes some of the daily tasks performed by nuclear pharmacists when working in the nuclear pharmacy.

Learning Outcomes: 1. Understand the fundamentals of radiation and radiation safety. 2. Know the principles of instrumentation used in nuclear pharmacy and understand the use of these instruments as related to daily practice. 3. Understand the theoretical foundations of the profession of nuclear pharmacy. 4. Meld theory and abilities in the practice setting. 5. Develop a basic knowledge base to enable a student to practice the profession (ex. summer internships). Credits: 2.00

RPMP 49300 - Regulatory Considerations For Nuclear Pharmacy Practice

Credit Hours: 2.00. This is the second course in the nuclear pharmacy series, with an emphasis on the regulatory oversight of nuclear pharmacy practice. While the previous course dealt with radiation safety issues, this course outlines how these safety skills relate to the regulatory requirements set forth by the various regulatory agencies.

Learning Outcomes: 1. Provide a basic overview of the various regulatory agencies that oversee nuclear pharmacy practice. 2. Relate practical radiation safety skills and tasks to their regulatory requirements. 3. Utilize clinical reasoning skills to address practical related problems. Credits: 2.00

RPMP 49400 - Clinical Aspects Of Nuclear Pharmacy Practice

Credit Hours: 2.00. This course will be offered as a lecture course with some interactive discussion and problem solving applications. In addition, students will be required to complete several distance learning activities that relate to/enhance the materials that will be covered in the lecture period. This course is the final course in the NUPH series that can be used to count toward the 200 hours of didactic training required for Authorized Nuclear pharmacist (ANP) status.

Learning Outcomes: 1. Understand the principles of drug design, radiopharmaceutical chemistry, product compounding and clinical applications as they apply to the currently available radiopharmaceutical products. 2. Understand the differences between SPECT and PET radiopharmaceuticals. 3. Understand the role of nuclear medicine procedures in the diagnostic and therapeutic workup of patients with certain clinical conditions. Credits: 2.00

RPMP 49500 - Applied Nuclear Pharmacy

Credit Hours: 3.00. This is the 4th course offered in the nuclear pharmacy series, with an emphasis on the skills needed for the preparation and dispensing of radiopharmaceuticals, with additional focus on the importance of quality assessment. In addition, we will emphasize clinical problem-solving skills to identify sources of problems that may occur during preparation or imaging when using various radiopharmaceuticals.

Learning Outcomes: 1. Understand the various techniques specific to the preparation of a variety of radiopharmaceutical products. 2. Enhance skills in kit selection, specific compounding requirements, radiochemical purity testing and dispensing of final doses for patient use. 3. Utilize practical pharmaceutical compounding skills including sterile product preparation guidelines as they apply to radiopharmaceutical preparation. 4. Utilize critical thinking skills to identify and problem-solve operational and clinical problems that arise when preparing various radiopharmaceuticals. Credits: 3.00

RPMP 49600 - Case Studies In Clinical Nuclear Medicine

Credit Hours: 1.00 or 2.00. Introduction to the clinical applications of radiopharmaceutical drug products and the associated practice of nuclear medicine, through analysis of a series of current clinical case studies. Factors examined include: patient medical history, with emphasis on recent diagnostic procedures and pharmacotherapy; radiopharmaceutical selection, dosage, and preparation; possible contraindications for the nuclear medicine procedure and associated interventional agents; diagnostic findings; and the impact of study outcome on subsequent patient treatment. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Independent study regarding Radiopharmaceutical case studies. Credits: 1.00 or 2.00

Religious Studies

REL 20000 - Introduction To The Study Of Religion (UCC: HUM)

Credit Hours: 3.00. This course will introduce students to the academic study of religion through an exploration of various methodologies available for a critical, reflective investigation of the study of religion.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

REL 20100 - Interpretation Of The New Testament

Credit Hours: 3.00. An investigation of the religious content of the Christian Scriptures in light of the historical, social, and intellectual contexts out of which they emerged. Other canons and extra-canonical interpretations of the New Testament will also be investigated.

Credits: 3.00

REL 20200 - Interpretation Of The Old Testament

Credit Hours: 3.00. An investigation of the religious content of documents Christians call the "Old Testament" in light of the historical, social, and intellectual contexts out of which they arose. The student will be introduced to problems and methods in their interpretation.

Credits: 3.00

REL 20300 - Theology Of Paul

Credit Hours: 3.00. A critical examination of the Pauline and Deutero-Pauline epistles, the book of Acts, and other first century texts associated with Paul of Tarsus. Students will be introduced to problems and methods in the interpretation of ancient texts.

Credits: 3.00

REL 20400 - Introduction To Christian Theology

Credit Hours: 3.00. This course is an introductory survey of the goals and aims of theology in the Christian tradition. Focus is on the content of Christian theology, its methodological presuppositions and principles of development.

Credits: 3.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

REL 24000 - Engaging Religious Diversity (UCC: HUM)

Credit Hours: 3.00. The course offers students case-based explorations of local and global religious diversity in various cultural contexts. Religious diversity in secular spaces and the significance of religion for shaping community identities will be examined from multiple disciplinary perspectives. Students will analyze religious representations and influences in the public sphere by studying examples from different genres and media. Additionally, this course offers students opportunities to improve their religious literacy and gain real-world experience through experiential learning projects.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify religious values and practices from multiple traditions. 2.

Explain the importance of engaging religious diversity in various contexts. 3. Analyze interactions between religion and civic participation. 4. Evaluate the role of religion in shaping identities. 5. Assess public representations of religion. Credits: 3.00

REL 25000 - A History Of The Christian Afterlife

Credit Hours: 3.00. An exploration of the ways Christians have envisioned the afterlife, including New Testament descriptions. Apocryphal notions, Patristic conceptions, mystical and 19th century descriptions of heaven as sexual union, and 20th century understandings of the afterlife as a "process of education".

Credits: 3.00

REL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of Interdisciplinary Studies and Liberal Arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres.

Credits: 3.00

REL 31700 - Ancient Judaism And Early Christianity

Credit Hours: 3.00. This course is a study of the emergence of Judaism and the rise of Christianity out of roots in the history of ancient Israel. This will include noticing the effects of Greek culture, evidence of anti-Semitism and admiration of the Jews, conversion in a setting of religious pluralism, and the development of Jewish and Christian self-definition in this climate.

Credits: 3.00

REL 31800 - The Bible And Its Early Interpreters

Credit Hours: 3.00. This course will start with observation of the development of early themes in later parts of the Hebrew Bible and proceed to the on-going influence of these themes in Jewish literature outside the Hebrew canon (apocrypha, pseudepigrapha, targums, midrash, Josephus, Philo, and other Hellenistic Jewish authors), as well as in pagan literature of this era and in early Christian literature, particularly the New Testament.

Credits: 3.00

REL 35100 - Christian Mysticism

Credit Hours: 3.00. A critical, historical examination of the development of Christian mystical thought, beginning with its earliest intimations in the Hebrew Scriptures, the thought of Plato and Aristotle and continuing through Patristic, Medieval, Renaissance, Reformation, Counter-Reformation and Modern periods to the present.

Credits: 3.00

REL 45000 - Christian Ethics

Credit Hours: 3.00. The course explores the historical development of Christian moral theology, from pre-Christian times to the present. It includes a study of Biblical moral conceptions, patristic, medieval, Enlightenment, modern, and contemporary understandings of Christian ethics.

Credits: 3.00

REL 45100 - Christology

Credit Hours: 3.00. The course examines the historical development of Christological doctrine in the Christian faith from the age of the New Testament to the late 20th/early 21st century, paying special attention to the New Testament and conciliar formulations.

Credits: 3.00

REL 45200 - Systematic Theology

Credit Hours: 3.00. An introduction to the nature, tasks, and methods of what Christians have called "systematic theology", historically conceived through an exploration of the writings of figures such as Augustine, Aquinas, Melancthon, John Calvin, Barth, and Paul Tillich.

Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

Russian

RUSS 10100 - Russian Level I (UCC: HUM)

Credit Hours: 4.00. A beginning course in Russian which builds basic skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook units. 3. Read and understand basic texts in Russian related to everyday activities. 4. Write a paragraph using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Begin learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 10200 - Russian Level II (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 10100. Further work on developing skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand additional details as well as the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook and other class materials. 3. Read and understand simple texts in Russian related to everyday activities. 4. Write a few paragraphs using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Continue learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 11100 - Conversation Supplement To Russian Level I

Credit Hours: 1.00. Basic development of intonation patterns, formulas for question and response in a variety of situations. Activization of basic Russian vocabulary and grammar. May be taken concurrently with RUSS 10100.

Credits: 1.00

RUSS 11200 - Conversation Supplement To Russian Level II

Credit Hours: 1.00. Guided practice in conversation based on vocabulary and grammar learned in RUSS 10200. May be taken concurrently with RUSS 10200.

Credits: 1.00

RUSS 20100 - Russian Level III (UCC: HUM)

Credit Hours: 4.00. An intermediate-level course designed to develop higher skills in speaking, listening, reading, and writing Russian, as well as in intercultural competence and communication through further work on conversational and writing ability. Students work individually and in small groups using authentic reading and audio materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both simple conversations on everyday topics and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain simple conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important life events, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 20200 - Russian Level IV (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 20100. Development of Russian language skills at the higher intermediate level in speaking, listening, reading, writing, and in cultural competence. Conversational and writing ability receive prominence, as well as a review of Russian grammar. Students continue working with authentic reading and audio materials individually and in small groups.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both ordinary conversations and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain ordinary conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts

in Russian related to everyday activities. 4. Write a report, an article, or a letter about important topics, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture.

Credits: 4.00

RUSS 21100 - Conversation Supplement To Russian Level III

Credit Hours: 1.00. Guided practice in conversation based on vocabulary, grammar, and readings covered in RUSS 20100. May be taken concurrently with RUSS 20100.

Credits: 1.00

RUSS 21200 - Conversation Supplement To Russian Level IV

Credit Hours: 1.00. Guided practice in conversation, based on vocabulary, grammar, and readings covered in RUSS 20200. May be taken concurrently with RUSS 20200.

Credits: 1.00

RUSS 29800 - Special Topics In Russian

Credit Hours: 3.00. Studies of particular aspects of Russian (e.g. culture, civilization, linguistics, literature, film, etc.) by examining varied selection of works. Readings, discussion, and papers in English.

Credits: 3.00

RUSS 30100 - Russian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Russian speaking, listening, reading, and writing abilities, using material dealing primarily with everyday life and civilization in the Soviet Union from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 30200 - Russian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Russian, on the basis of materials dealing with the ideas and events that have shaped present-day Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 31100 - Russian Conversation I

Credit Hours: 1.00. Guided practice in conversation on a variety of assigned and spontaneous topics to enhance communicative competence and develop oral and aural abilities. Small group discussions in Russian on various topics. May be taken alone or concurrently with RUSS 30100 or above. May be repeated for credit.

Learning Outcomes: 1. Improve their speaking ability in Russian. 2. Improve their aural comprehension in Russian. 3. Acquire new vocabulary and grammar. 4. Preserve their language ability in a semester when they are not taking a course in the regular sequence of language study. Credits: 1.00

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 33100 - Post-Soviet Russian Cinema

Credit Hours: 3.00. Viewing and analysis of significant post-Soviet Russian films, providing an understanding of the nuanced sociopolitical situation in contemporary Russia. Evolution of Russian cinema in the post-Soviet era, its place in world cinema, and its relation to cultural, political, and social trends. The course builds an understanding of the Russian political, historical, and cultural context through an exploration of cinematic artistry. It presents and analyzes films that depict aspects of contemporary Russia, covering subjects from the collapse of the Soviet Union to the rise and hold on power of Vladimir Putin, through cinematic adaptation of literary and theatrical works. Conducted in English. Knowledge of Russian is not required.

Learning Outcomes: 1. Have an understanding and appreciation of contemporary (post-Soviet) Russian cinema. 2. Have familiarity with 21st-century cinematographic techniques as implemented in Russian cinema. 3. Discuss the artistic merits of prominent Russian films and their relevance in the historical, social, political, and cultural context of the corresponding time period. 4. List and discuss a number of Russian films which are considered important milestones in the development of post-Soviet cinematography. 5. Identify prominent

contemporary Russian directors and actors, and describe their contribution to cinematography. Credits: 3.00

RUSS 34100 - Russian Literature In The Nineteenth Century

Credit Hours: 3.00. Selected Russian poetry, prose, and drama from the Kievan period to 1900 in historical and cultural context. Students will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role of literature in 19th century Russian culture and society. 2. Situate the works they read in their historical and political content. 3. Improve understanding of the way literary works function through various artistic devices. 4. Improve ability to perform close readings of literary texts. 5. Increase ability to write analytical papers supporting a thesis. 6. Increase ability to conduct and present independent research. 7. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 34200 - Revolution, Repression, Renewal: Soviet Literature And Beyond

Credit Hours: 3.00. Selected Russian poetry, prose, and drama of the 20th century in historical and cultural context. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role and position of literature in the Soviet Union. 2. Situate the works they read in their historical and political context. 3. Understand the relationship between writers, the Soviet state, and the means of disseminating texts. 4. Improve understanding of the way literary works function through various artistic devices. 5. Improve ability to perform close readings of literary texts. 6. Increase ability to write analytical papers supporting a thesis. 7. Increase ability to conduct and present independent research. 8. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 38000 - Russian Culture And Civilization I

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia, starting with the founding of the Kievan state and continuing to the last days of the Russian Empire. No knowledge of Russian is required.

Learning Outcomes: 1. Understand the forces and circumstances (geographical, historical, political) that shaped the Russian state and gave rise to its distinctive forms of culture. 2. Understand the distinction between rossiskoe (Russian as pertains to the polity) and russkoe (ethnically and linguistically Russian), and improve understanding of Russia as a multi-ethnic state. 3. Discover the contributions of non-ethnic Russians to Russian culture. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. 5. Increase ability to read critically and write persuasively. Credits: 3.00

RUSS 38100 - Russian Culture And Civilization II

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia from the revolutionary period to the present. No knowledge of Russian is required.

Learning Outcomes: 1. Increase understanding of the interactions between revolutionary politics and revolutionary art, and explore the role of art in a political society while encountering various strategies authors, composers, etc. used to navigate between creative impulses and political requirements. 2. Move beyond the simplistic dichotomy of propaganda vs. dissidence and explore the complex gradations between the extremes of official anti-Soviet culture. 3. Increase knowledge of the relationship between cultural production, distribution, and consumption and the forms that culture takes. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. Credits: 3.00

RUSS 39900 - Special Study Abroad Credit In Russian

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Russian earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

RUSS 40100 - Russian Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Russian speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 40200 - Russian Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in Russian. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Improve proficiency in the four language skills: speaking, listening, writing, and reading. 2. Achieve a proficiency of Intermediate High to Advanced Low (ACTFL scale), Level 3 (State Department Scale). 3. Gain greater familiarity with various elements of Russian society and both high and popular culture. Credits: 3.00

RUSS 41100 - Advanced Russian Conversation I

Credit Hours: 1.00. Guided practice in conversation on a variety of advanced assigned and spontaneous topics to enhance communicative competence and develop oral and aural abilities. Small group discussions in Russian on various topics. May be taken alone or concurrently with RUSS 40100 or above. May be repeated for credit.

Learning Outcomes: 1. Improve their speaking ability in Russian. 2. Improve their aural comprehension in Russian. 3. Acquire new vocabulary and grammar. 4. Preserve their language ability in a semester when they are not taking a course in the regular sequence of language study. Credits: 1.00

RUSS 42400 - Business Russian

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

RUSS 49700 - Topics In Russian Literature

Credit Hours: 3.00 to 6.00. This course provides in-depth study of a particular author or facet of the Russian literary tradition. Possible topics include Dostoevsky and His Age; The Art and Thought of Leo Tolstoy; Russian Romanticism: Pushki, Gogol, Lermontov; The Russian Stage: Theater in Russia and the Soviet Union.

Learning Outcomes: 1. Increase familiarity with various writers, movements, and other aspects of the Russian literary tradition. 2. Improve understanding of the ways in which Russian writers confronted moral and artistic problems in their works. 3. Able to contextualize Russian literary works in the historical and cultural context in which they appeared. 4. Increase ability to read critically and write persuasively. 5. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

RUSS 49800 - Topics In Russian Culture

Credit Hours: 3.00 to 6.00. This course provides a sustained examination of some aspect of Russian culture or a topic relevant to Russian cultural studies. Topics may include Russia Confronts the East; The Caucasus: An Introduction; Popular Culture in Russia.

Learning Outcomes: 1. Attain an in-depth understanding of a particular movement, feature, or aspect of Russian culture. 2. Improve knowledge of Russian history and society as it pertains to cultural development. 3. Increase ability to read critically and write persuasively. 4. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

RUSS 56100 - The Structure Of Russian I: Phonology And Syntax

Credit Hours: 3.00. This course treats the sound system and sentence structure of Russian, dealing with the structural pattern on various levels (phonetic, phonemic, syntactic) from various points of view. One weekly class is devoted to theoretical issues affecting Russian phonology and syntax.

Credits: 3.00

RUSS 56200 - The Structure Of Russian II: Morphology

Credit Hours: 3.00. This course will present a systematic study of Russian morphology in the light of current linguistic research, dealing both with the various categories of inflected words (nouns, pronouns, adjectives, verbs) and with word formation.

Credits: 3.00

RUSS 59000 - Directed Reading In Russian

Credit Hours: 1.00 to 4.00. Directed readings in Russian. Permission of instructor required.

Credits: 1.00 to 4.00

RUSS 59600 - Special Topics In Russian Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

Sociology

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

SOC 26700 - Religion In The Modern World

Credit Hours: 3.00. A sociological overview of religious change in the modern world covering topics such as secularization, religious freedom, religious and ethnic conflicts, the mutual impacts between religion and various social institutions, such as the family, economy, politics, education, and international relations. The thematic and regional foci may vary when the course is offered in different semesters, but the course will emphasize the sociological approach to understanding religion from a global-comparative perspective.

Learning Outcomes: 1. Summarize the key teachings and practices of the major religions in various regions of the world. 2. Describe the general social characteristics of religious believers in various regions of the world. 3. Explain the major social and political events and their impacts on religious change, or religious impacts on social and political events. 4. Learn to appreciate religious diversity in the increasingly globalizing world. Credits: 3.00

SOC 27500 - Sociology Of Aging And The Life Course (UCC: BSS)

Credit Hours: 3.00. An examination of research on the social context of human aging, including demographic and developmental changes. A life course perspective is emphasized for studying health, life events, and quality of life. Considers exceptional longevity in comparative perspective.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Comprehension of the basic concepts, theories, and methods of the sociology of aging. 2. Think sociologically and write more clearly. 3. Application of course content in personal and vocational experiences. Credits: 3.00

SOC 28500 - Criminal Law And Procedure

Credit Hours: 3.00. This course will introduce students to the fundamental role of law in the American criminal justice arena with an overview on general legal principles, the contemporary form and function of criminal laws in today's American society. The course provides a survey on Substantive Criminal Laws emphasizing definitions of a criminal act, elements of criminal culpability, constitutional limitations on declaring certain conduct criminal, and the purposes of punishment. An overview on criminal procedure defined through federal and state case law will guide understanding on guidelines governing lawful law enforcement procedures and practices, courtroom decorum and admissibility. Emphasis is given on the role of technology in law enforcement to include Fourth Amendment search and seizure, Fifth Amendment right of privacy and electronic surveillance, self-incrimination, and other topics concerning balance of powers pertaining to rights of citizens and rights of state.

Learning Outcomes: 1. Identify and summarize the elements necessary to establish a crime and criminal liability. 2. Demonstrate knowledge about crime and criminality from perspectives of legal definition and criminal intent. 3. Apply

important concepts from precedent case laws to draw conclusions about procedural outcomes. Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

SOC 32600 - Social Conflict And Criminal Justice (UCC: BSS)

Credit Hours: 3.00. This course examines the dynamics of social conflict, with a special focus on legal institutions and criminological processes. Students will learn to think more analytically about the causes of social conflict, its dynamics, and strategies for resolution.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Become familiar with classic theories of social conflict and social order. 2. Understand why society needs dissent. 3. Understand strategies for conflict resolution. Credits: 3.00

SOC 32700 - Crime, Deviance And Mass Media

Credit Hours: 3.00. Various forms of mass media are used to explore the sociology of crime and deviance. Topics may include white collar crime, juvenile delinquency, street crime, sexuality and sexual orientation, hate crimes, deviance and community. Assignments include quizzes and short papers.

Learning Outcomes: 1. Able to identify concepts associated with specific theoretical perspectives and be able to describe these concepts. 2. Able to use these concepts to the media forms presented in the class. 3. Use the concepts to craft explanations for characters' actions in the fictional films. 4. Able to conduct analyses of the news that conform to accepted methodological standards of quantitative and qualitative research. Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 33400 - Urban Sociology

Credit Hours: 3.00. Development of the city and its functions; types of social behavior in cities; influences of city life on

personality; city planning.

Credits: 3.00

SOC 33500 - Political Sociology (UCC: STS)

Credit Hours: 3.00. Analysis of the social and social psychological sources of routine political participation such as voting and interest group activity, and nonroutine political action such as protest movements and revolution; the organization of power at the community, national, and international level; and political ideology.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Have a basic understanding of sociological theories of the state 2. Acquire an understanding of recent social and political science explanations of political processes and events 3. Apply sociological principles to make sense of current world events and to contribute to social debates 4. Comprehend different opportunities to influence political decisions by average citizens. Credits: 3.00

SOC 33800 - Global Social Movements

Credit Hours: 3.00. Explores dynamics of social movements in the world; emphasizes movements in non-western world. Examines emergences of movements, mobilization, tactical actions and consequences, and formal and informal organizations within movements to understand how international, national and local structures affect people.

Credits: 3.00

SOC 33900 - Sociology Of Global Development

Credit Hours: 3.00. Analysis of the causes and consequences of global development. Topics include: globalization; colonialism and decolonization; food insecurity and dependency; industrialization, poverty and inequality; migration; debt and trade; women's empowerment; global health; rights and social change; and sustainable development. This course will introduce you to the study of global development and globalization. The primary questions we will address are: What is development? What is globalization and what is its relationship with development? How have the processes of global development produced inequalities among nations, regions, races, genders, and classes? Is there a "developing" world and a "developed" world? If so, what are their differences and how do they relate with each other? How have some developing countries become more developed than others? What roles do corporations, the state, and civil society organizations play in the processes of global development? How is global development interrelated with the physical environment, inequalities of consumption, and the environmental crisis? How do people resist the inequalities and perceived injustices of global development through global social movements? How are we interconnected economically, politically, culturally, socially, and ecologically with people all over the world? What are the possible futures of development? To address these issues, our focus will be on the developing world, our scope will be global and long-term, our methodology will be historical-comparative, and our perspective will be social-scientific and critical.

Learning Outcomes: 1. Demonstrate knowledge of the causes and consequences of global development. 2. Outline the strengths and weaknesses of the basic theoretical perspectives on global development. 3. Identify the key historical events that have led to the project of global development. 4. Apply sociological analysis to different complex and power dynamics. 5. Describe how small- and large-scale projects might contribute to or hinder sustainable development. Credits: 3.00

SOC 34000 - General Social Psychology

Credit Hours: 3.00. Social influences on the individual and processes of social interaction. Individual attitudes and behavior as related to socialization, social norms, social roles, communication and propaganda, and other social influences. Among the interaction processes considered are interpersonal attraction, influence, leadership, cooperation, and conflict. Not open to students with credit in PSY 24000.

Learning Outcomes: 1. Develop an understanding of how politics has been approached and analyzed by sociologists over time, and an appreciation for the important thinkers and historical events that have shaped these approaches. 2. Identify specific areas of political polarization and political consensus in contemporary American politics, including where we find evidence of partisan asymmetry. 3. Demonstrate ability to develop and communicate sociological insights as they relate to political history and contemporary political dynamics, both in class and in written assignments. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental

problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

SOC 34500 - Analyzing Culture On TV

Credit Hours: 3.00. This course uses television shows to explore sociological perspectives on culture. The premise of this class is that we can learn a great deal about how culture is constructed, shared, consumed, and contested from watching (and critically analyzing) television shows. We will read theoretical and empirical work about how culture is defined in the social sciences and some of the leading approaches to studying culture in sociology, and then use those concepts to analyze popular television shows. The study of culture centrally concerns the place of meaning in human life, and we will explore how television shapes and is shaped by culture. We will consider how signs, symbols, language, conceptual structures, forms of knowledge, and forms of power interact to create meaning in our life. Cultural change both produces and is produced by changes in meaning, and we will investigate how cultural change occurs, with a focus on topics like changes to American cultures of love, work, religion, and politics.

Learning Outcomes: 1. Identify key concepts and theories central to the sociology of culture through readings and written responses. 2. Explain how cultural change occurs and how power and inequality are central to the ways cultural norms change through papers and class discussions. 3. Describe how television both reflects and shapes American culture through papers and class discussions. 4. Apply concepts from sociology of culture to critically evaluate popular media through papers and workshops. Credits: 3.00

SOC 35000 - Sociology Of Family

Credit Hours: 3.00. Designed to provide an understanding of contemporary courtship, marriage, and family interaction as cultural, social, and social-psychological phenomena. Consideration of the major sources of marital strain and conflict within a heterogeneous, rapidly changing society.

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Understand the experiences of people suffering from chronic illness. Credits: 3.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 36700 - Religion In America

Credit Hours: 3.00. Examines the social dimensions of religion in American life; religion in American culture; social profiles of America's religious groups, trends in individual religious commitment; and religion's impact on American life.

Learning Outcomes: 1. Describe the sizes and influences of major (and some minor) religious groups in America and how these sizes and

influences have changed over the past 50 years. 2. Explain and evaluate the influence of religious groups and ideas on at least one other important aspect of social life. 3. Explain ways in which trends in American society over the past 50 years (e.g., changing gender roles, political shifts, etc.) are bringing about changes in American religion. Credits: 3.00

SOC 36800 - The Social Significance Of Religion

Credit Hours: 3.00. Examines religion's relationship with family, work, politics, gender, war and peace, race and ethnicity, health, crime and deviance, education, law, and poverty. Content differs each time course is taught.

Credits: 3.00

SOC 36900 - Religion And Chinese Society

Credit Hours: 3.00. This course provides an overview of various religions in contemporary China, examines religiosity at the micro, meso and macro levels, and discusses the mutual impacts between religion and social, cultural and political life in Chinese societies.

Learning Outcomes: 1. Summarize the key teachings and rituals of the major religions in Chinese society. 2. Describe the general social characteristics of religious believers in contemporary Chinese society. 3. Explain the major social and political events and their impacts on religious change. 4. Appreciate religious diversity and cultural significance in the increasingly globalizing world. Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

SOC 37700 - Sociology Of Mental Health

Credit Hours: 3.00. Examines social influences and consequences of mental health and illness. Considers definitions of psychological disorders, stress, stigma, labeling, and treatments.

Learning Outcomes: 1. Understand sociological approaches to mental health and illness. 2. Become familiar with issues in the history of mental illness and treatment. 3. Evaluate the origins and consequences of social policies toward mental disorder. 4. Examine the emergence and application of specific categories of mental disorder. 5. Examine the integration of social and biomedical approaches to mental illness. Credits: 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data

collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 39000 - Individual Research In Sociology

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of sociology under the guidance of a Sociology faculty member. Permission of instructor required.

Credits: 1.00 to 3.00

SOC 39100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Various topics in sociology that may change from semester to semester are presented by Sociology faculty members.

Credits: 1.00 to 3.00

SOC 39103 - Applied Internship In Sociology

Credit Hours: 0.00 to 3.00. Internships offer experiential learning opportunities where students can apply classroom knowledge and develop practical skills while earning academic credit. Permission of department required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 3.00

SOC 40200 - Sociological Theory

Credit Hours: 3.00. An advanced critical treatment of the theories, concepts, and methods of sociology. A basic course required of undergraduate majors in sociology.

Credits: 3.00

SOC 40900 - Social Networks

Credit Hours: 3.00. Social networks are patterns of social relationships among people, organizations, and other entities (words, events, etc.) that allow communication and influence and provide a context for social life. This course considers social networks both on and off the internet that are important in people's lives for finding dates, getting jobs, maintaining friends and family, finding and maintaining identities, belonging to groups, and communication and influence more generally.

Learning Outcomes: 1. Communicate the essentials of nodes and relationships that compose networks in words and visualizations. 2. Identify patterns in social networks that have consequences for both individual people and social systems. 3. Identify sources of social relationships and patterns of relationships that then have further consequences for people and social systems. 4. Summarize and make sense of basic social network data. 5. Recognize social networks in forms beyond Facebook, Instagram, Twitter, etc. Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

SOC 42100 - Juvenile Delinquency

Credit Hours: 3.00. A study of social and psychological factors influencing individual delinquent behavior patterns. Emphasis on preventive and rehabilitative programs and the role of community agencies such as social service agencies, juvenile courts, and youth authorities. Visits to selected organizations and institutions.

Learning Outcomes: 1. Understand the causes and consequences of juvenile crime on individuals, families, and society. 2. Understand the prevalence and types of juvenile delinquency in the United States. 3. Learn the basic theories of juvenile crime. 4. Assess the theories onset of, recidivism, and desistance from crime. 5. Assess effects of social factors in

delinquency, such as parents, siblings, family structure, and peers. 6. Know the history of and reasons for the juvenile justice system. 7. Critically evaluate the juvenile justice system and social response to juvenile crime. 8. Identify and evaluate multiple local organizations and institutions that intervene or act in juvenile delinquency prevention, rehabilitation, or response. Credits: 3.00

SOC 42300 - Field Practicum In Sociology And Law And Society

Credit Hours: 4.00. Field experience in criminal justice system or social services. Students serve as "interns" in a criminal justice or social service agency one day (or its equivalent) per week, under the supervision of agency personnel. Application of theory and empirical research findings to field problems. Permission of instructor required.

Learning Outcomes: 1. Learn professional skills from a working professional. 2. Discover the relation between academic and practical knowledge Credits: 4.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 43000 - Sociology of Aging

Credit Hours: 3.00. Examination of the theories of aging, problems confronting older persons, and programs designed to assist the elderly. Consideration of social aspects of aging in the U.S. in the areas of retirement, employment, housing, income, health care, and the family relationships with cross-cultural and a historical comparisons.

Credits: 3.00

SOC 43200 - Work In Contemporary America

Credit Hours: 3.00. Examines meaning and organization of work in technological society, including job satisfaction, alienation, mobility, conflict, stratification, and unemployment and the impact of race-sex composition of occupations on mobility and politics. Also considers relations with colleagues, organization, clients, and public.

Learning Outcomes: 1. Knowledge of core sociological concepts and theories regarding work. 2. Develop the ability to use these tools to critically analyze historical and contemporary issues of work in society. Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

SOC 46100 - Health And Social Behavior

Credit Hours: 3.00. This course provides a sociological examination of health and illness, with a particular focus on social position (e.g., race, socioeconomic status, gender), stress and social support, and health care. Goals for this course include developing critical thinking skills, understanding the broader implications of issues related to health, and thinking creatively about potential societal solutions to these issues.

Learning Outcomes: 1. Understand the ways in which social factors influence health and social behavior as well as the broader implications of these issues. 2. Develop critical thinking skills through critical writing and classroom discourse on issues related to the sociology of health and illness. 3. Apply a sociological perspective to potential solutions to health-related issues. Credits: 3.00

SOC 48900 - Research Internship In Sociology And Law And Society

Credit Hours: 3.00 to 6.00. Course organized around internship experience in organizations that collect or analyze data from surveys, social media, focus groups, interviews, or experiments. Completion of 60 credits with a minimum GPA of 3.0, including 15 credits of Sociology with a minimum grade of B in SOC 10000, SOC 38200, and SOC 38300. Permission of instructor required.

Learning Outcomes: 1. Able to do and disseminate social science research in a real world setting. 2. Apply social science data collection and analysis techniques in a real world setting. 3. Evaluate research critically.

Credits: 3.00 to 6.00

SOC 49300 - Interdisciplinary Undergraduate Seminar

Credit Hours: 1.00 to 3.00. An undergraduate seminar devoted to an interdisciplinary examination of social, economic, political, and intellectual movements, using the faculty resources of the participating departments. Subject matter will vary. Each offering of the seminar will be approved by a committee of department heads from the sponsoring departments. Permission of instructor required.

Credits: 1.00 to 3.00

SOC 49700 - Senior Honors Seminar

Credit Hours: 3.00. A critical examination of some major works in sociology and anthropology, both classical and modern, and of some current theoretical and substantive issues in these disciplines. Open only to students in the departmental honors program.

Credits: 3.00

SOC 49800 - Senior Honors Paper

Credit Hours: 3.00. The production of a major paper on a topic selected by the student in consultation with the instructor. The students will meet early in the semester for orientation and discussion of topics; in the middle of the semester for progress reports; and late in the semester for presentation and critique of their papers. Open only to students in the departmental honors program.

Credits: 3.00

SOC 51400 - Racial And Cultural Minorities

Credit Hours: 3.00. America's minority groups; immigration; interracial and intercultural conflicts; assimilation.

Credits: 3.00

SOC 52500 - Social Movements

Credit Hours: 3.00. A history of social movements and social movement theories from the 19th through the 20th centuries, focused on Western Europe and the USA, although students are encouraged to explore new theories and new movements for their course projects.

Credits: 3.00

SOC 53100 - Community Organization

Credit Hours: 3.00. A history of communities and community studies from pre-contact North America to the present (including virtual communities, which students may choose to study for their course projects).

Learning Outcomes: 1. Know what communities are. 2. Know what community studies are. 3. Understand how communities are created and transformed, 4. Understand how and why communities are important. Credits: 3.00

SOC 57000 - Sociology Of Education

Credit Hours: 3.00. Analysis of the American public school as a social organization. Includes: interrelations among community power structure, social stratification, and the school; the roles of superintendent, principal, and teacher in community and school; the classroom as a social system; student culture; and teaching as a profession.

Credits: 3.00

SOC 57200 - Comparative Healthcare Systems

Credit Hours: 3.00. Using cost, quality, and access to care as core concepts, this course explores healthcare in comparative context. Special topics are health and gender, the environment, epidemics, long-term care, technology, and rationing, among others.

Credits: 3.00

SOC 57300 - The Human Side Of Medicine

Credit Hours: 3.00. Focuses on sociological theory and research related to social conflicts over the delivery of healthcare in the U.S. Considers social issues pertaining to abortion, AIDS, human experimentation, reproductive technologies, euthanasia, and others.

Credits: 3.00

SOC 57400 - The Social Organization Of Healthcare

Credit Hours: 3.00. Analysis of the determinants and consequences of the social organization of medical care. Considers morbidity and mortality, costs and utilization of medical services, healthcare occupations and institutions, and change in programs and policies.

Credits: 3.00

SOC 57600 - Health And Aging In Social Context

Credit Hours: 3.00. Analysis of the social and cultural influences on health in adulthood and later life. Considers distribution of illness among older adults, health behavior, and health services use, including long-term care.

Credits: 3.00

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence

intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

SOC 59000 - Individual Research Problems

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of sociology under a Sociology department staff member. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 3.00

SOC 59100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

SOC 60000 - Development Of Sociological Theory

Credit Hours: 3.00. The development of sociological thought in Western Europe and subsequently in the United States from the publication of Marx's early manuscripts through the sociological writings of the 1940s.

Credits: 3.00

SOC 60200 - Contemporary Sociological Theories

Credit Hours: 3.00. A companion course to SOC 60000 . Examination of the works of recent and contemporary sociological theorists such as Durkheim, Weber, Pareto, Parsons, and Merton, and of major theorists in related disciplines such as Marx, Freud, and Malinowski. Includes an examination of major "schools" or frames of reference such as ecology, structural-functionalism, etc.

Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 61000 - Seminar On Teaching Sociology

Credit Hours: 3.00. Acquaints students with the literature on teaching sociology and its issues and provides practice instruction through videotaped microteaching, syllabus and examination construction, etc. A theoretical or research paper is required. Prerequisite: Master's student standing.

Credits: 3.00

SOC 61100 - Social Inequality: Class, Race, And Gender

Credit Hours: 3.00. Survey of major approaches (functional, status attainment, labor market, class, culture) to the sociological study of inequality, including qualitative and quantitative, historical and comparative studies. Students will be asked to complete a project analyzing inequality, which might provide the basis for a publishable paper. Prerequisite: Master's student standing and Sociology majors only.

Credits: 3.00

SOC 63000 - Seminar In Political Sociology

Credit Hours: 3.00. Intensive consideration of a selected topic or set of topics in political sociology such as political socialization, political movements, comparative political analysis, political ideology in the industrialized West.

Credits: 3.00

SOC 65900 - Seminar In Marriage And The Family

Credit Hours: 3.00. Seminar in Marriage and the Family. Offered in alternate years.

Credits: 3.00

SOC 66700 - Seminar In The Sociology Of Religion

Credit Hours: 3.00. Examines topics of traditional or emerging interest in the sociology of religion. Topics covered depend on the theoretical research interests of participating faculty and students.

Credits: 3.00

SOC 67400 - Seminar In Medical Sociology

Credit Hours: 2.00 or 3.00. Seminar in Medical Sociology. Prerequisite: SOC 57400 .

Credits: 2.00 or 3.00

SOC 67700 - Research Seminar On Aging And The Life Course

Credit Hours: 1.00. An interdisciplinary seminar examining recent research on aging and the responsible conduct of research. Emphasis is given to professional development in gerontology and related fields.

Credits: 1.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written

documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

SOC 69300 - Interdisciplinary Seminar

Credit Hours: 3.00. A seminar on a topic of interdisciplinary interest, taught in cooperation with a member of another department.

Credits: 3.00

SOC 69500 - Analytic Project In Sociology

Credit Hours: 3.00 or 6.00. Designed to provide experience in defining a research problem, in assessing knowledge and research about the problem, and in analysis. Prerequisite: SOC 58000 , SOC 58100 . Permission of instructor required.

Credits: 3.00 or 6.00

SOC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Space Force Training

SFT 11000 - Foundations Of The Space Force I

Credit Hours: 1.00. A survey of officership, professionalism, communications skills, the Space Force organization and its mission. Emphasis is placed on helping students understand what they will experience as a Space Force officer.

Learning Outcomes: 1. Explain the military role of the US Space Force. 2. Describe leadership fundamentals, service benefits, and opportunities for officers. 3. Explain how the Space Force has evolved from a historical perspective. 4. Explain the Space Force's Guardian Commitment as an ethical framework. 5. Demonstrate the fundamentals of communicating effectively. Credits: 1.00

SFT 12000 - Foundations Of The Space Force II

Credit Hours: 1.00. A survey of Space Force installation design and location, Space Force professions, principles of spaceflight and the space environment, geopolitics, defense policy and strategy, and the Space Force's partner services in the Department of Defense. Emphasis is placed on helping students understand what they will experience as a Space Force officer.

Learning Outcomes: 1. Explain the evolution of the Space Force from its beginning in the Air Force to the present-day. 2. Describe the structure of the Space Force and its overarching mission. 3. Apply basic orbital mechanics, properties of the space environment, and how they affect spacecraft. 4. Communicate the capabilities of space operations and applications to joint functions. 5. Demonstrate the fundamentals of communicating effectively.

Credits: 1.00

SFT 23000 - Evolution Of Space Power

Credit Hours: 1.00. An exploration of Space Force heritage and leaders and an examination of distinctive space power capabilities and functions. Its purpose is to instill an appreciation of space power development and employment, while continuing to develop cadet communication skills.

Learning Outcomes: 1. Communicate the evolution of rocketry and space power throughout history. 2. Describe the employment of space power from an institutional, doctrinal, and historical perspective. 3. Explain the similarities and differences between the US space program and international partners and competitors. 4. Apply the Full-Range Leadership Model to Space force scenarios.

Credits: 1.00

SFT 24000 - Team And Leadership Fundamentals

Credit Hours: 1.00. This course provides a fundamental understanding of both leadership and team building. Topics include leadership principles, conflict and stress management, and ethical decision making in the context of space Force officership.

Learning Outcomes: 1. Apply the Space Force's Guardian Commitment as an ethical framework in the context of Space Force officership. 2. Describe the employment of space power from an institutional, doctrinal, and historical

perspective. 3. Employ the necessary conflict management styles as appropriate for a Space Force officer. 4. Explain how resiliency strategies can be used to mitigate stress in the military environment. Credits: 1.00

SFT 35100 - Space Security, Law, Policy, And Doctrine I

Credit Hours: 3.00. An examination of space law and policy at the national and international levels with particular focus on the Outer Space Treaty of 1967 and the United Nations' Remote Sensing Principles. Students examine how these laws and policies are viewed in real-world situations.

Learning Outcomes: 1. Explain the historical development of space law and policy. 2. Compare and contrast Space Force doctrine and joint doctrine. 3. Compare and contrast space law, policy, and doctrine in the historical context of space security. 4. Describe current U.S. Space policy and law. Credits: 3.00

SFT 36100 - Space Security, Law, Policy, And Doctrine II

Credit Hours: 3.00. This course address the use of space power as an instrument of national power, emphasizing Space Force doctrine, joint doctrine, and space as an operational domain of war. Students examine both the United States' and other nations' space security programs and how international partners and adversaries view and apply space power.

Learning Outcomes: 1. Explain the application of space power through unified space action. 2. Compare and contrast Space Force doctrine and joint doctrine. 3. Compare and contrast space law, policy, and doctrine in historical contexts of space security. 4. Explain how Space Force core competencies support national policy. Credits: 3.00

SFT 47100 - National Security, Leadership Responsibilities, And Commissioning Preparation I

Credit Hours: 3.00. This course examines security challenges around the world and identifies how the Space Force and the other services are organized and employed in response to those challenges. Topics include fundamental aspects of command, the military justice system, and effective communication.

Learning Outcomes: 1. Describe the basic process of developing national security policy. 2. Explain the Space Force warfighting domains and their interrelationships. 3. Discuss current domestic and international issues affecting the military profession 4. Explain the purpose and legal requirements of the Uniform Code of Military Justice. 5. Identify the responsibilities, authorities, and functions of a Space Force commander. Credits: 3.00

Spanish

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

SPAN 10500 - Accelerated Basic Spanish (UCC: HUM)

Credit Hours: 4.00. Accelerated Basic Spanish course that substitutes for SPAN 10100 and 10200.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify appropriate use of Spanish language in specific contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

SPAN 11200 - Elementary Spanish Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group; discussions in Spanish on various topics. Not open to students enrolled in or having credit for SPAN 20100 or above.

Learning Outcomes: 1. Develop listening skills and improve oral Spanish proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language. Credits: 1.00

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

SPAN 20200 - Spanish Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 20100. CTL:IWL 1913 Spanish Level IV

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate control of most structures, considerable breadth of vocabulary, and appropriate communicative competence. 2. Develop the linguistic and analytic skills needed for advanced study in Spanish. 3. Be able to communicate in an academic setting, critically assess ideas and texts, and be able to present them in writing to an academic audience. 4. Show the knowledge of the rich cultural, geographical, and linguistic variety of the Spanish-speaking world. Credits: 3.00

SPAN 20500 - Accelerated Intermediate Spanish (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate Spanish course that substitutes for SPAN 20100 and 20200.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify appropriate use of Spanish language in a variety of contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a broad set of grammatical rules and standards in the language. 4. Produce a variety of sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

SPAN 21200 - Intermediate Spanish Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in Spanish conversation to enhance communicative competence. Small group discussions in Spanish on various topics.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral Spanish proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen and discuss relevant intermediate texts in the target languages. Credits: 1.00

SPAN 22400 - Spanish Level IV: Business Spanish

Credit Hours: 3.00. Practical reading, writing, speaking, and

listening comprehension skills directed towards use of Spanish for business purposes. Course materials cover a variety of business aspects in several professions.

Credits: 3.00

SPAN 23100 - Cervantes' Don Quixote

Credit Hours: 3.00. Reading and discussion of Cervantes' masterpiece. All readings, discussion, papers, and examinations will be in English.

Credits: 3.00

SPAN 23500 - Spanish American Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Spanish American literature. The course context will change from semester to semester. Knowledge of Spanish not required.

Credits: 3.00

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

SPAN 28000 - Second-Year Spanish: Special Topics

Credit Hours: 3.00. Selected topics on the civilization, culture, and literature of Spain and Spanish America. Lectures and readings primarily in English, but knowledge of Spanish at the first-year level necessary.

Credits: 3.00

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence

but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

SPAN 31200 - Advanced Spanish Conversation

Credit Hours: 1.00. One credit hour advanced Spanish conversation course focused on guided practice in conversation to enhance communicative competence. Discussions in Spanish on various topics. Course may be taken concurrently with SPAN 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral Spanish proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in Spanish. Credits: 1.00

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2. Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them

in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

SPAN 32400 - Cultural Engineering Research In Spanish

Credit Hours: 1.00 to 3.00. The course will apply principles examined and mindsets developed during the Humanities-Informed Engineering Projects course to engineering projects in situ during an internship in the Spanish-speaking world. The local context of the students in this class (i.e., internship abroad) allows students to gain knowledge and practice with a humanistic-engineering framework situated in a particular community and professional setting. There are two, multistep main projects in this course: 1) Case study project and 2) Spanish language use and development project. To connect language learning and intercultural competence more strongly to the humanistic-engineering framework set up in the prior course, this course is conducted in Spanish.

Learning Outcomes: 1. Define the humanities and their application to an engineering career. 2. Identify key components of communicative competence. 3. Apply the concept of communicative competence by developing and tracking their professional language goals. 4. Formulate opinions about the concepts of systems thinking and design thinking and express them via a written reflection assignment. 5. Expand their engineering problem-solving approaches to include a humanities-informed perspective, which involves considerations relating to context, stakeholders, history, culture, economics, technical issues, etc. Credits: 1.00 to 3.00

SPAN 32500 - Spanish For Engineering And Technology

Credit Hours: 3.00. This is an intermediate-level course directed towards the use of Spanish in Engineering and Technology professions. It covers specialized vocabulary from the different technical areas, as well as grammar and syntax, with the goal of developing speaking, listening, reading, and writing abilities. Students will have the opportunity to apply their skills in practical contexts, including job interviews, internships, formal presentations and communication in the workplace.

Learning Outcomes: 1. Recognize and apply a broad range of engineering and technical-related vocabulary. 2. Read, understand, and discuss specific engineering and technical topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific engineering problems in Spanish. Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of

Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

SPAN 36600 - Spanish In The United States

Credit Hours: 3.00. The course explores the linguistic profile of established and emerging Spanish-speaking communities in the United States. Topics addressed are the current demographic profiles of Spanish speakers, the historical presence of Spanish, language identity, the meaning of linguistic landscapes, American Spanish and its speakers in the media and social institutions, as well as the varieties of Spanish in the U.S. The course is conducted in Spanish.

Learning Outcomes: 1. Describe Spanish-speaking populations in the U.S. considering their diverse histories. 2. Use course-related concepts and terms accurately in class discussions and written texts. 3. Examine the experience of Spanish-speakers in the U.S. through course activities. 4. Investigate the sociopolitical position of language through course readings and data analysis. 5. Identify a topic of research and conduct research to contribute to our knowledge of Spanish or Spanish speakers in the U.S. Credits: 3.00

SPAN 38000 - Spanish Language And Culture Abroad

Credit Hours: 1.00 to 6.00. This course must be taken concurrently with participation in an experiential learning opportunity abroad (e.g., study abroad, internship) that requires a period abroad in a Spanish-speaking location. The course will guide students to improve their Spanish language abilities and gain cultural knowledge about their experiential learning location. This course, coupled with the immersion experience, will enhance student learning through Spanish language activities and also cultural research projects. Permission of instructor is required.

Learning Outcomes: 1. Identify important moments of daily learning and reflect on them in written form in Spanish. 2. Explain experiences in the Spanish-speaking location through conversations in Spanish with a peer. 3. Compare experiences and problems encountered through conversations in Spanish with a peer; formulate possible solutions to problems if encountered in the future. 4. Research cultural surroundings and present findings in various modes of communication (e.g., presentational, written). 5. Assess learning during the immersion period in a summative way, reflecting on language and cultural learning through the creation of a final presentation project. Credits: 1.00 to 6.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in

Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 39900 - Special Study Abroad Credit In Spanish

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Spanish earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 41201 - Advanced Spanish Conversation II

Credit Hours: 1.00. This course is designed to help students use and improve their Spanish speaking and comprehensive skills. Students will be expected to actively participate in classroom discussions, prepare for class, and utilize the target language only. No textbook is needed.

Learning Outcomes: 1. Build Spanish speaking and comprehension skills through classroom discussions. 2. Explain and assess relevant texts and audio materials in the target language. 3. Formulate ideas based on texts and audio materials as expressed in written and oral Spanish. Credits: 1.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over the phone, conference, etc.). 5. Understand the

basic principles of cross-cultural communication. Credits: 3.00

SPAN 41900 - Directed Tutoring In Spanish

Credit Hours: 1.00 to 4.00. Guided practicum in tutoring Spanish, operation of a tutorial laboratory, and the rationale for audio tutorial second language learning. Students learn tutorial techniques, grade homework, and maintain records under the supervision of the SPAN 10100 -SPAN 10200 course chairperson and experienced teaching assistants. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

SPAN 44400 - Advanced Communication In Spanish

Credit Hours: 3.00. Advanced-level communication course that delves into oral and written communication within the Spanish-speaking world, emphasizing cultural context and practical application. This course explores complex grammar structures, pronunciation, lexical variations, and intercultural differences in authentic scenarios. Students will enhance their Spanish language proficiency, focusing particularly on oral expression. Taught in Spanish.

Learning Outcomes: 1. Engage in advanced formal and informal Spanish conversations across various settings. 2. Identify and apply different language functions used in everyday oral communication. 3. Discern and explain cultural nuances in both spoken and unspoken communication and analyze prevalent communication styles in Spanish. 4. Investigate and discuss contemporary topics related to the Spanish world fluently in Spanish, in written and oral form. 5. Explore and critique facets of Spanish-speaking cultures, contrasting them with personal cultural norms and traditions. Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48100 - Spanish Culture

Credit Hours: 3.00. The development of the cultural life of the Spanish people as reflected in the geography, history, music, art, and architecture of Spain. Lectures in Spanish.

Learning Outcomes: 1. Catalogue and describe in Spanish the major historical epochs of Spain. 2. Correctly identify major works of painting and music, and locate them temporally, geographically, and by cultural movement or period. 3. Debate accurately Spain's current regional conflicts through knowledgeable assessment of the historical evolution of the language, literature, commerce, and agriculture. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin

American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 49800 - Advanced Topics In Spanish

Credit Hours: 1.00 to 3.00. Advanced studies of particular aspects of Spanish (e.g. culture, civilization, literature, linguistics, film, etc) by examining a varied selection of works. Readings, discussion, and papers in Spanish.

Credits: 1.00 to 3.00

SPAN 51900 - Teaching College Spanish

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

SPAN 54000 - Spanish Literature Of The Middle Ages

Credit Hours: 3.00. A survey of Spanish Literature from 11th to the 15th century through the reading and discussion of representative prose, dramatic and poetic works. Lectures and supplemental readings on literary criticism and on various aspects of the period useful to an understanding of the literature it produced. Permission of instructor required.

Learning Outcomes: 1. Discuss the history and the development of Spanish literature. 2. Explain the importance the adoption of foreign prose had on the development of Spanish novel. 3. Describe Spanish literary movements. 4. Analyze literary works produced. Credits: 3.00

SPAN 54100 - Spanish Literature Of The Golden Age

Credit Hours: 3.00. A survey of Spanish literature from 1500 to 1681. Reading and discussion of representative prose, dramatic and poetic works. Lectures and supplemental readings on literary criticism and on various aspects of the period useful to an understanding of the literature it produced.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 54200 - Cervantes Don Quijote

Credit Hours: 3.00. Reading and discussion of Don Quixote in the context of Spanish Renaissance literature and subsequent developments in the genre of the novel.

Credits: 3.00

SPAN 54300 - Spanish Literature Of The 18th And 19th Centuries

Credit Hours: 3.00. The development of Spanish peninsular literature from Neoclassicism to Realism. Reading, analysis, and discussion of a representative selection of works of the periods.

Credits: 3.00

SPAN 54500 - Spanish Literature Of The 20th Century

Credit Hours: 3.00. The study of major trends in Spanish peninsular literature from the generation of 1898 to the present. Reading, analysis, and discussion of a representative selection of works of the period.

Credits: 3.00

SPAN 54900 - Hispanic Women Writers

Credit Hours: 3.00. A survey of the literature of Hispanic women writers from Latin America, the Caribbean, and Spain in light of their traditions and of feminist literary theory and criticism. Permission of instructor required.

Learning Outcomes: 1. Discuss female characters from an informed perspective, whether applying feminist theories or not . 2. Compare and contrast literary innovations of male and female writers in literary movement since Modernity Credits: 3.00

SPAN 55000 - Spanish American Literature Of The Colonial Period

Credit Hours: 3.00. A survey of Spanish American literature of the colonial period. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55100 - Spanish American Literature Of The 19th Century

Credit Hours: 3.00. A survey of Spanish American literature of the 19th century. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55200 - Spanish American Literature From 1900 To 1970

Credit Hours: 3.00. A survey of Spanish American literature from 1900 to 1970. Readings and discussion of a number of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55300 - Spanish American Literature From 1970 - Present

Credit Hours: 3.00. A survey of Spanish American literature from 1970 to the present. Readings and discussion of a number of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55400 - Hispanic Caribbean Literature

Credit Hours: 3.00. This course focuses on various topics pertaining to Hispanic Caribbean literature. The particular works included will change each time the course is offered. All coursework and discussion is in Spanish.

Credits: 3.00

SPAN 55500 - Latino/a Literature

Credit Hours: 3.00. This class offers an overview of U.S. Latino/a literature, written in Spanish and English and produced in the United States. It will introduce students to the many and diverse experiences of different Latino/a groups through their literary production. Permission of instructor required.

Learning Outcomes: 1. Gain a sense of the diversity of the Latino/a experience in the U.S. as well as the longevity and richness of the Latino/a literary tradition in the U.S. 2. Become familiar with some of the major themes and trends in Latino/a literature. 3. Consider the ways in which identities like - class, race, and gender - intersect with one another and are constructed in relation to one another. 4. Learn how to close-read a literary or cultural object, such as a novel, a film, or a poem. 5. Work on improving their writing and research skills through the development of an original research project dealing with Latino/a literature. Credits: 3.00

SPAN 55600 - Mexican Literature

Credit Hours: 3.00. A survey of Mexican literature. Reading and discussion of a number of representative works as well as excerpts from several others. Permission of instructor required.

Learning Outcomes: 1. Discuss the impact the history of Mexico has on literary production. 2. Examine the nature of the development of Mexican literary movements. 3. Analyze Mexican literature with consideration of its individual literary innovations. Credits: 3.00

SPAN 55700 - Argentine Literature

Credit Hours: 3.00. A survey of Argentine literature. Reading and discussion of a number of representative works as well as excerpts from several others and from standard anthologies.

Credits: 3.00

SPAN 56100 - The Structure Of Spanish I: Phonetics, Phonology, And Dialectology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a theoretical and contrastive Spanish/English perspective.

Learning Outcomes: 1. Understand, recall, and discuss the main concepts in the fields of phonetics and phonology. 2. Apply and adapt the fundamental concepts of phonetics and phonology to multiple varieties of Spanish. 3.

Examine and critically assess current research in the field. 4. Design and conduct original research in the field of Spanish phonetics and phonology. Credits: 3.00

SPAN 56200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Have knowledge and understanding of basic notions of Spanish syntax including syntagmatic structure, X-bar theory, thematic roles, argument structure, constituents and hierarchical representation, and syntactic operations (e.g., wh-movement). 2. Be able to observe, describe, and formulate abstract theoretical concepts in relation to the syntactic structure of Spanish. 3. Be able to relate theoretical analysis to experimental syntax, specifically in relation to the acquisition of Spanish syntax and semantics among second language learners and heritage speakers. Credits: 3.00

SPAN 56300 - History Of The Spanish Language

Credit Hours: 3.00. Development of Spanish since the Ancient Latin period, taking into account influences of other cultures and languages; Spanish in relation to Latin and other Romance languages; basic principles of language change; language change underlying differences between American and Peninsular Spanish.

Learning Outcomes: 1. Have a perspective of the evolution of Spanish and being able to identify the basic features of Spanish through its history, as well as understanding the influence of external influences in the evolution of the language. 2. Understand the configuration of the different varieties of Spanish in the different areas (peninsular Spanish and Spanish in America). 3. Read publications on general aspects of History of Spanish Language with critical sense and understanding basic problems of diachronic studies and basic principles of language change. 4. Able to read, understand and linguistically analyze texts from all the stages of Spanish. Credits: 3.00

SPAN 56401 - Spanish Sociolinguistics

Credit Hours: 3.00. This course addresses the linguistic variation found at all linguistic levels of Spanish (e.g., phonetics, morphology, syntax) that is explained through social variation (e.g., socio-economic status, race, gender). Regional varieties of Spanish in Latin America, the U.S., and Peninsular societies will be studied. Related topics are style and identity, language attitudes, discourse analysis, and pragmatics. All classes will be conducted in Spanish.

Learning Outcomes: 1. Define and express main understandings about language, the study of linguistics, and language variation. 2. Analyze and discuss specific examples of Spanish variation analyzed through use of various methods. 3. Identify and evaluate the pros and cons of various sociolinguistic methods of research. 4. Reflect on the relationships among social factors, language, diversity, and power in society. 5. Use previous investigations to demonstrate the need for additional research in a specific area, thereby identifying a research topic. 6. Consider one's own perspective of language use in social settings and reflect on any changes in that perspective that resulted from interaction with the course. 7. Speak, read, write, and comprehend Spanish to communicate about the course topics. Credits: 3.00

SPAN 59000 - Directed Reading In Spanish

Credit Hours: 1.00 to 4.00. Directed readings in Spanish. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 59400 - Special Topics In Hispanic Literature

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 59600 - Special Topics In Spanish Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 60300 - Second Course To Establish Reading Knowledge

Credit Hours: 3.00. Readings in the physical and biological sciences, mathematics, and engineering. Prerequisite: SPAN 60100.

Credits: 3.00

SPAN 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in Spanish.

Credits: 3.00

SPAN 64200 - Seminar In Spanish Theater

Credit Hours: 3.00. Advanced study of Spanish theater. Content will vary depending on the choice of periods, authors, works, and themes. Permission of instructor required.

Credits: 3.00

SPAN 65900 - Seminar In Hispanic Literature

Credit Hours: 3.00. Advanced study of special subject. Topics to be announced in advance. Content varies. Permission of instructor required.

Credits: 3.00

SPAN 67900 - Seminar In Spanish Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in Spanish linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

SPAN 68200 - Topics In Latin American Culture

Credit Hours: 3.00. Selected facets of Latin American culture through the eyes of the continent's artists, creative writers, essayists, and social scientists - and in view of current theories of the arts, literatures, multiculturalism, and postcolonialism.

Credits: 3.00

SPAN 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

SPAN 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Speech, Language and Hearing Science

SLHS 11000 - Exploring The Science And Practice Of Speech, Language, And Hearing Sciences

Credit Hours: 1.00. The Speech, Language, and Hearing Sciences (SLHS) Learning Community will provide SLHS majors with an opportunity to connect with each other, with SLHS graduate students, and with SLHS faculty. Students will be exposed to a variety of different learning and career opportunities within the SLHS field. Participants will also enroll in SLHS 11500 (Introduction to Communication Sciences and Disorders).

Learning Outcomes: 1. Understand the role of speech-language pathologists and audiologists in the community. 2. Understand the breadth and scope of career opportunities in the major. 3. Understand how and why the sciences of speech, language, and hearing can improve human lives. Credits: 1.00

SLHS 11500 - Introduction To Communicative Disorders (UCC: STS)

Credit Hours: 3.00. Nature, systems, and causes of communicative disorders and the principal methods used for remediation.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

SLHS 13000 - Perception, Action, And Cognition In The Speech, Language, And Hearing Sciences (UCC: IL)

Credit Hours: 3.00. This course provides a broad introduction to basic science topics that underlie research in the speech, language, and hearing sciences. Topics center around biological and psychological aspects of perception (especially hearing), action (especially speech production), and cognition (especially language). Topics are addressed in terms of developing an understanding of material drawn from popular media aimed at interested non-specialists, including long-form journalism, essays and editorials, documentaries, TEDtalks, popular films and TV shows, etc.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Provide an overview of fundamental biological and psychological aspects of perception, action, and cognition.

Credits: 3.00

SLHS 21500 - Exploring Audiology And Hearing Science (UCC: STS)

Credit Hours: 3.00. This course will introduce students to the discipline of hearing science and to the clinical profession of audiology, with a focus on the unique and exciting aspects of the auditory system. Students will be introduced to the acoustic properties of environmental and speech sounds in relation to hearing loss, the fundamental anatomical and physiological bases of hearing, normal development of hearing and auditory behaviors, history and scope of practice in Audiology, hearing disorders across the life span and assessment and intervention

techniques used to manage hearing disorders in children and adults. Guest speakers will include hearing researchers from Purdue University who will talk about their specific research, audiologists from Purdue University and the community who will talk about clinical practice and individuals with hearing disorders who will speak about their personal stories.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SLHS 30100 - Introduction To Cognitive Neuroscience

Credit Hours: 3.00. (PSY 32400) Introduction to the neural bases of complex human mental abilities. Emphasis on integrating research from cognitive science, brain-scanning techniques, and the lesion technique. Topics include perception, attention, memory, language, motor control, planning/decision-making, and consciousness.

Credits: 3.00

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception.

Credits: 3.00

SLHS 30300 - Anatomy And Physiology Of The Speech Mechanism

Credit Hours: 3.00. This course provides an introduction to the anatomical and physiological bases of the speech mechanism with an emphasis on the neural, respiratory, laryngeal, and supralaryngeal subsystems.

Learning Outcomes: 1. Develop knowledge of the major subsystems underlying speech and language production. 2. Identify major anatomical structures associated with speech production. 3. Describe the physiology of speech production. Credits: 3.00

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

SLHS 31000 - Introduction To Audiology: Foundations, Assessment And Management

Credit Hours: 3.00. This course will cover the breadth of audiology practice beginning with foundational content on the acoustic properties of environmental and speech sounds in relation to hearing loss, the fundamental anatomical and physiological bases of hearing, typical development of hearing and auditory behaviors, and the history and scope of practice in Audiology. Clinical topics will include hearing disorders across the lifespan, as well as assessment and intervention techniques used to manage hearing disorders in children and adults. Threaded throughout the course will also be activities designed to develop personal intercultural competence to enhance students' ability to work with diverse patients in a clinical setting.

Learning Outcomes: 1. Explain the basic properties of sounds, and structure and functions of the parts of the ear. 2. Explain the importance of obtaining a thorough case history and be able to write a case history report. 3.

Interpret audiograms to determine types of hearing loss and mark audiograms. 4. Explain different management options for hearing loss including device fitting and aural rehabilitation. 5. Describe why intercultural competence is important for clinicians (and everybody) in this diverse world and develop your personal intercultural competence. Credits: 3.00

SLHS 40100 - Language And The Brain

Credit Hours: 3.00. (PSY 40100) This course is an overview of the neutral systems that underlie the core components of language, including speech perception and production, reading and writing, morphology, syntax, semantics, and discourse. During the past few decades, there has been an unprecedented increase in studies on these topics, due in large part to the widespread use of highly sensitive brain mapping techniques that enable researchers to identify relationships between particular brain areas and particular language functions. The findings that have been emerged from this recent explosion of research are exciting and important for several reasons. They provide fresh insights into the nature of the uniquely human capacity for language, and they have significant implications for understanding and treating language disorders that result from brain injury.

Learning Outcomes: 1. Understand the main methods for investigating the neural substrates of language. 2. Understand the classic and progressive aphasia syndromes. 3. Basic neural underpinnings of the core aspects of language. 4. Critically evaluate research on language. 5. Critically evaluate research on language and the brain. Credits: 3.00

SLHS 40200 - Introduction To Hearing Loss Treatment And Management

Credit Hours: 3.00. This course provides a broad introduction to audiological treatment and management of hearing loss and its associated challenges. Course topics include an overview of current technology options, including hearing aids, cochlear implants, assistive listening devices, and tinnitus treatment devices. This course emphasizes appropriate counseling techniques, communication strategies, and patient-centered treatment considerations.

Learning Outcomes: 1. List the protected rights for individuals with hearing loss under the Americans with Disabilities Act. 2. Describe the audiological and lifestyle factors that determine hearing-aid, cochlear-implant, and assistive listening device (ALD) candidacy. 3. Describe the available treatments for individuals with tinnitus. 4. Describe the various types of communication strategies used by individuals with hearing loss and their communication partners. 5. Describe various counseling approaches and their role in patient-driven treatment and management of hearing loss. Credits: 3.00

SLHS 40300 - Psycholinguistics

Credit Hours: 3.00. (SLHS 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

SLHS 40400 - End Of Life Care And Management

Credit Hours: 3.00. We will discuss end of life care and management, primarily from the perspective of speech-language pathologists and audiologists. We will read books, chapters, and articles to gain broad perspectives on end of life, death and dying, and advanced care planning. We will discuss alternative breathing and nutritional interventions, along with their advantages and disadvantages. We will consider methods of counseling patients and families at end of life. We will cover advanced care planning, health care proxies, advanced directives, palliative care (including hospice). Guest speakers with expertise in related areas will be engaged to provide students with a strong background in these topics.

Learning Outcomes: 1. Understand cultural and individual differences in approaches to end of life care and management. 2. Describe advanced care planning, health care proxies, advanced directives, and palliative care and

resources available to support families with these needs. 3. Understand the role of allied health professionals (especially speech-language pathologists and audiologists) in serving patients and families facing end of life decisions. 4. Describe alternative breathing and nutritional interventions commonly used at end of life and the advantages and disadvantages of these interventions for patient care at end of life. Credits: 3.00

SLHS 40500 - Science Of Reading

Credit Hours: 2.00. This course offers an extensive review of the scientific evidence regarding how children learn to read and best practices in teaching reading to typically achieving and struggling readers. Emphasis is placed on informed assessment, the five elements of reading and how to provide an interdisciplinary approach to reading instruction that is explicit, systematic, and cumulative.

Learning Outcomes: 1. Describe the developmental process of learning to read detailing the five elements of reading. 2. Assimilate knowledge of linguistic concepts required for the development of reading skills. 3. Identify appropriate tools used to assess literacy development in school-age children to determine strengths and weaknesses of children with reading difficulties. 4. Discuss performance on literacy tasks, outline intervention needs and possible supports. 5. Communicate results to stakeholders conveying the reading profile of children and their needs. Credits: 2.00

SLHS 40600 - Introduction To Neurodegenerative Disorders

Credit Hours: 3.00. This course is an upper-level elective course for undergraduates in the SLHS major and others who are interested in learning more about neurodegenerative disorders and the effect these disorders have on the cranial sensorimotor system. This course assumes a basic knowledge of the anatomical and physiological bases of the speech mechanism (SLHS 30300) with an emphasis on the neural, respiratory, laryngeal, supralaryngeal, and aerodigestive subsystems. Information presented in this course will build on that basic knowledge and will focus on the effect of neurodegeneration on each of these systems through lectures, article reviews, case-based discussions, and disease-specific group presentations.

Learning Outcomes: 1. Develop additional knowledge of the anatomy and physiology of the central and peripheral nervous system and the basic anatomy of the motor system. 2. Develop problem-solving skills to differentiate between a variety of neurodegenerative disorders. 3. Develop the skills needed to read and critique relevant publications in the field of neurodegeneration. 4. Develop the skills to discuss evaluation of cranial sensorimotor behaviors. 5. Discuss current treatment options for neurodegenerative disorders. Credits: 3.00

SLHS 40700 - Culturally And Linguistically Diverse Children With Communication Disorders

Credit Hours: 3.00. This course provides students with an overall understanding of typical speech and language development, and communication disorders, across cultural-linguistic groups and issues related to the assessment of and intervention with children from culturally and linguistically diverse populations.

Learning Outcomes: 1. Describe typical speech and language development across cultural-linguistic groups. 2. Develop skills for the formal and informal assessment of speech and language abilities of children speaking dialect(s), speaking more than one language, and/or speaking language(s) other than English. 3. Describe approaches to assessment and intervention when clinicians do and do not speak the child's language(s). 4. Begin to design intervention programs for infants and children who exhibit a range of communicative deficits, and who are from culturally and linguistically diverse populations. Credits: 3.00

SLHS 40800 - Introduction To Voice, Upper Airway, And Swallowing Disorders

Credit Hours: 3.00. This course is focused disorders of the larynx and the affect they have on speaking, breathing, and swallowing. This course assumes a basic knowledge of the anatomical and physiological bases of the speech mechanism (SLHS 30300) with an emphasis on the respiratory, laryngeal, and aerodigestive subsystems. Information presented in this course will build on that knowledge and will focus on the etiologies and characteristics of voice, upper airway, and swallowing impairments and the role of speech-language pathologist in assessing and treating these conditions.

Learning Outcomes: 1. Identify normal anatomy and physiology of the larynx and aerodigestive tract. 2. Describe etiologies and characteristics of disorders associated with the larynx and aerodigestive tract resulting in voice, upper airway, and swallowing impairments. 3. Analyze the clinical presentations of various voice, upper airway, and swallowing disorders. 4. Identify the role of the Speech-Language Pathologist with regards to these disorders. Credits: 3.00

SLHS 40900 - Introduction To The Neural Bases Of Speech And Hearing

Credit Hours: 3.00. An introduction to the neuroanatomy and neurophysiology of the sensory and motor systems involved in speech and hearing. Topics covered include general neuroscience principles, methods for studying the nervous system, and neural mechanisms underlying speech and hearing. The course also introduces disordered systems and contemporary speech and auditory neuroscience research topics.

Learning Outcomes: 1. Demonstrate basic knowledge of neuroscience including general neuroanatomy, neurophysiology, and cellular mechanisms. 2. Identify critical neural structures and neurophysiology involved in hearing and speaking. 3. Describe important neural mechanisms underlying auditory processing and speech production. 4. Develop basic understanding of the neuroscience methods, communication disorders, and ongoing research topics in speech, language, and hearing sciences. Credits: 3.00

SLHS 41000 - Evolution Of Language

Credit Hours: 3.00. This course provides an overview of what is known and what is hypothesized about the evolution of human language. Issues include how we can study evolution of language and speech, how human language compares to animal communication, what neural resources are needed for language use and what is known about how such resources developed in the human brain (perception, production, auditory and visual).

Learning Outcomes: 1. Be familiar with the basic approaches and controversies regarding how language evolved, and for what purpose. 2. Evaluate various hypotheses with respect to relevant data. 3. Become familiar with some new views on human language, including spoken language, sign language, and gesturing. 4. Develop critical thinking in the form of the ability to read and understand an argument for or against a particular theory of language evolution. Credits: 3.00

SLHS 41100 - Speech Vs Sign: Perception, Production, Structure

Credit Hours: 3.00. This course offers a 'compare and contrast' of signed languages and spoken languages, and in the process provides a review of what students have learned about language and speech in their other classes. Issues covered include the definition of 'language', understanding the interaction of cognition and language, neural resources necessary for use of language in speech and in signing, the relationship between gesture and sign languages, and perception and production in both modalities.

Learning Outcomes: 1. Identify and explain similarities and differences in the grammars of sign and spoken languages, from the structure inside single syllables and word formation to the level of sentences and discourse. 2. Articulate a broader definition of 'language'. For example, they will be able to explain the parts of signs that perform the same functions as consonants and vowels making up syllables, the different types of morphemes such as classifiers that are found in sign and spoken languages (even though not in English), the differences between hearing people's gestures and signs in a sign language, and the impact of visual vs. auditory modality on the perception and production of these languages. 3. Explain how claims about sign language structure are tested using standard procedures. 4. Describe how signal-level 'sign science' is done and how it compares to acoustic/articulatory level speech science. 5. Explain why simultaneous fluent speech and fluent ASL are not possible (physically, cognitively, linguistically). 6. Describe differences between auditory and visual systems with respect to light and sound, neural wiring, and spatial and temporal

processing. 7. Explain how and why acquisition of speech and sign are similar and different at cognitive, neural, and linguistic levels, and provide examples for each comparison. 8. Apply this comparison to explain educational and clinical implications of the relative roles of sign and spoken languages in the context of severe to profound deafness. Credits: 3.00

SLHS 41200 - Pediatric Audiology

Credit Hours: 3.00. This course will cover the breadth of pediatric audiology practice including the historical developments in pediatric audiology, as well as assessment, hearing disorders, and management of hard-of-hearing infants, toddlers, young children, and adolescents. Threaded throughout the course will also be activities designed to develop personal intercultural competence to enhance students' ability to work with diverse patients in a clinical setting.

Learning Outcomes: 1. Describe age-appropriate assessment procedures for infants, toddlers, and older children. 2. Describe family-centered counseling methods. 3. Describe the etiology and signs and symptoms of common hearing disorders in children. 4. Describe management options for hard-of-hearing children. 5. Describe why intercultural competence is important for clinicians (and everybody) in this diverse world and develop your personal intercultural competence. Credits: 3.00

SLHS 41800 - Understanding Autism

Credit Hours: 3.00. (HDFS 41800, PSY 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associate with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

SLHS 41900 - Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of selected topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary by course. This is an experiential course number, learning outcomes will be different for each course designed under this number. Credits: 1.00 to 3.00

SLHS 42000 - Introduction To Developmental Speech And Language Disorders

Credit Hours: 3.00. Students cannot receive credit for both AUS 42000 and AUS 42200. Introduction to disorders of speech and language in children. Characteristics of these disorders, methods of evaluation, and intervention procedures are discussed.

Credits: 3.00

SLHS 43000 - Speech-Language Disorders In Health Care Settings

Credit Hours: 3.00. Presents speech-language disorders across the lifespan, encountered in a variety of health care settings. Discusses the etiology, evaluation, and management of these disorders; addresses administrative structures, team approaches, and reimbursement issues in health care settings.

Learning Outcomes: 1. Understand the types of organic and neurogenic disorders of communication that are within the scope of

practice for a speech-language pathologist. 2. Understand the types of health-care settings where a speech-language pathologist may work. 3. Understand aspects of evaluating communication disorders that are organically and neurologically based. 4. Understand aspects of treating communication disorders that are organically and neurologically based. 5. Understand the roles of a speech-language pathologist and other personnel on a variety of client intervention teams. Credits: 3.00

SLHS 44400 - Introduction To Research In Communication Sciences And Disorders

Credit Hours: 3.00. An introduction to fundamental concepts of research in the basic and clinical disorder aspects of speech, language, and hearing processes. Among topics to be covered are research design/strategies, model and theory development, research ethics and data collection and interpretation. Permission of instructor required.

Credits: 3.00

SLHS 44900 - Introduction To Clinical Practice In Communication Disorders

Credit Hours: 3.00. A course designed to provide instruction in basic diagnostic procedures and therapeutic approaches to speech, language, and hearing disorders.

Learning Outcomes: 1. To expose students to clients who have a variety of speech, language, and/or hearing disabilities in order to develop an understanding of the nature of communication disorders across a wide age-span and diverse cultures 2. To familiarize students with clinical methods in Audiology and Speech-Language Pathology through video and live observations, lectures, discussions, and readings. 3. To assist students in developing a professional approach to inter-personal interactions and practices in the field of communication disorders 4. To help students gather and organize resources related to the assessment and treatment of individuals with communication disorders 5. To provide opportunities for students to complete and document 25 hours of observation in the field of communication disorders. Credits: 3.00

SLHS 46000 - Assessment Audiology And Aural Rehabilitation Across The Lifespan

Credit Hours: 4.00. This course will provide an introduction to disorders of the auditory system, the basic assessments that are used to diagnose disorders, and habilitation/rehabilitation. The laboratory provides practical instruction in the procedures discussed in class.

Learning Outcomes: 1. Describe and explain the basic battery of audiological tests. 2. Perform these tests. 3. Interpret the results of the test battery. 4. Describe and explain devices and strategies used for habilitation/rehabilitation. Credits: 4.00

SLHS 49000 - Directed Study Special Problems

Credit Hours: 1.00 to 6.00. Designed for student to work with individual instructors on special topics of interest. Permission of instructor required.

Credits: 1.00 to 6.00

SLHS 49800 - Undergraduate Research Experience

Credit Hours: 1.00 to 4.00. The course allows students an opportunity to obtain first-hand experience with research in speech, language, and hearing sciences. Permission of instructor required.

Credits: 1.00 to 4.00

SLHS 50100 - Neural Bases Of Speech And Hearing

Credit Hours: 3.00. Study of normal human neuroanatomy and neurophysiology related to speech, language, and hearing functions. Includes material concerning normal and abnormal neurological development over the lifespan.

Credits: 3.00

SLHS 50200 - Fundamentals Of Speech Production And Perception

Credit Hours: 3.00. The physical, biological, and behavioral correlates of normal speech production and perception. Includes an exposure to the measures and methods of speech science.

Learning Outcomes: 1. The student will be able to describe how the muscles and nerves (cranial and spinal) of the respiratory, laryngeal, and supralaryngeal systems are involved in normal speech production. 2. The student will be able to describe how the acoustic speech signal is formed by the speech production system and understand the resulting acoustic signal for consonants and vowels. 3. The student will understand the underlying principles of speech perception. 4. The student will

demonstrate acceptable writing skills. 5. The student will demonstrate how research principles can be integrated into evidence-based practice. Credits: 3.00

SLHS 50300 - Auditory Perception

Credit Hours: 3.00. Behavioral measurement of the capabilities of the normal and impaired auditory system. The laboratory experience includes an exposure to the measures and methods of hearing science.

Credits: 3.00

SLHS 50401 - The Auditory Periphery

Credit Hours: 3.00. Acoustics and Fourier analysis; outer-ear resonance and interaural differences; middle-ear impedance and structure; inner-ear mechanical responses; hair-cell transduction, electrophysiology, motility; cochlear potentials; cochlear amplifier; suppression; otoacoustic emissions; efferent feedback to the cochlea; damage to the ear; treatments for damaged ears. Permission of department required.

Learning Outcomes: 1. Understand the application of signals and systems theory to experimental characterizations of the peripheral auditory system. 2. Understand the anatomical and physiological bases for normal hearing in the peripheral auditory system. 3. Understand the anatomical and physiological bases for conductive and sensorineural hearing loss, and associated diagnostics. 4. Understand the general approaches to treating peripheral hearing loss, and the anatomical and physiological limitations in doing so. 5. Read primary journal articles. 6. Communicate scientific information orally. 7. Communicate scientific results with laypeople (e.g., patients, spouses, family members). Credits: 3.00

SLHS 50601 - Neural Bases Of Hearing

Credit Hours: 3.00. **Section I.** Neuroanatomy. Anatomy terminology, overview of cochlear neuroanatomy; afferent and efferent cochlear innervation; auditory nerve formation and termination points in the cochlear nucleus; Neuroanatomy of Cochlear Nucleus, Superior Olivary complex, Nuclei of Lateral lemniscus, Inferior colliculus, Medial geniculate body and the auditory cortex, corticofugal efferent pathways complex. **Section II.** Physiology Neuronal Physiology; response properties of the auditory nerve, cochlear nucleus, superior olivary complex, inferior colliculus, medial geniculate body and auditory cortex, rate-place and temporal-place neural encoding schemes in the auditory nerve, intensity encoding, frequency tuning in normal and cochlear loss, binaural processing in the superior olivary complex and inferior colliculus, feature maps in the inferior colliculus and medial geniculate body and serial, parallel, hierarchical processing in the auditory cortex and role of cortico thalamic and corticocollicular pathways in shaping subcortical neural representation.

Learning Outcomes: 1. Remember and integrate the neuroanatomical organization of nuclei and tracts along the central auditory ascending and descending pathways. 2. Evaluate and integrate the functional properties of different neurons in each nucleus along the central auditory pathway and apply to understand how they contribute to the neural mechanisms for encoding stimulus features important for perception. 3. Understand and integrate the anatomical and physiological bases for normal hearing processes along the auditory pathway and apply knowledge to evaluate how structural lesions can impair hearing processes in the central auditory system and its relationship to lesions in the peripheral auditory system. 4. Evaluate and analyze the anatomical and physiological bases of sensorineural hearing loss, and central auditory processing deficits. 5. Understand and evaluate the general structure function relationship in the central auditory system and learn to predict the perceptual consequences of structural lesions. 6. Apply knowledge of the relationship between structure and function as a rationale for the creation/development of clinical diagnostic tests. Credits: 3.00

SLHS 51800 - Counseling In Speech-Language Pathology And Audiology

Credit Hours: 2.00. Application of counseling models, theories, and methods to persons with communicative disorders and their families. Permission of instructor required.

Credits: 2.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 52101 - Speech Disorders In Children

Credit Hours: 3.00. Knowledge base necessary for the competent assessment, diagnosis, and treatment of speech sound disorders in children, including developmental phonological disorders, motor speech disorders, and residual speech errors.

Learning Outcomes: 1. Design an assessment plan for a child referred due to poor speech intelligibility and/or for a suspected speech disorder. 2. Describe a child's phonological knowledge at multiple levels of representation to distinguish between normal and disordered speech development. 3. Compare the characteristics of the common subtypes of speech sound disorders. 4. Interpret the results of the speech assessment to select an appropriate treatment approach. 5. Create appropriate short-term and long-term treatment goals, including relevant instructional objectives, for a child with a speech disorder. Credits: 3.00

SLHS 52200 - Language Disorders Of Exceptional Children

Credit Hours: 3.00. Description and diagnosis of children with language disorders and procedures for management. Students in a certification program for EMR, ED, LD or TMR should register for this course rather than AUS 52300.

Credits: 3.00

SLHS 52300 - Language Disorders In Children: Basic Principles

Credit Hours: 3.00. Principles of description assessment and intervention for children with language disorders. Specific language evaluation and treatment procedures for children in the preschool years.

Credits: 3.00

SLHS 52501 - Language And Communication In Autism Spectrum Disorders

Credit Hours: 2.00. This course explores the characteristics, courses, and potential causes of autism spectrum disorder (ASD) with a particular emphasis on language and social communication. And, how our understanding of these issues informs the assessment, diagnosis, and treatment of ASD. Students discuss and evaluate issues associated with ASD, including early diagnosis, behavioral challenges, evidence-based treatment techniques, and current issues in the field.

Learning Outcomes: 1. Learn the theoretical foundations and milestones of social communication in order to contextualize typical/atypical development. 2. Understand the interactions between social, cognitive, and linguistic competencies in order to analyze the impact of social communication deficits across the lifespan. 3. Describe and evaluate treatment approaches for language and social communication impairments in order to prepare students for clinical practice. Credits: 2.00

SLHS 52900 - Stuttering: Nature, Diagnosis, And Treatment

Credit Hours: 2.00. Reviews applications of research findings and theoretical developments to our understanding of the onset, development, perpetuation, and amelioration of stuttering. Demonstrates and discusses methods and procedures for diagnosing and treating stuttering across the lifespan.

Learning Outcomes: 1. Students will learn the characteristics of stuttering in preschool and school-age children, adolescents, and adults. 2. Students will learn assessment and treatment procedures for preschool children, school age children, adolescents, and adults who stutter. 3. Students will become familiar with the major theoretical and clinical approaches to stuttering treatment. 4. Students will learn how to read research articles in the area of fluency and will be familiar with the major research findings in the field. 5. Students will learn about the nature and treatment of stuttering in diverse populations and will learn to use clinical methods that are sensitive to developmental and cultural differences Credits: 2.00

SLHS 53100 - Language Disorders In Adults

Credit Hours: 3.00. Study of the causes, assessment, and treatment of acquired language disorders in adults, including aphasia, right hemisphere syndromes, and dementia.

Credits: 3.00

SLHS 53200 - Voice Disorders

Credit Hours: 2.00. Principles of differential diagnosis and clinical management for children and adults presenting voice disorders, based on a working knowledge of normal laryngeal structure and function.

Credits: 2.00

SLHS 53300 - Medical Speech-Language Pathology

Credit Hours: 2.00. Introduces the graduate speech-language

pathology student to issues encountered in the medical environment in preparation for a healthcare externship and a career in the healthcare setting. Topics will include collaborative models in the medical setting, clinical documentation, ethical issues, equipment and instrumentation, medications, among others.

Learning Outcomes: 1. Increase understanding of the medical speech-language pathology environment. 2. Learn about various departments, professionals, and their collaborative roles with speech-language pathologists. 3. Develop an understanding of solutions to ethical dilemmas related to the medical field. 4. Understand and explain medications and their effects on swallowing and communication disordered individuals. 5. Become familiar with equipment, instrumentation, and medical tests in the intensive care unit and other acute care settings. 6. Discuss future trends related to the medical and speech pathology healthcare arena. 7. Comprehend and explain information obtained from a medical record. Credits: 2.00

SLHS 53600 - Traumatic Brain Injury

Credit Hours: 2.00. The mechanisms, effects, assessment, and rehabilitation of traumatic brain injury in children and adults, with emphasis on a team approach to remediation.

Credits: 2.00

SLHS 53800 - Motor Disorders Of Speech

Credit Hours: 2.00. A study of the neuropathologies that affect the speech production system. Emphasizes the differential diagnosis and management of acquired motor speech disorders.

Learning Outcomes: 1. The student will be able to describe how the types of dysarthria relate to damage in the brain and how the cranial nerves are involved in dysarthria. 2. The student will be able to describe and different views of disability and the levels at which individuals are affected by their difficulties and be able to implement these issues when assessing individuals with dysarthria and when setting goals for treatment. 3. The student will be able to correctly identify dysarthrias, based on case information and symptoms. 4. The student will be able to explain and describe appropriate intervention procedures given specific dysarthrias or speech, voice, resonance, and respiratory symptoms. 5. The student will demonstrate acceptable writing skills. Credits: 2.00

SLHS 53900 - Dysphagia

Credit Hours: 3.00. A study of the normal and disordered anatomy and physiology of the swallowing process. Principles of evaluation and treatment of dysphagia are discussed.

Learning Outcomes: 1. Knowledge of the anatomy of the respiratory, laryngeal, and articulatory subsystems. 2. Understanding of the normal physiology of the repertory, laryngeal, and articulatory subsystems. 3. Basic knowledge of the cranial nerve system. Credits: 3.00

SLHS 54001 - Augmentative And Alternative Communication (AAC)

Credit Hours: 2.00. This course will orient students to the use of augmentative and alternative communication (AAC) across the lifespan. Assessment and evidence-based intervention for people who cannot meet their daily communication needs via natural speech and/or writing and who need AAC will be covered. AAC is neither disorder- nor age-specific. As such, AAC strategies, techniques, and options may be used across the lifespan and with people who have severe communication disorders that interfere with expressive and/or receptive speech and/or language. In that way, AAC can have broad applicability across settings and populations.

Learning Outcomes: 1. Demonstrate knowledge of hardware, software, feature matching, and evidence related to use of AAC and SGD with individuals with complex communication needs (CCNs). 2. Demonstrate knowledge related to the assessment and intervention for various people for whom AAC might be appropriate. 3. Apply and integrate evidence-based knowledge of typical language development toward the assessment and intervention for individuals with complex communication needs (CCNs). 4. Acquire knowledge and evaluate information about a range of augmentative and alternative communication (AAC) modalities as it applies to the assessment and intervention for individuals with complex communication needs (CCN)

across the lifespan. 5. Acquire familiarity with and demonstrate use of AAC app evaluation rubrics used in decision-making regarding a range of complex communication needs (CCN). 6. Acquire, evaluate, and effectively present evidence-based knowledge on a specific topic within the scope of augmentative and alternative communication modalities. Credits: 2.00

SLHS 54100 - Cognitive Communication Disorders

Credit Hours: 2.00. This course examines the theoretical aspects and clinical management of cognitive communication disorders with an emphasis on right hemisphere brain damage, traumatic brain injury, dementia, and other degenerative neurological conditions.

Learning Outcomes: 1. Evaluate how the various theories of attention, memory, and executive function relate to the impairments observed in clients with cognitive communication disorders. 2. Analyze assessments for how appropriate they are in evaluating clients with cognitive communication disorders. 3. Identify evidence-based treatment interventions for cognitive impairments and use this knowledge to create treatment plans for clients with cognitive communication disorders. Credits: 2.00

SLHS 54300 - Assessment And Treatment Of Literacy Disorders

Credit Hours: 2.00. An introduction to the characteristics, definitions, etiologies, and assessment of literacy development in school-aged children (4-18 years of age). Emphasis is placed on the scope of practice for speech-language pathologists in the assessment and intervention process for children diagnosed with language-based literacy disorders.

Learning Outcomes: 1. Differentiate between normal and disordered literacy development. 2. Identify formal and informal assessment tools in each of the following areas: phonological processing, decoding, encoding, oral reading fluency, reading comprehension. 3. Summarize literacy strengths and weaknesses in clients with various profiles. 4. Identify appropriate strategies / techniques to remediate client weaknesses. 5. Identify various organizations, websites, programs, and supporting research for parents and educators. Credits: 2.00

SLHS 54400 - Clinical School Methods For Communication Disorders

Credit Hours: 2.00. Organization, materials, and methods for conducting speech, language, and hearing services in elementary and secondary schools. Permission of instructor required.

Credits: 2.00

SLHS 54401 - School-Clinical Methods In Communication Disorders

Credit Hours: 1.00. The focus of this course is on the implementation of speech, language, and hearing services with preschool to secondary (P-12) school-aged children. Students develop a working knowledge of special education law, disability law, and other resources for school-aged children.

Learning Outcomes: 1. Implement special education and disability laws. 2. Select the most effective instructional strategies for English Language Learners. 3. Explain the professional qualifications, roles and responsibilities related to speech-language pathology and audiology in a school setting. 4. Describe tasks required for the provision of speech, language, and hearing services in a school setting. 5. Have the knowledge and thinking skills to understand and evaluate research to incorporate evidence based strategies into clinical practice. Credits: 1.00

SLHS 54600 - Clinical Seminar In Speech-Language Pathology

Credit Hours: 1.00. This is a clinical seminar course designed to support students' ability to meet knowledge and skills standards related to the scope of practice of speech-language pathologists. This course provides supplemental learning opportunities and support for students as they complete their hands-on clinical practice each semester by taking a more in-depth look at conditions within the nine areas of practice as well as cultural and linguistically diverse families, ethical standards in clinical practice, professional issues and trends within communication sciences and disorders, and interprofessional education and practice. The course is offered each semester and objectives vary to advance the knowledge and skills required to meet the program and ASHA/CAA guidelines for completion of the program as well as certification standards as indicated by the CFCC.

Learning Outcomes: 1. Assess the interaction of cultural and linguistic variables between caregivers and the individual served. 2. Reflect on the impact of both implicit and explicit bias in clinical service delivery and actively explore individual biases and how they relate to clinical services. 3. Deconstruct the social determinants of health and environmental factors for individuals served and how these determinants relate to clinical services. 4. Distinguish the roles and importance of interdisciplinary/interprofessional assessment and intervention and connecting one's own role and those of other professions to appropriately assess and address the needs of the individuals and populations served. 5. Justify the importance of individual and collective (e.g., local, national organizations) advocacy for clients/patients/students' right to care. 6. Explore contemporary professional issues that affect Speech-Language Pathology, entry-level and advanced certifications, licensure, and other relevant professional credentials, as well as local, state, and national regulations and policies relevant to professional practice. 7. Interpret Professional code of ethics and professional fiduciary responsibility. 8. Develop leadership and mentoring skills related to the supervisory process. 9. Prioritize continuous learning in speech, language, and hearing sciences. Credits: 1.00

SLHS 54900 - Clinical Practice In Speech-Language Pathology I

Credit Hours: 1.00 to 8.00. The second in a series of practicum courses designed to provide instruction and practical experience in fundamental diagnostic and therapeutic approaches to speech and language disorders. AUS 43000 is recommended. Permission of instructor required.

Learning Outcomes: 1. Develop an in-depth understanding of the process of team development, the roles, and practices of collaboration to support effective performance in a variety of settings. (Interprofessional Education) 2. Build leadership skills that support collaborative practice, team effectiveness, and understanding of how one's uniqueness contributes to effective communication, conflict resolution, and positive Interprofessional working relationships. (Interprofessional Education) 3. Prioritize the needs, values, preferred mode of communication and cultural/linguistic background of the patient, family, caregiver, and relevant others. (Cultural Humility/Responsiveness) 4. Defend ideas of justice, equity, diversity, inclusion and intersectionality and acknowledge implicit bias in order to actively contribute to a climate supportive of diversity and inclusion. (Cultural Humility/Responsiveness) 5. Examine ASHA Code of Ethics, Scope of Practice, certification process, supervision guidelines, and professional affiliations. (Stewardship & Accountability) 6. Dissect federal, state, and institutional regulations and discuss contemporary professional issues and advocacy related to trends in practice, privacy policies, models of service delivery, reimbursement procedures/fiduciary responsibilities. (Stewardship & Accountability) 7. Improve skills in oral and written or other forms of communication sufficient for entry into professional practice. (Effective Communication) 8. Compile information related to etiologies, characteristics and interdependence of communicative and swallowing disorders as well as evidence-based practices to treat each disorder. (Continuous Learning) Credits: 1.00 to 8.00

SLHS 55300 - Implantable Devices

Credit Hours: 3.00. Provides fundamental principles to assist audiologists and speech-language pathologists in the understanding of candidacy, principles of signal processing, and audiologic rehabilitation for children and adults who use cochlear implants.

Credits: 3.00

SLHS 56000 - Audiologic Diagnostics

Credit Hours: 3.00. Audiometers, audiometric standards, and the use of pure tone and speech signals in the measurement of auditory abilities. Laboratory provides practical instruction in the procedures discussed in class.

Credits: 3.00

SLHS 56100 - Medical Audiology

Credit Hours: 3.00. Study of the etiology, pathogenesis, symptomology, epidemiology, diagnosis and treatment of diseases, and injuries to the auditory system.

Learning Outcomes: 1. Apply knowledge about the development of human anatomical and physiological systems generally to the development of the auditory system and ear specifically in order to describe relationships between pathologies across systems. 2. Evaluate the effects on auditory function caused by environmental and hereditary factors that are related to systemic disease. 3. Differentiate between genetic and non-genetic disorders that are related to congenital and delayed-onset hearing loss. Apply this knowledge to cattegorize disorders that are unique to children, unique to adults, and common to all ages. 4. Justify the importance of Early Hearing Loss Detection and Intervention (EHDI) programs using knowledge about risk indicators, adverse consequences of hearing loss, and the benefits of early detection. Credits: 3.00

SLHS 56300 - Pediatric Audiology

Credit Hours: 3.00. Examination of protocols for the identification and evaluation of infants and children with hearing loss, using behavioral, physiologic, and electro-physiologic assessment methods. Course content places an emphasis on clinical decision-making and problem-solving skills.

Learning Outcomes: 1. Provide a scientific foundation focused on the assessment and management of hearing loss in infants, toddlers, young children and adolescents. Credits: 3.00

SLHS 56400 - Hearing Aids I

Credit Hours: 3.00. An examination of amplification systems as applied in audiological rehabilitation; acoustic, electroacoustic, electronic, and clinical considerations. Laboratory exercises in measurement, modifications, maintenance, selection, and dispensing of hearing aid systems.

Credits: 3.00

SLHS 56501 - Vestibular Assessment And Rehabilitation

Credit Hours: 3.00. This course will review anatomy and physiology of the vestibular system. Diagnostic assessment, interpretation and proper recommendation techniques will be discussed. Current research addressing dizziness and balance issues will be reviewed as well as case history discussions to help prepare students to see these patients in a clinic setting. The clinical practice of audiology encompasses the assessment and habilitation/rehabilitation vestibular and balance disorders arising from a wide variety of medical and environmental etiologies. It is essential that audiologists have a firm understanding of the most common causes and medical treatments of vestibular disorders for all age groups. Additionally, vestibular assessment and treatment options are expanding rapidly in the past 5-10 years. Student clinicians need exposure to this area of care so that they may grow as research and technology change. Audiologists practice in a medical setting and thus must be comfortable with the medical approaches and terminology used by otolaryngologists, otologists, neuro-otologists, pediatricians, physical therapists and other allied health professions.

Learning Outcomes: 1. Perform a detailed case history for dizzy patients and understand basic concepts for report writing. 2. Understand and discuss many common disorders that lead to vestibular problems and how to diagnose these disorders properly. 3. Have a working knowledge of anatomy and physiology of the vestibular system in order to properly diagnose dysfunction. 4. Analyze test results from a vestibular test battery to diagnose disorders and to make recommendations for follow-up care. 5. Understand the need for interprofessional collaborative care by discussing current techniques for vestibular rehabilitation. Credits: 3.00

SLHS 56700 - Auditory Evoked Responses I

Credit Hours: 3.00. Evaluation of peripheral and brainstem auditory system function using evoked potentials.

Credits: 3.00

SLHS 56800 - Tinnitus Assessment And Rehabilitation

Credit Hours: 2.00. Ringing in the ears (tinnitus) is a common problem among millions of individuals with sensorineural hearing loss. This course will review the physiology, measurement, and treatment for tinnitus.

Credits: 2.00

SLHS 57000 - Hearing Conservation

Credit Hours: 2.00. A study of noise as a health hazard and as a nuisance; an examination of the ways in which hearing problems related to noise may be reduced. Permission of instructor required.

Credits: 2.00

SLHS 57401 - Hearing Aids II

Credit Hours: 2.00. The focus of this course is on the evolving technology in hearing aids with an emphasis on the information students will need to make efficacious clinical decisions not only for the hearing aids of today but also for the hearing aids of tomorrow. For each of the hearing aid features that are discussed, we review (1) the need or potential benefit to the patient, (2) the engineering behind the feature, (3) research supporting its efficacy and effectiveness, (4) its limitations, and (5) how to conduct routine clinical measurements to document its functioning.

Learning Outcomes: 1. Evaluate critically manufacturers' claims by developing an understanding of the mechanisms, advantages, and disadvantages of different hearing aid features. 2. Select the most cost effective hearing aid technology for your patients. 3. Inform patients, families, other appropriate individuals, and professionals the reasons of choosing the hearing aid features for a patient, and how to use these advanced features effectively. 4. Perform appropriate tests to check hearing aid features and assess the functionality of these features. 5. Attain knowledge and thinking skills to understand and evaluate new hearing aid features. Credits: 2.00

SLHS 57700 - Auditory Evoked Responses II

Credit Hours: 3.00. Administration and interpretation of auditory evoked responses generated in the auditory thalamus and cortex. Emphasis is on application of auditory evoked potentials in clinical diagnosis and intraoperative monitoring. Topics include middle (AMLR), late (AEP), and steady-state (SSEP) evoked responses.

Credits: 3.00

SLHS 57900 - Clinical Practice In Audiology

Credit Hours: 1.00 to 12.00. Supervised clinical practicum in evaluation of hearing and communication status and in remediation of communication problems. Clinical practices include, but are not limited to, auditory site of lesion, sensory aid selection, fitting and evaluation and communication training for children and adults. Clinical practicum is available in the M. D. Steer Audiology Center and off-campus facilities. Permission of instructor required.

Credits: 1.00 to 12.00

SLHS 58500 - Engineering Projects In Community Service: AuD I

Credit Hours: 2.00. Audiology clinical doctoral students, engineering, and speech, language, and hearing sciences undergraduate students work in a team-oriented research and development service-learning process. Students with faculty advisors collaborate with community partners to develop technology meeting adaptive and educational needs.

Credits: 2.00

SLHS 58800 - Evaluating Research In Evidence-Based Practice

Credit Hours: 2.00. The focus of this course is on developing the skills necessary to critically consume literature and apply it to clinical practice as speech-language pathologists and audiologists. Students complete a comprehensive evidence-based practice project, which includes developing a clinical question, conducting a literature review, and critiquing acquired research articles. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in appraising research necessary for evidence-based practice.

Learning Outcomes: 1. Learn to read and critique research literature. 2. Understand the basis for evidence-based practice. 3. Apply evidence-based practice to clinical questions. 4. Consider how to further our literature base about clinical questions. Credits: 2.00

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

SLHS 60900 - Seminar In Language Acquisition

Credit Hours: 2.00. Critical review of current research in selected areas of typical and atypical language acquisition. Permission of instructor required.

Credits: 2.00

SLHS 61900 - Advanced Topics In Audiology And Speech Pathology

Credit Hours: 0.00 to 3.00. Study of advanced topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary based on topics covered. Credits: 0.00 to 3.00

SLHS 64800 - Speech-Language Pathology Education Externship

Credit Hours: 1.00 to 8.00. Full-time school-clinical experience to provide speech, language, and hearing services in

elementary and secondary schools, under the supervision of a school clinician and university staff holding the ASHA Certificate of Clinical Competency.

Credits: 1.00 to 8.00

SLHS 64900 - Speech-Language Pathology Healthcare Externship

Credit Hours: 1.00 to 8.00. An advanced-level clinical practicum in speech and language disorders. Prerequisite: SLHS 54900 . Permission of instructor required.

Credits: 1.00 to 8.00

SLHS 65800 - Advanced Topics In Audiology

Credit Hours: 2.00 or 3.00. Detailed study of selected topics in audiology. Permission of instructor required.

Credits: 2.00 or 3.00

SLHS 65900 - Audiology Practice Management

Credit Hours: 2.00. An examination of business and professional issues related to audiology. Practice management topics include conducting a feasibility analysis, writing a business plan, employee management, marketing, reimbursement, and practice growth. Professional issues include licensing, certification, liability issues, and career planning. Prerequisite: SLHS 57900 and Doctor of Audiology majors only.

Credits: 2.00

SLHS 66100 - Advanced Medical Audiology

Credit Hours: 3.00. The clinical practice of audiology encompasses the audiological assessment and habilitation/rehabilitation of hearing loss arising from a wide variety of medical and environmental etiologies. It is essential that audiologists have a firm understanding of the most common causes and medical treatments of hearing impairment for all age groups. Additionally, the future clinician will be better served by recognizing the how rapidly information changes in this arena and becoming comfortable with reliable educational resources that are available for life-long learning in this area. Audiologists also practice in a medical setting and thus must be comfortable with the medical approaches and terminology used by otolaryngologists, otologists, neuro-otologists, pediatricians, radiologists, anesthesiologists and other physicians. Additionally, audiologists may be the first contact with a hearing-impaired patient and their role in the referral process will be emphasized.

Learning Outcomes: 1. Explain the anatomical and physiological bases for normal hearing in the peripheral auditory system. 2. Describe the anatomical and physiological bases of conductive and sensorineural hearing loss, and their associated diagnostics. 3. Compare and contrast the main approaches to treat peripheral hearing loss. 4. Assess the quality of primary journal articles. 5. Summarize scientific information effectively. Credits: 3.00

SLHS 67000 - Integrative Audiology Grand Rounds

Credit Hours: 1.00. This course provides advanced audiology students an opportunity to share and think deeply about the complex cases they are experiencing on off-campus placements. Students share cases online with their peer students who will provide thoughtful responses and reflections based on their own experiences. This course also provides a summative assessment of the students' knowledge in the final two years of their education. Due to the highly complex nature of the cases, students must use past clinical experiences and knowledge learned in multiple courses in order to successfully present cases and to respond in thoughtful ways that contribute to the online learning environment. Permission of department required; must also be currently enrolled in SLHS 57900 or SLHS 67900 completing an audiology externship.

Learning Outcomes: 1. Discuss complicated audiology cases with their fellow classmates and faculty members. 2. Share best practices in their case presentations. 3. Examine cases from different perspectives (medical model, professional issues, patient's rights, ethical considerations, etc.). Credits: 1.00

SLHS 67800 - Audiology Educational Externship

Credit Hours: 1.00 to 8.00. School clinical experience to provide audiology services in elementary and secondary schools under the supervision of a school clinician and University staff holding the Certificate of Clinical Competence in Audiology from the American Speech-Language and Hearing Association. Permission of department required.

Credits: 1.00 to 8.00

SLHS 67900 - Advanced Clinical Practice In Audiology

Credit Hours: 4.00. An advanced-level clinical practicum in audiology. Permission of instructor required.

Learning Outcomes: 1. Documented clinical experiences that cover the depth and breadth of the scope of practice of audiology. 2. Meet the knowledge and skills associated with certification standards of the American Speech-Language-Hearing Association. Credits: 4.00

SLHS 68800 - Research Integration And Dissemination For Evidence Based Practice

Credit Hours: 2.00. The focus of this course is on developing skills integrating current research and communicating about research in clinical practice. Students complete a

comprehensive project involving a literature review, clinical decision and poster. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in scientific communication in a variety of modes, including developing an oral pitch, preparing a literature review and evaluation, and creating and delivering a poster and writing a research abstract. Pre-Requisite: Students must complete Evaluating Research - currently offered as SLHS 51900.

Learning Outcomes: 1. Evaluate and synthesize findings from the literature into a written and oral comprehensive review. 2. Refine scientific communication skills. 3. Understand principles of evidence-based practice guides and apply them to clinical decision making. Credits: 2.00

SLHS 69000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SLHS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

SLHS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Statistics

STAT 10100 - Freshman Orientation Seminar

Credit Hours: 1.00. A one-credit course for first-year Statistics/Mathematics majors designed to develop concepts and skills in team building, time management, and professional development that complement the students' academic and research training. Talks from a broad range of speakers are included.

Learning Outcomes: 1. Demonstrate the ability to communicate with peers & speakers in classroom. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths. Credits: 1.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 17000 - Introduction To Actuarial Science

Credit Hours: 2.00. (MA 17000) An introduction to actuarial science from the point of view of practicing actuaries from life insurance, casualty insurance and consulting; introduction to insurance and the mathematical theory of interest; application of spreadsheets to problems related to actuarial science.

Learning Outcomes: 1. Describe different expressions of interest rates. Calculate an equivalent rate given another rate. 2. Calculate the present value of a set of cash flows. 3. Apply basic probability principles. 4. Describe and apply different types of probabilities used by actuaries. 5. Calculate the expected present value of a set of cash flows. 6. Describe basic types of insurance and their characteristics. 7. Define and apply basic components of insurance. Examples: premium, claim, deductible, coverage, limit, coinsurance, insured, owner. 8. Describe the ratemaking process. Calculate the rate of a simple insurance product. 9. Describe the pricing process. Calculate the price of a simple insurance product. 10. Describe different accounting regimes and their purposes. 11. Define a policy reserve. Calculate a simple policy reserve. 12. Define a loss reserve.

Calculate a simple loss reserve. 13. Demonstrate a basic level of knowledge by applying Excel to solve problems. Credits: 2.00

STAT 19000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the freshman level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Discover data science and professional development opportunities to prepare for a career. 2. Design efficient search strategies to acquire new data science skills. 3. Devise the most appropriate data science strategy to answer a research question. Credits: 1.00 to 5.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 25000 - Problems Solving In Probability

Credit Hours: 2.00. (MA 25000) This course is designed to teach techniques for solving problems in probability theory which are relevant to the actuarial sciences. It is intended to help actuarial students prepare for the Society of Actuaries and Casualty Actuarial Society Exam P/1. Credit by Examination is not available for this course. MA/STAT 41600 is strongly recommended.

Credits: 2.00

STAT 29000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the sophomore level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Design efficient search strategies in order to acquire new data science skills. 2. Devise the most appropriate data science strategy in order to answer a research question. 3. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 5.00

STAT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data

analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional experience in Statistics. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional experience in Statistics. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in Statistics. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39000 - Topics In Statistics For

Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the junior level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Acquire new data science skills. 2. Devise the most appropriate data science strategy in order to answer a research question. 3. Apply data science techniques in order to answer a research question about a big data set. 4. Apply techniques for documenting, testing, sharing and creating a repository for code. 5. Apply the best workflow practices in data science. Credits: 1.00 to 5.00

STAT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 41800 - Computational Methods In Data Science

Credit Hours: 3.00. This course introduces essential

computational methods in modern data science, focusing on simulation, resampling, Bayesian data analysis, and the utilization of large language models (LLMs) in data science workflows. Students will learn foundational simulation techniques, such as random variable generation through the inverse cumulative distribution function and rejection sampling. The course provides an overview of Frequentist and Bayesian inference, highlighting their theoretical foundations and practical applications. Key resampling methods, including bootstrapping and cross-validation, will be explored as tools for assessing variability, constructing confidence intervals, and validating predictive models. The course also emphasizes the practical and responsible use of LLMs in data science pipelines, including tasks such as text preprocessing, feature extraction, and leveraging pre-trained models to enhance data analysis and annotation. The course culminates in a capstone project where students will synthesize their learning by designing and implementing comprehensive solutions to real-world data science problems, demonstrating both theoretical understanding and practical implementation skills.

Learning Outcomes: 1. Apply simulation techniques, including Monte Carlo methods, transformation approaches, and rejection sampling, to analyze probabilistic behavior in data science applications. They will compare and evaluate Frequentist and Bayesian inference paradigms by examining their theoretical foundations, identify their strengths and limitations, and explain their roles in statistical modeling and decision-making. Students will design, implement, and assess resampling methods, focusing on both nonparametric and parametric forms of the bootstrap, to estimate variability, construct confidence intervals, and improve statistical estimates through bias correction techniques. They will learn the principles of cross-validation, analyze its role in model assessment, and apply it to compute model performance metrics, detect overfitting and underfitting, and select models with reliable predictive accuracy using Python libraries. 2. Construct and interpret posterior distributions and credible intervals, apply Markov Chain Monte Carlo methods to approximate posteriors, and evaluate the role of prior distributions in Bayesian inference. In addition, students will utilize large language models in creative and practical ways within data science workflows, such as contextual data augmentation, feature engineering, and integrating structured and unstructured data to enhance predictive models, addressing challenges such as privacy and reliability. The course will culminate in a capstone project where students will synthesize selected course topics to design, develop, and present robust solutions to real-world data science challenges. By integrating computational methods, statistical principles, and real-world datasets, students will demonstrate their ability to create effective, data-driven solutions that showcase both theoretical understanding and applied expertise. Credits: 3.00

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard

mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

STAT 47301 - Introduction To Arbitrage-Free Pricing Of Financial Derivatives

Credit Hours: 3.00. This course exposes students to a number of financial economics concepts related to arbitrage-free option pricing in the binomial market model and the Black-Scholes model. Specific models include (1) Options and parity relationship between options; (2) Option Pricing under the Binomial model; (3) Option Pricing under the Black-Scholes model; (4) Option hedging and the market maker's overnight profit; (5) Black Scholes theory with Brownian motion and Ito calculus; (6) Risk-neutral option pricing and Monte Carlo valuation; (7) Stochastic interest rates and Stochastic Volatility. This course provides the background for Couse MFE of the Society of Actuaries and Course 3F of the Casualty Actuarial Society.

Learning Outcomes: 1. Use arbitrage-free option pricing in the binomial market model and the Black-Scholes model. 2. Adapt the binomial setting to computing exotic and path-dependent option prices, including the determination of optimal exercise. 3. Follow marking-to-market strategies for approximate discrete delta hedging. Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

STAT 47500 - Life Contingencies II - EXPIRED - PL*

Credit Hours: 2.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200 and STAT 47201. Permission of instructor required.

Credits: 2.00

STAT 47501 - Advanced Long Term Actuarial Mathematics

Credit Hours: 3.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200.

Learning Outcomes: 1. Understand key concepts concerning multiple state mortality/morbidity and joint life mortality models for insurance and annuity contracts. 2. Understand key concepts concerning estimation and construction of multiple state and joint life models for insurance and annuity contracts. 3. Perform calculations on the present value random variables associated with benefits and expenses for any of the models in the first learning objective. 4. Analyze emerging surplus, and to set premiums and reserves, using profit testing. 5. Understand how retirement benefits are accrued, valued, and funded. 6. Understand various types of equity-linked life insurance guarantees, options that are embedded in life insurance and annuity contracts and be able to price, reserve and hedge the risk inherent in these options. Credits: 3.00

STAT 47701 - Statistics Risk Modeling II

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of linear regression models. 2. Understand the basics of generalized linear models. 3. Understand the basics of decision trees. 4. Understand the basics of principle components analysis. 5. Understand the basics of cluster analysis. Credits: 3.00

STAT 47902 - Fundamental Short Term Actuarial Mathematics

Credit Hours: 3.00. This course aligns with one of the Society of Actuaries examinations. The course will cover the learning objectives for a portion of the Society of Actuaries Examination STAM. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Calculate moments,

percentiles, and generating functions. 2. Describe how changes in the parameters affect the distribution. 3. Recognize classes of distributions, including extreme value distributions, and their relationships. 4. Create new distributions by multiplication by a constraint, raising to a power, exponentiation, and mixing. 5. Identify the applications to which each distribution may apply and explain why. 6. Apply the distribution to an application, given the parameters. 7. Compare two distributions based on various characteristics of their tails, including moments, ratios of moments, limiting tail behavior, hazard rate function, and mean excess function. Credits: 3.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors,

credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51500 - Statistical Consulting Problem

Credit Hours: 0.00 to 1.00. Taken by students in the Applied Statistics Master's program who have participated in the Statistical Consulting Service (STAT 59700). Focus is on addressing statistical consultation problems that involve either design of experiments or statistical analysis. Problems involve written reports and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Determining an

appropriate design of an experiment. 2. Choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 3. Implementing various statistical methods via software and summarizing the output for the client. 4. Recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 0.00 to 1.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis

and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

STAT 52700 - Introduction To Computing For Statistics

Credit Hours: 3.00. This course provides a thorough introduction to the R programming language, and its use for statistical computing and data science. The course will first look at the fundamentals of R, including different data-structures, control-flow, and the basic vocabulary. An emphasis will be placed on learning idiomatic and efficient R, covering ideas such as recycling, vectorization and functional programming. The course will then look at principles and tools for tasks like organizing data ('tidy data'), manipulating data ('data carpentry'), querying data (through topics like regular expressions) as well as visualizing data (including interactive visualizations). The material and the homework will encourage development of modular reusable code and reproducible research through ideas such as object-oriented programming and dynamic documents in R Markdown. The last part of the course will study statistical procedures such as least-squares regression, LASSO, Monte Carlo sampling and Markov chain Monte Carlo. Besides exams and homeworks, the course will involve a final project that students can collaborate together on.

Learning Outcomes: 1. Read and write idiomatic R code. 2. Be familiar with the entire data science pipeline, from organizing, manipulating, querying and visualizing data. 3. Introduce computational tools like optimization and simulation in the context of statistical algorithms. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory.

Credits: 3.00

STAT 52900 - Applied Decision Theory And Bayesian Statistics

Credit Hours: 3.00. Bayesian and decision-theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; Bayesian design and sequential analysis; comparisons of statistical paradigms.

Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

STAT 53800 - Probability Theory I

Credit Hours: 3.00. (MA 53800) Mathematically rigorous, measure-theoretic introduction to probability spaces, random variables, expectation, independence, weak and strong laws of large numbers, conditional expectations, and martingales.

Learning Outcomes: 1. Learn rigorous mathematical approach to probability theory.

Credits: 3.00

STAT 53900 - Probability Theory II

Credit Hours: 3.00. (MA 53900) Convergence of probability laws; characteristic functions; convergence to the normal law; infinitely divisible and stable laws; Brownian motion and the invariance principle.

Credits: 3.00

STAT 54000 - Computational Finance I

Credit Hours: 3.00. An introduction to the mathematical tools and techniques of modern finance theory, in the context of Black-Scholes option pricing. Brownian motion and its stochastic calculus, Ito's formula, and Feynman-Kac formula. Pricing and hedging of claims on Black-Scholes assets. Incomplete markets. Path-dependent options. Stochastic portfolio optimization.

Learning Outcomes: 1. Obtain necessary mathematical background necessary to study quantitative methods in finance. 2. Understand mathematical models of modern financial markets. Credits: 3.00

STAT 54100 - Computational Finance II

Credit Hours: 3.00. Stochastic interest rate models. American options from the probabilistic and PDE points of view. Numerical methods for European and American options, including binomial, trinomial, and Monte-Carlo methods.

Learning Outcomes: 1. Learn advanced topics in quantitative finance. Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

STAT 54600 - Computational Statistics

Credit Hours: 3.00. The course focuses on two fundamental aspects in computational statistics: (1) what to compute and (2) how to compute. The first is covered with a brief review of advanced topics in statistical inference, including Fisher's fiducial inference, Bayesian and frequenstist methods, and the Dempster-Shafer (DS) Theory. The second is discussed in detail by examining exact, approximation, and interactive simulation methods for statistical inference with a variety of commonly used statistical models. The emphasis is on the EM-type and quasi-Newton algorithms, numerical differentiation and integration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Master commonly used numerical matrix operations, including the sweep operator, Cholesky decomposition, eigenvalue decomposition, and single value decomposition. 2. Understand statistical thinking in development of interactive numerical methods. 3. Apply optimization algorithms such as quasi-Newton and conjugate gradient

methods. 4. Implement EM-type algorithms for maximum likelihood estimation when expanded complete-data models are available, including commonly used statistical models. 5. Create random number generators. 6. Implement the Gibbs sampler and Metropolis-Hastings algorithms for Bayesian data analysis. Credits: 3.00

STAT 54900 - An Introduction To QTL Mapping In Experimental Populations

Credit Hours: 3.00. This is an introductory/interdisciplinary (master's level) quantitative trait locus (QTL) mapping course. QTL mapping is associated with the statistical analysis of genetic/genomic data and is considered part of the general science known as bioinformatics.

Credits: 3.00

STAT 55300 - Theory Of Linear Models And Analysis Of Experimental Designs

Credit Hours: 3.00. Least squares analysis of linear models. Gauss Markov Theorem. Estimability and testability of parameters. Confidence regions and prediction regions. Introduction to design of experiments. Analysis of variance. Factorial and block designs. Analysis of random, fixed, and mixed models. Components of variance. Distribution of linear and quadratic forms in normal vectors. A firm background in matrix algebra and some previous exposure to linear models or analysis of variance is desirable.

Credits: 3.00

STAT 57900 - Foundations Of Statistical Machine Learning

Credit Hours: 3.00. This course provides a comprehensive treatment of modern statistical machine learning topics. These include linear regression, kernel method, trees, boosting, and deep neural networks. We understand these subjects from a statistical perspective with some mathematical rigorousness.

Learning Outcomes: 1. Understand classical supervised learning methods such as linear regression, nonlinear regression, random forest, and boosting. 2. Understand classical unsupervised learning methods such as K-means clustering and PCA. 3. Understand modern AI techniques using deep neural networks, such as manifold learning and deep generative models. 4. Practice complex and high dimensional data analysis using the methodology and software packages. Credits: 3.00

STAT 58000 - Application Of Statistical Theory

Credit Hours: 3.00. The use of numerical methods to obtain answers in problems arising in probability and statistics. Topics will include the use of the likelihood function, Bayesian and classical methods of estimation and testing, evaluation of probabilities, linear and nonlinear regression. STAT 53200 , 55400, and some knowledge of computing and complex analysis are desirable.

Credits: 3.00

STAT 58100 - Bioinformatics Seminar

Credit Hours: 1.00. This is a weekly forum for presenting both applied and theoretical work in the broad area of bioinformatics. Bioinformatics is the science of generating, organizing, and analyzing biological data. This seminar series occurs both in the fall and spring semesters and attracts speakers from Purdue University, as well as throughout the world. Students are encouraged to register for this course, and everyone else is encouraged to attend this open seminar.

Credits: 1.00

STAT 58200 - Statistical Consulting And Collaboration

Credit Hours: 3.00. This course is designed to emphasize and develop the skills needed by a statistical consultant/collaborator. Topics include: problem solving, consulting session management, written and oral communication, research ethics, design of experiments, collection of data, and application of statistical methods to real problems. Class activities include actively participating in consulting sessions held by the Statistical Consulting Service, small group projects, short papers, and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Be aware of the skills necessary to be an effective statistical consultant/collaborator. These skills include consulting session management, written and oral communication with clients, interpreting facial and body language, handling personality conflicts, practicing sound research ethics, properly designing an experiment and determining an appropriate sample size, and choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 2. Know how to recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 3.00

STAT 58700 - Machine Learning In Finance

Credit Hours: 3.00. This graduate course on Machine Learning in Finance explores contemporary topics in quantitative finance, including optimal execution, dynamics of limit order books, optimal portfolio selection, and more. The course focuses on illustrating how machine learning methods are applied in these specific areas.

Learning Outcomes: 1. Gain a comprehensive understanding of the latest advancements in machine learning methodologies. 2. Apply these methodologies using practical applications within the context of financial markets. Credits: 3.00

STAT 59000 - Internship Seminar

Credit Hours: 1.00 to 3.00. Students complete an internship where they will use statistical methods. A detailed report describing the internship work is required. Permission of department required. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 59700 - Statistical Consulting Seminar

Credit Hours: 1.00. Active participation in weekly consulting meetings, directed reading in the statistical literature, application of statistical methods to real problems, report writing. Permission of Instructor required.

Learning Outcomes: 1. Improve on the skills needed to be an effective statistical consultant and collaborator, including problem solving, time management, and written and oral communication. 2. Develop good listener and questioner skills in order to understand the goals of a study and the data (to be) collected. 3. Apply appropriate statistical methods to address real-world problems. Credits: 1.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

STAT 63800 - Stochastic Processes I

Credit Hours: 3.00. (MA 63800) Advanced topics in probability theory which may include stationary processes, independent increment processes, Gaussian processes; martingales, Markov processes, ergodic theory. Prerequisite: STAT 53900.

Credits: 3.00

STAT 63900 - Stochastic Processes II

Credit Hours: 3.00. (MA 63900) Continuation of STAT 63800.

Credits: 3.00

STAT 65600 - Bayesian Data Analysis

Credit Hours: 3.00. Bayesian data analysis refers to practical inferential methods that use probability models for both observable and unobservable quantities. The flexibility and generality of these methods allow them to address complex real-life problems that are not amenable to other techniques. This course will provide a pragmatic introduction to Bayesian data analysis and its powerful applications. Topics include: the fundamentals of Bayesian inference for single and multiparameter models, regression, hierarchical models, model checking, approximation of a posterior distribution by iterative and non-iterative sampling methods, and Bayesian nonparametrics. Specific topics and the course outline are subject to change as the semester progresses. All topics will be motivated by problems from the physical, life, social, and management sciences. Conceptual understanding and inference via computer simulation will be emphasized throughout the course. Permission of department required.

Learning Outcomes: 1. Acquire fluency in the principles and techniques of Bayesian data analysis. 2. Apply Bayesian methodology to solve real-life problems. 3. Utilize R for Bayesian computation, visualization, and analysis of data. 4. Discuss what is learned in lectures and assignments through an oral presentation and written report. Credits: 3.00

STAT 66700 - Measure-Theoretic Statistics: Decision Theoretic And Classical

Credit Hours: 3.00. Decision theoretic approach to statistical problems, complete class theorems, Bayes and minimax procedures, sequential decision problems, sufficiency, comparison of experiments, invariance; most stringent, similar, unbiased, likelihood ratio tests; efficiency, Cramer-Rao inequality, estimation analogues of good tests; confidence sets. Prerequisite: MA 57100, STAT 52800, STAT 53900, STAT 57600.

Credits: 3.00

STAT 69000 - Seminar

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 69100 - Seminar In Probability Theory

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 69200 - Research Colloquium

Credit Hours: 1.00. A colloquium or seminar course with discussion. Colloquium speakers present current technical results from statistics. A discussion follows in which the speaker and instructor take questions and explain issues in detail. Students give reports on lectures. Permission of department

required.

Learning Outcomes: 1. Expand understanding of research in statistics and data science. 2. Strengthen oral and written communication skills. 3. Build relationships with peers and mentors involved in research. 4. Increase information fluency and ability to find relevant research literature. 5. Enhance ability to evaluate sources of research information. Credits: 1.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

STAT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Studies College of Liberal Arts

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 11000 - Language And Cultural Exchange I: Self In Context (UCC: HUM)

Credit Hours: 3.00. The course takes a social science-based approach to investigating the American university by examining contemporary college life, the history of the American academy, social and environmental issues on campus, and opportunities

for engagement with the wider community. Students will improve their speaking, listening, reading, writing skills in English so that they can actively participate in social and academic communication.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Speak English more fluently. 2. Read English more fluently. 3. Communicate in English with increased clarity (writing effective academic sentences and paragraphs; speaking on familiar topics). 4. Develop and apply a process for cross-cultural comparison and reflection. Credits: 3.00

SCLA 11100 - Language And Cultural Exchange II: Texts And Contexts

Credit Hours: 3.00. Students will continue to develop the foundational language skills and knowledge that they need to succeed in their other classes at Purdue and to prepare for further academic and professional opportunities. Students will also deepen their understanding of American culture and improve their ability to think about cultural differences in positive ways. In a sense, this class will be a bridge to help you transition to other language-intensive courses at Purdue where you need to read, write, and speak frequently and/or work in groups (such as business, engineering, literature, public speaking, and social sciences).

Learning Outcomes: 1. Speak and read English more fluently. 2. Present academic topics to an audience with increased clarity and within time constraints (write effective, short academic essays; present information orally to an academic audience). 3. Understand reasons and practices for using outside sources in an American academic context. Credits: 3.00

SCLA 11500 - Introduction To Career Decisions

Credit Hours: 1.00. This course is designed to guide the student through self-exploration and an investigation of the world of work. The class format will be short lectures followed by class discussions and activities. Not open to students who have completed GS 11900.

Credits: 1.00

SCLA 19100 - Special Topics In Liberal Arts

Credit Hours: 1.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum. Permission from instructor required.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 1.00 to 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

SCLA 29100 - Special Topics In Liberal Arts

Credit Hours: 1.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum. Permission from instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better

understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

SCLA 31500 - Internship Development Strategies

Credit Hours: 1.00. This course offers sophomore and junior students the opportunity to gain key skills to prepare for a professional internship. Topics range from "Why intern" to conducting searches, to resumé writing and interview techniques to establishing a professional identity.

Credits: 1.00

SCLA 32000 - Theories And Methods Of Mentoring Academic Writers Across The Disciplines

Credit Hours: 3.00. A practicum to teach undergraduates the theories and methods of mentoring academic writers across the disciplines in the one-to-one setting of a writing lab.

Learning Outcomes: 1. Describe and apply theoretical concepts and specific tutoring strategies to meet student needs. 2. Identify best practices for teaching writing and mentoring rhetorical awareness in writing lab interactions and develop their own unique, robust toolbox of strategies. 3. Demonstrate awareness of genre and different expectations for writing across the disciplines, cultivating the ability to adapt, riff, and improvise according to the rich dynamics of a consultation. 4. Identify and analyze affective, behavioral, and cognitive dimensions of writing and learning and their role in writing consultation. 5. Develop a professional identification with writing center studies and demonstrate knowledge of the field through application of its shared language and theories. 6. Practice metacognition by reflecting on their composing processes and relating their experiences in the classroom and at the OWL to the larger context of writing center studies. 7. Propose an inquiry that enters into a scholarly conversation within contemporary writing center studies research and assess its potential impact for consulting practices at the OWL. 8. Use the insights gained within the course to support the Purdue campus community. Credits: 3.00

SCLA 39000 - Special Credit For Study Abroad In Liberal Arts

Credit Hours: 1.00 to 4.00. This course number is for assignment of credits in studies in Liberal Arts earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

SCLA 39100 - Special Topics In Liberal Arts

Credit Hours: 1.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum. Permission from instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 3.00

SCLA 41500 - Senior Job Search Seminar

Credit Hours: 2.00. This course is designed to get LA seniors actively started on their job search. Highly intensive assignments, in-class activities, presentations and projects are designed to better prepare students for all aspects of the job search process.

Credits: 2.00

SCLA 49000 - Directed Reading

Credit Hours: 1.00 to 3.00. Designed for a student to work with an instructor on a topic of special interest.

Credits: 1.00 to 3.00

SCLA 49100 - Special Topics In Liberal Arts

Credit Hours: 0.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum.

Credits: 0.00 to 3.00

SCLA 49105 - Liberal Arts Undergraduate Research Experience

Credit Hours: 0.00. This course is for students in the Dammon Dean's Scholars program or the Margo Katherine Wilke Undergraduate Research program. This course is required each semester a student participates in either program. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of research activity. Credits: 0.00

SCLA 49500 - Special Credit For Study Abroad In Liberal Arts

Credit Hours: 1.00 to 4.00. This course number is for assignment of credits in studies in Liberal Arts earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

SCLA 50500 - Technology, War, And Strategy

Credit Hours: 3.00. This course introduces students to the interaction between strategy and technology internationally and across historical eras. The course is rooted in historical political, military, economic, technological, and cultural strategy, and it engages core ideas that cut across disparate schools of thought and historical contexts. The course prepares students to appreciate and understand the foundational principles of designing and executing broad strategic initiatives with world-changing consequences that engage profound national economic and technological commitments.

Learning Outcomes: 1. Classify and compare the core strategic competencies needed in designing and implementing strategic defense technologies. 2. Sequence and apply in strategic planning historical constants of strategic technology development. 3. Assess the concept of strategic technological offset in context. 4. Devise effective communication and presentation skills. Credits: 3.00

SCLA 50600 - Space Strategy

Credit Hours: 3.00. Space is the most recent domain in which nations and great powers dispute strategic political, military, economic, and legal interests. The course analyzes the origins, tensions, and promises embedded in the space-focused strategies of major international players. The course will discuss these issues from the US national and strategic interests perspective, focusing on how strategic competition and conflict in space could and should be handled. The course combines technological with grand strategy concerns.

Learning Outcomes: 1. Distinguish the key characteristics of grand strategy with examples for each great power involved in space strategy. 2. Distinguish the main phases in the history of space exploration and appraise their role in revealing various strategic priorities for space policy. 3. Differentiate essential provisions of the key space legal documents and principles by their domain and effect. 4. Assess the main space-paced conflictual relationships and prioritize them by importance and immediacy. 5. Differentiate the role of governments and private organizations in space strategic control and determine their main common interests by great power. Credits: 3.00

SCLA 50700 - Grand Challenges In Defense Engineering

Credit Hours: 3.00. This course examines past, present, and future engineering challenges to develop new conceptual insight, research priorities, system integration, and timely methods to meet emerging national defense engineering needs. The course matter involves challenges in Energy, Logistics and Information, and Rapid Offense and Defensive Systems and subsets of each designed to develop understanding depth and transfer analytic and planning skills needed to meet future defense needs. The selected three topics begin with a past engineering challenge to gain perspective on how prior needs were met in their time, a present challenge under current focus, and a possible future challenge and solutions that will require combining prior best practices with the accelerated development needed in the changing world.

Learning Outcomes: 1. Develop professional methods to identify, research, collaborate, and develop solutions to engineering challenges while maintaining appropriate systematic thinking. 2. Formulate and solve structured problems using standardized professional methods including case study research, system engineering design, and policy analysis. 3. Appraise historic, present, and anticipated future engineering challenges by identifying the necessary parameters required for solving them, such as specifying challenge dimensions, generating appropriate assumptions for missing information, formulating solutions, and projecting possible results. 4. Identify, locate, and integrate data, parameters, or information about past, present and future practices needed to develop solutions to course problems. 5. Assemble and compose written and oral communications involving solutions and arguments valuable for both senior and technical leadership while maintaining ethical and professional conduct. Credits: 3.00

SCLA 50800 - Cyber Strategy

Credit Hours: 3.00. Cybersecurity is a crucial domain upon which individuals, organizations, communities, states, nations, and great powers rely to protect cyber-based personal, business, economic, infrastructural, community, legal, strategic political, and military interests. The course analyzes the policies, issues, risks, and opportunities embedded in the cyber strategies of organizations. The course will discuss these issues

from the perspective of the U.S. national and strategic interests, focusing on how cyber issues and conflicts could and should be handled. Among the cyber strategy key considerations to be discussed are: Understanding and assessing an organization's cyber threat landscape; Assessing an organization's cybersecurity maturity; Organizational cyber strategy goals; Cyber strategy policy-making process; Examination of strategies for strengthening, defending, and maintaining an organization's cyber infrastructure -Models, requirements, frameworks, and best practices; Management commitment and responsibilities to an organization's cyber strategy and policies; Cyber strategy staffing, training, and budgeting; Global and domestic cyber business relationships in governmental and private industry; Promoting awareness of historic, ongoing, and emerging cyber threats and actors; Promoting awareness of domestic, global and insider cyber threats and actors; Cyber risk management; Cyber incident management.

Learning Outcomes: 1. Understand, assess, and design cyber strategy requirements and goals - Distinguish national cyber strategy goals between U.S., China, and Russia. Understand U.S. cyber strategy policy-making process. 2. Understand, assess, and design cyber strategy means - Understand the national strategies for strengthening, defending, and maintaining cyberinfrastructure, with examples of models, requirements, frameworks, best practices. 3. Understand, assess, and design cyber risk management methods - Understand cyber threat analysis, U.S. national cyber incident management. 4. Understand, assess, and design cyber strategy in the context of international conflict/war - Assess the main cyber conflictual relationships and prioritize them by importance and immediacy. Credits: 3.00

SCLA 50900 - Strategic Intelligence: Organizations, Technologies, Procedures, Policies

Credit hours: 3.00. The present course will examine all facets of strategic intelligence, anchoring the investigation around specific organizations and processes, from the major civilian to the major military-strategic intelligence agencies, the legislation that directs their work, and the supervisory bodies. The course will also include case studies that analyze and operationalize how intelligence agencies contribute to national security. The course aims to provide the students with a rounded and practical education in strategic intelligence, describing who is responsible for its deployment and exploitation and what its benefits are for national security.

Learning Outcomes: 1. Analyze the diplomatic, economic, informational, military, and political elements influencing national strategic intelligence. 2. Evaluate key agencies, institutions, and legislative frameworks that shape U.S. strategic intelligence collection, analysis, and dissemination. 3. Differentiate between various strategic intelligence organizations - civilian and military - and understand their unique contributions and limitations. 4. Assess how political, institutional, and cultural factors affect the development and execution of national strategic intelligence policies. 5. Formulate recommendations for improving strategic intelligence oversight, policymaking, and response mechanisms to current and emerging global threats. Credits: 3.00

SCLA 51000 - Data And AI Storytelling

Credit Hours: 3.00. The primary assumption of our course is that the goal of communicating with data is ultimately to identify causal mechanisms and change the status quo due to the obtained insights. All audiences have previous understandings of the world, and meaningful data stories should challenge their assumptions about that world. The communication of this data-based new knowledge violates prior assumptions, shares memorable new information and moves the audience to act based on the new knowledge. This is best accomplished through a story. In other words, this communication assumes the form of a story, which is defined as the narrative of how an unexpected cause creates an effect.

Learning Outcomes: 1. Provide high-quality data story examples and justify why they meet the good story criteria. 2. Identify and extrapolate core relationships between research design and story-building. 3. Generate hypotheses based on data. 4. Create specific data visualizations which maintain casual narratives. 5. Identify story elements that map onto the five tenets of What is a Data Story? 6. Identify in examples the adherence or violation of data transparency, validity and ethics. Credits: 3.00

SCLA 51300 - Game Theory For Strategy And Defense

Credit Hours: 3.00. This course explores the intersection of strategic decision-making and national defense through the lens of game theory. Participants will develop analytical and strategic skills by studying three interconnected modules: (1) Game Theory Foundations: understanding the fundamentals of strategic interactions, Nash equilibria, and applications to competitive and cooperative settings, (2) Mechanism Design: Crafting systems to incentivize desired outcomes, with a focus on resource allocation and strategic interactions in defense, (3) Social Choice: analyzing how groups can make collective decisions in a way that balances fairness, efficiency, and strategic behavior. A final module of the course will apply the concepts developed in a family of games called Attacker-Defender games, which model scenarios involving adversarial interactions, including cybersecurity, physical security, and military strategy. The course connects theoretical frameworks with real-world defense challenges, analyzing past, present, and future applications. By the end of the course, participants will be equipped to apply these concepts to complex, rapidly evolving strategic environments in national and global defense.

Learning Outcomes: 1. Understand and Apply Game-Theoretic Concepts: Identify, formulate, and analyze strategic interactions using foundational concepts such as Nash equilibria, mechanism design principles, and social choice frameworks. 2. Model and Solve Real-World Problems: Use structured game-theoretic models, mechanisms, and optimization techniques to address challenges such as resource allocation, adversarial interactions, and decision-making under uncertainty. 3. Analyze Historical, Current, and Emerging Scenarios: Evaluate past, present, and future (defense) strategies by identifying critical game theoretic factors, and projecting outcomes based on established theoretical frameworks. 4. Develop Research and Communication Skills: Investigate real-world (defense) scenarios using tools from game theory, social choice, and mechanism design, and synthesize findings into clear and persuasive written and oral presentations. 5. Adapt Strategic Thinking to Complex Environments: Integrate interdisciplinary methods to address multi-agent and multi-objective problems in evolving contexts, balancing robustness, efficiency, and ethical considerations. Credits: 3.00

SCLA 52000 - Social And Digital Media Analytics For Strategic Communication

Credit Hours: 3.00. This course provides an overview of how to transform social media and digital media information into business intelligence and actionable insight. Although students are not expected to know a programming language prior to taking the course, students are expected to understand basic statistics and to have a desire to learn the processes, procedures and vocabulary used by data analysts in modern organizations. The goal is not to train them as practicing data scientists, but as knowledgeable data analytics consumers and as informed teammates and leaders of cross-functional teams tasked to make decisions using data.

Learning Outcomes: 1. Differentiate between the opportunities and limitations with social media data. 2. Identify methods for using ready and custom-made tools to transform information into insight, from data collection to analysis, interpretation, and recommendation. 3. Sharpen their quantitative and business analytical skills using spreadsheets and online tools. 4. Write effective reports and draft scorecards. 5. Be prepared to interact with data scientists by speaking their language and understanding their processes for data mining and business intelligence. Credits: 3.00

SCLA 52100 - Societal Impacts Of Artificial Intelligence

Credit Hours: 3.00. Students in this course will draw upon knowledge from multiple fields to understand how AI is transforming social, political, and economic practices in institutions and in society. They will utilize interdisciplinary theories and methodological tools to measure and evaluate the societal impacts of AI. The utilizes a mix of case and source data and recent research in the field of AI to create opportunities for shared communication and learning among those in technical and non-technical fields that utilize artificial intelligence. Students will engage in systematic analysis of societal impact.

Learning Outcomes: 1. Describe how AI is transforming social, political, and economic institutions, practices and employment in multiple sectors, including healthcare, education, finance, communications, criminal

justice and others. 2. Explain the nature of risks of AI in society and outline common strategies to manage risks. 3. Evaluate core theories used to understand AI's potential societal impact on connectedness, trust, creativity, and conflict. 4. Assess and communicate AI impacts by applying interdisciplinary tools drawing from social sciences, humanities, and STEM fields. 5. Identify the human rights implications of AI and understand potential mitigation practices. Credits: 3.00

SCLA 52200 - Artificial Intelligence Policy, Governance, And Ethics

Credit Hours: 3.00. This course provides students with a strong grounding in the policy, ethical, and legal regulatory dimensions and environment that shape the governance of AI. Students will analyze current and emerging laws, regulations, and governance strategies shaping the AI landscape across multiple jurisdictions and sectors. The course will help students gain an interdisciplinary understanding of the core ethical principles and values that guide AI.

Learning Outcomes: 1. Describe key stakeholders, institutions, and strategies involved in AI policymaking across multiple levels of government (local to global) in multiple fields and explain their roles in governing AI systems. 2. Evaluate the legal, regulatory, and other governance strategies that have been proposed or adopted by governments, firms, and civil society organizations, such as model cards, liability frameworks, standards, and impact assessments. 3. Analyze ethical and social issues related to the development and application of AI systems within multiple fields, including power, model bias, transparency, accountability, worker well-being, and privacy, as well as the translation of ethical values into technical aspects of AI governance practices within public and private, and non-profit sector organizations. 4. Synthesize, analyze, and communicate information about emerging policy issues in AI and the associated ethical and social dimensions, identify stakeholder perspectives, and summarize proposed solutions. 5. Assess current and evolving trends, debates, and solutions in AI governance and ethics through case studies, contemporary issues, and comparative analysis. Credits: 3.00

SCLA 53000 - Strategic Foresight And Leadership

Credit Hours: 3.00. This course provides emerging leaders with strategic foresight tools and skills to understand and make decisions regarding long-term future operational defense-related environments. Strategic foresight is the ability to create and sustain a variety of high-quality long-term views and apply emerging insights in organizationally adaptive ways. Strategic foresight produces scenarios that are the basis for strategies and plans to help defense or industry organizations remain competitive into the foreseeable future.

Learning Outcomes: 1. Define and explain strategic foresight. 2. Distinguish the difference between a growth, fixed, and futures mindset in strategic foresight. 3. Make use of specific strategic foresight methodologies: horizon scanning, signals and drivers of change, the 2 x 2 matrix and archetype methods. 4. Make use of vision and alignment in executing a strategic foresight model. 5. Argue the importance of vision for strategic leadership. Credits: 3.00

SCLA 59000 - Special Topics

Credit Hours: 3.00. This course, whose specific topics might change, focuses on strategy and military studies a global scale. The course will be rooted in all the elements of strategy (political, military, economic and cultural), plus strategic theory and technology's impact on it. The course exposes students to a set of historical and contemporary strategic dilemmas that involved difficult trade-offs, costly investments, wild risks, incredible victories, and crushing defeats. This is a multidisciplinary course that focuses on several core ideas and principles that cut across schools of thought and examples from past, present and future.

Learning Outcomes: 1. Develop and analyze system-level trade-offs. 2. Plan long-term on a national scale. 3. Devolve authority and allowing

for chance contingency while staying on mission. 4. Maintain individual morals and national values in strategic thinking. 5. Balance the possibilities and limits of soft power (money, prestige, culture) as strategic tools of influence. 6. Examine the learning competition aspects of strategy and security. Credits: 3.00

SCLA 62000 - Academic And Professional Communication For International Teaching Assistants

Credit Hours: 5.00. Student must be an enrolled graduate student and a non-native speaker of English. Permission of department required.

Learning Outcomes: 1. State their strengths and weaknesses in oral English. 2. Demonstrate improved pronunciation, prosody, grammar, listening comprehension, and vocabulary, depending on their strengths and weaknesses. 3. Identify and carry out specific strategies for developing their language skills. 4. Demonstrate effective communication and presentation skills including question and answer strategies, negotiating for meaning, paraphrasing, compensatory strategies, and nonverbal skills. 5. Compose and assess presentations and interaction appropriate for a variety of professional contexts. 6. Demonstrate behavior appropriate for professional and instructional contexts in higher education in the United States. 7. Identify the characteristics of students, teaching assistantships, and higher education in the United States. Credits: 5.00

Sustainable Food and Farm Systems

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 30100 - Agroecology

Credit Hours: 3.00. This course introduces students to the application of ecological concepts to food production systems and farm management. We will consider species interactions, nutrient and water cycles, regenerative practices, alternative approaches to agriculture, and ecosystem services provided to and by agro-ecosystems.

Learning Outcomes: 1. Understand key connections between ecology and agriculture. 2. Apply the agro-ecosystem concept to farming systems. 3. Discuss the relative strengths and weaknesses of conventional and alternative forms of agriculture. 4. Understand the effect of farm management practices on primary productivity, nutrient cycling, and species interaction. 5. Evaluate ecosystem services provided to and by agro-ecosystems. 6. Consider the role of social factors on farming systems. 7. Discuss the potential for ecologically based agriculture to address farming issues at local, regional, and global levels. Credits: 3.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

SFS 31100 - Aquaponics

Credit Hours: 1.00. (FNR 31300) (HORT 31100) There has been significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia, and our impending food crisis has kindled an interest in developing aquaponic systems in western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. High input costs can, however, be a limitation. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of post harvest food storage and pest management. Credits: 1.00

SFS 31200 - Urban Agriculture

Credit Hours: 1.00. Urban agriculture has the potential to address a range of social, economic and environmental issues including food insecurity, energy conservation, and human health and well-being. During this 5-week course, students will learn about the forces driving urban agriculture as well as the

political and biophysical factors constraining it by reading articles, reviewing case studies, and visiting urban farms, vertical farm factories, food pantries, and local food advocacy groups. At the end of this course, students will apply the knowledge they've gained by developing a plan to increase urban agriculture in the greater Lafayette metropolitan area.

Learning Outcomes: 1. Understand the complexity of our global food system and learn how urban agriculture can address social, economic and ecological issues in cities around the world. 2. Develop critical thinking and communication skills through in-class discussions and writing assignments that integrate agroecology, urban planning, and civic engagement as they relate to urban agriculture. 3. Apply relevant theories and examples by developing a plan to facilitate the growth of urban agriculture. Credits: 1.00

SFS 31300 - Farm To Fork

Credit Hours: 1.00. This course will investigate the culinary opportunities of local and seasonal foods and the horticultural demands of producing and marketing them. Dr. Hallett will represent the "farm", giving students a brief overview of the production of local and seasonal foods in Indiana. The "farm" will harvest produce at the student farm and deliver it to the "fork" -- Chef Ambarish Lulay - who will work his culinary magic in the teaching kitchens in the HTM department. The focus, from both "sides" of the course will be the importance of niche marketing for farmers and chefs. This course is going to be tasty and fun!

Learning Outcomes: 1. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 2. Have a broad awareness of the role of agriculture in global society. 3. Understand the advantages and disadvantages of different approaches to food production. 4. Understand the principles of food marketing and sales. 5. Understand the principles of postharvest food storage and pest management. 6. Be able to handle multiple tasks and deadline pressures. 7. Be able to work effectively with individuals from diverse cultures. 8. Have strong professional ethics and integrity. 9. Understand the importance of developing leadership skills. 10. Be able to work effectively in teams. Credits: 1.00

SFS 31400 - Comparative Livestock Production Systems

Credit Hours: 1.00. This course will compare and contrast the various livestock and poultry systems in the United States. The course will begin with in depth analysis of the history and structure of prevalent or conventional livestock and poultry production systems followed by a similar analysis of the various alternative production systems currently in use in the US, including organic, grass-fed, and pasture-raised among others. A heavy focus will be placed on critically evaluating the pros and cons of each system, regulations of both conventional and process-verified systems and potential differences in products resulting from different management and processing systems.

Learning Outcomes: 1. Understand the structure of conventional livestock and poultry production systems in the US. 2. Understand the alternative livestock and poultry production systems prevalent in the US. 3. Know how each system is regulated including the various process verified systems. 4. Know how different management and processing systems do or do not impact final product qualities. 5. Be able to critically evaluate and compare the benefits and challenges inherent in different production systems. Credits: 1.00

SFS 31500 - Principles Of Permaculture

Credit Hours: 1.00. The goal of this class is to encourage students to think of farming systems, including their energy and resource flows, economics and social characteristics, in the ways that ecologists think of ecological systems. How does energy flow through farming systems, and how do resources recycle (or not)? What are the weaknesses of farming systems that could be mitigated by mimicking natural systems? Issues of efficiency, sustainability and resilience will be investigated in the context of permaculture, a theory of food production and landscape design that has an emphasis on perennial crops, low input production, and ecological diversity. The centerpiece of the course will be to further develop the Purdue Student Farm using permaculture principles.

Learning Outcomes: 1. Analyze energy and natural resource issues of modern society in the context of ecological systems thinking. Credits: 1.00

SFS 35100 - SFS Capstone Project

Credit Hours: 1.00. The SFS Capstone Project is a directed-learning course that will require students to prepare and present a sustainability analysis of a farm enterprise, most likely the enterprise at which they conduct their required summer internship, and this may be an internship approved at an

operation other than a farm. Students will be required to analyze and enterprise taking into account its economic, environmental and social sustainability, and its broader role in sustaining the local and regional economy, environment and community. The analysis will be prepared as a paper and a presentation that will be given to the undergraduates of the SFS program at an SFS program meeting. The paper and the presentation will be prepared in consultation with a faculty mentor from the SFS program committee and will be graded by the faculty mentor. Completion of an approved work or internship experience.

Learning Outcomes: 1. Analyze complex concepts. 2. Think critically about systems and business operations from a range of different economic and social contexts. 3. Develop written and oral communication skills. Credits: 1.00

SFS 39100 - Special Problems In Sustainable Food And Farming Systems

Credit Hours: 1.00 to 3.00. Contemporary topics in sustainable food and farming systems are explored. Topic selection is based on student interest. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 2. Conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 3. Develop an understanding of and be able to practice the scientific method of investigation. 4. Handle multiple tasks and deadlines. 5. Have a strong professional ethics and integrity. 6. Have a working knowledge of SI (metric) units. Credits: 1.00 to 3.00

SFS 41100 - Structural Racism In US Agriculture

Credit Hours: 1.00. A discussion-based exploration of the history and legacies of structural racism in American agriculture. We will analyze the barriers to success faced by non-white farmers in the US, the structures that have oppressed minority groups in agriculture, and ways in which these forces might be reversed or resisted.

Learning Outcomes: 1. Deepen an understanding of racism, bias, and white privilege. 2. Develop an understanding of the governmental, institutional, and social structures that have led to racial and ethnic inequities in American agriculture. 3. Understand the relationship of all peoples with American agriculture, whether indigenous or arriving as enslaved person or immigrant, and the legacies of those relationships. 4. Analyze the ways in which immigration and foreign policy impact the US food system. 5. Learn to communicate issues of structural racism in American agriculture effectively. 6. Construct ideas that might promote a more equitable food system. Credits: 1.00

SFS 41200 - Colonialism, Globalization, And Food Justice

Credit Hours: 1.00. This course will uncover the foundations of inequities in access to healthy, nutritious food from the first era of colonization to the modern era of globalization. The course will make students aware of the racial and ethnic inequities in farming and food systems and consider mechanisms of decolonization: resistance against the status quo and the development of new food systems.

Learning Outcomes: 1. Understand the emergence of modern food systems through the eras of colonization and globalization. 2. Analyze the factors that contribute to inequities in access to healthy, nutritious food. 3. Investigate global and local food justice movements. 4. Evaluate the legacies of colonialism in today's food deserts. 5. Investigate local food movements, such as urban agriculture, represent attempts at decolonization. 6. Investigate the activism of indigenous groups around the world seeking decolonization and food justice. 7. Consider policies to reduce inequities in food systems. Credits: 1.00

SFS 41300 - The Cultures And Agricultures Of The United States

Credit Hours: 1.00. The United States is a vast country encompassing many climates, geographies, and human histories. This course will investigate the diversity of the United States by examining a dozen locations with respect to people-and-place. How have people shaped these places, and how have these places shaped the people who have lived in them?

Learning Outcomes: 1. Understand the different types of land use, especially agriculture, in different regions of the United States, and consider their sustainability. 2. Investigate the cultures and agricultures of American Indian tribes prior to first contact with Europeans. 3. Analyze the displacement and relocation of American Indian tribes in specific regions. 4. Analyze the nature and legacies of slavery, and the means by which African Americans have been excluded from land ownership since reconstruction. 5. Consider the contributions of Asian Americans to the cultures and agricultures of the United States. 6. Investigate changes to the natural, built, and cultural landscapes of the United States through time. 7. Consider how the sustainability of cultures, economies, environmental health, and agriculture can (or cannot) be sustained in different regions of the United States. Credits: 1.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

Technical Communications

TCM 18000 - Exploring Intercultural technical Communication

Credit Hours: 3.00. This course will explore issues in diverse technical communication workplace settings using Intergroup Dialogue. Students will explore intercultural communication, conflict resolution, social identity, community, and social justice with diverse groups. A component of this class will be engaging with clients, co- facilitators, and/or guest speakers. Topics in this course will include a variety of social identities including (but not limited to) race/ethnicity, nationality of origin/citizenship, gender, sex, sexual orientation/attraction, SES/social class, age, religion/spirituality, ability/disability status, body size/type, level of education.

Credits: 3.00

TCM 21800 - Introduction To Engineering Technical Reports

Credit Hours: 1.00. This integrated technical communication course introduces foundational skills for technical reports in engineering. Students will practice a recursive writing process and use techniques for analyzing content for different audiences and purposes.

Credits: 1.00

TCM 22000 - Technical Report Writing

Credit Hours: 3.00. Extensive application of the principles of clear writing in industrial reporting, with emphasis on adaptation to the audience; organization of ideas; and a concise, objective writing style.

Credits: 3.00

TCM 22200 - Introduction To Technical Documentation

Credit Hours: 1.00. This integrated technical communication course introduces foundational skills for creating effective technical documentation.

Credits: 1.00

TCM 24000 - Tools For Technical Communications

Credit Hours: 3.00. This course introduces students to how to use software tools that technical communicators need for

contemporary workplace practice. The course will develop students' conceptual knowledge of the capabilities and limitations of software that professionals use to create, deliver, and manage, technical communication. Included are principles of how technical communicators learn to use new software and how they evaluate its suitability for use in specific situations.

Learning Outcomes: 1. Describe and use basic, common tools for creating, managing, and delivering technical communication. 2. Explain concepts and features of commonly used technical communication software tools. 3. Explain how commonly-used technical communication tools fit into or alter processes of creating technical communication 4. Evaluate and recommend technical communication tools that meet the needs of specific situations.

Credits: 3.00

TCM 25000 - Career Planning In Engineering And Technology

Credit Hours: 1.00. Course will guide you through a systematic, hands-on approach to making career-related decisions. The course assumes that career planning is an ongoing process and requires understanding of self and one's environment; therefore, you will leave the course with the necessary tools to find and acquire an internship, co-op, or job now and in the future.

Credits: 1.00

TCM 31000 - Technical And Scientific Editing

Credit Hours: 3.00. The course focuses on techniques for editing functional technical and scientific products in academic and professional settings.

Credits: 3.00

TCM 32000 - Written Communication In Science And Industry

Credit Hours: 3.00. Analysis of current writing practices in technology and science, especially in organizational settings. Practice in designing and preparing reports for a variety of purposes and audiences.

Credits: 3.00

TCM 34000 - Correspondence In Business And Industry

Credit Hours: 3.00. The development and application of strategies and skills for writing letters for business and industry in technology and engineering. Applications may include resumes and letters of application, informational and persuasive letters, and in-house memoranda.

Credits: 3.00

TCM 35000 - Visual Technical Communication

Credit Hours: 3.00. Topics covered in this class include methods and principles of creating visual technical communication, basics of visual design, visualization of technical data, usability of visual technical communication products, the role of technical communicators in the workplace, and modern technology available to technical communicators.

Learning Outcomes: 1. Explain and apply basic principles of designing print and electronic products that communicate both visually and textually. 2. Analyze technical communication products that others have created in order to determine how the visual elements fit the communication situation. 3. Develop project management skills for technical communication context. Credits: 3.00

TCM 35800 - Technical Reporting Analysis And Development

Credit Hours: 1.00. This integrated technical communication course builds advanced technical reporting skills including analysis, synthesis, and development of technical content, structure, and style for technical audiences.

Credits: 1.00

TCM 35900 - Technical Data Reporting And Presentation

Credit Hours: 1.00. This integrated technical communication course builds advanced data reporting and presentation skills for technical and non-technical workplace audiences.

Credits: 1.00

TCM 36000 - Communication In Engineering Practice

Credit Hours: 2.00. The application of rhetorical principles to written and oral communication in the engineering professions. Planning, drafting, and revising professional engineering reports; planning and delivering oral presentations; organizing information; developing persuasive arguments.

Credits: 2.00

TCM 38000 - Technical Communication In The Healthcare Professions

Credit Hours: 3.00. Focuses on the writing demands of the healthcare industry and so includes principles of clear writing, concise style, and organized ideas. Students examine and write documents for audiences in their medical and clinical organizational contexts.

Credits: 3.00

TCM 41500 - Technical Communication For Design Projects

Credit Hours: 1.00. This integrated course applies advanced principles and theories of technical communication in a senior design project. Students will create and manage effective oral and written communication for workplace contexts.

Credits: 1.00

TCM 41600 - Advanced Technical Communication For Design

Credit Hours: 1.00. Students in this course integrate advanced technical communication principles as they complete senior projects.

Learning Outcomes: 1. Analyze the audiences for presentation of technical information. 2. Prepare and present technical information to technical and non-technical audiences. 3. Analyze data and create advanced visuals appropriate for technical reports. 4. Use presentation software effectively. 5. Work effectively in teams to plan, organize, and hold effective meetings. 6. Describe and use an advanced recursive planning and revision process for technical presentations and reports. Credits: 1.00

TCM 42000 - Field Experience In Technical Communication

Credit Hours: 1.00 to 3.00. Full- or part-time work in technical communications, supervised by a qualified professional in the cooperating organization and a faculty advisor. Requires periodic written and oral reports and final written and oral reports on work experience and assigned readings. Credit varies with scope of projects. Meets RISE criteria. May be repeated for a total of 4 credit hours. Permission of instructor required.

Credits: 1.00 to 3.00

TCM 42500 - Managing Document Quality

Credit Hours: 3.00. (ENG W532) This course examines and applies principles of creating technical publication in order to pursue quality management of the process. Students will produce effective publications by identifying and intervening in crucial points in documentation cycle - planning, researching, designing, drafting, reviewing, testing, and revising.

Credits: 3.00

TCM 43500 - Portfolio Preparation

Credit Hours: 1.00. Preparation of professional portfolio for review by faculty or subject matter experts. Includes readings and development of a professional career plan.

Credits: 1.00

TCM 49000 - Capstone In Technical Communication

Credit Hours: 3.00. This capstone course will apply skills and abilities from previous course work to complete activities and projects that demonstrate competence appropriate for technical communication workplaces. Students will reflect on and synthesize what they have learned throughout their technical communication studies and how that knowledge can be applied to future careers. Permission of instructor required.

Learning Outcomes: 1. Use a recursive communication process including planning, drafting, revising, and reviewing multiple versions of products. 2. Design information, perform tasks, and develop deliverables that meet audience and purpose needs. 3. Design usable content to meet compliance and production guidelines. 4. Manage projects to meet scheduled deadlines and monitor and report your progress. use advanced elements of technical and information literacy. 5. Analyze critically ethical issues in technical communication. Credits: 3.00

TCM 49900 - Issues in Technical Communcation

Credit Hours: 1.00 to 3.00. Topics of current and specialized interest for technical communicators. Hours and subject matter arranged by staff.

Credits: 1.00 to 3.00

TCM 51000 - Effective Workplace Technical Communication

Credit Hours: 3.00. Students from a variety of majors will blend theory and practice as they analyze variables in workplace communication contexts, apply iterative processes of creating effective technical communication, and produce publications within typical workplace technical communication genres.

Learning Outcomes: 1. Analyze workplace technical communication problems and recommend appropriate changes using arguments shaped by synthesis of secondary research findings. 2. Research, evaluate, select, organize, and present technical knowledge effectively to specific audiences in organizational settings. 3. Design communication that uses language and visual elements appropriately for the audience and circumstances in business and industry contexts. 4. Manage communication processes in individual and collaborative projects. 5. Evaluate relevant software to create and respond to technical communication. Credits: 3.00

TCM 54000 - Advanced Managing Document Quality

Credit Hours: 3.00 to 4.00. In this course, students will examine and apply principles of creating a technical or professional publication from start to finish Students will explore and practice publication quality management issues such as planning, researching audience and content, designing the publication, drafting, obtaining reviews, conducting usability testing, and negotiating within organizational cultures.

Learning Outcomes: 1. Explain the features that affect document quality. 2. Apply and explain the processes that lead to effective technical/professional publications. 3. Evaluate, use, and explain software tools that can aid technical communicators in managing the publication creation process. 4. Apply concepts relevant to effective processes that technical communicators need to understand. 5. Apply user-centered design principles and usability testing in the process of creating effective publications. 6. Synthesize ideas from secondary research concerning an emerging concept in the field that will be useful in professional practice. Credits: 3.00 to 4.00

TCM 55000 - Advanced Research Approaches For Technical And Professional Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of conducting applied research in technical and/or professional communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Generate effective research questions, suitable for workplace technical/professional communication research into audience, content, and communication approaches. 2. Conduct and report on results of secondary research relevant to technical/professional communication. 3. Design, conduct, and report on the results of primary research relevant to technical/professional communication. 4. Analyze reports of technical/professional communication research. 5. Explain the rationale for technical/professional research approaches, based on sound concepts and noting the capabilities and limitations of various approaches. Credits: 3.00 or 4.00

TCM 56000 - Technical And Scientific Communication In Academic Contexts

Credit Hours: 3.00. Develop reading, writing, and speaking skills for academic success as an engineering, science, or technology graduate student. Students analyze the structure, claims, and evidence of written documents and oral presentations. Students simulate these presentations and write similar documents to gain practical experience for successful writing and speaking in academic contexts.

Learning Outcomes: 1. Analyze examples of academic engineering, technical, and/or scientific written products and oral presentations to discover and identify conventions of discipline-specific content selection, organization, uses of visuals, and stylistic features. 2. Plan, prepare, and produce written and oral presentations, reports, and papers on engineering, technology, and science topics to technical and nontechnical audiences using the appropriate conventions for their fields. 3. Evaluate their own and other students' work, and provide constructive advice and feedback to colleagues as they develop their documents and presentations. Credits: 3.00

Technology

TECH 10000 - Technology Freshman Seminar

Credit Hours: 1.00. Technology Freshman Seminar.

Credits: 1.00

TECH 10001 - Polytechnic Success Seminar

Credit Hours: 1.00. This course is designed to provide information about the University environment, as well as to serve as an academic and socially supportive atmosphere, to aid the Polytechnic student in making the successful transition from high school to college. Permission of instructor required.

Learning Outcomes: 1. Identify student support services on campus in relation to personal and academic success. 2. Use appropriate tools and technologies that support and align with student success. 3. Demonstrate effective communication skills with faculty, staff and peers Identify and demonstrate traits consistent with effective time management and goal setting. Credits: 1.00

TECH 10100 - Women In Technology: Exploring The Possibilities

Credit Hours: 1.00. An in-depth view of the emerging role of women in technology. Presentations by career professionals and faculty in a variety of technology disciplines will increase familiarity with the diversity of programs within the school. Academic and interpersonal skills and strategies needed to succeed in technology careers, and issues such as balancing work and family, will be addressed.

Credits: 1.00

TECH 10500 - Introduction To Engineering Technology

Credit Hours: 3.00. Introduction to the different disciplines incorporated in engineering technology as well as the skill set needed to be a successful student in engineering technology. Focus will be on individual and professional development, problem identification, developing analytical skills, time and resource management, project planning, design, implementation and evaluation, and oral and written communication in the engineering technology profession.

Learning Outcomes: 1. Understand systematic approach to problem solving and design. 2. Understand measurement systems and the difference between fundamental and derived units. 3. Convert units between measurement systems and within measurement systems. 4. Perform dimensional analysis on complex engineering equations. 5. Understand significant figures, approximation, and rounding of results. 6. Appreciate the use of triangle trigonometry in the analysis of engineering systems. 7. Solve complex engineering equations. 8. Interpolate tabulated data. 9. Utilize spreadsheets for engineering calculations, data analysis, and data presentation. 10. Understand how to set up a laboratory experiment, gather and analyze data, and present the results in a proper format. 11. Students should understand professional registration and have an appreciation for professionalism and ethics in their careers.

Credits: 3.00

TECH 11000 - Freshman Honors Seminar

Credit Hours: 1.00. A first-year honors seminar designed to inform and challenge technology students. Discussion will include a broad range of technology and intellectual issues. By invitation or permission of the instructor. Permission of instructor required.

Credits: 1.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TECH 19900 - Special Topics In Technology

Credit Hours: 1.00 to 3.00. Special topics in Technology; subject matter to be arranged.

Credits: 1.00 to 3.00

TECH 22000 - Designing Technology For People

Credit Hours: 3.00. Innovating in our complex world requires understanding people and the issues and challenges they face. This unique course brings together perspectives from technology and anthropology to address this by exploring ethnographic studies of people and technology interactions. Through this process, students will practice the problem scoping skills necessary to identify and define problems and begin to generate appropriate design solutions. In addition, students will learn how to observe and talk with people about technology and discuss a range of ways people use technology. Accordingly, the course will focus on human-centered design and how to empathize with people during the design process. This will allow students to learn how to identify opportunities for innovation that emerge when designers carefully observe and listen to humans

using technology and/or experiencing problems with current technology. Note: This class engages the material in both the classroom and innovation labs.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

TECH 23199 - Professional Practice Extensive Seminar II

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical profession. Credits: 1.00

TECH 25000 - Technology Cooperative Education Practice II

Credit Hours: 1.00 to 3.00. Semester of external career related experiences designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required. Typically offered Fall Spring Summer.

Learning Outcomes: 1. Translate theory in to practice 2. Behave appropriately in the professional work environment. 3. Work within the ethical framework of the industry. Credits: 1.00 to 3.00

TECH 27199 - Professional Practice Extensive Seminar I

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions. Credits: 1.00

TECH 28155 - Technology Study Abroad

Credit Hours: 1.00 to 6.00. Faculty-led, short-term, study abroad experience with a technology-related focus. Topics and learning outcomes will vary by course offering. Instructor permission required.

Learning Outcomes: 1. Learning outcomes will vary by course offering. Credits: 1.00 to 6.00

TECH 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating exmployers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to

professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29900 - Special Topics In Technology II

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of technology provided by technology faculty.

Credits: 1.00 to 3.00

TECH 30000 - Technology Cooperative Education Practice III

Credit Hours: 1.00 to 3.00. Semester of external career related experiences designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required.

Credits: 1.00 to 3.00

TECH 30010 - Technology Career Enrichment Internship III

Credit Hours: 1.00 to 3.00. Semester of external career related experience designed to enhance the student's preparedness for entering an initial or secondary career. A minimum of 10 weeks and 200 hours are required. Instructor permission required.

Credits: 1.00 to 3.00

TECH 30100 - Renewable Energy Systems

Credit Hours: 3.00. Course provides the students with an introduction to renewable energy sources. Topics include photovoltaic, solar thermal systems, fuel-cells, hydrogen, wind power, waste heat, bio-fuels, wave/tidal power, geothermal power and hydroelectric. Analysis of technical, economic, environment, politics, and social policy are integral components of the course.

Credits: 3.00

TECH 30300 - Energy Efficiency And Auditing

Credit Hours: 3.00. Course discusses fundamentals of energy efficiency and energy auditing. Students will analyze audit data, research energy improvement measures, and prepare recommendations. Topics include energy audit process, energy audit reports, energy bill analysis, economic analysis, audit instrumentation, and will include a subset of the following: building envelope, electrical system, HVAC system, waste heat recovery, lighting, cogeneration, and other prevalent commercial/industrial systems.

Credits: 3.00

TECH 31000 - Seminar For Technology Transfer Students

Credit Hours: 1.00 to 4.00. A seminar and bridge course for Transfer Single Articulation Pathway Associate Degree graduates in EET and MET to prepare them for success in junior and senior technical classes.

Learning Outcomes: 1. Apply knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities. 2. Conduct standard tests and measurements to conduct, analyze, and interpret experiments, and to apply experimental results to improve processes. 3. Understand the need for an ability to engage in self-directed continuing professional development. 4. Know the impact of engineering technology solutions in a societal and global context. 5. Commit to quality, timeliness, and continuous improvement. Credits: 1.00 to 4.00

TECH 32000 - Technology And The Organization

Credit Hours: 3.00. A course intended to provide students with experiences mirroring what they will encounter in the world of work. Students will participate in interdisciplinary teams to explore technology solutions. Course topics include public policy, regulatory and ethical issues, teaming and leadership, and project management. Permission of department required.

Learning Outcomes: 1. Identify, apply and address public policy issues relevant to technology solutions. 2. Understand how technology solutions are developed, implemented, and maintained within a regulatory framework. 3. Identify, apply and address organizational ethics including conflicts of interest and individual ethical responsibilities. 4. Demonstrate the ability to function effectively in interdisciplinary teams. 5. Demonstrate effective oral and written communication skills. 6. Demonstrate project management competencies. Credits: 3.00

TECH 33000 - Technology And The Global Society

Credit Hours: 3.00. The intersection of technology, globalization, and society is at the core of this course. Students examine socio-cultural issues related to the development and use of technology across intercultural contexts, explore perspectives and principles behind global technology influences, and examine the complexities and ethical nuances of technology and innovation.

Learning Outcomes: 1. Reflect on the perceptions of cultural norms, interactions, gender roles, societal ethics, and religions in order to examine their potential impact on industry and society. 2. Evaluate digital media and socio-cultural information sources to predict their influence on individual and social interactions and perspectives. 3. Conduct formal and informal reflections about oneself and others, manage one's emotions in situations of differences, and apply techniques to bridge cultural differences. 4. Assess worldwide technology needs by examining global efforts, innovations, and issues that impact contemporary society. Credits: 3.00

TECH 33099 - Professional Practice Extensive Seminar III

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions. Credits: 1.00

TECH 33199 - Professional Practice Extensive Seminar IV

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical profession. Credits: 1.00

TECH 34000 - Prototyping Technology For People

Credit Hours: 3.00. Innovating in our complex world requires us to think strategically and make the best decisions possible for both designing and business development. Accordingly, this unique course brings together perspectives from technology and business management to iteratively prototype innovative solutions to student-selected problems. This process will include creating prototypes in a variety of media, using the appropriate methods/tools, as well as exploring the processes and biases related to how people process information and make decisions. This type of work will help to guide the innovation process by gaining insights from testing prototypes and interacting with people to deepen one's understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. At the conclusion of the course, students will pitch a viable design solution and business model for a validated problem to a variety of potential investors and/or stakeholders. Note: This class engages the material in both the classroom and innovation labs. Students of all levels of experience, will explore tools/programs related to computer aided design, 3D printing, app development, and digital prototyping.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to develop prototypes in a variety of media (digital and/or physical) for the level of fidelity necessary to communicate, understand, and test innovative ideas/designs. 3. Select and use appropriate methods/tools/equipment to make decisions and prototype innovative ideas. 4. Revise designs to reflect a deepening understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. 5. Pitch a viable design solution/business model for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

TECH 34099 - Professional Practice Seminar I

Credit Hours: 1.00. Optional co-op seminar course where

students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions.

Credits: 1.00

TECH 35000 - Technology Cooperative Education Practice IV

Credit Hours: 1.00 to 3.00. Semester of external career related experience designed to enhance the student's preparedness for entering an initial or secondary career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required.

Credits: 1.00 to 3.00

TECH 35010 - Technology Career Enrichment Internship IV

Credit Hours: 1.00 to 3.00. Semester of external career related experience designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required.

Credits: 1.00 to 3.00

TECH 35099 - Professional Practice Seminar II

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions.

Credits: 1.00

TECH 36099 - Professional Practice Seminar III

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions.

Credits: 1.00

TECH 38155 - Technology For Study Abroad

Credit Hours: 1.00 to 6.00. Faculty-led, short-term, study abroad experience with a technology-related focus. Topics and learning outcomes will vary by course offering. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering

Credits: 1.00-6.00

TECH 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems.

Credits: 0.00

TECH 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems.

Credits: 0.00

TECH 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems.

Credits: 0.00

TECH 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of

instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39699 - Professional Practice Internship

Credit Hours: 0.00 to 3.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems. Credits: 0.00 to 3.00

TECH 39900 - Special Topics In Technology III

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of technology provided by technology faculty.

Credits: 1.00 to 3.00

TECH 40000 - Technology Study Abroad

Credit Hours: 1.00 to 8.00. This course is utilized to record credits earned through participation in Purdue study abroad programs. Permission of instructor required.

Credits: 1.00 to 8.00

TECH 43099 - Professional Practice Extensive Seminar V

Credit Hours: 2.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions. Credits: 2.00

TECH 48155 - Technology Study Abroad

Credit Hours: 1.00 to 6.00. Faculty-led, short-term, study abroad experience with a technology-related focus. Topics and learning outcomes will vary by course offering. Instructor permission required.

Learning Outcomes: 1. Learning outcomes will vary by course offering. Credits: 1.00 to 6.00

TECH 49100 - Senior Seminar For Engineering Technology

Credit Hours: 1.00. A seminar course for programs in Engineering Technology that evaluates current practices and trends in engineering and technological industry through active learning processes. Typically offered Fall Spring.

Learning Outcomes: 1. Understand the need for and an ability to engage in self-directed continuing professional development through

particular active learning processes. 2. Understand the current practices and trends in engineering and technological industry. 3. Develop critical thinking ability on the current practices and trends in engineering and technological industry through various active learning processes. 4. Analyze the impact of engineering technology solutions in a societal and global context and further develop competence in applying learned knowledge on potential applications of engineering and technology. Credits: 1.00

TECH 49600 - Senior Design Project Proposal

Credit Hours: 1.00. Capstone problem identification and solution design course demonstrating synthesis of technical, professional, and general knowledge for senior engineering technology students. Proposal presentation is required.

Credits: 1.00

TECH 49700 - Senior Design Project

Credit Hours: 2.00. Teams will develop innovative solutions based on proposal outcomes in TECH 49600 for current issues in the engineering technology profession, workplace, or community. Project deliverable, presentation, and written report are required.

Learning Outcomes: 1. Present reports (oral or written) at each stage of the project. 2. Determine if the functional specifications of a project based on abstract concepts. 3. Design a block diagram for a project. 4. Determine the theoretical design based on functional specifications. 5. Write and implement a project test-plan. Credits: 2.00

TECH 49900 - Special Topics In Technology IV

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of technology provided by technology faculty.

Credits: 1.00 to 3.00

TECH 52200 - Sustainability Foundations

Credit Hours: 3.00. Emphasis is placed on definitions of sustainability for corporate, governmental and non-governmental organizations, as well as the frameworks used for developing and implementing sustainability programs. Areas of emphasis in environmental, economic, social, and energy sustainability are explored along with policy and regulations that apply to decision-making. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge in environmental, economic, energy, and social aspects of sustainability. 2. Identify key measurements for sustainability. 3. Understand the frameworks and system approaches for developing and implementing sustainability for both the public and private sectors. 4. Recognize policies and regulations needed for sustainability efforts. 5. Prepare and present a major project demonstrating in-depth knowledge of the current state of the literature, major challenges and proposed solutions for a specific sustainability project. Credits: 3.00

TECH 52300 - Sustainable Critical Infrastructures

Credit Hours: 3.00. This is an applied sustainability course that explores critical infrastructures needed for sustainability efforts, and explores several industrial segments in-depth including supply chain and energy. Frameworks for evaluating benefits versus risks will be introduced as well as metrics for evaluating. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge in critical infrastructures and policy implications for maintaining environmental, economic, energy, and social aspects of sustainability. 2. Identify key metrics for evaluating sustainability program effectiveness for both the public and private sectors. 3. Develop policies and regulations needed for sustainability efforts. 4. Prepare and present a major project demonstrating in-depth knowledge of the current state of the literature, major challenges and proposed solutions for a specific sustainability project. Credits: 3.00

TECH 52400 - Sustainability Analysis Assessment

Credit Hours: 3.00. Applied research project where students conduct a sustainability project under instructor guidance. Emphasis is on new developments relating to technical and operational aspects of sustainability as it applied in industry using triple bottom line evaluations. This course emphasizes a holistic approach to sustainability that includes environmental, economic, and social aspects as well as the impact of policy, standards and regulations on decision-making for sustainability. Permission of instructor required.

Learning Outcomes: 1. Describe and discuss multiple frameworks by which sustainability may

be applied and evaluated. 2. Demonstrate knowledge of seminal works in sustainability models, assessments and measurements. 3. Evaluate the sustainability of a product or process. 4. Independently design and implement sustainability improvements in a product or process. 5. Critically evaluate policies, standards and regulations in applied studies. 6. Demonstrate the research knowledge and skills required to conduct an applied sustainability project. 7. Prepare and present a major product demonstrating in-depth knowledge of the current state of the literature, major challenges and proposed solutions for a specific sustainability project. Credits: 3.00

TECH 53300 - Design Theory And Technology

Credit Hours: 3.00. This course provides an overview of theories and approaches to the transdisciplinary concept of design, spanning multiple disciplines and types of design outputs with a focus on technology. Students will read the work of leading design scholars, and situate their personal approach to design practice and research based on historical and current trends in the literature. Student work will be focused on theoretical and practical outcomes, with two main learning goals: 1) building upon and critiquing theories, methods, and processes of design in their original research; and 2) generating an awareness and representation of their personal design philosophy.

Learning Outcomes: 1. Situate design as a unique epistemology and ontology. 2. Explain key aspects of design activity. 3. Identify scholars, seminal works, and theories relating to design. 4. Distinguish between every day and professional design, craft, and art. 5. Critique theoretical foundations of their own discipline using the language and constructs of design theory. 6. Identify and articulate vital components of their design activity. 7. Synthesize and prioritize their design commitments. 8. Communicate their philosophy of design in multiple discipline-appropriate ways. Credits: 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

TECH 58300 - Smart Manufacturing Applied Technologies

Credit Hours: 3.00. This course addresses new content focusing on the 9 core capabilities and technologies that are at the forefront of digital transformation in the manufacturing industry. It also discusses the three core principles driving this transformation, particularly with the use of the Internet of Things (IoT) to create digital, smart, and connected systems using data to optimize key business drivers and objectives in manufacturing. The goal is to enable faster, flexible, and more efficient processes to produce higher-quality goods, reduce manufacturing costs, increase productivity, and foster industrial growth. These new concepts have not been previously taught at Purdue.

Learning Outcomes: 1. Analyze how the nine enabling technologies of Industry 4.0 are transforming the manufacturing industry. 2. Demonstrate understanding of the socio-economic impact of Industrial IoT and cyber-physical manufacturing systems will have on human workforce and the manufacturing industry alike. 3. Demonstrate how digital and data-assisted systems in manufacturing can be used for decision-making and augmenting human capabilities in manufacturing. 4. Analyze how information is acquired, exchanged, managed, and leveraged across manufacturing value chains. Credits: 3.00

TECH 58400 - Financial Analysis For Smart Manufacturing

Credit Hours: 3.00. The course will provide manufacturing professionals with foundational tools needed to conduct financial analysis for planning, implementing, and assessing Industry 4.0 projects focused on the application of technology for the integration of the smart manufacturing enterprise. The course begins with basic financial topics including financial statements, financial ratio analysis, and the strategic profit model, and then moves into concepts needed to address typical investment projects for Industry 4.0. Particular attention will be paid to asset lifecycle management models and the priorities that are important in the application of Industry 4.0 technologies to achieve performance improvements. Focus areas will include digital cost reduction efforts such as cost, level of effort, and impact needed to drive capital efficiencies and lower organizational costs. Project budgeting, savings and return on investment models, and project scalability and repeatability will

all be discussed. A final corporate financial investment project is required.

Learning Outcomes: 1. Use key financial statements including income statements and balance sheets, statements of retained earnings and statements of cash flows. 2. Use common financial tools to your advantage: ratio analysis, common-sized (percentage) statements, pro-forma statements, and time value associated with money. 3. Calculate a variety of financial ratios important in manufacturing productivity and asset management. 4. Identify the impact of the application of Industry 4.0 technologies on both the balance sheet and income statement of the organization. 5. Evaluate and select the best application of Industry 4.0 technologies, and finance it using appropriate capital investment opportunities. Credits: 3.00

TECH 60100 - Research Seminar In Technology

Credit Hours: 1.00. This course provides an introduction to the field and scholarship of Technology and the skills necessary for success. Prerequisite: Doctoral student standing.

Credits: 1.00

TECH 60200 - Seminar In Technology And Society

Credit Hours: 1.00. This course focuses on relevant issues and challenges facing professionals in technology-related careers. Topics may include, but are not limited to: ethics, legal issues, public policy, defining technology, and technology and society. Prerequisite: Doctoral student standing.

Credits: 1.00

TECH 60300 - Graduate Seminar - Planning

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives.

Learning Outcomes: 1. Create an Individual Development Plan. 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow for your studies. 4. Reflect on your progress to your future. 5. Critique your individual development plan. Credits: 1.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

TECH 62700 - Digital Leadership

Credit Hours: 3.00. This course will provide an overview of the strategic use and management of social media by technology leaders. In the digital age, technology and data transform every step of the business process, generating a need for new digital tools across all industries and capabilities. Technology innovation leaders and enterprise leaders must be conversant in current and emerging technologies, particularly the growing influence of social media, to identify opportunities and create competitive advantage. Permission of department required.

Learning Outcomes: 1. Identify the types and purposes of social media platforms to create strategic advantage. 2. Demonstrate the ability to create, manage, and/or update a social media presence for a business or organization. 3. Outline a strategic marketing plan for a business or organization. 4. Develop a Digital Portfolio to chronicle the social media research project. 5. Evaluate strategies for leveraging digital opportunities for more effective leadership. 6. Describe the six competencies that technology leaders need to lead effectively in the era of social media. Credits: 3.00

TECH 62800 - Technology Research And Use Of Data Analytics

Credit Hours: 3.00. Examines concepts, models and methods useful for applying data analytics in business environments. Focusing on Hypothesis generation, the capturing, storage and expression of data, analysis for research and visualization. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking abilities and analytical thought. 2. Identify a variety of data types and storage strategies. 3. Source, cleanse, join, and analyze a set of data yielding actionable insights that can be applied to research or business. 4. Discuss aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 5. Gain a wide

perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

TECH 62900 - Global Supply Chain Analysis & Optimization

Credit Hours: 3.00. This course will provide an overview to supply chain management including history of supply chain, elements of supply chain, interactions of supply chain elements, and factors that impact supply chain success.

Learning Outcomes: 1. Identify supply chain organizations and current trends in supply chain. 2. Demonstrate the demand planning elements of a product lifecycle and how to compute material requirements planning explosions. 3. Calculate forecasts using different approaches such as moving average and weighted moving average. 4. Offer critiqued solutions for impact to supply chain effectiveness. 5. Design a supply chain performance management system. Credits: 3.00

TECH 63000 - Leadership Of Cybersecurity & Cyberforensics

Credit Hours: 3.00. This course will provide an overview of cybersecurity for technology leaders. The digital age is ever changing and provides new challenges, threats and opportunities to the technologies that we use. As leaders, we need to learn the considerations of the impact of our decisions on the stakeholders in our environment and the risks they expose. In this course, we will analyze current trends and threats in the information security space. In addition, the course will also force the analysis of current computing environments and the unique challenges they can bring. Permission of department required.

Learning Outcomes: 1. Identify and analyze computing information security models and summarize their purpose. 2. Have the ability to identify and understand the concepts of Frameworks, Computing Environments, Cybercrime, Computing warfare and the internet as a holistic entity. 3. Critically assess their network environment and contrast it to various models of effective cybersecurity. 4. Identify and analyze common information security threats and demonstrate how these threats and threat actors relate to their network environment. 5. Analyze the current information security controls for their network environment. Credits: 3.00

TECH 63100 - Global Perspectives On Emerging Technologies

Credit Hours: 3.00. This course centers on an in-depth treatment of the discipline of technology and its intersections with culture, innovation and economics. Systematic analysis of technology and its international dimensions will be required as is horizon scanning, both nationally and internationally. Proficient written and oral communication is necessary for success. Permission of department required.

Learning Outcomes: 1. Develop and report an informed analysis of the influence (psychological, sociological and other) of technology on the culture, education, economy, lifestyle, standard of living of countries. 2. Compare and contrast selected country practices of technological human resource development/education and evaluate their capability to provide technically proficient personnel. 3. Advance and synthesize their international perspectives on the impacts that current and emerging technologies have on the economies, supply chain, culture, governance, environments and political character of developed and developing nations. 4. Perform a systematic horizon scan to identify, evaluate and synthesize key resources, i.e., publications, associations, agencies, etc., of relevance to advancing their practice of technology development, leadership and education. 5. Employ technology systems analysis procedures to explain the evolution trajectory of a historical or emerging technology. 6. Analyze and evaluate selected strategies for promotion and advancement of technological innovation capabilities of individuals, enterprises and nations. 7. Research, and describe cultural considerations necessary for international business and professional practice in technology in a variety of nations and regions. 8. Demonstrate scholarly proficiency in

assembling thoughts and writing and presenting on a topic of relevance to technology, culture and innovation. Credits: 3.00

TECH 63200 - Demographic Leadership

Credit Hours: 3.00. This course addresses the major underlying changes redefining the United States. It directly yet sensitively examines how we as individuals can more readily deal with demographic shifts, and in the end, how changes in racial and ethnic diversity and age distribution present us all an opportunity to be our better selves. Permission of department required.

Learning Outcomes: 1. Students will be able to synthesize and report on the ability to differentiate, question and analyze the changing demographics of our society and support or question conclusions. 2. Students will have the ability to synthesize, interpret and report on the concepts of unconscious/implicit bias. Additionally, the student will demonstrate proficiency in methodology in evaluating studies on this concept to create informed decisions. 3. Students will be able to critically assess demographic data and trends to formulate strategies for better decision making. Credits: 3.00

TECH 63300 - Strategic Management Of Technology Innovation

Credit Hours: 3.00. This course looks at how organizations manage the technology innovation process and the function of new product development teams. We discuss idea generation, new product research and development, management of the innovation process, strategies for successful deployment and marketing of technology innovation, applicable laws, and regulations, and return on investment. We will take a broad look at industry though three lenses: 1 - large public companies, 2 - mid-sized family and privately controlled enterprises, and 3 - entrepreneurially led startups.

Learning Outcomes: 1. Identify the drivers of technological innovation. 2. Describe the idea generation process leading to the development of a new product or service, taking it from concept through the patent process toward commercialization. 3. Articulate successful strategies and tactics to lead and manage the innovation process. 4. Investigate how different dimensions of organizational structure affect a firm's ability to innovate. 5. Discuss the role of team leadership and administration in ensuring the team has access to the resources it needs and that team members feel committed to team goals. 6. Identify the key elements of deployment including timing, licensing and compatibility, pricing, distribution, and marketing. Credits: 3.00

TECH 63400 - Global, Legal, Ethical Issues For Technology Leaders

Credit Hours: 3.00. In this course, the nature of contemporary ethical, legal, and technological issues facing organizational leaders are examined. Effective organizational leadership strategies will be explored through a series of readings, discussions, case studies and reflective practice, and organizational effectiveness will be discussed in terms of topics such as ethical decision-making, corporate social responsibility, codes of ethics, public policies/government regulations, the global environment, technological innovation, risk management, and specific areas of law covering health and safety, contracts, warranties and liabilities, intellectual property, technology, and international laws and regulations. Strategies for effective leadership within the framework of managerial decision-making in an ethical context will be examined. Graduate student standing or senior status with consent of instructor.

Learning Outcomes: 1. Interpret the various ways that technology is pervasive in contemporary society. 2. Analyze international ethical, legal, and technological issues in organizational settings through the case study methodology. 3. Apply ethical and legal principles to organizational and governmental processes related to technological change. 4. Engage in reflective practice, applying course theory to practical situations. 5. Create an academic research paper that addresses a topic of interest related to the intersection of global, legal, ethical issues for technology leaders utilizing appropriate techniques for academic research writing. Credits: 3.00

TECH 63500 - Global Perspectives In Emerging Technology

Credit Hours: 3.00. This course involves an in-depth treatment of technology and its intersections with culture, innovation and economics. Systematic analysis of technology and its international dimensions will be required. Horizon scanning both in North America and internationally is needed to succeed in this course as is proficient written and oral communication.

Learning Outcomes: 1. Develop and demonstrate an informed understanding of the influence (psychological, sociological and other) of technology on the culture, education, economy, lifestyle, standard of living of countries. 2. Describe various countries' practices of technological human resource development/education and their relationship to their capability for technology and development. 3. Form an international perspective on the impacts that current and emerging technologies have on the economies, supply chain, culture, governance, environments and political character of developed and developing nations. Credits: 3.00

TECH 63700 - Research Focus: The Social Internet

Credit Hours: 3.00. This course simulates an interdisciplinary think tank environment where students identify research questions and examine the impact of social media and social networking technologies on various aspects of society, business, culture, communication, web experience, and interface design. The course integrates immersion in social media with consideration of several theoretical perspectives from diverse fields. Students complete an original research project customized to fit individual or team interests. The course encourages theoretical and methodological diversity. Permission of instructor required.

Learning Outcomes: 1. Conduct independent research with and about social media on topics of their own interest. 2. Recognize the defining principles of social media. 3. Recognize the changes effected by social media in some major aspects of culture and society, as well as their own area of interest. 4. Identify major trends in social media research. 5. Create social media solutions and apply them to their own area of interest. Credits: 3.00

TECH 63800 - Leading & Managing Tech Organizations

Credit Hours: 3.00. This course will provide an overview of many Issues in leadership to include topics such as but not limited to Leadership framework, strategies, and an overview of critical business processes. Leading organizations and the teams within are elements of this course that will be addressed and demonstrated throughout the books and exercises in this course. We will focus on what is needed to be a great leader in various situations, and paths to improving leadership trust and leader thinking skills.

Learning Outcomes: 1. Identify issues in technology-focused places of work (to include problem-solving plans), determine the potential impacts of leader actions, critically analyze process changes (pros/cons) and possible further actions for improvement. 2. Demonstrate the ability to create a positive work environment (with peer review), analyze the work environment (company culture and impact on others), and review/revise for follow-up and further improvement. 3. Outline a plan to improve training in a technology-based workplace, with a focus on development of continuous self-improvement of critical thinking skills, along with analysis of other areas for improvement. (Teamwork (peer-reviewed), feedback, analysis, and reporting is required throughout this course.) Credits: 3.00

TECH 64000 - Research DTech Thesis

Credit Hours: 1.00 to 18.00. This course will be the research course for Online Doctor of Technology (DTech) students. This research dissertation course is to reflect the student's work to prepare and pass the preliminary examination, prepare and pass the dissertation proposal and successfully defend and pass the DTech dissertation.

Learning Outcomes: 1. Acquire skills involved with conducting academic and scholarly research in a rigorous manner. 2. Learning objectives will be specific and unique to the student's research area as outlined by the student's major professor and advisory committee. Credits: 1.00 to 18.00

TECH 64100 - Advanced Analytics For Research And Industry

Credit Hours: 3.00. Offers students training and experience in advanced parametric statistical techniques in both research and industrial applications. While statistical theory necessary to properly conduct analyses will be discussed, this course focuses on practical applications of analysis strategies, including issues in handling data from organizations and industry settings. Material includes overview and implementation of relevant statistical software applications. Practical skills in presenting advanced analyses to both

professional and scientific audiences is a key component of the course. Prerequisites: IET 50700 or STAT 50100 . Permission of instructor required.

Learning Outcomes: 1. Explain the types of analyses available to solve various industrial and organizational problems, the rationale behind analytic selection, and be able to select the appropriate analyses for a variety of situations. 2. Explain the role of employees at all levels in planning, conducting, or participating in effective research, and how to properly integrate input and data from various levels of an organization or laboratory research design into comprehensive analyses. 3. Design, set up, run, evaluate, and interpret advanced statistical analyses in real-world and laboratory settings, and explain these findings to both lay and expert audiences. 4. Read, interpret and critically evaluate complex and multivariate analyses reported in applied research journals. 5. Set up and interpret computer data sets and outputs which are required to carry out analyses, and write up in proper publication format the results of such outputs. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

TECH 67600 - Analysis Of Research Methods

Credit Hours: 3.00. Analysis of research and evaluation of research reports and funding - emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, business, and government environments.

Learning Outcomes: 1. Identify descriptive statistics appropriate to sampling used. 2. Evaluate appropriate use of inferential statistics. 3. Determine when data favor nonparametric vis-a-vis parametric statistical analysis. 4. Use manual and library database methods to find appropriate research and write an appropriate research report that will add to your body of knowledge. 5. Explain procedures for computer-aided data base searches of published research. 6. Identify descriptive research, surveys, and prediction studies. 7. Differentiate between experimental and quasi-experimental studies. 8. Identify common errors in research. 9. Develop a working knowledge or basic vocabulary and concepts or research methods (quant and qual). 10. Evaluate and critique research studies and articles. 11. Be familiar with a multitude of different types of research. 12. Differentiate between varying qualities of research studies and reports. 13. Understand how and why a university does research and how it is funded. 14. Have tools and knowledge to build and/or enhance the framework of your proposal or thesis. Credits: 3.00

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

TECH 69500 - Graduate Professional Practice

Credit Hours: 0.00. Advanced professional experience in Technology. The experience is coordinated by the major professor with cooperation of a participating employer. Students submit a summary report. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively in their field of study. 2. Think critically, creatively, and solve problems in Technology. Credits: 0.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying

qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Technology Leadership and Innovation

TLI 10000 - Organizational Leadership Career Orientation

Credit Hours: 1.00. In this course students are introduced to potential organizational leadership-related career paths. Topics include introduction to organizational leadership careers, self-assessment and career alignment, and networking and professional development.

Learning Outcomes: 1. Define various organizational leadership-related career paths. 2. Apply self-assessment techniques to identify personal strengths and areas for development. 3. Examine the role of professional networks in careers. Credits: 1.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 11500 - Foundations Of Conflict Competence: Navigating Conflict For Growth And Resolution

Credit Hours: 3.00. This course equips students with the knowledge and skills necessary to become conflict-competent individuals who can turn conflicts into opportunities for growth, learning and building stronger connections with others. Participants will understand conflict competence, explore different conflict resolution approaches, develop strategies for repairing relationships harmed by conflict and identify university resources available to assist with conflicts.

Learning Outcomes: 1. Explain the concept of conflict competence. 2. Expand understanding and use of a range of conflict strategies to improve relationships. 3. Increase awareness of methods for repairing relationships harmed by conflict. 4. Identify campus resources to assist with conflicts. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

TLI 15500 - Foundations Of Learning In Human Resource Development

Credit Hours: 3.00. This course explores the concept of learning within the interdisciplinary field of Human Resource Development, focusing on how people learn in different environments in the workplace - both formal (e.g., training) and informal (e.g., on the job). The course will cover theoretical frameworks, learning methods, and practical applications to

enhance workplace learning and outcomes.

Learning Outcomes: 1. Understand key theories and concepts of learning in HRD. 2. Analyze the impact of cognitive, social, and cultural factors on workplace learning. 3. Explain the role of technology in workplace learning. 4. Evaluate assessment and evaluation approaches in workplace learning. 5. Apply learning principles to real-world workplace challenges. Credits: 3.00

TLI 16100 - Prototyping In Engineering/Technology Education

Credit Hours: 3.00. Design, make, and innovate! This course provides basic instruction on the proper and safe use of tools and equipment used to prototype innovative ideas. This includes 3D printers, laser cutters/engravers, fabrication tools/equipment, CNC mills/routers, and microcontrollers/microcomputers.

Learning Outcomes: 1. Demonstrate the technical competencies to properly and safely operate common prototyping equipment and tools. 2. Apply knowledge of materials properties to select the appropriate materials for a desired prototype. 3. Create operations process flow charts for planning product development. 4. Test prototypes in real situations to gather data related to their performance. Credits: 3.00

TLI 20000 - Organization Leadership Career Exploration

Credit Hours: 1.00. In this course students continue their exploration of organizational leadership-related career opportunities. Topics include resume building and internship search strategies, interview skills and professional etiquette, and identifying and securing internships.

Learning Outcomes: 1. Apply resume-building strategies to highlight organizational leadership experiences. 2. Create a professional digital presence through relevant platforms. 3. Evaluate the impact of experiential learning on personal and professional development. Credits: 1.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

TLI 25500 - Foundations Of Human Resource Development

Credit Hours: 3.00. Much has been discussed about the importance of people in organizations, difficulties within organizations, and challenges faced by today's organizations. This course covers the field of human resource development (HRD) as an important area of practice within organizations. The course provides an introduction to HRD theories, principles, concepts, and practices. It provides foundations through the study of history, current paradigms, and perspectives on the future of the field of HRD while specifically focusing on training and development, organization development, and career development as organizational functions within HRD.

Learning Outcomes: 1. Conduct a learning assessment. 2. Conduct a performance assessment. 3. Write training performance improvement objectives. 4. Describe core HRD functions. 5. Describe methods of HRD program evaluation. Credits: 3.00

TLI 26200 - Foundations Of Integrated STEM Education

Credit Hours: 3.00. This course provides students with a conceptual understanding of an integrated approach to teaching Science, Technology, Engineering, and Mathematics (STEM). Integrated STEM pedagogies include project/problem-based (PBL), design-based, and inquiry-based approaches to teaching. Students engage in a co-teaching model to deliver STEM instruction and observe local K-12 classrooms.

Learning Outcomes: "1. Identify foundational learning theories that blend an integrated approach to teaching. 2. Identify common practices for scientists, technologists, engineers, and mathematicians and similarities with other STEM careers. 3. Describe the key

tenants of PBL, design-based, and scientific inquiry-based approaches to teaching content. 4. Create integrated STEM lessons that address two STEM subjects and state/national standards. Credits: 3.00

TLI 26500 - Teaching The TE Of STEM

Credit Hours: 3.00. A course for teacher education majors that provides rationale and techniques for integrating engineering and technological literacy into the K-12 mathematics and science curriculum. Experiences focus on the engineering design process, mechanisms, robotics, strength of materials, electrical circuits, and electronics.

Learning Outcomes: 1. Describe the national importance of the integrative nature of the K-12 STEM curriculum. 2. Describe how technology and engineering can be integrated into K-12 mathematics and science. 3. Demonstrate hands-on learning activities appropriate to integrate technology and engineering into the K-12 STEM curriculum. Credits: 3.00

TLI 29000 - Independent Study In Technology Leadership And Innovation

Credit Hours: 1.00 to 3.00. Supervised individual study in technology leadership and innovation topics. Permission of instructor required.

Credits: 1.00 to 3.00

TLI 29900 - Special Topics In Technology Leadership & Innovation

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faulty. Group instruction in new or specialty areas of Technology Leadership and Innovation is provided by Technology faculty, subject to TLI Curriculum Committee approval.

Credits: 1.00 to 3.00

TLI 30000 - Organizational Leadership Career Transition

Credit Hours: 1.00. In this course students prepare to make the transition from organizational leadership students to organizational leadership professionals. Topics include career planning and advancement, professional networking and relationship building, and transitioning successfully from college to career.

Learning Outcomes: 1. Demonstrate career planning and advancement strategies. 2. Apply effective networking strategies for professional growth. 3. Synthesize achievements into a professional portfolio for presentation. Credits: 1.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

TLI 31500 - New Product Development

Credit Hours: 3.00. This course introduces the process of technological innovation and new product development from concept to commercialization. Topics covered include ideation, R&D, prototyping (design and modeling), testing for quality, the patent process, intellectual property rights, marketing and cost evaluation.

Learning Outcomes: 1. Describe the process of innovation as it relates to new product development. 2. Identify quality standards and testing procedures for new products. 3. Describe the patent process. 4. Explain methods for protecting domestic and international intellectual property rights. 5. Describe the process for conducting market research. Credits: 3.00

TLI 35510 - Training And Talent Development

Credit Hours: 3.00. This course is designed to develop theoretical and applied perspectives on needs assessment, design, development, delivery, and evaluation of training and

development in organizational contexts. Emphasis is placed on assessing learning and performance outcomes throughout the training and development process. Implication of training to talent development are also highlighted in a highly automated workplace.

Learning Outcomes: 1. Conduct a training needs assessment. 2. Analyze job tasks for purposes of planning training activities. 3. Write training learning objectives. 4. Describe an instructional system design process. 5. Describe methods of training program evaluation. 6. Identify talent development approaches in a digitalized economy. Credits: 3.00

TLI 35520 - Organization Development And Change

Credit Hours: 3.00. This course provides an introduction to major theories, concepts, skills and techniques for the practice of organization development processes and interventions using a consultancy approach. Implications for organizational change are integrated as part of an OD effort.

Learning Outcomes: 1. Describe the historical roots and theoretical underpinnings of organizational development. 2. Apply the action research model for professional practice. 3. Effectively participate in small groups. 4. Identify intervention strategies at the individual, small group, and large systems levels. 5. Conduct organization development analysis. Credits: 3.00

TLI 35530 - Strategic Human Resources

Credit Hours: 3.00. This course equips you with the skills to lead strategic human resource initiatives, enhancing your understanding of how HR strategy impacts organizational performance. Strategic Human Resources involves aligning HR practices with organizational goals to optimize the value of human capital. As future HR professionals, you will learn to contribute significantly to strategic planning and organizational success by leveraging human talent strategically and effectively.

Learning Outcomes: 1. Design and execute HR strategies that align with organizational goals and enhance overall performance. 2. Assess how various HR practices contribute to achieving strategic objectives and improving organizational outcomes. 3. Apply HR strategies to various case studies from actual company/industry scenarios to address key business issues and leverage human capital effectively. 4. Gain a deep understanding of the principles and theories underlying strategic HR and their application in real-world scenarios. 5. Identify and propose solutions to current strategic business issues faced by HR professionals in today's dynamic workplace. Credits: 3.00

TLI 35540 - Staffing Organizations

Credit Hours: 3.00. This course provides an overview of the processes by which organizations staff positions with both internal and external applicants. The course covers theory, research, and legal foundations that inform organizational staffing actions. Topics include staffing strategy and context, measurement of staffing effectiveness, job/competency analysis, human resource planning, recruitment and job choice, retention, and internal and external selections practices.

Learning Outcomes: 1. Describe the role of staffing to support an organization's strategy and to improve productivity. 2. Develop a model for staffing an organization that supports company's human resources strategy and sustains productive operations. 3. Describe the key legal compliance issues associated with staffing organizations. 4. Develop recruitment plans using both internal and external recruitment. 5. Design a selection process that incorporates a variety of assessment methods and a supporting decision method for candidate selection. 6. Develop a workforce retention program for an organization. Credits: 3.00

TLI 35550 - Compensation And Rewards

Credit Hours: 3.00. This course examines the compensation and reward structures of organizations. It covers the planning and implementation of a total compensation system, including job evaluation, salary survey and analysis, benefits, and development of a structured pay system. Included are behavior implications and legal compliance issues related to compensation and rewards.

Learning Outcomes: 1. Differentiate traditional, incentive, and person-focused pay systems. 2. Describe the process of building internally consistent compensation systems. 3. Build a market-competitive compensations system. 4.

Differentiate discretionary versus legally required benefits. Credits: 3.00

TLI 35560 - Employment And Labor Law For The Human Resource Professionals

Credit Hours: 3.00. This course provides a foundation for understanding the impact of labor laws and legal issues in organizations. Topics include corporate social responsibility, employment law, environmental issues, conflict resolution, and global challenges.

Learning Outcomes: 1. Select and apply legally and practically appropriate staffing techniques according to basic principles of validity and reliability. 2. Articulate the value of employee training, development, job design, and job enrichment. 3. Summarize basic components of compensation plans and performance evaluation systems, assess potential deficiencies, and compare elements as they relate to organizational objectives. 4. Apply major labor laws to employment practices in employee relations, health, safety and security, and to consider the connection between labor relations practices and outcomes. 5. Articulate unique challenges throughout HRM related to practice in public, private, and non-profit sectors. 6. Compare HRM practices and policies from varying perspectives, evaluate source credibility, and draw conclusions based on that information. Credits: 3.00

TLI 35570 - Job Analysis And Job Design

Credit Hours: 3.00. This course demonstrates procedures for analyzing tasks related to specific jobs. Topics include collecting occupational data and information, the relevance of job analysis on individual and organizational performance, impact on training and development, and associated legal issues.

Learning Outcomes: 1. Explain the background and progression of job analysis techniques. 2. Collect information about jobs and develop an organized job analysis report. 3. Conduct job analysis. 4. Effectively utilize the Dictionary of Occupational Titles and O*NET to gain occupational information. 5. Recognize HR Information System and its relationship with compliance with federal and state regulations/Laws. 6. Analyze jobs within an organization for the purpose of developing training or recommending other performance interventions. 7. Demonstrate various uses of job analysis. 8. Articulate the role of a job analysis in the improvement of organizational performance. Credits: 3.00

TLI 35580 - The Individual And Organizational Performance

Credit Hours: 3.00. This course develops an understanding of the principles and theoretical foundations of individual and organizational performance management. Emphasis is placed on the perspectives, methodology, and theoretical frameworks as well as applications for performance management from the perspective of human resources professionals.

Learning Outcomes: 1. Develop an understanding of the principles and theoretical foundations of individual and organizational performance management. 2. Identify and analyze performance problems in an organizational system. 3. Identify and evaluate interventions in performance improvement at different levels (individual, team/process and organizational). 4. Understand human resource approaches to individual and organizational performance management. 5. Examine various technologies for managing individual and organizational performance. Credits: 3.00

TLI 36100 - Engineering And Technology Education Instructional Planning And Evaluation

Credit Hours: 3.00. This course addresses selecting content, writing instructional objectives, planning lessons, preparing a unit of study, and evaluating student progress. Emphasis is placed on evaluating instruction and student achievement to include developing valid, reliable testing instruments as they relate to measuring student achievement in the cognitive, affective, and psychomotor domains.

Learning Outcomes: 1. Demonstrate instructional planning skills related to the delivery of engineering/technology education to both middle-level and high school students. 2. Prepare lesson plans, a unit of study, and evaluation instruments. 3. Appraise instructional material effectiveness and propose revisions for improvement. 4. Prepare appropriate

assessment instruments that align with identified learning objectives. Credits: 3.00

TLI 36700 - Teaching Design And Innovation I

Credit Hours: 3.00. This course focuses on the development of appropriate engineering design knowledge and skill required to effectively teach middle and high school engineering/technology education courses by infusing engineering design into the curriculum. Students will use 3-D solid modeling software, rapid prototyping, and other design technologies as they engage in the engineering design process through an open-ended engineering design challenge.

Learning Outcomes: 1. Display the ability to teach students to develop skills for living in a knowledge-based, technological society using design-based pedagogical approaches. 2. Use the engineering design process to solve open-ended, ill-defined problems. 3. Demonstrate the ability to teach basic engineering design techniques. Credits: 3.00

TLI 45560 - Professional Internship In Human Resources

Credit Hours: 3.00. The undergraduate internship course is designed as a culminating learning experience for students nearing graduation. Students have an opportunity to seek out practical work experience related to human resources to use knowledge acquired in the classroom. The course will serve as a professional development opportunity helping students reflect and build upon their experiences gained through the required 500-hours human resources related work.

Learning Outcomes: 1. Learn and grow personally and professionally from an internship experience. 2. Express gained competencies and skills through evidence and critical reflection. 3. Receive, evaluate and apply constructive performance feedback and evaluation, as assessed by the internship supervisor. 4. Understand one's self in a professional context. 5. Integrate HRD theory and professional practice. Credits: 3.00

TLI 45570 - Global Human Resources

Credit Hours: 3.00. This course prepares students to lead human resource activities within a global, technology-driven economy and business environment. Topics include recruitment, training and development processes, cultural issues, policies and regulations within a global and international context.

Learning Outcomes: 1. Identify the main differences between domestic and international human resources. 2. Understand the challenges of international business dynamics on international human resources and the procedures for preparing employees for international assignments. 3. Understand how managing expatriates helps to improve their performance and minimize their business failures in international assignments. 4. Recognize that training and development of expatriates is a key factor for their success in their assignments. 5. Understand the complexity of international human resources and the need for staffing international human resources in accordance to the models of business organizations. 6. Recognize the challenges of repatriation of expatriates and develop the skill to minimize their stress in the parent country organizations. 7. Recognize the need for balancing the process international human resource adaptation and standardization in the host country. 8. Identify relevant theories on performance management in the context of international human resources. 9. Develop intercultural knowledge and competence. Credits: 3.00

TLI 45580 - Human Resource Information Systems And People Analytics

Credit Hours: 3.00. This class surveys Human Resource Information Systems (HRIS) to understand how they facilitate communication processes, policy implementations and change management. Big data is transforming how firms recruit and develop talent and this course introduces concepts and methods for making better through people analytics.

Learning Outcomes: 1. Translate the origins of HR Information Technology to an organization; and infer the need to obtain involvement and commitment from others to set in place mechanisms to affect successful Human Resources Information System Programs and strategies. 2. Develop an understanding of basic systems and the criteria for success in using HR software in organizations. 3. Identify

HR Information Systems trends. 4. Detail various approaches to Human Resources Information systems design, selection and implementation and define characteristics of current Human Resource Information technology implementation strategies. 5. Recognize HR Information System and its relationship with compliance with federal and state regulations/Laws. 6. Explain benefits of new technologies in recruiting and training in individual development of employees. 7. Describe and discuss the various HR Portal and associated programs and their associated values, costs, and benefits to the organization. 8. Students will employ statistical software to conduct quantitative analyses, for example to predict the potential of applicants to improve hiring decisions or to evaluate the effectiveness of training and talent development programs. 9. Students will learn how to manage the workforce and how to take advantage of analytics in their decision making process. Credits: 3.00

TLI 45590 - Foundations Of Human Resources Capstone

Credit Hours: 3.00. This course synthesizes all of the required and secondary content areas described in the SHRM HR Curriculum Guidelines. Students will prepare for the SHRM Certified Professional (SHRM-CP) exam while demonstrating their accumulated knowledge and in the area of human resources.

Learning Outcomes: 1. Reflect on the entire HR-related areas. 2. Synthesize all HR-related knowledge, skills, and competencies. 3. Engage in test-taking for obtaining licensure. 4. Demonstrate an understanding of all HR-related concepts, terms, applications, and processes. 5. Successfully complete mock SHRM-CP exams. Credits: 3.00

TLI 45800 - Leadership For Competitive Advantage

Credit Hours: 3.00. Organizations who consistently outperform competitors realize bottom-line impact through efficient leveraging of organizational strategy, leadership, internal and external talent acquisition, organizational culture, and marketing strategies. This course will explore the relationships between these areas and introduce organizational tools and concepts to enable the student to recognize and build capacity for sustainable competitive advantage in technology organizations.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

TLI 45810 - Internship Program

Credit Hours: 1.00. An internship designed to combine university study with work experience directly related to the student's plan of study. Permission of department required.

Learning Outcomes: 1. Apply organizational leadership theory in a corporate environment. Credits: 1.00

TLI 45820 - Internship Program Seminar

Credit Hours: 2.00. An internship designed to combine university study with work experience directly related to the student's plan of study. Includes reflection on interning experience as well as a written final paper and oral presentation covering the student's internship experience. Permission of department required.

Learning Outcomes: 1. Compare and contrast internship experiences of different types of organizations. 2. Describe the internship experience. 3. Evaluate the effectiveness of the internship experience. Credits: 2.00

TLI 46000 - Teaching Design And Innovation II

Credit Hours: 3.00. This course expands the engineering design process, incorporating rapid prototyping and other fabrication technologies to create a specified solution. The course emphasizes process flow chart planning and logistics of engineering/technology education laboratory management. Prototypes will be tested in real situations and data gathered on performance. Designs will be revised to reflect a deeper understanding of manufacturing and use, being sensitive to structure, function, and behavior from a systems-level perspective. Intellectual property, marketing, and infrastructure will be discussed.

Learning Outcomes: 1. Describe the complexity of implementing design solutions. 2. Select appropriate fabrication technologies. 3. Operationalize performance criteria into measurable variables. 4. Gather data to make

rational decisions, which are transparent and justifiable. 5. Optimize design solutions and perform iteratively in the design process. Credits: 3.00

TLI 46100 - Engineering/Technology Teacher Lab Planning

Credit Hours: 3.00. This course provides future engineering/technology education teachers with information on designing, organizing, and managing engineering/technology education facilities. An in-depth study of specific laboratory requirements related to safety is covered. Management skills related to students, equipment, and supplies are addressed. Students design an engineering/technology education laboratory.

Learning Outcomes: 1. Develop techniques for planning and organizing laboratory tools, supplies, and equipment for efficient and educationally sound laboratory operation. 2. Explain the importance of safety in engineering/technology education facilities and prescribed methods of rendering facilities safe for student activities. 3. Describe government requirements and mandates related to the engineering/technology education laboratory. 4. Develop a system for inventory, purchase, and maintenance of equipment and supplies for an instructional facility. 5. Design an engineering/technology education laboratory. Credits: 3.00

TLI 46200 - Methods Of Teaching Engineering/Technology Education

Credit Hours: 3.00. Students identify a variety of instructional techniques appropriate for teaching engineering/technology education. Students will present lessons and develop evaluation instruments to determine student achievement. Methodological insights and understanding for teaching technical subject matter is stressed.

Learning Outcomes: 1. Demonstrate skills in delivering instruction using various teaching methods. 2. Demonstrate different techniques for addressing cognitive, affective, and psychomotor domains of learning. 3. Design and prepare teacher-made lesson materials. 4. Demonstrate skills in delivering instruction using various teaching methods. Credits: 3.00

TLI 49000 - Independent Study In Technology Leadership And Innovation

Credit Hours: 1.00 to 3.00. Supervised individual study in technology leadership and innovation topics. Permission of instructor required.

Credits: 1.00 to 3.00

TLI 49800 - Undergraduate Research In Technology Leadership And Innovation

Credit Hours: 1.00 to 3.00. Students will conduct research in the area of technology leadership and innovation with a primary investigator. The primary focus of the course is to contribute to ongoing research, while learning current research techniques. Analyzing data, determining courses of action, developing critical thinking, and presenting results are emphasized. Requires prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Learning Outcomes: 1. Demonstrate subject-matter competency, integrating technology theories. 2. Conduct research using generally accepted methods appropriate for the research question. 3. Demonstrate critical thinking skills. 4. Explain various ethical issues facing researchers in technology. Credits: 1.00 to 3.00

TLI 49900 - Special Topics In Technology Leadership & Innovation

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faulty. Group instruction in new or specialty areas of Technology Leadership and Innovation is provided by Technology faculty, subject to TLI Curriculum Committee approval.

Credits: 1.00 to 3.00

TLI 52000 - Foundations Of Innovation Studies

Credit Hours: 3.00. Foundations Of Innovation Studies has been designed to provide a broad spectrum introduction to the field of innovation studies. Students will gain practical and theoretical knowledge of innovation at a variety of levels, including the individual, team, organizational, and ecosystem contexts. Students will examine innovation strategies and tensions within the innovation "Triple Helix" of industry, academia, and government through the use of case studies and individually selected research reports. Throughout the class, students will examine recent innovation efforts and present short innovation cases that align with the learning objectives of the class.

Learning Outcomes: 1. Identify innovations in multiple settings and define the key characteristics that enabled those innovations. 2. Relate multi-level innovation practices to institutional outcomes. 3. Define and contrast

the conditions that foster innovative thinking and development. 4. Critically assess modern examples of innovation and suggest ways to improve outcomes. Credits: 3.00

TLI 54000 - Smart Manufacturing Enterprise: Organizational Behavior And Leadership In The Digital Enterprise

Credit Hours: 3.00. Smart manufacturing is about increasing efficiency and eliminating pain points in your system. It's characterized by a highly connected, knowledge-enabled industrial enterprise where all organizations and operating systems are linked, leading to enhanced productivity, sustainability, and economic performance. Implementing smart manufacturing techniques requires an effective understanding of organizational behavior and leadership skills required for the new digital enterprise. This knowledge of individuals' perceptions, attitudes, and behavior enables leaders to choose appropriate leadership styles and managerial practices to increase organizational effectiveness and positive human outcomes. This course will provide an overview of organizational behavior and leadership concepts important for implementing change within a smart manufacturing enterprise.

Learning Outcomes: 1. Critique the opportunities and challenges related to organizational behavior resulting from implementing smart manufacturing and Industry 4.0. 2. Apply organizational behavior theories, frameworks, principles and tactics to prevent and respond to organizational behavior problems driven by employing smart manufacturing related changes. 3. Evaluate an understanding of one's own leadership style and create a plan to improve their own personal leadership skills. Credits: 3.00

TLI 62500 - Research In Open Innovation I

Credit Hours: 3.00. This is a research-oriented course designed for graduate students who aim to develop and implement a scientific research project in the field of open innovation. They will critically discuss and evaluate scientific writings relevant to the new research area of open innovation from the fields and disciplines of innovation studies, information systems, and other social sciences. Through synthesis of theories and frameworks used in academic articles, the students will develop a theoretically and practically motivated research question. They will also implement a pilot study to examine their hypotheses. The Research Center for Open Digital Innovation (RCODI) in the Discovery Park at Purdue will offer opportunities to plan and implement individual questions, if students have not identified their own data source. In addition, the students will participate in an action-oriented research project in open innovation performed by the class as a group project to gain experience in experimental innovation research and practice. Prerequisites: Basic statistics (at least STAT 30100 or equivalent, STAT 50100 or higher is recommended); foundational knowledge in scientific research (TECH 64600 or SOC 58000 or equivalent). Permission of instructor required.

Learning Outcomes: 1. Evaluate and synthesize scientific literature on open innovation. 2. Develop a research question and model for an empirical study in the field of open innovation. 3. Implement a pilot study in open innovation and prepare a scientific article. Credits: 3.00

TLI 62600 - Technology Entrepreneurship And Research Translation

Credit Hours: 3.00. (ABE 62600) The course is designed to introduce graduate students and faculty mentors to the intellectual, financial, and management processes associated with translating research into tangible products through university initiated, early-stage commercialization (start-up) activities. Lectures will present case studies of technologies and pathways to commercialization. Guest speakers will illustrate the start-up process through real-world experience, and will also address approaches for managing entrepreneurial activities, intellectual property and conflicts of interest in a university environment. No course prerequisites, however students should be involved in research with commercial implications. Permission of instructor required.

Learning Outcomes: 1. Understand the processes through which translation of research from laboratory to products occur. 2. Describe technologies and commercialization strategies for IT, analytical instrumentation, biopharmaceutical, biomedical, biofuels, and other technologies. 3. Achieve literacy in the business and other discourse related to intellectual property and technology commercialization. 4. Be connected to a network of innovators, entrepreneurs, and service providers on and off campus. 5. Execute analysis required to determine if, how, and when to launch new technologies into a translational pathway. Credits: 3.00

TLI 66200 - Philosophy Of Technology

Credit Hours: 3.00. The term technology has multiple meanings and applications so vast that one clear and all-encompassing definition of the term has become unattainable. However, to build an epistemology of technology, we must explore ways to

define technology so to provide a foundation for a philosophy of technology. This course will explore multiple views and definitions of technology embedded within the scholarly work focused on technology in order to build and defend a philosophy of technology.

Learning Outcomes: 1. Develop a working definition of technology. 2. Describe the multiple views of technology and explain how these views shape the way people develop a philosophy of technology. 3. Identify ways in which technology influences society and how society influences technology. 4. Debate the lines between science vs. technology in order to identify their similarities and differences. 5. Explore the ethical implications of technology. Credits: 3.00

The Data Mine

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 11100 - Corporate Partners I

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire

new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 11200 - Corporate Partners II

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 19000 - The Data Mine Special Topics

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the freshman level for undergraduates are given under this number.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 5.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits:

1.00

TDM 21100 - Corporate Partners III

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 21200 - Corporate Partners IV

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 29000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting,

manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 31100 - Corporate Partners V

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 31200 - Corporate Partners VI

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 39000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 41100 - Corporate Partners VII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 41200 - Corporate Partners VIII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 49000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

TDM 50100 - The Data Mine Seminar

Credit Hours: 1.00. Intended for any student across campus desiring broad coverage of data science and analytics topics.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the

difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 51100 - Corporate Partners

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 59000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. Focused topical coverage of data science and analytic topics intended for any student across campus.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

Theatre

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery

Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16000 - Introduction To Scene Design And Technology

Credit Hours: 2.00. This course is designed to introduce the students to the process and tools of scene design and technology.

Credits: 2.00

THTR 16100 - Introduction To Costume Design And Technology

Credit Hours: 2.00. Introduction to analytical, artistic, and practical skills required when creating costumes for theatre. Beginning training in elements and principles of design, rendering and presentation skills. Elementary instruction in costume construction, including hand and machine sewing, costume crafts, and basic patterning.

Credits: 2.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 21300 - Voice For The Actor

Credit Hours: 2.00. Designed to heighten the actor's awareness of the vocal instrument. Elementary vocal techniques will be practiced to expand the student's vocal flexibility and range. Emphasis on freeing habitual vocal tensions and teaching the student the fundamentals of vocal health.

Learning Outcomes: 1. Understand and apply the vocal techniques required of the actor and practice a specific vocal warm-up procedure. 2. Recognize and use effectively the phonetic alphabet in your text work. 3. Hear, feel, and evaluate healthy vocal practices. 4. Understand and employ the bodily structures that allow for sound production and how to feel/adjust sound placement. 5. Develop and explore new ways in which to use your voice to support your acting work/how the voice can convey an emotional journey and create character (and the technical demands that accompany it) that you can apply

to your work after this course. Credits: 2.00

THTR 23300 - Acting II

Credit Hours: 3.00. Continued development of the basic acting tools of objectives, actions, justification, and personalization; continued vocal and physical work; introduction of script and character analysis; and the introduction of audition techniques. The course will use material from contemporary dramatic literature in the rehearsal process. Prerequisite: THTR 133. Instructor permission required for non-majors.

Learning Outcomes: 1. Practice and incorporate relaxation, physical, vocal, and sense memory exercises into a daily warm-up. 2. See, connect, and respond to a partner within improvised scenarios. 3. Read plays with insight and imagine the experience of the characters in the given circumstance of a play. 4. Analyze and break scenes down into beats, with each beat having a clear action and objective. 5. Analyze, rehearse and publicly perform an open scene, and a contemporary monologue and scene. Credits: 3.00

THTR 23500 - Vocal/Physical Preparation

Credit Hours: 2.00. Vocal/Physical Preparation is designed to increase and deepen student's physical awareness, develop physical and vocal stamina, flexibility and strength, modify habitual modes of expression, expand vocal and physical range, and increase student's ability to respond expressively.

Learning Outcomes: 1. Aware of dysfunctional and limiting vocal and physical patterns. 2. Reduce tension, increase flexibility, improve balance and coordination, and expand expressive range. 3. Develop a grounded, focused and dynamic theatrical presence. 4. Integrate breath, voice and movement in solo and group performance. 5. Create a personalized training program that prepares you for the challenges of the profession. Credits: 2.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating professional AV system documentation. Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

THTR 25600 - Stage Make-Up

Credit Hours: 2.00. Study of facial anatomy, the aging process, the principles of light and shadow, and character analysis. Theory and practice in the basic techniques of applying stage makeup.

Credits: 2.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

THTR 29000 - Special Topics In Theatre

Credit Hours: 1.00 to 3.00. Topics will vary.

Credits: 1.00 to 3.00

THTR 32300 - Acting: Movement For The Actor

Credit Hours: 3.00. Designed to heighten body awareness in movement and stillness. Characterization techniques will be practiced that expand the student's flexibility, aerobic capacity, strength, agility, and range of self-expression. Emphasis on freeing habitual tension patterns through the exploration of expressive movement.

Credits: 3.00

THTR 33300 - Acting III

Credit Hours: 3.00. Application of foundational acting techniques to specific disciplines. May be repeated for credit. Instructor permission required for non-majors.

Learning Outcomes: 1. Identify, define, describe and demonstrate the basic principles of the craft of acting. 2. Identify, define, describe and demonstrate the basic terminology of stage technique. 3. Identify, define and describe the basic principles of script & character analysis. 4. Read, investigate, interpret and articulate your analysis of specific plays from the canon of 20th and 21st Century realistic dramatic literature. 5. Develop critical thinking as it applies to your own work, your peers' work and in production work. Credits: 3.00

THTR 33400 - Acting III: Acting For The Camera

Credit Hours: 3.00. Continued development of acting technique, as it relates to challenges unique to acting on film, television and commercials. Students will develop an effective process for on-camera performance. Class exercises/presentations are recorded, viewed and critiqued by the students and the instructor.

Learning Outcomes: 1. Acquire the ability to distinguish and differentiate between techniques used for acting for the live theatre and acting for the camera. 2. Successfully analyze new types of dramatic text (e.g., TV scenes, commercial copy, film scripts, etc.). 3. Demonstrate a general knowledge of the Terminology used for acting for the camera. 4. Develop actor's skills with on-camera blocking, business, subtext and reactions. 5. Develop skills that are specific for on-camera auditions. Credits: 3.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 35400 - Painting For The Stage

Credit Hours: 3.00. The principles and practice of painting for the stage. Study of tools, media, and techniques used in traditional scenic painting, costume painting, and the creation of dimensionality on various surfaces. Offered alternate years.

Credits: 3.00

THTR 36000 - Scenic Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into an environment for dramatic action. Emphasis on the interrelationship among all aspects of production and how the scenic element becomes a building block toward total picturization. Offered alternate years.

Credits: 3.00

THTR 36100 - Costume Design

Credit Hours: 3.00. Theory and principles of design specifically applied to stage costume design. Emphasis on the interrelationship of all aspects of production and how the costume becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block

toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 38000 - Histories Of Theatre

Credit Hours: 3.00. Variable topics in theatre and performance history. Emphasis on the study of the works, aesthetics, and innovations of a theatrical form/genre alongside social, cultural, economic, and political contexts.

Credits: 3.00

THTR 38100 - Theatre And Performance Historiography

Credit Hours: 3.00. Historiographic analysis of theatre, drama, and performance of the 20th and 21st centuries. Emphasis on the relationship between modern and contemporary performance to world history from social, political, and cultural perspectives. Course includes both written and practical components. Prerequisites: THTR 201, THTR 271.

Learning Outcomes: 1. Interpret plays, performances, and performance theory from the 20th and 21st century. 2. Analyze theatre and performance histories through a combination of historical research, critical questioning, and practical application. 3. Demonstrate how political, economic, and cultural structures impact theatre and performance histories of the 20th and 21st Century. 4. Demonstrate skills in research, collaboration, and oral presentation. Credits: 3.00

THTR 39000 - Directed Study Of Special Theatre Problems

Credit Hours: 1.00 to 3.00. An undergraduate level, individualized, and intensive study of any aspect of theatre required by the student's plan of study. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 43300 - Acting IV

Credit Hours: 3.00. Adaptation of acting techniques to professional applications.

Learning Outcomes: 1. Develop and demonstrate the application of metrical analysis. 2. Identify the poetic devices in classical text and demonstrate these in performance. 3. Demonstrate critical thinking skills of analysis, interpretation and application. 4. Analyze Shakespeare's characters in reference to their historical period. 5. Develop a systematic approach for performing classical text. Credits: 3.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

THTR 45800 - Problems In Theatre Technology

Credit Hours: 1.00 to 3.00. A tutorial in technical theatre. Available for students who wish to do more extensive work in theatre technology. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 46800 - Problems In Theatre Design

Credit Hours: 1.00 to 3.00. A tutorial in theatre design. Available for students who wish to do more extensive work in the design aspects of production. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 47902 - Capstone Project

Credit Hours: 3.00. Students will develop, present, and reflect upon a performance event based on the research framework developed in THTR 49701: Capstone Preparation in the subsequent semester. Students will demonstrate their learning through a focused experience that requires the integration and application of the full breadth of skills and knowledge gained during the course of study. These events are ideally collaborative, but solo project proposals are allowed. Capstone Project includes the rehearsal process and performance at the end of the semester, with a reflection submitted during finals week. The instructor will meet with students through the course

of the semester to mentor this performance/production-based process. Permission of instructor required.

Learning Outcomes: 1. Collaborate with other artists, designers, and craftspeople from different disciplines. 2. Devise unique performances and relate them to historical, aesthetic, and personal contexts. 3. Implement creative development and reflection process utilizing practice-as-research approaches. Credits: 3.00

THTR 48400 - Performance, Media, And Technology

Credit Hours: 3.00. This course explores the intersection of performance, media, and technology from the early 20th century through present day, examining how technological innovations have transformed performance practices and audience experiences.

Learning Outcomes: 1. Describe the historical development of media and technology in 20th and 21st-century performance. 2. Apply theories of liveness, remediation, intermediality, and mediatization toward analysis of contemporary performance practices. 3. Assess the impacts of new media on concepts such as narrative, space, text, and embodiment. 4. Generate strategies for conceptualizing projects that integrate media into performance. Credits: 3.00

THTR 49000 - Special Topics In Theatre

Credit Hours: 1.00 to 3.00. Topics will vary.

Credits: 1.00 to 3.00

THTR 49701 - Capstone Preparation

Credit Hours: 3.00. Students will build the research-as-practice framework and development structure for a performance that will be realized during THTR 49702: Capstone Project in the subsequent semester. This proposal will evolve out of research that will include examining works related to the research enquiry of the topic identified in their proposal as well as practice-as-research frameworks to determine which frameworks fit the performance. The instructor will meet with students through the course of the semester to mentor this research-based process. All requests for space, equipment, costume and props, production staff and monetary support, as well as the creative idea of the project, must approved by the semester's end. Permission of instructor required.

Learning Outcomes: 1. Collaborate with other artists, designers, and craftspeople from different disciplines. 2. Devise unique performances and relate them to historical, aesthetic, and personal contexts. 3. Design a creative development and reflection process utilizing practice-as-research approaches. Credits: 3.00

THTR 51000 - Stage Dialects

Credit Hours: 2.00. A study of the actor's use of dialects. Learning dialects and their practical use through scene study. Permission of instructor required. Offered in alternate years.

Credits: 2.00

THTR 51300 - Vocal Production For The Stage I

Credit Hours: 2.00. The study of the voice production mechanism. Emphasis on exercises in relaxation, breath, alignment, and tonal focus. Permission of instructor required.

Learning Outcomes: 1. Recognize the anatomy of the voice production mechanism. 2. Classify and apply to text the International Phonetic Alphabet and the Lessac System. 3. Identify any unnecessary vocal tensions to develop a clear open vocal instrument. 4. Develop a flexible vocal instrument, enabling the voice to respond to a wide variety of emotional and vocal stimuli. 5. Evaluate your personal vocal growth and establish a routine for continued vocal health. Credits: 2.00

THTR 51400 - Vocal Production For The Stage II

Credit Hours: 2.00. Continuation of Vocal Production for the Stage I. Emphasis on exercises in vocal exploration through application to performance. Permission of instructor required.

Learning Outcomes: 1. Recognize the anatomy of the voice production mechanism. 2. Classify and apply to text the International Phonetic Alphabet and the Lessac System. 3. Identify any unnecessary vocal tensions to develop a clear open vocal instrument. 4. Develop a flexible vocal instrument, enabling the voice to respond to a wide variety of emotional and vocal stimuli. 5. Evaluate your personal vocal growth and establish a routine for continued vocal health. 6. Apply and practice Lessac's three vocal Energies through performance. 7. Develop an exercise support system for the actor to use in his/her professional life. 8. To develop personal awareness of your vocal skill

and the ability to analyze others. Credits: 2.00

THTR 52300 - Creating A Character I

Credit Hours: 2.00. Techniques towards the physical embodiment of a character. Permission of instructor required.

Credits: 2.00

THTR 52400 - Creating A Character II

Credit Hours: 3.00. Advanced techniques towards the physical embodiment of a character.

Credits: 3.00

THTR 52500 - Theatrical Characterization

Credit Hours: 3.00. The discovery of a unique performing personality through the use of a wide range of mask and clown characterization techniques.

Credits: 3.00

THTR 52600 - Advanced Stage Movement

Credit Hours: 2.00 to 3.00. Advanced movement training, including one or more of the following: stage combat, circus skills, gymnastics, period movement, dance, repatterning techniques, martial arts disciplines, and explorations into character.

Credits: 2.00 to 3.00

THTR 53200 - Professional Issues In Theatre

Credit Hours: 2.00. Training in the techniques of the prepared audition, cold readings, improvisational auditions, and interviews. A survey of various employment opportunities and the demands of the professional theatre, educational theatre, and professional training. Permission of instructor required. Offered in alternate years.

Learning Outcomes: 1. Understand the protocols, ethics, expectations, and demands of the professional theatre. 2. Pinpoint and prioritize professional goals and develop a specific, post-graduate career plan to achieve them. 3. Acquire a professional photo and acting resume for use in professional auditions. 4. Research the resources and information necessary to establish, build and sustain your acting career. Credits: 2.00

THTR 53300 - Acting Technique

Credit Hours: 3.00. Intensive study of the internal and external elements of acting through the use of improvisational principles within the context of scene study.

Learning Outcomes: 1. Demonstrate the ability to "live truthfully under an imaginary circumstance" within both exercise and scene work. 2. Listen and respond to your partner in a truthful, organic, open and spontaneous manner. 3. Invent imaginary circumstances and relationships in the Independent Activity exercise. 4. Apply the above principles to scripted material. 5. Articulate current information in the professional theater. 6. Access and evoke vivid, truthful emotion, and express this emotion through the reality of doing and the active pursuit of objectives. 7. Recognize and distinguish between authentic and inauthentic emotions and behavior in yourself. 8. Practice and maintain spontaneity in planned and rehearsed performances of scene work, within the context of the given circumstances of the script. 9. Identify significant movements and philosophies in the history of actor training, and their important teachers. Credits: 3.00

THTR 53500 - Vocal/Physical Preparation

Credit Hours: 1.00. Practice in the coordination of the vocal and physical apparatus of the actor. Permission of instructor required.

Credits: 1.00

THTR 53600 - Advanced Problems In Acting

Credit Hours: 2.00 or 3.00. Advanced study of selected problems in acting, including detailed role and play analyses, thorough rehearsals and critiques of performance. Permission of instructor required.

Credits: 2.00 or 3.00

THTR 53800 - Acting For The Camera

Credit Hours: 3.00. Development of acting styles and audition techniques for the camera. Permission of instructor required.

Credits: 3.00

THTR 53900 - Period Style For The Actor

Credit Hours: 3.00. Applied focus on theatrical styles of acting. Scene study related to the development of skills necessary to perform work from a variety of periods and a variety of genres.

Credits: 3.00

THTR 54000 - Advanced Directing

Credit Hours: 3.00. Application of principles of directing to the various types of drama; laboratory practice in directing plays for experimental production.

Credits: 3.00

THTR 54500 - Directional Process In Production

Credit Hours: 3.00. A study of models the director uses when dealing with the other creative personnel involved in production. Primary emphasis will be placed on the directorial and actoral processes as they relate to the work of the designers and

technicians. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 55000 - Advanced Scenery Technology

Credit Hours: 3.00. A theoretical and practical study of theatrical scenery planning, construction, and stage use. Topics will vary by semester and will include project management techniques, mechanical design, automation systems, show control systems, rigging, and safety issues. Permission of instructor required.

Credits: 3.00

THTR 55100 - Advanced Costume Techniques

Credit Hours: 3.00. An advanced study of specialized skills and construction techniques used in the creation of theatre costumes.

Learning Outcomes: 1. Apply flat patterning and draping techiques to create a garment from a costume sketch. 2. Determine how a pattern was created and thus assemble garments in the costume shop with a higher degree of success. 3. Design a buckram pod hat as well as dye fabrics to a desired color and pattern that demonstrate course techniques. Credits: 3.00

THTR 55300 - Theatre Audio Technology II

Credit Hours: 3.00. The study of the technical aspects of audio as they relate to use of, and experimentation with, various techniques in the design, installation, and specification of theatre sound systems, etc. Priority for majors. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 55600 - Advanced Stage Makeup

Credit Hours: 3.00. Advanced training and practice in the application of theatrical makeup. Emphasis on problem solving and varied materials and application techniques. Offered in alternate years.

Credits: 3.00

THTR 55800 - Advanced Problems In Theatre Technology

Credit Hours: 1.00 to 3.00. Advanced study and application of technical theatre problems and practice. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 56000 - Advanced Scenic Design

Credit Hours: 3.00. Advanced study of the principles of design and their application to specific staging problems.

Credits: 3.00

THTR 56100 - Advanced Costume Design

Credit Hours: 3.00. Advanced study of the principles of costume design and their application to specific problems.

Credits: 3.00

THTR 56200 - Advanced Light Design

Credit Hours: 3.00. Advanced study of the principles of light design and their application to specific lighting problems.

Credits: 3.00

THTR 56300 - Advanced Sound Design

Credit Hours: 3.00. Advanced study of the principles of sound design for theatre and theory application to specific problems. Offered in alternate years.

Credits: 3.00

THTR 56400 - Theatrical Rendering

Credit Hours: 3.00. Provides advanced training in rendering techniques used by theatrical designers. Students will study perspective drawing, figure drawing, painting, and explore different materials used by designers to communicate their artistic vision.

Credits: 3.00

THTR 56700 - Model Construction

Credit Hours: 3.00. Model construction is one of many skills required of scene designers and is a preferred communication tool for many directors and designers. This course offers a variety of practical exercises for presenting both blueline and full-color models.

Credits: 3.00

THTR 56800 - Advanced Problems In Design

Credit Hours: 1.00 to 3.00. A described tutorial in theatrical design or design research. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

THTR 57001 - Statics And Structures For Theatre I

Credit Hours: 3.00. Advanced study of static forces and analysis of the ability of specific structural shapes and materials traditionally used in theatrical scenery construction to resist these forces. This course will be taught both fall and spring semesters once every three years.

Credits: 3.00

THTR 58000 - Period Research For The Designer

Credit Hours: 3.00. A seminar focused on methods of research that effectively and responsibly relate the context of visual and cultural history to storytelling for the stage.

Learning Outcomes: 1. Recognize broad aesthetic trends in visual and written resources. 2. Communicate discoveries verbally and in

writing. 3. Plan and evaluate research methods. 4. Define and apply critical theory to historical aesthetics. Credits: 3.00

THTR 59000 - Directed Study Of Special Theatre Problems

Credit Hours: 1.00 to 3.00. An individualized and intensive study of any aspect of theatre required by the student's plan of study. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

THTR 61300 - Classical Text I

Credit Hours: 3.00. Concentration on increasing vocal flexibility through exploration and preparation of Shakespearean texts. Permission of instructor required. Prerequisite: THTR 51400.

Learning Outcomes: 1. Develop and demonstrate the application of metrical analysis. 2. Identify the poetic devices in classical text and demonstrate these in performance. 3. Demonstrate critical thinking skills of analysis, interpretation and application. 4. Analyze Shakespeare's characters in reference to their historical period. 5. Develop a systematic approach for performing classical text. 6. Evaluate their vocal strengths and deficiencies and develop their own procedure for continued vocal growth. Credits: 3.00

THTR 61400 - Classical Text II

Credit Hours: 3.00. Continuation of Classical Text I, with emphasis on studio scene work beginning with Shakespeare and progressing through the works of other major classical playwrights. Permission of instructor required. Prerequisite: THTR 61300.

Learning Outcomes: 1. Develop and demonstrate the application of metrical analysis. 2. Identify the poetic devices in classical text and demonstrate these in performance. 3. Demonstrate critical thinking skills of analysis, interpretation and application. 4. Analyze Shakespeare's characters in reference to their historical period. 5. Develop a systematic approach for performing classical text. 6. Identify classical and poetic language through a variety of authors. 7. Develop the ability to enhance the performance of dialogue using vocal orchestration. Credits: 3.00

THTR 63300 - Interpretive Acting Techniques

Credit Hours: 3.00. Advanced work in script and character analysis, character development, interpretation, interaction and relationship dynamics; rehearsal of complex scenes using material from various contemporary forms and theatrical genres. Prerequisite: THTR 53300 . Permission of instructor required.

Credits: 3.00

THTR 64000 - Directing Internship

Credit Hours: 1.00 to 6.00. Practical experience with a university, professional, or community theatre to facilitate the transition from student to professional director. Available for graduate students in their final year. Particular assignment must be approved by the student's major professor. Permission of instructor required.

Credits: 1.00 to 6.00

THTR 65800 - Special Problems In Technology

Credit Hours: 1.00 to 3.00. A described tutorial leading to postgraduate level project work for those students who are developing advanced theories in stage technology. Prerequisite: THTR 55800 . Permission of instructor required.

Credits: 1.00 to 3.00

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

THTR 67000 - Script Interpretation

Credit Hours: 3.00. The study of scripts through several lenses, ranging from Aristotelian analysis to holistic, contemplative practice. The course includes seminar discussion, response papers, group projects, exercises, and a final script interpretation in the form of a formal paper. Prerequisite: THTR 60100. Permission of department required.

Credits: 3.00

THTR 67100 - Modern Theory And Criticism

Credit Hours: 3.00. A seminar on modern performance theory, aesthetics, and practice. Emphasis on European theatre since 1875 and American theatre after 1960, with application through performance projects. Prerequisite: THTR 60100. Permission of instructor required.

Learning Outcomes: 1. Contextualize modern and postmodern performance theory, aesthetics, and practice. 2. Develop the writing

and analytical skills in terms of critical theory. 3. Employ a theoretical lens (form, content, and performance style) in a scene presentation. 4. Justify how a play fits into a particular movement. Credits: 3.00

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

THTR 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Or MFA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Vertically Integrated Projects

VIP 17910 - First-Year Participation In Vertically Integrated Projects (VIP) Lim (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies, and development tools. Permission of department required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17911 - First Year Participation In Vertically Integrated Projects (VIP) I (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering

judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17912 - First Year Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17920 - First Year Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication,

leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 27910 - Sophomore Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral

presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 27920 - Sophomore Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 27930 - Sophomore Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the

specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 3.00

VIP 37900 - Participation in Vertically Integrated Projects (VIP)

Credit Hours: 0.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Permission of instructor required.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 0.00

VIP 37910 - Junior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams

(first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.
Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 37920 - Junior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral

presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 37930 - Junior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

VIP 47910 - Senior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health,

safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 47920 - Senior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47921 - Senior Design Participation In Vertically Integrated Projects (VIP) I

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on

interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47922 - Senior Design Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional

responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47930 - Senior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

Veterinary Clinical Sciences

VCS 21000 - Veterinary Nursing Techniques For The Small Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, small animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and implement common restraint techniques used for various small animal species. 2. Measure the temperature, pulse, and respiratory rates, and provide an explanation of the normal parameters. 3. Identify and explain different sites for injections and venipuncture. 4. Identify common breeds of canines and felines and describe normal behavior of each species. 5. Conduct a comprehensive patient history and perform a thorough, standardized physical examination. 6. Engage in discussions with clients about routine preventive care, including recommended vaccinations for different large animal species. Credits: 2.00

VCS 21100 - Veterinary Nursing Techniques For The Large Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, large animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients, including vaccinations that are recommended for large animal species. 4. Collect diagnostic samples

from large animals. 5. Administer medications via common routes to large animals. 6. Identify common breeds of horses, cattle, swine, goats and sheep. Credits: 2.00

VCS 22100 - Veterinary Nursing Techniques For The Normal Animal (SA & LA)

Credit Hours: 4.00. The course will introduce the students to concepts related to normal, healthy large and small animal patients. The course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals and small animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients including vaccinations that are recommended for both large and small animal species. 4. Collect diagnostic samples from small and large animals. 5. Administer medications via common routes to small and large animals. 6. Identify common breeds of dogs, cats, horses, cattle, swine, and sheep. Credits: 4.00

VCS 22200 - Dentistry-VN

Credit Hours: 1.00. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs. 5. Develop and provide client education. Credits: 1.00

VCS 22300 - Surgical Nursing-VN

Credit Hours: 1.50. This course is an introduction to the surgical environment and all aspects related to the principles of asepsis and the practice of sterile technique. Students will learn using a variety of teaching modalities (lecture, group work, laboratory experience).

Learning Outcomes: 1. Identify basic surgical instruments. 2. Explain the principles of aseptic technique. 3. Perform the duties of surgical nurse. 4. Perform the duties of the circulating nurse. 5. Explain procedures to prepare items for sterilization and the techniques used for sterilization. 6. Demonstrate bandaging techniques for both large and small animal patients. 7. Identify the phases of wound healing. Credits: 1.50

VCS 22400 - Small Animal Nursing I

Credit Hours: 2.00. This course will introduce students to nursing and diagnostic techniques for small animals and the body response to disease.

Learning Outcomes: 1. Recognize and report conditions of hospitalized small animal patients. 2. Provide appropriate nursing care to hospitalized patients. 3. Place IV catheters in small animal patients and administer fluids appropriately. 4. Perform diagnostic procedures and exams for small animal patients. 5. Provide technical assistance to a DVM for diagnostics and therapeutics. 6. Recognize emergent conditions and provide appropriate treatment. 7. Perform basic training techniques with dogs. Credits: 2.00

VCS 22500 - Large Animal Nursing I

Credit Hours: 2.00. This course builds on concepts learning in VCS 22100 related to normal, healthy large animal patients. It also introduces the students to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify and explain the nursing concepts of hospitalized and post-op LA patients. 2. Select and apply nursing concepts to the LA patient. 3. Place an IV catheter in a large animal patient and identify the problems that can occur from long term catheterization. 4. Describe milking procedures and the tests used to identify problems. 5. Collect diagnostic samples from large animals. 6. Administer medications via common routes to large animals. 7. Calculate fluid therapy rates for LA patients. 8. Identify the appropriate uses for bandages, splints, casts. 9. Identify the steps utilized in intensive neonatal care and medical emergencies. Credits: 2.00

VCS 22600 - Principles Of Anesthesia-VN

Credit Hours: 2.00. This course is an introduction to surgical

nursing and anesthesia. The principles of asepsis and sterile technique will be introduced and demonstrated by staff and in some cases, practiced by the student. The basics of anesthesia will be introduced and practiced by the student.

Learning Outcomes: 1. Identify basic surgical instruments. 2. State the principles of aseptic technique. 3. Identify breaks in aseptic technique. 4. Perform open gloving. 5. Perform aseptic personnel scrub; gowning and closed gloving. 6. Identify the parts of an anesthesia machine. 7. Know the function of the above parts. 8. Trace the flow of oxygen through an anesthetic machine, with rebreathing and nonbreathing systems. 9. Identify rebreathing and nonbreathing systems. 10. Practice monitoring principles and identify normal parameters. 11. Identify a variety of analgesic and anesthetic drugs. 12. Begin to identify and state the uses and classifications of these drugs. 13. Perform general anesthesia; from physical exam through recovery. Credits: 2.00

VCS 22800 - Small And Large Animal Nutrition-VN

Credit Hours: 1.00. This course will introduce students to an overview of nutritional concepts as it applies to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as therapeutic use of diets as it relates to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediatric stages to adulthood. 5. Define specific differences in diets based upon breed (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VCS 25100 - Introduction To Diagnostic Imaging-VN

Credit Hours: 0.50. This course is an introduction to veterinary diagnostic imaging and is designed to instruct the veterinary technician student in the basic principles of imaging, necessary to perform imaging tasks within a veterinary hospital. This course will introduce the fundamentals needed in the clinical imaging rotations and in practice.

Learning Outcomes: 1. Apply the principles of physics and x-ray machine anatomy, to the generation of X-rays. 2. Calculate and utilize exposure factors in the production of diagnostic quality radiographs. 3. Appreciate the importance of radiation safety, personal protective equipment and occupational health. 4. Employ the best combinations of grids, intensifying screens, cassettes and film to reduce scatter and produce diagnostic quality radiographs. 5. Develop and process radiographic film using processing chemicals and appropriate darkroom techniques. 6. Troubleshoot exposure, processing and handling problems with non-diagnostic films. Credits: 0.50

VCS 25200 - Diagnostic Imaging-VN

Credit Hours: 2.00. Provides an introduction to imaging of domestic animals. Emphasis will be placed on radiological principles and techniques, darkroom procedures and design, preparing technique charts for various X-ray units, animal positioning, and radiation safety.

Learning Outcomes: 1. Recall and apply diagnostic imaging guidelines and safety procedures. 2. Produce diagnostic images of soft tissue and orthopedic projections of both small and large animal patients. 3. Produce diagnostic images of skull projections of small animal patients. 4. Perform diagnostic contrast studies of the circulatory, renal and gastrointestinal systems. 5. Utilize computed and digital imaging systems to produce

diagnostic images of both large and small animal patients. 6. Assist with performing diagnostic ultrasound scans of small animal patients. 7. Possess a basic understanding and introductory working knowledge of CT, MRI and Nuclear Medicine scanning procedures on both small and large animal patients. Credits: 2.00

VCS 32100 - Large Animal Nursing II

Credit Hours: 2.00. This course build on concepts learned in VCS 22100 and VCS 22500 related to normal, healthy large animals patients. It also introduces the student to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify the key principles associated with herd health management. 2. Understand the role of regulatory issues in large animal medicine. 3. Demonstrate an understanding of the common diseases affecting large animal species. 4. Develop an understanding of naturally occurring toxic plants. Credits: 2.00

VCS 32200 - Small Animal Nursing II

Credit Hours: 2.00. This course will cover management of hospitalized patients, client education, and preventative medicine programs. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Describe basic information about small animal medicine conditions to clients. 2. Educate clients regarding preventative small animal medicine. 3. Utilize knowledge of small animal medical conditions to provide nursing care to patients. 4. Utilize knowledge of small animal medical conditions to anticipate DVM needs for diagnosis and treatment of hospitalized patients. Credits: 2.00

VCS 46700 - Medical Equipment & Maintenance-VN

Credit Hours: 2.00. A laboratory in the utilization, care, and maintenance of electronic equipment used in veterinary diagnostics.

Learning Outcomes: 1. Develop an integrated knowledge base of the functions of the selected equipment. 2. Select, evaluate, and adjust selected equipment to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. 3. Recognize and respond appropriately to the selected equipment malfunctions or inappropriate equipment setup to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. Credits: 2.00

VCS 46800 - Advanced Emergency And Critical Care For Veterinary Nurses

Credit Hours: 2.00. This course is a culmination of previously studied clinical skills, disease processes, and small animal nursing that is focused on transferring knowledge to practical use. The course will be taught utilizing emergency and critical care case studies to highlight disease processes, physiology, critical thinking skills, and the role of the veterinary nurse in providing high level patient care. The course goal is to prepare graduates to respond to emergent and critical patient scenarios in all types of small animal veterinary practices.

Learning Outcomes: 1. Identify veterinary emergency situations utilizing patient vital signs and knowledge of disease processes. 2. Identify common emergency disease processes and anticipate patient treatments based on observations. 3. Anticipate changes in patient status by utilizing critical thinking skills. 4. Apply important communication skills to improve teamwork. 5. Recognize indicators of mental health issues in self. Credits: 2.00

VCS 60200 - Problems In Clinical Medicine And Surgery

Credit Hours: 1.00 to 5.00. Individualized topics selected from the various areas of Veterinary Clinical Sciences. May include directed readings, discussion, and other intensive studies in specialized topics. Prerequisite: DVM degree. Permission of instructor required.

Credits: 1.00 to 5.00

VCS 60300 - Introduction To Clinical Research, Trials and Translational Research

Credit Hours: 1.00. This course is designed for students entering the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which introduce students to the elements and scope of clinical research, including the methods used in clinical research, trials and translational research. Topics covered will explain the principles of safe and ethical conduct of clinical research. Students will also be introduced to the principles of data collection, management and interpretation. Permission of instructor required.

Learning Outcomes: 1. To help students understand the elements and scope of clinical research. 2. To expose students to the methods used in clinical research, trials and translational research. 3. To understand the principles of safe and ethical conduct of clinical research. 4. To understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60400 - Animal Models In Translational Research

Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60500 - Supervised Surgical Laboratory Training In Small Animal Surgical Techniques And Approaches

Credit Hours: 1.00. Small animal neurosurgical, orthopedic and soft tissues approaches, techniques, and procedures practiced in cadaver labs. Only graduate students enrolled in an American College of Veterinary Surgeons or American College of Veterinary Internal Medicine - Neurology/Neurosurgery residency will be eligible. Permission of instructor required.

Learning Outcomes: 1. Funnel different existing surgical techniques from literature and textbooks into a patient detailed approach. 2. Assess recent literature reports of surgical techniques. 3. Gain proficiency in surgical techniques and skills. 4. Become comfortable handling specific surgical equipment. 5. Provide exposure to infrequently performed techniques. 6. Learn methods/techniques to troubleshot certain intraoperative complications. Credits: 1.00

VCS 61000 - Clinical Training In Veterinary Clinical Sciences

Credit Hours: 2.00 to 6.00. Veterinary Clinical Sciences (VCS) residents working in specific specialty areas rotate through relevant specialty clinical services in the Veterinary Teaching Hospital (or other specialty facilities) as determined by the resident committee and the requirements of each specialty college. Rotation lengths are 2.5 to 5 weeks. Residents are closely supervised by VCS faculty and gradually are given more individual responsibility as decision-making and clinical skills develop. Permission of instructor required.

Credits: 2.00 to 6.00

VCS 62000 - Seminar In Clinical Medicine And Surgery

Credit Hours: 1.00 to 3.00. Seminars provide a forum for discussion of current concepts and research results in clinical medicine and surgery, and other aspects of veterinary medicine. Permission of instructor required.

Credits: 1.00 to 3.00

VCS 62100 - Topics In Advanced Medicine

Credit Hours: 1.00 to 3.00. Advanced study and investigation of the pathophysiology, occurrence, diagnosis, treatment, management, and prevention of animal diseases. Emphasis will be given to the medical aspects of diseases by body system (e.g., renal, gastrointestinal, etc.) and by medical discipline (e.g., oncology, ophthalmology, etc.). Permission of instructor required.

Credits: 1.00 to 3.00

VCS 63000 - Current Topics In Veterinary Clinical Sciences

Credit Hours: 1.00 to 6.00. One-two hour sessions organized and conducted weekly by VCS residents, with input/discussion from the attending VCS faculty. Alternating weekly topic sessions may include journal club and morbidity and mortality patient rounds or other topics appropriate to the specialty. Permission of instructor required.

Credits: 1.00 to 6.00

VCS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

VCS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of Department required.

Learning Outcomes: 1. Develop research skills

in the appropriate research areas including animal testing methodologies, laboratory techniques, data collection and management, scientific writing and general conduct of clinical and translational research. Credits: 1.00 to 18.00

VCS 80110 - Veterinary Skills And Competencies I

Credit Hours: 2.50. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism, and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate basic safety, husbandry, and restraint of dogs, cats, food animals, and horses. 2. Demonstrate basic principles of hygiene and bio-security. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications per oz. to dogs, cats, food animals, and horses. 5. Demonstrate correct calculation of IV fluid dosing. 6. Demonstrate knowledge of basic medical equipment use. 7. Demonstrate knowledge of surgical instrumentation, needles, and suture material. 8. Demonstrate ability to perform complete basic physical examination of a dog, cat, food animal, and horse. 9. Demonstrate effective use of non-verbal communication. 10. Demonstrate an understanding of stress management techniques. 11. Demonstrate an understanding of social media's impact on a professional career and client relationships. 12. Demonstrate an understanding of the principles of collegiality with respect to competition and the impact of dishonesty in a professional setting. 13. Demonstrate an awareness of the risks for and methods for prevention of suicide. 14. Demonstrate an understanding of the definition of cyberbullying and methods to protect yourself. 15. Demonstrate an ability to manage conflict within the veterinary team. 16. Demonstrate an understanding of the laws and policies of veterinary medicine. 17. Demonstrate an understanding of USDA identification techniques. Credits: 2.50

VCS 80120 - Veterinary Skills And Competencies II

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate competency in the advanced restraint of dogs, cats, food animals, and horses. 2. Demonstrate basic safety, husbandry, and restraint of avian and exotic species. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses. 5. Demonstrate ability to safely and appropriately perform jugular venipuncture of cats, dogs, food animals, and horses using models. 6. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a cat, dog, food animal, and horse. 7. Demonstrate ability to perform a FNA and prepare a slide for cytology. 8. Demonstrate ability to collect specimens for diagnostic lab submission. 9. Demonstrate ability to operate radiographic equipment. 10. Demonstrate ability to position for abdominal radiographs in small animals. 11. Demonstrate ability to perform PCV/TP, blood glucose, I-Stat, and USG diagnostics. 12.

Demonstrate ability to create understandable discharge instructions which foster client compliance. 13. Demonstrate an understanding of student loan information and re-payment options. 14. Demonstrate effective communication within the veterinary team. 15. Demonstrate effective communication with owners about finances and be able to provide estimates for medical recommendations. Credits: 2.00

VCS 80130 - Introduction To Population Medicine And Veterinary Ethics

Credit Hours: 2.00. This course will introduce first year veterinary students to the fundamental principles of population medicine. This will include concepts behind population versus individual animal medicine, population animal industries and their management practices, population animal diseases, outbreak investigation, regulatory medicine, and interactions between wild and domestic animals. Following an introduction to population medicine, students will shift to a discussion of veterinary ethics and its application to various animal industries. Students will explore basic concepts in animal use ethics and welfare, ethical and moral reasoning, and critical thinking and problem solving in population medicine.

Learning Outcomes: 1. Develop an understanding of the concepts of population medicine and compare and contrast those to individual animal medicine. 2. Acquire a basic understanding of the production animal industries and management practices employed by those industries. 3. Attain a familiarity of the major disease challenges common to each of the animal populations presented. 4. Be able to intelligently approach a disease outbreak investigation and recommend sound basic sampling, management, and treatment options. 5. Understand and appreciate the role of regulatory medicine in disease control. 6. Understand and appreciate the wild and domestic animal interactions and challenges. 7. Review basic concepts in ethics of animal use and animal welfare science. 8. Illustrate how ethics and moral reasoning may be used to resolve contentious animal issues of relevance to veterinary medicine. 9. Develop skills in critical thinking and collaborative problem solving relative to population medicine. 10. Enhance information gathering, assimilation, and communication skills. Credits: 2.00

VCS 80140 - Fundamental Principles Of Comparative Nutrition

Credit Hours: 2.00. This course will cover fundamental aspects of comparative nutrition building on knowledge from veterinary comparative anatomy and physiology courses. Multiple species will be discussed to provide the student a broad-based foundational knowledge in key nutritional concepts, including feeds and feeding assessment and the animal's physiologic state/lifestage. The student will learn how physiologic status will impacts energy needs and nutritional adequacy, on an individual and/or group basis. The student will also develop skills in forage identification, pet food assessment, and when the individual/group is at risk of nutrient deficiency.

Learning Outcomes: 1. Discuss with the owner/client the nutritional assessment of the animal/herd, incorporating physiologic state and concerns involving environment, food, or feeding management. 2. Identify and assess common feeds and forages. 3. Explain the role of nutrition throughout the lifecycle for health to support growth, lactation, and gestation as well as adult maintenance to include aging. 4. Complete a nutritional history, whether herd or individual, to be used in assessment of health status and likelihood of risk for nutritional deficiencies or toxicities. 5. Calculate energy needs based on lifestage or physiologic status. 6. Perform assessment of pet foods to determine nutritional adequacy. 7. List the unique dietary requirements of small mammals and reptiles. Credits: 2.00

VCS 80210 - Veterinary Skills And Competencies III

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching

animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses (using cadavers). 2. Demonstrate safe and appropriate jugular and peripheral venipuncture of dogs, cats, food animals, and horses (using models). 3. Demonstrate ability to collect and submit venous samples for hematology and chemistry. 4. Demonstrate ability to collect and submit voided urine samples. 5. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a dog, cat, food animal, and horse. 6. Demonstrate ability to perform a cardiologic examination in dogs, cats, food animals, and horses. 7. Demonstrate ability to perform a neurologic examination in dogs, cats, food animals, and horses. 8. Demonstrate four techniques for oxygen administration. 9. Demonstrate ability to correctly and aseptically place an IV catheter (in models) of large and small animals. 10. Demonstrate intubation of dogs and cats. 11. Demonstrate understanding of regulatory paperwork, the completion of the USDA accreditation modules, and the ability to perform tuberculosis and brucellosis testing. 12. Demonstrate ability to measure systemic blood pressure using both Doppler and oscillometric techniques. 13. Demonstrate ability to perform a bone marrow aspirate and bone marrow core biopsy. 14. Demonstrate ability to correctly set up and position for thoracic radiographs. 15. Demonstrate ability to complete one- and two-hand ties, instrument ties and square knots. 16. Demonstrate ability to prepare Diff-quick staining on cytologic samples. 17. Demonstrate understanding of the principles of OR conduct and correct gowning and gloving protocols. 18. Demonstrate ability to measure SpO2 via pulse oximetry. 19. Demonstrate ability to perform a diagnostic and 10 lead EKG. 20. Demonstrate appropriate telephone communication and etiquette with owners and fellow veterinarians. 21. Demonstrate understanding communication strategies to improve treatment compliance. 22. Demonstrate understanding of their personal credit score-both its calculation and impact. 23. Demonstrate knowledge of Veterinary Teaching Hospital protocols for patients in ICU and wards. 24. Demonstrate understanding of the use of the Omincell. 25. Demonstrate ability to complete patient rounds with ICU technicians. 26. Demonstrate knowledge of Veterinary Teaching Hospital and Animal Disease Diagnostic Lab forms and protocols for sample submission. 27. Demonstrate ability to perform and interpret SNAP tests. 28. Demonstrate ability to complete drug calculations, write prescriptions for medications, and write a veterinary feed directive. Credits: 2.00

VCS 80220 - Veterinary Skills And Competencies IV

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via IV to dogs, cats, food animals, and horses. 2. Demonstrate ability to perform biopsies of dogs, cats, food animals, and horses and to submit specimen to the diagnostic laboratory. 3. Demonstrate ability to perform basic regional anesthetic techniques. 4. Demonstrate understanding of the anatomy of, types of, and testing of anesthetic machines. 5. Demonstrate

understanding and use of various feeding tubes in small animals. 6. Demonstrate ability to properly position small animals for radiographs of limbs. 7. Demonstrate ability to correctly operate fluid and syringe pumps. 8. Demonstrate understanding of FAMACHA scoring. 9. Demonstrate ability to place nasal oxygen cannula, perform nebulization, and coupage. 10. Demonstrate ability to perform end-tidal CO2 monitoring. 11. Demonstrate ability to pass orogastric tubes and esophageal feeders on ruminant models. 12. Demonstrate ability to perform injections and venipuncture on live animals both small and large. 13. Demonstrate ability to establish rapport with a client in an emergency situation. 14. Demonstrate ability to communicate appropriately in situations involving ethical issues. 15. Demonstrate understanding of educational debt to income level and options to manage educational debt repayment. 16. Demonstrate understanding of appropriate reporting of reportable diseases and foreign animal disease investigations. Credits: 2.00

VCS 80301 - Veterinary Clinical Skills I

Credit Hours: 2.00. This course introduces students to the clinical environment in the Veterinary Teaching Hospital (VTH). Students will assist with treatments of patients and participate in activities of the various clinical services. Students will be assigned daytime and after-hours shifts. Laboratory sessions will address clinical skills, client communication skills, financial management, professionalism and wellness.

Credits: 2.00

VCS 80302 - Veterinary Clinical Skills II

Credit Hours: 2.00. This course is a continuation of VCS 80301 Clinical Skills I. Students will work with 4th year veterinary students in VTH. Students will assist with treatments of patients and participate in activities of the various clinical services. Students will be assigned daytime and after-hours shifts. Laboratory sessions will address clinical skills, client communication skills, financial management, professionalism and wellness.

Credits: 2.00

VCS 80310 - Veterinary Skills And Competencies V

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective compassionate communication with clients about euthanasia. 2. Demonstrate ability to pass nasoesophageal, nasogastric, orogastric, and esophageal feeders in various species. 3. Demonstrate ability to safely perform enteral feeding with a syringe and syringe pump. 4. Demonstrate ability to perform equine dental examination and dental float. 5. Demonstrate ability to administer, monitor, and prepare transfusions with various blood products. 6. Demonstrate ability to place intraosseous and multiple lumen jugular catheters in small animals. 7. Demonstrate ability to perform urinary catheterization and use a closed urinary collection system. 8. Demonstrate ability to perform a complete ophthalmic examination in dogs, cats, food animals, and horses. 9. Demonstrate ability to perform a complete orthopedic examination in small animals. 10. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 11. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 80320 - Veterinary Skills And Competencies VI

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective

communication regarding medical errors. 2. Demonstrate ability to perform transtracheal wash in small animals. 3. Demonstrate ability to perform a dermatologic exam and intradermal skin testing in large and small animals. 4. Demonstrate ability to perform ultrasound examinations of limbs. 5. Demonstrate ability to perform ultrasound guided cystocentesis. 6. Demonstrate ability to perform abdominocentesis, periocardiocentesis, and thoracocentesis in large and small animals. 7. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 8. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 80400 - Behavior In Domestic Animals

Credit Hours: 1.00. Instruction in basic principles of behavior; factors determining normal and abnormal behavior; and the different types of learning. The main domestic species will be characterized in terms of their normal behavior with which behavior problems are most important in the different species.

Learning Outcomes: 1. Apply the principles of learning to behavior analysis and modification. 2. Characterize the domestic species in terms of their normal behavior. 3. Identify environmental factors contributing to abnormal behavior and compromising their welfare. 4. Utilize knowledge on behavioral development and environmental and management effects on behavior for problem prevention and strengthening the human-animal bond. 5. Integrate behavioral knowledge into veterinary medicine and its practice. Credits: 1.00

VCS 80500 - Small Animal Behavioral Therapy

Credit Hours: 1.00. Provides information on the diagnosis, treatment, and prevention of behavior problems of dogs and cats, with emphasis on differential diagnosis of behavioral problems and behavioral pharmacology. Topics include aggression, anxiety related problems, inappropriate elimination, client counseling, and problem prevention. Client interaction and the question of euthanasia for behavioral problems is also discussed.

Learning Outcomes: 1. Identify stress signs as well as the mood (positive or negative) in dogs and cats by reading their body language. 2. Apply behavior knowledge into veterinary practice. 3. Formulate a diagnostic work-up for the more common behavior problems in companion animals and arrive at a list of differential diagnoses. 4. Choose the appropriate behavior modification techniques to prevent developing behavior problems. 5. Compare and contrast the various FDA approved drugs and dosing regimen to treat the more common behavior problems in companion animals. 6. Interact efficiently and compassionately with owners of patients with a behavior problem and discuss the question of behavior-related euthanasia. 7. Discuss welfare topics relating to small animals intelligently. Credits: 1.00

VCS 80600 - Small Animal Medicine And Surgery I

Credit Hours: 3.50. An overview of clinical approach to common medical and surgical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus is on diagnosis and treatment of common diseases encountered in small animal clinical practice.

Credits: 3.50

VCS 80610 - Small Animal Medicine I

Credit Hours: 3.50. This course is the first in a series that provides an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment

options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 3.50

VCS 80616 - Small Animal Clinical Nutrition

Credit Hours: 1.00. This nutrition course presents the established knowledge of metabolism and physiological chemistry pertaining to nutrients and the control of biochemical pathways at the gene, cell, organ, and system level. The goal of this course is to provide the fundamentals of nutrient metabolism while discussing nutritional modification in the management of disease. At the completion of this course, the veterinary student should be proficient in recognizing a nutrition-related problem in a clinical patient, conducting a thorough nutritional assessment, and constructing appropriate nutritional strategies for both the pet and client. The veterinary student will achieve an understanding of systemic metabolism that can be applied to the contemporary practice of veterinary medicine.

Learning Outcomes: 1. Explain the role of the practitioner in incorporating evidence-based nutrition plans for all life stages. 2. List the components of a complete nutritional assessment for both dogs and cats. 3. Define the role of nutrition throughout the lifecycle for health to support proper growth, maturation, aging, lactation, and gestation. 4. Describe the impact of nutrient deficiency for each lifestage. 5. Demonstrate ability to calculate daily energy needs for all lifestages, during illness, and for weight loss programs. 6. Identify key nutrients of concern in common diseases and identify the key characteristics found in the nutrient profile of an appropriate therapeutic diet. 7. Develop a nutritional plan for common nutritional problems presented to a small animal practitioner. 8. List options for assisted-feeding to include potential limitations for each technique. Credits: 1.00

VCS 80620 - Small Animal Medicine II

Credit Hours: 1.50. This is the second course in a series providing an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 1.50

VCS 80630 - Small Animal Surgery

Credit Hours: 2.50. This course will teach basic surgical principles applicable across species such as suture materials and patterns and principles of hemostasis. Common surgical diseases affecting the various body systems of dogs and cats will be discussed with a focus on pre- and postoperative care. Routinely performed surgical procedures (neuter, spay, C-section) will be discussed. Orthopedic topics will include bone healing, management of musculoskeletal trauma, fracture management, and fundamentals of external and internal fracture stabilization techniques for dogs and cats. The course will conclude with discussions of select musculotendinous conditions, principles of amputation and joint and limb salvage, and an introduction to principles of physical therapy.

Learning Outcomes: 1. Explain correct preparation of the surgical site, draping and procedures for maintaining aseptic technique. 2. Identify commonly used surgical instruments, suture materials, and suture patterns and explain the indications for their use. 3. Explain the indications, procedures and complications of surgical procedures common in general practice such as ovariectomy, ovariohysterectomy, castration, cesarean-section/hysterotomy, enterotomy, gastrotomy, and cystotomy. 4. Recognize the clinical signs associated with common surgical diseases of the upper airway, ear, gastrointestinal tract, and urinary tract and formulate appropriate diagnostic and treatment plans. 5. Explain principles for surgical management of tumors. 6. Recognize different types of wounds and recommend appropriate steps for initial wound management. 7. Describe

the process of bone healing and explain the principles of fracture fixation to optimize bone healing. 8. Describe fractures based on type, classification and location. 9. Explain the diagnosis, perioperative management, and treatment options for common fractures and joint injuries involving appendicular bones and mandible. 10. Formulate a diagnostic plan for common orthopedic diseases. 11. Explain the etiology, pathophysiology, diagnosis, and medical and surgical treatment of developmental and degenerative joint diseases of dogs. 12. Explain the etiology, pathophysiology, diagnosis, and treatment of developmental and acquired multicentric diseases of the long bones of dogs. 13. Explain the etiology, pathophysiology, diagnosis, and treatment of more common musculotendinous conditions. 14. Explain the indications, principles and anticipated outcomes for amputations, arthrodesis, and limb salvage procedures. 15. Describe the basic principles, modalities, goals, and anticipated outcomes of current physical therapy and rehabilitation therapies. Credits: 2.50

VCS 80700 - Small Animal Medicine And Surgery II

Credit Hours: 2.00. An overview of clinical approach to common medical and surgical diseases of dogs and cats. A systems approach is used to teach the major concepts of disease affecting each body system. The focus is on diagnosis and treatment of common diseases encountered in small animal clinical practice.

Credits: 2.00

VCS 80800 - Equine Medicine And Surgery

Credit Hours: 2.50. Diagnostic methods and prevention, control, and treatment regimens for common diseases affecting horses. Issues related to diseases of regulatory importance (epidemic and exotic) are discussed. Students also learn about surgical correction of selected problems and elective surgical procedures.

Credits: 2.50

VCS 80801 - Equine Medicine

Credit Hours: 2.50. Core course focused on the major equine diseases and preventive medicine/herd health (biosecurity, vaccination, parasite control, dental disease). The course will cover pathogenesis, diagnosis, and treatment/management of these conditions or syndromes.

Learning Outcomes: 1. List the names of the common diseases affecting equines, the causal agent(s) or predisposing/risk factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems affecting equines. 3. Identify clinically relevant and practical management changes or therapies that are used to treat and control common diseases of equines. 4. Formulate a biosecurity plan for a farm dealing with an outbreak of a contagious equine disease. 5. Critically evaluate current literature and apply evidence-based medicine (EBM) to equine cases and clinical decision making. Credits: 2.50

VCS 80900 - Ruminant Medicine And Surgery

Credit Hours: 2.00. Diagnostic methods and prevention, control, and treatment regimens for common diseases affecting ruminants. Issues related to food quality assurance and safety, and diseases of regulatory importance (epidemic and exotic). Surgical correction of selected problems and elective surgical procedures.

Credits: 2.00

VCS 80910 - Food Animal Medicine

Credit Hours: 4.00. This course focuses on the major infectious, metabolic, and parasitic diseases of ruminants, camelids, swine, poultry and other avian flocks. The pathogenesis, diagnosis, and treatment of these conditions or syndromes will be reviewed. Additionally, the course will cover proper management, including vaccinations and animal husbandry, to prevent the development of these conditions.

Learning Outcomes: 1. List the names of the common diseases of ruminants, the causal agent(s) or predisposing factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems in ruminants/camelids. 3. Describe management changes or therapeutic methods that are used to treat and control common diseases of ruminants. 4. Discuss the important issues of

food safety, quality assurance, and health regulations as they relate to the ruminant industries. Swine 5. List the names of the common diseases of swine and their causal agent(s), predisposing factors, and where possible, underlying mechanisms. 6. Develop a differential diagnosis list and select a suitable diagnostic plan to determine the definitive diagnosis. 7. Describe management changes or therapeutic methods to prevent, control, and treat common swine diseases/problems. Poultry 8. Provide students with a basic practical knowledge of avian medicine. After completing this course, students are expected to be able to: 9. Identify the economical and public health diseases of flocks. 10. Identify the proper diagnostic tests needed to diagnose each disease. 11. Explain the economic and public health consequences of each disease. 12. Design treatment and prevention strategies for each disease. Credits: 4.00

VCS 80920 - Large Animal Surgery

Credit Hours: 2.50. This course will cover the core fundamentals of surgical diseases of multiple large animal species, including the horse, bovine, small ruminants and camelids. Case management approaches are utilized to provide examples of disease conditions affecting these large animal species.

Learning Outcomes: 1. Present core large animal surgical diseases of horses, cattle, small ruminants, pigs, and camelids. 2. Present surgical management of large animal diseases. Credits: 2.50

VCS 81000 - Swine Production Medicine

Credit Hours: 1.00. Diagnostic methods and prevention, control, and treatment regimens for common diseases affecting swine. Issues related to food quality assurance and safety and diseases of regulatory importance (epidemic and exotic) are discussed.

Credits: 1.00

VCS 81100 - General Surgery Laboratory

Credit Hours: 1.00. Introduction to basic skills in surgery and anesthesia. Models are used to learn basic skills of instrument use, tissue handling, dissection, and suturing. Students will progress to common anesthetic and surgical procedures on live and cadaver animals.

Credits: 1.00

VCS 81101 - Small Animal Surgery Lab I

Credit Hours: 1.50. Introduction to basic skills in surgery and anesthesia. Models are used to learn basic skills of instrument use, ligation, dissection, and suturing. Students will progress to common anesthetic and surgical procedures on live and cadaver animals. The live animal surgery will teach physical examination, formulating an anesthetic plan, anesthetic induction, maintenance and recovery, as well as feline spay and neuter.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Scrub, gown and glove correctly, and maintain aseptic technique in the operating room. 5. Prepare the surgical site and drape correctly. 6. Name and correctly use each general surgical instrument. 7. Efficiently perform one-handed ties, two-handed ties, and instrument ties to make square knots. 8. Correctly place basic suture patterns. 9. Correctly and gently handle tissues and apply appropriate hemostatic techniques. 10. Open the abdomen through a ventral midline abdominal incision and close it properly. 11. Correctly and safely perform ovariohysterectomy and castration in cats. 12. Perform the emergency procedures of chest tube placement and tracheotomy tube placement. 13. Induce and maintain general anesthesia and monitor the anesthetized patient. 14. Safely recover an animal from general anesthesia. 15. Perform cardiopulmonary resuscitation. 16. Administer postoperative care, including analgesic therapy, and detect postoperative complications. 17. Keep appropriate medical records. Credits: 1.50

VCS 81200 - Principles Of Anesthesia, Surgery, And Emergency Medicine

Credit Hours: 2.00. Introduction to basic principles of anesthesiology and surgical practice. The principles of aseptic technique, operating room protocol, tissue handling, hemostasis, and wound repair. Principles of emergency

medicine, including shock therapy, fluid therapy, and trauma management.

Credits: 2.00

VCS 81201 - Principles Of Veterinary Anesthesiology

Credit Hours: 2.00. Introduction to basic principles of anesthesiology. Pharmacology of anesthesia and analgesic drugs, anesthetic equipment, monitoring, regional and local anesthetic techniques, pain management and anesthesia care of multiple species and special disease considerations will be covered.

Learning Outcomes: 1. Learn the pharmacology and clinical effects of (and indications and contraindications for) common preanesthetic agents, including anticholinergic agents, tranquilizers and sedatives. 2. Learn the basic principles of general anesthesia of small and large animals. 3. Understand the pharmacology and clinical effects of (and indications and contraindications for) various injectable and inhalant anesthetics. 4. Learn the principles of local and regional anesthesia and understand how they are applied in the clinical setting. To learn the pharmacology of local anesthetic drugs 5. Learn how to evaluate a patient preoperatively and determine the appropriate choice of anesthetic, monitor the patient during general anesthesia and recovery, and recognize and treat emergencies. 6. Learn anesthetic techniques suitable for a variety of species and how to apply them in various clinical settings. 7. Learn how to anesthetize patients with a variety of medical conditions. 8. Learn the principles of pain management and apply them to a variety of clinical situations. Credits: 2.00

VCS 81210 - Small Animal Primary Care And Wellness

Credit Hours: 2.00. This course will discuss conditions that are commonly treated in small animal primary care practice. Topics will include wellness and preventative care for dogs and cats at all lifestages, dental care, diagnosis and management of common oral and skin diseases, and emergency medicine. Humane euthanasia and palliative care will also be discussed.

Learning Outcomes: 1. Explain the role the primary care veterinarian has developing and implementing lifestage wellness programs. 2. Describe the key goals of a wellness program for each lifestage. 3. Describe vaccine and infectious disease screening programs for both cat and dog including available preventative medications. 3. Demonstrate standard procedure for oral evaluation, oral care to include dental cleaning and extractions. 4. Recognize common dermatologic diseases in the dog and cat and describe treatment to resolve these medical problems. 5. Demonstrate common dermatologic diagnostics procedures. 6. Explain key concepts of companion animal patients presenting as a primary care emergency patient: shock, coagulation abnormalities, oxygenation abnormalities, and sepsis. 7. Solve common fluid therapy problems addressed in both primary care hospitals and in primary care emergency practices. 8. Explain key concepts of palliative care, humane euthanasia, and natural death. Credits: 2.00

VCS 81300 - Diagnostic Imaging

Credit Hours: 1.00. In the first half of the core diagnostic imaging course, emphasis is on how images are made using current technology. Although radiography is emphasized, imaging modalities such as ultrasonography, computed tomography, magnetic resonance imaging, scintigraphy, and thermography are discussed. In the second half of the course, types of lesions that can be observed in large and small animals with the various imaging modalities are explained. The course is offered once annually, and its successful completion is required for any of the elective courses offered by Diagnostic Imaging.

Credits: 1.00

VCS 81400 - Comparative Theriogenology

Credit Hours: 1.00. Basic aspects of reproduction in large and small animals, including obstetrics and genital diseases, on a single animal or group basis are covered.

Credits: 1.00

VCS 81410 - Comparative Theriogenology

Credit Hours: 2.00. This course develops a broad clinical knowledge of common reproductive management strategies and clinical conditions associated with reproduction in the major domestic species. It provides information and strategies for the conduct of breeding soundness examinations and infertility work-ups in the male; estrous cycle characteristics, diagnostics and control in females; breeding management strategies,

pregnancy diagnosis, and management of gestation; investigation and control strategies for pregnancy loss; management of parturition and treatment of dystocia; normal postpartum changes and diseases of the peripartum period and the pathophysiology and treatment of uterine infections. Material will be presented in both comparative and species-specific manner. Students should review reproductive anatomy and physiology notes in preparation for this course.

Learning Outcomes: 1. Be conversant with core reproductive principles of all major species (bovine, equine, small animals with canine as the model, porcine, small ruminants). 2. Understand similarities and differences in the physiological basis of key reproductive events across species. 3. Integrate knowledge from various disciplines to understand clinical situations pertaining to the reproductive health of animals on an individual or herd basis. 4. Understand the pathophysiology, clinical presentations, therapies, and prognoses for clinical issues pertaining to the reproductive health of animals on an individual or herd basis. Credits: 2.00

VCS 81500 - Ophthalmology

Credit Hours: 1.00. This course is an introduction to veterinary comparative ophthalmology. It covers the anatomy of the eye, diagnosis, pathophysiology, and treatment of the ocular diseases commonly seen in companion and food animal species: canine, feline, equine, avian, bovine, caprine, ovine, porcine, lagomorphs. Covers pharmacology as it relates to medications used to treat ocular disease.

Learning Outcomes: 1. Acquire basics of normal ocular anatomy and physiology, common ophthalmic diseases in all species for general practice, including their pathophysiology clinical presentations, therapies, and prognoses. 2. Become familiar with ophthalmic terminology. 3. Gain a basic knowledge of the diseases of the anterior and posterior segments of the eye, the eyelids, and the globe. 4. Use correct ophthalmic terminology to describe ocular conditions. 5. Recognize common ocular conditions involving the adnexa, globe, and orbit. 6. Create a list of differential diagnoses for the conditions covered in class. 7. Determine appropriate diagnostic plans for the conditions covered in class. 8. Determine appropriate treatment plans and give an accurate prognosis for the conditions covered in class. 9. Learn the ocular medications listed on the ocular pharmacology sheet handed out in class and will know indications, contra-indications, and frequency for all medications. Credits: 1.00

VCS 81700 - Achieving Success In Private Practice

Credit Hours: 1.50. Provides a foundation for the application of practice management principles. Focuses on operations management, financial management, human resource management, and marketing management.

Learning Outcomes: 1. Improve communication skills - clients, staff, public speaking, listening, team building. 2. Gain financial skills - personal (financial awareness, educational debt management) and business (cost controls, compensation). 3. Increase career skills - interviewing, resume development, job search, jurisprudence of the profession. 4. Gain business skills - value management, marketing techniques, human resources, inventory. 5. Develop risk management skills - establishing policies/practices consistent with medical laws, practice best practices to ensure patient safety (i.e., appropriate medication calculations/dosing and administration). Credits: 1.50

VCS 81800 - Small Animal Surgery Laboratory I

Credit Hours: 0.50. Common orthopedic and soft tissue surgical procedures are performed on cadaver and live animals.

Credits: 0.50

VCS 81802 - Small Animal Surgery Laboratory II

Credit Hours: 1.50. This course will build on VCS 81100 by emphasizing the importance of proper basic surgical skills (instrument carriage, suturing, knot tying). Surgical skills will be expanded by performing several procedures on cadaveric tissue: abdominal approaches, gastrointestinal surgery, urogenital surgery, wound management, amputations. One lab will be dedicated to ophthalmologic procedures. Ovariohysterectomies and castrations will be performed on live dogs and cats to further develop the students' surgical skills as well as skills in physical examination, formulating an anesthetic plan, anesthetic induction, maintenance & recovery and postoperative care.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Safely perform elective surgery on patients using aseptic techniques for surgeon and patient, gentle tissue handling and dissection, secure vessel ligation, good hemostasis and appropriate suturing technique and patterns; and instrument carriage. 5. Be proficient at opening and closing abdominal incisions. 6. Explain common soft tissue surgical procedures performed in small animals. 7. Safely anesthetize, monitor and recover a small animal patient from anesthesia. 8. Explain the indications and general techniques for basic ophthalmic procedures. Credits: 1.50

VCS 81900 - Small Animal Dentistry

Credit Hours: 3.00. Students will be involved with the evaluation and treatment of small animal dentistry patients. Patient activity will occur during four days of the week. On the fifth day, procedure labs using cadaver specimens will be held. Daily patient discussions will occur, topic/additional patient rounds may also be presented on the fifth day. A complete spectrum of small animal dentistry treatments is provided by the clinical service. Therefore, the students will be involved with all levels of dental/oral care. For students enrolled in Small Animal/Companion Animal and mixed animal tracks. Total clinic hours 129.

Credits: 3.00

VCS 82000 - Small Animal Surgery Laboratory II

Credit Hours: 0.50. More advanced soft tissue and orthopedic surgical techniques are practiced on cadaver and live animals.

Credits: 0.50

VCS 82100 - Clinical Neurology

Credit Hours: 3.00. Students will be directly or indirectly involved in the evaluation, treatment and care of patients present to the neurology/neurosurgery service. Cadaver work may supplement the clinical experience. Students will be expected to accomplish the objectives of the Neurology/Neurosurgery block and to develop greater knowledge, clinical judgment, diagnostic capabilities and neurologic examination skills that would enable them to manage more complex cases, such as intervertebral disc disease, seizures, encephalopathies and neuropathies.

Learning Outcomes: 1. Perform a neurologic examination. 2. Neurolocalize basic lesions effectively. 3. Perform a physical rehabilitation examination. 4. Treat, using a variety of physical rehabilitation modalities and therapeutic exercises, various orthopedic and neurologic conditions. Credits: 3.00

VCS 82200 - Large Animal Surgery I

Credit Hours: 0.50. Basic surgical training in large animals, including both soft tissue and orthopedic procedures.

Learning Outcomes: 1. Provide students with the opportunity to develop their basic skills and knowledge in large animal surgery through performance of common surgical procedures, preoperative evaluation and post-operative case management. 2. Enhance the students' clinical application of large animal surgery principles and techniques taught in didactic courses. Credits: 0.50

VCS 82300 - Large Animal Surgery II

Credit Hours: 0.50. More advanced surgical training in large animals, including both soft tissue and orthopedic procedures.

Learning Outcomes: 1. Provide students with the opportunity to develop their basic skills and knowledge in large animal surgery through performance of common surgical procedures, preoperative evaluation and post-operative case management. 2. Enhance the students' clinical application of large animal surgery principles and techniques taught in didactic courses. Credits: 0.50

VCS 82501 - Ruminant Theriogenology

Credit Hours: 1.50. This course will cover clinically pertinent aspects of ruminant reproduction in more detail than prerequisite courses, including obstetrics and genital diseases on an individual and group basis. The laboratory portion will teach the proper techniques for rectal palpation and reproductive ultrasound in ruminants. Principles of embryo recovery and transfer will be practiced.

Learning Outcomes: 1. Recognize normal and abnormal reproductive function in the individual animal and herd. 2. Develop reasonable corrective actions for abnormal reproductive function and prognosis for return to normal. 3. Understand how to manipulate the reproductive

cycle, and apply appropriate manipulations to various clinical scenarios. 4. Recognize dystocia and outline a plan to correct the dystocia. 5. Recognize common peripartum complications and create a plan to correct the abnormalities. 6. Understand the basics of assisted reproductive technologies in the bovine. Credits: 1.50

VCS 82700 - Small Animal Imaging

Credit Hours: 2.00. A continuation of VCS 81300 . Specific diseases of small animals where imaging is part of the diagnosis are discussed. Emphasis is on radiography and ultrasonography. The use of alternate imaging modalities is discussed where appropriate.

Credits: 2.00

VCS 82701 - Diagnostic Imaging

Credit Hours: 3.00. This course covers basic mechanisms of image generation and interpretation. The first half of the course deals with principles of image formation and the introduction to advanced imaging modalities. A synopsis of the principles of radiobiology and radiation safety is offered. The second part of the course features imaging interpretation based on previously mastered imaging principles. The third part of the course builds the foundation of film reading and interpretation such as radiographic anatomy and radiographic signs of specific disease conditions. This course serves as a foundation for the fourth-year diagnostic radiology rotation.

Learning Outcomes: 1. Describe the basic operation of an x-ray machine, including the components of the x-ray tube. 2. Understand the relationship of kVp, mAs and exposure time to x-ray production. 3. Know the fundamental properties of x-rays and gamma rays. 4. Know technical factors that affect detail, density, distortion and contrast in the generation of the x-ray image. 5. Know the reason for using a grid and the construction of a grid. See textbook. 6. Understand the terms latitude and scale of contrast as they relate to radiographic exposure. 7. Describe the differences between and applications of medium (par), high speed and slow speed intensifying screens. 8. Know the advantages and disadvantages of using digital versus conventional radiography. 9. Know the basics of analog radiographic processing-what happens during development, rinse, fixation and washing. 10. Know the common artifacts that are produced in the darkroom, i.e., fixer versus developer spills, exhausted developer, static electricity, light leakage, improper temperature or mixing of chemicals and screen-based problems. See textbook. 11. Be familiar with the basic radiation protection measures used by veterinary workers. 12. Know the major effects (cancer induction, teratogenesis, etc.) of ionizing radiation and cellular mechanisms (free radical production, DNA damage, and mutation) involved in radiation injury. 13. Have a working knowledge of how an ultrasound machine functions and how ultrasonic images are interpreted (terminology). 14. Be familiar with imaging principles and advantages of nuclear medicine imaging. 15. Understand the difference between CT and MR imaging, and their relative indications in veterinary medicine. 16. Know the advantages and disadvantages of CT and MR imaging over radiography. 17. Know which imaging modalities are used to provide physiologic information. 18. Know how to name x-ray projections. 19. Understand the concept of "windowing" as it relates to digital forms of imaging. 20. Understand differences between file types for digital imaging, e.g., DICOM (.dcm), TIFF (.tif), JPEG (.jpg). 21. Recognize abnormal radiographic findings of commonly seen disease conditions in small animals. 22. Describe radiological findings according to Roentgen signs. 23. Formulate a meaningful differential diagnosis for commonly seen radiographic abnormalities in small animals. Credits: 3.00

VCS 82800 - Clinical Rotation In Neurology And Physical Rehabilitation

Credit Hours: 3.00. The first week of the 3-week block, students will spend 100% of the time on the neurology service. Weeks 2 and 3 of the block, the students will spend 100% of the time on

the physical rehabilitation service. The course is a 3.0-credit elective clinical rotation. Currently, the neurology service receives three days per week (M, W, F), and the physical rehabilitation service receives new appointments one day per week (T) and recheck appointments daily (M-F). A PVM clinician will lead this elective rotation. The majority of cases will be small animal patients, but some exposure to large animal, equine and small ruminant cases may take place. Students are also expected to practice clinical and technical skills which are required for each service.

Learning Outcomes: 1. Gain experience in performing physical/neurological examinations, localizing lesions, generating differential diagnoses, and selecting an appropriate treatment plan for animals presented to the Neurology service. 2. Integrate knowledge to provide patient care, including medical management, preoperative, surgical, and postoperative care of client-owned animals. This includes principles of analgesia, fluids, drugs, nutrition, exercise limitations and/or rehabilitation. 3. Develop greater knowledge, clinical judgement, surgical/technical skills, and diagnostic capabilities that enable management of more complex cases. 4. Increase the student's clinical experience in diagnosis and treatment of common ailments for which physical rehabilitation is recommended. 5. Develop exposure to both orthopedic and neurologic conditions in the more chronic stage of treatment. Typically students are exposed to such conditions during the peridiagnosis period. This rotation would give students exposure to disease and post-operative healing 2-8 weeks following diagnosis/surgical repair. 6. Learn how to appropriately select PT modalities for a patient. 7. Learn how to appropriately use different PT modalities. 8. Learn how to perform goniometry and limb girth. 9. Learn how to perform a gait lab analysis and how to interpret the findings. 10. Learn how to perform therapeutic exercises such as massage and range of motion. 11. Improve oral and written communication skills and medical documentation. 12. Practice the principles of teamwork and professionalism through interactions with faculty/clinicians, colleagues, technicians, and pet owners. Credits: 3.00

VCS 82900 - Equine Imaging

Credit Hours: 1.00. A continuation of VCS 81300 . Specific diseases of horses where imaging is part of the diagnosis are discussed. Emphasis is on radiography and ultrasonography. The use of alternate imaging modalities is discussed where appropriate.

Credits: 1.00

VCS 83100 - Equine Theriogenology Laboratory

Credit Hours: 1.00. This elective course provides the student with the opportunity to become proficient in all aspects of mare reproductive management. Palpation of the mare's reproductive tract will be emphasized. It also allows students to enhance their abilities to recognize reproductive problems and to formulate and carry out a diagnostic and therapeutic plan.

Learning Outcomes: 1. Safely and competently perform a transrectal palpation and ultrasound of the reproductive tract of the mare. 2. Acquire basic understanding of managing the mares estrous cycle for breeding based on transrectal and ultrasound findings. 3. Obtain entry level knowledge of common procedures including caslick, vaginoscopy, endometrial biopsy, uterine culture and cytology, artificial insemination, uterine lavage and flushing.

Credits: 1.00

VCS 83200 - Equine Lameness

Credit Hours: 0.50. Advanced study of equine lameness, with a focus on the performance horse. Physical examination of the locomotor system, lameness diagnosis, and the establishment of a prognosis are emphasized.

Credits: 0.50

VCS 83201 - Equine Lameness

Credit Hours: 2.00. Advanced study of equine lameness with a focus on the performance/sport horse. Physical examination of the locomotor system (axial and appendicular), diagnosis, treatment, and establishment of a prognosis are emphasized through lecture and laboratory sessions.

Learning Outcomes: 1. Examine a horse for lameness and be able to identify which limb is lame and then formulate and execute a diagnostic plan to be able to reach a definitive diagnosis and then develop a treatment plan and prognosis. 2. Recognize the

pathognomonic abnormal gaits for the forelimb and hind limb in horses. 3. Examine equine radiographs and identify common diseases of the joints and explain the difference between the various advanced imaging modalities and when would be appropriate to utilize them. 4. Explain the importance and basic principles of farriery and demonstrate how to properly remove a shoe from a hoof. 5. Recognize the common lameness conditions in horses and describe their basic treatment options and prognoses. Credits: 2.00

VCS 83300 - Advanced Equine Medicine

Credit Hours: 1.00. A continuation of VCS 50800.

Credits: 1.00

VCS 83400 - Food Animal Surgery

Credit Hours: 0.50. A continuation of Large Animal Surgery for students with a selected interest in large animal/mixed practice. Surgical diseases of cattle are emphasized.

Credits: 0.50

VCS 83700 - Clinical Nutrition For Ruminants And Swine

Credit Hours: 1.00. Current information on nutritional requirements of cattle and pigs, along with the relationships between nutrients and outcomes when nutrients are under- or oversupplied in different phases of the life cycle of cattle and pigs. Specific rations and nutritional requirements of cattle and pigs. Students will be expected to evaluate nutritional problems.

Credits: 1.00

VCS 83800 - Swine Production Medicine

Credit Hours: 1.00. Introduction to production and health management in swine herds. The concept of the model herd is introduced, and the use of records in the diagnosis of problems and maximizing production efficiency is covered. The focus is herd-based and includes problem-solving.

Credits: 1.00

VCS 83901 - Beef Production Medicine

Credit Hours: 1.00. The goal of this course is to present the concepts of beef production medicine to prepare the student to formulate plans to solve herd problems. The topics of herd health, fertility, nutrition, records, genetics, marketing and environment will be discussed and students will work in groups to solve real herd issues. An optional herd visit will also be available to all students.

Learning Outcomes: 1. Focus on owner's goals for herd improvements and make recommendations to achieve herd goals. 2. Research questions during case-based exercises and formulate a plan to solve the problems. 3. Utilize the divisions of health, records, nutrition, genetics, marketing, environment and fertility when formulating herd reports. 4. Demonstrate an understanding the economics of beef production. 5. Be prepared to enter a high level practice where beef production medicine is an emphasis. Credits: 1.00

VCS 83902 - Dairy Production Medicine

Credit Hours: 1.00. The goal of this course is to present the concepts of dairy production medicine to prepare the student to formulate plans to solve herd problems. The topics of dairy cow nutrition (including ration balancing programs), calf nutrition and management, records analysis including the use of PCDart computer program, vaccination programs, and animal welfare evaluations. Additionally, students will be exposed to team troubleshooting and performing farm evaluations. Outside speakers may be used as content experts.

Learning Outcomes: 1. Demonstrate an understanding of how to successfully evaluate the "roadblocks" for improving the production and animal health of individual dairy farms. 2. Demonstrate an understanding of the concepts of herd-based medical and management decisions vs. individual animal medicine. 3. Gain exposure to fundamentals of monitoring health and productivity based on herd parameters. 4. Gain exposure to concepts and computer programs for dairy nutrition and records analysis. 5. Be prepared to enter progressive dairy practices. Credits: 1.00

VCS 83903 - Cattle Production Medicine

Credit Hours: 1.50. "Production medicine" is an important part of modern bovine veterinary practice. This course will demonstrate this role of production medicine in bovine practice and the potential value to the producer and veterinarian. Topics discussed during the class will include cattle nutrition (including exposure to ration balancing programs), calf nutrition and management, records analysis including the use of computer programs, mastitis and milk quality measurements, economics, and animal welfare evaluations exposure to different facets of the beef industry (cow/calf, stocker, feedlot) and the differences in management in those systems, genomics, and immunology/vaccinology. Additionally, students will be exposed to team troubleshooting and performing farm evaluations.

Outside speakers may be used as content experts.

Credits: 1.50

VCS 84000 - Small Ruminant/Llama Medicine

Credit Hours: 1.00. The pathogenesis, diagnosis, treatment, and prevention of common diseases of small ruminants and llamas.

Credits: 1.00

VCS 84101 - Advanced Ophthalmology

Credit Hours: 0.50. This course is an advanced course in ophthalmology covering topics not covered in the core ophthalmology course. Species discussed will include canine, feline, equine, bovine, ovine, caprine and exotic species. Topics include vision and neuro-ophthalmology, surgery, ocular emergencies, ocular manifestations of systemic disease, ocular examination, and diagnostic techniques and modalities specific to diseases of the eye.

Learning Outcomes: 1. To provide students with advanced instructions in clinical ophthalmology and diagnostic testing for diseases of the eye. Credits: 0.50

VCS 84300 - Successful Practice Skills

Credit Hours: 0.50. Builds upon the foundation for the application of practice management principles learned in VCS 51700. Focus is in the areas of communications and relationships with clients, staff, and colleagues; leadership development; and key essentials of practice operation for the prospective associate (or practice director).

Learning Outcomes: 1. Develop a vision for your career and understand the process of goal setting. 2. Understand types of practice ownership and the process to become an owner/partner. 3. Explain key ingredients for practice growth and financial success. Credits: 0.50

VCS 84400 - Client Communications - Companion Animal Practice

Credit Hours: 0.50. The course will be taught in a discussion format utilizing small group exercises and role-plays. The goal is to demonstrate and describe effective client communication skills. Because effective client communication is a learned skill, the course will provide multiple opportunities for students to practice and refine their skills. Students who participate in this course will be videotaped working through a scenario with a simulated client. While being videotaped and then watching oneself can be very uncomfortable and potentially embarrassing, it is a great way to improve communication skills and is worth the potential momentary discomfort.

Learning Outcomes: 1. Learn basic communication skills that are effective in client, other professional and personal interactions. 2. Identify their current communication strengths and weaknesses in a fun, non-threatening environment. 3. Learn techniques to build on those strengths and improve areas of difficulty. 4. Learn communication strategies that can be used in difficult client situations. 5. Practice communication skills and receive targeted feedback through class discussions, role plays and a videotaped encounter with a simulated client. Credits: 0.50

VCS 84600 - Advanced Small Animal Medicine

Credit Hours: 2.00. An advanced course dealing with selected diseases of dogs and cats. Designed for the student who is focusing on small animal or companion animal practice. A systems approach is used to teach the major concepts of diseases affecting each body system. Focuses on diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics covered in this elective include endocrinology, nephrology, gastroenterology, and immune-mediated diseases.

Credits: 2.00

VCS 84601 - Small Animal Medicine III

Credit Hours: 2.00. An advanced elective course focused on selected diseases of dogs and cats. Designed for the student who is considering entering either small animal exclusive practice, mixed animal practice, or companion animal practice. A systems approach is used to teach the major concepts of diseases affecting each body system while developing a deeper understanding of common diseases in the dog and cat. This course will concentrate on the diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics in this elective include nephrology, urology, oncology, endocrinology, infectious diseases, cardiology, gastroenterology (includes liver and pancreas).

Learning Outcomes: 1. List clinical signs for selected medical diseases in the dog and cat. 2. Explain diagnoses for dogs and cats in each organ system. 3. Describe treatment of selected medical diseases in the dog and cat. 4. Apply a problem-based approach to selected medical diseases in the dog and cat. 5. Describe diagnostic approach for selected medical diseases in the dog and cat. 6. Integrate knowledge obtained in core small animal medicine courses with selected diseases to develop an expanded differential diagnoses list

for common clinical presentations. 7. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. Credits: 2.00

VCS 84700 - Advanced Small Animal Specialties

Credit Hours: 2.00. An advanced course dealing with selected diseases of dogs and cats. Designed for the student who is focusing on small animal or companion animal practice. A systems approach is used to teach the major concepts of diseases affecting each body system. Focuses on diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics included in this elective include cardiology, dermatology, neurology, and oncology.

Credits: 2.00

VCS 84701 - Small Animal Medicine IV

Credit Hours: 2.00. An advanced elective course focused on selected diseases of dogs and cats. Designed for the student who is considering entering either small animal exclusive practice, mixed animal practice, or companion animal practice, following graduation. A systems approach is used to teach the major concepts of diseases affecting each body system while developing a deeper understanding of common diseases in the dog and cat. This course will concentrate on the diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics in this elective include neurology, respiratory, oncology, dermatology, and immune-mediated diseases.

Learning Outcomes: 1. List clinical signs for selected medical diseases in the dog and cat. 2. Explain diagnoses for dogs and cats in each organ system. 3. Describe treatment of selected medical diseases in the dog and cat. 4. Apply a problem-based approach to selected medical diseases in the dog and cat. 5. Describe diagnostic approach for selected medical diseases in the dog and cat. 6. Integrate knowledge obtained in core small animal medicine courses with selected diseases to develop an expanded differential diagnoses list for common clinical presentations. 7. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. Credits: 2.00

VCS 84800 - Advanced Small Animal Surgery

Credit Hours: 1.50. An advanced course dealing with selected surgical diseases of dogs and cats. Designed for the student who will be practicing on small animals (small animal, companion animal, or mixed animal track). A systems approach is used to teach important concepts of surgical diseases and procedures affecting each body system. Focuses on the diagnosis and treatment of diseases commonly encountered in small animal practice.

Learning Outcomes: 1. Identify minimally invasive surgical equipment. 2. Explain the diagnostic and therapeutic approaches to hepatic and biliary surgical disease. 3. Discuss special considerations with thoracic surgery and surgical management of more common intrathoracic diseases. 4. Explain wound reconstruction options for various types of wounds including the advantages and disadvantages of each technique. 5. Develop a diagnostic and treatment plans for dogs and cats with common fractures and joint injuries involving appendicular bones and mandible. 6. Describe the etiology, pathophysiology, diagnosis, and treatment of more common musculotendinous conditions. 7. Explain the basic principles, modalities, goals, and anticipated outcomes of current physical therapy and rehabilitation therapies. 8. List currently available physical therapy modalities and identify commonly used equipment. Credits: 1.50

VCS 85000 - Small Animal Dentistry

Credit Hours: 0.50. A thorough understanding and practical knowledge of the oral examination, dental prophylaxis, and tooth extraction. The principles of endodontics, periodontics, orthodontics, and restorations are discussed. Techniques useful in oral surgery, such as dental bonding and intra-oral splinting are presented.

Credits: 0.50

VCS 85100 - Medicine And Surgery Of Nontraditional Pets

Credit Hours: 2.00. An overview of clinical approach to common medical and surgical diseases of nontraditional pets. Focuses on diagnosis and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop an understanding of problem-solving approaches to medical and surgical problems in exotic pets. 2. Develop an understanding of common husbandry and nutritional needs of various

exotic pets. 3. Develop an integrated knowledge base of common medical and surgical diseases. 4. Problem-solve using an integrated understanding of anatomy, physiology, pathology, pathophysiology, clinical pathology, pharmacology, parasitology, bacteriology, virology, immunology, diagnostic imaging, and physical diagnostic techniques. Credits: 2.00

VCS 85300 - Small Animal Emergency And Critical Care

Credit Hours: 1.00. The emergently-ill pet is a frequent scenario for both primary care private practices and the primary emergency care center. Due to the unpredictable nature of these clinical scenarios, this course provides the veterinary student the knowledge to quickly assess and stabilize pets using standard of care protocols. Common presentations and diseases are used to reinforce key concepts in emergency and critical care medicine.

Learning Outcomes: 1. Describe the fundamental approach to triage for the emergent patient. 2. Recognize and describe common emergency scenarios in small animal practice. 3. Interpret clinical data in a case scenario and create identify appropriate stabilization plan. 4. List the Rule of 20 used in assessing and monitoring critical patients. 5. Identify different point-of-care instruments used for patient assessment and monitoring. Credits: 1.00

VCS 86000 - Emergency Medicine/ICU

Credit Hours: 0.00. Designed to teach principles of intensive medical care. Advanced monitoring, critical care technology, and nursing care principles are applied as appropriate for patients under the supervision of their attending clinician.

Credits: 0.00

VCS 86001 - Small Animal Emergency And Critical Care

Credit Hours: 3.00. This course is designed to provide an extensive three-week experiential clinical rotation that is focused on small animal emergency and critical care. The student will participate in receiving, triaging, and treating small animal emergency cases, as well as monitoring and treating critically ill small animal patients admitted to the Veterinary Teaching Hospital. Rounds will be topic and case oriented. For students in all tracks.

Learning Outcomes: 1. Understand and be able to execute the principles of patient triage. 2. Develop an understanding of the variety of cases seen in emergency situations. 3. Understand how to effectively evaluate and treat various levels of emergency, trauma, and critical care patients. 4. Understand and learn client communication skills utilized during emergency situations. 5. Understand the practical elements related to providing cost-effective, efficient and quality veterinary care for emergency patients. 6. Learn the principles and develop the skills for various critical care procedures and techniques. Credits: 3.00

VCS 86002 - Small Animal Emergency And Critical Care II

Credit Hours: 3.00. This course is designed to provide an intensive 3-week experiential clinical rotation that is focused on small animal emergency and critical care. The student will participate in receiving, triaging, evaluating emergency cases as well as monitoring and treating critically ill small animal patients admitted to the Veterinary Teaching Hospital. There will be a focus on providing additional opportunities for the student to participate in and perform advanced critical care techniques.

Learning Outcomes: 1. Teach and encourage the students to maximally utilize the "Veterinary Team" to provide efficient and effective quality veterinary care in emergency situations. 2. Help the students develop an understanding of physiologic and pathophysiologic principles as related to emergency and critical care patients. 3. Teach the students the principles and proper execution of patient triage. 4. Help the students develop an understanding of the depth and diversity of the clientele and types of cases seen in emergency situations. 5. Teach the students to appropriately assess an emergent or trauma patient as well as formulate and implement a diagnostic and therapeutic plan for the emergent or trauma patient. 6. Teach the students to appropriately assess the critical care patient as well as formulate and adjust diagnostic and therapeutic plans for those critical care patients. 7. Teach the students the principles and skills associated with various

monitoring modalities associated with emergency and critical care. 8. Teach the students client communication skills utilized during emergency situations or when discussing critical care patients. 9. Teach the students the practical elements related to providing cost effective, efficient and quality veterinary care for emergency patients. 10. Teach the students the principles and skills associated with various emergency and critical care procedures and techniques. 11. Teach the students to effectively utilize the problem oriented medical record format as it applies to the emergency patient to facilitate appropriate and thorough documentation and communication. 12. Teach the students to pursue case related information or a topic in appropriate depth using appropriate resources and to effectively communicate and apply this knowledge. Credits: 3.00

VCS 86003 - Small Animal After-Hours Care & ICU Rotation

Credit Hours: 3.00. This course is designed to provide experience in the principles of intensive medical care and management of hospitalized small animal cases. This course will provide learning opportunities for students to practice skills and to gain experience assessing and working with hospitalized patients in the intensive care unit (ICU) and hospital wards during after-hours shifts (including evenings, overnights, and weekends dependent upon student numbers) while working with attending clinician(s) and nursing staff. As emergency caseload and ICU populations are unscheduled and their timing is unpredictable, there may be both in-hospital shifts as well as times that students are on call during this rotation. (129 clinical hours)

Learning Outcomes: 1. Demonstrate appropriate sanitation for an ICU run. 2. Demonstrate appropriate sanitation for an ICU cage. 3. Identify and use all the common equipment in the ICU: doppler blood pressure unites, oscillometric blood pressure unites, continuous ECG monitoring, syringe pumps, IV fluids pumps (all models), omnicell, various warming unites. 4. Empty and quantify drains and urine collection bags using appropriate aseptic technique. 5. Demonstrate appropriate knowledge and utilization of the Snyder oxygen cage. 6. Set up the oxygen cage door and provide oxygen in the cage. 7. Set up and provide flow-by oxygen. 8. Use PPE appropriately for isolation and barrier patients. 9. Place peripheral IV catheters (3 placements minimum during the rotation). 10. Wrap IV catheters appropriately (including central lines). 11. Place a urinary catheter (either indwelling or temporary) at least once during the rotation. 12. Meet a fellow student or clinician at the door of ICU with a patient that they would like to check into ICU. Take the patient from the student or clinician and set up the cage, catheter, fluids, medications, etc. required to allow the student or clinician on the case to focus on writing the treatment orders. 13. Draw up all medications required overnight for all cases in the ICU if not already completed by the student on the case after checking with the student or clinician to ensure the animal is continuing to receive those medications overnight. 14. Note missing information on ICU treatment sheets. Contact the clinician or student on the case to obtain that missing information (ex. clinician phone numbers, call parameters, etc.). 15. Be comfortable and competent contacting a clinician about a situation where the call parameters dictate that the clinician be called. Document the information discussed on the phone. Communicate the information to the technicians. Complete the doctor's directive. Credits: 3.00

VCS 86004 - Large Animal After-Hours & Emergency Rotation

Credit Hours: 3.00. This course is designed to provide experience in the principles of intensive medical care and management of large animal emergency cases. Students will work with the attending clinician(s) and nursing staff to care for the emergency and critical care cases admitted to the hospital. As emergency cases are unscheduled and their timing is unpredictable, there will be both in-hospital shifts as well as times that students are on call during this rotation. (129 clinical hours)

Learning Outcomes: 1. Assess and develop a diagnostic and/or treatment plan for emergency large animal patients in a timely manner reflecting the urgency of the particular case. 2. Interpret diagnostic tests and utilize them to make clinical decisions in the ongoing management of emergency large animal patients. 3. Utilize clinical monitoring modalities associated with emergency and critical case cases in large animals to assess and correctly identify changes in a patients' clinical status. 4. Perform competently entry-level clinical procedures on large animal emergency and critical care patients. 5. Work effectively as part of a team in delivering emergency health care to large animal patients, including client and team communications, case triage and patient transfer. 6. Complete an accurate medical record, including history, physical examination, progress notes and surgical reports (when applicable) for emergency large animal patients. Credits: 3.00

VCS 86100 - Small Animal Medicine I

Credit Hours: 3.00. Basic clinical experience and training in the art and science of small animal medicine. Total clinic hours 129.

Credits: 3.00

VCS 86201 - Small Animal Surgery - Soft Tissue I

Credit Hours: 3.00. Students will be expected to participate in the evaluation, treatment, and care of patients, learning from clinical case material, reviewing topics, and reading the surgical literature. Students will perform elective neutering procedures as the primary surgeon and assist in other surgical procedures. Students will participate in surgery rounds at least once each day, with every student researching and discussing the theoretical aspects of cases and making a formal case or topic presentation to other students and faculty at least once during the course. Total clinic hours 129.

Credits: 3.00

VCS 86202 - Small Animal Surgery - Orthopedic I

Credit Hours: 3.00. Students will be expected to participate in the small animal orthopedic service. Students will be expected to participate in the evaluation, treatment and care of patients, learning from clinical case material, reviewing topics, and reading the surgical literature. Students will gain experience performing orthopedic and neurologic examinations and localizing lesions. Students will participate in surgery rounds at least once each day, with every student researching and discussing the theoretical aspects of cases and making a formal case or topic presentation to other students and faculty at least once during the course.

Credits: 3.00

VCS 86203 - Shelter Medicine And Surgery

Credit Hours: 3.00. Students will spend two weeks performing elective surgery on shelter animals in the mobile surgery unit and one week working at an off-campus shelter. The mobile surgery unit, staffed by a DVM faculty member and a full-time RVT will operate 4 days per week, estimated 12 hours per day. Students will perform independent study on the day they do not participate in mobile surgery. During the one week at the shelter, students will work approximately 50 hours spread over 5 days of the week assisting the shelter medicine veterinarian in all aspects of shelter medicine. There will be a limit of 4 students per block, with a maximum of 3 students participating in the mobile surgery unit at any time. Preference will be given to students who are planning to specialize in shelter medicine.

Learning Outcomes: 1. Improve their knowledge, technical skills, and competence in small animal elective surgery and anesthesia, including pediatric surgery, so that they will be able to safely anesthetize and, with high quality and attention to detail, perform a dog spay in 45 minutes or less. 2. Gain insight into issues in shelter medicine, including small animal population medicine, infectious disease control, animal welfare and pet relinquishment issues. 3. Improve their physical examination and patient evaluation skills, anatomical knowledge, efficiency of movement, and interpersonal communication skills. 4. Foster relationships between Purdue University and local animal shelters. Credits: 3.00

VCS 86204 - Clinical Rotation In Shelter Medicine At IndyHumane

Credit Hours: 3.00. The course is a 3-week clinical rotation at the Humane Society of Indianapolis, 7929 N. Michigan Road, Indianapolis, IN 46268, under the supervision of on-site staff veterinarians serving as mentors. The student will assist the on-site mentors in ongoing day-to-day veterinary assessment, medical care, surgical treatment including spay/neuter, preventive care including vaccinations, and infectious disease control involving shelter animals (primarily dogs and cats).

Learning Outcomes: 1. Increase the student's understanding of the ongoing day-to-day application of small animal medicine and surgery in the shelter medicine context. 2. Apply

principles of infectious disease prevention and control in shelter housing and to shelter animals. 3. Apply surgical principles in spay/neuter procedures on shelter animals. 4. Apply clinical and communication skills during on-site vaccine clinics, performing wellness exams and determining appropriate preventive medicine plans for each patient. 5. Apply behavioral and medical assessment of new animals at intake. 6. Develop an understanding of management skills and principles needed in the operation of a municipal animal shelter.

Credits: 3.00

VCS 86300 - Small Animal Community Practice

Credit Hours: 3.00. Provides students with training in outpatient small animal medicine and client communication. Special emphasis is placed on preventive medicine. Students are required to write one paper as arranged with the instructor. Total clinic hours 129.

Credits: 3.00

VCS 86400 - Dermatology/Behavior

Credit Hours: 3.00. During the 3-week block, students will spend 50% of time in each service (7.5 total contact days for each service). Currently the Dermatology service receives 2 days a week and the Behavior service receives 2 days a week. On the fifth business day the students will take care of follow-ups from clients as well as in-house consultations. Students are also expected to practice clinical and technical skills which are required for each service. This elective rotation provides opportunities in dermatology to perform a thorough dermatologic assessment of the patient including dermatological history and physical examination of the skin and adnexa, identification and description of skin lesions and formulation of a reasonable list of differential diagnoses. The students will be involved in performing and interpreting skin scrapings, trichogram, cytology, bacterial cultures, fungal cultures, skin biopsy, and otoscopic/video-otoscopic exam. In aptitude for diagnosing and treating a variety of dermatologic conditions. Finally, the students will have the opportunity to develop the art of client communication and client education in veterinary dermatology.

Credits: 3.00

VCS 86502 - Large Animal Medicine I

Credit Hours: 3.00. Clinical training in problem solving of medical diseases, performance of diagnostic procedures, treatment, and care of individual animals. Emphasis on bovine cases. Total clinic hours 129.

Credits: 3.00

VCS 86600 - Large Animal Surgery I

Credit Hours: 3.00. Students are exposed to, and responsible for, case-oriented problem-solving experiences with large animal surgical diseases, including lameness. Students may have an opportunity to focus on a particular species during a portion of the basic block. The basic block includes the development of skills and capability with the principles of surgery (e.g. anesthesia, asepsis, and wound healing) as applied to large animal patients. The basic block experience is directed to primary level care. Total clinic hours 129.

Credits: 3.00

VCS 86700 - Equine Field Service I

Credit Hours: 3.00. This course will provide training in outpatient and ambulatory equine medicine, surgery, theriogenology, and preventive medicine.

Learning Outcomes: 1. Develop a consistent clinical thought process and logical approach to cases. 2. Demonstrate proficient clinical skills with routine procedures. 3. Practice equine field medicine as a contributing and inclusive team member. Credits: 3.00

VCS 86800 - Equine Field Service II

Credit Hours: 3.00. Provides students with training in outpatient and ambulatory equine medicine, surgery, theriogenology, and preventive medicine. Special emphasis on client communications and computerized practice management is provided. A special project in practice management is required. Total clinic hours 129.

Learning Outcomes: 1. Develop a consistent clinical thought process and logical approach to cases. 2. Demonstrate proficient clinical skills with routine procedures. 3. Practice equine field medicine as a contributing and inclusive team member. Credits: 3.00

VCS 87000 - Clinical Cardiology

Credit Hours: 3.00. Students will actively participate in diagnostic and therapeutic procedures in all veterinary species with an emphasis on small animals. Students will be instructed and actively perform such diagnostic and therapeutic procedures including: electrocardiography, echocardiography, blood pressure determination and catheter placement. Students will be given exposure to invasive procedures such as angiography, intracavitary pressure determinations, PDA embolization, balloon valvuloplasty and pacemaker implantation. Students will receive "active" clinical instruction as well as lectures in the form of teaching rounds. Current concepts in cardiovascular medicine will be emphasized. Total clinic hours 129.

Credits: 3.00

VCS 87100 - Small Animal Medicine II

Credit Hours: 3.00. Additional clinical experience and training in the art and science of small animal medicine. Total clinic hours

129.

Credits: 3.00

VCS 87102 - Oncology I

Credit Hours: 3.00. This block is designed to provide maximum exposure to clinical and comparative oncology. Students will develop skills necessary to fully evaluate and treat canine and feline cancer patients. Students will receive two weeks of exposure to the medical oncology clinic and one week of exposure to the radiation oncology clinic. Students will gain experience with various biopsy techniques and with therapeutic modalities including chemotherapy and radiation therapy. Independent study of relevant current literature is expected. The oncology student will concentrate on handling oncology patients but will have general internal medicine responsibilities during non-clinic hours.

Credits: 3.00

VCS 87104 - Clinical Investigation In Oncology II

Credit Hours: 3.00. This elective will allow senior students the opportunity to investigate a problem in clinical oncology. The problem and method of investigation will be defined by the student and instructor. Methods of investigation available could include: 1) prospective or retrospective studies relating to the diagnosis, biological behavior, and treatment of specific canine or feline neoplasms, and 2) in vitro evaluation of tumor cells (e.g. cell culture). Oncology rounds attendance and case responsibility in oncology will also be expected. The experience gained in this course may aid in preparing the student to enter graduate or residency training. An expanded course description for the specific problem to be investigated must be placed on file in the departmental office and in the office of the Associate Dean of Academic Affairs. Total clinic hours 129. Permission of instructor required.

Credits: 3.00

VCS 87105 - Pet Practice

Credit Hours: 6.00. Advanced instruction and clinical experience in dermatologic medicine. Students participate fully in diagnostics, therapeutics, patient management, drug studies, and research activities. Extensive self-study materials are available. Small Animal Community Practice: Students will receive training in primary care small animal and exotic pet medicine, behavior, theriogenology, client preventive medicine and overall pet wellness to promote the family-pet bond. Students will be required to write one paper as arranged with instructor.

Credits: 6.00

VCS 87201 - Clinical Veterinary Anesthesiology

Credit Hours: 3.00. This course will provide clinical training in anesthesiology. Students may focus on large animals, small animals, or a mixture of the both. The students will participate in daily rounds to discuss case work-up as well as advanced topics in anesthesia that are not covered in other courses. Topics may include mechanical ventilation, blood gas interpretation, neuromuscular blockade, and adjunctive anesthetic procedures (epidural analgesia, brachial plexus block, etc.).

Credits: 3.00

VCS 87202 - Small Animal Surgery - Soft Tissue II

Credit Hours: 3.00. Students will be expected to assume greater responsibility for evaluation, treatment, and care of patients while developing greater knowledge, clinical judgment, and diagnostic capabilities that enable them to manage more complex cases. Students will learn from clinical case material, reviewing topics, and reading the surgical literature and will be given more responsibility for case management. Students will perform elective neutering procedures as the primary surgeon and assist in other surgical procedures. Students will participate in surgery rounds at least once each day, with every student researching and leading case discussions, demonstrating more initiative and independence. Each student will make a formal case or topic presentation to other students and faculty at least once during the course. Total clinic hours 129.

Credits: 3.00

VCS 87203 - Small Animal Surgery - Orthopedic II

Credit Hours: 3.00. Students will be expected to assume greater responsibility for evaluation, treatment, and care of patients while developing greater knowledge, clinical judgment, and diagnostics capabilities that enable them to manage more complex cases. Students will be expected to learn from clinical case material, reviewing topics, and reading the surgical literature. Students will gain additional experience performing orthopedic examinations.

Credits: 3.00

VCS 87502 - Large Animal Medicine II

Credit Hours: 3.00. Advanced clinical training in problem-solving of medical diseases, performance of diagnostic procedures, treatment, and care. Students may be allowed to spend up to three working days off campus to work with a veterinarian engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 87600 - Large Animal Surgery II

Credit Hours: 3.00. Students have advanced responsibility for large animal surgical patients with a species focus. Students are expected to conduct the appropriate presurgical physical examination, assist with the surgery, and be responsible for the postoperative care of most primary care level patients and many secondary care level patients. Total clinic hours 129.

Credits: 3.00

VCS 87700 - Large Animal Lameness

Credit Hours: 3.00. Students are exposed to, and responsible for, case-oriented problem-solving experiences with large animal lamenesses and orthopedic diseases. The case

exposure is primarily equine, but lameness students are expected to help with food animal lamenesses and orthopedics, as a comparative biomedical approach to studying locomotion and the musculoskeletal system. Depending upon the availability of lameness cases, lameness students will participate with the general clinic responsibilities and emergency duty in the large animal surgery. Students may be allowed to spend up to three days off campus to work with a veterinarian engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 87800 - Swine Production Medicine I

Credit Hours: 3.00. Advanced training and extensive experience in working with swine herds on a herd health management program. Total clinic hours 129.

Credits: 3.00

VCS 87900 - Bovine Theriogenology And Production Medicine I

Credit Hours: 3.00. Training and experience in working with reproductive management problems in dairy and beef herds. The importance of herd records in assessing performance and health is stressed, and training is provided in the use of computerized recording systems and ration formulation programs. Total clinic hours 129.

Credits: 3.00

VCS 87902 - Comparative Theriogenology

Credit Hours: 3.00. Training and experience in working with reproductive management problems in dairy and beef herds. The importance of herd records in assessing performance and health is stressed, and training is provided in the use of computerized recording systems and ration formulation programs. Total clinic hours 129.

Credits: 3.00

VCS 87903 - Bovine Theriogenology And Production Medicine II

Credit Hours: 3.00. Advanced training in the areas of embryo transfer, embryo grading, artificial insemination, oviduct patency tests, and ultrasound use in ambulatory food animal practice. Training will also focus on repeat breeder cows. Additional responsibilities will be designated in the areas of herd health, production medicine and the recognition of disease processes.

Credits: 3.00

VCS 87905 - Advanced Beef Cow-Calf Production Medicine

Credit Hours: 3.00. This course is designed to provide an intensive 3-week experiential clinical rotation that is focused on beef cow-calf production medicine. The students will spend about 50% of the time on herd visits and about 50% on research and writing up herd reports. Each student will be responsible for a specific area of focus on each herd visit. Purdue students taking the block will be available for back-up emergency duty on days when they are on campus.

Learning Outcomes: 1. Become increasingly proficient at taking a thorough history. 2. Improve active listening skills. 3. Develop skills in oral and written communication. 4. Learn to evaluate and analyze beef herd records and to make recommendations for improvement where indicated. 5. Learn how to find credible sources of information when the answer to a question is not known. 6. Learn the difference between a differential diagnosis and speculation. One is good and one is bad. 7. Learn to develop a team of experts to help you solve problems outside your areas of expertise. 8. Maintain a positive attitude and open-mindedness toward change. 9. Understand the economics of beef production. 10. Accept responsibility for lifelong learning and continuing education by keeping current with advances in the profession. When you're through learning, you're through. Credits: 3.00

VCS 87910 - Bovine Field Service I

Credit Hours: 3.00. Students will be trained and experience working with individual animal and herd health issues in an ambulatory setting. Students will have the opportunity to participate in after-hours emergencies on a voluntary basis. In addition, students will have the opportunity to provide routine veterinary services at the Purdue ASREC Dairy and Beef Unit. Students may elect to schedule up to five business days of the rotation at a farm animal focused private practice.

Learning Outcomes: 1. Manage a range of individual animal and herd health issues. 2. Prescribe and/or administer medications to farm animals based on current best practices. 3. Communicate effectively with producers concerning their individual animal's or herd's veterinary service needs. Credits: 3.00

VCS 87920 - Bovine Field Service II

Credit Hours: 3.00. Advanced training in the areas of embryo transfer, embryo grading, artificial insemination, oviduct patency tests and ultrasound use in ambulatory food animal practice. Training will also focus on repeat breeder cows. Additional responsibilities will be designated in the areas of herd health, production medicine and the recognition of disease processes.

Learning Outcomes: 1. Manage a range of

individual animal and herd health issues. 2. Prescribe and/or administer medications to farm animals based on current best practices. 3. Communicate effectively with producers concerning their individual animal's or herd's veterinary service needs. Credits: 3.00

VCS 88000 - Ruminant (Dairy) Production Medicine I

Credit Hours: 3.00. Training and faculty-directed independent study in dairy production medicine. Emphasis is on health and management from the newborn calf to the lactating dairy cow. Particular attention is paid to nutritional management, herd monitoring, and herd records analysis. Additionally, vaccination programs, facilities, and welfare auditing will be covered. The block may be customized according to the interests of the students enrolled. A limited amount of time is spent on individual animal care. Farm visits to observe different management styles and to provide troubleshooting of herd problems will also be scheduled during the block. Students may be allowed to spend up to five working days off-campus to work with a veterinarian engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 88001 - Ruminant (Dairy) Production Medicine II

Credit Hours: 3.00. This course is meant to build on the knowledge gained in VCS 88000 and is directed at students that are focused on future intensive dairy practice. The structure of the block will be similar to VCS 88000, but there will be more in-depth discussion of ration building, records analysis, and mild quality. Additional farm visits will also be performed to provide exposure to different types of dairy farms that will be encountered in dairy practice.

Credits: 3.00

VCS 88002 - Clinical Veterinary Services For The Indiana State Fair

Credit Hours: 3.00. The course is a 3-credit clinical rotation. A PVM clinician will lead this elective 3-week clinical rotation. Students will spend 3 weeks providing veterinary care to all exhibition animals at the Indiana State Fair. The veterinary services provided include health assessment during check-in, assessment of ill animals, and on-call service after business hours. The majority of cases will be swine and cattle, but can also include horses, poultry, and small ruminants.

Learning Outcomes: 1. Increase the student's clinical experience in diagnosis and treatment of common disease conditions in a wide variety of species. 2. Develop communication skills in an environment which presents diverse interactions (ex. client, general public). 3. Develop leadership skills. 4. Develop an understanding of regulatory medicine, to include animal welfare, for livestock exhibition. 5. Increase the student's exposure to disease biosecurity and control. Credits: 3.00

VCS 88100 - Small Animal Medicine III

Credit Hours: 3.00. Further clinical exposure with emphasis on cases in the student's area of interest. A faculty mentor will be assigned to each student. Total clinic hours 129.

Credits: 3.00

VCS 88300 - Clinical Investigation In Theriogenology

Credit Hours: 3.00. Provides senior students an opportunity to investigate a clinical problem in a laboratory situation. The student is expected to apply one of the many research techniques available in the school to address the question. The experiences gained may allow the candidate to pursue graduate and residency training in theriogenology. An expanded course description for the specific problem to be investigated must be placed on file in the departmental office and in the office of the associate dean of academic affairs. Total clinic hours 129.

Credits: 3.00

VCS 88400 - Equine Theriogenology Clinical Rotation

Credit Hours: 3.00. This 3-week rotation will offer students the opportunity to work directly with the Equine Theriogenology in-house service. Students will be able to observe and manage both mares and stallions with reproductive conditions commonly seen in practice. The rotation may include management of hospitalized high-risk mares during their gestation, mares with hospitalized neonates that need reproductive evaluation and treatment, and dystocia diagnosis and treatment.

Learning Outcomes: 1. Perform record keeping/maintenance to facilitate successful breeding management of horses. 2. Describe mare management strategies for pregnancy establishment. 3. Choose appropriate pharmacologic treatments for successful timed artificial insemination protocols. 4. Collect and analyze equine semen for proper calculation of breeding doses for cooled or cryopreserved semen and describe proper shipment or storage of the semen. 5. Perform breeding soundness evaluations for mares and stallions. Credits: 3.00

VCS 88500 - Large Animal Medicine III

Credit Hours: 3.00. Advanced clinical training with focused interest in a specialized type of practice, in-depth training in internal medicine, or participation in large animal related research activities. Students may be allowed to spend up to three working days off campus to work with a veterinarian engaged in practice in the student's area of interest. This experience should enhance the student's education by complementing experience gained on campus. The short off-campus experience should be arranged with the professor of record of the course at least 30 days prior to the beginning of the block.

Credits: 3.00

VCS 88600 - Large Animal Surgery III

Credit Hours: 3.00. Students at this level are expected to function with greater independence, carrying out the history, physical examination, and postoperative care of all elective and certain emergency/intensive care patients of the species of their choice. Depending upon the capabilities and competence of the student, as determined by the surgery faculty and staff, he or she will have the opportunity to conduct supervised surgical procedures. Students may be allowed to spend up to three days off campus to work with a veterinarian engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 88601 - Large Animal Surgery III Food Animal

Credit Hours: 3.00. This course will focus on food animal surgery and lameness and will only be offered 1-2 times per year. Students will be expected to function with greater independence than during LAS I and II, carrying out the history, physical examination and postoperative care of elective and certain emergency/intensive care patients. Depending upon the capabilities and competence of the student, as determined by the surgery faculty and staff, he/she will have the opportunity to conduct supervised surgical procedures. This block will focus on food animal surgical diseases through seminars, in-clinic hands-on laboratory sessions, rounds discussions and an emphasis on food animal clinical cases. Total clinic hours 129.

Credits: 3.00

VCS 88602 - Clinical Veterinary Services At Caesars Entertainment Equine Specialty Hospital

Credit Hours: 3.00. In this 3-week rotation students will assist the staff with diagnosis and treatment of sports-related conditions including lameness diagnosis and treatment, evaluation and treatment of upper respiratory diseases, and diagnosis and treatment of a variety of surgical conditions such as lacerations and traumatic injuries to the musculoskeletal system. Students will assist in advanced diagnostic imaging including nuclear imaging and CT imaging with a unit that allows horses to be imaged while standing. A dynamic endoscope is available for use on the track to evaluate upper respiratory disease while the horse is exercising. Students will perform lameness examinations under guidance of the staff clinicians and will be expected to participate in after-hours emergencies. Rounds will be held daily when horses are hospitalized. The caseload is not limited to racing Thoroughbred horses but includes a diverse population of sport horses including Standardbred racehorses, working Quarter Horses, and hunter-jumper and dressage horses.

Learning Outcomes: 1. Become proficient in performing physical examinations, localizing lesions, generating differential diagnoses, and selecting an appropriate treatment plan for horses presented to the hospital with lameness and other sports medicine conditions. 2. Become familiar with the indications and application of advanced diagnostic imaging modalities. 3. Able to diagnose and create a treatment plan for common sports related injuries. 4. Learn to integrate knowledge to provide patient care, including medical management, preoperative, surgical, and postoperative care of client-owned horses. This includes principles of analgesia, surgical treatment and exercise limitations and/or rehabilitation. 5. Develop greater knowledge, clinical judgment, technical skills, and diagnostic capabilities that enable management of more complex cases of sport horses. 6. Learn numerous aspects of sport horse medicine including regional anesthesia, intra-articular anesthesia and intra-articular medications. 7. Observe procedures, such as orthopedic and respiratory surgeries, under both sedation with local anesthesia and under general anesthesia thereby expanding their knowledge on surgical treatment of sports injuries. 8. Scrub in to assist surgeons on elective surgical cases and emergency conditions such as lacerations when feasible based upon procedures being performed. 9. Learn and master bandaging and administration of medications orally, intravenously, and intramuscularly. 10. Practice teamwork and professionalism through

interactions with faculty/clinicians, colleagues, technicians, and horse owners. Credits: 3.00

VCS 88800 - Swine Production Medicine II

Credit Hours: 3.00. This course is a faculty-directed independent study. Students are expected to use campus, state, and national resources to deal with herd problems. The goal is to bring the knowledge base of the student to the entry level expected for a swine practitioner. Emphasis is placed on veterinary services needed to maintain top production efficiency in swine herds. Total clinic hours 129.

Credits: 3.00

VCS 89100 - Diagnostic Imaging

Credit Hours: 3.00. Clinical training and experience in radiology and ultrasound imaging as it contributes to the practice of veterinary medicine. Seminars are based on small animal imaging. Total clinic hours 129.

Credits: 3.00

VCS 89101 - Veterinary Diagnostic - Ultrasound

Credit Hours: 3.00. This rotation will provide opportunity for hands-on small animal ultrasound imaging. The student will have the opportunity to pre-scan the patients prior to actual scan by the radiologist. By doing so, the student will learn the ultrasound scanning techniques and real-time interpretation of ultrasonography. In addition, students will observe the scanning of veterinary patients by the radiologist and will be asked to participate in ultrasonography interpretation.

Credits: 3.00

VCS 89200 - Veterinary Forensic Medicine

Credit Hours: 1.00. The definition of forensic medicine is a science that deals with the relation and application of medical facts to legal problems. The primary role of a forensic specialist is to provide law enforcement officials, judges, and jury members with the information necessary to make decisions (decision to prosecute, render a verdict, etc.) regarding a case. This elective course is designed to expose students to the many situations where veterinary medicine and the law intersect.

Learning Outcomes: 1. Introduce students to the scope of interaction between legal authorities and veterinary medicine. 2. Understand how to collect materials and write reports that can be used in a legal case. 3. Know about the use of forensic investigation to document animal neglect and cruelty. Credits: 1.00

VCS 89300 - Shelter Animal Medicine

Credit Hours: 1.00. The Shelter Animal medicine course will be offered to second and third year veterinary students. The course will cover topics essential to understanding the complexity of population medicine in a shelter environment and related welfare issues. Topics to be covered include animal shelter models (no-kill/adoption guarantee, tradition, etc.), population medicine and disease control as it relates to the environment and the animals, critical care in a shelter environment, foster care, neonatal care of shelter animals, population statistics, animal behavior and relinquishment issues, abuse and cruelty, legal and ethical issues, euthanasia, and developing and implementing animal disaster plans.

Learning Outcomes: 1. Develop a clear understanding of shelter population management and factors that affect it. 2. Be familiarized with the medical aspect of caring for animals in a shelter environment. 3. Recognize and understand the factors surrounding animal relinquishment and the challenges faced caring for them. 4. Incorporate acquired knowledge and apply it to a real-life shelter situation. Credits: 1.00

VCS 89400 - Comparative Ophthalmology I

Credit Hours: 3.00. Students are given the opportunity to develop the technical skills needed to test for vision and examine each ocular structure for abnormalities. The rotation includes clinical experience and instruction in veterinary (comparative) ophthalmology with participation in the diagnosis, therapy, and management of clinical cases and various research activities. A seminar presentation and/or special project is required. Total clinic hours 129.

Credits: 3.00

VCS 89500 - Purdue Veterinary Hospital Practicum

Credit Hours: 0.00. Students will be assigned to work on a service in the Purdue Veterinary Hospital (PVH) over one-half of the December-January holiday period. The student will gain hands-on practical experience in the diagnosis and treatment of patients presented to the PVH. The student will also gain some experience managing emergent cases. Total clinic hours 45.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00

Veterinary Medicine

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost

of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

VM 10500 - Intro To Veterinary Nursing - DL

Credit Hours: 1.00. An introduction to the profession of Veterinary Technology will be presented. It will include the many roles of veterinary technicians on the veterinary teams in practice and non-practice areas. Learning skills with an emphasis on medical terminology will be covered to help the student develop a foundation of medical vocabulary for future courses.

Learning Outcomes: 1. Describe the various roles of veterinary technicians on practice and non-practice veterinary teams. 2. Select appropriate strategies for dealing with personal and emotional issues confronting veterinary technicians. 3. Discuss the historical events that influenced the development of the veterinary technology profession. 4. Discuss legal and ethical issues related to the veterinary technology profession. 5. Analyze roots and affixes of medical terms as a foundation of learning medical terminology. 6. Identify common occupational hazards encountered in veterinary medicine and utilize appropriate strategies to mitigate their effects. 7. Utilize appropriate tools and strategies to be a successful online learner. Credits: 1.00

VM 10800 - Veterinary Nursing Career Exploration

Credit Hours: 1.00. This course will introduce students to basic concepts related to the veterinary technology profession. The course will provide an introduction to the various career opportunities within the veterinary healthcare profession as well as a general introduction to the attributes and traits of veterinary medical professionals. Veterinary technology as a career will be explored to promote understanding of the responsibilities of the veterinary technician and technologist in the veterinary medical field. Enrollment restricted to non-veterinary technology majors and first-year veterinary technology students. Second through fourth-year veterinary technology students may not register for this course.

Learning Outcomes: 1. Communicate knowledge of the veterinary technology profession's history. 2. Demonstrate understanding of the roles of veterinary technicians and technologists within the veterinary healthcare team. 3. Describe current legal and ethical issues in veterinary medicine. 4. Describe diversity issues in veterinary medicine. 5. Explain academic standards for the veterinary technology program. 6. Successfully navigate the admissions process for non-veterinary technology majors. 7. Apply appropriate study skills. 8. Explain appropriate use of animals in teaching and research. 9. Describe various career opportunities available within the veterinary technology profession. Credits: 1.00

VM 10900 - Veterinary Nursing Learning Community

Credit Hours: 1.00. This Learning Community course is designed for freshman in the Veterinary Nursing Program and is focused on new student integration, providing resources available on campus to facilitate student success in the first year, creating community, and introduce students to Purdue and the Program.

Learning Outcomes: 1. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 2. Engage in outside activities to build community with classmates, upperclassmen, and instructors. 3. Understand the importance of being engaged in veterinary nursing as a new student. 4. Expand knowledge of the available resources offered by Purdue University, the College of Veterinary Medicine, and the Veterinary Nursing Program that facilitate student success. 5. Demonstrate proper classroom etiquette, and how to conduct oneself appropriately when interacting with faculty, academic advisors, DVM students, upperclassmen, and other members of the campus community. Credits: 1.00

VM 11400 - Anatomy I - DL

Credit Hours: 2.00. This course is the first of two courses in the distance learning program that presents an introduction to the

study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orienting the animal for diagnostic procedures and to aid in evaluating the diagnostic imaging results obtained by such procedures. 3. Be able to identify anatomical structures on dissected specimens, skeletons, radiographs, and anatomical models. 4. Be able to integrate the anatomical differences and similarities of the common domesticated species studies in this course. Credits: 2.00

VM 11600 - Anatomy II - DL

Credit Hours: 2.00. This course is the second of two courses in the distance learning program that presents an introduction to the study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orientating the animal for diagnostic procedures and to aid in evaluating the diagnostic imaging results obtained by such procedures. 3. Identify anatomical structures on dissected specimens; skeletons; radiographs; and anatomical models. 4. Integrate the anatomical differences and similarities of the common domesticated species studied in this course. Credits: 2.00

VM 11700 - Anatomy - DL

Credit Hours: 3.00. This course will introduce students to the general anatomy of mammalian body systems and biological processes, with an emphasis on domestic animals. The course will review body systems and comparative anatomy between canine, feline, equine, and ruminant species. It will focus on anatomy of the immune, cardiovascular, nervous, muscular, respiratory, renal, endocrine, reproductive, and digestive systems.

Learning Outcomes: 1. Describe directional, anatomical, and regional terms of major domestic species. 2. Discuss the different anatomical structures within the organ and body system levels. 3. Identify anatomical structures on images, radiographs, anatomical models, and live animals. 4. Compare and contrast between the anatomical components of the immune, nervous, muscular, cardiovascular, respiratory, renal, endocrine, reproductive, and digestive systems. 5. Evaluate comparative anatomy between major domestic species. Credits: 3.00

VM 12000 - Introduction To Veterinary Nursing I

Credit Hours: 1.00. This is the first in a two-course sequence for first-year Veterinary Nursing students. This course will introduce students to the Veterinary Nursing program and profession focusing on new student integration, providing resources available on campus to facilitate student success, and entry-level professional skill development. Students will learn and apply professional attributes of the veterinary medical professional.

Learning Outcomes: 1. Develop effective interpersonal communications skills to increase their ability to communicate within the veterinary medical team. 2. Explore career options within the field of Veterinary Nursing. 3. Cultivate a shared sense of community at Purdue through relationships with peers and instructors. 4. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 5. Understand the importance of being engaged in veterinary nursing as a new student. 6. Expand knowledge of the available resources offered by Purdue University, the College of Veterinary Medicine, and the Veterinary Nursing Program that facilitate student success. 7. Demonstrate proper classroom etiquette and how to conduct oneself appropriately when interacting with faculty, academic advisors, DVM students, upperclassmen, and other members of the campus community. Credits: 1.00

VM 12100 - Introduction To Veterinary Nursing II

Credit Hours: 1.00. This is the second in a two-course sequence for first-year Veterinary Nursing students. This course introduces the various opportunities within the veterinary healthcare profession as well as a general introduction to the attributes and traits of veterinary medical professionals. Students will learn about veterinary clinical education and expectations and continue to explore the profession by speaking with current professionals and observing current practices.

Learning Outcomes: 1. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 2. Understand attributes and traits of veterinary medical professionals and be able to apply those in a clinical education setting. 3. Explore the Veterinary Nursing Profession by speaking with current professional(s) and observing current practices. Credits: 1.00

VM 13500 - Physiology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to general physiology of the mammalian body systems and the general physiological process with emphasis on domestic animals. This course will address the functions of the different systems and homeostasis; the functions of the cell; the different compartments and solute transport; blood and defense; general functions of the nervous system, reflexes and special senses; the function of the nerve and muscle; cardiovascular system; and digestive system.

Learning Outcomes: 1. Discuss the major physiological functions of blood, and the cardiovascular, nervous, muscle, and digestive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 13600 - Physiology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that addresses the functions of the kidney and its role in regulation of extracellular volume and acid-base; respiration, mechanics of respiration and its control, transport of gases and hypoxia; physiology of the endocrine system, functions of the gonads, fertilization, pregnancy, parturition and lactation.

Learning Outcomes: 1. Discuss the major physiological functions of the respiratory, renal, endocrine, and reproductive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 13700 - Physiology - DL

Credit Hours: 2.00. This course will introduce students to the general physiology of mammalian body systems and biological processes, with an emphasis on domestic animals. The course will place emphasis on the function of cellular components, blood, the immune system, and the physiology of the cardiovascular, nervous, muscular, respiratory, renal, endocrine, reproductive, and digestive systems.

Learning Outcomes: 1. Compare and contrast between the functions of the immune, nervous, muscular, cardiovascular, respiratory, renal, endocrine, reproductive, and digestive systems. 2. Discuss the different physiological processes that occur at the cell, organ, and system level. 3. Summarize the contribution of different systems to homeostasis, the maintenance of relatively constant conditions in the cellular environment. 4. Describe examples of disorders and diseases related to the body systems and identify appropriate treatments. Credits: 2.00

VM 14000 - Introduction To Veterinary Technology

Credit Hours: 1.00. This course provides an orientation to the profession of Veterinary Technology.

Learning Outcomes: 1. Become familiar with the various facets and career opportunities in the field of Veterinary Technology. Credits: 1.00

VM 14001 - Small Animal Nursing I - DL

Credit Hours: 3.00. This is the first of two courses involving nursing and management of the small animal patient. This is the introduction to small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Introduce the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the fundamental techniques involved with reproduction, neonatal care, and pediatrics of small animals. Credits: 3.00

VM 14700 - Surgical Nursing - DL

Credit Hours: 1.00. This course is designed to instruct veterinary technician students in the basic principles of veterinary operating room protocols and sterilization of surgical supplies commonly used within a veterinary hospital. Emphasis will be placed upon key concepts of surgical preparation of the patient, and the role of the circulating nurse and surgical nurse. In addition, the concepts of proper instrument care, sterilization procedures and inventory rotation will be covered.

Learning Outcomes: 1. Know the basic roles of circulating or surgical nurse. 2. Present fundamental techniques of aseptic technique. 3. Know the concepts of sterilization of instruments and inventory rotation. Credits: 1.00

VM 14801 - Large Animal Nursing I - DL

Credit Hours: 2.00. This is the first of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary facility.

Learning Outcomes: 1. Discuss the impact of livestock health from "farm to fork", including markets. 2. Explain fundamental livestock health management and nursing concepts to clients. 3. Identify and discuss the commonalities and variations that exist between livestock species. 4. Identify the concepts of nursing care and develop a care plan for the livestock patient. 5. Know the basics of herd health management and regulatory issues of large animal species. 6. Present the fundamental techniques used in herd health management. Credits: 2.00

VM 15001 - Clinical Pathology I - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of cytological sample handling and evaluation.

Learning Outcomes: 1. Introduce the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. 3. Serve as a prerequisite course for the Clinical Pathology clinical mentorship. Credits: 2.00

VM 20100 - Medical Math And Terminology For Veterinary Nursing

Credit Hours: 1.50. A didactic course which presents the basic skills that will be used in all nursing courses and in the overall curriculum. In addition, the course introduces medical math and terminology used in veterinary medicine. Students will complete exercises utilizing math concepts for dosage calculations, conversions, proper notation, dispensing medications, fluid therapy calculations, and percent solutions. Students will use medical terminology including prefixes, roots, and suffixes of medical terms to complete exercises. This knowledge will be utilized in didactic courses and labs as well as in clinical rotations. Students will learn normal temperature, pulse and respiration values for various species. There will be both in-class and study components.

Learning Outcomes: 1. Utilize medical math to calculate drug dosages, dispense medications, fluid therapy rates, and percent solutions. 2. Apply medical math concepts to perform conversions and use proper notation. 3. Understand and utilize medical terminology in didactic classes, laboratories, and clinic rotations. 4. Know normal temperature, pulse and respiration values for various species and report abnormalities. 5. Apply diversity and inclusion skills as they apply in veterinary medicine. 6. Discuss compassion fatigue and

euthanasia in veterinary medicine. Credits: 1.50

VM 20200 - Pharmacy Procedures - DL

Credit Hours: 1.00. This course introduces students to the concepts of pharmacy procedures used in veterinary practice. Concepts covered in this course include basic record keeping, safe handling of drugs and chemicals, inventory control, calculation of amount of drugs to be dispensed or dosed, reading prescriptions, labeling drug containers, compounding, and drug regulatory matters that impact the veterinary hospital pharmacy.

Learning Outcomes: 1. Know the basics of pharmacy procedures; inventory control and regulations on how drugs are to be dispensed or stored. 2. Present the concepts of safe handling of cytotoxic drugs and chemicals. 3. Develop and practice doing dosage calculations. Credits: 1.00

VM 20500 - Small Animal Nursing Mentorship I - DL

Credit Hours: 1.50. This is the first of three clinical mentorships in small animal nursing. This clinical mentorship will require the veterinary technician student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of history taking, physical examination, simple diagnostic sample collection, parenteral and oral administration of medication, and venipuncture. Permission of department required.

Learning Outcomes: 1. Perform the basics of examination; monitoring; and history taking of veterinary patients. 2. Perform the basics of restraint. 3. Perform the basics of topical and parenteral administration of drugs. 4. Perform the basics of basic grooming and patient hygiene procedures. 5. Perform competence techniques for collecting urine and taking ear swabs for diagnostic procedures. Credits: 1.50

VM 20501 - Small Animal Nursing Mentorship I - DL

Credit Hours: 2.50. This is the first of three Clinical Mentorships in Small Animal Nursing. This Clinical Mentorship will require the student to work with a veterinary facility to perform tasks under the supervision of a clinical mentor (veterinarian or credentialed veterinary technician). This Clinical Mentorship focuses on the principles of history taking, physical examination, simple diagnostic sample collection, parenteral and oral administration of medication, and venipuncture. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Demonstrate proper examination, monitoring, and history taking of veterinary patients. 2. Demonstrate handling and restraint in dogs and cats. 3. Perform topical and parenteral administration of drugs. 4. Perform grooming and patient hygiene procedures. 5. Utilize the proper techniques for collecting urine and ear samples for diagnostic testing. Credits: 2.50

VM 20600 - Small Animal Nursing Mentorship II - DL

Credit Hours: 1.00. This is the second of three clinical mentorships in small animal nursing. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of venipuncture, catheter placement, various methods of urine collection, vaginal cytology, dental prophylaxis, and ECG tracings. Permission of department required.

Learning Outcomes: 1. Perform a jugular venipuncture of veterinary patients. 2. Perform the placement of peripheral catheters. 3. Perform urine collection by urinary catheter and cystocentesis. 4. Perform the basics of collection and preparation of vaginal cytology. 5. Perform techniques for completing enemas; stomach tubing and diagnostic ECG tracings. 6. Perform a complete dental prophylaxis. Credits: 1.00

VM 20700 - Small Animal Nursing Mentorship III - DL

Credit Hours: 1.00. This is the third of three clinical mentorships in small animal nursing. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of oncology,

dermatology, ophthalmology, and emergency care procedures. Permission of department required.

Learning Outcomes: 1. Perform fine needle aspiration of veterinary patients. 2. Perform Tru-Cut biopsy. 3. Perform sample collection for dermatophyte culture. 4. Perform Schirmer Tear Test; a fluorescein stain test. 5. Perform use of a Schiotz tonometry. 6. Perform dilation of the eye and examination of the internal eye structures. 7. Perform history on a critical patient. 8. Perform physical examination on a critical patient. 9. Perform hospitalized patient care; record keeping and observation. 10. Perform the placement of a jugular IV catheter. 11. Perform calculating; monitoring and maintaining correct IV fluid rate for critical care patients. 12. Perform the collection of an arterial blood gas sample from femoral artery. 13. Perform first aid procedures. 14. Demonstrate closed chest CPR. Credits: 1.00

VM 20800 - Farm Animal Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of basic handling, nursing, and diagnostic techniques used in large animal medicine. Permission of department required.

Learning Outcomes: 1. Perform handling and restraint techniques on cattle, sheep, goats, and swine. 2. Perform knot-tying techniques. 3. Perform assistance with food animal bandaging techniques. 4. Perform food animal sample collection techniques. 5. Perform animal injection techniques. 6. Perform data collection techniques in food animals (TPR, etc.). 7. Perform techniques for administration of oral medications in the ruminant. 8. Perform placement and maintenance of indwelling catheters in food animals. 9. Perform determination of age food animals. 10. Perform the California Mastitis Test (CMT) technique. Credits: 1.00

VM 20900 - Equine Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of handling, restraint, and equine nursing care. Tasks to be documented include restraint and handling techniques, data collection, basic nursing care, and administration of medication and treatments. Permission of department required.

Learning Outcomes: 1. Perform equine restraint and handling techniques. 2. Determine age of horses. 3. Perform placement and maintenance of indwelling catheters in horses. 4. Perform data collection techniques in horses (TPR, etc.). 5. Perform hoof care and grooming techniques in horses. 6. Perform sample collection techniques in horses. 7. Perform proper placement of a mouth speculum in a horse. 8. Perform equine injection techniques. 9. Perform application of leg and tail wraps in a horse. Credits: 1.00

VM 21000 - Small Animal Anesthesia Mentorship - DL

Credit Hours: 2.00. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of anesthesia from induction, maintenance to recovery. Permission of department required.

Learning Outcomes: 1. Perform the basics of history and physical exam pertinent to anesthesia. 2. Perform the basics of patient care before, during and after anesthesia. 3. Perform the basics of proper record keeping for patients under anesthesia. 4. Perform the basics of induction of general anesthesia in the small animal. 5. Perform the basics of patient monitoring and recovery from anesthesia. Credits: 2.00

VM 21100 - Food Animal And Equine Anesthesia-Clinical Mentorship-DL

Credit Hours: 1.00. This mentorship focuses on the principles of large animal anesthesia from induction and maintenance to recovery. Students will be required to complete projects and participate in discussions related to large animal anesthesia cases.

Learning Outcomes: 1. Demonstrate knowledge of history and physical exam pertinent to large animal anesthesia. 2. Discuss large animal patient care before, during and after anesthesia. 3. Demonstrate proper record

keeping for patients under anesthesia. 4. Discuss large animal anesthesia cases related to aspects of induction, maintenance and patient monitoring, and recovery from anesthesia. Credits: 1.00

VM 21200 - Surgical Nursing Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work in a veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of operating room procedures, patient and instrument preparation for surgery and the duties of the circulating nurse and the scrub nurse. Permission of department required.

Learning Outcomes: 1. Perform the basics of instrument identification and care. 2. Perform the basics of sterilization of surgical packs and single instruments. 3. Perform the basics of patient preparation for surgical procedures. 4. Perform the basics of personal preparation for surgical procedures. 5. Perform the duties of the circulating and surgical nurse. Credits: 0.50

VM 21201 - Surgical Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship will require the student to work in a veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of operating room procedures, patient and instrument preparation for surgery and the duties of the circulating nurse and the scrub nurse. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Identify commonly used surgical instruments. 2. Perform instrument care. 3. Sterilize surgical packs and single instruments. 4. Prepare dog and cat patients for common surgical procedures. 5. Prepare yourself as the circulating and or surgical nurse aseptically for surgical procedures. 6. Perform the duties of a circulating and a surgical nurse. Credits: 1.00

VM 21300 - Microbiology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or microbiologist). This Clinical Mentorship focuses on the motor skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques. Permission of department required.

Learning Outcomes: 1. Perform collection of microbiology samples for culture and inoculating culture media. 2. Perform techniques for staining and completing differential tests on microbiology samples. Credits: 0.50

VM 21400 - Parasitology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or parasitologist). This Clinical Mentorship focuses on the motor skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques.

Learning Outcomes: 1. Perform techniques for collecting samples for fecal examination. 2. Perform techniques for testing for intestinal parasites and heartworms. 3. Perform techniques for collection of samples and examination for external parasites. Credits: 0.50

VM 21500 - Small Animal Diagnostic Imaging Mentorship I - DL

Credit Hours: 1.00. This is the first of two clinical mentorships in diagnostic imaging. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of film loading, processing, presentation for viewing radiographs, care and maintenance of processors, and imaging of the thorax and abdomen. Permission of department required.

Learning Outcomes: 1. Perform the basics of film loading and unloading. 2. Perform the basics of automatic processing and manual processing. 3. Perform the basics of film labeling and presentation for viewing. 4. Perform the basics of caring for the automatic and manual processing units. 5. Perform the techniques for obtaining diagnostic views of the

thorax and abdomen. Credits: 1.00

VM 21600 - Small Animal Diagnostic Imaging Mentorship II - DL

Credit Hours: 1.50. This is the second clinical mentorship in small animal diagnostic imaging. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the preparation of a technique chart, imaging of the shoulder, radius, ulna, stifle, spine, skull, and pelvis. Permission of department required.

Learning Outcomes: 1. Perform techniques for preparing a technique chart. 2. Perform diagnostic views: shoulder, radius/ulna, stifle, spine skull, pelvis, maxillary molars and premolars, mandibular molars and premolars, intraoral dental film: Mandibular premolars, Maxillary premolars. Credits: 1.50

VM 21700 - Equine Diagnostic Imaging Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work with a food animal/equine veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the imaging of the carpus, fetlock, tarsus, navicular projection, P3 views, and the dorsoproximal-palmarodistal view. Permission of department required.

Learning Outcomes: 1. Produce diagnostic radiographic carpus images in the equine patient. 2. Produce diagnostic radiographic fetlock images in the equine patient. 3. Produce diagnostic radiographic tarsus images in the equine patient. 4. Produce diagnostic radiographic Coffin Bone images in the equine patient. Credits: 0.50

VM 21701 - Equine Diagnostic Imaging Mentorship - DL

Credit Hours: 1.00. This clinical mentorship will require the student to work with an equine veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the imaging of the carpus, fetlock, tarsus, navicular projection, P3 views, and oblique radiographic views. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Produce diagnostic radiographic carpus images in the equine patient. 2. Produce diagnostic radiographic fetlock images in the equine patient. 3. Produce diagnostic radiographic tarsus images in the equine patient. 4. Produce diagnostic radiographic Coffin Bone images in the equine patient. Credits: 1.00

VM 21800 - Small Animal Diagnostic Imaging Mentorship - DL

Credit Hours: 2.00. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of radiographic presentation for viewing radiographs, radiation safety, usage of a radiographic technique chart and log, imaging of the thorax and abdomen, imaging of orthopedic areas (thoracic limb, pelvic limb, skull), dental intraoral imaging. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Demonstrate proper radiographic presentation techniques. 2. Label radiographic images according to machine standard conventions accurately. 3. Utilize a radiographic technique chart and a radiographic log to ensure accurate exposure settings. 4. Perform diagnostic radiographic imaging of the thorax and abdomen of feline and canine patients while adhering to radiation safety protocols. 5. Obtain high-quality orthopedic radiographic images of the thoracic and pelvic

limb, and skull while maintaining proper radiation safety. 6. Execute full-mouth intraoral dental radiography with proper positioning and techniques while following proper radiation safety. Credits: 2.00

VM 22100 - Laboratory Animal Health II -DL

Credit Hours: 1.00. This course is the second of two courses that provide basic instruction in the concepts of laboratory animal health management to the veterinary technician student. This course will place an emphasis on the care of laboratory animals as well as specific procedures that are used in laboratory animal medicine.

Credits: 1.00

VM 22300 - Pharmacy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the veterinary technician student to work with a veterinary care facility to practice tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of drug order fulfillment, reconstitution of medications, correct storage of medications (including controlled substances), safe handling of hazardous medications, and inventory control procedures. Permission of department required.

Learning Outcomes: 1. Interpret accurately a DVM medication order and transcribe that order onto a prescription label of the appropriate type for the container used, with appropriate information on the label. 2. Interpret accurately DVM orders for an oral solid and an oral liquid medication and fill the orders. 3. Interpret accurately DVM orders and reconstitute a medication for dispensing and a vaccine for administration to a patient. 4. Dispense an oral liquid medication and topical medication to a client, explaining medication administration, administration devices, and special instructions if indicated. 5. Describe appropriate storage and record keeping of controlled substances in a veterinary practice. 6. Describe the process for pharmacy inventory in a facility and critique the process. 7. Describe safe storage and handling of biological and hazardous medications. Credits: 0.50

VM 22400 - Necropsy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship focuses on the motor skills and techniques in performing a basic prosection (necropsy). Tasks include basic necropsy technique, techniques for sample collection and storage, and safety issues related to handling animal specimens. Course is offered as Distance Learning. Permission of department required.

Learning Outcomes: 1. Perform the basics of necropsy on a non-preserved animal. 2. Perform techniques for sample collection, storage and shipping from a necropsied animal. 3. Perform techniques for handling rabies suspect bodies and samples safely. 4. Perform the proper storage and disposal of dead animals. Credits: 0.50

VM 22500 - Advanced Clinical Mentorship - DL

Credit Hours: 1.50. This clinical mentorship will require the student to complete 120 hours of additional work experience while completing a series of selected projects related to veterinary medicine. Permission of department required.

Learning Outcomes: 1. Perform 120 hours experience in a practice. 2. Describe cases and procedures. 3. Perform quality improvement project related to the functioning of the veterinary facility. 4. Perform client education. 5. Perform a presentation to the public or peer group. Credits: 1.50

VM 22501 - Parasitology - DL

Credit Hours: 2.00. This course provides basic instruction in the concepts of parasitology to the veterinary technician student. Emphasis will be on the basic information needed to accurately identify parasites commonly encountered in veterinary medicine. Emphasis will also be placed on life cycles and zoonotic aspects of the parasites covered.

Learning Outcomes: 1. Identify parasite diagnostic stages. 2. Describe the life cycles, transmission, basic pathogenesis, zoonotic aspects, adult parasite predilection site, clinical manifestations and parasitic control methods for parasites. 3. Apply appropriate public health information to clients regarding the common parasites of domestic animals. Credits: 2.00

VM 22600 - Lab Animal Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the motor skills involved with the basic handling, restraint, administration of medication and nursing care of laboratory animals. Permission of department required.

Learning Outcomes: 1. Perform the basics of handling and restraint of rabbits and rodents. 2. Perform the determination of sex of rabbits and

rodents. 3. Perform the basics of drug and medication administration in rabbits and rodents. 4. Perform the basics of blood collection in rabbits and rodents. Credits: 1.00

VM 22700 - Clinical Pathology Mentorship - DL

Credit Hours: 2.00. This clinical mentorship will require the student to work with a laboratory, small or large animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of blood film evaluation for different species, manual and automated CBCs, normal and abnormal cellular morphology, urinalysis, chemistry panels, and differentials. Permission of department required.

Learning Outcomes: 1. Perform a total protein and packed cell volume. 2. Perform a unopette WBC and platelet count. 3. Perform manual and automated evaluation of normal and abnormal CBCs. 4. Perform urinalysis, chemistry panels and electrolyte screenings. 5. Perform ELISA testing and hormone assay. 6. Perform morphology evaluation and differentials. Credits: 2.00

VM 22701 - Clinical Pathology Mentorship - DL

Credit Hours: 1.00. This mentorship will require the student to work with a laboratory within a small or large animal veterinary care facility to complete clinical pathology tasks under the supervision of a clinical mentor. The mentorship tasks will focus on the principles of microscope use, urinalysis, blood sample collection and preparation, manual and automated CBCs, differentials, chemistry panels, coagulation, crossmatch, and normal vs. abnormal cellular morphology. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Demonstrate appropriate use, care, and cleaning of microscopes. 2. Prepare blood samples for chemistry panel. 3. Properly prepare and accurately evaluate a blood film, including a normal and abnormal differential. 4. Properly collect, process, and accurately evaluate cellular findings for vaginal and auricular cytology. 5. Perform, read, and record results of the following- basic urinalysis, packed cell volume, total protein, and hematology panel (CBC), chemistry panel and agglutination test, coagulation test, crossmatch procedure. Credits: 1.00

VM 22800 - Integrations - DL

Credit Hours: 2.00. This course will provide instruction in the concepts problem based learning for the nursing process (patient evaluations, interventions, and desire resolutions) using a cased based approach. This course will integrate foundational knowledge form anatomy, physiology, with the information in the veterinary nursing courses. Cases will involve different domestic animal species.

Learning Outcomes: 1. Identify and apply the components of nursing process (physical exam, patient history, SOAP). 2. Explain the rationale for using the nursing process as it relates to veterinary patient care. 3. Identify and explain how patient interventions change the physiology of the animal. 4. Integrate and apply knowledge from foundation courses to understand the rationale behind nursing intervention in clinical cases. 5. Identify individual strengths in problem solving as a part of a small group. 6. Apply the elements of critical thinking in case studies. Credits: 2.00

VM 22900 - Lab Animal Medicine - DL

Credit Hours: 2.00. This course will provide instruction in the concepts of Laboratory Animal Health Management to the veterinary technician student. This course will place an emphasis on the information needed to work with laboratory animals as well as issues that apply to laboratory animal medicine along with the care of laboratory animals and exotics and specific procedures that are used in laboratory animal and exotic pet medicine. Students are expected to achieve a level of understanding of laboratory animal care and management so that they will be able to communicate effectively with the veterinarian and other individuals.

Learning Outcomes: 1. Explain the concepts of animal welfare and animal rights. 2. Introduce the student to the basic concepts of laboratory animal medicine. 3. Explain basic laboratory

animal housing and environmental control concepts. 4. Identify the basic concepts of experimental methodology. 5. Introduce the student to the different laboratory animals and exotic pocket pets. 6. Explain basic restraint, husbandry, and anesthesia of laboratory animals and pocket pets. Credits: 2.00

VM 23000 - Public & Occupational Health -DL

Credit Hours: 1.00. This is the first of two courses that provide basic instruction in the concepts of workplace safety related to the veterinary technician. This course will place an emphasis on the basic information needed to recognize hazards commonly encountered and the steps that should be taken to reduce the risk of exposure to hazards. Other practical aspects of public health will be discussed.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Locate current information related to veterinary medical occupational hazards. 4. Communicate appropriate safety principles to colleagues and the public. Credits: 1.00

VM 23001 - Small Animal Nursing II - DL

Credit Hours: 2.50. This is the second of two courses involving nursing and management of the small animal patient. This course continues the concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Demonstrate the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the fundamental techniques involved with critical care and management of common diseases of small animals. Credits: 2.50

VM 23100 - Diagnostic Imaging - DL

Credit Hours: 3.00. This course involves principles of imaging that are necessary for the performance of diagnostic imaging procedures in a veterinary hospital. This course provides an introduction to x-ray generation, image formation, exposure factors, scatter radiation, grids, film, screens, safety, basic terminology, positioning, darkroom techniques, artifact identification, advanced positioning techniques for the small animal, large animal techniques, contrast techniques, technique charts, basic ultrasound, diagnostic imaging in exotic animals.

Learning Outcomes: 1. Explain the basic and advanced concepts of diagnostic imaging for small and large animal patients. 2. Describe fundamental techniques used in setting up, taking, and developing radiographs. 3. Explain concepts of safe use of radiographic equipment. 4. Present key points on assessment of radiographic technique. 5. Describe techniques used in large animal, exotics, and special procedures. 6. Explain the process required to develop a radiographic technique chart. 7. Explain the basic information regarding ultrasound. 8. Differentiate the uses for CT/MRI. Credits: 3.00

VM 23200 - Principles Of Anesthesia - DL

Credit Hours: 3.00. This course involves the basic principles of anesthesia and anesthetic delivery for the veterinary technician. This course focuses on the preparation of the patient for anesthesia, the agents used as pre-anesthetics, induction agents and general anesthesia, the physiologic impacts of anesthesia on the body, multi-species anesthetic techniques (small animal, large animal/equine, pocket pets), managing high risk patients, anesthetic complications, and pain management.

Learning Outcomes: 1. Discuss the preparation of the patient and equipment for anesthesia. 2. Explain the agents used, advantages/disadvantages, and indications/contraindications of pre-anesthetics, induction agents and general anesthetic agents. 3. Describe the physiologic impacts of anesthesia on the body. 4. Explain the different anesthetic techniques required for multiple species (small animal, bovine, equine, porcine, small ruminant, and pocket pets). 5. Discuss the management of high risk patients. 6. Recognize anesthetic complications and the steps to prevent. 7. Discuss the options for pain management in all species. Credits: 3.00

VM 23300 - Optho, Derm & Oncology - DL

Credit Hours: 1.00. This course involves the instruction of nursing and management of small animal patients related to ophthalmology, dermatology, and oncology. It presents concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient, and preventative medicine related to these specific clinical disciplines. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Know the basics of ophthalmology; dermatology and oncology. 2. Present the fundamental techniques used in ophthalmology; dermatology and oncology. 3. Know the nursing aspects of managing some common small animal diseases. Credits: 1.00

VM 23400 - Microbiology - DL

Credit Hours: 2.00. This course is designed to enable the veterinary technician to satisfactorily collect and process specimens, and characterize and identify microorganisms that may be encountered in veterinary practice situations. This course will introduce microorganisms commonly encountered in veterinary medicine. Different laboratory techniques will be illustrated.

Learning Outcomes: 1. Identify the common microorganisms seen in veterinary medicine and describe characteristics of each and the diseases that they cause including zoonotic implications that may be applicable. 2. Apply biochemical tests to aid in the identification of microorganisms. 3. Explain appropriate public health information to clients regarding the diseases of domestic animals caused by common microorganisms. Credits: 2.00

VM 23500 - Pharmacology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to the principles of pharmacy and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs, and dosage calculations.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of pharmaceuticals. Credits: 1.00

VM 23600 - Pharmacology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that presents an introduction to the principles of therapeutics and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of pharmaceuticals. Credits: 1.00

VM 23701 - Large Animal Nursing II - DL

Credit Hours: 3.00. This is the second of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary facility.

Learning Outcomes: 1. Explain fundamental individual patient management and nursing concepts to clients. 2. Identify the concepts of nursing care and develop a care plan for the individual patient. 3. Explain the basics of individual patient management of the large animal species. 4. Present the fundamental techniques used in individual patient management. Credits: 3.00

VM 23900 - Dentistry - DL

Credit Hours: 0.50. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs 5. Develop and provide client education. Credits: 0.50

VM 24000 - Nutrition - DL

Credit Hours: 1.00. This course will provide an overview of

nutritional concepts as they apply to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as the therapeutic use of diets as they relate to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediataric stages to adulthood. 5. Define specific differences in diets based upon breeds (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VM 24100 - Occupational & Public Health I

Credit Hours: 1.00. This course will cover selected zoonotic diseases, occupational hazards and safety issues, related to the veterinary health care team and veterinary facility.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Understand where to find current information related to veterinary medical occupational hazards. 4. Effectively communicate appropriate safety principles to colleagues. Credits: 1.00

VM 24200 - Integrations I

Credit Hours: 1.00. An introduction to problem based learning of the nursing process (patient evaluations, interventions, and desired resolutions) using a case based approach. This course will integrate foundational knowledge from anatomy, physiology, with information in the veterinary nursing courses. Cases will involve different domestic animal species. Students will learn using a variety of teaching modalities (lecture, group work, problem based learning).

Learning Outcomes: 1. Identify and apply the components of nursing process (physical exam, patient history, SOAP). 2. Explain the rationale for using the nursing process as it relates to veterinary patient care. 3. Identify and explain how patient interventions change the physiology of the animal. 4. Integrate and apply knowledge from foundation courses to understand the rationale behind nursing intervention in clinical cases. 5. Identify individual strengths in problem solving as a part of a small group. 6. Use verbal and written communication skills appropriately with other members of the veterinary team, with clients, and the general public. Credits: 1.00

VM 24300 - Clinic Rotations I

Credit Hours: 1.50. This course will provide the basic learning situations for developing the techniques required of veterinary technicians in pharmacy, radiology, surgery, medical nursing, and ancillary areas. Total clinic hours 9/week.

Learning Outcomes: 1. Become acquainted with clinical areas, personnel, responsibilities and basic procedures. 2. Perform basic nursing duties as they are learned in concurrent courses and by experience. 3. Become familiar with the veterinary team concept and its benefit to patient care. Credits: 1.50

VM 24400 - Clinical Rotations II

Credit Hours: 1.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed basic nursing duties learned in previous courses and as they are learned in concurrent courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 1.50

VM 24500 - Veterinary Management Topics - DL

Credit Hours: 1.50. This course is the first of two courses that provide basic instruction in the concepts of a veterinary technician's role in the management of day-to-day operations of a veterinary clinic. This course will emphasize problems related

to ethical and liability issues, medical records, inventory, marketing and fees, writing cover letters and resumes, and job interviews. Students must be currently working/volunteering at least 10-15 hours a week at a veterinary facility.

Learning Outcomes: 1. Plan and manage a job search in the veterinary profession. 2. Analyze the ethical issues that can confront veterinary technicians. 3. Apply effective strategies for communicating with clients and coworkers and providing excellent client service and client retention. 4. Develop and implement appropriate strategies for marketing a practice's products and services. 5. Develop and implement appropriate strategies for inventory management, fee-setting strategies and medical records management. Credits: 1.50

VM 24800 - Animal Disease - DL

Credit Hours: 2.00. This course is a survey of common small animal and large animal diseases, their clinical signs, and how these signs can be explained by physiology and pathophysiology. The zoonotic potential for the disease and the role of the veterinary technician in the treatment, management, and education of client/owner of the affected animal is also emphasized.

Learning Outcomes: 1. Identify the key features of common small animal and large animal disease. 2. Explain the role of the veterinary technician in the management of these diseases. 3. Explain the zoonotic potential and public health potential of these disease to clients and peers. Credits: 2.00

VM 24900 - Clinical Rotations III

Credit Hours: 3.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities, and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 3.50

VM 25001 - Clinical Pathology II - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of cytological sample handling and evaluation.

Learning Outcomes: 1. Understand the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. Credits: 2.00

VM 25100 - Medical Math And Terminology For Veterinary Technicians

Credit Hours: 0.50. This course will introduce students to fundamental medical terminology and basic math and dosage calculations commonly used in veterinary medicine. The course includes both classroom and on-line components.

Learning Outcomes: 1. The student will be able to identify and recognize the part of a medical term, define the meaning of commonly used prefixes combining forms and suffixes, recognize and correctly apply approximately 350 basic medical terms. 2. The student will be able to recognize the importance of spelling and pronouncing medical terms correctly. 3. The student will be able to calculate doses of medication and fluid administration rates for patients. 4. The student will be able to calculate concentrations of percent solutions, and calculate amount of a medication to dispense given the dosage and drug concentration or strength. Credits: 0.50

VM 32300 - Laboratory Animals & Exotic Pet Medicine-VN

Credit Hours: 2.00. This course will cover the proper methods of restraint, daily care, nursing techniques, and housing needs for the common species of laboratory animals.

Learning Outcomes: 1. Understand nutritional requirements, physiological data, anesthesia, blood collection, drug administration, handling, sexing, and common diseases of laboratory rodents, primates, and lagomorphs as well as non-traditional pets including small mammals, fish, amphibians, reptiles, and birds. 2. Familiarization with laboratory housing, environmental control, and environmental enrichment concepts. 3. Familiarization with

basic genetics and breeding programs of laboratory animals. 4. Understand sanitation and hygiene procedures as they relate to laboratory animal management. 5. Introduce concepts of experimental methodology and regulatory compliance within laboratory animal medicine. 6. Introduce wildlife triage and wildlife nursing techniques. Credits: 2.00

VM 34200 - Integrations II

Credit Hours: 1.00. A continuation to problem based learning of the nursing process using a case based approach. This course will integrate foundational knowledge from anatomy, physiology, veterinary nursing courses, clinical pathology, pharmacology, anesthesia diagnostic imaging, microbiology and parasitology. Cases will involve different domestic animal species and laboratory animals. Students will learn using a variety of teaching modalities (lecture, group work, problem-based learning).

Learning Outcomes: 1. Apply previous knowledge of the nursing process. 2. Apply the elements of critical thinking in case studies. 3. Integrate and apply knowledge from other courses to explain the rationale behind nursing cases. 4. Identify individual strengths of all members in problem solving as a part of small group learning. Credits: 1.00

VM 34210 - Integrations-VN

Credit Hours: 2.00. This course will give an introduction to problem-based learning of the nursing process (patient evaluations, interventions, and desire resolutions) using a case-based approach. This course will integrate foundational knowledge from anatomy, physiology, and information in the veterinary nursing courses. This course will draw on fundamentals and concepts learned from all courses to this point including pharmacology, diagnostic imaging, parasitology, small animal nursing, and large animal nursing, so as to enable you to apply knowledge of understanding of clinical cases. Cases will involve different domestic animal species.

Learning Outcomes: 1. Integrate and apply knowledge from foundational coursework. 2. Identify and apply the components of the veterinary nursing process. 3. Follow evidence-based medicine practices and relate to patient case scenarios. 4. Utilize critical thinking skills to apply the veterinary nursing process to patient case scenarios. 5. Use verbal and written communication skills appropriately with other members of the veterinary team. Credits: 2.00

VM 34300 - Clinic Rotations IV-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34400 - Clinic Rotations V-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34500 - Veterinary Management Topics I-VN

Credit Hours: 1.50. The course will introduce students to concepts related to working in and managing a veterinary practice. Emphasis will be on client communication and education as well as facilitating a job search, interviewing and cover letter and resume creation.

Learning Outcomes: 1. Create a professional cover letter and resume. 2. Properly prepare for and participate in employment interviews. 3. Utilize techniques that build excellent relationships by exceeding client expectations, providing great client service and building a rapport with clients. 4. Utilize techniques for handling emotional or difficult clients. 5. Utilize techniques for working with special needs clients. 6. Explain the grief process. 7. Discuss professionalism and legal and ethical issues related to the veterinary technology profession.

8. Describe the ways in which fees are set for products and services at a veterinary clinic. 9. Define marketing and describe how marketing strategies can be used in a veterinary clinic setting. 10. Describe inventory management strategies. 11. Identify professional organizations related to veterinary technology and veterinary practice management. Credits: 1.50

VM 36500 - Laboratory Animal Management-VN

Credit Hours: 3.00. This course will cover the principles of laboratory animal science for the technologist (veterinary and LATG). Concepts of facility management, animal health and diseases, regulatory issues, compliance, and instrumentation will be presented.

Learning Outcomes: 1. Gain a broader knowledge of facility design, facility management, regulatory compliance, disaster planning and fiscal management. 2. Gain exposure to research protocol development, animal use alternatives, and the use of non-rodent models in research. 3. Gain an in-depth look at rodent breeding colony management and animal health. Credits: 3.00

VM 39000 - Practicum

Credit Hours: 4.00. Veterinary technologist level off-campus experience in one area of interest totaling 480 hours over 12 weeks.

Credits: 4.00

VM 40900 - International Veterinary Medicine

Credit Hours: 0.50. The course will consist of a series of lectures and discussions addressing international aspects of veterinary medicine. The course will include the following topics: foreign animal diseases, biosecurity, animal welfare and ethics, veterinary medicine around the world, food security, and cultural competence.

Learning Outcomes: 1. Become familiar with international issues that impact the veterinary profession. 2. Develop an understanding of the role that veterinary professionals play in global education and global health. 3. Develop respect for diverse people and cultures. 4. Develop an understanding of the skills required for working across cultures. 5. Develop the knowledge and skills necessary to keep themselves and others safe when traveling internationally and to maximize the benefits of their experience. Credits: 0.50

VM 41001 - International Practicum

Credit Hours: 4.00. The student will experience an integrated employment situation combined with veterinary team interaction to augment his/her specialized CoVM clinical learning experiences. The student will work under the direct supervision of a licensed veterinarian or credentialed veterinary technician designee of tech veterinarian. The student is required to complete a pre-departure orientation with the PVM Director of International Programs.

Learning Outcomes: 1. Perform technical duties in medical and surgical nursing, imaging, laboratory procedures, anesthesia, and client interaction when working in a practice setting. 2. Perform tech duties required of the position in the industry setting. 3. Observe and record the case cycle concept of vet med in its components of history, assessment, problem listing, interventions and actions, potential problems encountered, patient outcomes and evaluations, and discharge planning as it pertains to veterinary nursing. 4. Identify and critically address management issues. 5. Create and deliver an oral presentation. 6. Develop communication skills. Credits: 4.00

VM 41003 - International Veterinary Medicine for the Veterinary Nurse - Directed Experience

Credit Hours: 0.50 to 2.00. This course allows veterinary technology students to participate in a unique faculty/staff-led veterinary learning experience in an international location. Credit will be assigned on the basis of 0.5 credit for each 45-60 hours of student effort, up to a max of 2 credits. In most instances, one week of experience will equal 0.5 credit. Each veterinary learning experience will be designed by the faculty/staff leader to accomplish specific learning goals in the focused area of study. The course will vary in length from 1-4 weeks depending on the specific experience.

Learning Outcomes: 1. Increase student's understanding of a focused area of veterinary medicine in its international context. 2. Develop an understanding of the importance of a global education. 3. Increase awareness of global health issues. 4. Become aware of international veterinary career options. 5. Encourage

leadership development and diversity awareness. 6. Develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 7. Foster relationships between Purdue University and international colleagues. Credits: 0.50 to 2.00

VM 42500 - Veterinary Technician Grand Rounds

Credit Hours: 0.00. Provides a regular forum to bring those in the college together, focused around their common interest in veterinary medicine. Case-based presentations emphasize the basic pathophysiology of disease and clinical investigation and demonstrate the interactions between the clinical and basic sciences.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to international educational opportunities that are available to them. 3. Expose students to the breadth of career opportunities that are available to veterinarians, veterinary technicians, and veterinary technologies. Credits: 0.00

VM 44100 - Occupational & Public Health II-VN

Credit Hours: 1.00. The course covers selected aspects of public health and safety related to the veterinary health care team, patient, client and public.

Learning Outcomes: 1. Able to select and utilize the appropriate measures to assist in preventing problems or mitigate their effects. 2. Able to seek, select, compile and effectively communicate appropriate material to their colleagues, the clients and public. Credits: 1.00

VM 44200 - Veterinary Management Topics II-VN

Credit Hours: 1.50. This course is a continuation of the first veterinary practice management course. It will introduce students to concepts related to leading a veterinary medical team and managing the day-to-day management of the veterinary practice. Emphasis will be on human resources, marketing and financial management.

Learning Outcomes: 1. Describe the attributes of a good leader. 2. Create a personal financial plan (i.e. budget) use credit wisely. 3. Describe strategies for recruiting, managing, and motivating employees. 4. Utilize techniques for proper delegation of work within a veterinary facility. 5. Create effective client surveys. 6. Use social media to effectively market a veterinary facility. 7. Create and interpret financial statements. 8. Describe techniques used for controlling expenses at a veterinary facility. 9. Assess a veterinary facility's financial performance by utilizing industry benchmarks. Credits: 1.50

VM 44300 - Clinic Rotations VI-VN

Credit Hours: 2.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increase awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Perform nursing duties learned in previous courses and by experience. 3. Participate in the utilization of the veterinary team concepts and contributed to its patient care benefits. Credits: 2.00

VM 44400 - Veterinary Technology Clinical Orientation

Credit Hours: 3.00. This course is an intensive experience and clinical orientation to the Veterinary Teaching Hospital for graduates from another AVMA accredited Veterinary Technology program who wish to complete a BS degree at Purdue University. This course is a four week long, full day rotation (40 hours per week).

Learning Outcomes: 1. Function effectively in the clinical ancillary areas of the Veterinary Teaching Hospital complex. 2. Demonstrate compliance with VTH policies and procedures. 3. Demonstrate an understanding of Purdue nursing methodologies and skills utilized in the VTH. 4. Self-identify areas of technical skills which will require further development to attain standards of performance expected of Purdue Veterinary Technologists. 5. Perform nursing duties assigned by instructors, and participate as a fully functioning member of the veterinary team and effectively contribute to patient care. Credits: 3.00

VM 44500 - Senior Project-VN

Credit Hours: 4.00. This is an independent study course in which the student engages in learning activities to enhance their knowledge in a particular area of veterinary technology of their choosing, demonstrate effective oral and written communication, and apply analysis, integration, and syntheses to achieve a solution.

Learning Outcomes: 1. Acquisition of knowledge at the veterinary technologist level in an area of interest or focus. 2. Demonstrate effective oral communication. 3. Demonstrate effective written communication. 4. Demonstrate the ability to analyze, integrate, and synthesize a solution to solve a problem. Credits: 4.00

VM 45000 - Animals in Emergencies - Disaster Management-VN

Credit Hours: 1.00. The course is intended to assist animal care providers in understanding the incident command system and developing plans that improve the care of and mitigating the impact of disasters on livestock and pets.

Learning Outcomes: 1. Increase awareness and preparedness among animal care providers regarding animals in disasters. 2. Describe how the Incident Command System (ICS) is involved in managing animals in disasters. 3. Identify potential hazards and threats in their area - Describe how hazards affect animals and what can be done to reduce the impact of those hazards, including animal suffering and economic losses. 4. Assist in developing effective plans for managing animals in emergencies. Credits: 1.00

VM 45100 - Contemporary Topics In Life Skills-VN

Credit Hours: 1.00. This course will introduce the student to a variety of different skills needed to be successful after graduating from college. It will introduce students to concepts related to managing a job search and evaluating job offers, establishing and using credit, investing, saving, risk assessment and managing college debt.

Learning Outcomes: 1. Effectively manage personal finances and devise an appropriate plan for saving for retirement. 2. Discuss the pros and cons of using credit and strategies for monitoring credit on an on-going basis. 3. Describe appropriate strategies for the effective management of time and stress. 4. Organize and execute an effective job search. 5. Compare and contrast renting vs. buying a home and describe the mortgage process. 6. Implement appropriate strategies for managing student loan debt. 7. Manage risk via the utilization of appropriate types of insurance (life, car, house, health, disability, etc.). 8. Gather the appropriate information needed to file taxes and utilize the most advantageous form for filing taxes. Credits: 1.00

VM 45300 - The Role Of The Clinical Research And Diagnostic Technician

Credit Hours: 1.00. This course is aimed for the student with an interest in clinical trial research or diagnostic medicine. The student will gain a broader knowledge of the vital team role the clinical research technician/nurse and diagnostic laboratory technician plays. The student will gain exposure to the various laboratories in a diagnostic laboratory and the clinical research laboratory. Enrollment minimum is 5 students per semester.

Learning Outcomes: 1. Understand the importance of the technician/nurse in clinical research and diagnostic laboratories. 2. Increase knowledge of the different equipment and supplies used in diagnostic laboratories for the different laboratories. 3. Understand the importance of standard operating procedures and validation of diagnostic tests. 4. Understand the clinical research's role in implementing new procedures. Credits: 1.00

VM 45400 - Animal Rehabilitation And Physiotherapy

Credit Hours: 1.00. This course is an introduction to physical rehabilitation of the veterinary patient. It is designed to instruct students in the basic principles of rehabilitation. This course will introduce the fundamentals needed in clinical practice.

Learning Outcomes: 1. The student will be able to apply the principles of biomechanics and anatomy to the movement of animal patients. 2. The student will be able to identify clinical situations where physical rehabilitation may be applicable to patient care and develop a basic therapeutic exercise plan for a canine, feline or equine patient. Credits: 1.00

VM 45500 - Equine Behavior-VN

Credit Hours: 1.00. This course is an in-depth look at equine behavior beyond the basics covered in the nursing courses. It is designed to show how the environment in which the horse is kept can affect its behavior. This course will also demonstrate how the study of behavior is applied in equine welfare and to the solution of practical problems and problem behavior in the equine patient.

Learning Outcomes: 1. The student will be able to understand the natural behavior of the equine patient, recognize the different behaviors of equines in various working environments. 2. The student will be able to discuss methods used to assess the welfare of equines, appreciate the specific welfare issues associated with equines, and evaluate the current research in equine behavior and welfare. Credits: 1.00

VM 45600 - Advanced Ophthalmology-VN

Credit Hours: 1.00. This course is an in-depth look at ocular anatomy and physiology, use of exam equipment, diagnostic techniques, imaging, pharmacology, surgical instrument identification, cleaning, and care of instruments, surgical nursing, surgical procedures, anesthesia protocols and concerns that are associated with these procedures.

Learning Outcomes: 1. Identify ophthalmic surgical instruments. 2. Explain care and use of ophthalmic surgical instruments. 3. Identify and locate ocular lesions. 4. Explain anesthetic protocols for various ophthalmic surgeries. 5. Explain the when, why, and how of advanced exam techniques including imaging. 6. Identify commonly used ophthalmic medications and relate them to ocular physiology and the treatment of eye conditions. 7. Comprehend proper equine restraint and sedation protocols. 8. Describe an equine pre purchase exam. 9. Compare and contrast "field" ophthalmology with "in clinic" ophthalmology. 10. Evaluate ophthalmic issues for sport/show horses and medication rules. 11. Identify ocular lesions associated with systemic disease. Credits: 1.00

VM 45700 - Advanced Neurology-VN

Credit Hours: 1.00. This course will focus on neuroanatomy and neurophysiology as well as explore a variety of common neurologic diseases and the basic pathophysiology behind those disease processes. Students will also learn proper nursing care techniques associated with patients with these diseases.

Learning Outcomes: 1. Become knowledgeable with the functional anatomy of the nervous system. 2. Localize lesions to regions of the brain, spinal cord or peripheral system. 3. Become familiar with a variety of neurologic diseases commonly presented to general or private practice and demonstrate an organized approach to identifying these diseases. 4. Ability to understand the basic principles of nursing care for neurologic diseases. Credits: 1.00

VM 45800 - Advanced Surgical Nursing And Anesthesia

Credit Hours: 1.00. This course is an in-depth look at small animal surgical nursing, surgical procedures, surgical instrumentation, wound management and the physiological reason certain anesthetic protocols are used. Students will learn using a variety of teaching modalities.

Learning Outcomes: 1. Identify and explain the physical exam findings and physiological changes of a patient that is a possible surgical case. 2. Explain the physiological reasons and pharmacological impact for anesthetic protocol choices for the critical patient. 3. Maintain and troubleshoot surgical instrumentation. 4. Explain different pain management including epidurals, ring blocks and brachial plexus blocks. 5. Explain the additional critical surgical nursing components that are required for the neonatal and critical care surgical patient. 6. Explain wound management and identify the nursing skills required to care for the patient with the problematic wound. Credits: 1.00

VM 49000 - Topics In Veterinary Medicine

Credit Hours: 0.50 to 5.00. Advanced study in the field of animal health and practice of veterinary medicine. Permission of instructor required.

Credits: 0.50 to 5.00

VM 80900 - International Veterinary Medicine

Credit Hours: 0.50 or 1.00. The course will consist of eight lectures addressing international aspects of the following topics: zoonotic diseases, food hygiene, biosecurity, animal welfare, animal husbandry, infectious diseases, cultural competence, veterinary medical education, and role of international

organizations in animal health. Participating students will be required to choose an internationally relevant topic of interest to research. The last session of the course will be a poster session in which each student will present and discuss a poster. The posters will be evaluated by a panel of 3-4 faculty members and a grade assessed. Permission of Department required.

Learning Outcomes: 1. Students should be familiar with the international issues that impact the veterinary profession. 2. Understand the role that veterinarians play in global health and education. 3. Have respect for diverse people and cultures and develop skills for working across cultures. 4. Students gain skills and knowledge to keep themselves safe when traveling overseas. Credits: 0.50 or 1.00

VM 81000 - Veterinary Externship

Credit Hours: 6.00. A six-week or 280-contact-hour work experience, under the direct supervision of a veterinarian, in a facet of veterinary medicine selected as a career goal by the student.

Credits: 6.00

VM 81001 - International Veterinary Experience

Credit Hours: 1.00 to 6.00. This course will allow veterinary students to establish a unique veterinary learning experience in their area of interest in an international location. Each veterinary learning experience will be designed by the student with input from faculty advisor and the professor of record. Permission of instructor required.

Learning Outcomes: 1. Develop an understanding of the importance of global education. 2. Increase awareness of global health issues. 3. Develop awareness of international veterinary career opportunities. 4. Encourage leadership development and diversity awareness. 5. Develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 6. Foster relationships between Purdue university and international colleagues. Credits: 1.00 to 6.00

VM 81003 - International Veterinary Medicine-Directed Experience

Credit Hours: 1.00 to 6.00. This course allows veterinary students to participate in a unique faculty-led veterinary learning experience in an international location. Credit will be assigned on the basis of 1 credit for each 45-50 hours of student effort up to a maximum of 6 credits. In most instances, one week of experience will equal one credit. Each veterinary learning experience will be designed by the faculty leader to accomplish specific learning goals in the focuses area of study. The course will be offered in the summer and will vary in length from 1-6 weeks depending on the specific experience.

Learning Outcomes: 1. To increase the student's understanding of a focused area of veterinary medicine in its international context. 2. To develop an understanding of the importance of a global education. 3. To increase awareness of global health issues. 4. To become aware of international veterinary career opportunities. 5. To encourage leadership development and diversity awareness. 6. To develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 7. To foster relationships between Purdue University and international colleagues. Credits: 1.00 to 6.00

VM 81004 - Conservation Medicine And Exotic Pet Medicine And Surgery In Czech Republic And Austria

Credit Hours: 3.00. This course is a 3-week international rotation for 2nd and 3rd year DVM students in Czech Republic and Austria. Students will spend 4-8 days in UVPS clinics and several days onsite at Zoo Brno. Additional lectures, animal science and behavior experience in both countries. Permission of department required.

Learning Outcomes: 1. Increase understanding of zoo, wildlife and exotic pet medicine in its international context. 2. Increase awareness of global conservation and health issues. 3. Develop an understanding of the importance of a global education. 4. Develop an understanding of the unique issues encountered in exotic pet medicine in central Europe. 5. Develop an understanding of caring for collections of several large urban zoos. 6. Increase awareness of international veterinary career opportunities. 7. Encourage development of leadership skills and diversity awareness. 8. Foster relationships between Purdue University,

UVPS Brno, VetMedUni, as well as zoo colleagues at Zoo Brno, Zoo Praha and the Vienna Zoo. Credits: 3.00

VM 81005 - Pre-Clinical Practicum In Veterinary Medicine

Credit Hours: 1.00 to 3.00. This practicum will provide international students with hands-on experience working in a modern veterinary practice or other veterinary medical setting. The student will gain experience working as a member of the veterinary team and participate in wellness care as well as diagnosis and treatment of disease using contemporary equipment and facilities.

Learning Outcomes: 1. Develop skills for restraint and handling of domestic animals. 2. Develop physical examination skills by examining normal and ill animals. 3. Develop technical skills such as sample collection, catheter placement and medication administration. 4. Gain experience administering anesthetics and correctly monitoring anesthetized patients and postoperative patients. 5. Practice surgical preparation techniques. 6. Become familiar with surgical anatomy by observing and assisting with surgical procedures. 7. Develop an understanding of the operation of a modern, full-service veterinary hospital in the U.S. Credits: 1.00 to 3.00

VM 81006 - Veterinary Externship I

Credit Hours: 3.00. A three-week (140 contact hour) work experience, under the direct supervision of a veterinarian, in a facet of veterinary medicine selected as a career goal by the student. Students are required to spend the entire three weeks at externship site(s). Splitting time between two externship sites is permitted by approval by Instructor of Record. Arrangements for the externship are the responsibility of the student and the supervising veterinarian. All cost are paid by the student, but the student may receive compensation (stipend or hourly) from the veterinarian.

Learning Outcomes: 1. Develop medical and surgical skills in the area of practice which meet their career goals. 2. Develop knowledge of management practices including inventory, human resources and practice economics. 3. Build communication techniques with both the public and other veterinary healthcare staff. Credits: 3.00

VM 81007 - Veterinary Externship II

Credit Hours: 3.00. A three-week (140 contact hour) work experience, under the direct supervision of a veterinarian, in a facet of veterinary medicine selected as a career goal by the student. Students are required to spend the entire three weeks at externship site(s). Splitting time between two externship sites is permitted by approval by Instructor of Record. Arrangements for the externship are the responsibility of the student and the supervising veterinarian. All cost are paid by the student, but the student may receive compensation (stipend or hourly) from the veterinarian.

Learning Outcomes: 1. Develop medical and surgical skills in the area of practice which meet their career goals. 2. Develop knowledge of management practices including inventory, human resources and practice economics. 3. Build communication techniques with both the public and other veterinary healthcare staff. Credits: 3.00

VM 82000 - Applications And Integrations I

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, but not limited to, tutorial group evaluation, peer evaluation, self-evaluation, and comprehensive content and process examinations. Introductory session on hematology, clinical chemistry and radiography will be included to facilitate student interpretation of testing used in the cases.

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the students understanding of how the basic science material provides the foundation for solving problems, thereby increasing the student's perception of relevance, motivation, and retention of basic science information. 4.

Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VM 83000 - Applications And Integrations II

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials and research problems. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include material from VM 82000 and other current DVM courses (anatomy, physiology, etc.).

Learning Outcomes: 1. Improve the student's retention of learned information and continue to build a working knowledge base that the student will expand and utilize to solve clinical problems throughout his/her career. 2. Increase the students responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis-formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the

ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills including utilizing appropriate resources to adequately. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 84000 - Applications And Integrations III

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include materials from previous classes (VM 82000/83000 and other freshman DVM courses) as well as the current DVM coursework (hematology, parasitology, bacteriology, pharmacology and pathology).

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 86000 - Early Origins Of Veterinary Medicine Seminar

Credit Hours: 1.00. Students will study the very early origins of man's fascination with animals from the Paleolithic era, and the roots of veterinary medicine in Mesopotamia, Ancient Egypt, and East and South Asia. Particular attention will be paid to works of art that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history.

Learning Outcomes: 1. Appreciate and understand the history of the human-animal bond that ultimately led to the establishment of a respectable veterinary profession based on comparative medicine dedicated to the health of animals. 2. Explain the early history of man's fascination with animals and how this led to the development of the human-animal bond. 3. Cite examples of art that demonstrate the development of the human-animal bond. 4. Trace the development of early animal care and explain the veterinary origins in Ancient Egypt, East and South Asia. 5. Compare the role of animal "doctors" in Mesopotamia, and animal care in Ancient Egypt. 6. Describe the

prehistory and speculation regarding the domestication of animals. 7. Explain the roots of veterinary medicine in East and South Asia. Credits: 1.00

VM 86500 - History Of Veterinary Medicine From Marshals, Horse Doctors, Cow Leeches, The First Schools Of VM

Credit Hours: 1.00. The students will study the history of marshals, horse doctors, cow leeches, and authors, an emphasis on the launching of European veterinary education with a rationale for a veterinary profession, and the history of the first official schools of veterinary medicine in France (Lyon and Alfort), concluding with the history of the increasing demand for veterinary schools. Particular attention will be paid to works that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history. Special note: This syllabus and course schedule is subject to revisions as needed throughout the semester. Students will be given advance notice of any change.

Learning Outcomes: 1. Appreciate and understand the history of veterinary progress that ultimately led to the establishment of a respectable veterinary profession based on comparative medicine dedicated to the health of animals. 2. Cite examples of books that demonstrate the development of veterinary medicine from the sixteenth to the nineteenth centuries. 3. Trace the progress in understanding diseases that led to veterinary progress. 4. Describe the history of animal care from the Middle Ages to the nineteenth century. 5. Explain the roots of equine medicine in Europe that led to the first schools of veterinary medicine in France. Credits: 1.00

VM 86600 - Pathogenic Bacteria, Viruses, Mayhew, Darwin, And Mendel

Credit Hours: 1.00. Students will study the golden age of pathogenic bacteriology from the 1860s to the end of the nineteenth century; the discovery of viruses; the development of immunological products; intractable vector-borne hemoprotozoal parasitic diseases; horse-doctoring in the nineteenth century; care of animals used in transport, war and sport; and will conclude with Darwin's natural selection and Mendel's fractional inheritance. Particular attention will be paid to works that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history.

Learning Outcomes: 1. Explain the history of progress in bacterial etiology of animal diseases. 2. Explain the significance of Jenner's cowpox vaccine, Pasteur's discovery of attenuation and the production of vaccine strains, including rabies. 3. Trace the progress in understanding diseases that led to veterinary progress. 4. Describe the special contribution of Edward Mayhew to horse-doctoring in the nineteenth century. 5. Discuss the care of animals used in transport, war, and sport. 6. Explain the significance of the work of Charles Darwin, Gregor Mendel, and the interpretation of life's blueprint (DNA). Credits: 1.00

VM 86700 - Veterinary Medicine Comes Of Age

Credit Hours: 1.00. Students will study early veterinary contributions to biomedical science; how livestock production was enhanced by veterinary specialists; companion animal medicine; bioethics, animal experimentation, and sentience; overcoming the exclusion of women, and the evolving spectrum of opportunity in veterinary careers. Particular attention will be paid to works that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history.

Learning Outcomes: 1. Discuss the fine tradition in veterinary anatomy, physiology, pharmacology, and veterinary leadership in early twentieth-century parasitology. 2. Explain Rudolf Virchow's reform in cellular pathology, the contributions of William Osler, Duncan McEachran, and others to veterinary medicine, and the establishment of the Bureau of Animal Industry. 3. Make the historical case for a veterinary role in public health. 4. Describe the transformation of veterinary surgery and practice through the contributions of Sir Frederick Hobday, and the establishment of the American Animal Hospital Association. 5. Discuss early activists who protested animal abuses in society. 6. Discuss the new profession from 1762 to the present time, and overcoming the exclusion of women. Credits: 1.00

VM 87000 - History Of Veterinary Medicine From

The Ancient Greeks Through The Renaissance Seminar

Credit Hours: 1.00. The students will study the contributions of the ancient Greeks and Romans to the development of animal doctors. The veterinary highpoint during the Byzantine Empire and Arabian medical and veterinary progress will also be studied. Animals in the Dark Ages, equine and canine medicine in Medieval Europe, and the Italian roots of the Renaissance in medical sciences will be studied. Particular attention will be paid to works of art that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history.

Learning Outcomes: 1. Appreciate and understand the history of veterinary progress that ultimately led to the establishment of respectable veterinary profession based on comparative medicine dedicated to the health of animals. 2. Explain the history of man's fascination with animals in Ancient Greece and Rome and how this led to the development of veterinary medicine. 3. Cite examples of art that demonstrate the development of veterinary medicine. 4. Trace the development of early Arabian medical and veterinary progress. 5. Describe the history of animal care in the Dark Ages. 6. Explain the roots of equine and canine medicine in Medieval Europe, and describe the Italian Renaissance in medical science. Credits: 1.00

VM 87800 - Swine Herd Health And Diagnostic Pathology

Credit Hours: 3.00. Arrange total clinic hours 129. Advanced training and experience in working with swine herds on a herd health management program (see VCS 87800 , 129 clinic hours) and advanced training in diagnostic approaches to identification of the causes and pathogenesis of disease of mammals (see VCS 88600 , 129 clinic hours).

Credits: 3.00

VM 89000 - Topics In Veterinary Medicine

Credit Hours: 0.50 to 5.00. Advanced study in the field of animal health and practice of veterinary medicine. Permission of instructor required.

Credits: 0.50 to 5.00

VM 89100 - Special Topics In Veterinary Medicine Arranged

Credit Hours: 3.00. Opportunities for as many as 50 off-campus, three-week blocks are available for each fourth-year class. Only educational experiences that have no comparable coverage in the Purdue DVM curriculum will be acceptable. Permission of instructor required.

Credits: 3.00

VM 89400 - International Veterinary Medicine-Directed Clinical Experience

Credit Hours: 1.00 to 3.00. This course allows veterinary students to participate in a unique faculty-led veterinary learning experience in an international location. Credit will be assigned on the basis of 1 credit for each 45-50 hours of student effort up to a maximum of 3 credits. In most instances, one week of experience will equal one credit. Each veterinary learning experience will be designed by the faculty leader to accomplish specific learning goals in the focuses area of study. The course will be offered at various times during the clinical year and will vary in length from 1-3 weeks depending on the specific experience.

Learning Outcomes: 1. To increase the student's understanding of a focused area of veterinary medicine in its international context. 2. To develop an understanding of the importance of a global education. 3. To increase awareness of global health issues. 4. To become aware of international veterinary career opportunities. 5. To encourage leadership development and diversity awareness. 6. To develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 7. To foster relationships between Purdue University and international colleagues. Credits: 1.00 to 3.00

VM 89401 - Clinical Rotation In Small Animal Medicine In Switzerland

Credit Hours: 3.00. This course is a 3-credit clinical rotation. A faculty member will lead this elective 3-week clinical rotation in Switzerland. Students will spend one week each participating in rotations in small animal medicine and related disciplines at the University of Zurich, University of Bern, and one or two private veterinary clinics in Switzerland or southern Germany. The Purdue faculty member leading the rotation each year will spend one week at each rotation site. During time that the Purdue faculty member is not with the students at rotation sites, on-site mentors will supervise the students' clinical experience.

Learning Outcomes: 1. Increase understanding of small animal medicine in its international context. 2. Increase awareness of global health

issues. 3. Develop an understanding of the importance of a global education. 4. Develop an understanding of the unique issues encountered in small animal medicine in Switzerland and central Europe. 5. Become aware of international veterinary career opportunities. 6. Encourage development of leadership skills and intercultural competency. 7. Foster relationships between Purdue University, University of Zurich, University of Bern, and international colleagues in private veterinary practice. Credits: 3.00

VM 89900 - Veterinary Medicine Topics

Credit Hours: 0.50 to 6.00. This is a variable title/variable credit course for VM.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.50 to 6.00

Women's Gender and Sexuality Studies

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

WGSS 28100 - Variable Topics In Women's, Gender, And Sexuality Studies

Credit Hours: 1.00 to 4.00. This course examines in-depth particular topics from the introductory course in Women's Studies. It addresses gender issues for both men and women. Possible topics include gender and popular culture, women's bodies, body image, and health, masculinities, queering gender and gender transgression.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism;

3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life.

Credits: 3.00

WGSS 38100 - Women Of Color In The United States

Credit Hours: 3.00. Explores the diversity of racial and ethnic groups in the United States with a particular emphasis on the histories, experiences, and cultural contributions of women of color. Provides a broad introduction to the intersections of gender, race and ethnicity.

Credits: 3.00

WGSS 38200 - Love, Sex And Sexuality

Credit Hours: 3.00. Explores intimate relationships and marriage practices in Western and non-Western societies from a historical and comparative perspective. Examines the changes in love and marriage in Greco-Roman societies, medieval and modern Europe, China, India and the Muslim world, among others.

Credits: 3.00

WGSS 38300 - Women, Work, And Labor

Credit Hours: 3.00. Examines race, class and gender issues as they affect working women in America. Covering women's work from domestic labor to informal economies to factories, topics include women's participation in trade unions, wage inequalities, family leave policies and sexual harassment.

Learning Outcomes: 1. Have acquired a broad comprehension of the work, including economic activity often not recognized as "work", that women typically have performed or is typically associated with women, world-wide and since the onset of industrialization. 2. Be capable of evaluating current global economic and cultural systems that impact what kinds of labor contemporary women perform, the conditions under which they work, and the nature of the gendered systems of labor that prevail in the U.S. and elsewhere. 3. Gain appreciation for the significance of women's unpaid or underpaid care-work, relational work, affective labor, and the "reproductive" labor underpinning global capitalism and industrialism. 4. Place their own personal lives and contexts within an analytical framework informed by feminist, Marxist, and intersectional perspectives on work and labor.

Credits: 3.00

WGSS 39000 - Variable Topics In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Variable topics under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 48200 - Interdisciplinary Studies In Sexuality

Credit Hours: 3.00. This course offers an interdisciplinary introduction to recent work in lesbian and gay studies in various fields, including literature, history, film, cultural theory, medicine, law, and studies of sexuality.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

WGSS 48300 - Feminisms In Global Perspective

Credit Hours: 3.00. Explores feminist struggles through the writings of First and Third World feminist scholars. Focuses on feminist projects within and against colonial, nationalist, religious and global contexts. Includes Third World feminist critiques of Western feminisms.

Credits: 3.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they invoke. 3. Apply feminist and queer theorizing of gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

WGSS 49200 - Practicum In Women's, Gender, and Sexuality Studies

Credit Hours: 2.00 to 4.00. This course is designed to integrate knowledge derived from women's studies scholarship with practical experience. Students will define their own projects in consultation with women's studies faculty. Periodic conferences and written reports required. Permission of instructor required.

Credits: 2.00 to 4.00

WGSS 49900 - Independent Study In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of the instructor in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation,

structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 59900 - Selected Topics In Women's Gender And Sexuality Studies

Credit Hours: 3.00. A study of selected topics taught by an instructor in whose particular field of specialization the content of the course falls. Permission of instructor required.

Learning Outcomes: 1. Understand the influence of men's views and control of women's participation in sport across age, race/ethnicity and sexual orientation. 2. Understand feminist perspectives on sport. 3. Clarify the meaning of one's own sport experience. 4. Appreciate the contributions of pioneering women in creating opportunities for women today. 5. Identify obligations to those in future generations regarding access to future sport participation. 6. Understand and appreciate the differences in experiences and perceptions of others through group work and class discussions. 7. Lean how gender ideologies impact women and men's access to sport. 8. Interrogate masculinity and femininity in order to understanding how gender is constructed in and through sport. 9. Enhance students critical thinking and analytical skills Credits: 3.00

WGSS 68000 - Feminist Theory

Credit Hours: 3.00. This course focuses on feminist theories at an advanced level and in a global perspective. Graduate students engage with key theoretical issues in contemporary feminist studies, and examine how feminist scholars have theorized women and gender issues across disciplines.

Credits: 3.00

WGSS 68100 - Contemporary Issues In Feminist Scholarship

Credit Hours: 3.00. Applies feminist theory, knowledge, and methods to the examination of selected contemporary issues. Emphasizes ways in which theory and practice interact in feminist scholarship. Content may vary according to the issues examined. Prerequisite: WGSS 68000 .

Credits: 3.00

WGSS 68200 - Issues In Feminist Research And Methodology

Credit Hours: 3.00. This course provides a methodological framework for theorizing, constructing and executing research from a feminist perspective. Students acquire knowledge of the diversity of feminist research projects and methods; they learn to pose research questions; and they will be able to prepare a research or grant proposal drawing on interdisciplinary methods. The course is designed to meet the needs of graduate students in Women's Studies and is open to students in other programs who are interested in feminist research. The course deals with both theoretical and practical issues in methodology. Prerequisites: WGSS 68000 .

Learning Outcomes: 1. To understand and describe the distinguishing features of feminist research from a variety of disciplines. 2. About the range of qualitative and quantitative research methods used by feminist scholars. 3. To examine how interdisciplinary feminist perspectives shape research methods. 4. About discussions of feminist epistemology, including feminist critiques of science and the development of feminist empiricist, standpoint and postmodernist epistemologies. 5. To develop the skills to interpret and critically evaluate research in women's studies, in both interdisciplinary journals and discipline-specific journals. 6. To develop their own feminist methods and approaches by producing a research project. Credits: 3.00

Exploratory Studies (Undergraduate)

Honors College

Purdue University In Indianapolis

24 Indy

Announcing our next giant leap: a new extension of our flagship campus bringing the academic rigor and

accessible excellence we're known for to central Indiana. Purdue is uniquely able to fuel growth and accelerate an innovation-based economy for Indianapolis, the state and the nation.

"Fueling a transformational growth, Purdue University's first comprehensive urban campus will offer unique opportunities for Boilermaker students and faculty. We will expand enrollment. We will build startups. We will create new knowledge. We will connect talents and industry. We will maximize Indy's unique strengths such as sports and biomedical technology. Purdue campuses now bookend the Hard Tech Corridor: 65 miles connecting Indy and West Lafayette with LEAP Innovation District at the midpoint. We will generate talents, jobs and innovation together in America's heartland!" **Mung Chiang,** *President, Purdue University*

Find more information on the website: Purdue University in Indianapolis

Associate

Mechanical Engineering Technology, AS (Statewide)

Degree Requirements

Departmental/Program Major Courses (27 credits)

Required Major Courses (27 credits)

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented.

Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

Other Departmental/Program Course Requirements (30 Credits)

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply

diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

Tech Selectives (3 credits)

Additional Requirements

Notes

Program Requirements

Fall 1st Year

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of

ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

15 Credits

Spring 1st Year

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented.

Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

15 Credits

Fall 2nd Year

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have

formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

16 Credits

Spring 2nd Year

14 Credits

Veterinary Nursing Distance Learning, AAS

About the Program

Degree Requirements

Departmental/Program Major Courses (65 credits)

Required Major Courses (46.5 credits)

VM 10500 - Intro To Veterinary Nursing - DL

Credit Hours: 1.00. An introduction to the profession of Veterinary Technology will be presented. It will include the many roles of veterinary technicians on the veterinary teams in practice and non-practice areas. Learning skills with an emphasis on medical terminology will be covered to help the student develop a foundation of medical vocabulary for future courses.

Learning Outcomes: 1. Describe the various roles of veterinary technicians on practice and non-practice veterinary teams. 2. Select appropriate strategies for dealing with personal and emotional issues confronting veterinary technicians. 3. Discuss the historical events that influenced the development of the veterinary technology profession. 4. Discuss legal and ethical issues related to the veterinary technology profession. 5. Analyze roots and affixes of medical terms as a foundation of learning medical terminology. 6. Identify common occupational hazards encountered in veterinary medicine and utilize appropriate strategies to mitigate their effects. 7. Utilize appropriate tools and strategies to be a successful online learner. Credits: 1.00

VM 24500 - Veterinary Management Topics - DL

Credit Hours: 1.50. This course is the first of two courses that provide basic instruction in the concepts of a veterinary technician's role in the management of day-to-day operations of a veterinary clinic. This course will emphasize problems related to ethical and liability issues, medical records, inventory, marketing and fees, writing cover letters and resumes, and job interviews. Students must be currently working/volunteering at least 10-15 hours a week at a veterinary facility.

Learning Outcomes: 1. Plan and manage a job search in the veterinary profession. 2. Analyze the ethical issues that can confront veterinary technicians. 3. Apply effective strategies for communicating with clients and coworkers and providing excellent client service and client retention. 4. Develop and implement appropriate strategies for marketing a practice's products and services. 5. Develop and implement appropriate strategies for inventory management, fee-setting strategies and medical records management. Credits: 1.50

VM 24800 - Animal Disease - DL

Credit Hours: 2.00. This course is a survey of common small animal and large animal diseases, their clinical signs, and how these signs can be explained by physiology and pathophysiology. The zoonotic potential for the disease and the role of the veterinary technician in the treatment, management, and education of client/owner of the affected animal is also emphasized.

Learning Outcomes: 1. Identify the key features of common small animal and large animal disease. 2. Explain the role of the veterinary technician in the management of these diseases. 3. Explain the zoonotic potential and public health potential of these disease to

clients and peers. Credits: 2.00

VM 22800 - Integrations - DL

Credit Hours: 2.00. This course will provide instruction in the concepts problem based learning for the nursing process (patient evaluations, interventions, and desire resolutions) using a cased based approach. This course will integrate foundational knowledge form anatomy, physiology, with the information in the veterinary nursing courses. Cases will involve different domestic animal species.

Learning Outcomes: 1. Identify and apply the components of nursing process (physical exam, patient history, SOAP). 2. Explain the rationale for using the nursing process as it relates to veterinary patient care. 3. Identify and explain how patient interventions change the physiology of the animal. 4. Integrate and apply knowledge from foundation courses to understand the rationale behind nursing intervention in clinical cases. 5. Identify individual strengths in problem solving as a part of a small group. 6. Apply the elements of critical thinking in case studies. Credits: 2.00

VM 22900 - Lab Animal Medicine - DL

Credit Hours: 2.00. This course will provide instruction in the concepts of Laboratory Animal Health Management to the veterinary technician student. This course will place an emphasis on the information needed to work with laboratory animals as well as issues that apply to laboratory animal medicine along with the care of laboratory animals and exotics and specific procedures that are used in laboratory animal and exotic pet medicine. Students are expected to achieve a level of understanding of laboratory animal care and management so that they will be able to communicate effectively with the veterinarian and other individuals.

Learning Outcomes: 1. Explain the concepts of animal welfare and animal rights. 2. Introduce the student to the basic concepts of laboratory animal medicine. 3. Explain basic laboratory animal housing and environmental control concepts. 4. Identify the basic concepts of experimental methodology. 5. Introduce the student to the different laboratory animals and exotic pocket pets. 6. Explain basic restraint, husbandry, and anesthesia of laboratory animals and pocket pets. Credits: 2.00

VM 11600 - Anatomy II - DL

Credit Hours: 2.00. This course is the second of two courses in the distance learning program that presents an introduction to the study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orientating the animal for diagnostic procedures and to aid in evaluating the diagnostic imaging results obtained by such procedures. 3. Identify anatomical structures on dissected specimens; skeletons; radiographs; and anatomical models. 4. Integrate the anatomical differences and similarities of the common domesticated species studied in this course. Credits: 2.00

VM 13500 - Physiology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to general physiology of the mammalian body systems and the general physiological process with emphasis on domestic animals. This course will address the functions of the different systems and homeostasis; the functions of the cell; the different compartments and solute transport; blood and defense; general functions of the nervous system, reflexes and special senses; the function of the nerve and muscle; cardiovascular system; and digestive system.

Learning Outcomes: 1. Discuss the major physiological functions of blood, and the cardiovascular, nervous, muscle, and digestive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to

effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 13600 - Physiology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that addresses the functions of the kidney and its role in regulation of extracellular volume and acid-base; respiration, mechanics of respiration and its control, transport of gases and hypoxia; physiology of the endocrine system, functions of the gonads, fertilization, pregnancy, parturition and lactation.

Learning Outcomes: 1. Discuss the major physiological functions of the respiratory, renal, endocrine, and reproductive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 23400 - Microbiology - DL

Credit Hours: 2.00. This course is designed to enable the veterinary technician to satisfactorily collect and process specimens, and characterize and identify microorganisms that may be encountered in veterinary practice situations. This course will introduce microorganisms commonly encountered in veterinary medicine. Different laboratory techniques will be illustrated.

Learning Outcomes: 1. Identify the common microorganisms seen in veterinary medicine and describe characteristics of each and the diseases that they cause including zoonotic implications that may be applicable. 2. Apply biochemical tests to aid in the identification of microorganisms. 3. Explain appropriate public health information to clients regarding the diseases of domestic animals caused by common microorganisms. Credits: 2.00

VM 23000 - Public & Occupational Health -DL

Credit Hours: 1.00. This is the first of two courses that provide basic instruction in the concepts of workplace safety related to the veterinary technician. This course will place an emphasis on the basic information needed to recognize hazards commonly encountered and the steps that should be taken to reduce the risk of exposure to hazards. Other practical aspects of public health will be discussed.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Locate current information related to veterinary medical occupational hazards. 4. Communicate appropriate safety principles to colleagues and the public. Credits: 1.00

VM 20200 - Pharmacy Procedures - DL

Credit Hours: 1.00. This course introduces students to the concepts of pharmacy procedures used in veterinary practice. Concepts covered in this course include basic record keeping, safe handling of drugs and chemicals, inventory control, calculation of amount of drugs to be dispensed or dosed, reading prescriptions, labeling drug containers, compounding, and drug regulatory matters that impact the veterinary hospital pharmacy.

Learning Outcomes: 1. Know the basics of pharmacy procedures; inventory control and regulations on how drugs are to be dispensed or stored. 2. Present the concepts of safe handling of cytotoxic drugs and chemicals. 3. Develop and practice doing dosage calculations. Credits: 1.00

VM 24000 - Nutrition - DL

Credit Hours: 1.00. This course will provide an overview of nutritional concepts as they apply to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as the therapeutic use of diets as they relate to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological

processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediataric stages to adulthood. 5. Define specific differences in diets based upon breeds (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VM 23100 - Diagnostic Imaging - DL

Credit Hours: 3.00. This course involves principles of imaging that are necessary for the performance of diagnostic imaging procedures in a veterinary hospital. This course provides an introduction to x-ray generation, image formation, exposure factors, scatter radiation, grids, film, screens, safety, basic terminology, positioning, darkroom techniques, artifact identification, advanced positioning techniques for the small animal, large animal techniques, contrast techniques, technique charts, basic ultrasound, diagnostic imaging in exotic animals.

Learning Outcomes: 1. Explain the basic and advanced concepts of diagnostic imaging for small and large animal patients. 2. Describe fundamental techniques used in setting up, taking, and developing radiographs. 3. Explain concepts of safe use of radiographic equipment. 4. Present key points on assessment of radiographic technique. 5. Describe techniques used in large animal, exotics, and special procedures. 6. Explain the process required to develop a radiographic technique chart. 7. Explain the basic information regarding ultrasound. 8. Differentiate the uses for CT/MRI. Credits: 3.00

VM 23200 - Principles Of Anesthesia - DL

Credit Hours: 3.00. This course involves the basic principles of anesthesia and anesthetic delivery for the veterinary technician. This course focuses on the preparation of the patient for anesthesia, the agents used as pre-anesthetics, induction agents and general anesthesia, the physiologic impacts of anesthesia on the body, multi-species anesthetic techniques (small animal, large animal/equine, pocket pets), managing high risk patients, anesthetic complications, and pain management.

Learning Outcomes: 1. Discuss the preparation of the patient and equipment for anesthesia. 2. Explain the agents used, advantages/disadvantages, and indications/contraindications of pre-anesthetics, induction agents and general anesthetic agents. 3. Describe the physiologic impacts of anesthesia on the body. 4. Explain the different anesthetic techniques required for multiple species (small animal, bovine, equine, porcine, small ruminant, and pocket pets). 5. Discuss the management of high risk patients. 6. Recognize anesthetic complications and the steps to prevent. 7. Discuss the options for pain management in all species. Credits: 3.00

VM 11400 - Anatomy I - DL

Credit Hours: 2.00. This course is the first of two courses in the distance learning program that presents an introduction to the study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orienting the animal for diagnostic procedures and to aid in evaluating the diagnostic imaging results obtained by such procedures. 3. Be able to identify anatomical structures on dissected specimens, skeletons, radiographs, and anatomical models. 4. Be able to integrate the anatomical differences and similarities of the common domesticated species studies in this course. Credits: 2.00

VM 14001 - Small Animal Nursing I - DL

Credit Hours: 3.00. This is the first of two courses involving nursing and management of the small animal patient. This is the introduction to small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Introduce the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the fundamental techniques involved with reproduction, neonatal care, and pediatrics of small animals. Credits: 3.00

VM 23500 - Pharmacology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to the principles of pharmacy and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs, and dosage calculations.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of pharmaceuticals. Credits: 1.00

VM 23600 - Pharmacology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that presents an introduction to the principles of therapeutics and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of pharmaceuticals. Credits: 1.00

VM 15001 - Clinical Pathology I - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of cytological sample handling and evaluation.

Learning Outcomes: 1. Introduce the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. 3. Serve as a prerequisite course for the Clinical Pathology clinical mentorship. Credits: 2.00

VM 22501 - Parasitology - DL

Credit Hours: 2.00. This course provides basic instruction in the concepts of parasitology to the veterinary technician student. Emphasis will be on the basic information needed to accurately identify parasites commonly encountered in veterinary medicine. Emphasis will also be placed on life cycles and zoonotic aspects of the parasites covered.

Learning Outcomes: 1. Identify parasite diagnostic stages. 2. Describe the life cycles, transmission, basic pathogenesis, zoonotic aspects, adult parasite predilection site, clinical manifestations and parasitic control methods for parasites. 3. Apply appropriate public health information to clients regarding the common parasites of domestic animals. Credits: 2.00

VM 25001 - Clinical Pathology II - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of cytological sample handling and evaluation.

Learning Outcomes: 1. Understand the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. Credits: 2.00

VM 14700 - Surgical Nursing - DL

Credit Hours: 1.00. This course is designed to instruct veterinary technician students in the basic principles of veterinary operating room protocols and sterilization of surgical supplies commonly used within a veterinary hospital. Emphasis will be placed upon key concepts of surgical preparation of the patient, and the role of the circulating nurse and surgical nurse. In addition, the concepts of proper instrument care, sterilization procedures and inventory rotation will be covered.

Learning Outcomes: 1. Know the basic roles of circulating or surgical nurse. 2. Present fundamental techniques of aseptic technique. 3. Know the concepts of sterilization of instruments and inventory rotation. Credits: 1.00

VM 14801 - Large Animal Nursing I - DL

Credit Hours: 2.00. This is the first of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary facility.

Learning Outcomes: 1. Discuss the impact of livestock health from "farm to fork", including markets. 2. Explain fundamental livestock health management and nursing concepts to clients. 3. Identify and discuss the commonalities and variations that exist between livestock species. 4. Identify the concepts of nursing care and develop a care plan for the livestock patient. 5. Know the basics of herd health management and regulatory issues of large animal species. 6. Present the fundamental techniques used in herd health management. Credits: 2.00

VM 23001 - Small Animal Nursing II - DL

Credit Hours: 2.50. This is the second of two courses involving nursing and management of the small animal patient. This course continues the concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Demonstrate the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the fundamental techniques involved with critical care and management of common diseases of small animals. Credits: 2.50

VM 23300 - Optho, Derm & Oncology - DL

Credit Hours: 1.00. This course involves the instruction of nursing and management of small animal patients related to ophthalmology, dermatology, and oncology. It presents concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient, and preventative medicine related to these specific clinical disciplines. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Know the basics of ophthalmology; dermatology and oncology. 2. Present the fundamental techniques used in ophthalmology; dermatology and oncology. 3. Know the nursing aspects of managing some common small animal diseases. Credits: 1.00

VM 23701 - Large Animal Nursing II - DL

Credit Hours: 3.00. This is the second of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary facility.

Learning Outcomes: 1. Explain fundamental individual patient management and nursing concepts to clients. 2. Identify the concepts of nursing care and develop a care plan for the individual patient. 3. Explain the basics of individual patient management of the large animal species. 4. Present the fundamental techniques used in individual patient management. Credits: 3.00

VM 23900 - Dentistry - DL

Credit Hours: 0.50. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs 5. Develop and provide client education. Credits: 0.50

Required Major Clinical Mentorships (18.5 credits)

VM 20500 - Small Animal Nursing Mentorship I - DL

Credit Hours: 1.50. This is the first of three clinical mentorships in small animal nursing. This clinical mentorship will require the veterinary technician student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of history taking, physical examination, simple diagnostic sample collection, parenteral and oral administration of medication, and venipuncture. Permission of department required.

Learning Outcomes: 1. Perform the basics of examination; monitoring; and history taking of veterinary patients. 2. Perform the basics of restraint. 3. Perform the basics of topical and parenteral administration of drugs. 4. Perform the basics of basic grooming and patient hygiene procedures. 5. Perform competence techniques for collecting urine and taking ear swabs for diagnostic procedures. Credits: 1.50

VM 20600 - Small Animal Nursing Mentorship II - DL

Credit Hours: 1.00. This is the second of three clinical mentorships in small animal nursing. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of venipuncture, catheter placement, various methods of urine collection, vaginal cytology, dental prophylaxis, and ECG tracings. Permission of department required.

Learning Outcomes: 1. Perform a jugular venipuncture of veterinary patients. 2. Perform the placement of peripheral catheters. 3. Perform urine collection by urinary catheter and cystocentesis. 4. Perform the basics of collection and preparation of vaginal cytology. 5. Perform techniques for completing enemas; stomach tubing and diagnostic ECG tracings. 6. Perform a complete dental prophylaxis. Credits: 1.00

VM 20700 - Small Animal Nursing Mentorship III - DL

Credit Hours: 1.00. This is the third of three clinical mentorships in small animal nursing. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of oncology, dermatology, ophthalmology, and emergency care procedures. Permission of department required.

Learning Outcomes: 1. Perform fine needle aspiration of veterinary patients. 2. Perform Tru-Cut biopsy. 3. Perform sample collection for dermatophyte culture. 4. Perform Schirmer Tear Test; a fluorescein stain test. 5. Perform use of a Schiotz tonometry. 6. Perform dilation of the eye and examination of the internal eye structures. 7. Perform history on a critical patient. 8. Perform physical examination on a critical patient. 9. Perform hospitalized patient care; record keeping and observation. 10. Perform the placement of a jugular IV catheter. 11. Perform calculating; monitoring and maintaining correct IV fluid rate for critical care patients. 12. Perform the collection of an arterial blood gas sample from femoral artery. 13. Perform first aid procedures. 14. Demonstrate closed chest CPR. Credits: 1.00

VM 20800 - Farm Animal Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of basic handling, nursing, and diagnostic techniques used in large animal medicine. Permission of department required.

Learning Outcomes: 1. Perform handling and restraint techniques on cattle, sheep, goats, and swine. 2. Perform knot-tying techniques. 3. Perform assistance with food animal bandaging techniques. 4. Perform food animal sample collection techniques. 5. Perform animal injection techniques. 6. Perform data collection techniques in food animals (TPR, etc.). 7. Perform techniques for administration of oral medications in the ruminant. 8. Perform placement and maintenance of indwelling catheters in food animals. 9. Perform determination of age food animals. 10. Perform the California Mastitis Test (CMT) technique. Credits: 1.00

VM 20900 - Equine Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of handling, restraint, and equine nursing care. Tasks to be documented include restraint and handling techniques, data collection, basic nursing care, and administration of medication and treatments. Permission of department required.

Learning Outcomes: 1. Perform equine restraint and handling techniques. 2. Determine age of horses. 3. Perform placement and maintenance of indwelling catheters in horses. 4. Perform data collection techniques in horses (TPR, etc.). 5. Perform hoof care and grooming techniques in horses. 6. Perform sample collection techniques in horses. 7. Perform proper placement of a mouth speculum in a horse. 8. Perform equine injection techniques. 9. Perform application of leg and tail wraps in a horse. Credits: 1.00

VM 21000 - Small Animal Anesthesia Mentorship - DL

Credit Hours: 2.00. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of anesthesia from induction, maintenance to recovery. Permission of department required.

Learning Outcomes: 1. Perform the basics of history and physical exam pertinent to anesthesia. 2. Perform the basics of patient care before, during and after anesthesia. 3. Perform the basics of proper record keeping for patients under anesthesia. 4. Perform the basics of induction of general anesthesia in the small animal. 5. Perform the basics of patient monitoring and recovery from anesthesia. Credits: 2.00

VM 21100 - Food Animal And Equine Anesthesia-Clinical Mentorship-DL

Credit Hours: 1.00. This mentorship focuses on the principles of large animal anesthesia from induction and maintenance to recovery. Students will be required to complete projects and participate in discussions related to large animal anesthesia cases.

Learning Outcomes: 1. Demonstrate knowledge of history and physical exam pertinent to large animal anesthesia. 2. Discuss large animal patient care before, during and after anesthesia. 3. Demonstrate proper record keeping for patients under anesthesia. 4. Discuss large animal anesthesia cases related to aspects of induction, maintenance and patient monitoring, and recovery from anesthesia. Credits: 1.00

VM 21200 - Surgical Nursing Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work in a veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of operating room procedures, patient and instrument preparation for surgery and the duties of the circulating nurse and the scrub nurse. Permission of department required.

Learning Outcomes: 1. Perform the basics of instrument identification and care. 2. Perform the basics of sterilization of surgical packs and single instruments. 3. Perform the basics of patient preparation for surgical procedures. 4. Perform the basics of personal preparation for surgical procedures. 5. Perform the duties of the circulating and surgical nurse. Credits: 0.50

VM 21500 - Small Animal Diagnostic Imaging Mentorship I - DL

Credit Hours: 1.00. This is the first of two clinical mentorships in diagnostic imaging. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of film loading, processing, presentation for viewing radiographs, care and maintenance of processors, and imaging of the thorax and abdomen. Permission of department required.

Learning Outcomes: 1. Perform the basics of film loading and unloading. 2. Perform the basics of automatic processing and manual processing. 3. Perform the basics of film labeling and presentation for viewing. 4. Perform the basics of caring for the automatic and manual processing units. 5. Perform the techniques for obtaining diagnostic views of the thorax and abdomen. Credits: 1.00

VM 21600 - Small Animal Diagnostic Imaging Mentorship II - DL

Credit Hours: 1.50. This is the second clinical mentorship in small animal diagnostic imaging. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the preparation of a technique chart, imaging of the shoulder, radius, ulna, stifle, spine, skull, and pelvis. Permission of department required.

Learning Outcomes: 1. Perform techniques for preparing a technique chart. 2. Perform diagnostic views: shoulder, radius/ulna, stifle, spine skull, pelvis, maxillary molars and premolars, mandibular molars and premolars, intraoral dental film: Mandibular premolars, Maxillary premolars. Credits: 1.50

VM 21700 - Equine Diagnostic Imaging Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work with a food animal/equine veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the imaging of the carpus, fetlock, tarsus, navicular projection, P3 views, and the dorsoproximal-palmarodistal view. Permission of department required.

Learning Outcomes: 1. Produce diagnostic radiographic carpus images in the equine patient. 2. Produce diagnostic radiographic fetlock images in the equine patient. 3. Produce diagnostic radiographic tarsus images in the equine patient. 4. Produce diagnostic radiographic Coffin Bone images in the equine patient. Credits: 0.50

VM 22300 - Pharmacy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the veterinary technician student to work with a veterinary care facility to practice tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of drug order fulfillment, reconstitution of medications, correct storage of medications (including controlled substances), safe handling of hazardous medications, and inventory control procedures. Permission of department required.

Learning Outcomes: 1. Interpret accurately a DVM medication order and transcribe that order onto a prescription label of the appropriate type for the container used, with appropriate information on the label. 2. Interpret accurately DVM orders for an oral solid and an oral liquid medication and fill the orders. 3. Interpret accurately DVM orders and reconstitute a medication for dispensing and a vaccine for administration to a patient. 4. Dispense an oral liquid medication and topical medication to a client, explaining medication administration, administration devices, and special instructions if indicated. 5. Describe appropriate storage and record keeping of controlled substances in a veterinary practice. 6. Describe the process for pharmacy inventory in a facility and critique the process. 7. Describe safe storage and handling of biological and hazardous medications. Credits: 0.50

VM 22400 - Necropsy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship focuses on the motor skills and techniques in performing a basic prosection (necropsy). Tasks include basic necropsy technique, techniques for sample collection and storage, and safety issues related to handling animal specimens. Course is offered as Distance Learning. Permission of department required.

Learning Outcomes: 1. Perform the basics of

necropsy on a non-preserved animal. 2. Perform techniques for sample collection, storage and shipping from a necropsied animal. 3. Perform techniques for handling rabies suspect bodies and samples safely. 4. Perform the proper storage and disposal of dead animals. Credits: 0.50

VM 22500 - Advanced Clinical Mentorship - DL

Credit Hours: 1.50. This clinical mentorship will require the student to complete 120 hours of additional work experience while completing a series of selected projects related to veterinary medicine. Permission of department required.

Learning Outcomes: 1. Perform 120 hours experience in a practice. 2. Describe cases and procedures. 3. Perform quality improvement project related to the functioning of the veterinary facility. 4. Perform client education. 5. Perform a presentation to the public or peer group. Credits: 1.50

VM 22600 - Lab Animal Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the motor skills involved with the basic handling, restraint, administration of medication and nursing care of laboratory animals. Permission of department required.

Learning Outcomes: 1. Perform the basics of handling and restraint of rabbits and rodents. 2. Perform the determination of sex of rabbits and rodents. 3. Perform the basics of drug and medication administration in rabbits and rodents. 4. Perform the basics of blood collection in rabbits and rodents. Credits: 1.00

VM 22700 - Clinical Pathology Mentorship - DL

Credit Hours: 2.00. This clinical mentorship will require the student to work with a laboratory, small or large animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of blood film evaluation for different species, manual and automated CBCs, normal and abnormal cellular morphology, urinalysis, chemistry panels, and differentials. Permission of department required.

Learning Outcomes: 1. Perform a total protein and packed cell volume. 2. Perform a unopette WBC and platelet count. 3. Perform manual and automated evaluation of normal and abnormal CBCs. 4. Perform urinalysis, chemistry panels and electrolyte screenings. 5. Perform ELISA testing and hormone assay. 6. Perform morphology evaluation and differentials. Credits: 2.00

VM 21300 - Microbiology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or microbiologist). This Clinical Mentorship focuses on the motor skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques. Permission of department required.

Learning Outcomes: 1. Perform collection of microbiology samples for culture and inoculating culture media. 2. Perform techniques for staining and completing differential tests on microbiology samples. Credits: 0.50

VM 21400 - Parasitology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or parasitologist). This Clinical Mentorship focuses on the motor skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques.

Learning Outcomes: 1. Perform techniques for collecting samples for fecal examination. 2. Perform techniques for testing for intestinal parasites and heartworms. 3. Perform techniques for collection of samples and examination for external parasites. Credits: 0.50

Other Departmental/Program Course Requirements (3-4 credits)

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent).

Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (2 credits)

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Transfer Credit Policy

Notes

Sample 9-Semester Plan

Semester 1

VM 10500 - Intro To Veterinary Nursing - DL

Credit Hours: 1.00. An introduction to the profession of Veterinary Technology will be presented. It will include the many roles of veterinary technicians on the veterinary teams in practice and non-practice areas. Learning skills with an emphasis on medical terminology will be covered to help the student develop a foundation of medical vocabulary for future courses.

Learning Outcomes: 1. Describe the various roles of veterinary technicians on practice and non-practice veterinary teams. 2. Select appropriate strategies for dealing with personal and emotional issues confronting veterinary technicians. 3. Discuss the historical events that influenced the development of the veterinary technology profession. 4. Discuss legal and ethical issues related to the veterinary technology profession. 5. Analyze roots and affixes of medical terms as a foundation of

learning medical terminology. 6. Identify common occupational hazards encountered in veterinary medicine and utilize appropriate strategies to mitigate their effects. 7. Utilize appropriate tools and strategies to be a successful online learner. Credits: 1.00

VM 13500 - Physiology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to general physiology of the mammalian body systems and the general physiological process with emphasis on domestic animals. This course will address the functions of the different systems and homeostasis; the functions of the cell; the different compartments and solute transport; blood and defense; general functions of the nervous system, reflexes and special senses; the function of the nerve and muscle; cardiovascular system; and digestive system.

Learning Outcomes: 1. Discuss the major physiological functions of blood, and the cardiovascular, nervous, muscle, and digestive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 13600 - Physiology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that addresses the functions of the kidney and its role in regulation of extracellular volume and acid-base; respiration, mechanics of respiration and its control, transport of gases and hypoxia; physiology of the endocrine system, functions of the gonads, fertilization, pregnancy, parturition and lactation.

Learning Outcomes: 1. Discuss the major physiological functions of the respiratory, renal, endocrine, and reproductive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 23000 - Public & Occupational Health -DL

Credit Hours: 1.00. This is the first of two courses that provide basic instruction in the concepts of workplace safety related to the veterinary technician. This course will place an emphasis on the basic information needed to recognize hazards commonly encountered and the steps that should be taken to reduce the risk of exposure to hazards. Other practical aspects of public health will be discussed.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Locate current information related to veterinary medical occupational hazards. 4. Communicate appropriate safety principles to colleagues and the public. Credits: 1.00

VM 11400 - Anatomy I - DL

Credit Hours: 2.00. This course is the first of two courses in the distance learning program that presents an introduction to the study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orienting the animal for diagnostic procedures and to aid in evaluating the diagnostic imaging results obtained by such procedures. 3. Be able to identify anatomical structures on dissected specimens, skeletons,

radiographs, and anatomical models. 4. Be able to integrate the anatomical differences and similarities of the common domesticated species studies in this course. Credits: 2.00

6 Credits

Semester 2

VM 11600 - Anatomy II - DL

Credit Hours: 2.00. This course is the second of two courses in the distance learning program that presents an introduction to the study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orientating the animal for diagnostic procedures and to aid in evaluating the diagnostic imaging results obtained by such procedures. 3. Identify anatomical structures on dissected specimens; skeletons; radiographs; and anatomical models. 4. Integrate the anatomical differences and similarities of the common domesticated species studied in this course. Credits: 2.00

VM 20200 - Pharmacy Procedures - DL

Credit Hours: 1.00. This course introduces students to the concepts of pharmacy procedures used in veterinary practice. Concepts covered in this course include basic record keeping, safe handling of drugs and chemicals, inventory control, calculation of amount of drugs to be dispensed or dosed, reading prescriptions, labeling drug containers, compounding, and drug regulatory matters that impact the veterinary hospital pharmacy.

Learning Outcomes: 1. Know the basics of pharmacy procedures; inventory control and regulations on how drugs are to be dispensed or stored. 2. Present the concepts of safe handling of cytotoxic drugs and chemicals. 3. Develop and practice doing dosage calculations. Credits: 1.00

VM 24000 - Nutrition - DL

Credit Hours: 1.00. This course will provide an overview of nutritional concepts as they apply to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as the therapeutic use of diets as they relate to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediataric stages to adulthood. 5. Define specific differences in diets based upon breeds (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VM 23500 - Pharmacology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to the principles of pharmacy and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs, and dosage calculations.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of

pharmaceuticals. Credits: 1.00

VM 15001 - Clinical Pathology I - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of cytological sample handling and evaluation.

Learning Outcomes: 1. Introduce the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. 3. Serve as a prerequisite course for the Clinical Pathology clinical mentorship. Credits: 2.00

7 Credits

Semester 3

VM 22300 - Pharmacy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the veterinary technician student to work with a veterinary care facility to practice tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of drug order fulfillment, reconstitution of medications, correct storage of medications (including controlled substances), safe handling of hazardous medications, and inventory control procedures. Permission of department required.

Learning Outcomes: 1. Interpret accurately a DVM medication order and transcribe that order onto a prescription label of the appropriate type for the container used, with appropriate information on the label. 2. Interpret accurately DVM orders for an oral solid and an oral liquid medication and fill the orders. 3. Interpret accurately DVM orders and reconstitute a medication for dispensing and a vaccine for administration to a patient. 4. Dispense an oral liquid medication and topical medication to a client, explaining medication administration, administration devices, and special instructions if indicated. 5. Describe appropriate storage and record keeping of controlled substances in a veterinary practice. 6. Describe the process for pharmacy inventory in a facility and critique the process. 7. Describe safe storage and handling of biological and hazardous medications. Credits: 0.50

VM 14001 - Small Animal Nursing I - DL

Credit Hours: 3.00. This is the first of two courses involving nursing and management of the small animal patient. This is the introduction to small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Introduce the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the fundamental techniques involved with reproduction, neonatal care, and pediatrics of small animals. Credits: 3.00

VM 23600 - Pharmacology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that presents an introduction to the principles of therapeutics and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of pharmaceuticals. Credits: 1.00

VM 25001 - Clinical Pathology II - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of

cytological sample handling and evaluation.

Learning Outcomes: 1. Understand the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. Credits: 2.00

VM 14700 - Surgical Nursing - DL

Credit Hours: 1.00. This course is designed to instruct veterinary technician students in the basic principles of veterinary operating room protocols and sterilization of surgical supplies commonly used within a veterinary hospital. Emphasis will be placed upon key concepts of surgical preparation of the patient, and the role of the circulating nurse and surgical nurse. In addition, the concepts of proper instrument care, sterilization procedures and inventory rotation will be covered.

Learning Outcomes: 1. Know the basic roles of circulating or surgical nurse. 2. Present fundamental techniques of aseptic technique. 3. Know the concepts of sterilization of instruments and inventory rotation. Credits: 1.00

7.5 Credits

Semester 4

VM 20500 - Small Animal Nursing Mentorship I - DL

Credit Hours: 1.50. This is the first of three clinical mentorships in small animal nursing. This clinical mentorship will require the veterinary technician student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of history taking, physical examination, simple diagnostic sample collection, parenteral and oral administration of medication, and venipuncture. Permission of department required.

Learning Outcomes: 1. Perform the basics of examination; monitoring; and history taking of veterinary patients. 2. Perform the basics of restraint. 3. Perform the basics of topical and parenteral administration of drugs. 4. Perform the basics of basic grooming and patient hygiene procedures. 5. Perform competence techniques for collecting urine and taking ear swabs for diagnostic procedures. Credits: 1.50

VM 22700 - Clinical Pathology Mentorship - DL

Credit Hours: 2.00. This clinical mentorship will require the student to work with a laboratory, small or large animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of blood film evaluation for different species, manual and automated CBCs, normal and abnormal cellular morphology, urinalysis, chemistry panels, and differentials. Permission of department required.

Learning Outcomes: 1. Perform a total protein and packed cell volume. 2. Perform a unopette WBC and platelet count. 3. Perform manual and automated evaluation of normal and abnormal CBCs. 4. Perform urinalysis, chemistry panels and electrolyte screenings. 5. Perform ELISA testing and hormone assay. 6. Perform morphology evaluation and differentials. Credits: 2.00

VM 14801 - Large Animal Nursing I - DL

Credit Hours: 2.00. This is the first of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary facility.

Learning Outcomes: 1. Discuss the impact of livestock health from "farm to fork", including markets. 2. Explain fundamental livestock health management and nursing concepts to clients. 3. Identify and discuss the commonalities and variations that exist between livestock species. 4. Identify the concepts of nursing care and develop a care plan for the livestock patient. 5. Know the basics of herd health management and regulatory issues of large animal species. 6. Present the fundamental techniques used in herd health management. Credits: 2.00

VM 23001 - Small Animal Nursing II - DL

Credit Hours: 2.50. This is the second of two courses involving

nursing and management of the small animal patient. This course continues the concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Demonstrate the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the fundamental techniques involved with critical care and management of common diseases of small animals. Credits: 2.50

10 Credits

Semester 5

VM 20600 - Small Animal Nursing Mentorship II - DL

Credit Hours: 1.00. This is the second of three clinical mentorships in small animal nursing. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of venipuncture, catheter placement, various methods of urine collection, vaginal cytology, dental prophylaxis, and ECG tracings. Permission of department required.

Learning Outcomes: 1. Perform a jugular venipuncture of veterinary patients. 2. Perform the placement of peripheral catheters. 3. Perform urine collection by urinary catheter and cystocentesis. 4. Perform the basics of collection and preparation of vaginal cytology. 5. Perform techniques for completing enemas; stomach tubing and diagnostic ECG tracings. 6. Perform a complete dental prophylaxis. Credits: 1.00

VM 21200 - Surgical Nursing Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work in a veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of operating room procedures, patient and instrument preparation for surgery and the duties of the circulating nurse and the scrub nurse. Permission of department required.

Learning Outcomes: 1. Perform the basics of instrument identification and care. 2. Perform the basics of sterilization of surgical packs and single instruments. 3. Perform the basics of patient preparation for surgical procedures. 4. Perform the basics of personal preparation for surgical procedures. 5. Perform the duties of the circulating and surgical nurse. Credits: 0.50

VM 23100 - Diagnostic Imaging - DL

Credit Hours: 3.00. This course involves principles of imaging that are necessary for the performance of diagnostic imaging procedures in a veterinary hospital. This course provides an introduction to x-ray generation, image formation, exposure factors, scatter radiation, grids, film, screens, safety, basic terminology, positioning, darkroom techniques, artifact identification, advanced positioning techniques for the small animal, large animal techniques, contrast techniques, technique charts, basic ultrasound, diagnostic imaging in exotic animals.

Learning Outcomes: 1. Explain the basic and advanced concepts of diagnostic imaging for small and large animal patients. 2. Describe fundamental techniques used in setting up, taking, and developing radiographs. 3. Explain concepts of safe use of radiographic equipment. 4. Present key points on assessment of radiographic technique. 5. Describe techniques used in large animal, exotics, and special procedures. 6. Explain the process required to develop a radiographic technique chart. 7. Explain the basic information regarding ultrasound. 8. Differentiate the uses for CT/MRI. Credits: 3.00

VM 23701 - Large Animal Nursing II - DL

Credit Hours: 3.00. This is the second of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the

veterinary technician in the veterinary facility.

Learning Outcomes: 1. Explain fundamental individual patient management and nursing concepts to clients. 2. Identify the concepts of nursing care and develop a care plan for the individual patient. 3. Explain the basics of individual patient management of the large animal species. 4. Present the fundamental techniques used in individual patient management. Credits: 3.00

VM 23900 - Dentistry - DL

Credit Hours: 0.50. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs 5. Develop and provide client education. Credits: 0.50

8 Credits

Semester 6

VM 20700 - Small Animal Nursing Mentorship III - DL

Credit Hours: 1.00. This is the third of three clinical mentorships in small animal nursing. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of oncology, dermatology, ophthalmology, and emergency care procedures. Permission of department required.

Learning Outcomes: 1. Perform fine needle aspiration of veterinary patients. 2. Perform Tru-Cut biopsy. 3. Perform sample collection for dermatophyte culture. 4. Perform Schirmer Tear Test; a fluorescein stain test. 5. Perform use of a Schiotz tonometry. 6. Perform dilation of the eye and examination of the internal eye structures. 7. Perform history on a critical patient. 8. Perform physical examination on a critical patient. 9. Perform hospitalized patient care; record keeping and observation. 10. Perform the placement of a jugular IV catheter. 11. Perform calculating; monitoring and maintaining correct IV fluid rate for critical care patients. 12. Perform the collection of an arterial blood gas sample from femoral artery. 13. Perform first aid procedures. 14. Demonstrate closed chest CPR. Credits: 1.00

VM 20900 - Equine Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of handling, restraint, and equine nursing care. Tasks to be documented include restraint and handling techniques, data collection, basic nursing care, and administration of medication and treatments. Permission of department required.

Learning Outcomes: 1. Perform equine restraint and handling techniques. 2. Determine age of horses. 3. Perform placement and maintenance of indwelling catheters in horses. 4. Perform data collection techniques in horses (TPR, etc.). 5. Perform hoof care and grooming techniques in horses. 6. Perform sample collection techniques in horses. 7. Perform proper placement of a mouth speculum in a horse. 8. Perform equine injection techniques. 9. Perform application of leg and tail wraps in a horse. Credits: 1.00

VM 23200 - Principles Of Anesthesia - DL

Credit Hours: 3.00. This course involves the basic principles of anesthesia and anesthetic delivery for the veterinary technician. This course focuses on the preparation of the patient for anesthesia, the agents used as pre-anesthetics, induction agents and general anesthesia, the physiologic impacts of anesthesia on the body, multi-species anesthetic techniques (small animal, large animal/equine, pocket pets), managing high risk patients, anesthetic complications, and pain management.

Learning Outcomes: 1. Discuss the preparation of the patient and equipment for anesthesia. 2. Explain the agents used,

advantages/disadvantages, and indications/contraindications of pre-anesthetics, induction agents and general anesthetic agents. 3. Describe the physiologic impacts of anesthesia on the body. 4. Explain the different anesthetic techniques required for multiple species (small animal, bovine, equine, porcine, small ruminant, and pocket pets). 5. Discuss the management of high risk patients. 6. Recognize anesthetic complications and the steps to prevent. 7. Discuss the options for pain management in all species. Credits: 3.00

VM 22501 - Parasitology - DL

Credit Hours: 2.00. This course provides basic instruction in the concepts of parasitology to the veterinary technician student. Emphasis will be on the basic information needed to accurately identify parasites commonly encountered in veterinary medicine. Emphasis will also be placed on life cycles and zoonotic aspects of the parasites covered.

Learning Outcomes: 1. Identify parasite diagnostic stages. 2. Describe the life cycles, transmission, basic pathogenesis, zoonotic aspects, adult parasite predilection site, clinical manifestations and parasitic control methods for parasites. 3. Apply appropriate public health information to clients regarding the common parasites of domestic animals. Credits: 2.00

VM 23300 - Optho, Derm & Oncology - DL

Credit Hours: 1.00. This course involves the instruction of nursing and management of small animal patients related to ophthalmology, dermatology, and oncology. It presents concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient, and preventative medicine related to these specific clinical disciplines. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Know the basics of ophthalmology; dermatology and oncology. 2. Present the fundamental techniques used in ophthalmology; dermatology and oncology. 3. Know the nursing aspects of managing some common small animal diseases. Credits: 1.00

8 Credits

Semester 7

VM 20800 - Farm Animal Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of basic handling, nursing, and diagnostic techniques used in large animal medicine. Permission of department required.

Learning Outcomes: 1. Perform handling and restraint techniques on cattle, sheep, goats, and swine. 2. Perform knot-tying techniques. 3. Perform assistance with food animal bandaging techniques. 4. Perform food animal sample collection techniques. 5. Perform animal injection techniques. 6. Perform data collection techniques in food animals (TPR, etc.). 7. Perform techniques for administration of oral medications in the ruminant. 8. Perform placement and maintenance of indwelling catheters in food animals. 9. Perform determination of age food animals. 10. Perform the California Mastitis Test (CMT) technique. Credits: 1.00

VM 21100 - Food Animal And Equine Anesthesia-Clinical Mentorship-DL

Credit Hours: 1.00. This mentorship focuses on the principles of large animal anesthesia from induction and maintenance to recovery. Students will be required to complete projects and participate in discussions related to large animal anesthesia cases.

Learning Outcomes: 1. Demonstrate knowledge of history and physical exam pertinent to large animal anesthesia. 2. Discuss large animal patient care before, during and after anesthesia. 3. Demonstrate proper record keeping for patients under anesthesia. 4. Discuss large animal anesthesia cases related to aspects of induction, maintenance and patient monitoring, and recovery from anesthesia. Credits: 1.00

VM 21500 - Small Animal Diagnostic Imaging Mentorship I - DL

Credit Hours: 1.00. This is the first of two clinical mentorships in diagnostic imaging. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of film loading, processing, presentation for viewing radiographs, care and maintenance of processors, and imaging of the thorax and abdomen. Permission of department required.

Learning Outcomes: 1. Perform the basics of film loading and unloading. 2. Perform the basics of automatic processing and manual processing. 3. Perform the basics of film labeling and presentation for viewing. 4. Perform the basics of caring for the automatic and manual processing units. 5. Perform the techniques for obtaining diagnostic views of the thorax and abdomen. Credits: 1.00

VM 21300 - Microbiology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or microbiologist). This Clinical Mentorship focuses on the motor skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques. Permission of department required.

Learning Outcomes: 1. Perform collection of microbiology samples for culture and inoculating culture media. 2. Perform techniques for staining and completing differential tests on microbiology samples. Credits: 0.50

VM 21400 - Parasitology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or parasitologist). This Clinical Mentorship focuses on the motor skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques.

Learning Outcomes: 1. Perform techniques for collecting samples for fecal examination. 2. Perform techniques for testing for intestinal parasites and heartworms. 3. Perform techniques for collection of samples and examination for external parasites. Credits: 0.50

VM 22900 - Lab Animal Medicine - DL

Credit Hours: 2.00. This course will provide instruction in the concepts of Laboratory Animal Health Management to the veterinary technician student. This course will place an emphasis on the information needed to work with laboratory animals as well as issues that apply to laboratory animal medicine along with the care of laboratory animals and exotics and specific procedures that are used in laboratory animal and exotic pet medicine. Students are expected to achieve a level of understanding of laboratory animal care and management so that they will be able to communicate effectively with the veterinarian and other individuals.

Learning Outcomes: 1. Explain the concepts of animal welfare and animal rights. 2. Introduce the student to the basic concepts of laboratory animal medicine. 3. Explain basic laboratory animal housing and environmental control concepts. 4. Identify the basic concepts of experimental methodology. 5. Introduce the student to the different laboratory animals and exotic pocket pets. 6. Explain basic restraint, husbandry, and anesthesia of laboratory animals and pocket pets. Credits: 2.00

VM 23400 - Microbiology - DL

Credit Hours: 2.00. This course is designed to enable the veterinary technician to satisfactorily collect and process specimens, and characterize and identify microorganisms that may be encountered in veterinary practice situations. This course will introduce microorganisms commonly encountered in veterinary medicine. Different laboratory techniques will be illustrated.

Learning Outcomes: 1. Identify the common microorganisms seen in veterinary medicine and describe characteristics of each and the diseases that they cause including zoonotic implications that may be applicable. 2. Apply biochemical tests to aid in the identification of microorganisms. 3. Explain appropriate public health information to clients regarding the diseases of domestic animals caused by common microorganisms. Credits: 2.00

8 Credits

Semester 8

VM 21000 - Small Animal Anesthesia Mentorship - DL

Credit Hours: 2.00. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of anesthesia from induction, maintenance to recovery. Permission of department required.

Learning Outcomes: 1. Perform the basics of history and physical exam pertinent to anesthesia. 2. Perform the basics of patient care before, during and after anesthesia. 3. Perform the basics of proper record keeping for patients under anesthesia. 4. Perform the basics of induction of general anesthesia in the small animal. 5. Perform the basics of patient monitoring and recovery from anesthesia. Credits: 2.00

VM 21600 - Small Animal Diagnostic Imaging Mentorship II - DL

Credit Hours: 1.50. This is the second clinical mentorship in small animal diagnostic imaging. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the preparation of a technique chart, imaging of the shoulder, radius, ulna, stifle, spine, skull, and pelvis. Permission of department required.

Learning Outcomes: 1. Perform techniques for preparing a technique chart. 2. Perform diagnostic views: shoulder, radius/ulna, stifle, spine skull, pelvis, maxillary molars and premolars, mandibular molars and premolars, intraoral dental film: Mandibular premolars, Maxillary premolars. Credits: 1.50

VM 21700 - Equine Diagnostic Imaging Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work with a food animal/equine veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the imaging of the carpus, fetlock, tarsus, navicular projection, P3 views, and the dorsoproximal-palmarodistal view. Permission of department required.

Learning Outcomes: 1. Produce diagnostic radiographic carpus images in the equine patient. 2. Produce diagnostic radiographic fetlock images in the equine patient. 3. Produce diagnostic radiographic tarsus images in the equine patient. 4. Produce diagnostic radiographic Coffin Bone images in the equine patient. Credits: 0.50

VM 24500 - Veterinary Management Topics - DL

Credit Hours: 1.50. This course is the first of two courses that provide basic instruction in the concepts of a veterinary technician's role in the management of day-to-day operations of a veterinary clinic. This course will emphasize problems related to ethical and liability issues, medical records, inventory, marketing and fees, writing cover letters and resumes, and job interviews. Students must be currently working/volunteering at least 10-15 hours a week at a veterinary facility.

Learning Outcomes: 1. Plan and manage a job search in the veterinary profession. 2. Analyze the ethical issues that can confront veterinary technicians. 3. Apply effective strategies for communicating with clients and coworkers and providing excellent client service and client retention. 4. Develop and implement appropriate strategies for marketing a practice's products and services. 5. Develop and implement appropriate strategies for inventory management, fee-setting strategies and medical records management. Credits: 1.50

VM 24800 - Animal Disease - DL

Credit Hours: 2.00. This course is a survey of common small animal and large animal diseases, their clinical signs, and how these signs can be explained by physiology and pathophysiology. The zoonotic potential for the disease and the role of the veterinary technician in the treatment, management, and education of client/owner of the affected animal is also emphasized.

Learning Outcomes: 1. Identify the key features of common small animal and large animal disease. 2. Explain the role of the veterinary technician in the management of these

diseases. 3. Explain the zoonotic potential and public health potential of these disease to clients and peers. Credits: 2.00

7.5 Credits

Semester 9

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

VM 22400 - Necropsy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship focuses on the motor skills and techniques in performing a basic prosection (necropsy). Tasks include basic necropsy technique, techniques for sample collection and storage, and safety issues related to handling animal specimens. Course is offered as Distance Learning. Permission of department required.

Learning Outcomes: 1. Perform the basics of necropsy on a non-preserved animal. 2. Perform techniques for sample collection, storage and shipping from a necropsied animal. 3. Perform techniques for handling rabies suspect bodies and samples safely. 4. Perform the proper storage and disposal of dead animals. Credits: 0.50

VM 22500 - Advanced Clinical Mentorship - DL

Credit Hours: 1.50. This clinical mentorship will require the student to complete 120 hours of additional work experience while completing a series of selected projects related to veterinary medicine. Permission of department required.

Learning Outcomes: 1. Perform 120 hours experience in a practice. 2. Describe cases and procedures. 3. Perform quality improvement project related to the functioning of the veterinary facility. 4. Perform client education. 5. Perform a presentation to the public or peer

group. Credits: 1.50

VM 22600 - Lab Animal Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the motor skills involved with the basic handling, restraint, administration of medication and nursing care of laboratory animals. Permission of department required.

Learning Outcomes: 1. Perform the basics of handling and restraint of rabbits and rodents. 2. Perform the determination of sex of rabbits and rodents. 3. Perform the basics of drug and medication administration in rabbits and rodents. 4. Perform the basics of blood collection in rabbits and rodents. Credits: 1.00

VM 22800 - Integrations - DL

Credit Hours: 2.00. This course will provide instruction in the concepts problem based learning for the nursing process (patient evaluations, interventions, and desire resolutions) using a cased based approach. This course will integrate foundational knowledge form anatomy, physiology, with the information in the veterinary nursing courses. Cases will involve different domestic animal species.

Learning Outcomes: 1. Identify and apply the components of nursing process (physical exam, patient history, SOAP). 2. Explain the rationale for using the nursing process as it relates to veterinary patient care. 3. Identify and explain how patient interventions change the physiology of the animal. 4. Integrate and apply knowledge from foundation courses to understand the rationale behind nursing intervention in clinical cases. 5. Identify individual strengths in problem solving as a part of a small group. 6. Apply the elements of critical thinking in case studies. Credits: 2.00

8-9 Credits

Veterinary Nursing, AAS

About the Program

Degree Requirements

Departmental/Program Major Courses (63.5 credits)

BMS 33100 - Pharmacology-VN

Credit Hours: 1.50. This course introduces the concepts of drugs used in the different body systems. Mechanisms of action, side effects, and therapeutic applications are presented.

Learning Outcomes: 1. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the GI tract. 2. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of cardiovascular system. 3. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the respiratory tract. 4. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the endocrine systems. 5. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-inflammatory drugs. 6. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases/conditions of the nervous system. 7. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-parasitic drugs. Credits: 1.50

BMS 23300 - Introduction To Pharmacology-VN

Credit Hours: 0.50. This course introduces the concepts and terminology of pharmacology including basic terminology, pharmacokinetics, and pharmacodynamics.

Learning Outcomes: "1. Explain what the different types of drugs names are. 2. Recognize the characteristics of different solid and liquid dosage formulations. 3. Explain the significance of the terminology used in drug references to describe drugs. 4. List and describe the criteria for acceptable extra-label use of drugs. 5. Describe the difference between OTC and prescription drugs. 6. Explain the factors that affect movement of drug molecules throughout the body. 7. Describe the requirements for prescriptions and drug labels. 8. Describe the characteristics of each route of drug administration. 9. Read and write abbreviations commonly used in drug orders accurately. 10. Explain physiological factors that change the way drugs move through the body. 11. Describe regulations and warnings surrounding dispensing containers. 12. Describe factors that alter the way drugs are absorbed, distributed, metabolized, and excreted. 13. Describe reasons and procedures for handling and storing drugs. 14. Explain the interaction between drugs and receptors and how that produces cellular effects. 15. Describe legal requirements for dispensing and storage of controlled substances. 16. Describe how pharmacokinetics and pharmacodynamics impact every drug treatment. 17. Describe special storage and handling requirements for cytotoxic and hazardous drugs. 18. Describe the issues surrounding and guidelines required for acceptable drug compounding. Credits: 0.50

BMS 23200 - Physiology-VN

Credit Hours: 2.00. Basic mammalian physiology, which covers general physiological processes with emphasis on domestic animals. Laboratory experiences and demonstrations form a major part of the laboratory instruction.

Learning Outcomes: 1. Describe and explain the functions of body fluids. The types of formed elements in blood and their functions. 2. Describe and explain the functions of the central and peripheral nervous systems. 3. Describe and explain the types of muscles in the body and their functions. 4. Describe and explain the regulation of the functions of the heart, lungs, kidneys, endocrine glands and gonads. 5. Describe and explain the regulation of blood pressure, gas exchange in the lungs and acid-base balance. 6. Describe and explain the hormonal regulation of metabolic processes and reproduction. Credits: 2.00

BMS 23100 - Anatomy-VN

Credit Hours: 4.00. Gross and microscopic study of body systems and topographic relationships in major animal species. Laboratory consists of dissection as well as study of living animals.

Learning Outcomes: 1. Identify the Musculoskeletal. Students will be able to identify, draw and describe function of, in models, radiographs and live animals: major bones and bony prominences; major muscles; major nerves; major blood vessels associated with limbs; and describe long bone development. 2. Identify the Thorax. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of lungs, esophagus, trachea, major vessels, nerves and heart; pathway of blood through heart; position of thoracic and pleural cavities; and important topography. 3. Identify the Abdomen. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of major GI and reproductive organs, major vessels, and nerves; GI and UG development; position of abdominal and peritoneal cavities; and important topography. 4. Identify the Head and Neck. Students will be

able to identify and describe, in models, radiographs and live animals: major bones of skull; number teeth; major cavities of skull; major features of the eye and ear; major glands, vessels and nerves of the neck and skull; major topography of the head and neck; and major parts and function of the brain. Credits: 4.00

CPB 35200 - Parasitology-VN

Credit Hours: 2.00. Biology and life cycles of selected protozoan, helminth, and arthropod parasites of veterinary importance. Emphasis will be placed on laboratory procedures for the identification of common parasites of domestic and laboratory animals.

Learning Outcomes: 1. Identify gross and microscopic parasite stages that help in disease diagnosis. 2. Select and perform the appropriate assays used in laboratory diagnosis of parasitic infections. 3. Summarize parasite life cycle, pathogenesis and clinical signs of various parasitic diseases. 4. Advocate the methods of parasite control and prevention. 5. Create a safety plan to prevent zoonotic disease transmission. Credits: 2.00

CPB 35100 - Microbiology-VN

Credit Hours: 2.00. Biology and laboratory identification of bacteria and fungi that cause infectious diseases in animals. Emphasis will be placed on the collection of specimens for culture, the isolation and identification of pathogenic organisms, and antibiotic susceptibility testing. Procedures and commercial systems available to veterinary practices will be utilized.

Learning Outcomes: 1. Select appropriate samples for laboratory diagnostics of infectious disease. 2. Perform basic microbiological techniques used in the laboratory setting of a veterinary hospital. (for example: Gram stain, catalase test, oxidase test, inoculate an agar plate for isolated colonies, Kirby Bauer test). 3. Identify organisms from an "unknown sample" using a variety of tests. 4. Create a shortlist of differential diagnoses for infectious disease cases. 5. Implement biosafety protocols (for example: personal protective equipment, isolation of animals). 6. Differentiate the biology of bacteria, viruses, and fungi. 7. Prevent and control the spread or introduction of infectious diseases. 8. Explain zoonotic diseases to laypeople. Credits: 2.00

CPB 25500 - Clinical Pathology-VN

Credit Hours: 4.00. Basic instruction in clinical pathology, including theory and techniques of hematology, clinical chemistry, urinalysis, cytology, and specimen handling.

Learning Outcomes: 1. Have a clinically relevant working knowledge and mastery of laboratory skills related to erythrocytes (red blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of RBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal RBCs; C. Define anemia and classify anemia by mechanisms and RBC indices; D. Accurately perform laboratory analysis of blood samples to produce relevant erythrocyte data for an erythrogram. 2. Have a clinically relevant working knowledge and mastery of laboratory skills related to leukocytes (white blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of WBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal WBCs; C. Accurately describe abnormal leukograms using proper medical terminology and categorize the clinical significance of these abnormalities (e.g., inflammation, stress, excitement, neoplasia, etc.); D. Accurately perform laboratory analysis of blood samples to produce relevant leukocyte

data for a leukogram. 3. Have a clinically relevant working knowledge and mastery of laboratory skills related to platelets (thrombocytes) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe or identify from questions features of platelet production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal platelets/thrombocytes; C. Define thrombocytopenia and thrombocytosis and describe major mechanisms for each; D. Accurately perform laboratory analysis of blood samples to provide accurate estimates of platelet numbers. 4. Have a clinically relevant working knowledge and mastery of laboratory skills related to analysis of urine. This includes the ability to: A. Accurately perform a complete urinalysis including the physical, chemical and sediment examination; B. Identify normal and abnormal urine elements by microscopy, gross visual examination and photographs. 5. Have a clinically relevant working knowledge and mastery of laboratory skills related to diagnostic cytology. This includes the ability to: A. Collect and process fluids, skin and subcutaneous samples, and vaginal cytologic preparations; B. Correctly classify cytologic preparations as normal, malignant or inflammatory; C. Recognize and describe normal and abnormal leukocytes in cytologic preps. This includes visual recognition and/or description of the following features: macrophage activation, neutrophil degeneration, lymphocyte reactivity; D. Recognize and distinguish between bacteria & fungal organisms; E. Classify stages of the reproductive cycle based on vaginal cytology from dogs and cats. 6. Correctly associate specific clinical chemistry tests with their primary organ of involvement (e.g., kidney, liver, etc.), process (e.g., acid-base) or class of analyte (e.g., electrolytes). 7. Have a clinically relevant working knowledge and mastery of the physiology of hemostasis and how that relates to common laboratory tests for hemostasis disorders. This includes the ability to: A. Correctly categorize the role of key elements of hemostasis into primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis; B. Select appropriate tests to assess disorders of primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis. 8. Have a clinically relevant working knowledge and mastery of in-house serologic testing. Credits: 4.00

VCS 22200 - Dentistry-VN

Credit Hours: 1.00. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs. 5. Develop and provide client education. Credits: 1.00

VCS 22300 - Surgical Nursing-VN

Credit Hours: 1.50. This course is an introduction to the surgical environment and all aspects related to the principles of asepsis and the practice of sterile technique. Students will learn using a variety of teaching modalities (lecture, group work, laboratory experience).

Learning Outcomes: 1. Identify basic surgical instruments. 2. Explain the principles of aseptic technique. 3. Perform the duties of surgical nurse. 4. Perform the duties of the circulating nurse. 5. Explain procedures to prepare items for sterilization and the techniques used for sterilization. 6. Demonstrate bandaging

techniques for both large and small animal patients. 7. Identify the phases of wound healing. Credits: 1.50

VCS 22400 - Small Animal Nursing I

Credit Hours: 2.00. This course will introduce students to nursing and diagnostic techniques for small animals and the body response to disease.

Learning Outcomes: 1. Recognize and report conditions of hospitalized small animal patients. 2. Provide appropriate nursing care to hospitalized patients. 3. Place IV catheters in small animal patients and administer fluids appropriately. 4. Perform diagnostic procedures and exams for small animal patients. 5. Provide technical assistance to a DVM for diagnostics and therapeutics. 6. Recognize emergent conditions and provide appropriate treatment. 7. Perform basic training techniques with dogs. Credits: 2.00

VCS 22500 - Large Animal Nursing I

Credit Hours: 2.00. This course builds on concepts learning in VCS 22100 related to normal, healthy large animal patients. It also introduces the students to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify and explain the nursing concepts of hospitalized and post-op LA patients. 2. Select and apply nursing concepts to the LA patient. 3. Place an IV catheter in a large animal patient and identify the problems that can occur from long term catheterization. 4. Describe milking procedures and the tests used to identify problems. 5. Collect diagnostic samples from large animals. 6. Administer medications via common routes to large animals. 7. Calculate fluid therapy rates for LA patients. 8. Identify the appropriate uses for bandages, splints, casts. 9. Identify the steps utilized in intensive neonatal care and medical emergencies. Credits: 2.00

VCS 22600 - Principles Of Anesthesia-VN

Credit Hours: 2.00. This course is an introduction to surgical nursing and anesthesia. The principles of asepsis and sterile technique will be introduced and demonstrated by staff and in some cases, practiced by the student. The basics of anesthesia will be introduced and practiced by the student.

Learning Outcomes: 1. Identify basic surgical instruments. 2. State the principles of aseptic technique. 3. Identify breaks in aseptic technique. 4. Perform open gloving. 5. Perform aseptic personnel scrub; gowning and closed gloving. 6. Identify the parts of an anesthesia machine. 7. Know the function of the above parts. 8. Trace the flow of oxygen through an anesthetic machine, with rebreathing and nonbreathing systems. 9. Identify rebreathing and nonbreathing systems. 10. Practice monitoring principles and identify normal parameters. 11. Identify a variety of analgesic and anesthetic drugs. 12. Begin to identify and state the uses and classifications of these drugs. 13. Perform general anesthesia; from physical exam through recovery. Credits: 2.00

VCS 22800 - Small And Large Animal Nutrition-VN

Credit Hours: 1.00. This course will introduce students to an overview of nutritional concepts as it applies to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as therapeutic use of diets as it relates to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediatric stages to adulthood. 5. Define specific differences in diets based upon breed (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture

management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VCS 25200 - Diagnostic Imaging-VN

Credit Hours: 2.00. Provides an introduction to imaging of domestic animals. Emphasis will be placed on radiological principles and techniques, darkroom procedures and design, preparing technique charts for various X-ray units, animal positioning, and radiation safety.

Learning Outcomes: 1. Recall and apply diagnostic imaging guidelines and safety procedures. 2. Produce diagnostic images of soft tissue and orthopedic projections of both small and large animal patients. 3. Produce diagnostic images of skull projections of small animal patients. 4. Perform diagnostic contrast studies of the circulatory, renal and gastrointestinal systems. 5. Utilize computed and digital imaging systems to produce diagnostic images of both large and small animal patients. 6. Assist with performing diagnostic ultrasound scans of small animal patients. 7. Possess a basic understanding and introductory working knowledge of CT, MRI and Nuclear Medicine scanning procedures on both small and large animal patients. Credits: 2.00

VCS 32100 - Large Animal Nursing II

Credit Hours: 2.00. This course build on concepts learned in VCS 22100 and VCS 22500 related to normal, healthy large animals patients. It also introduces the student to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify the key principles associated with herd health management. 2. Understand the role of regulatory issues in large animal medicine. 3. Demonstrate an understanding of the common diseases affecting large animal species. 4. Develop an understanding of naturally occurring toxic plants. Credits: 2.00

VCS 32200 - Small Animal Nursing II

Credit Hours: 2.00. This course will cover management of hospitalized patients, client education, and preventative medicine programs. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Describe basic information about small animal medicine conditions to clients. 2. Educate clients regarding preventative small animal medicine. 3. Utilize knowledge of small animal medical conditions to provide nursing care to patients. 4. Utilize knowledge of small animal medical conditions to anticipate DVM needs for diagnosis and treatment of hospitalized patients. Credits: 2.00

VM 24100 - Occupational & Public Health I

Credit Hours: 1.00. This course will cover selected zoonotic diseases, occupational hazards and safety issues, related to the veterinary health care team and veterinary facility.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Understand where to find current information related to veterinary medical occupational hazards. 4. Effectively communicate appropriate safety principles to colleagues. Credits: 1.00

VM 24300 - Clinic Rotations I

Credit Hours: 1.50. This course will provide the basic learning situations for developing the techniques required of veterinary technicians in pharmacy, radiology, surgery, medical nursing, and ancillary areas. Total clinic hours 9/week.

Learning Outcomes: 1. Become acquainted with clinical areas, personnel, responsibilities and basic procedures. 2. Perform basic nursing duties as they are learned in concurrent courses and by experience. 3. Become familiar with the veterinary team concept and its benefit to patient care. Credits: 1.50

VM 24400 - Clinical Rotations II

Credit Hours: 1.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed basic nursing duties learned in previous courses and as they are learned in concurrent courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 1.50

VM 24900 - Clinical Rotations III

Credit Hours: 3.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities, and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 3.50

VM 32300 - Laboratory Animals & Exotic Pet Medicine-VN

Credit Hours: 2.00. This course will cover the proper methods of restraint, daily care, nursing techniques, and housing needs for the common species of laboratory animals.

Learning Outcomes: 1. Understand nutritional requirements, physiological data, anesthesia, blood collection, drug administration, handling, sexing, and common diseases of laboratory rodents, primates, and lagomorphs as well as non-traditional pets including small mammals, fish, amphibians, reptiles, and birds. 2. Familiarization with laboratory housing, environmental control, and environmental enrichment concepts. 3. Familiarization with basic genetics and breeding programs of laboratory animals. 4. Understand sanitation and hygiene procedures as they relate to laboratory animal management. 5. Introduce concepts of experimental methodology and regulatory compliance within laboratory animal medicine. 6. Introduce wildlife triage and wildlife nursing techniques. Credits: 2.00

VM 34300 - Clinic Rotations IV-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34400 - Clinic Rotations V-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34500 - Veterinary Management Topics I-VN

Credit Hours: 1.50. The course will introduce students to concepts related to working in and managing a veterinary practice. Emphasis will be on client communication and education as well as facilitating a job search, interviewing and cover letter and resume creation.

Learning Outcomes: 1. Create a professional cover letter and resume. 2. Properly prepare for and participate in employment interviews. 3. Utilize techniques that build excellent relationships by exceeding client expectations,

providing great client service and building a rapport with clients. 4. Utilize techniques for handling emotional or difficult clients. 5. Utilize techniques for working with special needs clients. 6. Explain the grief process. 7. Discuss professionalism and legal and ethical issues related to the veterinary technology profession. 8. Describe the ways in which fees are set for products and services at a veterinary clinic. 9. Define marketing and describe how marketing strategies can be used in a veterinary clinic setting. 10. Describe inventory management strategies. 11. Identify professional organizations related to veterinary technology and veterinary practice management. Credits: 1.50

VM 39000 - Practicum

Credit Hours: 4.00. Veterinary technologist level off-campus experience in one area of interest totaling 480 hours over 12 weeks.

Credits: 4.00

VM 41001 - International Practicum

Credit Hours: 4.00. The student will experience an integrated employment situation combined with veterinary team interaction to augment his/her specialized CoVM clinical learning experiences. The student will work under the direct supervision of a licensed veterinarian or credentialed veterinary technician designee of tech veterinarian. The student is required to complete a pre-departure orientation with the PVM Director of International Programs.

Learning Outcomes: 1. Perform technical duties in medical and surgical nursing, imaging, laboratory procedures, anesthesia, and client interaction when working in a practice setting. 2. Perform tech duties required of the position in the industry setting. 3. Observe and record the case cycle concept of vet med in its components of history, assessment, problem listing, interventions and actions, potential problems encountered, patient outcomes and evaluations, and discharge planning as it pertains to veterinary nursing. 4. Identify and critically address management issues. 5. Create and deliver an oral presentation. 6. Develop communication skills. Credits: 4.00

VM 20100 - Medical Math And Terminology For Veterinary Nursing

Credit Hours: 1.50. A didactic course which presents the basic skills that will be used in all nursing courses and in the overall curriculum. In addition, the course introduces medical math and terminology used in veterinary medicine. Students will complete exercises utilizing math concepts for dosage calculations, conversions, proper notation, dispensing medications, fluid therapy calculations, and percent solutions. Students will use medical terminology including prefixes, roots, and suffixes of medical terms to complete exercises. This knowledge will be utilized in didactic courses and labs as well as in clinical rotations. Students will learn normal temperature, pulse and respiration values for various species. There will be both in-class and study components.

Learning Outcomes: 1. Utilize medical math to calculate drug dosages, dispense medications, fluid therapy rates, and percent solutions. 2. Apply medical math concepts to perform conversions and use proper notation. 3. Understand and utilize medical terminology in didactic classes, laboratories, and clinic rotations. 4. Know normal temperature, pulse and respiration values for various species and report abnormalities. 5. Apply diversity and inclusion skills as they apply in veterinary medicine. 6. Discuss compassion fatigue and euthanasia in veterinary medicine. Credits: 1.50

VM 34210 - Integrations-VN

Credit Hours: 2.00. This course will give an introduction to problem-based learning of the nursing process (patient evaluations, interventions, and desire resolutions) using a case-based approach. This course will integrate foundational knowledge from anatomy, physiology, and information in the veterinary nursing courses. This course will draw on fundamentals and concepts learned from all courses to this point including pharmacology, diagnostic imaging, parasitology, small animal nursing, and large animal nursing, so as to enable you to apply knowledge of understanding of clinical cases. Cases will involve different domestic animal species.

Learning Outcomes: 1. Integrate and apply knowledge from foundational coursework. 2. Identify and apply the components of the

veterinary nursing process. 3. Follow evidence-based medicine practices and relate to patient case scenarios. 4. Utilize critical thinking skills to apply the veterinary nursing process to patient case scenarios. 5. Use verbal and written communication skills appropriately with other members of the veterinary team. Credits: 2.00

VCS 21100 - Veterinary Nursing Techniques For The Large Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, large animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients, including vaccinations that are recommended for large animal species. 4. Collect diagnostic samples from large animals. 5. Administer medications via common routes to large animals. 6. Identify common breeds of horses, cattle, swine, goats and sheep. Credits: 2.00

VCS 21000 - Veterinary Nursing Techniques For The Small Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, small animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and implement common restraint techniques used for various small animal species. 2. Measure the temperature, pulse, and respiratory rates, and provide an explanation of the normal parameters. 3. Identify and explain different sites for injections and venipuncture. 4. Identify common breeds of canines and felines and describe normal behavior of each species. 5. Conduct a comprehensive patient history and perform a thorough, standardized physical examination. 6. Engage in discussions with clients about routine preventive care, including recommended vaccinations for different large animal species. Credits: 2.00

Other Departmental/Program Course Requirements (3-4 credits)

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC:

IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

Electives (3.5 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Notes

Sample 2-Year Plan

Fall 1st Year

BMS 23200 - Physiology-VN

Credit Hours: 2.00. Basic mammalian physiology, which covers general physiological processes with emphasis on domestic animals. Laboratory experiences and demonstrations form a major part of the laboratory instruction.

Learning Outcomes: 1. Describe and explain the functions of body fluids. The types of formed elements in blood and their functions. 2. Describe and explain the functions of the central and peripheral nervous systems. 3. Describe and explain the types of muscles in the body and their functions. 4. Describe and explain the regulation of the functions of the heart, lungs, kidneys, endocrine glands and gonads. 5.

Describe and explain the regulation of blood pressure, gas exchange in the lungs and acid-base balance. 6. Describe and explain the hormonal regulation of metabolic processes and reproduction. Credits: 2.00

BMS 23100 - Anatomy-VN

Credit Hours: 4.00. Gross and microscopic study of body systems and topographic relationships in major animal species. Laboratory consists of dissection as well as study of living animals.

Learning Outcomes: 1. Identify the Musculoskeletal. Students will be able to identify, draw and describe function of, in models, radiographs and live animals: major bones and bony prominences; major muscles; major nerves; major blood vessels associated with limbs; and describe long bone development. 2. Identify the Thorax. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of lungs, esophagus, trachea, major vessels, nerves and heart; pathway of blood through heart; position of thoracic and pleural cavities; and important topography. 3. Identify the Abdomen. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of major GI and reproductive organs, major vessels, and nerves; GI and UG development; position of abdominal and peritoneal cavities; and important topography. 4. Identify the Head and Neck. Students will be able to identify and describe, in models, radiographs and live animals: major bones of skull; number teeth; major cavities of skull; major features of the eye and ear; major glands, vessels and nerves of the neck and skull; major topography of the head and neck; and major parts and function of the brain. Credits: 4.00

VCS 22200 - Dentistry-VN

Credit Hours: 1.00. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs. 5. Develop and provide client education. Credits: 1.00

VCS 22300 - Surgical Nursing-VN

Credit Hours: 1.50. This course is an introduction to the surgical environment and all aspects related to the principles of asepsis and the practice of sterile technique. Students will learn using a variety of teaching modalities (lecture, group work, laboratory experience).

Learning Outcomes: 1. Identify basic surgical instruments. 2. Explain the principles of aseptic technique. 3. Perform the duties of surgical nurse. 4. Perform the duties of the circulating nurse. 5. Explain procedures to prepare items for sterilization and the techniques used for sterilization. 6. Demonstrate bandaging techniques for both large and small animal patients. 7. Identify the phases of wound healing. Credits: 1.50

VM 24100 - Occupational & Public Health I

Credit Hours: 1.00. This course will cover selected zoonotic diseases, occupational hazards and safety issues, related to the veterinary health care team and veterinary facility.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Understand where to find current information related to veterinary medical occupational hazards. 4. Effectively communicate appropriate safety principles to colleagues. Credits: 1.00

VM 24300 - Clinic Rotations I

Credit Hours: 1.50. This course will provide the basic learning

situations for developing the techniques required of veterinary technicians in pharmacy, radiology, surgery, medical nursing, and ancillary areas. Total clinic hours 9/week.

Learning Outcomes: 1. Become acquainted with clinical areas, personnel, responsibilities and basic procedures. 2. Perform basic nursing duties as they are learned in concurrent courses and by experience. 3. Become familiar with the veterinary team concept and its benefit to patient care. Credits: 1.50

VM 20100 - Medical Math And Terminology For Veterinary Nursing

Credit Hours: 1.50. A didactic course which presents the basic skills that will be used in all nursing courses and in the overall curriculum. In addition, the course introduces medical math and terminology used in veterinary medicine. Students will complete exercises utilizing math concepts for dosage calculations, conversions, proper notation, dispensing medications, fluid therapy calculations, and percent solutions. Students will use medical terminology including prefixes, roots, and suffixes of medical terms to complete exercises. This knowledge will be utilized in didactic courses and labs as well as in clinical rotations. Students will learn normal temperature, pulse and respiration values for various species. There will be both in-class and study components.

Learning Outcomes: 1. Utilize medical math to calculate drug dosages, dispense medications, fluid therapy rates, and percent solutions. 2. Apply medical math concepts to perform conversions and use proper notation. 3. Understand and utilize medical terminology in didactic classes, laboratories, and clinic rotations. 4. Know normal temperature, pulse and respiration values for various species and report abnormalities. 5. Apply diversity and inclusion skills as they apply in veterinary medicine. 6. Discuss compassion fatigue and euthanasia in veterinary medicine. Credits: 1.50

VCS 21100 - Veterinary Nursing Techniques For The Large Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, large animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients, including vaccinations that are recommended for large animal species. 4. Collect diagnostic samples from large animals. 5. Administer medications via common routes to large animals. 6. Identify common breeds of horses, cattle, swine, goats and sheep. Credits: 2.00

VCS 21000 - Veterinary Nursing Techniques For The Small Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, small animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and implement common restraint techniques used for various small animal species. 2. Measure the temperature, pulse, and respiratory rates, and provide an explanation of the normal parameters. 3. Identify and explain different sites for injections and venipuncture. 4. Identify common breeds of canines and felines and describe normal behavior of each species. 5. Conduct a comprehensive patient history and perform a thorough, standardized physical examination. 6. Engage in discussions with clients about routine preventive care, including recommended vaccinations for different large animal species. Credits: 2.00

15.5 Credits

Spring 1st Year

BMS 23300 - Introduction To Pharmacology-VN

Credit Hours: 0.50. This course introduces the concepts and terminology of pharmacology including basic terminology, pharmacokinetics, and pharmacodynamics.

Learning Outcomes: "1. Explain what the different types of drugs names are. 2. Recognize the characteristics of different solid

and liquid dosage formulations. 3. Explain the significance of the terminology used in drug references to describe drugs. 4. List and describe the criteria for acceptable extra-label use of drugs. 5. Describe the difference between OTC and prescription drugs. 6. Explain the factors that affect movement of drug molecules throughout the body. 7. Describe the requirements for prescriptions and drug labels. 8. Describe the characteristics of each route of drug administration. 9. Read and write abbreviations commonly used in drug orders accurately. 10. Explain physiological factors that change the way drugs move through the body. 11. Describe regulations and warnings surrounding dispensing containers. 12. Describe factors that alter the way drugs are absorbed, distributed, metabolized, and excreted. 13. Describe reasons and procedures for handling and storing drugs. 14. Explain the interaction between drugs and receptors and how that produces cellular effects. 15. Describe legal requirements for dispensing and storage of controlled substances. 16. Describe how pharmacokinetics and pharmacodynamics impact every drug treatment. 17. Describe special storage and handling requirements for cytotoxic and hazardous drugs. 18. Describe the issues surrounding and guidelines required for acceptable drug compounding. Credits: 0.50

CPB 25500 - Clinical Pathology-VN

Credit Hours: 4.00. Basic instruction in clinical pathology, including theory and techniques of hematology, clinical chemistry, urinalysis, cytology, and specimen handling.

Learning Outcomes: 1. Have a clinically relevant working knowledge and mastery of laboratory skills related to erythrocytes (red blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of RBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal RBCs; C. Define anemia and classify anemia by mechanisms and RBC indices; D. Accurately perform laboratory analysis of blood samples to produce relevant erythrocyte data for an erythrogram. 2. Have a clinically relevant working knowledge and mastery of laboratory skills related to leukocytes (white blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of WBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal WBCs; C. Accurately describe abnormal leukograms using proper medical terminology and categorize the clinical significance of these abnormalities (e.g., inflammation, stress, excitement, neoplasia, etc.); D. Accurately perform laboratory analysis of blood samples to produce relevant leukocyte data for a leukogram. 3. Have a clinically relevant working knowledge and mastery of laboratory skills related to platelets (thrombocytes) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe or identify from questions features of platelet production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal platelets/thrombocytes; C. Define thrombocytopenia and thrombocytosis and describe major mechanisms for each; D. Accurately perform laboratory analysis of blood samples to provide accurate estimates of

platelet numbers. 4. Have a clinically relevant working knowledge and mastery of laboratory skills related to analysis of urine. This includes the ability to: A. Accurately perform a complete urinalysis including the physical, chemical and sediment examination; B. Identify normal and abnormal urine elements by microscopy, gross visual examination and photographs. 5. Have a clinically relevant working knowledge and mastery of laboratory skills related to diagnostic cytology. This includes the ability to: A. Collect and process fluids, skin and subcutaneous samples, and vaginal cytologic preparations; B. Correctly classify cytologic preparations as normal, malignant or inflammatory; C. Recognize and describe normal and abnormal leukocytes in cytologic preps. This includes visual recognition and/or description of the following features: macrophage activation, neutrophil degeneration, lymphocyte reactivity; D. Recognize and distinguish between bacteria & fungal organisms; E. Classify stages of the reproductive cycle based on vaginal cytology from dogs and cats. 6. Correctly associate specific clinical chemistry tests with their primary organ of involvement (e.g., kidney, liver, etc.), process (e.g., acid-base) or class of analyte (e.g., electrolytes). 7. Have a clinically relevant working knowledge and mastery of the physiology of hemostasis and how that relates to common laboratory tests for hemostasis disorders. This includes the ability to: A. Correctly categorize the role of key elements of hemostasis into primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis; B. Select appropriate tests to assess disorders of primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis. 8. Have a clinically relevant working knowledge and mastery of in-house serologic testing. Credits: 4.00

VCS 22400 - Small Animal Nursing I

Credit Hours: 2.00. This course will introduce students to nursing and diagnostic techniques for small animals and the body response to disease.

Learning Outcomes: 1. Recognize and report conditions of hospitalized small animal patients. 2. Provide appropriate nursing care to hospitalized patients. 3. Place IV catheters in small animal patients and administer fluids appropriately. 4. Perform diagnostic procedures and exams for small animal patients. 5. Provide technical assistance to a DVM for diagnostics and therapeutics. 6. Recognize emergent conditions and provide appropriate treatment. 7. Perform basic training techniques with dogs. Credits: 2.00

VCS 22500 - Large Animal Nursing I

Credit Hours: 2.00. This course builds on concepts learning in VCS 22100 related to normal, healthy large animal patients. It also introduces the students to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify and explain the nursing concepts of hospitalized and post-op LA patients. 2. Select and apply nursing concepts to the LA patient. 3. Place an IV catheter in a large animal patient and identify the problems that can occur from long term catheterization. 4. Describe milking procedures and the tests used to identify problems. 5. Collect diagnostic samples from large animals. 6. Administer medications via common routes to large animals. 7. Calculate fluid therapy rates for LA patients. 8. Identify the appropriate uses for bandages, splints, casts. 9. Identify the steps utilized in intensive neonatal care and medical emergencies. Credits: 2.00

VCS 22600 - Principles Of Anesthesia-VN

Credit Hours: 2.00. This course is an introduction to surgical nursing and anesthesia. The principles of asepsis and sterile technique will be introduced and demonstrated by staff and in some cases, practiced by the student. The basics of anesthesia

will be introduced and practiced by the student.

Learning Outcomes: 1. Identify basic surgical instruments. 2. State the principles of aseptic technique. 3. Identify breaks in aseptic technique. 4. Perform open gloving. 5. Perform aseptic personnel scrub; gowning and closed gloving. 6. Identify the parts of an anesthesia machine. 7. Know the function of the above parts. 8. Trace the flow of oxygen through an anesthetic machine, with rebreathing and nonbreathing systems. 9. Identify rebreathing and nonbreathing systems. 10. Practice monitoring principles and identify normal parameters. 11. Identify a variety of analgesic and anesthetic drugs. 12. Begin to identify and state the uses and classifications of these drugs. 13. Perform general anesthesia; from physical exam through recovery. Credits: 2.00

VCS 25200 - Diagnostic Imaging-VN

Credit Hours: 2.00. Provides an introduction to imaging of domestic animals. Emphasis will be placed on radiological principles and techniques, darkroom procedures and design, preparing technique charts for various X-ray units, animal positioning, and radiation safety.

Learning Outcomes: 1. Recall and apply diagnostic imaging guidelines and safety procedures. 2. Produce diagnostic images of soft tissue and orthopedic projections of both small and large animal patients. 3. Produce diagnostic images of skull projections of small animal patients. 4. Perform diagnostic contrast studies of the circulatory, renal and gastrointestinal systems. 5. Utilize computed and digital imaging systems to produce diagnostic images of both large and small animal patients. 6. Assist with performing diagnostic ultrasound scans of small animal patients. 7. Possess a basic understanding and introductory working knowledge of CT, MRI and Nuclear Medicine scanning procedures on both small and large animal patients. Credits: 2.00

VM 24400 - Clinical Rotations II

Credit Hours: 1.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed basic nursing duties learned in previous courses and as they are learned in concurrent courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 1.50

14 Credits

Summer 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6.

Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

VM 24900 - Clinical Rotations III

Credit Hours: 3.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities, and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 3.50

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

6.5-7.5 Credits

Fall 2nd Year

BMS 33100 - Pharmacology-VN

Credit Hours: 1.50. This course introduces the concepts of drugs used in the different body systems. Mechanisms of action, side effects, and therapeutic applications are presented.

Learning Outcomes: 1. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for

common veterinary drugs used to treat diseases of the GI tract. 2. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of cardiovascular system. 3. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the respiratory tract. 4. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the endocrine systems. 5. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-inflammatory drugs. 6. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases/conditions of the nervous system. 7. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-parasitic drugs. Credits: 1.50

VCS 22800 - Small And Large Animal Nutrition-VN

Credit Hours: 1.00. This course will introduce students to an overview of nutritional concepts as it applies to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as therapeutic use of diets as it relates to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediatric stages to adulthood. 5. Define specific differences in diets based upon breed (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VCS 32100 - Large Animal Nursing II

Credit Hours: 2.00. This course build on concepts learned in VCS 22100 and VCS 22500 related to normal, healthy large animals patients. It also introduces the student to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify the key principles associated with herd health management. 2. Understand the role of regulatory issues in large animal medicine. 3. Demonstrate an understanding of the common diseases affecting large animal species. 4. Develop an understanding of naturally occurring toxic plants. Credits: 2.00

VCS 32200 - Small Animal Nursing II

Credit Hours: 2.00. This course will cover management of hospitalized patients, client education, and preventative medicine programs. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Describe basic information about small animal medicine conditions to clients. 2. Educate clients regarding preventative small animal medicine. 3. Utilize knowledge of small animal medical conditions to provide nursing care to patients. 4. Utilize knowledge of small animal medical conditions to anticipate DVM needs for diagnosis and treatment of hospitalized patients. Credits: 2.00

VM 32300 - Laboratory Animals & Exotic Pet Medicine-VN

Credit Hours: 2.00. This course will cover the proper methods of restraint, daily care, nursing techniques, and housing needs for the common species of laboratory animals.

Learning Outcomes: 1. Understand nutritional requirements, physiological data, anesthesia, blood collection, drug administration, handling, sexing, and common diseases of laboratory rodents, primates, and lagomorphs as well as non-traditional pets including small mammals, fish, amphibians, reptiles, and birds. 2. Familiarization with laboratory housing, environmental control, and environmental enrichment concepts. 3. Familiarization with basic genetics and breeding programs of laboratory animals. 4. Understand sanitation and hygiene procedures as they relate to laboratory animal management. 5. Introduce concepts of experimental methodology and regulatory compliance within laboratory animal medicine. 6. Introduce wildlife triage and wildlife nursing techniques. Credits: 2.00

VM 34300 - Clinic Rotations IV-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

13.5 Credits

Spring 2nd Year

CPB 35200 - Parasitology-VN

Credit Hours: 2.00. Biology and life cycles of selected protozoan, helminth, and arthropod parasites of veterinary importance. Emphasis will be placed on laboratory procedures for the identification of common parasites of domestic and laboratory animals.

Learning Outcomes: 1. Identify gross and microscopic parasite stages that help in disease diagnosis. 2. Select and perform the appropriate assays used in laboratory diagnosis of parasitic infections. 3. Summarize parasite life cycle, pathogenesis and clinical signs of various parasitic diseases. 4. Advocate the methods of parasite control and prevention. 5. Create a safety plan to prevent zoonotic disease transmission. Credits: 2.00

CPB 35100 - Microbiology-VN

Credit Hours: 2.00. Biology and laboratory identification of bacteria and fungi that cause infectious diseases in animals. Emphasis will be placed on the collection of specimens for culture, the isolation and identification of pathogenic organisms, and antibiotic susceptibility testing. Procedures and commercial systems available to veterinary practices will be utilized.

Learning Outcomes: 1. Select appropriate samples for laboratory diagnostics of infectious disease. 2. Perform basic microbiological techniques used in the laboratory setting of a veterinary hospital. (for example: Gram stain, catalase test, oxidase test, inoculate an agar plate for isolated colonies, Kirby Bauer test). 3. Identify organisms from an "unknown sample" using a variety of tests. 4. Create a shortlist of differential diagnoses for infectious disease cases. 5. Implement biosafety protocols (for example: personal protective equipment, isolation of animals). 6. Differentiate the biology of bacteria, viruses, and fungi. 7. Prevent and control the spread or introduction of infectious diseases. 8. Explain zoonotic diseases to laypeople. Credits: 2.00

VM 34400 - Clinic Rotations V-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of

clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34500 - Veterinary Management Topics I-VN

Credit Hours: 1.50. The course will introduce students to concepts related to working in and managing a veterinary practice. Emphasis will be on client communication and education as well as facilitating a job search, interviewing and cover letter and resume creation.

Learning Outcomes: 1. Create a professional cover letter and resume. 2. Properly prepare for and participate in employment interviews. 3. Utilize techniques that build excellent relationships by exceeding client expectations, providing great client service and building a rapport with clients. 4. Utilize techniques for handling emotional or difficult clients. 5. Utilize techniques for working with special needs clients. 6. Explain the grief process. 7. Discuss professionalism and legal and ethical issues related to the veterinary technology profession. 8. Describe the ways in which fees are set for products and services at a veterinary clinic. 9. Define marketing and describe how marketing strategies can be used in a veterinary clinic setting. 10. Describe inventory management strategies. 11. Identify professional organizations related to veterinary technology and veterinary practice management. Credits: 1.50

VM 34210 - Integrations-VN

Credit Hours: 2.00. This course will give an introduction to problem-based learning of the nursing process (patient evaluations, interventions, and desire resolutions) using a case-based approach. This course will integrate foundational knowledge from anatomy, physiology, and information in the veterinary nursing courses. This course will draw on fundamentals and concepts learned from all courses to this point including pharmacology, diagnostic imaging, parasitology, small animal nursing, and large animal nursing, so as to enable you to apply knowledge of understanding of clinical cases. Cases will involve different domestic animal species.

Learning Outcomes: 1. Integrate and apply knowledge from foundational coursework. 2. Identify and apply the components of the veterinary nursing process. 3. Follow evidence-based medicine practices and relate to patient case scenarios. 4. Utilize critical thinking skills to apply the veterinary nursing process to patient case scenarios. 5. Use verbal and written communication skills appropriately with other members of the veterinary team. Credits: 2.00

16 Credits

Summer 2nd Year

VM 39000 - Practicum

Credit Hours: 4.00. Veterinary technologist level off-campus experience in one area of interest totaling 480 hours over 12 weeks.

Credits: 4.00

VM 41001 - International Practicum

Credit Hours: 4.00. The student will experience an integrated employment situation combined with veterinary team interaction to augment his/her specialized CoVM clinical learning experiences. The student will work under the direct supervision of a licensed veterinarian or credentialed veterinary technician designee of tech veterinarian. The student is required to complete a pre-departure orientation with the PVM Director of International Programs.

Learning Outcomes: 1. Perform technical duties in medical and surgical nursing, imaging, laboratory procedures, anesthesia, and client interaction when working in a practice setting. 2. Perform tech duties required of the position in the industry setting. 3. Observe and record the case cycle concept of vet med in its components of history, assessment, problem listing, interventions and actions, potential problems encountered, patient outcomes and

evaluations, and discharge planning as it pertains to veterinary nursing. 4. Identify and critically address management issues. 5. Create and deliver an oral presentation. 6. Develop communication skills. Credits: 4.00

4 Credits

Baccalaureate

Accelerated Nursing, BSN

About the Program

Requirements

Departmental/Program Major Course Requirements

Required Major Courses (59 credits)

NUR 21901 - Pathopharmacology I

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort and the pharmacotherapies utilized as treatment for alterations and disease states. This introductory knowledge provides the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe primary regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations in body structure and function affecting homeostasis; metabolic processes; immune response; circulation; renal elimination; fluid/electrolyte and acid/base balance; sensory perception and comfort. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and comfort. 4. Idenify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contraindications, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22101 - Pathopharmocology II

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function and the pharmacotherapies utilized as treatment for alterations and disease states. This course builds on the learning objectives from Pathopharmacology I to provide the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe the primary regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 3. Describe selected diagnostic, therapeutic and pharmacologic

interventions in the prevention and treatment of alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 4. Identify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contradictions, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into the overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3. Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

NUR 31401 - Health Alterations In Adults I

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of well-being as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in tissue integrity related to surgical interventions, cellular division, reproductive function, elimination, nutrition and sensory function that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision-making when caring for diverse populations of adults experiencing selected illnesses. 2. Utilize the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related (including gerontologic) pathophysiology when providing care to diverse populations of adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence- based, legal, ethical, compassionate, and culturally

sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to client, client's family, and other members of the healthcare team. 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes. 10. Utilize patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31501 - Nursing Of Childbearing Families

Credit Hours: 5.00. Promotes the development of nursing skills when caring for families and their newborns during uncomplicated and/or complicated childbearing experiences within a variety of clinical settings. Emphasizes the study and application of the nursing process, integrating evidence based practice while meeting the health and safety needs of diverse childbearing families.

Learning Outcomes: 1. Integrate theory and evidence to guide nursing practice and clinical decision-making throughout the care of childbearing families. 2. Incorporate childbearing family participation throughout health promotion, disease prevention, and risk reduction processes. 3. Address the childbearing family's developmental, physiologic, and psychological needs. 4. Assess ethical, legal, and sociocultural influences on resource utilization and compassionate maternal-child health care delivery. 5. Design targeted plans of care via a partnership with childbearing families, intra- and interprofessional teams, professional organizations, and institutions. 6. Utilize information technology to enhance learning, practice, and communication. Credits: 5.00

NUR 31601 - Integration Seminar I

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and obstetrical diagnoses. Through the course activities the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medical-surgical and obstetrical populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

NUR 31701 - Health Alterations In Adults II

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of wellbeing as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in health related to oxygenation, circulatory dynamics, endocrine regulation, neurological regulation, immune regulation and musculoskeletal dynamics that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision making when caring for diverse populations of adults experiencing selected illnesses. 2. Demonstrate appropriate use of the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related pathophysiology when providing care to adults experiencing health alterations. 4. Collaborate with members

of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence-based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to the client, client's family, and other members of the health care team 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes that emphasize client safety and evidence-based practice. 10. Use patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31801 - Psychiatric And Mental Health Nursing

Credit Hours: 5.00. Focuses on providing nursing care that supports mental health and the care of persons with mental illness while providing a conceptual integration of the nursing process, theories, and research from the biopsychosocial sciences and humanities. Demonstrates the relevance of psychiatric-mental health nursing concepts to all areas of professional practice.

Learning Outcomes: 1. Examine the effects of myths, stereotypes, stigma, values, beliefs and culture on the practice of psychiatric nursing. 2. Compare past, current, and projected systems in delivery of evidence based mental health care and its social implications. 3. Identify legal and ethical implications involved in the practice of psychiatric mental health nursing. 4. Utilize the nursing process in the phases ofthe therapeutic nurse-client relationship to delineate the complex needs of clients with psychiatric disorders.. 5. Identify the principles of communication and therapeutic relationships in the care of clients with psychiatric disorders. 6. Determine specific nursing care interventions for acute and serious behavioral health issues that demonstrate developmentally and culturally appropriate strategies. 7. Utilize the ANA Standards of Psychiatric and Mental Health Nursing Practice as a basis for safe and competent care. 8. Incorporate theory, research and evidence from the psychobiological sciences, biological sciences, and humanities into an evidenced based practice approach to psychiatric nursing care. 9. Utilize client care technologies, information systems, and communication resources to access, organize and communicate information in a professional manner. 10. Establish therapeutic, collaborative relationships with members of the interdisciplinary treatment team. 11. Demonstrate personal and professional growth and skill development when providing evidence-based nursing care to clients with psychiatric disorders. Credits: 5.00

NUR 31901 - Integration Seminar II

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and psychiatric diagnoses. Through the course activities, the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medically and psychologically unstable populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing

practice problems. Credits: 1.00

NUR 41401 - Pediatric Nursing

Credit Hours: 5.00. Explores factors influencing the health and wellness of children and families. Students will apply principles, concepts and research from the health and human sciences to the care of children and families across the health-illness continuum. A structured clinical component focuses on clinical reasoning and evidence based practice. Students will provide family centered care to healthy, at risk and ill children across a variety of clinical settings.

Learning Outcomes: 1. Integrate family theories; growth and development; genomics; environmental and psychosocial factors in the care of children across the health-illness continuum. 2. Integrate nursing concepts into evidence based nursing practice for children and families across a variety of health care settings. 3. Apply knowledge of information technologies to improve health outcomes of children and families. 4. Evaluate environmental and psychosocial risk factors for children and families. 5. Adapt nursing care to families, recognizing their diverse needs, ethnicity, culture, and values. 6. Evaluate the collaborative role of the nurse with other health care disciplines in the provision of comprehensive nursing care for healthy, at risk, and ill children. 7. Demonstrate a spirit of inquiry, responsibility and accountability within legal, ethical, professional and organizational parameters. Credits: 5.00

NUR 41501 - Public Health Nursing

Credit Hours: 5.00. Utilize health promotion, maintenance, education and disease prevention in coordinating and providing population-focused care to individuals, families and aggregates in the community. A variety of clinical settings are used to offer students a broad, comprehensive perspective of public health nursing, a field that synthesizes content from nursing, social and public health sciences. Collaboration with the community and implementation of population-focused interventions foster critical thinking and independent decision making in the delivery of nursing care.

Learning Outcomes: 1. Synthesize concepts, theories, knowledge and practice from nursing, social and public health sciences. 2. Examine the structure, function, and influence of historical, political, social, environmental, cultural, and ethical factors to the health of individuals, families, and communities. 3. Collaborate with interdisciplinary healthcare and human service providers to address the health needs of individuals, families, and communities. 4. Utilize principles, concepts, models, theories and research to guide culturally sensitive nursing care and public health practice of individuals, families, and communities. 5. Explore the delivery of public health nursing services to diverse and vulnerable populations. 6. Formulate client teaching strategies that address the principles of disease prevention and health promotion to clients across the lifespan. 7. Evaluate interventions implemented using community and family resources to address mutually identified health needs of clients. 8. Use principles of caseload management, in the delivery of safe, quality public health nursing services that reflect legal, ethical, and professional standards. 9. Apply national health objectives in planning interventions to meet the individual, system, and community level needs of diverse populations. 10.Utilize health care technology to improve health outcomes of individuals, families, and communities. 11.Integrate the role of advocacy into the delivery of care to individuals, families, and communities. Credits: 5.00

NUR 41701 - Leadership In Nursing

Credit Hours: 3.00. Studies the components of nursing leadership and management functions with an emphasis on critical thinking, problem solving, communication, and team building within the context of experiential problem-based group projects. This course will provide specific practice and evaluation of strategic and financial planning, conflict management, delegation, and complex change. Competencies to be gained, at a novice level, include professional communication, sound ethical and legal judgments within personal and organizational frameworks, leadership skills in the

management and evaluation of others, and an understanding of the drivers of healthcare change and finances.

Learning Outcomes: 1. Synthesize concepts of nursing leadership and management in relation to the role of the professional nurse, nurse leader, and manager in promoting safe and quality care. 2. Organize a quality improvement project by utilizing project management strategies, quality improvement principles, and evidence-based practices to promote system changes in healthcare delivery. 3. Utilize concepts of professional communication, delegation, and evaluation of healthcare team members with an awareness of ethical, professional, social, and legal issues implicit to nursing leadership and management. 4. Describes economic, policy, social, and organizational factors that influence the professional nurse and healthcare systems. 5. Evaluate the impact of professional and unprofessional behaviors on healthcare delivery and professional interactions and presentations through knowledge of nursing standards of excellence. Credits: 3.00

NUR 22401 - Nursing Practice Foundations I: Health Assessment

Credit Hours: 4.00. Designed for second degree students, this course focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical experience, learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client-centered, safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Develop beginning critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 2. Discuss the impact of evidence based nursing research in guiding practice. 3. Identify the effect of personal values and beliefs on professional practice. 4. Develop basic physical and psychosocial clinical assessment skills for the client across the lifespan including interviewing techniques, and comprehensive history and physical exam. 5. Employ basic principles of documentation to describe clinical findings. 6. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 7. Use informatics appropriately in simulation and in the clinical setting. 8. Identify methods and resources for personal and professional growth. Credits: 4.00

NUR 22501 - Nursing Practice Foundations II: Fundamentals

Credit Hours: 4.00. Designed for second degree students, this course continues to expand on the professional nurse role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients representing healthy to chronically ill populations. 2. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients in the clinical setting. 3. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 4. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 5. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 6. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 7. Identify client adaptation and coping strategies when adjusting to changes along the health-wellness continuum. Credits: 4.00

NUR 22601 - Topics In Nursing Research And Evidence-Based Practice

Credit Hours: 3.00. Introduces foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. The

principles of research process and strengths and limitations of research articles in relation to EBP in nursing and healthcare are identified.

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently according to Information Literacy Competency Standards for Higher Education. 3. Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical research. 5. Examine economic, legal, and ethical issues related to conduction research. 6. Discuss the process of translating research evidence into practice. 7. Demonstrate the characteristics of an innovator that are necessary for EBP, which include leadership, a sense of inquiry, flexibility to change, awareness of self and of the environment, effective communication, critical thinking, lifelong learning, and professionalism. Credits: 3.00

NUR 41901 - Professional Nursing: Evolution As A Clinician And Leader

Credit Hours: 3.00. Incorporate the use of critical thinking, clinical reasoning, and active learning in analyzing contemporary issues related to professional nursing practice and obtaining professional nursing licensure. Issues surrounding political action, socio-legal concerns, cultural diversity and ethics in nursing practice are used as a framework.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Articulate the value of pursuing practice excellence, life-long learning, and engagement in professional nursing practice including membership in professional organization, completion of continuing education, and specialty certifications. 3. Integrate principles of evidence-based practice, ethical decision-making, inter-professional communication, and advocacy to answer complex questions related to the practice setting. 4. Evaluate the impact of local, state, national and global health policy on the healthcare system. 5. Differentiate the professional nurse's role in health policy development and implementation. 6. Apply effective study habits and test taking strategies to enhance performance on the NCLEX-RN exam. Credits: 3.00

Civics Literacy Proficiency Requirement:

Sample 4-Semester Plan

Fall 1st Year

NUR 21901 - Pathopharmacology I

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort and the pharmacotherapies utilized as treatment for alterations and disease states. This introductory knowledge provides the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe primary regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations in body structure and function affecting homeostasis; metabolic processes; immune response; circulation; renal elimination; fluid/electrolyte and acid/base balance; sensory perception and comfort. 3. Describe selected diagnostic, therapeutic and pharmacologic

interventions in the prevention and treatment of alterations affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and comfort. 4. Idenify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contraindications, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3. Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

NUR 22401 - Nursing Practice Foundations I: Health Assessment

Credit Hours: 4.00. Designed for second degree students, this course focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical experience, learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client-centered, safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Develop beginning critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 2. Discuss the impact of evidence based nursing research in guiding practice. 3. Identify the effect of personal values and beliefs on professional practice. 4. Develop basic physical and psychosocial clinical assessment skills for the client across the lifespan including interviewing techniques, and comprehensive history and physical exam. 5. Employ basic principles of documentation to describe clinical findings. 6. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 7. Use informatics appropriately in simulation and in the clinical setting. 8. Identify methods and resources for personal and professional growth.

Credits: 4.00

NUR 22501 - Nursing Practice Foundations II: Fundamentals

Credit Hours: 4.00. Designed for second degree students, this course continues to expand on the professional nurse role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients representing healthy to chronically ill populations. 2. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients in the clinical setting. 3. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 4. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 5. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 6. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 7. Identify client adaptation and coping strategies when adjusting to changes along the health-wellness continuum.
Credits: 4.00

NUR 22601 - Topics In Nursing Research And Evidence-Based Practice

Credit Hours: 3.00. Introduces foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. The principles of research process and strengths and limitations of research articles in relation to EBP in nursing and healthcare are identified.

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently according to Information Literacy Competency Standards for Higher Education. 3. Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical research. 5. Examine economic, legal, and ethical issues related to conduction research. 6. Discuss the process of translating research evidence into practice. 7. Demonstrate the characteristics of an innovator that are necessary for EBP, which include leadership, a sense of inquiry, flexibility to change, awareness of self and of the environment, effective communication, critical thinking, lifelong learning, and professionalism.
Credits: 3.00

16 Credits

Spring 1st Year

NUR 22101 - Pathopharmocology II

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function and the pharmacotherapies utilized as treatment for alterations and disease states. This course builds on the learning objectives from Pathopharmacology I to provide the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe the primary regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular,

gastrointestinal and reproductive function. 4. Identify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contradictions, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into the overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 31701 - Health Alterations In Adults II

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of wellbeing as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in health related to oxygenation, circulatory dynamics, endocrine regulation, neurological regulation, immune regulation and musculoskeletal dynamics that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision making when caring for diverse populations of adults experiencing selected illnesses. 2. Demonstrate appropriate use of the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related pathophysiology when providing care to adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence-based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to the client, client's family, and other members of the health care team 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes that emphasize client safety and evidence-based practice. 10. Use patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31801 - Psychiatric And Mental Health Nursing

Credit Hours: 5.00. Focuses on providing nursing care that supports mental health and the care of persons with mental illness while providing a conceptual integration of the nursing process, theories, and research from the biopsychosocial sciences and humanities. Demonstrates the relevance of psychiatric-mental health nursing concepts to all areas of professional practice.

Learning Outcomes: 1. Examine the effects of myths, stereotypes, stigma, values, beliefs and culture on the practice of psychiatric nursing. 2. Compare past, current, and projected systems in delivery of evidence based mental health care and its social implications. 3. Identify legal and ethical implications involved in the practice of psychiatric mental health nursing. 4. Utilize the nursing process in the phases ofthe therapeutic nurse-client relationship to delineate the complex needs of clients with psychiatric disorders.. 5. Identify the principles of communication and therapeutic relationships in the care of clients with psychiatric disorders. 6. Determine specific nursing care interventions for acute and serious behavioral health issues

that demonstrate developmentally and culturally appropriate strategies. 7. Utilize the ANA Standards of Psychiatric and Mental Health Nursing Practice as a basis for safe and competent care. 8. Incorporate theory, research and evidence from the psychobiological sciences, biological sciences, and humanities into an evidenced based practice approach to psychiatric nursing care. 9. Utilize client care technologies, information systems, and communication resources to access, organize and communicate information in a professional manner. 10. Establish therapeutic, collaborative relationships with members of the interdisciplinary treatment team. 11. Demonstrate personal and professional growth and skill development when providing evidence-based nursing care to clients with psychiatric disorders. Credits: 5.00

NUR 31901 - Integration Seminar II

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and psychiatric diagnoses. Through the course activities, the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medically and psychologically unstable populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

15 Credits

Summer 1st Year

NUR 31401 - Health Alterations In Adults I

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of well-being as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in tissue integrity related to surgical interventions, cellular division, reproductive function, elimination, nutrition and sensory function that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision-making when caring for diverse populations of adults experiencing selected illnesses. 2. Utilize the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related (including gerontologic) pathophysiology when providing care to diverse populations of adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence- based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to client, client's family, and other members of the healthcare team. 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes. 10. Utilize patient care

technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31501 - Nursing Of Childbearing Families

Credit Hours: 5.00. Promotes the development of nursing skills when caring for families and their newborns during uncomplicated and/or complicated childbearing experiences within a variety of clinical settings. Emphasizes the study and application of the nursing process, integrating evidence based practice while meeting the health and safety needs of diverse childbearing families.

Learning Outcomes: 1. Integrate theory and evidence to guide nursing practice and clinical decision-making throughout the care of childbearing families. 2. Incorporate childbearing family participation throughout health promotion, disease prevention, and risk reduction processes. 3. Address the childbearing family's developmental, physiologic, and psychological needs. 4. Assess ethical, legal, and sociocultural influences on resource utilization and compassionate maternal-child health care delivery. 5. Design targeted plans of care via a partnership with childbearing families, intra- and interprofessional teams, professional organizations, and institutions. 6. Utilize information technology to enhance learning, practice, and communication. Credits: 5.00

NUR 31601 - Integration Seminar I

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and obstetrical diagnoses. Through the course activities the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medical-surgical and obstetrical populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

12 Credits

Fall 2nd Year

NUR 41401 - Pediatric Nursing

Credit Hours: 5.00. Explores factors influencing the health and wellness of children and families. Students will apply principles, concepts and research from the health and human sciences to the care of children and families across the health-illness continuum. A structured clinical component focuses on clinical reasoning and evidence based practice. Students will provide family centered care to healthy, at risk and ill children across a variety of clinical settings.

Learning Outcomes: 1. Integrate family theories; growth and development; genomics; environmental and psychosocial factors in the care of children across the health-illness continuum. 2. Integrate nursing concepts into evidence based nursing practice for children and families across a variety of health care settings. 3. Apply knowledge of information technologies to improve health outcomes of children and families. 4. Evaluate environmental and psychosocial risk factors for children and families. 5. Adapt nursing care to families, recognizing their diverse needs, ethnicity, culture, and values. 6. Evaluate the collaborative role of the nurse with other health care disciplines in the provision of comprehensive nursing care for healthy, at risk, and ill children. 7. Demonstrate a spirit of inquiry, responsibility and accountability within legal, ethical, professional and organizational

parameters. Credits: 5.00

NUR 41501 - Public Health Nursing

Credit Hours: 5.00. Utilize health promotion, maintenance, education and disease prevention in coordinating and providing population-focused care to individuals, families and aggregates in the community. A variety of clinical settings are used to offer students a broad, comprehensive perspective of public health nursing, a field that synthesizes content from nursing, social and public health sciences. Collaboration with the community and implementation of population-focused interventions foster critical thinking and independent decision making in the delivery of nursing care.

Learning Outcomes: 1. Synthesize concepts, theories, knowledge and practice from nursing, social and public health sciences. 2. Examine the structure, function, and influence of historical, political, social, environmental, cultural, and ethical factors to the health of individuals, families, and communities. 3. Collaborate with interdisciplinary healthcare and human service providers to address the health needs of individuals, families, and communities. 4. Utilize principles, concepts, models, theories and research to guide culturally sensitive nursing care and public health practice of individuals, families, and communities. 5. Explore the delivery of public health nursing services to diverse and vulnerable populations. 6. Formulate client teaching strategies that address the principles of disease prevention and health promotion to clients across the lifespan. 7. Evaluate interventions implemented using community and family resources to address mutually identified health needs of clients. 8. Use principles of caseload management, in the delivery of safe, quality public health nursing services that reflect legal, ethical, and professional standards. 9. Apply national health objectives in planning interventions to meet the individual, system, and community level needs of diverse populations. 10.Utilize health care technology to improve health outcomes of individuals, families, and communities. 11.Integrate the role of advocacy into the delivery of care to individuals, families, and communities. Credits: 5.00

NUR 41701 - Leadership In Nursing

Credit Hours: 3.00. Studies the components of nursing leadership and management functions with an emphasis on critical thinking, problem solving, communication, and team building within the context of experiential problem-based group projects. This course will provide specific practice and evaluation of strategic and financial planning, conflict management, delegation, and complex change. Competencies to be gained, at a novice level, include professional communication, sound ethical and legal judgments within personal and organizational frameworks, leadership skills in the management and evaluation of others, and an understanding of the drivers of healthcare change and finances.

Learning Outcomes: 1. Synthesize concepts of nursing leadership and management in relation to the role of the professional nurse, nurse leader, and manager in promoting safe and quality care. 2. Organize a quality improvement project by utilizing project management strategies, quality improvement principles, and evidence-based practices to promote system changes in healthcare delivery. 3. Utilize concepts of professional communication, delegation, and evaluation of healthcare team members with an awareness of ethical, professional, social, and legal issues implicit to nursing leadership and management. 4. Describes economic, policy, social, and organizational factors that influence the professional nurse and healthcare systems. 5. Evaluate the impact of professional and unprofessional behaviors on healthcare delivery and professional interactions and presentations through knowledge of nursing standards of excellence. Credits: 3.00

NUR 41901 - Professional Nursing: Evolution As A Clinician And Leader

Credit Hours: 3.00. Incorporate the use of critical thinking, clinical reasoning, and active learning in analyzing contemporary issues related to professional nursing practice and obtaining professional nursing licensure. Issues

surrounding political action, socio-legal concerns, cultural diversity and ethics in nursing practice are used as a framework.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Articulate the value of pursuing practice excellence, life-long learning, and engagement in professional nursing practice including membership in professional organization, completion of continuing education, and specialty certifications. 3. Integrate principles of evidence-based practice, ethical decision-making, inter-professional communication, and advocacy to answer complex questions related to the practice setting. 4. Evaluate the impact of local, state, national and global health policy on the healthcare system. 5. Differentiate the professional nurse's role in health policy development and implementation. 6. Apply effective study habits and test taking strategies to enhance performance on the NCLEX-RN exam. Credits: 3.00

16 Credits

Notes

Accounting, BS

About the Program

Degree Requirements

Department/Program Major Courses (75 credits)

Required Major Courses (54 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy

functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50400 - Tax Accounting

Credit Hours: 3.00. Basic tax course designed to provide an understanding of the various federal taxes, including income, gift, estate, excise, federal insurance contribution, self-employment, and unemployment taxes.

Learning Outcomes: 1. Calculate the income tax liability for individuals, understand basic tax planning strategies, and prepare individual tax returns. 2. Understand broadly how different business entities are taxed including formation, operations, distributions, and liquidations. 3. Calculate the income tax liability for C Corporations, understand basic tax planning strategies, and prepare basic C Corporation tax returns. 4. Report the results from operations for partnerships and S Corporations. 5. Understand broadly the tax treatment of property transactions encountered by individuals and business entities. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 35100 - Intermediate Accounting II

Credit Hours: 3.00. Continuation of Intermediate Accounting I. An examination of additional problems in financial reporting, including long-term assets, liabilities, owners' equity, income taxes, earnings per share, leases, and pensions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 35000 - Intermediate Accounting I

Credit Hours: 3.00. Financial reporting for interested external parties. Emphasis on asset valuation, income measurement, and preparation of financial statements, and on appreciation of discretion available to preparers.

Learning Outcomes: 1. Understand the objectives of financial reporting. 2. Explain and apply the basic principles of accounting. 3. Describe how to prepare and analyze an income statement, balance sheet, statement of cash flows and statement of retained earnings under generally acceptable accounting principles (GAAP). 4. Understand the tradeoffs involved in standard setting, the limitations of current accounting standards, and the effects that these tradeoffs and limitations have on the quality and content of financial statements. 5. Gain an appreciation of firms' ability and incentives to choose from a wide variety of alternative measurement bases and accounting procedures and the effects that those choices have on readers of firms' financial statements. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a

result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 19700 - Careers In Accounting & Finance

Credit Hours: 1.00. This course explores the various career opportunities available to accounting majors, as well as opportunities available to non-accounting majors who have a strong background in accounting. While most students believe public/private accounting are the only career options for accounting majors, we examine other avenues such as hedge funds, private equity and consulting, among others.

Learning Outcomes: 1. Identify potential career paths for both accounting and non-accounting majors with a strong accounting background. 2. Demonstrate an understanding of the various tasks employees perform in several distinct careers. 3. Develop the attributes necessary to succeed in various careers designed for individuals with an accounting major or a strong understanding of accounting (for non-accounting majors). Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based

on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Major Selectives (18 credits)

Accounting Selective (12-15 credits)

MGMT 53100 - Government/Not-For-Profit Accounting

Credit Hours: 3.00. This course is designed to provide students with a solid understanding of the financial reporting and accounting principles used in the preparation of governmental and not-for-profit entities. Topics include, but are not limited to, fund accounting, city government accounting, state government accounting, special funds, budgetary accounting for the general and special revenue funds, fiduciary funds and government-wide statements, university accounting, accounting for community foundations, not-for-profit accounting, and auditing not-for-profit entities.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions: Students will be able to demonstrate their understanding of generally accepted accounting Principles for government and not-for-profit entities and how accounting information is used in decision-making for those organizations through the completion of multiple projects. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate their understanding of ethics in reporting through team projects that analyze a government or not-for-profit's accounting system. They will also be able to demonstrate their understanding of how to properly account for fiduciary (trust) funds. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate oral and written communication skills through class participation and the writing and presentation of team projects. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environmental: Students will demonstrate their

leadership and teamwork skills by effectively working as a team to produce and present team projects. 5. Achieve their understanding of generally accepted accounting principles for government and not-for-profit entities through team projects and examination(s). Credits: 3.00

MGMT 50900 - International Accounting

Credit Hours: 3.00. Provides insight into and an understanding of the many accounting problems and issues faced in an international business environment. The material is approached from two compatible and overlapping perspectives: the perspective of accounting or financial management in a U.S. multinational corporation and the perspective of an investor interested in understanding the international business environment.

Learning Outcomes: 1. Learn about the development of international accounting movements and implications in a globalized financial market. 2. Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS) 3. Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event. 4. Learn to cope with differences in financial measurement, recognition and reporting practices when performing international financial statement analyses. 5. Enhance the students' communication and presentation skills. 6. Contribute to the requisite background required for professional examinations such as CPA and to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

MGMT 50300 - Advanced Accounting

Credit Hours: 3.00. Advanced course in financial accounting. A range of contemporary issues in financial reporting, such as business combinations, investments, consolidations, inflation, multinationals, and tax allocation are covered. Both technical proficiency and user applications are emphasized.

Learning Outcomes: 1. Develop a conceptual understanding of and appreciation for the significant accounting and reporting requirements pertaining to consolidated or affiliated enterprises, foreign currency transactions and translation and other topics listed in the schedule below. 2. Provide you with the technical skills and knowledge to produce financial information that can be used by management, shareholders and stakeholders. 3. Improve your ability to interpret and use such financial reports. 4. Enhance the students' communication skills. 5. Contribute to the requisite background required for professional examinations such as CPA or CMA. However, it is not the primary goal to memorize 2019 standards or regulations, but rather to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice

communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 37300 - Accounting Information Systems & Data Analytics

Credit Hours: 3.00. Learn how to manage the design, control and operation of accounting information systems. The emphasis is on identifying the information needs of decision makers and developing appropriate business process control in the design of accounting information systems. Gain an understanding and appreciation of the accounting information system and how it is used to successfully manage, audit and develop processes to support today's evolving business environment.

Learning Outcomes: 1. Understand and apply basic tools necessary for diagrammatically analyzing and documenting organizational data flows and business processes including data modeling and flowcharting. 2. Gain an understanding of the various business processes necessary for an enterprise to successfully operate, the key controls for maintaining successful business processes, and application of the methodology for evaluating risks and controls within the given business process. 3. Explain, justify and evaluate the components of organizational governance and associated effective internal control systems. 4. Develop a basic understanding of data analytics and emerging technologies in accounting information systems. 5. Explain and justify AIS auditing, computer fraud, and security techniques. Credits: 3.00

Business Selective (3-6 credits)

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 41601 - Corporate Mergers And Acquisitions

Credit Hours: 3.00. The financial analysis of corporate acquisitions, mergers, and reorganizations including asset acquisitions, joint ventures, spin-offs, sell-offs, equity carve-outs, bankruptcy proceedings and reorganizations, and corporate governance. The course uses a combination of lectures, readings, and case analysis.

Learning Outcomes: 1. Understand the processes of valuation, negotiation, and financial outcomes of transactions involving mergers and acquisitions. Credits: 3.00

MGMT 41500 - International Financial Management

Credit Hours: 3.00. The course explores financial decision making in an international framework from the perspective of the management of a multinational corporation. Topics covered include the international financial markets, the measurement and management of exchange risk and political risk, and the

financial aspects of the decision to set up cross-border operations.

Learning Outcomes: 1. Students will learn about financial decision making in an international framework from the perspective of the management of a multinational corporation through topics such as international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations. Credits: 3.00

MGMT 41300 - Corporate Finance

Credit Hours: 3.00. The course provides the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending, or investment banking setting. Topics include corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition, and mergers/acquisition.

Learning Outcomes: 1. Know the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending or investment banking system through study of topics including corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition and mergers/acquisition. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform

large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

Cultural Competency Selectives (3 credits)

Other Departmental/Program Course Requirements (23-35 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate

feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2.

Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence

intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (10-22 credits)

Optional Concentrations for Accounting, BS

Sample 4-Year Plan

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An

understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 19700 - Careers In Accounting & Finance

Credit Hours: 1.00. This course explores the various career opportunities available to accounting majors, as well as opportunities available to non-accounting majors who have a strong background in accounting. While most students believe public/private accounting are the only career options for accounting majors, we examine other avenues such as hedge funds, private equity and consulting, among others.

Learning Outcomes: 1. Identify potential career paths for both accounting and non-accounting majors with a strong accounting background. 2. Demonstrate an understanding of the various tasks employees perform in several distinct careers. 3. Develop the attributes necessary to succeed in various careers designed for individuals with an accounting major or a strong understanding of accounting (for non-accounting majors). Credits: 1.00

13-21 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5.

Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits:

1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

16-20 Credits

Fall 2nd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role

and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 35000 - Intermediate Accounting I

Credit Hours: 3.00. Financial reporting for interested external parties. Emphasis on asset valuation, income measurement, and preparation of financial statements, and on appreciation of discretion available to preparers.

Learning Outcomes: 1. Understand the objectives of financial reporting. 2. Explain and apply the basic principles of accounting. 3. Describe how to prepare and analyze an income statement, balance sheet, statement of cash flows and statement of retained earnings under generally acceptable accounting principles (GAAP). 4. Understand the tradeoffs involved in standard setting, the limitations of current accounting standards, and the effects that these tradeoffs and limitations have on the quality and content of financial statements. 5. Gain an appreciation of firms' ability and incentives to choose from a wide variety of alternative measurement bases and accounting procedures and the effects that those choices have on readers of firms' financial statements. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret

standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table

operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

15 Credits

Spring 2nd Year

MGMT 35100 - Intermediate Accounting II

Credit Hours: 3.00. Continuation of Intermediate Accounting I. An examination of additional problems in financial reporting, including long-term assets, liabilities, owners' equity, income taxes, earnings per share, leases, and pensions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

15 Credits

Fall 3rd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing

concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

15 Credits

Fall 4th Year

MGMT 50400 - Tax Accounting

Credit Hours: 3.00. Basic tax course designed to provide an understanding of the various federal taxes, including income, gift, estate, excise, federal insurance contribution, self-employment, and unemployment taxes.

Learning Outcomes: 1. Calculate the income tax liability for individuals, understand basic tax planning strategies, and prepare individual tax returns. 2. Understand broadly how different business entities are taxed including formation, operations, distributions, and liquidations. 3. Calculate the income tax liability for C Corporations, understand basic tax planning strategies, and prepare basic C Corporation tax returns. 4. Report the results from operations for partnerships and S Corporations. 5. Understand broadly the tax treatment of property transactions encountered by individuals and business entities. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

15 Credits

Spring 4th Year

12 Credits

Actuarial Science Honors, BS

About the Program

Degree Requirements

Departmental/Program Requirements (59 credits)

Required Major Courses (59 credits)

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization

techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard

parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information

contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial

information is utilized in the decision-making process. Credits: 3.00

STAT 47301 - Introduction To Arbitrage-Free Pricing Of Financial Derivatives

Credit Hours: 3.00. This course exposes students to a number of financial economics concepts related to arbitrage-free option pricing in the binomial market model and the Black-Scholes model. Specific models include (1) Options and parity relationship between options; (2) Option Pricing under the Binomial model; (3) Option Pricing under the Black-Scholes model; (4) Option hedging and the market maker's overnight profit; (5) Black Scholes theory with Brownian motion and Ito calculus; (6) Risk-neutral option pricing and Monte Carlo valuation; (7) Stochastic interest rates and Stochastic Volatility. This course provides the background for Couse MFE of the Society of Actuaries and Course 3F of the Casualty Actuarial Society.

Learning Outcomes: 1. Use arbitrage-free option pricing in the binomial market model and the Black-Scholes model. 2. Adapt the binomial setting to computing exotic and path-dependent option prices, including the determination of optimal exercise. 3. Follow marking-to-market strategies for approximate discrete delta hedging. Credits: 3.00

STAT 47501 - Advanced Long Term Actuarial Mathematics

Credit Hours: 3.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200.

Learning Outcomes: 1. Understand key concepts concerning multiple state mortality/morbidity and joint life mortality models for insurance and annuity contracts. 2. Understand key concepts concerning estimation and construction of multiple state and joint life models for insurance and annuity contracts. 3. Perform calculations on the present value random variables associated with benefits and expenses for any of the models in the first learning objective. 4. Analyze emerging surplus, and to set premiums and reserves, using profit testing. 5. Understand how retirement benefits are accrued, valued, and funded. 6. Understand various types of equity-linked life insurance guarantees, options that are embedded in life insurance and annuity contracts and be able to price, reserve and hedge the risk inherent in these options. Credits: 3.00

STAT 47902 - Fundamental Short Term Actuarial Mathematics

Credit Hours: 3.00. This course aligns with one of the Society of Actuaries examinations. The course will cover the learning objectives for a portion of the Society of Actuaries Examination STAM. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Calculate moments, percentiles, and generating functions. 2. Describe how changes in the parameters affect the distribution. 3. Recognize classes of distributions, including extreme value distributions, and their relationships. 4. Create new distributions by multiplication by a constraint, raising to a power, exponentiation, and mixing. 5. Identify the applications to which each distribution may apply and explain why. 6. Apply the distribution to an application, given the parameters. 7. Compare two distributions based on various characteristics of their tails, including moments, ratios of moments, limiting tail behavior, hazard rate function, and mean excess function. Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

MA 48200 - Advanced Short Term Actuarial Mathematics

Credit Hours: 3.00. This course provides comprehensive coverage of a wide range of advanced short-term actuarial analysis techniques including severity and aggregate models, parametric models' estimation and selection, parametric and empirical credibility, and reserving, pricing for short-term insurance coverages. This course prepares actuarial students for the SOA Exam ASTAM: Advanced Short-Term Actuarial Mathematics.

Learning Outcomes: 1. Understand and apply methods for modeling severity and aggregate loss distributions, including creating new distributions and comparing tail behaviors. 2. Analyze the impact of coverage modifications and inflation on loss modeling in insurance. 3. Estimate parameters using the maximum likelihood method and assess the asymptotic normality of the maximum likelihood estimator for a function of parameters. 4. Select models based on graphical and score-based approaches and perform goodness-of-fit tests. 5. Evaluate credibility concepts, including limited fluctuation credibility, Bayesian credibility with conjugate priors, and Bühlmann and Bühlmann-Straub models. 6. Apply techniques for estimating unpaid losses, incurred but not reported (IBNR) losses, and project losses using trend analysis, as well as calculate overall average rates, rate changes, and risk classification differential changes. Credits: 3.00

STAT 47701 - Statistics Risk Modeling II

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of linear regression models. 2. Understand the basics of generalized linear models. 3. Understand the basics of decision trees. 4. Understand the basics of principle components analysis. 5. Understand the basics of cluster analysis. Credits: 3.00

Program Requirement (0 credits)

Other Departmental Course Requirements (38-61 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm

designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections.

Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able

to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Electives (0-23 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

16-19 Credits

Spring 1st Year

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution,

work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

15-16 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical

sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

16-18 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

12-15 Credits

Fall 3rd Year

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

16-17 Credits

Spring 3rd Year

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed

income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

STAT 47902 - Fundamental Short Term Actuarial Mathematics

Credit Hours: 3.00. This course aligns with one of the Society of Actuaries examinations. The course will cover the learning objectives for a portion of the Society of Actuaries Examination STAM. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Calculate moments, percentiles, and generating functions. 2. Describe how changes in the parameters affect the distribution. 3. Recognize classes of distributions, including extreme value distributions, and their relationships. 4. Create new distributions by multiplication by a constraint, raising to a power, exponentiation, and mixing. 5. Identify the applications to which each distribution may apply and explain why. 6. Apply the distribution to an application, given the parameters. 7. Compare two distributions based on various characteristics of their tails, including moments, ratios of moments, limiting tail behavior, hazard rate function, and mean excess function. Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

15-16 Credits

Fall 4th Year

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

STAT 47301 - Introduction To Arbitrage-Free Pricing Of Financial Derivatives

Credit Hours: 3.00. This course exposes students to a number of financial economics concepts related to arbitrage-free option pricing in the binomial market model and the Black-Scholes model. Specific models include (1) Options and parity relationship between options; (2) Option Pricing under the Binomial model; (3) Option Pricing under the Black-Scholes model; (4) Option hedging and the market maker's overnight profit; (5) Black Scholes theory with Brownian motion and Ito calculus; (6) Risk-neutral option pricing and Monte Carlo valuation; (7) Stochastic interest rates and Stochastic Volatility. This course provides the background for Couse MFE of the Society of Actuaries and Course 3F of the Casualty Actuarial Society.

Learning Outcomes: 1. Use arbitrage-free option pricing in the binomial market model and the Black-Scholes model. 2. Adapt the binomial setting to computing exotic and path-dependent option prices, including the determination of optimal exercise. 3. Follow marking-to-market strategies for approximate discrete delta hedging. Credits: 3.00

STAT 47501 - Advanced Long Term Actuarial Mathematics

Credit Hours: 3.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200.

Learning Outcomes: 1. Understand key concepts concerning multiple state mortality/morbidity and joint life mortality models for insurance and annuity contracts. 2. Understand key concepts concerning estimation and construction of multiple state and joint life models for insurance and annuity contracts. 3. Perform calculations on the present value random variables associated with benefits and expenses for any of the models in the first

learning objective. 4. Analyze emerging surplus, and to set premiums and reserves, using profit testing. 5. Understand how retirement benefits are accrued, valued, and funded. 6. Understand various types of equity-linked life insurance guarantees, options that are embedded in life insurance and annuity contracts and be able to price, reserve and hedge the risk inherent in these options. Credits: 3.00

STAT 47701 - Statistics Risk Modeling II

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of linear regression models. 2. Understand the basics of generalized linear models. 3. Understand the basics of decision trees. 4. Understand the basics of principle components analysis. 5. Understand the basics of cluster analysis. Credits: 3.00

15 Credits

Spring 4th Year

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

STAT 47902 - Fundamental Short Term Actuarial Mathematics

Credit Hours: 3.00. This course aligns with one of the Society of Actuaries examinations. The course will cover the learning objectives for a portion of the Society of Actuaries Examination STAM. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Calculate moments, percentiles, and generating functions. 2. Describe how changes in the parameters affect the distribution. 3. Recognize classes of distributions, including extreme value distributions, and their relationships. 4. Create new distributions by multiplication by a constraint, raising to a power, exponentiation, and mixing. 5. Identify the applications to which each distribution may apply and explain why. 6. Apply the distribution to an application, given the parameters. 7. Compare two distributions based on various characteristics of their tails, including moments, ratios of moments, limiting tail behavior, hazard rate function, and mean

excess function. Credits: 3.00

MA 48200 - Advanced Short Term Actuarial Mathematics

Credit Hours: 3.00. This course provides comprehensive coverage of a wide range of advanced short-term actuarial analysis techniques including severity and aggregate models, parametric models' estimation and selection, parametric and empirical credibility, and reserving, pricing for short-term insurance coverages. This course prepares actuarial students for the SOA Exam ASTAM: Advanced Short-Term Actuarial Mathematics.

Learning Outcomes: 1. Understand and apply methods for modeling severity and aggregate loss distributions, including creating new distributions and comparing tail behaviors. 2. Analyze the impact of coverage modifications and inflation on loss modeling in insurance. 3. Estimate parameters using the maximum likelihood method and assess the asymptotic normality of the maximum likelihood estimator for a function of parameters. 4. Select models based on graphical and score-based approaches and perform goodness-of-fit tests. 5. Evaluate credibility concepts, including limited fluctuation credibility, Bayesian credibility with conjugate priors, and Bühlmann and Bühlmann-Straub models. 6. Apply techniques for estimating unpaid losses, incurred but not reported (IBNR) losses, and project losses using trend analysis, as well as calculate overall average rates, rate changes, and risk classification differential changes. Credits: 3.00

14-17 Credits

Actuarial Science, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (53 credits)

Required Major Courses

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3.

Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3.

Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

STAT 47301 - Introduction To Arbitrage-Free Pricing Of Financial Derivatives

Credit Hours: 3.00. This course exposes students to a number of financial economics concepts related to arbitrage-free option pricing in the binomial market model and the Black-Scholes model. Specific models include (1) Options and parity relationship between options; (2) Option Pricing under the Binomial model; (3) Option Pricing under the Black-Scholes model; (4) Option hedging and the market maker's overnight profit; (5) Black Scholes theory with Brownian motion and Ito calculus; (6) Risk-neutral option pricing and Monte Carlo valuation; (7) Stochastic interest rates and Stochastic Volatility. This course provides the background for Couse MFE of the Society of Actuaries and Course 3F of the Casualty Actuarial Society.

Learning Outcomes: 1. Use arbitrage-free option pricing in the binomial market model and the Black-Scholes model. 2. Adapt the binomial setting to computing exotic and path-dependent option prices, including the determination of optimal exercise. 3. Follow marking-to-market strategies for approximate discrete delta hedging. Credits: 3.00

STAT 47501 - Advanced Long Term Actuarial Mathematics

Credit Hours: 3.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200.

Learning Outcomes: 1. Understand key concepts concerning multiple state mortality/morbidity and joint life mortality models for insurance and annuity contracts. 2. Understand key concepts concerning estimation

and construction of multiple state and joint life models for insurance and annuity contracts. 3. Perform calculations on the present value random variables associated with benefits and expenses for any of the models in the first learning objective. 4. Analyze emerging surplus, and to set premiums and reserves, using profit testing. 5. Understand how retirement benefits are accrued, valued, and funded. 6. Understand various types of equity-linked life insurance guarantees, options that are embedded in life insurance and annuity contracts and be able to price, reserve and hedge the risk inherent in these options. Credits: 3.00

STAT 47902 - Fundamental Short Term Actuarial Mathematics

Credit Hours: 3.00. This course aligns with one of the Society of Actuaries examinations. The course will cover the learning objectives for a portion of the Society of Actuaries Examination STAM. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Calculate moments, percentiles, and generating functions. 2. Describe how changes in the parameters affect the distribution. 3. Recognize classes of distributions, including extreme value distributions, and their relationships. 4. Create new distributions by multiplication by a constraint, raising to a power, exponentiation, and mixing. 5. Identify the applications to which each distribution may apply and explain why. 6. Apply the distribution to an application, given the parameters. 7. Compare two distributions based on various characteristics of their tails, including moments, ratios of moments, limiting tail behavior, hazard rate function, and mean excess function. Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

MA 48200 - Advanced Short Term Actuarial Mathematics

Credit Hours: 3.00. This course provides comprehensive coverage of a wide range of advanced short-term actuarial analysis techniques including severity and aggregate models, parametric models' estimation and selection, parametric and empirical credibility, and reserving, pricing for short-term insurance coverages. This course prepares actuarial students for the SOA Exam ASTAM: Advanced Short-Term Actuarial Mathematics.

Learning Outcomes: 1. Understand and apply methods for modeling severity and aggregate loss distributions, including creating new distributions and comparing tail behaviors. 2. Analyze the impact of coverage modifications and inflation on loss modeling in insurance. 3. Estimate parameters using the maximum likelihood method and assess the asymptotic normality of the maximum likelihood estimator for a function of parameters. 4. Select models based on graphical and score-based approaches and perform goodness-of-fit tests. 5. Evaluate credibility concepts, including limited fluctuation credibility, Bayesian credibility with conjugate priors, and Bühlmann and Bühlmann-Straub models. 6. Apply techniques for estimating unpaid losses, incurred but not reported (IBNR) losses, and project losses using trend analysis, as well as calculate overall average rates, rate changes, and risk classification differential changes. Credits: 3.00

STAT 47701 - Statistics Risk Modeling II

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics

of linear regression models. 2. Understand the basics of generalized linear models. 3. Understand the basics of decision trees. 4. Understand the basics of principle components analysis. 5. Understand the basics of cluster analysis. Credits: 3.00

Other Departmental/Program Course Requirements (38-61 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Course (4-5 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is

primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Electives (6-29 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to

apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

16-19 Credits

Spring 1st Year

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the

program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define and recognize concepts related to interest rate

swaps, and will be able to do calculations involving these concepts. Credits: 3.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the

statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

16-17 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their

properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career.

Credits: 3.00

15 Credits

Fall 3rd Year

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

16-17 Credits

Spring 3rd Year

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 47902 - Fundamental Short Term Actuarial Mathematics

Credit Hours: 3.00. This course aligns with one of the Society of Actuaries examinations. The course will cover the learning objectives for a portion of the Society of Actuaries Examination STAM. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Calculate moments, percentiles, and generating functions. 2. Describe how changes in the parameters affect the distribution. 3. Recognize classes of distributions, including extreme value distributions, and their relationships. 4. Create new distributions by multiplication by a constraint, raising to a power, exponentiation, and mixing. 5. Identify the applications to which each distribution may apply and explain why. 6. Apply the distribution to an application, given the parameters. 7. Compare two distributions based on various characteristics of their tails, including moments, ratios of moments, limiting tail behavior, hazard rate function, and mean excess function. Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

12 Credits

Fall 4th Year

STAT 47501 - Advanced Long Term Actuarial Mathematics

Credit Hours: 3.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200.

Learning Outcomes: 1. Understand key concepts concerning multiple state mortality/morbidity and joint life mortality models for insurance and annuity contracts. 2. Understand key concepts concerning estimation and construction of multiple state and joint life models for insurance and annuity contracts. 3. Perform calculations on the present value random variables associated with benefits and expenses for any of the models in the first learning objective. 4. Analyze emerging surplus, and to set premiums and reserves, using profit

testing. 5. Understand how retirement benefits are accrued, valued, and funded. 6. Understand various types of equity-linked life insurance guarantees, options that are embedded in life insurance and annuity contracts and be able to price, reserve and hedge the risk inherent in these options. Credits: 3.00

STAT 47701 - Statistics Risk Modeling II

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of linear regression models. 2. Understand the basics of generalized linear models. 3. Understand the basics of decision trees. 4. Understand the basics of principle components analysis. 5. Understand the basics of cluster analysis. Credits: 3.00

12 Credits

Spring 4th Year

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

STAT 47301 - Introduction To Arbitrage-Free Pricing Of Financial Derivatives

Credit Hours: 3.00. This course exposes students to a number of financial economics concepts related to arbitrage-free option pricing in the binomial market model and the Black-Scholes model. Specific models include (1) Options and parity relationship between options; (2) Option Pricing under the Binomial model; (3) Option Pricing under the Black-Scholes model; (4) Option hedging and the market maker's overnight profit; (5) Black Scholes theory with Brownian motion and Ito calculus; (6) Risk-neutral option pricing and Monte Carlo valuation; (7) Stochastic interest rates and Stochastic Volatility. This course provides the background for Couse MFE of the Society of Actuaries and Course 3F of the Casualty Actuarial Society.

Learning Outcomes: 1. Use arbitrage-free option pricing in the binomial market model and the Black-Scholes model. 2. Adapt the binomial setting to computing exotic and path-dependent option prices, including the determination of optimal exercise. 3. Follow marking-to-market strategies for approximate discrete delta hedging. Credits: 3.00

MA 48200 - Advanced Short Term Actuarial Mathematics

Credit Hours: 3.00. This course provides comprehensive coverage of a wide range of advanced short-term actuarial analysis techniques including severity and aggregate models, parametric models' estimation and selection, parametric and empirical credibility, and reserving, pricing for short-term insurance coverages. This course prepares actuarial students for the SOA Exam ASTAM: Advanced Short-Term Actuarial Mathematics.

Learning Outcomes: 1. Understand and apply methods for modeling severity and aggregate loss distributions, including creating new distributions and comparing tail behaviors. 2. Analyze the impact of coverage modifications and inflation on loss modeling in insurance. 3. Estimate parameters using the maximum likelihood method and assess the asymptotic normality of the maximum likelihood estimator for a function of parameters. 4. Select models based on graphical and score-based approaches and perform goodness-of-fit tests. 5. Evaluate credibility concepts, including limited fluctuation credibility, Bayesian credibility with conjugate priors, and Bühlmann and Bühlmann-Straub models. 6. Apply techniques for estimating unpaid losses, incurred but not reported (IBNR) losses, and project losses using trend analysis, as well as calculate overall average rates, rate changes, and risk classification differential changes. Credits: 3.00

14 Credits

Aeronautical and Astronautical Engineering, BSAAE

About the Program

Degree Requirements

AAE Engineering Major Courses (56 credits)

AAE 20000 - Undergraduate Sophomore Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn the requirements for earning a BSAAE degree. 2. Learn advising and registration processes in AAE. 3. Learn professional ethics. 4. Learn current events in Aerospace Engineering. Credits: 0.00

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 20401 - Aeromechanics II Laboratory

Credit Hours: 1.00. Introduction to strain gauges, dial gauges, and photoelasticity. Tensile test. Torsion of solid and hollow propeller shafts. Stress concentration around skin cut-outs.

Bending of symmetrical box wing beams. Combined axial and flexural test of aircraft stringers. Buckling of slender stringers.

Credits: 1.00

AAE 25100 - Introduction To Aerospace Design

Credit Hours: 3.00. The role of design in aerospace engineering. Introduction to aerodynamics, performance, propulsion, structures, stability and control, and weights. Layout and general arrangement of aerospace vehicles. Design concept generation and selection. Computational methods for design. Trade studies and graphical optimization. Conceptual design exercise involving aircraft, spacecraft, or both. Technical presentations and communication for aerospace engineering.

Learning Outcomes: 1. Acquire and apply basic technical knowledge about aerospace engineering. 2. Develop intuition about aerospace engineering and aerospace vehicles. 3. Understand and implement the design process for aerospace systems. 4. Use computers in aerospace design. 5. Solve problems as part of a team. 6. Design an aerospace vehicle/system. 7. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

AAE 30000 - Undergraduate Junior Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn how to program options within the AAE degree and how to choose them. 2. Learn how to interview. 3. Learn how to get an internship or other engineering experience. 4. Learn professional ethics. 5. Learn about current events in Aerospace Engineering. Credits: 0.00

AAE 30100 - Signal Analysis For Aerospace Engineering

Credit Hours: 3.00. Signal processing and spectral analysis for aerospace engineering. Fourier and fast Fourier transforms. Vibration analysis; estimation of natural frequencies, wing vibrations. Introduction to linear circuits, operational amplifiers and filtering. Noise suppression.

Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

AAE 33301 - Fluid Mechanics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Experiments in incompressible viscous flow; flow measurement and visualization; laminar and turbulent boundary layers; wakes.

Learning Outcomes: 1. Measure and differentiate between absolute, differential, and gauge pressure. 2. Make basic pressure and velocity measurements. 3. Utilize elementary flow visualization tools. 4. Deduce fluid physics information from flow visualization. 5. Calculate flow characteristics such as Reynolds number, friction factor, pressure and drag coefficient from laboratory measurements. 6. Identify and discuss foundation-level fluid phenomena including boundary layers, wakes, laminar to turbulent transition, turbulence, flow separation, drag on a body, and surface pressure distributions. 7. Design an experiment to meet a defined objective, conduct the experiment,

analyze the data, and draw conclusions. Credits: 1.00

AAE 33400 - Aerodynamics

Credit Hours: 3.00. Incompressible airfoil and lifting line theory. Steady and unsteady, one-dimensional, linear and nonlinear flows. Normal shock waves. Steady, supersonic, two-dimensional linear and nonlinear flows. Oblique shock waves. Perturbation theory for wings and bodies. Design applications. Credits: 3.00

AAE 33401 - Aerodynamics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Airfoil pressure distribution. Finite wing lift, drag, and moment. Supersonic flow around bodies. Shock waves. Credits: 1.00

AAE 33800 - Thermal Sciences

Credit Hours: 3.00. A fundamental course covering a range of topics selected from the disciplines of engineering thermodynamics, fluid mechanics, heat transfer and combustion, with an emphasis on their application to propulsion. This is an entry level course to prepare students for advanced analysis of propulsion and energy systems. Upon completion of this course, students are expected to be able to apply fundamental principles to perform thermodynamic analysis for thermophysical problems involving fluid flow, heat transfer and combustion.

Learning Outcomes: 1. Identify types of problems from thermo-fluid systems. 2. Perform heat conduction analysis for steady and unsteady problems. 3. Perform analysis for radiation heat transfer. 4. Develop deeper understanding of the laws of thermodynamics and their applications to various problems. 5. Apply fundamentals of fluid mechanics to various fluid flow problems. 6. Analyze convection heat transfer problems. 7. Conduct analysis of simple combustion systems such as adiabatic or chemical equilibrium. 8. Analyze simple thermo-fluid systems using fundamentals we learn from the class. Credits: 3.00

AAE 33900 - Aerospace Propulsion

Credit Hours: 3.00. Survey of air-breathing and rocket propulsion systems for AAE students not in the propulsion option. Thermodynamic cycles, analysis of air-breathing systems and components. Rocket Equation, rocket cycles, liquid and solid propellants, chemical equilibrium.

Learning Outcomes: 1. Knowledge of propulsion applications that use gas turbine engines and rockets. 2. Understanding of the Brayton cycle and ability to calculate enthalpy and work balance. 3. Ability to solve mass, momentum, and energy balances using a control volume approach. 4. Ability to perform top-level performance and sizing calculations of gas turbine engines. 5. Ability to apply Euler's work equation to compressors and turbines to calculate work. 6. Ability to use the Rocket Equation to calculate impulse requirements and size rocket thrusters. Credits: 3.00

AAE 34000 - Dynamics And Vibrations

Credit Hours: 3.00. Kinematics and kinetics of particles and rigid bodies. Topics include a particle in orbit, systems of particles, vibrations, Euler's equations of motion, Eulerian angles, and aerospace vehicle dynamics.

Learning Outcomes: 1. Analyze the free and forced response of a spring/mass/damper. 2. Formulate the EOMs of particles, systems of particles and rigid bodies. 3. Solve the EOMs numerically. 4. Understand the various forms of Euler angles and be able to apply them to rigid body dynamics. 5. Simulate the motion of a spacecraft in MATLAB. Credits: 3.00

AAE 35200 - Structural Analysis I

Credit Hours: 3.00. Properties of wing and fuselage sections. Beam-column moments. Torsion of thin-walled and skin-stringer multiple-cell sections. Nonsymmetrical bending of skin-stringer wing sections. Flexural shear in open and closed thin-walled and skin-stringer sections. Loads and stresses in the rib system. Cutouts and shear lag. Modified beam theory for wing and fuselage design. Deflection by energy method. Introduction to composite structures.

Learning Outcomes: 1. Use analytical/empirical tools for determining the distribution of load (or displacement) in typical aerospace components. 2. Understand and implement the procedures

for relating applied loads (or displacements) to component "failure." 3. Select of materials to resist structural failure. 4. Be exposed to other professional development topics are also to be presented as time permits (e.g., technical communications, teamwork issues, economic considerations, engineering ethics, case histories, regulatory and certification, topics, etc.). Credits: 3.00

AAE 35201 - Structural Analysis I Laboratory

Credit Hours: 1.00. Location of shear center. Torsion of thin-walled open and closed sections. Torsion of multiple-cell, thin-walled section. Nonsymmetrical bending of skin-stringer cross section. Shear lag effect. Bending of composite beam.

Credits: 1.00

AAE 36400 - Control System Analysis

Credit Hours: 3.00. Modeling and analysis of dynamical systems with aerospace applications. Laplace transforms, transfer functions, block diagrams. Transient and steady-state response of dynamical systems. Root Locus, Bode, Nyquist methods for control systems analysis. Introduction to controller design.

Credits: 3.00

AAE 36401 - Control Systems Laboratory

Credit Hours: 1.00. Enhance student awareness of control systems by providing hands-on experience using dynamic systems representative of air and space vehicles. Design of a control system from start to finish by mapping requirements into control solutions through the process of modeling, identification, and controller design (PID and Lead-Lag).

Credits: 1.00

AAE 40000 - Undergraduate Senior Seminar

Credit Hours: 1.00. A lecture-demonstration series emphasizing evaluation of career options, identification and development of professional skills. Example of career-related topics include choosing a job, and post graduate education in engineering or other disciplines. Examples of professional skills topics covered include interviewing, writing, and ethics. Assessment of student achievement of AAE program learning outcomes.

Learning Outcomes: 1. Learn how to get a job 2. Learn how to get into graduate school (and why) 3. Learn how to succeed in the workplace 4. Learn about current events in Aerospace Engineering Credits: 1.00

AAE 42100 - Flight Dynamics And Control

Credit Hours: 3.00. Flight vehicle rigid-body equations of motion; linearization via small perturbation techniques. Trim analysis, static and dynamic stability, aerodynamic stability derivatives and control effectiveness. Vehicle transfer functions, stability augmentation, aircraft handling qualities. Introduction to flexible vehicle effects.

Credits: 3.00

AAE 44000 - Spacecraft Attitude Dynamics

Credit Hours: 3.00. Description of orientation, angular velocity, and angular acceleration in terms of direction cosines, Euler parameters, and angles. Forces and moments acting on space vehicles. Attitude stability of various types of satellites in circular and elliptic orbits. Spin stabilization and gravity gradient torques. Gyroscopic devices and energy dissipation. Introduction to attitude control.

Credits: 3.00

AAE 45000 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the aerospace curriculum. Components include analysis methods for preliminary design, development of an initial vehicle concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with spacecraft, rocket and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Demonstrate design viability through testing, both real and virtual. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

AAE 45100 - Aircraft Design

Credit Hours: 3.00. Senior students perform a team-based aircraft design, requiring application of the education and skills developed in the aerospace curriculum. Aircraft mission requirements include engine cycle selection and airframe/engine integration, performance, stability and control, structures, human factors, avionics, sensors, and manufacturing processes. The teams present oral and written reports on their designs.

Learning Outcomes: 1. Deepen your knowledge of topics relevant to aircraft design. 2. Identify and formulate the design requirements for an aircraft. 3. Conduct a set of trade studies to make decisions about the aircraft design. 4. Describe an aircraft design that is likely to meet the set of requirements. 5. Use modern engineering tools to complete the design process. 6. Apply engineering knowledge and skills acquired in previous classes to the design problem. 7. Solve problems as part of a team. Credits: 3.00

Other Program/Departmental Requirements (74-89)

First Year Engineering Requirements (29-39 credits)

Other Departmental Requirements (27-35 credits)

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

General Education Requirements (18 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Aeronautical and Astronautical Engineering Program Requirements

Fall 2nd Year

AAE 20000 - Undergraduate Sophomore Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational

meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn the requirements for earning a BSAAE degree. 2. Learn advising and registration processes in AAE. 3. Learn professional ethics. 4. Learn current events in Aerospace Engineering. Credits: 0.00

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data

stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

15-19 Credits

Spring 2nd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 20401 - Aeromechanics II Laboratory

Credit Hours: 1.00. Introduction to strain gauges, dial gauges, and photoelasticity. Tensile test. Torsion of solid and hollow propeller shafts. Stress concentration around skin cut-outs. Bending of symmetrical box wing beams. Combined axial and flexural test of aircraft stringers. Buckling of slender stringers.

Credits: 1.00

AAE 25100 - Introduction To Aerospace Design

Credit Hours: 3.00. The role of design in aerospace engineering. Introduction to aerodynamics, performance, propulsion, structures, stability and control, and weights. Layout and general arrangement of aerospace vehicles. Design concept generation and selection. Computational methods for design. Trade studies and graphical optimization. Conceptual design exercise involving aircraft, spacecraft, or both. Technical presentations and communication for aerospace engineering.

Learning Outcomes: 1. Acquire and apply basic technical knowledge about aerospace engineering. 2. Develop intuition about aerospace engineering and aerospace vehicles. 3. Understand and implement the design process for aerospace systems. 4. Use computers in aerospace design. 5. Solve problems as part of a team. 6. Design an aerospace vehicle/system. 7. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

19-21 Credits

Fall 3rd Year

AAE 30000 - Undergraduate Junior Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn how to program options within the AAE degree and how to choose them. 2. Learn how to interview. 3. Learn how to get an internship or other engineering experience. 4. Learn professional ethics. 5. Learn about current events in Aerospace Engineering. Credits: 0.00

AAE 30100 - Signal Analysis For Aerospace Engineering

Credit Hours: 3.00. Signal processing and spectral analysis for aerospace engineering. Fourier and fast Fourier transforms. Vibration analysis; estimation of natural frequencies, wing vibrations. Introduction to linear circuits, operational amplifiers and filtering. Noise suppression.

Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

AAE 33301 - Fluid Mechanics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Experiments in incompressible viscous flow; flow measurement and visualization; laminar and turbulent boundary layers; wakes.

Learning Outcomes: 1. Measure and differentiate between absolute, differential, and gauge pressure. 2. Make basic pressure and velocity measurements. 3. Utilize elementary flow visualization tools. 4. Deduce fluid physics information from flow visualization. 5. Calculate flow characteristics such as Reynolds number, friction factor, pressure and drag coefficient from laboratory measurements. 6. Identify and discuss foundation-level fluid phenomena including boundary layers, wakes, laminar to turbulent transition, turbulence, flow separation, drag on a body, and surface pressure distributions. 7. Design an experiment to meet a defined objective, conduct the experiment, analyze the data, and draw conclusions. Credits: 1.00

AAE 35200 - Structural Analysis I

Credit Hours: 3.00. Properties of wing and fuselage sections. Beam-column moments. Torsion of thin-walled and skin-stringer multiple-cell sections. Nonsymmetrical bending of skin-stringer wing sections. Flexural shear in open and closed thin-walled and skin-stringer sections. Loads and stresses in the rib system. Cutouts and shear lag. Modified beam theory for wing and fuselage design. Deflection by energy method. Introduction to composite structures.

Learning Outcomes: 1. Use analytical/empirical tools for determining the distribution of load (or displacement) in typical aerospace components. 2. Understand and implement the procedures for relating applied loads (or displacements) to component "failure." 3. Select of materials to resist structural failure. 4. Be exposed to other professional development topics are also to be presented as time permits (e.g., technical communications, teamwork issues, economic considerations, engineering ethics, case histories, regulatory and certification, topics, etc.). Credits: 3.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

16 Credits

Spring 3rd Year

AAE 33400 - Aerodynamics

Credit Hours: 3.00. Incompressible airfoil and lifting line theory. Steady and unsteady, one-dimensional, linear and nonlinear flows. Normal shock waves. Steady, supersonic, two-dimensional linear and nonlinear flows. Oblique shock waves. Perturbation theory for wings and bodies. Design applications.

Credits: 3.00

AAE 33401 - Aerodynamics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Airfoil pressure distribution. Finite wing lift, drag, and moment. Supersonic flow around bodies. Shock waves.

Credits: 1.00

AAE 33800 - Thermal Sciences

Credit Hours: 3.00. A fundamental course covering a range of topics selected from the disciplines of engineering thermodynamics, fluid mechanics, heat transfer and combustion, with an emphasis on their application to propulsion. This is an entry level course to prepare students for advanced analysis of propulsion and energy systems. Upon completion of this course, students are expected to be able to apply fundamental principles to perform thermodynamic analysis for thermophysical problems involving fluid flow, heat transfer and combustion.

Learning Outcomes: 1. Identify types of problems from thermo-fluid systems. 2. Perform heat conduction analysis for steady and unsteady problems. 3. Perform analysis for radiation heat transfer. 4. Develop deeper understanding of the laws of thermodynamics and their applications to various problems. 5. Apply fundamentals of fluid mechanics to various fluid flow problems. 6. Analyze convection heat transfer problems. 7. Conduct analysis of simple combustion systems such as adiabatic or chemical equilibrium. 8. Analyze simple thermo-fluid systems using fundamentals we learn from the class. Credits: 3.00

AAE 33900 - Aerospace Propulsion

Credit Hours: 3.00. Survey of air-breathing and rocket propulsion systems for AAE students not in the propulsion option. Thermodynamic cycles, analysis of air-breathing systems and components. Rocket Equation, rocket cycles, liquid and solid propellants, chemical equilibrium.

Learning Outcomes: 1. Knowledge of propulsion applications that use gas turbine engines and rockets. 2. Understanding of the Brayton cycle and ability to calculate enthalpy and work balance. 3. Ability to solve mass, momentum, and energy balances using a control volume approach. 4. Ability to perform top-level performance and sizing calculations of gas turbine engines. 5. Ability to apply Euler's work equation to compressors and turbines to calculate work. 6. Ability to use the Rocket Equation to calculate impulse requirements and size rocket thrusters. Credits: 3.00

AAE 34000 - Dynamics And Vibrations

Credit Hours: 3.00. Kinematics and kinetics of particles and rigid bodies. Topics include a particle in orbit, systems of particles, vibrations, Euler's equations of motion, Eulerian angles, and aerospace vehicle dynamics.

Learning Outcomes: 1. Analyze the free and forced response of a spring/mass/damper. 2. Formulate the EOMs of particles, systems of particles and rigid bodies. 3. Solve the EOMs numerically. 4. Understand the various forms of Euler angles and be able to apply them to rigid body dynamics. 5. Simulate the motion of a spacecraft in MATLAB. Credits: 3.00

AAE 35201 - Structural Analysis I Laboratory

Credit Hours: 1.00. Location of shear center. Torsion of thin-walled open and closed sections. Torsion of multiple-cell, thin-walled section. Nonsymmetrical bending of skin-stringer cross section. Shear lag effect. Bending of composite beam.

Credits: 1.00

AAE 36400 - Control System Analysis

Credit Hours: 3.00. Modeling and analysis of dynamical systems with aerospace applications. Laplace transforms, transfer functions, block diagrams. Transient and steady-state response of dynamical systems. Root Locus, Bode, Nyquist methods for control systems analysis. Introduction to controller design.

Credits: 3.00

18 Credits

Fall 4th Year

AAE 36401 - Control Systems Laboratory

Credit Hours: 1.00. Enhance student awareness of control systems by providing hands-on experience using dynamic systems representative of air and space vehicles. Design of a control system from start to finish by mapping requirements into control solutions through the process of modeling, identification, and controller design (PID and Lead-Lag).

Credits: 1.00

AAE 40000 - Undergraduate Senior Seminar

Credit Hours: 1.00. A lecture-demonstration series emphasizing evaluation of career options, identification and development of professional skills. Example of career-related topics include choosing a job, and post graduate education in engineering or other disciplines. Examples of professional skills topics covered include interviewing, writing, and ethics. Assessment of student achievement of AAE program learning outcomes.

Learning Outcomes: 1. Learn how to get a job 2. Learn how to get into graduate school (and why) 3. Learn how to succeed in the workplace 4. Learn about current events in Aerospace Engineering Credits: 1.00

17 Credits

Spring 4th Year

AAE 42100 - Flight Dynamics And Control

Credit Hours: 3.00. Flight vehicle rigid-body equations of motion; linearization via small perturbation techniques. Trim analysis, static and dynamic stability, aerodynamic stability derivatives and control effectiveness. Vehicle transfer functions, stability augmentation, aircraft handling qualities. Introduction to flexible vehicle effects.

Credits: 3.00

AAE 44000 - Spacecraft Attitude Dynamics

Credit Hours: 3.00. Description of orientation, angular velocity, and angular acceleration in terms of direction cosines, Euler parameters, and angles. Forces and moments acting on space vehicles. Attitude stability of various types of satellites in circular and elliptic orbits. Spin stabilization and gravity gradient torques. Gyroscopic devices and energy dissipation. Introduction to attitude control.

Credits: 3.00

AAE 45000 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the aerospace curriculum. Components include analysis methods for preliminary design, development of an initial vehicle concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with spacecraft, rocket and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to

demonstrate design feasibility. 5. Demonstrate design viability through testing, both real and virtual. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

AAE 45100 - Aircraft Design

Credit Hours: 3.00. Senior students perform a team-based aircraft design, requiring application of the education and skills developed in the aerospace curriculum. Aircraft mission requirements include engine cycle selection and airframe/engine integration, performance, stability and control, structures, human factors, avionics, sensors, and manufacturing processes. The teams present oral and written reports on their designs.

Learning Outcomes: 1. Deepen your knowledge of topics relevant to aircraft design. 2. Identify and formulate the design requirements for an aircraft. 3. Conduct a set of trade studies to make decisions about the aircraft design. 4. Describe an aircraft design that is likely to meet the set of requirements. 5. Use modern engineering tools to complete the design process. 6. Apply engineering knowledge and skills acquired in previous classes to the design problem. 7. Solve problems as part of a team. Credits: 3.00

18 Credits

Aeronautical Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (75 credits)

Required Major Courses (75 credits)

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5.

Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 20501 - Statics For Aerostructures

Credit Hours: 3.00. This course provides an introduction to the static analysis of aerostructures. Force systems, resultants and equilibrium, moments, distributed loads, and centroids as they relate to aeronautical structures are studied. CAD software is introduced.

Learning Outcomes: 1. Determine the resultant of multiple vectors. 2. Draw free-body diagrams and apply equilibrium equations to those diagrams. 3. Demonstrate an understanding of the analysis of distributed loads in aerostructures. 4. Develop knowledge of internal forces and moments in structural members. 5. Develop an ability to calculate centroids and moments of inertia. 6. Use CAD software to represent and analyze aerostructures. Credits: 3.00

AT 20700 - Introduction To Aircraft Systems

Credit Hours: 3.00. Principles and design concepts of aircraft operating systems are covered. Emphasis is given to flight control, electrical, environmental, hydraulic, pneumatic, pressurization, oxygen, heating, cooling, fire protection, and ice and rain protection systems. Also included are theory of operation and design of aircraft instruments and associate systems.

Learning Outcomes: 1. Learn the function and operational principles aircraft instruments. 2. Learn the function of various components in a system for maintaining a healthful and comfortable environment in an aircraft. 3. Study, inspect, and check ice, rain, and fire control aircraft systems. 4. Determine the location of the elements in the aircraft and become familiar with the function and operating procedures for the typical system found on light single or light twin engine aircraft. 5. Learn to recognize various fittings and their application when used for rigid tubing and flexible hose. 6. Learn the use of tools and FAA Regulations in relation to aircraft tube and hose fabrication. 7. Learn the basic fundamentals of hydraulic systems, power, components and control. 8. Learn the different hydraulic fluids, seal design and system compatibility used in hydraulic systems. Credits: 3.00

AT 20802 - Aircraft Materials

Credit Hours: 3.00. In this course students study aluminum and composite materials used in aircraft. The course covers elements of design, fabrication, final assembly, and testing. Students also study the practical application of statics for airframe loads.

Learning Outcomes: 1. Use tools for the fabrication, final assembly, and testing of materials. 2. Use and apply technical information, including drawings, sketches, blueprints, charts, and graphs. 3. Analyze damage and design repairs to aircraft materials. 4. Demonstrate the basic skills of oxyacetylene welding and the concepts of welded repair design. 5. Apply the concepts of statics as they relate to airframe structural members. Credits: 3.00

AT 26200 - Basic Aircraft Powerplant Technology

Credit Hours: 4.00. A study of the design, construction, and operating practices of aircraft reciprocating and small gas turbine engines. Laboratory exercises emphasize airworthiness evaluation, fault-isolation techniques, and standard service/maintenance practices.

Learning Outcomes: 1. Compare and contrast different types of reciprocating engines. 2. Explain the principles of the Otto cycle. 3. Explain Volumetric Efficiency. 4. Identify the importance of reciprocating engine designs and construction. 5. Demonstrate the ability to operate and troubleshoot a reciprocating engine. Credits: 4.00

AT 26502 - Aircraft Electrical Systems

Credit Hours: 3.00. An in-depth study of aircraft electrical components, both individually and as systems in the aircraft. DC electrical circuits, series and parallel circuits, magnetism, and electromagnetism are covered, as are DC power systems, schematics, and aircraft wiring practices. Aircraft charging systems, main power distribution, solid state electronics, batteries, and motors are also discussed.

Learning Outcomes: 1. Develop an understanding of electrical principles as they relate to aircraft system operation. 2. Construct, analyze, and isolate faults in circuits. 3. Demonstrate troubleshooting procedures for direct currently electrical aircraft components and power distribution circuits. Credits: 3.00

AT 26700 - Fixed And Rotary Wing Assemblies

Credit Hours: 3.00. An overview of various fixed and rotary wing components and systems. Flight control systems, landing gear, fuel systems, wheels, brakes, and rotor systems are among the subjects studied.

Learning Outcomes: 1. Read, analyze, and interpret technical instructions. 2. Complete a set of aviation maintenance related tasks. 3. Jack, hoist, shore, level, and weigh an aircraft and calculate its weight and balance. 4. Knowledge of radio communications and aircraft mooring. 5. Operate a helicopter rotor balancing computer and balance a helicopter main and tail rotor. Credits: 3.00

AT 27200 - Introduction To Composite Technology

Credit Hours: 3.00. An introduction to basic composite materials, processes, construction, testing, and repair. Students will work with a variety of wet and pre-impregnated fiber and matrix systems including glass, aramid fiber, and carbon-graphite.

Learning Outcomes: 1. Demonstrate familiarity with wet lay, prepreg, and VARTM processes. 2. Use solid modeling software for part design, drafting, and composite design. 3. Demonstrate understanding of basic CNC machining, mold-making, and curing, 4. Repair damaged composite structures. Credits: 3.00

AT 27800 - Nondestructive Testing For Aircraft

Credit Hours: 3.00. A study of nondestructive testing methods used to evaluate the structural integrity of airframes, engines, and components. Magnetic particle, liquid penetrant, electromagnetic, ultrasonic, and radiographic inspection are covered.

Learning Outcomes: 1. Learn basic concepts and procedures for effective Penetrant Testing, different systems (white light, black light), sequences and evaluation of defects. 2. Learn basic concepts and procedures for effective Magnetic Particle Testing, system set up and checks, calculation of amperage used, identification of issues of materials and choice of methods, evaluation of defects. 3. Learn basic concepts and procedures for effective Eddy Current Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different wave forms on indications, and evaluation of defects. 4. Learn basic concepts and procedures for effective Ultrasonic Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different methods (surface, though, etc.) and evaluation of defects. Credits: 3.00

AT 30702 - Advanced Aircraft Systems

Credit Hours: 3.00. An in-depth study of aircraft components and operation with an emphasis on transport-category aircraft. Systems covered include fuel, environmental, fluid-power, flight control, fire protection, ice-control, warning, and auxiliary power. Practical projects utilize small ad transport-category aircraft.

Learning Outcomes: 1. Demonstrate an understanding of the terminology of systems analysis and design. 2. Demonstrate proper project planning ability. 3. Demonstrate knowledge of the industrial safety culture and the ability to analyze all safety issues of the project, including team member safety. 4. Determine system airworthiness. 5. Develop troubleshooting skills in an industry

environment. Credits: 3.00

AT 30802 - Aircraft Materials Processes

Credit Hours: 3.00. A study of the processes by which aircraft materials are converted into usable components. Laboratory activities include machining, welding, and analysis of material properties.

Learning Outcomes: 1. Demonstrate familiarity with the basic operations of lathes and mills, maintaining close tolerances on work. 2. Demonstrate familiarity with the various properties and strength attributes of aerospace materials and their measurement and application. 3. Demonstrate familiarity with the basic concepts of damage-tolerant repair design. 4. Demonstrate familiarity with the concept of aircraft reliability control as used to support large transport category aircraft. 5. Use teamwork and communication skills to produce parts and/or assemblies. Credits: 3.00

AT 33502 - Avionics Systems

Credit Hours: 3.00. This course covers the theory of operation and applications of common electrical components used in various aircraft circuits. The theory and mathematical relationships of alternating current, reactance, impedance, and phase shift are examined. Operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems are investigated.

Learning Outcomes: 1. Demonstrate the theory of operation and application of common electrical components used in various aircraft circuits. 2. Demonstrate the operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems. 3. Explain the theory and mathematical relationship of alternating current, reactance, impedance, and phase shift. Credits: 3.00

AT 36302 - Fundamentals Of Powerplant Systems

Credit Hours: 4.00. This course covers powerplant systems, including fuel metering devices, ignition systems, and propeller and propeller-related systems. Students learn to use the special tools required for these systems, and the processes for inspection, repair, and overhaul. Airworthiness evaluation and determination is stressed, as are testing and fault diagnosis procedures. The properties and operating characteristics of aircraft fuels are also covered.

Learning Outcomes: 1. Demonstrate the ability to support, maintain, and overhaul powerplant systems. 2. Apply standard testing protocol and procedures to powerplant systems. 3. Develop an understanding of technical information related to powerplant systems. 4. Develop an understanding of fuel characteristics and operation. Credits: 4.00

AT 37200 - Aircraft Maintenance Practices

Credit Hours: 3.00. An in-depth study of practices and procedures used to ensure that an aircraft is maintained in an airworthy state. Aircraft publications and maintenance methodology are emphasized.

Learning Outcomes: 1. Develop inspection skills, techniques and associated practices using appropriate technical publications, form, records, tools and equipment. 2. Make airworthiness determinations concerning airframe, engine, propeller and component parts used in the construction of aircraft. 3. Complete the paperwork, records and job card entries for returning aircraft to service according to aircraft industry standards. Credits: 3.00

AT 37600 - Aircraft Gas Turbine Engine Technology I

Credit Hours: 4.00. Basic aircraft gas turbine engine theory, nomenclature, component design, turbine engine systems, operation, and fault isolation techniques are emphasized. Turbine engine maintenance, overhaul, operation, and inspection procedures are studied in detail.

Learning Outcomes: 1. Understand the basic operating principles of gas turbine engines. 2. Understand the operation and function of the major components of the gas turbine engine. 3. Understand the operation, function and troubleshooting of gas turbine engine systems. 4. Explain the basic procedures and operations used or encountered in maintaining airworthiness of gas turbine engines. Credits:

4.00

AT 38500 - Design Support Analysis

Credit Hours: 2.00. This course is designed to teach students interested in engineering design, design support, customer support, or aerospace manufacturing, the elements of product support and the analysis of design as related to the manufacturability, maintainability, and supportability of aerospace products. The students will be expected to complete a life cycle cost analysis and logistics plan for a design.

Learning Outcomes: 1. Able to break the system into its functional groups. 2. Determine the Mean Time Between Failure of the system and the Availability of the system. 3. Determine the Life Cycle Cost of ownership of the system. 4. Determine the facilities, staffing, tooling, and spare parts requirements for a system. Credits: 2.00

AT 40300 - Airman Certification Procedures

Credit Hours: 1.00. A survey of the procedures for obtaining federal certification as an Aircraft Maintenance Technician.

Learning Outcomes: 1. Review Airmen Certification Standards for Aircraft Mechanic Certificate for Airframe and Powerplant ratings. 2. Complete General, Airframe, and Powerplant written test. Credits: 1.00

AT 44502 - Aircraft Electronics

Credit Hours: 3.00. A study of the computer-based electronic systems used to control both flight and engine parameters on modern aircraft. The course examines the various systems with an emphasis on how each component integrates into the electronic structure of the aircraft.

Learning Outcomes: 1. Demonstrate an understanding of design, operation, and troubleshooting concepts of advanced digital and analog systems found on modern aircraft. Credits: 3.00

AT 47200 - Advanced Composite Technology

Credit Hours: 3.00. Students will perform a variety of fabrication, testing, and repair tasks using specialized composite fibers, matrices, and core materials.

Learning Outcomes: 1. Understand composite part manufacturing process and tooling. 2. Describe different composite part manufacturing process. 3. Understand complex composite materials design solutions and applications. 4. Obtain knowledge of part manufacturing and machining. 5. Design machining tool path using computer-aided manufacturing (CAM) software. 6. Proficient with computer numerical control (CNC) milling machine. 7. Operate different equipment for composite part manufacturing and machining process. Credits: 3.00

AT 47600 - Aircraft Gas Turbine Engine Technology II

Credit Hours: 3.00. This is a study of turbofan engines and systems. Engine installation, testing, and operational procedures are stressed. Emphasis is placed on performance evaluation, data calculations, and predictions of operational properties. Turbofan design theory, operational efficiencies, and fault isolation are discussed.

Learning Outcomes: 1. Operate the test cell and perform parameter recording and thrust evaluations. 2. Given an operable engine installation, remove the engine and simulate procedures to be followed to store the engine. 3. Inspect, perform routine service and troubleshooting on turbine engine fuel system. 4. Using the manufacturer's recommended procedures, simulate adjustment of the fuel metering system and electronic fuel control on a turbine engine. 5. Inspect, check, service, troubleshoot, and repair turbine engine airflow, pressure and temperature measurement systems. Credits: 3.00

AT 49700 - Applied Research Project

Credit Hours: 3.00. Students transform their product/process design proposal created in the proposal design course into a requirements-driven, functional product. During design, they employ rigorous R&D criteria and metrics, global quality, safety, and other industry-based standards, tracking and reporting project development using Technology Readiness Level criteria. For deployment and test phases they incorporate human subject certification, protocols, and develop user-test measures using quantitative and qualitative analysis. The course

deliverable is a final written report and functional project demonstration/presentation.

Learning Outcomes: 1. Integrate knowledge and skills to implement a process/product/service improvement or process/product/service design for design, aircraft operations, or maintenance. 2. Develop, deploy, and validate a project from a proposal. 3. Demonstrate the application of research, design, and test methodologies. 4. Demonstrate the application of problem-solving skills and technical knowledge gained throughout the curriculum. Credits: 3.00

AT 49200 - Aircraft Airworthiness Assurance

Credit Hours: 3.00. Students apply foundational airworthiness assurance principles from the aviation and aerospace industries, performing maintenance and inspection tasks on the school's large transport category laboratory aircraft. They research OEM data to develop and test air vehicle work instructions, incorporating modern maintenance and inspection practices like MSG-3, Reliability Centered Maintenance, and global Safety and Quality standards and Industry 4.0 data science frameworks relating to air vehicle maintenance. They also practice essential participative team and leadership competencies, taking on leadership roles with their laboratory peers as technical team members in a live airport ramp environment.

Learning Outcomes: 1. Recall and explain the definitions, key components and location of U.S. and global regulatory guidance related to Airworthiness, Safety Management Systems (SMS), Quality Management Systems (QMS) and Reliability Centered Maintenance (RCM) for MRO and Aerospace Advanced Manufacturing operations. 2. Use OEM and FAA technical data/guidance for standard maintenance practices, perform air vehicle maintenance and inspection tasks using the lab's large airplane. 3. Create technical Work Instructions and air vehicle General Familiarization Training using OEM data, demonstrating compliance to airworthiness and quality standards for large air vehicles. 4. Demonstrate key leadership and team coordination competencies for working with hazardous air vehicle systems, technologies and processes. Credits: 3.00

AT 11600 - Aircraft Science For Engineering Technology

Credit Hours: 3.00. Required for AET. This course is an introduction to theory of flight, aircraft nomenclature, aircraft configurations, high speed flight, and helicopter configurations and rotor dynamics. Covers lift/drag and concepts for flight at an engineering technology level beyond that of flight ground school. Federal regulatory systems for aircraft design and persons other than flight personnel and associated technical documents are covered. Introduces center of gravity theory, defines how to locate centers of gravity, and introduces weight and balance procedures for engineering technology, not covered by flight ground school. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Able to explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Able to define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Able to define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Able to successfully demonstrate on time performance of required activities. 7. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 32001 - Advanced Aviation Operations

Credit Hours: 3.00. This course covers modern principles for managing complex global aviation maintenance, ground and aerospace manufacturing operations. Particular emphasis is placed on "system-of-systems" and organizational resilience concepts in air vehicle lifecycle maintenance, aerospace manufacturing and airport surface/gate operations. Principles of Data Science, systems-thinking, process visualization, emerging technologies and modern workforce challenges and their impact on global sustainable airworthiness, safety, quality and performance reliability are covered in-depth.

Learning Outcomes: 1. Compare/contrast historic versus modern day aviation operations management philosophies and the crucial role of the modern 5P operations management paradigm. 2. Analyze and describe disruptive technology advances driving modern aviation and aerospace operations and the role of Data Science in air vehicle design and lifecycle management. 3. Analyze the tightly coupled nature and system failure modes in high consequence aviation/aerospace operations. 4. Apply System-of-Systems, Resilience Engineering, Safety II and other next generation operations management concepts to problem-based case studies and current issues in aviation and aerospace. 5. Demonstrate understanding of aviation/aerospace industry workforce competency models including applied roles of innovation, teamwork and problem-solving. Credits: 3.00

AT 49600 - Applied Research Proposal

Credit Hours: 2.00. Students perform a structured analysis of an industry-based problem or design challenge, producing a professionally written project proposal. Students engage all aspects of a product or process engineering design proposal including problem analysis, identifying design requirements, conceptualizing, and communicating a solution. Students incorporate rigorous research and industry methodologies like Quality Functional Deployment, Failure Mode and Effects Analysis, literature reviews, and project cost/ROI estimates to create and defend a written project proposal.

Learning Outcomes: 1. Integrate knowledge and skills to create a written project proposal reflecting proficiency at professional industry standards. 2. Demonstrate application and proper use of problem-solving methods, tools and research practices salient to the aviation andaerospace industry. 3. Apply life-long learning skills and competencies to acquire the knowledge, skills and resources required to complete the project. Credits: 2.00

AT 12700 - Publications Records And Regulations

Credit Hours: 3.00. Required for AET. This course provides students with the concepts, and information to understand the regulations and publications specific to aviation and aerospace vehicle repair and maintenance. The privileges and limitations of the 14 CFR Part 65 airmen certificates are covered, as well as the regulations governing repair facilities and repair stations. The specific forms and records, and the proper disposition of those records are covered. In addition, aircraft technical drawings and prints are examined and the student is to develop the ability to read and comprehend aircraft drawings, as well as make drawings/sketches for vehicle repair and/or alteration. Precision measuring equipment is covered as is the hardware specific to aviation and aerospace. Inspection procedures and conformity checks are covered. Engine run up operations for inspection purpose are covered. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Identify the privileges and limitations of their 14 CFR Part 65 certificates. 2. Complete all appropriate forms and records related to aircraft maintenance and repair operations. 3. Solve problems and answer technical questions using these materials. 4. Read and interpret the output of precision measuring devices and be able to take precision measurements. 5. Identify various types of AN, MS, and NAS hardware, and understand the appropriate use of aircraft hardware. 6. Start, operate, and functionally check a reciprocating engine. Credits: 3.00

AT 48000 - Advanced Aviation Manufacturing (Lean Six Sigma Methodologies)

Credit Hours: 3.00. Course is a selective choice in the AET program. This is a study of advanced aviation manufacturing principles, lean six sigma methodologies and project management basics. Permission of instructor required.

Learning Outcomes: 1. Develop the competencies to utilize required advanced manufacturing processes to operate a manufacturing facility. 2. Cultivate the ability to utilize advanced process quality planning methods to implement a quality program in a manufacturing facility. 3. Gain the knowledge and experience required to effectively implement supply chain management techniques and logistic programs in a manufacturing facility. 4. Incorporate an effective continuous improvement process to be utilized and promoted throughout the curriculum. 5. Select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities. 6. Select and apply knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies. 7. Conduct standard tests and measurements; to conduct, analyze, and interpret experiments. 8. Apply project-based learning techniques to improve processes, and communicate a commitment to quality, timeliness, and continuous improvement. All the objectives listed are crucial in the manufacturing world. Credits: 3.00

Other Departmental/Program Course Requirements (39 credits)

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of

differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the

design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (6 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 27800 - Nondestructive Testing For Aircraft

Credit Hours: 3.00. A study of nondestructive testing methods used to evaluate the structural integrity of airframes, engines, and components. Magnetic particle, liquid penetrant, electromagnetic, ultrasonic, and radiographic inspection are covered.

Learning Outcomes: 1. Learn basic concepts and procedures for effective Penetrant Testing, different systems (white light, black light), sequences and evaluation of defects. 2. Learn basic concepts and procedures for effective Magnetic Particle Testing, system set up and checks, calculation of amperage used, identification of issues of materials and choice of methods, evaluation of defects. 3. Learn basic concepts and procedures for effective Eddy Current Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different wave forms on indications, and evaluation of defects. 4. Learn basic concepts and procedures for effective Ultrasonic Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different methods (surface, though, etc.) and evaluation of defects. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic,

and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

AT 11600 - Aircraft Science For Engineering Technology

Credit Hours: 3.00. Required for AET. This course is an introduction to theory of flight, aircraft nomenclature, aircraft configurations, high speed flight, and helicopter configurations and rotor dynamics. Covers lift/drag and concepts for flight at an engineering technology level beyond that of flight ground school. Federal regulatory systems for aircraft design and persons other than flight personnel and associated technical documents are covered. Introduces center of gravity theory, defines how to locate centers of gravity, and introduces weight and balance procedures for engineering technology, not covered by flight ground school. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Able to explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Able to define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Able to define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to

calculate an aircraft's weight and balance. 6. Able to successfully demonstrate on time performance of required activities. 7. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 12700 - Publications Records And Regulations

Credit Hours: 3.00. Required for AET. This course provides students with the concepts, and information to understand the regulations and publications specific to aviation and aerospace vehicle repair and maintenance. The privileges and limitations of the 14 CFR Part 65 airmen certificates are covered, as well as the regulations governing repair facilities and repair stations. The specific forms and records, and the proper disposition of those records are covered. In addition, aircraft technical drawings and prints are examined and the student is to develop the ability to read and comprehend aircraft drawings, as well as make drawings/sketches for vehicle repair and/or alteration. Precision measuring equipment is covered as is the hardware specific to aviation and aerospace. Inspection procedures and conformity checks are covered. Engine run up operations for inspection purpose are covered. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Identify the privileges and limitations of their 14 CFR Part 65 certificates. 2. Complete all appropriate forms and records related to aircraft maintenance and repair operations. 3. Solve problems and answer technical questions using these materials. 4. Read and interpret the output of precision measuring devices and be able to take precision measurements. 5. Identify various types of AN, MS, and NAS hardware, and understand the appropriate use of aircraft hardware. 6. Start, operate, and functionally check a reciprocating engine. Credits: 3.00

16 Credits

Spring 1st Year

AT 20700 - Introduction To Aircraft Systems

Credit Hours: 3.00. Principles and design concepts of aircraft operating systems are covered. Emphasis is given to flight control, electrical, environmental, hydraulic, pneumatic, pressurization, oxygen, heating, cooling, fire protection, and ice and rain protection systems. Also included are theory of operation and design of aircraft instruments and associate systems.

Learning Outcomes: 1. Learn the function and operational principles aircraft instruments. 2. Learn the function of various components in a system for maintaining a healthful and comfortable environment in an aircraft. 3. Study, inspect, and check ice, rain, and fire control aircraft systems. 4. Determine the location of the elements in the aircraft and become familiar with the function and operating procedures for the typical system found on light single or light twin engine aircraft. 5. Learn to recognize various fittings and their application when used for rigid tubing and flexible hose. 6. Learn the use of tools and FAA Regulations in relation to aircraft tube and hose fabrication. 7. Learn the basic fundamentals of hydraulic systems, power, components and control. 8. Learn the different hydraulic fluids, seal design and system compatibility used in hydraulic systems. Credits: 3.00

AT 20802 - Aircraft Materials

Credit Hours: 3.00. In this course students study aluminum and composite materials used in aircraft. The course covers elements of design, fabrication, final assembly, and testing. Students also study the practical application of statics for airframe loads.

Learning Outcomes: 1. Use tools for the fabrication, final assembly, and testing of materials. 2. Use and apply technical information, including drawings, sketches, blueprints, charts, and graphs. 3. Analyze damage and design repairs to aircraft materials. 4. Demonstrate the basic skills of oxyacetylene welding and the concepts of welded repair

design. 5. Apply the concepts of statics as they relate to airframe structural members. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

15 Credits

Fall 2nd Year

AT 26502 - Aircraft Electrical Systems

Credit Hours: 3.00. An in-depth study of aircraft electrical components, both individually and as systems in the aircraft. DC electrical circuits, series and parallel circuits, magnetism, and electromagnetism are covered, as are DC power systems, schematics, and aircraft wiring practices. Aircraft charging systems, main power distribution, solid state electronics,

batteries, and motors are also discussed.

Learning Outcomes: 1. Develop an understanding of electrical principles as they relate to aircraft system operation. 2. Construct, analyze, and isolate faults in circuits. 3. Demonstrate troubleshooting procedures for direct currently electrical aircraft components and power distribution circuits. Credits: 3.00

AT 26700 - Fixed And Rotary Wing Assemblies

Credit Hours: 3.00. An overview of various fixed and rotary wing components and systems. Flight control systems, landing gear, fuel systems, wheels, brakes, and rotor systems are among the subjects studied.

Learning Outcomes: 1. Read, analyze, and interpret technical instructions. 2. Complete a set of aviation maintenance related tasks. 3. Jack, hoist, shore, level, and weigh an aircraft and calculate its weight and balance. 4. Knowledge of radio communications and aircraft mooring. 5. Operate a helicopter rotor balancing computer and balance a helicopter main and tail rotor. Credits: 3.00

AT 27200 - Introduction To Composite Technology

Credit Hours: 3.00. An introduction to basic composite materials, processes, construction, testing, and repair. Students will work with a variety of wet and pre-impregnated fiber and matrix systems including glass, aramid fiber, and carbon-graphite.

Learning Outcomes: 1. Demonstrate familiarity with wet lay, prepreg, and VARTM processes. 2. Use solid modeling software for part design, drafting, and composite design. 3. Demonstrate understanding of basic CNC machining, mold-making, and curing, 4. Repair damaged composite structures. Credits: 3.00

AT 30702 - Advanced Aircraft Systems

Credit Hours: 3.00. An in-depth study of aircraft components and operation with an emphasis on transport-category aircraft. Systems covered include fuel, environmental, fluid-power, flight control, fire protection, ice-control, warning, and auxiliary power. Practical projects utilize small ad transport-category aircraft.

Learning Outcomes: 1. Demonstrate an understanding of the terminology of systems analysis and design. 2. Demonstrate proper project planning ability. 3. Demonstrate knowledge of the industrial safety culture and the ability to analyze all safety issues of the project, including team member safety. 4. Determine system airworthiness. 5. Develop troubleshooting skills in an industry environment. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 2nd Year

AT 26200 - Basic Aircraft Powerplant Technology

Credit Hours: 4.00. A study of the design, construction, and operating practices of aircraft reciprocating and small gas turbine engines. Laboratory exercises emphasize airworthiness evaluation, fault-isolation techniques, and standard service/maintenance practices.

Learning Outcomes: 1. Compare and contrast different types of reciprocating engines. 2. Explain the principles of the Otto cycle. 3. Explain Volumetric Efficiency. 4. Identify the importance of reciprocating engine designs and construction. 5. Demonstrate the ability to operate and troubleshoot a reciprocating engine. Credits: 4.00

AT 33502 - Avionics Systems

Credit Hours: 3.00. This course covers the theory of operation and applications of common electrical components used in various aircraft circuits. The theory and mathematical relationships of alternating current, reactance, impedance, and phase shift are examined. Operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems are investigated.

Learning Outcomes: 1. Demonstrate the theory of operation and application of common electrical components used in various aircraft circuits. 2. Demonstrate the operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems. 3. Explain the theory and mathematical relationship of alternating current, reactance, impedance, and phase shift. Credits: 3.00

AT 36302 - Fundamentals Of Powerplant Systems

Credit Hours: 4.00. This course covers powerplant systems, including fuel metering devices, ignition systems, and propeller and propeller-related systems. Students learn to use the special tools required for these systems, and the processes for inspection, repair, and overhaul. Airworthiness evaluation and determination is stressed, as are testing and fault diagnosis procedures. The properties and operating characteristics of aircraft fuels are also covered.

Learning Outcomes: 1. Demonstrate the ability to support, maintain, and overhaul powerplant systems. 2. Apply standard testing protocol and procedures to powerplant systems. 3. Develop an understanding of technical information related to powerplant systems. 4. Develop an understanding of fuel characteristics and operation. Credits: 4.00

AT 37600 - Aircraft Gas Turbine Engine Technology I

Credit Hours: 4.00. Basic aircraft gas turbine engine theory, nomenclature, component design, turbine engine systems, operation, and fault isolation techniques are emphasized. Turbine engine maintenance, overhaul, operation, and inspection procedures are studied in detail.

Learning Outcomes: 1. Understand the basic operating principles of gas turbine engines. 2. Understand the operation and function of the major components of the gas turbine engine. 3. Understand the operation, function and troubleshooting of gas turbine engine systems. 4. Explain the basic procedures and operations used or encountered in maintaining airworthiness of gas turbine engines. Credits: 4.00

15 Credits

Fall 3rd Year

AT 20501 - Statics For Aerostructures

Credit Hours: 3.00. This course provides an introduction to the static analysis of aerostructures. Force systems, resultants and equilibrium, moments, distributed loads, and centroids as they relate to aeronautical structures are studied. CAD software is introduced.

Learning Outcomes: 1. Determine the resultant of multiple vectors. 2. Draw free-body diagrams and apply equilibrium equations to those diagrams. 3. Demonstrate an understanding of the analysis of distributed loads in aerostructures. 4. Develop knowledge of internal forces and moments in structural members. 5. Develop an ability to calculate centroids and moments of inertia. 6. Use CAD software to represent and analyze aerostructures. Credits: 3.00

AT 37200 - Aircraft Maintenance Practices

Credit Hours: 3.00. An in-depth study of practices and procedures used to ensure that an aircraft is maintained in an airworthy state. Aircraft publications and maintenance methodology are emphasized.

Learning Outcomes: 1. Develop inspection skills, techniques and associated practices using appropriate technical publications, form, records, tools and equipment. 2. Make airworthiness determinations concerning airframe, engine, propeller and component parts used in the construction of aircraft. 3. Complete the paperwork, records and job card entries for returning aircraft to service according to aircraft industry standards. Credits: 3.00

AT 40300 - Airman Certification Procedures

Credit Hours: 1.00. A survey of the procedures for obtaining federal certification as an Aircraft Maintenance Technician.

Learning Outcomes: 1. Review Airmen Certification Standards for Aircraft Mechanic Certificate for Airframe and Powerplant ratings. 2. Complete General, Airframe, and Powerplant written test. Credits: 1.00

AT 47600 - Aircraft Gas Turbine Engine Technology II

Credit Hours: 3.00. This is a study of turbofan engines and systems. Engine installation, testing, and operational procedures are stressed. Emphasis is placed on performance evaluation, data calculations, and predictions of operational properties. Turbofan design theory, operational efficiencies, and fault isolation are discussed.

Learning Outcomes: 1. Operate the test cell and perform parameter recording and thrust evaluations. 2. Given an operable engine installation, remove the engine and simulate procedures to be followed to store the engine. 3. Inspect, perform routine service and troubleshooting on turbine engine fuel system. 4. Using the manufacturer's recommended procedures, simulate adjustment of the fuel metering system and electronic fuel control on a turbine engine. 5. Inspect, check, service, troubleshoot, and repair turbine engine airflow, pressure and temperature measurement systems. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

16 Credits

Spring 3rd Year

AT 30802 - Aircraft Materials Processes

Credit Hours: 3.00. A study of the processes by which aircraft materials are converted into usable components. Laboratory activities include machining, welding, and analysis of material properties.

Learning Outcomes: 1. Demonstrate familiarity with the basic operations of lathes and mills, maintaining close tolerances on work. 2. Demonstrate familiarity with the various

properties and strength attributes of aerospace materials and their measurement and application. 3. Demonstrate familiarity with the basic concepts of damage-tolerant repair design. 4. Demonstrate familiarity with the concept of aircraft reliability control as used to support large transport category aircraft. 5. Use teamwork and communication skills to produce parts and/or assemblies. Credits: 3.00

AT 38500 - Design Support Analysis

Credit Hours: 2.00. This course is designed to teach students interested in engineering design, design support, customer support, or aerospace manufacturing, the elements of product support and the analysis of design as related to the manufacturability, maintainability, and supportability of aerospace products. The students will be expected to complete a life cycle cost analysis and logistics plan for a design.

Learning Outcomes: 1. Able to break the system into its functional groups. 2. Determine the Mean Time Between Failure of the system and the Availability of the system. 3. Determine the Life Cycle Cost of ownership of the system. 4. Determine the facilities, staffing, tooling, and spare parts requirements for a system. Credits: 2.00

AT 47200 - Advanced Composite Technology

Credit Hours: 3.00. Students will perform a variety of fabrication, testing, and repair tasks using specialized composite fibers, matrices, and core materials.

Learning Outcomes: 1. Understand composite part manufacturing process and tooling. 2. Describe different composite part manufacturing process. 3. Understand complex composite materials design solutions and applications. 4. Obtain knowledge of part manufacturing and machining. 5. Design machining tool path using computer-aided manufacturing (CAM) software. 6. Proficient with computer numerical control (CNC) milling machine. 7. Operate different equipment for composite part manufacturing and machining process. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AT 32001 - Advanced Aviation Operations

Credit Hours: 3.00. This course covers modern principles for managing complex global aviation maintenance, ground and aerospace manufacturing operations. Particular emphasis is placed on "system-of-systems" and organizational resilience concepts in air vehicle lifecycle maintenance, aerospace manufacturing and airport surface/gate operations. Principles of Data Science, systems-thinking, process visualization, emerging technologies and modern workforce challenges and their impact on global sustainable airworthiness, safety, quality and performance reliability are covered in-depth.

Learning Outcomes: 1. Compare/contrast historic versus modern day aviation operations management philosophies and the crucial role of the modern 5P operations management paradigm. 2. Analyze and describe disruptive technology advances driving modern aviation and aerospace operations and the role of Data Science in air vehicle design and lifecycle

management. 3. Analyze the tightly coupled nature and system failure modes in high consequence aviation/aerospace operations. 4. Apply System-of-Systems, Resilience Engineering, Safety II and other next generation operations management concepts to problem-based case studies and current issues in aviation and aerospace. 5. Demonstrate understanding of aviation/aerospace industry workforce competency models including applied roles of innovation, teamwork and problem-solving. Credits: 3.00

AT 48000 - Advanced Aviation Manufacturing (Lean Six Sigma Methodologies)

Credit Hours: 3.00. Course is a selective choice in the AET program. This is a study of advanced aviation manufacturing principles, lean six sigma methodologies and project management basics. Permission of instructor required.

Learning Outcomes: 1. Develop the competencies to utilize required advanced manufacturing processes to operate a manufacturing facility. 2. Cultivate the ability to utilize advanced process quality planning methods to implement a quality program in a manufacturing facility. 3. Gain the knowledge and experience required to effectively implement supply chain management techniques and logistic programs in a manufacturing facility. 4. Incorporate an effective continuous improvement process to be utilized and promoted throughout the curriculum. 5. Select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities. 6. Select and apply knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies. 7. Conduct standard tests and measurements; to conduct, analyze, and interpret experiments. 8. Apply project-based learning techniques to improve processes, and communicate a commitment to quality, timeliness, and continuous improvement. All the objectives listed are crucial in the manufacturing world. Credits: 3.00

14 Credits

Fall 4th Year

AT 44502 - Aircraft Electronics

Credit Hours: 3.00. A study of the computer-based electronic systems used to control both flight and engine parameters on modern aircraft. The course examines the various systems with an emphasis on how each component integrates into the electronic structure of the aircraft.

Learning Outcomes: 1. Demonstrate an understanding of design, operation, and troubleshooting concepts of advanced digital and analog systems found on modern aircraft. Credits: 3.00

AT 49600 - Applied Research Proposal

Credit Hours: 2.00. Students perform a structured analysis of an industry-based problem or design challenge, producing a professionally written project proposal. Students engage all aspects of a product or process engineering design proposal including problem analysis, identifying design requirements, conceptualizing, and communicating a solution. Students incorporate rigorous research and industry methodologies like Quality Functional Deployment, Failure Mode and Effects Analysis, literature reviews, and project cost/ROI estimates to create and defend a written project proposal.

Learning Outcomes: 1. Integrate knowledge and skills to create a written project proposal reflecting proficiency at professional industry standards. 2. Demonstrate application and proper use of problem-solving methods, tools and research practices salient to the aviation andaerospace industry. 3. Apply life-long learning skills and competencies to acquire the knowledge, skills and resources required to complete the project. Credits: 2.00

14 Credits

Spring 4th Year

AT 49700 - Applied Research Project

Credit Hours: 3.00. Students transform their product/process design proposal created in the proposal design course into a requirements-driven, functional product. During design, they employ rigorous R&D criteria and metrics, global quality, safety, and other industry-based standards, tracking and reporting project development using Technology Readiness Level criteria. For deployment and test phases they incorporate human subject certification, protocols, and develop user-test measures using quantitative and qualitative analysis. The course deliverable is a final written report and functional project demonstration/presentation.

Learning Outcomes: 1. Integrate knowledge and skills to implement a process/product/service improvement or process/product/service design for design, aircraft operations, or maintenance. 2. Develop, deploy, and validate a project from a proposal. 3. Demonstrate the application of research, design, and test methodologies. 4. Demonstrate the application of problem-solving skills and technical knowledge gained throughout the curriculum. Credits: 3.00

AT 49200 - Aircraft Airworthiness Assurance

Credit Hours: 3.00. Students apply foundational airworthiness assurance principles from the aviation and aerospace industries, performing maintenance and inspection tasks on the school's large transport category laboratory aircraft. They research OEM data to develop and test air vehicle work instructions, incorporating modern maintenance and inspection practices like MSG-3, Reliability Centered Maintenance, and global Safety and Quality standards and Industry 4.0 data science frameworks relating to air vehicle maintenance. They also practice essential participative team and leadership competencies, taking on leadership roles with their laboratory peers as technical team members in a live airport ramp environment.

Learning Outcomes: 1. Recall and explain the definitions, key components and location of U.S. and global regulatory guidance related to Airworthiness, Safety Management Systems (SMS), Quality Management Systems (QMS) and Reliability Centered Maintenance (RCM) for MRO and Aerospace Advanced Manufacturing operations. 2. Use OEM and FAA technical data/guidance for standard maintenance practices, perform air vehicle maintenance and inspection tasks using the lab's large airplane. 3. Create technical Work Instructions and air vehicle General Familiarization Training using OEM data, demonstrating compliance to airworthiness and quality standards for large air vehicles. 4. Demonstrate key leadership and team coordination competencies for working with hazardous air vehicle systems, technologies and processes. Credits: 3.00

15 Credits

Aeronautical Technology, BS (Statewide)

About the Program

You can earn your Purdue University bachelor's degree in aeronautical technology in two years if you already have an aviation-related Vincennes University associate's degree. Your Purdue coursework builds on the skills you learned during your first two years at Vincennes while it expands your career options. Your classes and labs will also be at the Aviation Technology Center at the Indianapolis International Airport.

Special features:

- Flexible curriculum based on your career goals
- Internship and other work experience opportunities at aviation-related companies surrounding Indianapolis International Airport
- Access to Aviation Technology Center labs: Advanced Composites Laboratory, Air Traffic Control/Computer Laboratory, FAA-approved flight simulator, Avionics Laboratory, Non-Destructive Testing Laboratory, and Materials Processing Laboratory

Course topics include:

- Operations management
- Safety problems
- Aviation finance
- Human factors in aviation
- Aviation law

Degree Requirements

Departmental/Program Major Requirements (33 Credits)

Required Major Requirements (33 Credits)

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 30702 - Advanced Aircraft Systems

Credit Hours: 3.00. An in-depth study of aircraft components and operation with an emphasis on transport-category aircraft. Systems covered include fuel, environmental, fluid-power, flight control, fire protection, ice-control, warning, and auxiliary power. Practical projects utilize small ad transport-category aircraft.

Learning Outcomes: 1. Demonstrate an understanding of the terminology of systems analysis and design. 2. Demonstrate proper project planning ability. 3. Demonstrate knowledge of the industrial safety culture and the ability to analyze all safety issues of the project, including team member safety. 4. Determine system airworthiness. 5. Develop troubleshooting skills in an industry environment. Credits: 3.00

AT 33800 - Airline Management

Credit Hours: 3.00. This course is a detailed study of airline management principles and processes. Topics include airline, economics, organization, forecasting, marketing, alliances, pricing, scheduling, finance, fleet planning, labor relations and air freight. Business ethics pertaining to airlines are introduced.

Learning Outcomes: 1. Explain the economic characteristics and the management structure of the commercial airline industry. 2. Explain forecasting, marketing, pricing, scheduling, fleeting planning, labor relations, financing, and air cargo operations. 3. Demonstrate oral and written communication skills on topics related to the airline industry. 4. Discuss global geography in relation to the international aviation industry. Credits: 3.00

AT 35900 - Airport Management

Credit Hours: 3.00. This course is a study of the history and development of contemporary airport facilities. Areas of study will include FAA airport design requirements, master plans, and airport operations. Field trips may be required.

Learning Outcomes: 1. Understand how airports are managed. 2. Describe and understand the issues and challenges facing airport managers. Credits: 3.00

AT 38100 - Aviation Security

Credit Hours: 3.00. This course introduces the challenges and complexity of aviation security faced by aviation professionals across the industry. It traces the evolution of current security approaches and explores technologies and processes targeting threat mitigation and improved operational efficiency.

Learning Outcomes: 1. Understand the literature in the student's field. 2. Exhibit the highest level of professionalism in the aviation security industry. 3. Solve problems in aviation security. 4. Work effectively as part of a team. 5. Conduct basic research, interpret ad analyze the data and make useful presentations based on that research. Credits: 3.00

AT 41200 - Aviation Finance

Credit Hours: 3.00. The course will focus on the financial knowledge needed to operate and evaluate aviation businesses. Content will cover the impact of financial decisions on operational outcomes that add/decrease value to an aviation company's bottom line. Case studies will be utilized to demonstrate practical aspects of financial decisions as they relate to organizational performance and profitability.

Learning Outcomes: 1. Explain common financial reports and their impact on operations. 2. Demonstrate reading and construction of cash flow, profit and loss, and balance sheets and explain how they are related. 3. Explain hedging concepts and how to build a selective hedging program to mitigate risk. 5. Analyze financial measurements and explain how they affect operational decisions for bottom line improvements. Credits: 3.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance.

Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

AT 48100 - Aviation Safety Problems

Credit Hours: 3.00. This course provides the opportunity for students to study problems associated with aviation safety. Particular attention will be given to the formulation of specific recommendations for improvements in aviation safety.

Learning Outcomes: 1. Familiar with the fundamental safety theories and possible applications. 2. Understand the characteristics human errors. 3. Identify and analyze the casual factors of a mishap. 4. Explain the process of emergency response and accident prevention programs. Credits: 3.00

AT 49800 - Aviation Technology Capstone

Credit Hours: 3.00. The Aviation Technology Capstone course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous experience of the student's curriculum. It also provides an opportunity for students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 3.00

AT 23300 - Ethics And Aviation

Credit Hours: 3.00. This discussion-oriented class is an introduction to the principles of ethical theory and the application of that theory to practical problems associated with the aviation industry. Actual aviation case studies are used to illustrate major concepts.

Learning Outcomes: 1. Apply ethics to historical situations in aviation. 2. Apply ethics to current situations in aviation. 3. Discuss case studies centered on ethical situations in aviation. Credits: 3.00

AT 45400 - Human Factors in Aviation

Credit Hours: 3.00. Students investigate the disciplines known as human factors and ergonomics and how they apply to various aviation career areas from a management perspective. Common industry models and error management strategies will be studied and evaluated.

Credits: 3.00

Other Departmental Course Requirements (74 Credits)

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal

Finance

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate

effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ENGL 10400 - English Composition I

Credit Hours: 3.00. Emphasis on the organization of the expository theme. Directed writings of themes based on personal experience, on the relationship between experience and language, and on the relationship between experience and ideas.

Credits: 3.00

Electives (13 Credits)

Non-Course/Non-Credit Requirement

Supplemental List

Program Notes

Sample 4-Year Plan

Fall 1st Year

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

15 Credits

Spring 1st Year

16 Credits

Fall 2nd Year

14 Credits

Spring 2nd Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

15 Credits

Fall 3rd Year

AT 33800 - Airline Management

Credit Hours: 3.00. This course is a detailed study of airline management principles and processes. Topics include airline, economics, organization, forecasting, marketing, alliances, pricing, scheduling, finance, fleet planning, labor relations and air freight. Business ethics pertaining to airlines are introduced. Learning Outcomes: 1. Explain the economic characteristics and the management structure of the commercial airline industry. 2. Explain forecasting, marketing, pricing, scheduling, fleeting planning, labor relations, financing, and air cargo operations. 3. Demonstrate oral and written communication skills on topics related to the airline industry. 4. Discuss global geography in relation to the international aviation industry. Credits: 3.00

AT 48100 - Aviation Safety Problems

Credit Hours: 3.00. This course provides the opportunity for students to study problems associated with aviation safety. Particular attention will be given to the formulation of specific recommendations for improvements in aviation safety. Learning Outcomes: 1. Familiar with the fundamental safety theories and possible applications. 2. Understand the characteristics human errors. 3. Identify and analyze the casual factors of a mishap. 4. Explain the process of emergency response and accident prevention programs. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800. University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives. University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

15 Credits

Spring 3rd Year

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 41200 - Aviation Finance

Credit Hours: 3.00. The course will focus on the financial knowledge needed to operate and evaluate aviation businesses. Content will cover the impact of financial decisions on operational outcomes that add/decrease value to an aviation company's bottom line. Case studies will be utilized to demonstrate practical aspects of financial decisions as they relate to organizational performance and profitability.

Learning Outcomes: 1. Explain common financial reports and their impact on operations. 2. Demonstrate reading and construction of cash flow, profit and loss, and balance sheets and explain how they are related. 3. Explain hedging concepts and how to build a selective hedging program to mitigate risk. 5. Analyze financial measurements and explain how they affect operational decisions for bottom line improvements. Credits: 3.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance.

Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

15 Credits

Fall 4th Year

AT 35900 - Airport Management

Credit Hours: 3.00. This course is a study of the history and development of contemporary airport facilities. Areas of study will include FAA airport design requirements, master plans, and airport operations. Field trips may be required.

Learning Outcomes: 1. Understand how airports are managed. 2. Describe and understand the issues and challenges facing airport managers. Credits: 3.00

AT 38100 - Aviation Security

Credit Hours: 3.00. This course introduces the challenges and complexity of aviation security faced by aviation professionals across the industry. It traces the evolution of current security approaches and explores technologies and processes targeting threat mitigation and improved operational efficiency.

Learning Outcomes: 1. Understand the literature in the student's field. 2. Exhibit the highest level of professionalism in the aviation security industry. 3. Solve problems in aviation security. 4. Work effectively as part of a team. 5. Conduct basic research, interpret ad analyze the data and make useful presentations based on that research. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of

STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

14 Credits

Spring 4th Year

AT 30702 - Advanced Aircraft Systems

Credit Hours: 3.00. An in-depth study of aircraft components and operation with an emphasis on transport-category aircraft. Systems covered include fuel, environmental, fluid-power, flight control, fire protection, ice-control, warning, and auxiliary power. Practical projects utilize small ad transport-category aircraft.

Learning Outcomes: 1. Demonstrate an understanding of the terminology of systems analysis and design. 2. Demonstrate proper project planning ability. 3. Demonstrate knowledge of the industrial safety culture and the ability to analyze all safety issues of the project, including team member safety. 4. Determine system airworthiness. 5. Develop troubleshooting skills in an industry environment. Credits: 3.00

AT 49800 - Aviation Technology Capstone

Credit Hours: 3.00. The Aviation Technology Capstone course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous experience of the student's curriculum. It also provides an opportunity for students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

16 Credits

African American Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (30 credits)

A. African American Studies Foundation Courses (9 credits)

AAS 47400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers research techniques used by researchers to observe and to interpret scholarly investigation on race, class and gender from an African-American perspective.

Credits: 3.00

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37100 - The African American Experience

Credit Hours: 3.00. Focus on specific topics of the personal experiences of blacks, in Africa and the diaspora, including black identity, black culture, and the relationships between blacks and society.

Credits: 3.00

AAS 27100 - Introduction To African American Studies (UCC: HUM)

Credit Hours: 3.00. Introduction to the philosophical and methodological principles underlying Afro-American studies. Dimensions of the black experience, including history, education, politics, psychology, economics, religion, social organization, and art, will be covered, and the requisite academic tools and sources will be examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

B. Social Science Courses Related to Africa or the African Diaspora (9 credits)

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37100 - The African American Experience

Credit Hours: 3.00. Focus on specific topics of the personal experiences of blacks, in Africa and the diaspora, including black identity, black culture, and the relationships between blacks and society.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and

socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SOC 51400 - Racial And Cultural Minorities

Credit Hours: 3.00. America's minority groups; immigration; interracial and intercultural conflicts; assimilation.

Credits: 3.00

C. History Courses Related to Africa or the African Diaspora (6 credits)

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 39200 - Caribbean History And Culture

Credit Hours: 3.00. This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 44100 - Africa In The Twentieth Century

Credit Hours: 3.00. A problem-oriented course in the modern history of Africa from 1880 to 1975. It analyzes origins of African nationalism, European colonialism, racial conflict, and war leading to the independence revolution of the 1960s and 1970s.

Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights

movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

HIST 39800 - African American History Since 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history from 1877 that focus on Black Americans' struggle to overcome social, economic, and political oppression and to win basic civil and human rights while making valuable contributions to American society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

D. English Courses Related to Africa or the African Diaspora (3 credits)

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

AAS 35900 - Black Women Writers

Credit Hours: 3.00. (ENGL 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black

women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

E. Visual and Performing Arts Courses Related to Africa or the African Diaspora (3 credits)

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 27700 - African American Popular Culture

Credit Hours: 3.00. This course focuses on the production of popular culture through African-based and non African-based traditions among African Americans in the United States. Pop culture forms covered include film, theatre, visual arts, literature, dance, sports, music and religious traditions.

Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

Electives (17-54 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-16 Credits

Spring 1st Year

AAS 27100 - Introduction To African American Studies (UCC: HUM)

Credit Hours: 3.00. Introduction to the philosophical and methodological principles underlying Afro-American studies. Dimensions of the black experience, including history, education, politics, psychology, economics, religion, social organization, and art, will be covered, and the requisite academic tools and sources will be examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

15 Credits

Fall 2nd Year

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37100 - The African American Experience

Credit Hours: 3.00. Focus on specific topics of the personal experiences of blacks, in Africa and the diaspora, including black identity, black culture, and the relationships between blacks and society.

Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

AAS 47400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers research techniques used by researchers to observe and to interpret scholarly investigation on race, class and gender from an African-American perspective.

Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 27700 - African American Popular Culture

Credit Hours: 3.00. This course focuses on the production of popular culture through African-based and non African-based traditions among African Americans in the United States. Pop culture forms covered include film, theatre, visual arts, literature, dance, sports, music and religious traditions.

Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

15 Credits

Agribusiness: Agribusiness Management Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (60 credits)

Required Major Courses (25 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6.

Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

Agribusiness Management Concentration Courses (15 credits)

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional

conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various

control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model; total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction

between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Agricultural Economics Departmental Selectives (20 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world

issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding

of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (16-17 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation

techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations.
Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or

validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial

decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and

understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model; total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

15 Credits

Spring 3rd Year

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

13-14 Credits

Agribusiness: Agricultural Finance Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (60 credits)

Required Major Courses (25 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market

equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

Agricultural Finance Concentration Courses (18 credits)

AGEC 42500 - Estate Planning And Property Transfer

Credit Hours: 3.00. The ownership and transfer of farm business property. Includes tax and other implications of life estates, trust arrangements, sale of property, and charitable contributions.

Credits: 3.00

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate

critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGEC 45600 - Federal Income Tax Law

Credit Hours: 3.00. Introduction to the federal income tax laws applicable to individuals and small business with emphasis on the farming business. The course includes management implications and the policy basis for the tax law system. Techniques and practice for the preparation of selected forms will be included. There will be limited exposure to taxation of partnerships, corporations, estates, and to federal gift and estate tax law.

Learning Outcomes: 1. Develop an understanding of the federal income tax law: for individuals and small businesses and for economic and financial decision making. 2. Gain an understanding of the management opportunities for the income tax law and how they can be applied by individuals, families, and small businesses. 3. Develop the ability to analyze facts for tax law alternatives and to communicate tax planning alternatives. Credits: 3.00

AGEC 52400 - Agricultural Finance

Credit Hours: 3.00. Designed to provide students the concepts and tools to apply financial management principles to farm businesses. Topics include financing alternatives, preparation and interpretation of financial statements, and capital investment analysis using discounted cash flows.

Learning Outcomes: 1. Prepare, interpret, and analyze financial statements used for agricultural businesses. 2. Analyze and suggest methods to improve the financial performance of agricultural businesses. 3. Evaluate capital investments using discounted cash flow methods. 4. Describe and analyze the risk and returns faced by agricultural businesses. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

AGEC Departmental Selectives (17 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of

differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (16-17 credits)

Supplemental List

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in

achieving efficiency and equity. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12.

Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional

conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career.

Credits: 3.00

15 Credits

Spring 3rd Year

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

15 Credits

Fall 4th Year

AGEC 42500 - Estate Planning And Property Transfer

Credit Hours: 3.00. The ownership and transfer of farm business property. Includes tax and other implications of life estates, trust arrangements, sale of property, and charitable contributions.

Credits: 3.00

AGEC 45600 - Federal Income Tax Law

Credit Hours: 3.00. Introduction to the federal income tax laws applicable to individuals and small business with emphasis on the farming business. The course includes management implications and the policy basis for the tax law system. Techniques and practice for the preparation of selected forms will be included. There will be limited exposure to taxation of partnerships, corporations, estates, and to federal gift and estate tax law.

Learning Outcomes: 1. Develop an understanding of the federal income tax law: for individuals and small businesses and for economic and financial decision making. 2. Gain an understanding of the management opportunities for the income tax law and how they can be applied by individuals, families, and small businesses. 3. Develop the ability to analyze facts for tax law alternatives and to communicate tax planning alternatives. Credits: 3.00

15 Credits

Spring 4th Year

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 52400 - Agricultural Finance

Credit Hours: 3.00. Designed to provide students the concepts and tools to apply financial management principles to farm businesses. Topics include financing alternatives, preparation and interpretation of financial statements, and capital investment analysis using discounted cash flows.

Learning Outcomes: 1. Prepare, interpret, and analyze financial statements used for agricultural businesses. 2. Analyze and suggest methods to improve the financial performance of agricultural businesses. 3. Evaluate capital investments using discounted cash flow methods. 4. Describe and analyze the risk and returns faced by agricultural businesses. Credits: 3.00

13-14 Credits

Agribusiness: Agricultural Marketing Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (60 credits)

Required Major Courses (25 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.

Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging

from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9.

Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

Agricultural Marketing Concentration Courses (15 credits)

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

AGEC Departmental Selectives (20 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem

of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (16-17 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as

unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create

visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the

design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures

and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

15 Credits

Spring 4th Year

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

13-14 Credits

Agribusiness: Food Marketing Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (59 credits)

Required Major Courses (25 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as

unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present

and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to

analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

Food Marketing Concentration Courses (17 credits)

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 33300 - Food Distribution - A Retailing Perspective

Credit Hours: 3.00. Distribution factors that affect the food industry. Particular attention to the food wholesaling and retailing sectors. Presentation of economic tools to evaluate performance in the food industry. Discussion of the relative importance of each of the major departments in the modern supermarket. Discussion of current and future industry prototypes.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific

method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

FS 24500 - Food Packaging

Credit Hours: 1.00. Elements of packaging science and technology applied to preservation, distribution, and marketing of food products; packaging materials; principles of diffusion and permeability; procedures for developing, evaluating, and testing food packages; packaging requirements for specific types of foods; other special topics of current interest.

Learning Outcomes: 1. Appreciate the important role that packaging plays in today's sophisticated food processing operations, its effect on final product quality and self-life, and its influence on distribution methods and marketing related decisions. 2. Understand the basic packaging materials and the technology to produce food packages. 3. Understand basic concepts of diffusion, permeation, and migration, especially as they relate to package properties, food quality, and product shelf-life. 4. Develop general guidelines for selecting appropriate packaging materials to fit the needs of specific food products. 5. Have a general appreciation of the methods used to test and evaluate packaging materials for specific properties and whole containers for integrity, suitability, and overall performance. 6. Intelligently discuss current food packaging related topics (i.e. package

degradability/recyclability, tamper evident/proof packaging, modified atmosphere packaging, aseptic packaging, microwaveable packaging, etc.) Credits: 1.00

FS 34000 - Introduction To Food Law And Regulations

Credit Hours: 1.00. This course will cover basic knowledge and familiarity of the principal law and regulations governing raw and processed foods. Class meets during weeks 1-5.

Learning Outcomes: 1. To gain a basic knowledge and familiarity of the principal laws and regulations governing raw and processed foods. 2. To develop an understanding of the law's core - adulteration and misbranding. 3. To learn basic food labeling and health claim regulations. 4. To obtain a working knowledge of US food law and promulgated regulations, current issues concerning food regulations, and how to obtain further information for specific regulatory problems. Credits: 1.00

AGEC Departmental Selectives (17 credits)

Other Departmental /Program Course Requirements (43-44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and

solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial

statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (17-18 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level

required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations.
Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

FS 24500 - Food Packaging

Credit Hours: 1.00. Elements of packaging science and technology applied to preservation, distribution, and marketing of food products; packaging materials; principles of diffusion and permeability; procedures for developing, evaluating, and testing food packages; packaging requirements for specific types of foods; other special topics of current interest.

Learning Outcomes: 1. Appreciate the important role that packaging plays in today's sophisticated food processing operations, its effect on final product quality and self-life, and its influence on distribution methods and marketing related decisions. 2. Understand the basic packaging materials and the technology to produce food packages. 3. Understand basic concepts of diffusion, permeation, and migration, especially as they relate to package properties, food quality, and product shelf-life. 4. Develop general guidelines for selecting appropriate packaging materials to fit the needs of specific food products. 5. Have a general appreciation of the methods used to test and evaluate packaging materials for specific properties and whole containers for integrity, suitability, and overall performance. 6. Intelligently discuss current food packaging related topics (i.e. package degradability/recyclability, tamper evident/proof packaging, modified atmosphere packaging,

aseptic packaging, microwaveable packaging, etc.) Credits: 1.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different

aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

15 Credits

Spring 3rd Year

AGEC 33300 - Food Distribution - A Retailing Perspective

Credit Hours: 3.00. Distribution factors that affect the food industry. Particular attention to the food wholesaling and retailing sectors. Presentation of economic tools to evaluate performance in the food industry. Discussion of the relative importance of each of the major departments in the modern supermarket. Discussion of current and future industry prototypes.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience

and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

FS 34000 - Introduction To Food Law And Regulations

Credit Hours: 1.00. This course will cover basic knowledge and familiarity of the principal law and regulations governing raw and processed foods. Class meets during weeks 1-5.

Learning Outcomes: 1. To gain a basic knowledge and familiarity of the principal laws and regulations governing raw and processed foods. 2. To develop an understanding of the law's core - adulteration and misbranding. 3. To learn basic food labeling and health claim regulations. 4. To obtain a working knowledge of US food law and promulgated regulations, current issues concerning food regulations, and how to obtain further information for specific regulatory problems. Credits: 1.00

16 Credits

Fall 4th Year

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

12 Credits

Spring 4th Year

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

14-15 Credits

Agricultural Communication, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (21 credits)

Required Major Courses (21 credits)

ASEC 48000 - Agricultural Communication Capstone Seminar

Credit Hours: 3.00. Prepares graduating students for entry to the workplace, assesses and enhances their communication knowledge and skills, and provides project experiences that will

demonstrate their ability to communicate scientific and technical information through a variety of media. Projects will include student presentations and magazine style articles on issues of concern to agricultural and general audiences; and a final project that requires students to conceive and create a web site that uses converging media to communicate effectively a topical issue.

Learning Outcomes: 1. Display mastery in the art of communicating science (agriculture, health, or environmental science) in explanatory writing form for non-technical audiences. 2. Conduct interviews, organize and produce professional-quality writing products. 3. Quickly assemble content, seek approvals and make revisions under tight deadlines. 4. Gather data and analyze audiences. 5. Work with a team to identify effective communication goals; determine communications resources and coordinate those for strategic outcomes. 6. Develop creative products for professional portfolios to showcase communication expertise and assist in the job search. Credits: 3.00

ASEC 15200 - Agricultural Communication Seminar

Credit Hours: 3.00. This course provides an introduction to agricultural communication as a professional field, including its current status and role within the larger U.S. mass media system. The course will also provide an overview of career options and professional skills and competencies required of agricultural communicators.

Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC) Credits: 3.00

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

ASEC 25000 - Storytelling For Professional Communication

Credit Hours: 3.00. In this course students will develop skills to help them develop and produce professional-quality narratives for a variety of professional communication applications, including content creation, marketing, and advocacy. Students will understand how to identify, focus, and structure stories and messages that resonate with audiences and help them achieve practical communication goals. The work students produce will include both written and visual components.

Learning Outcomes: 1. Focus stories for effective results. 2. Structure ideas to create consistently compelling stories. 3. Apply storytelling principles to written media and understand how they apply to other media, such as photography, video, and audio. 4. Know when and how to use storytelling techniques to inform, market, and advocate to various audiences. 5. Demonstrate professionalism and professional "improvisation." Credits: 3.00

Other Departmental/Program Course Requirements (90-94 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12100 - Introduction To Agricultural Sciences Education And Communication Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Sciences Education and Communication which includes Agricultural Communication and Agricultural Education. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 20100 - Communicating Across Culture (UCC: BSS/IL)

Credit Hours: 3.00. This course will provide students with an opportunity to understand their place in a multicultural, multiethnic, multinational country, the United States. It is designed to provide an academic overview of the field of multicultural education as it evolved to this day. The course will offer an introductory overview of the many differences that exist within all human beings. Because the diversity among

individuals is endless, we cannot study all differences, but will study a sampling such as race, ethnicity, gender identity, age, social class, disability, learning styles, and religion/spiritual orientation. Issues of poverty, language, and social justice may also be examined in relationship to the above major areas of emphasis.

University Core Curriculum (UCC): (UCC: BSS/IL) Credits: 3.00

ASEC 49100 - Special Topics In Agricultural Science And Education Communication

Credit Hours: 1.00 to 3.00. Designed for specialized topic areas for which there is no specific course, but have enough student interest to justify formalized teaching of an undergraduate-level course. The course may be repeated by a student as long as the topic being taught is not repeated. The specific topic that is offered will be indicated on the student's record. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those

choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ASEC 59500 - Internship In Agricultural Sciences Education And Communication

Credit Hours: 1.00 to 10.00. A special course designed to provide practical field experience under professional supervision in selected situation related to the student's area of specialization. Amount of credit to be determined by the nature and extent of the assignment. To be arranged with the instructor of departmental representative prior to registering. Permission of instructor required.

Learning Outcomes: 1. Explore components of Purdue Extension or other agricultural entities. 2. Participate in activities, projects, and programs of Purdue Extension or other agricultural entities. 3. Reflect on organizational philosophy, structure, and outcomes. Credits: 1.00 to 10.00

ASEC 35500 - Controversial Science And Media In The Public Sphere (UCC: HUM/STS)

Credit Hours: 3.00. This course will utilize case studies of controversial science news to explore the multiple factors that converge to influence how science and technology become controversial issues across a variety of social/ political domains. In addition to foundational understanding of communication theory, students will develop two primary skills: 1) a structure for the critical analysis of science news, 2) the skills to meaningfully communicate across stakeholders. The science content (GMOs, climate change, pesticide use, etc.) will provide the background information for analysis of the main focus of the course, which is in learning the communication process for effectively communicating science to non-science audiences. Case studies and applied critical media theory will be utilized to explore such controversies as climate change, genetically modified foods, and other emergent science controversies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Evaluate forces shaping public understanding of/and engagement with/science, including the role of technology in misinformation (fake news, bots, algorithms, misinformation campaigns, and propaganda) and the role of commercial funding of media. 2. Able to critically analyze media reports of science issues including: Types of Journalism, Levels of Completeness, and Evidence within the story. 3. Apply reliable evidence from your critical news analysis to your projects. 4. Identify and analyze prominent and recurrent patterns in the communication of controversial issues. 5. Apply the skills learned to communicate controversial science to a non-science audience. 6. Critically evaluate the evolving role of media in shaping understanding of science across democratic societies. 7. Know content (quizzes and reflection papers). 8. Process Knowledge (Discussion and applied projects). 9. Use integrated knowledge to meaningfully critique others work. 10.

Demonstrate process comprehension through construction of a critical news analysis of a current controversial issue. Credits: 3.00

ASEC 28000 - Digital Storytelling

Credit Hours: 3.00. Students will plan, shoot, and edit videos; collaborate in teams; plan and generate social media; and write feature pieces for digital platforms. Students will gain meaningful digital storytelling experiences that will enhance their understanding of various platforms and build their professional portfolios.

Learning Outcomes: 1. Develop compelling, audience-appropriate written and video feature stories for online platforms. This requires critical thinking (for planning, audience analysis, etc.), knowledge (effective storytelling techniques), and communication (must collaborate with classmates to coordinate topics and schedules). 2. Plan and integrate social media strategies into your work. This requires critical thinking (must plan ahead to include these pieces from the beginning of the project, must analyze audience), communication (must create and schedule effective, audience-relevant posts), and communication (must collaborate with classmates to coordinate posts and schedules). 3. Develop projects that meet a client's expectations and communication goals. This requires communication (with the client and source), knowledge (of effective interviewing and shooting principles), and critical thinking (to determine what audiences want to know and assess what they may already know). 4. Communicate science topics to lay audiences. This requires communication (to translate sometimes difficult subjects in ways that even elementary age audiences will understand), critical thinking (to determine what should and should not be covered), and knowledge (of effective video storytelling techniques). 5. Collaborate effectively with others. This requires communication (with colleagues all topics and schedules) and ethics (to be reliable team members who are just as responsible to each other as to themselves). 6. Reflect the diversity of the community you report on. This requires ethics (students must ensure that their work is diverse and inclusive) and critical thinking (students must be aware of when their work does not reflect the diversity of the population they serve). Credits: 3.00

ASEC 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices,

etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ASEC 30100 - Building Intercultural Partnerships (UCC: HUM)

Credit Hours: 3.00. This course uses a combination of readings, videos, experiential activities, presentations, and face-to-face & virtual excursions/engagement with "other/different" international cultural groups to deepen students' ownership of their own learning and to identify and understand both similarities and differences in values and social norms across countries and cultures. Students will enhance their intercultural communication skills, their emotional resilience, and their ability to engage effectively and equitably in conversations and partnerships with people from other countries and cultures.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate that you recognize the relevance of the learning process and the roles you and other play in that process. 2. Recognize and participate in cultural differences in verbal and nonverbal communication and begin to appropriately engage with people from other countries and cultures to negotiate a shared understanding based on those differences. 3. Recognize your own strengths and understand both the values and social norms across countries and cultures and challenges in adapting and adjusting under stress, and identify practices and techniques for managing your emotions. 4. Analyze substantial connections between the worldviews, experiences, and power structures of multiple cultural groups while incorporating respectful interactions with them. Credits: 3.00

ASEC 55000 - Program Evaluation In Formal And Non-formal Settings

Credit Hours: 3.00. The purpose of this course it to provide a basic understanding of program evaluation processes, concepts, and theories and to develop expertise needed to

design and conduct systematic evaluation of formal and non-formal programs.

Learning Outcomes: 1. Acquire basic knowledge and skills in program evaluation. 2. Understand key components of various evaluation models/frameworks and identify their strengths and weaknesses. 3. Apply evaluation knowledge and skills to plan, implement, and evaluate a program. 4. Develop knowledge and skills, (including writing skills) to critically evaluate a published evaluation study. 5. Understand the various phases of evaluation from beginning to end, including evaluation utilization of evaluation results. 6. Develop expertise in presenting evaluation results and outcomes to key stakeholders. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations

in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical

and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (5-9 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12100 - Introduction To Agricultural Sciences Education And Communication Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Sciences Education and Communication which includes Agricultural Communication and Agricultural Education. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

ASEC 15200 - Agricultural Communication Seminar

Credit Hours: 3.00. This course provides an introduction to agricultural communication as a professional field, including its current status and role within the larger U.S. mass media system. The course will also provide an overview of career options and professional skills and competencies required of agricultural communicators.

Credits: 3.00

14-15 Credits

Spring 1st Year

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application

problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-17 Credits

Fall 2nd Year

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or

validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

ASEC 25000 - Storytelling For Professional Communication

Credit Hours: 3.00. In this course students will develop skills to help them develop and produce professional-quality narratives for a variety of professional communication applications, including content creation, marketing, and advocacy. Students will understand how to identify, focus, and structure stories and messages that resonate with audiences and help them achieve practical communication goals. The work students produce will include both written and visual components.

Learning Outcomes: 1. Focus stories for effective results. 2. Structure ideas to create consistently compelling stories. 3. Apply storytelling principles to written media and understand how they apply to other media, such as photography, video, and audio. 4. Know when and how to use storytelling techniques to inform, market, and advocate to various audiences. 5. Demonstrate professionalism and professional "improvisation." Credits: 3.00

14-16 Credits

Spring 2nd Year

AGR 20100 - Communicating Across Culture (UCC: BSS/IL)

Credit Hours: 3.00. This course will provide students with an opportunity to understand their place in a multicultural, multiethnic, multinational country, the United States. It is designed to provide an academic overview of the field of multicultural education as it evolved to this day. The course will offer an introductory overview of the many differences that exist within all human beings. Because the diversity among individuals is endless, we cannot study all differences, but will study a sampling such as race, ethnicity, gender identity, age, social class, disability, learning styles, and religion/spiritual orientation. Issues of poverty, language, and social justice may also be examined in relationship to the above major areas of emphasis.

University Core Curriculum (UCC): (UCC: BSS/IL) Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC) Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

15-17 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors

and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 3rd Year

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

15 Credits

Fall 4th Year

ASEC 48000 - Agricultural Communication Capstone Seminar

Credit Hours: 3.00. Prepares graduating students for entry to the workplace, assesses and enhances their communication knowledge and skills, and provides project experiences that will demonstrate their ability to communicate scientific and technical information through a variety of media. Projects will include student presentations and magazine style articles on issues of concern to agricultural and general audiences; and a final project that requires students to conceive and create a web site that uses converging media to communicate effectively a topical issue.

Learning Outcomes: 1. Display mastery in the art of communicating science (agriculture, health, or environmental science) in explanatory writing form for non-technical audiences. 2. Conduct interviews, organize and produce professional-quality writing products. 3. Quickly assemble content, seek approvals and make revisions under tight deadlines. 4. Gather data and analyze audiences. 5. Work with a team to identify effective communication goals; determine communications resources and coordinate those for strategic outcomes. 6. Develop creative products for professional portfolios to showcase communication expertise and assist in the job search. Credits: 3.00

15 Credits

Spring 4th Year

14-16 Credits

Agricultural Economics: Applied Agricultural Economics

Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (54 credits)

Major Required Courses (13 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization.

4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic

phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

Applied Agricultural Economics Concentration Courses (21 credits)

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC Departmental Selectives (20 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic

statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (22-23 credits)

Supplemental List

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and

regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon

which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 2nd Year

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the

statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

13-14 Credits

Agricultural Economics: Policy

and Pre-Law Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (54 credits)

Major Required Courses (13 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization.

4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic

phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

Policy and Pre-Law Concentration Courses (24 credits)

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 37500 - The Process Of Economic Research

Credit Hours: 1.00. This course is a study of the process of conducting economic research. The course examines the research problem and objectives, literature review, conceptual framework, methods and procedures, and reporting research. Students will identify a research topic and project advisor. For Honors program students only in Agricultural Economics. Permission of instructor required.

Learning Outcomes: 1. Understand and appreciate the process of conducting economic research. 2. Develop a research plan of work for an honors thesis. 3. Discuss your research and the research of others. Credits: 1.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn

how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

AGEC Departmental Selectives (17 credits)

Other Departmental/Program Course Requirements (43 - 44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7.

Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the

statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (22-23 credits)

Supplemental List

Course Requirements and Notes

Sample 4-year plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem

of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3.

Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 37500 - The Process Of Economic Research

Credit Hours: 1.00. This course is a study of the process of conducting economic research. The course examines the research problem and objectives, literature review, conceptual framework, methods and procedures, and reporting research. Students will identify a research topic and project advisor. For Honors program students only in Agricultural Economics. Permission of instructor required.

Learning Outcomes: 1. Understand and appreciate the process of conducting economic research. 2. Develop a research plan of work for an honors thesis. 3. Discuss your research and the research of others. Credits: 1.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret

the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3.

Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

14 Credits

Spring 3rd Year

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

15 Credits

Fall 4th Year

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

15 Credits

Spring 4th Year

13-14 Credits

Agricultural Economics: Quantitative Data Analytics Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (54 credits)

Required Major Courses (13 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information

contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

Quantitative Data Analytics Concentration Courses (24 credits)

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 37500 - The Process Of Economic Research

Credit Hours: 1.00. This course is a study of the process of conducting economic research. The course examines the research problem and objectives, literature review, conceptual framework, methods and procedures, and reporting research. Students will identify a research topic and project advisor. For Honors program students only in Agricultural Economics. Permission of instructor required.

Learning Outcomes: 1. Understand and appreciate the process of conducting economic research. 2. Develop a research plan of work for an honors thesis. 3. Discuss your research and the research of others. Credits: 1.00

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

AGR 33300 - Data Science For Agriculture

Credit Hours: 3.00. Students will apply data processes including identifying data needs, acquiring data, assessing data quality, data wrangling, filtering, and visualization. In each of several topic areas (forestry, animal science, agronomy, food science, entomology, engineering, economics), data-driven insights and improved decision making will be the culmination of applied data skills. Students will understand data ethics and practice data management skills including the merging of disparate but related data sets.

Learning Outcomes: 1. Construct a research

question that helps address a decision. 2. Describe different types of experimental designs and discuss the differences between observational and experimental studies. 3. Identify data needed to address various research questions. 4. Identify how these data sources are used in data analysis: agronomics, machine data, maps, spreadsheets, sensor data. 5. Describe how various data sets are acquired. 6. Describe how the following impact data ethics: ownership, storage, access. 7. Assess data quality and utility. 9. Identify potential limitations of a dataset. 10. Describe the following aspects of data wrangling: data formats, data compatibility, mobility. 11. Describe the following aspects of data management: storage, curation, metadata, FAIR (findable, accessible, interoperable, reusable). 12. List reasons for filtering, cleaning, and pre-processing data. 13. Describe tools for data cleaning. 14. Integrate disparate data sets. 15. Describe uses for the following in data visualization: bar charts, line charts, maps, tables. 16. Use the following tools to analyze data: correlations, mean generation, confidence intervals, simple model building, R Python. 17. Make decisions based on data outcomes. Credits: 3.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 41100 - Corporate Partners VII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and

presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 41200 - Corporate Partners VIII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

AGEC Departmental Selectives (17 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and

regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression

procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (22-23 credits)

Sample 4-year plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 37500 - The Process Of Economic Research

Credit Hours: 1.00. This course is a study of the process of conducting economic research. The course examines the

research problem and objectives, literature review, conceptual framework, methods and procedures, and reporting research. Students will identify a research topic and project advisor. For Honors program students only in Agricultural Economics. Permission of instructor required.

Learning Outcomes: 1. Understand and appreciate the process of conducting economic research. 2. Develop a research plan of work for an honors thesis. 3. Discuss your research and the research of others. Credits: 1.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

AGR 33300 - Data Science For Agriculture

Credit Hours: 3.00. Students will apply data processes including identifying data needs, acquiring data, assessing data quality, data wrangling, filtering, and visualization. In each of several topic areas (forestry, animal science, agronomy, food science, entomology, engineering, economics), data-driven insights and improved decision making will be the culmination of applied data skills. Students will understand data ethics and practice data management skills including the merging of disparate but related data sets.

Learning Outcomes: 1. Construct a research question that helps address a decision. 2. Describe different types of experimental designs and discuss the differences between observational and experimental studies. 3. Identify data needed to address various research questions. 4. Identify how these data sources are used in data analysis: agronomics, machine data, maps, spreadsheets, sensor data. 5. Describe how various data sets are acquired. 6. Describe how the following impact data ethics: ownership, storage, access. 7. Assess data quality and utility. 9. Identify

potential limitations of a dataset. 10. Describe the following aspects of data wrangling: data formats, data compatibility, mobility. 11. Describe the following aspects of data management: storage, curation, metadata, FAIR (findable, accessible, interoperable, reusable). 12. List reasons for filtering, cleaning, and pre-processing data. 13. Describe tools for data cleaning. 14. Integrate disparate data sets. 15. Describe uses for the following in data visualization: bar charts, line charts, maps, tables. 16. Use the following tools to analyze data: correlations, mean generation, confidence intervals, simple model building, R Python. 17. Make decisions based on data outcomes. Credits: 3.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most

appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 41100 - Corporate Partners VII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

15-17 Credits

Spring 3rd Year

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 41200 - Corporate Partners VIII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

16 Credits

Fall 4th Year

12 Credits

Spring 4th Year

13-14 Credits

Notes

Agricultural Education, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (50 credits)

Required Major Courses (12 credits)

ASEC 31900 - Planning Agricultural Science And Business Programs

Credit Hours: 2.00. Development of course content plans that coordinate and utilize agricultural science and business, community resources, FFA, and supervised agricultural experience programs.

Learning Outcomes: 1. Explain the functions of an advisory committee. 2. Develop a philosophy/mission statement, vision, and goals. 3. Conduct a needs assessment. 4. Plan and implement strategies to build school and community support, including recruitment of students. 5. Describe the purpose of developing an effective FFA Program of Activities. 6. Describe the purpose and process of evaluating an agricultural education program. Credits: 2.00

ASEC 31800 - Coordination Of Supervised Agricultural Experience Programs

Credit Hours: 2.00. Record keeping and supervisory skills needed to advise and coordinate supervised agricultural experience programs for secondary agricultural science and business students. Integration of supervised agricultural experiences with programming in youth organizations and classroom instruction for secondary agricultural science and business classrooms.

Learning Outcomes: 1. Model a comprehensive design for school-based agricultural education.

2. Analyze Supervised Agricultural Experiences for learner career readiness. 3. Utilize a comprehensive record-keeping system. 4. Utilize student recognition tools such as FFA degree and proficiency applications. Credits: 2.00

ASEC 24000 - Seminar In Agricultural Education

Credit Hours: 1.00. Development of an understanding of the origin, scope, and objectives of agricultural education; role of the agricultural science and business teacher as a professional educator; basic responsibilities of a teacher of agricultural science and business; and significance of legislation affecting agricultural education.

Learning Outcomes: 1. Summarize the history, philosophy and aims of agricultural education. 2. Demonstrate small group communication through committee activities. 3. Practice the roles of an advisor to a student organization. 4. Evaluate self-awareness and understanding of own style of working with and relating to others and begin to make appropriate modifications. 5. Explain the importance of professional networks and the techniques to develop them. Credits: 1.00

ASEC 44000 - Methods Of Teaching Agricultural Education

Credit Hours: 3.00. Principles and procedures for teaching agricultural science and business in public schools. Must be admitted to teacher education program.

Learning Outcomes: 1. Describe the role of the instructor in the learning process, including characteristics of effective instructors and teaching. 2. Identify factors affecting individual learner differences. 3. Prepare lesson plans which address diversity in student populations. 4. Correctly demonstrate the use of the teacher-centered, social interaction, and student-centered learning activities within the agricultural education setting. 5. Develop and teach lessons using appropriate learning activities which build learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 6. Select appropriate educational technology to enhance learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 7. Design lessons which incorporate the use of agricultural teaching laboratories and/or equipment. Credits: 3.00

ASEC 34000 - Laboratory Practices In Agricultural Education

Credit Hours: 2.00. This course is designed to introduce pre-service agricultural education teachers to laboratory integration into the agricultural education curriculum at the middle school and secondary school level. Emphasis is placed on laboratory safety, skill acquisition, developing knowledge of laboratory components in Agriscience, laboratory utilization, facilitating student learning in the laboratory setting, appropriate teaching methods and techniques, curriculum applications, and classroom resources. Travel to on and off-campus sites will be required.

Learning Outcomes: 1. Facilitate learning in agricultural teaching laboratory settings. 2. Utilize resources in agricultural teaching laboratory settings. 3. Practice safe procedures with agricultural teaching laboratory equipment, supplies, and materials. Credits: 2.00

ASEC 34100 - Curriculum Development In Agricultural Education

Credit Hours: 2.00. This course is designed to expose students to appropriate teaching techniques, curricula and resources within agricultural education. Procedures for designing, implementing, and evaluating curriculum will be examined. Emphasis will be placed on new and emerging areas in agriculture, food, and natural resources.

Learning Outcomes: 1. Design curriculum for instruction in agriculture, food, and natural resources. 2. Implement curriculum for instruction in agriculture, food, and natural resources. 3. Evaluate curriculum for instruction in agriculture, food, and natural resources. Credits: 2.00

Professional Education Requirements (38 credits)

Professional Education Courses (23 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach

appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich

relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Professional Education Capstone Course (12 credits)

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

Other Departmental /Program Course Requirements (78-79 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 20100 - Construction And Maintenance

Credit Hours: 3.00. Fundamental principles in the selection and use of tools for the construction and maintenance of agricultural and related facilities, equipment, and machines. Areas covered include small engines, concrete and masonry, wood, plumbing, electricity, and metal.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 44100 - Methods Of Teaching Agricultural Mechanics

Credit Hours: 2.00. Emphasis on facilities, shop layout, organization, course planning, and demonstrations. Course meets during weeks 8-16. For students seeking career opportunities, certification, and instructional skill of educating others in agricultural mechanics and engineering technology utilizing a hands-on problem--solving approach. Students shall develop skills necessary to educate youth, employees, and/or consumers about complex agricultural systems. Special emphasis will be given to developing materials for kinesthetic learners.

Learning Outcomes: 1. Integrate S.T.E.M. approach in teaching and demonstrations of agricultural mechanics. 2. Develop hands-on demonstrations around agricultural technology and mechanics. 3. Analyze approaches to educational learning objectives. 4. Apply basic principles of agricultural technology and mechanics operations management. 5. Understand and apply the basic principles of creating a safe educational environment (hazard awareness). 6. Estimate project materials, cost, and layout for hands-on learning. Credits: 2.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12100 - Introduction To Agricultural Sciences Education And Communication Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Sciences Education and Communication which includes Agricultural Communication and Agricultural Education. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course

produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription,

protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to

construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water

pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

HORT 21200 - Greenhouse And Landscape Fundamentals For Educators

Credit Hours: 3.00. (ASEC 21200) This course will prepare future educators in using a greenhouse and landscape as teaching tools. The key focus will be preparing students to apply greenhouse and landscape management fundamentals in order to teach these concepts in the classroom. Laboratories will explore how to identify and produce both woody and herbaceous plants while safely maintaining and operating greenhouse technologies. Students will also explore how to implement landscape design technologies and identify tools, equipment, and landscape plants. Permission of instructor required.

Learning Outcomes: 1. Identify and apply basic propagation techniques. 2. Identify and describe plant species specific to greenhouse and landscape plantings. 3. Interpret funding for greenhouses, greenhouse technologies, and landscape design equipment. 4. Apply IPM, irrigation, and propagation techniques while safely maintaining and operating a greenhouse. 5. Analyze and utilize landscape design software and tools to design a landscape. Credits: 3.00

GPA Requirements

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12100 - Introduction To Agricultural Sciences Education And Communication Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Sciences Education and Communication which includes Agricultural Communication and Agricultural Education. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how

they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ASEC 24000 - Seminar In Agricultural Education

Credit Hours: 1.00. Development of an understanding of the origin, scope, and objectives of agricultural education; role of the agricultural science and business teacher as a professional educator; basic responsibilities of a teacher of agricultural science and business; and significance of legislation affecting agricultural education.

Learning Outcomes: 1. Summarize the history, philosophy and aims of agricultural education. 2. Demonstrate small group communication through committee activities. 3. Practice the roles of an advisor to a student organization. 4. Evaluate self-awareness and understanding of own style of working with and relating to others and begin to make appropriate modifications. 5. Explain the importance of professional networks and the techniques to develop them. Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete

the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in

diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

16 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural

resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

17 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate

and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

ASEC 31900 - Planning Agricultural Science And Business Programs

Credit Hours: 2.00. Development of course content plans that coordinate and utilize agricultural science and business, community resources, FFA, and supervised agricultural experience programs.

Learning Outcomes: 1. Explain the functions of an advisory committee. 2. Develop a philosophy/mission statement, vision, and goals. 3. Conduct a needs assessment. 4. Plan and implement strategies to build school and community support, including recruitment of students. 5. Describe the purpose of developing an effective FFA Program of Activities. 6. Describe the purpose and process of evaluating an agricultural education program. Credits: 2.00

ASEC 31800 - Coordination Of Supervised Agricultural Experience Programs

Credit Hours: 2.00. Record keeping and supervisory skills needed to advise and coordinate supervised agricultural experience programs for secondary agricultural science and business students. Integration of supervised agricultural experiences with programming in youth organizations and classroom instruction for secondary agricultural science and business classrooms.

Learning Outcomes: 1. Model a comprehensive design for school-based agricultural education. 2. Analyze Supervised Agricultural Experiences for learner career readiness. 3. Utilize a comprehensive record-keeping system. 4. Utilize student recognition tools such as FFA degree and proficiency applications. Credits: 2.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 21200 - Greenhouse And Landscape Fundamentals For Educators

Credit Hours: 3.00. (ASEC 21200) This course will prepare future educators in using a greenhouse and landscape as teaching tools. The key focus will be preparing students to apply greenhouse and landscape management fundamentals in order to teach these concepts in the classroom. Laboratories will explore how to identify and produce both woody and herbaceous plants while safely maintaining and operating greenhouse technologies. Students will also explore how to implement landscape design technologies and identify tools, equipment, and landscape plants. Permission of instructor required.

Learning Outcomes: 1. Identify and apply basic propagation techniques. 2. Identify and describe plant species specific to greenhouse and landscape plantings. 3. Interpret funding for greenhouses, greenhouse technologies, and landscape design equipment. 4. Apply IPM, irrigation, and propagation techniques while safely maintaining and operating a greenhouse. 5. Analyze and utilize landscape design software and tools to design a landscape. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal

and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify

differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

17 Credits

Fall 3rd Year

ASM 20100 - Construction And Maintenance

Credit Hours: 3.00. Fundamental principles in the selection and use of tools for the construction and maintenance of agricultural and related facilities, equipment, and machines. Areas covered include small engines, concrete and masonry, wood, plumbing, electricity, and metal.

Credits: 3.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

ASEC 34000 - Laboratory Practices In Agricultural Education

Credit Hours: 2.00. This course is designed to introduce pre-service agricultural education teachers to laboratory integration into the agricultural education curriculum at the middle school and secondary school level. Emphasis is placed on laboratory safety, skill acquisition, developing knowledge of laboratory components in Agriscience, laboratory utilization, facilitating student learning in the laboratory setting, appropriate teaching methods and techniques, curriculum applications, and classroom resources. Travel to on and off-campus sites will be required.

Learning Outcomes: 1. Facilitate learning in agricultural teaching laboratory settings. 2. Utilize resources in agricultural teaching laboratory settings. 3. Practice safe procedures with agricultural teaching laboratory equipment, supplies, and materials. Credits: 2.00

16 Credits

Spring 3rd Year

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 44100 - Methods Of Teaching Agricultural Mechanics

Credit Hours: 2.00. Emphasis on facilities, shop layout, organization, course planning, and demonstrations. Course meets during weeks 8-16. For students seeking career opportunities, certification, and instructional skill of educating others in agricultural mechanics and engineering technology utilizing a hands-on problem--solving approach. Students shall develop skills necessary to educate youth, employees, and/or consumers about complex agricultural systems. Special emphasis will be given to developing materials for kinesthetic learners.

Learning Outcomes: 1. Integrate S.T.E.M. approach in teaching and demonstrations of agricultural mechanics. 2. Develop hands-on demonstrations around agricultural technology and mechanics. 3. Analyze approaches to educational learning objectives. 4. Apply basic principles of agricultural technology and mechanics operations management. 5. Understand and apply the basic principles of creating a safe educational environment (hazard awareness). 6. Estimate project materials, cost, and layout for hands-on learning. Credits: 2.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

ASEC 34100 - Curriculum Development In Agricultural Education

Credit Hours: 2.00. This course is designed to expose students to appropriate teaching techniques, curricula and resources within agricultural education. Procedures for designing, implementing, and evaluating curriculum will be examined. Emphasis will be placed on new and emerging areas in agriculture, food, and natural resources.

Learning Outcomes: 1. Design curriculum for instruction in agriculture, food, and natural resources. 2. Implement curriculum for instruction in agriculture, food, and natural resources. 3. Evaluate curriculum for instruction in agriculture, food, and natural resources. Credits: 2.00

17 Credits

Fall 4th Year

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for

building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

ASEC 44000 - Methods Of Teaching Agricultural Education

Credit Hours: 3.00. Principles and procedures for teaching agricultural science and business in public schools. Must be admitted to teacher education program.

Learning Outcomes: 1. Describe the role of the instructor in the learning process, including characteristics of effective instructors and teaching. 2. Identify factors affecting individual learner differences. 3. Prepare lesson plans which address diversity in student populations. 4. Correctly demonstrate the use of the teacher-centered, social interaction, and student-centered learning activities within the agricultural education setting. 5. Develop and teach lessons using appropriate learning activities which build learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 6. Select appropriate educational technology to enhance learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 7. Design lessons which incorporate the use of agricultural teaching laboratories and/or equipment. Credits: 3.00

18 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Agricultural Engineering, BSAGE

About the Program

Degree Requirements

Departmental/Program Major Courses (34 credits)

Required Major Courses (34 credits)

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics,

materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS)
Credits: 1.00

ABE 30500 - Physical Properties Of Biological Materials

Credit Hours: 3.00. Physical properties of agricultural crops and food products and their relationship to harvesting, storage, and processing. Physical properties covered include: density, shape, moisture content, water potential, water activity, friction and flow or particulate solids, terminal velocity, thermal properties, interaction with electromagnetic radiation, and viscoelastic behavior of solids.

Credits: 3.00

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 32000 - Solid Modeling, Simulation, And Analysis

Credit Hours: 3.00. Introduction to parametric, feature-based solid modeling; dimensioned 2D and 3D engineering drawings; tolerancing; mechanical dynamic simulation; kinematic models, analysis and simulation of simple linkages and complex systems; mechanism design and evaluation; visualization and animation of results; interfacing of computer aided engineering software. Projects involving industrial parts and assemblies will be discussed and assigned.

Credits: 3.00

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired goal subject to constraints. Credits: 4.00

ABE 33000 - Design Of Machine Components

Credit Hours: 3.00. Introduction to design; stress analysis; deformation and stiffness considerations; static and fatigue strength design; design of components of the food processing, farm and off-highway machines, and mechanical systems.

Credits: 3.00

ABE 43500 - Hydraulic Control Systems For Mobile Equipment

Credit Hours: 3.00. Design of basic fluid power components and systems. Includes power steering, hydrostatic and hydromechanical transmission, electrohydraulic servo valves, servomechanism, and manually controlled systems.

Credits: 3.00

ABE 45000 - Computational Modeling And Data Analysis In Agricultural Engineering

Credit Hours: 3.00. The course is divided into three sections. Students will (1) learn about first and second-order dynamic systems, block diagrams, modeling of mechanical and electrical systems, and control theory while using Matlab and Simulink for modeling; (2) Learn about numerical methods for modeling of continuum mechanics and transport phenomena including finite element method and finite difference method. Applications in heat transfer, fluid flow, and solid mechanics will be studied in the computer lab; (3) Learn about data analysis topics including statistical models, probability theory, regression analysis, classification techniques, and machine learning.

Learning Outcomes: 1. Understand the fundamentals of dynamic systems modeling. 2. Create block diagram models for mechanical and electrical systems. 3. Understand control theory concepts and use it to design controllers. 4. Understand the fundamentals of finite element method and finite difference method including 1-D and 2-D formulations, boundary conditions, and postprocessing. 5. Use a major FEA software tool. 6. Evaluate the accuracy of the results. 7. Understand probability theory and regression analysis. 8. Explore classification techniques and machine learning concepts. 9. Apply data analysis skills to real-world datasets. Credits: 3.00

ABE 48400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Credits: 1.00

ABE 48600 - Agricultural Engineering Design

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ABE 48400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive design report and/or project reports for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams with consultation available to students from government and industry engineers and marketing personnel. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering or project management practice with

professionalism and ethical responsibility.
Credits: 3.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

Other Departmental/Program Course Requirements (91-101 credits)

Other Departmental Course Requirements (62 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and

eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and fundamental concepts to measuring and analyzing fluid systems and flows. 3. Learn a laboratory design project on a flow system reinforces the design process. Credits: 1.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and

control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

Elective (0-3 credits)

Supplemental Information

Transfer Credit Policy

Sample 4-Year Plan

Fall 2nd Year

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS)
Credits: 1.00

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

17 Credits

Spring 2nd Year

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about

the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

17 Credits

Fall 3rd Year

ABE 30500 - Physical Properties Of Biological Materials

Credit Hours: 3.00. Physical properties of agricultural crops and food products and their relationship to harvesting, storage, and processing. Physical properties covered include: density, shape, moisture content, water potential, water activity, friction and flow or particulate solids, terminal velocity, thermal properties, interaction with electromagnetic radiation, and viscoelastic behavior of solids.

Credits: 3.00

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired goal subject to constraints. Credits: 4.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of

this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and fundamental concepts to measuring and analyzing fluid systems and flows. 3. Learn a laboratory design project on a flow system reinforces the design process. Credits: 1.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

17 Credits

Spring 3rd Year

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 32000 - Solid Modeling, Simulation, And Analysis

Credit Hours: 3.00. Introduction to parametric, feature-based solid modeling; dimensioned 2D and 3D engineering drawings; tolerancing; mechanical dynamic simulation; kinematic models, analysis and simulation of simple linkages and complex systems; mechanism design and evaluation; visualization and animation of results; interfacing of computer aided engineering software. Projects involving industrial parts and assemblies will be discussed and assigned.

Credits: 3.00

ABE 33000 - Design Of Machine Components

Credit Hours: 3.00. Introduction to design; stress analysis; deformation and stiffness considerations; static and fatigue strength design; design of components of the food processing, farm and off-highway machines, and mechanical systems.

Credits: 3.00

16 Credits

Fall 4th Year

ABE 43500 - Hydraulic Control Systems For Mobile Equipment

Credit Hours: 3.00. Design of basic fluid power components and systems. Includes power steering, hydrostatic and hydromechanical transmission, electrohydraulic servo valves, servomechanism, and manually controlled systems.

Credits: 3.00

ABE 45000 - Computational Modeling And Data Analysis In Agricultural Engineering

Credit Hours: 3.00. The course is divided into three sections. Students will (1) learn about first and second-order dynamic

systems, block diagrams, modeling of mechanical and electrical systems, and control theory while using Matlab and Simulink for modeling; (2) Learn about numerical methods for modeling of continuum mechanics and transport phenomena including finite element method and finite difference method. Applications in heat transfer, fluid flow, and solid mechanics will be studied in the computer lab; (3) Learn about data analysis topics including statistical models, probability theory, regression analysis, classification techniques, and machine learning.

Learning Outcomes: 1. Understand the fundamentals of dynamic systems modeling. 2. Create block diagram models for mechanical and electrical systems. 3. Understand control theory concepts and use it to design controllers. 4. Understand the fundamentals of finite element method and finite difference method including 1-D and 2-D formulations, boundary conditions, and postprocessing. 5. Use a major FEA software tool. 6. Evaluate the accuracy of the results. 7. Understand probability theory and regression analysis. 8. Explore classification techniques and machine learning concepts. 9. Apply data analysis skills to real-world datasets.
Credits: 3.00

ABE 48400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Credits: 1.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

14 Credits

Spring 4th Year

ABE 48600 - Agricultural Engineering Design

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ABE 48400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive design report and/or project reports for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams with consultation available to students from government and industry engineers and marketing personnel. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering or project management practice with professionalism and ethical responsibility.
Credits: 3.00

13-15 Credits

Agricultural Systems Management, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (50-53 credits)

Required Major Courses (22 credits)

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include

firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand

professional and ethical responsibilities and put them into practice. Credits: 3.00

ASM (No Concentration) Courses (28-31 credits)

ASM Courses (12 credits)

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 24500 - Materials Handling And Processing

Credit Hours: 3.00. Principles of materials handling and processing. Physical properties and characteristics of food, fiber, and feed materials as related to harvesting, handling, processing, and storage. Processing of agricultural materials including drying, preservation, size reduction (e.g. grinding, crushing, shredding), mixing and blending, refrigeration, extrusion, and pelleting. Conveying and transport systems with consideration of their effects on damage and quality. The course elements are tied together by a treatment of scheduling and coordination of biologically based systems, which involve production, handling, quality control, and processing.

Credits: 3.00

ASM 34500 - Power Units And Power Trains

Credit Hours: 3.00. An introduction to power generation and transfer in mechanical and fluid power systems. Internal combustion engines, fuels, and cycles are introduced. Clutches, mechanical transmissions, automatic transmissions, hydrostatic transmissions, and final drives are discussed. Principles of hydraulics, fluids, cylinders, pumps, motors, valves, hoses, filters, reservoirs, and accumulators are studied.

Credits: 3.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6. Understand basics of circuits programmed using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop a general awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5. Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

ASM Selectives (16-19 credits)

Other Departmental/Program Course Requirements (67-70 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business

communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work

effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of

STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Supplemental Information

GPA Requirements

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary

functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

16 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

15-16 Credits

Fall 2nd Year

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

14 Credits

Spring 2nd Year

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis;

adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 24500 - Materials Handling And Processing

Credit Hours: 3.00. Principles of materials handling and processing. Physical properties and characteristics of food, fiber, and feed materials as related to harvesting, handling, processing, and storage. Processing of agricultural materials including drying, preservation, size reduction (e.g. grinding, crushing, shredding), mixing and blending, refrigeration, extrusion, and pelleting. Conveying and transport systems with consideration of their effects on damage and quality. The course elements are tied together by a treatment of scheduling and coordination of biologically based systems, which involve production, handling, quality control, and processing.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop a general awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5.

Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

13-15 Credits

Spring 3rd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community.

Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

ASM 34500 - Power Units And Power Trains

Credit Hours: 3.00. An introduction to power generation and transfer in mechanical and fluid power systems. Internal combustion engines, fuels, and cycles are introduced. Clutches, mechanical transmissions, automatic transmissions, hydrostatic transmissions, and final drives are discussed. Principles of hydraulics, fluids, cylinders, pumps, motors, valves, hoses, filters, reservoirs, and accumulators are studied.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6. Understand basics of circuits programmed using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and

transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16 Credits

Fall 4th Year

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

14 Credits

Spring 4th Year

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester

and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

13-16 Credits

Agricultural Systems Management: AgroSecurity, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (50-53 credits)

Required Major Courses (22 credits)

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or

instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

AgroSecurity Concentration Courses (28-31 credits)

AgroSecurity Concentration Courses (21 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 24500 - Materials Handling And Processing

Credit Hours: 3.00. Principles of materials handling and processing. Physical properties and characteristics of food, fiber, and feed materials as related to harvesting, handling, processing, and storage. Processing of agricultural materials including drying, preservation, size reduction (e.g. grinding, crushing, shredding), mixing and blending, refrigeration, extrusion, and pelleting. Conveying and transport systems with consideration of their effects on damage and quality. The course elements are tied together by a treatment of scheduling and coordination of biologically based systems, which involve production, handling, quality control, and processing.

Credits: 3.00

ASM 34500 - Power Units And Power Trains

Credit Hours: 3.00. An introduction to power generation and transfer in mechanical and fluid power systems. Internal combustion engines, fuels, and cycles are introduced. Clutches, mechanical transmissions, automatic transmissions, hydrostatic transmissions, and final drives are discussed. Principles of hydraulics, fluids, cylinders, pumps, motors, valves, hoses, filters, reservoirs, and accumulators are studied.

Credits: 3.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation

and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6. Understand basics of circuits programmed using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

ASM 51000 - Agrosecurity-Emergency Management For Agricultural Production Operations

Credit Hours: 3.00. Prepares individuals for management and loss control positions in agricultural production, agribusiness operations, and emergency management agencies. Addresses prevention, preparation, mitigation, response, and recovery from disasters such as fires, explosions, entrapments, tornadoes, floods, winter storms, earthquakes, vandalism, chemical releases, and bio-terrorism. Students complete a community service learning activity, in which they assist a farm or agribusiness manager in developing formal emergency preparedness plans.

Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop a general awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5. Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

ASM 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

ASM 51200 - Managing Resources and Applications for Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business

continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

Agrosecurity Concentration Selectives (7-10 credits)

ASM 59000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of the instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 6.00

TLI 35520 - Organization Development And Change

Credit Hours: 3.00. This course provides an introduction to major theories, concepts, skills and techniques for the practice of organization development processes and interventions using a consultancy approach. Implications for organizational change are integrated as part of an OD effort.

Learning Outcomes: 1. Describe the historical roots and theoretical underpinnings of organizational development. 2. Apply the action research model for professional practice. 3. Effectively participate in small groups. 4. Identify intervention strategies at the individual, small group, and large systems levels. 5. Conduct organization development analysis. Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

Other Departmental/Program Course Requirements (67-70 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-

making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts,

fences, and animal liability) and cases.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7.

Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services,

scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

16 Credits

Spring 1st Year

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

15-16 Credits

Fall 2nd Year

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

14 Credits

Spring 2nd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 24500 - Materials Handling And Processing

Credit Hours: 3.00. Principles of materials handling and processing. Physical properties and characteristics of food, fiber, and feed materials as related to harvesting, handling, processing, and storage. Processing of agricultural materials including drying, preservation, size reduction (e.g. grinding, crushing, shredding), mixing and blending, refrigeration, extrusion, and pelleting. Conveying and transport systems with consideration of their effects on damage and quality. The course elements are tied together by a treatment of scheduling and coordination of biologically based systems, which involve production, handling, quality control, and processing.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific

method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

ASM 34500 - Power Units And Power Trains

Credit Hours: 3.00. An introduction to power generation and transfer in mechanical and fluid power systems. Internal combustion engines, fuels, and cycles are introduced. Clutches, mechanical transmissions, automatic transmissions, hydrostatic transmissions, and final drives are discussed. Principles of hydraulics, fluids, cylinders, pumps, motors, valves, hoses, filters, reservoirs, and accumulators are studied.

Credits: 3.00

ASM 59000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of the instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 6.00

TLI 35520 - Organization Development And Change

Credit Hours: 3.00. This course provides an introduction to major theories, concepts, skills and techniques for the practice of organization development processes and interventions using a consultancy approach. Implications for organizational change are integrated as part of an OD effort.

Learning Outcomes: 1. Describe the historical roots and theoretical underpinnings of organizational development. 2. Apply the action research model for professional practice. 3. Effectively participate in small groups. 4. Identify intervention strategies at the individual, small group, and large systems levels. 5. Conduct organization development analysis. Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Develop a general

awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5. Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

13-15 Credits

Spring 3rd Year

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6. Understand basics of circuits programmed

using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16 Credits

Fall 4th Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional

conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

ASM 51000 - Agrosecurity-Emergency Management For Agricultural Production Operations

Credit Hours: 3.00. Prepares individuals for management and loss control positions in agricultural production, agribusiness operations, and emergency management agencies. Addresses prevention, preparation, mitigation, response, and recovery from disasters such as fires, explosions, entrapments, tornadoes, floods, winter storms, earthquakes, vandalism, chemical releases, and bio-terrorism. Students complete a community service learning activity, in which they assist a farm or agribusiness manager in developing formal emergency preparedness plans.

Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability,

and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

ASM 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

14 Credits

Spring 4th Year

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

ASM 51200 - Managing Resources and Applications for Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

13-16 Credits

Agricultural Systems

Management: Data and Information Systems, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (50-53 credits)

Required Major Courses (22 credits)

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and

formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

Required Courses - Data and Information Systems Concentration (28-31 credits)

Data and Information Systems Concentration Courses (15 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems.

Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

Data and Informational Concentration Selectives (13-16 credits)

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

CNIT 35500 - Mobile Programming

Credit Hours: 3.00. This is an advanced programming course that teaches students the skills necessary to develop applications for mobile computing devices (e.g. Smartphones and tablet computers). Combining theory and practice, this course gives students hands-on experience with the latest technologies, tools and techniques used to develop mobile software solutions for business and entertainment.

Learning Outcomes: 1. List the popular mobile device platforms and market share. 2. Understand the difference between developing apps for mobile devices and developing apps for PCs and servers. 3. Understand user interface design concepts specific to mobile devices. 4. Demonstrate how to persist app data to a mobile device. 5. Develop casual games that use essential game programming concepts. 6. Demonstrate how to use graphics programming techniques for drawing shapes, text, and sprites. 7. Develop apps that use more than one processing thread. 8. Develop apps that communicate with code running on a server. Credits: 3.00

AGR 33300 - Data Science For Agriculture

Credit Hours: 3.00. Students will apply data processes including identifying data needs, acquiring data, assessing data quality, data wrangling, filtering, and visualization. In each of several topic areas (forestry, animal science, agronomy, food science, entomology, engineering, economics), data-driven insights and improved decision making will be the culmination of applied data skills. Students will understand data ethics and practice data management skills including the merging of disparate but related data sets.

Learning Outcomes: 1. Construct a research question that helps address a decision. 2. Describe different types of experimental designs and discuss the differences between observational and experimental studies. 3. Identify data needed to address various research questions. 4. Identify how these data sources are used in data analysis: agronomics, machine data, maps, spreadsheets, sensor data. 5. Describe how various data sets are acquired. 6. Describe how the following impact data ethics: ownership, storage, access. 7. Assess data quality and utility. 9. Identify potential limitations of a dataset. 10. Describe the following aspects of data wrangling: data formats, data compatibility, mobility. 11. Describe the following aspects of data management: storage, curation, metadata, FAIR (findable, accessible, interoperable, reusable). 12. List reasons for filtering, cleaning, and pre-processing data. 13. Describe tools for data cleaning. 14. Integrate disparate data sets. 15. Describe uses for the following in data visualization: bar charts, line charts, maps, tables. 16. Use the following tools to analyze data: correlations, mean generation, confidence intervals, simple model building, R Python. 17. Make decisions based on data outcomes. Credits: 3.00

Other Departmental/Program Course Requirements (67-70 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community.

Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales

presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness

of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret

standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are

determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of

differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

16 Credits

Spring 1st Year

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic

chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

15-16 Credits

Fall 2nd Year

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

14 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures

and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience

and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Spring 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

16 Credits

Fall 4th Year

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor

meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use

object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

CNIT 35500 - Mobile Programming

Credit Hours: 3.00. This is an advanced programming course that teaches students the skills necessary to develop applications for mobile computing devices (e.g. Smartphones and tablet computers). Combining theory and practice, this course gives students hands-on experience with the latest technologies, tools and techniques used to develop mobile software solutions for business and entertainment.

Learning Outcomes: 1. List the popular mobile device platforms and market share. 2. Understand the difference between developing apps for mobile devices and developing apps for PCs and servers. 3. Understand user interface design concepts specific to mobile devices. 4. Demonstrate how to persist app data to a mobile device. 5. Develop casual games that use essential game programming concepts. 6. Demonstrate how to use graphics programming techniques for drawing shapes, text, and sprites. 7. Develop apps that use more than one processing thread. 8. Develop apps that communicate with code running on a server. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability,

and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

12-14 Credits

Spring 4th Year

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

13-16 Credits

Agricultural Systems Management: Leadership and Management, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (50-53 credits)

Required Major Courses (22 credits)

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up

tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral

communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

Leadership and Management Concentration Required Courses (28-31 credits)

Leadership and Management Concentration Courses

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology

leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Leadership and Management Concentration Selectives

Other Departmental/Program Course Requirements (67-70 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency

in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential

programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary

functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish

communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

16 Credits

Spring 1st Year

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up

tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

15-16 Credits

Fall 2nd Year

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be

introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

14 Credits

Spring 2nd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield

futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

13-15 Credits

Spring 3rd Year

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate

instances where linear programming and simulation modeling might be valuable. Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16 Credits

Fall 4th Year

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of

them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice. Credits: 1.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

14 Credits

Spring 4th Year

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use

economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

13-16 Credits

Agronomy: Agronomic Business and Marketing Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (62-63 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

Agronomic Business and Marketing Concentration (51-52 credits)

Required Concentration Courses (30-31 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with

effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 41100 - Farm Management

Credit Hours: 4.00. Principles of farm organization and management, farmer interviews, and the application of computerized farm decision-making methods.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens.

Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

Concentration Selective Courses (21 credits)

Other Departmental/Program Course Requirements (48-52 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team.

Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology,

biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first

semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the

design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting

methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on

when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (5-10 credits)

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil

and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem

conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients,

compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop

observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-16 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates

knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations

in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-18 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7.

Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

16-17 Credits

Spring 2nd Year

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

15-16 Credits

Fall 3rd Year

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound

approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

14-15 Credits

Spring 3rd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

16 Credits

Fall 4th Year

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

13 Credits

Spring 4th Year

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

13-16 Credits

Agronomy: Crop and Soil Management Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (59 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for

lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

Crop and Soil Management Concentration (48 credits)

Required Concentration Courses (6 credits)

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

Concentration Selective Courses (15 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market

equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Directed Selective (27 credits)

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures.

Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

NRES 23000 - Survey Of Meteorology (UCC: SCI)

Credit Hours: 3.00. (EAPS 22100) An introductory course for both science and non-science students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate, ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC) Credits: 3.00

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 45600 - Advertising Writing

Credit Hours: 3.00. The theory and practice of copy writing in various advertising contexts.

Credits: 3.00

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to

specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in

turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 31900 - Controlled Environment Production Of Horticultural Crops

Credit Hours: 3.00. This course combines production principles with environmental concepts and advances in technology to provide a comprehensive training in sustainable production of herbaceous ornamentals and vegetables in controlled environment systems. The laboratory instruction provides hands-on experience with the practice of growing crops under controlled environments by combining the learning from lab prep with the use of technology to control environment during production.

Learning Outcomes: 1. Become familiar with best management practices for growing herbaceous ornamentals and vegetables that improve sustainability in controlled environments. 2. Learn how above and below ground environments interact with crop production. 3. Learn basics about the state-of-the-art technologies used in controlled environment agricultural production to monitor and control environments. 4. Interact with industry professionals to gain first-hand knowledge about careers and development in commercial horticulture. 5. Gain sufficient background in science, technology and regulations required to become entrepreneurs, next generation growers and researchers in the controlled environment agriculture industry. Credits: 3.00

ASEC 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-

standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across

diverse audiences. Credits: 3.00

Other Departmental/Program Course Requirements (48-52 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path

leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of

calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6.

Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (9-13 credits)

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test

hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit

proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety,

measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-16 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data

measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-18 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience

and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

14 Credits

Spring 2nd Year

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness

of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.
University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

15 Credits

Fall 3rd Year

16 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.
Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

16 Credits

Fall 4th Year

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions,

professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

14-15 Credits

Spring 4th Year

12-14 Credits

Agronomy: International Agronomy Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (62 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional

conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

International Agronomy Concentration (51 credits)

Required Concentration Courses (19 credits)

AGEC 34000 - International Economic Development

Credit Hours: 3.00. This course is designed to introduce students to issues and problems related to international economic development. Topics covered include a description of the current situation in developing countries and the history of growth and development. The course is grounded in the body of theory associated with economic development, but concentrates on the many practical problems such as poverty, population growth, urbanization, education and the environment. The three areas with the greatest attention are agricultural development, international trade, and policy analysis for developing countries.

Learning Outcomes: 1. Build an appreciation for the conditions and constraints of contemporary life in developing countries. 2. Have your own notions of what it means to live in poverty, the challenges of improving welfare, and the role of economics in development. 3. Demonstrate how economic principles, models, and analysis can help evaluate and refine approaches to improving human welfare in developing countries. 4. Develop the ability to analyze and write about real-world problems and solutions. The course, particularly the assignments, will allow you to acquire technical skills that will contribute to your future professional work. Credits: 3.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international

trade, especially trade in food and agricultural products. Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 35000 - Global Awareness

Credit Hours: 1.00 to 3.00. A seminar-type course about world geography, cultures, and agriculture. Speakers are selected from the many Purdue graduate students and visiting scholars from around the world. Extra credit may be earned through independent study of a global issue.

Credits: 1.00 to 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

AGRY 59800 - Special Problems

Credit Hours: 1.00 to 6.00. Research on agronomic problems conducted in laboratory, field, or library; report required; arrange with an agronomy staff member before registering. Permission of instructor required.

Credits: 1.00 to 6.00

Concentration Selective Courses (32 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.
Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in

achieving efficiency and equity. Credits: 3.00

Other Departmental/Program Course Requirements (48-52 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path

leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of

calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6.

Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (6-10 credits)

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills

needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to

demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but

are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data

sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-16 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts

and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-18 Credits

Fall 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles,

policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy

options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

14 Credits

Spring 2nd Year

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

16 Credits

Spring 3rd Year

AGEC 34000 - International Economic Development

Credit Hours: 3.00. This course is designed to introduce students to issues and problems related to international economic development. Topics covered include a description of the current situation in developing countries and the history of growth and development. The course is grounded in the body of theory associated with economic development, but concentrates on the many practical problems such as poverty, population growth, urbanization, education and the environment. The three areas with the greatest attention are agricultural development, international trade, and policy analysis for developing countries.

Learning Outcomes: 1. Build an appreciation for the conditions and constraints of contemporary life in developing countries. 2. Have your own notions of what it means to live in poverty, the challenges of improving welfare, and the role of economics in development. 3. Demonstrate how economic principles, models, and analysis can help evaluate and refine approaches to improving human welfare in developing countries. 4. Develop the ability to analyze and write about real-world problems and solutions. The course, particularly the assignments, will allow you to acquire technical skills that will contribute to your future professional work.

Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 35000 - Global Awareness

Credit Hours: 1.00 to 3.00. A seminar-type course about world geography, cultures, and agriculture. Speakers are selected from the many Purdue graduate students and visiting scholars from around the world. Extra credit may be earned through independent study of a global issue.

Credits: 1.00 to 3.00

15 Credits

Fall 4th Year

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal

expenses when necessary.

Credits: 3.00

AGRY 59800 - Special Problems

Credit Hours: 1.00 to 6.00. Research on agronomic problems conducted in laboratory, field, or library; report required; arrange with an agronomy staff member before registering. Permission of instructor required.

Credits: 1.00 to 6.00

12-13 Credits

Spring 4th Year

13-16 Credits

American Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (30 credits)

A. American Studies Foundation Courses (12 credits)

AMST 49000 - Senior Capstone In American Studies

Credit Hours: 6.00. Interdisciplinary senior capstone project in American Studies. Permission of department required.

Learning Outcomes: 1. Conceptualizing a research project from two or more disciplinary perspectives, conducting original research designed to reveal key aspects of American culture past or contemporary, and presenting interdisciplinary research findings in verbal, visual, or an approved creative form. Credits: 6.00

AMST 30100 - Perspectives On America

Credit Hours: 3.00. Advanced interdisciplinary study of American culture, history, and society in their national and global contexts.

Credits: 3.00

AMST 20100 - Interpreting America (UCC: HUM)

Credit Hours: 3.00. Introduction to the interdisciplinary study of American culture, history, and society in its national and global contexts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major themes and issues prompted by the term American. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

B. American Studies Selectives (18 credits)

Electives (17-54 credits)

GPA Requirements

Grade Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-16 Credits

Spring 1st Year

15 Credits

Fall 2nd Year

AMST 20100 - Interpreting America (UCC: HUM)

Credit Hours: 3.00. Introduction to the interdisciplinary study of American culture, history, and society in its national and global contexts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major themes and issues prompted by the term American. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

15 Credits

Spring 2nd Year

AMST 30100 - Perspectives On America

Credit Hours: 3.00. Advanced interdisciplinary study of American culture, history, and society in their national and global contexts.

Credits: 3.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

AMST 49000 - Senior Capstone In American Studies

Credit Hours: 6.00. Interdisciplinary senior capstone project in American Studies. Permission of department required.

Learning Outcomes: 1. Conceptualizing a research project from two or more disciplinary perspectives, conducting original research designed to reveal key aspects of American culture past or contemporary, and presenting interdisciplinary research findings in verbal, visual, or an approved creative form. Credits: 6.00

15 Credits

Spring 4th Year

15 Credits

Animal Sciences: Animal Agribusiness Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (77 credits)

Required Major Courses (30 credits)

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic

parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It

integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

Animal Agribusiness Concentration Requirements (47 credits)

Concentration Required Courses (37 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external

decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

Animal Sciences Restricted Selectives (10 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic

scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 24500 - Applied Animal Management

Credit Hours: 2.00. Skills and practices related to handling and care of beef and dairy cattle, horses, poultry, sheep, and swine.

Credits: 2.00

ANSC 28100 - Career Planning In Animal Sciences

Credit Hours: 1.00. A seminar course designed to inform students of the career opportunities in animal industries, develop their interviewing and other interpersonal skills, and begin to plan the course of study, work experiences, and marketing methods needed to obtain a successful internship and employment.

Credits: 1.00

ANSC 29300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and AGR 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 29500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in formal courses of the department. The specific topic that is offered will be indicated on the student's record. May be repeated for credit with variable title. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

ANSC 33200 - Environmental Physiology Of Domestic Animals

Credit Hours: 2.00. Interactions of environmental factors with physiological processes in domestic animals.

Credits: 2.00

ANSC 34500 - Animal Health Management

Credit Hours: 3.00. The objectives of this course are to familiarize the student with disease processes and mechanisms. Management techniques in food, companion, and research animal species that minimize or prevent disease will be emphasized, as well as the consequences on animal production, reproduction, and human health.

Credits: 3.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

ANSC 37000 - Livestock Evaluation

Credit Hours: 2.00. This course is designed to develop logical thinking and speaking skills, while developing the ability to critically evaluate livestock in their production environments. Prior experience in public speaking or judging is not required. The combination of ANSC 37000, ANSC 37100, ANSC 37200, ANSC 47000, ANSC 47100, and ANSC 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 37100 - Dairy Evaluation

Credit Hours: 2.00. This course will enable the student to become familiar with breeds of dairy, parts of dairy cattle and their relationship to function. Opportunities will exist to associate with people from various breed organizations within the dairy industry. The combination of ANSC 37000, 37100, 37200, 47000, 47100, and 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 38100 - Leadership For A Diverse Workplace

Credit Hours: 3.00. An interactive, small group discussion class covering effective interpersonal and group skills needed to enhance career satisfaction in a diverse workplace including building networks within industry, cross-cultural communication and gaining experiences in group problem-solving and decision-making. This course may be used as an additional written communication elective as required in all plans of study in Animal Sciences.

Learning Outcomes: 1. Learn opportunities and mechanisms used to pursue job placement, graduate school or professional schools. 2. Interact with alumni to build networks and appreciate the real-life challenges faced in careers in animal industries. 3. Use numerous team experiences to develop comfort and effectiveness in functioning in teams and committees. Credits: 3.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 47000 - Livestock Judging

Credit Hours: 1.00. This course is designed to teach livestock evaluation, relationship of production data to live animal evaluation characteristics, expand logical thinking and reasoning skills, and enhance oral communication skills. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 47100 - Dairy Judging

Credit Hours: 1.00. Opportunities will exist to allow the student to practice analysis and enhance decision-making processes in placing animals in collegiate dairy contests. Communication skills will be developed to properly present and defend those decisions with confidence. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 48500 - Dairy Farm Evaluation

Credit Hours: 2.00. This course will provide students with an opportunity to integrate and apply knowledge of dairy cattle management systems, nutrition, reproduction, genetics, milk quality, animal handling, physical farm facilities, manure handling and management, personnel and their financial implications. Students will develop critical analysis skills and apply troubleshooting principles in the identification and resolution of dairy farm management issues in a learning environment that is structured around farm evaluation field trips and case studies.

Learning Outcomes: 1. Increase understanding of dairy farm management systems. 2. Integrate knowledge of animal sciences with dairy-specific experiences. 3. Highlight opportunities for lifelong learning. 4. Foster critical thinking and evaluation skills. 5. Promote communication skills. 6. Encourage professionalism through tactful delivery of critical analyses. 7. Provide critical evaluations of dairy farms as a service to the owners.

Credits: 2.00

ANSC 49100 - Special Problems

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or library assignments. Written reports required. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and 49300 cannot

exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

ANSC 51300 - Design Of Animal Breeding Programs

Credit Hours: 3.00. Integration of principles of animal breeding and genetics into animal improvement programs. Emphasis is placed on the interaction among genetics, nutrition, and physiology.

Credits: 3.00

ANSC 52200 - Monogastric Nutrition

Credit Hours: 3.00. Digestion and absorption, nutrient utilization and interrelationships in poultry, swine, and other monogastric animals.

Credits: 3.00

ANSC 52400 - Ruminant Nutrition And Physiology

Credit Hours: 3.00. Physiological, microbiological, and biochemical effects and their interrelationships on digestion and metabolism in the ruminant animal.

Credits: 3.00

ANSC 53400 - Advanced Reproductive Physiology

Credit Hours: 3.00. A study of mechanisms that interact to control reproduction in farm animals. Current scientific literature and hypotheses are presented, and potential methods to enhance reproductive efficiency are examined.

Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology, biochemistry and chemistry of muscle (meat) and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4. Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 33100 - The Role Of Horses In Human History, Culture, And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces

students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ANSC 32500 - Applied Ruminant Nutrition

Credit Hours: 2.00. Application of the principles of ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic ruminant nutrition principles are applied to solve ""real world"" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 32600 - Applied Non-ruminant Nutrition

Credit Hours: 2.00. Application of the principles of non-ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic non-ruminant nutrition principles are applied to solve "real world" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

ANSC 42500 - Ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with the reproductive management of beef cattle, dairy cattle, goats, and sheep will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of ruminant livestock. Credits: 2.00

ANSC 42600 - Non-ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with reproductive management of swine and horses will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in non-ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of non-ruminant livestock. Credits: 2.00

ANSC 41500 - Advanced Animal Physiology

Credit Hours: 3.00. This course is an advanced physiology course building on concepts and knowledge introduced in ANSC 23000 about whole body physiology. Additionally, this course will introduce interpretation of scientific literature to understand physiological processes.

Learning Outcomes: 1. Interpret and analyze scientific literature in Animal Physiology. 2. Evaluate the background and methodology used in the literature, compare different and opposing lines of thought, including their own conclusions derived from the work. 3. Acknowledge the critical thinking process in scientific work and how it could lead to the right or wrong conclusions if not carefully assessed. 4. Identify and name the components of the body systems. 5. Describe the physiological process that govern the body systems. 6. Describe the interactions between body systems. Credits: 3.00

Other Departmental/Program Course Requirements (36-37 credits)

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand

academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results.

21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market

equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Electives (6-7 credits)

Additional Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological

techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits:

4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

14-15 Credits

Spring 1st Year

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of

functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

16 Credits

Fall 2nd Year

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and

foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

18 Credits

Spring 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform

and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

17 Credits

Fall 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding

of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Spring 3rd Year

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

13 Credits

Fall 4th Year

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

13 Credits

Spring 4th Year

13-14 Credits

Animal Sciences: Animal Production and Industry Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (71 credits)

Required Major Courses (30 credits)

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in

today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

Animal Production and Industry Concentration Requirements (41 credits)

Required Concentration Courses (31 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of

disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and

interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology, biochemistry and chemistry of muscle (meat)

and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4. Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

Animal Sciences Restricted Selectives (10 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and

utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 24500 - Applied Animal Management

Credit Hours: 2.00. Skills and practices related to handling and care of beef and dairy cattle, horses, poultry, sheep, and swine.

Credits: 2.00

ANSC 28100 - Career Planning In Animal Sciences

Credit Hours: 1.00. A seminar course designed to inform students of the career opportunities in animal industries, develop their interviewing and other interpersonal skills, and begin to plan the course of study, work experiences, and marketing methods needed to obtain a successful internship and employment.

Credits: 1.00

ANSC 29300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and AGR 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 29500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in formal courses of the department. The specific topic that is offered will be indicated on the student's record. May be repeated for credit with variable title. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

ANSC 33200 - Environmental Physiology Of Domestic Animals

Credit Hours: 2.00. Interactions of environmental factors with physiological processes in domestic animals.

Credits: 2.00

ANSC 34500 - Animal Health Management

Credit Hours: 3.00. The objectives of this course are to familiarize the student with disease processes and mechanisms. Management techniques in food, companion, and research animal species that minimize or prevent disease will be emphasized, as well as the consequences on animal production, reproduction, and human health.

Credits: 3.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-

products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

ANSC 37000 - Livestock Evaluation

Credit Hours: 2.00. This course is designed to develop logical thinking and speaking skills, while developing the ability to critically evaluate livestock in their production environments. Prior experience in public speaking or judging is not required. The combination of ANSC 37000, ANSC 37100, ANSC 37200, ANSC 47000, ANSC 47100, and ANSC 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 37100 - Dairy Evaluation

Credit Hours: 2.00. This course will enable the student to become familiar with breeds of dairy, parts of dairy cattle and their relationship to function. Opportunities will exist to associate with people from various breed organizations within the dairy industry. The combination of ANSC 37000, 37100, 37200, 47000, 47100, and 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 38100 - Leadership For A Diverse Workplace

Credit Hours: 3.00. An interactive, small group discussion class covering effective interpersonal and group skills needed to enhance career satisfaction in a diverse workplace including building networks within industry, cross-cultural communication and gaining experiences in group problem-solving and decision-making. This course may be used as an additional written communication elective as required in all plans of study in Animal Sciences.

Learning Outcomes: 1. Learn opportunities and mechanisms used to pursue job placement, graduate school or professional schools. 2. Interact with alumni to build networks and appreciate the real-life challenges faced in careers in animal industries. 3. Use numerous team experiences to develop comfort and effectiveness in functioning in teams and committees. Credits: 3.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 47000 - Livestock Judging

Credit Hours: 1.00. This course is designed to teach livestock evaluation, relationship of production data to live animal evaluation characteristics, expand logical thinking and reasoning skills, and enhance oral communication skills. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 47100 - Dairy Judging

Credit Hours: 1.00. Opportunities will exist to allow the student to practice analysis and enhance decision-making processes in placing animals in collegiate dairy contests. Communication skills will be developed to properly present and defend those decisions with confidence. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 48500 - Dairy Farm Evaluation

Credit Hours: 2.00. This course will provide students with an opportunity to integrate and apply knowledge of dairy cattle management systems, nutrition, reproduction, genetics, milk quality, animal handling, physical farm facilities, manure handling and management, personnel and their financial implications. Students will develop critical analysis skills and apply troubleshooting principles in the identification and resolution of dairy farm management issues in a learning environment that is structured around farm evaluation field trips and case studies.

Learning Outcomes: 1. Increase understanding of dairy farm management systems. 2. Integrate knowledge of animal sciences with dairy-specific experiences. 3. Highlight opportunities for lifelong learning. 4. Foster critical thinking and evaluation skills. 5. Promote communication skills. 6. Encourage professionalism through tactful delivery of critical analyses. 7. Provide critical evaluations of dairy farms as a service to the owners.

Credits: 2.00

ANSC 49100 - Special Problems

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or library assignments. Written reports required. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

ANSC 51300 - Design Of Animal Breeding Programs

Credit Hours: 3.00. Integration of principles of animal breeding and genetics into animal improvement programs. Emphasis is placed on the interaction among genetics, nutrition, and physiology.

Credits: 3.00

ANSC 52200 - Monogastric Nutrition

Credit Hours: 3.00. Digestion and absorption, nutrient utilization and interrelationships in poultry, swine, and other monogastric animals.

Credits: 3.00

ANSC 52400 - Ruminant Nutrition And Physiology

Credit Hours: 3.00. Physiological, microbiological, and biochemical effects and their interrelationships on digestion and metabolism in the ruminant animal.

Credits: 3.00

ANSC 53400 - Advanced Reproductive Physiology

Credit Hours: 3.00. A study of mechanisms that interact to control reproduction in farm animals. Current scientific literature and hypotheses are presented, and potential methods to enhance reproductive efficiency are examined.

Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology, biochemistry and chemistry of muscle (meat) and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4. Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 33100 - The Role Of Horses In Human History, Culture, And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ANSC 32500 - Applied Ruminant Nutrition

Credit Hours: 2.00. Application of the principles of ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic ruminant nutrition principles are applied to solve ""real world"" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 32600 - Applied Non-ruminant Nutrition

Credit Hours: 2.00. Application of the principles of non-ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic non-ruminant nutrition principles are applied to solve "real world" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

ANSC 42500 - Ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with the reproductive management of beef cattle, dairy cattle, goats, and sheep will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of ruminant livestock. Credits: 2.00

ANSC 42600 - Non-ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with reproductive management of swine and horses will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in non-ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of non-ruminant livestock. Credits: 2.00

ANSC 41500 - Advanced Animal Physiology

Credit Hours: 3.00. This course is an advanced physiology course building on concepts and knowledge introduced in ANSC 23000 about whole body physiology. Additionally, this course will introduce interpretation of scientific literature to understand physiological processes.

Learning Outcomes: 1. Interpret and analyze scientific literature in Animal Physiology. 2. Evaluate the background and methodology used in the literature, compare different and opposing lines of thought, including their own conclusions derived from the work. 3. Acknowledge the critical thinking process in scientific work and how it could lead to the right or wrong conclusions if not carefully assessed. 4. Identify and name the components of the

body systems. 5. Describe the physiological process that govern the body systems. 6. Describe the interactions between body systems. Credits: 3.00

Other Departmental/Program Course Requirements (40-41 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation,

communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic

probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Electives (8-9 credits)

Supplemental List

Additional Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the

chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

14-15 Credits

Spring 1st Year

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of

functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

16 Credits

Fall 2nd Year

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

16 Credits

Spring 2nd Year

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students

who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

16 Credits

Fall 3rd Year

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

15 Credits

Spring 3rd Year

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

17 Credits

Fall 4th Year

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods,

solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

13 Credits

Spring 4th Year

12-13 Credits

Animal Sciences: Behavior/Well-Being Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (73 credits)

Required Major Courses (30 credits)

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships

between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

Behavior/Well-Being Concentration Requirements (43 credits)

Required Concentration Courses (33 Credits)

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and

critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Animal Sciences Restricted Selectives (10 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given

information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 33200 - Environmental Physiology Of Domestic Animals

Credit Hours: 2.00. Interactions of environmental factors with physiological processes in domestic animals.

Credits: 2.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

ANSC 51300 - Design Of Animal Breeding Programs

Credit Hours: 3.00. Integration of principles of animal breeding and genetics into animal improvement programs. Emphasis is placed on the interaction among genetics, nutrition, and physiology.

Credits: 3.00

ANSC 52200 - Monogastric Nutrition

Credit Hours: 3.00. Digestion and absorption, nutrient utilization and interrelationships in poultry, swine, and other monogastric animals.

Credits: 3.00

ANSC 52400 - Ruminant Nutrition And Physiology

Credit Hours: 3.00. Physiological, microbiological, and biochemical effects and their interrelationships on digestion and metabolism in the ruminant animal.

Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology, biochemistry and chemistry of muscle (meat) and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4.

Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 32500 - Applied Ruminant Nutrition

Credit Hours: 2.00. Application of the principles of ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic ruminant nutrition principles are applied to solve ""real world"" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 32600 - Applied Non-ruminant Nutrition

Credit Hours: 2.00. Application of the principles of non-ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic non-ruminant nutrition principles are applied to solve "real world" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

ANSC 42500 - Ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with the reproductive management of beef cattle, dairy cattle, goats, and sheep will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of ruminant livestock. Credits: 2.00

ANSC 42600 - Non-ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with reproductive management of swine and horses will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in non-ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of non-ruminant livestock. Credits: 2.00

ANSC 41500 - Advanced Animal Physiology

Credit Hours: 3.00. This course is an advanced physiology course building on concepts and knowledge introduced in ANSC 23000 about whole body physiology. Additionally, this course will introduce interpretation of scientific literature to understand physiological processes.

Learning Outcomes: 1. Interpret and analyze scientific literature in Animal Physiology. 2. Evaluate the background and methodology used in the literature, compare different and opposing lines of thought, including their own conclusions derived from the work. 3. Acknowledge the critical thinking process in scientific work and how it could lead to the right or wrong conclusions if not carefully assessed. 4. Identify and name the components of the body systems. 5. Describe the physiological process that govern the body systems. 6. Describe the interactions between body systems. Credits: 3.00

Other Departmental /Program Course Requirements (36-37 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and

services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative

genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices

individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Electives (10-11 credits)

GPA Requirements

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology,

biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a

laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Spring 1st Year

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop

observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-16 Credits

Fall 2nd Year

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9.

Propose animal production systems within given environments(s). Credits: 3.00

16 Credits

Spring 2nd Year

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

16 Credits

Fall 3rd Year

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of

heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

16 Credits

Spring 3rd Year

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

14 Credits

Fall 4th Year

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal

industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

14 Credits

Spring 4th Year

13-14 Credits

Animal Sciences: Biosciences Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (71 credits)

Required Major Courses (30 credits)

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and

physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

Biosciences Concentration Requirements (41 credits)

Concentration Required Courses (31 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication,

transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a

laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Animal Science Restricted Selectives (10 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 24500 - Applied Animal Management

Credit Hours: 2.00. Skills and practices related to handling and care of beef and dairy cattle, horses, poultry, sheep, and swine.

Credits: 2.00

ANSC 28100 - Career Planning In Animal Sciences

Credit Hours: 1.00. A seminar course designed to inform students of the career opportunities in animal industries, develop their interviewing and other interpersonal skills, and begin to plan the course of study, work experiences, and marketing methods needed to obtain a successful internship and employment.

Credits: 1.00

ANSC 29300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and AGR 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 29500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in formal courses of the department. The specific topic that is offered will be indicated on the student's record. May be repeated for credit with variable title. Permission

of instructor required.

Credits: 0.00 to 3.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

ANSC 33200 - Environmental Physiology Of Domestic Animals

Credit Hours: 2.00. Interactions of environmental factors with physiological processes in domestic animals.

Credits: 2.00

ANSC 34500 - Animal Health Management

Credit Hours: 3.00. The objectives of this course are to familiarize the student with disease processes and mechanisms. Management techniques in food, companion, and research animal species that minimize or prevent disease will be emphasized, as well as the consequences on animal production, reproduction, and human health.

Credits: 3.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

ANSC 37000 - Livestock Evaluation

Credit Hours: 2.00. This course is designed to develop logical thinking and speaking skills, while developing the ability to critically evaluate livestock in their production environments. Prior experience in public speaking or judging is not required. The combination of ANSC 37000, ANSC 37100, ANSC 37200, ANSC 47000, ANSC 47100, and ANSC 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 37100 - Dairy Evaluation

Credit Hours: 2.00. This course will enable the student to become familiar with breeds of dairy, parts of dairy cattle and their relationship to function. Opportunities will exist to associate with people from various breed organizations within the dairy industry. The combination of ANSC 37000, 37100, 37200, 47000, 47100, and 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 38100 - Leadership For A Diverse Workplace

Credit Hours: 3.00. An interactive, small group discussion class covering effective interpersonal and group skills needed to

enhance career satisfaction in a diverse workplace including building networks within industry, cross-cultural communication and gaining experiences in group problem-solving and decision-making. This course may be used as an additional written communication elective as required in all plans of study in Animal Sciences.

Learning Outcomes: 1. Learn opportunities and mechanisms used to pursue job placement, graduate school or professional schools. 2. Interact with alumni to build networks and appreciate the real-life challenges faced in careers in animal industries. 3. Use numerous team experiences to develop comfort and effectiveness in functioning in teams and committees. Credits: 3.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 47000 - Livestock Judging

Credit Hours: 1.00. This course is designed to teach livestock evaluation, relationship of production data to live animal evaluation characteristics, expand logical thinking and reasoning skills, and enhance oral communication skills. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 47100 - Dairy Judging

Credit Hours: 1.00. Opportunities will exist to allow the student to practice analysis and enhance decision-making processes in placing animals in collegiate dairy contests. Communication skills will be developed to properly present and defend those decisions with confidence. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 48500 - Dairy Farm Evaluation

Credit Hours: 2.00. This course will provide students with an opportunity to integrate and apply knowledge of dairy cattle

management systems, nutrition, reproduction, genetics, milk quality, animal handling, physical farm facilities, manure handling and management, personnel and their financial implications. Students will develop critical analysis skills and apply troubleshooting principles in the identification and resolution of dairy farm management issues in a learning environment that is structured around farm evaluation field trips and case studies.

Learning Outcomes: 1. Increase understanding of dairy farm management systems. 2. Integrate knowledge of animal sciences with dairy-specific experiences. 3. Highlight opportunities for lifelong learning. 4. Foster critical thinking and evaluation skills. 5. Promote communication skills. 6. Encourage professionalism through tactful delivery of critical analyses. 7. Provide critical evaluations of dairy farms as a service to the owners.

Credits: 2.00

ANSC 49100 - Special Problems

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or library assignments. Written reports required. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

ANSC 51300 - Design Of Animal Breeding Programs

Credit Hours: 3.00. Integration of principles of animal breeding and genetics into animal improvement programs. Emphasis is placed on the interaction among genetics, nutrition, and physiology.

Credits: 3.00

ANSC 52200 - Monogastric Nutrition

Credit Hours: 3.00. Digestion and absorption, nutrient utilization and interrelationships in poultry, swine, and other monogastric animals.

Credits: 3.00

ANSC 52400 - Ruminant Nutrition And Physiology

Credit Hours: 3.00. Physiological, microbiological, and biochemical effects and their interrelationships on digestion and metabolism in the ruminant animal.

Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology,

biochemistry and chemistry of muscle (meat) and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4. Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 33100 - The Role Of Horses In Human History, Culture, And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ANSC 32500 - Applied Ruminant Nutrition

Credit Hours: 2.00. Application of the principles of ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic ruminant nutrition principles are applied to solve ""real world"" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 32600 - Applied Non-ruminant Nutrition

Credit Hours: 2.00. Application of the principles of non-ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic non-ruminant nutrition principles are applied to solve "real world" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to

develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

ANSC 42500 - Ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with the reproductive management of beef cattle, dairy cattle, goats, and sheep will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of ruminant livestock. Credits: 2.00

ANSC 42600 - Non-ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with reproductive management of swine and horses will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in non-ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of non-ruminant livestock. Credits: 2.00

ANSC 41500 - Advanced Animal Physiology

Credit Hours: 3.00. This course is an advanced physiology course building on concepts and knowledge introduced in ANSC 23000 about whole body physiology. Additionally, this course will introduce interpretation of scientific literature to understand physiological processes.

Learning Outcomes: 1. Interpret and analyze scientific literature in Animal Physiology. 2. Evaluate the background and methodology used in the literature, compare different and opposing lines of thought, including their own conclusions derived from the work. 3. Acknowledge the critical thinking process in scientific work and how it could lead to the right or wrong conclusions if not carefully assessed. 4. Identify and name the components of the body systems. 5. Describe the physiological process that govern the body systems. 6. Describe the interactions between body systems. Credits: 3.00

ANSC 50500 - Advanced Animal Welfare Assessment

Credit Hours: 3.00. Animal welfare assessment is a critical component of working with live animals. Throughout this course, students will receive instruction in the fundamental aspects of animal welfare assessment. Students will learn how behavior, physiology, health and production parameters are used to critically assess animal welfare. The welfare of farm, exotic, companion, and laboratory animals will be assessed, focusing on four example species that change every year. The species of focus will be determined in the summer semester and students can contact the instructor for details prior to registering for the course. Students will engage in classroom discussions and peer evaluation. Students will have the option to represent Purdue University at the American Veterinary Medical Association's annual welfare judging and assessment contest where they will compete with teams from other universities. Field trips may be required.

Learning Outcomes: 1. Discuss and present peer-reviewed articles. 2. Explain how behavior, physiology, production and health measures are used to evaluate animal welfare. 3. Weigh the importance and implications of different animal welfare indicators. 4. Use scientific evidence, as well as general principles and species-specific information to critically compare and assess the welfare of animals in different scenarios. 5. Present oral and written reasons in a concise and well-articulated manner. Credits: 3.00

Other Departmental/Program Course Requirements (36-37 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2.

Demonstrate depth in major. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Electives (12-13 credits)

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students

will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Spring 1st Year

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2.

Demonstrate depth in major. Credits: 4.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Fall 2nd Year

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is

on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

15 Credits

Spring 2nd Year

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

16 Credits

Fall 3rd Year

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 3rd Year

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

14 Credits

Fall 4th Year

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

15 Credits

Spring 4th Year

12-13 Credits

Animal Sciences: Pre-Veterinary Medicine Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (79 credits)

Required Major Courses (30 credits)

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career

success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

Pre-Veterinary Medicine Concentration Requirements (49 credits)

Concentration Required Courses (39 Credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the

macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular

basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To

computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the

experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Animal Sciences Restricted Selectives (10 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 24500 - Applied Animal Management

Credit Hours: 2.00. Skills and practices related to handling and care of beef and dairy cattle, horses, poultry, sheep, and swine.

Credits: 2.00

ANSC 28100 - Career Planning In Animal Sciences

Credit Hours: 1.00. A seminar course designed to inform students of the career opportunities in animal industries, develop their interviewing and other interpersonal skills, and begin to plan the course of study, work experiences, and marketing methods needed to obtain a successful internship and employment.

Credits: 1.00

ANSC 29300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and AGR 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 29500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in formal courses of the department. The specific topic that is offered will be indicated on the student's record. May be repeated for credit with variable title. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3.

Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

ANSC 33200 - Environmental Physiology Of Domestic Animals

Credit Hours: 2.00. Interactions of environmental factors with physiological processes in domestic animals.

Credits: 2.00

ANSC 34500 - Animal Health Management

Credit Hours: 3.00. The objectives of this course are to familiarize the student with disease processes and mechanisms. Management techniques in food, companion, and research animal species that minimize or prevent disease will be emphasized, as well as the consequences on animal production, reproduction, and human health.

Credits: 3.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

ANSC 37000 - Livestock Evaluation

Credit Hours: 2.00. This course is designed to develop logical thinking and speaking skills, while developing the ability to critically evaluate livestock in their production environments. Prior experience in public speaking or judging is not required. The combination of ANSC 37000, ANSC 37100, ANSC 37200, ANSC 47000, ANSC 47100, and ANSC 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 37100 - Dairy Evaluation

Credit Hours: 2.00. This course will enable the student to become familiar with breeds of dairy, parts of dairy cattle and their relationship to function. Opportunities will exist to associate with people from various breed organizations within the dairy industry. The combination of ANSC 37000, 37100, 37200, 47000, 47100, and 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 38100 - Leadership For A Diverse Workplace

Credit Hours: 3.00. An interactive, small group discussion class covering effective interpersonal and group skills needed to enhance career satisfaction in a diverse workplace including building networks within industry, cross-cultural communication and gaining experiences in group problem-solving and decision-making. This course may be used as an additional written communication elective as required in all plans of study in Animal Sciences.

Learning Outcomes: 1. Learn opportunities and mechanisms used to pursue job placement, graduate school or professional schools. 2. Interact with alumni to build networks and appreciate the real-life challenges faced in careers in animal industries. 3. Use numerous team experiences to develop comfort and effectiveness in functioning in teams and committees. Credits: 3.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal

use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 47000 - Livestock Judging

Credit Hours: 1.00. This course is designed to teach livestock evaluation, relationship of production data to live animal evaluation characteristics, expand logical thinking and reasoning skills, and enhance oral communication skills. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 47100 - Dairy Judging

Credit Hours: 1.00. Opportunities will exist to allow the student to practice analysis and enhance decision-making processes in placing animals in collegiate dairy contests. Communication skills will be developed to properly present and defend those decisions with confidence. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 48500 - Dairy Farm Evaluation

Credit Hours: 2.00. This course will provide students with an opportunity to integrate and apply knowledge of dairy cattle management systems, nutrition, reproduction, genetics, milk quality, animal handling, physical farm facilities, manure handling and management, personnel and their financial implications. Students will develop critical analysis skills and apply troubleshooting principles in the identification and resolution of dairy farm management issues in a learning environment that is structured around farm evaluation field trips and case studies.

Learning Outcomes: 1. Increase understanding of dairy farm management systems. 2. Integrate knowledge of animal sciences with dairy-specific experiences. 3. Highlight opportunities for lifelong learning. 4. Foster critical thinking and evaluation skills. 5. Promote communication skills. 6. Encourage professionalism through tactful delivery of critical analyses. 7. Provide critical evaluations of dairy farms as a service to the owners.

Credits: 2.00

ANSC 49100 - Special Problems

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or library assignments. Written reports required. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 49500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

ANSC 51300 - Design Of Animal Breeding Programs

Credit Hours: 3.00. Integration of principles of animal breeding and genetics into animal improvement programs. Emphasis is placed on the interaction among genetics, nutrition, and physiology.

Credits: 3.00

ANSC 52200 - Monogastric Nutrition

Credit Hours: 3.00. Digestion and absorption, nutrient utilization and interrelationships in poultry, swine, and other monogastric animals.

Credits: 3.00

ANSC 52400 - Ruminant Nutrition And Physiology

Credit Hours: 3.00. Physiological, microbiological, and biochemical effects and their interrelationships on digestion and metabolism in the ruminant animal.

Credits: 3.00

ANSC 53400 - Advanced Reproductive Physiology

Credit Hours: 3.00. A study of mechanisms that interact to control reproduction in farm animals. Current scientific literature and hypotheses are presented, and potential methods to enhance reproductive efficiency are examined.

Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology, biochemistry and chemistry of muscle (meat) and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4. Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and

technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 33100 - The Role Of Horses In Human History, Culture, And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ANSC 32500 - Applied Ruminant Nutrition

Credit Hours: 2.00. Application of the principles of ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic ruminant nutrition principles are applied to solve ""real world"" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 32600 - Applied Non-ruminant Nutrition

Credit Hours: 2.00. Application of the principles of non-ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic non-ruminant nutrition principles are applied to solve "real world" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

ANSC 42500 - Ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with the reproductive management of beef cattle, dairy cattle, goats, and sheep will be discussed. Laboratories require use of both live animals and animal

specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of ruminant livestock. Credits: 2.00

ANSC 42600 - Non-ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with reproductive management of swine and horses will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in non-ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of non-ruminant livestock. Credits: 2.00

ANSC 41500 - Advanced Animal Physiology

Credit Hours: 3.00. This course is an advanced physiology course building on concepts and knowledge introduced in ANSC 23000 about whole body physiology. Additionally, this course will introduce interpretation of scientific literature to understand physiological processes.

Learning Outcomes: 1. Interpret and analyze scientific literature in Animal Physiology. 2. Evaluate the background and methodology used in the literature, compare different and opposing lines of thought, including their own conclusions derived from the work. 3. Acknowledge the critical thinking process in scientific work and how it could lead to the right or wrong conclusions if not carefully assessed. 4. Identify and name the components of the body systems. 5. Describe the physiological process that govern the body systems. 6. Describe the interactions between body systems. Credits: 3.00

ANSC 50500 - Advanced Animal Welfare Assessment

Credit Hours: 3.00. Animal welfare assessment is a critical component of working with live animals. Throughout this course, students will receive instruction in the fundamental aspects of animal welfare assessment. Students will learn how behavior, physiology, health and production parameters are used to critically assess animal welfare. The welfare of farm, exotic, companion, and laboratory animals will be assessed, focusing on four example species that change every year. The species of focus will be determined in the summer semester and students can contact the instructor for details prior to registering for the course. Students will engage in classroom discussions and peer evaluation. Students will have the option to represent Purdue University at the American Veterinary Medical Association's annual welfare judging and assessment contest where they will compete with teams from other universities. Field trips may be required.

Learning Outcomes: 1. Discuss and present peer-reviewed articles. 2. Explain how behavior, physiology, production and health measures are used to evaluate animal welfare. 3. Weigh the importance and implications of different animal welfare indicators. 4. Use scientific evidence, as well as general principles and species-specific information to critically compare and assess the welfare of animals in different scenarios. 5. Present oral and written reasons in a concise and well-articulated manner. Credits: 3.00

Other Departmental /Program Course Requirements (36-37 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path

leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different

audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

Electives (4-5 credits)

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and

regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative

genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the

experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Spring 1st Year

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least

7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at

least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use. Credits: 2.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-16 Credits

Fall 2nd Year

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal,

and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

16 Credits

Spring 2nd Year

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough

understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

17 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be

introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

17 Credits

Spring 3rd Year

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14 Credits

Fall 4th Year

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

13 Credits

Spring 4th Year

12-13 Credits

Animation And Visual Effects, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (54 credits)

Required Major Courses (39 credits)

CGT 11200 - Sketching For Visualization And Communication

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication, and creativity within a sketching metaphor. Exercises and projects in graphic theory, problem solving, and sketching skill development provide students with activities that focus on further development within the discipline. A variety of sketching techniques are used to gather critical information and transform data into effective communication instruments.

Learning Outcomes: 1. Awaken creativity and problem-solving through the means of sketching. 2. Develop fine motor skills: Becoming a artisan. 3. Explore Aesthetics as it pertains to sketching. 4. Learn and practice professional methods of look development. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 24100 - Introduction To Computer Animation

Credit Hours: 3.00. This course introduces the knowledge base on which digital animation and spatial graphics technology are founded and developed. Emphasis will be placed on developing a working knowledge of the mechanics of 3D geometric formats, spline-based modeling with polygon mesh & NURBS, procedural mapping of raster images, simplified polygon modeling, rendering methods, hierarchical linking, and kinematic fundamentals.

Learning Outcomes: 1. Explain the basic concepts of animating objects over a specific amount of time. 2. Apply appropriate design parameters to achieve a pre-defined animation outcome. 3. Define and explain clearly production timeline needs associated with animation projects. 4. Create animation along a timeline using various techniques such as anticipation, follow through, squash & stretch, balance, gravity, etc. for desired motion.

Credits: 3.00

CGT 14700 - Visual Effects Introduction

Credit Hours: 3.00. This course introduces students to the visual effects techniques using common methodologies and tools. Topics include procedural frameworks, 3D pipeline implementation, vector operations, and simulating physical phenomena for entertainment graphics. Special emphasis is placed on achieving aesthetically please entertainment-grade graphics using visual effects techniques.

Learning Outcomes: 1. Describe visual effects pipeline. 2. Implement simple simulations using common visual effects tools and techniques. 3. Explore options for visual effects career pathways. 4. Create aesthetically pleasing visual effects using production tools and techniques. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 12300 - Animation Foundations

Credit Hours: 3.00. In this course, students are introduced to the core concepts and principles of animated motion. The course includes an overview of animation history and the evolution of animation technology. Principles of animation production are explored through practical exercises executed in a range of animation software types. These exercises will familiarize students with different approaches to creating animated motion, with a focus on keyframed digital animation.

Learning Outcomes: 1. Identify the sequence of major milestones in the history of animation technology, style and industry. 2. Demonstrate fundamental animation skills and principles including anticipation, squash & stretch, timing, easing and motion arcs. 3. Create animated images of objects and characters in digital animation software that communicate believable motion. 4. Arrange and manipulate geometric objects and systems in digital animation software, creating a range of defined outputs including still images and image sequences suitable for animation workflows. Credits: 3.00

CGT 44200 - Production For Computer Animation

Credit Hours: 3.00. An applied course covering advanced spline modeling techniques, lighting techniques, applied shading, motion dynamics and controllers, particle systems, application customization programming, and pre-production development and planning. Study of emerging advancements in computer animation and spatial graphic technologies will be included.

Learning Outcomes: 1. Identify career opportunities in computer graphics and related industries. 2. Assess, classify and critique peer and professional-level portfolios in relation to industry roles 3. Define major project outcomes that align with specific career pathways. 4. Develop and manage production plans for a major entertainment graphics project. 5. Manage teams or individual tasks to execute defined goals within entertainment graphics projects. 6. Create professional portfolio or showreel pieces that demonstrate industry relevant skills. Credits: 3.00

CGT Entertainment Selectives (15 credits)

Other Departmental/Program Course Requirements (52 credits)

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects

of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve

sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to

liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (14 Credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

CGT 11200 - Sketching For Visualization And Communication

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication, and creativity within a sketching metaphor. Exercises and projects in graphic theory, problem solving, and sketching skill development provide students with activities that focus on further development within the discipline. A variety of sketching techniques are used to gather critical information and transform data into effective communication instruments.

Learning Outcomes: 1. Awaken creativity and problem-solving through the means of sketching. 2. Develop fine motor skills: Becoming a artisan. 3. Explore Aesthetics as it pertains to sketching. 4. Learn and practice professional methods of look development. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

CGT 12300 - Animation Foundations

Credit Hours: 3.00. In this course, students are introduced to the core concepts and principles of animated motion. The course includes an overview of animation history and the evolution of animation technology. Principles of animation production are explored through practical exercises executed in a range of animation software types. These exercises will familiarize students with different approaches to creating animated motion, with a focus on keyframed digital animation.

Learning Outcomes: 1. Identify the sequence of major milestones in the history of animation technology, style and industry. 2. Demonstrate fundamental animation skills and principles including anticipation, squash & stretch, timing, easing and motion arcs. 3. Create animated images of objects and characters in digital animation software that communicate believable motion. 4. Arrange and manipulate geometric objects and systems in digital animation software, creating a range of defined outputs including still images and image sequences suitable for animation workflows. Credits: 3.00

15 Credits

Spring 1st Year

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 24100 - Introduction To Computer Animation

Credit Hours: 3.00. This course introduces the knowledge base on which digital animation and spatial graphics technology are founded and developed. Emphasis will be placed on developing a working knowledge of the mechanics of 3D geometric formats, spline-based modeling with polygon mesh & NURBS, procedural mapping of raster images, simplified polygon modeling, rendering methods, hierarchical linking, and kinematic fundamentals.

Learning Outcomes: 1. Explain the basic

concepts of animating objects over a specific amount of time. 2. Apply appropriate design parameters to achieve a pre-defined animation outcome. 3. Define and explain clearly production timeline needs associated with animation projects. 4. Create animation along a timeline using various techniques such as anticipation, follow through, squash & stretch, balance, gravity, etc. for desired motion. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

15 Credits

Fall 2nd Year

CGT 14700 - Visual Effects Introduction

Credit Hours: 3.00. This course introduces students to the

visual effects techniques using common methodologies and tools. Topics include procedural frameworks, 3D pipeline implementation, vector operations, and simulating physical phenomena for entertainment graphics. Special emphasis is placed on achieving aesthetically please entertainment-grade graphics using visual effects techniques.

Learning Outcomes: 1. Describe visual effects pipeline. 2. Implement simple simulations using common visual effects tools and techniques. 3. Explore options for visual effects career pathways. 4. Create aesthetically pleasing visual effects using production tools and techniques. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 2nd Year

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify

substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive,

explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

14 Credits

Fall 3rd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit

Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

CGT 44200 - Production For Computer Animation

Credit Hours: 3.00. An applied course covering advanced spline modeling techniques, lighting techniques, applied shading, motion dynamics and controllers, particle systems, application customization programming, and pre-production development and planning. Study of emerging advancements in computer animation and spatial graphic technologies will be included.

Learning Outcomes: 1. Identify career opportunities in computer graphics and related industries. 2. Assess, classify and critique peer and professional-level portfolios in relation to industry roles 3. Define major project outcomes that align with specific career pathways. 4. Develop and manage production plans for a major entertainment graphics project. 5. Manage teams or individual tasks to execute defined goals within entertainment graphics projects. 6. Create professional portfolio or showreel pieces that demonstrate industry relevant skills. Credits: 3.00

15 Credits

Spring 3rd Year

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 44200 - Production For Computer Animation

Credit Hours: 3.00. An applied course covering advanced spline modeling techniques, lighting techniques, applied shading, motion dynamics and controllers, particle systems, application customization programming, and pre-production development and planning. Study of emerging advancements in computer animation and spatial graphic technologies will be included.

Learning Outcomes: 1. Identify career opportunities in computer graphics and related industries. 2. Assess, classify and critique peer and professional-level portfolios in relation to industry roles 3. Define major project outcomes that align with specific career pathways. 4.

Develop and manage production plans for a major entertainment graphics project. 5. Manage teams or individual tasks to execute defined goals within entertainment graphics projects. 6. Create professional portfolio or showreel pieces that demonstrate industry relevant skills. Credits: 3.00

15 Credits

Fall 4th Year

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

16 Credits

Spring 4th Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in

written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

15 Credits

Anthropology Honors, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (42 credits)

Area A - Anthropology Requirements (15 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated

research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century. Credits: 3.00

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

Area B - Anthropology Honors Selectives (21 credits)

Area C - Anthropology Honors Requirements (6 credits)

ANTH 49700 - Senior Honors Seminar

Credit Hours: 3.00. A critical examination of some major works in anthropology and sociology, both classical and modern, and of some current theoretical and substantive issues in these disciplines. Open only to students in the departmental honors program.

Credits: 3.00

ANTH 49800 - Senior Honors Paper

Credit Hours: 3.00. Requires a substantial paper on a topic approved by the instructor. The student is expected to work closely with the instructor on the paper's content and style. A presentation of the results of the work is made at the end of the semester. Open only to students in the departmental honors program.

Credits: 3.00

Optional Concentrations

Electives (5-42 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

15 Credits

Spring 1st Year

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

15-16 Credits

Fall 2nd Year

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

ANTH 49700 - Senior Honors Seminar

Credit Hours: 3.00. A critical examination of some major works in anthropology and sociology, both classical and modern, and of some current theoretical and substantive issues in these disciplines. Open only to students in the departmental honors program.

Credits: 3.00

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century.

Credits: 3.00

15 Credits

Spring 4th Year

ANTH 49800 - Senior Honors Paper

Credit Hours: 3.00. Requires a substantial paper on a topic approved by the instructor. The student is expected to work closely with the instructor on the paper's content and style. A presentation of the results of the work is made at the end of the semester. Open only to students in the departmental honors program.

Credits: 3.00

15 Credits

Anthropology, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (36 credits)

Area A - Anthropology Requirements (15 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media.

Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors

on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century. Credits: 3.00

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

Area B - Anthropology Selectives (21 credits)

Optional Concentrations

Electives (11-48 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

15 Credits

Spring 1st Year

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

15-16 Credits

Fall 2nd Year

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century. Credits: 3.00

15 Credits

Spring 4th Year

15 Credits

Anthropology, BS

About the Program

Degree Requirements

Liberal Arts Curriculum

Departmental/Program Major Courses (36 credits)

Area A - Anthropology Requirements (15 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental

architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century. Credits: 3.00

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives

within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

Area B - Anthropology Selectives (21 credits)

Optional Concentrations

Electives (29-53 credits)

Grade Requirements

GPA Requirements

College of Liberal Arts Pass/No Pass Option Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

15-16 Credits

Spring 1st Year

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

15 Credits

Fall 2nd Year

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current

theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century. Credits: 3.00

15 Credits

Spring 4th Year

15 Credits

Applied Mathematics, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (34 credits)

Required Major Courses (28 credits)

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8.

Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear

dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

Math/Statistics Selective (6 credits)

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define

and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

MA 45401 - Galois Theory Honors

Credit Hours: 3.00. This course will give a thorough introduction to Galois theory. Galois theory is a fundamental tool in many areas of mathematics, including number theory and algebraic geometry. This course will increase students' mathematical maturity and prepare them for graduate school. Topics include finite extension fields and their symmetries, ruler and compass constructions, complex roots of unity, solvable groups, and the solvability of polynomial equations by arithmetic and radical operations. This course is intended for third- or fourth-year students who have taken MA 45000 (Algebra Honors) or MA 45300 (Elements of Algebra I).

Learning Outcomes: 1. Know the historical background of Galois theory. 2. Know the classical version which addresses questions about roots of polynomials and the modern formulation in terms of abstract algebra. 3. Know about finite extension fields and their symmetries. 4. Know how Galois theory answers ancient questions about ruler and compass constructions. 5. Know about cyclotomic fields generated by complex roots of unity. 6. Know how Galois theory answers questions about the solvability of polynomial equations by arithmetic and radical operations. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do

not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

Other Departmental/Program Course Requirements (41-67 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or

departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum,

and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Courses (4-5 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms,

graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Electives (19-45 credits)

Grade Requirements

GPA Requirements

Course Requirements

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of

functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

15-18 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix

multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15-16 Credits

Fall 3rd Year

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets,

infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

13-16 Credits

Spring 3rd Year

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

12-16 Credits

Fall 4th Year

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

12-15 Credits

Spring 4th Year

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of

signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

12-14 Credits

Applied Meteorology and Climatology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (32 credits)

Required Major Courses (32 credits)

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 43100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (EAPS 42100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 3.00

AGRY 43200 - Atmospheric Dynamics I

Credit Hours: 3.00. (EAPS 42200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations; thermal wind relationships; circulation, vorticity, divergence, and vertical motion.

Credits: 3.00

AGRY 43300 - Atmospheric Dynamics II

Credit Hours: 3.00. (EAPS 42300) An extension of AGRY 43200 with the emphasis on perturbation theory and hydrodynamic stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

AGRY 44100 - Synoptic Laboratory I

Credit Hours: 1.00. (EAPS 43100) Analysis of vertical distributions of temperature and moisture with applications to adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 1.00

AGRY 44200 - Synoptic Laboratory II

Credit Hours: 1.00. (EAPS 43200) Analysis of horizontal distributions of pressure, temperature, wind, vorticity, and vertical motions. Applications to synoptic scale wave propagation.

Credits: 1.00

AGRY 44300 - Synoptic Laboratory III

Credit Hours: 1.00. (EAPS 43300) Diagnosis of midtropospheric wave propagation and growth. Analysis of surface pressure fields and fronts and their relationships to upper air features. Extensive use is made of teletype and facsimile weather information.

Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

AGRY 53500 - Boundary Layer Meteorology

Credit Hours: 3.00. (EAPS 52500) This course has required class trips. Students will pay individual lodging or meal expenses where necessary. A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

AGRY 53600 - Environmental Biophysics

Credit Hours: 3.00. An analysis of the energy fluxes to and from terrestrial plants, insects, mammals, and humans as they exist in their macro and microclimates. Agricultural meteorology methods (both research and operational) will be presented. Labs will be both in-laboratory and in-field with reports required. A special project will be required of all students and will be presented in class and written as if for publication.

Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information.

Credits: 3.00

Other Departmental /Program Course Requirements (77-80 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team.
Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes

an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

EAPS 43400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (AGRY 44400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation

techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three

dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for

one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Electives (8-11 credits)

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core

curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of

the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits:

5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

15-16 Credits

Spring 1st Year

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

14-16 Credits

Fall 2nd Year

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design

and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

15 Credits

Spring 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 44100 - Synoptic Laboratory I

Credit Hours: 1.00. (EAPS 43100) Analysis of vertical distributions of temperature and moisture with applications to adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 1.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8.

Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

17 Credits

Fall 3rd Year

AGRY 43100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (EAPS 42100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of

STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

15 Credits

Spring 3rd Year

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

AGRY 43200 - Atmospheric Dynamics I

Credit Hours: 3.00. (EAPS 42200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations; thermal wind relationships; circulation, vorticity, divergence, and vertical motion.

Credits: 3.00

AGRY 44200 - Synoptic Laboratory II

Credit Hours: 1.00. (EAPS 43200) Analysis of horizontal distributions of pressure, temperature, wind, vorticity, and vertical motions. Applications to synoptic scale wave propagation.

Credits: 1.00

13-14 Credits

Fall 4th Year

AGRY 43300 - Atmospheric Dynamics II

Credit Hours: 3.00. (EAPS 42300) An extension of AGRY 43200 with the emphasis on perturbation theory and hydrodynamic stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

AGRY 44300 - Synoptic Laboratory III

Credit Hours: 1.00. (EAPS 43300) Diagnosis of midtropospheric wave propagation and growth. Analysis of surface pressure fields and fronts and their relationships to upper air features. Extensive use is made of teletype and facsimile weather information.

Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

AGRY 53500 - Boundary Layer Meteorology

Credit Hours: 3.00. (EAPS 52500) This course has required class trips. Students will pay individual lodging or meal expenses where necessary. A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely

sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information.

Credits: 3.00

13-14 Credits

Spring 4th Year

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

EAPS 43400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (AGRY 44400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

AGRY 53600 - Environmental Biophysics

Credit Hours: 3.00. An analysis of the energy fluxes to and from terrestrial plants, insects, mammals, and humans as they exist in their macro and microclimates. Agricultural meteorology methods (both research and operational) will be presented. Labs will be both in-laboratory and in-field with reports required. A special project will be required of all students and will be presented in class and written as if for publication.

Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods.

Credits: 3.00

15-16 Credits

Applied Physics Honors, BS

About the Program

Degree Requirements

Applied Physics Honors Major Courses (70-78 credits)

Required Major Courses (46-54 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface

integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom

spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

PHYS 59300 - Independent Research

Credit Hours: 1.00 to 4.00. Research in some area of modern physics (spectroscopy, nuclear physics, solid state physics, elementary particle physics, biophysics, geophysics, etc.) with student receiving individualized supervision and guidance from staff member. This course may be used to satisfy the independent project or 500-level elective requirement of the undergraduate majors in Honors and Applied Physics Honors Programs. Permission of instructor required.

Credits: 1.00 to 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Major Selective* - 24 credits

Other Departmental/Program Course Requirements (39-62 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-

based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-

based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret

statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Electives (0-11 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Group 1

PHYS 15200 - Mechanics (UCC: SCI)

Credit Hours: 0.00 to 5.00. Statics, uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; hydrostatics and hydrodynamics; simple harmonic motion; wave motion and sound.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Learn the basic theories of mechanics and their application, including uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; properties of matter; simple harmonic and wave motion. Credits: 0.00 to 5.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 21800 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Analyze physical circumstances according to Newton's Laws of motion properly. 2. Apply basic conservation laws and and to recognize the circumstances in which they apply. 3. Use physical terms such as energy, acceleration, momentum, impulse, velocity, etc., properly. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills;

reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Group 2

PHYS 21900 - General Physics II (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Learn the basic theory and application of electricity, magnetism, dc and ac circuits; geometrical and physical optics; topics in modern physics. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Group 3

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 41000 - Physical Mechanics I Honors

Credit Hours: 3.00. Newtonian, Lagrangian, and Hamiltonian mechanics. Emphasis on point mass mechanics. Free, driven, and damped harmonic motion, central force problem.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 3.00

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

Group 4

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

Group 5

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3.

Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Group 6

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 43000 - Electricity And Magnetism I Honors

Credit Hours: 3.00. Electrostatics, solutions of Poisson's equation in spherical and cylindrical coordinates, macroscopic and microscopic theory of dielectrics, electrostatic energy, conduction; magnetostatics, electromagnetic induction, and magnetic properties of matter.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

Group 7

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular

momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

Group 8

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

Non-course / Non-credit Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 .

Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting

methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab

results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-16 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire

capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface

integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

16-17 Credits

Spring 2nd Year

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data

and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15-16 Credits

Fall 3rd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using

Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

16-17 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

17 Credits

Fall 4th Year

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 59300 - Independent Research

Credit Hours: 1.00 to 4.00. Research in some area of modern physics (spectroscopy, nuclear physics, solid state physics, elementary particle physics, biophysics, geophysics, etc.) with student receiving individualized supervision and guidance from staff member. This course may be used to satisfy the independent project or 500-level elective requirement of the undergraduate majors in Honors and Applied Physics Honors Programs. Permission of instructor required.

Credits: 1.00 to 4.00

16-17 Credits

Spring 4th Year

12-14 Credits

Applied Physics, BS

About the Program

Degree Requirements

Applied Physics Major Courses (66-74 credits)

Required Major Courses (42-50 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe

Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to

understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Major Selective* - (24 credits)

Other Departmental/Program Course Requirements (39-62 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make

efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data

measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be

introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Electives (0-11 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Group 1

PHYS 15200 - Mechanics (UCC: SCI)

Credit Hours: 0.00 to 5.00. Statics, uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; hydrostatics and hydrodynamics; simple harmonic motion; wave motion and sound.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Learn the basic theories of mechanics and their application, including uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; properties of matter; simple harmonic and wave motion. Credits: 0.00 to 5.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics

and thermodynamics. Credits: 4.00

PHYS 21800 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Analyze physical circumstances according to Newton's Laws of motion properly. 2. Apply basic conservation laws and and to recognize the circumstances in which they apply. 3. Use physical terms such as energy, acceleration, momentum, impulse, velocity, etc., properly. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Group 2

PHYS 21900 - General Physics II (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Learn the basic theory and application of electricity, magnetism, dc and ac circuits; geometrical and physical optics; topics in modern physics. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's

equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Group 3

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 41000 - Physical Mechanics I Honors

Credit Hours: 3.00. Newtonian, Lagrangian, and Hamiltonian mechanics. Emphasis on point mass mechanics. Free, driven, and damped harmonic motion, central force problem.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 3.00

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

Group 4

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

Group 5

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Group 6

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 43000 - Electricity And Magnetism I Honors

Credit Hours: 3.00. Electrostatics, solutions of Poisson's equation in spherical and cylindrical coordinates, macroscopic and microscopic theory of dielectrics, electrostatic energy, conduction; magnetostatics, electromagnetic induction, and magnetic properties of matter.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to

apply the core physics subject of Electromagnetism. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

Group 7

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

Group 8

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4.

Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

Non-course / Non-credit Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions.

Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how

scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient,

how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the

geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications.
Credits: 5.00

16-18 Credits

Spring 2nd Year

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.
Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems.
Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.
Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing.
Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.
University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15-16 Credits

Fall 3rd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in

Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

16-17 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

17 Credits

Fall 4th Year

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

15 Credits

Spring 4th Year

12 Credits

Applied Statistics, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (24-25 credits)

Required Major Courses (18 credits)

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret

statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and

moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

Applied Statistics Selective (6-7 credits)

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a

single decrement and multiple decrement environment. Credits: 4.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 47301 - Introduction To Arbitrage-Free Pricing Of Financial Derivatives

Credit Hours: 3.00. This course exposes students to a number of financial economics concepts related to arbitrage-free option pricing in the binomial market model and the Black-Scholes model. Specific models include (1) Options and parity relationship between options; (2) Option Pricing under the Binomial model; (3) Option Pricing under the Black-Scholes model; (4) Option hedging and the market maker's overnight profit; (5) Black Scholes theory with Brownian motion and Ito calculus; (6) Risk-neutral option pricing and Monte Carlo valuation; (7) Stochastic interest rates and Stochastic Volatility. This course provides the background for Couse MFE of the Society of Actuaries and Course 3F of the Casualty Actuarial Society.

Learning Outcomes: 1. Use arbitrage-free option pricing in the binomial market model and the Black-Scholes model. 2. Adapt the binomial setting to computing exotic and path-dependent

option prices, including the determination of optimal exercise. 3. Follow marking-to-market strategies for approximate discrete delta hedging. Credits: 3.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating

insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire

new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

STAT 41800 - Computational Methods In Data Science

Credit Hours: 3.00. This course introduces essential computational methods in modern data science, focusing on simulation, resampling, Bayesian data analysis, and the utilization of large language models (LLMs) in data science workflows. Students will learn foundational simulation techniques, such as random variable generation through the inverse cumulative distribution function and rejection sampling. The course provides an overview of Frequentist and Bayesian inference, highlighting their theoretical foundations and practical applications. Key resampling methods, including bootstrapping and cross-validation, will be explored as tools for assessing variability, constructing confidence intervals, and validating predictive models. The course also emphasizes the practical and responsible use of LLMs in data science pipelines, including tasks such as text preprocessing, feature extraction, and leveraging pre-trained models to enhance data analysis and annotation. The course culminates in a capstone project where students will synthesize their learning by designing and implementing comprehensive solutions to real-world data science problems, demonstrating both theoretical understanding and practical implementation skills.

Learning Outcomes: 1. Apply simulation techniques, including Monte Carlo methods, transformation approaches, and rejection sampling, to analyze probabilistic behavior in data science applications. They will compare and evaluate Frequentist and Bayesian inference paradigms by examining their theoretical foundations, identify their strengths and limitations, and explain their roles in statistical modeling and decision-making. Students will design, implement, and assess resampling methods, focusing on both nonparametric and parametric forms of the bootstrap, to estimate variability, construct confidence intervals, and improve statistical estimates through bias correction techniques. They will learn the principles of cross-validation, analyze its role in model assessment, and apply it to compute model performance metrics, detect overfitting and underfitting, and select models with reliable predictive accuracy using Python libraries. 2. Construct and interpret posterior distributions and credible intervals, apply Markov Chain Monte Carlo methods to approximate posteriors, and evaluate the role of prior distributions in Bayesian inference. In addition, students will utilize large language models in creative and practical ways within data science workflows, such as contextual data augmentation, feature engineering, and integrating structured and unstructured data to enhance predictive models, addressing challenges such as privacy and reliability. The course will culminate in a capstone project where students will synthesize selected course

topics to design, develop, and present robust solutions to real-world data science challenges. By integrating computational methods, statistical principles, and real-world datasets, students will demonstrate their ability to create effective, data-driven solutions that showcase both theoretical understanding and applied expertise. Credits: 3.00

Other Departmental/Program Course Requirements (38-64 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and

manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find

tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Electives (31-58 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C

programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

15-18 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear

equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15 Credits

Fall 3rd Year

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500,

31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

15-16 Credits

Spring 3rd Year

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

12-15 Credits

Fall 4th Year

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

12-15 Credits

Spring 4th Year

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

12-14 Credits

Aquatic Sciences: Fisheries Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (67-68 credits)

Required Major Courses (56-57 credits)

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most

critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37100 - Fisheries And Aquatic Sciences Practicum

Credit Hours: 5.00. Specific field instruction in fisheries and aquatic sciences. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Develop knowledge in the principles and techniques associated with sampling and assessing fish populations, aquatic habitats, and lower trophic levels (e.g.. zooplankton. benthic invertebrates, etc.) in stream/river (i.e.. lotic) and pond/lake (i.e.. lentic) ecosystems. 2. Develop practical, hands-on experience in aquatic resource assessment, data analysis, reporting, and decision-making as it pertains to sampling and management of aquatic ecosystems. 3. Sharpen critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic sciences as they apply to both basic and applied science. Credits: 5.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for

informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess

issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of

the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

FNR 45600 - Fish And Marine Population Dynamics

Credit Hours: 4.00. Theory of population dynamics of animal populations in freshwater and marine environments. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, marine and freshwater invertebrates, sport and commercial fish populations, and aquatic communities. Human resource users and non-users are considered.

Learning Outcomes: 1. Quantitatively assess the status of a fish population and develop considerations for management. 2. Practice and develop critical thinking skills through in-class discussions and a group research project. 3. Learn to interpret the scientific literature through reading of the primary literature. 4. Broaden understanding of fisheries and natural resource management. Credits: 4.00

FNR 38500 - Fish Biology And Ecology

Credit Hours: 4.00. Advanced study of the biology and ecology of fishes. In particular, the course covers aspects of the morphology, physiology, development, behavior, evolution, and diversity of fishes throughout the world. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems will be explored. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual, population, community structure, and anthropogenic effects.

Learning Outcomes: 1. Know key primitive fish groups and understand how modern fishes evolved through time. 2. Develop skills in fish taxonomy and scientific nomenclature, including identification of a wide range of fish specimens. 3. Understand fish diversity in terms of morphology, behavior, feeding, reproduction and habitats. 4. Build fish laboratory skills, including fish dissection, data collection and data analysis. 5. Understand the broad ecological roles of fishes in freshwater and marine systems. 6. Understand the principles of fish population dynamics and how populations

respond to various biotic and abiotic factors. 7. Develop an understanding of the scientific method and demonstrate the ability to solve. problems, think critically and write scientific reports. Credits: 4.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 35110 - Aquatic Sampling Techniques I

Credit Hours: 2.00. This course presents an introduction to field sampling methods used in aquaculture, aquatic ecology, and fisheries biology. The course emphasizes the proper care and use of field sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with assessing physical habitat, lower trophic levels, and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including basic data analysis and decision-making as it pertains to the sampling and management of aquatic ecosystems. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

FNR 35150 - Aquatic Sampling Techniques II

Credit Hours: 2.00. This course presents an introduction to laboratory and field sampling methods used in aquaculture, limnology, and fisheries biology. The course emphasizes the proper care and use of laboratory equipment and field sampling gears, as well as the analyses and reporting of fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with hatchery and freshwater and marine fish culture systems and assessment of fish health, fish diet and age, physical habitat, water quality and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including data

analysis, reporting, and decision-making as it pertains to the sampling and management of fish culture systems and aquatic ecosystems. 3. Advance critical thinking and written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

Required Concentration Courses (11 credits)

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

FNR 45200 - Aquaculture

Credit Hours: 3.00. Historical perspectives and current practices in aquaculture, including production systems, feeds, water quality requirements, and diseases of commercially important species.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45300 - Fish Physiology

Credit Hours: 3.00. Presentation and discussion of physiological mechanisms exhibited by freshwater and marine invertebrates and vertebrates. Primary materials used for class presentation and discussions will be examples from primary research literature. Topics include respiration, osmoregulation, stress physiology, absorption and metabolism of compounds, and hormonal control of selected physiological mechanisms. Offered in odd-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 54300 - Conservation Biology I

Credit Hours: 3.00. Introduction to conservation biology, including population dynamics and genetic structure of rare organisms. Recovery planning, restoration ecology, environmental policy making, and sustainable developments are

considered, as is ethics in conservation of biological diversity. Offered in odd-numbered years. Permission of instructor required.

Learning Outcomes: 1. Read and interpret the scientific literature on conservation of natural resources with an awareness of the current status of what is known about biodiversity, endangered species and ecosystems, biological invasions, and the effects of climate change on natural communities. 2. Explain how conservation research is carried out, and appreciate common pitfalls in designing research for goals of conservation interest. 3. Consider and evaluate the balance between conservation goals and other priorities in land management, societal and economic goals, and socio-political systems. Credits: 3.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 45700 - Practical Fisheries Management

Credit Hours: 2.00. Theory and practice of fisheries management, with emphasis on strategies utilized for the management of freshwater and marine fisheries. Course content will include hands-on assessment of fish populations, as well as development of management plans and the setting of appropriate goals and objectives for effective, science-based management.

Learning Outcomes: 1. Develop understanding of the practical management of fisheries. 2. Compare and contrast a variety of fisheries management techniques with an emphasis on local fisheries. 3. Demonstrate quantitative skills in population modeling and the writing of fisheries management plans. Credits: 2.00

FNR 45800 - Advanced Marine Biology

Credit Hours: 3.00. Focus is placed on the structure and function of major marine ecosystems, including estuarine, mangrove, coastal, coral reef, open ocean, and deep ocean environments. Course content will include rigorous treatment of the biogeochemical processes that support these ecosystems, as well as the biology and ecology of characteristic flora and fauna.

Learning Outcomes: 1. Demonstrate in-depth understanding of the structure and function of key marine ecosystems of the world. 2. Demonstrate thorough understanding of the major groups of organisms characteristic of key marine ecosystems of the world. 3. Demonstrate thorough understanding of the biogeochemical processes that sustain key marine ecosystems and their constituent taxa. 4. Understand major threats to sustainability of key marine ecosystems of the world. 5. Demonstrate improved critical thinking and scientific writing skills. Credits: 3.00

FNR 37800 - Marine Biology Practicum

Credit Hours: 3.00. This course presents students with expanded opportunities to use field techniques to sample and report on marine habitats and organisms. The course emphasizes the proper care and use of field sampling gear and identification of fish and invertebrates samples from exposed shore, lagoon, and estuary habitats. A trip to the coast of either the Atlantic Ocean or Gulf of Mexico is a central component of this course; a course fee is required to cover the expenses of the trip.

Learning Outcomes: 1. Demonstrate enhanced knowledge of the basic principles and techniques associated with sampling organisms in coastal environments. 2. Demonstrate practical knowledge and skills in sampling, handling, identifying, and reporting on marine biological communities characteristic of several costal habitat types. 3. Demonstrate improved critical thinking, written and oral communication,

and professional skills related to marine biology. Credits: 3.00

FNR 31300 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (HORT 31110) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in Western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of postharvest food storage and pest management. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 14. Be able to handle multiple tasks and deadline pressures. 15. Be able to work effectively with individuals from diverse cultures. 16. Have strong professional ethics and integrity. 17. Understand the importance of developing leadership skills. 18. Be able to work effectively in teams. 19. Have a working knowledge of SI (metric) units. Credits: 1.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

Other Departmental/Program Course Requirements (50-53 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and

services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and

obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological

processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific

understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and

non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

EAPS 10400 - Oceanography (UCC: STS)

Credit Hours: 3.00. Origin of the oceans and marine life. Seafloor spreading and marine geology; currents, waves, and tides; marine organisms and ecology; beaches and nearshore life. Man's use and abuse of the sea, including contemporary problems and future opportunities. The role of oceans in climate and evolution of the biosphere.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand ocean and coastal processes. 2. Understand potential future impacts of ocean and other environmental changes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

Electives (0-3 credits)

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular

basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of

differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

14-16 Credits

Spring 1st Year

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

16 Credits

Fall 2nd Year

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and

ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 35110 - Aquatic Sampling Techniques I

Credit Hours: 2.00. This course presents an introduction to field sampling methods used in aquaculture, aquatic ecology, and fisheries biology. The course emphasizes the proper care and use of field sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with assessing physical habitat, lower trophic levels, and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including basic data analysis and decision-making as it pertains to the sampling and management of aquatic ecosystems. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

16 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic,

political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a

meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 35150 - Aquatic Sampling Techniques II

Credit Hours: 2.00. This course presents an introduction to laboratory and field sampling methods used in aquaculture, limnology, and fisheries biology. The course emphasizes the proper care and use of laboratory equipment and field sampling gears, as well as the analyses and reporting of fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with hatchery and freshwater and marine fish culture systems and assessment of fish health, fish diet and age, physical habitat, water quality and fish

populations in lentic and lotic environments. 2. Assess aquatic resources, including data analysis, reporting, and decision-making as it pertains to the sampling and management of fish culture systems and aquatic ecosystems. 3. Advance critical thinking and written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

14 Credits

Summer Session

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37100 - Fisheries And Aquatic Sciences Practicum

Credit Hours: 5.00. Specific field instruction in fisheries and aquatic sciences. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Develop knowledge in the principles and techniques associated with sampling and assessing fish populations, aquatic habitats, and lower trophic levels (e.g.. zooplankton. benthic invertebrates, etc.) in stream/river (i.e.. lotic) and pond/lake (i.e.. lentic) ecosystems. 2. Develop practical, hands-on experience in aquatic resource assessment, data analysis, reporting, and decision-making as it pertains to sampling and management of aquatic ecosystems. 3. Sharpen critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic sciences as they apply to both basic and applied science. Credits: 5.00

6 Credits

Fall 3rd Year

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a

focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 45600 - Fish And Marine Population Dynamics

Credit Hours: 4.00. Theory of population dynamics of animal populations in freshwater and marine environments. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, marine and freshwater invertebrates, sport and commercial fish populations, and aquatic communities. Human resource users and non-users are considered.

Learning Outcomes: 1. Quantitatively assess the status of a fish population and develop considerations for management. 2. Practice and develop critical thinking skills through in-class discussions and a group research project. 3. Learn to interpret the scientific literature through reading of the primary literature. 4. Broaden understanding of fisheries and natural resource management. Credits: 4.00

13 Credits

Spring 3rd Year

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure.

Credits: 3.00

FNR 38500 - Fish Biology And Ecology

Credit Hours: 4.00. Advanced study of the biology and ecology of fishes. In particular, the course covers aspects of the morphology, physiology, development, behavior, evolution, and diversity of fishes throughout the world. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems will be explored. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual, population, community structure, and anthropogenic effects.

Learning Outcomes: 1. Know key primitive fish groups and understand how modern fishes evolved through time. 2. Develop skills in fish taxonomy and scientific nomenclature, including identification of a wide range of fish specimens. 3. Understand fish diversity in terms of morphology, behavior, feeding, reproduction and habitats. 4. Build fish laboratory skills, including fish dissection, data collection and data analysis. 5. Understand the broad ecological roles of fishes in freshwater and marine systems. 6. Understand the principles of fish population dynamics and how populations respond to various biotic and abiotic factors. 7. Develop an understanding of the scientific method and demonstrate the ability to solve. problems, think critically and write scientific reports. Credits: 4.00

13 Credits

Fall 4th Year

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 45700 - Practical Fisheries Management

Credit Hours: 2.00. Theory and practice of fisheries management, with emphasis on strategies utilized for the management of freshwater and marine fisheries. Course content will include hands-on assessment of fish populations, as

well as development of management plans and the setting of appropriate goals and objectives for effective, science-based management.

Learning Outcomes: 1. Develop understanding of the practical management of fisheries. 2. Compare and contrast a variety of fisheries management techniques with an emphasis on local fisheries. 3. Demonstrate quantitative skills in population modeling and the writing of fisheries management plans. Credits: 2.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

13-14 Credits

Spring 4th Year

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 45200 - Aquaculture

Credit Hours: 3.00. Historical perspectives and current practices in aquaculture, including production systems, feeds, water quality requirements, and diseases of commercially important species.

Learning Outcomes: 1. Demonstrate use of the

scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

13-14 Credits

Aquatic Sciences: Marine and Freshwater Biology Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (65-66 credits)

Required Major Courses (56-57 credits)

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation.

Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37100 - Fisheries And Aquatic Sciences Practicum

Credit Hours: 5.00. Specific field instruction in fisheries and aquatic sciences. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Develop knowledge in the principles and techniques associated with sampling and assessing fish populations, aquatic habitats, and lower trophic levels (e.g.. zooplankton. benthic invertebrates, etc.) in stream/river (i.e.. lotic) and pond/lake (i.e.. lentic) ecosystems. 2. Develop practical, hands-on experience in aquatic resource assessment, data analysis, reporting, and decision-making as it pertains to sampling and management of aquatic ecosystems. 3. Sharpen critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic sciences as they apply to both basic and applied science. Credits: 5.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary

literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical,

physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

FNR 45600 - Fish And Marine Population Dynamics

Credit Hours: 4.00. Theory of population dynamics of animal populations in freshwater and marine environments. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, marine and freshwater invertebrates, sport and commercial fish populations, and aquatic communities. Human resource users and non-users are considered.

Learning Outcomes: 1. Quantitatively assess the status of a fish population and develop considerations for management. 2. Practice and develop critical thinking skills through in-class discussions and a group research project. 3. Learn to interpret the scientific literature through reading of the primary literature. 4. Broaden understanding of fisheries and natural resource management. Credits: 4.00

FNR 38500 - Fish Biology And Ecology

Credit Hours: 4.00. Advanced study of the biology and ecology of fishes. In particular, the course covers aspects of the morphology, physiology, development, behavior, evolution, and diversity of fishes throughout the world. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems will be explored. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual, population, community structure, and anthropogenic effects.

Learning Outcomes: 1. Know key primitive fish groups and understand how modern fishes evolved through time. 2. Develop skills in fish taxonomy and scientific nomenclature, including identification of a wide range of fish specimens. 3. Understand fish diversity in terms of morphology, behavior, feeding, reproduction and habitats. 4. Build fish laboratory skills, including fish dissection, data collection and data analysis. 5. Understand the broad ecological roles of fishes in freshwater and marine systems. 6. Understand the principles of fish population dynamics and how populations respond to various biotic and abiotic factors. 7. Develop an understanding of the scientific method and demonstrate the ability to solve. problems, think critically and write scientific reports. Credits: 4.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and

pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 35110 - Aquatic Sampling Techniques I

Credit Hours: 2.00. This course presents an introduction to field sampling methods used in aquaculture, aquatic ecology, and fisheries biology. The course emphasizes the proper care and use of field sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with assessing physical habitat, lower trophic levels, and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including basic data analysis and decision-making as it pertains to the sampling and management of aquatic ecosystems. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

FNR 35150 - Aquatic Sampling Techniques II

Credit Hours: 2.00. This course presents an introduction to laboratory and field sampling methods used in aquaculture, limnology, and fisheries biology. The course emphasizes the proper care and use of laboratory equipment and field sampling gears, as well as the analyses and reporting of fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with hatchery and freshwater and marine fish culture systems and assessment of fish health, fish diet and age, physical habitat, water quality and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including data analysis, reporting, and decision-making as it pertains to the sampling and management of fish culture systems and aquatic ecosystems. 3. Advance critical thinking and written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

Concentration Courses (9 credits)

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide

undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

FNR 45200 - Aquaculture

Credit Hours: 3.00. Historical perspectives and current practices in aquaculture, including production systems, feeds, water quality requirements, and diseases of commercially important species.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45300 - Fish Physiology

Credit Hours: 3.00. Presentation and discussion of physiological mechanisms exhibited by freshwater and marine invertebrates and vertebrates. Primary materials used for class presentation and discussions will be examples from primary research literature. Topics include respiration, osmoregulation, stress physiology, absorption and metabolism of compounds, and hormonal control of selected physiological mechanisms. Offered in odd-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 54300 - Conservation Biology I

Credit Hours: 3.00. Introduction to conservation biology, including population dynamics and genetic structure of rare organisms. Recovery planning, restoration ecology, environmental policy making, and sustainable developments are considered, as is ethics in conservation of biological diversity. Offered in odd-numbered years. Permission of instructor required.

Learning Outcomes: 1. Read and interpret the scientific literature on conservation of natural resources with an awareness of the current status of what is known about biodiversity, endangered species and ecosystems, biological invasions, and the effects of climate change on natural communities. 2. Explain how conservation research is carried out, and appreciate common pitfalls in designing research for goals of conservation interest. 3. Consider and evaluate the balance between conservation goals and other priorities in land management, societal and economic goals, and socio-political systems. Credits: 3.00

FNR 45700 - Practical Fisheries Management

Credit Hours: 2.00. Theory and practice of fisheries management, with emphasis on strategies utilized for the management of freshwater and marine fisheries. Course content will include hands-on assessment of fish populations, as well as development of management plans and the setting of appropriate goals and objectives for effective, science-based management.

Learning Outcomes: 1. Develop understanding of the practical management of fisheries. 2. Compare and contrast a variety of fisheries management techniques with an emphasis on local fisheries. 3. Demonstrate quantitative skills in population modeling and the writing of fisheries management plans. Credits: 2.00

FNR 45800 - Advanced Marine Biology

Credit Hours: 3.00. Focus is placed on the structure and function of major marine ecosystems, including estuarine, mangrove, coastal, coral reef, open ocean, and deep ocean environments. Course content will include rigorous treatment of the biogeochemical processes that support these ecosystems, as well as the biology and ecology of characteristic flora and fauna.

Learning Outcomes: 1. Demonstrate in-depth understanding of the structure and function of key marine ecosystems of the world. 2. Demonstrate thorough understanding of the

major groups of organisms characteristic of key marine ecosystems of the world. 3. Demonstrate thorough understanding of the biogeochemical processes that sustain key marine ecosystems and their constituent taxa. 4. Understand major threats to sustainability of key marine ecosystems of the world. 5. Demonstrate improved critical thinking and scientific writing skills. Credits: 3.00

FNR 37800 - Marine Biology Practicum

Credit Hours: 3.00. This course presents students with expanded opportunities to use field techniques to sample and report on marine habitats and organisms. The course emphasizes the proper care and use of field sampling gear and identification of fish and invertebrates samples from exposed shore, lagoon, and estuary habitats. A trip to the coast of either the Atlantic Ocean or Gulf of Mexico is a central component of this course; a course fee is required to cover the expenses of the trip.

Learning Outcomes: 1. Demonstrate enhanced knowledge of the basic principles and techniques associated with sampling organisms in coastal environments. 2. Demonstrate practical knowledge and skills in sampling, handling, identifying, and reporting on marine biological communities characteristic of several costal habitat types. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills related to marine biology. Credits: 3.00

FNR 31300 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (HORT 31110) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in Western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of postharvest food storage and pest management. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 14. Be able to handle multiple tasks and deadline pressures. 15. Be able to work effectively with individuals from diverse cultures. 16. Have strong professional ethics and integrity. 17. Understand the importance of developing leadership skills. 18. Be able to work effectively in teams. 19. Have a working knowledge of SI (metric) units. Credits: 1.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals,

hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

Other Departmental /Program Course Requirements (50-53 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources.

Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers

as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating

biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and

modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions.

6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

EAPS 10400 - Oceanography (UCC: STS)

Credit Hours: 3.00. Origin of the oceans and marine life. Seafloor spreading and marine geology; currents, waves, and tides; marine organisms and ecology; beaches and nearshore life. Man's use and abuse of the sea, including contemporary problems and future opportunities. The role of oceans in climate and evolution of the biosphere.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand ocean and coastal processes. 2. Understand potential future impacts of ocean and other environmental changes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

Electives (1-5 credits)

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core

curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms

interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications

related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

14-16 Credits

Spring 1st Year

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues,

facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 35110 - Aquatic Sampling Techniques I

Credit Hours: 2.00. This course presents an introduction to field sampling methods used in aquaculture, aquatic ecology, and fisheries biology. The course emphasizes the proper care and use of field sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with assessing physical habitat, lower trophic levels, and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including basic data analysis and decision-making as it pertains to the sampling and management of aquatic ecosystems. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

16 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues

in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 35150 - Aquatic Sampling Techniques II

Credit Hours: 2.00. This course presents an introduction to laboratory and field sampling methods used in aquaculture, limnology, and fisheries biology. The course emphasizes the proper care and use of laboratory equipment and field sampling gears, as well as the analyses and reporting of fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with hatchery and freshwater and marine fish culture systems and assessment of fish health, fish diet and age, physical habitat, water quality and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including data analysis, reporting, and decision-making as it pertains to the sampling and management of fish culture systems and aquatic ecosystems. 3. Advance critical thinking and written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

14 Credits

Summer Session

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37100 - Fisheries And Aquatic Sciences Practicum

Credit Hours: 5.00. Specific field instruction in fisheries and aquatic sciences. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Develop knowledge in the principles and techniques associated with sampling and assessing fish populations, aquatic habitats, and lower trophic levels (e.g.. zooplankton. benthic invertebrates, etc.) in stream/river (i.e.. lotic) and pond/lake (i.e.. lentic) ecosystems. 2. Develop practical, hands-on experience in aquatic resource assessment, data analysis, reporting, and decision-making as it pertains to sampling and management of aquatic ecosystems. 3. Sharpen critical thinking, written and oral communication, and professional skills relative to fisheries and aquatic sciences as they apply to both basic and applied science. Credits: 5.00

6 Credits

Fall 3rd Year

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical,

physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 45600 - Fish And Marine Population Dynamics

Credit Hours: 4.00. Theory of population dynamics of animal populations in freshwater and marine environments. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, marine and freshwater invertebrates, sport and commercial fish populations, and aquatic communities. Human resource users and non-users are considered.

Learning Outcomes: 1. Quantitatively assess the status of a fish population and develop considerations for management. 2. Practice and develop critical thinking skills through in-class discussions and a group research project. 3. Learn to interpret the scientific literature through reading of the primary literature. 4. Broaden understanding of fisheries and natural resource management. Credits: 4.00

FNR 37800 - Marine Biology Practicum

Credit Hours: 3.00. This course presents students with expanded opportunities to use field techniques to sample and report on marine habitats and organisms. The course emphasizes the proper care and use of field sampling gear and identification of fish and invertebrates samples from exposed shore, lagoon, and estuary habitats. A trip to the coast of either the Atlantic Ocean or Gulf of Mexico is a central component of this course; a course fee is required to cover the expenses of the trip.

Learning Outcomes: 1. Demonstrate enhanced knowledge of the basic principles and techniques associated with sampling organisms in coastal environments. 2. Demonstrate practical knowledge and skills in sampling, handling, identifying, and reporting on marine biological communities characteristic of several costal habitat types. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills related to marine biology. Credits: 3.00

16 Credits

Spring 3rd Year

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

FNR 38500 - Fish Biology And Ecology

Credit Hours: 4.00. Advanced study of the biology and ecology of fishes. In particular, the course covers aspects of the morphology, physiology, development, behavior, evolution, and diversity of fishes throughout the world. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems will be explored. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual, population, community structure, and anthropogenic effects.

Learning Outcomes: 1. Know key primitive fish groups and understand how modern fishes evolved through time. 2. Develop skills in fish taxonomy and scientific nomenclature, including identification of a wide range of fish specimens. 3. Understand fish diversity in terms of morphology, behavior, feeding, reproduction and habitats. 4. Build fish laboratory skills, including fish dissection, data collection and data analysis. 5. Understand the broad ecological roles of fishes in freshwater and marine systems. 6. Understand the principles of fish population dynamics and how populations respond to various biotic and abiotic factors. 7. Develop an understanding of the scientific method and demonstrate the ability to solve. problems, think critically and write scientific reports. Credits: 4.00

12-13 Credits

Fall 4th Year

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

EAPS 10400 - Oceanography (UCC: STS)

Credit Hours: 3.00. Origin of the oceans and marine life. Seafloor spreading and marine geology; currents, waves, and tides; marine organisms and ecology; beaches and nearshore life. Man's use and abuse of the sea, including contemporary problems and future opportunities. The role of oceans in climate and evolution of the biosphere.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand ocean and coastal processes. 2. Understand potential future impacts of ocean and other environmental changes. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

13 Credits

Spring 4th Year

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping &

linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 45800 - Advanced Marine Biology

Credit Hours: 3.00. Focus is placed on the structure and function of major marine ecosystems, including estuarine, mangrove, coastal, coral reef, open ocean, and deep ocean environments. Course content will include rigorous treatment of the biogeochemical processes that support these ecosystems, as well as the biology and ecology of characteristic flora and fauna.

Learning Outcomes: 1. Demonstrate in-depth understanding of the structure and function of key marine ecosystems of the world. 2. Demonstrate thorough understanding of the major groups of organisms characteristic of key marine ecosystems of the world. 3. Demonstrate thorough understanding of the biogeochemical processes that sustain key marine ecosystems and their constituent taxa. 4. Understand major threats to sustainability of key marine ecosystems of the world. 5. Demonstrate improved critical thinking and scientific writing skills. Credits: 3.00

12 Credits

Art History, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (51-54 credits)

Required Major Courses (39 credits)

A. A&D Courses (9 credits)

1. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

2. Studio Art (3 credits)

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the

technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

1. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

B. Art History Selectives (30 credits)

1. Ancient And Medieval Art

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

2. Renaissance and Baroque Art

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas. Credits: 3.00

AD 34300 - Northern Renaissance Art

Credit Hours: 3.00. The development of a mature North European art originating in the International Gothic tradition and culminating in the works of Albrecht Durer, Jerome Bosch, and Pieter Bruegel, the Elder.

Learning Outcomes: 1. Be familiar with the history of the period in general and with major artists in particular. 2. Show the ability to read and think critically about a work of art, to look carefully at a work and to discuss what he or she is seeing. 3. Be able to describe clearly a work of art and to compare it to other works and artists of the period. 4. Be able to write an explanation of how a work of art illustrates a particular theme or idea in clear and understandable prose with correct spelling and punctuation in paragraphs that lead logically from one to another. 5. Show the ability to follow instructions and pay attention to detail in the preparation and presentation of research citing sources accurately. Credits: 3.00

3. Modern and Contemporary Art

AD 33900 - Women Artists (UCC: BSS)

Credit Hours: 3.00. A critical overview of the lives, works, and experiences of women artists from the late 19th century to the present, examining the social and cultural challenges they faced, and reflecting on the changing roles women have played in art and society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks and artists. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about women artists and women art by contextualizing and analyzing them and selecting artworks to illustrate your comments. 4. Apply the knowledge they will have acquired to analyze and write about artworks we would not have studied in class. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

4. World Art

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of

Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

5. Design History

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

AD 59200 - Graduate Seminar In Art Or Design History

Credit Hours: 3.00. This is a graduate seminar that focuses on a particular theme, period, or movement in the history of art or design. Permission from department required.

Learning Outcomes: 1. Analyze and discuss

scholarly readings related to the history of art and design. 2. Analyze primary sources, artifacts, images, and other such materials related to the theme of the term. 3. Conduct original primary and scholarly research on a topic related to the seminar and present that research in written, visual, or oral forms. 4. Understand the social, cultural, and/or political context of art and design history. Credits: 3.00

6. Photography History

AD 25100 - History Of Photography I (UCC: HUM)

Credit Hours: 3.00. An introduction of the history of photography from the medium's inception until 1950. Emphasis is placed on understanding photographs from a variety of aesthetic, social, and cultural perspectives, including those of race, class, and gender.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

7. Museum Studies

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

1. Ancient And Medieval Art

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context.

3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

Required Minor (12-15 credits)

A. A&D Courses (9 credits)

1. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

2. Studio Art (3 credits)

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

1. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

Electives (32-44 credits)

GPA Requirement

Additional Information

Sample 4-Year Plan

Fall 1st Year

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

15 Credits

15 Credits

Spring 2nd Year

15 Credits

15 Credits

Fall 3rd Year

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

15 Credits

15 Credits

Spring 4th Year

15 Credits

15 Credits

Fall 1st Year

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15-16 Credits

15-16 Credits

About the Program

Artificial Intelligence, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (44-46 credits)

Area A: Required Courses (6 credits)

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

Area B: History of Philosophy (3 credits)

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30400 - Nineteenth-Century Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of the major movements and directions of nineteenth-century philosophy, including such figures as Hegel, Comte, Mach, Schopenhauer, Nietzsche, Mill, Royce and Peirce.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30600 - Twentieth-Century Philosophy

Credit Hours: 3.00. A critical examination of the main currents of contemporary philosophical thought, such as pragmatism, analytic philosophy, phenomenology, and existentialism, and other recent developments. The course will cover selected works of such philosophers as Russell, Wittgenstein, Peirce, Whitehead, Heidegger, and Sartre.

Credits: 3.00

Note for Areas C & D

Area C: Value Theory (3 credits)

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

Area D: Additional Philosophy Courses (15 credits)

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

PHIL 35000 - Philosophy And Probability

Credit Hours: 3.00. This course introduces the student to mathematical probability and its philosophical applications. Topics may include theories of probability, Hume's problem of induction, Goodman's paradox, and the foundations of scientific reasoning.

Credits: 3.00

PHIL 42100 - Philosophy Of Science

Credit Hours: 3.00. An examination of central issues in philosophy of science. Topics include theories of explanation, confirmation, reduction, laws, the status of theoretical entities, and the epistemological foundations of scientific theories.

Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and

design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

PHIL 55300 - Mathematical Logic

Credit Hours: 3.00. This class is an introduction to various logical foundations of mathematics as well as the basics of logical metatheory.

Learning Outcomes: 1. Understand some of the more advanced methods employed in logical analysis. 2. Explain important problems and issues in foundational mathematical logic and express them in clear and precise terms. 3. Analyze and assess foundational results in mathematical logic. 4. Explain, apply, and appraise the use of formal languages. 5. Assess and construct precise, abstract arguments using the tools of mathematical logic. (This will help students engage in better written and oral communication, in particular in circumstances where perspicuity and logicality are of special importance.) Credits: 3.00

PHIL 25501 - Introduction To Cognitive Science: Minds, Brains, And Machines

Credit Hours: 3.00. This will provide an introduction to foundational topics in the philosophy of mind. We will consider the relationship between the mind and the body, and the mental to the physical more generally. We'll ask, and look at some candidate answers to, questions like "What is a mind, and what are its component parts? How does a mind work? How are minds related to brains, and to the physical bodies that they seem to animate and control? How do minds represent the world around them? What is a self? What is the nature of consciousness and subjective experience? Could other animals, aliens, computers, robots or other types of entities have minds, or be conscious? How would we know? How can empirical efforts like the cognitive sciences help shed light on these questions? Could scientific theories of the mind supplant our intuitive conceptions of the mind? If so, what would be the implications?"

Learning Outcomes: 1. Analyze the main arguments for different theories in the philosophy of mind, such as dualism, behaviorism, and functionalism. 2. Develop original arguments that apply concepts from class to real-life current events. 3. Evaluate the implications of different theories for ethical, political, and social issues. Credits: 3.00

PHIL 25601 - Philosophy And Artificial Intelligence

Credit Hours: 3.00. Just what is it to be artificially intelligent and

what will be AIs impact on our future? This course tackles these questions using an interdisciplinary and historically anchored approach beginning with the development of AI to arrive at a more holistic, socially- and ethically-ensconced account of what it means to be artificially intelligent. Will AI agents change the nature of work? Can they be used to regulate individuals and their opportunities through automated algorithms and sorting software? What are the human and environmental costs of a full-throated adoption of AI? This class will arm you with the philosophical and historical background to begin to devise and weigh the creative opportunities and challenges posed by this future. We'll first consider traditional questions and issues in the philosophy of computation, epistemology, ethics and justice before turning to home onto a series of specific challenges that may include issues of AI in equity, AI and the law, AI and gender, AI and labor, AI and policy, the future of AI, and whether we can even design 'ethical' AI.

Learning Outcomes: 1. Examine the theoretical foundations of AI. 2. Identify ethical and epistemological implications of emerging AI technologies. 3. Evaluate policy challenges posed by AI technologies. Credits: 3.00

Area E: Required Computer Science Courses (17-19 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences,

management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the

link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

CS 24300 - Artificial Intelligence Basics

Credit Hours: 3.00. This course provides an introduction to foundational areas of artificial intelligence and current techniques for building intelligent systems. As an entry-level course for Artificial Intelligence, the primary goals of this course are: Teach fundamental building blocks of an intelligent system, namely, knowledge representation; learning; model validation, diagnosis, and visualization; reasoning and decision-making; probabilities and uncertainty in AI. Provide students with first-hand experiences in building a working machine learning and an automated reasoning system. Provide an overview of current state-of-the-art technologies in multiple domains of artificial intelligence. Broaden the students' horizon and spark their interests via learning about exciting applications of artificial intelligence in many aspects of human society.

Learning Outcomes: 1. Use data processing and implement learning and reasoning algorithms using Python. 2. Determine how to represent knowledge in an AI system. 3. Build a first-hand machine learning system. Know and be able to build all basic components of the entire machine learning pipeline, including data collection, wrangling, cleaning, model selection, training, cross-validation, and diagnosis. 4. Master the mathematical theory behind linear regressors and classifiers. 5. Build a first-hand automated reasoning system, learn how to formulate real-world problems as constraint programs, solve reasoning problems and make complex decisions using AI. 6. Produce a reasoning system using depth-first search. 7. Demonstrate basic knowledge of the full landscape of AI: game playing, causality, fairness/bias/ethics, uncertainty handling, reinforcement learning. Credits: 3.00

Electives (1-40 credits)

GPA Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

12-16 Credits

Spring 1st Year

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and

power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

16-17 Credits

Fall 2nd Year

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30400 - Nineteenth-Century Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of the major movements and directions of nineteenth-century philosophy, including such figures as Hegel, Comte, Mach, Schopenhauer, Nietzsche, Mill, Royce and Peirce.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30600 - Twentieth-Century Philosophy

Credit Hours: 3.00. A critical examination of the main currents of contemporary philosophical thought, such as pragmatism, analytic philosophy, phenomenology, and existentialism, and other recent developments. The course will cover selected works of such philosophers as Russell, Wittgenstein, Peirce, Whitehead, Heidegger, and Sartre.

Credits: 3.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

15-16 Credits

Spring 2nd Year

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in

ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-16 Credits

Fall 3rd Year

CS 24300 - Artificial Intelligence Basics

Credit Hours: 3.00. This course provides an introduction to foundational areas of artificial intelligence and current techniques for building intelligent systems. As an entry-level course for Artificial Intelligence, the primary goals of this course are: Teach fundamental building blocks of an intelligent system, namely, knowledge representation; learning; model validation, diagnosis, and visualization; reasoning and decision-making; probabilities and uncertainty in AI. Provide students with first-hand experiences in building a working machine learning and an automated reasoning system. Provide an overview of current state-of-the-art technologies in multiple domains of artificial intelligence. Broaden the students' horizon and spark their interests via learning about exciting applications of artificial intelligence in many aspects of human society.

Learning Outcomes: 1. Use data processing and implement learning and reasoning algorithms using Python. 2. Determine how to represent knowledge in an AI system. 3. Build a first-hand machine learning system. Know and be able to build all basic components of the entire machine learning pipeline, including data collection, wrangling, cleaning, model selection, training, cross-validation, and diagnosis. 4. Master the mathematical theory behind linear regressors and classifiers. 5. Build a first-hand automated reasoning system, learn how to formulate real-world problems as constraint programs, solve reasoning problems and make complex decisions using AI. 6. Produce a reasoning system using depth-first search. 7. Demonstrate basic knowledge of the full landscape of AI: game playing, causality, fairness/bias/ethics, uncertainty handling, reinforcement learning. Credits: 3.00

16-18 Credits

Spring 3rd Year

12-15 Credits

Fall 4th Year

12 Credits

Spring 4th Year

15 Credits

Program Learning Outcomes

Artificial Intelligence, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (62-63 credits)

Required Major Courses (50-51 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 20000 - Introduction To Cognitive Psychology

Credit Hours: 3.00. A survey of psychology as the science of mental life, covering theories and research in perception, reading, attention, consciousness, imagery, memory and its improvement, problem solving, creativity, decision-making, and artificial intelligence.

Learning Outcomes: 1. Describe basic aspects of visual perception and visual imagery. 2. Explain the role of attention in cognition. 3. Describe basic representations and processes of memory. 4. Understand high-level cognitive functions such as reasoning, problem solving, and language. 5. Understand how cognitive neuroscience can inform cognitive psychology. Credits: 3.00

PSY 22200 - Introduction To Behavioral Neuroscience

Credit Hours: 3.00. An introduction to how the nervous system controls behavior. Topics include evolution and comparative psychobiology, the neuroscience of sensation and perception, the neuroscience of motivation, neuropsychology, and cognitive neuroscience.

Learning Outcomes: 1. Describe the basic structure and function of the brain including neuroanatomy and neural communication. 2. Explain how the central nervous system processes internal and external stimuli. 3. Explain how experience influences current and future behavior. 4. Discern normal from abnormal brain function and describe its influence on behavior. Credits: 3.00

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS

18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100,

STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.
Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them

clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

CS 24300 - Artificial Intelligence Basics

Credit Hours: 3.00. This course provides an introduction to foundational areas of artificial intelligence and current techniques for building intelligent systems. As an entry-level course for Artificial Intelligence, the primary goals of this course are: Teach fundamental building blocks of an intelligent system, namely, knowledge representation; learning; model validation, diagnosis, and visualization; reasoning and decision-making; probabilities and uncertainty in AI. Provide students with first-hand experiences in building a working machine learning and an automated reasoning system. Provide an overview of current state-of-the-art technologies in multiple domains of artificial intelligence. Broaden the students' horizon and spark their interests via learning about exciting applications of artificial intelligence in many aspects of human society.

Learning Outcomes: 1. Use data processing and implement learning and reasoning algorithms using Python. 2. Determine how to represent knowledge in an AI system. 3. Build a first-hand machine learning system. Know and be able to build all basic components of the entire machine learning pipeline, including data collection, wrangling, cleaning, model selection, training, cross-validation, and diagnosis. 4.

Master the mathematical theory behind linear regressors and classifiers. 5. Build a first-hand automated reasoning system, learn how to formulate real-world problems as constraint programs, solve reasoning problems and make complex decisions using AI. 6. Produce a reasoning system using depth-first search. 7. Demonstrate basic knowledge of the full landscape of AI: game playing, causality, fairness/bias/ethics, uncertainty handling, reinforcement learning. Credits: 3.00

CS Selective I (6 credits)

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including

data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

CS Selective II (3 credits)

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be

capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

Philosophy Selective (3 credits)

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 43200 - Theory Of Knowledge

Credit Hours: 3.00. An analysis of selected texts on knowledge and rationality. Topics such as the following will be considered: foundationalism, coherentism, internalism, externalism, skepticism, contextualism, empiricism, rationalism, analyses of epistemic concepts, and the Gettier problem.

Credits: 3.00

PHIL 43500 - Philosophy Of Mind

Credit Hours: 3.00. An examination of some central issues in the philosophy of mind. Attention is given to such topics as the knowledge of other minds, the relation between mind and body, the nature of persons, and the analysis of certain relevant concepts such as action, emotion, and perception. Readings are selected primarily from the writings of contemporary philosophers.

Credits: 3.00

PHIL 25501 - Introduction To Cognitive Science: Minds, Brains, And Machines

Credit Hours: 3.00. This will provide an introduction to foundational topics in the philosophy of mind. We will consider the relationship between the mind and the body, and the mental to the physical more generally. We'll ask, and look at some candidate answers to, questions like "What is a mind, and what are its component parts? How does a mind work? How are minds related to brains, and to the physical bodies that they seem to animate and control? How do minds represent the

world around them? What is a self? What is the nature of consciousness and subjective experience? Could other animals, aliens, computers, robots or other types of entities have minds, or be conscious? How would we know? How can empirical efforts like the cognitive sciences help shed light on these questions? Could scientific theories of the mind supplant our intuitive conceptions of the mind? If so, what would be the implications?"

Learning Outcomes: 1. Analyze the main arguments for different theories in the philosophy of mind, such as dualism, behaviorism, and functionalism. 2. Develop original arguments that apply concepts from class to real-life current events. 3. Evaluate the implications of different theories for ethical, political, and social issues. Credits: 3.00

PHIL 25601 - Philosophy And Artificial Intelligence

Credit Hours: 3.00. Just what is it to be artificially intelligent and what will be AIs impact on our future? This course tackles these questions using an interdisciplinary and historically anchored approach beginning with the development of AI to arrive at a more holistic, socially- and ethically-ensconced account of what it means to be artificially intelligent. Will AI agents change the nature of work? Can they be used to regulate individuals and their opportunities through automated algorithms and sorting software? What are the human and environmental costs of a full-throated adoption of AI? This class will arm you with the philosophical and historical background to begin to devise and weigh the creative opportunities and challenges posed by this future. We'll first consider traditional questions and issues in the philosophy of computation, epistemology, ethics and justice before turning to home onto a series of specific challenges that may include issues of AI in equity, AI and the law, AI and gender, AI and labor, AI and policy, the future of AI, and whether we can even design 'ethical' AI.

Learning Outcomes: 1. Examine the theoretical foundations of AI. 2. Identify ethical and epistemological implications of emerging AI technologies. 3. Evaluate policy challenges posed by AI technologies. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 Credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of

homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Electives (2-27 credits)

Grade Requirements

GPA Requirements

Sample 4-year Plan

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral

calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-17 Credits

Spring 1st Year

PSY 20000 - Introduction To Cognitive Psychology

Credit Hours: 3.00. A survey of psychology as the science of mental life, covering theories and research in perception, reading, attention, consciousness, imagery, memory and its improvement, problem solving, creativity, decision-making, and artificial intelligence.

Learning Outcomes: 1. Describe basic aspects of visual perception and visual imagery. 2. Explain the role of attention in cognition. 3. Describe basic representations and processes of memory. 4. Understand high-level cognitive

functions such as reasoning, problem solving, and language. 5. Understand how cognitive neuroscience can inform cognitive psychology. Credits: 3.00

PSY 22200 - Introduction To Behavioral Neuroscience

Credit Hours: 3.00. An introduction to how the nervous system controls behavior. Topics include evolution and comparative psychobiology, the neuroscience of sensation and perception, the neuroscience of motivation, neuropsychology, and cognitive neuroscience.

Learning Outcomes: 1. Describe the basic structure and function of the brain including neuroanatomy and neural communication. 2. Explain how the central nervous system processes internal and external stimuli. 3. Explain how experience influences current and future behavior. 4. Discern normal from abnormal brain function and describe its influence on behavior. Credits: 3.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of

absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-15 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between

discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in

global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

CS 24300 - Artificial Intelligence Basics

Credit Hours: 3.00. This course provides an introduction to foundational areas of artificial intelligence and current techniques for building intelligent systems. As an entry-level course for Artificial Intelligence, the primary goals of this course are: Teach fundamental building blocks of an intelligent system, namely, knowledge representation; learning; model validation, diagnosis, and visualization; reasoning and decision-making; probabilities and uncertainty in AI. Provide students with first-hand experiences in building a working machine learning and an automated reasoning system. Provide an overview of current state-of-the-art technologies in multiple domains of artificial intelligence. Broaden the students' horizon and spark their interests via learning about exciting applications of artificial intelligence in many aspects of human society.

Learning Outcomes: 1. Use data processing and implement learning and reasoning algorithms using Python. 2. Determine how to represent knowledge in an AI system. 3. Build a first-hand machine learning system. Know and be able to build all basic components of the entire machine learning pipeline, including data collection, wrangling, cleaning, model selection, training, cross-validation, and diagnosis. 4. Master the mathematical theory behind linear regressors and classifiers. 5. Build a first-hand automated reasoning system, learn how to formulate real-world problems as constraint programs, solve reasoning problems and make complex decisions using AI. 6. Produce a reasoning system using depth-first search. 7. Demonstrate basic knowledge of the full landscape of AI: game playing, causality, fairness/bias/ethics, uncertainty handling, reinforcement learning. Credits: 3.00

16-18 Credits

Spring 2nd Year

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

15-16 Credits

Fall 3rd Year

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

15-17 Credits

Spring 3rd Year

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

15-17 Credits

Fall 4th Year

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing,

planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

15-17 Credits

Spring 4th Year

15-17 Credits

Asian Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (27-28 credits)

Pre-requisite Courses

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 4.00

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3. Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof. Credits: 4.00

KOR 10100 - Korean Level I (UCC: HUM)

Credit Hours: 4.00. This course is the first half of the Elementary Korean language sequence. It is designed for those who have no prior (or very limited) knowledge of Korean. Lecture will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Emphasis is placed on the fundamentals of listening, speaking, reading, and writing. In addition, students will be exposed to everyday life contexts (e.g., language use, culture, etc.) likely to be encountered in contemporary Korean society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Assess the meaning of limited vocabulary and some simple questions or statements auditorily and visually in the context of everyday events, such as greetings, introductions, giving directions, expressing needs, and making requests in Korean. 2. Construct short statements and ask simple questions by combining grammatical and lexical items using spoken Korean in a limited number of content areas, particularly if strongly supported by the situational context. 3. Identify meanings communicated in written Hangul, a Korean writing system, related to basic language use and immediate needs, such as prices in stores, dates on schedules, and short letters, messages, or memos relating information relevant to various aspects of student life. 4. Construct simple fixed expressions and limited memorized material by combining grammatical and lexical items in written form using Hangul. 5. Describe facts and

evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, pop lyrics, or traditional grams. Credits: 4.00

KOR 10200 - Korean Level II

Credit Hours: 4.00. This course is the second half of the elementary Korean language sequence. As a continuation of KOR 10100, the main purpose of this course is to expand on the study of the Korean language and culture. The class will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Students continue to learn vocabulary, pronunciation, grammar, and the writing system by practicing Korean to achieve Novice High level of speaking, listening, reading, and writing.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of recombinations of learned elements applied to a limited number of contexts, such as organizing a party, shopping, placing orders, making telephone calls, describing symptoms of illness and scheduling appointments. 2. Solve communicative problems related to uncomplicated, basic communicative tasks and social situations, such as making an apology, accepting and declining invitations, and making polite requests and suggestions by identifying linguistic meanings and producing new linguistic content. 3. Identify meanings expressed in written materials with emphasis on survival and immediate needs, such as memos, messages, postcards, journal entries, brief narratives, and short letters relating information relevant to various aspects of student life. 4. Produce simple texts of a few paragraphs such as skit, messages, short letters, and brief narratives by recombining learned material in Korean. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

KOR 20100 - Korean Level III

Credit Hours: 4.00. This course is the first half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Low proficiency level. Some class meetings are conducted entirely in Korean. Students practice reading and listening comprehension, grammar, vocabulary building, and conversations that require a variety of styles, pragmatic considerations, and knowledge of Korean cultural topics. Skills for simple narration and written report will be enhanced. Students rely on authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of a sufficient amount of vocabulary and expressions to communicate in a variety of situations covered in the course. 2. Apply basic components of Korean grammatical structures to construct standard Korean sentences to express creative ideas and to make comparisons. 3. Solve communicative problems related to a variety of uncomplicated social situations by asking and answering questions. 4. Compose written language in Korean to meet practical writing needs, such as short personal letters and journals. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

A. Language Requirement Course (3-4 credits)

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The course provides students with further conversational and grammatical skills. Students practice reading comprehension, grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

B. Survey course requirement (3 credits)

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

C. Asian Studies Selectives - Choose Seven (21 credits)

Electives (19-57 credits)

Minor Information

GPA Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3. Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof. Credits: 4.00

KOR 10100 - Korean Level I (UCC: HUM)

Credit Hours: 4.00. This course is the first half of the Elementary Korean language sequence. It is designed for those who have no prior (or very limited) knowledge of Korean. Lecture will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Emphasis is placed on the fundamentals of listening, speaking, reading, and writing. In addition, students will be exposed to everyday life contexts (e.g., language use, culture, etc.) likely to be encountered in contemporary Korean society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Assess the meaning of limited vocabulary and some simple questions or statements auditorily and visually in the context of everyday events, such as greetings, introductions, giving directions, expressing needs, and making requests in Korean. 2. Construct short statements and ask simple questions by combining grammatical and lexical items using spoken Korean in a limited number of content areas, particularly if strongly supported by the situational context. 3. Identify meanings communicated in written Hangul, a Korean writing system, related to basic language use and immediate needs, such as

prices in stores, dates on schedules, and short letters, messages, or memos relating information relevant to various aspects of student life. 4. Construct simple fixed expressions and limited memorized material by combining grammatical and lexical items in written form using Hangul. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, pop lyrics, or traditional grams. Credits: 4.00

15-16 Credits

Spring 1st Year

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

KOR 10200 - Korean Level II

Credit Hours: 4.00. This course is the second half of the elementary Korean language sequence. As a continuation of KOR 10100, the main purpose of this course is to expand on the study of the Korean language and culture. The class will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Students continue to learn vocabulary, pronunciation, grammar, and the writing system by practicing Korean to achieve Novice High level of speaking, listening, reading, and writing.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of recombinations of learned elements applied to a limited number of contexts, such as organizing a party, shopping, placing orders, making telephone calls, describing symptoms of illness and scheduling appointments. 2. Solve communicative problems related to uncomplicated, basic communicative tasks and social situations, such as making an apology, accepting and declining invitations, and making polite requests and suggestions by identifying linguistic meanings and producing new linguistic content. 3. Identify meanings expressed in written materials with emphasis on survival and immediate needs, such as memos, messages, postcards, journal entries, brief narratives, and short letters relating information relevant to various aspects of student life. 4. Produce simple texts of a few paragraphs such as skit, messages, short letters, and brief narratives by recombining learned material in Korean. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

15-17 Credits

Fall 2nd Year

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

KOR 20100 - Korean Level III

Credit Hours: 4.00. This course is the first half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Low proficiency level. Some class meetings are conducted entirely in Korean. Students practice reading and listening comprehension, grammar, vocabulary building, and conversations that require a variety of styles, pragmatic considerations, and knowledge of Korean cultural topics. Skills for simple narration and written report will be enhanced. Students rely on authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of a sufficient amount of vocabulary and expressions to communicate in a variety of situations covered in the course. 2. Apply basic components of Korean grammatical structures

to construct standard Korean sentences to express creative ideas and to make comparisons. 3. Solve communicative problems related to a variety of uncomplicated social situations by asking and answering questions. 4. Compose written language in Korean to meet practical writing needs, such as short personal letters and journals. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

15-16 Credits

Spring 2nd Year

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The course provides students with further conversational and grammatical skills. Students practice reading comprehension, grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

15-16 Credits

Fall 3rd Year

14-15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Astrophysics, BS

About the Program

Degree Requirements

Astrophysics Major Courses (61-63 credits)

Required Major Courses (50 credits)

ASTR 36300 - The Solar System

Credit Hours: 3.00. This course is intended for students in science or engineering. The components of the course consist of an overview of solar system objects and an overview of the physical processes that control the evolution of solar system objects since formation. The overview of solar system includes observations of the Sun, planets, asteroids and Kuiper-belt objects, comets, and interplanetary dust. Specific processes that are discussed include hydrostatic equilibrium, orbital dynamics, radioactive decay, and heat flow. The role of these processes in shaping planetary surfaces and atmosphere is explored.

Learning Outcomes: 1. The students will acquire extensive knowledge on the solar system, including its formation and evolution. Credits: 3.00

ASTR 36400 - Stars And Galaxies

Credit Hours: 3.00. This course is intended for students in Science or Engineering. This is the second of a two-semester introductory sequence on astronomy and astrophysics, although it is designed to be a standalone course. It is intended mainly for Science and Engineering majors who are comfortable with calculus-based contents. The course provides an overview on the formation and evolution of stars, galaxies, and clusters of galaxies. Selected topics that are covered in more detail include stellar structure and atmosphere, properties of black holes, neutron stars, and white dwarfs, galactic dynamics, and dark matter in galaxies and clusters of galaxies.

Learning Outcomes: 1. The students will acquire extensive knowledge on the properties of stars and galaxies. Credits: 3.00

ASTR 37000 - Cosmology

Credit Hours: 3.00. Intended for science and engineering majors. Basic physics and math knowledge will be assumed. The picture of how the Universe came to be and how it has evolved has recently come into sharp focus. This progress is the result of improved observational techniques that have resulted in high resolution images of very distant galaxies, a more accurate mapping of the Large Scale Structure of the Universe or the high resolution picture of the young universe provided by Cosmic Microwave Background observations. We will present a historical perspective of how ideas and data have shaped Cosmology through the centuries. In addition, we will review the theoretical models that are in agreement with the current observations. Our goal will be to provide the students with a broad overview of the current research in Cosmology with an eye toward stimulating the students curiosity about the many questions still awaiting answers in this field.

Learning Outcomes: 1. Students will acquire extensive knowledge and a broad overview of Cosmology, the study of how the Universe came to be and how it has evolved. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and

parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional

environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

PHYS 59000 - Reading And Research

Credit Hours: 1.00 to 3.00. (Calumet, Fort Wayne) 1.00 to 6.00 (West Lafayette, IUPUI). Reading and research in Physics. Permission of instructor required.

Credits: 1.00 to 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Major Selective* (11-13 credits)

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

PHYS 49000 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, laboratory work, or research in special areas of physics. Intended for upperclass students. Permission of instructor required.

Credits: 1.00 to 3.00

ASTR 56000 - Stellar Evolution

Credit Hours: 3.00. (PHYS 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

ASTR 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (PHYS 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

ASTR 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (PHYS 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

ASTR 56300 - Astroparticle Physics

Credit Hours: 3.00. (PHYS 56300) An overview of an emerging research frontier in modern physics that lies at the interface of particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology, cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

ASTR 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (PHYS 56700) Fundamental concepts in observational astronomy, including coordinate and time systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal.

Credits: 3.00

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 56000 - Stellar Evolution

Credit Hours: 3.00. (ASTR 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

PHYS 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (ASTR 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

PHYS 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (ASTR 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

PHYS 56300 - Astroparticle Physics

Credit Hours: 3.00. (ASTR 56300) An overview of an emerging research frontier in modern physics that lies at the interface of particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology,

cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

PHYS 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (ASTR 56700) Fundamental concepts in observational astronomy, including coordinate and time systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal. Credits: 3.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

EAPS 39500 - Astrobiology

Credit Hours: 3.00. Course explores current ideas on how life originated on Earth and may have originated elsewhere in the universe. Lectures will cover zones of habitability in stellar systems, planetary surface and atmosphere evolution and the environment of the early Earth. Topics include how life on Earth functions and its earliest evolution, SETI, planetary quarantine, panspermia, mass extinctions and the potential for life elsewhere in our own solar system.

Learning Outcomes: 1. Know the outlines of how life developed on the Earth, the principal requirements for life to originate and persist, what features makes a planet (in our system or around other stars) habitable for life. 2. Understand how extrasolar planets are found and what limitations exist in our knowledge of those planets. 3. Understand how NASA is seeking for life on Mars and elsewhere in the solar system, why we are concerned about quarantining spacecraft and returned samples. 4. Acquainted with the rationale and methods of the SETI search for intelligent life in the universe. Credits: 3.00

PHYS 32300 - Research With Big Data I

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

PHYS 32400 - Research In Big Data II

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

Other Departmental/Program Course Requirements (50-62 credits)

COLLEGE OF SCIENCE CORE REQUIREMENTS

Composition & Presentation

Written Communication (3-4 credits)

Technical Writing And Presentation* (3-6 credits)

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to

identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Cultural Diversity (Language & Culture)^* (9 credits)

General Education^ (9 credits)

Great Issues In Science (3 credits)

Laboratory Science (8 credits)

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods

associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop

observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to

apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Science Technology and Society^* (1-3 credits)

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Team-Building and Collaboration* (0-3 credits)

Electives (0-9 credits)

GPA Requirements

Non-course / Non-credit Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry,

synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-16 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

13-16 Credits

Fall 2nd Year

ASTR 36300 - The Solar System

Credit Hours: 3.00. This course is intended for students in science or engineering. The components of the course consist of an overview of solar system objects and an overview of the physical processes that control the evolution of solar system objects since formation. The overview of solar system includes observations of the Sun, planets, asteroids and Kuiper-belt objects, comets, and interplanetary dust. Specific processes that are discussed include hydrostatic equilibrium, orbital dynamics, radioactive decay, and heat flow. The role of these processes in shaping planetary surfaces and atmosphere is explored.

Learning Outcomes: 1. The students will acquire extensive knowledge on the solar system, including its formation and evolution. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof.

Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

14-15 Credits

Spring 2nd Year

ASTR 36400 - Stars And Galaxies

Credit Hours: 3.00. This course is intended for students in Science or Engineering. This is the second of a two-semester introductory sequence on astronomy and astrophysics, although it is designed to be a standalone course. It is intended mainly for Science and Engineering majors who are comfortable with calculus-based contents. The course provides an overview on the formation and evolution of stars, galaxies, and clusters of galaxies. Selected topics that are covered in more detail include stellar structure and atmosphere, properties of black holes, neutron stars, and white dwarfs, galactic dynamics, and dark matter in galaxies and clusters of galaxies.

Learning Outcomes: 1. The students will acquire extensive knowledge on the properties of stars and galaxies. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic

probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15 Credits

Fall 3rd Year

ASTR 37000 - Cosmology

Credit Hours: 3.00. Intended for science and engineering majors. Basic physics and math knowledge will be assumed. The picture of how the Universe came to be and how it has evolved has recently come into sharp focus. This progress is the result of improved observational techniques that have resulted in high resolution images of very distant galaxies, a more accurate mapping of the Large Scale Structure of the Universe or the high resolution picture of the young universe provided by Cosmic Microwave Background observations. We will present a historical perspective of how ideas and data have shaped Cosmology through the centuries. In addition, we will review the theoretical models that are in agreement with the current observations. Our goal will be to provide the students with a broad overview of the current research in Cosmology with an eye toward stimulating the students curiosity about the many questions still awaiting answers in this field.

Learning Outcomes: 1. Students will acquire extensive knowledge and a broad overview of Cosmology, the study of how the Universe came to be and how it has evolved. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team

to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

16-17 Credits

Spring 3rd Year

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 59000 - Reading And Research

Credit Hours: 1.00 to 3.00. (Calumet, Fort Wayne) 1.00 to 6.00 (West Lafayette, IUPUI). Reading and research in Physics. Permission of instructor required.

Credits: 1.00 to 3.00

15 Credits

Fall 4th Year

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

14 Credits

Spring 4th Year

12-18 Credits

Program Learning Outcomes

Atmospheric Science, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (39 credits)

Required Major Courses (39 credits)

EAPS 11700 - Introduction To Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. The weather/climate system. Solar variability and Milankovitch Theory. Atmospheric scales of motion. Chemistry of greenhouse gases and aerosols. Fundamental laws of meteorological dynamics and radiation. Weather systems, air masses and fronts. Severe storms, hurricanes and tornadoes. (Required for atmospheric sciences majors.).

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Appreciate the temporal and spatial scales of climate change, from Milankovitch Theory and glacial/interglacial regions, to the anthropogenic effects of greenhouse gases (GHG's). 2. Appreciation of how weather events collectively and cumulatively, lead to the establishment of climate. 3. Understand the basic scales of atmospheric motion (space and time) and the classification of weather events into these scales (planetary, synoptic, mesoscale and microscale). 4. Understand the definition of

aerosols and GHG's and their relation to weather and climate. 5. Understand the four basic laws of radiation (beginning with Planck's Law). 6. Understand the fundamental laws of atmospheric motion, and some general principles of weather prediction. 7. Understand the basic principles of cloud physics, from CCN to cloud formation and precipitation. 8. Understand the First Law of Thermodynamics, and the general concepts of thermal convection, including lapse rates and the concept of latent heat release. 9. Understand the behavior, including simulation and differences, of geophysical columnar vortices, from dust devils to tornadoes to hurricanes. 10. Understand the broad context of atmospheric science, from solar physics and space weather, to meteorology and lower atmosphere weather phenomena. 11. Understand how the planetary atmospheric circulation establishes a jet stream and the semi-permanent pattern of wind and pressure belts (e.g., the trade winds and the westerlies). 12. Understand the formation and movement of air masses and fronts, including the formation of Extratropical Cyclones. 13. Understand the formation of thunderstorms, including severs thunderstorms, hail and tornadoes. 14. Understand tornado climatology in the USA, the tornado intensity scale, taxonomy and climate considerations such as ENSO pattern of El Nino and La Nina. 15. Understand weather hazards in the field of aviation, particularly thunderstorm phenomena (such as hail and downburst winds). 16. Understand a basic review of weather/climate and energy (from wind farms to climate changes). Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

EAPS 42100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (AGRY 43100) Structure and composition

of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in introductory atmospheric science, second semester physics or thermodynamics is required.

Credits: 3.00

EAPS 42200 - Atmospheric Dynamics I

Credit Hours: 3.00. (AGRY 43200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations, thermal wind relationships; circulation, vorticity, divergence, and vertical motion. Prior course work in atmospheric thermodynamics and differential equations is required.

Credits: 3.00

EAPS 42300 - Atmospheric Dynamics II

Credit Hours: 3.00. (AGRY 43300) An extension of EAPS 42200, with emphasis on perturbation theory and hydrodynamics stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 42501 - Physics Of Climate

Credit Hours: 3.00. To understand climate we describe and synthesize physical processes in the atmosphere and their coupling to the ocean, ice, and land. We quantitatively explore climatology with an equal balance of physical principles and scrutiny of available modern data. Topics include: visualization of atmospheric/land surface/oceanographic climatological data sets; theories of climate dynamics; and climate change. Beginning with radiative balance and simple energy balance models, the course progresses toward understanding the effects of radiative-convective forcing and rotation on the fluid

envelopes. Analysis of data in an interactive computer-enabled environment is an important part of the course. By the end of this course, the student should know how the Earth System behaves at large scales and grasp the physical understandings of why.

Learning Outcomes: 1. Quantitatively describe climatology, climate variability, and climate change through physical principles and modern climate data. 2. Use radiative equilibrium, radiative-convective equilibrium, and energy balance models to make predictions of climate change and compare with observations. 3. Describe and synthesize atmosphere and ocean dynamics, large-scale circulation patterns, and interactions with ice and land surfaces. 4. Analyze major contemporary atmospheric science problems and phenomena, such as global warming, ozone hole, El Nino, etc., and the information provided by past climates on Earth. Credits: 3.00

EAPS 23001 - Laboratory In Atmospheric Science: Introduction To Weather And Climate Datasets

Credit Hours: 2.00. This course is a Python-based introduction to the array of weather and climate datasets freely available on the internet in an online computational laboratory setting. The course will emphasize the importance of having data be freely available and "FAIR" (Findable, Accessible, Interoperable, Reusable) from the point of view of the philosophy of science, from a data science perspective, and from a practical "how to do it" perspective.

Learning Outcomes: 1. Write Python code to read in, plot, and perform simple analyses using a wide range of weather and climate datasets (observations, numerical weather forecasts, reanalysis, climate models) in different formats that are publicly available on the internet. 2. Visualize weather and climate data in maps and graphs. 3. Communicate weather and climate information clearly and concisely to non-experts using weather and climate data visualizations. Credits: 2.00

Other Departmental/Program Course Requirements (51-72 credits)

College of Science Additional Information

Computing (2-4 credits)

ECE 49500 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

Credits: 1.00 to 4.00

ENGR 14200 - Honors Creativity And Innovation In Engineering Design II

Credit Hours: 3.50. This course continues building on the foundation developed in ENGR 14100 . Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students extend and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., C, Excel®, LabView®, MATLAB®, and Python).

Learning Outcomes: 1. Describe, in greater depth, the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a mathematical model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural

communication. 7. Further development of strategies to facilitate generating creative ideas for complex design challenges. 8. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 9. Implement complex algorithmic solutions to engineering problems/designs using the most appropriate computer tool (C , Excel, LABVIEW, MATLAB, and Python) and be able to explain your rationale for your choice. 10. Apply a systems approach in solving engineering problems and in undertaking design projects. 11. Synthesize your knowledge of effective and ethical membership on a technical team (i.e., teaming skills) to appropriately behavior. 12 Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

ENGR 16200 - Honors Introduction To Innovation And The Physical Science Of Engineering Design II (UCC: IL/SCI)

Credit Hours: 4.00. Students will take an in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. The students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g. MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control in an effort to identify and characterize physical material systems.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Utilize knowledge of the engineering education process, courses, and options, and engineering job functions and roles to prepare a final course of study for academic and career success (3). 2. Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories (10). 3. Apply the unified approach to material interactions to a broad array of applications including asteroids, black holes, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity (7). 4. Model natural phenomena using computer simulations (7). 5. Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem solving to ensure that the broader impacts of engineering work are consistently evaluated and accounted for (3). 6. Display proficiency in the applications of engineering content knowledge including statistics, statics, mechanics of materials, the universal accounting equation, electrical theory, and design of experiments (8). 7. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole (2). 8. Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (2). 9. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 10. Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms (5). 11. Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class (3). 12. Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 13. Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (3). 14. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering challenges (2). Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Discover data science and professional development opportunities in

order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn

a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric

functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests

for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong

assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

Required Pre-Requisite Courses (14-16 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3.

Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a

laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (19-40 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

EAPS 11700 - Introduction To Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. The weather/climate system. Solar variability and Milankovitch Theory. Atmospheric scales of motion. Chemistry of greenhouse gases and aerosols. Fundamental laws of meteorological dynamics and radiation. Weather systems, air masses and fronts. Severe storms, hurricanes and tornadoes. (Required for atmospheric sciences majors.).

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Appreciate the temporal and spatial scales of climate change, from Milankovitch Theory and glacial/interglacial regions, to the anthropogenic effects of greenhouse gases (GHG's). 2. Appreciation of how weather events collectively and cumulatively, lead to the establishment of climate. 3. Understand the basic scales of atmospheric motion (space and time) and the classification of weather events into these scales (planetary, synoptic, mesoscale and microscale). 4. Understand the definition of aerosols and GHG's and their relation to weather and climate. 5. Understand the four basic laws of radiation (beginning with Planck's Law). 6. Understand the fundamental laws of atmospheric motion, and some general principles of weather prediction. 7. Understand the basic principles of cloud physics, from CCN to cloud formation and precipitation. 8. Understand the First Law of Thermodynamics, and the general concepts of thermal convection, including lapse rates and the concept of latent heat release. 9. Understand the behavior, including simulation and differences, of geophysical columnar vortices, from dust devils to tornadoes to hurricanes. 10. Understand the broad context of atmospheric science, from solar physics and space weather, to meteorology and lower atmosphere weather phenomena. 11. Understand how the planetary atmospheric circulation establishes a jet stream and the semi-permanent pattern of wind and pressure belts (e.g., the trade winds and the westerlies). 12. Understand the formation and movement of air masses and fronts, including the formation of Extratropical Cyclones. 13. Understand the formation of thunderstorms, including severs thunderstorms, hail and tornadoes. 14. Understand tornado climatology in the USA, the tornado intensity scale, taxonomy and climate considerations such as ENSO pattern of El Nino and La Nina. 15. Understand weather hazards in the field of aviation, particularly thunderstorm phenomena (such as hail and downburst winds). 16. Understand a basic review of weather/climate and energy (from wind farms to climate changes). Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-18 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

12-16 Credits

Fall 2nd Year

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of

vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

17-19 Credits

Spring 2nd Year

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well,

both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

EAPS 23001 - Laboratory In Atmospheric Science: Introduction To Weather And Climate Datasets

Credit Hours: 2.00. This course is a Python-based introduction to the array of weather and climate datasets freely available on the internet in an online computational laboratory setting. The course will emphasize the importance of having data be freely available and "FAIR" (Findable, Accessible, Interoperable, Reusable) from the point of view of the philosophy of science, from a data science perspective, and from a practical "how to do it" perspective.

Learning Outcomes: 1. Write Python code to read in, plot, and perform simple analyses using a wide range of weather and climate datasets (observations, numerical weather forecasts, reanalysis, climate models) in different formats that are publicly available on the internet. 2. Visualize weather and climate data in maps and graphs. 3. Communicate weather and climate information clearly and concisely to non-experts using weather and climate data visualizations. Credits: 2.00

15 Credits

Fall 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

EAPS 42100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (AGRY 43100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in introductory atmospheric science, second semester physics or thermodynamics is required.

Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

12-14 Credits

Spring 3rd Year

EAPS 42200 - Atmospheric Dynamics I

Credit Hours: 3.00. (AGRY 43200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations, thermal wind relationships; circulation, vorticity, divergence, and vertical motion. Prior course work in atmospheric thermodynamics and differential equations is required.

Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

13-16 Credits

Fall 4th Year

EAPS 42300 - Atmospheric Dynamics II

Credit Hours: 3.00. (AGRY 43300) An extension of EAPS 42200, with emphasis on perturbation theory and hydrodynamics stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

EAPS 42501 - Physics Of Climate

Credit Hours: 3.00. To understand climate we describe and synthesize physical processes in the atmosphere and their coupling to the ocean, ice, and land. We quantitatively explore climatology with an equal balance of physical principles and scrutiny of available modern data. Topics include: visualization of atmospheric/land surface/oceanographic climatological data sets; theories of climate dynamics; and climate change. Beginning with radiative balance and simple energy balance models, the course progresses toward understanding the effects of radiative-convective forcing and rotation on the fluid envelopes. Analysis of data in an interactive computer-enabled environment is an important part of the course. By the end of this course, the student should know how the Earth System behaves at large scales and grasp the physical understandings of why.

Learning Outcomes: 1. Quantitatively describe climatology, climate variability, and climate change through physical principles and modern climate data. 2. Use radiative equilibrium, radiative-convective equilibrium, and energy balance models to make predictions of climate change and compare with observations. 3. Describe and synthesize atmosphere and ocean dynamics, large-scale circulation patterns, and interactions with ice and land surfaces. 4. Analyze major contemporary

atmospheric science problems and phenomena, such as global warming, ozone hole, El Nino, etc., and the information provided by past climates on Earth. Credits: 3.00

12-17 Credits

Spring 4th Year

12-17 Credits

Audio Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (52 credits)

Required Major Courses (52 credits)

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers,

BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including

power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

ECET 33900 - Digital Signal Processing

Credit Hours: 3.00. The course introduces students to the fundamental principles associated with processing discrete time signals. The architecture, instruction set and hardware and software development tools associated with a fixed point general purpose VLSI digital signal processor are examined. Some common real-time applications are implemented such as digital filters and DFT-based spectral estimation on a typical fixed point digital signal processor.

Learning Outcomes: 1. Describe the architectural features of a DSP and relate these to the DSP kernel equation. 2. Manipulate different binary number formats associated with a fixed point DSP. 3. Develop and debug simple programs that involve SOPs, modulo addressing, scaling and extraction of result, and common DSP program structures. 4. Describe the consequences and limitations of sampling baseband signals including the Nyquist rate and bandwidth, quantization noise, aliasing, frequency folding, reconstruction, spectrum of sampled baseband signals. 5. Express a sampled deterministic analog signal in closed

mathematical form and expanded form using the unit sample. 6. Express a sampled signal in terms of the Z transform, in expanded and closed form. 7. Describe the relationship between the transfer function and impulse response in an LTI system. 8. Describe the operation of convolution and its implementation using hand calculations, mathematical software packages, and a fixed-point DSP. 9. Design and analyze FIR filters with the aid of a mathematical software package such as MATLAB. Credits: 3.00

ECET 38800 - Analog IC Applications

Credit Hours: 3.00. This course is a study of the applications of analog integrated circuits. Topics include linear amplifiers, IC specifications, linear regulators, waveform generation, linear and switched-capacitor active filters, and nonlinear circuit applications. Computer aided analysis of these circuits is also presented.

Learning Outcomes: 1. Analyze and design a wide variety of digitally controlled analog circuits, selecting among several alternative configurations, accounting for the non-ideal IC behavior, and selecting appropriate devices. 2. Evaluate the performance of a variety of analog circuits, using appropriate standard laboratory measurement procedures, and simulations. Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.

Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide. Credits: 3.00

ECET 31800 - Foundations Of Audio Electronics

Credit Hours: 3.00. The design, fabrication, and testing of the electronics that comprise audio signal transduction, transmission, processing, amplification and delivery to a loudspeaker are studied at an introductory level. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Quantify and measure sound and signal levels in terms of dB. 2. Convert dB, crest factor, THD, and frequency cut-off specifications into circuit design parameters. 3. Interface circuitry to microphones and loud speakers. 4. Design, build, and test a small audio system containing differential transmitters, differential amplifiers, simple active filters summers/mixers, class AB and class D power and bridged audio power amplifiers. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3.

Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

ECET 42801 - Advanced Acoustics And Audio Engineering Technologies

Credit Hours: 3.00. This course introduces topics on acoustics and audio features/elements from hardware and/or software perspectives. Topics covered include the preparation and augmentation of audio data and designing, implementing, and evaluating the audio data using AI machine learning. This course also investigates electro-acoustic applications, their hardware element details, and their contributions to the system. This will pave students' understanding of the state-of-the-art technology in the acoustic and audio engineering technology field.

Learning Outcomes: 1. Define sound features that are both speaker-independent and -dependent. 2. Analyze acoustic/audio signals using AI machine learning. 3. Investigate electro-acoustic transducers and applications. 4. Review and evaluate acoustics/audio-related state-of-arts technology. Credits: 3.00

Other Departmental/Program Course Requirements (62-72 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course

produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the

workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

FLM 32100 - Live Production I: Theater/Music/Arts

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as narrative development.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating professional AV system documentation. Credits: 3.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation

solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It

exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MET 31800 - Applied Room Acoustics

Credit Hours: 3.00. Concepts of acoustics are applied to rooms, automotive applications, speakers, musical instruments, audio electronics, and other areas of interest. Modeling and design skills are developed through applied labs and a semester project. Lectures and mathematical exercises are combined with hands-on labs and a semester project to link abstract and physical concepts. As part of the semester project, a special fee will be assessed to be used towards materials for the semester project.

Learning Outcomes: 1. Analyze sound in terms of amplitude and frequency content. 2. Analyze the signal chain in a sound system (course will use a typical commercial sound system as a basis for discussion). 3. Describe the basic types of room treatments for different acoustical environments. 4. Describe the basic function of filters. 5. Analyze acoustic spaces using modeling software. 6. Design the acoustic performance of an enclosed space given representative physical and economic requirements. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound

reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

Electives (0-6 credits)

Supplemental List

Professional Experience

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or

15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of

elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It

exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16-19 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of

homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

16-18 Credits

Fall 2nd Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

14-15 Credits

Spring 2nd Year

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization

of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 31800 - Foundations Of Audio Electronics

Credit Hours: 3.00. The design, fabrication, and testing of the electronics that comprise audio signal transduction, transmission, processing, amplification and delivery to a loudspeaker are studied at an introductory level. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Quantify and measure sound and signal levels in terms of dB. 2. Convert dB, crest factor, THD, and frequency cut-off specifications into circuit design parameters. 3. Interface circuitry to microphones and loud speakers. 4. Design, build, and test a small audio system containing differential transmitters, differential amplifiers, simple active filters summers/mixers, class AB and class D power and bridged audio power amplifiers. Credits: 3.00

15 Credits

Fall 3rd Year

FLM 32100 - Live Production I: Theater/Music/Arts

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as narrative development.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard

symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating professional AV system documentation. Credits: 3.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 38800 - Analog IC Applications

Credit Hours: 3.00. This course is a study of the applications of analog integrated circuits. Topics include linear amplifiers, IC specifications, linear regulators, waveform generation, linear and switched-capacitor active filters, and nonlinear circuit applications. Computer aided analysis of these circuits is also presented.

Learning Outcomes: 1. Analyze and design a wide variety of digitally controlled analog circuits, selecting among several alternative configurations, accounting for the non-ideal IC behavior, and selecting appropriate devices. 2. Evaluate the performance of a variety of analog circuits, using appropriate standard laboratory measurement procedures, and simulations. Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.

Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound

reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

13-16 Credits

Spring 3rd Year

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and

Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MET 31800 - Applied Room Acoustics

Credit Hours: 3.00. Concepts of acoustics are applied to rooms, automotive applications, speakers, musical instruments, audio electronics, and other areas of interest. Modeling and design skills are developed through applied labs and a semester project. Lectures and mathematical exercises are combined with hands-on labs and a semester project to link abstract and physical concepts. As part of the semester project, a special fee will be assessed to be used towards materials for the semester project.

Learning Outcomes: 1. Analyze sound in terms of amplitude and frequency content. 2. Analyze the signal chain in a sound system (course will use a typical commercial sound system as a basis for discussion). 3. Describe the basic types of room treatments for different acoustical environments. 4. Describe the basic function of filters. 5. Analyze acoustic spaces using modeling software. 6. Design the acoustic performance of an enclosed space given representative physical and economic requirements. Credits: 3.00

16-17 Credits

Fall 4th Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of

accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

ECET 33900 - Digital Signal Processing

Credit Hours: 3.00. The course introduces students to the fundamental principles associated with processing discrete time signals. The architecture, instruction set and hardware and software development tools associated with a fixed point general purpose VLSI digital signal processor are examined. Some common real-time applications are implemented such as digital filters and DFT-based spectral estimation on a typical fixed point digital signal processor.

Learning Outcomes: 1. Describe the architectural features of a DSP and relate these to the DSP kernel equation. 2. Manipulate different binary number formats associated with a fixed point DSP. 3. Develop and debug simple programs that involve SOPs, modulo addressing, scaling and extraction of result, and common DSP program structures. 4. Describe the consequences and limitations of sampling baseband signals including the Nyquist rate and bandwidth, quantization noise, aliasing, frequency folding, reconstruction, spectrum of sampled baseband signals. 5. Express a sampled deterministic analog signal in closed mathematical form and expanded form using the unit sample. 6. Express a sampled signal in terms of the Z transform, in expanded and closed form. 7. Describe the relationship between the transfer function and impulse response in an LTI system. 8. Describe the operation of convolution and its implementation using hand calculations, mathematical software packages, and a fixed-point DSP. 9. Design and analyze FIR filters with the aid of a mathematical software package such as MATLAB. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate

the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Spring 4th Year

ECET 42801 - Advanced Acoustics And Audio Engineering Technologies

Credit Hours: 3.00. This course introduces topics on acoustics and audio features/elements from hardware and/or software perspectives. Topics covered include the preparation and augmentation of audio data and designing, implementing, and evaluating the audio data using AI machine learning. This course also investigates electro-acoustic applications, their hardware element details, and their contributions to the system. This will pave students' understanding of the state-of-the-art technology in the acoustic and audio engineering technology field.

Learning Outcomes: 1. Define sound features that are both speaker-independent and -dependent. 2. Analyze acoustic/audio signals using AI machine learning. 3. Investigate electro-acoustic transducers and applications. 4. Review and evaluate acoustics/audio-related state-of-arts technology. Credits: 3.00

12 Credits

Automation and Systems Integration Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (59 credits)

Required Major Courses (59 credits)

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection

structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

MFET 37400 - Manufacturing Integration I

Credit Hours: 3.00. The fundamentals of data communications and local area networks are taught in order to show students how to integrate modern manufacturing systems. Emphasis is on the various levels of communications between shop floor computers, PLCs, robots, and automatic identification equipment. Database technology is used as an integration tool. This course prepares students for the MFET capstone course.

Learning Outcomes: 1. Achieve communications between various types of controls and devices. 2. Interface various peripheral manufacturing devices using networking and serial communications. Credits: 3.00

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures,

products or services. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 11300 - Mechanics Applications

Credit Hours: 1.00. Concepts of mechanics are applied to structures, machine components, and frames. Stresses and deformations resulting from axial, shear, torsional, and flexural loads are considered. Kinematics and kinetics of motion are introduced.

Learning Outcomes: 1. Solve linear and rotational kinematics problems that are based on constant or linearly-varying acceleration. 2. Apply the principles of dynamic equilibrium to solve linear particle and rotational kinetics problems. 3. Calculate axial stress, shear stress, bearing stress, torsional stress, and flexural stress. 4. Use material properties and design factors to confirm simple loading of machines, frames, beams, and columns. Credits: 1.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

MFET 48003 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering

design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Other Departmental/Program Course Requirements (60 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate

feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers.

7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4.

Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to

compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena

in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply

chain technologies, analysis, and performance measurements. Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty. Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences. University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle. Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty. University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres.

2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (1 credits)

Supplemental List

Professional Requirement

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays,

pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

13-16 Credits

Spring 1st Year

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a

technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.
Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

15-17 Credits

Fall 2nd Year

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab
University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.
Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MET 11300 - Mechanics Applications

Credit Hours: 1.00. Concepts of mechanics are applied to structures, machine components, and frames. Stresses and deformations resulting from axial, shear, torsional, and flexural loads are considered. Kinematics and kinetics of motion are

introduced.

Learning Outcomes: 1. Solve linear and rotational kinematics problems that are based on constant or linearly-varying acceleration. 2. Apply the principles of dynamic equilibrium to solve linear particle and rotational kinetics problems. 3. Calculate axial stress, shear stress, bearing stress, torsional stress, and flexural stress. 4. Use material properties and design factors to confirm simple loading of machines, frames, beams, and columns. Credits: 1.00

15-17 Credits

Spring 2nd Year

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

16 Credits

Fall 3rd Year

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture

of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 3rd Year

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

MFET 37400 - Manufacturing Integration I

Credit Hours: 3.00. The fundamentals of data communications and local area networks are taught in order to show students how to integrate modern manufacturing systems. Emphasis is on the various levels of communications between shop floor computers, PLCs, robots, and automatic identification equipment. Database technology is used as an integration tool. This course prepares students for the MFET capstone course.

Learning Outcomes: 1. Achieve communications between various types of controls and devices. 2. Interface various peripheral manufacturing devices using networking and serial communications. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

15 Credits

Fall 4th Year

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MFET 48003 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

15 Credits

Aviation Management, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (59 credits)

Required Major Courses (59 credits)

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication. Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and

supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 14400 - Private Pilot Lectures

Credit Hours: 4.00. A study of the subject areas and information needed to operate as a private pilot in the aviation environment. The FAA private pilot written exam will be offered to those who qualify after taking the Lecture Course offering.

Learning Outcomes: 1. Recall the aeronautical subject areas required by the FAA as a private pilot. 2. Analyze aspects of professionalism and decision making within the aviation environment. 3. Compare and contrast the reference information available covering a given aviation concept or best practice. 4. Explain to team members about issues requiring resolution or input. 5. Demonstrate the knowledge, skills, and abilities to manage, lead, and empower others to efficiently address organizational and group needs and objectives. Credits: 4.00

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major aircraft systems work together. Credits: 3.00

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 25200 - Aviation Projects

Credit Hours: 3.00. This course will introduce the students to group projects in collaboration with industrial partners in aviation. A new project will be conducted each semester. Students will participate in the development of project goals, conducting field research, and developing a final course document and presentation. Travel outside of the normal assigned classroom time might be required. Permission of Department required.

Learning Outcomes: 1. Become familiar with the conduct of an industry research project. 2. Work in small research teams. 3. Develop presentation skills. Credits: 3.00

AT 36201 - Aviation Operations

Credit Hours: 3.00. This course introduces students to the principles of managing a complex aviation operation. Students will be assigned active roles in monitoring and reporting on aircraft flight and maintenance practices. Every student will be assigned a role as part of a small group whose responsibility is to gather appropriate information, develop reports, and conduct practical research tasks as assigned. Weekly and monthly group meetings will be conducted similar to those found in the airline industry with students playing an active role in these meetings.

Learning Outcomes: 1. Become familiar with the operation of a functioning flight operation. 2. Develop research and presentation skills appropriate to those utilized in airline management. 3. Work within a team as well as

how to lead a team. Credits: 3.00

AT 41200 - Aviation Finance

Credit Hours: 3.00. The course will focus on the financial knowledge needed to operate and evaluate aviation businesses. Content will cover the impact of financial decisions on operational outcomes that add/decrease value to an aviation company's bottom line. Case studies will be utilized to demonstrate practical aspects of financial decisions as they relate to organizational performance and profitability.

Learning Outcomes: 1. Explain common financial reports and their impact on operations. 2. Demonstrate reading and construction of cash flow, profit and loss, and balance sheets and explain how they are related. 3. Explain hedging concepts and how to build a selective hedging program to mitigate risk. 5. Analyze financial measurements and explain how they affect operational decisions for bottom line improvements. Credits: 3.00

AT 42101 - Managerial Economics In Aviation

Credit Hours: 3.00. This course explores the process of making managerial decisions based on modern economic principles and concepts, and provides the student with a set of tools that can be used to make those decisions. Marginal analysis, forecasting, and cost analysis concepts are introduced, as are game-theoretic and probabilistic decision-making models. Bargaining strategies and linear programming tools are covered, as well.

Learning Outcomes: 1. Identify the practices of a functioning operations department in aviation businesses. 2. Analyze flight operations data similar to those utilized in the aviation industry. 3. Apply aviation operations theory to solve aviation industry related challenges in a group setting. Credits: 3.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance.

Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

AT 48100 - Aviation Safety Problems

Credit Hours: 3.00. This course provides the opportunity for students to study problems associated with aviation safety. Particular attention will be given to the formulation of specific recommendations for improvements in aviation safety.

Learning Outcomes: 1. Familiar with the fundamental safety theories and possible applications. 2. Understand the characteristics human errors. 3. Identify and analyze the casual factors of a mishap. 4. Explain the process of emergency response and accident prevention programs. Credits: 3.00

AT 49800 - Aviation Technology Capstone

Credit Hours: 3.00. The Aviation Technology Capstone course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous experience of the student's curriculum. It also provides an opportunity for students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its

operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Other Departmental /Program Course Requirements (49 credits)

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis,

discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (12 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Aviation Management Selective Requirement

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 14400 - Private Pilot Lectures

Credit Hours: 4.00. A study of the subject areas and information needed to operate as a private pilot in the aviation environment. The FAA private pilot written exam will be offered to those who qualify after taking the Lecture Course offering.

Learning Outcomes: 1. Recall the aeronautical subject areas required by the FAA as a private pilot. 2. Analyze aspects of professionalism and decision making within the aviation environment. 3. Compare and contrast the reference information available covering a given aviation concept or best practice. 4. Explain to team members about issues requiring resolution or input. 5. Demonstrate the knowledge, skills, and abilities to manage, lead, and empower others to efficiently address organizational and group needs and objectives. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity,

coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14 Credits

Spring 1st Year

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication. Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem

of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major aircraft systems work together. Credits: 3.00

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 25200 - Aviation Projects

Credit Hours: 3.00. This course will introduce the students to group projects in collaboration with industrial partners in aviation. A new project will be conducted each semester. Students will participate in the development of project goals, conducting field research, and developing a final course document and presentation. Travel outside of the normal assigned classroom time might be required. Permission of Department required.

Learning Outcomes: 1. Become familiar with the conduct of an industry research project. 2. Work in small research teams. 3. Develop presentation skills. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Spring 2nd Year

AT 36201 - Aviation Operations

Credit Hours: 3.00. This course introduces students to the principles of managing a complex aviation operation. Students will be assigned active roles in monitoring and reporting on aircraft flight and maintenance practices. Every student will be assigned a role as part of a small group whose responsibility is to gather appropriate information, develop reports, and conduct practical research tasks as assigned. Weekly and monthly group meetings will be conducted similar to those found in the airline industry with students playing an active role in these meetings.

Learning Outcomes: 1. Become familiar with the operation of a functioning flight operation. 2. Develop research and presentation skills appropriate to those utilized in airline management. 3. Work within a team as well as how to lead a team. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used

to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

16 Credits

Fall 3rd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 3rd Year

AT 42101 - Managerial Economics In Aviation

Credit Hours: 3.00. This course explores the process of making managerial decisions based on modern economic principles and concepts, and provides the student with a set of tools that can be used to make those decisions. Marginal analysis, forecasting, and cost analysis concepts are introduced, as are game-theoretic and probabilistic decision-making models. Bargaining strategies and linear programming tools are covered, as well.

Learning Outcomes: 1. Identify the practices of a functioning operations department in aviation businesses. 2. Analyze flight operations data similar to those utilized in the aviation industry. 3. Apply aviation operations theory to solve aviation industry related challenges in a group setting. Credits: 3.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance.

Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

15 Credits

Fall 4th Year

AT 41200 - Aviation Finance

Credit Hours: 3.00. The course will focus on the financial knowledge needed to operate and evaluate aviation businesses. Content will cover the impact of financial decisions on operational outcomes that add/decrease value to an aviation company's bottom line. Case studies will be utilized to demonstrate practical aspects of financial decisions as they

relate to organizational performance and profitability.

Learning Outcomes: 1. Explain common financial reports and their impact on operations. 2. Demonstrate reading and construction of cash flow, profit and loss, and balance sheets and explain how they are related. 3. Explain hedging concepts and how to build a selective hedging program to mitigate risk. 5. Analyze financial measurements and explain how they affect operational decisions for bottom line improvements. Credits: 3.00

AT 48100 - Aviation Safety Problems

Credit Hours: 3.00. This course provides the opportunity for students to study problems associated with aviation safety. Particular attention will be given to the formulation of specific recommendations for improvements in aviation safety.

Learning Outcomes: 1. Familiar with the fundamental safety theories and possible applications. 2. Understand the characteristics human errors. 3. Identify and analyze the casual factors of a mishap. 4. Explain the process of emergency response and accident prevention programs. Credits: 3.00

15 Credits

Spring 4th Year

AT 49800 - Aviation Technology Capstone

Credit Hours: 3.00. The Aviation Technology Capstone course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous experience of the student's curriculum. It also provides an opportunity for students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 3.00

15 Credits

Biochemistry (Chemistry), BSCH

About the Program

Degree Requirements

Departmental/Program Major Courses (84-94 credits)

Required Major Courses (48-50 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental

knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BIOL 23000 - Biology Of The Living Cell

Credit Hours: 3.00. An introduction to modern cell biology for students who may not have taken a previous college course in biology. All students with the appropriate prerequisites are welcome, and this course will be of special interest to students from engineering, chemistry, physics and computer science. This course will provide a solid foundation in modern cell biology concepts for engineers and students from other disciplines.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3.

Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.

Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of

organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3.

Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data

measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Laboratory Selectives (16-22 credits)

Option 1: Selectives (16-21 credits)

Area 1: Organic Laboratory (2 credits)

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5.

Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

Area 2: Physical Chemistry (10-11 credits)

Sequence 1

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

Sequence 2

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills:

identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

Sequence 3

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

Area 3: Analytical (4-8 credits)

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to

quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

Option 2: Selectives (18-22 credits)

Area 1: Physical Chemistry (11-14 credits)

Sequence 1

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving

skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

Sequence 2

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5.

Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

Sequence 3

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

Area 2: Analytical Selective (7-8 credits)

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to

quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

Chemistry Foundational Selectives

BIOL 39500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent

introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

Required Calculus and Physics Courses (20-22 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the

interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits,

thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Other Departmental /Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.

Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Electives (0-17 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze

experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

12-18 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-17 Credits

Fall 2nd Year

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials.

Credits: 2.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

16 Credits

Spring 2nd Year

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries.

Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

13-15 Credits

Fall 3rd Year

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the

links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

15 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.

Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment.

Credits: 3.00

CHM 53800 - Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins.

Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM

33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

13-14 Credits

Fall 4th Year

15-17 Credits

Spring 4th Year

15-18 Credits

Biochemistry, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (50-54 credits)

Required Major Courses (26-29 credits)

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical

arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular

techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help biochemistry students with professional development and career planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate,

evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

MCMP 54400 - Drug Classes And Mechanisms

Credit Hours: 3.00. The course will integrate basic principles of medicinal chemistry and pharmacology to achieve an understanding of drug mechanisms as applied to autonomic/endocrine, cardiovascular/renal, CNS, and chemotherapy/infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease.

Learning Outcomes: 1. Knowledge and understanding of the major drug classes. 2. Knowledge of the relationships between mechanism of action with drug interactions and adverse reactions. 3. Development of an introductory-level ability to critically evaluate primary literature. 4. An appreciation for the relevant research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. 5. A broad knowledge of pharmaceutical and related sciences. 6. An understanding of drug discovery, development, and commercialization. 7. Effective written and oral communication skills. 8. An ability to integrate and apply knowledge to solve problems. Credits: 3.00

PHSC 42200 - Immunology

Credit Hours: 3.00. This course exposes students to the basic principles of immunology, teaches students to use those principles to understand the cause of immunological disease and the basis of immunoprophylaxis and immunotherapy, and provides students with sufficient information to understand the principles and challenges of gene therapy and the application of genomics to future drug development.

Learning Outcomes: 1. The basic components of the immune system and their roles in innate and adaptive immunity. 2. The development and function of lymphocytes in adaptive immunity. 3. The molecular basis of antibody diversity. 4. How antigens are recognized by T cells. 5. How B cells develop and function in the body. 6. How T cells develop in the body and differentiate into specialized subsets. 7. How lymphocytes undergo positive and negative selection. 8. How B cells and T cells are activated and participate in adaptive immunity. 9. The basis of MHC polymorphism and the role on the immune response. 10. How the complement system is activated and plays its role in immune responses. 11. How the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. How the body remembers a previous infection. 13. The types and causes of immunodeficiency diseases. 14. How infection with HIV affects the immune system. 15. How the immune system sometimes recognizes harmless antigens (allergic reactions). 16. How the immune system can damage healthy tissue. 17. The basis and practice of immunization. 18. How the immune system complicates organ transplantation. 19. How the immune system recognizes cancer cells and can be used to combat cancer. Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular

structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CS 47800 - Introduction To Bioinformatics

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biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an

understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding

site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 61200 - Bioinformatic Analysis Of Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data. Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells,

introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g.

RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

Biochemistry Selective Courses (24-25 credits)

Other Departmental/Program Course Requirements (57-58 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible

conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of

molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and

power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.

Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (8-13 credits)

Supplemental List

Grade Requirements

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and

regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological

function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior

knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and

power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

13-15 Credits

Fall 2nd Year

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell

function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple

methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing

professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the

physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

16-17 Credits

Fall 3rd Year

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help biochemistry students with professional development and career planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and

physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

14 Credits

Spring 3rd Year

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory

practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

14-15 Credits

Fall 4th Year

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

15-16 Credits

Spring 4th Year

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

12-17 Credits

Biochemistry: Pre-Med Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (52-56 credits)

Required Major Courses (26-29 credits)

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help

biochemistry students with professional development and career planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and

conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

MCMP 54400 - Drug Classes And Mechanisms

Credit Hours: 3.00. The course will integrate basic principles of medicinal chemistry and pharmacology to achieve an understanding of drug mechanisms as applied to autonomic/endocrine, cardiovascular/renal, CNS, and chemotherapy/infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease.

Learning Outcomes: 1. Knowledge and understanding of the major drug classes. 2. Knowledge of the relationships between mechanism of action with drug interactions and adverse reactions. 3. Development of an introductory-level ability to critically evaluate primary literature. 4. An appreciation for the relevant research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. 5. A broad knowledge of pharmaceutical and related sciences. 6. An understanding of drug discovery, development, and commercialization. 7. Effective written and oral communication skills. 8. An ability to integrate and apply knowledge to solve problems. Credits: 3.00

PHSC 42200 - Immunology

Credit Hours: 3.00. This course exposes students to the basic principles of immunology, teaches students to use those principles to understand the cause of immunological disease and the basis of immunoprophylaxis and immunotherapy, and provides students with sufficient information to understand the principles and challenges of gene therapy and the application of genomics to future drug development.

Learning Outcomes: 1. The basic components of the immune system and their roles in innate and adaptive immunity. 2. The development and function of lymphocytes in adaptive immunity. 3. The molecular basis of antibody diversity. 4. How antigens are recognized by T cells. 5. How B cells develop and function in the body. 6. How T cells develop in the body and differentiate into specialized subsets. 7. How lymphocytes undergo positive and negative selection. 8. How B cells and T cells are activated and participate in adaptive immunity. 9. The basis of MHC polymorphism and the role on the immune response. 10. How the complement system is activated and plays its role in immune responses. 11. How the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. How the body remembers a previous infection. 13. The types and causes of immunodeficiency diseases. 14. How infection with HIV affects the immune system. 15. How the immune system sometimes recognizes harmless antigens (allergic reactions). 16. How the immune system can damage healthy tissue. 17. The basis and practice of immunization. 18. How the immune system complicates organ transplantation. 19. How the immune system recognizes cancer cells and can be used to combat cancer. Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and

growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and

interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical

research problems.

Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the

tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 61200 - Bioinformatic Analysis Of Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data. Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge

established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a

sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

Pre-Med Concentration Course and Selectives (26-27 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will

understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 39600 - Premedical Planning Seminar

Credit Hours: 0.00. This course is designed for sophomore and junior students who are planning to attend medical school. The course offers information and advice on the MCAT, the application process, the personal statement, the interview, and

letters of recommendation. Students in the course will also formulate an alternative career plan. The course meets the first 10 weeks of the semester.

Credits: 0.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Other Departmental/Program Course Requirements (57-58 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs

offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in

cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad

understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective

foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact

through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (6-11 credits)

Grade Requirements

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with

taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods

associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

12-14 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts

and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-18 Credits

Fall 2nd Year

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription,

protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate

and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how

energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment.
Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking
University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.
University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.
Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.
Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and

materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

16-17 Credits

Fall 3rd Year

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help biochemistry students with professional development and career

planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify

substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

14 Credits

Spring 3rd Year

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

BIOL 39600 - Premedical Planning Seminar

Credit Hours: 0.00. This course is designed for sophomore and junior students who are planning to attend medical school. The course offers information and advice on the MCAT, the application process, the personal statement, the interview, and letters of recommendation. Students in the course will also formulate an alternative career plan. The course meets the first 10 weeks of the semester.

Credits: 0.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

14-16 Credits

Fall 4th Year

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form.

Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students

will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

14 Credits

Spring 4th Year

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles

that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

14-17 Credits

Biochemistry: Pre-Vet Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (52-57 credits)

Required Major Courses (26-29 credits)

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues

facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society,

including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help biochemistry students with professional development and career planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form.

Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

MCMP 54400 - Drug Classes And Mechanisms

Credit Hours: 3.00. The course will integrate basic principles of medicinal chemistry and pharmacology to achieve an understanding of drug mechanisms as applied to autonomic/endocrine, cardiovascular/renal, CNS, and chemotherapy/infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease.

Learning Outcomes: 1. Knowledge and understanding of the major drug classes. 2. Knowledge of the relationships between mechanism of action with drug interactions and adverse reactions. 3. Development of an introductory-level ability to critically evaluate primary literature. 4. An appreciation for the relevant research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. 5. A broad knowledge of pharmaceutical and related sciences. 6. An understanding of drug discovery, development, and commercialization. 7. Effective written and oral communication skills. 8. An ability to integrate and apply knowledge to solve problems. Credits: 3.00

PHSC 42200 - Immunology

Credit Hours: 3.00. This course exposes students to the basic principles of immunology, teaches students to use those principles to understand the cause of immunological disease and the basis of immunoprophylaxis and immunotherapy, and provides students with sufficient information to understand the principles and challenges of gene therapy and the application of genomics to future drug development.

Learning Outcomes: 1. The basic components of the immune system and their roles in innate and adaptive immunity. 2. The development and function of lymphocytes in adaptive immunity. 3. The molecular basis of antibody diversity. 4. How antigens are recognized by T cells. 5. How B cells develop and function in the body. 6. How T cells develop in the body and differentiate into specialized subsets. 7. How lymphocytes undergo positive and negative selection. 8. How B cells and T cells are activated and participate in adaptive immunity. 9. The basis of MHC polymorphism and the role on the immune response. 10. How the complement system is activated and plays its role in immune responses. 11. How the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. How the body remembers a previous infection. 13. The types and causes of immunodeficiency diseases. 14. How infection with HIV affects the immune system. 15. How the immune system sometimes recognizes harmless antigens (allergic reactions). 16. How the immune system can damage healthy tissue. 17. The basis and practice of immunization. 18. How the immune system complicates organ transplantation. 19.

How the immune system recognizes cancer cells and can be used to combat cancer. Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the

macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders,

such as cancer.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis

pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 61200 - Bioinformatic Analysis Of Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data.

Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first

generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems

involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

Pre-Vet Concentration Required Courses and Selectives (26-28 credits)

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts;

critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as

well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis,

discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

Other Departmental/Program Course Requirements (57-58 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and

biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods,

solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and

genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on

when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (5-11 credits)

Grade Requirements

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing

on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and

activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in

lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

12-14 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic

theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.
Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14-16 Credits

Fall 2nd Year

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students

will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance

test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological

systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

16-17 Credits

Fall 3rd Year

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help biochemistry students with professional development and career planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological

macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

14 Credits

Spring 3rd Year

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers.

3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

14-15 Credits

Fall 4th Year

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers.

3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication,

RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

16-17 Credits

Spring 4th Year

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature. Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required. Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5.

Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

13-18 Credits

Biological Engineering, BSBE

About the Program

Degree Requirements

Departmental/Program Major Courses (51 credits)

Required Major Courses (51 credits)

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 20200 - Thermodynamics In Biological Engineering

Credit Hours: 3.00. Thermodynamic principles and their applications to biochemical and biological systems with emphasis on the second law of thermodynamics and use of molecular interpretations of energies and entropies. Concept of entropy balances and process efficiency. Free energy and chemical equilibrium. Equilibrium between phases, colligative properties, binding of ligands and formation of biological membranes. Molecular motion and transport properties and their application in biochemical analytical methods. Development of physical chemical problem solving skills using MathCad and MatLab software.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations to macro scale

thermodynamic processes. 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering disciplines (First & Second Law of Thermodynamics; Open vs closed systems o Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility; Path dependence/independence). 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with bioprocesses. 4. Solve multiphysics and multi-scale problems for thermodynamic processes using the computer. 5. Develop the attitudinal dimensions of computational thinking. 6. Gain experience in working with non-linear systems and systems away from equilibrium. Credits: 3.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS) Credits: 1.00

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

ABE 30300 - Physical Chemistry In Biological Engineering

Credit Hours: 3.00. Physical chemical principles associated with transport of mass, momentum and energy in bioprocesses. Principles for measuring physical chemical properties, a description of predictive equations for their evaluation and the role of these principles in the design and optimization of bioprocesses.

Learning Outcomes: 1. Design complex engineering problems by applying physical chemistry. 2. Explain the principles of characterizing biological materials using physical and optical techniques. 3. Determine the appropriate methods to characterize or purify biological materials based on their physical properties. 4. Predict the results of a spectroscopic technique based on the optical properties of materials and vice versa. Credits: 3.00

ABE 30400 - Biological Engineering Laboratory

Credit Hours: 3.00. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Learning Outcomes: 1. Understand and analyze the flow behavior in biological systems. 2.

Understand and analyze enzymatic reasons in biological systems. 3. Understand and analyze fermentation processes. 4. Understand and analyze mixing and heat transfer in biological systems. 5. Collect and analyze rheological properties. 6. Design and safely execute experiments in a process laboratory. 7. Collection and statistical analysis of experimental data. 8. Present the results of analysis in the form of written report and oral presentation. Credits: 3.00

ABE 30700 - Momentum Transfer In Biological Engineering

Credit Hours: 3.00. Fluid statics, Newton's law of viscosity, shell momentum balances, equations of continuity and motion, one dimensional flow problems, flow through porous media, velocity distributions with more than one independent variable, two dimensional flow through a channel, stream function, velocity potential, dimensional analysis, boundary layer, turbulent flow, Reynolds stress, form and skin friction, application of macroscopic momentum and mechanical energy balances to engineering problems.

Learning Outcomes: 1. Know the principles of fluid statics. 2. Know the principles of dimensional analysis for analysis of flow problems. 3. Know the characteristics and analysis of the flow of food and biological fluids. 4. Gain an understanding of the principles of turbulent flow. 5. Know how to apply macroscopic mass and momentum balances to flow problems in food and biological systems. Credits: 3.00

ABE 30800 - Heat And Mass Transfer In Biological Engineering

Credit Hours: 3.00. Principles of transport of energy and mass. Mechanisms of heat transfer, heat conduction, heat convection and heat radiation. Development of applications using macroscopic and microscopic balances of energy. Application of thermal energy balances and Fourier's Law to describe steady state and transient conduction applications including heat generation. Effect of the geometry on these processes. Basic principles of design of heat transfer equipment and its operation. Application of species mass balances and Fick's Law to steady state and transient diffusion problems. Effect of geometry on these processes. Analogies between transport of momentum, heat and mass applications to the solution of practical problems in the Food Process and Biological Engineering fields.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multidisciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. Have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. A recognition of the need for, and an ability to engage in life-long learning. 8. A knowledge of contemporary issues. 9. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 37000 - Reaction Kinetics In Biological Engineering

Credit Hours: 3.00. This course will introduce students to the tenets of kinetics/rates of chemical/biochemical reactions. Reaction rate models will be developed and used to design basic ideal reactors and non-ideal flow reactors. Models for homogeneous, heterogeneous, and catalytic reactions will be developed and used to develop reactor designs. A variety of computational numerical modeling skills will be used in the solution of these models, including numerical interpolation, and numerical solution of set of differential equations. MatLAB software programming tools will be used by students for computational analysis.

Learning Outcomes: 1. Gain an understanding of the basic concepts of reaction kinetics for chemical and biochemical systems. 2. Gain an understanding of basic engineering reactor design models. 3. Gain an understanding of the application of kinetic models to reaction processes involving diffusive and convective mass transport. 4. Understand how kinetic reaction and reactor design models are applied

to food and biological engineering processes. 5. Apply mathematical skills to developing analytical and numerical solutions. Credits: 3.00

ABE 45700 - Unit Operations In Biological Engineering

Credit Hours: 3.00. Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipe flow, pumps, mixing, emulsification, extrusion, sheeting, heat exchanges, aseptic processing, sterilization, freezing, and evaporation.

Learning Outcomes: 1. Gain and understand the principles, design and analysis of biological and food process engineering operations. 2. Know the characteristics and analysis of the flow of biological fluids. 3. Gain an understanding of the principles, design and analysis of thermal processing operations. 4. Gain an understanding of the principles and analysis of freezing. Credits: 3.00

ABE 46000 - Sensors And Process Control

Credit Hours: 3.00. Fundamental aspects of transducers, biosensors, instrumentation, and computer control are presented, with particular emphasis on sensors and controls used in agricultural, biological, and food applications. Laboratory and pilot plant scale computer controlled equipment is used to examine response of process variables, sensor calibration, control system modeling, and controller selection and tuning. Prerequisite: differential equations and a course in either heat transfer or fluid mechanics.

Credits: 3.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

ABE 55700 - Biological Engineering Design I

Credit Hours: 3.00. Course includes analysis and design of operations, such as dehydration, fermentation, and separation processes. Development of experimental designs, integration of pilot plant results into the design, operation and scale-up process systems. Emphasis on how the properties of biological materials influence the quality of the processed product.

Learning Outcomes: 1. Develop ability for self-learning and preparation for lifelong learning. 2. Apply principles learned to the development of typical industrial processes. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Communicate technical information effectively. 5. Improve computer skills. 6. Work in teams. 7. Meet deadlines. 8. Evaluate ethical, global, and societal contemporary issues. Credits: 3.00

ABE 55800 - Biological Engineering Design II

Credit Hours: 3.00. This course will focus on the design, synthesis, creation, evaluation, and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Course will include group projects, oral and written reports.

Learning Outcomes: ". Develop an understanding of Bio and Food Separation Processes. 2. Evaluate the economic aspects of product costs. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Develop processes to minimize environmental and energy impact. 5. Develop an understanding of optimization (zero discharge/minimum energy). 6. Develop a business plan. 7. Communicate technological information. 8. Improve computer skills to operate and schedule processes (superPro Designer/Batches). 9. Work in teams to design a biological/food process. 10. Review technical and patent literature Credits: 3.00

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer

preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting pertinent information from scientific journal articles. Credits: 2.00

ABE 30200 - Biochemical Laboratory Techniques For Biological Engineers

Credit Hours: 1.00. Experiments that introduce methods for analysis and recovery of biological molecules and that utilize the mathematical concepts to manipulate collected data. Introduction to engineering experimental design.

Learning Outcomes: 1. Perform statistical analysis on collected data to produce results to be interpreted and disseminated both written and orally. 2. Demonstrate proficiency in the following lab skills: Read and understand both digital and analog outputs; Liquid handling and dilutions; Protein purification and determination assays; Column chromatography; Spectrophotometric assays; Enzyme activity assays. 3. Understand and apply scientific methods of experimental design and analysis. Credits: 1.00

Other Departmental Requirement Total (79-86 credits)

Other Departmental Requirements (46-47 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and

the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to

address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23000 - Biology Of The Living Cell

Credit Hours: 3.00. An introduction to modern cell biology for students who may not have taken a previous college course in biology. All students with the appropriate prerequisites are welcome, and this course will be of special interest to students from engineering, chemistry, physics and computer science. This course will provide a solid foundation in modern cell biology concepts for engineers and students from other disciplines. Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact

through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Electives (0-1 credits)

Optional Concentrations

Supplemental Information

GPA Requirements

Transfer Credit Policy

Sample 4-Year Plan

Fall 2nd Year

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS) Credits: 1.00

BIOL 23000 - Biology Of The Living Cell

Credit Hours: 3.00. An introduction to modern cell biology for students who may not have taken a previous college course in biology. All students with the appropriate prerequisites are welcome, and this course will be of special interest to students from engineering, chemistry, physics and computer science. This course will provide a solid foundation in modern cell biology concepts for engineers and students from other disciplines.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting

pertinent information from scientific journal articles. Credits: 2.00

18 Credits

Spring 2nd Year

ABE 20200 - Thermodynamics In Biological Engineering

Credit Hours: 3.00. Thermodynamic principles and their applications to biochemical and biological systems with emphasis on the second law of thermodynamics and use of molecular interpretations of energies and entropies. Concept of entropy balances and process efficiency. Free energy and chemical equilibrium. Equilibrium between phases, colligative properties, binding of ligands and formation of biological membranes. Molecular motion and transport properties and their application in biochemical analytical methods. Development of physical chemical problem solving skills using MathCad and MatLab software.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations to macro scale thermodynamic processes. 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering disciplines (First & Second Law of Thermodynamics; Open vs closed systems o Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility; Path dependence/independence). 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with bioprocesses. 4. Solve multiphysics and multi-scale problems for thermodynamic processes using the computer. 5. Develop the attitudinal dimensions of computational thinking. 6. Gain experience in working with non-linear systems and systems away from equilibrium. Credits: 3.00

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5.

Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic

properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

17-18 Credits

Fall 3rd Year

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

ABE 30300 - Physical Chemistry In Biological Engineering

Credit Hours: 3.00. Physical chemical principles associated with transport of mass, momentum and energy in bioprocesses. Principles for measuring physical chemical properties, a description of predictive equations for their evaluation and the role of these principles in the design and optimization of bioprocesses.

Learning Outcomes: 1. Design complex engineering problems by applying physical chemistry. 2. Explain the principles of characterizing biological materials using physical and optical techniques. 3. Determine the appropriate methods to characterize or purify biological materials based on their physical properties. 4. Predict the results of a spectroscopic technique based on the optical properties of materials and vice versa. Credits: 3.00

ABE 30700 - Momentum Transfer In Biological Engineering

Credit Hours: 3.00. Fluid statics, Newton's law of viscosity, shell momentum balances, equations of continuity and motion, one dimensional flow problems, flow through porous media, velocity distributions with more than one independent variable, two dimensional flow through a channel, stream function, velocity potential, dimensional analysis, boundary layer, turbulent flow, Reynolds stress, form and skin friction, application of macroscopic momentum and mechanical energy balances to engineering problems.

Learning Outcomes: 1. Know the principles of fluid statics. 2. Know the principles of dimensional analysis for analysis of flow

problems. 3. Know the characteristics and analysis of the flow of food and biological fluids. 4. Gain an understanding of the principles of turbulent flow. 5. Know how to apply macroscopic mass and momentum balances to flow problems in food and biological systems. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

ABE 30200 - Biochemical Laboratory Techniques For Biological Engineers

Credit Hours: 1.00. Experiments that introduce methods for analysis and recovery of biological molecules and that utilize the mathematical concepts to manipulate collected data. Introduction to engineering experimental design.

Learning Outcomes: 1. Perform statistical analysis on collected data to produce results to be interpreted and disseminated both written and orally. 2. Demonstrate proficiency in the following lab skills: Read and understand both digital and analog outputs; Liquid handling and dilutions; Protein purification and determination assays; Column chromatography; Spectrophotometric assays; Enzyme activity assays. 3. Understand and apply scientific methods of experimental design and analysis. Credits: 1.00

16 Credits

Spring 3rd Year

ABE 30400 - Biological Engineering Laboratory

Credit Hours: 3.00. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Learning Outcomes: 1. Understand and analyze the flow behavior in biological systems. 2. Understand and analyze enzymatic reasons in biological systems. 3. Understand and analyze fermentation processes. 4. Understand and analyze mixing and heat transfer in biological systems. 5. Collect and analyze rheological properties. 6. Design and safely execute experiments in a process laboratory. 7. Collection and statistical analysis of experimental data. 8. Present the results of analysis in the form of written report and oral presentation. Credits: 3.00

ABE 30800 - Heat And Mass Transfer In Biological Engineering

Credit Hours: 3.00. Principles of transport of energy and mass. Mechanisms of heat transfer, heat conduction, heat convection and heat radiation. Development of applications using macroscopic and microscopic balances of energy. Application of thermal energy balances and Fourier's Law to describe steady state and transient conduction applications including heat generation. Effect of the geometry on these processes. Basic principles of design of heat transfer equipment and its operation. Application of species mass balances and Fick's Law to steady state and transient diffusion problems. Effect of geometry on these processes. Analogies between transport of momentum,

heat and mass applications to the solution of practical problems in the Food Process and Biological Engineering fields.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multidisciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. Have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. A recognition of the need for, and an ability to engage in life-long learning. 8. A knowledge of contemporary issues. 9. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 37000 - Reaction Kinetics In Biological Engineering

Credit Hours: 3.00. This course will introduce students to the tenets of kinetics/rates of chemical/biochemical reactions. Reaction rate models will be developed and used to design basic ideal reactors and non-ideal flow reactors. Models for homogeneous, heterogeneous, and catalytic reactions will be developed and used to develop reactor designs. A variety of computational numerical modeling skills will be used in the solution of these models, including numerical interpolation, and numerical solution of set of differential equations. MatLAB software programming tools will be used by students for computational analysis.

Learning Outcomes: 1. Gain an understanding of the basic concepts of reaction kinetics for chemical and biochemical systems. 2. Gain an understanding of basic engineering reactor design models. 3. Gain an understanding of the application of kinetic models to reaction processes involving diffusive and convective mass transport. 4. Understand how kinetic reaction and reactor design models are applied to food and biological engineering processes. 5. Apply mathematical skills to developing analytical and numerical solutions. Credits: 3.00

ABE 45700 - Unit Operations In Biological Engineering

Credit Hours: 3.00. Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipe flow, pumps, mixing, emulsification, extrusion, sheeting, heat exchanges, aseptic processing, sterilization, freezing, and evaporation.

Learning Outcomes: 1. Gain and understand the principles, design and analysis of biological and food process engineering operations. 2. Know the characteristics and analysis of the flow of biological fluids. 3. Gain an understanding of the principles, design and analysis of thermal processing operations. 4. Gain an understanding of the principles and analysis of freezing. Credits: 3.00

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

18 Credits

Fall 4th Year

ABE 46000 - Sensors And Process Control

Credit Hours: 3.00. Fundamental aspects of transducers, biosensors, instrumentation, and computer control are presented, with particular emphasis on sensors and controls used in agricultural, biological, and food applications. Laboratory and pilot plant scale computer controlled equipment is used to examine response of process variables, sensor calibration, control system modeling, and controller selection and tuning. Prerequisite: differential equations and a course in either heat transfer or fluid mechanics.

Credits: 3.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

ABE 55700 - Biological Engineering Design I

Credit Hours: 3.00. Course includes analysis and design of operations, such as dehydration, fermentation, and separation processes. Development of experimental designs, integration of pilot plant results into the design, operation and scale-up process systems. Emphasis on how the properties of biological materials influence the quality of the processed product.

Learning Outcomes: 1. Develop ability for self-learning and preparation for lifelong learning. 2. Apply principles learned to the development of typical industrial processes. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Communicate technical information effectively. 5. Improve computer skills. 6. Work in teams. 7. Meet deadlines. 8. Evaluate ethical, global, and societal contemporary issues. Credits: 3.00

13-14 Credits

Spring 4th Year

ABE 55800 - Biological Engineering Design II

Credit Hours: 3.00. This course will focus on the design, synthesis, creation, evaluation, and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Course will include group projects, oral and written reports.

Learning Outcomes: ". Develop an understanding of Bio and Food Separation Processes. 2. Evaluate the economic aspects of product costs. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Develop processes to minimize environmental and energy impact. 5. Develop an understanding of optimization (zero discharge/minimum energy). 6. Develop a business plan. 7. Communicate technological information. 8. Improve computer skills to operate and schedule processes (superPro Designer/Batches). 9. Work in teams to design a biological/food process. 10. Review technical and patent literature Credits: 3.00

15 Credits

Biology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (33-35 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student

mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal,

and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate

subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into

our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (14-16 credits)

Intermediate Selective (0-4 credits)

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and

physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited

in various biotechniques. Credits: 2.00

Group A Selective (at least 2 credits)

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the

most current literature.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional

architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 54900 - Microbial Ecology

Credit Hours: 2.00. A study of microbial interactions with other organisms and the environment. Aquatic and terrestrial ecosystems as well as interactions between nonpathogenic microbes and plants and animals will be discussed. Offered in alternate years.

Credits: 2.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the

tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical

properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage

checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

Group B Selective (at least 2 credits)

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and

development, and environmental adaptation and acclimation. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those

experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently

communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data

mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

BIOL 500-level Selective (0 or 2-3 credits)

Base Lab Requirement (0-4 credits)

Additional Selective Courses (1-9 credits)

Undergraduate Research (0-3 credits)

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49900 - Biology Honors Thesis Research

Credit Hours: 1.00 to 4.00. Research under the guidance of a scientist. Submission of honors tutorial petition and consent of faculty tutor and Honors Committee. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

Academic Seminars/Other Courses

BIOL 44100 - Biology Senior Seminar In Genetics

Credit Hours: 1.00. This is a required course for genetics majors. It provides exposure to current research in genetics and molecular biology via invited faculty speakers. Students enrolled in the course who have actively participated in research also give a presentation on their own work. Other students are assigned to review current literature in one aspect of the semester's topic. The topic selected for review is in an area of current research in genetics and may vary from year to year.

Credits: 1.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in

common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

Other Departmental Requirements (53-79 credits)

Chemistry (17 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular

understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600. Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Biochemistry (4 credits)

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites. Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at

MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS

18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data

set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the

connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Mathematics (6-10 credits)

Calculus I

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100,

and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Electives (6-25 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To

computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-19 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-20 Credits

Fall 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate

skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is

designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and

present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

14-15 Credits

Fall 3rd Year

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

13-14 Credits

Spring 3rd Year

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14 Credits

Fall 4th Year

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

12-16 Credits

Spring 4th Year

12-14 Credits

Biomedical Engineering, BSBME

About the Program

Degree Requirements

Biomedical Engineering Major Requirements (67-71 credits)

Biomedical Engineering Major Required Courses (46 credits)

BME 25600 - Physiological Modeling In Human Health

Credit Hours: 3.00. Introduction to the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. Engineering skills taught and practiced within the context of human disease, injury, and illness on extended problem sets which include mathematical modeling and problem solving with appropriate documentation. Main physiological systems of focus are cardiovascular, pulmonary, and renal, and common afflictions thereof.

Learning Outcomes: 1. Understand the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. 2. Understand the process of mathematical modeling of human anatomy and physiology, including technical description of objectives, methods, results, and conclusions from modeling exercises. Credits: 3.00

BME 29500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

BME 49000 - Professional Elements Of Design

Credit Hours: 1.00. This course advances and enhances design tools, concepts, and knowledge relevant to biomedical engineering design. Students work individually and in small teams to investigate the topic within the context of their specific senior design project in preparation for their lab. Topics include project management, human and animal subjects, ethics, regulatory affairs, literature and patent searching, and entrepreneurship.

Learning Outcomes: 1. Effectively communicate skills in oral and written form, both individually and as part of a team. 2. Explain/discuss realistic design constraints, including regulatory issues, social influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. 3. Generate and justify solutions to a medical and/or biological problems that addresses customer needs and realistic constraints. Credits: 1.00

BME 48901 - Senior Design Project Lab

Credit Hours: 3.00. The biomedical engineering design process is completed starting from a preparatory design course, BME 39000, through a preliminary system design, build and test in Senior Design Project Lab. Students will work with their teammates to implement (e.g. build, test, iterate and evaluate) a solution to address a biomedical engineering problem statement and meet the technical specifications set forth. The resulting project design is presented and evaluated through an oral presentation, laboratory demonstration, and a final written document.

Learning Outcomes: 1. Demonstrate ability to integrate and apply knowledge and skills obtained in earlier course work with new concepts and practices essential to the design and testing of a system or device to meet desired needs. 2. Implement the engineering design process and project management within the context of relevant design constraints. 3. Effectively communicate skills in oral and written form, both individually and as part of a team. 4. Explain/discuss realistic design constraints, including regulatory issues, societal influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

BME 39000 - Professional Development And Design In Biomedical Engineering

Credit Hours: 2.00. Introduction to a diverse spectrum of current topics relevant to the technical, professional, and career aspects of Biomedical Engineers. The course topics will focus on the early stages of the design process (e.g. need identification, problem formulation, innovation and idea generation), professional communication skills (e.g. written and oral reporting and documentation), and ethics of biomedical design and research (e.g. ethical codes and decision making, animal care and use in research and testing, authorship and intellectual property, social and environmental impact of design).

Learning Outcomes: 1. Able to identify medical needs relevant to Biomedical Engineering solutions, an understanding of realistic constraints which impact biomedical engineering design 2. Understand ethical and professional responsibilities which impact design 3. Understand the need for a multidisciplinary team to solve biomedical engineering design projects. 4. Able to

independently acquire knowledge from a variety of sources including biology and medicine as well as other engineering disciplines. 5. Able to communicate effectively in written form and evaluate written reports 6. Able to identify a career development pathway that is relevant to their personal identity and training as Biomedical Engineers. Credits: 2.00

BME 21400 - Introduction To Biomechanical Analysis

Credit Hours: 3.00. The goal of this course is to provide a foundation in biomechanics (analysis of forces, moments, and stresses) that will allow students to quantify the loads in the skeleton as well as design surgical tools and total joint replacements. In addition to the topics on vectors, particle equilibrium, and rigid body mechanics one would expect in a classical mechanics course, biomedical engineers must also have a working knowledge of skeletal anatomy. Consequently, anatomical descriptions and anthropometric data will be incorporated throughout the course. As part of the implant design, students will also be introduced to more advanced topics in mechanics such as Hertz contact theory, shear-lag theory, and composite beam theory.

Learning Outcomes: 1. Understand particle statics, rigid body statics, and the mechanics of deformable solids and their applications to problems in orthopedics. 2. Analyze selected biomechanical systems and measurements at a range of biologically relevant length scales. 3. Evaluate quality and reliability of assumptions and methods used in selected biomechanics applications. Credits: 3.00

BME 38000 - Professionalization In Biomedical Engineering

Credit Hours: 2.00. This active learning course covers standards of practice, regulatory and legal requirements, and moral and ethical issues; increases awareness of career paths; and addresses current and emerging trends and challenges at the frontiers of the field of biomedical engineering. Most class sessions will consist of a short introduction to a topic followed by a breakout session for active investigation of the topic. During the breakout sessions, course instructors will be available to guide discussion and answer questions.

Learning Outcomes: 1. Recognize and describe professional and ethical codes of conduct, and ethical dilemmas which pertain to a practicing biomedical engineer. 2. Use basic technical writing skills to clearly and concisely synthesize relevant technical information, data, and ideas from multiple sources. 3. Generate personal statements, curriculum vitae and other professional documents that are used in choses career pathways that are available to biomedical engineers. 4. Describe contemporary issues in biomedical engineering and understand their impact on personal and public health. 5. Identify skills and opportunities that enhance professional career development. Credits: 2.00

BME 21401 - Biomechanical Analysis Laboratory

Credit Hours: 1.00. This course provides hands-on training in engineering and biological principles of biomechanics. Topics include translation of theoretical vector and equilibrium calculations to three-dimensional body problems, computer aided design and finite element analysis, harvest and storage of biological samples, and tension, compression and bending testing with mechanical testers. A design project reinforces the mechanical testing skills learned in class, combining skill-building in group work and experimental design. This course will prepare students for deeper study of biomechanics.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. 2. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (SO 4). 3. Implement the experimental design process, including proper maintenance of a design laboratory notebook and use of appropriate statistical analysis methods, as it applies to mechanical performance of materials used for medical device design (SO 6). 4. Employ fundamental tools, testing procedures, and analyses relevant to computer-assisted design (CAD), FEA, and biomechanics, for rapid prototype development, analysis of mechanical

properties of tissues, materials, and devices (SO 7). 5. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 1.00

BME 22000 - Biomolecules: Structure, Function, And Engineering Applications

Credit Hours: 3.00. Classes of molecules (biomolecules) such as sugars, lipids, proteins, and nucleic acids that form the cellular components of living organisms. Explores the chemistry behind the structure and function of these important classes of biological molecules. Hydrogen-bonding, hydrophobic forces, electrostatic interactions along with other weak interactions discussed with reference to their importance in biomolecular systems in an engineering context.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. Credits: 3.00

BME 23100 - Bioinstrumentation and Circuit Theory

Credit Hours: 3.00. In this course, we'll delve into the core principles of circuit theory, covering topics such as voltage-current relationships in resistive and reactive components, Ohm's Law, Kirchhoff's Laws, and source equivalency. We will also explore advanced concepts like transient responses, AC impedance, and the dynamic behavior of first and second-order systems. Students will gain proficiency in phasor analysis of sinusoidal signals, complex number calculations, signal sampling, and spectral analysis. We'll also touch on linear time-invariant systems, frequency response, and both the design and implementation of filters. A portion of the course will focus on control systems via the s-domain. To enrich your understanding and skill set, we will also introduce programming through Python, which will facilitate data processing and deepen your conceptual grasp. This course serves as a preparatory steppingstone for BME 33000 (Bioelectricity), equipping you with the essential physics knowledge and skills required for more advanced studies.

Learning Outcomes: 1. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 3.00

BME 28000 - Frontiers In Biomedical Engineering

Credit Hours: 1.00. This course introduces the rapidly emerging field of biomedical engineering by exposing students to a wide range of research activities in the Weldon School and to a variety of experiential learning opportunities. Topics addressed include career paths, professional development opportunities, and career development skills including creating a plan of study, informational and job interviewing, writing a resume, technical writing, preparing effective oral presentations, and peer-editing.

Learning Outcomes: 1. Construct a logical and articulate argument in written format from independent collection of information. 2. Construct and deliver a logical and articulate oral presentation based on independent collection of information. 3. Evaluate oral and/or written presentations for clarity and content. 4. Identify and/or describe how biomedical engineering solutions affect society 5. Identify multiple career pathways that are available to a biomedical engineer. 6. Recognize opportunities that enhance professional career development. 7. Recognize contemporary issues impacting biomedical engineering. Credits: 1.00

BME 32000 - Introduction To Biomaterials Science And Engineering

Credit Hours: 3.00. This junior-level course will introduce fundamental materials science and biomaterial concepts to BME students and will lay the foundation for more advanced courses in biomaterials and tissue engineering. The course will introduce the vocabulary and technical concepts in biomaterials science relevant for problems in medical device, biotechnology, or biomaterials industries. The course material will present phenomena at the intersection of materials science and biology.

Learning Outcomes: 1. Identify the basic classes of biomaterials and understand their chemical makeup. 2. Understand the relationship between chemical structure and biomaterial properties. 3. Understand interactions of implantable biomaterials with proteins and cells. 4. Describe the major components of the biological response to implanted materials. 5. Select basic in vitro and in vivo tests to evaluate material biocompatibility. 6. Understand regulations and standards that dictate biomaterial testing. Credits: 3.00

BME 32001 - Biomolecules And Biomaterials Laboratory

Credit Hours: 1.00. Introductory laboratory experience focused on engineering concepts and practices in the analysis of biomolecules and cells. Topics include fundamental quantitative techniques of analysis, methods of isolation, identification, and quantification of biomolecules and cells, and analysis of integrated biosystems. Concludes with student-driven design project.

Learning Outcomes: 1. Independently describe the theoretical basis of, and put into practice, fundamental analytical tools and techniques used in the isolation, characterization, and quantification of biomolecules and cells. 2. Collect, record, process, statistically analyze and report experimental data related to the analysis of biomolecules and cells in an accurate and understandable manner. 3. Conceptually design a simple analytical method and/or tool for solving a medically-relevant problem based upon detection/analysis of a specific biomolecular or cellular related abnormality. Credits: 1.00

BME 38900 - Junior Experimental Design Laboratory

Credit Hours: 2.00. Practical experience with engineering design principles is presented through inquiry-based modules. Each module contains computer simulation, experimental design, implementation, and data analysis. Modules address biomedical applications in different areas of BME.

Learning Outcomes: 1. Use theoretical equations from fluid, heat, and mass transport to describe, model, analyze, and explain biomedical data. 2. Design experiments to investigate biomedical transport phenomena, collect relevant data, and compile a comprehensive report that clearly demonstrates the findings and implications of the data. 3. Work in a term to simulate and experimentally model biomedical transport, and use peer-and self-reviews to describe how each team member contributed to group efforts. Credits: 2.00

BME 49101 - Biomedical Engineering Design

Credit Hours: 2.00. This course prepares students for engineering practice through a major design experience, encompassing conceptualization, requirement generation, and system and detailed design. Essential design constraints will be reviewed and applied including: safety, economics, and manufacturability. The course encompasses lectures, case studies, team formation, project assignments and generation of initial design.

Learning Outcomes: 1. Identify and formulate the design problem, including bringing precision to the problem statement through a requirements specification. 2. Use critical thinking in the design process. 3. Conduct design using an organized design process, including planning, literature search, requirements specification, consideration of alternative approaches, determination of strategies, and design reviews. 4. Conduct design using design principles. 5. Apply engineering principles, mathematics, and science in engineering design, including methods, tools and techniques. 6. Apply technical knowledge to design, including methods, tools and techniques. 7. Analyze and interpret data. 8. Apply analytical tools and techniques to solve a design problem at the interface of engineering and biology. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a progress report, adhering to the specified format using an appropriate writing style, grammar, and spelling. Credits: 2.00

BME 49200 - Biomedical Engineering Design II

Credit Hours: 3.00. This course continues the design experience from BME 491 with verification, validation, and re-design of student projects. Regulatory and ethical design constraints will be discussed. Oral presentation and report writing are required.

Learning Outcomes: 1. Use critical thinking in the testing and redesign process. 2. Make appropriate measurements necessary for

testing the design, addressing the problems associated with the interaction between living and nonliving systems. 3. Apply engineering principles, mathematics, and science in engineering redesign, including methods, tools and techniques. 4. Apply technical knowledge to testing and redesign, including methods, tools and techniques. 5. Analyze and interpret testing and verification data. 6. Discuss ethical issues in engineering design for biological and medical applications. 7. Determine ways to test a design to determine its functionality (success of the design). 8. Apply knowledge of regulatory constraints to engineering design. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a final report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 11. Make an oral presentation using effective visual aids. Credits: 3.00

BME 23101 - Bioinstrumentation and Circuit Theory Lab

Credit Hours: 1.00. Introduction of laboratory instruments used to measure physiological events. Stimulation and conduction of electric signals within the mammalian nervous system and other excitable tissues are demonstrated. Fundamental circuit elements and concepts include resistance, capacitance, inductance, op-amps, impedance, voltage, current, power, and frequency, following the content introduced in BME 231. Fundamental analog measurement concepts include adequate bandwidth and amplitude and phase linearity. Integrative design project emphasizes the practical aspects of quantitative physiological measurements. This course is to prepare learners with sufficient physics knowledge and lab skills to pursue the Bioinstrumentation and Imaging Depth Areas. Moreover, students are introduced to programming (using Python) to deepen the understanding of basic concepts and learn basic skills in data processing. SPICE software will be used throughout the course to design/simulate various analog circuits.

Learning Outcomes: 1. Appraise the validity of established bioelectricity hypotheses and circuit models based on quantitative physiological measurements. 2. Document procedures, measurements, and subsequent data analysis in clear and cohesive laboratory reports. 3. Design an analog bioinstrumentation measurement system meeting prescribed specifications to accurately record a physiological event. 4. Design and simulate analog circuits using SPICE. 5. Create simple Python code to plot, analyze, and denoise physiological data. Build functions to simulate a simple bioinstrumentation system. 6. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. Credits: 1.00

BME 20200 - Thermodynamics In Biomedical Engineering

Credit Hours: 3.00. The major objective for this course is to understand and exploit basic principles of thermodynamics as they apply to biological systems and biological processes. Specifically, the course will focus on biological processes across scales: from the nanometer scale of biomolecules, the micrometer scale of cells, the millimeter and meter scales of tissues and organisms, all the way up to the 100+ meter scale for bioprocess equipment and industry-scale production with a focus on dynamic behaviors of systems. The course can be loosely classified into two parts: (i) guiding principles and fundamental equations for thermodynamics in biological and biomedical engineering, and (ii) applications of engineering principles to the study of biological systems.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations that describe thermodynamic processes. (SO 1, 6, 7) 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering disciplines: First & Second Law of Thermodynamics; Open vs closed systems; Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility. (SO 1, 6, 7) 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with

bioprocesses. (SO 7) 4. Solve problems for thermodynamic processes using the computer. (SO 1, 2, 5, 7) 5. Develop the attitudinal dimensions of computational thinking: Confidence in dealing with complexity; Persistence in working with difficult problems; Tolerance for ambiguity; The ability to deal with open-ended problems; The ability to communicate and work with others to achieve a common goal or solution. (SO 2) 6. Gain experience in working with non-linear systems and systems away from equilibrium. (SO 1, 6) Credits: 3.00

Other Major Required Courses (24-28 credits)

CHM 13600 - General Chemistry Honors (UCC: SCI)

Credit Hours: 4.00. A sophisticated treatment of the principles of chemistry. Atomic structure and bonding, spectroscopy, equilibria, thermodynamics and kinetics. Includes weekly laboratory experiments. Two years of high school chemistry recommended. Students with a grade of C or better in CHM 13600 who need 8 hours of credit in general chemistry may request credit for CHM 11500.

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6.

Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena

in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power

series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

BME 32200 - Probability, Statistics, And Applications In Biomedical Engineering

Credit Hours: 3.00. Probability theory and statistical methods are developed for life science applications. Analytical tools such as hypothesis testing, estimation of moments, sampling theory, correlation and spectral analysis are developed and applied to identifying underlying processes in biological systems, developing realistic models of physiological processes, designing experiments, and interpreting biological data.

Learning Outcomes: 1. Solve probability problems with biomedical engineering applications using the basic axioms of probability (1). 2. Describe the fundamental properties of probability density functions with applications to single and multivariate random variables (1,6). 3. Describe the functional characteristics of probability density function frequently encountered in life-science research such as the Binomial, Uniform, Gaussian, and Poisson (1,6). 4. Calculate confidence intervals and levels of statistical significance using fundamental measures of expectation and variance for a given biological data set (6). 5. Quantify the correlation between sets of random processes for given mathematical functions and biological data sets (1,6). 6. Identify the distribution function underlying a given biological process or medical application (1,6). 7. Model and describe behavior of biological systems by means of random processes (1,3). 8. Apply basic statistical concepts including descriptive statistics, Bayes Theorem, statistical inference, and hypothesis testing to biological and medical systems (1). 9. Design a statistical experiment using appropriate control and test conditions (1,6). 10. Apply statistical tools (e.g. Student's t-test) to interpret experimental results

(1,6). 11. Apply statistics testing to the evaluation and acceptance of medical processes, devices, and systems (1). Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Other Departmental Course Requirements (45 credits)

Supplemental List

GPA Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample Biomedical Engineering Plan of Study

Fall 2nd Year

BME 29500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few

fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

BME 21400 - Introduction To Biomechanical Analysis

Credit Hours: 3.00. The goal of this course is to provide a foundation in biomechanics (analysis of forces, moments, and stresses) that will allow students to quantify the loads in the skeleton as well as design surgical tools and total joint replacements. In addition to the topics on vectors, particle equilibrium, and rigid body mechanics one would expect in a classical mechanics course, biomedical engineers must also have a working knowledge of skeletal anatomy. Consequently, anatomical descriptions and anthropometric data will be incorporated throughout the course. As part of the implant design, students will also be introduced to more advanced topics in mechanics such as Hertz contact theory, shear-lag theory, and composite beam theory.

Learning Outcomes: 1. Understand particle statics, rigid body statics, and the mechanics of deformable solids and their applications to problems in orthopedics. 2. Analyze selected biomechanical systems and measurements at a range of biologically relevant length scales. 3. Evaluate quality and reliability of assumptions and methods used in selected biomechanics applications. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in

Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

BME 21401 - Biomechanical Analysis Laboratory

Credit Hours: 1.00. This course provides hands-on training in engineering and biological principles of biomechanics. Topics include translation of theoretical vector and equilibrium calculations to three-dimensional body problems, computer aided design and finite element analysis, harvest and storage of biological samples, and tension, compression and bending testing with mechanical testers. A design project reinforces the mechanical testing skills learned in class, combining skill-building in group work and experimental design. This course will prepare students for deeper study of biomechanics.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. 2. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (SO 4). 3. Implement the experimental design process, including proper maintenance of a design laboratory notebook and use of appropriate statistical analysis methods, as it applies to mechanical performance of materials used for medical device design (SO 6). 4. Employ fundamental tools, testing procedures, and analyses relevant to computer-assisted design (CAD), FEA, and biomechanics, for rapid prototype development, analysis of mechanical properties of tissues, materials, and devices (SO 7). 5. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 1.00

BME 28000 - Frontiers In Biomedical Engineering

Credit Hours: 1.00. This course introduces the rapidly emerging field of biomedical engineering by exposing students to a wide range of research activities in the Weldon School and to a variety of experiential learning opportunities. Topics addressed include career paths, professional development opportunities, and career development skills including creating a plan of study, informational and job interviewing, writing a resume, technical writing, preparing effective oral presentations, and peer-editing.

Learning Outcomes: 1. Construct a logical and articulate argument in written format from independent collection of information. 2. Construct and deliver a logical and articulate oral presentation based on independent collection of information. 3. Evaluate oral and/or written presentations for clarity and content. 4. Identify and/or describe how biomedical engineering solutions affect society 5. Identify multiple career pathways that are available to a biomedical engineer. 6. Recognize opportunities that enhance professional career development. 7. Recognize contemporary issues impacting biomedical engineering. Credits: 1.00

18-21 Credits

Spring 2nd Year

BME 25600 - Physiological Modeling In Human Health

Credit Hours: 3.00. Introduction to the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. Engineering skills taught and practiced within the context of human disease, injury, and illness on extended problem sets which include mathematical modeling and problem solving with appropriate documentation. Main physiological systems of focus are cardiovascular, pulmonary, and renal, and common afflictions thereof.

Learning Outcomes: 1. Understand the physiology and medicine underlying practical

problems in biomedical engineering, especially with respect to medical device development. 2. Understand the process of mathematical modeling of human anatomy and physiology, including technical description of objectives, methods, results, and conclusions from modeling exercises. Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

BME 22000 - Biomolecules: Structure, Function, And Engineering Applications

Credit Hours: 3.00. Classes of molecules (biomolecules) such as sugars, lipids, proteins, and nucleic acids that form the cellular components of living organisms. Explores the chemistry

behind the structure and function of these important classes of biological molecules. Hydrogen-bonding, hydrophobic forces, electrostatic interactions along with other weak interactions discussed with reference to their importance in biomolecular systems in an engineering context.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. Credits: 3.00

BME 23100 - Bioinstrumentation and Circuit Theory

Credit Hours: 3.00. In this course, we'll delve into the core principles of circuit theory, covering topics such as voltage-current relationships in resistive and reactive components, Ohm's Law, Kirchhoff's Laws, and source equivalency. We will also explore advanced concepts like transient responses, AC impedance, and the dynamic behavior of first and second-order systems. Students will gain proficiency in phasor analysis of sinusoidal signals, complex number calculations, signal sampling, and spectral analysis. We'll also touch on linear time-invariant systems, frequency response, and both the design and implementation of filters. A portion of the course will focus on control systems via the s-domain. To enrich your understanding and skill set, we will also introduce programming through Python, which will facilitate data processing and deepen your conceptual grasp. This course serves as a preparatory steppingstone for BME 33000 (Bioelectricity), equipping you with the essential physics knowledge and skills required for more advanced studies.

Learning Outcomes: 1. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 3.00

BME 23101 - Bioinstrumentation and Circuit Theory Lab

Credit Hours: 1.00. Introduction of laboratory instruments used to measure physiological events. Stimulation and conduction of electric signals within the mammalian nervous system and other excitable tissues are demonstrated. Fundamental circuit elements and concepts include resistance, capacitance, inductance, op-amps, impedance, voltage, current, power, and frequency, following the content introduced in BME 231. Fundamental analog measurement concepts include adequate bandwidth and amplitude and phase linearity. Integrative design project emphasizes the practical aspects of quantitative physiological measurements. This course is to prepare learners with sufficient physics knowledge and lab skills to pursue the Bioinstrumentation and Imaging Depth Areas. Moreover, students are introduced to programming (using Python) to deepen the understanding of basic concepts and learn basic skills in data processing. SPICE software will be used throughout the course to design/simulate various analog circuits.

Learning Outcomes: 1. Appraise the validity of established bioelectricity hypotheses and circuit models based on quantitative physiological measurements. 2. Document procedures, measurements, and subsequent data analysis in clear and cohesive laboratory reports. 3. Design an analog bioinstrumentation measurement system meeting prescribed specifications to accurately record a physiological event. 4. Design and simulate analog circuits using SPICE. 5. Create simple Python code to plot, analyze, and denoise physiological data. Build functions to simulate a simple bioinstrumentation system. 6. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. Credits: 1.00

BME 20200 - Thermodynamics In Biomedical Engineering

Credit Hours: 3.00. The major objective for this course is to understand and exploit basic principles of thermodynamics as they apply to biological systems and biological processes. Specifically, the course will focus on biological processes across scales: from the nanometer scale of biomolecules, the micrometer scale of cells, the millimeter and meter scales of tissues and organisms, all the way up to the 100+ meter scale for bioprocess equipment and industry-scale production with a focus on dynamic behaviors of systems. The course can be loosely classified into two parts: (i) guiding principles and fundamental equations for thermodynamics in biological and biomedical engineering, and (ii) applications of engineering principles to the study of biological systems.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations that describe thermodynamic processes. (SO 1, 6, 7) 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering

disciplines: First & Second Law of Thermodynamics; Open vs closed systems; Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility. (SO 1, 6, 7) 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with bioprocesses. (SO 7) 4. Solve problems for thermodynamic processes using the computer. (SO 1, 2, 5, 7) 5. Develop the attitudinal dimensions of computational thinking: Confidence in dealing with complexity; Persistence in working with difficult problems; Tolerance for ambiguity; The ability to deal with open-ended problems; The ability to communicate and work with others to achieve a common goal or solution. (SO 2) 6. Gain experience in working with non-linear systems and systems away from equilibrium. (SO 1, 6) Credits: 3.00

17-19 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

BME 38000 - Professionalization In Biomedical Engineering

Credit Hours: 2.00. This active learning course covers standards of practice, regulatory and legal requirements, and moral and ethical issues; increases awareness of career paths; and addresses current and emerging trends and challenges at the frontiers of the field of biomedical engineering. Most class sessions will consist of a short introduction to a topic followed by a breakout session for active investigation of the topic. During the breakout sessions, course instructors will be available to guide discussion and answer questions.

Learning Outcomes: 1. Recognize and describe professional and ethical codes of conduct, and ethical dilemmas which pertain to a practicing biomedical engineer. 2. Use basic technical writing skills to clearly and concisely synthesize relevant technical information, data, and ideas from multiple sources. 3. Generate personal statements, curriculum vitae and other professional documents that are used in choses career pathways that are available to biomedical engineers. 4. Describe contemporary issues in biomedical engineering and understand their impact on personal and public health. 5. Identify skills and opportunities that enhance professional career development. Credits: 2.00

BME 32000 - Introduction To Biomaterials Science And Engineering

Credit Hours: 3.00. This junior-level course will introduce fundamental materials science and biomaterial concepts to BME students and will lay the foundation for more advanced courses in biomaterials and tissue engineering. The course will introduce the vocabulary and technical concepts in biomaterials science relevant for problems in medical device, biotechnology, or biomaterials industries. The course material will present phenomena at the intersection of materials science and biology.

Learning Outcomes: 1. Identify the basic classes of biomaterials and understand their chemical makeup. 2. Understand the relationship between chemical structure and biomaterial properties. 3. Understand interactions of implantable biomaterials with proteins and cells. 4. Describe the major components of the biological response to implanted materials. 5. Select basic in vitro and in vivo tests to evaluate material biocompatibility. 6. Understand regulations and standards that dictate biomaterial testing. Credits: 3.00

BME 32200 - Probability, Statistics, And Applications In Biomedical Engineering

Credit Hours: 3.00. Probability theory and statistical methods are developed for life science applications. Analytical tools such as hypothesis testing, estimation of moments, sampling theory, correlation and spectral analysis are developed and applied to identifying underlying processes in biological systems, developing realistic models of physiological processes, designing experiments, and interpreting biological data.

Learning Outcomes: 1. Solve probability problems with biomedical engineering applications using the basic axioms of probability (1). 2. Describe the fundamental properties of probability density functions with applications to single and multivariate random variables (1,6). 3. Describe the functional characteristics of probability density function frequently encountered in life-science research such as the Binomial, Uniform, Gaussian, and Poisson (1,6). 4. Calculate confidence intervals and levels of statistical significance using fundamental measures of expectation and variance for a given biological data set (6). 5. Quantify the correlation between sets of random processes for given mathematical functions and biological data sets (1,6). 6. Identify the distribution function underlying a given biological process or medical application (1,6). 7. Model and describe behavior of biological systems by means of random processes (1,3). 8. Apply basic statistical concepts including descriptive statistics, Bayes Theorem, statistical inference, and hypothesis testing to biological and medical systems (1). 9. Design a statistical experiment using appropriate control and test conditions (1,6). 10. Apply statistical tools (e.g. Student's t-test) to interpret experimental results

(1,6). 11. Apply statistics testing to the evaluation and acceptance of medical processes, devices, and systems (1). Credits: 3.00

BME 32001 - Biomolecules And Biomaterials Laboratory

Credit Hours: 1.00. Introductory laboratory experience focused on engineering concepts and practices in the analysis of biomolecules and cells. Topics include fundamental quantitative techniques of analysis, methods of isolation, identification, and quantification of biomolecules and cells, and analysis of integrated biosystems. Concludes with student-driven design project.

Learning Outcomes: 1. Independently describe the theoretical basis of, and put into practice, fundamental analytical tools and techniques used in the isolation, characterization, and quantification of biomolecules and cells. 2. Collect, record, process, statistically analyze and report experimental data related to the analysis of biomolecules and cells in an accurate and understandable manner. 3. Conceptually design a simple analytical method and/or tool for solving a medically-relevant problem based upon detection/analysis of a specific biomolecular or cellular related abnormality. Credits: 1.00

18 Credits

Spring 3rd Year

BME 39000 - Professional Development And Design In Biomedical Engineering

Credit Hours: 2.00. Introduction to a diverse spectrum of current topics relevant to the technical, professional, and career aspects of Biomedical Engineers. The course topics will focus on the early stages of the design process (e.g. need identification, problem formulation, innovation and idea generation), professional communication skills (e.g. written and oral reporting and documentation), and ethics of biomedical design and research (e.g. ethical codes and decision making, animal care and use in research and testing, authorship and intellectual property, social and environmental impact of design).

Learning Outcomes: 1. Able to identify medical needs relevant to Biomedical Engineering solutions, an understanding of realistic constraints which impact biomedical engineering design 2. Understand ethical and professional responsibilities which impact design 3. Understand the need for a multidisciplinary team to solve biomedical engineering design projects. 4. Able to independently acquire knowledge from a variety of sources including biology and medicine as well as other engineering disciplines. 5. Able to communicate effectively in written form and evaluate written reports 6. Able to identify a career development pathway that is relevant to their personal identity and training as Biomedical Engineers. Credits: 2.00

BME 38900 - Junior Experimental Design Laboratory

Credit Hours: 2.00. Practical experience with engineering design principles is presented through inquiry-based modules. Each module contains computer simulation, experimental design, implementation, and data analysis. Modules address biomedical applications in different areas of BME.

Learning Outcomes: 1. Use theoretical equations from fluid, heat, and mass transport to describe, model, analyze, and explain biomedical data. 2. Design experiments to investigate biomedical transport phenomena, collect relevant data, and compile a comprehensive report that clearly demonstrates the findings and implications of the data. 3. Work in a term to simulate and experimentally model biomedical transport, and use peer-and self-reviews to describe how each team member contributed to group efforts. Credits: 2.00

16 Credits

Fall 4th Year

BME 49000 - Professional Elements Of Design

Credit Hours: 1.00. This course advances and enhances design tools, concepts, and knowledge relevant to biomedical engineering design. Students work individually and in small teams to investigate the topic within the context of their specific senior design project in preparation for their lab. Topics include project management, human and animal subjects, ethics, regulatory affairs, literature and patent searching, and entrepreneurship.

Learning Outcomes: 1. Effectively communicate skills in oral and written form, both individually and as part of a team. 2. Explain/discuss realistic design constraints, including regulatory issues, social influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. 3. Generate and justify solutions to a medical and/or biological problems that addresses customer needs and realistic constraints. Credits: 1.00

BME 48901 - Senior Design Project Lab

Credit Hours: 3.00. The biomedical engineering design process is completed starting from a preparatory design course, BME 39000, through a preliminary system design, build and test in Senior Design Project Lab. Students will work with their teammates to implement (e.g. build, test, iterate and evaluate) a solution to address a biomedical engineering problem statement and meet the technical specifications set forth. The resulting project design is presented and evaluated through an oral presentation, laboratory demonstration, and a final written document.

Learning Outcomes: 1. Demonstrate ability to integrate and apply knowledge and skills obtained in earlier course work with new concepts and practices essential to the design and testing of a system or device to meet desired needs. 2. Implement the engineering design process and project management within the context of relevant design constraints. 3. Effectively communicate skills in oral and written form, both individually and as part of a team. 4. Explain/discuss realistic design constraints, including regulatory issues, societal influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. Credits: 3.00

BME 49101 - Biomedical Engineering Design

Credit Hours: 2.00. This course prepares students for engineering practice through a major design experience, encompassing conceptualization, requirement generation, and system and detailed design. Essential design constraints will be reviewed and applied including: safety, economics, and manufacturability. The course encompasses lectures, case studies, team formation, project assignments and generation of initial design.

Learning Outcomes: 1. Identify and formulate the design problem, including bringing precision to the problem statement through a requirements specification. 2. Use critical thinking in the design process. 3. Conduct design using an organized design process, including planning, literature search, requirements specification, consideration of alternative approaches, determination of strategies, and design reviews. 4. Conduct design using design principles. 5. Apply engineering principles, mathematics, and science in engineering design, including methods, tools and techniques. 6. Apply technical knowledge to design, including methods, tools and techniques. 7. Analyze and interpret data. 8. Apply analytical tools and techniques to solve a design problem at the interface of engineering and biology. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a progress report, adhering to the specified format using an appropriate writing style, grammar, and spelling. Credits: 2.00

16 Credits

Spring 4th Year

BME 49200 - Biomedical Engineering Design II

Credit Hours: 3.00. This course continues the design experience from BME 491 with verification, validation, and re-design of student projects. Regulatory and ethical design constraints will be discussed. Oral presentation and report writing are required.

Learning Outcomes: 1. Use critical thinking in the testing and redesign process. 2. Make appropriate measurements necessary for testing the design, addressing the problems associated with the interaction between living and nonliving systems. 3. Apply engineering principles, mathematics, and science in engineering redesign, including methods, tools and techniques. 4. Apply technical knowledge to testing and redesign, including methods, tools and techniques. 5. Analyze and interpret testing and verification data. 6. Discuss ethical issues in engineering design for biological and medical applications. 7. Determine ways to test a design to determine its functionality (success of the design). 8. Apply knowledge of regulatory constraints to engineering design. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a final report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 11. Make an oral presentation using effective visual aids. Credits: 3.00

15 Credits

Biomedical Health Sciences/Interdisciplinary Health Science Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Requirements (67 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological

function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods,

solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and

trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different

components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the

experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Interdisciplinary Health Science Concentration (24 credits)

Other Departmental/Program Course Requirements (15-16 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of

psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (13-14 credits)

Supplemental Information

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional

models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14 Credits

Fall 2nd Year

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the

essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a

fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available

for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific

leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

16 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and

organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14-15 Credits

Biomedical Health Sciences/Pre-Dentistry Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (67 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is

obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills

needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand

how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of

differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability

to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory

experiment. Credits: 1.00

Pre-Dentistry Concentration (24 credits)

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Other Departmental/Program Course Requirements (15-16 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (13-14 credits)

Supplemental Lists

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health

Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis,

structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation

techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14 Credits

Fall 2nd Year

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students

demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

16 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion

in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

16 Credits

Spring 3rd Year

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy,

and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14-15 Credits

Biomedical Health Sciences/Pre-Medicine Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Requirements (67 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3.

Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of

multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy:

Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and

technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time:

enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in

lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Pre-Medicine Concentration (25 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function,

heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of

macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern

genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.

Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)

Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Other Departmental/Program Course Requirements (15-16 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (12-13 credits)

Supplemental Lists

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health

Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis,

structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation

techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14 Credits

Fall 2nd Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments.
CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry

and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students

demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

16 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health,

industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic

pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

15 Credits

Spring 3rd Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern

genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

15 Credits

Fall 4th Year

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how

evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

16 Credits

Spring 4th Year

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

13-14 Credits

Biomedical Health Sciences/Pre-Optometry Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (67 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is

obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills

needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand

how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of

differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability

to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory

experiment. Credits: 1.00

Pre-Optometry Concentration (24 credits)

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary

methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Other Departmental/Program Course Requirements (15-16 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course

produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (13-14 credits)

Supplemental Lists

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of

creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding,

shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2.

Demonstrate depth in major. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14 Credits

Fall 2nd Year

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the

mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate

and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5.

Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

16 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based

curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems.

Credits: 3.00

16 Credits

Spring 3rd Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and

metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14-15 Credits

Biomedical Health Sciences/Pre-Physician Assistant

Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (67 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure,

and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of

disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple

methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction

to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of

and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Pre-Physician Assistant Concentration (24 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and

metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

Other Departmental/Program Course Requirements (15-16 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (13-14 credits)

Supplemental Lists

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the

application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of

differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA

1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging

from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14 Credits

Fall 2nd Year

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis

for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate

and characterize the products. Credits: 1.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

16 Credits

Fall 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the

student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge

of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

15 Credits

Spring 3rd Year

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain

the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of

microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14-15 Credits

Biomolecular Design, BS

About the Major

Degree Requirements

Interdisciplinary Science Foundation (73-84 credits)

Foundations in Mathematics (14-16 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand

the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

Foundations in Biology (13 credits)

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23000 - Biology Of The Living Cell

Credit Hours: 3.00. An introduction to modern cell biology for students who may not have taken a previous college course in biology. All students with the appropriate prerequisites are welcome, and this course will be of special interest to students from engineering, chemistry, physics and computer science. This course will provide a solid foundation in modern cell biology concepts for engineers and students from other disciplines.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis,

structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

Foundations in Chemistry (19-22 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in

organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain,

oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative

analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Computing for Biomolecular Design (17 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data

management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

CS 24300 - Artificial Intelligence Basics

Credit Hours: 3.00. This course provides an introduction to foundational areas of artificial intelligence and current techniques for building intelligent systems. As an entry-level course for Artificial Intelligence, the primary goals of this course are: Teach fundamental building blocks of an intelligent system, namely, knowledge representation; learning; model validation, diagnosis, and visualization; reasoning and decision-making; probabilities and uncertainty in AI. Provide students with first-hand experiences in building a working machine learning and an automated reasoning system. Provide an overview of current state-of-the-art technologies in multiple domains of artificial intelligence. Broaden the students' horizon and spark their interests via learning about exciting applications of artificial intelligence in many aspects of human society.

Learning Outcomes: 1. Use data processing and implement learning and reasoning algorithms using Python. 2. Determine how to represent knowledge in an AI system. 3. Build a first-hand machine learning system. Know and be able to build all basic components of the entire machine learning pipeline, including data collection, wrangling, cleaning, model selection, training, cross-validation, and diagnosis. 4. Master the mathematical theory behind linear regressors and classifiers. 5. Build a first-hand automated reasoning system, learn how to

formulate real-world problems as constraint programs, solve reasoning problems and make complex decisions using AI. 6. Produce a reasoning system using depth-first search. 7. Demonstrate basic knowledge of the full landscape of AI: game playing, causality, fairness/bias/ethics, uncertainty handling, reinforcement learning. Credits: 3.00

Foundations in Physics (8 credits)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane

potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Foundation in Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Upper level selective courses (6-9 credits)

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics,

transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

ABE 30400 - Biological Engineering Laboratory

Credit Hours: 3.00. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Learning Outcomes: 1. Understand and analyze the flow behavior in biological systems. 2. Understand and analyze enzymatic reasons in biological systems. 3. Understand and analyze fermentation processes. 4. Understand and analyze mixing and heat transfer in biological systems. 5. Collect and analyze rheological properties. 6. Design and safely execute experiments in a process laboratory. 7. Collection and statistical analysis of experimental data. 8. Present the results of analysis in the form of written report and oral presentation. Credits: 3.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency

with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

CHM 53800 - Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

BME 52100 - Biosensors: Fundamentals And Applications

Credit Hours: 3.00. (ABE 56000) An introduction to the field of biosensors and an in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and biosecurity applications.

Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design.

We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BME 51100 - Biomedical Signal Processing

Credit Hours: 3.00. An introduction to the application of digital signal processing to practical problems involving biomedical signals and systems. Topics include: overview of biomedical signals; filtering to remove artifacts; event detection; analysis of waveshape and waveform complexity; frequency domain characterization; modeling biomedical signal-generating systems; analysis of non-stationary signals; pattern classification and diagnostic decisions, MATLAB is used throughout to apply the theory and techniques discussed to biomedical signals.

Learning Outcomes: 1. Understand practical problems faced in objective analyses of biomedical signals. 2. Understand the underlying physiological and anatomical factors that are relevant for numerous types of biomedical signals. 3. Understand the theoretical background underlying the use of digital signal processing for biomedical applications. 4. Understand the practical benefits and limitations of various digital signal processing approaches and identify the best solution for specific problems. 5. Implement appropriate signal processing algorithms for practical problems involving biomedical signals and systems 6. Propose, carry out, orally present, and write up in a conference proceedings format a biomedical-research mini project using- signal processing algorithms. Credits: 3.00

ECE 30653 - Introduction To Nanotechnology And Quantum Science & Technology

Credit Hours: 3.00. This interdisciplinary course offers an introduction to nanotechnology and quantum science and technology for undergraduate students in science and engineering. The students will develop understanding of interdisciplinary nature of these fields and utilize concepts in physics, chemistry and mechanics to describe and analyze unique properties of quantum and nanoscale objects. The course will provide the opportunity to get exposed to highly interdisciplinary nature of today's most active and rapidly expanding fields of research and technologies.

Learning Outcomes: 1. Define major types of nanoparticles and their sources. 2. Illustrate by simple calculations unique physical properties of nanoscale objects, e.g. calculate de Broglie wavelength, surface energy, melting point. 3. Describe basic nanostructure measurement methods. 4. Give examples of economic benefits of nano and quantum technology. 5. Describe approaches for managing security, health and environmental risks. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BME 53000 - Imaging Diagnostic Technologies For Medical And Biological Applications

Credit Hours: 3.00. This gateway course teaches the physics, engineering techniques associated with modern imaging and diagnostic tools for biological and medical applications. The course covers fundamental principles of radiology, optics, contrast generation (including genetically encoded probes and physiological indicators), image formation, detection, and analysis. The specific biomedical imaging modalities covered include: x-ray, computed tomography, nuclear medicine imaging, ultrasound, optical microscopy and tomography, and MRI. The specific biological microscopy modalities covered include: phase contrast, DIC, confocal microscopy, two-photon microscopy and super-resolution microscopy. The course also teaches the principle concepts of adaptive optics, light sheet microscopy, 4Pi microscopy, and modern super-resolution microscopy techniques (PALM/STORM, STED and ISM). To bridge the technology and physics with the latest diagnostic advances and biomedical discoveries, research progresses in specific biomedical applications are presented by leading experts in their respective biomedical field such as OCT, ultrasound, MRI, fluorescence microscopy, electron microscopy, concurrent MRI and optical functional imaging, and super-resolution fluorescence microscopy. This course also includes a crash sub-course on MATLAB programming including both introductory content and contents of MATLAB-C API and MATLAB-C-CUDA (GPU computing).

Learning Outcomes: 1. Describe fundamental principles, such as atomic structure, particle and tissue interactions, light and sound propagation, Huygen's principle, refraction, interference, diffraction and abbe's fundamental resolution limit, wave propagation of light and sound, Fresnel and Fraunhofer diffraction principles. 2. Describe the general concept of signal detection, principles of detectors, noise sources and leading development trend of detectors such as APD, PMT, CCD, CMOS, EMCCD and sCMOS. 3. Describe physical principles and considerations of instrumentation design in planar radiography, fluoroscopy, computed tomography (CT), positron emission tomography (PET), single photon emission computed tomography, ultrasound imaging and magnetic resonance imaging. 4. Understand, design and draw basic optical sketches for a simplified imaging system in either wide-field, or focused optical geometry. These imaging systems includes: Widefield, Phase Contrast, DIC, Confocal, Two photon, Adaptive optics (AO) two photon, 4Pi, I5M, SIM, RESOLFT, STED and PALM/STORM microscopy techniques. Credits: 3.00

ABE 32700 - Biotechnology Laboratory II

Credit Hours: 2.00. The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (http://www.hhmi.org/grants/sea/) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (www.phagesdb.org and the Purdue institution page can be found here: https://phagesdb.org/institutions/PURD/).

Learning Outcomes: 1. Analyze the genetic code of a unique phage in order to determine potential genes. 2. Discover the genomic organization of their unique phage. 3. Use algorithms to define potential genes, assign

putative functions to them, and determine the order in which they appear in the genome. 4. Read and discuss scientific literature related to their research project. 5. Share the information gathered with others in the scientific community. Credits: 2.00

BIOL 32701 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

Research Analysis and Practice in Biomolecular Design (4-7 credits)

BIOL 11500 - Biology Resource Seminar (UCC: IL)

Credit Hours: 1.00. This course is designed to help integrate new biology students into the Department of Biological Sciences, to help them adjust to university life, and to assist them in developing academic and intellectual survival skills using the medium of introductory Biology courses. The course meets twice a week in groups of 20-25 students. Each section is led by an academic advisor and an undergraduate teaching intern. The class periods have an on-going emphasis on connecting students to one another as resources while learning information, critical thinking skills and problem-solving strategies. Topics include bioethics, time management, available academic resources, biology majors and curricula and career development. Students are exposed to opportunities in undergraduate research, summer internships, the study abroad program, and teaching internships. Throughout the course, students are encouraged to plan their college education rather than merely choose their courses. Permission of department required.

University Core Curriculum (UCC): (UCC: IL)

Credits: 1.00

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49500 - Special Assignments

Credit Hours: 0.00 to 18.00. Readings, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 49000 - Selected Topics In Chemistry For Upper-Division Students

Credit Hours: 1.00 to 4.00. Topics vary.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (1-27 credits)

Sample 4-Year Plan

Fall 1st Year

14-17 Credits

Spring 1st Year

16-19 Credits

Fall 2nd Year

15-17 Credits

Spring 2nd Year

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be

able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

16-18 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

16-17 Credits

Fall 4th Year

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

13-18 Credits

Spring 4th Year

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

12-15 Credits

Brain and Behavioral Sciences, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (36 credits)

A) Brain and Behavioral Sciences Required Courses (9 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

PSY 20300 - Introduction To Research Methods In Psychology

Credit Hours: 3.00. The use of scientific method in psychology. Lecture covers principles of collecting and interpreting data, using examples of research from many areas of psychology. In the laboratory portion, the student uses many different techniques from various areas of psychology. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand and produce research that adheres to the highest ethical standards. 2. Identify distinguishing features of good science, bad science and junk science. 3. Critically evaluate research findings. 4. Understand how study designs are used to answer research questions. 5. Present and interpret experimental data in an APA-style paper. Credits: 3.00

B) Brain and Behavioral Sciences Selectives (12 credits)

PSY 20000 - Introduction To Cognitive Psychology

Credit Hours: 3.00. A survey of psychology as the science of mental life, covering theories and research in perception, reading, attention, consciousness, imagery, memory and its improvement, problem solving, creativity, decision-making, and artificial intelligence.

Learning Outcomes: 1. Describe basic aspects of visual perception and visual imagery. 2. Explain the role of attention in cognition. 3. Describe basic representations and processes of memory. 4. Understand high-level cognitive functions such as reasoning, problem solving, and language. 5. Understand how cognitive neuroscience can inform cognitive psychology. Credits: 3.00

PSY 22200 - Introduction To Behavioral Neuroscience

Credit Hours: 3.00. An introduction to how the nervous system controls behavior. Topics include evolution and comparative psychobiology, the neuroscience of sensation and perception, the neuroscience of motivation, neuropsychology, and cognitive neuroscience.

Learning Outcomes: 1. Describe the basic structure and function of the brain including neuroanatomy and neural communication. 2. Explain how the central nervous system processes internal and external stimuli. 3. Explain how experience influences current and future behavior. 4. Discern normal from abnormal brain function and describe its influence on behavior. Credits: 3.00

PSY 23500 - Child Psychology

Credit Hours: 3.00. Not open to students with credit in PSY 36000. General principles of children's behavior and development, from conception to adolescence, including sensory and motor development, and basic psychological processes such as learning, motivation, and socialization.

Credits: 3.00

PSY 24000 - Introduction To Social Psychology

Credit Hours: 3.00. Not open to students with credit in SOC 34000 . A broad survey in current knowledge about human social behavior. Topics covered include aggression, attraction and love, social influence, attitudes and attitude change, nonverbal communication, leadership, prejudice and discrimination, and application of social psychology to law, medicine, and other fields. CTL:ISH 1024 Social Psychology

Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

PSY 31400 - Introduction To Learning

Credit Hours: 3.00. This course attempts to make clear the theoretical and practical implications of learning principles and findings. Various theories of learning are examined and the implications of these theories, and the learning approach generally, for a variety of practical problems are emphasized.

Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

C) Advanced Content Courses (15 credits)

PSY 30600 - Understanding And Analyzing Experiments

Credit Hours: 3.00. This course helps to prepare students for independent research. Students (1) develop an understanding of group-based statistical analyses, such as t-tests and ANOVA; (2) formulate and present a research idea based on statistical tools covered in class; and (3) get experience using statistical software to analyze data.

Learning Outcomes: 1. Determine which statistics to use, how to use them and how to interpret their findings using data for conventional experimental designs in psychological sciences. 2. Interpret current research in psychological sciences. 3. Give oral presentations based on research. 4. Develop and advance personal research interests. Credits: 3.00

PSY 31000 - Sensory And Perceptual Processes

Credit Hours: 3.00. A survey of the study of psychological experiences caused by stimulation to the senses. Topics include theory and research in seeing, hearing, touching, smelling, and tasting as experienced by humans and other animals.

Credits: 3.00

PSY 31100 - Human Memory

Credit Hours: 3.00. A survey of theories and research about how humans remember information and why they often forget. Topics include research on amnesia, forgetting, and sensory memory systems as well as on practical issues such as how to improve memory.

Learning Outcomes: 1. Explain how the science of human and memory enriches understanding of the human mind. 2. Describe what learning and memory are, how they work, and why they work that way. 3. Critically apply the science of learning and memory to evaluate ideas presented in popular media. Credits: 3.00

PSY 32400 - Introduction Cognitive Neuroscience

Credit Hours: 3.00. (SLHS 30100) Introduction to the neural bases of complex human mental abilities. Emphasis on integrating research from cognitive science, brain-scanning techniques, and the lesion technique. Topics include perception, attention, memory, language, motor control, planning/decision-making and consciousness.

Credits: 3.00

PSY 38000 - Behavior Change Methods

Credit Hours: 3.00. Application of behavioral learning principles to problems in living. Self-paced learning format covers design and evaluation of behavior modification programs, with practical and ethical issues. Relevant to work with children, adults, clinical patients, athletes, etc., in schools, institutions, and everyday situations.

Credits: 3.00

PSY 39000 - Research Experience In Psychology

Credit Hours: 1.00 to 3.00. Involvement in an ongoing research project in the Department of Psychological Sciences. Up to 6 credits may be taken for a letter grade. Additional credits after 6 must be taken as Pass/No Pass. Permission of instructor required.

Learning Outcomes: 1. Apply principles of research methodology within a lab setting, as appropriate for lab role. 2. Demonstrate ethical behavior in the conduct of psychological research. 3. Demonstrate professional communication skills through interactions with principal investigators, graduate students, lab personnel, and research participants. Credits: 1.00 to 3.00

PSY 40300 - Psycholinguistics

Credit Hours: 3.00. (PSY 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

PSY 42200 - Genes and Behavior

Credit Hours: 3.00. An examination of genetic influences on behavior, including the mechanisms of genetic influence, methods of gene manipulation, and the role of genes in development and evolution. Genetic influences on mental illness, learning, memory, and intelligence are considered.

Credits: 3.00

PSY 42800 - Drugs And Behavior

Credit Hours: 3.00. Discussion of the variety of drugs that affect the nervous system and behavior. Emphasis will be upon a discussion of the physiological and pharmacological bases for the use and misuse of drugs in our society.

Credits: 3.00

PSY 42900 - Hormones And Behavior

Credit Hours: 3.00. Discussion of the mechanisms and effects of endocrine hormones and brain peptides on sexual differentiation, sexual behavior, learning, response to stress, maternal behavior, and weight regulation.

Credits: 3.00

PSY 46400 - Research Ethics In Psychological Sciences

Credit Hours: 3.00. Research Ethics broadly refers to the application of everyday values, such as fairness, honesty, and

objectivity to scientific research. This course is designed to provide broad coverage of the ethical standards that research scientists must follow and allow exploration of various real-world ethical issues in the psychological sciences.

Credits: 3.00

PSY 48400 - The Psychology Of Consciousness

Credit Hours: 3.00. A survey of psychological experiments and theory in consciousness. An emphasis is placed on altered states of consciousness such as dreaming, hypnosis, drug-induced changes in consciousness, and meditation; and comparison with ordinary consciousness is made.

Credits: 3.00

PSY 49800 - Senior Research

Credit Hours: 3.00. Student conducts and writes a report on an individual research project under the guidance of a faculty member. Permission of instructor required.

Learning Outcomes: 1. Demonstrate expertise with the processes and procedures of research in psychological sciences. 2. Design and conduct a research project related to psychological sciences. Credits: 3.00

PSY 51200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, BIOL 56200) Background in cell biology, psychobiology, physiology, or anatomy is recommended. Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Permission of instructor required.

Credits: 3.00

PSY 57700 - Human Factors In Engineering

Credit Hours: 3.00. (IE 57700) Survey of human factors in engineering, with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments. Primarily for engineers and other non-psychology majors.

Credits: 3.00

PSY 40100 - Language And The Brain

Credit Hours: 3.00. (SLHS 40100) This course is an overview of the neutral systems that underlie the core components of language, including speech perception and production, reading and writing, morphology, syntax, semantics, and discourse. During the past few decades, there has been an unprecedented increase in studies on these topics, due in large part to the widespread use of highly sensitive brain mapping techniques that enable researchers to identify relationships between particular brain areas and particular language functions. The findings that have been emerged from this recent explosion of research are exciting and important for several reasons. They provide fresh insights into the nature of the uniquely human capacity for language, and they have significant implications for understanding and treating language disorders that result from brain injury.

Learning Outcomes: 1. Understand the main methods for investigating the neural substrates of language. 2. Understand the classic and progressive aphasia syndromes. 3. Basic neural underpinnings of the core aspects of language. 4. Critically evaluate research on language. 5. Critically evaluate research on language and the brain. Credits: 3.00

PSY 42100 - Alcohol Use And Disorders

Credit Hours: 3.00. The goal of this course is to provide students with a broad understanding of the biological bases of alcohol abuse and alcoholism. The course will cover neuroanatomical, neurochemical and biological systems that regulate the biological and behavioral response to alcohol. Coverage will also include discussions of the role of environment, age, gender, among other factors that influence the response to alcohol and propensity toward abuse and addiction. The course will also cover the neuroscience of treatment and relapse.

Learning Outcomes: 1. Acquire knowledge about alcohol's effects on the brain and behavior. 2. Demonstrate knowledge about the major theories of addiction. 3. Critically evaluate primary research about the neuroscience of alcohol. 4. Discuss and apply learned knowledge about the neuroscience of alcohol and theories of addiction to ""real-world"" situations. 5. Communicate proficient critical thinking skills about the neuroscience of alcohol through writing. Credits: 3.00

PSY 41800 - Understanding Autism

Credit Hours: 3.00. (HDFS 41800, SLHS 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment

of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history of ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associated with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

PSY 40400 - Honors Research Seminar I

Credit Hours: 3.00. Part one of a research series aimed at providing a structured learning experience to help students develop the basic research skills needed in order to conduct psychological research. Students will be expected to develop a research plan to be completed in concert with PSY 40500. Permission of department required.

Credits: 3.00

PSY 40500 - Honors Research Seminar II

Credit Hours: 3.00. Part two of a research series aimed at providing a structured learning experience to help students develop the basic research skills needed in order to conduct psychological research. Students will be expected to develop a research plan to be completed in concert with PSY 40400. Permission of department required.

Credits: 3.00

PSY 30500 - Understanding And Analyzing Psychological Data

Credit Hours: 3.00. This course is an upper level undergraduate statistics course for students in psychology and related fields who are interested in conducting or understanding quantitative research. Students should have successfully completed an introductory statistics course (e.g., PSY 20100). The course will begin with an accelerated review of fundamentals concepts (e.g., data visualization, central limit theorem, probability) and then will focus primarily on regression.

Learning Outcomes: 1. Demonstrate advanced conceptual understanding of foundational statistical principles. 2. Demonstrate ability to correctly analyze data by hand and using SPSS. 3. Demonstrate skills in managing their own data. 4. Demonstrate the ability to comprehensively analyze and interpret the results of correlation, simple regression, multiple regression, and two-way interaction models. 5. Demonstrate proper interpretation. 6. Demonstrate the ability to accurately report results of statistical analyses in APA format. Credits: 3.00

PSY 37600 - Attention And Cognitive Control

Credit Hours: 3.00. This upper-level undergraduate course provides an overview of research and theory related to attention and cognitive control. The first half of the course focuses on selective attention to locations, objects, and features, as well as the role of attention in memory and skilled performance. The second half focuses on divided attention and cognitive control in multitasking situations, as well as aspects of adaptive, hierarchical, and inhibitory control. The goal of the course is to provide you with an understanding of major theoretical views, key experimental findings, and common research procedures related to attention and cognitive control.

Learning Outcomes: 1. Define selective attention to locations, objects, and features. 2. Describe the relationship between eye movements and attention. 3. Identify the limits of attention. 4. Describe the role of attention in memory and skilled performance. 5. Discuss

divided attention, dual-task, task switching performance, task interruption and mind wandering. 6. Identify aspects of adaptive and hierarchical control. Credits: 3.00

PSY 35200 - Introduction To Neuropsychology

Credit Hours: 3.00. This course is an examination of the effects of various types of brain damage on human behavior, the methods used to assess brain damage, and evaluation of research studies on human brain damage and behavior.

Learning Outcomes: 1. Describe effects of damage to different human brain areas on behavior. 2. Discuss what effects of brain damage teach us about brain function and organization. 3. Describe approaches used to study human brain damage. 4. Critically evaluate published research studies on human brain damage and behavior. Credits: 3.00

PSY 43600 - Foods And Behavior

Credit Hours: 3.00. This course examines aspects of the scientific study of eating and drinking; its effects on individual health and well-being; broader implications of psychology, culture and society on eating and drinking; the effects of food policy on food and beverage intake and well-being. Topics to be covered include physiological signals affecting hunger and satiety, social norms and influences regarding food intake, identifying sources of food and its constituents, disordered food intake, malnutrition, poverty and food, and the influence of food and agriculture industries on food choices and consumption.

Learning Outcomes: 1. Describe how the scientific method applies to questions related to ingestive behavior. 2. Discuss how constituents of food contribute to physical and emotional well-being. 3. Describe biological, social and cultural factors that influence food choice. 4. Critically evaluate how society and culture influence eating and drinking habits. Credits: 3.00

PSY 58100 - Neuroethics

Credit Hours: 3.00. Neuroscience research has led to a better understanding of the neuronal basis of behavior. The knowledge, together with new technological approaches that can predict and even control some aspects of human behavior, can have a major impact on social and legal policies. The course explores ethical, social, and legal implications of the use of new technological and pharmacological advances in brain research. Permission of department required.

Learning Outcomes: 1. Learn some of the technology and pharmocology that is currently used to study/manipulate the human mind and behavior. 2. Critically evaluate ethical arguments/dilemmas surrounding the use of such scientific advances. 3. Research in depth a real-world topic in Neuroethics that may have social and/or legal implications at the present time. Credits: 3.00

PSY 39800 - Independent Research In Psychology

Credit Hours: 3.00. Students will conduct an independent research project related to research that is ongoing in the lab. Students will discuss theories and ideas related to the project, and plan and execute a thesis. Duties may include data coding and entry; participating in the planning of the research and the development of research materials; executing the research with responsibility for all aspects of data collection. Students are expected to be involved in the research project for an average of nine hours per week. Permission of instructor required.

Learning Outcomes: 1. Learn about many aspects of conducting research, such as human or animal subject issues, experimental design, interpreting results, relating results to theory, etc. 2. Learn how psychological questions can be answered through research. Credits: 3.00

PSY 51500 - Neuroscience Of Consciousness

Credit Hours: 3.00. How does your brain generate your uniquely subjective experience of the world? Is it possible to identify distinct neurophysiological markers of your awareness of a particular sight, sound, taste, or touch? What is the cortical basis of your sense of being a self with a first-person point of view that is spatiotemporally grounded in a body? How does consciousness relate to attention and working memory? Does consciousness have an adaptive function? Might a person in a coma or a vegetative state still have some form of awareness? Could a computer or a robot ever have what we would consider to be genuine experiences? During the past few decades, these and other questions about the nature of consciousness have been the focus of increasing empirical and theoretical research in neuroscience and other disciplines. The main purpose of the course is to introduce students to this exciting field of inquiry by exposing them to a variety of representative books and articles in the literature. The "backbone" of the course will be Stanislas Dehaene's Consciousness and the brain: Deciphering how the

brain codes our thoughts (2014). As we go through the course, we will use each successive chapter in this book as the starting point for a deeper and wider exploration of the given topic(s), bringing into our discussion relevant experimental findings and philosophical perspectives from other investigators. Requirements: Students will take turns guiding discussions and will also write 1-2 page "response papers" to the weekly readings. Permission of department required.

Learning Outcomes: 1. Learn historically relevant and current research - both theoretical and empirical - on the neuroscience of consciousness. 2. Understand theoretical and empirical approaches used to study the neuroscience of consciousness. 3. Gain background knowledge and experience needed to understand and critically evaluate theoretical and empirical research on the neuroscience of consciousness. Credits: 3.00

PSY 43700 - Behavioral And Neural Systems Of Learning And Memory

Credit Hours: 3.00. The purpose of this course is to integrate insights on learning and memory from behavioral and neuroscience perspectives based on animal and human research. How brain regions underlie different categories of learning will be covered. Discussions on how these types of learning contribute to clinical disorders, such as anxiety and addiction disorders.
Learning Outcomes: 1. Examine how brain regions underlie different categories of learning. 2. Discuss how types of learning contribute to clinical disorders. 3. Compare and contrast insights on learning and memory from behavioral and neuroscience perspectives based on animal and human research. 4. Comprehend and discuss behavioral processes, brain substrates and clinical perspectives for each topic covered. Credits: 3.00

Optional Concentration

Other Departmental/Program Course Requirements (41-70 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course

students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications

related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

D) Foundations in Natural Sciences, Mathematics & Information Technology Selective (5-9 credits)

E) Additional Study in Natural Sciences, Mathematics & Information Technology (9-13 credits)

Electives (8-29 credits)

Supplemental List

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional

models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

14-16 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research

and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

15 Credits

Fall 2nd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

14-17 Credits

Spring 2nd Year

PSY 20300 - Introduction To Research Methods In Psychology

Credit Hours: 3.00. The use of scientific method in psychology. Lecture covers principles of collecting and interpreting data, using examples of research from many areas of psychology. In the laboratory portion, the student uses many different techniques from various areas of psychology. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand and produce research that adheres to the highest ethical standards. 2. Identify distinguishing features of good science, bad science and junk science. 3. Critically evaluate research findings. 4. Understand how study designs are used to answer research questions. 5. Present and interpret experimental data in an APA-style paper. Credits: 3.00

14-15 Credits

Fall 3rd Year

13-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

15-16 Credits

Spring 4th Year

12-16 Credits

Building Information Modeling, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (45 credits)

Required Major Courses (36 credits)

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against

criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 21500 - Computer Graphics Programming I

Credit Hours: 3.00. This course focuses on programming fundamentals, logic, and problem solving necessary for advancement into upper level CGT courses. A cross-section of languages and technologies will be introduced and demonstrated.

Learning Outcomes: 1. Understand basic programming concepts such as variables, data types, selection and repetition control structures, arrays, files, and methods and functions. 2. Create simple object-oriented applications. 3. Demonstrate an understanding of the similarities between several different programming or scripting languages. 4. Demonstrate the ability to apply knowledge to different computer graphics software applications. Credits: 3.00

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-making throughout the project lifecycle. Credits: 3.00

CM 46000 - BIM IV: Model Creation & Management Utilizing Cloud

Credit Hours: 3.00. This course explores the impact of cloud-based technologies on managing construction projects with Building Information Modeling (BIM), emphasizing remote collaboration and real-time data access. Students will gain hands-on experience with industry-leading platforms like Autodesk Construction Cloud, learning to manage 3D discipline-specific models, coordinate teams, and oversee project workflows from any location. By integrating cloud-based management with BIM, the course prepares students to lead modern, digitally connected construction projects.

Learning Outcomes: 1. Manage construction projects using cloud-based BIM tools, enabling real-time collaboration, data sharing, and communication among group members as well as sponsors. 2. Coordinate multidisciplinary teams remotely, integrating project data from design to construction while ensuring seamless collaboration. 3. Master cloud-based technology to leverage data analytics that

optimize construction workflows, which allow them to make informed decisions, and automate project processes for improved efficiency and reduced risk generating automated reports, and track key metrics such as timelines, budgets, and safety. 4. Apply best practices in data management within cloud-based BIM platforms, ensuring secure storage, version control, and efficient risk management through clash detection and issue resolution. Credits: 3.00

CM 46200 - Applications Of Construction Documentation II

Credit Hours: 3.00. Creating, archiving, integrating, qualifying and utilizing computer-generated, three-dimensional architectural models in a light commercial construction enterprise. Topics include components of MEP, fire protection, blueprint reading and 4D BIM scheduling. Credit cannot be obtained for both CM 36000 and CM 46200.

Learning Outcomes: 1. Learn, decipher, and apply parametric and geometric technologies to AEC problems. 2. Explain where new and emerging software technologies can be applied in the industry. 3. Program database-driven parametric objects for use in various projects. 4. Explain how parametric technologies can benefit the production homebuilder. 5. Develop leadership and life-long learning skills applicable to the construction industry. 6. Incorporate renderings and 3D models into drawing sets for effective communication. 7. Prepare effective marketing materials for residential and commercial industry. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101.

Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CM 26000 - BIM I: Arch Modeling & Presentation Development

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers (IVCM) with essential skills in Building Information Modeling (BIM) for architectural design and marketing. Students will learn to create detailed, accurate 3D models and immersive visualizations that enhance construction workflows and serve as powerful marketing tools. By integrating BIM with project management, students will gain the technical and creative skills needed to transform complex construction data into persuasive visual content for clients and stakeholders.

Learning Outcomes: 1. Create accurate and detailed architectural Building Information Models, integrating design intent and construction data, while coordinating with other disciplines. 2. Demonstrate proficiency in creating high-quality visualizations, including renderings, animations, and walkthroughs, to develop professional presentations that clearly and persuasively communicate design concepts, project details, and potential construction impacts to stakeholders and clients. 3. Incorporate project management data, such as material quantities, cost estimates, and timelines, into models, preparing students for decision-making roles in construction management. 4. Develop the ability to manage BIM models throughout the

project lifecycle, ensuring accuracy, version control, and alignment with evolving project objectives, while preparing professional-grade presentations tailored to client needs. Credits: 3.00

Major Selectives* - Choose 3 courses (9 credits)

Other Departmental/Program Course Requirements (58 credits)

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for

creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of

functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms,

graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting,

revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (17 credits)

Cornerstone Certificate

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation,

and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting,

revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 1st Year

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis,

discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CM 26000 - BIM I: Arch Modeling & Presentation Development

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers (IVCM) with essential skills in Building Information Modeling (BIM) for architectural design and marketing. Students will learn to create detailed, accurate 3D models and immersive visualizations that enhance construction workflows and serve as powerful marketing tools. By integrating BIM with project management, students will gain the technical and creative skills needed to transform complex construction data into persuasive visual content for clients and stakeholders.

Learning Outcomes: 1. Create accurate and detailed architectural Building Information Models, integrating design intent and construction data, while coordinating with other disciplines. 2. Demonstrate proficiency in creating high-quality visualizations, including renderings, animations, and walkthroughs, to develop professional presentations that clearly and persuasively communicate design concepts, project details, and potential construction impacts to stakeholders and clients. 3. Incorporate project management data, such as material quantities, cost estimates, and timelines, into models, preparing students for decision-making roles in

construction management. 4. Develop the ability to manage BIM models throughout the project lifecycle, ensuring accuracy, version control, and alignment with evolving project objectives, while preparing professional-grade presentations tailored to client needs. Credits: 3.00

15 Credits

Fall 2nd Year

CGT 21500 - Computer Graphics Programming I

Credit Hours: 3.00. This course focuses on programming fundamentals, logic, and problem solving necessary for advancement into upper level CGT courses. A cross-section of languages and technologies will be introduced and demonstrated.

Learning Outcomes: 1. Understand basic programming concepts such as variables, data types, selection and repetition control structures, arrays, files, and methods and functions. 2. Create simple object-oriented applications. 3. Demonstrate an understanding of the similarities between several different programming or scripting languages. 4. Demonstrate the ability to apply knowledge to different computer graphics software applications. Credits: 3.00

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

16 Credits

Spring 2nd Year

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-making throughout the project lifecycle. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

16 Credits

Fall 3rd Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical

acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CM 46200 - Applications Of Construction Documentation II

Credit Hours: 3.00. Creating, archiving, integrating, qualifying and utilizing computer-generated, three-dimensional architectural models in a light commercial construction enterprise. Topics include components of MEP, fire protection, blueprint reading and 4D BIM scheduling. Credit cannot be obtained for both CM 36000 and CM 46200.

Learning Outcomes: 1. Learn, decipher, and apply parametric and geometric technologies to AEC problems. 2. Explain where new and emerging software technologies can be applied in the industry. 3. Program database-driven parametric objects for use in various projects. 4. Explain how parametric technologies can benefit the production homebuilder. 5. Develop leadership and life-long learning skills applicable to the construction industry. 6.

Incorporate renderings and 3D models into drawing sets for effective communication. 7. Prepare effective marketing materials for residential and commercial industry. Credits: 3.00

15 Credits

Spring 3rd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

CM 46000 - BIM IV: Model Creation & Management Utilizing Cloud

Credit Hours: 3.00. This course explores the impact of cloud-based technologies on managing construction projects with Building Information Modeling (BIM), emphasizing remote collaboration and real-time data access. Students will gain hands-on experience with industry-leading platforms like Autodesk Construction Cloud, learning to manage 3D discipline-specific models, coordinate teams, and oversee project workflows from any location. By integrating cloud-based management with BIM, the course prepares students to lead modern, digitally connected construction projects.

Learning Outcomes: 1. Manage construction projects using cloud-based BIM tools, enabling real-time collaboration, data sharing, and communication among group members as well as sponsors. 2. Coordinate multidisciplinary teams remotely, integrating project data from design to construction while ensuring seamless collaboration. 3. Master cloud-based technology to leverage data analytics that optimize construction workflows, which allow them to make informed decisions, and automate project processes for improved efficiency and reduced risk generating automated reports, and track key metrics such as timelines, budgets, and safety. 4. Apply best practices in data management within cloud-based BIM platforms, ensuring secure storage, version control, and efficient risk management through clash detection and issue resolution. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and

interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

15 Credits

Fall 4th Year

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and

plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

16 Credits

Spring 4th Year

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

12 Credits

Business Analytics & Information Management, BS

About the Program

Degree Requirements

Department/Program Major Courses (79-80 credits)

Required Major Courses (58-59 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or

networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship

(ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming

models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking

for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception.

2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities

that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Major Selectives (18 credits)

Choose Four Courses (12 credits)

MGMT 54500 - Systems Development

Credit Hours: 3.00. Focuses on information systems development theories, practices, and tools for rapid adaptation and management of leading-edge as well as emerging computing paradigms. MGMT 54400 Database Management is highly recommended. Permission of department required.

Learning Outcomes: 1. Define the essential processes involved in information systems development. 2. Analyze and represent business processes. 3. Develop and validate systems models and design specifications for an information system application. 4. Understand database concepts and design relational databases based on data models. 5. Effectively use and maintain databases through hands-on experience with Structured Query Language (SQL). 6. Work effectively on a team to successfully complete team projects. 7. Proficiently use various tools used in systems analysis and design. Credits: 3.00

MGMT 49000 - Problems In Industrial Management

Credit Hours: 1.00 to 4.00. Investigation in a specific management field. Arrange with instructor before enrolling. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and

other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 40500 - Six Sigma And Quality Analytics

Credit Hours: 3.00. The course is an undergraduate elective offered as part of the Center for Manufacturing Management Enterprises (CMME) quality initiatives. Provides an overview of various tools and methods for total quality management.

Learning Outcomes: 1. Make data driven conclusions and decisions for quality management operations through working on various business cases. 2. Apply previously gained statistical knowledge to understand and to analyze data. 3. Gain some advanced analytical technics such as Analysis of Variances (ANOVA) and Design of Experiment (DOE) to optimize obtaining data and learnings. 4. Master a simple yet powerful MINITAB software to carry out complex tasks. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 48800 - Data-Driven Decisions In Digital Markets

Credit Hours: 3.00. This course analyzes the changes in business models that have been enabled by Internet technologies, and exposes students to hands-on data analyses to quantify the impact these technologies and business models have on firms, economies, and people. A programming course such as MGMT 28800 Programming for Business Applications or MGMT 38800 Python for Business or CS 17600 Data Engineering in Python or CS 17700 Programming with Multimedia Objects or CNIT 17500 Visual Programming or CS 18000 Problem Solving & Object Oriented Programming and a statistics course such as STAT 30301 Probability & Statistics for Business or MGMT 30500 Business Statistics is highly recommended.

Learning Outcomes: 1. Recognize the role of business models and data-driven decisions in digital markets. 2. Measure, evaluate, and improve online technology usage, advertisement campaigns, and product pricing to meet specific business objective like better serving customers, customer acquisition, quantifying network effects, etc. 3. Analyze the sheer amount of data ("traces") collected by businesses from different touch points - Google Glass, Apple Watch, smart phones, or simple computing devices - and make critical business decisions. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

MGMT 46700 - Big Data & Cloud Computing

Credit Hours: 3.00. Cloud computing and big data technologies are rapidly enhancing an organization's business intelligence

ecosystem. Two modules of the course are specially designed for students to gain valuable hands-on experience in collecting, cleaning, formatting, integrating, and storing massive amounts of data that may be structured or unstructured, archived, or streaming in a cloud platform. The first module will introduce cloud computing fundamentals, its enabling technologies, main building blocks, and hands-on experience through projects utilizing Google Cloud Platform (GCP). The second module will cover processes for creating data pipelines in GCP so that the student will be able to curate big data for training, analysis, and prediction using AI/ML and other data science techniques.

Learning Outcomes: 1. Configure rapidly GCP to meet any analytics related challenge. 2. Build Data Lakes and Data Warehouses for big data analytics. 3. Use BigQuery and related services for advanced, real-time analytics. 4. Use BigQuery ML for classification and regression. 5. Build complex data pipelines using GCP's Dataflow, Cloud pub/sub, and Cloud Function to prepare data for machine learning algorithms. Credits: 3.00

MGMT 47500 - Machine Learning For Business

Credit Hours: 3.00. This course concerns the latest techniques in machine learning, focusing on deep learning and reinforcement learning, with applications to computer vision, natural language understanding, speech recognition, news recommendation, and others. The course plans to cover Neural Nets, Backpropagation, Convolutional neural network, Recurrent Networks, Autoencoders and other architectures in Deep Learning in the rst half. Next, the course plans to cover multi-armed bandits, Contextual bandits, Markov decision process, and Policy gradient methods in Reinforcement Learning.

Learning Outcomes: 1. Perceive the scope and importance of machine learning. 2. Understand and evaluate modern machine learning algorithms. 3. Apply appropriate programming skills to administer a machine learning algorithm in a real-world problem. 4. Communicate the machine learning results in an appropriate level of detail for an intended audience. Credits: 3.00

MGMT 47800 - Experiential Project In Analytics

Credit Hours: 3.00. Most degree programs offer students an opportunity to apply the knowledge learned from their studies in an applicable area via a thesis, a research project, or capstone. This course provides such an opportunity and is designed specifically for Business Analytics & Information Management undergraduate students that will pursue analytical-type careers (e.g., Data/OR Analyst, Data Scientist, Decision Scientist, Consultant, Developer, etc.). This course is designed to polish and integrate the knowledge, skills, and abilities you have developed from your coursework by successfully developing an analytics solution with an industry partner in a structured fashion. Thus, most of your time will be devoted to working with your project teammates to provide the answers and deliverables specified by the partner over the course of many sprints. Every project team will be provided with a project description, data dictionary, and access to the dataset (or directions in where to find the necessary data), as well as an NDA to read, understand, sign, and return to your professor before you can gain access to the data. These are tasks that might be required of you to perform when you work on a new project or have a new client. Students are expected to be familiar with at least one programming language (e.g., Python, R). Permission of instructor required.

Learning Outcomes: 1. Formulate a business problem into an analytical problem. 2. Deliver an analytical solution to stakeholders in an agile fashion in programming languages. 3. Communicate effectively with stakeholders. 4. Work effectively in a team. Credits: 3.00

MGMT 17300 - Data Mining Lab

Credit Hours: 1.00. The Data Mining Lab provides a guided Experiential Learning environment for School of Business', especially BS BAIM's, freshman and sophomore students to learn the basics of business data variety, how they are organized, and what insights may be mined for. Students will have hands-on experience to get familiar with a specific data mining tool, R, for carrying out some data mining experiments. Completion of this course will not only enable students to see how the prerequisite or accompanying foundational courses are relate to their major studies but also help them better preparing for successes in their multiple upper division course studies.

Learning Outcomes: 1. Recall examples of business data and data driven decisions. 2. Exemplify the concepts of structured business data and enterprise data management infrastructure. 3. Differentiate business applications of supervised and unsupervised data mining methods. 4. Explain data mining framework that consists of data understanding, insights derivation, and analytical result communication. 5. Use a data mining tool, R, for simple data mining related tasks. Credits:

1.00

Choose Two Courses (6 credits)

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

MGMT 44434 - Human Resources Analytics

Credit Hours: 3.00. This course introduces concepts, tools, and methods used in collecting, interpreting, and presenting HR data. Students will learn how to gain new insights, solve problems, and drive performance through HR analytics. A central focus of this course is the ethics of HR analytics. This course teaches students how to ask the right questions in order to intelligently use HR analytics and metrics for business decisions. It discusses the implications of internet AI, business AI, perception AI, and autonomous AI for HR. This course will cover applications including the intelligent use of analytics related to employee engagement, healthcare expenditure, learning and development, performance management, and safety.

Learning Outcomes: 1. Gain an understanding of the different analytical approaches used by HR Professionals to solve real business problems. 2. Examine actual business cases and apply problem solving and critical thinking skills through group case studies. 3. Learn how to make impact with data by using effective storytelling techniques. 4. Build on presentation skills and demonstrate the ability to work effectively in teams. Credits: 3.00

MGMT 38900 - Using R For Business Analytics

Credit Hours: 3.00. The main purpose of this course is to introduce and familiarize undergraduate students to RStudio and the R programming language as tools for business data analytics. Students will develop a small portfolio of projects that demonstrate fundamental knowledge of programming, exploratory data analysis, data visualization, and basic predictive modeling techniques using R. The emphasis of the course will be on hands-on applied projects in R in which students will be able to appreciate and visualize statistical and machine learning concepts tailored to real world business applications.

Learning Outcomes: 1. Process data using R and RStudio. 2. Apply statistical and machine learning principles using R and RStudio. 3. Produce meaningful data visualization outputs using R and RStudio. 4. Examine the interaction between business principles and data analytics. Credits: 3.00

Cultural Competencies (3 credits)

Other Departmental/Program Course Requirements (29-43 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of

polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An

understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize

presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling,

and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Electives (0-12 credits)

Optional Concentrations for Business Analytics & Information Management, BS

Sample 4-Year Plan

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical

awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding

of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-23 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in

achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own

words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

16-21 Credits

Fall 2nd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important

macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data

engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern

programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

13-15 Credits

Spring 2nd Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do

their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

15-16 Credits

Fall 3rd Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for

managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis

assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

14-15 Credits

Fall 4th Year

12 Credits

Spring 4th Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and

Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

12 Credits

Cell, Molecular, and Developmental Biology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (32-38 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity,

metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which

organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (13-19 credits)

Intermediate Biology Selective (3 credits)

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CMDB Selective I (5-6 credits)

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila,

nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the

compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

CMDB Selective II: BIOL 500-level (3 credits)

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

Biology Selective (for CMDB) (2-3 credits)

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including

viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a

foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the most current literature.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer

modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and

evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design.

We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations,

communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3.

Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

Base Lab Requirement (0-4 credits)

Other Departmental/ Program Course Requirements (53-79 credits)

Chemistry (17 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Biochemistry (4 credits)

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites. Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at

Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment

for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic

oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Mathematics (6-10 credits)

Calculus I

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and

minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Electives (3-35 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of

functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-19 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and

methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-20 Credits

Fall 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate

skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is

designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and

present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

14-16 Credits

Fall 3rd Year

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

12-16 Credits

Spring 3rd Year

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14-15 Credits

Fall 4th Year

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

13 Credits

Spring 4th Year

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major

intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

12-13 Credits

Chemical Biology & Biochemistry, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (64-65 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of

macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern

genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population

and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to

read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Chemistry Core (13 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Upper-Level Biology and Chemistry Coursework (32-33 credits)

Intermediate Biology Selective (3 credits)

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

Required coursework (18 credits)

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for

students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy. Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites. Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who

meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

BIOL 32701 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

CBB Selective I (3 credits)

CHM 56000 - Organic Spectroscopic Analysis

Credit Hours: 3.00. Identification of organic compounds and characteristic groups by the use of mass spectrometry, infrared, nuclear magnetic resonance, and ultraviolet spectroscopy.

Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

CBB Selective II: BIOL 500-level (3 credits)

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

CBB-Related Research (2-3 credits, across 2+ semesters)

CBB Research Capstone (3 credits)

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

Other Departmental/ Program Course Requirements (38-62 credits)

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia

objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform

appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using

concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Mathematics (8-10 credits)

Calculus I

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Electives (0-18 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of

integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-17 Credits

Fall 2nd Year

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency

with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific

method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific

knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

14-15 Credits

Fall 3rd Year

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3.

Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

15-17 Credits

Spring 3rd Year

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

14 Credits

Fall 4th Year

CHM 56000 - Organic Spectroscopic Analysis

Credit Hours: 3.00. Identification of organic compounds and characteristic groups by the use of mass spectrometry, infrared, nuclear magnetic resonance, and ultraviolet spectroscopy.

Credits: 3.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an

understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

12-13 Credits

Spring 4th Year

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CHM 49000 - Selected Topics In Chemistry For Upper-Division Students

Credit Hours: 1.00 to 4.00. Topics vary.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

15 Credits

Chemical Engineering, BSCHE

About the Program

Degree Requirements

Major Required Courses (46 credits)

CHE 20000 - Chemical Engineering Seminar

Credit Hours: 1.00. An orientation course to inform students of the various areas in chemical engineering, to assist them in selection of electives suited to their particular abilities and interest, and to instill a sense of professional ethics and responsibility. Lectures drawn from all fields of chemical engineering.

Learning Outcomes: 1. Demonstrate an understanding of the need for academic and professional integrity and ethical behavior. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Demonstrate an appreciation of the need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 20500 - Chemical Engineering Calculations

Credit Hours: 4.00. Quantitative applications of steady-state mass and energy balances to solve problems involving multi-component systems and multi-unit chemical processes. Single-component and multi-component phase equilibria, single-reaction and multiple-reaction stoichiometry, coupled mass and energy balances, chemical processes involving bypass and recycle streams.

Learning Outcomes: 1. Estimate physical properties of real chemical systems. 2. Evaluate introductory single-component and multi-component phase equilibria and incorporate these concepts into solutions of mass and energy balance problems. 3. Solve steady state and transient mass and energy balance problems for both reacting and non-reacting systems with or without recycle using analytical and computational methods. 4. Work professionally and ethically in teams to solve new mass and energy balance problems. 5. Identify contemporary chemical engineering problems, including their societal, environmental, and global impacts. Credits:

4.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CHE 30000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 20000. Lectures to acquaint the junior students with professional ethics, career choices, including graduate studies, and services of professional societies.

Learning Outcomes: 1. Identify the wide range of career opportunities offered by the Bachelor in Chemical Engineering degree. 2. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the professional practice of chemical engineering. 3. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 4. Demonstrate an appreciation of the need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 30600 - Design Of Staged Separation Processes

Credit Hours: 3.00. The application of equilibria and mass and energy balances for the design of staged separation processes. Use of various equilibrium data and thermodynamic principles for the design of batch and continuous distillation, absorption, stripping, and extraction systems. Stagewise calculations and graphical methods for design of binary systems. Design of multicomponent separators. Determination of stage efficiency and column size.

Learning Outcomes: 1. Utilize the concepts and relations of phase equilibria, particularly VLE, in the analysis, design, and simulation of separation processes. 2. Use mass and energy balances in the analysis of separation processes. 3. Use the McCabe-Thiele diagram for the solution of problems in binary separations. 4. Use reflux and multi-stage cascades to increase separation of a given component. 5. Use process simulators for binary and multi-component systems to solve, understand, and design separation processes. 6. Apply the basic principles of distillation, absorption/stripping, extraction and other unit operations for the solution of problems in separations. 7. Identify the safety aspects of various separation processes. 8. Communicate effectively the results of a designed separation process in writing. Credits: 3.00

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t

distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

CHE 34800 - Chemical Reaction Engineering

Credit Hours: 4.00. Application of kinetic rate equations, mass balances and energy balances to the analysis and design of chemical reactors involving homogeneous and heterogeneous chemical reactions. Chemical equilibria, kinetic rate equations for homogeneous and heterogeneously catalyzed reactions, design of ideal isothermal reactors, effects of non-isothermal operation, effects of diffusion in porous catalysts and non-ideal mixing in continuous flow reactors.

Learning Outcomes: 1. Apply fundamental material balances to derive the design equations for CSTR, PFR, PBR, and batch reactors. 2. Derive rate expressions from both elementary steps and reaction kinetics data for both homogeneous and heterogeneous reactions. 3. Use material and energy balances with kinetic data for both single and multiple reactions to design and analyze the behavior of isothermal and non-isothermal reactors. 4. Utilize effectiveness factors governing the coupling of reaction and diffusion in the description of heterogeneously catalyzed reactions. 5. Work professionally and ethically in teams to conduct reaction-based laboratory experiments. 6. Effectively report results in written form and practice safety as an integral part of laboratory work. 7. Apply appropriate computational tools for the solution of chemical reaction engineering problems. Credits: 4.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CHE 37800 - Heat And Mass Transfer

Credit Hours: 4.00. Macroscopic and differential energy balances. Heat transfer coefficients for free and forced convection and phase change. Conductive and radiative heat transfer. Applications to heat transfer equipment design and compressible fluid flow. Macroscopic and differential species balances. Mass transfer coefficients and analogies. Mass transfer with and without chemical reaction. Mass transfer equipment design.

Learning Outcomes: 1. Identify and explain the three mechanisms of heat transfer: conduction, convection, and radiation. 2. Apply microscopic and macroscopic thermal energy balances incorporating Fourier's Law for the solution of problems describing steady-state and transient conduction, including convective heat transfer. 3. Utilize mass and thermal energy balances for the design of heat transfer equipment and the analysis of its operation. 4. Identify and explain the two main mechanisms of mass transfer: convection and diffusion. 5. Apply microscopic and macroscopic species mass balances incorporating Fick's Law for the solution of problems describing steady-state and transient diffusion, including relevant rate equations and convective mass transfer. 6. Identify and apply the analogies between momentum, heat, and mass transfer. 7. Utilize mass balances and appropriate phase equilibrium relations for the design of continuous mass transfer equipment and the analysis of its operation. 8. Work professionally and ethically in teams to conduct heat and mass transfer-based laboratory experiments. 9. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CHE 40000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 30000. Lectures to acquaint the senior students with professional ethics, services of professional societies, and help them in the transition from being an undergraduate student to becoming a successful professional or graduate student.

Learning Outcomes: 1. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the professional practice of chemical engineering. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Identify the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 4. Demonstrate an appreciation of for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 42000 - Process Safety Management And Analysis

Credit Hours: 3.00. Develop knowledge of process safety management and analysis in the process industries, including hazard identification, hazard analysis and risk management.

Learning Outcomes: 1. Demonstrate knowledge and understanding of the elements of process safety management. 2. Apply the techniques, analytical skills, and modern computational tools necessary for performing process safety calculations in the design of safety. 3. Demonstrate an understanding and appreciation of the need for professional integrity and ethical decision making to promote safety in the workplace. 4. Be able to pro-actively identify and analyze safety hazards. 5. Demonstrate an understanding of the detrimental effects of the unsafe operation of chemical facilities on environmental, health, and safety issues and other public interests. Our graduate will be aware of the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 6. Demonstrate knowledge and understanding of risk management tools, programs and processes associated with process safety. Credits: 3.00

CHE 43500 - Chemical Engineering Laboratory

Credit Hours: 4.00. Quantitative experimental study of projects involving problems in fluid mechanics and heat and mass transfer or operation and evaluation of equipment; projects include analysis and data-based design of operations involving mass transfer such as distillation, absorption, drying, humidification, etc; study of rates and equilibria in simple chemical reaction systems; study of chemical processes;

application of methods of data analysis in practice; some library work; emphasis on group work, report writing, and oral communication.

Learning Outcomes: 1. Determine the intrinsic performance data required to complete the design of a given process or process equipment. 2. Design and conduct an experimental program to determine the required performance data. 3. Use the requisite performance data to obtain a technically feasible and economical design to meet desired needs. 4. Effectively report experimental results, performance data analyses and process designs both orally and in writing. 5. Use appropriate analytical and computational tools for the analysis and design of experiments. 6. Work effectively as a member of an engineering team in a professional and ethical manner, including different team roles. 7. Practice appropriate experimental safety measures. Credits: 4.00

CHE 45600 - Process Dynamics And Control

Credit Hours: 3.00. Dynamic response and control of chemical processing equipment, such as heat exchangers, chemical reactors, and absorption towers. Use is made of fundamental techniques of servomechanism theory, such as block diagrams, transfer functions, and frequency response. Introduction to advanced control techniques.

Learning Outcomes: 1. Develop a physically relevant mathematical model as a surrogate for a chemical process. 2. Apply appropriate analytical and computer packages for analyzing the process control behavior based on the developed model. 3. Design, model, and test a hierarchical control system on a complex process. 4. Describe the role of process control in meeting stringent safety, economic, environmental, societal, and corporate goals. 5. Describe the building blocks of process control and their synthesis for providing complete process control solutions. 6. Work effectively in a team to execute process control computer-based assignments in a professional and ethical manner. Credits: 3.00

CHE 45000 - Design And Analysis Of Processing Systems

Credit Hours: 4.00. Use of process synthesis methods and concepts; detailed design of unit operation equipment, the economics of chemical plants and flow sheet optimization methods. Synthesize, develop, and evaluate a preliminary design of a chemical process that meets market requirements for a specific product. Analysis of design alternatives using case studies and optimization methods.

Learning Outcomes: 1. Apply systematic strategies for synthesizing chemical process designs that involve conventional unit operations. 2. Describe both the difference between steady state and batch chemical processes and the implications on their design and operation. 3. Demonstrate the ability to obtain reliable information on industrial chemical processes, process operating parameters, equipment costs, cost of chemicals and materials, and associated safety and environmental hazards. 4. Describe the role of physical property estimates on process design and be able to use appropriate physical property estimation methods in unit operations design. 5. Estimate the capital and operating cost of a process and to assess its profitability. 6. Use process simulators and other tools to perform detailed analyses for the successful design of a chemical plant. 7. Communicate effectively project progress and final results in a professional manner both orally and in writing. 8. Work effectively in a team to execute open-ended design projects with time-bound deliverables in a professional and ethical manner, including different team roles. Credits: 4.00

Other Departmental/Program Requirements (87-97 credits)

First-Year Engineering Requirements (29-39 credits)

Other Departmental Courses (36-40 credits)

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in

CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 37000 - Topics In Physical Chemistry

Credit Hours: 3.00. Kinetic theory of gases; statistical thermodynamics; quantum mechanics; atomic and molecular structure and spectroscopy; properties of ionic phases. May not be used to satisfy requirements for graduation in chemistry.

Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations

in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

General Education Requirements (18 credits)

Electives - Credit Hours: 0.00-12.00

Supplemental List

Optional Concentrations

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Sample Chemical Engineering Plan of Study

Fall 2nd Year

CHE 20000 - Chemical Engineering Seminar

Credit Hours: 1.00. An orientation course to inform students of the various areas in chemical engineering, to assist them in selection of electives suited to their particular abilities and interest, and to instill a sense of professional ethics and responsibility. Lectures drawn from all fields of chemical engineering.

Learning Outcomes: 1. Demonstrate an understanding of the need for academic and professional integrity and ethical behavior. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Demonstrate an appreciation of the need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 20500 - Chemical Engineering Calculations

Credit Hours: 4.00. Quantitative applications of steady-state mass and energy balances to solve problems involving multi-component systems and multi-unit chemical processes. Single-component and multi-component phase equilibria, single-reaction and multiple-reaction stoichiometry, coupled mass and energy balances, chemical processes involving bypass and recycle streams.

Learning Outcomes: 1. Estimate physical properties of real chemical systems. 2. Evaluate introductory single-component and multi-component phase equilibria and incorporate these concepts into solutions of mass and energy balance problems. 3. Solve steady state and transient mass and energy balance problems for both reacting and non-reacting systems with or without recycle using analytical and computational methods. 4. Work professionally and ethically in teams to solve new mass and energy balance problems. 5. Identify contemporary chemical engineering problems, including their societal, environmental, and global impacts. Credits: 4.00

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

16 Credits

Spring 2nd Year

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and

hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

17 Credits

Fall 3rd Year

CHE 30600 - Design Of Staged Separation Processes

Credit Hours: 3.00. The application of equilibria and mass and energy balances for the design of staged separation processes. Use of various equilibrium data and thermodynamic principles for the design of batch and continuous distillation, absorption, stripping, and extraction systems. Stagewise calculations and graphical methods for design of binary systems. Design of multicomponent separators. Determination of stage efficiency and column size.

Learning Outcomes: 1. Utilize the concepts and relations of phase equilibria, particularly VLE, in the analysis, design, and simulation of separation processes. 2. Use mass and energy balances in the analysis of separation processes. 3. Use the McCabe-Thiele diagram for the solution of problems in binary separations. 4. Use reflux and multi-stage cascades to increase separation of a given component. 5. Use process simulators for binary and multi-component systems to solve, understand, and design separation processes. 6. Apply the basic principles of distillation, absorption/stripping, extraction and other unit operations for the solution of problems in

separations. 7. Identify the safety aspects of various separation processes. 8. Communicate effectively the results of a designed separation process in writing. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CHM 37000 - Topics In Physical Chemistry

Credit Hours: 3.00. Kinetic theory of gases; statistical thermodynamics; quantum mechanics; atomic and molecular structure and spectroscopy; properties of ionic phases. May not be used to satisfy requirements for graduation in chemistry. Credits: 3.00

16 Credits

Spring 3rd Year

CHE 30000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 20000. Lectures to acquaint the junior students with professional ethics, career choices, including graduate studies, and services of professional societies.

Learning Outcomes: 1. Identify the wide range of career opportunities offered by the Bachelor in Chemical Engineering degree. 2. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the professional practice of chemical engineering. 3. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 4. Demonstrate an appreciation of the need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 34800 - Chemical Reaction Engineering

Credit Hours: 4.00. Application of kinetic rate equations, mass balances and energy balances to the analysis and design of chemical reactors involving homogeneous and heterogeneous chemical reactions. Chemical equilibria, kinetic rate equations for homogeneous and heterogeneously catalyzed reactions, design of ideal isothermal reactors, effects of non-isothermal operation, effects of diffusion in porous catalysts and non-ideal mixing in continuous flow reactors.

Learning Outcomes: 1. Apply fundamental material balances to derive the design equations for CSTR, PFR, PBR, and batch reactors. 2. Derive rate expressions from both elementary steps and reaction kinetics data for both homogeneous and heterogeneous

reactions. 3. Use material and energy balances with kinetic data for both single and multiple reactions to design and analyze the behavior of isothermal and non-isothermal reactors. 4. Utilize effectiveness factors governing the coupling of reaction and diffusion in the description of heterogeneously catalyzed reactions. 5. Work professionally and ethically in teams to conduct reaction-based laboratory experiments. 6. Effectively report results in written form and practice safety as an integral part of laboratory work. 7. Apply appropriate computational tools for the solution of chemical reaction engineering problems. Credits: 4.00

CHE 37800 - Heat And Mass Transfer

Credit Hours: 4.00. Macroscopic and differential energy balances. Heat transfer coefficients for free and forced convection and phase change. Conductive and radiative heat transfer. Applications to heat transfer equipment design and compressible fluid flow. Macroscopic and differential species balances. Mass transfer coefficients and analogies. Mass transfer with and without chemical reaction. Mass transfer equipment design.

Learning Outcomes: 1. Identify and explain the three mechanisms of heat transfer: conduction, convection, and radiation. 2. Apply microscopic and macroscopic thermal energy balances incorporating Fourier's Law for the solution of problems describing steady-state and transient conduction, including convective heat transfer. 3. Utilize mass and thermal energy balances for the design of heat transfer equipment and the analysis of its operation. 4. Identify and explain the two main mechanisms of mass transfer: convection and diffusion. 5. Apply microscopic and macroscopic species mass balances incorporating Fick's Law for the solution of problems describing steady-state and transient diffusion, including relevant rate equations and convective mass transfer. 6. Identify and apply the analogies between momentum, heat, and mass transfer. 7. Utilize mass balances and appropriate phase equilibrium relations for the design of continuous mass transfer equipment and the analysis of its operation. 8. Work professionally and ethically in teams to conduct heat and mass transfer-based laboratory experiments. 9. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

18 Credits

Fall 4th Year

CHE 40000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 30000. Lectures to acquaint the senior students with professional ethics, services of professional societies, and help them in the transition from being an undergraduate student to becoming a successful professional or graduate student.

Learning Outcomes: 1. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the professional practice of chemical engineering. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Identify the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 4. Demonstrate an appreciation of for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 42000 - Process Safety Management And Analysis

Credit Hours: 3.00. Develop knowledge of process safety management and analysis in the process industries, including hazard identification, hazard analysis and risk management.

Learning Outcomes: 1. Demonstrate knowledge and understanding of the elements of process

safety management. 2. Apply the techniques, analytical skills, and modern computational tools necessary for performing process safety calculations in the design of safety. 3. Demonstrate an understanding and appreciation of the need for professional integrity and ethical decision making to promote safety in the workplace. 4. Be able to pro-actively identify and analyze safety hazards. 5. Demonstrate an understanding of the detrimental effects of the unsafe operation of chemical facilities on environmental, health, and safety issues and other public interests. Our graduate will be aware of the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 6. Demonstrate knowledge and understanding of risk management tools, programs and processes associated with process safety. Credits: 3.00

CHE 43500 - Chemical Engineering Laboratory

Credit Hours: 4.00. Quantitative experimental study of projects involving problems in fluid mechanics and heat and mass transfer or operation and evaluation of equipment; projects include analysis and data-based design of operations involving mass transfer such as distillation, absorption, drying, humidification, etc; study of rates and equilibria in simple chemical reaction systems; study of chemical processes; application of methods of data analysis in practice; some library work; emphasis on group work, report writing, and oral communication.

Learning Outcomes: 1. Determine the intrinsic performance data required to complete the design of a given process or process equipment. 2. Design and conduct an experimental program to determine the required performance data. 3. Use the requisite performance data to obtain a technically feasible and economical design to meet desired needs. 4. Effectively report experimental results, performance data analyses and process designs both orally and in writing. 5. Use appropriate analytical and computational tools for the analysis and design of experiments. 6. Work effectively as a member of an engineering team in a professional and ethical manner, including different team roles. 7. Practice appropriate experimental safety measures. Credits: 4.00

CHE 45600 - Process Dynamics And Control

Credit Hours: 3.00. Dynamic response and control of chemical processing equipment, such as heat exchangers, chemical reactors, and absorption towers. Use is made of fundamental techniques of servomechanism theory, such as block diagrams, transfer functions, and frequency response. Introduction to advanced control techniques.

Learning Outcomes: 1. Develop a physically relevant mathematical model as a surrogate for a chemical process. 2. Apply appropriate analytical and computer packages for analyzing the process control behavior based on the developed model. 3. Design, model, and test a hierarchical control system on a complex process. 4. Describe the role of process control in meeting stringent safety, economic, environmental, societal, and corporate goals. 5. Describe the building blocks of process control and their synthesis for providing complete process control solutions. 6. Work effectively in a team to execute process control computer-based assignments in a professional and ethical manner. Credits: 3.00

15-18 Credits

Spring 4th Year

CHE 45000 - Design And Analysis Of Processing Systems

Credit Hours: 4.00. Use of process synthesis methods and concepts; detailed design of unit operation equipment, the economics of chemical plants and flow sheet optimization methods. Synthesize, develop, and evaluate a preliminary design of a chemical process that meets market requirements for a specific product. Analysis of design alternatives using case studies and optimization methods.

Learning Outcomes: 1. Apply systematic strategies for synthesizing chemical process designs that involve conventional unit operations. 2. Describe both the difference between steady state and batch chemical processes and the implications on their design and operation. 3. Demonstrate the ability to obtain reliable information on industrial chemical processes, process operating parameters, equipment costs, cost of chemicals and materials, and associated safety and environmental hazards. 4. Describe the role of physical property estimates on process design and be able to use appropriate physical property estimation methods in unit operations design. 5. Estimate the capital and operating cost of a process and to assess its profitability. 6. Use process simulators and other tools to perform detailed analyses for the successful design of a chemical plant. 7. Communicate effectively project progress and final results in a professional manner both orally and in writing. 8. Work effectively in a team to execute open-ended design projects with time-bound deliverables in a professional and ethical manner, including different team roles. Credits: 4.00

16 Credits

Chemistry (ACS), BSCH

About the Program

Degree Requirements

Departmental/Program Major Courses (68-75 credits)

Required Major Courses (42-44 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties,

and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to

understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules

(Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on

when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the

experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

Analytical Selective (4 credits)

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

Upper Level Selective (3 credits)

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the

reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

Laboratory Selectives (3-6 credits)

Area 1

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction.

Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

Area 2

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original

problems related to analytical chemistry.

Credits: 4.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and

interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

Required Calculus and Physics Courses (16-18 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and

magnetism. Credits: 4.00

Other Departmental /Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression

procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Electives (8-35 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

12-18 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary

approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Fall 2nd Year

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

14-16 Credits

Spring 2nd Year

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic

materials and commodity chemical industries. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

15-17 Credits

Fall 3rd Year

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

14 Credits

Spring 3rd Year

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

12 Credits

Fall 4th Year

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in

depth understanding of central foundations of biology at a molecular level. Credits: 3.00

14 Credits

Spring 4th Year

13 Credits

Chemistry, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (61-69 credits)

Required Major Courses (35-37 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural

conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical

and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting

methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

Analytical Selective (4 credits)

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

Upper Level Selective (3-4 credits)

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of

specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

Required Laboratory Selectives (3-6 credits)

Area 1

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials.

Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

Area 2

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

Area 3

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and

mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular

models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of

chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

Required Calculus and Physics Courses (16-18 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college

algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Other Departmental /Program Course Requirements (22-38 credits)

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and

manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.
University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.
Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Electives (13-37 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including

stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety,

measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

12-18 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions.

Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and

critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-16 Credits

Fall 2nd Year

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information,

and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.

Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able

to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15-17 Credits

Spring 2nd Year

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical

chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

13-15 Credits

Fall 3rd Year

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

13-17 Credits

Spring 3rd Year

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells,

introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

12-16 Credits

Fall 4th Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

16-18 Credits

Spring 4th Year

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

15-16 Credits

Chinese Studies, BA (Language & Culture Track)

About the Program

Degree Requirements

Departmental/Program Major Courses (33 credits)

Pre-requisite Language Courses

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof. Credits: 4.00

Chinese Studies Major

A. Chinese Language (6 credits)

CHNS 30100 - Chinese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 30200 - Chinese Level VI (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources with stronger emphasis on authentic texts, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Chinese Studies Language & Culture Track

B. Advanced Chinese Language (9 credits)

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 40100 - Chinese Level VII (UCC: HUM)

Credit Hours: 3.00. Continued development of Mandarin Chinese speaking, listening, reading, and writing skills. Emphasis will be upon modern, everyday language and culture (with some introduction to traditional culture) using various sources such as textbooks, newspapers, and literary works.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 40200 - Chinese Level VIII (UCC: HUM)

Credit Hours: 3.00. Further development of Mandarin Chinese speaking, listening, reading, and writing skills. Materials will include advanced textbooks and original texts such as newspapers and literary works.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

C. Chinese Culture - Choose Two (6 credits)

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of

Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

D. Chinese Literature and Film - Choose Two (6 credits)

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

E. Other Requirements (6 credits)

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

LC 49000 - Special Topics In Foreign Languages And Literatures

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof.
Credits: 4.00

16 Credits

Spring 1st Year

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

16-17 Credits

Fall 2nd Year

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 4.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of

food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

16 Credits

Spring 2nd Year

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 4.00

14-16 Credits

Fall 3rd Year

CHNS 30100 - Chinese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

LC 49000 - Special Topics In Foreign Languages And Literatures

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15-16 Credits

Spring 3rd Year

CHNS 30200 - Chinese Level VI (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources with stronger emphasis on authentic texts, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Fall 4th Year

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 40100 - Chinese Level VII (UCC: HUM)

Credit Hours: 3.00. Continued development of Mandarin Chinese speaking, listening, reading, and writing skills. Emphasis will be upon modern, everyday language and culture (with some introduction to traditional culture) using various sources such as textbooks, newspapers, and literary works.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

14 Credits

Spring 4th Year

CHNS 40200 - Chinese Level VIII (UCC: HUM)

Credit Hours: 3.00. Further development of Mandarin Chinese speaking, listening, reading, and writing skills. Materials will include advanced textbooks and original texts such as newspapers and literary works.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

LC 49000 - Special Topics In Foreign Languages And Literatures

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

12 Credits

Chinese Studies: World Languages Teaching Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Courses

Pre-requisite Language Courses

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof. Credits: 4.00

Chinese Studies Major (33 credits)

A. Chinese Language (6 credits)

CHNS 30100 - Chinese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 30200 - Chinese Level VI (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources with stronger emphasis on authentic texts, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Education Track

B. Advanced Chinese Language (3 credits)

CHNS 40100 - Chinese Level VII (UCC: HUM)

Credit Hours: 3.00. Continued development of Mandarin Chinese speaking, listening, reading, and writing skills. Emphasis will be upon modern, everyday language and culture (with some introduction to traditional culture) using various sources such as textbooks, newspapers, and literary works.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

C. Introduction to Chinese Literature (3 credits)

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

D. Advanced Chinese Literature I (3 credits)

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

E. Advanced Chinese Literature II (3 credits)

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

F. Chinese Selectives (15 credits)

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 39900 - Special Study Abroad Credit In Chinese

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Chinese earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

CHNS 40200 - Chinese Level VIII (UCC: HUM)

Credit Hours: 3.00. Further development of Mandarin Chinese speaking, listening, reading, and writing skills. Materials will include advanced textbooks and original texts such as newspapers and literary works.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

Other Departmental (12 credits)

Core III: Linguistic Diversity (0 credits)

Foundational Requirements (12 credits)

Notes

Electives (28 credits)

Grade Requirements

GPA Requirements

Teacher Licensure Information

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)
Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts.
Credits: 0.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices.
Credits: 1.00 to 3.00

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof.
Credits: 4.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral

assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

15 Credits

Spring 1st Year

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports.

Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 4.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques,

and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013):

1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

16 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 30100 - Chinese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

14 Credits

Spring 3rd Year

CHNS 30200 - Chinese Level VI (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources with stronger emphasis on authentic texts, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4. Recognize how theories of individual and collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences.
Credits: 3.00

CHNS 40100 - Chinese Level VII (UCC: HUM)

Credit Hours: 3.00. Continued development of Mandarin Chinese speaking, listening, reading, and writing skills. Emphasis will be upon modern, everyday language and culture (with some introduction to traditional culture) using various

sources such as textbooks, newspapers, and literary works.
University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.
Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.
Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

18 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.
University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Civil Engineering, BSCE

About the Program

Degree Requirements

Departmental/Program Major Courses (65 credits)

Civil Engineering Required Courses (35 credits)

CE 20300 - Principles And Practice Of Geomatics

Credit Hours: 4.00. This course provides a broad overview of geomatics engineering including fundamental principles required for practical geomatics applications. This course includes subjects in traditional surveying, GPS surveying, remote sensing, photogrammetry, laser scanning, and Geographic Information Systems (GIS). Basic concepts on these subjects are applied to solve practical problems in various civil engineering applications; including computations for engineering project control and construction layout; theory of error propagation; fundamental concepts of horizontal and vertical curves; topographic mapping using various geospatial data acquisition technologies from ground, air, and space; GIS for visualization and analysis of geospatial data.

Learning Outcomes: 1. Design and execute a leveling survey. 2. Design and execute a traverse survey. 3. Use survey data to produce a topographic map. 4. Perform horizontal and vertical curve computations. 5. Collect GPS/RTK/RTN data with survey grade accuracy. 6. Perform remote sensing image classification. 7. Measure digital photographs and perform camera calibration. 8. Use software to generate 3D point cloud from digital imagery. 9. Perform multi-image bundle block adjustment. 10. Manipulate 3D point cloud data from a laser scanner, and extract engineering parameters. 11. Select appropriate geodetic references and map projections for geomatics applications. 12. Collect and register geospatial data from multiple sources for engineering applications. 13. Map and visualize collected geospatial data. Credits: 4.00

CE 27000 - Introductory Structural Mechanics

Credit Hours: 4.00. Loads; structural forms; analysis of axially loaded members, flexural members, torsional members; combined loading conditions; buckling. Basic behavioral characteristics of structural elements and systems illustrated by laboratory experiments.

Credits: 4.00

CE 29202 - Contemporary Issues In Civil Engineering

Credit Hours: 2.00. This course provides a forum on issues in the civil engineering profession in a contemporary context. Topics include professionalism and ethics, entrepreneurship, cultural differences, and collaborating globally. Students have interactions with engineering faculty and professionals outside the University. Guidance on the preparation of individual plans of study and information on civil engineering career options are provided. Students learn and apply fundamental aspects of written communication in professional settings. Emphasis is placed on delivery of technical and managerial content. Students will compile a professional portfolio of communication assignments, including lab reports prepared in other CE courses.

Learning Outcomes: 1. Ability to communicate effectively. 2. Ability to understand the impact of engineering solutions in a global and societal context. 3. Knowledge of contemporary issues, particularly with respect to nuclear topics. 4. Understanding of professional and ethical responsibility. Credits: 2.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and

momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

CE 39201 - Technical Communication In Civil Engineering

Credit Hours: 2.00. This course will build upon the technical communication components of CE 29202 , adding instruction in oral communication, projects, and working in teams. This course involves both individual and team assignments intended to offer students the opportunity to practice preparing and delivering written correspondence and reports, as well as oral presentations. These activities may be coordinated with other CE courses being taken by students in CE 39201.

Learning Outcomes: 1. Know the value of clear and concise communication. 2. Understand the audience and structuring of communications. 3. Employ the forms of arguments/reasoning. 4. Apply knowledge of scientific vocabulary and technical data-driven communication. 5. Work effectively in teams. 6. Employ issue analysis to plan team project work. 7. Understanding of good listening; oral communications. 8. Employ PowerPoint and visual communications effectively. 9. Deliver team technical presentations. 10. Develop and present lab reports. 11. Knowledge to prepare ""How-To"" video project. 12. Conduct meetings; running brainstorming sessions. 13. Develop persuasive presentations. 14. Prepare effective resumes, cover letters, and job searches. 15. Employ job interview skills. Credits: 2.00

CE 39800 - Introduction To Civil Engineering Systems Design

Credit Hours: 3.00. An introduction to engineering economy and systems analysis. A systematic approach to the engineering method of design and problem solving.

Credits: 3.00

CE 49800 - Civil Engineering Design Project

Credit Hours: 3.00. Planning, design, and analysis of a civil project; an integrated and realistic group project involves as much as possible all major aspects of the civil engineering profession.

Credits: 3.00

CE 21101 - Thermal And Energy Sciences

Credit Hours: 3.00. This course includes applications of thermal science and energy fundamentals to civil engineering topics. Emphasis is placed on fundamental concepts of properties of materials, work, heat, internal energy, entropy, equilibrium, and relations derived from the first and second laws of thermodynamics. Example applications include: power plants; fluid flow in ducts/pipes; thermal properties of building/construction materials and processes; geothermal systems; heating, ventilation, and air conditioning (HVAC) processes; energy balances in buildings; refrigeration; hydroelectric power; contaminant transport in air, water, and soil; climate change; the urban heat island effect; and energy use in the transportation sector.

Learning Outcomes: 1. Explain the principles of mass and energy conservation and their use in civil engineering applications. 2. Evaluate thermodynamic systems and several forms of work, energy, and heat transfer. 3. Apply conservation of mass and energy for closed systems and control volume processes. 4. Explain the second law of thermodynamics, entropy changes, and device efficiencies.

Credits: 3.00

CE 33500 - Civil Engineering Materials

Credit Hours: 4.00. An introduction to the relationships between fundamental structure of materials and their properties presented through a combination of materials science and engineering approaches. Emphasis on materials of particular interest for civil engineering applications, including metals, aggregates, portland cement concrete, bituminous materials, asphalt binders, asphalt mixtures, wood, polymers, composites, and masonry. Laboratory exercises illustrate atomic

structure, elastic and inelastic properties, and demonstrate applications of selected principle of mechanics, testing of aggregates, as well as designing and testing of asphalt and concrete mixtures.
Learning Outcomes: 1. Formulate equations that describe the properties of composite materials based on boundary conditions, assumptions and constituent properties. 2. Design and conduct experiments, as well as to analyze and interpret data. 3. Use non-destructive tests to estimate material properties. 4. Use non-destructive test to locate flaws in engineering systems. 5. Compare and contrast strength of materials and fracture mechanics solutions. 6. Use mathematics, science and engineering principles to estimate the influence of cracks on the mechanical response of engineering materials. 7. Use scientific and engineering principles to predict the elastic and viscoelastic of a material. 8. Interpret engineering properties from test data. 9. Use standardized test procedures to describe the properties of engineering materials. 10. Use mathematical, scientific and engineering principles to compute the influence of material proportions on the structure property relationships for concrete materials. 11. Design the proportions for a concrete mixture. 12. Explain the relationship between the properties of an asphalt mixture and its performance. 13. Select engineering materials for specific applications. 14. Communicate effectively using graphs. 15. Communicate effectively using an executive summary. 16. Communicate effectively using an engineering report. 17. Communicate the expected accuracy obtained from engineering data. Credits: 4.00

Technical Electives (30 credits)

Other Departmental/Program Course Requirements (65-72 credits)

Engineering Requirements for First Year (29-39 credits)

Other Departmental/Program Course Requirements (21-28 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.
Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand

the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5.

Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and

critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

General Education Requirement (15 credits)

Supplemental Lists

Optional Concentrations

Course Requirements and Notes

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample Civil Engineering Plan of Study

Fall 2nd Year

CE 20300 - Principles And Practice Of Geomatics

Credit Hours: 4.00. This course provides a broad overview of geomatics engineering including fundamental principles required for practical geomatics applications. This course includes subjects in traditional surveying, GPS surveying, remote sensing, photogrammetry, laser scanning, and Geographic Information Systems (GIS). Basic concepts on these subjects are applied to solve practical problems in various civil engineering applications; including computations for engineering project control and construction layout; theory of error propagation; fundamental concepts of horizontal and vertical curves; topographic mapping using various geospatial data acquisition technologies from ground, air, and space; GIS for visualization and analysis of geospatial data.

Learning Outcomes: 1. Design and execute a

leveling survey. 2. Design and execute a traverse survey. 3. Use survey data to produce a topographic map. 4. Perform horizontal and vertical curve computations. 5. Collect GPS/RTK/RTN data with survey grade accuracy. 6. Perform remote sensing image classification. 7. Measure digital photographs and perform camera calibration. 8. Use software to generate 3D point cloud from digital imagery. 9. Perform multi-image bundle block adjustment. 10. Manipulate 3D point cloud data from a laser scanner, and extract engineering parameters. 11. Select appropriate geodetic references and map projections for geomatics applications. 12. Collect and register geospatial data from multiple sources for engineering applications. 13. Map and visualize collected geospatial data. Credits: 4.00

CE 29202 - Contemporary Issues In Civil Engineering

Credit Hours: 2.00. This course provides a forum on issues in the civil engineering profession in a contemporary context. Topics include professionalism and ethics, entrepreneurship, cultural differences, and collaborating globally. Students have interactions with engineering faculty and professionals outside the University. Guidance on the preparation of individual plans of study and information on civil engineering career options are provided. Students learn and apply fundamental aspects of written communication in professional settings. Emphasis is placed on delivery of technical and managerial content. Students will compile a professional portfolio of communication assignments, including lab reports prepared in other CE courses.

Learning Outcomes: 1. Ability to communicate effectively. 2. Ability to understand the impact of engineering solutions in a global and societal context. 3. Knowledge of contemporary issues, particularly with respect to nuclear topics. 4. Understanding of professional and ethical responsibility. Credits: 2.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

18 Credits

Spring 2nd Year

CE 27000 - Introductory Structural Mechanics

Credit Hours: 4.00. Loads; structural forms; analysis of axially loaded members, flexural members, torsional members; combined loading conditions; buckling. Basic behavioral characteristics of structural elements and systems illustrated by laboratory experiments.

Credits: 4.00

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

CE 21101 - Thermal And Energy Sciences

Credit Hours: 3.00. This course includes applications of thermal science and energy fundamentals to civil engineering topics. Emphasis is placed on fundamental concepts of properties of materials, work, heat, internal energy, entropy, equilibrium, and relations derived from the first and second laws of thermodynamics. Example applications include: power plants; fluid flow in ducts/pipes; thermal properties of building/construction materials and processes; geothermal systems; heating, ventilation, and air conditioning (HVAC) processes; energy balances in buildings; refrigeration; hydroelectric power; contaminant transport in air, water, and soil; climate change; the urban heat island effect; and energy use in the transportation sector.

Learning Outcomes: 1. Explain the principles of

mass and energy conservation and their use in civil engineering applications. 2. Evaluate thermodynamic systems and several forms of work, energy, and heat transfer. 3. Apply conservation of mass and energy for closed systems and control volume processes. 4. Explain the second law of thermodynamics, entropy changes, and device efficiencies.
Credits: 3.00

16 Credits

Fall 3rd Year

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.
Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.
Credits: 1.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

CE 33500 - Civil Engineering Materials

Credit Hours: 4.00. An introduction to the relationships between fundamental structure of materials and their properties presented through a combination of materials science and engineering approaches. Emphasis on materials of particular interest for civil engineering applications, including metals, aggregates, portland cement concrete, bituminous materials, asphalt binders, asphalt mixtures, wood, polymers, composites, and masonry. Laboratory exercises illustrate atomic structure, elastic and inelastic properties, and demonstrate applications of selected principle of mechanics, testing of aggregates, as well as designing and testing of asphalt and concrete mixtures.
Learning Outcomes: 1. Formulate equations that describe the properties of composite materials based on boundary conditions, assumptions and constituent properties. 2. Design and conduct experiments, as well as to analyze and interpret data. 3. Use non-destructive tests to estimate material properties. 4. Use non-destructive test to locate flaws in engineering systems. 5. Compare and contrast strength of materials and fracture mechanics solutions. 6. Use mathematics, science and engineering principles to estimate the influence of cracks on the mechanical response of engineering materials. 7. Use scientific and engineering principles to predict the elastic and viscoelastic of a material. 8. Interpret engineering properties from test data. 9. Use standardized test procedures to describe the properties of engineering materials. 10. Use

mathematical, scientific and engineering principles to compute the influence of material proportions on the structure property relationships for concrete materials. 11. Design the proportions for a concrete mixture. 12. Explain the relationship between the properties of an asphalt mixture and its performance. 13. Select engineering materials for specific applications. 14. Communicate effectively using graphs. 15. Communicate effectively using an executive summary. 16. Communicate effectively using an engineering report. 17. Communicate the expected accuracy obtained from engineering data. Credits: 4.00

17 Credits

Spring 3rd Year

CE 39201 - Technical Communication In Civil Engineering

Credit Hours: 2.00. This course will build upon the technical communication components of CE 29202 , adding instruction in oral communication, projects, and working in teams. This course involves both individual and team assignments intended to offer students the opportunity to practice preparing and delivering written correspondence and reports, as well as oral presentations. These activities may be coordinated with other CE courses being taken by students in CE 39201.

Learning Outcomes: 1. Know the value of clear and concise communication. 2. Understand the audience and structuring of communications. 3. Employ the forms of arguments/reasoning. 4. Apply knowledge of scientific vocabulary and technical data-driven communication. 5. Work effectively in teams. 6. Employ issue analysis to plan team project work. 7. Understanding of good listening; oral communications. 8. Employ PowerPoint and visual communications effectively. 9. Deliver team technical presentations. 10. Develop and present lab reports. 11. Knowledge to prepare ""How-To"" video project. 12. Conduct meetings; running brainstorming sessions. 13. Develop persuasive presentations. 14. Prepare effective resumes, cover letters, and job searches. 15. Employ job interview skills. Credits: 2.00

CE 39800 - Introduction To Civil Engineering Systems Design

Credit Hours: 3.00. An introduction to engineering economy and systems analysis. A systematic approach to the engineering method of design and problem solving.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with

emphasis on the difference between causation and relationships. Credits: 3.00

17 Credits

Fall 4th Year

18 Credits

Spring 4th Year

CE 49800 - Civil Engineering Design Project

Credit Hours: 3.00. Planning, design, and analysis of a civil project; an integrated and realistic group project involves as much as possible all major aspects of the civil engineering profession.

Credits: 3.00

12-15 Credits

Combined Degree Information

Classical Studies, BA (Classical Languages Track)

About the Program

Degree Requirements

Departmental/Program Major Courses (33 credits)

A. Classical Studies Foundational Courses - Choose Two (6 Credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as

represented in ancient Greek and Latin texts and images.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

Classical Languages Concentration (27 credits)

B. Greek and Latin Language and Literature (18 credits)

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.
University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GREK 10100 - Ancient Greek Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to the grammar of Attic Greek of the Classical period, and first forays into the reading of connected prose. Emphasis on accidence, syntax, and vocabulary building.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain foundational Ancient Greek grammar and demonstrate familiarity with core vocabulary. 2. Bring together their knowledge of Ancient Greek grammar and vocabulary, creating clear English translations by analyzing basic texts adapted from Ancient Greek literature. 3. Apply this knowledge of grammar and vocabulary to writing simple sentences in Ancient Greek, and translating from English to Ancient Greek. Credits: 3.00

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn basics of reading and translating ancient Greek, completing their introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 20100 - Ancient Greek Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in New Testament Greek, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop skills in reading and translation.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn how to apply foundational knowledge of ancient Greek grammar and syntax to readings in the New

Testament. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 34400 - Greek Epic

Credit Hours: 3.00. Readings and discussion of the Greek epic, including selected passages from Homer and Hesiod.

Credits: 3.00

GREK 35300 - Greek Tragedy

Credit Hours: 3.00. Reading and discussion of selected Greek tragedies of the 5th century BCE.

Credits: 3.00

GREK 35400 - Greek Comedy

Credit Hours: 3.00. Readings and discussion of selected Greek comedies of the 4th and 5th centuries BCE.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical historians in the original Greek.

Credits: 3.00

GREK 49000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2.

Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts. Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from

Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 49000 - Directed Reading In Latin

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

GREK 59000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 4.00. Directed Reading In Classical Greek. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their disciplines. Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.

Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

LATN 10500 - Accelerated Basic Latin

Credit Hours: 4.00. Foundational Latin grammar course designed to prepare students to read classical and post-classical Latin in a single intensive semester. Focus on grammar, syntax, vocabulary, and elementary readings. The accelerated Latin course assumes *no* previous knowledge of Latin and makes it possible for the diligent student to be able to

read *any* Latin prose or poetry (with a dictionary) after a single semester. (Upon completion students will be prepared to enroll in Latin 201.)

Learning Outcomes: 1. Recite Latin texts aloud (with accurate pronunciation, meaningful phrase grouping, and appropriate voice inflection) by imitating models they have heard in class. 2. Analyze Latin texts by identifying and describing the basic elements of Latin grammar, sentence structure, and style. 3. Translate intermediate level un-adapted Latin texts into English. 4. Compose complex sentences while writing a short story in Latin. Credits: 4.00

GREK 10500 - Accelerated Introductory Ancient Greek

Credit Hours: 4.00. This course is an accelerated beginning-level course designed to develop language proficiency in Ancient Greek. The course will help students progress toward competence in reading and writing, as well as toward knowledge of Ancient Greek culture. The course focuses on developing deep understanding of Greek syntax and morphology and building strategies for fluent and accurate reading of ancient texts. Primary language of instruction is English.

Learning Outcomes: 1. Differentiate the syntactic structures used in Ancient Greek sentences and longer texts based on the study of model sentences. 2. Compose sentences in Ancient Greek by focusing on a set of grammatical rules and standards in the language. 3. Recite Ancient Greek aloud with accuracy and fluency and demonstrate their ability in in-class text readings and recordings. 4. Infer the meaning of unknown vocabulary in context by reading stories. 5. Identify and analyze grammatical forms in the Greek contexts in which they are used. 6. Generate smooth-flowing and elegant English translations of the Greek, attending to inherent differences in style and structure. Credits: 4.00

C. General Studies Courses (3 credits)

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and

seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 22000 - Topics In Classical Literature

Credit Hours: 3.00. Selected topics in Greek and Roman literature. All readings in English translation.

Learning Outcomes: 1. Gain a detailed historical understanding of the development of a specific genre or topic within ancient Greek and Roman literature. 2. Ability to appreciate and intelligently discuss major themes in ancient Greek and Roman literature through close reading of representative texts. 3. Ability to identify specific examples of the influence of the ancient Greek and Roman literature on the literature of the later western world. Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23300 - Comparative Mythology (UCC: HUM)

Credit Hours: 3.00. Comparative study of the myths of major ancient cultures, with emphasis on shared typological features.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have a detailed grasp of principal characters, narratives, and themes in the myths of a number of representative ancient world cultures (Mesopotamian, Egyptian, Celtic, Aztec, Mayan, East Asian, African); 2. Be able to appreciate the many functions of myths within ancient societies, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify recurrent patterns and themes in the myths of historically disparate ancient and modern cultures. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23600 - Ancient World Onscreen

Credit Hours: 3.00. How film represents ancient Mediterranean civilizations and retells ancient myths; how cinematic renderings of ancient history shape views of the past and how these are affected by contemporary sensibilities. No knowledge of Greek or Latin required.

Learning Outcomes: 1. Have a detailed historical grasp of the ways in which the ancient Greek and Roman worlds have found expression in modern cinema; 2. Be able to appreciate how ancient texts fare when translated into the radically different artistic medium of film; and 3. Be able to discuss intelligently what forces influence how we choose to see and represent the ancient western world. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the influence of ancient Greek tragedy on the drama of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 33700 - The Ancient Epic

Credit Hours: 3.00. Study of the epic in four ancient cultures, with emphasis on its structure, nature, and social functions. Readings may include Gilgamesh, Iliad, Odyssey, Aeneid, Beowulf, Tain, Mahabharata, and others.

Learning Outcomes: 1. Gain an enhanced understanding of the nature and development of the genre of epic through close reading of representative samples of the genre from different ancient cultures. 2. Ability to appreciate and intelligently discuss major themes in epic as they relate to both ancient and modern views of the heroic. 3. Ability to identify specific examples of the influence of ancient epic on the literature of the later western world. Credits: 3.00

CLCS 38000 - Alexander The Great And Hellenistic World (UCC: HUM)

Credit Hours: 3.00. Course examines the career of Alexander the Great and the rise of Macedonia in the Hellenistic Era. Topics include the emergence of Macedonia under Philip II; the achievements of Alexander the Great; and the wars of succession following his demise.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice.
Credits: 3.00

CLCS 38600 - Ancient Greek Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Greece, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the ancient Greek world from the Mycenaean to the Hellenistic period. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 48000 - Potters And Society In Antiquity

Credit Hours: 3.00. Course covers the range of eastern Mediterranean ceramics encountered in Rough Cilicia Archaeological Survey Project from the Bronze Age to the Later Roman Empire. Course also explores strategies employed by archaeologists and historians to exploit ceramics as research materials.

Credits: 3.00

CLCS 48100 - Culture And Society In The Age Of Pericles

Credit Hours: 3.00. Course explores interrelationships between the emergence of Greek democracy and the cultural, political, social, and economic rise of Athens in the fifth century BCE. More broadly, course surveys history of the Greek world from the Late Bronze Age to 362 BCE.

Credits: 3.00

CLCS 48300 - Republican Rome

Credit Hours: 3.00. Course examines the military, political, economic, and social developments that enabled the Roman people to expand from an Italian city-state to a trans-Mediterranean empire, and the consequences that initiated the decline and transition in their republican form of government.

Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

HEBR 28400 - Ancient Near Eastern History And Culture

Credit Hours: 3.00. This course is a survey of the development of the ancient Near East, from its pre-history to Alexander the Great. It emphasizes the evolutions of various Near Eastern cultures in their many manifestations; art, government, agriculture, economics, philosophy, religion, ethics, and science. Taught in English.

Learning Outcomes: 1. Understand the difference between pre-history and history. 2. Understand various ancient and modern ideas of the purpose of writing history. 3. Understand how the invention of writing and the origins of cities were coordinate developments. 4. Understand something of the flow of empires that succeeded each other, eventually displaced by the empire of Alexander the Great, whose conquests shaped the contours of the world much as we know it. 5. Become aware how art reflects the development of thought and idealism; how ideas of human government evolved; how religion, science, agriculture, and much else developed as empires built onto those they displaced. Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most

important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western

medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

D. Classical Languages Selectives (6 credits)

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-16 Credits

Spring 1st Year

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western

world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

15-16 Credits

Fall 2nd Year

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Classical Studies, BA (Literature & Culture Track)

About the Program

Degree Requirements

Departmental/Program Major Courses (33 credits)

A. Classical Studies Foundational Courses (6 credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

Concentration in Literature & Culture (27 credits)

B. Literary Studies Courses (15 credits)

CLCS 22000 - Topics In Classical Literature

Credit Hours: 3.00. Selected topics in Greek and Roman literature. All readings in English translation.

Learning Outcomes: 1. Gain a detailed historical understanding of the development of a specific genre or topic within ancient Greek and Roman literature. 2. Ability to appreciate and intelligently discuss major themes in ancient

Greek and Roman literature through close reading of representative texts. 3. Ability to identify specific examples of the influence of the ancient Greek and Roman literature on the literature of the later western world. Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CLCS 23300 - Comparative Mythology (UCC: HUM)

Credit Hours: 3.00. Comparative study of the myths of major ancient cultures, with emphasis on shared typological features.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of principal characters, narratives, and themes in the myths of a number of representative ancient world cultures (Mesopotamian, Egyptian, Celtic, Aztec, Mayan, East Asian, African); 2. Be able to appreciate the many functions of myths within ancient societies, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify recurrent patterns and themes in the myths of historically disparate ancient and modern cultures. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23600 - Ancient World Onscreen

Credit Hours: 3.00. How film represents ancient Mediterranean civilizations and retells ancient myths; how cinematic renderings of ancient history shape views of the past and how these are

affected by contemporary sensibilities. No knowledge of Greek or Latin required.

Learning Outcomes: 1. Have a detailed historical grasp of the ways in which the ancient Greek and Roman worlds have found expression in modern cinema; 2. Be able to appreciate how ancient texts fare when translated into the radically different artistic medium of film; and 3. Be able to discuss intelligently what forces influence how we choose to see and represent the ancient western world. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the influence of ancient Greek tragedy on the drama of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 33700 - The Ancient Epic

Credit Hours: 3.00. Study of the epic in four ancient cultures, with emphasis on its structure, nature, and social functions. Readings may include Gilgamesh, Iliad, Odyssey, Aeneid, Beowulf, Tain, Mahabharata, and others.

Learning Outcomes: 1. Gain an enhanced understanding of the nature and development of the genre of epic through close reading of representative samples of the genre from different ancient cultures. 2. Ability to appreciate and intelligently discuss major themes in epic as they relate to both ancient and modern views of the heroic. 3. Ability to identify specific examples of the influence of ancient epic on the literature of the later western world. Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

GREK 10100 - Ancient Greek Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to the grammar of Attic Greek of the Classical period, and first forays into the reading of connected prose. Emphasis on accidence, syntax, and vocabulary building.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain foundational Ancient Greek grammar and demonstrate familiarity with core vocabulary. 2. Bring together their knowledge of Ancient Greek grammar and vocabulary, creating clear English translations by analyzing basic texts adapted from Ancient Greek literature. 3. Apply this knowledge of grammar and vocabulary to writing simple sentences in Ancient Greek, and translating from English to Ancient Greek. Credits: 3.00

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn basics of reading and translating ancient Greek, completing their introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 20100 - Ancient Greek Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in New Testament Greek, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn how to apply foundational knowledge of ancient Greek grammar and syntax to readings in the New Testament. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 34400 - Greek Epic

Credit Hours: 3.00. Readings and discussion of the Greek epic, including selected passages from Homer and Hesiod.

Credits: 3.00

GREK 35300 - Greek Tragedy

Credit Hours: 3.00. Reading and discussion of selected Greek tragedies of the 5th century BCE.

Credits: 3.00

GREK 35400 - Greek Comedy

Credit Hours: 3.00. Readings and discussion of selected Greek comedies of the 4th and 5th centuries BCE.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical historians in the original Greek.

Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices.
Credits: 3.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed

in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts. Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

LATN 49000 - Directed Reading In Latin

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.

Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

LATN 10500 - Accelerated Basic Latin

Credit Hours: 4.00. Foundational Latin grammar course designed to prepare students to read classical and post-classical Latin in a single intensive semester. Focus on grammar, syntax, vocabulary, and elementary readings. The accelerated Latin course assumes *no* previous knowledge of Latin and makes it possible for the diligent student to be able to read *any* Latin prose or poetry (with a dictionary) after a single semester. (Upon completion students will be prepared to enroll in Latin 201.)

Learning Outcomes: 1. Recite Latin texts aloud (with accurate pronunciation, meaningful phrase grouping, and appropriate voice inflection) by imitating models they have heard in class. 2. Analyze Latin texts by identifying and describing the basic elements of Latin grammar, sentence structure, and style. 3. Translate intermediate level un-adapted Latin texts into English. 4. Compose complex sentences while writing a short story in Latin. Credits: 4.00

GREK 10500 - Accelerated Introductory Ancient Greek

Credit Hours: 4.00. This course is an accelerated beginning-level course designed to develop language proficiency in Ancient Greek. The course will help students progress toward competence in reading and writing, as well as toward knowledge of Ancient Greek culture. The course focuses on developing deep understanding of Greek syntax and morphology and building strategies for fluent and accurate reading of ancient texts. Primary language of instruction is English.

Learning Outcomes: 1. Differentiate the syntactic structures used in Ancient Greek sentences and longer texts based on the study of model sentences. 2. Compose sentences in Ancient Greek by focusing on a set of grammatical rules and standards in the language. 3. Recite Ancient Greek aloud with accuracy and fluency and demonstrate their ability in in-class text readings and recordings. 4. Infer the meaning of unknown vocabulary in

context by reading stories. 5. Identify and analyze grammatical forms in the Greek contexts in which they are used. 6. Generate smooth-flowing and elegant English translations of the Greek, attending to inherent differences in style and structure. Credits: 4.00

C. General Studies Courses (3 credits)

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 38000 - Alexander The Great And Hellenistic World (UCC: HUM)

Credit Hours: 3.00. Course examines the career of Alexander the Great and the rise of Macedonia in the Hellenistic Era. Topics include the emergence of Macedonia under Philip II; the achievements of Alexander the Great; and the wars of succession following his demise.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice. Credits: 3.00

CLCS 38600 - Ancient Greek Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Greece, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the ancient Greek world from the Mycenaean to the Hellenistic period. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more

clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 48000 - Potters And Society In Antiquity

Credit Hours: 3.00. Course covers the range of eastern Mediterranean ceramics encountered in Rough Cilicia Archaeological Survey Project from the Bronze Age to the Later Roman Empire. Course also explores strategies employed by archaeologists and historians to exploit ceramics as research materials.

Credits: 3.00

CLCS 48100 - Culture And Society In The Age Of Pericles

Credit Hours: 3.00. Course explores interrelationships between the emergence of Greek democracy and the cultural, political, social, and economic rise of Athens in the fifth century BCE. More broadly, course surveys history of the Greek world from the Late Bronze Age to 362 BCE.

Credits: 3.00

CLCS 48300 - Republican Rome

Credit Hours: 3.00. Course examines the military, political, economic, and social developments that enabled the Roman people to expand from an Italian city-state to a trans-Mediterranean empire, and the consequences that initiated the decline and transition in their republican form of government.

Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

HEBR 28400 - Ancient Near Eastern History And Culture

Credit Hours: 3.00. This course is a survey of the development of the ancient Near East, from its pre-history to Alexander the Great. It emphasizes the evolutions of various Near Eastern cultures in their many manifestations; art, government, agriculture, economics, philosophy, religion, ethics, and science. Taught in English.

Learning Outcomes: 1. Understand the difference between pre-history and history. 2. Understand various ancient and modern ideas of the purpose of writing history. 3. Understand how the invention of writing and the origins of cities were coordinate developments. 4. Understand something of the flow of empires that succeeded each other, eventually displaced by the empire of Alexander the Great, whose conquests shaped the contours of the world much as we know it. 5. Become aware how art reflects the development of thought and idealism; how ideas of human government evolved; how religion, science, agriculture, and much else developed as empires built onto those they displaced. Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

PHIL 50100 - Studies In Greek Philosophy

Credit Hours: 3.00. The subject matter will alternate between the intensive study of some fairly specific topic in Greek philosophy (e.g., Plato's theory of knowledge, Aristotle's ethics, etc.) and a general study of either the philosophy of Plato or the philosophy of Aristotle.

Credits: 3.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their disciplines. Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

D. Literature & Culture Selectives (9 credits)

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-16 Credits

Spring 1st Year

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information

about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

15 Credits

Fall 2nd Year

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various

communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Classical Studies, BA (Material Culture & History Track)

About the Program

Degree Requirements

Departmental/Program Major Courses (33 credits)

A. Classical Studies Foundational Courses - Choose Two (6 Credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy,

historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

Concentration in Material Culture & History (27 credits)

B. Historical and Archaeological Studies Courses (9 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and

behavior. Credits: 3.00

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 31200 - The Archaeology Of Ancient Egypt And The Near East

Credit Hours: 3.00. Selected topics on the archaeology of ancient Near Eastern cultures in Mesopotamia, the circum-Mediterranean area, Egypt, and the Nile Valley, emphasizing an anthropological interpretation of the political, social, religious, and economic systems that contributed to their development.

Learning Outcomes: 1. Summarize the rise and development of civilization in the Near East and North Africa from 10,000 years ago to 331 BC. 2. Distinguish the emergence and strategies of governance between these neighboring regions. 3. Recognize the historical and cultural context that gave rise to the Great Pyramids, cuneiform writing, and other significant achievements in the region. 4. Interpret the Near East and North Africa within Western historical narratives and popular imaginings. Credits: 3.00

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

ANTH 42800 - Field Methods In Archaeology

Credit Hours: 1.00 to 9.00. Introduces basic field and laboratory methods in contemporary archaeology: methods of site survey, mapping, and excavation through the excavation of archaeological sites; the basics of archaeological data analysis and classification, and the computer-based analysis of archaeological data. Permission of instructor required.

Learning Outcomes: 1. Describe, document, and record archaeological data and their spatial relationships in the field. 2. Apply basic archaeological field methods, including excavation, mapping, and data recording. 3. Practice database management, including sorting and labeling artifacts and samples, and maintaining a catalog of data. Credits: 1.00 to 9.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing

it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

CLCS 22000 - Topics In Classical Literature

Credit Hours: 3.00. Selected topics in Greek and Roman literature. All readings in English translation.

Learning Outcomes: 1. Gain a detailed historical understanding of the development of a specific genre or topic within ancient Greek and Roman literature. 2. Ability to appreciate and intelligently discuss major themes in ancient Greek and Roman literature through close reading of representative texts. 3. Ability to identify specific examples of the influence of the ancient Greek and Roman literature on the literature of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 38000 - Alexander The Great And Hellenistic World (UCC: HUM)

Credit Hours: 3.00. Course examines the career of Alexander the Great and the rise of Macedonia in the Hellenistic Era. Topics include the emergence of Macedonia under Philip II; the achievements of Alexander the Great; and the wars of succession following his demise.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice.
Credits: 3.00

CLCS 38600 - Ancient Greek Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Greece, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the ancient Greek world from the Mycenaean to the Hellenistic period. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 48000 - Potters And Society In Antiquity

Credit Hours: 3.00. Course covers the range of eastern Mediterranean ceramics encountered in Rough Cilicia Archaeological Survey Project from the Bronze Age to the Later Roman Empire. Course also explores strategies employed by archaeologists and historians to exploit ceramics as research materials.

Credits: 3.00

CLCS 48100 - Culture And Society In The Age Of Pericles

Credit Hours: 3.00. Course explores interrelationships between the emergence of Greek democracy and the cultural, political, social, and economic rise of Athens in the fifth century BCE. More broadly, course surveys history of the Greek world from the Late Bronze Age to 362 BCE.

Credits: 3.00

CLCS 48300 - Republican Rome

Credit Hours: 3.00. Course examines the military, political, economic, and social developments that enabled the Roman people to expand from an Italian city-state to a trans-Mediterranean empire, and the consequences that initiated the decline and transition in their republican form of government.

Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical historians in the original Greek.

Credits: 3.00

HEBR 28400 - Ancient Near Eastern History And Culture

Credit Hours: 3.00. This course is a survey of the development of the ancient Near East, from its pre-history to Alexander the Great. It emphasizes the evolutions of various Near Eastern cultures in their many manifestations; art, government, agriculture, economics, philosophy, religion, ethics, and science. Taught in English.

Learning Outcomes: 1. Understand the difference between pre-history and history. 2. Understand various ancient and modern ideas of the purpose of writing history. 3. Understand how the invention of writing and the origins of cities were coordinate developments. 4. Understand something of the flow of empires that succeeded each other, eventually displaced by the empire of Alexander the Great, whose conquests shaped the contours of the world

much as we know it. 5. Become aware how art reflects the development of thought and idealism; how ideas of human government evolved; how religion, science, agriculture, and much else developed as empires built onto those they displaced. Credits: 3.00

HIST 31700 - A History Of The Christian Church And The Expansion Of Christianity I

Credit Hours: 3.00. A history of the emergence of Christianity, the development of the Christian church, and the impact of Christian thought and institutions upon western Europe prior to the Reformation.

Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

C. General Studies Courses (3 credits)

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CLCS 23300 - Comparative Mythology (UCC: HUM)

Credit Hours: 3.00. Comparative study of the myths of major ancient cultures, with emphasis on shared typological features.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of principal characters, narratives, and themes in the myths of a number of representative ancient world cultures (Mesopotamian, Egyptian, Celtic, Aztec, Mayan, East Asian, African); 2. Be able to appreciate the many functions of myths within ancient societies, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify recurrent patterns and themes in the myths of historically disparate ancient and modern cultures. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23600 - Ancient World Onscreen

Credit Hours: 3.00. How film represents ancient Mediterranean civilizations and retells ancient myths; how cinematic renderings of ancient history shape views of the past and how these are affected by contemporary sensibilities. No knowledge of Greek or Latin required.

Learning Outcomes: 1. Have a detailed historical grasp of the ways in which the ancient Greek and Roman worlds have found expression in modern cinema; 2. Be able to appreciate how ancient texts fare when translated into the radically different artistic medium of film; and 3. Be able to discuss intelligently what forces influence how we

choose to see and represent the ancient western world. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the influence of ancient Greek tragedy on the drama of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 33700 - The Ancient Epic

Credit Hours: 3.00. Study of the epic in four ancient cultures, with emphasis on its structure, nature, and social functions. Readings may include Gilgamesh, Iliad, Odyssey, Aeneid, Beowulf, Tain, Mahabharata, and others.

Learning Outcomes: 1. Gain an enhanced understanding of the nature and development of the genre of epic through close reading of representative samples of the genre from different ancient cultures. 2. Ability to appreciate and intelligently discuss major themes in epic as they relate to both ancient and modern views of the heroic. 3. Ability to identify specific examples of the influence of ancient epic on the literature of the later western world. Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-

reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

GREK 10100 - Ancient Greek Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to the grammar of Attic Greek of the Classical period, and first forays into the reading of connected prose. Emphasis on accidence, syntax, and vocabulary building.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain foundational Ancient Greek grammar and demonstrate familiarity with core vocabulary. 2. Bring together their knowledge of Ancient Greek grammar and vocabulary, creating clear English translations by analyzing basic texts adapted from Ancient Greek literature. 3. Apply this knowledge of grammar and vocabulary to writing simple sentences in Ancient Greek, and translating from English to Ancient Greek. Credits: 3.00

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn basics of reading and translating ancient Greek, completing their introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 20100 - Ancient Greek Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in New Testament Greek, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn how to apply foundational knowledge of ancient Greek grammar and syntax to readings in the New Testament. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 34400 - Greek Epic

Credit Hours: 3.00. Readings and discussion of the Greek epic, including selected passages from Homer and Hesiod.

Credits: 3.00

GREK 35300 - Greek Tragedy

Credit Hours: 3.00. Reading and discussion of selected Greek tragedies of the 5th century BCE.

Credits: 3.00

GREK 35400 - Greek Comedy

Credit Hours: 3.00. Readings and discussion of selected Greek comedies of the 4th and 5th centuries BCE.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical

historians in the original Greek.

Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating

Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts. Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 49000 - Directed Reading In Latin

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their disciplines. Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.

Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such

as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

LATN 10500 - Accelerated Basic Latin

Credit Hours: 4.00. Foundational Latin grammar course designed to prepare students to read classical and post-classical Latin in a single intensive semester. Focus on grammar, syntax, vocabulary, and elementary readings. The accelerated Latin course assumes *no* previous knowledge of Latin and makes it possible for the diligent student to be able to read *any* Latin prose or poetry (with a dictionary) after a single semester. (Upon completion students will be prepared to enroll in Latin 201.)

Learning Outcomes: 1. Recite Latin texts aloud (with accurate pronunciation, meaningful phrase grouping, and appropriate voice inflection) by imitating models they have heard in class. 2. Analyze Latin texts by identifying and describing the basic elements of Latin grammar, sentence structure, and style. 3. Translate intermediate level un-adapted Latin texts into English. 4. Compose complex sentences while writing a short story in Latin. Credits: 4.00

GREK 10500 - Accelerated Introductory Ancient Greek

Credit Hours: 4.00. This course is an accelerated beginning-level course designed to develop language proficiency in Ancient Greek. The course will help students progress toward competence in reading and writing, as well as toward knowledge of Ancient Greek culture. The course focuses on developing deep understanding of Greek syntax and morphology and building strategies for fluent and accurate reading of ancient texts. Primary language of instruction is English.

Learning Outcomes: 1. Differentiate the syntactic structures used in Ancient Greek sentences and longer texts based on the study of model sentences. 2. Compose sentences in Ancient Greek by focusing on a set of grammatical rules and standards in the language. 3. Recite Ancient Greek aloud with accuracy and fluency and demonstrate their ability in in-class text readings and recordings. 4. Infer the meaning of unknown vocabulary in context by reading stories. 5. Identify and analyze grammatical forms in the Greek contexts in which they are used. 6. Generate smooth-flowing and elegant English translations of the Greek, attending to inherent differences in style and structure. Credits: 4.00

D. Material Culture & History Selectives (15 credits)

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-16 Credits

Spring 1st Year

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

15 Credits

Fall 2nd Year

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Classical Studies: World Languages Teaching Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (71 credits)

Pre-Requisite Languages Courses

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to reinforce

knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

A. Classical Studies Foundational Courses (6 Credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

Education Track (18 credits)

B. Culture and Civilization (3 credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

C. Etymology Course (3 credits)

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

D. Latin Literature Courses (9 credits)

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and

appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts. Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.

Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

E. Classics Selective (3 credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the influence of ancient Greek tragedy on the drama of the later western world. Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

Other Departmental - CLA Core (12 credits)

Core III: Linguistic Diversity (0 credits)

Foundational Requirements (12 credits)

Notes

Electives (37 credits)

Grade Requirements

GPA Requirements

Teacher Licensure Information

Course Requirements & Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes

students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

15 Credits

Spring 1st Year

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in

English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

EDCI 28500 - Multiculturalism And Education (UCC: BSS)

Credit Hours: 2.00 to 3.00. This course integrates an understanding of multiculturalism with principles of democratic education. Historical, sociological, cultural, political, philosophical, and pedagogical foundations of multiculturalism are explored and related to issues of pedagogy in a pluralistic society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop awareness of issues and concerns related to multicultural education. 2. Develop knowledge of how multiculturalism impacts teachers, schools, classrooms, and society. 3. Develop skills of critical thinking and reflection that will enable educators to contribute to meeting the needs of students in a multicultural and global world. Credits: 2.00 to 3.00

15 Credits

Fall 2nd Year

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 24000 - Children With Gifts, Creativity, And Talents

Credit Hours: 1.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted children youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). Cannot be taken concurrently with EDPS 24800.

Learning Outcomes: 1. Understand who gifted, creative and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 1.00

EDCI 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. (EDCI 20002) This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI

37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works well with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

16 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3.

Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000. Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common

inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

15 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

17 Credits

Spring 3rd Year

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of

various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4. Recognize how theories of individual and collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6.

Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

15 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Communication: Business Communication Concentration, BA

About the Program

Degree Requirements

Communication: Business Communication Concentration (15 credits)

Required Course (3 credits)

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

Concentration Selectives (12 credits)

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends

that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 31200 - Rhetoric In The Western World

Credit Hours: 3.00. An explanation of major theoretical and philosophical concepts concerning rhetoric; the relationships between rhetoric and political, social, and personal decisions are explored. Ancient and modern authors will be read.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 32800 - Diversity At Work: A Rhetorical Approach

Credit Hours: 3.00. Introduces students to theories and experiences related to issues dealing with both diversity in the workplace and diversity at work to change or influence the world.

Credits: 3.00

COM 37400 - Social Interaction Skills: Assessment And Development

Credit Hours: 3.00. An examination of several major communication skills and procedures for their development. Focus is on skill measurement, methods of enhancement, assessment of training programs, and personal skill development. Skills examined include those for conversing, managing conflict, providing support, and influencing.

Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

COM 49600 - Special Topics In Corporate Communication

Credit Hours: 3.00. This course offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments on current issue in corporate communication. Topics may include diversity in the workplace, organizational assessments, or spirituality in organizations. Permission of instructor required.

Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the

reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

COM 44400 - Introduction To Communication And Social Entrepreneurship

Credit Hours: 3.00. This class introduces students to the roles that communication and innovation play in social entrepreneurship. It explores activities of entrepreneurs, ethics and skill development at the individual and organizational levels, and communication functions in not-for-profit and social venture space.

Learning Outcomes: 1. Identify the major components of communication and social change. 2. Describe the social economy. 3. Articulate how both social entrepreneurship and social innovation benefit society. 4. Describe the difference between nonprofit organizations (NPs), social action efforts, NGOs and social enterprises, as well as traditional entrepreneurship, social entrepreneurship, social intrapreneurship and social innovation. 5. Explain how social enterprises function in different sectors and regions, of various sizes, with vastly different missions. 6. Articulate the challenges social entrepreneurs face as they startup, develop, and communicate with various publics. 7. Identify the best approaches and communication tools that can be deployed to assist in ""getting out the message"" about NP goals and objectives. Credits: 3.00

COM 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

COM 49507 - Executive Communication

Credit Hours: 3.00. This course defines executive communication, offers a rationale for its importance, provides a catalog of deliverables (or tactics) involved in the practice,

teaches students how to create those deliverables, and provides students with the tools to serve as strategic advisors to senior leaders. The ultimate goal of the course is to help students become more well-rounded and successful communication professionals.

Learning Outcomes: 1. Describe the breadth, depth and nuance of executive communication. 2. Create various internal and external executive communication deliverables. 3. Conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis of an executive's communication. 4. Define and execute the role of serving as a strategic communication advisor to an executive. 5. Learn from and connect with established communication professionals. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Required Course (3 credits)

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

Electives (4-41 credits)

Additional Information

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

13-16 Credits

13-16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

12-13 Credits

12-13 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

12-18 Credits

12-18 Credits

Spring 2nd Year

13-15 Credits

13-15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and

future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

15-17 Credits

15-17 Credits

Fall 4th Year

14 Credits

14 Credits

Spring 4th Year

15-18 Credits

15-18 Credits

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

13-16 Credits

13-16 Credits

About the Program

Communication: Communication of Science and Technology Concentration, BA

About the Program

Degree Requirements

Communication: Communication of Science and Technology Concentration (15 credits)

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Electives (4-41 credits)

Additional Information

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum

resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15-16 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14 Credits

Communication: General Communication Concentration, BA

About the Program

Degree Requirements

Communication: General Communication Concentration (15 credits)

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of

newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages.

Credits: 3.00

COM 26100 - Introduction To Digital Video Production

Credit Hours: 3.00. Basic production principles and practices. Emphasis on preplanning and conceptualizing skills in addition to practical production techniques. Required for admission to all television production courses. Permission of department required.

Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 31200 - Rhetoric In The Western World

Credit Hours: 3.00. An explanation of major theoretical and philosophical concepts concerning rhetoric; the relationships between rhetoric and political, social, and personal decisions are explored. Ancient and modern authors will be read.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and

future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 32800 - Diversity At Work: A Rhetorical Approach

Credit Hours: 3.00. Introduces students to theories and experiences related to issues dealing with both diversity in the workplace and diversity at work to change or influence the world.

Credits: 3.00

COM 33000 - Theories Of Mass Communication

Credit Hours: 3.00. An examination of mass communication theories and theorists. Readings and discussion of McLuhan, Lippman, De Fleur, Lazarsfeld, Schramm, Stephenson, and other significant contributors.

Credits: 3.00

COM 33600 - Advertising Media Strategy

Credit Hours: 3.00. Theory and practice of advertising as applied to advertising media strategy. Students build on a foundation of integrated marketing communication to develop digital advertising campaigns.

Learning Outcomes: 1. Explain how practitioners develop advertising campaigns. 2. Design and execute digital marketing plans. 3. Offer suggestions and feedback to classmates in a constructive manner. Credits: 3.00

COM 35100 - Mass Communication Ethics

Credit Hours: 3.00. A survey of various ethical approaches applied to situations confronting contemporary mass communicators, including misrepresentation in newsgathering, protection of sources, suppression of information, reporting of terror and violence, pressure from management and advertisers, and reporter bias.

Credits: 3.00

COM 35200 - Mass Communication Law

Credit Hours: 3.00. Study of Anglo-American traditions and trends as well as current American conditions of the laws of libel, privacy, fair comment and criticism, privilege, property rights, and copyright as such factors affect the print journalist and the broadcaster. Emphasis is on existing state and federal regulations and precedents.

Credits: 3.00

COM 35300 - Problems In Public Relations

Credit Hours: 3.00. Approaches to problems in public relations as they occur in industry, government, education, social agencies, and other institutions.

Learning Outcomes: 1. Develop an attitude of professionalism and tact. 2. Expand existing knowledge about theories in the practice of public relations. 3. Gain a greater understanding of the use of the tools of public relations practice. 4. Recognize types of public relations challenges and how to address them. 5. Work effectively and efficiently as a strong team member. 6. Write and edit well, and know how to improve at both. 7. Feel an increase in self-confidence and professionalism that will help with career advancement. Credits: 3.00

COM 35600 - Problems In Advertising

Credit Hours: 3.00. Approaches to problems in advertising as they involve the planning, creation, and evaluation of commercial messages.

Credits: 3.00

COM 37200 - Communication In Relationships

Credit Hours: 3.00. An examination of communication in personal relationships (including dating and marital relationships, friendships, and families) and professional relationships (including co-worker and supervisor-supervisee relationships and relationships in specific professions, such as doctor-patient and attorney-client).

Credits: 3.00

COM 37400 - Social Interaction Skills: Assessment And Development

Credit Hours: 3.00. An examination of several major

communication skills and procedures for their development. Focus is on skill measurement, methods of enhancement, assessment of training programs, and personal skill development. Skills examined include those for conversing, managing conflict, providing support, and influencing.

Credits: 3.00

COM 37600 - Communication And Gender

Credit Hours: 3.00. Course is based on the assumption that studies of gender and communication are intertwined. Focus is on communication processes that create symbols of gender and how those processes recreate the meanings of gender in the lives of individuals and groups.

Credits: 3.00

COM 38100 - Gender And Feminist Studies In Communication

Credit Hours: 3.00. This course examines the ways in which communication constructs and maintains our conceptions of gender. It explores different approaches to the study of gender and feminist issues in public, organizational, and mass communication.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 40800 - News Magazine Production

Credit Hours: 3.00. Students plan, write and produce a weekly video news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts. 4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 40900 - Video Journalism

Credit Hours: 3.00. Students plan, write and produce a weekly news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts. 4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social

phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

COM 41600 - United States Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the U.S.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Able to create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Able to write correctly and clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 42300 - Leadership, Communication And Organizations

Credit Hours: 3.00. This course explores leadership from a communication perspective. It examines topics such as leadership styles, leading change, influencing others, emotional intelligence, burnout, and engagement. Permission of instructor required.

Learning Outcomes: 1. Able to assess leadership styles. 2. Examine the relationship between leaders and followers in organizations. 3. Critique the literature in the area of communication and leadership. Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

COM 44700 - The Television Documentary

Credit Hours: 3.00. Study and application of principles of documentary television formats. Students will research an appropriate topic for documentary treatment and produce that program during the semester. Documentary formats examined include news, biographical, ethnographic, and documentary drama.

Credits: 3.00

COM 45600 - Advertising Writing

Credit Hours: 3.00. The theory and practice of copy writing in various advertising contexts.

Credits: 3.00

COM 49100 - Special Topics In Communication

Credit Hours: 1.00 to 3.00. Intensive study of selected topics, varying from semester to semester, from the literature or practice of communication. Course content will be drawn from areas not dealt with in the regular curriculum and may include such topics as photojournalism, economic reporting, and campaign communication. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of a specialized area of communication and its common applications. Credits: 1.00 to 3.00

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 49600 - Special Topics In Corporate Communication

Credit Hours: 3.00. This course offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments on current issue in corporate communication. Topics may include diversity in the workplace, organizational assessments, or spirituality in organizations. Permission of instructor required.

Credits: 3.00

COM 49700 - Special Topics In Mass Communication

Credit Hours: 3.00. Offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments, a current topic or trend in Media, Technology and Society. Possible offerings include Media and Social Change, Online Communities, and Technology and International Communication.

Credits: 3.00

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism, political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

COM 44400 - Introduction To Communication And Social Entrepreneurship

Credit Hours: 3.00. This class introduces students to the roles that communication and innovation play in social entrepreneurship. It explores activities of entrepreneurs, ethics and skill development at the individual and organizational levels, and communication functions in not-for-profit and social venture space.

Learning Outcomes: 1. Identify the major components of communication and social change. 2. Describe the social economy. 3. Articulate how both social entrepreneurship and social innovation benefit society. 4. Describe the difference between nonprofit organizations (NPs), social action efforts, NGOs and social enterprises, as well as traditional entrepreneurship, social entrepreneurship, social intrapreneurship and social innovation. 5. Explain how social enterprises function in different sectors and regions, of various sizes, with vastly different missions. 6. Articulate the challenges social entrepreneurs face as they startup, develop, and communicate with various publics. 7. Identify the best approaches and communication tools that can be deployed to assist in ""getting out the message"" about NP goals and objectives. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both

informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 49101 - Boiler Communication

Credit Hours: 1.00. This course provides a practical, hands-on approach to public relations by working in student-led teams to produce comprehensive, strategic communication campaigns for actual clients. The course also includes many opportunities for professional development and portfolio building.

Learning Outcomes: 1. Experience a real public relations campaign. 2. Develop professionally to be able to start a public relations career. 3. Use creativity and critical thinking to help clients with public relations needs while engaging in social responsibility. Credits: 1.00

COM 49501 - Sports Media Relations

Credit Hours: 3.00. This course examines the role of public relations and mass media in sports communication. It provides an understanding of the operation of sports media and communication and how sports information departments perform their functions. Emphasis is on written communication from athletics communication perspective.

Learning Outcomes: 1. Develop a clear understanding of the day to day responsibilities of sports public relations professionals. 2. Develop attention-grabbing writing skills that reflect an understanding of news judgment. 3. Learn about press box and game-management operations at a sports event, including news conference set-up and execution, coordination of interview requests, quote-gathering, and information and statistics updates and distribution. 4. Create promotional, multimedia content at a sports event, including written features, press releases, social media, video and infographics. 5. Explore communication strategies used by sports media relations professionals in breaking-news situations. 6. Study the evolution of the relationship between media and sports organizations. 7. Learn about the scope of responsibilities of sports media relations professionals, including the coordination of managed news events and special events, the production of media guides, the execution of publicity campaigns, and crisis communications. 8. Understand the effects of evolving technology and social media on sports media relations. Credits: 3.00

COM 49502 - Travel Writing

Credit Hours: 3.00. Travel writing is writing about places, persons, and things in other places-also writing about how to travel, when to travel, and advice on traveling-all with the reader in mind. It's about relaying your travel experiences to others so that they may emulate them or at the very least not make the same mistakes you did. And it's writing about things in your own back yard that are exotic to everyone else-a local farmer's market, historic site, restaurant, museum. In this class, you will explore the various ways travel writers can excite and assist readers.

Learning Outcomes: 1. Gain experience in writing effectively. 2. Identify typical features of travel writing genres. 3. Use research and observation as building blocks for travel writing. 4. Produce a variety of articles within this genre. 5. Understand the "business" of travel writing. Credits: 3.00

COM 33701 - Producing Digital Advertising

Credit Hours: 3.00. This course is designed as an advanced

level production course. Through lectures, discussions, critiques, screenings, and various exercises, you will gain experience designing video advertisements. You will develop and refine critical viewing/listening abilities to effectively analyze video content for aesthetic elements and overall message. Additionally, you will apply production techniques pertaining to producing, directing, shooting and editing in the creation of projects for real clients. The coursework consists of three major video projects, and a series of assignments organized under the corporate role that would be performing those tasks.

Learning Outcomes: 1. Work with a client in the development of a digital media advertisement. 2. Develop the concept for a digital media advertisement. 3. Pitch the idea for a digital media advertisement. 4. Write the script for a digital media advertisement. 5. Coordinate the production schedule for a digital media advertisement project. 6. Supervise videography for a digital media advertisement. 7. Complete post-production for a digital media advertisement. 8. Critique the final edit of a digital media advertisement. Credits: 3.00

COM 49503 - Public Relations For Social Change

Credit Hours: 3.00. The overarching goal of this course is for students to work cooperatively with a community partner to identify, define and address that organization's PR problems and opportunities from a long-term, in-house perspective, building on the work of previous students and incorporating social change theory from a relationship management perspective of PR. The applied work of this course will have the dual benefit of providing students the opportunity to gain contextualized, real-world experience at PR problem-solving and advancing the mission of a nonprofit organization that is important to the wellbeing of the Greater Lafayette community as a whole.

Learning Outcomes: 1. Construct and devise a strategic and mission-focused PR plan and critically evaluate its effects. 2. Explain and demonstrate how storytelling and community relations PR strategies can be used as tools for social change. 3. Describe how their own PR skillsets can be means for future civic engagement. 4. Develop an increased sense of efficacy when it comes to matters of civic engagement and PR practice. 5. Develop a broader view of how PR as a discipline can be applied within a community. Credits: 3.00

COM 49505 - Sports Communication

Credit Hours: 3.00. This class will help students learn to think critically about sports communication, but it will also help students learn to do sports communication. Through the use of sports books and movies, guest speakers, field trips, and case studies, students will learn not only about sports communication as a field of study and a profession, but also how they can be more thoughtful consumers of sports communication in its various forms.

Learning Outcomes: 1. Describe multiple ways that sports communication constructs and maintains culture. 2. Explain changes in sports communication related to race and gender. 3. List five key events in the last 100 years of sports communication. 4. List and analyze issues related to naming in sports. 5. Create a basic sports crisis communication plan. 6. Frame labor-management sports communication issues from both perspectives. Credits: 3.00

COM 33200 - Television Production

Credit Hours: 3.00. Basic principles of producing, writing, and directing for television. Treats program types and television criticism, and explores creative treatment of visual, artistic, and nonverbal elements of communication in television. Permission of department required.

Learning Outcomes: 1. Utilize the terminology used in studio production settings. 2. Conceptualize a studio production. 3. Script a studio production using correct industry format. 4. Develop critical viewing/listening skills and analytical abilities necessary to evaluate the content of video productions. 5. Demonstrate the proper operation of studio production equipment. 6. Work constructively as a member of a production team. 7. Produce a television studio program. 8. Direct a television studio program from a prewritten script. Credits: 3.00

COM 27100 - Podcasting

Credit Hours: 3.00. This directed study is designed as an introduction to podcasting. Students in the course will learn

about the structure and development of podcasting campaigns, then create their own weekly recording. Recording begins in the third week of classes, giving students 14 opportunities to develop their program.

Learning Outcomes: 1. Develop an idea for a podcast. 2. Write a treatment for a podcast. 3. Pitch the idea for a podcast to an audience. 4. Create a production outline. 5. Produce a budget for the work produced and identify potential funding sources for the project. 6. Execute an advertising campaign for a podcast. 7. Coordinate a schedule for a podcast recording. 8. Evaluate the finished production and the experience of creating that work. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

COM 49504 - Social Media For Social Good

Credit Hours: 3.00. Nonprofit organizations advance their missions through communication. This course is designed to introduce students to the use of social media by nonprofit organizations to create their brand and reach stakeholders. It will focus on best practices and critically assess local nonprofits return on social media investment.

Learning Outcomes: 1. Discuss the importance of social media to nonprofits for communicating, marketing, public relations, and fundraising. 2. Discuss the measurement of social media effectiveness in communicating messages and in fundraising. 3. Conduct a social media audit. 4. Develop a nonprofit social media strategy. Credits: 3.00

COM 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

COM 49701 - Live Sports Broadcasting Summer

Credit Hours: 1.00. In this experiential Live Sports Broadcasting course in partnership with the Lafayette Aviators, students will have the opportunity to work in the studio at Loeb Stadium in Lafayette, operate cameras on the field, produce promotional material to be used before, during, and after games, and interview players for segments on The Purdue Channel. The class spans the home season of the Aviators. Students are expected to register for all 3 1-credit modules in a summer. Permission of instructor required.

Learning Outcomes: 1. Demonstrate live sports broadcasting techniques including: studio operation, camera operation, play-by-play and commentary. 2. Interview athletes and staff for broadcast. 3. Develop promotional videos for

The Purdue Channel and/or the Aviators. Credits: 1.00

COM 49507 - Executive Communication

Credit Hours: 3.00. This course defines executive communication, offers a rationale for its importance, provides a catalog of deliverables (or tactics) involved in the practice, teaches students how to create those deliverables, and provides students with the tools to serve as strategic advisors to senior leaders. The ultimate goal of the course is to help students become more well-rounded and successful communication professionals.

Learning Outcomes: 1. Describe the breadth, depth and nuance of executive communication. 2. Create various internal and external executive communication deliverables. 3. Conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis of an executive's communication. 4. Define and execute the role of serving as a strategic communication advisor to an executive. 5. Learn from and connect with established communication professionals. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Electives (4-41 credits)

Additional Information

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15-16 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of

public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14 Credits

Communication: Health Communication Concentration, BA

About the Program

Degree Requirements

Communication: Health Communication Concentration (15 credits)

Required Course (3 credits)

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

Concentration Selectives (12 credits)

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32800 - Diversity At Work: A Rhetorical Approach

Credit Hours: 3.00. Introduces students to theories and experiences related to issues dealing with both diversity in the workplace and diversity at work to change or influence the world.

Credits: 3.00

COM 33000 - Theories Of Mass Communication

Credit Hours: 3.00. An examination of mass communication theories and theorists. Readings and discussion of McLuhan, Lippman, De Fleur, Lazarsfeld, Schramm, Stephenson, and other significant contributors.

Credits: 3.00

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore

the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 49507 - Executive Communication

Credit Hours: 3.00. This course defines executive communication, offers a rationale for its importance, provides a catalog of deliverables (or tactics) involved in the practice, teaches students how to create those deliverables, and provides students with the tools to serve as strategic advisors to senior leaders. The ultimate goal of the course is to help students become more well-rounded and successful communication professionals.

Learning Outcomes: 1. Describe the breadth, depth and nuance of executive communication. 2. Create various internal and external

executive communication deliverables. 3. Conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis of an executive's communication. 4. Define and execute the role of serving as a strategic communication advisor to an executive. 5. Learn from and connect with established communication professionals. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Electives (4-41 credits)

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15-16 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages.
Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14 Credits

Communication: Interpersonal Communication Concentration, BA

About the Program

Degree Requirements

Communication: Interpersonal Communication Concentration (15 credits)

Required Course (3 credits)

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

Concentration Selectives (12 credits)

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 37200 - Communication In Relationships

Credit Hours: 3.00. An examination of communication in personal relationships (including dating and marital relationships, friendships, and families) and professional relationships (including co-worker and supervisor-supervisee relationships and relationships in specific professions, such as doctor-patient and attorney-client).

Credits: 3.00

COM 37400 - Social Interaction Skills: Assessment And Development

Credit Hours: 3.00. An examination of several major communication skills and procedures for their development. Focus is on skill measurement, methods of enhancement, assessment of training programs, and personal skill development. Skills examined include those for conversing, managing conflict, providing support, and influencing.

Credits: 3.00

COM 37600 - Communication And Gender

Credit Hours: 3.00. Course is based on the assumption that studies of gender and communication are intertwined. Focus is on communication processes that create symbols of gender and how those processes recreate the meanings of gender in the lives of individuals and groups.

Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the

application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 49100 - Special Topics In Communication

Credit Hours: 1.00 to 3.00. Intensive study of selected topics, varying from semester to semester, from the literature or practice of communication. Course content will be drawn from areas not dealt with in the regular curriculum and may include such topics as photojournalism, economic reporting, and campaign communication. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of a specialized area of communication and its common applications. Credits: 1.00 to 3.00

Electives (25-49 credits)

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15-16 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC) Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working

knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14 Credits

Communication: Media and Mass Communication Concentration, BA

About the Program

Degree Requirements

Communication: Media and Mass Communication Concentration (15 credits)

Required Course (3 credits)

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

Concentration Selectives (12 credits)

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals,

institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 26100 - Introduction To Digital Video Production

Credit Hours: 3.00. Basic production principles and practices. Emphasis on preplanning and conceptualizing skills in addition to practical production techniques. Required for admission to all television production courses. Permission of department required.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 33000 - Theories Of Mass Communication

Credit Hours: 3.00. An examination of mass communication theories and theorists. Readings and discussion of McLuhan, Lippman, De Fleur, Lazarsfeld, Schramm, Stephenson, and other significant contributors.

Credits: 3.00

COM 35100 - Mass Communication Ethics

Credit Hours: 3.00. A survey of various ethical approaches applied to situations confronting contemporary mass communicators, including misrepresentation in newsgathering, protection of sources, suppression of information, reporting of terror and violence, pressure from management and advertisers, and reporter bias.

Credits: 3.00

COM 35200 - Mass Communication Law

Credit Hours: 3.00. Study of Anglo-American traditions and trends as well as current American conditions of the laws of libel, privacy, fair comment and criticism, privilege, property rights, and copyright as such factors affect the print journalist and the broadcaster. Emphasis is on existing state and federal regulations and precedents.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 40800 - News Magazine Production

Credit Hours: 3.00. Students plan, write and produce a weekly video news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts. 4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 40900 - Video Journalism

Credit Hours: 3.00. Students plan, write and produce a weekly news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts. 4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

COM 44700 - The Television Documentary

Credit Hours: 3.00. Study and application of principles of documentary television formats. Students will research an appropriate topic for documentary treatment and produce that program during the semester. Documentary formats examined include news, biographical, ethnographic, and documentary drama.

Credits: 3.00

COM 49700 - Special Topics In Mass Communication

Credit Hours: 3.00. Offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments, a current topic or trend in Media, Technology and Society. Possible offerings include Media and Social Change, Online Communities, and Technology and International Communication.

Credits: 3.00

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism, political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

COM 49501 - Sports Media Relations

Credit Hours: 3.00. This course examines the role of public relations and mass media in sports communication. It provides an understanding of the operation of sports media and communication and how sports information departments perform their functions. Emphasis is on written communication from athletics communication perspective.

Learning Outcomes: 1. Develop a clear understanding of the day to day responsibilities of sports public relations professionals. 2. Develop attention-grabbing writing skills that reflect an understanding of news judgment. 3. Learn about press box and game-management operations at a sports event, including news conference set-up and execution, coordination

of interview requests, quote-gathering, and information and statistics updates and distribution. 4. Create promotional, multimedia content at a sports event, including written features, press releases, social media, video and infographics. 5. Explore communication strategies used by sports media relations professionals in breaking-news situations. 6. Study the evolution of the relationship between media and sports organizations. 7. Learn about the scope of responsibilities of sports media relations professionals, including the coordination of managed news events and special events, the production of media guides, the execution of publicity campaigns, and crisis communications. 8. Understand the effects of evolving technology and social media on sports media relations. Credits: 3.00

COM 49502 - Travel Writing

Credit Hours: 3.00. Travel writing is writing about places, persons, and things in other places-also writing about how to travel, when to travel, and advice on traveling-all with the reader in mind. It's about relaying your travel experiences to others so that they may emulate them or at the very least not make the same mistakes you did. And it's writing about things in your own back yard that are exotic to everyone else-a local farmer's market, historic site, restaurant, museum. In this class, you will explore the various ways travel writers can excite and assist readers.

Learning Outcomes: 1. Gain experience in writing effectively. 2. Identify typical features of travel writing genres. 3. Use research and observation as building blocks for travel writing. 4. Produce a variety of articles within this genre. 5. Understand the "business" of travel writing. Credits: 3.00

COM 44900 - Media Management

Credit Hours: 3.00. An introduction to management for mass media outlets. The course will explore management styles and techniques in a variety of media situations, including radio, television, and internet-based business models. Topics such as business structure, advertising and promotion, programming, and leadership style will be included in the discussion. This class is designed as both a philosophical and practical model. Students will discover the theories and principles behind the structure of media businesses, as well as put those ideas into practice in real world situations. Students in the course will be responsible for the programming and promotion of the Brian Lamb School of Communication's channel space on Boiler TV. A mini internship experience is introduced in the second half of the semester, giving the student an opportunity to sample what these opportunities are like.

Learning Outcomes: 1. Define the roles of a media manager. 2. Program a media outlet's weekly schedule. 3. Promote a media outlet's programming to a target audience. 4. Produce a case study of an active media outlet. 5. Identify the characteristics of an effective media manager. 6. Work constructively as a member of a management team. 7. Create a long-range plan of operation for a media outlet. 8. Present findings from a media case study. 9. Conduct a programming and promotion meeting with a team. Credits: 3.00

COM 33701 - Producing Digital Advertising

Credit Hours: 3.00. This course is designed as an advanced level production course. Through lectures, discussions, critiques, screenings, and various exercises, you will gain experience designing video advertisements. You will develop and refine critical viewing/listening abilities to effectively analyze video content for aesthetic elements and overall message. Additionally, you will apply production techniques pertaining to producing, directing, shooting and editing in the creation of projects for real clients. The coursework consists of three major video projects, and a series of assignments organized under the corporate role that would be performing those tasks.

Learning Outcomes: 1. Work with a client in the development of a digital media advertisement. 2. Develop the concept for a digital media advertisement. 3. Pitch the idea for a digital media advertisement. 4. Write the script for a digital media advertisement. 5. Coordinate the production schedule for a digital media advertisement project. 6. Supervise videography for a digital media advertisement. 7. Complete post-production for a digital media advertisement. 8. Critique the final edit of a digital media advertisement. Credits: 3.00

COM 33200 - Television Production

Credit Hours: 3.00. Basic principles of producing, writing, and directing for television. Treats program types and television criticism, and explores creative treatment of visual, artistic, and nonverbal elements of communication in television. Permission of department required.

Learning Outcomes: 1. Utilize the terminology used in studio production settings. 2. Conceptualize a studio production. 3. Script a studio production using correct industry format. 4. Develop critical viewing/listening skills and analytical abilities necessary to evaluate the content of video productions. 5. Demonstrate the proper operation of studio production equipment. 6. Work constructively as a member of a production team. 7. Produce a television studio program. 8. Direct a television studio program from a prewritten script. Credits: 3.00

COM 27100 - Podcasting

Credit Hours: 3.00. This directed study is designed as an introduction to podcasting. Students in the course will learn about the structure and development of podcasting campaigns, then create their own weekly recording. Recording begins in the third week of classes, giving students 14 opportunities to develop their program.

Learning Outcomes: 1. Develop an idea for a podcast. 2. Write a treatment for a podcast. 3. Pitch the idea for a podcast to an audience. 4. Create a production outline. 5. Produce a budget for the work produced and identify potential funding sources for the project. 6. Execute an advertising campaign for a podcast. 7. Coordinate a schedule for a podcast recording. 8. Evaluate the finished production and the experience of creating that work. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

COM 49504 - Social Media For Social Good

Credit Hours: 3.00. Nonprofit organizations advance their missions through communication. This course is designed to introduce students to the use of social media by nonprofit organizations to create their brand and reach stakeholders. It will focus on best practices and critically assess local nonprofits return on social media investment.

Learning Outcomes: 1. Discuss the importance of social media to nonprofits for communicating, marketing, public relations, and fundraising. 2. Discuss the measurement of social media effectiveness in communicating messages and in fundraising. 3. Conduct a social media audit. 4. Develop a nonprofit social media strategy. Credits: 3.00

COM 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use

appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

COM 49701 - Live Sports Broadcasting Summer

Credit Hours: 1.00. In this experiential Live Sports Broadcasting course in partnership with the Lafayette Aviators, students will have the opportunity to work in the studio at Loeb Stadium in Lafayette, operate cameras on the field, produce promotional material to be used before, during, and after games, and interview players for segments on The Purdue Channel. The class spans the home season of the Aviators. Students are expected to register for all 3 1-credit modules in a summer. Permission of instructor required.

Learning Outcomes: 1. Demonstrate live sports broadcasting techniques including: studio operation, camera operation, play-by-play and commentary. 2. Interview athletes and staff for broadcast. 3. Develop promotional videos for The Purdue Channel and/or the Aviators. Credits: 1.00

COM 49507 - Executive Communication

Credit Hours: 3.00. This course defines executive communication, offers a rationale for its importance, provides a catalog of deliverables (or tactics) involved in the practice, teaches students how to create those deliverables, and provides students with the tools to serve as strategic advisors to senior leaders. The ultimate goal of the course is to help students become more well-rounded and successful communication professionals.

Learning Outcomes: 1. Describe the breadth, depth and nuance of executive communication. 2. Create various internal and external executive communication deliverables. 3. Conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis of an executive's communication. 4. Define and execute the role of serving as a strategic communication advisor to an executive. 5. Learn from and connect with established communication professionals. Credits: 3.00

COM 36200 - Broadcast Performance

Credit Hours: 3.00. This course will immerse students in both the foundational concepts of broadcasting and nuanced performance techniques necessary to take the craft to the next level as on-camera/on-air presenters. Through hands-on, experiential learning, students will refine existing journalistic and creative skills (such as prior reporting, video production, hosting, anchoring, or online media experience) and also develop new talents and portfolio pieces.

Learning Outcomes: 1. Produce on-camera segments that tell stories via studio, field, and social media. 2. Apply technical and creative skills necessary to produce and air basic broadcast programming by completing assigned class projects. 3. Comprehend, define, and analyze essential studio and broadcasting concepts by writing scripts to use in class practicals. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this

understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Electives (4-41credits)

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15-16 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC) Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define

and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14 Credits

Communication: Political and Civic Communication Concentration, BA

About the Program

Degree Requirements

Communication: Political and Civic Communication Concentration (15 credits)

Required Course (3 credits)

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism, political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

Concentration Selectives (12 credits)

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and

discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 31200 - Rhetoric In The Western World

Credit Hours: 3.00. An explanation of major theoretical and philosophical concepts concerning rhetoric; the relationships between rhetoric and political, social, and personal decisions are explored. Ancient and modern authors will be read.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 41600 - United States Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the U.S.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Able to create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Able to write correctly and clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 49100 - Special Topics In Communication

Credit Hours: 1.00 to 3.00. Intensive study of selected topics, varying from semester to semester, from the literature or practice of communication. Course content will be drawn from areas not dealt with in the regular curriculum and may include such topics as photojournalism, economic reporting, and campaign communication. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of a specialized area of communication and its common applications. Credits: 1.00 to 3.00

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 36001 - Mock Trial Practicum

Credit Hours: 1.00. This course prepares students to represent Purdue University in American Mock Trial Association competitions by focusing on legal reasoning, argumentation, and advocacy. Mock Trial students will become familiar with the United States' legal system and conduct a trial over a fictional civil or criminal case. Students develop and deliver opening statements, introduce and examine testimonial, physical, and demonstrative evidence, examine and cross examine witnesses, and develop and deliver closing statements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the underlying theory and content of specific laws through class discussions and exercises. 2. Locate, interpret, and explain information contained within the American Mock Trial Association's (AMTA's) annual case by reading assigned texts and participating in class discussion and exercises. 3. Formulate original arguments, objections, and replies within a legal setting by participating in class discussion and exercises, and through written assignments. 4. Deliver oral arguments, objections, and replies in accord with courtroom procedures by participating in mock trial exercises inside and outside of class. Credits: 1.00

Electives (4-41 credits)

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their

professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15-16 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages.
Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass

audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism, political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14 Credits

Communication: Public Relations and Strategic Communication, BA

About the Program

Degree Requirements

Communication: Public Relations and Strategic Communication Concentration (15 credits)

Required Course (3 credits)

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

Selectives (12 credits)

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 33600 - Advertising Media Strategy

Credit Hours: 3.00. Theory and practice of advertising as applied to advertising media strategy. Students build on a foundation of integrated marketing communication to develop digital advertising campaigns.

Learning Outcomes: 1. Explain how practitioners develop advertising campaigns. 2. Design and execute digital marketing plans. 3. Offer suggestions and feedback to classmates in a constructive manner. Credits: 3.00

COM 35300 - Problems In Public Relations

Credit Hours: 3.00. Approaches to problems in public relations as they occur in industry, government, education, social agencies, and other institutions.

Learning Outcomes: 1. Develop an attitude of professionalism and tact. 2. Expand existing knowledge about theories in the practice of public relations. 3. Gain a greater understanding of the use of the tools of public relations practice. 4. Recognize types of public relations challenges and how to address them. 5. Work effectively and efficiently as a strong team member. 6. Write and edit well, and know how to improve at both. 7. Feel an increase in self-confidence and professionalism that will help with career advancement. Credits: 3.00

COM 35600 - Problems In Advertising

Credit Hours: 3.00. Approaches to problems in advertising as they involve the planning, creation, and evaluation of commercial messages.

Credits: 3.00

COM 45600 - Advertising Writing

Credit Hours: 3.00. The theory and practice of copy writing in various advertising contexts.

Credits: 3.00

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism, political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

COM 49101 - Boiler Communication

Credit Hours: 1.00. This course provides a practical, hands-on approach to public relations by working in student-led teams to produce comprehensive, strategic communication campaigns for actual clients. The course also includes many opportunities for professional development and portfolio building.

Learning Outcomes: 1. Experience a real public relations campaign. 2. Develop professionally to be able to start a public relations career. 3. Use creativity and critical thinking to help clients with public relations needs while engaging in social responsibility. Credits: 1.00

COM 49501 - Sports Media Relations

Credit Hours: 3.00. This course examines the role of public relations and mass media in sports communication. It provides an understanding of the operation of sports media and communication and how sports information departments perform their functions. Emphasis is on written communication from athletics communication perspective.

Learning Outcomes: 1. Develop a clear understanding of the day to day responsibilities of sports public relations professionals. 2. Develop attention-grabbing writing skills that reflect an understanding of news judgment. 3. Learn about press box and game-management operations at a sports event, including news conference set-up and execution, coordination of interview requests, quote-gathering, and information and statistics updates and distribution. 4. Create promotional, multimedia content at a sports event, including written features, press releases, social media, video and infographics. 5. Explore communication strategies used by sports media relations professionals in breaking-news situations. 6. Study the evolution of the relationship between media and sports organizations. 7. Learn about the scope of responsibilities of sports media relations professionals, including the coordination of managed news events and special events, the production of media guides, the execution of publicity campaigns, and crisis communications. 8. Understand the effects of evolving technology and social media on sports media relations. Credits: 3.00

COM 49502 - Travel Writing

Credit Hours: 3.00. Travel writing is writing about places, persons, and things in other places-also writing about how to travel, when to travel, and advice on traveling-all with the reader in mind. It's about relaying your travel experiences to others so that they may emulate them or at the very least not make the same mistakes you did. And it's writing about things in your own back yard that are exotic to everyone else-a local farmer's market, historic site, restaurant, museum. In this class, you will explore the various ways travel writers can excite and assist readers.

Learning Outcomes: 1. Gain experience in writing effectively. 2. Identify typical features of travel writing genres. 3. Use research and observation as building blocks for travel writing. 4. Produce a variety of articles within this genre. 5. Understand the "business" of travel writing.

Credits: 3.00

COM 33701 - Producing Digital Advertising

Credit Hours: 3.00. This course is designed as an advanced level production course. Through lectures, discussions, critiques, screenings, and various exercises, you will gain experience designing video advertisements. You will develop and refine critical viewing/listening abilities to effectively analyze video content for aesthetic elements and overall message. Additionally, you will apply production techniques pertaining to producing, directing, shooting and editing in the creation of projects for real clients. The coursework consists of three major video projects, and a series of assignments organized under the corporate role that would be performing those tasks.

Learning Outcomes: 1. Work with a client in the development of a digital media advertisement. 2. Develop the concept for a digital media advertisement. 3. Pitch the idea for a digital media advertisement. 4. Write the script for a digital media advertisement. 5. Coordinate the production schedule for a digital media advertisement project. 6. Supervise videography for a digital media advertisement. 7. Complete post-production for a digital media advertisement. 8. Critique the final edit of a digital media advertisement. Credits: 3.00

COM 49503 - Public Relations For Social Change

Credit Hours: 3.00. The overarching goal of this course is for students to work cooperatively with a community partner to identify, define and address that organization's PR problems and opportunities from a long-term, in-house perspective, building on the work of previous students and incorporating social change theory from a relationship management perspective of PR. The applied work of this course will have the dual benefit of providing students the opportunity to gain contextualized, real-world experience at PR problem-solving and advancing the mission of a nonprofit organization that is important to the wellbeing of the Greater Lafayette community as a whole.

Learning Outcomes: 1. Construct and devise a strategic and mission-focused PR plan and critically evaluate its effects. 2. Explain and demonstrate how storytelling and community relations PR strategies can be used as tools for social change. 3. Describe how their own PR skillsets can be means for future civic engagement. 4. Develop an increased sense of efficacy when it comes to matters of civic engagement and PR practice. 5. Develop a broader view of how PR as a discipline can be applied within a community. Credits: 3.00

COM 49505 - Sports Communication

Credit Hours: 3.00. This class will help students learn to think critically about sports communication, but it will also help students learn to do sports communication. Through the use of sports books and movies, guest speakers, field trips, and case studies, students will learn not only about sports communication as a field of study and a profession, but also how they can be more thoughtful consumers of sports communication in its various forms.

Learning Outcomes: 1. Describe multiple ways that sports communication constructs and maintains culture. 2. Explain changes in sports communication related to race and gender. 3. List five key events in the last 100 years of sports communication. 4. List and analyze issues related to naming in sports. 5. Create a basic sports crisis communication plan. 6. Frame labor-management sports communication issues from both perspectives. Credits: 3.00

COM 27100 - Podcasting

Credit Hours: 3.00. This directed study is designed as an introduction to podcasting. Students in the course will learn about the structure and development of podcasting campaigns, then create their own weekly recording. Recording begins in the third week of classes, giving students 14 opportunities to develop their program.

Learning Outcomes: 1. Develop an idea for a podcast. 2. Write a treatment for a podcast. 3. Pitch the idea for a podcast to an audience. 4. Create a production outline. 5. Produce a budget for the work produced and identify potential funding sources for the project. 6. Execute an advertising campaign for a podcast. 7. Coordinate a schedule for a podcast recording. 8. Evaluate the finished production and the experience of creating that work. Credits: 3.00

COM 49504 - Social Media For Social Good

Credit Hours: 3.00. Nonprofit organizations advance their missions through communication. This course is designed to introduce students to the use of social media by nonprofit organizations to create their brand and reach stakeholders. It will focus on best practices and critically assess local nonprofits return on social media investment.

Learning Outcomes: 1. Discuss the importance of social media to nonprofits for communicating, marketing, public relations, and fundraising. 2. Discuss the measurement of social media effectiveness in communicating messages and in fundraising. 3. Conduct a social media audit. 4. Develop a nonprofit social media strategy. Credits: 3.00

COM 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

Electives (4-41 credits)

Sample 4-Year Plan

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and

satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages.
Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

15 Credits

Spring 3rd Year

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

14 Credits

Comparative Literature, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (30 credits)

A. Required Courses (9 credits)

Gateway Course (3 credits)

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

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World Literature Surveys (6 credits)

CMPL 26700 - World Literature: From 1700 A D To The Present (UCC: HUM)

Credit Hours: 3.00. (ENGL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

CMPL 26600 - World Literature: From The Beginnings To 1700 A D (UCC: HUM)

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University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural,

and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26700 - World Literature: From 1700 A.D. To The Present (UCC: HUM)

Credit Hours: 3.00. (CMPL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. Typically offered Summer Fall Spring. CCN: IEL 1251 World Literature 2

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

Selectives (21 credits)

B. World Languages, Literatures, and Cultures (6 credits)

C. Literature and Culture Courses in English (3 credits)

D. Film Studies (3 credits)

Supplemental List

Electives (17-54 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have

in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

CMPL 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (LC 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

15-19 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CMPL 26600 - World Literature: From The Beginnings To 1700 A D (UCC: HUM)

Credit Hours: 3.00. (ENGL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world,

and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

12-13 Credits

Fall 2nd Year

CMPL 26700 - World Literature: From 1700 A D To The Present (UCC: HUM)

Credit Hours: 3.00. (ENGL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26700 - World Literature: From 1700 A.D. To The Present (UCC: HUM)

Credit Hours: 3.00. (CMPL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. Typically offered Summer Fall Spring. CCN: IEL 1251 World Literature 2

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

15-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

13-15 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

14-16 Credits

Spring 4th Year

12-17 Credits

Computer and Information

Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (51 credits)

Computer and Information Technology Required Major Courses (30 credits)

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of

international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

Programming Selective - Credit Hours: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

Database Selective - Credit Hours: 3.00

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

Information Technology Selectives - Credit Hours: 15.00

Other Departmental/Program Course Requirements (24 credits)

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

Statistics Selective - Credit Hours: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of

STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

General Business - Credit Hours: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3.

Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Interdisciplinary Selective - Credit Hours: 15.00

Elective (3 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and

problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in

which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical

operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized

environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

15 Credits

Spring 2nd Year

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of

human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing

organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning

techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.

Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market

equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Spring 3rd Year

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple

purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will

examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

15 Credits

Fall 4th Year

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

15 Credits

Spring 4th Year

15 Credits

Computer Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (52 credits)

Required Major Courses (49 credits)

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 32900 - Advanced Embedded Digital Systems

Credit Hours: 3.00. This course focuses on the study and application of real-time embedded systems. Real-time operating systems (RTOS) are introduced and applied. Students learn and use programming and scripting languages to discover the advantages and limitations of RTOS application in the lab.

Learning Outcomes: 1. Define, compare and contrast embedded systems terms and the concepts of soft and hard real time. 2. Identify and explain real time operating system operational concepts. 3. Demonstrate the application of software design, documentation, and version control tools. 4. Demonstrate the application of an RTOS application programming interface and testing techniques to evaluate embedded system functional correctness and performance. Credits: 3.00

ECET 33900 - Digital Signal Processing

Credit Hours: 3.00. The course introduces students to the fundamental principles associated with processing discrete time signals. The architecture, instruction set and hardware and software development tools associated with a fixed point general purpose VLSI digital signal processor are examined. Some common real-time applications are implemented such as digital filters and DFT-based spectral estimation on a typical fixed point digital signal processor.

Learning Outcomes: 1. Describe the architectural features of a DSP and relate these to the DSP kernel equation. 2. Manipulate different binary number formats associated with a fixed point DSP. 3. Develop and debug simple programs that involve SOPs, modulo addressing, scaling and extraction of result, and common DSP program structures. 4. Describe

the consequences and limitations of sampling baseband signals including the Nyquist rate and bandwidth, quantization noise, aliasing, frequency folding, reconstruction, spectrum of sampled baseband signals. 5. Express a sampled deterministic analog signal in closed mathematical form and expanded form using the unit sample. 6. Express a sampled signal in terms of the Z transform, in expanded and closed form. 7. Describe the relationship between the transfer function and impulse response in an LTI system. 8. Describe the operation of convolution and its implementation using hand calculations, mathematical software packages, and a fixed-point DSP. 9. Design and analyze FIR filters with the aid of a mathematical software package such as MATLAB. Credits: 3.00

ECET 34900 - Advanced Digital Systems

Credit Hours: 3.00. This course investigates complex digital systems that are implemented with field programmable gate arrays (FPGAs) using concurrent and sequential digital design techniques. Applications will include interfacing with analog signals and memory systems.

Learning Outcomes: 1. Design FPGA solutions for given digital design problems using a hardware description language (HDL). 2. Design FPGA solutions for given digital problems using a high-level sequential programming language for embedded processors. 3. Design FPGA solutions by decomposing a system into concurrent and sequential functional blocks and using hierarchical system development techniques. 4. Verify digital designs using simulation and hardware prototyping. 5. Analyze and design memory subsystems. 6. Apply ADC and DAC circuits to interface digital systems with analog devices/systems. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

Other Departmental/Program Course Requirements (65 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained

from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana

certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems,

resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value

problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by

charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of

economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe

hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Elective (3 credits)

Supplemental List

Professional Requirement

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving

and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their

careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the

important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

16 Credits

Fall 2nd Year

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional

blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

16 Credits

Spring 2nd Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse

audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation

techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

15 Credits

Fall 3rd Year

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

ECET 33900 - Digital Signal Processing

Credit Hours: 3.00. The course introduces students to the fundamental principles associated with processing discrete time signals. The architecture, instruction set and hardware and software development tools associated with a fixed point general purpose VLSI digital signal processor are examined. Some common real-time applications are implemented such as digital filters and DFT-based spectral estimation on a typical fixed point digital signal processor.

Learning Outcomes: 1. Describe the architectural features of a DSP and relate these to the DSP kernel equation. 2. Manipulate different binary number formats associated with a fixed point DSP. 3. Develop and debug simple programs that involve SOPs, modulo addressing, scaling and extraction of result, and common DSP program structures. 4. Describe the consequences and limitations of sampling baseband signals including the Nyquist rate and bandwidth, quantization noise, aliasing, frequency folding, reconstruction, spectrum of sampled baseband signals. 5. Express a sampled deterministic analog signal in closed mathematical form and expanded form using the unit sample. 6. Express a sampled signal in terms of the Z transform, in expanded and closed form. 7. Describe the relationship between the transfer function and impulse response in an LTI system. 8. Describe the operation of convolution and its implementation using hand calculations, mathematical software packages, and a fixed-point DSP. 9. Design and analyze FIR filters with the aid of a

mathematical software package such as MATLAB. Credits: 3.00

ECET 34900 - Advanced Digital Systems

Credit Hours: 3.00. This course investigates complex digital systems that are implemented with field programmable gate arrays (FPGAs) using concurrent and sequential digital design techniques. Applications will include interfacing with analog signals and memory systems.

Learning Outcomes: 1. Design FPGA solutions for given digital design problems using a hardware description language (HDL). 2. Design FPGA solutions for given digital problems using a high-level sequential programming language for embedded processors. 3. Design FPGA solutions by decomposing a system into concurrent and sequential functional blocks and using hierarchical system development techniques. 4. Verify digital designs using simulation and hardware prototyping. 5. Analyze and design memory subsystems. 6. Apply ADC and DAC circuits to interface digital systems with analog devices/systems. Credits: 3.00

15 Credits

Spring 3rd Year

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

ECET 32900 - Advanced Embedded Digital Systems

Credit Hours: 3.00. This course focuses on the study and application of real-time embedded systems. Real-time operating systems (RTOS) are introduced and applied. Students learn and use programming and scripting languages to discover the advantages and limitations of RTOS application in the lab.

Learning Outcomes: 1. Define, compare and contrast embedded systems terms and the concepts of soft and hard real time. 2. Identify and explain real time operating system operational concepts. 3. Demonstrate the application of software design, documentation, and version control tools. 4. Demonstrate the application of an RTOS application programming interface and testing techniques to evaluate embedded system functional correctness and performance. Credits: 3.00

15 Credits

Fall 4th Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present

and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

15 Credits

Spring 4th Year

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

12 Credits

Computer Engineering, BSCMPE

About the Program

Degree Requirements

Computer Engineering Required Major Courses (53 credits)

Required Core Courses (30 credits)

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system. Credits: 4.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently

discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

Required Seminars (3 credits)

ECE 29401 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree requirements, professional writing and multicultural and professional development.

Learning Outcomes: 1. Knowledge of the ECE educational objectives and required outcomes. 2. Knowledge of the BSEE and/or BSCmpE degree requirements. 3. Ability to prepare a satisfactory plan-of-study. 4. Ability to write effectively in the English language. 5. Appreciation for ethical, professional and

academic conduct. Credits: 1.00

ECE 39401 - Professional Communications And Diversity

Credit Hours: 1.00. This course provides ECE students with practice in relevant aspects of communication. Topics include: successfully seeking employment, working effectively in teams, delivering engaging presentations, and leveraging the advantages and challenges of diversity and inclusion.

Learning Outcomes: 1. Ability to function effectively on a team whose members create a collaborative and inclusive environment, plan tasks, and meet objectives. 2. Communicate effectively with a range of audiences. 3. Develop and explain solutions to engineering problems, taking public health and cultural factors into consideration. Credits: 1.00

ECE 49401 - Professional Communication Capstone

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and plans for professional growth.

Learning Outcomes: 1. Communicate effectively with a range of audiences. 2. Function effectively on a team whose members together create a collaborative and inclusive environment, plan tasks, and meet objectives. 3. Ability to make informed judgments based ethical and professional responsibilities in engineering situations, giving consideration to global, economic, environmental, and/or societal contexts. Credits: 1.00

Senior Design Requirement - Choose One Option (4 credits)

Option 1:

ECE 47700 - Digital Systems Senior Project

Credit Hours: 4.00. A structured approach to the development and integration of embedded microcontroller hardware and software that provides senior-level students with significant design experience applying microcontrollers to a wide range of embedded systems (e.g., instrumentation, process control, telecommunications, and intelligent devices). The primary objective is to provide practical experience developing integrated hardware and software for embedded microcontroller systems in an environment that models one which students will most likely encounter in industry. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a microcontroller-based digital system. 2. Understand the engineering design process. 3. Function on a multidisciplinary team. 4. Be aware of professional and ethical responsibility. 5. Communicate effectively, in both oral and written form. Credits: 4.00

Option 2:

ECE 49022 - Electrical Engineering Senior Design Projects

Credit Hours: 4.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics). Lectures require use of the I-Clicker system.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a system, component, or process to meet desired needs. 2. Understand the engineering design process. 3. Function on an interdisciplinary team. 4. Acquire an awareness of professional and ethical responsibility. 5. Develop effective communication skills, both oral and written. Credits: 4.00

Option 3:

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

Option 4:

VIP 47922 - Senior Design Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47921 - Senior Design Participation In Vertically Integrated Projects (VIP) I

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended

research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

Computer Engineering Selectives (16 credits)

ECE 30834 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. Permission of department required.

Learning Outcomes: 1. An understanding of the design issues for creating raster graphics. 2. An ability to apply rendering techniques to an actual computer graphics problem and associated datasets. 3. An understanding of object transformations, representations, transformations and perspective projections. 4. An understanding of color, illumination, and shading techniques. 5. An understanding of the rendering and rasterization techniques. 6. An understanding of the application of computer graphics techniques to visualization, animation, and computer aided design. Credits: 3.00

ECE 33700 - ASIC Design Laboratory

Credit Hours: 2.00. Introduction to standard cell design of Application Specific Integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and verification.

Learning Outcomes: 1. Design combinational and sequential logic in a variety of styles and awareness of resource usage. 2. Use, modify, create scripts to control logic synthesis. 3. Create a test bench and use it to verify a design that incorporates multiple sequential blocks. 4. Place, route, and verify timing of an ASIC design. 5. Determine the RTL architecture

implied by HDL code of moderate complexity. 6. Explain the difference between various ASIC and digital system design approaches - standard cell, full custom, and programmable device. Credits: 2.00

ECE 40400 - Introduction To Computer Security

Credit Hours: 3.00. Introduction to security issues related to the operation of computers and the workings of computer networks. Topics covered include introduction to cryptography, authentication protocols, digital signature algorithms, internet vulnerabilities, worms and virus propagation, denial of service attacks, etc. The students will also learn how to design firewalls to protect a system against unwanted intrusions. Permission of department required.

Credits: 3.00

ECE 43700 - Computer Design And Prototyping

Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, datapath design, control strategies, pipelining, memory hierarchy, and I/O interface design.

Credits: 4.00

ECE 46300 - Introduction To Computer Communication Networks

Credit Hours: 3.00. An introduction to the design and implementation of computer communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet success. Topics include: digital transmission and multiplexing, protocols, MAC layer design (Ethernet/802.11), LAN interconnects and switching, congestion/flow/error control, routing, addressing, performance evaluation, internetworking (Internet) including TCP/IP, HTTP, DNS etc. This course will include one or more programming projects.

Learning Outcomes: 1. An understanding of the fundamental principles underlying packet switching networks, and different Local Area Network technologies. 2. An ability to implement network protocols using network socket programming. 3. An understanding of the key principles behind retransmission protocols, congestion control algorithms, and TCP. 4. An understanding of the basic concepts of routing. Credits: 3.00

ECE 46800 - Introduction To Compilers And Translation Engineering

Credit Hours: 4.00. The design and construction of compilers and other translators. Topics include compilation goals, organization of a translator, grammars and languages, symbol tables, lexical analysis, syntax analysis (parsing), error handling, intermediate and final code generation, assemblers, interpreters, and an introduction to optimization. Emphasis is on engineering a compiler or interpreter for a small programming language - typically a C or Pascal subset. Projects involve the stepwise implementation (and documentation) of such a system. Department permission required.

Credits: 4.00

ECE 46900 - Operating Systems Engineering

Credit Hours: 4.00. The design and construction of operating systems for both individual computers and distributed (networked) systems. Basic concepts and methods for managing processor, main memory, block-structured storage, and network resources are covered. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked versions of UNIX. These techniques are applied to design improvements of portions of a simplified, networked, UNIX-based operating system; the improvements are implemented and their performance is evaluated in laboratory experiments.

Credits: 4.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices,

home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECE 50863 - Computer Network Systems

Credit Hours: 3.00. The goal of this course is to provide students with a proper grounding in the basic concepts and seminal work in computer network protocols and systems, and to introduce students to research in the field. The course will cover classical concepts such as network architecture, switching, routing, congestion control, and quality-of-service, and discuss recent developments in these areas. The course will also cover new developments in networking such as network measurements, network management, overlay networking and peer-to-peer systems, network security, and new network architectures. The course will emphasize a system-oriented and empirical view of internet architecture. Graduate standing or consent of instructor.

Learning Outcomes: 1. Understand the architectural principles underlying internet design. 2. Understand LAN interconnects, routing algorithms, and congestion control algorithms. 3. Identify, formulate, and solve problems encountered in the design of networks. 4. Implement networking systems and rigorously evaluate them using systematic empirical methods. Credits: 3.00

ECE 40862 - Software For Embedded Systems

Credit Hours: 3.00. This course provides an introduction to software design for embedded computing systems. Major topics covered include the importance of time and timing in embedded systems, embedded software organization (FSM-based program design, polled loop systems, foreground-background systems, event driven architectures, multi-tasking, etc.), real-time scheduling and real-time operating systems, wired/wireless networked embedded systems, debugging techniques for embedded software, and advanced topics such as memory-safe programming, implementing reentrant functions, and minimizing code space, memory usage, and power consumption. The course features a series of integrated assignments using state-of-the-art embedded hardware platforms, embedded software design tools, and real-time operating systems that reinforce the concepts taught in the lectures.

Learning Outcomes: 1. Understand the embedded software design process and tools used. 2. Understand various software architectures for embedded systems. 3. Apply advanced debugging techniques to embedded software. 4. Analyze and implement real-time embedded applications. 5. Design and implement distributed applications for networked embedded systems. Credits: 3.00

Other Department/Program Course Requirements (33-43 credits)

General Engineering Requirement (3-6 credits)

C Programming (0-3 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

Engineering Breadth Selective - Choose One (3 credits)

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case

studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

CHE 20500 - Chemical Engineering Calculations

Credit Hours: 4.00. Quantitative applications of steady-state mass and energy balances to solve problems involving multi-component systems and multi-unit chemical processes. Single-component and multi-component phase equilibria, single-reaction and multiple-reaction stoichiometry, coupled mass and energy balances, chemical processes involving bypass and recycle streams.

Learning Outcomes: 1. Estimate physical properties of real chemical systems. 2. Evaluate introductory single-component and multi-component phase equilibria and incorporate these concepts into solutions of mass and energy balance problems. 3. Solve steady state and transient mass and energy balance problems for both reacting and non-reacting systems with or without recycle using analytical and computational methods. 4. Work professionally and ethically in teams to solve new mass and energy balance problems. 5. Identify contemporary chemical engineering problems, including their societal, environmental, and global impacts. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic

dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 41300 - Noise Control

Credit Hours: 3.00. Fundamentals of acoustic waves. Psychoacoustics and theories of hearing. Environmental and building acoustics. Measurement methods and common instrumentation. Noise control methods. Machinery noise. Community reaction. Legal aspects. Design-oriented semester project. Course work in differential equations.

Credits: 3.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

Mathematics Requirement - Choose One Option (13-14 credits)

Option 1 (13 credits)

ECE 36900 - Discrete Mathematics For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will

learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

Option 2 (14 credits)

ECE 36900 - Discrete Mathematics For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Credits: 3.00

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear

systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix

multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 51000 - Vector Calculus

Credit Hours: 3.00. Calculus of functions of several variables and of vector fields in orthogonal coordinate systems. Optimization problems, implicit function theorem, Green's theorem, Stokes' theorem, divergence theorems. Applications to engineering and the physical sciences. Not open to students with credit in MA 36200 or MA 41000.

Credits: 3.00

Science Requirement (4-8 credits)

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students

will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and

nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

ECE General Education Requirement (17-18 credits)

Electives (0-2 credits)

Optional Concentrations

Supplemental Lists

GPA Requirements

Pass/No Pass Policy

Transfer Credit Policy

Purdue in Indianapolis Students will be required to take the courses listed in First Year Engineering

Sample Computer Engineering Plan of Study

Fall 2nd Year

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 36900 - Discrete Mathematics For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and

minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

ECE 29401 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree requirements, professional writing and multicultural and professional development.

Learning Outcomes: 1. Knowledge of the ECE educational objectives and required outcomes. 2. Knowledge of the BSEE and/or BSCmpE degree requirements. 3. Ability to prepare a satisfactory plan-of-study. 4. Ability to write effectively in the English language. 5. Appreciation for ethical, professional and academic conduct. Credits: 1.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

16-19 Credits

Spring 2nd Year

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

16-17 Credits

Fall 3rd Year

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-

Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system. Credits: 4.00

ECE 39401 - Professional Communications And Diversity

Credit Hours: 1.00. This course provides ECE students with practice in relevant aspects of communication. Topics include: successfully seeking employment, working effectively in teams, delivering engaging presentations, and leveraging the advantages and challenges of diversity and inclusion.

Learning Outcomes: 1. Ability to function effectively on a team whose members create a collaborative and inclusive environment, plan tasks, and meet objectives. 2. Communicate effectively with a range of audiences. 3. Develop and explain solutions to engineering problems, taking public health and cultural factors into consideration. Credits: 1.00

14-18 Credits

Spring 3rd Year

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables.

Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

16 Credits

Fall 4th Year

ECE 47700 - Digital Systems Senior Project

Credit Hours: 4.00. A structured approach to the development and integration of embedded microcontroller hardware and software that provides senior-level students with significant design experience applying microcontrollers to a wide range of embedded systems (e.g., instrumentation, process control, telecommunications, and intelligent devices). The primary objective is to provide practical experience developing integrated hardware and software for embedded microcontroller systems in an environment that models one which students will most likely encounter in industry. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a microcontroller-based digital system. 2. Understand the engineering design process. 3. Function on a multidisciplinary team. 4. Be aware of professional and ethical responsibility. 5. Communicate effectively, in both oral and written form. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

13-16 Credits

Spring 4th Year

ECE 49401 - Professional Communication Capstone

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and plans for professional growth.

Learning Outcomes: 1. Communicate effectively with a range of audiences. 2. Function effectively on a team whose members together create a collaborative and inclusive environment, plan tasks, and meet objectives. 3. Ability to make informed judgments based

ethical and professional responsibilities in engineering situations, giving consideration to global, economic, environmental, and/or societal contexts. Credits: 1.00

16-18 Credits

Computer Science Honors: Algorithmic Foundations, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (58-60 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in

space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental

data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Algorithmic Foundations Concentration (18 credits)

Required Courses

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate

selections. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5.

Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in

problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One

more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace,

linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (5-31 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Program Requirements

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but

are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able

to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization

techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear

dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.
Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.
Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.
Credits: 3.00

15-17 Credits

Computer Science Honors: Computational Science and Engineering, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (61-64 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three

dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms,

implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Computational Science and Engineering Concentration (21-22 credits)

Required Courses (9-10 credits)

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

Applications (3 credits)

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation.

3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial

function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Systems (3 credits)

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

Selectives (6 credits)

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design

quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or

series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level

control using standard methods. Credits: 3.00

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson,

Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two

and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand

why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (1-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of

infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to

students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central

Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

15-17 Credits

Computer Science Honors: Computer Graphics and Visualization, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (58-60 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional

derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions;

hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Computer Graphics and Visualization Concentration (18 credits)

Required Courses

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 43400 - Advanced Computer Graphics

Credit Hours: 3.00. Advanced concepts and techniques of computer graphics. The course covers, in complete detail, going from a scene representation to a raster image without using OpenGL or other graphics packages. The course develops a complete graphics implementation in which the students implement every aspect of the graphics pipeline. This involves a substantial software project in C/C++.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-

oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 43400 - Advanced Computer Graphics

Credit Hours: 3.00. Advanced concepts and techniques of computer graphics. The course covers, in complete detail, going from a scene representation to a raster image without using OpenGL or other graphics packages. The course develops a complete graphics implementation in which the students implement every aspect of the graphics pipeline. This involves a substantial software project in C/C++.

Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

Project Option

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and

what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric

substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus. Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics:

variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (5-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of

elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus -

Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of

vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear

independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with

emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

15-17 Credits

Computer Science Honors: Database and Information Systems, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (61-63 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface

integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Database and Information Systems Concentration (21 credits)

Required Courses

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives

Category I - Computing Systems

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

Category II - Information Assurance

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information

security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

Category III - Related Studies

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 41100 - Senior Design Participation In EPICS

Credit Hours: 1.00. Continuation of EPICS courses. Seniors using EPCS 41100 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41200 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and

predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector

spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with

entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to

apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5.

Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (2-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-

endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions,

simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and

eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.
Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.
Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.
Credits: 3.00

15-17 Credits

Computer Science Honors: Machine Intelligence, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (58-60 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.
University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of

surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees;

proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Machine Intelligence Concentration (18 credits)

Required Courses (4 courses)

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming

systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives (2 courses)

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and

AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It

focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced

problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many

concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100,

STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (5-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in

computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute

areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable

chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and

understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the

difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One

more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained. Credits: 3.00

15-17 Credits

Computer Science Honors: Programming Language, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (58-60 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in

space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental

data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Programming Language Concentration (18 credits)

Required Courses

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

Selectives

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based

application and services, different countermeasures, and their effectiveness.
Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues.
Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent

approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing

hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

Additional College of Science Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 .

Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (5-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data

stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric

substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable

chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and

understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the

difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One

more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained. Credits: 3.00

15-17 Credits

Computer Science Honors: Security, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (58-60 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in

space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental

data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Security Concentration (18 credits)

Required Courses

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

Selectives

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools,

methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5.

Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply

the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded projects; working in teams. CS 35200 (Compilers) and CS 35400 (Operating Systems) are recommended, but not required.

Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system. Credits: 3.00

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit

a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear

dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (32-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data

displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (5-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum,

and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional

derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial

science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear

transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.
Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.
Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.
Credits: 3.00

15-17 Credits

Computer Science Honors: Software Engineering, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (58-60 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient,

how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Software Engineering Concentration (18 credits)

Required Courses

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 40700 - Software Engineering Senior Project

Credit Hours: 3.00. A capstone course combining all the concepts students have learned in the Software Engineering Track: software and software engineering, working as a team leader and as a team member, Agile Software Development, Scrum Software Development, Version Control, basing software development on reusable technology, developing requirements (User Stories and Use Cases), modelling with classes, design patterns, focusing on users, modelling interactions and behavior, architecting and designing software, testing and inspecting, managing the software development process. This is a project course. Students are organized into 4-6 student teams. Each team completes a full-semester software engineering project. Each team creates a Project Charter, Product Backlog, Design, and for 3 Sprints -- Planning Document, Demo, Retrospective Document. The final demo is a formal presentation.

Learning Outcomes: 1. Understand the software development process. 2. Understand the best methods to plan, analyze, design, test, measure, and manage software projects. 3. Understand agile methodologies in general and

specifically Scrum. 4. Understand how to use version control systems in a team software engineering project. 5. Understand that good people are one of, if not the most important, requirements for successful projects. 6. Understand how to work on a team project as a team leader and/or team member. Credits: 3.00

Selective

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 51000 - Software Engineering

Credit Hours: 3.00. Software life cycles, requirements engineering, software design, design of distributed systems, verification and validation, software architecture, process metrics and models, and research methods in software engineering.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded projects; working in teams. CS 35200 (Compilers) and CS 35400 (Operating Systems) are recommended, but not required.

Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system. Credits: 3.00

CS 35100 - Cloud Computing

Credit Hours: 3.00. Introduction to cloud computing. Cloud data center infrastructure, public and private clouds, servers and virtualized servers, data center networks and virtualized networks, virtualized disk, file, and object storage, the concept of scale-out, algorithms and programming systems used in the design and implementation of cloud-native software, especially using containers and orchestration systems, microservices, serverless designs, controller-based designs, edge and fog computing, security in a cloud environment, programming models.

Learning Outcomes: 1. Describe physical facilities and virtualized technologies used in a cloud data center. 2. Understand major algorithms and programming paradigms used to build cloud-native software. 3. Design and deploy containerized software in a cloud environment. 4. Demonstrate orchestration of container software. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced

problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

Software Engineering Senior Project

Concentration Notes

Required CS Honors (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and

results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric

functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100,

STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (5-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral

calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series.

3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial

derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and

eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear

dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.
Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.
Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.
Credits: 3.00

15-17 Credits

Computer Science Honors: Systems Software, BS

About the Program

Degree Requirements

Computer Science Honors Major Courses (58-60 credits)

Required CS Honors Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand

the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by

decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Systems Software Concentration (18 credits)

Required Courses

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines.

Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

Selectives

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve

recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms.
Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness.
Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues.
Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded projects; working in teams. CS 35200 (Compilers) and CS

35400 (Operating Systems) are recommended, but not required. Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system. Credits: 3.00

CS 35100 - Cloud Computing

Credit Hours: 3.00. Introduction to cloud computing. Cloud data center infrastructure, public and private clouds, servers and virtualized servers, data center networks and virtualized networks, virtualized disk, file, and object storage, the concept of scale-out, algorithms and programming systems used in the design and implementation of cloud-native software, especially using containers and orchestration systems, microservices, serverless designs, controller-based designs, edge and fog computing, security in a cloud environment, programming models.

Learning Outcomes: 1. Describe physical facilities and virtualized technologies used in a cloud data center. 2. Understand major algorithms and programming paradigms used to build cloud-native software. 3. Design and deploy containerized software in a cloud environment. 4. Demonstrate orchestration of container software. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This

includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

Concentration Notes

Required CS Honors - (12-13 credits)

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.
Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution,

work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (5-31 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues

and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions,

discrete probability, and asymptotic methods.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.

Credits: 3.00

16-17 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects,

helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

15-17 Credits

Spring 4th Year

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

15-17 Credits

Computer Science: Algorithmic Foundations, BS

About the Program

Degree Requirements

Computer Science Major Courses (46-47 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues

and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Algorithmic Foundations Concentration (18 credits)

Required Courses

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1.

This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control

techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

Concentration Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections.

Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand

statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (15-43 credits)

Grade Requirements

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11.

Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-18 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be

able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Computational Science And Engineering, BS

About the Program

Degree Requirements

Computer Science Major Courses (49-50 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial

derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance;

system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Computational Science and Engineering Concentration (21 credits)

Required Courses

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential

equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

Applications

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2.

Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Systems

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and

operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

Selectives

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's

planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

Concentration Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester

calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand

statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (15-43 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of

functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11.

Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be

able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Computer Graphics and Visualization, BS

About the Program

Degree Requirements

Computer Science Major Courses (46-50 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable

chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help

programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Computer Graphics and Visualization Concentration (18 credits)

Required Courses

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 43400 - Advanced Computer Graphics

Credit Hours: 3.00. Advanced concepts and techniques of computer graphics. The course covers, in complete detail, going from a scene representation to a raster image without using OpenGL or other graphics packages. The course develops a complete graphics implementation in which the students implement every aspect of the graphics pipeline. This involves a substantial software project in C/C++.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables,

semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 43400 - Advanced Computer Graphics

Credit Hours: 3.00. Advanced concepts and techniques of computer graphics. The course covers, in complete detail, going from a scene representation to a raster image without using OpenGL or other graphics packages. The course develops a complete graphics implementation in which the students implement every aspect of the graphics pipeline. This involves a substantial software project in C/C++.

Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate

various AI techniques and make appropriate selections. Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

Project Option

Concentration Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series,

polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (15-43 credits)

Grade Requirements

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash

tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming

embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and

sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Database and

Information Systems, BS

About the Program

Degree Requirements

Computer Science Major Courses (49-50 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms,

implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Database and Information Systems Concentration (21 credits)

Required Courses

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm;

middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to

choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives

Category I - Computing Systems

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

Category II - Information Assurance

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication

mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

Category III - Related Studies

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 41100 - Senior Design Participation In EPICS

Credit Hours: 1.00. Continuation of EPICS courses. Seniors using EPCS 41100 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41200 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing

thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Concentration Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a

statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (15-40 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of

elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus -

Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of

vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5.

Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Machine Intelligence, BS

About the Program

Degree Requirements

Computer Science Major Courses (46-47 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA;

device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Machine Intelligence Concentration (18 credits)

Required Courses for Machine Intelligence (12 credits)

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world

applications. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

Selectives (6 credits)

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the

important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating

contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Concentration Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (18-43 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning

relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees,

heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions;

hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the

difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Programming Languages, BS

About the Program

Degree Requirements

Computer Science Major Courses (46-47 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to

apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms,

implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Programming Language Concentration (18 credits)

Required Courses

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical

analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

Selectives

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of

algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

Concentration Notes

Other Departmental/Program Course Requirements (32-54 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the

interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (18-43 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming

language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing

probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Security, BS

About the Program

Degree Requirements

Computer Science Major Courses (46-47 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear

independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Security Concentration (18 credits)

Required Courses

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the

security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

Selectives

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and

security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded

projects; working in teams. CS 35200 (Compilers) and CS 35400 (Operating Systems) are recommended, but not required. Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system. Credits: 3.00

Concentration Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data

displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (18-43 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum,

and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional

derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course

emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Software Engineering, BS

About the Program

Degree Requirements

Computer Science Major Courses (46-47 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and

computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Software Engineering Concentration (18 credits)

Required Courses

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test

minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 40700 - Software Engineering Senior Project

Credit Hours: 3.00. A capstone course combining all the concepts students have learned in the Software Engineering Track: software and software engineering, working as a team leader and as a team member, Agile Software Development, Scrum Software Development, Version Control, basing software development on reusable technology, developing requirements (User Stories and Use Cases), modelling with classes, design patterns, focusing on users, modelling interactions and behavior, architecting and designing software, testing and inspecting, managing the software development process. This is a project course. Students are organized into 4-6 student teams. Each team completes a full-semester software engineering project. Each team creates a Project Charter, Product Backlog, Design, and for 3 Sprints -- Planning Document, Demo, Retrospective Document. The final demo is a formal presentation.

Learning Outcomes: 1. Understand the software development process. 2. Understand the best methods to plan, analyze, design, test, measure, and manage software projects. 3. Understand agile methodologies in general and specifically Scrum. 4. Understand how to use version control systems in a team software engineering project. 5. Understand that good people are one of, if not the most important, requirements for successful projects. 6. Understand how to work on a team project as a team leader and/or team member. Credits: 3.00

Selectives

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe

concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and

information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 51000 - Software Engineering

Credit Hours: 3.00. Software life cycles, requirements engineering, software design, design of distributed systems, verification and validation, software architecture, process metrics and models, and research methods in software engineering.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded projects; working in teams. CS 35200 (Compilers) and CS 35400 (Operating Systems) are recommended, but not required.

Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices

operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system. Credits: 3.00

CS 35100 - Cloud Computing

Credit Hours: 3.00. Introduction to cloud computing. Cloud data center infrastructure, public and private clouds, servers and virtualized servers, data center networks and virtualized networks, virtualized disk, file, and object storage, the concept of scale-out, algorithms and programming systems used in the design and implementation of cloud-native software, especially using containers and orchestration systems, microservices, serverless designs, controller-based designs, edge and fog computing, security in a cloud environment, programming models.

Learning Outcomes: 1. Describe physical facilities and virtualized technologies used in a cloud data center. 2. Understand major algorithms and programming paradigms used to build cloud-native software. 3. Design and deploy containerized software in a cloud environment. 4. Demonstrate orchestration of container software. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized

solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Software Engineering Senior Project

Concentration Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric

functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100,

STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (18-43 credits)

Grade Requirements

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but

are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able

to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions,

simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computer Science: Systems Software, BS

About the Program

Degree Requirements

Computer Science Major Courses (46-47 credits)

Required CS Major Math Courses (7-8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in

space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Required CS Major Core Courses (21 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental

data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

Systems Software Concentration (18 credits)

Required Courses (9 credits)

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

Selectives (9 credits)

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control,

atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded projects; working in teams. CS 35200 (Compilers) and CS 35400 (Operating Systems) are recommended, but not required.

Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system. Credits: 3.00

CS 35100 - Cloud Computing

Credit Hours: 3.00. Introduction to cloud computing. Cloud data center infrastructure, public and private clouds, servers and virtualized servers, data center networks and virtualized networks, virtualized disk, file, and object storage, the concept of scale-out, algorithms and programming systems used in the design and implementation of cloud-native software, especially using containers and orchestration systems, microservices, serverless designs, controller-based designs, edge and fog computing, security in a cloud environment, programming models.

Learning Outcomes: 1. Describe physical facilities and virtualized technologies used in a cloud data center. 2. Understand major algorithms and programming paradigms used to build cloud-native software. 3. Design and deploy containerized software in a cloud environment. 4. Demonstrate orchestration of container software. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between

advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

Notes

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral

calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum,

and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Electives (18-43 credits)

Grade Requirements

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging,

collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-18 Credits

Fall 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate

velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-17 Credits

Spring 2nd Year

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to

least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

16-17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and

what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

16-17 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

16-18 Credits

Spring 4th Year

15-17 Credits

Computing Infrastructure and Network Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (60 credits)

Computer and Information Technology Major Courses (48 credits)

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information

systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 34000 - UNIX Administration

Credit Hours: 3.00. This course focuses on the tasks and issues involved in the administration of UNIX systems. Topics include installation, networking, software management, scripting, and user management. In the laboratory portion of the course, students implement and maintain UNIX systems.

Learning Outcomes: 1. Understand the theory and practice of administering UNIX based operating systems. 2. Install and maintain UNIX operating systems. 3. Implement and maintain basic UNIX services including file sharing, e-mail, and X-Windows. 4. Secure UNIX operating systems. 5. Write and maintain UNIX shell

scripts. 6. Integrate UNIX and Windows systems. Credits: 3.00

CNIT 34500 - Internetwork Design And Implementation

Credit Hours: 3.00 or 4.00. This is an advanced course in network architecture. Students learn to design and implement local and wide area networks capable of simultaneous transport of real-time traffic and multiprotocol data over packet-switched and circuit-switched networks. An emphasis is placed on the integration of diverse communications technologies, while considering the effects of engineering decisions on overall performance, from both business and technology perspectives.

Learning Outcomes: 1. Understand the operation of shortest path spanning trees in internetworks. 2. Perform IP subnetworking to correctly size and allocate addressing to network devices. 3. Perform IP supernetworking to correctly size and allocate addressing to network devices. 4. Identify the correct network architecture to deploy a given set of requirements. 5. Deploy dynamic routing protocols. 6. Design, deploy, test, and maintain enterprise-class internetworks. 7. Demonstrate an understanding of medium characteristics, modulation and multiplexing techniques, physical layer framing structures used in data networks. Credits: 3.00 or 4.00

CNIT 34600 - Wireless Networks

Credit Hours: 3.00 or 4.00. This course introduces wireless networking. Topics include fundamental wireless communication concepts, wireless local area networks (LANs), and cellular systems. Wireless specific protocol elements are addressed in typical application environments. Data communications in multiple wireless environments are emphasized. In the laboratory section, students implement wireless solutions and integrate them into wired LAN environments.

Learning Outcomes: 1. Create and troubleshoot 802.11 wireless networks, as well as demonstrating integration into wired networks, devices and infrastructure. 2. Explain RF fundamentals, measurements and propagation theory. 3. Differentiate pertinent wireless networking standards, particularly those within the scope of the IEEE 802.11 standard. 4. Understand the underlying principles of the 802.11 MAC and how it relates to the upper and lower layers of the OSI model. 5. Implement wireless network security solutions and standards. Credits: 3.00 or 4.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger

economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

CNIT 34220 - Network Administration

Credit Hours: 2.00 or 3.00. This course focuses on the tasks and issues involved in the installation and administration of distributed computing systems. Topics include the administration of network operating systems and network system interoperability. Students will implement and maintain a comprehensive network service infrastructure.

Learning Outcomes: 1. Understand, implement, and maintain network services such as DNS, PKI, e-mail, and web. 2. Research and solve hardware and software implementation problems in laboratory projects. 3. Produce written reports that document project work performed in the laboratory. 4. Work cooperatively as a team to implement solutions. Credits: 2.00 or 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and

state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

Computing Infrastructure Selective - Credit Hours: 6.00

CNIT 43500 - Advanced Network Services

Credit Hours: 3.00. This course covers the concepts and technologies required to deploy advanced network services such as telephony and television over modern data networks. The underlying network structure and enabling services will be detailed along with a comprehensive analysis of protocols and services required to deploy such services.

Learning Outcomes: 1. Determine the relevant critical business and technical needs in order to develop a IP Telephony design framework. 2. Describe the technologies used in Voice over IP and select the appropriate hardware and software components to support a proposed IP telephony design. 3. Install, configure, and secure an IP Telephony solution. 4. Describe effective troubleshooting methods to resolve issues in IP Telephony Networks. Credits: 3.00

CNIT 44500 - Advanced Internetwork Routing And Switching

Credit Hours: 3.00. This course extends routing and switching knowledge with specific attention given to emerging trends. This course focuses on the concepts of traffic shaping, advanced exterior gateway routing protocols, label switching technologies, and quality of service. The necessary perspectives of integration of these topics into enterprise networks are addressed in both lecture and laboratory.

Credits: 3.00

CNIT 44600 - Advanced Wireless Networks

Credit Hours: 3.00. This course is an advanced course in wireless networking. Building on knowledge gained from the introductory wireless local area network course, this course addresses wireless network design and implementation on a large scale. Topics include mesh networking, broadband wireless access, backhauling, WiMAX and cellular systems. The laboratory portion of the course includes implementing and simulating these technologies in an outdoor setting.

Learning Outcomes: 1. Understand current WLAN, WMAN and WWAN design and implementation strategies. 2. Understand the increasing roles that WLANs, WMANs, WWANs are playing to increase mobility and augment wire line high throughout technologies. 3. Design and configure Metropolitan and Wide Area scaled wireless networks based on a given business scenario or problem. 4. Understand wireless data and telecommunications terminology and jargon. 5. Understand the basic underpinnings of important wireless technologies and wireless internet provider

management issues. 6. Conduct successful outdoor site surveys with different equipment and standards. 7. Be able to discuss wireless data and telecommunication issues with professionals in an informed and intelligent manner. 8. Formulate a checklist regarding existing and/or new wireless data/telecommunication systems and infrastructure. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 41700 - Critical Infrastructure Security

Credit Hours: 3.00. In the socio-political context of nation state sponsored threat actors and cyber cold wars, critical infrastructure (such as water supply and power generation) is a strategic target for attackers. This course investigates the current threat landscape and vulnerabilities in critical infrastructure. Students then investigate system and network architectural solutions to the problem. Students build a model industrial system and will implement these protections in their model environment.

Learning Outcomes: 1. Assess system architectures of industrial control networks to identify sources of vulnerability. 2. Analyze the threat landscape associated with industrial control environments. 3. Build and validate controls in a model industrial control network. Credits: 3.00

Information Technology Selectives - Credit Hours: 6.00

Other Departmental /Program Course Requirements (18 credits)

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of

STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data

displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or

15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of

organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

15 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key

steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

15 Credits

Spring 2nd Year

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with

applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic

problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

CNIT 34000 - UNIX Administration

Credit Hours: 3.00. This course focuses on the tasks and issues involved in the administration of UNIX systems. Topics include installation, networking, software management, scripting, and user management. In the laboratory portion of the course, students implement and maintain UNIX systems.

Learning Outcomes: 1. Understand the theory and practice of administering UNIX based operating systems. 2. Install and maintain UNIX operating systems. 3. Implement and maintain basic UNIX services including file sharing, e-mail, and X-Windows. 4. Secure UNIX operating systems. 5. Write and maintain UNIX shell scripts. 6. Integrate UNIX and Windows systems. Credits: 3.00

CNIT 34500 - Internetwork Design And Implementation

Credit Hours: 3.00 or 4.00. This is an advanced course in network architecture. Students learn to design and implement local and wide area networks capable of simultaneous transport of real-time traffic and multiprotocol data over packet-switched and circuit-switched networks. An emphasis is placed on the integration of diverse communications technologies, while considering the effects of engineering decisions on overall performance, from both business and technology perspectives.

Learning Outcomes: 1. Understand the operation of shortest path spanning trees in internetworks. 2. Perform IP subnetworking to correctly size and allocate addressing to network devices. 3. Perform IP supernetworking to correctly size and allocate addressing to network devices. 4. Identify the correct network architecture to deploy a given set of requirements. 5. Deploy dynamic routing protocols. 6. Design, deploy, test, and maintain enterprise-class internetworks. 7. Demonstrate an understanding of medium characteristics, modulation and multiplexing techniques, physical layer framing structures used in data networks. Credits: 3.00 or 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the

causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

15 Credits

Spring 3rd Year

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace

specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

CNIT 34600 - Wireless Networks

Credit Hours: 3.00 or 4.00. This course introduces wireless networking. Topics include fundamental wireless communication concepts, wireless local area networks (LANs), and cellular systems. Wireless specific protocol elements are addressed in typical application environments. Data communications in multiple wireless environments are emphasized. In the laboratory section, students implement wireless solutions and integrate them into wired LAN environments.

Learning Outcomes: 1. Create and troubleshoot 802.11 wireless networks, as well as demonstrating integration into wired networks, devices and infrastructure. 2. Explain RF fundamentals, measurements and propagation theory. 3. Differentiate pertinent wireless networking standards, particularly those within the scope of the IEEE 802.11 standard. 4. Understand the underlying principles of the 802.11 MAC and how it relates to the upper and lower layers of the OSI model. 5. Implement wireless network security solutions and standards. Credits: 3.00 or 4.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and

understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 34220 - Network Administration

Credit Hours: 2.00 or 3.00. This course focuses on the tasks and issues involved in the installation and administration of distributed computing systems. Topics include the administration of network operating systems and network system interoperability. Students will implement and maintain a comprehensive network service infrastructure.

Learning Outcomes: 1. Understand, implement, and maintain network services such as DNS, PKI, e-mail, and web. 2. Research and solve hardware and software implementation problems in laboratory projects. 3. Produce written reports that document project work performed in the laboratory. 4. Work cooperatively as a team to implement solutions. Credits: 2.00 or 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

15 Credits

Fall 4th Year

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in

multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of

knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

15 Credits

Spring 4th Year

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

15 Credits

Computing Systems Analysis & Design, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (51 credits)

Computer and Information Technology Required Major Courses - Credit Hours: 39.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements.

3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and

vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CNIT 38000 - Advanced Analysis And Design

Credit Hours: 3.00. This course is an advanced study of system analysis and design methods and techniques used by systems analysts to develop information systems. Object-oriented tools and the Unified Modeling Language (UML) will be used for describing object structure and behavior, and use cases will be used for modeling functional processes. Topics include rapid development concepts, application architecture and system design, transition from object-oriented analysis and models to components and services, graphical user interface design, web interface design, prototyping, and commercial software package integration. Emphasis is also placed on the use of an object-oriented CASE tool. This course surveys other important skills for the systems analyst, such as fact-finding (requirements discovery), communications, project management, and cost-benefit analysis.

Learning Outcomes: 1. Identify appropriate tools for modeling and implementing various systems aspects. 2. Apply use case and object modeling using Unified Modeling Language (UML) to a systems project. 3. Understand the Systems Development Life Cycle (SDLC) as an analytical problem solving approach to systems development. 4. Apply systems development tools and techniques during various stages of systems development. 5. Develop a system concept based on a given set of system requirements. Credits: 3.00

Programming Selective - Credit Hours: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create

classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

Information Technology Selective - Credit Hours: 3.00

Selectives - Credit Hours: 6.00

CNIT 38301 - Packaged Application Software Solutions

Credit Hours: 3.00. This course introduces knowledge, skills, tools, and techniques used to select and implement packaged application software solutions, both small and large (including ERP). Topics will include the make-verses-buy decision, critical success factors for packages, economic analysis, requirements analysis, identifying vendors and products, request for proposals, analysis of vendor proposals, decision analysis, implementation service providers, contracting for software and service, implementation project planning, life-cycle architecture, software installation and configuration, business process redesign organizational change management, integration with legacy system, customization verses adaptation, data conversion, system and application testing, training and support, system cutover and post go-live considerations. The course will focus on best practices, and consequences of less than best practices. This course will benefit students with career aspirations as systems analysts, business analysts, consultants, data and database administrators, and IT managers.

Learning Outcomes: 1. Describe holistically, in intelligent conversation, the make-versus-buy decision, criteria, implications, and implementation process differences. 2. Analyze and revise a Request for Proposal (RFP) more maximum efficiency and effectiveness. 3. Score a set of condensed software package proposals and submit a recommendation for the "best fit" for an organization. 4. Develop a checklist for analyzing a set of contracts for a software license and its implementation services. 5. Develop a project plan for the implementation of software packages. Credits: 3.00

CNIT 40500 - Software Development Methodologies

Credit Hours: 3.00. This course explores methodologies and practices commonly used in contemporary software development projects. Topics include programming standards, code ownership and accountability, source code management and version control, productivity and quality metrics, software testing, and software process maturity models.

Learning Outcomes: 1. Demonstrate a level of proficiency in software development process and project topics. 2. Understand what is needed to work in and lead a team developing comprehensive software projects. 3. Understand the advantages and disadvantages of software development process models. 4. Understand the ramifications of in house vs. outsourcing of software development projects. 5. Analyze and evaluate the various software development methodologies available. 6. Understand and be able to implement requirements traceability to software modules. 7. Understand and be able to implement software testing procedures. 8. Identify, monitor, and document risks involved with software and software development. 9. Produce reports detailing the proper implementation of a software development methodology or technology. 10. Understand change management as applied to software. 11. Understand software project, process and product metrics. 12. Understand software quality concepts and the processes required to ensure software quality. 13. Understand the issues of accountability, responsibility, and certification as they apply to software professionals. 14. Understand intellectual property rights as applied to software. Credits: 3.00

CNIT 55000 - Organizational Impact Of Information Technology

Credit Hours: 3.00. An enterprise view of the organizational impact of information technology as the most effective means for achieving "better, faster, cheaper operations" in today's highly competitive business environment. Examines how information technology has enabled new organizational forms and changes in business processes, products, markets, delivery systems, ways of working, and people management issues and challenges. Permission of instructor required.

Learning Outcomes: 1. Articulate methods and algorithms in network security. 2. Evaluate the strengths and weaknesses of different networking security approaches. 3. Describe how to deploy encryption techniques to secure data at rest and in transit. 4. Compare, contrast and critique existing applied research in network security. 5. Propose new ideas/technologies in network security and systematically assess your proposed work. Credits: 3.00

CNIT 55300 - Quality Management In Information Technology

Credit Hours: 3.00. This course explores quality and productivity models used to ensure quality in information technology systems development processes. Special emphasis is on learning and understanding process metrics and measurement, as well as initiatives such as Total Quality Management, Continuous Process Improvement, Six Sigma, and the Software Engineering Institute Capability Maturity Model. Permission of instructor required.

Learning Outcomes: 1. Use and apply information technology solutions. 2. Understand and apply high-level tools and emerging technologies. 3. Demonstrate independent critical thinking and problem solving skills. 4. Understand and apply information technology application methodologies. 5. Communicate effectively with customers, supervisors and peers, both orally and in writing. 6. Understand the expectations of an information technology professional. Credits: 3.00

CNIT 38501 - Advanced Systems Design And Integration

Credit Hours: 3.00. A continuation of CNIT 38000 with an emphasis on knowledge, skills, tools, and techniques that systems analysts and architects use to translate functional systems requirements into design specifications that can be subsequently implemented. Students will learn methods for developing specifications that fulfill desired quality properties such as performance, scalability, maintainability, security, privacy, and protection of corporate property, interoperability, and usability, to name a few. Special emphasis is placed on integrating new systems with older systems, as well as with business processes. This course takes a holistic view of design and integration that specifies a complete information technology or information systems solution from the perspectives of different stakeholders, and from different systemic viewpoints and perspectives. Increasingly, the result of design and integration is referred to as a solution's architecture.

Learning Outcomes: 1. Describe holistically, in intelligent conversation, the design and architecture of information technology solutions. 2. Identify and evaluate current and emerging technologies and assess their applicability to address an IT solution's needs. 3. Apply a comprehensive framework for IT solution architecture to an approved problem domain. 4. Document accurately system representations of multiple architectural and design "concerns" of an IT solution, from the perspectives of different stakeholders. 5. Work effectively in teams and communicate effectively with various stakeholders of an architectural description of an IT solution. Credits: 3.00

CNIT 58000 - Advanced Topics In Information Technology Project Management

Credit Hours: 3.00. The course explores and applies the advanced concepts, skills, knowledge, techniques, and tools required to successfully initiate, plan, manage, execute, control, and report on information technology projects. Special emphasis is placed on applying the PM BOK in a real life business case study as well as researching and learning concepts, techniques, and processes experienced project and program managers employ to successfully plan and manage projects. This course enables the student to learn project management through the application of project approaches in a team based setting. Through the application of project methodologies, tools and templates, the student learns the project life-cycle approach as demonstrated through actual and simulated project situations. Permission of Department required.

Learning Outcomes: 1. Explain and apply the processes and Weekly Assignments, Live, and artifacts prescribed by the PMBOK. 2. Assess

the objectives of a project management office and how organizations implement them based on their organizational structure and culture. 3. Research and analyze methodologies, tools, and techniques used by today's experienced IT project managers. 4. Research and analyze current business and technology conditions that affect project managers of today. 5. Describe and evaluate the competencies that are required to be an effective project manager. 6. Research innovative methods and techniques for performing IT project management. Credits: 3.00

CNIT 58600 - IT Requirements Management

Credit Hours: 3.00. The course explores the approaches used by today's information system professionals to conduct and manage the requirements development process. Course emphasis focuses on contemporary techniques for requirements elicitation, requirements analysis, requirements specification, requirements validation and verification. Emphasis is also placed on identifying stakeholders through the use of formal stakeholder analysis techniques, the use of formal change control, requirements traceability and the use of requirements management tools. The course is designed based on the principles and competencies prescribed by the Project Management institute's PM BOK (Project Management Body of Knowledge) and Business Analyst Guide as well as the International Institute of Business Analysis's BABOK (Business Analysis Body of Knowledge). Permission of Department required.

Learning Outcomes: 1. Research and analyze in order to discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for requirements management into information technology projects. 2. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 3. Accurately document, and communicate business requirements for an IT project. 4. Select, defend and utilize requirements management tools and techniques in the context of information technology projects and management. 5. For residential, thesis students, research and contribute to the requirements management body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 48200 - Six Sigma Data Quality For Continuous Improvement

Credit Hours: 3.00. A study of data quality for Six Sigma level of improvement, applying a Six Sigma DMAIC (Define, Measure, Analyze, Improve and Control) improvement methodology, utilizing information tools and techniques. The course addresses advanced topics in statistical based continuous improvement, data quality; and Big Data Analytics concepts, as pertains to systematic problems. An embedded certificate in SS is included in the body of knowledge.

Learning Outcomes: 1. Explain how Six Sigma principles are used for continuous improvement. 2. Apply the DMAIC and Big Data approach in solving team based, project based problems. 3. Demonstrate understanding of data quality principles as applied to compelling business cases. Credits: 3.00

Other Departmental /Program Course Requirements (27 credits)

PHIL 15000 - Principles Of Logic (UCC: QR)

Credit Hours: 3.00. A first course in formal deductive logic; mechanical and other procedures for distinguishing good arguments from bad. Truth-tables and proofs for sentential (Boolean) connectives, followed by quantificational logic with relations. Although metatheoretic topics are treated, the emphasis is on methods.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: Will add at a later date.

Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete

and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand

statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the

design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal

intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

PHIL 15000 - Principles Of Logic (UCC: QR)

Credit Hours: 3.00. A first course in formal deductive logic; mechanical and other procedures for distinguishing good arguments from bad. Truth-tables and proofs for sentential (Boolean) connectives, followed by quantificational logic with relations. Although metatheoretic topics are treated, the emphasis is on methods.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: Will add at a later date. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

15 Credits

Spring 2nd Year

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the

difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

15 Credits

Fall 3rd Year

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and

recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 38000 - Advanced Analysis And Design

Credit Hours: 3.00. This course is an advanced study of system analysis and design methods and techniques used by systems analysts to develop information systems. Object-oriented tools and the Unified Modeling Language (UML) will be used for describing object structure and behavior, and use cases will be used for modeling functional processes. Topics include rapid development concepts, application architecture and system design, transition from object-oriented analysis and models to components and services, graphical user interface design, web interface design, prototyping, and commercial software package integration. Emphasis is also placed on the use of an object-oriented CASE tool. This course surveys other important skills for the systems analyst, such as fact-finding (requirements discovery), communications, project management, and cost-benefit analysis.

Learning Outcomes: 1. Identify appropriate tools for modeling and implementing various systems aspects. 2. Apply use case and object modeling using Unified Modeling Language (UML) to a systems project. 3. Understand the Systems Development Life Cycle (SDLC) as an analytical problem solving approach to systems development. 4. Apply systems development tools and techniques during various stages of systems development. 5. Develop a system concept based on a given set of system requirements. Credits: 3.00

15 Credits

Spring 3rd Year

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles,

user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

15 Credits

Construction Engineering, BSCNE

About the Program

Degree Requirements

Construction Engineering Required Major Courses (66 credits)

CE 20300 - Principles And Practice Of Geomatics

Credit Hours: 4.00. This course provides a broad overview of geomatics engineering including fundamental principles required for practical geomatics applications. This course includes subjects in traditional surveying, GPS surveying, remote sensing, photogrammetry, laser scanning, and Geographic Information Systems (GIS). Basic concepts on these subjects are applied to solve practical problems in various civil engineering applications; including computations for engineering project control and construction layout; theory of error propagation; fundamental concepts of horizontal and vertical curves; topographic mapping using various geospatial data acquisition technologies from ground, air, and space; GIS for visualization and analysis of geospatial data.

Learning Outcomes: 1. Design and execute a leveling survey. 2. Design and execute a traverse survey. 3. Use survey data to produce a topographic map. 4. Perform horizontal and vertical curve computations. 5. Collect GPS/RTK/RTN data with survey grade accuracy. 6. Perform remote sensing image classification. 7. Measure digital photographs and perform camera calibration. 8. Use software to generate 3D point cloud from digital imagery. 9. Perform multi-image bundle block adjustment. 10. Manipulate 3D point cloud data from a laser scanner, and extract engineering parameters. 11. Select appropriate geodetic references and map projections for geomatics applications. 12. Collect and register geospatial

data from multiple sources for engineering applications. 13. Map and visualize collected geospatial data. Credits: 4.00

CE 27000 - Introductory Structural Mechanics

Credit Hours: 4.00. Loads; structural forms; analysis of axially loaded members, flexural members, torsional members; combined loading conditions; buckling. Basic behavioral characteristics of structural elements and systems illustrated by laboratory experiments.

Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

CE 37100 - Structural Analysis I

Credit Hours: 3.00. Stress resultants (reactions, axial forces, shear forces, and bending moments) for beams and framed structures. Deflections of beams and frames by geometric methods (moment-area theorems and applications; conjugate beam analogy). Analysis of statically indeterminate beams and frames by classical stiffness methods; slope deflection and moment distribution. Influence functions and their applications.

Credits: 3.00

CE 38300 - Geotechnical Engineering I

Credit Hours: 3.00. Introduction to the nature and origin of soils and rocks; engineering significance of geologic landforms and soil deposits; identification and engineering classification of soils; engineering behavior and properties of soils; permeability, compressibility, shearing resistance; soil compaction.

Credits: 3.00

CE 47300 - Reinforced Concrete Design

Credit Hours: 4.00. Design and behavior of reinforced concrete beams, one-way slabs, and columns.

Credits: 4.00

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating

and controlling costs on a construction project. Credits: 3.00

CEM 28000 - Construction Engineering Professional Development I

Credit Hours: 1.00. This course will prepare the student for professional practice in construction engineering including information on careers and issues in construction industries; History and Culture of the U.S. Construction Industry; Engineering Ethics and Preparation for Leadership. Information and assistance is also provided related to minors and selections associated with the plan of study; student's organizations; opportunities for construction research and community outreach at Purdue. Guest speakers with be utilized to enhance the experience. The guest speakers include industry partners as well as faculty and staff. There will be an emphasis on written and oral communication.

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to function on multidisciplinary teams. 4. Demonstrate an ability to identify, formulate, and solve engineering problems. 5. Demonstrate an understanding of professional and ethical responsibility. 6. Demonstrate ability to communicate effectively. 7. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 8. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 9. Demonstrate knowledge of contemporary issues. 10. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

CEM 30100 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. This course continues an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed facilities. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Able to design a process to meet desired needs within realistic constraints. Credits: 3.00

CEM 32400 - Human Resource Management In Construction

Credit Hours: 3.00. Introduce a broad set of fundamental topics regarding management of people in engineering and construction organizations in the U.S. Subjects include labor-management relations (laws, regulations and practices affecting construction workers and organizations); worker motivation, productivity, and training; roles and practices of managers; construction safety; management of quality.

Learning Outcomes: 1. Understand managerial aspects of the engineering and construction industry. 2. Know the background and the principal laws and practices concerning labor-management relations for the union and nonunion jobs. 3. Know current management practices involving worker supply and demand, workforce training, EEO and workforce diversity, professional ethics and construction safety. 4. Gain basic knowledge to help you become an effective manager in engineering and construction organizations. 5. Enhance communication skills. Credits: 3.00

CEM 45500 - Temporary Structures In Construction

Credit Hours: 3.00. This course will cover the design and construction of various temporary structures and systems used in building and transportation construction. The course describes not only design issues of temporary structures such as formwork, falsework, bracing, earth retention systems, scaffolding, cofferdams, and so forth by providing lectures and design examples, but it also covers business aspects associated with the design and construction of temporary structures in the real world such as business practice, legal aspects, and design philosophy.

Learning Outcomes: 1. Develop an understanding of design and performance of various systems. 2. Develop an understanding of the importance and value of these systems and the responsibilities that will be carried into a professional career. Credits: 3.00

CEM 48500 - Legal Aspects Of Construction Engineering

Credit Hours: 3.00. This course will cover legal principles and landmark cases relevant to civil and construction engineering. Specific subjects covered include contracts, torts, agency, professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties and ethics.

Learning Outcomes: 1. Read, comprehend and interpret construction contract plans and specifications for lock and dam facilities and other inland navigation structures. Through detailed study of project plans and specs as well as construction photos, students will be taken through the process of building these facilities from planning through construction. 2. Understand how a lock and dam facility functions. 3. Identify various components of lock and dam structures. 4. Understand various types of marine equipment necessary to construct a navigation facility in the dry or wet. Credits: 3.00

CEM 38000 - Construction Engineering Professional Development II

Credit Hours: 1.00. This course will build upon the topics discussed in CEM 28000 to further prepare students for their work in the construction industry. A focus of this class will be on presentation skills. By utilizing the first or last hour of CEM 42500 - Construction Practice Project, the students of CEM 38000 will have the opportunity to present and also participate as an audience and active participant in CEM 42500 Construction Practice Project. The presentations of CEM 38000 will consist of their required Summer Internship Reports, which are a compilation of the work they have completed and skills they have learned in their first two internships (CEM 19100 and CEM 29100).

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to identify, formulate, and solve engineering problems. 4. Demonstrate an understanding of professional and ethical responsibility. 5. Demonstrate an ability to communicate effectively. 6. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 8. Demonstrate knowledge of contemporary issues. Credits: 1.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CEM 18000 - Construction Engineering Pre-Professional Development

Credit Hours: 1.00. Online course consisting of 8 sessions and 1 module (10 hour OSHA training) is intended to be completed before the student's first work session (internship) in order to prepare the student in the form of oral and written communication that will assist them in being successful in their experiential learning opportunities within industry. This course will also introduce the students to the construction industry relative to office and field requirements and introduce the student to professional skills that will be needed for their experiential learning opportunities including but not limited to: verbiage and acronyms, tools, software platforms, and general business etiquette and ethics.

Learning Outcomes: 1. Demonstrate an ability

to apply knowledge of mathematics, science and engineering. 2. Demonstrate an understanding of professional and ethical responsibility. 3. Demonstrate ability to communicate effectively. 4. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 6. Demonstrate knowledge of contemporary issues. Credits: 1.00

CEM 42501 - Construction Engineering Capstone I

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design. Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and in construction internships.

Learning Outcomes: 1. Know phases and aspects of construction project planning, engineering, and management at the project level. 2. Know complexities and uncertainties of planning and decision-making in a realistic environment. 3. Know how construction activities by the constructor are influenced by owner needs and project design basis and features. 4. Demonstrate methods and skills of oral and written communication. 5. Demonstrate methods, techniques and experience of working in teams. Credits: 2.00

CEM 42502 - Construction Engineering Capstone II

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design. Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and in construction internships.

Learning Outcomes: 1. Able to read a contract and determine the scope of work to be provided and under what terms. 2. Able to assemble a schematic design and design development set of plans & specifications representative of the schedule and budget. 3. Able to create appropriate types of schedules based on work composition using various scheduling programs. 4. Able to select the appropriate equipment, labor resources, and materials including temporary structure to perform the work. 5. Able to develop an estimate and budget based on plans and specifications. Credits: 2.00

CE 21101 - Thermal And Energy Sciences

Credit Hours: 3.00. This course includes applications of thermal science and energy fundamentals to civil engineering topics. Emphasis is placed on fundamental concepts of properties of materials, work, heat, internal energy, entropy, equilibrium, and relations derived from the first and second laws of thermodynamics. Example applications include: power plants; fluid flow in ducts/pipes; thermal properties of building/construction materials and processes; geothermal systems; heating, ventilation, and air conditioning (HVAC) processes; energy balances in buildings; refrigeration; hydroelectric power; contaminant transport in air, water, and soil; climate change; the urban heat island effect; and energy use in the transportation sector.

Learning Outcomes: 1. Explain the principles of mass and energy conservation and their use in civil engineering applications. 2. Evaluate thermodynamic systems and several forms of work, energy, and heat transfer. 3. Apply conservation of mass and energy for closed systems and control volume processes. 4. Explain the second law of thermodynamics, entropy changes, and device efficiencies. Credits: 3.00

CE 33500 - Civil Engineering Materials

Credit Hours: 4.00. An introduction to the relationships between fundamental structure of materials and their properties presented through a combination of materials science and engineering approaches. Emphasis on materials of particular interest for civil engineering applications, including metals, aggregates, portland cement concrete, bituminous materials, asphalt binders, asphalt mixtures, wood, polymers, composites, and masonry. Laboratory exercises illustrate atomic structure, elastic and inelastic properties, and demonstrate applications of selected principle of mechanics, testing of aggregates, as well as designing and testing of asphalt and concrete mixtures.

Learning Outcomes: 1. Formulate equations that describe the properties of composite materials based on boundary conditions, assumptions and constituent properties. 2. Design and conduct experiments, as well as to analyze and interpret data. 3. Use non-destructive tests to estimate material properties. 4. Use non-destructive test to locate flaws in engineering systems. 5. Compare and contrast strength of materials and fracture mechanics solutions. 6. Use mathematics, science and engineering principles to estimate the influence of cracks on the mechanical response of engineering materials. 7. Use scientific and engineering principles to predict the elastic and viscoelastic of a material. 8. Interpret engineering properties from test data. 9. Use standardized test procedures to describe the properties of engineering materials. 10. Use mathematical, scientific and engineering principles to compute the influence of material proportions on the structure property relationships for concrete materials. 11. Design the proportions for a concrete mixture. 12. Explain the relationship between the properties of an asphalt mixture and its performance. 13. Select engineering materials for specific applications. 14. Communicate effectively using graphs. 15. Communicate effectively using an executive summary. 16. Communicate effectively using an engineering report. 17. Communicate the expected accuracy obtained from engineering data. Credits: 4.00

CEM 29199 - Experiential Learning Session I

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in

their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 29299 - Experiential Learning Session II

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the

ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 39399 - Experiential Learning Session III

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices

to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

Other Departmental/Program Course Requirements (60-73 credits)

First-Year Engineering Requirements (29-39 credits)

Other Course Requirements (22-25 credits)

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8.

Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are

conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge

of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

General Education Requirement (9 credits)

Optional Concentrations

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Sample Plan

Summer 1st Year

CEM 29199 - Experiential Learning Session I

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire

fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

0 Credit

Fall 2nd Year

CE 20300 - Principles And Practice Of Geomatics

Credit Hours: 4.00. This course provides a broad overview of geomatics engineering including fundamental principles required for practical geomatics applications. This course includes subjects in traditional surveying, GPS surveying, remote sensing, photogrammetry, laser scanning, and Geographic Information Systems (GIS). Basic concepts on these subjects are applied to solve practical problems in various civil engineering applications; including computations for engineering project control and construction layout; theory of error propagation; fundamental concepts of horizontal and vertical curves; topographic mapping using various geospatial data acquisition technologies from ground, air, and space; GIS for visualization and analysis of geospatial data.

Learning Outcomes: 1. Design and execute a leveling survey. 2. Design and execute a traverse survey. 3. Use survey data to produce a topographic map. 4. Perform horizontal and vertical curve computations. 5. Collect GPS/RTK/RTN data with survey grade accuracy. 6. Perform remote sensing image classification. 7. Measure digital photographs and perform camera calibration. 8. Use software to generate 3D point cloud from digital imagery. 9. Perform multi-image bundle block adjustment. 10. Manipulate 3D point cloud data from a laser scanner, and extract engineering parameters. 11. Select appropriate geodetic references and map projections for geomatics applications. 12. Collect and register geospatial data from multiple sources for engineering applications. 13. Map and visualize collected geospatial data. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CEM 28000 - Construction Engineering Professional Development I

Credit Hours: 1.00. This course will prepare the student for professional practice in construction engineering including information on careers and issues in construction industries;

History and Culture of the U.S. Construction Industry; Engineering Ethics and Preparation for Leadership. Information and assistance is also provided related to minors and selections associated with the plan of study; student's organizations; opportunities for construction research and community outreach at Purdue. Guest speakers with be utilized to enhance the experience. The guest speakers include industry partners as well as faculty and staff. There will be an emphasis on written and oral communication.

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to function on multidisciplinary teams. 4. Demonstrate an ability to identify, formulate, and solve engineering problems. 5. Demonstrate an understanding of professional and ethical responsibility. 6. Demonstrate ability to communicate effectively. 7. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 8. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 9. Demonstrate knowledge of contemporary issues. 10. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions.
Credits: 2.00

14 Credits

Spring 2nd Year

CE 27000 - Introductory Structural Mechanics

Credit Hours: 4.00. Loads; structural forms; analysis of axially loaded members, flexural members, torsional members; combined loading conditions; buckling. Basic behavioral characteristics of structural elements and systems illustrated by laboratory experiments.

Credits: 4.00

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project.
Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher

orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16-17 Credits

Summer 2nd Year

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and

describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CEM 29299 - Experiential Learning Session II

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

3-4 Credits

Fall 3rd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

CEM 30100 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. This course continues an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed facilities. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Able to design a process to meet desired needs within realistic constraints. Credits: 3.00

CEM 32400 - Human Resource Management In Construction

Credit Hours: 3.00. Introduce a broad set of fundamental topics regarding management of people in engineering and construction organizations in the U.S. Subjects include labor-management relations (laws, regulations and practices affecting construction workers and organizations); worker motivation, productivity, and training; roles and practices of managers; construction safety; management of quality.

Learning Outcomes: 1. Understand managerial aspects of the engineering and construction industry. 2. Know the background and the principal laws and practices concerning labor-management relations for the union and nonunion jobs. 3. Know current management practices involving worker supply and demand, workforce training, EEO and workforce diversity, professional ethics and construction safety. 4. Gain basic knowledge to help you become an effective manager in engineering and construction organizations. 5. Enhance communication skills. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

CE 33500 - Civil Engineering Materials

Credit Hours: 4.00. An introduction to the relationships between fundamental structure of materials and their properties presented through a combination of materials science and engineering approaches. Emphasis on materials of particular interest for civil engineering applications, including metals, aggregates, portland cement concrete, bituminous materials, asphalt binders, asphalt mixtures, wood, polymers, composites, and masonry. Laboratory exercises illustrate atomic structure, elastic and inelastic properties, and demonstrate applications of selected principle of mechanics, testing of aggregates, as well as designing and testing of asphalt and concrete mixtures.

Learning Outcomes: 1. Formulate equations that describe the properties of composite materials based on boundary conditions, assumptions and constituent properties. 2. Design and conduct experiments, as well as to analyze and interpret data. 3. Use non-destructive tests to estimate material properties. 4. Use non-destructive test to locate flaws in engineering systems. 5. Compare and contrast strength of materials and fracture mechanics solutions. 6. Use mathematics, science and engineering principles to estimate the influence of cracks on the mechanical response of engineering materials. 7. Use scientific and

engineering principles to predict the elastic and viscoelastic of a material. 8. Interpret engineering properties from test data. 9. Use standardized test procedures to describe the properties of engineering materials. 10. Use mathematical, scientific and engineering principles to compute the influence of material proportions on the structure property relationships for concrete materials. 11. Design the proportions for a concrete mixture. 12. Explain the relationship between the properties of an asphalt mixture and its performance. 13. Select engineering materials for specific applications. 14. Communicate effectively using graphs. 15. Communicate effectively using an executive summary. 16. Communicate effectively using an engineering report. 17. Communicate the expected accuracy obtained from engineering data. Credits: 4.00

16 Credits

Spring 3rd Year

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

CE 37100 - Structural Analysis I

Credit Hours: 3.00. Stress resultants (reactions, axial forces, shear forces, and bending moments) for beams and framed structures. Deflections of beams and frames by geometric methods (moment-area theorems and applications; conjugate beam analogy). Analysis of statically indeterminate beams and frames by classical stiffness methods; slope deflection and moment distribution. Influence functions and their applications.

Credits: 3.00

CE 38300 - Geotechnical Engineering I

Credit Hours: 3.00. Introduction to the nature and origin of soils and rocks; engineering significance of geologic landforms and soil deposits; identification and engineering classification of soils; engineering behavior and properties of soils; permeability, compressibility, shearing resistance; soil compaction.

Credits: 3.00

CEM 38000 - Construction Engineering Professional Development II

Credit Hours: 1.00. This course will build upon the topics discussed in CEM 28000 to further prepare students for their work in the construction industry. A focus of this class will be on presentation skills. By utilizing the first or last hour of CEM 42500 - Construction Practice Project, the students of CEM 38000 will have the opportunity to present and also participate as an audience and active participant in CEM 42500 Construction Practice Project. The presentations of CEM 38000 will consist of their required Summer Internship Reports, which are a compilation of the work they have completed and skills they have learned in their first two internships (CEM 19100 and CEM 29100).

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to identify, formulate, and solve engineering problems. 4. Demonstrate an understanding of professional and ethical responsibility. 5. Demonstrate an ability to communicate effectively. 6. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 8. Demonstrate knowledge of contemporary issues. Credits: 1.00

14 Credits

Summer 3rd Year

CEM 39399 - Experiential Learning Session III

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

3 Credits

Fall 4th Year

CE 47300 - Reinforced Concrete Design

Credit Hours: 4.00. Design and behavior of reinforced concrete beams, one-way slabs, and columns.

Credits: 4.00

CEM 45500 - Temporary Structures In Construction

Credit Hours: 3.00. This course will cover the design and construction of various temporary structures and systems used in building and transportation construction. The course describes not only design issues of temporary structures such as formwork, falsework, bracing, earth retention systems, scaffolding, cofferdams, and so forth by providing lectures and design examples, but it also covers business aspects associated with the design and construction of temporary structures in the real world such as business practice, legal aspects, and design philosophy.

Learning Outcomes: 1. Develop an understanding of design and performance of various systems. 2. Develop an understanding of the importance and value of these systems and the responsibilities that will be carried into a professional career. Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CEM 42501 - Construction Engineering Capstone I

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design. Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and in construction internships.

Learning Outcomes: 1. Know phases and aspects of construction project planning, engineering, and management at the project level. 2. Know complexities and uncertainties of planning and decision-making in a realistic environment. 3. Know how construction activities by the constructor are influenced by owner needs and project design basis and features. 4. Demonstrate methods and skills of oral and written communication. 5. Demonstrate methods, techniques and experience of working in teams. Credits: 2.00

CE 21101 - Thermal And Energy Sciences

Credit Hours: 3.00. This course includes applications of thermal science and energy fundamentals to civil engineering topics. Emphasis is placed on fundamental concepts of properties of materials, work, heat, internal energy, entropy, equilibrium, and relations derived from the first and second laws of thermodynamics. Example applications include: power plants; fluid flow in ducts/pipes; thermal properties of building/construction materials and processes; geothermal systems; heating, ventilation, and air conditioning (HVAC) processes; energy balances in buildings; refrigeration; hydroelectric power; contaminant transport in air, water, and soil; climate change; the urban heat island effect; and energy use in the transportation sector.

Learning Outcomes: 1. Explain the principles of mass and energy conservation and their use in civil engineering applications. 2. Evaluate thermodynamic systems and several forms of work, energy, and heat transfer. 3. Apply conservation of mass and energy for closed systems and control volume processes. 4. Explain the second law of thermodynamics, entropy changes, and device efficiencies. Credits: 3.00

15 Credits

Spring 4th Year

CEM 48500 - Legal Aspects Of Construction Engineering

Credit Hours: 3.00. This course will cover legal principles and landmark cases relevant to civil and construction engineering. Specific subjects covered include contracts, torts, agency,

professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties and ethics.

Learning Outcomes: 1. Read, comprehend and interpret construction contract plans and specifications for lock and dam facilities and other inland navigation structures. Through detailed study of project plans and specs as well as construction photos, students will be taken through the process of building these facilities from planning through construction. 2. Understand how a lock and dam facility functions. 3. Identify various components of lock and dam structures. 4. Understand various types of marine equipment necessary to construct a navigation facility in the dry or wet. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

CEM 42502 - Construction Engineering Capstone II

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design. Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and

in construction internships.

Learning Outcomes: 1. Able to read a contract and determine the scope of work to be provided and under what terms. 2. Able to assemble a schematic design and design development set of plans & specifications representative of the schedule and budget. 3. Able to create appropriate types of schedules based on work composition using various scheduling programs. 4. Able to select the appropriate equipment, labor resources, and materials including temporary structure to perform the work. 5. Able to develop an estimate and budget based on plans and specifications. Credits: 2.00

14 Credits

Construction Management, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (62 credits)

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

CM 15000 - Construction Management Fundamentals

Credit Hours: 6.00. This introductory course focuses on construction materials, methods, and contracts for basic commercial and residential projects. Students will develop essential skills in quantity estimating, construction plan reading, and project documentation. Students will participate in hands-on lab exercises that aim to connect theory with practice. The course includes OSHA 10-hour instruction, with students earning OSHA 10-hour certification cards upon completion, further emphasizing the importance of safety in construction practices.

Learning Outcomes: 1. Identify materials, means, and methods for a construction project throughout the entire project lifecycle. 2. Recognize project controls required during the pre-construction and construction phases of a construction project. 3. Explain project planning tasks relevant to a construction project. 4. Comprehend project administration on a construction project and the required

documentation and technology available within the current construction industry. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 40000 - Construction Capstone I

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of pre-construction management into a capstone project.

Learning Outcomes: 1. Design systems for a construction project during the pre-construction phase. 2. Create project controls required during the pre-construction phase of a construction project. 3. Evaluate pre-planning tasks relevant to be beginning a construction project. 4. Generate project administration for a construction project utilizing the required documentation and technology available within the current construction industry. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 43300 - Risk Management And Legal Issues In Design And Construction Integration

Credit Hours: 2.00. An advanced course dealing with risk management and legal issues as they pertain to the interaction of designers, contractors, and owners. Students will learn to identify and mitigate potential risks that may affect the multiple stakeholders and the business organizations they represent during design and construction activity. The course will also deal with trust and teamwork issues within collaborative processes in the built environment.

Learning Outcomes: 1. Identify potential risks for designers, contractors, and owners in a collaborative construction industry environment. 2. Understand potential trust issues that inhibit collaboration within the architecture, engineering, and construction (AEC) industry. 3. Develop mitigation measures to reduce risk and increase collaboration within architecture, engineering, and construction interactions. 4. Use clear and precise questions and consider diverse points of views when reasoning. 5. Demonstrate ability to gather, assess, record, and compare relevant information in order to support conclusions and related consequences. Credits: 2.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions.

Credits: 2.00

CM 16000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Learning Outcomes: 1. Understand fundamentals of surveying including the theory and practice of surveying. 2. Perform surveying computations of grade, direction, traverse adjustment, area, and horizontal and vertical curve geometry. 3. Perform field measurements using basic and modern surveying equipment. 4. Perform tasks within a group effectively and efficiently. Credits: 3.00

CM 20002 - Intermediate Pre-Construction Management

Credit Hours: 4.00. A project course covering intermediate level commercial, residential, heavy/civil, and industrial construction projects. Students will expand their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Calculate design components of a construction project during the pre-construction phase. 2. Produce project controls required during the pre-construction phase of a construction project. 3. Construct pre-planning documents relevant to beginning a construction project. 4. Apply project administration to a construction project utilizing the required documentation and technology available within the current construction industry. Credits: 4.00

CM 21500 - Mechanical Construction

Credit Hours: 3.00. Principles of code, design, methods, and materials are applied to plumbing, heating, ventilation, and air conditioning systems for buildings. The comprehension of mechanical construction plans and specifications is emphasized through exercises in mechanical estimating.

Learning Outcomes: 1. Relate materials, means, & methods for the MEP scope to a construction project throughout the project lifecycle. Prepare a list of CSI Divisions for the MEP scope and outline the MEP scope of work for a construction project; Propose sustainability concepts to the materials, means, and methods for the MEP scope of a construction project; Schedule work sequence for the MEP scope of construction phases of a project; Apply QA/QC documents and procedures required for the MEP scope during the construction phase. 2. Apply company management concepts to the MEP scope of a construction project during the construction phase. Create financial management plan required to complete the MEP scope of a construction project; Demonstrate interpersonal relations related to the MEP scope on a construction project; Integrating technology use on the MEP scope of a construction project during the construction phase. 3. Show professionalism by applying proper communication, team work, rules & regulations, and level of detail required within a construction company and on a construction jobsite. Demonstrate leadership skills within a team-based project; Utilize management skills required to complete tasks within a construction project; Practice teamwork utilizing the strengths of the individuals within the team; Apply oral and written communication skill required within a construction project; Use ethics in all decision making and daily activities in a construction project. Credits: 3.00

CM 21601 - Electrical Construction

Credit Hours: 2.00. Principles of code and basic concepts in electrical theory, materials, methods, design and estimating are applied to electrical systems for buildings. Comprehension of electrical construction plans and specifications as well as installation exercises are emphasized through lab experiences.

Learning Outcomes: 1. Demonstrate thorough knowledge of all documents normally used in the electrical construction process including

plans and specifications. 2. Recognize the applications of commonly used types of electrical materials required in building construction. 3. Interpret and evaluate materials selection, installation methods, and proper sizing and installation techniques using the National Electrical Code. 4. Illustrate the ability to effectively interact with building construction professionals regarding electrical construction. 5. Recall the names, nicknames, applications and rules for commonly used materials in the electrical contracting industry. 6. Construct proper electrical systems schematics. 7. Assemble the correct components and arrange them correctly to demonstrate basic electrical circuit knowledge. 8. Inspect electrical installations and identify rudimentary National Electrical Code violations. Credits: 2.00

CM 27000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Learning Outcomes: 1. Analyze force systems acting at a single point. 2. Analyze force systems that are non-concurrent. 3. Analyze/design cable systems. 4. Analyze/design trusses by graphical and numerical methods. 5. Analyze/design pinned frames. 6. Analyze/design 3-hinged arches. 7. Trace the live and dead loads throughout a building structure. Credits: 3.00

CM 30002 - Advanced Pre-Construction Management

Credit Hours: 4.00. A project course covering advanced level commercial, residential, heavy/civil, and industrial construction projects. Students will further develop their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Select design systems for a construction project during the pre-construction phase. 2. Illustrate project controls required during the pre-construction phase of a construction project. 3. Analyze pre-planning tasks relevant to beginning a construction project. 4. Differentiate project administration on a construction project utilizing the required documentation and technology available within the current construction industry. 5. Demonstrate professionalism by analyzing proper communication, teamwork, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 4.00

CM 30101 - Introduction To Construction Company Financial Management

Credit Hours: 2.00. An introduction to methods for recognizing revenue for long-term construction contracts and each method's impact on financial statements. Includes introduction to analysis of financial statements and their use in developing company budgets, projecting cash needs, pricing construction projects, and forecasting the impact of business decisions on construction company profit.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction contractor. 2. Identify the unique accounts required for percentage of completion revenue recognition, describe what the account represents, and indicate on which statement the account is found. 3. Interpret the outcomes of line-item analysis, vertical analysis, horizontal analysis, and cost-volume-profit analysis utilizing construction company financial statement data. 4. Perform a profit center analysis of an income statement. 5. Prepare an annual budget for a construction company given source documents. 6. Analyze the impact of various decisions on company profits by applying the cost-volume-profit financial analysis technique. 7. Select the appropriate overhead and profit allocation

technique given example company cost structures and compute minimum company overhead and profit mark-up rates. 8. Prepare a monthly company budget given the annual budget and other appropriate information. 9. Compare the monthly budget prepared to actual data. 10. Compare and contrast profit and cash flow for the construction company. 11. Prepare a cash flow projection by applying the company monthly budget. Credits: 2.00

CM 31000 - Equipment And Field Operations

Credit Hours: 3.00. Study of heavy equipment used in construction operations with an emphasis on equipment selection, application, cost, productivity, safety, and economics.

Learning Outcomes: 1. Understand each of the construction equipment functions and applications for construction operations. 2. Use the technique and method presented in class to: analyze ownership and operating costs; analyze earthwork volume, mass diagram, and hauling distance; analyze compaction operations; analyze power requirements; analyze dozer operation; analyze scraper operation; analyze excavator operation; analyze hauling operation; understand asphalt mix production and placement; understand concrete and concrete equipment operation; understand crane operation. Credits: 3.00

CM 36400 - Jobsite Management

Credit Hours: 3.00. Examination of construction project management on the jobsite. Topics include, submittals, record keeping, jobsite layout, meetings, negotiations, dispute resolution, labor relations, safety, subcontracting, quality, cost control, waste management, changes, claims, progress payments, and project closeout.

Learning Outcomes: 1. Understand and explain the fundamentals of project management. 2. Understand and explain the project team. 3. Understand and explain the use of construction documents on the jobsite. 4. Understand and explain submittals, samples, and shop drawings. 5. Understand and explain documentation and record keeping at the jobsite. 6. Understand and explain meetings, negotiations, and dispute resolution. 7. Understand and explain jobsite labor relations and control. 8. Understand and explain personnel and safety management. 9. Understand and explain subcontracting and purchasing. 10. Understand and explain project quality management. 11. Understand and explain time and cost controls. 12. Understand and explain waste and environmental management and sustainable construction practices. 13. Understand and explain computerized project administration. 14. Understand and explain building information modeling (BIM). 15. Understand and explain changes and claims. 16. Understand and explain progress payments. 17. Understand and explain project closeout. Credits: 3.00

CM 36500 - BIM For Project Managers And Field Supervision

Credit Hours: 2.00. One of the most important components of the construction industry is to visualize the project during its design, construction and over entire life cycle of structure, enabling invested parties to change/adjust the project. A construction project manager' job description is a person who can plan and oversee a construction project from initiation to close with the help of software, technology, resources and a reasonable budget. BIM has delivered a significant impact all aspects and types of AEC projects in terms of economic as well as technical viability. BIM plays a vital role in the management of the project. A project manager can leverage the capability of BIM to deliver a successful construction project and BIM reduces the burden on the project manager of manually calculating and managing tasks. It seems clear that for a construction project to be successful today, project managers would do well to adopt BIM technology. This course is the start that seeks to better understand & address student needs as a on job-site project manager utilizing advanced technologies coupled with Building Information Modeling to produce a form of Building Information Management. It will be given across the multiple disciplines/curricula in anticipation of integrating said new technologies extracted from BIM. Permission of instructor required.

Learning Outcomes: 1. Identify key components of BIM used in Field office. 2. Identify key

aspects of LOD (and what trades are most beneficial) needed in BIM for field office operations. 3. Improve Field and Office processes (and communication) utilizing BIM. 4. Facilitate and improve Coordination of discipline models. 5. Introducing the engineering design process in a quick, easy, and visible way. 6. Bridging the physical and digital model within field office. 7. Integrating hands-on experience with technology utilized in field. Credits: 2.00

CM 38000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Learning Outcomes: 1. Understand, apply, and analyze fundamentals of geotechnical engineering and construction techniques associated with various types of soil conditions. 2. Conduct various soil lab testing and create lab reports. 3. Use the knowledge of soils and foundation engineering and applications to: create lab reports as written communication; analyze engineering properties of soils; analyze different soil types and field exploration; analyze soil compaction; analyze permeability of water in soils; analyze subsurface stress, consolidation, and shear strength of soil; analyze shallow and deep foundation load, design, and construction; analyze lateral earth pressure and retaining wall structure. Credits: 3.00

CM 45001 - Construction Capstone II

Credit Hours: 3.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. Credits: 3.00

CM 45701 - Construction Safety

Credit Hours: 3.00. This course will examine the impact of safety on the construction industry, including in-depth discussions on the application of the Occupational Safety & Health Administration (OSHA) Safety and Health Standards for the construction industry. The emphasis of this course is to provide training for job sited supervisory personnel. This course will also fulfill the requirements for the OSHA 30-Hour Card.

Learning Outcomes: 1. Identify the role of OSHA in the construction industry and examine current issues related to safety. 2. Acquire knowledge of jobsite safety management and company safety risk management. 3. Identify and evaluate jobsite hazards, including abatement strategies and procedures. 4. Complete the requirements for an OSHA 30-hour card in Construction Safety & Health Administration. Credits: 3.00

CM 47500 - Construction Costs

Credit Hours: 2.00. A study of construction costs, including analysis of field records, job cost accounting, job cost control, and determination of unit prices.

Learning Outcomes: 1. Define the underlying concepts of construction cost control. 2. Prepare a construction project cash flow forecast using the project budget and time schedule. 3. Calculate construction project cost performance by measuring costs to-date, projecting remaining costs, and calculating variances at completion in terms of materials, subcontracts, general conditions, and project equipment. 4. Analyze construction labor cost performance using earned value, trending, and variance analysis. 5. Make capital acquisition decisions using time value of money concepts. Credits: 2.00

Other Departmental/Program Course Requirements (46 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6.

Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and

trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that

animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply

an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

Intercultural Requirement

Electives (12 credits)

Optional Concentrations

Supplemental List

Grade Requirements

GPA Requirements

Construction Work Experience Requirement

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide

constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview

of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

14-17 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential

elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of

functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CM 15000 - Construction Management Fundamentals

Credit Hours: 6.00. This introductory course focuses on construction materials, methods, and contracts for basic commercial and residential projects. Students will develop essential skills in quantity estimating, construction plan reading, and project documentation. Students will participate in hands-on lab exercises that aim to connect theory with practice. The course includes OSHA 10-hour instruction, with students earning OSHA 10-hour certification cards upon completion, further emphasizing the importance of safety in construction practices.

Learning Outcomes: 1. Identify materials, means, and methods for a construction project throughout the entire project lifecycle. 2. Recognize project controls required during the pre-construction and construction phases of a construction project. 3. Explain project planning tasks relevant to a construction project. 4. Comprehend project administration on a construction project and the required documentation and technology available within the current construction industry. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CM 16000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Learning Outcomes: 1. Understand fundamentals of surveying including the theory and practice of surveying. 2. Perform surveying computations of grade, direction, traverse adjustment, area, and horizontal and vertical curve geometry. 3. Perform field measurements using basic and modern surveying equipment. 4. Perform tasks within a group effectively and efficiently. Credits: 3.00

15-17 Credits

Fall 2nd Year

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization,

entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CM 20002 - Intermediate Pre-Construction Management

Credit Hours: 4.00. A project course covering intermediate level commercial, residential, heavy/civil, and industrial construction projects. Students will expand their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Calculate design components of a construction project during the pre-construction phase. 2. Produce project controls required during the pre-construction phase of a construction project. 3. Construct

pre-planning documents relevant to beginning a construction project. 4. Apply project administration to a construction project utilizing the required documentation and technology available within the current construction industry. Credits: 4.00

CM 21601 - Electrical Construction

Credit Hours: 2.00. Principles of code and basic concepts in electrical theory, materials, methods, design and estimating are applied to electrical systems for buildings. Comprehension of electrical construction plans and specifications as well as installation exercises are emphasized through lab experiences.

Learning Outcomes: 1. Demonstrate thorough knowledge of all documents normally used in the electrical construction process including plans and specifications. 2. Recognize the applications of commonly used types of electrical materials required in building construction. 3. Interpret and evaluate materials selection, installation methods, and proper sizing and installation techniques using the National Electrical Code. 4. Illustrate the ability to effectively interact with building construction professionals regarding electrical construction. 5. Recall the names, nicknames, applications and rules for commonly used materials in the electrical contracting industry. 6. Construct proper electrical systems schematics. 7. Assemble the correct components and arrange them correctly to demonstrate basic electrical circuit knowledge. 8. Inspect electrical installations and identify rudimentary National Electrical Code violations. Credits: 2.00

16 Credits

Spring 2nd Year

CM 21500 - Mechanical Construction

Credit Hours: 3.00. Principles of code, design, methods, and materials are applied to plumbing, heating, ventilation, and air conditioning systems for buildings. The comprehension of mechanical construction plans and specifications is emphasized through exercises in mechanical estimating.

Learning Outcomes: 1. Relate materials, means, & methods for the MEP scope to a construction project throughout the project lifecycle. Prepare a list of CSI Divisions for the MEP scope and outline the MEP scope of work for a construction project; Propose sustainability concepts to the materials, means, and methods for the MEP scope of a construction project; Schedule work sequence for the MEP scope of construction phases of a project; Apply QA/QC documents and procedures required for the MEP scope during the construction phase. 2. Apply company management concepts to the MEP scope of a construction project during the construction phase. Create financial management plan required to complete the MEP scope of a construction project; Demonstrate interpersonal relations related to the MEP scope on a construction project; Integrating technology use on the MEP scope of a construction project during the construction phase. 3. Show professionalism by applying proper communication, team work, rules & regulations, and level of detail required within a construction company and on a construction jobsite. Demonstrate leadership skills within a team-based project; Utilize management skills required to complete tasks within a construction project; Practice teamwork utilizing the strengths of the individuals within the team; Apply oral and written communication skill required within a construction project; Use ethics in all decision making and daily activities in a construction project. Credits: 3.00

CM 27000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of

determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Learning Outcomes: 1. Analyze force systems acting at a single point. 2. Analyze force systems that are non-concurrent. 3. Analyze/design cable systems. 4. Analyze/design trusses by graphical and numerical methods. 5. Analyze/design pinned frames. 6. Analyze/design 3-hinged arches. 7. Trace the live and dead loads throughout a building structure. Credits: 3.00

CM 31000 - Equipment And Field Operations

Credit Hours: 3.00. Study of heavy equipment used in construction operations with an emphasis on equipment selection, application, cost, productivity, safety, and economics.

Learning Outcomes: 1. Understand each of the construction equipment functions and applications for construction operations. 2. Use the technique and method presented in class to: analyze ownership and operating costs; analyze earthwork volume, mass diagram, and hauling distance; analyze compaction operations; analyze power requirements; analyze dozer operation; analyze scraper operation; analyze excavator operation; analyze hauling operation; understand asphalt mix production and placement; understand concrete and concrete equipment operation; understand crane operation. Credits: 3.00

15 Credits

Fall 3rd Year

CM 30002 - Advanced Pre-Construction Management

Credit Hours: 4.00. A project course covering advanced level commercial, residential, heavy/civil, and industrial construction projects. Students will further develop their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Select design systems for a construction project during the pre-construction phase. 2. Illustrate project controls required during the pre-construction phase of a construction project. 3. Analyze pre-planning tasks relevant to beginning a construction project. 4. Differentiate project administration on a construction project utilizing the required documentation and technology available within the current construction industry. 5. Demonstrate professionalism by analyzing proper communication, teamwork, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 4.00

CM 36500 - BIM For Project Managers And Field Supervision

Credit Hours: 2.00. One of the most important components of the construction industry is to visualize the project during its design, construction and over entire life cycle of structure, enabling invested parties to change/adjust the project. A construction project manager' job description is a person who can plan and oversee a construction project from initiation to close with the help of software, technology, resources and a reasonable budget. BIM has delivered a significant impact all aspects and types of AEC projects in terms of economic as well as technical viability. BIM plays a vital role in the management of the project. A project manager can leverage the capability of BIM to deliver a successful construction project and BIM reduces the burden on the project manager of manually calculating and managing tasks. It seems clear that for a construction project to be successful today, project managers would do well to adopt BIM technology. This course is the start that seeks to better understand & address student needs as a on job-site project manager utilizing advanced technologies coupled with Building Information Modeling to produce a form of Building Information Management. It will be given across the multiple disciplines/curricula in anticipation of integrating said new technologies extracted from BIM. Permission of instructor required.

Learning Outcomes: 1. Identify key components of BIM used in Field office. 2. Identify key aspects of LOD (and what trades are most beneficial) needed in BIM for field office operations. 3. Improve Field and Office processes (and communication) utilizing BIM. 4. Facilitate and improve Coordination of discipline

models. 5. Introducing the engineering design process in a quick, easy, and visible way. 6. Bridging the physical and digital model within field office. 7. Integrating hands-on experience with technology utilized in field. Credits: 2.00

CM 38000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Learning Outcomes: 1. Understand, apply, and analyze fundamentals of geotechnical engineering and construction techniques associated with various types of soil conditions. 2. Conduct various soil lab testing and create lab reports. 3. Use the knowledge of soils and foundation engineering and applications to: create lab reports as written communication; analyze engineering properties of soils; analyze different soil types and field exploration; analyze soil compaction; analyze permeability of water in soils; analyze subsurface stress, consolidation, and shear strength of soil; analyze shallow and deep foundation load, design, and construction; analyze lateral earth pressure and retaining wall structure. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

CM 30101 - Introduction To Construction Company Financial Management

Credit Hours: 2.00. An introduction to methods for recognizing revenue for long-term construction contracts and each method's impact on financial statements. Includes introduction to analysis of financial statements and their use in developing company budgets, projecting cash needs, pricing construction projects, and forecasting the impact of business decisions on construction company profit.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction contractor. 2. Identify the unique accounts required for percentage of completion revenue recognition, describe what the account represents, and indicate on which statement the account is found. 3. Interpret the outcomes of line-item analysis, vertical analysis, horizontal analysis, and cost-volume-profit analysis utilizing construction company financial statement data. 4. Perform a profit center analysis of an income statement. 5. Prepare an annual budget for a construction company given source documents. 6. Analyze the impact of various decisions on company profits by applying the cost-volume-profit financial analysis technique. 7. Select the appropriate overhead and profit allocation technique given example company cost structures and compute minimum company

overhead and profit mark-up rates. 8. Prepare a monthly company budget given the annual budget and other appropriate information. 9. Compare the monthly budget prepared to actual data. 10. Compare and contrast profit and cash flow for the construction company. 11. Prepare a cash flow projection by applying the company monthly budget. Credits: 2.00

CM 36400 - Jobsite Management

Credit Hours: 3.00. Examination of construction project management on the jobsite. Topics include, submittals, record keeping, jobsite layout, meetings, negotiations, dispute resolution, labor relations, safety, subcontracting, quality, cost control, waste management, changes, claims, progress payments, and project closeout.

Learning Outcomes: 1. Understand and explain the fundamentals of project management. 2. Understand and explain the project team. 3. Understand and explain the use of construction documents on the jobsite. 4. Understand and explain submittals, samples, and shop drawings. 5. Understand and explain documentation and record keeping at the jobsite. 6. Understand and explain meetings, negotiations, and dispute resolution. 7. Understand and explain jobsite labor relations and control. 8. Understand and explain personnel and safety management. 9. Understand and explain subcontracting and purchasing. 10. Understand and explain project quality management. 11. Understand and explain time and cost controls. 12. Understand and explain waste and environmental management and sustainable construction practices. 13. Understand and explain computerized project administration. 14. Understand and explain building information modeling (BIM). 15. Understand and explain changes and claims. 16. Understand and explain progress payments. 17. Understand and explain project closeout. Credits: 3.00

CM 45701 - Construction Safety

Credit Hours: 3.00. This course will examine the impact of safety on the construction industry, including in-depth discussions on the application of the Occupational Safety & Health Administration (OSHA) Safety and Health Standards for the construction industry. The emphasis of this course is to provide training for job sited supervisory personnel. This course will also fulfill the requirements for the OSHA 30-Hour Card.

Learning Outcomes: 1. Identify the role of OSHA in the construction industry and examine current issues related to safety. 2. Acquire knowledge of jobsite safety management and company safety risk management. 3. Identify and evaluate jobsite hazards, including abatement strategies and procedures. 4. Complete the requirements for an OSHA 30-hour card in Construction Safety & Health Administration. Credits: 3.00

17 Credits

Fall 4th Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime

crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CM 40000 - Construction Capstone I

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of pre-construction management into a capstone project.

Learning Outcomes: 1. Design systems for a construction project during the pre-construction phase. 2. Create project controls required during the pre-construction phase of a construction project. 3. Evaluate pre-planning tasks relevant to be beginning a construction project. 4. Generate project administration for a construction project utilizing the required documentation and technology available within the current construction industry. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 47500 - Construction Costs

Credit Hours: 2.00. A study of construction costs, including analysis of field records, job cost accounting, job cost control, and determination of unit prices.

Learning Outcomes: 1. Define the underlying concepts of construction cost control. 2. Prepare a construction project cash flow forecast using the project budget and time schedule. 3. Calculate construction project cost performance by measuring costs to-date, projecting remaining costs, and calculating variances at completion in terms of materials, subcontracts, general conditions, and project

equipment. 4. Analyze construction labor cost performance using earned value, trending, and variance analysis. 5. Make capital acquisition decisions using time value of money concepts. Credits: 2.00

14 Credits

Spring 4th Year

CM 43300 - Risk Management And Legal Issues In Design And Construction Integration

Credit Hours: 2.00. An advanced course dealing with risk management and legal issues as they pertain to the interaction of designers, contractors, and owners. Students will learn to identify and mitigate potential risks that may affect the multiple stakeholders and the business organizations they represent during design and construction activity. The course will also deal with trust and teamwork issues within collaborative processes in the built environment.

Learning Outcomes: 1. Identify potential risks for designers, contractors, and owners in a collaborative construction industry environment. 2. Understand potential trust issues that inhibit collaboration within the architecture, engineering, and construction (AEC) industry. 3. Develop mitigation measures to reduce risk and increase collaboration within architecture, engineering, and construction interactions. 4. Use clear and precise questions and consider diverse points of views when reasoning. 5. Demonstrate ability to gather, assess, record, and compare relevant information in order to support conclusions and related consequences. Credits: 2.00

CM 45001 - Construction Capstone II

Credit Hours: 3.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. Credits: 3.00

14 Credits

Creative Writing, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (30 credits)

Required Course (3 credits)

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

A. Creative Writing Courses - Choose Four (12 credits)

ENGL 31600 - Craft Of Fiction From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of fiction with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of fiction, statements of aesthetics and craft, and various fictional forms.

Learning Outcomes: 1. Analyze published fiction by applying terms of fiction craft. 2.

Identify the effects of fiction forms by articulating their differences and/or similarities. 3. Analyze their own fiction by applying the terms of fiction craft. Credits: 3.00

ENGL 31700 - Craft Of Poetry From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of poetry with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of poetry, statements of aesthetics and craft, and various poetic forms.

Learning Outcomes: 1. Analyze published poetry by applying terms of poetry craft. 2. Identify the effects of poetry forms by articulating their differences and/or similarities. 3. Analyze their own poetry by applying the terms of poetic craft. Credits: 3.00

ENGL 40700 - Intermediate Poetry Writing

Credit Hours: 3.00. Study and practice of methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems by using effective imagery, line breaks, stanzas, compression, and linguistic playfulness; 2. Produce a portfolio of poems by revising according to suggestions received in workshop and in individual conferences with the instructor. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary poetry. Credits: 3.00

ENGL 40800 - Creative Writing Capstone

Credit Hours: 3.00. This course will focus on the writing and revision of the capstone thesis in Creative Writing, consisting of a substantial portfolio of either fiction or poetry with an introductory essay. Workshop, discussion of published writing, and individual conferences will form the center of the course with readings, lecture, and discussion of various literary topics. Permission of instructor required.

Learning Outcomes: 1. Master specific topic on either poetry or fiction writing by giving a formal in-class presentation. 2. Master either poetry or fiction writing by producing a portfolio of their own creative work. 3. Understand their aesthetic by producing a formal essay which analyzes their creative writing. Credits: 3.00

ENGL 40900 - Intermediate Fiction Writing

Credit Hours: 3.00. Study and practice of methods of composing fiction, with a primary emphasis on the student's own work. Workshop criticism and discussion of published fiction.

Learning Outcomes: 1. Write and revise fiction by using effective character development, plot and scene. 2. Produce a polished fiction by revising according to suggestions received in workshop. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary fiction. Credits: 3.00

ENGL 50700 - Advanced Poetry Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems, using all the skills from ENGL 40700 but at a more proficient level. 2. Produce a portfolio of poems revised according to suggestions received in workshop and in individual conferences with the instructor. 3. Acquire a broader knowledge of the context of contemporary poetry by reading and discussing several volumes by contemporary poets. Credits: 3.00

ENGL 50900 - Advanced Fiction Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing fiction, with the primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise fiction, using all the skills from English 40900 but at a more proficient level. 2. Produce polished fiction revised according to suggestions received in workshop and feedback from the instructor. 3. Acquire a broader knowledge of the context of contemporary fiction by reading and discussing work by several contemporary fiction writers.

Credits: 3.00

B. Engaging English (3 credits)

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking, reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

C. Literature/Linguistics/English Education (12 credits)

Electives (17-54 credits)

Grade Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking, reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

15-16 Credits

Spring 1st Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

15 Credits

Fall 2nd Year

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Crop Science, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (33-34 credits)

Required Major Courses (27-28 credits)

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and

points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak

with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

AGRY 51500 - Plant Mineral Nutrition

Credit Hours: 3.00. Fundamental principles and concepts of the mineral nutrition of higher plants; processes and mechanisms controlling nutrient bioavailability and acquisition; physiological, genetic, and ecological aspects of plant nutrition including rhizosphere dynamics and interaction with disease.

Learning Outcomes: 1. Identify and describe the essential mineral nutrients required for plant growth. 2. Recognize the symptoms of nutrient deficiencies and toxicities in plants and understand the underlying physiological and biochemical changes. 3. Understand the mechanisms of nutrient uptake from the soil by roots, the role of root hairs, mycorrhizal associations, and the transport of nutrients within the plant through xylem and phloem. 4. Comprehend the biochemical pathways and processes through which plants assimilate and utilize nutrients. 5. Explore the signaling mechanisms that regulate nutrient uptake and utilization, including sensing mechanisms, gene expression, and hormonal responses. Credits: 3.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues,

facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

Agronomy Selectives (6 credits)

Other Departmental/Program Course Requirements (77-81 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication,

transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical,

and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to

produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of

Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions.
Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.
Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.
Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to

understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (5-10 credits)

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5.

Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures

flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

17-20 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and

integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants.

2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting

methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-17 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic

molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

13-15 Credits

Spring 2nd Year

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in

the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

13-15 Credits

Fall 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with

comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.
Credits: 4.00

17 Credits

Spring 3rd Year

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.
Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II
University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

13 Credits

Fall 4th Year

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.
Credits: 1.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.
Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.
Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.
Credits: 1.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.
University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

AGRY 51500 - Plant Mineral Nutrition

Credit Hours: 3.00. Fundamental principles and concepts of the mineral nutrition of higher plants; processes and mechanisms controlling nutrient bioavailability and acquisition; physiological, genetic, and ecological aspects of plant nutrition including rhizosphere dynamics and interaction with disease.

Learning Outcomes: 1. Identify and describe the essential mineral nutrients required for plant growth. 2. Recognize the symptoms of nutrient deficiencies and toxicities in plants and understand the underlying physiological and biochemical changes. 3. Understand the mechanisms of nutrient uptake from the soil by roots, the role of root hairs, mycorrhizal associations, and the transport of nutrients within the plant through xylem and phloem. 4. Comprehend the biochemical pathways and processes through which plants assimilate and utilize nutrients. 5. Explore the signaling mechanisms that regulate nutrient uptake and utilization, including sensing mechanisms, gene expression, and hormonal responses. Credits: 3.00

14 Credits

Spring 4th Year

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

12-14 Credits

Cybersecurity, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (66 credits)

Computer and Information Technology Required Major Courses (57 credits)

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present

data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 34000 - UNIX Administration

Credit Hours: 3.00. This course focuses on the tasks and issues involved in the administration of UNIX systems. Topics include installation, networking, software management, scripting, and user management. In the laboratory portion of the course, students implement and maintain UNIX systems.

Learning Outcomes: 1. Understand the theory and practice of administering UNIX based operating systems. 2. Install and maintain UNIX operating systems. 3. Implement and maintain basic UNIX services including file sharing, e-mail, and X-Windows. 4. Secure UNIX operating systems. 5. Write and maintain UNIX shell scripts. 6. Integrate UNIX and Windows systems. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

CNIT 34220 - Network Administration

Credit Hours: 2.00 or 3.00. This course focuses on the tasks and issues involved in the installation and administration of distributed computing systems. Topics include the administration of network operating systems and network system interoperability. Students will implement and maintain a comprehensive network service infrastructure.

Learning Outcomes: 1. Understand, implement, and maintain network services such as DNS, PKI, e-mail, and web. 2. Research and solve hardware and software implementation problems in laboratory projects. 3. Produce

written reports that document project work performed in the laboratory. 4. Work cooperatively as a team to implement solutions. Credits: 2.00 or 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 37000 - Introduction To Cryptography

Credit Hours: 3.00. Cryptography is an essential component to protect information in cyber systems. This course introduces the inner workings of cryptographic primitives and how to correctly use them. Specifically, the course covers cryptographic algorithms, protocols and techniques. The algorithms illustrate the art of encryption and secure hashing. The cryptographic protocols will expose the students to the world of building trust in an untrusted environment. Cryptographic techniques used in key management and algorithm choice will be explored.

Learning Outcomes: 1. Identify important real-world applications associated with cryptography. 2. Describe the major components of encryption techniques within symmetric and asymmetric cryptography. 3. Describe the major components of integrity protection and related properties. 4. Choose and apply appropriate cryptographic techniques to a plausible real-world security problem. Credits: 3.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

CNIT 27100 - Cybersecurity Fundamentals II

Credit Hours: 3.00. Course will investigate additional foundational ideas in cybersecurity and serves as a survey course in the field. The course provides extended exposure to utilizing tools to secure/harden aspects of info systems such as mandatory access control, wireless security, hardware security, cloud security and others.

Learning Outcomes: 1. Generate policy and governance decisions for high-risk information systems. 2. Implement technical controls to mitigate threats and vulnerabilities in modern networks and systems. 3. Analyze information systems to determine appropriate secure provisioning actions. Credits: 3.00

CNIT 32300 - Basic Cyberforensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyberforensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyberforensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system.

4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

Cybersecurity Selectives (9 credits)

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 34600 - Wireless Networks

Credit Hours: 3.00 or 4.00. This course introduces wireless networking. Topics include fundamental wireless communication concepts, wireless local area networks (LANs), and cellular systems. Wireless specific protocol elements are addressed in typical application environments. Data communications in multiple wireless environments are emphasized. In the laboratory section, students implement wireless solutions and integrate them into wired LAN environments.

Learning Outcomes: 1. Create and troubleshoot 802.11 wireless networks, as well as demonstrating integration into wired networks, devices and infrastructure. 2. Explain RF fundamentals, measurements and propagation theory. 3. Differentiate pertinent wireless networking standards, particularly those within the scope of the IEEE 802.11 standard. 4. Understand the underlying principles of the 802.11 MAC and how it relates to the upper and lower layers of the OSI model. 5. Implement wireless network security solutions and standards. Credits: 3.00 or 4.00

CNIT 42100 - Mobile Forensics

Credit Hours: 3.00. This course will help students understand the issues, techniques, and vulnerabilities of small scale digital device forensics. Emphasis will be placed on the forensically sound acquisition, preservation, analysis and presentation of small scale digital devices as evidence. Specific investigations will cover devices such as Personal Digital Assistants (PDA's), Cell Phones, and Smart Phones.

Learning Outcomes: 1. Identify various mobile devices. 2. Compare the characteristics of mobile devices. 3. Distinguish potential evidence found on mobile devices and ubiquitous systems. 4. Inspect forensically sound evidence from mobile devices and ubiquitous systems. 5. Produce a report for a courtroom presentation. Credits: 3.00

CNIT 44500 - Advanced Internetwork Routing And Switching

Credit Hours: 3.00. This course extends routing and switching knowledge with specific attention given to emerging trends. This course focuses on the concepts of traffic shaping, advanced exterior gateway routing protocols, label switching technologies, and quality of service. The necessary perspectives of integration of these topics into enterprise networks are addressed in both lecture and laboratory.

Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management

approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

CNIT 32200 - Research Methodology And Design

Credit Hours: 3.00. This course will discuss scientific research versus pseudoscience, experimental vs. quasi-experimental designs, different research controls and validity issues, and how study designs are used to answer research questions. Students will gain hands-on experience conducting observational and experimental research designs, and the process of writing a formal research paper.

Learning Outcomes: 1. Describe and produce ethical research. 2. Identify distinguishing features of good science vs. pseudoscience. 3. Critically evaluate different research methodologies and designs. 4. Present and interpret research data in a formal research paper. Credits: 3.00

CNIT 41500 - Advanced Coding Security

Credit Hours: 3.00. This course allows students to gain proficiency in secure coding principles. Security risks from common coding errors are examined. Techniques for integrating secure coding practices into the development process is detailed with an emphasis on ensuring that applications are designed and implemented with proper security requirements.

Learning Outcomes: 1. Analyze and apply secure coding standards and practices. 2. Understand common programming errors that lead to software vulnerabilities. 3. Demonstrate independent critical thinking and problem solving skills for effective mitigation strategies of security flaws. 4. Understand and apply systems development methodologies. Credits: 3.00

CNIT 52300 - File System Forensics

Credit Hours: 3.00. The plethora of strategies to store information in different formats continues to expand. This course examines the various media and strategies of storing information and the processes of documenting the collection, imaging, and processing of forensic evidence. Topics include file formats, file systems, hardware, and software involved in forensic investigation. The overall pattern of forensic evidence in file systems will be examine along with the acquisition, analysis, and reporting of evidence artifacts found in file systems.

Learning Outcomes: 1. Identify and repair corrupted file systems. 2. Examine and analyze file systems using a multiple-tool approach. 3. Demonstrate how to locate deleted and hidden data. 4. Report and explain their findings and conclusions in a digital investigation. 5. Present and communicate the digital forensics process for an investigation. Credits: 3.00

CNIT 52500 - Mobile And Embedded Device Forensics

Credit Hours: 3.00. Consumer technologies are rapidly moving forward with items integrating processing, storage, and transmission into their base functionality. The enterprise issues with the trend of "bring your own device" has rapidly expanded requirements on forensics investigators to address a plethora of mobile device types. Whether it is the automobile black box or a home thermostat, there are various elements of interesting evidence possible to be gained. The embedded and consumer device pantheon is developing as an important area of forensic science. This course explores techniques for conducting forensic analyses on a wide variety of mobile and embedded devices.

Learning Outcomes: 1. Identify components and sources of mobile and embedded device evidence. 2. Demonstrate how to preserve and acquire digital evidence while following the rules of evidence and the chain of custody. 3. Examine and analyze digital evidence using a multiple-tool approach for validation of the integrity of evidence. 4. Report and explain their findings and conclusions in a digital investigation. 5. Present and communicate the mobile forensics process for an investigation. Credits: 3.00

CNIT 48300 - Applied Machine Learning

Credit Hours: 3.00. In the past decade, we have observed the expeditious evolution and tremendous applications of machine learning, such as unmanned vehicle, autonomous language translation, and smart healthcare. This course will introduce both the fundamental knowledge and design/application insights of machine learning techniques via a series of hands-on real-world examples. The overall aim is to provide the students with a good understanding of machine learning technologies, building machine learning models, and applying machine-learning technologies to address real-world problems. In this course, students will also have an opportunity to explore the cutting-edge machine learning technologies, such as deep learning, adversarial attacks, and meta learning, and develop their own machine learning-based solutions.

Learning Outcomes: 1. Demonstrate both the fundamental knowledge and design/application insights of the state-of-the-art machine learning techniques. 2. Implement machine learning models. 3. Apply machine learning techniques to solve real-world problems. Credits: 3.00

CNIT 47700 - Blockchain

Credit Hours: 3.00. This course focuses on blockchain technologies. As IT practitioners and cybersecurity professionals, knowing the inner workings of blockchain technology is necessary for career preparation and development. This course aims to demystify blockchain technology by looking into its fundamental aspects, such as data structure, network consensus, economic incentives, security and privacy, applications, and regulations.

Learning Outcomes: 1. Identify enabling techniques for blockchain technology. 2. Describe the data structure and network layer of the Bitcoin blockchain. 3. Describe major components of blockchain, such as consensus, incentivization, and smart contracts. 4. Classify and analyze the security and legal issues of blockchain and cryptocurrency. Credits: 3.00

CNIT 41700 - Critical Infrastructure Security

Credit Hours: 3.00. In the socio-political context of nation state sponsored threat actors and cyber cold wars, critical infrastructure (such as water supply and power generation) is a strategic target for attackers. This course investigates the current threat landscape and vulnerabilities in critical infrastructure. Students then investigate system and network architectural solutions to the problem. Students build a model industrial system and will implement these protections in their model environment.

Learning Outcomes: 1. Assess system architectures of industrial control networks to identify sources of vulnerability. 2. Analyze the threat landscape associated with industrial control environments. 3. Build and validate controls in a model industrial control network. Credits: 3.00

Other Departmental /Program Course Requirements (12 credits)

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical

terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of

ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

15 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to

liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon

which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CNIT 27100 - Cybersecurity Fundamentals II

Credit Hours: 3.00. Course will investigate additional foundational ideas in cybersecurity and serves as a survey course in the field. The course provides extended exposure to utilizing tools to secure/harden aspects of info systems such as mandatory access control, wireless security, hardware security, cloud security and others.

Learning Outcomes: 1. Generate policy and governance decisions for high-risk information systems. 2. Implement technical controls to mitigate threats and vulnerabilities in modern networks and systems. 3. Analyze information systems to determine appropriate secure provisioning actions. Credits: 3.00

15 Credits

Spring 2nd Year

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing

fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and

sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

15 Credits

Fall 3rd Year

CNIT 34000 - UNIX Administration

Credit Hours: 3.00. This course focuses on the tasks and issues involved in the administration of UNIX systems. Topics include installation, networking, software management, scripting, and user management. In the laboratory portion of the course, students implement and maintain UNIX systems.

Learning Outcomes: 1. Understand the theory and practice of administering UNIX based operating systems. 2. Install and maintain UNIX operating systems. 3. Implement and maintain basic UNIX services including file sharing, e-mail, and X-Windows. 4. Secure UNIX operating systems. 5. Write and maintain UNIX shell scripts. 6. Integrate UNIX and Windows systems. Credits: 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 37000 - Introduction To Cryptography

Credit Hours: 3.00. Cryptography is an essential component to protect information in cyber systems. This course introduces the inner workings of cryptographic primitives and how to correctly use them. Specifically, the course covers cryptographic algorithms, protocols and techniques. The algorithms illustrate the art of encryption and secure hashing. The cryptographic protocols will expose the students to the world of building trust in an untrusted environment. Cryptographic techniques used in key management and algorithm choice will be explored.

Learning Outcomes: 1. Identify important real-world applications associated with cryptography. 2. Describe the major components of encryption techniques within symmetric and asymmetric cryptography. 3. Describe the major components of integrity protection and related properties. 4. Choose and apply appropriate cryptographic techniques to a plausible real-world security problem.

Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CNIT 34220 - Network Administration

Credit Hours: 2.00 or 3.00. This course focuses on the tasks and issues involved in the installation and administration of distributed computing systems. Topics include the administration of network operating systems and network system interoperability. Students will implement and maintain a comprehensive network service infrastructure.

Learning Outcomes: 1. Understand, implement, and maintain network services such as DNS, PKI, e-mail, and web. 2. Research and solve hardware and software implementation problems in laboratory projects. 3. Produce written reports that document project work performed in the laboratory. 4. Work cooperatively as a team to implement solutions. Credits: 2.00 or 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

CNIT 32300 - Basic Cyberforensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyberforensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyberforensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

15 Credits

Fall 4th Year

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

15 Credits

Spring 4th Year

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects

of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

15 Credits

Data Analytics, Technologies, and Applications, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (66 credits)

Computer and Information Technology Core Courses - Credit Hours: 27.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use

Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

DATA Core Courses - Credit Hours: 21.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints

and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

CNIT 32200 - Research Methodology And Design

Credit Hours: 3.00. This course will discuss scientific research versus pseudoscience, experimental vs. quasi-experimental designs, different research controls and validity issues, and how study designs are used to answer research questions. Students will gain hands-on experience conducting observational and experimental research designs, and the process of writing a formal research paper.

Learning Outcomes: 1. Describe and produce ethical research. 2. Identify distinguishing features of good science vs. pseudoscience. 3. Critically evaluate different research methodologies and designs. 4. Present and interpret research data in a formal research paper. Credits: 3.00

CNIT 48400 - Applications In Data Science

Credit Hours: 3.00. Students investigate practical applications of Data Science and evaluate their effectiveness in guiding decision making. Students will employ tools to assist in these efforts.

Learning Outcomes: 1. Extract knowledge and insights from a variety of datasets. 2. Evaluate the effectiveness of extracted knowledge and insights. 3. Examine the ethical and social implications of data-driven decision making and policies and one's own ethical and social responsibilities when working with data. Credits: 3.00

CNIT 48300 - Applied Machine Learning

Credit Hours: 3.00. In the past decade, we have observed the expeditious evolution and tremendous applications of machine learning, such as unmanned vehicle, autonomous language translation, and smart healthcare. This course will introduce both the fundamental knowledge and design/application insights of machine learning techniques via a series of hands-on real-world examples. The overall aim is to provide the students with a good understanding of machine learning technologies, building machine learning models, and applying machine-learning technologies to address real-world problems. In this course, students will also have an opportunity to explore the cutting-edge machine learning technologies, such as deep learning, adversarial attacks, and meta learning, and develop their own machine learning-based solutions.

Learning Outcomes: 1. Demonstrate both the fundamental knowledge and design/application insights of the state-of-the-art machine learning techniques. 2. Implement machine learning models. 3. Apply machine learning techniques to solve real-world problems. Credits: 3.00

CNIT 48200 - Six Sigma Data Quality For Continuous Improvement

Credit Hours: 3.00. A study of data quality for Six Sigma level of improvement, applying a Six Sigma DMAIC (Define, Measure, Analyze, Improve and Control) improvement methodology, utilizing information tools and techniques. The course addresses advanced topics in statistical based continuous improvement, data quality; and Big Data Analytics concepts, as pertains to systematic problems. An embedded certificate in SS is included in the body of knowledge.

Learning Outcomes: 1. Explain how Six Sigma principles are used for continuous improvement. 2. Apply the DMAIC and Big Data approach in solving team based, project based problems. 3. Demonstrate understanding of data quality principles as applied to compelling business

cases. Credits: 3.00

Cognate Application Focus Area - Credit Hours: 18.00

Other Departmental/Program Course Requirements (9 credits)

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are

conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course

covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

Elective (3 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple

digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive,

explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

15 Credits

Spring 2nd Year

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee,

and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be

able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

15 Credits

Fall 3rd Year

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

CNIT 32200 - Research Methodology And Design

Credit Hours: 3.00. This course will discuss scientific research versus pseudoscience, experimental vs. quasi-experimental designs, different research controls and validity issues, and how study designs are used to answer research questions. Students will gain hands-on experience conducting observational and experimental research designs, and the process of writing a formal research paper.

Learning Outcomes: 1. Describe and produce ethical research. 2. Identify distinguishing features of good science vs. pseudoscience. 3. Critically evaluate different research methodologies and designs. 4. Present and interpret research data in a formal research paper. Credits: 3.00

15 Credits

Spring 3rd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business

owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 48200 - Six Sigma Data Quality For Continuous Improvement

Credit Hours: 3.00. A study of data quality for Six Sigma level of improvement, applying a Six Sigma DMAIC (Define, Measure, Analyze, Improve and Control) improvement methodology, utilizing information tools and techniques. The course addresses advanced topics in statistical based continuous improvement, data quality; and Big Data Analytics concepts, as pertains to systematic problems. An embedded certificate in SS is included in the body of knowledge.

Learning Outcomes: 1. Explain how Six Sigma principles are used for continuous improvement. 2. Apply the DMAIC and Big Data approach in solving team based, project based problems. 3. Demonstrate understanding of data quality principles as applied to compelling business cases. Credits: 3.00

15 Credits

Fall 4th Year

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication.
Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

CNIT 48300 - Applied Machine Learning

Credit Hours: 3.00. In the past decade, we have observed the expeditious evolution and tremendous applications of machine learning, such as unmanned vehicle, autonomous language translation, and smart healthcare. This course will introduce both the fundamental knowledge and design/application insights of machine learning techniques via a series of hands-on real-world examples. The overall aim is to provide the students with a good understanding of machine learning technologies, building machine learning models, and applying machine-learning technologies to address real-world problems. In this course, students will also have an opportunity to explore the cutting-edge machine learning technologies, such as deep learning, adversarial attacks, and meta learning, and develop their own machine learning-based solutions.
Learning Outcomes: 1. Demonstrate both the fundamental knowledge and design/application

insights of the state-of-the-art machine learning techniques. 2. Implement machine learning models. 3. Apply machine learning techniques to solve real-world problems. Credits: 3.00

15 Credits

Spring 4th Year

CNIT 48400 - Applications In Data Science

Credit Hours: 3.00. Students investigate practical applications of Data Science and evaluate their effectiveness in guiding decision making. Students will employ tools to assist in these efforts.

Learning Outcomes: 1. Extract knowledge and insights from a variety of datasets. 2. Evaluate the effectiveness of extracted knowledge and insights. 3. Examine the ethical and social implications of data-driven decision making and policies and one's own ethical and social responsibilities when working with data. Credits: 3.00

15 Credits

Data Science, BS (CS)

About the Program

Degree Requirements

Department/Program Major Courses (51-52 credits)

Required Major Courses (36-37 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to

compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find

tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive

statistics and visualizations. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and

graphs. Credits: 3.00

CS Selectives (6-7 credits)

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its

cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets,

graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a

problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

Ethics Selective (3 credits)

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an

engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.
Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

Statistics Selective (3 credits)

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the

sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper

statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales. Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

Capstone Experience (3 credits)

Credit Course Options

CS 44100 - Data Science Capstone

Credit Hours: 3.00. The Capstone course aims at providing students with an opportunity to integrate their accumulated knowledge and technical and social skills in order to identify and solve realistic or real-world data science problem, with an emphasis on the application domain. Capstone projects are often sponsored by corporate partners or by academic or non-academic research groups. The Capstone course serves as preparation for students entering into the profession of Data Science. Students will conduct a team-based project through the entire data science pipeline, by following the six phases of the CRISP-DM (Cross-Industry Standard Process for Data Mining) methodology. Students get experience in working as teams, participating in project planning, writing reports, and giving presentations. Learning Outcomes: 1. Identify the business objectives in a complex problem. 2. Develop appropriate data science goals and project plan. 3. Implement the appropriate data pre-processing and analysis models. 4. Evaluate the above models and interpret results with respect to the "business" objectives. 5. Present the project outcomes through written reports and digital/oral presentations. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the

interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Electives (17-42 credits)

Grade Requirements

GPA Requirements

Computer Science Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to

compute areas of certain planar regions. Credits: 4.00

16-18 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity,

abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

14-18 Credits

Spring 2nd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science,

statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

16-18 Credits

Fall 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

15-16 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

16-17 Credits

Spring 4th Year

13-18 Credits

Data Science, BS (Mathematics)

About the Program

Degree Requirements

Data Science Major Courses (60-61 credits)

Required Major Courses (48-49 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial

science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial

derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and

draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to

implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

Ethics Selective (3 credits)

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is

on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.
Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

MA Selective (3 credits)

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.
Learning Outcomes: 1. Know applications of

Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

CS Selective (3 credits)

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

Capstone (3 credits)

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 41100 - Senior Design Participation In EPICS

Credit Hours: 1.00. Continuation of EPICS courses. Seniors

using EPCS 41100 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41200 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 38600 - Professional Practice IV

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 48700 - Professional Practice V

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

MA 38600 - Professional Practicum IV

Credit Hours: 0.00. Professional Practicum. Permission of department required.

Credits: 0.00

MA 48700 - Professional Practicum V

Credit Hours: 0.00 or 1.00. Professional Practicum. Permission of department required.

Credits: 0.00 or 1.00

MA 49000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 6.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 6.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

STAT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Electives (4-29 credits)

Grade Requirements

GPA Requirements

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.

Credits: 4.00

MA 10800 - Mathematics As A Profession And A Discipline

Credit Hours: 1.00. A seminar course for undergraduate students interested in majoring in an area of mathematics at Purdue. The purpose is to build prospective mathematics majors' awareness of opportunities to enhance their experiences at Purdue and of career paths available for graduates with a good mathematical background. The format of most classes is a presentation and discussion with an invited speaker/guest, including experts on a different aspect of mathematics in our world today. This course is recommended for undergraduates in their first or second year at Purdue.

Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions.

Credits: 4.00

CS 19300 - Tools

Credit Hours: 1.00. This course is designed to introduce new Computer Science students to various programming tools which will aid them in their Computer Science classes, personal projects, and software development job experiences.

Learning Outcomes: 1. Understand Unix/Linux commands for navigating directories and files and manipulating files and folders. 2.

Understand terminal commands for searching and input/output redirection. 3. Understand shells such as sh, csh, ksh, tcsh, bash, zsh. 4. Understand debugging via print statements and general debugger concepts. 5. Understand version control via Git and Github, source control, workflow, commit, collaboration, pull, push, create and pushing a new repository, cloning, branches, merging, and conflicts. 6. Understand vim including mouseless navigation, normal/insert mode, copy/paste, search/replace, and saving/quitting. Credits: 1.00

16-18 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

14-18 Credits

Spring 2nd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix

multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

16-18 Credits

Fall 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points,

boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how

to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

15-16 Credits

Spring 3rd Year

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

15-17 Credits

Fall 4th Year

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the

main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

16-17 Credits

Spring 4th Year

13-18 Credits

Data Science, BS (Statistics)

About the Program

Degree Requirements

Data Science Major Courses (51-52 credits)

Required Major Courses (36-37 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate

them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know

Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining

and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

Ethics Selective (3 credits)

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.
Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public

engagement and scholarly communication skills. Credits: 3.00

CS Selectives (6 credits)

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its

cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets,

graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

Statistics Selective (3 credits)

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance.

Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic

process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

STAT 41800 - Computational Methods In Data Science

Credit Hours: 3.00. This course introduces essential computational methods in modern data science, focusing on simulation, resampling, Bayesian data analysis, and the utilization of large language models (LLMs) in data science workflows. Students will learn foundational simulation techniques, such as random variable generation through the inverse cumulative distribution function and rejection sampling. The course provides an overview of Frequentist and Bayesian inference, highlighting their theoretical foundations and practical applications. Key resampling methods, including bootstrapping and cross-validation, will be explored as tools for assessing variability, constructing confidence intervals, and validating predictive models. The course also emphasizes the practical and responsible use of LLMs in data science pipelines, including tasks such as text preprocessing, feature extraction, and leveraging pre-trained models to enhance data analysis and annotation. The course culminates in a capstone project where students will synthesize their learning by designing and implementing comprehensive solutions to real-world data science problems, demonstrating both theoretical understanding and practical implementation skills.

Learning Outcomes: 1. Apply simulation techniques, including Monte Carlo methods, transformation approaches, and rejection sampling, to analyze probabilistic behavior in data science applications. They will compare and evaluate Frequentist and Bayesian inference paradigms by examining their theoretical foundations, identify their strengths and limitations, and explain their roles in statistical modeling and decision-making. Students will design, implement, and assess resampling methods, focusing on both nonparametric and parametric forms of the bootstrap, to estimate variability, construct confidence intervals, and improve statistical estimates through bias correction techniques. They will learn the principles of cross-validation, analyze its role in model assessment, and apply it to compute model performance metrics, detect overfitting and underfitting, and select models with reliable predictive accuracy using Python libraries. 2. Construct and interpret posterior distributions and credible intervals, apply Markov Chain Monte Carlo methods to approximate posteriors, and evaluate the role of prior distributions in Bayesian inference. In addition, students will utilize large language models in creative and practical ways within data science workflows, such as contextual data augmentation, feature engineering, and integrating structured and unstructured data to enhance predictive models, addressing challenges such as privacy and reliability. The course will culminate in a capstone project where students will synthesize selected course topics to design, develop, and present robust solutions to real-world data science challenges. By integrating computational methods, statistical principles, and real-world datasets, students will demonstrate their ability to create effective, data-driven solutions that showcase both theoretical understanding and applied expertise. Credits: 3.00

Capstone Experience (3 credits)

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors

using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 41100 - Senior Design Participation In EPICS

Credit Hours: 1.00. Continuation of EPICS courses. Seniors using EPCS 41100 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41200 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 38600 - Professional Practice IV

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 48700 - Professional Practice V

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

Other Departmental/Program Course Requirements (31-55 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of

homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Electives (13-38 credits)

Grade Requirements

GPA Requirements

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from

other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-18 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space.

2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

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Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

14-18 Credits

Spring 2nd Year

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

16-18 Credits

Fall 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

15-16 Credits

Spring 3rd Year

15-17 Credits

Fall 4th Year

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

16-17 Credits

Spring 4th Year

13-18 Credits

Data Visualization, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (43 credits)

Required Major Courses (37 credits)

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 21500 - Computer Graphics Programming I

Credit Hours: 3.00. This course focuses on programming fundamentals, logic, and problem solving necessary for advancement into upper level CGT courses. A cross-section of languages and technologies will be introduced and demonstrated.

Learning Outcomes: 1. Understand basic programming concepts such as variables, data types, selection and repetition control structures, arrays, files, and methods and functions. 2. Create simple object-oriented applications. 3. Demonstrate an understanding of the similarities between several different programming or scripting languages. 4. Demonstrate the ability to apply knowledge to different computer graphics software applications. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 37000 - Interactive Data Visualization

Credit Hours: 3.00. Data visualization is the art and science of putting quantitative numbers into pictorial or graphical format that are easy for users to understand, use, and take action upon the data. In this course, we will learn basic data visualization design principles, theories, data management skills, and fundamental web technologies to design and develop web based interactive date visualizations. The students will be able to design the proper visual representations of the data based on the data's characteristics, business needs, and prospective users.

Learning Outcomes: 1. Demonstrate understating of different types of data, their characteristics, relations, and business purpose. 2. Compare and choose proper visualization methods to represent the data based on the characteristic and purpose. 3. Apply perception theories and design principles in visualization design. 4. Utilize web toolkits and technologies to develop simple data visualization. 5. Develop an interaction information visualization system to represent data from different aspects. Credits: 3.00

CGT 37700 - Scientific Visualization

Credit Hours: 3.00. This course is an introduction to the use of computer graphics to help user gain insight into scientific datasets. Applications from atmospheric science, medicine and physics will be explored. Topics will include the fundamental approaches to scalar-valued data (volume rendering, iso-surface extraction), vector-valued data (glyphs, streamlines), and tenors-valued data (ellipsoidal, quadric and super quadric glyphs).

Learning Outcomes: 1. Describe sources of scalar-, vector-, and tensor-valued data and the properties of the data. 2. Assess the effectiveness of given visualization techniques. 3. Explain the differences between multiple approaches to visualization. 4. Create effective scientific visualizations using the vTk library, or tools based on vTk. Credits: 3.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 47000 - Data Visualization Studio

Credit Hours: 3.00. This course will teach students design and develop interactive data visualization systems to communicate and analyze complicated datasets. Students will learn interaction and visual design principles, draw from human perception and cognition theories, and focus on hands-on practice of developing interactive data visualization systems that enable users to see, understand, and analyze complex data and relations. At the end of the class, students will apply the design principles and use proper technologies to create a comprehensive interactive visualization system for data analysis.

Learning Outcomes: 1. Demonstrate understanding of design principles from perspectives of human perception, cognition, and design. 2. Choose the correct visual format based on the data, relations, and data usage. 3. Recognize the common problems in information visualization dashboard design. 4. Demonstrate the ability to process, filter, and transform data for visualization. 5. Utilize proper visual forms, visual analysis techniques, and practices for analyzing basic types of data and data relationships. 6. Develop complex interactive information visualizations system with multiple visualizations for communication and data analysis. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4.

Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 27500 - Data Visualization II

Credit Hours: 3.00. This course provides a practical introduction to exploratory data analysis and data mining to better inform data visualization applications. The course introduces a practical approach for making sense out of data. Students are introduced to issues inherent to the data analysis process or data mining projects. The course covers: (1) how to ***prepare*** data prior to analysis, (2) how to ***generate*** summaries of the data, (3) how to ***identify*** non-trivial facts, patterns and relationships in the data and (4) how to ***create*** models from the data to better understand the data and make predictions. After data is analyzed students will use the data visualization process and techniques to ***visually represent*** the data. The course will also introduce the use of high-level programming languages for data analysis and data visualization.

Learning Outcomes: 1. Prepare data prior to analysis. 2. Identify patterns and relationships in the data. 3. Use programming languages for visualizing data at an introductory level. Credits: 3.00

CGT 27001 - Topics In Data Visualization

Credit Hours: 1.00. This course provides students with first-hand knowledge about the field of data visualization and explore a collection of competencies that will help students think through, think about, and think with visual representation of data. Students will explore and examine current careers in data visualization and learn what skills they should work to refine in preparation for future internships and jobs. This course will provide insight into current data visualization literacy requirements in today's data driven world.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 1.00

Major Selectives* -Choose two courses (6 credits)

Other Departmental/Program Course Requirements (61 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life.

2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of

functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective

sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (16 credits)

Cornerstone Certificate

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application

problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective

sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 1st Year

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

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University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions

and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 27500 - Data Visualization II

Credit Hours: 3.00. This course provides a practical introduction to exploratory data analysis and data mining to better inform data visualization applications. The course introduces a practical approach for making sense out of data. Students are introduced to issues inherent to the data analysis process or data mining projects. The course covers: (1) how to ***prepare*** data prior to analysis, (2) how to ***generate*** summaries of the data, (3) how to ***identify*** non-trivial facts, patterns and relationships in the data and (4) how to ***create*** models from the data to better understand the data and make predictions. After data is analyzed students will use the data visualization process and techniques to ***visually represent*** the data. The course will also introduce the use of high-level programming languages for data analysis and data visualization.

Learning Outcomes: 1. Prepare data prior to analysis. 2. Identify patterns and relationships in the data. 3. Use programming languages for visualizing data at an introductory level. Credits: 3.00

15 Credits

Fall 2nd Year

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 21500 - Computer Graphics Programming I

Credit Hours: 3.00. This course focuses on programming fundamentals, logic, and problem solving necessary for advancement into upper level CGT courses. A cross-section of languages and technologies will be introduced and demonstrated.

Learning Outcomes: 1. Understand basic programming concepts such as variables, data types, selection and repetition control structures, arrays, files, and methods and functions. 2. Create simple object-oriented applications. 3. Demonstrate an understanding of the similarities between several different programming or scripting languages. 4. Demonstrate the ability to apply knowledge to different computer graphics software applications. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

CGT 27001 - Topics In Data Visualization

Credit Hours: 1.00. This course provides students with first-hand knowledge about the field of data visualization and explore a collection of competencies that will help students think through, think about, and think with visual representation of data. Students will explore and examine current careers in data visualization and learn what skills they should work to refine in preparation for future internships and jobs. This course will provide insight into current data visualization literacy requirements in today's data driven world.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 1.00

14 Credits

Spring 2nd Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student

professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

16 Credits

Fall 3rd Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of

analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CGT 37700 - Scientific Visualization

Credit Hours: 3.00. This course is an introduction to the use of computer graphics to help user gain insight into scientific datasets. Applications from atmospheric science, medicine and physics will be explored. Topics will include the fundamental approaches to scalar-valued data (volume rendering, iso-surface extraction), vector-valued data (glyphs, streamlines), and tenors-valued data (ellipsoidal, quadric and super quadric glyphs).

Learning Outcomes: 1. Describe sources of scalar-, vector-, and tensor-valued data and the properties of the data. 2. Assess the effectiveness of given visualization techniques. 3. Explain the differences between multiple approaches to visualization. 4. Create effective scientific visualizations using the vTk library, or tools based on vTk. Credits: 3.00

15 Credits

Spring 3rd Year

CGT 37000 - Interactive Data Visualization

Credit Hours: 3.00. Data visualization is the art and science of putting quantitative numbers into pictorial or graphical format that are easy for users to understand, use, and take action upon the data. In this course, we will learn basic data visualization design principles, theories, data management skills, and fundamental web technologies to design and develop web based interactive date visualizations. The students will be able to design the proper visual representations of the data based on the data's characteristics, business needs, and prospective users.

Learning Outcomes: 1. Demonstrate understating of different types of data, their characteristics, relations, and business purpose. 2. Compare and choose proper visualization

methods to represent the data based on the characteristic and purpose. 3. Apply perception theories and design principles in visualization design. 4. Utilize web toolkits and technologies to develop simple data visualization. 5. Develop an interaction information visualization system to represent data from different aspects. Credits: 3.00

15 Credits

Fall 4th Year

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 47000 - Data Visualization Studio

Credit Hours: 3.00. This course will teach students design and develop interactive data visualization systems to communicate and analyze complicated datasets. Students will learn interaction and visual design principles, draw from human perception and cognition theories, and focus on hands-on practice of developing interactive data visualization systems that enable users to see, understand, and analyze complex data and relations. At the end of the class, students will apply the design principles and use proper technologies to create a comprehensive interactive visualization system for data analysis.

Learning Outcomes: 1. Demonstrate understanding of design principles from perspectives of human perception, cognition, and design. 2. Choose the correct visual format based on the data, relations, and data usage. 3. Recognize the common problems in information visualization dashboard design. 4. Demonstrate the ability to process, filter, and transform data for visualization. 5. Utilize proper visual forms, visual analysis techniques, and practices for analyzing basic types of data and data relationships. 6. Develop complex interactive information visualizations system with multiple visualizations for communication and data analysis. Credits: 3.00

15 Credits

Spring 4th Year

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume.

4. Develop interviewing skills. Credits: 1.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

15 Credits

Design and Construction Integration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (68 credits)

Required Major Courses (67-68 credits)

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-making throughout the project lifecycle. Credits:

3.00

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

CM 15000 - Construction Management Fundamentals

Credit Hours: 6.00. This introductory course focuses on construction materials, methods, and contracts for basic commercial and residential projects. Students will develop essential skills in quantity estimating, construction plan reading, and project documentation. Students will participate in hands-on lab exercises that aim to connect theory with practice. The course includes OSHA 10-hour instruction, with students earning OSHA 10-hour certification cards upon completion, further emphasizing the importance of safety in construction practices.

Learning Outcomes: 1. Identify materials, means, and methods for a construction project throughout the entire project lifecycle. 2. Recognize project controls required during the pre-construction and construction phases of a construction project. 3. Explain project planning tasks relevant to a construction project. 4. Comprehend project administration on a construction project and the required documentation and technology available within the current construction industry. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 40000 - Construction Capstone I

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of pre-construction management into a capstone project.

Learning Outcomes: 1. Design systems for a construction project during the pre-construction phase. 2. Create project controls required during the pre-construction phase of a construction project. 3. Evaluate pre-planning tasks relevant to be beginning a construction project. 4. Generate project administration for a construction project utilizing the required documentation and technology available within the current construction industry. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 43300 - Risk Management And Legal Issues In Design And Construction Integration

Credit Hours: 2.00. An advanced course dealing with risk management and legal issues as they pertain to the interaction of designers, contractors, and owners. Students will learn to identify and mitigate potential risks that may affect the multiple stakeholders and the business organizations they represent during design and construction activity. The course will also deal with trust and teamwork issues within collaborative processes in the built environment.

Learning Outcomes: 1. Identify potential risks for designers, contractors, and owners in a collaborative construction industry environment. 2. Understand potential trust issues that inhibit

collaboration within the architecture, engineering, and construction (AEC) industry. 3. Develop mitigation measures to reduce risk and increase collaboration within architecture, engineering, and construction interactions. 4. Use clear and precise questions and consider diverse points of views when reasoning. 5. Demonstrate ability to gather, assess, record, and compare relevant information in order to support conclusions and related consequences. Credits: 2.00

CM 33200 - Architectural Design, Construction Techniques And Society

Credit Hours: 3.00. A course in which students will be exposed to the evolution of architecture and building techniques that influenced the western built environment. Emphasis will be given to the use of appropriate vocabulary and also how social and cultural factors have influenced the design of the built environment throughout the centuries. The course will survey topics from XVII century to recent times.

Learning Outcomes: 1. Recognize architectural and technical traditions of the Western culture. 2. Identify relationships between cultural patterns and social responsibilities of designers. 3. Recognize ways that history or related arts, humanities and technologies influence the built environment. 4. Use appropriate architectural and technical vocabulary. Credits: 3.00

CM 33000 - Design And Construction I

Credit Hours: 6.00. A course which introduces students to projects and the design information of the built environment as communication tools representing space and proportion. Through a blend of lectures and studio work, students obtain working knowledge of the traditions, documents and standards utilized in the planning for a built structure. Students will also experience how design decisions and programing are influenced by a multitude of outside influences.

Learning Outcomes: 1. Develop basic projects, sketches and pre-projects related to the built environment using appropriate design conventions. 2. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics and technical demands into consideration at the same time. 3. Analyze relevant precedents in order to make informed design choices. 4. Explain the feasibility analysis, supervision and coordination of integrated projects. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

CM 23301 - Mechanical, Electrical And Piping Systems In The Built Environment

Credit Hours: 3.00. An introductory course dealing with construction materials and methods related to building systems, focusing on mechanical, electrical, and piping (MEP) systems. Students will acquire fundamental skills in MEP construction plan reading, quantity estimating, basic systems' design and construction execution through lectures, laboratories and integrated project team exercises.

Learning Outcomes: 1. Recognize the basic principles and components of mechanical, electrical and piping (MEP) systems. 2. Explain the components of a given MEP system based on reading plan and specifications information. 3. Demonstrate the ability to understand conceptual cost and schedule of MEP systems. 4. Trace basic MEP systems lines, such as piping, lighting, and mechanical ducts. 5. Show an understanding of professionalism by applying proper communication, teamwork, rules & regulations, and level of detail required within a built environment business and on a construction jobsite. Credits: 3.00

CM 33100 - Design And Construction II

Credit Hours: 6.00. A course where students exert criticism and evaluation of existing design through a blend of lectures and studio work. Students will be exposed to typical impediments to the design of the built environment as they demonstrate integrative decision making in creating an aesthetic and functional design program that meet the needs of society in a resource efficient and sustainable manner. Students will regularly critique the work of others and have their work critiqued as they seek to shape and implement informed design decisions.

Learning Outcomes: 1. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics, cost, schedule, safety and technical demands into consideration at the same time. 2. Identify sustainability, efficiencies and resource conservation principles to be applied in the built environment. 3. Elaborate sketches, two-dimension drawings or three-dimension models using standard design conventions to aid in the design and construction coordination. 4. Demonstrate the skills associated with making integrated decisions across multiple systems and variables in the completion of a design project. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

CM 16000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Learning Outcomes: 1. Understand fundamentals of surveying including the theory and practice of surveying. 2. Perform surveying computations of grade, direction, traverse adjustment, area, and horizontal and vertical curve geometry. 3. Perform field measurements using basic and modern surveying equipment. 4. Perform tasks within a group effectively and efficiently. Credits: 3.00

CM 20002 - Intermediate Pre-Construction Management

Credit Hours: 4.00. A project course covering intermediate level commercial, residential, heavy/civil, and industrial construction projects. Students will expand their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Calculate design components of a construction project during the pre-construction phase. 2. Produce project controls required during the pre-construction phase of a construction project. 3. Construct pre-planning documents relevant to beginning a construction project. 4. Apply project administration to a construction project utilizing the required documentation and technology available within the current construction industry. Credits: 4.00

CM 27000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Learning Outcomes: 1. Analyze force systems acting at a single point. 2. Analyze force systems that are non-concurrent. 3. Analyze/design cable systems. 4. Analyze/design trusses by graphical and numerical methods. 5. Analyze/design pinned frames. 6. Analyze/design 3-hinged arches. 7. Trace the live and dead loads throughout a building structure. Credits: 3.00

CM 30002 - Advanced Pre-Construction Management

Credit Hours: 4.00. A project course covering advanced level commercial, residential, heavy/civil, and industrial construction projects. Students will further develop their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Select design systems for a construction project during the pre-construction phase. 2. Illustrate project controls required during the pre-construction phase of a construction project. 3. Analyze pre-planning tasks relevant to beginning a construction project. 4. Differentiate project administration on a construction project utilizing the required documentation and technology available within the current construction industry. 5. Demonstrate professionalism by analyzing proper communication, teamwork, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 4.00

CM 30101 - Introduction To Construction Company Financial Management

Credit Hours: 2.00. An introduction to methods for recognizing revenue for long-term construction contracts and each method's impact on financial statements. Includes introduction to analysis of financial statements and their use in developing company budgets, projecting cash needs, pricing construction projects, and forecasting the impact of business decisions on construction company profit.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction contractor. 2. Identify the unique accounts required for percentage of completion revenue recognition,

describe what the account represents, and indicate on which statement the account is found. 3. Interpret the outcomes of line-item analysis, vertical analysis, horizontal analysis, and cost-volume-profit analysis utilizing construction company financial statement data. 4. Perform a profit center analysis of an income statement. 5. Prepare an annual budget for a construction company given source documents. 6. Analyze the impact of various decisions on company profits by applying the cost-volume-profit financial analysis technique. 7. Select the appropriate overhead and profit allocation technique given example company cost structures and compute minimum company overhead and profit mark-up rates. 8. Prepare a monthly company budget given the annual budget and other appropriate information. 9. Compare the monthly budget prepared to actual data. 10. Compare and contrast profit and cash flow for the construction company. 11. Prepare a cash flow projection by applying the company monthly budget. Credits: 2.00

CM 38000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Learning Outcomes: 1. Understand, apply, and analyze fundamentals of geotechnical engineering and construction techniques associated with various types of soil conditions. 2. Conduct various soil lab testing and create lab reports. 3. Use the knowledge of soils and foundation engineering and applications to: create lab reports as written communication; analyze engineering properties of soils; analyze different soil types and field exploration; analyze soil compaction; analyze permeability of water in soils; analyze subsurface stress, consolidation, and shear strength of soil; analyze shallow and deep foundation load, design, and construction; analyze lateral earth pressure and retaining wall structure. Credits: 3.00

CM 45001 - Construction Capstone II

Credit Hours: 3.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. Credits: 3.00

CM 45701 - Construction Safety

Credit Hours: 3.00. This course will examine the impact of safety on the construction industry, including in-depth discussions on the application of the Occupational Safety & Health Administration (OSHA) Safety and Health Standards for the construction industry. The emphasis of this course is to provide training for job sited supervisory personnel. This course will also fulfill the requirements for the OSHA 30-Hour Card.

Learning Outcomes: 1. Identify the role of OSHA in the construction industry and examine current issues related to safety. 2. Acquire knowledge of jobsite safety management and company safety risk management. 3. Identify and evaluate jobsite hazards, including abatement strategies and procedures. 4. Complete the requirements for an OSHA 30-hour card in Construction Safety & Health Administration. Credits: 3.00

CM 47500 - Construction Costs

Credit Hours: 2.00. A study of construction costs, including analysis of field records, job cost accounting, job cost control, and determination of unit prices.

Learning Outcomes: 1. Define the underlying

concepts of construction cost control. 2. Prepare a construction project cash flow forecast using the project budget and time schedule. 3. Calculate construction project cost performance by measuring costs to-date, projecting remaining costs, and calculating variances at completion in terms of materials, subcontracts, general conditions, and project equipment. 4. Analyze construction labor cost performance using earned value, trending, and variance analysis. 5. Make capital acquisition decisions using time value of money concepts. Credits: 2.00

Other Departmental Course Requirements (43-47 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple

digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary

functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the

ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of

print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of

engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

Intercultural Requirement

Electives (5-10 credits)

Supplemental List

Optional Concentrations

Grade and Progression Requirements

GPA Requirements

Construction Work Experience

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write

with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate

ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

14-17 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of

differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CM 15000 - Construction Management Fundamentals

Credit Hours: 6.00. This introductory course focuses on construction materials, methods, and contracts for basic commercial and residential projects. Students will develop essential skills in quantity estimating, construction plan reading, and project documentation. Students will participate in hands-on lab exercises that aim to connect theory with practice. The course includes OSHA 10-hour instruction, with students earning OSHA 10-hour certification cards upon completion, further emphasizing the importance of safety in construction practices.

Learning Outcomes: 1. Identify materials, means, and methods for a construction project throughout the entire project lifecycle. 2. Recognize project controls required during the pre-construction and construction phases of a construction project. 3. Explain project planning tasks relevant to a construction project. 4. Comprehend project administration on a construction project and the required documentation and technology available within the current construction industry. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CM 16000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal

distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Learning Outcomes: 1. Understand fundamentals of surveying including the theory and practice of surveying. 2. Perform surveying computations of grade, direction, traverse adjustment, area, and horizontal and vertical curve geometry. 3. Perform field measurements using basic and modern surveying equipment. 4. Perform tasks within a group effectively and efficiently. Credits: 3.00

15-17 Credits

Fall 2nd Year

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CM 23301 - Mechanical, Electrical And Piping Systems In The Built Environment

Credit Hours: 3.00. An introductory course dealing with construction materials and methods related to building systems, focusing on mechanical, electrical, and piping (MEP) systems. Students will acquire fundamental skills in MEP construction plan reading, quantity estimating, basic systems' design and construction execution through lectures, laboratories and integrated project team exercises.

Learning Outcomes: 1. Recognize the basic principles and components of mechanical, electrical and piping (MEP) systems. 2. Explain the components of a given MEP system based on reading plan and specifications information. 3. Demonstrate the ability to understand conceptual cost and schedule of MEP systems. 4. Trace basic MEP systems lines, such as piping, lighting, and mechanical ducts. 5. Show an understanding of professionalism by applying proper communication, teamwork, rules & regulations, and level of detail required within a built environment business and on a construction jobsite. Credits: 3.00

CM 20002 - Intermediate Pre-Construction Management

Credit Hours: 4.00. A project course covering intermediate level commercial, residential, heavy/civil, and industrial construction projects. Students will expand their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Calculate design components of a construction project during the pre-construction phase. 2. Produce project controls required during the pre-construction phase of a construction project. 3. Construct pre-planning documents relevant to beginning a construction project. 4. Apply project administration to a construction project utilizing the required documentation and technology available within the current construction industry. Credits: 4.00

17 Credits

Spring 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate

the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-making throughout the project lifecycle. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CM 33000 - Design And Construction I

Credit Hours: 6.00. A course which introduces students to projects and the design information of the built environment as communication tools representing space and proportion. Through a blend of lectures and studio work, students obtain working knowledge of the traditions, documents and standards utilized in the planning for a built structure. Students will also experience how design decisions and programing are influenced by a multitude of outside influences.

Learning Outcomes: 1. Develop basic projects, sketches and pre-projects related to the built environment using appropriate design conventions. 2. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics and technical demands into consideration at the same time. 3. Analyze relevant precedents in order to make informed

design choices. 4. Explain the feasibility analysis, supervision and coordination of integrated projects. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

CM 27000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Learning Outcomes: 1. Analyze force systems acting at a single point. 2. Analyze force systems that are non-concurrent. 3. Analyze/design cable systems. 4. Analyze/design trusses by graphical and numerical methods. 5. Analyze/design pinned frames. 6. Analyze/design 3-hinged arches. 7. Trace the live and dead loads throughout a building structure. Credits: 3.00

15 Credits

Fall 3rd Year

CM 33200 - Architectural Design, Construction Techniques And Society

Credit Hours: 3.00. A course in which students will be exposed to the evolution of architecture and building techniques that influenced the western built environment. Emphasis will be given to the use of appropriate vocabulary and also how social and cultural factors have influenced the design of the built environment throughout the centuries. The course will survey topics from XVII century to recent times.

Learning Outcomes: 1. Recognize architectural and technical traditions of the Western culture. 2. Identify relationships between cultural patterns and social responsibilities of designers. 3. Recognize ways that history or related arts, humanities and technologies influence the built environment. 4. Use appropriate architectural and technical vocabulary. Credits: 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

CM 30002 - Advanced Pre-Construction Management

Credit Hours: 4.00. A project course covering advanced level commercial, residential, heavy/civil, and industrial construction projects. Students will further develop their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Select design systems for a construction project during the pre-construction phase. 2. Illustrate project controls required during the pre-construction phase of a construction project. 3. Analyze pre-planning tasks relevant to beginning a construction project. 4. Differentiate project administration on a construction project utilizing the required documentation and technology available within the current construction industry. 5. Demonstrate professionalism by analyzing proper communication, teamwork, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 4.00

CM 38000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Learning Outcomes: 1. Understand, apply, and analyze fundamentals of geotechnical engineering and construction techniques associated with various types of soil conditions. 2. Conduct various soil lab testing and create lab reports. 3. Use the knowledge of soils and foundation engineering and applications to: create lab reports as written communication; analyze engineering properties of soils; analyze different soil types and field exploration; analyze soil compaction; analyze permeability of water in soils; analyze subsurface stress, consolidation, and shear strength of soil; analyze shallow and deep foundation load, design, and construction; analyze lateral earth pressure and retaining wall structure. Credits: 3.00

16 Credits

Spring 3rd Year

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

CM 33100 - Design And Construction II

Credit Hours: 6.00. A course where students exert criticism and evaluation of existing design through a blend of lectures and studio work. Students will be exposed to typical impediments to the design of the built environment as they demonstrate integrative decision making in creating an aesthetic and functional design program that meet the needs of society in a resource efficient and sustainable manner. Students will regularly critique the work of others and have their work critiqued as they seek to shape and implement informed design decisions.

Learning Outcomes: 1. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics, cost, schedule, safety and technical demands into consideration at the same time. 2. Identify sustainability, efficiencies and resource conservation principles to be applied in the built

environment. 3. Elaborate sketches, two-dimension drawings or three-dimension models using standard design conventions to aid in the design and construction coordination. 4. Demonstrate the skills associated with making integrated decisions across multiple systems and variables in the completion of a design project. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

CM 30101 - Introduction To Construction Company Financial Management

Credit Hours: 2.00. An introduction to methods for recognizing revenue for long-term construction contracts and each method's impact on financial statements. Includes introduction to analysis of financial statements and their use in developing company budgets, projecting cash needs, pricing construction projects, and forecasting the impact of business decisions on construction company profit.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction contractor. 2. Identify the unique accounts required for percentage of completion revenue recognition, describe what the account represents, and indicate on which statement the account is found. 3. Interpret the outcomes of line-item analysis, vertical analysis, horizontal analysis, and cost-volume-profit analysis utilizing construction company financial statement data. 4. Perform a profit center analysis of an income statement. 5. Prepare an annual budget for a construction company given source documents. 6. Analyze the impact of various decisions on company profits by applying the cost-volume-profit financial analysis technique. 7. Select the appropriate overhead and profit allocation technique given example company cost structures and compute minimum company overhead and profit mark-up rates. 8. Prepare a monthly company budget given the annual budget and other appropriate information. 9. Compare the monthly budget prepared to actual data. 10. Compare and contrast profit and cash flow for the construction company. 11. Prepare a cash flow projection by applying the company monthly budget. Credits: 2.00

CM 45701 - Construction Safety

Credit Hours: 3.00. This course will examine the impact of safety on the construction industry, including in-depth discussions on the application of the Occupational Safety & Health Administration (OSHA) Safety and Health Standards for the construction industry. The emphasis of this course is to provide training for job sited supervisory personnel. This course will also fulfill the requirements for the OSHA 30-Hour Card.

Learning Outcomes: 1. Identify the role of OSHA in the construction industry and examine current issues related to safety. 2. Acquire knowledge of jobsite safety management and company safety risk management. 3. Identify and evaluate jobsite hazards, including abatement strategies and procedures. 4. Complete the requirements for an OSHA 30-hour card in Construction Safety & Health Administration. Credits: 3.00

14 Credits

Fall 4th Year

CM 40000 - Construction Capstone I

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of pre-construction management into a capstone project.

Learning Outcomes: 1. Design systems for a construction project during the pre-construction phase. 2. Create project controls required during the pre-construction phase of a construction project. 3. Evaluate pre-planning

tasks relevant to be beginning a construction project. 4. Generate project administration for a construction project utilizing the required documentation and technology available within the current construction industry. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 47500 - Construction Costs

Credit Hours: 2.00. A study of construction costs, including analysis of field records, job cost accounting, job cost control, and determination of unit prices.

Learning Outcomes: 1. Define the underlying concepts of construction cost control. 2. Prepare a construction project cash flow forecast using the project budget and time schedule. 3. Calculate construction project cost performance by measuring costs to-date, projecting remaining costs, and calculating variances at completion in terms of materials, subcontracts, general conditions, and project equipment. 4. Analyze construction labor cost performance using earned value, trending, and variance analysis. 5. Make capital acquisition decisions using time value of money concepts. Credits: 2.00

14 Credits

Spring 4th Year

CM 43300 - Risk Management And Legal Issues In Design And Construction Integration

Credit Hours: 2.00. An advanced course dealing with risk management and legal issues as they pertain to the interaction of designers, contractors, and owners. Students will learn to identify and mitigate potential risks that may affect the multiple stakeholders and the business organizations they represent during design and construction activity. The course will also deal with trust and teamwork issues within collaborative processes in the built environment.

Learning Outcomes: 1. Identify potential risks for designers, contractors, and owners in a collaborative construction industry environment. 2. Understand potential trust issues that inhibit collaboration within the architecture, engineering, and construction (AEC) industry. 3. Develop mitigation measures to reduce risk and increase collaboration within architecture, engineering, and construction interactions. 4. Use clear and precise questions and consider diverse points of views when reasoning. 5. Demonstrate ability to gather, assess, record, and compare relevant information in order to support conclusions and related consequences. Credits: 2.00

CM 45001 - Construction Capstone II

Credit Hours: 3.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. Credits: 3.00

12-13 Credits

Design Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (54 credits)

A. Art & Design Required Courses (9 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

B. Art History courses (9 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information

that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

C. Design-oriented Studio Courses (21 credits)

Industrial Design

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Apply concept that well-designed environments are products of a design

process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment. Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 23500 - Materials And Processes II

Credit Hours: 3.00. Problems in three-dimensional design, incorporating materials, production processes, and applications of current technology, emphasizing aspects of society and technology. An introduction to complete industrial design problems, including problem definition, concepts, resource information, design development, final proposals, and presentation techniques.

Learning Outcomes: 1. Apply knowledge of design for manufacturing and use of materials by creating and fabricating selected projects. 2. Evaluate the aesthetics, ergonomics, and manufacturability of designs by participating in in-class design critiques. 3. Utilize skills to analyze an existing product and redesign it with an expanded function. Credits: 3.00

AD 24600 - Design Drawing II

Credit Hours: 3.00. Continuation of the work done in A&D 245. Emphasis on development of skills and presentation quality design drawing.

Credits: 3.00

AD 25600 - Presentation Techniques

Credit Hours: 3.00. Studio preparing students for project presentations. Classes will cover graphic techniques, including page layout, typography, portfolio formats, perspective drawings, photography, and verbal communication.

Learning Outcomes: 1. Create original designs using iterative visualization techniques to

improve and refine their design concepts. 2. Develop computer-aided design skills to present these design concepts. 3. Demonstrate 3-D computer modeling skills. 4. Demonstrate computer rendering skills. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

Interior Design

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 13000 - Interior Design Communication

Credit Hours: 3.00. Spatial studies, conceptual ideation, and methods of communicating in various two- and three-dimensional media.

Learning Outcomes: 1. Produce basic design drawing and architectural lettering. 2. Apply the use of line weights when sketching and drawing when visualizing design ideas. 3. Explain architectural and interior design vocabulary. 4. Construct one- and two-point perspectives. 5. Apply basic skills and knowledge of AutoCAD Drafting Software. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology,

and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 23000 - Interior Design I

Credit Hours: 3.00. Study of behavior patterns, perceptions, needs, and usage of three-dimensional space through conceptual solutions to human environments. Interior design theory and application of design process through analysis, research, and synthesis will be explored.

Learning Outcomes: 1. Develop design communication skills through freehand and instrument drawing tools that can be used in both design and presentation work. 2. Explore a wide range of drawing media such as pencil, markers, and colored pencils to develop design communication skills. 3. Develop the ability to make informed and sensitive decisions regarding the use of color in presentation work. 4. Further develop speed and accuracy in constructing perspectives and renderings. Credits: 3.00

AD 24000 - Interior Drafting And Drawing

Credit Hours: 3.00. Basic drafting and drawing techniques used in residential and small commercial buildings. Emphasis on interior projects, on multi-view drawing, isometrics, perspective, and architectural construction drawings, and rendering techniques.

Learning Outcomes: 1. Learn to explore different concepts and present their ideas through sketches, design drawings, and final models for a small multilevel residential project. 2. Further develop hand sketching, drafting, AutoCAD, and model building skills to communicate their ideas and solutions in the residential remodel. 3. Research and apply information on furniture, stairs, equipment, plumbing, and other elements for a small house project. 4. Execute a comprehensive set of construction drawings for a multilevel residential remodel including floor plans, electrical plans, elevations, details and schedules. Credits: 3.00

AD 25000 - Interior Design II

Credit Hours: 3.00. Introduction to space planning methodology applied to small-scale residential and nonresidential environments. Human factors and user requirements, physical and psychological, will be emphasized. Interior materials, components, and special environmental concerns will be explored.

Learning Outcomes: 1. Identify principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Generate multiple solutions to solve a specified design problem, through ideation sketches, drawings, and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definitions and organization, to a specified design problem. 4. Communicate ideas developed in the design process through written, graphic, and oral communication. 5. Assess designed environments as an aesthetic art form within a functional environment. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search

strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

Visual Communication Design

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 20600 - Studio In Visual Communication Design

Credit Hours: 3.00. Investigation of visual communication design theory, history, skills, and methodology, as well as preparation of art and mechanicals for graphic arts reproduction.

Learning Outcomes: 1. Transition from fundamental design skills to advanced graphic design applications. 2. Introduce layout/grid systems and their theoretical and practical applications. 3. Introduce students to the fundamentals of typography, exploring the relationships between type and image. 4. Increase proficiency in graphic software in the context of graphic design projects. 5. Gain a better understanding of the history of graphic design. 6. Develop more advanced problem-solving skills. 7. Prepare students for the Sophomore Review, and advanced junior- and senior-level design courses. Credits: 3.00

AD 22800 - Visual Communication Design Computing I

Credit Hours: 3.00. An introductory course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Illustrator and Adobe InDesign. 2. Experiment with and iterate through image-making utilizing various methods and vector-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Increase ability to generate and choose intensely metaphoric imagery to enhance visual communication. 5. Understand and use design terminology and design principles. 6. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22900 - Visual Communication Design Computing II

Credit Hours: 3.00. An intermediate course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Photoshop and Adobe XD. 2. Experiment with and iterate through image-making utilizing various methods and pixel-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Understand and use design terminology and design principles. 5. Strengthen attention to detail and craft knowledge. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TECH 22000 - Designing Technology For People

Credit Hours: 3.00. Innovating in our complex world requires understanding people and the issues and challenges they face. This unique course brings together perspectives from technology and anthropology to address this by exploring ethnographic studies of people and technology interactions. Through this process, students will practice the problem scoping skills necessary to identify and define problems and begin to generate appropriate design solutions. In addition, students will learn how to observe and talk with people about technology and discuss a range of ways people use technology. Accordingly, the course will focus on human-centered design and how to empathize with people during the design process. This will allow students to learn how to identify opportunities for innovation that emerge when designers carefully observe and listen to humans using technology and/or experiencing problems with current technology. Note: This class engages the material in both the classroom and innovation labs.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

TECH 34000 - Prototyping Technology For People

Credit Hours: 3.00. Innovating in our complex world requires us

to think strategically and make the best decisions possible for both designing and business development. Accordingly, this unique course brings together perspectives from technology and business management to iteratively prototype innovative solutions to student-selected problems. This process will include creating prototypes in a variety of media, using the appropriate methods/tools, as well as exploring the processes and biases related to how people process information and make decisions. This type of work will help to guide the innovation process by gaining insights from testing prototypes and interacting with people to deepen one's understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. At the conclusion of the course, students will pitch a viable design solution and business model for a validated problem to a variety of potential investors and/or stakeholders. Note: This class engages the material in both the classroom and innovation labs. Students of all levels of experience, will explore tools/programs related to computer aided design, 3D printing, app development, and digital prototyping.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to develop prototypes in a variety of media (digital and/or physical) for the level of fidelity necessary to communicate, understand, and test innovative ideas/designs. 3. Select and use appropriate methods/tools/equipment to make decisions and prototype innovative ideas. 4. Revise designs to reflect a deepening understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. 5. Pitch a viable design solution/business model for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

Industrial Design

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment. Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 23500 - Materials And Processes II

Credit Hours: 3.00. Problems in three-dimensional design, incorporating materials, production processes, and applications of current technology, emphasizing aspects of society and technology. An introduction to complete industrial design problems, including problem definition, concepts, resource information, design development, final proposals, and presentation techniques.

Learning Outcomes: 1. Apply knowledge of design for manufacturing and use of materials by creating and fabricating selected projects. 2. Evaluate the aesthetics, ergonomics, and manufacturability of designs by participating in in-class design critiques. 3. Utilize skills to analyze an existing product and redesign it with an expanded function. Credits: 3.00

AD 24600 - Design Drawing II

Credit Hours: 3.00. Continuation of the work done in A&D 245. Emphasis on development of skills and presentation quality design drawing.

Credits: 3.00

AD 25600 - Presentation Techniques

Credit Hours: 3.00. Studio preparing students for project presentations. Classes will cover graphic techniques, including page layout, typography, portfolio formats, perspective drawings, photography, and verbal communication.

Learning Outcomes: 1. Create original designs using iterative visualization techniques to improve and refine their design concepts. 2. Develop computer-aided design skills to present these design concepts. 3. Demonstrate 3-D computer modeling skills. 4. Demonstrate computer rendering skills. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

D. Marketing and Entrepreneurship (9 credits)

Marketing and Management

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on

evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 39100 - Strategic Thinking And Decision-Making

Credit Hours: 3.00. This course focuses on how to think strategically and make good business decisions. By the end of the class, you will be able to do the following: (1) Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions; (2) Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity

necessary to communicate, understand, and test innovative ideas; (3) Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas; (4) Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas. 3. Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas. 4. Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

MGMT 29400 - Navigating Gender In The Workplace

Credit Hours: 3.00. This course has four objectives: (1) To Increase self-awareness and understand its value in managing careers; (2) To learn how gender culture and implicit bias may affect workplace experiences; (3) To develop strategies to deal with gender related challenges; and (4) To develop competencies in leading effective, gender-aware teams. By exploring these areas, students will develop new insights for managing their careers, and they will learn new leadership strategies to help their teams achieve higher levels of performance.

Learning Outcomes: 1. Through self-assessment, increase understanding of your strengths, core values and work styles. 2. Practice behaviors that demonstrate your confidence and leadership skills. 3. Learn how men and women might behave differently in certain work situations, based on research. 4. Understand implicit bias and its potential impact on talent assessment and advancement. 5. Learn effective strategies and skills to handle common gender-related work challenges - as an individual, as a team member and as a leader. Credits: 3.00

MGMT 29300 - Diversity In The Workplace

Credit Hours: 3.00. Diversity can be defined as real or perceived differences among people with regards to race, ethnicity, sexual orientation, religion, age, physical and mental ability, and family status that affect an individual's treatment, opportunities and outcomes. As demonstrated in the workplace, diversity is the numerous ways that employees are viewed as being similar or different. Through this course, students will examine the historical context and the emergence of diversity in the workplace including bias, meritocracy, privilege, social identity frameworks, organizational culture, allyship and advocacy.

Learning Outcomes: 1. Demonstrate knowledge of historical policy and employment regulations that drive current workplace decisions. 2. Demonstrate awareness of social identities, values, and biases of self and of others. 3. Demonstrate perspective and skills to effectively navigate workplace groups and relationships. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

Entrepreneurship

ENTR 48000 - Entrepreneurial Leadership And Careers

Credit Hours: 3.00. This course prepares students for entrepreneurial careers by requiring them to apply the knowledge and skills learned in prerequisite entrepreneurship

courses to the development of their professional goals and networks. Students explore how they can use their entrepreneurial talents, skills, and interests in a variety of ways, including launching startups, joining family businesses, or being intrapreneurs in established organizations. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify unique personal entrepreneurial strengths to help shape career decisions. 2. Understand the practical application of team building and leadership. 3. Explore different types of entrepreneurial careers in startups and large organizations. 4. Research and interview entrepreneurs about career pathways. 5. Use secondary research to assess potential employers and their alignment with personal goals. 6. Explore options for using entrepreneurial skills within existing organizations. 7. Understand key elements of personal financial planning and management. 8. Build a personal brand and use social media platforms to expand professional networks. 9. Create a personal business plan. Credits: 3.00

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

ENTR 31500 - Business Planning For Social Entrepreneurship

Credit Hours: 3.00. This course builds on entrepreneurship concepts and skills developed in ENTR 20000 (prerequisite course) to understand the differences, benefits, and opportunities associated with social impact business models. Students work in teams on experiential activities including gathering customer feedback, creating forecasts, developing a strategy, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Develop convincing social enterprise business models. 2. Conduct feasibility analysis. 3. Create pro-forma financial statements. 4. Understand legal, regulatory, and ethical issues social entrepreneurs face. 5.

Understand the process of recruiting, hiring, and developing a new venture team. 6. Identify sources of funding and investor needs. 7. Persuade potential investors to support a social impact venture. 8. Participate effectively as a team member or leader. Credits: 3.00

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Learning Outcomes: 1. Demonstrate knowledge of historical policy and employment regulations that drive current workplace decisions. 2. Demonstrate awareness of social identities, values, and biases of self and of others. 3. Demonstrate perspective and skills to effectively navigate workplace groups and relationships. Credits: 3.00

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Learning Outcomes: 1. Introduce students to

the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

E. Art & Design Selective Courses (6 credits)

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 20200 - Introduction To Art Education

Credit Hours: 2.00. Lectures, readings, and discussions covering the history, theory, and professional literature of art education.

Learning Outcomes: 1. Analyze children's artistic development to understand its stages and implications for teaching. 2. Evaluate works of art and learn how to develop that ability in their students. 3. Analyze components of visual arts curriculum, assessment, and art education programming. 4. Demonstrate knowledge and skill with teaching techniques appropriate for various teaching levels. 5. Compare art instruction at various levels of public -school education. Credits: 2.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore

students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided

as needed by individual students. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

A. Art & Design Required Courses (9 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

Electives (32-41 credits)

Sample 4-Year Plan

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.
University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I
University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.
Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.
University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify a range of styles

from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

15 Credits

15 Credits

Spring 2nd Year

15 Credits

15 Credits

Fall 3rd Year

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

15 Credits

15 Credits

Spring 4th Year

14-15 Credits

14-15 Credits

Notes

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and

architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15-16 Credits

15-16 Credits

Learning Objectives

About the Program

Developmental and Family Science, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (25-39 credits)

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the

relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 30500 - Biosocial Foundations Of The Family

Credit Hours: 3.00. Family ties and family processes in the promotion of individual health and management of disease across the life course are covered. Course reviews research on families and health from multiple disciplinary perspectives.

Learning Outcomes: 1. Describe evolutionary and biosocial theory as the basis of development, using a life course perspective from conception through old age. 2. Identify the key biological systems involved in behavior, and how they are measured in biosocial research. 3. Explain the direct implications for biological and environmental interactions for families, children, adolescents, and adults. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

HDFS 31300 - Adolescent Development

Credit Hours: 3.00. An overview of the normative developmental changes that occur during adolescence, with specific attention to individual and relational adjustment.

Learning Outcomes: 1. Critically evaluate popular conceptions of adolescence and adolescents. 2. Compare and contrast theoretical perspectives on normative development during adolescence. 3. Identify the diversity in the developmental pathways during adolescence. 4. Acquire a framework for assessing the connections between interpersonal development and the larger social context. Credits: 3.00

HDFS 33000 - Sexuality And Family Life

Credit Hours: 3.00. Provides the student with a basic knowledge of human sexuality as it pertains to individuals, couples and families. The course is designed to be helpful to students who will become family life educators as well as to be helpful to students as individuals, spouses, and parents.

Learning Outcomes: 1. Construct a basic knowledge of human sexuality as it pertains to family relations in the personal and professional settings. 2. Compare and describe social, cultural, historical, and technological trends and the interrelationships between these trends and their impact on sexuality, family relations, and personal values and attitudes. 3. Differentiate and examine the many different aspects of sexuality including biological, developmental, medical, cultural, historical, and interpersonal. 4. Demonstrate knowledge that helps to develop a better understanding of students' own feelings and attitudes related to sexuality and how those attitudes and feelings influence their beliefs about individuals, couples, and families. Credits: 3.00

HDFS 33200 - Stress And Coping In Contemporary Families

Credit Hours: 3.00. Examines theoretical perspectives related to family stress and resilience in multicultural and diverse family settings, and connects these perspectives to empirical work on family dynamics, coping, and dysfunction across the lifespan. Topics such as economic stress and poverty, immigrant families, single-parent families, homeless families, adoption, military families, maltreatment, and families coping with illness are explored. The class focuses on environmental, cultural, as well as biological contributions to both risk and resilience processes in individuals and families.

Learning Outcomes: 1. Describe theory and research concerning family stress, coping and social support. 2. Understand how an individual's or family's context plays a role in his/her exposure to and coping with stressors. 3. Explain how individual, familial and environmental processes contribute to risk and resilience in individuals and families. 4. Apply the principles of Family Stress Theory and Risk and Resilience Theory to case studies of families. 5. Demonstrate an ability to understand and empathize with total life experiences (physical. psychological, social) of others by identifying possible motivations/explanations for individual and family behavior. Credits: 3.00

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop the basic knowledge and skills needed to understand the research process, including generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present research studies and findings to a group. Credits: 3.00

HDFS 31400 - Atypical Child Development

Credit Hours: 3.00. Atypical child development from conception

to adolescence can emerge from genetic, medical/health, educational, psychological, and/or contextual factors. This course will survey factors (e.g., premature birth, obesity, neurodevelopmental disorders, learning difficulties, child abuse, and war) that contribute to atypical child development. It will assess how and when typical and atypical developmental trajectories diverge and the roles of measurement and intervention.

Learning Outcomes: 1. Describe at least three theories of atypical child development. 2. Differentiate typical and atypical child development and describe the roles measurement/assessment may play in this distinction. 3. Identify biological and contextual factors that may promote resilience or atypical development during the following developmental periods: prenatal, infancy, early to middle childhood, and adolescence. Credits: 3.00

HDFS 41800 - Understanding Autism

Credit Hours: 3.00. (PSY 41800, SLHS 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associated with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

HDFS 31200 - Adult Development

Credit Hours: 3.00. An in-depth study of developmental processes from the transition to adulthood through old age. Particular emphasis is placed on understanding the influence of contexts on adult development.

Learning Outcomes: 1. Identify biological, psychological, social, and demographic aspects of adult development and how they interact over time. 2. Identify theoretical perspectives on human development, and apply them in understanding life trajectories. 3. Understand and apply the process of doing research in adult development. 4. Communicate academic ideas clearly and effectively. Credits: 3.00

Optional Concentrations

Other Departmental/Program Course Requirements (40-48 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain

the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate

rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

Foreign Language Selective (9-12 credits)

Supplemental Lists

Electives (33-55 credits)

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

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Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things),

computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

16-19 Credits

Spring 1st Year

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Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research

and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

15-18 Credits

Fall 2nd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical

literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

12-13 Credits

Spring 2nd Year

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop

the basic knowledge and skills needed to understand the research process, including generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present research studies and findings to a group. Credits: 3.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

13-16 Credits

Spring 4th Year

12-16 Credits

Dietetics/Nutrition, Fitness and Health, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (99-107) credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis,

the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10600 - Introduction To The Profession Of Dietetics

Credit Hours: 1.00. Overview of the dietetics profession, including standards, ethics, educational and employment opportunities, and professional credentialing. Spring semester offered only through distance learning.

Learning Outcomes: 1. Describe the profession of dietetics and future trends. 2. Recognize the education preparation needed to pursue careers in dietetics including different education models of becoming an entry-level dietitian. 3. Demonstrate knowledge of the supervised practice experience application process. 4. Identify the credentialing of dietetic practitioners. 5. Recognize the major professional organizations in dietetics such as the Academy of Nutrition and Dietetics, state affiliates and district dietetic associations, and dietetic practice groups and the roles of each. 6. Demonstrate the ability to develop a professional development portfolio, resume, and cover letter. 7. Develop an understanding of professionalism related to dietetics including interviewing skills, professional etiquette, professional ethics, and professional practice standards. 8. Develop skills for planning a career in dietetics such as self-assessment, goal setting, networking, job search strategies, and timeline establishment. Credits: 1.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of

action and interactions of nutrients. Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 35000 - Dietetics Practicum In Quantity Food Production

Credit Hours: 1.00 to 3.00. Supervised on-the-job experience related to the food service management in health care facilities, schools, community programs, etc. Student is responsible for arrangement and approval of the experience through the supervising food service manager or dietitian and the course instructor. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge gained from coursework to actual work situations. 2. Develop skills related to management of food service. 3. Design and complete a project appropriate for a food service operation. Credits: 1.00 to 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 41100 - Dietetics Career Planning

Credit Hours: 1.00. This course will prepare students to successfully apply and interview for dietetics supervised practice experience, jobs and graduate programs.

Learning Outcomes: 1. Students will prepare resumes, personal statements, and sample applications. 2. Students will use available resources to develop skills in interviewing. 3. Students will identify the steps and deadlines for applying to graduate school and supervised practice programs. Credits: 1.00

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 44200 - Foodservice Systems Management

Credit Hours: 3.00. Systems approach to foodservice management. Foodservice operations based on nutritional goals of the target market. Food sanitation and safety, management of human resources, and supervision. Emphasis on applications to health-care facilities.

Learning Outcomes: 1. Identify and describe the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 2. Apply management and business theories and principles to the development, marketing and delivery of programs or services. 3. Determine costs of services or operations, prepare a budget and interpret financial data. 4. Apply the principles of

human resource management to different situations. 5. Apply safety principles related to food, personnel and consumers. Credits: 3.00

NUTR 48000 - Medical Nutrition Therapy I

Credit Hours: 4.00. Nutrition assessment in humans and introduction to the nutrition care process. Application of the nutrition care process to various disease states.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical evidence-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify nutrition-related problems for medical nutrition therapy. Credits: 4.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or

15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

HTM 31100 - Procurement Management For Foodservice

Credit Hours: 3.00. Identifies and describes food, supplies, and related merchandise used in the foodservice industry. Provides methods and criteria for recognizing quality, evaluating, specifying, purchasing, and inspecting these products. Discusses the use of technology in the purchasing component of the foodservice industry.

Learning Outcomes: 1. Explain foodservice procurement principles such as steps in the procurement process, procurement-menu relationship, quality standards, and vendor relations. 2. Explain factors impacting procurement decisions such as ethics, government regulations, global economic conditions, sustainability, distribution sales channels, technology, competitors, consumer behavior, and skills and knowledge of buyers. 3. Apply foodservice procurement principles, factors, and data analysis to formulate decisions related to product, quantity, price, supplier/producer/manufacturer, and inventory management. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of

macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism.

Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes

such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory

techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723

Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices.

CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

NUTR 12500 - Food Safety Certification And Career Development

Credit Hours: 1.00. Training in ServSafe food safety certification program.

Learning Outcomes: 1. Select appropriate food safety and sanitation practices according to ServSafe guidelines. 2. Assess professional development using resume and student portfolio. Credits: 1.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical

function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the

experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze

experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Other Departmental/Program Course Requirements (22-24 credits)

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

HK 42100 - Health Screening And Fitness Evaluation And Design

Credit Hours: 3.00. This course provides the learner with the knowledge and skills to successfully administer and interpret the results of health evaluations and fitness assessments for the purposes of analysis and the development of individualized exercise programs.

Learning Outcomes: 1. Apply specific physiological principles to individual physical health prescription: Cardiovascular Health, Body Composition, Posture, Muscular Strength, Muscular Endurance, Flexibility, ROM. 2. Explain verbally identified fitness assessment tests as would to a client indicating what, why, and how they are each performed. 3. Administer pre-exercise screening questionnaire/informed consent and identify needs for a medical clearance. 4. Administer accurately identified fitness assessment tests to a client and classify results. Credits: 3.00

HK 42200 - Basic Concepts In Exercise Program Design

Credit Hours: 3.00. Introduces basic program design concepts and rationale to design fitness programs for healthy adults emphasizing cardiovascular training, strength training, flexibility training, and balance.

Learning Outcomes: 1. Design and implement a safe and effective warm up and cool down protocol specific to the individual. 2. Create and implement well-planned, individualized, and progressive resistance training programs. 3. Develop progressive and individualized cardiovascular training programs. 4. Describe the role of exercise in healthy weight management. 5. Apply the scientific concepts to design exercise programs to improve athletic performance and optimize fitness in non-athlete healthy persons. Credits: 3.00

HK 46800 - Advanced Exercise Physiology II

Credit Hours: 3.00. An advanced undergraduate course in the area of exercise and human performance. Further examination of the physiological mechanisms and theories involved in the exercise response.

Credits: 3.00

HK 46900 - Exercise Testing And Prescription In Special Populations

Credit Hours: 3.00. Examines responses to exercise testing and prescription in healthy adults compared to exercise responses and special considerations for individuals with chronic diseases and conditions and issues of concern to pregnant women, children, and older adults, among others.

Learning Outcomes: 1. Identify the difference in testing and prescription for individuals with chronic conditions. 2. Evaluate critically the risks and benefits associated with exercise participation. 3. Apply appropriate emergency procedures in various exercise settings. 4. Deliver unique exercise programs to special populations. Credits: 3.00

NUTR 48800 - Topics In Nutrition, Fitness, And Health

Credit Hours: 3.00. This course critically evaluates the interrelationships between nutrition and exercise and their impact on physical performance and health. Concepts combining nutritional sciences and exercise physiology will be presented. Emerging science and controversies in the current literature will be discussed.

Learning Outcomes: 1. Value the integration of nutrition and exercise for human health promotion, especially related to dietary macronutrients and energy. 2. Discuss current controversial topics in nutrition and fitness and special topics. 3. Practice scientific literature searching, critical evaluation and interpretation of research, technical and scientific writing, and oral communication skills. Credits: 3.00

Electives (0 credit)

Course Requirements & Notes

Supplemental List

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10600 - Introduction To The Profession Of Dietetics

Credit Hours: 1.00. Overview of the dietetics profession, including standards, ethics, educational and employment opportunities, and professional credentialing. Spring semester offered only through distance learning.

Learning Outcomes: 1. Describe the profession of dietetics and future trends. 2. Recognize the education preparation needed to pursue careers in dietetics including different education models of becoming an entry-level dietitian. 3. Demonstrate knowledge of the supervised practice experience application process. 4. Identify the credentialing of dietetic practitioners. 5. Recognize the major professional organizations in dietetics such as the Academy of Nutrition and Dietetics, state affiliates and district dietetic associations, and dietetic practice groups and the roles of each. 6. Demonstrate the ability to develop a professional development portfolio, resume, and cover letter. 7. Develop an understanding of professionalism related to dietetics including interviewing skills, professional etiquette, professional ethics, and professional practice standards. 8. Develop skills for planning a career in dietetics such as self-assessment, goal setting, networking, job search strategies, and timeline establishment. Credits: 1.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety

of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and

biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to

understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-19 Credits

Spring 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality,

intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-17 Credits

Fall 2nd Year

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of

the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

NUTR 12500 - Food Safety Certification And Career Development

Credit Hours: 1.00. Training in ServSafe food safety certification program.

Learning Outcomes: 1. Select appropriate food safety and sanitation practices according to ServSafe guidelines. 2. Assess professional development using resume and student portfolio. Credits: 1.00

18 Credits

Spring 2nd Year

HTM 31100 - Procurement Management For Foodservice

Credit Hours: 3.00. Identifies and describes food, supplies, and related merchandise used in the foodservice industry. Provides methods and criteria for recognizing quality, evaluating, specifying, purchasing, and inspecting these products. Discusses the use of technology in the purchasing component of the foodservice industry.

Learning Outcomes: 1. Explain foodservice procurement principles such as steps in the procurement process, procurement-menu relationship, quality standards, and vendor relations. 2. Explain factors impacting procurement decisions such as ethics, government regulations, global economic conditions, sustainability, distribution sales channels, technology, competitors, consumer behavior, and skills and knowledge of buyers. 3. Apply foodservice procurement principles, factors, and data analysis to formulate decisions related to product, quantity, price, supplier/producer/manufacturer, and inventory management. Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students

will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical

instrumentation and spectroscopy. Credits: 3.00

15-17 Credits

Fall 3rd year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 35000 - Dietetics Practicum In Quantity Food Production

Credit Hours: 1.00 to 3.00. Supervised on-the-job experience related to the food service management in health care facilities, schools, community programs, etc. Student is responsible for arrangement and approval of the experience through the supervising food service manager or dietitian and the course instructor. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge gained from coursework to actual work situations. 2. Develop skills related to management of food service. 3. Design and complete a project appropriate for a food service operation. Credits: 1.00 to 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food

ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

15-16 Credits

Spring 3rd Year

HK 42100 - Health Screening And Fitness Evaluation And Design

Credit Hours: 3.00. This course provides the learner with the knowledge and skills to successfully administer and interpret the results of health evaluations and fitness assessments for the purposes of analysis and the development of individualized exercise programs.

Learning Outcomes: 1. Apply specific physiological principles to individual physical health prescription: Cardiovascular Health, Body Composition, Posture, Muscular Strength, Muscular Endurance, Flexibility, ROM. 2. Explain verbally identified fitness assessment tests as would to a client indicating what, why, and how they are each performed. 3. Administer pre-exercise screening questionnaire/informed consent and identify needs for a medical clearance. 4. Administer accurately identified fitness assessment tests to a client and classify results. Credits: 3.00

HK 46800 - Advanced Exercise Physiology II

Credit Hours: 3.00. An advanced undergraduate course in the area of exercise and human performance. Further examination of the physiological mechanisms and theories involved in the exercise response.

Credits: 3.00

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

17 Credits

Fall 4th Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of

economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

HK 42200 - Basic Concepts In Exercise Program Design

Credit Hours: 3.00. Introduces basic program design concepts and rationale to design fitness programs for healthy adults emphasizing cardiovascular training, strength training, flexibility training, and balance.

Learning Outcomes: 1. Design and implement a safe and effective warm up and cool down protocol specific to the individual. 2. Create and implement well-planned, individualized, and progressive resistance training programs. 3. Develop progressive and individualized cardiovascular training programs. 4. Describe the role of exercise in healthy weight management. 5. Apply the scientific concepts to design exercise programs to improve athletic performance and optimize fitness in non-athlete healthy persons. Credits: 3.00

NUTR 41100 - Dietetics Career Planning

Credit Hours: 1.00. This course will prepare students to successfully apply and interview for dietetics supervised practice experience, jobs and graduate programs.

Learning Outcomes: 1. Students will prepare resumes, personal statements, and sample applications. 2. Students will use available resources to develop skills in interviewing. 3. Students will identify the steps and deadlines for applying to graduate school and supervised practice programs. Credits: 1.00

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 48000 - Medical Nutrition Therapy I

Credit Hours: 4.00. Nutrition assessment in humans and introduction to the nutrition care process. Application of the nutrition care process to various disease states.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical evidence-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify

nutrition-related problems for medical nutrition therapy. Credits: 4.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices.
CTL:ISH 1040 Introduction To Economics
University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

17 Credits

Spring 4th Year

HK 46900 - Exercise Testing And Prescription In Special Populations

Credit Hours: 3.00. Examines responses to exercise testing and prescription in healthy adults compared to exercise responses and special considerations for individuals with chronic diseases and conditions and issues of concern to pregnant women, children, and older adults, among others.
Learning Outcomes: 1. Identify the difference in testing and prescription for individuals with chronic conditions. 2. Evaluate critically the risks and benefits associated with exercise participation. 3. Apply appropriate emergency procedures in various exercise settings. 4. Deliver unique exercise programs to special populations. Credits: 3.00

NUTR 44200 - Foodservice Systems Management

Credit Hours: 3.00. Systems approach to foodservice management. Foodservice operations based on nutritional goals of the target market. Food sanitation and safety, management of human resources, and supervision. Emphasis on applications to health-care facilities.
Learning Outcomes: 1. Identify and describe the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 2. Apply management and business theories and principles to the development, marketing and delivery of programs or services. 3. Determine costs of services or operations, prepare a budget and interpret financial data. 4. Apply the principles of human resource management to different situations. 5. Apply safety principles related to food, personnel and consumers. Credits: 3.00

NUTR 48800 - Topics In Nutrition, Fitness, And Health

Credit Hours: 3.00. This course critically evaluates the interrelationships between nutrition and exercise and their impact on physical performance and health. Concepts combining nutritional sciences and exercise physiology will be presented. Emerging science and controversies in the current literature will be discussed.
Learning Outcomes: 1. Value the integration of nutrition and exercise for human health promotion, especially related to dietary macronutrients and energy. 2. Discuss current controversial topics in nutrition and fitness and special topics. 3. Practice scientific literature searching, critical evaluation and interpretation of research, technical and scientific writing, and oral communication skills. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.
Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery

systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

12 Credits

Digital Agronomy, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (60-62 credits)

Required Major Courses (39-41 credits)

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 39900 - Individual Study

Credit Hours: 1.00 to 3.00. Supervised individual study or research over topics not covered in other courses. Arrange with agronomy faculty before registering. Permission of instructor required.

Credits: 1.00 to 3.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental

geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

ASM 42200 - Advanced Machine Technology For Agricultural Crop Production

Credit Hours: 3.00. The course examines technologies and techniques associated with modern farming practices often referred to in general as precision agriculture. It is structured to center around expert presentations from industry, academia, and farming practice, with a focus on technologies and appropriate application of such technologies in crop production systems in the Eastern Cornbelt. Consent of instructor required.

Learning Outcomes: 1. Identify and analyze technologies associated with precision agriculture. 2. Explain the appropriate use of the aforementioned technologies. 3. Compare technological alternatives in various crop production scenarios. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4.

Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

AGRY 48500 - Precision Crop Management

Credit Hours: 3.00. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital georeferenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. May be used in combination with AGRY 49800 to meet the Agronomy undergraduate capstone requirement; will also meet the GIS/GPS requirement in Agronomy plans of study.

Learning Outcomes: 1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from Dupont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input levels. 2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions. 3. Utilize data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific basis. 4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management. 5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates. 6. Utilize geo-referenced field scouting data and crop models to prescribe effective pest management strategies. 7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources. 8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies. 9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors 10. Evaluate potential crop response to varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions). 11. Describe and explain the impact of productivity influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management). 12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies. 13.

Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

AGRY 42000 - Computing For The Natural Sciences

Credit Hours: 3.00. Basic programming, problem solving, data visualization and communication in the context of agriculture and natural science research using R. Topics include iteration, functions, vectors, strings, algorithms, graphics and reproducible reports in R. This course is appropriate for undergraduates with a curiosity in computing fundamentals and interest in working with research data, especially those potentially applying to graduate school. Also appropriate for graduate students, researchers or other professionals who desire an introduction to programming with R. NO programming experience is necessary. This is not a statistics course; having had introductory statistics and some background coursework in agricultural or other natural sciences is expected.

Learning Outcomes: 1. Design, code and test small R programs. 2. Use programming to solve problems. 3. Communicate results with clean, reproducible reports. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a

proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

EAPS 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real-world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

AGRY 49700 - Agronomy Internship Or Research Reporting

Credit Hours: 1.00. Reflection and reporting on participation in government, industrial, or other internship program or research assistantship. This course is intended to provide an opportunity for students to reflect on their internship experience, interact with students with similar experience, and report on the experience, as part of preparation for a career in the environmental sciences. Permission of department required.

Learning Outcomes: 1. Compare and contrast different professional settings and work environments through the internship experience. 2. Reflect on the internship experience and how it informs career goals. 3. Analyze and interpret simple data, appropriate to the professional setting. 4. Communicate effectively using written and oral media. Credits: 1.00

Major Selectives (21 credits)

Other Departmental/Program Course Requirements (53-54 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking

opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription,

protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or

validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws

of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and

prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Electives (4-7 credits)

Supplemental Lists

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in

cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions.

6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14 Credits

Spring 1st Year

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop

from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

16-17 Credits

Fall 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

17 Credits

Spring 2nd Year

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures

and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

16 Credits

Fall 3rd Year

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

AGRY 39900 - Individual Study

Credit Hours: 1.00 to 3.00. Supervised individual study or research over topics not covered in other courses. Arrange with agronomy faculty before registering. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

AGRY 49700 - Agronomy Internship Or Research Reporting

Credit Hours: 1.00. Reflection and reporting on participation in government, industrial, or other internship program or research assistantship. This course is intended to provide an opportunity for students to reflect on their internship experience, interact with students with similar experience, and report on the experience, as part of preparation for a career in the environmental sciences. Permission of department required.

Learning Outcomes: 1. Compare and contrast different professional settings and work environments through the internship experience. 2. Reflect on the internship experience and how it informs career goals. 3. Analyze and interpret simple data, appropriate to the professional setting. 4. Communicate effectively using written and oral media. Credits: 1.00

13-15 Credits

Spring 3rd Year

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines

ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

EAPS 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real-world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

15 Credits

Fall 4th Year

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

ASM 42200 - Advanced Machine Technology For Agricultural Crop Production

Credit Hours: 3.00. The course examines technologies and techniques associated with modern farming practices often referred to in general as precision agriculture. It is structured to center around expert presentations from industry, academia, and farming practice, with a focus on technologies and appropriate application of such technologies in crop production systems in the Eastern Cornbelt. Consent of instructor required.

Learning Outcomes: 1. Identify and analyze technologies associated with precision agriculture. 2. Explain the appropriate use of the aforementioned technologies. 3. Compare technological alternatives in various crop production scenarios. Credits: 3.00

AGRY 48500 - Precision Crop Management

Credit Hours: 3.00. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital georeferenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. May be used in combination with AGRY 49800 to meet the Agronomy undergraduate capstone requirement; will also meet the GIS/GPS requirement in Agronomy plans of study.

Learning Outcomes: 1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from Dupont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input levels. 2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions. 3. Utilize

data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific basis. 4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management. 5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates. 6. Utilize geo-referenced field scouting data and crop models to prescribe effective pest management strategies. 7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources. 8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies. 9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors 10. Evaluate potential crop response to varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions). 11. Describe and explain the impact of productivity influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management). 12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies. 13. Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management. Credits: 3.00

AGRY 42000 - Computing For The Natural Sciences

Credit Hours: 3.00. Basic programming, problem solving, data visualization and communication in the context of agriculture and natural science research using R. Topics include iteration, functions, vectors, strings, algorithms, graphics and reproducible reports in R. This course is appropriate for undergraduates with a curiosity in computing fundamentals and interest in working with research data, especially those potentially applying to graduate school. Also appropriate for graduate students, researchers or other professionals who desire an introduction to programming with R. NO programming experience is necessary. This is not a statistics course; having had introductory statistics and some background coursework in agricultural or other natural sciences is expected.

Learning Outcomes: 1. Design, code and test small R programs. 2. Use programming to solve problems. 3. Communicate results with clean, reproducible reports. Credits: 3.00

13 Credits

Spring 4th Year

13-16 Credits

Digital Criminology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (57 credits)

Required Major Courses (57 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify

common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

CNIT 32300 - Basic Cyberforensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyberforensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyberforensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss

various social issues associated with computers and information systems. Credits: 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

Required Major Courses (57 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

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Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

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Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

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Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

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security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

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SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

Other Departmental/Program Course Requirements (36-57 credits)

Core I: Disciplinary Diversity (6-18 credits)

Core II: Scientific Research Ethics (3 credits)

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational

understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

ENGL 34400 - Environmental Ethics, Policy, And Sustainability

Credit Hours: 3.00. Environmental Ethics, Policy and Sustainability is an interdisciplinary course designed to open new pathways into ethical and eco-critical inquiry in the Anthropocene age. The course analyzes disciplinary differences in approaching the ethical, the human, and environmental problems such as sustainability, development, biodiversity, global security, and climate change. Students will explore what it means to be ethical in and through an interrogation of our contemporary conceptions of what it means to be human. These interrogations in turn will prompt us to reconsider human creations such as knowledge, culture, and technology, which will push us to genuinely think how humans as a species situate their creations within the realm of what they call Nature. Students will be introduced to the history of environmental studies in the discipline, to the rise of what is now known as "postcolonial ecocriticism" to theoretical inquiry into modern technology, and to other recent developments in the fields of environmental studies.

Learning Outcomes: 1. Learn, describe, and relate key developments in environmental ethics. 2. Distinguish and translate different perspectives concerning ethical challenges. 3. Comprehend the efficacies of environmental positions, and learn to push the boundaries of different disciplinary approaches to environmental dilemmas. 4. Evaluate the limitations of positions and the complex frameworks surrounding ethical problems in order to offer more imaginative and resilient solutions. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop an understanding of professional and ethical

responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

Core III: Cultural and Linguistic Diversity (6-9 credits)

Core IV: Analytical and Computational Methods (9 credits)

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL) Credits: 3.00

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical methods for single variables or for relationships between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7. Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

POL 45000 - Game Theory And Strategy In Political Science

Credit Hours: 3.00. This course introduces students to the basics of game theory and its applications in political science. The course will cover foundational concepts in game theory, including strategic rationality, best responses, normal and strategic form games, backward induction, and games of incomplete information. Students will complete problem sets to demonstrate mastery of these subjects. We will also apply these basic game theoretic tools to important problems in political

science to better understand the dynamics of bargaining, coercion, reassurance, cooperation, and other key concepts.

Learning Outcomes: 1. Demonstrate mastery of key game theoretic concepts, including utility theory, best responses and equilibrium, backward induction, and incomplete information. 2. Solve basic game theoretic problems and derive equilibria of both normal form and strategic form games with both simultaneous and sequential moves. 3. Apply game theoretic concepts to explain actions and outcomes in important contemporary and historical cases in political science, policy, and politics. Credits: 3.00

Core V: Additional Course Requirements (9-16 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value

problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

Calculus I (0-5 credits)

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II (3-5 credits)

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of

integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Psychological Sciences Courses (6 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2.

Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

Calculus I (0-5 credits)

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Core I: Disciplinary Diversity (6-18 credits)

Electives (6-27 credits)

Sample 4-Year Plan

Fall 1st Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3.

Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

13-15 Credits

13-15 Credits

Spring 2nd Year

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an

understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

15 Credits

15 Credits

Fall 3rd Year

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce written reports that document project work performed in the laboratory. Credits: 3.00

12 Credits

12 Credits

Spring 3rd Year

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

18 Credits

Fall 4th Year

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation

problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

15 Credits

15 Credits

Spring 4th Year

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 32300 - Basic Cyberforensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyberforensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyberforensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

15 Credits

15 Credits

Fall 1st Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

15-16 Credits

15-16 Credits

About the Program

Digital Enterprise Systems, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (60-61 credits)

Required Major Courses

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of

metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research

and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

MFET 20301 - Model-Based Definition

Credit Hours: 3.00. This course provides experience in the development of model-based product definition through the use of contemporary modeling tools and the application of ASME dimensional standards. This course also covers product data exchange and interoperability standards from the perspective of neutral and proprietary data formats and models. Long-term archival concepts are also covered.

Learning Outcomes: 1. Explain the significance of 2D and 3D CAD model standards relative to industrial practice. 2. Describe the elements and process of 3D model-based definition. 3. Incorporate model-based definition techniques into the CAD model database and technical documentation when creating geometry. 4. Implement modeling techniques that support long-term archival of product data. 5. Develop standard parts libraries which incorporate industrial standard parts specifications. 6. Select appropriate file format(s) for the communication of CAD data through different toolsets and data exchange media. 7. Develop basic literacy in interpreting technical documentation. Credits: 3.00

MFET 21301 - Simulation And Visualization Applications

Credit Hours: 3.00. This course provides an investigation of predictive and documentary capabilities of engineering simulation and visualization tools. The course is based on concepts derived from theoretical computer graphics and related industrial standards, as well as the use of the geometric model-based product definition.

Learning Outcomes: 1. Describe the processes of simulation and visualization methods and tools. 2. Select and use appropriate simulation and visualization tools for specific PLM tasks. 3. Describe the role of product data models to enhance the processes of engineering design optimization and verification. 4. Develop skills of communication and project management through written assignments, individual, and group projects. 5. Define and apply the fundamentals of technical simulation and visualization with CAx tools in a PLM environment. Credits: 3.00

MFET 30301 - Digital Manufacturing

Credit Hours: 3.00. This course investigates digital manufacturing methods, tools, and processes. Topics include additive and subtractive production techniques, CNC tools, geometric dimensioning and tolerance, model-based definition, measurement instruments and metrology, and scanning techniques for geometry validation.

Learning Outcomes: 1. Describe the differences between additive and subtractive manufacturing. 2. Create a simple CNC program to drive a desktop mill, lathe, and cutter. 3. Understand the basic steps to moving CAD data through a CAM system to drive a machine. 4. Use measurement techniques and model-based data to inspect a manufactured part. 5. Use 3D scanning technology to validate a manufactured part. Credits: 3.00

MFET 31301 - The Business Of Managing Digital Product Data

Credit Hours: 3.00. This course provides experience in the business-related aspects of PLM tools and methods. Topics include identifying specifications and roles for system users within an organization, creating database models for digital product information, workflows, virtual machine installation and configuration of PLM systems, budgeting, and benchmarking.

Learning Outcomes: 1. Identify specifications and requirements for users of PLM systems. 2. Identify user roles and create them with appropriate permissions in a PLM system. 3. Install and configure a PLM system to be used by student teams. 4. Develop the product data model consistent with user requirements. 5. Conduct basic benchmarking and budgeting activities for a PLM deployment. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

MFET 15900 - Introduction To The Smart Manufacturing Enterprise

Credit Hours: 1.00. This course serves as an introduction to modern smart manufacturing methods and processes. The course explores the manufacturing enterprise in different industry contexts to illustrate multiple, varied paths to inform students of multiple career opportunities.

Learning Outcomes: 1. Define the multiple areas that rely on the manufacturing process and connected enterprise. (Case studies, guest speakers) 2. Demonstrate understanding of the fundamentals of historical technology evolution and potential future trends of manufacturing through Industry 1.0, Industry 2.0, Industry 3.0, Industry 4.0, etc. 3. Identify potential manufacturing methods and processes in modern smart manufacturing. (Case studies, guest speakers) 4. Apply knowledge of different manufacturing methods to design a prototype of a manufacturing process. (prototyping and presentation) Credits: 1.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

MFET 25000 - Smart Manufacturing Cloud Computing Applications

Credit Hours: 3.00. This course introduces concepts and principles of cloud computing and the virtualization of computing resources and services for smart manufacturing applications. The fundamental topics of cloud computing will be addressed, including virtually processing, storing, modeling and analyzing of data in the cloud environment. Fundamental concepts about cloud tools, applications, and services from a production and manufacturing perspective will be presented.

Learning Outcomes: 1. State the challenges and advantages of cloud computing in smart manufacturing. 2. Explain the concepts and principles of cloud computing such as a scalability, elasticity, agility, fault tolerance, disaster recovery and networking. 3. Recognize the models, tools, and service types offered by the different cloud platforms for smart

manufacturing applications. 4. Select strategies for managing and optimizing cloud computing resources for different manufacturing applications. 5. Apply techniques in clouding computing to model and manage manufacturing data. 6. Build manufacturing apps using cloud based platform tools and services. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

MFET 48004 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Other Departmental/Program Course Requirements (52-59 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of

analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and

program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential

equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of

revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will

demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity,

coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (0-8 credits)

Supplemental List

Professional Experience

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC:

IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

14-18 Credits

Spring 1st Year

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16-19 Credits

Fall 2nd Year

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

MFET 20301 - Model-Based Definition

Credit Hours: 3.00. This course provides experience in the development of model-based product definition through the use of contemporary modeling tools and the application of ASME dimensional standards. This course also covers product data exchange and interoperability standards from the perspective of neutral and proprietary data formats and models. Long-term archival concepts are also covered.

Learning Outcomes: 1. Explain the significance of 2D and 3D CAD model standards relative to industrial practice. 2. Describe the elements and process of 3D model-based definition. 3. Incorporate model-based definition techniques into the CAD model database and technical documentation when creating geometry. 4. Implement modeling techniques that support long-term archival of product data. 5. Develop standard parts libraries which incorporate industrial standard parts specifications. 6. Select appropriate file format(s) for the communication of CAD data through different toolsets and data exchange media. 7. Develop basic literacy in interpreting technical documentation. Credits: 3.00

13-15 Credits

Spring 2nd Year

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

MFET 21301 - Simulation And Visualization Applications

Credit Hours: 3.00. This course provides an investigation of predictive and documentary capabilities of engineering simulation and visualization tools. The course is based on concepts derived from theoretical computer graphics and related industrial standards, as well as the use of the geometric model-based product definition.

Learning Outcomes: 1. Describe the processes of simulation and visualization methods and tools. 2. Select and use appropriate simulation and visualization tools for specific PLM tasks. 3. Describe the role of product data models to enhance the processes of engineering design optimization and verification. 4. Develop skills of communication and project management through written assignments, individual, and group projects. 5. Define and apply the fundamentals of technical simulation and visualization with CAx tools in a PLM environment. Credits: 3.00

15-16 Credits

Fall 3rd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret

standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

MFET 30301 - Digital Manufacturing

Credit Hours: 3.00. This course investigates digital manufacturing methods, tools, and processes. Topics include additive and subtractive production techniques, CNC tools, geometric dimensioning and tolerance, model-based definition, measurement instruments and metrology, and scanning techniques for geometry validation.

Learning Outcomes: 1. Describe the differences between additive and subtractive manufacturing. 2. Create a simple CNC program to drive a desktop mill, lathe, and cutter. 3. Understand the basic steps to moving CAD data through a CAM system to drive a machine. 4. Use measurement techniques and model-based data to inspect a manufactured part. 5. Use 3D scanning technology to validate a manufactured part. Credits: 3.00

15 Credits

Spring 3rd Year

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and

industry. 7. Communicate basic quality concepts. Credits: 3.00

MFET 31301 - The Business Of Managing Digital Product Data

Credit Hours: 3.00. This course provides experience in the business-related aspects of PLM tools and methods. Topics include identifying specifications and roles for system users within an organization, creating database models for digital product information, workflows, virtual machine installation and configuration of PLM systems, budgeting, and benchmarking.

Learning Outcomes: 1. Identify specifications and requirements for users of PLM systems. 2. Identify user roles and create them with appropriate permissions in a PLM system. 3. Install and configure a PLM system to be used by student teams. 4. Develop the product data model consistent with user requirements. 5. Conduct basic benchmarking and budgeting activities for a PLM deployment. Credits: 3.00

15 Credits

Fall 4th Year

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MFET 48004 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

12-15 Credits

Spring 4th Year

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

12-15 Credits

Early Childhood Education and Exceptional Needs, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (72 credits)

Required Major Courses (15 credits)

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological

development faced by the majority of children in the world. Credits: 3.00

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop the basic knowledge and skills needed to understand the research process, including generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present research studies and findings to a group. Credits: 3.00

Professional Education Requirements (57 credits)

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

HDFS 26000 - Young Children With Exceptional Needs

Credit Hours: 3.00. A broad overview of learner characteristics and service delivery models for young children (birth-8 years) who are at-risk or have identified disabilities. Students gain understanding of disabilities in young children, of laws relating to persons with disabilities, and roles of special and general educators in providing services to students with identified disabilities.

Learning Outcomes: 1. The student will demonstrate knowledge of: (a) Philosophical, historical, and legal foundations of special education. (b) How principles of development, motivation, behavioral and cognitive learning theories are related to learner differences. (c)

Characteristics of learners with exceptionalities, including individual and group diversity that may impact learning. (d) Issues related to environmental and personal barriers that hinder accessibility and acceptance of persons with disabilities and their families. (e) Applicable laws, rules and regulations, and procedural safeguards regarding the planning and implementation of early children special education interventions, including management of behaviors, of children with special learning needs. (f) Issues related to teacher professionalism and ethical practice. 2. The student will demonstrate skills to: (a) Articulate current issues in special education. (b) Define and describe and characteristics of learners with exceptionalities. 3. The student will demonstrate appropriate dispositions regarding: (a) The right of all children through the age of 21 to receive a free and appropriate public education. (b) Access to the natural environment and to the general curriculum as the starting point for special education and early intervention services. Credits: 3.00

HDFS 31000 - Guidance In Early Childhood

Credit Hours: 3.00. This course presents a developmental, child-centered approach to the guidance and discipline of young children, including children with disabilities. Influential theories, relevant research, and effective guidance methods for the early childhood teachers and other professionals working with young children and families, including families from different cultural and economic backgrounds, are discussed. Admitted to Gate B.

Learning Outcomes: 1. Understand the primary components of child guidance at different developmental stages. 2. Plan and implement developmentally appropriate methods of child guidance and discipline. 3. Understand the influential theoretical perspectives of child guidance/discipline. 4. Modify expectations and guidance strategies appropriately for children with diverse abilities, family demographic characteristics, and cultural backgrounds. 5. Promote and create environments and lessons that prevent challenging behaviors. 6. Demonstrate desirable modeling of behavior. 7. Increase understanding and skills surrounding effective communication with children and parents about child guidance. 8. Gain critical knowledge of the importance of understanding diverse family and community characteristics and how they influence child behavior. 9. Increase understanding and skills for engaging with families, other educators, and practitioners on child guidance. 10. Demonstrate growth in professionalism as early childhood educators. Credits: 3.00

HDFS 40600 - Mathematics In Preschool And Primary Grades

Credit Hours: 4.00. This course focuses on teaching mathematics in preschool and primary grade classrooms. It covers the developmental foundations and curriculum applications of mathematics teaching and includes ways to plan, implement and evaluate developmentally appropriate mathematics instructions for children with and without disabilities and children who are learning English. Field-based experiences in preschool or primary-grade classrooms are included.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching mathematics. 2. Demonstrate an understanding of how children think about mathematical concepts. 3. Identify key mathematics knowledge that children need to learn during the early childhood and primary years 4. Critically and creatively plan, implement, and evaluate developmentally appropriate instruction in mathematics, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Mathematics for children from birth-3rd grade (www.in.doe.gov/primetime/foundations.html and

http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml). 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Note: A 3 hour/week field experience provides students the opportunity to apply knowledge to practice as reflected in objectives 4-6 above. Credits: 4.00

HDFS 40800 - Early Intervention / Early Childhood Special Education: Issues And Professional Practices

Credit Hours: 4.00. An introduction to the field of early intervention / early childhood special education including its origin, services, and practices in working with young children ages birth through eight with or at risk for developmental delays and disabilities and their families. Designing curriculum, environments, and services where all children are included, have equal opportunity for access and engagement, and feel a sense of belonging is addressed. For Early Childhood Education and Exceptional Needs majors only. A field experience in preschool or primary-grade classrooms is included.

Learning Outcomes: 1. Discuss origins of early intervention / early childhood special education including key legislation affecting young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 2. Describe the value of and process for fostering family participation and professional-family collaboration in order to plan and implement family concerns, priorities, and access resources in intervention and education of young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 3. Explain considerations including individualized and culturally / linguistically appropriate service delivery models, assessment, and curriculum for designing and organizing learning environments and experiences for young children (0-8) who have or are at risk for developmental delays and disabilities. 4. Evaluate, select, implement, and reflect on individually and culturally/linguistically appropriate evidence-based instructional strategies and interventions for young children (0-8) who have or are at risk for developmental delays and disabilities. 5. Utilize appropriate teaming and collaboration models, skills, processes, and strategies to engage with families and other professionals in the development of individualized intervention and transition plans. 6. Discuss current issues in providing effective early intervention / early childhood special education services for young children and their families. 7. Exhibit growth in professional behavior related to the field of early intervention / early childhood special education. Credits: 4.00

HDFS 40900 - Science In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching science in preschool and primary grade classrooms. Developmental foundations and curriculum applications of science teaching including ways to plan, implement and evaluate developmentally appropriate science instruction for young children with and without disabilities and those who are learning English.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching science. 2. Demonstrate an understanding of how children think about science concepts at developmental levels between birth and 8 years. 3. Demonstrate understanding of critical approaches to scientific thinking. 4. Understand key science knowledge and skills that children need to learn from Pre-K to Grade 3 as represented in current science education standards. 5. Assess children's science knowledge, skills, and dispositions, and use the assessment data to plan science education activities. 6. Plan, implement, and evaluate developmentally appropriate classroom science activities, including responding to the needs of diverse learners. 7. Demonstrate positive dispositions and skills of

an early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

HDFS 41200 - Professionalism And Music And Movement In Early Childhood

Credit Hours: 3.00. This course focuses on foundations of professionalism in early childhood education and early childhood special education. Additionally, this course discusses music and movement in early learning environments. It covers the developmental foundation and curriculum applications of music and movement activities and includes ways to plan, implement and evaluate developmentally appropriate music and movement instruction for children with and without disabilities and children who are learning English.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the ethical and professional standards in early childhood education, including the importance of maintaining confidentiality, respecting diversity, teaming will colleagues, and upholding the well-being of children and families. 2. Describe principles of developmentally appropriate early childhood education and intervention as they relate to music and movement in early childhood and primary grades. 3. Demonstrate an understanding of children's development of creative expression through music and movement. 4. Plan, implement, and evaluate developmentally appropriate visual music and movement instruction, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Physical Education and Health and Music for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

HDFS 41500 - Approaches To Early Childhood Education

Credit Hours: 3.00. The historical and theoretical basis for early childhood education and early intervention is emphasized. Relations between theory and practice are examined and illustrated with model early childhood programs. Addresses cultural/developmental diversity, ethics, and standards in early childhood education and intervention.

Learning Outcomes: 1. Discuss recommended practices in early childhood education and early intervention, including historical and theoretical sources and reasons for these practices with young children. 2. Describe, evaluate, and apply ideas from influential early childhood curriculum models while incorporating cultural and developmental diversity among young children, families, and the profession. 3. Clearly articulate to others your theoretical assumptions, goals, and practices as an early childhood professional. 4. Describe ethical guidelines and best practice recommendations for early childhood teachers and early interventionists and be able to apply those principles to everyday problems in early childhood education and early intervention. 5. Read, think, speak, and write about the course material, demonstrating your development as a professional, with increased confidence that what you do every day as a teacher is grounded in theory, recommended best practices, cultural sensitivity, and research-based knowledge. Credits: 3.00

HDFS 42000 - Developmental Foundations Of Infant And Toddler Curriculum

Credit Hours: 3.00. Study of typical and atypical development in infants and toddlers as well as implication for practice. Focuses on infant toddler developmental assessment and designing and implementing learning activities in all developmental areas and enhancing parent/professional relationships. Includes a practicum experience with infants and toddlers.

Learning Outcomes: 1. Acquire knowledge of the needs, normal development patterns, and important variations in development (including delays and disabilities) of children from prenatal period to 3 years. 2. Acquire skills in designing, maintaining, and evaluating safe, supportive, stimulating environments for infants and toddlers. 3. Acquire knowledge and skills in implementing developmentally-appropriate and

culturally-appropriate assessment and programming for infants and toddlers. 4. Acquire skills providing basic care, education, and guidance for children under 3 years that may be applied in child care settings, family homes, or health care settings. 5. Acquire skills in developing supportive caregiving relationships with infants and toddlers. 6. Acquire skills in collaborating with key adults in infants' and toddlers' lives, including parents, other family members, and allied professionals. Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

AD 20100 - Art For Elementary School Teachers

Credit Hours: 3.00. Art theory and experiences, curriculum theory, and materials preparatory for instruction of elementary school children. No undergraduate students may be enrolled in this course until they have been admitted to teacher education and a copy of this acceptance is on file.

Learning Outcomes: 1. Apply visual arts methods to develop appropriate lessons to construct students' knowledge. 2. Utilize two- and three-dimensional media commonly used by elementary students to teach art production and encourage the expression of ideas. 3. Assess elementary students' artistic development levels and design activities to meet their artistic needs in the classroom. 4. Apply elements of art, principles of design, interpretation skills, and judgment conclusions to evaluate and respond to works of art and to foster that ability in their elementary students. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to

assist in data-driven decision making. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

HDFS 31801 - Developmental Assessment

Credit Hours: 3.00. This course provides an introduction to the variety and characteristics of developmental assessments for young children, birth to age 8. Students learn formal and informal strategies for documenting individual development and learning; linking assessment and instruction; and, the use of assessment for determining eligibility for early intervention/early childhood special education. Students learn partnering with families, other professionals, as well as cultural and ethical issues in assessment.

Learning Outcomes: 1. Explain appropriate uses of assessment with young children, birth - 8 years of age, for instruction and intervention. 2. Describe the appropriate use of standardized and non-standardized approaches to assessment with young children, including family-centered assessment strategies. 3. Describe and be able to apply the linked systems of assessment, intervention, and evaluation, including in the context of IEP/IFSP development, progress monitoring, and program evaluation. 4. Conduct assessments, accurately interpret results, and critically evaluate assessment data. 5. Explain approaches to inclusion of family members in assessments, including identification of resources and priorities, and strategies for communicating assessment results to families. 6. Describe ethical considerations in assessment as well as cultural, language, and developmental differences that effect assessment implementation and outcomes. 7. Exhibit growth in professional behavior related to assessment of young children and for the field of early childhood education / early childhood special education. Credits: 3.00

HDFS 44000 - Expanded ECEEN Student Teaching

Credit Hours: 1.00 to 3.00. This is a full semester of supervised expansion of student teaching in an approved environment that

serves children ages birth through 3rd grade with and without disabilities. This experience will occur the semester prior to full-time student teaching and be supervised by an HDFS faculty member and the classroom cooperating teacher. Monthly HDFS sponsored professional development seminars will also be required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Division for Early Childhood of the Council for Exceptional Children. 3. Engage in developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. Credits: 1.00 to 3.00

HDFS 40510 - Literacy In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching literacy in preschool and primary-grade classrooms. It covers the developmental foundations and curriculum applications of literacy teaching in pre-kindergarten and primary grades and includes ways to plan, implement, and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of reading and writing in early childhood classrooms and homes, including the importance of supporting children's vocabulary, language comprehension, alphabet knowledge, phonemic awareness, and concept and functional use of print. 2. Explain the science of reading, particularly the current state of reading research and implications of research for reading instruction. 3. Practice strategies for facilitating children's development of literacy skills. 4. Plan, implement, and evaluate developmentally appropriate instruction in literacy including responding to the needs of diverse learners. 5. Describe the importance and demonstrate the use of Indiana State Standards for literacy for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus. Credits: 3.00

HDFS 45010 - Supervised Teaching In Inclusive Programs For Young Children

Credit Hours: 12.00. This is 16 full-time weeks of supervised teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will be supervised by a HDFS faculty member and the classroom cooperating teacher. Monthly HDFS-sponsored professional development seminars and additional teacher education meetings will also be required. This will partially fulfill requirements for the Indiana Early Childhood Education and the Early Childhood Special Education teaching license. Admission to Student Teaching required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Council for Exceptional Children. 3. Design developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the student teaching environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. 5. Create and conduct one-to-one, small group and/or large group instruction, guidance, intervention, and developmental activities in the student teaching environment. 6. Design and implement appropriate child assessment and evaluation procedures that influence the teaching and learning process. 7. Evaluate their

own teaching practices through self-reflection and the analysis of child learning. Credits: 12.00

HDFS 40000 - Social Studies In Preschool And Primary Grades

Credit Hours: 2.00. This course focuses on teaching social studies in preschool and primary grade classrooms. It covers the developmental foundations and curriculum applications of social studies teaching in pre-kindergarten and of social studies in primary grades and includes ways to plan, implement and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of social studies in early childhood, including supporting children's understanding of themselves and the diverse nature of their communities, history, economics, citizenship, leadership, and civics and government. 2. Explain appropriate strategies for facilitating children's development of social studies skills. 3. Plan, implement, and evaluate developmentally appropriate instruction in social studies, including responding to the needs of diverse learners. 4. Demonstrate an understanding of Indiana State Standards for social studies for children from birth-3rd grade. 5. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 2.00

Other Departmental/Program Course Requirements (38-44 credits)

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple

digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 23000 - Great Narrative Works (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of great narratives from Homer's Odyssey to the present, considering works from a variety of cultures and time periods in order to develop an understanding of their ideas, structures, styles, and cultural values.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ENGL 23800 - Introduction To Fiction (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of fiction from different periods aimed at enhancing the student's understanding of genre, form, and style; how fiction grows out of and speaks to its historical moment; and how fiction addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of fiction. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LC 23900 - Women Writers In Translation (UCC: HUM)

Credit Hours: 3.00. An examination of international female writers' literary creativity in the context of women's studies and feminist theory, as articulated in their specific cultural and geographical milieu. Course content will vary in terms of cultural focus. In English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop skills in writing, reading, critical thinking, and oral expression. 2. Gain knowledge of female literary traditions in different geographical milieu and time periods. 3. Increase awareness of the ways in which women writers reflect upon and resist stereotypes of women in literature, and how this process may differ across cultures. 4. Understand fundamental concepts in women's gender and sexuality studies. Credits: 3.00

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SPAN 23500 - Spanish American Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Spanish American literature. The course context will change from semester to semester. Knowledge of Spanish not required.

Credits: 3.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 20600 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Continuation of BIOL 20500. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and

several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical Sciences* PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

Foreign Language Selective (9-12 credits)

Electives (4-10 credits)

GPA Requirements

Pass/No Pass Policy

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

BIOL 20600 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Continuation of BIOL 20500. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

15 Credits

Spring 1st Year

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family

processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Fall 2nd Year

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize

evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events.

4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical Sciences* PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for

anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

15 Credits

Spring 2nd Year

HDFS 26000 - Young Children With Exceptional Needs

Credit Hours: 3.00. A broad overview of learner characteristics and service delivery models for young children (birth-8 years) who are at-risk or have identified disabilities. Students gain understanding of disabilities in young children, of laws relating to persons with disabilities, and roles of special and general educators in providing services to students with identified disabilities.

Learning Outcomes: 1. The student will demonstrate knowledge of: (a) Philosophical, historical, and legal foundations of special education. (b) How principles of development, motivation, behavioral and cognitive learning theories are related to learner differences. (c) Characteristics of learners with exceptionalities, including individual and group diversity that may impact learning. (d) Issues related to environmental and personal barriers that hinder accessibility and acceptance of persons with disabilities and their families. (e) Applicable laws, rules and regulations, and procedural safeguards regarding the planning and implementation of early children special education interventions, including management of behaviors, of children with special learning needs. (f) Issues related to teacher professionalism and ethical practice. 2. The student will demonstrate skills to: (a) Articulate current issues in special education. (b) Define and describe and characteristics of learners with exceptionalities. 3. The student will demonstrate appropriate dispositions regarding: (a) The right of all children through the age of 21 to receive a free and appropriate public education. (b) Access to the natural environment and to the general curriculum as the starting point for special education and early intervention services. Credits: 3.00

HDFS 31000 - Guidance In Early Childhood

Credit Hours: 3.00. This course presents a developmental, child-centered approach to the guidance and discipline of young children, including children with disabilities. Influential theories, relevant research, and effective guidance methods for the early childhood teachers and other professionals working with young children and families, including families from different cultural and economic backgrounds, are discussed. Admitted to Gate B.

Learning Outcomes: 1. Understand the primary components of child guidance at different developmental stages. 2. Plan and implement developmentally appropriate methods of child guidance and discipline. 3. Understand the influential theoretical perspectives of child guidance/discipline. 4. Modify expectations and guidance strategies appropriately for children with diverse abilities, family demographic characteristics, and cultural backgrounds. 5. Promote and create environments and lessons that prevent challenging behaviors. 6. Demonstrate desirable modeling of behavior. 7. Increase understanding and skills surrounding effective communication with children and parents about child guidance. 8. Gain critical knowledge of the importance of understanding diverse family and community characteristics and how they influence child behavior. 9. Increase understanding and skills for engaging with families, other educators, and practitioners on child guidance. 10. Demonstrate growth in professionalism as early childhood educators. Credits: 3.00

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research

literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop the basic knowledge and skills needed to understand the research process, including generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present research studies and findings to a group. Credits: 3.00

HDFS 41200 - Professionalism And Music And Movement In Early Childhood

Credit Hours: 3.00. This course focuses on foundations of professionalism in early childhood education and early childhood special education. Additionally, this course discusses music and movement in early learning environments. It covers the developmental foundation and curriculum applications of music and movement activities and includes ways to plan, implement and evaluate developmentally appropriate music and movement instruction for children with and without disabilities and children who are learning English.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the ethical and professional standards in early childhood education, including the importance of maintaining confidentiality, respecting diversity, teaming will colleagues, and upholding the well-being of children and families. 2. Describe principles of developmentally appropriate early childhood education and intervention as they relate to music and movement in early childhood and primary grades. 3. Demonstrate an understanding of children's development of creative expression through music and movement. 4. Plan, implement, and evaluate developmentally appropriate visual music and movement instruction, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Physical Education and Health and Music for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and

use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive

image of the education profession. Credits: 1.00

16 Credits

Fall 3rd Year

HDFS 40800 - Early Intervention / Early Childhood Special Education: Issues And Professional Practices

Credit Hours: 4.00. An introduction to the field of early intervention / early childhood special education including its origin, services, and practices in working with young children ages birth through eight with or at risk for developmental delays and disabilities and their families. Designing curriculum, environments, and services where all children are included, have equal opportunity for access and engagement, and feel a sense of belonging is addressed. For Early Childhood Education and Exceptional Needs majors only. A field experience in preschool or primary-grade classrooms is included.

Learning Outcomes: 1. Discuss origins of early intervention / early childhood special education including key legislation affecting young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 2. Describe the value of and process for fostering family participation and professional-family collaboration in order to plan and implement family concerns, priorities, and access resources in intervention and education of young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 3. Explain considerations including individualized and culturally / linguistically appropriate service delivery models, assessment, and curriculum for designing and organizing learning environments and experiences for young children (0-8) who have or are at risk for developmental delays and disabilities. 4. Evaluate, select, implement, and reflect on individually and culturally/linguistically appropriate evidence-based instructional strategies and interventions for young children (0-8) who have or are at risk for developmental delays and disabilities. 5. Utilize appropriate teaming and collaboration models, skills, processes, and strategies to engage with families and other professionals in the development of individualized intervention and transition plans. 6. Discuss current issues in providing effective early intervention / early childhood special education services for young children and their families. 7. Exhibit growth in professional behavior related to the field of early intervention / early childhood special education. Credits: 4.00

HDFS 42000 - Developmental Foundations Of Infant And Toddler Curriculum

Credit Hours: 3.00. Study of typical and atypical development in infants and toddlers as well as implication for practice. Focuses on infant toddler developmental assessment and designing and implementing learning activities in all developmental areas and enhancing parent/professional relationships. Includes a practicum experience with infants and toddlers.

Learning Outcomes: 1. Acquire knowledge of the needs, normal development patterns, and important variations in development (including delays and disabilities) of children from prenatal period to 3 years. 2. Acquire skills in designing, maintaining, and evaluating safe, supportive, stimulating environments for infants and toddlers. 3. Acquire knowledge and skills in implementing developmentally-appropriate and culturally-appropriate assessment and programming for infants and toddlers. 4. Acquire skills providing basic care, education, and guidance for children under 3 years that may be applied in child care settings, family homes, or health care settings. 5. Acquire skills in developing supportive caregiving relationships with infants and toddlers. 6. Acquire skills in collaborating with key adults in infants' and toddlers' lives, including parents, other family members, and allied professionals. Credits: 3.00

HDFS 31801 - Developmental Assessment

Credit Hours: 3.00. This course provides an introduction to the variety and characteristics of developmental assessments for young children, birth to age 8. Students learn formal and informal strategies for documenting individual development and learning; linking assessment and instruction; and, the use of assessment for determining eligibility for early intervention/early childhood special education. Students learn partnering with families, other professionals, as well as cultural and ethical issues in assessment.

Learning Outcomes: 1. Explain appropriate uses of assessment with young children, birth - 8 years of age, for instruction and intervention. 2. Describe the appropriate use of standardized and non-standardized approaches to assessment with young children, including family-centered assessment strategies. 3. Describe and be able to apply the linked systems of assessment, intervention, and evaluation, including in the context of IEP/IFSP development, progress monitoring, and program evaluation. 4. Conduct assessments, accurately interpret results, and critically evaluate assessment data. 5. Explain approaches to inclusion of family members in assessments, including identification of resources and priorities, and strategies for communicating assessment results to families. 6. Describe ethical considerations in assessment as well as cultural, language, and developmental differences that effect assessment implementation and outcomes. 7. Exhibit growth in professional behavior related to assessment of young children and for the field of early childhood education / early childhood special education. Credits: 3.00

HDFS 40510 - Literacy In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching literacy in preschool and primary-grade classrooms. It covers the developmental foundations and curriculum applications of literacy teaching in pre-kindergarten and primary grades and includes ways to plan, implement, and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of reading and writing in early childhood classrooms and homes, including the importance of supporting children's vocabulary, language comprehension, alphabet knowledge, phonemic awareness, and concept and functional use of print. 2. Explain the science of reading, particularly the current state of reading research and implications of research for reading instruction. 3. Practice strategies for facilitating children's development of literacy skills. 4. Plan, implement, and evaluate developmentally appropriate instruction in literacy including responding to the needs of diverse learners. 5. Describe the importance and demonstrate the use of Indiana State Standards for literacy for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus. Credits: 3.00

16 Credits

Spring 3rd Year

HDFS 40600 - Mathematics In Preschool And Primary Grades

Credit Hours: 4.00. This course focuses on teaching mathematics in preschool and primary grade classrooms. It covers the developmental foundations and curriculum applications of mathematics teaching and includes ways to plan, implement and evaluate developmentally appropriate mathematics instructions for children with and without disabilities and children who are learning English. Field-based experiences in preschool or primary-grade classrooms are included.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching mathematics. 2. Demonstrate an understanding of how children think about mathematical concepts. 3. Identify key

mathematics knowledge that children need to learn during the early childhood and primary years 4. Critically and creatively plan, implement, and evaluate developmentally appropriate instruction in mathematics, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Mathematics for children from birth-3rd grade (www.in.doe.gov/primetime/foundations.html and http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml). 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Note: A 3 hour/week field experience provides students the opportunity to apply knowledge to practice as reflected in objectives 4-6 above. Credits: 4.00

HDFS 40900 - Science In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching science in preschool and primary grade classrooms. Developmental foundations and curriculum applications of science teaching including ways to plan, implement and evaluate developmentally appropriate science instruction for young children with and without disabilities and those who are learning English.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching science. 2. Demonstrate an understanding of how children think about science concepts at developmental levels between birth and 8 years. 3. Demonstrate understanding of critical approaches to scientific thinking. 4. Understand key science knowledge and skills that children need to learn from Pre-K to Grade 3 as represented in current science education standards. 5. Assess children's science knowledge, skills, and dispositions, and use the assessment data to plan science education activities. 6. Plan, implement, and evaluate developmentally appropriate classroom science activities, including responding to the needs of diverse learners. 7. Demonstrate positive dispositions and skills of an early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

HDFS 41500 - Approaches To Early Childhood Education

Credit Hours: 3.00. The historical and theoretical basis for early childhood education and early intervention is emphasized. Relations between theory and practice are examined and illustrated with model early childhood programs. Addresses cultural/developmental diversity, ethics, and standards in early childhood education and intervention.

Learning Outcomes: 1. Discuss recommended practices in early childhood education and early intervention, including historical and theoretical sources and reasons for these practices with young children. 2. Describe, evaluate, and apply ideas from influential early childhood curriculum models while incorporating cultural and developmental diversity among young children, families, and the profession. 3. Clearly articulate to others your theoretical assumptions, goals, and practices as an early childhood professional. 4. Describe ethical guidelines and best practice recommendations for early childhood teachers and early interventionists and be able to apply those principles to everyday problems in early childhood education and early intervention. 5. Read, think, speak, and write about the course material, demonstrating your development as a professional, with increased confidence that what you do every day as a teacher is grounded in theory, recommended best practices, cultural sensitivity, and research-based knowledge. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior

analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

HDFS 40000 - Social Studies In Preschool And Primary Grades

Credit Hours: 2.00. This course focuses on teaching social studies in preschool and primary grade classrooms. It covers the developmental foundations and curriculum applications of social studies teaching in pre-kindergarten and of social studies in primary grades and includes ways to plan, implement and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of social studies in early childhood, including supporting children's understanding of themselves and the diverse nature of their communities, history, economics, citizenship, leadership, and civics and government. 2. Explain appropriate strategies for facilitating children's development of social studies skills. 3. Plan, implement, and evaluate developmentally appropriate instruction in social studies, including responding to the needs of diverse learners. 4. Demonstrate an understanding of Indiana State Standards for social studies for children from birth-3rd grade. 5. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 2.00

17 Credits

Fall 4th Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

AD 20100 - Art For Elementary School Teachers

Credit Hours: 3.00. Art theory and experiences, curriculum theory, and materials preparatory for instruction of elementary school children. No undergraduate students may be enrolled in this course until they have been admitted to teacher education and a copy of this acceptance is on file.

Learning Outcomes: 1. Apply visual arts methods to develop appropriate lessons to

construct students' knowledge. 2. Utilize two- and three-dimensional media commonly used by elementary students to teach art production and encourage the expression of ideas. 3. Assess elementary students' artistic development levels and design activities to meet their artistic needs in the classroom. 4. Apply elements of art, principles of design, interpretation skills, and judgment conclusions to evaluate and respond to works of art and to foster that ability in their elementary students. Credits: 3.00

ENGL 23000 - Great Narrative Works (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of great narratives from Homer's Odyssey to the present, considering works from a variety of cultures and time periods in order to develop an understanding of their ideas, structures, styles, and cultural values.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ENGL 23800 - Introduction To Fiction (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of fiction from different periods aimed at enhancing the student's understanding of genre, form, and style; how fiction grows out of and speaks to its historical moment; and how fiction addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of fiction. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LC 23900 - Women Writers In Translation (UCC: HUM)

Credit Hours: 3.00. An examination of international female writers' literary creativity in the context of women's studies and feminist theory, as articulated in their specific cultural and geographical milieu. Course content will vary in terms of cultural focus. In English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop skills in writing, reading, critical thinking, and oral expression. 2. Gain knowledge of female literary traditions in different geographical milieu and time periods. 3. Increase awareness of the ways in which women writers reflect upon and resist stereotypes of women in literature, and how this process may differ across cultures. 4. Understand fundamental concepts in women's gender and sexuality studies. Credits: 3.00

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 23500 - Spanish American Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Spanish American literature. The course context will change from semester to semester. Knowledge of Spanish not required.

Credits: 3.00

HDFS 44000 - Expanded ECEEN Student Teaching

Credit Hours: 1.00 to 3.00. This is a full semester of supervised expansion of student teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will occur the semester prior to full-time student teaching and be supervised by an HDFS faculty member and the classroom cooperating teacher. Monthly HDFS sponsored professional development seminars will also be required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Division for Early Childhood of the Council for Exceptional Children. 3. Engage in developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. Credits: 1.00 to 3.00

14 Credits

Spring 4th Year

HDFS 45010 - Supervised Teaching In Inclusive Programs For Young Children

Credit Hours: 12.00. This is 16 full-time weeks of supervised teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will be supervised by a HDFS faculty member and the classroom cooperating teacher. Monthly HDFS-sponsored professional development seminars and additional teacher education meetings will also be required. This will partially fulfill requirements for the Indiana Early Childhood Education and the Early Childhood Special Education teaching license. Admission to Student Teaching required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Council for Exceptional Children. 3. Design developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the student teaching environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. 5. Create and conduct one-to-one, small group and/or large group instruction, guidance, intervention, and developmental activities in the student teaching environment. 6. Design and implement appropriate child assessment and evaluation procedures that influence the teaching and learning process. 7. Evaluate their own teaching practices through self-reflection and the analysis of child learning. Credits: 12.00

12 Credits

Ecology, Evolution, and Environmental Biology, BS

Degree Requirements

Departmental/Program Major Courses (33-37 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by

examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic

material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.

Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing

biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating

their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (14-18 credits)

Intermediate Biology Selective (2-4 credits)

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila,

nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6.

Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that

are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

Required Coursework (6 credits)

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

Ecology Selective I (3 credits)

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in

community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

Ecology Selective II (2-4 credits)

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R

programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g.,

glaciations). Credits: 3.00

FNR 44700 - Vertebrate Population Dynamics

Credit Hours: 4.00. Estimation and analysis of populations; computer modeling of sampling methods, population dynamics, population and habitat management. Knowledge of computer programming not required.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 4.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical

research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real

datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and

design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

Base Lab Requirement (1 credit)

BIOL 58602 - Laboratory In Ecology

Credit Hours: 1.00. This course is intended to complement many of the concepts discussed in BIOL 58601 Ecology Lecture. By studying selected topics in depth, both experimentally and through primary literature, you should gain a greater understanding of ecological principles and the process of science as it is applied to a variety of ecological topics. Permission of department required.

Learning Outcomes: 1. Read and discuss papers from the primary literature. 2. Develop hypotheses and conduct hypotheses testing through discussion of literature and predictions for experiments conducted in class. 3. Write and present on a scientific paper based on experiments conducted in class and lab-related topics. 4. Discuss parametric and non-parametric statistical tests and discuss the proper application of statistical tools. 5. Use multiple field techniques for sampling terrestrial plants, aquatic insects, and avian behavior. Credits: 1.00

Other Departmental /Program Course Requirements (53-79 credits)

Chemistry (17 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Biochemistry (4 credits)

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability

to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems.
Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing.
Credits: 1.00

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML

and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2.

Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Mathematics (6-10 credits)

Calculus I

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary

functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours

toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Electives (4-34 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution,

and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral

calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-19 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to

be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-20 Credits

Fall 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic

acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role

of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include

understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites. Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of

space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

12-15 Credits

Fall 3rd Year

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all

this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 58602 - Laboratory In Ecology

Credit Hours: 1.00. This course is intended to complement many of the concepts discussed in BIOL 58601 Ecology Lecture. By studying selected topics in depth, both experimentally and through primary literature, you should gain a greater understanding of ecological principles and the process of science as it is applied to a variety of ecological topics. Permission of department required.

Learning Outcomes: 1. Read and discuss papers from the primary literature. 2. Develop hypotheses and conduct hypotheses testing through discussion of literature and predictions for experiments conducted in class. 3. Write and present on a scientific paper based on experiments conducted in class and lab-related topics. 4. Discuss parametric and non-parametric statistical tests and discuss the proper application of statistical tools. 5. Use multiple field techniques for sampling terrestrial plants, aquatic insects, and avian behavior. Credits: 1.00

14-17 Credits

Spring 3rd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy,

and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

12-14 Credits

Fall 4th Year

12-15 Credits

Spring 4th Year

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

13-14 Credits

Economics, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (45-47 credits)

Pre-Economics Courses (9-11 credits)

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to

apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

Upper Division Economics (36 credits)

A. Foundational Courses (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be

able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

B. Economics Courses (6 credits)

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical

and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

C. Additional Economics Courses - Choose Nine (27 credits)

Electives (0-39 credits)

Grade Requirements

GPA Requirements

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety

of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course

emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through

revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

15-18 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in

markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

15 Credits

Spring 2nd Year

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Economics, BS

About the Program

Degree Requirements

Department/Program Major Courses (53 credits)

Required Major Courses (26 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It

emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different

macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication

through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications.

4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Cultural Competency Selective (3 credits)

Economics Selectives (24 Credits)

Other Departmental Requirements (20-32 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of

polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to

compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (38-50 credits)

Optional Concentrations for Daniels School of Business

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables.

Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the

individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in

business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15-17 Credits

Fall 2nd Year

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

13-16 Credits

Spring 2nd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Fall 3rd Year

14 Credits

Spring 3rd Year

12-15 Credits

Fall 4th Year

13-15 Credits

Spring 4th Year

13-15 Credits

Economics: Behavioral Economics Concentration, BS

About the Program

Degree Requirements

Major Requirements (29 credits)

Required Major Courses (26 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific

business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation

and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of

government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing;

Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to

determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Cultural Competency (3 credits)

Economics Concentration: Behavioral Economics (24 credits)

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the

relevant issues in a strategic situation. Credits: 3.00

ECON 37200 - Experimental Economics

Credit Hours: 3.00. This course will explore how experiments are used in economics to test economic theory, understand behavior, and evaluate new policies. Focusing on recent research, we read research papers on a variety of policy topics including labor market discrimination, payday lending, organ transplantation, media censorship, and voting. Applying the concepts from class, students will identify their own original research questions and design new experiments.

Learning Outcomes: 1. Understand why experiments are the gold standard for causal inference. 2. Identify the key elements of any economic experiment and evaluate design choices. 3. Generate original research questions that can be answered with an experiment. 4. Design novel experiments to test hypotheses. Credits: 3.00

Other Departmental Requirements (17-29 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through

reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate

content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics

and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

Electives (38-50 credits)

Optional Concentrations for School of Business

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary

functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate

various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify,

analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103

Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15-17 Credits

Fall 2nd Year

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The

analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 37200 - Experimental Economics

Credit Hours: 3.00. This course will explore how experiments are used in economics to test economic theory, understand behavior, and evaluate new policies. Focusing on recent research, we read research papers on a variety of policy topics including labor market discrimination, payday lending, organ transplantation, media censorship, and voting. Applying the concepts from class, students will identify their own original research questions and design new experiments.

Learning Outcomes: 1. Understand why experiments are the gold standard for causal inference. 2. Identify the key elements of any economic experiment and evaluate design choices. 3. Generate original research questions that can be answered with an experiment. 4. Design novel experiments to test hypotheses. Credits: 3.00

13-16 Credits

Spring 2nd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a

variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work. University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Fall 3rd Year

14 Credits

Spring 3rd Year

12-15 Credits

Fall 4th Year

14-15 Credits

Spring 4th Year

12-15 Credits

Economics: Business Economics Concentration, BS

About the Program

Degree Requirements

Major Requirements (29 credits)

Required Major Courses (26 credits)

ENGL 42000 - Business Writing

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workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical

inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust

with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations

will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Cultural Competency (3 credits)

Economics Concentration: Business Economics (24 credits)

ECON 46600 - International Economics

Credit Hours: 3.00. Analyzes topics in international economics, using more advantage techniques and more detailed treatment than in ECON 37000 or 37100. While coverage varies somewhat with instructor, some topics could include: economic growth, innovation and technology transfer, and the role of multinational corporations.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade and finances. 2. Understand the perspective provided by economic analysis regarding the interaction between economic growth and international trade. 3. Identify insights economics analysis provides concerning the benefits and costs of technology transfer and the role of multinational corporations. Credits: 3.00

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective

provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants (i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

ECON 43200 - Economics Of Growth & Innovation

Credit Hours: 3.00. Part one: we focus on this fact: the richest countries in the world have incomes nearly 200 times greater than the poorest, with profound consequences for the lives (and deaths) of their citizens. Why nations are poor and how they can become rich is one of the most important questions in Economics. We will look at the role of investment, schooling, population growth and technology. Part two: we explore how globalization affects productivity and innovation. This includes how international trade and domestic policies affect allocative efficiency, accelerate structural change, and discipline competitive behaviors by domestic firms. We explore how firms grow on global markets, how technology is embodied in traded

inputs, and how international markets for ideas and the possibility of imitation can lead to explosive growth. Part three: we explore a rapidly growing literature on the economics of innovation. We'll wrestle with the questions of: where new ideas come from, and whether it is becoming more difficult to innovate; how cities become hotbeds of innovation and how this will be affected by remote work; and how innovation can be shaped by choices of firms and by government policies.

Learning Outcomes: 1. Analyze income levels and growth rates across countries using economic models to understand and assess the underlying factors driving disparities in economic development, including investment, population growth, schooling, and technology; quantitatively assess these factors and make cross-country comparisons to build capabilities for engaging in economic reasoning through data; use economic models and research evidence to evaluate the causal drivers of, and impact of policy decisions on, innovation at the level of individuals, institutions, and places. Credits: 3.00

Other Departmental Requirements (17-29 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or

15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the

advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish

and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (38-50 credits)

Optional Concentrations for Daniels School of Business

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary

functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in

no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding

of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.
Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions

and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15-17 Credits

Fall 2nd Year

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical

and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

13-16 Credits

Spring 2nd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and

exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work. University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Fall 3rd Year

14 Credits

Spring 3rd Year

12-15 Credits

Fall 4th Year

14-15 Credits

Spring 4th Year

12-15 Credits

Economics: Economic Policy Concentration, BS

About the Program

Degree Requirements

Major Requirements (29 credits)

Required Major Courses (26 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better

business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or

more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3.

Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you

need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for

successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Cultural Competency (3 credits)

Economics Concentration: Economic Policy (24 credits)

ECON 45600 - Urban Economics

Credit Hours: 3.00. Examines the market forces that lead to the development, growth, and size of cities. In addition, this course covers the theory of location and land use, principles of local public finance, policy problems in the areas of urban housing, transportation, crime, and pollution.

Credits: 3.00

ECON 38500 - Labor Economics

Credit Hours: 3.00. The purpose of this course is to introduce important topics, theories, institutions, and policy issues relating to the functioning of labor markets. Topics to be considered include labor supply decisions, investments in human capital, compensating wage differentials, labor contract theory, unions, compensation programs, signaling in labor markets, the economics of unemployment, and government employment, retirement, and workplace safety.

Learning Outcomes: 1. Distinguish the major determinants of labor market participation and hours worked. 2. Analyze how welfare programs and business cycles affect labor supply. 3. Derive the short and long term demand for labor. 4. Construct a detailed demand and supply model of the labor market. 5. Find the equilibrium labor market outcomes in the context of the neoclassical model 6. Analyze the role played by jobs' and workers' characteristics in generating wage differentials. 7. Develop a schooling model that explains human capital investment. 8. Distinguish factors that affect earnings inequality and labor market discrimination. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across

countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 36700 - Law And Economics

Credit Hours: 3.00. It has become increasingly clear to economists, legal scholars and political scientists that it is impossible to understand economic institutions without first having an understanding of the legal framework within which they operate. Similarly, it is impossible to understand the impact of law on society without first having an understanding of economic principles. This problem is further complicated by the fact that there are often ambiguities in the written law that lead to significant differences between what the law appears to say and how the law is interpreted in the courts. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions.

Learning Outcomes: 1. Understand better the relationship of Law and Economics, two different disciplines that both directly impact the business climate. 2. Learn how the concepts taught in this class apply in a real world setting. Credits: 3.00

ECON 36200 - Health Economics

Credit Hours: 3.00. This course is designed to introduce upper level undergraduate students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues using tools from intermediate microeconomic theory. The course begins with an analysis of health care as a commodity and why health is different from other consumer goods. The course then examines the demand for and the production of health and health care, and the behavior and organization of health care providers. The discussion then switches to information asymmetries and the functioning of health insurance markets. Afterwards, the course turns to the analysis of government involvement in the health care system. The class concludes with an examination of medical care systems around the world, paying particular attention to the U.S. health care system.

Learning Outcomes: 1. Describe the main economic theories relating to health and health care markets. 2. Apply economic theory to the analysis of health care policy and institutions. 3. Construct a detailed demand and supply model of the health insurance market. 4. Critically evaluate key policy issues in health and health care from an economic perspective. Credits: 3.00

ECON 48500 - Economics Of Racial And Gender Discrimination

Credit Hours: 3.00. This course focuses on quantifying the extent of, and determining the underlying causes of racial and gender disparities in the labor market. Topics include the impact of prejudice on labor market outcomes, statistical discrimination, early childhood factors and differences in environment, and fertility and reproductive technology.

Learning Outcomes: 1. Quantify racial and

gender disparities in economic outcomes. 2. Recognize the differences and importance of disparities that control and do not control for observable factors. 3. Understand the difference between prejudice and discrimination, and the extent to which prejudice can cause discrimination. 4. Assess how discrimination can occur even in the absence of prejudice. 5. Evaluate the impact of policies designed to reduce disparities, such as affirmative action. Credits: 3.00

ECON 32200 - Economics Of Public Policy

Credit Hours: 3.00. The examination and analysis of public finance practices and problems in the federal fiscal system. Government activities that involve spending and taxation are analyzed applying basic principles of economics. Topics include public education, social security, healthcare, environment and tax systems. State and local government issues are also addressed.

Learning Outcomes: 1. Explain how the provision of government goods and services through political institutions differs from market provision of goods and services. 2. Examine and analyze taxes and subsidies with and without market failure. 3. Examine and analyze various types of government expenditures on public education, health care, social security, income assistance, unemployment compensation, etc. 4. Explain how cost-benefit analysis can be used to help government choose among alternative investment projects. 5. Examine and analyze the impact of various types of taxes on the economy. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

ECON 43200 - Economics Of Growth & Innovation

Credit Hours: 3.00. Part one: we focus on this fact: the richest countries in the world have incomes nearly 200 times greater than the poorest, with profound consequences for the lives (and deaths) of their citizens. Why nations are poor and how they can become rich is one of the most important questions in Economics. We will look at the role of investment, schooling, population growth and technology. Part two: we explore how globalization affects productivity and innovation. This includes how international trade and domestic policies affect allocative

efficiency, accelerate structural change, and discipline competitive behaviors by domestic firms. We explore how firms grow on global markets, how technology is embodied in traded inputs, and how international markets for ideas and the possibility of imitation can lead to explosive growth. Part three: we explore a rapidly growing literature on the economics of innovation. We'll wrestle with the questions of: where new ideas come from, and whether it is becoming more difficult to innovate; how cities become hotbeds of innovation and how this will be affected by remote work; and how innovation can be shaped by choices of firms and by government policies.

Learning Outcomes: 1. Analyze income levels and growth rates across countries using economic models to understand and assess the underlying factors driving disparities in economic development, including investment, population growth, schooling, and technology; quantitatively assess these factors and make cross-country comparisons to build capabilities for engaging in economic reasoning through data; use economic models and research evidence to evaluate the causal drivers of, and impact of policy decisions on, innovation at the level of individuals, institutions, and places. Credits: 3.00

Other Departmental Requirements (17-29 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety

of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections.

Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting

appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (38-50 credits)

Optional Concentrations for Daniels School of Business

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients,

compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson,

hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking

about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult

conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive,

explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15-17 Credits

Fall 2nd Year

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in

markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

13-16 Credits

Spring 2nd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the

determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work. University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Fall 3rd Year

14-17 Credits

Spring 3rd Year

12-15 Credits

Fall 4th Year

12-15 Credits

Spring 4th Year

12-15 Credits

Economics: Mathematical Economics Concentration, BS

About the Program

Degree Requirements

Major Requirements (29 credits)

Required Major Courses (26 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson,

Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic

costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an

audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Cultural Competency (3 credits)

Economics Concentration: Mathematical Economics (29-31 credits)

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three

dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential

equations (optional). Credits: 4.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

Other Departmental Requirements (17-29 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research

and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of

differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting

materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (31-45 credits)

Optional Concentrations for Daniels School of Business

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of

functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data

displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at

least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-

audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.
Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the

historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15-17 Credits

Fall 2nd Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

14-18 Credits

Spring 2nd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a

variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis,

Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

13-16 Credits

Fall 3rd Year

14-15 Credits

Spring 3rd Year

13-15 Credits

Fall 4th Year

12-15 Credits

Spring 4th Year

12-13 Credits

Economics: Quantitative Economics and Data Analytics Concentration, BS

About the Program

Degree Requirements

Major Requirements (29 credits)

Required Major Courses (26 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business

documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in

labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using

AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific

business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Cultural Competency (3 credits)

Economics Concentration: Quantitative Economics & Data Analytics (24 credits)

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of

a predictive analytics solution to a business problem. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a

strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

Other Departmental Requirements (17-29 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts;

critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative

literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (38-50 credits)

Optional Concentrations for School of Business

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie

statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative

literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential

elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative

literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15-17 Credits

Fall 2nd Year

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of

individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

13-16 Credits

Spring 2nd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical

techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify

best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Fall 3rd Year

14 Credits

Spring 3rd Year

12-15 Credits

Fall 4th Year

13-15 Credits

Spring 4th Year

13-15 Credits

Electrical Engineering

Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (55 credits)

Required Major Courses (55 credits)

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common

applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 38001 - Global Professional Issues In Engineering Technology

Credit Hours: 3.00. This course addresses professional ethics, legal issues, professional development, technology transfer, and corporate culture as they relate to EET graduates and our global society. Information relating to personal job and career choices, resumes, and interviews are included.

Learning Outcomes: 1. Demonstrate awareness in areas of intercultural knowledge and effectiveness. 2. Demonstrate awareness in areas of ethical reasoning. 3. Demonstrate awareness in areas of global citizenship and social awareness. 4. Identify applications of professional and ethical responsibilities including respect for diversity. 5. Demonstrate the ability to engage in self-directed continuing

professional development. 6. Demonstrate knowledge of the impact of engineering technology solutions in a societal and global context. Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.

Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

Other Departmental/Program Course Requirements (62 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical

acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make

efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution,

work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the

important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.
Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II
University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.
University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.
University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.
Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing.
Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.
University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance

test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial

advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Elective (3 credits)

Supplemental List

Professional Experience

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays,

pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of

electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple

iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the

foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

16 Credits

Fall 2nd Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages

business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

16 Credits

Spring 2nd Year

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis

techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations.
Credits: 3.00

15 Credits

Fall 3rd Year

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing.
Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.

Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and

economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide. Credits: 3.00

15 Credits

Spring 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these

objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12 Credits

Electrical Engineering, BSEE

About the Program

Degree Requirements

Required Major Courses (52 credits minimum)

Electrical Engineering Core Requirements (27 credits)

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference

equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic

measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ECE 30411 - Electromagnetics I

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic waves and transmission lines, which is continued in ECE 30412.

Learning Outcomes: 1. Work with electrostatic fields and find electric and potential fields from charge distributions including the presence of dielectric materials. 2. Work with magnetostatic fields and find magnetic fields from current distributions including the presence of magnetic materials. 3. Work with time varying fields including wave propagation. 4. Work with transmission lines in the time and frequency domains. Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

ECE 20008 - Electrical Engineering Fundamentals II Lab

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20002 Electrical Engineering Fundamentals II; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

Learning Outcomes: 1. Ability to competently select, use, and automate electronic measurement instruments. 2. Design, wire, and troubleshoot electronic circuits. 3. Ability to simulate electronic circuits. 4. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 5. Demonstrate knowledge of laboratory safety precautions. 6. Maintain laboratory notes and create professional experiment reports. Credits: 1.00

Required Seminars (3 credits)

ECE 29401 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree requirements, professional writing and multicultural and professional development.

Learning Outcomes: 1. Knowledge of the ECE educational objectives and required outcomes.

2. Knowledge of the BSEE and/or BSCmpE degree requirements. 3. Ability to prepare a satisfactory plan-of-study. 4. Ability to write effectively in the English language. 5. Appreciation for ethical, professional and academic conduct. Credits: 1.00

ECE 39401 - Professional Communications And Diversity

Credit Hours: 1.00. This course provides ECE students with practice in relevant aspects of communication. Topics include: successfully seeking employment, working effectively in teams, delivering engaging presentations, and leveraging the advantages and challenges of diversity and inclusion.

Learning Outcomes: 1. Ability to function effectively on a team whose members create a collaborative and inclusive environment, plan tasks, and meet objectives. 2. Communicate effectively with a range of audiences. 3. Develop and explain solutions to engineering problems, taking public health and cultural factors into consideration. Credits: 1.00

ECE 49401 - Professional Communication Capstone

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and plans for professional growth.

Learning Outcomes: 1. Communicate effectively with a range of audiences. 2. Function effectively on a team whose members together create a collaborative and inclusive environment, plan tasks, and meet objectives. 3. Ability to make informed judgments based ethical and professional responsibilities in engineering situations, giving consideration to global, economic, environmental, and/or societal contexts. Credits: 1.00

Advanced Electrical Engineering Selectives - Choose Three (9-12 credits)

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 32100 - Electromechanical Motion Devices

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Learning Outcomes: 1. Analyze/design electromagnetic circuits/devices. 2. Understand the concepts and principles of electromagnetic energy conversion. 3. Understand the concept of time-varying transformations in the analysis of time-varying systems. 4. Analyze dc machines. 5. Understand converters for dc drives. 6. Analyze brushless dc machines. 7. Analyze induction machines. Credits: 3.00

ECE 38200 - Feedback System Analysis And Design

Credit Hours: 3.00. In this course, classical concepts of feedback system analysis and associated compensation techniques are presented. In particular, the root locus, Bode diagram, and Nyquist criterion are used as determinants of stability.

Credits: 3.00

ECE 43800 - Digital Signal Processing With Applications

Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; short-time spectral analysis and synthesis; linear predictive coding. Image processing: two-dimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credits: 4.00

ECE 44000 - Transmission Of Information

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Learning Outcomes: 1. Recognize and analyze in the time and frequency domain the performance of amplitude and frequency modulated analog communications systems in the presence of noise. 2. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of analog systems, which include bandwidth and signal to noise ratio. 3. Recognize and analyze in the time and frequency domains the performance of various digital modulation formats, including ASK, QAM, PSK, and FSK in the presence of noise. 4. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of digital systems which include bandwidth and hit error probability. 5. Understand the basics of information theory and error control codes including the effect of error control codes on the bandwidth and bit error probability of digital systems. Credits: 4.00

ECE 53800 - Digital Signal Processing I

Credit Hours: 3.00. Theory and algorithms for processing of deterministic and stochastic signals. Topics include discrete signals, systems, and transforms, linear filtering, fast Fourier transform, nonlinear filtering, spectrum estimation, linear prediction, adaptive filtering, and array signal processing.

Learning Outcomes: 1. Understand the autocorrelation and covariance methods of estimating the correlation matrix. 2. Know the Discrete Time Fourier Transform (DTFT) and its relationship to the Discrete Fourier Transform (DFT). 3. Comprehend of parametric methods of spectrum estimation, including autoregressive modeling, minimum variance, linear prediction, and eigendecomposition-based methods. 4. Understand nonparametric methods of spectrum estimation, including the periodogram and the correlogram. 5. Understand of linear filters, including the Wiener filter, as applied stochastic to signals. 6. Introduce to adaptive filters, including the method of steepest descent and the least-mean-square (LMS) algorithms. Credits: 3.00

ECE 50653 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. The modern smartphone is enabled by a billion-plus nano-transistors, each having an active region that is barely a few hundred atoms long. Interestingly the same amazing technology has also led to a deeper understanding of the nature of current flow on an atomic scale. The aim of this course is to make the fundamentals of nanoelectronics accessible to anyone in any branch of science or engineering, assuming very little background beyond linear algebra and differential equations, although we will be discussing advanced concepts in non-equilibrium statistical mechanics that should be of interest even to specialists. We first introduce a new perspective connecting the quantized conductance of short ballistic conductors to the familiar Ohm's law of long diffusive conductors, along with a brief description of the modern nano-transistor. We then address fundamental conceptual issues related to the meaning of resistance on an atomic scale, the interconversion of electricity and heat, the second law of thermodynamics and the fuel value of information. Finally we introduce the concepts of quantum transport as applied to modern nanoscale electronic devices.

Learning Outcomes: 1. Perform semi-classical analysis of charge flow in nanoelectronic devices. 2. Perform semi-classical analysis of the interconversion of heat and electricity in nanoelectronic devices. 3. Perform quantum analysis of nanoelectronic devices. Credits: 3.00

ECE 51012 - Electromechanics

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of dc, induction, brushless dc, and stepper motors used in control applications are presented. Prerequisite by Topic: Basic circuit analysis; Elementary electromagnetics; Elementary mechanics.

Learning Outcomes: 1. Acquire knowledge of

magnetics and magnetic materials as it relates to electromechanical devices. 2. Understand the energy conversion process including field energy, co-energy, force and torque production. 3. Be familiar with the use in reference frame theory in the analysis of rotational electromechanical devices. 4. Understand the operation of rotating electric machines including stepper motors, permanent magnet ac machine, and induction machines. 5. Understand the acceptable and unacceptable practice with regard to taking exams, working on homework, working on the project, and the implications of unacceptable practices. Credits: 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system. Credits: 4.00

ECE 30412 - Electromagnetics II

Credit Hours: 3.00. Electromagnetics II builds on Electromagnetics I (ECE 31100) and emphasizes time-varying electromagnetic fields. Both fundamental understanding and an appreciation for applications that span all technologies related to electrical and computer engineering are emphasized. The topics covered include: Maxwell's equations, plane waves, transmission lines, waveguides and cavities, and antennas and radiation. Applications addressed relate to photonics, communications, and imaging and sensing. More generally, illustrations cover the basic principles on which devices and systems used every day operate.

Learning Outcomes: 1. Understand time-varying fields and Maxwell's equations. 2. Understand plane electromagnetic waves. 3. Understand the theory and application of transmission lines. 4. Understand waveguides and cavity resonators. 5. Understand antennas and radiating systems. Credits: 3.00

ECE 31032 - Power Systems Engineering

Credit Hours: 3.00. Introduction to the economic operation of power systems, three-phase circuit analysis, modeling of transformers and transmission lines, steady-state network analysis using a power flow, analysis during faults and state estimation.

Learning Outcomes: 1. Understand the function of the main components in a power system, and the basis of their circuit models. 2. Build a system representation from components' circuit models and to apply solution techniques to certain operational needs. Credits: 3.00

Electrical Engineering Electives (6-9 credits)

Senior Design Requirement - Choose One Option (4 credits)

Option 1:

ECE 49022 - Electrical Engineering Senior Design Projects

Credit Hours: 4.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics). Lectures require use of the I-Clicker system.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a system, component, or process to meet desired needs. 2. Understand the engineering design process. 3. Function on an interdisciplinary team. 4. Acquire an awareness of professional

and ethical responsibility. 5. Develop effective communication skills, both oral and written. Credits: 4.00

Option 2:

ECE 47700 - Digital Systems Senior Project

Credit Hours: 4.00. A structured approach to the development and integration of embedded microcontroller hardware and software that provides senior-level students with significant design experience applying microcontrollers to a wide range of embedded systems (e.g., instrumentation, process control, telecommunications, and intelligent devices). The primary objective is to provide practical experience developing integrated hardware and software for embedded microcontroller systems in an environment that models one which students will most likely encounter in industry. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a microcontroller-based digital system. 2. Understand the engineering design process. 3. Function on a multidisciplinary team. 4. Be aware of professional and ethical responsibility. 5. Communicate effectively, in both oral and written form. Credits: 4.00

Option 3:

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

Option 4:

VIP 47922 - Senior Design Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering

design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47921 - Senior Design Participation In Vertically Integrated Projects (VIP) I

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

Other Department Requirements (72-78 credits)

General Engineering Requirement (3-6 credits)

C Programming (0-3 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

Engineering Breadth Selective - Choose One (3 credits)

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more

curious and persistent learners through self-directed team projects. Credits: 4.00

CHE 20500 - Chemical Engineering Calculations

Credit Hours: 4.00. Quantitative applications of steady-state mass and energy balances to solve problems involving multi-component systems and multi-unit chemical processes. Single-component and multi-component phase equilibria, single-reaction and multiple-reaction stoichiometry, coupled mass and energy balances, chemical processes involving bypass and recycle streams.

Learning Outcomes: 1. Estimate physical properties of real chemical systems. 2. Evaluate introductory single-component and multi-component phase equilibria and incorporate these concepts into solutions of mass and energy balance problems. 3. Solve steady state and transient mass and energy balance problems for both reacting and non-reacting systems with or without recycle using analytical and computational methods. 4. Work professionally and ethically in teams to solve new mass and energy balance problems. 5. Identify contemporary chemical engineering problems, including their societal, environmental, and global impacts. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4.

Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

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IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 41300 - Noise Control

Credit Hours: 3.00. Fundamentals of acoustic waves. Psychoacoustics and theories of hearing. Environmental and building acoustics. Measurement methods and common instrumentation. Noise control methods. Machinery noise. Community reaction. Legal aspects. Design-oriented semester project. Course work in differential equations.

Credits: 3.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

Mathematics Requirement - Choose One Option (10-11 credits)

Option 1 (10 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three

dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

Option 2 (11 credits)

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and

minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric

representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 51000 - Vector Calculus

Credit Hours: 3.00. Calculus of functions of several variables and of vector fields in orthogonal coordinate systems. Optimization problems, implicit function theorem, Green's theorem, Stokes' theorem, divergence theorems. Applications to engineering and the physical sciences. Not open to students with credit in MA 36200 or MA 41000.

Credits: 3.00

Science Requirement (4-8 credits)

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of

the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena

in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to

collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

ECE General Education Course Requirement (17-18 credits)

Electives (0-8 credits)

Optional Concentrations:

Supplemental Lists

GPA Requirements

Purdue in Indianapolis Students will be required to take the courses listed in First Year Engineering

Sample Electrical Engineering Plan of Study

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple

integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ECE 29401 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree requirements, professional writing and multicultural and professional development.

Learning Outcomes: 1. Knowledge of the ECE educational objectives and required outcomes. 2. Knowledge of the BSEE and/or BSCmpE degree requirements. 3. Ability to prepare a satisfactory plan-of-study. 4. Ability to write effectively in the English language. 5. Appreciation for ethical, professional and academic conduct. Credits: 1.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course

that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

16 Credits

Spring 2nd Year

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits

behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20008 - Electrical Engineering Fundamentals II Lab

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20002 Electrical Engineering Fundamentals II; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

Learning Outcomes: 1. Ability to competently select, use, and automate electronic measurement instruments. 2. Design, wire, and troubleshoot electronic circuits. 3. Ability to simulate electronic circuits. 4. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 5. Demonstrate knowledge of laboratory safety precautions. 6. Maintain laboratory notes and create professional experiment reports. Credits: 1.00

17 Credits

Fall 3rd Year

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 39401 - Professional Communications And Diversity

Credit Hours: 1.00. This course provides ECE students with practice in relevant aspects of communication. Topics include: successfully seeking employment, working effectively in teams, delivering engaging presentations, and leveraging the advantages and challenges of diversity and inclusion.

Learning Outcomes: 1. Ability to function

effectively on a team whose members create a collaborative and inclusive environment, plan tasks, and meet objectives. 2. Communicate effectively with a range of audiences. 3. Develop and explain solutions to engineering problems, taking public health and cultural factors into consideration. Credits: 1.00

15 Credits

Spring 3rd Year

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

ECE 30411 - Electromagnetics I

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic waves and transmission lines, which is continued in ECE 30412.

Learning Outcomes: 1. Work with electrostatic fields and find electric and potential fields from charge distributions including the presence of dielectric materials. 2. Work with magnetostatic fields and find magnetic fields from current distributions including the presence of magnetic materials. 3. Work with time varying fields including wave propagation. 4. Work with transmission lines in the time and frequency domains. Credits: 3.00

15 Credits

Fall 4th Year

ECE 49022 - Electrical Engineering Senior Design Projects

Credit Hours: 4.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics). Lectures require use of the I-Clicker system.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a system, component, or process to meet desired needs. 2. Understand the engineering design process. 3. Function on an interdisciplinary team. 4. Acquire an awareness of professional and ethical responsibility. 5. Develop effective

communication skills, both oral and written. Credits: 4.00

16 Credits

Spring 4th Year

ECE 49401 - Professional Communication Capstone

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and plans for professional growth.

Learning Outcomes: 1. Communicate effectively with a range of audiences. 2. Function effectively on a team whose members together create a collaborative and inclusive environment, plan tasks, and meet objectives. 3. Ability to make informed judgments based ethical and professional responsibilities in engineering situations, giving consideration to global, economic, environmental, and/or societal contexts. Credits: 1.00

15 Credits

Elementary Education, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (81-83 credits)

Major Courses (50-52 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6.

Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 49600 - Student Teaching In The Elementary School (UCC: OC)

Credit Hours: 6.00 to 16.00. Full-time elementary classroom teaching experiences and a student teaching seminar under the mentorship of the classroom teacher and a University supervisor.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each child's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each child's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment

results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities.

Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 30101 - Inquiry Into Teaching And Learning In K-2

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the K-2 classroom. Admission to Teacher Education required. Cannot be taken concurrently with EDCI 30002.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach, assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6. Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 30102 - Inquiry Into Teaching And Learning In 3-6

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the 3-6 classroom. Admission to Teacher Education is required. Cannot be taken concurrently with EDCI 30101.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6. Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the

field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36102 - Teaching Social Studies In 3-6

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practices strategies for teaching social studies to children in the 3-6 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how 3-6 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the 3-6 grades.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the 3-6 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the 3-6 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the 3-6 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using children's ideas, beliefs, and experiences as primary resources. Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 21510 - Language & Literacy Foundations For Teachers

Credit Hours: 1.00. The goal of the course is to provide background information in language and literacy necessary for success in literacy methods courses. The course will address basic linguistics and phonetic patterns of English, as well as the structures of literature and literary terms.

Learning Outcomes: 1. Compare and contrast levels of language structure: phoneme, morpheme, root, affix, phrase, sentence. 2. Differentiate graphic from phonological elements of language (e.g., grapheme vs phoneme). 3. Compare and contrast vocabulary terms (e.g. synonym, homonym, homograph). 4. Define and articulate written elements (e.g. digraphs, consonant clusters, long/short vowels). 5. Identify morpho-syntactic structures and phonological patters in written and spoken language. 6. Compare and contrast literary genres (e.g. narrative, non-narrative, fiction, nonfiction). 7. Distinguish the organizational structures of fictional genres from those of nonfictional genres. 8. Identify literary terms in context (e.g. alliteration, character traits, plot, stanza). Credits: 1.00

EDCI 49601 - Elementary Education Expanded Student Teaching

Credit Hours: 1.00 to 8.00. This course is the initial residency experience that precedes a full semester of student teaching. The seminar and field experience focus on induction into the broader elementary school context and building mentoring relationships as both a mentee and mentor. Students will develop their identity as a professional educator who advocates for the profession, themselves, and their students. Includes a field experience. Admission to Teacher Education required.

Learning Outcomes: 1. Integrate their learning from Foundations and Methods courses into their teaching experiences in the classroom. 2. Design and deliver instruction that meets learner needs, continually assess student learning, and use assessment to drive instruction. 3. Develop their skills and professional identity as an educator through self-reflection, analysis of student learning, and analysis of feedback. 4. Use observation, academic and personal engagement, and assessment data to develop an understanding of their students as learners at the individual and group level. Credits: 1.00 to 8.00

EDCI 36402 - Teaching Mathematics In Grades 3-6

Credit Hours: 2.00. Focuses on teaching mathematics in the elementary school grades 3-6. Students learn what it means to teach mathematics interactionally using children's ideas, beliefs, and experiences as primary resources. Mathematical reasoning, problem solving, communication, and connections are foci.

Learning Outcomes: 1. Develop, apply, analyze, and evaluate strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Know and analyze methods of assessing and responding to the needs of mathematics learners labeled in schools. 3. Analyze and apply student's mathematical conceptual understanding and procedural knowledge to the development of problem-solving based mathematics lessons. 4. Create and analyze instructional activities drawing from student's conceptual understanding and procedural knowledge as primary resources. Credits: 2.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are

committed to social justice and education of all the children of all the people - especially in the area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDCI 36502 - Teaching Science Through Design In Grades 3-6

Credit Hours: 2.00. The aim of this course is to prepare students to teach science, engineering, and computational thinking with grade 3-6 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade 3 through 6 learners. At least 9 credits of science content courses are required.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 2.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school

district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Additional Methods Courses (9 credits)

AD 20100 - Art For Elementary School Teachers

Credit Hours: 3.00. Art theory and experiences, curriculum theory, and materials preparatory for instruction of elementary school children. No undergraduate students may be enrolled in this course until they have been admitted to teacher education and a copy of this acceptance is on file.

Learning Outcomes: 1. Apply visual arts methods to develop appropriate lessons to construct students' knowledge. 2. Utilize two- and three-dimensional media commonly used by elementary students to teach art production and encourage the expression of ideas. 3. Assess elementary students' artistic development levels and design activities to meet their artistic needs in the classroom. 4. Apply elements of art, principles of design, interpretation skills, and judgment conclusions to evaluate and respond to works of art and to foster that ability in their elementary students. Credits: 3.00

MUS 32400 - Teaching Music In The Elementary School

Credit Hours: 3.00. Develops basic musicianship through singing, playing instruments, reading and writing music, listening and moving to music. Surveys music teaching methods and materials. Includes lesson planning, experiences in teaching, and observation of children in music classes.

Learning Outcomes: 1. Advocate for the importance of music's inclusion (or exclusion, if desired) in the elementary classroom. 2. Develop curricula that appropriately advances the musical abilities, appreciation, and understanding of children. 3. Perform by singing and playing instruments both alone and in a group. 4. Synthesize appropriate terms to describe musical performance and recording. 5. Connect music to a variety of societal, cultural, and historical contexts. Credits: 3.00

EDCI 22222 - Integrated Health And Physical Education For Elementary Teachers

Credit Hours: 3.00. This course provides elementary education majors with a comprehensive understanding of the critical role health and physical education play in the overall development of young learners. Students will explore how physical activity and health education contribute to cognitive, social, emotional, and physical growth. The course emphasizes the importance of integrating movement and health topics such as personal safety, nutrition, and emotional health into the elementary classroom to enhance academic performance, promote wellness, and develop lifelong healthy habits. Through a blend of theory, practical strategies, and hands-on activities, students will learn to design inclusive, developmentally appropriate physical education lessons and comprehensive school health education (CSHE) plans that cater to diverse learners. By the end of the course, students will be equipped to create engaging, safe, and supportive environments that foster both physical well-being and academic success.

Learning Outcomes: 1. Understand health-related fitness concepts and principles related to physical activity and wellness. 2. Promote physical, emotional, and social well-being in elementary students. 3. Understand and teach proper nutrition, including the relationship between healthy eating, physical activity, and overall wellness. 4. Promote mental and emotional health by teaching coping strategies, stress management, and emotional regulation. 5. Teach personal safety and injury prevention, including strategies for safe play, accident prevention, and emergency response. 6. Integrate physical activity into daily classroom activities, promoting active learning and encouraging students to develop positive attitudes toward physical activity. 7. Develop inclusive and developmentally appropriate physical education lessons, ensuring students of all abilities can participate in and benefit from physical education. Credits: 3.00

Required Reading Concentration (13 credits)

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDCI 36303 - Literacy Teaching And Assessment In K-6

Credit Hours: 2.00 to 3.00. This course is an undergraduate, elementary education course designed to provide preservice teachers with classroom and practicum experiences focused on literacy instruction for children experiencing difficulty learning to read and write. Students learn to administer and analyze individual assessments to determine the strengths and needs of a struggling reader/writer and set intervention goals based on these results. Application of appropriate research-based reading instructional strategies for developing (structured literacy instruction) phonological awareness, phonics, comprehension, vocabulary, and fluency is the focus of weekly literacy teaching in local elementary schools.

Learning Outcomes: 1. Demonstrate the importance of providing instruction to meet the needs of all children through their teaching. 2. Implement a framework for assessment and instruction that allows the teacher to evaluate and adjust for an optimal match between the reader/writer, the text and the literacy context. 3. Translate assessment findings into a plan for instructional support that is realistic in view of the child's needs and the available resources. 4. Use assessment as an ongoing guide to instructional decisions. 5. Become skillful in observing, planning, implementing, and evaluating literacy lessons. 6. Demonstrate knowledge of materials, procedures, and strategies for individual and group literacy instruction. 7. Examine a range of assessment and evaluation tools and strategies. 8. Report to others their assessments of students' literacy learning. 9. Work as a team with peers and school personnel. Credits: 2.00 to 3.00

EDCI 32501 - Teaching Literacy In K-2

Credit Hours: 2.00. Students will study how children's oral language develops, how children learn to read and write in primary grade settings, and the teacher's role in this process. Students will learn how phonemic awareness, phonics, fluency, vocabulary and comprehension influence children's literacy development. Students will learn how to select appropriate instructional materials; employ teaching strategies to meet the cognitive and affective literacy needs of all children, and collect, interpret, and use data from various types of assessments to inform literacy teaching and learning processes.

Learning Outcomes: 1. Develop a sound background in theory and research about children's language and literacy development and learning. 2. Learn how literacy learning, teaching, and assessment in phonemic awareness, phonics, fluency, vocabulary, comprehension and writing can be effectively and systematically integrated and diversified to meet individual or group needs. 3. Design and implement developmentally appropriate instruction for primary grade students. Credits: 2.00

EDCI 32602 - Teaching Literacy In 3-6

Credit Hours: 2.00. Students will build on material learned in

EDCI 32501. They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children, and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Demonstrate an understanding of theoretical and evidence-based foundations that guide reading, writing processes, and instruction. 2. Design developmentally appropriate instruction that addresses the needs of all learners. 3. Teach developmentally appropriate lessons/units in the school setting. 4. Assess student learning by designing/using/adjusting formative and summative assessments for your group of students, and pre-assessments. 5. Reflect and analyze your own teaching. Credits: 2.00

EDCI 31103 - Integrating Media In The K-6 Classroom

Credit Hours: 3.00. This course prepares teacher candidates to select, evaluate, and integrate children's literature and media in K-6 classrooms. Focusing on high-quality, diverse texts and media, candidates will learn to choose materials that are developmentally appropriate and reflect the diversity of the world in which we live. Emphasis will be placed on the critical role literature and media play in fostering vocabulary development, enhancing critical thinking skills, and supporting literacy development across subjects. The course will focus on how K-6 students learn to use comprehension strategies independently and efficiently as they progress through elementary school fostering both their academic growth and their ability to engage with diverse texts.

Learning Outcomes: 1. Integrate literature and media into content area lessons to enhance vocabulary (including academic language skills), critical thinking, and comprehension. 2. Select and evaluate three trade books to read aloud during a math, a social studies, and a science lesson. 3. Identify instructional strategies supported by the Science of Reading that teach k-6 students' academic language skills, vocabulary knowledge, and reading and listening comprehension. Credits: 3.00

Required Learner Pathway Specialty Concentration (9 credits)

Optional Concentration

Other Departmental/Program Course Requirements (36-37 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3.

Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 20600 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Continuation of BIOL 20500. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation.

4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

MA 13900 - Mathematics For Elementary Teachers III

Credit Hours: 3.00. Geometric, measurement and spatial reasoning in one, two and three dimensions as the basis for elementary school geometry. Metric and non-metric geometry, transformation geometry. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Differentiate between various polygons based on number of sides and measures of angles. 2. Find the sum of the measures of the interior angles of a polygon. 3. Draw nets for polyhedra. 4. Differentiate between various types of polyhedra including all regular polyhedra. 5. Determine number of lines of symmetry for a plane figure and orders of rotational symmetry. 6. Determine number of planes of symmetry for a solid figure as well as axes of rotational symmetry. 7. Recognize and draw shapes that tessellate the plane and solid figures that tessellate space. 8. Determine dimensions of similar planar figures. 9. Determine surface area and volume of similar solid figures. 10. Construct perpendicular bisectors and parallel lines using a compass and straightedge. 11. Recognize and draw rigid motions of shapes including translations, reflections and rotations. 12. Determine area of plane figures and surface area and volume of solid figures. 13. Use the Pythagorean Theorem to determine diagonals of solid figures. Credits: 3.00

ECON 21900 - Economics For Future Elementary Teachers

Credit Hours: 3.00. A principles of economics course designed for future elementary and social studies teachers. The purpose of this course is to: 1) introduce the future teacher to basic economic concepts required by the Indiana Academic Standards for Social Studies, K-6, 2) learn methods for teaching these concepts in the K-6 curriculum, and 3) develop a catalog of curriculum materials appropriate for teaching economics in grades K-6. No credit for management students.

Learning Outcomes: 1. Identify and understand the basic concepts and principles of economics in order to teach at the elementary school level. 2. Develop an `Economic Way of Thinking? that can be utilized to make more efficient choices as consumers, and as voters. 3. Identify supplementary materials (DVDs, online and app-based resources, simulations, curriculum materials, etc.) that can be used in K-6 teaching or as a supplement in K-6 classrooms. 4. Apply this 'Economic Way of Thinking' in the analysis existing curriculum in K-6 economics, and of everyday current events. 5. Utilize the basic concepts and principles of economics to design and develop new K-6 curriculum. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different

audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

EDCI 22200 - Knowing The World Through Mathematics (UCC: QR)

Credit Hours: 3.00. In this course, *Knowing the World Through Mathematics*, students will connect their situated experiences to larger trends in equity and social justice around the globe through mathematical investigations embedded in the context of the United Nations 2030 Agenda (United Nations, 2015). Students in this course will make use of mathematics and global policy documents to critically interpret, model, and represent world phenomena. Students will collaboratively analyze quantitative information gathered through trustworthy, globally representative data sets and individual survey and questionnaire items to investigate local experiences in relation to students' area(s) of interest. Students will learn about and utilize the GAISE Framework for Statistical Problem Solving (Franklin, et al., 2005) and the Four Dimensions of Equity in Mathematics Education (Gutiérrez, 2012) to ground their discussions and deliverables for *Knowing the World Through Mathematics*.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use a critical mathematics perspective to interpret world patterns, situations, and events. 2. Create mathematical models of world phenomena. 3. Use multiple mathematical representations to present global issues. 4. Identify and implement appropriate mathematical strategies to investigate world phenomena. 5. Express mathematical arguments related to world phenomena. 6. Use mathematics to explore global policy documents. 7. Explore world phenomena through quantitative (and qualitative) methods. Credits: 3.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical Sciences* PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

Electives (0-3 credits)

EDPS 10101 - Learning In Context-An Introduction To The Learning Sciences

Credit Hours: 3.00. This introductory course is designed to acquaint first year Learning Science students with the core concepts, principles, and research findings of the learning sciences as they apply to a wide range of formal and informal educational contexts. The course provides students with

opportunities to interact with and learn about the scholarship of College of Education faculty who conduct research within the framework of the learning sciences. Students will learn about faculty projects that exemplify key features of the Learning Sciences such as attention to the complexity of learning environments, the study of social and cultural as well as individual dimensions of learning, and the cross-disciplinary nature of the field.

Learning Outcomes: 1. Identify the features of education as a design discipline. 2. Identify core principles, questions, and challenges, that define educational research and practice from a Learning Sciences perspective. 3. Identify the varied sources of cross-disciplinary knowledge that contribute to the design and study of effective learning environments. Credits: 3.00

EDCI 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

EDCI 53900 - Introduction To K-12 Integrated Science, Technology, Engineering And Mathematics (STEM) Education

Credit Hours: 3.00. This course will provide students with a conceptual understanding of integrated K-12 Science, Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current

approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral, social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

GPA Requirements

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 32400 - Teaching Music In The Elementary School

Credit Hours: 3.00. Develops basic musicianship through singing, playing instruments, reading and writing music, listening and moving to music. Surveys music teaching methods and materials. Includes lesson planning, experiences in teaching, and observation of children in music classes.

Learning Outcomes: 1. Advocate for the importance of music's inclusion (or exclusion, if desired) in the elementary classroom. 2.

Develop curricula that appropriately advances the musical abilities, appreciation, and understanding of children. 3. Perform by singing and playing instruments both alone and in a group. 4. Synthesize appropriate terms to describe musical performance and recording. 5. Connect music to a variety of societal, cultural, and historical contexts. Credits: 3.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6.

Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

16-17 Credits

Spring 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

BIOL 20600 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Continuation of BIOL 20500. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility

rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

EDCI 21510 - Language & Literacy Foundations For Teachers

Credit Hours: 1.00. The goal of the course is to provide background information in language and literacy necessary for success in literacy methods courses. The course will address basic linguistics and phonetic patterns of English, as well as the structures of literature and literary terms.

Learning Outcomes: 1. Compare and contrast levels of language structure: phoneme, morpheme, root, affix, phrase, sentence. 2. Differentiate graphic from phonological elements of language (e.g., grapheme vs phoneme). 3. Compare and contrast vocabulary terms (e.g. synonym, homonym, homograph). 4. Define and articulate written elements (e.g. digraphs, consonant clusters, long/short vowels). 5. Identify morpho-syntactic structures and phonological patters in written and spoken language. 6. Compare and contrast literary genres (e.g. narrative, non-narrative, fiction, nonfiction). 7. Distinguish the organizational structures of fictional genres from those of nonfictional genres. 8. Identify literary terms in context (e.g. alliteration, character traits, plot, stanza). Credits: 1.00

EDCI 22222 - Integrated Health And Physical Education For Elementary Teachers

Credit Hours: 3.00. This course provides elementary education majors with a comprehensive understanding of the critical role health and physical education play in the overall development of young learners. Students will explore how physical activity and health education contribute to cognitive, social, emotional, and physical growth. The course emphasizes the importance of integrating movement and health topics such as personal safety, nutrition, and emotional health into the elementary classroom to enhance academic performance, promote wellness, and develop lifelong healthy habits. Through a blend of theory, practical strategies, and hands-on activities, students will learn to design inclusive, developmentally appropriate physical education lessons and comprehensive school health education (CSHE) plans that cater to diverse learners. By the end of the course, students will be equipped to create engaging, safe, and supportive environments that foster both physical well-being and academic success.

Learning Outcomes: 1. Understand health-related fitness concepts and principles related to physical activity and wellness. 2. Promote physical, emotional, and social well-being in elementary students. 3. Understand and teach proper nutrition, including the relationship between healthy eating, physical activity, and overall wellness. 4. Promote mental and emotional health by teaching coping strategies, stress management, and emotional regulation. 5. Teach personal safety and injury prevention, including strategies for safe play, accident prevention, and emergency response. 6. Integrate physical activity into daily classroom activities, promoting active learning and encouraging students to develop positive attitudes toward physical activity. 7. Develop inclusive and developmentally appropriate physical education lessons, ensuring students of all abilities can participate in and benefit from physical education. Credits: 3.00

18 Credits

Fall 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of

principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

AD 20100 - Art For Elementary School Teachers

Credit Hours: 3.00. Art theory and experiences, curriculum theory, and materials preparatory for instruction of elementary school children. No undergraduate students may be enrolled in this course until they have been admitted to teacher education and a copy of this acceptance is on file.

Learning Outcomes: 1. Apply visual arts methods to develop appropriate lessons to construct students' knowledge. 2. Utilize two- and three-dimensional media commonly used by elementary students to teach art production and encourage the expression of ideas. 3. Assess elementary students' artistic development levels and design activities to meet their artistic needs in the classroom. 4. Apply elements of art, principles of design, interpretation skills, and judgment conclusions to evaluate and respond to works of art and to foster that ability in their elementary students. Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

EDCI 22200 - Knowing The World Through Mathematics (UCC: QR)

Credit Hours: 3.00. In this course, *Knowing the World Through Mathematics*, students will connect their situated experiences to larger trends in equity and social justice around the globe through mathematical investigations embedded in the context of the United Nations 2030 Agenda (United Nations, 2015). Students in this course will make use of mathematics and global policy documents to critically interpret, model, and represent world phenomena. Students will collaboratively analyze quantitative information gathered through trustworthy, globally representative data sets and individual survey and questionnaire items to investigate local experiences in relation to students' area(s) of interest. Students will learn about and utilize the GAISE Framework for Statistical Problem Solving (Franklin, et al., 2005) and the Four Dimensions of Equity in Mathematics Education (Gutiérrez, 2012) to ground their discussions and deliverables for *Knowing the World Through Mathematics*.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use a critical mathematics perspective to interpret world patterns, situations, and events. 2. Create mathematical models of world phenomena. 3. Use multiple mathematical representations to present global issues. 4. Identify and implement appropriate mathematical strategies to investigate world phenomena. 5. Express mathematical arguments related to world phenomena. 6. Use mathematics to explore global policy documents. 7. Explore world phenomena through quantitative (and qualitative) methods. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical*

Sciences PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

16 Credits

Spring 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

MA 13900 - Mathematics For Elementary Teachers III

Credit Hours: 3.00. Geometric, measurement and spatial reasoning in one, two and three dimensions as the basis for elementary school geometry. Metric and non-metric geometry, transformation geometry. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Differentiate between various polygons based on number of sides and measures of angles. 2. Find the sum of the measures of the interior angles of a polygon. 3.

Draw nets for polyhedra. 4. Differentiate between various types of polyhedra including all regular polyhedra. 5. Determine number of lines of symmetry for a plane figure and orders of rotational symmetry. 6. Determine number of planes of symmetry for a solid figure as well as axes of rotational symmetry. 7. Recognize and draw shapes that tessellate the plane and solid figures that tessellate space. 8. Determine dimensions of similar planar figures. 9. Determine surface area and volume of similar solid figures. 10. Construct perpendicular bisectors and parallel lines using a compass and straightedge. 11. Recognize and draw rigid motions of shapes including translations, reflections and rotations. 12. Determine area of plane figures and surface area and volume of solid figures. 13. Use the Pythagorean Theorem to determine diagonals of solid figures. Credits: 3.00

ECON 21900 - Economics For Future Elementary Teachers

Credit Hours: 3.00. A principles of economics course designed for future elementary and social studies teachers. The purpose of this course is to: 1) introduce the future teacher to basic economic concepts required by the Indiana Academic Standards for Social Studies, K-6, 2) learn methods for teaching these concepts in the K-6 curriculum, and 3) develop a catalog of curriculum materials appropriate for teaching economics in grades K-6. No credit for management students.

Learning Outcomes: 1. Identify and understand the basic concepts and principles of economics in order to teach at the elementary school level. 2. Develop an `Economic Way of Thinking? that can be utilized to make more efficient choices as consumers, and as voters. 3. Identify supplementary materials (DVDs, online and app-based resources, simulations, curriculum materials, etc.) that can be used in K-6 teaching or as a supplement in K-6 classrooms. 4. Apply this 'Economic Way of Thinking' in the analysis existing curriculum in K-6 economics, and of everyday current events. 5. Utilize the basic concepts and principles of economics to design and develop new K-6 curriculum. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement

system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

EDCI 32501 - Teaching Literacy In K-2

Credit Hours: 2.00. Students will study how children's oral language develops, how children learn to read and write in primary grade settings, and the teacher's role in this process. Students will learn how phonemic awareness, phonics, fluency, vocabulary and comprehension influence children's literacy development. Students will learn how to select appropriate instructional materials; employ teaching strategies to meet the cognitive and affective literacy needs of all children, and collect, interpret, and use data from various types of assessments to inform literacy teaching and learning processes.

Learning Outcomes: 1. Develop a sound background in theory and research about children's language and literacy development and learning. 2. Learn how literacy learning, teaching, and assessment in phonemic awareness, phonics, fluency, vocabulary, comprehension and writing can be effectively and systematically integrated and diversified to meet individual or group needs. 3. Design and implement developmentally appropriate instruction for primary grade students. Credits: 2.00

16 Credits

Fall 3rd Year

EDCI 30101 - Inquiry Into Teaching And Learning In K-2

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the K-2 classroom. Admission to Teacher Education required. Cannot be taken concurrently with EDCI 30002.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach, assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6. Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36303 - Literacy Teaching And Assessment In K-6

Credit Hours: 2.00 to 3.00. This course is an undergraduate, elementary education course designed to provide preservice teachers with classroom and practicum experiences focused on literacy instruction for children experiencing difficulty learning to read and write. Students learn to administer and analyze individual assessments to determine the strengths and needs of a struggling reader/writer and set intervention goals based on these results. Application of appropriate research-based reading instructional strategies for developing (structured literacy instruction) phonological awareness, phonics, comprehension, vocabulary, and fluency is the focus of weekly literacy teaching in local elementary schools.

Learning Outcomes: 1. Demonstrate the importance of providing instruction to meet the needs of all children through their teaching. 2. Implement a framework for assessment and instruction that allows the teacher to evaluate and adjust for an optimal match between the reader/writer, the text and the literacy context. 3. Translate assessment findings into a plan for instructional support that is realistic in view of the child's needs and the available resources. 4. Use assessment as an ongoing guide to instructional decisions. 5. Become skillful in observing, planning, implementing, and evaluating literacy lessons. 6. Demonstrate knowledge of materials, procedures, and strategies for individual and group literacy instruction. 7. Examine a range of assessment and evaluation tools and strategies. 8. Report to others their assessments of students' literacy learning. 9. Work as a team with peers and school personnel. Credits: 2.00 to 3.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using

children's ideas, beliefs, and experiences as primary resources. Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are committed to social justice and education of all the children of all the people - especially in the area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDCI 31103 - Integrating Media In The K-6 Classroom

Credit Hours: 3.00. This course prepares teacher candidates to select, evaluate, and integrate children's literature and media in K-6 classrooms. Focusing on high-quality, diverse texts and media, candidates will learn to choose materials that are developmentally appropriate and reflect the diversity of the world in which we live. Emphasis will be placed on the critical role literature and media play in fostering vocabulary development, enhancing critical thinking skills, and supporting literacy development across subjects. The course will focus on how K-6 students learn to use comprehension strategies independently and efficiently as they progress through elementary school fostering both their academic growth and their ability to engage with diverse texts.

Learning Outcomes: 1. Integrate literature and media into content area lessons to enhance vocabulary (including academic language skills), critical thinking, and comprehension. 2. Select and evaluate three trade books to read aloud during a math, a social studies, and a science lesson. 3. Identify instructional strategies supported by the Science of Reading

that teach k-6 students' academic language skills, vocabulary knowledge, and reading and listening comprehension. Credits: 3.00

16 Credits

Spring 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30102 - Inquiry Into Teaching And Learning In 3-6

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the 3-6 classroom. Admission to Teacher Education is required. Cannot be taken concurrently with EDCI 30101.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6. Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 36102 - Teaching Social Studies In 3-6

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practices strategies for teaching social studies to children in the 3-6 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how 3-6 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the 3-6 grades.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the 3-6 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the 3-6 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the 3-6 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36402 - Teaching Mathematics In Grades 3-6

Credit Hours: 2.00. Focuses on teaching mathematics in the elementary school grades 3-6. Students learn what it means to teach mathematics interactionally using children's ideas, beliefs, and experiences as primary resources. Mathematical reasoning, problem solving, communication, and connections are foci.

Learning Outcomes: 1. Develop, apply, analyze, and evaluate strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Know and analyze methods of assessing and responding to the needs of mathematics learners labeled in schools. 3. Analyze and apply student's mathematical conceptual understanding and procedural knowledge to the development of problem-solving based mathematics lessons. 4. Create and analyze instructional activities drawing from student's conceptual understanding and procedural knowledge as primary resources. Credits: 2.00

EDCI 36502 - Teaching Science Through Design In Grades 3-6

Credit Hours: 2.00. The aim of this course is to prepare students to teach science, engineering, and computational thinking with grade 3-6 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade 3 through 6 learners. At least 9 credits of science content courses are required.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 2.00

EDCI 32602 - Teaching Literacy In 3-6

Credit Hours: 2.00. Students will build on material learned in EDCI 32501. They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children, and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Demonstrate an understanding of theoretical and evidence-based foundations that guide reading, writing processes, and instruction. 2. Design developmentally appropriate instruction that addresses the needs of all learners. 3. Teach developmentally appropriate lessons/units in the school setting. 4. Assess student learning by designing/using/adjusting formative and summative assessments for your group of students, and pre-assessments. 5. Reflect and analyze your own teaching. Credits: 2.00

13 Credits

Fall 4th Year

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning

environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDCI 49601 - Elementary Education Expanded Student Teaching

Credit Hours: 1.00 to 8.00. This course is the initial residency experience that precedes a full semester of student teaching. The seminar and field experience focus on induction into the broader elementary school context and building mentoring relationships as both a mentee and mentor. Students will develop their identity as a professional educator who advocates for the profession, themselves, and their students. Includes a field experience. Admission to Teacher Education required.

Learning Outcomes: 1. Integrate their learning from Foundations and Methods courses into their teaching experiences in the classroom. 2. Design and deliver instruction that meets learner needs, continually assess student learning, and use assessment to drive instruction. 3. Develop their skills and professional identity as an educator through self-reflection, analysis of student learning, and analysis of feedback. 4. Use observation, academic and personal engagement, and assessment data to develop an understanding of their students as learners at the individual and group level. Credits: 1.00 to 8.00

12-13 Credits

Spring 4th Year

EDCI 49600 - Student Teaching In The Elementary School (UCC: OC)

Credit Hours: 6.00 to 16.00. Full-time elementary classroom teaching experiences and a student teaching seminar under the mentorship of the classroom teacher and a University supervisor.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each child's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each child's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Energy Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (52 credits)

Required Major Courses (52 credits)

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator,

oscilloscope or DVM. Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the

application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 33300 - Power Electronics In Energy Systems

Credit Hours: 3.00. A study of fundamentals and applications of switch-mode DC-DC and DC-AC power electronic converters. The emphasis is given to hardware development aspects. Students will learn how to safely work with high power and high voltage circuits.

Learning Outcomes: 1. Describe how power electronics enable energy efficiency in various applications such as energy conservation, renewable energy, and transportation. 2. Design and build switch mode DC-DC and DC-AC converters using commercially available components. 3. Develop closed loop control circuits for DC-DC converters using voltage mode and peak-current mode methods. 4. Simulate power electronic circuits. Credits: 3.00

ECET 37300 - Applied Electronic Drives

Credit Hours: 3.00. This course covers operational principles and application development consideration of all subsystems that make up electric drives: electric machines, power-electric based converters, mechanical system requirements, feedback controller design, and the interaction of drives with the utility grid. State of the art drive development tools are introduced through hands-on activities.

Learning Outcomes: 1. Describe the structure of electronic drive systems and their role in various applications such as flexible production systems, energy conservation, renewable energy, and transportation, making electric drives an enabling technology. 2. Understand the basic principles of power electronics in drives using switch-mode converters and pulse width modulation to synthesize the voltages in dc and ac motor drives. 3. Understand the operation of DC, AC, and brushless DC motors. 4. Construct and test traditional and electronic drive circuit for above motors. 5. Analyze various signals present in electric drive to evaluate drive performance. 6. Learn speed control of the above machines. Credits: 3.00

ECET 43600 - Electrical Power Transmissions, Distribution, And Smart Control

Credit Hours: 3.00. A course on the simple modeling and simulation of the power grid systems, power flow analysis, and advanced meter infrastructure (AMI). The fundamentals learned in this course will be useful in the study of the effects of distributed energy resources and storage in Smart Grid environment.

Learning Outcomes: 1. Explain the role of components of electrical power transmission and distribution network. 2. Identify characteristics of DC and AC transmission lines and cable systems. 3. Identify the characteristics of various power system loads and power quality issues. 4. Calculate and simulate power flow in a power systems network. 5. Explain how to stabilize power systems. 6. Apply Advanced Meter Infrastructure (AMI) as it is used in Smart Grid applications. Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.

Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of

significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

Other Departmental/Program Course Requirements (64-70 credits)

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform

necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and

biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate

rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem

of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of

differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the

ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of

human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and

concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MET 53000 - Facilities Engineering Technology

Credit Hours: 3.00. A study of the application of the engineering sciences and technology to the solution of problems associated with mechanical and electrical systems in buildings. Emphasizes commercial and industrial facilities. Identifying energy conservation measures for both mechanical and electrical systems and evaluating their economic impact are an important focus of the course.

Learning Outcomes: 1. Explain building energy trends and related policy. 2. Explain the organizations and personnel supporting the built environment. 3. Use building automation systems to monitor and control building operation. 4. Quantify energy use in building systems. 5. Use accepted professional practice for technical computations and writing. 6. Calculate the economic impact of energy and resource conservation measures for buildings. 7. Compute the impact of solar energy use for a building. 8. Apply strategies for maintaining Indoor Air Quality in buildings. 9. Evaluate the performance of mechanical or electrical systems in buildings. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective

sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (0-4 credits)

Supplemental List

Professional Experience

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6.

Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to

compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical

situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16-19 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing

principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

16-18 Credits

Fall 2nd Year

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as

modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic

behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

15-16 Credits

Spring 2nd Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of

global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

15 Credits

Fall 3rd Year

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions

and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing.
Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.
University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.
Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide.
Credits: 3.00

15 Credits

Spring 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.
Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.
Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming

solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 37300 - Applied Electronic Drives

Credit Hours: 3.00. This course covers operational principles and application development consideration of all subsystems that make up electric drives: electric machines, power-electric based converters, mechanical system requirements, feedback controller design, and the interaction of drives with the utility grid. State of the art drive development tools are introduced through hands-on activities.

Learning Outcomes: 1. Describe the structure of electronic drive systems and their role in various applications such as flexible production systems, energy conservation, renewable energy, and transportation, making electric drives an enabling technology. 2. Understand the basic principles of power electronics in drives using switch-mode converters and pulse width modulation to synthesize the voltages in dc and ac motor drives. 3. Understand the operation of DC, AC, and brushless DC motors. 4. Construct and test traditional and electronic drive circuit for above motors. 5. Analyze various signals present in electric drive to evaluate drive performance. 6. Learn speed control of the above machines. Credits: 3.00

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth

analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Fall 4th Year

ECET 33300 - Power Electronics In Energy Systems

Credit Hours: 3.00. A study of fundamentals and applications of switch-mode DC-DC and DC-AC power electronic converters. The emphasis is given to hardware development aspects. Students will learn how to safely work with high power and high voltage circuits.

Learning Outcomes: 1. Describe how power electronics enable energy efficiency in various applications such as energy conservation, renewable energy, and transportation. 2. Design and build switch mode DC-DC and DC-AC converters using commercially available components. 3. Develop closed loop control circuits for DC-DC converters using voltage mode and peak-current mode methods. 4. Simulate power electronic circuits. Credits: 3.00

15 Credits

Spring 4th Year

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop

original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes

of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

ECET 43600 - Electrical Power Transmissions, Distribution, And Smart Control

Credit Hours: 3.00. A course on the simple modeling and simulation of the power grid systems, power flow analysis, and advanced meter infrastructure (AMI). The fundamentals learned in this course will be useful in the study of the effects of distributed energy resources and storage in Smart Grid environment.

Learning Outcomes: 1. Explain the role of components of electrical power transmission and distribution network. 2. Identify characteristics of DC and AC transmission lines and cable systems. 3. Identify the characteristics of various power system loads and power quality issues. 4. Calculate and simulate power flow in a power systems network. 5. Explain how to stabilize power systems. 6. Apply Advanced Meter Infrastructure (AMI) as it is used in Smart Grid applications. Credits: 3.00

MET 53000 - Facilities Engineering Technology

Credit Hours: 3.00. A study of the application of the engineering sciences and technology to the solution of problems associated with mechanical and electrical systems in buildings. Emphasizes commercial and industrial facilities. Identifying energy conservation measures for both mechanical and electrical systems and evaluating their economic impact are an important focus of the course.

Learning Outcomes: 1. Explain building energy trends and related policy. 2. Explain the organizations and personnel supporting the built environment. 3. Use building automation systems to monitor and control building operation. 4. Quantify energy use in building systems. 5. Use accepted professional practice for technical computations and writing. 6. Calculate the economic impact of energy and resource conservation measures for buildings. 7. Compute the impact of solar energy use for a building. 8. Apply strategies for maintaining Indoor Air Quality in buildings. 9. Evaluate the performance of mechanical or electrical systems in buildings. Credits: 3.00

12 Credits

Engineering Technology Education, BS

About the Program

Degree Requirements

Major Required Courses (45 credits)

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 16100 - Prototyping In Engineering/Technology Education

Credit Hours: 3.00. Design, make, and innovate! This course provides basic instruction on the proper and safe use of tools and equipment used to prototype innovative ideas. This includes 3D printers, laser cutters/engravers, fabrication tools/equipment, CNC mills/routers, and microcontrollers/microcomputers.

Learning Outcomes: 1. Demonstrate the technical competencies to properly and safely operate common prototyping equipment and tools. 2. Apply knowledge of materials properties to select the appropriate materials for a desired prototype. 3. Create operations process flow charts for planning product development. 4. Test prototypes in real situations to gather data related to their performance. Credits: 3.00

TLI 26200 - Foundations Of Integrated STEM Education

Credit Hours: 3.00. This course provides students with a conceptual understanding of an integrated approach to teaching Science, Technology, Engineering, and Mathematics (STEM). Integrated STEM pedagogies include project/problem-based (PBL), design-based, and inquiry-based approaches to teaching. Students engage in a co-teaching model to deliver STEM instruction and observe local K-12 classrooms.

Learning Outcomes: "1. Identify foundational learning theories that blend an integrated approach to teaching. 2. Identify common practices for scientists, technologists, engineers, and mathematicians and similarities

with other STEM careers. 3. Describe the key tenants of PBL, design-based, and scientific inquiry-based approaches to teaching content. 4. Create integrated STEM lessons that address two STEM subjects and state/national standards. Credits: 3.00

TLI 26500 - Teaching The TE Of STEM

Credit Hours: 3.00. A course for teacher education majors that provides rationale and techniques for integrating engineering and technological literacy into the K-12 mathematics and science curriculum. Experiences focus on the engineering design process, mechanisms, robotics, strength of materials, electrical circuits, and electronics.

Learning Outcomes: 1. Describe the national importance of the integrative nature of the K-12 STEM curriculum. 2. Describe how technology and engineering can be integrated into K-12 mathematics and science. 3. Demonstrate hands-on learning activities appropriate to integrate technology and engineering into the K-12 STEM curriculum. Credits: 3.00

TLI 36100 - Engineering And Technology Education Instructional Planning And Evaluation

Credit Hours: 3.00. This course addresses selecting content, writing instructional objectives, planning lessons, preparing a unit of study, and evaluating student progress. Emphasis is placed on evaluating instruction and student achievement to include developing valid, reliable testing instruments as they relate to measuring student achievement in the cognitive, affective, and psychomotor domains.

Learning Outcomes: 1. Demonstrate instructional planning skills related to the delivery of engineering/technology education to both middle-level and high school students. 2. Prepare lesson plans, a unit of study, and evaluation instruments. 3. Appraise instructional material effectiveness and propose revisions for improvement. 4. Prepare appropriate assessment instruments that align with identified learning objectives. Credits: 3.00

TLI 36700 - Teaching Design And Innovation I

Credit Hours: 3.00. This course focuses on the development of appropriate engineering design knowledge and skill required to effectively teach middle and high school engineering/technology education courses by infusing engineering design into the curriculum. Students will use 3-D solid modeling software, rapid prototyping, and other design technologies as they engage in the engineering design process through an open-ended engineering design challenge.

Learning Outcomes: 1. Display the ability to teach students to develop skills for living in a knowledge-based, technological society using design-based pedagogical approaches. 2. Use the engineering design process to solve open-ended, ill-defined problems. 3. Demonstrate the ability to teach basic engineering design techniques. Credits: 3.00

TLI 46000 - Teaching Design And Innovation II

Credit Hours: 3.00. This course expands the engineering design process, incorporating rapid prototyping and other fabrication technologies to create a specified solution. The course emphasizes process flow chart planning and logistics of engineering/technology education laboratory management. Prototypes will be tested in real situations and data gathered on performance. Designs will be revised to reflect a deeper understanding of manufacturing and use, being sensitive to structure, function, and behavior from a systems-level perspective. Intellectual property, marketing, and infrastructure will be discussed.

Learning Outcomes: 1. Describe the complexity of implementing design solutions. 2. Select appropriate fabrication technologies. 3. Operationalize performance criteria into measurable variables. 4. Gather data to make rational decisions, which are transparent and justifiable. 5. Optimize design solutions and perform iteratively in the design process. Credits: 3.00

TLI 46100 - Engineering/Technology Teacher Lab Planning

Credit Hours: 3.00. This course provides future engineering/technology education teachers with information on designing, organizing, and managing engineering/technology education facilities. An in-depth study of specific laboratory requirements related to safety is covered. Management skills related to students, equipment, and supplies are addressed. Students design an engineering/technology education laboratory.

Learning Outcomes: 1. Develop techniques for

planning and organizing laboratory tools, supplies, and equipment for efficient and educationally sound laboratory operation. 2. Explain the importance of safety in engineering/technology education facilities and prescribed methods of rendering facilities safe for student activities. 3. Describe government requirements and mandates related to the engineering/technology education laboratory. 4. Develop a system for inventory, purchase, and maintenance of equipment and supplies for an instructional facility. 5. Design an engineering/technology education laboratory. Credits: 3.00

TLI 46200 - Methods Of Teaching Engineering/Technology Education

Credit Hours: 3.00. Students identify a variety of instructional techniques appropriate for teaching engineering/technology education. Students will present lessons and develop evaluation instruments to determine student achievement. Methodological insights and understanding for teaching technical subject matter is stressed.

Learning Outcomes: 1. Demonstrate skills in delivering instruction using various teaching methods. 2. Demonstrate different techniques for addressing cognitive, affective, and psychomotor domains of learning. 3. Design and prepare teacher-made lesson materials. 4. Demonstrate skills in delivering instruction using various teaching methods. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

Professional Education Requirements (38 credits)

Foundational Courses

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational

philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDCI 28500 - Multiculturalism And Education (UCC: BSS)

Credit Hours: 2.00 to 3.00. This course integrates an understanding of multiculturalism with principles of democratic education. Historical, sociological, cultural, political, philosophical, and pedagogical foundations of multiculturalism are explored and related to issues of pedagogy in a pluralistic society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop awareness of issues and concerns related to multicultural education. 2. Develop knowledge of how multiculturalism impacts teachers, schools, classrooms, and society. 3. Develop skills of critical thinking and reflection that will enable educators to contribute to meeting the needs of students in a multicultural and global world. Credits: 2.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports

for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 24000 - Children With Gifts, Creativity, And Talents

Credit Hours: 1.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted children youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). Cannot be taken concurrently with EDPS 24800.

Learning Outcomes: 1. Understand who gifted, creative and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 1.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000.

Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors

with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4.

Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. (EDCI 20002) This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works well with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity,

and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Capstone (12 credits)

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

K-12 Integrated STEM Optional Concentration

Other Departmental Requirements (25 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.
University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I
University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

Electives (12 Credits)

Supplemental List

GPA Requirements

Teacher Licensure Information

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.
University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to

teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

TLI 26200 - Foundations Of Integrated STEM Education

Credit Hours: 3.00. This course provides students with a conceptual understanding of an integrated approach to teaching Science, Technology, Engineering, and Mathematics (STEM). Integrated STEM pedagogies include project/problem-based (PBL), design-based, and inquiry-based approaches to teaching. Students engage in a co-teaching model to deliver STEM instruction and observe local K-12 classrooms.

Learning Outcomes: "1. Identify foundational learning theories that blend an integrated approach to teaching. 2. Identify common practices for scientists, technologists, engineers, and mathematicians and similarities with other STEM careers. 3. Describe the key tenants of PBL, design-based, and scientific inquiry-based approaches to teaching content. 4. Create integrated STEM lessons that address two STEM subjects and state/national standards. Credits: 3.00

15 Credits

Spring 1st Year

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TLI 16100 - Prototyping In Engineering/Technology Education

Credit Hours: 3.00. Design, make, and innovate! This course provides basic instruction on the proper and safe use of tools and equipment used to prototype innovative ideas. This includes 3D printers, laser cutters/engravers, fabrication tools/equipment, CNC mills/routers, and microcontrollers/microcomputers.

Learning Outcomes: 1. Demonstrate the technical competencies to properly and safely operate common prototyping equipment and tools. 2. Apply knowledge of materials properties to select the appropriate materials for a desired prototype. 3. Create operations process flow charts

for planning product development. 4. Test prototypes in real situations to gather data related to their performance. Credits: 3.00

EDCI 28500 - Multiculturalism And Education (UCC: BSS)

Credit Hours: 2.00 to 3.00. This course integrates an understanding of multiculturalism with principles of democratic education. Historical, sociological, cultural, political, philosophical, and pedagogical foundations of multiculturalism are explored and related to issues of pedagogy in a pluralistic society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop awareness of issues and concerns related to multicultural education. 2. Develop knowledge of how multiculturalism impacts teachers, schools, classrooms, and society. 3. Develop skills of critical thinking and reflection that will enable educators to contribute to meeting the needs of students in a multicultural and global world. Credits: 2.00 to 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and

current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 24000 - Children With Gifts, Creativity, And Talents

Credit Hours: 1.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted children youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). Cannot be taken concurrently with EDPS 24800.

Learning Outcomes: 1. Understand who gifted, creative and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 1.00

EDPS 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. (EDCI 20002) This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage

in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works well with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding

of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

TLI 26500 - Teaching The TE Of STEM

Credit Hours: 3.00. A course for teacher education majors that provides rationale and techniques for integrating engineering and technological literacy into the K-12 mathematics and science curriculum. Experiences focus on the engineering design process, mechanisms, robotics, strength of materials, electrical circuits, and electronics.

Learning Outcomes: 1. Describe the national importance of the integrative nature of the K-12 STEM curriculum. 2. Describe how technology and engineering can be integrated into K-12 mathematics and science. 3. Demonstrate hands-on learning activities appropriate to integrate technology and engineering into the K-12 STEM curriculum. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with

disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000. Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to

practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

16 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the

ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

TLI 36700 - Teaching Design And Innovation I

Credit Hours: 3.00. This course focuses on the development of appropriate engineering design knowledge and skill required to effectively teach middle and high school engineering/technology education courses by infusing engineering design into the curriculum. Students will use 3-D solid modeling software, rapid prototyping, and other design technologies as they engage in the engineering design process through an open-ended engineering design challenge.

Learning Outcomes: 1. Display the ability to teach students to develop skills for living in a knowledge-based, technological society using design-based pedagogical approaches. 2. Use the engineering design process to solve open-ended, ill-defined problems. 3. Demonstrate the ability to teach basic engineering design techniques. Credits: 3.00

17 Credits

Spring 3rd Year

TLI 36100 - Engineering And Technology Education Instructional Planning And Evaluation

Credit Hours: 3.00. This course addresses selecting content, writing instructional objectives, planning lessons, preparing a unit of study, and evaluating student progress. Emphasis is placed on evaluating instruction and student achievement to include developing valid, reliable testing instruments as they relate to measuring student achievement in the cognitive, affective, and psychomotor domains.

Learning Outcomes: 1. Demonstrate instructional planning skills related to the delivery of engineering/technology education to both middle-level and high school students. 2. Prepare lesson plans, a unit of study, and evaluation instruments. 3. Appraise instructional material effectiveness and propose revisions for improvement. 4. Prepare appropriate assessment instruments that align with identified learning objectives. Credits: 3.00

TLI 46000 - Teaching Design And Innovation II

Credit Hours: 3.00. This course expands the engineering design process, incorporating rapid prototyping and other fabrication technologies to create a specified solution. The course emphasizes process flow chart planning and logistics of engineering/technology education laboratory management. Prototypes will be tested in real situations and data gathered on performance. Designs will be revised to reflect a deeper understanding of manufacturing and use, being sensitive to structure, function, and behavior from a systems-level perspective. Intellectual property, marketing, and infrastructure will be discussed.

Learning Outcomes: 1. Describe the complexity of implementing design solutions. 2. Select appropriate fabrication technologies. 3. Operationalize performance criteria into measurable variables. 4. Gather data to make rational decisions, which are transparent and justifiable. 5. Optimize design solutions and perform iteratively in the design process. Credits: 3.00

15 Credits

Fall 4th Year

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and

use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

TLI 46100 - Engineering/Technology Teacher Lab Planning

Credit Hours: 3.00. This course provides future engineering/technology education teachers with information on designing, organizing, and managing engineering/technology education facilities. An in-depth study of specific laboratory requirements related to safety is covered. Management skills related to students, equipment, and supplies are addressed. Students design an engineering/technology education laboratory.

Learning Outcomes: 1. Develop techniques for planning and organizing laboratory tools, supplies, and equipment for efficient and educationally sound laboratory operation. 2. Explain the importance of safety in engineering/technology education facilities and prescribed methods of rendering facilities safe for student activities. 3. Describe government requirements and mandates related to the engineering/technology education laboratory. 4. Develop a system for inventory, purchase, and maintenance of equipment and supplies for an instructional facility. 5. Design an engineering/technology education laboratory. Credits: 3.00

TLI 46200 - Methods Of Teaching Engineering/Technology Education

Credit Hours: 3.00. Students identify a variety of instructional techniques appropriate for teaching engineering/technology education. Students will present lessons and develop evaluation instruments to determine student achievement. Methodological insights and understanding for teaching technical subject matter is stressed.

Learning Outcomes: 1. Demonstrate skills in delivering instruction using various teaching methods. 2. Demonstrate different techniques for addressing cognitive, affective, and psychomotor domains of learning. 3. Design and prepare teacher-made lesson materials. 4. Demonstrate skills in delivering instruction using various teaching methods. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

15 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Engineering Technology, BS (Statewide)

About the Program

Degree Requirements

Departmental/Program Major Courses (49-50 credits)

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 21100 - Applied Strength Of Materials

Credit Hours: 4.00. The principles of strength, stiffness, and stability are introduced and applied primarily to mechanical components.

Learning Outcomes: 1. Find internal shear and internal bending moment within a structure due to the external loading. 2. Undertsand basic mechanical properties of materials and cross-sectional/area properties of structures and apply them. 3. Identify and calculate the stress present due to internal loads. 4. Identify potential maximum stress locations and calculate the principle stresses and the maximum shear stress. 5. Calculate deflection in statically determinate structures. Credits: 4.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use

appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

ENGT 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Concentration Requirement (37 credits)

Other Departmental/Program Course Requirements (34-36 credits)

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward

graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in

the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Supplemental List

Grade Requirements

GPA Requirements

Non-course / Non-credit Requirements

Sample 4-Year Plan

Fall 1st Year

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

15 Credits

Spring 1st Year

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body

diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

15 Credits

Fall 2nd Year

MET 21100 - Applied Strength Of Materials

Credit Hours: 4.00. The principles of strength, stiffness, and stability are introduced and applied primarily to mechanical components.

Learning Outcomes: 1. Find internal shear and internal bending moment within a structure due to the external loading. 2. Undertsand basic mechanical properties of materials and cross-sectional/area properties of structures and apply them. 3. Identify and calculate the stress present due to internal loads. 4. Identify potential maximum stress locations and calculate the principle stresses and the maximum shear stress. 5. Calculate deflection in statically determinate structures. Credits: 4.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply

chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

14 Credits

Spring 2nd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

16 Credits

Fall 3rd Year

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

ENGT 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for

implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

15 Credits

English Education, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (87 credits)

English Content Courses (30 credits)

Required Courses (15 credits)

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 30100 - Ways Of Reading

Credit Hours: 3.00. Introduction to literary theory and practice. Close reading of and significant writing about selected literary texts informed by a variety of critical and/or theoretical perspectives.

Learning Outcomes: 1. Identify various theoretical approaches to literature, and then apply them to literary texts. 2. Define important literary terms, genres, and conventions within their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned arguments about literary texts based on appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 39200 - Young Adult Literature

Credit Hours: 3.00. This course examines the construct of Young Adult Literature as a genre crafted specifically for adolescents. Using both classic and contemporary novels, as well as relevant theoretical and research texts, this course explores how YA literature is defined, what it offers to adolescent readers, and how it is situated in the literary landscape.

Learning Outcomes: 1. Read, respond to, and

analyze selected works of Young Adult literature in order to think critically about various concepts and issues connected to the genre. 2. Explore, analyze, and critique the extent to which selected Young Adult literature affects and reflects teenage life. Credits: 3.00

Multiethnic Studies (3 credits)

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule. Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

Literary Traditions (6 credits)

List A

ENGL 23000 - Great Narrative Works (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of great narratives from Homer's Odyssey to the present, considering works from a variety of cultures and time periods in order to develop an understanding of their ideas, structures, styles, and cultural values.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 24000 - British Literature Before 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the medieval to the Romantic period.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Romantic period. 2.

Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Romantic literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 24100 - British Literature After 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the Romantic period on.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the Romantic period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about literature from the Romantic period to the present based on appropriate use of textual evidence. Credits: 3.00

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26700 - World Literature: From 1700 A.D. To The Present (UCC: HUM)

Credit Hours: 3.00. (CMPL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. Typically offered Summer Fall Spring. CCN: IEL 1251 World Literature 2

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 27600 - Shakespeare On Film (UCC: HUM)

Credit Hours: 3.00. Considers the relation of the written text of five or six Shakespeare plays to multiple film versions from a wide variety of times and cultures, e.g., the United States, England, France, Italy, Japan, Denmark, India, and Russia. Typically offered Fall Spring Summer.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explore a selected set of Shakespeare's plays through a comparative analytical lens. 2. Compare and contrast various

film versions of Shakespeare's plays in their respective contexts. 3. Respond to the films and written texts through reflective and critical writings and discussions. Credits: 3.00

ENGL 35000 - American Literature Before 1865 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from European colonization to the U.S. Civil War. CTL:IEL 1210 American Literature I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Civil War period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35100 - American Literature After 1865 (UCC: HUM)

Credit Hours: 3.00. A survey of American literature from the Civil War to the present. CTL:IEL 1211 American Literature II

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the post-Civil War period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

List B

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.

Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 44200 - Shakespeare

Credit Hours: 3.00. Shakespeare's dramatic craftsmanship, poetry, humor, characterization, psychology, and modern pertinence illustrated in representative tragedies, comedies, and history plays.

Credits: 3.00

ENGL 24900 - Great British Books

Credit Hours: 3.00. Why are British books so compelling? This course examines the dynamic history of British literature and explores how canonical and contemporary texts shaped the cultural landscape of Britain, the British Empire, and the world. Learning Outcomes: 1. Identify and make convincing arguments about major genres of British literature, including essays, journals, autobiographies, poetry, drama, and fiction. 2. Identify the diversity of peoples, interests, and ideologies within British literature and culture, and the texts that define them. 3. Define and analyze how literary texts both reflect and produce culture. 4. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

Language and Writing Selectives (6 credits)

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.) University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 32700 - English Language I: History And Development

Credit Hours: 3.00. Introduction to the history of the English language, its sounds, inflections, words, and sentence structures. Cultural and historical events affecting this history, and the interplay between language and literature. Credits: 3.00

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 . Credits: 3.00

ENGL 39000 - Practicum In Tutoring Writing

Credit Hours: 1.00 to 3.00. A practicum to teach undergraduates to teach writing in the one-to-one setting of a writing lab. Credits: 1.00 to 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels. Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as

usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 47000 - Advanced Topics In Rhetorical Studies

Credit Hours: 3.00. Study of rhetorical theories and practices past and present. Includes readings in primary texts in the history and theory of rhetoric. May be repeated for credit with a different topic.

Learning Outcomes: 1. Demonstrate advanced understanding of rhetorical concepts, theories, and practices. 2. Analyze and assess rhetorical situations from which arguments are generated; evaluate arguments and their public, institutional, or organizational success; produce arguments in a variety of genres and forms. 3. Demonstrate understanding of how and why rhetoric accomplishes its work from a variety of perspectives across the humanities and sciences. Credits: 3.00

ENGL 58900 - Directed Writing

Credit Hours: 1.00 to 3.00. Writing (creative, popularly technical, biographical, historical, philosophical) on subjects of the student's choice. Individual conferences only; no class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 22800 - Language And Social Identity

Credit Hours: 3.00. This course introduces linguistic diversity, including regional, cultural, and stylistic variation within a single language, code-switching in bilingual communities, and colonial, immigrant, Creole, indigenous, and sign languages. It also explores the role of language in supporting various types of social identity (e.g., age, gender, social class, race, ethnicity) as well as power structures that enable discrimination against less powerful groups.

Learning Outcomes: 1. Distinguish empirically-grounded facts about linguistic diversity and language use from popular attitudes and opinions that are not based in facts. 2. Recognize the legitimacy and systematic structure of all language varieties. 3. Describe the phonetic, lexical, grammatical, and pragmatic features as found in the language of different groups, through close analysis of primary linguistic data. 4. Show how individuals use linguistic features to help construct their social identities, through the close examination of case studies. 5. Recognize forms of linguistic discrimination as depicted in the popular media and as enacted in the education system, the workplace, the judicial system, and daily life. Credits: 3.00

Major Professional Education Courses (57 credits)

Foundational Courses (22 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social,

and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand

how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives

have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

English Methods Courses (26 credits)

EDCI 42200 - The Teaching Of English In Secondary Schools

Credit Hours: 3.00. Explores a wide variety of instructional practices suitable for teaching middle and high school English including language, literature, and writing - addressing specific pedagogical issues such as teaching diverse learners and developing cohesive units of instruction.

Learning Outcomes: 1. Explore different philosophical and instructional applications for secondary English teaching. 2. Examine diverse issues affecting teaching and learning in the secondary English classrooms. 3. Develop the reflective and critical thinking skills necessary for secondary English teachers. 4. Increase pedagogical competency in diverse aspects of teaching and learning, including classroom instruction, student interaction, and teacher development. Credits: 3.00

EDCI 43400 - Literacy Teaching And Learning In Secondary Schools

Credit Hours: 2.00. Exploration and development of various instructional methods and materials appropriate for supporting adolescent literacy in secondary English (i.e., middle and high school English Language Arts), including the teaching of reading. Content-area literacy methods and materials are also addressed. Includes a field experience of up to 20 hours in a secondary English school setting.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of secondary English literacy. 2. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 3. Support the

development of pedagogical competency through continued work with issues of teaching and learning in secondary English. Credits: 2.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

ENGL 39100 - Composition For English Teachers

Credit Hours: 3.00. Exploration of the theory, research, and pedagogy of teaching writing at the secondary level. Topics include the development of writing assignments and related activities, the study of writing process models, and the evaluation of student work in a variety of genres.

Learning Outcomes: 1. Design lesson plans for secondary writing instruction. 2. Incorporate writing-process strategies into assignments and activities. 3. Develop prompts for student writing in a variety of genres. 4. Map instructional activities to formal state or national curricular standards. 5. Reflect on differentiating lessons for diverse learners. Credits: 3.00

ENGL 49200 - Literature In The Secondary Schools

Credit Hours: 3.00. Exploration of the theory, research and pedagogy supporting the teaching of literature at the secondary level. Topics include text selection, instructional strategies, adolescent literacy, student engagement and the use of alternative texts.

Credits: 3.00

EDCI 38100 - Teaching For Social Justice: Culturally And Linguistically Diverse Learners

Credit Hours: 3.00. This course builds on the content of EDCI 28500 (Multicultural Education) with specific attention to issues of social justice related to literacy and linguistic diversity. Within this framework, students will learn strategies for teaching English language learners, deconstruct deficit perspectives of dialectical differences, and consider approaches to classroom management. Additionally, a field experience component with an ELL teacher will be included in the course.

Learning Outcomes: 1. Engage with the following concepts via reading, analysis/critique, and consideration of how they might apply in future classrooms: culturally relevant pedagogy and culturally sustaining pedagogy, code switching and code meshing, restorative justice. 2. Learn pedagogical strategies for working with ELLs in secondary English classrooms. 3. Understand the school-to-prison pipeline phenomenon and develop classroom management principles accordingly. 4. Participate in a field experience that requires interaction with culturally and linguistically diverse students in a local ELL classroom. Credits: 3.00

Required Learner Pathway Concentration (9 credits)

Other Departmental/Program Course Requirements (18-19 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course

includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

Electives (14-15 Credits)

GPA Requirements

Teacher Licensure Information

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical

and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

15-16 Credits

Spring 1st Year

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

ENGL 39100 - Composition For English Teachers

Credit Hours: 3.00. Exploration of the theory, research, and pedagogy of teaching writing at the secondary level. Topics include the development of writing assignments and related activities, the study of writing process models, and the evaluation of student work in a variety of genres.

Learning Outcomes: 1. Design lesson plans for secondary writing instruction. 2. Incorporate writing-process strategies into assignments and activities. 3. Develop prompts for student writing in a variety of genres. 4. Map instructional activities to formal state or national curricular standards. 5. Reflect on differentiating lessons for diverse learners. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3.

Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

17 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 49200 - Literature In The Secondary Schools

Credit Hours: 3.00. Exploration of the theory, research and pedagogy supporting the teaching of literature at the secondary level. Topics include text selection, instructional strategies, adolescent literacy, student engagement and the use of alternative texts.

Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies

of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

16 Credits

Fall 3rd Year

ENGL 30100 - Ways Of Reading

Credit Hours: 3.00. Introduction to literary theory and practice. Close reading of and significant writing about selected literary texts informed by a variety of critical and/or theoretical perspectives.

Learning Outcomes: 1. Identify various theoretical approaches to literature, and then apply them to literary texts. 2. Define important literary terms, genres, and conventions within their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned arguments about literary texts based on appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

EDCI 38100 - Teaching For Social Justice: Culturally And Linguistically Diverse Learners

Credit Hours: 3.00. This course builds on the content of EDCI 28500 (Multicultural Education) with specific attention to issues of social justice related to literacy and linguistic diversity. Within this framework, students will learn strategies for teaching English language learners, deconstruct deficit perspectives of dialectical differences, and consider approaches to classroom management. Additionally, a field experience component with an ELL teacher will be included in the course.

Learning Outcomes: 1. Engage with the following concepts via reading, analysis/critique, and consideration of how they might apply in future classrooms: culturally relevant pedagogy and culturally sustaining pedagogy, code switching and code meshing, restorative justice. 2. Learn pedagogical strategies for working with ELLs in secondary English classrooms. 3. Understand the school-to-prison pipeline phenomenon and develop classroom management principles accordingly. 4. Participate in a field experience that requires interaction with culturally and linguistically diverse students in a local ELL classroom. Credits: 3.00

17-18 Credits

Spring 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the

instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 43400 - Literacy Teaching And Learning In Secondary Schools

Credit Hours: 2.00. Exploration and development of various instructional methods and materials appropriate for supporting adolescent literacy in secondary English (i.e., middle and high school English Language Arts), including the teaching of reading. Content-area literacy methods and materials are also addressed. Includes a field experience of up to 20 hours in a secondary English school setting.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of secondary English literacy. 2. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 3. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary English. Credits: 2.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 39200 - Young Adult Literature

Credit Hours: 3.00. This course examines the construct of Young Adult Literature as a genre crafted specifically for adolescents. Using both classic and contemporary novels, as well as relevant theoretical and research texts, this course explores how YA literature is defined, what it offers to adolescent readers, and how it is situated in the literary landscape.

Learning Outcomes: 1. Read, respond to, and analyze selected works of Young Adult literature in order to think critically about various concepts and issues connected to the genre. 2. Explore, analyze, and critique the extent to which selected Young Adult literature affects and reflects teenage life. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 42200 - The Teaching Of English In Secondary Schools

Credit Hours: 3.00. Explores a wide variety of instructional practices suitable for teaching middle and high school English including language, literature, and writing - addressing specific pedagogical issues such as teaching diverse learners and developing cohesive units of instruction.

Learning Outcomes: 1. Explore different philosophical and instructional applications for secondary English teaching. 2. Examine diverse issues affecting teaching and learning in the secondary English classrooms. 3. Develop the reflective and critical thinking skills necessary for secondary English teachers. 4. Increase pedagogical competency in diverse aspects of teaching and learning, including classroom

instruction, student interaction, and teacher development. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

12 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

English: English Literature Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Area A - Gateway Course (3 credits)

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking, reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

English Literature Concentration (30 credits)

Area B - Required Concentration Courses (6 credits)

ENGL 30100 - Ways Of Reading

Credit Hours: 3.00. Introduction to literary theory and practice. Close reading of and significant writing about selected literary texts informed by a variety of critical and/or theoretical perspectives.

Learning Outcomes: 1. Identify various theoretical approaches to literature, and then apply them to literary texts. 2. Define important literary terms, genres, and conventions within their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned arguments about literary texts based on appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

ENGL 39900 - Beyond English

Credit Hours: 3.00. This class is designed for third- and fourth-year English majors. It will help students translate the worth of English and the humanities to the world beyond the university, providing them with tools to articulate their achievements and prepare for their professional and adult lives.

Learning Outcomes: 1. Be familiar with economic, scientific, and humanistic arguments for the value of English and the humanities. 2. Practice speaking clearly, writing persuasively, and collaborating effectively. 3. Enhance career preparation and professionalization. Credits: 3.00

Area C - The Literary Canon (12 credits)

Surveys of Western Literature (6 credits)

ENGL 24000 - British Literature Before 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the medieval to the Romantic period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Romantic period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Romantic literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 24100 - British Literature After 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the Romantic period on.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the Romantic period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural,

and aesthetic contexts. 3. Produce well-reasoned written arguments about literature from the Romantic period to the present based on appropriate use of textual evidence. Credits: 3.00

ENGL 35000 - American Literature Before 1865 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from European colonization to the U.S. Civil War. CTL:IEL 1210 American Literature I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Civil War period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35100 - American Literature After 1865 (UCC: HUM)

Credit Hours: 3.00. A survey of American literature from the Civil War to the present. CTL:IEL 1211 American Literature II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the post-Civil War period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

Western Canon (3 credits)

ENGL 44200 - Shakespeare

Credit Hours: 3.00. Shakespeare's dramatic craftsmanship, poetry, humor, characterization, psychology, and modern pertinence illustrated in representative tragedies, comedies, and history plays.

Credits: 3.00

ENGL 37401 - Studies In British Literary History

Credit Hours: 3.00. This class focuses on one of several important British literary-historical periods, ranging from medieval English to modern British literature. In it, students will examine individual authors and texts while also gaining a wider understanding of their historical context. Students will also engage with a variety of genres and practice numerous critical approaches to literature.

Learning Outcomes: 1. Identify and construct arguments about genres of, and theoretical approaches to, historical literature. 2. Explain the diversity of peoples, interests, and ideologies with specific British literacy-historical periods. 3. Show how literary artifacts are both agents and reflections of culture. 4. Construct written arguments that demonstrate historical, cultural, and global awareness. 5. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

ENGL 37800 - Studies In American Literary History

Credit Hours: 3.00. This class focuses on one of several important American literary-historical periods: colonial, nineteenth-, or twentieth- and twenty-first-century literature. In it, students examine individual authors and texts while also gaining a wider understanding of their historical context. Students also will engage with a variety of genres and practice numerous critical approaches to literature.

Learning Outcomes: 1. Identify and construct arguments about genres of, and theoretical approaches to, historical literature. 2. Explain the diversity of peoples, interests, and ideologies with specific American literary-historical periods. 3. Show how literary artifacts are both agents and reflections of culture. 4. Construct written arguments that demonstrate historical, cultural, and global awareness. 5. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

Other Literary Traditions (3 credits)

ENGL 23200 - Thematic Studies In Literature

Credit Hours: 3.00. Examination of a particular theme, such as the hero, death, or the city, and the techniques by which it is treated in various literary works, usually in more than one genre. Current offerings available from counselors.

Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 36000 - Gender And Literature (UCC: HUM)

Credit Hours: 3.00. An introduction to feminist approaches to the study of literature, including poetry, drama, fiction, and/or autobiography. Examines how gender intersects with race, ethnicity, sexual orientation, and class in shaping authorship, reading, and representation.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.

Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

Area D - Senior Capstone Seminar (3 credits)

ENGL 41100 - Studies In Major Authors

Credit Hours: 3.00. A study of the literary, critical, or cinematic works of one or two influential authors or directors. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of the works of a particular author. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a

substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41200 - Studies In Genre

Credit Hours: 3.00. A study of literary or cinematic works that share distinctive formal features. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate detailed knowledge of a single literary genre. 2. Discuss that genre in relation to its diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41300 - Studies In Literature And History

Credit Hours: 3.00. A study of literature or film produced during a well-defined historical period from the view of its social, political, religious, and economic contexts. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of a particular period in history. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41400 - Studies In Literature And Culture

Credit Hours: 3.00. A study of literature or film from the perspective of the cultural norms and values it expresses, celebrates, and challenges. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of the relationship between literary texts and their culture. 2. Discuss those relationships in light of texts' diverse historical and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

Area E - English Selectives (9 credits)

Elective (14-51 Credits)

Grade Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking, reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

15-16 Credits

Spring 1st Year

15 Credits

Fall 2nd Year

ENGL 30100 - Ways Of Reading

Credit Hours: 3.00. Introduction to literary theory and practice. Close reading of and significant writing about selected literary texts informed by a variety of critical and/or theoretical perspectives.

Learning Outcomes: 1. Identify various theoretical approaches to literature, and then apply them to literary texts. 2. Define important literary terms, genres, and conventions within their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned arguments about literary texts based on appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

ENGL 39900 - Beyond English

Credit Hours: 3.00. This class is designed for third- and fourth-year English majors. It will help students translate the worth of English and the humanities to the world beyond the university, providing them with tools to articulate their achievements and prepare for their professional and adult lives.

Learning Outcomes: 1. Be familiar with economic, scientific, and humanistic arguments for the value of English and the humanities. 2. Practice speaking clearly, writing persuasively, and collaborating effectively. 3. Enhance career preparation and professionalization. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Program Learning Outcomes

English: Global Context Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (30 credits)

Area A - Gateway Course (3 credits)

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking,

reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

Global Context Concentration (27 credits)

Area B - Multiethnic Studies (3 credits)

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.

Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

Area C - Introduction to Linguistics (3 credits)

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

Area D - English Language (12 credits)

Language Structure (3 credits)

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 .

Credits: 3.00

Phonetics and Phonology (3 credits)

ENGL 32900 - English Language III: Sound And Form

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on phonology and morphology. Implications of recent theory to the teaching of English.

Credits: 3.00

LING 31500 - Elements Of Phonetics

Credit Hours: 3.00. Introduction to articulatory phonetics. Mechanisms of production of speech sounds. Sounds of languages of the world, ear training for discriminating speech sounds, and practice in broad and narrow phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be given for both LING 31500 and SLHS 30600.

Credits: 3.00

Additional Courses (6 credits)

ENGL 32900 - English Language III: Sound And Form

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on phonology and morphology. Implications of recent theory to the teaching of English.

Credits: 3.00

LING 39800 - Special Topics In Linguistics I

Credit Hours: 3.00. Investigation of a special topic in linguistics. The topic will vary from semester to semester. Permission of instructor required.

Credits: 3.00

LING 31500 - Elements Of Phonetics

Credit Hours: 3.00. Introduction to articulatory phonetics. Mechanisms of production of speech sounds. Sounds of languages of the world, ear training for discriminating speech sounds, and practice in broad and narrow phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be given for both LING 31500 and SLHS 30600.

Credits: 3.00

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and

written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

ENGL 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, LC 56500, LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

LC 57500 - Theories Of Foreign Language Acquisition

Credit Hours: 3.00. An advanced course designed to provide an overview of major theoretical issues in foreign language acquisition research. Provides a broad historical introduction to theories of acquisition that underlie these different perspectives. This course also provides an understanding of skills assessment and selection of instructional materials. Permission of instructor required.

Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

ENGL 22800 - Language And Social Identity

Credit Hours: 3.00. This course introduces linguistic diversity, including regional, cultural, and stylistic variation within a single language, code-switching in bilingual communities, and colonial, immigrant, Creole, indigenous, and sign languages. It also explores the role of language in supporting various types of social identity (e.g., age, gender, social class, race, ethnicity) as well as power structures that enable discrimination against less powerful groups.

Learning Outcomes: 1. Distinguish empirically-grounded facts about linguistic diversity and language use from popular attitudes and opinions that are not based in facts. 2. Recognize the legitimacy and systematic structure of all language varieties. 3. Describe the phonetic, lexical, grammatical, and pragmatic features as found in the language of different groups, through close analysis of primary linguistic data. 4. Show how individuals use linguistic features to help construct their social identities, through the close examination of case studies. 5. Recognize forms of linguistic discrimination as depicted in the popular media and as enacted in the education system, the workplace, the judicial system, and daily life. Credits: 3.00

ENGL 21500 - Inventing Languages

Credit Hours: 3.00. "Invented languages" include linguistic systems created for fictional worlds, such as Dothraki (Game of Thrones), Na'vi (Avatar), Elvish (Lord of the Rings) and Klingon (Star Trek), as well as languages invented for international communication by real speakers, such as Esperanto. In this course, you will study these systems, learn the major properties of natural human languages, and construct your own rudimentary languages.

Learning Outcomes: 1. Understand the characteristics and goals of various invented languages from linguistic, cultural, and historical perspectives. 2. Show mastery of basic concepts of language structure and language typology. 3. Elucidate mastery of basic concepts of sociolinguistics, historical linguistics, and linguistic anthropology. 4. Explain how natural languages has influenced the development of invented languages. 5. Construct a rudimentary language system and create a back story, dictionary, grammar, and sample text. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

Area E - Second Language Acquisition and Teaching (6 credits)

Required TESL Sequence (6 credits)

ENGL 51600 - Teaching English As A Second Language: Theoretical Foundations

Credit Hours: 3.00. Survey of theories of learning and teaching English as a second/foreign/international language. Focus is on current theories and their implications for practice.

Learning Outcomes: 1. Demonstrate an understanding of current theories of second-language learning and teaching and their implications. Credits: 3.00

ENGL 51800 - Teaching English As A Second Language: Principles And Practices

Credit Hours: 3.00. Studies of issues and principles in ESL/EFL program development. Emphasis is on practical application of theory in a variety of English learning and teaching contexts in the U.S. and abroad.

Credits: 3.00

Area F - Capstone Seminar (3 credits)

ENGL 49000 - Worksite Internship Practicum

Credit Hours: 1.00 to 3.00. Course facilitates the transition between an English undergraduate degree and the workplace or professional life. The course has two components: a professor-guided component and a practicum component in a chosen area. Permission of instructor required.

Credits: 1.00 to 3.00

Elective (17-54 Credits)

Grade Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking, reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

15-16 Credits

Spring 1st Year

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

15 Credits

Fall 2nd Year

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 .

Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

ENGL 51600 - Teaching English As A Second Language: Theoretical Foundations

Credit Hours: 3.00. Survey of theories of learning and teaching English as a second/foreign/international language. Focus is on current theories and their implications for practice.

Learning Outcomes: 1. Demonstrate an understanding of current theories of second-language learning and teaching and their implications. Credits: 3.00

15 Credits

Spring 3rd Year

ENGL 51800 - Teaching English As A Second Language: Principles And Practices

Credit Hours: 3.00. Studies of issues and principles in ESL/EFL

program development. Emphasis is on practical application of theory in a variety of English learning and teaching contexts in the U.S. and abroad.

Credits: 3.00

15 Credits

Fall 4th Year

ENGL 49000 - Worksite Internship Practicum

Credit Hours: 1.00 to 3.00. Course facilitates the transition between an English undergraduate degree and the workplace or professional life. The course has two components: a professor-guided component and a practicum component in a chosen area. Permission of instructor required.

Credits: 1.00 to 3.00

15 Credits

Spring 4th Year

15 Credits

Program Learning Outcomes

Environmental and Ecological Engineering, BSEEE

About the Program

Degree Requirements

Departmental/Program Major Courses (52 credits)

Required Major Courses (25 credits)

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic

dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify

information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 39000 - Environmental And Ecological Engineering Professional Practice Seminar

Credit Hours: 1.00. Seminar lectures and discussions to introduce students to aspects of professional practice within Environmental and Ecological Engineering. Topics include career planning and placement skills, professional responsibility and ethics, functioning as a professional, and other current important topics in the profession. Students will interact with several practicing Environmental and Ecological Engineers.

Learning Outcomes: 1. Develop professional skills that will allow them to enter into the professional Environmental and Ecological Engineering field. 2. Gain an understanding of major professional issues. 3. Begin development of a personal approach to ethical professionalism. 4. Gain experience in professional communication. 5. Gain knowledge of the range of opportunities available in the profession. Credits: 1.00

EEE 38000 - Environmental Chemodynamics

Credit Hours: 3.00. Introduction to chemical thermodynamics and general equilibrium processes in environmental and ecological engineering systems. Introduction to the first and second laws of thermodynamics; properties of pure substances; ideal and real gases; thermodynamic cycles and processes; heat transfer and combustion; and chemical equilibrium in aquatic solutions, including equilibria between phases and reaction equilibria. Emphasis is on understanding and conceptualizing important processes, and competency in thermodynamic calculations.

Learning Outcomes: 1. Apply the First and Second Laws of thermodynamics to closed and open systems. 2. Understand, identify, and quantify the environmental impacts of closed and open systems, based on mass and energy transfer. 3. Analyze full-scale systems, and compare actual and theoretical operation. 4. Understand the structure and reactivity of environmentally relevant organic compounds. 5. Calculate concentrations of different components in equilibrium and non-equilibrium environmental systems. Credits: 3.00

EEE 29001 - Introduction To Environmental & Ecological Engineering Seminar

Credit Hours: 2.00. Guest presenters, peer panelists, and small group discussions introduce students to the knowledge, skills, and abilities needed in order to exhibit the highest levels of professionalism & stewardship expected of an Environmental and Ecological Engineering graduate. Topics include planning a course of study; internship, research, study abroad opportunities; career planning and placement skills; professional responsibility and ethics; and functioning as a professional.

Learning Outcomes: 1. Communicate professionally in both formal and informal settings. 2. Create career documents (e.g., resumes, cover letters, LinkedIn Profiles) that demonstrate professionalism and critical thinking. 3. Understand how their actions and/or inactions are perceived in professional settings. 4. Identify and justify their curricular path at Purdue University. 5. Identify a variety of curricular, extra-curricular, and professional opportunities that will best support the achievement of their career goals. Credits: 2.00

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are

assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering design proposal. Credits: 3.00

EEE 48100 - Reflective Practitioner

Description: Credit Hours: 1.00. Reflective practice is a term coined by Donald Schon in The Reflective Practitioner (1983). Reflective practice is the capacity to reflect on action to engage in a process of continuous learning. Reflective practice can be an important tool in practice-based professional learning settings where people learn from their own professional experiences, rather than from formal learning or knowledge transfer. It may be the most important source of personal professional development and improvement. It is also an important way to bring together theory and practice. A person who reflects throughout their practice is not just looking back on past actions and events, but is taking a conscious look at emotions, experiences, actions, and responses, and using that information to add to their existing knowledge base and reach a higher level of understanding. Critical reflection as part of experiential education generates, deepens, and documents learning. As a result of this course, you will be able to articulate the value of your experiential education opportunities toward marketing yourself for potential job opportunities and develop the skills needed to become a reflective practitioner for promotional growth in your future career. Permission of department required.

Learning Outcomes: 1. Reflect on experiential education experiences; Identify knowledge and skills gained from experiences; Identify connections between experiences and disciplinary knowledge. 2. Apply theories and concepts to practical sustainability problems; Identify ways in which individual actions within experiences contributed to improving sustainability; Identify ways to individually contribute to improving sustainability in future professional practice. 3. Synthesize experiential education experiences into a career development plan; Articulate strengths and weaknesses observed within experiences; Develop a self-improvement plan for future professional practice; Identify a potential career path; Synthesize knowledge and skills gained into high-quality LinkedIn page and Strengths Statement. Credits: 1.00

EEE 36001 - Water Quality And Treatment Laboratory

Credit Hours: 3.00. Laboratory procedures are described and performed that examine chemical, physical, and biological properties and constituent concentrations of natural waters. In addition, water treatment process experiments are performed to show how constituent concentrations can be altered during water treatment processes. Procedures include the analytical determination of several chemical and biological constituents in water by titrimetric, colorimetric, or chromatographic methods, whereas treatment processes include reactor design, pH adjustment, ion exchange, lime softening, coagulation, and disinfection.

Learning Outcomes: 1. Apply physical, chemical, and biological principles to each experimental procedure or measurement technique. 2. Conduct laboratory experiments, making quantitative measurements to assess water quality and water treatment process performance. 3. Organize, report, and

graphically display experimental data in common software packages. 4. Analyze and evaluate experimental data on its quality and significance (i.e., usefulness). 5. Identify issues (i.e., problems) with data collection and data uses. Credits: 3.00

EEE 36002 - Environmental Sustainability For Industry, Laboratory

Credit Hours: 3.00. This lab course provides an opportunity for students to gain hands-on experience with the physical and analytical tools of industrial sustainability. These include experimental methods for product testing and air quality measurement; design and planning of experiments; statistical interpretation of experimental data; design and environmental assessment of building energy use, combustion systems, and electrical circuits; and life-cycle management of electronic equipment and other household products. Students are encouraged to complete their statistics requirement.

Learning Outcomes: 1. Develop a hypothesis and design experiments to test the hypothesis. 2. Conduct/interpret statistical analysis of experimental results. 3. Describe power and energy demand in multiple contexts including electricity, combustion, and heat transfer. 4. Propose energy efficiency solutions and evaluate their economic and environmental consequences. 5. Design and measure the material and environmental impacts of a product's life cycle, including production, waste handling, and end-of-life scenarios. 6. Produce technical reports that clearly communicate methods, results, and conclusions for a professional audience. Credits: 3.00

EEE 48001 - Environmental And Ecological Engineering Senior Design I

Credit Hours: 1.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems. Permission of department required.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Have an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 1.00

EEE 48002 - Environmental And Ecological Engineering Senior Design II

Credit Hours: 2.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Gain an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 2.00

EEE Selectives (21 credits)

Technical Electives (6 credits)

Other Departmental/Program Requirements (75-93 credits)

Engineering Requirements for First Year (29-39 credits)

Other Course Requirements (28-36 credits)

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5.

Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing

biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses

and predictions, develop an experimental design. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3.

Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

BIOL 11200 - Fundamentals Of Biology (UCC: SCI)

Credit Hours: 2.00. This course is designed primarily to provide an introduction to the principles of biology. BIOL 11200, 11300 is a two-semester principles of biology sequence that introduces students to the major concepts of the discipline, with emphasis on the experimental and logical basis of the information presented. BIOL 11200/11300 includes lectures on diversity and evolution, and on the development, structure, and function of organisms, cell structure, cell function, ecology, genetics, biochemistry, and molecular biology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental

engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

EEE General Education Requirement (18 credits)

Elective (0-1 credit)

Supplemental Lists

GPA Requirements

Course Requirements and Notes

Non-Course/Non-Credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample Environmental and Ecological Engineering Plan of Study

Fall 2nd Year

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3.

Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

EEE 29001 - Introduction To Environmental & Ecological Engineering Seminar

Credit Hours: 2.00. Guest presenters, peer panelists, and small group discussions introduce students to the knowledge, skills, and abilities needed in order to exhibit the highest levels of professionalism & stewardship expected of an Environmental and Ecological Engineering graduate. Topics include planning a course of study; internship, research, study abroad opportunities; career planning and placement skills; professional responsibility and ethics; and functioning as a professional.

Learning Outcomes: 1. Communicate professionally in both formal and informal settings. 2. Create career documents (e.g., resumes, cover letters, LinkedIn Profiles) that demonstrate professionalism and critical thinking. 3. Understand how their actions and/or inactions are perceived in professional settings. 4. Identify and justify their curricular path at Purdue University. 5. Identify a variety of curricular, extra-curricular, and professional opportunities that will best support the achievement of their career goals. Credits: 2.00

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering

design proposal. Credits: 3.00

18 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of

differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

EEE 38000 - Environmental Chemodynamics

Credit Hours: 3.00. Introduction to chemical thermodynamics and general equilibrium processes in environmental and ecological engineering systems. Introduction to the first and second laws of thermodynamics; properties of pure substances; ideal and real gases; thermodynamic cycles and processes; heat transfer and combustion; and chemical equilibrium in aquatic solutions, including equilibria between phases and reaction equilibria. Emphasis is on understanding and conceptualizing important processes, and competency in thermodynamic calculations.

Learning Outcomes: 1. Apply the First and Second Laws of thermodynamics to closed and open systems. 2. Understand, identify, and quantify the environmental impacts of closed and open systems, based on mass and energy transfer. 3. Analyze full-scale systems, and compare actual and theoretical operation. 4. Understand the structure and reactivity of environmentally relevant organic compounds. 5. Calculate concentrations of different components in equilibrium and non-equilibrium environmental systems. Credits: 3.00

16 Credits

Fall 3rd Year

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone.

Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify

information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community

ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11200 - Fundamentals Of Biology (UCC: SCI)

Credit Hours: 2.00. This course is designed primarily to provide an introduction to the principles of biology. BIOL 11200, 11300 is a two-semester principles of biology sequence that introduces students to the major concepts of the discipline, with emphasis on the experimental and logical basis of the information presented. BIOL 11200/11300 includes lectures on diversity and evolution, and on the development, structure, and function of organisms, cell structure, cell function, ecology, genetics, biochemistry, and molecular biology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

EEE 36001 - Water Quality And Treatment Laboratory

Credit Hours: 3.00. Laboratory procedures are described and performed that examine chemical, physical, and biological properties and constituent concentrations of natural waters. In addition, water treatment process experiments are performed to show how constituent concentrations can be altered during water treatment processes. Procedures include the analytical determination of several chemical and biological constituents in water by titrimetric, colorimetric, or chromatographic methods, whereas treatment processes include reactor design, pH adjustment, ion exchange, lime softening, coagulation, and disinfection.

Learning Outcomes: 1. Apply physical, chemical, and biological principles to each experimental procedure or measurement technique. 2. Conduct laboratory experiments, making quantitative measurements to assess water quality and water treatment process performance. 3. Organize, report, and graphically display experimental data in common software packages. 4. Analyze and evaluate experimental data on its quality and significance (i.e., usefulness). 5. Identify issues (i.e., problems) with data collection and data uses. Credits: 3.00

EEE 36002 - Environmental Sustainability For Industry, Laboratory

Credit Hours: 3.00. This lab course provides an opportunity for students to gain hands-on experience with the physical and analytical tools of industrial sustainability. These include experimental methods for product testing and air quality measurement; design and planning of experiments; statistical interpretation of experimental data; design and environmental assessment of building energy use, combustion systems, and electrical circuits; and life-cycle management of electronic equipment and other household products. Students are encouraged to complete their statistics requirement.

Learning Outcomes: 1. Develop a hypothesis and design experiments to test the hypothesis. 2. Conduct/interpret statistical analysis of experimental results. 3. Describe power and energy demand in multiple contexts including electricity, combustion, and heat transfer. 4. Propose energy efficiency solutions and evaluate their economic and environmental

consequences. 5. Design and measure the material and environmental impacts of a product's life cycle, including production, waste handling, and end-of-life scenarios. 6. Produce technical reports that clearly communicate methods, results, and conclusions for a professional audience. Credits: 3.00

18 Credits

Spring 3rd Year

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

EEE 39000 - Environmental And Ecological Engineering Professional Practice Seminar

Credit Hours: 1.00. Seminar lectures and discussions to introduce students to aspects of professional practice within Environmental and Ecological Engineering. Topics include career planning and placement skills, professional responsibility and ethics, functioning as a professional, and other current important topics in the profession. Students will interact with several practicing Environmental and Ecological Engineers.

Learning Outcomes: 1. Develop professional skills that will allow them to enter into the professional Environmental and Ecological Engineering field. 2. Gain an understanding of major professional issues. 3. Begin development of a personal approach to ethical professionalism. 4. Gain experience in professional communication. 5. Gain knowledge of the range of opportunities available in the profession. Credits: 1.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical

and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5.

Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

15 Credits

Fall 4th Year

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

EEE 48100 - Reflective Practitioner

Description: Credit Hours: 1.00. Reflective practice is a term coined by Donald Schon in The Reflective Practitioner (1983). Reflective practice is the capacity to reflect on action to engage in a process of continuous learning. Reflective practice can be an important tool in practice-based professional learning settings where people learn from their own professional experiences, rather than from formal learning or knowledge transfer. It may be the most important source of personal professional development and improvement. It is also an important way to bring together theory and practice. A person who reflects throughout their practice is not just looking back on past actions and events, but is taking a conscious look at emotions, experiences, actions, and responses, and using that information to add to their existing knowledge base and reach a higher level of understanding. Critical reflection as part of experiential education generates, deepens, and documents learning. As a result of this course, you will be able to articulate the value of your experiential education opportunities toward marketing yourself for potential job opportunities and develop the skills needed to become a reflective practitioner for promotional growth in your future career. Permission of department required.

Learning Outcomes: 1. Reflect on experiential education experiences; Identify knowledge and skills gained from experiences; Identify connections between experiences and disciplinary knowledge. 2. Apply theories and concepts to practical sustainability problems; Identify ways in which individual actions within experiences contributed to improving sustainability; Identify ways to individually contribute to improving sustainability in future

professional practice. 3. Synthesize experiential education experiences into a career development plan; Articulate strengths and weaknesses observed within experiences; Develop a self-improvement plan for future professional practice; Identify a potential career path; Synthesize knowledge and skills gained into high-quality LinkedIn page and Strengths Statement. Credits: 1.00

EEE 48001 - Environmental And Ecological Engineering Senior Design I

Credit Hours: 1.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems. Permission of department required.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Have an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 1.00

14 Credits

Spring 4th Year

EEE 48002 - Environmental And Ecological Engineering Senior Design II

Credit Hours: 2.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Gain an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 2.00

17 Credits

Environmental and Natural Resources Engineering, BSAGE

About the Program

Degree Requirements

Departmental/Program Major Courses (25 credits)

Required Major Courses (25 credits)

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify

relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS) Credits: 1.00

ABE 30500 - Physical Properties Of Biological Materials

Credit Hours: 3.00. Physical properties of agricultural crops and food products and their relationship to harvesting, storage, and processing. Physical properties covered include: density, shape, moisture content, water potential, water activity, friction and flow or particulate solids, terminal velocity, thermal properties, interaction with electromagnetic radiation, and viscoelastic behavior of solids.

Credits: 3.00

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired

goal subject to constraints. Credits: 4.00

ABE 48400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Credits: 1.00

ABE 48600 - Agricultural Engineering Design

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ABE 48400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive design report and/or project reports for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams with consultation available to students from government and industry engineers and marketing personnel. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering or project management practice with professionalism and ethical responsibility. Credits: 3.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

ABE 42500 - Water Quality Engineering

Credit Hours: 3.00. This course provides in-depth perspectives on water quality in source and environmental water systems (lakes, rivers, groundwaters, and coastal waters) including sources and causes of water quality impairments and design of workable and cost-effective management solutions. The course integrates hydrology, chemistry, biology, and ecology as foundations of water quality management and incorporates operation mechanisms of management practices in designing solutions for pollution control. Students will have opportunities to engage with lectures, water quality measurements and data analysis, computer modeling, case studies, design, and discussion sessions.

Learning Outcomes: 1. Identify causes and sources of water quality impairments. 2. Explain the health, ecological, and societal consequences of impaired waters. 3. Collect in-field water quality measurements. 4. Analyze water samples and associated data. 5. Design watershed-based solutions for pollutant control and water quality protection. Credits: 3.00

ABE 42600 - Ecological Restoration Engineering

Credit Hours: 3.00. This course focuses on ecologically-based design principles to restore degraded ecosystems, specifically wetlands, stream/floodplains, and prairies. Students will identify and synthesize design elements, natural and anthropogenic stresses, and management considerations to develop resilient restoration designs. Laboratory experience provides open-ended projects, data collection, and field trips to reinforce the design process.

Learning Outcomes: 1. Identify and synthesize design elements, natural and anthropogenic stresses, and management considerations for restored streams, floodplains & riparian zones, wetlands, and prairies. 2. Apply governing principles of ecological engineering, including biological, chemical, and physical conditions to develop resilient restoration designs. 3. Characterize and give examples of ecological concepts, such as water and elemental cycling, vegetation succession, food web dynamics, and ecological disturbance and how they apply to monitoring restoration success. 4. Read and extract key findings from readings. 5. Communicate effectively in written and oral format to a wide audience. Credits: 3.00

Other Departmental/Program Requirements (101-111 credits)

Other Departmental Courses (72 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.

Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

CE 38300 - Geotechnical Engineering I

Credit Hours: 3.00. Introduction to the nature and origin of soils and rocks; engineering significance of geologic landforms and soil deposits; identification and engineering classification of soils; engineering behavior and properties of soils; permeability, compressibility, shearing resistance; soil compaction.

Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Electives (0-2 credits)

Supplemental List

GPA Requirements

Transfer Credit Policy

Sample 3-Year Plan

Fall 2nd Year

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4. Interpret results of statistical analyses and

communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS) Credits: 1.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop

observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

18 Credits

Spring 2nd Year

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in

a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

17 Credits

Fall 3rd Year

ABE 30500 - Physical Properties Of Biological Materials

Credit Hours: 3.00. Physical properties of agricultural crops and food products and their relationship to harvesting, storage, and processing. Physical properties covered include: density, shape, moisture content, water potential, water activity, friction and flow or particulate solids, terminal velocity, thermal properties, interaction with electromagnetic radiation, and viscoelastic behavior of solids.

Credits: 3.00

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired goal subject to constraints. Credits: 4.00

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

17 Credits

Spring 3rd Year

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CE 38300 - Geotechnical Engineering I

Credit Hours: 3.00. Introduction to the nature and origin of soils and rocks; engineering significance of geologic landforms and soil deposits; identification and engineering classification of soils; engineering behavior and properties of soils; permeability, compressibility, shearing resistance; soil compaction.

Credits: 3.00

ABE 42500 - Water Quality Engineering

Credit Hours: 3.00. This course provides in-depth perspectives on water quality in source and environmental water systems (lakes, rivers, groundwaters, and coastal waters) including sources and causes of water quality impairments and design of workable and cost-effective management solutions. The course integrates hydrology, chemistry, biology, and ecology as foundations of water quality management and incorporates operation mechanisms of management practices in designing solutions for pollution control. Students will have opportunities to engage with lectures, water quality measurements and data analysis, computer modeling, case studies, design, and discussion sessions.

Learning Outcomes: 1. Identify causes and sources of water quality impairments. 2. Explain the health, ecological, and societal consequences of impaired waters. 3. Collect in-field water quality measurements. 4. Analyze water samples and associated data. 5. Design watershed-based solutions for pollutant control and water quality protection. Credits: 3.00

ABE 42600 - Ecological Restoration Engineering

Credit Hours: 3.00. This course focuses on ecologically-based design principles to restore degraded ecosystems, specifically wetlands, stream/floodplains, and prairies. Students will identify and synthesize design elements, natural and anthropogenic stresses, and management considerations to develop resilient restoration designs. Laboratory experience provides open-ended projects, data collection, and field trips to reinforce the design process.

Learning Outcomes: 1. Identify and synthesize design elements, natural and anthropogenic stresses, and management considerations for restored streams, floodplains & riparian zones, wetlands, and prairies. 2. Apply governing principles of ecological engineering, including biological, chemical, and physical conditions to develop resilient restoration designs. 3. Characterize and give examples of ecological concepts, such as water and elemental cycling, vegetation succession, food web dynamics, and ecological disturbance and how they apply to monitoring restoration success. 4. Read and extract key findings from readings. 5. Communicate effectively in written and oral format to a wide audience. Credits: 3.00

16 Credits

Fall 4th Year

ABE 48400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Credits: 1.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

17 Credits

Spring 4th Year

ABE 48600 - Agricultural Engineering Design

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ABE 48400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive design report and/or project reports for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams with consultation available to students from government and industry engineers and marketing personnel. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering or project management practice with professionalism and ethical responsibility.

Credits: 3.00

14-15 Credits

Environmental Geoscience, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (53-54 credits)

Required Major Courses (53-54 credits)

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak

with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 36000 - Environmental And Ecological Engineering Laboratory

Credit Hours: 1.00 to 3.00. An introduction to laboratory methods of analysis of Environmental and Ecological Engineering systems. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes experimental design, treatment of data, the analytical determination of chemical and biological constituents in water, soil, and air; analysis of environmental and ecological engineering processes; analysis of life-cycle characteristics and impacts of consumer products and commodities; methods of prevention and remediation of manufacturing waste streams.

Learning Outcomes: 1. Ability to acquire experimental data and evaluate experimental error and variability. 2. Understanding of data reduction, analysis and presentation. 3. Ability to produce professional technical communication of experimental conclusions. 4. Ability to summarize results of quantitative analysis to propose management strategies for environmental problems. Credits: 1.00 to 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource

policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior

course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 38500 - Principles Of Engineering Geology

Credit Hours: 3.00. Application of geology to evaluation of design and construction problems relating to dams, highways, tunnels, and reservoirs; review of construction material sources and their utilization. A field investigation is required. Prior course work in mineralogy, petrology or geology for engineers is required.

Credits: 3.00

EAPS 41900 - Internship In Environmental Geosciences

Credit Hours: 1.00 to 6.00. This course provides students with an opportunity to gain practical work experience in environmental geoscience. The student works with a faculty advisor to set up an internship consisting of the equivalent of at least six weeks of full-time employment with a government agency, business, or consulting company. Internships typically involve field, laboratory, and office work. A portion of the internship may be part-time work during a regular semester, but at least three consecutive weeks must be full-time work. One credit hour per week of unpaid internship. Six week internship. Prior course work in upper level EAPS courses is required. Permission of department required.

Credits: 1.00 to 6.00

EAPS 49700 - Earth And Atmospheric Sciences Undergraduate Readings And Research

Credit Hours: 1.00 to 6.00. Supervised reading and/or research in various fields. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

EAPS 59100 - Advanced Topics In Earth And Atmospheric Sciences

Credit Hours: 0.00 to 18.00. Specialized study offered on an individual basis or through specially arranged courses. Permission of instructor required.

Credits: 0.00 to 18.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose

zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 31500 - Biogeochemistry

Credit Hours: 3.00. The course examines the main element cycles of Earth: carbon, oxygen/hydrogen, nitrogen, sulfur, phosphorous, and trace metals, and how they are interconnected from terrestrial, aquatic/ocean, and atmospheric perspectives. General chemistry concepts such as equilibrium, free energy, electrochemistry are used to understand the energetics of the cycles. Connection between the cycles and environmental problems, such as climate change and air pollution will be emphasized.

Learning Outcomes: 1. Construct a mental model of the Earth system and the flow of elements among different parts of the system. 2. Examine modern problems caused by human perturbation of the main biogeochemical cycles. 3. Perform basic research tasks and present scientific findings. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

EAPS 47700 - Earth And Planetary GIS

Credit Hours: 3.00. In this course, students will learn to display and analyze Earth and planetary data using geographic information systems (GIS). Students will learn how to find and work with data from various sources, including satellites and spacecraft missions. Using a variety of spatial data, students will make maps and visualizations of data, perform analyses using a range of toolboxes, and implement workflows in geoprocessing.

Learning Outcomes: 1. Communicate applications of GIS in the real world. 2. Locate geospatially relevant datasets in online repositories. 3. Organize and manage files (and their appropriate formats) used within GIS software. 4. Identify limitations and gaps in remote sensing datasets. 5. Design and implement a workflow to analyze remote sensing data. 6. Create maps and figures that visualize products within a geospatial analysis workflow. 7. Describe a goal (i.e., hypothesis being tested) that geospatial analysis can address, as well as the data inputs, steps in the workflow, and outcome (i.e., results) of the analysis in the form of a webpost that can be shared with employers and other GIS users.

Credits: 3.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

Other Departmental/Program Course Requirements (42-68 credits)

College of Science Additional Requirements

Computing (2-4 credits)

ECE 49500 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

Credits: 1.00 to 4.00

ENGR 14200 - Honors Creativity And Innovation In Engineering Design II

Credit Hours: 3.50. This course continues building on the foundation developed in ENGR 14100 . Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students extend and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., C, Excel®, LabView®, MATLAB®, and Python).

Learning Outcomes: 1. Describe, in greater depth, the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a mathematical model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and

visually and demonstrate skills for cross-cultural communication. 7. Further development of strategies to facilitate generating creative ideas for complex design challenges. 8. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 9. Implement complex algorithmic solutions to engineering problems/designs using the most appropriate computer tool (C , Excel, LABVIEW, MATLAB, and Python) and be able to explain your rationale for your choice. 10. Apply a systems approach in solving engineering problems and in undertaking design projects. 11. Synthesize your knowledge of effective and ethical membership on a technical team (i.e., teaming skills) to appropriately behavior. 12 Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

ENGR 16200 - Honors Introduction To Innovation And The Physical Science Of Engineering Design II (UCC: IL/SCI)

Credit Hours: 4.00. Students will take an in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. The students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g. MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control in an effort to identify and characterize physical material systems.

*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Utilize knowledge of the engineering education process, courses, and options, and engineering job functions and roles to prepare a final course of study for academic and career success (3). 2. Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories (10). 3. Apply the unified approach to material interactions to a broad array of applications including asteroids, black holes, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity (7). 4. Model natural phenomena using computer simulations (7). 5. Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem solving to ensure that the broader impacts of engineering work are consistently evaluated and accounted for (3). 6. Display proficiency in the applications of engineering content knowledge including statistics, statics, mechanics of materials, the universal accounting equation, electrical theory, and design of experiments (8). 7. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole (2). 8. Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (2). 9. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 10. Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms (5). 11. Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class (3). 12. Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 13. Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (3). 14. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering challenges (2). Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Discover data science

and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8-10 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this

course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the

experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze

experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus -

Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical

methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

Required Pre-Requisite Course (4 credits)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students

not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Electives (0-25 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on

groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum

theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 5.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.
Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions,

thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-18 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test

hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined

reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

16-17 Credits

Spring 2nd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT

30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but

rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

15-16 Credits

Fall 3rd Year

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 36000 - Environmental And Ecological Engineering Laboratory

Credit Hours: 1.00 to 3.00. An introduction to laboratory methods of analysis of Environmental and Ecological Engineering systems. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes experimental design, treatment of data, the analytical determination of chemical and biological constituents in water, soil, and air; analysis of environmental and ecological engineering processes; analysis of life-cycle characteristics and impacts of consumer products and commodities; methods of prevention and remediation of manufacturing waste streams.

Learning Outcomes: 1. Ability to acquire experimental data and evaluate experimental error and variability. 2. Understanding of data reduction, analysis and presentation. 3. Ability

to produce professional technical communication of experimental conclusions. 4. Ability to summarize results of quantitative analysis to propose management strategies for environmental problems. Credits: 1.00 to 3.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 38500 - Principles Of Engineering Geology

Credit Hours: 3.00. Application of geology to evaluation of design and construction problems relating to dams, highways, tunnels, and reservoirs; review of construction material sources and their utilization. A field investigation is required. Prior course work in mineralogy, petrology or geology for engineers is required.

Credits: 3.00

EAPS 31500 - Biogeochemistry

Credit Hours: 3.00. The course examines the main element cycles of Earth: carbon, oxygen/hydrogen, nitrogen, sulfur, phosphorous, and trace metals, and how they are interconnected from terrestrial, aquatic/ocean, and atmospheric perspectives. General chemistry concepts such as equilibrium, free energy, electrochemistry are used to understand the energetics of the cycles. Connection between the cycles and environmental problems, such as climate change and air pollution will be emphasized.

Learning Outcomes: 1. Construct a mental model of the Earth system and the flow of elements among different parts of the system. 2. Examine modern problems caused by human perturbation of the main biogeochemical cycles. 3. Perform basic research tasks and present scientific findings. Credits: 3.00

13 Credits

Spring 3rd Year

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points

of view. Credits: 3.00

13-14 Credits

Fall 4th Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

12-15 Credits

Spring 4th Year

EAPS 41900 - Internship In Environmental Geosciences

Credit Hours: 1.00 to 6.00. This course provides students with an opportunity to gain practical work experience in environmental geoscience. The student works with a faculty advisor to set up an internship consisting of the equivalent of at least six weeks of full-time employment with a government agency, business, or consulting company. Internships typically involve field, laboratory, and office work. A portion of the internship may be part-time work during a regular semester, but at least three consecutive weeks must be full-time work. One credit hour per week of unpaid internship. Six week internship. Prior course work in upper level EAPS courses is required. Permission of department required.

Credits: 1.00 to 6.00

EAPS 49700 - Earth And Atmospheric Sciences Undergraduate Readings And Research

Credit Hours: 1.00 to 6.00. Supervised reading and/or research in various fields. Permission of instructor required.

Credits: 1.00 to 6.00

13-16 Credits

Family and Consumer Sciences Education, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (109 credits)

Required Major Courses (109 credits)

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2.

Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 31000 - Guidance In Early Childhood

Credit Hours: 3.00. This course presents a developmental, child-centered approach to the guidance and discipline of young children, including children with disabilities. Influential theories, relevant research, and effective guidance methods for the early childhood teachers and other professionals working with young children and families, including families from different cultural and economic backgrounds, are discussed. Admitted to Gate B.

Learning Outcomes: 1. Understand the primary components of child guidance at different developmental stages. 2. Plan and implement developmentally appropriate methods of child guidance and discipline. 3. Understand the influential theoretical perspectives of child guidance/discipline. 4. Modify expectations and guidance strategies appropriately for children with diverse abilities, family demographic characteristics, and cultural backgrounds. 5. Promote and create environments and lessons that prevent challenging behaviors. 6. Demonstrate desirable modeling of behavior. 7. Increase understanding and skills surrounding effective communication with children and parents about child guidance. 8. Gain critical knowledge of the importance of understanding diverse family and community characteristics and how they influence child behavior. 9. Increase understanding and skills for engaging with families, other educators,
and practitioners on child guidance. 10. Demonstrate growth in professionalism as early childhood educators. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

HDFS 31300 - Adolescent Development

Credit Hours: 3.00. An overview of the normative developmental changes that occur during adolescence, with specific attention to individual and relational adjustment.

Learning Outcomes: 1. Critically evaluate popular conceptions of adolescence and adolescents. 2. Compare and contrast theoretical perspectives on normative development during adolescence. 3. Identify the diversity in the developmental pathways during adolescence. 4. Acquire a framework for assessing the connections between interpersonal development and the larger social context. Credits: 3.00

HDFS 33000 - Sexuality And Family Life

Credit Hours: 3.00. Provides the student with a basic knowledge of human sexuality as it pertains to individuals,

couples and families. The course is designed to be helpful to students who will become family life educators as well as to be helpful to students as individuals, spouses, and parents.

Learning Outcomes: 1. Construct a basic knowledge of human sexuality as it pertains to family relations in the personal and professional settings. 2. Compare and describe social, cultural, historical, and technological trends and the interrelationships between these trends and their impact on sexuality, family relations, and personal values and attitudes. 3. Differentiate and examine the many different aspects of sexuality including biological, developmental, medical, cultural, historical, and interpersonal. 4. Demonstrate knowledge that helps to develop a better understanding of students' own feelings and attitudes related to sexuality and how those attitudes and feelings influence their beliefs about individuals, couples, and families. Credits: 3.00

HDFS 33100 - Skills For Helping Professionals In Individual, Family And Group Settings

Credit Hours: 3.00. This course is an introduction to skills commonly used in helping professions, including relationship-building skills, beginning interviewing skills, and group process skills. Attention is paid to cultural competence and professional ethics. This course includes a weekly lab experience involving practice of the helping skills, as well as a service-learning project in which helping skills are used in a community setting.

Learning Outcomes: 1. Use basic helping skills effectively in both individual and group contexts. 2. Evaluate your own helping interactions and those of others, including making constructive suggestions for improvement. 3. Design, implement, and reflect on a service-learning project that uses helping skills in a community setting. 4. Contribute to your team's successful service-learning project and provide leadership to the team as appropriate. 5. Reflect on your experiences in the course through your writing and use those reflections to promote development toward your own professional goals. Credits: 3.00

HDFS 34800 - Administration Of Social Service Not-For-Profit Organizations

Credit Hours: 3.00. This course introduces students to aspects of not-for-profit management identified as keys by leaders in existing agencies. Students will prepare themselves for specifically establishing, building, working in and leading not-for-profit organizations.

Learning Outcomes: 1. Demonstrate knowledge, comprehension, analysis and application supporting competence in the defining features of nonprofit management by interactively thinking critically and creatively to develop a board of directors; design a strategic plan; write a corresponding operations plan; diagram an evaluation logic model; prepare a budget; making a fund raising ask; write a fund raising letter; write a grant proposal; write a press release; and make oral presentations. 2. Demonstrate knowledge, comprehension, application, analysis and synthesis by interactively solving an administrative problem in a nonprofit agency case study and presenting the solution. Credits: 3.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss

substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate

effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

EDCI 20700 - Construction And Textile Lab Management

Credit Hours: 3.00. A lecture/lab course which provides clothing construction and textile science content to be applied in the secondary family and consumer sciences classroom.

Learning Outcomes: 1. Demonstrate clothing construction concepts. 2. Apply basic textile science to fabric and clothing selection. 3. Manage a clothing and/or textile lab within a secondary family and consumer sciences classroom. Credits: 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of

philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

PUBH 23000 - Community, Culture And Social Justice From A Public Health Perspective

Credit Hours: 3.00. The course provides an introduction to the concepts of community, culture, and social justice. The interaction between community, cultural, ethical, social, economic, environmental, political and social justice dynamics that shape health will be explored.

Learning Outcomes: 1. Identify and understand the social determinants of health. 2. Describe how community, cultural, ethical, social, economical, environmental, political and social justice shape human health both locally and globally using a social determinants of health framework. 3. Learn about theories of justice related to the field of public health. 4. Understand community developmental theoretical frameworks dimensions associated with the social change, such as empowerment, community participation, and capacity building. 5. Identify roles and responsibilities of the public health educator, other practitioners, and community members as agents of change. 6. Compare and contrast the concepts of health inequities, health disparities and health inequalities. Credits: 3.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology, processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

Required Major Courses (109 credits)

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 31000 - Guidance In Early Childhood

Credit Hours: 3.00. This course presents a developmental, child-centered approach to the guidance and discipline of young children, including children with disabilities. Influential theories, relevant research, and effective guidance methods for the early childhood teachers and other professionals working with young children and families, including families from different cultural and economic backgrounds, are discussed. Admitted to Gate B.

Learning Outcomes: 1. Understand the primary components of child guidance at different developmental stages. 2. Plan and implement developmentally appropriate methods of child guidance and discipline. 3. Understand the influential theoretical perspectives of child guidance/discipline. 4. Modify expectations and guidance strategies appropriately for children with diverse abilities, family demographic characteristics, and cultural backgrounds. 5. Promote and create environments and lessons that prevent challenging behaviors. 6. Demonstrate desirable modeling of behavior. 7. Increase understanding and skills surrounding effective communication with children and parents about child guidance. 8. Gain critical knowledge of the importance of understanding diverse family and community characteristics and how they influence child behavior. 9. Increase understanding and skills for engaging with families, other educators, and practitioners on child guidance. 10.

Demonstrate growth in professionalism as early childhood educators. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

HDFS 31300 - Adolescent Development

Credit Hours: 3.00. An overview of the normative developmental changes that occur during adolescence, with specific attention to individual and relational adjustment.

Learning Outcomes: 1. Critically evaluate popular conceptions of adolescence and adolescents. 2. Compare and contrast theoretical perspectives on normative development during adolescence. 3. Identify the diversity in the developmental pathways during adolescence. 4. Acquire a framework for assessing the connections between interpersonal development and the larger social context. Credits: 3.00

HDFS 33000 - Sexuality And Family Life

Credit Hours: 3.00. Provides the student with a basic knowledge of human sexuality as it pertains to individuals, couples and families. The course is designed to be helpful to students who will become family life educators as well as to be helpful to students as individuals, spouses, and parents.

Learning Outcomes: 1. Construct a basic knowledge of human sexuality as it pertains to family relations in the personal and professional settings. 2. Compare and describe social, cultural, historical, and technological trends and the interrelationships between these trends and their impact on sexuality, family relations, and personal values and attitudes. 3. Differentiate and examine the many different aspects of sexuality including biological, developmental, medical, cultural, historical, and interpersonal. 4. Demonstrate knowledge that helps to develop a better understanding of students' own feelings and attitudes related to sexuality and how those attitudes and feelings influence their beliefs about individuals, couples, and families. Credits: 3.00

HDFS 33100 - Skills For Helping Professionals In Individual, Family And Group Settings

Credit Hours: 3.00. This course is an introduction to skills commonly used in helping professions, including relationship-building skills, beginning interviewing skills, and group process skills. Attention is paid to cultural competence and professional ethics. This course includes a weekly lab experience involving practice of the helping skills, as well as a service-learning project in which helping skills are used in a community setting.

Learning Outcomes: 1. Use basic helping skills effectively in both individual and group contexts. 2. Evaluate your own helping interactions and those of others, including making constructive suggestions for improvement. 3. Design, implement, and reflect on a service-learning project that uses helping skills in a community setting. 4. Contribute to your team's successful service-learning project and provide leadership to the team as appropriate. 5. Reflect on your

experiences in the course through your writing and use those reflections to promote development toward your own professional goals. Credits: 3.00

HDFS 34800 - Administration Of Social Service Not-For-Profit Organizations

Credit Hours: 3.00. This course introduces students to aspects of not-for-profit management identified as keys by leaders in existing agencies. Students will prepare themselves for specifically establishing, building, working in and leading not-for-profit organizations.

Learning Outcomes: 1. Demonstrate knowledge, comprehension, analysis and application supporting competence in the defining features of nonprofit management by interactively thinking critically and creatively to develop a board of directors; design a strategic plan; write a corresponding operations plan; diagram an evaluation logic model; prepare a budget; making a fund raising ask; write a fund raising letter; write a grant proposal; write a press release; and make oral presentations. 2. Demonstrate knowledge, comprehension, application, analysis and synthesis by interactively solving an administrative problem in a nonprofit agency case study and presenting the solution. Credits: 3.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe

special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits

and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

EDCI 20700 - Construction And Textile Lab Management

Credit Hours: 3.00. A lecture/lab course which provides clothing construction and textile science content to be applied in the secondary family and consumer sciences classroom.

Learning Outcomes: 1. Demonstrate clothing construction concepts. 2. Apply basic textile science to fabric and clothing selection. 3. Manage a clothing and/or textile lab within a secondary family and consumer sciences classroom. Credits: 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

PUBH 23000 - Community, Culture And Social Justice From A Public Health Perspective

Credit Hours: 3.00. The course provides an introduction to the concepts of community, culture, and social justice. The interaction between community, cultural, ethical, social, economic, environmental, political and social justice dynamics that shape health will be explored.

Learning Outcomes: 1. Identify and understand the social determinants of health. 2. Describe how community, cultural, ethical, social, economical, environmental, political and social justice shape human health both locally and globally using a social determinants of health framework. 3. Learn about theories of justice related to the field of public health. 4. Understand community developmental theoretical frameworks dimensions associated with the social change, such as empowerment, community participation, and capacity building. 5. Identify roles and responsibilities of the public health educator, other practitioners, and community members as agents of change. 6. Compare and contrast the concepts of health inequities, health disparities and health inequalities. Credits: 3.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated

with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology, processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

Professional Education Requirements

Foundational Courses

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of

the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8.

Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of

learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Family & Consumer Sciences Education

EDCI 25000 - Professional Development In Family And Consumer Sciences Education

Credit Hours: 0.00 to 2.00. This course focuses on students' professional development as family and consumer sciences educators. Characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; the Purdue Family and Consumer Sciences Education program; and expectations for Indiana FCS teacher-licensure are emphasized. Includes participation in professional organizations and meetings.

Learning Outcomes: 1. Formulate and implement plans for building and documenting one's professional identity, competence, and career development as a family and consumer sciences educator. 2. Examine characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; coursework and field-based experiences in the Purdue Family and Consumer Sciences Education (FCSE) program; and licensure requirements and standards for teachers of family and consumer sciences. Credits: 0.00 to 2.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

EDCI 35600 - Career Education In Family And Consumer Sciences

Credit Hours: 3.00. Examination of middle and high school career education accomplished through family and consumer sciences, including (1) life and career exploration and planning; (2) analysis of career paths and opportunities in family and consumer sciences; and (3) career preparation through laboratory and cooperative education programs. Historical and contemporary foundations for career education in family and consumer sciences is also are addressed. Includes observations and interactions with students and teachers in career-education programs and participation in professional meetings.

Learning Outcomes: 1. Examine purposes, curriculum, and implementation strategies for career education accomplished through family and consumer sciences, including FCS careers, FCS supporting content, and FCS life and career foundations. 2. Examine the structure

and delivery of career and technical education in the United States and Indiana, state and federal laws and regulations pertaining to career and technical education, and important events and developments in the history of career and technical education and family and consumer sciences education. 3. Engage in ethical professional practice professional development, and outreach in family and consumer sciences education, including advocacy and working with local advisory committees. 4. Analyze instructional strategies and procedures for career education in family and consumer sciences, including integration of career and technical student organizations, particularly the Family, Career and Community Leaders of America (FCCLA) and coordination of students' work-based learning experiences through in-school laboratories and community-based placements. Credits: 3.00

EDCI 36000 - Curriculum And Instruction In Family And Consumer Sciences: Middle School

Credit Hours: 3.00. Instructional program development for family and consumer sciences. Developmental needs and issues of early adolescents; study of adolescent literacy; and curriculum integration of language arts, math, and other content areas are emphasized. Development of a comprehensive unit of instruction that incorporates standard-based curriculum, assessment, and instruction for family and consumer sciences is a major component of the course. Includes observations and interactions with family and consumer sciences teachers and students and participation in professional meetings.

Learning Outcomes: 1. Utilize middle school philosophy/perspectives, state-level resources, and community assets to guide curriculum development in Family & Consumer Sciences that is challenging, exploratory, integrative, and diverse, and which fosters learning that is active, purposeful, and democratic. (FCS TEd 7) 2. Integrate professional knowledge/behaviors supportive of middle-level education learner development (physical, cognitive, socio-emotional, psychological) into FCS curricula/practices, attentive to the health, wellness, and social-emotional competence of learners. (FCS TEd 8) 3. Employ professional and other resources to develop a "literary" classroom environment that reflects all students. (FCS TEd 11) 4. Identify and collect resources, references, and other materials that support the identity, intellect, skill, and criticality development of students across FCS content. (FCS-Ted) 5. Create student-centered learning experiences in blended and online settings using UDL principles that are culturally responsive (TIBOT competency 3; FCS-Ted 7, 8, 11) 6. Review and critique FCS curriculum materials and practices for alignment with best practices for inclusion, access, equity, and diversity. (FCS-TEd 7, 8) 7. Relate family and consumer sciences programs to broader educational program goals and to community assets and needs. 8. Integrate foundational FCS perspectives (historical lens, Body of Knowledge, Critical Science approach) into professional schema. (FCS-TEd 12) 9. Develop and reflect on personal/professional characteristics that shape optimal middle school/FCS educator practice. (FCS-TEd 12) Credits: 3.00

EDCI 44400 - Methods For Teaching Family And Consumer Sciences

Credit Hours: 4.00. The culminating on-campus teacher-education course for the Purdue University Family and Consumer Sciences program. The course builds and consolidates teacher-candidates' knowledge and skills for teaching family and consumer sciences. Emphasis placed on standards-based instructional planning and materials; instructional strategies, including laboratories, assessment of student learning, and classroom management. Course includes field experiences. Program content requirements should be completed previous to or concurrent with this course.

Learning Outcomes: 1. Establish a comprehensive knowledge base of standards in a range of family and consumer sciences content areas, with a corresponding knowledge

base for integrating standards in other areas such as financial literacy, technology, English Language Arts, and mathematics. 2. Design and implement standards-based curriculum, teaching/learning strategies, and assessment of student learning to meet the needs of diverse learners. 3. Apply knowledge of student behavior, organizational skills, and classroom and laboratory management skills to create a safe, supportive, and productive learning environment. 4. Enable student learning of family and consumer sciences concepts and skills through instructional strategies and laboratory experiences that build student capacities for self-directed learning, critical-thinking, problem-solving, decision-making, leadership, and managent. Credits: 4.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

Learner Specialty Pathway Optional Concentration

Foundational Courses

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze

different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with

disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501. Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural. University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Other Departmental/Program Course Requirements (16-19 credits)

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform

research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions,

and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

MA 15555 - Quantitative Reasoning (UCC: QR)

Credit Hours: 3.00. This course will cover important mathematical ideas, including proportion, weighted averages, linear models, exponential models, basic probability and statistics, and some algebra, by using concrete real-world problems. It will not be a prerequisite for any other mathematics course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn proportion and how to apply it to unit conversions, percentage, sales tax and discounts, and inflation. 2. Learn weighted averages and how they apply to the consumer price index and other examples. 3. Learn paradoxes involving weighted averages. 4. Learn linear models and how they apply to electricity bills, income taxes, and climate change. 5. Learn exponential growth and how it applies to compound interest and other financial issues. 6. Learn basic probability theory and how it applies to insurance and games of chance. 7. Learn how algebra is related to the other things learned. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

SYS 30000 - It's A Complex World - Addressing Global Challenges (UCC: STS)

Credit Hours: 3.00. The main goal of this course is to address grand challenges that are of global concern - such as environmental sustainability and energy use, natural and human disasters, and political and economic development - using the ideas and tools of complex adaptive systems. The course exploits the broad expertise of the four faculty members by treating these challenges from diverse disciplinary perspectives, from the biological and physical sciences, to the social sciences, to engineering. By way of a set of case studies, students will analyze the features of these challenges which make them complex, and seek to explain and find solutions to the problems that arise in each case. Their treatment of the cases will be informed by published research and computer simulation. Students will actively participate in discussions regarding these global challenges, and contribute to the progress of the class using oral and written presentations. The course will culminate with a final project completed by teams composed of students from different disciplines.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe global challenges using engineering, biological, physical, and social scientific perspectives, including attention to the interdependence of the different perspectives. 2. Explain the fundamental concepts of 'complex adaptive systems, ' including applications to different global challenges. 3. Develop basic proficiency in applying computer modeling to represent the behavior of complex systems, with applications to the global challenges. 4. Apply the concepts and tools of complexity research to develop a group-based proposal of comprehensive policies/solutions/strategies in a new and unresolved problem area. Credits: 3.00

HIST 30305 - Food In Modern America (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the kitchen as an architectural space, a place of labor and food production, and an arena for technological innovation in modern American history. Cooking and eating reflect cultural sentiments about modernity, progress, ethnicity, and family, and the politics of how society nourishes bodies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Think historically and critically about the cultural consequences of technologies related to eating and food preparation. 2. Think historically and critically about approaches to the study of national identify and culture expressed through food. 3. Appreciate the circumstances and history of kitchen design in relation to raced and gendered identities, home space, and food preparation. 4. Understand and recognize how assumptions about food production during the late 19th and 20th centuries in the United States

reflected notions about labor, modernity, and progress. 5. Understand the difference between secondary and primary sources. Students will analyze and interpret primary documents related to kitchens, cooking, and food preparation. They also will understand the competing and conflicting nature of historical interpretation. 6. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

EDCI 22200 - Knowing The World Through Mathematics (UCC: QR)

Credit Hours: 3.00. In this course, *Knowing the World Through Mathematics*, students will connect their situated experiences to larger trends in equity and social justice around the globe through mathematical investigations embedded in the context of the United Nations 2030 Agenda (United Nations, 2015). Students in this course will make use of mathematics and global policy documents to critically interpret, model, and represent world phenomena. Students will collaboratively analyze quantitative information gathered through trustworthy, globally representative data sets and individual survey and questionnaire items to investigate local experiences in relation to students' area(s) of interest. Students will learn about and utilize the GAISE Framework for Statistical Problem Solving (Franklin, et al., 2005) and the Four Dimensions of Equity in Mathematics Education (Gutiérrez, 2012) to ground their discussions and deliverables for *Knowing the World Through Mathematics*.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use a critical mathematics perspective to interpret world patterns, situations, and events. 2. Create mathematical models of world phenomena. 3. Use multiple mathematical representations to present global issues. 4. Identify and implement appropriate mathematical strategies to investigate world phenomena. 5. Express mathematical arguments related to world phenomena. 6. Use mathematics to explore global policy documents. 7. Explore world phenomena through quantitative (and qualitative) methods. Credits: 3.00

GPA Requirements

Teacher Licensure Information

Non-course / Non-credit Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 25000 - Professional Development In Family And Consumer Sciences Education

Credit Hours: 0.00 to 2.00. This course focuses on students' professional development as family and consumer sciences educators. Characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; the Purdue Family and Consumer Sciences Education program; and expectations for Indiana FCS teacher-licensure are emphasized. Includes participation in professional organizations and meetings.

Learning Outcomes: 1. Formulate and implement plans for building and documenting one's professional identity, competence, and career development as a family and consumer sciences educator. 2. Examine characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; coursework and field-based experiences in the Purdue Family and Consumer Sciences Education (FCSE) program; and licensure requirements and standards for teachers of family and consumer sciences. Credits: 0.00 to 2.00

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve

problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

16 Credits

16 Credits

Spring 1st Year

EDCI 25000 - Professional Development In Family And Consumer Sciences Education

Credit Hours: 0.00 to 2.00. This course focuses on students' professional development as family and consumer sciences educators. Characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; the Purdue Family and Consumer Sciences Education program; and expectations for Indiana FCS teacher-licensure are emphasized. Includes participation in professional organizations and meetings.

Learning Outcomes: 1. Formulate and implement plans for building and documenting one's professional identity, competence, and career development as a family and consumer sciences educator. 2. Examine characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; coursework and field-based experiences in the Purdue Family and Consumer Sciences Education (FCSE) program; and licensure requirements and standards for teachers of family and consumer sciences. Credits: 0.00 to 2.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify key physical,

cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and

identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

17 Credits

Fall 2nd Year

EDCI 35600 - Career Education In Family And Consumer Sciences

Credit Hours: 3.00. Examination of middle and high school career education accomplished through family and consumer sciences, including (1) life and career exploration and planning; (2) analysis of career paths and opportunities in family and consumer sciences; and (3) career preparation through laboratory and cooperative education programs. Historical and contemporary foundations for career education in family and consumer sciences is also are addressed. Includes observations and interactions with students and teachers in career-education programs and participation in professional meetings.

Learning Outcomes: 1. Examine purposes, curriculum, and implementation strategies for career education accomplished through family and consumer sciences, including FCS careers, FCS supporting content, and FCS life and career foundations. 2. Examine the structure and delivery of career and technical education in the United States and Indiana, state and federal laws and regulations pertaining to career and technical education, and important events and developments in the history of career and technical education and family and consumer sciences education. 3. Engage in ethical professional practice professional development, and outreach in family and consumer sciences education, including advocacy and working with local advisory committees. 4. Analyze instructional strategies and procedures for career education in family and consumer sciences, including integration of career and technical student organizations, particularly the Family, Career and Community Leaders of America (FCCLA) and coordination of students' work-based learning experiences through in-school laboratories and community-based placements. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to

assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 20700 - Construction And Textile Lab Management

Credit Hours: 3.00. A lecture/lab course which provides clothing construction and textile science content to be applied in the secondary family and consumer sciences classroom.

Learning Outcomes: 1. Demonstrate clothing construction concepts. 2. Apply basic textile science to fabric and clothing selection. 3. Manage a clothing and/or textile lab within a secondary family and consumer sciences classroom. Credits: 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

16 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual

differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology, processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

17-18 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the

ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

HDFS 33000 - Sexuality And Family Life

Credit Hours: 3.00. Provides the student with a basic knowledge of human sexuality as it pertains to individuals, couples and families. The course is designed to be helpful to students who will become family life educators as well as to be helpful to students as individuals, spouses, and parents.

Learning Outcomes: 1. Construct a basic knowledge of human sexuality as it pertains to family relations in the personal and professional settings. 2. Compare and describe social, cultural, historical, and technological trends and the interrelationships between these trends and their impact on sexuality, family relations, and personal values and attitudes. 3. Differentiate and examine the many different aspects of sexuality including biological, developmental, medical, cultural, historical, and interpersonal. 4. Demonstrate knowledge that helps to develop a better understanding of students' own feelings and attitudes related to sexuality and how those attitudes and feelings influence their beliefs about individuals, couples, and families. Credits: 3.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential

learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

15 Credits

Spring 3rd Year

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

EDCI 36000 - Curriculum And Instruction In Family And Consumer Sciences: Middle School

Credit Hours: 3.00. Instructional program development for family and consumer sciences. Developmental needs and issues of early adolescents; study of adolescent literacy; and curriculum integration of language arts, math, and other content areas are emphasized. Development of a comprehensive unit of instruction that incorporates standard-based curriculum, assessment, and instruction for family and consumer sciences is a major component of the course. Includes observations and interactions with family and consumer sciences teachers and students and participation in professional meetings.

Learning Outcomes: 1. Utilize middle school philosophy/perspectives, state-level resources, and community assets to guide curriculum development in Family & Consumer Sciences that is challenging, exploratory, integrative, and diverse, and which fosters learning that is active, purposeful, and democratic. (FCS TEd 7) 2. Integrate professional knowledge/behaviors supportive of middle-level education learner development (physical, cognitive, socio-emotional, psychological) into FCS curricula/practices, attentive to the health, wellness, and social-emotional competence of learners. (FCS TEd 8) 3. Employ professional and other resources to develop a "literary" classroom environment that reflects all

students. (FCS TEd 11) 4. Identify and collect resources, references, and other materials that support the identity, intellect, skill, and criticality development of students across FCS content. (FCS-Ted) 5. Create student-centered learning experiences in blended and online settings using UDL principles that are culturally responsive (TIBOT competency 3; FCS-Ted 7, 8, 11) 6. Review and critique FCS curriculum materials and practices for alignment with best practices for inclusion, access, equity, and diversity. (FCS-TEd 7, 8) 7. Relate family and consumer sciences programs to broader educational program goals and to community assets and needs. 8. Integrate foundational FCS perspectives (historical lens, Body of Knowledge, Critical Science approach) into professional schema. (FCS-TEd 12) 9. Develop and reflect on personal/professional characteristics that shape optimal middle school/FCS educator practice. (FCS-TEd 12) Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 31000 - Guidance In Early Childhood

Credit Hours: 3.00. This course presents a developmental, child-centered approach to the guidance and discipline of young children, including children with disabilities. Influential theories, relevant research, and effective guidance methods for the early childhood teachers and other professionals working with young children and families, including families from different cultural and economic backgrounds, are discussed. Admitted to Gate B.

Learning Outcomes: 1. Understand the primary components of child guidance at different developmental stages. 2. Plan and implement developmentally appropriate methods of child guidance and discipline. 3. Understand the influential theoretical perspectives of child guidance/discipline. 4. Modify expectations and guidance strategies appropriately for children with diverse abilities, family demographic characteristics, and cultural backgrounds. 5. Promote and create environments and lessons that prevent challenging behaviors. 6. Demonstrate desirable modeling of behavior. 7. Increase understanding and skills surrounding effective communication with children and parents about child guidance. 8. Gain critical knowledge of the importance of understanding diverse family and community characteristics and how they influence child behavior. 9. Increase understanding and skills for engaging with families, other educators, and practitioners on child guidance. 10. Demonstrate growth in professionalism as early childhood educators. Credits: 3.00

HDFS 31300 - Adolescent Development

Credit Hours: 3.00. An overview of the normative developmental changes that occur during adolescence, with specific attention to individual and relational adjustment.

Learning Outcomes: 1. Critically evaluate popular conceptions of adolescence and adolescents. 2. Compare and contrast theoretical perspectives on normative development during adolescence. 3. Identify the diversity in the developmental pathways during adolescence. 4. Acquire a framework for

assessing the connections between interpersonal development and the larger social context. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

18 Credits

18 Credits

Fall 4th Year

EDCI 44400 - Methods For Teaching Family And Consumer Sciences

Credit Hours: 4.00. The culminating on-campus teacher-education course for the Purdue University Family and Consumer Sciences program. The course builds and consolidates teacher-candidates' knowledge and skills for teaching family and consumer sciences. Emphasis placed on standards-based instructional planning and materials; instructional strategies, including laboratories, assessment of student learning, and classroom management. Course includes field experiences. Program content requirements should be completed previous to or concurrent with this course.

Learning Outcomes: 1. Establish a comprehensive knowledge base of standards in a range of family and consumer sciences content areas, with a corresponding knowledge base for integrating standards in other areas such as financial literacy, technology, English Language Arts, and mathematics. 2. Design and implement standards-based curriculum, teaching/learning strategies, and assessment of student learning to meet the needs of diverse learners. 3. Apply knowledge of student behavior, organizational skills, and classroom and laboratory management skills to create a safe, supportive, and productive learning environment. 4. Enable student learning of family and consumer sciences concepts and skills through instructional strategies and laboratory experiences that build student capacities for self-directed learning, critical-thinking, problem-solving, decision-making, leadership, and managent. Credits: 4.00

HDFS 33100 - Skills For Helping Professionals In Individual, Family And Group Settings

Credit Hours: 3.00. This course is an introduction to skills commonly used in helping professions, including relationship-building skills, beginning interviewing skills, and group process skills. Attention is paid to cultural competence and professional ethics. This course includes a weekly lab experience involving practice of the helping skills, as well as a service-learning project in which helping skills are used in a community setting.

Learning Outcomes: 1. Use basic helping skills effectively in both individual and group contexts. 2. Evaluate your own helping interactions and those of others, including making constructive suggestions for improvement. 3. Design, implement, and reflect on a service-learning project that uses helping skills in a community

setting. 4. Contribute to your team's successful service-learning project and provide leadership to the team as appropriate. 5. Reflect on your experiences in the course through your writing and use those reflections to promote development toward your own professional goals. Credits: 3.00

HDFS 34800 - Administration Of Social Service Not-For-Profit Organizations

Credit Hours: 3.00. This course introduces students to aspects of not-for-profit management identified as keys by leaders in existing agencies. Students will prepare themselves for specifically establishing, building, working in and leading not-for-profit organizations.

Learning Outcomes: 1. Demonstrate knowledge, comprehension, analysis and application supporting competence in the defining features of nonprofit management by interactively thinking critically and creatively to develop a board of directors; design a strategic plan; write a corresponding operations plan; diagram an evaluation logic model; prepare a budget; making a fund raising ask; write a fund raising letter; write a grant proposal; write a press release; and make oral presentations. 2. Demonstrate knowledge, comprehension, application, analysis and synthesis by interactively solving an administrative problem in a nonprofit agency case study and presenting the solution. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

PUBH 23000 - Community, Culture And Social Justice From A Public Health Perspective

Credit Hours: 3.00. The course provides an introduction to the concepts of community, culture, and social justice. The interaction between community, cultural, ethical, social, economic, environmental, political and social justice dynamics that shape health will be explored.

Learning Outcomes: 1. Identify and understand the social determinants of health. 2. Describe how community, cultural, ethical, social, economical, environmental, political and social justice shape human health both locally and globally using a social determinants of health framework. 3. Learn about theories of justice related to the field of public health. 4. Understand community developmental theoretical frameworks dimensions associated with the social change, such as empowerment, community participation, and capacity building. 5. Identify roles and responsibilities of the public health educator, other practitioners, and community members as agents of change. 6. Compare and contrast the concepts of health inequities, health disparities and health inequalities. Credits: 3.00

14-16 Credits

14-16 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

12 Credits

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 25000 - Professional Development In Family And Consumer Sciences Education

Credit Hours: 0.00 to 2.00. This course focuses on students' professional development as family and consumer sciences educators. Characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; the Purdue Family and Consumer Sciences Education program; and expectations for Indiana FCS teacher-licensure are emphasized. Includes participation in professional organizations and meetings.

Learning Outcomes: 1. Formulate and implement plans for building and documenting one's professional identity, competence, and career development as a family and consumer sciences educator. 2. Examine characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; coursework and field-based experiences in the

Purdue Family and Consumer Sciences Education (FCSE) program; and licensure requirements and standards for teachers of family and consumer sciences. Credits: 0.00 to 2.00

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

16 Credits

16 Credits

Program Learning Outcomes

About the Program

Farm Management, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (61 credits)

Required Major Courses (29 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a

rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6.

Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 41100 - Farm Management

Credit Hours: 4.00. Principles of farm organization and management, farmer interviews, and the application of computerized farm decision-making methods.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH

1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

Major Selectives (18 credits)

AGEC Department Selectives (14 credits)

Other Departmental /Program Course Requirements (43-44 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and

regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (15-16 credits)

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics,

the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational

decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

16-17 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent

data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations.
Credits: 3.00

15 Credits

Fall 2nd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career.
Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression

procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 2nd Year

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16 Credits

Fall 3rd Year

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use

spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

AGEC 41100 - Farm Management

Credit Hours: 4.00. Principles of farm organization and management, farmer interviews, and the application of computerized farm decision-making methods.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

16 Credits

Spring 4th Year

11-12 Credits

Fermentation Science, BS

The field of Fermentation Science integrates scientific disciplines, such as microbiology and biochemistry, with process

engineering to discover ways to use microbes as biotechnological factories to produce goods of societal value, from foods to biofuels to pharmaceuticals. A fermentation scientist possesses the skills necessary to engineer microbes to convert diverse feedstocks into value-added products, design and operate fermentation processes, and recover and refine the synthesized products. Graduates apply scientific knowledge and economic principles to biotechnology and fermentation operation, research, development, and marketing or pursue graduate studies in biotechnology, applied microbiology, or biological engineering.

Degree Requirements

Departmental/Program Major Courses (33 credits)

Required Major Courses (33 credits)

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

FS 29800 - Sophomore Seminar

Credit Hours: 1.00. Current food science issues will be discussed by students, staff, and guest speakers. Career planning and improvement of communication skills will be emphasized.

Learning Outcomes: 1. Construct a professional resume that includes educational background and experience. 2. Construct a professional cover letter in reference to a job posting. 3. Demonstrate the ability to professionally answer interview questions in an interview setting. 4. Demonstrate the ability to present information with PowerPoint software. 5. Identify your Myers Briggs personality profile. 6. Explore some current issues in the food industry. 7. Plan your coursework for each semester through graduation. Credits: 1.00

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.

Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3. Identify the conditions under which important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 36100 - Food Plant Sanitation

Credit Hours: 1.00. Relation of food-plant sanitation to good manufacturing practices and regulations affecting sanitation; organization of a food-plant sanitation program; sanitary building and equipment construction; selection of cleaning, sanitizing, and pesticidal compounds; water, air, and waste treatment; food storage and transportation.

Credits: 1.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 36300 - Food Microbiology Laboratory

Credit Hours: 2.00. Classic and molecular methods for enumerating, isolating, and identifying spoilage, fermentative, and pathogenic food microorganisms in food systems.

Learning Outcomes: 1. Perform proper aseptic technique. 2. Sample foods for microbial analyses. 3. Test food products for common microorganism. 4. Interpret data obtained from microbiological analysis. 4. Understand basic molecular techniques used to identify foodborne pathogens. Credits: 2.00

FS 44400 - Statistical Process Control

Credit Hours: 1.00. Basic concepts and techniques of solving quality problems and assuring the quality of production processes; emphasis is on quality improvement programs, problem-solving tools, control charts for variables and attributes, process capability analysis, and sampling methods. Course meets during weeks 6-10.

Credits: 1.00

FS 48200 - Food Science Senior Seminar

Credit Hours: 1.00. Oral and written reports on selected food science topics.

Credits: 1.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

FS 16300 - Introduction To Fermentation Sciences

Credit Hours: 3.00. This course will provide an overview of the use of microorganisms in the food, pharmaceutical and chemical industries. The course will introduce fundamental concepts associated to the microbiological transformation of various substrates to produce desirable products such as foods, beverages, pharmaceuticals or chemical compounds. As an introductory course, the scientific principles of fermentation processes will be gradually introduced through the analysis of familiar fermented food products, such as bread, cheese, beer, wine, cocoa, coffee, etc. Once the fundamental concepts are learned, examples of advanced fermentation technology for production of pharmaceutical products and fine chemicals will be presented.

Learning Outcomes: 1. Explain the role of microorganisms in the transformation of various substrates into desirable products. 2. Identify the type of microorganism (bacteria, yeast or mold) involved in the production of various fermented foods and beverages. 3. Explain the impact of environmental processing conditions (T, pH, aw, O2) on microbial growth. 4. Recognize the similarities across a wide variety of products made through fermentation. Credits: 3.00

FS 37200 - Fermentation Microbiology

Credit Hours: 3.00. This course explores the principles underlying the design of microbes for their use in biotechnological applications. This project-based course will teach students fundamental molecular biology techniques, important parameters for strain selection and genetic engineering, and reactor design and operation in bioprocessing. Additionally, this course will cover today's diverse bioengineering goals and tools and the role of microbial biotechnology in society.

Learning Outcomes: 1. Articulate the concept of microbial cell factories and the relationship of microorganisms to food and industrial fermentations. 2. Identify genetic and environmental approaches to control the products, rate, and yield of bioconversion. 3. Understand microbial metabolic pathways and how they are engineered. 4. Design genetic strategies to engineer microbes. 5. Read primary literature relevant to fermentation biotechnology. Credits: 3.00

FS 37300 - Fermentation Microbiology Laboratory

Credit Hours: 1.00. The course provides a laboratory-based experiential learning experience with the learning of fundamental aspects of genetic, physiological and substrate manipulation to achieve product formation in industrial microbes.

Learning Outcomes: 1. Understand the genetic manipulation and physiological factors involved in successful fermentation approaches. 2. Apply various methods of monitoring growth of various bioreactor formats. 3. Manipulate and correlate growth with yield of organisms and products. 4. Identify the basic problems which cause fermentation processes to fail and understand the reasons for failure. 5. Create and troubleshoot a simple fermentation process. Credits: 1.00

FS 40100 - Fermentation Processing

Credit Hours: 2.00. The Integration of fermentation core concepts; the application of bioprocess engineering principles to biological systems; topics covering enzyme kinetics, fermentation, downstream processing, and integrated bioprocesses important to industries.

Learning Outcomes: 1. Understand applications and solve problems relating to the use of enzymes for industrial bioprocessing. 2. Apply engineering principles to address issues in fermentation processes. 3. Analyze and identify limiting factors in a bioprocess. 4. Explain and solve problems relating to mass and energy balances in biological reactors. 5. Explain how fermentation processing is used in various fields. Credits: 2.00

FS 40200 - Fermentation Processing Laboratory

Credit Hours: 1.00. The essential concepts of industrial bioprocessing with a focus on the physiology of fermentation; a series of laboratory experiments that follow value-adding processes from conception to completion.

Learning Outcomes: 1. Learn laboratory techniques, to design and conduct experiments,

and to analyze and interpret data. 2. Design appropriate bioreactor models based upon bioproducts and other process criteria. 3. Conduct fermentation experiments with process optimization and scale-up. 4. Model the growth of microorganisms in batch, fed-batch, and continuous flow processes. 5. Gain an overview of the fermentation industry. Credits: 1.00

FS 48300 - Fermentation Capstone

Credit Hours: 3.00. The development of value-added fermentation processes requires a complex blend of technoeconomic and market awareness, resource gathering, strain selection and engineering, reactor optimization and operation, product recovery, and project management skills. Keeping these diverse aspects in balance while managing project timelines is essential to a successful fermentation process - that is, one that is both technically and economically successful. This course is organized to develop your knowledge of the diverse inputs into design of microbial fermentation and your ability to apply concepts learned in prior fermentation classes to the design of a fermentation process, integrating microbiology, chemistry, and processing with basic marketing and business concepts. Students will be organized into project teams for the semester and challenged to design, market, develop, prototype, and scale up a new fermentation. Classes will include guest lectures from experts in the fermentation industry and academia. Project teams will be organized and project leaders selected to manage communication between individual groups and the instructors. Final product concepts will be presented to faculty and peers for evaluation.

Learning Outcomes: 1. Apply and practically integrate fundamental aspect of fermentation microbiology, chemistry, and processing in the design and development of a new value-added process. 2. Understand and navigate the challenges associated with scaling up a benchtop fermentation process. 3. Apply knowledge of factors impacting fermentation design, productivity, yield, and stability to optimize economic value of a process. 4. Generate an ""elevator speech"" to spur project investment. 5. Manage projects in group contexts. 6. Apply statistical principles in experimental design and assessment of experimental data as it relates to process control and product assessment. 7. Discuss current topics in fermentation science competently. Credits: 3.00

Other Departmental /Program Course Requirements (80-81 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11800 - Introduction To Food Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Food Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health,

industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell

function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as

well as key metabolic control mechanisms. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to

be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting pertinent information from scientific journal articles. Credits: 2.00

ABE 32700 - Biotechnology Laboratory II

Credit Hours: 2.00. The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (http://www.hhmi.org/grants/sea/) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (www.phagesdb.org and the Purdue institution page can be found here: https://phagesdb.org/institutions/PURD/).

Learning Outcomes: 1. Analyze the genetic code of a unique phage in order to determine potential genes. 2. Discover the genomic organization of their unique phage. 3. Use algorithms to define potential genes, assign putative functions to them, and determine the order in which they appear in the genome. 4. Read and discuss scientific literature related to their research project. 5. Share the information gathered with others in the scientific community. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of

chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (6-7 credits)

Additional Requirements

Program Requirements

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11800 - Introduction To Food Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Food Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of

macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of

functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of

integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

FS 16300 - Introduction To Fermentation Sciences

Credit Hours: 3.00. This course will provide an overview of the use of microorganisms in the food, pharmaceutical and chemical industries. The course will introduce fundamental concepts associated to the microbiological transformation of various substrates to produce desirable products such as foods, beverages, pharmaceuticals or chemical compounds. As an introductory course, the scientific principles of fermentation processes will be gradually introduced through the analysis of familiar fermented food products, such as bread, cheese, beer, wine, cocoa, coffee, etc. Once the fundamental concepts are learned, examples of advanced fermentation technology for production of pharmaceutical products and fine chemicals will be presented.

Learning Outcomes: 1. Explain the role of microorganisms in the transformation of various substrates into desirable products. 2. Identify the type of microorganism (bacteria, yeast or mold) involved in the production of various fermented foods and beverages. 3. Explain the impact of environmental processing conditions (T, pH, aw, O2) on microbial growth. 4. Recognize the similarities across a wide variety of products made through fermentation. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques

including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16 Credits

Fall 2nd Year

FS 29800 - Sophomore Seminar

Credit Hours: 1.00. Current food science issues will be discussed by students, staff, and guest speakers. Career planning and improvement of communication skills will be emphasized.

Learning Outcomes: 1. Construct a professional resume that includes educational background and experience. 2. Construct a professional cover letter in reference to a job posting. 3. Demonstrate the ability to professionally answer interview questions in an interview setting. 4. Demonstrate the ability to present information with PowerPoint software. 5. Identify your Myers Briggs personality profile. 6. Explore some current issues in the food industry. 7. Plan your coursework for each semester through graduation. Credits: 1.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students

who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting pertinent information from scientific journal articles. Credits: 2.00

14 Credits

Spring 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.

Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and

quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

16-17 Credits

Fall 3rd Year

FS 36100 - Food Plant Sanitation

Credit Hours: 1.00. Relation of food-plant sanitation to good manufacturing practices and regulations affecting sanitation; organization of a food-plant sanitation program; sanitary building and equipment construction; selection of cleaning, sanitizing, and pesticidal compounds; water, air, and waste treatment; food storage and transportation.

Credits: 1.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 36300 - Food Microbiology Laboratory

Credit Hours: 2.00. Classic and molecular methods for enumerating, isolating, and identifying spoilage, fermentative, and pathogenic food microorganisms in food systems.

Learning Outcomes: 1. Perform proper aseptic technique. 2. Sample foods for microbial analyses. 3. Test food products for common microorganism. 4. Interpret data obtained from microbiological analysis. 4. Understand basic molecular techniques used to identify foodborne pathogens. Credits: 2.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

15 Credits

Spring 3rd Year

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills;

reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

FS 37200 - Fermentation Microbiology

Credit Hours: 3.00. This course explores the principles underlying the design of microbes for their use in biotechnological applications. This project-based course will teach students fundamental molecular biology techniques, important parameters for strain selection and genetic engineering, and reactor design and operation in bioprocessing. Additionally, this course will cover today's diverse bioengineering goals and tools and the role of microbial biotechnology in society.

Learning Outcomes: 1. Articulate the concept of microbial cell factories and the relationship of microorganisms to food and industrial fermentations. 2. Identify genetic and environmental approaches to control the products, rate, and yield of bioconversion. 3. Understand microbial metabolic pathways and how they are engineered. 4. Design genetic strategies to engineer microbes. 5. Read primary literature relevant to fermentation biotechnology. Credits: 3.00

FS 37300 - Fermentation Microbiology Laboratory

Credit Hours: 1.00. The course provides a laboratory-based experiential learning experience with the learning of fundamental aspects of genetic, physiological and substrate manipulation to achieve product formation in industrial microbes.

Learning Outcomes: 1. Understand the genetic manipulation and physiological factors involved in successful fermentation approaches. 2. Apply various methods of monitoring growth of various bioreactor formats. 3. Manipulate and correlate growth with yield of organisms and products. 4. Identify the basic problems which cause fermentation processes to fail and understand the reasons for failure. 5. Create and troubleshoot a simple fermentation process. Credits: 1.00

ABE 32700 - Biotechnology Laboratory II

Credit Hours: 2.00. The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (http://www.hhmi.org/grants/sea/) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (www.phagesdb.org and the Purdue institution page can be found here: https://phagesdb.org/institutions/PURD/).

Learning Outcomes: 1. Analyze the genetic code of a unique phage in order to determine potential genes. 2. Discover the genomic organization of their unique phage. 3. Use algorithms to define potential genes, assign putative functions to them, and determine the order in which they appear in the genome. 4. Read and discuss scientific literature related to their research project. 5. Share the information gathered with others in the scientific community. Credits: 2.00

14 Credits

Fall 4th Year

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.

Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3.

Identify the conditions under which important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 44400 - Statistical Process Control

Credit Hours: 1.00. Basic concepts and techniques of solving quality problems and assuring the quality of production processes; emphasis is on quality improvement programs, problem-solving tools, control charts for variables and attributes, process capability analysis, and sampling methods. Course meets during weeks 6-10.

Credits: 1.00

FS 48200 - Food Science Senior Seminar

Credit Hours: 1.00. Oral and written reports on selected food science topics.

Credits: 1.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

FS 40100 - Fermentation Processing

Credit Hours: 2.00. The Integration of fermentation core concepts; the application of bioprocess engineering principles to biological systems; topics covering enzyme kinetics, fermentation, downstream processing, and integrated bioprocesses important to industries.

Learning Outcomes: 1. Understand applications and solve problems relating to the use of enzymes for industrial bioprocessing. 2. Apply engineering principles to address issues in fermentation processes. 3. Analyze and identify limiting factors in a bioprocess. 4. Explain and solve problems relating to mass and energy balances in biological reactors. 5. Explain how fermentation processing is used in various fields. Credits: 2.00

FS 40200 - Fermentation Processing Laboratory

Credit Hours: 1.00. The essential concepts of industrial bioprocessing with a focus on the physiology of fermentation; a series of laboratory experiments that follow value-adding processes from conception to completion.

Learning Outcomes: 1. Learn laboratory techniques, to design and conduct experiments, and to analyze and interpret data. 2. Design appropriate bioreactor models based upon bioproducts and other process criteria. 3. Conduct fermentation experiments with process optimization and scale-up. 4. Model the growth of microorganisms in batch, fed-batch, and continuous flow processes. 5. Gain an overview of the fermentation industry. Credits: 1.00

15 Credits

Spring 4th Year

FS 48300 - Fermentation Capstone

Credit Hours: 3.00. The development of value-added fermentation processes requires a complex blend of technoeconomic and market awareness, resource gathering, strain selection and engineering, reactor optimization and

operation, product recovery, and project management skills. Keeping these diverse aspects in balance while managing project timelines is essential to a successful fermentation process - that is, one that is both technically and economically successful. This course is organized to develop your knowledge of the diverse inputs into design of microbial fermentation and your ability to apply concepts learned in prior fermentation classes to the design of a fermentation process, integrating microbiology, chemistry, and processing with basic marketing and business concepts. Students will be organized into project teams for the semester and challenged to design, market, develop, prototype, and scale up a new fermentation. Classes will include guest lectures from experts in the fermentation industry and academia. Project teams will be organized and project leaders selected to manage communication between individual groups and the instructors. Final product concepts will be presented to faculty and peers for evaluation.

Learning Outcomes: 1. Apply and practically integrate fundamental aspect of fermentation microbiology, chemistry, and processing in the design and development of a new value-added process. 2. Understand and navigate the challenges associated with scaling up a benchtop fermentation process. 3. Apply knowledge of factors impacting fermentation design, productivity, yield, and stability to optimize economic value of a process. 4. Generate an ""elevator speech"" to spur project investment. 5. Manage projects in group contexts. 6. Apply statistical principles in experimental design and assessment of experimental data as it relates to process control and product assessment. 7. Discuss current topics in fermentation science competently. Credits: 3.00

14-15 Credits

Notes

Film & Video, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (36 credits)

A. Foundation Course (3 credits)

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

B. Film & Video Production (9-21 credits)

Directing

FLM 44200 - Directing The Narrative Short Film

Credit Hours: 3.00. Students will gain knowledge of all phases of film production in the course of completing multiple short films. This class will emulate standard film industry practices and guidelines.

Learning Outcomes: 1. Summarize the overall film production process. 2. Create examples of each stage of the production process. 3. Construct multiple complete films, in the roles of Director and/or Assistant Director, using professional and industry standard techniques based upon the production process. 4. Evaluate completed films for content and technique. Credits: 3.00

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

THTR 23300 - Acting II

Credit Hours: 3.00. Continued development of the basic acting tools of objectives, actions, justification, and personalization; continued vocal and physical work; introduction of script and character analysis; and the introduction of audition techniques. The course will use material from contemporary dramatic literature in the rehearsal process. Prerequisite: THTR 133. Instructor permission required for non-majors.

Learning Outcomes: 1. Practice and incorporate relaxation, physical, vocal, and sense memory exercises into a daily warm-up. 2. See, connect, and respond to a partner within improvised scenarios. 3. Read plays with insight and imagine the experience of the characters in the given circumstance of a play. 4. Analyze and break scenes down into beats, with each beat having a clear action and objective. 5. Analyze, rehearse and publicly perform an open scene, and a contemporary monologue and scene. Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

FLM 49900 - Capstone In Film/Video/Media Production

Credit Hours: 2.00 or 4.00. The Capstone in Film/Video/Media Production is intended to be the culminating experience of the Film/Video Studies or Film/Video and Theatre Production major. Each student Students will create a project of their own design. Students will pitch their project ideas to the program director and/or faculty and should develop a project based around their future career goals. Example areas include narrative/fiction cinema, documentary/non-fiction filmmaking, television production, live event production, etc. Students will fulfill the role of Writer/Producer/Director for their project (and potentially Director of Photography, Editor, etc.). This creative work will culminate in a presentation to an audience. Permission of instructor required.

Learning Outcomes: 1. Develop a complete and significant project idea/vision/creative work. 2. Plan out the execution of the creative work. 3. Assemble a team with which to craft the developed vision. 4. Complete the work to a professional level of quality. 5. Present the work to an audience with a Q&A session. Credits: 2.00 or 4.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition

techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

FLM 29104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

Editing

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

FLM 37100 - Editing I

Credit Hours: 3.00. The course introduces students to the principles of film and video editing. Projects, discussions, demonstrations, and hands-on exercises expose students to the technical and artistic aspects of the editing process.

Learning Outcomes: 1. Summarize the basic concepts involved in the editing process. 2. Compare and contrast historical and modern approaches to film and video editing. 3. Develop proficiency with industry standard software. 4. Execute an example of the editing process under strict time constraints. Credits: 3.00

FLM 37200 - Editing II

Credit Hours: 3.00. This course instructs students in advanced principles of film and video editing and color grading. Projects, discussions, demonstrations, and hands-on exercises expose students to the technical and artistic aspects of the editing process.

Learning Outcomes: 1. Develop an increased understanding of the art, technique, and philosophies of the editing process 2. Examine the concepts involved in the color grading process and visual effects. 3. Demonstrate techniques for basic color grading and visual effects. 4. Develop further proficiency with industry standard software. Credits: 3.00

FLM 44200 - Directing The Narrative Short Film

Credit Hours: 3.00. Students will gain knowledge of all phases of film production in the course of completing multiple short films. This class will emulate standard film industry practices and guidelines.

Learning Outcomes: 1. Summarize the overall film production process. 2. Create examples of each stage of the production process. 3. Construct multiple complete films, in the roles of Director and/or Assistant Director, using professional and industry standard techniques based upon the production process. 4. Evaluate

completed films for content and technique. Credits: 3.00

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating professional AV system documentation. Credits: 3.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

FLM 44600 - Producing Non-Fiction Video

Credit Hours: 3.00. This advanced course builds on previous knowledge and exposes students to the role of an independent video producer. By working with real-world clients on real-world projects, students will gain valuable experience in guiding productions from start to finish. Additionally, students will learn basic fundamentals of entrepreneurship and business skills designed to begin to prepare students to form their own video production business.

Learning Outcomes: 1. Summarize an understanding of the art, technique, philosophies, and business of the video production. 2. Construct budgets and business plans. 3. Organize, plan, and create video productions simulating professional processes and techniques. 4. Develop and produce multiple unique projects by working closely with real-world clients. Credits: 3.00

FLM 29107 - Special Topics In Editing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49107 - Special Topics In Editing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

Cinematography

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and

demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

FLM 36100 - Cinematography

Credit Hours: 3.00. This intermediate course in Cinematography will further prepare the student to use the technology of the camera as a basis for the art and visual storytelling of motion pictures. The student will also receive the basic background needed for understanding the skills and processes of a single camera production environment.

Learning Outcomes: 1. Discuss production techniques in film and video using the vocabulary of the industry. 2. Explore the production process for single camera environments. 3. Demonstrate an understanding of basic shot types and execute examples of these shots. 4. Demonstrate an understanding of the technology of capturing the moving image. 5. Identify career options and job types within film and video production. Credits: 3.00

FLM 44600 - Producing Non-Fiction Video

Credit Hours: 3.00. This advanced course builds on previous knowledge and exposes students to the role of an independent video producer. By working with real-world clients on real-world projects, students will gain valuable experience in guiding productions from start to finish. Additionally, students will learn basic fundamentals of entrepreneurship and business skills designed to begin to prepare students to form their own video production business.

Learning Outcomes: 1. Summarize an understanding of the art, technique, philosophies, and business of the video production. 2. Construct budgets and business plans. 3. Organize, plan, and create video productions simulating professional processes and techniques. 4. Develop and produce multiple unique projects by working closely with real-world clients. Credits: 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

FLM 29106 - Special Topics In Cinematography

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49106 - Special Topics In Cinematography

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

Screenwriting

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 31600 - Craft Of Fiction From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of fiction with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of fiction, statements of aesthetics and craft, and various fictional forms.

Learning Outcomes: 1. Analyze published fiction by applying terms of fiction craft. 2. Identify the effects of fiction forms by articulating their differences and/or similarities. 3. Analyze their own fiction by applying the terms of fiction craft. Credits: 3.00

FLM 35100 - Screenwriting

Credit Hours: 3.00. Students will gain a working knowledge of basic narrative elements and how these elements work to form a story. Writing and re-writing a three-act outline and an original screenplay will give you an understanding of script language and process.

Learning Outcomes: 1. Identify Aristotelian Three-Act Structure as applied to the screenplay. 2. Develop a specific technique of writing based on the course teachings. 4. Critique the work of self and others, including proper and professional screenplay formatting. 5. Determine methods to assess success or failure of writer's intent. Credits: 3.00

FLM 44200 - Directing The Narrative Short Film

Credit Hours: 3.00. Students will gain knowledge of all phases of film production in the course of completing multiple short films. This class will emulate standard film industry practices and guidelines.

Learning Outcomes: 1. Summarize the overall film production process. 2. Create examples of each stage of the production process. 3. Construct multiple complete films, in the roles of Director and/or Assistant Director, using professional and industry standard techniques based upon the production process. 4. Evaluate completed films for content and technique. Credits: 3.00

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

FLM 49900 - Capstone In Film/Video/Media Production

Credit Hours: 2.00 or 4.00. The Capstone in Film/Video/Media Production is intended to be the culminating experience of the Film/Video Studies or Film/Video and Theatre Production major. Each student Students will create a project of their own design. Students will pitch their project ideas to the program director and/or faculty and should develop a project based around their future career goals. Example areas include narrative/fiction cinema, documentary/non-fiction filmmaking, television production, live event production, etc. Students will fulfill the role of Writer/Producer/Director for their project (and potentially Director of Photography, Editor, etc.). This creative work will culminate in a presentation to an audience. Permission of instructor required.

Learning Outcomes: 1. Develop a complete and

significant project idea/vision/creative work. 2. Plan out the execution of the creative work. 3. Assemble a team with which to craft the developed vision. 4. Complete the work to a professional level of quality. 5. Present the work to an audience with a Q&A session. Credits: 2.00 or 4.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

FLM 29105 - Special Topics In Screenwriting

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49105 - Special Topics In Screenwriting

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

Live Event Video Production

FLM 32100 - Live Production I: Theater/Music/Arts

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as narrative development.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

FLM 49900 - Capstone In Film/Video/Media Production

Credit Hours: 2.00 or 4.00. The Capstone in Film/Video/Media Production is intended to be the culminating experience of the Film/Video Studies or Film/Video and Theatre Production major. Each student Students will create a project of their own design. Students will pitch their project ideas to the program director and/or faculty and should develop a project based around their future career goals. Example areas include narrative/fiction cinema, documentary/non-fiction filmmaking, television production, live event production, etc. Students will fulfill the role of Writer/Producer/Director for their project (and potentially Director of Photography, Editor, etc.). This creative work will culminate in a presentation to an audience. Permission of instructor required.

Learning Outcomes: 1. Develop a complete and significant project idea/vision/creative work. 2. Plan out the execution of the creative work. 3. Assemble a team with which to craft the developed vision. 4. Complete the work to a professional level of quality. 5. Present the work to an audience with a Q&A session. Credits: 2.00 or 4.00

FLM 32200 - Live Production I: Fall/Winter Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Fall/Winter sports include Cross Country, Soccer, Volleyball, Football, Swimming & Diving, Wrestling, Basketball, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 32300 - Live Production I: Winter/Spring Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Winter/Spring sports include Swimming & Diving, Wrestling, Basketball, Baseball, Softball, Tennis, Golf, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 49102 - Special Topics In Live Production

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29102 - Special Topics In Live Production

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 42200 - Live Production II: Fall/Winter Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of Producing and Directing live sports video and television. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Fall/Winter sports include Cross Country, Soccer, Volleyball, Football, Swimming & Diving, Wrestling, Basketball, or Track & Field. Permission of instructor required.

Learning Outcomes: 1. Identify career options and job types within live event production. 2. Operate the core components of a live video system, including a switcher, replay system, and advanced broadcast graphics. 3. Create examples of visual storytelling using live, multi-camera, production techniques. Credits: 1.00 to 4.00

FLM 42300 - Live Production II: Winter/Spring Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of Producing and Directing live sports video and television. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's

Winter/Spring sports include Swimming & Diving, Wrestling, Basketball, Baseball, Softball, Tennis, Golf, or Track & Field. Permission of instructor required.

Learning Outcomes: 1. Identify career options and job types within live event production. 2. Operate the core components of a live video system, including a switcher, replay system, and advanced broadcast graphics. 3. Create examples of visual storytelling using live, multi-camera, production techniques. Credits: 1.00 to 4.00

Directing

FLM 44200 - Directing The Narrative Short Film

Credit Hours: 3.00. Students will gain knowledge of all phases of film production in the course of completing multiple short films. This class will emulate standard film industry practices and guidelines.

Learning Outcomes: 1. Summarize the overall film production process. 2. Create examples of each stage of the production process. 3. Construct multiple complete films, in the roles of Director and/or Assistant Director, using professional and industry standard techniques based upon the production process. 4. Evaluate completed films for content and technique. Credits: 3.00

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

THTR 23300 - Acting II

Credit Hours: 3.00. Continued development of the basic acting tools of objectives, actions, justification, and personalization; continued vocal and physical work; introduction of script and character analysis; and the introduction of audition techniques. The course will use material from contemporary dramatic literature in the rehearsal process. Prerequisite: THTR 133. Instructor permission required for non-majors.

Learning Outcomes: 1. Practice and incorporate relaxation, physical, vocal, and sense memory exercises into a daily warm-up. 2. See, connect, and respond to a partner within improvised scenarios. 3. Read plays with insight and imagine the experience of the characters in the given circumstance of a play. 4. Analyze and break scenes down into beats, with each beat having a clear action and objective. 5. Analyze, rehearse and publicly perform an open scene, and a contemporary monologue and scene. Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

FLM 49900 - Capstone In Film/Video/Media Production

Credit Hours: 2.00 or 4.00. The Capstone in Film/Video/Media Production is intended to be the culminating experience of the Film/Video Studies or Film/Video and Theatre Production major. Each student Students will create a project of their own design. Students will pitch their project ideas to the program director and/or faculty and should develop a project based around their future career goals. Example areas include narrative/fiction

cinema, documentary/non-fiction filmmaking, television production, live event production, etc. Students will fulfill the role of Writer/Producer/Director for their project (and potentially Director of Photography, Editor, etc.). This creative work will culminate in a presentation to an audience. Permission of instructor required.

Learning Outcomes: 1. Develop a complete and significant project idea/vision/creative work. 2. Plan out the execution of the creative work. 3. Assemble a team with which to craft the developed vision. 4. Complete the work to a professional level of quality. 5. Present the work to an audience with a Q&A session. Credits: 2.00 or 4.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

FLM 29104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

C. Film & Video Studies (12-24 credits)

International Cinema

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 33000 - German Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of major German contributions to the cinema from the earliest period to the present. Emphasis on relevant aesthetic theories and on the schools of literature and painting that served as sources. Evaluation of the German film on the basis of social, artistic, and political criteria. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and describe the major movements and trends of German film history of the 20th and 21st centuries. 2. Analyze the cinematography of representative German films. 3. Interpret the explicit and implicit meanings of representative German films. Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte,

Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

LC 33300 - The Middle Ages On Film (UCC: HUM)

Credit Hours: 3.00. Introduction to the Middle Ages through films in various languages and genres from the beginning of film history to the present. Reading literary, historical, legal, and film theory texts in conjunction with the films, students critically analyze representations of the Middle Ages and the cultural context from which these emerge.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

LC 33800 - Language Through Films

Credit Hours: 3.00. The course critically explores language(s) via the medium of cinema where language plays a key role in the film. It is intended to introduce students to the fundamental place language occupies within human experience, to advance knowledge of some of the features of the system of language, develop a sharper ear for language, a better understanding of its nature, and a livelier interest in all its manifestations. The course will be taught in English and films will be shown with subtitles.

Learning Outcomes: 1. Identify the main building blocks of language. 2. Examine the universal characteristics of the many languages humans speak. 3. Appraise the relationship between language, cognition, emotion and world view. 4. Re-evaluate their thinking regarding the acquisition of a second language. 5. Access the significant position language plays within societies and cultures. Credits: 3.00

ARAB 33000 - The Middle East On Film

Credit Hours: 3.00. This course offers an introduction to films produced in the Middle East and on Middle Eastern Cultures. In this class, we will view films from the Arab world, including North Africa, and the large Middle Eastern region. Parallel to film screening, students will read critical and analytical material that

provide background as well as commentary and analysis of cultural and historical contexts on content of films and their making. The course will examine a series of topics such as identity politics, religious affiliation, gender, immigration, belonging, homeland and exile. We will also situate the films within the aesthetic traditions of production and reception and analyze how they provide critical perspectives and insights in central issues in the cultures of Middle Eastern cultures. The overarching goal of the class is to provide students with a solid understanding of the function of cinema and films in representation of the evolution and transformation of the cultures and societies of the region and the issues central to how communal and individual identities in the Middle Eastern region are shaped. The class will also equip the students with skills to analyze meaning making and the role of technical aspects such as cinematography, body language, script, setting and acting in the creation of characters. All films will be screened with English subtitles.

Learning Outcomes: 1. Assess formal and technical elements of Middle Eastern film cultures. 2. Analyze how social and cultural themes are represented in visual means and through the screen. 3. Identify and explain the important aspects of film making in the film industries of the region. 4. Construct critical responses to how cinematic work uses aesthetics to mediate culture. 5. Evaluate the role of films in articulating major shifts and movements in the cultures of the region. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

FLM 29103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

Cinema Studies

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

ENGL 27600 - Shakespeare On Film (UCC: HUM)

Credit Hours: 3.00. Considers the relation of the written text of five or six Shakespeare plays to multiple film versions from a wide variety of times and cultures, e.g., the United States, England, France, Italy, Japan, Denmark, India, and Russia. Typically offered Fall Spring Summer.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explore a selected set of Shakespeare's plays through a comparative analytical lens. 2. Compare and contrast various film versions of Shakespeare's plays in their respective contexts. 3. Respond to the films and written texts through reflective and critical writings and discussions. Credits: 3.00

ENGL 28600 - The Movies (UCC: HUM)

Credit Hours: 3.00. Introduction to the movies from classic to contemporary films. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to classic and contemporary films. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about classic and contemporary films based on appropriate use of evidence. Credits: 3.00

ENGL 38600 - History Of Film To 1950

Credit Hours: 3.00. This survey crosses the divide between the silent film era and the "talkies" to explore narrative, experimental, and documentary styles of feature films from the 1890s to 1950.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to film from its origins through the mid-twentieth century. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 38700 - History Of Film Since 1950

Credit Hours: 3.00. A survey of narrative, experimental, and documentary styles of feature films from the mid-twentieth century to the present.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to films from the mid-twentieth century. 2. Identify and articulate connections among these topics and conventions as they relate to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-1950 films based on appropriate use of evidence. Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

EAPS 10600 - Geosciences In The Cinema (UCC: STS)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about natural hazards based on the depictions of such hazards in movies. Topics include earthquakes, tsunamis, volcanoes, tornadoes, hurricanes, climate change, asteroid impacts, space exploration, and wildfires. The course focuses on the accuracy of the depiction of natural hazards in the movies, the underlying processes that control their formation and the dangers they represent, how they influence society, and how students can prepare for them and keep themselves safe.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how scientists explore natural hazards, make observations, and develop theories. 2. Explain the processes that control natural hazards and where and when they are likely to occur. 3. Know the natural hazards inherent to a student's location and be able to plan how to keep themselves safe in the event of such an occurrence. 4. Critically assess the reasonableness of depictions of natural hazards in the media. Credits: 3.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they

invoke. 3. Apply feminist and queer theorizing of gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

FLM 29108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

International Cinema

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 33000 - German Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of major German contributions to the cinema from the earliest period to the present. Emphasis on relevant aesthetic theories and on the schools of literature and painting that served as sources. Evaluation of the German film on the basis of social, artistic, and political criteria. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and describe the major movements and trends of German film history of the 20th and 21st centuries. 2. Analyze the cinematography of representative German films. 3. Interpret the explicit and implicit meanings of representative German films. Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

LC 33300 - The Middle Ages On Film (UCC: HUM)

Credit Hours: 3.00. Introduction to the Middle Ages through films in various languages and genres from the beginning of film history to the present. Reading literary, historical, legal, and film theory texts in conjunction with the films, students critically analyze representations of the Middle Ages and the cultural context from which these emerge.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and

Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

LC 33800 - Language Through Films

Credit Hours: 3.00. The course critically explores language(s) via the medium of cinema where language plays a key role in the film. It is intended to introduce students to the fundamental place language occupies within human experience, to advance knowledge of some of the features of the system of language, develop a sharper ear for language, a better understanding of its nature, and a livelier interest in all its manifestations. The course will be taught in English and films will be shown with subtitles.

Learning Outcomes: 1. Identify the main building blocks of language. 2. Examine the universal characteristics of the many languages humans speak. 3. Appraise the relationship between language, cognition, emotion and world view. 4. Re-evaluate their thinking regarding the acquisition of a second language. 5. Access the significant position language plays within societies and cultures. Credits: 3.00

ARAB 33000 - The Middle East On Film

Credit Hours: 3.00. This course offers an introduction to films produced in the Middle East and on Middle Eastern Cultures. In this class, we will view films from the Arab world, including North Africa, and the large Middle Eastern region. Parallel to film screening, students will read critical and analytical material that provide background as well as commentary and analysis of cultural and historical contexts on content of films and their making. The course will examine a series of topics such as identity politics, religious affiliation, gender, immigration, belonging, homeland and exile. We will also situate the films within the aesthetic traditions of production and reception and analyze how they provide critical perspectives and insights in central issues in the cultures of Middle Eastern cultures. The overarching goal of the class is to provide students with a solid understanding of the function of cinema and films in representation of the evolution and transformation of the cultures and societies of the region and the issues central to how communal and individual identities in the Middle Eastern region are shaped. The class will also equip the students with skills to analyze meaning making and the role of technical aspects such as cinematography, body language, script, setting and acting in the creation of characters. All films will be screened with English subtitles.

Learning Outcomes: 1. Assess formal and technical elements of Middle Eastern film cultures. 2. Analyze how social and cultural themes are represented in visual means and through the screen. 3. Identify and explain the important aspects of film making in the film industries of the region. 4. Construct critical responses to how cinematic work uses aesthetics to mediate culture. 5. Evaluate the

role of films in articulating major shifts and movements in the cultures of the region. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

FLM 29103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

A. Foundation Course (3 credits)

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

Optional Concentration

Electives (50-59 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

FLM 24100 - Foundations Of Cinema Production

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Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

15-19 Credits

15-19 Credits

Spring 1st Year

15-16 Credits

15-16 Credits

Fall 2nd Year

15-16 Credits

15-16 Credits

Spring 2nd Year

13-16 Credits

13-16 Credits

Fall 3rd Year

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

14 Credits

14 Credits

Spring 4th Year

13-14 Credits

13-14 Credits

Fall 1st Year

FLM 24100 - Foundations Of Cinema Production

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Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

15-19 Credits

15-19 Credits

About the Program

Finance, BS

About the Program

Degree Requirements

Department/Program Major Courses (78 credits)

Required Major Courses (54 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes

of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for

improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 35000 - Intermediate Accounting I

Credit Hours: 3.00. Financial reporting for interested external parties. Emphasis on asset valuation, income measurement, and preparation of financial statements, and on appreciation of discretion available to preparers.

Learning Outcomes: 1. Understand the objectives of financial reporting. 2. Explain and apply the basic principles of accounting. 3. Describe how to prepare and analyze an income statement, balance sheet, statement of cash flows and statement of retained earnings under generally acceptable accounting principles (GAAP). 4. Understand the tradeoffs involved in standard setting, the limitations of current accounting standards, and the effects that these tradeoffs and limitations have on the quality and content of financial statements. 5. Gain an appreciation of firms' ability and incentives to choose from a wide variety of alternative measurement bases and accounting procedures and the effects that those choices have on readers of firms' financial statements. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression

analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 28800 - Programming For Business Applications

Credit Hours: 3.00. This course will cover the fundamentals of business rules and logic in a business application development context. Students will acquire these skills using computer programming. A modern programming language will be used to learn and reinforce logical concepts, including abstraction, process flow, variable assignment, and control structures, as well as proper programming and application development practices, including documentation.

Learning Outcomes: 1. Understand and apply basic technical knowledge to managerial problems. 2. Successfully write, test, and run computer programs designed to address managerial problems. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants (i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions

and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder

analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and

implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 25300 - Finance Industry Exploration

Credit Hours: 2.00. Finance Industry Exploration will introduce students to various sectors of the financial services industry through lectures, guest lectures by financial market participants and regular reading of financial publications (Wall Street Journal, Financial Times, etc.). Students will understand potential career paths, how specific financial markets operate, career success factors, employment differentiation, industry vernacular and suggested future coursework. Topics covered may include (subject to speaker availability) - Investment Banking, Mergers and Acquisitions, Corporate Finance, Corporate Development, Public Finance, Commercial Banking, Sales and Trading, Wealth Management, Asset Management, Private Equity and Private Credit, Venture Capital, Investor Relations and FinTech.

Learning Outcomes: 1. Analyze and explain the commercial landscape of the finance industry, including key firms, influential personalities, and the challenges and opportunities each face. 2. Develop and evaluate a tailored career strategy by identifying one or two industry sectors, multiple companies, and specific roles of interest, and designing a curricular and extracurricular pathway to enhance competitiveness in the job market. 3. Identify and interpret the success factors of various industry sectors and evaluate how specific roles generate value for their company and clients. 4. Demonstrate the ability to discuss industry topics with professionals by using appropriate terminology and providing relevant historical and company-specific examples. Credits: 2.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Major Selectives (21 credits)

Major Required Courses (9 credits)

MGMT 41300 - Corporate Finance

Credit Hours: 3.00. The course provides the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending, or investment banking setting. Topics include corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition, and mergers/acquisition.

Learning Outcomes: 1. Know the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending or investment banking system through study of topics including corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition and mergers/acquisition. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given

to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

Major Selectives: Choose Four (12 credits)

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

MGMT 41601 - Corporate Mergers And Acquisitions

Credit Hours: 3.00. The financial analysis of corporate acquisitions, mergers, and reorganizations including asset acquisitions, joint ventures, spin-offs, sell-offs, equity carve-outs, bankruptcy proceedings and reorganizations, and corporate governance. The course uses a combination of lectures, readings, and case analysis.

Learning Outcomes: 1. Understand the processes of valuation, negotiation, and financial outcomes of transactions involving mergers and acquisitions. Credits: 3.00

MGMT 41500 - International Financial Management

Credit Hours: 3.00. The course explores financial decision making in an international framework from the perspective of the management of a multinational corporation. Topics covered include the international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations.

Learning Outcomes: 1. Students will learn about financial decision making in an international framework from the perspective of the management of a multinational corporation through topics such as international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations. Credits: 3.00

MGMT 41200 - Financial Institutions And Markets

Credit Hours: 3.00. Introduction to financial markets and management of financial institutions. Emphasis on determinants of interest rates, and measurement and management of financial risk. Concentration on management of depository firms such as banks and savings and loans.

Learning Outcomes: 1. Students will be introduced to financial markets and management of financial institutions through learning about determinants of interest rates,

and measurement and management of financial risk, with particular attention on management of depository firms such as banks and savings and loans. Credits: 3.00

MGMT 41250 - Fixed Income Securities

Credit Hours: 3.00. This course includes examination of fixed income securities institutions that invest, roles in institution, portfolios and math associated with assessing characteristics of fixed income securities.

Learning Outcomes: 1. Examine management of fixed income securities. 2. Examine portfolios and risk management strategies. 3. Demonstrate use of simulation models for risk assessment. Credits: 3.00

MGMT 41350 - Venture Capital And Entrepreneurial Finance

Credit Hours: 3.00. This course includes descriptions of markets for start-up businesses, venture capital financial structures, valuation of start-ups, role of venture capital in economic development and business growth strategies.

Learning Outcomes: 1. Evaluate start-up ventures and understand the markets for early-stage businesses. 2. Value these companies using Discounted Cash Flow models, markets multipliers and other industry-specific valuation methods. Credits: 3.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

MGMT 41650 - Financial Engineering

Credit Hours: 3.00. The objective of this course is to develop necessary skills to value and hedge a wide variety of derivative contracts traded in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous time. Some basic knowledge of stochastic processes would be helpful, but not essential: what needed will be covered in class. The analytic valuation and hedging of derivatives using the modern martingale methods will be the main focus of the course. Applications will include forwards, futures, and options on stocks, bonds and foreign currencies. The numerical methods such as parameter estimation, Monte Carlo simulations, discretization schemes as well as the conditional volatility estimation techniques will also be addressed. In addition to the valuation and hedging derivatives, course also covers Value-at-Risk, credit risk, modeling the term structure of interest rates and the construction of the VIX index using the S&P 500 index options obtained from the IvyDB OptionMetric database.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Outline and design new financial derivatives. 3. Develop the VIX index using options data. Credits: 3.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

Cultural Competency Selective (3 credits)

Other Departmental Requirements (23-25 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of

polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections.

Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and

justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (7-19 credits)

Optional Concentrations for Finance, BS

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to

leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 25300 - Finance Industry Exploration

Credit Hours: 2.00. Finance Industry Exploration will introduce students to various sectors of the financial services industry through lectures, guest lectures by financial market participants and regular reading of financial publications (Wall Street Journal, Financial Times, etc.). Students will understand potential career paths, how specific financial markets operate, career success factors, employment differentiation, industry vernacular and suggested future coursework. Topics covered may include (subject to speaker availability) - Investment Banking, Mergers and Acquisitions, Corporate Finance, Corporate Development, Public Finance, Commercial Banking, Sales and Trading, Wealth Management, Asset Management, Private Equity and Private Credit, Venture Capital, Investor Relations and FinTech.

Learning Outcomes: 1. Analyze and explain the commercial landscape of the finance industry, including key firms, influential personalities, and the challenges and opportunities each face. 2. Develop and evaluate a tailored career strategy by identifying one or two industry sectors, multiple companies, and specific roles of interest, and designing a curricular and extracurricular pathway to enhance competitiveness in the job market. 3. Identify and interpret the success factors of various industry sectors and evaluate how specific roles

generate value for their company and clients. 4. Demonstrate the ability to discuss industry topics with professionals by using appropriate terminology and providing relevant historical and company-specific examples. Credits: 2.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-19 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15-18 Credits

Fall 2nd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and

resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

15-18 Credits

Spring 2nd Year

MGMT 41300 - Corporate Finance

Credit Hours: 3.00. The course provides the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending, or investment banking setting. Topics include corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition, and mergers/acquisition.

Learning Outcomes: 1. Know the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending or investment banking system through study of topics including corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition and mergers/acquisition. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 35000 - Intermediate Accounting I

Credit Hours: 3.00. Financial reporting for interested external parties. Emphasis on asset valuation, income measurement, and preparation of financial statements, and on appreciation of discretion available to preparers.

Learning Outcomes: 1. Understand the objectives of financial reporting. 2. Explain and apply the basic principles of accounting. 3. Describe how to prepare and analyze an income statement, balance sheet, statement of cash flows and statement of retained earnings under generally acceptable accounting principles (GAAP). 4. Understand the tradeoffs involved in standard setting, the limitations of current accounting standards, and the effects that these tradeoffs and limitations have on the quality and content of financial statements. 5. Gain an appreciation of firms' ability and incentives to choose from a wide variety of alternative measurement bases and accounting procedures and the effects that those choices have on readers of firms' financial statements. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants (i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

15-18 Credits

Fall 3rd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple

purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-

assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15-16 Credits

Spring 3rd Year

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 28800 - Programming For Business Applications

Credit Hours: 3.00. This course will cover the fundamentals of business rules and logic in a business application development context. Students will acquire these skills using computer programming. A modern programming language will be used to learn and reinforce logical concepts, including abstraction, process flow, variable assignment, and control structures, as well as proper programming and application development practices, including documentation.

Learning Outcomes: 1. Understand and apply basic technical knowledge to managerial

problems. 2. Successfully write, test, and run computer programs designed to address managerial problems. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

15 Credits

Fall 4th Year

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing

concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

15 Credits

Spring 4th Year

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

13-15 Credits

Financial Counseling and Planning, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (30 credits)

AGEC 42500 - Estate Planning And Property Transfer

Credit Hours: 3.00. The ownership and transfer of farm business property. Includes tax and other implications of life estates, trust arrangements, sale of property, and charitable contributions.

Credits: 3.00

AGEC 45600 - Federal Income Tax Law

Credit Hours: 3.00. Introduction to the federal income tax laws applicable to individuals and small business with emphasis on the farming business. The course includes management implications and the policy basis for the tax law system. Techniques and practice for the preparation of selected forms will be included. There will be limited exposure to taxation of partnerships, corporations, estates, and to federal gift and estate tax law.

Learning Outcomes: 1. Develop an understanding of the federal income tax law: for individuals and small businesses and for economic and financial decision making. 2. Gain an understanding of the management opportunities for the income tax law and how they can be applied by individuals, families, and small businesses. 3. Develop the ability to

analyze facts for tax law alternatives and to communicate tax planning alternatives. Credits: 3.00

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

CSR 38600 - Risk Management

Credit Hours: 3.00. The course includes principles of insurance, analysis and evaluation of risk exposures, legal aspects of insurance, insurance needs and analysis, policy selection, and insurance company selection and due diligence. Types of insurance that are studied include: property and casualty, health, life, long-term care, disability and general business liability.

Credits: 3.00

CSR 48000 - Financial Counseling And Planning Internship

Credit Hours: 1.00. Supervised internship in the financial services industry. The experience will enable students to develop their professional interest and skills. Attendance at a pre-planning meeting required. Permission of department required.

Credits: 1.00

CSR 48100 - Ethics And Behaviors In Financial Planning

Credit Hours: 3.00. As research in behavioral finance makes increasingly clear, understanding the psychology of financial behaviors is a critical skill for financial planners. Simultaneously, understanding ethical challenges to financial planners' own behaviors, and complying with new and ever more complex regulations, is a key requirement of successful and relevant financial planning and advice-giving. The course will enable students to be better financial planners by reviewing rules of behaviors for financial planners, improving students' capacity to provide fiduciary advice, and enhance their ability to integrate psychological insights into customers' financial behavior throughout the financial planning process.

Learning Outcomes: 1. Identify ethical issues and compliance matters in the field of financial counseling and planning. 2. Evaluate client and planner attitudes, values, biases, behaviors, and their impact on the financial planning relationship. 3. Demonstrate understanding of The CFP Board's Code of Ethics and Professional Responsibility and Rules of Conduct; Disciplinary Rules and Procedures, and Financial Planning Practice Standards. 4.

Apply basic knowledge of behavioral finance and its impacts on clients' financial needs (including in times of crisis). Credits: 3.00

CSR 48400 - Consumer Investment And Savings Decisions

Credit Hours: 3.00. A survey of consumer investment alternatives, with emphasis on financial assets.

Learning Outcomes: 1. Analyze investment decisions and investment risk management through portfolio management, capital market equilibrium and asset pricing theories. Credits: 3.00

CSR 48500 - Case Studies In Financial Planning

Credit Hours: 3.00. Financial planning principles and practice. Course utilizes a case study approach toward financial planning for upper- and middle-income households. Business calculator required.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the content found within the Financial Planning curriculum and effectively apply and integrate this information in the formulation of a financial plan. 2. Effectively communicate the financial plan, both orally and in writing, including information based on research, peer, colleague or simulated client interaction and/or results emanating from synthesis of material. 3. Collect all necessary and relevant qualitative and quantitative information required to develop a financial plan. 4. Analyze personal financial situations, evaluating clients' objectives, needs, and values to develop an appropriate strategy within the financial plan. 5. Demonstrate logic and reasoning to identify the strengths and weaknesses of various approaches to a specific problem. 6. Evaluate the impact of economic, political, and regulatory issues with regard to the financial plan. 7. Apply the CFP Board Financial Planning Practice Standards to the financial planning process. Credits: 3.00

CSR 48600 - Retirement Planning And Employee Benefits

Credit Hours: 3.00. Analysis of employee benefit plans, retirement needs analysis, and types of retirement plans including employer-sponsored plans and participant-directed plans.

Learning Outcomes: 1. Evaluate a client's retirement income and savings need. 2. Explain important provisions of Social Security, The Affordable Care Act and Medicare. 3. Differentiate between individual Retirement Arrangements including those used by individuals and small businesses. 4. Know the rules relating to qualified retirement plans. 5. Conduct an in-depth analysis of qualified plans (e.g. defined benefit, profit sharing, 401(k) plans, stock bonus plans, and ESOPs). 6. Employ rules and strategies for appropriate retirement decumulation. 7. Understand deferred compensation plans, stock option plans, and planning for executive compensation. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a

variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ENTR 46000 - Internship And Career Preparation Seminar

Credit Hours: 1.00. This course is a distance option course for the Certificate in Entrepreneurship and Innovation. It equips students with professional skills based on entrepreneurship competencies. Students develop resources to illustrate their skills, talents, abilities, and goals to increase career preparedness. They learn what it takes to successfully transfer academic skills to a workplace setting and develop an entrepreneurial mindset that sets them apart from other job seekers.

Learning Outcomes: 1. Improve self-awareness of professional skills development through assessments and reflection. 2. Create a professional brand through an improved LinkedIn profile, resume review, interviewing, and networking skills. 3. Showcase educational and professional skills in an e-portfolio or website. Credits: 1.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

Other Departmental/Program Course Requirements (67-74 credits)

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record

financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the

curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization.

4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 45600 - Legal Foundations For Business II

Credit Hours: 3.00. A study of commercial law as prescribed by the Uniform Commercial Code, including the law of sales, documents of title, negotiable instruments, and the law relating to security interests. Additional material is presented covering the legal aspects of real estate transactions and personal property transfer.

Learning Outcomes: 1. Have a good basic understanding of the structure of the U.S. legal system. 2. Be able to understand and apply basic legal terms and concepts in almost every area of the law. 3. Be able to recognize common legal and ethical issues which will arise in the course of doing business. 4. Demonstrate your knowledge in classroom discussion and through the four (4) exams given during the semester. 5. Have the ability to more effectively communicate with and assist counsel on legal matters in your future business career. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn

about the marketing-decision making process. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and

proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (16-23 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate

feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

16-19 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market

equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

14-16 Credits

Fall 2nd Year

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and

transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15-16 Credits

Spring 2nd Year

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

CSR 38600 - Risk Management

Credit Hours: 3.00. The course includes principles of insurance, analysis and evaluation of risk exposures, legal aspects of insurance, insurance needs and analysis, policy selection, and insurance company selection and due diligence. Types of insurance that are studied include: property and casualty, health, life, long-term care, disability and general business liability.

Credits: 3.00

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career.

Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ENTR 46000 - Internship And Career Preparation Seminar

Credit Hours: 1.00. This course is a distance option course for the Certificate in Entrepreneurship and Innovation. It equips students with professional skills based on entrepreneurship competencies. Students develop resources to illustrate their skills, talents, abilities, and goals to increase career preparedness. They learn what it takes to successfully transfer academic skills to a workplace setting and develop an entrepreneurial mindset that sets them apart from other job seekers.

Learning Outcomes: 1. Improve self-awareness of professional skills development through assessments and reflection. 2. Create a professional brand through an improved LinkedIn profile, resume review, interviewing, and networking skills. 3. Showcase educational and professional skills in an e-portfolio or website. Credits: 1.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

13 Credits

Fall 3rd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building

selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 45600 - Federal Income Tax Law

Credit Hours: 3.00. Introduction to the federal income tax laws applicable to individuals and small business with emphasis on the farming business. The course includes management implications and the policy basis for the tax law system. Techniques and practice for the preparation of selected forms will be included. There will be limited exposure to taxation of partnerships, corporations, estates, and to federal gift and estate tax law.

Learning Outcomes: 1. Develop an understanding of the federal income tax law: for individuals and small businesses and for economic and financial decision making. 2. Gain an understanding of the management opportunities for the income tax law and how they can be applied by individuals, families, and small businesses. 3. Develop the ability to analyze facts for tax law alternatives and to communicate tax planning alternatives. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

15-16 Credits

Spring 3rd Year

AGEC 42500 - Estate Planning And Property Transfer

Credit Hours: 3.00. The ownership and transfer of farm business property. Includes tax and other implications of life estates, trust arrangements, sale of property, and charitable contributions.

Credits: 3.00

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 48100 - Ethics And Behaviors In Financial Planning

Credit Hours: 3.00. As research in behavioral finance makes increasingly clear, understanding the psychology of financial behaviors is a critical skill for financial planners. Simultaneously, understanding ethical challenges to financial planners' own behaviors, and complying with new and ever more complex regulations, is a key requirement of successful and relevant financial planning and advice-giving. The course will enable students to be better financial planners by reviewing rules of behaviors for financial planners, improving students' capacity to provide fiduciary advice, and enhance their ability to integrate psychological insights into customers' financial behavior throughout the financial planning process.

Learning Outcomes: 1. Identify ethical issues and compliance matters in the field of financial counseling and planning. 2. Evaluate client and planner attitudes, values, biases, behaviors, and their impact on the financial planning relationship. 3. Demonstrate understanding of The CFP Board's Code of Ethics and Professional Responsibility and Rules of Conduct; Disciplinary Rules and Procedures, and Financial Planning Practice Standards. 4. Apply basic knowledge of behavioral finance and its impacts on clients' financial needs (including in times of crisis). Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

15 Credits

Summer 3rd Year

CSR 48000 - Financial Counseling And Planning Internship

Credit Hours: 1.00. Supervised internship in the financial services industry. The experience will enable students to develop their professional interest and skills. Attendance at a pre-planning meeting required. Permission of department required.

Credits: 1.00

1 Credit

Fall 4th Year

CSR 48400 - Consumer Investment And Savings Decisions

Credit Hours: 3.00. A survey of consumer investment alternatives, with emphasis on financial assets.

Learning Outcomes: 1. Analyze investment decisions and investment risk management through portfolio management, capital market equilibrium and asset pricing theories. Credits: 3.00

CSR 48600 - Retirement Planning And Employee Benefits

Credit Hours: 3.00. Analysis of employee benefit plans, retirement needs analysis, and types of retirement plans including employer-sponsored plans and participant-directed plans.

Learning Outcomes: 1. Evaluate a client's retirement income and savings need. 2. Explain important provisions of Social Security, The Affordable Care Act and Medicare. 3. Differentiate between individual Retirement Arrangements including those used by individuals and small businesses. 4. Know the rules relating to qualified retirement plans. 5. Conduct an in-depth analysis of qualified plans (e.g. defined benefit, profit sharing, 401(k) plans, stock bonus plans, and ESOPs). 6. Employ rules and strategies for appropriate retirement decumulation. 7. Understand deferred compensation plans, stock option plans, and planning for executive compensation. Credits: 3.00

12-13 Credits

Spring 4th Year

CSR 48500 - Case Studies In Financial Planning

Credit Hours: 3.00. Financial planning principles and practice. Course utilizes a case study approach toward financial planning for upper- and middle-income households. Business calculator required.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the content found within the Financial Planning curriculum and effectively apply and integrate this information in the formulation of a financial plan. 2. Effectively communicate the financial plan, both orally and in writing, including information based on research, peer, colleague or simulated client interaction and/or results emanating from synthesis of material. 3. Collect all necessary and relevant qualitative and quantitative information required to develop a financial plan. 4. Analyze personal financial situations, evaluating clients' objectives, needs, and values to develop an appropriate strategy within the financial plan. 5. Demonstrate logic and reasoning to identify the strengths and weaknesses of various approaches to a specific problem. 6. Evaluate the impact of economic, political, and regulatory issues with regard to the financial plan. 7. Apply the CFP Board Financial Planning Practice Standards to the financial planning process. Credits: 3.00

MGMT 45600 - Legal Foundations For Business II

Credit Hours: 3.00. A study of commercial law as prescribed by the Uniform Commercial Code, including the law of sales, documents of title, negotiable instruments, and the law relating to security interests. Additional material is presented covering the legal aspects of real estate transactions and personal property transfer.

Learning Outcomes: 1. Have a good basic understanding of the structure of the U.S. legal system. 2. Be able to understand and apply basic legal terms and concepts in almost every area of the law. 3. Be able to recognize common legal and ethical issues which will arise in the course of doing business. 4. Demonstrate your knowledge in classroom discussion and through the four (4) exams given during the semester. 5. Have the ability to more effectively communicate with and assist counsel on legal matters in your future business career. Credits: 3.00

13-17 Credits

Program Learning Outcomes

Food Science, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (37 credits)

Required Major Courses (37 credits)

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

FS 24500 - Food Packaging

Credit Hours: 1.00. Elements of packaging science and technology applied to preservation, distribution, and marketing of food products; packaging materials; principles of diffusion and permeability; procedures for developing, evaluating, and testing food packages; packaging requirements for specific types of foods; other special topics of current interest.

Learning Outcomes: 1. Appreciate the important role that packaging plays in today's sophisticated food processing operations, its effect on final product quality and self-life, and its influence on distribution methods and marketing related decisions. 2. Understand the basic packaging materials and the technology to produce food packages. 3. Understand basic concepts of diffusion, permeation, and migration, especially as they relate to package properties, food quality, and product shelf-life. 4. Develop general guidelines for selecting appropriate packaging materials to fit the needs of specific food products. 5. Have a general appreciation of the methods used to test and evaluate packaging materials for specific properties and whole containers for integrity, suitability, and overall performance. 6. Intelligently discuss current food packaging related topics (i.e. package degradability/recyclability, tamper evident/proof packaging, modified atmosphere packaging, aseptic packaging, microwaveable packaging, etc.) Credits: 1.00

FS 29800 - Sophomore Seminar

Credit Hours: 1.00. Current food science issues will be discussed by students, staff, and guest speakers. Career planning and improvement of communication skills will be emphasized.

Learning Outcomes: 1. Construct a professional resume that includes educational background and experience. 2. Construct a professional cover letter in reference to a job posting. 3. Demonstrate the ability to professionally answer interview questions in an interview setting. 4. Demonstrate the ability to present information with PowerPoint software. 5. Identify your Myers Briggs personality profile. 6. Explore some current issues in the food industry. 7. Plan your coursework for each semester through graduation. Credits: 1.00

FS 34000 - Introduction To Food Law And Regulations

Credit Hours: 1.00. This course will cover basic knowledge and familiarity of the principal law and regulations governing raw and processed foods. Class meets during weeks 1-5.

Learning Outcomes: 1. To gain a basic knowledge and familiarity of the principal laws

and regulations governing raw and processed foods. 2. To develop an understanding of the law's core - adulteration and misbranding. 3. To learn basic food labeling and health claim regulations. 4. To obtain a working knowledge of US food law and promulgated regulations, current issues concerning food regulations, and how to obtain further information for specific regulatory problems. Credits: 1.00

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.

Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3. Identify the conditions under which important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 34200 - Food Processing I Laboratory

Credit Hours: 1.00. This laboratory course applies food engineering principles and thermal processing methods for production of safe and high-quality foods. The course will include applications of mathematics and physics principles in food processing operations, engineering problem-solving exercises and laboratory demonstrations. Engineering concepts such as heat transfer, fluid flow, mass and energy balances applied to various food systems will be a major portion of this laboratory.

Learning Outcomes: 1. Apply mathematical principles to food processing application. 2. Demonstrate an understanding of energy, heat transfer and fluid flow principles. 3. Apply engineering principles to thermal processing of foods. 4. Identify conditions under which microorganisms are commonly inactivated, killed, or made harmless in foods including pasteurization, sterilization, and aseptic processing. 5. Demonstrate use mass and energy balances for a food process. Credits: 1.00

FS 36100 - Food Plant Sanitation

Credit Hours: 1.00. Relation of food-plant sanitation to good manufacturing practices and regulations affecting sanitation; organization of a food-plant sanitation program; sanitary building and equipment construction; selection of cleaning, sanitizing, and pesticidal compounds; water, air, and waste treatment; food storage and transportation.

Credits: 1.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 36300 - Food Microbiology Laboratory

Credit Hours: 2.00. Classic and molecular methods for enumerating, isolating, and identifying spoilage, fermentative, and pathogenic food microorganisms in food systems.

Learning Outcomes: 1. Perform proper aseptic technique. 2. Sample foods for microbial analyses. 3. Test food products for common microorganism. 4. Interpret data obtained from microbiological analysis. 4. Understand basic molecular techniques used to identify foodborne pathogens. Credits: 2.00

FS 43500 - Sensory Science

Credit Hours: 1.00. Introduction to the fundamental concepts and practices of sensory analysis of food products. Technical aspects of planning and conducting human sensory panels on food products including analysis and interpretation of collected data. Course meets weeks 1-8.

Learning Outcomes: 1. Solve typical sensory problems occurring in the food industry. 2. Conduct sensory testes, analyze and interpret the results. 3. Write a report and executive summary of the findings. Credits: 1.00

FS 44200 - Food Processing II

Credit Hours: 2.00. Study of food processing and preservation methods based on the integrated knowledge of microbiology, chemistry, and food engineering; emphasis will be on temperature reduction, water activity, concentration, dehydration, irradiation, and extrusion.

Learning Outcomes: 1. Have sufficient knowledge of food chemistry to control reactions in foods. 2. Understand the major chemical reactions that limit shelf-life of foods. 3. Identify the conditions under which the important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Understand the principles involving food preservation via fermentation processes. 5. Be able to identify the conditions, including sanitation practices under which the important pathogens and spoilage microorganisms are commonly inactivated, killed, or made harmless in foods. 6. Explain the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage. 7. Understand the principles that make a food product safe for consumption. 8. Be able to use mass and energy balances for a given food process. 9. Explain the unit operation required to produce a given food product. 10.Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality. 11.Be able to apply and incorporate the principles of food science in practical, real-world situations. 12.Define a problem, identify causes and possible solutions, and make thoughtful recommendations. 13.Work effectively on a team project. Credits: 2.00

FS 44300 - Food Product Design (Capstone)

Credit Hours: 3.00. Teams develop a new product from concept through marketing. Final case study defense is presented to faculty and peers. Classes include guest lectures from the food industry.

Learning Outcomes: 1. Apply fundamental aspects of food chemistry, microbiology, food safety, nutrition, processing and packaging in the design and develop a new product from market concepts to practical prototype. 2. Apply knowledge food ingredient sourcing and functionality to the product development process. 3. Understand the basics of project management in the context of group projects. 4. Develop insight into bench top to pilot scale prototyping of food products. 5. Apply statistical principles through process control, experimental design and assessment of experimental data. 6. Have an appreciation for factors impacting product shelf-life and methods to control spoilage. 7. Intelligently discuss current topics in food science and trends that impact the food industry. Credits: 3.00

FS 44400 - Statistical Process Control

Credit Hours: 1.00. Basic concepts and techniques of solving quality problems and assuring the quality of production processes; emphasis is on quality improvement programs, problem-solving tools, control charts for variables and attributes, process capability analysis, and sampling methods. Course meets during weeks 6-10.

Credits: 1.00

FS 44700 - Food Processing II Laboratory

Credit Hours: 1.00. This lab is designed to build upon fundamental concepts associated with the preservation and processing of various food products. Concepts to be covered include water activity, dehydration (drum, spray and freeze drying), frying, high pressure, microwave and ohmic heating. The focus of this lab will be hands-on production of various food products and the demonstration of fundamental food processing unit operations and calculations related to each preservation method.

Learning Outcomes: 1. Perform experiments using appropriate food processing unit operations to create various food products. 2. Write a lab report that includes analysis and interpretation of the results. 3. Work on a project team to duplicate a commercial food product and present the finding of the project in an oral and written report. Credits: 1.00

FS 45300 - Food Chemistry

Credit Hours: 3.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Understand the importance of food chemistry and the relationship of food chemistry to other food science areas. 2. Understand the structures and functions of major food components, including water, proteins, carbohydrates, lipids, vitamins, and minerals. 3. Understand major reactions occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 4. Identify the major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 5. Be able to describe types and uses of basic sensory tests. 6. Be able to identify functions of most or all ingredients listed on the ingredient label of a food product. 7. Be able to discuss alternative ingredient choices for food products. 8. Be able to write a scientific abstract using IFT formatting. Credits: 3.00

FS 45400 - Food Chemistry Laboratory

Credit Hours: 1.00. Laboratory to demonstrate application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Performance of the students' progress will be evaluated by 7 lab reports and 3 in-class problem solving activities. Credits: 1.00

FS 46700 - Food Analysis

Credit Hours: 3.00. Application of quantitative and qualitative physical, chemical, and instrumental methods of analysis to the examination of food products; evaluation of methods for specific applications.

Learning Outcomes: 1. Describe the principles of the official and rapid methods of analysis for the following food components: moisture, ash, fat, and protein. 2. Select and justify the use of: (for any given food product) a) an official method, and b) a rapid method of analysis for the following food components: moisture, ash, fat, and protein. 3. Describe the principles of the method(s) of analysis for the following food components or properties: individual sugars, starch, total dietary fiber, individual minerals, oxygen demand, texture, color, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional quality, protein functional properties. 4. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy, spectrometry, immune-based assays, enzymatic assays, animal assays. 5. Identify government regulations that dictate

industrial standard practices of food analysis. Credits: 3.00

FS 46900 - Food Analysis Laboratory

Credit Hours: 2.00. Practical laboratory applications of food analysis, including relevant calculations using data gathered and interpretation of data. (Intended for upper-division students.)

Learning Outcomes: 1. Demonstrate practical proficiency in a food analysis laboratory, including relevant calculations using data gathered. Credits: 2.00

FS 48200 - Food Science Senior Seminar

Credit Hours: 1.00. Oral and written reports on selected food science topics.

Credits: 1.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

FS 53000 - Food Ingredient Technology

Credit Hours: 1.00. Identifies functions of ingredients listed on ingredient labels of food products and discusses alternative ingredient choices for food products.

Credits: 1.00

Other Departmental/Program Course Requirements (70-71 credits)

Course Requirements (67-68 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of

economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11800 - Introduction To Food Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Food Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods,

solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of

chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.

Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum

theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data

sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Professional Communications Selective (3 credits)

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 37400 - Social Interaction Skills: Assessment And Development

Credit Hours: 3.00. An examination of several major communication skills and procedures for their development. Focus is on skill measurement, methods of enhancement, assessment of training programs, and personal skill development. Skills examined include those for conversing, managing conflict, providing support, and influencing.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for

creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 43300 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants is a professional writing workshop that teaches students to write workplace proposals and grants in for-profit and not-for-profit companies and organizations. Students will also learn how to write business plans, a specialized form of proposal.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Generate new ideas for businesses, products, and services. 3. Organize proposals and grants using various proposal genres. 4. Write in a plain and persuasive style that is appropriate to readers. 5. Design documents in ways that make information accessible. 6. Edit and revise proposals and grants. 7. Work with authors, customers, and funding agencies to sharpen the message of a proposal or grant. Credits: 3.00

Electives (12-13 credits)

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services,

scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11800 - Introduction To Food Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Food Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD

BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.

Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Fall 2nd Year

FS 29800 - Sophomore Seminar

Credit Hours: 1.00. Current food science issues will be discussed by students, staff, and guest speakers. Career planning and improvement of communication skills will be emphasized.

Learning Outcomes: 1. Construct a professional resume that includes educational background and experience. 2. Construct a professional cover letter in reference to a job posting. 3. Demonstrate the ability to professionally answer interview questions in an interview setting. 4. Demonstrate the ability to present information with PowerPoint software. 5. Identify your Myers Briggs personality profile. 6. Explore some current issues in the food industry. 7. Plan your coursework for each semester through graduation. Credits: 1.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and

chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of

STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.

Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

FS 24500 - Food Packaging

Credit Hours: 1.00. Elements of packaging science and technology applied to preservation, distribution, and marketing of food products; packaging materials; principles of diffusion and permeability; procedures for developing, evaluating, and testing food packages; packaging requirements for specific types of foods; other special topics of current interest.

Learning Outcomes: 1. Appreciate the important role that packaging plays in today's sophisticated food processing operations, its effect on final product quality and self-life, and its influence on distribution methods and marketing related decisions. 2. Understand the basic packaging materials and the technology to produce food packages. 3. Understand basic concepts of diffusion, permeation, and migration, especially as they relate to package properties, food quality, and product shelf-life. 4. Develop general guidelines for selecting appropriate packaging materials to fit the needs of specific food products. 5. Have a general appreciation of the methods used to test and evaluate packaging materials for specific properties and whole containers for integrity, suitability, and overall performance. 6. Intelligently discuss current food packaging related topics (i.e. package degradability/recyclability, tamper evident/proof packaging, modified atmosphere packaging, aseptic packaging, microwaveable packaging, etc.) Credits: 1.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence

demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices.
CTL:ISH 1040 Introduction To Economics
University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

15 Credits

Fall 3rd Year

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.
Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3. Identify the conditions under which important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 34200 - Food Processing I Laboratory

Credit Hours: 1.00. This laboratory course applies food engineering principles and thermal processing methods for production of safe and high-quality foods. The course will include applications of mathematics and physics principles in food processing operations, engineering problem-solving exercises and laboratory demonstrations. Engineering concepts such as heat transfer, fluid flow, mass and energy balances applied to various food systems will be a major portion of this laboratory.
Learning Outcomes: 1. Apply mathematical principles to food processing application. 2. Demonstrate an understanding of energy, heat transfer and fluid flow principles. 3. Apply engineering principles to thermal processing of foods. 4. Identify conditions under which microorganisms are commonly inactivated, killed, or made harmless in foods including pasteurization, sterilization, and aseptic processing. 5. Demonstrate use mass and energy balances for a food process. Credits: 1.00

FS 36100 - Food Plant Sanitation

Credit Hours: 1.00. Relation of food-plant sanitation to good manufacturing practices and regulations affecting sanitation; organization of a food-plant sanitation program; sanitary building and equipment construction; selection of cleaning, sanitizing, and pesticidal compounds; water, air, and waste treatment; food

storage and transportation.

Credits: 1.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 36300 - Food Microbiology Laboratory

Credit Hours: 2.00. Classic and molecular methods for enumerating, isolating, and identifying spoilage, fermentative, and pathogenic food microorganisms in food systems.

Learning Outcomes: 1. Perform proper aseptic technique. 2. Sample foods for microbial analyses. 3. Test food products for common microorganism. 4. Interpret data obtained from microbiological analysis. 4. Understand basic molecular techniques used to identify foodborne pathogens. Credits: 2.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

17 Credits

Spring 3rd Year

FS 45300 - Food Chemistry

Credit Hours: 3.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Understand the importance of food chemistry and the relationship of food chemistry to other food science areas. 2. Understand the structures and functions of major food components, including water, proteins, carbohydrates, lipids, vitamins, and minerals. 3. Understand major reactions occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 4. Identify the major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 5. Be able to describe types and uses of basic sensory tests. 6. Be able to identify functions of

most or all ingredients listed on the ingredient label of a food product. 7. Be able to discuss alternative ingredient choices for food products. 8. Be able to write a scientific abstract using IFT formatting. Credits: 3.00

FS 45400 - Food Chemistry Laboratory

Credit Hours: 1.00. Laboratory to demonstrate application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Performance of the students' progress will be evaluated by 7 lab reports and 3 in-class problem solving activities. Credits: 1.00

FS 46700 - Food Analysis

Credit Hours: 3.00. Application of quantitative and qualitative physical, chemical, and instrumental methods of analysis to the examination of food products; evaluation of methods for specific applications.

Learning Outcomes: 1. Describe the principles of the official and rapid methods of analysis for the following food components: moisture, ash, fat, and protein. 2. Select and justify the use of: (for any given food product) a) an official method, and b) a rapid method of analysis for the following food components: moisture, ash, fat, and protein. 3. Describe the principles of the method(s) of analysis for the following food components or properties: individual sugars, starch, total dietary fiber, individual minerals, oxygen demand, texture, color, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional quality, protein functional properties. 4. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy, spectrometry, immune-based assays, enzymatic assays, animal assays. 5. Identify government regulations that dictate industrial standard practices of food analysis. Credits: 3.00

FS 46900 - Food Analysis Laboratory

Credit Hours: 2.00. Practical laboratory applications of food analysis, including relevant calculations using data gathered and interpretation of data. (Intended for upper-division students.)

Learning Outcomes: 1. Demonstrate practical proficiency in a food analysis laboratory, including relevant calculations using data gathered. Credits: 2.00

15 Credits

Fall 4th Year

FS 44200 - Food Processing II

Credit Hours: 2.00. Study of food processing and preservation methods based on the integrated knowledge of microbiology, chemistry, and food engineering; emphasis will be on temperature reduction, water activity, concentration, dehydration, irradiation, and extrusion.

Learning Outcomes: 1. Have sufficient knowledge of food chemistry to control reactions in foods. 2. Understand the major chemical reactions that limit shelf-life of foods. 3. Identify the conditions under which the important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Understand the principles involving food preservation via fermentation processes. 5. Be able to identify the conditions, including sanitation practices under which the important pathogens and spoilage microorganisms are commonly inactivated, killed, or made harmless in foods. 6. Explain the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage. 7. Understand the principles that make a food product safe for consumption. 8. Be able to use mass and energy balances for a given food process. 9. Explain the unit operation required to produce a given food product. 10.Understand

the principles and current practices of processing techniques and the effects of processing parameters on product quality. 11.Be able to apply and incorporate the principles of food science in practical, real-world situations. 12.Define a problem, identify causes and possible solutions, and make thoughtful recommendations. 13.Work effectively on a team project. Credits: 2.00

FS 44400 - Statistical Process Control

Credit Hours: 1.00. Basic concepts and techniques of solving quality problems and assuring the quality of production processes; emphasis is on quality improvement programs, problem-solving tools, control charts for variables and attributes, process capability analysis, and sampling methods. Course meets during weeks 6-10.

Credits: 1.00

FS 44700 - Food Processing II Laboratory

Credit Hours: 1.00. This lab is designed to build upon fundamental concepts associated with the preservation and processing of various food products. Concepts to be covered include water activity, dehydration (drum, spray and freeze drying), frying, high pressure, microwave and ohmic heating. The focus of this lab will be hands-on production of various food products and the demonstration of fundamental food processing unit operations and calculations related to each preservation method.

Learning Outcomes: 1. Perform experiments using appropriate food processing unit operations to create various food products. 2. Write a lab report that includes analysis and interpretation of the results. 3. Work on a project team to duplicate a commercial food product and present the finding of the project in an oral and written report. Credits: 1.00

FS 48200 - Food Science Senior Seminar

Credit Hours: 1.00. Oral and written reports on selected food science topics.

Credits: 1.00

FS 53000 - Food Ingredient Technology

Credit Hours: 1.00. Identifies functions of ingredients listed on ingredient labels of food products and discusses alternative ingredient choices for food products.

Credits: 1.00

12 Credits

Spring 4th Year

FS 34000 - Introduction To Food Law And Regulations

Credit Hours: 1.00. This course will cover basic knowledge and familiarity of the principal law and regulations governing raw and processed foods. Class meets during weeks 1-5.

Learning Outcomes: 1. To gain a basic knowledge and familiarity of the principal laws and regulations governing raw and processed foods. 2. To develop an understanding of the law's core - adulteration and misbranding. 3. To learn basic food labeling and health claim regulations. 4. To obtain a working knowledge of US food law and promulgated regulations, current issues concerning food regulations, and how to obtain further information for specific regulatory problems. Credits: 1.00

FS 43500 - Sensory Science

Credit Hours: 1.00. Introduction to the fundamental concepts and practices of sensory analysis of food products. Technical aspects of planning and conducting human sensory panels on food products including analysis and interpretation of collected data. Course meets weeks 1-8.

Learning Outcomes: 1. Solve typical sensory problems occurring in the food industry. 2. Conduct sensory testes, analyze and interpret the results. 3. Write a report and executive summary of the findings. Credits: 1.00

FS 44300 - Food Product Design (Capstone)

Credit Hours: 3.00. Teams develop a new product from concept through marketing. Final case study defense is presented to faculty and peers. Classes include guest lectures from the food industry.

Learning Outcomes: 1. Apply fundamental aspects of food chemistry, microbiology, food safety, nutrition, processing and packaging in

the design and develop a new product from market concepts to practical prototype. 2. Apply knowledge food ingredient sourcing and functionality to the product development process. 3. Understand the basics of project management in the context of group projects. 4. Develop insight into bench top to pilot scale prototyping of food products. 5. Apply statistical principles through process control, experimental design and assessment of experimental data. 6. Have an appreciation for factors impacting product shelf-life and methods to control spoilage. 7. Intelligently discuss current topics in food science and trends that impact the food industry. Credits: 3.00

13-14 Credits

Forestry: Forest Management Concentration, BSFOR

About the Program

Degree Requirements

Departmental/Program Major Courses (68 credits)

Required Major Courses (36 credits)

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data

in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various

types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth

and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

Forestry Management Concentration Courses (32 credits)

Forest Management Concentration Required Courses (26 credits)

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn fundamental

principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and

behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

FNR 43300 - Grand Challenges In Forest Management

Credit Hours: 3.00. This course will guide students through readings, discussions, and presentations of the grand challenges that face the field of forest management. These topics will vary with each iteration of the class but may include topics such as climate change, invasive species, pressure on forest lands from a growing population, altered disturbance regimes, development of new silvicultural techniques, economic pressure at multiple scales, and shifting public perceptions on the management of forests. Students will examine and discuss these challenges from the vantage points of multiple stakeholders to gain insight into their complexity and importance. Students will read and discuss on average 2-4 research or review articles, book chapters, or other sources per week.

Learning Outcomes: 1. Identify and discuss major challenges facing the field of forest management. 2. Describe how these challenges interact and develop an understanding of how these interactions may result in amplified effects on forests. 3. Understand how these challenges may be viewed from a variety of perspectives by different stakeholders. 4. Identify how forest management may be used to mitigate some of the effects of these challenges. 5. Organize and present an oral and written case study of a forest management scenario that is linked to multiple challenges discussed in class. Credits: 3.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

Forest Health Selectives (3 credits)

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BTNY 52500 - Intermediate Plant Pathology

Credit Hours: 3.00. Examines the biological and pathological characteristics of major causal agents; concepts of epidemiology and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions; disease management practices; and methods of disease diagnosis.

Learning Outcomes: 1. Understand concepts of disease and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions. 2. Understand the current state of knowledge in plant pathology from applied to molecular plant pathogen interactions. 3. Understand importance of plant disease in food security. 4. Understand plant pathogens and how they cause diseases; the biological and pathological characteristics of major pathogens; Understand pathogenesis of bacterial, fungal, nematode and viral diseases. 5. Understand plant disease resistance pathways, genetic resistance mechanisms starting form gene for gene interactions. 6. Understand resistance to necrotrophic plant pathogens. 7. Understand biotechnological approaches to plant diseases resistance. 8. Identify and describe an economically important plant disease. Credits: 3.00

BTNY 53500 - Plant Disease Epidemiology

Credit Hours: 3.00. Plant disease epidemics occur due to the suitable combination of various elements of the agroecosystem. Many plant pathogens and diseases have increased their geographic distribution and intensity in the U.S. and the world. A lack of epidemiological understanding can exacerbate problems and significantly challenge the management of diseases at the field level. This course is an introduction to the epidemiological basis of disease management strategies. The course includes concepts in botanical epidemiology, disease assessment and measurement, disease modeling, epidemics comparison, and a revision of the traditional plant disease control principles. *Plant Disease Epidemiology* is an upper-level course for students interested in plant pathology, agronomy, data-driven Ag, national or international agriculture, or closely related areas. Although some pathosystems are used as model systems, *Plant Disease Epidemiology* is not a "how-to" course on controlling specific plant diseases.

Learning Outcomes: 1. Standardize terminology used in epidemiology for disease management purposes. 2. Analyze the accuracy and precision of data. 3. Use models to describe plant disease epidemics. 4. Explain how epidemiology is used to evaluate disease

management options. Credits: 3.00

BTNY 55800 - Pathogens Of Plants

Credit Hours: 3.00. Plant pathology is the science of plant diseases and of the microorganisms that cause them and of our attempts to manage plant diseases. The ultimate goal of plant pathologists is to reduce the losses caused by diseases, thereby, increasing both the quality and quantity of the world food supply. Plant diseases are caused by the same types of microorganisms that cause disease in animals and humans and, as such, many of the principles that apply to human and animal medicine apply to plant diseases. It is the objective of this course to introduce students to the major types of plant pathogens (plant pathogenic bacteria, viruses, nematodes, and fungi), their basic biology and examples of the types of diseases they cause. It will be expected that students have knowledge in plant pathology.

Learning Outcomes: 1. Describe the characteristics of plant pathogenic bacteria, fungi, viruses, and nematodes and to distinguish between these pathogens. 2. Describe the methods that each pathogen group utilizes for reproduction, spread, infection of hosts, disease induction in hosts, and long term survival. 3. Classify plant pathogens in current taxonomic schemes. 4. Describe the disease cycles for plant pathogens covered in the course. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

Forestry Selectives (3 credits)

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical

properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

FNR 44400 - Arboricultural Practices

Credit Hours: 4.00. Course covers a broad spectrum of arboriculture principles and techniques, including pruning, transplanting, fertilization, climbing, rigging, removal, cabling, bracing, lightning protection, hazard tree evaluation, tree appraisal, and street tree inventory.

Learning Outcomes: 1. Recognize and explain the various arboricultural practices that enhance the sustainability of trees in the built environment. 2. Apply essential plant health care practices and arboricultural practices used in the cultivation and management of trees and other woody plants in the built environment including planting, pruning and pest management. Credits: 4.00

FNR 53500 - Forest Regeneration And Restoration

Credit Hours: 3.00. An overview of the dynamics associated with the regeneration of forestlands in North America. Topics include: seed collection and handling, forest tree nursery operations, seedling quality, managing for environmental stresses, planting operations, early stand management, and natural regeneration. Permission of instructor required. Offered in odd-numbered years.

Learning Outcomes: 1. Apply the following activities common in forest regeneration and restoration projects: artificial and natural regeneration, tree seed, site preparation, seedling quality and assessment, seedling storage and handling, planting operations, vegetation management, managing stresses in the regeneration environment, early stand management, and regeneration planning. Credits: 3.00

FNR 53600 - Ecology Of Disturbance

Credit Hours: 2.00. Advanced lecture- and discussion-based class examining how disturbance shapes the composition and structure of communities and landscapes across major terrestrial biomes. Students will examine and discuss the relationships between disturbance intensity, frequency, and spatial extent and how these characteristics affect ecological processes and ecologically-based management of forest and grassland ecosystems. The class will also examine the synergistic effects of multiple disturbances and the restoration of endemic disturbance regimes in contemporary ecosystems. Course is reading intensive; students will read and discuss on average 3-8 journal articles per week.

Learning Outcomes: 1. Describe how disturbance shapes community composition and structure for several major terrestrial biomes. 2. Understand how disturbance regulates biological diversity across terrestrial and aquatic ecosystems. 3. Understand the relationship between disturbance intensity, frequency, and spatial extent and how those factors affect management of forest and grassland ecosystems. 4. Describe the synergistic nature of disturbance and identify how disturbance factors interact across a landscape. 5. Describe how contemporary and restored disturbance regimes may facilitate or suppress the spread of invasive species. 6. Understand how management activities can mimic endemic disturbance regimes to promote biodiversity and sustainability. Credits: 2.00

FNR 53601 - Ecology Of Disturbance Practicum

Credit Hours: 1.00. This course is the practicum for FNR 53600 , hence enrollment is contingent upon enrollment in FNR 53600 . Course consists of a one or two-week long field trip to a remote site; prior trips have been taken to the Great Smokey National Park over spring break. Course requires an additional travel fee, depending on location visited.

Learning Outcomes: 1. How disturbance shapes

community composition and the distribution of species across landscapes. 2. How alterations to endemic disturbance regimes affect the composition, structure, and function of ecosystems. 3. How interactions between natural disturbance and invasion of exotic species influence forest community development. 4. Management that uses natural disturbance to restore and maintain biotic communities and ecosystems. Credits: 1.00

Other Departmental/Program Course Requirements (48-50 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or

networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and

non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the

design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Electives (6-8 credits)

GPA Requirements

Program Requirements

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed

include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 1st Year

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of

organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

16-17 Credits

Fall 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with

applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

15 Credits

Summer Session

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems.

Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

6 Credits

Fall 3rd Year

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define

patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

15 Credits

Spring 3rd Year

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common

basic statistical packages. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

15 Credits

Fall 4th Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and

consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

16 Credits

Spring 4th Year

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

FNR 43300 - Grand Challenges In Forest Management

Credit Hours: 3.00. This course will guide students through readings, discussions, and presentations of the grand challenges that face the field of forest management. These topics will vary with each iteration of the class but may include topics such as climate change, invasive species, pressure on forest lands from a growing population, altered disturbance regimes, development of new silvicultural techniques, economic pressure at multiple scales, and shifting public perceptions on the management of forests. Students will examine and discuss these challenges from the vantage points of multiple stakeholders to gain insight into their complexity and importance. Students will read and discuss on average 2-4 research or review articles, book chapters, or other sources per week.

Learning Outcomes: 1. Identify and discuss major challenges facing the field of forest management. 2. Describe how these challenges interact and develop an understanding of how these interactions may result in amplified effects on forests. 3. Understand how these challenges may be viewed from a variety of perspectives by different stakeholders. 4. Identify how forest management may be used to mitigate some of the effects of these challenges. 5. Organize and present an oral and written case study of a forest management scenario that is linked to multiple challenges discussed in class. Credits: 3.00

10-12 Credits

Forestry: Forest Science Concentration, BSFOR

About the Program

Degree Requirements

Departmental/Program Major Courses (70 credits)

Required Major Courses (36 credits)

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic

principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain

how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand

tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

Forest Science Concentration Courses (34 credits)

Forest Science Concentration Required Courses (22 credits)

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Learning Outcomes: 1. Write a research proposal describing a research initiative and explaining the scientific value in conducting the research. 2. Conduct research including forming the project scope, initiating and conducting the research, analyzing data and summarizing the results. 3. Present a summary of the research's findings in either oral or written format. Credits: 1.00 to 6.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on

examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

Forest Health Selectives (3 credits)

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BTNY 52500 - Intermediate Plant Pathology

Credit Hours: 3.00. Examines the biological and pathological characteristics of major causal agents; concepts of epidemiology and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions; disease management practices; and methods of disease diagnosis.

Learning Outcomes: 1. Understand concepts of disease and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions. 2. Understand the current state of knowledge in plant pathology from applied to molecular plant pathogen interactions. 3. Understand importance of plant disease in food security. 4. Understand plant pathogens and how they cause diseases; the biological and pathological characteristics of

major pathogens; Understand pathogenesis of bacterial, fungal, nematode and viral diseases. 5. Understand plant disease resistance pathways, genetic resistance mechanisms starting form gene for gene interactions. 6. Understand resistance to necrotrophic plant pathogens. 7. Understand biotechnological approaches to plant diseases resistance. 8. Identify and describe an economically important plant disease. Credits: 3.00

BTNY 53500 - Plant Disease Epidemiology

Credit Hours: 3.00. Plant disease epidemics occur due to the suitable combination of various elements of the agroecosystem. Many plant pathogens and diseases have increased their geographic distribution and intensity in the U.S. and the world. A lack of epidemiological understanding can exacerbate problems and significantly challenge the management of diseases at the field level. This course is an introduction to the epidemiological basis of disease management strategies. The course includes concepts in botanical epidemiology, disease assessment and measurement, disease modeling, epidemics comparison, and a revision of the traditional plant disease control principles. *Plant Disease Epidemiology* is an upper-level course for students interested in plant pathology, agronomy, data-driven Ag, national or international agriculture, or closely related areas. Although some pathosystems are used as model systems, *Plant Disease Epidemiology* is not a "how-to" course on controlling specific plant diseases.

Learning Outcomes: 1. Standardize terminology used in epidemiology for disease management purposes. 2. Analyze the accuracy and precision of data. 3. Use models to describe plant disease epidemics. 4. Explain how epidemiology is used to evaluate disease management options. Credits: 3.00

BTNY 55800 - Pathogens Of Plants

Credit Hours: 3.00. Plant pathology is the science of plant diseases and of the microorganisms that cause them and of our attempts to manage plant diseases. The ultimate goal of plant pathologists is to reduce the losses caused by diseases, thereby, increasing both the quality and quantity of the world food supply. Plant diseases are caused by the same types of microorganisms that cause disease in animals and humans and, as such, many of the principles that apply to human and animal medicine apply to plant diseases. It is the objective of this course to introduce students to the major types of plant pathogens (plant pathogenic bacteria, viruses, nematodes, and fungi), their basic biology and examples of the types of diseases they cause. It will be expected that students have knowledge in plant pathology.

Learning Outcomes: 1. Describe the characteristics of plant pathogenic bacteria, fungi, viruses, and nematodes and to distinguish between these pathogens. 2. Describe the methods that each pathogen group utilizes for reproduction, spread, infection of hosts, disease induction in hosts, and long term survival. 3. Classify plant pathogens in current taxonomic schemes. 4. Describe the disease cycles for plant pathogens covered in the course. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

Forest Science Selectives (9 credits)

Biometrics and Statistics

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

Forest Ecology and Silviculture

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

FNR 53500 - Forest Regeneration And Restoration

Credit Hours: 3.00. An overview of the dynamics associated with the regeneration of forestlands in North America. Topics include: seed collection and handling, forest tree nursery operations, seedling quality, managing for environmental stresses, planting operations, early stand management, and natural regeneration. Permission of instructor required. Offered in odd-numbered years.

Learning Outcomes: 1. Apply the following activities common in forest regeneration and restoration projects: artificial and natural regeneration, tree seed, site preparation, seedling quality and assessment, seedling storage and handling, planting operations, vegetation management, managing stresses in the regeneration environment, early stand management, and regeneration planning. Credits: 3.00

FNR 53600 - Ecology Of Disturbance

Credit Hours: 2.00. Advanced lecture- and discussion-based class examining how disturbance shapes the composition and structure of communities and landscapes across major terrestrial biomes. Students will examine and discuss the relationships between disturbance intensity, frequency, and spatial extent and how these characteristics affect ecological processes and ecologically-based management of forest and grassland ecosystems. The class will also examine the synergistic effects of multiple disturbances and the restoration of endemic disturbance regimes in contemporary ecosystems. Course is reading intensive; students will read and discuss on average 3-8 journal articles per week.

Learning Outcomes: 1. Describe how disturbance shapes community composition and structure for several major terrestrial biomes. 2. Understand how disturbance regulates biological diversity across terrestrial and aquatic ecosystems. 3. Understand the relationship between disturbance intensity, frequency, and spatial extent and how those factors affect management of forest and grassland ecosystems. 4. Describe the synergistic nature of disturbance and identify how disturbance factors interact across a landscape. 5. Describe how contemporary and restored disturbance regimes may facilitate or suppress the spread of invasive species. 6. Understand how management activities can mimic endemic disturbance regimes to promote biodiversity and sustainability. Credits: 2.00

FNR 53601 - Ecology Of Disturbance Practicum

Credit Hours: 1.00. This course is the practicum for FNR 53600 , hence enrollment is contingent upon enrollment in FNR 53600 . Course consists of a one or two-week long field trip to a remote site; prior trips have been taken to the Great Smokey

National Park over spring break. Course requires an additional travel fee, depending on location visited.

Learning Outcomes: 1. How disturbance shapes community composition and the distribution of species across landscapes. 2. How alterations to endemic disturbance regimes affect the composition, structure, and function of ecosystems. 3. How interactions between natural disturbance and invasion of exotic species influence forest community development. 4. Management that uses natural disturbance to restore and maintain biotic communities and ecosystems. Credits: 1.00

FNR 54300 - Conservation Biology I

Credit Hours: 3.00. Introduction to conservation biology, including population dynamics and genetic structure of rare organisms. Recovery planning, restoration ecology, environmental policy making, and sustainable developments are considered, as is ethics in conservation of biological diversity. Offered in odd-numbered years. Permission of instructor required.

Learning Outcomes: 1. Read and interpret the scientific literature on conservation of natural resources with an awareness of the current status of what is known about biodiversity, endangered species and ecosystems, biological invasions, and the effects of climate change on natural communities. 2. Explain how conservation research is carried out, and appreciate common pitfalls in designing research for goals of conservation interest. 3. Consider and evaluate the balance between conservation goals and other priorities in land management, societal and economic goals, and socio-political systems. Credits: 3.00

Forest Geospatial Analytics

ASM 21600 - Introduction To Surveying

Credit Hours: 1.00. Introduction to plane surveying, including instruction and practice in the use of surveying instruments. Basic overview of distance/angle measurement, leveling, direction, traversing, and mapping. Each weekly topic includes practical application and field exercises as applied to landscape architecture and forestry.

Learning Outcomes: 1. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 2. Function on multidisciplinary teams. 3. Use economics principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. Credits: 1.00

AT 20900 - Autonomous Aircraft Technology And Maintenance I

Credit Hours: 3.00. This course introduces fundamental concepts of autonomous aircraft technology and maintenance. Topics include history, airframe and powerplant selection, regulations governing uncrewed systems, airspace descriptions, safety, autonomous system programming and calibration, data package options, weather, system maintenance and repair, manual flight training, and aerodynamics and flight controls for autonomous aircraft.

Learning Outcomes: 1. Reflect on the history of UAS and project the future growth of UAS. 2. Analyze data sources to determine flight feasibility and mitigate hazards. 3. Collaborate effectively as a crew member both in the lab and in the field. 4. Design and print flight ready 3D model. 5. Assess airspace and flight feasibility by submission of FAA waiver application. 6. Demonstrate effective design choices. Credits: 3.00

Plant Biology

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given

information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 48000 - Plant Genetics

Credit Hours: 3.00. Principles and recent advances in plant genetics including: genetic segregation, linkage, DNA markers and applications, chromosomes and genomes, variation in chromosome number and structure, mutation, recombination and DNA repair, quantitatively inherited traits, introduction to principles of population genetics, gene expression, gene organization, regulation of gene activity, gene function, identifying important genes, cloning genes, reverse genetics, plant transformation, applications of genetic engineering, genome sequencing, using sequence data.

Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer

technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students

will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 39500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry

and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

AGRY 52000 - Principles And Methods Of Plant Breeding

Credit Hours: 3.00. Introduction to methods and techniques of breeding field crops, with emphasis on the application of genetic principles; analysis of and present approach to the solution of specific breeding problems in selected field crops.

Credits: 3.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

BTNY 55200 - Molecular Approaches In Plant Biology

Credit Hours: 3.00. This is mainly a laboratory exercise course designed to help students to be more familiar with common molecular techniques used in plant pathology studies. Techniques will include DNA/RNA isolation, hybridization, sequence analyses, various PCR reactions, library construction and screening, protein isolation, and plant transformation. Lectures will cover basic principles and applied aspects of molecular studies in plant pathology, and recent advances in genomics and proteomics techniques.

Learning Outcomes: 1. To understand the basic principles of common molecular and genomic techniques. 2. To become familiar with the application of common molecular and genomic approaches in the field of plant biology/pathology.3)To obtain laboratory experience of performing common techniques used in molecular biology. Credits: 3.00

CHM 53300 - Introductory Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry.

Credits: 3.00

Other Departmental/Program Course Requirements (48-50 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex

philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections.

Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to

fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Electives (4-6 credits)

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world

issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 1st Year

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

16-17 Credits

Fall 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically

evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

15 Credits

Summer Session

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos.

6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk

assessment for trees. Credits: 4.00

6 Credits

Fall 3rd Year

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Spring 3rd Year

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance

management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Learning Outcomes: 1. Write a research proposal describing a research initiative and explaining the scientific value in conducting the research. 2. Conduct research including forming the project scope, initiating and conducting the research, analyzing data and summarizing the results. 3. Present a summary of the research's findings in either oral or written format. Credits: 1.00 to 6.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

16 Credits

Fall 4th Year

FNR 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Learning Outcomes: 1. Write a research proposal describing a research initiative and explaining the scientific value in conducting the research. 2. Conduct research including forming the project scope, initiating and conducting the research, analyzing data and summarizing the results. 3. Present a summary of the research's findings in either oral or written format. Credits: 1.00 to 6.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better

business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

13 Credits

Spring 4th Year

FNR 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Learning Outcomes: 1. Write a research proposal describing a research initiative and explaining the scientific value in conducting the research. 2. Conduct research including forming the project scope, initiating and conducting the research, analyzing data and summarizing the results. 3. Present a summary of the research's findings in either oral or written

format. Credits: 1.00 to 6.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

12-14 Credits

Forestry: Sustainable Biomaterials Concentration, BSFOR

About the Program

Degree Requirements

Departmental/Program Major Courses (69 credits)

Required Major Courses (36 credits)

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems.

3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes

change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and

function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

Sustainable Biomaterials Concentration Courses (33 credits)

Sustainable Biomaterials Required Courses (21 credits)

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and

maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

FNR 48410 - Sustainable Wood Products, Furniture Design And Manufacturing

Credit Hours: 3.00. This project-based course explains principles of product development, furniture construction, strength design, performance testing, and product sustainability (life cycle analysis and end-of-life options). The course familiarizes students with methods such as Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), Computer Numerical Control (CNC) router operation, rapid prototyping, and basics of secondary wood products manufacturing, to build an actual product.

Learning Outcomes: 1. Understand Computer Aided Design (CAD). 2. Understand Computer Aided Manufacturing (CAM). 3. Understand CNC router operation. 4. Understand rapid prototyping. 5. Understand the basics of secondary wood products manufacturing. 6. Understand the principles of sustainable product development. Credits: 3.00

Sustainable Biomaterials Selectives (12 credits)

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 33200 - Cross-Cultural Marketing And International Retailing

Credit Hours: 3.00. Examination of marketing/retail practices used to target domestic and global consumer market segments. Development of successful retail and marketing strategies is stressed.

Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

AD 49000 - Special Problems In Art And Design

Credit Hours: 1.00 to 6.00. Individual problems in art and design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design

of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 43540 - Facilities Planning And Material Handling

Credit Hours: 3.00. This course takes a systematic approach to design of facilities and material handling systems for effective and lean production of goods and services. An array of qualitative and quantitative tools and techniques are introduced and utilized, emphasizing lean principles, waste reduction, and overall efficiency of operations. Flow analysis and optimization tools, including computer simulation, are introduced. Strong emphasis is placed on a comprehensive semester-long team project as an integral component of this course.

Learning Outcomes: 1. Calculate various elements of time study and Takt time. 2. Apply various flow analysis tools. 3. Apply the principles of line balancing. 4. Calculate the efficiency of an assembly line. 5. Calculate facility space requirements. 6. Develop a systematic approach to layout and resource planning, incorporating basic material handling systems. Credits: 3.00

AD 53500 - Furniture Design

Credit Hours: 3.00. Examination of furniture design trends and designers. Explore materials and manufacturing processes. Design and build a full-size seating unit. Shop skills required. Permission of instructor required.

Credits: 3.00

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements,

and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Other Departmental/Program Course Requirements (48-50 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as

usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions.

6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Electives (5-7 credits)

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand

academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 1st Year

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8.

Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

16-17 Credits

Fall 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view.
Credits: 3.00

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana.
Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

15 Credits

Summer Session

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17.

Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

6 Credits

Fall 3rd Year

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important

physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

13-15 Credits

Spring 3rd Year

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

15 Credits

Fall 4th Year

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 48410 - Sustainable Wood Products, Furniture Design And Manufacturing

Credit Hours: 3.00. This project-based course explains principles of product development, furniture construction, strength design, performance testing, and product sustainability (life cycle analysis and end-of-life options). The course familiarizes students with methods such as Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), Computer Numerical Control (CNC) router operation, rapid prototyping, and basics of secondary wood products manufacturing, to build an actual product.

Learning Outcomes: 1. Understand Computer Aided Design (CAD). 2. Understand Computer Aided Manufacturing (CAM). 3. Understand CNC router operation. 4. Understand rapid prototyping. 5. Understand the basics of secondary wood products manufacturing. 6. Understand the principles of sustainable product development. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making).

6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

13 Credits

Spring 4th Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

15 Credits

Forestry: Urban Forestry, BSFOR

About the Program

Degree Requirements

Departmental/Program Major Courses (75 credits)

Required Major Courses (36 credits)

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on

the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30.

Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and

written communication. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

Urban Forestry Concentration Courses (39 credits)

Urban Forestry Required Courses (33 credits)

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of

forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 44400 - Arboricultural Practices

Credit Hours: 4.00. Course covers a broad spectrum of arboriculture principles and techniques, including pruning, transplanting, fertilization, climbing, rigging, removal, cabling, bracing, lightning protection, hazard tree evaluation, tree appraisal, and street tree inventory.

Learning Outcomes: 1. Recognize and explain the various arboricultural practices that enhance the sustainability of trees in the built environment. 2. Apply essential plant health care practices and arboricultural practices used in the cultivation and management of trees and other woody plants in the built environment including planting, pruning and pest management. Credits: 4.00

FNR 44500 - Urban Forest Issues

Credit Hours: 3.00. This course presents an array of topics germane to the management of trees in the urban environment. This includes the benefits of trees and general tree care, tree appraisal, tree ordinances, tree inventory and management plans, and tree preservation and construction.

Learning Outcomes: 1. Understand sustainable urban & community forestry and why it is important. 2. Recognize the numerous benefits of urban/community forests to society, and the ecosystem services provided. 3. Identify common issues, challenges and pressures which threaten the urban forest. 4. Recognize the unique features of urban forest systems and how to apply the principles of urban forest management to real-world cases. 5. Acquire an understanding of sustainability as it pertains to urban forests and urban forestry programs in metropolitan regions, cities, towns, communities and neighborhoods. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know

what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

Urban Forestry Concentration Selectives (6 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and

symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay

individual lodging or meal expenses when necessary.

Credits: 3.00

LA 32500 - Ecological Landscape Performance And Planting

Credit Hours: 3.00. Study of plants and their integration with other site features (e.g., water, landform) to increase sustainability. Plants will not only be studied for their aesthetic and spatial uses in the landscape, but also their ecological functions and temporal dynamics. The relationship of plants to site planning, ecosystems, and human use will be explored. Various scales, sustainable practices, and landscape performance will be considered. Class trip may be required. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Be familiar with and able to use design principles and elements in the development of planting designs and understand the implications of plants as living things. 2. Understand the relationship of planting design, ecological functions, social factors, and sustainability. 3. Have a clear understanding of the concept and measurement methods of landscape performance. 4. Set smart and measurable sustainable goals and be able to select suitable plant material and create effective compositions appropriate for a variety of site conditions. 5. Know how to observe plants from multiple perspectives (plant needs & site/environmental conditions; human spatial needs; aesthetic responses; ecological implications) and be able to integrate these perspectives into functional designs. Credits: 3.00

LA 32600 - Studio V: Community Design And Planning

Credit Hours: 4.00. Community planning and design. Past, current and emerging planning theories are investigated via lectures, research assignments and studio projects. The interrelationship of land use, circulation, and open space are explored using environmental and sustainable principles within a framework of traditional neighborhood design.

Learning Outcomes: 1. Understand the fundamental terminologies, design strategies, and workflow of master plan community planning. 2. Distinguish the attributes and characteristics of different residential types. 3. Articulate, utilize and specify methods for spatial layout and resource Integration (open space, transportation, parking and facilities, and building blocks) in different community planning projects. 4. Develop well-reasoned design concept and defensible design decisions that best respond to site constraints and planning regulations. 5. Apply knowledge of stormwater management and sustainable practices to community design. 6. Improve the abilities to research, critical thinking, collaboration, model making (hand and digital), verbal representation, and digital rendering techniques. Credits: 4.00

ENTM 40100 - Addressing Grand Challenges Through Insect Biology

Credit Hours: 1.00. This course engages students in an examination of societal grand challenges by identifying the problems, understanding the current state of knowledge, identifying knowledge gaps, and implementing possible solutions. Permission of department required.

Learning Outcomes: 1. Explain how the accumulated knowledge and experiences of Insect Biology majors can be applied to address Grand Challenges. 2. Demonstrate where capstone projects and grand challenges intersect. 3. Explain roles insect biologists play in addressing grand challenges, and the relationship to future career options. 4. Demonstrate skills in communication, critical thinking and teamwork. Credits: 1.00

Other Departmental/Program Course Requirements (45-47 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other

topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and

accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in

achieving efficiency and equity. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Electives (2-4 credit)

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and

regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-16 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students

for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

16 Credits

Fall 2nd Year

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

13 Credits

Spring 2nd Year

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

15 Credits

Summer Session

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos,

topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for

access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

6 Credits

Fall 3rd Year

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

FNR 44400 - Arboricultural Practices

Credit Hours: 4.00. Course covers a broad spectrum of arboriculture principles and techniques, including pruning, transplanting, fertilization, climbing, rigging, removal, cabling, bracing, lightning protection, hazard tree evaluation, tree appraisal, and street tree inventory.

Learning Outcomes: 1. Recognize and explain the various arboricultural practices that enhance the sustainability of trees in the built environment. 2. Apply essential plant health care practices and arboricultural practices used in the cultivation and management of trees and other woody plants in the built environment including planting, pruning and pest management. Credits: 4.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

16 Credits

Spring 3rd Year

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 44500 - Urban Forest Issues

Credit Hours: 3.00. This course presents an array of topics germane to the management of trees in the urban environment. This includes the benefits of trees and general tree care, tree appraisal, tree ordinances, tree inventory and management plans, and tree preservation and construction.

Learning Outcomes: 1. Understand sustainable urban & community forestry and why it is important. 2. Recognize the numerous benefits of urban/community forests to society, and the ecosystem services provided. 3. Identify common issues, challenges and pressures which threaten the urban forest. 4. Recognize the unique features of urban forest systems and how to apply the principles of urban forest management to real-world cases. 5. Acquire an understanding of sustainability as it pertains to urban forests and urban forestry programs in metropolitan regions, cities, towns, communities and neighborhoods. Credits: 3.00

15 Credits

Fall 4th Year

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram

flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits: 3.00

15-16 Credits

Spring 4th Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and

regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

12-13 Credits

French, BA (Language & Culture Track)

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Pre-Requisite Courses

FR 10100 - French Level I (UCC: HUM)

Credit Hours: 3.00. A beginning French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. Permission of department required. CTL:IWL 1901 French Level I

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Explain and produce biographical information about themselves and others in the French language. 2. Identify necessary information by asking questions about people and things in the French language. 3. Solve a simple survival situation such as ordering food and beverages in the French language. 4. Compose with language by combining learned elements in the French language. Credits: 3.00

FR 10200 - French Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 10100 . CTL:IWL 1902 French Level II

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

FR 20100 - French Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1903 French Level III

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

FR 20200 - French Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 20100 . CTL:IWL 1904 French Level IV

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

French Major

Area A - French Language Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific

contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Area B - French Literature Course (3 credits)

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.

Credits: 3.00

Language & Culture Track

Area C - Advanced French Language (6 credits)

FR 40100 - French Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of French speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

FR 40200 - French Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in French. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Area D - French Linguistics Course (3 credits)

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

Area E - French Culture Course (3 credits)

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

Area F - French Electives (12 credits)

FR 28000 - Second-Year French: Special Topics

Credit Hours: 3.00. Selected topics on the civilization, culture, and literature of France. Lectures and readings primarily in English, but knowledge of French at the first-year level necessary.

Credits: 3.00

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

FR 34100 - French Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. Reading of selected poetry, prose, and theatre of France from the Middle Ages through the Enlightenment in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 34200 - French Literature II: The 19th And 20th Centuries

Credit Hours: 3.00. Reading of selected French poetry, novels, theatre, and short fiction of the 19th and 20th centuries in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 39400 - Special Topics In French Literature

Credit Hours: 3.00. Studies a particular aspect in French literature (e.g., theme, device, character type, motif, place) by

reading a varied selection of works of different genres, styles and/or periods. Readings, discussion, and papers in French.

Credits: 3.00

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 44300 - Introduction To Francophone Literature

Credit Hours: 3.00. The study of the most representative Francophone poets, playwrights, and novelists from various countries, such as Leopold Senghor, Aime Cesaire, Jacques Romain, Gabrielle Roy, Michel Tremblay, Mohamed Dib.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 52700 - Etudes de Style

Credit Hours: 3.00. Study of the expression of affective and artistic values in literary French. Detailed grammatical analyses and study of stylistic procedures. Comparison with English usage. Introduction to explication de texte as an approach to literature. Permission of department required.

Credits: 3.00

FR 54100 - Renaissance French Literature

Credit Hours: 3.00. Major works in verse and prose of the sixteenth century. Marot, du Bellay, Ronsard, Rabelais, Montaigne. Permission of department required.

Credits: 3.00

FR 54900 - French Literature And Film

Credit Hours: 3.00. An examination of the interrelationships of contemporary French literature and film. Discussion of the potential of each medium as an art form, problems of visual transposition of literary works, and extension of literary concepts such as Dadaism and Surrealism into cinema. Permission of department required.

Credits: 3.00

FR 55800 - French Novel Of The Twentieth Century

Credit Hours: 3.00. Consideration of the character, aesthetics, and evolution of the twentieth-century French novel. Readings from such representative novelists as Proust, Gide, Bernanos, Giono, Malraux, Camus, Robbe-Grillet, Saporta. Permission of department required.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature,

music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

FR 59400 - Special Topics In French Literature

Credit Hours: 1.00 to 4.00. Special topics in French Literature. Permission of instructor required.

Credits: 1.00 to 4.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

FR 49100 - Special Topics In French

Credit Hours: 1.00 to 4.00. This course will be offered as a guided reading or independent study course on a topic of mutual interest in French or Francophone literature, culture, film, or linguistics, to the student and faculty. Permission of instructor required.

Learning Outcomes: 1. Learning objectives will vary due to the nature of the course. Credits: 1.00 to 4.00

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

FR 10100 - French Level I (UCC: HUM)

Credit Hours: 3.00. A beginning French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. Permission of department required. CTL:IWL 1901 French Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain and produce biographical information about themselves and others in the French language. 2. Identify necessary information by asking questions about people and things in the French language. 3. Solve a simple survival situation

such as ordering food and beverages in the French language. 4. Compose with language by combining learned elements in the French language. Credits: 3.00

15-18 Credits

Spring 1st Year

FR 10200 - French Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 10100 . CTL:IWL 1902 French Level II

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15-16 Credits

Fall 2nd Year

FR 20100 - French Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1903 French Level III

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

14-16 Credits

Spring 2nd Year

FR 20200 - French Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 20100 . CTL:IWL 1904 French Level IV

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

12-18 Credits

Fall 3rd Year

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of

French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

15 Credits

Spring 3rd Year

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.

Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Fall 4th Year

FR 40100 - French Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of French speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Spring 4th Year

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes.

Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

13 Credits

French: World Languages Teaching Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (80 credits)

Pre-Requisite Courses

FR 10100 - French Level I (UCC: HUM)

Credit Hours: 3.00. A beginning French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. Permission of department required. CTL:IWL 1901 French Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain and produce biographical information about themselves and others in the French language. 2. Identify necessary information by asking questions about people and things in the French language. 3. Solve a simple survival situation such as ordering food and beverages in the French language. 4. Compose with language by combining learned elements in the French language. Credits: 3.00

FR 10200 - French Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 10100 . CTL:IWL 1902 French Level II

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 20100 - French Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1903 French Level III

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 20200 - French Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 20100 . CTL:IWL 1904 French Level IV

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

French Major (33 credits)

Area A - French Languages Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French

culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

Area B - French Literature Course (3 credits)

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.

Credits: 3.00

Education Track (24 credits)

Area C - Advanced French Language (9 credits)

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 40100 - French Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of French speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 40200 - French Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in French. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

Area D - French Culture Course (3 credits)

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4.

Behave appropriately in a French professional context. Credits: 3.00

Area E - French Electives (12 credits)

FR 28000 - Second-Year French: Special Topics

Credit Hours: 3.00. Selected topics on the civilization, culture, and literature of France. Lectures and readings primarily in English, but knowledge of French at the first-year level necessary.

Credits: 3.00

FR 31200 - Advanced French Conversation

Credit Hours: 1.00. One credit hour advanced French conversation focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative competence. Discussions in French on various topics. Course may be taken concurrently with FR 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral French proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in French.
Credits: 1.00

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

FR 34100 - French Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. Reading of selected poetry, prose, and theatre of France from the Middle Ages through the Enlightenment in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 34200 - French Literature II: The 19th And 20th Centuries

Credit Hours: 3.00. Reading of selected French poetry, novels, theatre, and short fiction of the 19th and 20th centuries in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 44300 - Introduction To Francophone Literature

Credit Hours: 3.00. The study of the most representative Francophone poets, playwrights, and novelists from various countries, such as Leopold Senghor, Aime Cesaire, Jacques Romain, Gabrielle Roy, Michel Tremblay, Mohamed Dib.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 52700 - Etudes de Style

Credit Hours: 3.00. Study of the expression of affective and artistic values in literary French. Detailed grammatical analyses and study of stylistic procedures. Comparison with English usage. Introduction to explication de texte as an approach to literature. Permission of department required.

Credits: 3.00

FR 54100 - Renaissance French Literature

Credit Hours: 3.00. Major works in verse and prose of the sixteenth century. Marot, du Bellay, Ronsard, Rabelais, Montaigne. Permission of department required.

Credits: 3.00

FR 54900 - French Literature And Film

Credit Hours: 3.00. An examination of the interrelationships of contemporary French literature and film. Discussion of the potential of each medium as an art form, problems of visual transposition of literary works, and extension of literary concepts

such as Dadaism and Surrealism into cinema. Permission of department required.

Credits: 3.00

FR 55800 - French Novel Of The Twentieth Century

Credit Hours: 3.00. Consideration of the character, aesthetics, and evolution of the twentieth-century French novel. Readings from such representative novelists as Proust, Gide, Bernanos, Giono, Malraux, Camus, Robbe-Grillet, Saporta. Permission of department required.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

FR 59400 - Special Topics In French Literature

Credit Hours: 1.00 to 4.00. Special topics in French Literature. Permission of instructor required.

Credits: 1.00 to 4.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as

national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

FR 49100 - Special Topics In French

Credit Hours: 1.00 to 4.00. This course will be offered as a guided reading or independent study course on a topic of mutual interest in French or Francophone literature, culture, film, or linguistics, to the student and faculty. Permission of instructor required.

Learning Outcomes: 1. Learning objectives will vary due to the nature of the course. Credits: 1.00 to 4.00

Other Departmental (12 credits)

Core III: Linguistic Diversity (0 credits)

Foundational Requirements (12 credits)

Notes

Electives (31 credits)

Grade Requirements

GPA Requirements

Teacher Licensure Information

Course/Credit Notes & Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

FR 10100 - French Level I (UCC: HUM)

Credit Hours: 3.00. A beginning French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. Permission of department required. CTL:IWL 1901 French Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain and produce biographical information about themselves and others in the French language. 2. Identify necessary information by asking questions about people and things in the French language. 3. Solve a simple survival situation such as ordering food and beverages in the French language. 4. Compose with language by combining learned elements in the French language. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

15 Credits

Spring 1st Year

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

FR 10200 - French Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 10100 . CTL:IWL 1902 French Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

FR 20100 - French Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1903 French Level III

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching

experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

FR 20200 - French Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 20100 . CTL:IWL 1904 French Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on

special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2,

4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

15 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

15 Credits

Spring 3rd Year

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.

Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4. Recognize how theories of individual and collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences.
Credits: 3.00

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 40100 - French Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of French speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are

clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

18 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Game Development, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (54 credits)

Required Major Courses (39 credits)

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online

body of work. Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the

execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 24500 - Game Development I: Core Skills And Technologies

Credit Hours: 3.00. (CNIT 30600) This course introduces students to the fundamental technologies and skill sets required to develop video games. Students will be taught agile development methodologies in a team-based environment.

Learning Outcomes: 1. Demonstrate a moderate level of individual skill with a commercial game engine. 2. Demonstrate the ability to observe game mechanics and reproduce them. 3. Acquire competency in each of the following domains: 3D and 2D level creation, basic art asset creation, visual programming basics, implementing game mechanics. 4. Demonstrate the ability to complete a market-ready video game in a team-based production environment. 5. Demonstrate the ability to implement agile production techniques. Credits: 3.00

CGT 25500 - Game Development II: Design And Psychology

Credit Hours: 3.00. (CNIT 30800) This course examines video game design, theory, and development from aesthetic, psychological, and technical perspectives. Students will gain experience with a commercial game development platform. Advanced game development techniques will be taught in this course.

Learning Outcomes: 1. Deconstruct and analyze an existing game and define its essential elements as per various theories of game design. 2. Identify major psychological paradigms and how they are applied in video game experiences. 3. Demonstrate proficiency in applying behavior modification principles in video games. 4. Demonstrate individual technical proficiency with a commercial game engine. 5. Complete a market-ready video game in a team-based production environment. 6. Implement agile production techniques. Credits: 3.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify

five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 10501 - Introduction To Games (UCC: STS)

Credit Hours: 3.00. Students learn the history of computer game design. Students engage in learning activities that help them remember basic game design principles. These principles are then applied using simple exercises within game engine technology.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Recall key facts about computer game design history. 2. Understand principles of computer game design. 3. Apply computer game design principles in exercises on paper and in game engine technology. 4. Analyze computer games via written critiques. Credits: 3.00

CGT 36500 - Game Development Practicum

Credit Hours: 3.00. This course provides an opportunity for teams of game developers to focus on a project without distraction by competing course deliverables. Students propose a game project and spend the entire semester working only on that project. Course instructors will function as facilitators, producers, and supervisors, helping each student team scaffold their work such that all course goals are met.

Learning Outcomes: 1. Decompose a large term game development project into an actionable sequence of smaller development tasks. 2. Face emergent open-ended development challenges and either solve them or adapt to them as project goals require. 3. Set short-term game production goals and consistently meet them. 4. Self-evaluate completed work and iterate as necessary to ensure it meets the project's quality goals. 5. Accept and incorporate criticism regarding one's work and use it to improve one's craft. 6. Deliver criticism constructively that is in service to meeting project quality goals. 7. Maintain group cohesion and morale across a physically separated accordance with industry best productions practices. 8. Internalize and structure individual work habits in accordance with industry best production practices. Credits: 3.00

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 11505 - Scripting And Computational Thinking

Credit Hours: 3.00. This course introduces the students to computer programming, computational thinking, and the mathematics of graphics programming. The act of programming is viewed through the lenses of Decomposition, Pattern Matching, Abstraction and Algorithms and then applied to writing some simple games in current scripting languages. No

prior programming experience is required. The principal objective of the course is to provide a working knowledge of programming fundamentals to game designers and artists as well as to prepare game programmers for more advanced game programming coursework. As computer programming is an applied discipline, this course uses an active learning approach that combines lecture time with extensive lab assignments.

Learning Outcomes: 1. Apply the elements of computational thinking to programming tasks. 2. Use scripting languages in a well-structured way to implement math-based graphical solutions. 3. Use scripting languages to create gameplay within a game engine. 4. Use the mathematics of 2D and 3D graphics programming. Credits: 3.00

CGT Entertainment Selectives (15 credits)

Other Departmental/Program Course Requirements (52 credits)

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse

audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws.

2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical

inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive,

explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (14 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse

function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

CGT 24500 - Game Development I: Core Skills And Technologies

Credit Hours: 3.00. (CNIT 30600) This course introduces students to the fundamental technologies and skill sets required to develop video games. Students will be taught agile development methodologies in a team-based environment.

Learning Outcomes: 1. Demonstrate a moderate level of individual skill with a commercial game engine. 2. Demonstrate the ability to observe game mechanics and reproduce them. 3. Acquire competency in each of the following domains: 3D and 2D level creation, basic art asset creation, visual programming basics, implementing game mechanics. 4. Demonstrate the ability to complete a market-ready video game in a team-based production environment. 5. Demonstrate the ability to implement agile production techniques. Credits: 3.00

CGT 10501 - Introduction To Games (UCC: STS)

Credit Hours: 3.00. Students learn the history of computer game design. Students engage in learning activities that help them remember basic game design principles. These principles are then applied using simple exercises within game engine technology.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recall key facts about computer game design history. 2. Understand principles of computer game design. 3. Apply computer game design principles in exercises on paper and in game engine technology. 4. Analyze computer games via written critiques. Credits: 3.00

15 Credits

Spring 1st Year

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CGT 25500 - Game Development II: Design And Psychology

Credit Hours: 3.00. (CNIT 30800) This course examines video game design, theory, and development from aesthetic, psychological, and technical perspectives. Students will gain experience with a commercial game development platform. Advanced game development techniques will be taught in this course.

Learning Outcomes: 1. Deconstruct and analyze an existing game and define its essential elements as per various theories of game design. 2. Identify major psychological paradigms and how they are applied in video game experiences. 3. Demonstrate proficiency in applying behavior modification principles in video games. 4. Demonstrate individual technical proficiency with a commercial game engine. 5. Complete a market-ready video game in a team-based production environment. 6. Implement agile production techniques. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

15 Credits

Fall 2nd Year

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking

about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CGT 11505 - Scripting And Computational Thinking

Credit Hours: 3.00. This course introduces the students to computer programming, computational thinking, and the mathematics of graphics programming. The act of programming is viewed through the lenses of Decomposition, Pattern Matching, Abstraction and Algorithms and then applied to writing some simple games in current scripting languages. No prior programming experience is required. The principal objective of the course is to provide a working knowledge of programming fundamentals to game designers and artists as well as to prepare game programmers for more advanced game programming coursework. As computer programming is an applied discipline, this course uses an active learning approach that combines lecture time with extensive lab assignments.

Learning Outcomes: 1. Apply the elements of computational thinking to programming tasks. 2. Use scripting languages in a well-structured way to implement math-based graphical solutions. 3. Use scripting languages to create gameplay within a game engine. 4. Use the mathematics of 2D and 3D graphics programming. Credits: 3.00

15 Credits

Spring 2nd Year

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the

foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective

sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

14 Credits

Fall 3rd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical

sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

CGT 36500 - Game Development Practicum

Credit Hours: 3.00. This course provides an opportunity for teams of game developers to focus on a project without distraction by competing course deliverables. Students propose a game project and spend the entire semester working only on that project. Course instructors will function as facilitators, producers, and supervisors, helping each student team scaffold their work such that all course goals are met.

Learning Outcomes: 1. Decompose a large term game development project into an actionable sequence of smaller development tasks. 2. Face emergent open-ended development challenges and either solve them or adapt to them as project goals require. 3. Set short-term game production goals and consistently meet them. 4. Self-evaluate completed work and iterate as necessary to ensure it meets the project's quality goals. 5. Accept and incorporate criticism regarding one's work and use it to improve one's craft. 6. Deliver criticism constructively that is in service to meeting project quality goals. 7. Maintain group cohesion and morale across a physically separated accordance with industry best productions practices. 8. Internalize and structure individual work habits in accordance with industry best production practices. Credits: 3.00

15 Credits

Spring 3rd Year

CGT 36500 - Game Development Practicum

Credit Hours: 3.00. This course provides an opportunity for teams of game developers to focus on a project without distraction by competing course deliverables. Students propose a game project and spend the entire semester working only on that project. Course instructors will function as facilitators, producers, and supervisors, helping each student team scaffold their work such that all course goals are met.

Learning Outcomes: 1. Decompose a large term game development project into an actionable sequence of smaller development tasks. 2. Face emergent open-ended development challenges and either solve them or adapt to them as project goals require. 3. Set short-term game production goals and consistently meet them. 4. Self-evaluate completed work and iterate as necessary to ensure it meets the project's quality goals. 5. Accept and incorporate criticism regarding one's work and

use it to improve one's craft. 6. Deliver criticism constructively that is in service to meeting project quality goals. 7. Maintain group cohesion and morale across a physically separated accordance with industry best productions practices. 8. Internalize and structure individual work habits in accordance with industry best production practices. Credits: 3.00

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

15 Credits

Fall 4th Year

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

16 Credits

Spring 4th Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

15 Credits

General Education: Curriculum and Instruction, BA (non-licensure)

About the Program

Degree Requirements

Departmental/Program Major Courses (31 credits)

Required Courses (19 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at

different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and

the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Special Populations Selective (6 credits)

EDCI 38100 - Teaching For Social Justice: Culturally And Linguistically Diverse Learners

Credit Hours: 3.00. This course builds on the content of EDCI 28500 (Multicultural Education) with specific attention to issues of social justice related to literacy and linguistic diversity. Within this framework, students will learn strategies for teaching English language learners, deconstruct deficit perspectives of dialectical differences, and consider approaches to classroom management. Additionally, a field experience component with an ELL teacher will be included in the course.

Learning Outcomes: 1. Engage with the following concepts via reading, analysis/critique,

and consideration of how they might apply in future classrooms: culturally relevant pedagogy and culturally sustaining pedagogy, code switching and code meshing, restorative justice. 2. Learn pedagogical strategies for working with ELLs in secondary English classrooms. 3. Understand the school-to-prison pipeline phenomenon and develop classroom management principles accordingly. 4. Participate in a field experience that requires interaction with culturally and linguistically diverse students in a local ELL classroom. Credits: 3.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral, social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

EDCI 32650 - Introduction To Linguistics And Language Acquisition In Education

Credit Hours: 3.00. This course addresses foundational knowledge in language and linguistics for pre-service teachers and educational researchers. The purpose of this course is to survey linguistics, the study of the science of language. In this course, we will focus on phonetics, phonology, morphology, syntax, and semantics. These topics will be discussed in terms of theory, as well as in the context of ESL classroom instruction, materials development, and assessment.

Learning Outcomes: 1. Understand and describe core concepts and terminology of descriptive linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics. 2. Apply course concepts to analyze linguistic data and gain a fuller understanding of the systematic nature of language. 3. Apply descriptive linguistic concepts to instruction to support the four domains of speaking, listening, reading, and writing. 4. Research and describe the biological, social, and cultural dimensions of linguistics, including pragmatics, discourse, dialects, bilingualism, and language in education. 5. Discuss the role of home language and culture in ELL instruction. 6. Apply an understanding of the role of culture and family background in the student's experience of the classroom. Credits: 3.00

EDCI 31950 - Approaches To English Learner Education

Credit Hours: 3.00. This course addresses English language instruction and content instruction for English Learning students in mainstream classrooms. The purpose of this course is to provide information necessary to the design of materials and

instructional strategies for English Language Learners in K-12 context. In this course, we will focus on current issues and techniques in instruction for ELL students who are at different stages of English language acquisition in the K-12 school context. The course will also consider the nature of immigrants' experiences of a new country and school context. Practical field experiences integrated into the course will provide students with the opportunity to apply and demonstrate principles and strategies presented in the course.

Learning Outcomes: 1. Use essential techniques for instruction of ELLs across various grade levels. 2. Evaluate the language used in resources for ELL content instruction. 3. Examine the role of visual and verbal language in ELL instruction. 4. Analyze the ways in which students use literacy as writing, drawing, and talk. 5. Describe the language characteristics of important school genres. 6. Apply the teaching and learning cycle in the genre approach to lesson planning. 7. Implement and reflect on a multimodal, content area ELL lesson. 8. Discuss the role of home language and culture in ELL instruction. 9. Apply an understanding of the role of culture and family background in the student's experience of the classroom. Credits: 3.00

EDPS 34201 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to curricular materials, curriculum development, and programs for gifted, creative, and talented (GCT) students. It serves the needs of pre-service teachers who are preparing to teach gifted students in mixed-ability, general education or specialized classrooms. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students. Major assignments will assess students' understanding and application of foundational concepts related to the education of students with gifts, creativity, and talent. Permission of instructor required.

Learning Outcomes: 1. Determine the degree of alignment between a gifted program's stated goals, continuum of services, and curriculum resources. [NAGC-CEC Standards (2013): 2.4, 3.1, 3.3, -4.4, 4.5, 5.1-5.3, 5.5, 6.1, 7.3] 2. Describe the most widely used curriculum and program models in gifted education. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] 3. Determine which curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. You may conclude that particular models "fit" different grade levels better than others. [NAGC-CEC Standards (2013): 3.1, 3.4, 4.4, 5.1, 5.2, 6.1]. 4. Justify the use of differentiation to meet the academic needs of gifted students. [NAGC-CEC Standards (2013): 3.2-3.4, 4.2, 4.4, 5.1] 5. Evaluate educational materials and practices to assess their suitability for use with high-ability students. [NAGC-CEC Standards (2013): 2.4,3.3, 4.1-4.4, 5.1-5.3, 6.1] 6. Practice designing and revising lessons to incorporate instructional strategies well-suited for high-ability students. [NAGC-CEC Standards (2013): 2.1-2.4, 3.1-3.4, 4.2, 4.4, 4.5,5.1-5.5] Credits: 3.00

EDPS 34501 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students and provides you with knowledge and skills needed to effectively support healthy psychosocial development through your work with gifted students. As well as providing an overview of the characteristics and needs of gifted students, we will also discuss special populations of gifted learners, diversity issues, family and peer relationships, and current educational approaches and counseling interventions, including considerations for career development for gifted students. Permission of instructor required.

Learning Outcomes: 1. Recognize the social and affective characteristics and needs of high-ability students; describe and apply research-based practices to support their affective developments across home, school, and community. [NAGC-CEC Standards: 1.1, 1.2, 2.1] 2. Practice designing products that incorporate meaningful and engaging social and affective components that promote social-emotional well-being, including coping skills,

proactive, adaptive behaviors, performance skills, and social skills. [NAGC-CEC Standards: 2.1-2.3, 3.1, 3.4, 4.5, 5.1] 3. Discuss characteristics and needs of subpopulations of high-ability learners and the implications for academic instruction, ethical leadership development, and/or counseling interventions. [NAGC-CEC Standards: 2.1-2.3, 4.1-4.5, 6.1, 6.3] 4. Increase knowledge and experience through regular participation in class discussion boards, interaction with gifted students and their parents, and completion of an in-depth, original affective case study of a high-ability students K-12. [NAGC-CEC Standards: 3.1, 4.3, 4.5, 7.1-7.2] Credits: 3.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

Foundations of Literacy (3 credits)

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 43400 - Literacy Teaching And Learning In Secondary Schools

Credit Hours: 2.00. Exploration and development of various instructional methods and materials appropriate for supporting adolescent literacy in secondary English (i.e., middle and high school English Language Arts), including the teaching of reading. Content-area literacy methods and materials are also addressed. Includes a field experience of up to 20 hours in a secondary English school setting.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of secondary English literacy. 2. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 3. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary English. Credits: 2.00

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

ENGL 39200 - Young Adult Literature

Credit Hours: 3.00. This course examines the construct of Young Adult Literature as a genre crafted specifically for

adolescents. Using both classic and contemporary novels, as well as relevant theoretical and research texts, this course explores how YA literature is defined, what it offers to adolescent readers, and how it is situated in the literary landscape.

Learning Outcomes: 1. Read, respond to, and analyze selected works of Young Adult literature in order to think critically about various concepts and issues connected to the genre. 2. Explore, analyze, and critique the extent to which selected Young Adult literature affects and reflects teenage life. Credits: 3.00

EDCI 21510 - Language & Literacy Foundations For Teachers

Credit Hours: 1.00. The goal of the course is to provide background information in language and literacy necessary for success in literacy methods courses. The course will address basic linguistics and phonetic patterns of English, as well as the structures of literature and literary terms.

Learning Outcomes: 1. Compare and contrast levels of language structure: phoneme, morpheme, root, affix, phrase, sentence. 2. Differentiate graphic from phonological elements of language (e.g., grapheme vs phoneme). 3. Compare and contrast vocabulary terms (e.g. synonym, homonym, homograph). 4. Define and articulate written elements (e.g. digraphs, consonant clusters, long/short vowels). 5. Identify morpho-syntactic structures and phonological patters in written and spoken language. 6. Compare and contrast literary genres (e.g. narrative, non-narrative, fiction, nonfiction). 7. Distinguish the organizational structures of fictional genres from those of nonfictional genres. 8. Identify literary terms in context (e.g. alliteration, character traits, plot, stanza). Credits: 1.00

EDCI 32501 - Teaching Literacy In K-2

Credit Hours: 2.00. Students will study how children's oral language develops, how children learn to read and write in primary grade settings, and the teacher's role in this process. Students will learn how phonemic awareness, phonics, fluency, vocabulary and comprehension influence children's literacy development. Students will learn how to select appropriate instructional materials; employ teaching strategies to meet the cognitive and affective literacy needs of all children, and collect, interpret, and use data from various types of assessments to inform literacy teaching and learning processes.

Learning Outcomes: 1. Develop a sound background in theory and research about children's language and literacy development and learning. 2. Learn how literacy learning, teaching, and assessment in phonemic awareness, phonics, fluency, vocabulary, comprehension and writing can be effectively and systematically integrated and diversified to meet individual or group needs. 3. Design and implement developmentally appropriate instruction for primary grade students. Credits: 2.00

Capstone Experience Selective (3 credits)

EDCI 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EPCS 40200 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100 /40200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 40200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40100 .

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire

new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 40100 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100/EPCS 40200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 40100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 30100 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-

solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

Required Minor or Certificate (9-15 credits)

Other Departmental/Program Course Requirements (30-31 credits)

Racial, Ethnic & Cultural Diversity (6 credits)

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black

American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations.
Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an

organized effort to work against hate and violence. Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

HIST 39800 - African American History Since 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history from 1877 that focus on Black Americans' struggle to overcome social, economic, and political oppression and to win basic civil and human rights while making valuable contributions to American society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

U.S. & Global History (6 credits)

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and

post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SYS 30000 - It's A Complex World - Addressing Global Challenges (UCC: STS)

Credit Hours: 3.00. The main goal of this course is to address grand challenges that are of global concern - such as environmental sustainability and energy use, natural and human disasters, and political and economic development - using the ideas and tools of complex adaptive systems. The course exploits the broad expertise of the four faculty members by treating these challenges from diverse disciplinary perspectives, from the biological and physical sciences, to the social sciences, to engineering. By way of a set of case studies, students will analyze the features of these challenges which make them complex, and seek to explain and find solutions to the problems that arise in each case. Their treatment of the cases will be informed by published research and computer simulation. Students will actively participate in discussions regarding these global challenges, and contribute to the progress of the class using oral and written presentations. The course will culminate with a final project completed by teams composed of students from different disciplines.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe global challenges using engineering, biological, physical, and social scientific perspectives, including attention to the interdependence of the different perspectives. 2. Explain the fundamental concepts of 'complex adaptive systems, ' including applications to different global challenges. 3. Develop basic proficiency in applying computer modeling to represent the behavior of complex systems, with applications to the global challenges. 4. Apply the concepts and tools of complexity research to develop a group-based proposal of comprehensive policies/solutions/strategies in a new and unresolved problem area. Credits: 3.00

UCC courses remaining (18-19 credits)

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent).

Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis,

discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

Electives (43-50 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety

of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a

range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-16 Credits

Spring 1st Year

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and

motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and

family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific

differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15-16 Credits

General Education: Educational Studies, BA (non-licensure)

About the Program

Degree Requirements

Departmental/Program Major Courses (42 credits)

Core Educational Studies Classes (10 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

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EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

Four Foundational Special Population Courses: (8 credits)

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals

with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Collaborative Leadership Certificate (9 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how

interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

EDPS 31600 - Collaborative Leadership: Cross-Cultural Settings (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the cultural nuances of leadership in the United States as well as around the world. This course will include impact of globalism as a context for leadership, conflict resolution in a global environment, and other important factors that impact culturally diverse or global teams.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Better understand what a culture is, broadly defined, and how it functions. 2. Better understand the importance of culturally aware, knowledgeable, and skillful leaders. 3. Increase professional and personal self-awareness in relation to leadership in diverse settings. 4. Better understand the importance of making cultural issues central for constructive conflict management. 5. Understand the complexity of leader-other interaction and impact of psycho-social variables on this interaction. Credits: 3.00

EDPS 31700 - Collaborative Leadership: Mentoring

Credit Hours: 3.00. The purpose of this course is to provide a theoretical and experiential overview of the basic elements of mentoring as a key aspect of effective collaborative leadership. The hallmark of this course is the inclusion of a service-learning component in which students will be paired with undergraduate mentees and required to participate in weekly mentoring meetings for the duration of the semester. This learning experience is designed to promote development of the knowledge, skills, and dispositions required for competent mentorship. Emphasis on peer mentoring.

Learning Outcomes: 1. Differenitate among various types, purposes, roles of mentoring/mentors. 2. Identify the essential elements of effective mentoring relationships. 3. Examine and discuss the ethical considerations involved in mentoring. 4. Acquire knowledge regarding how issues of diversity interact with the process of mentoring. 5. Evaluate empirical findings associated with mentoring. 6. Consider various approaches to evaluating mentoring and the outcomes of mentoring programs. Credits: 3.00

Counseling Psychology (3 credits)

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 50700 - Counseling Multicultural And Diverse Populations

Credit Hours: 3.00. Counseling strategies for multicultural and diverse populations encountered by helping professionals. Among the populations considered are ethnic and cultural minorities, older persons, the gifted, and the disabled.

Learning Outcomes: 1. Examine how social and cultural factors influence the counseling relationship and are reflected in counseling

theory and practice. 2. Develop strategies for working with diverse individuals, couples, families, groups, and communities. 3. Develop an awareness of multicultural and pluralistic trends, including characteristics and concerns of specific socially and culturally diverse groups. 4. Examine ethical and legal issues related to counseling diverse populations. Credits: 3.00

Human Development and Family Studies (3 credits)

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

Educational Psychology (3 credits)

EDPS 10101 - Learning In Context-An Introduction To The Learning Sciences

Credit Hours: 3.00. This introductory course is designed to acquaint first year Learning Science students with the core

concepts, principles, and research findings of the learning sciences as they apply to a wide range of formal and informal educational contexts. The course provides students with opportunities to interact with and learn about the scholarship of College of Education faculty who conduct research within the framework of the learning sciences. Students will learn about faculty projects that exemplify key features of the Learning Sciences such as attention to the complexity of learning environments, the study of social and cultural as well as individual dimensions of learning, and the cross-disciplinary nature of the field.

Learning Outcomes: 1. Identify the features of education as a design discipline. 2. Identify core principles, questions, and challenges, that define educational research and practice from a Learning Sciences perspective. 3. Identify the varied sources of cross-disciplinary knowledge that contribute to the design and study of effective learning environments. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

Education Research Methodology (6 credits)

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze,

and write a research project. Credits: 3.00

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

Other Departmental/Program Course Requirements (33-34 credits)

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

Quantitative Reasoning (6 credits)

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment

of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

Aesthetic Awareness (3 credits)

AD 20100 - Art For Elementary School Teachers

Credit Hours: 3.00. Art theory and experiences, curriculum theory, and materials preparatory for instruction of elementary school children. No undergraduate students may be enrolled in this course until they have been admitted to teacher education and a copy of this acceptance is on file.

Learning Outcomes: 1. Apply visual arts methods to develop appropriate lessons to construct students' knowledge. 2. Utilize two- and three-dimensional media commonly used by elementary students to teach art production and encourage the expression of ideas. 3. Assess elementary students' artistic development levels and design activities to meet their artistic needs in the classroom. 4. Apply elements of art, principles of design, interpretation skills, and judgment conclusions to evaluate and respond to works of art and to foster that ability in their elementary students. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 25500 - Art Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the problems overcome by mankind in the origins and growth of art.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

DANC 10100 - Modern Dance Technique I

Credit Hours: 2.00. An introduction to the techniques and principles of modern dance.

Learning Outcomes: 1. Demonstrate elementary level performance of skills and principles of Modern Dance technique. 2. Perform basic dance movement with personal expression. 3. Demonstrate fundamental bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 10200 - Ballet I

Credit Hours: 2.00. An introduction to the techniques and principles of classical ballet.

Learning Outcomes: 1. Demonstrate essential ballet skills, principles and techniques used in ballet. 2. Demonstrate correct use of ballet terminology. 3. Recognize and define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor. Credits: 2.00

DANC 10300 - Jazz Dance I

Credit Hours: 2.00. An introduction to the principles of jazz dance techniques: alignment, isolations, rhythmic patterns, and basic locomotion.

Learning Outcomes: 1. Perform basic skills of the body including coordination, proper alignment, and musicality through movement phrases and exercises aligned with Jazz Dance Techniques. 2. Demonstrate an elementary understanding of core principles, techniques and histories under the broad umbrella of Jazz Dance Technique. 3. Demonstrate a fundamental understanding of Jazz Dance vocabulary and basic body anatomy. Credits: 2.00

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 32400 - Teaching Music In The Elementary School

Credit Hours: 3.00. Develops basic musicianship through singing, playing instruments, reading and writing music, listening and moving to music. Surveys music teaching methods and materials. Includes lesson planning, experiences in teaching, and observation of children in music classes.

Learning Outcomes: 1. Advocate for the importance of music's inclusion (or exclusion, if desired) in the elementary classroom. 2. Develop curricula that appropriately advances the musical abilities, appreciation, and understanding of children. 3. Perform by singing and playing instruments both alone and in a group. 4. Synthesize appropriate terms to describe musical performance and recording. 5. Connect music to a variety of societal, cultural, and historical contexts. Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation.

2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

English Literature (3 credits)

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 23000 - Great Narrative Works (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of great narratives from Homer's Odyssey to the present, considering works from a variety of cultures and time periods in order to develop an understanding of their ideas, structures, styles, and cultural values.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 23100 - Introduction To Literature

Credit Hours: 3.00. Reading and discussion of great works of various types to develop an understanding of their ideas, structures, and styles. Includes poetry, drama, biography, essay, and prose fiction. CTL:IEL 1270 Appreciation Of Literature

Credits: 3.00

ENGL 23200 - Thematic Studies In Literature

Credit Hours: 3.00. Examination of a particular theme, such as the hero, death, or the city, and the techniques by which it is treated in various literary works, usually in more than one genre. Current offerings available from counselors.

Credits: 3.00

ENGL 23400 - Literature And The Environment (UCC: STS)

Credit Hours: 3.00. Literary study of nature writing; writing from the natural sciences; and canonical poetry, fiction, and essays through an ecological lens. Introduces students to ecocritical thought and environmental literary history.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and discursive conventions of literature about the environment. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 23700 - Introduction To Poetry (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of poetry from different periods aimed at enhancing the student's understanding of genre, form, and style; how poetry grows out of and speaks to its historical moment; and how poetry addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of poetry. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 23800 - Introduction To Fiction (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of fiction from different periods aimed at enhancing the student's understanding of genre, form, and style; how fiction grows out of and speaks to its historical moment; and how fiction addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of fiction. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature

they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 24000 - British Literature Before 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the medieval to the Romantic period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Romantic period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Romantic literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 24100 - British Literature After 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the Romantic period on.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the Romantic period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about literature from the Romantic period to the present based on appropriate use of textual evidence. Credits: 3.00

ENGL 25000 - Great American Books (UCC: HUM)

Credit Hours: 3.00. What makes great American books so compelling? This course examines the dynamic history of American literature and explores how canonical and contemporary books have shaped the cultural landscape of the U.S. and the world.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions related to great American books. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American books based on appropriate use of textual evidence. Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 26200 - Greek And Roman Classics In Translation

Credit Hours: 3.00. Study of important works of Greek and Roman literature, their intrinsic literary values, and their influence on later European and American writing and thinking.

Credits: 3.00

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250

World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26700 - World Literature: From 1700 A.D. To The Present (UCC: HUM)

Credit Hours: 3.00. (CMPL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. Typically offered Summer Fall Spring. CCN: IEL 1251 World Literature 2

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 35000 - American Literature Before 1865 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from European colonization to the U.S. Civil War. CTL:IEL 1210 American Literature I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Civil War period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35100 - American Literature After 1865 (UCC: HUM)

Credit Hours: 3.00. A survey of American literature from the Civil War to the present. CTL:IEL 1211 American Literature II

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the post-Civil War period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 36000 - Gender And Literature (UCC: HUM)

Credit Hours: 3.00. An introduction to feminist approaches to the study of literature, including poetry, drama, fiction, and/or autobiography. Examines how gender intersects with race, ethnicity, sexual orientation, and class in shaping authorship,

reading, and representation.
University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 36500 - Literature And Imperialism (UCC: HUM)

Credit Hours: 3.00. A study through cultural and theoretical works of the impact of imperialism on the ruling nations.
University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism/colonialism. 2. Develop a foundational knowledge of the historical contexts of and theoretical approaches to literary texts: gain an introductory knowledge of postcolonial literary theory. 3. Improve close reading and textual analysis skills. 4. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.
Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 37300 - Science Fiction And Fantasy (UCC: HUM)

Credit Hours: 3.00. Representative works of science fiction and fantasy examined in relation to both mainstream and popular literature. Emphasis is on technique, theme, and form.
University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.
Credits: 3.00

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.
Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts.
Credits: 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

ENGL 39200 - Young Adult Literature

Credit Hours: 3.00. This course examines the construct of Young Adult Literature as a genre crafted specifically for adolescents. Using both classic and contemporary novels, as well as relevant theoretical and research texts, this course explores how YA literature is defined, what it offers to adolescent readers, and how it is situated in the literary landscape.

Learning Outcomes: 1. Read, respond to, and analyze selected works of Young Adult literature in order to think critically about various concepts and issues connected to the genre. 2. Explore, analyze, and critique the extent to which selected Young Adult literature affects and reflects teenage life. Credits: 3.00

Race, Ethnic & Cultural Diversity (6 credits)

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts,

and to consider the relationship of the past to the present. Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period.

They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

HIST 39800 - African American History Since 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history from 1877 that focus on Black Americans' struggle to overcome social, economic, and political oppression and to win basic civil and human rights while making valuable contributions to American society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

Electives (44-45 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC:

IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

15-16 Credits

Spring 1st Year

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and

family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

15 Credits

Spring 2nd Year

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices.

Credits: 1.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

15 Credits

Fall 3rd Year

EDPS 10101 - Learning In Context-An Introduction To The Learning Sciences

Credit Hours: 3.00. This introductory course is designed to acquaint first year Learning Science students with the core concepts, principles, and research findings of the learning sciences as they apply to a wide range of formal and informal educational contexts. The course provides students with opportunities to interact with and learn about the scholarship of College of Education faculty who conduct research within the framework of the learning sciences. Students will learn about faculty projects that exemplify key features of the Learning Sciences such as attention to the complexity of learning environments, the study of social and cultural as well as individual dimensions of learning, and the cross-disciplinary nature of the field.

Learning Outcomes: 1. Identify the features of education as a design discipline. 2. Identify core principles, questions, and challenges, that define educational research and practice from a Learning Sciences perspective. 3. Identify the varied sources of cross-disciplinary knowledge that contribute to the design and study of effective learning environments. Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

15 Credits

Spring 3rd Year

EDPS 31600 - Collaborative Leadership: Cross-Cultural Settings (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the cultural nuances of leadership in the United States as well as around the world. This course will include impact of globalism as a context for leadership, conflict resolution in a global environment, and other important factors that impact culturally diverse or global teams.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Better understand what a culture is, broadly defined, and how it functions. 2. Better understand the importance of culturally aware, knowledgeable, and skillful leaders. 3. Increase professional and personal self-awareness in relation to leadership in diverse settings. 4. Better understand the importance of making cultural issues central for constructive conflict management. 5. Understand the complexity of leader-other interaction and impact of psycho-social variables on this interaction. Credits: 3.00

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this

information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 50700 - Counseling Multicultural And Diverse Populations

Credit Hours: 3.00. Counseling strategies for multicultural and diverse populations encountered by helping professionals. Among the populations considered are ethnic and cultural minorities, older persons, the gifted, and the disabled.

Learning Outcomes: 1. Examine how social and cultural factors influence the counseling relationship and are reflected in counseling theory and practice. 2. Develop strategies for working with diverse individuals, couples, families, groups, and communities. 3. Develop an awareness of multicultural and pluralistic trends, including characteristics and concerns of specific socially and culturally diverse groups. 4. Examine ethical and legal issues related to counseling diverse populations. Credits: 3.00

15 Credits

Fall 4th Year

EDPS 31700 - Collaborative Leadership: Mentoring

Credit Hours: 3.00. The purpose of this course is to provide a theoretical and experiential overview of the basic elements of mentoring as a key aspect of effective collaborative leadership. The hallmark of this course is the inclusion of a service-learning component in which students will be paired with undergraduate mentees and required to participate in weekly mentoring meetings for the duration of the semester. This learning experience is designed to promote development of the knowledge, skills, and dispositions required for competent mentorship. Emphasis on peer mentoring.

Learning Outcomes: 1. Differenitate among various types, purposes, roles of mentoring/mentors. 2. Identify the essential elements of effective mentoring relationships. 3. Examine and discuss the ethical considerations involved in mentoring. 4. Acquire knowledge regarding how issues of diversity interact with the process of mentoring. 5. Evaluate empirical findings associated with mentoring. 6. Consider various approaches to evaluating mentoring and the outcomes of mentoring programs. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

15 Credits

Spring 4th Year

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

15 Credits

General Management, BS

About the Program

Degree Requirements

Department/Program Major Courses (76 credits)

Required Major Courses (55 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective,

industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as

needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of

managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and

corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and

Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using

advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Economics Selective - Choose One: (3 credits)

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each

other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 46600 - International Economics

Credit Hours: 3.00. Analyzes topics in international economics, using more advantage techniques and more detailed treatment than in ECON 37000 or 37100. While coverage varies somewhat with instructor, some topics could include: economic growth, innovation and technology transfer, and the role of multinational corporations.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade and finances. 2. Understand the perspective provided by economic analysis regarding the interaction between economic growth and international trade. 3. Identify insights economics analysis provides concerning the benefits and costs of technology transfer and the role of multinational corporations. Credits: 3.00

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 38500 - Labor Economics

Credit Hours: 3.00. The purpose of this course is to introduce important topics, theories, institutions, and policy issues relating to the functioning of labor markets. Topics to be considered include labor supply decisions, investments in human capital, compensating wage differentials, labor contract theory, unions, compensation programs, signaling in labor markets, the economics of unemployment, and government employment, retirement, and workplace safety.

Learning Outcomes: 1. Distinguish the major determinants of labor market participation and hours worked. 2. Analyze how welfare programs and business cycles affect labor supply. 3. Derive the short and long term demand for labor. 4. Construct a detailed demand and supply model of the labor market. 5. Find the equilibrium labor market outcomes in the context of the neoclassical model 6. Analyze the role played by jobs' and workers' characteristics in generating wage differentials. 7. Develop a schooling model that explains human capital investment. 8. Distinguish factors that affect earnings inequality and labor market discrimination. Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 32500 - Economics Of Sports

Credit Hours: 3.00. This class applies economic principles to the professional sports entertainment industry and its derivative input markets. The class begins by examining the microeconomics of demand for (by fans) and supply of (by teams) sports entertainment. The labor markets for the primary input, athletic talent, receive significant attention. Coordination among economic agents, taking the forms of leagues, players' unions, and government, is considered at the end of the class, with an emphasis on how they affect the efficiency of the markets related to sports entertainment. Quantitative empirical analysis is emphasized throughout the class. This is not a sports trivia or fantasy sports strategy class.

Learning Outcomes: 1. Solve models of how fans, teams, and players behave. 2. Describe and evaluate the structures of the markets for sports outputs and inputs, e.g., players. 3. Explain information presented in quantitative forms, e.g., equations, graphs, tables. 4. Analyze the effects of leagues' or governmental polices on market efficiency. 5. Communicate conclusions about sports output and input markets in numerical, graphical, tabular, and written forms. Credits: 3.00

ECON 36200 - Health Economics

Credit Hours: 3.00. This course is designed to introduce upper level undergraduate students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues using tools from intermediate microeconomic theory. The course begins with an analysis of health care as a commodity and why health is different from other consumer goods. The course then examines the demand for and the production of health and health care, and the behavior and organization of health care providers. The discussion then switches to information asymmetries and the functioning of health insurance markets. Afterwards, the course turns to the analysis of government involvement in the health care system. The class concludes with an examination of medical care systems around the world, paying particular attention to the U.S. health care system.

Learning Outcomes: 1. Describe the main economic theories relating to health and health care markets. 2. Apply economic theory to the analysis of health care policy and institutions. 3. Construct a detailed demand and supply model of the health insurance market. 4. Critically evaluate key policy issues in health and health care from an economic perspective. Credits: 3.00

ECON 48500 - Economics Of Racial And Gender Discrimination

Credit Hours: 3.00. This course focuses on quantifying the extent of, and determining the underlying causes of racial and gender disparities in the labor market. Topics include the impact of prejudice on labor market outcomes, statistical discrimination, early childhood factors and differences in environment, and fertility and reproductive technology.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize the differences and importance of disparities that control and do not control for observable factors. 3. Understand the difference between prejudice and discrimination, and the extent to which prejudice can cause

discrimination. 4. Assess how discrimination can occur even in the absence of prejudice. 5. Evaluate the impact of policies designed to reduce disparities, such as affirmative action. Credits: 3.00

Major Selectives (15 credits)

Choose Three: (9 credits)

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

MGMT 44690 - Negotiation And Decision Making

Credit Hours: 3.00. The purpose of this course is to understand the theory and processes of negotiation so that you can negotiate successfully in organizational and management settings. This course covers a wide variety of negotiation problems faced by business people. In addition, models of effective and ineffective decision-making are introduced and students will have the opportunity to make decisions at both the individual and group levels.

Learning Outcomes: 1. Improve ability to effectively negotiate. 2. Recognize and analyze negotiation situations. 3. Gain confidence negotiating. 4. Improve decision-making knowledge and skills. Credits: 3.00

MGMT 44710 - Competitive Strategy

Credit Hours: 3.00. This course focuses on the dynamics between a firm and the marketplace including interaction with competition. Strategy implementation occurs over multiple periods and is highly dependent on choices and behavior of competition. The course material covers how these dynamics and expectations of competitor response will shape the decisions of managers. This is inclusive of signaling intent to competitors and mutual forbearance to avoid negative sum gain competition.

Learning Outcomes: 1. Improve ability at market and competitive analysis. 2. Recognize opportunities and problems for market entry that may follow from market and competitive analysis. 3. Improve decision making knowledge and skills. Credits: 3.00

MGMT 44810 - Technology Strategy

Credit Hours: 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage.

Learning Outcomes: 1. Improve ability to assess technology and innovation from a competitive perspective. 2. Learn about disruptive innovation and its effects on incumbents and new firms. 3. Consider internal processes for innovation management in existing firms. 4.

Improve decision-making and skills with respect to technology and innovation. Credits: 3.00

MGMT 44433 - Leading And Working In Teams

Credit Hours: 3.00. This course will explore the forces that affect behavior in teams, and the factors that lead to team success. We will use a variety of readings, cases, activities, and class discussions to build concrete skills related to leading and working in teams. The course will explore the specific challenges associated with leading teams, some of which include: building and designing teams, managing information exchange within and across teams, structuring effective group decision processes, igniting creative thinking, enabling complex problem solving, managing team diversity and conflict, and managing systems of teams. Permission of instructor required.

Learning Outcomes: 1. Identify and define concepts related to team functioning and effectiveness. 2. Apply those concepts to understand and diagnose issues associated with team effectiveness. 3. Develop a course of action to improve team functioning. Credits: 3.00

MGMT 44630 - Innovation Management

Credit Hours: 3.00. In this course you learn why organizations struggle to innovate, how to successfully analyze and implement an innovation strategy, and you learn to manage the innovation process. The course consists of two pillars (or 'walls') that enable a company to become innovative (Innovation Strategy and Organization Design) and the innovation process itself. The innovation process contains how to generate, select, implement, protect, experiment, scale, and diffuse ideas. Consequently, this course will provide you the skills and knowledge to manage innovations. Permission of department required.

Learning Outcomes: 1. Analyze the potential and implication of ideas and innovations for an organization and environment. 2. Formulate an innovation strategy. 3. Develop an innovation process. 4. Distinguish the different approaches to designing an innovative organization. Credits: 3.00

Choose Two: (6 credits)

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

MGMT 48400 - Management Of Entrepreneurial Ventures

Credit Hours: 3.00. This course teaches skills required to become an entrepreneur, succeed in a start-up venture, work in venture capital, join a family business, or develop a franchise operation. Students will learn about how to identify and shape emerging market opportunities, innovate new business models, prepare and evaluate business plans, raise capital, build a skilled founding team, network for resources, and grow an initial market.

Learning Outcomes: 1. Identify and shape

emerging market opportunities. 2. Innovate new business models. 3. Prepare and evaluate business plans. 4. Raise capital. 5. Build a skilled founding team, network for resources, and grow an initial market. Credits: 3.00

MGMT 45900 - International Management

Credit Hours: 3.00. This course focuses on the challenges top managers face in developing strategies and management policies in multinational corporations (MNCs). Major topics usually covered include foreign market entry strategies, motivations and organizational challenges of internationalization, analyzing global industries, managing MNC/host government relations, building competitive advantage in global industries, international alliances and acquisitions, structuring and controlling MNCs, risk management, and the country manager role.

Learning Outcomes: 1. Understand the range of competitive opportunities and challenges companies and managers face in creating value worldwide. 2. Appreciate the complexities of national institutions and the dynamics of industry competition. 3. Deal with a company's multiple stakeholders including its internal constituents. 4. Integrate the concepts, principles, skills, and knowledge acquired in functional courses. Credits: 3.00

MGMT 45200 - Manufacturing Strategy And Process Innovation

Credit Hours: 3.00. This course examines the management challenges posed by the growth in worldwide manufacturing capabilities, markets, and competition and by rapid advances in technology and the concomitant decline in product life cycles. The manufacturing function is considered within a broader context encompassing design, engineering, purchasing, marketing, and customer service in an effort to assess the degree to which existing management structures successfully meet the challenges arising from the changing manufacturing environment.

Learning Outcomes: 1. Identify the tradeoffs made between operations flexibility and cost. 2. Identify proper alignment between manufacturing strategy and business strategy. 3. Identify the pros and cons of different types of plant network strategies. 4. Identify the behavioral issues associated with implementation of rigid project management tools. 5. Identify the potential long term implications of outsourcing on the development of competition. Credits: 3.00

MGMT 44429 - Talent Management

Credit Hours: 3.00. This course focuses on the employer-employee relationship at work, and how managers work with employees to improve employee performance. Attention is given to the history of labor relations and performance management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing employee performance.

Learning Outcomes: 1. Identify and understand the tools and techniques of contemporary employee relations at work. 2. Identify and understand the tools and techniques of contemporary performance management at work. 3. Ability to apply these techniques. Credits: 3.00

MGMT 35500 - Consulting Tools And Skills

Credit Hours: 3.00. This novel course will provide an opportunity for motivated students to gain exposure to the skills and tools necessary to succeed in the consulting industry. There will be a chance to work in small teams to define client problems, collect and analyze data, develop solution proposals, and implement recommendations. Students will also be given an insider's look into the history of consulting, common types of consulting, and professional standards in this specialized area of management. Honing skills in project management, presentation delivery, storytelling, and stakeholder engagement will form the foundation of the tools used to solve client challenges.

Learning Outcomes: 1. Effectively and confidently use specific consulting business language. 2. Critically analyze resumes and case interviews. 3. Effectively research businesses and unfamiliar industries. 4. Use a consulting approach to problem solving. 5. Present a professional, engaging, and authentic persona. Credits: 3.00

MGMT 55500 - Leading Management Of Diversity And Inclusion In Organizations

Credit Hours: 2.00 or 3.00. This course is designed to help participants learn to effectively manage self, peers, teams,

clients, and firms in diverse organizational settings and to lead organizational change to foster inclusion, equality, and productive workplaces. The class is designed to develop your skills in leading diversity and inclusion from a multi-level view in the workplace: employee, leader, team member, organizational, and institutional/societal levels. Its goal is to a) improve your ability to work in diverse teams, as well as b) develop your ability to design, and implement strategies to foster cultural and structural change to support the management of an increasingly diverse workforce toward enhanced organizational effectiveness to benefit business, employees, and society. People and leaders in organizations are constantly working with members of different backgrounds, social identities, and experiences, often across distributed and/or digitally connected environments, fostering increased attention to diversity equity and inclusion in transforming employment settings. When understood, supported and leveraged effectively, these differences in social identities, difference and values can help attract and retain talent, strengthen societal and community economic equality, support organizational and team effectiveness; but when overlooked, or mismanaged, these differences can increase turnover, conflict, stress, talent under-utilization, and harm career and work-life wellbeing, health, and productivity. We will focus on advancing understanding of how intersecting organizational and institutional structures and cultures and their relation to strategies for creating diversity; an inclusive culture and positive climate for inclusion and talent management; and developing and retaining diverse talent to foster innovation and organizational effectiveness across multiple levels of intervention. We discuss how to conduct an organizational diagnosis of the current diversity climate and barriers and facilitators for creating a multicultural workplace and a flexible environment supportive of many identities, and how assumptions of "ideal workers" may vary across industry and cultural contexts. You as a leader will be better able to articulate your own DEI vision and develop understanding of strategies that move from description to evidence-based diagnosis to action strategies and implementation in order to move aspirations into organizational change realities. From an individual leadership perspective, we tackle the question: "Why does diversity, equity and inclusion matter in employing organizations and business, what is the state-of-the-art evidence-based knowledge, and what does it mean to me personally in my career and my leadership beliefs?" Specifically, we focus on the business and social science processes - including attitudes toward in-groups and out-groups, stereotyping, identity, privilege, and power, intersectionality, discrimination, bias, influence opportunity, bystander awareness, allyship, difficult conversations, and perspective taking - these topics relate to how members of different social groups perceive and interact with one another. Since managing social identity increasingly involves managing work-life boundaries and work and non-work public and private selves, we will also learn about authenticity choices and social and public/professional identity boundary management. Further, the opportunity to experience higher well-being and work-life balance is increasingly linked to job and life opportunities reflecting growing work-life inequality in society. From an organizational and group perspective, we address the questions: "What are best practices for successful management of diversity and inclusion? And why does it matter to me as a future leader personally and in business and in the communities and world in which I live."

Learning Outcomes: 1. Evaluate the aspects of your identity and personal experiences that shape how you interact and engage with others and how they interact and engage with you in organizations. 2. Explain how issues of power, privilege, discrimination, bias, equality, and equity influence opportunity and effectiveness in organizations operating both in local, domestic and global contexts. 3. Propose ways to make relationships across cultural and cross-cultural and gender differences in organizations more effective. 4. Describe current perspectives on the relationships among diversity, inclusion, creativity, and innovation in domestic and global organizations. 5. Analyze a company's current approach to leading diversity and use content from this course to propose ways to enhance learning and effectiveness in that company. Credits: 2.00 or 3.00

MGMT 55400 - Leading Global Organizations And People Across Cultures

Credit Hours: 2.00 or 3.00. This course focuses on the opportunities and challenges of managing a global multicultural workforce and implementing global organizational people strategies. The overall goal of this class is to help you become a more effective professional and leader in a global world on and off the job by providing information, tools and multicultural opportunities to increase conceptual and practical understanding of how national cultures shape employment settings and its implications for your own behavior as a global business professional and leader who implements human capital and organizational strategies, policies, and practices in a cross-national context. This course will also increase knowledge of and ability to implement current global human capital, international HRM, and organizational strategies for MNES and domestically. To achieve these goals, student engagement in class sessions, and willingness to share perspectives and opinions, and application of course readings and materials, are critical to the success of this course. A range of participative

learning methods are used to facilitate an active classroom environment, including learning log journaling, case analysis, experiential exercises, small group projects, break out discussions, company guest speakers, and self-assessments. The role of the instructor in this course is not always to provide "the" answer, but to create an environment where you can collectively explore, examine and experiment with students' own ideas and share ideas and perspectives on working and managing global firms.

Learning Outcomes: 1. Use cross-cultural leadership and organizational abilities to understand on how cultural differences shape workplace interactions so you can better implement organizational and people strategies to achieve business goals in a global environment. 2. Identify and avoid cultural mishaps and identify how your own national cultural values and assumptions about managing people and organizations shape your effectiveness in managing people, diversity, and systems in a global or cross-cultural firm. 3. Understand the challenges of adapting HRM policies and organizational people strategies when adapting HR and employment systems as organizations "go global" and develop a global workforce. 4. Understand the pros and cons of different multicultural strategies (cultural minimization, accommodation, cultural integration) for successfully implementing human capital strategies and HR practices in multicultural contexts. 5. Develop the core competencies needed by business leaders to work in multicultural teams contexts, including cultural intelligence, the ability to work in cross-cultural teams, develop clear and concise non country biased written communication, the ability to give effective presentations virtually and face to face, and the ability to engage in strategic cross-cultural thinking to implement global HR. 6. Understand and be able to apply core concepts in global HR/OB from 1)Global HR planning and organizational design; 2) Merger and Acquisition with a focus on linkages to successful people and organizational strategies; 3) Global talent management; 4) Development, reward, and performance management of global leaders; 5) Managing Global Teams, diversity, and cross-cultural communication; and 6) Implementing global change and improving organizational effectiveness. Credits: 2.00 or 3.00

MGMT 59200 - Contracts For Managers

Credit Hours: 3.00. Purpose of the course is to provide the student with an understanding of the contract legal environment as it pertains to profit and non-profit organizations and of the ethical considerations and social and political influences that affect such organizations. Students will examine a wide range of substantive rules of public law, which will provide a framework for a discussion of the ways in which managerial decision making affects and is affected by the legal environment.

Learning Outcomes: 1. Demonstrate a high-level of understanding of the law governing the formation of contracts. 2. Demonstrate the ability to identify and apply concepts of the law governing contractual interpretation and construction. 3. Demonstrate the ability to identify and apply concepts of the law governing contractual performance and breach. 4. Demonstrate the ability to identify and apply concepts of the law governing remedies for contract breach. 5. Demonstrate the ability to identify and apply concepts of the law governing the assignment of contractual rights and the delegation of contractual duties. 6. Demonstrate the ability to identify and apply concepts of the law governing third party beneficiaries to contracts. 7. Demonstrate their ability to do legal research and a publishable level. Credits: 3.00

Cultural Competencies I Selectives (3 credits)

Other Departmental Courses (23-35 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through

reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus

course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (9-21 credits)

Optional Concentrations for General Management, BS

Sample 4-Year Plan

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods.

Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-21 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python

libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite

application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

14-17 Credits

Fall 2nd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate

their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities

that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

15-18 Credits

Spring 2nd Year

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

15 Credits

Fall 3rd Year

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

15 Credits

Spring 3rd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and

situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Fall 4th Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

15 Credits

Spring 4th Year

15 Credits

Genetics, BS

About the Program

Genetics is the science of information transfer from one generation to another. We learn the laws of inheritance in all creatures big and small, how they evolve and how they change. On the molecular level we learn about DNA and RNA, on the cellular level we discover what makes a cell cancerous, and on an organismal level we examine the reproductive habits of various organisms. Crucial principles include the structure, function, and transmission of genes. Laboratory techniques explore genetic engineering from the "inside." Genetics is crucial to all of biology, hence a genetics major has great flexibility. This is excellent preparation for advanced study in biological sciences, law, genetic counseling, and many health-related professions.

Genetic Biology Website
Biological Sciences Major Change (CODO) Requirements

Degree Requirements

Departmental/Program Major Courses (31-37 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical

and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-

PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (12-18 credits)

Intermediate Biology Selective (2-4 credits)

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part

of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

Required Coursework (4 credits)

BIOL 44100 - Biology Senior Seminar In Genetics

Credit Hours: 1.00. This is a required course for genetics majors. It provides exposure to current research in genetics and molecular biology via invited faculty speakers. Students enrolled in the course who have actively participated in research also give a presentation on their own work. Other students are assigned to review current literature in one aspect of the semester's topic. The topic selected for review is in an area of current research in genetics and may vary from year to year.

Credits: 1.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving

problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

Genetics Selectives (6 credits)

Genetics Selective I: BIOL 500-level (3 credits)

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell

death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

Genetics Selective II (3 credits)

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and

molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

AGRY 53000 - Advanced Plant Genetics

Credit Hours: 3.00. Advanced treatment of principles and recent advances in plant genetics including: mutagenesis; cell, molecular and direct approaches to genetic analysis and genetic interactions; haploidy; chromosomal organization and aberrations; transposable elements; mutations, para mutation and epigenetics in higher plants; extra nuclear inheritance; cytogenetic and molecular affinities between crop plants and their wild relatives; genetic manipulations; gene discovery; genetic approaches to understanding agriculturally useful plant traits. ESTs and global gene expression analysis, proteomics, metabolic profiling, comparative genomics and genome evolution. Offered in odd-numbered years.

Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

Base Lab Requirement (0-4 credits)

Other Departmental Requirements: (53-79 credits)

Chemistry (17 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600. Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Biochemistry (4 credits)

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites. Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

College of Science Core Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the

program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given

multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic

behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Mathematics (6-10 credits)

Calculus I

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Electives (4-37 credits)

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA

1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-19 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to

biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of

absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-20 Credits

Fall 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates

and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of

biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written

methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of

scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

14-16 Credits

Fall 3rd Year

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

12-16 Credits

Spring 3rd Year

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14 Credits

Fall 4th Year

BIOL 44100 - Biology Senior Seminar In Genetics

Credit Hours: 1.00. This is a required course for genetics majors. It provides exposure to current research in genetics and molecular biology via invited faculty speakers. Students enrolled in the course who have actively participated in research also give a presentation on their own work. Other students are assigned to review current literature in one aspect of the semester's topic. The topic selected for review is in an area of current research in genetics and may vary from year to year.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

12-13 Credits

Spring 4th Year

13-14 Credits

Geology and Geophysics, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (49 credits)

Required Major Courses (37 credits)

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 30900 - Computer-Aided Analysis For Geosciences

Credit Hours: 3.00. Application of computer analysis techniques including error analysis, line and surface fitting, spatial and temporal correlations, contouring, interpolation, and map projections. These methods are discussed in terms of specific geologic applications. All exercises and examples are developed using commercial mathematical software package. A

three-hour-per-week computer laboratory tutorial provides hands-on experience with the techniques discussed in class. Prior course work in computer programming is required.

Learning Outcomes: 1. Carry out computational solutions to a given range of data analysis problems. 2. Select the appropriate analysis and visualization approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 31900 - Exploring Earth Through Time

Credit Hours: 3.00. The course will explore the history of the Earth from its beginning 4.5 billion years ago to the present. Our understanding and insight into the history of the Earth has greatly expanded during the last several decades. Emphasis will be placed on the relationships of tectonic processes that shaped the surface of the Earth and the evolution of the Earth's biosphere. The course will also examine how the role of evolution of life has played in the history of the atmosphere and oceans.

Credits: 3.00

EAPS 35200 - Structural Geology

Credit Hours: 3.00. This course deals with the nature and evolution of structures in rock deformed naturally by flow and fracture, as deduced from experimental, theoretical and field studies. Specific topics include: structures in three dimensions using descriptive geometry and stereonets, field measurements of rock geometry, tensors, strain and stress, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop, the structure and mechanics of mountain belts. Students will be expected to show competency with using a general set skills, techniques, and tools commonly used by professional geoscientists.

Learning Outcomes: 1. Interpret geologic structures in three dimensions using descriptive geometry, stereonets, and field measurements of rock geometry. 2. Evaluate quantitatively observations of the deformation in the crust using basic stress and strain theory, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop. 3. Recognize the structures and give a mechanical explanation for the development of mountain belts. 4. Apply these skills in the field. Credits: 3.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior

structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

EAPS 47400 - Sedimentary Geology

Credit Hours: 4.00. Systematic study of continental and marine depositional environments. Interpretation of sedimentary facies, structures, and microfacies. Principles and applications of stratigraphy, including applications of paleontology, field relations, paleomagnetism, well logs, seismic reflections, and chemistry. Field investigations may be required. Prior course work in earth materials, mineralogy and petrology is required.

Learning Outcomes: 1. Understand core areas of sedimentary geology, and interpret a wide range of earth processes on different temporal and spatial scales. 2. Develop proficiency interpreting depositional processes and environments of ancient sedimentary strata through bedrock exposures, well logs, and drill cores. 3. Demonstrate skills of interpretive analysis and critical thinking with respect to geological problems involving temporal and spatial relationships. 4. Develop writing abilities through scientific reports that will be written individually, revised based on instructor and peer feedback, and subsequently integrated into a comprehensive basin analysis report. 5. Demonstrate competence in collecting scientific data, including field observations and field and analytical measurements. Specifically, demonstrate competency in collecting the following field datasets from outcrops: paleocurrent indicators, lithofacies associations, stratigraphic sections, and facies architectures. 6. Conduct effective independent and collaborative investigations. Specifically, develop your ability to work both independently and collaboratively during acquisition, analysis, and dissemination of scientific datasets as part of basin analysis project. Credits: 4.00

EAPS 47500 - Geology And Geophysics Field Camp - Wasatch-Uinta Field Camp

Credit Hours: 6.00. The Wasatch-Uinta Field Camp is a six-week capstone course designed to prepare students for successful careers in the geosciences. This course emphasizes scientific methodology and traditional techniques that provide a strong foundation for the broad range of modern technologies used by today's industry, academic, government and private workforces. Students learn to develop research strategies, collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, and construct geologic maps and cross sections. Field exercises are located in geologically ideal locations in the Wasatch and Uinta mountains of Utah, the San Rafael Swell of southeastern Utah, Grand Teton National Park in Wyoming, and the Carlin-type gold deposits of Nevada. The Wasatch-Uinta Field Camp was established in 1967 by the University of Minnesota. The camp is operated by a consortium that currently includes Purdue University, the University of Minnesota-Duluth, University of Wisconsin-Madison, the University of Nebraska, and the University of Illinois.

Learning Outcomes: 1. Learn how to make systematic geological observations and also collect relevant data using a Brunton compass. This includes the ability to identify rock types and minerals and primary and secondary geological structures and require skills and information learned in mineralogy, petrology (igneous, metamorphic, and sedimentary), structural geology, and stratigraphy. 2. Collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, which will be used to construct geologic maps and cross sections. 3. Navigate in the field using topographic maps, and compasses. Proficiency in field navigation is crucial for locating and completing field studies. 4. Develop skills in interpreting geological history, including the sequence of

events and the geological evolution of an area based on field observations. 5. Deal with incomplete or ambiguous data and will be required to formulate hypotheses, make educated inferences, and solve geological problems based on limited information. 6. Enhance their ability to work effectively in a team, collaborating with peers on field projects, and communicating geological findings through clear and concise field notes, maps, and reports. 7. Learn to conduct geological fieldwork safely is paramount. Students should be able to identify potential hazards in the field, adhere to ethical and legal guidelines for collecting samples, and understand the importance of preserving natural landscapes. Learn best practices for safely conducting a field study. Credits: 6.00

EAPS 34400 - Igneous And Metamorphic Petrology

Credit Hours: 4.00. This course provides an overview of igneous and metamorphic petrology including, but not limited to, the following topics: experimental petrology and phase diagrams, melting of the Earth's interior, understanding the relationship between mineralogy, chemical composition, and physical conditions, relating magmatism and metamorphism to different tectonic environments, and exploring the similarities, and differences, between magmatism on Earth and other planetary bodies. The lectures and labs emphasize developing a basic understanding of petrology and petrologic processes, rather than the simple memorization of terms, definition, and facts.

Learning Outcomes: 1. Understand how petrologists determine the origin of common igneous and metamorphic rocks and the data that supports current interpretations. 2. Describe the types of igneous and metamorphic rocks that would be found in different tectonic settings. 3. Interpret and understand phase diagrams and how they are constructed. 4. Link mineralogy to chemical compositions and understand how compositions can change during melting, fractional crystallization, or open-system metamorphism. 5. Understand how metamorphic rocks can be utilized to quantitatively constrain the physical conditions that a rock experienced. 6. Gain confidence in understanding and using scientific methods and information to interpret igneous and metamorphic rocks. Credits: 4.00

Geology and Geophysics Selectives (12 credits)

Other Departmental/Program Course Requirements (45-72 credits)

College of Science Additional Requirements

Computing (3-4 credits)

ECE 49500 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

Credits: 1.00 to 4.00

ENGR 14200 - Honors Creativity And Innovation In Engineering Design II

Credit Hours: 3.50. This course continues building on the foundation developed in ENGR 14100 . Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students extend and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., C, Excel®, LabView®, MATLAB®, and Python).

Learning Outcomes: 1. Describe, in greater depth, the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create

written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a mathematical model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Further development of strategies to facilitate generating creative ideas for complex design challenges. 8. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 9. Implement complex algorithmic solutions to engineering problems/designs using the most appropriate computer tool (C , Excel, LABVIEW, MATLAB, and Python) and be able to explain your rationale for your choice. 10. Apply a systems approach in solving engineering problems and in undertaking design projects. 11. Synthesize your knowledge of effective and ethical membership on a technical team (i.e., teaming skills) to appropriately behavior. 12 Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

ENGR 16200 - Honors Introduction To Innovation And The Physical Science Of Engineering Design II (UCC: IL/SCI)

Credit Hours: 4.00. Students will take an in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. The

students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g. MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control in an effort to identify and characterize physical material systems.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)
University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Utilize knowledge of the engineering education process, courses, and options, and engineering job functions and roles to prepare a final course of study for academic and career success (3). 2. Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories (10). 3. Apply the unified approach to material interactions to a broad array of applications including asteroids, black holes, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity (7). 4. Model natural phenomena using computer simulations (7). 5. Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem solving to ensure that the broader impacts of engineering work are consistently evaluated and accounted for (3). 6. Display proficiency in the applications of engineering content knowledge including statistics, statics, mechanics of materials, the universal accounting equation, electrical theory, and design of experiments (8). 7. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole (2). 8. Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (2). 9. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 10. Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms (5). 11. Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class (3). 12. Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 13. Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (3). 14. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering challenges (2). Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on

experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a

few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100,

STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

Required Pre-Requisite Courses (8-10 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 5.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts

and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (0-26 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to

apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using

calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-18 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 5.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 31900 - Exploring Earth Through Time

Credit Hours: 3.00. The course will explore the history of the Earth from its beginning 4.5 billion years ago to the present. Our understanding and insight into the history of the Earth has greatly expanded during the last several decades. Emphasis will be placed on the relationships of tectonic processes that shaped the surface of the Earth and the evolution of the Earth's biosphere. The course will also examine how the role of evolution of life has played in the history of the atmosphere and oceans.

Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the

interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis

techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-17 Credits

Fall 2nd Year

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

14-15 Credits

Spring 2nd Year

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

13-14 Credits

Fall 3rd Year

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes

responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 47400 - Sedimentary Geology

Credit Hours: 4.00. Systematic study of continental and marine depositional environments. Interpretation of sedimentary facies, structures, and microfacies. Principles and applications of stratigraphy, including applications of paleontology, field relations, paleomagnetism, well logs, seismic reflections, and chemistry. Field investigations may be required. Prior course work in earth materials, mineralogy and petrology is required.

Learning Outcomes: 1. Understand core areas of sedimentary geology, and interpret a wide range of earth processes on different temporal and spatial scales. 2. Develop proficiency interpreting depositional processes and environments of ancient sedimentary strata through bedrock exposures, well logs, and drill cores. 3. Demonstrate skills of interpretive analysis and critical thinking with respect to geological problems involving temporal and spatial relationships. 4. Develop writing abilities through scientific reports that will be written individually, revised based on instructor and peer feedback, and subsequently integrated into a comprehensive basin analysis report. 5. Demonstrate competence in collecting scientific data, including field observations and field and analytical measurements. Specifically, demonstrate competency in collecting the following field datasets from outcrops: paleocurrent indicators, lithofacies associations, stratigraphic sections, and facies architectures. 6. Conduct effective independent and collaborative investigations. Specifically, develop your ability to work both independently and collaboratively during acquisition, analysis, and dissemination of scientific datasets as part of basin analysis project. Credits: 4.00

12-14 Credits

Spring 3rd Year

EAPS 30900 - Computer-Aided Analysis For Geosciences

Credit Hours: 3.00. Application of computer analysis techniques including error analysis, line and surface fitting, spatial and temporal correlations, contouring, interpolation, and map projections. These methods are discussed in terms of specific geologic applications. All exercises and examples are developed using commercial mathematical software package. A three-hour-per-week computer laboratory tutorial provides hands-on experience with the techniques discussed in class. Prior course work in computer programming is required.

Learning Outcomes: 1. Carry out computational solutions to a given range of data analysis problems. 2. Select the appropriate analysis and visualization approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 35200 - Structural Geology

Credit Hours: 3.00. This course deals with the nature and evolution of structures in rock deformed naturally by flow and fracture, as deduced from experimental, theoretical and field studies. Specific topics include: structures in three dimensions using descriptive geometry and stereonets, field measurements of rock geometry, tensors, strain and stress, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop, the structure and mechanics of mountain belts. Students will be expected to show competency with using a general set skills, techniques, and tools commonly used by professional geoscientists.

Learning Outcomes: 1. Interpret geologic structures in three dimensions using descriptive geometry, stereonets, and field measurements of rock geometry. 2. Evaluate quantitatively observations of the deformation in the crust using basic stress and strain theory, the theory of brittle and plastic rock behavior, theory and

field observation of folds and faults, structural analysis of an outcrop. 3. Recognize the structures and give a mechanical explanation for the development of mountain belts. 4. Apply these skills in the field. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and

sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

EAPS 34400 - Igneous And Metamorphic Petrology

Credit Hours: 4.00. This course provides an overview of igneous and metamorphic petrology including, but not limited to, the following topics: experimental petrology and phase diagrams, melting of the Earth's interior, understanding the relationship between mineralogy, chemical composition, and physical conditions, relating magmatism and metamorphism to different tectonic environments, and exploring the similarities, and differences, between magmatism on Earth and other planetary bodies. The lectures and labs emphasize developing a basic understanding of petrology and petrologic processes, rather than the simple memorization of terms, definition, and facts.

Learning Outcomes: 1. Understand how petrologists determine the origin of common igneous and metamorphic rocks and the data that supports current interpretations. 2. Describe the types of igneous and metamorphic rocks that would be found in different tectonic settings. 3. Interpret and understand phase diagrams and how they are constructed. 4. Link mineralogy to chemical compositions and understand how compositions can change during melting, fractional crystallization, or open-system metamorphism. 5. Understand how metamorphic rocks can be utilized to quantitatively constrain the physical conditions that a rock experienced. 6. Gain confidence in understanding and using scientific methods and information to interpret igneous and metamorphic rocks. Credits: 4.00

13-16 Credits

Summer 3rd Year

EAPS 47500 - Geology And Geophysics Field Camp - Wasatch-Uinta Field Camp

Credit Hours: 6.00. The Wasatch-Uinta Field Camp is a six-week capstone course designed to prepare students for successful careers in the geosciences. This course emphasizes scientific methodology and traditional techniques that provide a strong foundation for the broad range of modern technologies used by today's industry, academic, government and private workforces. Students learn to develop research strategies, collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, and construct geologic maps and cross sections. Field exercises are located

in geologically ideal locations in the Wasatch and Uinta mountains of Utah, the San Rafael Swell of southeastern Utah, Grand Teton National Park in Wyoming, and the Carlin-type gold deposits of Nevada. The Wasatch-Uinta Field Camp was established in 1967 by the University of Minnesota. The camp is operated by a consortium that currently includes Purdue University, the University of Minnesota-Duluth, University of Wisconsin-Madison, the University of Nebraska, and the University of Illinois.

Learning Outcomes: 1. Learn how to make systematic geological observations and also collect relevant data using a Brunton compass. This includes the ability to identify rock types and minerals and primary and secondary geological structures and require skills and information learned in mineralogy, petrology (igneous, metamorphic, and sedimentary), structural geology, and stratigraphy. 2. Collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, which will be used to construct geologic maps and cross sections. 3. Navigate in the field using topographic maps, and compasses. Proficiency in field navigation is crucial for locating and completing field studies. 4. Develop skills in interpreting geological history, including the sequence of events and the geological evolution of an area based on field observations. 5. Deal with incomplete or ambiguous data and will be required to formulate hypotheses, make educated inferences, and solve geological problems based on limited information. 6. Enhance their ability to work effectively in a team, collaborating with peers on field projects, and communicating geological findings through clear and concise field notes, maps, and reports. 7. Learn to conduct geological fieldwork safely is paramount. Students should be able to identify potential hazards in the field, adhere to ethical and legal guidelines for collecting samples, and understand the importance of preserving natural landscapes. Learn best practices for safely conducting a field study.

Credits: 6.00

6 Credits

Fall 4th Year

12-15 Credits

Spring 4th Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

12-15 Credits

German, BA (Language & Culture Track)

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Pre-requisite Language Courses

GER 10100 - German Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in German reserved exclusively for students who have had less than two years of German at the ninth-grade level or above. Students with two years or more of previous German study may not take this course for credit. Permission of department required. CTL:IWL 1920 German Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos of spoken German. 4. Compose German sentences by focusing on the set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 10200 - German Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 10100 . CTL:IWL 1921 German Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 20100 - German Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate German course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts, and listening to audio recordings, and watching videos of spoken German. 2. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 3. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 20200 - German Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 20100 . CTL:IWL 1923 German Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 22300 - German Level IV: Science And Engineering

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills, directed toward use of German in science and technology. Work on grammar as needed. Use of materials from recent publications in science and technology. Introduction to general and technical vocabulary. Conducted primarily in German. Credit will not be given for both GER 20200 and 22300.

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts about science, engineering, and business. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings about science, engineering, and business in spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos about science, engineering, and business in spoken German. 4. Compose German sentences about science, engineering, and business by focusing on a set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations that deal with science, engineering, and business. Credits: 3.00

GER 22400 - German Level IV: Business German

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed toward use of German for business purposes. Work on grammar as needed. Course materials cover daily business dealings as well as national and international trade, living conditions, environmental and social problems.

Credits: 3.00

GER 20500 - Accelerated Intermediate German (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate level course in German designed to achieve second year language proficiency in German. The course is appropriate for students who would like to accelerate the process of learning German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading a variety of German texts. 2. Identify German cultural aspects by watching videos in

spoken German language integrated in the book. 3. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 4. Compose grammatically correct German sentences by observing the norms and standards of the language. 5. Produce sentences in spoken German in the form of dialogues and presentations and respond appropriately to questions and statements related to everyday life. Credits: 4.00

German Major

A. German Language (6 credits)

GER 30100 - German Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of German speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Germany from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 30200 - German Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in German on the basis of materials dealing with the ideas and events that have shaped present-day Germany. Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

B. German Literature (3 credits)

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.

Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts. Credits: 3.00

Language & Culture Track

C. Advanced German Language (6 credits)

GER 40100 - German Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of German speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Germany. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 40200 - German Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking,

listening, reading, and writing abilities in German. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Compose essays in German after reading authentic German articles and books. 2. Discuss current events in German based on print and media sources from German-speaking countries. 3. Formulate arguments during debate in German through group discussion. 4. State their opinions in German on recordings, television shows, and texts. 5. Describe information in German from graphs, charts, diagrams, and pictures. Credits: 3.00

D. Advanced German Literature (6 credits)

GER 34100 - German Literature I: From The Middle Ages To The 18th Century

Credit Hours: 3.00. Reading and discussion of selected texts (poetry, prose, dramatic texts, cultural documents, and artworks) in German from the Middle Ages to the Eighteenth Century.

Credits: 3.00

GER 34200 - German Literature II: From The 18th Century To The 21st Century

Credit Hours: 3.00. Reading and discussion of selected texts in German with the dual context of literary movements and historical developments between the 18th and 21st centuries.

Credits: 3.00

E. German Linguistics (3 credits)

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

F. German Culture and Civilization (3 credits)

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

G. German Selectives (6 credits)

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering

In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

GER 33000 - German Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of major German contributions to the cinema from the earliest period to the present. Emphasis on relevant aesthetic theories and on the schools of literature and painting that served as sources. Evaluation of the German film on the basis of social, artistic, and political criteria. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and describe the major movements and trends of German film history of the 20th and 21st centuries. 2. Analyze the cinematography of representative German films. 3. Interpret the explicit and implicit meanings of representative German films. Credits: 3.00

GER 42400 - Business German

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Learn and practice vocabulary and cultural knowledge that is applicable to business situations in German-speaking countries. 2. Compare business practices in German-speaking countries with those in the United States, and will be able to discuss the similarities and differences in German. Credits: 3.00

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 49800 - Advanced Topics In German

Credit Hours: 3.00. Special topics on literature, linguistics and culture of contemporary German-speaking countries. Conducted in German.

Credits: 3.00

GER 52400 - German For International Trade

Credit Hours: 3.00. A broad spectrum of business and cultural materials to prepare students for work in international firms. Intensive study of technical terminology used in business transactions; stylistics in business correspondence and report writing; training for accurate oral expression in business negotiations.

Credits: 3.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

Electives (15-41 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

GER 10100 - German Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in German reserved exclusively for students who have had less than two years of German at the ninth-grade level or above. Students with two years or more of previous German study may not take this course for credit. Permission of department required. CTL:IWL 1920 German Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos of spoken German. 4. Compose German sentences by focusing on the set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

15 Credits

Spring 1st Year

GER 10200 - German Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 10100 . CTL:IWL 1921 German Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15-16 Credits

Fall 2nd Year

GER 20100 - German Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate German course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts, and listening to audio recordings, and watching videos of spoken German. 2. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 3. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

15 Credits

Spring 2nd Year

GER 20200 - German Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 20100 . CTL:IWL 1923 German Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Fall 3rd Year

GER 30100 - German Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of German speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Germany from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Spring 3rd Year

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.

Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts.
Credits: 3.00

GER 30200 - German Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in German on the basis of materials dealing with the ideas and events that have shaped present-day Germany. Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

15 Credits

Fall 4th Year

GER 34100 - German Literature I: From The Middle Ages To The 18th Century

Credit Hours: 3.00. Reading and discussion of selected texts (poetry, prose, dramatic texts, cultural documents, and artworks) in German from the Middle Ages to the Eighteenth Century.

Credits: 3.00

GER 40100 - German Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of German speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Germany. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Spring 4th Year

GER 34200 - German Literature II: From The 18th Century To The 21st Century

Credit Hours: 3.00. Reading and discussion of selected texts in German with the dual context of literary movements and historical developments between the 18th and 21st centuries.

Credits: 3.00

GER 40200 - German Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in German. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Compose essays in German after reading authentic German articles and books. 2. Discuss current events in German based on print and media sources from German-speaking countries. 3. Formulate arguments during debate in German through group discussion. 4. State their opinions in German on recordings, television shows, and texts. 5. Describe information in German from graphs, charts, diagrams, and pictures. Credits: 3.00

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

15 Credits

German: World Languages Teaching Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (80 credits)

Pre-requisite Language Courses

GER 10100 - German Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in German reserved exclusively for students who have had less than two years of German at the ninth-grade level or above. Students with two years or more of previous German study may not take this course for credit. Permission of department required. CTL:IWL 1920 German Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts. 2. Identify appropriate use of German language in specific contexts by

listening to audio recordings of spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos of spoken German. 4. Compose German sentences by focusing on the set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 10200 - German Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 10100 . CTL:IWL 1921 German Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 20100 - German Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate German course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts, and listening to audio recordings, and watching videos of spoken German. 2. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 3. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 20200 - German Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 20100 . CTL:IWL 1923 German Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 22300 - German Level IV: Science And Engineering

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills, directed toward use of German in science and technology. Work on grammar as needed. Use of materials from recent publications in science and technology. Introduction to general and technical vocabulary. Conducted primarily in German. Credit will not be given for both GER 20200 and 22300.

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts about science, engineering, and business. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings about science, engineering, and business in spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos about science, engineering, and business in spoken German. 4. Compose German sentences about science, engineering, and business by focusing on a set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations that deal with science, engineering, and business. Credits: 3.00

GER 22400 - German Level IV: Business German

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed toward use of German for business purposes. Work on grammar as needed. Course materials cover daily business dealings as well as national and international trade, living conditions, environmental and social problems.

Credits: 3.00

GER 20500 - Accelerated Intermediate German (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate level course in German designed to achieve second year language proficiency in German. The course is appropriate for students who would like to accelerate the process of learning German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading a variety of German texts. 2. Identify German cultural aspects by watching videos in spoken German language integrated in the book. 3. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 4. Compose grammatically correct German

sentences by observing the norms and standards of the language. 5. Produce sentences in spoken German in the form of dialogues and presentations and respond appropriately to questions and statements related to everyday life. Credits: 4.00

German Major (33 credits)

A. German Language (6 credits)

GER 30100 - German Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of German speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Germany from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 30200 - German Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in German on the basis of materials dealing with the ideas and events that have shaped present-day Germany. Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

B. German Literature (3 credits)

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.

Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts. Credits: 3.00

Education Track (24 credits)

C. Advanced German Language (3 credits)

GER 40100 - German Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of German speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Germany. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 40200 - German Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in German. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Compose essays in German after reading authentic German articles

and books. 2. Discuss current events in German based on print and media sources from German-speaking countries. 3. Formulate arguments during debate in German through group discussion. 4. State their opinions in German on recordings, television shows, and texts. 5. Describe information in German from graphs, charts, diagrams, and pictures. Credits: 3.00

D. Advanced German Literature (3 credits)

GER 34100 - German Literature I: From The Middle Ages To The 18th Century

Credit Hours: 3.00. Reading and discussion of selected texts (poetry, prose, dramatic texts, cultural documents, and artworks) in German from the Middle Ages to the Eighteenth Century.

Credits: 3.00

GER 34200 - German Literature II: From The 18th Century To The 21st Century

Credit Hours: 3.00. Reading and discussion of selected texts in German with the dual context of literary movements and historical developments between the 18th and 21st centuries.

Credits: 3.00

E. German Linguistics (3 credits)

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

F. German Culture and Civilization (3 credits)

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

G. German Selectives (12 credits)

GER 31200 - Advanced German Conversation

Credit Hours: 1.00. One credit hour advanced German conversation course focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative competence. Discussions in German on various topics. Course may be taken concurrently with GER 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral German proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen, and discuss relevant intermediate texts in the target language. Credits: 1.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

GER 42400 - Business German

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Learn and practice vocabulary and cultural knowledge that is applicable to business situations in German-speaking countries. 2. Compare business practices in German-speaking countries with those in the United States, and will be able to discuss the similarities and differences in German. Credits: 3.00

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 49800 - Advanced Topics In German

Credit Hours: 3.00. Special topics on literature, linguistics and culture of contemporary German-speaking countries. Conducted in German.

Credits: 3.00

GER 52400 - German For International Trade

Credit Hours: 3.00. A broad spectrum of business and cultural materials to prepare students for work in international firms. Intensive study of technical terminology used in business transactions; stylistics in business correspondence and report writing; training for accurate oral expression in business negotiations.

Credits: 3.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

Other Departmental (12 credits)

Core III: Linguistic Diversity (0 credits)

Foundational Requirements (12 credits)

Notes

Electives (28 credits)

Grade Requirements

GPA Requirements

Teacher Licensure Information

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

GER 10100 - German Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in German reserved exclusively for students who have had less than two years of German at the ninth-grade level or above. Students with two years or more of previous German study may not take this course for credit. Permission of department required. CTL:IWL 1920 German Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos of spoken German. 4. Compose German sentences by focusing on the set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by

examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

15 Credits

Spring 1st Year

GER 10200 - German Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 10100 . CTL:IWL 1921 German Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

GER 20100 - German Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate German course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts, and listening to audio recordings, and watching videos of spoken German. 2. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 3. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations

and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

GER 20200 - German Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 20100 . CTL:IWL 1923 German Level IV

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

GER 22300 - German Level IV: Science And Engineering

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills, directed toward use of German in science and technology. Work on grammar as needed. Use of materials from recent publications in science and technology. Introduction to general and technical vocabulary. Conducted primarily in German. Credit will not be given for both GER 20200 and 22300.

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts about science,

engineering, and business. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings about science, engineering, and business in spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos about science, engineering, and business in spoken German. 4. Compose German sentences about science, engineering, and business by focusing on a set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations that deal with science, engineering, and business. Credits: 3.00

GER 22400 - German Level IV: Business German

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed toward use of German for business purposes. Work on grammar as needed. Course materials cover daily business dealings as well as national and international trade, living conditions, environmental and social problems.

Credits: 3.00

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

GER 20500 - Accelerated Intermediate German (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate level course in German designed to achieve second year language proficiency in German. The course is appropriate for students who would like to accelerate the process of learning German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading a variety of German texts. 2. Identify German cultural aspects by watching videos in spoken German language integrated in the book. 3. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 4. Compose grammatically correct German sentences by observing the norms and standards of the language. 5. Produce sentences in spoken German in the form of dialogues and presentations and respond appropriately to questions and statements related to everyday life. Credits: 4.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques,

and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field

placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

15 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent

enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

GER 30100 - German Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of German speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Germany from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Spring 3rd Year

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.

Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts. Credits: 3.00

GER 30200 - German Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in German on the basis of materials dealing with the ideas and events that have shaped present-day Germany. Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4.

Recognize how theories of individual and collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences. Credits: 3.00

GER 34100 - German Literature I: From The Middle Ages To The 18th Century

Credit Hours: 3.00. Reading and discussion of selected texts (poetry, prose, dramatic texts, cultural documents, and artworks) in German from the Middle Ages to the Eighteenth Century.

Credits: 3.00

GER 34200 - German Literature II: From The 18th Century To The 21st Century

Credit Hours: 3.00. Reading and discussion of selected texts in German with the dual context of literary movements and historical developments between the 18th and 21st centuries.

Credits: 3.00

GER 40100 - German Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of German speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Germany. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal

philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

18 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Global Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (27 credits)

A. Global Studies Foundation Courses (12 credits)

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

GSLA 48000 - Senior Interdisciplinary Capstone Project In Global Studies I

Credit Hours: 3.00. The senior capstone course for Global Studies majors is designed to give students the chance to define and complete a research project of personal interest, and to integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001. The capstone courses are offered to students in their senior year to be completed the final two semesters of their major. Students will assemble a committee of two or more faculty members willing to direct their work. The Director of Global Studies will be an ex-officio member of the committee. Students will incorporate their prior coursework (including foreign language training), study abroad, and/or internships into their final project. The capstone may be, but is not limited to, a senior honors project, a multimedia project, service learning, or directed research. Timeline for a successful capstone project: Spring of Sophomore year: After three semesters of coursework, the student will start defining an area of interest or passion that will form the basis of their capstone research. Junior Year: The student will select courses in their interest area. They will also start speaking to faculty members in the field in order to assemble their committee. Spring of Junior Year: Students will finalize their faculty committee to direct their research. Fall of Senior Year: Research Semester, as directed by the committee. GSLA 48000. Spring of Senior Year: Complete project. GSLA 48001.

Learning Outcomes: 1. Demonstrate an awareness of Global issues through academic inquiry and extracurricular engagement. 2. Critically apply multi-perspective research frameworks to a concrete problem or case. 3. Recognize historic roots of Global inequality. 4. Develop intercultural competence and demonstrate empathy for difference. Credits: 3.00

GSLA 48001 - Senior Interdisciplinary Capstone Project In Global Studies II

Credit Hours: 3.00. The senior capstone is a year-long course for which Global Studies majors enroll in consecutive semesters. Its primary goal is for students to define and complete a research project of personal, academic, and/or professional interest, as they integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001 in order to complete the Global Studies major.

Learning Outcomes: 1. Varies per student project/ capstone. Credits: 3.00

B. Tracks (12 credits)

C. International Experience: Study Abroad or International Internship (3 credits)

Electives (20-57 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

15-16 Credits

Spring 1st Year

15 Credits

Fall 2nd Year

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

GSLA 48000 - Senior Interdisciplinary Capstone Project In Global Studies I

Credit Hours: 3.00. The senior capstone course for Global Studies majors is designed to give students the chance to define and complete a research project of personal interest, and to integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001. The capstone courses are offered to students in their senior year to be completed the final two semesters of their major. Students will assemble a committee of two or more faculty members willing to direct their work. The Director of Global Studies will be an ex-officio member of the committee. Students will incorporate their prior coursework (including foreign language training), study abroad, and/or internships into their final project. The capstone may be, but is not limited to, a senior honors project, a multimedia project, service learning, or directed research. Timeline for a successful capstone project: Spring of Sophomore year: After three semesters of coursework, the student will start defining an area of interest or passion that will form the basis of their capstone research. Junior Year: The student will select courses in their interest area. They will also start speaking to faculty members in the field in order to assemble their committee. Spring of Junior Year: Students will finalize their faculty committee to direct their research. Fall of Senior Year: Research Semester, as directed by the committee. GSLA 48000. Spring of Senior Year: Complete project. GSLA 48001.

Learning Outcomes: 1. Demonstrate an awareness of Global issues through academic inquiry and extracurricular engagement. 2. Critically apply multi-perspective research frameworks to a concrete problem or case. 3. Recognize historic roots of Global inequality. 4. Develop intercultural competence and demonstrate empathy for difference. Credits: 3.00

SCLA 49000 - Directed Reading

Credit Hours: 1.00 to 3.00. Designed for a student to work with an instructor on a topic of special interest.

Credits: 1.00 to 3.00

15 Credits

Spring 4th Year

GSLA 48001 - Senior Interdisciplinary Capstone Project In Global Studies II

Credit Hours: 3.00. The senior capstone is a year-long course for which Global Studies majors enroll in consecutive semesters. Its primary goal is for students to define and complete a research project of personal, academic, and/or professional interest, as they integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001 in order to complete the Global Studies major.

Learning Outcomes: 1. Varies per student project/ capstone. Credits: 3.00

15 Credits

Health and Disease, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (40-41 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular

components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and

execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental

design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (21-22 credits)

Intermediate Biology Selective (3 credits)

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

Human Anatomy & Physiology (8 credits)

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with

professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

Health & Disease Selective (3 credits)

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses,

and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

Biology Selectives (for HLDS) (5-6 credits)

Lecture Course Options (2-6 credits)

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting

and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will

understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the most current literature.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and

analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis

on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 54900 - Microbial Ecology

Credit Hours: 2.00. A study of microbial interactions with other organisms and the environment. Aquatic and terrestrial ecosystems as well as interactions between nonpathogenic microbes and plants and animals will be discussed. Offered in alternate years.

Credits: 2.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field

trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological

response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e.,

writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to

the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal

transduction research. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those

listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

Undergraduate Research (2-3 credits if selected)

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49900 - Biology Honors Thesis Research

Credit Hours: 1.00 to 4.00. Research under the guidance of a scientist. Submission of honors tutorial petition and consent of faculty tutor and Honors Committee. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

Laboratory Modules (2-3 credits if selected)

BIOL 44212 - Microscopy And Cell Biology

Credit Hours: 1.00. In this five-week module, students will learn how to prepare specimens for viewing by fluorescence microscopy. Specimens include mammalian tissue culture cells and zebrafish embryos. The emphasis will be on the staining of the cytoskeleton in these preparations, utilizing antibodies and fluorescence probes. The specimens will be viewed by wide-field and confocal laser scanning fluorescence microscopy. Images will be acquired, processed and analyzed by modern computational methods. Students will learn the basics of cell culture, immunocytochemistry, fluorescence microscopy, digital image processing and data analysis. At the end of the course, students prepare a PowerPoint presentation of their images and data.

Learning Outcomes: 1. Students demonstrate proficiency with skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Students

demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. Credits: 1.00

BIOL 54202 - Computer Laboratory: Data Analysis In Neuroscience

Credit Hours: 1.00. This course introduces students to computational techniques for analyzing real-world neuroscience data using Python and Jupyter Notebooks. Focusing on datasets such as neural time series, students will learn how to preprocess, visualize, and statistically analyze complex data. Topics include basic programming, statistical modeling, and practical applications relevant to neuroscience research. Emphasis is placed on developing hands-on skills for interpreting experimental data and solving real-world problems, preparing students for advanced study or careers in data-driven neuroscience.

Learning Outcomes: 1. Apply Python programming to process and analyze real-life neuroscience datasets, including time-series data. 2. Perform statistical modeling and hypothesis testing on neuroscience data to extract meaningful insights. 3. Use computational tools to create effective visualizations and interpret their relevance to neuroscience research. 4. Design and implement reproducible data analysis workflows using Jupyter Notebooks. 5. Combine programming, statistics, and neuroscience concepts to address real-world research questions. Credits: 1.00

Base Lab Requirement (2 credits)

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

BIOL 500-level Selective (0 credits)

Other Departmental Requirements: (56-80 credits)

Chemistry (17 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Biochemistry (4 credits)

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and

eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems.
Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing.
Credits: 1.00

Pre-Professional Selective (3 credits)

PUBH 40000 - Human Diseases And Disorders

Credit Hours: 3.00. The major communicable and noncommunicable diseases and disorders that afflict modern man, with particular emphasis upon the etiology, epidemiology, and ecology of these diseases and disorders.

Learning Outcomes: 1. Describe risk factors and modes of transmission for infectious and chronic diseases and how these diseases affect

both personal and population health. 2. List the leading causes of mortality and morbidity, and health disparities among local, regional, and global populations. 3. Discuss major local, national, and global health challenges. 4. Explain the influence that science and technology have on individual and population health. 5. Describe the multiple determinants of health. Credits: 3.00

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SOC 27500 - Sociology Of Aging And The Life Course (UCC: BSS)

Credit Hours: 3.00. An examination of research on the social context of human aging, including demographic and developmental changes. A life course perspective is emphasized for studying health, life events, and quality of life. Considers exceptional longevity in comparative perspective.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Comprehension of the basic concepts, theories, and methods of the sociology of aging. 2. Think sociologically and write more clearly. 3. Application of course content in personal and vocational experiences. Credits: 3.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

SOC 46100 - Health And Social Behavior

Credit Hours: 3.00. This course provides a sociological examination of health and illness, with a particular focus on social position (e.g., race, socioeconomic status, gender), stress and social support, and health care. Goals for this course include developing critical thinking skills, understanding the broader implications of issues related to health, and thinking creatively about potential societal solutions to these issues.

Learning Outcomes: 1. Understand the ways in which social factors influence health and social behavior as well as the broader implications of these issues. 2. Develop critical thinking skills through critical writing and classroom discourse on issues related to the sociology of health and illness. 3. Apply a sociological perspective to potential solutions to health-related issues. Credits: 3.00

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting,

manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Mathematics (6-10 credits)

Calculus I

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional

models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Electives (0-24 credits)

GPA Requirements

Course Requirements & Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-19 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and

power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-20 Credits

Fall 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting

and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and

function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.

Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing

biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and

organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

14 Credits

Fall 3rd Year

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors

in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion

in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

13-14 Credits

Spring 3rd Year

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14-15 Credits

Fall 4th Year

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation,

goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

14 Credits

Spring 4th Year

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

12-14 Credits

History Honors, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Area A - U.S. History (3 credits)

Area B - European History (3 credits)

Area C - Latin American, Asian, Middle Eastern, or African History (3 credits)

Area D - Period prior to 1800 (3 credits)

Area E - Thematic History (3 credits)

Area F - Advanced History (6 credits)

Additional Course (3 credits)

Junior Research Seminar (3 credits)

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming

historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

Honors Thesis (6 credits)

HIST 42100 - Honors Historical Methods

Credit Hours: 3.00. Designed as a prequel to Honors Thesis; this course introduces the Honors students to various advanced interpretative approaches to history and methods of historical research. Students also choose their topic for their Honors Thesis and begin research.

Credits: 3.00

HIST 42200 - Honors Thesis In Historical Research

Credit Hours: 3.00. Designed as a sequel to HIST 42100 (Honors Historical Methods); this course is intended as the culminating academic experience for students in the Department of History Honors Program. It will require the completion of an undergraduate thesis in history. Permission of instructor required.

Credits: 3.00

Area A - U.S. History (3 credits)

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-18 Credits

15-18 Credits

Spring 1st Year

15-17 Credits

15-17 Credits

Fall 2nd Year

13-16 Credits

13-16 Credits

Spring 2nd Year

13-16 Credits

13-16 Credits

Fall 3rd Year

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

HIST 42100 - Honors Historical Methods

Credit Hours: 3.00. Designed as a prequel to Honors Thesis; this course introduces the Honors students to various advanced interpretative approaches to history and methods of historical research. Students also choose their topic for their Honors Thesis and begin research.

Credits: 3.00

14-16 Credits

14-16 Credits

Spring 4th Year

HIST 42200 - Honors Thesis In Historical Research

Credit Hours: 3.00. Designed as a sequel to HIST 42100 (Honors Historical Methods); this course is intended as the culminating academic experience for students in the Department of History Honors Program. It will require the completion of an undergraduate thesis in history. Permission of instructor required.

Credits: 3.00

12-15 Credits

12-15 Credits

Fall 1st Year

15-18 Credits

15-18 Credits

About the Program

History of Science, Technology, and Medicine, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Area A - History of Science, Technology, and Medicine (12 credits)

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 39400 - Environmental History Of The United States (UCC: HUM)

Credit Hours: 3.00. This is a mid-level survey designed to provide students of environmental science with historical background and students of history with the unique perspective of environmental history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

HIST 31405 - Science, Technology, Engineering And Mathematics (STEM) And Gender (UCC: HUM/STS)

Credit Hours: 3.00. Scientific and technological innovation has been a cornerstone of American identity. How science and technology matters to gender, and gender matters to science and technology, will be explored through studying amateur and professional scientists and engineers, industrialization, education, sexual division of labor, and home and work spaces in twentieth-century America. Examining technological, scientific, and engineering innovation through the lens of gender

reveals changing relationships between men and women in modern America.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to gender. 2. Understand and recognize how assumptions about gender may influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

HIST 35205 - Death, Disease And Medicine In Twentieth Century American History (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of disease, dying, and medicine in the United States in the 20th century.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify and explain the relationship between science and culture and interdisciplinarity. 2. Analyze texts and cultural artifacts about medicine. 3. Identify medical practice and how it is informed by context and culture. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

HIST 33205 - The Nuclear Age (UCC: HUM/STS)

Credit Hours: 3.00. Once seen as a revolutionary and exceptional, nuclear technologies have become central to many aspects of life in the U.S. This course uses the history of nuclear technologies to trace how American society has grappled with technological change.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Write a persuasive essay evaluating nuclear energy as a source of power, using primary and secondary historical sources to support your claims. 2. Create a compelling argument about how societies cope with technological change, using the history of nuclear technologies as a central example. 3. Summarize the importance of

nuclear technologies in US history, drawing on primary and secondary historical sources introduced in the course. Credits: 3.00

HIST 30805 - History Of Life Sciences

Credit Hours: 3.00. This course will examine the development of life sciences from 1750 to the present, introducing students to critical problems related to biology and society through the study of primary and secondary sources. The "life sciences" include all the sciences that deal with life as an organic entity. A prominent theme in this historical treatment is the impact of social and political ideas on the life sciences. Topics will include theories of life, the origin of life, taxonomy and classification, theories of development, natural selection, genetics, eugenics, science and religion, the evolutionary synthesis, biodiversity, ecology and environmentalism, sociobiology, the discovery of DNA, cognition and the brain, and gender in science. Students will develop crucial skills in the interpretation of primary and secondary sources, research, analysis, and presentation.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical material. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 30905 - History Of Environmental Science

Credit Hours: 3.00. This course introduces students to various approaches to environmental science through time. It considers critical problems related to the environment and society. The "environmental sciences" include all the sciences that deal with the Earth's physical and organic environments.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical materials. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2. Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 49400 - Science And Society In American Civilization

Credit Hours: 3.00. This course examines the development of science in the United States from colonial times to the present. Emphasis in the earlier periods is placed on comparison and contrast of the American scene with that of Europe. Subsequent treatment deals with industrialization, and maturation of the American scientific community, and the increasing social effects of science. Among those considered are the forces making for urbanization, for greater interdependence among science, industry and government, and for repercussions in intellectual affairs.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of

science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 30701 - History Of Artificial Intelligence: Minds And Machines

Credit Hours: 3.00. This course examines the long history of efforts in automating human cognition. Historically, the attempts to automate human cognitive functions - from the mere reckoning of numbers to complex decision-making have been entangled with heated debates about what counts as good, proper, and desirable thinking; whose thinking machines should emulate; and whether the thinking of some humans is inferior to that of machines. In this course, we will examine how the invention of calculating machines - analogue and then digital - has developed in tandem with philosophical and scientific theories of human thinking and intelligence. In their turn, the latter developed as a response to changing social, political, and economic currents.

Learning Outcomes: 1. Critique the epistemological foundations and ethical implications of past and present approaches to the automation of human cognition. 2. Use primary sources to make arguments about the role of social, political, economic, and cultural currents that have historically provided the impulses for research and development in the automation of human cognition. 3. Assess historical scholarly arguments about social, economic, and political power asymmetries surrounding artificial intelligences. 4. Create websites to use text, imagery, and video content and effectively communicate how social factors have historically shaped the development of artificial intelligence. Credits: 3.00

HIST 36105 - History Of Science, Technology, And Environment In Pre-Modern East Asia

Credit Hours: 3.00. This course explores developments in scientific, technological, and ecological history specifically in Pre-modern East Asia. In this class, we will read basic theories and methods in the history of science and technology, as well as basic debates and questions that challenge scholars studying the history of science, technology, and the environment in a non-western pre-modern context. We will explore how society, culture, and politics affect knowledge production and people's engagement with nature, and how these interactions, in turn, shaped society, culture, and politics. All readings are in English. No prior knowledge of East Asia is necessary.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society in pre-modern East Asia. 2. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 3. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 4. Investigate the diversity of human experience in pre-modern East Asia, explain how social factors such as ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, have shaped the development or application of science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. 5. Identify and explain the major themes of the history of science, technology, and environment, write about the role of science in society, and describe ethical implications of technological and scientific developments. Credits: 3.00

HIST 30705 - History Of Data: How Data Became Big

Credit Hours: 3.00. This course offers a long history of Big Data. The first module focuses on how states collected data

from the 16th to 19th centuries. Here we will focus on mortality bills, census, statistics, and accounting tables. In the second model, we will pay special attention to data collection and privacy in the 20th century. In the third module, students will explore how previous developments in data collection were applied to the new developments in analog and digital computing. The final weeks of the course will focus on present-day artificial intelligence, big data, their technical limitations, and the ways they often amplify, exploit, and contribute to a wide array of social problems.

Learning Outcomes: 1. Understand a variety of historical contexts that have shaped how we use, collect, and analyze data in the 21st century. 2. Assess historical arguments about the place of data in the growth of state bureaucracies, colonialism, eugenics, national security, warfare, and scientific research made in scholarly secondary sources. 3. Use primary sources to make arguments about the historical contingency of the ways practitioners have been using data to solve state problems. 4. Develop critical thinking about data-empowered algorithms and envision a human-centered and ethical way of creating and implementing data technologies. Credits: 3.00

HIST 30902 - History Of Biotechnology

Credit Hours: 3.00. This class examines historical intersections between engineering and biology in the Western world. The course begins by considering several possible meanings of "biotechnology." It examines how and why different biotechnologies from the life sciences, biology, and medicine have arisen in specific historical contexts, changed over time, and affected society from the late 19th century to the present. We will study vaccines and beer-making in the 19th century, cell culture, birth control pills, and DNA sequencing in the 20th century, and 21st-century genome editing and synthetic biology, for example. Overall, this course argues that biotechnologies have always forced human beings to consider whether living and non-living entities are made up of the same fundamental "stuff," the implications of manipulating living things, and the nature of life itself.

Learning Outcomes: 1. Identify and describe examples of biotechnologies. 2. Describe the role of biotechnology in history and its relevance for society today. 3. Explain major themes in the history of biotechnology, such as how biotechnologies have changed through time and impacted society by way of their interactions with (for example) ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class. 4. Investigate the history and social impacts of a biotechnology of their choosing that has not been discussed in depth in this class. 5. Explain how and why this biotechnology arose in a specific historical context, changed over time, and impacted (or impacts) society (using historical methods). Credits: 3.00

HIST 28400 - The Computer Age From Babbage To The Blockchain

Credit Hours: 3.00. In this course we will explore the history of computing-from the pre-electronic days through the computer's ascent in the twentieth century to the various electronic computing and communications technologies that surround us today. This course will investigate why there was a desire to create computing machines in the first place, the economic and political arrangements that brought computers into existence, the debates over what computers could (and should) be used for, the development of the IT profession, and the gradual shift from computers being room-sized specialty machines to everyday objects that people carry around in their pockets.

Learning Outcomes: 1. Identify social, economic, political, and historic factors that have shaped the development and application of computer technology. 2. Describe the history of computing and its relevance for the world today. 3. Locate primary source materials, critically analyze those sources by considering their context and the reasons for their creation. 4. Examine work produced by, and arguments made by, historians. 5. Discuss the role that computers play in everyday life with an expansive view of the wide breadth of computerized systems that surround us. Credits: 3.00

HIST 30801 - American Eugenics

Credit Hours: 3.00. This course explores the pre-history and history of American eugenics, as well as its afterlives. It analyzes how Americans have used scientific ideas to grapple

with questions of heredity and human worth from the Early Republic to the present. We will explore the social and political uses of phrenology, physiognomy, and eugenics, and consider how those scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering.

Learning Outcomes: 1. Read and discuss primary sources. 2. Interpret how scientific knowledge has been applied in human lives and society from the 18th century to the present. 3. Analyze major themes in the history of eugenics. 4. Investigate how and why specific ideas about human value and genetic worth arise in specific historical contexts. 5. Critique the extent to which scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering. Credits: 3.00

HIST 36405 - Patient Voices In The History Of Medicine

Credit Hours: 3.00. This course examines the history of medicine in the United States from the early twentieth century to the present by starting with patient voices, which provide a glimpse into the experience of illness. Using patient reflections as the primary lens through which to examine the history of medicine, topics covered include historical changes and historical decision making related to the diagnostic process, therapeutic interventions, access to care, and medical institutions. The course also examines how assumptions about gender, race, and class have shaped differential health outcomes such as mortality rates, time to diagnosis, and determination of treatment approach and efficacy.

Learning Outcomes: 1. Identify in written and oral communication key features of the U.S. medical system by examining how patient experiences have changed over time and in different contexts. 2. Analyze how assumptions about race, gender, and class can affect the experience of illness, access to care, and health outcomes. 3. Engage with primary sources such as journal entries, memoirs, newspaper articles, artwork, and audiovisual material to identify patient perspectives and place them in historical context, and to illustrate how social, cultural, political, and economic factors have shaped the practice of medicine. 4. Reflect on the ethical issues that have arisen in medicine using patient voices as a lens to examine the impact of technology on the illness experience. 5. Examine patient experiences to make an argument about the history of medical practice, such as the diagnostic process or therapeutic approaches, using historical methods. Credits: 3.00

HIST 28200 - Science And Society In The Twentieth Century World (UCC: HUM/STS)

Credit Hours: 3.00. An introductory survey emphasizing cultural contexts, relationships with other institutions, and the lives of major figures. Covering selected major achievements as well as the problems these generate. Neither science nor engineering background is required.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society during the Twentieth Century. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society during the Twentieth Century. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contributions of different social groups in science and society during the Twentieth Century. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science during the Twentieth Century. Credits: 3.00

HIST 28000 - Science And Society In Western Civilization I (UCC: HUM/STS)

Credit Hours: 3.00. A survey of the main lines in the development of science and society in Western civilization from

earliest times to Newton's discovery of gravitation. Beginning with prehistory and Egyptian and Mesopotamian civilizations, the course treats in more detail the Greeks and Romans. The course then considers science during the Middle Ages, examining the transmissions of ancient science and its incorporation into the body of Christian doctrines. The course concludes with the new efforts of physicians and astronomers to free their studies from the influence of the Church and antiquity, and the new accommodations between science and society during the Scientific Revolution.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science.
Credits: 3.00

HIST 28100 - Science And Society In Western Civilization II (UCC: HUM/STS)

Credit Hours: 3.00. This course considers Western science and society from the time of Newton to the present. Beginning with Copernicus to Newton, topics next include biological classification, modern chemistry, and the onset of the industrial revolution. For the nineteenth century the course stresses the maturation of biology. Darwinian evolution, the dynamic synthesis and electromagnetic studies, and the second industrial revolution. In the twentieth century, the course covers modern physics, the life sciences, the understanding of the universe, and the interaction between pure and applied science. The course concludes with some of the modern social and political problems which science caused by its success.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science.
Credits: 3.00

Area B - General History (3 credits)

Area C - Period prior to 1800 (3 credits)

HIST 10300 - Introduction To The Medieval World (UCC: HUM)

Credit Hours: 3.00. Barbarians, kings, queens, peasants, witches, saints, teachers, students, heretics, Moslems, Jews, Christians, love, death, monks, farm life, city life, ordinary men, women, and children as Europe develops from A.D. 500 to 1500.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 20100 - Special Topics In History

Credit Hours: 3.00. This variable title course deals with broad historical topics that transcend and telescope traditional analytical, chronological, and geographical boundaries. Content will vary with the instructors teaching the class.

Credits: 3.00

HIST 22800 - English History To 1688

Credit Hours: 3.00. This course is designed to survey the growth and development of English society from its beginning through the seventeenth century. Emphasis is put upon those institutions and events that influenced the establishments of the English legal system.

Credits: 3.00

HIST 23800 - History Of Russia From Medieval Times To 1861 (UCC: HUM)

Credit Hours: 3.00. This course explores the main characteristics of early Russian society, culture and politics. Topics include: the Kievan principalities, Orthodox Christianity, the Mongols, the rise of Moscow, the Petrine reforms, peasant and national rebellions, revolutionary movements, and the Tsarist empire to the Crimean War.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major geographical features of the Russian homeland, the Baltics, Belarus, Ukraine, the Caucuses, Central Asia, the Volga-Urais, Siberia, and the Far East. 2. Trace and describe the main historical characteristics of Russian culture, social structure, and political life from the earliest origins under the Viking conquests to the emancipation of the serfs in 1861. 3. Analyze what the Russians both gave and took from the hundreds of Caucuses, Siberian, Central Asian, and European peoples, whom they gathered into the all-Russian state. 4. Understand the sources of Russia's triumphs and tragedies through the empire's consolidation of autocracy and serfdom. 5. Create a game-style simulation on the topic Russia's Circular Frontier and the Rise of Muscovy. Credits: 3.00

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 27100 - Introduction To Colonial Latin American History (1492-1810) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the principle historical themes of Latin America during the colonial period (roughly, from 1492 to 1810). No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate a grasp of the historical forces that in many ways laid the foundation for present-day Latin America. 2. Express understanding of how these major political, social, economic, and cultural issues unfolded in different ways in Latin America, with respect to region, time, and culture. Credits: 3.00

HIST 30200 - Historical Topics

Credit Hours: 3.00. This variable-title course deals with broad historical topics that transcend and collapse traditional analytical, chronological, and geographic boundaries. Content will vary with faculty member teaching the class.

Learning Outcomes: 1. Students will acquire a perspective on and basic understanding of the course content. 2. Students will engage in integrative learning as they examine the course content that transcends and collapses traditional analytical, chronological, and geographic boundaries. 3. Students will develop their creative and critical thinking skills. 4. Students will strengthen their information literacy and improve their writing skills. Credits: 3.00

HIST 31700 - A History Of The Christian Church And The Expansion Of Christianity I

Credit Hours: 3.00. A history of the emergence of Christianity, the development of the Christian church, and the impact of Christian thought and institutions upon western Europe prior to the Reformation.

Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 46100 - The Revolutionary Era, 1763 To 1800

Credit Hours: 3.00. An analysis of the origins, nature, and consequences of the American Revolution; of the achievements and difficulties of the new nation under the Articles of Confederation; of the drafting and adoption of the Constitution; and of the initial political, economic, and social progress of the United States under the Federalists.

Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision

process. Credits: 3.00

HIST 51200 - England Under The Stuarts

Credit Hours: 3.00. This intensive study of seventeenth-century England focuses on the political, religious, and economic tensions under the early Stuarts; the Civil War; Cromwell's Protectorate; and The Glorious Revolution. Topics discussed include parliament, puritanism, radicalism, the Restoration, and the Whig Oligarchy.

Credits: 3.00

HIST 32105 - Spain: The First Global Empire, 1469-1713

Credit Hours: 3.00. This course examines the history of Spain's global empire from the unification of the kingdoms of Castile and Aragon to the War of the Spanish Succession. Topics include Spain's European possessions, overseas empire, ruling dynasty, society, and culture.

Learning Outcomes: 1. Assess the mechanisms that made the Spanish imperial system successful and, likewise, appraise its inherit weaknesses. 2. Distinguish the different stages in the development of the Spanish empire. 3. Judge the extent of the Spanish empire's impact on international politics and regional histories. 4. Evaluate the substantial cultural output of the period. Credits: 3.00

HIST 37005 - Queens And Empresses In Early Modern Europe

Credit Hours: 3.00. This course explores the lives and legacies of queens and empresses in early modern Europe within the wider context of gender, political authority, culture, and monarchy. Students will be introduced to new scholarly approaches to the study of female rulership.

Learning Outcomes: 1. Compare the legal, cultural, and symbolic aspects of queenly authority across monarchies and centuries applying the relevant vocabulary and conceptual frameworks. 2. Evaluate the political intervention of various individual queens and empresses taking into account the many variables that shaped their rule. 3. Distinguish the ways in which queens and empresses shaped national histories as well as European international politics and culture. Credits: 3.00

HIST 30105 - Big History: Time And Scale

Credit Hours: 3.00. This course explores Big History, a new form of world / global history. Like all forms of world history, Big History transcends the limitations of nation-centered perspectives. Drawing on the history of science and environmental history, Big History considers the many forces (physical, biological, environmental, social, and political) that drive change across time.

Learning Outcomes: 1. Examine, interpret, and explain trends in Big History / World History at multiple scales. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to Big History. 3. Identify and explain the major themes of Big History. 4. Write about the role of Big History and social implications of science. Credits: 3.00

HIST 40500 - The French Revolution And Napoleon

Credit Hours: 3.00. A study of revolutionary France from the fall of the ancient regime to the Congress of Vienna. Divided in emphasis between the period of the revolution and the era of Napoleon, the course stresses social, political, ideological, and institutional developments.

Credits: 3.00

HIST 46000 - American Colonial History

Credit Hours: 3.00. An investigation of the foundation of the American colonies, their place in the British imperial structure, and the eventual conflict of imperial exigencies with colonial self-interest and national feeling.

Credits: 3.00

HIST 40300 - Europe In The Reformation

Credit Hours: 3.00. A study of decay and renewal in European society, 1300 to 1650. Concentrates on the Protestant and Catholic Reformation and religious wars, but also covers the Northern Renaissance, the New Monarchies, and the discovery and exploration of the New World.

Credits: 3.00

HIST 36105 - History Of Science, Technology, And Environment In Pre-Modern East Asia

Credit Hours: 3.00. This course explores developments in scientific, technological, and ecological history specifically in Pre-modern East Asia. In this class, we will read basic theories

and methods in the history of science and technology, as well as basic debates and questions that challenge scholars studying the history of science, technology, and the environment in a non-western pre-modern context. We will explore how society, culture, and politics affect knowledge production and people's engagement with nature, and how these interactions, in turn, shaped society, culture, and politics. All readings are in English. No prior knowledge of East Asia is necessary.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society in pre-modern East Asia. 2. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 3. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 4. Investigate the diversity of human experience in pre-modern East Asia, explain how social factors such as ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, have shaped the development or application of science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. 5. Identify and explain the major themes of the history of science, technology, and environment, write about the role of science in society, and describe ethical implications of technological and scientific developments.
Credits: 3.00

HIST 28000 - Science And Society In Western Civilization I (UCC: HUM/STS)

Credit Hours: 3.00. A survey of the main lines in the development of science and society in Western civilization from earliest times to Newton's discovery of gravitation. Beginning with prehistory and Egyptian and Mesopotamian civilizations, the course treats in more detail the Greeks and Romans. The course then considers science during the Middle Ages, examining the transmissions of ancient science and its incorporation into the body of Christian doctrines. The course concludes with the new efforts of physicians and astronomers to free their studies from the influence of the Church and antiquity, and the new accommodations between science and society during the Scientific Revolution.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science.
Credits: 3.00

Area D - Advanced History of Science, Technology, and Medicine (9 credits)

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the

revision process. Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

HIST 49400 - Science And Society In American Civilization

Credit Hours: 3.00. This course examines the development of science in the United States from colonial times to the present. Emphasis in the earlier periods is placed on comparison and contrast of the American scene with that of Europe. Subsequent treatment deals with industrialization, and maturation of the American scientific community, and the increasing social effects of science. Among those considered are the forces making for urbanization, for greater interdependence among science, industry and government, and for repercussions in intellectual affairs.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

Junior Research Seminar (3 credits)

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance

their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

Senior Research Seminar (3 credits)

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

Other Departmental - Liberal Arts Core (31-55 credits)

Core I: Disciplinary Diversity (6-18 credits)

Core II: Social Diversity (1-3 credits)

Core III: Linguistic Diversity (3-4 credits)

Foundational Requirements (21-30 credits)

Electives (32-56 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-18 Credits

Spring 1st Year

15-17 Credits

Fall 2nd Year

13-16 Credits

Spring 2nd Year

13-16 Credits

Fall 3rd Year

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary

sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

14-16 Credits

Spring 4th Year

12-15 Credits

Learning Outcomes

History, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Area A - U.S. History (3 credits)

Area B - European History (3 credits)

Area C - Latin American, Asian, Middle Eastern, or African History (3 credits)

Area D - Period prior to 1800 (3 credits)

Area E - Thematic History (3 credits)

Area F - Advanced History (9 credits)

Additional Course (3 credits)

Junior Research Seminar (3 credits)

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

Senior Research Seminar (3 credits)

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

Area A - U.S. History (3 credits)

Electives (14-51 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-18 Credits

15-18 Credits

Spring 1st Year

15-17 Credits

15-17 Credits

Fall 2nd Year

13-16 Credits

13-16 Credits

Spring 2nd Year

13-16 Credits

13-16 Credits

Fall 3rd Year

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

14-16 Credits

14-16 Credits

Spring 4th Year

12-15 Credits

12-15 Credits

Fall 1st Year

15-18 Credits

15-18 Credits

About the Program

Horticulture: Controlled Environment Agriculture Concentration, BS

Degree Requirements

Departmental/Program Major Courses (72 credits)

Required Major Courses (17 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Controlled Environment Agriculture Concentration (55 credits)

Controlled Environment Agriculture Required Courses (21 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the

topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

HORT 31110 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (FNR 31300) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature

of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of post harvest food storage and pest management. Credits: 1.00

HORT 32100 - Hydroponics Systems

Credit Hours: 3.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in controlled environment agriculture (CEA). This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

Learning Outcomes: 1. Describe essential components of single-pass and recirculating hydroponic systems. 2. Compare different substrates and hydroponic system designs. 3. Interpret water quality analysis results and recommend corrections. 4. Create nutrient solutions using salts or mixed fertilizers. 5. Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponics. 6. Select hydroponic systems for production of leafy greens, herbs, and vegetable crops. 7. Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems. Credits: 3.00

Concentration Selectives (34 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and

agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health,

industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and

non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such

as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of

organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (4-5 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve

problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 credits

Spring 1st Year

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

15-16 Credits

Fall 2nd Year

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and

transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

14 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

14 Credits

Fall 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

HORT 31110 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (FNR 31300) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of post harvest food storage and pest management. Credits: 1.00

HORT 32100 - Hydroponics Systems

Credit Hours: 3.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in controlled environment agriculture (CEA). This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

Learning Outcomes: 1. Describe essential components of single-pass and recirculating hydroponic systems. 2. Compare different substrates and hydroponic system designs. 3. Interpret water quality analysis results and recommend corrections. 4. Create nutrient solutions using salts or mixed fertilizers. 5. Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponics. 6. Select hydroponic systems for production of leafy greens, herbs, and vegetable crops. 7. Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems. Credits: 3.00

16 credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

15 Credits

Fall 4th Year

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 51400 - Sensors And Automation For Horticultural Crop Production

Credit Hours: 3.00. This course is designed to provide undergraduate (senior level) and graduate students with the knowledge of a wide range of environmental and plant sensors and automation devices for horticultural crop production, especially controlled environment production. Lectures will focus on the theory and application of different plant and

environmental sensors, electronic devices and computer programming for automation and environmental control using sensors while the laboratory activities provide hands-on experience on the application of sensors and automation devices to control below and above-ground environment during production.

Learning Outcomes: 1. Examine theory associated with different environmental and plant sensor measurements. 2. Implement methods to interface sensors to measurement devices such as dataloggers and micro-controllers and program them for automated and continuous sensor measurements. 3. Examine digital sensing technologies based on image analysis. 4. Demonstrate knowledge and practice hands-on experience with precision environmental control using datalogger and microcontrollers. Credits: 3.00

16 Credits

Spring 4th Year

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

13-14 Credits

Horticulture: Horticultural Production and Marketing Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (68 credits)

Required Major Courses (17 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can

assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Horticultural Production and Marketing Concentration Required Courses (26 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be

taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding

of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Horticultural Production and Marketing Concentration Selective Courses (25 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition.

Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens.

Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their

environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical

transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts

such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (8-9 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions.

6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 Credits

Spring 1st Year

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

15-16 Credits

Fall 2nd Year

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

14 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

14 Credits

Fall 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the

formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

15 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

15 Credits

Fall 4th Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

16 Credits

Spring 4th Year

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers

use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

16-17 Credits

Horticulture: Landscape Contracting and Management Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (74 credits)

Required Major Courses (17 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab

prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Landscape Contracting and Management Concentration Required Courses (48 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound

approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment,

working independently and as a team member. Credits: 3.00

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences

in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

Landscape Contracting and Management Concentration Selective Courses (9 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single

gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions,

kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to

identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in

influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (2-3 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and

services. Credits: 0.50

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts

such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 Credits

Spring 1st Year

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

15-16 Credits

Fall 2nd Year

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of

graphics. Credits: 3.00

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

15 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific

method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.
Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.
Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.
Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

17 Credits

Fall 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

15 Credits

Spring 3rd year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

LA 34604 - Site Engineering: Materials And Construction

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Learning Outcomes: 1. Demonstrate an understanding of common landscape construction materials and their application in the built environment. 2. Demonstrate an understanding of structural qualities and limitations of construction materials and systems. 3. Demonstrate an understanding of basic construction documentation. 4. Demonstrate the ability to access, evaluate, and document a variety of materials and construction systems commonly found in landscape construction. Credits: 4.00

16 Credits

Fall 4th Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with

other weed control methods. Credits: 3.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.
Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.
Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

15 Credits

Spring 4th Year

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.
Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

12-13 Credits

Horticulture: Landscape Design Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (75 credits)

Required Major Courses (17 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.
University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with

emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Landscape Design Concentration Required Courses (43 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of

graphics. Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

LA 32500 - Ecological Landscape Performance And Planting

Credit Hours: 3.00. Study of plants and their integration with other site features (e.g., water, landform) to increase sustainability. Plants will not only be studied for their aesthetic and spatial uses in the landscape, but also their ecological functions and temporal dynamics. The relationship of plants to site planning, ecosystems, and human use will be explored. Various scales, sustainable practices, and landscape performance will be considered. Class trip may be required. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Be familiar with and able to use design principles and elements in the development of planting designs and understand the implications of plants as living things. 2. Understand the relationship of planting design, ecological functions, social factors, and sustainability. 3. Have a clear understanding of the concept and measurement methods of landscape performance. 4. Set smart and measurable sustainable goals and be able to select suitable plant material and create effective compositions appropriate for a variety of site conditions. 5. Know how to observe plants from multiple perspectives (plant needs & site/environmental conditions; human spatial needs; aesthetic responses; ecological implications) and be able to integrate these perspectives into functional designs. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

LA 22704 - Studio III: Planting Design

Credit Hours: 4.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to

build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 4.00

LA 34604 - Site Engineering: Materials And Construction

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Learning Outcomes: 1. Demonstrate an understanding of common landscape construction materials and their application in the built environment. 2. Demonstrate an understanding of structural qualities and limitations of construction materials and systems. 3. Demonstrate an understanding of basic construction documentation. 4. Demonstrate the ability to access, evaluate, and document a variety of materials and construction systems commonly found in landscape construction. Credits: 4.00

Landscape Design Concentration Selective Courses (15 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking

opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test

hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription,

protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to

construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the

difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis

will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (1-2 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of

horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 Credits

Spring 1st Year

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

15-16 Credits

Fall 2nd Year

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design

response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

14 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher

plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

17 Credits

Fall 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be

familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

15 Credits

Spring 3rd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

LA 22704 - Studio III: Planting Design

Credit Hours: 4.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to

planting design. Credits: 4.00

LA 34604 - Site Engineering: Materials And Construction

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Learning Outcomes: 1. Demonstrate an understanding of common landscape construction materials and their application in the built environment. 2. Demonstrate an understanding of structural qualities and limitations of construction materials and systems. 3. Demonstrate an understanding of basic construction documentation. 4. Demonstrate the ability to access, evaluate, and document a variety of materials and construction systems commonly found in landscape construction. Credits: 4.00

17 Credits

Fall 4th Year

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

LA 32500 - Ecological Landscape Performance And Planting

Credit Hours: 3.00. Study of plants and their integration with other site features (e.g., water, landform) to increase sustainability. Plants will not only be studied for their aesthetic and spatial uses in the landscape, but also their ecological functions and temporal dynamics. The relationship of plants to site planning, ecosystems, and human use will be explored. Various scales, sustainable practices, and landscape performance will be considered. Class trip may be required. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Be familiar with and able to use design principles and elements in the development of planting designs and understand the implications of plants as living things. 2. Understand the relationship of planting design, ecological functions, social factors, and sustainability. 3. Have a clear understanding of the concept and measurement methods of landscape performance. 4. Set smart and measurable sustainable goals and be able to select suitable plant material and create effective compositions appropriate for a variety of site conditions. 5. Know how to observe plants from multiple perspectives (plant needs & site/environmental conditions; human spatial needs; aesthetic responses; ecological implications) and be able to integrate these perspectives into functional designs. Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

15 Credits

Spring 4th Year

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

12-13 Credits

Horticulture: Landscape Enterprise Management Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (70 credits)

Required Major Courses (17 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of

horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Required Concentration Courses (29 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of

accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape

architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

Landscape Enterprise Management Concentration Selectives (24 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates

knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts,

and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to

produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4.

Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear

regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The

role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to

work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (6-7 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 Credits

Spring 1st Year

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

15-16 Credits

Fall 2nd Year

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students

who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

15 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems.

4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

14 Credits

Fall 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements;

and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

15 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

15 Credits

Fall 4th Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the

sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

15 Credits

Spring 4th Year

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

14-15 Credits

Horticulture: Plant Science Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (67-68 credits)

Required Major Courses (17 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

Plant Science Concentration Required Courses (26-27 credits)

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and

quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic

And Biochemistry w/lab

Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 12100 - Medicine In The Garden (UCC: STS)

Credit Hours: 1.00. A survey of the uses and properties of horticultural plants for human health and well-being. Topics will focus on the close relationships between plants and human physiology, nutrition, medicines, mind-altering drugs, poisons, and beverages.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

HORT 42700 - Horticulture Capstone

Credit Hours: 1.00. Based on an approved work or internship experience, or case study, or mentored research experience, or production activity, students will collect information and develop a written analytical exploration of the commercial enterprise, internship institution, or research or production activity. The written analysis will be appropriate to the student's area of concentration. In addition, a summary oral presentation based on specific aspects of their experience will be made by each student. Prerequisite: Completion of an approved work or internship experience or mentored research experience.

Learning Outcomes: 1. Describe the structure and operation of a horticultural enterprise, public horticultural institution or the methodology for hypothesis testing in research. 2. Give examples of strengths and weaknesses of a horticultural enterprise, public horticultural institution or the methodology used in the research project. 3. Apply principles learned in coursework to evaluation of the observed horticultural enterprise, public horticultural institution or the methodology used in the research project including the management, operational, or horticultural setting and strategies. 4. Formulate proposals for ways in which the observed horticultural enterprise, public horticultural institution or the research activity might improve. Credits: 1.00

BTNY 26200 - Plant Structure And Tissue Biology

Credit Hours: 3.00. This course focuses on fundamental knowledge of the internal structure of plants, including distinct cell types, tissues, tissue systems, and organs that make up a plant. Lectures and laboratories will cover the structural parts that comprise the plant body including three major vegetative organs (roots, stems, and leaves) and a set of reproductive organs (flowers, fruits, and seeds). The goal of this course is to understand the internal organization of plants, to learn multiple lab techniques critical for plant science research, and to develop critical thinking and problem solving skills.

Learning Outcomes: 1. Describe the internal structure of plants. 2. Perform lab techniques, such as fresh sectioning and microscopy, for plant science research. 3. Critically evaluate plant cell, tissue, and organ structures. Credits: 3.00

Plant Science Concentration Selective Courses (24 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure,

and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of

disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations,

perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the

causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-

long group research project or experiment in applied insect biology. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (8-10 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to

construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 Credits

Spring 1st Year

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

16-17 Credits

Fall 2nd Year

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

HORT 12100 - Medicine In The Garden (UCC: STS)

Credit Hours: 1.00. A survey of the uses and properties of horticultural plants for human health and well-being. Topics will focus on the close relationships between plants and human physiology, nutrition, medicines, mind-altering drugs, poisons, and beverages.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

BTNY 26200 - Plant Structure And Tissue Biology

Credit Hours: 3.00. This course focuses on fundamental knowledge of the internal structure of plants, including distinct cell types, tissues, tissue systems, and organs that make up a plant. Lectures and laboratories will cover the structural parts that comprise the plant body including three major vegetative organs (roots, stems, and leaves) and a set of reproductive organs (flowers, fruits, and seeds). The goal of this course is to understand the internal organization of plants, to learn multiple lab techniques critical for plant science research, and to develop critical thinking and problem solving skills.

Learning Outcomes: 1. Describe the internal structure of plants. 2. Perform lab techniques, such as fresh sectioning and microscopy, for plant science research. 3. Critically evaluate plant cell, tissue, and organ structures. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7.

Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

14 Credits

Fall 3rd Year

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts,

and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

15-16 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R

programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

16 Credits

Fall 4th Year

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

14 Credits

Spring 4th Year

HORT 42700 - Horticulture Capstone

Credit Hours: 1.00. Based on an approved work or internship experience, or case study, or mentored research experience, or production activity, students will collect information and develop a written analytical exploration of the commercial enterprise, internship institution, or research or production activity. The written analysis will be appropriate to the student's area of concentration. In addition, a summary oral presentation based on specific aspects of their experience will be made by each student. Prerequisite: Completion of an approved work or internship experience or mentored research experience.

Learning Outcomes: 1. Describe the structure and operation of a horticultural enterprise, public horticultural institution or the methodology for hypothesis testing in research. 2. Give examples of strengths and weaknesses of a horticultural enterprise, public horticultural institution or the methodology used in the research project. 3. Apply principles learned in coursework to evaluation of the observed horticultural enterprise, public horticultural institution or the methodology used in the research project including the management, operational, or horticultural setting and strategies. 4. Formulate proposals for ways in which the observed horticultural enterprise, public horticultural institution or the research activity might improve. Credits: 1.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

14-16 Credits

Horticulture: Public Horticulture Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (67 credits)

Required Major Courses (17 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of

field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Public Horticulture Concentration Required Courses (32 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase

your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 30600 - History Of Horticulture (UCC: STS)

Credit Hours: 3.00. The origins and development of agriculture, with specific emphasis on horticulture from prehistory to the present in relation to civilization and modern culture.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four

ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

HORT 42700 - Horticulture Capstone

Credit Hours: 1.00. Based on an approved work or internship experience, or case study, or mentored research experience, or production activity, students will collect information and develop a written analytical exploration of the commercial enterprise, internship institution, or research or production activity. The written analysis will be appropriate to the student's area of concentration. In addition, a summary oral presentation based on specific aspects of their experience will be made by each student. Prerequisite: Completion of an approved work or internship experience or mentored research experience.

Learning Outcomes: 1. Describe the structure and operation of a horticultural enterprise, public horticultural institution or the methodology for hypothesis testing in research. 2. Give examples of strengths and weaknesses of a horticultural enterprise, public horticultural institution or the methodology used in the research project. 3. Apply principles learned in coursework to evaluation of the observed horticultural enterprise, public horticultural institution or the methodology used in the research project including the management, operational, or horticultural setting and strategies. 4. Formulate proposals for ways in which the observed horticultural enterprise, public horticultural institution or the research activity might improve. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative

range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

Public Horticulture Concentration Selective Courses (18 credits)

Other Departmental/Program Course Requirements (43-44 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional

conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in

deciding whether to use management strategies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary

mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance.

Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and

ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape

Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (9-10 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 Credits

Spring 1st Year

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

16-17 Credits

Fall 2nd Year

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students

who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

14 Credits

Spring 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test

hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

15 Credits

Fall 3rd Year

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can

distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

15 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

15 Credits

Fall 4th Year

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

15 Credits

Spring 4th Year

HORT 30600 - History Of Horticulture (UCC: STS)

Credit Hours: 3.00. The origins and development of agriculture, with specific emphasis on horticulture from prehistory to the present in relation to civilization and modern culture.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

HORT 42700 - Horticulture Capstone

Credit Hours: 1.00. Based on an approved work or internship experience, or case study, or mentored research experience, or production activity, students will collect information and develop a written analytical exploration of the commercial enterprise, internship institution, or research or production activity. The written analysis will be appropriate to the student's area of concentration. In addition, a summary oral presentation based on specific aspects of their experience will be made by each student. Prerequisite: Completion of an approved work or internship experience or mentored research experience.

Learning Outcomes: 1. Describe the structure and operation of a horticultural enterprise, public horticultural institution or the methodology for hypothesis testing in research.

2. Give examples of strengths and weaknesses of a horticultural enterprise, public horticultural institution or the methodology used in the research project. 3. Apply principles learned in coursework to evaluation of the observed horticultural enterprise, public horticultural institution or the methodology used in the research project including the management, operational, or horticultural setting and strategies. 4. Formulate proposals for ways in which the observed horticultural enterprise, public horticultural institution or the research activity might improve. Credits: 1.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

15-16 Credits

Hospitality and Tourism Management, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (68-69 credits)

CSR 48400 - Consumer Investment And Savings Decisions

Credit Hours: 3.00. A survey of consumer investment alternatives, with emphasis on financial assets.

Learning Outcomes: 1. Analyze investment decisions and investment risk management through portfolio management, capital market equilibrium and asset pricing theories. Credits: 3.00

HTM 10010 - Exploring Transformational Experiences In Hospitality And Tourism

Credit Hours: 1.00. In an age where experiences have become the new currency, businesses must adapt and thrive in the experience economy to succeed. This course introduces students to the concept of transformational experiences within the experience economy, providing them with the knowledge and skills needed to navigate this dynamic landscape. Students will gain a better understanding of where their passions lie within the broader scope of hospitality and tourism, preparing them for academic and career-related success.

Learning Outcomes: 1. Describe transformational experiences that drive business success in the experience economy. 2. Outline current and trending transformational experiences in hospitality, tourism, and affiliated industries. 3. Identify potential career paths within hospitality, tourism, and affiliated industries. Credits: 1.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

HTM 17300 - Tourism Systems

Credit Hours: 3.00. Tourism is a global phenomenon impacting destination communities, incorporating a range of hospitality-related businesses and organizations, and enriching the lives of tourists and residents alike. This course examines key elements of tourism systems, how these elements interact to deliver unique travel experiences, and how destination stakeholders can use tourism for sustainable development. The course will strengthen students' understanding of tourism systems while preparing them to successfully engage in it for a variety of career options in tourism and hospitality industries.

Learning Outcomes: 1. Explain the tourism system including the roles of travelers, tourism businesses and destinations, and other tourism system components. 2. Describe the impacts of tourism and the basic components of sustainable tourism practices. 3. Identify the key principles of destination marketing and management. 4. Describe key factors that influence consumer travel behavior including personal, interpersonal, and environmental factors. 5. Describe how to apply experience design principles to develop tourism products, services, and experiences. Credits: 3.00

HTM 21200 - Leading For Success In Service Industries

Credit Hours: 3.00. Effective leaders possess knowledge of organizational behavior and skills which provide the capacity to enhance organizational performance. Drawing upon leadership and organizational behavior theories, this course will provide students with the tools necessary to lead teams in service industries. Areas of focus include understanding individual differences and team dynamics, motivating and developing employees, effective decision-making, communication, influence, diversity, and leading change. This course will include preparation for a leadership development certificate, such as the Dale Carnegie Leadership certificate, to be earned upon successful completion of the course.

Learning Outcomes: 1. Describe the roles of managers and leaders in hospitality and tourism and the concepts of organizational efficiency and effectiveness. 2. Identify and explain basic management principles of planning, organizing, directing and controlling as applied to the hospitality and tourism business. 3. Identify basic leadership skills that effective managers in the hospitality and tourism industry possess, including business communication, motivation, decision making, and change management. 4. Identify contemporary management and leadership issues facing the hospitality and tourism industry. 5. Explain the basics of human behavior in organizations, including individual behavior and team dynamics. 6. Discriminate between ethical and non-ethical behaviors on the part of individuals inside and outside the organization. 7. Analyze the impacts of culture and diversity on organizations. Credits: 3.00

HTM 23100 - Marketing In Service Industries

Credit Hours: 3.00. Marketing plays a crucial role in service industries, addressing unique service challenges. Its importance lies in engaging customers, establishing trust and credibility, distinguishing from competitors, boosting revenue, and fostering sustainable growth and success. This course equips students with a customer-centric approach to service industry marketing, emphasizing the integral role of marketing in a service organization's strategic planning. The course exposes students to service marketing principles, components, and marketing practices.

Learning Outcomes: 1. Explain the unique challenges in marketing and managing services. 2. Describe the role of marketing in supporting

the strategic direction of a service organization. 3. Evaluate the role of the service marketing mix in solving marketing related problems and promoting the overall success for service organizations. Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

HTM 30200 - Hospitality And Tourism Industry Internship I

Credit Hours: 1.00 or 2.00. Opportunities for learning through professional work experience that is practical, meaningful, and aligned with career aspirations are important for career development, planning, and goal setting. As part of the professional development curriculum, this internship course provides students with entry-level experience within the hospitality and tourism industry, broadening their exposure and understanding of the industry to explore potential career paths. Guided by the Ray Kavanagh Career Center and the National Association of Colleges and Employers (NACE) Career Readiness Competencies, students apply what they are learning in the classroom to the workplace.

Learning Outcomes: 1. Develop and apply interviewing and negotiating skills during the process of seeking and being hired into an internship. 2. Recall and explain the strengths and weaknesses of departments and work units from the hospitality operation in which they interned. 3. Describe and explain interactions with the hospitality operation's guests and the development of a positive service oriented attitude. 4. Compare and contrast the differences and similarities of management styles and leadership skill of the supervisors they worked with; evaluate the effectiveness of supervisor or manager; analyze which type of style or skill fits best with their style. 5. Identify new and different experiences encountered during the internship; distinguish the positive and negative aspects of the experience, and appraise these experiences as to their value to their future Hospitality management career. 6. Recall coursework related knowledge and apply and demonstrate this knowledge in areas of Human Resource Management, Finance, Management, Law, and other applicable areas in a hospitality organization. 7. Synthesize the total internship learning experience by completing comprehensive management reports. Credits: 1.00 or 2.00

HTM 31200 - Talent Management For Service Industries

Credit Hours: 3.00. Service organizations are labor-intensive, requiring effective talent management to be successful. Managers must be able to attract, develop, motivate, and retain employees to deliver exceptional service. Building on leadership skills and management principles, this course will emphasize the strategic role of human resource management with topics that span the lifecycle of a job (e.g., recruitment, selection, training, performance management, compensation, etc.). Students will explore the science behind effective talent management, developing knowledge and skills that will prepare them to manage a growing and diverse workforce.

Learning Outcomes: 1. Explain the importance of the various elements of strategic human resource management and their contribution to organizational performance. 2. Critique human resource practices by applying theories and research. 3. Create solutions that would address current human resource issues in service industries such as associate engagement, diversity, ethics, and employee well-being. Credits: 3.00

HTM 38110 - Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management plays a vital role in guiding service businesses to allocate resources efficiently, understand customer behavior, stay competitive, and achieve long-term sustainability and profitability. This course provides students with the theoretical foundation and practical applications of revenue management in service industries. The course cultivates students' revenue optimization mindset and analytical skills. Students will have the opportunity to earn an industry-recognized certification.

Learning Outcomes: 1. Describe the evolution of revenue management in lodging business. 2. Explain commonly used terms in revenue management. 3. Describe the duties and responsibilities of the hotel revenue manager. 4. Demonstrate knowledge of common revenue management activities. 5. Apply the concepts of constrained capacity, market segmentation, and differential pricing when setting prices. 6. Forecast demand. 7. Explain the trade-off between dilution and spoilage when allocating capacity. 8. Set Booking limits with overbooking policies. 9. Explain the role of distribution channels in market competition. 10. Apply revenue management fundamentals to other areas of lodging business such as to food and beverage and meeting and events in hotels. 11. Differentiate between ethical and unethical practices in revenue management. 12. Identify latest technologies used in revenue management. 13. Discuss contemporary issues affecting revenue management." Credits: 3.00

HTM 41100 - Hospitality And Tourism Law

Credit Hours: 3.00. Legal issues can damage or even destroy businesses. The primary goal of this course is to educate students to identify behaviors and situations that are likely to result in legal liability for themselves and their operation. By identifying potential legal liabilities, students will be able to develop strategies to reduce their exposure and better determine when to involve a lawyer. Topics include court procedures, civil rights, contracts, negligence, legal and ethical relationships with patrons, employment law, real estate law, ethics, and risk management. Students will use critical thinking and effective problem-solving to analyze cases and determine potential ways to reduce the likelihood of similar legal problems in the future.

Learning Outcomes: 1. Discuss the framework of the legal system and how a case progresses. 2. Analyze legal and ethical standards for hospitality and tourism enterprises including interactions with guests, other patrons, tenants, suppliers, and employees to determine potential consequences if they have not been met. 3. Analyze torts impacting hospitality and tourism enterprises and describe their legal impacts. 4. Describe the dynamics of risk management and develop strategies to mitigate losses. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise,

including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

HTM 49901 - Strategic Management In Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. By analyzing internal and external forces, students develop strategies to help a service organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy development and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of a service organization. The course is structured to enhance students' analytical, critical thinking, and communication skills by integrating their academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Integrate and apply prior knowledge areas from the HTM curriculum in developing a business. 2. Develop and analyze the feasibility, situational, and operational aspects of a hospitality and tourism business. 3. Select and implement an appropriate business model in development of a business plan. 4. Describe the characteristics of a successful business and apply that knowledge to mitigate situational and operational risks. 5. Evaluate between ethical and unethical behaviors on the parts of individuals when preparing and presenting a business development plan to potential stakeholders. 6. Prepare and present a business development plan. Credits: 3.00

HTM 21800 - Creating Experiences For A Diverse Society

Credit Hours: 3.00. This course will provide students with knowledge and skills related to diversity, equity, and inclusion (DEI), and provide students an opportunity to actively increase their cultural competence to help them work with others effectively in professional settings. The course provides frameworks, terminology, and tools for engaging in productive conversations around difficult topics related to DEI. Students use critical and reflective thinking, as well as effective problem solving to create inclusive experiences for all stakeholders.

Learning Outcomes: 1. Define and apply terminology and concepts related to diversity, equity, and inclusion (DEI). 2. Develop awareness and knowledge of DEI best practices to create inclusive experiences for all stakeholders. 3. Demonstrate an understanding of issues related to DEI within the White Lodging-J.W. Marriott, Jr. School of Hospitality and Tourism Management disciplines. 4. Engage in inclusive and interdisciplinary collaborations. 5. Apply best practices to address and propose solutions to current DEI topics within students' academic disciplines. 6. Demonstrate effective oral, written, and visual communication. Credits: 3.00

HTM 25501 - Fundamentals Of Excel And Data Analytics In Service Industries

Credit Hours: 3.00. The proper application of data analytics is important for optimizing the performance of service enterprises. Spreadsheet programs make it easy to manage and visualize data as well as perform basic data analyses. Microsoft Excel is one of the primary tools used for business reporting and decision-making tasks. In this course, students will receive hands-on training in a wide range of Excel functionalities including using functions and formulas, working with tables, creating charts, and analyzing data using PivotTables. This course will use practical, real-world applications to train students how to make business decisions.

Learning Outcomes: 1. Apply built-in Excel functions and create formulas necessary to analyze data. 2. Apply data visualization techniques to identify and communicate business issues. 3. Demonstrate proficiency using Excel to formulate and solve business problems. Credits: 3.00

HTM 42200 - Hospitality Facilities Design And Management

Credit Hours: 3.00. The facility is the largest asset for most hospitality operations and profoundly impacts guest experience. How it is designed and managed can be the difference between operational success and failure. The primary goal of this course is to foster student understanding of facility design and physical plant maintenance. Students will learn standard language and concepts along with problem-solving and project management techniques to enable cost-effective decisions in creating a physical environment that maximizes the guest experience.

Learning Outcomes: 1. Explain how systems within a facility function and are maintained in a cost-effective, environmentally friendly manner that meets regulatory requirements and promotes a welcoming, safe environment for employees and guests. 2. Analyze a wide range of facility design and physical plant problems and improvement opportunities to develop cost-effective solutions using systematic problem-solving techniques. 3. Apply standard project management tools and techniques to design a hospitality facility space, including physical plant elements, that promotes a positive guest experience that is ergonomically friendly to guests and employees. Credits: 3.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

HTM 40000 - Career Mastery: Navigating Your Career And Professional Development Seminar

Credit Hours: 1.00. Successful professionals possess a strong sense of self and the ability to observe the world around them, reflecting, synthesizing, and responding effectively. As the capstone to the professional development curriculum, students have the ability to refine these skills through discussion and reflection in this seminar-style course. Guided by the National Association of Colleges and Employers (NACE) Career Readiness Competencies, this course focuses on honing various aspects of personal and professional development, with a focus on contemporary issues in the workplace, ensuring students are prepared to be effective leaders. Students will be confident, proactive, and well-prepared professionals with a mindset required to successfully transition into the professional world.

Learning Outcomes: 1. Demonstrate a strong sense of professional self-awareness, leadership competencies, and areas for future development. 2. Refine personal brand that best positions self in the competitive job market. 3. Critique complex workplace issues to formulate effective leadership strategies. 4. Formulate a career plan trajectory to achieve identified career goals post-graduation. Credits: 1.00

HTM 40200 - Hospitality And Tourism Industry Internship II

Credit Hours: 1.00. Career development is an ongoing process of refinement and reflection of professional aspirations as one moves along their career path accumulating work experience. As part of the professional development curriculum, and building on the HTM 30200 entry-level internship experience, this course provides students with a graduate-ready experience in their chosen field, focusing on leadership skill development. Through hands-on experiences and guided learning, students gain real-world professional experience while refining their leadership abilities. Students reflect on their performance to foster personal growth in preparedness for careers post-graduation.

Learning Outcomes: 1. Apply theoretical knowledge gained in the classroom to the

workplace. 2. Practice career readiness competencies as defined by National Association of Colleges and Employers (NACE) to entry-level management experience. 3. Demonstrate proficiency in effective leadership skills and styles relevant to an entry-level management position. 4. Assess leadership skill development and strengths through self-reflection. Credits: 1.00

HTM 18000 - Hospitality Operations

Credit Hours: 3.00. Hospitality leaders require a deep understanding of the fundamental principles and practical aspects of managing operations within the dynamic and fast-paced hospitality industry to effectively run a business. This course will address topics including principles of management, organizational structures, managerial decision-making, hospitality metrics, and the responsibilities of managers. Through these topics, the course will strengthen students' understanding of the hospitality industry as it exists today while preparing them for the industry of the future.

Learning Outcomes: 1. Describe the key principles of management. 2. Identify organizational structures, including brands, management, and ownership. 3. Compute key hospitality metrics. 4. Explain how work groups in major types of hospitality businesses interconnect. 5. Understand the responsibilities of leaders in hospitality operations. Credits: 3.00

HTM 18101 - The Union Club Hotel Experience

Credit Hours: 1.00. Hospitality businesses are complex operations requiring unique managerial approaches to deliver exceptional guest and employee experiences. The Union Club Hotel is ideally positioned to expose students to managerial roles in a multi-million-dollar asset. Students will shadow managers who oversee hotel departments and interact with corporate leaders through this experiential course while learning how managers ensure an exceptional guest experience, provide a positive employee experience, and execute efficient hospitality operations. The knowledge gained in this course is transferable to all hospitality businesses, making this course valuable for all.

Learning Outcomes: 1. Identify principles of management as demonstrated by managers of a hospitality operation. 2. Describe how various departments of a hospitality business interconnect to deliver the guest experience. 3. Describe the importance of fostering a positive work environment for hospitality employees. Credits: 1.00

HTM 35700 - Disruption And Innovation In Hospitality & Tourism

Credit Hours: 3.00. Hospitality and tourism businesses face unprecedented industry shifts requiring proactive leaders. Through this course students will develop an innovative mindset, rethink the status quo, and amplify their creative thinking in designing solutions to current and future business challenges.

Learning Outcomes: 1. Describe innovation theories and trends. 2. Explain how building and sustaining a culture of innovation is a competitive advantage. 3. Describe the core aspects of an end-to-end innovation process. 4. Develop and evaluate innovative solutions to product and service challenges. Credits: 3.00

HTM 38600 - Fundamentals Of Hotel Asset Management

Credit Hours: 3.00. The value of a hotel is based on both its operation and the real estate holding. A successful manager needs to understand the relationship between operations and the management of the real estate asset. Hotel asset management involves overseeing operating performance and real estate planning with the goal of achieving long-term profitability and enhancing the value of the hotel property. This course will introduce students to the principles and practices of hotel asset management including real estate management, contracts, as well as the planning and execution of hotel investments. Students with an interest in hospitality finance and real estate investment are encouraged to take graduate-level courses in this area and explore the finance and real estate minors following the successful completion of this course.

Learning Outcomes: 1. Explain the foundations and process of asset management. 2. Identify the key issues related to planning and managing real estate and physical assets. 3. Analyze the effects of contracts on hotel operations and asset value. 4. Apply financial theories and concepts in planning and executing hotel investments. Credits: 3.00

HTM 34200 - Financial Management For Service Industries

Credit Hours: 3.00. To create value for owners, managers need

to understand the implications of long-term investment and the importance of securing finance to ensure sustainable growth. The primary purpose of this course is to understand the role of financial management, to learn analytic concepts and managerial tools for making capital investment decisions and to become familiar with major financial instruments and concepts such as time value of money, risk-return, capital budgeting, cost of capital, and capital structure.

Learning Outcomes: 1. Identify financial management roles and describe the agency problem in hospitality and tourism businesses. 2. Demonstrate proficiency in using Excel to model cash flows and calculate returns in the capital budgeting process. 3. Explain how the risk-return relationship affects cost of capital and stocks/bonds valuation. 4. Explain how capital structure affects firm value and dividend decisions. Credits: 3.00

HTM 44300 - Hospitality Operations Control And Analysis

Credit Hours: 3.00. To be successful, a business must maximize revenue and efficiently control costs. This course will equip students with the knowledge and skills needed to plan, analyze, and control service operations. Students will learn essential managerial skills such as establishing operational standards, forecasting sales, budgeting, controlling, and evaluating performance throughout the product cycle.

Learning Outcomes: 1. Identify and monitor operational standards at each stage of the product cycle. 2. Analyze financial statements to identify the strengths and weaknesses of a business. 3. Make business decisions based on the cost structure and business environment. 4. Forecast future demand based on historical and advanced booking data. 5. Develop operational plans and incorporate in operations budgeting. Credits: 3.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology, processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

Optional Concentrations

Other Departmental/Program Course Requirements (36-43 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ANTH 10000 - Being Human: Introduction To Anthropology (UCC: BSS)

Credit Hours: 3.00. Introduces anthropology's holistic approach to human nature and behavior. This course uses the tools of cultural, biological, archaeological, and linguistic anthropology to follow the human journey of uniformity and diversity through time and across space.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the basic concepts and applications of anthropology, including biological, cultural, archaeological, and linguistic anthropology. 2. Recognize the deep social and biological histories that have shaped contemporary life. 3. Examine processes of ongoing biological and social change that influence the environment, social organization, language, and other aspects of the world they experience. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of

differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the

causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MA 15555 - Quantitative Reasoning (UCC: QR)

Credit Hours: 3.00. This course will cover important mathematical ideas, including proportion, weighted averages, linear models, exponential models, basic probability and statistics, and some algebra, by using concrete real-world problems. It will not be a prerequisite for any other mathematics course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn proportion and how to apply it to unit conversions, percentage, sales tax and discounts, and inflation. 2. Learn weighted averages and how they apply to the consumer price index and other examples. 3. Learn paradoxes involving weighted averages. 4. Learn linear models and how they apply to electricity bills, income taxes, and climate change. 5. Learn exponential growth and how it applies to compound interest and other financial issues. 6. Learn basic probability theory and how it applies to insurance and games of chance. 7. Learn how algebra is related to the other things learned. Credits: 3.00

Electives (8-16 credits)

Supplemental Lists

Grade Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HTM 10010 - Exploring Transformational Experiences In Hospitality And Tourism

Credit Hours: 1.00. In an age where experiences have become the new currency, businesses must adapt and thrive in the experience economy to succeed. This course introduces students to the concept of transformational experiences within the experience economy, providing them with the knowledge and skills needed to navigate this dynamic landscape. Students will gain a better understanding of where their passions lie within the broader scope of hospitality and tourism, preparing them for academic and career-related success.

Learning Outcomes: 1. Describe transformational experiences that drive business success in the experience economy. 2. Outline current and trending transformational experiences in hospitality, tourism, and affiliated industries. 3. Identify potential career paths within hospitality, tourism, and affiliated industries. Credits: 1.00

HTM 17300 - Tourism Systems

Credit Hours: 3.00. Tourism is a global phenomenon impacting destination communities, incorporating a range of hospitality-related businesses and organizations, and enriching the lives of tourists and residents alike. This course examines key elements of tourism systems, how these elements interact to deliver unique travel experiences, and how destination stakeholders can use tourism for sustainable development. The course will strengthen students' understanding of tourism systems while preparing them to successfully engage in it for a variety of career options in tourism and hospitality industries.

Learning Outcomes: 1. Explain the tourism system including the roles of travelers, tourism businesses and destinations, and other tourism system components. 2. Describe the impacts of tourism and the basic components of sustainable tourism practices. 3. Identify the key principles of destination marketing and management. 4. Describe key factors that influence consumer travel behavior including

personal, interpersonal, and environmental factors. 5. Describe how to apply experience design principles to develop tourism products, services, and experiences. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 15555 - Quantitative Reasoning (UCC: QR)

Credit Hours: 3.00. This course will cover important mathematical ideas, including proportion, weighted averages, linear models, exponential models, basic probability and statistics, and some algebra, by using concrete real-world problems. It will not be a prerequisite for any other mathematics course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn proportion and how to apply it to unit conversions, percentage, sales tax and discounts, and inflation. 2. Learn weighted averages and how they apply to the consumer price index and other examples. 3. Learn paradoxes involving weighted averages. 4. Learn linear models and how they apply to electricity bills, income taxes, and climate change. 5. Learn exponential growth and how it applies to compound interest and other financial issues. 6. Learn basic probability theory and

how it applies to insurance and games of chance. 7. Learn how algebra is related to the other things learned. Credits: 3.00

HTM 18000 - Hospitality Operations

Credit Hours: 3.00. Hospitality leaders require a deep understanding of the fundamental principles and practical aspects of managing operations within the dynamic and fast-paced hospitality industry to effectively run a business. This course will address topics including principles of management, organizational structures, managerial decision-making, hospitality metrics, and the responsibilities of managers. Through these topics, the course will strengthen students' understanding of the hospitality industry as it exists today while preparing them for the industry of the future.

Learning Outcomes: 1. Describe the key principles of management. 2. Identify organizational structures, including brands, management, and ownership. 3. Compute key hospitality metrics. 4. Explain how work groups in major types of hospitality businesses interconnect. 5. Understand the responsibilities of leaders in hospitality operations. Credits: 3.00

13-16 Credits

Spring 1st Year

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4.

Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

HTM 18101 - The Union Club Hotel Experience

Credit Hours: 1.00. Hospitality businesses are complex operations requiring unique managerial approaches to deliver exceptional guest and employee experiences. The Union Club Hotel is ideally positioned to expose students to managerial roles in a multi-million-dollar asset. Students will shadow managers who oversee hotel departments and interact with corporate leaders through this experiential course while learning how managers ensure an exceptional guest experience, provide a positive employee experience, and execute efficient hospitality operations. The knowledge gained in this course is transferable to all hospitality businesses, making this course valuable for all.

Learning Outcomes: 1. Identify principles of management as demonstrated by managers of a hospitality operation. 2. Describe how various departments of a hospitality business interconnect to deliver the guest experience. 3. Describe the importance of fostering a positive work environment for hospitality employees. Credits: 1.00

16 Credits

Fall 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ANTH 10000 - Being Human: Introduction To Anthropology (UCC: BSS)

Credit Hours: 3.00. Introduces anthropology's holistic approach to human nature and behavior. This course uses the tools of cultural, biological, archaeological, and linguistic anthropology to follow the human journey of uniformity and diversity through time and across space.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the basic concepts and applications of anthropology, including biological, cultural, archaeological, and linguistic anthropology. 2. Recognize the deep social and biological histories that have shaped contemporary life. 3. Examine processes of ongoing biological and social change that influence the environment, social organization, language, and other aspects of the world they experience. Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060

Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

HTM 25501 - Fundamentals Of Excel And Data Analytics In Service Industries

Credit Hours: 3.00. The proper application of data analytics is important for optimizing the performance of service enterprises. Spreadsheet programs make it easy to manage and visualize data as well as perform basic data analyses. Microsoft Excel is one of the primary tools used for business reporting and decision-making tasks. In this course, students will receive hands-on training in a wide range of Excel functionalities including using functions and formulas, working with tables, creating charts, and analyzing data using PivotTables. This course will use practical, real-world applications to train students how to make business decisions.

Learning Outcomes: 1. Apply built-in Excel functions and create formulas necessary to analyze data. 2. Apply data visualization techniques to identify and communicate business issues. 3. Demonstrate proficiency using Excel to formulate and solve business problems. Credits: 3.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete

in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology, processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

16 Credits

Spring 2nd Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

HTM 21200 - Leading For Success In Service Industries

Credit Hours: 3.00. Effective leaders possess knowledge of organizational behavior and skills which provide the capacity to enhance organizational performance. Drawing upon leadership and organizational behavior theories, this course will provide students with the tools necessary to lead teams in service industries. Areas of focus include understanding individual differences and team dynamics, motivating and developing employees, effective decision-making, communication, influence, diversity, and leading change. This course will include preparation for a leadership development certificate, such as the Dale Carnegie Leadership certificate, to be earned upon successful completion of the course.

Learning Outcomes: 1. Describe the roles of managers and leaders in hospitality and tourism and the concepts of organizational efficiency and effectiveness. 2. Identify and explain basic management principles of planning, organizing, directing and controlling as applied to the hospitality and tourism business. 3. Identify basic leadership skills that effective managers in the hospitality and tourism industry possess, including business communication, motivation, decision making, and change management. 4. Identify contemporary management and leadership issues facing the hospitality and tourism industry. 5. Explain the basics of human behavior in organizations, including individual behavior and team dynamics. 6. Discriminate

between ethical and non-ethical behaviors on the part of individuals inside and outside the organization. 7. Analyze the impacts of culture and diversity on organizations. Credits: 3.00

HTM 23100 - Marketing In Service Industries

Credit Hours: 3.00. Marketing plays a crucial role in service industries, addressing unique service challenges. Its importance lies in engaging customers, establishing trust and credibility, distinguishing from competitors, boosting revenue, and fostering sustainable growth and success. This course equips students with a customer-centric approach to service industry marketing, emphasizing the integral role of marketing in a service organization's strategic planning. The course exposes students to service marketing principles, components, and marketing practices.

Learning Outcomes: 1. Explain the unique challenges in marketing and managing services. 2. Describe the role of marketing in supporting the strategic direction of a service organization. 3. Evaluate the role of the service marketing mix in solving marketing related problems and promoting the overall success for service organizations. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

HTM 21800 - Creating Experiences For A Diverse Society

Credit Hours: 3.00. This course will provide students with knowledge and skills related to diversity, equity, and inclusion (DEI), and provide students an opportunity to actively increase their cultural competence to help them work with others effectively in professional settings. The course provides frameworks, terminology, and tools for engaging in productive conversations around difficult topics related to DEI. Students use critical and reflective thinking, as well as effective problem solving to create inclusive experiences for all stakeholders.

Learning Outcomes: 1. Define and apply terminology and concepts related to diversity, equity, and inclusion (DEI). 2. Develop awareness and knowledge of DEI best practices to create inclusive experiences for all stakeholders. 3. Demonstrate an understanding of issues related to DEI within the White Lodging-J.W. Marriott, Jr. School of Hospitality and Tourism Management disciplines. 4. Engage in inclusive and interdisciplinary collaborations. 5. Apply best practices to address and propose solutions to current DEI topics within students' academic disciplines. 6. Demonstrate effective oral, written, and visual communication. Credits: 3.00

14 Credits

Summer 2nd Year

HTM 30200 - Hospitality And Tourism Industry Internship I

Credit Hours: 1.00 or 2.00. Opportunities for learning through professional work experience that is practical, meaningful, and aligned with career aspirations are important for career development, planning, and goal setting. As part of the professional development curriculum, this internship course provides students with entry-level experience within the hospitality and tourism industry, broadening their exposure and understanding of the industry to explore potential career paths. Guided by the Ray Kavanagh Career Center and the National Association of Colleges and Employers (NACE) Career Readiness Competencies, students apply what they are

learning in the classroom to the workplace.

Learning Outcomes: 1. Develop and apply interviewing and negotiating skills during the process of seeking and being hired into an internship. 2. Recall and explain the strengths and weaknesses of departments and work units from the hospitality operation in which they interned. 3. Describe and explain interactions with the hospitality operation's guests and the development of a positive service oriented attitude. 4. Compare and contrast the differences and similarities of management styles and leadership skill of the supervisors they worked with; evaluate the effectiveness of supervisor or manager; analyze which type of style or skill fits best with their style. 5. Identify new and different experiences encountered during the internship; distinguish the positive and negative aspects of the experience, and appraise these experiences as to their value to their future Hospitality management career. 6. Recall coursework related knowledge and apply and demonstrate this knowledge in areas of Human Resource Management, Finance, Management, Law, and other applicable areas in a hospitality organization. 7. Synthesize the total internship learning experience by completing comprehensive management reports. Credits: 1.00 or 2.00

1-2 credits

Fall 3rd Year

CSR 48400 - Consumer Investment And Savings Decisions

Credit Hours: 3.00. A survey of consumer investment alternatives, with emphasis on financial assets.

Learning Outcomes: 1. Analyze investment decisions and investment risk management through portfolio management, capital market equilibrium and asset pricing theories. Credits: 3.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and

several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

HTM 38600 - Fundamentals Of Hotel Asset Management

Credit Hours: 3.00. The value of a hotel is based on both its operation and the real estate holding. A successful manager needs to understand the relationship between operations and the management of the real estate asset. Hotel asset management involves overseeing operating performance and real estate planning with the goal of achieving long-term profitability and enhancing the value of the hotel property. This course will introduce students to the principles and practices of hotel asset management including real estate management, contracts, as well as the planning and execution of hotel investments. Students with an interest in hospitality finance and real estate investment are encouraged to take graduate-level courses in this area and explore the finance and real estate minors following the successful completion of this course.

Learning Outcomes: 1. Explain the foundations and process of asset management. 2. Identify the key issues related to planning and managing real estate and physical assets. 3. Analyze the effects of contracts on hotel operations and asset value. 4. Apply financial theories and concepts in planning and executing hotel investments. Credits: 3.00

HTM 34200 - Financial Management For Service Industries

Credit Hours: 3.00. To create value for owners, managers need to understand the implications of long-term investment and the importance of securing finance to ensure sustainable growth. The primary purpose of this course is to understand the role of financial management, to learn analytic concepts and managerial tools for making capital investment decisions and to become familiar with major financial instruments and concepts such as time value of money, risk-return, capital budgeting, cost of capital, and capital structure.

Learning Outcomes: 1. Identify financial management roles and describe the agency problem in hospitality and tourism businesses. 2. Demonstrate proficiency in using Excel to model cash flows and calculate returns in the capital budgeting process. 3. Explain how the risk-return relationship affects cost of capital and stocks/bonds valuation. 4. Explain how capital structure affects firm value and dividend decisions. Credits: 3.00

15 Credits

Spring 3rd Year

HTM 31200 - Talent Management For Service Industries

Credit Hours: 3.00. Service organizations are labor-intensive, requiring effective talent management to be successful. Managers must be able to attract, develop, motivate, and retain employees to deliver exceptional service. Building on leadership skills and management principles, this course will emphasize the strategic role of human resource management with topics that span the lifecycle of a job (e.g., recruitment, selection, training, performance management, compensation, etc.). Students will explore the science behind effective talent management, developing knowledge and skills that will prepare them to manage a growing and diverse workforce.

Learning Outcomes: 1. Explain the importance of the various elements of strategic human resource management and their contribution to organizational performance. 2. Critique human resource practices by applying theories and research. 3. Create solutions that would address current human resource issues in service industries such as associate engagement, diversity, ethics, and employee well-being. Credits: 3.00

HTM 38110 - Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management plays a vital role in guiding service businesses to allocate resources efficiently, understand customer behavior, stay competitive, and achieve long-term sustainability and profitability. This course provides students with the theoretical foundation and practical applications of revenue management in service industries. The course cultivates students' revenue optimization mindset and analytical skills. Students will have the opportunity to earn an industry-recognized certification.

Learning Outcomes: 1. Describe the evolution of revenue management in lodging business. 2. Explain commonly used terms in revenue management. 3. Describe the duties and responsibilities of the hotel revenue manager. 4. Demonstrate knowledge of common revenue management activities. 5. Apply the concepts of constrained capacity, market segmentation, and differential pricing when setting prices. 6. Forecast demand. 7. Explain the trade-off between dilution and spoilage when allocating capacity. 8. Set Booking limits with overbooking policies. 9. Explain the role of distribution channels in market competition. 10. Apply revenue management fundamentals to other areas of lodging business such as to food and beverage and meeting and events in hotels. 11. Differentiate between ethical and unethical practices in revenue management. 12. Identify latest technologies used in revenue management. 13. Discuss contemporary issues affecting revenue management." Credits: 3.00

HTM 35700 - Disruption And Innovation In Hospitality & Tourism

Credit Hours: 3.00. Hospitality and tourism businesses face unprecedented industry shifts requiring proactive leaders. Through this course students will develop an innovative mindset, rethink the status quo, and amplify their creative thinking in designing solutions to current and future business challenges.

Learning Outcomes: 1. Describe innovation theories and trends. 2. Explain how building and sustaining a culture of innovation is a competitive advantage. 3. Describe the core aspects of an end-to-end innovation process. 4. Develop and evaluate innovative solutions to product and service challenges. Credits: 3.00

15 Credits

Summer 3rd Year

HTM 40200 - Hospitality And Tourism Industry Internship II

Credit Hours: 1.00. Career development is an ongoing process of refinement and reflection of professional aspirations as one moves along their career path accumulating work experience. As part of the professional development curriculum, and building on the HTM 30200 entry-level internship experience, this course provides students with a graduate-ready experience in their chosen field, focusing on leadership skill development. Through hands-on experiences and guided learning, students gain real-world professional experience while refining their leadership abilities. Students reflect on their performance to foster personal growth in preparedness for careers post-graduation.

Learning Outcomes: 1. Apply theoretical knowledge gained in the classroom to the workplace. 2. Practice career readiness competencies as defined by National Association of Colleges and Employers (NACE) to entry-level management experience. 3. Demonstrate proficiency in effective leadership skills and styles relevant to an entry-level management position. 4. Assess leadership skill development and strengths through self-reflection. Credits: 1.00

1 credit

Fall 4th Year

HTM 41100 - Hospitality And Tourism Law

Credit Hours: 3.00. Legal issues can damage or even destroy businesses. The primary goal of this course is to educate students to identify behaviors and situations that are likely to result in legal liability for themselves and their operation. By identifying potential legal liabilities, students will be able to develop strategies to reduce their exposure and better determine when to involve a lawyer. Topics include court procedures, civil rights, contracts, negligence, legal and ethical relationships with patrons, employment law, real estate law, ethics, and risk management. Students will use critical thinking and effective problem-solving to analyze cases and determine potential ways to reduce the likelihood of similar legal problems in the future.

Learning Outcomes: 1. Discuss the framework of the legal system and how a case progresses. 2. Analyze legal and ethical standards for hospitality and tourism enterprises including interactions with guests, other patrons, tenants, suppliers, and employees to determine potential consequences if they have not been met. 3. Analyze torts impacting hospitality and tourism enterprises and describe their legal impacts. 4. Describe the dynamics of risk management and develop strategies to mitigate losses. Credits: 3.00

HTM 40000 - Career Mastery: Navigating Your Career And Professional Development Seminar

Credit Hours: 1.00. Successful professionals possess a strong sense of self and the ability to observe the world around them, reflecting, synthesizing, and responding effectively. As the capstone to the professional development curriculum, students have the ability to refine these skills through discussion and reflection in this seminar-style course. Guided by the National Association of Colleges and Employers (NACE) Career Readiness Competencies, this course focuses on honing various aspects of personal and professional development, with a focus on contemporary issues in the workplace, ensuring students are prepared to be effective leaders. Students will be confident, proactive, and well-prepared professionals with a mindset required to successfully transition into the professional world.

Learning Outcomes: 1. Demonstrate a strong sense of professional self-awareness, leadership competencies, and areas for future development. 2. Refine personal brand that best positions self in the competitive job market. 3. Critique complex workplace issues to formulate effective leadership strategies. 4. Formulate a career plan trajectory to achieve identified career goals post-graduation. Credits: 1.00

HTM 44300 - Hospitality Operations Control And Analysis

Credit Hours: 3.00. To be successful, a business must maximize revenue and efficiently control costs. This course will equip students with the knowledge and skills needed to plan, analyze, and control service operations. Students will learn essential managerial skills such as establishing operational standards, forecasting sales, budgeting, controlling, and evaluating performance throughout the product cycle.

Learning Outcomes: 1. Identify and monitor operational standards at each stage of the product cycle. 2. Analyze financial statements to identify the strengths and weaknesses of a business. 3. Make business decisions based on the cost structure and business environment. 4. Forecast future demand based on historical and advanced booking data. 5. Develop operational plans and incorporate in operations budgeting. Credits: 3.00

15-17 Credits

Spring 4th Year

HTM 49901 - Strategic Management In Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. By analyzing internal and external forces, students develop strategies to help a service organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy development and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of a service organization. The course is structured to enhance students' analytical, critical thinking, and communication skills by integrating their academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Integrate and apply prior knowledge areas from the HTM curriculum in developing a business. 2. Develop and analyze the feasibility, situational, and operational aspects of a hospitality and tourism business. 3. Select and implement an appropriate business model in development of a business plan. 4. Describe the characteristics of a successful business and apply that knowledge to mitigate situational and operational risks. 5. Evaluate between ethical and unethical behaviors on the parts of individuals when preparing and presenting a business development plan to potential stakeholders. 6. Prepare and present a business development plan. Credits: 3.00

HTM 42200 - Hospitality Facilities Design And Management

Credit Hours: 3.00. The facility is the largest asset for most hospitality operations and profoundly impacts guest experience. How it is designed and managed can be the difference between operational success and failure. The primary goal of this course is to foster student understanding of facility design and physical plant maintenance. Students will learn standard language and concepts along with problem-solving and project management techniques to enable cost-effective decisions in creating a physical environment that maximizes the guest experience.

Learning Outcomes: 1. Explain how systems within a facility function and are maintained in a cost-effective, environmentally friendly manner that meets regulatory requirements and promotes a welcoming, safe environment for employees and guests. 2. Analyze a wide range of facility design and physical plant problems and improvement opportunities to develop cost-effective solutions using systematic problem-solving techniques. 3. Apply standard project management tools and techniques to design a hospitality facility space, including physical plant elements, that promotes a positive guest experience that is ergonomically friendly to guests and employees. Credits: 3.00

13-14 Credits

Human Resource Development, BS

About the Program

Degree Requirements

Departmental/Program Major Requirements (60 credits)

Required Major Courses (45 credits)

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for

identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

TLI 25500 - Foundations Of Human Resource Development

Credit Hours: 3.00. Much has been discussed about the importance of people in organizations, difficulties within organizations, and challenges faced by today's organizations. This course covers the field of human resource development (HRD) as an important area of practice within organizations. The course provides an introduction to HRD theories, principles, concepts, and practices. It provides foundations through the study of history, current paradigms, and perspectives on the future of the field of HRD while specifically focusing on training and development, organization development, and career development as organizational functions within HRD.

Learning Outcomes: 1. Conduct a learning assessment. 2. Conduct a performance assessment. 3. Write training performance improvement objectives. 4. Describe core HRD functions. 5. Describe methods of HRD program evaluation. Credits: 3.00

TLI 35510 - Training And Talent Development

Credit Hours: 3.00. This course is designed to develop theoretical and applied perspectives on needs assessment, design, development, delivery, and evaluation of training and development in organizational contexts. Emphasis is placed on assessing learning and performance outcomes throughout the training and development process. Implication of training to talent development are also highlighted in a highly automated workplace.

Learning Outcomes: 1. Conduct a training needs assessment. 2. Analyze job tasks for purposes of planning training activities. 3. Write training learning objectives. 4. Describe an instructional system design process. 5. Describe methods of training program evaluation. 6. Identify talent development approaches in a digitalized economy. Credits: 3.00

TLI 35520 - Organization Development And Change

Credit Hours: 3.00. This course provides an introduction to

major theories, concepts, skills and techniques for the practice of organization development processes and interventions using a consultancy approach. Implications for organizational change are integrated as part of an OD effort.

Learning Outcomes: 1. Describe the historical roots and theoretical underpinnings of organizational development. 2. Apply the action research model for professional practice. 3. Effectively participate in small groups. 4. Identify intervention strategies at the individual, small group, and large systems levels. 5. Conduct organization development analysis. Credits: 3.00

TLI 35530 - Strategic Human Resources

Credit Hours: 3.00. This course equips you with the skills to lead strategic human resource initiatives, enhancing your understanding of how HR strategy impacts organizational performance. Strategic Human Resources involves aligning HR practices with organizational goals to optimize the value of human capital. As future HR professionals, you will learn to contribute significantly to strategic planning and organizational success by leveraging human talent strategically and effectively.

Learning Outcomes: 1. Design and execute HR strategies that align with organizational goals and enhance overall performance. 2. Assess how various HR practices contribute to achieving strategic objectives and improving organizational outcomes. 3. Apply HR strategies to various case studies from actual company/industry scenarios to address key business issues and leverage human capital effectively. 4. Gain a deep understanding of the principles and theories underlying strategic HR and their application in real-world scenarios. 5. Identify and propose solutions to current strategic business issues faced by HR professionals in today's dynamic workplace. Credits: 3.00

TLI 35560 - Employment And Labor Law For The Human Resource Professionals

Credit Hours: 3.00. This course provides a foundation for understanding the impact of labor laws and legal issues in organizations. Topics include corporate social responsibility, employment law, environmental issues, conflict resolution, and global challenges.

Learning Outcomes: 1. Select and apply legally and practically appropriate staffing techniques according to basic principles of validity and reliability. 2. Articulate the value of employee training, development, job design, and job enrichment. 3. Summarize basic components of compensation plans and performance evaluation systems, assess potential deficiencies, and compare elements as they relate to organizational objectives. 4. Apply major labor laws to employment practices in employee relations, health, safety and security, and to consider the connection between labor relations practices and outcomes. 5. Articulate unique challenges throughout HRM related to practice in public, private, and non-profit sectors. 6. Compare HRM practices and policies from varying perspectives, evaluate source credibility, and draw conclusions based on that information. Credits: 3.00

TLI 45570 - Global Human Resources

Credit Hours: 3.00. This course prepares students to lead human resource activities within a global, technology-driven economy and business environment. Topics include recruitment, training and development processes, cultural issues, policies and regulations within a global and international context.

Learning Outcomes: 1. Identify the main differences between domestic and international human resources. 2. Understand the challenges of international business dynamics on international human resources and the procedures for preparing employees for international assignments. 3. Understand how managing expatriates helps to improve their performance and minimize their business failures in international assignments. 4. Recognize that training and development of expatriates is a key factor for their success in their assignments. 5. Understand the complexity of international human resources and the need

for staffing international human resources in accordance to the models of business organizations. 6. Recognize the challenges of repatriation of expatriates and develop the skill to minimize their stress in the parent country organizations. 7. Recognize the need for balancing the process international human resource adaptation and standardization in the host country. 8. Identify relevant theories on performance management in the context of international human resources. 9. Develop intercultural knowledge and competence. Credits: 3.00

TLI 45580 - Human Resource Information Systems And People Analytics

Credit Hours: 3.00. This class surveys Human Resource Information Systems (HRIS) to understand how they facilitate communication processes, policy implementations and change management. Big data is transforming how firms recruit and develop talent and this course introduces concepts and methods for making better through people analytics.

Learning Outcomes: 1. Translate the origins of HR Information Technology to an organization; and infer the need to obtain involvement and commitment from others to set in place mechanisms to affect successful Human Resources Information System Programs and strategies. 2. Develop an understanding of basic systems and the criteria for success in using HR software in organizations. 3. Identify HR Information Systems trends. 4. Detail various approaches to Human Resources Information systems design, selection and implementation and define characteristics of current Human Resource Information technology implementation strategies. 5. Recognize HR Information System and its relationship with compliance with federal and state regulations/Laws. 6. Explain benefits of new technologies in recruiting and training in individual development of employees. 7. Describe and discuss the various HR Portal and associated programs and their associated values, costs, and benefits to the organization. 8. Students will employ statistical software to conduct quantitative analyses, for example to predict the potential of applicants to improve hiring decisions or to evaluate the effectiveness of training and talent development programs. 9. Students will learn how to manage the workforce and how to take advantage of analytics in their decision making process. Credits: 3.00

TLI 31500 - New Product Development

Credit Hours: 3.00. This course introduces the process of technological innovation and new product development from concept to commercialization. Topics covered include ideation, R&D, prototyping (design and modeling), testing for quality, the patent process, intellectual property rights, marketing and cost evaluation.

Learning Outcomes: 1. Describe the process of innovation as it relates to new product development. 2. Identify quality standards and testing procedures for new products. 3. Describe the patent process. 4. Explain methods for protecting domestic and international intellectual property rights. 5. Describe the process for conducting market research. Credits: 3.00

TLI 35570 - Job Analysis And Job Design

Credit Hours: 3.00. This course demonstrates procedures for analyzing tasks related to specific jobs. Topics include collecting occupational data and information, the relevance of job analysis on individual and organizational performance, impact on training and development, and associated legal issues.

Learning Outcomes: 1. Explain the background and progression of job analysis techniques. 2. Collect information about jobs and develop an organized job analysis report. 3. Conduct job analysis. 4. Effectively utilize the Dictionary of Occupational Titles and O*NET to gain occupational information. 5. Recognize HR Information System and its relationship with compliance with federal and state

regulations/Laws. 6. Analyze jobs within an organization for the purpose of developing training or recommending other performance interventions. 7. Demonstrate various uses of job analysis. 8. Articulate the role of a job analysis in the improvement of organizational performance. Credits: 3.00

TLI 35580 - The Individual And Organizational Performance

Credit Hours: 3.00. This course develops an understanding of the principles and theoretical foundations of individual and organizational performance management. Emphasis is placed on the perspectives, methodology, and theoretical frameworks as well as applications for performance management from the perspective of human resources professionals.

Learning Outcomes: 1. Develop an understanding of the principles and theoretical foundations of individual and organizational performance management. 2. Identify and analyze performance problems in an organizational system. 3. Identify and evaluate interventions in performance improvement at different levels (individual, team/process and organizational). 4. Understand human resource approaches to individual and organizational performance management. 5. Examine various technologies for managing individual and organizational performance. Credits: 3.00

TLI 45560 - Professional Internship In Human Resources

Credit Hours: 3.00. The undergraduate internship course is designed as a culminating learning experience for students nearing graduation. Students have an opportunity to seek out practical work experience related to human resources to use knowledge acquired in the classroom. The course will serve as a professional development opportunity helping students reflect and build upon their experiences gained through the required 500-hours human resources related work.

Learning Outcomes: 1. Learn and grow personally and professionally from an internship experience. 2. Express gained competencies and skills through evidence and critical reflection. 3. Receive, evaluate and apply constructive performance feedback and evaluation, as assessed by the internship supervisor. 4. Understand one's self in a professional context. 5. Integrate HRD theory and professional practice. Credits: 3.00

TLI 45590 - Foundations Of Human Resources Capstone

Credit Hours: 3.00. This course synthesizes all of the required and secondary content areas described in the SHRM HR Curriculum Guidelines. Students will prepare for the SHRM Certified Professional (SHRM-CP) exam while demonstrating their accumulated knowledge and in the area of human resources.

Learning Outcomes: 1. Reflect on the entire HR-related areas. 2. Synthesize all HR-related knowledge, skills, and competencies. 3. Engage in test-taking for obtaining licensure. 4. Demonstrate an understanding of all HR-related concepts, terms, applications, and processes. 5. Successfully complete mock SHRM-CP exams. Credits: 3.00

Human Resource Management Minor required (15 credits)

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 44690 - Negotiation And Decision Making

Credit Hours: 3.00. The purpose of this course is to understand the theory and processes of negotiation so that you can negotiate successfully in organizational and management settings. This course covers a wide variety of negotiation problems faced by business people. In addition, models of effective and ineffective decision-making are introduced and students will have the opportunity to make decisions at both the individual and group levels.

Learning Outcomes: 1. Improve ability to effectively negotiate. 2. Recognize and analyze negotiation situations. 3. Gain confidence negotiating. 4. Improve decision-making knowledge and skills. Credits: 3.00

MGMT 44430 - Staffing: Talent Acquisition

Credit Hours: 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. It will also prepare students to evaluate methods for job analysis and selection. Students will learn how to design and ask interview questions that are behaviorally anchored and focused on organization-person fit and person-job fit, both of which are important for successful adaptation and effective performance on the job. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Describe workforce planning implementation issues and the importance of continuous refinement of the plan. 2. Define talent acquisition and differentiate between recruiting and selection processes. 3. Understand the various talent acquisition organization models. 4. Use tangible and intangible data to build a business case for effective talent acquisition. 5. Articulate the steps in a common talent analysis and translate the analysis into selection criteria and methods. 6. Conduct a job-fit and organization-fit analysis and translate the analysis into selection criteria and methods. 7. Develop behavior-based and situation-based interview questions derived from job analysis and conduct a professional interview. 8. Design a process for final candidate evaluation. 9. Highlight various strategies to orient and onboard new acquired talent. 10. Articulate an employer's legal responsibilities in the talent acquisition process. Credits: 3.00

MGMT 44431 - Compensation: Total Rewards

Credit Hours: 3.00. This course examines the tangible and

intangible aspects of compensation, through the lens of a total reward philosophy of an organization in order to attract, motivate, and retain their Human Capital. It also provides an overview of the considerations necessary to develop a compensation system that is internally and externally equitable and fiscally responsible, including the use of job evaluation and salary surveys.

Learning Outcomes: 1. Evaluate the difference Total Rewards programs can make in organizations. 2. Distinguish between total rewards and compensation and identify compensation and non-compensation elements of total rewards. 3. Recognize various reward systems, their relationship and connection to a total compensation and benefits philosophy, and how they impact the quality of work life and productivity organizations. 4. Assess the practical issues in compensation and employee benefits in light of a company's management philosophy and human resources strategies. 5. Define job evaluation and its use to develop internally equitable compensation systems. 6. Identify the implications of using salary surveys to ensure externally equitable and fiscally responsible compensation systems. 7. Explain the concepts of salary administration and application of compensation programs in the business environment. 8. Better understand effective salary and wage structures in organizations today. 9. Explain the relationship between performance evaluation methods and reward systems. 10. Discuss the legal aspects of compensation, benefits and performance appraisals. Credits: 3.00

Other Departmental/Program Course Requirements (50-52 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.

Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business

documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and

technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

TLI 15500 - Foundations Of Learning In Human Resource Development

Credit Hours: 3.00. This course explores the concept of learning within the interdisciplinary field of Human Resource Development, focusing on how people learn in different environments in the workplace - both formal (e.g., training) and informal (e.g., on the job). The course will cover theoretical frameworks, learning methods, and practical applications to enhance workplace learning and outcomes.

Learning Outcomes: 1. Understand key theories and concepts of learning in HRD. 2. Analyze the impact of cognitive, social, and cultural factors on workplace learning. 3. Explain the role of technology in workplace learning. 4. Evaluate assessment and evaluation approaches in workplace learning. 5. Apply learning principles to real-world workplace challenges. Credits: 3.00

Electives (8-10 credits)

Supplemental List

Grade Requirements

GPA Requirements

HRD Professional Requirement

TLI 45560 - Professional Internship In Human Resources

Credit Hours: 3.00. The undergraduate internship course is designed as a culminating learning experience for students nearing graduation. Students have an opportunity to seek out practical work experience related to human resources to use knowledge acquired in the classroom. The course will serve as a professional development opportunity helping students reflect and build upon their experiences gained through the required 500-hours human resources related work.

Learning Outcomes: 1. Learn and grow personally and professionally from an internship experience. 2. Express gained competencies and skills through evidence and critical reflection. 3. Receive, evaluate and apply constructive performance feedback and evaluation, as assessed by the internship supervisor. 4. Understand one's self in a professional context. 5. Integrate HRD theory and professional practice. Credits: 3.00

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a

technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

15-16 Credits

Spring 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

TLI 15500 - Foundations Of Learning In Human Resource Development

Credit Hours: 3.00. This course explores the concept of learning within the interdisciplinary field of Human Resource Development, focusing on how people learn in different environments in the workplace - both formal (e.g., training) and

informal (e.g., on the job). The course will cover theoretical frameworks, learning methods, and practical applications to enhance workplace learning and outcomes.

Learning Outcomes: 1. Understand key theories and concepts of learning in HRD. 2. Analyze the impact of cognitive, social, and cultural factors on workplace learning. 3. Explain the role of technology in workplace learning. 4. Evaluate assessment and evaluation approaches in workplace learning. 5. Apply learning principles to real-world workplace challenges. Credits: 3.00

14-15 Credits

Fall 2nd Year

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

TLI 25500 - Foundations Of Human Resource Development

Credit Hours: 3.00. Much has been discussed about the importance of people in organizations, difficulties within organizations, and challenges faced by today's organizations. This course covers the field of human resource development (HRD) as an important area of practice within organizations. The course provides an introduction to HRD theories, principles, concepts, and practices. It provides foundations through the study of history, current paradigms, and perspectives on the future of the field of HRD while specifically focusing on training and development, organization development, and career development as organizational functions within HRD.

Learning Outcomes: 1. Conduct a learning assessment. 2. Conduct a performance assessment. 3. Write training performance improvement objectives. 4. Describe core HRD functions. 5. Describe methods of HRD program evaluation. Credits: 3.00

TLI 31500 - New Product Development

Credit Hours: 3.00. This course introduces the process of technological innovation and new product development from concept to commercialization. Topics covered include ideation, R&D, prototyping (design and modeling), testing for quality, the patent process, intellectual property rights, marketing and cost evaluation.

Learning Outcomes: 1. Describe the process of innovation as it relates to new product development. 2. Identify quality standards and testing procedures for new products. 3. Describe the patent process. 4. Explain methods for protecting domestic and international intellectual property rights. 5. Describe the process for conducting market research. Credits: 3.00

15 Credits

Spring 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers'

statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

15 Credits

Fall 3rd Year

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the

use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

TLI 35510 - Training And Talent Development

Credit Hours: 3.00. This course is designed to develop theoretical and applied perspectives on needs assessment, design, development, delivery, and evaluation of training and development in organizational contexts. Emphasis is placed on assessing learning and performance outcomes throughout the training and development process. Implication of training to talent development are also highlighted in a highly automated workplace.

Learning Outcomes: 1. Conduct a training needs assessment. 2. Analyze job tasks for purposes of planning training activities. 3. Write training learning objectives. 4. Describe an instructional system design process. 5. Describe methods of training program evaluation. 6. Identify talent development approaches in a digitalized economy. Credits: 3.00

TLI 35560 - Employment And Labor Law For The Human Resource Professionals

Credit Hours: 3.00. This course provides a foundation for understanding the impact of labor laws and legal issues in organizations. Topics include corporate social responsibility, employment law, environmental issues, conflict resolution, and global challenges.

Learning Outcomes: 1. Select and apply legally and practically appropriate staffing techniques according to basic principles of validity and reliability. 2. Articulate the value of employee training, development, job design, and job enrichment. 3. Summarize basic components of compensation plans and performance evaluation systems, assess potential deficiencies, and compare elements as they relate to organizational objectives. 4. Apply major labor laws to employment practices in employee relations, health, safety and security, and to consider the connection between labor relations practices and outcomes. 5. Articulate unique challenges throughout HRM related to practice in public, private, and non-profit sectors. 6. Compare HRM practices and policies from varying perspectives, evaluate source credibility, and draw conclusions based on that information. Credits: 3.00

TLI 35570 - Job Analysis And Job Design

Credit Hours: 3.00. This course demonstrates procedures for analyzing tasks related to specific jobs. Topics include collecting occupational data and information, the relevance of job analysis on individual and organizational performance, impact on training and development, and associated legal issues.

Learning Outcomes: 1. Explain the background and progression of job analysis techniques. 2. Collect information about jobs and develop an organized job analysis report. 3. Conduct job analysis. 4. Effectively utilize the Dictionary of Occupational Titles and O*NET to gain occupational information. 5. Recognize HR Information System and its relationship with compliance with federal and state regulations/Laws. 6. Analyze jobs within an organization for the purpose of developing training or recommending other performance interventions. 7. Demonstrate various uses of job analysis. 8. Articulate the role of a job

analysis in the improvement of organizational performance. Credits: 3.00

15 Credits

Spring 3rd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 44690 - Negotiation And Decision Making

Credit Hours: 3.00. The purpose of this course is to understand the theory and processes of negotiation so that you can negotiate successfully in organizational and management settings. This course covers a wide variety of negotiation problems faced by business people. In addition, models of effective and ineffective decision-making are introduced and students will have the opportunity to make decisions at both the individual and group levels.

Learning Outcomes: 1. Improve ability to effectively negotiate. 2. Recognize and analyze negotiation situations. 3. Gain confidence negotiating. 4. Improve decision-making knowledge and skills. Credits: 3.00

TLI 35520 - Organization Development And Change

Credit Hours: 3.00. This course provides an introduction to major theories, concepts, skills and techniques for the practice of organization development processes and interventions using a consultancy approach. Implications for organizational change are integrated as part of an OD effort.

Learning Outcomes: 1. Describe the historical roots and theoretical underpinnings of organizational development. 2. Apply the action research model for professional practice. 3. Effectively participate in small groups. 4. Identify intervention strategies at the individual, small group, and large systems levels. 5. Conduct organization development analysis. Credits: 3.00

TLI 35530 - Strategic Human Resources

Credit Hours: 3.00. This course equips you with the skills to lead strategic human resource initiatives, enhancing your understanding of how HR strategy impacts organizational performance. Strategic Human Resources involves aligning HR practices with organizational goals to optimize the value of human capital. As future HR professionals, you will learn to contribute significantly to strategic planning and organizational success by leveraging human talent strategically and effectively.

Learning Outcomes: 1. Design and execute HR strategies that align with organizational goals and enhance overall performance. 2. Assess how various HR practices contribute to achieving strategic objectives and improving organizational outcomes. 3. Apply HR strategies to various case studies from actual company/industry scenarios to address key business issues and leverage human capital effectively. 4. Gain a deep understanding of the principles and theories underlying strategic HR and their application in real-world scenarios. 5. Identify and propose solutions to current strategic business issues faced by HR professionals in today's dynamic workplace. Credits: 3.00

TLI 35580 - The Individual And Organizational Performance

Credit Hours: 3.00. This course develops an understanding of the principles and theoretical foundations of individual and organizational performance management. Emphasis is placed on the perspectives, methodology, and theoretical frameworks as well as applications for performance management from the perspective of human resources professionals.

Learning Outcomes: 1. Develop an understanding of the principles and theoretical foundations of individual and organizational performance management. 2. Identify and analyze performance problems in an organizational system. 3. Identify and evaluate interventions in performance improvement at different levels (individual, team/process and organizational). 4. Understand human resource approaches to individual and organizational performance management. 5. Examine various technologies for managing individual and organizational performance. Credits: 3.00

15 Credits

Fall 4th Year

TLI 45570 - Global Human Resources

Credit Hours: 3.00. This course prepares students to lead human resource activities within a global, technology-driven economy and business environment. Topics include recruitment, training and development processes, cultural issues, policies and regulations within a global and international context.

Learning Outcomes: 1. Identify the main differences between domestic and international human resources. 2. Understand the challenges of international business dynamics on international human resources and the procedures for preparing employees for international assignments. 3. Understand how managing expatriates helps to improve their performance and minimize their business failures in international assignments. 4. Recognize that training and development of expatriates is a key factor for their success in their assignments. 5. Understand the complexity of international human resources and the need for staffing international human resources in accordance to the models of business organizations. 6. Recognize the challenges of repatriation of expatriates and develop the skill to minimize their stress in the parent country organizations. 7. Recognize the need for balancing the process international human resource adaptation and standardization in the host country. 8. Identify relevant theories on performance management in the context of international human resources. 9. Develop intercultural knowledge and competence. Credits: 3.00

TLI 45580 - Human Resource Information Systems And People Analytics

Credit Hours: 3.00. This class surveys Human Resource Information Systems (HRIS) to understand how they facilitate communication processes, policy implementations and change management. Big data is transforming how firms recruit and develop talent and this course introduces concepts and methods for making better through people analytics.

Learning Outcomes: 1. Translate the origins of HR Information Technology to an organization; and infer the need to obtain involvement and commitment from others to set in place mechanisms to affect successful Human Resources Information System Programs and strategies. 2. Develop an understanding of basic systems and the criteria for success in using HR software in organizations. 3. Identify HR Information Systems trends. 4. Detail various approaches to Human Resources Information systems design, selection and implementation and define characteristics of current Human Resource Information technology implementation strategies. 5. Recognize HR Information System and its relationship with compliance with federal and

state regulations/Laws. 6. Explain benefits of new technologies in recruiting and training in individual development of employees. 7. Describe and discuss the various HR Portal and associated programs and their associated values, costs, and benefits to the organization. 8. Students will employ statistical software to conduct quantitative analyses, for example to predict the potential of applicants to improve hiring decisions or to evaluate the effectiveness of training and talent development programs. 9. Students will learn how to manage the workforce and how to take advantage of analytics in their decision making process. Credits: 3.00

MGMT 44430 - Staffing: Talent Acquisition

Credit Hours: 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. It will also prepare students to evaluate methods for job analysis and selection. Students will learn how to design and ask interview questions that are behaviorally anchored and focused on organization-person fit and person-job fit, both of which are important for successful adaptation and effective performance on the job. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Describe workforce planning implementation issues and the importance of continuous refinement of the plan. 2. Define talent acquisition and differentiate between recruiting and selection processes. 3. Understand the various talent acquisition organization models. 4. Use tangible and intangible data to build a business case for effective talent acquisition. 5. Articulate the steps in a common talent analysis and translate the analysis into selection criteria and methods. 6. Conduct a job-fit and organization-fit analysis and translate the analysis into selection criteria and methods. 7. Develop behavior-based and situation-based interview questions derived from job analysis and conduct a professional interview. 8. Design a process for final candidate evaluation. 9. Highlight various strategies to orient and onboard new acquired talent. 10. Articulate an employer's legal responsibilities in the talent acquisition process. Credits: 3.00

TLI 45560 - Professional Internship In Human Resources

Credit Hours: 3.00. The undergraduate internship course is designed as a culminating learning experience for students nearing graduation. Students have an opportunity to seek out practical work experience related to human resources to use knowledge acquired in the classroom. The course will serve as a professional development opportunity helping students reflect and build upon their experiences gained through the required 500-hours human resources related work.

Learning Outcomes: 1. Learn and grow personally and professionally from an internship experience. 2. Express gained competencies and skills through evidence and critical reflection. 3. Receive, evaluate and apply constructive performance feedback and evaluation, as assessed by the internship supervisor. 4. Understand one's self in a professional context. 5. Integrate HRD theory and professional practice. Credits: 3.00

15 Credits

Spring 4th Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse

audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

MGMT 44431 - Compensation: Total Rewards

Credit Hours: 3.00. This course examines the tangible and intangible aspects of compensation, through the lens of a total reward philosophy of an organization in order to attract, motivate, and retain their Human Capital. It also provides an overview of the considerations necessary to develop a compensation system that is internally and externally equitable and fiscally responsible, including the use of job evaluation and salary surveys.

Learning Outcomes: 1. Evaluate the difference Total Rewards programs can make in organizations. 2. Distinguish between total rewards and compensation and identify compensation and non-compensation elements of total rewards. 3. Recognize various reward systems, their relationship and connection to a total compensation and benefits philosophy, and how they impact the quality of work life and productivity organizations. 4. Assess the practical issues in compensation and employee benefits in light of a company's management philosophy and human resources strategies. 5. Define job evaluation and its use to develop internally equitable compensation systems. 6. Identify the implications of using salary surveys to ensure externally equitable and fiscally responsible compensation systems. 7. Explain the concepts of salary administration and application of compensation programs in the business environment. 8. Better understand effective salary and wage structures in organizations today. 9. Explain the relationship between performance evaluation methods and reward systems. 10. Discuss the legal aspects of compensation, benefits and performance appraisals. Credits: 3.00

TLI 45590 - Foundations Of Human Resources Capstone

Credit Hours: 3.00. This course synthesizes all of the required and secondary content areas described in the SHRM HR Curriculum Guidelines. Students will prepare for the SHRM Certified Professional (SHRM-CP) exam while demonstrating their accumulated knowledge and in the area of human resources.

Learning Outcomes: 1. Reflect on the entire HR-related areas. 2. Synthesize all HR-related knowledge, skills, and competencies. 3. Engage in test-taking for obtaining licensure. 4. Demonstrate an understanding of all HR-related concepts, terms, applications, and processes. 5. Successfully complete mock SHRM-CP exams. Credits: 3.00

15 Credits

Human Services, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (45 credits)

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and

associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop the basic knowledge and skills needed to understand the research process, including

generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present research studies and findings to a group. Credits: 3.00

HDFS 45100 - Internship & Career Preparation For Human Services

Credit Hours: 2.00. This course includes an overview of HDFS-related professions, self-evaluation, career search skills, exploration of internship opportunities, and professional development. Students will complete arrangements for their field placement.

Learning Outcomes: 1. Assess career interests and identify potential internship sites. 2. Create a professional cover letter and resume. 3. Identify how resources available at the Purdue Center for Career Opportunities (CCO) and its website (myCCO) can be used in the job/internship search. 4. Develop skills and strategies for conducting an effective job/internship. 5. Develop and apply professional interview skills. 6. Demonstrate professional behavior through the successful and timely completion of course assignments. 7. Demonstrate preparation for the transition from student to intern. Credits: 2.00

Other Departmental/Program Requirements (40-46 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results

from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills

with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway

around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

Foreign Language Selective (9-12 credits)

Supplemental Lists

Optional Concentration

Electives (29-35 credits)

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the

requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool

you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

16 Credits

Spring 1st Year

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences,

situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

16 Credits

16 Credits

Fall 2nd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be

introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

15 Credits

Spring 2nd Year

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop the basic knowledge and skills needed to understand the research process, including generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present research studies and findings to a group. Credits: 3.00

15 Credits

15 Credits

Fall 3rd Year

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 33100 - Skills For Helping Professionals In Individual, Family And Group Settings

Credit Hours: 3.00. This course is an introduction to skills commonly used in helping professions, including relationship-building skills, beginning interviewing skills, and group process skills. Attention is paid to cultural competence and professional ethics. This course includes a weekly lab experience involving practice of the helping skills, as well as a service-learning project in which helping skills are used in a community setting.

Learning Outcomes: 1. Use basic helping skills effectively in both individual and group contexts. 2. Evaluate your own helping interactions and those of others, including making constructive suggestions for improvement. 3. Design, implement, and reflect on a service-learning project that uses helping skills in a community setting. 4. Contribute to your team's successful service-learning project and provide leadership to the team as appropriate. 5. Reflect on your experiences in the course through your writing and use those reflections to promote development toward your own professional goals. Credits: 3.00

15-17 Credits

15-17 Credits

Spring 3rd Year

HDFS 34300 - Assessment And Case Management

Credit Hours: 3.00. This course is an introduction to case management as a service delivery approach for helping individuals and families in need. This course provides opportunities to practice basic helping and case management skills such as building rapport, assessing client needs, developing intervention plans, professional ethics, and professional writing.

Learning Outcomes: 1. Explain the case management approach to addressing the health and human service needs of children, adults, and families. 2. Differentiate among the various phases and task responsibilities of case management. 3. Analyze how individual differences in human development and motivation for change influence case management work. 4. Apply basic assessment and case management skills in practice interviews with individuals and families. 5. Demonstrate professional documentation and writing ability through the preparation of assessment reports, case notes, and intervention plans. 6. Demonstrate professional helping capacities such as ethical behavior and reflective practice. Credits: 3.00

13-15 Credits

13-15 Credits

Fall 4th Year

HDFS 34100 - Working With Parents

Credit Hours: 3.00. This course focuses on developing and maintaining effective relationships between parents and professionals working with children, within the context of family-centered practices. Issues related to cultural, linguistic, economic, and developmental differences that affect relations between families and professionals are examined.

Learning Outcomes: 1. Demonstrate an understanding of the development tasks and concerns of parents across the life course. 2. Demonstrate an understanding of the content and design of innovative professional practices and program strategies that seek to promote positive parenting outcomes or reduce/prevent unhealthy parenting outcomes in each developmental stage of parenting. 3. Demonstrate an understanding of how diverse family characteristics and circumstances shape the developmental tasks, concerns, and needs of parents. 4. Demonstrate an understanding of the implications of diverse family characteristics and circumstances for professional practices

and program strategies aimed at supporting parents. 5. Demonstrate an understanding of how to creatively work with students colleagues to develop an original program idea that supports parents during a particular developmental stage. Credits: 3.00

HDFS 34800 - Administration Of Social Service Not-For-Profit Organizations

Credit Hours: 3.00. This course introduces students to aspects of not-for-profit management identified as keys by leaders in existing agencies. Students will prepare themselves for specifically establishing, building, working in and leading not-for-profit organizations.

Learning Outcomes: 1. Demonstrate knowledge, comprehension, analysis and application supporting competence in the defining features of nonprofit management by interactively thinking critically and creatively to develop a board of directors; design a strategic plan; write a corresponding operations plan; diagram an evaluation logic model; prepare a budget; making a fund raising ask; write a fund raising letter; write a grant proposal; write a press release; and make oral presentations. 2. Demonstrate knowledge, comprehension, application, analysis and synthesis by interactively solving an administrative problem in a nonprofit agency case study and presenting the solution. Credits: 3.00

HDFS 45100 - Internship & Career Preparation For Human Services

Credit Hours: 2.00. This course includes an overview of HDFS-related professions, self-evaluation, career search skills, exploration of internship opportunities, and professional development. Students will complete arrangements for their field placement.

Learning Outcomes: 1. Assess career interests and identify potential internship sites. 2. Create a professional cover letter and resume. 3. Identify how resources available at the Purdue Center for Career Opportunities (CCO) and its website (myCCO) can be used in the job/internship search. 4. Develop skills and strategies for conducting an effective job/internship. 5. Develop and apply professional interview skills. 6. Demonstrate professional behavior through the successful and timely completion of course assignments. 7. Demonstrate preparation for the transition from student to intern. Credits: 2.00

16 Credits

16 Credits

Spring 4th Year

HDFS 45500 - Human Services Capstone Internship

Credit Hours: 6.00 or 12.00. Supervised full-time or half-time internship in human services, doing work typical of an entry-level bachelor-degreed professional. Students will integrate and build upon knowledge developed during their studies in human services. Students will use and enhance their skills in direct service to client or indirect service. Students will work in the placement setting secured during HDFS 45400. Example field placement sites include: government or community agencies; social service agencies; hospitals; and recreational settings. Permission of Department required. Must be a student in good academic standing during the internship semester.

Learning Outcomes: 1. Synthesize previously acquired and new knowledge about individual development, family processes, and broader social contexts and apply it to their responsibilities in their internship setting. 2. Demonstrate skills in direct service to children, adults, and/or families in the planning, evaluation, management, or support of human services programs. 3. Exhibit professional work attitudes and behavior. Credits: 6.00 or 12.00

12 Credits

12 Credits

Fall 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of

computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

16 Credits

About the Program

Industrial Design Professional Program, BFA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (76 credits)

A. Art & Design Core (12 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in

a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

B. Industrial Design Core (36 credits)

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment.

Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 23500 - Materials And Processes II

Credit Hours: 3.00. Problems in three-dimensional design, incorporating materials, production processes, and applications of current technology, emphasizing aspects of society and technology. An introduction to complete industrial design problems, including problem definition, concepts, resource information, design development, final proposals, and presentation techniques.

Learning Outcomes: 1. Apply knowledge of design for manufacturing and use of materials by creating and fabricating selected projects. 2. Evaluate the aesthetics, ergonomics, and manufacturability of designs by participating in in-class design critiques. 3. Utilize skills to analyze an existing product and redesign it with an expanded function. Credits: 3.00

AD 24600 - Design Drawing II

Credit Hours: 3.00. Continuation of the work done in A&D 245. Emphasis on development of skills and presentation quality design drawing.

Credits: 3.00

AD 25600 - Presentation Techniques

Credit Hours: 3.00. Studio preparing students for project presentations. Classes will cover graphic techniques, including page layout, typography, portfolio formats, perspective drawings, photography, and verbal communication.

Learning Outcomes: 1. Create original designs using iterative visualization techniques to improve and refine their design concepts. 2. Develop computer-aided design skills to present these design concepts. 3. Demonstrate 3-D computer modeling skills. 4. Demonstrate computer rendering skills. Credits: 3.00

AD 30500 - Industrial Design I

Credit Hours: 3.00. Introduction to design principles in processes employing basic problem-solving techniques. Emphasis will be placed on man's interaction with form, thought processes, procedures, craftsmanship, and use of materials. Acceptance into professional industrial design concentration by successful performance in the mandatory portfolio review. Prerequisites: Passing mandatory portfolio review.

Learning Outcomes: 1. Improve functions, meet production needs efficiently, refine aesthetics, and always keep the user in mind. 2. Control advanced computer modeling, to be able to model complex forms accurately. 3. Create presentations that effectively communicate the student's design ideas. Credits: 3.00

AD 30600 - Industrial Design II

Credit Hours: 3.00. An analysis of design through organic and aesthetic principles, natural solutions, and man-made systems. Skills and techniques for communication of creative design solutions. Rapid visualization, rendering, model making, and working models will be stressed.

Credits: 3.00

AD 31500 - Design Methodology

Credit Hours: 3.00. This course will cover the fundamental concepts of design methodology. Studies in various problem-solving and research methods as they apply to the designer and society.

Learning Outcomes: 1. Design three-dimensional forms with attention to aesthetic and functional aspects. 2. Create presentations that effectively communicate the students' design ideas to diverse audiences. 3. Apply design research skills, including market mapping, ethnographic observation, and ergonomic analysis, to inform design decisions. 4. Develop skills in collaborative design, emphasizing teamwork, communication, and problem-solving. Credits: 3.00

AD 31600 - Seminar On Ideas In Industrial Design I: Design And Society

Credit Hours: 3.00. A study of design and the designer and the factors in society that affect his or her work.

Credits: 3.00

AD 40500 - Industrial Design III

Credit Hours: 3.00. Design projects emphasizing sophisticated problem-solving methods. Design projects will stress diversity of industrial design and will trace the development of products from initial concept, research, and development through production.

Credits: 3.00

AD 40600 - Industrial Design IV

Credit Hours: 3.00. Design of products in their relation to economic, physiological, psychological, and behavioral patterns of the consumer. Emphasis upon total thought processes to allow environmental considerations as well as technological realities.

Credits: 3.00

AD 41500 - Professional Techniques

Credit Hours: 3.00. Research development for product design, with emphasis on socioeconomic concerns and documentation techniques. Portfolio refinement, including verbal, written, and other visual documentation and presentation skills in various media, such as drawing. Photography and computer-generated graphics will be stressed.

Credits: 3.00

AD 25601 - Industrial Design Sophomore Review

Credit Hours: 0.00. This course is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Industrial Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Industrial Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

C. Industrial Design Supportive Requirements (19 credits)

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly

research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

AD 41600 - Seminar On Ideas In Industrial Design II: Design And Creative Problem Solving Methods

Credit Hours: 3.00. A study of creative problem solving methods as used by the designer in his or her work.

Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

AD 34000 - Furniture Development

Credit Hours: 3.00. This course is an introduction to furniture design. The focus of this course is information relevant to furniture design including: basic ergonomics, structural techniques and materials and processes. Additional pertinent information regarding new and ongoing design trends will be explored. A mid-semester field trip to a major furniture manufacturer and/or design studio is offered. Students will design and build two of the following objects: a small freestanding shelving unit, small table, bench, table top object or stool. Students must pass mandatory portfolio review for this course.

Learning Outcomes: 1. Increase knowledge of materials and processes including furniture design construction methods. 2. Gain a basic understanding of ergonomics. 3. Increase aesthetic sensibility. 4. Develop an awareness

of contemporary issues and trends in furniture design. 5. Design and build an original piece of furniture by the end of the class. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

D. Industrial Design Selectives - (9 credits)

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 20600 - Studio In Visual Communication Design

Credit Hours: 3.00. Investigation of visual communication design theory, history, skills, and methodology, as well as preparation of art and mechanicals for graphic arts reproduction.

Learning Outcomes: 1. Transition from fundamental design skills to advanced graphic design applications. 2. Introduce layout/grid systems and their theoretical and practical applications. 3. Introduce students to the fundamentals of typography, exploring the relationships between type and image. 4. Increase proficiency in graphic software in the context of graphic design projects. 5. Gain a better understanding of the history of graphic design. 6. Develop more advanced problem-solving skills. 7. Prepare students for the Sophomore Review, and advanced junior- and

senior-level design courses. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 22800 - Visual Communication Design Computing I

Credit Hours: 3.00. An introductory course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Illustrator and Adobe InDesign. 2. Experiment with and iterate through image-making utilizing various methods and vector-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Increase ability to generate and choose intensely metaphoric imagery to enhance visual communication. 5. Understand and use design terminology and design principles. 6. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22900 - Visual Communication Design Computing II

Credit Hours: 3.00. An intermediate course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Photoshop and Adobe XD. 2. Experiment with and iterate through image-making utilizing various methods and pixel-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Understand and use design terminology and design principles. 5. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 23600 - Lighting Fundamentals For Photography

Credit Hours: 3.00. Introductory course in understanding electronic strobe lighting. Begins with a review of basic lighting principles and a series of problem-solving assignments, which introduce control, and applications of electronic strobe lighting. Still life photography and portraiture are emphasized and covers on-location lighting.

Learning Outcomes: 1. Gain an understanding of the basic principles of light and how to use those principles to light photographic subject

matter. 2. Gain a basic understanding of the function of photographic lighting equipment. 3. Compile a portfolio of images that demonstrate a skill set learned regarding product and portrait and simple space lighting. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 36200 - Jewelry And Metalwork

Credit Hours: 3.00. Lost wax casting and mold making, mechanisms and stone setting for jewelry and metalwork.

Learning Outcomes: 1. Students will be able to design and make wax and non-wax models for jewelry and small metal projects by reductive, addictive, and construction processes. 2. Students will learn to sprue, invest and cast their models by the lost wax centrifugal and vacuum casting methods. 3. They will learn to make waste molds and reusable rubber molds to produce their jewelry projects. 4. They will learn to make mechanisms for jewelry and settings for incorporating stones or other nonmetal materials into their jewelry. Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36900 - Lithographic Printmaking

Credit Hours: 3.00. An introduction to the techniques of stone and plate lithography. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 40000 - Advanced Painting

Credit Hours: 3.00. A studio course concentrating on the development of an advanced body of work built upon the conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 40400 - Moldmaking And/Or Wheel-Throwing Production Techniques In Ceramics

Credit Hours: 3.00 to 6.00. This course will teach mold-making or wheel-throwing (depending on the individual student's interest) with a view to creating ceramic objects suitable for commercial mass-production. Both tableware and/or sculptural objects will be explored. For the wheel-throwing option the students must have at least one year of high school throwing or AD 24200 with a grade of at least "B" or permission of instructor. For the mold making and casting option only, students must be an Art and Design student or have permission of instructor.

Learning Outcomes: 1. The student will learn how to design a model, make the model from clay, make a mold of the designed model (or found object), cast and assemble cast ceramics pieces for possible commercial mass-production. If choosing the wheel-throwing option, the student will learn advanced techniques of throwing and assembling parts to make either functional and sculptural objects for mass-production. 2. Students will also learn simple glazing techniques, and have the option of learning how to screen print and use decals on their final products. Credits: 3.00 to 6.00

AD 41700 - Variable Topics In Electronic And Time-Based Art

Credit Hours: 3.00. Examination of thematic or specialized topics reflecting the most recent developments and contemporary artistic practices in Electronic and Time-Based Art. Permission of department required.

Learning Outcomes: 1. Use essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production. 2. Able to analyze key works and artists in the emerging field of Electronic and Time-Based Art. Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques,

methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 46200 - Metalsmithing

Credit Hours: 3.00. Metal forming and metalsmithing processes for small metal objects and jewelry.

Learning Outcomes: 1. Identify and utilize traditional jewelry and metalsmithing tools and materials in art metal projects. 2. Design and construct specialized tooling for metalworks. 3. Utilize newly developed tools into the fabrication of jewelry and other metal projects. Credits: 3.00

AD 51200 - Interaction Design Studies

Credit Hours: 3.00. This course examines concepts and methods for interaction design (IXD). It emphasizes a human-centered perspective and explores fundamental components involved in IXD research. Students will explore a wide range of literature and implement IXD theories in multi-disciplinary collaborative projects.

Learning Outcomes: 1. Understand the fundamental architecture and principles of the interaction design. 2. Be familiar with a range of research interests in the domain and start to consider the thesis research topic. 3. Be aware of the diversity of research areas, methodologies and practices relevant to the interaction design program, and be exposed to work of researchers beyond the university, drawn from regional and international venues, to keep informed about updated research achievements. 4. Identify and apply compositional theory to interaction design practice. 5. Develop the ability to articulate intention in work through design iteration. 6. Organize and conduct a design process within an interdisciplinary team. 7. Have a working level of programming fluency, in order to independently produce a working prototype that satisfies given design requirements. 8. Assess and improve production value through design practice, optimization, and media technique. 9. Explore creative process, perception, and problem solving. Credits: 3.00

AD 52200 - Interaction Design Evaluation

Credit Hours: 3.00. This course builds a foundation for interaction designers to conduct evaluation research. Students start from analyzing evaluation cases on interactive designs and systems to employing evaluation in design projects using quantitative, qualitative, or mixed methods of inquiry.

Learning Outcomes: 1. Identify the need, justification, and goal of conducting an evaluation. 2. Understand systematic knowledge, logical-deductive processes and various research types, and recognize causes & effects, systematic bias and measurement/observation errors in research. 3. Be familiar with different kinds of qualitative and quantitative research methods and how they differ from each other. Build up reliable knowledge for them. 4. Understand the structure of paradigms, theories, concepts, hypotheses, constructs, variables and data. 5. Be familiar with the techniques such as observation, interviews, contamination, exogenous effects, and unobtrusive measures. 6. Be able to organize quantitative and qualitative data, and use analysis software such as SPSS and ALTAS.ti to find patterns. 7. Present the evaluation outcomes, and try to organize and write research papers based on the analysis. Credits: 3.00

AD 53500 - Furniture Design

Credit Hours: 3.00. Examination of furniture design trends and designers. Explore materials and manufacturing processes. Design and build a full-size seating unit. Shop skills required. Permission of instructor required.

Credits: 3.00

AD 54200 - Information Visualization Design

Credit Hours: 3.00. This course starts from exploring visual perception and attention theories, studying modern visualization technologies and toolkits, and reviewing evolving visualization research. Students work on small exercises, and then

accomplish complicated virtual and physical visualization projects for information representation and communication.

Learning Outcomes: 1. Learn the principals involved in information visualization. Gain a background that will aid the design of new, innovative visualizations. 2. Learn about the variety of existing techniques and systems in information visualization. 3. Build a sound foundation in human visual perception and how it relates to creating effective information visualization. 4. Proceed through graph and map-making best practices toward advanced topics of data structure and programmatic visualizations. 5. Gain experience describing and critiquing the methods and approaches of data visualization through presentations and critiques. 6. Understand the key design principles for creating information visualizations. 7. Explore the communication and narrative potential of information visualizations. 8. Develop skills in critiquing visualization techniques as applied to particular tasks. 9. Evaluate information visualizations tools. 10.Design new, innovative visualizations. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

TECH 34000 - Prototyping Technology For People

Credit Hours: 3.00. Innovating in our complex world requires us to think strategically and make the best decisions possible for both designing and business development. Accordingly, this unique course brings together perspectives from technology and business management to iteratively prototype innovative solutions to student-selected problems. This process will include creating prototypes in a variety of media, using the appropriate methods/tools, as well as exploring the processes and biases related to how people process information and make decisions. This type of work will help to guide the innovation process by gaining insights from testing prototypes and interacting with people to deepen one's understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. At the conclusion of the course, students will pitch a viable design solution and business model for a validated problem to a variety of potential investors and/or stakeholders. Note: This class engages the material in both the classroom and innovation labs. Students of all levels of experience, will explore tools/programs related to computer aided design, 3D printing, app development, and digital prototyping.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to develop prototypes in a variety of media (digital and/or physical) for the level of fidelity necessary to communicate, understand, and test innovative ideas/designs. 3. Select and use appropriate methods/tools/equipment to make decisions and prototype innovative ideas. 4. Revise designs to reflect a deepening understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. 5. Pitch a viable design solution/business model for a

validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

Electives (16-27 credits)

GPA Requirements

Course Requirements and Notes

Non-Course / Non-Credit Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

15-16 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15 Credits

Fall 2nd Year

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment. Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 24600 - Design Drawing II

Credit Hours: 3.00. Continuation of the work done in A&D 245. Emphasis on development of skills and presentation quality design drawing.

Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

15 Credits

Spring 2nd Year

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 23500 - Materials And Processes II

Credit Hours: 3.00. Problems in three-dimensional design, incorporating materials, production processes, and applications of current technology, emphasizing aspects of society and technology. An introduction to complete industrial design problems, including problem definition, concepts, resource information, design development, final proposals, and presentation techniques.

Learning Outcomes: 1. Apply knowledge of design for manufacturing and use of materials by creating and fabricating selected projects. 2. Evaluate the aesthetics, ergonomics, and manufacturability of designs by participating in in-class design critiques. 3. Utilize skills to analyze an existing product and redesign it with an expanded function. Credits: 3.00

AD 25600 - Presentation Techniques

Credit Hours: 3.00. Studio preparing students for project presentations. Classes will cover graphic techniques, including page layout, typography, portfolio formats, perspective drawings, photography, and verbal communication.

Learning Outcomes: 1. Create original designs using iterative visualization techniques to improve and refine their design concepts. 2. Develop computer-aided design skills to present these design concepts. 3. Demonstrate 3-D computer modeling skills. 4. Demonstrate computer rendering skills. Credits: 3.00

AD 25601 - Industrial Design Sophomore Review

Credit Hours: 0.00. This course is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Industrial Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Industrial Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

16 Credits

Fall 3rd Year

AD 30500 - Industrial Design I

Credit Hours: 3.00. Introduction to design principles in processes employing basic problem-solving techniques.

Emphasis will be placed on man's interaction with form, thought processes, procedures, craftsmanship, and use of materials. Acceptance into professional industrial design concentration by successful performance in the mandatory portfolio review. Prerequisites: Passing mandatory portfolio review.

Learning Outcomes: 1. Improve functions, meet production needs efficiently, refine aesthetics, and always keep the user in mind. 2. Control advanced computer modeling, to be able to model complex forms accurately. 3. Create presentations that effectively communicate the student's design ideas. Credits: 3.00

AD 31500 - Design Methodology

Credit Hours: 3.00. This course will cover the fundamental concepts of design methodology. Studies in various problem-solving and research methods as they apply to the designer and society.

Learning Outcomes: 1. Design three-dimensional forms with attention to aesthetic and functional aspects. 2. Create presentations that effectively communicate the students' design ideas to diverse audiences. 3. Apply design research skills, including market mapping, ethnographic observation, and ergonomic analysis, to inform design decisions. 4. Develop skills in collaborative design, emphasizing teamwork, communication, and problem-solving. Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

17 Credits

Spring 3rd Year

AD 30600 - Industrial Design II

Credit Hours: 3.00. An analysis of design through organic and aesthetic principles, natural solutions, and man-made systems. Skills and techniques for communication of creative design solutions. Rapid visualization, rendering, model making, and working models will be stressed.

Credits: 3.00

AD 31600 - Seminar On Ideas In Industrial Design I: Design And Society

Credit Hours: 3.00. A study of design and the designer and the factors in society that affect his or her work.

Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary

sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 34000 - Furniture Development

Credit Hours: 3.00. This course is an introduction to furniture design. The focus of this course is information relevant to furniture design including: basic ergonomics, structural techniques and materials and processes. Additional pertinent information regarding new and ongoing design trends will be explored. A mid-semester field trip to a major furniture manufacturer and/or design studio is offered. Students will design and build two of the following objects: a small freestanding shelving unit, small table, bench, table top object or stool. Students must pass mandatory portfolio review for this course.

Learning Outcomes: 1. Increase knowledge of materials and processes including furniture design construction methods. 2. Gain a basic understanding of ergonomics. 3. Increase aesthetic sensibility. 4. Develop an awareness of contemporary issues and trends in furniture design. 5. Design and build an original piece of furniture by the end of the class. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

18 Credits

Fall 4th Year

AD 40500 - Industrial Design III

Credit Hours: 3.00. Design projects emphasizing sophisticated problem-solving methods. Design projects will stress diversity of industrial design and will trace the development of products from initial concept, research, and development through production.

Credits: 3.00

AD 41500 - Professional Techniques

Credit Hours: 3.00. Research development for product design, with emphasis on socioeconomic concerns and documentation techniques. Portfolio refinement, including verbal, written, and other visual documentation and presentation skills in various media, such as drawing. Photography and computer-generated graphics will be stressed.

Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

15 Credits

Spring 4th Year

AD 40600 - Industrial Design IV

Credit Hours: 3.00. Design of products in their relation to economic, physiological, psychological, and behavioral patterns of the consumer. Emphasis upon total thought processes to

allow environmental considerations as well as technological realities.

Credits: 3.00

AD 41600 - Seminar On Ideas In Industrial Design II: Design And Creative Problem Solving Methods

Credit Hours: 3.00. A study of creative problem solving methods as used by the designer in his or her work.

Credits: 3.00

15 Credits

Industrial Engineering Technology, BS

About the Program

The Industrial Engineering Technology major is part of the Industrial Engineering Technology program. The industrial engineering technology program is accredited by the Engineering Technology Accreditation Commission of ABET, https://www.abet.org, under the commission's general criteria and program criteria for Industrial Engineering Technology and similarly named programs.
When you major in industrial engineering technology at Purdue University, you will gain skills to prepare you for a wide variety of career options: manufacturing plants, government agencies, hospitals, healthcare organizations, retail companies, and more. You will focus on both technical and human-centered approaches to technology management. You will learn how to manage and coordinate engineering operations and lead projects from design to implementation. Coursework is enhanced with an overview of business and economics.

Industrial Engineering Technology Website
School of Engineering Technology Major Change (CODO) Requirements

Degree Requirements

Department/Program Major Courses (40 credits)

Required Department Courses (40 credits)

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

IET 33520 - Human Factors For Technology Systems

Credit Hours: 3.00. This course provides the foundation for examining the intersection of people, technology, policy, and work across technology systems. Topics include the evaluation, analysis, and design recommendations for improving the safety and efficiency of human-technology interactions.

Learning Outcomes: 1. Describe the relationship between human factors and technology systems. 2. Solve human-machine interaction problems, using appropriate human factors principles. 3. Recommend actions to correct safety deficiencies in existing environments. 4. Apply principles of innovation to design, conduct, and document a human factors study. Credits: 3.00

IET 33620 - Total Productive Maintenance

Credit Hours: 3.00. This course emphasizes the importance of effective maintenance planning and execution for efficient and economical operation of service or technology systems. A systems approach to maintenance planning is taken. Maintenance activities are discussed from reliability and productivity perspectives in the context of technology systems. Semester-long, team-based research project is typically required.

Learning Outcomes: 1. Differentiate among the various types of maintenance activities. 2. Calculate failure rate, mean time between failures, reliability, and maintenance cost versus profit. 3. Identify various state-of-the-art technologies and applications in PM and PDM maintenance management. 4. Evaluate maintenance management philosophies, organization, and practices of a manufacturing entity. 5. Articulate maintenance management philosophies and practices for manufacturing entities. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 43540 - Facilities Planning And Material Handling

Credit Hours: 3.00. This course takes a systematic approach to design of facilities and material handling systems for effective and lean production of goods and services. An array of qualitative and quantitative tools and techniques are introduced and utilized, emphasizing lean principles, waste reduction, and overall efficiency of operations. Flow analysis and optimization tools, including computer simulation, are introduced. Strong emphasis is placed on a comprehensive semester-long team project as an integral component of this course.

Learning Outcomes: 1. Calculate various elements of time study and Takt time. 2. Apply various flow analysis tools. 3. Apply the principles of line balancing. 4. Calculate the efficiency of an assembly line. 5. Calculate facility space requirements. 6. Develop a systematic approach to layout and resource planning, incorporating basic material handling systems. Credits: 3.00

IET 43630 - Design Of Experiments

Credit Hours: 3.00. Introduction to statistical design of experiments. The course examines the difference between single, multivariate, and factorial experimental designs. Concepts of optimization and response surface methodologies are introduced. The course focuses on interpreting and communicating experimental results.

Learning Outcomes: 1. Formulate null and alternate hypotheses. 2. Apply appropriate statistical tests. 3. Design an appropriate experiment to test a hypothesis. 4. Differentiate between main effects and interaction effects. 5. Distinguish between factorial and fractional factorial designs. 6. Apply response surface methodology. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and

issues in engineering technology. Credits: 4.00

IET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Other Departmental Courses (72 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial

views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in

programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have

formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

Electives (8 credits)

Additional Requirements

Program Requirements

Fall 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they

relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish

and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

15 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide

constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of

print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

15 Credits

Fall 2nd Year

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the

ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

16 Credits

Spring 2nd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic

theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

15 Credits

Fall 3rd Year

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

IET 33620 - Total Productive Maintenance

Credit Hours: 3.00. This course emphasizes the importance of effective maintenance planning and execution for efficient and economical operation of service or technology systems. A systems approach to maintenance planning is taken. Maintenance activities are discussed from reliability and productivity perspectives in the context of technology systems. Semester-long, team-based research project is typically required.

Learning Outcomes: 1. Differentiate among the various types of maintenance activities. 2. Calculate failure rate, mean time between failures, reliability, and maintenance cost versus profit. 3. Identify various state-of-the-art technologies and applications in PM and PDM maintenance management. 4. Evaluate maintenance management philosophies, organization, and practices of a manufacturing entity. 5. Articulate maintenance management philosophies and practices for manufacturing entities. Credits: 3.00

15 Credits

Spring 3rd Year

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

IET 33520 - Human Factors For Technology Systems

Credit Hours: 3.00. This course provides the foundation for examining the intersection of people, technology, policy, and work across technology systems. Topics include the evaluation, analysis, and design recommendations for improving the safety and efficiency of human-technology interactions.

Learning Outcomes: 1. Describe the relationship between human factors and technology systems. 2. Solve human-machine interaction problems, using appropriate human factors principles. 3. Recommend actions to correct safety deficiencies in existing environments. 4. Apply principles of innovation to design, conduct, and document a human factors study. Credits: 3.00

IET 43630 - Design Of Experiments

Credit Hours: 3.00. Introduction to statistical design of experiments. The course examines the difference between single, multivariate, and factorial experimental designs. Concepts of optimization and response surface methodologies are introduced. The course focuses on interpreting and communicating experimental results.

Learning Outcomes: 1. Formulate null and alternate hypotheses. 2. Apply appropriate statistical tests. 3. Design an appropriate experiment to test a hypothesis. 4. Differentiate between main effects and interaction effects. 5. Distinguish between factorial and fractional factorial designs. 6. Apply response surface methodology. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

15 Credits

Fall 4th Year

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

IET 43540 - Facilities Planning And Material Handling

Credit Hours: 3.00. This course takes a systematic approach to design of facilities and material handling systems for effective and lean production of goods and services. An array of qualitative and quantitative tools and techniques are introduced and utilized, emphasizing lean principles, waste reduction, and overall efficiency of operations. Flow analysis and optimization tools, including computer simulation, are introduced. Strong emphasis is placed on a comprehensive semester-long team project as an integral component of this course.

Learning Outcomes: 1. Calculate various elements of time study and Takt time. 2. Apply various flow analysis tools. 3. Apply the principles of line balancing. 4. Calculate the efficiency of an assembly line. 5. Calculate facility space requirements. 6. Develop a systematic approach to layout and resource planning, incorporating basic material handling systems. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

14 Credits

Notes

Industrial Engineering, BSIE

About the Program

Degree Requirements

Industrial Engineering Major Requirements (51 credits)

Required IE Courses (36 credits)

IE 20000 - Industrial Engineering Seminar

Credit Hours: 0.00. An orientation course to inform students of the major options in the industrial engineering program, assistance in selection of appropriate electives to meet career objectives, introduction to the faculty, and selection of an academic advisor.

Credits: 0.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IE 33200 - Computing In Industrial Engineering

Credit Hours: 3.00. Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Credits: 3.00

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

IE 38300 - Integrated Production Systems I

Credit Hours: 3.00. Basic concepts in the design and operational control of integrated production systems. Includes topics on facility layout and material handling, material flow and information flow, resource and capacity planning, and shop floor control and scheduling.

Credits: 3.00

IE 38600 - Work Analysis And Design I

Credit Hours: 3.00. Fundamentals of work methods and measurement. Applications of engineering, psychological, and physiological principles to the analysis and design of human work systems.

Credits: 3.00

IE 43100 - Industrial Engineering Design

Credit Hours: 3.00. Capstone design experience for industrial engineering students involving analysis and synthesis of unstructured problems in practical settings. Students work in teams to formulate issues, propose solutions, and communicate results in formal written and oral presentations. Prerequisite: all 30000-level industrial engineering courses required for the BS IE degree.

Credits: 3.00

IE 47400 - Industrial Control Systems

Credit Hours: 3.00. Introduction to automatic controls with reference to automation of industrial machines and processes, including linear dynamic systems, feedback control, and elements of systems analysis. Introduction to digital control.

Learning Outcomes: 1. Able to design basic control systems using block diagrams. 2. Able

to determine the feedback equation of block diagrams. 3. Able to interpret state-space models. 4. Able to compute state-spaced equations. 5. Able to conduct basic dynamic modeling of a control system. 6. Able to classify a linear time-invariant system into known classes. 7. Able to compute the dynamic response of a control system. Credits: 3.00

IE 48600 - Work Analysis And Design II

Credit Hours: 3.00. Continuation of IE 38600 . Applications of engineering, computer sciences, information sciences, and psychological principles and methods to the analysis and design of human work systems.

Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

IE Selectives (15 credits)

IE Selectives (6 credits)

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

IE 48400 - Integrated Production Systems II

Credit Hours: 3.00. Extensions of topics on the design and operational control of integrated production systems. Includes production databases, facility layout, material handling, advanced control and scheduling, and physical distribution. Case studies, lab assignments, and projects.

Credits: 3.00

Technical Selectives (9 credits)

Other Departmental/Program Requirements (72-85 credits)

Engineering Requirements for First Year (29-39 credits)

Other Course Requirements (25-28 credits)

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure

vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.
Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.
Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace

transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

IE General Education Requirement (18 credits)

Supplemental List

Course Requirements and Notes

GPA Requirements

Pass/No Pass Policy

Sample Industrial Engineering Plan of Study

Fall 2nd Year

IE 20000 - Industrial Engineering Seminar

Credit Hours: 0.00. An orientation course to inform students of the major options in the industrial engineering program, assistance in selection of appropriate electives to meet career objectives, introduction to the faculty, and selection of an academic advisor.

Credits: 0.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with

projects. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

16 Credits

Spring 2nd Year

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

18 Credits

Fall 3rd Year

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems.

4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

15 Credits

Spring 3rd Year

IE 33200 - Computing In Industrial Engineering

Credit Hours: 3.00. Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

IE 38300 - Integrated Production Systems I

Credit Hours: 3.00. Basic concepts in the design and operational control of integrated production systems. Includes topics on facility layout and material handling, material flow and information flow, resource and capacity planning, and shop floor control and scheduling.

Credits: 3.00

IE 38600 - Work Analysis And Design I

Credit Hours: 3.00. Fundamentals of work methods and measurement. Applications of engineering, psychological, and physiological principles to the analysis and design of human work systems.

Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

18 Credits

Fall 4th Year

IE 47400 - Industrial Control Systems

Credit Hours: 3.00. Introduction to automatic controls with reference to automation of industrial machines and processes, including linear dynamic systems, feedback control, and elements of systems analysis. Introduction to digital control.

Learning Outcomes: 1. Able to design basic control systems using block diagrams. 2. Able to determine the feedback equation of block diagrams. 3. Able to interpret state-space models. 4. Able to compute state-spaced equations. 5. Able to conduct basic dynamic modeling of a control system. 6. Able to classify a linear time-invariant system into known classes. 7. Able to compute the dynamic response of a control system. Credits: 3.00

IE 48600 - Work Analysis And Design II

Credit Hours: 3.00. Continuation of IE 38600 . Applications of engineering, computer sciences, information sciences, and psychological principles and methods to the analysis and design of human work systems.

Credits: 3.00

15 Credits

Spring 4th Year

IE 43100 - Industrial Engineering Design

Credit Hours: 3.00. Capstone design experience for industrial engineering students involving analysis and synthesis of unstructured problems in practical settings. Students work in teams to formulate issues, propose solutions, and communicate results in formal written and oral presentations. Prerequisite: all 30000-level industrial engineering courses required for the BS IE degree.

Credits: 3.00

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

IE 48400 - Integrated Production Systems II

Credit Hours: 3.00. Extensions of topics on the design and operational control of integrated production systems. Includes production databases, facility layout, material handling, advanced control and scheduling, and physical distribution. Case studies, lab assignments, and projects.

Credits: 3.00

15 Credits

Insect Biology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (46 credits)

Required Major Courses (43 credits)

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

ENTM 21000 - Introduction To Insect Behavior (UCC: SCI)

Credit Hours: 3.00. Description and introductory analysis of innate and learned insect behavior, including basic orientations and movements, behavioral periodicity, communication, chemical and structural defenses, host selection and feeding, reproduction, and insect societies. General biology and introductory entomology are desirable, but not essential.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

ENTM 31100 - Insect Ecology

Credit Hours: 3.00. Insect ecology investigates the fundamental concepts of ecology as they relate to insects, including insect interactions, other insects and their environment. Topics include population and community ecology, plant-insect interactions, insect biodiversity and biogeography, and theoretical and applied ecology. Examples from current entomological and ecological studies are used. Completion of college biology or an introductory course in entomology is recommended.

Learning Outcomes: 1. Comprehend ecological principles at different scales of biological organization, from the individual to the population to the community to the ecosystem. 2. Understand the mechanisms that mediate interactions of insects with their biotic and abiotic environments. 3. Appreciate the importance of insects as stabilizing and destabilizing components of food webs. 4. Recognize the value and application of insect ecology n solving real-world problems. 5. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 3.00

ENTM 33500 - Introduction To Insect Identification

Credit Hours: 4.00. This class is designed for learning more about the collection and identification of adult insects. Emphasis

will be placed on collection and sampling techniques, the preparation of specimens for future study, and identification.

Learning Outcomes: 1. Use keys and other published resources to identify unknown insects to the correct family and by-sight identification. 2. Collect a diversity of insects and related arthropods and to prepare specimens to professional standards. 3. State the scientific names, critical taxonomic characters, natural history and biology, unique or interesting behaviors, ecological role, taxonomic relationships and impacts on human activities of selected families. Credits: 4.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

ENTM 10100 - Insect Biology And Societal Grand Challenges

Credit Hours: 1.00. An introduction to the roles of insect biologists in addressing societal grand challenges.

Learning Outcomes: 1. Appreciate the scope of societal grand challenges. 2. Understand and demonstrate where Insect Biology and grand challenges intersect. 3. Evaluate and critique popular literature and media surrounding these issues. 4. Identify gaps in our current knowledge and understand future needs. Credits: 1.00

ENTM 10200 - The Practice Of Science

Credit Hours: 2.00. A critical examination of science, best practices for conducting science, the contribution of research to knowledge accumulation, and the ethical obligations of scientists.

Learning Outcomes: 1. Understand and practice the fundamental components of conducting scientific investigations (observation, explanation, and investigation). 2. Understand the concept of falsifiable hypotheses and their role in the practice of science. 3. Understand concepts underlying approaches to the quantitative analysis of data. 4. Appreciate the importance of accuracy, precision, and the identification and mitigation of sources of error in data collection and analysis. 5. Understand the ethical expectations of peers, sponsors, and the general public in the practice of science. 6. Understand the distinction between science and pseudoscience, and be able to recognize each. Credits: 2.00

ENTM 25300 - Insect Physiology And Biochemistry

Credit Hours: 4.00. Introductory course in insect cell biology, biochemistry, and physiology including structures and functions of insect internal and external tissues and organs. A year of college biology or equivalent knowledge is expected.

Learning Outcomes: 1. Understand (i) the structure and functions of insect cells, the major internal organ systems of insects, the insect integument, and homeostatic mechanisms; (ii) insect development and reproduction, and their endocrine control; and (iii) the neural mechanisms that underlie the interactions of insects with their environment and coordinated behavior. 2. Understand the physical and chemical principles underpinning animal physiology. 3. Understand the dependence of function on structure in physiology and biochemistry. 4. Acquire familiarity with commonly used experimental procedures for research in insect physiology and biochemistry. Credits: 4.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

ENTM 31200 - Plant-Insect Chemical Ecology

Credit Hours: 3.00. An overview of the structure and function of natural and synthetic chemical products in insect ecology. One year of college biology. One year of college chemistry strongly recommended.

Learning Outcomes: 1. Appreciate the history and scope of chemical ecology as a discipline. 2. Understand the role of chemistry in the biology/ecology of plants and animals. 3. Appreciate how chemical products influence processes at various levels of biological integration - from genes to ecosystems. 4. Evaluate and critique primary literature on chemical ecology. 5. Recognize the application of insect chemical ecology in solving grand challenges in entomology. Credits: 3.00

ENTM 35300 - Insecticides And Environment

Credit Hours: 3.00. Insecticides, their interactions with biological organisms and the environment, regulatory policies, environmental and human health outcomes, and current controversies. A year of college biology and college chemistry or equivalent knowledge is expected.

Learning Outcomes: 1. Communicate to the public about insecticide issues including risk, best practices for management and use. 2. Apply principles of toxicology including dose response, target sites, differential toxicity, and resistance. 3. Evaluate environmental hazards, their management and mitigation. 4. Interpret and implement insecticide label instructions. 5. Explain how Risk Assessment and Management is implemented in the U.S. to protect human health and safety balance economic and environmental risks. Credits: 3.00

ENTM 39300 - Insect Biology Practicum

Credit Hours: 1.00. Imbedded programmatic experiences for undergraduate students in Insect Biology including focused reflection on the knowledge, skills, and values necessary for contributions in the discipline. Permission of instructor required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of Insect Biology. 2. Be able to make relevant connections to their own academic, professional and personal motivations and goals in Insect Biology. 3. Understand procedures and approaches useful for research, teaching and extension in Insect Biology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

ENTM 40100 - Addressing Grand Challenges Through Insect Biology

Credit Hours: 1.00. This course engages students in an examination of societal grand challenges by identifying the problems, understanding the current state of knowledge, identifying knowledge gaps, and implementing possible solutions. Permission of department required.

Learning Outcomes: 1. Explain how the accumulated knowledge and experiences of Insect Biology majors can be applied to address Grand Challenges. 2. Demonstrate where capstone projects and grand challenges intersect. 3. Explain roles insect biologists play in addressing grand challenges, and the relationship to future career options. 4. Demonstrate skills in communication, critical thinking and teamwork. Credits: 1.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate

familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 49310 - Insect Biology Capstone Experience

Credit Hours: 2.00 or 4.00. Insect Biology majors complete a capstone project under the guidance of a faculty mentor. Permission of instructor required.

Learning Outcomes: 1. Conduct a capstone project and analyze and interpret the information generated. Credits: 2.00 or 4.00

ENTM 49390 - Insect Biology Capstone Forum

Credit Hours: 1.00. Students apply their accumulated knowledge to grand challenges and careers in insect biology. Permission of department required.

Learning Outcomes: 1. Demonstrate ability to integrate accumulated knowledge, technical and social skills to identify and solve a problem relevant to Insect Biology. 2. Communicate the results the Capstone mentored research project through oral and written presentations. Credits: 1.00

ENTM 39310 - Insect Biology Practicum II

Credit Hours: 1.00. This course provides imbedded programmatic experiences for undergraduate students. It introduces students to the breadth of the discipline of entomology by engaging them at a programmatic level. This is accomplished by incorporating students into laboratory meetings, research, extension or teaching activities and through discussions with the faculty instructor about the goals and motivations driving their weekly research, extension or teaching activities and how these activities address societal grand challenges. All students enrolled in ENTM 39310 will be required at the end of each of the 8-week sessions and provide a recorded presentation overviewing some aspect of the mentor's program and its linkage to societal grand challenges. Permission of department required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of entomology. 2. Provide students with an opportunity to make relevant connections to their own academic, professional and personal motivations and goals in entomology. 3. Understand procedures and approaches useful for research, teaching and extension in entomology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

ENTM 49320 - Insect Biology Capstone Experience II

Credit Hours: 2.00 to 4.00. This course is an experiential meant to familiarize students with the options and procedures associated with the Entomology capstone experience and provide students with an avenue for fulfilling their capstone requirement by conducting a capstone project. Students may use a research, extension or teaching project to meet this

requirement. Although the capstone project may build on or extend a previously conducted undergraduate research project, independent study, or study abroad, students enrolled in ENTM 49320 must conduct their capstone project in a manner that is independent from any other project for which credit will be awarded or for which they will be paid as an employee. Students may enroll in ENTM 49320 and conduct the capstone project at any time during the last 2 years of study. Permission of department required.

Learning Outcomes: 1. Demonstrate their ability to integrate their accumulated knowledge and technical and social skills in order to identify and solve a problem relevant to Entomology. 2. Conduct a capstone project and analyze or interpret the information generated. Credits: 2.00 to 4.00

Directed Science Selective (3 credits)

Other Departmental /Program Course Requirements (53-60 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11700 - Introduction To Entomology Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Entomology. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal

aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding.

7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721

Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and

trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (14-21credits)

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11700 - Introduction To Entomology Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Entomology. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the

mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the

molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

ENTM 10100 - Insect Biology And Societal Grand Challenges

Credit Hours: 1.00. An introduction to the roles of insect biologists in addressing societal grand challenges.

Learning Outcomes: 1. Appreciate the scope of societal grand challenges. 2. Understand and demonstrate where Insect Biology and grand challenges intersect. 3. Evaluate and critique popular literature and media surrounding these issues. 4. Identify gaps in our current knowledge and understand future needs. Credits: 1.00

ENTM 10200 - The Practice Of Science

Credit Hours: 2.00. A critical examination of science, best practices for conducting science, the contribution of research to knowledge accumulation, and the ethical obligations of scientists.

Learning Outcomes: 1. Understand and practice the fundamental components of conducting scientific investigations (observation, explanation, and investigation). 2. Understand the concept of falsifiable hypotheses and their role in the practice of science. 3. Understand concepts underlying approaches to the quantitative analysis of data. 4. Appreciate the importance of accuracy, precision, and the identification and mitigation of sources of error in data collection and analysis. 5. Understand the ethical expectations of peers, sponsors, and the general public in the practice of science. 6. Understand the distinction between science and pseudoscience, and be able to recognize each. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-17 Credits

Spring 1st Year

ENTM 21000 - Introduction To Insect Behavior (UCC: SCI)

Credit Hours: 3.00. Description and introductory analysis of innate and learned insect behavior, including basic orientations and movements, behavioral periodicity, communication, chemical and structural defenses, host selection and feeding, reproduction, and insect societies. General biology and introductory entomology are desirable, but not essential.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the

experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-18 Credits

Fall 2nd Year

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing.
Credits: 3.00

15 Credits

Spring 2nd Year

ENTM 31100 - Insect Ecology

Credit Hours: 3.00. Insect ecology investigates the fundamental concepts of ecology as they relate to insects, including insect interactions, other insects and their environment. Topics include

population and community ecology, plant-insect interactions, insect biodiversity and biogeography, and theoretical and applied ecology. Examples from current entomological and ecological studies are used. Completion of college biology or an introductory course in entomology is recommended.

Learning Outcomes: 1. Comprehend ecological principles at different scales of biological organization, from the individual to the population to the community to the ecosystem. 2. Understand the mechanisms that mediate interactions of insects with their biotic and abiotic environments. 3. Appreciate the importance of insects as stabilizing and destabilizing components of food webs. 4. Recognize the value and application of insect ecology n solving real-world problems. 5. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 3.00

ENTM 25300 - Insect Physiology And Biochemistry

Credit Hours: 4.00. Introductory course in insect cell biology, biochemistry, and physiology including structures and functions of insect internal and external tissues and organs. A year of college biology or equivalent knowledge is expected.

Learning Outcomes: 1. Understand (i) the structure and functions of insect cells, the major internal organ systems of insects, the insect integument, and homeostatic mechanisms; (ii) insect development and reproduction, and their endocrine control; and (iii) the neural mechanisms that underlie the interactions of insects with their environment and coordinated behavior. 2. Understand the physical and chemical principles underpinning animal physiology. 3. Understand the dependence of function on structure in physiology and biochemistry. 4. Acquire familiarity with commonly used experimental procedures for research in insect physiology and biochemistry. Credits: 4.00

16 Credits

Fall 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan

and perform an experiment. Credits: 1.00

ENTM 33500 - Introduction To Insect Identification

Credit Hours: 4.00. This class is designed for learning more about the collection and identification of adult insects. Emphasis will be placed on collection and sampling techniques, the preparation of specimens for future study, and identification.

Learning Outcomes: 1. Use keys and other published resources to identify unknown insects to the correct family and by-sight identification. 2. Collect a diversity of insects and related arthropods and to prepare specimens to professional standards. 3. State the scientific names, critical taxonomic characters, natural history and biology, unique or interesting behaviors, ecological role, taxonomic relationships and impacts on human activities of selected families. Credits: 4.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

ENTM 39300 - Insect Biology Practicum

Credit Hours: 1.00. Imbedded programmatic experiences for undergraduate students in Insect Biology including focused reflection on the knowledge, skills, and values necessary for contributions in the discipline. Permission of instructor required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of Insect Biology. 2. Be able to make relevant connections to their own academic, professional and personal motivations and goals in Insect Biology. 3. Understand procedures and approaches useful for research, teaching and extension in Insect Biology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

13-15 Credits

Spring 3rd Year

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

ENTM 31200 - Plant-Insect Chemical Ecology

Credit Hours: 3.00. An overview of the structure and function of natural and synthetic chemical products in insect ecology. One year of college biology. One year of college chemistry strongly recommended.

Learning Outcomes: 1. Appreciate the history and scope of chemical ecology as a discipline. 2. Understand the role of chemistry in the biology/ecology of plants and animals. 3. Appreciate how chemical products influence processes at various levels of biological integration - from genes to ecosystems. 4. Evaluate and critique primary literature on chemical ecology. 5. Recognize the application of insect chemical ecology in solving grand challenges in entomology. Credits: 3.00

ENTM 35300 - Insecticides And Environment

Credit Hours: 3.00. Insecticides, their interactions with biological organisms and the environment, regulatory policies, environmental and human health outcomes, and current controversies. A year of college biology and college chemistry or equivalent knowledge is expected.

Learning Outcomes: 1. Communicate to the public about insecticide issues including risk, best practices for management and use. 2. Apply principles of toxicology including dose response, target sites, differential toxicity, and resistance. 3. Evaluate environmental hazards, their management and mitigation. 4. Interpret and implement insecticide label instructions. 5. Explain how Risk Assessment and Management is implemented in the U.S. to protect human health and safety balance economic and environmental risks. Credits: 3.00

ENTM 39310 - Insect Biology Practicum II

Credit Hours: 1.00. This course provides imbedded programmatic experiences for undergraduate students. It introduces students to the breadth of the discipline of entomology by engaging them at a programmatic level. This is accomplished by incorporating students into laboratory meetings, research, extension or teaching activities and through discussions with the faculty instructor about the goals and motivations driving their weekly research, extension or teaching activities and how these activities address societal grand challenges. All students enrolled in ENTM 39310 will be required at the end of each of the 8-week sessions and provide a recorded presentation overviewing some aspect of the mentor's program and its linkage to societal grand challenges. Permission of department required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of entomology. 2. Provide students with an opportunity to make relevant connections to their own academic, professional and personal motivations and goals in entomology. 3. Understand procedures and approaches useful for research, teaching and extension in entomology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

15-16 Credits

Fall 4th Year

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species

associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 49310 - Insect Biology Capstone Experience

Credit Hours: 2.00 or 4.00. Insect Biology majors complete a capstone project under the guidance of a faculty mentor. Permission of instructor required.

Learning Outcomes: 1. Conduct a capstone project and analyze and interpret the information generated. Credits: 2.00 or 4.00

12-13 Credits

Spring 4th Year

ENTM 40100 - Addressing Grand Challenges Through Insect Biology

Credit Hours: 1.00. This course engages students in an examination of societal grand challenges by identifying the problems, understanding the current state of knowledge, identifying knowledge gaps, and implementing possible solutions. Permission of department required.

Learning Outcomes: 1. Explain how the accumulated knowledge and experiences of Insect Biology majors can be applied to address Grand Challenges. 2. Demonstrate where capstone projects and grand challenges intersect. 3. Explain roles insect biologists play in addressing grand challenges, and the relationship to future career options. 4. Demonstrate skills in communication, critical thinking and teamwork. Credits: 1.00

ENTM 49390 - Insect Biology Capstone Forum

Credit Hours: 1.00. Students apply their accumulated knowledge to grand challenges and careers in insect biology. Permission of department required.

Learning Outcomes: 1. Demonstrate ability to integrate accumulated knowledge, technical and social skills to identify and solve a problem relevant to Insect Biology. 2. Communicate the results the Capstone mentored research project through oral and written presentations. Credits: 1.00

ENTM 49320 - Insect Biology Capstone Experience II

Credit Hours: 2.00 to 4.00. This course is an experiential meant to familiarize students with the options and procedures associated with the Entomology capstone experience and provide students with an avenue for fulfilling their capstone requirement by conducting a capstone project. Students may use a research, extension or teaching project to meet this requirement. Although the capstone project may build on or extend a previously conducted undergraduate research project, independent study, or study abroad, students enrolled in ENTM 49320 must conduct their capstone project in a manner that is independent from any other project for which credit will be awarded or for which they will be paid as an employee. Students may enroll in ENTM 49320 and conduct the capstone project at any time during the last 2 years of study. Permission of department required.

Learning Outcomes: 1. Demonstrate their ability to integrate their accumulated knowledge and technical and social skills in order to identify and solve a problem relevant to Entomology. 2. Conduct a capstone project and analyze or interpret the information generated. Credits: 2.00 to 4.00

12-17 Credits

Integrated Business & Engineering, BS

About the Program

Degree Requirements

Department/Program Major Courses (85 credits)

Business Courses (46 credits)

Business Core Courses (37 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock

and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and

persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 49200 - Intellectual Property Management

Credit Hours: 2.00. Intellectual property (IP) has become a strategic opportunity for creating value for the firm. Firms are tasked with understanding how to utilize intellectual property as a competitive advantage in multiple market contexts. In the current economic environment, intellectual assets can be the largest portion of a firm's total wealth. Strategic management of these assets is very critical. Managing intellectual property is about transforming a firm's ideas, know-how, etc., into learning, products, and ultimately cash flow. In Managing Intellectual Property, we examine this topic by viewing intellectual property as both a legal asset (property ownership) and business asset (value-adding). The focus of Managing Intellectual Property is on the integration of IP generation, IP protection, and strategizing functions of the firm in creating value with an IP portfolio. Concepts and frameworks discussed/developed in lecture are exercised in case studies from multiple contexts.

Learning Outcomes: 1. Understand key elements in intellectual property management. 2. Aware of the different types/forms of intellectual property. 3. Understand how the difference in the types of intellectual property provides strategic opportunities. 4. Confidence in your own abilities to manage intellectual property. 5. Aware of the role of multiple functions in creating an intellectual property portfolio (e.g. R&D, Marketing, Legal, Merger & Acquisition, Business Development, Human Resources, Finance). Credits: 2.00

MGMT 49300 - Storytelling With Data

Credit Hours: 2.00. Business students are trained to be experts in turning data into information. With a strong focus on data visualization, the purpose of this course (Storytelling with Data) is to help students take the next step: Turning that information into action. This course will provide you with helpful frameworks for understanding your audience, insights about how people perceive information best, and effective skills to express your ideas in ways that connect.

Learning Outcomes: 1. Understand the importance of communication context, elements of good storytelling, and basic principles of human information processing as related to data visualization. 2. Apply this understanding to the communication of complex (i.e., data-driven) information. 3. Analyze data visualization design choices. 4. Evaluate the effectiveness of data communication. 5. Create a compelling story using data with the tools and skills taught in this course. Credits: 2.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

MGMT 29150 - IBE Professional Development

Credit Hours: 0.00. This course is meant to promote meaningful reflection on multiple experiential learning opportunities offered to IBE cohort members as 2nd Year/Sophomores & 3rd Year/Juniors. The course will be required each semester during the 2nd and 3rd Years of the IBE program cohort experience. Assignments will include a reflection quiz or paper based on each event experience. Students will be required to complete at a minimum, 3 experiential learning experiences and corresponding reflections. All questions for surveys will be available on the Brightspace page.

Learning Outcomes: 1. Reflect upon learning experiences that allow you to connect these opportunities in an academic, professional, and social context. 2. Determine how curricular, co-curricular, and industry-based experiences affect your goals and professional development. Credits: 0.00

Business Method Selectives (6 credits)

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

Business Depth Selective (3 credits)

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations

of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

MGMT 44810 - Technology Strategy

Credit Hours: 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage.

Learning Outcomes: 1. Improve ability to assess technology and innovation from a competitive perspective. 2. Learn about disruptive innovation and its effects on incumbents and new firms. 3. Consider internal processes for innovation management in existing firms. 4. Improve decision-making and skills with respect to technology and innovation. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets

the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

MGMT 48800 - Data-Driven Decisions In Digital Markets

Credit Hours: 3.00. This course analyzes the changes in business models that have been enabled by Internet technologies, and exposes students to hands-on data analyses to quantify the impact these technologies and business models have on firms, economies, and people. A programming course such as MGMT 28800 Programming for Business Applications or MGMT 38800 Python for Business or CS 17600 Data Engineering in Python or CS 17700 Programming with Multimedia Objects or CNIT 17500 Visual Programming or CS 18000 Problem Solving & Object Oriented Programming and a statistics course such as STAT 30301 Probability & Statistics for Business or MGMT 30500 Business Statistics is highly recommended.

Learning Outcomes: 1. Recognize the role of business models and data-driven decisions in digital markets. 2. Measure, evaluate, and improve online technology usage, advertisement campaigns, and product pricing to meet specific business objective like better serving customers, customer acquisition, quantifying network effects, etc. 3. Analyze the

sheer amount of data ("traces") collected by businesses from different touch points - Google Glass, Apple Watch, smart phones, or simple computing devices - and make critical business decisions. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants (i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

Engineering Courses (16 credits)

Engineering Required Courses (7 credits)

EPCS 12100 - First Year Participation In EPICS II (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and educational organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project for two or more semesters. First-year students participating in EPICS gain insight into the specific project, and more generally, into the design and development process. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Ability to apply material from their discipline to the design of community-based projects. 2. Understanding of design as a start-to-finish process. 3. Ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Awareness of the customer. 5. Ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Ability to communicate effectively with audiences with widely-varying backgrounds. 7. Awareness of professional ethics and responsibility. 8. Appreciation of the role that their discipline can play in social contexts. Credits: 1.00

EPCS 11100 - First Year Participation In EPICS I (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one-year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding

of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

VIP 17911 - First Year Participation In Vertically Integrated Projects (VIP) I (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17912 - First Year Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze

and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

ENGR 13300 - Transforming Ideas To Innovation, EPICS/VIP (UCC: IL)

Credit Hours: 2.00. Introduces students to the engineering professions using multidisciplinary, societally relevant content. Students will develop engineering approaches to systems, generate and explore creative ideas, and use quantitative methods to support design decisions. Students will experience the process of design and analysis in engineering including how to work effectively in teams, and will develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB). An emphasis will be placed on computing logic development and builds upon the co-requisite experience of the students in the EPICS class.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Examine and analyze career information from various resources to make informed decisions about which engineering discipline to pursue. 2. Develop metacognitive skills in evaluating own teamwork and leadership abilities, recognizing how own behavior impact the whole team, and make team process adjustments when necessary. 3. Explain critical and diverse use of modeling in engineering to understand problems, represent solutions, compare alternatives, make predications, etc. 4. Use multiple models, estimation, and logic to triangulate and evaluate information coming from various data sources. 5. Collect, analyze, and represent data to make informative explanations and persuasive arguments. 6. Develop a logical problem solving process which includes sequential structures, conditional structures, and repetition structures for fundamental engineering problems. 7. Solve fundamental engineering problems using computer tools. 8. Perform basic file management tasks using an appropriate computer tool. 9. Work effectively and ethically as a member of a technical team. 10. Develop a work ethic appropriate for the engineering profession. 11. Reflect on personal and team performance to achieve continuous improvement. Credits: 2.00

Engineering IBE Core Selectives - Choose Two: (6 credits)

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4.

Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for

this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

NUCL 30000 - Nuclear Structure And Radiation Interactions

Credit Hours: 3.00. Review of atomic properties and introduction to nuclear models. Discussion of radioactive decay and the interaction of nuclear radiation and reaction products with matter. Energetics and cross-sections of nuclear reactions with applications to problems typical of nuclear engineering.

Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

Engineering Selectives - Choose One: (3 credits)

IE 47200 - Imagine, Model, Make

Credit Hours: 3.00. This course develops a holistic view of an initial competency in engineering design by conceiving, designing, manufacturing, and optimizing a system component such as a complex structural part. Activities include hand sketching, CAD modeling, and operation of CNC machining equipment for rapid prototyping. Tolerance requirements will be verified and optimized prior to the fabrication of the part in the laboratory using rapid prototyping techniques. The focus is on the design process itself as well as the complementary roles of human creativity and computational methods and tools.

Learning Outcomes: 1. Create any object using

3D CAD design software (modeling, texturing, and animation). 2. Evaluate and optimize 3D designs for different manufacturing processes and materials. 3. Apply the principles of engineering tolerance to 3D CAD design. 4. Use rapid prototyping techniques (laser cutting, laser engraving, injection molding, and 3D printing) to manufacture 3D CAD designs. Credits: 3.00

SYS 30000 - It's A Complex World - Addressing Global Challenges (UCC: STS)

Credit Hours: 3.00. The main goal of this course is to address grand challenges that are of global concern - such as environmental sustainability and energy use, natural and human disasters, and political and economic development - using the ideas and tools of complex adaptive systems. The course exploits the broad expertise of the four faculty members by treating these challenges from diverse disciplinary perspectives, from the biological and physical sciences, to the social sciences, to engineering. By way of a set of case studies, students will analyze the features of these challenges which make them complex, and seek to explain and find solutions to the problems that arise in each case. Their treatment of the cases will be informed by published research and computer simulation. Students will actively participate in discussions regarding these global challenges, and contribute to the progress of the class using oral and written presentations. The course will culminate with a final project completed by teams composed of students from different disciplines.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe global challenges using engineering, biological, physical, and social scientific perspectives, including attention to the interdependence of the different perspectives. 2. Explain the fundamental concepts of 'complex adaptive systems, ' including applications to different global challenges. 3. Develop basic proficiency in applying computer modeling to represent the behavior of complex systems, with applications to the global challenges. 4. Apply the concepts and tools of complexity research to develop a group-based proposal of comprehensive policies/solutions/strategies in a new and unresolved problem area. Credits: 3.00

SYS 35000 - Systems Methods

Credit Hours: 3.00. Introduction to modeling tools and methods for understanding and designing systems. Topics include: defining the problem; defining and validating stakeholders' needs; system modeling and types of models; defining and modeling system behavior; defining and modeling functional, physical and allocated system architectures; and evaluating and modeling the tradeoffs between alternative system designs.

Learning Outcomes: 1. Emphasize patterns of systems thinking. 2. Introduce systems modeling and design processes and methods. 3. Introduce model-based systems analysis and design. 4. Provide practice in using model-based systems tools. Credits: 3.00

Seminar & Innovation Lab Selectives (11 credits)

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts.

Credits: 2.00

VIP 37920 - Junior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

MGMT 49400 - IBE Capstone

Credit Hours: 3.00. The objective of the IBE Capstone course is to provide students with the opportunity to apply and integrate what they have learned from prior courses in "Real World" settings. There are no traditional classes. Rather, students will work in self-managed teams of 5-6 on projects that have both business and engineering elements with the support of a mentor; in many cases the mentor will be from a sponsoring company. The role of the company mentor is to provide advice and guidance to the student team as well as to expose the students to the approaches and processes used in industrial and commercial organizations. The course instructors will also meet with the student teams on a weekly basis to assess progress and provide guidance. Possible options for the projects include: 'Product Design' and 'Business Solution'. The Product Design projects would be focused on the marketing, technical, and economic feasibility of a new product concept. The Business Solution projects would be focused on technical issues in a business context and developing solutions to a "real world" problem presented by a sponsoring company. Examples of these projects might include use of 3-D printing for spare and replacement parts or incorporation of autonomous transportation into a company's operations and supply chain.

Learning Outcomes: 1. Exhibit integrity, accept responsibility, take initiative, and provide leadership necessary to ensure project success. 2. Produce product designs or business solutions that meet important performance requirements while satisfying relevant societal, legal/regulatory, and professional constraints. 3. Establish relationships and implement practices with team members, advisors, and other stakeholders that support high performance and continuous improvement. 4. Plan, monitor, and manage project schedule, resources, and work assignments to ensure successful project completion. 5. Utilize and synthesize prior

knowledge, independent research, published information, and original ideas in addressing problems and generating solutions. 6. Make decisions based on customer and user needs, product design or business solution requirements, resource availability, and associated risks. 7. Demonstrate effective use of contemporary tools for engineering and business analysis. 8. Test and defend performance of a product design or business solution with respect to key requirements. 9. Use formal and informal communications with team, advisor, and other stakeholders to document and facilitate progress and to enhance impact of design products. Credits: 3.00

MGMT 29110 - Integrated Business & Engineering Seminar I

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 29120 - Integrated Business & Engineering Seminar II

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 29130 - Integrated Business & Engineering Seminar III

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 29140 - Integrated Business & Engineering Seminar IV

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of

seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

Specialty Areas - Choose One (12 credits)

A. Data Analytics Concentration

B. Financial Engineering Area

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 41250 - Fixed Income Securities

Credit Hours: 3.00. This course includes examination of fixed income securities institutions that invest, roles in institution, portfolios and math associated with assessing characteristics of fixed income securities.

Learning Outcomes: 1. Examine management of fixed income securities. 2. Examine portfolios and risk management strategies. 3. Demonstrate use of simulation models for risk assessment. Credits: 3.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

MGMT 41650 - Financial Engineering

Credit Hours: 3.00. The objective of this course is to develop necessary skills to value and hedge a wide variety of derivative contracts traded in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous time. Some basic knowledge of stochastic processes would be helpful, but not essential: what needed will be covered in class. The analytic valuation and hedging of derivatives using the modern martingale methods will be the main focus of the course. Applications will include forwards, futures, and options on stocks, bonds and foreign currencies. The numerical methods such as parameter estimation, Monte Carlo simulations, discretization schemes as well as the conditional volatility estimation techniques will also be addressed. In addition to the valuation and hedging derivatives, course also covers Value-at-Risk, credit risk, modeling the term structure of interest rates and the construction of the VIX index using the S&P 500 index options obtained from the IvyDB OptionMetric database.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Outline and design new financial derivatives. 3. Develop the VIX index using options data. Credits: 3.00

C. Operations & Supply Chain Management Concentration

D. Student Designed Specialty Area

Other Departmental/Program Course Requirements (32-38 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through

reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of

revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate

them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences

and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in

lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (0-3 credits)

Optional Concentrations for Integrated Business & Engineering, BS

Sample 4-Year Plan

Fall 1st Year

EPCS 11100 - First Year Participation In EPICS I (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one-year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An

appreciation of the role that their discipline can play in social contexts. Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount

the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

VIP 17911 - First Year Participation In Vertically Integrated Projects (VIP) I (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

MGMT 29110 - Integrated Business & Engineering Seminar I

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

ENGR 13300 - Transforming Ideas To Innovation, EPICS/VIP (UCC: IL)

Credit Hours: 2.00. Introduces students to the engineering professions using multidisciplinary, societally relevant content. Students will develop engineering approaches to systems, generate and explore creative ideas, and use quantitative methods to support design decisions. Students will experience

the process of design and analysis in engineering including how to work effectively in teams, and will develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB). An emphasis will be placed on computing logic development and builds upon the co-requisite experience of the students in the EPICS class.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Examine and analyze career information from various resources to make informed decisions about which engineering discipline to pursue. 2. Develop metacognitive skills in evaluating own teamwork and leadership abilities, recognizing how own behavior impact the whole team, and make team process adjustments when necessary. 3. Explain critical and diverse use of modeling in engineering to understand problems, represent solutions, compare alternatives, make predications, etc. 4. Use multiple models, estimation, and logic to triangulate and evaluate information coming from various data sources. 5. Collect, analyze, and represent data to make informative explanations and persuasive arguments. 6. Develop a logical problem solving process which includes sequential structures, conditional structures, and repetition structures for fundamental engineering problems. 7. Solve fundamental engineering problems using computer tools. 8. Perform basic file management tasks using an appropriate computer tool. 9. Work effectively and ethically as a member of a technical team. 10. Develop a work ethic appropriate for the engineering profession. 11. Reflect on personal and team performance to achieve continuous improvement. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-18 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

EPCS 12100 - First Year Participation In EPICS II (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and educational organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project for two or more semesters. First-year students participating in EPICS gain insight into the specific project, and more generally, into the design and development process. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Ability to apply material from their discipline to the design of community-

based projects. 2. Understanding of design as a start-to-finish process. 3. Ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Awareness of the customer. 5. Ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Ability to communicate effectively with audiences with widely-varying backgrounds. 7. Awareness of professional ethics and responsibility. 8. Appreciation of the role that their discipline can play in social contexts. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe

Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

VIP 17912 - First Year Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising

from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

15-16 Credits

Fall 2nd Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for

lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the

topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 29120 - Integrated Business & Engineering Seminar II

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 29150 - IBE Professional Development

Credit Hours: 0.00. This course is meant to promote meaningful reflection on multiple experiential learning opportunities offered to IBE cohort members as 2nd Year/Sophomores & 3rd Year/Juniors. The course will be required each semester during the 2nd and 3rd Years of the IBE program cohort experience. Assignments will include a reflection quiz or paper based on each event experience. Students will be required to complete at a minimum, 3 experiential learning experiences and corresponding reflections. All questions for surveys will be available on the Brightspace page.

Learning Outcomes: 1. Reflect upon learning experiences that allow you to connect these opportunities in an academic, professional, and social context. 2. Determine how curricular, co-curricular, and industry-based experiences affect your goals and professional development. Credits: 0.00

17-18 Credits

Spring 2nd Year

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding

of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 29130 - Integrated Business & Engineering Seminar III

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

MGMT 29150 - IBE Professional Development

Credit Hours: 0.00. This course is meant to promote meaningful reflection on multiple experiential learning opportunities offered to IBE cohort members as 2nd Year/Sophomores & 3rd Year/Juniors. The course will be required each semester during the 2nd and 3rd Years of the IBE program cohort experience. Assignments will include a reflection quiz or paper based on each event experience. Students will be required to complete at a minimum, 3 experiential learning experiences and corresponding reflections. All questions for surveys will be available on the Brightspace page.

Learning Outcomes: 1. Reflect upon learning experiences that allow you to connect these opportunities in an academic, professional, and social context. 2. Determine how curricular, co-curricular, and industry-based experiences affect your goals and professional development. Credits: 0.00

16 Credits

Fall 3rd Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 49200 - Intellectual Property Management

Credit Hours: 2.00. Intellectual property (IP) has become a strategic opportunity for creating value for the firm. Firms are tasked with understanding how to utilize intellectual property as a competitive advantage in multiple market contexts. In the current economic environment, intellectual assets can be the largest portion of a firm's total wealth. Strategic management of these assets is very critical. Managing intellectual property is about transforming a firm's ideas, know-how, etc., into learning, products, and ultimately cash flow. In Managing Intellectual Property, we examine this topic by viewing intellectual property as both a legal asset (property ownership) and business asset (value-adding). The focus of Managing Intellectual Property is on the integration of IP generation, IP protection, and strategizing functions of the firm in creating value with an IP portfolio. Concepts and frameworks discussed/developed in lecture are exercised in case studies from multiple contexts.

Learning Outcomes: 1. Understand key elements in intellectual property management. 2. Aware of the different types/forms of intellectual property. 3. Understand how the difference in the types of intellectual property provides strategic opportunities. 4. Confidence in your own abilities to manage intellectual property. 5. Aware of the role of multiple functions in creating an intellectual property portfolio (e.g. R&D, Marketing, Legal, Merger & Acquisition, Business Development, Human Resources, Finance). Credits: 2.00

MGMT 29150 - IBE Professional Development

Credit Hours: 0.00. This course is meant to promote meaningful reflection on multiple experiential learning opportunities offered to IBE cohort members as 2nd Year/Sophomores & 3rd Year/Juniors. The course will be required each semester during the 2nd and 3rd Years of the IBE program cohort experience. Assignments will include a reflection quiz or paper based on each event experience. Students will be required to complete at a minimum, 3 experiential learning experiences and corresponding reflections. All questions for surveys will be available on the Brightspace page.

Learning Outcomes: 1. Reflect upon learning experiences that allow you to connect these opportunities in an academic, professional, and social context. 2. Determine how curricular, co-curricular, and industry-based experiences affect your goals and professional development. Credits: 0.00

13 Credits

Spring 3rd Year

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that

information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 29150 - IBE Professional Development

Credit Hours: 0.00. This course is meant to promote meaningful reflection on multiple experiential learning opportunities offered to IBE cohort members as 2nd Year/Sophomores & 3rd Year/Juniors. The course will be required each semester during the 2nd and 3rd Years of the IBE program cohort experience. Assignments will include a reflection quiz or paper based on each event experience. Students will be required to complete at a minimum, 3 experiential learning experiences and corresponding reflections. All questions for surveys will be available on the Brightspace page.

Learning Outcomes: 1. Reflect upon learning experiences that allow you to connect these opportunities in an academic, professional, and social context. 2. Determine how curricular, co-curricular, and industry-based experiences affect your goals and professional development. Credits: 0.00

14 Credits

Fall 4th Year

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 49300 - Storytelling With Data

Credit Hours: 2.00. Business students are trained to be experts in turning data into information. With a strong focus on data visualization, the purpose of this course (Storytelling with Data) is to help students take the next step: Turning that information into action. This course will provide you with helpful frameworks for understanding your audience, insights about how people perceive information best, and effective skills to express your ideas in ways that connect.

Learning Outcomes: 1. Understand the importance of communication context, elements of good storytelling, and basic principles of human information processing as related to data visualization. 2. Apply this understanding to the communication of complex (i.e., data-driven) information. 3. Analyze data visualization design choices. 4. Evaluate the effectiveness of data communication. 5. Create a compelling story using data with the tools and skills taught in this course. Credits: 2.00

MGMT 29140 - Integrated Business & Engineering Seminar IV

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation. Credits: 1.00

15-16 Credits

Spring 4th Year

MGMT 49400 - IBE Capstone

Credit Hours: 3.00. The objective of the IBE Capstone course is to provide students with the opportunity to apply and integrate what they have learned from prior courses in "Real World" settings. There are no traditional classes. Rather, students will work in self-managed teams of 5-6 on projects that have both business and engineering elements with the support of a mentor; in many cases the mentor will be from a sponsoring company. The role of the company mentor is to provide advice and guidance to the student team as well as to expose the students to the approaches and processes used in industrial and commercial organizations. The course instructors will also meet with the student teams on a weekly basis to assess progress and provide guidance. Possible options for the projects include: 'Product Design' and 'Business Solution'. The Product Design projects would be focused on the marketing, technical, and economic feasibility of a new product concept. The Business Solution projects would be focused on technical issues in a business context and developing solutions to a "real world" problem presented by a sponsoring company. Examples of these projects might include use of 3-D printing for spare and replacement parts or incorporation of autonomous transportation into a company's operations and supply chain.

Learning Outcomes: 1. Exhibit integrity, accept responsibility, take initiative, and provide leadership necessary to ensure project success. 2. Produce product designs or business solutions that meet important performance requirements while satisfying relevant societal, legal/regulatory, and professional constraints. 3. Establish relationships and implement practices with team members, advisors, and other stakeholders that support high performance and continuous improvement. 4. Plan, monitor, and manage project schedule, resources, and work assignments to ensure successful project completion. 5. Utilize and synthesize prior knowledge, independent research, published information, and original ideas in addressing problems and generating solutions. 6. Make decisions based on customer and user needs, product design or business solution requirements, resource availability, and associated risks. 7. Demonstrate effective use of contemporary tools for engineering and business analysis. 8. Test and defend performance of a product design or business solution with respect to key requirements. 9. Use formal and informal communications with team, advisor, and other stakeholders to document and facilitate progress and to enhance impact of design products. Credits: 3.00

12 Credits

Integrated Studio Arts, BFA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (78 credits)

A. Art & Design Core (15 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

B. Integrated Studio Arts Core (18 credits)

2D Extended Media

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be

able to discuss art in an educated manner. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

Craft & Material Studies

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the

technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

Art, Culture, & Technology

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3.

Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 32600 - Physical Computing

Credit Hours: 3.00. Introduction to electronics and computer vision for artists. Students learn to create expressive audiovisual systems that can respond to events in the physical world (movement, light/temperature change, sound, touch, etc.) through custom interfaces.

Learning Outcomes: 1. Analyze key ideas in the field of Physical Computing by preparing a research presentation on the practice of an individual artist or collective. 2. Critique their own creative work as well as the work of their peers through group discussions. 3. Produce a variety of interactive artworks by the creative use of the Arduino microcontroller, simple electronic circuitry, and coding techniques. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

2D Extended Media

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic

design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

C. Art History and Cultural Context (12 credits)

Required Course

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

Selective Courses

AMST 30100 - Perspectives On America

Credit Hours: 3.00. Advanced interdisciplinary study of American culture, history, and society in their national and global contexts.

Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 25100 - History Of Photography I (UCC: HUM)

Credit Hours: 3.00. An introduction of the history of photography from the medium's inception until 1950. Emphasis is placed on understanding photographs from a variety of aesthetic, social, and cultural perspectives, including those of race, class, and gender.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view

them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 33900 - Women Artists (UCC: BSS)

Credit Hours: 3.00. A critical overview of the lives, works, and experiences of women artists from the late 19th century to the present, examining the social and cultural challenges they faced, and reflecting on the changing roles women have played in art and society.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks and artists. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about women artists and women art by contextualizing and analyzing them and selecting artworks to illustrate your comments. 4. Apply the knowledge they will have acquired to analyze and write about artworks we would not have studied in class. Credits: 3.00

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of

major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

AD 39100 - History Of Chinese Art

Credit Hours: 3.00. A historical survey of the visual arts and architecture of China from antiquity to the present. Emphasis

will be placed on the relation of a broad range of art forms to their social and cultural contexts.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Build knowledge and understanding of Chinese art. 6. Develop analytical and writing skills through textural studies of primary and secondary sources, as well as writing exercises.

Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use.

Credits: 3.00

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

AD 45400 - Modern Architecture

Credit Hours: 3.00. A study of nineteenth- and twentieth-century architecture.

Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas.

Credits: 3.00

AD 34300 - Northern Renaissance Art

Credit Hours: 3.00. The development of a mature North European art originating in the International Gothic tradition and culminating in the works of Albrecht Durer, Jerome Bosch, and Pieter Bruegel, the Elder.

Learning Outcomes: 1. Be familiar with the history of the period in general and with major artists in particular. 2. Show the ability to read and think critically about a work of art, to look carefully at a work and to discuss what he or she is seeing. 3. Be able to describe clearly a work of art and to compare it to other works and artists of the period. 4. Be able to write an explanation of how a work of art illustrates a particular theme or idea in clear and understandable prose with correct spelling and punctuation in paragraphs that lead logically from one to another. 5. Show the ability to follow instructions and pay attention to detail in the

preparation and presentation of research citing sources accurately. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

Required Course

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

D. Integrated Studio Arts Sophomore Portfolio Review (required, no credit)

E. Integrated Studio Arts Focus (21 credits)

F. Integrated Studio Arts Selectives (9 credits)

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be

able to discuss art in an educated manner. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

G. BFA Exhibition (3 credits)

AD 49900 - Studio Arts Professional Practice/Senior Exhibition

Credit Hours: 3.00. Study of professional practice in the contemporary art world: ethics, gallery, exhibition, studio practice, writing, visual documentation, and business of art. Seniors meet throughout spring semester to organize, install, and de-install Fine Arts Senior Exhibition.

Learning Outcomes: 1. Develop a professional artist statement and resume. 2. Identify and discuss trends in contemporary professional art practices. 3. Design a digital art portfolio. 4. Demonstrate skills necessary to organize and install art exhibitions. Credits: 3.00

A. Art & Design Core (15 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce

concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

Electives (14-23 credits)

GPA Requirements

Supplemental List

Additional Information

Sample 4-Year Plan

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in

a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new

technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

15 Credits

15 Credits

Spring 2nd Year

15 Credits

15 Credits

Fall 3rd Year

18 Credits

18 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

18 Credits

18 Credits

Spring 4th Year

AD 49900 - Studio Arts Professional Practice/Senior Exhibition

Credit Hours: 3.00. Study of professional practice in the contemporary art world: ethics, gallery, exhibition, studio practice, writing, visual documentation, and business of art. Seniors meet throughout spring semester to organize, install, and de-install Fine Arts Senior Exhibition.

Learning Outcomes: 1. Develop a professional

artist statement and resume. 2. Identify and discuss trends in contemporary professional art practices. 3. Design a digital art portfolio. 4. Demonstrate skills necessary to organize and install art exhibitions. Credits: 3.00

15 Credits

15 Credits

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

15-16 Credits

15-16 Credits

About the Program

Interdisciplinary Engineering Studies/Engineering Science Studies Concentration, BS

About the Program

Degree Requirements

Engineering Science Studies Concentration (52-53 credits)

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as

manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

Sample Interdisciplinary Engineering Studies Plan of Study

Fall 2nd Year

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16-17 Credits

Spring 2nd Year

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret

regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

15-18 Credits

Spring 4th Year

15 Credits

Interdisciplinary Engineering Studies/Pre-Medical Engineering Studies Concentration, BS

About the Program

Degree Requirements

Pre-Med Concentration (52 credits)

Engineering Electives (20 credits)

Area Electives (32 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PHSC 20800 - Biochemistry For Pharmaceutical Sciences

Credit Hours: 3.00. The overall objectives of this course are to increase students' biomedical understanding and knowledge and their ability to apply that understanding and knowledge. This requires the students in this course to learn and understand the facts, concepts, and formulaic processes, and to become skilled at applying what they have learned.

Learning Outcomes: 1. The student must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries: a. Basic principles of thermodynamics and kinetics and their role in defining chemical processes. b. The relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students

demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function,

molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students

demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal,

and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 39600 - Premedical Planning Seminar

Credit Hours: 0.00. This course is designed for sophomore and junior students who are planning to attend medical school. The course offers information and advice on the MCAT, the application process, the personal statement, the interview, and letters of recommendation. Students in the course will also formulate an alternative career plan. The course meets the first 10 weeks of the semester.

Credits: 0.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through

processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms

by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

Career Description

Developing an IDES degree pathway to become a physician

Preparation

Sample Interdisciplinary Engineering Studies Plan of Study

Fall 2nd Year

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

16 Credits

Spring 2nd Year

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving

first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate

the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

15 Credits

Spring 4th Year

15 Credits

Interdisciplinary Performance, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (45-46 credits)

A. Foundation Studies (23-24 credits)

1. Foundation Courses (12 credits)

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic

scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

DANC 30000 - Performance Production

Credit Hours: 3.00. This course teaches many aspects of producing a performance, from backstage to onstage. Students will learn the technical aspects of creating a professional performance by both observing performance production and developing an actual performance, which this semester is the Xperimental 2024 Concert. Students may participate in the production in a variety of active roles; however, they will be exposed to all aspects through observation, participation, and discussion. Production roles include: director and assistant director, choreographer, performer, lighting design and staging, sound design and technical support, and stage crew (stage manager, house manager, ticket manager, setup and strike support). Occasional class sessions cover skills to enhance your knowledge of some areas of production such as sound design, and lighting technology. For many students who are at the university level, the art of performance is defined almost totally by the act of being on stage performing, in studios or on stages. This course is designed to invite students to learn about all the activities that are done behind the scenes in order for live performances to be presented to an audience. We will discuss what is involved in both large institutional performance spaces, and compare this to our university performance. Then we will discuss what this scenario looks like for performance professionals after college. This course will greatly enhance students' ability to produce their own events in the future, and develop greater appreciation for the collaborative nature of live performance as art form.

Learning Outcomes: 1. Plan and create a small live performance production. 2. Identify the necessary components of a production of a professional performance and explain the key collaborative interactions among them. 3. Practice basic skills for working performers and producers including those relating to technology and business. Credits: 3.00

DANC 26000 - Dance Improvisation

Credit Hours: 3.00. In this course students explore a variety of techniques for creating movement. While physically researching concepts from a broad spectrum of improvisational artists, students expand their boundaries and definitions of dance, art and creativity. Important concepts include choice making, moving from internal motivations, and ensemble collaboration. All backgrounds in dance and movement are welcome, and will benefit from this course.

Learning Outcomes: 1. Demonstrate multiple approaches to create unique dance movement spontaneously. 2. Formulate and participate in improvised solo and group dance performances. 3. Generate qualities of movement and elements of dance composition through improvisation. 4. Evaluate the many critical roles of improvisation in the art of dance. Credits: 3.00

2. Foundation Selectives (11-12 credits)

Performance

DANC 10100 - Modern Dance Technique I

Credit Hours: 2.00. An introduction to the techniques and principles of modern dance.

Learning Outcomes: 1. Demonstrate elementary level performance of skills and principles of Modern Dance technique. 2. Perform basic dance movement with personal expression. 3. Demonstrate fundamental bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 10200 - Ballet I

Credit Hours: 2.00. An introduction to the techniques and principles of classical ballet.

Learning Outcomes: 1. Demonstrate essential ballet skills, principles and techniques used in ballet. 2. Demonstrate correct use of ballet terminology. 3. Recognize and define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor. Credits: 2.00

DANC 10300 - Jazz Dance I

Credit Hours: 2.00. An introduction to the principles of jazz dance techniques: alignment, isolations, rhythmic patterns, and basic locomotion.

Learning Outcomes: 1. Perform basic skills of the body including coordination, proper

alignment, and musicality through movement phrases and exercises aligned with Jazz Dance Techniques. 2. Demonstrate an elementary understanding of core principles, techniques and histories under the broad umbrella of Jazz Dance Technique. 3. Demonstrate a fundamental understanding of Jazz Dance vocabulary and basic body anatomy. Credits: 2.00

THTR 23300 - Acting II

Credit Hours: 3.00. Continued development of the basic acting tools of objectives, actions, justification, and personalization; continued vocal and physical work; introduction of script and character analysis; and the introduction of audition techniques. The course will use material from contemporary dramatic literature in the rehearsal process. Prerequisite: THTR 133. Instructor permission required for non-majors.

Learning Outcomes: 1. Practice and incorporate relaxation, physical, vocal, and sense memory exercises into a daily warm-up. 2. See, connect, and respond to a partner within improvised scenarios. 3. Read plays with insight and imagine the experience of the characters in the given circumstance of a play. 4. Analyze and break scenes down into beats, with each beat having a clear action and objective. 5. Analyze, rehearse and publicly perform an open scene, and a contemporary monologue and scene. Credits: 3.00

History, Theory

THTR 38000 - Histories Of Theatre

Credit Hours: 3.00. Variable topics in theatre and performance history. Emphasis on the study of the works, aesthetics, and innovations of a theatrical form/genre alongside social, cultural, economic, and political contexts.

Credits: 3.00

THTR 38100 - Theatre And Performance Historiography

Credit Hours: 3.00. Historiographic analysis of theatre, drama, and performance of the 20th and 21st centuries. Emphasis on the relationship between modern and contemporary performance to world history from social, political, and cultural perspectives. Course includes both written and practical components. Prerequisites: THTR 201, THTR 271.

Learning Outcomes: 1. Interpret plays, performances, and performance theory from the 20th and 21st century. 2. Analyze theatre and performance histories through a combination of historical research, critical questioning, and practical application. 3. Demonstrate how political, economic, and cultural structures impact theatre and performance histories of the 20th and 21st Century. 4. Demonstrate skills in research, collaboration, and oral presentation. Credits: 3.00

THTR 39000 - Directed Study Of Special Theatre Problems

Credit Hours: 1.00 to 3.00. An undergraduate level, individualized, and intensive study of any aspect of theatre required by the student's plan of study. Permission of instructor required.

Credits: 1.00 to 3.00

DANC 37800 - Survey Of Concert Dance History (UCC: HUM)

Credit Hours: 3.00. This course is a broad survey of concert dance history predominately in the 20th and 21st century in Western cultures. The direct relationship and influence of the culture, training, choreographic, and performative records of dance practices, to socio-political ideologies of gender, race, sexuality, and national identities will be the area of investigation. Students will read, watch, research and actively participate in discussion regarding important dance figures, movements, eras, and their social and cultural reverberations. Dance's relationship to other art practices throughout history will also be a subject of lecture and discussion.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate understanding of the foundational underpinnings of concert dance history. 2. Identify specific choreographers and their works of art in oral and written communication. 3. Recognize concert dance contexts in order to speak and write clearly about them. 4. Demonstrate an awareness of the relationships and interactions between dance and culture. Credits: 3.00

DANC 37900 - The Art Of Protest: An Examination Of The Role Of Arts, Artists, Activism, & Social Transformation

Credit Hours: 3.00. Throughout history, art has been used to advocate for political movements and provoke social action and transformation. This course examines the role of the arts and the artist and their relationship to activism throughout history and beyond. We will investigate how art has been used as a tool to transform cultural perspectives, alter policies, and promote social change. We will explore a range of artists whose methodologies, materials and approach challenge the cultural norms. From printmakers to musicians, to choreographers, to performance artists, students will engage and evaluate the act of art-making as a tactic of resistance and the responses to those acts. We will investigate readings that argue for and against the need for artists to make work that politically challenge their society. Once a foundation of knowledge has been laid, we will turn to the creative process through an investigation of materials and practices - performance, mixed media, and photography. Students will research, watch, discuss, create, and perform their own projects that promote social transformation.

Learning Outcomes: 1. Demonstrate effective oral and written communication in formal assignments, critical analysis, and class presentations. 2. Demonstrate through creative projects how art, culture, and activism have a direct and interactive relationship. 3. Investigate and critically engage with artists whose work transform cultural perspectives, alter policies, provide socio-political commentary, and promote social change. 4. Analyze seminal art and historical and philosophical texts that articulate the role and importance of political art. Credits: 3.00

THTR 48400 - Performance, Media, And Technology

Credit Hours: 3.00. This course explores the intersection of performance, media, and technology from the early 20th century through present day, examining how technological innovations have transformed performance practices and audience experiences.

Learning Outcomes: 1. Describe the historical development of media and technology in 20th and 21st-century performance. 2. Apply theories of liveness, remediation, intermediality, and mediatization toward analysis of contemporary performance practices. 3. Assess the impacts of new media on concepts such as narrative, space, text, and embodiment. 4. Generate strategies for conceptualizing projects that integrate media into performance. Credits: 3.00

Media Performance

THTR 33300 - Acting III

Credit Hours: 3.00. Application of foundational acting techniques to specific disciplines. May be repeated for credit. Instructor permission required for non-majors.

Learning Outcomes: 1. Identify, define, describe and demonstrate the basic principles of the craft of acting. 2. Identify, define, describe and demonstrate the basic terminology of stage technique. 3. Identify, define and describe the basic principles of script & character analysis. 4. Read, investigate, interpret and articulate your analysis of specific plays from the canon of 20th and 21st Century realistic dramatic literature. 5. Develop critical thinking as it applies to your own work, your peers' work and in production work. Credits: 3.00

DANC 35100 - Intermedia Dance Technology

Credit Hours: 3.00. An introduction to dance and intermedia within the choreographic process. Integration of movement and various forms of technology which might involve digital images, film, animation, programming, sensors, sound, lighting and/or robotics.

Learning Outcomes: 1. Demonstrate new approaches to choreography by integrating intermedia technology into the dance-making process. 2. Apply basic skills for creating or implementing film, digital media, sound editing, and/or programming. 3. Analyze intermedia dance technology works. 4. Develop awareness of dance intermedia technology art and examine its value and meaning as both a creator and observer. 5. Build a sense of personal expression and artistry through the composition of intermedia dance technology works. Credits: 3.00

DANC 35000 - Dance For The Camera

Credit Hours: 3.00. An introduction to technical and aesthetic techniques to create screendance or dance film, with an emphasis on camera use, editing techniques, development and production of choreographic projects designed specifically for film format.

Learning Outcomes: 1. Demonstrate how to use a camera and capture dance footage. 2. Demonstrate basic skills in non-linear digital video editing with attention to motion and action editing in dance. 3. Analyze the art of screendance and examine its value and meaning as both a creator and observer. 4. Create a sense of personal expression and artistry through crafting dance film projects. Credits: 3.00

Generative Leadership

DANC 34500 - Choreography

Credit Hours: 3.00. This course focuses on methods and practices of choreographing contemporary dance works. It teaches the choreographic process: how to create original movement and expand and build both solo and group dance works. Basic compositional elements of exploring and manipulating movement and structuring choreographed material are utilized. The development of production elements are taught to support choreographic intent. Highly recommended before enrolling in this course: DANC 24500 and DANC 30100.

Learning Outcomes: 1. Identify and apply choreographic tools to create a coherent dance composition. 2. Analyze dance composition and understand its value and meaning as both a creator and observer. 3. Express individual artistry through dance composition. Credits: 3.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

B. Performance and Production (10 credits)

1. Advanced Performance and Design Courses (6 credits)

DANC 20100 - Modern Dance Technique II

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 10100.

Learning Outcomes: 1. Demonstrate confident performance of skills and principles of Modern Dance technique. 2. Perform dance movement with personal expression and artistry. 3. Demonstrate increased bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 30100 - Modern Dance Techniques III

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 20100. Emphasis placed on expressive qualities of movement.

Learning Outcomes: 1. Demonstrate strong performance of skills and principles of Modern Dance technique. 2. Perform complex movement with personal expression and artistry. 3. Evaluate the art of Modern Dance and examine its value and meaning as both a creator and observer. Credits: 2.00

THTR 21300 - Voice For The Actor

Credit Hours: 2.00. Designed to heighten the actor's awareness of the vocal instrument. Elementary vocal techniques will be practiced to expand the student's vocal flexibility and range.

Emphasis on freeing habitual vocal tensions and teaching the student the fundamentals of vocal health.

Learning Outcomes: 1. Understand and apply the vocal techniques required of the actor and practice a specific vocal warm-up procedure. 2. Recognize and use effectively the phonetic alphabet in your text work. 3. Hear, feel, and evaluate healthy vocal practices. 4. Understand and employ the bodily structures that allow for sound production and how to feel/adjust sound placement. 5. Develop and explore new ways in which to use your voice to support your acting work/how the voice can convey an emotional journey and create character (and the technical demands that accompany it) that you can apply to your work after this course. Credits: 2.00

THTR 23500 - Vocal/Physical Preparation

Credit Hours: 2.00. Vocal/Physical Preparation is designed to increase and deepen student's physical awareness, develop physical and vocal stamina, flexibility and strength, modify habitual modes of expression, expand vocal and physical range, and increase student's ability to respond expressively.

Learning Outcomes: 1. Aware of dysfunctional and limiting vocal and physical patterns. 2. Reduce tension, increase flexibility, improve balance and coordination, and expand expressive range. 3. Develop a grounded, focused and dynamic theatrical presence. 4. Integrate breath, voice and movement in solo and group performance. 5. Create a personalized training program that prepares you for the challenges of the profession. Credits: 2.00

THTR 25600 - Stage Make-Up

Credit Hours: 2.00. Study of facial anatomy, the aging process, the principles of light and shadow, and character analysis. Theory and practice in the basic techniques of applying stage makeup.

Credits: 2.00

THTR 32300 - Acting: Movement For The Actor

Credit Hours: 3.00. Designed to heighten body awareness in movement and stillness. Characterization techniques will be practiced that expand the student's flexibility, aerobic capacity, strength, agility, and range of self-expression. Emphasis on freeing habitual tension patterns through the exploration of expressive movement.

Credits: 3.00

THTR 33300 - Acting III

Credit Hours: 3.00. Application of foundational acting techniques to specific disciplines. May be repeated for credit. Instructor permission required for non-majors.

Learning Outcomes: 1. Identify, define, describe and demonstrate the basic principles of the craft of acting. 2. Identify, define, describe and demonstrate the basic terminology of stage technique. 3. Identify, define and describe the basic principles of script & character analysis. 4. Read, investigate, interpret and articulate your analysis of specific plays from the canon of 20th and 21st Century realistic dramatic literature. 5. Develop critical thinking as it applies to your own work, your peers' work and in production work. Credits: 3.00

THTR 35400 - Painting For The Stage

Credit Hours: 3.00. The principles and practice of painting for the stage. Study of tools, media, and techniques used in traditional scenic painting, costume painting, and the creation of dimensionality on various surfaces. Offered alternate years.

Credits: 3.00

THTR 36000 - Scenic Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into an environment for dramatic action. Emphasis on the interrelationship among all aspects of production and how the scenic element becomes a building block toward total picturization. Offered alternate years.

Credits: 3.00

THTR 36100 - Costume Design

Credit Hours: 3.00. Theory and principles of design specifically applied to stage costume design. Emphasis on the interrelationship of all aspects of production and how the costume becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 43300 - Acting IV

Credit Hours: 3.00. Adaptation of acting techniques to professional applications.

Learning Outcomes: 1. Develop and demonstrate the application of metrical analysis. 2. Identify the poetic devices in classical text and demonstrate these in performance. 3. Demonstrate critical thinking skills of analysis, interpretation and application. 4. Analyze Shakespeare's characters in reference to their historical period. 5. Develop a systematic approach for performing classical text. Credits: 3.00

THTR 53600 - Advanced Problems In Acting

Credit Hours: 2.00 or 3.00. Advanced study of selected problems in acting, including detailed role and play analyses, thorough rehearsals and critiques of performance. Permission of instructor required.

Credits: 2.00 or 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

DANC 20200 - Ballet II

Credit Hours: 2.00. A continuation of the principles and techniques of classical ballet addressed in DANC 10200.

Learning Outcomes: 1. Demonstrate advanced ballet skills, principles and techniques used in ballet, with focus on increased strength and coordination. 2. Demonstrate correct use of ballet terminology. 3. Define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor, as well as various ballet variations. Credits: 2.00

DANC 20300 - Jazz Dance II

Credit Hours: 2.00. A continuation and refinement of the jazz dance concepts and movement vocabulary addressed in DANC 10300.

Credits: 2.00

DANC 26100 - Contact Improvisation

Credit Hours: 3.00. This course is both a physical practice and philosophical exploration of the techniques and underlying premise of this contemporary partner dance form. CI training involves a practice of movement improvisation while developing the body's ability to attend to the effects of gravity, muscle tone, and anatomical structures on dancing solo and in partnership. While increasing their body awareness, respect, sensitivity and connection, students learn about collaborative community creativity, which can be applied in other settings including design, performance, and social activism. DANC 26000 is a good preparation for this course, but not required. Course may be repeated for credit.

Learning Outcomes: 1. Demonstrate basic skills of solo movement in group dance setting. 2. Demonstrate basic skills of partnering using weight sharing and touch. 3. Model nonverbal communication with a partner. 4. Improve awareness and perception of the body. Credits: 3.00

2. Practicum Courses (4 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design

for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

DANC 34600 - Intermediate Choreography

Credit Hours: 1.00 or 2.00. A study of selected principles underlying the design of group performance in modern dance. Permission of instructor required.

Learning Outcomes: 1. Analyze and research methods for constructing and choreographing a group dance work. 2. Demonstrate ability to craft, edit and stage a piece of choreography for a professional-level dance performance. 3. Demonstrate growth in interpersonal and leadership skills while working with the group of dancers cast in their dance work. Credits: 1.00 or 2.00

C. Marketing and Management (6 credits) or the Certificate in Entrepreneurship and Innovation (6 credits)

1. Marketing and Management

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about

the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

MGMT 39100 - Strategic Thinking And Decision-Making

Credit Hours: 3.00. This course focuses on how to think strategically and make good business decisions. By the end of the class, you will be able to do the following: (1) Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions; (2) Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas; (3) Select and use appropriate methods/tools/equipment

to make decisions and design/prototype innovative ideas;
(4) Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas. 3. Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas. 4. Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

MGMT 29400 - Navigating Gender In The Workplace

Credit Hours: 3.00. This course has four objectives: (1) To Increase self-awareness and understand its value in managing careers; (2) To learn how gender culture and implicit bias may affect workplace experiences; (3) To develop strategies to deal with gender related challenges; and (4) To develop competencies in leading effective, gender-aware teams. By exploring these areas, students will develop new insights for managing their careers, and they will learn new leadership strategies to help their teams achieve higher levels of performance.

Learning Outcomes: 1. Through self-assessment, increase understanding of your strengths, core values and work styles. 2. Practice behaviors that demonstrate your confidence and leadership skills. 3. Learn how men and women might behave differently in certain work situations, based on research. 4. Understand implicit bias and its potential impact on talent assessment and advancement. 5. Learn effective strategies and skills to handle common gender-related work challenges - as an individual, as a team member and as a leader. Credits: 3.00

MGMT 29300 - Diversity In The Workplace

Credit Hours: 3.00. Diversity can be defined as real or perceived differences among people with regards to race, ethnicity, sexual orientation, religion, age, physical and mental ability, and family status that affect an individual's treatment, opportunities and outcomes. As demonstrated in the workplace, diversity is the numerous ways that employees are viewed as being similar or different. Through this course, students will examine the historical context and the emergence of diversity in the workplace including bias, meritocracy, privilege, social identity frameworks, organizational culture, allyship and advocacy.

Learning Outcomes: 1. Demonstrate knowledge of historical policy and employment regulations that drive current workplace decisions. 2. Demonstrate awareness of social identities, values, and biases of self and of others. 3. Demonstrate perspective and skills to effectively navigate workplace groups and relationships. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

2. Certificate in Entrepreneurship and Innovation*

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring

students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

ENTR 31500 - Business Planning For Social Entrepreneurship

Credit Hours: 3.00. This course builds on entrepreneurship concepts and skills developed in ENTR 20000 (prerequisite course) to understand the differences, benefits, and opportunities associated with social impact business models. Students work in teams on experiential activities including gathering customer feedback, creating forecasts, developing a strategy, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Develop convincing social enterprise business models. 2. Conduct feasibility analysis. 3. Create pro-forma financial statements. 4. Understand legal, regulatory, and ethical issues social entrepreneurs face. 5. Understand the process of recruiting, hiring, and developing a new venture team. 6. Identify sources of funding and investor needs. 7. Persuade potential investors to support a social impact venture. 8. Participate effectively as a team member or leader. Credits: 3.00

ENTR 32500 - Global Entrepreneurship And Innovation

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course), to provide students with a comprehensive understanding of entrepreneurship in a global context. It explores the differences, challenges, and opportunities associated with developing international ventures and expanding into overseas markets. Through topic lectures, case studies, and experiential team projects, students will gain insight into global trends, cultural nuances, business models, strategies, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify economic, political, technological, ethical, and cultural factors influencing entrepreneurship in global settings. 2. Develop cross-cultural awareness to navigate diverse business environments. 3. Conduct feasibility analysis for international venture establishment and expansion. 4. Recognize critical aspects of global supply

chains and associated business implications. 5. Describe international funding sources and currency considerations. 6. Explore global entrepreneurship and innovation ecosystems as scalability engines. 7. Understand the process of recruiting, hiring, and developing a global team. 8. Participate effectively as a team member or leader. Credits: 3.00

D. Capstone Project (6 credits)

Electives (40-50 credits)

Additional Information

Pass/No Pass Policy

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

DANC 37800 - Survey Of Concert Dance History (UCC: HUM)

Credit Hours: 3.00. This course is a broad survey of concert dance history predominately in the 20th and 21st century in Western cultures. The direct relationship and influence of the culture, training, choreographic, and performative records of dance practices, to socio-political ideologies of gender, race, sexuality, and national identities will be the area of investigation. Students will read, watch, research and actively participate in discussion regarding important dance figures, movements, eras, and their social and cultural reverberations. Dance's relationship to other art practices throughout history will also be a subject of lecture and discussion.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate understanding of the foundational underpinnings of concert dance history. 2. Identify specific choreographers and their works of art in oral and written communication. 3. Recognize concert dance contexts in order to speak and write clearly about them. 4. Demonstrate an awareness of the relationships and interactions between dance and culture. Credits: 3.00

15-17 Credits

Spring 1st Year

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

DANC 26000 - Dance Improvisation

Credit Hours: 3.00. In this course students explore a variety of techniques for creating movement. While physically researching concepts from a broad spectrum of improvisational artists,

students expand their boundaries and definitions of dance, art and creativity. Important concepts include choice making, moving from internal motivations, and ensemble collaboration. All backgrounds in dance and movement are welcome, and will benefit from this course.

Learning Outcomes: 1. Demonstrate multiple approaches to create unique dance movement spontaneously. 2. Formulate and participate in improvised solo and group dance performances. 3. Generate qualities of movement and elements of dance composition through improvisation. 4. Evaluate the many critical roles of improvisation in the art of dance. Credits: 3.00

15 Credits

Fall 2nd Year

DANC 30000 - Performance Production

Credit Hours: 3.00. This course teaches many aspects of producing a performance, from backstage to onstage. Students will learn the technical aspects of creating a professional performance by both observing performance production and developing an actual performance, which this semester is the Xperimental 2024 Concert. Students may participate in the production in a variety of active roles; however, they will be exposed to all aspects through observation, participation, and discussion. Production roles include: director and assistant director, choreographer, performer, lighting design and staging, sound design and technical support, and stage crew (stage manager, house manager, ticket manager, setup and strike support). Occasional class sessions cover skills to enhance your knowledge of some areas of production such as sound design, and lighting technology. For many students who are at the university level, the art of performance is defined almost totally by the act of being on stage performing, in studios or on stages. This course is designed to invite students to learn about all the activities that are done behind the scenes in order for live performances to be presented to an audience. We will discuss what is involved in both large institutional performance spaces, and compare this to our university performance. Then we will discuss what this scenario looks like for performance professionals after college. This course will greatly enhance students' ability to produce their own events in the future, and develop greater appreciation for the collaborative nature of live performance as art form.

Learning Outcomes: 1. Plan and create a small live performance production. 2. Identify the necessary components of a production of a professional performance and explain the key collaborative interactions among them. 3. Practice basic skills for working performers and producers including those relating to technology and business. Credits: 3.00

17-18 Credits

Spring 2nd Year

16-18 Credits

Fall 3rd Year

13-15 Credits

Spring 3rd Year

15-18 Credits

Fall 4th Year

THTR 49701 - Capstone Preparation

Credit Hours: 3.00. Students will build the research-as-practice framework and development structure for a performance that will be realized during THTR 49702: Capstone Project in the subsequent semester. This proposal will evolve out of research that will include examining works related to the research enquiry of the topic identified in their proposal as well as practice-as-research frameworks to determine which frameworks fit the performance. The instructor will meet with students through the course of the semester to mentor this research-based process. All requests for space, equipment, costume and props, production staff and monetary support, as well as the creative idea of the project, must approved by the semester's end. Permission of instructor required.

Learning Outcomes: 1. Collaborate with other artists, designers, and craftspeople from

different disciplines. 2. Devise unique performances and relate them to historical, aesthetic, and personal contexts. 3. Design a creative development and reflection process utilizing practice-as-research approaches. Credits: 3.00

15 Credits

Spring 4th Year

THTR 47902 - Capstone Project

Credit Hours: 3.00. Students will develop, present, and reflect upon a performance event based on the research framework developed in THTR 49701: Capstone Preparation in the subsequent semester. Students will demonstrate their learning through a focused experience that requires the integration and application of the full breadth of skills and knowledge gained during the course of study. These events are ideally collaborative, but solo project proposals are allowed. Capstone Project includes the rehearsal process and performance at the end of the semester, with a reflection submitted during finals week. The instructor will meet with students through the course of the semester to mentor this performance/production-based process. Permission of instructor required.

Learning Outcomes: 1. Collaborate with other artists, designers, and craftspeople from different disciplines. 2. Devise unique performances and relate them to historical, aesthetic, and personal contexts. 3. Implement creative development and reflection process utilizing practice-as-research approaches. Credits: 3.00

15 Credits

Interdisciplinary Science, BS (Biology)

Degree Requirements

Departmental/Program Major Courses: Areas (33-34 credits)

Required Biology Primary Area Courses (15-16 credits)

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9.

Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results,

and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the

immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

Required Supporting Area Courses (18 credits)

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (2-36 credits)

Sample 4-Year Plan

Fall 1st Year

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in

agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary

forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

15-18 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms,

implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

13-18 Credits

Fall 2nd Year

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and

biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

17 Credits

Fall 3rd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions,

simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to

generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by

practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

15-16 Credits

Fall 4th Year

15-16 Credits

Spring 4th Year

16-18 Credits

Interdisciplinary Science, BS (Chemistry)

Degree Requirements

Departmental/Program Major Courses: Areas (34-36 credits)

Required Chemistry Primary Area Courses (16-18 credits)

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

Organic Chemistry Lecture I (3-4 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes

and alkynes and the mechanisms by which they occur. Credits: 3.00

PHSC 20400 - Organic Chemistry I

Credit Hours: 3.00. A study of the compounds of carbon on a functional group basis, with particular emphasis on those organic compounds of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

Organic Chemistry Laboratory I (0-2 Credits)

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to

supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

Organic Chemistry Lecture II (3-4 credits)

PHSC 20500 - Organic Chemistry II

Credit Hours: 3.00. PHSC 20500 is a continuation of PHSC 20400. You will learn the principles of organic chemistry with an emphasis on reactions of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action. You will continue to apply the fundamentals learned in general chemistry to the functional classes of compounds that are most important in pharmaceutical and biological chemistry.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular

emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

Organic Chemistry Laboratory II (0-2 Credits)

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the

physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

Required Supporting Area Courses (18 credits)

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (0-35 credits)

Sample 4-Year Plan

Fall 1st Year

15-18 Credits

Spring 1st Year

15-18 Credits

Fall 2nd Year

15-17 Credits

Spring 2nd Year

15-17 Credits

Fall 3rd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction

to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15-16 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.
Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python

libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

16-18 Credits

Fall 4th Year

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

16 Credits

Spring 4th Year

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

16 Credits

Interdisciplinary Science, BS (Computer Science)

Degree Requirements

Departmental/Program Major Courses: Areas (34 credits)

Required Computer Science Primary Area Courses (16 credits)

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses,

dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

Required Supporting Area Courses (18 credits)

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (2-35 credits)

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral

calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

14-16 Credits

Fall 2nd Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

15-16 Credits

Spring 2nd Year

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15-16 Credits

Fall 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

15-16 Credits

Spring 3rd Year

15-16 Credits

Fall 4th Year

15-16 Credits

Spring 4th Year

15-16 Credits

Interdisciplinary Science, BS (Earth, Atmospheric, and Planetary Sciences)

Degree Requirements

Departmental/Program Major Courses: Areas (35 credits)

Required Earth, Atmospheric, and Planetary Sciences Primary Area Courses (17 credits)

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

EAPS 23000 - Laboratory In Atmospheric Science

Credit Hours: 2.00. A laboratory course that introduces the fundamentals of atmospheric science through quantitative exercises. The theoretical exercises include the vertical

structure of the atmosphere, the Earth's energy budget, atmospheric moisture, saturation and stability, clouds and precipitation and atmospheric motion. Data and map analysis exercises include mid-latitude cyclones, thunderstorms and tornadoes, hurricanes and controls of climate. Prior or current course work in introductory atmospheric science is required. This course may not be taken for credit by students in the atmospheric science option of the Department of Earth and Atmospheric Sciences.

Credits: 2.00

Required Supporting Area Courses (18 credits)

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (1-34 credits)

Sample 4-Year Plan

Fall 1st Year

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions.

Credits: 4.00

15-18 Credits

Spring 1st Year

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

EAPS 23000 - Laboratory In Atmospheric Science

Credit Hours: 2.00. A laboratory course that introduces the fundamentals of atmospheric science through quantitative exercises. The theoretical exercises include the vertical structure of the atmosphere, the Earth's energy budget, atmospheric moisture, saturation and stability, clouds and precipitation and atmospheric motion. Data and map analysis exercises include mid-latitude cyclones, thunderstorms and tornadoes, hurricanes and controls of climate. Prior or current course work in introductory atmospheric science is required. This course may not be taken for credit by students in the atmospheric science option of the Department of Earth and Atmospheric Sciences.

Credits: 2.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the

interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

16-17 Credits

Spring 2nd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the

program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using

various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-17 Credits

Fall 3rd Year

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified

approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

16-18 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

16-17 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15-18 Credits

Interdisciplinary Science, BS (Mathematics)

Degree Requirements

Departmental/Program Major Courses: Areas (35-36 credits)

Required Mathematics Primary Area Courses (17-18 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes

integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

Required Supporting Area Courses (18 credits)

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (0-34 credits)

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it

possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

16-17 Credits

Spring 2nd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team

to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation,

goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15 Credits

Fall 3rd Year

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the

properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

15-16 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

16-17 Credits

Fall 4th Year

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and

range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

16 Credits

Spring 4th Year

14-16 Credits

Interdisciplinary Science, BS (Physics)

Degree Requirements

Departmental/Program Major Courses: Areas (31-32 credits)

Required Physics Primary Area Courses (13-14 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

Required Supporting Area Courses (18 credits)

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (4-38 credits)

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

15-18 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary

approximation methods of integration. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

15-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including

lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

16-18 Credits

Spring 2nd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and

summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-17 Credits

Fall 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

16-17 Credits

Spring 3rd Year

16-18 Credits

Fall 4th Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval

estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

16 Credits

Spring 4th Year

15-18 Credits

Interdisciplinary Science, BS (Statistics)

Degree Requirements

Departmental/Program Major Courses: Areas (30-31 credits)

Required Statistics Primary Area Courses (12-13 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in

asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

Required Supporting Area Courses (18 credits)

Other Departmental/Program Course Requirements (17-37 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (5-39 credits)

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours

toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible

intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

15-17 Credits

Spring 2nd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations,

groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-16 Credits

Fall 3rd Year

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

15-16 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate

scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

16-17 Credits

Fall 4th Year

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

16 Credits

Spring 4th Year

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

15 Credits

Interior Architecture, BS (Indianapolis Only)

About the Program

Degree Requirements

Departmental/Program Major Courses (78 credits)

ARCH 11700 - Construction Drafting And CAD

Credit Hours: 3.00. Introduction to drafting and CAD fundamentals, with emphasis on architectural and civil engineering topics. Development of basic drafting skills, using

orthographic projections, auxiliary views, pictorial drawings, and drafting conventions. Students may not receive credit for both ART 116 and ART 117.

Credits: 3.00

ARCH 12000 - Introduction To Construction Drafting With Building Information Modeling (BIM)

Credit Hours: 3.00. Introduction to drafting fundamentals using Building Information Modeling (BIM), an intelligent 3D model-based process that equips architecture, engineering, and construction professionals with the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. Autodesk Revit will be the software presented.

Credits: 3.00

ARCH 15500 - Residential Construction

Credit Hours: 3.00. Wood frame construction through a semester project requiring planning, preliminary, and working drawings. Outside lab assignments are required.

Credits: 3.00

ARCH 21000 - History Of Architecture I

Credit Hours: 3.00. Survey of styles and influence of cultures which led to the development of architecture and engineering from the earliest times to the early 20th century.

Credits: 3.00

ARCH 22200 - Commercial Construction

Credit Hours: 3.00. Preparation of preliminary and working drawings for an intermediate-size commercial or institutional building.

Credits: 3.00

ARCH 22300 - 3D Architectural Modeling I

Credit Hours: 3.00. This course will study graphic solutions to visualizing interior spaces and environments by utilizing 3D modeling software. Students will learn the fundamentals and advanced toolset in the 3D modeling software Trimble SketchUp while working on a semester long visualization project.

Credits: 3.00

ARCH 32300 - 3D Architectural Modeling II

Credit Hours: 3.00. This course has been designed to expand the students' knowledge, creativity, and technique when creating 3D digital models and renderings. This class should not be the students' introduction into Autodesk Revit Software, but a course developed to refine modeling and rendering skills. Topics include but are not limited to: understanding the use of architecture, materials, lighting, etc.

Credits: 3.00

INT 10300 - Introduction To Interior Design

Credit Hours: 3.00. An overview of the field of interior design, its history, and theory. An application of the principles and elements of interior design. Basic hand drafting. This course is for those who are seeking or considering a degree in Interior Design.

Credits: 3.00

INT 12400 - Space Planning For Interiors

Credit Hours: 3.00. Introduction to the fundamentals of design for human activity, standards for space, programming, and graphic communication. Requirements for ADA and Universal Design will be included.

Credits: 3.00

INT 12500 - Color And Lighting Of Interiors

Credit Hours: 3.00. Exploration of the physiological, psychological, and phenomenal aspects of color and light in interior spaces. Application includes specification and selection of lighting fixtures and light sources.

Credits: 3.00

INT 15100 - Textiles For Interiors

Credit Hours: 3.00. An extensive study of textiles: fiber types, yarn production, fabric construction, finishing, coloring, and printing. Application of textiles for use in residential and commercial interiors.

Credits: 3.00

INT 20200 - Interior Materials And Applications

Credit Hours: 3.00. Analyzes information related to use of surfacing materials applied as interior finishes in interior design projects. The role of green design is introduced, and ecological issues are integrated into each category of materials analyzed.

Credits: 3.00

INT 20400 - History Of Interiors And Furniture I

Credit Hours: 3.00. A survey of historical development of interiors, furniture and decorative arts from early history to 1800 (early neoclassic). Emphasis on design motifs, ornamentation and furniture styles.

Credits: 3.00

INT 22400 - Residential Interior Design Studio

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered. The course will utilize computer-aided drafting and design (CAD).

Credits: 3.00

INT 22600 - Commercial Interiors I

Credit Hours: 3.00. This studio course emphasizes the elements used by designers in the development of nonresidential space. Studies include technological and building requirements; building and life-safety codes; square footage and space planning standards. Organizational, ergonomic, technical, spatial and environmental factors will be considered.

Credits: 3.00

INT 30400 - History Of Interiors And Furniture II

Credit Hours: 3.00. The continuation of a survey of historical development of interiors, furniture, and decorative arts beginning with 1650 Colonial America through the 20th century. Emphasis is on design motifs, ornamentation, and furniture styles. Adaptation and use of period styles within contemporary design are included.

Credits: 3.00

INT 32400 - Residential II: Housing Design

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered.

Credits: 3.00

INT 32600 - Commercial Interior Design Studio II

Credit Hours: 3.00. This studio course emphasizes the elements used in development of nonresidential space. Studies include technological and building requirements; building and life-safety codes, ADA guidelines, square footage and space planning standards.

Credits: 3.00

INT 42600 - Evidence-Based Design

Credit Hours: 3.00. This studio-based course emphasizes the principles of evidence-based design in modern practice. Students will acquire working knowledge of best practices with relation to healthcare or similar environments based on empirical data.

Credits: 3.00

INT 42800 - Interior Design Capstone Design Project

Credit Hours: 3.00. In this B.S. Capstone course the designer tackles a semester long advanced design problem by applying the design process from project obtainment through construction documents. This class is team-taught and must be taken in conjunction with INTR 48000.

Credits: 3.00

INT 45200 - Interior Building Systems

Credit Hours: 3.00. A survey course of building systems that covers the design implications of heating, air-conditioning, plumbing and electrical systems of both residential and commercial buildings. Sustainable technologies such as solar energy for heating, cooling, or hot water heating, day-lighting, and recycling systems will be included.

Credits: 3.00

INT 45300 - Business Practices Of Interior Design

Credit Hours: 3.00. Business principles and practices as they relate to the interior design profession. Includes business formation and management, professional ethics and organization, certification and licensing issues, design liability, and project management.

Credits: 3.00

INT 48000 - Senior Portfolio

Credit Hours: 3.00. This course will assist the student with developing a professional level portfolio and related materials which may be used in interviewing for an Interior Design position, and provides an opportunity to showcase all academic work created at this institution. Topics and activities include branding, resume preparation, website design, social media management, interviewing, and the creation of various related portfolio materials.

Credits: 3.00

INT 49500 - Sustainable Design In Engineering And Technology

Credit Hours: 3.00. In this multidisciplinary course students will create industrial ecological solutions within their unique disciplines. A theoretical framework on Green Design is used to identify and apply green concepts while working on multidisciplinary teams. Environmental concerns for better air quality and global environmental issues are explored.

Credits: 3.00

INT 30200 - Three-Dimensional Design

Credit Hours: 3.00. This studio class examines the fundamentals of three-dimensional design, detailing and documentation, along with 3D thinking and visualization of design solutions sensitive to functional, ergonomic and aesthetic objectives.

Credits: 3.00

ARCH 32500 - Building Science & Energy

Credit Hours: 3.00. The study and practice of interior lighting with an emphasis on environmentally efficient lighting systems and energy economy. Through the design process and execution of luminaire layouts, students will examine the visual process, lamp and luminaire selection, calculation methods, lighting controls and evaluation of effective solutions.

Credits: 3.00

Other Departmental/Program Course Requirements (36-48 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

CGT 21100 - Raster Imaging For Computer Graphics

Credit Hours: 3.00. Digital images are produced using a variety of computer technologies. Advanced color theory, surface rendering, and light control are emphasized in relation to technical illustration, hardware characteristics, and software capabilities.

Learning Outcomes: 1. Demonstrate understanding of the primary attributes and differences between vector and raster graphics and their application to various communicative products and tasks. 2. Demonstrate understanding of analog and digital data forms and the conversion processes relating to digital imaging. 3. Appropriately use common imaging application features such as layers, channels, paths, filters, color adjustment and correction tools, histograms, color mode tools, and calibration tools. 4. Demonstrate understanding of input, manipulation, and output technologies related to raster graphics. 5. Demonstrate understanding of color theory, color models, color systems, and the physiological and psychological effects of color in raster imaging. 6. Demonstrate understanding of miscellaneous raster graphics issues such as file formats, compression technologies, vector to raster conversion methods and the legal implications of copyrights, trademarks, licenses, and releases. 7. Demonstrate skill and proficiency in creating professional raster graphics for all types of output including: textures for use in 3D

environments, photographic reproduction, digital illustration, web delivery, CD-ROM multimedia, and self-promotion. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

TECH 39699 - Professional Practice Internship

Credit Hours: 0.00 to 3.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems. Credits: 0.00 to 3.00

OLS 37100 - Project Management

Credit Hours: 3.00. This course provides the basics of the project management discipline and allows the student to apply these skills in team-based situations.

Credits: 3.00

Electives (0-6 credits)

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

INT 10300 - Introduction To Interior Design

Credit Hours: 3.00. An overview of the field of interior design, its history, and theory. An application of the principles and elements of interior design. Basic hand drafting. This course is for those who are seeking or considering a degree in Interior Design.

Credits: 3.00

15 Credits

Spring 1st Year

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

ARCH 11700 - Construction Drafting And CAD

Credit Hours: 3.00. Introduction to drafting and CAD fundamentals, with emphasis on architectural and civil engineering topics. Development of basic drafting skills, using orthographic projections, auxiliary views, pictorial drawings, and drafting conventions. Students may not receive credit for both ART 116 and ART 117.

Credits: 3.00

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Credit Hours: 3.00. Introduction to drafting fundamentals using Building Information Modeling (BIM), an intelligent 3D model-based process that equips architecture, engineering, and construction professionals with the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. Autodesk Revit will be the software presented.

Credits: 3.00

INT 15100 - Textiles For Interiors

Credit Hours: 3.00. An extensive study of textiles: fiber types, yarn production, fabric construction, finishing, coloring, and printing. Application of textiles for use in residential and commercial interiors.

Credits: 3.00

15 Credits

Fall 2nd Year

CGT 21100 - Raster Imaging For Computer Graphics

Credit Hours: 3.00. Digital images are produced using a variety of computer technologies. Advanced color theory, surface rendering, and light control are emphasized in relation to technical illustration, hardware characteristics, and software capabilities.

Learning Outcomes: 1. Demonstrate understanding of the primary attributes and differences between vector and raster graphics and their application to various communicative products and tasks. 2. Demonstrate understanding of analog and digital data forms and the conversion processes relating to digital imaging. 3. Appropriately use common imaging application features such as layers, channels, paths, filters, color adjustment and correction tools, histograms, color mode tools, and calibration tools. 4. Demonstrate understanding of input, manipulation, and output technologies related to raster graphics. 5. Demonstrate understanding of color theory, color models, color systems, and the physiological and psychological effects of color in raster imaging. 6. Demonstrate understanding of miscellaneous raster graphics issues such as file formats, compression technologies, vector to raster conversion methods and the legal implications of copyrights, trademarks, licenses, and releases. 7. Demonstrate skill and proficiency in creating professional raster graphics for all types of output including: textures for use in 3D environments, photographic reproduction, digital illustration, web delivery, CD-ROM multimedia, and self-promotion. Credits: 3.00

ARCH 15500 - Residential Construction

Credit Hours: 3.00. Wood frame construction through a

semester project requiring planning, preliminary, and working drawings. Outside lab assignments are required.

Credits: 3.00

INT 12400 - Space Planning For Interiors

Credit Hours: 3.00. Introduction to the fundamentals of design for human activity, standards for space, programming, and graphic communication. Requirements for ADA and Universal Design will be included.

Credits: 3.00

INT 12500 - Color And Lighting Of Interiors

Credit Hours: 3.00. Exploration of the physiological, psychological, and phenomenal aspects of color and light in interior spaces. Application includes specification and selection of lighting fixtures and light sources.

Credits: 3.00

INT 20200 - Interior Materials And Applications

Credit Hours: 3.00. Analyzes information related to use of surfacing materials applied as interior finishes in interior design projects. The role of green design is introduced, and ecological issues are integrated into each category of materials analyzed.

Credits: 3.00

15 Credits

Spring 2nd Year

ARCH 21000 - History Of Architecture I

Credit Hours: 3.00. Survey of styles and influence of cultures which led to the development of architecture and engineering from the earliest times to the early 20th century.

Credits: 3.00

ARCH 22200 - Commercial Construction

Credit Hours: 3.00. Preparation of preliminary and working drawings for an intermediate-size commercial or institutional building.

Credits: 3.00

INT 20400 - History Of Interiors And Furniture I

Credit Hours: 3.00. A survey of historical development of interiors, furniture and decorative arts from early history to 1800 (early neoclassic). Emphasis on design motifs, ornamentation and furniture styles.

Credits: 3.00

INT 22400 - Residential Interior Design Studio

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered. The course will utilize computer-aided drafting and design (CAD).

Credits: 3.00

INT 22600 - Commercial Interiors I

Credit Hours: 3.00. This studio course emphasizes the elements used by designers in the development of nonresidential space. Studies include technological and building requirements; building and life-safety codes; square footage and space planning standards. Organizational, ergonomic, technical, spatial and environmental factors will be considered.

Credits: 3.00

15 Credits

Fall 3rd Year

ARCH 22300 - 3D Architectural Modeling I

Credit Hours: 3.00. This course will study graphic solutions to visualizing interior spaces and environments by utilizing 3D modeling software. Students will learn the fundamentals and advanced toolset in the 3D modeling software Trimble SketchUp while working on a semester long visualization project.

Credits: 3.00

INT 30400 - History Of Interiors And Furniture II

Credit Hours: 3.00. The continuation of a survey of historical development of interiors, furniture, and decorative arts beginning with 1650 Colonial America through the 20th century. Emphasis is on design motifs, ornamentation, and furniture styles. Adaptation and use of period styles within contemporary design are included.

Credits: 3.00

INT 32400 - Residential II: Housing Design

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered.

Credits: 3.00

INT 30200 - Three-Dimensional Design

Credit Hours: 3.00. This studio class examines the fundamentals of three-dimensional design, detailing and documentation, along with 3D thinking and visualization of design solutions sensitive to functional, ergonomic and aesthetic objectives.

Credits: 3.00

ARCH 32500 - Building Science & Energy

Credit Hours: 3.00. The study and practice of interior lighting with an emphasis on environmentally efficient lighting systems and energy economy. Through the design process and execution of luminaire layouts, students will examine the visual process, lamp and luminaire selection, calculation methods, lighting controls and evaluation of effective solutions.

Credits: 3.00

15 Credits

Spring 3rd Year

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

ARCH 32300 - 3D Architectural Modeling II

Credit Hours: 3.00. This course has been designed to expand the students' knowledge, creativity, and technique when creating 3D digital models and renderings. This class should not be the students' introduction into Autodesk Revit Software, but a course developed to refine modeling and rendering skills. Topics include but are not limited to: understanding the use of architecture, materials, lighting, etc.

Credits: 3.00

OLS 37100 - Project Management

Credit Hours: 3.00. This course provides the basics of the project management discipline and allows the student to apply these skills in team-based situations.

Credits: 3.00

INT 32600 - Commercial Interior Design Studio II

Credit Hours: 3.00. This studio course emphasizes the elements used in development of nonresidential space. Studies include technological and building requirements; building and life-safety codes, ADA guidelines, square footage and space planning standards.

Credits: 3.00

15 Credits

Fall 4th Year

TECH 39699 - Professional Practice Internship

Credit Hours: 0.00 to 3.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems. Credits: 0.00 to 3.00

INT 42600 - Evidence-Based Design

Credit Hours: 3.00. This studio-based course emphasizes the principles of evidence-based design in modern practice. Students will acquire working knowledge of best practices with relation to healthcare or similar environments based on empirical data.

Credits: 3.00

INT 45200 - Interior Building Systems

Credit Hours: 3.00. A survey course of building systems that covers the design implications of heating, air-conditioning, plumbing and electrical systems of both residential and commercial buildings. Sustainable technologies such as solar energy for heating, cooling, or hot water heating, day-lighting, and recycling systems will be included.

Credits: 3.00

INT 48000 - Senior Portfolio

Credit Hours: 3.00. This course will assist the student with developing a professional level portfolio and related materials which may be used in interviewing for an Interior Design position, and provides an opportunity to showcase all academic work created at this institution. Topics and activities include branding, resume preparation, website design, social media management, interviewing, and the creation of various related portfolio materials.

Credits: 3.00

15 Credits

Spring 4th Year

INT 42800 - Interior Design Capstone Design Project

Credit Hours: 3.00. In this B.S. Capstone course the designer tackles a semester long advanced design problem by applying the design process from project obtainment through construction documents. This class is team-taught and must be taken in conjunction with INTR 48000.

Credits: 3.00

INT 45300 - Business Practices Of Interior Design

Credit Hours: 3.00. Business principles and practices as they relate to the interior design profession. Includes business formation and management, professional ethics and organization, certification and licensing issues, design liability, and project management.

Credits: 3.00

INT 49500 - Sustainable Design In Engineering And Technology

Credit Hours: 3.00. In this multidisciplinary course students will create industrial ecological solutions within their unique disciplines. A theoretical framework on Green Design is used to identify and apply green concepts while working on multidisciplinary teams. Environmental concerns for better air quality and global environmental issues are explored.

Credits: 3.00

15 Credits

Interior Design Professional Program, BFA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (78 credits)

A. Art & Design Core (12 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen

observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

B. Interior Design Core (33 credits)

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 13000 - Interior Design Communication

Credit Hours: 3.00. Spatial studies, conceptual ideation, and methods of communicating in various two- and three-dimensional media.

Learning Outcomes: 1. Produce basic design drawing and architectural lettering. 2. Apply the use of line weights when sketching and drawing when visualizing design ideas. 3. Explain architectural and interior design vocabulary. 4. Construct one- and two-point perspectives. 5. Apply basic skills and knowledge of AutoCAD Drafting Software. Credits: 3.00

AD 23000 - Interior Design I

Credit Hours: 3.00. Study of behavior patterns, perceptions, needs, and usage of three-dimensional space through conceptual solutions to human environments. Interior design theory and application of design process through analysis, research, and synthesis will be explored.

Learning Outcomes: 1. Develop design communication skills through freehand and instrument drawing tools that can be used in both design and presentation work. 2. Explore a wide range of drawing media such as pencil, markers, and colored pencils to develop design communication skills. 3. Develop the ability to make informed and sensitive decisions regarding the use of color in presentation work. 4. Further develop speed and accuracy in constructing perspectives and renderings. Credits: 3.00

AD 24000 - Interior Drafting And Drawing

Credit Hours: 3.00. Basic drafting and drawing techniques used in residential and small commercial buildings. Emphasis on interior projects, on multi-view drawing, isometrics, perspective, and architectural construction drawings, and rendering techniques.

Learning Outcomes: 1. Learn to explore different concepts and present their ideas through sketches, design drawings, and final models for a small multilevel residential project. 2. Further develop hand sketching, drafting, AutoCAD, and model building skills to communicate their ideas and solutions in the residential remodel. 3. Research and apply information on furniture, stairs, equipment, plumbing, and other elements for a small house project. 4. Execute a comprehensive set of

construction drawings for a multilevel residential remodel including floor plans, electrical plans, elevations, details and schedules. Credits: 3.00

AD 25000 - Interior Design II

Credit Hours: 3.00. Introduction to space planning methodology applied to small-scale residential and nonresidential environments. Human factors and user requirements, physical and psychological, will be emphasized. Interior materials, components, and special environmental concerns will be explored.

Learning Outcomes: 1. Identify principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Generate multiple solutions to solve a specified design problem, through ideation sketches, drawings, and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definitions and organization, to a specified design problem. 4. Communicate ideas developed in the design process through written, graphic, and oral communication. 5. Assess designed environments as an aesthetic art form within a functional environment. Credits: 3.00

AD 33000 - Interior Design III

Credit Hours: 3.00. Study of advanced space-planning criteria and selection of furnishings, equipment, materials, and finishes. Design considerations for special populations (e.g., disabled, aged, low-income) will be explored.

Learning Outcomes: 1. Design functional and creative spaces based on the needs of specific building conditions or requirements. 2. Create design solutions through the execution of conceptual diagrams, realistic visualization techniques and 3-dimensional modeling. 3. Apply information on building codes and the special requirements of barrier-free design and design for physically challenged individuals or groups in design projects. 4. Produce interior materials, furnishings and finishes for commercial spaces in keeping with those needs and as outlined in the design project. Credits: 3.00

AD 35000 - Interior Design IV

Credit Hours: 3.00. Study of large-scale public and social spaces, emphasizing interior systems and components. Application of design for historic preservation, renovation, or adaptive reuse will be considered.

Learning Outcomes: 1. Apply principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Create multiple ideas, which solve a specified design problem, through ideation sketches, drawings and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definition and organization. 4. Describe ideas developed in the design process through written, graphic and oral communication. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 43000 - Interior Design V

Credit Hours: 3.00. Design of multi-use complex environments,

emphasizing program and problem solving, facility planning, building systems, and materials technology. Application of alternative presentation technologies will be explored.

Learning Outcomes: 1. Apply appropriate code and accessibility regulations to commercial design solutions. 2. Use advanced level of space planning strategies in the design of large corporate interior spaces. 3. Identify appropriate evidence that can inform the solution of a design problem. Credits: 3.00

AD 44000 - Interior Detailing And Construction

Credit Hours: 3.00. The process of designing, detailing, specifying, and constructing interior environments. Emphasis on teams, building systems, architectural drawing, and building codes.

Credits: 3.00

AD 34700 - Lighting For Interior Environments

Credit Hours: 3.00. The study of illuminating principles, design criteria, specifications and environmental systems applied to architectural interiors in public and private spaces.

Learning Outcomes: 1. Describe the fundamentals of lighting, seeing and lighting on color. 2. Identify the range of sources for information and research about light and controlling light in the spatial environment. 3. Explain the effects of lighting on human behavior and well-being. 4. Design appropriate applications of luminaires in terms of function, aesthetics, sustainability, and accessible design. 5. Assess the environmental impact of illumination strategies and decisions. Credits: 3.00

AD 25001 - Interior Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Interior Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Submit selected projects and design portfolio to the Interior Design faculty members and be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

C. Interior Design Supportive Requirements (27 credits)

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 28500 - Interior Components And Materials

Credit Hours: 3.00. Study of surface materials and subsystems and their application to architectural interior spaces. Emphasis on specification guidelines, including product performance, building codes, fire, safety, and health regulations.

Credits: 3.00

AD 39700 - Sustainability In The Built Environment

Credit Hours: 3.00. The study of philosophical concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants. To provide a foundation for evaluation of materials, processes, and applications of design components for environmentally responsible. Field trips will be required.

Learning Outcomes: 1. Define sustainability and assess the ways that sustainable design strategies, processes, and products may be integrated effectively into the built environment. 2. Identify complex social, ecological, and economic dimensions that affect the well-being of humans, neighborhoods, communities, and ecological systems. 3. Apply critical thinking skills to explain how green building methods affect the way built environments are designed, constructed, and operated. 4. Utilize appropriate methodological tools to analyze sustainable

problems and provide environmentally responsible solutions for a green-building scenario. 5. Articulate a comprehensive, progressive world view that integrates diverse approaches to sustainability. 6. Utilize USGBC materials and other educational sources to explain the LEED rating system, LEED professional credentials, and Green Building principles and techniques preparatory to obtaining the LEED Green Associate credential. Credits: 3.00

AD 46500 - Professional Practice

Credit Hours: 3.00. The study of professional office and business procedures for the practice of interior design. Includes project administration, contracts, forms, and documents as used in the marketplace.

Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-making throughout the project lifecycle. Credits: 3.00

AD 33800 - Advanced Interior Design Communication

Credit Hours: 3.00. Study of graphic design fundamentals and application of interior design visual presentation. To provide a foundation for developing proficiency in the use visual communication design in interior design presentation. Offered 3rd year in the Interior Design BFA program of study.

Learning Outcomes: 1. Learn graphic design fundamentals and techniques as a tool for communicating interior design. 2. Develop the skills, ability, and judgement to visualize, develop, and communicate interior design ideas through graphic representation. 3. Strengthen a student's interior design portfolio through review and organization of contents. 4. Learn to graphically represent design ideas, design processes, and design outcomes. Credits: 3.00

CM 23301 - Mechanical, Electrical And Piping Systems In The Built Environment

Credit Hours: 3.00. An introductory course dealing with construction materials and methods related to building systems, focusing on mechanical, electrical, and piping (MEP) systems. Students will acquire fundamental skills in MEP construction plan reading, quantity estimating, basic systems' design and construction execution through lectures, laboratories and integrated project team exercises.

Learning Outcomes: 1. Recognize the basic principles and components of mechanical,

electrical and piping (MEP) systems. 2. Explain the components of a given MEP system based on reading plan and specifications information. 3. Demonstrate the ability to understand conceptual cost and schedule of MEP systems. 4. Trace basic MEP systems lines, such as piping, lighting, and mechanical ducts. 5. Show an understanding of professionalism by applying proper communication, teamwork, rules & regulations, and level of detail required within a built environment business and on a construction jobsite. Credits: 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

AD 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

AD 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating

employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

D. Interior Design Studio Arts Selectives (3 credits)

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits:

3.00

AD 23600 - Lighting Fundamentals For Photography

Credit Hours: 3.00. Introductory course in understanding electronic strobe lighting. Begins with a review of basic lighting principles and a series of problem-solving assignments, which introduce control, and applications of electronic strobe lighting. Still life photography and portraiture are emphasized and covers on-location lighting.

Learning Outcomes: 1. Gain an understanding of the basic principles of light and how to use those principles to light photographic subject matter. 2. Gain a basic understanding of the function of photographic lighting equipment. 3. Compile a portfolio of images that demonstrate a skill set learned regarding product and portrait and simple space lighting. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical

thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 33300 - Photo Silk Screen

Credit Hours: 3.00. Advanced study of the techniques of photo silkscreen and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 40400 - Moldmaking And/Or Wheel-Throwing Production Techniques In Ceramics

Credit Hours: 3.00 to 6.00. This course will teach mold-making or wheel-throwing (depending on the individual student's interest) with a view to creating ceramic objects suitable for commercial mass-production. Both tableware and/or sculptural objects will be explored. For the wheel-throwing option the students must have at least one year of high school throwing or AD 24200 with a grade of at least "B" or permission of instructor. For the mold making and casting option only, students must be an Art and Design student or have permission of instructor.

Learning Outcomes: 1. The student will learn how to design a model, make the model from clay, make a mold of the designed model (or found object), cast and assemble cast ceramics pieces for possible commercial mass-production. If choosing the wheel-throwing option, the student will learn advanced techniques of throwing and assembling parts to

make either functional and sculptural objects for mass-production. 2. Students will also learn simple glazing techniques, and have the option of learning how to screen print and use decals on their final products. Credits: 3.00 to 6.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

E. Interior Design Art History Selectives (3 credits)

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 33900 - Women Artists (UCC: BSS)

Credit Hours: 3.00. A critical overview of the lives, works, and experiences of women artists from the late 19th century to the

present, examining the social and cultural challenges they faced, and reflecting on the changing roles women have played in art and society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks and artists. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about women artists and women art by contextualizing and analyzing them and selecting artworks to illustrate your comments. 4. Apply the knowledge they will have acquired to analyze and write about artworks we would not have studied in class. Credits: 3.00

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary

sources as well as writing exercises. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas. Credits: 3.00

AD 34300 - Northern Renaissance Art

Credit Hours: 3.00. The development of a mature North European art originating in the International Gothic tradition and culminating in the works of Albrecht Durer, Jerome Bosch, and Pieter Bruegel, the Elder.

Learning Outcomes: 1. Be familiar with the history of the period in general and with major artists in particular. 2. Show the ability to read and think critically about a work of art, to look carefully at a work and to discuss what he or she is seeing. 3. Be able to describe clearly a work of art and to compare it to other works and artists of the period. 4. Be able to write an explanation of how a work of art illustrates a particular theme or idea in clear and understandable prose with correct spelling and punctuation in paragraphs that lead logically from one to another. 5. Show the ability to follow instructions and pay attention to detail in the preparation and presentation of research citing sources accurately. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

A. Art & Design Core (12 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

Elective (8-17 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-Course/Non-Credit Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 13000 - Interior Design Communication

Credit Hours: 3.00. Spatial studies, conceptual ideation, and methods of communicating in various two- and three-dimensional media.

Learning Outcomes: 1. Produce basic design drawing and architectural lettering. 2. Apply the use of line weights when sketching and drawing when visualizing design ideas. 3. Explain architectural and interior design vocabulary. 4. Construct one- and two-point perspectives. 5.

Apply basic skills and knowledge of AutoCAD Drafting Software. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

AD 23000 - Interior Design I

Credit Hours: 3.00. Study of behavior patterns, perceptions, needs, and usage of three-dimensional space through conceptual solutions to human environments. Interior design theory and application of design process through analysis, research, and synthesis will be explored.

Learning Outcomes: 1. Develop design communication skills through freehand and instrument drawing tools that can be used in both design and presentation work. 2. Explore a wide range of drawing media such as pencil, markers, and colored pencils to develop design communication skills. 3. Develop the ability to make informed and sensitive decisions regarding the use of color in presentation work. 4. Further develop speed and accuracy in constructing perspectives and renderings. Credits: 3.00

AD 24000 - Interior Drafting And Drawing

Credit Hours: 3.00. Basic drafting and drawing techniques used in residential and small commercial buildings. Emphasis on interior projects, on multi-view drawing, isometrics, perspective, and architectural construction drawings, and rendering techniques.

Learning Outcomes: 1. Learn to explore different concepts and present their ideas through sketches, design drawings, and final models for a small multilevel residential project. 2. Further develop hand sketching, drafting, AutoCAD, and model building skills to

communicate their ideas and solutions in the residential remodel. 3. Research and apply information on furniture, stairs, equipment, plumbing, and other elements for a small house project. 4. Execute a comprehensive set of construction drawings for a multilevel residential remodel including floor plans, electrical plans, elevations, details and schedules. Credits: 3.00

15 Credits

15 Credits

Spring 2nd Year

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 25000 - Interior Design II

Credit Hours: 3.00. Introduction to space planning methodology applied to small-scale residential and nonresidential environments. Human factors and user requirements, physical and psychological, will be emphasized. Interior materials, components, and special environmental concerns will be explored.

Learning Outcomes: 1. Identify principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Generate multiple solutions to solve a specified design problem, through ideation sketches, drawings, and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definitions and organization, to a specified design problem. 4. Communicate ideas developed in the design process through written, graphic, and oral communication. 5. Assess designed environments as an aesthetic art form within a functional environment. Credits: 3.00

AD 28500 - Interior Components And Materials

Credit Hours: 3.00. Study of surface materials and subsystems and their application to architectural interior spaces. Emphasis on specification guidelines, including product performance, building codes, fire, safety, and health regulations.

Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 25001 - Interior Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Interior Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Submit selected projects and design portfolio to the Interior Design faculty members and be assessed by faculty to identify the student's

strengths, abilities, and areas of needed improvement. Credits: 0.00

16 Credits

16 Credits

Fall 3rd Year

AD 33000 - Interior Design III

Credit Hours: 3.00. Study of advanced space-planning criteria and selection of furnishings, equipment, materials, and finishes. Design considerations for special populations (e.g., disabled, aged, low-income) will be explored.

Learning Outcomes: 1. Design functional and creative spaces based on the needs of specific building conditions or requirements. 2. Create design solutions through the execution of conceptual diagrams, realistic visualization techniques and 3-dimensional modeling. 3. Apply information on building codes and the special requirements of barrier-free design and design for physically challenged individuals or groups in design projects. 4. Produce interior materials, furnishings and finishes for commercial spaces in keeping with those needs and as outlined in the design project. Credits: 3.00

AD 33800 - Advanced Interior Design Communication

Credit Hours: 3.00. Study of graphic design fundamentals and application of interior design visual presentation. To provide a foundation for developing proficiency in the use visual communication design in interior design presentation. Offered 3rd year in the Interior Design BFA program of study.

Learning Outcomes: 1. Learn graphic design fundamentals and techniques as a tool for communicating interior design. 2. Develop the skills, ability, and judgement to visualize, develop, and communicate interior design ideas through graphic representation. 3. Strengthen a student's interior design portfolio through review and organization of contents. 4. Learn to graphically represent design ideas, design processes, and design outcomes. Credits: 3.00

AD 34700 - Lighting For Interior Environments

Credit Hours: 3.00. The study of illuminating principles, design criteria, specifications and environmental systems applied to architectural interiors in public and private spaces.

Learning Outcomes: 1. Describe the fundamentals of lighting, seeing and lighting on color. 2. Identify the range of sources for information and research about light and controlling light in the spatial environment. 3. Explain the effects of lighting on human behavior and well-being. 4. Design appropriate applications of luminaires in terms of function, aesthetics, sustainability, and accessible design. 5. Assess the environmental impact of illumination strategies and decisions. Credits: 3.00

CM 23301 - Mechanical, Electrical And Piping Systems In The Built Environment

Credit Hours: 3.00. An introductory course dealing with construction materials and methods related to building systems, focusing on mechanical, electrical, and piping (MEP) systems. Students will acquire fundamental skills in MEP construction plan reading, quantity estimating, basic systems' design and construction execution through lectures, laboratories and integrated project team exercises.

Learning Outcomes: 1. Recognize the basic principles and components of mechanical, electrical and piping (MEP) systems. 2. Explain the components of a given MEP system based on reading plan and specifications information. 3. Demonstrate the ability to understand conceptual cost and schedule of MEP systems. 4. Trace basic MEP systems lines, such as piping, lighting, and mechanical ducts. 5. Show an understanding of professionalism by applying proper communication, teamwork, rules & regulations, and level of detail required within a built environment business and on a construction jobsite. Credits: 3.00

18 Credits

18 Credits

Spring 3rd Year

AD 35000 - Interior Design IV

Credit Hours: 3.00. Study of large-scale public and social spaces, emphasizing interior systems and components. Application of design for historic preservation, renovation, or adaptive reuse will be considered.

Learning Outcomes: 1. Apply principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Create multiple ideas, which solve a specified design problem, through ideation sketches, drawings and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definition and organization. 4. Describe ideas developed in the design process through written, graphic and oral communication. Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

17 Credits

17 Credits

Fall 4th Year

AD 39700 - Sustainability In The Built Environment

Credit Hours: 3.00. The study of philosophical concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants. To provide a foundation for evaluation of materials, processes, and applications of design components for environmentally responsible. Field trips will be required.

Learning Outcomes: 1. Define sustainability and assess the ways that sustainable design strategies, processes, and products may be integrated effectively into the built environment. 2. Identify complex social, ecological, and economic dimensions that affect the well-being of humans, neighborhoods, communities, and ecological systems. 3. Apply critical thinking skills to explain how green building methods affect the way built environments are designed, constructed, and operated. 4. Utilize appropriate methodological tools to analyze sustainable problems and provide environmentally responsible solutions for a green-building scenario. 5. Articulate a comprehensive, progressive world view that integrates diverse approaches to sustainability. 6. Utilize USGBC materials and other educational sources to explain the LEED rating system, LEED professional credentials, and Green Building principles and techniques preparatory to obtaining the LEED Green Associate credential. Credits: 3.00

AD 43000 - Interior Design V

Credit Hours: 3.00. Design of multi-use complex environments, emphasizing program and problem solving, facility planning, building systems, and materials technology. Application of alternative presentation technologies will be explored.

Learning Outcomes: 1. Apply appropriate code and accessibility regulations to commercial design solutions. 2. Use advanced level of space planning strategies in the design of large

corporate interior spaces. 3. Identify appropriate evidence that can inform the solution of a design problem. Credits: 3.00

15 Credits

15 Credits

Spring 4th Year

AD 44000 - Interior Detailing And Construction

Credit Hours: 3.00. The process of designing, detailing, specifying, and constructing interior environments. Emphasis on teams, building systems, architectural drawing, and building codes.

Credits: 3.00

AD 46500 - Professional Practice

Credit Hours: 3.00. The study of professional office and business procedures for the practice of interior design. Includes project administration, contracts, forms, and documents as used in the marketplace.

Credits: 3.00

15 Credits

15 Credits

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

15-16 Credits

15-16 Credits

About the Program

Italian Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (27 credits)

Pre-requisite Language Courses

ITAL 10100 - Italian Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Italian course with emphasis on communicative skills (listening and speaking), literacy (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize familiar words and very basic phrases. 2. Speak and write simple phrases and sentences. 3. Interact in a basic way, provided the other person is prepared to repeat or rephrase things at a slower rate of speech and help the student to formulate the intended thought. 4. Ask and answer simple questions in areas of immediate need or on very familiar topics. Credits: 3.00

ITAL 10200 - Italian Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of ITAL 10100.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Speak a series of simple phrases and sentences to describe commonly discussed topics. 2. Develop a basic understanding of simple social exchanges. 3. Write short, simple sentences related to areas of immediate needs. 4. Read short, simple texts, by identifying predictable information. Credits: 3.00

ITAL 10500 - Accelerated Basic Italian (UCC: HUM)

Credit Hours: 3.00. An accelerated basic Italian course that substitutes for ITAL 10100 and ITAL 10200 . Knowledge of a foreign language required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 20100 - Italian Level III (UCC: HUM)

Credit Hours: 3.00. A continuation of ITAL 10200 .

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 20200 - Italian Level IV (UCC: HUM)

Credit Hours: 3.00. An intermediate Italian course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 20500 - Accelerated Intermediate Italian (UCC: HUM)

Credit Hours: 3.00. An accelerated second-year Italian course with focus on furthering the development of listening, reading, speaking and writing abilities at the intermediate level.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

Area A - Required Courses (24 credits)

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact

of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

Area B - Italian Studies Selectives (3 credits)

PSY 40300 - Psycholinguistics

Credit Hours: 3.00. (PSY 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

HIST 35100 - The Second World War (UCC: HUM)

Credit Hours: 3.00. A study of the diplomacy, economic mobilization, and military operations of World War II, 1939-1945.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 40700 - Road To World War I: Europe 1870-1919

Credit Hours: 3.00. Studies the increase in Europe's wealth and power through conquest, industrialization, and nation-state rivalries, along with the social stress and cultural anxiety that culminated in World War I; examines the war from the perspectives of both combatants and civilians.

Credits: 3.00

HIST 40800 - Dictatorship And Democracy: Europe 1919-1945

Credit Hours: 3.00. This course examines the fleeting triumph of democracy across Europe. Followed by the rise of fascism, communism, and Nazism. Emphasis will be placed on broad economic, social, and cultural transformations as well as individual choices to resist or conform.

Credits: 3.00

ITAL 23100 - Dante's Divine Comedy

Credit Hours: 3.00. Reading and discussion of Dante's Divine Comedy. The major critical approaches to Dante's masterpiece will be reviewed. All readings, papers, and examinations will be in English.

Credits: 3.00

ITAL 28000 - Italian Culture And Civilization (UCC: HUM)

Credit Hours: 3.00. Course focuses on salient aspects of Italian culture and civilization from the Middle Ages to the present. In English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of Italian culture and its legacy in the world. 2. Identify crucial developments of Italian society and culture of the time studied. 3. Situate the arts, literature, and music of Italy in their historical context. 4. Become aware of the

political and national struggles that Italy faced throughout the centuries. 5. Be introduced to key figures from different fields of studies whose work, inventions, and discoveries changed and are still changing our world perspectives.
Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

ITAL 39300 - Special Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will focus on particular aspects of Italian literature, cinema or culture. No knowledge of Italian required.

Credits: 3.00

ITAL 49300 - Advanced Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will analyze in depth particular aspects of Italian literature, cinema or culture. No knowledge of Italian necessary.

Credits: 3.00

LC 23000 - Crossing Borders: Introduction To Comparative Literature

Credit Hours: 3.00. (CMPL 23000) Foundations for comparison of works in different languages, thematic (philosophical, sociological, psychological) and structural (genre, composition, use of linguistic devices); parallel interrelation of theme and structure in works of different literatures. The importance of literary norms and systems of genres. Examination of crosscurrents in different literatures during successive periods of development.

Learning Outcomes: 1. Provide familiarity with the original languages that lie behind English translations of world literature. 2. Relate a particular culture to the larger patterns of world literature to gain an appreciative of cultural diversity and global awareness of class, ethnicity, gender, and race. 3. Provide practical experience in oral communication through class presentations and reports and projects. 4. Provide practical experience in oral communication through class presentations and reports and projects. 5. Provide appropriate level practice in information literacy related to the study of comparative literature, including researching source materials, research methodologies, and intellectual approaches.
Credits: 3.00

LC 33100 - Comparative Literature In Translation

Credit Hours: 3.00. A course in the study of a special topic related to works in several foreign literatures, directed by an instructor whose particular field of specialization will be highlighted.

Credits: 3.00

LING 20100 - Introduction To Linguistics (UCC: BSS)

Credit Hours: 3.00. Basic concepts of linguistics and methods of analysis of language; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax, and semantics, and to problem-solving techniques, with material drawn from a variety of languages.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

MARS 22000 - Introduction To Medieval And Renaissance Studies

Credit Hours: 3.00. An introduction to the interdisciplinary study of the Middle Ages and Renaissance.

Credits: 3.00

LC 57000 - Introduction To Semiotics

Credit Hours: 3.00. (ANTH 51900, SLHS 58900, COM 50700, ENGL 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena that can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple

perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas. Credits: 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

LC 26100 - Introduction To The Linguistic Study Of Foreign Languages (UCC: BSS)

Credit Hours: 3.00. Overview of linguistics and the role of language in society; fundamental concepts of linguistic analysis. The course focuses on linguistic phenomena found in French, German, Russian, and Spanish, with material, examples, and assignments drawn primarily from those languages whenever appropriate.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

HIST 40600 - Rebels And Romantics: Europe 1815-1870

Credit Hours: 3.00. Examines the dramatic social, cultural, and political developments in Europe following the defeat of Napoleon through various rebellious and romantic personalities, as well as figures who supported conservative or reformist solutions to the upheavals of industrialization, revolution, and nationalism.

Credits: 3.00

ITAL 28500 - Intercultural Migration To Italy In Film, Literature, And Art (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the complexities of recent migrations to Italy through the perspectives of film, literature, and art. The course covers a wide range of topics, from a historical and geographical overview of migrations to Italy, to the hotly debated issues of immigration policies, Italian citizenship law, human rights and social justice, and the process of reimagining the Italian identity in more diverse and inclusive terms. Course taught in English. No Italian knowledge required.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Define the historical context, geographical routes, and reasons of migration to Italy. 2. Explain the impact of

migration on Italian demographics, economy, and Italian identity ("Italianità"). 3. Compare diverse cultural representations of migration to Italy with diverse representations of migration in their own cultural contexts. 4. Outline the intersections between migration and the issues of citizenship, human rights, and social justice in Italian and their own cultural context. 5. Reflect on their intercultural learning in the domain of curiosity, openness, empathy, and global awareness. Credits: 3.00

Electives (20-57 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

ITAL 10100 - Italian Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Italian course with emphasis on communicative skills (listening and speaking), literacy (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize familiar words and very basic phrases. 2. Speak and write simple phrases and sentences. 3. Interact in a basic way, provided the other person is prepared to repeat or rephrase things at a slower rate of speech and help the student to formulate the intended thought. 4. Ask and answer simple questions in areas of immediate need or on very familiar topics. Credits: 3.00

15 Credits

Spring 1st Year

ITAL 10200 - Italian Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of ITAL 10100.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Speak a series of simple phrases and sentences to describe commonly discussed topics. 2. Develop a basic understanding of simple social exchanges. 3. Write short, simple sentences related to areas of immediate needs. 4. Read short, simple texts, by identifying predictable information. Credits: 3.00

15-16 Credits

Fall 2nd Year

ITAL 20100 - Italian Level III (UCC: HUM)

Credit Hours: 3.00. A continuation of ITAL 10200 .

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Spring 2nd Year

ITAL 20200 - Italian Level IV (UCC: HUM)

Credit Hours: 3.00. An intermediate Italian course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

15 Credits

Fall 3rd Year

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

15-16 Credits

Spring 3rd Year

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Fall 4th Year

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

15 Credits

Spring 4th Year

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 39300 - Special Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will focus on particular aspects of Italian literature, cinema or culture. No knowledge of Italian required.

Credits: 3.00

15 Credits

Japanese, BA (Language & Culture Track)

About the Program

Degree Requirements

Departmental/Program Major Requirement Requirements (33 credits)

Pre-requisite Language Courses

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3. Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

Japanese Major (33 credits)

Area A - Japanese Language (6 credits)

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Area B - Japanese Literature (3 credits)

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

Language & Culture Track

Area C - Advanced Japanese Language (6 credits)

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 40200 - Japanese Level VIII (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of Fourth Year Japanese I. It continues work on the acquisition of advanced-level proficiency in speaking, listening, reading and writing. Students are given opportunities to understand the main ideas of extended discourse, to read texts which are linguistically complex, and to write about a variety of topics.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Area D - Advanced Japanese Literature (3 credits)

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

Area E - Japanese Linguistics (6 credits)

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

Area F - Japanese Selectives (9 credits)

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3.

Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

15-18 Credits

Spring 1st Year

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

15-17 Credits

Fall 2nd Year

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

13-16 Credits

Spring 2nd Year

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

13-17 Credits

Fall 3rd Year

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

13-15 Credits

Spring 3rd Year

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

15 Credits

Fall 4th Year

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

13-17 Credits

Spring 4th Year

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 40200 - Japanese Level VIII (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of Fourth Year Japanese I. It continues work on the acquisition of advanced-level proficiency in speaking, listening, reading and writing. Students are given opportunities to understand the main ideas of extended discourse, to read texts which are linguistically complex, and to write about a variety of topics.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

12-16 Credits

Japanese: World Languages Teaching Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Requirement Requirements (77 credits)

Pre-requisite Language Courses

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3. Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

Japanese Major (30 credits)

Area A - Japanese Language (6 credits)

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Area B - Japanese Literature (3 credits)

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

Education Track (21 credits)

Area C - Advanced Japanese Language (6 credits)

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Area D - Japanese Film & Culture in Translation (3 credits)

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

Area E - Advanced Japanese Literature (3 credits)

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

Area F - Japanese Linguistics (3 credits)

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

Area G - Japanese Selectives (6 credits)

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 40200 - Japanese Level VIII (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of Fourth Year Japanese I. It continues work on the acquisition of advanced-level proficiency in speaking, listening, reading and writing. Students are given opportunities to understand the main ideas of extended discourse, to read texts which are linguistically complex, and to write about a variety of topics.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2.

Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

Other Departmental (12 credits)

Core III: Linguistic Diversity (0 credits)

Foundational Requirements (12 credits)

Notes

Electives (31 credits)

Grade Requirements

GPA Requirements

Teacher Licensure Information

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3. Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these

larger issues to reflective teaching practices. Credits: 1.00 to 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

15-16 Credits

Spring 1st Year

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

EDCI 28500 - Multiculturalism And Education (UCC: BSS)

Credit Hours: 2.00 to 3.00. This course integrates an understanding of multiculturalism with principles of democratic education. Historical, sociological, cultural, political, philosophical, and pedagogical foundations of multiculturalism are explored and related to issues of pedagogy in a pluralistic society.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Develop awareness of issues and concerns related to multicultural education. 2. Develop knowledge of how multiculturalism impacts teachers, schools, classrooms, and society. 3. Develop skills of critical thinking and reflection that will enable educators to contribute to meeting the needs of students in a multicultural and global world. Credits: 2.00 to 3.00

15-17 Credits

Fall 2nd Year

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 24000 - Children With Gifts, Creativity, And Talents

Credit Hours: 1.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted children youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted

students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). Cannot be taken concurrently with EDPS 24800.

Learning Outcomes: 1. Understand who gifted, creative and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 1.00

EDPS 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. (EDCI 20002) This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large

group instruction and practicing the duties of a teacher who works well with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

15-16 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504

and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000. Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich

relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

15-16 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent

enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

17 Credits

Spring 3rd Year

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4. Recognize how theories of individual and collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences. Credits: 3.00

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

18 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Jewish Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Required Course (3 credits)

HIST 30200 - Historical Topics

Credit Hours: 3.00. This variable-title course deals with broad historical topics that transcend and collapse traditional analytical, chronological, and geographic boundaries. Content will vary with faculty member teaching the class.

Learning Outcomes: 1. Students will acquire a perspective on and basic understanding of the course content. 2. Students will engage in integrative learning as they examine the course content that transcends and collapses traditional analytical, chronological, and geographic boundaries. 3. Students will develop their creative and critical thinking skills. 4. Students will strengthen their information literacy and improve their writing skills. Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 49300 - Interdisciplinary Undergraduate Seminar

Credit Hours: 1.00 to 3.00. An undergraduate seminar devoted to an interdisciplinary examination of social, economic, political, and intellectual movements, using the faculty resources of the participating departments. Subject matter will vary. Each offering of the seminar will be approved by a committee of department heads from the sponsoring departments. Permission of instructor required.

Credits: 1.00 to 3.00

Hebrew Courses (12 credits)

HEBR 10100 - Modern Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to Modern Hebrew: the writing and sound systems, and systematic presentation of basic structures. All language skills - reading, writing, speaking, and comprehension - are emphasized. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HEBR 10200 - Modern Hebrew II (UCC: HUM)

Credit Hours: 3.00. Continuation and extension of the first semester. The course aims to develop fluency in reading, comprehension, and spoken language. Knowledge of grammar and vocabulary is expanded.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HEBR 12100 - Biblical Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. The first semester of biblical Hebrew will present the basic elements of the language, including alphabet, vocabulary, and grammar. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 12200 - Biblical Hebrew Level II (UCC: HUM)

Credit Hours: 3.00. The second semester of biblical Hebrew will continue the study of reading, vocabulary and grammar, based on selections from the Hebrew Bible.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 20100 - Modern Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading both in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 20200 - Modern Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22100 - Biblical Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. The third semester of biblical Hebrew focuses on reading and translation of extended passages form the Pentateuch and the use of textual criticism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22200 - Biblical Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. The fourth semester of biblical Hebrew exposes the student to both narrative and poetic sections of the Bible.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Jewish Studies Selective Areas (18 credits)

Electives (14-51 credits)

GPA Requirements

Supplemental List

Additional Information

Sample 4-Year Plan

Fall 1st Year

HEBR 10100 - Modern Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to Modern Hebrew: the writing and sound systems, and systematic presentation of basic structures. All language skills - reading, writing, speaking, and comprehension - are emphasized. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 12100 - Biblical Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. The first semester of biblical Hebrew will present the basic elements of the language, including alphabet, vocabulary, and grammar. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Spring 1st Year

HEBR 10200 - Modern Hebrew II (UCC: HUM)

Credit Hours: 3.00. Continuation and extension of the first semester. The course aims to develop fluency in reading, comprehension, and spoken language. Knowledge of grammar and vocabulary is expanded.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 12200 - Biblical Hebrew Level II (UCC: HUM)

Credit Hours: 3.00. The second semester of biblical Hebrew will continue the study of reading, vocabulary and grammar, based on selections from the Hebrew Bible.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 30200 - Historical Topics

Credit Hours: 3.00. This variable-title course deals with broad historical topics that transcend and collapse traditional analytical, chronological, and geographic boundaries. Content will vary with faculty member teaching the class.

Learning Outcomes: 1. Students will acquire a perspective on and basic understanding of the course content. 2. Students will engage in integrative learning as they examine the course content that transcends and collapses traditional analytical, chronological, and geographic boundaries. 3. Students will develop their creative and critical thinking skills. 4. Students will strengthen their information literacy and improve their writing skills. Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 49300 - Interdisciplinary Undergraduate Seminar

Credit Hours: 1.00 to 3.00. An undergraduate seminar devoted to an interdisciplinary examination of social, economic, political, and intellectual movements, using the faculty resources of the participating departments. Subject matter will vary. Each offering of the seminar will be approved by a committee of department heads from the sponsoring departments. Permission of instructor required.

Credits: 1.00 to 3.00

15-16 Credits

Fall 2nd Year

HEBR 20100 - Modern Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading both in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22100 - Biblical Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. The third semester of biblical Hebrew focuses on reading and translation of extended passages form the Pentateuch and the use of textual criticism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Spring 2nd Year

HEBR 20200 - Modern Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22200 - Biblical Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. The fourth semester of biblical Hebrew exposes the student to both narrative and poetic sections of the Bible.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Kinesiology, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (40 credits)

HK 13500 - Introduction To Health And Kinesiology

Credit Hours: 1.00. Overviews the disciplines of health and kinesiology. Students explore skills and academic interests in theses areas. Describes career opportunities and options for graduate study. Provides strategies for professional and portfolio development. Students complete five hours of community service per semester. Permission of instructor required.

Credits: 1.00

HK 25300 - Principles Of Motor Development

Credit Hours: 3.00. This course provides an introduction to motor development from a life-span perspective. Students will learn how infants develop from mainly reflexive beings into children and adults that are capable of interacting with the world in a goal-directed manner. This course specifically examines how changes in physical growth, aging, and maturation of the central nervous system influence motor performance. Finally, the decline of motor skills associated with advanced age is discussed.

Learning Outcomes: 1. Students will be able to describe how motor skills develop in children and decline in older adults. 2. Students will be able to apply the principles of motor development to clinical, education, and sport sciences settings. Credits: 3.00

HK 25800 - Foundations Of Motor Skill Learning

Credit Hours: 3.00. Concepts and principles of motor skill learning, with emphasis on the acquisition and retention of gross movement and sport skills.

Credits: 3.00

HK 30200 - Applied Clinical Anatomy

Credit Hours: 3.00. An introduction to the regional anatomical study of the human body for undergraduate allied health students. Lectures will be supplemented by observation and demonstration of prosected cadaver material, radiographs, osteology, and surface anatomy.

Credits: 3.00

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

HK 37200 - Sport And Exercise Psychology I

Credit Hours: 3.00. This course focuses on social and psychological factors related to participation in sport, exercise, and physical activity. The class explores both (a) how social and psychological factors influence participation and performance in physical activity, and (b) how sport, exercise, and physical activity participation affects psychological well-being. Topics include personality, socialization, learning and feedback, stress and coping, self-perceptions, motivation, and psychological methods for enhancing personal development and physical performance.

Learning Outcomes: 1. Develop an

understanding of social and psychological processes that operate in physical activity. 2. Acquire the knowledge to successfully apply social psychological principles within a variety of physical activity settings. Credits: 3.00

HK 46500 - Research Methods

Credit Hours: 3.00. This course will be conducted in a lecture/lab format. The lectures will introduce the basic knowledge necessary to understanding the entire research process as it is found in health and kinesiology. The laboratories will be designed to give students practice in discovering research questions, preparing research proposals, evaluating existing research, and applying research to practical problems.

Learning Outcomes: 1. Describe the nature of research and the scientific method. 2. Describe the different types of research conducted within health and kinesiology, and the value of each type of research. 3. Provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating research in basic and applied settings. 4. Identify a potential topic/issue to examine and conduct a review of the existing research literature and summarize and critically evaluate a research article. 5. Describe the steps involved in developing a research proposal, collecting and analyzing data, and reporting the results of a research project. Credits: 3.00

HK 49600 - Mentored Research In Kinesiology

Credit Hours: 1.00 to 3.00. Students are engaged in a research project under the guidance of a faculty member in one of the areas of inquiry in the kinesiology major. Permission of instructor required.

Credits: 1.00 to 3.00

HK 10000 - Foundations Of Kinesiology

Credit Hours: 3.00. This course will provide an introduction to the physical and behavioral sciences underlying kinesiology, the study of human movement. The course will cover foundational concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. The course will take an interdisciplinary perspective, exploring both key concepts in each of these sub-areas of kinesiology, and how they are integrated to understand problems in human movement, exercise, physical activity, sport, and healthy lifestyles.

Learning Outcomes: 1. Explain basic concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. 2. Apply and integrate concepts from the sub-disciplines of kinesiology to better understand human behavior. Credits: 3.00

HK 26300 - Biomechanical Foundations Of Motor Skills

Credit Hours: 3.00. Fundamental anatomical and mechanical concepts and procedures for analyzing motor skills, with particular reference to sport, dance, and aquatic activities.

Learning Outcomes: 1. Describe motion with mechanical and anatomical terminology. 2. Quantify linear and angular characteristics of motion. 3. Describe and quantify the cause and effect relationship between force and motion. 4. Collect, analyze and interpret biomechanical measures of human movement. Credits: 3.00

Optional Concentrations

Other Departmental/Program Course Requirements (40-45 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent).

Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles

that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of

STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (35-40 credits) or (17-22 credits) or (16-21 credits) or (29-34 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

HK 13500 - Introduction To Health And Kinesiology

Credit Hours: 1.00. Overviews the disciplines of health and kinesiology. Students explore skills and academic interests in theses areas. Describes career opportunities and options for graduate study. Provides strategies for professional and portfolio development. Students complete five hours of community service per semester. Permission of instructor required.

Credits: 1.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple

digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular,

organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

14-15 Credits

Spring 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding.

6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

HK 10000 - Foundations Of Kinesiology

Credit Hours: 3.00. This course will provide an introduction to the physical and behavioral sciences underlying kinesiology, the study of human movement. The course will cover foundational concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. The course will take an interdisciplinary perspective, exploring both key concepts in each of these sub-areas of kinesiology, and how they are integrated to understand problems in human movement, exercise, physical activity, sport, and healthy lifestyles.

Learning Outcomes: 1. Explain basic concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. 2. Apply and integrate concepts from the sub-disciplines of kinesiology to better understand human behavior. Credits: 3.00

16 Credits

Fall 2nd Year

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-16 Credits

Spring 2nd Year

HK 30200 - Applied Clinical Anatomy

Credit Hours: 3.00. An introduction to the regional anatomical study of the human body for undergraduate allied health students. Lectures will be supplemented by observation and demonstration of prosected cadaver material, radiographs, osteology, and surface anatomy.

Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

HK 26300 - Biomechanical Foundations Of Motor Skills

Credit Hours: 3.00. Fundamental anatomical and mechanical concepts and procedures for analyzing motor skills, with particular reference to sport, dance, and aquatic activities.

Learning Outcomes: 1. Describe motion with mechanical and anatomical terminology. 2. Quantify linear and angular characteristics of motion. 3. Describe and quantify the cause and effect relationship between force and motion. 4.

Collect, analyze and interpret biomechanical measures of human movement. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-16 Credits

Fall 3rd Year

HK 25300 - Principles Of Motor Development

Credit Hours: 3.00. This course provides an introduction to motor development from a life-span perspective. Students will learn how infants develop from mainly reflexive beings into children and adults that are capable of interacting with the world in a goal-directed manner. This course specifically examines how changes in physical growth, aging, and maturation of the central nervous system influence motor performance. Finally, the decline of motor skills associated with advanced age is discussed.

Learning Outcomes: 1. Students will be able to describe how motor skills develop in children and decline in older adults. 2. Students will be able to apply the principles of motor development to clinical, education, and sport sciences settings. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective

foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 3rd Year

HK 25800 - Foundations Of Motor Skill Learning

Credit Hours: 3.00. Concepts and principles of motor skill learning, with emphasis on the acquisition and retention of gross movement and sport skills.

Credits: 3.00

HK 37200 - Sport And Exercise Psychology I

Credit Hours: 3.00. This course focuses on social and psychological factors related to participation in sport, exercise, and physical activity. The class explores both (a) how social and psychological factors influence participation and performance in physical activity, and (b) how sport, exercise, and physical activity participation affects psychological well-being. Topics include personality, socialization, learning and feedback, stress and coping, self-perceptions, motivation, and psychological methods for enhancing personal development and physical performance.

Learning Outcomes: 1. Develop an understanding of social and psychological processes that operate in physical activity. 2. Acquire the knowledge to successfully apply social psychological principles within a variety of physical activity settings. Credits: 3.00

HK 46500 - Research Methods

Credit Hours: 3.00. This course will be conducted in a lecture/lab format. The lectures will introduce the basic knowledge necessary to understanding the entire research process as it is found in health and kinesiology. The laboratories will be designed to give students practice in discovering research questions, preparing research proposals, evaluating existing research, and applying research to practical problems.

Learning Outcomes: 1. Describe the nature of research and the scientific method. 2. Describe the different types of research conducted within health and kinesiology, and the value of each type of research. 3. Provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating research in basic and applied settings. 4. Identify a potential topic/issue to examine and conduct a review of the existing

research literature and summarize and critically evaluate a research article. 5. Describe the steps involved in developing a research proposal, collecting and analyzing data, and reporting the results of a research project. Credits: 3.00

HK 49600 - Mentored Research In Kinesiology

Credit Hours: 1.00 to 3.00. Students are engaged in a research project under the guidance of a faculty member in one of the areas of inquiry in the kinesiology major. Permission of instructor required.

Credits: 1.00 to 3.00

15 Credits

Fall 4th Year

14-16 Credits

Spring 4th Year

15 Credits

Landscape Architecture, BSLA

About the Program

Degree Requirements

Departmental/Program Major Courses (63 credits)

Required Major Courses (63 credits)

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

LA 11700 - Graphic Communication In Design II

Credit Hours: 3.00. A course in graphic communication theory focusing on digital skills and processes. Project-based instruction will be used to simulate design office procedures through 2D and 3D exercises using raster and vector software.

Learning Outcomes: 1. Prepare students for internship and professional practice through office-ready digital workflows. 2. Develop and refine a personal graphic style along with a critical ""designer's eye"" through formal presentation and discussion. 3. Analyze a problem and determine the best tool(s) for the task while pursuing graphic innovation by knowing the ""why"" and ""how"" of digital tools. Credits: 3.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site

design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

LA 22600 - Studio II: Site Analysis And Design

Credit Hours: 4.00. Methods, principles and the process of designing in the built environment. Basic principles of site organization and composition are presented and applied in a series of exercises and studio projects. Role of the design process is reinforced both as a problem-solving tool and as a means of creativity and ideation.

Learning Outcomes: 1. Recognize and discuss theoretical design principles, identify those principles in well-designed sites, and apply those principles to their own design work. 2. Apply a robust design process to solve increasingly complex site design problems. 3. Ideate and assess appropriate program elements based on client and site needs and investigate the impact of alternate program elements on successful site design. 4. Analyze natural systems and apply that understanding to determine the appropriate design of sites. 5. Apply knowledge of the functional requirements of landscape elements to locate, size, and use these elements in the landscape. Credits: 4.00

LA 24600 - Site Engineering: Earthwork And Stormwater

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation, and nomenclature. Methods for calculating volumes of cut and fill.

Learning Outcomes: 1. Understand three-dimensional forms in the built environment and how these forms are represented using standard graphic conventions. 2. Visualize and manipulate geomorphic and manmade terrains. 3. Articulate, utilize, and specify methods for landscape architecture earthwork manipulation and stormwater management. 4. Demonstrate an understanding of circulation systems design, including rationale, safety, and proper documentation for construction through the design of circulation systems. 5. Apply knowledge of hydrology and traditional and sustainable stormwater management techniques to the design of site-specific stormwater systems. Credits: 4.00

LA 31600 - Studio IV: Park And Open Space Design

Credit Hours: 4.00. Design theory and meaning in landscape architecture. Past, current and emerging design theories are investigated via lectures, research assignments and studio projects. Projects gain in size, complexity and depth of meaning. Emphasis on the role theory plays both as a stabilizing force and as a catalyst for change.

Learning Outcomes: 1. Access available landscape data to summarize critical natural resource needs at the site scale and translate this into fundamental ecological design principles for parks and open spaces. 2. Analyze the activities people participate in using available community parks and open space, categorize the landscape elements necessary to support current and projected future activities, and develop a parks program

recommendation based on these social conditions. 3. Design public spaces that support multi-functional landscapes that fulfill recreation, education, and conservation program goals. Credits: 4.00

LA 32500 - Ecological Landscape Performance And Planting

Credit Hours: 3.00. Study of plants and their integration with other site features (e.g., water, landform) to increase sustainability. Plants will not only be studied for their aesthetic and spatial uses in the landscape, but also their ecological functions and temporal dynamics. The relationship of plants to site planning, ecosystems, and human use will be explored. Various scales, sustainable practices, and landscape performance will be considered. Class trip may be required. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Be familiar with and able to use design principles and elements in the development of planting designs and understand the implications of plants as living things. 2. Understand the relationship of planting design, ecological functions, social factors, and sustainability. 3. Have a clear understanding of the concept and measurement methods of landscape performance. 4. Set smart and measurable sustainable goals and be able to select suitable plant material and create effective compositions appropriate for a variety of site conditions. 5. Know how to observe plants from multiple perspectives (plant needs & site/environmental conditions; human spatial needs; aesthetic responses; ecological implications) and be able to integrate these perspectives into functional designs. Credits: 3.00

LA 32600 - Studio V: Community Design And Planning

Credit Hours: 4.00. Community planning and design. Past, current and emerging planning theories are investigated via lectures, research assignments and studio projects. The interrelationship of land use, circulation, and open space are explored using environmental and sustainable principles within a framework of traditional neighborhood design.

Learning Outcomes: 1. Understand the fundamental terminologies, design strategies, and workflow of master plan community planning. 2. Distinguish the attributes and characteristics of different residential types. 3. Articulate, utilize and specify methods for spatial layout and resource Integration (open space, transportation, parking and facilities, and building blocks) in different community planning projects. 4. Develop well-reasoned design concept and defensible design decisions that best respond to site constraints and planning regulations. 5. Apply knowledge of stormwater management and sustainable practices to community design. 6. Improve the abilities to research, critical thinking, collaboration, model making (hand and digital), verbal representation, and digital rendering techniques. Credits: 4.00

LA 35600 - Site Engineering: Construction Documents And Advanced Systems

Credit Hours: 4.00. Methods and standards of construction documentation using current technology. Preparation and packaging of site-related technical drawings and bid packages. Methods for site layout and dimensioning. Organization and composition of planting plans, plant lists, grading plans, lighting plans, and associated detail sheets. Standards and sequence of site-related specification documents.

Learning Outcomes: 1. Develop office-ready documentation techniques toward the efficient and complete generation of legally binding CD drawings. 2. Understand and demonstrate CAD drawing standards. 3. Understand and capable of developing construction details and technical specifications to describe all project components. 4. Demonstrate a preliminary understanding of on-site construction observation work. Credits: 4.00

LA 41600 - Studio VI: Urban Design

Credit Hours: 4.00. An intensive design studio focusing on urban issues, including environmental, social, and economic approaches to the built environment. Exploration of development history, regulatory structures, local and regional demographics, economies, and environmental systems will be

expressed through detailed design proposals, case study, and presentation critiques.

Learning Outcomes: 1. Explore spatial, social, and economic issues of design in an urban context. 2. Create design proposals dealing with urban populations and systems including urban ecology and demographics. 3. Analyze existing built works and design theories for lessons learned to inform innovative design solutions. Credits: 4.00

LA 42600 - Studio VII: Landscape Architecture Capstone

Credit Hours: 4.00. This course will focus on the integration and application of accumulated knowledge of landscape architecture from the student's previous coursework and internship experience. Students will be challenged to identify and solve problems in community-based projects. The students will also communicate, through reports and presentations, their results and plan to community audiences, faculty, and other students. Students will also do directed readings and then discuss topics related to the current and future practices of landscape architecture and environmental design.

Learning Outcomes: 1. Apply a meaningful and exhaustive process of investigation along with analysis that codifies modeling and testing of design hypotheses and expression. 2. Address all critical issues in the development of the project including challenges and limitations. 3. Develop clear and precise concepts defining theoretical and practical solutions to project issues, including aesthetics; site/environmental factors; and behavioral, historic, contextual and technological elements during the process of design. Credits: 4.00

LA 47600 - Professional Practice Of Landscape Architecture

Credit Hours: 2.00. A study of the principles and practice of landscape architecture in private and public offices. The course covers project acquisition, office management, and project implementation procedures. Preparation of a professional compendium is required.

Credits: 2.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape

architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

LA 30900 - Co-Op Preparation

Credit Hours: 1.00. The material presented in this course consists of a broad overview of the employment opportunities in the professional practice of landscape architecture and the ways to secure an internship. It provides the student with information about career choices in landscape architecture and an appropriate knowledge base with which to make informed internship choices. Students prepare written and graphic documents for seeking employment. Students prepare for interviews and communications leading to employment as an intern in landscape architecture. Course meets during weeks 1-8.

Learning Outcomes: 1. Prepare and critique application materials in pursuit of gaining a co-op internship. 2. Practice interview skills and research firms available for co-op internships. Credits: 1.00

LA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 22704 - Studio III: Planting Design

Credit Hours: 4.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish

the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 4.00

LA 34604 - Site Engineering: Materials And Construction

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Learning Outcomes: 1. Demonstrate an understanding of common landscape construction materials and their application in the built environment. 2. Demonstrate an understanding of structural qualities and limitations of construction materials and systems. 3. Demonstrate an understanding of basic construction documentation. 4. Demonstrate the ability to access, evaluate, and document a variety of materials and construction systems commonly found in landscape construction. Credits: 4.00

LA 50102 - Research Methods For Design Applications

Credit Hours: 2.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 2.00

Other Departmental/Program Course Requirements (50-51 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles,

policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits:

3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including

diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and

participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (6-7 credits)

Supplemental List

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year (Pre-Program)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure,

and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of

disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

16 Credits

Spring 1st Year (Pre-Program)

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in

agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

14-15 Credits

Fall 2nd Year

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

LA 11700 - Graphic Communication In Design II

Credit Hours: 3.00. A course in graphic communication theory focusing on digital skills and processes. Project-based instruction will be used to simulate design office procedures through 2D and 3D exercises using raster and vector software.

Learning Outcomes: 1. Prepare students for internship and professional practice through office-ready digital workflows. 2. Develop and refine a personal graphic style along with a critical ""designer's eye"" through formal presentation and discussion. 3. Analyze a problem and determine the best tool(s) for the task while pursuing graphic innovation by knowing the ""why"" and ""how"" of digital tools. Credits: 3.00

LA 22600 - Studio II: Site Analysis And Design

Credit Hours: 4.00. Methods, principles and the process of designing in the built environment. Basic principles of site organization and composition are presented and applied in a series of exercises and studio projects. Role of the design process is reinforced both as a problem-solving tool and as a means of creativity and ideation.

Learning Outcomes: 1. Recognize and discuss theoretical design principles, identify those principles in well-designed sites, and apply those principles to their own design work. 2. Apply a robust design process to solve increasingly complex site design problems. 3. Ideate and assess appropriate program elements based on client and site needs and investigate the impact of alternate program elements on successful site design. 4. Analyze natural systems and apply that understanding to determine the appropriate design of sites. 5. Apply knowledge of the functional requirements of landscape elements to locate, size, and use these elements in the landscape. Credits: 4.00

LA 24600 - Site Engineering: Earthwork And Stormwater

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation, and nomenclature. Methods for calculating volumes of cut and fill.

Learning Outcomes: 1. Understand three-dimensional forms in the built environment and how these forms are represented using standard graphic conventions. 2. Visualize and manipulate geomorphic and manmade terrains. 3. Articulate, utilize, and specify methods for landscape architecture earthwork manipulation and stormwater management. 4. Demonstrate an understanding of circulation systems design, including rationale, safety, and proper documentation for construction through the design of circulation systems. 5. Apply knowledge of hydrology and traditional and sustainable stormwater management techniques to the design of site-specific stormwater systems. Credits: 4.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

16 Credits

Spring 2nd Year

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

LA 22600 - Studio II: Site Analysis And Design

Credit Hours: 4.00. Methods, principles and the process of designing in the built environment. Basic principles of site organization and composition are presented and applied in a series of exercises and studio projects. Role of the design

process is reinforced both as a problem-solving tool and as a means of creativity and ideation.

Learning Outcomes: 1. Recognize and discuss theoretical design principles, identify those principles in well-designed sites, and apply those principles to their own design work. 2. Apply a robust design process to solve increasingly complex site design problems. 3. Ideate and assess appropriate program elements based on client and site needs and investigate the impact of alternate program elements on successful site design. 4. Analyze natural systems and apply that understanding to determine the appropriate design of sites. 5. Apply knowledge of the functional requirements of landscape elements to locate, size, and use these elements in the landscape. Credits: 4.00

LA 22700 - Planting I: Creating Ecologically Connected Landscapes

Credit Hours: 3.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants in fall.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 3.00

LA 34600 - Site Systems II

Credit Hours: 3.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Credits: 3.00

ASM 21600 - Introduction To Surveying

Credit Hours: 1.00. Introduction to plane surveying, including instruction and practice in the use of surveying instruments. Basic overview of distance/angle measurement, leveling, direction, traversing, and mapping. Each weekly topic includes practical application and field exercises as applied to landscape architecture and forestry.

Learning Outcomes: 1. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 2. Function on multidisciplinary teams. 3. Use economics principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. Credits: 1.00

LA 22704 - Studio III: Planting Design

Credit Hours: 4.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a

planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 4.00

LA 34604 - Site Engineering: Materials And Construction

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Learning Outcomes: 1. Demonstrate an understanding of common landscape construction materials and their application in the built environment. 2. Demonstrate an understanding of structural qualities and limitations of construction materials and systems. 3. Demonstrate an understanding of basic construction documentation. 4. Demonstrate the ability to access, evaluate, and document a variety of materials and construction systems commonly found in landscape construction. Credits: 4.00

15 Credits

Fall 3rd Year

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

LA 31600 - Studio IV: Park And Open Space Design

Credit Hours: 4.00. Design theory and meaning in landscape architecture. Past, current and emerging design theories are investigated via lectures, research assignments and studio projects. Projects gain in size, complexity and depth of meaning. Emphasis on the role theory plays both as a stabilizing force and as a catalyst for change.

Learning Outcomes: 1. Access available landscape data to summarize critical natural resource needs at the site scale and translate this into fundamental ecological design principles for parks and open spaces. 2. Analyze the activities people participate in using available community parks and open space, categorize the landscape elements necessary to support current and projected future activities, and develop a parks program recommendation based on these social conditions. 3. Design public spaces that support multi-functional landscapes that fulfill recreation, education, and conservation program goals. Credits: 4.00

LA 32500 - Ecological Landscape Performance And Planting

Credit Hours: 3.00. Study of plants and their integration with other site features (e.g., water, landform) to increase sustainability. Plants will not only be studied for their aesthetic and spatial uses in the landscape, but also their ecological functions and temporal dynamics. The relationship of plants to site planning, ecosystems, and human use will be explored. Various scales, sustainable practices, and landscape performance will be considered. Class trip may be required. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Be familiar with and able to use design principles and elements in the development of planting designs and understand the implications of plants as living things. 2. Understand the relationship of planting design, ecological functions, social factors, and sustainability. 3. Have a clear understanding of the concept and measurement methods of landscape performance. 4. Set smart and measurable sustainable goals and be able to select suitable plant material and create effective compositions appropriate for a variety of site conditions. 5. Know how to observe

plants from multiple perspectives (plant needs & site/environmental conditions; human spatial needs; aesthetic responses; ecological implications) and be able to integrate these perspectives into functional designs. Credits: 3.00

LA 30900 - Co-Op Preparation

Credit Hours: 1.00. The material presented in this course consists of a broad overview of the employment opportunities in the professional practice of landscape architecture and the ways to secure an internship. It provides the student with information about career choices in landscape architecture and an appropriate knowledge base with which to make informed internship choices. Students prepare written and graphic documents for seeking employment. Students prepare for interviews and communications leading to employment as an intern in landscape architecture. Course meets during weeks 1-8.

Learning Outcomes: 1. Prepare and critique application materials in pursuit of gaining a co-op internship. 2. Practice interview skills and research firms available for co-op internships. Credits: 1.00

14 Credits

Spring 3rd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

LA 32600 - Studio V: Community Design And Planning

Credit Hours: 4.00. Community planning and design. Past, current and emerging planning theories are investigated via lectures, research assignments and studio projects. The interrelationship of land use, circulation, and open space are explored using environmental and sustainable principles within a framework of traditional neighborhood design.

Learning Outcomes: 1. Understand the fundamental terminologies, design strategies, and workflow of master plan community planning. 2. Distinguish the attributes and characteristics of different residential types. 3. Articulate, utilize and specify methods for spatial layout and resource Integration (open space, transportation, parking and facilities, and building blocks) in different community planning projects. 4. Develop well-reasoned design concept and defensible design decisions that best respond to site constraints and planning regulations. 5. Apply knowledge of stormwater management and sustainable practices to community design. 6. Improve the abilities to research, critical thinking, collaboration, model making (hand and digital), verbal

representation, and digital rendering techniques. Credits: 4.00

LA 35600 - Site Engineering: Construction Documents And Advanced Systems

Credit Hours: 4.00. Methods and standards of construction documentation using current technology. Preparation and packaging of site-related technical drawings and bid packages. Methods for site layout and dimensioning. Organization and composition of planting plans, plant lists, grading plans, lighting plans, and associated detail sheets. Standards and sequence of site-related specification documents.

Learning Outcomes: 1. Develop office-ready documentation techniques toward the efficient and complete generation of legally binding CD drawings. 2. Understand and demonstrate CAD drawing standards. 3. Understand and capable of developing construction details and technical specifications to describe all project components. 4. Demonstrate a preliminary understanding of on-site construction observation work. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

15 Credits

Fall & Spring 4th Year

LA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and

company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

Fall 5th Year

LA 41600 - Studio VI: Urban Design

Credit Hours: 4.00. An intensive design studio focusing on urban issues, including environmental, social, and economic approaches to the built environment. Exploration of development history, regulatory structures, local and regional demographics, economies, and environmental systems will be expressed through detailed design proposals, case study, and presentation critiques.

Learning Outcomes: 1. Explore spatial, social, and economic issues of design in an urban context. 2. Create design proposals dealing with urban populations and systems including urban ecology and demographics. 3. Analyze existing built works and design theories for lessons learned to inform innovative design solutions. Credits: 4.00

LA 47600 - Professional Practice Of Landscape Architecture

Credit Hours: 2.00. A study of the principles and practice of landscape architecture in private and public offices. The course covers project acquisition, office management, and project implementation procedures. Preparation of a professional compendium is required.

Credits: 2.00

LA 50102 - Research Methods For Design Applications

Credit Hours: 2.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social

and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 2.00

14 Credits

Spring 5th Year

LA 42600 - Studio VII: Landscape Architecture Capstone

Credit Hours: 4.00. This course will focus on the integration and application of accumulated knowledge of landscape architecture from the student's previous coursework and internship experience. Students will be challenged to identify and solve problems in community-based projects. The students will also communicate, through reports and presentations, their results and plan to community audiences, faculty, and other students. Students will also do directed readings and then discuss topics related to the current and future practices of landscape architecture and environmental design.
Learning Outcomes: 1. Apply a meaningful and exhaustive process of investigation along with analysis that codifies modeling and testing of design hypotheses and expression. 2. Address all critical issues in the development of the project including challenges and limitations. 3. Develop clear and precise concepts defining theoretical and practical solutions to project issues, including aesthetics; site/environmental factors; and behavioral, historic, contextual and technological elements during the process of design. Credits: 4.00

14-15 Credits

Law and Society, BA

About the Program

Law and society is a sociology major emphasizing concepts, theories, and research methods as applied to the study of law and law-related structures and processes. Coursework encompasses a variety of areas including deviant behavior, juvenile delinquency, the role of law in society, family law, and the sociology of police. These areas of study are intertwined with other crucial sociological concerns such inequality, power, social organization, social psychology, social change, race, gender, culture, and communication.
Please visit Law and Society for more information.

3 Year Degrees

The College of Liberal Arts offers the opportunity for students to complete their degree in three years. Degree in 3 majors allow students to enter the work force or graduate school a year earlier than traditional plans of study while also providing a cost-effective way to complete an undergraduate degree.

Students can complete the three-year option with or without AP credit by adding summer sessions to traditional coursework in Fall and Spring semesters. Degree in 3 offers a great combination of cost-savings and the opportunity to accelerate your future and achieve your goals.

Degree Requirements

Departmental/Program Major Course Requirements (36 credits)

Requirement A. Foundation Courses (6 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

Requirement B. Theory and Quantitative Methods (9 credits)

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 40200 - Sociological Theory

Credit Hours: 3.00. An advanced critical treatment of the theories, concepts, and methods of sociology. A basic course required of undergraduate majors in sociology.

Credits: 3.00

Requirement C. Law and Process (9 credits)

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

Requirement D. Inequality Systems (3 credits)

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of

role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

Requirement E. Sociology Electives (9 credits)

SOC 32600 - Social Conflict And Criminal Justice (UCC: BSS)

Credit Hours: 3.00. This course examines the dynamics of social conflict, with a special focus on legal institutions and criminological processes. Students will learn to think more analytically about the causes of social conflict, its dynamics, and strategies for resolution.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Become familiar with classic theories of social conflict and social order. 2. Understand why society needs dissent. 3. Understand strategies for conflict resolution.

Credits: 3.00

SOC 32700 - Crime, Deviance And Mass Media

Credit Hours: 3.00. Various forms of mass media are used to explore the sociology of crime and deviance. Topics may include white collar crime, juvenile delinquency, street crime, sexuality and sexual orientation, hate crimes, deviance and community. Assignments include quizzes and short papers.

Learning Outcomes: 1. Able to identify concepts associated with specific theoretical perspectives and be able to describe these concepts. 2. Able to use these concepts to the media forms presented in the class. 3. Use the concepts to craft explanations for characters' actions in the fictional films. 4. Able to conduct analyses of the news that conform to accepted methodological standards of quantitative and qualitative research. Credits: 3.00

SOC 33400 - Urban Sociology

Credit Hours: 3.00. Development of the city and its functions; types of social behavior in cities; influences of city life on personality; city planning.

Credits: 3.00

SOC 34000 - General Social Psychology

Credit Hours: 3.00. Social influences on the individual and processes of social interaction. Individual attitudes and behavior as related to socialization, social norms, social roles, communication and propaganda, and other social influences. Among the interaction processes considered are interpersonal attraction, influence, leadership, cooperation, and conflict. Not open to students with credit in PSY 24000.

Learning Outcomes: 1. Develop an understanding of how politics has been approached and analyzed by sociologists over time, and an appreciation for the important thinkers and historical events that have shaped these approaches. 2. Identify specific areas of political polarization and political consensus in contemporary American politics, including where we find evidence of partisan asymmetry. 3. Demonstrate ability to develop and communicate sociological insights as they relate to political history and contemporary political dynamics, both in class and in written assignments. Credits: 3.00

SOC 35000 - Sociology Of Family

Credit Hours: 3.00. Designed to provide an understanding of contemporary courtship, marriage, and family interaction as cultural, social, and social-psychological phenomena. Consideration of the major sources of marital strain and conflict within a heterogeneous, rapidly changing society.

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Understand the experiences of people suffering from chronic illness. Credits: 3.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 39000 - Individual Research In Sociology

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of sociology under the guidance of a Sociology faculty member. Permission of instructor required.

Credits: 1.00 to 3.00

SOC 39100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Various topics in sociology that may change from semester to semester are presented by Sociology faculty members.

Credits: 1.00 to 3.00

SOC 42100 - Juvenile Delinquency

Credit Hours: 3.00. A study of social and psychological factors influencing individual delinquent behavior patterns. Emphasis on preventive and rehabilitative programs and the role of community agencies such as social service agencies, juvenile courts, and youth authorities. Visits to selected organizations and institutions.

Learning Outcomes: 1. Understand the causes and consequences of juvenile crime on individuals, families, and society. 2. Understand the prevalence and types of juvenile delinquency in the United States. 3. Learn the basic theories of juvenile crime. 4. Assess the theories onset of, recidivism, and desistance from crime. 5. Assess effects of social factors in delinquency, such as parents, siblings, family structure, and peers. 6. Know the history of and reasons for the juvenile justice system. 7. Critically evaluate the juvenile justice system and social response to juvenile crime. 8. Identify and evaluate multiple local organizations and institutions that intervene or act in juvenile delinquency prevention, rehabilitation, or response. Credits: 3.00

SOC 42300 - Field Practicum In Sociology And Law And Society

Credit Hours: 4.00. Field experience in criminal justice system or social services. Students serve as "interns" in a criminal justice or social service agency one day (or its equivalent) per week, under the supervision of agency personnel. Application of theory and empirical research findings to field problems. Permission of instructor required.

Learning Outcomes: 1. Learn professional skills from a working professional. 2. Discover the relation between academic and practical knowledge Credits: 4.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SOC 33500 - Political Sociology (UCC: STS)

Credit Hours: 3.00. Analysis of the social and social psychological sources of routine political participation such as voting and interest group activity, and nonroutine political action such as protest movements and revolution; the organization of power at the community, national, and international level; and political ideology.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Have a basic understanding of sociological theories of the state 2. Acquire an understanding of recent social and political science explanations of political processes and events 3. Apply sociological principles to make sense of current world events and to contribute to social debates 4. Comprehend different opportunities to influence political decisions by average citizens. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

SOC 39103 - Applied Internship In Sociology

Credit Hours: 0.00 to 3.00. Internships offer experiential learning opportunities where students can apply classroom knowledge and develop practical skills while earning academic credit. Permission of department required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

Requirement A. Foundation Courses (6 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of

social behaviors and inequalities. Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

Electives (11-48 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

15 Credits

15 Credits

Spring 2nd Year

15 Credits

15 Credits

Fall 3rd Year

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations.

Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences.

Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

15 Credits

15 Credits

Spring 4th Year

14-15 Credits

14-15 Credits

Fall 1st Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

15-16 Credits

15-16 Credits

Degree Requirements

Linguistics, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Area A. Introduction to Linguistics (3 credits)

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

LING 20100 - Introduction To Linguistics (UCC: BSS)

Credit Hours: 3.00. Basic concepts of linguistics and methods of analysis of language; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax, and semantics, and to problem-solving techniques, with material drawn from a variety of languages.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

LC 26100 - Introduction To The Linguistic Study Of Foreign Languages (UCC: BSS)

Credit Hours: 3.00. Overview of linguistics and the role of language in society; fundamental concepts of linguistic analysis. The course focuses on linguistic phenomena found in French, German, Russian, and Spanish, with material, examples, and assignments drawn primarily from those languages whenever appropriate.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

Area B. General Linguistics (9 credits)

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications

of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 .

Credits: 3.00

ENGL 32900 - English Language III: Sound And Form

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on phonology and morphology. Implications of recent theory to the teaching of English.

Credits: 3.00

LC 36100 - Sound And Form In Language

Credit Hours: 3.00. Examination of the nature of sound systems (phonology) and form systems (morphology) of language, as well as techniques of phonological and morphological analysis, using material from various languages. Central focus on phonetic and phonological structure, and on inflectional and derivational morphology.

Credits: 3.00

LC 37100 - Phonetics Of Foreign Languages

Credit Hours: 3.00. Introduction to articulatory phonetics for students of foreign languages. Mechanisms of production of speech sounds. Production and discrimination of sounds of other languages; contrast with English sounds; practice in pronunciation and phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be awarded for more than one of SLHS 30600 , LING 31500 , and LC 37100.

Credits: 3.00

LING 32100 - Foundations Of Syntax And Semantics

Credit Hours: 3.00. Introduction to syntactic and semantic analysis based on American English and its dialects. Underlying structure and its relation to meaning. Analysis of parts of speech, constituent phrases, sentence structure, representations, ambiguity, and applications of current theory. Credit will not be given for both LING 32100 and ENGL 32800 .

Credits: 3.00

LING 31500 - Elements Of Phonetics

Credit Hours: 3.00. Introduction to articulatory phonetics. Mechanisms of production of speech sounds. Sounds of languages of the world, ear training for discriminating speech sounds, and practice in broad and narrow phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be given for both LING 31500 and SLHS 30600.

Credits: 3.00

LING 31100 - Fundamentals Of Phonology And Morphology

Credit Hours: 3.00. Basic concepts and tools of phonological and morphological analysis viewed through the material of American English. Current theoretical approaches to phonology and morphology, including word-formation processes and applications.

Credits: 3.00

Area C. Linguistics of Particular Languages (6 credits)

Area D. Language Courses/Typological Diversity (3 credits)

Area E. Linguistics Selective (12 credits)

Supplemental List

Electives (14-51 credits)

Grade/GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-19 Credits

15-19 Credits

Spring 1st Year

15-16 Credits

15-16 Credits

Fall 2nd Year

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

LING 20100 - Introduction To Linguistics (UCC: BSS)

Credit Hours: 3.00. Basic concepts of linguistics and methods of analysis of language; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax, and semantics, and to problem-solving techniques, with material drawn from a variety of languages.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

LC 26100 - Introduction To The Linguistic Study Of Foreign Languages (UCC: BSS)

Credit Hours: 3.00. Overview of linguistics and the role of language in society; fundamental concepts of linguistic analysis. The course focuses on linguistic phenomena found in French, German, Russian, and Spanish, with material, examples, and assignments drawn primarily from those languages whenever appropriate.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

15-16 Credits

15-16 Credits

Spring 2nd Year

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

ENGL 32900 - English Language III: Sound And Form

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on phonology and morphology. Implications of recent theory to the teaching of English.

Credits: 3.00

LC 36100 - Sound And Form In Language

Credit Hours: 3.00. Examination of the nature of sound systems (phonology) and form systems (morphology) of language, as well as techniques of phonological and morphological analysis, using material from various languages. Central focus on phonetic and phonological structure, and on inflectional and derivational morphology.

Credits: 3.00

LC 37100 - Phonetics Of Foreign Languages

Credit Hours: 3.00. Introduction to articulatory phonetics for students of foreign languages. Mechanisms of production of speech sounds. Production and discrimination of sounds of other languages; contrast with English sounds; practice in pronunciation and phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be awarded for more than one of SLHS 30600 , LING 31500 , and LC 37100.

Credits: 3.00

LING 31500 - Elements Of Phonetics

Credit Hours: 3.00. Introduction to articulatory phonetics. Mechanisms of production of speech sounds. Sounds of languages of the world, ear training for discriminating speech sounds, and practice in broad and narrow phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be given for both LING 31500 and SLHS 30600.

Credits: 3.00

LING 31100 - Fundamentals Of Phonology And Morphology

Credit Hours: 3.00. Basic concepts and tools of phonological and morphological analysis viewed through the material of American English. Current theoretical approaches to phonology and morphology, including word-formation processes and applications.

Credits: 3.00

15-16 Credits

15-16 Credits

Fall 3rd Year

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 .

Credits: 3.00

LING 32100 - Foundations Of Syntax And Semantics

Credit Hours: 3.00. Introduction to syntactic and semantic analysis based on American English and its dialects. Underlying structure and its relation to meaning. Analysis of parts of speech, constituent phrases, sentence structure, representations, ambiguity, and applications of current theory. Credit will not be given for both LING 32100 and ENGL 32800 .

Credits: 3.00

15 Credits

15 Credits

Spring 3rd Year

12-15 Credits

12-15 Credits

Fall 4th Year

12-17 Credits

12-17 Credits

Spring 4th Year

12-16 Credits

12-16 Credits

Fall 1st Year

15-19 Credits

15-19 Credits

About the Program

Marketing, BS

About the Program

Degree Requirements

Department/Program Major Courses (50 credits)

Required Major Courses (47 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as

regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis

testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a

variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based

on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Cultural Competency Selective (3 credits)

Major Selectives - Choose Seven (21 credits)

MGMT 42610 - Brand Management

Credit Hours: 3.00. This course is designed to provide an understanding of how to manage a brand, product, or product category. The course concerns issues related to customer behavior and customer decision making, with an emphasis on how to utilize such customer-oriented knowledge for building and maintaining brand equity. This course builds on concepts and topics covered in the core marketing course.

Learning Outcomes: 1. Increase understanding of the important issues in planning and evaluating brand strategies. 2. Provide appropriate theories, models, and other tools to make better brand management decisions. 3. Provide students with insights into how profitable brand strategies can be created. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

MGMT 42210 - International Marketing

Credit Hours: 3.00. Most U.S. businesses, large and small, are becoming deeply involved in international business. The trend is going to grow even stronger because of the influence of World Trade Organization and regional trade blocks. Under these circumstances, it is imperative that business managers possess the skill sets to adapt their marketing strategies to the needs of

international markets. This course will cover the concepts and theories pertaining to international marketing. It is aimed to provide students with skills in formulating a marketing plan for foreign market entry and conducting business in a foreign country.

Learning Outcomes: 1. Understand the issues involved in formulating and evaluating international marketing strategies. 2. Learn about global market entry, expansion, and sustainment. 3. Be exposed to the appropriate theories, models, and other tools to make better marketing decisions in cross-cultural business settings. 4. Obtain insights into how profitable global marketing strategies can be created. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 42000 - Consumer Analytics

Credit Hours: 3.00. Many firms possess extensive information about customers, their transactions, and their relationships with the firms, necessitating expertise for intelligent utilization. The objective of this course is to equip you with a scientific approach to customer marketing, featuring hands-on use of databases, analytics, and computing to collect, analyze, and act on customer information for various industries. This course specifically focuses on customer relationship analytics, including identifying promising prospects and customer acquisition, customer development through up-selling, cross-selling, and personalization, as well as managing customer attrition, retention, and evaluating customer lifetime value. It also explores advanced analytics models such as conjoint analysis, purchase forecasting, and perception analysis.

Learning Outcomes: 1. Use data analytics to improve customer engagement and elevate the overall customer experience. 2. Clarify the role of analytical customer relationship management in achieving strategic marketing goals across various industries. 3. Carry out analytical skills through practical experience with customer datasets. 4. Recognize advanced modeling techniques commonly employed in the field. 5.

Summarize the financial advantages of adopting marketing strategies based on the concept of 'Customer Lifetime Value'. Credits: 3.00

MGMT 42910 - Experiential Marketing

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet regularly with the faculty supervisor and also the project sponsor to review project progress and discuss the next steps towards meeting project requirements. Projects are done in teams, although evaluation is individual. Permission of instructor required.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the project analysis and information gathered into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Experience challenges of working in teams to achieve projects goals. Credits: 3.00

MGMT 43800 - Pricing Strategies

Credit Hours: 3.00. In the era of Big Data, where extensive information is available at the customer level, managers benefit from an increased ability to learn from their customers' behavior. In this scenario pricing becomes a crucial lever for increasing the relationship with the customer and maximizing profits and shareholder value. In this course, students will learn how to systematically approach pricing decisions, taking the perspective of the marketing manager. The course will use a combination of lectures, case discussions and in-class exercises to leverage micro-level transaction data for pricing decisions.

Learning Outcomes: 1. Become familiar with the concepts, theory, and latest thinking bearing on the key issues in pricing, taking the perspective of the marketing manager. 2. Apply concepts and theory to the solution of real pricing problems in marketing settings. 3. Develop your business communication skills and receive feedback from your peers and the instructor. Credits: 3.00

MGMT 43700 - Social Media Marketing

Credit Hours: 3.00. This course is deigned to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class. The deliverables for this project will be a slide presentation (no more than 10 pages, excluding appendices) to showcase what you have learned. This may be included as a part of your resume to show your potential employers. These are some of the basic knowledge of useful skills in web crawling, data mining, and statistical analyses, so you may leverage your portfolio when seeking entry/junior level marketing analyst positions.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and

resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

MGMT 42120 - Data & AI-Driven Marketing

Credit Hours: 3.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course offers an immersive exploration into the intersection of data science, artificial intelligence, and marketing strategies, providing students with the knowledge and skills to thrive in the digital era. It will discuss uses of data science tools and AI algorithms in marketing applications, such as personalized marketing, sentiment analysis, and ad campaign optimization. Students will also gain hands-on experience on applying the methods to real-world data.

Learning Outcomes: 1. Identify modern statistical & machine learning methods required for marketing using big data. 2. Carry out applying statistical and machine learning methods to improve major marketing decisions. 3. Implement statistical and machine learning methods in Python using real-world data. Credits: 3.00

MGMT 42410 - Retail Management

Credit Hours: 3.00. Understanding and executing effective sales and retail strategies are essential for achieving overall business success, impacting growth, customer relationships, and competitiveness in the market. This course combines theoretical foundations with practical applications, guiding students in integrating sales and retail management principles into comprehensive business decision-making processes.

Learning Outcomes: 1. Apply market analysis techniques to identifying customer segments, analyze sales techniques and create a strategic sales plan. 2. Demonstrate an understanding of the principles of inventory management, merchandising strategies and their impact on customer experience and profitability. 3. Analyze the alignment of sales and retail strategies with broader business objectives. 4. Apply sales and retail management concepts to diverse business scenarios. Credits: 3.00

MGMT 42130 - Consumer Behavior

Credit Hours: 3.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, economics and sociology to learn why consumers behave in the ways that they do. The course focuses on three general topics. 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision-making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior.

Learning Outcomes: 1. Organize, explain and predict consumers judgements and choices using social science multiple concepts, frameworks and theories. 2. Identify & analyze consumer behavior issues and apply relevant theories to aid in managerial decision-making. 3. Generate basic applied experiments in consumer behavior to test relevant theories with real consumers. Credits: 3.00

MGMT 42420 - Sales Management

Credit Hours: 3.00. An introduction to sales force management, this course offers a comprehensive examination of the salesforce management process. Key topics include the principles and best practices of recruiting, selecting, training, compensating, and motivating sales personnel. Additionally, the course will cover strategies for effective supervision and evaluation of a sales team to ensure optimal performance.

Learning Outcomes: 1. Explain the different components/skills of relationship sales management and apply them through course assignments. 2. Compare and contrast different sales management strategies through cases

and simulations. 3. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues, and activities. Credits: 3.00

Other Departmental Requirements (23-35 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research

and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties,

and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence

intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (14-26 credits)

Optional Concentration for Daniels School of Business

Sample 8-semester Plan of Study

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An

understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-20 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other

data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation,

including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

13-15 Credits

Fall 2nd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources

and best practices in regard to benefits packages and money management. Credits: 1.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

13-17 Credits

Spring 2nd Year

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes

of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

15 Credits

Fall 3rd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format

involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

14-15 Credits

Fall 4th Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for

improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

12-15 Credits

Spring 4th Year

12-20 Credits

Marketing: Digital Marketing and Product Innovation, BS

About the Program

Degree Requirements

Marketing Major Requirements (56 credits)

Required Major Courses (47 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able

to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions,

presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical

Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there

will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing

applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Cultural Competency Selectives (3 credits)

Marketing Concentration: Digital Marketing & Product Innovation (21 credits)

MGMT 42610 - Brand Management

Credit Hours: 3.00. This course is designed to provide an understanding of how to manage a brand, product, or product category. The course concerns issues related to customer behavior and customer decision making, with an emphasis on how to utilize such customer-oriented knowledge for building and maintaining brand equity. This course builds on concepts and topics covered in the core marketing course.

Learning Outcomes: 1. Increase understanding of the important issues in planning and evaluating brand strategies. 2. Provide appropriate theories, models, and other tools to make better brand management decisions. 3. Provide students with insights into how profitable brand strategies can be created. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the

course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

MGMT 42210 - International Marketing

Credit Hours: 3.00. Most U.S. businesses, large and small, are becoming deeply involved in international business. The trend is going to grow even stronger because of the influence of World Trade Organization and regional trade blocks. Under these circumstances, it is imperative that business managers possess the skill sets to adapt their marketing strategies to the needs of international markets. This course will cover the concepts and theories pertaining to international marketing. It is aimed to provide students with skills in formulating a marketing plan for foreign market entry and conducting business in a foreign country.

Learning Outcomes: 1. Understand the issues involved in formulating and evaluating international marketing strategies. 2. Learn about global market entry, expansion, and sustainment. 3. Be exposed to the appropriate theories, models, and other tools to make better marketing decisions in cross-cultural business settings. 4. Obtain insights into how profitable global marketing strategies can be created. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 42000 - Consumer Analytics

Credit Hours: 3.00. Many firms possess extensive information about customers, their transactions, and their relationships with the firms, necessitating expertise for intelligent utilization. The objective of this course is to equip you with a scientific approach to customer marketing, featuring hands-on use of databases, analytics, and computing to collect, analyze, and act on customer information for various industries. This course specifically focuses on customer relationship analytics, including identifying promising prospects and customer acquisition, customer development through up-selling, cross-selling, and

personalization, as well as managing customer attrition, retention, and evaluating customer lifetime value. It also explores advanced analytics models such as conjoint analysis, purchase forecasting, and perception analysis.

Learning Outcomes: 1. Use data analytics to improve customer engagement and elevate the overall customer experience. 2. Clarify the role of analytical customer relationship management in achieving strategic marketing goals across various industries. 3. Carry out analytical skills through practical experience with customer datasets. 4. Recognize advanced modeling techniques commonly employed in the field. 5. Summarize the financial advantages of adopting marketing strategies based on the concept of 'Customer Lifetime Value'. Credits: 3.00

MGMT 42910 - Experiential Marketing

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet regularly with the faculty supervisor and also the project sponsor to review project progress and discuss the next steps towards meeting project requirements. Projects are done in teams, although evaluation is individual. Permission of instructor required.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the project analysis and information gathered into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Experience challenges of working in teams to achieve projects goals. Credits: 3.00

MGMT 43800 - Pricing Strategies

Credit Hours: 3.00. In the era of Big Data, where extensive information is available at the customer level, managers benefit from an increased ability to learn from their customers' behavior. In this scenario pricing becomes a crucial lever for increasing the relationship with the customer and maximizing profits and shareholder value. In this course, students will learn how to systematically approach pricing decisions, taking the perspective of the marketing manager. The course will use a combination of lectures, case discussions and in-class exercises to leverage micro-level transaction data for pricing decisions.

Learning Outcomes: 1. Become familiar with the concepts, theory, and latest thinking bearing on the key issues in pricing, taking the perspective of the marketing manager. 2. Apply concepts and theory to the solution of real pricing problems in marketing settings. 3. Develop your business communication skills and receive feedback from your peers and the instructor. Credits: 3.00

MGMT 43700 - Social Media Marketing

Credit Hours: 3.00. This course is deigned to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class. The deliverables for this project will be a slide presentation (no more than 10 pages, excluding appendices) to showcase what you have learned. This may be included as a part of your resume to show your potential employers. These are some of the basic knowledge of useful skills in web crawling, data mining, and statistical analyses, so you may leverage your portfolio when seeking entry/junior level marketing analyst positions.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms

and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

MGMT 42120 - Data & AI-Driven Marketing

Credit Hours: 3.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course offers an immersive exploration into the intersection of data science, artificial intelligence, and marketing strategies, providing students with the knowledge and skills to thrive in the digital era. It will discuss uses of data science tools and AI algorithms in marketing applications, such as personalized marketing, sentiment analysis, and ad campaign optimization. Students will also gain hands-on experience on applying the methods to real-world data.

Learning Outcomes: 1. Identify modern statistical & machine learning methods required for marketing using big data. 2. Carry out applying statistical and machine learning methods to improve major marketing decisions. 3. Implement statistical and machine learning methods in Python using real-world data. Credits: 3.00

MGMT 42410 - Retail Management

Credit Hours: 3.00. Understanding and executing effective sales and retail strategies are essential for achieving overall business success, impacting growth, customer relationships, and competitiveness in the market. This course combines theoretical foundations with practical applications, guiding students in integrating sales and retail management principles into comprehensive business decision-making processes.

Learning Outcomes: 1. Apply market analysis techniques to identifying customer segments, analyze sales techniques and create a strategic sales plan. 2. Demonstrate an understanding of the principles of inventory management, merchandising strategies and their impact on customer experience and profitability. 3. Analyze the alignment of sales and retail strategies with broader business objectives. 4. Apply sales and retail management concepts to diverse business scenarios. Credits: 3.00

MGMT 42130 - Consumer Behavior

Credit Hours: 3.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, economics and sociology to learn why consumers behave in the ways that they do. The course focuses on three general topics. 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision-making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior.

Learning Outcomes: 1. Organize, explain and predict consumers judgements and choices using social science multiple concepts, frameworks and theories. 2. Identify & analyze consumer behavior issues and apply relevant theories to aid in managerial decision-making. 3. Generate basic applied experiments in consumer behavior to test relevant theories with real consumers. Credits: 3.00

MGMT 42420 - Sales Management

Credit Hours: 3.00. An introduction to sales force management, this course offers a comprehensive examination of the salesforce management process. Key topics include the principles and best practices of recruiting, selecting, training, compensating, and motivating sales personnel. Additionally, the course will cover strategies for effective supervision and evaluation of a sales team to ensure optimal performance.

Learning Outcomes: 1. Explain the different components/skills of relationship sales management and apply them through course assignments. 2. Compare and contrast different sales management strategies through cases and simulations. 3. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues, and activities. Credits: 3.00

Other Departmental Requirements (23-35 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a

one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables.

Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (14-26 credits)

Optional Concentration for Daniels School of Business

Sample 8-semester Plan of Study

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in

which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-20 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as

applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python

functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement

data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

12-14 Credits

Fall 2nd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a

variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

13-17 Credits

Spring 2nd Year

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role

and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

15 Credits

Fall 3rd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels

School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work. University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations. Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

15 Credits

Fall 4th Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the

components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

14-16 Credits

Spring 4th Year

12-18 Credits

Marketing: Marketing Analytics Concentration, BS

About the Program

Degree Requirements

Marketing Major Requirements (50 credits)

Required Major Courses (47 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation,

and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits:

3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on

behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables

impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Cultural Competency Selective (3 credits)

Marketing Concentration: Marketing Analytics (21 credits)

MGMT 42610 - Brand Management

Credit Hours: 3.00. This course is designed to provide an understanding of how to manage a brand, product, or product category. The course concerns issues related to customer behavior and customer decision making, with an emphasis on how to utilize such customer-oriented knowledge for building and maintaining brand equity. This course builds on concepts and topics covered in the core marketing course.

Learning Outcomes: 1. Increase understanding of the important issues in planning and evaluating brand strategies. 2. Provide appropriate theories, models, and other tools to make better brand management decisions. 3. Provide students with insights into how profitable brand strategies can be created. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

MGMT 42210 - International Marketing

Credit Hours: 3.00. Most U.S. businesses, large and small, are becoming deeply involved in international business. The trend is going to grow even stronger because of the influence of World Trade Organization and regional trade blocks. Under these circumstances, it is imperative that business managers possess the skill sets to adapt their marketing strategies to the needs of international markets. This course will cover the concepts and theories pertaining to international marketing. It is aimed to provide students with skills in formulating a marketing plan for foreign market entry and conducting business in a foreign country.

Learning Outcomes: 1. Understand the issues involved in formulating and evaluating international marketing strategies. 2. Learn about global market entry, expansion, and sustainment. 3. Be exposed to the appropriate theories, models, and other tools to make better marketing decisions in cross-cultural business settings. 4. Obtain insights into how profitable global marketing strategies can be created. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing

strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 42000 - Consumer Analytics

Credit Hours: 3.00. Many firms possess extensive information about customers, their transactions, and their relationships with the firms, necessitating expertise for intelligent utilization. The objective of this course is to equip you with a scientific approach to customer marketing, featuring hands-on use of databases, analytics, and computing to collect, analyze, and act on customer information for various industries. This course specifically focuses on customer relationship analytics, including identifying promising prospects and customer acquisition, customer development through up-selling, cross-selling, and personalization, as well as managing customer attrition, retention, and evaluating customer lifetime value. It also explores advanced analytics models such as conjoint analysis, purchase forecasting, and perception analysis.

Learning Outcomes: 1. Use data analytics to improve customer engagement and elevate the overall customer experience. 2. Clarify the role of analytical customer relationship management in achieving strategic marketing goals across various industries. 3. Carry out analytical skills through practical experience with customer datasets. 4. Recognize advanced modeling techniques commonly employed in the field. 5. Summarize the financial advantages of adopting marketing strategies based on the concept of 'Customer Lifetime Value'. Credits: 3.00

MGMT 42910 - Experiential Marketing

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet regularly with the faculty supervisor and also the project sponsor to review project progress and discuss the next steps towards meeting project requirements. Projects are done in teams, although evaluation is individual. Permission of instructor required.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the project analysis and information gathered into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Experience challenges of working in teams to achieve projects goals. Credits: 3.00

MGMT 43800 - Pricing Strategies

Credit Hours: 3.00. In the era of Big Data, where extensive information is available at the customer level, managers benefit from an increased ability to learn from their customers' behavior. In this scenario pricing becomes a crucial lever for increasing the relationship with the customer and maximizing profits and shareholder value. In this course, students will learn how to systematically approach pricing decisions, taking the perspective of the marketing manager. The course will use a combination of lectures, case discussions and in-class exercises to leverage micro-level transaction data for pricing decisions.

Learning Outcomes: 1. Become familiar with the concepts, theory, and latest thinking bearing on the key issues in pricing, taking the perspective of the marketing manager. 2. Apply concepts and theory to the solution of real pricing problems in marketing settings. 3. Develop your

business communication skills and receive feedback from your peers and the instructor. Credits: 3.00

MGMT 43700 - Social Media Marketing

Credit Hours: 3.00. This course is deigned to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class. The deliverables for this project will be a slide presentation (no more than 10 pages, excluding appendices) to showcase what you have learned. This may be included as a part of your resume to show your potential employers. These are some of the basic knowledge of useful skills in web crawling, data mining, and statistical analyses, so you may leverage your portfolio when seeking entry/junior level marketing analyst positions.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

MGMT 42120 - Data & AI-Driven Marketing

Credit Hours: 3.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course offers an immersive exploration into the intersection of data science, artificial intelligence, and marketing strategies, providing students with the knowledge and skills to thrive in the digital era. It will discuss uses of data science tools and AI algorithms in marketing applications, such as personalized marketing, sentiment analysis, and ad campaign optimization. Students will also gain hands-on experience on applying the methods to real-world data.

Learning Outcomes: 1. Identify modern statistical & machine learning methods required for marketing using big data. 2. Carry out applying statistical and machine learning methods to improve major marketing decisions. 3. Implement statistical and machine learning methods in Python using real-world data. Credits: 3.00

MGMT 42410 - Retail Management

Credit Hours: 3.00. Understanding and executing effective sales and retail strategies are essential for achieving overall business success, impacting growth, customer relationships, and competitiveness in the market. This course combines theoretical foundations with practical applications, guiding students in integrating sales and retail management principles into comprehensive business decision-making processes.

Learning Outcomes: 1. Apply market analysis techniques to identifying customer segments, analyze sales techniques and create a strategic sales plan. 2. Demonstrate an understanding of the principles of inventory management, merchandising strategies and their impact on customer experience and profitability. 3. Analyze the alignment of sales and retail strategies with broader business objectives. 4. Apply sales and retail management concepts to diverse business scenarios. Credits: 3.00

MGMT 42130 - Consumer Behavior

Credit Hours: 3.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, economics and sociology to learn why consumers behave in the ways that they do. The course focuses on three general topics. 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision-making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior.

Learning Outcomes: 1. Organize, explain and predict consumers judgements and choices using social science multiple concepts, frameworks and theories. 2. Identify & analyze consumer behavior issues and apply relevant theories to aid in managerial decision-making. 3. Generate basic applied experiments in consumer behavior to test relevant theories with real consumers. Credits: 3.00

MGMT 42420 - Sales Management

Credit Hours: 3.00. An introduction to sales force management, this course offers a comprehensive examination of the salesforce management process. Key topics include the principles and best practices of recruiting, selecting, training, compensating, and motivating sales personnel. Additionally, the course will cover strategies for effective supervision and evaluation of a sales team to ensure optimal performance.

Learning Outcomes: 1. Explain the different components/skills of relationship sales management and apply them through course assignments. 2. Compare and contrast different sales management strategies through cases and simulations. 3. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues, and activities. Credits: 3.00

Other Departmental Requirements (23-35 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to

informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world,

and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (14-26 credits)

Optional Concentration for School of Business

Sample 8-semester Plan of Study

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to

compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-20 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that

animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

13-15 Credits

Fall 2nd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles

and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity

to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

13-17 Credits

Spring 2nd Year

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can

be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

15 Credits

Fall 3rd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that

information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)
Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a

marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

14-15 Credits

Fall 4th Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

12-15 Credits

Spring 4th Year

12-20 Credits

Marketing: Sales Management Concentration, BS

About the Program

Degree Requirements

Marketing Major Requirements (50 credits)

Required Major Courses (47 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical

documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of

managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and

corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an

awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern

programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Cultural Competency Selective (3 credits)

Marketing Concentration: Sales Management (21 credits)

MGMT 42610 - Brand Management

Credit Hours: 3.00. This course is designed to provide an understanding of how to manage a brand, product, or product category. The course concerns issues related to customer behavior and customer decision making, with an emphasis on how to utilize such customer-oriented knowledge for building and maintaining brand equity. This course builds on concepts and topics covered in the core marketing course.

Learning Outcomes: 1. Increase understanding of the important issues in planning and evaluating brand strategies. 2. Provide appropriate theories, models, and other tools to make better brand management decisions. 3. Provide students with insights into how profitable brand strategies can be created. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

MGMT 42210 - International Marketing

Credit Hours: 3.00. Most U.S. businesses, large and small, are becoming deeply involved in international business. The trend is going to grow even stronger because of the influence of World Trade Organization and regional trade blocks. Under these circumstances, it is imperative that business managers possess the skill sets to adapt their marketing strategies to the needs of international markets. This course will cover the concepts and theories pertaining to international marketing. It is aimed to provide students with skills in formulating a marketing plan for foreign market entry and conducting business in a foreign country.

Learning Outcomes: 1. Understand the issues involved in formulating and evaluating international marketing strategies. 2. Learn about global market entry, expansion, and sustainment. 3. Be exposed to the appropriate theories, models, and other tools to make better marketing decisions in cross-cultural business settings. 4. Obtain insights into how profitable global marketing strategies can be created. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of

marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 42000 - Consumer Analytics

Credit Hours: 3.00. Many firms possess extensive information about customers, their transactions, and their relationships with the firms, necessitating expertise for intelligent utilization. The objective of this course is to equip you with a scientific approach to customer marketing, featuring hands-on use of databases, analytics, and computing to collect, analyze, and act on customer information for various industries. This course specifically focuses on customer relationship analytics, including identifying promising prospects and customer acquisition, customer development through up-selling, cross-selling, and personalization, as well as managing customer attrition, retention, and evaluating customer lifetime value. It also explores advanced analytics models such as conjoint analysis, purchase forecasting, and perception analysis.

Learning Outcomes: 1. Use data analytics to improve customer engagement and elevate the overall customer experience. 2. Clarify the role of analytical customer relationship management in achieving strategic marketing goals across various industries. 3. Carry out analytical skills through practical experience with customer datasets. 4. Recognize advanced modeling techniques commonly employed in the field. 5. Summarize the financial advantages of adopting marketing strategies based on the concept of 'Customer Lifetime Value'. Credits: 3.00

MGMT 42910 - Experiential Marketing

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet regularly with the faculty supervisor and also the project sponsor to review project progress and discuss the next steps towards meeting project requirements. Projects are done in teams, although evaluation is individual. Permission of instructor required.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire

practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the project analysis and information gathered into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Experience challenges of working in teams to achieve projects goals. Credits: 3.00

MGMT 43800 - Pricing Strategies

Credit Hours: 3.00. In the era of Big Data, where extensive information is available at the customer level, managers benefit from an increased ability to learn from their customers' behavior. In this scenario pricing becomes a crucial lever for increasing the relationship with the customer and maximizing profits and shareholder value. In this course, students will learn how to systematically approach pricing decisions, taking the perspective of the marketing manager. The course will use a combination of lectures, case discussions and in-class exercises to leverage micro-level transaction data for pricing decisions.

Learning Outcomes: 1. Become familiar with the concepts, theory, and latest thinking bearing on the key issues in pricing, taking the perspective of the marketing manager. 2. Apply concepts and theory to the solution of real pricing problems in marketing settings. 3. Develop your business communication skills and receive feedback from your peers and the instructor. Credits: 3.00

MGMT 43700 - Social Media Marketing

Credit Hours: 3.00. This course is deigned to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class. The deliverables for this project will be a slide presentation (no more than 10 pages, excluding appendices) to showcase what you have learned. This may be included as a part of your resume to show your potential employers. These are some of the basic knowledge of useful skills in web crawling, data mining, and statistical analyses, so you may leverage your portfolio when seeking entry/junior level marketing analyst positions.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

MGMT 42120 - Data & AI-Driven Marketing

Credit Hours: 3.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course offers an immersive exploration into the intersection of data science, artificial intelligence, and marketing strategies, providing students with the knowledge and skills to thrive in the digital era. It will discuss uses of data science tools and AI algorithms in marketing applications, such as personalized marketing, sentiment analysis, and ad campaign

optimization. Students will also gain hands-on experience on applying the methods to real-world data.

Learning Outcomes: 1. Identify modern statistical & machine learning methods required for marketing using big data. 2. Carry out applying statistical and machine learning methods to improve major marketing decisions. 3. Implement statistical and machine learning methods in Python using real-world data. Credits: 3.00

MGMT 42410 - Retail Management

Credit Hours: 3.00. Understanding and executing effective sales and retail strategies are essential for achieving overall business success, impacting growth, customer relationships, and competitiveness in the market. This course combines theoretical foundations with practical applications, guiding students in integrating sales and retail management principles into comprehensive business decision-making processes.

Learning Outcomes: 1. Apply market analysis techniques to identifying customer segments, analyze sales techniques and create a strategic sales plan. 2. Demonstrate an understanding of the principles of inventory management, merchandising strategies and their impact on customer experience and profitability. 3. Analyze the alignment of sales and retail strategies with broader business objectives. 4. Apply sales and retail management concepts to diverse business scenarios. Credits: 3.00

MGMT 42130 - Consumer Behavior

Credit Hours: 3.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, economics and sociology to learn why consumers behave in the ways that they do. The course focuses on three general topics. 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision-making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior.

Learning Outcomes: 1. Organize, explain and predict consumers judgements and choices using social science multiple concepts, frameworks and theories. 2. Identify & analyze consumer behavior issues and apply relevant theories to aid in managerial decision-making. 3. Generate basic applied experiments in consumer behavior to test relevant theories with real consumers. Credits: 3.00

MGMT 42420 - Sales Management

Credit Hours: 3.00. An introduction to sales force management, this course offers a comprehensive examination of the salesforce management process. Key topics include the principles and best practices of recruiting, selecting, training, compensating, and motivating sales personnel. Additionally, the course will cover strategies for effective supervision and evaluation of a sales team to ensure optimal performance.

Learning Outcomes: 1. Explain the different components/skills of relationship sales management and apply them through course assignments. 2. Compare and contrast different sales management strategies through cases and simulations. 3. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues, and activities. Credits: 3.00

Other Departmental Requirements (23-35 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential

elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or

15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity,

coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

Electives (14-26 credits)

Optional Concentration for School of Business

Sample 8-semester Plan of Study

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments.

CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation

techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity,

coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-20 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and

managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

13-15 Credits

Fall 2nd Year

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course

emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

13-17 Credits

Spring 2nd Year

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

15 Credits

Fall 3rd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems,

and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to

use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

14-15 Credits

Fall 4th Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

12-15 Credits

Spring 4th Year

12-20 Credits

Materials Engineering, BSMSE

About the Program

Degree Requirements

Departmental/Program Major Requirements (63 credits)

Required Major Courses (45 credits)

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 23500 - Second Year Materials Engineering Laboratory

Credit Hours: 3.00. Laboratory experiments using standard equipment to measure material properties, characterize material structure and composition, and explore processing methods to form functional shapes, and modify properties of the formed shapes. Experiments are carried out with metal, ceramic, and polymeric materials to illustrate property-structure-processing relationships.

Learning Outcomes: 1. Identify and properly utilize primary sources and online databases to find information about material structures, properties, and processing techniques. 2. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 3. Apply characterization techniques appropriate for the class of material analyzed. 4. Assess validity of experimental data and recognize experimental factors affecting data. 5. Accurately and clearly report engineering data using figures, graphs, and tables and proper statistical methods. 6. Display effective written communication in technical reports. Credits: 3.00

MSE 25000 - Physical Properties In Engineering Systems

Credit Hours: 3.00. Class connects math, science and engineering practice and applications. Presents foundational aspects of engineering problem solving, use of computer math tools for engineering problem solving, basic engineering statics, dynamics and mechanics, group problem solving approaches, and introductory aspects of design and materials selection.

Credits: 3.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses

and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

MSE 33000 - Processing And Properties Of Materials

Credit Hours: 3.00. An introduction to the relationships between the processing of materials and their properties. Heat treating, forming, casting, consolidation, and other more material-specific manufacturing processes. Elucidation of the role of phenomena such as heat flow, mass diffusion, nucleation, interfacial tension, elastic and plastic deformation, precipitation, grain growth.

Credits: 3.00

MSE 33500 - Materials Characterization Laboratory

Credit Hours: 3.00. The principles of analytical methods for characterization of materials for structure and composition; optical microscopy, scanning electron microscopy, X-ray spectroscopy and diffraction, atomic absorption, emission spectroscopy, and mass spectrometry. Laboratory experiments in X-ray spectroscopy, X-ray diffraction, optical microscopy, and scanning electron microscopy.

Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

MSE 36700 - Materials Processing Laboratory

Credit Hours: 3.00. This laboratory is intended as an intensive experience in processing techniques used for ceramics, metals, and polymers. Sintering of a ceramic, casting and post-processing (work hardening, heat treatment, etc.) of a metal, and preparation and extrusion of a polymer are the suggested processes. The measurements (e.g., powder size, compaction force, temperature, grain size, molecular weight) applicable to the successful processing of the material and the final

properties (e.g., hardness, ductility, strength, stiffness) will be emphasized.

Learning Outcomes: 1. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 2. Demonstrate effective written communication in lab reports. 3. Demonstrate effective oral communication in final project presentation. 4. Characterize the physical mechanisms that underlie the basic interactions between macroscopic shaping processes and microstructure development for the core bulk processing routes of each of the main classes of materials and how they relate to properties. 5. Assess validity of experimental data and recognize experimental factors affecting data. 6. Identify specific processing capabilities and limitations for the main classes of materials. Credits: 3.00

MSE 37000 - Electrical, Optical, And Magnetic Properties Of Materials

Credit Hours: 3.00. An introductory course to provide basic background on the behavior of materials; electronic band structure, electronic and ionic conduction, electronic processes in semiconductors, dielectric, optical, and magnetic properties, and superconductivity; emphasis is on the relation between the properties and the structural aspects of materials.

Credits: 3.00

MSE 38200 - Mechanical Response Of Materials

Credit Hours: 3.00. This course encompasses deformation-based microscopic mechanisms, including dislocation motion, diffusion, and viscoplasticity. Macroscopic mechanical response of metals, ceramics, polymers, and composites will be related to elasticity and plasticity concepts for single crystal, polycrystalline, and amorphous materials. Practical design considerations for deformation will be included as well as an introduction to fracture mechanisms.

Learning Outcomes: 1. Conversant with conventional nomenclature, units and notation of mechanical behavior. Examples: Stress, strain, yield strength, fracture strength; yield criteria, flow rules, creep, fracture. 2. Estimate relative ranges and values for important properties of common engineering materials. Examples: Young's modulus at room temperature for steels versus most polymers; yield strength ranges for ductile metals. 3. Recognize mechanisms for important mechanical behaviors. Examples: Plastic deformation by dislocation glide; plastic deformation by molecular rearrangement; dilatant deformation processes; strengthening mechanisms in crystalline solids. 4. Predict mechanical responses based on given information. Examples: Will yielding occur given a stress state and properties? Will fracture occur given a stress state and properties? How will the material change shape for the applied deformation? Which slip system(s) will be operative? 5. Explain the fundamental basis for important deformation mechanisms or processes. Examples: Dislocation glide, cross-slip, dislocation climb, precipitation strengthening; molecular orientation; Nabarro-Herring creep; plane strain fracture. 6. Apply the mechanisms of deformation to component design or alloy design. Credits: 3.00

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MSE 43000 - Materials Processing And Design I

Credit Hours: 3.00. Experience in the initiation and execution of a specific materials project or study involving research, processing, and design; a written proposal on the project prepared by the student under the supervision of an individual faculty member; oral progress report at the end of the semester.

Learning Outcomes: 1. Ability to apply knowledge of mathematics, science, & engineering to problems in materials engineering. 2. Ability to exhibit effective oral and written communication skills. 3. Recognition of the need for, and an ability to engage in life-

long learning. 4. A knowledge of contemporary issues, particularly as they relate to materials engineering. Credits: 3.00

MSE 44000 - Materials Processing And Design II

Credit Hours: 3.00. Continuation and completion of the materials project or study initiated in MSE 43000 and presentation of a written dissertation on the results and conclusions. Competence in technical writing is emphasized in the preparation of the dissertation.

Learning Outcomes: 1. Exhibit effective oral and written communication. 2. Become aware of the complexity of working in teams to achieve goals, including issues related to the importance of individual ownership of project assignments, communication, leadership roles, establishing goals, and recognizing a diversity of talents among group members. 3. Have a basic understanding of different ethical systems, including legal positivism, ethical egoism, utilitarianism, deontological, etc. 4. Understand consequences of unethical behavior in the profession. 5. Understand and apply the basic tools of engineering design. 6. Draw simple logic diagrams that relate the important precedent relationships for tasks required to complete an engineering program. 7. Develop and learn necessary modelling, processing and characterization tools needed to successfully execute the project. 8. Use statistical analysis to infer conclusions from experiments. Credits: 3.00

MSE 44500 - Materials Engineering Systems Analysis And Design

Credit Hours: 3.00. Integration of materials engineering core coursework with statistical, economic and environmental considerations for analysis and design of systems. Analysis of primary materials processing operations using mathematical and statistical models for predicting interactive effects and process optimization. Specification of materials and processes for mechanical designs, incorporating properties assessment and tradeoffs, cost analysis, and performance optimization with multiple constraints.

Learning Outcomes: 1. Translate performance attributes in a given design to the corresponding nominal material properties. 2. Derive and apply material indices to materials selection for single- and multi-objective designs using the CES materials database and software tools. 3. Specify manufacturing processes for a given component design (material, shape, production rate) using basic cost modeling. 4. Apply a computational model for simulating a materials production and/or processing operation. 5. Quantify material properties, processing and performance variability using statistical methods. Examples: error analysis, probability distributions, sampling theory, statistic intervals and statistical process control charts. 6. Perform basic calculations for engineering cost analysis and use those results to make choices among trade-offs in product design or process operation. 7. Locate and evaluate design information for specific materials and processes. Examples: testing standards, processing specifications, commercial data and patents. 8. Apply quantitative trade-off strategies in selection of materials for designs with conflicting objectives. 9. Apply computational models for materials production and/or processing operations to predict interactive effects of inputs on material quality, production rates, cost minimization, and environmental impact. 10. Optimize material and process selection simultaneously, based on refined functional relationships between processing, properties and costs. Credits: 3.00

MSE 42000 - Structure And Properties Of Organic Materials

Credit Hours: 3.00. This course presents information on the chemical and physical structure and basic material properties of organic materials, including synthetic plastics and specialty polymers and surfactants as well as select natural materials (e.g., proteins, carbohydrates, lipids). Fundamental concepts from organic chemistry will be presented along with descriptions of how the chemical and physical structures of organic molecules directly impact the properties of bulk materials over

multiple length scales, from the molecular-level to the macroscale. This course will prepare students to be successful in higher-level polymer and soft material elective courses in materials engineering.

Learning Outcomes: 1. Describe atomic-scale bonding and identify common hydrocarbon units in organic molecules and describe common organic reactions involving those units. 2. Select the appropriate characterization techniques for chemical structures, physical structures, and bulk material properties and interpret basic data from selected techniques. 3. Explain how macromolecules are synthesized and outline the most common synthesis reactions. 4. Distinguish between chemical and physical structures or organic materials and classify different structures into appropriate material length scales. 5. Explain important structure-property relationships over multiple length scales. Credits: 3.00

MSE Technical Electives (18 credits)

Other Departmental/Program Course Requirements (61-75 credits)

Engineering Requirements for First Year (29-39 credits)

Other Departmental Requirements (14-18 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of

linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields,

magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

MSE General Education Requirement (18 Credits)

Electives (1 credit)

Optional Concentration

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Sample Materials Engineering Plan of Study

Fall 2nd Year

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 25000 - Physical Properties In Engineering Systems

Credit Hours: 3.00. Class connects math, science and engineering practice and applications. Presents foundational aspects of engineering problem solving, use of computer math tools for engineering problem solving, basic engineering statics, dynamics and mechanics, group problem solving approaches, and introductory aspects of design and materials selection.

Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to

compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-20 Credits

Spring 2nd Year

MSE 23500 - Second Year Materials Engineering Laboratory

Credit Hours: 3.00. Laboratory experiments using standard equipment to measure material properties, characterize material structure and composition, and explore processing methods to form functional shapes, and modify properties of the formed shapes. Experiments are carried out with metal, ceramic, and polymeric materials to illustrate property-structure-processing relationships.

Learning Outcomes: 1. Identify and properly utilize primary sources and online databases to find information about material structures, properties, and processing techniques. 2. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 3. Apply characterization techniques appropriate for the class of material analyzed. 4. Assess validity of experimental data and recognize experimental factors affecting data. 5. Accurately and clearly report engineering data using figures, graphs, and tables and proper statistical methods. 6. Display effective written communication in technical reports. Credits: 3.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and

limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

16 Credits

Fall 3rd Year

MSE 33500 - Materials Characterization Laboratory

Credit Hours: 3.00. The principles of analytical methods for characterization of materials for structure and composition; optical microscopy, scanning electron microscopy, X-ray spectroscopy and diffraction, atomic absorption, emission spectroscopy, and mass spectrometry. Laboratory experiments in X-ray spectroscopy, X-ray diffraction, optical microscopy, and scanning electron microscopy.

Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

MSE 36700 - Materials Processing Laboratory

Credit Hours: 3.00. This laboratory is intended as an intensive experience in processing techniques used for ceramics, metals, and polymers. Sintering of a ceramic, casting and post-processing (work hardening, heat treatment, etc.) of a metal, and preparation and extrusion of a polymer are the suggested processes. The measurements (e.g., powder size, compaction force, temperature, grain size, molecular weight) applicable to the successful processing of the material and the final properties (e.g., hardness, ductility, strength, stiffness) will be emphasized.

Learning Outcomes: 1. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 2. Demonstrate effective written communication in lab reports. 3. Demonstrate effective oral communication in final project presentation. 4. Characterize the physical mechanisms that underlie the basic interactions between macroscopic shaping processes and microstructure development for the core bulk processing routes of each of the main classes of materials and how they relate to properties. 5. Assess validity of experimental data and recognize experimental factors affecting data. 6. Identify specific processing capabilities and limitations for the main classes of materials.

Credits: 3.00

MSE 37000 - Electrical, Optical, And Magnetic Properties Of Materials

Credit Hours: 3.00. An introductory course to provide basic background on the behavior of materials; electronic band structure, electronic and ionic conduction, electronic processes in semiconductors, dielectric, optical, and magnetic properties, and superconductivity; emphasis is on the relation between the properties and the structural aspects of materials.

Credits: 3.00

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MSE 42000 - Structure And Properties Of Organic Materials

Credit Hours: 3.00. This course presents information on the chemical and physical structure and basic material properties of organic materials, including synthetic plastics and specialty polymers and surfactants as well as select natural materials (e.g., proteins, carbohydrates, lipids). Fundamental concepts from organic chemistry will be presented along with descriptions of how the chemical and physical structures of organic molecules directly impact the properties of bulk materials over multiple length scales, from the molecular-level to the macroscale. This course will prepare students to be successful in higher-level polymer and soft material elective courses in materials engineering.

Learning Outcomes: 1. Describe atomic-scale bonding and identify common hydrocarbon units in organic molecules and describe common organic reactions involving those units. 2. Select the appropriate characterization techniques for chemical structures, physical structures, and bulk material properties and interpret basic data from selected techniques. 3. Explain how macromolecules are synthesized and outline the most common synthesis reactions. 4. Distinguish between chemical and physical

structures or organic materials and classify different structures into appropriate material length scales. 5. Explain important structure-property relationships over multiple length scales. Credits: 3.00

15 Credits

Spring 3rd Year

MSE 33000 - Processing And Properties Of Materials

Credit Hours: 3.00. An introduction to the relationships between the processing of materials and their properties. Heat treating, forming, casting, consolidation, and other more material-specific manufacturing processes. Elucidation of the role of phenomena such as heat flow, mass diffusion, nucleation, interfacial tension, elastic and plastic deformation, precipitation, grain growth.

Credits: 3.00

MSE 33500 - Materials Characterization Laboratory

Credit Hours: 3.00. The principles of analytical methods for characterization of materials for structure and composition; optical microscopy, scanning electron microscopy, X-ray spectroscopy and diffraction, atomic absorption, emission spectroscopy, and mass spectrometry. Laboratory experiments in X-ray spectroscopy, X-ray diffraction, optical microscopy, and scanning electron microscopy.

Credits: 3.00

MSE 36700 - Materials Processing Laboratory

Credit Hours: 3.00. This laboratory is intended as an intensive experience in processing techniques used for ceramics, metals, and polymers. Sintering of a ceramic, casting and post-processing (work hardening, heat treatment, etc.) of a metal, and preparation and extrusion of a polymer are the suggested processes. The measurements (e.g., powder size, compaction force, temperature, grain size, molecular weight) applicable to the successful processing of the material and the final properties (e.g., hardness, ductility, strength, stiffness) will be emphasized.

Learning Outcomes: 1. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 2. Demonstrate effective written communication in lab reports. 3. Demonstrate effective oral communication in final project presentation. 4. Characterize the physical mechanisms that underlie the basic interactions between macroscopic shaping processes and microstructure development for the core bulk processing routes of each of the main classes of materials and how they relate to properties. 5. Assess validity of experimental data and recognize experimental factors affecting data. 6. Identify specific processing capabilities and limitations for the main classes of materials. Credits: 3.00

MSE 38200 - Mechanical Response Of Materials

Credit Hours: 3.00. This course encompasses deformation-based microscopic mechanisms, including dislocation motion, diffusion, and viscoplasticity. Macroscopic mechanical response of metals, ceramics, polymers, and composites will be related to elasticity and plasticity concepts for single crystal, polycrystalline, and amorphous materials. Practical design considerations for deformation will be included as well as an introduction to fracture mechanisms.

Learning Outcomes: 1. Conversant with conventional nomenclature, units and notation of mechanical behavior. Examples: Stress, strain, yield strength, fracture strength; yield criteria, flow rules, creep, fracture. 2. Estimate relative ranges and values for important properties of common engineering materials. Examples: Young's modulus at room temperature for steels versus most polymers; yield strength ranges for ductile metals. 3. Recognize mechanisms for important mechanical behaviors. Examples: Plastic deformation by dislocation glide; plastic deformation by molecular rearrangement; dilatant deformation processes; strengthening mechanisms in crystalline solids. 4. Predict mechanical responses based on given information. Examples: Will yielding occur given a stress state and properties? Will fracture occur given a stress state and properties? How will the material change shape for the applied

deformation? Which slip system(s) will be operative? 5. Explain the fundamental basis for important deformation mechanisms or processes. Examples: Dislocation glide, cross-slip, dislocation climb, precipitation strengthening; molecular orientation; Nabarro-Herring creep; plane strain fracture. 6. Apply the mechanisms of deformation to component design or alloy design. Credits: 3.00

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

15 Credits

Fall 4th Year

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MSE 43000 - Materials Processing And Design I

Credit Hours: 3.00. Experience in the initiation and execution of a specific materials project or study involving research, processing, and design; a written proposal on the project prepared by the student under the supervision of an individual faculty member; oral progress report at the end of the semester.

Learning Outcomes: 1. Ability to apply knowledge of mathematics, science, & engineering to problems in materials engineering. 2. Ability to exhibit effective oral and written communication skills. 3. Recognition of the need for, and an ability to engage in life-long learning. 4. A knowledge of contemporary issues, particularly as they relate to materials engineering. Credits: 3.00

MSE 44500 - Materials Engineering Systems Analysis And Design

Credit Hours: 3.00. Integration of materials engineering core coursework with statistical, economic and environmental considerations for analysis and design of systems. Analysis of primary materials processing operations using mathematical and statistical models for predicting interactive effects and process optimization. Specification of materials and processes for mechanical designs, incorporating properties assessment and tradeoffs, cost analysis, and performance optimization with multiple constraints.

Learning Outcomes: 1. Translate performance attributes in a given design to the corresponding nominal material properties. 2. Derive and apply material indices to materials selection for single- and multi-objective designs using the CES materials database and software tools. 3. Specify manufacturing processes for a given component design (material, shape, production rate) using basic cost modeling. 4. Apply a computational model for simulating a materials production and/or processing operation. 5. Quantify material properties, processing and performance variability using statistical methods. Examples: error analysis, probability distributions, sampling theory, statistic intervals and statistical process control charts. 6. Perform basic calculations for engineering cost analysis and use those results to make choices among trade-offs in product design or process operation. 7. Locate and evaluate design information for specific materials and processes. Examples: testing standards, processing specifications, commercial data and patents. 8. Apply quantitative trade-off strategies in selection of materials for designs with conflicting objectives. 9. Apply computational models for materials production and/or processing operations to predict interactive effects of inputs on material quality, production rates, cost minimization, and environmental impact. 10. Optimize material and process selection simultaneously, based on refined functional relationships between processing, properties and costs. Credits: 3.00

15 Credits

Spring 4th Year

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MSE 44000 - Materials Processing And Design II

Credit Hours: 3.00. Continuation and completion of the materials project or study initiated in MSE 43000 and presentation of a written dissertation on the results and conclusions. Competence in technical writing is emphasized in the preparation of the dissertation.

Learning Outcomes: 1. Exhibit effective oral and written communication. 2. Become aware of the complexity of working in teams to achieve goals, including issues related to the importance of individual ownership of project assignments, communication, leadership roles, establishing goals, and recognizing a diversity of talents among group members. 3. Have a basic understanding of different ethical systems, including legal positivism, ethical egoism, utilitarianism, deontological, etc. 4. Understand consequences of unethical behavior in the profession. 5. Understand and apply the basic tools of engineering design. 6. Draw simple logic diagrams that relate the important precedent relationships for tasks required to complete an engineering program. 7. Develop and learn necessary modelling, processing and characterization tools needed to successfully execute the project. 8. Use statistical analysis to infer conclusions from experiments. Credits: 3.00

18 Credits

Mathematics Education, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (87-91 credits)

Required Major Courses (43-47 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or

better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.

Credits: 4.00

MA 30100 - An Introduction To Proof Through Real Analysis

Credit Hours: 3.00. An introduction to abstract reasoning in the context of real analysis. Topics may include axioms for the real numbers, mathematical induction, formal definition of limits, density, decimal representations, convergence of sequences and series, continuity, differentiability, the extreme value, mean value and intermediate value theorems, and cardinality. The emphasis, however, is more on the concept of proof than on any one given topic.

Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace

transforms and their applications to differential equations (optional). Credits: 4.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 48400 - Seminar On Teaching College Algebra And Trigonometry

Credit Hours: 3.00. This course is a seminar on the teaching of mathematics for our best undergraduate mathematics education students. It provides supervised teaching experience along with a chance for the students to perfect their knowledge of algebra before going on to be high school teachers. Students who take this class will also teach a section of MA 15300. Permission of instructor required.

Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

MA 46000 - Geometry

Credit Hours: 3.00. This course begins at the high-school level and then moves quickly to intermediate and advanced topics including an introduction to non-Euclidean geometry. Emphasis on proofs.

Learning Outcomes: 1. Learn geometry topics included in the Indiana state standards. 2. Learn to solve a wide range of geometry problems. 3. Learn the meaning of definition, axiom, theorem, and proof, and use these words correctly. 4. Learn the proofs in book I of Euclid's elements. 5. Learn some basic ideas of non-Euclidean geometry. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers,

polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Calculus I Option

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to

compute areas of certain planar regions. Credits: 4.00

Calculus II Option

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Calculus III Option

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Professional Education Requirements (44 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 42500 - Teaching Of Secondary Mathematics - Methods I

Credit Hours: 3.00. This is the first of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, curriculum, teaching, learning, assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's principles and standards, as well as the content and process standards included in Indiana Academic Standards for Mathematics, and pedagogical strategies for teaching these in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 42600 - Teaching Of Secondary Mathematics - Methods II

Credit Hours: 3.00. This is the second of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, mathematical task design, classroom discourse, classroom environment assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's Professional Standards as well as the content and process standards included in Indiana Academic Standards for Mathematics and pedagogical strategies for teaching in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing

classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment

techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDCI 22550 - Mathematics Education Seminar

Credit Hours: 1.00. In this course, students will be introduced to many aspects of mathematics education, including pedagogies, professional organizations, standards, research, lesson planning, technology, etc. In addition, they will have opportunities to get to know others in their major earlier in their program.

Learning Outcomes: 1. Examine critically current pedagogical practices used in secondary mathematics classrooms. 2. Explore alternative pedagogies to enhance student engagement and conceptions of the relevance of mathematics. 3. Become familiar with technologies available for use in mathematics teaching and learning, mathematics education research, and professional organizations and standards. Credits: 1.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and

family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a

community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Optional Concentration

Other Departmental/ Program Core Requirements (23-45 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two

and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Electives (0-10 credits)

GPA Requirements

Teacher Licensure Information

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)
Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts.
Credits: 0.00 to 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions.
Credits: 4.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices.
Credits: 1.00 to 3.00

15-17 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

EDCI 22550 - Mathematics Education Seminar

Credit Hours: 1.00. In this course, students will be introduced to many aspects of mathematics education, including pedagogies, professional organizations, standards, research, lesson planning, technology, etc. In addition, they will have opportunities to get to know others in their major earlier in their program.

Learning Outcomes: 1. Examine critically current pedagogical practices used in secondary mathematics classrooms. 2. Explore alternative pedagogies to enhance student engagement and conceptions of the relevance of mathematics. 3. Become familiar with technologies available for use in mathematics teaching and learning, mathematics education research, and professional organizations and standards. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and

communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

14-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 46000 - Geometry

Credit Hours: 3.00. This course begins at the high-school level and then moves quickly to intermediate and advanced topics including an introduction to non-Euclidean geometry. Emphasis on proofs.

Learning Outcomes: 1. Learn geometry topics included in the Indiana state standards. 2. Learn to solve a wide range of geometry problems. 3. Learn the meaning of definition, axiom, theorem, and proof, and use these words correctly. 4. Learn the proofs in book I of Euclid's elements. 5. Learn some basic ideas of non-Euclidean geometry. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as

well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

15-17 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of

learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

16-18 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and

applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 30100 - An Introduction To Proof Through Real Analysis

Credit Hours: 3.00. An introduction to abstract reasoning in the context of real analysis. Topics may include axioms for the real numbers, mathematical induction, formal definition of limits, density, decimal representations, convergence of sequences and series, continuity, differentiability, the extreme value, mean value and intermediate value theorems, and cardinality. The emphasis, however, is more on the concept of proof than on any one given topic.

Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

17-18 Credits

Spring 3rd Year

EDCI 42500 - Teaching Of Secondary Mathematics - Methods I

Credit Hours: 3.00. This is the first of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, curriculum, teaching, learning, assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's principles and standards, as well as the content and process standards included in Indiana Academic Standards for Mathematics, and pedagogical strategies for teaching these in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among

mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

16 Credits

Fall 4th Year

EDCI 42600 - Teaching Of Secondary Mathematics - Methods II

Credit Hours: 3.00. This is the second of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, mathematical task design, classroom discourse, classroom environment assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's Professional Standards as well as the content and process standards included in Indiana Academic Standards for Mathematics and pedagogical strategies for teaching in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an

understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 48400 - Seminar On Teaching College Algebra And Trigonometry

Credit Hours: 3.00. This course is a seminar on the teaching of mathematics for our best undergraduate mathematics education students. It provides supervised teaching experience along with a chance for the students to perfect their knowledge of algebra before going on to be high school teachers. Students who take this class will also teach a section of MA 15300. Permission of instructor required.

Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

15-16 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Mathematics Honors, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (31 credits)

Required Major Courses (22 credits)

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA Selectives (9 credits)

Computer Science

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods

including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

Discrete Mathematics, Foundations

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

Linear Algebra

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear

independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

Numerical Analysis

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

Statistics, Probability

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis

tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use

these properties in computations. Credits: 3.00

Advanced Topics Course

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

Algebra Selectives

MA 45401 - Galois Theory Honors

Credit Hours: 3.00. This course will give a thorough introduction to Galois theory. Galois theory is a fundamental tool in many areas of mathematics, including number theory and algebraic geometry. This course will increase students' mathematical maturity and prepare them for graduate school. Topics include finite extension fields and their symmetries, ruler and compass constructions, complex roots of unity, solvable groups, and the solvability of polynomial equations by arithmetic and radical operations. This course is intended for third- or fourth-year students who have taken MA 45000 (Algebra Honors) or MA 45300 (Elements of Algebra I).

Learning Outcomes: 1. Know the historical background of Galois theory. 2. Know the classical version which addresses questions about roots of polynomials and the modern formulation in terms of abstract algebra. 3. Know about finite extension fields and their symmetries. 4. Know how Galois theory answers ancient questions about ruler and compass constructions. 5. Know about cyclotomic fields generated by complex roots of unity. 6. Know how Galois theory answers questions about the solvability of polynomial equations by arithmetic and radical operations. Credits: 3.00

Approved for MATH/MAED dual majors ONLY

MA 48400 - Seminar On Teaching College Algebra And Trigonometry

Credit Hours: 3.00. This course is a seminar on the teaching of mathematics for our best undergraduate mathematics education students. It provides supervised teaching experience along with a chance for the students to perfect their knowledge of algebra before going on to be high school teachers. Students who take this class will also teach a section of MA 15300. Permission of instructor required.

Credits: 3.00

Approved for MATH/PHYS dual majors ONLY

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

Other Departmental/Program Course Requirements (41-67 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained

for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A"

or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able

to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Electives (22-48 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be

able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

15-18 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4.

Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

16-17 Credits

Fall 3rd Year

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

15-17 Credits

Spring 3rd Year

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier

series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

15-16 Credits

Fall 4th Year

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

15-18 Credits

Spring 4th Year

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

15 Credits

Mathematics, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (28 credits)

Required Major Courses (19 credits)

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

Math Selective (9 credits)

Algebra

MA 45401 - Galois Theory Honors

Credit Hours: 3.00. This course will give a thorough introduction to Galois theory. Galois theory is a fundamental tool in many areas of mathematics, including number theory and algebraic geometry. This course will increase students' mathematical maturity and prepare them for graduate school. Topics include finite extension fields and their symmetries, ruler and compass constructions, complex roots of unity, solvable groups, and the solvability of polynomial equations by arithmetic and radical operations. This course is intended for third- or fourth-year students who have taken MA 45000 (Algebra Honors) or MA 45300 (Elements of Algebra I).

Learning Outcomes: 1. Know the historical background of Galois theory. 2. Know the classical version which addresses questions about roots of polynomials and the modern formulation in terms of abstract algebra. 3. Know about finite extension fields and their symmetries. 4. Know how Galois theory answers ancient questions about ruler and compass constructions. 5. Know about cyclotomic fields generated by complex roots of unity. 6. Know how Galois theory answers questions about the solvability of polynomial equations by arithmetic and radical operations. Credits: 3.00

Analysis

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and

proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

Computer Science

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a

sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

Discrete Mathematics, Foundations

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

Numerical Analysis

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

Statistics, Probability

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families

of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

Advanced Topics Course

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

Allowed for MATH/MAED dual majors ONLY

MA 48400 - Seminar On Teaching College Algebra And Trigonometry

Credit Hours: 3.00. This course is a seminar on the teaching of mathematics for our best undergraduate mathematics education students. It provides supervised teaching experience along with a chance for the students to perfect their knowledge of algebra before going on to be high school teachers. Students who take this class will also teach a section of MA 15300. Permission of instructor required.

Credits: 3.00

Allowed for MATH/PHYS dual majors ONLY

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

Other Departmental/Program Course Requirements (41-67 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the

program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to

students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the

divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Electives (25-51 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to

apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

15-18 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and

resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15 Credits

Fall 3rd Year

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann

or Riemann-Stieltjes integrals. Credits: 3.00

15-16 Credits

Spring 3rd Year

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

15-16 Credits

Fall 4th Year

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings

and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

15-18 Credits

Spring 4th Year

15 Credits

Mathematics/Business, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (40-43 credits)

Required Major Courses (25 credits)

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to

use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to

apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

Minor Requirement (15-18 credits)

Other Departmental/Program Course Requirements (41-67 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of

revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and

line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis

testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Electives (10-39 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-17 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate

the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to

programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts

related to immunization, and will be able to do calculations involving these concepts. 7. Define and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

15-16 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to

solve the problem (Statistical Thinking). Credits: 3.00

15 Credits

Fall 3rd Year

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

16-18 Credits

Spring 3rd Year

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

15-17 Credits

Fall 4th Year

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

16-17 Credits

Spring 4th Year

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

15 Credits

Mathematics/Computer Science, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (31 credits)

Required Major Courses (19 credits)

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite

probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MACS Math Selective (6 credits)

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

CS Selective (3 credits)

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA/STAT Selective (3 credits)

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem,

discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science,

statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

Other Departmental/Program Course Requirements (42-67 credits)

College of Science Additional Requirements

Computing (4 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation

techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Electives (22-47 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

15-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate

velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15-17 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear

independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

15 Credits

Fall 3rd Year

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

15-16 Credits

Spring 3rd Year

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

15-16 Credits

Fall 4th Year

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas;

numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

15 Credits

Spring 4th Year

15-18 Credits

Mathematics/Statistics, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (30-31 credits)

Required Major Courses (24 credits)

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear

independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.
Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.
Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.
Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.
Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical

Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

Advanced MA Selective (3-4 credits)

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models.

4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions

converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45401 - Galois Theory Honors

Credit Hours: 3.00. This course will give a thorough introduction to Galois theory. Galois theory is a fundamental tool in many areas of mathematics, including number theory and algebraic geometry. This course will increase students' mathematical maturity and prepare them for graduate school. Topics include finite extension fields and their symmetries, ruler and compass constructions, complex roots of unity, solvable groups, and the solvability of polynomial equations by arithmetic and radical operations. This course is intended for third- or fourth-year students who have taken MA 45000 (Algebra Honors) or MA 45300 (Elements of Algebra I).

Learning Outcomes: 1. Know the historical background of Galois theory. 2. Know the classical version which addresses questions about roots of polynomials and the modern formulation in terms of abstract algebra. 3. Know about finite extension fields and their symmetries. 4. Know how Galois theory answers ancient questions about ruler and compass constructions. 5. Know about cyclotomic fields generated by complex roots of unity. 6. Know how Galois theory answers questions about the solvability of polynomial equations by arithmetic and radical operations. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its

samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

STAT Selective (3 credits)

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is

learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm.

7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML

and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to

answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

Other Departmental/Program Course Requirements (38-64 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.

Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Statistics (3 credits)

Electives (25-52 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-18 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be

able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

15-18 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits:

3.00

15 Credits

Fall 3rd Year

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

15-16 Credits

Spring 3rd Year

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

15-17 Credits

Fall 4th Year

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

15-16 Credits

Spring 4th Year

15-17 Credits

Mechanical Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (59 credits)

Required Major Courses (47 credits)

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties,

processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 21100 - Applied Strength Of Materials

Credit Hours: 4.00. The principles of strength, stiffness, and stability are introduced and applied primarily to mechanical components.

Learning Outcomes: 1. Find internal shear and internal bending moment within a structure due to the external loading. 2. Undertsand basic mechanical properties of materials and cross-sectional/area properties of structures and apply them. 3. Identify and calculate the stress present due to internal loads. 4. Identify potential maximum stress locations and calculate the principle stresses and the maximum shear stress. 5. Calculate deflection in statically determinate structures. Credits: 4.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use

appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

MET 32000 - Applied Thermodynamics

Credit Hours: 3.00. Following a review of fundamental concepts, advanced power and refrigeration cycles are analyzed. Applications such as gas mixtures, air-vapor mixtures, and chemical reactions of combustion processes are presented.

Learning Outcomes: 1. Use thermodynamic properties of gases and vapors in system analysis. 2. Apply the first and second laws of thermodynamics to real and ideal systems. 3. Analyze thermodynamic cycles (e.g., Otto, Diesel, Brayton, Rankine, vapor compression). 4. Compute properties of gas mixtures. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

MET 31400 - Applications Of Machine Elements

Credit Hours: 3.00. The methods developed in statics, dynamics, and strength of materials are applied to the selection of basic machine components (gears, shafts, bearings, chain and belt drives, clutches and brakes, and motors).

Learning Outcomes: 1. Analyze and design chain and belt drive systems. 2. Analyze, design, and select appropriate gears for a machine. 3. Identify motors that are appropriate to use in a machine with specific components and loading criteria. 4. Analyze a machine to select rolling element bearings based on loading and life requirements. 5. Design clutches and brakes that store and/or transfer rotational energy. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3.

Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

MET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MET Selectives (12 credits)

Other Departmental/Program Course Requirements (61 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of

analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of

technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through

revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Supplemental List

Optional Concentrations

Professional Requirement

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream

use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

15 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of

integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply

ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and

Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MET 21100 - Applied Strength Of Materials

Credit Hours: 4.00. The principles of strength, stiffness, and stability are introduced and applied primarily to mechanical components.

Learning Outcomes: 1. Find internal shear and internal bending moment within a structure due to the external loading. 2. Undertsand basic mechanical properties of materials and cross-sectional/area properties of structures and apply them. 3. Identify and calculate the stress present due to internal loads. 4. Identify potential maximum stress locations and calculate the principle stresses and the maximum shear stress. 5. Calculate deflection in statically determinate structures. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

14 Credits

Spring 2nd Year

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via

standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

16 Credits

Fall 3rd Year

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure,

reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15 Credits

Spring 3rd Year

MET 32000 - Applied Thermodynamics

Credit Hours: 3.00. Following a review of fundamental concepts, advanced power and refrigeration cycles are analyzed. Applications such as gas mixtures, air-vapor mixtures, and chemical reactions of combustion processes are presented.

Learning Outcomes: 1. Use thermodynamic

properties of gases and vapors in system analysis. 2. Apply the first and second laws of thermodynamics to real and ideal systems. 3. Analyze thermodynamic cycles (e.g., Otto, Diesel, Brayton, Rankine, vapor compression). 4. Compute properties of gas mixtures. Credits: 3.00

MET 31400 - Applications Of Machine Elements

Credit Hours: 3.00. The methods developed in statics, dynamics, and strength of materials are applied to the selection of basic machine components (gears, shafts, bearings, chain and belt drives, clutches and brakes, and motors).

Learning Outcomes: 1. Analyze and design chain and belt drive systems. 2. Analyze, design, and select appropriate gears for a machine. 3. Identify motors that are appropriate to use in a machine with specific components and loading criteria. 4. Analyze a machine to select rolling element bearings based on loading and life requirements. 5. Design clutches and brakes that store and/or transfer rotational energy. Credits: 3.00

15 Credits

Fall 4th Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online

presence. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term

capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

15 Credits

Mechanical Engineering, BSME

About the Program

Degree Requirements

Mechanical Engineering Major Requirements (61-62 credits)

Mechanical Engineering Major Courses (41 credits)

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

ME 29000 - Global Engineering Professional Seminar (UCC: STS)

Credit Hours: 1.00. Forum on contemporary issues in the global profession of mechanical engineering. Professionalism and ethics. Interactions with engineering faculty and with professionals outside the University. Quizzes on assigned readings in the areas of globalization, cultural difference and collaborating across cultural boundaries. Individually developed professional profiles describe technical interests and convey awareness of ethical responsibilities in global context.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Provide a solid foundation in global engineering skills. 2. Introduce the in global engineering community and encourage active involvement with professional associations such as ASME and SAE to develop teamwork and leadership skills. 3. Explore the ME Curriculum and identify resources available for planning a academic program including global literacies (language and area studies) and for obtaining diverse industrial experience appropriate for developing global competencies. 4. Support the development of a strong ethical framework for global professional workplace, including an appreciation for cultural differences, as a responsible member of the global engineering community. Credits: 1.00

ME 31500 - Heat And Mass Transfer

Credit Hours: 4.00. Fundamentals of heat transfer by conduction, convection, and radiation; mass transfer by convection. Relevance to engineering applications.

Learning Outcomes: 1. Develop the ability to identify the relevant transport processes (heat,

momentum and energy) when confronted with a particular problem. [1, 7] 2. Develop the ability to model and analyze heat and mass transfer processes. [1, 2, 3, 5, 7] 3. Augment the ability to design and conduct experiments to solve open-ended engineering problems. [2, 3, 5, 6, 7] 4. Reinforce technical written and oral communication skills through a formal project report. [3, 4, 5] Credits: 4.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

ME 46300 - Engineering Design

Credit Hours: 3.00. Application of the design process to the design of various engineering components and systems. Mathematical modeling in design is emphasized. Design problems from all areas of mechanical engineering are considered.

Learning Outcomes: 1. Reinforce the philosophy that engineering design problems are open-ended and multifaceted. [1, 2, 3, 5] 2. Exercise a collaborative design methodology. [2, 3, 4, 5, 6, 7] 3. Broaden skills in leadership, teamwork, communication, project planning, innovation, design, and entrepreneurship. [3, 5] 4. Experience the application of core course materials, engineering design methods, and testing to practical open-ended design problems. [1, 2, 6] 5. Reinforce a philosophy of professional and ethical behavior. [4] 6. Provide a practical foundation for knowledge acquisition and continued learning as needed in students' future careers. [7] Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to

the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and fundamental concepts to measuring and analyzing fluid systems and flows. 3. Learn a laboratory design project on a flow system reinforces the design process. Credits: 1.00

ME 35400 - Machine Design

Credit Hours: 3.00. Design, analysis, and selection of machine components for fluctuating loading. Application of design fundamentals to mechanical components and integration of components to form systems. Open-ended design projects reinforce the design process.

Learning Outcomes: 1. Apply Statics, Dynamics, and Strength of Materials to the realization of machine components. 2. Understand fatigue failure mechanisms 3. Apply fatigue failure theories to create reliable mechanical components. 4. Select standard machine components and materials. 5. Enhance problem-solving and communication skills through design projects. Credits: 3.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

ME 32301 - Mechanics Of Materials Laboratory

Credit Hours: 1.00. Experimental methods and techniques employed for the measurement of mechanical properties and evaluation of mechanical structures. Application of mechanics of materials and fundamental concepts to measuring and analyzing mechanical structures. A laboratory design project on mechanical structures.

Learning Outcomes: 1. Conduct simple experiments and analyze data. 2. Enhance systematic problem-solving skills and sharpen written-communication skills through short technical laboratory memos. 3. Complete a design project on a mechanical structure. Credits: 1.00

ME 26400 - Introduction To Manufacturing For Mechanical Design

Credit Hours: 3.00. Introduction to manufacturing processes for typical engineering materials. Basics of material properties and behavior for manufacturing processes. Material selection and manufacturing process selection for mechanical design. Hands-on projects in the lab reinforce the knowledge of manufacturing processes.

Learning Outcomes: 1. Understand material properties and behavior for design and manufacturing. 2. Gain a fundamental knowledge of manufacturing processes. 3. Gain knowledge of the practice of measurements and manufacturing processes through laboratory experiments. 4. Enhance knowledge on the selection of materials and manufacturing processes for product design. 5. Enhance technical communication skills through short technical lab reports. Credits: 3.00

ME 36400 - Systematic Engineering Design

Credit Hours: 3.00. The engineering design process including planning and clarification, conceptual design, embodiment design, and detail design. Identification of customer requirements and development of engineering specifications. Concept generation and selection. Rules and guidelines for embodiment design. Design considerations including quality, modularity, manufacturing, assembly, and economics. Detail design to support manufacturing.

Learning Outcomes: 1. Understand and apply a systematic design method. 2. Understand customer needs and translate needs to engineering specifications. 3. Generate concepts and use ideation techniques. 4. Develop layouts using embodiment design techniques. 5. Generate designs that are manufacturable. 6. Communicate design effectively to various stakeholders. 7. Work effectively in a team environment. 8. Acquire and apply new knowledge and tools to support the design process. Credits: 3.00

ME 23900 - Introduction To Data Science For Mechanical Engineers

Credit Hours: 1.00. Introduction to data science for sophomore mechanical engineers with no prior knowledge of the topic; Overview of Python basics using Jupyter notebooks; review of probability theory as the language of uncertainty, Monte Carlo sampling for uncertainty propagation; basics of supervised (Bayesian generalized linear regression, logistic regression, deep neural networks, convolutional neural networks), and unsupervised learning (k-means clustering, principal component analysis, Gaussian mixtures).

Learning Outcomes: 1. Represent uncertainty in parameters in engineering or scientific models using probability theory. 2. Propagate uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Solve basic supervised learning tasks, such as regression and classification. 4. Solve basic unsupervised learning tasks, such as clustering, dimensionality reduction, and density estimation. 5. Develop and apply various Python coding skills. 6. Load and visualize data sets in Jupyter notebooks. 7. Visualize uncertainty in Jupyter notebooks. 8. Recognize basic Python software (e.g., Pandas, numpy, scipy, scikit-learn) and advanced Python software (e.g., pytorch, pyrho, Tensorflow) commonly used in data analytics. Credits: 1.00

Other Departmental Required Courses (20-21 credits)

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and

line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

Other Program/Department Requirements (35-36 credits)

Mechanical Engineering Electives (6 credits)

Other Departmental Requirements (14-15 credits)

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ME 16400 - Geometric And Annotation Modeling

Credit Hours: 3.00. This course focuses on CAD-based modeling and engineering graphics standards (national - ANSI/ASME and international - ISO), including coordinate and geometric dimensioning and tolerancing practices. It covers principles and techniques of three-dimensional surface and solid modeling. This course teaches students how to model real-world engineering objects and assemblies using the capabilities of commercial CAD systems. Conceptual, preliminary and detailed part and assembly models are assigned as exercises to reinforce the classroom lectures. This course teaches the graphics language and standards necessary for engineering students to read, understand, and sign off engineering drawings and documents. Students are required to detail (create engineering drawings) their CAD models, demonstrating their ability to both read and apply graphic standards.

Learning Outcomes: 1. Improve sketching. 2. Understand wireframe, surface and solid modeling techniques found in a modern commercial CAD package. [3] 3. Create CAD models of basic machine components and assemblies. [2] 4. Design and create CAD models of average to complex mechanical components. [2] 5. Understand the approaches and processes used in component and assembly modeling, i.e., top-down and bottom-up design. [2] 6. Read and understand engineering drawings composed of multiple views with standard dimensioning and tolerancing nomenclature. [3] 7. Read and understand engineering drawings that contain geometric dimensioning and tolerancing symbols. [3] 8. Use of standards for geometric modeling, dimensioning, and tolerancing. [2] 9. Work in collaboration with fellow teammates to accomplish both the learning of the CAD tool and the executing of the modeling projects. [5] Credits: 3.00

General Education Requirement (15 credits)

Elective (3 credits)

Optional Concentrations

Supplemental List

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Mechanical Engineering Program Requirements

Fall 2nd Year

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 29000 - Global Engineering Professional Seminar (UCC: STS)

Credit Hours: 1.00. Forum on contemporary issues in the global profession of mechanical engineering. Professionalism and ethics. Interactions with engineering faculty and with professionals outside the University. Quizzes on assigned readings in the areas of globalization, cultural difference and collaborating across cultural boundaries. Individually developed professional profiles describe technical interests and convey awareness of ethical responsibilities in global context.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Provide a solid foundation in global engineering skills. 2. Introduce the in global engineering community and encourage active involvement with professional associations such as ASME and SAE to develop teamwork and leadership skills. 3. Explore the ME Curriculum and identify resources available for planning a academic program including global literacies (language and area studies) and for obtaining diverse industrial experience appropriate for developing global competencies. 4. Support the development of a strong ethical framework for global professional workplace, including an appreciation for cultural differences, as a responsible member of the global engineering community. Credits: 1.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and

line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ME 16400 - Geometric And Annotation Modeling

Credit Hours: 3.00. This course focuses on CAD-based modeling and engineering graphics standards (national - ANSI/ASME and international - ISO), including coordinate and geometric dimensioning and tolerancing practices. It covers principles and techniques of three-dimensional surface and solid modeling. This course teaches students how to model real-world engineering objects and assemblies using the capabilities of commercial CAD systems. Conceptual, preliminary and detailed part and assembly models are assigned as exercises to reinforce the classroom lectures. This course teaches the graphics language and standards necessary for engineering students to read, understand, and sign off engineering drawings and documents. Students are required to detail (create engineering drawings) their CAD models, demonstrating their ability to both read and apply graphic standards.

Learning Outcomes: 1. Improve sketching. 2. Understand wireframe, surface and solid modeling techniques found in a modern commercial CAD package. [3] 3. Create CAD models of basic machine components and assemblies. [2] 4. Design and create CAD models of average to complex mechanical components. [2] 5. Understand the approaches and processes used in component and assembly modeling, i.e., top-down and bottom-up design. [2] 6. Read and understand engineering drawings composed of multiple views with standard dimensioning and tolerancing nomenclature. [3] 7. Read and understand engineering drawings that contain geometric dimensioning and tolerancing symbols. [3] 8. Use of standards for geometric modeling, dimensioning, and tolerancing. [2] 9. Work in collaboration with fellow teammates to accomplish both the learning of the CAD tool and the executing of the modeling projects. [5] Credits: 3.00

16-17 Credits

Spring 2nd Year

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems.

4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ME 26400 - Introduction To Manufacturing For Mechanical Design

Credit Hours: 3.00. Introduction to manufacturing processes for typical engineering materials. Basics of material properties and behavior for manufacturing processes. Material selection and manufacturing process selection for mechanical design. Hands-on projects in the lab reinforce the knowledge of manufacturing processes.

Learning Outcomes: 1. Understand material properties and behavior for design and manufacturing. 2. Gain a fundamental knowledge of manufacturing processes. 3. Gain knowledge of the practice of measurements and manufacturing processes through laboratory experiments. 4. Enhance knowledge on the selection of materials and manufacturing processes for product design. 5. Enhance technical communication skills through short technical lab reports. Credits: 3.00

ME 23900 - Introduction To Data Science For Mechanical Engineers

Credit Hours: 1.00. Introduction to data science for sophomore mechanical engineers with no prior knowledge of the topic; Overview of Python basics using Jupyter notebooks; review of probability theory as the language of uncertainty, Monte Carlo sampling for uncertainty propagation; basics of supervised (Bayesian generalized linear regression, logistic regression, deep neural networks, convolutional neural networks), and unsupervised learning (k-means clustering, principal component analysis, Gaussian mixtures).

Learning Outcomes: 1. Represent uncertainty in parameters in engineering or scientific models using probability theory. 2. Propagate uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Solve basic supervised learning tasks, such as regression and classification. 4. Solve basic unsupervised learning tasks, such as clustering, dimensionality reduction, and density estimation. 5. Develop and apply various Python coding skills. 6. Load and visualize data sets in Jupyter notebooks. 7. Visualize uncertainty in Jupyter notebooks. 8. Recognize basic Python software (e.g., Pandas, numpy,

scipy, scikit-learn) and advanced Python software (e.g., pytorch, pyrho, Tensorflow) commonly used in data analytics. Credits: 1.00

17 Credits

Fall 3rd Year

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4)
Credits: 3.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.
Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market

equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

ME 32301 - Mechanics Of Materials Laboratory

Credit Hours: 1.00. Experimental methods and techniques employed for the measurement of mechanical properties and evaluation of mechanical structures. Application of mechanics of materials and fundamental concepts to measuring and analyzing mechanical structures. A laboratory design project on mechanical structures.

Learning Outcomes: 1. Conduct simple experiments and analyze data. 2. Enhance systematic problem-solving skills and sharpen written-communication skills through short technical laboratory memos. 3. Complete a design project on a mechanical structure. Credits: 1.00

16 Credits

Spring 3rd Year

ME 31500 - Heat And Mass Transfer

Credit Hours: 4.00. Fundamentals of heat transfer by conduction, convection, and radiation; mass transfer by convection. Relevance to engineering applications.

Learning Outcomes: 1. Develop the ability to identify the relevant transport processes (heat, momentum and energy) when confronted with a particular problem. [1, 7] 2. Develop the ability to model and analyze heat and mass transfer processes. [1, 2, 3, 5, 7] 3. Augment the ability to design and conduct experiments to solve open-ended engineering problems. [2, 3, 5, 6, 7] 4. Reinforce technical written and oral communication skills through a formal project report. [3, 4, 5] Credits: 4.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and

fundamental concepts to measuring and analyzing fluid systems and flows. 3. Learn a laboratory design project on a flow system reinforces the design process. Credits: 1.00

ME 36400 - Systematic Engineering Design

Credit Hours: 3.00. The engineering design process including planning and clarification, conceptual design, embodiment design, and detail design. Identification of customer requirements and development of engineering specifications. Concept generation and selection. Rules and guidelines for embodiment design. Design considerations including quality, modularity, manufacturing, assembly, and economics. Detail design to support manufacturing.

Learning Outcomes: 1. Understand and apply a systematic design method. 2. Understand customer needs and translate needs to engineering specifications. 3. Generate concepts and use ideation techniques. 4. Develop layouts using embodiment design techniques. 5. Generate designs that are manufacturable. 6. Communicate design effectively to various stakeholders. 7. Work effectively in a team environment. 8. Acquire and apply new knowledge and tools to support the design process. Credits: 3.00

17 Credits

Fall 4th Year

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 35400 - Machine Design

Credit Hours: 3.00. Design, analysis, and selection of machine components for fluctuating loading. Application of design fundamentals to mechanical components and integration of components to form systems. Open-ended design projects reinforce the design process.

Learning Outcomes: 1. Apply Statics, Dynamics, and Strength of Materials to the realization of machine components. 2. Understand fatigue failure mechanisms 3. Apply fatigue failure theories to create reliable mechanical components. 4. Select standard machine components and materials. 5. Enhance problem-solving and communication skills through design projects. Credits: 3.00

18-19 Credits

Spring 4th Year

ME 46300 - Engineering Design

Credit Hours: 3.00. Application of the design process to the design of various engineering components and systems. Mathematical modeling in design is emphasized. Design problems from all areas of mechanical engineering are considered.

Learning Outcomes: 1. Reinforce the philosophy that engineering design problems are open-ended and multifaceted. [1, 2, 3, 5] 2.

Exercise a collaborative design methodology. [2, 3, 4, 5, 6, 7] 3. Broaden skills in leadership, teamwork, communication, project planning, innovation, design, and entrepreneurship. [3, 5] 4. Experience the application of core course materials, engineering design methods, and testing to practical open-ended design problems. [1, 2, 6] 5. Reinforce a philosophy of professional and ethical behavior. [4] 6. Provide a practical foundation for knowledge acquisition and continued learning as needed in students' future careers. [7] Credits: 3.00

15 Credits

Mechatronics Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (120 credits)

Required Major Courses (74 credits)

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication,

and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and

pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

MET 33400 - Advanced Fluid Power

Credit Hours: 3.00. Hydraulic and pneumatic circuits and their steady state and time-variant behavior as it affects the selection and design of components and systems used in fluid power transmission and motion control are studied. Emphasis is placed on industrial and mobile applications, but the principles also apply to aerospace, marine, and other fluid power systems.

Learning Outcomes: 1. Utilize the applicable laws of fluid mechanics to compute the requirements of fluid power systems. 2. Utilize computer software to evaluate starting and stopping transient behaviors in hydraulic systems. 3. Design motion control strategies with various actuators and valves to accomplish a specified task with hydraulic and pneumatic systems. 4. Analyze the performance of various pumps and compressors and specify the appropriate pump or compressor for a hydraulic or pneumatic system. Credits: 3.00

MET 43200 - Hydraulic Motion Control Systems

Credit Hours: 3.00. Hydraulic feedback motion control systems, types, and applications are studied. Simulation and performance of closed loop control systems with single and multiple signal paths are emphasized. Dynamic system performance is predicted and evaluated. System parameters including accuracy, response speed, fluid compressibility effects, load disturbances, and nonlinear behavior of the components are studied.

Learning Outcomes: 1. Identify the origins, development and applications of servo mechanisms. 2. Explain hydraulic system and component nonlinearities such as friction, deadband, backlash, and hysteresis. 3. Recognize control terms, definitions, and fluid power components of a hydraulic system. 4. Evaluate transfer functions and their use in predicting the performance of a system. 5. Utilize computer software simulation tools to investigate the dynamic performance of simple control loops. 6. Develop methods for improving hydraulic system stability through the use of simulation tools. Credits: 3.00

MET 48200 - Mechatronics

Credit Hours: 3.00. Fundamental concepts and applications of practical mechatronics are presented, with emphasis on product design, systems integration, and functional relationships between mechanical structure, sensor data, precision actuators, power resources, embedded microcontrollers, control logic, and drives. Students gain hands-on experience with mechatronics components and measurement equipment which is applied in a team-based design-build mechatronics system project.

Learning Outcomes: 1. Describe the design and operation of mechatronics. 2. Demonstrate input/output characteristics of microcontroller and its interfacing. 3. Create a mechatronic system solution to a given problem. 4. Explain

programming and interfacing issues involved in the design of mechatronic system. Credits: 3.00

MET 31500 - Applied Mechanism Kinematics And Dynamics

Credit Hours: 3.00. Displacements, velocities, and accelerations are determined using graphical, semi-graphical, and numerical analyses of rotational and translational motions of common mechanisms such as linkages, cams, gears, screws, and chains as well as their loading.

Learning Outcomes: 1. Categorize and model common mechanisms, including their degrees of freedom. 2. Determine the displacements, velocities, and accelerations in common linkages. 3. Analyze and synthesize common mechanisms (e.g., linkages, cams, gears, screws, belts, chains, shafts). 4. Use software in kinematic analysis and synthesis. Credits: 3.00

ECET 36900 - Applied Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course provides fundamental knowledge of integrated computer imaging or vision systems for sensing, quality control and automation applications. Fundamental basis of optics, illumination, camera types with associated technologies, and image acquisition to develop a customized computer imaging or vision systems will be covered. Algorithms for image processing, image analysis and pattern recognition will also be covered. Emerging technologies-based integrated computer vision or imaging system for sensor system, inspection, quality control and automation in different sectors (medical, manufacturing, security, construction etc.) will be examined. Parallel laboratory hands-on experience will allow the students to apply and validate the concepts learned in the lecture.

Learning Outcomes: 1. Identify different components of a computer vision/imaging system and their needs. 2. Identify and specify different components of a computer imaging system for selected different applications. 3. Interpret and implement different operations related to image processing, image analysis and image understanding. 4. Evaluate different real-world case studies to learn from successes and failures related to computer imaging system-based devices or components. 5. Formulate or create tentative solution for selected real world applications. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

MET 38200 - Controls And Instrumentation For Automation

Credit Hours: 3.00. Study of the procedures and techniques essential to industrial measurement and transmission of data is provided in the areas of microprocessor control, process control, and automated testing. Concepts of hysteresis, repeatability, weighted signals, span, suppression, range, and closed loop control are emphasized.

Learning Outcomes: 1. Evaluate and select sensors for a given application based on relevant specifications. 2. Select a data acquisition system based on the requirements of a given application. 3. Explain how process gain, dead band, and lag affect the performance of a closed loop control system. 4. Tune a closed loop PID controller. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning

applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

MFET 24100 - Automatic Control Systems

Credit Hours: 3.00. This course provides students with a comprehensive understanding of feedback control systems and their practical implementation. Students will learn modeling and simulations of linear/linearized dynamic systems, stability study, time domain analysis, frequency domain analysis, root-locus method, design of PID control, compensators, derivation of control law, and system performance analysis through hands-on exercises and simulations. The curriculum emphasizes applications of mechatronics, robotics, and mechanical/electrical engineering technology fields.

Learning Outcomes: 1. Utilize the fundamental concepts for feedback control system design. 2. Create mathematical models of dynamic systems. 3. Analyze the performance of control systems through simulations. 4. Optimize controller parameters for desired system behavior. 5. Apply control theory to real-world engineering problems. Credits: 3.00

MFET 47100 - Electric Machines

Credit Hours: 3.00. This course provides a comprehensive introduction to electrical machines fundamentals, three-phase circuits, electromagnetic principles, AC and DC motors, transformers, magnetism in motors, energy conversion in electric machines as well as their industrial and commercial applications.

Learning Outcomes: 1. Utilize working principles of electric machinery for design and performance analysis. 2. Master application of three-phase circuits, transformers, electromagnetic field analysis, electrical/mechanical energy conversion and efficiency, and interaction between motors and power systems. 3. Develop teamwork and problem-solving skills through electric machine projects. 4. Select and integrate electric machines in multidisciplinary systems. Credits: 3.00

MFET 37100 - Introduction To Precision Machine Design

Credit Hours: 3.00. This is a multidisciplinary course focusing on engineering techniques that are employed to design and develop high-precision automation products equipped with precision mechanisms. Fine mechanisms and precision instruments will be used to illustrate the concepts and applications. Topics covered include design strategy, high-precision mechanical components, sensors and measurement, servo control, design for controllability, control software development, controller hardware as well as automated error detection and recovery.

Learning Outcomes: 1. Utilize principles of precision machine and mechanism design for smart and precision machinery. 2. Design electromechanical components and systems using multidisciplinary techniques. 3. Design smart machinery with sensing, transmission, actuation technologies, and machine control

strategies. 4. Perform product value analysis and product life performance analysis of precision machines. Credits: 3.00

MFET 48005 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Other Departmental/Program Course Requirements (45-53 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading,

analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a

one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the

design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs,

behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (0-1 credits)

Supplemental List

Professional Requirement

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16-19 Credits

Spring 1st Year

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium

to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

15-18 Credits

Fall 2nd Year

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

16 Credits

Spring 2nd Year

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MFET 24100 - Automatic Control Systems

Credit Hours: 3.00. This course provides students with a comprehensive understanding of feedback control systems and their practical implementation. Students will learn modeling and simulations of linear/linearized dynamic systems, stability study, time domain analysis, frequency domain analysis, root-locus method, design of PID control, compensators, derivation of control law, and system performance analysis through hands-on exercises and simulations. The curriculum emphasizes applications of mechatronics, robotics, and mechanical/electrical engineering technology fields.

Learning Outcomes: 1. Utilize the fundamental concepts for feedback control system design. 2. Create mathematical models of dynamic systems. 3. Analyze the performance of control systems through simulations. 4. Optimize controller parameters for desired system behavior. 5. Apply control theory to real-world engineering problems. Credits: 3.00

16 Credits

Fall 3rd Year

MET 33400 - Advanced Fluid Power

Credit Hours: 3.00. Hydraulic and pneumatic circuits and their steady state and time-variant behavior as it affects the selection and design of components and systems used in fluid power transmission and motion control are studied. Emphasis is placed on industrial and mobile applications, but the principles also apply to aerospace, marine, and other fluid power systems.

Learning Outcomes: 1. Utilize the applicable laws of fluid mechanics to compute the requirements of fluid power systems. 2. Utilize computer software to evaluate starting and stopping transient behaviors in hydraulic systems. 3. Design motion control strategies with various actuators and valves to accomplish a specified task with hydraulic and pneumatic systems. 4. Analyze the performance of various pumps and compressors and specify the appropriate pump or compressor for a hydraulic or pneumatic system. Credits: 3.00

ECET 36900 - Applied Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course provides fundamental knowledge of integrated computer imaging or vision systems for sensing, quality control and automation applications. Fundamental basis of optics, illumination, camera types with associated technologies, and image acquisition to develop a customized computer imaging or vision systems will be covered. Algorithms for image processing, image analysis and pattern recognition will also be covered. Emerging technologies-based integrated computer vision or imaging system for sensor system, inspection, quality control and automation in different sectors (medical, manufacturing, security, construction etc.) will be examined. Parallel laboratory hands-on experience will allow the students to apply and validate the concepts learned in the lecture.

Learning Outcomes: 1. Identify different components of a computer vision/imaging system and their needs. 2. Identify and specify different components of a computer imaging system for selected different applications. 3. Interpret and implement different operations related to image processing, image analysis and image understanding. 4. Evaluate different real-world case studies to learn from successes and failures related to computer imaging system-based devices or components. 5. Formulate or create tentative solution for selected real world applications. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated

machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

14-15 Credits

Spring 3rd Year

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

MET 31500 - Applied Mechanism Kinematics And Dynamics

Credit Hours: 3.00. Displacements, velocities, and accelerations are determined using graphical, semi-graphical, and numerical analyses of rotational and translational motions of common mechanisms such as linkages, cams, gears, screws, and chains as well as their loading.

Learning Outcomes: 1. Categorize and model common mechanisms, including their degrees of freedom. 2. Determine the displacements, velocities, and accelerations in common linkages. 3. Analyze and synthesize common mechanisms (e.g., linkages, cams, gears, screws, belts, chains, shafts). 4. Use software in kinematic analysis and synthesis. Credits: 3.00

MET 38200 - Controls And Instrumentation For Automation

Credit Hours: 3.00. Study of the procedures and techniques essential to industrial measurement and transmission of data is provided in the areas of microprocessor control, process control, and automated testing. Concepts of hysteresis, repeatability, weighted signals, span, suppression, range, and closed loop control are emphasized.

Learning Outcomes: 1. Evaluate and select sensors for a given application based on relevant specifications. 2. Select a data acquisition system based on the requirements of a given application. 3. Explain how process gain, dead band, and lag affect the performance of a closed loop control system. 4. Tune a closed loop PID controller. Credits: 3.00

MFET 37100 - Introduction To Precision Machine Design

Credit Hours: 3.00. This is a multidisciplinary course focusing on engineering techniques that are employed to design and develop high-precision automation products equipped with precision mechanisms. Fine mechanisms and precision instruments will be used to illustrate the concepts and applications. Topics covered include design strategy, high-precision mechanical components, sensors and measurement, servo control, design for controllability, control software development, controller hardware as well as automated error detection and recovery.

Learning Outcomes: 1. Utilize principles of precision machine and mechanism design for smart and precision machinery. 2. Design electromechanical components and systems using multidisciplinary techniques. 3. Design smart machinery with sensing, transmission, actuation technologies, and machine control strategies. 4. Perform product value analysis and product life performance analysis of precision machines. Credits: 3.00

15-16 Credits

Fall 4th Year

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of

gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

MET 48200 - Mechatronics

Credit Hours: 3.00. Fundamental concepts and applications of practical mechatronics are presented, with emphasis on product design, systems integration, and functional relationships between mechanical structure, sensor data, precision actuators, power resources, embedded microcontrollers, control logic, and drives. Students gain hands-on experience with mechatronics components and measurement equipment which is applied in a team-based design-build mechatronics system project.

Learning Outcomes: 1. Describe the design and operation of mechatronics. 2. Demonstrate input/output characteristics of microcontroller and its interfacing. 3. Create a mechatronic system solution to a given problem. 4. Explain programming and interfacing issues involved in the design of mechatronic system. Credits: 3.00

MFET 47100 - Electric Machines

Credit Hours: 3.00. This course provides a comprehensive introduction to electrical machines fundamentals, three-phase circuits, electromagnetic principles, AC and DC motors, transformers, magnetism in motors, energy conversion in electric machines as well as their industrial and commercial applications.

Learning Outcomes: 1. Utilize working principles of electric machinery for design and performance analysis. 2. Master application of three-phase circuits, transformers, electromagnetic field analysis, electrical/mechanical energy conversion and efficiency, and interaction between motors and power systems. 3. Develop teamwork and problem-solving skills through electric machine projects. 4. Select and integrate electric machines in multidisciplinary systems. Credits: 3.00

MFET 48005 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

MET 43200 - Hydraulic Motion Control Systems

Credit Hours: 3.00. Hydraulic feedback motion control systems, types, and applications are studied. Simulation and performance of closed loop control systems with single and multiple signal paths are emphasized. Dynamic system performance is predicted and evaluated. System parameters including accuracy, response speed, fluid compressibility effects, load disturbances, and nonlinear behavior of the components are studied.

Learning Outcomes: 1. Identify the origins, development and applications of servo mechanisms. 2. Explain hydraulic system and component nonlinearities such as friction, deadband, backlash, and hysteresis. 3. Recognize control terms, definitions, and fluid power components of a hydraulic system. 4. Evaluate transfer functions and their use in predicting the performance of a system. 5. Utilize computer software simulation tools to investigate the dynamic performance of simple control loops. 6. Develop methods for improving hydraulic system stability through the use of simulation tools. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

13 Credits

Medical Laboratory Sciences, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (94 credits)

Required Major Courses (62 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the

population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 13000 - Introduction To Medical Laboratory Science

Credit Hours: 1.00. An introduction to career opportunities in medical technology. Preprofessional and professional requirements. A survey of the major clinical laboratory departments and their applications to patient care and management. Discussion and interpretation of some of the major diagnostic tests, i.e., for cardiac enzymes, cholesterol, blood cells, diabetes, and drug monitoring.

Learning Outcomes: 1. Have a clearer and more in depth understanding of the field of medical laboratory science. 2. Have an appreciation for the diverse disciplines and thus career opportunities within this field. 3. Have an opportunity to engage in and contribute to your own knowledge gain. 4. Have the ability to translate a simple job description into an exciting professional career. Credits: 1.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and

disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 33300 - Introduction To Immunology

Credit Hours: 3.00. Introduction to Immunology will meet twice weekly and provide an overview of this evolving field of science with an emphasis on the clinical implications and application of learned knowledge. The immunologic mechanisms associated with the normal and abnormal immune response will be discussed and students will put this knowledge into practice by directing their own case study. In addition, a number of common clinical concerns with respect to immunity will be reviewed. Furthermore, we will explore the critical role our knowledge of this branch of science plays in patient diagnosis, treatment and care both now and in the future.

Learning Outcomes: 1. Have solid understanding of the science of Immunology and the Immune Response. 2. Have an appreciation for the complexity of the immune system, its cellular components, its regulation and implications of its dysfunction. 3. Have a clearer understanding of the clinical applications and implications of the immune response. 4. Have enhanced knowledge of the course material. 5. Have the ability to transfer the written word into practical application of its principles. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.

13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic

molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and

including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data

sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Clinical Year (32 credits)

HSCI 45100 - Clinical Biochemistry

Credit Hours: 1.00 to 10.00. This course is designed to provide principles of biochemistry for clinical application for medical technologists. The course encompasses an introduction to carbohydrate, amino acid, and lipid metabolism. Also included are lectures on basic endocrinology, enzymes, and biosynthesis of steroid hormones. Physiological principles are stressed with respect to liver, lung, and kidney function. Special emphasis is placed on correlation of the theoretical and clinical areas.

Credits: 1.00 to 10.00

HSCI 45200 - Clinical Chemistry

Credit Hours: 1.00 to 10.00. This course is designed to provide the medical technologist with the principles and application of clinical chemistry. Methods of instrumental analysis include a variety of automated procedures, electrophoresis, immunoelectrophoresis, immunodiffusion, radioisotopes, steroids, hormone assay, and toxicology. Quality control for clinical chemistry is included. Supervised clinical laboratory experience is offered, with students rotating through the various areas of clinical chemistry on a sequential rotational basis.

Credits: 1.00 to 10.00

HSCI 45300 - Clinical Hematology

Credit Hours: 1.00 to 10.00. Study of the functions, maturation, and morphology of blood cells. Blood cells, platelets, and reticulocyte counting procedure. Experiences in the study of cellular content of other body fluids are offered. Lectures and laboratory are designed to teach techniques of sedimentation rates, hematocrits, corpuscular indices, hemoglobin red cell fragility, and special staining procedures. Also, routine and special coagulation studies are taught. Supervised experience in clinical hematology offers opportunities for study in routine and special hematology and coagulation procedures.

Credits: 1.00 to 10.00

HSCI 45400 - Clinical Immunohematology

Credit Hours: 1.00 to 10.00. A review of serologic principles and technical fundamentals of transfusion practice; a comprehensive consideration of all blood groups, with emphasis on ABO and Rh-Hr blood group systems. Extensive practice is gained in pre-transfusion techniques and antibody identification in the laboratory. Other blood types and antigen-antibody relationships are taught in laboratory and lectures. Also included are blood donor room procedures; preparation of blood components; correlation of blood component therapy with disease states; quality control of all reagents, procedures, and equipment used; and laboratory safety measures, all of which offer the best patient care and protection of laboratory personnel.

Credits: 1.00 to 10.00

HSCI 45500 - Clinical Microbiology

Credit Hours: 1.00 to 10.00. Lectures and clinical laboratory experience in diagnostic procedures as aids to the diagnosis of human disease. Proper selection of techniques for the isolation and identification of medically important bacteria. Special emphasis is placed on newer methods for anaerobic bacteria identification. Also includes lectures and laboratory identification in the fields of mycology and microbacteriology, with emphasis on isolation and identification. Practical applications of fluorescent antibody tests are performed.

Credits: 1.00 to 10.00

HSCI 45700 - Clinical Parasitology

Credit Hours: 1.00 to 10.00. Techniques of specimen examination, identification of cysts and ova, life cycles of parasites.

Credits: 1.00 to 10.00

HSCI 45800 - Clinical Serology

Credit Hours: 1.00 to 10.00. Lectures and a laboratory experience in serology, including the preparation of antigen, flocculation tests for syphilis, heterophile antibody tests, creative proteins, RA test, FTA, rubella testing. Also included are lectures in immunology that include classifications of immunoglobulins; mechanism of antibody formation; immune response; types of antigen-antibody reactions; and theories of radioimmunoassay.

Credits: 1.00 to 10.00

HSCI 46000 - Clinical Urinalysis

Credit Hours: 1.00 to 10.00. Routine analysis, chemical tests, sediment identification, renal function tests, pregnancy tests.

Credits: 1.00 to 10.00

HSCI 46500 - Introduction To Laboratory Education And Management

Credit Hours: 1.00 to 3.00. A study of the principles and techniques of clinical instruction, and inservice and continuing education as well as administration and supervision.

Credits: 1.00 to 3.00

HSCI 49000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for senior students. Permission of instructor required.

Credits: 1.00 to 8.00

Required Major Courses (62 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2.

Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 13000 - Introduction To Medical Laboratory Science

Credit Hours: 1.00. An introduction to career opportunities in medical technology. Preprofessional and professional requirements. A survey of the major clinical laboratory departments and their applications to patient care and management. Discussion and interpretation of some of the major diagnostic tests, i.e., for cardiac enzymes, cholesterol, blood cells, diabetes, and drug monitoring.

Learning Outcomes: 1. Have a clearer and more in depth understanding of the field of medical laboratory science. 2. Have an appreciation for the diverse disciplines and thus career opportunities within this field. 3. Have an opportunity to engage in and contribute to your own knowledge gain. 4. Have the ability to translate a simple job description into an exciting professional career. Credits: 1.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 33300 - Introduction To Immunology

Credit Hours: 3.00. Introduction to Immunology will meet twice weekly and provide an overview of this evolving field of science with an emphasis on the clinical implications and application of learned knowledge. The immunologic mechanisms associated with the normal and abnormal immune response will be discussed and students will put this knowledge into practice by directing their own case study. In addition, a number of common clinical concerns with respect to immunity will be reviewed. Furthermore, we will explore the critical role our knowledge of this branch of science plays in patient diagnosis, treatment and care both now and in the future.

Learning Outcomes: 1. Have solid understanding of the science of Immunology and the Immune Response. 2. Have an appreciation for the complexity of the immune system, its cellular components, its regulation and implications of its dysfunction. 3. Have a clearer understanding of the clinical applications and implications of the immune response. 4. Have enhanced knowledge of the course material. 5. Have the ability to transfer the written word into practical application of its principles. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing

biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn

through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations

in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Other Departmental/Program Course Requirements (23-24 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2.

Demonstrate depth in major. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

Electives (2-3 credits)

Supplemental Information

GPA Requirements

Pass/No Pass Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work.

Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their

environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods

associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

HSCI 13000 - Introduction To Medical Laboratory Science

Credit Hours: 1.00. An introduction to career opportunities in medical technology. Preprofessional and professional requirements. A survey of the major clinical laboratory departments and their applications to patient care and management. Discussion and interpretation of some of the major diagnostic tests, i.e., for cardiac enzymes, cholesterol, blood cells, diabetes, and drug monitoring.

Learning Outcomes: 1. Have a clearer and more in depth understanding of the field of medical laboratory science. 2. Have an appreciation for the diverse disciplines and thus career opportunities within this field. 3. Have an opportunity to engage in and contribute to your own knowledge gain. 4. Have the ability to translate a simple job description into an exciting professional career. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.

Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Fall 2nd Year

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students

demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

14 Credits

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4.

Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

14 Credits

14 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9.

Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

13-14 Credits

13-14 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

HSCI 33300 - Introduction To Immunology

Credit Hours: 3.00. Introduction to Immunology will meet twice weekly and provide an overview of this evolving field of science with an emphasis on the clinical implications and application of learned knowledge. The immunologic mechanisms associated with the normal and abnormal immune response will be discussed and students will put this knowledge into practice by directing their own case study. In addition, a number of common clinical concerns with respect to immunity will be reviewed. Furthermore, we will explore the critical role our knowledge of this branch of science plays in patient diagnosis, treatment and care both now and in the future.

Learning Outcomes: 1. Have solid understanding of the science of Immunology and the Immune Response. 2. Have an appreciation for the complexity of the immune system, its cellular components, its regulation and implications of its dysfunction. 3. Have a clearer understanding of the clinical applications and implications of the immune response. 4. Have enhanced knowledge of the course material. 5. Have the ability to transfer the written word into practical application of its principles. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

14-15 Credits

14-15 Credits

Fall 4th Year

16 Credits

16 Credits

Spring 4th Year

16 Credits

16 Credits

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of

the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how

scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

About the Program

Microbiology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (35-36 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will

demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary

literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a

distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (16-17 credits)

Intermediate Biology Selective (3 credits)

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

Required Coursework: BIOL 500-Level (3 credits)

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

Microbiology Selectives (8-9 credits)

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology

affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 54900 - Microbial Ecology

Credit Hours: 2.00. A study of microbial interactions with other organisms and the environment. Aquatic and terrestrial ecosystems as well as interactions between nonpathogenic microbes and plants and animals will be discussed. Offered in alternate years.

Credits: 2.00

FS 37200 - Fermentation Microbiology

Credit Hours: 3.00. This course explores the principles underlying the design of microbes for their use in biotechnological applications. This project-based course will teach students fundamental molecular biology techniques,

important parameters for strain selection and genetic engineering, and reactor design and operation in bioprocessing. Additionally, this course will cover today's diverse bioengineering goals and tools and the role of microbial biotechnology in society.

Learning Outcomes: 1. Articulate the concept of microbial cell factories and the relationship of microorganisms to food and industrial fermentations. 2. Identify genetic and environmental approaches to control the products, rate, and yield of bioconversion. 3. Understand microbial metabolic pathways and how they are engineered. 4. Design genetic strategies to engineer microbes. 5. Read primary literature relevant to fermentation biotechnology. Credits: 3.00

FS 58100 - Microbial Genomics And Metabolism

Credit Hours: 3.00. Microbial genomics and metabolism will introduce students to how genomes are assembled, how microbial functional predictions are made, and how systems biology techniques are used to query microbial function in diverse ecosystems. Students will participate in activities including classroom lecture, group discussion, reading of primary literature, hands-on computational assignments, exams, and student projects. Basic knowledge of microbiology and molecular biology is expected. Permission of department required.

Learning Outcomes: 1. Run various sequence and genome analysis programs from the command line. 2. Identify the important properties of sequencing technology and genome organization that underlie the genomics of bacteria, archaea, and microbial eukaryotes. 3. Predict gene function using bioinformatic tools and genome properties to annotate and curate microbial genomes. 4. Analyze genomes to predict metabolic pathways and compare related genomes to identify differences in microbial potential function. 5. Present and defend genome-based predictions of organismal metabolism both orally or in scientific writing. Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

Base Lab Requirement (2 credits)

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

Other Departmental Requirements (51-76 credits)

Chemistry (17 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and

structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Biochemistry (4 credits)

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6.

Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing.
Credits: 1.00

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.
Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the

difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena

in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for

characterizing biomolecules. Credits: 4.00

Mathematics (6-10 credits)

Calculus I

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of

integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that

they can study and utilize additional statistical methods. Credits: 3.00

Electives (5-32 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral

calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-18 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in

organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-20 Credits

Fall 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn

through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of

how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based

curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems.

Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing.

Credits: 1.00

15-16 Credits

Fall 3rd Year

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion

is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

15-16 Credits

Spring 3rd Year

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

13-14 Credits

Fall 4th Year

12-14 Credits

Spring 4th Year

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to

graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

12-14 Credits

Motorsports Engineering, BSMSPE (Indianapolis Only)

About the Program

Degree Requirements

Motorsports Engineering Major Requirements (69 credits)

Motorsports Engineering Requirements (37 credits)

Motorsports Engineering Required Courses (31 credits)

MSPE 48200 - Motorsports Aerodynamics

Credit Hours: 3.00. A focused introductory course into the study of aerodynamics principles as applied to automotive and motorsports vehicles. Broad range of topics introduce students to the complexity of fluid flow in and around the vehicle. Analytical methods including Computational Fluid Dynamics are utilized to emphasize key aerodynamics principles taught in the course.

Learning Outcomes: 1. Students will understand the basics of aerodynamic analysis and design as applied to motorsports vehicles. 2. Students will be able to apply Computational Fluid Dynamics modeling and analysis techniques to motorsports design. 3. Students will be able to integrate the various aspects of motorsports modeling and design. Credits: 3.00

MSPE 29800 - Programming And Computer Modeling For Motorsports

Credit Hours: 2.00. Introductory course detailing methods for creating virtual models of vehicle systems for design, analysis and optimization. Virtualization methods include object-oriented programming techniques for creating mathematical models in Excel, Matlab and Python. Students will learn the basics of data regression consistent with the analysis methods conducted in the motorsports industry. The methods introduced through this course lay the foundation for advanced courses in vehicle design, simulation, and analysis.

Learning Outcomes: 1. Introductory understanding of Object-Oriented Programming using Excel VBA and C#. Credits: 2.00

MSPE 31700 - Motorsports Practicum I

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a professional motorsports organization.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team. 10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 35000 - Computer Aided Design And Manufacturing

Credit Hours: 3.00. This course provides the basis for the computer-aided engineering and analysis skills needed in the Motorsports Industry. The ability to visualize and conceptualize a real part in the physical world and produce graphical representations of it in 2D and 3D in Solidworks or an equivalent

is a primary objective. Further skills to be developed include the ability to produce large assemblies of such parts with appropriate tolerancing, free form surfacing, casting shapes and casting machining, 2D drawings for use in 3D sheet metal fabrication including shrink and stretch, use of 3D models to facilitate Finite Element Analysis, Conversation of CAD model to programming of CAM machining.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to problems involving the design and manufacturing of components and systems. 2. Design a system, component, or process to meet desired needs. 3. Identify, formulate, and solve engineering problems involving the design and manufacturing of components and systems. 4. Use the techniques, skill, and modern engineering tools necessary for engineering practice. Credits: 3.00

MSPE 41400 - Motorsports Design II

Credit Hours: 3.00. This is the culminating course in the Motorsports Engineering Plan of Study, tying together concepts from all the other courses in the curriculum, and requires a capstone design project representative of a real world project with the Motorsports Industry.

Learning Outcomes: 1. Apply knowledge of mathematics, science and engineering to the solution of complex and comprehensive design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs pertinent to the motorsports industry. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively in written reports and oral presentations. 7. Use the technique, skill, and modern engineering tools necessary for engineering practice in the motorsports industry. Credits: 3.00

MSPE 47200 - Vehicle Dynamics

Credit Hours: 3.00. Analytical and mathematical model development of the automotive and motorsports vehicles to understand how key vehicle parameters influence vehicle performance. Areas of focus include rectilinear motion, lateral motion, suspension kinematics, tire dynamics and drivetrain modeling.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools necessary for analysis of vehicle dynamics and design of vehicle systems. 2. Apply current knowledge and adapt to emerging applications appropriate to the topic of vehicle dynamics. 3. Conduct, analyze and interpret experiments and apply experimental results to improve processes. 4. Apply creativity in the design of systems, components or processes appropriate to program objectives. 5. Function effectively on teams. 6. Identify, analyze and solve technical problems. 7. Communicate effectively. Credits: 3.00

MSPE 29701 - Computer Modeling For Motorsports

Credit Hours: 2.00. An introductory course detailing methods for designing and modeling motorsports components using Computer Aided Design (CAD) software.

Learning Outcomes: 1. Understand Bottom-up Design of systems and components. 2. Utilize modern engineering tools to model components as solid models in 3 dimensions. 3. Utilize modern engineering tools to generate detail two-dimensional detail drawings of components. 4. Utilize modern engineering tools to model and constrain component assemblies in 3 dimensions. 5. Communicate thoughts and ideas. Credits: 2.00

MSPE 32000 - Motorsports Design I

Credit Hours: 3.00. Introduction to the principles of design and analysis of vehicle subsystems and components within those subsystems. Vehicle subsystems are reviewed and evaluated for functionality, and reliability with emphasis on the utilization of analytical tools in design. Analytical methods developed in vehicle dynamics are utilized to support the understanding of forward and reverse engineering principles.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to

solution of design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively. Credits: 3.00

MSPE 41700 - Motorsports Practicum II

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a race team in the motorsports industry. Students will be expected to show mastery of at least 12 of the 12 skills outlined in the Course Objectives.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team. 10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 42600 - Internal Combustion Engines

Credit Hours: 3.00. This course will cover fundamentals of hybrid electric and battery electric transportation systems with particular emphasis on high performance vehicles. It will cover powertrain configurations of Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), and Battery Electric Vehicle (BEV). Component sizing and energy management topics will also be covered.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools needed for design and analysis of engines. 2. Apply current knowledge and adapt to emerging applications in engine development. 3. Conduct, analyze and interpret experiments and apply results to improve processes. 4. Function effectively on teams. 5. Identify, analyze and solve technical problems. 6. Communicate effectively. Credits: 3.00

MSPE 43100 - Race Engineering

Credit Hours: 3.00. Motorsports engineering knowledge obtained throughout the curriculum are brought together to create foundational knowledge in the discipline. Analytical tools in Excel or Matlab along with data analysis tools from Cosworth or Motec are utilized to guide the application of motorsports engineering principles to vehicle performance optimization. Race strategy topics are investigated to provide foundational knowledge beyond vehicle system.

Learning Outcomes: 1. Utilize Excel or Matlab to analyze vehicle systems and performance. 2. Utilize Cosworth Toolbox or Motec i2 software to analyze vehicle systems and performance. 3. Calculate fuel error and its impact on race strategy. 4. Understand tire degradation principles and its impact on race strategy. 5. Write technical reports to disseminate the technical information in a clear and concise manner. Credits: 3.00

MSPE 29000 - Motorsports Engineering Seminar

Credit Hours: 1.00. An overview of the motorsports industry including types of vehicles, types of competition, careers available, historical perspective, development of pertinent technologies, and brief discussions of engineering related topics that will be covered in more detail in future classes. Interactions with motorsport and mechanical engineering faculty along with motorsports engineers currently working in the industry. Professionalism and ethics are discussed along with topical discussions as related to the motorsports industry in the areas of globalization, cultural differences, and collaboration across cultural boundaries.

Learning Outcomes: 1. Demonstrate knowledge of the motorsports industry and recognize techniques, skills and modern tools of the motorsports industry. 2. Apply current knowledge and solve introductory problems relevant to the motorsports industry. 3. Possess

a general knowledge of the history and evolution of motor racing nationally and internationally. 4. Develop technical writing skills beyond those learned in first-year engineering. 5. Recognize professional, ethical, and societal responsibilities in the context of the motorsports industry. Credits: 1.00

MSPE 33000 - Systems Engineering For Motorsports

Credit Hours: 3.00. Systems engineering encompasses the engineering knowledge to specify, design, program and analyze the electrical systems of a motorsports vehicle. The course will explore those systems to provide the engineering foundation in instrumentation, data analysis, data reduction, and system programming. Project work will supplement the learning outcomes through direct engagement of designing and specifying a data system for a motorsports vehicle, manufacturing a motorsports vehicle sensor loom, and programming the communication pathways between different vehicle electrical systems.

Learning Outcomes: 1. Understand the fundamentals of the data acquisition systems installation, operation, software, and maintenance, while appreciating the importance of data integrity 2. Understand the implications of design decisions when designing the data acquisition system or designing around the data acquisition system. 3. Understand the limitations and possibilities of the data acquisition system. 4. Utilize data acquisition analysis tools to properly import and display data signals. 5. Understanding on how to write math channels to interpret and analyze data. 6. Initial understanding of how recorded data represents vehicle and driver performance. 7. Utilize motorsports wiring tools to manufacture a motorsports sensor harness. 8. Understand the basics of digital car communication including the math associated with communicating digital signals throughout the vehicle. Credits: 3.00

Motorsports Engineering Selectives (6 credits)

Mechanical Engineering Requirements (32 credits)

Mechanical Engineering Required Courses (26 credits)

ME 26300 - Introduction To Mechanical Engineering Design, Innovation And Entrepreneurship

Credit Hours: 3.00. The product design process. Development of product design specifications using customer inputs, benchmarking, product/market research and patent review. Concept generation and evaluation using brainstorming, functional decomposition, modeling and decision matrices. Detailed product design including assembly, economic analysis, CAD, and bill of materials. Oral and written design reviews. Key skills developed include teamwork, communication, project planning, innovation, design, and entrepreneurship.

Learning Outcomes: 1. Instill the philosophy that real engineering design problems are open-ended and multifaceted. 2. Teach a systemic design methodology. 3. Provide guidance in applying engineering principles to open-ended problems. 4. Develop the ability to mathematically model and analyze engineering systems. 5. Sharpen skills in leadership, teamwork, communication, project planning, innovation, design and entrepreneurship. 6. Instill a philosophy of professional and ethical behavior. 7. Provide a foundation for the rest of the mechanical engineering curriculum and future careers. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3.

Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and fundamental concepts to measuring and analyzing fluid systems and flows. 3. Learn a

laboratory design project on a flow system reinforces the design process. Credits: 1.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

ME 32301 - Mechanics Of Materials Laboratory

Credit Hours: 1.00. Experimental methods and techniques employed for the measurement of mechanical properties and evaluation of mechanical structures. Application of mechanics of materials and fundamental concepts to measuring and analyzing mechanical structures. A laboratory design project on mechanical structures.

Learning Outcomes: 1. Conduct simple experiments and analyze data. 2. Enhance systematic problem-solving skills and sharpen written-communication skills through short technical laboratory memos. 3. Complete a design project on a mechanical structure. Credits: 1.00

ME 26400 - Introduction To Manufacturing For Mechanical Design

Credit Hours: 3.00. Introduction to manufacturing processes for typical engineering materials. Basics of material properties and behavior for manufacturing processes. Material selection and manufacturing process selection for mechanical design. Hands-on projects in the lab reinforce the knowledge of manufacturing processes.

Learning Outcomes: 1. Understand material properties and behavior for design and manufacturing. 2. Gain a fundamental knowledge of manufacturing processes. 3. Gain knowledge of the practice of measurements and manufacturing processes through laboratory experiments. 4. Enhance knowledge on the selection of materials and manufacturing processes for product design. 5. Enhance technical communication skills through short technical lab reports. Credits: 3.00

Motorsports or Mechanical Engineering Selectives (6 credits)

Other Departmental Course Requirements (59-61 credits)

Other Departmental Required Courses (47-49 credits)

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5.

Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to

directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market

equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

General Education Requirement (12 credits)

Supplemental List

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Motorsports Engineering Program Requirements

Fall 1st Year

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities,

EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and

instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-17 Credits

Spring 1st Year

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12.

Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two

and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative

equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-17 Credits

Fall 2nd Year

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MSPE 29800 - Programming And Computer Modeling For Motorsports

Credit Hours: 2.00. Introductory course detailing methods for creating virtual models of vehicle systems for design, analysis and optimization. Virtualization methods include object-oriented programming techniques for creating mathematical models in Excel, Matlab and Python. Students will learn the basics of data regression consistent with the analysis methods conducted in the motorsports industry. The methods introduced through this course lay the foundation for advanced courses in vehicle design, simulation, and analysis.

Learning Outcomes: 1. Introductory understanding of Object-Oriented Programming using Excel VBA and C#. Credits: 2.00

MSPE 29701 - Computer Modeling For Motorsports

Credit Hours: 2.00. An introductory course detailing methods for designing and modeling motorsports components using Computer Aided Design (CAD) software.

Learning Outcomes: 1. Understand Bottom-up Design of systems and components. 2. Utilize modern engineering tools to model components as solid models in 3 dimensions. 3. Utilize modern engineering tools to generate detail two-dimensional detail drawings of components. 4. Utilize modern engineering tools to model and constrain component assemblies in 3 dimensions. 5. Communicate thoughts and ideas. Credits: 2.00

MSPE 29000 - Motorsports Engineering Seminar

Credit Hours: 1.00. An overview of the motorsports industry including types of vehicles, types of competition, careers available, historical perspective, development of pertinent technologies, and brief discussions of engineering related topics that will be covered in more detail in future classes. Interactions with motorsport and mechanical engineering faculty along with motorsports engineers currently working in the industry. Professionalism and ethics are discussed along with topical discussions as related to the motorsports industry in the areas of globalization, cultural differences, and collaboration across cultural boundaries.

Learning Outcomes: 1. Demonstrate knowledge of the motorsports industry and recognize

techniques, skills and modern tools of the motorsports industry. 2. Apply current knowledge and solve introductory problems relevant to the motorsports industry. 3. Possess a general knowledge of the history and evolution of motor racing nationally and internationally. 4. Develop technical writing skills beyond those learned in first-year engineering. 5. Recognize professional, ethical, and societal responsibilities in the context of the motorsports industry. Credits: 1.00

15 Credits

Spring 2nd Year

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture

course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ME 26400 - Introduction To Manufacturing For Mechanical Design

Credit Hours: 3.00. Introduction to manufacturing processes for typical engineering materials. Basics of material properties and behavior for manufacturing processes. Material selection and manufacturing process selection for mechanical design. Hands-on projects in the lab reinforce the knowledge of manufacturing processes.

Learning Outcomes: 1. Understand material properties and behavior for design and manufacturing. 2. Gain a fundamental knowledge of manufacturing processes. 3. Gain knowledge of the practice of measurements and manufacturing processes through laboratory experiments. 4. Enhance knowledge on the selection of materials and manufacturing processes for product design. 5. Enhance technical communication skills through short technical lab reports. Credits: 3.00

17 Credits

Fall 3rd Year

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 32301 - Mechanics Of Materials Laboratory

Credit Hours: 1.00. Experimental methods and techniques employed for the measurement of mechanical properties and evaluation of mechanical structures. Application of mechanics of materials and fundamental concepts to measuring and analyzing mechanical structures. A laboratory design project on mechanical structures.

Learning Outcomes: 1. Conduct simple experiments and analyze data. 2. Enhance systematic problem-solving skills and sharpen written-communication skills through short technical laboratory memos. 3. Complete a design project on a mechanical structure. Credits: 1.00

MSPE 35000 - Computer Aided Design And Manufacturing

Credit Hours: 3.00. This course provides the basis for the computer-aided engineering and analysis skills needed in the Motorsports Industry. The ability to visualize and conceptualize a real part in the physical world and produce graphical representations of it in 2D and 3D in Solidworks or an equivalent

is a primary objective. Further skills to be developed include the ability to produce large assemblies of such parts with appropriate tolerancing, free form surfacing, casting shapes and casting machining, 2D drawings for use in 3D sheet metal fabrication including shrink and stretch, use of 3D models to facilitate Finite Element Analysis, Conversation of CAD model to programming of CAM machining.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to problems involving the design and manufacturing of components and systems. 2. Design a system, component, or process to meet desired needs. 3. Identify, formulate, and solve engineering problems involving the design and manufacturing of components and systems. 4. Use the techniques, skill, and modern engineering tools necessary for engineering practice. Credits: 3.00

MSPE 47200 - Vehicle Dynamics

Credit Hours: 3.00. Analytical and mathematical model development of the automotive and motorsports vehicles to understand how key vehicle parameters influence vehicle performance. Areas of focus include rectilinear motion, lateral motion, suspension kinematics, tire dynamics and drivetrain modeling.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools necessary for analysis of vehicle dynamics and design of vehicle systems. 2. Apply current knowledge and adapt to emerging applications appropriate to the topic of vehicle dynamics. 3. Conduct, analyze and interpret experiments and apply experimental results to improve processes. 4. Apply creativity in the design of systems, components or processes appropriate to program objectives. 5. Function effectively on teams. 6. Identify, analyze and solve technical problems. 7. Communicate effectively. Credits: 3.00

MSPE 33000 - Systems Engineering For Motorsports

Credit Hours: 3.00. Systems engineering encompasses the engineering knowledge to specify, design, program and analyze the electrical systems of a motorsports vehicle. The course will explore those systems to provide the engineering foundation in instrumentation, data analysis, data reduction, and system programming. Project work will supplement the learning outcomes through direct engagement of designing and specifying a data system for a motorsports vehicle, manufacturing a motorsports vehicle sensor loom, and programming the communication pathways between different vehicle electrical systems.

Learning Outcomes: 1. Understand the fundamentals of the data acquisition systems installation, operation, software, and maintenance, while appreciating the importance of data integrity 2. Understand the implications of design decisions when designing the data acquisition system or designing around the data acquisition system. 3. Understand the limitations and possibilities of the data acquisition system. 4. Utilize data acquisition analysis tools to properly import and display data signals. 5. Understanding on how to write math channels to interpret and analyze data. 6. Initial understanding of how recorded data represents vehicle and driver performance. 7. Utilize motorsports wiring tools to manufacture a motorsports sensor harness. 8. Understand the basics of digital car communication including the math associated with communicating digital signals throughout the vehicle. Credits: 3.00

16 Credits

Spring 3rd Year

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic

and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

MSPE 31700 - Motorsports Practicum I

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a professional motorsports organization.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team. 10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 32000 - Motorsports Design I

Credit Hours: 3.00. Introduction to the principles of design and analysis of vehicle subsystems and components within those subsystems. Vehicle subsystems are reviewed and evaluated for functionality, and reliability with emphasis on the utilization of analytical tools in design. Analytical methods developed in vehicle dynamics are utilized to support the understanding of forward and reverse engineering principles.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to solution of design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively. Credits: 3.00

16 Credits

Fall 4th Year

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and fundamental concepts to measuring and

analyzing fluid systems and flows. 3. Learn a laboratory design project on a flow system reinforces the design process. Credits: 1.00

MSPE 48200 - Motorsports Aerodynamics

Credit Hours: 3.00. A focused introductory course into the study of aerodynamics principles as applied to automotive and motorsports vehicles. Broad range of topics introduce students to the complexity of fluid flow in and around the vehicle. Analytical methods including Computational Fluid Dynamics are utilized to emphasize key aerodynamics principles taught in the course.

Learning Outcomes: 1. Students will understand the basics of aerodynamic analysis and design as applied to motorsports vehicles. 2. Students will be able to apply Computational Fluid Dynamics modeling and analysis techniques to motorsports design. 3. Students will be able to integrate the various aspects of motorsports modeling and design. Credits: 3.00

MSPE 41700 - Motorsports Practicum II

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a race team in the motorsports industry. Students will be expected to show mastery of at least 12 of the 12 skills outlined in the Course Objectives.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team. 10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 42600 - Internal Combustion Engines

Credit Hours: 3.00. This course will cover fundamentals of hybrid electric and battery electric transportation systems with particular emphasis on high performance vehicles. It will cover powertrain configurations of Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), and Battery Electric Vehicle (BEV). Component sizing and energy management topics will also be covered.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools needed for design and analysis of engines. 2. Apply current knowledge and adapt to emerging applications in engine development. 3. Conduct, analyze and interpret experiments and apply results to improve processes. 4. Function effectively on teams. 5. Identify, analyze and solve technical problems. 6. Communicate effectively. Credits: 3.00

17 Credits

Spring 4th Year

MSPE 41400 - Motorsports Design II

Credit Hours: 3.00. This is the culminating course in the Motorsports Engineering Plan of Study, tying together concepts from all the other courses in the curriculum, and requires a capstone design project representative of a real world project with the Motorsports Industry.

Learning Outcomes: 1. Apply knowledge of mathematics, science and engineering to the solution of complex and comprehensive design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs pertinent to the motorsports industry. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively in written reports and oral presentations. 7. Use the technique, skill,

and modern engineering tools necessary for engineering practice in the motorsports industry. Credits: 3.00

MSPE 43100 - Race Engineering

Credit Hours: 3.00. Motorsports engineering knowledge obtained throughout the curriculum are brought together to create foundational knowledge in the discipline. Analytical tools in Excel or Matlab along with data analysis tools from Cosworth or Motec are utilized to guide the application of motorsports engineering principles to vehicle performance optimization. Race strategy topics are investigated to provide foundational knowledge beyond vehicle system.

Learning Outcomes: 1. Utilize Excel or Matlab to analyze vehicle systems and performance. 2. Utilize Cosworth Toolbox or Motec i2 software to analyze vehicle systems and performance. 3. Calculate fuel error and its impact on race strategy. 4. Understand tire degradation principles and its impact on race strategy. 5. Write technical reports to disseminate the technical information in a clear and concise manner. Credits: 3.00

15 Credits

Multidisciplinary Engineering/Acoustical Engineering Concentration, BSE

About the Program

Degree Requirements

Acoustical Engineering Concentration (32 credits)

Sound System Option (32 credits)

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace

transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 30862 - Object-Oriented Programming In C++ And Java

Credit Hours: 3.00. C++ and Java programming languages, including classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function, overloading and overriding, function name overload resolution, container classes, and template classes.

Learning Outcomes: 1. An understanding of the concepts of inheritance and polymorphism. 2. An ability to overload operators in C++. 3. An understanding of the difference between function overloading and function overriding. 4. An ability to incorporate exception handling in object-oriented programs. 5. An ability to use template classes and the STL Library in C++. 6. An ability to write object-oriented programs of moderate complexity in Java. 7. An ability to write programs with multiple threads and use synchronization among threads. Credits: 3.00

ECE 32100 - Electromechanical Motion Devices

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Learning Outcomes: 1. Analyze/design electromagnetic circuits/devices. 2. Understand the concepts and principles of electromagnetic energy conversion. 3. Understand the concept of time-varying transformations in the analysis of time-varying systems. 4. Analyze dc machines. 5. Understand converters for dc drives. 6. Analyze brushless dc machines. 7. Analyze induction machines. Credits: 3.00

ECE 45300 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts developed in the last 25 years which constitute the fundamentals of nanoelectronics and mesoscopic physics, assuming a minimal set of prerequisites. Topics covered include the new Ohm's law, conductance quantization, the nanotransistor, spin valves, thermoelectricity, quantum systems and the non-equilibrium Green's function (NEGF) method.

Learning Outcomes: 1. Ability to perform semiclassical analysis of charge flow in nanoelectonic devices. 2. Ability to perform semiclassical analysis of spin flow and heat flow in nanoelectronic devices. 3. Ability to perform quantum analysis of nanoelectonic devices. Credits: 3.00

ME 41300 - Noise Control

Credit Hours: 3.00. Fundamentals of acoustic waves. Psychoacoustics and theories of hearing. Environmental and building acoustics. Measurement methods and common instrumentation. Noise control methods. Machinery noise. Community reaction. Legal aspects. Design-oriented semester project. Course work in differential equations.

Credits: 3.00

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating professional AV system documentation. Credits: 3.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 55300 - Theatre Audio Technology II

Credit Hours: 3.00. The study of the technical aspects of audio as they relate to use of, and experimentation with, various techniques in the design, installation, and specification of theatre sound systems, etc. Priority for majors. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 56300 - Advanced Sound Design

Credit Hours: 3.00. Advanced study of the principles of sound design for theatre and theory application to specific problems. Offered in alternate years.

Credits: 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 30411 - Electromagnetics I

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic waves and transmission lines, which is continued in ECE 30412.

Learning Outcomes: 1. Work with electrostatic fields and find electric and potential fields from charge distributions including the presence of dielectric materials. 2. Work with magnetostatic fields and find magnetic fields from current distributions including the presence of magnetic materials. 3. Work with time varying fields including wave propagation. 4. Work with transmission lines in the time and frequency domains. Credits: 3.00

Vibrational Option (32 credits)

CE 31100 - Architectural Engineering

Credit Hours: 3.00. This course introduces energy efficiency, thermal comfort, indoor environmental quality and green building design concepts. The course covers engineering fundamentals required for the design and analysis of building systems such as thermodynamics, fluid mechanics, heat and mass transfer, light and sound transmission. The course presents engineering principles and selected applications related to hydrothermal analysis of building enclosures, air conditioning processes in heating, ventilating and air conditioning systems, building illumination, and building acoustics.

Learning Outcomes: 1. Identify and analyze the characteristics of building environmental loads, building construction, and building operations as they define the requirements for a comfortable and healthy indoor environment. 2. Demonstrate knowledge of thermodynamics , fluid mechanics, heat and mass transfer, photometric quantities and sound transmission for use in building design. 3. Identify, formulate and solve realistic Architectural Engineering problems related to hygrothermal analysis of building enclosures, air conditioning processes in Heating Ventilating and Air Conditioning Systems, pipe and duct flow, building illumination and building acoustics. 4.

Demonstrate an understanding of building systems integration to achieve efficient operation. Credits: 3.00

ME 41300 - Noise Control

Credit Hours: 3.00. Fundamentals of acoustic waves. Psychoacoustics and theories of hearing. Environmental and building acoustics. Measurement methods and common instrumentation. Noise control methods. Machinery noise. Community reaction. Legal aspects. Design-oriented semester project. Course work in differential equations.

Credits: 3.00

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating professional AV system documentation. Credits: 3.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

THTR 55300 - Theatre Audio Technology II

Credit Hours: 3.00. The study of the technical aspects of audio as they relate to use of, and experimentation with, various techniques in the design, installation, and specification of theatre sound systems, etc. Priority for majors. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

Sample Multidisciplinary Engineering Plan of Study/Acoustical Engineering Concentration (Sound Systems)

Fall 2nd Year

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an

understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I;

however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

15-16 Credits

Spring 2nd Year

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties

and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating professional AV system documentation. Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2.

Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

14-19 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic

pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of

stresses and principal stresses; elastic stability, elected topics.
Credits: 3.00

15-16 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.
Credits: 3.00

ME 41300 - Noise Control

Credit Hours: 3.00. Fundamentals of acoustic waves. Psychoacoustics and theories of hearing. Environmental and building acoustics. Measurement methods and common instrumentation. Noise control methods. Machinery noise. Community reaction. Legal aspects. Design-oriented semester project. Course work in differential equations.
Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.
Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.
Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

16-17 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.
Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

15-17 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex

product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

15 Credits

Multidisciplinary Engineering/Educational Engineering Concentration, BSE

About the Program

Degree Requirements

Educational Engineering Concentration (32-35 credits)

EDPS 10500 - Academic And Career Planning (UCC: IL)

Credit Hours: 3.00. Builds understanding of career interests and personality characteristics related to academic and career decisions. Expands knowledge of Purdue academic programs and of the world of work. Introduces decision-making strategies.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe and explain multiple facets of your identity. 2. Identify and analyze potential academic majors. 3. Identify and analyze potential careers. 4. Evaluate potential majors and careers in relation to yourself. Credits: 3.00

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 26500 - The Inclusive Classroom

Credit Hours: 3.00. Characteristics of students with special needs/talents; strategies for helping students learn and develop in general educational settings. Emphasis placed upon research evidence, case studies, problem-based learning, and development of a plan for an inclusive classroom. A field-based component is included.

Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors.

4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

EDPS 31600 - Collaborative Leadership: Cross-Cultural Settings (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the cultural nuances of leadership in the United States as well as around the world. This course will include impact of globalism as a context for leadership, conflict resolution in a global environment, and other important factors that impact culturally diverse or global teams.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Better understand what a culture is, broadly defined, and how it functions. 2. Better understand the importance of culturally aware, knowledgeable, and skillful leaders. 3. Increase professional and personal self-awareness in relation to leadership in diverse settings. 4. Better understand the importance of making cultural issues central for constructive conflict management. 5. Understand the complexity of leader-other interaction and impact of psycho-social variables on this interaction. Credits: 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 42100 - The Teaching Of Biology In Secondary Schools

Credit Hours: 3.00. The rationale, objectives, methods, and materials of teaching biology and life science in junior and senior high schools. Extensive use of multimedia resources in planning specifically for the student teaching experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Have a conceptual understanding of science, how to develop a learning community within a classroom, and an understanding of and strategies to implement educational equity in a classroom. 2. Learn how to carry out the practical activities of science

teaching, develop worksheets, hold class discussions, develop and grade tests, and use textbooks. 3. Learn about the nature of scientific understanding and classroom communities, and how to use theoretical knowledge of learners & communities to guide their teaching. Credits: 3.00

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population. Credits: 3.00

EDCI 42500 - Teaching Of Secondary Mathematics - Methods I

Credit Hours: 3.00. This is the first of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, curriculum, teaching, learning, assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's principles and standards, as well as the content and process standards included in Indiana Academic Standards for Mathematics, and pedagogical strategies for teaching these in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 42600 - Teaching Of Secondary Mathematics - Methods II

Credit Hours: 3.00. This is the second of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, mathematical task design, classroom discourse, classroom environment assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's Professional Standards as well as the content and process standards included in Indiana Academic Standards for Mathematics and pedagogical strategies for teaching in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2.

Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

ENE 49800 - Undergraduate Research In Engineering Education

Credit Hours: 1.00 to 3.00. Individual research projects for students with the approval of their academic advisors. Requires prior approval of, and arrangement with, a faculty research advisor in the Department of Engineering Education. Written and oral final reports are required. Permission of instructor required.

Credits: 1.00 to 3.00

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 30100 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30200 .

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire

new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

ENE 50200 - History And Philosophy Of Engineering Education

Credit Hours: 3.00. Examines the history and philosophy of engineering education by: (1) exploring the history of engineering education through archival research and historical documents (critical moments, tensions, issues); (2) investigating philosophies of education and the philosophies that have guided engineering as a profession; and (3) critiquing the evolution of engineering education, identifying alternative scenarios, and imagining a future role in engineering education. This course introduces students to the field of engineering education while broadening their views of the roles of interrelationships between teaching and research. Open to students in Engineering Education. Permission of instructor required.

Learning Outcomes: 1. Develop a culture of critical reflection, engagement, and collaborative learning. 2. Provide opportunities for students to identify and understand tools to inquire into the history and philosophy of engineering education and develop the skills for using these tools. 3. Provide opportunities for students to use these inquiry tools to form persuasive arguments about the nature of engineering education. Credits: 3.00

ENE 59000 - Special Problems In Engineering Education

Credit Hours: 1.00 to 6.00. Project or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum. Interested students should seek a faculty advisor by meeting individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken and expected outcomes and deliverables. An individual project must be approved by the faculty member supervising the project and the student's advisor before registering for the course. An approved written report is required. Permission of instructor required.

Learning Outcomes: 1. Objectives vary based on course topics. Credits: 1.00 to 6.00

EDCI 28500 - Multiculturalism And Education (UCC: BSS)

Credit Hours: 2.00 to 3.00. This course integrates an understanding of multiculturalism with principles of democratic education. Historical, sociological, cultural, political, philosophical, and pedagogical foundations of multiculturalism are explored and related to issues of pedagogy in a pluralistic society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop awareness of issues and concerns related to multicultural education. 2. Develop knowledge of how multiculturalism impacts teachers, schools, classrooms, and society. 3. Develop skills of critical thinking and reflection that will enable educators to contribute to meeting the needs of students in a multicultural and global world. Credits: 2.00 to 3.00

IDE 38500 - Design Methodologies For Diverse Stakeholders

Credit Hours: 3.00. This course focuses on engineering design methodologies with a concern for the needs of diverse stakeholders. The course brings together topics drawn from a variety of disciplines (including anthropology, education, psychology, human-computer interaction and engineering) to introduce interdisciplinary engineering approaches to: (1) design tools, systems, and/or environments to support cognitive processes and (2) engage in human-centered and learner-centered design. The semester design project provides a context for students to apply these methods. Permission of Instructor required.

Learning Outcomes: 1. Learn about cognitive processes (including learning processes), how to design products, processes and environments to support cognition. 2. Learn methodologies and develop skills to be able to apply human-centered principles in the design of interfaces, every-day products and learning environments, whether in industrial or academic settings. 3. Engage in reflective practices to connect the course material to previous learning experiences as well as personal learning goals, with a goal of furthering their life-long learning skills. Credits: 3.00

Sample Multidisciplinary Engineering Plan of Study/Engineering Education Concentration

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate

technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2.

Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing

operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

17-19 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st

order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

14-16 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag

coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

EPCS 30100 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30200 .

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

14-15 Credits

Spring 3rd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts.

Credits: 2.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of

statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

17 Credits

Fall 4th Year

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

16-18 Credits

Spring 4th Year

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

14 Credits

Multidisciplinary Engineering/Engineering Management Concentration, BSE

About the Program

Degree Requirements

Engineering Management Concentration (32 credits)

Sample Multidisciplinary Engineering Plan of Study/ Engineering Management Concentration

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting

processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and

their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies.

Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena

in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16-19 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases

in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

14 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments

from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

16-17 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

15-17 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex

product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

15 Credits

Multidisciplinary Engineering/General Engineering Concentration, BSE

About the Program

Degree Requirements

General Engineering Concentration (32 credits)

Engineering Design Selective (3 credits)

Beginning Engineering Selective (3 credits)

AAE 33400 - Aerodynamics

Credit Hours: 3.00. Incompressible airfoil and lifting line theory. Steady and unsteady, one-dimensional, linear and nonlinear flows. Normal shock waves. Steady, supersonic, two-dimensional linear and nonlinear flows. Oblique shock waves. Perturbation theory for wings and bodies. Design applications.

Credits: 3.00

ABE 33000 - Design Of Machine Components

Credit Hours: 3.00. Introduction to design; stress analysis; deformation and stiffness considerations; static and fatigue strength design; design of components of the food processing, farm and off-highway machines, and mechanical systems.

Credits: 3.00

ABE 43500 - Hydraulic Control Systems For Mobile Equipment

Credit Hours: 3.00. Design of basic fluid power components and systems. Includes power steering, hydrostatic and hydromechanical transmission, electrohydraulic servo valves, servomechanism, and manually controlled systems.

Credits: 3.00

CHE 20500 - Chemical Engineering Calculations

Credit Hours: 4.00. Quantitative applications of steady-state mass and energy balances to solve problems involving multi-component systems and multi-unit chemical processes. Single-component and multi-component phase equilibria, single-reaction and multiple-reaction stoichiometry, coupled mass and energy balances, chemical processes involving bypass and recycle streams.

Learning Outcomes: 1. Estimate physical properties of real chemical systems. 2. Evaluate introductory single-component and multi-component phase equilibria and incorporate these concepts into solutions of mass and energy balance problems. 3. Solve steady state and transient mass and energy balance problems for both reacting and non-reacting systems with or without recycle using analytical and computational methods. 4. Work professionally and ethically in teams to solve new mass and energy balance problems. 5. Identify contemporary chemical engineering problems, including their societal, environmental, and global impacts. Credits: 4.00

CE 20300 - Principles And Practice Of Geomatics

Credit Hours: 4.00. This course provides a broad overview of geomatics engineering including fundamental principles required for practical geomatics applications. This course includes subjects in traditional surveying, GPS surveying, remote sensing, photogrammetry, laser scanning, and Geographic Information Systems (GIS). Basic concepts on these subjects are applied to solve practical problems in various civil engineering applications; including computations for engineering project control and construction layout; theory of error propagation; fundamental concepts of horizontal and vertical curves; topographic mapping using various geospatial data acquisition technologies from ground, air, and space; GIS

for visualization and analysis of geospatial data.

Learning Outcomes: 1. Design and execute a leveling survey. 2. Design and execute a traverse survey. 3. Use survey data to produce a topographic map. 4. Perform horizontal and vertical curve computations. 5. Collect GPS/RTK/RTN data with survey grade accuracy. 6. Perform remote sensing image classification. 7. Measure digital photographs and perform camera calibration. 8. Use software to generate 3D point cloud from digital imagery. 9. Perform multi-image bundle block adjustment. 10. Manipulate 3D point cloud data from a laser scanner, and extract engineering parameters. 11. Select appropriate geodetic references and map projections for geomatics applications. 12. Collect and register geospatial data from multiple sources for engineering applications. 13. Map and visualize collected geospatial data. Credits: 4.00

CE 22200 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. The objective of this course is to introduce concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity of construction equipment as well as the costs associated with construction equipment and construction labor. 4. Calculate the peak financial requirement for a given project based on project revenue and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

CE 31100 - Architectural Engineering

Credit Hours: 3.00. This course introduces energy efficiency, thermal comfort, indoor environmental quality and green building design concepts. The course covers engineering fundamentals required for the design and analysis of building systems such as thermodynamics, fluid mechanics, heat and mass transfer, light and sound transmission. The course presents engineering principles and selected applications related to hydrothermal analysis of building enclosures, air conditioning processes in heating, ventilating and air conditioning systems, building illumination, and building acoustics.

Learning Outcomes: 1. Identify and analyze the characteristics of building environmental loads, building construction, and building operations as they define the requirements for a comfortable and healthy indoor environment. 2. Demonstrate knowledge of thermodynamics , fluid mechanics, heat and mass transfer, photometric quantities and sound transmission for use in building design. 3. Identify, formulate and solve realistic Architectural Engineering problems related to hygrothermal analysis of building enclosures, air conditioning processes in Heating Ventilating and Air Conditioning Systems, pipe and duct flow, building illumination and building acoustics. 4. Demonstrate an understanding of building systems integration to achieve efficient operation. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop

original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

CE 47000 - Structural Steel Design

Credit Hours: 3.00. The elements of structural steel design, including tension members and their connections; structural connections, including welding, and high-strength bolts; compression members; rolled and built-up flexural members; and combined axial and flexural loading effects.

Credits: 3.00

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

EEE 25000 - Environmental, Ecological, And Engineering Systems

Credit Hours: 3.00. An overview of systems thinking and examples, and applications to environmental, ecological, and engineering systems. Students will develop an understanding of complex and global systems, along with the tools and analysis methods required to deal with them. Basic environmental and ecological science concepts are also included.

Learning Outcomes: 1. Understand the types of relationships and dynamics common in complex systems, including environmental systems, ecological systems, and engineering systems.

2. Able to apply fundamental systems tools and modeling approaches to a wide variety of engineering, environmental, and ecological problems. 3. Understand the foundational concepts and vocabulary of global environment and ecological systems. 4. Appreciate the complexity of contemporary issues related to society and EEE, including and understanding of the roles and responsibilities of stakeholders. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

IE 38600 - Work Analysis And Design I

Credit Hours: 3.00. Fundamentals of work methods and measurement. Applications of engineering, psychological, and physiological principles to the analysis and design of human work systems.

Credits: 3.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

ME 26300 - Introduction To Mechanical Engineering Design, Innovation And Entrepreneurship

Credit Hours: 3.00. The product design process. Development of product design specifications using customer inputs, benchmarking, product/market research and patent review. Concept generation and evaluation using brainstorming, functional decomposition, modeling and decision matrices. Detailed product design including assembly, economic analysis, CAD, and bill of materials. Oral and written design reviews. Key skills developed include teamwork, communication, project planning, innovation, design, and entrepreneurship.

Learning Outcomes: 1. Instill the philosophy that real engineering design problems are open-ended and multifaceted. 2. Teach a systemic design methodology. 3. Provide guidance in applying engineering principles to open-ended problems. 4. Develop the ability to mathematically model and analyze engineering systems. 5. Sharpen skills in leadership, teamwork, communication, project planning, innovation, design and entrepreneurship. 6. Instill a philosophy of professional and ethical behavior. 7. Provide a foundation for the rest of the mechanical engineering curriculum and future careers. Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

CE 45600 - Wastewater Treatment Processes

Credit Hours: 3.00. (EEE 45600) Fundamental design principles and practice of wastewater treatment to prepare students for designing wastewater treatment systems. The major topics include design and construction process, preliminary treatment of wastewater, primary treatment, wastewater microbiology, secondary treatment, nitrogen removal, phosphorus removal, attached microbial growth, secondary settling, disinfection and post-aeration, tertiary treatment, and wastewater plant residuals management.

Learning Outcomes: 1. Understand design principles and practice of wastewater treatment. 2. Apply the knowledge to select the best process to treat wastewater. 3. Design a wastewater treatment component or process to meet water quality goals. 4. Critically review relevant literature or contemporary issues in wastewater treatment. Credits: 3.00

Follow-up Engineering Selective (3 credits)

AAE 33400 - Aerodynamics

Credit Hours: 3.00. Incompressible airfoil and lifting line theory. Steady and unsteady, one-dimensional, linear and nonlinear flows. Normal shock waves. Steady, supersonic, two-dimensional linear and nonlinear flows. Oblique shock waves. Perturbation theory for wings and bodies. Design applications.

Credits: 3.00

AAE 33800 - Thermal Sciences

Credit Hours: 3.00. A fundamental course covering a range of topics selected from the disciplines of engineering thermodynamics, fluid mechanics, heat transfer and combustion, with an emphasis on their application to propulsion. This is an entry level course to prepare students for advanced analysis of propulsion and energy systems. Upon completion of this course, students are expected to be able to apply fundamental principles to perform thermodynamic analysis for thermophysical problems involving fluid flow, heat transfer and combustion.

Learning Outcomes: 1. Identify types of problems from thermo-fluid systems. 2. Perform heat conduction analysis for steady and unsteady problems. 3. Perform analysis for radiation heat transfer. 4. Develop deeper understanding of the laws of thermodynamics and their applications to various problems. 5. Apply fundamentals of fluid mechanics to various fluid flow problems. 6. Analyze convection heat transfer problems. 7. Conduct analysis of simple combustion systems such as

adiabatic or chemical equilibrium. 8. Analyze simple thermo-fluid systems using fundamentals we learn from the class. Credits: 3.00

ABE 43500 - Hydraulic Control Systems For Mobile Equipment

Credit Hours: 3.00. Design of basic fluid power components and systems. Includes power steering, hydrostatic and hydromechanical transmission, electrohydraulic servo valves, servomechanism, and manually controlled systems.

Credits: 3.00

CHE 37800 - Heat And Mass Transfer

Credit Hours: 4.00. Macroscopic and differential energy balances. Heat transfer coefficients for free and forced convection and phase change. Conductive and radiative heat transfer. Applications to heat transfer equipment design and compressible fluid flow. Macroscopic and differential species balances. Mass transfer coefficients and analogies. Mass transfer with and without chemical reaction. Mass transfer equipment design.

Learning Outcomes: 1. Identify and explain the three mechanisms of heat transfer: conduction, convection, and radiation. 2. Apply microscopic and macroscopic thermal energy balances incorporating Fourier's Law for the solution of problems describing steady-state and transient conduction, including convective heat transfer. 3. Utilize mass and thermal energy balances for the design of heat transfer equipment and the analysis of its operation. 4. Identify and explain the two main mechanisms of mass transfer: convection and diffusion. 5. Apply microscopic and macroscopic species mass balances incorporating Fick's Law for the solution of problems describing steady-state and transient diffusion, including relevant rate equations and convective mass transfer. 6. Identify and apply the analogies between momentum, heat, and mass transfer. 7. Utilize mass balances and appropriate phase equilibrium relations for the design of continuous mass transfer equipment and the analysis of its operation. 8. Work professionally and ethically in teams to conduct heat and mass transfer-based laboratory experiments. 9. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

ECE 30862 - Object-Oriented Programming In C++ And Java

Credit Hours: 3.00. C++ and Java programming languages, including classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function, overloading and overriding, function name overload resolution, container classes, and template classes.

Learning Outcomes: 1. An understanding of the concepts of inheritance and polymorphism. 2. An ability to overload operators in C++. 3. An understanding of the difference between function overloading and function overriding. 4. An ability to incorporate exception handling in object-oriented programs. 5. An ability to use template classes and the STL Library in C++. 6. An ability to write object-oriented programs of moderate complexity in Java. 7. An ability to write programs with multiple threads and use synchronization among threads. Credits: 3.00

ECE 32100 - Electromechanical Motion Devices

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Learning Outcomes: 1. Analyze/design electromagnetic circuits/devices. 2. Understand the concepts and principles of electromagnetic energy conversion. 3. Understand the concept of time-varying transformations in the analysis of time-varying systems. 4. Analyze dc machines. 5. Understand converters for dc drives. 6. Analyze brushless dc machines. 7. Analyze induction machines. Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding.

Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

IE 38600 - Work Analysis And Design I

Credit Hours: 3.00. Fundamentals of work methods and measurement. Applications of engineering, psychological, and physiological principles to the analysis and design of human work systems.

Credits: 3.00

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

IE 48600 - Work Analysis And Design II

Credit Hours: 3.00. Continuation of IE 38600 . Applications of engineering, computer sciences, information sciences, and psychological principles and methods to the analysis and design of human work systems.

Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

ME 30000 - Thermodynamics II

Credit Hours: 3.00. Properties of gas mixtures, air-vapor mixtures, applications. Thermodynamics of combustion processes, equilibrium. Energy conversion, power, and refrigeration systems.

Credits: 3.00

ME 31500 - Heat And Mass Transfer

Credit Hours: 4.00. Fundamentals of heat transfer by conduction, convection, and radiation; mass transfer by convection. Relevance to engineering applications.

Learning Outcomes: 1. Develop the ability to identify the relevant transport processes (heat, momentum and energy) when confronted with a particular problem. [1, 7] 2. Develop the ability to model and analyze heat and mass transfer processes. [1, 2, 3, 5, 7] 3. Augment the ability to design and conduct experiments to solve open-ended engineering problems. [2, 3, 5, 6, 7] 4. Reinforce technical written and oral communication skills through a formal project report. [3, 4, 5] Credits: 4.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting

the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

Advanced Engineering Elective (3 credits)

ENGR 30500 - Fundamentals Of Innovation Theory And Practice

Credit Hours: 3.00. This course is designed to provide students with initial exposure to the fundamental patterns, mindsets, behaviors, attributes, tools, and methods employed in the innovative activity of individuals and organizations. Emphasis is placed on understanding and effectively utilizing techniques to systematically drive innovation that are drawn from the fields of business, design, problem-solving, engineering, and the social sciences. Lecture, in-class small group activities, and individual and team assignments are employed across an array of contemporary socio-technical challenges to provide students with the opportunity to apply conveyed theory and methods to rigorously structure problems, understand involved stakeholders, utilize innovation motifs and analogical reasoning to develop robust views of potential solutions spaces, tailor solution design to stakeholder context, consider the full suite of functional, social, and emotional dimensions that could influence solution prioritization, and document and systematically assess underlying solution assumptions to iterate toward a viable and sustainable forward-looking plan that could achieve target outcomes. This course counts toward, serves as a required entry course for, the College of Engineering Minor in Innovation and Transformational Change.

Learning Outcomes: 1. Develop working knowledge of established innovation forms and motifs. 2. Demonstrate ability to link innovation motifs to specific classes of problems. 3. Understand, and be able to pursue, the core

aspects of an end-to-end innovation process. 4. Recognize the mental models, mindsets and behaviors of innovators. 5. Gain awareness of the approaches various forms of organizations take to systematically innovate. 6. Acquire leadership and communication skills through teamwork, oral presentations, and written deliverables. Credits: 3.00

ENGR 49001 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multi-disciplinary student teams directly apply cumulative learning to address selected parts of a real-world complex societal challenge in close collaboration with a partner organization, in an experiential learning format. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation. Permission of instructor required.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually-exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services, and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversion methodologies and the role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Understand combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion, and retention of new solutions. Credits: 3.00

ENGR 31000 - Engineering In Global Context (UCC: STS)

Credit Hours: 3.00. This course provides students with opportunities to study how engineering is intertwined with larger economic, social, cultural, and technological dynamics in an era of intensified globalization. Its major goals are to help students understand and appreciate what engineering is, how engineers are trained, what engineers do, and how engineering and society interact. The course approaches these themes through discussion of: the relation and interaction of engineering, science, technology, and society; the historical origins and development of engineering as a profession; diversity issues in engineering and other STEM fields; engineering in cross-national/cultural contexts; and contemporary challenges related to globalization, ethics, and sustainability. In summary, the course is designed to help students understand what it means to identify as, and/or work with, engineers. Recitation sections and/or independent projects (at the instructor's discretion) provide further opportunities for students to expand their knowledge and improve their skills in relation to course themes.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe and evaluate the specific kinds of knowledge and methods typically employed by engineers, including in comparison with other professional fields. 2. Understand the historical development of engineering education and the engineering profession in the United States. 3. Recognize how national differences are important in engineering work, including by comparing and contrasting different national cultures and styles of engineering. 4. Explain the significance of

diversity in engineering education and professional practice, including by evaluating competing perspectives on diversity in different historical and sociocultural contexts. 5. Understand contemporary trends and issues related to globalization, ethics, social responsibility, and sustainability, and interpret their significance in relation to engineering education and practice. 6. Demonstrate written communication capabilities at the level of emerging or higher (as defined by the Purdue Core Curriculum guidelines). Credits: 3.00

Engineering Electives (5 credits)

Area Electives (15 credits)

Sample Multidisciplinary Engineering Plan of Study / General Engineering Concentration

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case

studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,

establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples:

Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed

throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve

systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

14 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's

circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

16-17 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

15-17 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex

product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

15 Credits

Multidisciplinary Engineering/Humanitarian Engineering Concentration, BSE

About the Program

Degree Requirements

Humanitarian Engineering Concentration (32 credits)

Area Electives - Humanitarian Interests (15 credits)

Engineering Design Selective (3 credits)

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 30100 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30200 .

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

Engineering Elective (2 credits)

Engineering Selectives (6 credits)

ABE 30500 - Physical Properties Of Biological Materials

Credit Hours: 3.00. Physical properties of agricultural crops and food products and their relationship to harvesting, storage, and processing. Physical properties covered include: density, shape, moisture content, water potential, water activity, friction and flow or particulate solids, terminal velocity, thermal properties, interaction with electromagnetic radiation, and viscoelastic behavior of solids.

Credits: 3.00

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired goal subject to constraints. Credits: 4.00

CE 32201 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. The objective of this course is to continue an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed faculties. Building on the broad framework introduced in the prerequisite course, this course develops further ability with analytical tools and extends the basic foundation for advanced topics in construction engineering and management. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Demonstrate an ability to design a process to meet desired needs within realistic constraints. Credits: 3.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions

about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

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Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in

teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone.
Credits: 3.00

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.
Credits: 1.00 to 6.00

ME 41500 - Energy Systems Engineering

Credit Hours: 3.00. Application of Thermodynamics, fluid mechanics, and heat transfer fundamentals to the design of energy systems. Applications include thermal regulation in buildings, electronic equipment, energy generation, conversion, and storage, manufacturing processes, and combustion processes. Beyond the fundamentals, this course will focus on design and analysis techniques, including analysis of energy costs, economics, and environmental issues.
Credits: 3.00

ME 43000 - Power Engineering

Credit Hours: 3.00. Rankine cycle analysis, fossil-fuel steam generators, energy balances, fans, pumps, cooling towers, steam turbines, availability (second law) analysis of power systems, energy management systems, and rate analysis.
Credits: 3.00

ENE 55400 - Globalization And Engineering

Credit Hours: 3.00. The focus is on the multifaceted dynamics of globalization, and its impact on engineering practice and the lives and education of engineers. The course emphasizes engineering and globalization from the perspectives of the emerging Asian economies and Europe, as well as the United States. This course is designed for practicing engineers and engineering educators. It is taught within a learner-centric, highly interactive, collaborative learning environment in which students are expected to learn from the experiences and thinking of each other, as well as from the instructor, and other course resources. The course places emphasis on reading, writing, web-based research, and discussion. Students are recommended (but not required) to have a minimum of two years work experience as a practicing engineer and strong communication skills (self-assessed). Permission of instructor is required.
Learning Outcomes: 1. Have increased global awareness. 2. Have knowledge of the dynamics of globalization as an economic and social process including contrasting theories and interpretations of events. 3. Have knowledge of how globalization is studied and characterized by economists, political scientists, and sociologists. 4. Able to interpret studies and research on globalization. 5. Understand the nature and roles of engineering education and life-long learning within the globalization dynamic. 6. Understand the innovation process within a global enterprise including contrasting theories and the ability to analyze specific cases. 7. Able to lead and innovate within a rapidly globalizing profession. 8. Know the engineering profession, engineering education, and globalization from the perspectives of countries beyond the United States, particularly perspectives from Europe and the emerging

economies of Asia. Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

ME 51400 - Fundamentals Of Wind Energy

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet, turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component machine and off-design performance. Inspection trip to industrial plan required.

Learning Outcomes: 1. Introduce students to the technology and economics of converting wind energy to electricity. 2. Inform students to the environmental concerns of wind energy. 3. Understand principles of wind turbine aerodynamics. 4. Develop the ability to design optimum blading. 5. Develop the ability to evaluate a potential site in terms of wind energy. 6. Understand wind turbine structural dynamics issues. Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (AGRY 38500) Designed as an upper-level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 4.00

EEE 36001 - Water Quality And Treatment Laboratory

Credit Hours: 3.00. Laboratory procedures are described and performed that examine chemical, physical, and biological properties and constituent concentrations of natural waters. In addition, water treatment process experiments are performed to show how constituent concentrations can be altered during water treatment processes. Procedures include the analytical determination of several chemical and biological constituents in water by titrimetric, colorimetric, or chromatographic methods, whereas treatment processes include reactor design, pH adjustment, ion exchange, lime softening, coagulation, and disinfection.

Learning Outcomes: 1. Apply physical, chemical, and biological principles to each experimental procedure or measurement technique. 2. Conduct laboratory experiments, making quantitative measurements to assess water quality and water treatment process performance. 3. Organize, report, and graphically display experimental data in common software packages. 4. Analyze and evaluate experimental data on its quality and

significance (i.e., usefulness). 5. Identify issues (i.e., problems) with data collection and data uses. Credits: 3.00

Global Design Team (3 credits)

ENGR 50000 - Global Design Team V

Credit Hours: 0.00 to 3.00. Global Design Team brings together undergraduate and graduate students from different disciplines, inside and outside of the College of Engineering to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic and GPA. Permission of department required.

Learning Outcomes: 1. An awareness of varying regulations, codes of practice, standards, technical specifications testing/inspection procedures, environmental regulations, and systems of measurement between countries and regions. 2. Familiarity with the concept of a "global product platform". 3. Ability to apply familiar concepts to unfamiliar, real-world problems. 4. Ability to use design tools to solve engineering problems. 5. Ability to adapt to cultural norms in a professional arena and act appropriately. 6. Ability to make ethical and socially responsible decisions in the context of a culture divergent from my own. 7. Ability to analyze problems from a different cultural frame of reference. 8. Ability to communicate professionally in a culturally-appropriate manner. 9. Ability to practice social and cultural responsibility, e.g. resource sustainability. 10. Proficiency in a second language. 11. Ability to be cross-culturally adaptable/flexible. 12. Ability to contribute to a culturally-diverse team. Credits: 0.00 to 3.00

GEP 40000 - Global Design Team IV

Credit Hours: 1.00 to 3.00. Global design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 1.00 to 3.00

ENGR 39697 - Global Engineering Projects

Credit Hours: 1.00 to 3.00. Students will work in teams to formulate solutions to engineering problems. Project topics will focus on a problem outside the U.S. and/or incorporate teammates from international universities. International teams may work remotely with the possibility for international travel and in-person collaboration. Permission of instructor required.

Learning Outcomes: 1. Obtain practical skills through engagement in a real-life project utilizing engineering principles. 2. Enhance communication and teamwork skills through experience working on a diverse team. Credits: 1.00 to 3.00

Global Engineering Requirement (3 credits)

ENGR 31000 - Engineering In Global Context (UCC: STS)

Credit Hours: 3.00. This course provides students with opportunities to study how engineering is intertwined with larger economic, social, cultural, and technological dynamics in an era of intensified globalization. Its major goals are to help students understand and appreciate what engineering is, how engineers are trained, what engineers do, and how engineering and society interact. The course approaches these themes through discussion of: the relation and interaction of engineering, science, technology, and society; the historical origins and development of engineering as a profession; diversity issues in

engineering and other STEM fields; engineering in cross-national/cultural contexts; and contemporary challenges related to globalization, ethics, and sustainability. In summary, the course is designed to help students understand what it means to identify as, and/or work with, engineers. Recitation sections and/or independent projects (at the instructor's discretion) provide further opportunities for students to expand their knowledge and improve their skills in relation to course themes.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe and evaluate the specific kinds of knowledge and methods typically employed by engineers, including in comparison with other professional fields. 2. Understand the historical development of engineering education and the engineering profession in the United States. 3. Recognize how national differences are important in engineering work, including by comparing and contrasting different national cultures and styles of engineering. 4. Explain the significance of diversity in engineering education and professional practice, including by evaluating competing perspectives on diversity in different historical and sociocultural contexts. 5. Understand contemporary trends and issues related to globalization, ethics, social responsibility, and sustainability, and interpret their significance in relation to engineering education and practice. 6. Demonstrate written communication capabilities at the level of emerging or higher (as defined by the Purdue Core Curriculum guidelines). Credits: 3.00

Sample Multidisciplinary Engineering Plan of Study/Humanitarian Engineering Concentration

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in

biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple

models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6.

Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16-19 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear

resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

17-19 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of

such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

EPCS 30100 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's

circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

ENGR 31000 - Engineering In Global Context (UCC: STS)

Credit Hours: 3.00. This course provides students with opportunities to study how engineering is intertwined with larger economic, social, cultural, and technological dynamics in an era of intensified globalization. Its major goals are to help students understand and appreciate what engineering is, how engineers are trained, what engineers do, and how engineering and society interact. The course approaches these themes through discussion of: the relation and interaction of engineering, science, technology, and society; the historical origins and development of engineering as a profession; diversity issues in engineering and other STEM fields; engineering in cross-national/cultural contexts; and contemporary challenges related to globalization, ethics, and sustainability. In summary, the course is designed to help students understand what it means to identify as, and/or work with, engineers. Recitation sections and/or independent projects (at the instructor's discretion) provide further opportunities for students to expand their knowledge and improve their skills in relation to course themes.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe and evaluate the specific kinds of knowledge and methods typically employed by engineers, including in comparison with other professional fields. 2. Understand the historical development of engineering education and the engineering profession in the United States. 3. Recognize how national differences are important in engineering work, including by comparing and contrasting different national cultures and styles of engineering. 4. Explain the significance of diversity in engineering education and professional practice, including by evaluating competing perspectives on diversity in different historical and sociocultural contexts. 5. Understand contemporary trends and issues related to globalization, ethics, social responsibility, and sustainability, and interpret their significance in relation to engineering education and practice. 6. Demonstrate written communication capabilities at the level of emerging or higher (as defined by the Purdue Core Curriculum guidelines). Credits: 3.00

14-15 Credits

Spring 3rd Year

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

ENGR 50000 - Global Design Team V

Credit Hours: 0.00 to 3.00. Global Design Team brings together

undergraduate and graduate students from different disciplines, inside and outside of the College of Engineering to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic and GPA. Permission of department required.

Learning Outcomes: 1. An awareness of varying regulations, codes of practice, standards, technical specifications testing/inspection procedures, environmental regulations, and systems of measurement between countries and regions. 2. Familiarity with the concept of a "global product platform". 3. Ability to apply familiar concepts to unfamiliar, real-world problems. 4. Ability to use design tools to solve engineering problems. 5. Ability to adapt to cultural norms in a professional arena and act appropriately. 6. Ability to make ethical and socially responsible decisions in the context of a culture divergent from my own. 7. Ability to analyze problems from a different cultural frame of reference. 8. Ability to communicate professionally in a culturally-appropriate manner. 9. Ability to practice social and cultural responsibility, e.g. resource sustainability. 10. Proficiency in a second language. 11. Ability to be cross-culturally adaptable/flexible. 12. Ability to contribute to a culturally-diverse team. Credits: 0.00 to 3.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

14 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

15 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

15-17 Credits

Multidisciplinary Engineering/Lighting Concentration, BSE

About the Program

Degree Requirements

Lighting Engineering Concentration (32 credits)

Area Selectives (13 credits)

CE 31100 - Architectural Engineering

Credit Hours: 3.00. This course introduces energy efficiency, thermal comfort, indoor environmental quality and green building design concepts. The course covers engineering fundamentals required for the design and analysis of building systems such as thermodynamics, fluid mechanics, heat and mass transfer, light and sound transmission. The course presents engineering principles and selected applications related to hydrothermal analysis of building enclosures, air conditioning processes in heating, ventilating and air conditioning systems, building illumination, and building acoustics.

Learning Outcomes: 1. Identify and analyze the characteristics of building environmental loads, building construction, and building operations as they define the requirements for a comfortable and healthy indoor environment. 2. Demonstrate knowledge of thermodynamics , fluid mechanics, heat and mass transfer, photometric quantities and sound transmission for use in building design. 3. Identify, formulate and solve realistic Architectural Engineering problems related to hygrothermal analysis of building enclosures, air conditioning processes in Heating Ventilating and Air Conditioning Systems, pipe and duct flow, building illumination and building acoustics. 4. Demonstrate an understanding of building systems integration to achieve efficient operation. Credits: 3.00

CE 41300 - Building Envelope Design And Thermal Loads

Credit Hours: 3.00. This course discusses the basic thermal processes in buildings and presents comprehensive methods for thermal design of envelope assemblies in commercial and residential buildings. The first part of the course includes steady-state transient conduction through envelope assemblies, convection and radiation heat transfer in buildings, solar radiation and solar gains, thermal performance of windows,

internal gains, ventilation and infiltration. The second part of the course considers surface and room energy balance equations and presents analytical and computational models for calculation of hourly heating and cooling loads throughout the year. Climate-based standards, passive solar design, advanced energy guides, and innovative technologies for high performance buildings are discussed. The course also includes a design project on analytical heating/cooling load calculations for a commercial building.

Learning Outcomes: 1. Calculate heat transfer through envelope assemblies for commercial and residential buildings. 2. Solve energy balance equations for building surfaces and room air. 3. Calculate solar and internal gains and predict transient hourly heating and cooling loads for a building throughout the year using analytical and computational models. 4. Design building envelopes according to national standards. 5. Understand principles of passive solar design and the application of innovative envelope technologies. Credits: 3.00

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

CE 51300 - Lighting In Buildings

Credit Hours: 3.00. This course focuses on the design of illumination systems in buildings (electric and natural lighting) in order to achieve energy efficiency and visual comfort. The first part of the course includes analytical lighting calculation techniques, visual perception, radiative transfer, lamp characteristics, electric lighting system design and control for calculation of required indoor illuminance levels. The second part of the course covers daylighting (natural lighting) systems, including state-of-the-art daylighting prediction models as well as design and control of such devices and advanced metrics. The course also has a lab section, in which the students learn how to work with lighting and daylighting tools and build their own computational transient lighting models in open programming languages, in order to design illumination systems and predict electricity consumption and potential energy savings.

Learning Outcomes: 1. Understand fundamental illumination concepts. 2. Design and assess the performance of electric and natural lighting systems in buildings. 3. Calculate fundamental

illuminance, non-point sources, radiant energy, lamp types, lighting controls, interior lighting design, daylight prediction models, optical properties of windows, advanced metrics and shading devices. 4. Build and solve lighting and daylighting models using advanced software and programming techniques to design lighting systems and calculate energy savings from the use of natural light and lighting controls. 5. Design a project, submit a project report and make an oral presentation (only individual projects are allowed). The project themes cover a wide variety of lighting/daylighting design and control such as: daylighting and lighting design of commercial buildings, measurements/monitoring of lighting levels in laboratory settings, prediction of protentional energy savings, impact of shading design and control, and advanced daylighting system modeling. Credits: 3.00

THTR 56800 - Advanced Problems In Design

Credit Hours: 1.00 to 3.00. A described tutorial in theatrical design or design research. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

ECE Required Course (3 credits)

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE Selective (3 credits)

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 31100 - Electric And Magnetic Fields

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credits: 3.00

ECE 41200 - Introduction To Engineering Optics

Credit Hours: 3.00. The control and characteristics of optical radiation are covered. Applications to optical instrumentation, thin films, holography, and polarizing optics are discussed.

Learning Outcomes: 1. Analyze simple optical systems (dielectric slabs, thin lenses, reflectors). 2. Model Gaussian beams and the transformation of beams. 3. Analyze and design polarization systems, including polarizers and wave plates. 4. Know optical interferometers and the operations of interferometers such as the Michelson, Fabry-Perot and double-slit. 5. Analyze diffraction patterns. Credits: 3.00

ECE 41400 - Elements Of Electro And Fiber Optics

Credit Hours: 3.00. Introduction to the use of lasers, fiber and integrated optical components and devices in communication and sensory applications. Topics include generation, transformation, modulation, deflection, and detection of laser beams, and their applications in fiber communication sensory systems.

Credits: 3.00

Engineering Design Selective (4 credits)

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

Theatre Course (2 credits)

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

Engineering Electives (7 credits)

Non-course / Non-credit Requirements

Sample Multidisciplinary Engineering Plan of Study/ Lighting Engineering Concentration

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and

equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an

understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.
Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.
University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.
University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.
University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.
Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

16-18 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided

design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16-19 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace

transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20008 - Electrical Engineering Fundamentals II Lab

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20002 Electrical Engineering Fundamentals II; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

Learning Outcomes: 1. Ability to competently select, use, and automate electronic measurement instruments. 2. Design, wire, and troubleshoot electronic circuits. 3. Ability to simulate electronic circuits. 4. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 5. Demonstrate knowledge of laboratory safety precautions. 6. Maintain laboratory notes and create professional experiment reports. Credits: 1.00

14 Credits

Spring 3rd Year

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps,

etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 31100 - Electric And Magnetic Fields

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credits: 3.00

ECE 41200 - Introduction To Engineering Optics

Credit Hours: 3.00. The control and characteristics of optical radiation are covered. Applications to optical instrumentation, thin films, holography, and polarizing optics are discussed.

Learning Outcomes: 1. Analyze simple optical systems (dielectric slabs, thin lenses, reflectors). 2. Model Gaussian beams and the transformation of beams. 3. Analyze and design

polarization systems, including polarizers and wave plates. 4. Know optical interferometers and the operations of interferometers such as the Michelson, Fabry-Perot and double-slit. 5. Analyze diffraction patterns. Credits: 3.00

ECE 41400 - Elements Of Electro And Fiber Optics

Credit Hours: 3.00. Introduction to the use of lasers, fiber and integrated optical components and devices in communication and sensory applications. Topics include generation, transformation, modulation, deflection, and detection of laser beams, and their applications in fiber communication sensory systems.

Credits: 3.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15-16 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate

the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

16 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid

design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

14 Credits

Multidisciplinary Engineering/Nano Engineering, BSE

About the Program

Degree Requirements

Nano Engineering Concentration (32 credits)

Area Selectives - Choose one sequence (15 credits)

Chemistry Sequence (15 credits)

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3.

Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

Physics Sequence (15 credits)

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

STEM Selectives

Electrical or Materials Option - Choose one (17 credits)

Electrical Option (17 credits)

Required Courses (10 credits)

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 31100 - Electric And Magnetic Fields

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

Electrical Selectives (6 credits)

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 39595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits:

1.00 to 5.00

ECE 45300 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts developed in the last 25 years which constitute the fundamentals of nanoelectronics and mesoscopic physics, assuming a minimal set of prerequisites. Topics covered include the new Ohm's law, conductance quantization, the nanotransistor, spin valves, thermoelectricity, quantum systems and the non-equilibrium Green's function (NEGF) method.

Learning Outcomes: 1. Ability to perform semiclassical analysis of charge flow in nanoelectonic devices. 2. Ability to perform semiclassical analysis of spin flow and heat flow in nanoelectronic devices. 3. Ability to perform quantum analysis of nanoelectonic devices. Credits: 3.00

Engineering Electives (1 credit)

Materials Options (17 credits)

Engineering Design Selective (3 credits)

Materials Selecive - Choose Four (12 credits)

MSE 23500 - Second Year Materials Engineering Laboratory

Credit Hours: 3.00. Laboratory experiments using standard equipment to measure material properties, characterize material structure and composition, and explore processing methods to form functional shapes, and modify properties of the formed shapes. Experiments are carried out with metal, ceramic, and polymeric materials to illustrate property-structure-processing relationships.

Learning Outcomes: 1. Identify and properly utilize primary sources and online databases to find information about material structures, properties, and processing techniques. 2. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 3. Apply characterization techniques appropriate for the class of material analyzed. 4. Assess validity of experimental data and recognize experimental factors affecting data. 5. Accurately and clearly report engineering data using figures, graphs, and tables and proper statistical methods. 6. Display effective written communication in technical reports. Credits: 3.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity

coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

MSE 33000 - Processing And Properties Of Materials

Credit Hours: 3.00. An introduction to the relationships between the processing of materials and their properties. Heat treating, forming, casting, consolidation, and other more material-specific manufacturing processes. Elucidation of the role of phenomena such as heat flow, mass diffusion, nucleation, interfacial tension, elastic and plastic deformation, precipitation, grain growth.

Credits: 3.00

MSE 33500 - Materials Characterization Laboratory

Credit Hours: 3.00. The principles of analytical methods for characterization of materials for structure and composition; optical microscopy, scanning electron microscopy, X-ray spectroscopy and diffraction, atomic absorption, emission spectroscopy, and mass spectrometry. Laboratory experiments in X-ray spectroscopy, X-ray diffraction, optical microscopy, and scanning electron microscopy.

Credits: 3.00

MSE 36700 - Materials Processing Laboratory

Credit Hours: 3.00. This laboratory is intended as an intensive experience in processing techniques used for ceramics, metals, and polymers. Sintering of a ceramic, casting and post-processing (work hardening, heat treatment, etc.) of a metal, and preparation and extrusion of a polymer are the suggested processes. The measurements (e.g., powder size, compaction force, temperature, grain size, molecular weight) applicable to

the successful processing of the material and the final properties (e.g., hardness, ductility, strength, stiffness) will be emphasized.

Learning Outcomes: 1. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 2. Demonstrate effective written communication in lab reports. 3. Demonstrate effective oral communication in final project presentation. 4. Characterize the physical mechanisms that underlie the basic interactions between macroscopic shaping processes and microstructure development for the core bulk processing routes of each of the main classes of materials and how they relate to properties. 5. Assess validity of experimental data and recognize experimental factors affecting data. 6. Identify specific processing capabilities and limitations for the main classes of materials. Credits: 3.00

MSE 37000 - Electrical, Optical, And Magnetic Properties Of Materials

Credit Hours: 3.00. An introductory course to provide basic background on the behavior of materials; electronic band structure, electronic and ionic conduction, electronic processes in semiconductors, dielectric, optical, and magnetic properties, and superconductivity; emphasis is on the relation between the properties and the structural aspects of materials.

Credits: 3.00

Engineering Electives (2 credits)

Sample Multidisciplinary Engineering Plan of Study/ Nano Engineering Concentration (Electrical)

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in

biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple

models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model

natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

14-16 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8.

Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16-19 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of

flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and

without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

16-17 Credits

Spring 3rd Year

ECE 31100 - Electric And Magnetic Fields

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credits: 3.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15 Credits

Fall 4th Year

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2.

Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 39595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 45300 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts developed in the last 25 years which constitute the fundamentals of nanoelectronics and mesoscopic physics, assuming a minimal set of prerequisites. Topics covered include the new Ohm's law, conductance quantization, the nanotransistor, spin valves, thermoelectricity, quantum systems and the non-equilibrium Green's function (NEGF) method.

Learning Outcomes: 1. Ability to perform semiclassical analysis of charge flow in nanoelectonic devices. 2. Ability to perform semiclassical analysis of spin flow and heat flow in nanoelectronic devices. 3. Ability to perform quantum analysis of nanoelectonic devices. Credits: 3.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and

ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

15 Credits

Spring 4th Year

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits:

1.00 to 5.00

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 39595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 45300 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts developed in the last 25 years which constitute the fundamentals of nanoelectronics and mesoscopic physics, assuming a minimal set of prerequisites. Topics covered include the new Ohm's law, conductance quantization, the nanotransistor, spin valves, thermoelectricity, quantum systems and the non-equilibrium Green's function (NEGF) method.

Learning Outcomes: 1. Ability to perform semiclassical analysis of charge flow in nanoelectonic devices. 2. Ability to perform semiclassical analysis of spin flow and heat flow in nanoelectronic devices. 3. Ability to perform quantum analysis of nanoelectonic devices. Credits: 3.00

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

15 Credits

Sample Multidisciplinary Engineering Plan of Study/ Nano Engineering Concentration (Materials)

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and

solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct

equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three

dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

14-16 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving

differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16-19 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and

equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

16-17 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret

regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and

modern engineering tools necessary for engineering practice. Credits: 1.00

15 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

15 Credits

Multidisciplinary Engineering/Theatre Engineering Concentration, BSE

About the Program

Degree Requirements

Theatre Engineering Concentration (32 credits)

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and

demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 55000 - Advanced Scenery Technology

Credit Hours: 3.00. A theoretical and practical study of theatrical scenery planning, construction, and stage use. Topics will vary by semester and will include project management techniques, mechanical design, automation systems, show control systems, rigging, and safety issues. Permission of instructor required.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

Sample Multidisciplinary Engineering Plan of Study

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and

thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate

effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase

transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to

directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

17-19 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about

linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

THTR 55000 - Advanced Scenery Technology

Credit Hours: 3.00. A theoretical and practical study of theatrical scenery planning, construction, and stage use. Topics will vary by semester and will include project management techniques, mechanical design, automation systems, show control systems, rigging, and safety issues. Permission of instructor required.

Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

16 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

THTR 55000 - Advanced Scenery Technology

Credit Hours: 3.00. A theoretical and practical study of theatrical scenery planning, construction, and stage use. Topics will vary by semester and will include project management techniques, mechanical design, automation systems, show control systems, rigging, and safety issues. Permission of instructor required.

Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions.

Credits: 2.00

15-17 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

16 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

15-17 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

12 Credits

Multidisciplinary Engineering/Visual Design Engineering Concentration, BSE

About the Program

Degree Requirements

Visual Design Engineering Concentration (32 credits)

Engineering Design Selective (3 credits)

Engineering Electives (14 credits)

Area Selectives (15-20 credits)

Sample Multidisciplinary Engineering Plan of Study/Visual Design Engineering Concentration

Fall 2nd Year

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials.

Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive

and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically

consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply

Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

16-18 Credits

Spring 2nd Year

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

14 Credits

Fall 3rd Year

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain boundary-layer flow properties. Credits: 3.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps,

etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

16-17 Credits

Spring 3rd Year

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in

problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

15 Credits

Fall 4th Year

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues.

Credits: 1.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

15-17 Credits

Spring 4th Year

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

15 Credits

Multidisciplinary Technology, BS (Statewide)

About the Program

From businesses to industries to government, Purdue's multidisciplinary technology program will give you the skills to focus on the management, operation, and maintenance of complex technological systems. In this program you'll prepare for a career that requires knowledge in industrial and manufacturing technologies as well as quality assurance and plant supervision. The skills you gain will help your employers become more efficient and safe.
Purdue Polytechnic Vincennes students receive their A.S. degree from Vincennes University before continuing on with the B.S. with Purdue Polytechnic. Each plan of study below corresponds with a different A.S. major that feeds into the B.S. program.

- Computer Integrated Manufacturing - Industrial Maintenance
- Computer Integrated Manufacturing/Robotics
- Drafting and Design/CAD
- Electronics Technology
- Machine Trades - Injection Molding
- Machine Trades - Tool & Die

Music: General Music Studies Concentration, BA

About the Program

Degree Requirements

Auditions and Interviews

Departmental/Program Major Courses (42-46 credits)

Required Major Courses (24-28 credits)

Foundational Studies (15 credits)

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

Discovery Forum (0 credits)

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

Symposia (Non-course Requirement)

Music History (3 credits)

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Music Making Studies (6-10 credits)

Studio Courses (6 credits)

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

Ensemble Participation (0-4 credits)

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an

organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

BAND 34100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 33100 - Summer Jazz Bands

Credit Hours: 2.00. Continuation of BAND 33000.

Credits: 2.00

BAND 33000 - Summer Concert Bands

Credit Hours: 2.00. Continuation of BAND 32000.

Credits: 2.00

BAND 12100 - Symphony Orchestra

Credit Hours: 2.00. Symphony Orchestra.

Credits: 2.00

BAND 11900 - Varsity Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11800 - Collegiate Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11700 - Concert Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11600 - Symphonic Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11500 - String Orchestra

Credit Hours: 2.00. The rehearsal, study, and performance of string orchestra music from the classical, romantic and contemporary areas of composition.

Credits: 2.00

BAND 11300 - Jazz Ensemble

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Permission of instructor required.

Credits: 2.00

BAND 11000 - Marching Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Mandatory participation required in Marching Band Workshop one week prior to start of fall classes which conflicts with Boilermaker Gold Rush. Workshop covers similar orientation to Gold Rush. Do enroll in BAND 11000 during summer registration prior to the workshop and audition process.

Credits: 2.00

General Music Studies Concentration (18 credits)

Required Courses

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the

globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

History

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Theory and Composition Studies

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part

compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 23300 - Music Theory IV: Contemporary Music

Credit Hours: 3.00. A study of music theory from the late Romantic era through current practice. Students may be asked to compose works in a variety of styles that include late Romanticism, Impressionism, Neoclassicism, Atonality, Pointillism, Minimalism, Sound-Mass Composition, Indeterminacy, Ambient music, Graphic Notation and Neoromanticism.

Learning Outcomes: 1. Demonstrate a theoretical understanding of harmonic practice from the Late Romantic Era through the contemporary period. 2. Analyze the structural elements of music from the Late Romantic Era through the contemporary period. 3. Produce original compositions in the styles associated with the Late Romantic Era through the contemporary period. Credits: 3.00

Music Courses 30000+

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece

composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

Other Departmental - Liberal Arts Core For BFA, Professional, & Education (25-34 credits)

Core III: Linguistic Diversity (3-4 credits)

Foundational Requirements (21-30 credits)

Notes

Electives (40-53 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research,

compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

15-16 Credits

Spring 1st Year

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

15-17 Credits

Fall 2nd Year

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre,

describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

17-18 Credits

Spring 2nd Year

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated

with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14-15 Credits

Fall 3rd Year

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style

and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14 Credits

Spring 3rd Year

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

15 Credits

Fall 4th Year

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

15 Credits

Spring 4th Year

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain

awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

15 Credits

Music: Jazz Studies Concentration, BA

About the Program

Degree Requirements

Auditions and Interviews

Departmental/Program Major Courses (42-46 credits)

Required Major Courses (24-28 credits)

Foundational Studies (15 credits)

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters.

Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

Discovery Forum (0 credits)

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

Symposia (Non-course Requirement)

Music History (3 credits)

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Music Making Studies (6-10 credits)

Studio Courses (6 credits)

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to

perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility.

Credits: 2.00

Ensemble Participation (0-4 credits)

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

BAND 34100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 33100 - Summer Jazz Bands

Credit Hours: 2.00. Continuation of BAND 33000.

Credits: 2.00

BAND 33000 - Summer Concert Bands

Credit Hours: 2.00. Continuation of BAND 32000.

Credits: 2.00

BAND 12100 - Symphony Orchestra

Credit Hours: 2.00. Symphony Orchestra.

Credits: 2.00

BAND 11900 - Varsity Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11800 - Collegiate Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11700 - Concert Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11600 - Symphonic Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11500 - String Orchestra

Credit Hours: 2.00. The rehearsal, study, and performance of string orchestra music from the classical, romantic and contemporary areas of composition.

Credits: 2.00

BAND 11300 - Jazz Ensemble

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Permission of instructor required.

Credits: 2.00

BAND 11000 - Marching Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Mandatory participation required in Marching Band Workshop one week prior to start of fall classes which conflicts with Boilermaker Gold Rush. Workshop covers similar orientation to Gold Rush. Do enroll in BAND 11000 during summer registration prior to the workshop and audition process.

Credits: 2.00

Jazz Studies Concentration (18 credits)

Music Studies (9 Credits)

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 32800 - Jazz Theory, Composition And Arranging

Credit Hours: 3.00. This course is an introduction to contemporary jazz theory, composition and arranging practices. Topics covered will include the study of chord and scale constructions, substitutions, analyzing and building harmonic progressions, modal functions, identifying various styles and idioms, and writing for combo and big band. Students will learn how to compose in various jazz styles and score their works for small and large ensembles. Prerequisites: MUS 13300, Music Theory II and MUS 27000, Computer Skills in Music or consent of instructor.

Learning Outcomes: 1. Explain common chords, scales and modes used in contemporary jazz music. 2. Define common terms used in jazz arranging and composition. 3. Explain and demonstrate common features of various jazz styles. 4. Create original jazz compositions and arrangements. Credits: 3.00

Music Studies II (3 Credits)

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe

performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Jazz Improvisation (6 Credits)

MUS 17100 - Jazz Improvisation I

Credit Hours: 2.00. This course is an introduction to the development of beginning jazz improvisational and theoretical skills for all instrumentalists and vocalists. Fundamentals theoretical and musicianship skills are addressed through practical application, guided listening, dictation, transcription, harmonic and rhythmic analysis, and performance of standard jazz repertoire.

Learning Outcomes: 1. Explain the fundamentals of jazz theory and musicianship. 2. Write or transcribe a jazz solo from a recording. 3. Explain and notate jazz harmonies and voicings using established forms of analysis. 4. Describe various jazz styles in performance. 5. Perform selected jazz repertoire. 6. Perform an improvised jazz solo. Credits: 2.00

MUS 27100 - Jazz Improvisation II

Credit Hours: 2.00. This course is a continuation of MUS 17100, Jazz Improvisation I. Students will continue to develop their jazz improvisation skills that include scale development, pattern playing, guided listening, dictation, transcription skills, harmonic, melodic and rhythmic studies as well as performing standard jazz repertoire. Students should have at least two years of previous experience in band, orchestra, choir, or piano study prior to enrolling in this course. Students will be required to perform in class. Prerequisites for this class are MUS 13200, Music Theory I and MUS 17100, Jazz Improvisation I or consent of the department.

Learning Outcomes: 1. Define common terminology and techniques used in jazz. 2. Explain common chord progressions found in jazz. 3. Demonstrate common linear approaches to jazz improvisation. 4. Explain similarities and differences between various jazz styles and how they impact improvisation. 5. Perform effective jazz solos. Credits: 2.00

Music Courses 30000+

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

Other Departmental - Liberal Arts Core For BFA, Professional, & Education (25-34 credits)

Core III: Linguistic Diversity (3-4 credits)

Foundational Requirements (21-30 credits)

Notes

Electives (40-53 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

15-16 Credits

Spring 1st Year

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices;

nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

15-17 Credits

Fall 2nd Year

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

17-18 Credits

Spring 2nd Year

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14-15 Credits

Fall 3rd Year

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14 Credits

Spring 3rd Year

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 32800 - Jazz Theory, Composition And Arranging

Credit Hours: 3.00. This course is an introduction to contemporary jazz theory, composition and arranging practices. Topics covered will include the study of chord and scale constructions, substitutions, analyzing and building harmonic progressions, modal functions, identifying various styles and idioms, and writing for combo and big band. Students will learn how to compose in various jazz styles and score their works for small and large ensembles. Prerequisites: MUS 13300, Music Theory II and MUS 27000, Computer Skills in Music or consent of instructor.

Learning Outcomes: 1. Explain common chords, scales and modes used in contemporary jazz music. 2. Define common terms used in jazz arranging and composition. 3. Explain and demonstrate common features of various jazz styles. 4. Create original jazz compositions and arrangements. Credits: 3.00

15 Credits

Fall 4th Year

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits:

3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

15 Credits

Spring 4th Year

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

15 Credits

Music: Music Technology Concentration, BA

About the Program

Degree Requirements

Auditions and Interviews

Departmental/Program Major Courses (42-46 credits)

Required Major Courses (24-28 credits)

Foundational Studies (15 credits)

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

Discovery Forum (0 credits)

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

Symposia (Non-course Requirement)

Music History (3 credits)

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe

performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Music Making Studies (6-10 credits)

Studio Courses (6 credits) - Courses must be repeated

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

Ensemble Participation (0-4 credits)

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

BAND 34100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 33100 - Summer Jazz Bands

Credit Hours: 2.00. Continuation of BAND 33000.

Credits: 2.00

BAND 33000 - Summer Concert Bands

Credit Hours: 2.00. Continuation of BAND 32000.

Credits: 2.00

BAND 12100 - Symphony Orchestra

Credit Hours: 2.00. Symphony Orchestra.

Credits: 2.00

BAND 11900 - Varsity Band

Credit Hours: 2.00. Open through audition. Additional lab and

activity fees involved.

Credits: 2.00

BAND 11800 - Collegiate Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11700 - Concert Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11600 - Symphonic Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11500 - String Orchestra

Credit Hours: 2.00. The rehearsal, study, and performance of string orchestra music from the classical, romantic and contemporary areas of composition.

Credits: 2.00

BAND 11300 - Jazz Ensemble

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Permission of instructor required.

Credits: 2.00

BAND 11000 - Marching Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Mandatory participation required in Marching Band Workshop one week prior to start of fall classes which conflicts with Boilermaker Gold Rush. Workshop covers similar orientation to Gold Rush. Do enroll in BAND 11000 during summer registration prior to the workshop and audition process.

Credits: 2.00

Music Technology Concentration (18 credits)

Required Courses (12 credits)

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and

demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

MUS 38400 - Digital Record And Production II

Credit Hours: 3.00. This course is a continuation of MUS 38300, Digital Audio Recording and Production I. Topics covered will include advanced musical sequencing, multitrack audio recording, audio signal processing, mixing, mastering and advanced audio and digital production. Students will be required to develop music recording and production projects.

Learning Outcomes: 1. Explain and demonstrate multitrack recording, mixing, analog and digital effects processing, sampling, use of specialized filters and audio tools such as vocoders and other electronic instruments to shape and edit sound. 2. Explain and demonstrate advanced musical sequencing and digital audio editing. 3. Explain and demonstrate issues and techniques used when combining digital sound with acoustic instruments and voices. 4. Create professional mixes that use reverb, compression, and special effects, etc. 5. Explain and demonstrate techniques used in combining sound and music to video and film productions. Credits: 3.00

Culture (3 credits)

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Theory & Composition Studies (3 credits)

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st

Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 23300 - Music Theory IV: Contemporary Music

Credit Hours: 3.00. A study of music theory from the late Romantic era through current practice. Students may be asked to compose works in a variety of styles that include late Romanticism, Impressionism, Neoclassicism, Atonality, Pointillism, Minimalism, Sound-Mass Composition, Indeterminacy, Ambient music, Graphic Notation and Neoromanticism.

Learning Outcomes: 1. Demonstrate a theoretical understanding of harmonic practice from the Late Romantic Era through the contemporary period. 2. Analyze the structural elements of music from the Late Romantic Era through the contemporary period. 3. Produce original compositions in the styles associated with the Late Romantic Era through the contemporary period. Credits: 3.00

Music Courses 30000+

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

Electives (40-53 credits)

Other Departmental - Liberal Arts Core For BFA, Professional, & Education (25-34 credits)

Core III: Linguistic Diversity (3-4 credits)

Foundational Requirements (21-30 credits)

Notes

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and

chords. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

15-16 Credits

Spring 1st Year

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

15-17 Credits

Fall 2nd Year

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western

European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

17-18 Credits

Spring 2nd Year

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14-15 Credits

Fall 3rd Year

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference

between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14 Credits

Spring 3rd Year

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 38400 - Digital Record And Production II

Credit Hours: 3.00. This course is a continuation of MUS 38300, Digital Audio Recording and Production I. Topics covered will include advanced musical sequencing, multitrack audio recording, audio signal processing, mixing, mastering and advanced audio and digital production. Students will be required to develop music recording and production projects.

Learning Outcomes: 1. Explain and demonstrate multitrack recording, mixing, analog and digital effects processing, sampling, use of specialized filters and audio tools such as vocoders and other electronic instruments to shape and edit sound. 2. Explain and demonstrate advanced musical sequencing and digital audio editing. 3. Explain and demonstrate issues and techniques used when combining digital sound with acoustic instruments and voices. 4. Create professional mixes that use reverb, compression, and special effects, etc. 5. Explain and demonstrate techniques used in

combining sound and music to video and film productions. Credits: 3.00

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

15 Credits

Music: Music Theory & Composition Concentration, BA

About the Program

Degree Requirements

Auditions and Interviews

Departmental/Program Major Courses (42-46 credits)

Required Major Courses (24-28 credits)

Foundational Studies (15 credits)

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital

interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

Discovery Forum (0 credits)

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

Symposia (Non-course Requirement)

Music History (3 credits)

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Music Making Studies (6-10 credits)

Studio Courses (6 credits)

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique.
Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility.
Credits: 2.00

Ensemble Participation (0-4 credits)

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

BAND 34100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 33100 - Summer Jazz Bands

Credit Hours: 2.00. Continuation of BAND 33000.

Credits: 2.00

BAND 33000 - Summer Concert Bands

Credit Hours: 2.00. Continuation of BAND 32000.

Credits: 2.00

BAND 12100 - Symphony Orchestra

Credit Hours: 2.00. Symphony Orchestra.

Credits: 2.00

BAND 11900 - Varsity Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11800 - Collegiate Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11700 - Concert Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11600 - Symphonic Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11500 - String Orchestra

Credit Hours: 2.00. The rehearsal, study, and performance of string orchestra music from the classical, romantic and contemporary areas of composition.

Credits: 2.00

BAND 11300 - Jazz Ensemble

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Permission of instructor required.

Credits: 2.00

BAND 11000 - Marching Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Mandatory participation required in Marching Band Workshop one week prior to start of fall classes which conflicts with Boilermaker Gold Rush. Workshop covers similar orientation to Gold Rush. Do enroll in BAND 11000 during summer registration prior to the workshop and audition process.

Credits: 2.00

Music Theory and Composition Concentration (18 credits)

Music Theory and Composition Required Courses (9 Credits)

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 23300 - Music Theory IV: Contemporary Music

Credit Hours: 3.00. A study of music theory from the late Romantic era through current practice. Students may be asked to compose works in a variety of styles that include late Romanticism, Impressionism, Neoclassicism, Atonality, Pointillism, Minimalism, Sound-Mass Composition, Indeterminacy, Ambient music, Graphic Notation and Neoromanticism.

Learning Outcomes: 1. Demonstrate a theoretical understanding of harmonic practice from the Late Romantic Era through the contemporary period. 2. Analyze the structural elements of music from the Late Romantic Era through the contemporary period. 3. Produce original compositions in the styles associated with the Late Romantic Era through the contemporary period. Credits: 3.00

Music Studies I (3 Credits)

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 32800 - Jazz Theory, Composition And Arranging

Credit Hours: 3.00. This course is an introduction to contemporary jazz theory, composition and arranging practices. Topics covered will include the study of chord and scale constructions, substitutions, analyzing and building harmonic progressions, modal functions, identifying various styles and idioms, and writing for combo and big band. Students will learn how to compose in various jazz styles and score their works for small and large ensembles. Prerequisites: MUS 13300, Music Theory II and MUS 27000, Computer Skills in Music or consent of instructor.

Learning Outcomes: 1. Explain common chords, scales and modes used in contemporary jazz music. 2. Define common terms used in jazz arranging and composition. 3. Explain and demonstrate common features of various jazz styles. 4. Create original jazz compositions and arrangements. Credits: 3.00

MUS 32100 - Songwriting

Credit Hours: 3.00. This course is an introduction to contemporary songwriting. Topics covered will include the study of contemporary chord progressions, melodic development, essential songwriting forms and lyric writing. Students will analyze and compose original songs that will cover a wide range of musical styles and genres including folk, country, pop, rock, jazz and hip-hop. Students interested in Art Song composition should take MUS 34100 or 34200, Composition I-II. Prerequisites include MUS 13200, Music Theory I and MUS 27000, Computer Skills in Music or consent of department.

Learning Outcomes: 1. Demonstrate a theoretical and practical understanding of contemporary songwriting. 2. Explain traditional and contemporary harmonic and melodic practice in songwriting. 3. Define common terms such as verse, chorus, bridge, refrain and hook. 4. Analyze and compose works in simple forms such as binary, ternary, AABA and blues forms. 5. Explain and demonstrate common features of various beats and styles associated with songwriting: samba, bossa nova, swing, bop, funk, hip-hop. 6. Analyze and write effective lyrics. 7. Create original songs. Credits: 3.00

Music History and Literature (3 Credits)

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

Music Studies II (3 Credits)

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and

performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

MUS 38400 - Digital Record And Production II

Credit Hours: 3.00. This course is a continuation of MUS 38300, Digital Audio Recording and Production I. Topics covered will include advanced musical sequencing, multitrack audio recording, audio signal processing, mixing, mastering and advanced audio and digital production. Students will be required to develop music recording and production projects.

Learning Outcomes: 1. Explain and demonstrate multitrack recording, mixing, analog and digital effects processing, sampling, use of specialized filters and audio tools such as vocoders and other electronic instruments to shape and edit sound. 2. Explain and demonstrate advanced musical sequencing and digital audio editing. 3. Explain and demonstrate issues and techniques used when combining digital sound with acoustic instruments and voices. 4. Create professional mixes that use reverb, compression, and special effects, etc. 5. Explain and demonstrate techniques used in combining sound and music to video and film productions. Credits: 3.00

MUS 32800 - Jazz Theory, Composition And Arranging

Credit Hours: 3.00. This course is an introduction to contemporary jazz theory, composition and arranging practices. Topics covered will include the study of chord and scale constructions, substitutions, analyzing and building harmonic progressions, modal functions, identifying various styles and idioms, and writing for combo and big band. Students will learn how to compose in various jazz styles and score their works for small and large ensembles. Prerequisites: MUS 13300, Music Theory II and MUS 27000, Computer Skills in Music or consent of instructor.

Learning Outcomes: 1. Explain common chords, scales and modes used in contemporary jazz music. 2. Define common terms used in jazz arranging and composition. 3. Explain and demonstrate common features of various jazz styles. 4. Create original jazz compositions and arrangements. Credits: 3.00

MUS 32100 - Songwriting

Credit Hours: 3.00. This course is an introduction to contemporary songwriting. Topics covered will include the study of contemporary chord progressions, melodic development, essential songwriting forms and lyric writing. Students will analyze and compose original songs that will cover a wide range of musical styles and genres including folk, country, pop, rock, jazz and hip-hop. Students interested in Art Song composition should take MUS 34100 or 34200, Composition I-II. Prerequisites include MUS 13200, Music Theory I and MUS 27000, Computer Skills in Music or consent of department.

Learning Outcomes: 1. Demonstrate a theoretical and practical understanding of contemporary songwriting. 2. Explain traditional and contemporary harmonic and melodic practice in songwriting. 3. Define common terms such as verse, chorus, bridge, refrain and hook. 4. Analyze and compose works in simple forms such as binary, ternary, AABA and blues

forms. 5. Explain and demonstrate common features of various beats and styles associated with songwriting: samba, bossa nova, swing, bop, funk, hip-hop. 6. Analyze and write effective lyrics. 7. Create original songs. Credits: 3.00

MUS 37000 - Introduction To Instrumental And Choral Conducting

Credit Hours: 3.00. This course is an introduction to instrumental and choral conducting. Topics covered will include the study of essential skills necessary to lead vocal and instrumental ensembles that will involve warmup techniques, choral and instrumental tone production, baton and directing patterns, ensemble organizational leadership and score analysis. Prerequisites include MUS 13300, Music Theory II or consent of the department.

Learning Outcomes: 1. Define common terms used in musical scores. 2. Demonstrate a wide variety of conducting hand and baton patterns. 3. Explain how musical analysis can influence conducting. 4. Explain standard organizational and leadership approaches in conducting musical groups. 5. Explain frequent errors made by conductors. Credits: 3.00

Music Courses 30000+

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer,

performer and audience for this piece. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

Other Departmental - Liberal Arts Core For BFA, Professional, & Education (25-34 credits)

Core III: Linguistic Diversity (3-4 credits)

Foundational Requirements (21-30 credits)

Notes

Electives (40-53 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to

present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

15-16 Credits

Spring 1st Year

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

MUS 23300 - Music Theory IV: Contemporary Music

Credit Hours: 3.00. A study of music theory from the late Romantic era through current practice. Students may be asked to compose works in a variety of styles that include late Romanticism, Impressionism, Neoclassicism, Atonality, Pointillism, Minimalism, Sound-Mass Composition, Indeterminacy, Ambient music, Graphic Notation and Neoromanticism.

Learning Outcomes: 1. Demonstrate a theoretical understanding of harmonic practice from the Late Romantic Era through the contemporary period. 2. Analyze the structural elements of music from the Late Romantic Era through the contemporary period. 3. Produce original compositions in the styles associated with the Late Romantic Era through the contemporary period. Credits: 3.00

15-17 Credits

Fall 2nd Year

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

17-18 Credits

Spring 2nd Year

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14-15 Credits

Fall 3rd Year

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

14 Credits

Spring 3rd Year

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

15 Credits

Fall 4th Year

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre,

describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

15 Credits

Spring 4th Year

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

15 Credits

Natural Resources and Environmental Science: Climate and Energy Solutions Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (38-39 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and

points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based

laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

Climate and Energy Solutions Concentration Courses (27-28 credits)

Climate And Energy Solutions Required Courses (15-16 credits)

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

NRES 23000 - Survey Of Meteorology (UCC: SCI)

Credit Hours: 3.00. (EAPS 22100) An introductory course for both science and non-science students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate, ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of

latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

Climate and Energy Solutions Selective Courses (12 credits)

EPCS 40200 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100 /40200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 40200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 40100 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100/EPCS 40200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 40100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material

from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

AD 39700 - Sustainability In The Built Environment

Credit Hours: 3.00. The study of philosophical concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants. To provide a foundation for evaluation of materials, processes, and applications of design components for environmentally responsible. Field trips will be required.

Learning Outcomes: 1. Define sustainability and assess the ways that sustainable design strategies, processes, and products may be integrated effectively into the built environment. 2. Identify complex social, ecological, and

economic dimensions that affect the well-being of humans, neighborhoods, communities, and ecological systems. 3. Apply critical thinking skills to explain how green building methods affect the way built environments are designed, constructed, and operated. 4. Utilize appropriate methodological tools to analyze sustainable problems and provide environmentally responsible solutions for a green-building scenario. 5. Articulate a comprehensive, progressive world view that integrates diverse approaches to sustainability. 6. Utilize USGBC materials and other educational sources to explain the LEED rating system, LEED professional credentials, and Green Building principles and techniques preparatory to obtaining the LEED Green Associate credential. Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 32700 - Climate, Science And Society

Credit Hours: 3.00. This course will examine the broad problems of climate change by examining the relationship between science, politics, and society by using climate change as a lens through which to examine larger issues. Students will be encouraged to identify similar themes in their own experiences as emerging scientists, engineers and global leaders. Adequate preparation to write essays and perform basic arithmetic calculations needed. Prior knowledge of climate change science is not necessary.

Learning Outcomes: 1. Able to think logically and creatively. 2. Able to apply knowledge to practical situations. 3. Able to respond flexibly as situation changes. 4. Understand ethical issues, particularly in Science. 5. Appreciate diverse experiences, thoughts, backgrounds. 6. Understand and appreciate Science in the world environment. Credits: 3.00

EAPS 37500 - Great Issues - Fossil Fuels, Energy And Society

Credit Hours: 3.00. Prosperity of the 20th century was based on abundant and cheap energy; during the 21st century we will be faced with difficult challenges. Our society will face higher energy prices, decline of petroleum based fuels supplies, increased environmental effects of fossil fuels usage, and the challenge of solving the technological problems of developing alternative fuels. This course will review the structure, economics, and geopolitical issues faced by fossil fuel industries and the mitigation strategies that will be needed to change to low fossil fuel use society based on low polluting renewable energy sources. Counts for Great Issues course in College of Science for Juniors and Seniors.

Credits: 3.00

EAPS 42000 - Global Change Modeling

Credit Hours: 3.00. Understanding, monitoring, and modeling global environmental change. Each session examines the response of the interrelated earth systems to different geological, ecological, atmospheric, oceanic, or societal impacts. Topics include global warming, major biogeochemical cycles, atmospheric ozone, coevolution of life and climate, asteroid impacts, and ecological disruptions. The laboratory uses object-oriented modeling software and current NASA satellite data. No prior knowledge of computer programming is required.

Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and

Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MET 53000 - Facilities Engineering Technology

Credit Hours: 3.00. A study of the application of the engineering sciences and technology to the solution of problems associated with mechanical and electrical systems in buildings. Emphasizes commercial and industrial facilities. Identifying energy conservation measures for both mechanical and electrical systems and evaluating their economic impact are an important focus of the course.

Learning Outcomes: 1. Explain building energy trends and related policy. 2. Explain the organizations and personnel supporting the built environment. 3. Use building automation systems to monitor and control building operation. 4. Quantify energy use in building systems. 5. Use accepted professional practice for technical computations and writing. 6. Calculate the economic impact of energy and resource conservation measures for buildings. 7. Compute the impact of solar energy use for a building. 8. Apply strategies for maintaining Indoor Air Quality in buildings. 9. Evaluate the performance of mechanical or electrical systems in buildings. Credits: 3.00

EAPS 31500 - Biogeochemistry

Credit Hours: 3.00. The course examines the main element cycles of Earth: carbon, oxygen/hydrogen, nitrogen, sulfur, phosphorous, and trace metals, and how they are interconnected from terrestrial, aquatic/ocean, and atmospheric perspectives. General chemistry concepts such as equilibrium, free energy, electrochemistry are used to understand the energetics of the cycles. Connection between the cycles and environmental problems, such as climate change and air pollution will be emphasized.

Learning Outcomes: 1. Construct a mental model of the Earth system and the flow of elements among different parts of the system. 2. Examine modern problems caused by human perturbation of the main biogeochemical cycles. 3. Perform basic research tasks and present scientific findings. Credits: 3.00

EAPS 53000 - Extreme Weather And Climate: Science And Risk

Credit Hours: 3.00. This project-oriented course introduces students to the real-world analysis of weather and climate risk, including under climate change. Course will provide a risk-relevant introduction to different types of impactful weather (e.g., hurricanes, drought) and how the climate system can cause them to vary on monthly (e.g., Madden-Julian Oscillation), seasonal (e.g., El Nino and La Nina), and longer timescales (e.g., climate change). The course will further connect this intrinsic uncertainty in weather outcomes to uncertainties in real-world applications (e.g., crop yields) across a variety of economic sectors - "risk". Students will be introduced to basic methods in probability and statistics for analyzing data required to help someone make real-world decisions that depend on weather/climate. The principal course outcome is a semester-long "start-to-finish" project where students define a hypothetical real-world decision that is weather-dependent, find and analyze data to guide that decision-maker, write a concise report on their findings, and concisely present their results orally to the class.

Learning Outcomes: 1. Explain the meaning of "risk" in weather/climate and impacts. 2. Describe the basics of various types of impactful weather. 3. Describe how modes of climate variability cause weather to vary on monthly, seasonal, and longer time scales. 4. Explain how weather and climate variability translates to risk in a wide range of applications and economic sectors. 5. Analyze weather/climate data to find real-world solutions to weather risk problems. 6. Gain experience working as a hypothetical weather/climate science consultant in a team setting. 7. Summarize research in a succinct and compelling technical report. 8. Summarize research in a succinct and compelling oral presentation. 9. Use data to help someone find a solution to a real-world problem that depends on the weather/climate. Credits: 3.00

PHIL 40300 - Moral Psychology And Climate Change

Credit Hours: 3.00. This course investigates the ethical challenges posed by climate change in conjunction with the deep cognitive and motivational factors that shape our individual and collective responses to it. Current research on human moral psychology is examined, drawing on work from a range of disciplines. Ethical theories concerning the unique moral challenges posed by a threat that spans national borders and human generations are considered. Strategies for addressing climate change that try to avoid our common cognitive foibles, and to leverage what we know about human moral capacities for collective action, are examined.

Learning Outcomes: 1. Identify the structure, thesis statement, and main lines of argumentation in written work of philosophers and psychologists, and also to analyze the arguments by breaking them down into their component parts, and formulating their own objections. 2. Discuss a wide variety of issues and sources surrounding moral psychology, from philosophers, psychologists, biologists, economists and anthropologists; they will develop this ability by summarizing and commenting on the assigned readings in weekly blog posts. 3. Compare the threat raised by climate change to other existential threats by reporting on the way different kinds of threats are processed cognitively. 4. Appraise the strengths and weaknesses of different strategies for addressing climate change, as assessed from the point of view of the state of the art understanding of human cognition and moral motivation; they will write a research paper that assesses the pros and cons of such strategies. 5. Identify common cognitive blind spots, predictable irrationalities, and motivational hurdles, and will be able to use this to appreciate the scope of the collective action problems associated with climate change; they will develop these skills by reading academic texts devoted to these issues. Credits: 3.00

ASEC 35500 - Controversial Science And Media In The Public Sphere (UCC: HUM/STS)

Credit Hours: 3.00. This course will utilize case studies of controversial science news to explore the multiple factors that converge to influence how science and technology become controversial issues across a variety of social/ political domains. In addition to foundational understanding of communication theory, students will develop two primary skills: 1) a structure for the critical analysis of science news, 2) the skills to meaningfully communicate across stakeholders. The science content (GMOs, climate change, pesticide use, etc.) will provide the background information for analysis of the main focus of the course, which is in learning the communication process for effectively communicating science to non-science audiences. Case studies and applied critical media theory will be utilized to explore such controversies as climate change, genetically modified foods, and other emergent science controversies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Evaluate forces shaping public understanding of/and engagement with/science, including the role of technology in misinformation (fake news, bots, algorithms, misinformation campaigns, and propaganda) and the role of commercial funding of media. 2. Able to critically analyze media reports of science issues including: Types of Journalism, Levels of Completeness, and Evidence within the story. 3. Apply reliable evidence from your critical news analysis to your projects. 4. Identify and analyze prominent and recurrent patterns in the communication of controversial issues. 5. Apply the skills learned to communicate controversial science to a non-science audience. 6. Critically evaluate the evolving role of media in shaping understanding of science across democratic societies. 7. Know content (quizzes and reflection papers). 8. Process Knowledge (Discussion and applied projects). 9. Use integrated knowledge to meaningfully critique others work. 10. Demonstrate process comprehension through construction of a critical news analysis of a current controversial issue. Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

Other Departmental/Program Course Requirements (62-67 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career

opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process

through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and

principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12.

Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to

construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral

formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7.

Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals

in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions,

social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab

results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (14-20 credits)

Supplemental Lists

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource

system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions.

6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits:

3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use

evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general

developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit

proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 2nd Year

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

NRES 23000 - Survey Of Meteorology (UCC: SCI)

Credit Hours: 3.00. (EAPS 22100) An introductory course for both science and non-science students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate, ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their

structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

17 Credits

Fall 3rd Year

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

13-14 Credits

Spring 3rd Year

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how

people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

14-15 Credits

Fall 4th Year

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

13-16 Credits

Spring 4th Year

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

12-14 Credits

Natural Resources and Environmental Science: Emerging Environmental Challenges Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (38-39 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the

application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

Emerging Environmental Challenges Concentration Courses (27-28 credits)

Other Departmental /Program Course Requirements (62-67 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are

determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or

15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource

policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications,

develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS

workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at

least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the

design of both oral and written popular press stories. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and

communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of

controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (14-20 credits)

Supplemental Lists

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and

the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem

of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading,

writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension.

Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use

evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students

demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral

pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 2nd Year

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8.

Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

17 Credits

Fall 3rd Year

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students

will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

16-17 Credits

Spring 3rd Year

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

12-15 Credits

Fall 4th Year

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

12-14 Credits

Spring 4th Year

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

12-14 Credits

Natural Resources and Environmental Science: Environmental Policy and Analysis Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (38-39 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture

supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to

solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.
Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural

resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

Environmental Policy And Analysis Concentration Courses (27-28 credits)

Required Concentration Courses (9 Credits)

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

Environmental Policy And Analysis Selectives (18-19 credits)

Other Departmental/Program Course Requirements (62-67 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral

communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent).

Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit

proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving

spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical

situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science

stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits:

3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to

understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (14-20 credits)

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and

services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and

trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits:

3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic

probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic

theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to

produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 2nd Year

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function,

molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

17 Credits

Fall 3rd Year

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international

politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

13-14 Credits

Spring 3rd Year

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

12-16 Credits

Fall 4th Year

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages

business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6.

Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form,

poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

12 Credits

Spring 4th Year

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

12-15 Credits

Natural Resources and Environmental Science: Environmental Quality And Restoration Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (38-39 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test

hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear

regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining

what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

Environmental Quality And Restoration Concentration Courses (27-28 credits)

Required Concentration Courses (15-16 credits)

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

Environmental Quality and Restoration Selective (12 credits)

Other Departmental/Program Course Requirements (62-67 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors.

4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research

and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as

modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit

proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems.

2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for

organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking

about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational

understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human

nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (14-20 credits)

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of

differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors

and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.

Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14-18 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit

proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 2nd Year

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

17 Credits

Fall 3rd Year

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena

as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

12-13 Credits

Spring 3rd Year

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

14-16 Credits

Fall 4th Year

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the

world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

15-16 Credits

Spring 4th Year

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

12-14 Credits

Natural Resources and Environmental Science: Sustainability Science Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (39 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze

data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear

regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining

what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

Sustainability Science Concentration Courses (28 credits)

Required Concentration Courses (16 credits)

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the

role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving

approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering design proposal. Credits: 3.00

Sustainability Science Concentration Selectives (12 credits)

Other Departmental/Program Course Requirements (62-67 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental

goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource

management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least

7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the

impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 .

Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of

differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish

and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell

components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human

nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and

critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (14-19 credits)

Supplemental Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not

permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes

topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety

of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting

methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including

diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

15 Credits

Spring 2nd Year

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and

regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

17 Credits

Fall 3rd Year

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the

resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using

industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering design proposal. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

13-14 Credits

Spring 3rd Year

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and

encourage the willing contributions of everyone. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

13-16 Credits

Fall 4th Year

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

14 Credits

Spring 4th Year

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

12-15 Credits

Natural Resources and Environmental Science: Watershed Management Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (38-39 credits)

Required Major Courses (11 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

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NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

Watershed Management Concentration Courses (27-28 credits)

Required Concentration Courses (15-16 credits)

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

NRES 33700 - Environmental Hydrology

Credit Hours: 3.00. (AGRY 33700) This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Learning Outcomes: 1. Become familiar with hydrological processes, interactions and their representations over scales from point to ""continental"" and times from seconds to years. The major emphasis is on surface and near surface phenomenon. 2. Gain qualitative and quantitative understanding of land surface water budgets and how they respond to environmental change. 3. Develop problem solving abilities on topics related to surface water hydrology. Credits: 3.00

NRES 27000 - Landscape-Level Planning

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NRES 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Discuss the complexity of involving stakeholders in decisions about

landscape management. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

HORT 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Demonstrate knowledge of a variety of participatory and facilitation techniques. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

Watershed Management Selective (12 credits)

Other Departmental/Program Course Requirements (62-67 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited

to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as

applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular

components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe,

explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of

STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results

and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6.

Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in

science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science

stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use

evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (14-20 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics,

the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational,

quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental

science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze

this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to

improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and

communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak

with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12.

Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-15 Credits

Spring 2nd Year

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and

wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

17 Credits

Fall 3rd Year

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to

develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems.

Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

13-14 Credits

Spring 3rd Year

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we

face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

NRES 33700 - Environmental Hydrology

Credit Hours: 3.00. (AGRY 33700) This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Learning Outcomes: 1. Become familiar with hydrological processes, interactions and their representations over scales from point to ""continental"" and times from seconds to years. The major emphasis is on surface and near surface phenomenon. 2. Gain qualitative and quantitative understanding of land surface water budgets and how they respond to environmental change. 3. Develop problem solving abilities on topics related to surface water hydrology. Credits: 3.00

14-17 Credits

Fall 4th Year

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

NRES 27000 - Landscape-Level Planning

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Learning Outcomes: 1. Understand the role of

planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00 Credits: 1.00

NRES 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Discuss the complexity of involving stakeholders in decisions about landscape management. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

HORT 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Demonstrate knowledge of a variety of participatory and facilitation techniques. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

13-15 Credits

Spring 4th Year

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

12-14 Credits

Neurobiology and Physiology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (31-37 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and

metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate

skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5.

Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (12-18 Credits)

Intermediate Biology Selective (4 credits)

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

Neurobiology & Physiology Selectives (6 credits)

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and

function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate

critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

Biology Selective (for NRPH) (2-4 credits)

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including

experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in

cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and

molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the most current literature.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces

fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how

evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry

and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as

applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate

an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn

how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply

course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

Base Lab Requirement (0-4 credits)

Other Departmental Requirements: (51-73 credits)

Chemistry (17 credits)

General Chemistry (5 credits)

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

Organic Chemistry (8 credits)

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Biochemistry (4 credits)

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of

space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

College of Science Additional Requirements

Computing (2-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team

to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to

programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

Physics I

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Physics II

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits,

thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Mathematics (6-10 credits)

Calculus I

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 .

Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

Calculus II

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Electives (10-37 credits)

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally

covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

16-19 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of

homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

16-20 Credits

Fall 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9.

Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15-16 Credits

Spring 2nd Year

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of

multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of

biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites. Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they

apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

14 Credits

Fall 3rd Year

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described

in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

13 Credits

Spring 3rd Year

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction

to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

14-16 Credits

Fall 4th Year

12 Credits

Spring 4th Year

12-18 Credits

Nuclear Engineering, BSNE

About the Program

Degree Requirements

Nuclear Engineering Major Courses (44 credits)

Required Major Courses (44 credits)

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

NUCL 20500 - Nuclear Engineering Undergraduate Laboratory I

Credit Hours: 2.00. A laboratory course designed for the study of the properties of radiation, radioactive material, and radiation detectors. The hazards of radiation and safe handling techniques are emphasized.

Credits: 2.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

NUCL 29800 - Sophomore Seminar

Credit Hours: 0.00. Career areas in nuclear engineering, job opportunities, areas of related study, topics of current interest, orientation, professional ethics, and responsibility.

Credits: 0.00

NUCL 30000 - Nuclear Structure And Radiation Interactions

Credit Hours: 3.00. Review of atomic properties and introduction to nuclear models. Discussion of radioactive decay and the interaction of nuclear radiation and reaction products with matter. Energetics and cross-sections of nuclear reactions with applications to problems typical of nuclear engineering.

Credits: 3.00

NUCL 30500 - Nuclear Engineering Undergraduate Laboratory II

Credit Hours: 2.00. Continuation of NUCL 20500 . Experiments with scintillation detectors, multichannel analyzers, neutron detectors, the subcritical pile, and the reactor will be performed. Measurements will be made to demonstrate neutron activation analysis techniques, neutron slowing down, neutron flux distributions, and the effects of control rods on neutron fluxes.

Credits: 2.00

NUCL 31000 - Introduction To Neutron Physics

Credit Hours: 3.00. Development of diffusion theory for neutrons. Neutron interactions and development of one-group neutron diffusion theory with point, plane, and fission sources. Application to one- and two-region reactors. Introduction to buckling, multiplication constants, critical size, neutron slowing down, and resonance capture. Applications using two-group theory.

Credits: 3.00

NUCL 32000 - Introduction To Materials For Nuclear Applications

Credit Hours: 3.00. Nuclear environments and materials selection for nuclear applications, bonding, crystal structure and symmetry, defects and irradiation, chemical thermodynamics, phase equilibria, phase transformations, and corrosion in nuclear systems and design.

Credits: 3.00

NUCL 32500 - Nuclear Materials Laboratory

Credit Hours: 3.00. Nuclear materials laboratory that evaluates various characterization techniques and technologies, tensile properties, hardness, fracture toughness, microstructures, X-ray diffraction, electron microscopy, mechanical properties of thin-films, NDE techniques and data acquisition in materials characterization techniques.

Learning Outcomes: 1. Understanding of what materials are, and how they perform and fail. 2. Understand the conceptual tools dealing with materials phenomena. 3. Be able to communicate with professionals about materials problems. 4. Be able to address the limitations of materials in design, and improve them.

Credits: 3.00

NUCL 35000 - Nuclear Thermal-Hydraulics I

Credit Hours: 3.00. The first of an integrated two-course sequence introducing the concepts of nuclear reactor thermal transport and associated hydraulics with applications to design and safety. Macroscopic balances, dimensional analysis, and flow measurement. Fluid behavior, momentum transfer, and applications to reactor systems and design.

Credits: 3.00

NUCL 35100 - Nuclear Thermal-Hydraulics II

Credit Hours: 3.00. Emphasis is given to the fluid transport of heat from reactor fuel elements. Heat transfer in fluids, analogies, and applications to reactor coolant channel analysis. Two-phase flow and convective boiling. Radiative heat transfer. Applications to safety analysis and reactor design.

Credits: 3.00

NUCL 35500 - Nuclear Thermohydraulics Laboratory

Credit Hours: 3.00. Laboratory course corresponding to NUCL 35000 and NUCL 35100 . Various fluid flow and heat transfer phenomena applied to nuclear reactor systems and design.

Credits: 3.00

NUCL 39800 - Junior Seminar

Credit Hours: 0.00. Continuation of NUCL 29800 .

Credits: 0.00

NUCL 40200 - Engineering Of Nuclear Power Systems

Credit Hours: 3.00. Principles and practice of power plant systems with design applications; thermal cycles, heat transport, mechanical designs, control, safety analysis, shielding analysis, fuel cycles; resources, optimization, options, waste management. Fusion and alternate energy sources.

Credits: 3.00

NUCL 42001 - Radiation Interaction With Materials And Applications

Credit Hours: 3.00. Fundamental of radiation interaction with materials and applications, types of radiation and radiation sources, physical mechanisms of radiation interaction with solids, radiation damage, ion mixing, applications in nuclear fission and fusion reactors, applications in materials synthesis.

Learning Outcomes: 1. Learn the types and sources of radiation. 2. Understand the physical mechanisms of radiation interaction with materials and model these interactions quantitatively. 3. Understand and model the phenomenon of radiation damage to bulk, surfaces and interfaces. 4. Relate the concepts of radiation damage to neutron interaction with solids in both fission and fusion reactors. 5. Understand the technological applications of radiation interaction with materials. Credits: 3.00

NUCL 44900 - Senior Design Proposal

Credit Hours: 1.00. The course outcome is the writing and presentation of a proposal for the senior design project, NUCL 45000 . The tasks include the selection of project design topics (various nuclear engineering components and systems designs), the selection of teams, introduction to design process, team management, communication, and engineering ethics, literature and patents survey, initiation of design activities and familiarization with design tools (for example software).

Credits: 1.00

NUCL 45000 - Design In Nuclear Engineering

Credit Hours: 3.00. Application of the design process to the project design topics identified in NUCL 44900 . The design process usually includes, but not limited to, mathematical modeling in design, neutronic, thermal-hydraulics and safety studies, risk assessment, economics, policy and regulation, environmental impact.

Credits: 3.00

NUCL 46000 - Introduction To Controlled Thermonuclear Fusion

Credit Hours: 3.00. Energy resources and the potential role of nuclear fusion. Ignition and breakeven conditions for fusion power plants. Particle and energy confinement in linear and toroidal magnetic fields. Review of magnetic and inertial confinement experiments and conceptual reactor configurations.

Credits: 3.00

NUCL 49800 - Senior Seminar

Credit Hours: 0.00. Lectures to acquaint the senior students with professional ethics, job opportunities, graduate schools, continuing study, and services of professional societies.

Credits: 0.00

NUCL 41000 - Introduction To Reactor Theory And Applications

Credit Hours: 3.00. Intermediate treatment of reactor theory and its relevance to routine design engineering calculations, including introduction to transport theory, criticality evaluation, multi-group theory, isotopic depletion, and concludes with short overview of multi-level reactor design calculations, critical experiments, and treatment of neutronic uncertainties. List of Topics: Derivation of Boltzmann transport equation, and its reduction to steady state and time dependent diffusion equation. Introduction to multi-group theory, and evaluation of group parameters in both wide and narrow resonance approximations. Introduction to homogenization theory, and evaluation of lattice parameters. Evaluation of criticality condition for bare and reflected reactor geometries. Development of discretization techniques for the time-dependent multi-group diffusion theory equation. Reactor kinetics, reactivity coefficients and reactivity balance equation. Flowchart of multi-level reactor design calculations. Introduction to critical experiments and startup reactor physics test. Sources and treatment of uncertainties in reactor calculations.

Learning Outcomes: 1. Develop an understanding of reactor physics value for engineering design calculations, and to learn how it is applied to make engineering design decision regarding material choice, composition, type, and operating conditions to sustain and control chain reactor over reactor operating horizon. 2. Learn how to develop a computer code to solve a reactor physics problem.
Credits: 3.00

Other Departmental/Program Course Requirements (81-95 credits)

First-Year Engineering Requirements (29-39 credits)

Other Departmental Requirements (40-44 credits)

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

General Education Requirement (12 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Sample Nuclear Engineering Sample Plan of Study

Fall 2nd Year

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical communication skills. Credits: 3.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

NUCL 29800 - Sophomore Seminar

Credit Hours: 0.00. Career areas in nuclear engineering, job opportunities, areas of related study, topics of current interest, orientation, professional ethics, and responsibility.

Credits: 0.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate

the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

16-19 Credits

Spring 2nd Year

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

NUCL 20500 - Nuclear Engineering Undergraduate Laboratory I

Credit Hours: 2.00. A laboratory course designed for the study of the properties of radiation, radioactive material, and radiation detectors. The hazards of radiation and safe handling techniques are emphasized.

Credits: 2.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

NUCL 29800 - Sophomore Seminar

Credit Hours: 0.00. Career areas in nuclear engineering, job opportunities, areas of related study, topics of current interest, orientation, professional ethics, and responsibility.

Credits: 0.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students

with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

17-18 Credits

Fall 3rd Year

NUCL 30000 - Nuclear Structure And Radiation Interactions

Credit Hours: 3.00. Review of atomic properties and introduction to nuclear models. Discussion of radioactive decay and the interaction of nuclear radiation and reaction products with matter. Energetics and cross-sections of nuclear reactions with applications to problems typical of nuclear engineering.

Credits: 3.00

NUCL 32000 - Introduction To Materials For Nuclear Applications

Credit Hours: 3.00. Nuclear environments and materials selection for nuclear applications, bonding, crystal structure and symmetry, defects and irradiation, chemical thermodynamics, phase equilibria, phase transformations, and corrosion in nuclear systems and design.

Credits: 3.00

NUCL 32500 - Nuclear Materials Laboratory

Credit Hours: 3.00. Nuclear materials laboratory that evaluates various characterization techniques and technologies, tensile properties, hardness, fracture toughness, microstructures, X-ray diffraction, electron microscopy, mechanical properties of thin-films, NDE techniques and data acquisition in materials characterization techniques.

Learning Outcomes: 1. Understanding of what materials are, and how they perform and fail. 2. Understand the conceptual tools dealing with materials phenomena. 3. Be able to communicate with professionals about materials problems. 4. Be able to address the limitations of materials in design, and improve them. Credits: 3.00

NUCL 35000 - Nuclear Thermal-Hydraulics I

Credit Hours: 3.00. The first of an integrated two-course sequence introducing the concepts of nuclear reactor thermal transport and associated hydraulics with applications to design and safety. Macroscopic balances, dimensional analysis, and flow measurement. Fluid behavior, momentum transfer, and applications to reactor systems and design.

Credits: 3.00

NUCL 39800 - Junior Seminar

Credit Hours: 0.00. Continuation of NUCL 29800 .

Credits: 0.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

18 Credits

Spring 3rd Year

NUCL 31000 - Introduction To Neutron Physics

Credit Hours: 3.00. Development of diffusion theory for neutrons. Neutron interactions and development of one-group neutron diffusion theory with point, plane, and fission sources. Application to one- and two-region reactors. Introduction to buckling, multiplication constants, critical size, neutron slowing down, and resonance capture. Applications using two-group theory.

Credits: 3.00

NUCL 35100 - Nuclear Thermal-Hydraulics II

Credit Hours: 3.00. Emphasis is given to the fluid transport of heat from reactor fuel elements. Heat transfer in fluids, analogies, and applications to reactor coolant channel analysis. Two-phase flow and convective boiling. Radiative heat transfer. Applications to safety analysis and reactor design.

Credits: 3.00

NUCL 35500 - Nuclear Thermohydraulics Laboratory

Credit Hours: 3.00. Laboratory course corresponding to NUCL 35000 and NUCL 35100 . Various fluid flow and heat transfer phenomena applied to nuclear reactor systems and design.

Credits: 3.00

NUCL 39800 - Junior Seminar

Credit Hours: 0.00. Continuation of NUCL 29800 .

Credits: 0.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

18 Credits

Fall 4th Year

NUCL 30500 - Nuclear Engineering Undergraduate Laboratory II

Credit Hours: 2.00. Continuation of NUCL 20500 . Experiments with scintillation detectors, multichannel analyzers, neutron detectors, the subcritical pile, and the reactor will be performed. Measurements will be made to demonstrate neutron activation analysis techniques, neutron slowing down, neutron flux distributions, and the effects of control rods on neutron fluxes.

Credits: 2.00

NUCL 40200 - Engineering Of Nuclear Power Systems

Credit Hours: 3.00. Principles and practice of power plant systems with design applications; thermal cycles, heat transport,

mechanical designs, control, safety analysis, shielding analysis, fuel cycles; resources, optimization, options, waste management. Fusion and alternate energy sources.

Credits: 3.00

NUCL 42001 - Radiation Interaction With Materials And Applications

Credit Hours: 3.00. Fundamental of radiation interaction with materials and applications, types of radiation and radiation sources, physical mechanisms of radiation interaction with solids, radiation damage, ion mixing, applications in nuclear fission and fusion reactors, applications in materials synthesis.

Learning Outcomes: 1. Learn the types and sources of radiation. 2. Understand the physical mechanisms of radiation interaction with materials and model these interactions quantitatively. 3. Understand and model the phenomenon of radiation damage to bulk, surfaces and interfaces. 4. Relate the concepts of radiation damage to neutron interaction with solids in both fission and fusion reactors. 5. Understand the technological applications of radiation interaction with materials. Credits: 3.00

NUCL 44900 - Senior Design Proposal

Credit Hours: 1.00. The course outcome is the writing and presentation of a proposal for the senior design project, NUCL 45000 . The tasks include the selection of project design topics (various nuclear engineering components and systems designs), the selection of teams, introduction to design process, team management, communication, and engineering ethics, literature and patents survey, initiation of design activities and familiarization with design tools (for example software).

Credits: 1.00

NUCL 46000 - Introduction To Controlled Thermonuclear Fusion

Credit Hours: 3.00. Energy resources and the potential role of nuclear fusion. Ignition and breakeven conditions for fusion power plants. Particle and energy confinement in linear and toroidal magnetic fields. Review of magnetic and inertial confinement experiments and conceptual reactor configurations.

Credits: 3.00

NUCL 49800 - Senior Seminar

Credit Hours: 0.00. Lectures to acquaint the senior students with professional ethics, job opportunities, graduate schools, continuing study, and services of professional societies.

Credits: 0.00

NUCL 41000 - Introduction To Reactor Theory And Applications

Credit Hours: 3.00. Intermediate treatment of reactor theory and its relevance to routine design engineering calculations, including introduction to transport theory, criticality evaluation, multi-group theory, isotopic depletion, and concludes with short overview of multi-level reactor design calculations, critical experiments, and treatment of neutronic uncertainties. List of Topics: Derivation of Boltzmann transport equation, and its reduction to steady state and time dependent diffusion equation. Introduction to multi-group theory, and evaluation of group parameters in both wide and narrow resonance approximations. Introduction to homogenization theory, and evaluation of lattice parameters. Evaluation of criticality condition for bare and reflected reactor geometries. Development of discretization techniques for the time-dependent multi-group diffusion theory equation. Reactor kinetics, reactivity coefficients and reactivity balance equation. Flowchart of multi-level reactor design calculations. Introduction to critical experiments and startup reactor physics test. Sources and treatment of uncertainties in reactor calculations.

Learning Outcomes: 1. Develop an understanding of reactor physics value for engineering design calculations, and to learn how it is applied to make engineering design decision regarding material choice, composition, type, and operating conditions to sustain and control chain reactor over reactor operating horizon. 2. Learn how to develop a computer code to solve a reactor physics problem. Credits: 3.00

15 Credits

Spring 4th Year

NUCL 45000 - Design In Nuclear Engineering

Credit Hours: 3.00. Application of the design process to the project design topics identified in NUCL 44900 . The design process usually includes, but not limited to, mathematical modeling in design, neutronic, thermal-hydraulics and safety studies, risk assessment, economics, policy and regulation, environmental impact.

Credits: 3.00

NUCL 49800 - Senior Seminar

Credit Hours: 0.00. Lectures to acquaint the senior students with professional ethics, job opportunities, graduate schools, continuing study, and services of professional societies.

Credits: 0.00

12 Credits

Nursing, BSN

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (66 credits)

Nursing Courses Level I (23 credits)

NUR 10800 - Introduction To Nursing

Credit Hours: 1.00. Introduce students entering the nursing profession to foundations of the baccalaureate nursing curriculum, including concepts, competencies, mandatory requirements and responsibilities within the profession. Students are introduced to the rigor of the curriculum and begin to build a sense of community within the Purdue School of Nursing.

Learning Outcomes: 1. Explain the relationship between the Essentials of Baccalaureate Education for Professional Nursing Practice document and Purdue's baccalaureate nursing curriculum. 2. Describe the roles of the professional nurse in the healthcare delivery system. 3. Describe individuals, families, communities, and populations as consumers of nursing care. 4. Reflect upon personal and professional responsibilities in relation to the nursing profession. 5. Communicate in oral and written form at a professional level. 6. Identify personal behaviors necessary for success in an academic and professional career. 7. Engage in student and/or nursing organizations as an aspect of professional growth and development.

Credits: 1.00

NUR 21801 - Health Assessment And Essentials Of Nursing Practice I

Credit Hours: 5.00. Focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client centered safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients from the healthy to chronically ill populations. 2. Develop critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 3. Discuss the impact of evidence based nursing research in guiding practice. 4. Identify the effect of personal values and beliefs on professional practice. 5. Develop basic physical and psychosocial clinical assessment skills for the client across the lifespan, including interviewing techniques, and comprehensive history and physical exam. 6. Employ basic principles of documentation to describe clinical findings. 7. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 8. Use informatics appropriately in simulation and in the clinical setting. 9. Identify methods and resources for personal and professional growth.

Credits: 5.00

NUR 21901 - Pathopharmacology I

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort and the pharmacotherapies utilized as treatment for alterations and disease states. This introductory knowledge provides the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe primary regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations in body structure and function affecting homeostasis; metabolic processes; immune response; circulation; renal elimination; fluid/electrolyte and acid/base balance; sensory perception and comfort. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and comfort. 4. Idenify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contraindications, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22001 - Essentials Of Nursing Practice II

Credit Hours: 5.00. Continues to expand on the professional nursing role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients in the clinical setting. 2. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 3. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 4. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 5. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 6. Identify client adaption and coping strategies when adjusting to changes along the health-wellness continuum. Credits: 5.00

NUR 22101 - Pathopharmocology II

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function and the pharmacotherapies utilized as treatment for alterations and disease states. This course builds on the learning objectives from Pathopharmacology I to provide the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe the primary regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 4. Identify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with

emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contradictions, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into the overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3. Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

NUR 22301 - Foundations Of Research And Evidence-Based Practice (UCC: IL)

Credit Hours: 3.00. Students gain foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. Students learn the principles of research process and identify strengths and limitations of research articles in relation to EBP in nursing and healthcare.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently to Information Literacy Competency Standards for Higher Education. 3. Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical practice. 5. Examine economic, legal and ethical issues related to conducting research. Credits: 3.00

NUR 10900 - Introduction To Nursing II

Credit Hours: 1.00. Using knowledge acquired in NUR 10800 students will examine the profession of nursing and their role and responsibilities within the profession. Topics to be discussed include informatics and technology, the importance of professional communication in oral and written form, the global image of nursing, wellness and self-care, and preparation for progression into the sophomore year. Permission of department required.

Learning Outcomes: 1. Demonstrate the ability to communicate in oral and written form at a professional level. 2. Explore the roles of the professional nurse in both domestic and global healthcare delivery systems. 3. Examine the

role of social media and its impact on healthcare. 4. Identify components of effective and ineffective communication in the healthcare environment. 5. Discuss the use of informatics in documenting the management of patient care. 6. Identify skills and personal behaviors necessary for success in an academic and professional career. Credits: 1.00

Nursing Courses Level II (24 credits)

NUR 31401 - Health Alterations In Adults I

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of well-being as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in tissue integrity related to surgical interventions, cellular division, reproductive function, elimination, nutrition and sensory function that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision-making when caring for diverse populations of adults experiencing selected illnesses. 2. Utilize the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related (including gerontologic) pathophysiology when providing care to diverse populations of adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence- based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to client, client's family, and other members of the healthcare team. 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes. 10. Utilize patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31501 - Nursing Of Childbearing Families

Credit Hours: 5.00. Promotes the development of nursing skills when caring for families and their newborns during uncomplicated and/or complicated childbearing experiences within a variety of clinical settings. Emphasizes the study and application of the nursing process, integrating evidence based practice while meeting the health and safety needs of diverse childbearing families.

Learning Outcomes: 1. Integrate theory and evidence to guide nursing practice and clinical decision-making throughout the care of childbearing families. 2. Incorporate childbearing family participation throughout health promotion, disease prevention, and risk reduction processes. 3. Address the childbearing family's developmental, physiologic, and psychological needs. 4. Assess ethical, legal, and sociocultural influences on resource utilization and compassionate maternal-child health care delivery. 5. Design targeted plans of care via a partnership with childbearing families, intra- and interprofessional teams, professional organizations, and institutions. 6. Utilize information technology to enhance learning, practice, and communication. Credits: 5.00

NUR 31601 - Integration Seminar I

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and obstetrical diagnoses. Through the

course activities the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medical-surgical and obstetrical populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

NUR 31701 - Health Alterations In Adults II

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of wellbeing as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in health related to oxygenation, circulatory dynamics, endocrine regulation, neurological regulation, immune regulation and musculoskeletal dynamics that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision making when caring for diverse populations of adults experiencing selected illnesses. 2. Demonstrate appropriate use of the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related pathophysiology when providing care to adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence-based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to the client, client's family, and other members of the health care team 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes that emphasize client safety and evidence-based practice. 10. Use patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31801 - Psychiatric And Mental Health Nursing

Credit Hours: 5.00. Focuses on providing nursing care that supports mental health and the care of persons with mental illness while providing a conceptual integration of the nursing process, theories, and research from the biopsychosocial sciences and humanities. Demonstrates the relevance of psychiatric-mental health nursing concepts to all areas of professional practice.

Learning Outcomes: 1. Examine the effects of myths, stereotypes, stigma, values, beliefs and culture on the practice of psychiatric nursing. 2. Compare past, current, and projected systems in delivery of evidence based mental health care and its social implications. 3. Identify legal and ethical implications involved in the practice of psychiatric mental health nursing. 4. Utilize the nursing process in the phases ofthe therapeutic nurse-client relationship to delineate the complex needs of clients with psychiatric disorders.. 5. Identify the principles of communication and therapeutic relationships in the care of clients with psychiatric disorders. 6. Determine specific nursing care interventions

for acute and serious behavioral health issues that demonstrate developmentally and culturally appropriate strategies. 7. Utilize the ANA Standards of Psychiatric and Mental Health Nursing Practice as a basis for safe and competent care. 8. Incorporate theory, research and evidence from the psychobiological sciences, biological sciences, and humanities into an evidenced based practice approach to psychiatric nursing care. 9. Utilize client care technologies, information systems, and communication resources to access, organize and communicate information in a professional manner. 10. Establish therapeutic, collaborative relationships with members of the interdisciplinary treatment team. 11. Demonstrate personal and professional growth and skill development when providing evidence-based nursing care to clients with psychiatric disorders. Credits: 5.00

NUR 31901 - Integration Seminar II

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and psychiatric diagnoses. Through the course activities, the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medically and psychologically unstable populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

Nursing Courses Level III (19 credits)

NUR 41401 - Pediatric Nursing

Credit Hours: 5.00. Explores factors influencing the health and wellness of children and families. Students will apply principles, concepts and research from the health and human sciences to the care of children and families across the health-illness continuum. A structured clinical component focuses on clinical reasoning and evidence based practice. Students will provide family centered care to healthy, at risk and ill children across a variety of clinical settings.

Learning Outcomes: 1. Integrate family theories; growth and development; genomics; environmental and psychosocial factors in the care of children across the health-illness continuum. 2. Integrate nursing concepts into evidence based nursing practice for children and families across a variety of health care settings. 3. Apply knowledge of information technologies to improve health outcomes of children and families. 4. Evaluate environmental and psychosocial risk factors for children and families. 5. Adapt nursing care to families, recognizing their diverse needs, ethnicity, culture, and values. 6. Evaluate the collaborative role of the nurse with other health care disciplines in the provision of comprehensive nursing care for healthy, at risk, and ill children. 7. Demonstrate a spirit of inquiry, responsibility and accountability within legal, ethical, professional and organizational parameters. Credits: 5.00

NUR 41501 - Public Health Nursing

Credit Hours: 5.00. Utilize health promotion, maintenance, education and disease prevention in coordinating and providing population-focused care to individuals, families and aggregates in the community. A variety of clinical settings are used to offer students a broad, comprehensive perspective of public health nursing, a field that synthesizes content from nursing, social and public health sciences. Collaboration with the community and implementation of population-focused interventions foster critical thinking and independent decision making in the delivery of nursing care.

Learning Outcomes: 1. Synthesize concepts, theories, knowledge and practice from nursing, social and public health sciences. 2. Examine the structure, function, and influence of historical, political, social, environmental, cultural, and ethical factors to the health of individuals, families, and communities. 3. Collaborate with interdisciplinary healthcare and human service providers to address the health needs of individuals, families, and communities. 4. Utilize principles, concepts, models, theories and research to guide culturally sensitive nursing care and public health practice of individuals, families, and communities. 5. Explore the delivery of public health nursing services to diverse and vulnerable populations. 6. Formulate client teaching strategies that address the principles of disease prevention and health promotion to clients across the lifespan. 7. Evaluate interventions implemented using community and family resources to address mutually identified health needs of clients. 8. Use principles of caseload management, in the delivery of safe, quality public health nursing services that reflect legal, ethical, and professional standards. 9. Apply national health objectives in planning interventions to meet the individual, system, and community level needs of diverse populations. 10.Utilize health care technology to improve health outcomes of individuals, families, and communities. 11.Integrate the role of advocacy into the delivery of care to individuals, families, and communities. Credits: 5.00

NUR 41701 - Leadership In Nursing

Credit Hours: 3.00. Studies the components of nursing leadership and management functions with an emphasis on critical thinking, problem solving, communication, and team building within the context of experiential problem-based group projects. This course will provide specific practice and evaluation of strategic and financial planning, conflict management, delegation, and complex change. Competencies to be gained, at a novice level, include professional communication, sound ethical and legal judgments within personal and organizational frameworks, leadership skills in the management and evaluation of others, and an understanding of the drivers of healthcare change and finances.

Learning Outcomes: 1. Synthesize concepts of nursing leadership and management in relation to the role of the professional nurse, nurse leader, and manager in promoting safe and quality care. 2. Organize a quality improvement project by utilizing project management strategies, quality improvement principles, and evidence-based practices to promote system changes in healthcare delivery. 3. Utilize concepts of professional communication, delegation, and evaluation of healthcare team members with an awareness of ethical, professional, social, and legal issues implicit to nursing leadership and management. 4. Describes economic, policy, social, and organizational factors that influence the professional nurse and healthcare systems. 5. Evaluate the impact of professional and unprofessional behaviors on healthcare delivery and professional interactions and presentations through knowledge of nursing standards of excellence. Credits: 3.00

NUR 41001 - Issues In Professional Nursing

Credit Hours: 2.00. Promotes the use of critical thinking, clinical reasoning, and active learning to analyze contemporary issues related to professional nursing practice. Issues and key trends surrounding social determinants of health policy and economics, regulatory agencies, political action, cultural diversity, practice competency, nursing informatics and ethics are used as a framework. Permission of department required.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Evaluate historical components and current nursing practice that impact healthcare systems. 3. Demonstrate understanding of the impact of local, state, national and global regulations on healthcare trends and healthcare policy. 4.

Evaluate the impact that economic, political, cultural, and social concerns have on the role of professional nursing and the healthcare delivery system. 5. Articulate the value of pursuing practice excellence, life-long learning, engagement, self care, and resilience in professional nursing practice. 6. Utilize inquiry, analysis, information literacy, nursing informatics to address practice issues, ambiguity, and unpredictability in the healthcare systems. Credits: 2.00

NUR 42001 - Transition To Professional Nursing Practice

Credit Hours: 4.00. This course challenges students to use critical thinking and clinical reasoning to identify, prioritize and evaluate nursing interventions for clients with complex healthcare issues. Students interact with members of the healthcare team and clinical faculty to practice effective leadership, delegation and supervision of nursing students in clinical environments.

Learning Outcomes: 1. Apply sound clinical judgment, professional behavior, communication, collaboration and integration of best practice in clinical settings. Demonstrate/apply professional behavior, communication, collaboration and sound clinical judgment by integrating best practice in clinical settings. 2. Utilize the nursing process when caring for clients with complex healthcare needs. 3. Articulate the value of pursuing practice excellence, life-long learning, patient advocacy and engagement in professional nursing practice. 4. Demonstrate effective leadership, delegation and supervision when collaborating with members of the healthcare team. 5. Assume personal responsibility for professional growth. 6. Analyze system barriers that effect quality healthcare delivery in patients affected by complex conditions. Credits: 4.00

Other Departmental/Program Course Requirements (51-52 credits)

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide

a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 34000 - General Social Psychology

Credit Hours: 3.00. Social influences on the individual and processes of social interaction. Individual attitudes and behavior as related to socialization, social norms, social roles, communication and propaganda, and other social influences. Among the interaction processes considered are interpersonal attraction, influence, leadership, cooperation, and conflict. Not open to students with credit in PSY 24000.

Learning Outcomes: 1. Develop an understanding of how politics has been approached and analyzed by sociologists over time, and an appreciation for the important thinkers and historical events that have shaped these approaches. 2. Identify specific areas of political polarization and political consensus in contemporary American politics, including where we find evidence of partisan asymmetry. 3. Demonstrate ability to develop and communicate sociological insights as they relate to political history and contemporary political dynamics, both in class and in written assignments. Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the

concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

General Courses

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate

content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

Science Courses

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students

demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit

proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

Electives (2-3 credits)

Supplemental Lists

Grade Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

NUR 10800 - Introduction To Nursing

Credit Hours: 1.00. Introduce students entering the nursing profession to foundations of the baccalaureate nursing curriculum, including concepts, competencies, mandatory requirements and responsibilities within the profession. Students are introduced to the rigor of the curriculum and begin to build a sense of community within the Purdue School of Nursing.

Learning Outcomes: 1. Explain the relationship between the Essentials of Baccalaureate Education for Professional Nursing Practice document and Purdue's baccalaureate nursing curriculum. 2. Describe the roles of the professional nurse in the healthcare delivery system. 3. Describe individuals, families, communities, and populations as consumers of

nursing care. 4. Reflect upon personal and professional responsibilities in relation to the nursing profession. 5. Communicate in oral and written form at a professional level. 6. Identify personal behaviors necessary for success in an academic and professional career. 7. Engage in student and/or nursing organizations as an aspect of professional growth and development. Credits: 1.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve

problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

14-15 Credits

Spring 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will

understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

NUR 10900 - Introduction To Nursing II

Credit Hours: 1.00. Using knowledge acquired in NUR 10800 students will examine the profession of nursing and their role and responsibilities within the profession. Topics to be discussed include informatics and technology, the importance of professional communication in oral and written form, the global image of nursing, wellness and self-care, and preparation for progression into the sophomore year. Permission of department required.

Learning Outcomes: 1. Demonstrate the ability to communicate in oral and written form at a professional level. 2. Explore the roles of the professional nurse in both domestic and global healthcare delivery systems. 3. Examine the role of social media and its impact on healthcare. 4. Identify components of effective and ineffective communication in the healthcare environment. 5. Discuss the use of informatics in documenting the management of patient care. 6. Identify skills and personal behaviors necessary for success in an academic and professional career. Credits: 1.00

17 Credits

Fall 2nd Year

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

NUR 21801 - Health Assessment And Essentials Of Nursing Practice I

Credit Hours: 5.00. Focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client centered safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients from the healthy to chronically ill populations. 2. Develop critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 3. Discuss the impact of evidence based nursing research in guiding practice. 4. Identify the effect of personal values and beliefs on professional practice. 5. Develop basic physical and psychosocial clinical assessment skills for the client across the lifespan, including interviewing techniques, and comprehensive history and physical exam. 6. Employ basic principles of documentation to describe clinical findings. 7. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 8. Use informatics appropriately in simulation and in the clinical setting. 9. Identify methods and resources for personal and professional growth. Credits: 5.00

NUR 21901 - Pathopharmacology I

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort and the pharmacotherapies utilized as treatment for alterations and disease states. This introductory knowledge provides the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe primary regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations in body structure and function affecting homeostasis; metabolic processes; immune response; circulation; renal elimination; fluid/electrolyte and acid/base balance; sensory perception and comfort. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and comfort. 4. Idenify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contraindications, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22301 - Foundations Of Research And Evidence-Based Practice (UCC: IL)

Credit Hours: 3.00. Students gain foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. Students learn the principles of research process and identify strengths and limitations of research articles in relation to EBP in nursing and healthcare.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently to Information Literacy Competency Standards for Higher Education. 3. Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical practice. 5.

Examine economic, legal and ethical issues related to conducting research. Credits: 3.00

14 Credits

Spring 2nd Year

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

NUR 22001 - Essentials Of Nursing Practice II

Credit Hours: 5.00. Continues to expand on the professional nursing role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients in the clinical setting. 2. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 3. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 4. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 5. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 6. Identify client adaption and coping strategies when adjusting to changes along the health-wellness continuum. Credits: 5.00

NUR 22101 - Pathopharmocology II

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function and the pharmacotherapies utilized as treatment for alterations and disease states. This course builds on the learning objectives from Pathopharmacology I to provide the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe the primary regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 4. Identify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contradictions, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into the overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3. Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems.

12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

17 Credits

Fall 3rd Year

NUR 31401 - Health Alterations In Adults I

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of well-being as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in tissue integrity related to surgical interventions, cellular division, reproductive function, elimination, nutrition and sensory function that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision-making when caring for diverse populations of adults experiencing selected illnesses. 2. Utilize the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related (including gerontologic) pathophysiology when providing care to diverse populations of adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence- based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to client, client's family, and other members of the healthcare team. 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes. 10. Utilize patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31501 - Nursing Of Childbearing Families

Credit Hours: 5.00. Promotes the development of nursing skills when caring for families and their newborns during uncomplicated and/or complicated childbearing experiences within a variety of clinical settings. Emphasizes the study and application of the nursing process, integrating evidence based practice while meeting the health and safety needs of diverse childbearing families.

Learning Outcomes: 1. Integrate theory and evidence to guide nursing practice and clinical decision-making throughout the care of childbearing families. 2. Incorporate childbearing family participation throughout health promotion, disease prevention, and risk reduction processes. 3. Address the childbearing family's developmental,

physiologic, and psychological needs. 4. Assess ethical, legal, and sociocultural influences on resource utilization and compassionate maternal-child health care delivery. 5. Design targeted plans of care via a partnership with childbearing families, intra- and interprofessional teams, professional organizations, and institutions. 6. Utilize information technology to enhance learning, practice, and communication. Credits: 5.00

NUR 31601 - Integration Seminar I

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and obstetrical diagnoses. Through the course activities the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medical-surgical and obstetrical populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

15 Credits

Spring 3rd Year

NUR 31701 - Health Alterations In Adults II

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of wellbeing as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in health related to oxygenation, circulatory dynamics, endocrine regulation, neurological regulation, immune regulation and musculoskeletal dynamics that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision making when caring for diverse populations of adults experiencing selected illnesses. 2. Demonstrate appropriate use of the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related pathophysiology when providing care to adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence-based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to the client, client's family, and other members of the health care team 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes that emphasize client safety and evidence-based practice. 10. Use patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31801 - Psychiatric And Mental Health Nursing

Credit Hours: 5.00. Focuses on providing nursing care that supports mental health and the care of persons with mental

illness while providing a conceptual integration of the nursing process, theories, and research from the biopsychosocial sciences and humanities. Demonstrates the relevance of psychiatric-mental health nursing concepts to all areas of professional practice.

Learning Outcomes: 1. Examine the effects of myths, stereotypes, stigma, values, beliefs and culture on the practice of psychiatric nursing. 2. Compare past, current, and projected systems in delivery of evidence based mental health care and its social implications. 3. Identify legal and ethical implications involved in the practice of psychiatric mental health nursing. 4. Utilize the nursing process in the phases ofthe therapeutic nurse-client relationship to delineate the complex needs of clients with psychiatric disorders.. 5. Identify the principles of communication and therapeutic relationships in the care of clients with psychiatric disorders. 6. Determine specific nursing care interventions for acute and serious behavioral health issues that demonstrate developmentally and culturally appropriate strategies. 7. Utilize the ANA Standards of Psychiatric and Mental Health Nursing Practice as a basis for safe and competent care. 8. Incorporate theory, research and evidence from the psychobiological sciences, biological sciences, and humanities into an evidenced based practice approach to psychiatric nursing care. 9. Utilize client care technologies, information systems, and communication resources to access, organize and communicate information in a professional manner. 10. Establish therapeutic, collaborative relationships with members of the interdisciplinary treatment team. 11. Demonstrate personal and professional growth and skill development when providing evidence-based nursing care to clients with psychiatric disorders. Credits: 5.00

NUR 31901 - Integration Seminar II

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and psychiatric diagnoses. Through the course activities, the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medically and psychologically unstable populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

12 Credits

Fall 4th Year

NUR 41701 - Leadership In Nursing

Credit Hours: 3.00. Studies the components of nursing leadership and management functions with an emphasis on critical thinking, problem solving, communication, and team building within the context of experiential problem-based group projects. This course will provide specific practice and evaluation of strategic and financial planning, conflict management, delegation, and complex change. Competencies to be gained, at a novice level, include professional communication, sound ethical and legal judgments within personal and organizational frameworks, leadership skills in the management and evaluation of others, and an understanding of the drivers of healthcare change and finances.

Learning Outcomes: 1. Synthesize concepts of nursing leadership and management in relation to the role of the professional nurse, nurse leader, and manager in promoting safe and quality care. 2. Organize a quality improvement project by utilizing project management strategies, quality improvement principles, and evidence-based practices to promote system

changes in healthcare delivery. 3. Utilize concepts of professional communication, delegation, and evaluation of healthcare team members with an awareness of ethical, professional, social, and legal issues implicit to nursing leadership and management. 4. Describes economic, policy, social, and organizational factors that influence the professional nurse and healthcare systems. 5. Evaluate the impact of professional and unprofessional behaviors on healthcare delivery and professional interactions and presentations through knowledge of nursing standards of excellence. Credits: 3.00

NUR 41001 - Issues In Professional Nursing

Credit Hours: 2.00. Promotes the use of critical thinking, clinical reasoning, and active learning to analyze contemporary issues related to professional nursing practice. Issues and key trends surrounding social determinants of health policy and economics, regulatory agencies, political action, cultural diversity, practice competency, nursing informatics and ethics are used as a framework. Permission of department required.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Evaluate historical components and current nursing practice that impact healthcare systems. 3. Demonstrate understanding of the impact of local, state, national and global regulations on healthcare trends and healthcare policy. 4. Evaluate the impact that economic, political, cultural, and social concerns have on the role of professional nursing and the healthcare delivery system. 5. Articulate the value of pursuing practice excellence, life-long learning, engagement, self care, and resilience in professional nursing practice. 6. Utilize inquiry, analysis, information literacy, nursing informatics to address practice issues, ambiguity, and unpredictability in the healthcare systems. Credits: 2.00

NUR 42001 - Transition To Professional Nursing Practice

Credit Hours: 4.00. This course challenges students to use critical thinking and clinical reasoning to identify, prioritize and evaluate nursing interventions for clients with complex healthcare issues. Students interact with members of the healthcare team and clinical faculty to practice effective leadership, delegation and supervision of nursing students in clinical environments.

Learning Outcomes: 1. Apply sound clinical judgment, professional behavior, communication, collaboration and integration of best practice in clinical settings. Demonstrate/apply professional behavior, communication, collaboration and sound clinical judgment by integrating best practice in clinical settings. 2. Utilize the nursing process when caring for clients with complex healthcare needs. 3. Articulate the value of pursuing practice excellence, life-long learning, patient advocacy and engagement in professional nursing practice. 4. Demonstrate effective leadership, delegation and supervision when collaborating with members of the healthcare team. 5. Assume personal responsibility for professional growth. 6. Analyze system barriers that effect quality healthcare delivery in patients affected by complex conditions. Credits: 4.00

14-15 Credits

Spring 4th Year

NUR 41401 - Pediatric Nursing

Credit Hours: 5.00. Explores factors influencing the health and wellness of children and families. Students will apply principles, concepts and research from the health and human sciences to the care of children and families across the health-illness continuum. A structured clinical component focuses on clinical reasoning and evidence based practice. Students will provide family centered care to healthy, at risk and ill children across a variety of clinical settings.

Learning Outcomes: 1. Integrate family theories; growth and development; genomics;

environmental and psychosocial factors in the care of children across the health-illness continuum. 2. Integrate nursing concepts into evidence based nursing practice for children and families across a variety of health care settings. 3. Apply knowledge of information technologies to improve health outcomes of children and families. 4. Evaluate environmental and psychosocial risk factors for children and families. 5. Adapt nursing care to families, recognizing their diverse needs, ethnicity, culture, and values. 6. Evaluate the collaborative role of the nurse with other health care disciplines in the provision of comprehensive nursing care for healthy, at risk, and ill children. 7. Demonstrate a spirit of inquiry, responsibility and accountability within legal, ethical, professional and organizational parameters. Credits: 5.00

NUR 41501 - Public Health Nursing

Credit Hours: 5.00. Utilize health promotion, maintenance, education and disease prevention in coordinating and providing population-focused care to individuals, families and aggregates in the community. A variety of clinical settings are used to offer students a broad, comprehensive perspective of public health nursing, a field that synthesizes content from nursing, social and public health sciences. Collaboration with the community and implementation of population-focused interventions foster critical thinking and independent decision making in the delivery of nursing care.

Learning Outcomes: 1. Synthesize concepts, theories, knowledge and practice from nursing, social and public health sciences. 2. Examine the structure, function, and influence of historical, political, social, environmental, cultural, and ethical factors to the health of individuals, families, and communities. 3. Collaborate with interdisciplinary healthcare and human service providers to address the health needs of individuals, families, and communities. 4. Utilize principles, concepts, models, theories and research to guide culturally sensitive nursing care and public health practice of individuals, families, and communities. 5. Explore the delivery of public health nursing services to diverse and vulnerable populations. 6. Formulate client teaching strategies that address the principles of disease prevention and health promotion to clients across the lifespan. 7. Evaluate interventions implemented using community and family resources to address mutually identified health needs of clients. 8. Use principles of caseload management, in the delivery of safe, quality public health nursing services that reflect legal, ethical, and professional standards. 9. Apply national health objectives in planning interventions to meet the individual, system, and community level needs of diverse populations. 10.Utilize health care technology to improve health outcomes of individuals, families, and communities. 11.Integrate the role of advocacy into the delivery of care to individuals, families, and communities. Credits: 5.00

16 Credits

Program Learning Outcomes

Nutrition and Dietetics, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (99-107 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles,

policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10600 - Introduction To The Profession Of Dietetics

Credit Hours: 1.00. Overview of the dietetics profession, including standards, ethics, educational and employment opportunities, and professional credentialing. Spring semester offered only through distance learning.

Learning Outcomes: 1. Describe the profession of dietetics and future trends. 2. Recognize the education preparation needed to pursue careers in dietetics including different education models of becoming an entry-level dietitian. 3. Demonstrate knowledge of the supervised practice experience application process. 4. Identify the credentialing of dietetic practitioners. 5. Recognize the major professional organizations in dietetics such as the Academy of Nutrition and Dietetics, state affiliates and district dietetic associations, and dietetic practice groups and the roles of each. 6. Demonstrate the ability to develop a professional development portfolio, resume, and cover letter. 7. Develop an understanding of professionalism related to dietetics including interviewing skills, professional etiquette, professional ethics, and professional practice standards. 8. Develop skills for planning a career in dietetics such as self-assessment, goal setting, networking, job search strategies, and timeline establishment. Credits: 1.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 35000 - Dietetics Practicum In Quantity Food Production

Credit Hours: 1.00 to 3.00. Supervised on-the-job experience related to the food service management in health care facilities, schools, community programs, etc. Student is responsible for arrangement and approval of the experience through the supervising food service manager or dietitian and the course instructor. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge gained from coursework to actual work situations. 2. Develop skills related to management of food service. 3. Design and complete a project appropriate for a food service operation. Credits: 1.00 to 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood,

adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 41100 - Dietetics Career Planning

Credit Hours: 1.00. This course will prepare students to successfully apply and interview for dietetics supervised practice experience, jobs and graduate programs.

Learning Outcomes: 1. Students will prepare resumes, personal statements, and sample applications. 2. Students will use available resources to develop skills in interviewing. 3. Students will identify the steps and deadlines for applying to graduate school and supervised practice programs. Credits: 1.00

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the

cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 44200 - Foodservice Systems Management

Credit Hours: 3.00. Systems approach to foodservice management. Foodservice operations based on nutritional goals of the target market. Food sanitation and safety, management of human resources, and supervision. Emphasis on applications to health-care facilities.

Learning Outcomes: 1. Identify and describe the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 2. Apply management and business theories and principles to the development, marketing and delivery of programs or services. 3. Determine costs of services or operations, prepare a budget and interpret financial data. 4. Apply the principles of human resource management to different situations. 5. Apply safety principles related to food, personnel and consumers. Credits: 3.00

NUTR 48000 - Medical Nutrition Therapy I

Credit Hours: 4.00. Nutrition assessment in humans and introduction to the nutrition care process. Application of the nutrition care process to various disease states.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical evidence-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify nutrition-related problems for medical nutrition therapy. Credits: 4.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least

7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

HTM 31100 - Procurement Management For Foodservice

Credit Hours: 3.00. Identifies and describes food, supplies, and related merchandise used in the foodservice industry. Provides methods and criteria for recognizing quality, evaluating, specifying, purchasing, and inspecting these products. Discusses the use of technology in the purchasing component of the foodservice industry.

Learning Outcomes: 1. Explain foodservice procurement principles such as steps in the procurement process, procurement-menu relationship, quality standards, and vendor relations. 2. Explain factors impacting procurement decisions such as ethics, government regulations, global economic conditions, sustainability, distribution sales channels, technology, competitors, consumer behavior, and skills and knowledge of buyers. 3. Apply foodservice procurement principles, factors, and data analysis to formulate decisions related to product, quantity, price, supplier/producer/manufacturer, and inventory management. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes

an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of

Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical

processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and

behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the

community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

NUTR 12500 - Food Safety Certification And Career Development

Credit Hours: 1.00. Training in ServSafe food safety certification program.

Learning Outcomes: 1. Select appropriate food safety and sanitation practices according to ServSafe guidelines. 2. Assess professional development using resume and student portfolio. Credits: 1.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s)

to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Other Departmental/Program Course Requirements (4-6 credits)

Electives (7-17 credits)

Course Requirements & Notes

Supplemental List

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10600 - Introduction To The Profession Of Dietetics

Credit Hours: 1.00. Overview of the dietetics profession, including standards, ethics, educational and employment opportunities, and professional credentialing. Spring semester offered only through distance learning.

Learning Outcomes: 1. Describe the profession of dietetics and future trends. 2. Recognize the education preparation needed to pursue careers in dietetics including different education models of becoming an entry-level dietitian. 3. Demonstrate knowledge of the supervised practice experience application process. 4. Identify the credentialing of dietetic

practitioners. 5. Recognize the major professional organizations in dietetics such as the Academy of Nutrition and Dietetics, state affiliates and district dietetic associations, and dietetic practice groups and the roles of each. 6. Demonstrate the ability to develop a professional development portfolio, resume, and cover letter. 7. Develop an understanding of professionalism related to dietetics including interviewing skills, professional etiquette, professional ethics, and professional practice standards. 8. Develop skills for planning a career in dietetics such as self-assessment, goal setting, networking, job search strategies, and timeline establishment. Credits: 1.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the

application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature,

measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-19 Credits

Spring 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting

methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-17 Credits

Fall 2nd Year

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food,

nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.

13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

NUTR 12500 - Food Safety Certification And Career Development

Credit Hours: 1.00. Training in ServSafe food safety certification program.

Learning Outcomes: 1. Select appropriate food safety and sanitation practices according to ServSafe guidelines. 2. Assess professional development using resume and student portfolio. Credits: 1.00

17-18 Credits

Spring 2nd Year

HTM 31100 - Procurement Management For Foodservice

Credit Hours: 3.00. Identifies and describes food, supplies, and related merchandise used in the foodservice industry. Provides methods and criteria for recognizing quality, evaluating, specifying, purchasing, and inspecting these products. Discusses the use of technology in the purchasing component of the foodservice industry.

Learning Outcomes: 1. Explain foodservice procurement principles such as steps in the procurement process, procurement-menu relationship, quality standards, and vendor

relations. 2. Explain factors impacting procurement decisions such as ethics, government regulations, global economic conditions, sustainability, distribution sales channels, technology, competitors, consumer behavior, and skills and knowledge of buyers. 3. Apply foodservice procurement principles, factors, and data analysis to formulate decisions related to product, quantity, price, supplier/producer/manufacturer, and inventory management. Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be

familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

12-17 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication,

transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 35000 - Dietetics Practicum In Quantity Food Production

Credit Hours: 1.00 to 3.00. Supervised on-the-job experience related to the food service management in health care facilities, schools, community programs, etc. Student is responsible for arrangement and approval of the experience through the supervising food service manager or dietitian and the course instructor. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge gained from coursework to actual work situations. 2. Develop skills related to management of food service. 3. Design and complete a project appropriate for a food service operation. Credits: 1.00 to 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression

procedures, and understand correlation. Credits: 3.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

15-16 Credits

Spring 3rd Year

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related

problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

12-15 Credits

Fall 4th Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

NUTR 41100 - Dietetics Career Planning

Credit Hours: 1.00. This course will prepare students to successfully apply and interview for dietetics supervised practice experience, jobs and graduate programs.

Learning Outcomes: 1. Students will prepare resumes, personal statements, and sample applications. 2. Students will use available resources to develop skills in interviewing. 3. Students will identify the steps and deadlines for applying to graduate school and supervised practice programs. Credits: 1.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 48000 - Medical Nutrition Therapy I

Credit Hours: 4.00. Nutrition assessment in humans and introduction to the nutrition care process. Application of the nutrition care process to various disease states.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical evidence-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify nutrition-related problems for medical nutrition therapy. Credits: 4.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making.

2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

12-15 Credits

Spring 4th Year

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 44200 - Foodservice Systems Management

Credit Hours: 3.00. Systems approach to foodservice management. Foodservice operations based on nutritional goals of the target market. Food sanitation and safety, management of human resources, and supervision. Emphasis on applications to health-care facilities.

Learning Outcomes: 1. Identify and describe the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 2. Apply management and business theories and principles to the development, marketing and delivery of programs or services. 3. Determine costs of services or operations, prepare a budget and interpret financial data. 4. Apply the principles of human resource management to different situations. 5. Apply safety principles related to food, personnel and consumers. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

12-15 Credits

Nutrition Science, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (22-23 credits)

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities,

research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10700 - Introduction To Nutrition Science

Credit Hours: 1.00. An overview of professional opportunities for nutrition scientists. Introduces tools and resources available for becoming a nutrition scientist.

Learning Outcomes: 1. To identify and describe the current professional opportunities for nutrition scientists. 2. To comprehend the educational preparation necessary to pursue a career as a nutrition scientist. 3. To name and become knowledgeable about the functions of, and advantages of belonging to, major professional organizations in nutrition science such as the American Society of Nutrition. 4. To apply modern information technology to the problem of discovering scientifically valid nutrition science information. Credits: 1.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 39000 - Independent Undergraduate Research

Credit Hours: 1.00 to 3.00. Individual research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven

research projects. Credits: 1.00 to 3.00

NUTR 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for Honors College and Department of Nutrition Science Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 45300 - Food Chemistry

Credit Hours: 4.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Recognize and predict how chemical structures and reactions influence sensory and analytical properties of food. 3. Explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives, and evaluate the validity of health controversies related to these ingredients. 5. Design, execute, and explain (via oral and written reports) a food experiment using the scientific method. Credits: 4.00

NUTR 49000 - Independent Undergraduate Research

Credit Hours: 1.00 to 4.00. Independent research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 4.00

NUTR 49700 - Honors Research Project

Credit Hours: 1.00 to 3.00. The completion of the independent honors research project for Honors College and Department of Nutrition Science Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Learning Outcomes: 1. Demonstrate critical thinking skills in nutrition science. 2. Present and defend hypothesis-driven research project. Credits: 1.00 to 3.00

NUTR 49600 - Evaluation Of Nutrition Science Research

Credit Hours: 3.00. Evaluation of nutrition science research as it relates to health and disease.

Learning Outcomes: 1. Distinguish between data and interpretation through the practice of reading, analyzing, critiquing, and discussing nutrition science research articles. 2. Access and integrate the contribution of multiple research studies to an area of nutrition science rresearch and its impact on health and disease. 3. Explain, orally and in writing, the evaluation of nutrition science research. 4. Identify and assess the validity of sensational nutrition science research presented in media. Credits: 3.00

Other Departmental/Program Course Requirements (75-82 credits)

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that

illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate

subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and

non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results,

and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of

macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern

genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary

functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will

feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to

collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (15-23 credits)

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10700 - Introduction To Nutrition Science

Credit Hours: 1.00. An overview of professional opportunities for nutrition scientists. Introduces tools and resources available for becoming a nutrition scientist.

Learning Outcomes: 1. To identify and describe the current professional opportunities for nutrition scientists. 2. To comprehend the educational preparation necessary to pursue a career as a nutrition scientist. 3. To name and become knowledgeable about the functions of, and advantages of belonging to, major professional organizations in nutrition science such as the American Society of Nutrition. 4. To apply modern information technology to the problem of discovering scientifically valid nutrition science information. Credits: 1.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide

constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data,

statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory

practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14 Credits

Fall 2nd Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including

experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological

function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

14 Credits

Spring 2nd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic

concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and

metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

16-17 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding

of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful

for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

15 Credits

Spring 3rd Year

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic

probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

15 Credits

Fall 4th Year

NUTR 39000 - Independent Undergraduate Research

Credit Hours: 1.00 to 3.00. Individual research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for Honors College and Department of Nutrition Science Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 45300 - Food Chemistry

Credit Hours: 4.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Recognize and predict how chemical structures and reactions influence sensory and analytical properties of food. 3. Explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives, and evaluate the validity of health controversies related to these ingredients. 5. Design, execute,

and explain (via oral and written reports) a food experiment using the scientific method. Credits: 4.00

NUTR 49000 - Independent Undergraduate Research

Credit Hours: 1.00 to 4.00. Independent research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 4.00

NUTR 49700 - Honors Research Project

Credit Hours: 1.00 to 3.00. The completion of the independent honors research project for Honors College and Department of Nutrition Science Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Learning Outcomes: 1. Demonstrate critical thinking skills in nutrition science. 2. Present and defend hypothesis-driven research project. Credits: 1.00 to 3.00

12-17 Credits

Spring 4th Year

NUTR 49600 - Evaluation Of Nutrition Science Research

Credit Hours: 3.00. Evaluation of nutrition science research as it relates to health and disease.

Learning Outcomes: 1. Distinguish between data and interpretation through the practice of reading, analyzing, critiquing, and discussing nutrition science research articles. 2. Access and integrate the contribution of multiple research studies to an area of nutrition science rresearch and its impact on health and disease. 3. Explain, orally and in writing, the evaluation of nutrition science research. 4. Identify and assess the validity of sensational nutrition science research presented in media. Credits: 3.00

13-18 Credits

Nutrition, Fitness, and Health, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (34 credits)

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the

""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate

the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 48800 - Topics In Nutrition, Fitness, And Health

Credit Hours: 3.00. This course critically evaluates the interrelationships between nutrition and exercise and their impact on physical performance and health. Concepts combining nutritional sciences and exercise physiology will be presented. Emerging science and controversies in the current literature will be discussed.

Learning Outcomes: 1. Value the integration of nutrition and exercise for human health promotion, especially related to dietary macronutrients and energy. 2. Discuss current controversial topics in nutrition and fitness and special topics. 3. Practice scientific literature searching, critical evaluation and interpretation of research, technical and scientific writing, and oral communication skills. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

Other Departmental/Program Course Requirements (66-75 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

HK 42100 - Health Screening And Fitness Evaluation And Design

Credit Hours: 3.00. This course provides the learner with the knowledge and skills to successfully administer and interpret the results of health evaluations and fitness assessments for the purposes of analysis and the development of individualized exercise programs.

Learning Outcomes: 1. Apply specific physiological principles to individual physical health prescription: Cardiovascular Health, Body Composition, Posture, Muscular Strength,

Muscular Endurance, Flexibility, ROM. 2. Explain verbally identified fitness assessment tests as would to a client indicating what, why, and how they are each performed. 3. Administer pre-exercise screening questionnaire/informed consent and identify needs for a medical clearance. 4. Administer accurately identified fitness assessment tests to a client and classify results. Credits: 3.00

HK 42200 - Basic Concepts In Exercise Program Design

Credit Hours: 3.00. Introduces basic program design concepts and rationale to design fitness programs for healthy adults emphasizing cardiovascular training, strength training, flexibility training, and balance.

Learning Outcomes: 1. Design and implement a safe and effective warm up and cool down protocol specific to the individual. 2. Create and implement well-planned, individualized, and progressive resistance training programs. 3. Develop progressive and individualized cardiovascular training programs. 4. Describe the role of exercise in healthy weight management. 5. Apply the scientific concepts to design exercise programs to improve athletic performance and optimize fitness in non-athlete healthy persons. Credits: 3.00

HK 46800 - Advanced Exercise Physiology II

Credit Hours: 3.00. An advanced undergraduate course in the area of exercise and human performance. Further examination of the physiological mechanisms and theories involved in the exercise response.

Credits: 3.00

HK 46900 - Exercise Testing And Prescription In Special Populations

Credit Hours: 3.00. Examines responses to exercise testing and prescription in healthy adults compared to exercise responses and special considerations for individuals with chronic diseases and conditions and issues of concern to pregnant women, children, and older adults, among others.

Learning Outcomes: 1. Identify the difference in testing and prescription for individuals with chronic conditions. 2. Evaluate critically the risks and benefits associated with exercise participation. 3. Apply appropriate emergency procedures in various exercise settings. 4. Deliver unique exercise programs to special populations. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course

students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12.

Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students

demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods,

solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations

in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical

and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (11-20 credits)

Supplemental List

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course

produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription,

protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to

construct arguments related to real-world issues. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in

lecture. Credits: 1.00

14-18 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

13-17 Credits

Fall 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and

maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to

understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

16-17 Credits

Spring 2nd Year

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of

Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations,

perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

14-16 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

12-13 Credits

Spring 3rd Year

HK 42100 - Health Screening And Fitness Evaluation And Design

Credit Hours: 3.00. This course provides the learner with the

knowledge and skills to successfully administer and interpret the results of health evaluations and fitness assessments for the purposes of analysis and the development of individualized exercise programs.

Learning Outcomes: 1. Apply specific physiological principles to individual physical health prescription: Cardiovascular Health, Body Composition, Posture, Muscular Strength, Muscular Endurance, Flexibility, ROM. 2. Explain verbally identified fitness assessment tests as would to a client indicating what, why, and how they are each performed. 3. Administer pre-exercise screening questionnaire/informed consent and identify needs for a medical clearance. 4. Administer accurately identified fitness assessment tests to a client and classify results. Credits: 3.00

HK 46800 - Advanced Exercise Physiology II

Credit Hours: 3.00. An advanced undergraduate course in the area of exercise and human performance. Further examination of the physiological mechanisms and theories involved in the exercise response.

Credits: 3.00

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

17 Credits

Fall 4th Year

HK 42200 - Basic Concepts In Exercise Program Design

Credit Hours: 3.00. Introduces basic program design concepts and rationale to design fitness programs for healthy adults emphasizing cardiovascular training, strength training, flexibility training, and balance.

Learning Outcomes: 1. Design and implement a safe and effective warm up and cool down protocol specific to the individual. 2. Create and implement well-planned, individualized, and progressive resistance training programs. 3. Develop progressive and individualized cardiovascular training programs. 4. Describe the role of exercise in healthy weight management. 5. Apply the scientific concepts to design exercise programs to improve athletic performance and optimize fitness in non-athlete healthy persons. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 48800 - Topics In Nutrition, Fitness, And Health

Credit Hours: 3.00. This course critically evaluates the interrelationships between nutrition and exercise and their impact on physical performance and health. Concepts combining nutritional sciences and exercise physiology will be presented. Emerging science and controversies in the current literature will be discussed.

Learning Outcomes: 1. Value the integration of nutrition and exercise for human health promotion, especially related to dietary macronutrients and energy. 2. Discuss current controversial topics in nutrition and fitness and special topics. 3. Practice scientific literature searching, critical evaluation and interpretation of research, technical and scientific writing, and oral communication skills. Credits: 3.00

13 Credits

Spring 4th Year

HK 46900 - Exercise Testing And Prescription In Special Populations

Credit Hours: 3.00. Examines responses to exercise testing and prescription in healthy adults compared to exercise responses and special considerations for individuals with chronic diseases and conditions and issues of concern to pregnant women, children, and older adults, among others.

Learning Outcomes: 1. Identify the difference in testing and prescription for individuals with chronic conditions. 2. Evaluate critically the risks and benefits associated with exercise participation. 3. Apply appropriate emergency procedures in various exercise settings. 4. Deliver unique exercise programs to special populations. Credits: 3.00

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to

demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

13-17 Credits

Occupational and Environmental Health Sciences, BS

About the Program

Degree Requirements

Departmental/Major Course Requirements (93-94 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place,

and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

HSCI 34600 - Industrial Hygiene Engineering Control

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Describe/understand different approaches for controlling exposures in the occupational environment, and give hypothetical and real situations in terms of the best control methods. 2. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a complete ventilation

system. 3. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 4. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to prevent it in the workplace. 5. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 6. Synthesize and apply knowledge of the IH paradigm (AREC) in analyzing practical industrial hygiene/occupational health problems. Credits: 4.00

HSCI 34800 - Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. Sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Explain the rationale of the sampling strategy. 2. Perform basic sampling procedures for certain gases, vapors, particulates, noise, and heat, including proper selection, set-up, and operation of equipment. 3. Summarize the basic principles of the sampling procedures and explain why they function as they do. 4. Describe the limitations of sampling and analysis in real-world situations and how to deal with them. 5. Collect, analyze, interpret, and summarize laboratory data into a well-written report. 6. Describe the advantages as well as the difficulties of working together on a team. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal,

and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting

and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12.

Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to

use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.
Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system.

Credits: 4.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in

public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 58000 - Occupational Biomechanics And Ergonomics

Credit Hours: 2.00. Occupational safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. Occupational ergonomics is a branch of science that focuses on optimizing the relationships between workers and their work environment. This course focuses on the principles and applications of safety and ergonomics as it applies to workers. The first part of the course will consist of lectures on the fundamentals of safety standards and liability and the development of work-related musculoskeletal disorders, ergonomic risk factors including work practices, tools and workstation design. The last part will consist of identification and use of safety and ergonomic controls to reduce and prevent work-related fatalities, injuries, and musculoskeletal disorders.

Learning Outcomes: 1. Describe ergonomic risk factors in the workplace. 2. Analyze work stations and identify ergonomic risk factors. 3. Develop solutions to minimize identified ergonomic risk factors. 4. Describe cumulative trauma disorders which may occur due to exposure to poor ergonomic conditions. 5. Explain how people perceive & understand information, and use this knowledge to improve work flow. Credits: 2.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

HSCI 11000 - Careers And Research In Occupational And Environmental Health

Credit Hours: 1.00. The goal of this course is to familiarize students to the variety of research and careers available within the broad field of environmental and occupational health. The course will focus on two areas: current research in occupational and environmental health and careers in occupational and environmental health. This content will be delivered through interactive lectures and discussions with a variety of guest speakers as well as HSCI faculty. Advice and guidance on applying for internships/jobs in the field will also be provided. A highlight of the event is a student/professional networking event which will be coordinated towards the end of the program.

Learning Outcomes: 1. Understand and apply key terms within occupational and environmental health. 2. Describe current research in occupational and environmental health. 3. Describe the extent and variety of careers available in occupational and environmental health. 4. Deliver an oral presentation about a contemporary issue in occupational and environmental health. Credits: 1.00

HSCI 35300 - Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and frontline employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. This

course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the frontline employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the frontline employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the frontline employees and upper management together in their vision of a safe and healthy workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. 6. Demonstrate group and team building strategies as it relates to health and safety. Credits: 3.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 55300 - Advanced Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization, protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front line employees. As such, the successful health and safety manager needs to skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the front line employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the front line employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the front line employees and upper management together in their vision of a safe and health workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. Credits: 3.00

HSCI 44400 - Exposure Assessment In OEHS

Credit Hours: 3.00. Exposure assessment is an essential component of Environmental Health Science and industrial hygiene. This course provides students basic scientific knowledge of exposure assessment, with emphasis on practical aspects of exposure science, including study design, data and measurement collection, data analysis, and results interpretation and presentation. Course topics include major exposure media and pathways (air, water, food, soil, etc.) and

important exposure routes (inhalation, ingestion, dermal absorption); exposure measurement and assessment; strengths and weaknesses of various exposure assessment techniques, how to link exposure assessment with environmental health, and human subject research in exposure studies. The course includes case studies and group projects. Students are expected to develop entry-level skills for designing exposure studies applicable to human exposure monitoring, epidemiologic investigations and health risk assessment.

Learning Outcomes: 1. Describe basic components of exposure assessment studies. 2. Design a study to conduct basic assessments of exposure to chemical hazards at workplace or in a community setting. 3. Obtain and analyze existing data, collect and analyze measurement data, prepare technical reports, and present results. 4. Discuss ethical and professional responsibilities in exposure studies. 5. Function effectively on a team that identify, evaluate and solve problems related to exposures in occupational and environmental settings. Credits: 3.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in

the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 3.00

HSCI 58001 - Occupational Biomechanics And Ergonomics Laboratory

Credit Hours: 1.00. This course will be the laboratory component for HSCI 58000. Occupational Biomechanics and Ergonomics. Laboratory exercises will accompany and illustrate each topic discussed during the lecture course. An ergonomic project will allow the students to evaluate an individual performing a job and provide ergonomic recommendations to improve the work situation. The course will also emphasize report writing, teamwork, and communication skills.

Learning Outcomes: 1. Evaluate scientific literature to identify the strengths & weaknesses of study designs, interpretation of results, and implications for the future. 2. Display techniques for performing ergonomic measurements. 3. Evaluate ergonomic hazards of the workplace and make recommendations to correct the identified hazards. 4. Write professional quality reports summarizing laboratory procedures, clearly display experiment results, and interpret those results in the context of the principles learned in the HSCI 58000 lectures. Credits: 1.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Other Departmental/Program Course Requirements (18-19 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least

7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

Electives (7-9 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course

includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes

such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications

related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

HSCI 11000 - Careers And Research In Occupational And Environmental Health

Credit Hours: 1.00. The goal of this course is to familiarize students to the variety of research and careers available within the broad field of environmental and occupational health. The course will focus on two areas: current research in occupational and environmental health and careers in occupational and environmental health. This content will be delivered through interactive lectures and discussions with a variety of guest speakers as well as HSCI faculty. Advice and guidance on applying for internships/jobs in the field will also be provided. A highlight of the event is a student/professional networking event which will be coordinated towards the end of the program.

Learning Outcomes: 1. Understand and apply key terms within occupational and environmental health. 2. Describe current research in occupational and environmental health. 3. Describe the extent and variety of careers available in occupational and environmental health. 4. Deliver an oral presentation about a contemporary issue in occupational and environmental health. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Fall 2nd Year

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally

related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of

concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

16 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate

the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

14 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the

structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HSCI 35300 - Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and frontline employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the frontline employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the frontline employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the frontline employees and upper management together in their vision of a safe and healthy workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. 6. Demonstrate group and team building strategies as it relates to health and safety. Credits: 3.00

HSCI 55300 - Advanced Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization,

protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front line employees. As such, the successful health and safety manager needs to skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the front line employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the front line employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the front line employees and upper management together in their vision of a safe and health workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. Credits: 3.00

16 Credits

Spring 3rd Year

HSCI 34800 - Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. Sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Explain the rationale of the sampling strategy. 2. Perform basic sampling procedures for certain gases, vapors, particulates, noise, and heat, including proper selection, set-up, and operation of equipment. 3. Summarize the basic principles of the sampling procedures and explain why they function as they do. 4. Describe the limitations of sampling and analysis in real-world situations and how to deal with them. 5. Collect, analyze, interpret, and summarize laboratory data into a well-written report. 6. Describe the advantages as well as the difficulties of working together on a team. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to

assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 3.00

13 Credits

Fall 4th Year

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 58000 - Occupational Biomechanics And Ergonomics

Credit Hours: 2.00. Occupational safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. Occupational ergonomics is a branch of science that focuses on optimizing the relationships between workers and their work environment. This course focuses on the principles and applications of safety and ergonomics as it applies to workers. The first part of the course will consist of lectures on the fundamentals of safety standards and liability and the development of work-related musculoskeletal disorders, ergonomic risk factors including work practices, tools and workstation design. The last part will consist of identification and use of safety and ergonomic controls to reduce and prevent work-related fatalities, injuries, and musculoskeletal disorders.

Learning Outcomes: 1. Describe ergonomic risk factors in the workplace. 2. Analyze work

stations and identify ergonomic risk factors. 3. Develop solutions to minimize identified ergonomic risk factors. 4. Describe cumulative trauma disorders which may occur due to exposure to poor ergonomic conditions. 5. Explain how people perceive & understand information, and use this knowledge to improve work flow. Credits: 2.00

HSCI 58001 - Occupational Biomechanics And Ergonomics Laboratory

Credit Hours: 1.00. This course will be the laboratory component for HSCI 58000. Occupational Biomechanics and Ergonomics. Laboratory exercises will accompany and illustrate each topic discussed during the lecture course. An ergonomic project will allow the students to evaluate an individual performing a job and provide ergonomic recommendations to improve the work situation. The course will also emphasize report writing, teamwork, and communication skills.

Learning Outcomes: 1. Evaluate scientific literature to identify the strengths & weaknesses of study designs, interpretation of results, and implications for the future. 2. Display techniques for performing ergonomic measurements. 3. Evaluate ergonomic hazards of the workplace and make recommendations to correct the identified hazards. 4. Write professional quality reports summarizing laboratory procedures, clearly display experiment results, and interpret those results in the context of the principles learned in the HSCI 58000 lectures. Credits: 1.00

15 Credits

Spring 4th Year

HSCI 34600 - Industrial Hygiene Engineering Control

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Describe/understand different approaches for controlling exposures in the occupational environment, and give hypothetical and real situations in terms of the best control methods. 2. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a complete ventilation system. 3. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 4. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to prevent it in the workplace. 5. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 6. Synthesize and apply knowledge of the IH paradigm (AREC) in analyzing practical industrial hygiene/occupational health problems. Credits: 4.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real

situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 4.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 44400 - Exposure Assessment In OEHS

Credit Hours: 3.00. Exposure assessment is an essential component of Environmental Health Science and industrial hygiene. This course provides students basic scientific knowledge of exposure assessment, with emphasis on practical aspects of exposure science, including study design, data and measurement collection, data analysis, and results interpretation and presentation. Course topics include major exposure media and pathways (air, water, food, soil, etc.) and important exposure routes (inhalation, ingestion, dermal absorption); exposure measurement and assessment; strengths and weaknesses of various exposure assessment techniques, how to link exposure assessment with environmental health, and human subject research in exposure studies. The course includes case studies and group projects. Students are expected to develop entry-level skills for designing exposure studies applicable to human exposure monitoring, epidemiologic investigations and health risk assessment.

Learning Outcomes: 1. Describe basic components of exposure assessment studies. 2. Design a study to conduct basic assessments of exposure to chemical hazards at workplace or in a community setting. 3. Obtain and analyze existing data, collect and analyze measurement data, prepare technical reports, and present results. 4. Discuss ethical and professional responsibilities in exposure studies. 5. Function effectively on a team that identify, evaluate and solve problems related to exposures in occupational and environmental settings. Credits: 3.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and

how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

14-15 Credits

Organizational Leadership, BS

About the Program

Degree Requirements

Department/Program Major Courses (57 credits)

OLS 48700 - Leadership Philosophy

Credit Hours: 3.00. A review of current managerial, education, and development theories and practices; discussions of fundamental social, economic, and political changes affecting business and the art of managing; implications of these changes for individual development and continued growth.

Learning Outcomes: 1. Discuss disparate texts/writings on leadership from different eras and cultures. 2. Exhibit familiarity with a philosophical approach to studying leadership. 3. Explain a personal leadership philosophy. Credits: 3.00

OLS 48400 - Leadership Strategies For Quality And Productivity

Credit Hours: 3.00. A study of how organizational leaders create an environment conducive to high levels of employee self-motivation, quality, and productivity (TQM). Actual case situations are used to illustrate the application of course content.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

OLS 47700 - Conflict Management

Credit Hours: 3.00. A study of the methods for dealing with innerpersonal, interpersonal, and political disputes by means generally outside the traditional court system. Students will investigate the theoretical and practical aspects of conflict assessment, negotiation, problem solving, mediation, and arbitration.

Learning Outcomes: 1. Interpret and summarize major conflict management concepts. 2. Apply course conflict management concepts to new situations and real-world applications. 3. Assess conflict situations and apply appropriate methods to mitigate conflict. 4. Demonstrate ability to handle difficult people and situations. Credits: 3.00

OLS 45400 - Gender And Diversity In Management

Credit Hours: 3.00. Today's workforce is composed of employees with a variety of individual differences, including race, gender, LGBTQ+, culture, national origin, mental and physical disabilities and age. This course will use the knowledge of diversity, equity, inclusion and ethical responsibilities to develop effective leadership.

Learning Outcomes: 1. Define managing diversity, valuing diversity and affirmative action. 2. Compare American cultural values with non-American cultural values. 3. Describe the major diversity issues, including inclusion, equity and ethical responsibilities, encountered in the workplace. 4. Explain how federal anti-discrimination laws affect the management of diversity and ethical responsibilities. 5. Describe how leaders can effectively manage diversity, inclusion, equity and ethical responsibilities. 6. List the major components of a diversity/inclusion program. Credits: 3.00

OLS 45000 - Advanced Project Management

Credit Hours: 3.00. An introduction to project management concepts and practices in the context of human resource development projects.

Learning Outcomes: 1. Apply the Project Management Institute's methodology to plan a project in the training and development field. 2. Apply instructional development methodology. Credits: 3.00

OLS 38800 - Leadership Through Teams

Credit Hours: 3.00. The group process, team development and exploration of dynamics that impact group and team performance.

Learning Outcomes: 1. Identify various principles and theories of group dynamics. 2. Plan and lead effective meetings. 3. Provide opportunities to become skilled participant-observers of team processes. 4. Demonstrate the behavior of the team leader and team members in molding work groups into high performance teams. 5. Demonstrate the process of human communications in small group context. 6. Use communication skills to more competently solve problems in task-oriented groups. 7. Use personal knowledge and interpersonal skills in dealing with people in all group types. 8. Analyze and comprehend why teams are functional or dysfunctional. Credits: 3.00

OLS 38600 - Leadership For Organizational Change

Credit Hours: 3.00. Introduction to and overview of fundamental concepts of leading organizational change. Topics include setting the stage for organizational change, implementing organizational change, sustaining organizational change, and the role of the change manager. Concepts and frameworks taught in this course are applicable to change at multiple scales from small enterprises and large corporations to communities and ecosystems.

Learning Outcomes: 1. Identify organizational culture and transformation readiness. 2. Apply various change management frameworks to leading organizational change. 3. Understand the role organizational culture plays in change and transformation. 4. Identify the effect of technological change on organizations, communities, and society. 5. Develop and apply a change management framework. Credits: 3.00

OLS 37800 - Labor And Management Relations

Credit Hours: 3.00. An introduction to, and overview of, the fundamental concepts of labor relations, collective bargaining, and dispute resolution procedures. An international comparative analysis is used to assess some of the legal, economic, and political structures of labor relations.

Credits: 3.00

OLS 37500 - Training Methods

Credit Hours: 3.00. Principles, practices, and methods of employee training. Introduction to systematic training program design, development, and evaluation. Emphasis is on the supervisor as a trainer.

Learning Outcomes: 1. Define the role training and development plays in sustaining a competitive advantage across the full array of modern organizations. 2. Explain how training is a systemic process and how it relates to the overall leadership, supervision, and human resource management system of an organization. 3. Describe the purpose and scope of a training needs assessment and plan, including its key components in designing

training systems in leadership, supervision, and human resource management system of an organization. 4. Compare and contrast various training delivery methods, citing advantages and disadvantages of each. 5. Describe the essential principles of adult learning and intervention evaluation in developing and designing a training program in leadership, supervision, and human resource management system of an organization. Credits: 3.00

OLS 34600 - Critical Thinking And Ethics

Credit Hours: 3.00. A course in complex problem solving and creative thinking with an emphasis on the ethical impacts of these solutions.

Learning Outcomes: 1. Define various approaches to the study of ethics in leadership. 2. Recognize and apply laws and regulations that affect ethical behavior in business and industry. 3. Work through processes to better identify what are real problems and perceived problems. 4. Use various techniques to ensure the real problem is identified and generate solutions. 5. Relate methods and concepts learned to new situations in order to solve problems. 6. Identify necessary steps to evaluate and implement solutions. 7. Develop individual problem solving and analytical skills. 8. Identify ethical, legal, and global challenges facing organizational leaders. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a

culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model; total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

TLI 45800 - Leadership For Competitive Advantage

Credit Hours: 3.00. Organizations who consistently outperform competitors realize bottom-line impact through efficient leveraging of organizational strategy, leadership, internal and external talent acquisition, organizational culture, and marketing strategies. This course will explore the relationships between these areas and introduce organizational tools and concepts to enable the student to recognize and build capacity for sustainable competitive advantage in technology organizations.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

OLS 58300 - Coaching And Mentoring In Organizations

Credit Hours: 3.00. This course explores issues and practices in technologically-driven organizations pertaining to the roles and functions that coaching and mentoring play in employee development. A "best practices" approach, utilizing the case method, is emphasized. Presented from the point of view of a human resource manager/leader, the focus of the course is on identifying coaching opportunities, enhancing communication skills, developing and implementing coaching and mentoring strategies, and evaluating the outcomes of these strategies. Attention is directed to facilitating personal coaching mentoring skills. Course may be offered in traditional, distance, or blended format. Permission of department required.

Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

TLI 31500 - New Product Development

Credit Hours: 3.00. This course introduces the process of technological innovation and new product development from concept to commercialization. Topics covered include ideation,

R&D, prototyping (design and modeling), testing for quality, the patent process, intellectual property rights, marketing and cost evaluation.

Learning Outcomes: 1. Describe the process of innovation as it relates to new product development. 2. Identify quality standards and testing procedures for new products. 3. Describe the patent process. 4. Explain methods for protecting domestic and international intellectual property rights. 5. Describe the process for conducting market research. Credits: 3.00

TECH 34000 - Prototyping Technology For People

Credit Hours: 3.00. Innovating in our complex world requires us to think strategically and make the best decisions possible for both designing and business development. Accordingly, this unique course brings together perspectives from technology and business management to iteratively prototype innovative solutions to student-selected problems. This process will include creating prototypes in a variety of media, using the appropriate methods/tools, as well as exploring the processes and biases related to how people process information and make decisions. This type of work will help to guide the innovation process by gaining insights from testing prototypes and interacting with people to deepen one's understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. At the conclusion of the course, students will pitch a viable design solution and business model for a validated problem to a variety of potential investors and/or stakeholders. Note: This class engages the material in both the classroom and innovation labs. Students of all levels of experience, will explore tools/programs related to computer aided design, 3D printing, app development, and digital prototyping.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to develop prototypes in a variety of media (digital and/or physical) for the level of fidelity necessary to communicate, understand, and test innovative ideas/designs. 3. Select and use appropriate methods/tools/equipment to make decisions and prototype innovative ideas. 4. Revise designs to reflect a deepening understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. 5. Pitch a viable design solution/business model for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

TLI 10000 - Organizational Leadership Career Orientation

Credit Hours: 1.00. In this course students are introduced to potential organizational leadership-related career paths. Topics include introduction to organizational leadership careers, self-assessment and career alignment, and networking and professional development.

Learning Outcomes: 1. Define various organizational leadership-related career paths. 2. Apply self-assessment techniques to identify personal strengths and areas for development. 3. Examine the role of professional networks in careers. Credits: 1.00

TLI 20000 - Organization Leadership Career Exploration

Credit Hours: 1.00. In this course students continue their exploration of organizational leadership-related career opportunities. Topics include resume building and internship search strategies, interview skills and professional etiquette, and identifying and securing internships.

Learning Outcomes: 1. Apply resume-building strategies to highlight organizational leadership experiences. 2. Create a professional digital presence through relevant platforms. 3. Evaluate the impact of experiential learning on personal and professional development. Credits: 1.00

TLI 30000 - Organizational Leadership Career Transition

Credit Hours: 1.00. In this course students prepare to make the transition from organizational leadership students to organizational leadership professionals. Topics include career planning and advancement, professional networking and relationship building, and transitioning successfully from college to career.

Learning Outcomes: 1. Demonstrate career planning and advancement strategies. 2. Apply effective networking strategies for professional growth. 3. Synthesize achievements into a

professional portfolio for presentation. Credits: 1.00

Other Departmental Courses (54-55 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and

interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 33000 - Technology And The Global Society

Credit Hours: 3.00. The intersection of technology, globalization, and society is at the core of this course. Students examine socio-cultural issues related to the development and use of technology across intercultural contexts, explore perspectives and principles behind global technology influences, and examine the complexities and ethical nuances of technology and innovation.

Learning Outcomes: 1. Reflect on the perceptions of cultural norms, interactions, gender roles, societal ethics, and religions in order to examine their potential impact on industry and society. 2. Evaluate digital media and socio-cultural information sources to predict their influence on individual and social interactions and perspectives. 3. Conduct formal and informal reflections about oneself and others, manage one's emotions in situations of differences, and apply techniques to bridge cultural differences. 4. Assess worldwide technology needs by examining global efforts, innovations, and issues that impact contemporary society. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate

effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of

accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

TECH 22000 - Designing Technology For People

Credit Hours: 3.00. Innovating in our complex world requires understanding people and the issues and challenges they face. This unique course brings together perspectives from technology and anthropology to address this by exploring ethnographic studies of people and technology interactions. Through this process, students will practice the problem scoping skills necessary to identify and define problems and begin to generate appropriate design solutions. In addition, students will learn how to observe and talk with people about technology and discuss a range of ways people use technology. Accordingly, the course will focus on human-centered design and how to empathize with people during the design process. This will allow students to learn how to identify opportunities for innovation that emerge when designers carefully observe and listen to humans using technology and/or experiencing problems with current technology. Note: This class engages the material in both the classroom and innovation labs.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (8-9 credits)

Supplemental List

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 10000 - Organizational Leadership Career Orientation

Credit Hours: 1.00. In this course students are introduced to potential organizational leadership-related career paths. Topics include introduction to organizational leadership careers, self-assessment and career alignment, and networking and professional development.

Learning Outcomes: 1. Define various organizational leadership-related career paths. 2. Apply self-assessment techniques to identify personal strengths and areas for development. 3. Examine the role of professional networks in careers. Credits: 1.00

16-17 Credits

Spring 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish

and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Fall 2nd Year

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 22000 - Designing Technology For People

Credit Hours: 3.00. Innovating in our complex world requires understanding people and the issues and challenges they face. This unique course brings together perspectives from technology and anthropology to address this by exploring ethnographic studies of people and technology interactions. Through this process, students will practice the problem scoping skills necessary to identify and define problems and begin to generate appropriate design solutions. In addition, students will learn how to observe and talk with people about technology and discuss a range of ways people use technology. Accordingly, the course will focus on human-centered design and how to empathize with people during the design process. This will allow students to learn how to identify opportunities for innovation that emerge when designers carefully observe and listen to humans using technology and/or experiencing problems with current technology. Note: This class engages the material in both the classroom and innovation labs.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

15 Credits

Spring 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

OLS 38600 - Leadership For Organizational Change

Credit Hours: 3.00. Introduction to and overview of fundamental concepts of leading organizational change. Topics include setting the stage for organizational change, implementing organizational change, sustaining organizational change, and the role of the change manager. Concepts and frameworks taught in this course are applicable to change at multiple scales from small enterprises and large corporations to communities and ecosystems.

Learning Outcomes: 1. Identify organizational culture and transformation readiness. 2. Apply various change management frameworks to leading organizational change. 3. Understand the role organizational culture plays in change and transformation. 4. Identify the effect of technological change on organizations, communities, and society. 5. Develop and apply a change management framework. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

TLI 20000 - Organization Leadership Career Exploration

Credit Hours: 1.00. In this course students continue their exploration of organizational leadership-related career opportunities. Topics include resume building and internship search strategies, interview skills and professional etiquette, and identifying and securing internships.

Learning Outcomes: 1. Apply resume-building strategies to highlight organizational leadership experiences. 2. Create a professional digital presence through relevant platforms. 3. Evaluate the impact of experiential learning on personal and professional development. Credits: 1.00

16 Credits

Fall 3rd Year

OLS 37500 - Training Methods

Credit Hours: 3.00. Principles, practices, and methods of employee training. Introduction to systematic training program design, development, and evaluation. Emphasis is on the supervisor as a trainer.

Learning Outcomes: 1. Define the role training and development plays in sustaining a competitive advantage across the full array of modern organizations. 2. Explain how training is a systemic process and how it relates to the overall leadership, supervision, and human

resource management system of an organization. 3. Describe the purpose and scope of a training needs assessment and plan, including its key components in designing training systems in leadership, supervision, and human resource management system of an organization. 4. Compare and contrast various training delivery methods, citing advantages and disadvantages of each. 5. Describe the essential principles of adult learning and intervention evaluation in developing and designing a training program in leadership, supervision, and human resource management system of an organization. Credits: 3.00

TECH 33000 - Technology And The Global Society

Credit Hours: 3.00. The intersection of technology, globalization, and society is at the core of this course. Students examine socio-cultural issues related to the development and use of technology across intercultural contexts, explore perspectives and principles behind global technology influences, and examine the complexities and ethical nuances of technology and innovation.

Learning Outcomes: 1. Reflect on the perceptions of cultural norms, interactions, gender roles, societal ethics, and religions in order to examine their potential impact on industry and society. 2. Evaluate digital media and socio-cultural information sources to predict their influence on individual and social interactions and perspectives. 3. Conduct formal and informal reflections about oneself and others, manage one's emotions in situations of differences, and apply techniques to bridge cultural differences. 4. Assess worldwide technology needs by examining global efforts, innovations, and issues that impact contemporary society. Credits: 3.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

TLI 31500 - New Product Development

Credit Hours: 3.00. This course introduces the process of technological innovation and new product development from concept to commercialization. Topics covered include ideation, R&D, prototyping (design and modeling), testing for quality, the patent process, intellectual property rights, marketing and cost evaluation.

Learning Outcomes: 1. Describe the process of innovation as it relates to new product development. 2. Identify quality standards and testing procedures for new products. 3. Describe the patent process. 4. Explain methods for protecting domestic and international intellectual property rights. 5. Describe the process for conducting market research. Credits: 3.00

TECH 34000 - Prototyping Technology For People

Credit Hours: 3.00. Innovating in our complex world requires us to think strategically and make the best decisions possible for both designing and business development. Accordingly, this unique course brings together perspectives from technology and business management to iteratively prototype innovative

solutions to student-selected problems. This process will include creating prototypes in a variety of media, using the appropriate methods/tools, as well as exploring the processes and biases related to how people process information and make decisions. This type of work will help to guide the innovation process by gaining insights from testing prototypes and interacting with people to deepen one's understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. At the conclusion of the course, students will pitch a viable design solution and business model for a validated problem to a variety of potential investors and/or stakeholders. Note: This class engages the material in both the classroom and innovation labs. Students of all levels of experience, will explore tools/programs related to computer aided design, 3D printing, app development, and digital prototyping.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to develop prototypes in a variety of media (digital and/or physical) for the level of fidelity necessary to communicate, understand, and test innovative ideas/designs. 3. Select and use appropriate methods/tools/equipment to make decisions and prototype innovative ideas. 4. Revise designs to reflect a deepening understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. 5. Pitch a viable design solution/business model for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

TLI 30000 - Organizational Leadership Career Transition

Credit Hours: 1.00. In this course students prepare to make the transition from organizational leadership students to organizational leadership professionals. Topics include career planning and advancement, professional networking and relationship building, and transitioning successfully from college to career.

Learning Outcomes: 1. Demonstrate career planning and advancement strategies. 2. Apply effective networking strategies for professional growth. 3. Synthesize achievements into a professional portfolio for presentation. Credits: 1.00

16 Credits

Spring 3rd Year

OLS 38800 - Leadership Through Teams

Credit Hours: 3.00. The group process, team development and exploration of dynamics that impact group and team performance.

Learning Outcomes: 1. Identify various principles and theories of group dynamics. 2. Plan and lead effective meetings. 3. Provide opportunities to become skilled participant-observers of team processes. 4. Demonstrate the behavior of the team leader and team members in molding work groups into high performance teams. 5. Demonstrate the process of human communications in small group context. 6. Use communication skills to more competently solve problems in task-oriented groups. 7. Use personal knowledge and interpersonal skills in dealing with people in all group types. 8. Analyze and comprehend why teams are functional or dysfunctional. Credits: 3.00

OLS 37800 - Labor And Management Relations

Credit Hours: 3.00. An introduction to, and overview of, the fundamental concepts of labor relations, collective bargaining, and dispute resolution procedures. An international comparative analysis is used to assess some of the legal, economic, and political structures of labor relations.

Credits: 3.00

OLS 34600 - Critical Thinking And Ethics

Credit Hours: 3.00. A course in complex problem solving and creative thinking with an emphasis on the ethical impacts of these solutions.

Learning Outcomes: 1. Define various approaches to the study of ethics in leadership. 2. Recognize and apply laws and regulations that affect ethical behavior in business and

industry. 3. Work through processes to better identify what are real problems and perceived problems. 4. Use various techniques to ensure the real problem is identified and generate solutions. 5. Relate methods and concepts learned to new situations in order to solve problems. 6. Identify necessary steps to evaluate and implement solutions. 7. Develop individual problem solving and analytical skills. 8. Identify ethical, legal, and global challenges facing organizational leaders. Credits: 3.00

TLI 45800 - Leadership For Competitive Advantage

Credit Hours: 3.00. Organizations who consistently outperform competitors realize bottom-line impact through efficient leveraging of organizational strategy, leadership, internal and external talent acquisition, organizational culture, and marketing strategies. This course will explore the relationships between these areas and introduce organizational tools and concepts to enable the student to recognize and build capacity for sustainable competitive advantage in technology organizations.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

14-15 Credits

Fall 4th Year

OLS 48700 - Leadership Philosophy

Credit Hours: 3.00. A review of current managerial, education, and development theories and practices; discussions of fundamental social, economic, and political changes affecting business and the art of managing; implications of these changes for individual development and continued growth.

Learning Outcomes: 1. Discuss disparate texts/writings on leadership from different eras and cultures. 2. Exhibit familiarity with a philosophical approach to studying leadership. 3. Explain a personal leadership philosophy. Credits: 3.00

OLS 47700 - Conflict Management

Credit Hours: 3.00. A study of the methods for dealing with innerpersonal, interpersonal, and political disputes by means generally outside the traditional court system. Students will investigate the theoretical and practical aspects of conflict assessment, negotiation, problem solving, mediation, and arbitration.

Learning Outcomes: 1. Interpret and summarize major conflict management concepts. 2. Apply course conflict management concepts to new situations and real-world applications. 3. Assess conflict situations and apply appropriate methods to mitigate conflict. 4. Demonstrate ability to handle difficult people and situations. Credits: 3.00

OLS 45400 - Gender And Diversity In Management

Credit Hours: 3.00. Today's workforce is composed of employees with a variety of individual differences, including race, gender, LGBTQ+, culture, national origin, mental and physical disabilities and age. This course will use the knowledge of diversity, equity, inclusion and ethical responsibilities to develop effective leadership.

Learning Outcomes: 1. Define managing diversity, valuing diversity and affirmative action. 2. Compare American cultural values with non-American cultural values. 3. Describe the major diversity issues, including inclusion, equity and ethical responsibilities, encountered in the workplace. 4. Explain how federal anti-discrimination laws affect the management of diversity and ethical responsibilities. 5. Describe how leaders can effectively manage diversity, inclusion, equity and ethical responsibilities. 6. List the major components of a diversity/inclusion program. Credits: 3.00

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model;

total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

OLS 58300 - Coaching And Mentoring In Organizations

Credit Hours: 3.00. This course explores issues and practices in technologically-driven organizations pertaining to the roles and functions that coaching and mentoring play in employee development. A "best practices" approach, utilizing the case method, is emphasized. Presented from the point of view of a human resource manager/leader, the focus of the course is on identifying coaching opportunities, enhancing communication skills, developing and implementing coaching and mentoring strategies, and evaluating the outcomes of these strategies. Attention is directed to facilitating personal coaching mentoring skills. Course may be offered in traditional, distance, or blended format. Permission of department required.

Credits: 3.00

15 Credits

Spring 4th Year

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

OLS 48400 - Leadership Strategies For Quality And Productivity

Credit Hours: 3.00. A study of how organizational leaders create an environment conducive to high levels of employee self-motivation, quality, and productivity (TQM). Actual case situations are used to illustrate the application of course content.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

OLS 45000 - Advanced Project Management

Credit Hours: 3.00. An introduction to project management concepts and practices in the context of human resource development projects.

Learning Outcomes: 1. Apply the Project Management Institute's methodology to plan a project in the training and development field. 2. Apply instructional development methodology. Credits: 3.00

12 Credits

Pharmaceutical Sciences, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (47-50 credits)

PHSC 42200 - Immunology

Credit Hours: 3.00. This course exposes students to the basic principles of immunology, teaches students to use those principles to understand the cause of immunological disease and the basis of immunoprophylaxis and immunotherapy, and provides students with sufficient information to understand the principles and challenges of gene therapy and the application of genomics to future drug development.

Learning Outcomes: 1. The basic components of the immune system and their roles in innate and adaptive immunity. 2. The development and function of lymphocytes in adaptive immunity. 3. The molecular basis of antibody diversity. 4. How antigens are recognized by T cells. 5. How B cells develop and function in the body. 6. How T cells develop in the body and differentiate into specialized subsets. 7. How lymphocytes undergo positive and negative selection. 8. How B cells and T cells are activated and participate in adaptive immunity. 9. The basis of MHC polymorphism and the role on the immune response. 10. How the complement system is activated and plays its role in immune responses. 11. How the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. How the body remembers a previous infection. 13. The types and causes of immunodeficiency diseases. 14. How infection with HIV affects the immune system. 15. How the immune system sometimes recognizes harmless antigens (allergic reactions). 16. How the immune system can damage healthy tissue. 17. The basis and practice of immunization. 18. How the immune system complicates organ transplantation. 19. How the immune system recognizes cancer cells and can be used to combat cancer.
Credits: 3.00

PHSC 20800 - Biochemistry For Pharmaceutical Sciences

Credit Hours: 3.00. The overall objectives of this course are to increase students' biomedical understanding and knowledge and their ability to apply that understanding and knowledge. This requires the students in this course to learn and understand the facts, concepts, and formulaic processes, and to become skilled at applying what they have learned.

Learning Outcomes: 1. The student must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries: a. Basic principles of thermodynamics and kinetics and their role in defining chemical processes. b. The relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics.
Credits: 3.00

PHSC 20500 - Organic Chemistry II

Credit Hours: 3.00. PHSC 20500 is a continuation of PHSC 20400. You will learn the principles of organic chemistry with an emphasis on reactions of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action. You will continue to apply the fundamentals learned in general chemistry to the functional classes of compounds that are most important in pharmaceutical and biological chemistry.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to

predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

PHSC 10000 - Introduction To Pharmacy And Pharmaceutical Sciences

Credit Hours: 1.00. This first semester pre-pharmacy course is designed to provide the pre-pharmacy student with an introduction to the profession of pharmacy and to Purdue University College of Pharmacy. The topics presented in this course will allow the pre-pharmacy students to develop informed perspectives on: pharmacy summer employment opportunities for students; pharmacy career opportunities; current pharmacy practice trends; the importance of professionalism, values, and ethics as it pertains to the profession; resume and cover letter development; the College's curriculum, admissions process, and course registration process.

Learning Outcomes: 1. Describe various pharmacy career paths and opportunities. 2. Discuss professionalism as it relates to the profession. 3. Discuss current pharmacy practices trends in various settings. 4. Develop a resume. 5. Develop a cover letter. 6. Describe the College's admissions process. Credits: 1.00

PHSC 46000 - Drug Discovery And Development I

Credit Hours: 3.00. Focuses on the strategies, current methods and technologies used in early stage pre-clinical research to discover, validate and select lead drug candidates.

Learning Outcomes: 1. A variety of college outcomes related to: conceptual competence, scientific comprehension, integrative competence, critical thinking and decision-making abilities, communication skills and abilities, responsible use of professional values and ethical principles, and group interaction and citizenship. Credits: 3.00

PHSC 46100 - Drug Discovery And Development II

Credit Hours: 3.00. The course focuses on the process of drug development from pre-formulation to unit operations. The emphasis is on the scientific principles behind every step in moving from a drug molecule to its products.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the following theoretical foundations and apply these to basic anatomy/physiology, delivery of drugs from various dosage forms, relationship between chemical structure and dosage form selection, influences of pharmacokentics on formulation and dosage form design, unit operations of drug manufacturing. 2. Demonstrate comprehension of major scientific discoveries and methods. 3. Be able to use mathematical variables to analyze physical and pharmacokentic properties of a drug compound. 4. Meld theory and abilities in a practical setting to identify and provide solutions of related problems. 5. Examine issues rationally logically, and coherently. 6. Be able to read, write, speak, listen, use data, media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 7. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances, in particular, working together in their term-projects. Credits: 3.00

PHSC 20400 - Organic Chemistry I

Credit Hours: 3.00. A study of the compounds of carbon on a functional group basis, with particular emphasis on those organic compounds of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical

thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

PHSC 48500 - Intercultural And Global Health Issues

Credit Hours: 2.00. This course is designed to meet the University Embedded Outcomes of Intercultural Knowledge, and Global Citizenship and Social Awareness. Students will discuss and develop presentations (verbal and written) about various intercultural and global health issues.

Learning Outcomes: 1. Examine health issues that have global and/or cross-cultural impact. 2. Identify and articulate personal insights about intercultural and global health issues. 3. Develop and present an oral and poster presentation in a seminar fashion. Credits: 2.00

PHSC 20100 - Bachelor Of Science In The Pharmaceutical Sciences Orientation II

Credit Hours: 1.00. This seminar course is designed to enhance the BSPS student's professional skills career exploration and prepare for post-graduation employment. It provides the academic content to link experiences in professional fields to study in Pharmaceutical Sciences as well as social, economic and intellectual forces that shape views and work experiences. The intent is to prepare the student to successfully transfer skills to workplace. Typically taken in the junior year. The course builds on IMPH 10000, but students are not required to have taken that course. The course consists of a mix of on-line modules and assignments and in-person class sessions.

Learning Outcomes: 1. Build on-the-job skills; and develop and cultivate professional skills and relationships. 2. Analyze self-assessment of performance, professional expectations and ethical issues involved with being professional. 3. Articulate how classroom-acquired knowledge applies to real-world situations. 4. Explore critical topics that will assist the transition into a professional environment. 5. Reflect on professional development goals and needs. Credits: 1.00

PHSC 42400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy.

Learning Outcomes: 1. Understand the basic principles of pathophysiology and pharmacology. 2. Understand the basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHSC 42800 - Dosage Forms I

Credit Hours: 3.00. The purpose of this course is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms:

solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Provide an understanding of the relationship between dosage forms, the design of dosage forms, including how to turn molecules into medicines, and drug delivery and the physicochemical properties and structures of drug molecules. 2. Enable students to comprehend the underlying principles of drug product quality and be able to apply them to engage in critical thinking of drug stability, formulation, and delivery. 3. Recognize the importance of physiological conditions on the design, selection, and performance of dosage forms. 4. Build up the knowledge in drug development and delivery and develop problem-solving skills. 5. Build a solid foundation for understanding the role of formulations in drug therapy. Credits: 3.00

PHSC 42900 - Dosage Forms II

Credit Hours: 2.00. The purpose of this course is to educate beginning pharmacy students to thoroughly understand the basic physical-chemical principles involved in preparing liquid and semisolid dosage forms and controlled drug delivery systems used in the practice of pharmacy.

Learning Outcomes: 1. Explain the basic scientific principles involved in the performance of liquid dosage forms, including solution, emulsion, and suspension, and their chemical and physical stability. 2. Explain the basic scientific principles involved in controlled drug delivery and nanomedicine and list examples. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including transdermal and mucosal routes. 4. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and iso-osmolality, IV bags and drip sets. 5. Explain how biopharmaceuticals including peptides, proteins, and nucleic acids are formulated and advise on their handling in clinical pharmacy setting. 6. Advise patients on the proper use and storage of dosage forms and understand the relationship of dosage form selection to clinical outcomes. 7. Explain unique properties of veterinary products. Credits: 2.00

PHSC 43600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. The overall objective of this course is to expand students' knowledge of biochemistry obtained in the prerequisite one-semester Biochemistry course to understanding advanced aspects of human biochemistry related to pharmaceutical sciences.

Learning Outcomes: 1. Apply an advanced understanding and knowledge of biochemistry to pharmaceutical sciences and the practice of pharmacy. 2. Demonstrate advanced understanding of biochemistry including integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and the development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and the advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Understand the molecular basis of many idiopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseased of aberrant molecular transport; including the mechanisms of DNA damage and repair and the mechanisms of action of antimetabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented as well as

demonstrate understanding of the each content area is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHSC 20401 - Organic Chemistry I Laboratory

Credit Hours: 1.00. Laboratory experiments to accompany PHSC 20400 performing laboratory experiments involving the methods of purification, reactions, and synthesis of organic compounds.

Learning Outcomes: 1. Perform lab exercises that demonstrate some of the principles studied in PHSC 20400 Organic Lecture. 2. Complete "dry lab" and "wet chemistry" experiments that directly relate to the contents that are covered in PHSC 20400 lecture. 3. Work together in groups to gather and analyze data in several lab exercises. Credits: 1.00

PHSC 20501 - Organic Chemistry II Lab

Credit Hours: 1.00. This course has been designed to help you apply the concepts of organic chemistry and to enhance your understanding of the subject. This lab is an extension of the PHSC 20401 laboratory, and you will continue to use the concepts and techniques that you learned in organic chemistry I.

Learning Outcomes: 1. Perform lab exercises demonstrating some of the principles studied in lecture. 2. Complete "wet chemistry" experiments directly related to the reactions that are covered in lecture. 3. Learn about and engage in several analytical and purification techniques like thin-layer chromatography and column chromatography. Credits: 1.00

PHSC 40000 - Research Methodology And Pharmacokinetic Concepts

Credit Hours: 1.00. This course is designed to provide students with a working knowledge of fundamental concepts in pharmacokinetics and research methodology. In particular, students will learn the importance of determining and deploying the pharmacokinetics of experimental therapeutic agents to appropriately design and analyze preclinical studies in drug discovery.

Learning Outcomes: 1. Define the concepts of clearance, volume of distribution, half-life, and systemic availability. 2. Define the key concepts for quantifying drug response, including ED50, EC50, Emax, IC50, and TD50. 3. Describe the key elements of hypothesis formulation and testing. 4. Define the terms specificity, selectivity, and sensitivity as they regard to experimental data. 5. Use basic concepts of experimental methodology, design a basic study to determine the pharmacokinetics of a drug in a species after intravenous administration of an experimental drug. 6. Provide EC50 data from cell studies on the effects of an experimental drug, design a study to determine the dose needed to achieve the EC50 in a given species. 7. Formulate a hypothesis and design a study to determine the effects of an experimental agent on a model disease, including measures of reproducibility and appropriate data analysis. 8. Design a basic study to assess the reproducibility of an assay. Credits: 1.00

PHSC 44400 - Drug Classes And Mechanisms

Credit Hours: 3.00. This course provides an overview of the major therapeutic classes of pharmaceuticals. It integrates basic principles of medicinal chemistry and pharmacology in order to achieve an understanding of drug mechanisms. The major classes of drugs that are covered are those targeting the autonomic nervous, endocrine system, cardiovascular system, renal system, respiratory system and central nervous system, in addition to chemotherapy drugs and drugs targeting infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease. Lectures will focus on representative drugs to illustrate key concepts related to mechanisms of action.

Learning Outcomes: 1. Attain knowledge and understanding of the major drug classes. 2. Attain knowledge of the relationships among mechanisms of action, drug interactions, and adverse reactions. 3. Gain the ability to critically analyze primary literature. 4. Gain an appreciation for research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. Credits: 3.00

Other Departmental/Program Course Requirements (58-61 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to

specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among

organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing

biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations.

2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic

probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

Electives (9-15 credits)

PHSC 20000 - Introduction To Pharmacy And Admissions Process

Credit Hours: 2.00. A second orientation course to provide students interested in pre-pharmacy an introduction to the profession of pharmacy and to the Purdue University College of Pharmacy. Topics include personal development, academic program and career planning, pharmacy career opportunities, professionalism and ethics, and the Pharm.D. curriculum and the pharmacy admissions process. The course builds on PHPR 10000, but students are not required to have taken that course in order to enroll in this course.

Learning Outcomes: 1. Identify personal strengths and weaknesses and a plan to build on this knowledge. 2. Recognize the variety of traditional and non-traditional career options available in pharmacy. 3. Develop a personal plan for career development. 4. Reflect on how ethics and professionalism apply to the pharmacist's practice role. 5. Obtain information to be able to outline the content and structure of the Pharm.D. curriculum as well as to be able to explain the professional program application process. Credits: 2.00

Supplemental Lists

Course Requirements and Notes

College of Pharmacy Pass/No Pass Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

PHSC 10000 - Introduction To Pharmacy And Pharmaceutical Sciences

Credit Hours: 1.00. This first semester pre-pharmacy course is designed to provide the pre-pharmacy student with an introduction to the profession of pharmacy and to Purdue University College of Pharmacy. The topics presented in this course will allow the pre-pharmacy students to develop informed perspectives on: pharmacy summer employment opportunities

for students; pharmacy career opportunities; current pharmacy practice trends; the importance of professionalism, values, and ethics as it pertains to the profession; resume and cover letter development; the College's curriculum, admissions process, and course registration process.

Learning Outcomes: 1. Describe various pharmacy career paths and opportunities. 2. Discuss professionalism as it relates to the profession. 3. Discuss current pharmacy practices trends in various settings. 4. Develop a resume. 5. Develop a cover letter. 6. Describe the College's admissions process. Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic

ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

16-17 Credits

Spring 1st Year

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHSC 20400 - Organic Chemistry I

Credit Hours: 3.00. A study of the compounds of carbon on a functional group basis, with particular emphasis on those organic compounds of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

PHSC 20401 - Organic Chemistry I Laboratory

Credit Hours: 1.00. Laboratory experiments to accompany PHSC 20400 performing laboratory experiments involving the methods of purification, reactions, and synthesis of organic compounds.

Learning Outcomes: 1. Perform lab exercises that demonstrate some of the principles studied in PHSC 20400 Organic Lecture. 2. Complete "dry lab" and "wet chemistry" experiments that directly relate to the contents that are covered in PHSC 20400 lecture. 3. Work together in groups to gather and analyze data in several lab exercises. Credits: 1.00

14-16 Credits

Fall 2nd Year ǂ

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

PHSC 20500 - Organic Chemistry II

Credit Hours: 3.00. PHSC 20500 is a continuation of PHSC 20400. You will learn the principles of organic chemistry with an

emphasis on reactions of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action. You will continue to apply the fundamentals learned in general chemistry to the functional classes of compounds that are most important in pharmaceutical and biological chemistry.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

PHSC 20501 - Organic Chemistry II Lab

Credit Hours: 1.00. This course has been designed to help you apply the concepts of organic chemistry and to enhance your understanding of the subject. This lab is an extension of the PHSC 20401 laboratory, and you will continue to use the concepts and techniques that you learned in organic chemistry I.

Learning Outcomes: 1. Perform lab exercises demonstrating some of the principles studied in lecture. 2. Complete "wet chemistry" experiments directly related to the reactions that are covered in lecture. 3. Learn about and engage in several analytical and purification techniques like thin-layer chromatography and column chromatography. Credits: 1.00

15-17 Credits

Spring 2nd Year

PHSC 42200 - Immunology

Credit Hours: 3.00. This course exposes students to the basic principles of immunology, teaches students to use those principles to understand the cause of immunological disease and the basis of immunoprophylaxis and immunotherapy, and provides students with sufficient information to understand the principles and challenges of gene therapy and the application of genomics to future drug development.

Learning Outcomes: 1. The basic components of the immune system and their roles in innate and adaptive immunity. 2. The development and function of lymphocytes in adaptive immunity. 3. The molecular basis of antibody diversity. 4. How antigens are recognized by T cells. 5. How B cells develop and function in the body. 6. How T cells develop in the body and differentiate into specialized subsets. 7. How lymphocytes undergo positive and negative selection. 8. How B cells and T cells are activated and participate in adaptive immunity. 9. The basis of MHC polymorphism and the role on the immune response. 10. How the complement system is activated and plays its role in immune responses. 11. How the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. How the body remembers a previous infection. 13. The types and causes of immunodeficiency diseases. 14. How infection with HIV affects the immune system. 15. How the immune system sometimes recognizes harmless antigens (allergic reactions). 16. How the immune system can damage healthy tissue. 17. The basis and practice of immunization. 18. How the immune system complicates organ transplantation. 19. How the immune system recognizes cancer cells and can be used to combat cancer.
Credits: 3.00

PHSC 20800 - Biochemistry For Pharmaceutical Sciences

Credit Hours: 3.00. The overall objectives of this course are to increase students' biomedical understanding and knowledge and their ability to apply that understanding and knowledge. This requires the students in this course to learn and understand the facts, concepts, and formulaic processes, and to become skilled at applying what they have learned.

Learning Outcomes: 1. The student must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries: a. Basic principles of thermodynamics and kinetics and their role in defining chemical processes. b. The relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics.
Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5.

Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

17 Credits

Fall 3rd Year

PHSC 20100 - Bachelor Of Science In The Pharmaceutical Sciences Orientation II

Credit Hours: 1.00. This seminar course is designed to enhance the BSPS student's professional skills career exploration and prepare for post-graduation employment. It provides the academic content to link experiences in professional fields to study in Pharmaceutical Sciences as well as social, economic and intellectual forces that shape views and work experiences. The intent is to prepare the student to successfully transfer skills to workplace. Typically taken in the junior year. The course builds on IMPH 10000, but students are not required to have taken that course. The course consists of a mix of on-line modules and assignments and in-person class sessions.

Learning Outcomes: 1. Build on-the-job skills; and develop and cultivate professional skills and relationships. 2. Analyze self-assessment of performance, professional expectations and ethical issues involved with being professional. 3. Articulate how classroom-acquired knowledge applies to real-world situations. 4. Explore critical topics that will assist the transition into a professional environment. 5. Reflect on professional development goals and needs. Credits: 1.00

PHSC 42400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy.

Learning Outcomes: 1. Understand the basic principles of pathophysiology and pharmacology. 2. Understand the basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHSC 42800 - Dosage Forms I

Credit Hours: 3.00. The purpose of this course is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Provide an understanding of the relationship between dosage forms, the design of dosage forms, including how to turn molecules into medicines, and drug delivery and the physicochemical properties and structures of drug molecules. 2. Enable students to comprehend the underlying principles of drug product quality and be able to apply them to engage in critical thinking of drug stability, formulation, and delivery. 3. Recognize the importance of physiological conditions on the design, selection, and performance of dosage forms. 4. Build up the knowledge in drug development and delivery and develop problem-solving skills. 5. Build a solid

foundation for understanding the role of formulations in drug therapy. Credits: 3.00

PHSC 43600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. The overall objective of this course is to expand students' knowledge of biochemistry obtained in the prerequisite one-semester Biochemistry course to understanding advanced aspects of human biochemistry related to pharmaceutical sciences.

Learning Outcomes: 1. Apply an advanced understanding and knowledge of biochemistry to pharmaceutical sciences and the practice of pharmacy. 2. Demonstrate advanced understanding of biochemistry including integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and the development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and the advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Understand the molecular basis of many idiopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseased of aberrant molecular transport; including the mechanisms of DNA damage and repair and the mechanisms of action of antimetabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented as well as demonstrate understanding of the each content area is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

13 Credits

Spring 3rd Year

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

PHSC 42900 - Dosage Forms II

Credit Hours: 2.00. The purpose of this course is to educate beginning pharmacy students to thoroughly understand the basic physical-chemical principles involved in preparing liquid and semisolid dosage forms and controlled drug delivery systems used in the practice of pharmacy.

Learning Outcomes: 1. Explain the basic scientific principles involved in the performance of liquid dosage forms, including solution, emulsion, and suspension, and their chemical and physical stability. 2. Explain the basic scientific principles involved in controlled drug delivery and nanomedicine and list examples. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including transdermal and mucosal routes. 4. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and iso-osmolality, IV bags and drip sets. 5. Explain how biopharmaceuticals including peptides, proteins, and nucleic acids are formulated and advise on

their handling in clinical pharmacy setting. 6. Advise patients on the proper use and storage of dosage forms and understand the relationship of dosage form selection to clinical outcomes. 7. Explain unique properties of veterinary products. Credits: 2.00

PHSC 44400 - Drug Classes And Mechanisms

Credit Hours: 3.00. This course provides an overview of the major therapeutic classes of pharmaceuticals. It integrates basic principles of medicinal chemistry and pharmacology in order to achieve an understanding of drug mechanisms. The major classes of drugs that are covered are those targeting the autonomic nervous, endocrine system, cardiovascular system, renal system, respiratory system and central nervous system, in addition to chemotherapy drugs and drugs targeting infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease. Lectures will focus on representative drugs to illustrate key concepts related to mechanisms of action.

Learning Outcomes: 1. Attain knowledge and understanding of the major drug classes. 2. Attain knowledge of the relationships among mechanisms of action, drug interactions, and adverse reactions. 3. Gain the ability to critically analyze primary literature. 4. Gain an appreciation for research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. Credits: 3.00

15 Credits

Fall 4th Year

PHSC 46000 - Drug Discovery And Development I

Credit Hours: 3.00. Focuses on the strategies, current methods and technologies used in early stage pre-clinical research to discover, validate and select lead drug candidates.

Learning Outcomes: 1. A variety of college outcomes related to: conceptual competence, scientific comprehension, integrative competence, critical thinking and decision-making abilities, communication skills and abilities, responsible use of professional values and ethical principles, and group interaction and citizenship. Credits: 3.00

PHSC 40000 - Research Methodology And Pharmacokinetic Concepts

Credit Hours: 1.00. This course is designed to provide students with a working knowledge of fundamental concepts in pharmacokinetics and research methodology. In particular, students will learn the importance of determining and deploying the pharmacokinetics of experimental therapeutic agents to appropriately design and analyze preclinical studies in drug discovery.

Learning Outcomes: 1. Define the concepts of clearance, volume of distribution, half-life, and systemic availability. 2. Define the key concepts for quantifying drug response, including ED50, EC50, Emax, IC50, and TD50. 3. Describe the key elements of hypothesis formulation and testing. 4. Define the terms specificity, selectivity, and sensitivity as they regard to experimental data. 5. Use basic concepts of experimental methodology, design a basic study to determine the pharmacokinetics of a drug in a species after intravenous administration of an experimental drug. 6. Provide EC50 data from cell studies on the effects of an experimental drug, design a study to determine the dose needed to achieve the EC50 in a given species. 7. Formulate a hypothesis and design a study to determine the effects of an experimental agent on a model disease, including measures of reproducibility and appropriate data analysis. 8. Design a basic study to assess the reproducibility of an assay. Credits: 1.00

13-15 Credits

Spring 4th Year

PHSC 46100 - Drug Discovery And Development II

Credit Hours: 3.00. The course focuses on the process of drug development from pre-formulation to unit operations. The emphasis is on the scientific principles behind every step in moving from a drug molecule to its products.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the following theoretical foundations and apply these to basic anatomy/physiology, delivery of drugs from various dosage forms, relationship between chemical structure and dosage form selection, influences of pharmacokentics on formulation and dosage form design, unit operations of drug manufacturing. 2. Demonstrate comprehension of major scientific discoveries and methods. 3. Be able to use mathematical variables to analyze physical and pharmacokentic properties of a drug compound. 4. Meld theory and abilities in a practical setting to identify and provide solutions of related problems. 5. Examine issues rationally logically, and coherently. 6. Be able to read, write, speak, listen, use data, media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 7. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances, in particular, working together in their term-projects. Credits: 3.00

PHSC 48500 - Intercultural And Global Health Issues

Credit Hours: 2.00. This course is designed to meet the University Embedded Outcomes of Intercultural Knowledge, and Global Citizenship and Social Awareness. Students will discuss and develop presentations (verbal and written) about various intercultural and global health issues.

Learning Outcomes: 1. Examine health issues that have global and/or cross-cultural impact. 2. Identify and articulate personal insights about intercultural and global health issues. 3. Develop and present an oral and poster presentation in a seminar fashion. Credits: 2.00

12-15 Credits

Philosophy, BA

About the Program

The Philosophy curriculum provides the opportunity to study a wide range of philosophical issues from a diverse array of philosophical traditions, methodologies and perspectives. Students engage important portions of their intellectual heritage through the writings of influential philosophers of the past and present, and acquire a sense of the influence of these figures on the broader society and culture.

Please visit Philosophy for more information.

3 Year Degrees

The College of Liberal Arts offers the opportunity for students to complete their degree in three years. Degree in 3 majors allow students to enter the work force or graduate school a year earlier than traditional plans of study while also providing a cost-effective way to complete an undergraduate degree.

Students can complete the three-year option with or without AP credit by adding summer sessions to traditional coursework in Fall and Spring semesters. Degree in 3 offers a great combination of cost-savings and the opportunity to accelerate your future and achieve your goals.

Degree Requirements

Departmental/Program Major Course Requirements (27 credits)

Area A (6 credits)

PHIL 15000 - Principles Of Logic (UCC: QR)

Credit Hours: 3.00. A first course in formal deductive logic;

mechanical and other procedures for distinguishing good arguments from bad. Truth-tables and proofs for sentential (Boolean) connectives, followed by quantificational logic with relations. Although metatheoretic topics are treated, the emphasis is on methods.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: Will add at a later date.
Credits: 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

Area B: History of Philosophy (3 credits)

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30400 - Nineteenth-Century Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of the major movements and directions of nineteenth-century philosophy, including such figures as Hegel, Comte, Mach, Schopenhauer, Nietzsche, Mill, Royce and Peirce.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30600 - Twentieth-Century Philosophy

Credit Hours: 3.00. A critical examination of the main currents of contemporary philosophical thought, such as pragmatism, analytic philosophy, phenomenology, and existentialism, and other recent developments. The course will cover selected works of such philosophers as Russell, Wittgenstein, Peirce, Whitehead, Heidegger, and Sartre.

Credits: 3.00

Area C: Value Theory (3 credits)

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in

ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

Area D: Additional Philosophy Courses (15 credits)

Note for Areas C & D

Optional Concentration (15 credits)

Electives (20-57 credits)

Grade Requirements

GPA Requirement

Additional Information

Sample 4-Year Plan

Fall 1st Year

15 - 16 Credits

Spring 1st Year

PHIL 15000 - Principles Of Logic (UCC: QR)

Credit Hours: 3.00. A first course in formal deductive logic; mechanical and other procedures for distinguishing good arguments from bad. Truth-tables and proofs for sentential (Boolean) connectives, followed by quantificational logic with relations. Although metatheoretic topics are treated, the emphasis is on methods.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: Will add at a later date.
Credits: 3.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

14-15 Credits

Fall 2nd Year

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth

century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Spring 2nd Year

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

15 Credits

Fall 3rd Year

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30400 - Nineteenth-Century Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of the major movements and directions of nineteenth-century philosophy, including such figures as Hegel, Comte, Mach, Schopenhauer, Nietzsche, Mill, Royce and Peirce.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 30600 - Twentieth-Century Philosophy

Credit Hours: 3.00. A critical examination of the main currents of contemporary philosophical thought, such as pragmatism, analytic philosophy, phenomenology, and existentialism, and other recent developments. The course will cover selected works of such philosophers as Russell, Wittgenstein, Peirce, Whitehead, Heidegger, and Sartre.

Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Program Learning Outcomes

Physics Honors, BS

About the Program

Degree Requirements

Physics Honors Major Courses (68-77 credits)

Required Major Courses (53-61 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to

take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann

equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 41100 - Physical Mechanics II Honors

Credit Hours: 2.00. Continuation of mechanics in PHYS 41000 . Coupled systems, general theory of small oscillations, the vibrating string, perturbation theory. Rigid body motion. Motion of charged particles in electromagnetic fields. Elements of continuum mechanics.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The

student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 2.00

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 43100 - Electricity And Magnetism II Honors

Credit Hours: 2.00. A continuation of PHYS 43000 . Magnetic energy; applications of Maxwell's equations to a.c. circuits, filters, transmission lines, waveguides, and antennae; Lienard-Wiechert potentials.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 2.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

PHYS 46100 - Quantum Mechanics II Honors

Credit Hours: 3.00. Angular momenta, radial equation, operators, matrices, spin, time-independent perturbation theory, electron-electromagnetic field interaction, hydrogen atom, structure of atoms, molecules, radiation; selected topics in radiative transitions, collision theory, solids, nuclei, elementary particles and their symmetries.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 59300 - Independent Research

Credit Hours: 1.00 to 4.00. Research in some area of modern physics (spectroscopy, nuclear physics, solid state physics, elementary particle physics, biophysics, geophysics, etc.) with student receiving individualized supervision and guidance from staff member. This course may be used to satisfy the independent project or 500-level elective requirement of the undergraduate majors in Honors and Applied Physics Honors Programs. Permission of instructor required.

Credits: 1.00 to 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for

convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Major Selective* (15-16 credits)

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

Other Departmental/Program Course Requirements (39-62 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming

language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use

evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and

critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit

Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Electives (0-13 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Group 1

PHYS 15200 - Mechanics (UCC: SCI)

Credit Hours: 0.00 to 5.00. Statics, uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; hydrostatics and hydrodynamics; simple harmonic motion; wave motion and sound.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Learn the basic theories of mechanics and their application, including uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; properties of matter; simple harmonic and wave motion. Credits: 0.00 to 5.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 21800 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Analyze physical circumstances according to Newton's Laws of motion properly. 2. Apply basic conservation laws and and to recognize the circumstances in which they apply. 3. Use physical terms such as energy, acceleration, momentum, impulse, velocity, etc., properly. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Group 2

PHYS 21900 - General Physics II (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Learn the basic theory and application of electricity, magnetism, dc and ac circuits; geometrical and physical optics; topics in modern physics. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)

Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy,

and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Group 3

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 41000 - Physical Mechanics I Honors

Credit Hours: 3.00. Newtonian, Lagrangian, and Hamiltonian mechanics. Emphasis on point mass mechanics. Free, driven, and damped harmonic motion, central force problem.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 3.00

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

Group 4

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

Group 5

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom

spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Group 6

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 43000 - Electricity And Magnetism I Honors

Credit Hours: 3.00. Electrostatics, solutions of Poisson's equation in spherical and cylindrical coordinates, macroscopic and microscopic theory of dielectrics, electrostatic energy, conduction; magnetostatics, electromagnetic induction, and magnetic properties of matter.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

Group 7

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

Group 8

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

Non-course / Non-credit Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or

departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to

collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary

approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use

evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics

majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of

multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

16-17 Credits

Spring 2nd Year

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie

statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15 Credits

Fall 3rd Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 46100 - Quantum Mechanics II Honors

Credit Hours: 3.00. Angular momenta, radial equation, operators, matrices, spin, time-independent perturbation theory, electron-electromagnetic field interaction, hydrogen atom, structure of atoms, molecules, radiation; selected topics in radiative transitions, collision theory, solids, nuclei, elementary particles and their symmetries.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to

programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

16-17 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

17 Credits

Fall 4th Year

PHYS 41100 - Physical Mechanics II Honors

Credit Hours: 2.00. Continuation of mechanics in PHYS 41000 . Coupled systems, general theory of small oscillations, the vibrating string, perturbation theory. Rigid body motion. Motion of charged particles in electromagnetic fields. Elements of continuum mechanics.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 2.00

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 59300 - Independent Research

Credit Hours: 1.00 to 4.00. Research in some area of modern physics (spectroscopy, nuclear physics, solid state physics, elementary particle physics, biophysics, geophysics, etc.) with student receiving individualized supervision and guidance from staff member. This course may be used to satisfy the independent project or 500-level elective requirement of the undergraduate majors in Honors and Applied Physics Honors Programs. Permission of instructor required.

Credits: 1.00 to 4.00

15 Credits

Spring 4th Year

PHYS 43100 - Electricity And Magnetism II Honors

Credit Hours: 2.00. A continuation of PHYS 43000 . Magnetic energy; applications of Maxwell's equations to a.c. circuits, filters, transmission lines, waveguides, and antennae; Lienard-Wiechert potentials.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 2.00

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

14-15 Credits

Physics, BS

About the Program

Degree Requirements

Physics Major Courses (54-63 credits)

Required Major Courses (42-50 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of

double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and

standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics

problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering

by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable

chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Major Selective* (12-13 credits)

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

Other Departmental/Program Course Requirements (39-62 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS

18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data

sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data

sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course

emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Electives (0-27 credits)

GPA Requirements

Course Requirements and Notes

Group 1

PHYS 15200 - Mechanics (UCC: SCI)

Credit Hours: 0.00 to 5.00. Statics, uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; hydrostatics and hydrodynamics; simple harmonic motion; wave motion and sound.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Learn the basic theories of mechanics and their application, including uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; properties of matter; simple harmonic and wave motion. Credits: 0.00 to 5.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 21800 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Analyze physical circumstances according to Newton's Laws of motion properly. 2. Apply basic conservation laws and and to recognize the circumstances in which they apply. 3. Use physical terms such as energy, acceleration, momentum, impulse, velocity, etc., properly. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify

substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

Group 2

PHYS 21900 - General Physics II (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Learn the basic theory and application of electricity, magnetism, dc and ac circuits; geometrical and physical optics; topics in modern physics. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)

Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Group 3

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 41000 - Physical Mechanics I Honors

Credit Hours: 3.00. Newtonian, Lagrangian, and Hamiltonian mechanics. Emphasis on point mass mechanics. Free, driven, and damped harmonic motion, central force problem.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 3.00

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

Group 4

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

Group 5

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3.

Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Group 6

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 43000 - Electricity And Magnetism I Honors

Credit Hours: 3.00. Electrostatics, solutions of Poisson's equation in spherical and cylindrical coordinates, macroscopic and microscopic theory of dielectrics, electrostatic energy, conduction; magnetostatics, electromagnetic induction, and magnetic properties of matter.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

Group 7

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular

momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

Group 8

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

Non-course / Non-credit Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 .

Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting

methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab

results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire

capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface

integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

16-18 Credits

Spring 2nd Year

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data

and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15-17 Credits

Fall 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using

loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

16-17 Credits

Spring 3rd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

15 Credits

Fall 4th Year

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

15 Credits

Spring 4th Year

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

13-14 Credits

Planetary Sciences, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (38 credits)

Required Major Courses (26 credits)

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

EAPS 40000 - Planetary Sciences Senior Capstone

Credit Hours: 3.00. In this course, students will use the knowledge they have gained as part of their education at Purdue to develop a comprehensive science-driven planetary exploration strategy. First, students will review the history of planetary exploration. Next, students will understand the current landscape for planetary exploration including missions and

instruments which will soon fly. Throughout the course, student-led research and presentation exercises will build to the development of a mission concept for planetary exploration.

Learning Outcomes: 1. Understand of the history of planetary exploration and the major science questions that influenced the designs of historical, ongoing, and proposed spacecraft missions. 2. Make effective and engaging scientific presentations and posters using the Assertion-Evidence model. 3. Understand how the grant proposal writing and evaluation process works within the NASA ROSES grant proposal system, including knowing how to: 4. Write proposals for competitive grant programs, such as NASA ROSES. 5. Evaluate grant proposals to determine their scientific merit. 6. Participate in a proposal peer review panel discussion. 7. Learn to write proposal evaluation peer review reports in a style consistent with NASA ROSES proposal peer review panel guidelines. 8. Become an effective team member in a science-driven spacecraft mission proposal design study. Credits: 3.00

EAPS 20500 - Fundamentals Of Planetary Science

Credit Hours: 3.00. This course provides a quantitative understanding of the fundamental principles that govern the behavior of planetary systems, including their atmospheres, surfaces, interiors, and orbital dynamics. This course is intended to be a quantitative follow-on to EAPS 10500, and aims to provide students with hands-on experience with physics-based problem solving, scientific programming, and developing research projects. Lecture periods will include lectures as well as group work on problems, and lab periods will focus on programming projects in Python. By the end of the course, students will have a strong foundation in the principles and techniques of planetary science and be well-prepared to engage in upper-year courses and conduct planetary science research. It is recommended that students have completed EAPS 10500 The Planets, PHYS 17200 Modern Mechanics or equivalent, and have some previous programming experience (preferably in Python).

Learning Outcomes: 1. Apply principles of classical physics to investigations of planetary orbital dynamics, surfaces, interiors, and atmospheres. 2. Write and debug basic data analysis, graphical display, and numeric computation code in Python. 3. Come up with a science question, conduct a literature review, test hypotheses using real data or models, and present an informed assessment. Credits: 3.00

Skills Selective (3 credits)

EAPS 30900 - Computer-Aided Analysis For Geosciences

Credit Hours: 3.00. Application of computer analysis techniques including error analysis, line and surface fitting, spatial and temporal correlations, contouring, interpolation, and map projections. These methods are discussed in terms of specific geologic applications. All exercises and examples are developed using commercial mathematical software package. A three-hour-per-week computer laboratory tutorial provides hands-on experience with the techniques discussed in class. Prior course work in computer programming is required.

Learning Outcomes: 1. Carry out computational solutions to a given range of data analysis problems. 2. Select the appropriate analysis and visualization approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 57700 - Remote Sensing Of The Planets

Credit Hours: 3.00. Introduction to key planetary and Earth science satellite remote sensing datasets, including visible and thermal imagery, visible through mid-infrared spectroscopy, radar, gamma ray and neutron spectroscopy, and laser altimetry. Students will receive hands-on-experience with data acquisition, image processing in IDL, spectral analysis in ENVI and Davinci, crater counting, and geologic mapping in GIS programs. Includes 1-2 full-day field trips. Junior, Senior, or Graduate status required. Recommended minimum background for undergraduates: Introductory knowledge of Earth or planetary surface processes and basic programming skills.

Learning Outcomes: 1. Understand the underlying physical principles behind the interpretation of remote sensing data. 2. Gain proficiency in the acquisition, processing, and analysis of remote sensing data. 3. Gain field experience with using and ground truthing remote sensing data at planetary analog sites. 4. Propose a research topic, conduct a literature review, and design and complete an original

research project. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 55501 - Numerical Modeling Of Planetary Orbits

Credit Hours: 3.00. The goal of the course is twofold. First, you will develop quantitative skills to understand the orbital motions of planets and minor bodies in planetary systems, both in our solar system and in exosolar systems. Second, you will develop practical skills and techniques for using computers to solve scientific problems. We will begin with classical analyses of the two-body and N-body problems. We will then learn about modern, powerful, analytical and numerical techniques. We will then see how these techniques are applied to solving real problems in understanding the origin and evolution of planetary systems. These problems will include understanding planet formation, planet migration, resonance dynamics and resonance capture, tidal evolution of planets and natural satellites, and the collisional evolution of small body populations. Permission from instructor required.

Learning Outcomes: 1. Demonstrate proficiency with modern numerical methods and tools. 2. Demonstrate proficiency with methods of analysis and theory related to the dynamics of solar system bodies. Credits: 3.00

EAPS 52400 - Laboratory Analysis

Credit Hours: 3.00. This course focuses on becoming familiar with various laboratory techniques used in the analysis of earth and planetary materials and understanding what questions data products from these techniques can answer. This course will include discussion of the instruments and how they operate, as well as provide hands-on experience working in the lab and processing data.

Learning Outcomes: 1. Become familiar with common laboratory analytical techniques used in earth and planetary science. 2. Gain experience working with analytical instruments and the associated laboratory data. 3. Propose a research topic, conduct a literature review, and design an original research project requiring use of coordinated analytical techniques. Credits: 3.00

EAPS 47700 - Earth And Planetary GIS

Credit Hours: 3.00. In this course, students will learn to display and analyze Earth and planetary data using geographic information systems (GIS). Students will learn how to find and work with data from various sources, including satellites and spacecraft missions. Using a variety of spatial data, students will make maps and visualizations of data, perform analyses using a range of toolboxes, and implement workflows in geoprocessing.

Learning Outcomes: 1. Communicate applications of GIS in the real world. 2. Locate geospatially relevant datasets in online repositories. 3. Organize and manage files (and their appropriate formats) used within GIS software. 4. Identify limitations and gaps in remote sensing datasets. 5. Design and implement a workflow to analyze remote sensing data. 6. Create maps and figures that visualize products within a geospatial analysis workflow. 7. Describe a goal (i.e., hypothesis being tested) that geospatial analysis can address, as well as the data inputs, steps in the workflow, and outcome (i.e., results) of the analysis in the form of a webpost that can be shared with employers and other GIS users. Credits: 3.00

EAPS Selective (3 credits)

Planetary Science Selectives (9 credits)

Other Departmental/Program Course Requirements (53-80 credits)

College of Science Additional Requirements

Computing (2-4 credits)

ECE 49500 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

Credits: 1.00 to 4.00

ENGR 14200 - Honors Creativity And Innovation In Engineering Design II

Credit Hours: 3.50. This course continues building on the foundation developed in ENGR 14100 . Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students extend and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., C, Excel®, LabView®, MATLAB®, and Python).

Learning Outcomes: 1. Describe, in greater depth, the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a mathematical model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Further development of strategies to facilitate generating creative ideas for complex design challenges. 8. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 9. Implement complex algorithmic solutions to engineering problems/designs using the most appropriate computer tool (C , Excel, LABVIEW, MATLAB, and Python) and be able to explain your rationale for your choice. 10. Apply a systems approach in solving engineering problems and in undertaking design projects. 11. Synthesize your knowledge of effective and ethical membership on a technical team (i.e., teaming skills) to appropriately behavior. 12 Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.

Credits: 4.00

ENGR 16200 - Honors Introduction To Innovation And The Physical Science Of Engineering Design II (UCC: IL/SCI)

Credit Hours: 4.00. Students will take an in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. The students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g. MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control in an effort to identify and characterize physical material systems.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Utilize knowledge of the engineering education process, courses, and options, and engineering job functions and roles to prepare a final course of study for academic and career success (3). 2. Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories (10). 3. Apply the unified approach to material interactions to a broad array of applications including asteroids, black holes, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity (7). 4. Model natural phenomena using computer simulations (7). 5. Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem solving to ensure that the broader impacts of engineering work are consistently evaluated and accounted for (3). 6. Display proficiency in the applications of engineering content knowledge including statistics, statics, mechanics of materials, the universal accounting equation, electrical theory, and design of experiments (8). 7. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole (2). 8. Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (2). 9. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the

systems (6). 10. Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms (5). 11. Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class (3). 12. Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 13. Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (3). 14. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering challenges (2). Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format,

extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (8 credits)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the

interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance;

contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

Required Pre-Requisite Courses (16-18 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 5.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these

equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in

lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in

lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (2-29 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering,

erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-18 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods

associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-17 Credits

Fall 2nd Year

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6.

Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

15-16 Credits

Spring 2nd Year

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about

the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

13-16 Credits

Fall 3rd Year

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

15-16 Credits

Spring 3rd Year

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large

moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100,

STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

14-16 Credits

Fall 4th Year

12-15 Credits

Spring 4th Year

EAPS 44500 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the planetary sciences curriculum. Components include analysis methods for preliminary design, development of an initial spacecraft and mission concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with science operation, science objectives, and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Learn how to generate a Science Traceability Matrix. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

12-16 Credits

Plant Genetics, Breeding, and Biotechnology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (21-22 credits)

Required Major Courses (21-22 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis,

phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 48000 - Plant Genetics

Credit Hours: 3.00. Principles and recent advances in plant genetics including: genetic segregation, linkage, DNA markers and applications, chromosomes and genomes, variation in chromosome number and structure, mutation, recombination and DNA repair, quantitatively inherited traits, introduction to principles of population genetics, gene expression, gene organization, regulation of gene activity, gene function, identifying important genes, cloning genes, reverse genetics, plant transformation, applications of genetic engineering, genome sequencing, using sequence data.

Credits: 3.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

AGRY 52000 - Principles And Methods Of Plant Breeding

Credit Hours: 3.00. Introduction to methods and techniques of breeding field crops, with emphasis on the application of genetic principles; analysis of and present approach to the solution of specific breeding problems in selected field crops.

Credits: 3.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

Other Departmental /Program Course Requirements (89-93 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting

and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability

to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3.

Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients,

compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course

using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041

Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to

understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (5-10 credits)

Supplemental List

GPA Requirements

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics

include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and

understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the

course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16-18 Credits

Spring 1st Year

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by

the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants.

2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

14-15 Credits

Fall 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based

Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual

representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

15-16 Credits

Fall 3rd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems.

4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in

cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

14-15 Credits

Spring 3rd Year

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial

function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

16 Credits

Fall 4th Year

AGRY 48000 - Plant Genetics

Credit Hours: 3.00. Principles and recent advances in plant genetics including: genetic segregation, linkage, DNA markers and applications, chromosomes and genomes, variation in chromosome number and structure, mutation, recombination and DNA repair, quantitatively inherited traits, introduction to principles of population genetics, gene expression, gene organization, regulation of gene activity, gene function, identifying important genes, cloning genes, reverse genetics, plant transformation, applications of genetic engineering, genome sequencing, using sequence data.

Credits: 3.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2.

Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AGRY 52000 - Principles And Methods Of Plant Breeding

Credit Hours: 3.00. Introduction to methods and techniques of breeding field crops, with emphasis on the application of genetic principles; analysis of and present approach to the solution of specific breeding problems in selected field crops.

Credits: 3.00

13 Credits

Spring 4th Year

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

14-16 Credits

Plant Science, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (28 credits)

Required Major Courses (28 credits)

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to

the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

BTNY 49700 - Undergraduate Research Capstone

Credit Hours: 1.00. Professional preparation of a presentation related to the student's undergraduate research experience (BTNY 49800). Students will prepare a presentation to summarize their work and present at an academic research event. Other subjects covered: graduate school and/or career preparation, resume production/refinement, interpreting scientific data, public presenting. Students must have completed BTNY 49800 prior to registering for BTNY 49700.

Learning Outcomes: 1. Define and explain the scientific method as it applies to the student's individual research project. 2. Synthesize their undergraduate research project in the form of a scientific poster. 3. Master communication skills for engaging a broad audience on scientific principles related to the student's unique research. Credits: 1.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

BTNY 26200 - Plant Structure And Tissue Biology

Credit Hours: 3.00. This course focuses on fundamental knowledge of the internal structure of plants, including distinct cell types, tissues, tissue systems, and organs that make up a plant. Lectures and laboratories will cover the structural parts that comprise the plant body including three major vegetative organs (roots, stems, and leaves) and a set of reproductive organs (flowers, fruits, and seeds). The goal of this course is to understand the internal organization of plants, to learn multiple lab techniques critical for plant science research, and to develop critical thinking and problem solving skills.

Learning Outcomes: 1. Describe the internal structure of plants. 2. Perform lab techniques, such as fresh sectioning and microscopy, for plant science research. 3. Critically evaluate plant cell, tissue, and organ structures. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 20800 - Introduction To Plant Science Research

Credit Hours: 1.00. The course is designed to expose students to the diversity of Plant Science research at Purdue and help students to get started in research and in the fantastic world of scientific discovery. Students will learn the importance of Plant Science research in society and how to become active participants of Purdue research discoveries. Students will learn about the scientific method and how discoveries are made to find answers to world problems. The students will explore department and campus resources to identify areas of research interest, learn how to search and apply for research/internship opportunities and find faculty that can serve as professional models and mentors. We will provide opportunities for students to interact and network with faculty members, professionals from industry and students involved in diverse research areas.

Learning Outcomes: 1. Recognize the importance of plant science research and its contribution to society. 2. Define ""scientific method"" and outline the process of scientific discovery. 3. Recognize the value of publishing/communicating scientific knowledge. 4. Critically evaluate claims in both scientific and popular media publications. 5. Identify possible research and internships experiences. 6. Identify necessary skills for specific careers in Plant Sciences. Credits: 1.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell

components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Other Departmental/Program Course Requirements (78.5-79.5 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience

with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT

50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic

theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

Electives (12.5-13.5 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of

functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14.5-15.5 Credits

Spring 1st Year

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BTNY 20800 - Introduction To Plant Science Research

Credit Hours: 1.00. The course is designed to expose students to the diversity of Plant Science research at Purdue and help students to get started in research and in the fantastic world of scientific discovery. Students will learn the importance of Plant Science research in society and how to become active participants of Purdue research discoveries. Students will learn about the scientific method and how discoveries are made to find answers to world problems. The students will explore department and campus resources to identify areas of research interest, learn how to search and apply for research/internship opportunities and find faculty that can serve as professional models and mentors. We will provide opportunities for students to interact and network with faculty members, professionals from industry and students involved in diverse research areas.

Learning Outcomes: 1. Recognize the importance of plant science research and its contribution to society. 2. Define ""scientific method"" and outline the process of scientific discovery. 3. Recognize the value of publishing/communicating scientific knowledge. 4. Critically evaluate claims in both scientific and popular media publications. 5. Identify possible research and internships experiences. 6. Identify necessary skills for specific careers in Plant Sciences. Credits: 1.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

15.5 Credits

Fall 2nd Year

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

BTNY 26200 - Plant Structure And Tissue Biology

Credit Hours: 3.00. This course focuses on fundamental knowledge of the internal structure of plants, including distinct cell types, tissues, tissue systems, and organs that make up a plant. Lectures and laboratories will cover the structural parts

that comprise the plant body including three major vegetative organs (roots, stems, and leaves) and a set of reproductive organs (flowers, fruits, and seeds). The goal of this course is to understand the internal organization of plants, to learn multiple lab techniques critical for plant science research, and to develop critical thinking and problem solving skills.

Learning Outcomes: 1. Describe the internal structure of plants. 2. Perform lab techniques, such as fresh sectioning and microscopy, for plant science research. 3. Critically evaluate plant cell, tissue, and organ structures. Credits: 3.00

14 Credits

Spring 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental

principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

16 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

16 Credits

Spring 3rd Year

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Fall 4th Year

BTNY 49700 - Undergraduate Research Capstone

Credit Hours: 1.00. Professional preparation of a presentation related to the student's undergraduate research experience (BTNY 49800). Students will prepare a presentation to summarize their work and present at an academic research event. Other subjects covered: graduate school and/or career preparation, resume production/refinement, interpreting scientific data, public presenting. Students must have completed BTNY 49800 prior to registering for BTNY 49700.

Learning Outcomes: 1. Define and explain the scientific method as it applies to the student's individual research project. 2. Synthesize their undergraduate research project in the form of a scientific poster. 3. Master communication skills for engaging a broad audience on scientific principles related to the student's unique research. Credits: 1.00

12-13 Credits

Spring 4th Year

15 Credits

Political Science: American Politics Concentration, BA

About the Program

Degree Requirements

Political Science: American Politics Concentration (12 credits)

Required Foundation Course (3 credits)

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 31400 - The President And Policy Process

Credit Hours: 3.00. A study of presidential leadership as the embodiment of social forces and as reflective of the personality of the incumbent; the president as national leader reflecting national myths and ideologies; the growth of the presidency; issues and forces affecting the continuity of presidential leadership; the degree of institutionalization of the presidency.

Credits: 3.00

POL 37300 - Campaigns And Elections

Credit Hours: 3.00. This course analyzes the role of political parties, issues, candidates, media, funding, and electoral and campaign strategies in presidential, congressional, and state campaigns. Contemporary election examples will be utilized.

Credits: 3.00

POL 41100 - Congress: Structure And Functioning

Credit Hours: 3.00. A study of how Congress actually operates. Formal and informal power structures within both chambers and roles of the individual members of Congress are analyzed. Attention is directed to latent, as well as manifest, functions of legislative, investigative, and other major activities of Congress. The problem of bringing expertise to bear on the legislative process is considered throughout.

Credits: 3.00

Selectives (9 credits)

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 31400 - The President And Policy Process

Credit Hours: 3.00. A study of presidential leadership as the embodiment of social forces and as reflective of the personality of the incumbent; the president as national leader reflecting national myths and ideologies; the growth of the presidency; issues and forces affecting the continuity of presidential leadership; the degree of institutionalization of the presidency.

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 37200 - Indiana Government And Politics (UCC: BSS)

Credit Hours: 3.00. An examination of the political and governmental organization of the state of Indiana. Includes the political and historical development of Indiana state government and comparison of policies and institutions with those of other states.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 37300 - Campaigns And Elections

Credit Hours: 3.00. This course analyzes the role of political parties, issues, candidates, media, funding, and electoral and campaign strategies in presidential, congressional, and state campaigns. Contemporary election examples will be utilized.

Credits: 3.00

POL 41000 - Political Parties And Politics

Credit Hours: 3.00. An analysis of the nature and functioning of U.S. political parties in terms of social and economic forces that shape our political system. Interactions among political parties, pressure groups, and formal government structures are emphasized throughout. Special attention is devoted to political leadership, nominating processes, campaign management, voting behavior, and other important aspects of American politics.

Credits: 3.00

POL 41100 - Congress: Structure And Functioning

Credit Hours: 3.00. A study of how Congress actually operates. Formal and informal power structures within both chambers and roles of the individual members of Congress are analyzed. Attention is directed to latent, as well as manifest, functions of legislative, investigative, and other major activities of Congress. The problem of bringing expertise to bear on the legislative process is considered throughout.

Credits: 3.00

POL 41300 - Analysis Of Political Attitudes And Behavior

Credit Hours: 3.00. A broad-based survey of human political attitudes and behavior and the forces that underlie them, utilizing contemporary research tools to examine and evaluate theoretical claims. Examines how people respond to information about politics, communicate about politics, form attitudes and preferences about politics, and their political interactions with other individuals, groups, and nations. Introduces survey research methodology, its uses, and its challenges in measuring political attitudes and behavior.

Learning Outcomes: 1. Compare and contrast foundational and contemporary theories that explain political attitudes and behavior. 2. Critically evaluate sources of information about public opinion and understand how to communicate, accurately, the results from survey research. 3. Synthesize course knowledge to create a theoretically-grounded analysis of political attitudes or behavior using empirical data and appropriate research methods. 4. Describe and explain to specialists and non-specialists the theories and empirical evidence of the causes and consequences of political attitudes and behavior. Credits: 3.00

POL 41500 - US Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the United States.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of

diversity in relation to mass and political communications. 5. Write correctly and clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 42900 - Contemporary Political Problems

Credit Hours: 3.00. Contemporary political problems in the United States affecting the interpretation of democracy, human rights and welfare, social pressures, and intergovernmental relations.

Credits: 3.00

POL 46000 - Judicial Politics

Credit Hours: 3.00. A survey of judicial processes as they operate in America. Both trial courts and appellate courts will be examined in light of the procedures with which they operate. The external social, economic, and political pressures surrounding courts and the impact courts have on society will be considered.

Credits: 3.00

POL 46100 - Constitutional Law I

Credit Hours: 3.00. A survey of selected areas of constitutional law, considering the political and social influences as well as the doctrinal forces that have produced these policies and interpretations.

Credits: 3.00

POL 46200 - Constitutional Law II

Credit Hours: 3.00. An examination of the development of individual rights and civil liberties through constitutional law and interpretation of the Bill of Rights and Civil War Amendments. Both doctrinal and political pressures will be discussed to illustrate the evolution of these rights.

Credits: 3.00

POL 22900 - Emerging Problems In Political Science

Credit Hours: 1.00 to 3.00. This course focuses on problems and issues that are beginning to be recognized as worthy of public discussion or policy action, or that may be new areas of expertise and interest for our faculty members. We use it to introduce new topics and approaches, including experimental pedagogies, courses that involve travel, and the like. The content of the course varies from one offering to the next. Possible topics are Bioethics and Politics, Food Policy, and Bicycle Politics.

Credits: 1.00 to 3.00

Optional Concentration

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy

and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

15-16 Credits

Spring 1st Year

15-19 Credits

Fall 2nd Year

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)

Credits: 3.00

13-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12-13 Credits

Program Learning Outcomes

Political Science: Comparative

and International Politics Concentration, BA

About the Program

Degree Requirements

Political Science: Comparative and International Politics Concentration (12 credits)

Required Foundation Course (3 credits)

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

Selectives (9 credits)

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 23000 - Introduction To Peace Science

Credit Hours: 3.00. This course provides an introduction to the field of peace science, the systematic study of the causes and consequences of conflict between and within states, including conflict resolution and strategies for creating sustainable peace.

Learning Outcomes: 1. Identify the elements of conflict, including the stakeholders, their motivations, and their decision-making processes. 2. Describe the complexities of why conflicts get started, how and why they escalate or de-escalate, and how and why outsiders get involved. 3. Compare and evaluate explanations for how and why conflicts end and factors that increase the likelihood of enduring peace.

Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 23200 - Contemporary Crises In International Relations

Credit Hours: 3.00. The focus of this course will be on major world crises, such as in the Middle East and Southern Africa, and ways in which these crises may be analyzed.

Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 34500 - West European Democracies In The Post-Industrial Era

Credit Hours: 3.00. An introduction to the political institutions and processes in West European democracies. The course focuses on the ability of Western democracy to survive the transition to the post-industrial era.

Credits: 3.00

POL 34700 - Introduction To Latin American Politics

Credit Hours: 3.00. Major aspects of Latin American politics and development. Questions such as the impact of the military on political development, the dynamics of Latin American industrialization, and Latin America's changing international role will be explored.

Credits: 3.00

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international

""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43500 - International Law

Credit Hours: 3.00. A study of international legal theories, principles, and practices, with an emphasis on the role and utility of law in contemporary international relations.

Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

POL 33500 - China And The Challenges Of Globalization (UCC: BSS)

Credit Hours: 3.00. Globalization is a very popular topic, resulting in a lot of loose and poorly thought-through talk and writing around the subject. The view taken in this course is that to understand current processes of globalization we need to examine it in less broad and amorphous ways by focusing on its specific manifestations. Thus, this course focuses on how China has managed the challenges of globalization. China is a particularly useful case study because it failed the challenges of globalization in the late 19th and early 20th centuries. For an ancient civilization such as China, this failure had tremendous impact on its national pride. The Chinese refer to this historical juncture as the "century of shame." Towards the end of the 20th century and the onset of the 21st, China faced again the challenges of globalization and has arisen to the tasks in a spectacular fashion, transforming a largely rural and agriculture economy into the world's second largest economic power. This amazing transformation is leading some to proclaim that the 21st century will belong to China!

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recall basic facts about China's geography, people, economy, and culture. 2. Identify key historical moments in China's engagement with globalization. 3. Demonstrate a clear grasp of the concept of globalization and contending definitions of it. 4. Apply knowledge to explain how China has dealt with challenges of globalization. Credits: 3.00

POL 45000 - Game Theory And Strategy In Political Science

Credit Hours: 3.00. This course introduces students to the basics of game theory and its applications in political science. The course will cover foundational concepts in game theory, including strategic rationality, best responses, normal and strategic form games, backward induction, and games of incomplete information. Students will complete problem sets to demonstrate mastery of these subjects. We will also apply these basic game theoretic tools to important problems in political science to better understand the dynamics of bargaining, coercion, reassurance, cooperation, and other key concepts.

Learning Outcomes: 1. Demonstrate mastery of key game theoretic concepts, including utility theory, best responses and equilibrium, backward induction, and incomplete information. 2. Solve basic game theoretic problems and derive equilibria of both normal form and strategic form games with both simultaneous and sequential moves. 3. Apply game theoretic concepts to explain actions and outcomes in important contemporary and historical cases in political science, policy, and politics. Credits: 3.00

POL 54101 - Applied Foundations Of Global Development

Credit Hours: 3.00. Describes the foundational concepts of economic development and the historical emergence of global inequality, provides explanations of global inequality, and explores Western efforts to mitigate it through foreign aid. Applies concepts to analyze current trends in development and

emerging practices in foreign aid.

Learning Outcomes: 1. Explain the global history of economic and human development. 2. Contrast notions of development beyond the narrow concept of economic growth. 3. Identify and critique a wide array of explanations for why some countries are developed and others are not. 4. Analyze international, domestic, and geographical constraints on economic development. 5. Describe the workings of the international aid regime. 6. Demonstrate practical skills for working in the field of development such as communication, organization, and analysis. Credits: 3.00

POL 52701 - Local To Global Governance Of Data, AI, And Emerging Technology

Credit Hours: 3.00. This course introduces students to the institutions and governing systems at the subnational, national, supranational, and international levels that regulate emerging technology, AI, and data. Focusing on laws, standards, and best practices, students will examine comparative case studies of regulation of big tech in differing governing environments. Students will explore how social, economic, and political factors shape differences in technology regulation across the globe.

Learning Outcomes: 1. Summarize the main policy institutions, stakeholders, and regulatory actors in subnational, national, supranational, and international settings as applied to area of emerging technology, AI, and data. 2. Analyze the current state of policy and its implementation in one or more regions or states as applied to areas of emerging technology, AI, and data. 3. Develop a proposal for best practices for managing the use of AI, data resources, or other emerging technology in a private, public, or non-profit setting. 4. Compare and contrast differences in technology regulation across the globe and explain common sources for these differences. Credits: 3.00

Optional Concentration

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003

Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

15-16 Credits

Spring 1st Year

15-19 Credits

Fall 2nd Year

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)
Credits: 3.00

13-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12-13 Credits

Political Science: Environmental Politics and Policy Concentration, BA

About the Program

Degree Requirements

Political Science: Environmental Politics and Policy Concentration (12 credits)

Required Course (3 credits)

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights,

political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

Electives (9 credits)

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL) Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 42900 - Contemporary Political Problems

Credit Hours: 3.00. Contemporary political problems in the United States affecting the interpretation of democracy, human rights and welfare, social pressures, and intergovernmental relations.

Credits: 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

Optional Concentration

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and

administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

15-16 Credits

Spring 1st Year

15-19 Credits

Fall 2nd Year

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)

Credits: 3.00

13-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12-13 Credits

Program Learning Outcomes

Political Science: Law and

Political Thought Concentration, BA

About the Program

Degree Requirements

Political Science: Law and Political Thought Concentration (12 credits)

Required Courses (6 credits)

POL 46000 - Judicial Politics

Credit Hours: 3.00. A survey of judicial processes as they operate in America. Both trial courts and appellate courts will be examined in light of the procedures with which they operate. The external social, economic, and political pressures surrounding courts and the impact courts have on society will be considered.

Credits: 3.00

POL 46100 - Constitutional Law I

Credit Hours: 3.00. A survey of selected areas of constitutional law, considering the political and social influences as well as the doctrinal forces that have produced these policies and interpretations.

Credits: 3.00

Additional Courses (6 credits)

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 35200 - Selected Topics In Political Theory

Credit Hours: 3.00. This course is intended to provide a more narrowly focused analysis of selected problems and topics, giving special emphasis to their conceptual frameworks and their significance in the history of political philosophy. This course also will allow students to see the practical role of the political theorist by stressing the methods and criteria used in the selection, formulation, and solution of problems in political philosophy. Course topics will be different each semester.

Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 43500 - International Law

Credit Hours: 3.00. A study of international legal theories, principles, and practices, with an emphasis on the role and utility of law in contemporary international relations.

Credits: 3.00

POL 46200 - Constitutional Law II

Credit Hours: 3.00. An examination of the development of individual rights and civil liberties through constitutional law and interpretation of the Bill of Rights and Civil War Amendments. Both doctrinal and political pressures will be discussed to illustrate the evolution of these rights.

Credits: 3.00

POL 46400 - Legal Writing, Ethics, And Professionalism

Credit Hours: 3.00. This class is designed to provide students with the practical skills and knowledge they will need to embark

on an internship or career in the legal environment. The class will focus on legal ethics, writing and research skills.

Learning Outcomes: 1. Explain the basic principles of legal ethics and recognize common ethical issues in law practice. 2. Identify ways to address legal issues, expectations, and consequences for lawyers and their staff. 3. Draft several standard legal documents. 4. Demonstrate ability to conduct basic legal research and write a professional report.

Credits: 3.00

Optional Concentration

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

15-16 Credits

Spring 1st Year

15-19 Credits

Fall 2nd Year

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)
Credits: 3.00

13-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12-13 Credits

Program Learning Outcomes

Political Science: National and International Security Concentration, BA

About the Program

Degree Requirements

Political Science: National and International Security Concentration (12 credits)

Required Foundation Course (3 credits)

POL 23000 - Introduction To Peace Science

Credit Hours: 3.00. This course provides an introduction to the field of peace science, the systematic study of the causes and consequences of conflict between and within states, including conflict resolution and strategies for creating sustainable peace.

Learning Outcomes: 1. Identify the elements of conflict, including the stakeholders, their motivations, and their decision-making processes. 2. Describe the complexities of why conflicts get started, how and why they escalate or de-escalate, and how and why outsiders get involved. 3. Compare and evaluate explanations for how and why conflicts end and factors that increase the likelihood of enduring peace.
Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy.

Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 20400 - Spies And Lies: Studies In Intelligence And National Security

Credit Hours: 3.00. This course examines the role that the collection, analysis, and dissemination of intelligence plays in US foreign policy and national security. We will unpack the missions and methods of the US Intelligence Community. Who does what? What are the different challenges for those engaged in the different aspects of intelligence? Why is the intelligence community configured like it is? We will also spend time with more contemporary topics in intelligence. What role does intelligence play meeting future national security and foreign policy challenges? What is the role of intelligence in modern warfare, including cyber-warfare? What role does intelligence play in a liberal democracy? What should intelligence oversight look like?

Learning Outcomes: 1. Gain a better understanding of the complexities of our intelligence community and the role it plays in protecting against threats to our nation's security and achieving foreign policy objectives. 2. Understand the structure of the US Intelligence Community and how it's changed over time. 3. Understand how intelligence is collected, analyzed, disseminated, and utilized by policymakers. 4. Understand new threats and challenges facing the Intelligence Community. Credits: 3.00

Selectives (9 credits)

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23000 - Introduction To Peace Science

Credit Hours: 3.00. This course provides an introduction to the field of peace science, the systematic study of the causes and consequences of conflict between and within states, including conflict resolution and strategies for creating sustainable peace.

Learning Outcomes: 1. Identify the elements of conflict, including the stakeholders, their motivations, and their decision-making processes. 2. Describe the complexities of why conflicts get started, how and why they escalate or de-escalate, and how and why outsiders get involved. 3. Compare and evaluate explanations for how and why conflicts end and factors that increase the likelihood of enduring peace. Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23200 - Contemporary Crises In International Relations

Credit Hours: 3.00. The focus of this course will be on major world crises, such as in the Middle East and Southern Africa, and ways in which these crises may be analyzed.

Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

POL 43500 - International Law

Credit Hours: 3.00. A study of international legal theories, principles, and practices, with an emphasis on the role and utility of law in contemporary international relations.

Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

POL 53100 - Terrorism And WMD Threat Assessment

Credit Hours: 3.00. "Terrorism and WMD Threat Assessment" is designed to teach students how to analyze and assess the threats terrorist organizations present in the area of nuclear and radiological security and weapons of mass destruction more generally. The goal of this class is to enable students to identify, prioritize, and assess terrorist threats and propose appropriate, proportional, and cost-effective counter-measures.

Learning Outcomes: 1. Understand the causes, motivations, strategies, and tactics of terrorist organizations, particularly regarding nuclear terrorism. 2. Understand challenges associated with implementing effective counterterrorism strategies and policies. 3. Analyze current and future nuclear proliferation threats from countries and non-state or sub-state actors and provide recommendations on how to address these security issues. 4. Define and analyze the various types of transnational threats and targets in order to craft effective policy responses. 5. Describe nuclear weapons proliferation, including incentives and disincentives for proliferation. 6. Analyze counter-proliferation strategies. Credits: 3.00

POL 53200 - Nuclear Strategy And Proliferation

Credit Hours: 3.00. "Nuclear Strategy and Proliferation" is designed to teach students about 1) the conceptual elements and operational requirements of nuclear deterrence and 2) the historical dynamics of nuclear proliferation and nonproliferation. The goal of the class is to enable students to 1) evaluate the deterrent effects of different nuclear weapons and various configurations of nuclear arsenals and 2) analyze the technological, political and legal incentives and obstacles for acquiring nuclear weapons.

Learning Outcomes: 1. Understand the historical development of ideas about nuclear deterrence and its requirements. 2. Understand debates about the requirements for nuclear deterrence. 3. Analyze and evaluate the size and structure of the nuclear arsenals of current nuclear powers. 4. Identify and explain the main technological challenges and obstacles to acquiring nuclear weapons. 5. Evaluate potential explanations of why nations choose to acquire nuclear weapons (or refrain from doing so). Credits: 3.00

POL 20400 - Spies And Lies: Studies In Intelligence And National Security

Credit Hours: 3.00. This course examines the role that the collection, analysis, and dissemination of intelligence plays in US foreign policy and national security. We will unpack the missions and methods of the US Intelligence Community. Who does what? What are the different challenges for those engaged

in the different aspects of intelligence? Why is the intelligence community configured like it is? We will also spend time with more contemporary topics in intelligence. What role does intelligence play meeting future national security and foreign policy challenges? What is the role of intelligence in modern warfare, including cyber-warfare? What role does intelligence play in a liberal democracy? What should intelligence oversight look like?

Learning Outcomes: 1. Gain a better understanding of the complexities of our intelligence community and the role it plays in protecting against threats to our nation's security and achieving foreign policy objectives. 2. Understand the structure of the US Intelligence Community and how it's changed over time. 3. Understand how intelligence is collected, analyzed, disseminated, and utilized by policymakers. 4. Understand new threats and challenges facing the Intelligence Community. Credits: 3.00

POL 45000 - Game Theory And Strategy In Political Science

Credit Hours: 3.00. This course introduces students to the basics of game theory and its applications in political science. The course will cover foundational concepts in game theory, including strategic rationality, best responses, normal and strategic form games, backward induction, and games of incomplete information. Students will complete problem sets to demonstrate mastery of these subjects. We will also apply these basic game theoretic tools to important problems in political science to better understand the dynamics of bargaining, coercion, reassurance, cooperation, and other key concepts.

Learning Outcomes: 1. Demonstrate mastery of key game theoretic concepts, including utility theory, best responses and equilibrium, backward induction, and incomplete information. 2. Solve basic game theoretic problems and derive equilibria of both normal form and strategic form games with both simultaneous and sequential moves. 3. Apply game theoretic concepts to explain actions and outcomes in important contemporary and historical cases in political science, policy, and politics. Credits: 3.00

POL 23400 - The Politics Of Terrorism

Credit Hours: 3.00. This class examines the phenomenon of terrorism and counterterrorism. Why do terrorists do what they do? What can governments do to stop them? We will begin with issues of definition, and theoretical and empirical approaches to the study of terrorism. We will then delve into the history and evolution of the tactic (taking time to study some of the more notorious organizations). At this point in time it is critical that we look at both domestic-particularly in the United States-and transnational forms of terrorism. The study of terrorism is rife with puzzles that we will explore. Why resort to violence in the first place? How and why do groups evolve over time? How and why do some groups end, and others continue for years? Why are some individuals/groups not classified as terrorists? What are the consequences of terrorism? We will also look closely at counterterrorism policy. What are the most effective ways to respond to terrorism? What doesn't work? How do policies differ between states? To what extent is there global cooperation on counterterrorism? We will conclude the class by taking a critical look at US counterterrorism policy and the massive counterterrorism apparatus that has developed in the aftermath of the attacks of September 11, 2001. Should counterterrorism dominate US national security priorities to the degree it does?

Learning Outcomes: 1. Understand the leading theories and concepts for understanding terrorist behavior. 2. Have a greater understanding of counterterrorism strategies and their impact on terrorist organizations/lone wolfs. 3. Identify current trends and make predictions about the future of both terrorism and counterterrorism. 4. Think analytically about global threats. Credits: 3.00

POL 43200 - Selected Problems In World Order

Credit Hours: 3.00. An in-depth analysis of how selected problems in international relations are treated within international organizations.

Credits: 3.00

Optional Concentration

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

15-16 Credits

Spring 1st Year

15-19 Credits

Fall 2nd Year

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL) Credits: 3.00

13-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12-13 Credits

Political Science: Politics of Groups, Organizations, and Representation Concentration, BA

About the Program

Degree Requirements

Political Science: Politics of Groups, Organizations, and Representation Concentration (12 credits)

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 41000 - Political Parties And Politics

Credit Hours: 3.00. An analysis of the nature and functioning of U.S. political parties in terms of social and economic forces that shape our political system. Interactions among political parties, pressure groups, and formal government structures are emphasized throughout. Special attention is devoted to political leadership, nominating processes, campaign management, voting behavior, and other important aspects of American politics.

Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 46200 - Constitutional Law II

Credit Hours: 3.00. An examination of the development of individual rights and civil liberties through constitutional law and interpretation of the Bill of Rights and Civil War Amendments. Both doctrinal and political pressures will be discussed to illustrate the evolution of these rights.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

POL 54101 - Applied Foundations Of Global Development

Credit Hours: 3.00. Describes the foundational concepts of economic development and the historical emergence of global inequality, provides explanations of global inequality, and explores Western efforts to mitigate it through foreign aid. Applies concepts to analyze current trends in development and emerging practices in foreign aid.

Learning Outcomes: 1. Explain the global history of economic and human development. 2.

Contrast notions of development beyond the narrow concept of economic growth. 3. Identify and critique a wide array of explanations for why some countries are developed and others are not. 4. Analyze international, domestic, and geographical constraints on economic development. 5. Describe the workings of the international aid regime. 6. Demonstrate practical skills for working in the field of development such as communication, organization, and analysis. Credits: 3.00

Optional Concentration

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

15-16 Credits

Spring 1st Year

15-19 Credits

Fall 2nd Year

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)

Credits: 3.00

13-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12-13 Credits

Program Learning Outcomes

Political Science: Public Policy Concentration, BA

About the Program

Degree Requirements

Political Science: Public Policy Concentration (12 credits)

Required Foundation Course (3 credits)

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

Selectives (9 credits)

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political

system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the

United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

POL 52101 - Applied Public Policy: Institutions, Processes, Practices

Credit Hours: 3.00. Applied introduction to the institutions, processes, and practices in the field of public policy. Students will examine the role of government institutions, standards organizations, corporate actors, and non-governmental organizations, policymakers, regulators, and the public in the policy process. The course will draw examples from one or more applied policy areas such as economic development, emerging technology policy, sustainability policy, energy, foreign policy, or social policy.

Learning Outcomes: 1. Summarize and describe the institutions, actors, and policy process for different political systems. 2. Compare and contrast the role of political analysis and policy analysis for analyzing the viability and success of policy. 3. Evaluate a policy area and write a policy brief describing the history of the policy, current stakeholders in the area, the current state of policy, and emerging policy challenges or prospective changes. 4. Design translational communication materials to convey policy information to different audiences including specialists and non-specialists. Credits: 3.00

POL 54101 - Applied Foundations Of Global Development

Credit Hours: 3.00. Describes the foundational concepts of economic development and the historical emergence of global inequality, provides explanations of global inequality, and explores Western efforts to mitigate it through foreign aid. Applies concepts to analyze current trends in development and emerging practices in foreign aid.

Learning Outcomes: 1. Explain the global history of economic and human development. 2. Contrast notions of development beyond the narrow concept of economic growth. 3. Identify and critique a wide array of explanations for why some countries are developed and others are not. 4. Analyze international, domestic, and geographical constraints on economic development. 5. Describe the workings of the international aid regime. 6. Demonstrate practical skills for working in the field of development such as communication, organization, and analysis. Credits: 3.00

POL 52601 - Technology, AI, And Ethics In Public Policy And Public Administration

Credit Hours: 3.00. Examines how emerging technologies like artificial intelligence (AI), automated decision systems, and digital platforms are being adopted in the public sector. It explores the benefits as well as ethical risks and challenges associated with implementing these technologies in areas like healthcare, education, child welfare, and criminal justice. Students will analyze governance strategies, policies, and administrative procedures to promote responsible technology use in government.

Learning Outcomes: 1. Summarize the main forms of digital technology and algorithmic practices (AI) that are being adopted in government operations and decision-making, including automated decision systems, digital public interfaces, and data integration platforms. 2. Analyze emerging trends and developments in the use of AI, automated decision systems, and data analytics in public agencies and governments, in the U.S., internationally, and at the local level. 3. Assess the benefits as well as

risks and challenges associated with implementing these technologies in the public sector, including how the use of new technology is transforming interactions between government and citizens, impacting social welfare, and implicating issues of transparency, accountability, discretion, discrimination, and public trust. 4. Evaluate ethical concerns, biases, and risks to social welfare that may arise from the use of AI and automated decision systems in administering public programs and services and demonstrate the ability to examine issues from multiple stakeholder perspectives. 5. Propose governance strategies, policy solutions, and administrative procedures to ensure responsible and ethical use of AI and other emerging technologies in the public sector, such as best practices for procurement, implementation, auditing, and public engagement. Credits: 3.00

POL 52701 - Local To Global Governance Of Data, AI, And Emerging Technology

Credit Hours: 3.00. This course introduces students to the institutions and governing systems at the subnational, national, supranational, and international levels that regulate emerging technology, AI, and data. Focusing on laws, standards, and best practices, students will examine comparative case studies of regulation of big tech in differing governing environments. Students will explore how social, economic, and political factors shape differences in technology regulation across the globe.

Learning Outcomes: 1. Summarize the main policy institutions, stakeholders, and regulatory actors in subnational, national, supranational, and international settings as applied to area of emerging technology, AI, and data. 2. Analyze the current state of policy and its implementation in one or more regions or states as applied to areas of emerging technology, AI, and data. 3. Develop a proposal for best practices for managing the use of AI, data resources, or other emerging technology in a private, public, or non-profit setting. 4. Compare and contrast differences in technology regulation across the globe and explain common sources for these differences. Credits: 3.00

Optional Concentration

Electives (32-56 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

15-16 Credits

Spring 1st Year

15-19 Credits

Fall 2nd Year

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)

Credits: 3.00

13-16 Credits

Spring 2nd Year

15-16 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

12-13 Credits

Program Learning Outcomes

Professional Flight Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (114 credits)

Required Major Courses (65 credits)

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication. Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

AT 14400 - Private Pilot Lectures

Credit Hours: 4.00. A study of the subject areas and information needed to operate as a private pilot in the aviation environment. The FAA private pilot written exam will be offered to those who qualify after taking the Lecture Course offering.

Learning Outcomes: 1. Recall the aeronautical subject areas required by the FAA as a private pilot. 2. Analyze aspects of professionalism and decision making within the aviation environment. 3. Compare and contrast the reference information available covering a given aviation concept or best practice. 4. Explain to team members about issues requiring resolution or input. 5. Demonstrate the knowledge, skills, and abilities to manage, lead, and empower others to efficiently address organizational and group needs and objectives. Credits: 4.00

AT 14500 - Private Pilot Flight

Credit Hours: 2.00. In this course, the student will receive the necessary dual flight instruction and solo flight time to qualify for the FAA Private Pilot Certificate under Part 61 of the Federal Aviation Regulations.

Learning Outcomes: 1. Demonstrate proficiency in take-offs and landings. 2. Demonstrate proficiency in flight at minimum controllable airspeed, including stalls and recoveries. 3. Demonstrate proficiency in planning and execution of cross-country flights using various means of navigation. 4. Demonstrate proficiency in night operations and simulated instrument flight. 5. Demonstrate proficiency in abnormal and emergency procedures. Credits: 2.00

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major aircraft systems work together. Credits: 3.00

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 21000 - Ground Trainer I

Credit Hours: 1.00. Included in this course are maneuvers to develop basic attitude instrument flying skills, including tracking, holding, and approach procedures. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in attitude instrument flying skills 2. Demonstrate proficiency in the use of enroute and approach navigation methods 3. Demonstrate proficiency in holding and arc maneuvers Credits: 1.00

AT 21100 - Ground Trainer II

Credit Hours: 1.00. This course is designed to develop a higher degree of coordination and judgement through additional experience in the flight training device. This course will continue to prepare the student for the FAA Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations. 2. Demonstrate proficiency in emergency aircraft operations. 3. Demonstrate proficiency in cross-country navigation procedures. Credits: 1.00

AT 22300 - Human Factors For Flight Crews

Credit Hours: 3.00. This course explores the fundamental concepts of single pilot and multi-crew human factors issues. The first part of the course focuses on the physiological factors that affect single pilot aeronautical decision-making. The second part examines human error, threat and error management, and domains of crew resources management. The third segment utilizes team-building exercises, case study presentations, and a formal assignment to emphasis course learning outcomes.

Learning Outcomes: 1. Examine the relationship of human factor issues to aviation safety 2. Examine crew resource management fundamentals in single and multi-crew environments. 3. Apply appropriate decision-making and problem-solving skills in team situations. Credits: 3.00

AT 24302 - Commercial Flight I Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to develop a higher degree of coordination and judgment through additional experience in more advanced flight maneuvers and cross-country flying under Part 141 of the Federal Aviation Regulations. It will start to prepare the student for the FAA

Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in takeoffs, landings, and flight at minimum controllable airspeed. 2. Demonstrate proficiency in advanced commercial pilot maneuvers. 3. Demonstrate proficiency in cross-country flight and electronic navigation. 4. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

AT 24802 - Commercial Flight II Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to finish preparation for the FAA Commercial Pilot Certificate practical exam. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in advanced commercial pilot maneuvers. 2. Demonstrate proficiency in cross-country flight and electronic navigation. 3. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

AT 24900 - Instrument Flight Lectures

Credit Hours: 3.00. A study of the operation of flight instruments and radio navigation aids, federal aviation regulations pertinent to instrument flight, meteorology, instrument charts, instrument flight planning, and air traffic control procedures. Preparation for the FAA Instrument Rating written examination.

Learning Outcomes: 1. Demonstrate competency in aircraft flight instruments and navigation systems. 2. Demonstrate competency in the Federal Aviation Regulations for instrument flight. 3. Demonstrate competency in using instrument enroute charts, approach charts, SIDS and STARS in IFR flight planning. 4. Demonstrate knowledge in conducting instrument approaches and holding patterns. 5. Demonstrate knowledge in aviation weather and aviation weather services. Credits: 3.00

AT 25302 - Instrument Flight Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to prepare the student for the FAA Instrument Rating under Part 141 of the Federal Aviation Regulations. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in holding procedures, instrument approaches, and IFR cross-country procedures. 2. Accomplish Instrument rating Practical Test. Credits: 2.00

AT 25400 - Commercial Flight Lectures

Credit Hours: 3.00. The course is designed to review the principles of flight, aircraft systems, pertinent federal aviation regulations, and airman publications and service in order to prepare the student for the FAA Commercial Pilot written examination.

Learning Outcomes: 1. Explain selected concepts from previous flight and ground courses. 2. Describe advanced aircraft systems and appropriate regulations needed in commercial operations. 3. Complete the Commercial Pilot Written Exam. Credits: 3.00

AT 32501 - Advanced Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who are preparing for careers as professional pilots or dispatchers and require an advanced knowledge of the impact of weather on aviation operations.

Learning Outcomes: 1. Develop increased awareness of meteorology and its application to aviation operations. 2. Demonstrate knowledge of aviation meteorological concepts, with an emphasis on meteorological hazards for instrument flight operations. 3. Demonstrate the use of aviation weather data types and sources. 4. Develop expertise in obtaining and evaluating appropriate weather data, and in integrating these data into the preflight planning required for a professionally-flown instrument flight. Credits: 3.00

AT 32700 - Advanced Transport Flight Operations

Credit Hours: 3.00. This course addresses advanced aviation topics to include high speed aerodynamics, automated cockpit instrumentation, domestic/international flight operations, and global navigation.

Learning Outcomes: 1. Explain subsonic and transonic aerodynamic principles and how they relate to aircraft design and performance. 2. Analyze issues related to CFIT, upset recovery, wind shear, in-flight and low altitude wake encounters, volcanic ash, anti-de-icing, and crossing restrictions/climb and descent planning. 3. Interpret RNP, RNAV, GPS, and Q route IFR charts. 4. Reflect upon, and internalize concepts of professional conduct and professionalism as a professional aviator. Credits: 3.00

AT 35300 - Multi-Engine Flight

Credit Hours: 1.00. This course prepares the student for the FAA multi-engine rating. Dual flight instruction is conducted in a multi-engine aircraft. Individual ground instruction will be arranged.

Learning Outcomes: 1. Explain the design and operation of multiengine aircraft systems. 2. Develop proficiency in handling engine power failures. 3. Develop proficiency in flight at minimum controllable airspeeds including stalls. 4. Develop proficiency in takeoffs and landings. 5. Develop proficiency in abnormal and emergency procedures. Credits: 1.00

AT 35400 - Turbine Flight Operations Lecture

Credit Hours: 2.00. A study of corporate aircraft systems and operations and an orientation to operational procedures.

Learning Outcomes: 1. Locate Federal Aviation Regulations related to oxygen requirements. 2. Describe turbine aircraft systems, associated cockpit procedures and checklist usage. 3. Compute turbine basic weight & balance and flight planning calculations. 4. Demonstrate safety and security procedures related to the operation of turbine aircraft. Credits: 2.00

AT 38800 - Large Aircraft Systems

Credit Hours: 3.00. This course introduces transport aircraft limitations, systems, and systems operation. Topics include turbojet aircraft powerplants, flight instruments, electrical power, air-conditioning, pressurization, hydraulic, and flight control systems. Emphasis is aircraft and systems manufacturer's design and operational philosophies.

Learning Outcomes: 1. Define large aircraft systems terminology and nomenclature. 2. Understand the theory and basic operation of major aircraft systems. 3. Describe aircraft and system manufacturer's design philosophies. 4. Explain how major aircraft systems work together. Credits: 3.00

AT 41600 - Airline Indoctrination

Credit Hours: 2.00. This course provides the background knowledge required to serve as a crewmember operating a transport-category airplane. Topics include aircraft systems, airline operations, and FAR Part 121 regulations.

Learning Outcomes: 1. Demonstrate knowledge of air carrier operating procedures and techniques, including cockpit scans and flows. 2. Demonstrate knowledge of transport-category aircraft systems. 3. Demonstrate working knowledge of applicable Federal Aviation Regulations. Credits: 2.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance.

Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

AT 43900 - Aviation Command Leadership

Credit Hours: 2.00. Examination of pilot professional development and strategies for career planning and industry advancement. Emphasis is placed on leadership, command training, and mentorship for pilots throughout their career.

Learning Outcomes: 1. Examine regulatory requirements, policies, and procedures that impact authority and leadership. 2.

Demonstrate techniques for reinforcing high standards of professionalism. 3. Assemble knowledge and skills necessary for effective leadership. 4. Create a 5 year professional development plan to become an effective leader. Credits: 2.00

AT 11200 - Introduction To Operational Aviation Safety

Credit Hours: 1.00. This course teaches students about industry safety standards and the School of Aviation and Transportation Technology's Safety Program. This course will emphasize applying various safety models to accident case studies and reported incidents.

Learning Outcomes: 1. Identify safety models commonly used by flight operations. 2. Differentiate amongst commonly used safety models. 3. Given a case study/safety report, students will be able to apply the appropriate safety model to the event. Credits: 1.00

AT 21200 - Operational Risk Assessment

Credit Hours: 1.00. This course gives students a comprehensive understanding of industry incident risk assessment and analyses. Students will learn about Safety Management Systems (SMS) feedback loop processes and techniques utilized to find root causes. Additionally, residual risks of real-world mishaps during flight operations will be examined.

Learning Outcomes: 1. Determine root causes from provided safety reports. 2. Produce a risk analysis from provided safety reports. 3. Extrapolate substitute and residual risk from provided safety reports. Credits: 1.00

AT 31400 - Operational Safety Mitigation

Credit Hours: 1.00. This course provides students with a hands-on learning experience within the Professional Flight Safety program. Students will use data and evidence from real-world safety reports to assess risks, develop control measures, and generate proposals that may be implemented into flight operations. Students will gain a clearer understanding of how flight operations and safety operations collaborate to mitigate hazards.

Learning Outcomes: 1. Recommend solutions for a risk assessment by using the data and evidence collected from a provided event. 2. Develop a mitigation proposal for an operational circumstance. Credits: 1.00

AT 48400 - Transport Aircraft Operations Simulation Laboratory

Credit Hours: 4.00. This course provides jet turbine-type aircraft simulator experience, allowing students to engage in typical aircraft maneuvers in visual and instrument atmospheric conditions. The laboratory lessons emphasize aircraft procedures in normal and abnormal flight or equipment conditions, focusing on crew resources management, applicable flight regulations, and aircraft systems knowledge in a scenario-based experiential learning environment.

Learning Outcomes: 1. Demonstrate familiarization with normal & non-normal aircraft operations and instrument flying procedures. 2. Perform routine IFR/VFR procedures and crew resource management per industry standards. 3. Demonstrate effective teamwork, communication, leadership, resilience, and decision-making skills. 4. Manipulate flight deck switches accurately in accordance with standard operating procedures. 5. Demonstrates the ability to explain aircraft systems and their interrelatedness. Credits: 4.00

AT 48900 - Capstone For Professional Flight Students

Credit Hours: 3.00. This capstone for Professional Flight students course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous knowledge of the student's curriculum. It also allows students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Analyze current literature to determine current aviation problems. 2. Plan a project within a small team utilizing effective communication and problem-solving skills. 3. Demonstrate the ability to combine knowledge, skills, and experiences from different areas and sources to create new applications. Credits: 3.00

Other Departmental/Program Course Requirements (49 credits)

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be

introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive,

explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (6 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 14400 - Private Pilot Lectures

Credit Hours: 4.00. A study of the subject areas and information needed to operate as a private pilot in the aviation environment. The FAA private pilot written exam will be offered to those who qualify after taking the Lecture Course offering.

Learning Outcomes: 1. Recall the aeronautical subject areas required by the FAA as a private pilot. 2. Analyze aspects of professionalism and decision making within the aviation environment. 3. Compare and contrast the

reference information available covering a given aviation concept or best practice. 4. Explain to team members about issues requiring resolution or input. 5. Demonstrate the knowledge, skills, and abilities to manage, lead, and empower others to efficiently address organizational and group needs and objectives. Credits: 4.00

AT 14500 - Private Pilot Flight

Credit Hours: 2.00. In this course, the student will receive the necessary dual flight instruction and solo flight time to qualify for the FAA Private Pilot Certificate under Part 61 of the Federal Aviation Regulations.

Learning Outcomes: 1. Demonstrate proficiency in take-offs and landings. 2. Demonstrate proficiency in flight at minimum controllable airspeed, including stalls and recoveries. 3. Demonstrate proficiency in planning and execution of cross-country flights using various means of navigation. 4. Demonstrate proficiency in night operations and simulated instrument flight. 5. Demonstrate proficiency in abnormal and emergency procedures. Credits: 2.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

16 Credits

Spring 1st Year

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication. Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

AT 21000 - Ground Trainer I

Credit Hours: 1.00. Included in this course are maneuvers to develop basic attitude instrument flying skills, including tracking, holding, and approach procedures. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in attitude instrument flying skills 2. Demonstrate proficiency in the use of enroute and approach navigation methods 3. Demonstrate proficiency in holding and arc maneuvers Credits: 1.00

AT 24900 - Instrument Flight Lectures

Credit Hours: 3.00. A study of the operation of flight instruments and radio navigation aids, federal aviation regulations pertinent to instrument flight, meteorology, instrument charts, instrument flight planning, and air traffic control procedures. Preparation for the FAA Instrument Rating written examination.

Learning Outcomes: 1. Demonstrate competency in aircraft flight instruments and navigation systems. 2. Demonstrate competency in the Federal Aviation Regulations for instrument flight. 3. Demonstrate competency in using instrument enroute charts, approach charts, SIDS and STARS in IFR flight planning. 4. Demonstrate knowledge in conducting instrument approaches and holding patterns. 5. Demonstrate knowledge in aviation weather and aviation weather services. Credits: 3.00

AT 25302 - Instrument Flight Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to prepare the student for the FAA Instrument Rating under Part 141 of the Federal Aviation Regulations. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in holding procedures, instrument approaches, and IFR cross-country procedures. 2. Accomplish Instrument rating Practical Test. Credits: 2.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level

required to perform standard applications related to life sciences, management and technology. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

AT 11200 - Introduction To Operational Aviation Safety

Credit Hours: 1.00. This course teaches students about industry safety standards and the School of Aviation and Transportation Technology's Safety Program. This course will emphasize applying various safety models to accident case studies and reported incidents.

Learning Outcomes: 1. Identify safety models commonly used by flight operations. 2. Differentiate amongst commonly used safety models. 3. Given a case study/safety report, students will be able to apply the appropriate safety model to the event. Credits: 1.00

16 Credits

Fall 2nd Year

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major aircraft systems work together. Credits: 3.00

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 21100 - Ground Trainer II

Credit Hours: 1.00. This course is designed to develop a higher degree of coordination and judgement through additional experience in the flight training device. This course will continue to prepare the student for the FAA Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations. 2. Demonstrate proficiency in emergency aircraft operations. 3. Demonstrate proficiency in cross-country navigation procedures. Credits: 1.00

AT 22300 - Human Factors For Flight Crews

Credit Hours: 3.00. This course explores the fundamental

concepts of single pilot and multi-crew human factors issues. The first part of the course focuses on the physiological factors that affect single pilot aeronautical decision-making. The second part examines human error, threat and error management, and domains of crew resources management. The third segment utilizes team-building exercises, case study presentations, and a formal assignment to emphasis course learning outcomes.

Learning Outcomes: 1. Examine the relationship of human factor issues to aviation safety 2. Examine crew resource management fundamentals in single and multi-crew environments. 3. Apply appropriate decision-making and problem-solving skills in team situations. Credits: 3.00

AT 24302 - Commercial Flight I Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to develop a higher degree of coordination and judgment through additional experience in more advanced flight maneuvers and cross-country flying under Part 141 of the Federal Aviation Regulations. It will start to prepare the student for the FAA Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in takeoffs, landings, and flight at minimum controllable airspeed. 2. Demonstrate proficiency in advanced commercial pilot maneuvers. 3. Demonstrate proficiency in cross-country flight and electronic navigation. 4. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

AT 25400 - Commercial Flight Lectures

Credit Hours: 3.00. The course is designed to review the principles of flight, aircraft systems, pertinent federal aviation regulations, and airman publications and service in order to prepare the student for the FAA Commercial Pilot written examination.

Learning Outcomes: 1. Explain selected concepts from previous flight and ground courses. 2. Describe advanced aircraft systems and appropriate regulations needed in commercial operations. 3. Complete the Commercial Pilot Written Exam. Credits: 3.00

AT 21200 - Operational Risk Assessment

Credit Hours: 1.00. This course gives students a comprehensive understanding of industry incident risk assessment and analyses. Students will learn about Safety Management Systems (SMS) feedback loop processes and techniques utilized to find root causes. Additionally, residual risks of real-world mishaps during flight operations will be examined.

Learning Outcomes: 1. Determine root causes from provided safety reports. 2. Produce a risk analysis from provided safety reports. 3. Extrapolate substitute and residual risk from provided safety reports. Credits: 1.00

16 Credits

Spring 2nd Year

AT 24802 - Commercial Flight II Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to finish preparation for the FAA Commercial Pilot Certificate practical exam. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in advanced commercial pilot maneuvers. 2. Demonstrate proficiency in cross-country flight and electronic navigation. 3. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and

creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

AT 31400 - Operational Safety Mitigation

Credit Hours: 1.00. This course provides students with a hands-on learning experience within the Professional Flight Safety program. Students will use data and evidence from real-world safety reports to assess risks, develop control measures, and generate proposals that may be implemented into flight operations. Students will gain a clearer understanding of how flight operations and safety operations collaborate to mitigate hazards.

Learning Outcomes: 1. Recommend solutions for a risk assessment by using the data and evidence collected from a provided event. 2. Develop a mitigation proposal for an operational circumstance. Credits: 1.00

16 Credits

Fall 3rd Year

AT 32501 - Advanced Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who are preparing for careers as professional pilots or dispatchers and require an advanced knowledge of the impact of weather on aviation operations.

Learning Outcomes: 1. Develop increased awareness of meteorology and its application to aviation operations. 2. Demonstrate knowledge of aviation meteorological concepts, with an emphasis on meteorological hazards for instrument flight operations. 3. Demonstrate the use of aviation weather data types and sources. 4. Develop expertise in obtaining and evaluating appropriate weather data, and in integrating these data into the preflight planning required for a professionally-flown instrument flight. Credits: 3.00

AT 35300 - Multi-Engine Flight

Credit Hours: 1.00. This course prepares the student for the FAA multi-engine rating. Dual flight instruction is conducted in a multi-engine aircraft. Individual ground instruction will be arranged.

Learning Outcomes: 1. Explain the design and operation of multiengine aircraft systems. 2. Develop proficiency in handling engine power failures. 3. Develop proficiency in flight at minimum controllable airspeeds including stalls. 4. Develop proficiency in takeoffs and landings. 5. Develop proficiency in abnormal and emergency procedures. Credits: 1.00

AT 35400 - Turbine Flight Operations Lecture

Credit Hours: 2.00. A study of corporate aircraft systems and operations and an orientation to operational procedures.

Learning Outcomes: 1. Locate Federal Aviation Regulations related to oxygen requirements. 2. Describe turbine aircraft systems, associated cockpit procedures and checklist usage. 3. Compute turbine basic weight & balance and flight planning calculations. 4. Demonstrate safety and security procedures related to the operation of turbine aircraft. Credits: 2.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Spring 3rd Year

AT 32700 - Advanced Transport Flight Operations

Credit Hours: 3.00. This course addresses advanced aviation topics to include high speed aerodynamics, automated cockpit instrumentation, domestic/international flight operations, and global navigation.

Learning Outcomes: 1. Explain subsonic and transonic aerodynamic principles and how they relate to aircraft design and performance. 2. Analyze issues related to CFIT, upset recovery, wind shear, in-flight and low altitude wake encounters, volcanic ash, anti-de-icing, and crossing restrictions/climb and descent planning. 3. Interpret RNP, RNAV, GPS, and Q route IFR charts. 4. Reflect upon, and internalize concepts of professional conduct and professionalism as a professional aviator. Credits: 3.00

AT 38800 - Large Aircraft Systems

Credit Hours: 3.00. This course introduces transport aircraft limitations, systems, and systems operation. Topics include turbojet aircraft powerplants, flight instruments, electrical power, air-conditioning, pressurization, hydraulic, and flight control systems. Emphasis is aircraft and systems manufacturer's design and operational philosophies.

Learning Outcomes: 1. Define large aircraft systems terminology and nomenclature. 2. Understand the theory and basic operation of major aircraft systems. 3. Describe aircraft and system manufacturer's design philosophies. 4. Explain how major aircraft systems work together. Credits: 3.00

AT 41600 - Airline Indoctrination

Credit Hours: 2.00. This course provides the background knowledge required to serve as a crewmember operating a transport-category airplane. Topics include aircraft systems, airline operations, and FAR Part 121 regulations.

Learning Outcomes: 1. Demonstrate knowledge of air carrier operating procedures and techniques, including cockpit scans and flows. 2. Demonstrate knowledge of transport-category aircraft systems. 3. Demonstrate

working knowledge of applicable Federal Aviation Regulations. Credits: 2.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance. Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

14 Credits

Fall 4th Year

AT 43900 - Aviation Command Leadership

Credit Hours: 2.00. Examination of pilot professional development and strategies for career planning and industry advancement. Emphasis is placed on leadership, command training, and mentorship for pilots throughout their career. Learning Outcomes: 1. Examine regulatory requirements, policies, and procedures that impact authority and leadership. 2. Demonstrate techniques for reinforcing high standards of professionalism. 3. Assemble knowledge and skills necessary for effective leadership. 4. Create a 5 year professional development plan to become an effective leader. Credits: 2.00

AT 48400 - Transport Aircraft Operations Simulation Laboratory

Credit Hours: 4.00. This course provides jet turbine-type aircraft simulator experience, allowing students to engage in typical aircraft maneuvers in visual and instrument atmospheric conditions. The laboratory lessons emphasize aircraft procedures in normal and abnormal flight or equipment conditions, focusing on crew resources management, applicable flight regulations, and aircraft systems knowledge in a scenario-based experiential learning environment. Learning Outcomes: 1. Demonstrate familiarization with normal & non-normal aircraft operations and instrument flying procedures. 2. Perform routine IFR/VFR procedures and crew resource management per industry standards. 3. Demonstrate effective teamwork, communication, leadership, resilience, and decision-making skills. 4. Manipulate flight deck switches accurately in accordance with standard operating procedures. 5. Demonstrates the ability to explain aircraft systems and their interrelatedness. Credits: 4.00

15 Credits

Spring 4th Year

AT 48900 - Capstone For Professional Flight Students

Credit Hours: 3.00. This capstone for Professional Flight students course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous knowledge of the student's curriculum. It also allows students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major. Learning Outcomes: 1. Analyze current literature to determine current aviation problems. 2. Plan a project within a small team utilizing effective communication and problem-solving skills. 3. Demonstrate the ability to combine knowledge, skills, and experiences from different areas and sources to create new applications. Credits: 3.00

12 Credits

Professional Writing, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Area A - English Literature 20000-Level (3 credits)

ENGL 23000 - Great Narrative Works (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of great narratives from Homer's Odyssey to the present, considering works from a variety of cultures and time periods in order to develop an understanding of their ideas, structures, styles, and cultural values.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ENGL 23700 - Introduction To Poetry (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of poetry from different periods aimed at enhancing the student's understanding of genre, form, and style; how poetry grows out of and speaks to its historical moment; and how poetry addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of poetry. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 23800 - Introduction To Fiction (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of fiction from different periods aimed at enhancing the student's understanding of genre, form, and style; how fiction grows out of and speaks to its historical moment; and how fiction addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of fiction. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 24000 - British Literature Before 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the medieval to the Romantic period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Romantic period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Romantic literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 24100 - British Literature After 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the Romantic period on.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the Romantic period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about literature from the Romantic period to the present based on appropriate use of textual evidence. Credits: 3.00

ENGL 25000 - Great American Books (UCC: HUM)

Credit Hours: 3.00. What makes great American books so compelling? This course examines the dynamic history of American literature and explores how canonical and contemporary books have shaped the cultural landscape of the

U.S. and the world.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions related to great American books. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American books based on appropriate use of textual evidence. Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 26200 - Greek And Roman Classics In Translation

Credit Hours: 3.00. Study of important works of Greek and Roman literature, their intrinsic literary values, and their influence on later European and American writing and thinking.

Credits: 3.00

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26700 - World Literature: From 1700 A.D. To The Present (UCC: HUM)

Credit Hours: 3.00. (CMPL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. Typically offered Summer Fall Spring. CCN: IEL 1251 World Literature 2

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 24900 - Great British Books

Credit Hours: 3.00. Why are British books so compelling? This course examines the dynamic history of British literature and explores how canonical and contemporary texts shaped the cultural landscape of Britain, the British Empire, and the world.

Learning Outcomes: 1. Identify and make convincing arguments about major genres of British literature, including essays, journals, autobiographies, poetry, drama, and fiction. 2.

Identify the diversity of peoples, interests, and ideologies within British literature and culture, and the texts that define them. 3. Define and analyze how literary texts both reflect and produce culture. 4. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

Area B - Background (9 credits)

ENGL 20300 - Introduction To Research For Professional Writers

Credit Hours: 3.00. Introduction to research sources and methods useful for professional writers, including electronic resources. Focus on collecting print and online information, interviewing, surveying, and conducting observations; and on evaluating, summarizing, analyzing, and reporting research.

Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30600 - Introduction To Professional Writing

Credit Hours: 3.00. Development of skill in analyzing rhetorical situations in the workplace. Practice in planning, writing, evaluating, and revising a variety of documents typical of those used in the arts and industry.

Learning Outcomes: 1. Understand the basic rhetorical theories that underlie professional and technical writing. 2. Explore issues and challenges in professional writing in a variety of professional and technical contexts. 3. Produce critical writing on rhetorical issues in the field. 4. Solve workplace or organizational problems using writing. Credits: 3.00

ENGL 28000 - Games, Narrative, Culture

Credit Hours: 3.00. This is an introduction to the field of game studies, and to games as narrative and cultural media. We will look at the stories games tell; the way their narrative elements or plot devices intersect with the culture around the games and gaming itself; and how all these things come together to affect game design, meaning, and play.

Learning Outcomes: 1. Demonstrate knowledge of key concepts in both game studies and narrative theory in order to critique a game's systems and narrative elements. 2. Articulate how a game's narrative and the industry's workplace practices are situated in specific historical and cultural contexts. 3. Demonstrate critical thinking skills suited to cultural and historical complexities. 4. Articulate concise, coherent arguments about the effects of writing, narrative, and workplace practices and policies on the video game industry and a game's audience. Credits: 3.00

Area C - Advanced Writing Courses (21 credits)

ENGL 30900 - Digital Design And Production

Credit Hours: 3.00. The development of the ability to write and design documents using electronic publishing technologies. Students will receive instruction in writing, graphics, and publishing software and will write, design, produce, and critique a number of publications.

Learning Outcomes: 1. Understand the foundational principles of document design and gain practical experience with contemporary design tools. 2. Build portfolio pieces that employ a design thinking approach, both in content and execution 3. Apply theories of document design to a variety of different genres directed to different audiences and rhetorical purposes. Credits: 3.00

Track 1: Writing And Publishing (18 credits)

Required Course (3 credits)

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

Selectives (15 credits)

ENGL 39000 - Practicum In Tutoring Writing

Credit Hours: 1.00 to 3.00. A practicum to teach undergraduates to teach writing in the one-to-one setting of a writing lab.

Credits: 1.00 to 3.00

ENGL 40600 - Review Writing

Credit Hours: 3.00. Intensive practice in the writing of book, film, and theatre criticism, as well as reviews of musical programs and art exhibits. Readings in critics to serve as possible models. Audience analysis of newspapers and periodicals that would be potential markets.

Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective,

industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

ENGL 47000 - Advanced Topics In Rhetorical Studies

Credit Hours: 3.00. Study of rhetorical theories and practices past and present. Includes readings in primary texts in the history and theory of rhetoric. May be repeated for credit with a different topic.

Learning Outcomes: 1. Demonstrate advanced understanding of rhetorical concepts, theories, and practices. 2. Analyze and assess rhetorical situations from which arguments are generated; evaluate arguments and their public, institutional, or organizational success; produce arguments in a variety of genres and forms. 3. Demonstrate understanding of how and why rhetoric accomplishes its work from a variety of perspectives across the humanities and sciences. Credits: 3.00

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

ENGL 49400 - Research Practicum For Undergraduates

Credit Hours: 2.00 or 3.00. This course introduces students to research techniques and trains them to participate in a research laboratory or a professor-sponsored research project. Permission of instructor required.

Credits: 2.00 or 3.00

ENGL 50700 - Advanced Poetry Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems, using all the skills from ENGL 40700 but at a more proficient level. 2. Produce a portfolio of poems revised according to suggestions

received in workshop and in individual conferences with the instructor. 3. Acquire a broader knowledge of the context of contemporary poetry by reading and discussing several volumes by contemporary poets. Credits: 3.00

ENGL 50900 - Advanced Fiction Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing fiction, with the primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise fiction, using all the skills from English 40900 but at a more proficient level. 2. Produce polished fiction revised according to suggestions received in workshop and feedback from the instructor. 3. Acquire a broader knowledge of the context of contemporary fiction by reading and discussing work by several contemporary fiction writers. Credits: 3.00

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

ENGL 43300 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants is a professional writing workshop that teaches students to write workplace proposals and grants in for-profit and not-for-profit companies and organizations. Students will also learn how to write business plans, a specialized form of proposal.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Generate new ideas for businesses, products, and services. 3. Organize proposals and grants using various proposal genres. 4. Write in a plain and persuasive style that is appropriate to readers. 5. Design documents in ways that make information accessible. 6. Edit and revise proposals and grants. 7. Work with authors, customers, and funding agencies to sharpen the message of a proposal or grant. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

ENGL 43201 - Editing And Publishing

Credit Hours: 3.00. Editing and Publishing is a professional writing workshop that teaches students how to proofread, copyedit, substantive edit, and global edit documents. Students will learn how to navigate the publishing industry and work with authors on print, electronic, online, and multimedia documents.

Learning Outcomes: 1. Understand how the publishing industry operates, especially from an editor's perspective. 2. Apply the four levels of edit (global editing, substantive editing, copyediting, and proofreading) in an editorial project. 3. Work collaboratively with authors to produce clearly written and persuasive documents. 4. Edit document design and graphics in a document. 5. Interact with publishers to bring a text from manuscript form into a published manuscript. Credits: 3.00

ENGL 38000 - Issues In Rhetoric And Public Life (UCC: IL/WC)

Credit Hours: 3.00. Study of how language and media create

belief and change. Examines ancient and contemporary rhetorical theory as it applies to public discourse, media, and technology.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate knowledge of a range rhetorical techniques and practices in the public realm, past and/or present. 2. Discuss those techniques and practices in relation to their diverse historical, cultural, and technological contexts. 3. Produce well-reasoned written arguments about the rhetorical techniques and practices they study using appropriate forms of research and evidence. Credits: 3.00

ENGL 20700 - Introduction To Rhetoric & Argument

Credit Hours: 3.00. Introduces the art, science, and practical applications of rhetoric through ancient, contemporary, and transcultural concepts. Helps students gain a grounded understanding of rhetoric and its application in everyday life and professional contexts. This course will feature the application of persuasion in diverse fields and for diverse purposes. Students will learn to apply rhetorical principles to written, visual, and multimodal forms.

Learning Outcomes: 1. Articulate a comprehensive understanding of the evolution of rhetoric, from ancient to contemporary theorists. 2. Summarize the role of proofs in human communication and evaluate how rhetorical strategies can be used in persuasive messaging. 3. Develop and apply skills in identifying, analyzing, and employing rhetorical frameworks to enhance persuasive communication strategies. 4. Select rhetorical strategies appropriate for written, visual, and multimodal forms. Credits: 3.00

ENGL 32001 - Rhetoric, Artificial Intelligence, And Technology

Credit Hours: 3.00. This course examines the relationships between rhetoric and generative artificial intelligence (AI) using classical and contemporary rhetorical theory. While exploring how AI can support writing, students will gain insights into the challenges posed by AI, including issues of ethics, freedom, privacy, and sustainability. Includes application of rhetorical principles to the design and critique of new technologies.

Learning Outcomes: 1. Use knowledge of rhetorical history and contemporary rhetorical theory to evaluate the emergence of generative artificial intelligence (AI). 2. Write and design workplace documents by engaging common elements of AI tools, such as prompts and training data. 3. Integrate AI tools with other writing tools to create persuasive and informative content in diverse media. 4. Develop ethical approaches to using AI in research, persuasion, and critique. Credits: 3.00

ENGL 32101 - Content Strategy & Rhetoric

Credit Hours: 3.00. This course explores common methods for intentionally auditing, developing, and managing content across multiple media. Students will consider how different audiences and purposes shape how content is structured and delivered in varying rhetorical contexts and diverse media. Emphasizes both analytical and technical elements of content strategy.

Learning Outcomes: 1. Create and implement content strategies aligned with organizational goals and tailored to specific audiences, contexts, and purposes. 2. Perform content audits and inventories using common approaches such as lifecycle development and user testing. 3. Articulate how specific needs influence the structure and delivery of content across multiple media. 4. Use tools such as content management systems to engage and inform relevant stakeholders and contributors. Credits: 3.00

Track 2: Technical Writing (18 credits)

Required Course (3 credits)

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

Selectives (15 credits)

ENGL 39000 - Practicum In Tutoring Writing

Credit Hours: 1.00 to 3.00. A practicum to teach undergraduates to teach writing in the one-to-one setting of a writing lab.

Credits: 1.00 to 3.00

ENGL 40600 - Review Writing

Credit Hours: 3.00. Intensive practice in the writing of book, film, and theatre criticism, as well as reviews of musical programs and art exhibits. Readings in critics to serve as possible models. Audience analysis of newspapers and periodicals that would be potential markets.

Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

ENGL 47000 - Advanced Topics In Rhetorical Studies

Credit Hours: 3.00. Study of rhetorical theories and practices past and present. Includes readings in primary texts in the history and theory of rhetoric. May be repeated for credit with a different topic.

Learning Outcomes: 1. Demonstrate advanced understanding of rhetorical concepts, theories, and practices. 2. Analyze and assess rhetorical situations from which arguments are generated; evaluate arguments and their public, institutional, or organizational success; produce arguments in a variety of genres and forms. 3. Demonstrate understanding of how and why rhetoric accomplishes its work from a variety of perspectives across the humanities and sciences. Credits: 3.00

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

ENGL 49400 - Research Practicum For Undergraduates

Credit Hours: 2.00 or 3.00. This course introduces students to research techniques and trains them to participate in a research laboratory or a professor-sponsored research project. Permission of instructor required.

Credits: 2.00 or 3.00

ENGL 34500 - Games And World Building

Credit Hours: 3.00. Every game designer and gamer knows that there is more to narrative than just words on a page and more to worldbuilding than images on a screen. This course looks at the ways that narrative worlds get built-in games. We will begin by looking at the narrative elements in analog games that have been the foundation of many digital games and move on to look at the elements in digital games that come together to form the worlds.

Learning Outcomes: 1. Comprehend theoretical texts about game design and world building and demonstrate this by discussing them in class and with written assignments. 2. Analyze digital and analog games for specific world building techniques and strategies and demonstrate this via class discussion and written assignments. 3. Synthesize what they have learned about world building from theoretical texts and gameplay and demonstrate this by applying it to a final project in which they design their own game worlds. Credits: 3.00

ENGL 43300 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants is a professional writing workshop that teaches students to write workplace proposals and grants in for-profit and not-for-profit companies and organizations. Students will also learn how to write business plans, a specialized form of proposal.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Generate new ideas for businesses, products, and services. 3. Organize proposals and grants using various proposal genres. 4. Write in a plain and persuasive style that is appropriate to readers. 5. Design documents in ways that make information accessible. 6. Edit

and revise proposals and grants. 7. Work with authors, customers, and funding agencies to sharpen the message of a proposal or grant. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

ENGL 33000 - Games And Diversity

Credit Hours: 3.00. This course looks critically at diversity in games, game development, and in the larger mainstream games community. Students will analyze and play games that related to women, minorities, members of the LGBTQ community, and/or those who lack access because of disability.

Learning Outcomes: 1. Analyze a game's narrative based on a specific frame of diversity (i.e. gender, ethnicity, sexuality, and/or disability). 2. Explain how video games relate to contemporary cultural issues. 3. Use evidence-based arguments to defend a position related to video games and diversity. Credits: 3.00

ENGL 33200 - Games And User Experience (UX)

Credit Hours: 3.00. This course connects gamers and their experiences with games by developing ways to harvest gaming experiences for the improvement of games. We aim to prepare you to better understand gaming experiences, use those understandings to improve games in development, and be able to think and write critically about those experiences.

Learning Outcomes: 1. Identify and address the variables affecting usability investigation. 2. Articulate and employ methods for collecting and processing usability/user experience information about games. 3. Practice evidence-based arguments on game development and improvements. Credits: 3.00

ENGL 43201 - Editing And Publishing

Credit Hours: 3.00. Editing and Publishing is a professional writing workshop that teaches students how to proofread, copyedit, substantive edit, and global edit documents. Students will learn how to navigate the publishing industry and work with authors on print, electronic, online, and multimedia documents.

Learning Outcomes: 1. Understand how the publishing industry operates, especially from an editor's perspective. 2. Apply the four levels of edit (global editing, substantive editing, copyediting, and proofreading) in an editorial project. 3. Work collaboratively with authors to produce clearly written and persuasive documents. 4. Edit document design and graphics in a document. 5. Interact with publishers to bring a text from manuscript form into a published manuscript. Credits: 3.00

ENGL 38000 - Issues In Rhetoric And Public Life (UCC: IL/WC)

Credit Hours: 3.00. Study of how language and media create belief and change. Examines ancient and contemporary rhetorical theory as it applies to public discourse, media, and technology.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate knowledge of a range rhetorical techniques and practices in the public realm, past and/or present. 2. Discuss those techniques and practices in relation to their diverse historical, cultural, and technological contexts. 3. Produce well-reasoned written arguments about the rhetorical techniques and practices they study using appropriate forms of research and evidence. Credits: 3.00

ENGL 20700 - Introduction To Rhetoric & Argument

Credit Hours: 3.00. Introduces the art, science, and practical applications of rhetoric through ancient, contemporary, and transcultural concepts. Helps students gain a grounded understanding of rhetoric and its application in everyday life and professional contexts. This course will feature the application of persuasion in diverse fields and for diverse purposes. Students will learn to apply rhetorical principles to written, visual, and multimodal forms.

Learning Outcomes: 1. Articulate a comprehensive understanding of the evolution of rhetoric, from ancient to contemporary theorists. 2. Summarize the role of proofs in human communication and evaluate how rhetorical strategies can be used in persuasive messaging. 3. Develop and apply skills in identifying, analyzing, and employing rhetorical frameworks to enhance persuasive communication strategies. 4. Select rhetorical strategies appropriate for written, visual, and multimodal forms. Credits: 3.00

ENGL 32001 - Rhetoric, Artificial Intelligence, And Technology

Credit Hours: 3.00. This course examines the relationships between rhetoric and generative artificial intelligence (AI) using classical and contemporary rhetorical theory. While exploring how AI can support writing, students will gain insights into the challenges posed by AI, including issues of ethics, freedom, privacy, and sustainability. Includes application of rhetorical principles to the design and critique of new technologies.

Learning Outcomes: 1. Use knowledge of rhetorical history and contemporary rhetorical theory to evaluate the emergence of generative artificial intelligence (AI). 2. Write and design workplace documents by engaging common elements of AI tools, such as prompts and training data. 3. Integrate AI tools with other writing tools to create persuasive and informative content in diverse media. 4. Develop ethical approaches to using AI in research, persuasion, and critique. Credits: 3.00

ENGL 32101 - Content Strategy & Rhetoric

Credit Hours: 3.00. This course explores common methods for intentionally auditing, developing, and managing content across multiple media. Students will consider how different audiences and purposes shape how content is structured and delivered in varying rhetorical contexts and diverse media. Emphasizes both analytical and technical elements of content strategy.

Learning Outcomes: 1. Create and implement content strategies aligned with organizational goals and tailored to specific audiences, contexts, and purposes. 2. Perform content audits and inventories using common approaches such as lifecycle development and user testing. 3. Articulate how specific needs influence the structure and delivery of content across multiple media. 4. Use tools such as content management systems to engage and inform relevant stakeholders and contributors. Credits: 3.00

Required Minor (12-15 credits)

Electives (19-39 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-16 Credits

Spring 1st Year

15 Credits

Fall 2nd Year

ENGL 20300 - Introduction To Research For Professional Writers

Credit Hours: 3.00. Introduction to research sources and methods useful for professional writers, including electronic resources. Focus on collecting print and online information, interviewing, surveying, and conducting observations; and on evaluating, summarizing, analyzing, and reporting research.

Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 28000 - Games, Narrative, Culture

Credit Hours: 3.00. This is an introduction to the field of game studies, and to games as narrative and cultural media. We will look at the stories games tell; the way their narrative elements or plot devices intersect with the culture around the games and gaming itself; and how all these things come together to affect game design, meaning, and play.

Learning Outcomes: 1. Demonstrate knowledge of key concepts in both game studies and narrative theory in order to critique a game's systems and narrative elements. 2. Articulate how a game's narrative and the industry's workplace practices are situated in specific historical and cultural contexts. 3. Demonstrate critical thinking skills suited to cultural and historical complexities. 4. Articulate concise, coherent arguments about the effects of writing, narrative, and workplace practices and policies on the video game industry and a game's audience. Credits: 3.00

15 Credits

Spring 2nd Year

ENGL 30600 - Introduction To Professional Writing

Credit Hours: 3.00. Development of skill in analyzing rhetorical situations in the workplace. Practice in planning, writing, evaluating, and revising a variety of documents typical of those used in the arts and industry.

Learning Outcomes: 1. Understand the basic rhetorical theories that underlie professional and technical writing. 2. Explore issues and challenges in professional writing in a variety of professional and technical contexts. 3. Produce critical writing on rhetorical issues in the field. 4. Solve workplace or organizational problems using writing. Credits: 3.00

15 Credits

Fall 3rd Year

ENGL 30900 - Digital Design And Production

Credit Hours: 3.00. The development of the ability to write and design documents using electronic publishing technologies. Students will receive instruction in writing, graphics, and publishing software and will write, design, produce, and critique a number of publications.

Learning Outcomes: 1. Understand the foundational principles of document design and gain practical experience with contemporary design tools. 2. Build portfolio pieces that employ a design thinking approach, both in content and execution 3. Apply theories of document design to a variety of different genres directed to different audiences and rhetorical purposes. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

15 Credits

Spring 4th Year

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

15 Credits

Program Learning Outcomes

Psychological Sciences, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (36 credits)

A) Psychology Required Courses (9 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

PSY 20300 - Introduction To Research Methods In Psychology

Credit Hours: 3.00. The use of scientific method in psychology. Lecture covers principles of collecting and interpreting data, using examples of research from many areas of psychology. In the laboratory portion, the student uses many different techniques from various areas of psychology. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand and produce research that adheres to the highest ethical standards. 2. Identify distinguishing features of good science, bad science and junk

science. 3. Critically evaluate research findings. 4. Understand how study designs are used to answer research questions. 5. Present and interpret experimental data in an APA-style paper. Credits: 3.00

B) Psychology Selectives (12 credits)

PSY 20000 - Introduction To Cognitive Psychology

Credit Hours: 3.00. A survey of psychology as the science of mental life, covering theories and research in perception, reading, attention, consciousness, imagery, memory and its improvement, problem solving, creativity, decision-making, and artificial intelligence.

Learning Outcomes: 1. Describe basic aspects of visual perception and visual imagery. 2. Explain the role of attention in cognition. 3. Describe basic representations and processes of memory. 4. Understand high-level cognitive functions such as reasoning, problem solving, and language. 5. Understand how cognitive neuroscience can inform cognitive psychology. Credits: 3.00

PSY 22200 - Introduction To Behavioral Neuroscience

Credit Hours: 3.00. An introduction to how the nervous system controls behavior. Topics include evolution and comparative psychobiology, the neuroscience of sensation and perception, the neuroscience of motivation, neuropsychology, and cognitive neuroscience.

Learning Outcomes: 1. Describe the basic structure and function of the brain including neuroanatomy and neural communication. 2. Explain how the central nervous system processes internal and external stimuli. 3. Explain how experience influences current and future behavior. 4. Discern normal from abnormal brain function and describe its influence on behavior. Credits: 3.00

PSY 23500 - Child Psychology

Credit Hours: 3.00. Not open to students with credit in PSY 36000. General principles of children's behavior and development, from conception to adolescence, including sensory and motor development, and basic psychological processes such as learning, motivation, and socialization.

Credits: 3.00

PSY 24000 - Introduction To Social Psychology

Credit Hours: 3.00. Not open to students with credit in SOC 34000 . A broad survey in current knowledge about human social behavior. Topics covered include aggression, attraction and love, social influence, attitudes and attitude change, nonverbal communication, leadership, prejudice and discrimination, and application of social psychology to law, medicine, and other fields. CTL:ISH 1024 Social Psychology

Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

PSY 31400 - Introduction To Learning

Credit Hours: 3.00. This course attempts to make clear the theoretical and practical implications of learning principles and findings. Various theories of learning are examined and the implications of these theories, and the learning approach generally, for a variety of practical problems are emphasized.

Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the

etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

C) Additional Psychology Courses (15 credits)

Optional Concentration

Other Departmental/Program Course Requirements (31-68 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations

with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to

apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

Electives (16-53 credits)

Supplemental List

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the

advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-17 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a

written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

15 - 16 Credits

Fall 2nd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

15 Credits

Spring 2nd Year

PSY 20300 - Introduction To Research Methods In Psychology

Credit Hours: 3.00. The use of scientific method in psychology. Lecture covers principles of collecting and interpreting data, using examples of research from many areas of psychology. In the laboratory portion, the student uses many different techniques from various areas of psychology. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand and produce research that adheres to the highest ethical standards. 2. Identify distinguishing features of good science, bad science and junk science. 3. Critically evaluate research findings. 4. Understand how study designs are used to answer research questions. 5. Present and interpret experimental data in an APA-style paper. Credits: 3.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Public Health, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (39 credits)

PUBH 20500 - Basic Public Health Studies

Credit Hours: 3.00. Examination of basic scientific concepts as applied to the problems and issues in selected areas of human health behavior with particular attention to their influence on population and individual health. Restricted to students enrolled in major degree programs for which this course is a requirement.

Learning Outcomes: 1. Discuss the nature of public health promotion and disease prevention in the US. 2. List the leading causes of death and describe leading theories of health behavior. 3. Define the components of psychological health and describe the basic traits shared by psychologically healthy people. 4. Describe the nature of stress, the physiology of the stress response, and the relationship of stress to health/disease; identify the major sources of stress in contemporary society and discuss interventions for stress management. 5. Discuss categories of drugs, routes of administration and drug interactions. 6. Describe the relationship of alcohol, tobacco and caffeine to health and disease. 7. Describe the general concepts of nutrition, list and explain the recommendations made to the public by various health agencies to decrease risk of chronic disease. 8. Describe various theories of obesity, discuss concepts of weight management, define/describe body image and the disordered eating continuum, define anorexia and bulimia nervosa, and list symptomatology and risk factors. 9. Discuss the relationship of physical activity and physical fitness to health and/or disease and provide rationale (based on evidence from exercise epidemiology) for the recommendations made to the public concerning activity/exercise participation. 10. Describe the anatomy and basic functions of the cardiovascular system and the prevalence/incidence of heart disease, identify risk factors and describe the features of atherogenesis and other diseases of the heart and vascular system. 11. Describe the prevalence and incidence of the various types of cancer and identify cancer risk factors. 12. Describe the prevalence and incidence of diabetes and list risk factors for diabetes. Credits: 3.00

PUBH 32000 - Health Behavior And Health Promotion

Credit Hours: 3.00. Introduces health behavior theory and practice in the context of health promotion and education. Examines individual, interpersonal, and community approaches to explaining and predicting health behavior and emphasizes their application to interventions in health promotion and education.

Learning Outcomes: 1. Identify basic theories, concepts and models from a range of social and behavioral disciplines that are used in public health research and practice. 2. Apply different health behavior theories and models in the U.S. and internationally to important public health issues such as tobacco use, physical inactivity, poor diet, etc. 3. Identify the causes of social and behavioral factors that affect health of individuals and populations. 4. Describe the role of social and community factors in both the onset and solution of public health problems. 5. Specify multiple targets and levels of intervention for social and behavioral science programs and/or policies. 6. Understand theoretical constructs from an ecological perspective; Understand theories and models relevant at multiple levels of behavioral influence, including the individual, interpersonal, community, and organizational levels. Credits:

3.00

PUBH 32500 - Methods Of Health Promotion And Education

Credit Hours: 3.00. Methods and materials of health promotion and education; preparation and use of content and materials related to health concerns of target populations. A variety of strategies and media are covered with theoretical and practical applications.

Credits: 3.00

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

PUBH 48000 - Internship For Public Health

Credit Hours: 9.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques they have mastered in the classroom to a professional work experience in the field. Each student in the Public Health Major at Purdue University is required to perform a 400 hour internship experience that meets the expectations of the student, the internship/practicum site, and the University. The internship is to be a culminating experience representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Must have completed all other major requirements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge, skills, and abilities to be applied through the practicum experience within the areas of a) Administration, b) Program Development, c) Supervising Programs, d) Agency Operations. 2. Demonstrate professional and ethical decision making skills, verbal and written communication skills, and an ability to work with various needs of diverse populations. 3. Demonstrate professional relationships that present themselves as part of the organization with staff and clientele throughout their practicum experience. 4. Assess, plan, implement, and evaluate a research or facility enhancing major project within the practicum site. Credits: 9.00

PUBH 29500 - Internship & Career Preparation

Credit Hours: 1.00. This course provides students with professional competencies in identification and development of professional resources that aid in a greater understanding and preparation for careers in public health. Upon completion of the course, students will be prepared to seek an internship and apply concepts learned to their professional development experiences.

Learning Outcomes: 1. Define and conceptualize individual areas of study as a professional discipline, including its purpose, goals, trends, professional expectations, types of settings, etc. 2. Identify procedures for internship preparation. 3. Demonstrate the ability to develop a professional cover letter and resume. Credits: 1.00

PUBH 24000 - Global Health

Credit Hours: 2.00. This course introduces students to current challenges, debates, and efforts at solutions in global public health with a focus on low-and middle-income countries. It

provides an interdisciplinary overview of topics that include measures of health and disease, health disparities, communicable and non-communicable diseases, women's health, maternal and child health, food systems and nutrition, health systems, and global cooperation. It also highlights the central role of data in achieving the global health agenda. Permission of department required.

Learning Outcomes: 1. Identify major issues and trends in global health and their drivers, with a focus on low and middle-income countries. 2. Characterize the determinants of health and risk factors for conditions of importance to global health. 3. Identify key issues in health disparities between and within countries. 4. Describe the role of data in informing and driving decision-making and actions in global health. 5. Formulate evidence-based arguments for or against global health policies or interventions. Credits: 2.00

PUBH 23000 - Community, Culture And Social Justice From A Public Health Perspective

Credit Hours: 3.00. The course provides an introduction to the concepts of community, culture, and social justice. The interaction between community, cultural, ethical, social, economic, environmental, political and social justice dynamics that shape health will be explored.

Learning Outcomes: 1. Identify and understand the social determinants of health. 2. Describe how community, cultural, ethical, social, economical, environmental, political and social justice shape human health both locally and globally using a social determinants of health framework. 3. Learn about theories of justice related to the field of public health. 4. Understand community developmental theoretical frameworks dimensions associated with the social change, such as empowerment, community participation, and capacity building. 5. Identify roles and responsibilities of the public health educator, other practitioners, and community members as agents of change. 6. Compare and contrast the concepts of health inequities, health disparities and health inequalities. Credits: 3.00

PUBH 10001 - Introduction To Public Health

Credit Hours: 3.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health. 3. Explain the role of public health in society. 4. Understand the government's role in matters pertaining to the health of the public. 5. Understand the role of health disparities in public health. 6. Achieve a basic understanding of the major investigative tool in public health: Epidemiology. 7. Identify the principal environmental determinants of health. 8. Know major and widespread challenges to good health: smoking, obesity, chronic disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health, including the current pandemic. Credits: 3.00

PUBH 38000 - Public Health Policy

Credit Hours: 3.00. This course will provide the opportunity to examine and analyze the financing, organization and delivery of health care in the U.S. and how these core elements are shaped and influenced by health care policy and decision-making.

Learning Outcomes: 1. Describe the role of policy, law and government relations in health care and public health. 2. Explain how federal, state, and local health policy is made. 3. Identify and critique the difference between population health and individual health. 4. Explain the policy interests between the public good (public health) and individual rights. 5. Explain the organization of the health care system, including principles and examples of health insurance and health care finance. 6. Describe

health care policy formulation and implementation. 7. Explain and apply health policy principles to the policy topics discussed in class. Credits: 3.00

PUBH 36500 - Public Health Research Methods

Credit Hours: 3.00. The course is designed to help you (1) develop an understanding of the nature of research and the scientific method in public health, (2) acquire an appreciation for the different types of research conducted within public health, and (3) provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating public health research in basic and applied settings.

Learning Outcomes: 1. Explain and discuss the public health research process. 2. Identify or develop sound public health research questions and hypotheses, and discuss appropriate methods for testing the hypotheses. 3. Demonstrate appropriate techniques regarding data collection in public health. 4. Interpret research findings and discuss their implications relative to public health. Credits: 3.00

Other Departmental/Program Course Requirements (54-59 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through

reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues,

radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment.
Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription,

protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional

models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

Electives (22-27 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular

and molecular level. Credits: 4.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential

equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

PUBH 10001 - Introduction To Public Health

Credit Hours: 3.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health. 3. Explain the role of public health in society. 4. Understand the government's role in matters pertaining to the health of the public. 5. Understand the role of health disparities in public health. 6. Achieve a basic understanding of the major investigative tool in public health: Epidemiology. 7. Identify the principal environmental determinants of health. 8. Know major and widespread challenges to good health: smoking, obesity, chronic disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health, including the current pandemic. Credits: 3.00

16-18 Credits

16-18 Credits

Spring 1st Year

PUBH 20500 - Basic Public Health Studies

Credit Hours: 3.00. Examination of basic scientific concepts as applied to the problems and issues in selected areas of human health behavior with particular attention to their influence on population and individual health. Restricted to students enrolled in major degree programs for which this course is a requirement.

Learning Outcomes: 1. Discuss the nature of public health promotion and disease prevention in the US. 2. List the leading causes of death and describe leading theories of health behavior. 3. Define the components of psychological health and describe the basic traits shared by psychologically healthy people. 4. Describe the nature of stress, the physiology of the stress response, and the relationship of stress to health/disease; identify the major sources of stress in contemporary society and discuss interventions for stress management. 5. Discuss categories of drugs, routes of administration and drug interactions. 6. Describe the relationship of alcohol, tobacco and caffeine to health and disease. 7. Describe the general concepts of nutrition, list and

explain the recommendations made to the public by various health agencies to decrease risk of chronic disease. 8. Describe various theories of obesity, discuss concepts of weight management, define/describe body image and the disordered eating continuum, define anorexia and bulimia nervosa, and list symptomatology and risk factors. 9. Discuss the relationship of physical activity and physical fitness to health and/or disease and provide rationale (based on evidence from exercise epidemiology) for the recommendations made to the public concerning activity/exercise participation. 10. Describe the anatomy and basic functions of the cardiovascular system and the prevalence/incidence of heart disease, identify risk factors and describe the features of atherogenesis and other diseases of the heart and vascular system. 11. Describe the prevalence and incidence of the various types of cancer and identify cancer risk factors. 12. Describe the prevalence and incidence of diabetes and list risk factors for diabetes. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills

needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PUBH 23000 - Community, Culture And Social Justice From A Public Health Perspective

Credit Hours: 3.00. The course provides an introduction to the concepts of community, culture, and social justice. The interaction between community, cultural, ethical, social, economic, environmental, political and social justice dynamics that shape health will be explored.

Learning Outcomes: 1. Identify and understand the social determinants of health. 2. Describe how community, cultural, ethical, social, economical, environmental, political and social justice shape human health both locally and globally using a social determinants of health framework. 3. Learn about theories of justice related to the field of public health. 4. Understand community developmental theoretical frameworks dimensions associated with the social change, such as empowerment, community participation, and capacity building. 5. Identify roles and responsibilities of the public health educator, other practitioners, and community members as agents of change. 6. Compare and contrast the concepts of health inequities, health disparities and health inequalities. Credits: 3.00

16-17 Credits

Fall 2nd Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

PUBH 24000 - Global Health

Credit Hours: 2.00. This course introduces students to current challenges, debates, and efforts at solutions in global public health with a focus on low-and middle-income countries. It provides an interdisciplinary overview of topics that include measures of health and disease, health disparities, communicable and non-communicable diseases, women's health, maternal and child health, food systems and nutrition, health systems, and global cooperation. It also highlights the central role of data in achieving the global health agenda. Permission of department required.

Learning Outcomes: 1. Identify major issues and trends in global health and their drivers, with a focus on low and middle-income countries. 2. Characterize the determinants of health and risk factors for conditions of importance to global health. 3. Identify key issues in health disparities between and within countries. 4. Describe the role of data in informing and driving decision-making and actions in global health. 5. Formulate evidence-based arguments for or against global health policies or interventions. Credits: 2.00

17 Credits

Spring 2nd Year

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and

significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15 Credits

15 Credits

Fall 3rd Year

PUBH 32000 - Health Behavior And Health Promotion

Credit Hours: 3.00. Introduces health behavior theory and practice in the context of health promotion and education. Examines individual, interpersonal, and community approaches to explaining and predicting health behavior and emphasizes their application to interventions in health promotion and education.

Learning Outcomes: 1. Identify basic theories, concepts and models from a range of social and behavioral disciplines that are used in public health research and practice. 2. Apply different health behavior theories and models in the U.S. and internationally to important public health issues such as tobacco use, physical inactivity, poor diet, etc. 3. Identify the causes of social and behavioral factors that affect health of individuals and populations. 4. Describe the role of social and community factors in both the onset and solution of public health problems. 5. Specify multiple targets and levels of intervention for social and behavioral science programs and/or policies. 6. Understand theoretical constructs from an ecological perspective; Understand theories and models relevant at multiple levels of behavioral influence, including the individual, interpersonal, community, and organizational levels. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions

involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

PUBH 29500 - Internship & Career Preparation

Credit Hours: 1.00. This course provides students with professional competencies in identification and development of professional resources that aid in a greater understanding and preparation for careers in public health. Upon completion of the course, students will be prepared to seek an internship and apply concepts learned to their professional development experiences.

Learning Outcomes: 1. Define and conceptualize individual areas of study as a professional discipline, including its purpose, goals, trends, professional expectations, types of settings, etc. 2. Identify procedures for internship preparation. 3. Demonstrate the ability to develop a professional cover letter and resume. Credits: 1.00

14-16 Credits

14-16 Credits

Spring 3rd Year

PUBH 32500 - Methods Of Health Promotion And Education

Credit Hours: 3.00. Methods and materials of health promotion and education; preparation and use of content and materials related to health concerns of target populations. A variety of strategies and media are covered with theoretical and practical applications.

Credits: 3.00

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and

implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

13-15 Credits

13-15 Credits

Fall 4th Year

PUBH 38000 - Public Health Policy

Credit Hours: 3.00. This course will provide the opportunity to examine and analyze the financing, organization and delivery of health care in the U.S. and how these core elements are shaped and influenced by health care policy and decision-making.

Learning Outcomes: 1. Describe the role of policy, law and government relations in health care and public health. 2. Explain how federal, state, and local health policy is made. 3. Identify and critique the difference between population health and individual health. 4. Explain the policy interests between the public good (public health) and individual rights. 5. Explain the organization of the health care system, including principles and examples of health insurance and health care finance. 6. Describe health care policy formulation and implementation. 7. Explain and apply health policy principles to the policy topics discussed in class. Credits: 3.00

PUBH 36500 - Public Health Research Methods

Credit Hours: 3.00. The course is designed to help you (1) develop an understanding of the nature of research and the scientific method in public health, (2) acquire an appreciation for the different types of research conducted within public health, and (3) provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating public health research in basic and applied settings.

Learning Outcomes: 1. Explain and discuss the public health research process. 2. Identify or develop sound public health research questions and hypotheses, and discuss appropriate methods for testing the hypotheses. 3. Demonstrate appropriate techniques regarding data collection in public health. 4. Interpret research findings and discuss their implications relative to public health. Credits: 3.00

12-15 Credits

12-15 Credits

Spring 4th Year

PUBH 48000 - Internship For Public Health

Credit Hours: 9.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques they have mastered in the classroom to a professional work experience in the field. Each student in the Public Health Major at Purdue University is required to perform a 400 hour internship experience that meets the expectations of

the student, the internship/practicum site, and the University. The internship is to be a culminating experience representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Must have completed all other major requirements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge, skills, and abilities to be applied through the practicum experience within the areas of a) Administration, b) Program Development, c) Supervising Programs, d) Agency Operations. 2. Demonstrate professional and ethical decision making skills, verbal and written communication skills, and an ability to work with various needs of diverse populations. 3. Demonstrate professional relationships that present themselves as part of the organization with staff and clientele throughout their practicum experience. 4. Assess, plan, implement, and evaluate a research or facility enhancing major project within the practicum site. Credits: 9.00

12 Credits

12 Credits

Fall 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how

energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of

functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

PUBH 10001 - Introduction To Public Health

Credit Hours: 3.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health. 3. Explain the role of public health in society. 4. Understand the government's role in matters pertaining to the health of the public. 5. Understand the role of health disparities in public health. 6. Achieve a basic understanding of the major investigative tool in public health: Epidemiology. 7. Identify the principal environmental determinants of health. 8. Know major and widespread challenges to good health: smoking, obesity, chronic disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health, including the current pandemic. Credits: 3.00

16-18 Credits

16-18 Credits

Program Learning Outcomes

About the Program

Quantitative Business Economics, BS

About the Program

Degree Requirements

Department/Program Major Courses (83 credits)

Required Major Courses (56 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson,

hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 49900 - Economics Capstone Research

Credit Hours: 3.00. The course combines experiential learning with a hands-on research project that unfolds over the course of a semester, serving as a culminating experience at the end of their degree program. The overarching objective of the capstone project is for students to understand how business problems can be addressed with empirical methods. This course is designed to help students develop a more comprehensive and integrative understanding of the major, apply their knowledge to develop and execute a methodologically rigorous research a project, and demonstrate their mastery of critical thinking and research skills they have acquired throughout their time in the major. In addition to a paper, completion of the research project may involve the presentation of the findings in a seminar or workshop setting.

Learning Outcomes: 1. Complete a high quality research paper that applies Economic analysis to a topic of particular interest to the student. 2. Develop a deep understanding of the roles that Economic theory and/or empirical analysis (Econometrics) play in creating high-quality economic analysis. 3. Identify the economics literature (journals, books, monographs, etc.) that relates to the research topic considered. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective

courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits:

3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics

in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business

economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Cultural Competency Selectives (3 credits)

Major Selectives (24 credits)

Business Economics Selectives (9 credits)

ECON 46600 - International Economics

Credit Hours: 3.00. Analyzes topics in international economics, using more advantage techniques and more detailed treatment than in ECON 37000 or 37100. While coverage varies somewhat with instructor, some topics could include: economic growth, innovation and technology transfer, and the role of multinational corporations.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade and finances. 2. Understand the perspective provided by economic analysis regarding the interaction between economic growth and international trade. 3. Identify insights economics analysis provides concerning the benefits and costs of technology transfer and the role of multinational corporations. Credits: 3.00

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 43200 - Economics Of Growth & Innovation

Credit Hours: 3.00. Part one: we focus on this fact: the richest countries in the world have incomes nearly 200 times greater than the poorest, with profound consequences for the lives (and deaths) of their citizens. Why nations are poor and how they can become rich is one of the most important questions in

Economics. We will look at the role of investment, schooling, population growth and technology. Part two: we explore how globalization affects productivity and innovation. This includes how international trade and domestic policies affect allocative efficiency, accelerate structural change, and discipline competitive behaviors by domestic firms. We explore how firms grow on global markets, how technology is embodied in traded inputs, and how international markets for ideas and the possibility of imitation can lead to explosive growth. Part three: we explore a rapidly growing literature on the economics of innovation. We'll wrestle with the questions of: where new ideas come from, and whether it is becoming more difficult to innovate; how cities become hotbeds of innovation and how this will be affected by remote work; and how innovation can be shaped by choices of firms and by government policies.

Learning Outcomes: 1. Analyze income levels and growth rates across countries using economic models to understand and assess the underlying factors driving disparities in economic development, including investment, population growth, schooling, and technology; quantitatively assess these factors and make cross-country comparisons to build capabilities for engaging in economic reasoning through data; use economic models and research evidence to evaluate the causal drivers of, and impact of policy decisions on, innovation at the level of individuals, institutions, and places. Credits: 3.00

Economic Analytics Requirement (3 credits)

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

Analytics Selectives (6 credits)

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes;

(5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students

opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

Economics Selectives (6 credits)

Other Departmental/Program Course Requirements (17-29 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral

communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and

exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and

document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (8-20 credits)

Optional Concentrations for Quantitative Business Economics, BS

Additional Information

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits:

5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market

prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy

options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to

be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15 Credits

Fall 2nd Year

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

16-18 Credits

Spring 2nd Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using

AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Fall 3rd Year

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

14-17 Credits

Spring 3rd Year

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

12-15 Credits

Fall 4th Year

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce

students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions.

Credits: 3.00

12-15 Credits

Spring 4th Year

ECON 49900 - Economics Capstone Research

Credit Hours: 3.00. The course combines experiential learning with a hands-on research project that unfolds over the course of a semester, serving as a culminating experience at the end of their degree program. The overarching objective of the capstone project is for students to understand how business problems can be addressed with empirical methods. This course is designed to help students develop a more comprehensive and integrative understanding of the major, apply their knowledge to develop and execute a methodologically rigorous research a project, and demonstrate their mastery of critical thinking and research skills they have acquired throughout their time in the major. In addition to a paper, completion of the research project may involve the presentation of the findings in a seminar or workshop setting.

Learning Outcomes: 1. Complete a high quality research paper that applies Economic analysis to a topic of particular interest to the student. 2. Develop a deep understanding of the roles that Economic theory and/or empirical analysis (Econometrics) play in creating high-quality economic analysis. 3. Identify the economics literature (journals, books, monographs, etc.) that relates to the research topic considered.

Credits: 3.00

12 Credits

Radiological Health Sciences: Health Physics Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (48 credits)

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields

including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health,

industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and

maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health,

industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior

knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using

calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Health Physics Concentration (52-54 credits)

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

NUCL 20500 - Nuclear Engineering Undergraduate Laboratory I

Credit Hours: 2.00. A laboratory course designed for the study of the properties of radiation, radioactive material, and radiation detectors. The hazards of radiation and safe handling techniques are emphasized.

Credits: 2.00

NUCL 30500 - Nuclear Engineering Undergraduate Laboratory II

Credit Hours: 2.00. Continuation of NUCL 20500 . Experiments with scintillation detectors, multichannel analyzers, neutron detectors, the subcritical pile, and the reactor will be performed. Measurements will be made to demonstrate neutron activation analysis techniques, neutron slowing down, neutron flux distributions, and the effects of control rods on neutron fluxes.

Credits: 2.00

HSCI 48500 - Health Physics Internship

Credit Hours: 1.00 to 8.00. Applied work experience as a health physics assistant or technician at a nuclear power generating station, government laboratory, hospital, or education and research institution. Permission of instructor required.

Credits: 1.00 to 8.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and

how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical

physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Other Departmental/Program Course Requirements (18-19 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course

students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (0-3 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A"

or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience

chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

17-18 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of

absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience

chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Fall 2nd Year

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

15 Credits

15 Credits

Spring 2nd Year

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

NUCL 20500 - Nuclear Engineering Undergraduate Laboratory I

Credit Hours: 2.00. A laboratory course designed for the study of the properties of radiation, radioactive material, and radiation detectors. The hazards of radiation and safe handling techniques are emphasized.

Credits: 2.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital

statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

12-13 Credits

12-13 Credits

Fall 3rd Year

NUCL 30500 - Nuclear Engineering Undergraduate Laboratory II

Credit Hours: 2.00. Continuation of NUCL 20500 . Experiments with scintillation detectors, multichannel analyzers, neutron detectors, the subcritical pile, and the reactor will be performed. Measurements will be made to demonstrate neutron activation analysis techniques, neutron slowing down, neutron flux distributions, and the effects of control rods on neutron fluxes.

Credits: 2.00

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly

reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

16 Credits

Spring 3rd Year

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that

emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

16 Credits

Fall 4th Year

HSCI 48500 - Health Physics Internship

Credit Hours: 1.00 to 8.00. Applied work experience as a health

physics assistant or technician at a nuclear power generating station, government laboratory, hospital, or education and research institution. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

14 Credits

14 Credits

Spring 4th Year

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

13 Credits

13 Credits

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students

demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral

pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use

evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

17-18 Credits

About the Program

Radiological Health Sciences: Pre-Medical Physics Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (48 credits)

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection

and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad

understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5.

Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological

theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations

in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Pre-Medical Physics Concentration (49-51 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure

academic setting. Credits: 2.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Other Departmental/Program Course Requirements (18-19 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage

multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (2-5 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health,

industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation

techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

17-18 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum,

and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15-17 Credits

Fall 2nd Year

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression

procedures, and understand correlation. Credits: 3.00

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

14 Credits

Fall 3rd Year

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection

and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12

Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

16 Credits

Spring 3rd Year

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These

skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

15 Credits

Fall 4th Year

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to

the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

14 Credits

Spring 4th Year

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

14-15 Credits

Radiological Health Sciences: Radiation Health and Safety Concentration, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (48 credits)

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2.

Demonstrate depth in major. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods,

solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12.

Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical

and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Radiation Health and Safety Concentration (46 credits)

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

HSCI 48500 - Health Physics Internship

Credit Hours: 1.00 to 8.00. Applied work experience as a health physics assistant or technician at a nuclear power generating station, government laboratory, hospital, or education and research institution. Permission of instructor required.

Credits: 1.00 to 8.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To

computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon

prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

HSCI 41500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. The course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the state and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. Group exercises and simulations in applied nuclear security scenarios will complement lectures. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. Obtain a broad picture of nuclear security components and their interconnections, and of the planning of nuclear security activities at the state and facility level. 2. Learn the basic concept of nuclear security. 3. Learn the basics of nuclear security planning at the facility and state level. 4. Learn proliferation efforts, framing them within the historical and security-related context. 5. Create a foundational understanding of relevent security, safeguards and nonproliferation treaties and agreements. 6. Leverage existing technical knowledge in coming to policy conclusions. 7. Develop both a regime and state specific knowledge base. 8. Illustrate understanding through technical and policy oriented exercises. 9. Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts. Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

HSCI 35300 - Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and frontline employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies

will be viewed from multiple perspectives. In relation to the frontline employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the frontline employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the frontline employees and upper management together in their vision of a safe and healthy workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. 6. Demonstrate group and team building strategies as it relates to health and safety. Credits: 3.00

Other Departmental/Program Course Requirements (18-19 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to

compose for different purposes. Credits: 3.00

Electives (7-8 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the

chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course

for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work.

Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory

experiment. Credits: 1.00

14-15 Credits

Fall 2nd Year

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based

Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

14 Credits

14 Credits

Spring 2nd Year

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding.

6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

14 Credits

14 Credits

Fall 3rd Year

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with

applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

HSCI 35300 - Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and frontline employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the frontline employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the frontline employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the frontline employees and upper management together in their vision of a safe and healthy workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. 6. Demonstrate group and team building strategies as it relates to health and safety. Credits: 3.00

17 Credits

17 Credits

Spring 3rd Year

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of

radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

14 Credits

14 Credits

Fall 4th Year

HSCI 48500 - Health Physics Internship

Credit Hours: 1.00 to 8.00. Applied work experience as a health physics assistant or technician at a nuclear power generating station, government laboratory, hospital, or education and research institution. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

17 Credits

Spring 4th Year

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 41500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. The course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the state and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. Group exercises and simulations in applied nuclear security scenarios will complement lectures. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. Obtain a broad picture of nuclear security components and their interconnections, and of the planning of nuclear security activities at the state and facility level. 2. Learn the basic concept of nuclear security. 3. Learn the basics of nuclear security planning at the facility and state level. 4. Learn proliferation efforts, framing them within the historical and security-related context. 5. Create a foundational understanding of relevent security, safeguards and nonproliferation treaties and agreements. 6. Leverage existing technical knowledge in coming to policy conclusions. 7. Develop both a regime and state specific knowledge base. 8. Illustrate understanding through technical and policy oriented exercises. 9. Expand relevant technical knowledge base as well as introduce students

to new instrumentation and concepts. Credits: 3.00

13-14 Credits

13-14 Credits

Fall 1st Year

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad

understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

16 Credits

About the Program

Religious Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

A. Required Courses (9 credits)

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

REL 20000 - Introduction To The Study Of Religion (UCC: HUM)

Credit Hours: 3.00. This course will introduce students to the academic study of religion through an exploration of various methodologies available for a critical, reflective investigation of the study of religion.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

B. Category I: Religious Traditions and Diversity (6 credits)

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 46200 - The Bible As Literature: The Old Testament

Credit Hours: 3.00. A study of the Old Testament - Pentateuch, Prophets, and other books such as Psalms, Proverbs, Job, and Ecclesiastes - with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 46300 - The Bible As Literature: The New Testament

Credit Hours: 3.00. A study of the New Testament, with emphasis on its unique literary characteristics.

Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

REL 20100 - Interpretation Of The New Testament

Credit Hours: 3.00. An investigation of the religious content of the Christian Scriptures in light of the historical, social, and intellectual contexts out of which they emerged. Other canons and extra-canonical interpretations of the New Testament will also be investigated.

Credits: 3.00

REL 20200 - Interpretation Of The Old Testament

Credit Hours: 3.00. An investigation of the religious content of documents Christians call the "Old Testament" in light of the historical, social, and intellectual contexts out of which they arose. The student will be introduced to problems and methods in their interpretation.

Credits: 3.00

REL 20300 - Theology Of Paul

Credit Hours: 3.00. A critical examination of the Pauline and Deutero-Pauline epistles, the book of Acts, and other first century texts associated with Paul of Tarsus. Students will be introduced to problems and methods in the interpretation of ancient texts.

Credits: 3.00

REL 31700 - Ancient Judaism And Early Christianity

Credit Hours: 3.00. This course is a study of the emergence of Judaism and the rise of Christianity out of roots in the history of ancient Israel. This will include noticing the effects of Greek culture, evidence of anti-Semitism and admiration of the Jews,

conversion in a setting of religious pluralism, and the development of Jewish and Christian self-definition in this climate.

Credits: 3.00

REL 31800 - The Bible And Its Early Interpreters

Credit Hours: 3.00. This course will start with observation of the development of early themes in later parts of the Hebrew Bible and proceed to the on-going influence of these themes in Jewish literature outside the Hebrew canon (apocrypha, pseudepigrapha, targums, midrash, Josephus, Philo, and other Hellenistic Jewish authors), as well as in pagan literature of this era and in early Christian literature, particularly the New Testament.

Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

REL 24000 - Engaging Religious Diversity (UCC: HUM)

Credit Hours: 3.00. The course offers students case-based explorations of local and global religious diversity in various cultural contexts. Religious diversity in secular spaces and the significance of religion for shaping community identities will be examined from multiple disciplinary perspectives. Students will analyze religious representations and influences in the public sphere by studying examples from different genres and media. Additionally, this course offers students opportunities to improve their religious literacy and gain real-world experience through experiential learning projects.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify religious values and practices from multiple traditions. 2. Explain the importance of engaging religious diversity in various contexts. 3. Analyze interactions between religion and civic participation. 4. Evaluate the role of religion in shaping identities. 5. Assess public representations of religion. Credits: 3.00

C. Category II: Religion, Society and the Public Square (9 credits)

ANTH 37300 - Anthropology Of Religion

Credit Hours: 3.00. Anthropological theories of the origin, development, and functions of religion, ritual, and myth. Data drawn from western and non-western societies, with special emphasis on the relationship of religion to social structure, cultural patterns, and social change.

Learning Outcomes: 1. Explain anthropological approaches to the study of religious belief systems. 2. Investigate religious and cultural differences using anthropological skills. 3. Describe a diversity of faiths and worldviews. 4. Summarize the key ways that humans of the past and present have sought to make sense of the mysteries of life and the sacred. Credits: 3.00

HIST 24600 - Modern Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course explores the political, social, and cultural factors that have contributed to the formation of the modern Middle East. Course includes short stories and a selection of documentary films from the region.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 31700 - A History Of The Christian Church And The Expansion Of Christianity I

Credit Hours: 3.00. A history of the emergence of Christianity, the development of the Christian church, and the impact of Christian thought and institutions upon western Europe prior to the Reformation.

Credits: 3.00

SOC 36700 - Religion In America

Credit Hours: 3.00. Examines the social dimensions of religion in American life; religion in American culture; social profiles of America's religious groups, trends in individual religious commitment; and religion's impact on American life.

Learning Outcomes: 1. Describe the sizes and influences of major (and some minor) religious groups in America and how these sizes and influences have changed over the past 50 years. 2. Explain and evaluate the influence of religious groups and ideas on at least one other important aspect of social life. 3. Explain ways

in which trends in American society over the past 50 years (e.g., changing gender roles, political shifts, etc.) are bringing about changes in American religion. Credits: 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

HIST 31905 - Christianity In The Global Age

Credit Hours: 3.00. This course examines the social, cultural, economic, legal, and religious dynamics of global Christianity in its emerging centers of Latin America, Asia, and Africa during the 20th and 21st centuries.

Learning Outcomes: 1. Understand key issues in the global Christianity in 20th and 21st centuries. 2. Distinguish between secondary and primary sources, and be able to critically read both types of sources. 3. Synthesize information and arguments from both types of sources. 4. Engage in independent historical analysis with the use of primary and secondary sources. 5. Write analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. 6. Research a contemporary topic using a variety of international sources and write a report analyzing the issue in the context of longer historical developments. Credits: 3.00

HIST 40300 - Europe In The Reformation

Credit Hours: 3.00. A study of decay and renewal in European society, 1300 to 1650. Concentrates on the Protestant and Catholic Reformation and religious wars, but also covers the Northern Renaissance, the New Monarchies, and the discovery and exploration of the New World.

Credits: 3.00

PHIL 22700 - Science And Religion

Credit Hours: 3.00. Are science and religion irrelevant to each other? Or can one of them challenge, support, shape, presuppose, explain-or explain *away*-the other? This course examines how science in general, as well as specific scientific disciplines such as evolutionary biology, physical cosmology, and cognitive science, are related to religion in general, and to particular religious traditions.

Learning Outcomes: 1. Identify specific ways in which science and religion appear to be in tension and specific ways in which they appear to support one another. 2. Demonstrate familiarity both with attempts to resolve alleged tensions between science and religion and with attempts to challenge claims that science and religion support one another. 3. Present, explain, defend, and evaluate complex philosophical perspectives on the relationship between science and religion, in oral and written communication. 4. Locate, interpret, understand, and evaluate philosophical arguments encountered in complex texts on the relationship science and religion. Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

D. Category III: Philosophy, Culture, and Intellectual History (9 credits)

PHIL 20600 - Introduction To Philosophy Of Religion (UCC: HUM)

Credit Hours: 3.00. The course encourages critical reflection on traditional and contemporary views about God and other religious ideas. Topics include arguments for God's existence, the problem of evil, understanding the divine attributes, miracles, religious pluralism, and life after death. CTL:ISH 1052 Philosophy Of Religion

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate familiarity with one or more conceptions of God and with arguments for and against the coherence of such conceptions. 2. Demonstrate a familiarity with some of the arguments for and against God's existence and with some of the objections to those arguments. 3. Recognize the

importance of and demonstrate familiarity with multiple religious ideas and beliefs. 4. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 5. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 40200 - Studies In Medieval Christian Thought

Credit Hours: 3.00. A survey of medieval (and patristic) philosophical theology. Issues include the nature and existence of God, religious language, and doctrines such as the Trinity, Incarnation, and Atonement. Readings (in English translation) will include, among others, Augustine, Boethius, Anselm, and Aquinas.

Credits: 3.00

PHIL 40600 - Intermediate Philosophy Of Religion

Credit Hours: 3.00. An intensive study of some important problems such as the existence of God, the problem of evil, immortality, or the nature of religion. Or the religious philosophy of some significant thinkers such as Buber, Berdyaev, Tillich, Barth, Maritain, or Chardin may form the content of the course. Subject matter may vary.

Credits: 3.00

REL 20400 - Introduction To Christian Theology

Credit Hours: 3.00. This course is an introductory survey of the goals and aims of theology in the Christian tradition. Focus is on the content of Christian theology, its methodological presuppositions and principles of development.

Credits: 3.00

REL 25000 - A History Of The Christian Afterlife

Credit Hours: 3.00. An exploration of the ways Christians have envisioned the afterlife, including New Testament descriptions. Apocryphal notions, Patristic conceptions, mystical and 19th century descriptions of heaven as sexual union, and 20th century understandings of the afterlife as a "process of education".

Credits: 3.00

REL 35100 - Christian Mysticism

Credit Hours: 3.00. A critical, historical examination of the development of Christian mystical thought, beginning with its earliest intimations in the Hebrew Scriptures, the thought of Plato and Aristotle and continuing through Patristic, Medieval, Renaissance, Reformation, Counter-Reformation and Modern periods to the present.

Credits: 3.00

REL 45000 - Christian Ethics

Credit Hours: 3.00. The course explores the historical development of Christian moral theology, from pre-Christian times to the present. It includes a study of Biblical moral conceptions, patristic, medieval, Enlightenment, modern, and contemporary understandings of Christian ethics.

Credits: 3.00

REL 45100 - Christology

Credit Hours: 3.00. The course examines the historical development of Christological doctrine in the Christian faith from the age of the New Testament to the late 20th/early 21st century, paying special attention to the New Testament and conciliar formulations.

Credits: 3.00

REL 45200 - Systematic Theology

Credit Hours: 3.00. An introduction to the nature, tasks, and methods of what Christians have called "systematic theology", historically conceived through an exploration of the writings of figures such as Augustine, Aquinas, Melancthon, John Calvin, Barth, and Paul Tillich.

Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the

human good, the nature of God, and divine language.

Credits: 3.00

PHIL 50600 - Advanced Philosophy Of Religion

Credit Hours: 3.00. A detailed critical investigation of some central problems in a philosophical approach to religion. Readings will be selected from leading representatives of traditional theism and various contemporary schools. The thought of the representative thinkers will be analyzed, discussed, and critically evaluated. The problems discussed will be selected from the existence of God, the problem of evil, freedom and determinism, the problem of immortality, and the nature of religious language. Variable content.

Credits: 3.00

PHIL 52000 - Existentialism

Credit Hours: 3.00. A detailed exploration and examination of the existentialist movement in modern thought, including its historical roots, its philosophical formulations, and its influence and expression in and relation to art, literature, psychology, social criticism, and religion. Readings will be from at least some of the major existentialists: Kierkegaard, Nietzsche, Jaspers, Heidegger, and Sartre. In addition, texts from existentialist thinkers in other areas will be used.

Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

Note for B, C, D

Electives (14-51 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

15-16 Credits

Spring 1st Year

REL 20000 - Introduction To The Study Of Religion (UCC: HUM)

Credit Hours: 3.00. This course will introduce students to the academic study of religion through an exploration of various methodologies available for a critical, reflective investigation of the study of religion.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

15 Credits

Fall 2nd Year

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

15 Credits

Spring 2nd Year

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Retail Management, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (45-47 credits)

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and

establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

CSR 20900 - Introduction To Retail Management

Credit Hours: 3.00. Retail career paths, management training, merchandise control, organization and service structure, and a comparison of store types.

Credits: 3.00

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

CSR 30000 - Field Experience In Retail Management

Credit Hours: 1.00. Approved in-service training, a total of 140 hours; development of activities plan; and report of activities. Recommended for semesters 3,4,5, or 6. Advance approval of director and employer and attendance at pre- and post-organizational meeting is required. Permission of instructor required.

Credits: 1.00

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 32300 - Visual Merchandising

Credit Hours: 3.00. Creative experimentation, production, and analysis of promotional formats for merchandising of product in a retail setting. Study of the elements and principles of design and their application for promotion of retail merchandise and/or services.

Credits: 3.00

CSR 33100 - Consumer Behavior

Credit Hours: 3.00. An interdisciplinary survey of consumer behavior theory focused on psychological, sociological, and cultural influences on consumer choice and use of products and services. Credit will not be given for both CSR 33100.

Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

CSR 34400 - Fundamentals Of Negotiations

Credit Hours: 3.00. This course is designed to be relevant to the broad spectrum of bargaining "problems" that are traditionally faced by the manager, sales personnel and financial advisors. The course explores the processes of bargaining and negotiation as social and managerial activities. Special emphasis will be given to the areas of interpersonal and interpersonal and intergroup conflict, in addition to the interpersonal influence techniques and the tactics and strategies involved with improved bargaining and negotiation. The major purpose of the course is for each student to gain insight into his or her own negotiating style and to become a more effective negotiator, as well as a more astute observer of social process. The course will involve extensive use of cases, role-plays, and related participative activities, enhanced by rigorous self-review and introspection.

Learning Outcomes: 1. Explore the major concepts and theories of the psychology of bargaining and negotiation. 2. Understand the

dynamics of interpersonal and intergroup conflict and its resolution. 3. Help develop the sophistication to analyze bargaining and conflict relationships. 4. Learn about your own individual "bargaining" style. 5. Development appropriate negotiation strategies and tactics for specific situations. Credits: 3.00

CSR 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an International experience that is recognized by the University. Permission of department required.

Credits: 1.00 to 6.00

CSR 40400 - Strategic Management For Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. Through the analysis of internal and external forces, students develop strategies to help an organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of an organization. The course is structured to enhance students' analytical, critical thinking, and verbal skills by integrating academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Demonstrate through effective written and oral communication, the ability to conduct a strategic situational analysis of a service organization. 2. Develop a business strategy for a service organization. 3. Integrate and apply prior knowledge areas from your major to propose a functional strategy that aligns with the strategic vision of your service organization. Credits: 3.00

CSR 40600 - E-Retailing

Credit Hours: 3.00. To provide understanding of the technological and retail infrastructure that underlines doing retailing over the internet. Build an understanding of business strategies over the net. To identify management issues and consumer issues in e-retailing.

Learning Outcomes: 1. Understand the technological and retail infrastructure that underlies doing retailing over the Internet. 2. Learn the vocabulary to discuss e-retailing. 3. Build and understand business strategies over the Internet. 4. Acquire power to exploit any business opportunities that jump out your way. 5. Provide the ability to get your hands dirty and use some of the most important net marketing tools. 6. Understand the "business case" for Internet commerce in retailing (or other business). 7. Identify management issues in e-retailing. 8. Understand the consumer issues in e-retailing. 9. Acquire skill sets that allow a competitive market advantage in interviews, jobs and careers. Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their

personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ENTR 46000 - Internship And Career Preparation Seminar

Credit Hours: 1.00. This course is a distance option course for the Certificate in Entrepreneurship and Innovation. It equips students with professional skills based on entrepreneurship competencies. Students develop resources to illustrate their skills, talents, abilities, and goals to increase career preparedness. They learn what it takes to successfully transfer academic skills to a workplace setting and develop an entrepreneurial mindset that sets them apart from other job seekers.

Learning Outcomes: 1. Improve self-awareness of professional skills development through assessments and reflection. 2. Create a professional brand through an improved LinkedIn profile, resume review, interviewing, and networking skills. 3. Showcase educational and professional skills in an e-portfolio or website. Credits: 1.00

CSR 41600 - Retail Supply Chain Management

Credit Hours: 3.00. Supply chain management is a set of approaches utilized to efficiently integrate all parties of the supply chain to fulfill a request from a customer. Companies like Amazon, Zara, Walmart, Toyota, Dell, and Procter & Gamble are proof that excellence in supply chain management is a must to achieve industry leadership. With increasing competition around the globe, supply chain management is both a challenge and an opportunity for companies. The main goal of this course is to introduce you to the key concepts and techniques that will allow you to analyze, manage and improve supply chain processes for different industries. The course is a combination of lectures, case studies, in-class exercises, and games with the goal of defining key tradeoffs that managers need to understand and evaluate to successfully manage complex supply chains. Quantitative tools designed to evaluate these tradeoffs will be studied and used extensively throughout the course. Topics that will be covered in this course include: Managing inventory, forecasting in supply chains, the optimal design of the supply chain, transportation and distribution, bullwhip effects and dealing with uncertainty, sourcing and supply contracts.

Learning Outcomes: 1. Develop an understanding of how supply chain management can improve operations efficiency and market responsiveness under uncertainty. 2. Utilize and apply theories, concepts, and optimization techniques in analyzing, managing and improving supply chain processes for various industries. 3. Obtain skills to assess supply chain performance and make recommendations to enhance supply chain competitiveness in today's business environment. 4. Identify current issues and trends in global supply chain management such

as sustainability, consumer health, and national security. Credits: 3.00

CSR 20100 - Introduction To Professional Sales

Credit Hours: 3.00. Introduction to sales process, business to business communication strategies, and expectations of a sales professional.

Learning Outcomes: 1. Describe the operationalization of sales and the purchasing function within a business. 2. Define the variety of sales roles and determine best fit. 3. Demonstrate the skills necessary to succeed in a sales role. 4. Apply sales process to a role play sales call. Credits: 3.00

CSR 34100 - Luxury Brand Management

Credit Hours: 3.00. Students examine the innovation and creativity that foster the development of luxury brands in the current business environment. A key facet of this course is the opportunity to develop unique brand strategies that generate social, aesthetic, quality, and emotional value for luxury consumers. Students learn the ways brands tailor services, products, and experiences to achieve these goals.

Learning Outcomes: 1. Define the psychological and cultural elements of luxury brand experiences. 2. Explain the connections between service excellence, craftsmanship, and creative direction within the management of luxury brands. 3. Analyze social, economic, and technological trends within the luxury market. 4. Describe the ethical and social challenges of managing luxury brands. 5. Develop strategies that create brand prestige and generate value for luxury consumers. Credits: 3.00

CSR 35700 - Retail Technology: Merchandise Planning And Allocation

Credit Hours: 3.00. The application of software technology in retail merchandising, planning and allocation systems. Builds on basic knowledge of buying functions utilizing industry software, to develop skills needed in higher-order planning and allocation of merchandise. Students apply knowledge and skills through simulations with real-world data.

Learning Outcomes: 1. Explain the relationship between planning and buying merchandise. 2. Explain the relationship between allocation and supply chain. 3. Evaluate the effects of planning/allocation on revenue & profit. 4. Demonstrate analytical skills through the application of industry software, to make effective merchandising decisions. Credits: 3.00

CSR 31000 - Buying Of Merchandise

Credit Hours: 3.00. Principles of volume buying applicable to department, chain, specialty, and independent stores.

Learning Outcomes: 1. Demonstrate knowledge of the buying and merchandising functions, and their role in a retail organization. 2. Describe definitions and concepts of terminology related to merchandising math. 3. Apply basic mathematical concepts to solve typical merchandising problems and make decisions. 4. Use data to analyze and evaluate the performance of merchandising strategies. Credits: 3.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an

internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

Other Departmental/Program Course Requirements (52-59 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage

multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish

between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon

which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and

what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

HTM 25500 - Advanced Spreadsheet Techniques For Hospitality And Tourism Management

Credit Hours: 2.00. This course builds upon information and skills obtained in an entry-level-computing course. It will take students to the next level by introducing them to more advanced techniques used in Hospitality, Tourism, Retail, and Sales Management.

Learning Outcomes: 1. Demonstrate proper utilization of spreadsheet techniques to effectively organize and analyze data for management presentations. 2. Explain the purpose of selected spreadsheet techniques and describe how they are used in Hospitality, Tourism, Retail, and Sales Management. 3. Demonstrate advanced spreadsheet techniques, such as: Advanced Spreadsheet Formulas; Statistical Analysis; Validating Data Entry; Conditional Formatting; Advanced Charting Techniques; Pivot Tables; Spreadsheet Dashboards; Recording and Using Spreadsheet Macros; Power Query; Advanced Cell/Column/Row/Table Formatting; Creating Templates. Credits: 2.00

Electives (14-23 credits)

Supplemental Lists

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 20900 - Introduction To Retail Management

Credit Hours: 3.00. Retail career paths, management training, merchandise control, organization and service structure, and a comparison of store types.

Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

16-17 Credits

Spring 1st Year

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and

techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

14-16 Credits

Fall 2nd Year

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

CSR 33100 - Consumer Behavior

Credit Hours: 3.00. An interdisciplinary survey of consumer behavior theory focused on psychological, sociological, and cultural influences on consumer choice and use of products and services. Credit will not be given for both CSR 33100.

Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits

and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ENTR 46000 - Internship And Career Preparation Seminar

Credit Hours: 1.00. This course is a distance option course for the Certificate in Entrepreneurship and Innovation. It equips students with professional skills based on entrepreneurship competencies. Students develop resources to illustrate their skills, talents, abilities, and goals to increase career preparedness. They learn what it takes to successfully transfer academic skills to a workplace setting and develop an entrepreneurial mindset that sets them apart from other job seekers.

Learning Outcomes: 1. Improve self-awareness of professional skills development through assessments and reflection. 2. Create a professional brand through an improved LinkedIn profile, resume review, interviewing, and networking skills. 3. Showcase educational and professional skills in an e-portfolio or website. Credits: 1.00

HTM 25500 - Advanced Spreadsheet Techniques For Hospitality And Tourism Management

Credit Hours: 2.00. This course builds upon information and skills obtained in an entry-level-computing course. It will take students to the next level by introducing them to more advanced techniques used in Hospitality, Tourism, Retail, and Sales Management.

Learning Outcomes: 1. Demonstrate proper utilization of spreadsheet techniques to effectively organize and analyze data for management presentations. 2. Explain the purpose of selected spreadsheet techniques and describe how they are used in Hospitality, Tourism, Retail, and Sales Management. 3. Demonstrate advanced spreadsheet techniques, such as: Advanced Spreadsheet Formulas; Statistical Analysis; Validating Data Entry; Conditional Formatting; Advanced Charting Techniques; Pivot Tables; Spreadsheet Dashboards; Recording and Using Spreadsheet Macros; Power Query; Advanced Cell/Column/Row/Table Formatting; Creating Templates. Credits: 2.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with

essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

14-16 Credits

Spring 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-

profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

CSR 32300 - Visual Merchandising

Credit Hours: 3.00. Creative experimentation, production, and analysis of promotional formats for merchandising of product in a retail setting. Study of the elements and principles of design and their application for promotion of retail merchandise and/or services.

Credits: 3.00

CSR 20100 - Introduction To Professional Sales

Credit Hours: 3.00. Introduction to sales process, business to business communication strategies, and expectations of a sales professional.

Learning Outcomes: 1. Describe the operationalization of sales and the purchasing function within a business. 2. Define the variety of sales roles and determine best fit. 3. Demonstrate the skills necessary to succeed in a sales role. 4. Apply sales process to a role play sales call. Credits: 3.00

CSR 34100 - Luxury Brand Management

Credit Hours: 3.00. Students examine the innovation and creativity that foster the development of luxury brands in the current business environment. A key facet of this course is the opportunity to develop unique brand strategies that generate social, aesthetic, quality, and emotional value for luxury consumers. Students learn the ways brands tailor services, products, and experiences to achieve these goals.

Learning Outcomes: 1. Define the psychological and cultural elements of luxury brand experiences. 2. Explain the connections between service excellence, craftsmanship, and creative direction within the management of luxury brands. 3. Analyze social, economic, and technological trends within the luxury market. 4. Describe the ethical and social challenges of managing luxury brands. 5. Develop strategies that create brand prestige and generate value for luxury consumers. Credits: 3.00

CSR 31000 - Buying Of Merchandise

Credit Hours: 3.00. Principles of volume buying applicable to department, chain, specialty, and independent stores.

Learning Outcomes: 1. Demonstrate knowledge of the buying and merchandising functions, and their role in a retail organization. 2. Describe definitions and concepts of terminology related to merchandising math. 3. Apply basic mathematical concepts to solve typical merchandising problems and make decisions. 4. Use data to analyze and evaluate the performance of merchandising strategies. Credits: 3.00

15 Credits

Spring 3rd Year

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 34400 - Fundamentals Of Negotiations

Credit Hours: 3.00. This course is designed to be relevant to the broad spectrum of bargaining "problems" that are traditionally faced by the manager, sales personnel and financial advisors. The course explores the processes of bargaining and negotiation as social and managerial activities. Special emphasis will be given to the areas of interpersonal and interpersonal and intergroup conflict, in addition to the interpersonal influence techniques and the tactics and strategies involved with improved bargaining and negotiation. The major purpose of the course is for each student to gain insight into his or her own negotiating style and to become a more effective negotiator, as well as a more astute observer of social process. The course will involve extensive use of cases, role-plays, and related participative activities, enhanced by rigorous self-review and introspection.

Learning Outcomes: 1. Explore the major concepts and theories of the psychology of bargaining and negotiation. 2. Understand the dynamics of interpersonal and intergroup conflict and its resolution. 3. Help develop the sophistication to analyze bargaining and conflict relationships. 4. Learn about your own individual "bargaining" style. 5. Development appropriate negotiation strategies and tactics for specific situations. Credits: 3.00

CSR 35700 - Retail Technology: Merchandise Planning And Allocation

Credit Hours: 3.00. The application of software technology in retail merchandising, planning and allocation systems. Builds on basic knowledge of buying functions utilizing industry software, to develop skills needed in higher-order planning and allocation of merchandise. Students apply knowledge and skills through simulations with real-world data.

Learning Outcomes: 1. Explain the relationship between planning and buying merchandise. 2. Explain the relationship between allocation and supply chain. 3. Evaluate the effects of planning/allocation on revenue & profit. 4. Demonstrate analytical skills through the application of industry software, to make effective merchandising decisions. Credits: 3.00

14-15 Credits

Summer 3rd Year

CSR 30000 - Field Experience In Retail Management

Credit Hours: 1.00. Approved in-service training, a total of 140 hours; development of activities plan; and report of activities. Recommended for semesters 3,4,5, or 6. Advance approval of director and employer and attendance at pre- and post-organizational meeting is required. Permission of instructor required.

Credits: 1.00

CSR 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an International experience that is recognized by the University. Permission of department required.

Credits: 1.00 to 6.00

1-3 Credits

Fall 4th Year

CSR 40600 - E-Retailing

Credit Hours: 3.00. To provide understanding of the technological and retail infrastructure that underlines doing retailing over the internet. Build an understanding of business strategies over the net. To identify management issues and consumer issues in e-retailing.

Learning Outcomes: 1. Understand the technological and retail infrastructure that underlies doing retailing over the Internet. 2. Learn the vocabulary to discuss e-retailing. 3. Build and understand business strategies over the Internet. 4. Acquire power to exploit any business opportunities that jump out your way. 5. Provide the ability to get your hands dirty and use some of the most important net marketing tools. 6. Understand the "business case" for Internet commerce in retailing (or other business). 7. Identify management issues in e-retailing. 8. Understand the consumer issues in e-retailing. 9. Acquire skill sets that allow a competitive market advantage in interviews, jobs and careers. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

12-15 Credits

Spring 4th Year

CSR 40400 - Strategic Management For Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. Through the analysis of internal and external forces, students develop strategies to help an organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of an organization. The course is structured to enhance students' analytical, critical thinking, and verbal skills

by integrating academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Demonstrate through effective written and oral communication, the ability to conduct a strategic situational analysis of a service organization. 2. Develop a business strategy for a service organization. 3. Integrate and apply prior knowledge areas from your major to propose a functional strategy that aligns with the strategic vision of your service organization. Credits: 3.00

CSR 41600 - Retail Supply Chain Management

Credit Hours: 3.00. Supply chain management is a set of approaches utilized to efficiently integrate all parties of the supply chain to fulfill a request from a customer. Companies like Amazon, Zara, Walmart, Toyota, Dell, and Procter & Gamble are proof that excellence in supply chain management is a must to achieve industry leadership. With increasing competition around the globe, supply chain management is both a challenge and an opportunity for companies. The main goal of this course is to introduce you to the key concepts and techniques that will allow you to analyze, manage and improve supply chain processes for different industries. The course is a combination of lectures, case studies, in-class exercises, and games with the goal of defining key tradeoffs that managers need to understand and evaluate to successfully manage complex supply chains. Quantitative tools designed to evaluate these tradeoffs will be studied and used extensively throughout the course. Topics that will be covered in this course include: Managing inventory, forecasting in supply chains, the optimal design of the supply chain, transportation and distribution, bullwhip effects and dealing with uncertainty, sourcing and supply contracts.

Learning Outcomes: 1. Develop an understanding of how supply chain management can improve operations efficiency and market responsiveness under uncertainty. 2. Utilize and apply theories, concepts, and optimization techniques in analyzing, managing and improving supply chain processes for various industries. 3. Obtain skills to assess supply chain performance and make recommendations to enhance supply chain competitiveness in today's business environment. 4. Identify current issues and trends in global supply chain management such as sustainability, consumer health, and national security. Credits: 3.00

12-15 Credits

Program Learning Outcomes

Robotics Engineering Technology, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (76-77 credits)

Required Major Courses (64-65 credits)

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial

views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ECET 32700 - Instrumentation And Data Acquisition Design

Credit Hours: 3.00. This course builds upon the prerequisite knowledge and covers implementation of electric systems to measure and record mechanical, electrical, and biological parameters. Signal characteristics, transducer specification and selection, signal conditioning and transmission design, data conversion, software, and an overall system error budget are developed.

Learning Outcomes: 1. Differentiate appropriate transducers for sensing various signals, including mechanical, biological, and electrical. 2. Design, simulate and verify signal conditioning circuits. 3. Implement analog-to-digital converters and examine conditioned data for sampling and quantization effects. 4. Create software programs to interface with analog-to-digital converters, process data, and display or utilize the results. 5. Evaluate common sources

of errors in instrumentation systems. Credits: 3.00

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

MFET 34800 - Introduction To Robot Kinematics

Credit Hours: 3.00. This course introduces the fundamentals of robotics with an emphasis on solutions to the kinematics problems of serial robotic manipulators. It covers robot modeling and simulation, forward kinematics, inverse kinematics, analysis of robot motion and static forces, and trajectory planning.

Learning Outcomes: 1. Create the kinematics model of a robotic manipulator. 2. Solve forward and inverse kinematics problems of a robotic manipulator. 3. Analyze the motion and static forces of a robotic manipulator. 4. Plan trajectories of a robotic manipulator. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for

metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

MET 31500 - Applied Mechanism Kinematics And Dynamics

Credit Hours: 3.00. Displacements, velocities, and accelerations are determined using graphical, semi-graphical, and numerical analyses of rotational and translational motions of common mechanisms such as linkages, cams, gears, screws, and chains as well as their loading.

Learning Outcomes: 1. Categorize and model common mechanisms, including their degrees of freedom. 2. Determine the displacements, velocities, and accelerations in common linkages. 3. Analyze and synthesize common mechanisms (e.g., linkages, cams, gears, screws, belts, chains, shafts). 4. Use software in kinematic analysis and synthesis. Credits: 3.00

ECET 36900 - Applied Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course provides fundamental knowledge of integrated computer imaging or vision systems for sensing, quality control and automation applications. Fundamental basis of optics, illumination, camera types with associated technologies, and image acquisition to develop a customized computer imaging or vision systems will be covered. Algorithms for image processing, image analysis and pattern recognition will also be covered. Emerging technologies-based integrated computer vision or imaging system for sensor system, inspection, quality control and automation in different sectors (medical, manufacturing, security, construction etc.) will be examined. Parallel laboratory hands-on experience will allow the students to apply and validate the concepts learned in the lecture.

Learning Outcomes: 1. Identify different components of a computer vision/imaging system and their needs. 2. Identify and specify different components of a computer imaging system for selected different applications. 3. Interpret and implement different operations related to image processing, image analysis and image understanding. 4. Evaluate different real-world case studies to learn from successes and failures related to computer imaging system-based devices or components. 5. Formulate or create tentative solution for selected real world applications. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

MFET 44200 - Programming Robots With ROS

Credit Hours: 3.00. Robot Operating Systems (ROS) will be used as a programming platform to explore the topics of computer vision, SLAM (Simultaneous Localization and Mapping), path planning, grasping, and social interaction in robotic systems, as well as programming large systems for physical interaction with the world. Self-contained implementation projects are core to the class. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of matrices is assumed.

Learning Outcomes: 1. Apply software versioning techniques to the programming of large software projects with hardware in-the-loop. 2. Build ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 3. Apply basic software engineering techniques to designing and documenting software. 4. Apply and evaluate computer vision techniques based on templates to track objects in 2-D. 5. Synthesize 3-D computer vision techniques for 3-D sensors from 2-D algorithms. 6. Analyze and evaluate hardware sensors with respect to specific software task needs. 7. Apply SLAM methods to real-world scenes to interpret the world on real hardware in real-time. 8. Analyze execution times and evaluate trade-offs in computational hardware performance with respect to sensor

data throughput. 9. Implement feedback controllers and tune for specific hardware characteristics. 10. Apply manual path planning techniques to 2-D and 3-D maps extracted from SLAM algorithms. 11. Apply automatic path planning tools and software to 2-D and 3-D maps extracted from SLAM algorithms. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3. Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

MFET 48002 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering

design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Required Concentration (12 credits)

Other Departmental/Program Course Requirements (40-43 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3.

Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements

for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of

integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students

not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (0-4 credits)

Supplemental List

Professional Experience

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

15-18 Credits

Spring 1st Year

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

16-19 Credits

Fall 2nd Year

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

15-16 Credits

Spring 2nd Year

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Fall 3rd Year

ECET 32700 - Instrumentation And Data Acquisition Design

Credit Hours: 3.00. This course builds upon the prerequisite knowledge and covers implementation of electric systems to measure and record mechanical, electrical, and biological parameters. Signal characteristics, transducer specification and selection, signal conditioning and transmission design, data conversion, software, and an overall system error budget are developed.

Learning Outcomes: 1. Differentiate appropriate transducers for sensing various signals, including mechanical, biological, and electrical. 2. Design, simulate and verify signal conditioning circuits. 3. Implement analog-to-digital converters and examine conditioned data for sampling and quantization effects. 4. Create software programs to interface with analog-to-digital converters, process data, and display or utilize the results. 5. Evaluate common sources of errors in instrumentation systems. Credits: 3.00

ECET 36900 - Applied Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course provides fundamental knowledge of integrated computer imaging or vision systems for sensing, quality control and automation applications. Fundamental basis of optics, illumination, camera types with associated technologies, and image acquisition to develop a customized computer imaging or vision systems will be covered. Algorithms for image processing, image analysis and pattern recognition will also be covered. Emerging technologies-based integrated computer vision or imaging system for sensor system, inspection, quality control and automation in different sectors (medical, manufacturing, security, construction etc.) will be examined. Parallel laboratory hands-on experience will allow the students to apply and validate the concepts learned in the lecture.

Learning Outcomes: 1. Identify different components of a computer vision/imaging system and their needs. 2. Identify and specify different components of a computer imaging system for selected different applications. 3. Interpret and implement different operations related to image processing, image analysis and image understanding. 4. Evaluate different real-world case studies to learn from successes and failures related to computer imaging system-based devices or components. 5. Formulate or create tentative solution for selected real world applications. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

15 Credits

Spring 3rd Year

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

MET 31500 - Applied Mechanism Kinematics And Dynamics

Credit Hours: 3.00. Displacements, velocities, and accelerations are determined using graphical, semi-graphical, and numerical analyses of rotational and translational motions of common mechanisms such as linkages, cams, gears, screws, and chains as well as their loading.

Learning Outcomes: 1. Categorize and model common mechanisms, including their degrees of freedom. 2. Determine the displacements, velocities, and accelerations in common linkages. 3. Analyze and synthesize common mechanisms (e.g., linkages, cams, gears,

screws, belts, chains, shafts). 4. Use software in kinematic analysis and synthesis. Credits: 3.00

MFET 44200 - Programming Robots With ROS

Credit Hours: 3.00. Robot Operating Systems (ROS) will be used as a programming platform to explore the topics of computer vision, SLAM (Simultaneous Localization and Mapping), path planning, grasping, and social interaction in robotic systems, as well as programming large systems for physical interaction with the world. Self-contained implementation projects are core to the class. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of matrices is assumed.

Learning Outcomes: 1. Apply software versioning techniques to the programming of large software projects with hardware in-the-loop. 2. Build ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 3. Apply basic software engineering techniques to designing and documenting software. 4. Apply and evaluate computer vision techniques based on templates to track objects in 2-D. 5. Synthesize 3-D computer vision techniques for 3-D sensors from 2-D algorithms. 6. Analyze and evaluate hardware sensors with respect to specific software task needs. 7. Apply SLAM methods to real-world scenes to interpret the world on real hardware in real-time. 8. Analyze execution times and evaluate trade-offs in computational hardware performance with respect to sensor data throughput. 9. Implement feedback controllers and tune for specific hardware characteristics. 10. Apply manual path planning techniques to 2-D and 3-D maps extracted from SLAM algorithms. 11. Apply automatic path planning tools and software to 2-D and 3-D maps extracted from SLAM algorithms. Credits: 3.00

15 Credits

Fall 4th Year

MFET 34800 - Introduction To Robot Kinematics

Credit Hours: 3.00. This course introduces the fundamentals of robotics with an emphasis on solutions to the kinematics problems of serial robotic manipulators. It covers robot modeling and simulation, forward kinematics, inverse kinematics, analysis of robot motion and static forces, and trajectory planning.

Learning Outcomes: 1. Create the kinematics model of a robotic manipulator. 2. Solve forward and inverse kinematics problems of a robotic manipulator. 3. Analyze the motion and static forces of a robotic manipulator. 4. Plan trajectories of a robotic manipulator. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction

in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3. Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

MFET 48002 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

13 Credits

Russian, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

Pre-requisite Language Courses

RUSS 10100 - Russian Level I (UCC: HUM)

Credit Hours: 4.00. A beginning course in Russian which builds basic skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook units. 3. Read and understand basic texts in Russian related to everyday activities. 4. Write a paragraph using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Begin learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 10200 - Russian Level II (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 10100. Further work on developing skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand additional details as well as the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook and other class materials. 3. Read and understand simple texts in Russian related to everyday activities. 4. Write a few paragraphs using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Continue learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 20100 - Russian Level III (UCC: HUM)

Credit Hours: 4.00. An intermediate-level course designed to develop higher skills in speaking, listening, reading, and writing Russian, as well as in intercultural competence and communication through further work on conversational and writing ability. Students work individually and in small groups using authentic reading and audio materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both simple conversations on everyday topics and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain simple conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important life events, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 20200 - Russian Level IV (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 20100. Development of Russian language skills at the higher intermediate level in speaking, listening, reading, writing, and in cultural competence. Conversational and writing ability receive prominence, as well as a review of Russian grammar. Students continue working with authentic reading and audio materials individually and in small groups.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both ordinary conversations and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain ordinary conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important topics, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

A. Russian Language (12 credits)

RUSS 30100 - Russian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Russian speaking, listening, reading, and writing abilities, using material dealing primarily with everyday life and civilization in the Soviet Union from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

RUSS 30200 - Russian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Russian, on the basis of materials dealing with the ideas and events that have shaped present-day Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

RUSS 40100 - Russian Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Russian speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

RUSS 40200 - Russian Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in Russian. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve proficiency in the four language skills: speaking, listening, writing, and reading. 2. Achieve a proficiency of Intermediate High to Advanced Low (ACTFL scale), Level 3 (State Department Scale). 3. Gain greater familiarity with various elements of Russian society and both high and popular culture. Credits: 3.00

B. Russian Literature (3 credits)

RUSS 34100 - Russian Literature In The Nineteenth Century

Credit Hours: 3.00. Selected Russian poetry, prose, and drama from the Kievan period to 1900 in historical and cultural context. Students will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role of literature in 19th century Russian culture and society. 2. Situate the works they read in their historical and political content. 3. Improve understanding of the way literary works function through various artistic devices. 4. Improve ability to perform close readings of literary texts. 5. Increase ability to write analytical papers supporting a thesis. 6. Increase ability to conduct and present independent research. 7. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 34200 - Revolution, Repression, Renewal: Soviet Literature And Beyond

Credit Hours: 3.00. Selected Russian poetry, prose, and drama of the 20th century in historical and cultural context. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role and position of literature in the Soviet Union. 2. Situate the works they read in their historical and political context. 3. Understand the relationship between writers, the Soviet state, and the means of disseminating texts. 4. Improve understanding of the way literary works function through various artistic devices. 5. Improve ability to perform close readings of literary texts. 6. Increase ability to write analytical papers supporting a thesis. 7. Increase ability to conduct and present independent research. 8. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

C. Russian Culture (3 credits)

RUSS 38000 - Russian Culture And Civilization I

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia, starting with the founding of the Kievan state and continuing to the last days of the Russian Empire. No knowledge of Russian is required.

Learning Outcomes: 1. Understand the forces and circumstances (geographical, historical, political) that shaped the Russian state and gave rise to its distinctive forms of culture. 2. Understand the distinction between rossiskoe

(Russian as pertains to the polity) and russkoe (ethnically and linguistically Russian), and improve understanding of Russia as a multi-ethnic state. 3. Discover the contributions of non-ethnic Russians to Russian culture. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. 5. Increase ability to read critically and write persuasively. Credits: 3.00

RUSS 38100 - Russian Culture And Civilization II

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia from the revolutionary period to the present. No knowledge of Russian is required.

Learning Outcomes: 1. Increase understanding of the interactions between revolutionary politics and revolutionary art, and explore the role of art in a political society while encountering various strategies authors, composers, etc. used to navigate between creative impulses and political requirements. 2. Move beyond the simplistic dichotomy of propaganda vs. dissidence and explore the complex gradations between the extremes of official anti-Soviet culture. 3. Increase knowledge of the relationship between cultural production, distribution, and consumption and the forms that culture takes. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. Credits: 3.00

D. Russian Linguistics (6 credits)

RUSS 56100 - The Structure Of Russian I: Phonology And Syntax

Credit Hours: 3.00. This course treats the sound system and sentence structure of Russian, dealing with the structural pattern on various levels (phonetic, phonemic, syntactic) from various points of view. One weekly class is devoted to theoretical issues affecting Russian phonology and syntax.

Credits: 3.00

RUSS 56200 - The Structure Of Russian II: Morphology

Credit Hours: 3.00. This course will present a systematic study of Russian morphology in the light of current linguistic research, dealing both with the various categories of inflected words (nouns, pronouns, adjectives, verbs) and with word formation.

Credits: 3.00

E. Russian Electives (9 credits)

RUSS 29800 - Special Topics In Russian

Credit Hours: 3.00. Studies of particular aspects of Russian (e.g. culture, civilization, linguistics, literature, film, etc.) by examining varied selection of works. Readings, discussion, and papers in English.

Credits: 3.00

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

RUSS 34100 - Russian Literature In The Nineteenth Century

Credit Hours: 3.00. Selected Russian poetry, prose, and drama from the Kievan period to 1900 in historical and cultural context. Students will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role of literature in 19th century Russian culture and society. 2. Situate the works they read in their historical and political content. 3. Improve understanding of the way literary works function through various artistic devices. 4. Improve ability to perform close readings of literary texts. 5. Increase ability to write analytical papers supporting a thesis. 6. Increase ability to conduct and present independent research. 7. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 34200 - Revolution, Repression, Renewal: Soviet Literature And Beyond

Credit Hours: 3.00. Selected Russian poetry, prose, and drama of the 20th century in historical and cultural context. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role and position of literature in the Soviet Union. 2. Situate the works they read in their historical and political context. 3. Understand the relationship between writers, the Soviet state, and the means of disseminating texts. 4. Improve understanding of the way literary works function through various artistic devices. 5. Improve ability to perform close readings of literary texts. 6. Increase ability to write analytical papers supporting a thesis. 7. Increase ability to conduct and present independent research. 8. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 42400 - Business Russian

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

RUSS 59600 - Special Topics In Russian Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

RUSS 38000 - Russian Culture And Civilization I

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia, starting with the founding of the Kievan state and continuing to the last days of the Russian Empire. No knowledge of Russian is required.

Learning Outcomes: 1. Understand the forces and circumstances (geographical, historical, political) that shaped the Russian state and gave rise to its distinctive forms of culture. 2. Understand the distinction between rossiskoe (Russian as pertains to the polity) and russkoe (ethnically and linguistically Russian), and improve understanding of Russia as a multi-ethnic state. 3. Discover the contributions of non-ethnic Russians to Russian culture. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. 5. Increase ability to read critically and write persuasively. Credits: 3.00

RUSS 38100 - Russian Culture And Civilization II

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia from the revolutionary period to the present. No knowledge of Russian is required.

Learning Outcomes: 1. Increase understanding of the interactions between revolutionary politics and revolutionary art, and explore the role of art in a political society while encountering various strategies authors, composers, etc. used to navigate between creative impulses and political requirements. 2. Move beyond the simplistic dichotomy of propaganda vs. dissidence and explore the complex gradations between the extremes of official anti-Soviet culture. 3. Increase knowledge of the relationship between cultural production, distribution, and consumption and the forms that culture takes. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. Credits: 3.00

RUSS 49700 - Topics In Russian Literature

Credit Hours: 3.00 to 6.00. This course provides in-depth study of a particular author or facet of the Russian literary tradition. Possible topics include Dostoevsky and His Age; The Art and Thought of Leo Tolstoy; Russian Romanticism: Pushki, Gogol, Lermontov; The Russian Stage: Theater in Russia and the Soviet Union.

Learning Outcomes: 1. Increase familiarity with various writers, movements, and other aspects of the Russian literary tradition. 2. Improve understanding of the ways in which Russian writers confronted moral and artistic problems in their works. 3. Able to contextualize Russian literary works in the historical and cultural

context in which they appeared. 4. Increase ability to read critically and write persuasively. 5. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

RUSS 49800 - Topics In Russian Culture

Credit Hours: 3.00 to 6.00. This course provides a sustained examination of some aspect of Russian culture or a topic relevant to Russian cultural studies. Topics may include Russia Confronts the East; The Caucasus: An Introduction; Popular Culture in Russia.

Learning Outcomes: 1. Attain an in-depth understanding of a particular movement, feature, or aspect of Russian culture. 2. Improve knowledge of Russian history and society as it pertains to cultural development. 3. Increase ability to read critically and write persuasively. 4. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

Electives (14-51 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

RUSS 10100 - Russian Level I (UCC: HUM)

Credit Hours: 4.00. A beginning course in Russian which builds basic skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook units. 3. Read and understand basic texts in Russian related to everyday activities. 4. Write a paragraph using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Begin learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

16 Credits

Spring 1st Year

RUSS 10200 - Russian Level II (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 10100. Further work on developing skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand additional details as well as the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook and other class materials. 3. Read and understand simple texts in Russian related to everyday activities. 4. Write a few paragraphs using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Continue learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

16-17 Credits

Fall 2nd Year

RUSS 20100 - Russian Level III (UCC: HUM)

Credit Hours: 4.00. An intermediate-level course designed to develop higher skills in speaking, listening, reading, and writing Russian, as well as in intercultural competence and communication through further work on conversational and writing ability. Students work individually and in small groups using authentic reading and audio materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both simple conversations on everyday topics and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain simple conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important life events, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 34100 - Russian Literature In The Nineteenth Century

Credit Hours: 3.00. Selected Russian poetry, prose, and drama from the Kievan period to 1900 in historical and cultural context. Students will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role of literature in 19th century Russian culture and society. 2. Situate the works they read in their historical and political content. 3. Improve understanding of the way literary works function through various artistic devices. 4. Improve ability to perform close readings of literary texts. 5. Increase ability to write analytical papers supporting a thesis. 6. Increase ability to conduct and present independent research. 7. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 34200 - Revolution, Repression, Renewal: Soviet Literature And Beyond

Credit Hours: 3.00. Selected Russian poetry, prose, and drama of the 20th century in historical and cultural context. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role and position of literature in the Soviet Union. 2. Situate the works they read in their historical and political context. 3. Understand the relationship between writers, the Soviet state, and the means of disseminating texts. 4. Improve understanding of the way literary works function through various artistic devices. 5. Improve ability to perform close readings of literary texts. 6. Increase ability to write analytical papers supporting a thesis. 7. Increase ability to conduct and present independent research. 8. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 56100 - The Structure Of Russian I: Phonology And Syntax

Credit Hours: 3.00. This course treats the sound system and sentence structure of Russian, dealing with the structural pattern on various levels (phonetic, phonemic, syntactic) from various points of view. One weekly class is devoted to theoretical issues affecting Russian phonology and syntax.

Credits: 3.00

16 Credits

Spring 2nd Year

RUSS 20200 - Russian Level IV (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 20100. Development of Russian language skills at the higher intermediate level in speaking, listening, reading, writing, and in cultural competence. Conversational and writing ability receive prominence, as well as a review of Russian grammar. Students continue working with authentic reading and audio materials individually and in small groups.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both ordinary conversations and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain ordinary conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important topics, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 56200 - The Structure Of Russian II: Morphology

Credit Hours: 3.00. This course will present a systematic study of Russian morphology in the light of current linguistic research, dealing both with the various categories of inflected words (nouns, pronouns, adjectives, verbs) and with word formation.

Credits: 3.00

RUSS 38000 - Russian Culture And Civilization I

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia, starting with the founding of the Kievan state and continuing to the last days of the Russian Empire. No knowledge of Russian is required.

Learning Outcomes: 1. Understand the forces and circumstances (geographical, historical, political) that shaped the Russian state and gave rise to its distinctive forms of culture. 2. Understand the distinction between rossiskoe (Russian as pertains to the polity) and russkoe (ethnically and linguistically Russian), and improve understanding of Russia as a multi-ethnic state. 3. Discover the contributions of non-ethnic Russians to Russian culture. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. 5. Increase ability to read critically and write persuasively. Credits: 3.00

RUSS 38100 - Russian Culture And Civilization II

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia from the revolutionary period to the present. No knowledge of Russian is required.

Learning Outcomes: 1. Increase understanding of the interactions between revolutionary politics and revolutionary art, and explore the role of art in a political society while encountering various strategies authors, composers, etc. used to navigate between creative impulses and political requirements. 2. Move beyond the simplistic dichotomy of propaganda vs. dissidence and explore the complex gradations between the extremes of official anti-Soviet culture. 3. Increase knowledge of the relationship between cultural production, distribution, and consumption and the forms that culture takes. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. Credits: 3.00

16 Credits

Fall 3rd Year

RUSS 30100 - Russian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Russian speaking, listening, reading, and writing abilities, using material dealing primarily with everyday life and civilization in the Soviet Union from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

15-16 Credits

Spring 3rd Year

RUSS 30200 - Russian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Russian, on the basis of materials dealing with the ideas and events that have shaped present-day Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

15 Credits

Fall 4th Year

RUSS 40100 - Russian Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Russian speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

13 Credits

Spring 4th Year

RUSS 40200 - Russian Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in Russian. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Improve proficiency in the four language skills: speaking, listening, writing, and reading. 2. Achieve a proficiency of Intermediate High to Advanced Low (ACTFL scale), Level 3 (State Department Scale). 3. Gain greater familiarity with various elements of Russian society and both high and popular culture. Credits: 3.00

12 Credits

Sales and Marketing, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (55 credits)

Required Major Courses (38 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest

rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business

communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze

data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 43100 - Advanced Industrial Sales And Marketing

Credit Hours: 4.00. Advanced presentation techniques, sales management and analysis, improving communication skills, study of industrial marketing strategies, interaction with industry executives, and strategies for career development. Requires class trips. Students will pay individual lodging or meal expenses when necessary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to

analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

Communication Marketing Selective (3 credits)

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

AGEC Department Selectives (14 credits)

Other Departmental /Program Course Requirements (46-47 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe,

explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of

organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (18-19 credits)

Supplemental List

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services,

scholarship offerings, career opportunities and services. Credits: 0.50

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

14-15 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it

examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

16 Credits

Fall 2nd Year

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2.

Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

16 Credits

Spring 2nd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations

of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

15 Credits

Fall 3rd Year

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming

problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

15 Credits

Fall 4th Year

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental

principles to living in a global community. Credits: 3.00

AGEC 43100 - Advanced Industrial Sales And Marketing

Credit Hours: 4.00. Advanced presentation techniques, sales management and analysis, improving communication skills, study of industrial marketing strategies, interaction with industry executives, and strategies for career development. Requires class trips. Students will pay individual lodging or meal expenses when necessary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

16 Credits

Spring 4th Year

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

13 Credits

Science Education: Biology Concentration, BS

Degree Requirements

Departmental/Program Major Courses (61-69)

Required Science Education Core Courses (24-30 credits)

Required Chemistry Course (4-5 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this

course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Required Computing Option (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the

difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Required Calculus Courses (6-10 credits)

Option 1 (all concentrations)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series.

3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

Option 2 (all concentrations)

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Option 3 (Biology only)

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

Required Physics Courses (8 credits)

Option 1 (Biology, Chemistry, Earth/Space)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Option 2 (Physics only)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a

few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Option 3 (Biology, Chemistry, Earth/Space)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

Option 4 (Earth/Space only)

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think

critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

Option 5 (Biology only)

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Required Statistics Course (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented

introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Biology Concentration (37-39 credits)

Biology Core (19 credits)

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3.

Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.

Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how

evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a

hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

Upper-Level Biology Coursework (10-12 credits)

Intermediate Selective (0-4 credits)

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed

mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

Group A Selective (at least 2 credits)

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced

disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the most current literature.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results,

and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional

architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 54900 - Microbial Ecology

Credit Hours: 2.00. A study of microbial interactions with other organisms and the environment. Aquatic and terrestrial ecosystems as well as interactions between nonpathogenic microbes and plants and animals will be discussed. Offered in alternate years.

Credits: 2.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the

tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the

relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement,

Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

Group B Selective (at least 2 credits)

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry

contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological

problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations,

communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

BIOL 500-level Selective (0 or 2-3 credits)

Base Lab Requirement (0-4 credits)

Additional Selective Courses (0-7 credits)

Undergraduate Research (0-2 credits)

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3.

Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49900 - Biology Honors Thesis Research

Credit Hours: 1.00 to 4.00. Research under the guidance of a scientist. Submission of honors tutorial petition and consent of faculty tutor and Honors Committee. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

Academic Seminars/Other Courses

BIOL 44100 - Biology Senior Seminar In Genetics

Credit Hours: 1.00. This is a required course for genetics majors. It provides exposure to current research in genetics and molecular biology via invited faculty speakers. Students enrolled in the course who have actively participated in research also give a presentation on their own work. Other students are assigned to review current literature in one aspect of the semester's topic. The topic selected for review is in an area of current research in genetics and may vary from year to year.

Credits: 1.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

Organic Chemistry (8 credits)

Organic Chemistry I

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms

of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Organic Chemistry II

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

Professional Education Requirements (43-44 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how

they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

EDCI 42100 - The Teaching Of Biology In Secondary Schools

Credit Hours: 3.00. The rationale, objectives, methods, and materials of teaching biology and life science in junior and senior high schools. Extensive use of multimedia resources in planning specifically for the student teaching experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Have a conceptual understanding of science, how to develop a learning community within a classroom, and an understanding of and strategies to implement educational equity in a classroom. 2. Learn how to carry out the practical activities of science teaching, develop worksheets, hold class discussions, develop and grade tests, and use textbooks. 3. Learn about the nature of scientific understanding and classroom communities, and how to use theoretical knowledge of learners & communities to guide their teaching. Credits: 3.00

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3.

Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English

language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-

based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000.

Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community

stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Optional Concentration

Other Departmental /Program Course Requirements (9-21 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (0-11 credits)

GPA Requirements

Teacher Licensure Information

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This

course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute

integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

16-18 Credits

Spring 1st Year

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography,

distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of

schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

16-18 Credits

Fall 2nd Year

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application

and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000.

Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role

of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include

understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8.

Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

16 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well

as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

17-18 Credits

Spring 3rd Year

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2.

Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context

of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

15-17 Credits

Fall 4th Year

EDCI 42100 - The Teaching Of Biology In Secondary Schools

Credit Hours: 3.00. The rationale, objectives, methods, and materials of teaching biology and life science in junior and senior high schools. Extensive use of multimedia resources in planning specifically for the student teaching experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Have a conceptual understanding of science, how to develop a learning community within a classroom, and an understanding of and strategies to implement educational equity in a classroom. 2. Learn how to carry out the practical activities of science teaching, develop worksheets, hold class discussions, develop and grade tests, and use textbooks. 3. Learn about the nature of scientific understanding and classroom communities, and how to use theoretical knowledge of learners & communities to guide their teaching. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and

motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.
Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

17-19 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.
University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Science Education: Chemistry Concentration, BS

Degree Requirements

Departmental/Program Major Courses

Required Science Education Core Courses (26-30 credits)

Required Chemistry Course (4-5 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Required Computing Option (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data

structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.

Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Required Calculus Selective Courses (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 .

Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Required Physics Selective Courses (8 credits)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)

Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a

unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Required Statistics Course (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

Chemistry Concentration (39-44 credits)

Required Concentration Courses (19-20 credits)

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 22400 - Introductory Quantitative Analysis

Credit Hours: 4.00. Introduction to titrimetric, gravimetric, and instrumental methods of analysis; principles of separation processes, including chromatography; recognition and evaluation of possible sources of error. Required of students

majoring in biology who do not take CHM 32100 .

Credits: 4.00

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries.

Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.

Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how

scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Biochemistry Selective (3 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation,

photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in

depth understanding of central foundations of biology at a molecular level. Credits: 3.00

Physical Chemistry Selective (4-7 credits)

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

Upper Level Selective (3 credits)

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an

understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing

genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

Analytical Selective (4 credits)

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

Required Laboratory Selective (3-6 credits)

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular

understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5.

Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3.

Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

Professional Education Requirements (43-44 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of

software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population. Credits: 3.00

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and

learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of

diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and

motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally

and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Optional Concentration

Other Departmental /Program Course Requirements (10-24 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (0-6 credits)

Teacher Licensure Information

GPA Requirements

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts.

Credits: 0.00 to 3.00

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3.

Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and

critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all

this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in

lecture. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

18-20 Credits

Fall 2nd Year

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12

contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

15-17 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to

methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into

themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

18-19 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of

content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie

statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

15 Credits

Spring 3rd Year

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the

program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

16-17 Credits

Fall 4th Year

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population.

Credits: 3.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the

concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

16 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Science Education: Earth Space Science Concentration, BS

Degree Requirements

Departmental/Program Major Courses (56-63 credits)

Required Science Education Core Courses (24-30 credits)

Required Chemistry Course (4-5 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding,

shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Required Computing Option (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving

and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Required Calculus Selective Courses (6-10 credits)

Option 1 (all concentrations)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for

this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

Option 2 (all concentrations)

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it

possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Option 3 (Biology only)

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

Required Physics Selective Courses (8 credits)

Option 1 (Biology, Chemistry, Earth/Space)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by

charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Option 2 (Physics only)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Option 3 (Biology, Chemistry, Earth/Space)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

Option 4 (Earth/Space only)

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)

Credits: 4.00

Option 5 (Biology only)

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for

characterizing biomolecules. Credits: 4.00

Required Statistics Course (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Earth Space Science Concentration (32-33 credits)

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 5.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 13600 - General Chemistry Honors (UCC: SCI)

Credit Hours: 4.00. A sophisticated treatment of the principles of chemistry. Atomic structure and bonding, spectroscopy, equilibria, thermodynamics and kinetics. Includes weekly laboratory experiments. Two years of high school chemistry recommended. Students with a grade of C or better in CHM 13600 who need 8 hours of credit in general chemistry may request credit for CHM 11500.

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 11700 - Introduction To Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. The weather/climate system. Solar

variability and Milankovitch Theory. Atmospheric scales of motion. Chemistry of greenhouse gases and aerosols. Fundamental laws of meteorological dynamics and radiation. Weather systems, air masses and fronts. Severe storms, hurricanes and tornadoes. (Required for atmospheric sciences majors.).

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Appreciate the temporal and spatial scales of climate change, from Milankovitch Theory and glacial/interglacial regions, to the anthropogenic effects of greenhouse gases (GHG's). 2. Appreciation of how weather events collectively and cumulatively, lead to the establishment of climate. 3. Understand the basic scales of atmospheric motion (space and time) and the classification of weather events into these scales (planetary, synoptic, mesoscale and microscale). 4. Understand the definition of aerosols and GHG's and their relation to weather and climate. 5. Understand the four basic laws of radiation (beginning with Planck's Law). 6. Understand the fundamental laws of atmospheric motion, and some general principles of weather prediction. 7. Understand the basic principles of cloud physics, from CCN to cloud formation and precipitation. 8. Understand the First Law of Thermodynamics, and the general concepts of thermal convection, including lapse rates and the concept of latent heat release. 9. Understand the behavior, including simulation and differences, of geophysical columnar vortices, from dust devils to tornadoes to hurricanes. 10. Understand the broad context of atmospheric science, from solar physics and space weather, to meteorology and lower atmosphere weather phenomena. 11. Understand how the planetary atmospheric circulation establishes a jet stream and the semi-permanent pattern of wind and pressure belts (e.g., the trade winds and the westerlies). 12. Understand the formation and movement of air masses and fronts, including the formation of Extratropical Cyclones. 13. Understand the formation of thunderstorms, including severs thunderstorms, hail and tornadoes. 14. Understand tornado climatology in the USA, the tornado intensity scale, taxonomy and climate considerations such as ENSO pattern of El Nino and La Nina. 15. Understand weather hazards in the field of aviation, particularly thunderstorm phenomena (such as hail and downburst winds). 16. Understand a basic review of weather/climate and energy (from wind farms to climate changes). Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand

sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

EAPS 39000 - Geologic Field Methods

Credit Hours: 3.00. Introduction to geologic mapping principles on quadrangle (7 1/2 min., 15 min., 1:250,000 scales) maps. Application of aerial photography, GPS, and GIS techniques. Emphasis on construction of cross sections, measurement of stratigraphic sections, and preparation of geologic reports. Several weekend field exercises will be required.

Credits: 3.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections

between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data

sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Professional Education Requirements (43-44 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple,

diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population. Credits: 3.00

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to

develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources

to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics

addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness,

knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Optional Concentration

Other Departmental/Program Course Requirements (11-15 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Electives (2-14 credits)

GPA Requirements

Teacher Licensure Information

Course Requirements and Notes

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze

experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

16-19 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 5.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 13600 - General Chemistry Honors (UCC: SCI)

Credit Hours: 4.00. A sophisticated treatment of the principles of chemistry. Atomic structure and bonding, spectroscopy, equilibria, thermodynamics and kinetics. Includes weekly laboratory experiments. Two years of high school chemistry recommended. Students with a grade of C or better in CHM 13600 who need 8 hours of credit in general chemistry may request credit for CHM 11500.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of

integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory

practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community

stakeholders through formal and informal conversations. Credits: 3.00

15-17 Credits

Fall 2nd Year

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations

and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

17 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the

Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and

communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC

Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

17 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

EAPS 11700 - Introduction To Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. The weather/climate system. Solar variability and Milankovitch Theory. Atmospheric scales of motion. Chemistry of greenhouse gases and aerosols. Fundamental laws of meteorological dynamics and radiation. Weather systems, air masses and fronts. Severe storms, hurricanes and tornadoes. (Required for atmospheric sciences majors.).

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Appreciate the temporal and spatial scales of climate change, from Milankovitch Theory and glacial/interglacial regions, to the anthropogenic effects of greenhouse gases (GHG's). 2. Appreciation of how weather events collectively and cumulatively, lead to the establishment of climate. 3. Understand the basic scales of atmospheric motion (space and time) and the classification of weather events into these scales (planetary, synoptic, mesoscale and microscale). 4. Understand the definition of aerosols and GHG's and their relation to weather and climate. 5. Understand the four basic laws of radiation (beginning with Planck's Law). 6. Understand the fundamental laws of atmospheric motion, and some general principles of weather prediction. 7. Understand the basic principles of cloud physics, from CCN to cloud formation and precipitation. 8. Understand the First Law of Thermodynamics, and the general concepts of thermal convection, including lapse rates and the concept of latent heat release. 9. Understand the behavior, including simulation and differences, of geophysical columnar vortices, from dust devils to tornadoes to hurricanes. 10. Understand the broad context of atmospheric science, from solar physics and space weather, to meteorology and lower atmosphere weather phenomena. 11. Understand how the planetary atmospheric circulation establishes a jet stream and the semi-permanent pattern of wind and pressure belts (e.g., the trade winds and the westerlies). 12. Understand the formation and movement of air masses and fronts, including the formation of Extratropical Cyclones. 13. Understand the formation of thunderstorms, including severs thunderstorms, hail and tornadoes. 14. Understand tornado climatology in the USA, the tornado intensity scale, taxonomy and climate considerations such as ENSO pattern of El Nino and La Nina. 15. Understand weather hazards in the field of aviation, particularly thunderstorm phenomena (such as hail and downburst winds). 16. Understand a basic review of weather/climate and energy (from wind farms to climate changes). Credits: 3.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific

paper. Credits: 3.00

14-17 Credits

Spring 3rd Year

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

EAPS 39000 - Geologic Field Methods

Credit Hours: 3.00. Introduction to geologic mapping principles on quadrangle (7 1/2 min., 15 min., 1:250,000 scales) maps. Application of aerial photography, GPS, and GIS techniques. Emphasis on construction of cross sections, measurement of stratigraphic sections, and preparation of geologic reports. Several weekend field exercises will be required.

Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

14-18 Credits

Fall 4th Year

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an

informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population.
Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.
Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.
Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.
Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.
University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.
Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are

clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

16 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Science Education: Physics Concentration, BS

Degree Requirements

Departmental/Program Major Courses

Required Science Education Core Courses (24-30 credits)

Required Chemistry Course (4-5 credits)

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories,

and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Required Computing Option (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format,

extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Required Calculus Selective Courses (6-10 credits)

Option 1 (all concentrations)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

Option 2 (all concentrations)

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the

advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Option 3 (Biology only)

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential

equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

Required Physics Courses (8 credits)

Option 1 (Biology, Chemistry, Earth/Space)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Option 2 (Physics only)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and

describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

Option 3 (Biology, Chemistry, Earth/Space)

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

Option 4 (Earth/Space only)

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

Option 5 (Biology only)

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

Required Statistics Selective Courses (3 credits)

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data

and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

Physics Concentration (36-38 credits)

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 13600 - General Chemistry Honors (UCC: SCI)

Credit Hours: 4.00. A sophisticated treatment of the principles of chemistry. Atomic structure and bonding, spectroscopy, equilibria, thermodynamics and kinetics. Includes weekly laboratory experiments. Two years of high school chemistry recommended. Students with a grade of C or better in CHM 13600 who need 8 hours of credit in general chemistry may request credit for CHM 11500.

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts,

representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

PHYS Major Selectives (6-7 credits)

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

Professional Education Requirements (43-44 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver

instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population.

Credits: 3.00

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners'

strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000.

Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated

instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Optional Concentration

Other Departmental /Program Course Requirements (15-20 credits)

College of Science Additional Requirements

Computing (3-4 credits)

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

Statistics (3 credits)

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof.

Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Electives (0-6 credits)

GPA Requirements

Teacher Licensure Information

Course Requirements and Notes

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this

course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

17-19 Credits

Spring 1st Year

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 5.00

CHM 13600 - General Chemistry Honors (UCC: SCI)

Credit Hours: 4.00. A sophisticated treatment of the principles of chemistry. Atomic structure and bonding, spectroscopy, equilibria, thermodynamics and kinetics. Includes weekly laboratory experiments. Two years of high school chemistry recommended. Students with a grade of C or better in CHM 13600 who need 8 hours of credit in general chemistry may request credit for CHM 11500.

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3.

Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and

critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

16-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to

understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and

data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

18-19 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing.

Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to

support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

15 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that

should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

17 Credits

Spring 3rd Year

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make

efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution.
Credits: 4.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources

to leverage connections across disciplines to facilitate integration. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-17 Credits

Fall 4th Year

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population. Credits: 3.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an

educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

17 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Selling and Sales Management, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33-35 credits)

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase

decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

CSR 30700 - Field Experience In Selling And Sales Management

Credit Hours: 1.00. Approved in-service training and supervised work experience in selling and sales management. Total of 140 hours required with in-depth report and analysis of activities. Permission of department required.

Learning Outcomes: 1. Provide exposure to career options in a real world setting through direct practice or by observation and interaction with colleague at the internship site. 2. Apply theory and relevant coursework in a professional setting, where the student will combine academic and work site assignments. 3. Advance skills and professional experience to enhance the student's career development. Credits: 1.00

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 31500 - Relationship Selling

Credit Hours: 3.00. This course focuses on long-term relationship selling. The course is organized around a seven-step selling process which has proven to be effective. The course adds to this process some principles of marketing and business strategy. The elements are necessary for the success of professional salesperson both in successful prospecting and

making strategic choices as to how to allocate their time within the territory. Important to the learning process is actually practice of principles. Students will do various exercises of principles such as prospecting and negotiation. At the end of the semester, students will hone the skills learned through the semester with a series of role plays designed to put them in position of both seller and buyer.

Learning Outcomes: 1. Recognize that selling is a process which can be taught versus an innate trait. 2. Have an organized approach to the process of selling which can be applied to any industry. 3. Know principles of marketing and strategy which students can apply to the selling process. 4. Know principles of negotiation and handling objections both through class assignments and role playing. 5. Know how to do effective product presentation and frame benefits to the clients through a series of role play scenarios. Credits: 3.00

CSR 33100 - Consumer Behavior

Credit Hours: 3.00. An interdisciplinary survey of consumer behavior theory focused on psychological, sociological, and cultural influences on consumer choice and use of products and services. Credit will not be given for both CSR 33100.

Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

CSR 34400 - Fundamentals Of Negotiations

Credit Hours: 3.00. This course is designed to be relevant to the broad spectrum of bargaining "problems" that are traditionally faced by the manager, sales personnel and financial advisors. The course explores the processes of bargaining and negotiation as social and managerial activities. Special emphasis will be given to the areas of interpersonal and interpersonal and intergroup conflict, in addition to the interpersonal influence techniques and the tactics and strategies involved with improved bargaining and negotiation. The major purpose of the course is for each student to gain insight into his or her own negotiating style and to become a more effective negotiator, as well as a more astute observer of social process. The course will involve extensive use of cases, role-plays, and related participative activities, enhanced by rigorous self-review and introspection.

Learning Outcomes: 1. Explore the major concepts and theories of the psychology of bargaining and negotiation. 2. Understand the dynamics of interpersonal and intergroup conflict and its resolution. 3. Help develop the sophistication to analyze bargaining and conflict relationships. 4. Learn about your own individual "bargaining" style. 5. Development appropriate negotiation strategies and tactics for specific situations. Credits: 3.00

CSR 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an International experience that is recognized by the University. Permission of department required.

Credits: 1.00 to 6.00

CSR 40400 - Strategic Management For Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. Through the analysis of internal and external forces, students develop strategies to help an organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of an organization. The course is structured to enhance students' analytical, critical thinking, and verbal skills by integrating academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Demonstrate through effective written and oral communication, the ability to conduct a strategic situational analysis of a service organization. 2. Develop a business strategy for a service organization. 3. Integrate and apply prior knowledge areas from your major to propose a functional strategy that aligns with the strategic vision of your service organization. Credits: 3.00

CSR 41500 - Sales Force Management

Credit Hours: 3.00. An introduction to sales force management. An examination of the sales force management process, including principles of recruiting and selecting, training, compensation, motivation, supervision, and evaluation. Planning skills, including sales force deployment and the role of the sales force in sales forecasting, are also covered.

Learning Outcomes: 1. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues and activities. Credits: 3.00

CSR 41800 - Selling And Sales Management Capstone

Credit Hours: 3.00. A capstone course in advanced professional selling taught in a seminar format and designed to prepare students for the transition from student to professional. Students are introduced to practitioner-focused issues involved in long-term, major B2B account sales and an emphasis is placed on professional presentation skills. Students will complete a senior group research project and a major account sales project. Professional dress code from business-casual to full-business attire required based on the scheduled day-to-day activity.

Learning Outcomes: 1. Construct a complete selling and sales management program (term project). 2. Demonstrate the ability to analyze selling and sales management situations, and apply skills to solving selling and sales management problems and developing effective selling strategies (exams; quizzes; class exercises). 3. Identify how diversity, ethical, global, and multicultural considerations affect the selling and sales management decision-making processes (exams; class exercises). 4. Demonstrate effectively communication skills by the presentation of a research project in an oral presentation and in a written paper (term project presentations and project updates). Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using

Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ENTR 46000 - Internship And Career Preparation Seminar

Credit Hours: 1.00. This course is a distance option course for the Certificate in Entrepreneurship and Innovation. It equips students with professional skills based on entrepreneurship competencies. Students develop resources to illustrate their skills, talents, abilities, and goals to increase career preparedness. They learn what it takes to successfully transfer academic skills to a workplace setting and develop an entrepreneurial mindset that sets them apart from other job seekers.

Learning Outcomes: 1. Improve self-awareness of professional skills development through assessments and reflection. 2. Create a professional brand through an improved LinkedIn profile, resume review, interviewing, and networking skills. 3. Showcase educational and professional skills in an e-portfolio or website. Credits: 1.00

CSR 20100 - Introduction To Professional Sales

Credit Hours: 3.00. Introduction to sales process, business to business communication strategies, and expectations of a sales professional.

Learning Outcomes: 1. Describe the operationalization of sales and the purchasing function within a business. 2. Define the variety of sales roles and determine best fit. 3. Demonstrate the skills necessary to succeed in a sales role. 4. Apply sales process to a role play sales call. Credits: 3.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

Other Departmental/Program Requirements (58-65 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model

and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to

compose for different purposes. Credits: 3.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss

various social issues associated with computers and information systems. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important

macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to

managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques,

sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

HTM 25500 - Advanced Spreadsheet Techniques For Hospitality And Tourism Management

Credit Hours: 2.00. This course builds upon information and skills obtained in an entry-level-computing course. It will take students to the next level by introducing them to more advanced techniques used in Hospitality, Tourism, Retail, and Sales Management.

Learning Outcomes: 1. Demonstrate proper utilization of spreadsheet techniques to effectively organize and analyze data for management presentations. 2. Explain the purpose of selected spreadsheet techniques and describe how they are used in Hospitality, Tourism, Retail, and Sales Management. 3. Demonstrate advanced spreadsheet techniques, such as: Advanced Spreadsheet Formulas; Statistical Analysis; Validating Data Entry; Conditional Formatting; Advanced Charting Techniques; Pivot Tables; Spreadsheet Dashboards; Recording and Using Spreadsheet Macros; Power Query; Advanced Cell/Column/Row/Table Formatting; Creating Templates. Credits: 2.00

Electives (20-29 credits)

Supplemental Lists

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Sample 4-Year Plan

Fall 1st Year

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

16-17 Credits

16-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

14-16 Credits

Fall 2nd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

HTM 25500 - Advanced Spreadsheet Techniques For Hospitality And Tourism Management

Credit Hours: 2.00. This course builds upon information and skills obtained in an entry-level-computing course. It will take students to the next level by introducing them to more advanced techniques used in Hospitality, Tourism, Retail, and Sales Management.

Learning Outcomes: 1. Demonstrate proper utilization of spreadsheet techniques to effectively organize and analyze data for management presentations. 2. Explain the purpose of selected spreadsheet techniques and describe how they are used in Hospitality, Tourism, Retail, and Sales Management. 3. Demonstrate advanced spreadsheet techniques, such as: Advanced Spreadsheet Formulas; Statistical Analysis; Validating Data Entry; Conditional Formatting; Advanced Charting Techniques; Pivot Tables; Spreadsheet Dashboards; Recording and Using Spreadsheet Macros; Power Query; Advanced Cell/Column/Row/Table Formatting; Creating Templates. Credits: 2.00

CSR 20100 - Introduction To Professional Sales

Credit Hours: 3.00. Introduction to sales process, business to business communication strategies, and expectations of a sales professional.

Learning Outcomes: 1. Describe the operationalization of sales and the purchasing function within a business. 2. Define the variety of sales roles and determine best fit. 3. Demonstrate the skills necessary to succeed in a sales role. 4. Apply sales process to a role play sales call. Credits: 3.00

14-16 Credits

Spring 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives

and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business

marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

15 Credits

15 Credits

Fall 3rd Year

CSR 31500 - Relationship Selling

Credit Hours: 3.00. This course focuses on long-term relationship selling. The course is organized around a seven-step selling process which has proven to be effective. The course adds to this process some principles of marketing and business strategy. The elements are necessary for the success of professional salesperson both in successful prospecting and making strategic choices as to how to allocate their time within the territory. Important to the learning process is actually

practice of principles. Students will do various exercises of principles such as prospecting and negotiation. At the end of the semester, students will hone the skills learned through the semester with a series of role plays designed to put them in position of both seller and buyer.

Learning Outcomes: 1. Recognize that selling is a process which can be taught versus an innate trait. 2. Have an organized approach to the process of selling which can be applied to any industry. 3. Know principles of marketing and strategy which students can apply to the selling process. 4. Know principles of negotiation and handling objections both through class assignments and role playing. 5. Know how to do effective product presentation and frame benefits to the clients through a series of role play scenarios. Credits: 3.00

CSR 33100 - Consumer Behavior

Credit Hours: 3.00. An interdisciplinary survey of consumer behavior theory focused on psychological, sociological, and cultural influences on consumer choice and use of products and services. Credit will not be given for both CSR 33100.

Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

15 Credits

15 Credits

Spring 3rd Year

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership principles through in-class discussion and written assignments. Credits: 3.00

CSR 34400 - Fundamentals Of Negotiations

Credit Hours: 3.00. This course is designed to be relevant to the broad spectrum of bargaining "problems" that are traditionally faced by the manager, sales personnel and financial advisors. The course explores the processes of bargaining and negotiation as social and managerial activities. Special emphasis will be given to the areas of interpersonal and interpersonal and intergroup conflict, in addition to the interpersonal influence techniques and the tactics and strategies involved with improved bargaining and negotiation. The major purpose of the course is for each student to gain insight into his or her own negotiating style and to become a more effective negotiator, as well as a more astute observer of social process. The course will involve extensive use of cases, role-plays, and related participative activities, enhanced by rigorous self-review and introspection.

Learning Outcomes: 1. Explore the major concepts and theories of the psychology of bargaining and negotiation. 2. Understand the dynamics of interpersonal and intergroup conflict and its resolution. 3. Help develop the sophistication to analyze bargaining and conflict relationships. 4. Learn about your own individual "bargaining" style. 5. Development appropriate negotiation strategies and tactics for specific situations. Credits: 3.00

CSR 41500 - Sales Force Management

Credit Hours: 3.00. An introduction to sales force management. An examination of the sales force management process, including principles of recruiting and selecting, training,

compensation, motivation, supervision, and evaluation. Planning skills, including sales force deployment and the role of the sales force in sales forecasting, are also covered.

Learning Outcomes: 1. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues and activities. Credits: 3.00

15 Credits

15 Credits

Summer 3rd Year

CSR 30700 - Field Experience In Selling And Sales Management

Credit Hours: 1.00. Approved in-service training and supervised work experience in selling and sales management. Total of 140 hours required with in-depth report and analysis of activities. Permission of department required.

Learning Outcomes: 1. Provide exposure to career options in a real world setting through direct practice or by observation and interaction with colleague at the internship site. 2. Apply theory and relevant coursework in a professional setting, where the student will combine academic and work site assignments. 3. Advance skills and professional experience to enhance the student's career development. Credits: 1.00

CSR 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an International experience that is recognized by the University. Permission of department required.

Credits: 1.00 to 6.00

1-3 Credits

1-3 Credits

Fall 4th Year

CSR 40400 - Strategic Management For Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. Through the analysis of internal and external forces, students develop strategies to help an organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of an organization. The course is structured to enhance students' analytical, critical thinking, and verbal skills by integrating academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Demonstrate through effective written and oral communication, the ability to conduct a strategic situational analysis of a service organization. 2. Develop a business strategy for a service organization. 3. Integrate and apply prior knowledge areas from your major to propose a functional strategy that aligns with the strategic vision of your service organization. Credits: 3.00

CSR 41800 - Selling And Sales Management Capstone

Credit Hours: 3.00. A capstone course in advanced professional selling taught in a seminar format and designed to prepare students for the transition from student to professional. Students are introduced to practitioner-focused issues involved in long-term, major B2B account sales and an emphasis is placed on professional presentation skills. Students will complete a senior group research project and a major account sales project. Professional dress code from business-casual to full-business attire required based on the scheduled day-to-day activity.

Learning Outcomes: 1. Construct a complete selling and sales management program (term project). 2. Demonstrate the ability to analyze selling and sales management situations, and apply skills to solving selling and sales management problems and developing effective selling strategies (exams; quizzes; class exercises). 3. Identify how diversity, ethical,

global, and multicultural considerations affect the selling and sales management decision-making processes (exams; class exercises). 4. Demonstrate effectively communication skills by the presentation of a research project in an oral presentation and in a written paper (term project presentations and project updates). Credits: 3.00

15 Credits

15 Credits

Spring 4th Year

13-15 Credits

13-15 Credits

Fall 1st Year

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

16-17 Credits

16-17 Credits

Program Learning Outcomes

About the Program

Smart Manufacturing Industrial Informatics, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (64 credits)

Required Major Courses (64 credits)

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of

the design solution. 5. Present final solution recommendations. Credits: 3.00

MFET 41000 - Introduction To Additive Manufacturing

Credit Hours: 3.00. This course covers topics in additive manufacturing (AM) technologies. Topics include the AM benefits and drawbacks of additive as compared to subtractive manufacturing, additive manufacturing process and material selection, design for additive manufacturing, support structure generation, printing process planning, and quality control techniques, such as monitoring, inspection, and surface modification.

Learning Outcomes: 1. Describe the concepts, benefits, and application of additive manufacturing. 2. Select appropriate additive manufacturing processes and material for producing parts. 3. Design 3D objects for additive manufacturing considering the process requirements. 4. Develop strategies and practices incorporating appropriate quality control techniques. Credits: 3.00

MFET 35000 - Smart Manufacturing Systems Modeling & Simulation

Credit Hours: 3.00. This course addresses application of industrial internet of things (IIoT) for modeling and simulation of smart manufacturing assets, processes, and operations. Emphasis is on synchronizing modeling/simulation with real-time data to develop innovative services, create efficiencies, and enable productivity improvement in smart factories.

Learning Outcomes: 1. Describe the convergence of the physical and digital worlds, technology, and standards of IIoT-aided modeling and simulation. 2. Implement process data modeling and application to various types of plant data (drives, pumps, production lines) using real-time, historical, and event-based data. 3. Develop digital/virtual-cloud representation models to be mirrored onto physical manufacturing systems. 4. Create digital twin (DT) models using data from IIoT devices for monitoring and automating control of smart connected assets. 5. Construct DT-oriented simulation model for IoT-aided manufacturing system for applications in productivity, reliability, efficiency, and predictive maintenance operations. 6. Develop application of augmented reality and manufacturing model proxies in diagnostic and troubleshooting operations. Credits: 3.00

MFET 23000 - Industrial Internet Of Things, Networks, And Systems I

Credit Hours: 3.00. This course provides an introduction to Industrial Internet of Things (IIoT) devices, networks, and standards in the context of converged information technology (IT) and operations technology (OT) industrial automation systems. Course topics include an examination of IT and OT networks, hardware, architecture, protocols, standards, and security practices in the context of industrial applications.

Learning Outcomes: 1. Explain the concept of Industrial Internet of Things (IIoT) and the enabling technologies. 2. Describe IT and OT development and detail differences in priorities and capabilities. 3. Design, implement, and analyze an integrated industrial network. 4. Configure host-level and network-level technical security controls in IT and OT systems. 5. Apply industry standards and reference architectures to ensure best practices in the selection, deployment, and operation of IIoT devices. Credits: 3.00

MFET 23100 - Industrial Internet Of Things, Networks, And Systems II

Credit Hours: 3.00. This course offers a practical exploration of Industrial Internet of Things (IIoT) in converged information and operations technology (IT/OT) industrial automation systems. Course topics include IT and OT reference architectures, industrial network convergence, standards, and security practices in the context of Edge, hybrid, and Cloud-based industrial applications. Specific focus is given to integrating and securing networked industrial devices with local and cloud-based IT systems in greenfield and brownfield scenarios.

Learning Outcomes: 1. Apply industry standards to develop a basic industrial network for converged IT/OT smart manufacturing systems. 2. Demonstrate the implementation of key security components required for converged IT/OT industrial networks. 3 Describe the role,

characteristics, and requirements of safety systems in smart manufacturing. 4. Implement batch and real-time computation and basic machine learning models in an automated system. Credits: 3.00

MFET 25000 - Smart Manufacturing Cloud Computing Applications

Credit Hours: 3.00. This course introduces concepts and principles of cloud computing and the virtualization of computing resources and services for smart manufacturing applications. The fundamental topics of cloud computing will be addressed, including virtually processing, storing, modeling and analyzing of data in the cloud environment. Fundamental concepts about cloud tools, applications, and services from a production and manufacturing perspective will be presented.

Learning Outcomes: 1. State the challenges and advantages of cloud computing in smart manufacturing. 2. Explain the concepts and principles of cloud computing such as a scalability, elasticity, agility, fault tolerance, disaster recovery and networking. 3. Recognize the models, tools, and service types offered by the different cloud platforms for smart manufacturing applications. 4. Select strategies for managing and optimizing cloud computing resources for different manufacturing applications. 5. Apply techniques in clouding computing to model and manage manufacturing data. 6. Build manufacturing apps using cloud based platform tools and services. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

MFET 35100 - Mixed Reality Smart Manufacturing Applications & Design

Credit Hours: 3.00. The course investigates development strategies, use cases, and mixed reality (MR) application in industrial IoT (IIoT)-based smart manufacturing systems. Emphasis is on superimposing digital content onto physical systems, integrating data from smart and connected manufacturing production operations, processes, and machines.

Learning Outcomes: 1. Outline the benefits and applications of mixed reality (MR) offers in smart manufacturing environments. 2. Link the MR concepts, industrial IoT (IIoT) technologies, and development approaches with smart manufacturing applications. 3. Develop proficiency in using hardware, software tools and technologies to design and prototype effective MR applications for manufacturing. 4. Design and develop MR user interfaces and interaction techniques for augmented human-machine systems. Credits: 3.00

MFET 35200 - Smart Manufacturing Production Information Systems

Credit Hours: 3.00. An examination of smart manufacturing information systems with particular focus on applications for horizontal- and vertically-integrated manufacturing organizations. Topics include cloud-based integrated information systems to provide connectivity, visibility, and analytics of production and shop-floor execution systems and integrating manufacturing execution, manufacturing operations management, and enterprise resource planning (ERP) systems.

Learning Outcomes: 1. Apply ISA-95 standards for horizontal and vertically integrated smart manufacturing operations using Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and Enterprise Resource Planning (ERP) systems. 2. Apply

cloud infrastructure and data concepts for storing, distributing, and accessing manufacturing enterprise data for planning, scheduling, management, and production control. 3. Implement real-time, batch, and streaming data processing techniques for visualization and analytics of production data. 4. Apply cloud-based Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and ERP for creating efficiency, optimization, and control of production operations. Credits: 3.00

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3. Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

MFET 36300 - Intelligent Manufacturing Systems I

Credit Hours: 3.00. This course investigates how artificial intelligence, industrial IoT, and big data are used to enable predictive analytics with machine learning. Emphasis is on optimizing production processes, improving productivity, quality, efficiency, and integrating predictive maintenance applications in smart manufacturing operations.

Learning Outcomes: 1. Apply appropriate machine learning algorithms for improving and optimizing manufacturing operations. 2. Enable predictive analytics with machine learning for maintenance operations. 3. Evaluate manufacturing processes using machine learning. 4. Identify and solve manufacturing problems using machine learning and root cause analysis. 5. Describe how data- and knowledge-based systems are used in product and design lifecycles. Credits: 3.00

MFET 36400 - Intelligent Manufacturing Systems II

Credit Hours: 3.00. Artificial intelligence (AI), machine learning (ML), industrial IoT (IIoT), and big data are applied to enable predictive analytics with machine learning for optimizing processes and operations in a horizontally-integrated smart manufacturing value-chain network.

Learning Outcomes: 1. Integrate cloud platforms with industrial big data, advanced analytics, AI/ML, and IIoT in a horizontally integrated supply chain network. 2. Implement data, analytics, and machine learning to create insights and drive decision-making in a horizontally integrated value chain network. 3. Describe how intelligent systems are connected to physical assets via IIoT infrastructure to automate inventory, and asset management across a manufacturing value chain network. 4. Apply predictive modeling, analytics, and AI/ML techniques to optimize material management, production planning, scheduling, and supply operations across a manufacturing value chain network. Credits: 3.00

MFET 34100 - Process And Continuous Control Applications

Credit Hours: 3.00. An examination of devices, algorithms, strategies, and standards used in smart manufacturing continuous process and control serves as the basis of this course. Concepts include Proportional, Integral, & Derivative Control (P&ID), loop modeling, transfer functions, PID design, implementation and tuning. Course laboratories focus on implementing and tuning systems using industry-grade hardware and devices.

Learning Outcomes: 1. Explain the importance of control systems in the management of a continuous process. 2. Apply fundamental control theory concepts and models to a process or continuous control scenario. 3. Document process control applications, using recognized standards and symbology. 4. Apply controller algorithms and tuning methods to refine the performance of control loops. 5. Determine appropriate control architecture and hardware for single and multiple loop systems. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

MFET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Other Departmental/Program Course Requirements (51-53 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult

conversations, and conveying meaning. Credits: 3.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety

of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic

operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3.

Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these

objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (3-5 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16 Credits

Spring 1st Year

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

14-15 Credits

Fall 2nd Year

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and

manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MFET 23000 - Industrial Internet Of Things, Networks, And Systems I

Credit Hours: 3.00. This course provides an introduction to Industrial Internet of Things (IIoT) devices, networks, and standards in the context of converged information technology (IT) and operations technology (OT) industrial automation systems. Course topics include an examination of IT and OT networks, hardware, architecture, protocols, standards, and security practices in the context of industrial applications.

Learning Outcomes: 1. Explain the concept of Industrial Internet of Things (IIoT) and the enabling technologies. 2. Describe IT and OT development and detail differences in priorities and capabilities. 3. Design, implement, and analyze an integrated industrial network. 4. Configure host-level and network-level technical security controls in IT and OT systems. 5. Apply industry standards and reference architectures to ensure best practices in the selection, deployment, and operation of IIoT devices. Credits: 3.00

MFET 25000 - Smart Manufacturing Cloud Computing Applications

Credit Hours: 3.00. This course introduces concepts and principles of cloud computing and the virtualization of computing resources and services for smart manufacturing applications. The fundamental topics of cloud computing will be addressed, including virtually processing, storing, modeling and analyzing of data in the cloud environment. Fundamental concepts about cloud tools, applications, and services from a production and manufacturing perspective will be presented.

Learning Outcomes: 1. State the challenges and advantages of cloud computing in smart manufacturing. 2. Explain the concepts and principles of cloud computing such as a scalability, elasticity, agility, fault tolerance, disaster recovery and networking. 3. Recognize the models, tools, and service types offered by the different cloud platforms for smart manufacturing applications. 4. Select strategies for managing and optimizing cloud computing resources for different manufacturing applications. 5. Apply techniques in clouding computing to model and manage manufacturing data. 6. Build manufacturing apps using cloud based platform tools and services. Credits: 3.00

16 Credits

Spring 2nd Year

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

MFET 23100 - Industrial Internet Of Things, Networks, And Systems II

Credit Hours: 3.00. This course offers a practical exploration of Industrial Internet of Things (IIoT) in converged information and operations technology (IT/OT) industrial automation systems. Course topics include IT and OT reference architectures, industrial network convergence, standards, and security practices in the context of Edge, hybrid, and Cloud-based industrial applications. Specific focus is given to integrating and securing networked industrial devices with local and cloud-based IT systems in greenfield and brownfield scenarios.

Learning Outcomes: 1. Apply industry standards to develop a basic industrial network for converged IT/OT smart manufacturing systems. 2. Demonstrate the implementation of key security components required for converged IT/OT industrial networks. 3 Describe the role, characteristics, and requirements of safety systems in smart manufacturing. 4. Implement batch and real-time computation and basic machine learning models in an automated system. Credits: 3.00

15 Credits

Fall 3rd Year

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green

materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

MFET 35000 - Smart Manufacturing Systems Modeling & Simulation

Credit Hours: 3.00. This course addresses application of industrial internet of things (IIoT) for modeling and simulation of smart manufacturing assets, processes, and operations. Emphasis is on synchronizing modeling/simulation with real-time data to develop innovative services, create efficiencies, and enable productivity improvement in smart factories.

Learning Outcomes: 1. Describe the convergence of the physical and digital worlds, technology, and standards of IIoT-aided modeling and simulation. 2. Implement process data modeling and application to various types of plant data (drives, pumps, production lines) using real-time, historical, and event-based data. 3. Develop digital/virtual-cloud representation models to be mirrored onto physical manufacturing systems. 4. Create digital twin (DT) models using data from IIoT devices for monitoring and automating control of smart connected assets. 5. Construct DT-oriented simulation model for IoT-aided manufacturing system for applications in productivity, reliability, efficiency, and predictive maintenance operations. 6. Develop application of augmented reality and manufacturing model proxies in diagnostic and troubleshooting operations. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

MFET 35100 - Mixed Reality Smart Manufacturing Applications & Design

Credit Hours: 3.00. The course investigates development strategies, use cases, and mixed reality (MR) application in industrial IoT (IIoT)-based smart manufacturing systems. Emphasis is on superimposing digital content onto physical systems, integrating data from smart and connected manufacturing production operations, processes, and machines.

Learning Outcomes: 1. Outline the benefits and applications of mixed reality (MR) offers in smart manufacturing environments. 2. Link the MR concepts, industrial IoT (IIoT) technologies, and development approaches with smart manufacturing applications. 3. Develop proficiency in using hardware, software tools and technologies to design and prototype effective MR applications for manufacturing. 4. Design and develop MR user interfaces and interaction techniques for augmented human-machine systems. Credits: 3.00

15 Credits

Spring 3rd Year

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture

of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

MFET 35200 - Smart Manufacturing Production Information Systems

Credit Hours: 3.00. An examination of smart manufacturing information systems with particular focus on applications for horizontal- and vertically-integrated manufacturing organizations. Topics include cloud-based integrated information systems to provide connectivity, visibility, and analytics of production and shop-floor execution systems and integrating manufacturing execution, manufacturing operations management, and enterprise resource planning (ERP) systems.

Learning Outcomes: 1. Apply ISA-95 standards for horizontal and vertically integrated smart manufacturing operations using Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and Enterprise Resource Planning (ERP) systems. 2. Apply cloud infrastructure and data concepts for storing, distributing, and accessing manufacturing enterprise data for planning, scheduling, management, and production control. 3. Implement real-time, batch, and streaming data processing techniques for visualization and analytics of production data. 4. Apply cloud-based Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and ERP for creating efficiency, optimization, and control of production operations. Credits: 3.00

MFET 36300 - Intelligent Manufacturing Systems I

Credit Hours: 3.00. This course investigates how artificial intelligence, industrial IoT, and big data are used to enable predictive analytics with machine learning. Emphasis is on optimizing production processes, improving productivity, quality, efficiency, and integrating predictive maintenance applications in smart manufacturing operations.

Learning Outcomes: 1. Apply appropriate machine learning algorithms for improving and optimizing manufacturing operations. 2. Enable predictive analytics with machine learning for maintenance operations. 3. Evaluate manufacturing processes using machine learning. 4. Identify and solve manufacturing problems using machine learning and root cause analysis. 5. Describe how data- and knowledge-based systems are used in product and design lifecycles. Credits: 3.00

15 Credits

Fall 4th Year

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3.

Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

MFET 36400 - Intelligent Manufacturing Systems II

Credit Hours: 3.00. Artificial intelligence (AI), machine learning (ML), industrial IoT (IIoT), and big data are applied to enable predictive analytics with machine learning for optimizing processes and operations in a horizontally-integrated smart manufacturing value-chain network.

Learning Outcomes: 1. Integrate cloud platforms with industrial big data, advanced analytics, AI/ML, and IIoT in a horizontally integrated supply chain network. 2. Implement data, analytics, and machine learning to create insights and drive decision-making in a horizontally integrated value chain network. 3. Describe how intelligent systems are connected to physical assets via IIoT infrastructure to automate inventory, and asset management across a manufacturing value chain network. 4. Apply predictive modeling, analytics, and AI/ML techniques to optimize material management, production planning, scheduling, and supply operations across a manufacturing value chain network. Credits: 3.00

MFET 34100 - Process And Continuous Control Applications

Credit Hours: 3.00. An examination of devices, algorithms, strategies, and standards used in smart manufacturing continuous process and control serves as the basis of this course. Concepts include Proportional, Integral, & Derivative Control (P&ID), loop modeling, transfer functions, PID design, implementation and tuning. Course laboratories focus on implementing and tuning systems using industry-grade hardware and devices.

Learning Outcomes: 1. Explain the importance of control systems in the management of a continuous process. 2. Apply fundamental control theory concepts and models to a process or continuous control scenario. 3. Document process control applications, using recognized standards and symbology. 4. Apply controller algorithms and tuning methods to refine the performance of control loops. 5. Determine appropriate control architecture and hardware for single and multiple loop systems. Credits: 3.00

MFET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution

recommendations. Credits: 3.00

MFET 41000 - Introduction To Additive Manufacturing

Credit Hours: 3.00. This course covers topics in additive manufacturing (AM) technologies. Topics include the AM benefits and drawbacks of additive as compared to subtractive manufacturing, additive manufacturing process and material selection, design for additive manufacturing, support structure generation, printing process planning, and quality control techniques, such as monitoring, inspection, and surface modification.

Learning Outcomes: 1. Describe the concepts, benefits, and application of additive manufacturing. 2. Select appropriate additive manufacturing processes and material for producing parts. 3. Design 3D objects for additive manufacturing considering the process requirements. 4. Develop strategies and practices incorporating appropriate quality control techniques. Credits: 3.00

14 Credits

Professional Experience

Social Studies Education, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (119-120 credits)

Major: Required Education Courses (44 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability

to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 42300 - The Teaching Of Social Studies In Secondary Schools

Credit Hours: 3.00. The purpose of this course is the development of a theoretical framework and pedagogical skills necessary to teach social studies to middle and high school students. Students are introduced to the general issues involved in planning and organizing a social studies curriculum.

Learning Outcomes: 1. Develop theoretical understanding and pedagogical skills necessary to teach social studies to middle and high school students. 2. Develop understanding of cross collaboration, communication, and the characteristics of the community, school, and classroom. 3. Develop specific and relevant understanding of student characteristics, approaches to learning, or skills and prior learning. 4. Learn general issues involved in planning and organizing a social studies curriculum. 5. Obtain the knowledge, skills, and attitudes necessary to become a reflective and skilled social studies teacher. Credits: 3.00

EDCI 43300 - Advanced Social Studies Methods

Credit Hours: 2.00. Foundations of social studies; methods, techniques, strategies of teaching, and activities - with special attention to skills of planning, questioning, and testing. Includes observation, participation, and microteaching in social studies classrooms. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Develop knowledge of social studies content, appropriate state and national standards, and social studies specific pedagogy. 2. Develop and apply knowledge of middle level learners' academic needs and interests. 3. Utilize their new understandings to draw conclusions about what constitutes powerful social studies teaching and learning in middle school. Credits: 2.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning

using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and

evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to

practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 21910 - Teaching For Economic Literacy: Developing An Economic Way Of Thinking

Credit Hours: 1.00. Course focuses on preparing students in the social studies education licensure program to teach high school economics and to integrate economics into other middle and/or high school social studies courses. Course addresses issues of economic pedagogy. It will address economic content/concepts specifically and only in a way to illustrate/expand on the teaching ideas, resources, methods, and assessment.

Learning Outcomes: 1. Develop a rationale for teaching high school economics. 2. Identify state and national standards addressing economic content. 3. Explore methods for active teaching/learning in economics. 4. Identify resources appropriate for the active teaching/learning of economics. Credits: 1.00

EDCI 21610 - Teaching History: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching history in powerful, exciting and innovative ways through a topical study (e.g., American Civil Rights Movement) approach. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national history standards. 2. Use research and theory about how grades 5-12 students learn history. 3. Merge historical content and processes with pedagogy to forge pedagogical content knowledge. 4. Employ appropriate history-specific academic language in history lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful and purposeful history teaching and learning grades 5-12. Credits: 1.00

EDCI 21710 - Teaching Geography: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching geography in powerful, exciting and innovative ways through a study of geographic concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national geography standards. 2. Use research and theory about how secondary students learn geography. 3. Merge geographical content and process with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful geography lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary geography teaching and learning. Credits: 1.00

EDCI 21810 - Teaching Civics And Government: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching civics and government in powerful, exciting and innovative ways through a study of civics and political science concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national civics and government standards. 2. Use research and theory about how secondary students learn civics and government. 3. Merge political

science content and processes with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful civics and government-oriented lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary civics and government teaching and learning. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Required Learner Specialty Pathway Concentration (9 credits)

Major: Social Studies Content (57 credits)

Historical Perspectives (21 Credits)

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Civics and Government (15 credits)

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 37200 - Indiana Government And Politics (UCC: BSS)

Credit Hours: 3.00. An examination of the political and governmental organization of the state of Indiana. Includes the political and historical development of Indiana state government and comparison of policies and institutions with those of other states.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

Economics (9 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.
Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

Diversified (12 credits)

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

EAPS 11600 - Earthquakes And Volcanoes (UCC: SCI)

Credit Hours: 3.00. A survey class on earthquakes and volcanoes. Topics include earthquake hazards and forecasting, the use of seismic waves to investigate the earth's interior, volcanoes and tectonics, volcanic hazards, and the influence of volcanoes on climate. Examples of recent and historic earthquakes and volcanic eruptions are presented.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

EAPS 13800 - Thunderstorms And Tornadoes (UCC: SCI)

Credit Hours: 3.00. Not open to juniors and seniors majoring in atmospheric science. An elementary treatment of the physical structure of the atmosphere and the dynamical conditions that lead to the development of convective clouds, thunderstorms, and severe weather (including tornadoes, hail, wind, rain, lightning, and flash floods). This course will also focus on storm climatology, the socioeconomic impact of severe weather, as well as prediction, detection, warnings, and safety procedures. Analysis of severe weather events will include tornado movies and case studies of ground/aerial surveys of storm damage.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

Optional Concentration for Social Studies Education

Other Departmental/Program Course Requirements (9-10 credits)

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

Electives (0-1 credits)

Course Requirements and Notes

GPA Requirements

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

16 Credits

Spring 1st Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the

Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 37200 - Indiana Government And Politics (UCC: BSS)

Credit Hours: 3.00. An examination of the political and governmental organization of the state of Indiana. Includes the political and historical development of Indiana state government and comparison of policies and institutions with those of other states.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

EDCI 21610 - Teaching History: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching history in powerful, exciting and innovative ways through a topical study (e.g., American Civil Rights Movement) approach. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national history standards. 2. Use research and theory about how grades 5-12 students learn history. 3. Merge historical content and processes with pedagogy to forge pedagogical content knowledge. 4. Employ appropriate history-specific academic language in history lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful and purposeful history teaching and learning grades 5-12. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community

stakeholders through formal and informal conversations. Credits: 3.00

16 Credits

Fall 2nd Year

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDCI 21910 - Teaching For Economic Literacy: Developing An Economic Way Of Thinking

Credit Hours: 1.00. Course focuses on preparing students in the social studies education licensure program to teach high school economics and to integrate economics into other middle and/or high school social studies courses. Course addresses issues of economic pedagogy. It will address economic content/concepts specifically and only in a way to illustrate/expand on the teaching ideas, resources, methods, and assessment.

Learning Outcomes: 1. Develop a rationale for teaching high school economics. 2. Identify state and national standards addressing economic content. 3. Explore methods for active

teaching/learning in economics. 4. Identify resources appropriate for the active teaching/learning of economics. Credits: 1.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with

disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 21810 - Teaching Civics And Government: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching civics and government in powerful, exciting and innovative ways through a study of civics and political science concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national civics and government standards. 2. Use research and theory about how secondary students learn civics and government. 3. Merge political science content and processes with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful civics and government-oriented lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary civics and government teaching and learning. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy.

Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

17 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space.
Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 11600 - Earthquakes And Volcanoes (UCC: SCI)

Credit Hours: 3.00. A survey class on earthquakes and volcanoes. Topics include earthquake hazards and forecasting, the use of seismic waves to investigate the earth's interior, volcanoes and tectonics, volcanic hazards, and the influence of volcanoes on climate. Examples of recent and historic earthquakes and volcanic eruptions are presented.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 13800 - Thunderstorms And Tornadoes (UCC: SCI)

Credit Hours: 3.00. Not open to juniors and seniors majoring in atmospheric science. An elementary treatment of the physical structure of the atmosphere and the dynamical conditions that lead to the development of convective clouds, thunderstorms, and severe weather (including tornadoes, hail, wind, rain, lightning, and flash floods). This course will also focus on storm climatology, the socioeconomic impact of severe weather, as well as prediction, detection, warnings, and safety procedures. Analysis of severe weather events will include tornado movies and case studies of ground/aerial surveys of storm damage.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications.
Credits: 3.00

EDCI 21710 - Teaching Geography: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching geography in powerful, exciting and innovative ways through a study of geographic concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of

appropriate state and national geography standards. 2. Use research and theory about how secondary students learn geography. 3. Merge geographical content and process with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful geography lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary geography teaching and learning. Credits: 1.00

15 Credits

Spring 3rd Year

EDCI 42300 - The Teaching Of Social Studies In Secondary Schools

Credit Hours: 3.00. The purpose of this course is the development of a theoretical framework and pedagogical skills necessary to teach social studies to middle and high school students. Students are introduced to the general issues involved in planning and organizing a social studies curriculum.

Learning Outcomes: 1. Develop theoretical understanding and pedagogical skills necessary to teach social studies to middle and high school students. 2. Develop understanding of cross collaboration, communication, and the characteristics of the community, school, and classroom. 3. Develop specific and relevant understanding of student characteristics, approaches to learning, or skills and prior learning. 4. Learn general issues involved in planning and organizing a social studies curriculum. 5. Obtain the knowledge, skills, and attitudes necessary to become a reflective and skilled social studies teacher. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 43300 - Advanced Social Studies Methods

Credit Hours: 2.00. Foundations of social studies; methods, techniques, strategies of teaching, and activities - with special attention to skills of planning, questioning, and testing. Includes observation, participation, and microteaching in social studies classrooms. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Develop knowledge of social studies content, appropriate state and national standards, and social studies specific pedagogy. 2. Develop and apply knowledge of middle level learners' academic needs and interests. 3. Utilize their new understandings to draw conclusions about what constitutes powerful social studies teaching and learning in middle school. Credits: 2.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop

advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

14 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Sociology, BA

Degree Requirements

Departmental/Program Major Course Requirements (36 credits)

Requirement A: Foundation (6 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to

major social problems. Credits: 3.00

Requirement B. Theory and Methods (9 credits)

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 40200 - Sociological Theory

Credit Hours: 3.00. An advanced critical treatment of the theories, concepts, and methods of sociology. A basic course required of undergraduate majors in sociology.

Credits: 3.00

Requirement C. Sociology Fundamentals (6 credits)

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 35000 - Sociology Of Family

Credit Hours: 3.00. Designed to provide an understanding of contemporary courtship, marriage, and family interaction as cultural, social, and social-psychological phenomena. Consideration of the major sources of marital strain and conflict within a heterogeneous, rapidly changing society.

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Understand the experiences of people suffering from chronic illness. Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate

and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 36700 - Religion In America

Credit Hours: 3.00. Examines the social dimensions of religion in American life; religion in American culture; social profiles of America's religious groups, trends in individual religious commitment; and religion's impact on American life.

Learning Outcomes: 1. Describe the sizes and influences of major (and some minor) religious groups in America and how these sizes and influences have changed over the past 50 years. 2. Explain and evaluate the influence of religious groups and ideas on at least one other important aspect of social life. 3. Explain ways in which trends in American society over the past 50 years (e.g., changing gender roles, political shifts, etc.) are bringing about changes in American religion. Credits: 3.00

SOC 36800 - The Social Significance Of Religion

Credit Hours: 3.00. Examines religion's relationship with family, work, politics, gender, war and peace, race and ethnicity, health, crime and deviance, education, law, and poverty. Content differs each time course is taught.

Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

SOC 46100 - Health And Social Behavior

Credit Hours: 3.00. This course provides a sociological examination of health and illness, with a particular focus on social position (e.g., race, socioeconomic status, gender), stress and social support, and health care. Goals for this course include developing critical thinking skills, understanding the broader implications of issues related to health, and thinking creatively about potential societal solutions to these issues.

Learning Outcomes: 1. Understand the ways in which social factors influence health and social behavior as well as the broader implications of these issues. 2. Develop critical thinking skills through critical writing and classroom discourse on issues related to the sociology of health and illness. 3. Apply a sociological perspective to potential solutions to health-related issues. Credits: 3.00

Requirement D. Sociology Electives (15 credits)

Requirement A: Foundation (6 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

Additional Information

Electives (11-48 credits)

Grade Requirements

GPA Requirements

Course Notes & Requirements

Sample 4-Year Plan

Fall 1st Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of

social behaviors and inequalities. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

15 Credits

15 Credits

Spring 2nd Year

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

15 Credits

15 Credits

Fall 3rd Year

SOC 40200 - Sociological Theory

Credit Hours: 3.00. An advanced critical treatment of the theories, concepts, and methods of sociology. A basic course required of undergraduate majors in sociology.

Credits: 3.00

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

15 Credits

15 Credits

Spring 4th Year

14-15 Credits

14-15 Credits

Fall 1st Year

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

15-16 Credits

15-16 Credits

Degree Requirements

Soil and Water Sciences, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (38-39 credits)

Required Major Courses (29-30 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7.

Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (NRES 38500) Designed as an upper level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society

at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 4.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

AGRY 58500 - Soils And Land Use

Credit Hours: 3.00. Soils as a resource in development planning; soil properties affecting land use; use of soil survey, aerial photos, topographic maps, and other resource data in land-use allocation; nonengineering aspects of site selection for various land uses, water conservation, waste disposal, and erosion control.

Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form

opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

Major Selectives (9 credits)

Other Departmental/Program Course Requirements (70-73 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain

which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2.

Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and

trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a

few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can

be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Electives (8-12 credits)

Additional Information

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic

acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational,

quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

14-16 Credits

Spring 1st Year

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the

plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary

approximation methods of integration. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

15-17 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to

demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

15 Credits

Spring 2nd Year

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think

critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.
Credits: 4.00

15 Credits

Fall 3rd Year

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.
Credits: 3.00

AGRY 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (NRES 38500) Designed as an upper level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 4.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology
University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II
University Core Curriculum (UCC): (UCC: SCI)
Credits: 4.00

15-16 Credits

Spring 3rd Year

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.
Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

15 Credits

Fall 4th Year

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage. Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

AGRY 58500 - Soils And Land Use

Credit Hours: 3.00. Soils as a resource in development planning; soil properties affecting land use; use of soil survey, aerial photos, topographic maps, and other resource data in land-use allocation; nonengineering aspects of site selection for various land uses, water conservation, waste disposal, and erosion control.

Credits: 3.00

13 Credits

Spring 4th Year

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

15-17 Credits

Sound for the Performing Arts, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (39-41 credits)

A. Foundation Studies (18-20 credits)

1. Theatre Required Courses (13-15 credits)

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental

functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

2. Music Selective (3 credits)

MUS 11200 - Fundamentals Of Music (UCC: HUM)

Credit Hours: 3.00. Fundamentals of music notation, ear training, and music reading.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand music notation, rhythmic structure, meter, scales, blues form, chords, basic musicianship and ear training, and fundamentals of songwriting. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

3. Required Dance Course (2 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

1. Theatre Required Courses (13-15 credits)

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

B. Sound in the Visual & Performing Arts Courses (21 credits)

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 56300 - Advanced Sound Design

Credit Hours: 3.00. Advanced study of the principles of sound design for theatre and theory application to specific problems. Offered in alternate years.

Credits: 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

A. Foundation Studies (18-20 credits)

1. Theatre Required Courses (13-15 credits)

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4.

Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

2. Music Selective (3 credits)

MUS 11200 - Fundamentals Of Music (UCC: HUM)

Credit Hours: 3.00. Fundamentals of music notation, ear training, and music reading.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand music notation, rhythmic structure, meter, scales, blues form, chords, basic musicianship and ear training, and fundamentals of songwriting. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass;

secondary dominants; chromatic harmonies. Credits: 3.00

3. Required Dance Course (2 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

1. Theatre Required Courses (13-15 credits)

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre

practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

Electives (45-56 credits)

ECE 40020 - Sound Reinforcement System Design

Credit Hours: 3.00. An introduction to computational tools used in the measurement and analysis of electro-acoustic systems, and their application to sound reinforcement system engineering. Service learning based projects, serving the needs of community clients, provide the context for application of sound reinforcement system design principles and practices.

Learning Outcomes: 1. An ability to apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design a sound reinforcement system. 2. An understanding of the engineering design process. 3. An ability to function on a multidisciplinary team. 4. An awareness of professional and ethical responsibility. 5. An ability to communicate effectively, in both oral and written form. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 41700 - Variable Topics In Electronic And Time-Based Art

Credit Hours: 3.00. Examination of thematic or specialized topics reflecting the most recent developments and contemporary artistic practices in Electronic and Time-Based Art. Permission of department required.

Learning Outcomes: 1. Use essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production. 2. Able to analyze key works and artists in the emerging field of Electronic and Time-Based Art. Credits: 3.00

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37500 - Selected Topics In Music

Credit Hours: 3.00. A study of a specific genre in music (symphony, opera, chamber music, etc.) or the works of a single composer.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 3.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 49000 - Guided Reading In Music

Credit Hours: 1.00 to 6.00. For students with specialized needs and interests in the field. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 6.00

THTR 21300 - Voice For The Actor

Credit Hours: 2.00. Designed to heighten the actor's awareness of the vocal instrument. Elementary vocal techniques will be practiced to expand the student's vocal flexibility and range. Emphasis on freeing habitual vocal tensions and teaching the student the fundamentals of vocal health.

Learning Outcomes: 1. Understand and apply the vocal techniques required of the actor and practice a specific vocal warm-up procedure. 2. Recognize and use effectively the phonetic alphabet in your text work. 3. Hear, feel, and evaluate healthy vocal practices. 4. Understand and employ the bodily structures that allow for sound production and how to feel/adjust sound

placement. 5. Develop and explore new ways in which to use your voice to support your acting work/how the voice can convey an emotional journey and create character (and the technical demands that accompany it) that you can apply to your work after this course. Credits: 2.00

THTR 55300 - Theatre Audio Technology II

Credit Hours: 3.00. The study of the technical aspects of audio as they relate to use of, and experimentation with, various techniques in the design, installation, and specification of theatre sound systems, etc. Priority for majors. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 56800 - Advanced Problems In Design

Credit Hours: 1.00 to 3.00. A described tutorial in theatrical design or design research. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

17-18 Credits

17-18 Credits

Spring 1st Year

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio

recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

MUS 11200 - Fundamentals Of Music (UCC: HUM)

Credit Hours: 3.00. Fundamentals of music notation, ear training, and music reading.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand music notation, rhythmic structure, meter, scales, blues form, chords, basic musicianship and ear training, and fundamentals of songwriting. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

14-15 Credits

14-15 Credits

Spring 2nd Year

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

THTR 56300 - Advanced Sound Design

Credit Hours: 3.00. Advanced study of the principles of sound design for theatre and theory application to specific problems. Offered in alternate years.

Credits: 3.00

14-15 Credits

14-15 Credits

Fall 3rd Year

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

15 Credits

15 Credits

Spring 4th Year

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

15 Credits

15 Credits

Fall 1st Year

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

17-18 Credits

17-18 Credits

About the Program

Spanish, BA (Language & Culture Track)

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (30 credits)

Pre-requisite Language Courses

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

SPAN 20200 - Spanish Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 20100. CTL:IWL 1913 Spanish Level IV

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate control of most structures, considerable breadth of vocabulary, and appropriate communicative competence. 2. Develop the linguistic and analytic skills needed for advanced study in Spanish. 3. Be able to communicate in an academic setting, critically assess ideas and texts, and be able to present them in writing to an academic audience. 4. Show the knowledge of the rich cultural, geographical, and linguistic variety of the Spanish-speaking world. Credits: 3.00

SPAN 22400 - Spanish Level IV: Business Spanish

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed towards use of Spanish for business purposes. Course materials cover a variety of business aspects in several professions.

Credits: 3.00

SPAN 10500 - Accelerated Basic Spanish (UCC: HUM)

Credit Hours: 4.00. Accelerated Basic Spanish course that substitutes for SPAN 10100 and 10200.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of Spanish language in specific contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

SPAN 20500 - Accelerated Intermediate Spanish (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate Spanish course that substitutes for SPAN 20100 and 20200.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of Spanish language in a variety of contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a broad set of grammatical rules and standards in the language. 4. Produce a variety of sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

Spanish Major (30 credits)

Area A - Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

Area B - Spanish Literature (3 credits)

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

Language & Culture Track (21 credits)

Area C - Advanced Spanish Language (3 credits)

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 44400 - Advanced Communication In Spanish

Credit Hours: 3.00. Advanced-level communication course that delves into oral and written communication within the Spanish-speaking world, emphasizing cultural context and practical application. This course explores complex grammar structures, pronunciation, lexical variations, and intercultural differences in authentic scenarios. Students will enhance their Spanish language proficiency, focusing particularly on oral expression. Taught in Spanish.

Learning Outcomes: 1. Engage in advanced formal and informal Spanish conversations across various settings. 2. Identify and apply different language functions used in everyday oral communication. 3. Discern and explain cultural nuances in both spoken and unspoken communication and analyze prevalent communication styles in Spanish. 4. Investigate and discuss contemporary topics related to the Spanish world fluently in Spanish, in written and oral form. 5. Explore and critique facets of Spanish-speaking cultures, contrasting them with personal cultural norms and traditions. Credits: 3.00

Area D - Advanced Spanish Literature (3 credits)

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

Area E - Spanish Linguistics (6 credits)

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on

morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

Area F - Spanish Electives (9 credits)

SPAN 23500 - Spanish American Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Spanish American literature. The course context will change from semester to semester. Knowledge of Spanish not required.

Credits: 3.00

SPAN 31200 - Advanced Spanish Conversation

Credit Hours: 1.00. One credit hour advanced Spanish conversation course focused on guided practice in conversation to enhance communicative competence. Discussions in Spanish on various topics. Course may be taken concurrently with SPAN 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral Spanish proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in Spanish. Credits: 1.00

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation

and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over the phone, conference, etc.). 5. Understand the basic principles of cross-cultural communication. Credits: 3.00

SPAN 41900 - Directed Tutoring In Spanish

Credit Hours: 1.00 to 4.00. Guided practicum in tutoring Spanish, operation of a tutorial laboratory, and the rationale for audio tutorial second language learning. Students learn tutorial techniques, grade homework, and maintain records under the supervision of the SPAN 10100 -SPAN 10200 course chairperson and experienced teaching assistants. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48100 - Spanish Culture

Credit Hours: 3.00. The development of the cultural life of the Spanish people as reflected in the geography, history, music, art, and architecture of Spain. Lectures in Spanish.

Learning Outcomes: 1. Catalogue and describe in Spanish the major historical epochs of Spain. 2. Correctly identify major works of painting and music, and locate them temporally, geographically, and by cultural movement or period. 3. Debate accurately Spain's current regional conflicts through knowledgeable assessment of the historical evolution of the language, literature, commerce, and agriculture. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries,

including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 49800 - Advanced Topics In Spanish

Credit Hours: 1.00 to 3.00. Advanced studies of particular aspects of Spanish (e.g. culture, civilization, literature, linguistics, film, etc) by examining a varied selection of works. Readings, discussion, and papers in Spanish.

Credits: 1.00 to 3.00

SPAN 54000 - Spanish Literature Of The Middle Ages

Credit Hours: 3.00. A survey of Spanish Literature from 11th to the 15th century through the reading and discussion of representative prose, dramatic and poetic works. Lectures and supplemental readings on literary criticism and on various aspects of the period useful to an understanding of the literature it produced. Permission of instructor required.

Learning Outcomes: 1. Discuss the history and the development of Spanish literature. 2. Explain the importance the adoption of foreign prose had on the development of Spanish novel. 3. Describe Spanish literary movements. 4. Analyze literary works produced. Credits: 3.00

SPAN 54100 - Spanish Literature Of The Golden Age

Credit Hours: 3.00. A survey of Spanish literature from 1500 to 1681. Reading and discussion of representative prose, dramatic and poetic works. Lectures and supplemental readings on literary criticism and on various aspects of the period useful to an understanding of the literature it produced.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 54200 - Cervantes Don Quijote

Credit Hours: 3.00. Reading and discussion of Don Quixote in the context of Spanish Renaissance literature and subsequent developments in the genre of the novel.

Credits: 3.00

SPAN 54300 - Spanish Literature Of The 18th And 19th Centuries

Credit Hours: 3.00. The development of Spanish peninsular literature from Neoclassicism to Realism. Reading, analysis, and discussion of a representative selection of works of the periods.

Credits: 3.00

SPAN 54900 - Hispanic Women Writers

Credit Hours: 3.00. A survey of the literature of Hispanic women writers from Latin America, the Caribbean, and Spain in light of their traditions and of feminist literary theory and criticism. Permission of instructor required.

Learning Outcomes: 1. Discuss female characters from an informed perspective, whether applying feminist theories or not . 2. Compare and contrast literary innovations of male and female writers in literary movement since Modernity Credits: 3.00

SPAN 55000 - Spanish American Literature Of The Colonial Period

Credit Hours: 3.00. A survey of Spanish American literature of the colonial period. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55100 - Spanish American Literature Of The 19th Century

Credit Hours: 3.00. A survey of Spanish American literature of the 19th century. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55200 - Spanish American Literature From 1900 To 1970

Credit Hours: 3.00. A survey of Spanish American literature from 1900 to 1970. Readings and discussion of a number of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55300 - Spanish American Literature From 1970 - Present

Credit Hours: 3.00. A survey of Spanish American literature from 1970 to the present. Readings and discussion of a number

of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55400 - Hispanic Caribbean Literature

Credit Hours: 3.00. This course focuses on various topics pertaining to Hispanic Caribbean literature. The particular works included will change each time the course is offered. All coursework and discussion is in Spanish.

Credits: 3.00

SPAN 55500 - Latino/a Literature

Credit Hours: 3.00. This class offers an overview of U.S. Latino/a literature, written in Spanish and English and produced in the United States. It will introduce students to the many and diverse experiences of different Latino/a groups through their literary production. Permission of instructor required.

Learning Outcomes: 1. Gain a sense of the diversity of the Latino/a experience in the U.S. as well as the longevity and richness of the Latino/a literary tradition in the U.S. 2. Become familiar with some of the major themes and trends in Latino/a literature. 3. Consider the ways in which identities like - class, race, and gender - intersect with one another and are constructed in relation to one another. 4. Learn how to close-read a literary or cultural object, such as a novel, a film, or a poem. 5. Work on improving their writing and research skills through the development of an original research project dealing with Latino/a literature. Credits: 3.00

SPAN 55600 - Mexican Literature

Credit Hours: 3.00. A survey of Mexican literature. Reading and discussion of a number of representative works as well as excerpts from several others. Permission of instructor required.

Learning Outcomes: 1. Discuss the impact the history of Mexico has on literary production. 2. Examine the nature of the development of Mexican literary movements. 3. Analyze Mexican literature with consideration of its individual literary innovations. Credits: 3.00

SPAN 55700 - Argentine Literature

Credit Hours: 3.00. A survey of Argentine literature. Reading and discussion of a number of representative works as well as excerpts from several others and from standard anthologies.

Credits: 3.00

SPAN 56100 - The Structure Of Spanish I: Phonetics, Phonology, And Dialectology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a theoretical and contrastive Spanish/English perspective.

Learning Outcomes: 1. Understand, recall, and discuss the main concepts in the fields of phonetics and phonology. 2. Apply and adapt the fundamental concepts of phonetics and phonology to multiple varieties of Spanish. 3. Examine and critically assess current research in the field. 4. Design and conduct original research in the field of Spanish phonetics and phonology. Credits: 3.00

SPAN 56200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Have knowledge and understanding of basic notions of Spanish syntax including syntagmatic structure, X-bar theory, thematic roles, argument structure, constituents and hierarchical representation, and syntactic operations (e.g., wh-movement). 2. Be able to observe, describe, and formulate abstract theoretical concepts in relation to the syntactic structure of Spanish. 3. Be able to relate theoretical analysis to experimental syntax, specifically in relation to the acquisition of Spanish syntax and semantics among

second language learners and heritage speakers. Credits: 3.00

SPAN 56300 - History Of The Spanish Language

Credit Hours: 3.00. Development of Spanish since the Ancient Latin period, taking into account influences of other cultures and languages; Spanish in relation to Latin and other Romance languages; basic principles of language change; language change underlying differences between American and Peninsular Spanish.

Learning Outcomes: 1. Have a perspective of the evolution of Spanish and being able to identify the basic features of Spanish through its history, as well as understanding the influence of external influences in the evolution of the language. 2. Understand the configuration of the different varieties of Spanish in the different areas (peninsular Spanish and Spanish in America). 3. Read publications on general aspects of History of Spanish Language with critical sense and understanding basic problems of diachronic studies and basic principles of language change. 4. Able to read, understand and linguistically analyze texts from all the stages of Spanish. Credits: 3.00

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2. Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

SPAN 56401 - Spanish Sociolinguistics

Credit Hours: 3.00. This course addresses the linguistic variation found at all linguistic levels of Spanish (e.g., phonetics, morphology, syntax) that is explained through social variation (e.g., socio-economic status, race, gender). Regional varieties of Spanish in Latin America, the U.S., and Peninsular societies will be studied. Related topics are style and identity, language attitudes, discourse analysis, and pragmatics. All classes will be conducted in Spanish.

Learning Outcomes: 1. Define and express main understandings about language, the study of linguistics, and language variation. 2. Analyze and discuss specific examples of Spanish variation analyzed through use of various methods. 3. Identify and evaluate the pros and cons of various sociolinguistic methods of research. 4. Reflect on the relationships among social factors, language, diversity, and power in society. 5. Use previous investigations to demonstrate the need for additional research in a specific area, thereby identifying a research topic. 6. Consider one's own perspective of language use in social settings and reflect on any changes in that perspective that resulted from interaction with the course. 7. Speak, read, write, and comprehend Spanish to communicate about the course topics. Credits: 3.00

SPAN 32500 - Spanish For Engineering And Technology

Credit Hours: 3.00. This is an intermediate-level course directed towards the use of Spanish in Engineering and Technology professions. It covers specialized vocabulary from the different technical areas, as well as grammar and syntax, with the goal of developing speaking, listening, reading, and writing abilities. Students will have the opportunity to apply their skills in practical contexts, including job interviews, internships, formal presentations and communication in the workplace.

Learning Outcomes: 1. Recognize and apply a

broad range of engineering and technical-related vocabulary. 2. Read, understand, and discuss specific engineering and technical topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific engineering problems in Spanish. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 41201 - Advanced Spanish Conversation II

Credit Hours: 1.00. This course is designed to help students use and improve their Spanish speaking and comprehensive skills. Students will be expected to actively participate in classroom discussions, prepare for class, and utilize the target language only. No textbook is needed.

Learning Outcomes: 1. Build Spanish speaking and comprehension skills through classroom discussions. 2. Explain and assess relevant texts and audio materials in the target language. 3. Formulate ideas based on texts and audio materials as expressed in written and oral Spanish. Credits: 1.00

SPAN 38000 - Spanish Language And Culture Abroad

Credit Hours: 1.00 to 6.00. This course must be taken concurrently with participation in an experiential learning opportunity abroad (e.g., study abroad, internship) that requires a period abroad in a Spanish-speaking location. The course will guide students to improve their Spanish language abilities and gain cultural knowledge about their experiential learning location. This course, coupled with the immersion experience, will enhance student learning through Spanish language activities and also cultural research projects. Permission of instructor is required.

Learning Outcomes: 1. Identify important moments of daily learning and reflect on them in written form in Spanish. 2. Explain experiences in the Spanish-speaking location through conversations in Spanish with a peer. 3. Compare experiences and problems encountered through conversations in Spanish with a peer; formulate possible solutions to problems if encountered in the future. 4. Research cultural surroundings and present findings in various modes of communication (e.g., presentational, written). 5. Assess learning during the immersion period in a summative way, reflecting on language and cultural learning through the creation of a final presentation project. Credits: 1.00 to 6.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives

evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

SPAN 36600 - Spanish In The United States

Credit Hours: 3.00. The course explores the linguistic profile of established and emerging Spanish-speaking communities in the United States. Topics addressed are the current demographic profiles of Spanish speakers, the historical presence of Spanish, language identity, the meaning of linguistic landscapes, American Spanish and its speakers in the media and social institutions, as well as the varieties of Spanish in the U.S. The course is conducted in Spanish.

Learning Outcomes: 1. Describe Spanish-speaking populations in the U.S. considering their diverse histories. 2. Use course-related concepts and terms accurately in class discussions and written texts. 3. Examine the experience of Spanish-speakers in the U.S. through course activities. 4. Investigate the sociopolitical position of language through course readings and data analysis. 5. Identify a topic of research and conduct research to contribute to our knowledge of Spanish or Spanish speakers in the U.S. Credits: 3.00

Electives (17-54 credits)

Grade Requirements

GPA Requirements

Sample 4-Year Plan

Fall 1st Year

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

15-17 Credits

Spring 1st Year

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

15-16 Credits

Fall 2nd Year

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with

emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

13-15 Credits

Spring 2nd Year

SPAN 20200 - Spanish Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 20100. CTL:IWL 1913 Spanish Level IV

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate control of most structures, considerable breadth of vocabulary, and appropriate communicative competence. 2. Develop the linguistic and analytic skills needed for advanced study in Spanish. 3. Be able to communicate in an academic setting, critically assess ideas and texts, and be able to present them in writing to an academic audience. 4. Show the knowledge of the rich cultural, geographical, and linguistic variety of the Spanish-speaking world. Credits: 3.00

13-15 Credits

Fall 3rd Year

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

15-16 Credits

Spring 3rd Year

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

15-16 Credits

Fall 4th Year

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

12-16 Credits

Spring 4th Year

14-17 Credits

Additional Information

Spanish: World Languages Teaching Concentration, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (77 credits)

Pre-requisite Language Courses

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

SPAN 20200 - Spanish Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 20100. CTL:IWL 1913 Spanish Level IV

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate control of most structures, considerable breadth of vocabulary, and appropriate communicative competence. 2. Develop the linguistic and analytic skills needed for advanced study in Spanish. 3. Be able to communicate in an academic setting, critically assess ideas and texts, and be able to present them in writing to an academic audience. 4. Show the knowledge of the rich cultural, geographical, and linguistic variety of the Spanish-speaking world. Credits: 3.00

SPAN 22400 - Spanish Level IV: Business Spanish

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed towards use of Spanish for business purposes. Course materials cover a variety of business aspects in several professions.

Credits: 3.00

SPAN 10500 - Accelerated Basic Spanish (UCC: HUM)

Credit Hours: 4.00. Accelerated Basic Spanish course that substitutes for SPAN 10100 and 10200.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of Spanish language in specific contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

SPAN 20500 - Accelerated Intermediate Spanish (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate Spanish course that substitutes for SPAN 20100 and 20200.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of Spanish language in a variety of contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a broad set of

grammatical rules and standards in the language. 4. Produce a variety of sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

Spanish Major (30 credits)

Area A - Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

Area B - Spanish Literature (3 credits)

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

Education Track (21 credits)

Area C - Advanced Spanish Language (3 credits)

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

Area D - Advanced Spanish Literature (3 credits)

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

Area E - Spanish Linguistics (6 credits)

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

Area F - Spanish Culture (3 credits)

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

Area G - Spanish Selectives (6 credits)

SPAN 23100 - Cervantes' Don Quixote

Credit Hours: 3.00. Reading and discussion of Cervantes' masterpiece. All readings, discussion, papers, and examinations will be in English.

Credits: 3.00

SPAN 23500 - Spanish American Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Spanish American literature. The course

context will change from semester to semester. Knowledge of Spanish not required.

Credits: 3.00

SPAN 28000 - Second-Year Spanish: Special Topics

Credit Hours: 3.00. Selected topics on the civilization, culture, and literature of Spain and Spanish America. Lectures and readings primarily in English, but knowledge of Spanish at the first-year level necessary.

Credits: 3.00

SPAN 31200 - Advanced Spanish Conversation

Credit Hours: 1.00. One credit hour advanced Spanish conversation course focused on guided practice in conversation to enhance communicative competence. Discussions in Spanish on various topics. Course may be taken concurrently with SPAN 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral Spanish proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in Spanish. Credits: 1.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific

topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over the phone, conference, etc.). 5. Understand the basic principles of cross-cultural communication. Credits: 3.00

SPAN 41900 - Directed Tutoring In Spanish

Credit Hours: 1.00 to 4.00. Guided practicum in tutoring Spanish, operation of a tutorial laboratory, and the rationale for audio tutorial second language learning. Students learn tutorial techniques, grade homework, and maintain records under the supervision of the SPAN 10100 -SPAN 10200 course chairperson and experienced teaching assistants. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written

reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 49800 - Advanced Topics In Spanish

Credit Hours: 1.00 to 3.00. Advanced studies of particular aspects of Spanish (e.g. culture, civilization, literature, linguistics, film, etc) by examining a varied selection of works. Readings, discussion, and papers in Spanish.

Credits: 1.00 to 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 41201 - Advanced Spanish Conversation II

Credit Hours: 1.00. This course is designed to help students use and improve their Spanish speaking and comprehensive skills. Students will be expected to actively participate in classroom discussions, prepare for class, and utilize the target language only. No textbook is needed.

Learning Outcomes: 1. Build Spanish speaking and comprehension skills through classroom discussions. 2. Explain and assess relevant texts and audio materials in the target language. 3. Formulate ideas based on texts and audio materials as expressed in written and oral Spanish. Credits: 1.00

Other Departmental - Liberal Arts Core (12 credits)

Core III: Linguistic Diversity (0 credits)

Foundational Requirements (12 credits)

Notes

Electives (31 credits)

Grade Requirements

GPA Requirements

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

15 Credits

Spring 1st Year

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4.

Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

15 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

SPAN 20200 - Spanish Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 20100. CTL:IWL 1913 Spanish Level IV

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate control of most structures, considerable breadth of vocabulary, and appropriate communicative competence. 2. Develop the linguistic and analytic skills needed for advanced study in Spanish. 3. Be able to communicate in an academic setting, critically assess ideas and texts, and be able to present them in writing to an academic audience. 4. Show the knowledge of the rich cultural, geographical, and linguistic variety of the Spanish-speaking world. Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

15 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes,

fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 56100 - The Structure Of Spanish I: Phonetics, Phonology, And Dialectology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a theoretical and contrastive Spanish/English perspective.

Learning Outcomes: 1. Understand, recall, and discuss the main concepts in the fields of phonetics and phonology. 2. Apply and adapt the fundamental concepts of phonetics and phonology to multiple varieties of Spanish. 3. Examine and critically assess current research in the field. 4. Design and conduct original research in the field of Spanish phonetics and phonology. Credits: 3.00

17 Credits

Spring 3rd Year

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4. Recognize how theories of individual and

collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

15 Credits

Fall 4th Year

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences. Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the

study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 56200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Have knowledge and understanding of basic notions of Spanish syntax including syntagmatic structure, X-bar theory, thematic roles, argument structure, constituents and hierarchical representation, and syntactic operations (e.g., wh-movement). 2. Be able to observe, describe, and formulate abstract theoretical concepts in relation to the syntactic structure of Spanish. 3. Be able to relate theoretical analysis to experimental syntax, specifically in relation to the acquisition of Spanish syntax and semantics among second language learners and heritage speakers. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area

performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.
Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

16 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.
University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Special Education Mild and Intense Intervention P to 12, BA

About the Program

Degree Requirements

Departmental/Program Major Requirements (99 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.
University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4.

Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 46100 - Practicum In Strategies For Teaching Individuals With Disabilities

Credit Hours: 1.00 to 6.00. Practicum experience in assessment and teaching of individuals with disabilities. Experience in design, delivery, implementation, and evaluation of instruction. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A and B.

Learning Outcomes: 1. Provide instruction that is responsive to student differences and promotes development and learning for all students. 2. Match expectations to the unique characteristics, abilities, developmental levels, and behavior of students. 3. Identify characteristics of students with disabilities and design classroom accommodations. 4. Adjust instruction according to student needs and performances. 5. Use a variety of evidence-based instructional strategies. 6. Plan and deliver standards-based, data-driven differentiated instruction that actively engages students in the learning process. 7. Demonstrate an appreciation and concern for students as individuals and interact with them in positive ways that encourage and teach appropriate behavior. 8. Model effective use of language. 9. Demonstrate effective classroom and behavior management and establish a positive, productive, and safe learning environment with high expectations for all students. 10. Integrate instructional technology by creating instructional materials, delivering instruction using technology, or encouraging student use of technology in assignments. 11. Reflect on practices. 12. Engage in professional development activities to remain current with best practices. 13. Collaborate effectively with colleagues, parents, and others to increase the effectiveness of instruction and engage in professional growth. Credits: 1.00 to 6.00

EDPS 49800 - Supervised Teaching- Special Education (UCC: OC)

Credit Hours: 1.00 to 16.00. A student planning to enroll in EDCI 49600, EDCI 49800, EDCI 49900; EDPS 49800, EDPS 49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually

impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A, B, and C.

University Core Curriculum (UCC): (UCC: OC)
Credits: 1.00 to 16.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)
Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts.
Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed.
Credits: 1.00 to 3.00

EDCI 43400 - Literacy Teaching And Learning In Secondary Schools

Credit Hours: 2.00. Exploration and development of various instructional methods and materials appropriate for supporting adolescent literacy in secondary English (i.e., middle and high school English Language Arts), including the teaching of reading. Content-area literacy methods and materials are also addressed. Includes a field experience of up to 20 hours in a secondary English school setting.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of secondary English literacy. 2. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 3. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary English. Credits: 2.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make

reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 36300 - Psychoeducational, Medical, And Physical Aspects Of Individuals With Disabilities

Credit Hours: 3.00. Introduction to characteristics of individuals with mild and severe intellectual disabilities: defining characteristics, etiological factors, assessment, social, legal and educational issues, and basic physical or medical disability management issues and techniques. Admission to Teacher Education Program, passage of Gates A required.

Learning Outcomes: 1. Demonstrate the knowledge of the roles and responsibilities of the educational team. 2. Demonstrate the knowledge of instructional strategies needed to promote independence. 3. Demonstrate the knowledge of motor tone and motor patterns. 4. Demonstrate the knowledge of proper positioning, lifting, and handling techniques. 5. Demonstrate the knowledge of feeding and toileting techniques. 6. Demonstrate the knowledge of infection control. 7. Demonstrate the knowledge of assessment and monitoring techniques of major health conditions. Credits: 3.00

EDPS 46300 - Teaching Individuals With Severe Disabilities

Credit Hours: 3.00. Education of individuals with severe or multiple disabilities. Application of innovative technology, design of individual educational programs, strategies and methods for instruction, evaluation of instruction, community-based instruction, generalization and maintenance of skills. Admission to Teacher Education Program, passage of Gate A required.

Learning Outcomes: 1. Demonstrate the knowledge of the various aspects of trial management. 2. Demonstrate the knowledge of the ability to record, graph, and interpret ongoing data of student performance. 3. Demonstrate the knowledge of the ability to apply the principles of learning and strategies of instruction. 4. Demonstrate the knowledge of the components of community referenced curriculum and community-based instruction. 5. Demonstrate the knowledge of the inclusionary/collaborative strategies for students with severe disabilities. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective

management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00 to 3.00. Given the needs of variety of needs of readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine evidence-based science of reading approaches designed to ensure all students have access to effective, researched-based literacy instruction.

Learning Outcomes: 1. Establish an understanding of P-12 science of reading principles and practices. 2. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 3. Understand how to implement Tier 1 and Tier 2 reading practices in a classroom. 4. Establish an understanding of reading difficulties/disabilities. 5. Extend knowledge of unique needs of struggling readers. Credits: 2.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component

is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 30400 - Assessment And Transition (Data-Based Decision-Making)

Credit Hours: 3.00. This course addresses assessment techniques and transition planning in special education, with applications to curriculum. It includes norm-referenced and curriculum-based measurement, error analyses, observational ratings, data-based decision-making, and transition planning from early intervention to post-secondary settings.

Learning Outcomes: 1. Apply their understanding of specialized curricula to inform their programmatic and instructional decisions for individuals with exceptionalities across a variety of contexts and the continuum of placement options (CEC 3.2) 2. Develop, select, administer, analyze, and interpret multiple measures of student learning, behavior, and the classroom environment to evaluate and support classroom and school-based systems of intervention for students with and without exceptionalities (CEC 4.1). 3. Develop, select, and administer multiple, formal and informal, culturally and linguistically appropriate measures and procedures that are valid and

reliable, to contribute to eligibility determination for special education services CEC 4.2). 4. Assess, collaboratively analyze, interpret, and communicate students' progress toward measurable outcomes, using technology as appropriate, to inform both short and long-term planning, and make ongoing adjustments to instruction (CEC 4.3). 5. Utilize appropriate progress monitoring skills in order to develop individualized education plans (IEPs) for students. Credits: 3.00

EDPS 40200 - P-12 Reading Methods For Exceptional Learners

Credit Hours: 2.00 to 3.00. This course is designed to meet the expectations of CEC, NCTQ, IDA and REPA 3 and prepare students in the science of reading for exceptional learners (including students with dyslexia and those with intensive needs) in Tiers 2 and 3. This course will provide implementation details on Response to Intervention (RTI) and Multi-tiered Systems of Support (MTSS). The course will present strategies and programs used in strategic and intensive intervention efforts for those learners needing additional, unique, and/or more focused remediation efforts. Topics will include understanding reading intervention research, the behavior analytic and learning sciences' contributions to understanding the reading process, the sequence of learning to read (systematic instruction), reading to learn, and the five components of reading instruction for P-12 learners. This course will specifically address the REPA 3 Standard: Focused work using (interventions that are direct, explicit, and multi-sensory) as a component of scientifically-based reading.

Learning Outcomes: 1. Review the five components of effective reading instruction for those in P-3 and those in grades 4-12. 2. Explain the models for remediation of prereading/reading difficulties and describe how they function: RTI, MTSS. 3. Describe and demonstrate how to use various screeners and progress monitoring assessments for P-12 students in Tiers 2 and 3. 4. Describe the meaning of direct and systematic instruction. 5. Demonstrate mastery of Corrective Reading sounds. 6. Demonstrate methods of increasing student engagement. 7. Discuss strategies to enhance content area reading performance. 8. Illustrate a scope and sequence for reading remediation for readers needing strategic and intensive intervention. 9. Explain how reading instruction can be made more explicit for those needing more focused efforts 10. Demonstrate how to provide systematic and explicit small group/one-on-one reading instruction. 11. Describe Big Direct Instruction and published scientifically-based programs that are designed based on the science of reading instruction and demonstrate how they are implemented. 12. Describe the use of Universal Design for Learning and assistive technology approaches to increase access to reading materials and/or improve reading skills. Credits: 2.00 to 3.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using children's ideas, beliefs, and experiences as primary resources.

Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are committed to social justice and education of all the children of all the people - especially in the area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these

laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral, social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 30900 - Systematic And Explicit Instruction

Credit Hours: 3.00. Students will learn evidence based instructional strategies for students with disabilities. The key components of systematic and explicit instruction will be explored. Students will learn how to use explicit instructional strategies to foster engagement and motivation. Methods for implementing systematic instruction across academic, functional, communication, social, and behavior goals will be addressed. Additionally, implementation in a variety of settings including 1:1, small group, and large group settings will be explored. Planning for generalization and maintenance of skills will also be addressed.

Learning Outcomes: 1. Contrast and compare a range of pedagogical models (e.g. Constructivist, Cognitive, Behavioral, etc) in special education. 2. Use formative and summative assessment to identify students

current level of performance and inform instructional planning and decision making. 3. Identify instructional strategies necessary for promoting engagement, motivation, and opportunities to respond. 4. Identify components of systematic instruction. 5. Identify and implement a variety of strategies necessary for preparing the setting to support learning. 6. Demonstrate understanding of how to use flexible grouping to meet individual and large group needs. Credits: 3.00

EDPS 31100 - Supporting Exceptional Learners: Foundations And Mathematics

Credit Hours: 3.00. Teaching students with special needs requires the ability to locate evidence-based interventions, implement those interventions with fidelity, and track student performance over time. Mathematics is a content area in which success or failure yields major ramifications for postsecondary success. This course will cover the common math interventions employed for mild to severe disabilities across grade levels K-12.

Learning Outcomes: 1. Develop standards-based lesson plans for math that consider individual abilities, interests, learning environments, and cultural and linguistic factors. 2. Use technologies to support instructional assessment, planning, and delivery of mathematics for individuals with exceptionalities. 3. Identify strategies for teaching to mastery and promote generalization of learning in mathematics for both fluency and world problem solving. 4. Produce standards-based lesson plans for numeracy that incorporate evidence-based practices, classroom resources (e.g. peer and paraprofessional), and technological supports for use with students who have diverse learning needs. Credits: 3.00

EDPS 31200 - Inclusive Practices In Cross-Content Curriculum

Credit Hours: 3.00. This course aims to teach best practices for cross-content integration in an inclusive or self-contained classroom. It develops pre-service teacher understanding of core curricula along with how to integrate the curricula across subject areas. This course will also cover curricula to implement a well-rounded education (e.g., visual arts, dance, theater, music, etc.), provide methods for inclusive practices within the content, and discuss the implementation of collaborative approaches to cross-content planning and delivery.

Learning Outcomes: 1. Apply understanding of curricula across curricular content areas to develop integrated units of study which provide a well-rounded education. 2. Develop curricular content knowledge in order to develop learning progressions for individuals with exceptionalities. 3. Select appropriate curricula for individuals with exceptionalities across multiple content areas. 4. Teach cross-disciplinary knowledge and skills (e.g., critical and creative thinking, problem-solving) through integrated lesson planning and curricular units of study. 5. Implement cross-content curriculum across a wide range of settings through collaborative practices. Credits: 3.00

EDPS 40300 - Individual Social, Emotional, Behavioral Supports

Credit Hours: 3.00. This course is designed to prepare students with advanced knowledge and skills in designing and delivering individualized social-emotional and behavioral supports for learners. Emphasis will be placed on functional behavior assessment and function-based interventions and supports.

Learning Outcomes: 1. Identify the advanced principles of behavior and provide classroom examples. 2. Articulate the connection between social-emotional skills and challenging behavior. 3. Define learner behaviors. 4. Select an appropriate behavior measurement system for learner outcomes. 5. Measure and graph learner behavior. 6. Conduct a functional behavior assessment. 7. Develop and implement a behavior support plan. 8. Analyze learner data to guide educational programming decisions. Credits: 3.00

EDPS 42100 - Supporting Exceptional Learners: Social Studies And Science

Credit Hours: 3.00. This course is designed to prepare special educators to deliver social studies and science content to

children and adolescents with disabilities across PK-12 settings. It will also prepare special educators to make programmatic and instructional decisions related to least restrictive environment, appropriate educational supports, assistive technology, accommodations, and modification specific to science and social studies instruction. This course includes assignments that will be linked to EDPS 46100 the Special Education Student Teaching Residency.

Learning Outcomes: 1. Use knowledge of general and specialized social studies curricula to individualize learning for individuals with exceptionalities. 2. Use knowledge of general and specialized science curricula to individualize learning for individuals with exceptionalities. 3. Use strategies to enhance language development and communication skills of individuals with exceptionalities across social studies and science content area. Credits: 3.00

EDPS 32600 - Health, Wellness, And Adaptive Physical Education

Credit Hours: 3.00. Through a blend of theoretical knowledge and practical application, students will acquire the skills necessary to design and implement effective programs that promote overall student wellness. Students will gain a comprehensive understanding of health, wellness, and physical education of school-aged children with and without disabilities: emphasizing the importance of inclusive instruction. Additionally, students in this course will examine the responsibilities and opportunities for teachers in supporting and enhancing student health, with an emphasis on developing effective strategies for creating a healthy and safe learning environment for everyone.

Learning Outcomes: 1. Identify and explain how nutrition and common diseases promote health-related fitness and are associated with disease and injury prevention, for students with and without disabilities. 2. Identify and explain how, basic functions and structures of human body systems, including human growth and development, basic motor skills, movement patterns, and physical activities, promote participation and responsible behaviors and safety in various physical activities for students with and without disabilities. 3. Identify and describe the influence of family, peers, culture, media, technology, as well as student interpersonal relationships and communication, have on various health behaviors for students with and without disabilities. 4. Assess, design, and perform evidence-based health, wellness, and physical education instruction, for students with and without disabilities in promoting their overall health and physical well-being. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally

and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

Required Learner Specialty Pathway Concentration (9 credits)

Other Departmental/Program Course Requirements (21 credits)

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences

between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

Optional Concentration

GPA Requirements

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and

schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral, social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

15 Credits

Spring 1st Year

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives

have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDPS 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00 to 3.00. Given the needs of variety of needs of readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine evidence-based science of reading approaches designed to ensure all students have access to effective, researched-based literacy instruction.

Learning Outcomes: 1. Establish an understanding of P-12 science of reading principles and practices. 2. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 3. Understand how to implement Tier 1 and Tier 2 reading practices in a classroom. 4. Establish an understanding of reading difficulties/disabilities. 5. Extend knowledge of unique needs of struggling readers. Credits: 2.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it

relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

13 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development.

4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 30900 - Systematic And Explicit Instruction

Credit Hours: 3.00. Students will learn evidence based instructional strategies for students with disabilities. The key components of systematic and explicit instruction will be explored. Students will learn how to use explicit instructional strategies to foster engagement and motivation. Methods for implementing systematic instruction across academic, functional, communication, social, and behavior goals will be addressed. Additionally, implementation in a variety of settings including 1:1, small group, and large group settings will be explored. Planning for generalization and maintenance of skills will also be addressed.

Learning Outcomes: 1. Contrast and compare a range of pedagogical models (e.g. Constructivist, Cognitive, Behavioral, etc) in special education. 2. Use formative and summative assessment to identify students current level of performance and inform instructional planning and decision making. 3. Identify instructional strategies necessary for promoting engagement, motivation, and opportunities to respond. 4. Identify components of systematic instruction. 5. Identify and implement a variety of strategies necessary for preparing the setting to support learning. 6. Demonstrate understanding of how to use flexible grouping to meet individual and large group needs. Credits: 3.00

EDPS 32600 - Health, Wellness, And Adaptive Physical Education

Credit Hours: 3.00. Through a blend of theoretical knowledge and practical application, students will acquire the skills necessary to design and implement effective programs that promote overall student wellness. Students will gain a comprehensive understanding of health, wellness, and physical education of school-aged children with and without disabilities: emphasizing the importance of inclusive instruction. Additionally, students in this course will examine the responsibilities and opportunities for teachers in supporting and enhancing student health, with an emphasis on developing effective strategies for creating a healthy and safe learning environment for everyone.

Learning Outcomes: 1. Identify and explain how nutrition and common diseases promote health-related fitness and are associated with disease and injury prevention, for students with and without disabilities. 2. Identify and explain how, basic functions and structures of human body systems, including human growth and development, basic motor skills, movement patterns, and physical activities, promote participation and responsible behaviors and

safety in various physical activities for students with and without disabilities. 3. Identify and describe the influence of family, peers, culture, media, technology, as well as student interpersonal relationships and communication, have on various health behaviors for students with and without disabilities. 4. Assess, design, and perform evidence-based health, wellness, and physical education instruction, for students with and without disabilities in promoting their overall health and physical well-being. Credits: 3.00

15 Credits

Fall 3rd Year

EDPS 30400 - Assessment And Transition (Data-Based Decision-Making)

Credit Hours: 3.00. This course addresses assessment techniques and transition planning in special education, with applications to curriculum. It includes norm-referenced and curriculum-based measurement, error analyses, observational ratings, data-based decision-making, and transition planning from early intervention to post-secondary settings.

Learning Outcomes: 1. Apply their understanding of specialized curricula to inform their programmatic and instructional decisions for individuals with exceptionalities across a variety of contexts and the continuum of placement options (CEC 3.2) 2. Develop, select, administer, analyze, and interpret multiple measures of student learning, behavior, and the classroom environment to evaluate and support classroom and school-based systems of intervention for students with and without exceptionalities (CEC 4.1). 3. Develop, select, and administer multiple, formal and informal, culturally and linguistically appropriate measures and procedures that are valid and reliable, to contribute to eligibility determination for special education services CEC 4.2). 4. Assess, collaboratively analyze, interpret, and communicate students' progress toward measurable outcomes, using technology as appropriate, to inform both short and long-term planning, and make ongoing adjustments to instruction (CEC 4.3). 5. Utilize appropriate progress monitoring skills in order to develop individualized education plans (IEPs) for students. Credits: 3.00

EDPS 40200 - P-12 Reading Methods For Exceptional Learners

Credit Hours: 2.00 to 3.00. This course is designed to meet the expectations of CEC, NCTQ, IDA and REPA 3 and prepare students in the science of reading for exceptional learners (including students with dyslexia and those with intensive needs) in Tiers 2 and 3. This course will provide implementation details on Response to Intervention (RTI) and Multi-tiered Systems of Support (MTSS). The course will present strategies and programs used in strategic and intensive intervention efforts for those learners needing additional, unique, and/or more focused remediation efforts. Topics will include understanding reading intervention research, the behavior analytic and learning sciences' contributions to understanding the reading process, the sequence of learning to read (systematic instruction), reading to learn, and the five components of reading instruction for P-12 learners. This course will specifically address the REPA 3 Standard: Focused work using (interventions that are direct, explicit, and multi-sensory) as a component of scientifically-based reading.

Learning Outcomes: 1. Review the five components of effective reading instruction for those in P-3 and those in grades 4-12. 2. Explain the models for remediation of prereading/reading difficulties and describe how they function: RTI, MTSS. 3. Describe and demonstrate how to use various screeners and progress monitoring assessments for P-12 students in Tiers 2 and 3. 4. Describe the meaning of direct and systematic instruction. 5. Demonstrate mastery of Corrective Reading sounds. 6. Demonstrate methods of increasing student engagement. 7. Discuss strategies to enhance content area reading performance. 8. Illustrate a scope and sequence for reading remediation for readers needing strategic and

intensive intervention. 9. Explain how reading instruction can be made more explicit for those needing more focused efforts 10. Demonstrate how to provide systematic and explicit small group/one-on-one reading instruction. 11. Describe Big Direct Instruction and published scientifically-based programs that are designed based on the science of reading instruction and demonstrate how they are implemented. 12. Describe the use of Universal Design for Learning and assistive technology approaches to increase access to reading materials and/or improve reading skills. Credits: 2.00 to 3.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using children's ideas, beliefs, and experiences as primary resources. Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering

practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are committed to social justice and education of all the children of all the people - especially in the area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

16 Credits

Spring 3rd Year

EDCI 43400 - Literacy Teaching And Learning In Secondary Schools

Credit Hours: 2.00. Exploration and development of various instructional methods and materials appropriate for supporting adolescent literacy in secondary English (i.e., middle and high school English Language Arts), including the teaching of reading. Content-area literacy methods and materials are also addressed. Includes a field experience of up to 20 hours in a secondary English school setting.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of secondary English literacy. 2. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 3. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary English. Credits: 2.00

EDPS 36300 - Psychoeducational, Medical, And Physical Aspects Of Individuals With Disabilities

Credit Hours: 3.00. Introduction to characteristics of individuals with mild and severe intellectual disabilities: defining characteristics, etiological factors, assessment, social, legal and educational issues, and basic physical or medical disability management issues and techniques. Admission to Teacher Education Program, passage of Gates A required.

Learning Outcomes: 1. Demonstrate the knowledge of the roles and responsibilities of the educational team. 2. Demonstrate the knowledge of instructional strategies needed to promote independence. 3. Demonstrate the knowledge of motor tone and motor patterns. 4. Demonstrate the knowledge of proper positioning, lifting, and handling techniques. 5. Demonstrate the knowledge of feeding and toileting techniques. 6. Demonstrate the

knowledge of infection control. 7. Demonstrate the knowledge of assessment and monitoring techniques of major health conditions. Credits: 3.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 31100 - Supporting Exceptional Learners: Foundations And Mathematics

Credit Hours: 3.00. Teaching students with special needs requires the ability to locate evidence-based interventions, implement those interventions with fidelity, and track student performance over time. Mathematics is a content area in which success or failure yields major ramifications for postsecondary success. This course will cover the common math interventions employed for mild to severe disabilities across grade levels K-12.

Learning Outcomes: 1. Develop standards-based lesson plans for math that consider individual abilities, interests, learning environments, and cultural and linguistic factors. 2. Use technologies to support instructional assessment, planning, and delivery of mathematics for individuals with exceptionalities. 3. Identify strategies for teaching to mastery and promote generalization of learning in mathematics for both fluency and world problem solving. 4. Produce standards-based lesson plans for numeracy that incorporate evidence-based practices, classroom resources (e.g. peer and paraprofessional), and technological supports for use with students who have diverse learning needs. Credits: 3.00

EDPS 31200 - Inclusive Practices In Cross-Content Curriculum

Credit Hours: 3.00. This course aims to teach best practices for cross-content integration in an inclusive or self-contained classroom. It develops pre-service teacher understanding of core curricula along with how to integrate the curricula across subject areas. This course will also cover curricula to implement a well-rounded education (e.g., visual arts, dance, theater, music, etc.), provide methods for inclusive practices within the content, and discuss the implementation of collaborative approaches to cross-content planning and delivery.

Learning Outcomes: 1. Apply understanding of curricula across curricular content areas to develop integrated units of study which provide a well-rounded education. 2. Develop curricular content knowledge in order to develop learning progressions for individuals with exceptionalities. 3. Select appropriate curricula for individuals with exceptionalities across multiple content areas. 4. Teach cross-disciplinary knowledge and skills (e.g., critical and creative thinking, problem-solving) through integrated lesson planning and curricular units of study. 5. Implement cross-content curriculum across a wide range of settings through collaborative practices. Credits: 3.00

EDPS 40300 - Individual Social, Emotional, Behavioral Supports

Credit Hours: 3.00. This course is designed to prepare students with advanced knowledge and skills in designing and delivering individualized social-emotional and behavioral supports for learners. Emphasis will be placed on functional behavior

assessment and function-based interventions and supports.

Learning Outcomes: 1. Identify the advanced principles of behavior and provide classroom examples. 2. Articulate the connection between social-emotional skills and challenging behavior. 3. Define learner behaviors. 4. Select an appropriate behavior measurement system for learner outcomes. 5. Measure and graph learner behavior. 6. Conduct a functional behavior assessment. 7. Develop and implement a behavior support plan. 8. Analyze learner data to guide educational programming decisions. Credits: 3.00

18 Credits

Fall 4th Year

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 46100 - Practicum In Strategies For Teaching Individuals With Disabilities

Credit Hours: 1.00 to 6.00. Practicum experience in assessment and teaching of individuals with disabilities. Experience in design, delivery, implementation, and evaluation of instruction. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A and B.

Learning Outcomes: 1. Provide instruction that is responsive to student differences and promotes development and learning for all students. 2. Match expectations to the unique characteristics, abilities, developmental levels, and behavior of students. 3. Identify characteristics of students with disabilities and design classroom accommodations. 4. Adjust instruction according to student needs and performances. 5. Use a variety of evidence-based instructional strategies. 6. Plan and deliver standards-based, data-driven differentiated instruction that actively engages students in the learning process. 7. Demonstrate an appreciation and concern for students as individuals and interact with them in positive ways that encourage and teach appropriate behavior. 8. Model effective use of language. 9. Demonstrate effective classroom and behavior management and establish a positive, productive, and safe learning environment with high expectations for all students. 10. Integrate instructional technology by creating instructional materials, delivering instruction using technology, or encouraging student use of technology in assignments. 11. Reflect on practices. 12. Engage in professional development activities to remain current with best practices. 13. Collaborate

effectively with colleagues, parents, and others to increase the effectiveness of instruction and engage in professional growth. Credits: 1.00 to 6.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 46300 - Teaching Individuals With Severe Disabilities

Credit Hours: 3.00. Education of individuals with severe or multiple disabilities. Application of innovative technology, design of individual educational programs, strategies and methods for instruction, evaluation of instruction, community-based instruction, generalization and maintenance of skills. Admission to Teacher Education Program, passage of Gate A required.

Learning Outcomes: 1. Demonstrate the knowledge of the various aspects of trial management. 2. Demonstrate the knowledge of the ability to record, graph, and interpret ongoing data of student performance. 3. Demonstrate the knowledge of the ability to apply the principles of learning and strategies of instruction. 4. Demonstrate the knowledge of the components of community referenced curriculum and community-based instruction. 5. Demonstrate the knowledge of the inclusionary/collaborative strategies for students with severe disabilities. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 42100 - Supporting Exceptional Learners: Social Studies And Science

Credit Hours: 3.00. This course is designed to prepare special educators to deliver social studies and science content to children and adolescents with disabilities across PK-12 settings. It will also prepare special educators to make programmatic and instructional decisions related to least restrictive environment, appropriate educational supports, assistive technology, accommodations, and modification specific to science and social studies instruction. This course includes assignments that will be linked to EDPS 46100 the Special Education Student Teaching Residency.

Learning Outcomes: 1. Use knowledge of

general and specialized social studies curricula to individualize learning for individuals with exceptionalities. 2. Use knowledge of general and specialized science curricula to individualize learning for individuals with exceptionalities. 3. Use strategies to enhance language development and communication skills of individuals with exceptionalities across social studies and science content area. Credits: 3.00

16 Credits

Spring 4th Year

EDPS 49800 - Supervised Teaching- Special Education (UCC: OC)

Credit Hours: 1.00 to 16.00. A student planning to enroll in EDCI 49600, EDCI 49800, EDCI 49900; EDPS 49800, EDPS 49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A, B, and C.

University Core Curriculum (UCC): (UCC: OC) Credits: 1.00 to 16.00

12 Credits

Special Education/Elementary Education, BA

About the Program

Degree Requirements

Departmental/Program Major Requirements (94 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the

cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 46100 - Practicum In Strategies For Teaching Individuals With Disabilities

Credit Hours: 1.00 to 6.00. Practicum experience in assessment and teaching of individuals with disabilities. Experience in design, delivery, implementation, and evaluation of instruction. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A and B.

Learning Outcomes: 1. Provide instruction that is responsive to student differences and promotes development and learning for all students. 2. Match expectations to the unique characteristics, abilities, developmental levels, and behavior of students. 3. Identify characteristics of students with disabilities and design classroom accommodations. 4. Adjust instruction according to student needs and performances. 5. Use a variety of evidence-based instructional strategies. 6. Plan and deliver standards-based, data-driven differentiated instruction that actively engages students in the learning process. 7. Demonstrate an appreciation and concern for students as individuals and interact with them in positive ways that encourage and teach appropriate behavior. 8. Model effective use of language. 9. Demonstrate effective classroom and behavior management and establish a positive, productive, and safe learning environment with high expectations for all students. 10. Integrate instructional technology by creating instructional materials, delivering instruction using technology, or encouraging student use of technology in assignments. 11. Reflect on practices. 12. Engage in professional development activities to remain current with best practices. 13. Collaborate effectively with colleagues, parents, and others to increase the effectiveness of instruction and engage in professional growth. Credits: 1.00 to 6.00

EDPS 49800 - Supervised Teaching- Special Education (UCC: OC)

Credit Hours: 1.00 to 16.00. A student planning to enroll in EDCI 49600, EDCI 49800, EDCI 49900; EDPS 49800, EDPS 49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A, B, and C.

University Core Curriculum (UCC): (UCC: OC)
Credits: 1.00 to 16.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)
Learning Outcomes: 1. Learn what it means to

teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 49600 - Student Teaching In The Elementary School (UCC: OC)

Credit Hours: 6.00 to 16.00. Full-time elementary classroom teaching experiences and a student teaching seminar under the mentorship of the classroom teacher and a University supervisor.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each child's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each child's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these

larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00 to 3.00. Given the needs of variety of needs of readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine evidence-based

science of reading approaches designed to ensure all students have access to effective, researched-based literacy instruction.

Learning Outcomes: 1. Establish an understanding of P-12 science of reading principles and practices. 2. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 3. Understand how to implement Tier 1 and Tier 2 reading practices in a classroom. 4. Establish an understanding of reading difficulties/disabilities. 5. Extend knowledge of unique needs of struggling readers. Credits: 2.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 30400 - Assessment And Transition (Data-Based Decision-Making)

Credit Hours: 3.00. This course addresses assessment techniques and transition planning in special education, with applications to curriculum. It includes norm-referenced and curriculum-based measurement, error analyses, observational ratings, data-based decision-making, and transition planning from early intervention to post-secondary settings.

Learning Outcomes: 1. Apply their understanding of specialized curricula to inform their programmatic and instructional decisions for individuals with exceptionalities across a variety of contexts and the continuum of placement options (CEC 3.2) 2. Develop, select, administer, analyze, and interpret multiple measures of student learning, behavior, and the classroom environment to evaluate and support classroom and school-based systems of intervention for students with and without exceptionalities (CEC 4.1). 3. Develop, select, and administer multiple, formal and informal, culturally and linguistically appropriate measures and procedures that are valid and reliable, to contribute to eligibility determination for special education services CEC 4.2). 4. Assess, collaboratively analyze, interpret, and communicate students' progress toward measurable outcomes, using technology as appropriate, to inform both short and long-term planning, and make ongoing adjustments to instruction (CEC 4.3). 5. Utilize appropriate progress monitoring skills in order to develop individualized education plans (IEPs) for students. Credits: 3.00

EDPS 40200 - P-12 Reading Methods For Exceptional Learners

Credit Hours: 2.00 to 3.00. This course is designed to meet the expectations of CEC, NCTQ, IDA and REPA 3 and prepare students in the science of reading for exceptional learners (including students with dyslexia and those with intensive needs) in Tiers 2 and 3. This course will provide implementation details on Response to Intervention (RTI) and Multi-tiered Systems of Support (MTSS). The course will present strategies and programs used in strategic and intensive intervention efforts for those learners needing additional, unique, and/or more focused remediation efforts. Topics will include understanding reading intervention research, the behavior analytic and learning sciences' contributions to understanding the reading process, the sequence of learning to read (systematic instruction), reading to learn, and the five components of reading instruction for P-12 learners. This course will specifically address the REPA 3 Standard: Focused work using (interventions that are direct, explicit, and multi-sensory) as a component of scientifically-based reading.

Learning Outcomes: 1. Review the five components of effective reading instruction for those in P-3 and those in grades 4-12. 2. Explain the models for remediation of prereading/reading difficulties and describe how they function: RTI, MTSS. 3. Describe and demonstrate how to use various screeners and progress monitoring assessments for P-12 students in Tiers 2 and 3. 4. Describe the meaning of direct and systematic instruction. 5. Demonstrate mastery of Corrective Reading sounds. 6. Demonstrate methods of increasing student engagement. 7. Discuss strategies to enhance content area reading performance. 8. Illustrate a scope and sequence for reading remediation for readers needing strategic and intensive intervention. 9. Explain how reading instruction can be made more explicit for those needing more focused efforts 10. Demonstrate how to provide systematic and explicit small group/one-on-one reading instruction. 11. Describe Big Direct Instruction and published scientifically-based programs that are designed based on the science of reading instruction and demonstrate how they are implemented. 12. Describe the use of Universal Design for Learning and assistive technology approaches to increase access to reading materials and/or improve reading skills. Credits: 2.00 to 3.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify

the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36102 - Teaching Social Studies In 3-6

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practices strategies for teaching social studies to children in the 3-6 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how 3-6 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the 3-6 grades.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the 3-6 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the 3-6 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the 3-6 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using children's ideas, beliefs, and experiences as primary resources. Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 36402 - Teaching Mathematics In Grades 3-6

Credit Hours: 2.00. Focuses on teaching mathematics in the elementary school grades 3-6. Students learn what it means to teach mathematics interactionally using children's ideas, beliefs, and experiences as primary resources. Mathematical reasoning, problem solving, communication, and connections are foci.

Learning Outcomes: 1. Develop, apply, analyze, and evaluate strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Know and analyze methods of assessing and responding to the needs of mathematics learners labeled in schools. 3. Analyze and apply student's mathematical conceptual understanding and procedural knowledge to the development of problem-solving based mathematics lessons. 4. Create and analyze instructional activities drawing from student's conceptual understanding and procedural knowledge as primary resources. Credits: 2.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science.

Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are committed to social justice and education of all the children of all the people - especially in the area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDCI 36502 - Teaching Science Through Design In Grades 3-6

Credit Hours: 2.00. The aim of this course is to prepare students to teach science, engineering, and computational thinking with grade 3-6 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade 3 through 6 learners. At least 9 credits of science content courses are required.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 2.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral,

social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 30900 - Systematic And Explicit Instruction

Credit Hours: 3.00. Students will learn evidence based instructional strategies for students with disabilities. The key components of systematic and explicit instruction will be explored. Students will learn how to use explicit instructional strategies to foster engagement and motivation. Methods for implementing systematic instruction across academic, functional, communication, social, and behavior goals will be addressed. Additionally, implementation in a variety of settings including 1:1, small group, and large group settings will be explored. Planning for generalization and maintenance of skills will also be addressed.

Learning Outcomes: 1. Contrast and compare a range of pedagogical models (e.g. Constructivist, Cognitive, Behavioral, etc) in special education. 2. Use formative and summative assessment to identify students current level of performance and inform instructional planning and decision making. 3. Identify instructional strategies necessary for promoting engagement, motivation, and opportunities to respond. 4. Identify components

of systematic instruction. 5. Identify and implement a variety of strategies necessary for preparing the setting to support learning. 6. Demonstrate understanding of how to use flexible grouping to meet individual and large group needs. Credits: 3.00

EDPS 31100 - Supporting Exceptional Learners: Foundations And Mathematics

Credit Hours: 3.00. Teaching students with special needs requires the ability to locate evidence-based interventions, implement those interventions with fidelity, and track student performance over time. Mathematics is a content area in which success or failure yields major ramifications for postsecondary success. This course will cover the common math interventions employed for mild to severe disabilities across grade levels K-12.

Learning Outcomes: 1. Develop standards-based lesson plans for math that consider individual abilities, interests, learning environments, and cultural and linguistic factors. 2. Use technologies to support instructional assessment, planning, and delivery of mathematics for individuals with exceptionalities. 3. Identify strategies for teaching to mastery and promote generalization of learning in mathematics for both fluency and world problem solving. 4. Produce standards-based lesson plans for numeracy that incorporate evidence-based practices, classroom resources (e.g. peer and paraprofessional), and technological supports for use with students who have diverse learning needs. Credits: 3.00

EDPS 31200 - Inclusive Practices In Cross-Content Curriculum

Credit Hours: 3.00. This course aims to teach best practices for cross-content integration in an inclusive or self-contained classroom. It develops pre-service teacher understanding of core curricula along with how to integrate the curricula across subject areas. This course will also cover curricula to implement a well-rounded education (e.g., visual arts, dance, theater, music, etc.), provide methods for inclusive practices within the content, and discuss the implementation of collaborative approaches to cross-content planning and delivery.

Learning Outcomes: 1. Apply understanding of curricula across curricular content areas to develop integrated units of study which provide a well-rounded education. 2. Develop curricular content knowledge in order to develop learning progressions for individuals with exceptionalities. 3. Select appropriate curricula for individuals with exceptionalities across multiple content areas. 4. Teach cross-disciplinary knowledge and skills (e.g., critical and creative thinking, problem-solving) through integrated lesson planning and curricular units of study. 5. Implement cross-content curriculum across a wide range of settings through collaborative practices. Credits: 3.00

EDPS 40300 - Individual Social, Emotional, Behavioral Supports

Credit Hours: 3.00. This course is designed to prepare students with advanced knowledge and skills in designing and delivering individualized social-emotional and behavioral supports for learners. Emphasis will be placed on functional behavior assessment and function-based interventions and supports.

Learning Outcomes: 1. Identify the advanced principles of behavior and provide classroom examples. 2. Articulate the connection between social-emotional skills and challenging behavior. 3. Define learner behaviors. 4. Select an appropriate behavior measurement system for learner outcomes. 5. Measure and graph learner behavior. 6. Conduct a functional behavior assessment. 7. Develop and implement a behavior support plan. 8. Analyze learner data to guide educational programming decisions. Credits: 3.00

EDPS 42100 - Supporting Exceptional Learners: Social Studies And Science

Credit Hours: 3.00. This course is designed to prepare special educators to deliver social studies and science content to children and adolescents with disabilities across PK-12 settings. It will also prepare special educators to make programmatic and instructional decisions related to least restrictive environment, appropriate educational supports, assistive technology, accommodations, and modification specific to science and social studies instruction. This course includes assignments that will be linked to EDPS 46100 the Special Education Student

Teaching Residency.

Learning Outcomes: 1. Use knowledge of general and specialized social studies curricula to individualize learning for individuals with exceptionalities. 2. Use knowledge of general and specialized science curricula to individualize learning for individuals with exceptionalities. 3. Use strategies to enhance language development and communication skills of individuals with exceptionalities across social studies and science content area. Credits: 3.00

EDCI 32602 - Teaching Literacy In 3-6

Credit Hours: 2.00. Students will build on material learned in EDCI 32501. They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children, and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Demonstrate an understanding of theoretical and evidence-based foundations that guide reading, writing processes, and instruction. 2. Design developmentally appropriate instruction that addresses the needs of all learners. 3. Teach developmentally appropriate lessons/units in the school setting. 4. Assess student learning by designing/using/adjusting formative and summative assessments for your group of students, and pre-assessments. 5. Reflect and analyze your own teaching. Credits: 2.00

EDPS 32600 - Health, Wellness, And Adaptive Physical Education

Credit Hours: 3.00. Through a blend of theoretical knowledge and practical application, students will acquire the skills necessary to design and implement effective programs that promote overall student wellness. Students will gain a comprehensive understanding of health, wellness, and physical education of school-aged children with and without disabilities: emphasizing the importance of inclusive instruction. Additionally, students in this course will examine the responsibilities and opportunities for teachers in supporting and enhancing student health, with an emphasis on developing effective strategies for creating a healthy and safe learning environment for everyone.

Learning Outcomes: 1. Identify and explain how nutrition and common diseases promote health-related fitness and are associated with disease and injury prevention, for students with and without disabilities. 2. Identify and explain how, basic functions and structures of human body systems, including human growth and development, basic motor skills, movement patterns, and physical activities, promote participation and responsible behaviors and safety in various physical activities for students with and without disabilities. 3. Identify and describe the influence of family, peers, culture, media, technology, as well as student interpersonal relationships and communication, have on various health behaviors for students with and without disabilities. 4. Assess, design, and perform evidence-based health, wellness, and physical education instruction, for students with and without disabilities in promoting their overall health and physical well-being. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in

diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDCI 31103 - Integrating Media In The K-6 Classroom

Credit Hours: 3.00. This course prepares teacher candidates to select, evaluate, and integrate children's literature and media in K-6 classrooms. Focusing on high-quality, diverse texts and media, candidates will learn to choose materials that are developmentally appropriate and reflect the diversity of the world in which we live. Emphasis will be placed on the critical role literature and media play in fostering vocabulary development, enhancing critical thinking skills, and supporting literacy development across subjects. The course will focus on how K-6 students learn to use comprehension strategies independently and efficiently as they progress through elementary school fostering both their academic growth and their ability to engage with diverse texts.

Learning Outcomes: 1. Integrate literature and media into content area lessons to enhance vocabulary (including academic language skills), critical thinking, and comprehension. 2. Select and evaluate three trade books to read aloud during a math, a social studies, and a science lesson. 3. Identify instructional strategies supported by the Science of Reading that teach k-6 students' academic language skills, vocabulary knowledge, and reading and listening comprehension. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

Optional Concentrations

Other Departmental/Program Course Requirements (33 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

MA 13900 - Mathematics For Elementary Teachers III

Credit Hours: 3.00. Geometric, measurement and spatial reasoning in one, two and three dimensions as the basis for elementary school geometry. Metric and non-metric geometry, transformation geometry. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Differentiate between various polygons based on number of sides and measures of angles. 2. Find the sum of the measures of the interior angles of a polygon. 3. Draw nets for polyhedra. 4. Differentiate between various types of polyhedra including all regular polyhedra. 5. Determine number of lines of symmetry for a plane figure and orders of rotational symmetry. 6. Determine number of planes of symmetry for a solid figure as well as axes of rotational symmetry. 7. Recognize and draw shapes that tessellate the plane and solid figures that tessellate space. 8. Determine dimensions of similar planar figures. 9. Determine surface area and volume of similar solid figures. 10. Construct perpendicular bisectors and parallel lines using a compass and straightedge. 11. Recognize and draw rigid motions of shapes including translations, reflections and rotations. 12. Determine area of plane figures and surface area and volume of solid figures. 13. Use the Pythagorean Theorem to determine diagonals of solid figures. Credits: 3.00

ECON 21900 - Economics For Future Elementary Teachers

Credit Hours: 3.00. A principles of economics course designed for future elementary and social studies teachers. The purpose of this course is to: 1) introduce the future teacher to basic economic concepts required by the Indiana Academic Standards for Social Studies, K-6, 2) learn methods for teaching these concepts in the K-6 curriculum, and 3) develop a catalog of curriculum materials appropriate for teaching economics in grades K-6. No credit for management students.

Learning Outcomes: 1. Identify and understand the basic concepts and principles of economics in order to teach at the elementary school level. 2. Develop an `Economic Way of Thinking? that can be utilized to make more efficient choices as consumers, and as voters. 3. Identify supplementary materials (DVDs, online and app-based resources, simulations, curriculum materials, etc.) that can be used in K-6 teaching or as a supplement in K-6 classrooms. 4. Apply this 'Economic Way of Thinking' in the analysis existing curriculum in K-6 economics, and of

everyday current events. 5. Utilize the basic concepts and principles of economics to design and develop new K-6 curriculum. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

EDCI 22200 - Knowing The World Through Mathematics (UCC: QR)

Credit Hours: 3.00. In this course, *Knowing the World Through Mathematics*, students will connect their situated experiences to larger trends in equity and social justice around the globe through mathematical investigations embedded in the context of the United Nations 2030 Agenda (United Nations, 2015). Students in this course will make use of mathematics and global policy documents to critically interpret, model, and represent world phenomena. Students will collaboratively analyze quantitative information gathered through trustworthy, globally representative data sets and individual survey and questionnaire items to investigate local experiences in relation to students' area(s) of interest. Students will learn about and utilize the GAISE Framework for Statistical Problem Solving (Franklin, et al., 2005) and the Four Dimensions of Equity in Mathematics Education (Gutiérrez, 2012) to ground their discussions and deliverables for *Knowing the World Through Mathematics*.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use a critical mathematics perspective to interpret world patterns, situations, and events. 2. Create mathematical models of world phenomena. 3. Use multiple mathematical representations to present global issues. 4. Identify and implement appropriate mathematical strategies to investigate world phenomena. 5. Express mathematical arguments related to world phenomena. 6. Use mathematics to explore global policy documents. 7. Explore world phenomena through quantitative (and qualitative) methods. Credits: 3.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and

the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical Sciences* PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

GPA Requirements

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong

knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral, social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

18 Credits

Spring 1st Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

EDCI 22200 - Knowing The World Through Mathematics (UCC: QR)

Credit Hours: 3.00. In this course, *Knowing the World Through Mathematics*, students will connect their situated experiences to larger trends in equity and social justice around the globe

through mathematical investigations embedded in the context of the United Nations 2030 Agenda (United Nations, 2015). Students in this course will make use of mathematics and global policy documents to critically interpret, model, and represent world phenomena. Students will collaboratively analyze quantitative information gathered through trustworthy, globally representative data sets and individual survey and questionnaire items to investigate local experiences in relation to students' area(s) of interest. Students will learn about and utilize the GAISE Framework for Statistical Problem Solving (Franklin, et al., 2005) and the Four Dimensions of Equity in Mathematics Education (Gutiérrez, 2012) to ground their discussions and deliverables for *Knowing the World Through Mathematics*.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use a critical mathematics perspective to interpret world patterns, situations, and events. 2. Create mathematical models of world phenomena. 3. Use multiple mathematical representations to present global issues. 4. Identify and implement appropriate mathematical strategies to investigate world phenomena. 5. Express mathematical arguments related to world phenomena. 6. Use mathematics to explore global policy documents. 7. Explore world phenomena through quantitative (and qualitative) methods. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of

multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

17 Credits

Fall 2nd Year

MA 13900 - Mathematics For Elementary Teachers III

Credit Hours: 3.00. Geometric, measurement and spatial reasoning in one, two and three dimensions as the basis for elementary school geometry. Metric and non-metric geometry, transformation geometry. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Differentiate between various polygons based on number of sides and measures of angles. 2. Find the sum of the measures of the interior angles of a polygon. 3. Draw nets for polyhedra. 4. Differentiate between various types of polyhedra including all regular polyhedra. 5. Determine number of lines of symmetry for a plane figure and orders of rotational symmetry. 6. Determine number of planes of symmetry for a solid figure as well as axes of rotational symmetry. 7. Recognize and draw shapes that tessellate the plane and solid figures that tessellate space. 8. Determine dimensions of similar planar figures. 9. Determine surface area and volume of similar solid figures. 10. Construct perpendicular bisectors and parallel lines using a compass and straightedge. 11. Recognize and draw rigid motions of shapes including translations, reflections and rotations. 12. Determine area of plane figures and surface area and volume of solid figures. 13. Use the Pythagorean Theorem to determine diagonals of solid figures. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDPS 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00 to 3.00. Given the needs of variety of needs

of readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine evidence-based science of reading approaches designed to ensure all students have access to effective, researched-based literacy instruction.

Learning Outcomes: 1. Establish an understanding of P-12 science of reading principles and practices. 2. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 3. Understand how to implement Tier 1 and Tier 2 reading practices in a classroom. 4. Establish an understanding of reading difficulties/disabilities. 5. Extend knowledge of unique needs of struggling readers. Credits: 2.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5.

Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical Sciences* PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

16 Credits

Spring 2nd Year

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

ECON 21900 - Economics For Future Elementary Teachers

Credit Hours: 3.00. A principles of economics course designed for future elementary and social studies teachers. The purpose of this course is to: 1) introduce the future teacher to basic economic concepts required by the Indiana Academic Standards for Social Studies, K-6, 2) learn methods for teaching these concepts in the K-6 curriculum, and 3) develop a catalog of curriculum materials appropriate for teaching economics in grades K-6. No credit for management students.

Learning Outcomes: 1. Identify and understand the basic concepts and principles of economics in order to teach at the elementary school level. 2. Develop an `Economic Way of Thinking? that can be utilized to make more efficient choices as consumers, and as voters. 3. Identify supplementary materials (DVDs, online and app-based resources, simulations, curriculum materials, etc.) that can be used in K-6 teaching or as a supplement in K-6 classrooms. 4. Apply this 'Economic Way of Thinking' in the analysis existing curriculum in K-6 economics, and of everyday current events. 5. Utilize the basic concepts and principles of economics to design and develop new K-6 curriculum. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at

different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 30900 - Systematic And Explicit Instruction

Credit Hours: 3.00. Students will learn evidence based instructional strategies for students with disabilities. The key components of systematic and explicit instruction will be explored. Students will learn how to use explicit instructional strategies to foster engagement and motivation. Methods for implementing systematic instruction across academic, functional, communication, social, and behavior goals will be addressed. Additionally, implementation in a variety of settings including 1:1, small group, and large group settings will be explored. Planning for generalization and maintenance of skills will also be addressed.

Learning Outcomes: 1. Contrast and compare a range of pedagogical models (e.g. Constructivist, Cognitive, Behavioral, etc) in special education. 2. Use formative and summative assessment to identify students current level of performance and inform instructional planning and decision making. 3. Identify instructional strategies necessary for promoting engagement, motivation, and opportunities to respond. 4. Identify components of systematic instruction. 5. Identify and implement a variety of strategies necessary for preparing the setting to support learning. 6. Demonstrate understanding of how to use flexible grouping to meet individual and large group needs. Credits: 3.00

EDPS 32600 - Health, Wellness, And Adaptive Physical Education

Credit Hours: 3.00. Through a blend of theoretical knowledge and practical application, students will acquire the skills necessary to design and implement effective programs that promote overall student wellness. Students will gain a comprehensive understanding of health, wellness, and physical education of school-aged children with and without disabilities: emphasizing the importance of inclusive instruction. Additionally, students in this course will examine the responsibilities and opportunities for teachers in supporting and enhancing student health, with an emphasis on developing effective strategies for creating a healthy and safe learning environment for everyone.

Learning Outcomes: 1. Identify and explain how nutrition and common diseases promote health-related fitness and are associated with disease and injury prevention, for students with and without disabilities. 2. Identify and explain how, basic functions and structures of human body systems, including human growth and development, basic motor skills, movement patterns, and physical activities, promote participation and responsible behaviors and safety in various physical activities for students with and without disabilities. 3. Identify and describe the influence of family, peers, culture, media, technology, as well as student interpersonal relationships and communication, have on various health behaviors for students with and without disabilities. 4. Assess, design, and perform evidence-based health, wellness, and physical education instruction, for students with and without disabilities in promoting their overall health and physical well-being. Credits: 3.00

EDCI 31103 - Integrating Media In The K-6 Classroom

Credit Hours: 3.00. This course prepares teacher candidates to

select, evaluate, and integrate children's literature and media in K-6 classrooms. Focusing on high-quality, diverse texts and media, candidates will learn to choose materials that are developmentally appropriate and reflect the diversity of the world in which we live. Emphasis will be placed on the critical role literature and media play in fostering vocabulary development, enhancing critical thinking skills, and supporting literacy development across subjects. The course will focus on how K-6 students learn to use comprehension strategies independently and efficiently as they progress through elementary school fostering both their academic growth and their ability to engage with diverse texts.

Learning Outcomes: 1. Integrate literature and media into content area lessons to enhance vocabulary (including academic language skills), critical thinking, and comprehension. 2. Select and evaluate three trade books to read aloud during a math, a social studies, and a science lesson. 3. Identify instructional strategies supported by the Science of Reading that teach k-6 students' academic language skills, vocabulary knowledge, and reading and listening comprehension. Credits: 3.00

18 Credits

Fall 3rd Year

EDPS 30400 - Assessment And Transition (Data-Based Decision-Making)

Credit Hours: 3.00. This course addresses assessment techniques and transition planning in special education, with applications to curriculum. It includes norm-referenced and curriculum-based measurement, error analyses, observational ratings, data-based decision-making, and transition planning from early intervention to post-secondary settings.

Learning Outcomes: 1. Apply their understanding of specialized curricula to inform their programmatic and instructional decisions for individuals with exceptionalities across a variety of contexts and the continuum of placement options (CEC 3.2) 2. Develop, select, administer, analyze, and interpret multiple measures of student learning, behavior, and the classroom environment to evaluate and support classroom and school-based systems of intervention for students with and without exceptionalities (CEC 4.1). 3. Develop, select, and administer multiple, formal and informal, culturally and linguistically appropriate measures and procedures that are valid and reliable, to contribute to eligibility determination for special education services CEC 4.2). 4. Assess, collaboratively analyze, interpret, and communicate students' progress toward measurable outcomes, using technology as appropriate, to inform both short and long-term planning, and make ongoing adjustments to instruction (CEC 4.3). 5. Utilize appropriate progress monitoring skills in order to develop individualized education plans (IEPs) for students. Credits: 3.00

EDPS 40200 - P-12 Reading Methods For Exceptional Learners

Credit Hours: 2.00 to 3.00. This course is designed to meet the expectations of CEC, NCTQ, IDA and REPA 3 and prepare students in the science of reading for exceptional learners (including students with dyslexia and those with intensive needs) in Tiers 2 and 3. This course will provide implementation details on Response to Intervention (RTI) and Multi-tiered Systems of Support (MTSS). The course will present strategies and programs used in strategic and intensive intervention efforts for those learners needing additional, unique, and/or more focused remediation efforts. Topics will include understanding reading intervention research, the behavior analytic and learning sciences' contributions to understanding the reading process, the sequence of learning to read (systematic instruction), reading to learn, and the five components of reading instruction for P-12 learners. This course will specifically address the REPA 3 Standard: Focused work using (interventions that are direct, explicit, and multi-sensory) as a component of scientifically-based reading.

Learning Outcomes: 1. Review the five components of effective reading instruction for those in P-3 and those in grades 4-12. 2. Explain the models for remediation of prereading/reading difficulties and describe how they function: RTI, MTSS. 3. Describe and demonstrate how to use various screeners and progress monitoring assessments for P-12

students in Tiers 2 and 3. 4. Describe the meaning of direct and systematic instruction. 5. Demonstrate mastery of Corrective Reading sounds. 6. Demonstrate methods of increasing student engagement. 7. Discuss strategies to enhance content area reading performance. 8. Illustrate a scope and sequence for reading remediation for readers needing strategic and intensive intervention. 9. Explain how reading instruction can be made more explicit for those needing more focused efforts 10. Demonstrate how to provide systematic and explicit small group/one-on-one reading instruction. 11. Describe Big Direct Instruction and published scientifically-based programs that are designed based on the science of reading instruction and demonstrate how they are implemented. 12. Describe the use of Universal Design for Learning and assistive technology approaches to increase access to reading materials and/or improve reading skills. Credits: 2.00 to 3.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using children's ideas, beliefs, and experiences as primary resources. Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to

meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are committed to social justice and education of all the children of all the people - especially in the area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 31200 - Inclusive Practices In Cross-Content Curriculum

Credit Hours: 3.00. This course aims to teach best practices for cross-content integration in an inclusive or self-contained classroom. It develops pre-service teacher understanding of core curricula along with how to integrate the curricula across subject areas. This course will also cover curricula to implement a well-rounded education (e.g., visual arts, dance, theater, music, etc.), provide methods for inclusive practices within the content, and discuss the implementation of collaborative approaches to cross-content planning and delivery.

Learning Outcomes: 1. Apply understanding of curricula across curricular content areas to develop integrated units of study which provide a well-rounded education. 2. Develop curricular content knowledge in order to develop learning progressions for individuals with exceptionalities. 3. Select appropriate curricula for individuals with exceptionalities across multiple content areas. 4. Teach cross-disciplinary knowledge and skills (e.g., critical and creative thinking, problem-solving) through integrated lesson planning and curricular units of study. 5. Implement cross-content curriculum across a wide range of settings through collaborative practices. Credits: 3.00

16 Credits

Spring 3rd Year

EDCI 36102 - Teaching Social Studies In 3-6

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the

field, and of best practices strategies for teaching social studies to children in the 3-6 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how 3-6 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the 3-6 grades.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the 3-6 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the 3-6 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the 3-6 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36402 - Teaching Mathematics In Grades 3-6

Credit Hours: 2.00. Focuses on teaching mathematics in the elementary school grades 3-6. Students learn what it means to teach mathematics interactionally using children's ideas, beliefs, and experiences as primary resources. Mathematical reasoning, problem solving, communication, and connections are foci.

Learning Outcomes: 1. Develop, apply, analyze, and evaluate strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Know and analyze methods of assessing and responding to the needs of mathematics learners labeled in schools. 3. Analyze and apply student's mathematical conceptual understanding and procedural knowledge to the development of problem-solving based mathematics lessons. 4. Create and analyze instructional activities drawing from student's conceptual understanding and procedural knowledge as primary resources. Credits: 2.00

EDCI 36502 - Teaching Science Through Design In Grades 3-6

Credit Hours: 2.00. The aim of this course is to prepare students to teach science, engineering, and computational thinking with grade 3-6 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade 3 through 6 learners. At least 9 credits of science content courses are required.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 2.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 31100 - Supporting Exceptional Learners: Foundations And Mathematics

Credit Hours: 3.00. Teaching students with special needs requires the ability to locate evidence-based interventions, implement those interventions with fidelity, and track student performance over time. Mathematics is a content area in which success or failure yields major ramifications for postsecondary

success. This course will cover the common math interventions employed for mild to severe disabilities across grade levels K-12.

Learning Outcomes: 1. Develop standards-based lesson plans for math that consider individual abilities, interests, learning environments, and cultural and linguistic factors. 2. Use technologies to support instructional assessment, planning, and delivery of mathematics for individuals with exceptionalities. 3. Identify strategies for teaching to mastery and promote generalization of learning in mathematics for both fluency and world problem solving. 4. Produce standards-based lesson plans for numeracy that incorporate evidence-based practices, classroom resources (e.g. peer and paraprofessional), and technological supports for use with students who have diverse learning needs. Credits: 3.00

EDPS 40300 - Individual Social, Emotional, Behavioral Supports

Credit Hours: 3.00. This course is designed to prepare students with advanced knowledge and skills in designing and delivering individualized social-emotional and behavioral supports for learners. Emphasis will be placed on functional behavior assessment and function-based interventions and supports.

Learning Outcomes: 1. Identify the advanced principles of behavior and provide classroom examples. 2. Articulate the connection between social-emotional skills and challenging behavior. 3. Define learner behaviors. 4. Select an appropriate behavior measurement system for learner outcomes. 5. Measure and graph learner behavior. 6. Conduct a functional behavior assessment. 7. Develop and implement a behavior support plan. 8. Analyze learner data to guide educational programming decisions. Credits: 3.00

EDCI 32602 - Teaching Literacy In 3-6

Credit Hours: 2.00. Students will build on material learned in EDCI 32501. They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children, and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Demonstrate an understanding of theoretical and evidence-based foundations that guide reading, writing processes, and instruction. 2. Design developmentally appropriate instruction that addresses the needs of all learners. 3. Teach developmentally appropriate lessons/units in the school setting. 4. Assess student learning by designing/using/adjusting formative and summative assessments for your group of students, and pre-assessments. 5. Reflect and analyze your own teaching. Credits: 2.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

18 Credits

Fall 4th Year

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances

achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 46100 - Practicum In Strategies For Teaching Individuals With Disabilities

Credit Hours: 1.00 to 6.00. Practicum experience in assessment and teaching of individuals with disabilities. Experience in design, delivery, implementation, and evaluation of instruction. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A and B.

Learning Outcomes: 1. Provide instruction that is responsive to student differences and promotes development and learning for all students. 2. Match expectations to the unique characteristics, abilities, developmental levels, and behavior of students. 3. Identify characteristics of students with disabilities and design classroom accommodations. 4. Adjust instruction according to student needs and performances. 5. Use a variety of evidence-based instructional strategies. 6. Plan and deliver standards-based, data-driven differentiated instruction that actively engages students in the learning process. 7. Demonstrate an appreciation and concern for students as individuals and interact with them in positive ways that encourage and teach appropriate behavior. 8. Model effective use of language. 9. Demonstrate effective classroom and behavior management and establish a positive, productive, and safe learning environment with high expectations for all students. 10. Integrate instructional technology by creating instructional materials, delivering instruction using technology, or encouraging student use of technology in assignments. 11. Reflect on practices. 12. Engage in professional development activities to remain current with best practices. 13. Collaborate effectively with colleagues, parents, and others to increase the effectiveness of instruction and engage in professional growth. Credits: 1.00 to 6.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security,

plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 42100 - Supporting Exceptional Learners: Social Studies And Science

Credit Hours: 3.00. This course is designed to prepare special educators to deliver social studies and science content to children and adolescents with disabilities across PK-12 settings. It will also prepare special educators to make programmatic and instructional decisions related to least restrictive environment, appropriate educational supports, assistive technology, accommodations, and modification specific to science and social studies instruction. This course includes assignments that will be linked to EDPS 46100 the Special Education Student Teaching Residency.

Learning Outcomes: 1. Use knowledge of general and specialized social studies curricula to individualize learning for individuals with exceptionalities. 2. Use knowledge of general and specialized science curricula to individualize learning for individuals with exceptionalities. 3. Use strategies to enhance language development and communication skills of individuals with exceptionalities across social studies and science content area. Credits: 3.00

12 Credits

Spring 4th Year

EDPS 49800 - Supervised Teaching- Special Education (UCC: OC)

Credit Hours: 1.00 to 16.00. A student planning to enroll in EDCI 49600, EDCI 49800, EDCI 49900; EDPS 49800, EDPS

49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A, B, and C.

University Core Curriculum (UCC): (UCC: OC)
Credits: 1.00 to 16.00

EDCI 49600 - Student Teaching In The Elementary School (UCC: OC)

Credit Hours: 6.00 to 16.00. Full-time elementary classroom teaching experiences and a student teaching seminar under the mentorship of the classroom teacher and a University supervisor.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Understand and address each child's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each child's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Speech, Language, and Hearing Sciences, BS

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (33 credits)

SLHS Foundation Requirements (18 credits)

SLHS 11500 - Introduction To Communicative Disorders (UCC: STS)

Credit Hours: 3.00. Nature, systems, and causes of communicative disorders and the principal methods used for remediation.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception. Credits: 3.00

SLHS 30300 - Anatomy And Physiology Of The Speech Mechanism

Credit Hours: 3.00. This course provides an introduction to the anatomical and physiological bases of the speech mechanism with an emphasis on the neural, respiratory, laryngeal, and supralaryngeal subsystems.

Learning Outcomes: 1. Develop knowledge of the major subsystems underlying speech and language production. 2. Identify major anatomical structures associated with speech production. 3. Describe the physiology of speech production. Credits: 3.00

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

Area 1: Speech, Language, and Hearing Sciences Selective (15 credits)

SLHS Foundation Requirements (18 credits)

SLHS 11500 - Introduction To Communicative Disorders (UCC: STS)

Credit Hours: 3.00. Nature, systems, and causes of communicative disorders and the principal methods used for remediation.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception. Credits: 3.00

SLHS 30300 - Anatomy And Physiology Of The Speech Mechanism

Credit Hours: 3.00. This course provides an introduction to the anatomical and physiological bases of the speech mechanism with an emphasis on the neural, respiratory, laryngeal, and supralaryngeal subsystems.

Learning Outcomes: 1. Develop knowledge of the major subsystems underlying speech and language production. 2. Identify major anatomical structures associated with speech production. 3. Describe the physiology of speech production. Credits: 3.00

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and

principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

Other Departmental/Program Course Requirements (51-74 credits)

Cultural Competence Selective (12-16 credits)

Math and Science Requirements (12-16 credits)

Area 2: Pure and Applied Sciences (6-8 credits)

Area 3: Behavioral, Linguistic, and Social Sciences (6 credits)

Additional Other Departmental/Program Course Requirements: (15-28 credits)

Cultural Competence Selective (12-16 credits)

Electives (13-36 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

SLHS 11500 - Introduction To Communicative Disorders (UCC: STS)

Credit Hours: 3.00. Nature, systems, and causes of communicative disorders and the principal methods used for remediation.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

15-17 Credits

15-17 Credits

Spring 1st Year

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

15-17 Credits

15-17 Credits

Fall 2nd Year

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception. Credits: 3.00

SLHS 30300 - Anatomy And Physiology Of The Speech Mechanism

Credit Hours: 3.00. This course provides an introduction to the anatomical and physiological bases of the speech mechanism with an emphasis on the neural, respiratory, laryngeal, and supralaryngeal subsystems.

Learning Outcomes: 1. Develop knowledge of the major subsystems underlying speech and language production. 2. Identify major anatomical structures associated with speech production. 3. Describe the physiology of speech production. Credits: 3.00

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

15-16 Credits

15-16 Credits

Spring 2nd Year

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception. Credits: 3.00

SLHS 30300 - Anatomy And Physiology Of The Speech Mechanism

Credit Hours: 3.00. This course provides an introduction to the anatomical and physiological bases of the speech mechanism with an emphasis on the neural, respiratory, laryngeal, and supralaryngeal subsystems.

Learning Outcomes: 1. Develop knowledge of the major subsystems underlying speech and language production. 2. Identify major anatomical structures associated with speech production. 3. Describe the physiology of speech production. Credits: 3.00

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

15-16 Credits

15-16 Credits

Fall 3rd Year

15 Credits

15 Credits

Spring 3rd Year

15-18 Credits

15-18 Credits

Fall 4th Year

15-16 Credits

15-16 Credits

Spring 4th Year

15-16 Credits

15-16 Credits

Fall 1st Year

SLHS 11500 - Introduction To Communicative Disorders (UCC: STS)

Credit Hours: 3.00. Nature, systems, and causes of communicative disorders and the principal methods used for remediation.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

15-17 Credits

15-17 Credits

About the Program

Statistics Honors, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (30-31 credits)

Required Major Courses (24 credits)

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms,

graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to

perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting

probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

Advanced Math Selective (3-4 credits)

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and

proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 52000 - Boundary Value Problems Of Differential Equations

Credit Hours: 3.00. Separation of variables; Fourier series; boundary value problems; Fourier transforms; Bessel functions; Legendre polynomials.

Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time

and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

Statistics Selective (3 credits)

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science

and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits:

1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

STAT 41800 - Computational Methods In Data Science

Credit Hours: 3.00. This course introduces essential computational methods in modern data science, focusing on simulation, resampling, Bayesian data analysis, and the utilization of large language models (LLMs) in data science workflows. Students will learn foundational simulation techniques, such as random variable generation through the inverse cumulative distribution function and rejection sampling. The course provides an overview of Frequentist and Bayesian inference, highlighting their theoretical foundations and practical applications. Key resampling methods, including bootstrapping and cross-validation, will be explored as tools for assessing variability, constructing confidence intervals, and validating predictive models. The course also emphasizes the practical and responsible use of LLMs in data science pipelines, including tasks such as text preprocessing, feature extraction, and leveraging pre-trained models to enhance data analysis and annotation. The course culminates in a capstone project where students will synthesize their learning by designing and implementing comprehensive solutions to real-world data science problems, demonstrating both theoretical understanding and practical implementation skills.

Learning Outcomes: 1. Apply simulation techniques, including Monte Carlo methods, transformation approaches, and rejection sampling, to analyze probabilistic behavior in data science applications. They will compare and evaluate Frequentist and Bayesian inference paradigms by examining their theoretical foundations, identify their strengths and limitations, and explain their roles in statistical modeling and decision-making. Students will design, implement, and assess resampling methods, focusing on both nonparametric and parametric forms of the bootstrap, to estimate variability, construct confidence intervals, and improve statistical estimates through bias correction techniques. They will learn the principles of cross-validation, analyze its role in model assessment, and apply it to compute model performance metrics, detect overfitting and underfitting, and select models with reliable predictive accuracy using Python libraries. 2. Construct and interpret posterior distributions and credible intervals, apply Markov Chain Monte Carlo methods to approximate posteriors, and evaluate the role of prior distributions in Bayesian inference. In addition, students will utilize large language models in creative and practical ways within data science workflows, such as contextual data augmentation, feature engineering, and integrating structured and unstructured data to enhance predictive models, addressing challenges such as privacy and reliability. The course will culminate in a capstone project where students will synthesize selected course topics to design, develop, and present robust solutions to real-world data science challenges. By integrating computational methods, statistical principles, and real-world datasets, students will demonstrate their ability to create effective, data-driven solutions that showcase

both theoretical understanding and applied expertise. Credits: 3.00

Other Departmental/Program Course Requirements (38-64 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge

datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Required Pre-Requisite Course (4-5 Credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know

Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Electives (25-52 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

15-19 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm

designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format,

extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

15-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

15-18 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix

multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15 Credits

Fall 3rd Year

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs

using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

15-16 Credits

Spring 3rd Year

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

15-16 Credits

Fall 4th Year

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

12-15 Credits

Spring 4th Year

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt,

least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

13-15 Credits

Statistics: Math Emphasis, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (30-31 credits)

Required Major Courses (24 credits)

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and

continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov

process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

Advanced Math Selective (3-4 credits)

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to

engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45401 - Galois Theory Honors

Credit Hours: 3.00. This course will give a thorough introduction to Galois theory. Galois theory is a fundamental tool in many areas of mathematics, including number theory and algebraic geometry. This course will increase students' mathematical maturity and prepare them for graduate school. Topics include finite extension fields and their symmetries, ruler and compass constructions, complex roots of unity, solvable groups, and the solvability of polynomial equations by arithmetic and radical operations. This course is intended for third- or fourth-year students who have taken MA 45000 (Algebra Honors) or MA 45300 (Elements of Algebra I).

Learning Outcomes: 1. Know the historical background of Galois theory. 2. Know the classical version which addresses questions about roots of polynomials and the modern

formulation in terms of abstract algebra. 3. Know about finite extension fields and their symmetries. 4. Know how Galois theory answers ancient questions about ruler and compass constructions. 5. Know about cyclotomic fields generated by complex roots of unity. 6. Know how Galois theory answers questions about the solvability of polynomial equations by arithmetic and radical operations. Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

Statistics Selective (3 credits)

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate

and test hypotheses. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3.

Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting,

manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

Other Departmental/Program Course Requirements (38-64 credits)

College of Science Additional Requirements

Computing (3-4 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained

for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

Laboratory Science (6-8 credits)

Mathematics (8-10 credits)

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A"

or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

Statistics (3 credits)

Required Pre-Requisite Courses (4-5 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

Electives (25-52 credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Sample 4-Year Plan

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

14-17 Credits

Spring 1st Year

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to

identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

13-18 Credits

Fall 2nd Year

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

15-16 Credits

Spring 2nd Year

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

15 Credits

Fall 3rd Year

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

15-16 Credits

Spring 3rd Year

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses;

distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

15 Credits

Fall 4th Year

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov

process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

12-15 Credits

Spring 4th Year

13-16 Credits

Studio Arts and Technology, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (48 credits)

A. Studio Arts and Technology Fundamental Courses (15 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts

from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

B. Art History courses (6 credits)

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that

influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

C. Studio Arts and Technology Core (9 credits)

2D Extended Media

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

Craft/Material Studies

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

Art, Culture, and Technology

AD 23600 - Lighting Fundamentals For Photography

Credit Hours: 3.00. Introductory course in understanding electronic strobe lighting. Begins with a review of basic lighting principles and a series of problem-solving assignments, which introduce control, and applications of electronic strobe lighting. Still life photography and portraiture are emphasized and covers on-location lighting.

Learning Outcomes: 1. Gain an understanding of the basic principles of light and how to use those principles to light photographic subject matter. 2. Gain a basic understanding of the function of photographic lighting equipment. 3. Compile a portfolio of images that demonstrate a skill set learned regarding product and portrait and simple space lighting. Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 32600 - Physical Computing

Credit Hours: 3.00. Introduction to electronics and computer vision for artists. Students learn to create expressive audiovisual systems that can respond to events in the physical world (movement, light/temperature change, sound, touch, etc.) through custom interfaces.

Learning Outcomes: 1. Analyze key ideas in the field of Physical Computing by preparing a research presentation on the practice of an individual artist or collective. 2. Critique their own creative work as well as the work of their peers through group discussions. 3. Produce a variety of interactive artworks by the creative use of the Arduino microcontroller, simple electronic circuitry, and coding techniques. Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 36300 - Documentary Photography

Credit Hours: 3.00. This course is an introduction to the great tradition of documentary photography. Students learn to see the world around them in a new way and produce a documentary project. The course requires reading and writing about photography, as well as making photography on a regular basis. The class emphasis is on thinking about why people photograph, what photographs do and do not mean to us, and on doing documentary work, on telling stories with photographs.

Learning Outcomes: 1. Understand the history of documentary photography. 2. Demonstrate a narrative photography experimented through personal, social, cultural, topographical politics. Credits: 3.00

2D Extended Media

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

D. Portfolio Assessment (required, no credit)

E. Studio Arts and Technology Areas of Concentration (15 credits)

2D Extended Media

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 30000 - Life Drawing II

Credit Hours: 3.00. Emphasis is given to organizing the figure in pictorial space.

Learning Outcomes: 1. Draw successful figure drawings through use of gesture, exploration of media, and application of basic art and design principles. 2. Apply expressive and conceptual frameworks to develop their artistic voices. 3. Apply critical thinking skills both as a group and on their own. Credits: 3.00

AD 33300 - Photo Silk Screen

Credit Hours: 3.00. Advanced study of the techniques of photo silkscreen and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36500 - Intermediate Painting

Credit Hours: 3.00. A studio course concentrating on the development of conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36900 - Lithographic Printmaking

Credit Hours: 3.00. An introduction to the techniques of stone and plate lithography. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 40000 - Advanced Painting

Credit Hours: 3.00. A studio course concentrating on the development of an advanced body of work built upon the conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 46800 - Printmaking III

Credit Hours: 3.00. Advanced studies in selected printmaking processes including relief, silkscreen, lithography, intaglio and book arts. Emphasis on color printmaking, photomechanical methods, fine art conceptual issues, creativity, and professional practices.

Learning Outcomes: 1. Create strong contemporary personal work in printmaking with expressive and original ideas. 2. Cultivate personal style through self-directed artist research, image development and experimentation in printmaking. 3. Demonstrate advanced technical skill in one or more printmaking mediums. 4. Acquire advanced technical skills to create multi-colored prints utilizing color, layering, and registration. 5. Describe and critique the work of professional printmaking artists, self and peers. Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

Craft/Material Studies

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 36200 - Jewelry And Metalwork

Credit Hours: 3.00. Lost wax casting and mold making, mechanisms and stone setting for jewelry and metalwork.

Learning Outcomes: 1. Students will be able to design and make wax and non-wax models for jewelry and small metal projects by reductive, addictive, and construction processes. 2. Students will learn to sprue, invest and cast their models by the lost wax centrifugal and vacuum casting methods. 3. They will learn to make waste molds and reusable rubber molds to produce their jewelry projects. 4. They will learn to make mechanisms for jewelry and settings for incorporating stones or other nonmetal materials into their jewelry. Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 40400 - Moldmaking And/Or Wheel-Throwing Production Techniques In Ceramics

Credit Hours: 3.00 to 6.00. This course will teach mold-making or wheel-throwing (depending on the individual student's interest) with a view to creating ceramic objects suitable for commercial mass-production. Both tableware and/or sculptural objects will be explored. For the wheel-throwing option the students must have at least one year of high school throwing or AD 24200 with a grade of at least "B" or permission of instructor. For the mold making and casting option only, students must be an Art and Design student or have permission of instructor.

Learning Outcomes: 1. The student will learn how to design a model, make the model from

clay, make a mold of the designed model (or found object), cast and assemble cast ceramics pieces for possible commercial mass-production. If choosing the wheel-throwing option, the student will learn advanced techniques of throwing and assembling parts to make either functional and sculptural objects for mass-production. 2. Students will also learn simple glazing techniques, and have the option of learning how to screen print and use decals on their final products. Credits: 3.00 to 6.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 46200 - Metalsmithing

Credit Hours: 3.00. Metal forming and metalsmithing processes for small metal objects and jewelry.

Learning Outcomes: 1. Identify and utilize traditional jewelry and metalsmithing tools and materials in art metal projects. 2. Design and construct specialized tooling for metalworks. 3. Utilize newly developed tools into the fabrication of jewelry and other metal projects. Credits: 3.00

AD 47000 - Advanced Studies In Textiles

Credit Hours: 3.00. A textile seminar and studio course in advanced textile design, with the purpose of developing a personal direction and competence in textiles as fiber art.

Credits: 3.00

Art, Culture, and Technology

AD 23600 - Lighting Fundamentals For Photography

Credit Hours: 3.00. Introductory course in understanding electronic strobe lighting. Begins with a review of basic lighting principles and a series of problem-solving assignments, which introduce control, and applications of electronic strobe lighting. Still life photography and portraiture are emphasized and covers on-location lighting.

Learning Outcomes: 1. Gain an understanding of the basic principles of light and how to use those principles to light photographic subject matter. 2. Gain a basic understanding of the function of photographic lighting equipment. 3. Compile a portfolio of images that demonstrate a skill set learned regarding product and portrait and simple space lighting. Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 32600 - Physical Computing

Credit Hours: 3.00. Introduction to electronics and computer vision for artists. Students learn to create expressive audiovisual systems that can respond to events in the physical world (movement, light/temperature change, sound, touch, etc.) through custom interfaces.

Learning Outcomes: 1. Analyze key ideas in the field of Physical Computing by preparing a research presentation on the practice of an individual artist or collective. 2. Critique their own creative work as well as the work of their peers through group discussions. 3. Produce a variety of interactive artworks by the creative use of the Arduino microcontroller, simple electronic circuitry, and coding techniques. Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 33700 - Commercial And Professional Practice In Photography

Credit Hours: 3.00. This course introduces students the skills necessary to attain entry-level employment in the photographic field and familiarizes students with the vocabulary, procedures, and working realities specific to occupations in the field of photography in the areas of photo-journalism, magazine illustration, advertising/web design, and fine arts. Permission of department required.

Learning Outcomes: 1. To prepare materials related to practical application within photographic industry. 2. To learn techniques and strategies for job searches, interviewing, and developing portfolio presentation skills. 3. To produce three parts portfolio consisting of a print portfolio, on-line web portfolio, and job interview portfolio. Credits: 3.00

AD 36101 - The Constructed Image

Credit Hours: 3.00. An intermediate level course focusing on the production of creative images constructed in the studio and in the field. Projects will address the planning and design of photographic images through the use of set design, styling, and post-production. Students will investigate both historical and contemporary trends in the art of the photographically-constructed image.

Learning Outcomes: 1. Construct and compose images using set design, styling, collage, and photomontage. 2. Develop communication skills to successfully interpret proposals and instructions from clients. 3. Analyze theoretical and historical concerns regarding constructed images and demonstrate an understanding of those concerns. 4. Develop visual communication and conceptual image making skills. 5. Develop techniques of creating photographically constructed images and demonstrate an understanding of those techniques. Credits: 3.00

AD 41700 - Variable Topics In Electronic And Time-Based Art

Credit Hours: 3.00. Examination of thematic or specialized topics reflecting the most recent developments and contemporary artistic practices in Electronic and Time-Based Art. Permission of department required.

Learning Outcomes: 1. Use essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production. 2. Able to analyze key works and artists in the emerging field of Electronic and Time-Based Art. Credits: 3.00

AD 42100 - Advanced Studies In Photography And Related Media I

Credit Hours: 3.00. The first of two advanced level courses in photography/related media focusing on production of a formally and conceptually coherent body of work. Course emphasizes

development of studio and critical thinking skills, and initiates investigation of the creative process.

Learning Outcomes: 1. Create a photographic series using advanced techniques and processes. 2. Evaluate the work of contemporary working photographers. 3. Define photographic terminology related to a contemporary and commercial photography practice. Credits: 3.00

AD 38100 - Alternative Photographic Processes

Credit Hours: 3.00. This course is designed to explore methods and concepts for creating photographs using alternative and historic processes. Through technical workshops and assigned projects students will become well-versed in medium and large format film cameras, as well as various 19th century processes.

Learning Outcomes: 1. Know various types of 19th century photographic processes. 2. Know large format photographic cameras. 3. Understand visual language and aesthetics of early photographic processes and printing methods. Credits: 3.00

AD 33100 - Digital Video Production And Aesthetics

Credit Hours: 3.00. This course is a basic studio introduction to video production and how video can be used as an artistic medium in conjunction with the students' photography. Topics include video/film formats, lighting, audio, editing, distribution, experimental, commercial and music video, production paperwork and extensive time spent on mastering the camera. Classes will consist of hands-on demonstrations, and critiques.

Learning Outcomes: 1. Demonstrate DSLR cameras. 2. Demonstrate basic to intermediate lighting for Video Production. 3. Obtain knowledge on commercial video production: music video and commercial advertisement video. Credits: 3.00

AD 36300 - Documentary Photography

Credit Hours: 3.00. This course is an introduction to the great tradition of documentary photography. Students learn to see the world around them in a new way and produce a documentary project. The course requires reading and writing about photography, as well as making photography on a regular basis. The class emphasis is on thinking about why people photograph, what photographs do and do not mean to us, and on doing documentary work, on telling stories with photographs.

Learning Outcomes: 1. Understand the history of documentary photography. 2. Demonstrate a narrative photography experimented through personal, social, cultural, topographical politics. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

2D Extended Media

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional

practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 30000 - Life Drawing II

Credit Hours: 3.00. Emphasis is given to organizing the figure in pictorial space.

Learning Outcomes: 1. Draw successful figure drawings through use of gesture, exploration of media, and application of basic art and design principles. 2. Apply expressive and conceptual frameworks to develop their artistic voices. 3. Apply critical thinking skills both as a group and on their own. Credits: 3.00

AD 33300 - Photo Silk Screen

Credit Hours: 3.00. Advanced study of the techniques of photo silkscreen and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36500 - Intermediate Painting

Credit Hours: 3.00. A studio course concentrating on the development of conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36900 - Lithographic Printmaking

Credit Hours: 3.00. An introduction to the techniques of stone and plate lithography. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 40000 - Advanced Painting

Credit Hours: 3.00. A studio course concentrating on the development of an advanced body of work built upon the conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 46800 - Printmaking III

Credit Hours: 3.00. Advanced studies in selected printmaking processes including relief, silkscreen, lithography, intaglio and book arts. Emphasis on color printmaking, photomechanical methods, fine art conceptual issues, creativity, and professional practices.

Learning Outcomes: 1. Create strong contemporary personal work in printmaking with expressive and original ideas. 2. Cultivate personal style through self-directed artist research, image development and experimentation in printmaking. 3. Demonstrate advanced technical skill in one or more printmaking mediums. 4. Acquire advanced technical skills to create multi-colored prints utilizing color, layering, and registration. 5. Describe and critique the work of professional printmaking artists, self and peers. Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

F. Studio Arts Professional Practice/Senior Exhibition (3 credits)

AD 49900 - Studio Arts Professional Practice/Senior Exhibition

Credit Hours: 3.00. Study of professional practice in the contemporary art world: ethics, gallery, exhibition, studio practice, writing, visual documentation, and business of art. Seniors meet throughout spring semester to organize, install, and de-install Fine Arts Senior Exhibition.

Learning Outcomes: 1. Develop a professional artist statement and resume. 2. Identify and discuss trends in contemporary professional art practices. 3. Design a digital art portfolio. 4. Demonstrate skills necessary to organize and install art exhibitions. Credits: 3.00

A. Studio Arts and Technology Fundamental Courses (15 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio

project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

Electives (38-47 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

15-16 Credits

15-16 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

15 Credits

15 Credits

Fall 2nd Year

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3.

Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

15 Credits

15 Credits

Spring 2nd Year

15 Credits

15 Credits

Fall 3rd Year

15 Credits

15 Credits

Spring 3rd Year

15 Credits

15 Credits

Fall 4th Year

15 Credits

15 Credits

Spring 4th Year

AD 49900 - Studio Arts Professional Practice/Senior Exhibition

Credit Hours: 3.00. Study of professional practice in the contemporary art world: ethics, gallery, exhibition, studio practice, writing, visual documentation, and business of art. Seniors meet throughout spring semester to organize, install, and de-install Fine Arts Senior Exhibition.

Learning Outcomes: 1. Develop a professional artist statement and resume. 2. Identify and discuss trends in contemporary professional art practices. 3. Design a digital art portfolio. 4. Demonstrate skills necessary to organize and install art exhibitions. Credits: 3.00

15 Credits

15 Credits

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

15-16 Credits

15-16 Credits

About the Program

Supply Chain & Operations Management, BS

About the Program

Degree Requirements

Department/Program Major Courses (77 credits)

Required Major Courses (56 credits)

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or

networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help

students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other

courses and in one's professional career. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 46400 - Logistics: Concepts And Models

Credit Hours: 3.00. The course familiarizes students with main concepts and models of business logistics management. Through the course, students develop an ability to design, improve, and manage logistics operations such as Inventory, Transportation, Warehousing, and Logistics Network Design. Since logistics decisions often require certain trade-offs to be made, students develop necessary quantitative and qualitative analytical skills to improve their decision-making. At the end of the course, students should be able to analyze logistics strategy of a firm, identify problems and tradeoffs in different logistics functions, formulate the corresponding models, identify quantitative methods to solve it, obtain results and interpret them for small-size problems using standard spreadsheet software, communicate the results to a broader audience using business language, discuss issues and challenges in same-day delivery, humanitarian logistics, physical internet.

Learning Outcomes: 1. Know vocabulary of Logistics, and Supply Chain. 2. Design, improve and manage processes by learning decision making tools. 3. Become familiar with the key issues and problems facing an operations manager. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce,

and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional

decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

MGMT 46501 - Strategic Sourcing And Procurement Operations Analytics

Credit Hours: 3.00. This elective course will serve as an important complement to the existing OM modules (e.g., MGMT 36100 Operations Management) to introduce more in-depth knowledge about supply chain management to undergraduate students, especially those major in SC&OM, focusing on strategic sourcing and procurement operations which are the building blocks for supply chain operations. More specifically, this course will introduce procure-to-pay process, category management, supplier selection and evaluation, supplier relationship management, vertical integration, global sourcing, outsourcing, auctioning, supply contract design and negotiation, business ethics, legal and compliance issues, etc. Sourcing and procurement is the major job title for supply chain operations jobs in the industry and our course can also help students to get the professional certificate of sourcing and procurement. Hence, it may also help senior students prepare for the job placements. Learning Outcomes: 1. Master the working knowledge and vocabulary of strategic sourcing and procurement. 2. Know how to design and manage the business process in sourcing operations. 3. Know how to align sourcing strategies with corporate strategies. 4. Know how to model the key decision-making process of sourcing operations. 5. Apply data analytics techniques to develop sourcing strategies. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work. University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

Major Selectives I (12 credits)

MGMT 46200 - Advanced Manufacturing Planning And Control Systems

Credit Hours: 3.00. The course examines key concepts in the planning, control, and improvement of processes in manufacturing and service operations. Specific topics covered in the course include: (i) Product/service characteristics that provide value to customers and competitive priorities, (ii) Role of processes and key operations choices to support the competitive priorities, (iii) Process analysis and scheduling, (iv) Throughput principles to deal with adverse impacts of process uncertainties and bottlenecks, (v) Managing capacity and lead times, (vi) Throughput principles to deal with wastes and errors, including the Toyota Production System and Lean Operations, and (vii) Coordinating material/order flows in supply chain - MRP, and Resources and Production Planning - Aggregate Production Planning. The class uses a combination of lectures, cases, simulations, outside speakers, experiential exercises, and student presentations. An important component of the course is a hands-on exercise where students in teams of seven or eight design and run a production process to meet demand for a quality-conscious customer. The teams then present the lessons learned to the class.

Learning Outcomes: 1. Learn the details of production planning, master scheduling, materials planning, short range capacity planning, production floor execution, and quality control. Credits: 3.00

MGMT 45200 - Manufacturing Strategy And Process Innovation

Credit Hours: 3.00. This course examines the management challenges posed by the growth in worldwide manufacturing capabilities, markets, and competition and by rapid advances in technology and the concomitant decline in product life cycles. The manufacturing function is considered within a broader context encompassing design, engineering, purchasing, marketing, and customer service in an effort to assess the degree to which existing management structures successfully meet the challenges arising from the changing manufacturing environment.

Learning Outcomes: 1. Identify the tradeoffs made between operations flexibility and cost. 2. Identify proper alignment between manufacturing strategy and business strategy. 3. Identify the pros and cons of different types of plant network strategies. 4. Identify the behavioral issues associated with implementation of rigid project management tools. 5. Identify the potential long term implications of outsourcing on the development of competition. Credits: 3.00

MGMT 40500 - Six Sigma And Quality Analytics

Credit Hours: 3.00. The course is an undergraduate elective offered as part of the Center for Manufacturing Management Enterprises (CMME) quality initiatives. Provides an overview of various tools and methods for total quality management.

Learning Outcomes: 1. Make data driven conclusions and decisions for quality management operations through working on various business cases. 2. Apply previously gained statistical knowledge to understand and to analyze data. 3. Gain some advanced analytical technics such as Analysis of Variances (ANOVA) and Design of Experiment (DOE) to optimize obtaining data and learnings. 4. Master a simple yet powerful MINITAB software to carry out complex tasks. Credits: 3.00

MGMT 26100 - Introduction To Supply Chain Management

Credit Hours: 3.00. This course seeks to introduce general concepts in supply chain management, including procurement, supply planning, demand planning, and logistics. This course is designed around a corporate partnership to provide students with the opportunity to collaborate on solving a large-scale supply chain challenge. In the first five weeks of the semester, students will be introduced to basics of SCM through lectures,

cases, and assignments. Beginning in the sixth week, students will form teams to work on a real-world case presented by the corporate partner, a complex problem broken down into six learning areas, each with a corresponding deliverable.

Learning Outcomes: 1. Define, measure, and recommend improvements to an organization's supply chain. 2. Gain experience in applying these skills to a real-world business problem. 3. Learn about the different aspects of supply chain management. Credits: 3.00

MGMT 46800 - Supply Chain Technology

Credit Hours: 3.00. The course will introduce the major SCM information systems and technologies utilized by industry leaders to integrate SCM operations and achieve coordination within and across various business functions. The students will learn how to manage SCM operations, including: sales & distribution, materials management, production planning and control, warehouse management, retail operations. The course will provide students the opportunity to study, analyze, and observe the information systems and technology tools. Topics include Enterprise Resource Planning Systems (ERP), Blockchain, Warehouse Management System (WMS), Transportation Management Systems (TMS), Internet of Things (IOT) in retail. The students will learn how to use the SAP software to execute SCM operations. The course will review the technology implementation process and how such projects should be organized and managed.

Learning Outcomes: 1. Learn how to manage SCM operations, including: sales & distribution, materials management, production planning and control, warehouse management, retail operations. Methods of Evaluation: HWs, Quizzes. 2. Study, analyze, and observe the information systems and technology tools. Methods of Evaluation: Case studies, lab sessions, online discussions. 3. Learn how to use the SAP software to execute SCM operations. Methods of Evaluation: Lab exercises, team workshop, games. Credits: 3.00

MGMT 46900 - Supply Chain & Operations Analytics Consulting

Credit Hours: 3.00. This supply chain experiential learning course aims to provide students opportunities to apply theories and methods learned from supply chain and operations management courses to tackle real-world supply chain problems. A salient feature of this course is that it consists of two pillars. The first pillar is the partnerships with leading companies (e.g., Wabash, Corteva and Rolls Royce) to offer project opportunities and assign internal experts to advise student teams. Students will have opportunities to visit company sites, interact with domain experts, and present their findings to leadership teams. The second pillar is the partnership with a group of Purdue alumni to leverage their extensive supply chain consulting and corporate leadership experiences to advise students the consultation approach to problem-solving: how to approach problems, engage stakeholders, and professionally manage project delivery processes as internal or external consultants for business organizations.

Learning Outcomes: 1. Apply knowledge and skills learned in classes to real-world supply chain and operations problems. 2. Identify and approach real-world supply chain problems. 3. Collect, process and analyze real-world data. 4. Communicate and interact with supply chain executives. 5. Manage supply chain projects as a consultant. Credits: 3.00

Major Selectives II (6 credits)

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained

for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning,

promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 28800 - Programming For Business Applications

Credit Hours: 3.00. This course will cover the fundamentals of business rules and logic in a business application development context. Students will acquire these skills using computer programming. A modern programming language will be used to learn and reinforce logical concepts, including abstraction, process flow, variable assignment, and control structures, as well as proper programming and application development practices, including documentation.

Learning Outcomes: 1. Understand and apply basic technical knowledge to managerial problems. 2. Successfully write, test, and run computer programs designed to address managerial problems. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data

visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

MGMT 48800 - Data-Driven Decisions In Digital Markets

Credit Hours: 3.00. This course analyzes the changes in business models that have been enabled by Internet technologies, and exposes students to hands-on data analyses to quantify the impact these technologies and business models have on firms, economies, and people. A programming course such as MGMT 28800 Programming for Business Applications or MGMT 38800 Python for Business or CS 17600 Data Engineering in Python or CS 17700 Programming with Multimedia Objects or CNIT 17500 Visual Programming or CS 18000 Problem Solving & Object Oriented Programming and a statistics course such as STAT 30301 Probability & Statistics for Business or MGMT 30500 Business Statistics is highly recommended.

Learning Outcomes: 1. Recognize the role of business models and data-driven decisions in digital markets. 2. Measure, evaluate, and improve online technology usage, advertisement campaigns, and product pricing to meet specific business objective like better serving customers, customer acquisition, quantifying network effects, etc. 3. Analyze the sheer amount of data ("traces") collected by businesses from different touch points - Google Glass, Apple Watch, smart phones, or simple computing devices - and make critical business decisions. Credits: 3.00

MGMT 42120 - Data & AI-Driven Marketing

Credit Hours: 3.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course offers an immersive exploration into the intersection of data science, artificial intelligence, and marketing strategies, providing students with the knowledge and skills to thrive in the digital era. It will discuss uses of data science tools and AI algorithms in marketing applications, such as personalized marketing, sentiment analysis, and ad campaign optimization. Students will also gain hands-on experience on applying the methods to real-world data.

Learning Outcomes: 1. Identify modern statistical & machine learning methods required for marketing using big data. 2. Carry out applying statistical and machine learning methods to improve major marketing decisions. 3. Implement statistical and machine learning methods in Python using real-world data. Credits: 3.00

Cultural Competency Selectives (3 credits)

Other Departmental/Program Course Requirements (29-43 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments.

CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of

social behaviors and inequalities. Credits: 3.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation

techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is

primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity,

coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of

good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions,

conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Electives (0-14 credits)

Optional Concentration for Supply Chain & Operations Management, BS

Sample 4-Year Plan

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different

audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-21 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to

informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with

transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

16-21 Credits

Fall 2nd Year

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

13-15 Credits

Spring 2nd Year

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their

business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

15 Credits

Fall 3rd Year

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by

modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

MGMT 46501 - Strategic Sourcing And Procurement Operations Analytics

Credit Hours: 3.00. This elective course will serve as an important complement to the existing OM modules (e.g., MGMT 36100 Operations Management) to introduce more in-depth knowledge about supply chain management to undergraduate students, especially those major in SC&OM, focusing on strategic sourcing and procurement operations which are the building blocks for supply chain operations. More specifically, this course will introduce procure-to-pay process, category management, supplier selection and evaluation, supplier relationship management, vertical integration, global sourcing, outsourcing, auctioning, supply contract design and negotiation, business ethics, legal and compliance issues, etc. Sourcing and procurement is the major job title for supply chain operations jobs in the industry and our course can also help students to get the professional certificate of sourcing and procurement. Hence, it may also help senior students prepare for the job placements.

Learning Outcomes: 1. Master the working knowledge and vocabulary of strategic sourcing and procurement. 2. Know how to design and manage the business process in sourcing operations. 3. Know how to align sourcing strategies with corporate strategies. 4. Know how to model the key decision-making process of sourcing operations. 5. Apply data analytics techniques to develop sourcing strategies. Credits: 3.00

15 Credits

Spring 3rd Year

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise

marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

15 Credits

Fall 4th Year

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective,

industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MGMT 46400 - Logistics: Concepts And Models

Credit Hours: 3.00. The course familiarizes students with main concepts and models of business logistics management. Through the course, students develop an ability to design, improve, and manage logistics operations such as Inventory, Transportation, Warehousing, and Logistics Network Design. Since logistics decisions often require certain trade-offs to be made, students develop necessary quantitative and qualitative analytical skills to improve their decision-making. At the end of the course, students should be able to analyze logistics strategy of a firm, identify problems and tradeoffs in different logistics functions, formulate the corresponding models, identify quantitative methods to solve it, obtain results and interpret them for small-size problems using standard spreadsheet software, communicate the results to a broader audience using business language, discuss issues and challenges in same-day delivery, humanitarian logistics, physical internet.

Learning Outcomes: 1. Know vocabulary of Logistics, and Supply Chain. 2. Design, improve and manage processes by learning decision making tools. 3. Become familiar with the key issues and problems facing an operations manager. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

15 Credits

Spring 4th Year

15 Credits

Supply Chain & Sales Engineering Technology, BS

About the Program

Degree Requirements

Department/Program Major Courses (46 credits)

Required Department Courses (46 credits)

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 34200 - Warehouse And Inventory Management

Credit Hours: 3.00. A course designed to develop understanding of types of warehouses, methods of organizing the warehouse environment, and determining efficient inventory control procedures. Technology applications related to the management of warehouse and inventory stock-keeping units (SKU) are investigated. Storage of inventory, placement of inventory, picking, packing, shipping, and other internal logistics management topics will be explored.

Learning Outcomes: 1. Identify activities associated with inventory and warehouse management. 2. Explain the relationship of inventory and warehouse management to supply chain management with other various functional areas, including corporate strategy. 3. Design various warehouse activities under given circumstances. 4. Describe material/distribution requirements planning (MRP/DRP) systems. Credits: 3.00

IET 34300 - Technical And Service Selling

Credit Hours: 3.00. A study of sales models and techniques for technical and service sales in business-to-business environments, including development of channel relationships, long-term sales agreements, customer relationship

management efforts, total cost of ownership tools and complex sales presentations. Covers critical sales skills such as e-economy sales and marketing, lead management, building credibility, consultative selling, ethical negotiations, and sustainable product management.

Learning Outcomes: 1. Explain the roles of technical and service sales in business to business channels. 2. Describe the relationship between personal selling and marketing. 3. Describe critical influencing factors on organizational buyer behavior. 4. Describe various types of buying situations and typical sales agreements. 5. Demonstrate a personal selling communication model. 6. Describe customer relationship management. Credits: 3.00

IET 34350 - Business To Business Sales Management

Credit Hours: 3.00. This course covers key topics in sales management while emphasizing customer relationship management, sales productivity, and the effects of technology on the sales function. Topics include analyzing multiple channel models; establishing sales plans; incentivizing and motivating the sales force; and evaluating, monitoring, and managing the effectiveness of the sales force.

Learning Outcomes: 1. Describe the responsibilities and challenges of sales in the management role. 2. Describe strategic sales planning; supporting sales recruitment, hiring, and training, evaluation and performance feedback. 3. Demonstrate a variety of data analytic techniques to forecast sales, establish sales goals, and create budgets. 4. Explain sales productivity measures used to establish and manage sales territories. 5. Describe the appropriate use of technology in managing sales. Credits: 3.00

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model; total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 43630 - Design Of Experiments

Credit Hours: 3.00. Introduction to statistical design of experiments. The course examines the difference between single, multivariate, and factorial experimental designs. Concepts of optimization and response surface methodologies are introduced. The course focuses on interpreting and communicating experimental results.

Learning Outcomes: 1. Formulate null and alternate hypotheses. 2. Apply appropriate statistical tests. 3. Design an appropriate experiment to test a hypothesis. 4. Differentiate between main effects and interaction effects. 5.

Distinguish between factorial and fractional factorial designs. 6. Apply response surface methodology. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

IET 44275 - Global Transportation And Logistics Management

Credit Hours: 3.00. A study of the various aspects of logistics. The development, implementation, and control of physical transportation systems, product distribution, warehousing, and inventory policy models will be emphasized. A working knowledge of third and fourth-party logistics and transportation strategies will be analyzed. The impact of logistics and transportation in the global environment will be discussed.

Learning Outcomes: 1. Describe the role of logistics and its relationship to other functional areas of business within a single firm and within the supply chain. 2. Explain various management and control techniques in logistics. 3. Apply statistical principles to evaluate the relative worth of cost-savings initiatives in the logistics industry. 4. Describe how enterprise resource planning (ERP) systems are used to manage logistics and transportation functions. Credits: 3.00

IET 44500 - Strategic Supply Chain Management

Credit Hours: 3.00. A course designed to build upon previous courses with subjects related to managing a distribution enterprise. Modules in sales management, financial analysis, strategic planning, logistics, purchasing, and the legalities of distributor and manufacturer relationships will be combined with case studies to provide students with practice in establishing policy and making decisions from the manager's point of view. Field trips may be required.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision making. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3.

Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

IET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

Other Departmental Courses (69 Credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide

constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-

assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with

comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality

management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs,

behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

Electives (5 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

14 Credits

Spring 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts;

critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain

strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

16 Credits

Fall 2nd Year

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16 Credits

Spring 2nd Year

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

IET 34200 - Warehouse And Inventory Management

Credit Hours: 3.00. A course designed to develop understanding of types of warehouses, methods of organizing the warehouse environment, and determining efficient inventory control procedures. Technology applications related to the management of warehouse and inventory stock-keeping units

(SKU) are investigated. Storage of inventory, placement of inventory, picking, packing, shipping, and other internal logistics management topics will be explored.

Learning Outcomes: 1. Identify activities associated with inventory and warehouse management. 2. Explain the relationship of inventory and warehouse management to supply chain management with other various functional areas, including corporate strategy. 3. Design various warehouse activities under given circumstances. 4. Describe material/distribution requirements planning (MRP/DRP) systems. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

15 Credits

Fall 3rd Year

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 34300 - Technical And Service Selling

Credit Hours: 3.00. A study of sales models and techniques for technical and service sales in business-to-business environments, including development of channel relationships, long-term sales agreements, customer relationship management efforts, total cost of ownership tools and complex sales presentations. Covers critical sales skills such as e-economy sales and marketing, lead management, building credibility, consultative selling, ethical negotiations, and sustainable product management.

Learning Outcomes: 1. Explain the roles of technical and service sales in business to business channels. 2. Describe the relationship between personal selling and marketing. 3. Describe critical influencing factors on organizational buyer behavior. 4. Describe various types of buying situations and typical sales agreements. 5. Demonstrate a personal selling communication model. 6. Describe customer relationship management. Credits: 3.00

IET 44275 - Global Transportation And Logistics Management

Credit Hours: 3.00. A study of the various aspects of logistics. The development, implementation, and control of physical transportation systems, product distribution, warehousing, and inventory policy models will be emphasized. A working knowledge of third and fourth-party logistics and transportation strategies will be analyzed. The impact of logistics and transportation in the global environment will be discussed.

Learning Outcomes: 1. Describe the role of logistics and its relationship to other functional areas of business within a single firm and within the supply chain. 2. Explain various management and control techniques in logistics. 3. Apply statistical principles to evaluate the relative worth of cost-savings initiatives in the logistics industry. 4. Describe how enterprise resource planning (ERP) systems are used to manage logistics and transportation functions. Credits: 3.00

15 Credits

Spring 3rd Year

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

IET 34350 - Business To Business Sales Management

Credit Hours: 3.00. This course covers key topics in sales management while emphasizing customer relationship management, sales productivity, and the effects of technology on the sales function. Topics include analyzing multiple channel models; establishing sales plans; incentivizing and motivating the sales force; and evaluating, monitoring, and managing the effectiveness of the sales force.

Learning Outcomes: 1. Describe the responsibilities and challenges of sales in the management role. 2. Describe strategic sales planning; supporting sales recruitment, hiring, and training, evaluation and performance feedback. 3. Demonstrate a variety of data analytic techniques to forecast sales, establish sales goals, and create budgets. 4. Explain sales productivity measures used to establish and manage sales territories. 5. Describe the appropriate use of technology in managing sales. Credits: 3.00

IET 43630 - Design Of Experiments

Credit Hours: 3.00. Introduction to statistical design of

experiments. The course examines the difference between single, multivariate, and factorial experimental designs. Concepts of optimization and response surface methodologies are introduced. The course focuses on interpreting and communicating experimental results.

Learning Outcomes: 1. Formulate null and alternate hypotheses. 2. Apply appropriate statistical tests. 3. Design an appropriate experiment to test a hypothesis. 4. Differentiate between main effects and interaction effects. 5. Distinguish between factorial and fractional factorial designs. 6. Apply response surface methodology. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

15 Credits

Fall 4th Year

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model; total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

ENGT 48000 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

15 Credits

Spring 4th Year

IET 44500 - Strategic Supply Chain Management

Credit Hours: 3.00. A course designed to build upon previous courses with subjects related to managing a distribution enterprise. Modules in sales management, financial analysis, strategic planning, logistics, purchasing, and the legalities of distributor and manufacturer relationships will be combined with case studies to provide students with practice in establishing policy and making decisions from the manager's point of view. Field trips may be required.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision making. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

14 Credits

Sustainable Food and Farming Systems, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (26 credits)

Required Major Courses (11 credits)

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural

enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

SFS 35100 - SFS Capstone Project

Credit Hours: 1.00. The SFS Capstone Project is a directed-learning course that will require students to prepare and present a sustainability analysis of a farm enterprise, most likely the enterprise at which they conduct their required summer internship, and this may be an internship approved at an operation other than a farm. Students will be required to analyze and enterprise taking into account its economic, environmental and social sustainability, and its broader role in sustaining the local and regional economy, environment and community. The analysis will be prepared as a paper and a presentation that will be given to the undergraduates of the SFS program at an SFS program meeting. The paper and the presentation will be prepared in consultation with a faculty mentor from the SFS program committee and will be graded by the faculty mentor. Completion of an approved work or internship experience.

Learning Outcomes: 1. Analyze complex concepts. 2. Think critically about systems and

business operations from a range of different economic and social contexts. 3. Develop written and oral communication skills. Credits: 1.00

Major Selectives (15 credits)

Ecology/Environment Selective (3 credits)

Pest Management Selectives (6 credits)

Systems Modules Selective (6 credits)

Other Departmental/Program Course Requirements (71-72 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience

and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience

and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises

illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12.

Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical

processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical

models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.
University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.
Credits: 3.00

AGRY 58000 - Soil And Rhizosphere Microbiology

Credit Hours: 3.00. Soils are complex ecosystems that host a diverse array of organisms, which interact with and respond to their environment. This course explores the ecology, evolution, and functions of soil microbes, with a particular focus on their interactions with plants. Through this course, students will gain an understanding of the metabolic processes and life-history strategies of archaea, bacteria, fungi, and viruses in soil, root, and rhizosphere compartments. Students will also survey the microbiomes of diverse soil ecosystems, such as forests, agroecosystems, and grasslands, and learn principles of soil microbiology and biogeochemistry. In addition, students will acquire practical knowledge about the methods used for characterizing microbes in soil and plant systems.
Learning Outcomes: 1. Demonstrate understanding of the ecology and physiology of major groups of bacteria, archaea, fungi, and viruses found in soils, the rhizosphere, and roots. 2. Compare and contrast soil and rhizosphere microbiomes, and their differences between the managed versus natural ecosystems. 3. Use verbal and basic mathematical descriptions to explain theories related to microbial growth, survival, and symbioses. 4. Predict the occurrence of microbial processes and soil conditions that govern the cycling of carbon, nitrogen, phosphorus, sulfur, and metals in soils and relate this knowledge to ecosystem functions. 5. Envision potential applications for soil and root-borne microbes in natural resource management, such as agriculture, forestry, and soil conservation. 6. Apply knowledge of plant-microbe interactions to develop hypotheses, design experiments, and select appropriate study methods. 7. Recognize and select appropriate resources and tools to effectively analyze microbiome data. Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab

prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human

nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

HORT 32100 - Hydroponics Systems

Credit Hours: 3.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in controlled environment agriculture (CEA). This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

Learning Outcomes: 1. Describe essential components of single-pass and recirculating hydroponic systems. 2. Compare different substrates and hydroponic system designs. 3. Interpret water quality analysis results and recommend corrections. 4. Create nutrient solutions using salts or mixed fertilizers. 5. Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponics. 6. Select hydroponic systems for production of leafy greens, herbs, and vegetable crops. 7. Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Electives (22-23 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in

cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions.

6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15 Credits

Spring 1st Year

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of

creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7.

Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

16-17 Credits

Fall 2nd Year

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 30100 - Agroecology

Credit Hours: 3.00. This course introduces students to the application of ecological concepts to food production systems and farm management. We will consider species interactions, nutrient and water cycles, regenerative practices, alternative approaches to agriculture, and ecosystem services provided to and by agro-ecosystems.

Learning Outcomes: 1. Understand key connections between ecology and agriculture. 2. Apply the agro-ecosystem concept to farming systems. 3. Discuss the relative strengths and weaknesses of conventional and alternative forms of agriculture. 4. Understand the effect of farm management practices on primary productivity, nutrient cycling, and species interaction. 5. Evaluate ecosystem services provided to and by agro-ecosystems. 6. Consider the role of social factors on farming systems. 7. Discuss the potential for ecologically based agriculture to address farming issues at local, regional, and global levels. Credits: 3.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

15 Credits

Spring 2nd Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The

behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great

activities and opportunities that Purdue has to offer. Credits: 1.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the

molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

16-17 Credits

Fall 3rd Year

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific

method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

AGRY 58000 - Soil And Rhizosphere Microbiology

Credit Hours: 3.00. Soils are complex ecosystems that host a diverse array of organisms, which interact with and respond to their environment. This course explores the ecology, evolution, and functions of soil microbes, with a particular focus on their interactions with plants. Through this course, students will gain an understanding of the metabolic processes and life-history strategies of archaea, bacteria, fungi, and viruses in soil, root, and rhizosphere compartments. Students will also survey the microbiomes of diverse soil ecosystems, such as forests, agroecosystems, and grasslands, and learn principles of soil microbiology and biogeochemistry. In addition, students will acquire practical knowledge about the methods used for characterizing microbes in soil and plant systems.

Learning Outcomes: 1. Demonstrate understanding of the ecology and physiology of major groups of bacteria, archaea, fungi, and viruses found in soils, the rhizosphere, and roots. 2. Compare and contrast soil and rhizosphere microbiomes, and their differences between the managed versus natural ecosystems. 3. Use verbal and basic mathematical descriptions to explain theories related to microbial growth, survival, and symbioses. 4. Predict the occurrence of microbial processes and soil conditions that govern the cycling of carbon, nitrogen, phosphorus, sulfur, and metals in soils and relate this knowledge to ecosystem functions. 5. Envision potential applications for soil and root-borne microbes in natural resource management, such as agriculture, forestry, and soil conservation. 6. Apply knowledge of plant-microbe interactions to develop hypotheses, design experiments, and select appropriate study methods. 7. Recognize and select appropriate resources and tools to effectively analyze microbiome data. Credits: 3.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze

book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

15 Credits

Spring 3rd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab

prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 31900 - Controlled Environment Production Of Horticultural Crops

Credit Hours: 3.00. This course combines production principles with environmental concepts and advances in technology to provide a comprehensive training in sustainable production of herbaceous ornamentals and vegetables in controlled environment systems. The laboratory instruction provides hands-on experience with the practice of growing crops under controlled environments by combining the learning from lab prep with the use of technology to control environment during production.

Learning Outcomes: 1. Become familiar with best management practices for growing herbaceous ornamentals and vegetables that improve sustainability in controlled environments. 2. Learn how above and below ground environments interact with crop production. 3. Learn basics about the state-of-the-art technologies used in controlled environment agricultural production to monitor and control environments. 4. Interact with industry professionals to gain first-hand knowledge about careers and development in commercial horticulture. 5. Gain sufficient background in science, technology and regulations required to become entrepreneurs, next generation growers and researchers in the controlled environment agriculture industry. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

15 Credits

Fall 4th Year

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial

terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

SFS 35100 - SFS Capstone Project

Credit Hours: 1.00. The SFS Capstone Project is a directed-learning course that will require students to prepare and present a sustainability analysis of a farm enterprise, most likely the enterprise at which they conduct their required summer internship, and this may be an internship approved at an operation other than a farm. Students will be required to analyze and enterprise taking into account its economic, environmental and social sustainability, and its broader role in sustaining the local and regional economy, environment and community. The analysis will be prepared as a paper and a presentation that will be given to the undergraduates of the SFS program at an SFS program meeting. The paper and the presentation will be prepared in consultation with a faculty mentor from the SFS program committee and will be graded by the faculty mentor. Completion of an approved work or internship experience.

Learning Outcomes: 1. Analyze complex concepts. 2. Think critically about systems and business operations from a range of different economic and social contexts. 3. Develop written and oral communication skills. Credits: 1.00

16 Credits

Spring 4th Year

13-14 Credits

Theatre, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (39 credits)

A. Foundation Studies (21 credits)

1. Required Courses (17 credits)

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 38000 - Histories Of Theatre

Credit Hours: 3.00. Variable topics in theatre and performance history. Emphasis on the study of the works, aesthetics, and innovations of a theatrical form/genre alongside social, cultural, economic, and political contexts.

Credits: 3.00

THTR 38100 - Theatre And Performance Historiography

Credit Hours: 3.00. Historiographic analysis of theatre, drama, and performance of the 20th and 21st centuries. Emphasis on the relationship between modern and contemporary performance to world history from social, political, and cultural perspectives. Course includes both written and practical components. Prerequisites: THTR 201, THTR 271.

Learning Outcomes: 1. Interpret plays, performances, and performance theory from the

20th and 21st century. 2. Analyze theatre and performance histories through a combination of historical research, critical questioning, and practical application. 3. Demonstrate how political, economic, and cultural structures impact theatre and performance histories of the 20th and 21st Century. 4. Demonstrate skills in research, collaboration, and oral presentation. Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

2. Foundation Practicums (4 credits)

THTR 16000 - Introduction To Scene Design And Technology

Credit Hours: 2.00. This course is designed to introduce the students to the process and tools of scene design and technology.

Credits: 2.00

THTR 16100 - Introduction To Costume Design And Technology

Credit Hours: 2.00. Introduction to analytical, artistic, and practical skills required when creating costumes for theatre. Beginning training in elements and principles of design, rendering and presentation skills. Elementary instruction in costume construction, including hand and machine sewing, costume crafts, and basic patterning.

Credits: 2.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of

a sound crew. Credits: 2.00

B. Theatre Immersions (3 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 53600 - Advanced Problems In Acting

Credit Hours: 2.00 or 3.00. Advanced study of selected problems in acting, including detailed role and play analyses, thorough rehearsals and critiques of performance. Permission of instructor required.

Credits: 2.00 or 3.00

C. Theatre and Perfomance Selectives (12 credits)

1. Studies in Theatre and Performance

THTR 38000 - Histories Of Theatre

Credit Hours: 3.00. Variable topics in theatre and performance history. Emphasis on the study of the works, aesthetics, and innovations of a theatrical form/genre alongside social, cultural, economic, and political contexts.

Credits: 3.00

DANC 37900 - The Art Of Protest: An Examination Of The Role Of Arts, Artists, Activism, & Social Transformation

Credit Hours: 3.00. Throughout history, art has been used to advocate for political movements and provoke social action and transformation. This course examines the role of the arts and the artist and their relationship to activism throughout history and beyond. We will investigate how art has been used as a tool to transform cultural perspectives, alter policies, and promote social change. We will explore a range of artists whose methodologies, materials and approach challenge the cultural norms. From printmakers to musicians, to choreographers, to performance artists, students will engage and evaluate the act of art-making as a tactic of resistance and the responses to those acts. We will investigate readings that argue for and against the need for artists to make work that politically challenge their society. Once a foundation of knowledge has been laid, we will turn to the creative process through an investigation of materials and practices - performance, mixed media, and photography. Students will research, watch, discuss, create, and perform their own projects that promote social transformation.

Learning Outcomes: 1. Demonstrate effective oral and written communication in formal assignments, critical analysis, and class presentations. 2. Demonstrate through creative projects how art, culture, and activism have a direct and interactive relationship. 3. Investigate and critically engage with artists whose work transform cultural perspectives, alter policies, provide socio-political commentary, and promote social change. 4. Analyze seminal art and historical and philosophical texts that articulate the role and importance of political art. Credits: 3.00

THTR 48400 - Performance, Media, And Technology

Credit Hours: 3.00. This course explores the intersection of performance, media, and technology from the early 20th century through present day, examining how technological innovations have transformed performance practices and audience

experiences.

Learning Outcomes: 1. Describe the historical development of media and technology in 20th and 21st-century performance. 2. Apply theories of liveness, remediation, intermediality, and mediatization toward analysis of contemporary performance practices. 3. Assess the impacts of new media on concepts such as narrative, space, text, and embodiment. 4. Generate strategies for conceptualizing projects that integrate media into performance. Credits: 3.00

2. Design for Theatre and Performance

THTR 35400 - Painting For The Stage

Credit Hours: 3.00. The principles and practice of painting for the stage. Study of tools, media, and techniques used in traditional scenic painting, costume painting, and the creation of dimensionality on various surfaces. Offered alternate years.

Credits: 3.00

THTR 36000 - Scenic Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into an environment for dramatic action. Emphasis on the interrelationship among all aspects of production and how the scenic element becomes a building block toward total picturization. Offered alternate years.

Credits: 3.00

THTR 36100 - Costume Design

Credit Hours: 3.00. Theory and principles of design specifically applied to stage costume design. Emphasis on the interrelationship of all aspects of production and how the costume becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

3. Acting for Theatre and Performance

THTR 23300 - Acting II

Credit Hours: 3.00. Continued development of the basic acting tools of objectives, actions, justification, and personalization; continued vocal and physical work; introduction of script and character analysis; and the introduction of audition techniques. The course will use material from contemporary dramatic literature in the rehearsal process. Prerequisite: THTR 133. Instructor permission required for non-majors.

Learning Outcomes: 1. Practice and incorporate relaxation, physical, vocal, and sense memory exercises into a daily warm-up. 2. See, connect, and respond to a partner within improvised scenarios. 3. Read plays with insight and imagine the experience of the characters in the given circumstance of a play. 4. Analyze and break scenes down into beats, with each beat having a clear action and objective. 5. Analyze, rehearse and publicly perform an open scene, and a contemporary monologue and scene. Credits: 3.00

THTR 33300 - Acting III

Credit Hours: 3.00. Application of foundational acting techniques to specific disciplines. May be repeated for credit. Instructor permission required for non-majors.

Learning Outcomes: 1. Identify, define, describe and demonstrate the basic principles of the craft of acting. 2. Identify, define, describe and demonstrate the basic terminology of stage technique. 3. Identify, define and describe the basic principles of script & character analysis. 4. Read, investigate, interpret and articulate your analysis of specific plays from the canon of 20th and 21st Century realistic dramatic literature. 5. Develop critical thinking as it applies to your own work, your peers' work and in production work. Credits: 3.00

THTR 43300 - Acting IV

Credit Hours: 3.00. Adaptation of acting techniques to professional applications.

Learning Outcomes: 1. Develop and demonstrate the application of metrical analysis. 2. Identify the poetic devices in classical text and demonstrate these in performance. 3. Demonstrate critical thinking skills of analysis, interpretation and application. 4. Analyze Shakespeare's characters in reference to their historical period. 5. Develop a systematic approach for performing classical text. Credits: 3.00

D. Upper Level Electives in Theatre and Performance (3 credits)

Optional Concentrations

Electives (47-56 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

15-16 Credits

Spring 1st Year

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 53600 - Advanced Problems In Acting

Credit Hours: 2.00 or 3.00. Advanced study of selected problems in acting, including detailed role and play analyses, thorough rehearsals and critiques of performance. Permission of instructor required.

Credits: 2.00 or 3.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

14-17 Credits

Fall 2nd Year

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 53600 - Advanced Problems In Acting

Credit Hours: 2.00 or 3.00. Advanced study of selected problems in acting, including detailed role and play analyses, thorough rehearsals and critiques of performance. Permission of instructor required.

Credits: 2.00 or 3.00

15-17 Credits

Spring 2nd Year

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 53600 - Advanced Problems In Acting

Credit Hours: 2.00 or 3.00. Advanced study of selected problems in acting, including detailed role and play analyses, thorough rehearsals and critiques of performance. Permission of instructor required.

Credits: 2.00 or 3.00

16-18 Credits

Fall 3rd Year

THTR 38100 - Theatre And Performance Historiography

Credit Hours: 3.00. Historiographic analysis of theatre, drama, and performance of the 20th and 21st centuries. Emphasis on the relationship between modern and contemporary performance to world history from social, political, and cultural perspectives. Course includes both written and practical components. Prerequisites: THTR 201, THTR 271.

Learning Outcomes: 1. Interpret plays, performances, and performance theory from the 20th and 21st century. 2. Analyze theatre and performance histories through a combination of historical research, critical questioning, and practical application. 3. Demonstrate how political, economic, and cultural structures impact theatre and performance histories of the 20th and 21st Century. 4. Demonstrate skills in research, collaboration, and oral presentation. Credits: 3.00

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

13-15 Credits

Spring 4th Year

15 Credits

Themed Entertainment Design, BS (Indianapolis Only)

About the Program

Degree Requirements

Departmental/Program Major Courses (76 credits)

Required Major Courses (49 credits)

CGT 11200 - Sketching For Visualization And Communication

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication, and creativity within a sketching metaphor. Exercises and projects in graphic theory, problem solving, and sketching skill development provide students with activities that focus on further development within the discipline. A variety of sketching techniques are used to gather critical information and transform data into effective communication instruments.

Learning Outcomes: 1. Awaken creativity and problem-solving through the means of sketching. 2. Develop fine motor skills: Becoming a artisan. 3. Explore Aesthetics as it pertains to sketching. 4. Learn and practice professional methods of look development. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14700 - Visual Effects Introduction

Credit Hours: 3.00. This course introduces students to the visual effects techniques using common methodologies and tools. Topics include procedural frameworks, 3D pipeline implementation, vector operations, and simulating physical phenomena for entertainment graphics. Special emphasis is placed on achieving aesthetically please entertainment-grade graphics using visual effects techniques.

Learning Outcomes: 1. Describe visual effects pipeline. 2. Implement simple simulations using common visual effects tools and techniques. 3. Explore options for visual effects career pathways. 4. Create aesthetically pleasing visual effects using production tools and techniques. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT

professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 12300 - Animation Foundations

Credit Hours: 3.00. In this course, students are introduced to the core concepts and principles of animated motion. The course includes an overview of animation history and the evolution of animation technology. Principles of animation production are explored through practical exercises executed in a range of animation software types. These exercises will familiarize students with different approaches to creating animated motion, with a focus on keyframed digital animation.

Learning Outcomes: 1. Identify the sequence of major milestones in the history of animation technology, style and industry. 2. Demonstrate fundamental animation skills and principles including anticipation, squash & stretch, timing, easing and motion arcs. 3. Create animated images of objects and characters in digital animation software that communicate believable motion. 4. Arrange and manipulate geometric objects and systems in digital animation software, creating a range of defined outputs including still images and image sequences suitable for animation workflows. Credits: 3.00

CGT 44200 - Production For Computer Animation

Credit Hours: 3.00. An applied course covering advanced spline modeling techniques, lighting techniques, applied shading, motion dynamics and controllers, particle systems, application customization programming, and pre-production development and planning. Study of emerging advancements in computer animation and spatial graphic technologies will be included.

Learning Outcomes: 1. Identify career opportunities in computer graphics and related

industries. 2. Assess, classify and critique peer and professional-level portfolios in relation to industry roles 3. Define major project outcomes that align with specific career pathways. 4. Develop and manage production plans for a major entertainment graphics project. 5. Manage teams or individual tasks to execute defined goals within entertainment graphics projects. 6. Create professional portfolio or showreel pieces that demonstrate industry relevant skills. Credits: 3.00

CGT 25100 - Principles Of Creative Design

Credit Hours: 3.00. This course is an exploration of conceptualization and problem-solving using the integration of type and image as both visual and verbal communication. Topics such as systems of organization, visual hierarchy, creativity, typography, color, and navigation are introduced and explored.

Credits: 3.00

CGT 31300 - Digital Painting I For Computer Graphics

Credit Hours: 3.00. This course introduces students to digital painting techniques for graphical visualization and communication. Topics include industry standard practices and instruction in digital brush creation, digital mark making, value under painting, color palettes, and lighting and rendering to produce various computer graphics.

Credits: 3.00

CGT 40700 - Current And Future Trends In Themed Attraction Design

Credit Hours: 3.00. Students will learn about current trends in immersive attractions. Current technologies will be explored that can be used to enhance the narrative in a themed immersive space. Students will explore technologies, narrative techniques and integration of engineering.

Credits: 3.00

CGT 11700 - Illustrating For Visualization And Communication

Credit Hours: 3.00. This foundation course stresses the use of pictorial illustration for visualization and communication. Various projection systems are introduced with discussion focusing on the appropriate use of view and system utilized to accentuate and provide clear communication. A variety of digital tools are used to construct, extract and render pictorial views using vector and raster tools.

Credits: 3.00

CGT 20400 - Introduction To Themed Attraction Design

Credit Hours: 3.00. An introduction to immersive attraction; including the consideration of operations, graphics, engineering, technology and design. Students will apply their knowledge in narration and graphic principles to concept projects in immersive spaces.

Credits: 3.00

CGT 32800 - Business Of Themed Entertainment

Credit Hours: 3.00. This course provides an insider's look at the skills needed to succeed in themed entertainment industry as well as provide an overview of the experience economy. Students will get an insider understanding of the project process, working with outside vendors, team communication, common constraints and budgeting.

Credits: 3.00

CGT 31700 - Planning And Communicating Themed Attraction Design

Credit Hours: 3.00. Building on students knowledge of narrative creation and design, students will learn about the fundamentals of operations, graphics, engineering, technology and design to create theme-based immersive attractions. This course will focus on design concepts, technical design, management and creation of immersive experiences.

Credits: 3.00

CGT 36700 - Previsualization In Themed Entertainment

Credit Hours: 3.00. This course provides an overview of themed entertainment development from concept to previsualization and communication. Students will have the opportunity to take initial concepts for themed experiences and visualize them to communicate to multiple external audiences.

Credits: 3.00

CGT Entertainment Selectives (15 credits)

Other Departmental/Program Course Requirements (40 credits)

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences.

Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business

documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify

substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in

quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Technical Selectives (12 credits)

Elective (4 credits)

Supplemental Information

Grade Requirements

GPA Requirements

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

CGT 11200 - Sketching For Visualization And Communication

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication, and creativity within a sketching metaphor. Exercises and projects in graphic theory, problem solving, and sketching skill development provide students with activities that focus on further development within the discipline. A variety of sketching techniques are used to gather critical information and transform data into effective communication instruments.

Learning Outcomes: 1. Awaken creativity and problem-solving through the means of sketching. 2. Develop fine motor skills: Becoming a artisan. 3. Explore Aesthetics as it pertains to sketching. 4. Learn and practice professional methods of look development. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

CGT 12300 - Animation Foundations

Credit Hours: 3.00. In this course, students are introduced to the core concepts and principles of animated motion. The course includes an overview of animation history and the evolution of animation technology. Principles of animation production are explored through practical exercises executed in a range of animation software types. These exercises will familiarize students with different approaches to creating animated motion, with a focus on keyframed digital animation.

Learning Outcomes: 1. Identify the sequence of major milestones in the history of animation technology, style and industry. 2. Demonstrate fundamental animation skills and principles including anticipation, squash & stretch, timing, easing and motion arcs. 3. Create animated

images of objects and characters in digital animation software that communicate believable motion. 4. Arrange and manipulate geometric objects and systems in digital animation software, creating a range of defined outputs including still images and image sequences suitable for animation workflows. Credits: 3.00

CGT 11700 - Illustrating For Visualization And Communication

Credit Hours: 3.00. This foundation course stresses the use of pictorial illustration for visualization and communication. Various projection systems are introduced with discussion focusing on the appropriate use of view and system utilized to accentuate and provide clear communication. A variety of digital tools are used to construct, extract and render pictorial views using vector and raster tools.

Credits: 3.00

15 Credits

Spring 1st Year

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CGT 25100 - Principles Of Creative Design

Credit Hours: 3.00. This course is an exploration of conceptualization and problem-solving using the integration of type and image as both visual and verbal communication. Topics such as systems of organization, visual hierarchy, creativity, typography, color, and navigation are introduced and explored.

Credits: 3.00

CGT 20400 - Introduction To Themed Attraction Design

Credit Hours: 3.00. An introduction to immersive attraction; including the consideration of operations, graphics, engineering, technology and design. Students will apply their knowledge in narration and graphic principles to concept projects in immersive spaces.

Credits: 3.00

15 Credits

Fall 2nd Year

CGT 14700 - Visual Effects Introduction

Credit Hours: 3.00. This course introduces students to the visual effects techniques using common methodologies and tools. Topics include procedural frameworks, 3D pipeline

implementation, vector operations, and simulating physical phenomena for entertainment graphics. Special emphasis is placed on achieving aesthetically please entertainment-grade graphics using visual effects techniques.

Learning Outcomes: 1. Describe visual effects pipeline. 2. Implement simple simulations using common visual effects tools and techniques. 3. Explore options for visual effects career pathways. 4. Create aesthetically pleasing visual effects using production tools and techniques. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 2nd Year

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals,

and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CGT 32800 - Business Of Themed Entertainment

Credit Hours: 3.00. This course provides an insider's look at the skills needed to succeed in themed entertainment industry as well as provide an overview of the experience economy. Students will get an insider understanding of the project process, working with outside vendors, team communication, common constraints and budgeting.

Credits: 3.00

CGT 31700 - Planning And Communicating Themed Attraction Design

Credit Hours: 3.00. Building on students knowledge of narrative creation and design, students will learn about the fundamentals of operations, graphics, engineering, technology and design to create theme-based immersive attractions. This course will focus on design concepts, technical design, management and creation of immersive experiences.

Credits: 3.00

17 Credits

Fall 3rd Year

CGT 44200 - Production For Computer Animation

Credit Hours: 3.00. An applied course covering advanced spline modeling techniques, lighting techniques, applied shading, motion dynamics and controllers, particle systems, application customization programming, and pre-production development and planning. Study of emerging advancements in computer animation and spatial graphic technologies will be included.

Learning Outcomes: 1. Identify career opportunities in computer graphics and related industries. 2. Assess, classify and critique peer and professional-level portfolios in relation to industry roles 3. Define major project outcomes that align with specific career pathways. 4. Develop and manage production plans for a major entertainment graphics project. 5. Manage teams or individual tasks to execute defined goals within entertainment graphics projects. 6. Create professional portfolio or showreel pieces that demonstrate industry relevant skills. Credits: 3.00

CGT 36700 - Previsualization In Themed Entertainment

Credit Hours: 3.00. This course provides an overview of themed entertainment development from concept to previsualization and communication. Students will have the opportunity to take initial concepts for themed experiences and visualize them to communicate to multiple external audiences.

Credits: 3.00

15 Credits

Spring 3rd Year

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 31300 - Digital Painting I For Computer Graphics

Credit Hours: 3.00. This course introduces students to digital painting techniques for graphical visualization and communication. Topics include industry standard practices and instruction in digital brush creation, digital mark making, value under painting, color palettes, and lighting and rendering to produce various computer graphics.

Credits: 3.00

15 Credits

Fall 4th Year

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 40700 - Current And Future Trends In Themed Attraction Design

Credit Hours: 3.00. Students will learn about current trends in immersive attractions. Current technologies will be explored that can be used to enhance the narrative in a themed immersive space. Students will explore technologies, narrative techniques and integration of engineering.

Credits: 3.00

14 Credits

Spring 4th Year

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

14 Credits

Turf Management and Science, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (39 credits)

Required Major Courses (18 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn care companies, and sod production facilities in an efficient and environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

Major Selectives (21 credits)

Other Departmental/Program Course Requirements (74-76 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to

undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems.

4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is

on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to

apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

Electives (5-7 credits)

Supplemental List

Internship/Work Experience Requirement

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application

problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

15-16 Credits

Spring 1st Year

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

15 Credits

Fall 2nd Year

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

16 Credits

Spring 2nd Year

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

15 Credits

Fall 3rd Year

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

15 Credits

Spring 3rd Year

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.
Credits: 4.00

15-16 Credits

Fall 4th Year

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn care companies, and sod production facilities in an efficient and environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

AGRY 51400 - Environmental Stress Management For Turfgrass

Credit Hours: 1.00. Designed for students who desire an understanding of how environmental stresses influence turfgrass growth and how they can be managed with cultural practices. The course covers current research findings in stress management and integrates turfgrass environmental physiology with turfgrass management.

Learning Outcomes: 1. Demonstrate ability to identify problems, analyze data and derive

conclusions. 2. Demonstrate critical thinking and the ability to write and speak with effectiveness. 3. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 1.00

16 Credits

Spring 4th Year

12-14 Credits

Unmanned Aerial Systems, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (64 credits)

Required Major Courses (64 credits)

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication. Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission

of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major aircraft systems work together. Credits: 3.00

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 26502 - Aircraft Electrical Systems

Credit Hours: 3.00. An in-depth study of aircraft electrical components, both individually and as systems in the aircraft. DC electrical circuits, series and parallel circuits, magnetism, and electromagnetism are covered, as are DC power systems, schematics, and aircraft wiring practices. Aircraft charging systems, main power distribution, solid state electronics, batteries, and motors are also discussed.

Learning Outcomes: 1. Develop an understanding of electrical principles as they relate to aircraft system operation. 2. Construct, analyze, and isolate faults in circuits. 3. Demonstrate troubleshooting procedures for direct currently electrical aircraft components and power distribution circuits. Credits: 3.00

AT 33502 - Avionics Systems

Credit Hours: 3.00. This course covers the theory of operation and applications of common electrical components used in various aircraft circuits. The theory and mathematical relationships of alternating current, reactance, impedance, and phase shift are examined. Operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems are investigated.

Learning Outcomes: 1. Demonstrate the theory of operation and application of common electrical components used in various aircraft circuits. 2. Demonstrate the operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems. 3. Explain the theory and mathematical relationship of alternating current, reactance, impedance, and phase shift. Credits: 3.00

AT 20900 - Autonomous Aircraft Technology And Maintenance I

Credit Hours: 3.00. This course introduces fundamental concepts of autonomous aircraft technology and maintenance. Topics include history, airframe and powerplant selection, regulations governing uncrewed systems, airspace descriptions, safety, autonomous system programming and calibration, data package options, weather, system maintenance and repair, manual flight training, and aerodynamics and flight controls for autonomous aircraft.

Learning Outcomes: 1. Reflect on the history of UAS and project the future growth of UAS. 2. Analyze data sources to determine flight feasibility and mitigate hazards. 3. Collaborate effectively as a crew member both in the lab and in the field. 4. Design and print flight ready 3D model. 5. Assess airspace and flight feasibility by submission of FAA waiver application. 6. Demonstrate effective design choices. Credits: 3.00

AT 21900 - Autonomous Aircraft Technology And Maintenance II

Credit Hours: 3.00. This course will further develop skills and understanding of autonomous aircraft technology and maintenance. Emphasis will be on design, selection, construction, flight test, evaluation, and repair, of stabilized uncrewed aircraft. Students will work hands-on with open-source flight controllers to perform autonomous missions. Additionally, students will design and deploy scenario-specific sensors using student-constructed rotorcraft. Students will be expected to demonstrate their sensor payload through lab and field demonstration and professional documentation.

Learning Outcomes: 1. Apply flight principles to building a UAS capable of performing a specific operation. 2. Analyze and compare flight characteristics of UAS under different environmental and physical conditions. 3. Predict and compare flight characteristics of UAS using different components and configurations. 4. Integrate custom sensor payload into UAS design. 5. Safely and efficiently coordinate automated flights with team members. 6. Develop an enterprise-ready online user manual for UAS and sensor payload. Credits: 3.00

AT 31900 - Uncrewed Aircraft Systems: Applications, Data, And Documentation

Credit Hours: 3.00. Focused on applying uncrewed aircraft technology to specific data gathering missions. Sensor types, mounting selection, and control will be demonstrated. Emphasis will be placed on sensor payloads, mission planning, and data acquisition. Post-flight data processing and analysis will be conducted using GIS and Remote Sensing software applications. All specifications and procedures will be documented in an industry-accepted format.

Learning Outcomes: 1. Develop missions for fully autonomous aircraft. 2. Monitor and control system performance in real-time. 3. Conduct post-flight data analysis, with system performance evaluation and optimization. Credits: 3.00

AT 40900 - Advanced Air Mobility: Management And Operations

Credit Hours: 3.00. UAS capstone course. Application of AAM technologies across multiple commercial-type operations, including certification, application, and management. A demonstration of the cumulative knowledge and skills learned in previous UAS courses. Requires current FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Demonstrate the application of safety and risk management principles to AAM operations. 2. Examine the AAM entrepreneurial ecosystem and formulate a business prospectus based on current industry trends and regulatory policy. 3. Assess technical data sources to evaluate system health, to include ground and flight testing, troubleshooting, maintenance and repair, system configuration and payload integration. 4. Demonstrate the ability to plan, manage, and execute various AAM missions safely, legally, and efficiently. Credits: 3.00

AT 41901 - Advanced Air Mobility Capstone

Credit Hours: 3.00. The conclusion and demonstration of the cumulative knowledge and skills learned within the UAS curriculum. Students will engage in a series of assignments that will guide them toward proposing and researching a capstone project that demonstrates knowledge gained in UAS and AAM topics. Students are expected to focus on the development of deliverable products that demonstrate their skills as effective UAS operators.

Learning Outcomes: 1. Engage in applied UAS

and AAM research that applies skills and knowledge gained in UAS curriculum. 2. Focus on deliverable products that demonstrate marketable skills as a UAS pilot and operator. 3. Develop a strong foundation upon which to pursue UAS and AAM in the workplace or further graduate research. Credits: 3.00

AT 30901 - Introduction To UAS Sensor Technology

Credit Hours: 3.00. This course introduces students to multiple forms of UAS sensors and core fundamentals of Remote Sensing and Geospatial Technology. Students will be introduced to basic data capture and processing techniques and to effectively apply different forms of UAS sensors to real-world applications.

Learning Outcomes: 1. Identify and define core geospatial and remote sensing technology concepts. 2. Effectively associate and relate UAS sensor technology with related portions of the electromagnetic spectrum. 3. Identify and explain geographic coordinate systems and projections. 4. Process and Create UAS data products within a Geographic Information System. Credits: 3.00

AT 10901 - Introduction To Uncrewed Aircraft System Operations

Credit Hours: 3.00. This course will provide students the aeronautical knowledge required to operate a small UAS in the National Airspace. Students are introduced to various aspects of uncrewed aviation operations, which includes UAS system types and components, regulations and operational approvals, and indoctrination to the civil and commercial applications of UAS. Through the use of UAS simulation technology, students will develop basic small UAS flight skills and successfully complete various UAS operational scenarios. Upon successful completion of the course students will be prepared to obtain a Federal Aviation Administration (FAA) Remote Pilot Certificate with a Small UAS Rating. Permission of department is required.

Learning Outcomes: 1. Obtain an FAA Remote Pilot Certificate with a Small UAS Rating. 2. Understand small UAS terminology and technology. 3. Comply with regulatory framework and understand various UAS approval processes. 4. Understand basic small UAS operating procedures. 5. Appreciate and gain perspective on how to safely operate UAS in the national airspace system. 6. Using simulation technology, demonstrate basic small UAS flight maneuvers and execute basic flight operations. Credits: 3.00

AT 11901 - Uncrewed Aerial Systems: Safety And Risk Management

Credit Hours: 3.00. This course discusses the fundamental concepts of Safety and Risk Management and their application to UAS operations. The course will provide insight into strategies for developing and implementing a formal safety management system (SMS) that effectively supports an organization's UAS operations. In addition, students will gain an understanding of ethical decision-making and its relationship to safety. Laboratory exercises provide students practical application of this knowledge to various UAS operational scenarios, which includes utilizing SMS principles in assessing risks and developing appropriate mitigations. Must possess a valid FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Understand and demonstrate the application of safety and risk management principles to UAS operations. 2. Exemplify the UAS regulatory environment, which includes related regulatory approval and waiver processes. 3. Understand and apply technical data sources to evaluate UAS airworthiness and system health, to include ground and flight testing, troubleshooting, maintenance and repair. 4. Demonstrate the ability to plan and safely complete basic UAS missions that are regulatory compliant. 5. Understand and demonstrate ethical decision-making. Credits: 3.00

Other Departmental /Program Course Requirements (37 credits)

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions

and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance

test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective

sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (19 credits)

Supplemental Lists

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

AT 10901 - Introduction To Uncrewed Aircraft System Operations

Credit Hours: 3.00. This course will provide students the aeronautical knowledge required to operate a small UAS in the National Airspace. Students are introduced to various aspects of uncrewed aviation operations, which includes UAS system types and components, regulations and operational approvals, and indoctrination to the civil and commercial applications of UAS. Through the use of UAS simulation technology, students will develop basic small UAS flight skills and successfully complete various UAS operational scenarios. Upon successful completion of the course students will be prepared to obtain a Federal Aviation Administration (FAA) Remote Pilot Certificate with a Small UAS Rating. Permission of department is required.

Learning Outcomes: 1. Obtain an FAA Remote Pilot Certificate with a Small UAS Rating. 2. Understand small UAS terminology and technology. 3. Comply with regulatory framework and understand various UAS approval processes. 4. Understand basic small UAS operating procedures. 5. Appreciate and gain perspective on how to safely operate UAS in the national airspace system. 6. Using simulation technology, demonstrate basic small UAS flight maneuvers and execute basic flight operations. Credits: 3.00

16 Credits

Spring 1st Year

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication. Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

AT 26502 - Aircraft Electrical Systems

Credit Hours: 3.00. An in-depth study of aircraft electrical components, both individually and as systems in the aircraft. DC electrical circuits, series and parallel circuits, magnetism, and electromagnetism are covered, as are DC power systems, schematics, and aircraft wiring practices. Aircraft charging systems, main power distribution, solid state electronics, batteries, and motors are also discussed.

Learning Outcomes: 1. Develop an understanding of electrical principles as they relate to aircraft system operation. 2. Construct, analyze, and isolate faults in circuits. 3. Demonstrate troubleshooting procedures for direct currently electrical aircraft components and power distribution circuits. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and

trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AT 11901 - Uncrewed Aerial Systems: Safety And Risk Management

Credit Hours: 3.00. This course discusses the fundamental concepts of Safety and Risk Management and their application to UAS operations. The course will provide insight into strategies for developing and implementing a formal safety management system (SMS) that effectively supports an organization's UAS operations. In addition, students will gain an understanding of ethical decision-making and its relationship to safety. Laboratory exercises provide students practical application of this knowledge to various UAS operational scenarios, which includes utilizing SMS principles in assessing risks and developing appropriate mitigations. Must possess a valid FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Understand and demonstrate the application of safety and risk management principles to UAS operations. 2. Exemplify the UAS regulatory environment, which includes related regulatory approval and waiver processes. 3. Understand and apply technical data sources to evaluate UAS airworthiness and system health, to include ground and flight testing, troubleshooting, maintenance and repair. 4. Demonstrate the ability to plan and safely complete basic UAS missions that are regulatory compliant. 5. Understand and demonstrate ethical decision-making. Credits: 3.00

15 Credits

Fall 2nd Year

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major aircraft systems work together. Credits: 3.00

AT 33502 - Avionics Systems

Credit Hours: 3.00. This course covers the theory of operation and applications of common electrical components used in various aircraft circuits. The theory and mathematical relationships of alternating current, reactance, impedance, and phase shift are examined. Operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems are investigated.

Learning Outcomes: 1. Demonstrate the theory of operation and application of common electrical components used in various aircraft circuits. 2. Demonstrate the operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems. 3. Explain the theory and mathematical relationship of alternating current, reactance, impedance, and phase shift. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary

methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

AT 20900 - Autonomous Aircraft Technology And Maintenance I

Credit Hours: 3.00. This course introduces fundamental concepts of autonomous aircraft technology and maintenance. Topics include history, airframe and powerplant selection, regulations governing uncrewed systems, airspace descriptions, safety, autonomous system programming and calibration, data package options, weather, system maintenance and repair, manual flight training, and aerodynamics and flight controls for autonomous aircraft.

Learning Outcomes: 1. Reflect on the history of UAS and project the future growth of UAS. 2. Analyze data sources to determine flight feasibility and mitigate hazards. 3. Collaborate effectively as a crew member both in the lab and in the field. 4. Design and print flight ready 3D model. 5. Assess airspace and flight feasibility by submission of FAA waiver application. 6. Demonstrate effective design choices. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

16 Credits

Spring 2nd Year

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be

introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

AT 21900 - Autonomous Aircraft Technology And Maintenance II

Credit Hours: 3.00. This course will further develop skills and understanding of autonomous aircraft technology and maintenance. Emphasis will be on design, selection, construction, flight test, evaluation, and repair, of stabilized uncrewed aircraft. Students will work hands-on with open-source flight controllers to perform autonomous missions. Additionally, students will design and deploy scenario-specific sensors using student-constructed rotorcraft. Students will be expected to demonstrate their sensor payload through lab and field demonstration and professional documentation.

Learning Outcomes: 1. Apply flight principles to building a UAS capable of performing a specific operation. 2. Analyze and compare flight characteristics of UAS under different environmental and physical conditions. 3. Predict and compare flight characteristics of UAS using different components and configurations. 4. Integrate custom sensor payload into UAS design. 5. Safely and efficiently coordinate automated flights with team members. 6. Develop an enterprise-ready online user manual for UAS and sensor payload. Credits: 3.00

15 Credits

Fall 3rd Year

AT 30901 - Introduction To UAS Sensor Technology

Credit Hours: 3.00. This course introduces students to multiple forms of UAS sensors and core fundamentals of Remote Sensing and Geospatial Technology. Students will be introduced to basic data capture and processing techniques and to effectively apply different forms of UAS sensors to real-world applications.

Learning Outcomes: 1. Identify and define core geospatial and remote sensing technology concepts. 2. Effectively associate and relate UAS sensor technology with related portions of the electromagnetic spectrum. 3. Identify and explain geographic coordinate systems and projections. 4. Process and Create UAS data products within a Geographic Information System. Credits: 3.00

15 Credits

Spring 3rd Year

AT 31900 - Uncrewed Aircraft Systems: Applications, Data, And Documentation

Credit Hours: 3.00. Focused on applying uncrewed aircraft technology to specific data gathering missions. Sensor types, mounting selection, and control will be demonstrated. Emphasis will be placed on sensor payloads, mission planning, and data acquisition. Post-flight data processing and analysis will be conducted using GIS and Remote Sensing software applications. All specifications and procedures will be documented in an industry-accepted format.

Learning Outcomes: 1. Develop missions for fully autonomous aircraft. 2. Monitor and control system performance in real-time. 3. Conduct post-flight data analysis, with system performance evaluation and optimization. Credits: 3.00

15 Credits

Fall 4th Year

AT 40900 - Advanced Air Mobility: Management And Operations

Credit Hours: 3.00. UAS capstone course. Application of AAM technologies across multiple commercial-type operations, including certification, application, and management. A demonstration of the cumulative knowledge and skills learned in previous UAS courses. Requires current FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Demonstrate the application of safety and risk management principles to AAM operations. 2. Examine the AAM entrepreneurial ecosystem and formulate a business prospectus based on current industry trends and regulatory policy. 3. Assess technical data sources to evaluate system health, to include ground and flight testing, troubleshooting, maintenance and repair, system configuration and payload integration. 4. Demonstrate the ability to plan, manage, and execute various AAM missions safely, legally, and efficiently. Credits: 3.00

15 Credits

Spring 4th Year

AT 41901 - Advanced Air Mobility Capstone

Credit Hours: 3.00. The conclusion and demonstration of the cumulative knowledge and skills learned within the UAS curriculum. Students will engage in a series of assignments that will guide them toward proposing and researching a capstone project that demonstrates knowledge gained in UAS and AAM topics. Students are expected to focus on the development of deliverable products that demonstrate their skills as effective UAS operators.

Learning Outcomes: 1. Engage in applied UAS and AAM research that applies skills and knowledge gained in UAS curriculum. 2. Focus on deliverable products that demonstrate marketable skills as a UAS pilot and operator. 3. Develop a strong foundation upon which to pursue UAS and AAM in the workplace or further graduate research. Credits: 3.00

13 Credits

UX Design, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (45 credits)

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile

platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 17207 - User Experience Design Experience Studio I

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students learn about the roles they can pursue and build foundational collaboration and project management skills. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Participate actively and contribute to team activities. 2. Identify and use project management tools. 3. Explore areas of UX specialization. 4. Explain project objectives in a professional manner. Credits: 3.00

CGT 27207 - User Experience Design Experience Studio II

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students continue to develop their abilities and contribute significantly to projects. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 3.00

CGT 37207 - User Experience Design Experience Studio III

Credit Hours: 3.00. This course provides students with opportunities to explore opportunities in a company-like environment. Students are knowledgeable project members and beginning to transition into subject matter experts and managers. Projects utilize human-centered design principles to provide a rich user experience.

Learning Outcomes: 1. Create and manage teams, resources, and activities. 2. Create and manage project strategy. 3. Demonstrate depth in one or more UX specializations. 4. Champion UX approaches to diverse stakeholders in a professional manner. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project

specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 37208 - User Experience Design Studio V: Specialization

Credit Hours: 3.00. This course prepares students to lead complex and strategic design projects. Students become proficient in the most advanced approaches, methods and techniques of human-centered design. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using expert data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems to advance stakeholder strategies and goals. 3. Demonstrate advanced application and evaluation of visual and interaction design principles by using advanced prototyping techniques to create working interactive digital prototypes. 4. Demonstrate the ability to lead UX teams through the user-centered design processes, employing appropriate approaches, processes and methodologies. 5. Practice human-centered design in concordance with their personal design philosophy. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate

problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 27108 - User Experience Design Studio II: Screen

Credit Hours: 3.00. Intermediate exploration of various approaches to human-centered design. Students learn intermediate research and design methods and create high-fidelity prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct intermediate analysis of situations, clients, and problems using multiple approaches to problem framing. 2. Create a variety of concepts that address the issues in the problem statement. 3. Use intermediate data gathering and analysis techniques to inform design decisions. 4. Demonstrate intermediate application of principles of visual and interaction design to create high-fidelity prototypes. 5. Distinguish among major approaches to user-centered design. 6. Compare and contrast the core values of various approaches to user-centered design. Credits: 3.00

CGT 37108 - User Experience Design Studio IV: Strategy

Credit Hours: 3.00. Advanced exploration of strategic human-centered design that aligns user experience with organizational strategy and business goals, using approaches such as agile, waterfall, and lean UX. Students utilize visual, information, and usability principles as well as various approaches and methods of human-centered design to create interactive digital prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using advanced data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems that aligns with the client organizational strategy and business goals. 3. Demonstrate fluent application and evaluation of visual and interaction design principles by using advanced prototyping techniques to create interactive prototypes. 4. Demonstrate the ability to make recommendations for appropriate major design approaches and methodologies that fit a particular design situation and team. 5. Articulate their design identity and personal design philosophy. Credits: 3.00

CGT 27208 - User Experience Design Studio III: Cross-Channel

Credit Hours: 3.00. Advanced exploration of cross-channel approaches to human-centered design such as service design that span digital and physical experiences. Students utilize principles of usability and user experience to create and evaluate physical prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct advanced analysis. 2. Create a variety of concepts that address the issues of situations, clients, and problems that demonstrate an awareness of multiple user touchpoints. 3. Use physically-based techniques for data gathering and analysis to inform design decisions. 4. Demonstrate application of human factors principles to create physical prototypes. 5. Distinguish among popular processes and methodologies for UX. 6. Explain how design philosophy impacts design practice. Credits: 3.00

Other Departmental/Program Course Requirements (66 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments.

CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the

historical, and the contemporary. Credits: 3.00

Electives (9 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Sample 4-Year Plan

Fall 1st Year

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level

required to perform standard applications related to life sciences, management and technology. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15 Credits

Spring 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CGT 17207 - User Experience Design Experience Studio I

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students learn about the roles they can pursue and build foundational collaboration and project management skills. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Participate actively and contribute to team activities. 2. Identify and use project management tools. 3. Explore areas of UX specialization. 4. Explain project objectives in a professional manner. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

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CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components

of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

15 Credits

Fall 2nd Year

CGT 27207 - User Experience Design Experience Studio II

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students continue to develop their abilities and contribute significantly to projects. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 3.00

CGT 27108 - User Experience Design Studio II: Screen

Credit Hours: 3.00. Intermediate exploration of various approaches to human-centered design. Students learn intermediate research and design methods and create high-fidelity prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct intermediate analysis of situations, clients, and problems using multiple approaches to problem framing. 2. Create a variety of concepts that address the issues in the problem statement. 3. Use intermediate data gathering and analysis techniques to inform design decisions. 4. Demonstrate intermediate application of principles of visual and interaction design to create high-fidelity prototypes. 5. Distinguish among major approaches to user-centered design. 6. Compare and contrast the core values of various approaches to user-centered design. Credits: 3.00

15 Credits

Spring 2nd Year

CGT 27207 - User Experience Design Experience Studio II

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students continue to develop their abilities and contribute significantly to projects. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 3.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 27208 - User Experience Design Studio III: Cross-Channel

Credit Hours: 3.00. Advanced exploration of cross-channel approaches to human-centered design such as service design that span digital and physical experiences. Students utilize principles of usability and user experience to create and evaluate physical prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct advanced analysis. 2. Create a variety of concepts that address the issues of situations, clients, and problems that demonstrate an awareness of multiple user touchpoints. 3. Use physically-based techniques for data gathering and analysis to inform design decisions. 4. Demonstrate application of human factors principles to create physical prototypes. 5. Distinguish among popular processes and methodologies for UX. 6. Explain how design philosophy impacts design practice. Credits: 3.00

16 Credits

Fall 3rd Year

CGT 37207 - User Experience Design Experience Studio III

Credit Hours: 3.00. This course provides students with opportunities to explore opportunities in a company-like environment. Students are knowledgeable project members and beginning to transition into subject matter experts and managers. Projects utilize human-centered design principles to provide a rich user experience.

Learning Outcomes: 1. Create and manage teams, resources, and activities. 2. Create and manage project strategy. 3. Demonstrate depth in one or more UX specializations. 4. Champion UX approaches to diverse stakeholders in a professional manner. Credits: 3.00

CGT 37108 - User Experience Design Studio IV: Strategy

Credit Hours: 3.00. Advanced exploration of strategic human-centered design that aligns user experience with organizational strategy and business goals, using approaches such as agile, waterfall, and lean UX. Students utilize visual, information, and usability principles as well as various approaches and methods of human-centered design to create interactive digital prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using advanced data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems that aligns with the client organizational strategy and business goals. 3. Demonstrate fluent application and evaluation of visual and interaction design principles by using advanced prototyping techniques to create interactive prototypes. 4. Demonstrate the ability to make recommendations for appropriate major design approaches and methodologies that fit a particular design situation and team. 5. Articulate their design identity and personal design philosophy. Credits: 3.00

15 Credits

Spring 3rd Year

CGT 37207 - User Experience Design Experience Studio III

Credit Hours: 3.00. This course provides students with opportunities to explore opportunities in a company-like environment. Students are knowledgeable project members and beginning to transition into subject matter experts and managers. Projects utilize human-centered design principles to provide a rich user experience.

Learning Outcomes: 1. Create and manage teams, resources, and activities. 2. Create and manage project strategy. 3. Demonstrate depth in one or more UX specializations. 4. Champion UX approaches to diverse stakeholders in a professional manner. Credits: 3.00

CGT 37208 - User Experience Design Studio V: Specialization

Credit Hours: 3.00. This course prepares students to lead complex and strategic design projects. Students become proficient in the most advanced approaches, methods and techniques of human-centered design. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using expert data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems to advance stakeholder strategies and goals. 3. Demonstrate advanced application and evaluation of visual and interaction design principles by using advanced prototyping techniques to create working interactive digital prototypes. 4. Demonstrate the ability to lead UX teams through the user-centered design processes, employing appropriate approaches, processes and methodologies. 5. Practice human-centered design in concordance with their personal design philosophy. Credits: 3.00

15 Credits

Fall 4th Year

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

14 Credits

Spring 4th Year

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on

feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

15 Credits

Veterinary Nursing, BSVN

About the Program

Degree Requirements

Departmental/Program Major Courses (87 credits)

BMS 33100 - Pharmacology-VN

Credit Hours: 1.50. This course introduces the concepts of drugs used in the different body systems. Mechanisms of action, side effects, and therapeutic applications are presented.

Learning Outcomes: 1. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the GI tract. 2. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of cardiovascular system. 3. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the respiratory tract. 4. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the endocrine systems. 5. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-inflammatory drugs. 6. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases/conditions of the nervous system. 7. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-parasitic drugs. Credits: 1.50

BMS 23300 - Introduction To Pharmacology-VN

Credit Hours: 0.50. This course introduces the concepts and terminology of pharmacology including basic terminology, pharmacokinetics, and pharmacodynamics.

Learning Outcomes: "1. Explain what the different types of drugs names are. 2. Recognize the characteristics of different solid and liquid dosage formulations. 3. Explain the significance of the terminology used in drug references to describe drugs. 4. List and describe the criteria for acceptable extra-label use of drugs. 5. Describe the difference between OTC and prescription drugs. 6. Explain the factors that affect movement of drug molecules throughout the body. 7. Describe the requirements for prescriptions and drug labels. 8. Describe the characteristics of each route of drug administration. 9. Read and write abbreviations commonly used in drug orders accurately. 10. Explain physiological factors that change the way drugs move through the body. 11. Describe regulations and warnings surrounding dispensing containers. 12.

Describe factors that alter the way drugs are absorbed, distributed, metabolized, and excreted. 13. Describe reasons and procedures for handling and storing drugs. 14. Explain the interaction between drugs and receptors and how that produces cellular effects. 15. Describe legal requirements for dispensing and storage of controlled substances. 16. Describe how pharmacokinetics and pharmacodynamics impact every drug treatment. 17. Describe special storage and handling requirements for cytotoxic and hazardous drugs. 18. Describe the issues surrounding and guidelines required for acceptable drug compounding. Credits: 0.50

BMS 23200 - Physiology-VN

Credit Hours: 2.00. Basic mammalian physiology, which covers general physiological processes with emphasis on domestic animals. Laboratory experiences and demonstrations form a major part of the laboratory instruction.

Learning Outcomes: 1. Describe and explain the functions of body fluids. The types of formed elements in blood and their functions. 2. Describe and explain the functions of the central and peripheral nervous systems. 3. Describe and explain the types of muscles in the body and their functions. 4. Describe and explain the regulation of the functions of the heart, lungs, kidneys, endocrine glands and gonads. 5. Describe and explain the regulation of blood pressure, gas exchange in the lungs and acid-base balance. 6. Describe and explain the hormonal regulation of metabolic processes and reproduction. Credits: 2.00

BMS 23100 - Anatomy-VN

Credit Hours: 4.00. Gross and microscopic study of body systems and topographic relationships in major animal species. Laboratory consists of dissection as well as study of living animals.

Learning Outcomes: 1. Identify the Musculoskeletal. Students will be able to identify, draw and describe function of, in models, radiographs and live animals: major bones and bony prominences; major muscles; major nerves; major blood vessels associated with limbs; and describe long bone development. 2. Identify the Thorax. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of lungs, esophagus, trachea, major vessels, nerves and heart; pathway of blood through heart; position of thoracic and pleural cavities; and important topography. 3. Identify the Abdomen. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of major GI and reproductive organs, major vessels, and nerves; GI and UG development; position of abdominal and peritoneal cavities; and important topography. 4. Identify the Head and Neck. Students will be able to identify and describe, in models, radiographs and live animals: major bones of skull; number teeth; major cavities of skull; major features of the eye and ear; major glands, vessels and nerves of the neck and skull; major topography of the head and neck; and major parts and function of the brain. Credits: 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of

contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

CPB 35200 - Parasitology-VN

Credit Hours: 2.00. Biology and life cycles of selected protozoan, helminth, and arthropod parasites of veterinary importance. Emphasis will be placed on laboratory procedures for the identification of common parasites of domestic and laboratory animals.

Learning Outcomes: 1. Identify gross and microscopic parasite stages that help in disease diagnosis. 2. Select and perform the appropriate assays used in laboratory diagnosis of parasitic infections. 3. Summarize parasite life cycle, pathogenesis and clinical signs of various parasitic diseases. 4. Advocate the methods of parasite control and prevention. 5. Create a safety plan to prevent zoonotic disease transmission. Credits: 2.00

CPB 35100 - Microbiology-VN

Credit Hours: 2.00. Biology and laboratory identification of bacteria and fungi that cause infectious diseases in animals. Emphasis will be placed on the collection of specimens for culture, the isolation and identification of pathogenic organisms, and antibiotic susceptibility testing. Procedures and commercial systems available to veterinary practices will be utilized.

Learning Outcomes: 1. Select appropriate samples for laboratory diagnostics of infectious disease. 2. Perform basic microbiological techniques used in the laboratory setting of a veterinary hospital. (for example: Gram stain, catalase test, oxidase test, inoculate an agar plate for isolated colonies, Kirby Bauer test). 3. Identify organisms from an "unknown sample" using a variety of tests. 4. Create a shortlist of differential diagnoses for infectious disease cases. 5. Implement biosafety protocols (for example: personal protective equipment, isolation of animals). 6. Differentiate the biology of bacteria, viruses, and fungi. 7. Prevent and control the spread or introduction of infectious diseases. 8. Explain zoonotic diseases to laypeople. Credits: 2.00

CPB 25500 - Clinical Pathology-VN

Credit Hours: 4.00. Basic instruction in clinical pathology, including theory and techniques of hematology, clinical chemistry, urinalysis, cytology, and specimen handling.

Learning Outcomes: 1. Have a clinically relevant working knowledge and mastery of laboratory skills related to erythrocytes (red blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of RBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal RBCs; C. Define anemia and classify anemia by mechanisms and RBC indices; D. Accurately perform laboratory analysis of blood samples to produce relevant erythrocyte data for an erythrogram. 2. Have a clinically relevant working knowledge and mastery of laboratory skills related to leukocytes (white blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of WBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal WBCs; C. Accurately describe abnormal leukograms using proper medical terminology and categorize the clinical significance of these abnormalities (e.g., inflammation, stress, excitement, neoplasia, etc.); D. Accurately perform laboratory analysis of blood samples to produce relevant leukocyte data for a leukogram. 3. Have a clinically relevant working knowledge and mastery of laboratory skills related to platelets

(thrombocytes) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe or identify from questions features of platelet production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal platelets/thrombocytes; C. Define thrombocytopenia and thrombocytosis and describe major mechanisms for each; D. Accurately perform laboratory analysis of blood samples to provide accurate estimates of platelet numbers. 4. Have a clinically relevant working knowledge and mastery of laboratory skills related to analysis of urine. This includes the ability to: A. Accurately perform a complete urinalysis including the physical, chemical and sediment examination; B. Identify normal and abnormal urine elements by microscopy, gross visual examination and photographs. 5. Have a clinically relevant working knowledge and mastery of laboratory skills related to diagnostic cytology. This includes the ability to: A. Collect and process fluids, skin and subcutaneous samples, and vaginal cytologic preparations; B. Correctly classify cytologic preparations as normal, malignant or inflammatory; C. Recognize and describe normal and abnormal leukocytes in cytologic preps. This includes visual recognition and/or description of the following features: macrophage activation, neutrophil degeneration, lymphocyte reactivity; D. Recognize and distinguish between bacteria & fungal organisms; E. Classify stages of the reproductive cycle based on vaginal cytology from dogs and cats. 6. Correctly associate specific clinical chemistry tests with their primary organ of involvement (e.g., kidney, liver, etc.), process (e.g., acid-base) or class of analyte (e.g., electrolytes). 7. Have a clinically relevant working knowledge and mastery of the physiology of hemostasis and how that relates to common laboratory tests for hemostasis disorders. This includes the ability to: A. Correctly categorize the role of key elements of hemostasis into primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis; B. Select appropriate tests to assess disorders of primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis. 8. Have a clinically relevant working knowledge and mastery of in-house serologic testing. Credits: 4.00

VCS 22200 - Dentistry-VN

Credit Hours: 1.00. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs. 5. Develop and provide client education. Credits: 1.00

VCS 22300 - Surgical Nursing-VN

Credit Hours: 1.50. This course is an introduction to the surgical environment and all aspects related to the principles of asepsis and the practice of sterile technique. Students will learn using a variety of teaching modalities (lecture, group work, laboratory experience).

Learning Outcomes: 1. Identify basic surgical instruments. 2. Explain the principles of aseptic technique. 3. Perform the duties of surgical nurse. 4. Perform the duties of the circulating nurse. 5. Explain procedures to prepare items for sterilization and the techniques used for sterilization. 6. Demonstrate bandaging techniques for both large and small animal patients. 7. Identify the phases of wound healing. Credits: 1.50

VCS 22400 - Small Animal Nursing I

Credit Hours: 2.00. This course will introduce students to nursing and diagnostic techniques for small animals and the body response to disease.

Learning Outcomes: 1. Recognize and report conditions of hospitalized small animal patients. 2. Provide appropriate nursing care to hospitalized patients. 3. Place IV catheters in small animal patients and administer fluids appropriately. 4. Perform diagnostic procedures and exams for small animal patients. 5. Provide technical assistance to a DVM for diagnostics and therapeutics. 6. Recognize emergent conditions and provide appropriate treatment. 7. Perform basic training techniques with dogs. Credits: 2.00

VCS 22500 - Large Animal Nursing I

Credit Hours: 2.00. This course builds on concepts learning in VCS 22100 related to normal, healthy large animal patients. It also introduces the students to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify and explain the nursing concepts of hospitalized and post-op LA patients. 2. Select and apply nursing concepts to the LA patient. 3. Place an IV catheter in a large animal patient and identify the problems that can occur from long term catheterization. 4. Describe milking procedures and the tests used to identify problems. 5. Collect diagnostic samples from large animals. 6. Administer medications via common routes to large animals. 7. Calculate fluid therapy rates for LA patients. 8. Identify the appropriate uses for bandages, splints, casts. 9. Identify the steps utilized in intensive neonatal care and medical emergencies. Credits: 2.00

VCS 22600 - Principles Of Anesthesia-VN

Credit Hours: 2.00. This course is an introduction to surgical nursing and anesthesia. The principles of asepsis and sterile technique will be introduced and demonstrated by staff and in some cases, practiced by the student. The basics of anesthesia will be introduced and practiced by the student.

Learning Outcomes: 1. Identify basic surgical instruments. 2. State the principles of aseptic technique. 3. Identify breaks in aseptic technique. 4. Perform open gloving. 5. Perform aseptic personnel scrub; gowning and closed gloving. 6. Identify the parts of an anesthesia machine. 7. Know the function of the above parts. 8. Trace the flow of oxygen through an anesthetic machine, with rebreathing and nonbreathing systems. 9. Identify rebreathing and nonbreathing systems. 10. Practice monitoring principles and identify normal parameters. 11. Identify a variety of analgesic and anesthetic drugs. 12. Begin to identify and state the uses and classifications of these drugs. 13. Perform general anesthesia; from physical exam through recovery. Credits: 2.00

VCS 22800 - Small And Large Animal Nutrition-VN

Credit Hours: 1.00. This course will introduce students to an overview of nutritional concepts as it applies to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as therapeutic use of diets as it relates to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediatric stages to adulthood. 5. Define specific differences in diets based upon breed (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and

livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VCS 25200 - Diagnostic Imaging-VN

Credit Hours: 2.00. Provides an introduction to imaging of domestic animals. Emphasis will be placed on radiological principles and techniques, darkroom procedures and design, preparing technique charts for various X-ray units, animal positioning, and radiation safety.

Learning Outcomes: 1. Recall and apply diagnostic imaging guidelines and safety procedures. 2. Produce diagnostic images of soft tissue and orthopedic projections of both small and large animal patients. 3. Produce diagnostic images of skull projections of small animal patients. 4. Perform diagnostic contrast studies of the circulatory, renal and gastrointestinal systems. 5. Utilize computed and digital imaging systems to produce diagnostic images of both large and small animal patients. 6. Assist with performing diagnostic ultrasound scans of small animal patients. 7. Possess a basic understanding and introductory working knowledge of CT, MRI and Nuclear Medicine scanning procedures on both small and large animal patients. Credits: 2.00

VCS 32100 - Large Animal Nursing II

Credit Hours: 2.00. This course build on concepts learned in VCS 22100 and VCS 22500 related to normal, healthy large animals patients. It also introduces the student to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify the key principles associated with herd health management. 2. Understand the role of regulatory issues in large animal medicine. 3. Demonstrate an understanding of the common diseases affecting large animal species. 4. Develop an understanding of naturally occurring toxic plants. Credits: 2.00

VCS 32200 - Small Animal Nursing II

Credit Hours: 2.00. This course will cover management of hospitalized patients, client education, and preventative medicine programs. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Describe basic information about small animal medicine conditions to clients. 2. Educate clients regarding preventative small animal medicine. 3. Utilize knowledge of small animal medical conditions to provide nursing care to patients. 4. Utilize knowledge of small animal medical conditions to anticipate DVM needs for diagnosis and treatment of hospitalized patients. Credits: 2.00

VCS 46700 - Medical Equipment & Maintenance-VN

Credit Hours: 2.00. A laboratory in the utilization, care, and maintenance of electronic equipment used in veterinary diagnostics.

Learning Outcomes: 1. Develop an integrated knowledge base of the functions of the selected equipment. 2. Select, evaluate, and adjust selected equipment to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. 3. Recognize and respond appropriately to the selected equipment malfunctions or inappropriate equipment setup to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. Credits: 2.00

VM 24100 - Occupational & Public Health I

Credit Hours: 1.00. This course will cover selected zoonotic diseases, occupational hazards and safety issues, related to the veterinary health care team and veterinary facility.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Understand where to find current information related to veterinary medical occupational hazards. 4. Effectively communicate appropriate safety principles to colleagues. Credits: 1.00

VM 24300 - Clinic Rotations I

Credit Hours: 1.50. This course will provide the basic learning situations for developing the techniques required of veterinary technicians in pharmacy, radiology, surgery, medical nursing, and ancillary areas. Total clinic hours 9/week.

Learning Outcomes: 1. Become acquainted with clinical areas, personnel, responsibilities and basic procedures. 2. Perform basic nursing duties as they are learned in concurrent courses and by experience. 3. Become familiar with the veterinary team concept and its benefit to patient care. Credits: 1.50

VM 24400 - Clinical Rotations II

Credit Hours: 1.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed basic nursing duties learned in previous courses and as they are learned in concurrent courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 1.50

VM 24900 - Clinical Rotations III

Credit Hours: 3.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities, and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 3.50

VM 32300 - Laboratory Animals & Exotic Pet Medicine-VN

Credit Hours: 2.00. This course will cover the proper methods of restraint, daily care, nursing techniques, and housing needs for the common species of laboratory animals.

Learning Outcomes: 1. Understand nutritional requirements, physiological data, anesthesia, blood collection, drug administration, handling, sexing, and common diseases of laboratory rodents, primates, and lagomorphs as well as non-traditional pets including small mammals, fish, amphibians, reptiles, and birds. 2. Familiarization with laboratory housing, environmental control, and environmental enrichment concepts. 3. Familiarization with basic genetics and breeding programs of laboratory animals. 4. Understand sanitation and hygiene procedures as they relate to laboratory animal management. 5. Introduce concepts of experimental methodology and regulatory compliance within laboratory animal medicine. 6. Introduce wildlife triage and wildlife nursing techniques. Credits: 2.00

VM 34300 - Clinic Rotations IV-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34400 - Clinic Rotations V-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care

benefits. Credits: 5.00

VM 34500 - Veterinary Management Topics I-VN

Credit Hours: 1.50. The course will introduce students to concepts related to working in and managing a veterinary practice. Emphasis will be on client communication and education as well as facilitating a job search, interviewing and cover letter and resume creation.

Learning Outcomes: 1. Create a professional cover letter and resume. 2. Properly prepare for and participate in employment interviews. 3. Utilize techniques that build excellent relationships by exceeding client expectations, providing great client service and building a rapport with clients. 4. Utilize techniques for handling emotional or difficult clients. 5. Utilize techniques for working with special needs clients. 6. Explain the grief process. 7. Discuss professionalism and legal and ethical issues related to the veterinary technology profession. 8. Describe the ways in which fees are set for products and services at a veterinary clinic. 9. Define marketing and describe how marketing strategies can be used in a veterinary clinic setting. 10. Describe inventory management strategies. 11. Identify professional organizations related to veterinary technology and veterinary practice management. Credits: 1.50

VM 39000 - Practicum

Credit Hours: 4.00. Veterinary technologist level off-campus experience in one area of interest totaling 480 hours over 12 weeks.

Credits: 4.00

VM 44100 - Occupational & Public Health II-VN

Credit Hours: 1.00. The course covers selected aspects of public health and safety related to the veterinary health care team, patient, client and public.

Learning Outcomes: 1. Able to select and utilize the appropriate measures to assist in preventing problems or mitigate their effects. 2. Able to seek, select, compile and effectively communicate appropriate material to their colleagues, the clients and public. Credits: 1.00

VM 44200 - Veterinary Management Topics II-VN

Credit Hours: 1.50. This course is a continuation of the first veterinary practice management course. It will introduce students to concepts related to leading a veterinary medical team and managing the day-to-day management of the veterinary practice. Emphasis will be on human resources, marketing and financial management.

Learning Outcomes: 1. Describe the attributes of a good leader. 2. Create a personal financial plan (i.e. budget) use credit wisely. 3. Describe strategies for recruiting, managing, and motivating employees. 4. Utilize techniques for proper delegation of work within a veterinary facility. 5. Create effective client surveys. 6. Use social media to effectively market a veterinary facility. 7. Create and interpret financial statements. 8. Describe techniques used for controlling expenses at a veterinary facility. 9. Assess a veterinary facility's financial performance by utilizing industry benchmarks. Credits: 1.50

VM 44300 - Clinic Rotations VI-VN

Credit Hours: 2.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increase awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Perform nursing duties learned in previous courses and by experience. 3. Participate in the utilization of the veterinary team concepts and contributed to its patient care benefits. Credits: 2.00

VM 44500 - Senior Project-VN

Credit Hours: 4.00. This is an independent study course in which the student engages in learning activities to enhance their knowledge in a particular area of veterinary technology of their choosing, demonstrate effective oral and written communication, and apply analysis, integration, and syntheses to achieve a solution.

Learning Outcomes: 1. Acquisition of knowledge at the veterinary technologist level in an area of interest or focus. 2. Demonstrate effective oral communication. 3. Demonstrate effective written communication. 4. Demonstrate the ability to analyze, integrate, and synthesize a solution to solve a problem. Credits: 4.00

VM 41001 - International Practicum

Credit Hours: 4.00. The student will experience an integrated employment situation combined with veterinary team interaction to augment his/her specialized CoVM clinical learning experiences. The student will work under the direct supervision of a licensed veterinarian or credentialed veterinary technician designee of tech veterinarian. The student is required to complete a pre-departure orientation with the PVM Director of International Programs.

Learning Outcomes: 1. Perform technical duties in medical and surgical nursing, imaging, laboratory procedures, anesthesia, and client interaction when working in a practice setting. 2. Perform tech duties required of the position in the industry setting. 3. Observe and record the case cycle concept of vet med in its components of history, assessment, problem listing, interventions and actions, potential problems encountered, patient outcomes and evaluations, and discharge planning as it pertains to veterinary nursing. 4. Identify and critically address management issues. 5. Create and deliver an oral presentation. 6. Develop communication skills. Credits: 4.00

VM 20100 - Medical Math And Terminology For Veterinary Nursing

Credit Hours: 1.50. A didactic course which presents the basic skills that will be used in all nursing courses and in the overall curriculum. In addition, the course introduces medical math and terminology used in veterinary medicine. Students will complete exercises utilizing math concepts for dosage calculations, conversions, proper notation, dispensing medications, fluid therapy calculations, and percent solutions. Students will use medical terminology including prefixes, roots, and suffixes of medical terms to complete exercises. This knowledge will be utilized in didactic courses and labs as well as in clinical rotations. Students will learn normal temperature, pulse and respiration values for various species. There will be both in-class and study components.

Learning Outcomes: 1. Utilize medical math to calculate drug dosages, dispense medications, fluid therapy rates, and percent solutions. 2. Apply medical math concepts to perform conversions and use proper notation. 3. Understand and utilize medical terminology in didactic classes, laboratories, and clinic rotations. 4. Know normal temperature, pulse and respiration values for various species and report abnormalities. 5. Apply diversity and inclusion skills as they apply in veterinary medicine. 6. Discuss compassion fatigue and euthanasia in veterinary medicine. Credits: 1.50

CPB 46400 - Clinical Toxicology-VN

Credit Hours: 2.00. The common toxicants and advanced topics on the drugs most commonly encountered in veterinary medicine. Emphasis is on mechanisms, indications, contraindications, and proper applications and handling of these drugs. Permission of department required.

Learning Outcomes: 1. Appropriately use and understand common terminology used in toxicology and clinical toxicology. 2. Describe the medical rationale and specific drugs used as emetics, cathartics, and other compounds used to decrease animal exposure to ingested toxicants. 3. Ask the appropriate questions during a history to help better identify toxicosis cases and to identify potential sources for intoxication. 4. Describe the mechanism of action for commonly encountered drug toxicants, herbal/diet supplement intoxications, household toxicants, insecticides, rodenticides, herbicides, toxic plants, and toxic animal envenomation. 5. Describe the general presenting clinical appearance and any key clinical signs characteristic of common veterinary toxicants. 6. Describe the diagnostics and treatment protocols used for common veterinary toxicants. 7. Identify means by which clients/animal owners can reduce the risk of intoxicant of animals by toxicants. Credits: 2.00

VM 34210 - Integrations-VN

Credit Hours: 2.00. This course will give an introduction to problem-based learning of the nursing process (patient evaluations, interventions, and desire resolutions) using a case-based approach. This course will integrate foundational knowledge from anatomy, physiology, and information in the veterinary nursing courses. This course will draw on fundamentals and concepts learned from all courses to this point including pharmacology, diagnostic imaging, parasitology, small animal nursing, and large animal nursing, so as to enable you to apply knowledge of understanding of clinical cases. Cases will involve different domestic animal species.

Learning Outcomes: 1. Integrate and apply knowledge from foundational coursework. 2. Identify and apply the components of the veterinary nursing process. 3. Follow evidence-based medicine practices and relate to patient case scenarios. 4. Utilize critical thinking skills to apply the veterinary nursing process to patient case scenarios. 5. Use verbal and written communication skills appropriately with other members of the veterinary team. Credits: 2.00

VCS 21100 - Veterinary Nursing Techniques For The Large Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, large animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients, including vaccinations that are recommended for large animal species. 4. Collect diagnostic samples from large animals. 5. Administer medications via common routes to large animals. 6. Identify common breeds of horses, cattle, swine, goats and sheep. Credits: 2.00

VCS 21000 - Veterinary Nursing Techniques For The Small Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, small animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and implement common restraint techniques used for various small animal species. 2. Measure the temperature, pulse, and respiratory rates, and provide an explanation of the normal parameters. 3. Identify and explain different sites for injections and venipuncture. 4. Identify common breeds of canines and felines and describe normal behavior of each species. 5. Conduct a comprehensive patient history and perform a thorough, standardized physical examination. 6. Engage in discussions with clients about routine preventive care, including recommended vaccinations for different large animal species. Credits: 2.00

VM 12000 - Introduction To Veterinary Nursing I

Credit Hours: 1.00. This is the first in a two-course sequence for first-year Veterinary Nursing students. This course will introduce students to the Veterinary Nursing program and profession focusing on new student integration, providing resources available on campus to facilitate student success, and entry-level professional skill development. Students will learn and apply professional attributes of the veterinary medical professional.

Learning Outcomes: 1. Develop effective interpersonal communications skills to increase their ability to communicate within the veterinary medical team. 2. Explore career options within the field of Veterinary Nursing. 3. Cultivate a shared sense of community at Purdue through relationships with peers and instructors. 4. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 5. Understand the importance of being engaged in veterinary nursing as a new student. 6. Expand knowledge of the available resources offered by Purdue University, the College of Veterinary Medicine, and the Veterinary Nursing Program that facilitate student success. 7. Demonstrate proper classroom etiquette and how to conduct

oneself appropriately when interacting with faculty, academic advisors, DVM students, upperclassmen, and other members of the campus community. Credits: 1.00

VM 12100 - Introduction To Veterinary Nursing II

Credit Hours: 1.00. This is the second in a two-course sequence for first-year Veterinary Nursing students. This course introduces the various opportunities within the veterinary healthcare profession as well as a general introduction to the attributes and traits of veterinary medical professionals. Students will learn about veterinary clinical education and expectations and continue to explore the profession by speaking with current professionals and observing current practices.

Learning Outcomes: 1. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 2. Understand attributes and traits of veterinary medical professionals and be able to apply those in a clinical education setting. 3. Explore the Veterinary Nursing Profession by speaking with current professional(s) and observing current practices. Credits: 1.00

Veterinary Nursing Selectives

Other Program Course Requirements (35-38 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in

organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages

business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health,

industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical

bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and

successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience

chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience

chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (2.5-5.5 Credits)

Grade Requirements

GPA Requirements

Course Requirements and Notes

Pass/No Pass Policy

Transfer Credit Policy

Notes

Sample 4-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of

the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

VM 24100 - Occupational & Public Health I

Credit Hours: 1.00. This course will cover selected zoonotic diseases, occupational hazards and safety issues, related to the veterinary health care team and veterinary facility.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Understand where to find current information related to veterinary medical occupational hazards. 4. Effectively communicate appropriate safety principles to colleagues. Credits: 1.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in

lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

VM 12000 - Introduction To Veterinary Nursing I

Credit Hours: 1.00. This is the first in a two-course sequence for first-year Veterinary Nursing students. This course will introduce students to the Veterinary Nursing program and profession focusing on new student integration, providing resources available on campus to facilitate student success, and entry-level professional skill development. Students will learn and apply professional attributes of the veterinary medical professional.

Learning Outcomes: 1. Develop effective interpersonal communications skills to increase their ability to communicate within the veterinary medical team. 2. Explore career options within the field of Veterinary Nursing. 3. Cultivate a shared sense of community at Purdue through relationships with peers and instructors. 4. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 5. Understand the importance of being engaged in veterinary nursing as a new student. 6. Expand knowledge of the available resources offered by Purdue University, the College of Veterinary Medicine, and the Veterinary Nursing Program that facilitate student success. 7. Demonstrate proper classroom etiquette and how to conduct oneself appropriately when interacting with faculty, academic advisors, DVM students, upperclassmen, and other members of the campus community. Credits: 1.00

15-17 Credits

Spring 1st Year

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not

permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

VM 20100 - Medical Math And Terminology For Veterinary Nursing

Credit Hours: 1.50. A didactic course which presents the basic skills that will be used in all nursing courses and in the overall curriculum. In addition, the course introduces medical math and terminology used in veterinary medicine. Students will complete exercises utilizing math concepts for dosage calculations, conversions, proper notation, dispensing medications, fluid therapy calculations, and percent solutions. Students will use medical terminology including prefixes, roots, and suffixes of medical terms to complete exercises. This knowledge will be utilized in didactic courses and labs as well as in clinical rotations. Students will learn normal temperature, pulse and respiration values for various species. There will be both in-class and study components.

Learning Outcomes: 1. Utilize medical math to calculate drug dosages, dispense medications, fluid therapy rates, and percent solutions. 2. Apply medical math concepts to perform conversions and use proper notation. 3. Understand and utilize medical terminology in didactic classes, laboratories, and clinic rotations. 4. Know normal temperature, pulse and respiration values for various species and report abnormalities. 5. Apply diversity and inclusion skills as they apply in veterinary medicine. 6. Discuss compassion fatigue and euthanasia in veterinary medicine. Credits: 1.50

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic

theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

VM 12100 - Introduction To Veterinary Nursing II

Credit Hours: 1.00. This is the second in a two-course sequence for first-year Veterinary Nursing students. This course introduces the various opportunities within the veterinary healthcare profession as well as a general introduction to the attributes and traits of veterinary medical professionals. Students will learn about veterinary clinical education and expectations and continue to explore the profession by speaking with current professionals and observing current practices.

Learning Outcomes: 1. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 2. Understand

attributes and traits of veterinary medical professionals and be able to apply those in a clinical education setting. 3. Explore the Veterinary Nursing Profession by speaking with current professional(s) and observing current practices. Credits: 1.00

15.5-16.5 Credits

Fall 2nd Year

BMS 23200 - Physiology-VN

Credit Hours: 2.00. Basic mammalian physiology, which covers general physiological processes with emphasis on domestic animals. Laboratory experiences and demonstrations form a major part of the laboratory instruction.

Learning Outcomes: 1. Describe and explain the functions of body fluids. The types of formed elements in blood and their functions. 2. Describe and explain the functions of the central and peripheral nervous systems. 3. Describe and explain the types of muscles in the body and their functions. 4. Describe and explain the regulation of the functions of the heart, lungs, kidneys, endocrine glands and gonads. 5. Describe and explain the regulation of blood pressure, gas exchange in the lungs and acid-base balance. 6. Describe and explain the hormonal regulation of metabolic processes and reproduction. Credits: 2.00

BMS 23100 - Anatomy-VN

Credit Hours: 4.00. Gross and microscopic study of body systems and topographic relationships in major animal species. Laboratory consists of dissection as well as study of living animals.

Learning Outcomes: 1. Identify the Musculoskeletal. Students will be able to identify, draw and describe function of, in models, radiographs and live animals: major bones and bony prominences; major muscles; major nerves; major blood vessels associated with limbs; and describe long bone development. 2. Identify the Thorax. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of lungs, esophagus, trachea, major vessels, nerves and heart; pathway of blood through heart; position of thoracic and pleural cavities; and important topography. 3. Identify the Abdomen. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of major GI and reproductive organs, major vessels, and nerves; GI and UG development; position of abdominal and peritoneal cavities; and important topography. 4. Identify the Head and Neck. Students will be able to identify and describe, in models, radiographs and live animals: major bones of skull; number teeth; major cavities of skull; major features of the eye and ear; major glands, vessels and nerves of the neck and skull; major topography of the head and neck; and major parts and function of the brain. Credits: 4.00

VCS 22200 - Dentistry-VN

Credit Hours: 1.00. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs. 5. Develop and provide client education. Credits: 1.00

VCS 22300 - Surgical Nursing-VN

Credit Hours: 1.50. This course is an introduction to the surgical environment and all aspects related to the principles of asepsis and the practice of sterile technique. Students will learn using a variety of teaching modalities (lecture, group work, laboratory experience).

Learning Outcomes: 1. Identify basic surgical

instruments. 2. Explain the principles of aseptic technique. 3. Perform the duties of surgical nurse. 4. Perform the duties of the circulating nurse. 5. Explain procedures to prepare items for sterilization and the techniques used for sterilization. 6. Demonstrate bandaging techniques for both large and small animal patients. 7. Identify the phases of wound healing. Credits: 1.50

VM 24300 - Clinic Rotations I

Credit Hours: 1.50. This course will provide the basic learning situations for developing the techniques required of veterinary technicians in pharmacy, radiology, surgery, medical nursing, and ancillary areas. Total clinic hours 9/week.

Learning Outcomes: 1. Become acquainted with clinical areas, personnel, responsibilities and basic procedures. 2. Perform basic nursing duties as they are learned in concurrent courses and by experience. 3. Become familiar with the veterinary team concept and its benefit to patient care. Credits: 1.50

VCS 21100 - Veterinary Nursing Techniques For The Large Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, large animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients, including vaccinations that are recommended for large animal species. 4. Collect diagnostic samples from large animals. 5. Administer medications via common routes to large animals. 6. Identify common breeds of horses, cattle, swine, goats and sheep. Credits: 2.00

VCS 21000 - Veterinary Nursing Techniques For The Small Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, small animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and implement common restraint techniques used for various small animal species. 2. Measure the temperature, pulse, and respiratory rates, and provide an explanation of the normal parameters. 3. Identify and explain different sites for injections and venipuncture. 4. Identify common breeds of canines and felines and describe normal behavior of each species. 5. Conduct a comprehensive patient history and perform a thorough, standardized physical examination. 6. Engage in discussions with clients about routine preventive care, including recommended vaccinations for different large animal species. Credits: 2.00

14 Credits

Spring 2nd Year

BMS 23300 - Introduction To Pharmacology-VN

Credit Hours: 0.50. This course introduces the concepts and terminology of pharmacology including basic terminology, pharmacokinetics, and pharmacodynamics.

Learning Outcomes: "1. Explain what the different types of drugs names are. 2. Recognize the characteristics of different solid and liquid dosage formulations. 3. Explain the significance of the terminology used in drug references to describe drugs. 4. List and describe the criteria for acceptable extra-label use of drugs. 5. Describe the difference between OTC and prescription drugs. 6. Explain the factors that affect movement of drug molecules throughout the body. 7. Describe the requirements for prescriptions and drug labels. 8. Describe the characteristics of each route of drug administration. 9. Read and write abbreviations commonly used in drug orders accurately. 10. Explain physiological factors that

change the way drugs move through the body. 11. Describe regulations and warnings surrounding dispensing containers. 12. Describe factors that alter the way drugs are absorbed, distributed, metabolized, and excreted. 13. Describe reasons and procedures for handling and storing drugs. 14. Explain the interaction between drugs and receptors and how that produces cellular effects. 15. Describe legal requirements for dispensing and storage of controlled substances. 16. Describe how pharmacokinetics and pharmacodynamics impact every drug treatment. 17. Describe special storage and handling requirements for cytotoxic and hazardous drugs. 18. Describe the issues surrounding and guidelines required for acceptable drug compounding. Credits: 0.50

CPB 25500 - Clinical Pathology-VN

Credit Hours: 4.00. Basic instruction in clinical pathology, including theory and techniques of hematology, clinical chemistry, urinalysis, cytology, and specimen handling. Learning Outcomes: 1. Have a clinically relevant working knowledge and mastery of laboratory skills related to erythrocytes (red blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of RBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal RBCs; C. Define anemia and classify anemia by mechanisms and RBC indices; D. Accurately perform laboratory analysis of blood samples to produce relevant erythrocyte data for an erythrogram. 2. Have a clinically relevant working knowledge and mastery of laboratory skills related to leukocytes (white blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of WBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal WBCs; C. Accurately describe abnormal leukograms using proper medical terminology and categorize the clinical significance of these abnormalities (e.g., inflammation, stress, excitement, neoplasia, etc.); D. Accurately perform laboratory analysis of blood samples to produce relevant leukocyte data for a leukogram. 3. Have a clinically relevant working knowledge and mastery of laboratory skills related to platelets (thrombocytes) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe or identify from questions features of platelet production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal platelets/thrombocytes; C. Define thrombocytopenia and thrombocytosis and describe major mechanisms for each; D. Accurately perform laboratory analysis of blood samples to provide accurate estimates of platelet numbers. 4. Have a clinically relevant working knowledge and mastery of laboratory skills related to analysis of urine. This includes the ability to: A. Accurately perform a complete urinalysis including the physical, chemical and sediment examination; B. Identify normal and abnormal urine elements by microscopy, gross visual examination and photographs. 5. Have a clinically relevant working knowledge and mastery of laboratory skills related to diagnostic cytology. This includes the ability to: A. Collect and process fluids, skin and subcutaneous samples, and vaginal cytologic preparations; B.

Correctly classify cytologic preparations as normal, malignant or inflammatory; C. Recognize and describe normal and abnormal leukocytes in cytologic preps. This includes visual recognition and/or description of the following features: macrophage activation, neutrophil degeneration, lymphocyte reactivity; D. Recognize and distinguish between bacteria & fungal organisms; E. Classify stages of the reproductive cycle based on vaginal cytology from dogs and cats. 6. Correctly associate specific clinical chemistry tests with their primary organ of involvement (e.g., kidney, liver, etc.), process (e.g., acid-base) or class of analyte (e.g., electrolytes). 7. Have a clinically relevant working knowledge and mastery of the physiology of hemostasis and how that relates to common laboratory tests for hemostasis disorders. This includes the ability to: A. Correctly categorize the role of key elements of hemostasis into primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis; B. Select appropriate tests to assess disorders of primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis. 8. Have a clinically relevant working knowledge and mastery of in-house serologic testing. Credits: 4.00

VCS 22400 - Small Animal Nursing I

Credit Hours: 2.00. This course will introduce students to nursing and diagnostic techniques for small animals and the body response to disease.

Learning Outcomes: 1. Recognize and report conditions of hospitalized small animal patients. 2. Provide appropriate nursing care to hospitalized patients. 3. Place IV catheters in small animal patients and administer fluids appropriately. 4. Perform diagnostic procedures and exams for small animal patients. 5. Provide technical assistance to a DVM for diagnostics and therapeutics. 6. Recognize emergent conditions and provide appropriate treatment. 7. Perform basic training techniques with dogs. Credits: 2.00

VCS 22500 - Large Animal Nursing I

Credit Hours: 2.00. This course builds on concepts learning in VCS 22100 related to normal, healthy large animal patients. It also introduces the students to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify and explain the nursing concepts of hospitalized and post-op LA patients. 2. Select and apply nursing concepts to the LA patient. 3. Place an IV catheter in a large animal patient and identify the problems that can occur from long term catheterization. 4. Describe milking procedures and the tests used to identify problems. 5. Collect diagnostic samples from large animals. 6. Administer medications via common routes to large animals. 7. Calculate fluid therapy rates for LA patients. 8. Identify the appropriate uses for bandages, splints, casts. 9. Identify the steps utilized in intensive neonatal care and medical emergencies. Credits: 2.00

VCS 22600 - Principles Of Anesthesia-VN

Credit Hours: 2.00. This course is an introduction to surgical nursing and anesthesia. The principles of asepsis and sterile technique will be introduced and demonstrated by staff and in some cases, practiced by the student. The basics of anesthesia will be introduced and practiced by the student.

Learning Outcomes: 1. Identify basic surgical instruments. 2. State the principles of aseptic technique. 3. Identify breaks in aseptic technique. 4. Perform open gloving. 5. Perform aseptic personnel scrub; gowning and closed gloving. 6. Identify the parts of an anesthesia machine. 7. Know the function of the above parts. 8. Trace the flow of oxygen through an anesthetic machine, with rebreathing and nonbreathing systems. 9. Identify rebreathing and nonbreathing systems. 10. Practice monitoring principles and identify normal

parameters. 11. Identify a variety of analgesic and anesthetic drugs. 12. Begin to identify and state the uses and classifications of these drugs. 13. Perform general anesthesia; from physical exam through recovery. Credits: 2.00

VCS 25200 - Diagnostic Imaging-VN

Credit Hours: 2.00. Provides an introduction to imaging of domestic animals. Emphasis will be placed on radiological principles and techniques, darkroom procedures and design, preparing technique charts for various X-ray units, animal positioning, and radiation safety.

Learning Outcomes: 1. Recall and apply diagnostic imaging guidelines and safety procedures. 2. Produce diagnostic images of soft tissue and orthopedic projections of both small and large animal patients. 3. Produce diagnostic images of skull projections of small animal patients. 4. Perform diagnostic contrast studies of the circulatory, renal and gastrointestinal systems. 5. Utilize computed and digital imaging systems to produce diagnostic images of both large and small animal patients. 6. Assist with performing diagnostic ultrasound scans of small animal patients. 7. Possess a basic understanding and introductory working knowledge of CT, MRI and Nuclear Medicine scanning procedures on both small and large animal patients. Credits: 2.00

VM 24400 - Clinical Rotations II

Credit Hours: 1.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed basic nursing duties learned in previous courses and as they are learned in concurrent courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 1.50

14 Credits

Summer between 2nd and 3rd Year

VM 24900 - Clinical Rotations III

Credit Hours: 3.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities, and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 3.50

3.5 Credits

Fall 3rd Year

BMS 33100 - Pharmacology-VN

Credit Hours: 1.50. This course introduces the concepts of drugs used in the different body systems. Mechanisms of action, side effects, and therapeutic applications are presented.

Learning Outcomes: 1. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the GI tract. 2. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of cardiovascular system. 3. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the respiratory tract. 4. Identify, describe the mechanisms of action, and describe the major side effects,

contraindications or warnings for common veterinary drugs used to treat diseases of the endocrine systems. 5. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-inflammatory drugs. 6. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases/conditions of the nervous system. 7. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-parasitic drugs. Credits: 1.50

VCS 22800 - Small And Large Animal Nutrition-VN

Credit Hours: 1.00. This course will introduce students to an overview of nutritional concepts as it applies to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as therapeutic use of diets as it relates to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediatric stages to adulthood. 5. Define specific differences in diets based upon breed (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VCS 32100 - Large Animal Nursing II

Credit Hours: 2.00. This course build on concepts learned in VCS 22100 and VCS 22500 related to normal, healthy large animals patients. It also introduces the student to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify the key principles associated with herd health management. 2. Understand the role of regulatory issues in large animal medicine. 3. Demonstrate an understanding of the common diseases affecting large animal species. 4. Develop an understanding of naturally occurring toxic plants. Credits: 2.00

VCS 32200 - Small Animal Nursing II

Credit Hours: 2.00. This course will cover management of hospitalized patients, client education, and preventative medicine programs. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Describe basic information about small animal medicine conditions to clients. 2. Educate clients regarding preventative small animal medicine. 3. Utilize knowledge of small animal medical conditions to provide nursing care to patients. 4. Utilize knowledge of small animal medical conditions to anticipate DVM needs for diagnosis and treatment of hospitalized patients. Credits: 2.00

VM 32300 - Laboratory Animals & Exotic Pet Medicine-VN

Credit Hours: 2.00. This course will cover the proper methods of restraint, daily care, nursing techniques, and housing needs for the common species of laboratory animals.

Learning Outcomes: 1. Understand nutritional requirements, physiological data, anesthesia, blood collection, drug administration, handling, sexing, and common diseases of laboratory rodents, primates, and lagomorphs as well as non-traditional pets including small mammals, fish, amphibians, reptiles, and birds. 2. Familiarization with laboratory housing, environmental control, and environmental

enrichment concepts. 3. Familiarization with basic genetics and breeding programs of laboratory animals. 4. Understand sanitation and hygiene procedures as they relate to laboratory animal management. 5. Introduce concepts of experimental methodology and regulatory compliance within laboratory animal medicine. 6. Introduce wildlife triage and wildlife nursing techniques. Credits: 2.00

VM 34300 - Clinic Rotations IV-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

13.5 Credits

Spring 3rd Year

CPB 35200 - Parasitology-VN

Credit Hours: 2.00. Biology and life cycles of selected protozoan, helminth, and arthropod parasites of veterinary importance. Emphasis will be placed on laboratory procedures for the identification of common parasites of domestic and laboratory animals.

Learning Outcomes: 1. Identify gross and microscopic parasite stages that help in disease diagnosis. 2. Select and perform the appropriate assays used in laboratory diagnosis of parasitic infections. 3. Summarize parasite life cycle, pathogenesis and clinical signs of various parasitic diseases. 4. Advocate the methods of parasite control and prevention. 5. Create a safety plan to prevent zoonotic disease transmission. Credits: 2.00

CPB 35100 - Microbiology-VN

Credit Hours: 2.00. Biology and laboratory identification of bacteria and fungi that cause infectious diseases in animals. Emphasis will be placed on the collection of specimens for culture, the isolation and identification of pathogenic organisms, and antibiotic susceptibility testing. Procedures and commercial systems available to veterinary practices will be utilized.

Learning Outcomes: 1. Select appropriate samples for laboratory diagnostics of infectious disease. 2. Perform basic microbiological techniques used in the laboratory setting of a veterinary hospital. (for example: Gram stain, catalase test, oxidase test, inoculate an agar plate for isolated colonies, Kirby Bauer test). 3. Identify organisms from an "unknown sample" using a variety of tests. 4. Create a shortlist of differential diagnoses for infectious disease cases. 5. Implement biosafety protocols (for example: personal protective equipment, isolation of animals). 6. Differentiate the biology of bacteria, viruses, and fungi. 7. Prevent and control the spread or introduction of infectious diseases. 8. Explain zoonotic diseases to laypeople. Credits: 2.00

VM 34400 - Clinic Rotations V-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34500 - Veterinary Management Topics I-VN

Credit Hours: 1.50. The course will introduce students to concepts related to working in and managing a veterinary practice. Emphasis will be on client communication and

education as well as facilitating a job search, interviewing and cover letter and resume creation.

Learning Outcomes: 1. Create a professional cover letter and resume. 2. Properly prepare for and participate in employment interviews. 3. Utilize techniques that build excellent relationships by exceeding client expectations, providing great client service and building a rapport with clients. 4. Utilize techniques for handling emotional or difficult clients. 5. Utilize techniques for working with special needs clients. 6. Explain the grief process. 7. Discuss professionalism and legal and ethical issues related to the veterinary technology profession. 8. Describe the ways in which fees are set for products and services at a veterinary clinic. 9. Define marketing and describe how marketing strategies can be used in a veterinary clinic setting. 10. Describe inventory management strategies. 11. Identify professional organizations related to veterinary technology and veterinary practice management. Credits: 1.50

VM 34210 - Integrations-VN

Credit Hours: 2.00. This course will give an introduction to problem-based learning of the nursing process (patient evaluations, interventions, and desire resolutions) using a case-based approach. This course will integrate foundational knowledge from anatomy, physiology, and information in the veterinary nursing courses. This course will draw on fundamentals and concepts learned from all courses to this point including pharmacology, diagnostic imaging, parasitology, small animal nursing, and large animal nursing, so as to enable you to apply knowledge of understanding of clinical cases. Cases will involve different domestic animal species.

Learning Outcomes: 1. Integrate and apply knowledge from foundational coursework. 2. Identify and apply the components of the veterinary nursing process. 3. Follow evidence-based medicine practices and relate to patient case scenarios. 4. Utilize critical thinking skills to apply the veterinary nursing process to patient case scenarios. 5. Use verbal and written communication skills appropriately with other members of the veterinary team. Credits: 2.00

15.5 Credits

Summer between 3rd and 4th Year

VM 39000 - Practicum

Credit Hours: 4.00. Veterinary technologist level off-campus experience in one area of interest totaling 480 hours over 12 weeks.

Credits: 4.00

VM 41001 - International Practicum

Credit Hours: 4.00. The student will experience an integrated employment situation combined with veterinary team interaction to augment his/her specialized CoVM clinical learning experiences. The student will work under the direct supervision of a licensed veterinarian or credentialed veterinary technician designee of tech veterinarian. The student is required to complete a pre-departure orientation with the PVM Director of International Programs.

Learning Outcomes: 1. Perform technical duties in medical and surgical nursing, imaging, laboratory procedures, anesthesia, and client interaction when working in a practice setting. 2. Perform tech duties required of the position in the industry setting. 3. Observe and record the case cycle concept of vet med in its components of history, assessment, problem listing, interventions and actions, potential problems encountered, patient outcomes and evaluations, and discharge planning as it pertains to veterinary nursing. 4. Identify and critically address management issues. 5. Create and deliver an oral presentation. 6. Develop communication skills. Credits: 4.00

4 Credits

Fall 4th Year

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

VCS 46700 - Medical Equipment & Maintenance-VN

Credit Hours: 2.00. A laboratory in the utilization, care, and maintenance of electronic equipment used in veterinary diagnostics.

Learning Outcomes: 1. Develop an integrated knowledge base of the functions of the selected equipment. 2. Select, evaluate, and adjust selected equipment to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. 3. Recognize and respond appropriately to the selected equipment malfunctions or inappropriate equipment setup to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. Credits: 2.00

VM 44100 - Occupational & Public Health II-VN

Credit Hours: 1.00. The course covers selected aspects of public health and safety related to the veterinary health care team, patient, client and public.

Learning Outcomes: 1. Able to select and utilize the appropriate measures to assist in preventing problems or mitigate their effects. 2. Able to seek, select, compile and effectively communicate appropriate material to their colleagues, the clients and public. Credits: 1.00

VM 44200 - Veterinary Management Topics II-VN

Credit Hours: 1.50. This course is a continuation of the first veterinary practice management course. It will introduce students to concepts related to leading a veterinary medical team and managing the day-to-day management of the veterinary practice. Emphasis will be on human resources, marketing and financial management.

Learning Outcomes: 1. Describe the attributes of a good leader. 2. Create a personal financial plan (i.e. budget) use credit wisely. 3. Describe strategies for recruiting, managing, and motivating employees. 4. Utilize techniques for proper delegation of work within a veterinary facility. 5. Create effective client surveys. 6. Use social media to effectively market a veterinary facility. 7. Create and interpret financial statements. 8. Describe techniques used for controlling expenses at a veterinary facility. 9. Assess a veterinary facility's financial performance by utilizing industry benchmarks. Credits: 1.50

VM 44300 - Clinic Rotations VI-VN

Credit Hours: 2.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increase awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Perform nursing duties learned in previous courses and by experience. 3. Participate in the utilization of the veterinary team concepts and contributed to its patient care benefits. Credits: 2.00

CPB 46400 - Clinical Toxicology-VN

Credit Hours: 2.00. The common toxicants and advanced topics on the drugs most commonly encountered in veterinary

medicine. Emphasis is on mechanisms, indications, contraindications, and proper applications and handling of these drugs. Permission of department required.

Learning Outcomes: 1. Appropriately use and understand common terminology used in toxicology and clinical toxicology. 2. Describe the medical rationale and specific drugs used as emetics, cathartics, and other compounds used to decrease animal exposure to ingested toxicants. 3. Ask the appropriate questions during a history to help better identify toxicosis cases and to identify potential sources for intoxication. 4. Describe the mechanism of action for commonly encountered drug toxicants, herbal/diet supplement intoxications, household toxicants, insecticides, rodenticides, herbicides, toxic plants, and toxic animal envenomation. 5. Describe the general presenting clinical appearance and any key clinical signs characteristic of common veterinary toxicants. 6. Describe the diagnostics and treatment protocols used for common veterinary toxicants. 7. Identify means by which clients/animal owners can reduce the risk of intoxicant of animals by toxicants. Credits: 2.00

12.5-15.5 Credits

Spring 4th Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication

situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

VM 44500 - Senior Project-VN

Credit Hours: 4.00. This is an independent study course in which the student engages in learning activities to enhance their

knowledge in a particular area of veterinary technology of their choosing, demonstrate effective oral and written communication, and apply analysis, integration, and syntheses to achieve a solution.

Learning Outcomes: 1. Acquisition of knowledge at the veterinary technologist level in an area of interest or focus. 2. Demonstrate effective oral communication. 3. Demonstrate effective written communication. 4. Demonstrate the ability to analyze, integrate, and synthesize a solution to solve a problem. Credits: 4.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

17 Credits

Visual Arts Design Education, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (45 credits)

A. Art & Design Required Courses (27 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be

introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

B. Art & Design Sequence (9 credits)

Interior Design

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 13000 - Interior Design Communication

Credit Hours: 3.00. Spatial studies, conceptual ideation, and methods of communicating in various two- and three-dimensional media.

Learning Outcomes: 1. Produce basic design drawing and architectural lettering. 2. Apply the use of line weights when sketching and drawing when visualizing design ideas. 3. Explain architectural and interior design vocabulary. 4. Construct one- and two-point perspectives. 5. Apply basic skills and knowledge of AutoCAD Drafting Software. Credits: 3.00

AD 23000 - Interior Design I

Credit Hours: 3.00. Study of behavior patterns, perceptions, needs, and usage of three-dimensional space through conceptual solutions to human environments. Interior design theory and application of design process through analysis, research, and synthesis will be explored.

Learning Outcomes: 1. Develop design communication skills through freehand and instrument drawing tools that can be used in both design and presentation work. 2. Explore a wide range of drawing media such as pencil, markers, and colored pencils to develop design communication skills. 3. Develop the ability to make informed and sensitive decisions regarding the use of color in presentation work. 4. Further develop speed and accuracy in constructing perspectives and renderings. Credits: 3.00

Visual Communication Design

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional

design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 20600 - Studio In Visual Communication Design

Credit Hours: 3.00. Investigation of visual communication design theory, history, skills, and methodology, as well as preparation of art and mechanicals for graphic arts reproduction.

Learning Outcomes: 1. Transition from fundamental design skills to advanced graphic design applications. 2. Introduce layout/grid systems and their theoretical and practical applications. 3. Introduce students to the fundamentals of typography, exploring the relationships between type and image. 4. Increase proficiency in graphic software in the context of graphic design projects. 5. Gain a better understanding of the history of graphic design. 6. Develop more advanced problem-solving skills. 7. Prepare students for the Sophomore Review, and advanced junior- and senior-level design courses. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

Industrial Design

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment. Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 23500 - Materials And Processes II

Credit Hours: 3.00. Problems in three-dimensional design, incorporating materials, production processes, and applications of current technology, emphasizing aspects of society and technology. An introduction to complete industrial design problems, including problem definition, concepts, resource information, design development, final proposals, and presentation techniques.

Learning Outcomes: 1. Apply knowledge of design for manufacturing and use of materials by creating and fabricating selected projects. 2. Evaluate the aesthetics, ergonomics, and manufacturability of designs by participating in in-class design critiques. 3. Utilize skills to analyze an existing product and redesign it with an expanded function. Credits: 3.00

C. Art History Courses (9 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork.

5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

Professional Education Requirements (46 credits)

Art Education Courses (11 credits)

AD 20200 - Introduction To Art Education

Credit Hours: 2.00. Lectures, readings, and discussions covering the history, theory, and professional literature of art education.

Learning Outcomes: 1. Analyze children's artistic development to understand its stages and implications for teaching. 2. Evaluate works of art and learn how to develop that ability in their students. 3. Analyze components of visual arts curriculum, assessment, and art education programming. 4. Demonstrate knowledge and skill with teaching techniques appropriate for various teaching levels. 5. Compare art instruction at various levels of public -school education. Credits: 2.00

AD 30200 - Theory And Practice Of Elementary School Art

Credit Hours: 3.00. Theory and practice of art education for elementary school from early childhood through middle childhood. Restricted to art education majors.

Credits: 3.00

AD 30300 - Art In Middle/Junior High Schools

Credit Hours: 3.00. Theory and practice of art education for early adolescent students in the middle/junior high school.

Credits: 3.00

AD 40200 - Art In Secondary School

Credit Hours: 3.00. Theory and practice of art education for adolescent and young adult students in the secondary school. Required prior to professional semester.

Credits: 3.00

Education Courses (35 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as

each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching

experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Learner Specialty Pathway Optional Concentration

Other Departmental - Liberal Arts Core For BFA, Professional, & Education (18-34 credits)

LA Core III: Linguistic Diversity (3-4 credits)

Foundational Requirements (15-30 credits)

Notes

Electives (1-17 credits)

GPA Requirements

Teacher Licensure Information

Additional Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

15-16 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.
University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

AD 20200 - Introduction To Art Education

Credit Hours: 2.00. Lectures, readings, and discussions covering the history, theory, and professional literature of art education.
Learning Outcomes: 1. Analyze children's artistic development to understand its stages and implications for teaching. 2. Evaluate works of art and learn how to develop that ability in their students. 3. Analyze components of visual arts curriculum, assessment, and art education programming. 4. Demonstrate knowledge and skill with teaching techniques appropriate for various teaching levels. 5. Compare art instruction at various levels of public -school education. Credits: 2.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students'

specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

16-17 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 30300 - Art In Middle/Junior High Schools

Credit Hours: 3.00. Theory and practice of art education for early adolescent students in the middle/junior high school.

Credits: 3.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific

differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

17-18 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

AD 30200 - Theory And Practice Of Elementary School Art

Credit Hours: 3.00. Theory and practice of art education for elementary school from early childhood through middle childhood. Restricted to art education majors.

Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by

contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

14 Credits

Spring 3rd Year

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

AD 40200 - Art In Secondary School

Credit Hours: 3.00. Theory and practice of art education for adolescent and young adult students in the secondary school. Required prior to professional semester.

Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an

overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

17 Credits

Fall 4th Year

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

18 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Visual Arts Education, BA

About the Program

Degree Requirements

Departmental/Program Major Course Requirements (45 credits)

A. Art & Design Courses (18 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and

computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

B. Studio Courses (18 credits)

Group 1 - Required Courses (12 credits)

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

Group 2 - Choose One (3 credits)

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

Group 3 - Choose One (3 credits)

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and

analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

C. Art History Courses (9 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social

forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

Professional Requirements (46 credits)

Art Education Courses (11 credits)

AD 20200 - Introduction To Art Education

Credit Hours: 2.00. Lectures, readings, and discussions covering the history, theory, and professional literature of art education.

Learning Outcomes: 1. Analyze children's artistic development to understand its stages and implications for teaching. 2. Evaluate works of art and learn how to develop that ability in their students. 3. Analyze components of visual arts curriculum, assessment, and art education programming. 4. Demonstrate knowledge and skill with teaching techniques appropriate for various teaching levels. 5. Compare art instruction at various levels of public -school education. Credits: 2.00

AD 30200 - Theory And Practice Of Elementary School Art

Credit Hours: 3.00. Theory and practice of art education for elementary school from early childhood through middle childhood. Restricted to art education majors.

Credits: 3.00

AD 30300 - Art In Middle/Junior High Schools

Credit Hours: 3.00. Theory and practice of art education for early adolescent students in the middle/junior high school.

Credits: 3.00

AD 40200 - Art In Secondary School

Credit Hours: 3.00. Theory and practice of art education for adolescent and young adult students in the secondary school. Required prior to professional semester.

Credits: 3.00

Education Requirements (35 credits)

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts.

Credits: 0.00 to 3.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as

each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching

experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

Learner Specialty Pathway Optional Concentration

Other Departmental - Liberal Arts Core For BFA, Professional, & Education (18-34 credits)

LA Core III: Linguistic Diversity (3-4 credits)

Foundational Requirements (15-30 credits)

Notes

Electives (2-18 credits)

GPA Requirements

Additional Information

Teacher Licensure Information

Sample 4-Year Plan

Fall 1st Year

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

15-16 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.
University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

15 Credits

Fall 2nd Year

AD 20200 - Introduction To Art Education

Credit Hours: 2.00. Lectures, readings, and discussions covering the history, theory, and professional literature of art education.
Learning Outcomes: 1. Analyze children's artistic development to understand its stages and implications for teaching. 2. Evaluate works of art and learn how to develop that ability in their students. 3. Analyze components of visual arts curriculum, assessment, and art education programming. 4. Demonstrate knowledge and skill with teaching techniques appropriate for various teaching levels. 5. Compare art instruction at various levels of public -school education. Credits: 2.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students'

specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDPS 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works with ELLs and students with

GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

16-17 Credits

Spring 2nd Year

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 30300 - Art In Middle/Junior High Schools

Credit Hours: 3.00. Theory and practice of art education for early adolescent students in the middle/junior high school.

Credits: 3.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken

concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

17-18 Credits

Fall 3rd Year

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the classroom setting.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes,

fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

AD 30200 - Theory And Practice Of Elementary School Art

Credit Hours: 3.00. Theory and practice of art education for elementary school from early childhood through middle childhood. Restricted to art education majors.

Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

16 Credits

Spring 3rd Year

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure

with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 40200 - Art In Secondary School

Credit Hours: 3.00. Theory and practice of art education for adolescent and young adult students in the secondary school. Required prior to professional semester.

Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an

inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

17 Credits

Fall 4th Year

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom

processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

18 Credits

Spring 4th Year

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

12 Credits

Visual Communication Design, BFA

About the Program

Degree Requirements

Departmental/Program Major Courses (78 credits)

A. Art & Design Core (12 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the

application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

B. Visual Communication Design Core (35 credits)

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 20600 - Studio In Visual Communication Design

Credit Hours: 3.00. Investigation of visual communication design theory, history, skills, and methodology, as well as preparation of art and mechanicals for graphic arts reproduction.

Learning Outcomes: 1. Transition from fundamental design skills to advanced graphic design applications. 2. Introduce layout/grid systems and their theoretical and practical applications. 3. Introduce students to the fundamentals of typography, exploring the relationships between type and image. 4. Increase proficiency in graphic software in the context of graphic design projects. 5. Gain a better understanding of the history of graphic design. 6. Develop more advanced problem-solving skills. 7. Prepare students for the Sophomore Review, and advanced junior- and senior-level design courses. Credits: 3.00

AD 22800 - Visual Communication Design Computing I

Credit Hours: 3.00. An introductory course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Illustrator and Adobe InDesign. 2. Experiment with and iterate through image-making utilizing various methods and vector-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Increase ability to generate and choose intensely metaphoric imagery to enhance visual

communication. 5. Understand and use design terminology and design principles. 6. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22900 - Visual Communication Design Computing II

Credit Hours: 3.00. An intermediate course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Photoshop and Adobe XD. 2. Experiment with and iterate through image-making utilizing various methods and pixel-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Understand and use design terminology and design principles. 5. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 31800 - Fundamentals Of Interactive Multimedia Design

Credit Hours: 3.00. Fundamental issues of interactive multimedia design: Animation, interface design, and experience design from a visual communications perspective.

Learning Outcomes: 1. Produce proposals, storyboards, and project reports. 2. Propose and implement visual communication design strategies for digital media projects. 3. Produce design solutions by applying compositional, typographical, and design elements and principles of new media design. 4. Apply design skills associated with the use of interface design (GUI). 5. Apply design skills associated with the use of digital color theory based on the RGB and HSB Color systems. 6. Apply design skills associated with the use of experience design concepts. 7. Continue to develop computing skills (Illustrator, Photoshop, AdobeAero, etc.). 8. Develop design skills to work collaboratively, presential, and remotely. 9. Develop illustrational and story-telling design abilities. Credits: 3.00

AD 31900 - Web Design For Visual Communication

Credit Hours: 3.00. Introduction to web-based design from a visual communication application.

Learning Outcomes: 1. Design web application prototypes by proposing creative concepts and producing media assets. 2. Apply visual storytelling to web design by incorporating visual communication strategies. 3. Demonstrate teamwork skills in web design by participating in group discussions while sharing ideas and receiving feedback for project improvement. Credits: 3.00

AD 33200 - Visual Communication Design I

Credit Hours: 3.00. A course designed to introduce the student to projects that will develop an understanding of basic problem-solving techniques in the areas of publication and promotional graphics. Acceptance into professional VCD sequence via mandatory portfolio review.

Learning Outcomes: 1. Provide opportunities to explore the elements and principles of design and process as they relate to typography and letter forms. 2. Engage students' conceptual skills in branding design. 3. Further strengthen students' ability to create effective visual communications by way of complex problems emphasizing critical thinking, design process and presentation. Credits: 3.00

AD 36600 - Visual Communication Design II

Credit Hours: 3.00. Field trips may be required. The study of corporate graphics and visual identity programs.

Learning Outcomes: 1. Build expertise in problem-solving and expanding a brand visually based on market research. 2. Practice synthesizing research, critical dialogue (feedback), and Critiques within an iterative design process. 3. Develop skills to construct/combine graphic form using various digital tools, software, and screen-based media as well as print and 3D objects. 4. Create system designs and brand identities. 5.

Strengthen attention to detail and craft knowledge. 6. Strengthen ability to pitch ideas and create viable solutions for real-world clients. Credits: 3.00

AD 43100 - Visual Communication Design III

Credit Hours: 3.00. The advanced study of communication concepts of poster and poster application in current media.

Learning Outcomes: 1. Demonstrate the ability to initiate and develop creative concepts; evaluate creative work; apply current technology; and communicate effectively. Credits: 3.00

AD 43200 - Visual Communication Design IV

Credit Hours: 3.00. The study of product identity, packaging, and branding.

Learning Outcomes: 1. Demonstrate ability to initiate and develop creative concepts; present and evaluate creative work; apply current technology related to the profession. Credits: 3.00

AD 43400 - Professional Practice For Visual Communication Designers

Credit Hours: 2.00. Specific professional practice topics for the visual communication designer. Topics include contracts, professional associations, ethics, portfolio and resume preparation, self-promotion and exhibition of creative work, the job market and the future of the profession. Field trips may be required.

Learning Outcomes: 1. Develop proficiency in the use of career search media and tools. 2. Develop a practical understanding of the visual communications job market. 3. Seek functional solutions that meet specific visual communication career goals 4. Develop an expanded ability to generate contacts and leads for employment or graduate school. 5. Strengthen student's design portfolio through review and organization of contents. Credits: 2.00

AD 52000 - Student Visual Design Service

Credit Hours: 3.00. The course simulates the operation of a professional design studio affording the opportunity for hands-on experience in the development of a graphic product from concept to finish and include contact with clients, and printers.

Learning Outcomes: 1. Design and produce portfolio banner to be shown in the Senior Portfolio Exhibition. 2. Produce branding theme, schedule, marketing strategy, for the Senior Portfolio Exhibition. 3. Market, install and takedown the Senior Portfolio Exhibition. 4. Examine current market trends and assess their influence on magazine content and design decisions. 5. Create a comprehensive magazine design that showcases a range of skills in publication typography, page layout and image development. Credits: 3.00

AD 22901 - Visual Communication Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Visual Communication Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Visual Communication Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

C. Visual Communication Design Supportive Requirement (19 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to

artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical

events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

D. Visual Communication Design Selectives (12 credits)

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 23600 - Lighting Fundamentals For Photography

Credit Hours: 3.00. Introductory course in understanding

electronic strobe lighting. Begins with a review of basic lighting principles and a series of problem-solving assignments, which introduce control, and applications of electronic strobe lighting. Still life photography and portraiture are emphasized and covers on-location lighting.

Learning Outcomes: 1. Gain an understanding of the basic principles of light and how to use those principles to light photographic subject matter. 2. Gain a basic understanding of the function of photographic lighting equipment. 3. Compile a portfolio of images that demonstrate a skill set learned regarding product and portrait and simple space lighting. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 24600 - Design Drawing II

Credit Hours: 3.00. Continuation of the work done in A&D 245. Emphasis on development of skills and presentation quality design drawing.

Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis

on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 32600 - Physical Computing

Credit Hours: 3.00. Introduction to electronics and computer vision for artists. Students learn to create expressive audiovisual systems that can respond to events in the physical world (movement, light/temperature change, sound, touch, etc.) through custom interfaces.

Learning Outcomes: 1. Analyze key ideas in the field of Physical Computing by preparing a research presentation on the practice of an individual artist or collective. 2. Critique their own creative work as well as the work of their peers through group discussions. 3. Produce a variety of interactive artworks by the creative use of the Arduino microcontroller, simple electronic circuitry, and coding techniques. Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 36101 - The Constructed Image

Credit Hours: 3.00. An intermediate level course focusing on the production of creative images constructed in the studio and in the field. Projects will address the planning and design of photographic images through the use of set design, styling, and post-production. Students will investigate both historical and contemporary trends in the art of the photographically-constructed image.

Learning Outcomes: 1. Construct and compose images using set design, styling, collage, and photomontage. 2. Develop communication skills to successfully interpret proposals and instructions from clients. 3. Analyze theoretical and historical concerns regarding constructed images and demonstrate an understanding of those concerns. 4. Develop visual communication and conceptual image making skills. 5. Develop techniques of creating photographically constructed images and demonstrate an understanding of those techniques. Credits: 3.00

AD 36200 - Jewelry And Metalwork

Credit Hours: 3.00. Lost wax casting and mold making, mechanisms and stone setting for jewelry and metalwork.

Learning Outcomes: 1. Students will be able to design and make wax and non-wax models for jewelry and small metal projects by reductive, addictive, and construction processes. 2. Students will learn to sprue, invest and cast their models by the lost wax centrifugal and vacuum casting methods. 3. They will learn to make waste molds and reusable rubber molds to produce their jewelry projects. 4. They will learn to make mechanisms for jewelry and settings for incorporating stones or other nonmetal materials into their jewelry. Credits: 3.00

AD 36500 - Intermediate Painting

Credit Hours: 3.00. A studio course concentrating on the development of conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

AD 40000 - Advanced Painting

Credit Hours: 3.00. A studio course concentrating on the development of an advanced body of work built upon the conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 41700 - Variable Topics In Electronic And Time-Based Art

Credit Hours: 3.00. Examination of thematic or specialized topics reflecting the most recent developments and contemporary artistic practices in Electronic and Time-Based Art. Permission of department required.

Learning Outcomes: 1. Use essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production. 2. Able to analyze key works and artists in the emerging field of Electronic and Time-Based Art. Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 46200 - Metalsmithing

Credit Hours: 3.00. Metal forming and metalsmithing processes

for small metal objects and jewelry.

Learning Outcomes: 1. Identify and utilize traditional jewelry and metalsmithing tools and materials in art metal projects. 2. Design and construct specialized tooling for metalworks. 3. Utilize newly developed tools into the fabrication of jewelry and other metal projects. Credits: 3.00

AD 47000 - Advanced Studies In Textiles

Credit Hours: 3.00. A textile seminar and studio course in advanced textile design, with the purpose of developing a personal direction and competence in textiles as fiber art.

Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 26100 - Introduction To Digital Video Production

Credit Hours: 3.00. Basic production principles and practices. Emphasis on preplanning and conceptualizing skills in addition to practical production techniques. Required for admission to all television production courses. Permission of department required.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 33600 - Advertising Media Strategy

Credit Hours: 3.00. Theory and practice of advertising as applied to advertising media strategy. Students build on a foundation of integrated marketing communication to develop digital advertising campaigns.

Learning Outcomes: 1. Explain how practitioners develop advertising campaigns. 2. Design and execute digital marketing plans. 3. Offer suggestions and feedback to classmates in a constructive manner. Credits: 3.00

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

AD 51200 - Interaction Design Studies

Credit Hours: 3.00. This course examines concepts and methods for interaction design (IXD). It emphasizes a human-centered perspective and explores fundamental components involved in IXD research. Students will explore a wide range of literature and implement IXD theories in multi-disciplinary collaborative projects.

Learning Outcomes: 1. Understand the fundamental architecture and principles of the interaction design. 2. Be familiar with a range of research interests in the domain and start to consider the thesis research topic. 3. Be aware of the diversity of research areas, methodologies and practices relevant to the interaction design program, and be exposed to work of researchers beyond the university, drawn from regional and international venues, to keep informed about updated research achievements. 4. Identify and apply compositional theory to interaction design practice. 5. Develop the ability to articulate intention in work through design iteration. 6. Organize and conduct a design process within an interdisciplinary team. 7. Have a working level of programming fluency, in order to independently produce a working prototype that satisfies given design requirements. 8. Assess and improve production value through design practice, optimization, and media technique. 9. Explore creative process, perception, and problem solving. Credits: 3.00

AD 52200 - Interaction Design Evaluation

Credit Hours: 3.00. This course builds a foundation for interaction designers to conduct evaluation research. Students start from analyzing evaluation cases on interactive designs and systems to employing evaluation in design projects using quantitative, qualitative, or mixed methods of inquiry.

Learning Outcomes: 1. Identify the need, justification, and goal of conducting an evaluation. 2. Understand systematic knowledge, logical-deductive processes and various research types, and recognize causes & effects, systematic bias and measurement/observation errors in research. 3. Be familiar with different kinds of qualitative and quantitative research methods and how they differ from each other. Build up reliable knowledge for them. 4. Understand the structure of paradigms, theories, concepts, hypotheses, constructs, variables and data. 5. Be familiar with the techniques such as observation, interviews, contamination, exogenous effects, and unobtrusive measures. 6. Be able to organize quantitative and qualitative data, and use analysis software such as SPSS and ALTAS.ti to find patterns. 7. Present the evaluation outcomes, and try to organize and write research papers based on the analysis. Credits: 3.00

AD 54200 - Information Visualization Design

Credit Hours: 3.00. This course starts from exploring visual perception and attention theories, studying modern visualization technologies and toolkits, and reviewing evolving visualization research. Students work on small exercises, and then accomplish complicated virtual and physical visualization projects for information representation and communication.

Learning Outcomes: 1. Learn the principals involved in information visualization. Gain a background that will aid the design of new, innovative visualizations. 2. Learn about the variety of existing techniques and systems in information visualization. 3. Build a sound foundation in human visual perception and how it relates to creating effective information visualization. 4. Proceed through graph and map-making best practices toward advanced topics of data structure and programmatic visualizations. 5. Gain experience describing and critiquing the methods and approaches of data visualization through presentations and critiques. 6. Understand the key design principles for creating information visualizations. 7. Explore the communication and narrative potential of information visualizations. 8. Develop skills in critiquing visualization techniques as applied to particular tasks. 9. Evaluate information visualizations tools. 10.Design new, innovative visualizations. Credits: 3.00

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the

processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

AD 33100 - Digital Video Production And Aesthetics

Credit Hours: 3.00. This course is a basic studio introduction to video production and how video can be used as an artistic medium in conjunction with the students' photography. Topics include video/film formats, lighting, audio, editing, distribution, experimental, commercial and music video, production paperwork and extensive time spent on mastering the camera. Classes will consist of hands-on demonstrations, and critiques.

Learning Outcomes: 1. Demonstrate DSLR cameras. 2. Demonstrate basic to intermediate lighting for Video Production. 3. Obtain knowledge on commercial video production: music video and commercial advertisement video. Credits: 3.00

AD 36300 - Documentary Photography

Credit Hours: 3.00. This course is an introduction to the great tradition of documentary photography. Students learn to see the world around them in a new way and produce a documentary project. The course requires reading and writing about photography, as well as making photography on a regular basis. The class emphasis is on thinking about why people photograph, what photographs do and do not mean to us, and on doing documentary work, on telling stories with photographs.

Learning Outcomes: 1. Understand the history of documentary photography. 2. Demonstrate a narrative photography experimented through personal, social, cultural, topographical politics. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

ENTR 31500 - Business Planning For Social Entrepreneurship

Credit Hours: 3.00. This course builds on entrepreneurship concepts and skills developed in ENTR 20000 (prerequisite course) to understand the differences, benefits, and opportunities associated with social impact business models. Students work in teams on experiential activities including gathering customer feedback, creating forecasts, developing a strategy, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in

Entrepreneurship and Innovation.

Learning Outcomes: 1. Develop convincing social enterprise business models. 2. Conduct feasibility analysis. 3. Create pro-forma financial statements. 4. Understand legal, regulatory, and ethical issues social entrepreneurs face. 5. Understand the process of recruiting, hiring, and developing a new venture team. 6. Identify sources of funding and investor needs. 7. Persuade potential investors to support a social impact venture. 8. Participate effectively as a team member or leader. Credits: 3.00

E. Other Program Requirements (Required, No Credit)

Sophomore Portfolio Review

AD 22901 - Visual Communication Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Visual Communication Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Visual Communication Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

Elective (14-24 credits)

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

15-17 Credits

Spring 1st Year

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.
Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.
University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.
Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

15-16 Credits

Fall 2nd Year

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.
Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 22800 - Visual Communication Design Computing I

Credit Hours: 3.00. An introductory course in visual design computing programs used in the study and production of visual communication design.
Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Illustrator and Adobe InDesign. 2. Experiment with and iterate through image-making utilizing various methods and vector-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Increase ability to generate and choose intensely metaphoric imagery to enhance visual communication. 5. Understand and use design terminology and design principles. 6. Strengthen attention to detail and craft

knowledge. Credits: 3.00

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

16-19 Credits

Spring 2nd Year

AD 20600 - Studio In Visual Communication Design

Credit Hours: 3.00. Investigation of visual communication design theory, history, skills, and methodology, as well as preparation of art and mechanicals for graphic arts reproduction.

Learning Outcomes: 1. Transition from fundamental design skills to advanced graphic design applications. 2. Introduce layout/grid systems and their theoretical and practical applications. 3. Introduce students to the fundamentals of typography, exploring the relationships between type and image. 4. Increase proficiency in graphic software in the context of graphic design projects. 5. Gain a better understanding of the history of graphic design. 6. Develop more advanced problem-solving skills. 7. Prepare students for the Sophomore Review, and advanced junior- and senior-level design courses. Credits: 3.00

AD 22900 - Visual Communication Design Computing II

Credit Hours: 3.00. An intermediate course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Photoshop and Adobe XD. 2. Experiment with and iterate through image-making utilizing various methods and pixel-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Understand and use design terminology and design principles. 5. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22901 - Visual Communication Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Visual Communication Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Visual Communication Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

15-16 Credits

Fall 3rd Year

AD 31800 - Fundamentals Of Interactive Multimedia Design

Credit Hours: 3.00. Fundamental issues of interactive multimedia design: Animation, interface design, and experience design from a visual communications perspective.

Learning Outcomes: 1. Produce proposals, storyboards, and project reports. 2. Propose and implement visual communication design strategies for digital media projects. 3. Produce design solutions by applying compositional, typographical, and design elements and principles of new media design. 4. Apply design skills associated with the use of interface design (GUI). 5. Apply design skills associated with the use of digital color theory based on the RGB and HSB Color systems. 6. Apply design skills associated with the use of experience design concepts. 7. Continue to develop computing skills (Illustrator, Photoshop, AdobeAero, etc.). 8. Develop design skills to work collaboratively, presential, and remotely. 9. Develop illustrational and story-telling design abilities. Credits: 3.00

AD 33200 - Visual Communication Design I

Credit Hours: 3.00. A course designed to introduce the student to projects that will develop an understanding of basic problem-solving techniques in the areas of publication and promotional graphics. Acceptance into professional VCD sequence via mandatory portfolio review.

Learning Outcomes: 1. Provide opportunities to explore the elements and principles of design and process as they relate to typography and letter forms. 2. Engage students' conceptual skills in branding design. 3. Further strengthen students' ability to create effective visual communications by way of complex problems emphasizing critical thinking, design process and presentation. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

18 Credits

Spring 3rd Year

AD 31900 - Web Design For Visual Communication

Credit Hours: 3.00. Introduction to web-based design from a visual communication application.

Learning Outcomes: 1. Design web application prototypes by proposing creative concepts and producing media assets. 2. Apply visual storytelling to web design by incorporating visual communication strategies. 3. Demonstrate teamwork skills in web design by participating in group discussions while sharing ideas and receiving feedback for project improvement. Credits: 3.00

AD 36600 - Visual Communication Design II

Credit Hours: 3.00. Field trips may be required. The study of corporate graphics and visual identity programs.

Learning Outcomes: 1. Build expertise in problem-solving and expanding a brand visually based on market research. 2. Practice synthesizing research, critical dialogue (feedback), and Critiques within an iterative design process. 3. Develop skills to construct/combine graphic form using various digital tools, software, and screen-based media as well as print and 3D objects. 4. Create system designs and brand identities. 5. Strengthen attention to detail and craft knowledge. 6. Strengthen ability to pitch ideas and create viable solutions for real-world clients. Credits: 3.00

12 Credits

Fall 4th Year

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 43100 - Visual Communication Design III

Credit Hours: 3.00. The advanced study of communication concepts of poster and poster application in current media.

Learning Outcomes: 1. Demonstrate the ability to initiate and develop creative concepts; evaluate creative work; apply current technology; and communicate effectively. Credits: 3.00

AD 43400 - Professional Practice For Visual Communication Designers

Credit Hours: 2.00. Specific professional practice topics for the visual communication designer. Topics include contracts, professional associations, ethics, portfolio and resume preparation, self-promotion and exhibition of creative work, the job market and the future of the profession. Field trips may be required.

Learning Outcomes: 1. Develop proficiency in the use of career search media and tools. 2. Develop a practical understanding of the visual communications job market. 3. Seek functional solutions that meet specific visual communication career goals 4. Develop an expanded ability to generate contacts and leads for employment or graduate school. 5. Strengthen student's design portfolio through review and organization of contents. Credits: 2.00

15-17 Credits

Spring 4th Year

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the

creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 43200 - Visual Communication Design IV

Credit Hours: 3.00. The study of product identity, packaging, and branding.

Learning Outcomes: 1. Demonstrate ability to initiate and develop creative concepts; present and evaluate creative work; apply current technology related to the profession. Credits: 3.00

AD 52000 - Student Visual Design Service

Credit Hours: 3.00. The course simulates the operation of a professional design studio affording the opportunity for hands-on experience in the development of a graphic product from concept to finish and include contact with clients, and printers.

Learning Outcomes: 1. Design and produce portfolio banner to be shown in the Senior Portfolio Exhibition. 2. Produce branding theme, schedule, marketing strategy, for the Senior Portfolio Exhibition. 3. Market, install and takedown the Senior Portfolio Exhibition. 4. Examine current market trends and assess their influence on magazine content and design decisions. 5. Create a comprehensive magazine design that showcases a range of skills in publication typography, page layout and image development. Credits: 3.00

14-17 Credits

Web Programming & Design, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (48 credits)

Required Major Courses (36 credits)

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create

production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 35300 - Principles Of Interactive And Dynamic Media

Credit Hours: 3.00. This course explores the development of interactive and dynamic media components for web and interactive media products. The course examines the design, creation and integration of 2D animation, 2D games, text, sound, video, programming, and databases for use in web and other interactive media.

Learning Outcomes: 1. Develop skills and proficiency in creating interactive components using HTML5, JavaScript libraries, and CSS. 2. Demonstrate understanding of JavaScript programming. 3. Develop beginning to moderately complex front-end designs. 4. Understand the emerging capabilities of delivering Web content. 5. Extend the ability to systematically develop content for the Web, from concept to implementation. Credits: 3.00

CGT 45600 - Advanced Web Programming, Development And Data Integration

Credit Hours: 3.00. This course presents the advanced technologies available for use on the World Wide Web and within corporate intranet environments. Emphasis and discussion is focused on the advantages and disadvantages of these technologies as well as on implementation to create unique solutions for business and industry. Strategies for planning, development, and implementation will be discussed and demonstrated. Significant time is spent on advanced programming and scripting as well as manipulation and visualization of data from various sources, including robust database management systems. Students are required to plan, design and implement a major project.

Learning Outcomes: 1. Demonstrate understanding of ASP.NET, C#, and the .NET Framework. 2. Create and compile advanced dynamic web projects using ASP.NET technology. 3. Demonstrate understanding of advanced database applications and SQL. 4. Show understanding of the logic behind advanced web applications. 5. Integrate front-end and back-end technologies in developing professional web applications. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 37000 - Interactive Data Visualization

Credit Hours: 3.00. Data visualization is the art and science of putting quantitative numbers into pictorial or graphical format that are easy for users to understand, use, and take action upon the data. In this course, we will learn basic data visualization design principles, theories, data management skills, and fundamental web technologies to design and develop web based interactive date visualizations. The students will be able to design the proper visual representations of the data based on the data's characteristics, business needs, and prospective users.

Learning Outcomes: 1. Demonstrate understating of different types of data, their characteristics, relations, and business purpose. 2. Compare and choose proper visualization methods to represent the data based on the characteristic and purpose. 3. Apply perception theories and design principles in visualization design. 4. Utilize web toolkits and technologies to develop simple data visualization. 5. Develop an interaction information visualization system to represent data from different aspects. Credits: 3.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 35600 - Web Programming, Development And Data Integration

Credit Hours: 3.00. A course focusing on the development of dynamic content and applications to facilitate information distribution. The course stresses development strategies for managing the rapidly changing information of corporations and organizations for just-in-time distribution, using authoring programs to create interactive multimedia products that utilize database management systems, file systems, and XML to provide a method for visualizing and manipulating that data. Significant time is spent on intermediate to advanced programming and scripting.

Learning Outcomes: 1. Demonstrate an understanding of how to use server-side

technology to develop dynamic database-driven websites and personalize content for users. 2. Integrate server-side and client-side technology in developing web applications. 3. Demonstrate an understanding of the logic behind web applications. 4. Create projects using server-side technologies to be used in a database-driven Web project. 5. Show understanding of basic database design, theory, and application. Credits: 3.00

CGT 11505 - Scripting And Computational Thinking

Credit Hours: 3.00. This course introduces the students to computer programming, computational thinking, and the mathematics of graphics programming. The act of programming is viewed through the lenses of Decomposition, Pattern Matching, Abstraction and Algorithms and then applied to writing some simple games in current scripting languages. No prior programming experience is required. The principal objective of the course is to provide a working knowledge of programming fundamentals to game designers and artists as well as to prepare game programmers for more advanced game programming coursework. As computer programming is an applied discipline, this course uses an active learning approach that combines lecture time with extensive lab assignments.

Learning Outcomes: 1. Apply the elements of computational thinking to programming tasks. 2. Use scripting languages in a well-structured way to implement math-based graphical solutions. 3. Use scripting languages to create gameplay within a game engine. 4. Use the mathematics of 2D and 3D graphics programming. Credits: 3.00

CGT 25300 - Front-End Web Development

Credit Hours: 3.00. This is a course in Front-End Web Development that emphasizes the importance of JavaScript, its libraries, and other front-end technologies in crafting engaging and interactive user interfaces. The JavaScript programming language has been the backbone of modern front-end web development. It enables developers to create dynamic content that enriches the user experience and interaction on websites. This course will cover the fundamental ideas of JavaScript. Students will learn to use the Document Object Model (DOM) in JavaScript to make web pages that can update and change in real-time. Students will also explore various JavaScript libraries or other front-end technologies that help streamline the development process and allow for the creation of complex user interfaces with less code.

Learning Outcomes: 1. Develop skills and proficiency in creating professional interactive components using HTML, JavaScript, JavaScript libraries, and CSS. 2. Demonstrate understanding of front-end programming. 3. Create interactive front-end user interfaces for websites. 4. Systematically develop content for the Web, from concept to implementation. 5. Further enhance cognitive skills in problem-solving, debugging, and programming. Credits: 3.00

Major Selectives* - Choose three courses (12 credits)

Other Departmental/Program Course Requirements (61 credits)

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective,

industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation,

international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (11 credits)

Supplemental List

Grade Requirements

GPA Requirements

Course Requirements and Notes

Non-course / Non-credit Requirements

Pass/No Pass Policy

Transfer Credit Policy

Sample 4-Year Plan

Fall 1st Year

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CGT 11505 - Scripting And Computational Thinking

Credit Hours: 3.00. This course introduces the students to computer programming, computational thinking, and the mathematics of graphics programming. The act of programming is viewed through the lenses of Decomposition, Pattern Matching, Abstraction and Algorithms and then applied to writing some simple games in current scripting languages. No prior programming experience is required. The principal objective of the course is to provide a working knowledge of programming fundamentals to game designers and artists as well as to prepare game programmers for more advanced game programming coursework. As computer programming is an applied discipline, this course uses an active learning approach that combines lecture time with extensive lab assignments.

Learning Outcomes: 1. Apply the elements of computational thinking to programming tasks. 2. Use scripting languages in a well-structured way to implement math-based graphical solutions. 3. Use scripting languages to create gameplay within a game engine. 4. Use the mathematics of 2D and 3D graphics programming. Credits: 3.00

15 Credits

Spring 1st Year

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting

appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

15 Credits

Fall 2nd Year

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

CGT 25300 - Front-End Web Development

Credit Hours: 3.00. This is a course in Front-End Web Development that emphasizes the importance of JavaScript, its libraries, and other front-end technologies in crafting engaging and interactive user interfaces. The JavaScript programming language has been the backbone of modern front-end web development. It enables developers to create dynamic content that enriches the user experience and interaction on websites. This course will cover the fundamental ideas of JavaScript. Students will learn to use the Document Object Model (DOM) in JavaScript to make web pages that can update and change in real-time. Students will also explore various JavaScript libraries or other front-end technologies that help streamline the development process and allow for the creation of complex user interfaces with less code.

Learning Outcomes: 1. Develop skills and proficiency in creating professional interactive components using HTML, JavaScript, JavaScript libraries, and CSS. 2. Demonstrate understanding of front-end programming. 3. Create interactive front-end user interfaces for websites. 4. Systematically develop content for the Web, from concept to implementation. 5. Further enhance cognitive skills in problem-solving, debugging, and programming. Credits: 3.00

16 Credits

Spring 2nd Year

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 37000 - Interactive Data Visualization

Credit Hours: 3.00. Data visualization is the art and science of putting quantitative numbers into pictorial or graphical format that are easy for users to understand, use, and take action upon the data. In this course, we will learn basic data visualization design principles, theories, data management skills, and fundamental web technologies to design and develop web based interactive date visualizations. The students will be able to design the proper visual representations of the data based on the data's characteristics, business needs, and prospective users.

Learning Outcomes: 1. Demonstrate understating of different types of data, their characteristics, relations, and business purpose. 2. Compare and choose proper visualization methods to represent the data based on the characteristic and purpose. 3. Apply perception theories and design principles in visualization design. 4. Utilize web toolkits and technologies to develop simple data visualization. 5. Develop an interaction information visualization system to represent data from different aspects. Credits: 3.00

16 Credits

Fall 3rd Year

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical,

and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

CGT 35600 - Web Programming, Development And Data Integration

Credit Hours: 3.00. A course focusing on the development of dynamic content and applications to facilitate information distribution. The course stresses development strategies for managing the rapidly changing information of corporations and organizations for just-in-time distribution, using authoring programs to create interactive multimedia products that utilize database management systems, file systems, and XML to

provide a method for visualizing and manipulating that data. Significant time is spent on intermediate to advanced programming and scripting.

Learning Outcomes: 1. Demonstrate an understanding of how to use server-side technology to develop dynamic database-driven websites and personalize content for users. 2. Integrate server-side and client-side technology in developing web applications. 3. Demonstrate an understanding of the logic behind web applications. 4. Create projects using server-side technologies to be used in a database-driven Web project. 5. Show understanding of basic database design, theory, and application. Credits: 3.00

15 Credits

Spring 3rd Year

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

CGT 45600 - Advanced Web Programming, Development And Data Integration

Credit Hours: 3.00. This course presents the advanced technologies available for use on the World Wide Web and within corporate intranet environments. Emphasis and discussion is focused on the advantages and disadvantages of these technologies as well as on implementation to create unique solutions for business and industry. Strategies for planning, development, and implementation will be discussed and demonstrated. Significant time is spent on advanced programming and scripting as well as manipulation and visualization of data from various sources, including robust database management systems. Students are required to plan, design and implement a major project.

Learning Outcomes: 1. Demonstrate understanding of ASP.NET, C#, and the .NET Framework. 2. Create and compile advanced dynamic web projects using ASP.NET technology. 3. Demonstrate understanding of advanced database applications and SQL. 4. Show understanding of the logic behind advanced web applications. 5. Integrate front-end and back-end technologies in developing professional web applications. Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

15 Credits

Fall 4th Year

CGT 35300 - Principles Of Interactive And Dynamic Media

Credit Hours: 3.00. This course explores the development of interactive and dynamic media components for web and interactive media products. The course examines the design, creation and integration of 2D animation, 2D games, text, sound, video, programming, and databases for use in web and other interactive media.

Learning Outcomes: 1. Develop skills and proficiency in creating interactive components using HTML5, JavaScript libraries, and CSS. 2. Demonstrate understanding of JavaScript programming. 3. Develop beginning to moderately complex front-end designs. 4. Understand the emerging capabilities of

delivering Web content. 5. Extend the ability to systematically develop content for the Web, from concept to implementation. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3. Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

16 Credits

Spring 4th Year

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

12 Credits

Wildlife, BS

About the Program

Degree Requirements

Departmental/Program Major Courses (63-64 credits)

Required Major Courses (55-56 credits)

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 34100 - Wildlife Habitat Management

Credit Hours: 3.00. Principles, practices, and justification of the habitat management approach to the manipulation of wildlife populations.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 34800 - Wildlife Investigational Techniques

Credit Hours: 3.00. An introduction to current wildlife research techniques that are used in managing populations and habitats. Laboratory and field exercises are used to gather and analyze data; basic data analysis and written dissemination of results is emphasized.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37300 - Wildlife Practicum

Credit Hours: 4.00. Specific field instruction in wildlife science and management. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Able to identify the common birds seen and heard on the campus of Covenant Point and surrounding areas. 2. Able to set up mist nets, remove birds safely from the nets and take down and store the equipment properly. 3. Able to safely handle and measure birds, mark them with leg bands and record appropriate data. 4. Create and maintain a field notebook of their observations and activities during the week. 5. Able to lay out a small mammal trapping grid and properly place traps. 6. Able to remove small mammals from live traps, mark those animals, measure them for identification and release them. 7. Able to operate a telemetry to receiver to estimate the location of a radio collar via triangulation and use homing technique to find that transmitter. 8. Able to identify bat roosting habitat, use acoustic recorders to detect bats and use software to identify bat species from recorded calls. 9. Able to track small mammals using both spool and line and fluorescent powder techniques. 10. Able to develop a null hypothesis about habitat selection and use a chi square test for independence to accept or reject that null hypothesis. 11. Perform current techniques for sampling herpetofanua and macroinvertebrates. 12. Describe and perform herpetofanual marking techniques. 13. Identify

anuran species by call. 14. Identify and dissect larval amphibians. 15. Identify macroinvertebrate species in lentic and lotic habitats. 16. Describe common diseases of amphibians. Credits: 4.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 44700 - Vertebrate Population Dynamics

Credit Hours: 4.00. Estimation and analysis of populations; computer modeling of sampling methods, population dynamics, population and habitat management. Knowledge of computer programming not required.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 4.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and

biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 46500 - History And Role Of Hunting In North American Wildlife Conservation

Credit Hours: 1.00. Introduction to the social, economic and wildlife management importance of hunting and how it relates to North American wildlife conservation. History of hunting and the North American Model of wildlife conservation, contrasted with those of European nations. Students will be required to participate in or observe hunting-related activities outside of class. This exercise is conducted off-campus on local Purdue-maintained properties.

Learning Outcomes: 1. Understand the history and role of hunting in North America. 2. Understand the economic impacts of hunting to wildlife conservation. 3. Examine how hunting influences wildlife management. 4. Examine the relationship of hunter demographics, ethics, public perception, and animal rights issues to hunting. 5. Apply the tenets of the North American Model of Wildlife Conservation to management and conservation challenges. 6. Experience hunting through first-hand activities. 7. Articulate the impacts of hunting to peers and constituents. Credits: 1.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural

resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain

databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

Major Selectives (8 credits)

Other Departmental /Program Course Requirements (50-52 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the

plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the

application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities,

and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to

species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

Electives (4-7 credits)

Supplemental List

Sample 4-Year Plan

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including

diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions.

Credits: 4.00

14-16 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team.
Credits: 4.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form

opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

16 Credits

Fall 2nd Year

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a

combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

13 Credits

Spring 2nd Year

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

FNR 34800 - Wildlife Investigational Techniques

Credit Hours: 3.00. An introduction to current wildlife research techniques that are used in managing populations and habitats. Laboratory and field exercises are used to gather and analyze data; basic data analysis and written dissemination of results is emphasized.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data

concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

15 Credits

Summer Session

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37300 - Wildlife Practicum

Credit Hours: 4.00. Specific field instruction in wildlife science and management. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Able to identify the common birds seen and heard on the campus of Covenant Point and surrounding areas. 2. Able to set up mist nets, remove birds safely from the nets and take down and store the equipment properly. 3. Able to safely handle and measure birds, mark them with leg bands and record appropriate data. 4. Create and maintain a field notebook of their observations and activities during the week. 5. Able to lay out a small mammal trapping grid and properly place traps. 6. Able to remove small mammals from live traps, mark those animals, measure them for identification and release them. 7. Able to operate a telemetry to receiver to estimate the location of a radio collar via triangulation and use homing technique to find that transmitter. 8. Able to identify bat roosting habitat, use acoustic recorders to detect bats and use software to identify bat species from recorded calls. 9. Able to track small mammals using both spool and line and fluorescent powder techniques. 10. Able to develop a null hypothesis about habitat selection and use a chi square test for independence to accept or reject that null hypothesis. 11. Perform current techniques for sampling herpetofanua and macroinvertebrates. 12. Describe and perform herpetofanual marking techniques. 13. Identify anuran species by call. 14. Identify and dissect larval amphibians. 15. Identify macroinvertebrate species in lentic and lotic habitats. 16. Describe common diseases of

amphibians. Credits: 4.00

6 Credits

Fall 3rd Year

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 34100 - Wildlife Habitat Management

Credit Hours: 3.00. Principles, practices, and justification of the habitat management approach to the manipulation of wildlife populations.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

15 Credits

Spring 3rd Year

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize

case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

13-14 Credits

Fall 4th Year

FNR 44700 - Vertebrate Population Dynamics

Credit Hours: 4.00. Estimation and analysis of populations; computer modeling of sampling methods, population dynamics, population and habitat management. Knowledge of computer programming not required.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 4.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians,

birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 46500 - History And Role Of Hunting In North American Wildlife Conservation

Credit Hours: 1.00. Introduction to the social, economic and wildlife management importance of hunting and how it relates to North American wildlife conservation. History of hunting and the North American Model of wildlife conservation, contrasted with those of European nations. Students will be required to participate in or observe hunting-related activities outside of class. This exercise is conducted off-campus on local Purdue-maintained properties.

Learning Outcomes: 1. Understand the history and role of hunting in North America. 2. Understand the economic impacts of hunting to wildlife conservation. 3. Examine how hunting influences wildlife management. 4. Examine the relationship of hunter demographics, ethics, public perception, and animal rights issues to hunting. 5. Apply the tenets of the North American Model of Wildlife Conservation to management and conservation challenges. 6. Experience hunting through first-hand activities. 7. Articulate the impacts of hunting to peers and constituents. Credits: 1.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at

subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

13-16 Credits

Spring 4th Year

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness;

determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

12 Credits

Women's, Gender & Sexuality Studies, BA

About the Program

Degree Requirements

Departmental/Program Major Courses (24 credits)

A. Women's Studies Required Courses (9 credits)

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts.

4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

B. Women's Studies Selectives (9 credits)

WGSS 49900 - Independent Study In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of the instructor in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 49200 - Practicum In Women's, Gender, and Sexuality Studies

Credit Hours: 2.00 to 4.00. This course is designed to integrate knowledge derived from women's studies scholarship with practical experience. Students will define their own projects in consultation with women's studies faculty. Periodic conferences and written reports required. Permission of instructor required.

Credits: 2.00 to 4.00

WGSS 48300 - Feminisms In Global Perspective

Credit Hours: 3.00. Explores feminist struggles through the writings of First and Third World feminist scholars. Focuses on feminist projects within and against colonial, nationalist, religious and global contexts. Includes Third World feminist critiques of Western feminisms.

Credits: 3.00

WGSS 48200 - Interdisciplinary Studies In Sexuality

Credit Hours: 3.00. This course offers an interdisciplinary introduction to recent work in lesbian and gay studies in various fields, including literature, history, film, cultural theory, medicine, law, and studies of sexuality.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

WGSS 38300 - Women, Work, And Labor

Credit Hours: 3.00. Examines race, class and gender issues as they affect working women in America. Covering women's work from domestic labor to informal economies to factories, topics include women's participation in trade unions, wage inequalities, family leave policies and sexual harassment.

Learning Outcomes: 1. Have acquired a broad comprehension of the work, including economic activity often not recognized as "work", that women typically have performed or is typically associated with women, world-wide and since the onset of industrialization. 2. Be capable of evaluating current global economic and cultural systems that impact what kinds of labor contemporary women perform, the conditions under which they work, and the nature of the gendered systems of labor that prevail in the U.S. and elsewhere. 3. Gain appreciation for the significance of women's unpaid or underpaid care-work, relational work, affective labor, and the "reproductive" labor underpinning global capitalism and industrialism. 4. Place their own personal lives and contexts within an analytical framework informed by feminist, Marxist, and intersectional perspectives on work and labor. Credits: 3.00

WGSS 38200 - Love, Sex And Sexuality

Credit Hours: 3.00. Explores intimate relationships and marriage practices in Western and non-Western societies from a historical and comparative perspective. Examines the changes in love and marriage in Greco-Roman societies, medieval and modern Europe, China, India and the Muslim world, among others.

Credits: 3.00

WGSS 38100 - Women Of Color In The United States

Credit Hours: 3.00. Explores the diversity of racial and ethnic groups in the United States with a particular emphasis on the histories, experiences, and cultural contributions of women of color. Provides a broad introduction to the intersections of gender, race and ethnicity.

Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 28100 - Variable Topics In Women's, Gender, And Sexuality Studies

Credit Hours: 1.00 to 4.00. This course examines in-depth particular topics from the introductory course in Women's Studies. It addresses gender issues for both men and women. Possible topics include gender and popular culture, women's bodies, body image, and health, masculinities, queering gender and gender transgression.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality,

race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 59900 - Selected Topics In Women's Gender And Sexuality Studies

Credit Hours: 3.00. A study of selected topics taught by an instructor in whose particular field of specialization the content of the course falls. Permission of instructor required.

Learning Outcomes: 1. Understand the influence of men's views and control of women's participation in sport across age, race/ethnicity and sexual orientation. 2. Understand feminist perspectives on sport. 3. Clarify the meaning of one's own sport experience. 4. Appreciate the contributions of pioneering women in creating opportunities for women today. 5. Identify obligations to those in future generations regarding access to future sport participation. 6. Understand and appreciate the differences in experiences and perceptions of others through group work and class discussions. 7. Lean how gender ideologies impact women and men's access to sport. 8. Interrogate masculinity and femininity in order to understanding how gender is constructed in and through sport. 9. Enhance students critical thinking and analytical skills Credits: 3.00

WGSS 39000 - Variable Topics In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Variable topics under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they invoke. 3. Apply feminist and queer theorizing of gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

C. Liberal Arts Selectives (6 credits)

Electives (23-60 credits)

Grade Requirements

GPA Requirements

Additional Information

Sample 4-Year Plan

Fall 1st Year

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

15-16 Credits

Spring 1st Year

15 Credits

Fall 2nd Year

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life.

Credits: 3.00

15 Credits

Spring 2nd Year

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

15 Credits

Fall 3rd Year

15 Credits

Spring 3rd Year

15 Credits

Fall 4th Year

15 Credits

Spring 4th Year

15 Credits

Certificate

Agriculture Leadership and Professional Development Program Certificate

About the Program

Purpose, Goals and Objectives

Competencies

Requirements for the Certificate

AGR 29000 - Special Topics In Agriculture

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. The specific topic that is offered will be indicated on the student's academic record.

Learning Outcomes: 1. Learning outcomes addressed include communication, critical thinking, and professional development. Credits: 0.00 to 3.00

Student Qualifications

Applications in Data Science Certificate

About the Certificate

Requirements for the Certificate (16 credits)

Core Courses (10 credits)

Foundation in Statistical Methods (3 credits)

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)
Credits: 3.00

BIOL 39500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 49500 - Special Assignments

Credit Hours: 0.00 to 18.00. Readings, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

PHYS 49000 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, laboratory work, or research in special areas of physics. Intended for upperclass students. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability.

Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2.

Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college

of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills by taking advanced quantitative methods courses. Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no

prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical methods for single variables or for relationships between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7. Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

SOC 40900 - Social Networks

Credit Hours: 3.00. Social networks are patterns of social relationships among people, organizations, and other entities (words, events, etc.) that allow communication and influence and provide a context for social life. This course considers social networks both on and off the internet that are important in people's lives for finding dates, getting jobs, maintaining friends and family, finding and maintaining identities, belonging to groups, and communication and influence more generally.

Learning Outcomes: 1. Communicate the essentials of nodes and relationships that compose networks in words and visualizations. 2. Identify patterns in social networks that have consequences for both individual people and

social systems. 3. Identify sources of social relationships and patterns of relationships that then have further consequences for people and social systems. 4. Summarize and make sense of basic social network data. 5. Recognize social networks in forms beyond Facebook, Instagram, Twitter, etc. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

Foundation in Computation (3 credits)

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify

relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies

to stretch your vision of potential uses. Credits: 3.00

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 46900 - Operating Systems Engineering

Credit Hours: 4.00. The design and construction of operating systems for both individual computers and distributed (networked) systems. Basic concepts and methods for managing processor, main memory, block-structured storage, and network resources are covered. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked versions of UNIX. These techniques are applied to design improvements of portions of a simplified, networked, UNIX-based operating system; the improvements are implemented and their performance is evaluated in laboratory experiments.

Credits: 4.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

IE 33200 - Computing In Industrial Engineering

Credit Hours: 3.00. Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems,

resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 19000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 23500 - Introduction To Organizational Computing

Credit Hours: 3.00. People and organizations, decision-making, information systems, telecommunications, desktop systems, integration tools, collaboration and groupware, multimedia, authoring multimedia documents, emerging technologies. May not be taken for credit by Computer Science majors.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

MGMT 28800 - Programming For Business Applications

Credit Hours: 3.00. This course will cover the fundamentals of business rules and logic in a business application development context. Students will acquire these skills using computer programming. A modern programming language will be used to learn and reinforce logical concepts, including abstraction, process flow, variable assignment, and control structures, as well as proper programming and application development practices, including documentation.

Learning Outcomes: 1. Understand and apply basic technical knowledge to managerial problems. 2. Successfully write, test, and run computer programs designed to address managerial problems. Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

MA 16290 - Data Science Labs: Calculus

Credit hours: 1.00. This course consists of weekly computer laboratories which apply concepts learned in Calculus I and II to data science problems. Main topics covered include function sampling and approximation, numerical differentiation, numerical integration, Jupyter notebooks, introductory Python programming, object oriented programming, and data acquisition with microcontrollers and sensors.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python 2. 4. Acquire basic object oriented programming skills. 5. Acquire and interpret sensor data. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of

good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

CE 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

EAPS 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open-source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

Foundation in Data Literacy, Management, and Analytics (3 credits)

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 30010 - Introduction To Machine Learning And Pattern Recognition

Credit Hours: 3.00. Intelligent information processing, search and retrieval, classification, recognition, prediction and optimization with machine learning and pattern recognition algorithms such as neural networks, support vector machines, decision trees and data mining methods, current models and architectures, implementation topics especially in software, applications in areas such as information processing, search and retrieval of internet data, forecasting (prediction), classification, signal/image processing, pattern recognition, optimization, simulation, system identification, communications, control, management and finance. Topics covered will also be

illustrated with the software package MATLAB and related toolboxes. Permission of instructor required.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multi-disciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. 7. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. Credits: 3.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

BIOL 49500 - Special Assignments

Credit Hours: 0.00 to 18.00. Readings, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CS 19000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

PHYS 49000 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, laboratory work, or research in special areas of physics. Intended for upperclass students. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

EAPS 59100 - Advanced Topics In Earth And Atmospheric Sciences

Credit Hours: 0.00 to 18.00. Specialized study offered on an individual basis or through specially arranged courses. Permission of instructor required.

Credits: 0.00 to 18.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

HONR 39500 - Interdisciplinary Honors - Independent Study

Credit Hours: 1.00 to 3.00. Individualized course of study undertaken with faculty supervision. Permission of instructor required.

Credits: 1.00 to 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad

introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the

roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

ENTM 24200 - Data Science

Credit Hours: 3.00. Develop a data science skill set that complements coursework in mathematics, statistics, and experimental design. Data Science facilitates research by developing skills in data sourcing, formatting and using different types of data, and hypothesis generation. Mathematical communication skills are developed through data graphics, animation, and delivery of results through multiple platforms including interactive simulations on webpages.

Learning Outcomes: 1. Source different types of data and know what analyses are appropriate for each type. 2. Transform and format data for analyses. 3. Detect trends in data as part of hypothesis generation. 4. Communicate findings to different audiences through appropriate graphics and animations, including through web pages. 5. Write R scripts to accomplish all of the above. Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

ILS 10300 - Introduction To Data Lifecycle Management

Credit Hours: 1.00. Introduces concepts of the management of data throughout its lifecycle. Understanding different types of data and their functions. Managing data in the context of a particular discipline or profession. Finding and evaluating data purposefully. Using data ethically and responsibly. Creating and sharing data for reuse, accountability, and enhancement. Making decisions and communicating using data, including data analysis and visualization. Protecting and archiving data.

Learning Outcomes: 1. Describe the data lifecycle and types of data that are used in their discipline or profession. 2. Discuss the ethical and responsible use of data. 3. Locate and evaluate datasets for reuse that are relevant to their research or work. 4. Apply a variety of introductory data collection, analysis, and visualization techniques. 5. Understand the basics of securing, archiving, and sharing data. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the

results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

MA 16290 - Data Science Labs: Calculus

Credit hours: 1.00. This course consists of weekly computer laboratories which apply concepts learned in Calculus I and II to data science problems. Main topics covered include function sampling and approximation, numerical differentiation, numerical integration, Jupyter notebooks, introductory Python programming, object oriented programming, and data acquisition with microcontrollers and sensors.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python 2. 4. Acquire basic object oriented programming skills. 5. Acquire and interpret sensor data. Credits: 1.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in

order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

AGRY 42000 - Computing For The Natural Sciences

Credit Hours: 3.00. Basic programming, problem solving, data visualization and communication in the context of agriculture and natural science research using R. Topics include iteration, functions, vectors, strings, algorithms, graphics and reproducible reports in R. This course is appropriate for undergraduates with a curiosity in computing fundamentals and interest in working with research data, especially those potentially applying to graduate school. Also appropriate for graduate students, researchers or other professionals who desire an introduction to programming with R. NO programming experience is necessary. This is not a statistics course; having had introductory statistics and some background coursework in agricultural or other natural sciences is expected.

Learning Outcomes: 1. Design, code and test small R programs. 2. Use programming to solve problems. 3. Communicate results with clean, reproducible reports. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS)

plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

Foundation in Data Ethics and Digital Citizenship (1-4 credits)

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29300 - Selected Topics In Philosophy

Credit Hours: 1.00 to 3.00. A critical examination of some special topic or topics in philosophy. Details concerning topics selected for treatment in a given semester may be obtained in advance from the Department of Philosophy. Sections of this course may sometimes be initiated by students upon petition to the department.

Credits: 1.00 to 3.00

HONR 49900 - Honors Research Project

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of faculty-led collaborative research projects. Topics will vary by semester. Permission of department required.

Credits: 1.00 to 6.00

HONR 39900 - Interdisciplinary Honors - Special Topics Seminar

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of honors seminars that stress interdisciplinary understanding, intellectual flexibility, creative thought, and group discussion. Topics vary by semester. Open to students at all levels.

Credits: 1.00 to 6.00

POL 22900 - Emerging Problems In Political Science

Credit Hours: 1.00 to 3.00. This course focuses on problems and issues that are beginning to be recognized as worthy of public discussion or policy action, or that may be new areas of expertise and interest for our faculty members. We use it to

introduce new topics and approaches, including experimental pedagogies, courses that involve travel, and the like. The content of the course varies from one offering to the next. Possible topics are Bioethics and Politics, Food Policy, and Bicycle Politics.

Credits: 1.00 to 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication.
Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.
Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data

Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

ILS 10300 - Introduction To Data Lifecycle Management

Credit Hours: 1.00. Introduces concepts of the management of data throughout its lifecycle. Understanding different types of data and their functions. Managing data in the context of a particular discipline or profession. Finding and evaluating data purposefully. Using data ethically and responsibly. Creating and sharing data for reuse, accountability, and enhancement. Making decisions and communicating using data, including data analysis and visualization. Protecting and archiving data.

Learning Outcomes: 1. Describe the data lifecycle and types of data that are used in their discipline or profession. 2. Discuss the ethical and responsible use of data. 3. Locate and evaluate datasets for reuse that are relevant to their research or work. 4. Apply a variety of introductory data collection, analysis, and visualization techniques. 5. Understand the basics of securing, archiving, and sharing data. Credits: 1.00

Application Focus (6 credits)

Agriculture

ABE 49800 - Undergraduate Research In Agricultural And Biological Engineering

Credit Hours: 1.00 to 3.00. Credit and hours to be arranged. Individual research projects for students with the approval of their advisors. Requires prior approval of, and arrangement with, a faculty research advisor. A written report and public oral presentation of final results are required. Permission of instructor required.

Credits: 1.00 to 3.00

AGEC 30500 - Agricultural Prices

Credit Hours: 3.00. Analysis of prices and the movement of farm product prices; relations of farm product prices to farm input and other prices; conceptual and statistical analysis of agricultural supply and demand relationships; application of price analysis, price forecasting, agricultural outlook, agricultural policy; adjustment of farming to new price conditions.

Learning Outcomes: 1. Understand economic principles that determine prices in markets. 2. Provide knowledge of markets and the entities and factors that impact market equilibrium outcomes. 3. Apply economic principles and empirical estimation tools to inform decision-making. Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze

data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 42100 - Advanced Commodity Marketing

Credit Hours: 3.00. Application of commodity marketing principles to grain, livestock, and other commodity sectors. Applications include hedging, speculation, risk management, and fundamental and technical price analysis. Examination and testing of pricing strategies and the development of commodity marketing plans.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze

data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC 49800 - Special Problems

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who want to study special problems in agricultural economics not covered in regular work. Permission of instructor required.

Credits: 1.00 to 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 49000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. A written report and oral presentation of final results is required. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and

oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 39900 - Individual Study

Credit Hours: 1.00 to 3.00. Supervised individual study or research over topics not covered in other courses. Arrange with agronomy faculty before registering. Permission of instructor required.

Credits: 1.00 to 3.00

AGRY 44400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (EAPS 43400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the

activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

BCHM 49801 - Head Start To Biochemistry Research

Credit Hours: 0.50 to 2.00. Supervised individual research. Weeks 9-16. This course is intended to provide a brief research experience in preparation for in-depth, independent undergraduate research the following semester. The students enrolled in this course will begin to learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 0.50 to 2.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

ENTM 49700 - Special Problems In Forensic Science

Credit Hours: 1.00 to 4.00. This course will provide an opportunity for qualified sophomores, juniors and seniors to engage in the study of special Forensic Science problems not covered in regular coursework. It will also provide a mechanism for recording these independent studies on their transcript. Permission of department required.

Learning Outcomes: 1. To develop content knowledge and critical thinking skills and allow students an opportunity to demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49800 - Special Problems In Entomology

Credit Hours: 1.00 to 4.00. Open to qualified sophomores, juniors, and seniors who want to study special problems in entomology not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 4.00

FS 44400 - Statistical Process Control

Credit Hours: 1.00. Basic concepts and techniques of solving quality problems and assuring the quality of production processes; emphasis is on quality improvement programs, problem-solving tools, control charts for variables and attributes, process capability analysis, and sampling methods. Course meets during weeks 6-10.

Credits: 1.00

FS 49100 - Special Assignments In Food Science

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who desire to study special problems in science not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 3.00

FNR 34800 - Wildlife Investigational Techniques

Credit Hours: 3.00. An introduction to current wildlife research techniques that are used in managing populations and habitats. Laboratory and field exercises are used to gather and analyze data; basic data analysis and written dissemination of results is emphasized.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35100 - Aquatic Sampling Techniques

Credit Hours: 3.00. An introduction to laboratory and field sampling methods in aquaculture, limnology, and fisheries biology. Emphasis will be placed on the proper use of laboratory equipment and sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 49800 - Special Assignments

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. 2. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

LA 49000 - Special Problems In Landscape Architecture

Credit Hours: 1.00 to 6.00. Independent in-depth study and presentation of specific research or design problems selected by the student in consultation with the instructor. Open only to advanced students. Permission of instructor required.

Credits: 1.00 to 6.00

NRES 49800 - Individual Studies In Environmental Science

Credit Hours: 1.00 to 3.00. An opportunity for upper-level undergraduates to focus their interests and knowledge on an environmentally related problem. Arrangements must be made with a Natural Resources and Environmental Science Program faculty member before registration. Permission of instructor required.

Credits: 1.00 to 3.00

ASEC 49900 - Special Problems In Agricultural Communication

Credit Hours: 1.00 to 3.00. Application of principles of mass communication in the production of agriculturally related news, feature, and magazine articles, radio and television reports, photographs, and publications in the Department of Agricultural Communication Service. Permission of instructor required.

Credits: 1.00 to 3.00

ASEC 49700 - Thesis Research

Credit Hours: 1.00 to 6.00. For Honors students only doing specialized youth development and agricultural education research. Arrange with academic advisor and honors research coordinator before registering.

Credits: 1.00 to 6.00

ASEC 49000 - Special Problems

Credit Hours: 1.00 to 6.00. Open to undergraduates who desire to study special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

AGEC 51600 - Mathematical Tools For Agricultural And Applied Economics

Credit Hours: 3.00. This course provides first year graduate students and advanced undergraduate students with the specific set of applied mathematical tools needed to support graduate coursework in microeconomics, macroeconomics, economic programming, and econometrics. The course reviews skills and concepts from a number of fields of mathematics including matrix algebra, calculus, optimization theory, and mathematical statistics. The course emphasizes specific applications to economic theory and applied problems in agricultural economics and related areas. Students should be comfortable with introductory-level calculus before entering the course. Permission of instructor required.

Learning Outcomes: 1. Knowledge and Scholarship: The ability to identify and conduct original research, scholarship or creative endeavors. 2. Communication: The ability to effectively communicate their field of study. 3. Critical Thinking and Problem Solving: Think critically, creatively and solve problems in their field of study. 4. Ethical Conduct: Conduct

research in an ethical and responsible manner. 5. Professional Development: demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 53000 - Advanced Plant Genetics

Credit Hours: 3.00. Advanced treatment of principles and recent advances in plant genetics including: mutagenesis; cell, molecular and direct approaches to genetic analysis and genetic interactions; haploidy; chromosomal organization and aberrations; transposable elements; mutations, para mutation and epigenetics in higher plants; extra nuclear inheritance; cytogenetic and molecular affinities between crop plants and their wild relatives; genetic manipulations; gene discovery; genetic approaches to understanding agriculturally useful plant traits. ESTs and global gene expression analysis, proteomics, metabolic profiling, comparative genomics and genome evolution. Offered in odd-numbered years.

Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

AGRY 59800 - Special Problems

Credit Hours: 1.00 to 6.00. Research on agronomic problems conducted in laboratory, field, or library; report required; arrange with an agronomy staff member before registering. Permission of instructor required.

Credits: 1.00 to 6.00

AGRY 60000 - Genomics

Credit Hours: 3.00. An introduction to the technologies and analytical methods used in studying genomes, their functions and systems biology. This course prepares graduate students for further study of these techniques in additional courses and in their research. Students with an understanding of introductory genetics and statistics will be suitably prepared for this course. Offered in even-numbered years.

Credits: 3.00

BTNY 53500 - Plant Disease Epidemiology

Credit Hours: 3.00. Plant disease epidemics occur due to the suitable combination of various elements of the agroecosystem. Many plant pathogens and diseases have increased their geographic distribution and intensity in the U.S. and the world. A lack of epidemiological understanding can exacerbate problems and significantly challenge the management of diseases at the field level. This course is an introduction to the epidemiological basis of disease management strategies. The course includes concepts in botanical epidemiology, disease assessment and measurement, disease modeling, epidemics comparison, and a revision of the traditional plant disease control principles. *Plant Disease Epidemiology* is an upper-level course for students interested in plant pathology, agronomy, data-driven Ag, national or international agriculture, or closely related areas. Although some pathosystems are used as model systems, *Plant Disease Epidemiology* is not a "how-to" course on controlling specific plant diseases.

Learning Outcomes: 1. Standardize terminology used in epidemiology for disease management purposes. 2. Analyze the accuracy and precision of data. 3. Use models to describe plant disease epidemics. 4. Explain how epidemiology is used to evaluate disease management options. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

HORT 55100 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

ASEC 59000 - Special Problems

Credit Hours: 1.00 to 6.00. A study of special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 42200 - Advanced Machine Technology For Agricultural Crop Production

Credit Hours: 3.00. The course examines technologies and techniques associated with modern farming practices often referred to in general as precision agriculture. It is structured to center around expert presentations from industry, academia, and farming practice, with a focus on technologies and appropriate application of such technologies in crop production systems in the Eastern Cornbelt. Consent of instructor required.

Learning Outcomes: 1. Identify and analyze technologies associated with precision agriculture. 2. Explain the appropriate use of the aforementioned technologies. 3. Compare technological alternatives in various crop production scenarios. Credits: 3.00

SFS 39100 - Special Problems In Sustainable Food And Farming Systems

Credit Hours: 1.00 to 3.00. Contemporary topics in sustainable food and farming systems are explored. Topic selection is based on student interest. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 2. Conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 3. Develop an understanding of and be able to practice the scientific method of investigation. 4. Handle multiple tasks and deadlines. 5. Have a strong professional ethics and integrity. 6. Have a working knowledge of SI (metric) units. Credits: 1.00 to 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique

of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 49310 - Insect Biology Capstone Experience

Credit Hours: 2.00 or 4.00. Insect Biology majors complete a capstone project under the guidance of a faculty mentor. Permission of instructor required.

Learning Outcomes: 1. Conduct a capstone project and analyze and interpret the information generated. Credits: 2.00 or 4.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

AGRY 48500 - Precision Crop Management

Credit Hours: 3.00. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital georeferenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. May be used in combination with AGRY 49800 to meet the Agronomy undergraduate capstone requirement; will also meet the GIS/GPS requirement in Agronomy plans of study.

Learning Outcomes: 1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from Dupont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input levels. 2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions. 3. Utilize data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific basis. 4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management. 5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates. 6. Utilize geo-referenced field scouting data and crop models to prescribe

effective pest management strategies. 7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources. 8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies. 9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors 10. Evaluate potential crop response to varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions). 11. Describe and explain the impact of productivity influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management). 12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies. 13. Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

AGR 33300 - Data Science For Agriculture

Credit Hours: 3.00. Students will apply data processes including identifying data needs, acquiring data, assessing data quality, data wrangling, filtering, and visualization. In each of several topic areas (forestry, animal science, agronomy, food science, entomology, engineering, economics), data-driven insights and improved decision making will be the culmination of applied data skills. Students will understand data ethics and

practice data management skills including the merging of disparate but related data sets.

Learning Outcomes: 1. Construct a research question that helps address a decision. 2. Describe different types of experimental designs and discuss the differences between observational and experimental studies. 3. Identify data needed to address various research questions. 4. Identify how these data sources are used in data analysis: agronomics, machine data, maps, spreadsheets, sensor data. 5. Describe how various data sets are acquired. 6. Describe how the following impact data ethics: ownership, storage, access. 7. Assess data quality and utility. 9. Identify potential limitations of a dataset. 10. Describe the following aspects of data wrangling: data formats, data compatibility, mobility. 11. Describe the following aspects of data management: storage, curation, metadata, FAIR (findable, accessible, interoperable, reusable). 12. List reasons for filtering, cleaning, and pre-processing data. 13. Describe tools for data cleaning. 14. Integrate disparate data sets. 15. Describe uses for the following in data visualization: bar charts, line charts, maps, tables. 16. Use the following tools to analyze data: correlations, mean generation, confidence intervals, simple model building, R Python. 17. Make decisions based on data outcomes. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes

(natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

Data Mine

EAPS 19100 - Introductory Topics In Earth And Atmospheric Science

Credit Hours: 1.00 to 3.00. Introductory special topics in earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 39000 - Special Assignments

Credit Hours: 1.00 to 4.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Learning Outcomes: 1. Understand physics and physical laws of nature by learning beyond what is offered by currently available fixed-title courses. Credits: 1.00 to 4.00

MGMT 29000 - Problems In Management

Credit Hours: 0.00 to 4.00. Arrange with instructor before enrolling. Investigation in a specific management field. Permission of instructor required.

Credits: 0.00 to 4.00

TDM 11100 - Corporate Partners I

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 11200 - Corporate Partners II

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 21100 - Corporate Partners III

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order

to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 21200 - Corporate Partners IV

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 31100 - Corporate Partners V

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 31200 - Corporate Partners VI

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is

appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 41100 - Corporate Partners VII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 41200 - Corporate Partners VIII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 51100 - Corporate Partners

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in

order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

Education

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address

specific performance gaps. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic

achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

Engineering

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 45000 - Computational Modeling And Data Analysis In Agricultural Engineering

Credit Hours: 3.00. The course is divided into three sections. Students will (1) learn about first and second-order dynamic systems, block diagrams, modeling of mechanical and electrical systems, and control theory while using Matlab and Simulink for modeling; (2) Learn about numerical methods for modeling of continuum mechanics and transport phenomena including finite element method and finite difference method. Applications in heat transfer, fluid flow, and solid mechanics will be studied in the computer lab; (3) Learn about data analysis topics including statistical models, probability theory, regression analysis, classification techniques, and machine learning.

Learning Outcomes: 1. Understand the fundamentals of dynamic systems modeling. 2. Create block diagram models for mechanical and electrical systems. 3. Understand control theory concepts and use it to design controllers. 4. Understand the fundamentals of finite element method and finite difference method including 1-D and 2-D formulations, boundary conditions, and postprocessing. 5. Use a major FEA software tool. 6. Evaluate the accuracy of the results. 7. Understand probability theory and regression analysis. 8. Explore classification techniques and machine learning concepts. 9. Apply data analysis skills to real-world datasets. Credits: 3.00

ABE 46000 - Sensors And Process Control

Credit Hours: 3.00. Fundamental aspects of transducers, biosensors, instrumentation, and computer control are presented, with particular emphasis on sensors and controls used in agricultural, biological, and food applications. Laboratory and pilot plant scale computer controlled equipment is used to examine response of process variables, sensor calibration, control system modeling, and controller selection and tuning. Prerequisite: differential equations and a course in either heat transfer or fluid mechanics.

Credits: 3.00

BME 40100 - Mathematical & Computational Analysis Of Complex System Dynamics In Biology, Medicine, & Healthcare

Credit Hours: 3.00. An introduction to analysis of complex system dynamics that appear in biology, medicine, and healthcare. Key topics include nonlinear dynamical concepts associated with phase plane, bifurcation, stability diagram, oscillation, and chaotic systems along with concepts from discrete systems and stochastic processes. These topics are taught within the context of mathematical and computational models related to both non-communicable diseases (i.e. cancer) and communicable diseases (i.e. HIV/AIDS). Courses projects are drawn from recent literature.

Learning Outcomes: 1. Graphically, analytically, and numerically analyze nonlinear dynamical models and numerically analyze discrete-event

and stochastic models of biological, medical, or healthcare systems. 2. Describe possible behaviors of a given system, including how a system may be manipulated within the inherent boundaries. 3. Present, in oral and written format, an analysis and critique of the application of dynamical modeling of a biological system to solve or understand an engineering problem. Credits: 3.00

ECE 30834 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. Permission of department required.

Learning Outcomes: 1. An understanding of the design issues for creating raster graphics. 2. An ability to apply rendering techniques to an actual computer graphics problem and associated datasets. 3. An understanding of object transformations, representations, transformations and perspective projections. 4. An understanding of color, illumination, and shading techniques. 5. An understanding of the rendering and rasterization techniques. 6. An understanding of the application of computer graphics techniques to visualization, animation, and computer aided design. Credits: 3.00

ECE 43800 - Digital Signal Processing With Applications

Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; short-time spectral analysis and synthesis; linear predictive coding. Image processing: two-dimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credits: 4.00

ECE 44000 - Transmission Of Information

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Learning Outcomes: 1. Recognize and analyze in the time and frequency domain the performance of amplitude and frequency modulated analog communications systems in the presence of noise. 2. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of analog systems, which include bandwidth and signal to noise ratio. 3. Recognize and analyze in the time and frequency domains the performance of various digital modulation formats, including ASK, QAM, PSK, and FSK in the presence of noise. 4. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of digital systems which include bandwidth and hit error probability. 5. Understand the basics of information theory and error control codes including the effect of error control codes on the bandwidth and bit error probability of digital systems. Credits: 4.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

EEE 25000 - Environmental, Ecological, And Engineering Systems

Credit Hours: 3.00. An overview of systems thinking and examples, and applications to environmental, ecological, and engineering systems. Students will develop an understanding of complex and global systems, along with the tools and analysis methods required to deal with them. Basic environmental and

ecological science concepts are also included.

Learning Outcomes: 1. Understand the types of relationships and dynamics common in complex systems, including environmental systems, ecological systems, and engineering systems. 2. Able to apply fundamental systems tools and modeling approaches to a wide variety of engineering, environmental, and ecological problems. 3. Understand the foundational concepts and vocabulary of global environment and ecological systems. 4. Appreciate the complexity of contemporary issues related to society and EEE, including and understanding of the roles and responsibilities of stakeholders. Credits: 3.00

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

ABE 52700 - Computer Models In Environmental And Natural Resources Engineering

Credit Hours: 3.00. Offers students in environmental and natural resources engineering programs an understanding of the hydrological processes and related design skills. Principles of soil erosion by water; drainage of agricultural lands; surface runoff; flood and reservoir routing; hydrodynamic and water quality in pipe network; nonpoint source pollution; and transport phenomenon are studied. Current computer models utilized in industry for decision support are applied using case studies to further enhance the understanding of the hydrological processes. Limitations and advantages of the models are discussed. Offered in alternate years.

Credits: 3.00

ABE 53100 - Instrumentation And Data Acquisition

Credit Hours: 3.00. This course educates students in the use, selection, and design of instrumentation and data acquisition for agricultural, food, environmental, and biological systems. Emphasis is on measurement of position (GPS), force, pressure, power, torque, flow, and temperature along with environmental sensors. Labs focus on building and using measurement systems and programming PC computers for data acquisition and analysis. Prior knowledge of electrical circuitry is desirable.

Learning Outcomes: 1. Understand the principles of operation and limitations of common measuring instruments. 2. Model instruments and their operating conditions to use the instruments correctly. 3. Design and use signal conditioning devices. 4. Program computers to automate the acquisition and processing of data. 5. Design systems for the acquisition, analysis, and communication of data. 6. Gain awareness of economical and societal aspects of instrumentation systems and communication of data. Credits: 3.00

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57700 - Engineering Aspects Of Remote Sensing

Credit Hours: 3.00. Introduction to the concepts of multispectral image data generation and analysis. Basic principles of optical radiation, reflection, and measurement in natural scenes. Fundamentals of multispectral sensor design and data analysis for complex scenes. Application of signal processing and signal design principles and of statistical pattern recognition to these problems. Spatial image processing methods and algorithms as appropriate to land scene data. Practice with analysis of actual aircraft and spacecraft data in a cross-disciplinary environment. Offered even years.

Learning Outcomes: 1. Knowledge of a number of important technologies based on multispectral/hyperspectral remote sensing and related image processing techniques. 2. Knowledge of machine learning techniques such as deep learning for remote sensing technologies. 3. Knowledge of developments in the areas of statistical analysis for remote sensing. 4. Knowledge of a number of other topics, such as MATLAB and Python for remote sensing algorithms. 5. Ability to utilize the theoretical analysis of topics based statistical pattern recognition and machine learning for various system designs. Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

NUCL 59700 - Selected Topics In Nuclear Engineering I

Credit Hours: 1.00 to 3.00. Development of individual research and study projects. Permission of instructor required.

Learning Outcomes: 1. Vary with coursework. Credits: 1.00 to 3.00

CHE 45000 - Design And Analysis Of Processing Systems

Credit Hours: 4.00. Use of process synthesis methods and concepts; detailed design of unit operation equipment, the economics of chemical plants and flow sheet optimization methods. Synthesize, develop, and evaluate a preliminary design of a chemical process that meets market requirements for a specific product. Analysis of design alternatives using case studies and optimization methods.

Learning Outcomes: 1. Apply systematic strategies for synthesizing chemical process designs that involve conventional unit operations. 2. Describe both the difference between steady state and batch chemical processes and the implications on their design and operation. 3. Demonstrate the ability to obtain reliable information on industrial chemical processes, process operating parameters, equipment costs, cost of chemicals and materials, and associated safety and environmental hazards. 4. Describe the role of physical property estimates on process design and be able to use appropriate physical property estimation methods in unit operations design. 5. Estimate the capital and operating cost of a process and to assess its profitability. 6. Use process simulators and other tools to perform detailed analyses for the successful design of a chemical plant. 7. Communicate effectively project progress and final results in a professional manner both orally and in writing. 8. Work effectively in a team to execute open-ended design projects with time-bound deliverables in a professional and ethical manner, including different team roles. Credits: 4.00

VIP 47920 - Senior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering

design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 37920 - Junior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47922 - Senior Design Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering

design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47921 - Senior Design Participation In Vertically Integrated Projects (VIP) I

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental

engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

Health and Human Sciences

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

PSY 49800 - Senior Research

Credit Hours: 3.00. Student conducts and writes a report on an individual research project under the guidance of a faculty member. Permission of instructor required.

Learning Outcomes: 1. Demonstrate expertise with the processes and procedures of research in psychological sciences. 2. Design and conduct a research project related to psychological sciences. Credits: 3.00

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques. Students will acquire the ability to utilize statistical software as a tool to facilitate the processing, editing, storing, displaying, analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

PSY 51400 - Introduction To Mathematical Psychology

Credit Hours: 3.00. This course introduces the student to the field of mathematical modeling of psychological processes. Mathematical techniques employed in modeling are learned, and a number of mathematical models and theories that have been developed and employed in various important areas of experimental psychology are explained. An introduction to problems in theory and model testability also is given.

Credits: 3.00

HTM 50200 - Management Information Systems For The Hospitality Industry

Credit Hours: 3.00. Analysis and design of management information systems for hotels, restaurants, and the travel industry. Topics include cost and value information, data management, local area and wide area networks, implementation of system and impact of information systems on hospitality organizations.

Credits: 3.00

PSY 30500 - Understanding And Analyzing Psychological Data

Credit Hours: 3.00. This course is an upper level undergraduate statistics course for students in psychology and related fields who are interested in conducting or understanding quantitative research. Students should have successfully completed an introductory statistics course (e.g., PSY 20100). The course will begin with an accelerated review of fundamentals concepts (e.g., data visualization, central limit theorem, probability) and then will focus primarily on regression.

Learning Outcomes: 1. Demonstrate advanced conceptual understanding of foundational statistical principles. 2. Demonstrate ability to correctly analyze data by hand and using SPSS. 3. Demonstrate skills in managing their own data. 4. Demonstrate the ability to comprehensively analyze and interpret the results of correlation, simple regression, multiple regression, and two-way interaction models. 5. Demonstrate proper interpretation. 6. Demonstrate the ability to accurately report results of statistical analyses in APA format. Credits: 3.00

PSY 39800 - Independent Research In Psychology

Credit Hours: 3.00. Students will conduct an independent research project related to research that is ongoing in the lab. Students will discuss theories and ideas related to the project, and plan and execute a thesis. Duties may include data coding and entry; participating in the planning of the research and the development of research materials; executing the research with responsibility for all aspects of data collection. Students are expected to be involved in the research project for an average of nine hours per week. Permission of instructor required.

Learning Outcomes: 1. Learn about many aspects of conducting research, such as human or animal subject issues, experimental design, interpreting results, relating results to theory, etc. 2. Learn how psychological questions can be answered through research. Credits: 3.00

PSY 51300 - Introduction To Computational Cognitive Neuroscience

Credit Hours: 3.00. Computational cognitive neuroscience is a new field of study that lies at the intersection of computational neuroscience and the similar fields of machine learning, neural network theory, connectionism, and artificial intelligence. Like computational neuroscience, computational cognitive neuroscience strives for neurobiological accuracy and like connectionism, a major goal is to account for behavior. Covered topics include feature extraction / optimization, connectionism, computational neuroscience, and computational cognitive neuroscience applications. Permission of department required.

Learning Outcomes: 1. Understand critically existing computational models. 2. Master important computational modeling methods. 3. Implement and simulate computational models. Credits: 3.00

Information Studies

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

Liberal Arts

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to

future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29300 - Selected Topics In Philosophy

Credit Hours: 1.00 to 3.00. A critical examination of some special topic or topics in philosophy. Details concerning topics selected for treatment in a given semester may be obtained in advance from the Department of Philosophy. Sections of this course may sometimes be initiated by students upon petition to the department.

Credits: 1.00 to 3.00

SOC 34000 - General Social Psychology

Credit Hours: 3.00. Social influences on the individual and processes of social interaction. Individual attitudes and behavior as related to socialization, social norms, social roles, communication and propaganda, and other social influences. Among the interaction processes considered are interpersonal attraction, influence, leadership, cooperation, and conflict. Not open to students with credit in PSY 24000.

Learning Outcomes: 1. Develop an understanding of how politics has been approached and analyzed by sociologists over time, and an appreciation for the important thinkers and historical events that have shaped these approaches. 2. Identify specific areas of political polarization and political consensus in contemporary American politics, including where we find evidence of partisan asymmetry. 3. Demonstrate ability to develop and communicate sociological insights as they relate to political history and contemporary political dynamics, both in class and in written assignments. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

POL 22900 - Emerging Problems In Political Science

Credit Hours: 1.00 to 3.00. This course focuses on problems and issues that are beginning to be recognized as worthy of public discussion or policy action, or that may be new areas of expertise and interest for our faculty members. We use it to introduce new topics and approaches, including experimental pedagogies, courses that involve travel, and the like. The content of the course varies from one offering to the next. Possible topics are Bioethics and Politics, Food Policy, and Bicycle Politics.

Credits: 1.00 to 3.00

ENGL 28000 - Games, Narrative, Culture

Credit Hours: 3.00. This is an introduction to the field of game studies, and to games as narrative and cultural media. We will look at the stories games tell; the way their narrative elements or plot devices intersect with the culture around the games and gaming itself; and how all these things come together to affect game design, meaning, and play.

Learning Outcomes: 1. Demonstrate knowledge of key concepts in both game studies and narrative theory in order to critique a game's systems and narrative elements. 2. Articulate how a game's narrative and the industry's workplace practices are situated in specific historical and cultural contexts. 3. Demonstrate critical thinking skills suited to cultural and historical complexities. 4. Articulate concise, coherent arguments about the effects of writing, narrative, and workplace practices and policies on the video game industry and a game's audience. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical

reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

Management

ECON 58500 - Behavioral Economics

Credit Hours: 2.00 or 3.00. This course explores human economic behavior, with a strong emphasis on laboratory and field experiment methodology used in behavioral economics research. Topics considered include behavior in markets for financial assets and auction markets, and behavior in social dilemmas that arise when people try to provide public goods voluntarily or increase economic surplus through trust. Students will also study how people bargain with and exhibit social preferences towards others. Decision-making and anomalies for risky uncertain choices will also be covered.

Credits: 2.00 or 3.00

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also

evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 40500 - Six Sigma And Quality Analytics

Credit Hours: 3.00. The course is an undergraduate elective offered as part of the Center for Manufacturing Management Enterprises (CMME) quality initiatives. Provides an overview of various tools and methods for total quality management.

Learning Outcomes: 1. Make data driven conclusions and decisions for quality management operations through working on various business cases. 2. Apply previously gained statistical knowledge to understand and to analyze data. 3. Gain some advanced analytical technics such as Analysis of Variances (ANOVA) and Design of Experiment (DOE) to optimize obtaining data and learnings. 4. Master a simple yet powerful MINITAB software to carry out complex tasks. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related

to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

ECON 32500 - Economics Of Sports

Credit Hours: 3.00. This class applies economic principles to the professional sports entertainment industry and its derivative input markets. The class begins by examining the microeconomics of demand for (by fans) and supply of (by teams) sports entertainment. The labor markets for the primary input, athletic talent, receive significant attention. Coordination among economic agents, taking the forms of leagues, players' unions, and government, is considered at the end of the class, with an emphasis on how they affect the efficiency of the markets related to sports entertainment. Quantitative empirical analysis is emphasized throughout the class. This is not a sports trivia or fantasy sports strategy class.

Learning Outcomes: 1. Solve models of how fans, teams, and players behave. 2. Describe and evaluate the structures of the markets for sports outputs and inputs, e.g., players. 3. Explain information presented in quantitative forms, e.g., equations, graphs, tables. 4. Analyze the effects of leagues' or governmental polices on market efficiency. 5. Communicate conclusions about sports output and input markets in numerical, graphical, tabular, and written forms. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid

predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

MGMT 48800 - Data-Driven Decisions In Digital Markets

Credit Hours: 3.00. This course analyzes the changes in business models that have been enabled by Internet technologies, and exposes students to hands-on data analyses to quantify the impact these technologies and business models have on firms, economies, and people. A programming course such as MGMT 28800 Programming for Business Applications or MGMT 38800 Python for Business or CS 17600 Data Engineering in Python or CS 17700 Programming with Multimedia Objects or CNIT 17500 Visual Programming or CS 18000 Problem Solving & Object Oriented Programming and a statistics course such as STAT 30301 Probability & Statistics for Business or MGMT 30500 Business Statistics is highly recommended.

Learning Outcomes: 1. Recognize the role of business models and data-driven decisions in digital markets. 2. Measure, evaluate, and improve online technology usage, advertisement campaigns, and product pricing to meet specific business objective like better serving customers, customer acquisition, quantifying network effects, etc. 3. Analyze the sheer amount of data ("traces") collected by businesses from different touch points - Google Glass, Apple Watch, smart phones, or simple computing devices - and make critical business decisions. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will

use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

ECON 48500 - Economics Of Racial And Gender Discrimination

Credit Hours: 3.00. This course focuses on quantifying the extent of, and determining the underlying causes of racial and gender disparities in the labor market. Topics include the impact of prejudice on labor market outcomes, statistical discrimination, early childhood factors and differences in environment, and fertility and reproductive technology.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize the differences and importance of disparities that control and do not control for observable factors. 3. Understand the difference between prejudice and discrimination, and the extent to which prejudice can cause discrimination. 4. Assess how discrimination can occur even in the absence of prejudice. 5. Evaluate the impact of policies designed to reduce disparities, such as affirmative action. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

Polytechnic

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to

Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

CNIT 48700 - Database Administration

Credit Hours: 3.00. This course explores tools and techniques for managing an organization's database technology. Topics include database architecture, database technology installation, database creation and maintenance, Database Management System (DBMS) operation and troubleshooting, and database performance tuning. In the laboratory, students engage in activities performed by a typical database administrator.

Learning Outcomes: 1. Describe the architecture of a database management system. 2. Perform the roles of a database administrator including storage and user management, and data persistence. 3. Apply the principles and methods of performance tuning on a database management system. Credits: 3.00

CGT 45600 - Advanced Web Programming, Development And Data Integration

Credit Hours: 3.00. This course presents the advanced technologies available for use on the World Wide Web and within corporate intranet environments. Emphasis and discussion is focused on the advantages and disadvantages of these technologies as well as on implementation to create unique solutions for business and industry. Strategies for planning, development, and implementation will be discussed and demonstrated. Significant time is spent on advanced programming and scripting as well as manipulation and visualization of data from various sources, including robust database management systems. Students are required to plan, design and implement a major project.

Learning Outcomes: 1. Demonstrate understanding of ASP.NET, C#, and the .NET Framework. 2. Create and compile advanced dynamic web projects using ASP.NET technology. 3. Demonstrate understanding of advanced database applications and SQL. 4. Show understanding of the logic behind advanced web applications. 5. Integrate front-end and back-end technologies in developing professional web applications. Credits: 3.00

ECET 32700 - Instrumentation And Data Acquisition Design

Credit Hours: 3.00. This course builds upon the prerequisite knowledge and covers implementation of electric systems to measure and record mechanical, electrical, and biological parameters. Signal characteristics, transducer specification and selection, signal conditioning and transmission design, data conversion, software, and an overall system error budget are developed.

Learning Outcomes: 1. Differentiate appropriate transducers for sensing various signals, including mechanical, biological, and electrical. 2. Design, simulate and verify signal

conditioning circuits. 3. Implement analog-to-digital converters and examine conditioned data for sampling and quantization effects. 4. Create software programs to interface with analog-to-digital converters, process data, and display or utilize the results. 5. Evaluate common sources of errors in instrumentation systems. Credits: 3.00

ECET 35901 - Computer Based Data Acquisition Applications

Credit Hours: 3.00. This course focuses on the study and application of computer based data acquisition (DAQ) systems. Concepts of high resolution and high throughput data acquisition are introduced and applied. Students learn and use programming and scripting languages to discover the interfacing, advantages and limitations of computer based (DAQ) systems.

Learning Outcomes: 1. Define, compare and contrast common data acquisition terms. 2. Analyze the advantages and limitations of DAQ systems. 3. Demonstrate proficiency with software tools and computer based data acquisition. 4. Develop user-friendly applications for the purpose of DAQ system control. 5. Collect, analyze, and reduce data from a system for the purpose of written and oral reporting. Credits: 3.00

CNIT 55900 - Data Warehousing

Credit Hours: 3.00. The design and implementation of data warehouses (including data marts and operational data stores) are studied using current database technologies. Topics include data modeling for warehouses, data warehousing infrastructure and tool selection, data exploration, data synthesis and reduction, organizational metadata, data warehouse administration, and other contemporary issues. Preference is given to students having graduate status in the College of Technology with a CIT concentration. Permission of instructor required.

Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

CGT 52000 - Computer Graphics Programming

Credit Hours: 3.00. This course provides a working knowledge of computer graphics fundamentals, such as using transformation matrices, writing programmable shaders, implementing a lighting model and texture mapping using a modern graphics API. Coursework focuses on creating real-time interactive applications using a low-level programming language.

Learning Outcomes: 1. Understand the graphics pipeline exposed by modern graphics APIs. 2. Understand and use transformation matrices and coordinate frames. 3. Implement the Phong lighting model using programmable shaders. 4. Understand and use texture mapping and texture state such as filtering and wrapping modes. 5. Understand and implement interaction techniques using mouse, keyboard and user interface. Credits: 3.00

CGT 52100 - Advanced Real-Time Computer Graphics

Credit Hours: 3.00. This course focuses on a working knowledge of real-time rendering and shaders using a modern graphics API. Students will learn the performance implications of program design choices with respect to the highly parallelized nature of the GPU and the characteristics of the GPU memory hierarchy. Students will learn about optional specialized programmable shader stages, as well as advanced techniques such as physically-based lighting and shadowing techniques.

Learning Outcomes: 1. Understand the graphics pipeline exposed by modern graphics APIs. 2. Understand and apply modern GPU features. 3. Understand and use buffers efficiently for data access in shaders 4. Understand and use techniques such as tangent-space bumpmapping or shadow mapping which require the use of additional

coordinate frames and transformation matrices. 5. Implement a physically-based lighting model using programmable shaders. Credits: 3.00

CGT 58100 - Workshop In Computer Graphics Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 8.00

AT 31900 - Uncrewed Aircraft Systems: Applications, Data, And Documentation

Credit Hours: 3.00. Focused on applying uncrewed aircraft technology to specific data gathering missions. Sensor types, mounting selection, and control will be demonstrated. Emphasis will be placed on sensor payloads, mission planning, and data acquisition. Post-flight data processing and analysis will be conducted using GIS and Remote Sensing software applications. All specifications and procedures will be documented in an industry-accepted format.

Learning Outcomes: 1. Develop missions for fully autonomous aircraft. 2. Monitor and control system performance in real-time. 3. Conduct post-flight data analysis, with system performance evaluation and optimization. Credits: 3.00

CNIT 48101 - Topics In Computer Information Technology IV

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

TECH 53300 - Design Theory And Technology

Credit Hours: 3.00. This course provides an overview of theories and approaches to the transdisciplinary concept of design, spanning multiple disciplines and types of design outputs with a focus on technology. Students will read the work of leading design scholars, and situate their personal approach to design practice and research based on historical and current trends in the literature. Student work will be focused on theoretical and practical outcomes, with two main learning goals: 1) building upon and critiquing theories, methods, and processes of design in their original research; and 2) generating an awareness and representation of their personal design philosophy.

Learning Outcomes: 1. Situate design as a unique epistemology and ontology. 2. Explain key aspects of design activity. 3. Identify scholars, seminal works, and theories relating to design. 4. Distinguish between every day and professional design, craft, and art. 5. Critique theoretical foundations of their own discipline using the language and constructs of design theory. 6. Identify and articulate vital components of their design activity. 7. Synthesize and prioritize their design commitments. 8. Communicate their philosophy of design in multiple discipline-appropriate ways. Credits: 3.00

CGT 37000 - Interactive Data Visualization

Credit Hours: 3.00. Data visualization is the art and science of putting quantitative numbers into pictorial or graphical format that are easy for users to understand, use, and take action upon the data. In this course, we will learn basic data visualization design principles, theories, data management skills, and fundamental web technologies to design and develop web based interactive date visualizations. The students will be able to design the proper visual representations of the data based on the data's characteristics, business needs, and prospective users.

Learning Outcomes: 1. Demonstrate understating of different types of data, their characteristics, relations, and business purpose. 2. Compare and choose proper visualization methods to represent the data based on the characteristic and purpose. 3. Apply perception theories and design principles in visualization design. 4. Utilize web toolkits and technologies to develop simple data visualization. 5. Develop an interaction information visualization system to represent data from different aspects. Credits: 3.00

CGT 37700 - Scientific Visualization

Credit Hours: 3.00. This course is an introduction to the use of computer graphics to help user gain insight into scientific datasets. Applications from atmospheric science, medicine and physics will be explored. Topics will include the fundamental approaches to scalar-valued data (volume rendering, iso-

surface extraction), vector-valued data (glyphs, streamlines), and tenors-valued data (ellipsoidal, quadric and super quadric glyphs).

Learning Outcomes: 1. Describe sources of scalar-, vector-, and tensor-valued data and the properties of the data. 2. Assess the effectiveness of given visualization techniques. 3. Explain the differences between multiple approaches to visualization. 4. Create effective scientific visualizations using the vTk library, or tools based on vTk. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 47000 - Data Visualization Studio

Credit Hours: 3.00. This course will teach students design and develop interactive data visualization systems to communicate and analyze complicated datasets. Students will learn interaction and visual design principles, draw from human perception and cognition theories, and focus on hands-on practice of developing interactive data visualization systems that enable users to see, understand, and analyze complex data and relations. At the end of the class, students will apply the design principles and use proper technologies to create a comprehensive interactive visualization system for data analysis.

Learning Outcomes: 1. Demonstrate understanding of design principles from perspectives of human perception, cognition, and design. 2. Choose the correct visual format based on the data, relations, and data usage. 3. Recognize the common problems in information visualization dashboard design. 4. Demonstrate the ability to process, filter, and transform data for visualization. 5. Utilize proper visual forms, visual analysis techniques, and practices for analyzing basic types of data and data relationships. 6. Develop complex interactive information visualizations system with multiple visualizations for communication and data analysis. Credits: 3.00

CGT 67000 - Applications In Visual Analytics

Credit Hours: 3.00. Visual Analytics (VA) provides a fast way for people to make sense of large number of data, and has applications in many sectors. This course will introduce Visual Analytics through foundational theories and a broad range of techniques and tools, focusing on using visualization methods to reason and solve complex problems in a wide variety of applications. Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces that synthesize human and computational ability to attack large complex problems. It is concerned with analytical reasoning, interaction, data transformations, data visualization, analytic reporting, and technology transition. While the different visual analytics applications share common theories and strategies, each of them has its unique data composition, visual representations, and analytical needs and strategies. Through survey and study a broad range of visual analytics applications, students will be able to apply visual analytics on their own applications, analyze and break down a complex analytical problem into proper components and steps, evaluate different visual analytic techniques and strategies, and finally design and develop an effective visual analytics solution toward the problem.

Learning Outcomes: 1. Describe the purposes, foundational theories, research components, and process of visual analytics. 2. Select proper visualization forms from visual analytics tools to answer specific reasoning questions. 3. Apply information visualization and visual analytics approaches to analyze complex problems from data processing, transformation, to

visualization, and analysis. 4. Compare, analyze and assess different visual analytics approaches from various aspects such as effectiveness, efficiency, scalability, learnability, and user experience. 5. Develop a visual analytics solution and evaluate its efficacy in solving a complex domain problem. Credits: 3.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

CGT 51200 - Foundational Readings Of User Experience Design

Credit Hours: 3.00. This course provides an overview of the field of human-computer interaction (HCI) and user experience (UX) design. Students will explore the main themes, paradigms, and theories of HCI and UX from its inception to the present. The course takes a broad, chronological approach, examining the history and evolution of HCI and UX, including its major intellectual shifts, successes and failures, and its dynamic relationship to other fields. Students will read seminal works from leading researchers. This course is intended to provide a solid foundation for further research. No specific technical or programming experience is required.

Learning Outcomes: 1. Engage with major theories, paradigms, and themes throughout the history of HCI and UX. 2. Identify, describe, and assess strengths and limitations of various methods and approaches with HCI and UX. 3. Critically evaluate existing research in the field and develop their scholarly and intellectual skills in preparation for future research. Credits: 3.00

CGT 27500 - Data Visualization II

Credit Hours: 3.00. This course provides a practical introduction to exploratory data analysis and data mining to better inform data visualization applications. The course introduces a practical approach for making sense out of data. Students are introduced to issues inherent to the data analysis process or data mining projects. The course covers: (1) how to ***prepare*** data prior to analysis, (2) how to ***generate*** summaries of the data, (3) how to ***identify*** non-trivial facts, patterns and relationships in the data and (4) how to ***create*** models from the data to better understand the data and make predictions. After data is analyzed students will use the data visualization process and techniques to ***visually represent*** the data. The course will also introduce the use of high-level programming languages for data analysis and data visualization.

Learning Outcomes: 1. Prepare data prior to analysis. 2. Identify patterns and relationships in the data. 3. Use programming languages for visualizing data at an introductory level. Credits: 3.00

CGT 27001 - Topics In Data Visualization

Credit Hours: 1.00. This course provides students with first-hand knowledge about the field of data visualization and explore a collection of competencies that will help students think through, think about, and think with visual representation of data. Students will explore and examine current careers in data visualization and learn what skills they should work to refine in preparation for future internships and jobs. This course will provide insight into current data visualization literacy requirements in today's data driven world.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4.

Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 1.00

CNIT 48200 - Six Sigma Data Quality For Continuous Improvement

Credit Hours: 3.00. A study of data quality for Six Sigma level of improvement, applying a Six Sigma DMAIC (Define, Measure, Analyze, Improve and Control) improvement methodology, utilizing information tools and techniques. The course addresses advanced topics in statistical based continuous improvement, data quality; and Big Data Analytics concepts, as pertains to systematic problems. An embedded certificate in SS is included in the body of knowledge.

Learning Outcomes: 1. Explain how Six Sigma principles are used for continuous improvement. 2. Apply the DMAIC and Big Data approach in solving team based, project based problems. 3. Demonstrate understanding of data quality principles as applied to compelling business cases. Credits: 3.00

CGT 35600 - Web Programming, Development And Data Integration

Credit Hours: 3.00. A course focusing on the development of dynamic content and applications to facilitate information distribution. The course stresses development strategies for managing the rapidly changing information of corporations and organizations for just-in-time distribution, using authoring programs to create interactive multimedia products that utilize database management systems, file systems, and XML to provide a method for visualizing and manipulating that data. Significant time is spent on intermediate to advanced programming and scripting.

Learning Outcomes: 1. Demonstrate an understanding of how to use server-side technology to develop dynamic database-driven websites and personalize content for users. 2. Integrate server-side and client-side technology in developing web applications. 3. Demonstrate an understanding of the logic behind web applications. 4. Create projects using server-side technologies to be used in a database-driven Web project. 5. Show understanding of basic database design, theory, and application. Credits: 3.00

Science

BIOL 29400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by freshman and sophomores. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 31200 - Great Issues Genomics And Society

Credit Hours: 3.00. The course will revolve around genomics, the science and technology involved in determining the sequence of the entire DNA complement in an organism. Almost everyone has heard of the human genome project, but fewer are aware of the spectacular technical progress in this field and the fact that many thousands of genomes have been sequenced. Until recently, most of these have been microorganisms, but technological and computational progress has made it progressively easier and cheaper to sequence the genomes of higher organisms. This field may have more of an impact on your future lives than almost any other field of the life sciences - mostly because it touches on all areas of study. The course will focus on the impact that genomes will have in selected areas. It will begin with a basic understanding of the science and technology that gave rise to our current capabilities in sequencing and the fact that technology continues to provide greater capacity and cheaper prices. You will soon see that every field in the College of Science is well represented in the science and technology. We will then go on to see how genomics influences many topics that affect our daily lives and can possibly provide answers to some critical questions (or at

least pose better questions): What is the basis of personalized medicine? What does genomics tell us about the genealogy of mankind? What impact will genomics have on our future food supply and our ability to feed a population of 9 billion people? What is the human microbiome and what does that mean to me? Similarly, what is the gut microbiome, the mouth microbiome, etc? What impact will genomics have on the development of alternative energy sources, especially biofuels? In every area, we will discuss the scientific challenges, but also the ethical and societal implications. In most cases, there is no one right answer, but a series of choices that can be guided by ethical considerations.

Learning Outcomes: 1. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. Credits: 3.00

BIOL 44207 - Exploration Of Protein Structure

Credit Hours: 1.00. This module is a hands-on exploration of the principles of enzyme structure. Students will use computers to retrieve and inspect protein structures from publicly available databases. Through the performance and analysis of sequence structural alignments, students will explore the relationship between primary, secondary and tertiary structures and the final active form of a protein.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to

specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49500 - Special Assignments

Credit Hours: 0.00 to 18.00. Readings, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 49900 - Biology Honors Thesis Research

Credit Hours: 1.00 to 4.00. Research under the guidance of a scientist. Submission of honors tutorial petition and consent of faculty tutor and Honors Committee. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures;

object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

EAPS 30900 - Computer-Aided Analysis For Geosciences

Credit Hours: 3.00. Application of computer analysis techniques including error analysis, line and surface fitting, spatial and temporal correlations, contouring, interpolation, and map projections. These methods are discussed in terms of specific geologic applications. All exercises and examples are developed using commercial mathematical software package. A three-hour-per-week computer laboratory tutorial provides hands-on experience with the techniques discussed in class. Prior course work in computer programming is required.

Learning Outcomes: 1. Carry out computational solutions to a given range of data analysis problems. 2. Select the appropriate analysis and visualization approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 42000 - Global Change Modeling

Credit Hours: 3.00. Understanding, monitoring, and modeling global environmental change. Each session examines the response of the interrelated earth systems to different geological, ecological, atmospheric, oceanic, or societal impacts. Topics include global warming, major biogeochemical cycles, atmospheric ozone, coevolution of life and climate, asteroid impacts, and ecological disruptions. The laboratory uses object-oriented modeling software and current NASA satellite data. No prior knowledge of computer programming is required.

Credits: 3.00

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

BIOL 61100 - Crystallography Of Macromolecules

Credit Hours: 3.00. The special techniques required in the structure determination of biological macromolecules. Symmetry of macromolecules. Data collection and processing. The isomorphous replacement technique. The molecular replacement technique. Use of anomalous dispersion. Restraint and constraint refinement. Computational techniques. Prerequisite: BIOL 51100. Permission of instructor required.

Credits: 3.00

EAPS 50900 - Data Analysis Techniques In Earth And Atmospheric Sciences

Credit Hours: 3.00. Application of statistical techniques to

analyze and interpret data containing substantial information about the dynamics of our planet Earth. Emphasis on fundamentals with elements of atmospheric/climate time series analysis and weather and climate extremes (necessary for understanding current research) interwoven with computer-intensive bootstrap methods (which work for complex data sets typical in geosciences). Offered Spring.

Learning Outcomes: 1. Gain a solid basis for practical application of statistical methods to data analysis in geosciences. 2. Gain exposure to atmospheric and climate time series analysis including weather and climate extremes, necessary for understanding current topics in weather and climate research. 3. Experience computer-intensive methods to handle complex data sets without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. Credits: 3.00

EAPS 52300 - Radar Meteorology

Credit Hours: 3.00. Origin and evolution of radar. Modern weather radar systems and their component parts. Propagation of microwave energy in the atmosphere. Rayleigh and Mie scattering theory, with application to scattering by precipitation. Utilization of radar systems in forecasting quantitative analyses and cloud physics research. Recent refinement and future potential. Prior coursework in synoptic meteorology labs and atmospheric physics is required.

Credits: 3.00

EAPS 55700 - Introduction To Seismology

Credit Hours: 3.00. Theory of propagation to seismic waves in elastic media. Solution of wave equations for compressional, shear, and surface waves. Analysis of travel-times, amplitudes, and attenuation of seismic waves in terms of ray and wave theory. Principles of the seismograph. Structure of the earth as determined by seismological studies. Investigation of the causes, effects, distribution, and characteristics of earthquakes. Earthquake prediction.

Credits: 3.00

EAPS 55900 - Topics In Seismology

Credit Hours: 1.00 to 3.00. This course covers current topics in seismology. Recent topics have included seismic structure of the crust and mantle, seismic anisotropy, and earthquake sources. Professor Nowack. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 57700 - Remote Sensing Of The Planets

Credit Hours: 3.00. Introduction to key planetary and Earth science satellite remote sensing datasets, including visible and thermal imagery, visible through mid-infrared spectroscopy, radar, gamma ray and neutron spectroscopy, and laser altimetry. Students will receive hands-on-experience with data acquisition, image processing in IDL, spectral analysis in ENVI and Davinci, crater counting, and geologic mapping in GIS programs. Includes 1-2 full-day field trips. Junior, Senior, or Graduate status required. Recommended minimum background for undergraduates: Introductory knowledge of Earth or planetary surface processes and basic programming skills.

Learning Outcomes: 1. Understand the underlying physical principles behind the interpretation of remote sensing data. 2. Gain proficiency in the acquisition, processing, and analysis of remote sensing data. 3. Gain field experience with using and ground truthing remote sensing data at planetary analog sites. 4. Propose a research topic, conduct a literature review, and design and complete an original research project. Credits: 3.00

EAPS 59100 - Advanced Topics In Earth And Atmospheric Sciences

Credit Hours: 0.00 to 18.00. Specialized study offered on an individual basis or through specially arranged courses. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis

pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source

computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 51000 - Climate Time Series Analysis

Credit Hours: 3.00. This course in time series analysis combines traditionally taught basics with topics of central importance in current weather and climate research, including long memory, extremes, nonlinear time series, chaos and complexity.

Learning Outcomes: 1. Understand concepts and methods of classical time series analysis. 2. Get hands on experience in resampling methods for time series analysis, which work for complex data sets without having to rely on strong assumptions common in classical time series analysis but rarely met in geosciences. 3. Learn how to match a time series methods to a particular geosciences data set or question. 4. Develop skills in writing programs in R to analyze geosciences data and interpret results. 5. Learn basics of advanced topics instrumental in geosciences: long memory, extremes, nonlinear time series, chaos and complexity. 6. Improve their critical thinking and oral communication skills via giving presentations on their research projects involving topics covered in the course. Credits: 3.00

EAPS 53000 - Extreme Weather And Climate: Science And Risk

Credit Hours: 3.00. This project-oriented course introduces students to the real-world analysis of weather and climate risk, including under climate change. Course will provide a risk-relevant introduction to different types of impactful weather (e.g., hurricanes, drought) and how the climate system can cause them to vary on monthly (e.g., Madden-Julian Oscillation), seasonal (e.g., El Nino and La Nina), and longer timescales (e.g., climate change). The course will further connect this intrinsic uncertainty in weather outcomes to uncertainties in real-world applications (e.g., crop yields) across a variety of economic sectors - "risk". Students will be introduced to basic methods in probability and statistics for analyzing data required to help someone make real-world decisions that depend on weather/climate. The principal course outcome is a semester-long "start-to-finish" project where students define a hypothetical real-world decision that is weather-dependent, find and analyze data to guide that decision-maker, write a concise report on their findings, and concisely present their results orally to the class.

Learning Outcomes: 1. Explain the meaning of "risk" in weather/climate and impacts. 2. Describe the basics of various types of impactful weather. 3. Describe how modes of climate variability cause weather to vary on monthly, seasonal, and longer time scales. 4. Explain how weather and climate variability translates to risk in a wide range of applications and economic sectors. 5. Analyze weather/climate data to find real-world solutions to weather risk problems. 6. Gain experience working as a hypothetical weather/climate science consultant in a team setting. 7. Summarize research in a succinct and compelling technical report. 8. Summarize research in a succinct and compelling oral presentation. 9. Use data to help someone find a solution to a real-world problem that depends on the weather/climate. Credits: 3.00

EAPS 54000 - Introduction To Geodesy

Credit Hours: 3.00. Course offers an introduction and overview of theory, techniques, data sources, and applications of geodesy. Provides understanding of how various geodetic techniques work and how they can be used to investigate a number of geological, atmospheric, and related problems. Evaluation of the robustness and quality of data as well as assessment of models and conclusions derived from geodetic methods.

Learning Outcomes: 1. Explain essential theory behind various geodetic techniques. 2. Describe how geodetic techniques and datasets can be used to investigate geological problems. 3. Identify and break down contributing sources to complex data signals. 4. Assess which data and model types are most appropriate for a particular problem. 5. Devise an original

research project topic and develop hypothesis and a methodology for its evaluation. 6. Analyze and critique scientific journal articles. 7. Summarize main research results in a clear, concise manner in both written and oral form. Credits: 3.00

EAPS 54100 - Geodetic Data And Applications

Credit Hours: 3.00. This course will provide students with hands-on experience in the selection, processing, and analysis of geodetic data sets, particularly InSAR and GPS. Students will learn how to select data, evaluate its strengths and weaknesses, process and analyze the data, and apply it to the investigation of geological problems.

Learning Outcomes: 1. Explain essential theory behind processing geodetic data. 2. Describe various processing parameters and how they influence data analysis. 3. Evaluate quality of various datasets and determine most appropriate analysis strategies for desired application. 4. Interpret analyzed datasets in the context of geological problems. 5. Judge whether models fit data and if model parameters are compatible with available non-geodetic data sources. 6. Devise an original research project topic and develop hypothesis and a methodology for its evaluation. 7. Summarize main research results in a clear, concise manner in both written and oral form. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

PHYS 32300 - Research With Big Data I

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

PHYS 32400 - Research In Big Data II

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results

that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

MA 16290 - Data Science Labs: Calculus

Credit hours: 1.00. This course consists of weekly computer laboratories which apply concepts learned in Calculus I and II to data science problems. Main topics covered include function sampling and approximation, numerical differentiation, numerical integration, Jupyter notebooks, introductory Python programming, object oriented programming, and data acquisition with microcontrollers and sensors.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python 2. 4. Acquire basic object oriented programming skills. 5. Acquire and interpret sensor data. Credits: 1.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

CE 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

EAPS 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real-world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

EAPS 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open-source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate

the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

Notes

Biostatistics Certificate

About the Certificate

Requirements (18-19 credits)

Biological Foundation Course (3-4 credits)

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency

with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

Foundations in Statistical Science (6 credits)

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics.

Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear

regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

BME 50100 - Multivariate Analyses In Biostatistics

Credit Hours: 3.00. This course focuses on fundamental principles of multivariate statistical analyses in biostatistics, including multiple linear regression, multiple logistic regression, analysis of variance, and basic epidemiology. The fundamental theories are applied to analyze various biomedical applications ranging from laboratory data to large-scale epidemiological data.

Learning Outcomes: 1. Understand fundamental concepts in multivariate regression analyses. 2. Translate research questions into suitable multivariate frameworks. 3. Design studies with appropriate statistical power. 4. Compute and interpret appropriate statistical estimates from multivariate analyses. 5. Use a major statistical software package (e.g. STATA, SAS, SPSS, and R) to perform large-size data analyses. Credits: 3.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to

translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

Foundations in Public Health (6 credits)

PUBH 20500 - Basic Public Health Studies

Credit Hours: 3.00. Examination of basic scientific concepts as applied to the problems and issues in selected areas of human health behavior with particular attention to their influence on population and individual health. Restricted to students enrolled in major degree programs for which this course is a requirement.

Learning Outcomes: 1. Discuss the nature of public health promotion and disease prevention in the US. 2. List the leading causes of death and describe leading theories of health behavior. 3. Define the components of psychological health and describe the basic traits shared by psychologically healthy people. 4. Describe the nature of stress, the physiology of the stress response, and the relationship of stress to health/disease; identify the major sources of stress in contemporary society and discuss interventions for stress management. 5. Discuss categories of drugs, routes of administration and drug interactions. 6. Describe the relationship of alcohol, tobacco and caffeine to health and disease. 7. Describe the general concepts of nutrition, list and explain the recommendations made to the public by various health agencies to decrease risk of chronic disease. 8. Describe various theories of obesity, discuss concepts of weight management, define/describe body image and the disordered eating continuum, define anorexia and bulimia nervosa, and list symptomatology and risk factors. 9. Discuss the relationship of physical activity and physical fitness to health and/or disease and provide rationale (based on evidence from exercise epidemiology) for the recommendations made to the public concerning activity/exercise participation. 10. Describe the anatomy and basic functions of the cardiovascular system and the prevalence/incidence of heart disease, identify risk factors and describe the features of atherogenesis and other diseases of the heart and vascular system. 11. Describe the prevalence and incidence of the various types of cancer and identify cancer risk factors. 12. Describe the prevalence and incidence of diabetes and list risk factors for diabetes. Credits: 3.00

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal

principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

PUBH 36500 - Public Health Research Methods

Credit Hours: 3.00. The course is designed to help you (1) develop an understanding of the nature of research and the scientific method in public health, (2) acquire an appreciation for the different types of research conducted within public health, and (3) provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating public health research in basic and applied settings.

Learning Outcomes: 1. Explain and discuss the public health research process. 2. Identify or develop sound public health research questions and hypotheses, and discuss appropriate methods for testing the hypotheses. 3. Demonstrate appropriate techniques regarding data collection in public health. 4. Interpret research findings and discuss their implications relative to public health. Credits: 3.00

Advanced Quantitative/Computational Methods (3 credits)

PSY 30600 - Understanding And Analyzing Experiments

Credit Hours: 3.00. This course helps to prepare students for independent research. Students (1) develop an understanding of group-based statistical analyses, such as t-tests and ANOVA; (2) formulate and present a research idea based on statistical tools covered in class; and (3) get experience using statistical software to analyze data.

Learning Outcomes: 1. Determine which statistics to use, how to use them and how to interpret their findings using data for conventional experimental designs in psychological sciences. 2. Interpret current research in psychological sciences. 3. Give oral presentations based on research. 4. Develop and advance personal research interests. Credits: 3.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information

on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

PUBH 52600 - Randomized Control Trials In Public Health

Credit Hours: 3.00. Randomized control trials provide solid evidence on whether interventions and programs "work" to improve health outcomes. In this course, students will learn how to design a randomized study, handle practical issues that arise in data collection, analyze data using appropriate methods and good statistical practice, identify limitations to statistical evidence, and interpret and communicate findings in an audience-appropriate way. This is a hands-on course in which students will work with data and build skills using SAS statistical software in preparation for careers as biostatisticians, data scientists, and researchers. Pre-requisite: A graduate level introductory statistics course that includes simple linear regression.

Learning Outcomes: 1. Identify and plan an appropriate randomized study design to answer a substantive question. 2. Identify limitations to statistical evidence that arise in study design and implementation. 3. Analyze data from randomized trials using appropriate methods and good statistical practice. 4. Interpret and communicate findings from randomized trials in an audience-appropriate way. Credits: 3.00

Learning Outcomes

Collaborative Leadership Certificate

Requirements for the Certificate (9 credits)

Required Courses (9 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

EDPS 31600 - Collaborative Leadership: Cross-Cultural Settings (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the cultural nuances of leadership in the United States as well as around the world. This course will include impact of globalism as a context for leadership, conflict resolution in a global environment, and other important factors that impact culturally

diverse or global teams.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Better understand what a culture is, broadly defined, and how it functions. 2. Better understand the importance of culturally aware, knowledgeable, and skillful leaders. 3. Increase professional and personal self-awareness in relation to leadership in diverse settings. 4. Better understand the importance of making cultural issues central for constructive conflict management. 5. Understand the complexity of leader-other interaction and impact of psycho-social variables on this interaction. Credits: 3.00

EDPS 31700 - Collaborative Leadership: Mentoring

Credit Hours: 3.00. The purpose of this course is to provide a theoretical and experiential overview of the basic elements of mentoring as a key aspect of effective collaborative leadership. The hallmark of this course is the inclusion of a service-learning component in which students will be paired with undergraduate mentees and required to participate in weekly mentoring meetings for the duration of the semester. This learning experience is designed to promote development of the knowledge, skills, and dispositions required for competent mentorship. Emphasis on peer mentoring.

Learning Outcomes: 1. Differenitate among various types, purposes, roles of mentoring/mentors. 2. Identify the essential elements of effective mentoring relationships. 3. Examine and discuss the ethical considerations involved in mentoring. 4. Acquire knowledge regarding how issues of diversity interact with the process of mentoring. 5. Evaluate empirical findings associated with mentoring. 6. Consider various approaches to evaluating mentoring and the outcomes of mentoring programs. Credits: 3.00

Notes

Cornerstone Certificate

About the Certificate

Requirements for the Certificate (15 credits)

Level I: Explore (6 credits)

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Level II: Invent (3 credits)

Theme 1 - Science & Technology

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay

between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 25100 - History Of Photography I (UCC: HUM)

Credit Hours: 3.00. An introduction of the history of photography from the medium's inception until 1950. Emphasis is placed on understanding photographs from a variety of aesthetic, social, and cultural perspectives, including those of race, class, and gender.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

GER 22300 - German Level IV: Science And Engineering

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills, directed toward use of German in science and technology. Work on grammar as needed. Use of materials from recent publications in science and technology. Introduction to general and technical vocabulary. Conducted primarily in German. Credit will not be given for both GER 20200 and 22300.

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts about science, engineering, and business. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings about science, engineering, and business in spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos about science, engineering, and business in spoken German. 4. Compose German sentences about science, engineering, and business by focusing on a set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations that deal with science, engineering, and business. Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

ENGL 22300 - Literature And Technology (UCC: STS)

Credit Hours: 3.00. This class uses literature to explore how technological innovation both enables and constrains creativity. It also explores how technology has been represented in literature, and examines the relationship between literature and new media.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Define technology and

its implications. 2. Employ multiple approaches to critical thinking well-suited to cultural complexities. 3. Demonstrate written, visual, and technological literacies while working with diverse media. 4. Demonstrate creativity through remediation (moving information from one medium to another) and iteration. 5. Explain the relationship between information and digital media production. 6. Explain and employ multiple critical approaches to narrative and storytelling. Credits: 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

Theme 2 - Environment and Sustainability: Cultural Impact & Representation

ANTH 23500 - The Great Apes

Credit Hours: 3.00. Students will learn the behavior and conservation of our closest relatives and how early ape studies changed our understanding of what it meant to be human. Topics include gender in science, ethics of research and cross-cultural understandings.

Learning Outcomes: 1. Identify the geographic distribution as well as the anatomical and behavioral traits that characterize great ape species. 2. Explain the major achievements of and challenges to great ape research in the wild and captivity. 3. Demonstrate an understanding of why and how anthropologists use great apes to model human evolution. 4. Describe the ethical issues of conducting research on our closest living relatives and conserving them in the wild. Credits: 3.00

ENGL 23400 - Literature And The Environment (UCC: STS)

Credit Hours: 3.00. Literary study of nature writing; writing from the natural sciences; and canonical poetry, fiction, and essays through an ecological lens. Introduces students to ecocritical thought and environmental literary history.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and discursive conventions of literature about the environment. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as

modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

Theme 3 - Healthcare & Medicine

ANTH 20300 - Biological Bases Of Human Social Behavior (UCC: BSS)

Credit Hours: 3.00. This course is an introduction to human social behavior from the perspective of biological anthropology, with special emphasis on human evolution and non-human primates. Topics include aggression, communication, learning, maturation, sexuality, and the evolution of social systems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Demonstrate understanding of core concepts and theories of human evolutionary biology and ecology. 2. Describe key components of human life course evolution and hunter-gatherer lifestyles. 3. Analyze the evolutionary mechanisms underlying behavioral variation across primates. 4. Assess cross-cultural variation in food acquisition, mating, parenting, and social systems. Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an

understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SOC 27500 - Sociology Of Aging And The Life Course (UCC: BSS)

Credit Hours: 3.00. An examination of research on the social context of human aging, including demographic and developmental changes. A life course perspective is emphasized for studying health, life events, and quality of life. Considers exceptional longevity in comparative perspective.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Comprehension of the basic concepts, theories, and methods of the sociology of aging. 2. Think sociologically and write more clearly. 3. Application of course content in personal and vocational experiences. Credits: 3.00

ENGL 22600 - Narrative Medicine (UCC: STS)

Credit Hours: 3.00. "Narrative Medicine" encompasses stories about the interior lives of doctors and medical professionals, the complexities of medicine past and present, and health-care for patients and their families. Ultimately, this course emphasizes the essential role of rhetoric and storytelling in the face of medical crisis and uses stories about illness and disability to explore the human condition.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Explain medicine from a humanistic perspective. 2. Explain contemporary health issues. 3. Define storytelling as an intellectual and empathic discourse. 4. Analyze fictional and factual narratives (stories). Credits: 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

ANTH 21500 - Introduction To Forensic Anthropology

Credit Hours: 3.00. Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. This course introduces students to methods used to

recover and positively identify human remains, and to evaluate trauma and taphonomy in medico-legal situations. Topics include an overview of historical and current developments in the field. Students will develop a comprehensive understanding of the sequential order of applied work from the search for forensic scenes through the recovery of remains, and skeletal analysis in the laboratory.

Learning Outcomes: 1. Understand the legal context in which anthropologists work in both state and federal courts by the standards of the US medico-legal system. 2. Explain the statistical approaches to forensic anthropological problems by analysis of problem sets. 3. Gain general knowledge about the methods of the biological profile (age, sex, ancestry, stature and pathology) to improve competency and understand the errors associated with each method by review and evaluation of relevant literature. 4. Explain the biological basis of the components of the biological profile by advancing reasonable conclusions. 5. Critically examine the use of the terms race and ancestry in forensic contexts by group discussion. Credits: 3.00

ANTH 24000 - Medicine, Science, And Culture

Credit Hours: 3.00. This course explores the intersections of medicine, science, and culture as powerful shapers of our lives and the world today. Anthropology broadly studies the human experience to help explain how our bodies, biologies, and beliefs inform what "medicine," "health," "illness," and "healing" come to mean in diverse and cross-cultural contexts. The course will cover foundations in medical anthropology by exploring a range of topics and applications.

Learning Outcomes: 1. Describe what medical anthropology is and what medical anthropologists do. 2. Analyze the dynamic intersections of medicine, science, and culture. 3. Explain what medical anthropology contributes to understanding the multiple dimensions of health, illness, and healing. 4. Apply anthropological frameworks to real-world examples. Credits: 3.00

Theme 4 - Business and Management

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written

and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

HIST 27800 - Money, Trade, And Power: The History Of Capitalism

Credit Hours: 3.00. This course examines the origins of capitalist institutions and their changes over time, including banks, joint-stock companies, and modern corporations -- all viewed with respect to their impact on industrialization, colonial expansion, business cycles, and the emergence of a global economy.

Learning Outcomes: 1. Explain the history of capitalism based on a combination of readings, course lectures, and course discussions. 2. Develop compelling historical arguments and demonstrate your understanding of the course material through examinations. 3. Write clear and concise analytical papers based on templates and feedback supplied by the professor. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

Theme 5 - Conflict Resolution & Justice: Cultural Impact & Representation

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship,

family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 26000 - Philosophy And Law

Credit Hours: 3.00. A discussion of philosophical issues in the law: a critical examination of such basic concepts in law as property, civil liberty, punishment, right, contract, crime and responsibility; and a survey of some main philosophical theories about the nature and justification of legal systems. Readings will be drawn from both law and philosophy.

Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

Theme 1 - Science & Technology

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 25100 - History Of Photography I (UCC: HUM)

Credit Hours: 3.00. An introduction of the history of photography from the medium's inception until 1950. Emphasis is placed on understanding photographs from a variety of aesthetic, social, and cultural perspectives, including those of race, class, and gender.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent

theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

GER 22300 - German Level IV: Science And Engineering

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills, directed toward use of German in science and technology. Work on grammar as needed. Use of materials from recent publications in science and technology. Introduction to general and technical vocabulary. Conducted primarily in German. Credit will not be given for both GER 20200 and 22300.

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts about science, engineering, and business. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings about science, engineering, and business in spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos about science, engineering, and business in spoken German. 4. Compose German sentences about science, engineering, and business by focusing on a set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations that deal with science, engineering, and business. Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication.
Credits: 3.00

ENGL 22300 - Literature And Technology (UCC: STS)

Credit Hours: 3.00. This class uses literature to explore how technological innovation both enables and constrains creativity. It also explores how technology has been represented in literature, and examines the relationship between literature and new media.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Define technology and its implications. 2. Employ multiple approaches to critical thinking well-suited to cultural complexities. 3. Demonstrate written, visual, and technological literacies while working with diverse media. 4. Demonstrate creativity through remediation (moving information from one medium to another) and iteration. 5. Explain the relationship between information and digital media production. 6. Explain and employ multiple critical approaches to narrative and storytelling. Credits: 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone

tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

Level III: Engage (6 credits)

Theme 1 - Science & Technology

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use.
Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

ENGL 37300 - Science Fiction And Fantasy (UCC: HUM)

Credit Hours: 3.00. Representative works of science fiction and fantasy examined in relation to both mainstream and popular literature. Emphasis is on technique, theme, and form.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to

specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

PHIL 35000 - Philosophy And Probability

Credit Hours: 3.00. This course introduces the student to mathematical probability and its philosophical applications. Topics may include theories of probability, Hume's problem of induction, Goodman's paradox, and the foundations of scientific reasoning.

Credits: 3.00

PHIL 42100 - Philosophy Of Science

Credit Hours: 3.00. An examination of central issues in philosophy of science. Topics include theories of explanation, confirmation, reduction, laws, the status of theoretical entities, and the epistemological foundations of scientific theories.

Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

ENGL 36700 - Mystery And Detective Fiction (UCC: HUM)

Credit Hours: 3.00. An introduction to the detective genre, examining its origins, its characteristics, and its intersections with empiricism, forensic science, race, class, gender, sex, and empire.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Be familiar with the generic conventions of, and theoretical

approaches to, the detective genre. 2. Use detective fiction to improve students' historical, cultural, and global awareness. 3. Practice analyzing, interpreting, and synthesizing information within and across texts and other media. 4. Practice successful academic writing, including a debatable thesis, as well as appropriately-selected and presented evidence. Credits: 3.00

ENGL 32200 - Word, Image, Media (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the study of images, their relationship to language, and their functions in media. From decoding advertising messages to analyzing digital journalism, students will learn how images and their viewers make meaning in a variety of media contexts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze images using multiple critical methods. 2. Explain how images and their viewers make meaning. 3. Explain what role images play (or have played) in our cultures. 4. Explain what it means to negotiate so many images in our daily lives. 5. Produce effective written, verbal, and visual communication that demonstrates critical thinking, creative problem solving, empathy, and visual literacy. 6. Access and analyze information. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

HIST 33205 - The Nuclear Age (UCC: HUM/STS)

Credit Hours: 3.00. Once seen as a revolutionary and exceptional, nuclear technologies have become central to many aspects of life in the U.S. This course uses the history of nuclear technologies to trace how American society has grappled with technological change.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Write a persuasive essay evaluating nuclear energy as a source of power, using primary and secondary historical sources to support your claims. 2. Create a compelling argument about how societies cope with technological change, using the history of nuclear technologies as a central example. 3. Summarize the importance of nuclear technologies in US history, drawing on primary and secondary historical sources introduced in the course. Credits: 3.00

Theme 2 - Environment and Sustainability: Cultural Impact & Representation

ANTH 32700 - Environment And Culture

Credit Hours: 3.00. This course provides a general overview to the field of environmental anthropology, and surveys key methods, and theories that anthropologists use to interpret human-environment interactions. Topics include culture ecology, agroecology, ethnobiology, political ecology, and environmental justice.

Learning Outcomes: 1. Identify and explain the key theories in environmental anthropology. 2. Identify several cross-cultural examples of human-environment interactions. 3. Distinguish between anthropological approaches and other disciplines that study the environment. 4. Apply the theories and methods learned in this course

to real world environmental issues. 5. Demonstrate professional skills in research, analysis, presentation and peer review. Credits: 3.00

ANTH 33500 - Primate Behavior

Credit Hours: 3.00. This course is an introduction to the primate order and primate studies. The emphasis is on field studies. Ecological influences on social organization and behavior, learning, play, and communication will be considered as adaptations within an evolutionary framework.

Learning Outcomes: 1. Understand the diversity of anatomical and behavioral traits in primates, and how that diversity is taxonomically organized. 2. Describe the science of primatology, critically evaluate scientific research on primates, and contextualize primatology within Anthropology and closely related fields. 3. Communicate an understanding of the relationships among primates and their ecosystems as well as the ecological, evolutionary, and social forces that shape their lives. 4. Appreciate the complexities of the work of preserving and managing primate populations. Credits: 3.00

HIST 38001 - History Of United States Agriculture (UCC: HUM/STS)

Credit Hours: 3.00. This course surveys the main development in North American agricultural history, emphasizing the continental United States. Topics include early American agriculture, the plantation system, land policy, scientific and technological change, agrarian politics, water rights, migrant labor, and agricultural policy.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain a broad understanding of the major economic, social, political, scientific and technological development in the history of American agriculture. 2. Analyze the causes, consequences, and significance of the major events and issues that have influenced the agricultural history of the United States. Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

ENGL 34400 - Environmental Ethics, Policy, And Sustainability

Credit Hours: 3.00. Environmental Ethics, Policy and Sustainability is an interdisciplinary course designed to open new pathways into ethical and eco-critical inquiry in the Anthropocene age. The course analyzes disciplinary differences in approaching the ethical, the human, and environmental problems such as sustainability, development, biodiversity, global security, and climate change. Students will explore what it means to be ethical in and through an interrogation of our contemporary conceptions of what it means to be human. These interrogations in turn will prompt us to reconsider human creations such as knowledge, culture, and technology, which will push us to genuinely think how humans as a species situate their creations within the realm of what they call Nature. Students will be introduced to the history of environmental studies in the discipline, to the rise of what is now known as "postcolonial ecocriticism" to theoretical inquiry into modern technology, and to other recent developments in the fields of environmental studies.

Learning Outcomes: 1. Learn, describe, and relate key developments in environmental ethics. 2. Distinguish and translate different perspectives concerning ethical challenges. 3. Comprehend the efficacies of environmental positions, and learn to push the boundaries of

different disciplinary approaches to environmental dilemmas. 4. Evaluate the limitations of positions and the complex frameworks surrounding ethical problems in order to offer more imaginative and resilient solutions. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

Theme 3 - Healthcare & Medicine

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 33700 - Human Diet: Origins And Evolution

Credit Hours: 3.00. This course will survey humans evolving relationship with food over the last few million years; from our Plio-pleistocene origins (foraging) through the origins of agriculture to modern industrial food production.

Learning Outcomes: 1. Explain "the human diet," its evolution, and its range of variation. 2. Summarize the role that dietary studies have played in the development of anthropological and biological theory. 3. Identify primate dietary adaptations and explain how these adaptive traits inform human evolution studies. 4. Describe major dietary issues faced by humans today. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public

health information while writing both individually and in teams. Credits: 3.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

ENGL 43900 - Topics In Disability Studies

Credit Hours: 3.00. Explores cultural, social, and political meanings and effects of disability in relation to literature and/or rhetoric. Specific topics will vary.

Learning Outcomes: 1. Discuss the strengths and weaknesses of different models for understanding disability. 2. Understand ways normalcy is socially constructed. 3. Identify cultural practices that exclude disabled people. 4. Compare and contrast disability with other identity categories such as race, gender, and sexuality. 5. Discuss ways in which culture defines disability as impairing one's subjectivity and even humanity. 6. Analyze literary representations of disabled characters. 7.

Examine the role of disability in literary works more broadly. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

HIST 35205 - Death, Disease And Medicine In Twentieth Century American History (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of disease, dying, and medicine in the United States in the 20th century.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify and explain the relationship between science and culture and interdisciplinarity. 2. Analyze texts and cultural artifacts about medicine. 3. Identify medical practice and how it is informed by context and culture. Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2. Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

SOC 46100 - Health And Social Behavior

Credit Hours: 3.00. This course provides a sociological examination of health and illness, with a particular focus on social position (e.g., race, socioeconomic status, gender), stress and social support, and health care. Goals for this course include developing critical thinking skills, understanding the broader implications of issues related to health, and thinking creatively about potential societal solutions to these issues.

Learning Outcomes: 1. Understand the ways in which social factors influence health and social behavior as well as the broader implications of these issues. 2. Develop critical thinking skills through critical writing and classroom discourse on issues related to the sociology of health and illness. 3. Apply a sociological perspective to potential solutions to health-related issues. Credits: 3.00

ANTH 34600 - Pregnancy, Birth, And Babies

Credit Hours: 3.00. This course examines human universal patterns and cross-cultural variation in pregnancy, birth, and infant care practices, using evolutionary and biocultural perspectives. Students will connect course themes to current events and controversies, such as medical models of birth, public breastfeeding, and parent-infant co-sleeping.

Learning Outcomes: 1. Identify evolutionarily novel aspects of the human reproductive pattern. 2. Compare birthing, infant feeding, and infant care practices across human societies using a biocultural framework. 3. Evaluate contemporary medical controversies surrounding pregnancy, birth, and babies critically. Credits: 3.00

Theme 4 - Business and Management

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

SOC 33400 - Urban Sociology

Credit Hours: 3.00. Development of the city and its functions; types of social behavior in cities; influences of city life on personality; city planning.

Credits: 3.00

SOC 33900 - Sociology Of Global Development

Credit Hours: 3.00. Analysis of the causes and consequences of global development. Topics include: globalization; colonialism and decolonization; food insecurity and dependency; industrialization, poverty and inequality; migration; debt and trade; women's empowerment; global health; rights and social change; and sustainable development. This course will introduce you to the study of global development and globalization. The primary questions we will address are: What is development? What is globalization and what is its relationship with development? How have the processes of global development produced inequalities among nations, regions, races, genders, and classes? Is there a "developing" world and a "developed" world? If so, what are their differences and how do they relate with each other? How have some developing countries become more developed than others? What roles do corporations, the state, and civil society organizations play in the processes of global development? How is global development interrelated with the physical environment, inequalities of consumption, and the environmental crisis? How do people resist the inequalities and perceived injustices of global development through global social

movements? How are we interconnected economically, politically, culturally, socially, and ecologically with people all over the world? What are the possible futures of development? To address these issues, our focus will be on the developing world, our scope will be global and long-term, our methodology will be historical-comparative, and our perspective will be social-scientific and critical.

Learning Outcomes: 1. Demonstrate knowledge of the causes and consequences of global development. 2. Outline the strengths and weaknesses of the basic theoretical perspectives on global development. 3. Identify the key historical events that have led to the project of global development. 4. Apply sociological analysis to different complex and power dynamics. 5. Describe how small- and large-scale projects might contribute to or hinder sustainable development. Credits: 3.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

WGSS 38300 - Women, Work, And Labor

Credit Hours: 3.00. Examines race, class and gender issues as they affect working women in America. Covering women's work from domestic labor to informal economies to factories, topics include women's participation in trade unions, wage inequalities, family leave policies and sexual harassment.

Learning Outcomes: 1. Have acquired a broad comprehension of the work, including economic activity often not recognized as "work", that women typically have performed or is typically associated with women, world-wide and since the onset of industrialization. 2. Be capable of evaluating current global economic and cultural systems that impact what kinds of labor contemporary women perform, the conditions under which they work, and the nature of the gendered systems of labor that prevail in the U.S. and elsewhere. 3. Gain appreciation for the significance of women's unpaid or underpaid care-work, relational work, affective labor, and the "reproductive" labor underpinning global capitalism and industrialism. 4. Place their own personal lives and contexts within an analytical framework informed by feminist, Marxist, and intersectional perspectives on work and labor. Credits: 3.00

ECON 36500 - History Of Economic Thought

Credit Hours: 3.00. The course traces the development of theories of value and economic growth from the seventeenth century to Karl Marx. Among the authors studied are the mercantilists, Hume, Smith, Ricardo, and Marx. Excerpts from the original works are read and evaluated in light of modern theory.

Credits: 3.00

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2. Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be

developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

SOC 43200 - Work In Contemporary America

Credit Hours: 3.00. Examines meaning and organization of work in technological society, including job satisfaction, alienation, mobility, conflict, stratification, and unemployment and the impact of race-sex composition of occupations on mobility and politics. Also considers relations with colleagues, organization, clients, and public.

Learning Outcomes: 1. Knowledge of core sociological concepts and theories regarding work. 2. Develop the ability to use these tools to critically analyze historical and contemporary issues of work in society. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

Theme 5 - Conflict Resolution & Justice: Cultural Impact & Representation

HIST 30000 - Eve Of Destruction: Global Crises And World Organization In The 20th Century (UCC: HUM)

Credit Hours: 3.00. Using a variety of case studies, this course considers 20th-century turning points -- often violent and disastrous ones -- in an emerging global conversation about urgent world problems and their possible solutions.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 38300 - Recent American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Intensive study of constitutional questions and Supreme Court answers from the period of the Warren Court to present. Particularly emphasized are the areas of segregation, civil rights, and civil liberties and guarantees for personal rights.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 37200 - Indiana Government And Politics (UCC: BSS)

Credit Hours: 3.00. An examination of the political and governmental organization of the state of Indiana. Includes the political and historical development of Indiana state government and comparison of policies and institutions with those of other states.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 46000 - Judicial Politics

Credit Hours: 3.00. A survey of judicial processes as they operate in America. Both trial courts and appellate courts will be examined in light of the procedures with which they operate. The external social, economic, and political pressures surrounding courts and the impact courts have on society will be considered.

Credits: 3.00

SOC 32600 - Social Conflict And Criminal Justice (UCC: BSS)

Credit Hours: 3.00. This course examines the dynamics of social conflict, with a special focus on legal institutions and criminological processes. Students will learn to think more analytically about the causes of social conflict, its dynamics, and strategies for resolution.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Become familiar with classic theories of social conflict and social order. 2. Understand why society needs dissent. 3. Understand strategies for conflict resolution.

Credits: 3.00

SOC 33900 - Sociology Of Global Development

Credit Hours: 3.00. Analysis of the causes and consequences of global development. Topics include: globalization; colonialism and decolonization; food insecurity and dependency; industrialization, poverty and inequality; migration; debt and trade; women's empowerment; global health; rights and social change; and sustainable development. This course will introduce you to the study of global development and globalization. The primary questions we will address are: What is development? What is globalization and what is its relationship with development? How have the processes of global development produced inequalities among nations, regions, races, genders, and classes? Is there a "developing" world and a "developed" world? If so, what are their differences and how do they relate with each other? How have some developing countries become more developed than others? What roles do corporations, the state, and civil society organizations play in the processes of global development? How is global development interrelated with the physical environment, inequalities of consumption, and the environmental crisis? How do people resist the inequalities and perceived injustices of global development through global social movements? How are we interconnected economically, politically, culturally, socially, and ecologically with people all over the world? What are the possible futures of development? To address these issues, our focus will be on the developing world, our scope will be global and long-term, our methodology will be historical-comparative, and our perspective will be social-scientific and critical.

Learning Outcomes: 1. Demonstrate knowledge of the causes and consequences of global development. 2. Outline the strengths and weaknesses of the basic theoretical perspectives on global development. 3. Identify the key historical events that have led to the project of global development. 4. Apply sociological analysis to different complex and power dynamics. 5. Describe how small- and large-scale projects might contribute to or hinder sustainable development. Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world. Credits: 3.00

SOC 33500 - Political Sociology (UCC: STS)

Credit Hours: 3.00. Analysis of the social and social psychological sources of routine political participation such as voting and interest group activity, and nonroutine political action such as protest movements and revolution; the organization of power at the community, national, and international level; and political ideology.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Have a basic understanding of sociological theories of the state 2. Acquire an understanding of recent social and political science explanations of political processes and events 3. Apply sociological principles to make sense of current world events and to contribute to social debates 4. Comprehend different opportunities to

influence political decisions by average citizens. Credits: 3.00

HIST 38200 - American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Survey of the fundamental principles of American constitutionalism and dominant trends in judicial interpretation, from the creation of the Constitution to the period of the New Deal.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Theme 1 - Science & Technology

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use.
Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

ENGL 37300 - Science Fiction And Fantasy (UCC: HUM)

Credit Hours: 3.00. Representative works of science fiction and fantasy examined in relation to both mainstream and popular literature. Emphasis is on technique, theme, and form.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective,

industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

PHIL 35000 - Philosophy And Probability

Credit Hours: 3.00. This course introduces the student to mathematical probability and its philosophical applications. Topics may include theories of probability, Hume's problem of induction, Goodman's paradox, and the foundations of scientific reasoning.

Credits: 3.00

PHIL 42100 - Philosophy Of Science

Credit Hours: 3.00. An examination of central issues in philosophy of science. Topics include theories of explanation, confirmation, reduction, laws, the status of theoretical entities, and the epistemological foundations of scientific theories.

Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

ENGL 36700 - Mystery And Detective Fiction (UCC: HUM)

Credit Hours: 3.00. An introduction to the detective genre, examining its origins, its characteristics, and its intersections with empiricism, forensic science, race, class, gender, sex, and empire.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Be familiar with the generic conventions of, and theoretical approaches to, the detective genre. 2. Use detective fiction to improve students' historical, cultural, and global awareness. 3. Practice analyzing, interpreting, and synthesizing information within and across texts and other

media. 4. Practice successful academic writing, including a debatable thesis, as well as appropriately-selected and presented evidence. Credits: 3.00

ENGL 32200 - Word, Image, Media (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the study of images, their relationship to language, and their functions in media. From decoding advertising messages to analyzing digital journalism, students will learn how images and their viewers make meaning in a variety of media contexts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze images using multiple critical methods. 2. Explain how images and their viewers make meaning. 3. Explain what role images play (or have played) in our cultures. 4. Explain what it means to negotiate so many images in our daily lives. 5. Produce effective written, verbal, and visual communication that demonstrates critical thinking, creative problem solving, empathy, and visual literacy. 6. Access and analyze information. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

HIST 33205 - The Nuclear Age (UCC: HUM/STS)

Credit Hours: 3.00. Once seen as a revolutionary and exceptional, nuclear technologies have become central to many aspects of life in the U.S. This course uses the history of nuclear technologies to trace how American society has grappled with technological change.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Write a persuasive essay evaluating nuclear energy as a source of power, using primary and secondary historical sources to support your claims. 2. Create a compelling argument about how societies cope with technological change, using the history of nuclear technologies as a central example. 3. Summarize the importance of nuclear technologies in US history, drawing on primary and secondary historical sources introduced in the course. Credits: 3.00

Level I: Explore (6 credits)

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding

of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Notes

About the Certificate

Deans Scholar Certificate

Requirements for the Certificate

AGR 20500 - Dean's Scholars Seminar

Credit Hours: 1.00. Students are introduced to the breadth and mission of the College of Agriculture. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the opportunities within undergraduate research, and the challenges facing the food, agricultural, and natural resource system. Students will be exposed to a series of guest lecturers to gain an overview of the various fields within the college and undergraduate research or scholarly work opportunities.

Learning Outcomes: 1. Have an increased appreciation for the diversity of disciplines in agriculture and the contributions that a specific discipline can make to addressing human issues. 2. Gain an interdisciplinary understanding of Purdue Agriculture through research, scholarly article reviews, common reading experiences, group discussions and project work. 3. Work collaboratively with fellow students and peer mentors. 4. Develop a relationship with a small group of Dean's Scholars thus enhancing own college experience and learning skills. 5. Understand the requirements for the Dean's Scholars program including honors coursework, undergraduate honors research or scholarly project. Credits: 1.00

Selection Criteria

Notes

Digital Humanities Certificate

About the Certificate

Requirements for the Certificate (15 credits)

Required Courses (6 credits)

IDIS 49000 - Directed Reading In Interdisciplinary Studies

Credit Hours: 1.00 to 3.00. Reading under the direction of the instructor in a particular field of study. Permission of instructor required.

Credits: 1.00 to 3.00

IDIS 20100 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods through critical inquiry. 4. Create a process for developing and completing a digital project. Credits: 3.00

Selective Courses (9 credits)

Culture and Society

AAS 37100 - The African American Experience

Credit Hours: 3.00. Focus on specific topics of the personal experiences of blacks, in Africa and the diaspora, including black identity, black culture, and the relationships between blacks and society.

Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

ILS 39500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digitals scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Department approval required.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

Digital Literacy

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CS 23500 - Introduction To Organizational Computing

Credit Hours: 3.00. People and organizations, decision-making, information systems, telecommunications, desktop systems, integration tools, collaboration and groupware, multimedia, authoring multimedia documents, emerging technologies. May not be taken for credit by Computer Science majors.

Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

Programming

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

Visualization

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

COM 26100 - Introduction To Digital Video Production

Credit Hours: 3.00. Basic production principles and practices. Emphasis on preplanning and conceptualizing skills in addition to practical production techniques. Required for admission to all television production courses. Permission of department required.

Credits: 3.00

FLM 37100 - Editing I

Credit Hours: 3.00. The course introduces students to the principles of film and video editing. Projects, discussions, demonstrations, and hands-on exercises expose students to the technical and artistic aspects of the editing process.

Learning Outcomes: 1. Summarize the basic concepts involved in the editing process. 2. Compare and contrast historical and modern approaches to film and video editing. 3. Develop proficiency with industry standard software. 4. Execute an example of the editing process under strict time constraints. Credits: 3.00

ILS 10300 - Introduction To Data Lifecycle Management

Credit Hours: 1.00. Introduces concepts of the management of data throughout its lifecycle. Understanding different types of data and their functions. Managing data in the context of a particular discipline or profession. Finding and evaluating data purposefully. Using data ethically and responsibly. Creating and sharing data for reuse, accountability, and enhancement. Making decisions and communicating using data, including data analysis and visualization. Protecting and archiving data.

Learning Outcomes: 1. Describe the data lifecycle and types of data that are used in their discipline or profession. 2. Discuss the ethical and responsible use of data. 3. Locate and evaluate datasets for reuse that are relevant to their research or work. 4. Apply a variety of introductory data collection, analysis, and visualization techniques. 5. Understand the basics of securing, archiving, and sharing data. Credits: 1.00

Entrepreneurship and Innovation Certificate

ENTR main Pic

About the Certificate

Requirements for the Certificate

Two Introductory Core Courses (2 courses)

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business

concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

ENTR 31500 - Business Planning For Social Entrepreneurship

Credit Hours: 3.00. This course builds on entrepreneurship concepts and skills developed in ENTR 20000 (prerequisite course) to understand the differences, benefits, and opportunities associated with social impact business models. Students work in teams on experiential activities including gathering customer feedback, creating forecasts, developing a strategy, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Develop convincing social enterprise business models. 2. Conduct feasibility analysis. 3. Create pro-forma financial statements. 4. Understand legal, regulatory, and ethical issues social entrepreneurs face. 5. Understand the process of recruiting, hiring, and developing a new venture team. 6. Identify sources of funding and investor needs. 7. Persuade potential investors to support a social impact venture. 8. Participate effectively as a team member or leader. Credits: 3.00

ENTR 32500 - Global Entrepreneurship And Innovation

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course), to provide students with a comprehensive understanding of entrepreneurship in a global context. It explores the differences, challenges, and opportunities associated with developing international ventures and expanding into overseas markets. Through topic lectures, case studies, and experiential team projects, students will gain insight into global trends, cultural nuances, business models, strategies, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify economic, political, technological, ethical, and cultural factors influencing entrepreneurship in global settings. 2. Develop cross-cultural awareness to navigate diverse business environments. 3. Conduct feasibility analysis for international venture establishment and expansion. 4. Recognize critical aspects of global supply chains and associated business implications. 5. Describe international funding sources and currency considerations. 6. Explore global entrepreneurship and innovation ecosystems as scalability engines. 7. Understand the process of recruiting, hiring, and developing a global team. 8. Participate effectively as a team

member or leader. Credits: 3.00

Two Option Courses (2 courses)

One Capstone Course (1 course)

Notes

Environmental and Sustainability Studies Certificate

About the Certificate

Requirements for the Certificate (15 credits)

1. Required Course (3 credits)

NRES 49800 - Individual Studies In Environmental Science

Credit Hours: 1.00 to 3.00. An opportunity for upper-level undergraduates to focus their interests and knowledge on an environmentally related problem. Arrangements must be made with a Natural Resources and Environmental Science Program faculty member before registration. Permission of instructor required.

Credits: 1.00 to 3.00

POL 42900 - Contemporary Political Problems

Credit Hours: 3.00. Contemporary political problems in the United States affecting the interpretation of democracy, human rights and welfare, social pressures, and intergovernmental relations.

Credits: 3.00

EEE 39500 - Experimental Course

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credits. Permission of instructor required.

Credits: 0.00 to 6.00

ENGL 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ANTH 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish, paraphrase, and translate different disciplinary perspectives on these key environmental and sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

ANTH 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ENGL 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish,

paraphrase, and translate different disciplinary perspectives on these key environmental and sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

2. Environmental & Sustainability Selectives (9 credits)

3. Interdisciplinary Capstone Project (3 credits)

ABE 48600 - Agricultural Engineering Design

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ABE 48400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive design report and/or project reports for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams with consultation available to students from government and industry engineers and marketing personnel. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering or project management practice with professionalism and ethical responsibility. Credits: 3.00

ABE 49800 - Undergraduate Research In Agricultural And Biological Engineering

Credit Hours: 1.00 to 3.00. Credit and hours to be arranged. Individual research projects for students with the approval of their advisors. Requires prior approval of, and arrangement with, a faculty research advisor. A written report and public oral presentation of final results are required. Permission of instructor required.

Credits: 1.00 to 3.00

EEE 48000 - Environmental And Ecological Engineering Senior Design

Credit Hours: 1.00 to 3.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems. Permission of department required.

Learning Outcomes: 1. An ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. An understanding of the complete design process and an ability to perform the process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An ability to function on multidisciplinary teams. 5. An ability to communicate professional design and design decisions effectively. 6. An awareness of professional ethics and responsibility of engineers. 7. An appreciation of the role of engineering and of EEE in social contexts. Credits: 1.00 to 3.00

NRES 49800 - Individual Studies In Environmental Science

Credit Hours: 1.00 to 3.00. An opportunity for upper-level undergraduates to focus their interests and knowledge on an environmentally related problem. Arrangements must be made with a Natural Resources and Environmental Science Program faculty member before registration. Permission of instructor required.

Credits: 1.00 to 3.00

ANTH 39000 - Individual Research In Anthropology

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of anthropology under the guidance of an anthropology

faculty member. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

COM 49100 - Special Topics In Communication

Credit Hours: 1.00 to 3.00. Intensive study of selected topics, varying from semester to semester, from the literature or practice of communication. Course content will be drawn from areas not dealt with in the regular curriculum and may include such topics as photojournalism, economic reporting, and campaign communication. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of a specialized area of communication and its common applications. Credits: 1.00 to 3.00

POL 49500 - Undergraduate Research Experience

Credit Hours: 1.00 to 3.00. Students are able to earn credit by working on a research project with a faculty member. Students will become familiar with all phases of the research process. Credit and course requirements are arranged with the instructor. Permission of instructor required.

Credits: 1.00 to 3.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

HTM 39001 - Undergraduate Research In Hospitality And Tourism Management

Credit Hours: 1.00 to 3.00. This course allows undergraduate students to gain valuable experience and knowledge through research in the hospitality and tourism industry. Permission of instructor required.

Learning Outcomes: 1. Demonstrate a basic understanding of research by participating in a research project under the supervision and guidance of a HTM faculty member. Credits: 1.00 to 3.00

Additional Information

Notes

Extensive Industry Co-op Certificate

About the Certificate

Course Requirement

College of Agriculture

AGEC 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in entomology.

Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

College of Engineering

AAE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating

employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mechanical

engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

College of Health and Human Sciences

NUR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

PSY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

College of Liberal Arts

AD 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

AD 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to

identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

School of Management

ECON 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

College of Pharmacy

PHRM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

Polytechnic Institute

TECH 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in technology.

Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating exmployers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

College of Science

STAT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in computer

science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and

practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

Additional Courses:

AAE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ABE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

BME 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ECE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

EEE 39699 - Professional Practice Internship

Credit Hours: 0.00. One-session professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39899 - GEARE Global Internship

Credit Hours: 0.00. Global internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with global employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the GEARE program requirements b) assess course outcomes via student evaluation of work

sessions and work session technical report Credits: 0.00

ENGR 39799 - GEARE Domestic Internship

Credit Hours: 0.00. Domestic internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with domestic employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the GEARE program requirements b) assess course outcomes via student evaluation of work sessions and work session technical report Credits: 0.00

ENGR 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report Credits: 0.00

IE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business and a comprehensive written report of this practice. Permission of department required.

Credits: 0.00

MSE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in Materials Engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Develop the ability to function on multi-disciplinary teams and receive the broad education necessary to understand the impact of engineering solutions in global, economics, environmental and societal context. Credits: 0.00

ME 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

NUCL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

NUR 39699 - Professional Practice Internship

Credit Hours: 0.00. Program coordinated by Nursing with cooperation of participating employers and the Office of Professional Practice. Students will submit summary reports and company evaluations related to the experience. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional nursing context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Incorporate knowledge of the nursing profession and practice, basic nursing principles, and principles and practice of ethical responsibilities in professional work. Credits: 0.00

BIOL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHM 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate depth in major. Credits: 0.00

TECH 39699 - Professional Practice Internship

Credit Hours: 0.00 to 3.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems. Credits: 0.00 to 3.00

IDE 39699 - Professional Practice Internship

Credit Hours: 0.00. Internship experience in multidisciplinary engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ENTR 39699 - Internship And Research Experiences

Credit Hours: 0.00. Interns for Indiana internships work experience with participating employers. Students submit a summary report and company evaluation. Through a mutual selection process, students may be placed as interns with entrepreneurial companies. Placements are determined through a screening process based upon students' skills and experiences gained through their major fields of study. Fulfills a capstone requirement for the Certificate in Entrepreneurship and Innovation Program. Contact the Office of Professional Practice. Permission of instructor required. Discovery Park Undergraduate Research Internships. Check the DURI website for further information. https://www.purdue.edu/discoverypark/duri/.

Learning Outcomes: 1. Gain skills and experiences through their major fields of study. Credits: 0.00

Gerontology Certificate

Requirements for the Certificate (18 credits)

Required Courses (3 credits)

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

Selectives (15 credits)

HK 25300 - Principles Of Motor Development

Credit Hours: 3.00. This course provides an introduction to motor development from a life-span perspective. Students will learn how infants develop from mainly reflexive beings into children and adults that are capable of interacting with the world in a goal-directed manner. This course specifically examines how changes in physical growth, aging, and maturation of the central nervous system influence motor performance. Finally, the decline of motor skills associated with advanced age is discussed.

Learning Outcomes: 1. Students will be able to describe how motor skills develop in children and decline in older adults. 2. Students will be

able to apply the principles of motor development to clinical, education, and sport sciences settings. Credits: 3.00

HK 44400 - Balance Rehab In Older Adults

Credit Hours: 3.00. In this course, students learn about the decline in motor function that occurs in older adults and techniques to improve motor function in an older population. Topics include decreased balance control, loss of muscle strength, and declines in adaptive locomotion as a function of age. Students enrolled in this class also participate in an off-campus lab. In the lab, students are paired with an older adult and use the knowledge gained in lecture to improve the motor function of the older adult. This class provides students with a unique opportunity to gain hands-on experience working with an older population. Permission of instructor required.

Learning Outcomes: 1. Describe the declines in motor function that occur in older adults. 2. Critically assess intervention research with aims to improve motor function in older adults. 3. Describe and evaluate types of interventions and their effectiveness. 4. Use quantitative equipment to assess balance and mobility of younger and older adults. Credits: 3.00

HK 46900 - Exercise Testing And Prescription In Special Populations

Credit Hours: 3.00. Examines responses to exercise testing and prescription in healthy adults compared to exercise responses and special considerations for individuals with chronic diseases and conditions and issues of concern to pregnant women, children, and older adults, among others.

Learning Outcomes: 1. Identify the difference in testing and prescription for individuals with chronic conditions. 2. Evaluate critically the risks and benefits associated with exercise participation. 3. Apply appropriate emergency procedures in various exercise settings. 4. Deliver unique exercise programs to special populations. Credits: 3.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

PSY 36700 - Adult Development And Aging

Credit Hours: 3.00. Theory and research on adult development from young adulthood through the elderly years. Course covers biological, cognitive, personality, and social issues. Topics include vocational choice, marriage, parenthood, the empty nest, menopause, memory and aging, retirement, widowhood, longevity, and death and dying.

Credits: 3.00

SLHS 11500 - Introduction To Communicative Disorders (UCC: STS)

Credit Hours: 3.00. Nature, systems, and causes of communicative disorders and the principal methods used for remediation.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception. Credits: 3.00

SLHS 30300 - Anatomy And Physiology Of The Speech Mechanism

Credit Hours: 3.00. This course provides an introduction to the anatomical and physiological bases of the speech mechanism with an emphasis on the neural, respiratory, laryngeal, and supralaryngeal subsystems.

Learning Outcomes: 1. Develop knowledge of the major subsystems underlying speech and language production. 2. Identify major anatomical structures associated with speech production. 3. Describe the physiology of speech production. Credits: 3.00

SLHS 43000 - Speech-Language Disorders In Health Care Settings

Credit Hours: 3.00. Presents speech-language disorders across the lifespan, encountered in a variety of health care settings. Discusses the etiology, evaluation, and management of these disorders; addresses administrative structures, team approaches, and reimbursement issues in health care settings.

Learning Outcomes: 1. Understand the types of organic and neurogenic disorders of communication that are within the scope of

practice for a speech-language pathologist. 2. Understand the types of health-care settings where a speech-language pathologist may work. 3. Understand aspects of evaluating communication disorders that are organically and neurologically based. 4. Understand aspects of treating communication disorders that are organically and neurologically based. 5. Understand the roles of a speech-language pathologist and other personnel on a variety of client intervention teams. Credits: 3.00

SLHS 46000 - Assessment Audiology And Aural Rehabilitation Across The Lifespan

Credit Hours: 4.00. This course will provide an introduction to disorders of the auditory system, the basic assessments that are used to diagnose disorders, and habilitation/rehabilitation. The laboratory provides practical instruction in the procedures discussed in class.

Learning Outcomes: 1. Describe and explain the basic battery of audiological tests. 2. Perform these tests. 3. Interpret the results of the test battery. 4. Describe and explain devices and strategies used for habilitation/rehabilitation. Credits: 4.00

ANTH 10000 - Being Human: Introduction To Anthropology (UCC: BSS)

Credit Hours: 3.00. Introduces anthropology's holistic approach to human nature and behavior. This course uses the tools of cultural, biological, archaeological, and linguistic anthropology to follow the human journey of uniformity and diversity through time and across space.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the basic concepts and applications of anthropology, including biological, cultural, archaeological, and linguistic anthropology. 2. Recognize the deep social and biological histories that have shaped contemporary life. 3. Examine processes of ongoing biological and social change that influence the environment, social organization, language, and other aspects of the world they experience. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what

anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3. Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

SOC 27500 - Sociology Of Aging And The Life Course (UCC: BSS)

Credit Hours: 3.00. An examination of research on the social context of human aging, including demographic and developmental changes. A life course perspective is emphasized for studying health, life events, and quality of life. Considers exceptional longevity in comparative perspective.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Comprehension of the basic concepts, theories, and methods of the sociology of aging. 2. Think sociologically and write more clearly. 3. Application of course content in personal and vocational experiences. Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative

analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

HDFS 31200 - Adult Development

Credit Hours: 3.00. An in-depth study of developmental processes from the transition to adulthood through old age. Particular emphasis is placed on understanding the influence of contexts on adult development.

Learning Outcomes: 1. Identify biological, psychological, social, and demographic aspects of adult development and how they interact over time. 2. Identify theoretical perspectives on human development, and apply them in understanding life trajectories. 3. Understand and apply the process of doing research in adult development. 4. Communicate academic ideas clearly and effectively. Credits: 3.00

SOC 46100 - Health And Social Behavior

Credit Hours: 3.00. This course provides a sociological examination of health and illness, with a particular focus on social position (e.g., race, socioeconomic status, gender), stress and social support, and health care. Goals for this course include developing critical thinking skills, understanding the broader implications of issues related to health, and thinking creatively about potential societal solutions to these issues.

Learning Outcomes: 1. Understand the ways in which social factors influence health and social behavior as well as the broader implications of these issues. 2. Develop critical thinking skills through critical writing and classroom discourse on issues related to the sociology of health and illness. 3. Apply a sociological perspective to potential solutions to health-related issues. Credits: 3.00

Human Resource Management Certificate (Indianapolis and Statewide)

Required Courses (18 Credits)

Phase 1: Foundation (9 Credits)

OLS 37500 - Training Methods

Credit Hours: 3.00. Principles, practices, and methods of employee training. Introduction to systematic training program design, development, and evaluation. Emphasis is on the supervisor as a trainer.

Learning Outcomes: 1. Define the role training and development plays in sustaining a competitive advantage across the full array of modern organizations. 2. Explain how training is a systemic process and how it relates to the overall leadership, supervision, and human resource management system of an organization. 3. Describe the purpose and scope of a training needs assessment and plan, including its key components in designing training systems in leadership, supervision, and human resource management system of an organization. 4. Compare and contrast various training delivery methods, citing advantages and disadvantages of each. 5. Describe the essential principles of adult learning and intervention evaluation in developing and designing a training program in leadership, supervision, and human resource management system of an organization. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective

practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Phase 2: Broadening (9 Credits)

OLS 38600 - Leadership For Organizational Change

Credit Hours: 3.00. Introduction to and overview of fundamental concepts of leading organizational change. Topics include setting the stage for organizational change, implementing organizational change, sustaining organizational change, and the role of the change manager. Concepts and frameworks taught in this course are applicable to change at multiple scales from small enterprises and large corporations to communities and ecosystems.

Learning Outcomes: 1. Identify organizational culture and transformation readiness. 2. Apply various change management frameworks to leading organizational change. 3. Understand the role organizational culture plays in change and transformation. 4. Identify the effect of technological change on organizations, communities, and society. 5. Develop and apply a change management framework. Credits: 3.00

OLS 37800 - Labor And Management Relations

Credit Hours: 3.00. An introduction to, and overview of, the fundamental concepts of labor relations, collective bargaining, and dispute resolution procedures. An international comparative analysis is used to assess some of the legal, economic, and political structures of labor relations.

Credits: 3.00

OLS 37600 - Human Resource Issues

Credit Hours: 3.00. Analysis and discussion of case problems concerning typical leadership and personnel situations that impact upon the supervisor/manager. Emphasis directed toward development of attitude, philosophy, analytical ability, and problem-solving skills within the working environment.

Credits: 3.00

Industrial Engineering Technology Certificate (Statewide)

Requirements for the Certificate (18 credits)

Industrial Engineering Technology (Choose 18 credits)

IET 33100 - Advanced Industrial Safety And Health Management

Credit Hours: 3.00. An introduction to OSHA and standards development for occupational health in general industry. Special emphasis is on fire protection and egress, flammable and combustible liquids, electrical, personal protective equipment, machine guarding, industrial hygiene/blood-borne pathogens, ergonomics, and ISO 9000/14000 integration.

Learning Outcomes: 1. Explain the purpose of the Occupational Safety and Health Administration (OSHA). 2. Describe the fundamental requirements of each of the General Industry Regulations in 29 CFR 1910. 3. Apply the General Industry Regulations in real-life scenarios within the workplace. 4.

Explain how to prepare for the OHSA workplace inspection. 5. Create an adequate training plan for workplace employees. 6. Identify readily available resources for creating a workplace free from recognized hazards. Credits: 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31300 - Technology Innovation And Integration: Bar Codes To Biometrics

Credit Hours: 3.00. This course provides the foundation for automatically capturing data in a system. The content covers an introduction to technology used in automatic identification and data capture systems, including: bar codes; radio frequency identification; smart cards, and biometrics. Topics also include an immersive semester project that examines the integration of these technologies, as well as advanced problem-solving.

Learning Outcomes: 1. Describe the essential components of an AIDC system. 2. Evaluate and propose solutions to AIDC system-related problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles of integrating and managing AIDC systems. 5. Identify opportunities for system improvement. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic

equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

IET 33520 - Human Factors For Technology Systems

Credit Hours: 3.00. This course provides the foundation for examining the intersection of people, technology, policy, and work across technology systems. Topics include the evaluation, analysis, and design recommendations for improving the safety and efficiency of human-technology interactions.

Learning Outcomes: 1. Describe the relationship between human factors and technology systems. 2. Solve human-machine interaction problems, using appropriate human factors principles. 3. Recommend actions to correct safety deficiencies in existing environments. 4. Apply principles of innovation to design, conduct, and document a human factors study. Credits: 3.00

IET 33620 - Total Productive Maintenance

Credit Hours: 3.00. This course emphasizes the importance of effective maintenance planning and execution for efficient and economical operation of service or technology systems. A systems approach to maintenance planning is taken. Maintenance activities are discussed from reliability and productivity perspectives in the context of technology systems. Semester-long, team-based research project is typically required.

Learning Outcomes: 1. Differentiate among the various types of maintenance activities. 2. Calculate failure rate, mean time between failures, reliability, and maintenance cost versus profit. 3. Identify various state-of-the-art technologies and applications in PM and PDM maintenance management. 4. Evaluate maintenance management philosophies, organization, and practices of a manufacturing entity. 5. Articulate maintenance management philosophies and practices for manufacturing entities. Credits: 3.00

IET 34200 - Warehouse And Inventory Management

Credit Hours: 3.00. A course designed to develop understanding of types of warehouses, methods of organizing the warehouse environment, and determining efficient inventory control procedures. Technology applications related to the management of warehouse and inventory stock-keeping units (SKU) are investigated. Storage of inventory, placement of inventory, picking, packing, shipping, and other internal logistics management topics will be explored.

Learning Outcomes: 1. Identify activities associated with inventory and warehouse management. 2. Explain the relationship of inventory and warehouse management to supply chain management with other various functional areas, including corporate strategy. 3. Design various warehouse activities under given circumstances. 4. Describe material/distribution requirements planning (MRP/DRP) systems. Credits: 3.00

IET 34300 - Technical And Service Selling

Credit Hours: 3.00. A study of sales models and techniques for technical and service sales in business-to-business environments, including development of channel relationships, long-term sales agreements, customer relationship management efforts, total cost of ownership tools and complex sales presentations. Covers critical sales skills such as e-economy sales and marketing, lead management, building credibility, consultative selling, ethical negotiations, and sustainable product management.

Learning Outcomes: 1. Explain the roles of technical and service sales in business to business channels. 2. Describe the relationship between personal selling and marketing. 3. Describe critical influencing factors on organizational buyer behavior. 4. Describe various types of buying situations and typical sales agreements. 5. Demonstrate a personal selling communication model. 6. Describe customer relationship management. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure,

analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

Notes

Industrial Selling Certificate

The Certificate in Industrial Selling is open to students in any major who are interested in Industrial Selling.
It has three required courses and a capstone course, totaling thirteen credit hours. Each certificate earner must also complete a day long industry sales experience with a B2B sales practitioner in their area of professional interest, and must participate in a sales or marketing oriented experience on campus. It is expected that additional courses (sales management, negotiations, etc.) will be developed over time as alternatives and complements to this set of initial courses.

Requirements for the Certificate (13 credits)

Required Courses (9 credits)

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

CSR 31500 - Relationship Selling

Credit Hours: 3.00. This course focuses on long-term relationship selling. The course is organized around a seven-step selling process which has proven to be effective. The course adds to this process some principles of marketing and business strategy. The elements are necessary for the success of professional salesperson both in successful prospecting and making strategic choices as to how to allocate their time within the territory. Important to the learning process is actually practice of principles. Students will do various exercises of principles such as prospecting and negotiation. At the end of the semester, students will hone the skills learned through the semester with a series of role plays designed to put them in position of both seller and buyer.

Learning Outcomes: 1. Recognize that selling is a process which can be taught versus an innate trait. 2. Have an organized approach to the process of selling which can be applied to any industry. 3. Know principles of marketing and strategy which students can apply to the selling process. 4. Know principles of negotiation and handling objections both through class assignments and role playing. 5. Know how to do effective product presentation and frame benefits to the clients through a series of role play scenarios. Credits: 3.00

Capstone Course (4 credits)

AGEC 43100 - Advanced Industrial Sales And Marketing

Credit Hours: 4.00. Advanced presentation techniques, sales management and analysis, improving communication skills, study of industrial marketing strategies, interaction with industry executives, and strategies for career development. Requires class trips. Students will pay individual lodging or meal expenses when necessary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

Industry Co-op Certificate

About the Certificate

Course Requirements (3 course sequence)

AAE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering.

Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating exmployers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

AD 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit

summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and

practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in landscape

architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

PSY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

Additional Courses:

AAE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ABE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

BME 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ECE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

EEE 39699 - Professional Practice Internship

Credit Hours: 0.00. One-session professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39899 - GEARE Global Internship

Credit Hours: 0.00. Global internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with global employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the GEARE program requirements b) assess course outcomes via student evaluation of work sessions and work session technical report Credits: 0.00

ENGR 39799 - GEARE Domestic Internship

Credit Hours: 0.00. Domestic internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with domestic employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the GEARE program requirements b) assess course outcomes via student evaluation of work sessions and work session technical report Credits: 0.00

ENGR 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report Credits: 0.00

IE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business and a comprehensive written report of this practice. Permission of department required.

Credits: 0.00

MSE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in Materials Engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Develop the ability to function on multi-disciplinary teams and receive the broad education necessary to understand the impact of engineering solutions in global, economics, environmental and societal context. Credits: 0.00

ME 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

NUCL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

NUR 39699 - Professional Practice Internship

Credit Hours: 0.00. Program coordinated by Nursing with cooperation of participating employers and the Office of Professional Practice. Students will submit summary reports and company evaluations related to the experience. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional nursing context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Incorporate knowledge of the nursing profession and practice, basic nursing principles, and principles and practice of ethical responsibilities in professional work. Credits: 0.00

BIOL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHM 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate depth in major. Credits: 0.00

TECH 39699 - Professional Practice Internship

Credit Hours: 0.00 to 3.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems. Credits: 0.00 to 3.00

IDE 39699 - Professional Practice Internship

Credit Hours: 0.00. Internship experience in multidisciplinary engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ENTR 39699 - Internship And Research Experiences

Credit Hours: 0.00. Interns for Indiana internships work experience with participating employers. Students submit a summary report and company evaluation. Through a mutual selection process, students may be placed as interns with entrepreneurial companies. Placements are determined through a screening process based upon students' skills and experiences gained through their major fields of study. Fulfills a capstone requirement for the Certificate in Entrepreneurship and Innovation Program. Contact the Office of Professional

Practice. Permission of instructor required. Discovery Park Undergraduate Research Internships. Check the DURI website for further information. https://www.purdue.edu/discoverypark/duri/.

Learning Outcomes: 1. Gain skills and experiences through their major fields of study. Credits: 0.00

Innovation for Public Service Certificate

About the Certificate

Requirements for the Certificate (16 credits)

Required Courses (1 credits)

ENGR 10301 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small seminars led by faculty designed to introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or assist in their decision of an engineering degree. Permission of department required.

Learning Outcomes: 1. Introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Credits: 1.00

Experiential Learning in Public Service (6 credits)

Selective Courses (9 credits)

Humanities/Social Sciences/Policy Courses

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

SOC 33900 - Sociology Of Global Development

Credit Hours: 3.00. Analysis of the causes and consequences of global development. Topics include: globalization; colonialism and decolonization; food insecurity and dependency; industrialization, poverty and inequality; migration; debt and trade; women's empowerment; global health; rights and social change; and sustainable development. This course will introduce you to the study of global development and globalization. The primary questions we will address are: What is development? What is globalization and what is its relationship with development? How have the processes of global development produced inequalities among nations, regions, races, genders, and classes? Is there a "developing" world and a "developed" world? If so, what are their differences and how do they relate with each other? How have some developing countries become more developed than others? What roles do corporations, the state, and civil society organizations play in the processes of global development? How is global development interrelated with the physical environment, inequalities of consumption, and the environmental crisis? How do people resist the inequalities and perceived injustices of global development through global social movements? How are we interconnected economically, politically, culturally, socially, and ecologically with people all over the world? What are the possible futures of development? To address these issues, our focus will be on the developing world, our scope will be global and long-term, our methodology will be historical-comparative, and our perspective will be social-scientific and critical.

Learning Outcomes: 1. Demonstrate knowledge of the causes and consequences of global development. 2. Outline the strengths and weaknesses of the basic theoretical perspectives on global development. 3. Identify the key historical events that have led to the project of global development. 4. Apply sociological analysis to different complex and power dynamics. 5. Describe how small- and large-scale projects might contribute to or hinder sustainable development. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation,

social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 48400 - Management Of Entrepreneurial Ventures

Credit Hours: 3.00. This course teaches skills required to become an entrepreneur, succeed in a start-up venture, work in venture capital, join a family business, or develop a franchise operation. Students will learn about how to identify and shape emerging market opportunities, innovate new business models, prepare and evaluate business plans, raise capital, build a skilled founding team, network for resources, and grow an initial market.

Learning Outcomes: 1. Identify and shape emerging market opportunities. 2. Innovate new business models. 3. Prepare and evaluate business plans. 4. Raise capital. 5. Build a skilled founding team, network for resources, and grow an initial market. Credits: 3.00

HIST 38505 - Media, Politics And Popular Culture (UCC: HUM)

Credit Hours: 3.00. This class examines the relationship of media, politics, and popular culture over the course of the twentieth century in American history. Students trace how new media shaped political institutions and practices and afforded opportunities for political change.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the historical development in American political, cultural, economic, and social structures by examining primary and secondary sources. 2. Analyze primary and secondary sources to explain how and why these historical developments happened. 3. Pursue original primary research about a specific topic in American history and synthesize primary and secondary materials to advance on original arguments about the roots, shape, and implications of a historical moment. 4. Interrogate modern media myths with an analysis of primary sources that will allow students to go beyond popular narratives of history and understand a more complicated historical reality. 5. Recognize the historical roots of contemporary political debates. 6. Understand the relationship between politics and popular culture in ways that will allow students to navigate the contours of the mass media, entertainment, and the American political process more effectively. Credits: 3.00

COM 44400 - Introduction To Communication And Social Entrepreneurship

Credit Hours: 3.00. This class introduces students to the roles that communication and innovation play in social entrepreneurship. It explores activities of entrepreneurs, ethics and skill development at the individual and organizational levels, and communication functions in not-for-profit and social venture space.

Learning Outcomes: 1. Identify the major components of communication and social change. 2. Describe the social economy. 3. Articulate how both social entrepreneurship and social innovation benefit society. 4. Describe the difference between nonprofit organizations (NPs), social action efforts, NGOs and social enterprises, as well as traditional entrepreneurship, social entrepreneurship, social intrapreneurship and social innovation. 5. Explain how social enterprises function in different sectors and regions, of various sizes, with vastly different missions. 6. Articulate the challenges social entrepreneurs face as they startup, develop, and communicate with various publics. 7. Identify the best approaches and communication tools that can be deployed to

assist in ""getting out the message"" about NP goals and objectives. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.
Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.
Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research

papers from the visualization literatures. Credits: 2.00 or 3.00

HIST 33205 - The Nuclear Age (UCC: HUM/STS)

Credit Hours: 3.00. Once seen as a revolutionary and exceptional, nuclear technologies have become central to many aspects of life in the U.S. This course uses the history of nuclear technologies to trace how American society has grappled with technological change.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Write a persuasive essay evaluating nuclear energy as a source of power, using primary and secondary historical sources to support your claims. 2. Create a compelling argument about how societies cope with technological change, using the history of nuclear technologies as a central example. 3. Summarize the importance of nuclear technologies in US history, drawing on primary and secondary historical sources introduced in the course. Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2. Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect

critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

LC 32300 - Global Sustainable Engineering

Credit Hours: 1.00 or 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 or 3.00

ANTH 30800 - Critical Data Studies

Credit Hours: 3.00. Critical Data Studies (CDS), is an interdisciplinary field that addresses the ethical, legal, socio-cultural, epistemological and political aspects of data science, big data and digital infrastructure. This course focuses on current topics in critical data studies scholarship. Particular emphasis will be given to democratic and participatory approaches to algorithm design and responsible data

management, curation and dissemination. Students will develop tools and methods to help scholars think critically and identify issues of concern to Local Communities. This is a research and writing intensive course.

Learning Outcomes: 1. Engage in current debates surrounding data science, big data and digital infrastructure from an anthropological perspective. 2. Acquire anthropological tools and methods to analyze societal impact of emergent technologies. 3. Learn to demonstrate collaboration, public engagement and scholarly communication skills. 4. Apply anthropological frameworks to novel research problems. Credits: 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

HIST 30701 - History Of Artificial Intelligence: Minds And Machines

Credit Hours: 3.00. This course examines the long history of efforts in automating human cognition. Historically, the attempts to automate human cognitive functions - from the mere reckoning of numbers to complex decision-making have been entangled with heated debates about what counts as good, proper, and desirable thinking; whose thinking machines should emulate; and whether the thinking of some humans is inferior to that of machines. In this course, we will examine how the invention of calculating machines - analogue and then digital - has developed in tandem with philosophical and scientific theories of human thinking and intelligence. In their turn, the latter developed as a response to changing social, political, and economic currents.

Learning Outcomes: 1. Critique the epistemological foundations and ethical implications of past and present approaches to the automation of human cognition. 2. Use primary sources to make arguments about the role of social, political, economic, and cultural currents that have historically provided the impulses for research and development in the automation of human cognition. 3. Assess historical scholarly arguments about social, economic, and political power asymmetries surrounding artificial intelligences. 4. Create websites to use text, imagery, and video content and effectively communicate how social factors have historically shaped the development of artificial intelligence. Credits: 3.00

HIST 30705 - History Of Data: How Data Became Big

Credit Hours: 3.00. This course offers a long history of Big Data. The first module focuses on how states collected data from the 16th to 19th centuries. Here we will focus on mortality bills, census, statistics, and accounting tables. In the second model, we will pay special attention to data collection and privacy in the 20th century. In the third module, students will explore how previous developments in data collection were applied to the new developments in analog and digital computing. The final weeks of the course will focus on present-day artificial intelligence, big data, their technical limitations, and the ways they often amplify, exploit, and contribute to a wide array of social problems.

Learning Outcomes: 1. Understand a variety of historical contexts that have shaped how we use, collect, and analyze data in the 21st century. 2. Assess historical arguments about the place of data in the growth of state bureaucracies, colonialism, eugenics, national security, warfare, and scientific research made in scholarly secondary sources. 3. Use primary sources to make arguments about the historical contingency of the ways practitioners have been using data to solve state problems. 4. Develop critical thinking about data-empowered algorithms and envision a human-centered and

ethical way of creating and implementing data technologies. Credits: 3.00

HIST 30902 - History Of Biotechnology

Credit Hours: 3.00. This class examines historical intersections between engineering and biology in the Western world. The course begins by considering several possible meanings of "biotechnology." It examines how and why different biotechnologies from the life sciences, biology, and medicine have arisen in specific historical contexts, changed over time, and affected society from the late 19th century to the present. We will study vaccines and beer-making in the 19th century, cell culture, birth control pills, and DNA sequencing in the 20th century, and 21st-century genome editing and synthetic biology, for example. Overall, this course argues that biotechnologies have always forced human beings to consider whether living and non-living entities are made up of the same fundamental "stuff," the implications of manipulating living things, and the nature of life itself.

Learning Outcomes: 1. Identify and describe examples of biotechnologies. 2. Describe the role of biotechnology in history and its relevance for society today. 3. Explain major themes in the history of biotechnology, such as how biotechnologies have changed through time and impacted society by way of their interactions with (for example) ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class. 4. Investigate the history and social impacts of a biotechnology of their choosing that has not been discussed in depth in this class. 5. Explain how and why this biotechnology arose in a specific historical context, changed over time, and impacted (or impacts) society (using historical methods). Credits: 3.00

ILS 30000 - Information, Culture, And Society

Credit Hours: 3.00. Information and information systems shape our beliefs, influence decision-making, define our collective knowledge, and are integral to being an informed, responsible, and engaged citizen in our modern world. This course will examine the intricate relationship between information and society to better understand how information ecosystems, constituted by various technologies and practices, shape and are shaped by individual identities, structures of power, and ethical considerations/human values. Using an interdisciplinary and team-based approach, students will gain essential skills to navigate their information-rich world.

Learning Outcomes: 1. Identify and apply frameworks to critically evaluate the impact of information and technology on cultural norms, values, and societal structures. 2. Explore the concept of information identity, including how individuals and communities construct their identities through information consumption and production, and critically analyze the impact of information identity on culture and society. 3. Explain the components of information ecosystems, including producers, consumers, intermediaries, and technologies, and how they interact within different cultural and societal contexts. 4. Analyze the power structures in information ecosystems, including the privileged access and control of certain individuals or groups, and explain how these power dynamics intersect with social constructs like race, gender, class, and ethnicity to shape cultural and societal dynamics. 5. Articulate ethical principles related to information ownership, privacy, censorship, transparency, and research in various contexts. Credits: 3.00

ILS 30100 - Data Foundations, Tools, And Applications

Credit Hours: 3.00. Data are everywhere. Data permeates every aspect of our lives, from journalistic reporting to workplace projects to artificial intelligence applications. This course covers the basics of the data research lifecycle, including locating and managing datasets, along with applying different methods and tools a to craft compelling stories about data. Students will learn the difference between data and information and how to transform raw data into information to be communicated to a wider audience. This course offers unique skills for students from any discipline who want to discover the world of data.

Learning Outcomes: 1. Understand the differences between data and information. 2. Navigate the basics of data management, ethics, and analysis. 3. Explore different datasets and their lifecycles. 4. Apply fundamental methods--and tools--of data location, analysis, cleaning, and visualization. 5.

Create an original data story with and about data. Credits: 3.00

POL 52101 - Applied Public Policy: Institutions, Processes, Practices

Credit Hours: 3.00. Applied introduction to the institutions, processes, and practices in the field of public policy. Students will examine the role of government institutions, standards organizations, corporate actors, and non-governmental organizations, policymakers, regulators, and the public in the policy process. The course will draw examples from one or more applied policy areas such as economic development, emerging technology policy, sustainability policy, energy, foreign policy, or social policy.

Learning Outcomes: 1. Summarize and describe the institutions, actors, and policy process for different political systems. 2. Compare and contrast the role of political analysis and policy analysis for analyzing the viability and success of policy. 3. Evaluate a policy area and write a policy brief describing the history of the policy, current stakeholders in the area, the current state of policy, and emerging policy challenges or prospective changes. 4. Design translational communication materials to convey policy information to different audiences including specialists and non-specialists. Credits: 3.00

POL 52601 - Technology, AI, And Ethics In Public Policy And Public Administration

Credit Hours: 3.00. Examines how emerging technologies like artificial intelligence (AI), automated decision systems, and digital platforms are being adopted in the public sector. It explores the benefits as well as ethical risks and challenges associated with implementing these technologies in areas like healthcare, education, child welfare, and criminal justice. Students will analyze governance strategies, policies, and administrative procedures to promote responsible technology use in government.

Learning Outcomes: 1. Summarize the main forms of digital technology and algorithmic practices (AI) that are being adopted in government operations and decision-making, including automated decision systems, digital public interfaces, and data integration platforms. 2. Analyze emerging trends and developments in the use of AI, automated decision systems, and data analytics in public agencies and governments, in the U.S., internationally, and at the local level. 3. Assess the benefits as well as risks and challenges associated with implementing these technologies in the public sector, including how the use of new technology is transforming interactions between government and citizens, impacting social welfare, and implicating issues of transparency, accountability, discretion, discrimination, and public trust. 4. Evaluate ethical concerns, biases, and risks to social welfare that may arise from the use of AI and automated decision systems in administering public programs and services and demonstrate the ability to examine issues from multiple stakeholder perspectives. 5. Propose governance strategies, policy solutions, and administrative procedures to ensure responsible and ethical use of AI and other emerging technologies in the public sector, such as best practices for procurement, implementation, auditing, and public engagement. Credits: 3.00

POL 52901 - Applied Policy And Program Evaluation

Credit Hours: 3.00. This course introduces students to the logic of designing and implementing program evaluations to assess implemented policies and programs. The course examines research designs for different evaluation goals, the application of evaluation strategies, and strategies for reporting results to specialist and non-specialist audiences.

Learning Outcomes: 1. Describe the role and principles of evidence-based policymaking and program evaluation, including ethical considerations. 2. Explain the different aspects of evaluation, including inputs, outputs, outcomes, impacts, and processes, and identify complementary evaluation strategies. 3. Compare and contrast different methods for program impact evaluation, including ethical considerations. 4. Synthesize knowledge of program evaluation strategies to solve applied

problems. 5. Communicate program evaluation results to specialists and non-specialists effectively. Credits: 3.00

Technical Courses

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired goal subject to constraints. Credits: 4.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

CE 29202 - Contemporary Issues In Civil Engineering

Credit Hours: 2.00. This course provides a forum on issues in the civil engineering profession in a contemporary context. Topics include professionalism and ethics, entrepreneurship, cultural differences, and collaborating globally. Students have interactions with engineering faculty and professionals outside the University. Guidance on the preparation of individual plans of study and information on civil engineering career options are provided. Students learn and apply fundamental aspects of written communication in professional settings. Emphasis is placed on delivery of technical and managerial content. Students will compile a professional portfolio of communication assignments, including lab reports prepared in other CE courses.

Learning Outcomes: 1. Ability to communicate effectively. 2. Ability to understand the impact of engineering solutions in a global and societal context. 3. Knowledge of contemporary issues, particularly with respect to nuclear topics. 4. Understanding of professional and ethical responsibility. Credits: 2.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the

environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

CE 36100 - Transportation Engineering

Credit Hours: 3.00. Transportation functions; transportation systems, including land, air, and marine modes; transportation system elements, including traveled way, vehicle, controls, and terminals; techniques of transportation system planning, design, and operation.

Credits: 3.00

CE 39201 - Technical Communication In Civil Engineering

Credit Hours: 2.00. This course will build upon the technical communication components of CE 29202 , adding instruction in oral communication, projects, and working in teams. This course involves both individual and team assignments intended to offer students the opportunity to practice preparing and delivering written correspondence and reports, as well as oral presentations. These activities may be coordinated with other CE courses being taken by students in CE 39201.

Learning Outcomes: 1. Know the value of clear and concise communication. 2. Understand the audience and structuring of communications. 3. Employ the forms of arguments/reasoning. 4. Apply knowledge of scientific vocabulary and technical data-driven communication. 5. Work effectively in teams. 6. Employ issue analysis to plan team project work. 7. Understanding of good listening; oral communications. 8. Employ PowerPoint and visual communications effectively. 9. Deliver team technical presentations. 10. Develop and present lab reports. 11. Knowledge to prepare ""How-To"" video project. 12. Conduct meetings; running brainstorming sessions. 13. Develop persuasive presentations. 14. Prepare effective resumes, cover letters, and job searches. 15. Employ job interview skills. Credits: 2.00

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

HSOP 55600 - Healthcare Economics And Public Policy

Credit Hours: 3.00. Principles and theories of healthcare economics applied in analysis of the U.S. healthcare system. Perspectives are presented on the differential roles of economic analysis and policy analysis. Topics include medical care as an input to health, pharmaceutical service market, adequacy of health manpower supply, health associations and demand for

legislation. Healthcare reform, the pharmaceutical industry, and social values that guide policy are explored.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

TECH 32000 - Technology And The Organization

Credit Hours: 3.00. A course intended to provide students with experiences mirroring what they will encounter in the world of work. Students will participate in interdisciplinary teams to explore technology solutions. Course topics include public policy, regulatory and ethical issues, teaming and leadership, and project management. Permission of department required.

Learning Outcomes: 1. Identify, apply and address public policy issues relevant to technology solutions. 2. Understand how technology solutions are developed, implemented, and maintained within a regulatory framework. 3. Identify, apply and address organizational ethics including conflicts of interest and individual ethical responsibilities. 4. Demonstrate the ability to function effectively in interdisciplinary teams. 5. Demonstrate effective oral and written communication skills. 6. Demonstrate project management competencies. Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

AGRY 12000 - Water And Food Security

Credit Hours: 3.00. General science introduction to global and regional water resources issues, especially with respect to food security. It will address the role of water in agriculture throughout the world and agriculture's impact on water resources. Students will focus first on developing the scientific underpinnings of water supply and crop water use. With this background, they will explore key issues relating to water scarcity and balancing agricultural and urban demands for water, water quality and soil salinization, water footprints of food and the use of virtual water embedded in food to offset national water deficits, regulation and roles science and policy in solving water problems.

Learning Outcomes: 1. Be familiar with water resources concepts, including water supply, water demand, irrigation needs, crop water use and water contamination. 2. Gain qualitative and quantitative understanding of water scarcity, water use efficiency and water footprints. 3. Develop oral and written communication skills and problem solving abilities on topics related to agricultural water resources. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology

solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

EAPS 36400 - Natural Hazards: Science And Society

Credit Hours: 3.00. This course will investigate the role of data and science in policy and decision-making as it relates to natural hazard resiliency. The scientific fundamentals of specific hazards will be introduced along with an explanation of how available data, various policies, programs, and real-time decisions can impact a community's response and recovery from disasters. Guest speakers describe their role in specific disasters, and in framing the policies and decisions made in the aftermath of the natural hazards. This course counts as a Great Issues course in the College of Science for Juniors and Seniors.

Learning Outcomes: 1. Demonstrate the ability to write knowledgeably and persuasively about the issues examined. 2. Use statistics and data ethically in the discussion of great issues. 3. Work as an active and contributing member of a team. 4. Transmit accumulated knowledge in effective written and oral presentations. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop a general awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5. Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

ASEC 35500 - Controversial Science And Media In The Public Sphere (UCC: HUM/STS)

Credit Hours: 3.00. This course will utilize case studies of controversial science news to explore the multiple factors that converge to influence how science and technology become controversial issues across a variety of social/ political domains. In addition to foundational understanding of communication theory, students will develop two primary skills: 1) a structure for the critical analysis of science news, 2) the skills to meaningfully communicate across stakeholders. The science content (GMOs, climate change, pesticide use, etc.) will provide the background information for analysis of the main focus of the course, which is in learning the communication process for effectively communicating science to non-science audiences. Case studies and applied critical media theory will be utilized to explore such controversies as climate change, genetically modified foods, and other emergent science controversies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Evaluate forces shaping public understanding of/and engagement with/science, including the role of

technology in misinformation (fake news, bots, algorithms, misinformation campaigns, and propaganda) and the role of commercial funding of media. 2. Able to critically analyze media reports of science issues including: Types of Journalism, Levels of Completeness, and Evidence within the story. 3. Apply reliable evidence from your critical news analysis to your projects. 4. Identify and analyze prominent and recurrent patterns in the communication of controversial issues. 5. Apply the skills learned to communicate controversial science to a non-science audience. 6. Critically evaluate the evolving role of media in shaping understanding of science across democratic societies. 7. Know content (quizzes and reflection papers). 8. Process Knowledge (Discussion and applied projects). 9. Use integrated knowledge to meaningfully critique others work. 10. Demonstrate process comprehension through construction of a critical news analysis of a current controversial issue. Credits: 3.00

BME 56200 - Regulatory Issues Surrounding Approval Of Biomedical Devices

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly-regulated environment. This course primarily concerns the processes for obtaining FDA marketing approval or clearance for biomedical devices. Prior to marketing a medical device in the US, a specific governmental approval or clearance is required depending on the type of device and the risk associated with the device. This course is part of a three-course series dealing with various aspects of regulatory science. Regulatory processes for class I, II, and III devices, including combination devices, are covered with specific focus on 510(k) and PMA requirements. Approval requirements in the EU, Japan and other countries will also be briefly considered. Throughout the course, emphasis will be placed on regulatory science, regulatory strategy and principles of interacting with regulatory agencies.

Learning Outcomes: 1. Use the appropriate regulatory classification and pathway for any medical device in the U.S. 2. Describe the significance of each major component of a 510(k) submission. 3. Describe the significance of each major component of a PMA submission. 4. Develop awareness for the need to seek country-specific expertise to prepare submissions for countries outside the U.S. 5. Select the appropriate messages and clearly present, in both oral and written communication, in a mock FDA meeting. 6. Identify contents of a CER and know the strategy for writing a CER. Credits: 3.00

ABE 51200 - Good Regulatory Practices

Credit Hours: 3.00. Includes a review of the FDA and ICH regulations on good manufacturing, good laboratory, good clinical practices. The meaning of these regulations, the globalization of practices and the roles and responsibilities of various professionals implementing these regulations will be addressed. Special emphasis will be detailed coverage of the process for the assembly and submission of an IND or NDA, and the function of the regulatory affairs department in a pharmaceutical company.

Learning Outcomes: 1. Identify cGMP regulations, and relationship to maintaining control of the chemical and ultimately the drug product with a focus on Phase 3, product introduction, and post marketing. 2. Examine about the regulatory history of the FDA and the GxP framework. 3. Identify NDA and BLA applications, product control including specifications, quality outcomes, critical quality attributes, and ICH framework. 4. Evaluate the regulations governing the manufacture of drug products, including the methods used to prove this, validation of those methods, validation of the manufacture, quality by design, comparability protocols, and continuous improvement. 5. Identify and evaluate compliance to GMP and warning letters. 6. Evaluate Good Distribution Practices (GDP) and the integration of supply chain controls into the Quality Management System. 7. Learn GCP, clinical regulations, and relationship to ensuring the drug or device is safe and efficacious. 8. Evaluate and describe basic clinical trial design

and how to write the investigator's brochure that informs patients (through the informed consent document that they sign) of clinical information. 9. Examine the rigid control that governs the clinical protocols and processes such as compliance oversight procedures, the role of clinical auditors and the process of auditing a clinical trial to ensure that it is done right. 10. Identify about the impact of technology and patient involvement in clinical trials through online resources, such as clinicaltrials.gov, YouTube instruction videos including videos describing GCP for devices. 11. Summarize the impact of recent adverse clinical trial events with innovative applications such as in biologics (Tegerno) and gene therapy (Gelsinger). Students will also identify and describe the role of approved Risk Evaluation and Mitigation Strategies (REMS), pharmacovigilance programs and adverse drug event reporting. 12. Identify and evaluate GLP and regulations that ensure a drug product is safe. 13. Examine GLP protocols, toxicology testing, including animal and human safety, and indicators for safety (irregular heartbeats in animals, etc.). 14. Evaluate the ethical considerations of testing, including impact of falsifying safety testing. 15. Analyze how GLP regulations are implemented during development and testing of devices. 16. Discover how technology and innovation impact the regulatory process. 17. Review data integrity and compliance with cGMP. 18. Evaluate the role of computer systems and computer systems validation. 19. Assess the emerging area of predictive toxicology and the potential for testing without animals. 20. Evaluate and explain innovation in safety and adaptive clinical trials. 21. Examine innovation in CMC including quality by design and predicting the quality of manufacturing on the large scale with small scale experiments, including analytics modeling. 22. Discover how the global environment impacts the regulatory process. 23. Evaluate special considerations of implementing a generic system in the developing and third world country . 24. Analyze global regulatory authorities and WHO PQ process. 25. Examine special considerations of the regulatory process as applied to devices, diagnostics and generics. 26. Identify the importance of design to a device, attributes that lead to the specifications and raw materials for diagnostics and the importance of product equivalence for generics and special considerations for biologics. Credits: 3.00

CE 59801 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multidisciplinary student teams directly apply cumulative learning to address a real-world complex societal challenge in close collaboration with a partner organization in an experiential learning format. The course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversation methodologies and role they can play in design activities. 5. Recognize the

importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion and retention of new solutions. Credits: 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ABE 42500 - Water Quality Engineering

Credit Hours: 3.00. This course provides in-depth perspectives on water quality in source and environmental water systems (lakes, rivers, groundwaters, and coastal waters) including sources and causes of water quality impairments and design of workable and cost-effective management solutions. The course integrates hydrology, chemistry, biology, and ecology as foundations of water quality management and incorporates operation mechanisms of management practices in designing solutions for pollution control. Students will have opportunities to engage with lectures, water quality measurements and data analysis, computer modeling, case studies, design, and discussion sessions.

Learning Outcomes: 1. Identify causes and sources of water quality impairments. 2. Explain the health, ecological, and societal consequences of impaired waters. 3. Collect in-field water quality measurements. 4. Analyze water samples and associated data. 5. Design watershed-based solutions for pollutant control

and water quality protection. Credits: 3.00

PUBH 10001 - Introduction To Public Health

Credit Hours: 3.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health. 3. Explain the role of public health in society. 4. Understand the government's role in matters pertaining to the health of the public. 5. Understand the role of health disparities in public health. 6. Achieve a basic understanding of the major investigative tool in public health: Epidemiology. 7. Identify the principal environmental determinants of health. 8. Know major and widespread challenges to good health: smoking, obesity, chronic disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health, including the current pandemic. Credits: 3.00

PUBH 38000 - Public Health Policy

Credit Hours: 3.00. This course will provide the opportunity to examine and analyze the financing, organization and delivery of health care in the U.S. and how these core elements are shaped and influenced by health care policy and decision-making.

Learning Outcomes: 1. Describe the role of policy, law and government relations in health care and public health. 2. Explain how federal, state, and local health policy is made. 3. Identify and critique the difference between population health and individual health. 4. Explain the policy interests between the public good (public health) and individual rights. 5. Explain the organization of the health care system, including principles and examples of health insurance and health care finance. 6. Describe health care policy formulation and implementation. 7. Explain and apply health policy principles to the policy topics discussed in class. Credits: 3.00

ASM 51200 - Managing Resources and Applications for Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 53600 - IT Policy, Law, And Ethics

Credit Hours: 3.00. This course examines the policy, legal, and ethical aspects of information technology. Issues covered include ethical decision making, policy development, professionalism, privacy, freedom of expression, intellectual property, liability, and social responsibility. Included will be the philosophical ethical theories that underpin ethical decision making in the context of executing IT based projects.

Learning Outcomes: 1. Research and assess current related legislation affecting IT and IT based projects (SOX, HIPAA, etc.). 2. Research and assess the importance of Intellectual Property and Copyrights. 3. Research and analyze the key components of process improvement and product quality as related to ethical software development. 4. Research and assess the importance of

employee and organizational liability. 5. Discuss the pros and cons in intelligent discourse concerning ethics and acting ethically for both individuals and organizations. 6. Discuss, in intelligent discourse, personal and societal impact of information privacy issues. Credits: 3.00

NUTR 54100 - Food Policy And Nutrition

Credit Hours: 3.00. We will explore the nature of contemporary United States food policy and key events throughout history that have shaped what it is today. We will investigate and discuss the roles individuals, corporations, and federal, state, and other government agencies play in creating food policy, and how these stakeholders as well as complex sociological and economic factors influence the way Americans eat. These questions will lead us to consider the future of food and food policy in the United States. Can Americans develop food policy that supports the agricultural economy AND promotes the consumption of healthy foods? Could our agricultural system support this? We will learn about and explore these questions with class discussions, debate, research, guest lectures, relevant documentary films, and thought-provoking readings that present a variety of viewpoints. You will explore current, real-life problems and have an opportunity to develop potential solutions. Credits: 3.00

CIT 20300 - Information Security Fundamentals

Credit Hours: 3.00. This course provides students with an overview of the field of Information Security and Assurance. Students will explore current encryption, hardware, software and managerial controls needed to operate networks and computer systems in a safe and secure manner. In addition, students will participate in a semester project to re-enforce key concepts such as policy development and business contingency planning. Credits: 3.00

ECE 40100 - Engineering Ethics and Professionalism

Credit Hours: 1.00. Some ethical, social, political, legal, and ecological issues that practicing engineers may encounter. (ECE 401 and ME 401 are cross-listed courses; students may not get credit for both ECE 401 and ME 401.)

Credits: 1.00

CMGT 38000 - Infrastructure Planning, Engineering, And Economics

Credit Hours: 3.00. Introduction to the planning and analysis of infrastructure projects. The focus will be on the prioritization, stewardship, management and decision-making roles within the division of a large public works agency. This course will cover municipal infrastructure system, infrastructure alternatives, financial and economic analyses, environmental and social impact assessment, uncertainty and risk-benefit analysis, sustainability, and public-private partnerships including numerous case studies.

Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

Program Learning Outcomes

Keywords

Landscape Management and Turf Management Certificate

Requirements for the Certificate (23 credits)

Required Courses (23 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions.

6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

Notes

Leadership Series Certificate (Indianapolis and Statewide)

Required Courses (18 Credits)

Phase 1: Foundation (6 Credits)

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Phase 2: Broadening (6 Credits)

OLS 38600 - Leadership For Organizational Change

Credit Hours: 3.00. Introduction to and overview of fundamental

concepts of leading organizational change. Topics include setting the stage for organizational change, implementing organizational change, sustaining organizational change, and the role of the change manager. Concepts and frameworks taught in this course are applicable to change at multiple scales from small enterprises and large corporations to communities and ecosystems.

Learning Outcomes: 1. Identify organizational culture and transformation readiness. 2. Apply various change management frameworks to leading organizational change. 3. Understand the role organizational culture plays in change and transformation. 4. Identify the effect of technological change on organizations, communities, and society. 5. Develop and apply a change management framework. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

Phase 3: Specialization (6 Credits)

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4.

Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

Learning Beyond the Classroom Certificate

Requirements for the Certificate

Courses

AGR 49000 - Special Problems

Credit Hours: 0.00 to 3.00. Topics and credit hours to be arranged.

Credits: 0.00 to 3.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EPCS 20200 - Sophomore Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Sophomores participating in EPCS 20100 gain insight into the specific project, and, more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 20200 is offered for two credits. Permission of instructor required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 20100 - Sophomore Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). Sophomores participating in EPCS 20100 gain insight into the specific project, and, more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 20100 is offered for one credit.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 10200 - First Year Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Participants in EPCS 10200 gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Working with team's sophomores, juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 10200 is offered for two credits and is intended for students who have exhibited significant achievement in EPCS 10100 and desire the level of responsibility that is appropriate for two credits. May be repeated for credit. Permission of department required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 10100 - First Year Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS 10100 gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's sophomores, juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. May be repeated for credit.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that

their discipline can play in social contexts.
Credits: 1.00

ENTM 49800 - Special Problems In Entomology

Credit Hours: 1.00 to 4.00. Open to qualified sophomores, juniors, and seniors who want to study special problems in entomology not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 4.00

PSY 39000 - Research Experience In Psychology

Credit Hours: 1.00 to 3.00. Involvement in an ongoing research project in the Department of Psychological Sciences. Up to 6 credits may be taken for a letter grade. Additional credits after 6 must be taken as Pass/No Pass. Permission of instructor required.

Learning Outcomes: 1. Apply principles of research methodology within a lab setting, as appropriate for lab role. 2. Demonstrate ethical behavior in the conduct of psychological research. 3. Demonstrate professional communication skills through interactions with principal investigators, graduate students, lab personnel, and research participants. Credits: 1.00 to 3.00

SCI 10000 - Multicultural Leadership Seminar

Credit Hours: 1.00. Exposes students to career opportunities via presentations from corporate and academic representatives; provides an opportunity for minority science students to share concerns and to become aware of existing academic and non-academic support systems on campus. Provides an overview of the significant contributions to the sciences by minority groups; reinforces good study habits for academic success.

Credits: 1.00

SCI 19500 - Special Topics In Science

Credit Hours: 0.00 to 3.00. This is a special projects course that will be used for special circumstances with individual study or for experimental courses, pointed toward students who are first- or second-year students.

Credits: 0.00 to 3.00

GS 49000 - Directed Reading In General Studies

Credit Hours: 1.00 to 4.00. Reading to be done under the direction of the instructor in the particular field of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

MCMP 49000 - Special Topics

Credit Hours: 1.00 to 3.00. A course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest, utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Credits: 1.00 to 3.00

BIOL 11500 - Biology Resource Seminar (UCC: IL)

Credit Hours: 1.00. This course is designed to help integrate new biology students into the Department of Biological Sciences, to help them adjust to university life, and to assist them in developing academic and intellectual survival skills using the medium of introductory Biology courses. The course meets twice a week in groups of 20-25 students. Each section is led by an academic advisor and an undergraduate teaching intern. The class periods have an on-going emphasis on connecting students to one another as resources while learning information, critical thinking skills and problem-solving strategies. Topics include bioethics, time management, available academic resources, biology majors and curricula and career development. Students are exposed to opportunities in undergraduate research, summer internships, the study abroad program, and teaching internships. Throughout the course, students are encouraged to plan their college education rather than merely choose their courses. Permission of department required.

University Core Curriculum (UCC): (UCC: IL)
Credits: 1.00

BIOL 19700 - Biology Freshman Honors Seminar

Credit Hours: 1.00. Discussion meetings with Freshman Honors students to cover various aspects of freshman biology, research opportunities in biology, and career choices in biology. Open only to students in the Biological Sciences Honors Program. The credit may be used only toward free electives. Permission of department required.

Credits: 1.00

BIOL 29300 - Sophomore Seminar: Planning Your Future In Biology

Credit Hours: 1.00. Biology 29300 is a one-credit course designed for sophomores in the Department of Biological Sciences. This course will help students maximum the remainder of their undergraduate career. The course will cover biology career information and suggestions for professional development. Students will learn about the various disciplines that make up modern Biological Sciences. Students will learn

about opportunities in undergraduate research and tour a research laboratory. In-depth presentations from biology alumni from a variety of fields are featured. Assignments include a Plan of Study, a resume, and a written paper evaluating the career path of one alumni speaker and describing the student's response to the presentation.

Learning Outcomes: 1. Demonstrate the ability to communicate well, both orally and in writing. 2. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 29400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by freshman and sophomores. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 29500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, or laboratory work selected for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 39300 - Preparing For Your Future In Biology

Credit Hours: 1.00. Biology 39300 is a one-credit course for junior and seniors in the Department of Biological Sciences. This course will help students begin to prepare for life after Purdue. Students will learn about interviewing, job searching, graduate and professional school searching, resumes, industrial practices, and how to evaluate job/school offers. Construct a polished image on top of your solid biology foundation! Get the job or get admitted to the school you want.

Learning Outcomes: 1. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49700 - Biology Honors Seminar

Credit Hours: 1.00. Required of all students participating in honors research. Discussions and presentations of research, including seminars by those students who are completing their honors research thesis.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the

impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Become familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Understand the chemical and physical principles that govern biochemical and physiological processes. 9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Understand the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 12. Understand the principles governing the development of multi-cellular animals and plants. 13. Understand ways in which organisms interact ecologically with each other and their environment. 14. Understand how evolutionary forces influence organisms to produce adaptations. 15. Acquire knowledge of the ways in which animals communicate with each other. 16. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 17. Be familiar with taxonomic and phylogenetic relationships among organisms. 18. Extend basic ecological principles to species and ecosystem conservation. 19. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 20. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Demonstrate an understanding of laboratory skills used in genetics. 23. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 24. Become familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 25. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 26. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 27. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 28. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 29. Demonstrate an understanding of prokaryotic cell structure. Credits: 1.00

BIOL 49800 - Biology Teaching

Credit Hours: 3.00. Supervised teaching experience for juniors and seniors. Must have approval of course instructor in advance. Permission of instructor required.

Credits: 3.00

BIOL 49900 - Biology Honors Thesis Research

Credit Hours: 1.00 to 4.00. Research under the guidance of a scientist. Submission of honors tutorial petition and consent of faculty tutor and Honors Committee. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 19700 - Chemistry Freshman Honors Research

Credit Hours: 1.00. Supervised individual research performed by student.

Credits: 1.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

CS 19100 - Freshman Resources Seminar

Credit Hours: 1.00. This course is intended to integrate freshman majors in computer sciences into the department, help them adjust to university life, and assist them in developing academic and intellectual survival skills. Weekly recitation sections enable the students to work in teams. Strongly recommended for freshmen. The credit may be used only toward free electives.

Credits: 1.00

CS 19700 - Freshman Honors Seminar

Credit Hours: 1.00. A seminar dealing with the history, context, and future of computer science. Open only to students in the Computer Sciences Honors Program. The credit may be used only toward free electives.

Credits: 1.00

CS 29100 - Sophomore Development Seminar

Credit Hours: 1.00. Presentations by corporate partners about careers in computer science. Presentations by faculty about careers in academia and research. Students learn about upper-division courses, tour research laboratories, and attend job fairs.

Credits: 1.00

CS 39000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 39100 - Junior Resources Seminar

Credit Hours: 1.00. This seminar course engages a number of outside speakers who typically present information on the role of research in computer science, how the research components of computer science relate to each other, approaches to software development in industry, different types of application development paradigms, technological trends, and societal, ethical, and legal issues. The credit may be used only toward free electives.

Credits: 1.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

EAPS 19100 - Introductory Topics In Earth And Atmospheric Science

Credit Hours: 1.00 to 3.00. Introductory special topics in earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 35200 - Structural Geology

Credit Hours: 3.00. This course deals with the nature and evolution of structures in rock deformed naturally by flow and fracture, as deduced from experimental, theoretical and field studies. Specific topics include: structures in three dimensions using descriptive geometry and stereonets, field measurements of rock geometry, tensors, strain and stress, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop, the structure and

mechanics of mountain belts. Students will be expected to show competency with using a general set skills, techniques, and tools commonly used by professional geoscientists.

Learning Outcomes: 1. Interpret geologic structures in three dimensions using descriptive geometry, stereonets, and field measurements of rock geometry. 2. Evaluate quantitatively observations of the deformation in the crust using basic stress and strain theory, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop. 3. Recognize the structures and give a mechanical explanation for the development of mountain belts. 4. Apply these skills in the field. Credits: 3.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 39000 - Geologic Field Methods

Credit Hours: 3.00. Introduction to geologic mapping principles on quadrangle (7 1/2 min., 15 min., 1:250,000 scales) maps. Application of aerial photography, GPS, and GIS techniques. Emphasis on construction of cross sections, measurement of stratigraphic sections, and preparation of geologic reports. Several weekend field exercises will be required.

Credits: 3.00

EAPS 39100 - Topics In Earth And Atmospheric Sciences

Credit Hours: 1.00 to 4.00. Intermediate special topics in the earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 4.00

EAPS 41900 - Internship In Environmental Geosciences

Credit Hours: 1.00 to 6.00. This course provides students with an opportunity to gain practical work experience in environmental geoscience. The student works with a faculty advisor to set up an internship consisting of the equivalent of at least six weeks of full-time employment with a government agency, business, or consulting company. Internships typically involve field, laboratory, and office work. A portion of the internship may be part-time work during a regular semester, but at least three consecutive weeks must be full-time work. One credit hour per week of unpaid internship. Six week internship. Prior course work in upper level EAPS courses is required. Permission of department required.

Credits: 1.00 to 6.00

EAPS 43400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (AGRY 44400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

EAPS 49700 - Earth And Atmospheric Sciences Undergraduate Readings And Research

Credit Hours: 1.00 to 6.00. Supervised reading and/or research in various fields. Permission of instructor required.

Credits: 1.00 to 6.00

SCI 49000 - Topics In Science For Undergraduates

Credit Hours: 1.00 to 5.00. Selected interdisciplinary topics. Offered as a scheduled course when appropriate. Also available

for supervised reading and reports of an interdisciplinary nature. Permission of instructor required.

Learning Outcomes: 1. Demonstrate the ability to communicate well, both orally and in writing. 2. Demonstrate the ability to work on a team. Credits: 1.00 to 5.00

MA 10800 - Mathematics As A Profession And A Discipline

Credit Hours: 1.00. A seminar course for undergraduate students interested in majoring in an area of mathematics at Purdue. The purpose is to build prospective mathematics majors' awareness of opportunities to enhance their experiences at Purdue and of career paths available for graduates with a good mathematical background. The format of most classes is a presentation and discussion with an invited speaker/guest, including experts on a different aspect of mathematics in our world today. This course is recommended for undergraduates in their first or second year at Purdue.

Credits: 1.00

MA 17000 - Introduction To Actuarial Science

Credit Hours: 2.00. (STAT 17000) An introduction to actuarial science from the point of view of practicing actuaries from life insurance, casualty insurance and consulting; introduction to insurance and the mathematical theory of interest; application of spreadsheets to problems related to actuarial science.

Learning Outcomes: 1. Describe different expressions of interest rates. Calculate an equivalent rate given another rate. 2. Calculate the present value of a set of cash flows. 3. Apply basic probability principles. 4. Describe and apply different types of probabilities used by actuaries. 5. Calculate the expected present value of a set of cash flows. 6. Describe basic types of insurance and their characteristics. 7. Define and apply basic components of insurance. Examples: premium, claim, deductible, coverage, limit, coinsurance, insured, owner. 8. Describe the ratemaking process. Calculate the rate of a simple insurance product. 9. Describe the pricing process. Calculate the price of a simple insurance product. 10. Describe different accounting regimes and their purposes. 11. Define a policy reserve. Calculate a simple policy reserve. 12. Define a loss reserve. Calculate a simple loss reserve. 13. Demonstrate a basic level of knowledge by applying Excel to solve problems. Credits: 2.00

MA 48400 - Seminar On Teaching College Algebra And Trigonometry

Credit Hours: 3.00. This course is a seminar on the teaching of mathematics for our best undergraduate mathematics education students. It provides supervised teaching experience along with a chance for the students to perfect their knowledge of algebra before going on to be high school teachers. Students who take this class will also teach a section of MA 15300. Permission of instructor required.

Credits: 3.00

MA 49000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 6.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 6.00

PHYS 23500 - Seminar In Careers In Physics

Credit Hours: 1.00. Course is designed to help physics majors evaluate different career options. Permission of instructor required.

Credits: 1.00

PHYS 39000 - Special Assignments

Credit Hours: 1.00 to 4.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Learning Outcomes: 1. Understand physics and physical laws of nature by learning beyond what is offered by currently available fixed-title courses. Credits: 1.00 to 4.00

PHYS 49000 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, laboratory work, or research in special areas of physics. Intended for upperclass students. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 17000 - Introduction To Actuarial Science

Credit Hours: 2.00. (MA 17000) An introduction to actuarial science from the point of view of practicing actuaries from life insurance, casualty insurance and consulting; introduction to

insurance and the mathematical theory of interest; application of spreadsheets to problems related to actuarial science.

Learning Outcomes: 1. Describe different expressions of interest rates. Calculate an equivalent rate given another rate. 2. Calculate the present value of a set of cash flows. 3. Apply basic probability principles. 4. Describe and apply different types of probabilities used by actuaries. 5. Calculate the expected present value of a set of cash flows. 6. Describe basic types of insurance and their characteristics. 7. Define and apply basic components of insurance. Examples: premium, claim, deductible, coverage, limit, coinsurance, insured, owner. 8. Describe the ratemaking process. Calculate the rate of a simple insurance product. 9. Describe the pricing process. Calculate the price of a simple insurance product. 10. Describe different accounting regimes and their purposes. 11. Define a policy reserve. Calculate a simple policy reserve. 12. Define a loss reserve. Calculate a simple loss reserve. 13. Demonstrate a basic level of knowledge by applying Excel to solve problems. Credits: 2.00

STAT 19000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the freshman level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Discover data science and professional development opportunities to prepare for a career. 2. Design efficient search strategies to acquire new data science skills. 3. Devise the most appropriate data science strategy to answer a research question. Credits: 1.00 to 5.00

STAT 29000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the sophomore level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Design efficient search strategies in order to acquire new data science skills. 2. Devise the most appropriate data science strategy in order to answer a research question. 3. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 5.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

EAPS 55600 - Planetary Surface Processes

Credit Hours: 3.00. The application of petrology and structural geology to other planets. Topics include: theories of star and solar system formation, orbital dynamics and Kepler's laws, petrology and geochemistry of meteorites, age dating techniques, structure and composition of the terrestrial, giant, and icy planets, planetary surfaces, planetary atmospheres, and theories of the formation of the moon. Offered in alternate years. Prior course work in earth materials is required.

Learning Outcomes: 1. Understand the physical and chemical principles behind processes that modify planetary surfaces. 2. Identify planetary surface features in orbital imagery and use

observational evidence to postulate their origin and modification histories. 3. Gain field experience with planetary surface processes and landforms at local planetary analog sites. 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic. Credits: 3.00

EAPS 59000 - Field Geology North America

Credit Hours: 2.00. Advanced study of tectonic evolution and stratigraphic history of specific geologic provinces. Particular emphasis on the relationship between tectonics, basin development, and sedimentation. Field component deals with application of field techniques used in basin analysis and structural studies. A 10-day field trip is required. Permission of instructor required.

Credits: 2.00

PHYS 59000 - Reading And Research

Credit Hours: 1.00 to 3.00. (Calumet, Fort Wayne) 1.00 to 6.00 (West Lafayette, IUPUI). Reading and research in Physics. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 59300 - Independent Research

Credit Hours: 1.00 to 4.00. Research in some area of modern physics (spectroscopy, nuclear physics, solid state physics, elementary particle physics, biophysics, geophysics, etc.) with student receiving individualized supervision and guidance from staff member. This course may be used to satisfy the independent project or 500-level elective requirement of the undergraduate majors in Honors and Applied Physics Honors Programs. Permission of instructor required.

Credits: 1.00 to 4.00

ENTR 48000 - Entrepreneurial Leadership And Careers

Credit Hours: 3.00. This course prepares students for entrepreneurial careers by requiring them to apply the knowledge and skills learned in prerequisite entrepreneurship courses to the development of their professional goals and networks. Students explore how they can use their entrepreneurial talents, skills, and interests in a variety of ways, including launching startups, joining family businesses, or being intrapreneurs in established organizations. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify unique personal entrepreneurial strengths to help shape career decisions. 2. Understand the practical application of team building and leadership. 3. Explore different types of entrepreneurial careers in startups and large organizations. 4. Research and interview entrepreneurs about career pathways. 5. Use secondary research to assess potential employers and their alignment with personal goals. 6. Explore options for using entrepreneurial skills within existing organizations. 7. Understand key elements of personal financial planning and management. 8. Build a personal brand and use social media platforms to expand professional networks. 9. Create a personal business plan. Credits: 3.00

SCI 39500 - Special Topics In Science

Credit Hours: 0.00 to 3.00. This is a special topics course that will be used for special circumstances with individual study or for experimental courses.

Credits: 0.00 to 3.00

PHYS 10400 - First Year Physics Seminar

Credit Hours: 1.00. A one-credit course for first-year Physics majors designed to develop concepts and skills in team building, time management, and professional development that complement the students' academic and research training. Talks from a broad range of speakers are included.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths of the Physics programs. Credits: 1.00

GS 29501 - Understanding Your Undergraduate Research Experience I

Credit Hours: 1.00. This course is for Purdue undergraduates who are part of an active research project and/or creative endeavor. Students will hone skills necessary for reflecting on

and completing these experiences. During this course, students will utilize their research experience to apply skills including but not limited to: managing time with a research project, communicating research findings, using Purdue Libraries' resources, and providing constructive feedback to peer researchers. Students will deliver elevator pitches on their own research projects and critique pitches from their peers.

Learning Outcomes: 1. Communicate research to various audiences with an oral research elevator pitch and a written research abstract. 2. Provide constructive feedback, interact with peers, and incorporate feedback in your work. 3. Define skills and attributes you have developed and expanded as a result of your involvement in an undergraduate research experience. 4. Develop and expand your network of peer researchers within and across disciplines. 5. Reflect on and apply transferable skills necessary to be a successful undergraduate researcher. Credits: 1.00

GS 19501 - Preparing For Your Undergraduate Research Experience

Credit Hours: 1.00. This course is for prospective Purdue undergraduate researchers who are interested in conducting undergraduate research or creative endeavors. Purdue students who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs. Throughout the course, students will develop components for a final application packet to submit to a research team or program they choose.

Learning Outcomes: 1. Identify professional and personal goals sought from an undergraduate research experience. 2. Learn research skills such as assessing literature credibility and compiling a review of the topic important to all fields. 3. Utilize online and in person resources and programs to assist in locating and applying to undergraduate research experiences. 4. Evaluate research programs/projects to determine how they fit within personal and professional goals. 5. Create and submit an application/proposal including a resume and personal statement for research programs/projects. Credits: 1.00

GS 39501 - Understanding Your Undergraduate Research Experience II

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build upon the previous course and focus on research data collection, analysis, and communication for current Purdue undergraduate researchers. During this course, students will learn and discuss various forms of data and collection practices. Students will develop their own academic poster to present their research project's data and implications.

Learning Outcomes: 1. Learn about quantitative and qualitative research methods and discuss how to utilize both in a research project. 2. Create and present an academic poster applying data visualization best practices. 3. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

VIP 17911 - First Year Participation In Vertically Integrated Projects (VIP) I (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering

design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17912 - First Year Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 47920 - Senior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management,

intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 37920 - Junior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of

the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 17920 - First Year Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47922 - Senior Design Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team

whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 27920 - Sophomore Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47921 - Senior Design Participation In Vertically Integrated Projects (VIP) I

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering

design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

PHYS 32300 - Research With Big Data I

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

PHYS 32400 - Research In Big Data II

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

VIP 47930 - Senior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering

judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

VIP 37930 - Junior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Discover data science

and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 11100 - Corporate Partners I

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 11200 - Corporate Partners II

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the

difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 21100 - Corporate Partners III

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 21200 - Corporate Partners IV

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 31100 - Corporate Partners V

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the

research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 31200 - Corporate Partners VI

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 41100 - Corporate Partners VII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 41200 - Corporate Partners VIII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in

these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 51100 - Corporate Partners

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

VIP 17910 - First-Year Participation In Vertically Integrated Projects (VIP) Lim (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies, and development tools. Permission of department required.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and

meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 27910 - Sophomore Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 37910 - Junior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-

world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 47910 - Senior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive

environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 27930 - Sophomore Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 3.00

Notes

Learning While Working Certificate

About the Certificate

Requirements for the Certificate

Option 1: 2 Full Time & 4 Part Time

ENGR 26099 - Learning While Working Full-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36199 - Learning While Working Part-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36299 - Learning While Working Part-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46399 - Learning While Working Part-Time Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering,

polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46499 - Learning While Working Part-Time Co-Op IV

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36099 - Learning While Working Full-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

Option 2: 3 Full Time & 1 Part Time

ENGR 26099 - Learning While Working Full-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning

While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36199 - Learning While Working Part-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46099 - Learning While Working Full-Time Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36099 - Learning While Working Full-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work

experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

Option 1: 2 Full Time & 4 Part Time

ENGR 26099 - Learning While Working Full-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36199 - Learning While Working Part-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36299 - Learning While Working Part-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46399 - Learning While Working Part-Time Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46499 - Learning While Working Part-Time Co-Op IV

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36099 - Learning While Working Full-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

About the Certificate

Medical Humanities Certificate

About the Certificate

Requirements for the Certificate (18 credits)

A. Required Courses (15 credits)

Category 1: Humanities (6+ credits)

ASL 28000 - American Deaf Community: Language, Culture, And Society

Credit Hours: 3.00. The linguistic, cultural, and societal context of the deaf community in America. Both historical and contemporary aspects of deaf identity will be included, with an emphasis on the central role that ASL plays in the lives of deaf individuals.

Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice. Credits: 3.00

COM 49100 - Special Topics In Communication

Credit Hours: 1.00 to 3.00. Intensive study of selected topics, varying from semester to semester, from the literature or practice of communication. Course content will be drawn from areas not dealt with in the regular curriculum and may include such topics as photojournalism, economic reporting, and campaign communication. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of a specialized area of communication and its common applications. Credits: 1.00 to 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

HIST 48800 - History Of Sexual Regulation In The United States

Credit Hours: 3.00. This course will illuminate broad themes in the historical regulation of sexual violence, consensual sex, and homosexuality. Student will understand and analyze how cultural, social, religious, and moral ideologies have influenced conceptions of deviant and normative sexuality in the United States.

Learning Outcomes: 1. Students will be able to articulate verbally and in writing what they have learned about the nineteenth and twentieth century history of sexual regulation. 2. Students will be able to identify and analyze the cultural and religious values which informed sexual regulation. 3. Students will develop a deeper understanding of how regulations and reform worked by conducting primary source research and synthesizing it into written arguments. Credits: 3.00

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 22500 - Philosophy And Gender (UCC: HUM)

Credit Hours: 3.00. An examination of the beliefs, assumptions, and values found in traditional and contemporary philosophical analyses of women. A range of feminist approaches to knowledge, values, and social issues will be introduced.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improved knowledge of human cultures, creative thinking, critical thinking, integrative learning. Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

HIST 31505 - American Beauty (UCC: HUM)

Credit Hours: 3.00. This course explores twentieth-century gender history in the United States through the concept of beauty. Ideals about beauty intersect with politics, economics, technological developments, medical innovations, and nation building. A critical examination of beauty as seen through advertising, pageants, and material culture, yields insight about modern womanhood, everyday life, and identify formation in the twentieth-century United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Appreciate the ways that beauty has been pursued by individuals, health practitioners, corporations, and media cultures since 1900. 2. Understand and recognize how assumptions about gender have influenced the way that beauty is constructed and experienced at different places and times. 3. Think historically and critically about the culture consequences of technologies related to beauty. 4. Think historically and critically about approaches to the study of beauty in modern American history. 5. Understand the difference between secondary and primary sources. 6. Analyze and interpret primary documents related to beauty cultures. 7. Understand the competing and conflicting nature of historical interpretation. 8. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

CDIS 23900 - Introduction To Disability Studies

Credit Hours: 3.00. Introduces students to the principles of and debates within disability studies. Topics explored include ideas of normalcy; the social model of disability; history of eugenics and its current manifestations; relations between disability and other identity categories; issues of social and physical access; cultural representations of disabled people.

Learning Outcomes: 1. Identify different models of understanding disability. 2. Understand the ways normalcy is socially constructed. 3. Distinguish between impairment and disability. 4. Offer informed opinions on current eugenic practices. 5. Compare and contrast disability to other identity categories such as race, gender, and sexuality. 6. Identify exclusionary practices that marginalize disabled people. Credits: 3.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their disciplines. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand

how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

ENGL 43900 - Topics In Disability Studies

Credit Hours: 3.00. Explores cultural, social, and political meanings and effects of disability in relation to literature and/or rhetoric. Specific topics will vary.

Learning Outcomes: 1. Discuss the strengths and weaknesses of different models for understanding disability. 2. Understand ways normalcy is socially constructed. 3. Identify cultural practices that exclude disabled people. 4. Compare and contrast disability with other identity categories such as race, gender, and sexuality. 5. Discuss ways in which culture defines disability as impairing one's subjectivity and even humanity. 6. Analyze literary representations of disabled characters. 7. Examine the role of disability in literary works more broadly. Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

HIST 30305 - Food In Modern America (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the kitchen as an architectural space, a place of labor and food production, and an arena for technological innovation in modern American history. Cooking and eating reflect cultural sentiments about modernity, progress, ethnicity, and family, and the politics of how society nourishes bodies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Think

historically and critically about the cultural consequences of technologies related to eating and food preparation. 2. Think historically and critically about approaches to the study of national identify and culture expressed through food. 3. Appreciate the circumstances and history of kitchen design in relation to raced and gendered identities, home space, and food preparation. 4. Understand and recognize how assumptions about food production during the late 19th and 20th centuries in the United States reflected notions about labor, modernity, and progress. 5. Understand the difference between secondary and primary sources. Students will analyze and interpret primary documents related to kitchens, cooking, and food preparation. They also will understand the competing and conflicting nature of historical interpretation. 6. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 35205 - Death, Disease And Medicine In Twentieth Century American History (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of disease, dying, and medicine in the United States in the 20th century.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify and explain the relationship between science and culture and interdisciplinarity. 2. Analyze texts and cultural artifacts about medicine. 3. Identify medical practice and how it is informed by context and culture. Credits: 3.00

ENGL 22600 - Narrative Medicine (UCC: STS)

Credit Hours: 3.00. "Narrative Medicine" encompasses stories about the interior lives of doctors and medical professionals, the complexities of medicine past and present, and health-care for patients and their families. Ultimately, this course emphasizes the essential role of rhetoric and storytelling in the face of medical crisis and uses stories about illness and disability to explore the human condition.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Explain medicine from a humanistic perspective. 2. Explain contemporary health issues. 3. Define storytelling as an intellectual and empathic discourse. 4. Analyze fictional and factual narratives (stories). Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2. Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 36105 - History Of Science, Technology, And Environment In Pre-Modern East Asia

Credit Hours: 3.00. This course explores developments in scientific, technological, and ecological history specifically in Pre-modern East Asia. In this class, we will read basic theories and methods in the history of science and technology, as well as basic debates and questions that challenge scholars studying the history of science, technology, and the environment in a non-western pre-modern context. We will explore how society, culture, and politics affect knowledge production and people's engagement with nature, and how these interactions, in turn, shaped society, culture, and politics. All readings are in English. No prior knowledge of East Asia is necessary.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society in pre-modern East Asia. 2. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 3. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 4. Investigate the diversity of human experience in pre-modern East Asia, explain how social factors such as ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, have shaped the development or application of science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. 5. Identify and explain the major themes of the history of science, technology, and environment, write about the role of science in society, and describe ethical implications of technological and scientific developments.
Credits: 3.00

Category 2: Social Sciences (6+ credits)

HK 13500 - Introduction To Health And Kinesiology

Credit Hours: 1.00. Overviews the disciplines of health and kinesiology. Students explore skills and academic interests in theses areas. Describes career opportunities and options for graduate study. Provides strategies for professional and portfolio development. Students complete five hours of community service per semester. Permission of instructor required.

Credits: 1.00

PUBH 20500 - Basic Public Health Studies

Credit Hours: 3.00. Examination of basic scientific concepts as applied to the problems and issues in selected areas of human health behavior with particular attention to their influence on population and individual health. Restricted to students enrolled in major degree programs for which this course is a requirement.

Learning Outcomes: 1. Discuss the nature of public health promotion and disease prevention in the US. 2. List the leading causes of death and describe leading theories of health behavior. 3. Define the components of psychological health and describe the basic traits shared by psychologically healthy people. 4. Describe the nature of stress, the physiology of the stress response, and the relationship of stress to health/disease; identify the major sources of stress in contemporary society and discuss interventions for stress management. 5. Discuss categories of drugs, routes of administration and drug interactions. 6. Describe the relationship of alcohol, tobacco and caffeine to health and disease. 7. Describe the general concepts of nutrition, list and explain the recommendations made to the public by various health agencies to decrease risk of chronic disease. 8. Describe various theories of obesity, discuss concepts of weight management, define/describe body image and the disordered eating continuum, define anorexia and bulimia nervosa, and list symptomatology and risk factors. 9. Discuss the relationship of physical activity and physical fitness to health and/or disease and provide rationale (based on evidence from exercise epidemiology) for the recommendations made to the public concerning activity/exercise participation. 10. Describe the anatomy and basic functions of the cardiovascular system and the prevalence/incidence of heart disease, identify risk factors and describe the features of atherogenesis and other diseases of the heart and vascular system. 11. Describe the prevalence and incidence of the various types of cancer and identify cancer risk factors. 12.

Describe the prevalence and incidence of diabetes and list risk factors for diabetes. Credits: 3.00

PUBH 22500 - Contemporary Women's Health

Credit Hours: 3.00. Examines behavioral, psychological, and sociocultural aspects of women's experience in healthcare systems. Includes the influence of factors such as age, social class, and ethnicity on women's roles as recipients and providers of health care.

Credits: 3.00

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

PUBH 40000 - Human Diseases And Disorders

Credit Hours: 3.00. The major communicable and noncommunicable diseases and disorders that afflict modern man, with particular emphasis upon the etiology, epidemiology, and ecology of these diseases and disorders.

Learning Outcomes: 1. Describe risk factors and modes of transmission for infectious and chronic diseases and how these diseases affect both personal and population health. 2. List the leading causes of mortality and morbidity, and health disparities among local, regional, and global populations. 3. Discuss major local, national, and global health challenges. 4. Explain the influence that science and technology have on individual and population health. 5. Describe the multiple determinants of health. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 32500 - Health And Health Care For Children And Families

Credit Hours: 3.00. This course discusses leading causes of child health problems as well as examines the child and family reactions and adjustment to illness and disability. A developmental perspective on coping with health problems from early childhood through adolescence is presented. An overview on global child health disparities is also addressed.

Learning Outcomes: 1. Discuss the impact of illness on children, adolescents, and families. 2. Examine and analyze the leading causes of child and adolescent health. 3. Examine and compare health disparities among national and international children. 4. Determine the complexities and implications of health care policy and barriers to access to care on children, adolescents and families. 5. Determine the importance of implementing family centered care and interdisciplinary collaboration while providing care for children and adolescents. 6. Identify professional opportunities in child and family health. Credits: 3.00

HDFS 33000 - Sexuality And Family Life

Credit Hours: 3.00. Provides the student with a basic knowledge of human sexuality as it pertains to individuals, couples and families. The course is designed to be helpful to students who will become family life educators as well as to be helpful to students as individuals, spouses, and parents.

Learning Outcomes: 1. Construct a basic

knowledge of human sexuality as it pertains to family relations in the personal and professional settings. 2. Compare and describe social, cultural, historical, and technological trends and the interrelationships between these trends and their impact on sexuality, family relations, and personal values and attitudes. 3. Differentiate and examine the many different aspects of sexuality including biological, developmental, medical, cultural, historical, and interpersonal. 4. Demonstrate knowledge that helps to develop a better understanding of students' own feelings and attitudes related to sexuality and how those attitudes and feelings influence their beliefs about individuals, couples, and families. Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

PSY 36700 - Adult Development And Aging

Credit Hours: 3.00. Theory and research on adult development from young adulthood through the elderly years. Course covers biological, cognitive, personality, and social issues. Topics include vocational choice, marriage, parenthood, the empty nest, menopause, memory and aging, retirement, widowhood, longevity, and death and dying.

Credits: 3.00

ANTH 20300 - Biological Bases Of Human Social Behavior (UCC: BSS)

Credit Hours: 3.00. This course is an introduction to human social behavior from the perspective of biological anthropology, with special emphasis on human evolution and non-human primates. Topics include aggression, communication, learning, maturation, sexuality, and the evolution of social systems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Demonstrate understanding of core concepts and theories of human evolutionary biology and ecology. 2. Describe key components of human life course evolution and hunter-gatherer lifestyles. 3. Analyze the evolutionary mechanisms underlying behavioral variation across primates. 4. Assess cross-cultural variation in food acquisition, mating, parenting, and social systems. Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural

approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 34100 - Culture And Personality

Credit Hours: 3.00. A cross-cultural survey stressing different basic personality types and the processes by which adult personality is acquired. Case studies of selected non-Western cultures will be used to provide comparative perspective.

Learning Outcomes: 1. Explain in words and diagrams the dialectical relations among culture, personality, and cognition. 2. Distinguish and relate childhood and adult processes of enculturation and socialization. 3. Appraise how, why, and to what extent every individual and every society is unique, comparable to some others, and similar to all others. Credits: 3.00

ANTH 39200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Various topics in anthropology that may change from semester to semester are presented by anthropology faculty members.

Credits: 1.00 to 3.00

ANTH 43600 - Human Evolution

Credit Hours: 3.00. This class examines the fossil evidence for human evolution and theories proposed to explain the development that led from the origin of primates to modern humans. This course will include lectures, exercises with fossil casts, presentation, and discussions.

Learning Outcomes: 1. Explain the analytical and research methods used in hominin

paleobiology. 2. Identify important research questions within human paleobiology as well as theoretical approaches and methods used to evaluate them. 3. Describe the relevant fossil evidence to investigate the evolution of the primate lineage. 4. Demonstrate understanding of evolutionary processes, particularly those that shaped the biocultural evolution of modern humans. 5. Evaluate interpretations of the hominin fossil record and appraise the strengths and weaknesses of current debates in human evolution. Credits: 3.00

ANTH 48200 - Sexual Diversity In Global Perspectives

Credit Hours: 3.00. This course focuses on anthropological and interdisciplinary research in the study of sexuality with particular attention to lesbian, gay, bisexual and transgender identities. It explores historical, theoretical and ethnographic work on sexualities and genders in the US and globally.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3. Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's

roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 59200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

SOC 57200 - Comparative Healthcare Systems

Credit Hours: 3.00. Using cost, quality, and access to care as core concepts, this course explores healthcare in comparative context. Special topics are health and gender, the environment, epidemics, long-term care, technology, and rationing, among others.

Credits: 3.00

SOC 57300 - The Human Side Of Medicine

Credit Hours: 3.00. Focuses on sociological theory and research related to social conflicts over the delivery of healthcare in the U.S. Considers social issues pertaining to abortion, AIDS, human experimentation, reproductive technologies, euthanasia, and others.

Credits: 3.00

SOC 57400 - The Social Organization Of Healthcare

Credit Hours: 3.00. Analysis of the determinants and consequences of the social organization of medical care. Considers morbidity and mortality, costs and utilization of medical services, healthcare occupations and institutions, and change in programs and policies.

Credits: 3.00

ECON 36200 - Health Economics

Credit Hours: 3.00. This course is designed to introduce upper level undergraduate students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues using tools from intermediate microeconomic theory. The course begins with an analysis of health care as a commodity and why health is different from other consumer goods. The course then examines the demand for and the production of health and health care, and the behavior and organization of health care providers. The discussion then switches to information asymmetries and the functioning of health insurance markets. Afterwards, the course turns to the analysis of government involvement in the health care system. The class concludes with an examination of medical care systems around the world, paying particular attention to the U.S. health care system.

Learning Outcomes: 1. Describe the main economic theories relating to health and health care markets. 2. Apply economic theory to the analysis of health care policy and institutions. 3. Construct a detailed demand and supply model of the health insurance market. 4. Critically evaluate key policy issues in health and health care from an economic perspective. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

B. Interdisciplinary Capstone Course (3 credits)

Notes

Music Technology Certificate

About the Certificate

Requirements for the Certificate (21 credits)

Foundational Studies (12 credits)

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

Music Technology (9 credits)

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and

filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

Foundational Studies (12 credits)

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

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MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

Notes

Requirements for the Certificate (21 credits)

Foundational Studies (12 credits)

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Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

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Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

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Music Technology (9 credits)

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and

performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

Foundational Studies (12 credits)

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

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Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

Pharmaceutical Manufacturing Certificate

About the Certificate

Requirements for the Certificate (10 credits)

Required Courses (1 credit)

ENGR 10301 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small seminars led by faculty designed to introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or assist in their decision of an engineering degree. Permission of department required.

Learning Outcomes: 1. Introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Credits: 1.00

Experiential Learning in Pharmaceutical Manufacturing

Technical Areas (9 credits)

Pharmaceutical Product Development and Regulatory Affairs

MCMP 54400 - Drug Classes And Mechanisms

Credit Hours: 3.00. The course will integrate basic principles of medicinal chemistry and pharmacology to achieve an understanding of drug mechanisms as applied to autonomic/endocrine, cardiovascular/renal, CNS, and chemotherapy/infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease.

Learning Outcomes: 1. Knowledge and understanding of the major drug classes. 2. Knowledge of the relationships between mechanism of action with drug interactions and adverse reactions. 3. Development of an introductory-level ability to critically evaluate primary literature. 4. An appreciation for the relevant research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. 5. A broad knowledge of pharmaceutical and related sciences. 6. An understanding of drug discovery, development, and commercialization. 7. Effective written and oral communication skills. 8. An ability to integrate and apply knowledge to solve problems. Credits: 3.00

PHRM 82400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy. Prerequisite: MCMP 20400, 20500, 20800, and BIOL 20300, 20400 or 30100, 30200. Departmental permission required.

Learning Outcomes: 1. Conceptual Competence: Pathophysiology, Principles of pharmacology. 2. Scientific Comprehension: Basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Critical Thinking and Decision Making Abilities: Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Communication Skills and Abilities: Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Responsible use of Professional Values and Ethical Principles: Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Professional Abilities and Habits: Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHRM 82800 - Dosage Forms I

Credit Hours: 3.00. The purpose of Dosage Forms I is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Explain the basic scientific principles involved in drug delivery such as dissolution, chemical stability, physical stability, content uniformity, and bioavailability.

2. Describe the essential scientific principles involved in the design of solutions, emulsions, suspensions, as well as dermatological and ophthalmic dosage forms. 3. Evaluate the quality parameters of dosage forms that are involved in product selection. 4. Analyze and interpret the results of bioequivalence studies that are important in product selection. 5. Advise patients on the proper use and storage of liquid dosage forms. Credits: 3.00

PHRM 82900 - Dosage Forms II

Credit Hours: 2.00. Education in the use of dosage forms to deliver drugs. Collaboration with peers and other members of the health care team regarding the proper use of the various dosage forms so that the desired therapeutic objective is achieved.

Learning Outcomes: 1. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and isoosmolality, IV bags and drip sets. 2. Explain the basic scientific principles involved in the performance of solid dosage forms, including amorphous and crystalline solids, polymorphism, dissolution, diffusion, chemical and physical stability, bioequivalence and bioavailability. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including oral, buccal, rectal, subcutaneous and transdermal routes. 4. Evaluate quality parameters for solid dosage forms, as an aid to product selection. 5. Advise patients on the proper use and storage of solid dosage forms, and understand the relationship of dosage form selection to clinical outcomes. 6. Explain the factors involved in the use of generic versions of solid dosage forms and their influence on therapeutic outcomes, including the ability to identify drugs for which switching to a generic form should be approached with caution. Credits: 2.00

HSOP 50100 - Food And Drug Law I

Credit Hours: 3.00. A systematic study of the structure and function of the major federal (USA) laws and regulations governing the manufacturing, distribution, and marketing of foods, drugs, cosmetics, and devices. Permission of instructor required.

Credits: 3.00

BIOL 39500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and

the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 55800 - Safety Engineering

Credit Hours: 3.00. Application of human factors and engineering practice in accident prevention and the reduction of health hazards are presented. The objective of this course is to provide an understanding of the safety and health practices which fall within the responsibilities of the engineer in industry. Special attention is devoted to the detection and correction of hazards and to contemporary laws and enforcement on occupational safety and health.

Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration

or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BME 56100 - Preclinical And Clinical Study Design

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly regulated environment. This course concerns the preclinical and clinical study design processes for obtaining FDA marketing approval for biomedical devices. Prior to marketing a medical device in the US, specific governmental approval is required dependent on the type of device and the risk associated. This course is part of a three-course series dealing with various aspect of regulatory science. Regulatory science considers the scientific and technical foundations that support the practical testing and regulations that ensure the safety and effectiveness of medical devices. This course covers the responsible conduct of clinical and preclinical research, including evaluation of device tissue interactions and how they may be studied with preclinical animal models to predict safety and performance in human clinical trials that are necessary to gain regulatory approval for marketing. In the section on ethics we will cover several topics related to responsible conduct of clinical and preclinical research, including informed consent, risk assessment and ethical decisions, IRB oversight and ethical study design.

Learning Outcomes: 1. Understand and apply the various considerations and perspectives in designing and implementing a preclinical and clinical study strategy that will successfully lead to the marketing approval by a regulatory authority (e.g. FDA). 2. Follow a structured, iterative decision-making process for moral reasoning to reach a supported-conclusion regarding ethical dilemmas in engineering design and testing. Credits: 3.00

BME 56200 - Regulatory Issues Surrounding Approval Of Biomedical Devices

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly-regulated environment. This course primarily concerns the processes for obtaining FDA marketing approval or clearance for biomedical devices. Prior to marketing a medical device in the US, a specific governmental approval or clearance is required depending on the type of device and the risk associated with the device. This course is part of a three-course series dealing with various aspects of regulatory science. Regulatory processes for class I, II, and III devices, including combination devices, are covered with specific focus on 510(k) and PMA requirements. Approval requirements in the EU, Japan and other countries will also be briefly considered. Throughout the course, emphasis will be placed on regulatory science, regulatory strategy and principles of interacting with regulatory agencies.

Learning Outcomes: 1. Use the appropriate regulatory classification and pathway for any medical device in the U.S. 2. Describe the significance of each major component of a 510(k) submission. 3. Describe the significance of each major component of a PMA submission. 4. Develop awareness for the need to seek country-specific expertise to prepare submissions for countries outside the U.S. 5. Select the appropriate messages and clearly present, in both oral and written communication, in a mock FDA meeting. 6. Identify contents of a CER and know the strategy for writing a CER. Credits: 3.00

BME 56300 - Quality Systems For Regulatory Compliance

Credit Hours: 3.00. Medical devices are developed and manufactured in a highly regulated environment. This course will provide an introduction, overview, and systematic study of the intent and impact of the major federal laws and regulations governing the development, manufacturing, distribution, and marketing of medical devices. Focus is on understanding the critical elements of regulatory science and quality compliance from a design control perspective. Instruction and mentoring in regulatory science skills is provided by academics and industry representatives with expertise in their fields. This course is part of a three-course series.

Learning Outcomes: 1. Demonstrate a functional understanding of regulatory compliance for biomedical devices. 2. Use the main tools within the quality craft (Ex: confidence interval, control chart, difference between a T-test and F-test). 3. Demonstrate understanding of how the FDA approaches control. Credits: 3.00

ABE 51100 - Drug Development

Credit Hours: 3.00. A review of drug discovery and drug development, with emphasis on the regulatory aspects of these activities. Animal preclinical research and human clinical research are discussed in detail. In addition, the process for the assembly of an IND and NDA is discussed along with the Phases (I,II,III) of human clinical trials. The CMC (chemistry manufacturing and control) aspects of drug development are presented along with ICH documents and manufacturing process analytical technologies. The course concludes with a brief review of international regulatory issues and patents.

Learning Outcomes: 1. Comprehend strategies used for biotechnology innovation: regulatory and quality documents and materials in the areas of drug development and discovery. 2. Ability to meld theory and practice. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use data, media and computers to send and respond effectively to communication for varied audiences and purposes. 5. Demonstrate sensitivity to and facility with personal values and ethical principles in professional and social contexts. Credits: 3.00

BME 55600 - Introduction To Clinical Medicine For Engineering Solutions

Credit Hours: 3.00. This course introduces students to the physiology and medicine underlying major human diseases likely to become research targets in biomedical engineering and medical device development. It encourages students to upgrade research target selection to include projects that promise to improve patient care, with a major emphasis on pathophysiology and disease mechanisms. The information and intellectual approach offered will help students recognize needs for engineering solutions to current challenges in medicine. The course also previews the intellectual content of medical school, including rigor and level of detail, for engineering students considering designing medical solutions or translational engineering research as a career, emphasizing the key "11-points" necessary for practical understanding of any disease: definition of the condition, causes, functional abnormalities, structural abnormalities, early signs, history and physical findings, differential diagnosis, special studies (lab, imaging, etc.), treatment strategy, specific steps of treatment, and follow up, as well as current clinical needs for innovation and research opportunities for the future. To avoid possible redundancy with the Weldon School undergraduate curriculum, focal areas of the course include topics and body systems not covered in BME 25600, including infectious diseases, cardiopulmonary diseases, hematology-oncology, and gastrointestinal diseases.

Learning Outcomes: 1. Describe the pathogenesis of selected diseases, including causes, abnormal anatomy, and abnormal physiology. 2. Describe the diagnosis of selected diseases, including the history, physical findings, laboratory workup, imaging, and special procedures. 3. Describe the treatment for selected diseases, including strategy, specific steps, drugs, surgery, and follow-up. Credits: 3.00

ABE 51200 - Good Regulatory Practices

Credit Hours: 3.00. Includes a review of the FDA and ICH regulations on good manufacturing, good laboratory, good clinical practices. The meaning of these regulations, the globalization of practices and the roles and responsibilities of various professionals implementing these regulations will be addressed. Special emphasis will be detailed coverage of the process for the assembly and submission of an IND or NDA, and the function of the regulatory affairs department in a pharmaceutical company.

Learning Outcomes: 1. Identify cGMP regulations, and relationship to maintaining control of the chemical and ultimately the drug product with a focus on Phase 3, product introduction, and post marketing. 2. Examine about the regulatory history of the FDA and the GxP framework. 3. Identify NDA and BLA applications, product control including specifications, quality outcomes, critical quality attributes, and ICH framework. 4. Evaluate the regulations governing the manufacture of drug products, including the methods used to prove this, validation of those methods, validation of the manufacture, quality by design, comparability protocols, and continuous improvement. 5. Identify and evaluate

compliance to GMP and warning letters. 6. Evaluate Good Distribution Practices (GDP) and the integration of supply chain controls into the Quality Management System. 7. Learn GCP, clinical regulations, and relationship to ensuring the drug or device is safe and efficacious. 8. Evaluate and describe basic clinical trial design and how to write the investigator's brochure that informs patients (through the informed consent document that they sign) of clinical information. 9. Examine the rigid control that governs the clinical protocols and processes such as compliance oversight procedures, the role of clinical auditors and the process of auditing a clinical trial to ensure that it is done right. 10. Identify about the impact of technology and patient involvement in clinical trials through online resources, such as clinicaltrials.gov, YouTube instruction videos including videos describing GCP for devices. 11. Summarize the impact of recent adverse clinical trial events with innovative applications such as in biologics (Tegerno) and gene therapy (Gelsinger). Students will also identify and describe the role of approved Risk Evaluation and Mitigation Strategies (REMS), pharmacovigilance programs and adverse drug event reporting. 12. Identify and evaluate GLP and regulations that ensure a drug product is safe. 13. Examine GLP protocols, toxicology testing, including animal and human safety, and indicators for safety (irregular heartbeats in animals, etc.). 14. Evaluate the ethical considerations of testing, including impact of falsifying safety testing. 15. Analyze how GLP regulations are implemented during development and testing of devices. 16. Discover how technology and innovation impact the regulatory process. 17. Review data integrity and compliance with cGMP. 18. Evaluate the role of computer systems and computer systems validation. 19. Assess the emerging area of predictive toxicology and the potential for testing without animals. 20. Evaluate and explain innovation in safety and adaptive clinical trials. 21. Examine innovation in CMC including quality by design and predicting the quality of manufacturing on the large scale with small scale experiments, including analytics modeling. 22. Discover how the global environment impacts the regulatory process. 23. Evaluate special considerations of implementing a generic system in the developing and third world country . 24. Analyze global regulatory authorities and WHO PQ process. 25. Examine special considerations of the regulatory process as applied to devices, diagnostics and generics. 26. Identify the importance of design to a device, attributes that lead to the specifications and raw materials for diagnostics and the importance of product equivalence for generics and special considerations for biologics. Credits: 3.00

ABE 51300 - Quality Management, Audits, Inspections

Credit Hours: 3.00. This course provides advanced topics in quality management and business improvement methods that apply to the pharmaceutical industry. Emphasis will be placed on specific issues of industry, audits, and inspections, as well as the successful selection and presentation of business and quality improvement projects to produce compliance and competitive advantage.

Learning Outcomes: 1. Understand quality management definitions, concepts, and guidelines. 2. Define quality and how to establish a quality management system. 3. Define quality plan, describe its purpose for the organization as a whole and identify various functional areas and people that have responsibility for contributing to its development. 4. Understand the audit process and quality control, including the various approaches to audits, inspections and reviews. 5. Understand basic skills required to manage audits, inspections and reviews. 6. Learn how to set up

effective self audit systems. 7. Understand the impact of changing technologies, such as electronic systems, on supporting a quality management system. 8. Understand how quality management functions support global business decisions for asset acquisitions and growth of a company. 9. Understand the key elements of supply chain management, assessing risk, and managing outcomes from supplier and vendor audits. 10. Understand regulatory compliance aspects and implementation of ICH and global quality principles in supply chain management, including good distribution practices. 11. Define a continuous quality improvement or business improvement project within an organization. 12. Select and define continuous quality improvement tools and techniques in order to achieve operational excellence. 13. Develop in-depth knowledge of how to implement and obtain operational excellence and present the findings in a coherent and informative manner. Credits: 3.00

BME 56400 - Ethical Engineering Of Medical Technologies

Credit Hours: 3.00. This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice.

Learning Outcomes: 1. Recognize and analyze personal and systemic ethical issues and challenges to ethical reasoning and social responsibility. 2. Engage in empathy building activities to enhance their abilities to understand and value the perspectives of other stakeholders. 3. Use a structured, iterative, and collaborative decision-making process that considers the perspectives of multiple stakeholders in optimizing a design decision when facing an engineering problem in design and development of medical devices or assistive technologies that are ethical and socially responsible. Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing

principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

Pharmaceutical Manufacturing Science and Technology (Materials, Measurement and Manufacturing)

ABE 30300 - Physical Chemistry In Biological Engineering

Credit Hours: 3.00. Physical chemical principles associated with transport of mass, momentum and energy in bioprocesses. Principles for measuring physical chemical properties, a description of predictive equations for their evaluation and the role of these principles in the design and optimization of bioprocesses.

Learning Outcomes: 1. Design complex engineering problems by applying physical chemistry. 2. Explain the principles of characterizing biological materials using physical and optical techniques. 3. Determine the appropriate methods to characterize or purify biological materials based on their physical properties. 4. Predict the results of a spectroscopic technique based on the optical properties of materials and vice versa. Credits: 3.00

ABE 30400 - Biological Engineering Laboratory

Credit Hours: 3.00. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Learning Outcomes: 1. Understand and analyze the flow behavior in biological systems. 2. Understand and analyze enzymatic reasons in biological systems. 3. Understand and analyze fermentation processes. 4. Understand and analyze mixing and heat transfer in biological systems. 5. Collect and analyze rheological properties. 6. Design and safely execute experiments in a process laboratory. 7. Collection and statistical analysis of experimental data. 8. Present the results of analysis in the form of written report and oral presentation. Credits: 3.00

ABE 30700 - Momentum Transfer In Biological Engineering

Credit Hours: 3.00. Fluid statics, Newton's law of viscosity, shell momentum balances, equations of continuity and motion, one dimensional flow problems, flow through porous media, velocity distributions with more than one independent variable, two dimensional flow through a channel, stream function, velocity potential, dimensional analysis, boundary layer, turbulent flow, Reynolds stress, form and skin friction, application of macroscopic momentum and mechanical energy balances to engineering problems.

Learning Outcomes: 1. Know the principles of fluid statics. 2. Know the principles of dimensional analysis for analysis of flow problems. 3. Know the characteristics and analysis of the flow of food and biological fluids. 4. Gain an understanding of the principles of turbulent flow. 5. Know how to apply macroscopic mass and momentum balances to flow problems in food and biological systems. Credits: 3.00

ABE 30800 - Heat And Mass Transfer In Biological Engineering

Credit Hours: 3.00. Principles of transport of energy and mass. Mechanisms of heat transfer, heat conduction, heat convection and heat radiation. Development of applications using macroscopic and microscopic balances of energy. Application of thermal energy balances and Fourier's Law to describe steady state and transient conduction applications including heat generation. Effect of the geometry on these processes. Basic principles of design of heat transfer equipment and its operation. Application of species mass balances and Fick's Law to steady state and transient diffusion problems. Effect of geometry on these processes. Analogies between transport of momentum, heat and mass applications to the solution of practical problems in the Food Process and Biological Engineering fields.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multidisciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. Have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. A recognition of the need for, and an ability to engage in life-long learning. 8. A knowledge of contemporary issues. 9. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 37000 - Reaction Kinetics In Biological Engineering

Credit Hours: 3.00. This course will introduce students to the tenets of kinetics/rates of chemical/biochemical reactions. Reaction rate models will be developed and used to design basic ideal reactors and non-ideal flow reactors. Models for homogeneous, heterogeneous, and catalytic reactions will be developed and used to develop reactor designs. A variety of computational numerical modeling skills will be used in the solution of these models, including numerical interpolation, and numerical solution of set of differential equations. MatLAB software programming tools will be used by students for computational analysis.

Learning Outcomes: 1. Gain an understanding of the basic concepts of reaction kinetics for chemical and biochemical systems. 2. Gain an understanding of basic engineering reactor design models. 3. Gain an understanding of the application of kinetic models to reaction processes involving diffusive and convective mass transport. 4. Understand how kinetic reaction and reactor design models are applied to food and biological engineering processes. 5. Apply mathematical skills to developing analytical and numerical solutions. Credits: 3.00

ABE 45700 - Unit Operations In Biological Engineering

Credit Hours: 3.00. Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipe flow, pumps, mixing, emulsification, extrusion, sheeting, heat exchanges, aseptic processing, sterilization, freezing, and evaporation.

Learning Outcomes: 1. Gain and understand

the principles, design and analysis of biological and food process engineering operations. 2. Know the characteristics and analysis of the flow of biological fluids. 3. Gain an understanding of the principles, design and analysis of thermal processing operations. 4. Gain an understanding of the principles and analysis of freezing. Credits: 3.00

ABE 46000 - Sensors And Process Control

Credit Hours: 3.00. Fundamental aspects of transducers, biosensors, instrumentation, and computer control are presented, with particular emphasis on sensors and controls used in agricultural, biological, and food applications. Laboratory and pilot plant scale computer controlled equipment is used to examine response of process variables, sensor calibration, control system modeling, and controller selection and tuning. Prerequisite: differential equations and a course in either heat transfer or fluid mechanics.

Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

PHRM 83600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. This course provides instruction in biochemistry that builds on basic knowledge by presenting content on advanced aspects of human biochemistry for students in pharmaceutical sciences. The content emphasizes the integration of biochemical knowledge and the application of biochemical understanding to medically relevant situations including disease etiology, medical diagnosis, disease research, drug discovery, drug and toxin mechanisms of action, and mechanism of drug metabolism.

Learning Outcomes: 1. Understanding and knowledge of biochemistry to an advanced level and to increase the ability to apply that understanding and knowledge to pharmaceutical sciences and the practice of pharmacy. 2. Advanced understanding of biochemistry includes integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Application of biochemical understanding and knowledge includes understanding the molecular basis of many idopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseases of aberrant molecular transport. It also includes the mechanisms of DNA damage and repair and the mechanisms of action of anti-metabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented in this course, as well as demonstrate understanding of the concepts in each content area presented in this course ta is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

ABE 55700 - Biological Engineering Design I

Credit Hours: 3.00. Course includes analysis and design of operations, such as dehydration, fermentation, and separation processes. Development of experimental designs, integration of pilot plant results into the design, operation and scale-up process systems. Emphasis on how the properties of biological materials influence the quality of the processed product.

Learning Outcomes: 1. Develop ability for self-learning and preparation for lifelong learning. 2. Apply principles learned to the development of typical industrial processes. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Communicate technical information effectively. 5. Improve computer skills. 6. Work in teams. 7. Meet deadlines. 8. Evaluate ethical, global, and societal contemporary issues. Credits: 3.00

ABE 55800 - Biological Engineering Design II

Credit Hours: 3.00. This course will focus on the design, synthesis, creation, evaluation, and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Course will include group projects, oral and written reports.

Learning Outcomes: ". Develop an understanding of Bio and Food Separation Processes. 2. Evaluate the economic aspects of product costs. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Develop processes to minimize environmental and energy impact. 5. Develop an understanding of optimization (zero discharge/minimum energy). 6. Develop a business plan. 7. Communicate technological information. 8. Improve computer skills to operate and schedule processes (superPro Designer/Batches). 9. Work in teams to design a biological/food process. 10. Review technical and patent literature Credits: 3.00

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work

is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 55500 - Computer Integrated Process Operations

Credit Hours: 3.00. Introduction to computer-aided process operations management. Topics include: process monitoring, regulatory control, data reconciliation, unit and plant-wide optimization, process fault diagnosis, supervisory control, planning, and scheduling. A design project involving a unified application of the presented methodologies is taken from a published industrial benchmark problem.

Credits: 3.00

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

MGMT 45200 - Manufacturing Strategy And Process Innovation

Credit Hours: 3.00. This course examines the management challenges posed by the growth in worldwide manufacturing capabilities, markets, and competition and by rapid advances in technology and the concomitant decline in product life cycles. The manufacturing function is considered within a broader context encompassing design, engineering, purchasing, marketing, and customer service in an effort to assess the degree to which existing management structures successfully meet the challenges arising from the changing manufacturing environment.

Learning Outcomes: 1. Identify the tradeoffs made between operations flexibility and cost. 2. Identify proper alignment between manufacturing strategy and business strategy. 3. Identify the pros and cons of different types of plant network strategies. 4. Identify the behavioral issues associated with implementation of rigid project management tools. 5. Identify the potential long term implications of outsourcing on the development of competition. Credits: 3.00

MSE 51200 - Powder Processing

Credit Hours: 3.00. Processing of engineering materials from powders. Synthesis of metals, ceramics, and polymers in powder form. Characteristics of particulates. Behavior of collections of particles; surface forces, particle agglomeration and dispersion, gelation, particle packing. Consolidation of powders; mechanics of dry flow and compaction, slurry rheology, shaping processes. Densification and microstructural development; geometry, thermodynamics, and kinetics of sintering, liquid-phase sintering, reaction densification, infiltration. Powder processing of composites.

Learning Outcomes: 1. Describe a powder fabrication process from starting reagent to finished powder. interpret a particle size distribution and estimate mean particle size and specific surface area from the data. 2. Review an ASTM standard for particulate materials characterization. 3. Describe the role of van der Waals interactions in determining structure on the colloidal and macroscopic length scales. 4. Differentiate between processing routes more favorable for processing bulk materials versus routes geared towards processing thin films. 5. Describe when it is appropriate to process dry powders versus processing powders suspended in a liquid medium. 6. Calculate the packing density of bimodal particle size distributions and describe the difference between calculated values and what one might expect to observe in experimental measurements. 7. Describe the effects of particle agglomeration on interparticle forces and the packing density of powder compacts. 8. Calculate the particle size at which gravitational segregation becomes significant during aqueous colloidal processing. 9.

Describe how segregation effects may be minimized during aqueous colloidal processing and any advantages and disadvantages associated with the modified process. 10. Describe the effects of interparticle forces on powder compact homogeneity and subsequent effects on compact densification. 11. Describe the effects of furnace atmosphere on the density, the specific surface area, and the microstructure of a powder compact. Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 59500 - Special-Topic Minicourses

Credit Hours: 1.00. A series of one-credit-hour courses on special topics offered as ME 59500, 59500, etc. These special-topic minicourses will provide an opportunity for introducing students to topics of contemporary importance or special interest that fall outside the scope of the curriculum. Information about current offerings may be obtained from the schedule of classes or the mechanical engineering registration deputy.

Credits: 1.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites. Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

EEE 59500 - Environmental And Ecological Engineering Projects

Credit Hours: 0.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 6.00

CHE 55100 - Principles Of Pharmaceutical Engineering

Credit Hours: 3.00. This course is designed to provide engineering, science and pharmacy students with an understanding of the structure, economic and regulatory context, product discovery and development pipeline dynamics, intellectual property considerations and common manufacturing technology of the global pharmaceutical industry.

Learning Outcomes: 1. Develop a "big picture" view of the Pharmaceutical Industry: its structure and key players; economic and regulatory context; international trends and markets; product pipeline dynamics; current manufacturing technology, strengths and limitations. 2. Develop a working vocabulary of domain concepts. 3. Develop an appreciation of technical challenges and opportunities over the life cycle of a pharmaceutical product. 4. Develop an appreciation of the important role of intellectual property law and the strategies used in maintaining and challenging product patents. 5. Enhance skills in critical review of topics involving the interplay of technology and economics and in succinctly reporting the most important conclusions in written and oral form. 6. Acquire the technical and economic context for more detailed follow-up courses in ChE, ME and IPPH. Credits: 3.00

CHE 55300 - Pharmaceutical Process, Development And Design

Credit Hours: 3.00. This course introduces the engineering methodologies involved in translating a laboratory recipe for a drug compound produced via synthetic organic chemistry methods to an industrial process. The basic features of common unit operations used in the pharmaceutical industry will be reviewed, including batch reaction, solid-liquid separation, crystallization, drying, mixing, batch distillation and other separation systems. Both dedicated and multi-product production system design and batch and semi-continuous operating modes will be covered.

Learning Outcomes: 1. Develop knowledge and skills in the thermodynamic, reaction and transport phenomena arising in the typical batch unit operations used in the pharma and specialty chemicals industries, including batch reaction, crystallization, solid-liquid separation, mixing, distillation, drying and liquid-liquid extraction. 2. Develop knowledge and skills in the use experimental data and relevant models to design and predict the performance of these units. 3. Develop knowledge and skills in the use of engineering software to conduct studies of these operations and interpret and critically assess the results such software produces. 4. Understand different modes of operation for batch processes and their scheduling. 5. Understand aspects of the design of batch process in which the set of batch operations are integrated. 6. Develop knowledge and skills in the use of planning/scheduling software to conduct design and operational studies of integrated process. 7. Enhance skills in succinctly reporting the most important conclusions of team projects in written and oral form. Credits: 3.00

MSE 52700 - Introduction To Biomaterials

Credit Hours: 3.00. This course aims to introduce students to Biomaterials concepts: structure, properties, and applications. The class will cover the main classes of materials: metals, ceramics and polymers in the context of their use in medicine as implant materials, drug delivery vehicles, and as tissue engineering scaffolds. Permission of instructor required.

Learning Outcomes: 1. Be familiar with the main concepts of Biomaterials principles: biocompatibility, structure-property-applications relationships, mechanical response of natural tissues, cellular pathways for tissue-material ingrowth. 2. Understand the requirements for metals and alloys, as well as ceramic materials to be used in load bearing implants (corrosion concepts, stress shielding, mechanical

properties, composition). 3. Understand what properties of polymers impact their use in medicine (leaching and swelling, creep and stress relaxation). 4. Understand the tissue response to biomaterials: cytotoxicity, carcinogenicity, immune reactions. 5. Be able to expand the understanding of materials concepts to drug delivery applications (polymer degradation, encapsulation) and tissue engineering (scaffold porosity, diffusion of nutrients, mechanical properties). Credits: 3.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

BME 47000 - Biomolecular Engineering

Credit Hours: 3.00. The course covers key chemical concepts one needs in order to modify existing biomolecules, link biomolecules with other (bio)molecules, link biomolecules with inorganic entities, create composite (bio)structures, modify specific properties of biomolecules, alter/enhance biomolecule functionality. Taken together, the rational application of these biological, chemical, and engineering tools can be used to; engineer new biomolecules, design sensors for molecular detection, create diagnostic tests, develop new imaging modalities, and design and test novel biomaterials, to name a few examples.

Learning Outcomes: 1. Describe and discuss the physiochemical properties of biomolecules. 2. Design new molecules to perform new functions. 3. Able to critically analyze literature on biomolecular engineering. Credits: 3.00

ME 53101 - Particle, Powder, And Compact Characterization

Credit Hours: 2.00. The goal of this course is to familiarize students with the properties and methods used to characterize the physical and mechanical behavior of particles, granules, and compacts with the intention of using these properties for process and performance design.

Learning Outcomes: 1. Define and describe the significant properties of particles, granules, powders, and compacts. 2. Explain how these properties are measured. 3. Illustrate how these properties influence the performance of particle-based products and manufacturing processes.

4. Create a computational or web-based tool that demonstrates or implements concepts from the course. Credits: 2.00

ME 53102 - Particle, Powder, And Compact Characterization Laboratory

Credit Hours: 1.00. The goal of this laboratory course is to train students on state-of-the-art laboratory equipment used to measure the mechanical properties of particles, granules, powders, and compacts.

Learning Outcomes: 1. Follow laboratory safety guidelines. 2. Operate common laboratory equipment and follow standard operating procedures used to measure the mechanical properties of particles, granules, powders, and compacts. 3. Plan and perform measurements as part of a team, analyze results, and summarize the results in a written report. Credits: 1.00

CHE 55400 - Smart Manufacturing In Process Industries

Credit Hours: 3.00. This course surveys the tools and techniques, which are relevant to support the multiple levels of technical decisions that arise in modern integrated operation of manufacturing facilities in the chemical related process industries. The linkage of these decisions levels and sharing of associated data and knowledge via effective IT methodology is currently termed Smart Manufacturing in the US and Industry 4.0 in Europe. The topics covered in the course include the structure of the operations decision hierarchy, role of online process measurements, elements of sensor network design, information systems to support process operations, plant data reconciliation, detection and diagnosis of process faults, plant wide control, real time process optimization, production planning and scheduling, and supply chain management. Each topic will be addressed by first summarizing the basic role and scope of that component, then discussing the structure of the decision problem, and then will outline some representative tools available to address that decision problem. Each major topic will include a lecture given by an industrial practitioner who will offer a perspective on the state of industrial practice. Permission of instructor required.

Learning Outcomes: 1. Explain the function, information requirements and main decisions made at each level of the operational hierarchy of an integrated processing system. 2. Understand the design requirements of a sensor network, that insures that all variables which must be managed are observable. 3. Explain that process data storage requirements are and how these requirements are met in integrated process systems. 4. Know how to use data reconciliation methods to obtain the maximum likelihood estimate of the state of process. 5. Explain why exceptional events are important to process operations. 6. Use multivariate statistic methods to determine whether and when an exceptional event has occurred. 7. Explain what fault diagnosis is, why it is needed and what general types of methods are available for effective diagnosis. 8. Understand the role of plant-wide control and how it relates to individual unit operations control. 9. Test, evaluate and improve a specific plant wide control systems design using a process simulation model. 10. Explain the role of real time process operations and the differences between steady state and dynamic RTO. 11. Implement and solve a steady state RTO problem based on material balances. 12. Explain the differences and relationship between process planning and scheduling. 13. Represent a process planning problem by formulating a linear programming model and solving it using standard LP tools. 14. Explain the main decision variables of a process scheduling application and understand the underlying computational complexity of scheduling problems. 15. Represent a scheduling problem using a state task network and solve it using a commercial solver. 16. Explain how supply chain management relates to the operational planning of individual processes. 17. Understand the main components and operational decision variables of a supply chain optimization problem. 18. Explain the information requirements for effective supply chain management. 19. Understand where the sources of uncertainty

arise in supply chain planning and what strategies can be used to accommodate to these uncertainties. Credits: 3.00

ABE 50501 - Particle, Powder, and Compact Characterization

Credit Hours: 2.00. The goal of this course is to familiarize students with the properties and methods used to characterize the physical and mechanical behavior of particles, granules, and compacts with the intention of using these properties for process and performance design.

Learning Outcomes: 1. Define and describe the significant properties of particles, granules, powders, and compacts. 2. Explain how these properties are measured. 3. Illustrate how these properties influence the performance of particle-based products and manufacturing processes. 4. Create a computational or a web-based tool that demonstrates or implements concepts from the course. Credits: 2.00

ABE 50502 - Particles, Powders, And Compact Characterization Laboratory

Credit Hours: 1.00. The goal of this laboratory course is to train students on state-of-the-art laboratory equipment used to measure the mechanical properties of particles, granules, powders, and compacts.

Learning Outcomes: 1. Follow laboratory safety guidelines. [6] 2. Operate common laboratory equipment and follow standard operating procedures used to measure the mechanical properties of particles, granules, powders, and compacts. [6] 3. Plan and perform measurements, analyze results, and summarize the results in a written report. [3,5,6] Credits: 1.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

Data Analytics and Computing

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical

arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

BME 40100 - Mathematical & Computational Analysis Of Complex System Dynamics In Biology, Medicine, & Healthcare

Credit Hours: 3.00. An introduction to analysis of complex system dynamics that appear in biology, medicine, and healthcare. Key topics include nonlinear dynamical concepts associated with phase plane, bifurcation, stability diagram, oscillation, and chaotic systems along with concepts from discrete systems and stochastic processes. These topics are taught within the context of mathematical and computational models related to both non-communicable diseases (i.e. cancer) and communicable diseases (i.e. HIV/AIDS). Courses projects are drawn from recent literature.

Learning Outcomes: 1. Graphically, analytically, and numerically analyze nonlinear dynamical models and numerically analyze discrete-event and stochastic models of biological, medical, or healthcare systems. 2. Describe possible behaviors of a given system, including how a system may be manipulated within the inherent boundaries. 3. Present, in oral and written format, an analysis and critique of the application of dynamical modeling of a biological system to solve or understand an engineering problem. Credits: 3.00

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

IE 33200 - Computing In Industrial Engineering

Credit Hours: 3.00. Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Credits: 3.00

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and

integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.

Credits: 1.00 to 6.00

IE 53300 - Industrial Applications Of Statistics

Credit Hours: 3.00. The application of statistics to the effective design and analysis of industrial studies relating to manufacturing and human factors engineering in order to optimize the utilization of equipment and resources. Emphasis on conducting these studies at the least cost.

Credits: 3.00

IE 53500 - Linear Programming

Credit Hours: 3.00. Optimization of linear objective functions subject to linear constraints. Development of theory and algorithmic strategies for solving linear programming problems.

Credits: 3.00

IE 53600 - Stochastic Models In Operations Research I

Credit Hours: 3.00. An introduction to techniques for modeling random processes used in operations research. Markov chains, continuous time Markov processes, Markovian queues, reliability and inventory models.

Credits: 3.00

IE 58000 - Systems Simulation

Credit Hours: 3.00. Philosophy and elements of digital simulation language. Practical application of simulation to diverse systems. Computer simulation exercises and applications are required.

Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design.

Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these

concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

MGMT 48800 - Data-Driven Decisions In Digital Markets

Credit Hours: 3.00. This course analyzes the changes in business models that have been enabled by Internet technologies, and exposes students to hands-on data analyses to quantify the impact these technologies and business models have on firms, economies, and people. A programming course such as MGMT 28800 Programming for Business Applications or MGMT 38800 Python for Business or CS 17600 Data Engineering in Python or CS 17700 Programming with Multimedia Objects or CNIT 17500 Visual Programming or CS 18000 Problem Solving & Object Oriented Programming and a statistics course such as STAT 30301 Probability & Statistics for Business or MGMT 30500 Business Statistics is highly recommended.

Learning Outcomes: 1. Recognize the role of business models and data-driven decisions in digital markets. 2. Measure, evaluate, and improve online technology usage, advertisement campaigns, and product pricing to meet specific business objective like better serving customers, customer acquisition, quantifying network effects, etc. 3. Analyze the sheer amount of data ("traces") collected by businesses from different touch points - Google Glass, Apple Watch, smart phones, or simple computing devices - and make critical business decisions. Credits: 3.00

IE 48100 - Introduction To System Simulation

Credit Hours: 3.00. The course presents a general introduction to simulation concept and methodology. It covers simulation modeling in specialized simulation environments. Practical application of simulation to diverse systems will be discussed. Proper design and analysis of the simulation experiment is emphasized. Permission of department required.

Learning Outcomes: 1. Construct discrete-event simulation models using a representative simulation software package. 2. Identify different types of simulation models and determine scenarios where each would be appropriate. 3. Perform analysis of data for the development of input models. 4. Design simulation experiments and conduct statistical analysis. 5. Verify and validate a simulation model. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students

will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

ILS 29500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular

expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

BME 50100 - Multivariate Analyses In Biostatistics

Credit Hours: 3.00. This course focuses on fundamental principles of multivariate statistical analyses in biostatistics, including multiple linear regression, multiple logistic regression, analysis of variance, and basic epidemiology. The fundamental theories are applied to analyze various biomedical applications ranging from laboratory data to large-scale epidemiological data.

Learning Outcomes: 1. Understand fundamental concepts in multivariate regression analyses. 2. Translate research questions into suitable multivariate frameworks. 3. Design studies with appropriate statistical power. 4. Compute and interpret appropriate statistical estimates from multivariate analyses. 5. Use a major statistical software package (e.g. STATA, SAS, SPSS, and R) to perform large-size data analyses. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

ILS 10300 - Introduction To Data Lifecycle Management

Credit Hours: 1.00. Introduces concepts of the management of data throughout its lifecycle. Understanding different types of data and their functions. Managing data in the context of a particular discipline or profession. Finding and evaluating data purposefully. Using data ethically and responsibly. Creating and sharing data for reuse, accountability, and enhancement. Making decisions and communicating using data, including data analysis and visualization. Protecting and archiving data.

Learning Outcomes: 1. Describe the data lifecycle and types of data that are used in their discipline or profession. 2. Discuss the ethical and responsible use of data. 3. Locate and evaluate datasets for reuse that are relevant to their research or work. 4. Apply a variety of introductory data collection, analysis, and visualization techniques. 5. Understand the basics of securing, archiving, and sharing data. Credits: 1.00

MGMT 47500 - Machine Learning For Business

Credit Hours: 3.00. This course concerns the latest techniques in machine learning, focusing on deep learning and reinforcement learning, with applications to computer vision, natural language understanding, speech recognition, news recommendation, and others. The course plans to cover Neural Nets, Backpropagation, Convolutional neural network, Recurrent Networks, Autoencoders and other architectures in

Deep Learning in the rst half. Next, the course plans to cover multi-armed bandits, Contextual bandits, Markov decision process, and Policy gradient methods in Reinforcement Learning.

Learning Outcomes: 1. Perceive the scope and importance of machine learning. 2. Understand and evaluate modern machine learning algorithms. 3. Apply appropriate programming skills to administer a machine learning algorithm in a real-world problem. 4. Communicate the machine learning results in an appropriate level of detail for an intended audience. Credits: 3.00

Supply Chain and Business Operations

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.

Credits: 1.00 to 6.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

IE 56600 - Production Management Control

Credit Hours: 3.00. Background and development of production management, plus current concepts and controls applicable to production management functions. Not open to Industrial Engineering students with a minor in management.

Credits: 3.00

IE 57900 - Design And Control Of Production And Manufacturing Systems

Credit Hours: 3.00. Design and control of discrete part manufacturing systems in contemporary production environments, with emphasis on flexible, demand-driven, product-based manufacturing. Currently used planning and control methodologies, such as MRP, OPT, and JIT are reviewed and integrated with appropriate facility design methodologies, including cellular design algorithms. Introduction to Computer Integrated Manufacturing (CIM) architecture and reference models and relevant control procedures, including basis approaches to appropriate data management methodologies.

Credits: 3.00

IE 58200 - Advanced Facilities Design

Credit Hours: 3.00. Study of the theoretical and applied aspects of manufacturing systems layout. Emphasis on contemporary manufacturing, including the layout of cellular systems, automated material handling systems, and storage systems.

Credits: 3.00

MGMT 46200 - Advanced Manufacturing Planning And Control Systems

Credit Hours: 3.00. The course examines key concepts in the planning, control, and improvement of processes in manufacturing and service operations. Specific topics covered in the course include: (i) Product/service characteristics that provide value to customers and competitive priorities, (ii) Role of processes and key operations choices to support the competitive priorities, (iii) Process analysis and scheduling, (iv) Throughput principles to deal with adverse impacts of process uncertainties and bottlenecks, (v) Managing capacity and lead times, (vi) Throughput principles to deal with wastes and errors, including the Toyota Production System and Lean Operations, and (vii) Coordinating material/order flows in supply chain - MRP, and Resources and Production Planning - Aggregate Production Planning. The class uses a combination of lectures, cases, simulations, outside speakers, experiential exercises, and student presentations. An important component of the course is a hands-on exercise where students in teams of seven or eight design and run a production process to meet demand for a quality-conscious customer. The teams then present the lessons learned to the class.

Learning Outcomes: 1. Learn the details of production planning, master scheduling, materials planning, short range capacity planning, production floor execution, and quality control. Credits: 3.00

MGMT 40500 - Six Sigma And Quality Analytics

Credit Hours: 3.00. The course is an undergraduate elective offered as part of the Center for Manufacturing Management Enterprises (CMME) quality initiatives. Provides an overview of various tools and methods for total quality management.

Learning Outcomes: 1. Make data driven conclusions and decisions for quality management operations through working on various business cases. 2. Apply previously gained statistical knowledge to understand and to analyze data. 3. Gain some advanced analytical technics such as Analysis of Variances (ANOVA) and Design of Experiment (DOE) to optimize obtaining data and learnings. 4. Master a simple yet powerful MINITAB software to carry out complex tasks. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 46400 - Logistics: Concepts And Models

Credit Hours: 3.00. The course familiarizes students with main concepts and models of business logistics management. Through the course, students develop an ability to design, improve, and manage logistics operations such as Inventory, Transportation, Warehousing, and Logistics Network Design. Since logistics decisions often require certain trade-offs to be made, students develop necessary quantitative and qualitative analytical skills to improve their decision-making. At the end of the course, students should be able to analyze logistics strategy of a firm, identify problems and tradeoffs in different logistics functions, formulate the corresponding models, identify quantitative methods to solve it, obtain results and interpret them for small-size problems using standard spreadsheet software, communicate the results to a broader audience using business language, discuss issues and challenges in same-day delivery, humanitarian logistics, physical internet.

Learning Outcomes: 1. Know vocabulary of Logistics, and Supply Chain. 2. Design, improve and manage processes by learning decision making tools. 3. Become familiar with the key issues and problems facing an operations manager. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

MGMT 26100 - Introduction To Supply Chain Management

Credit Hours: 3.00. This course seeks to introduce general concepts in supply chain management, including procurement, supply planning, demand planning, and logistics. This course is designed around a corporate partnership to provide students with the opportunity to collaborate on solving a large-scale supply chain challenge. In the first five weeks of the semester, students will be introduced to basics of SCM through lectures, cases, and assignments. Beginning in the sixth week, students will form teams to work on a real-world case presented by the corporate partner, a complex problem broken down into six learning areas, each with a corresponding deliverable.

Learning Outcomes: 1. Define, measure, and recommend improvements to an organization's

supply chain. 2. Gain experience in applying these skills to a real-world business problem. 3. Learn about the different aspects of supply chain management. Credits: 3.00

MGMT 46501 - Strategic Sourcing And Procurement Operations Analytics

Credit Hours: 3.00. This elective course will serve as an important complement to the existing OM modules (e.g., MGMT 36100 Operations Management) to introduce more in-depth knowledge about supply chain management to undergraduate students, especially those major in SC&OM, focusing on strategic sourcing and procurement operations which are the building blocks for supply chain operations. More specifically, this course will introduce procure-to-pay process, category management, supplier selection and evaluation, supplier relationship management, vertical integration, global sourcing, outsourcing, auctioning, supply contract design and negotiation, business ethics, legal and compliance issues, etc. Sourcing and procurement is the major job title for supply chain operations jobs in the industry and our course can also help students to get the professional certificate of sourcing and procurement. Hence, it may also help senior students prepare for the job placements.

Learning Outcomes: 1. Master the working knowledge and vocabulary of strategic sourcing and procurement. 2. Know how to design and manage the business process in sourcing operations. 3. Know how to align sourcing strategies with corporate strategies. 4. Know how to model the key decision-making process of sourcing operations. 5. Apply data analytics techniques to develop sourcing strategies. Credits: 3.00

Public Policy Certificate

About the Certificate

Requirements for the Certificate (12 credits)

A. Required course (3 credits)

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

B. Social and Economic Policy - Select one course (3 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3.

Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay

between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

POL 54101 - Applied Foundations Of Global Development

Credit Hours: 3.00. Describes the foundational concepts of economic development and the historical emergence of global inequality, provides explanations of global inequality, and explores Western efforts to mitigate it through foreign aid. Applies concepts to analyze current trends in development and emerging practices in foreign aid.

Learning Outcomes: 1. Explain the global history of economic and human development. 2. Contrast notions of development beyond the narrow concept of economic growth. 3. Identify and critique a wide array of explanations for why some countries are developed and others are not. 4. Analyze international, domestic, and geographical constraints on economic development. 5. Describe the workings of the international aid regime. 6. Demonstrate practical skills for working in the field of development such as communication, organization, and analysis. Credits: 3.00

C. Science, Technology, and Environmental Policy (STEP) - Select one course (3 credits)

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42900 - Contemporary Political Problems

Credit Hours: 3.00. Contemporary political problems in the United States affecting the interpretation of democracy, human rights and welfare, social pressures, and intergovernmental relations.

Credits: 3.00

POL 53100 - Terrorism And WMD Threat Assessment

Credit Hours: 3.00. "Terrorism and WMD Threat Assessment" is designed to teach students how to analyze and assess the threats terrorist organizations present in the area of nuclear and radiological security and weapons of mass destruction more generally. The goal of this class is to enable students to identify, prioritize, and assess terrorist threats and propose appropriate, proportional, and cost-effective counter-measures.

Learning Outcomes: 1. Understand the causes, motivations, strategies, and tactics of terrorist organizations, particularly regarding nuclear terrorism. 2. Understand challenges associated with implementing effective counterterrorism strategies and policies. 3. Analyze current and future nuclear proliferation threats from countries and non-state or sub-state actors and provide recommendations on how to address these security issues. 4. Define and analyze the various types of transnational threats and targets in order to craft effective policy responses. 5. Describe nuclear weapons proliferation, including incentives and disincentives for proliferation. 6. Analyze counter-proliferation strategies. Credits: 3.00

POL 53200 - Nuclear Strategy And Proliferation

Credit Hours: 3.00. "Nuclear Strategy and Proliferation" is designed to teach students about 1) the conceptual elements and operational requirements of nuclear deterrence and 2) the historical dynamics of nuclear proliferation and nonproliferation. The goal of the class is to enable students to 1) evaluate the deterrent effects of different nuclear weapons and various configurations of nuclear arsenals and 2) analyze the technological, political and legal incentives and obstacles for acquiring nuclear weapons.

Learning Outcomes: 1. Understand the historical development of ideas about nuclear deterrence and its requirements. 2. Understand debates about the requirements for nuclear deterrence. 3. Analyze and evaluate the size and structure of the nuclear arsenals of current nuclear powers. 4. Identify and explain the main technological challenges and obstacles to acquiring nuclear weapons. 5. Evaluate potential explanations of why nations choose to acquire nuclear weapons (or refrain from doing so). Credits: 3.00

POL 52601 - Technology, AI, And Ethics In Public Policy And Public Administration

Credit Hours: 3.00. Examines how emerging technologies like artificial intelligence (AI), automated decision systems, and digital platforms are being adopted in the public sector. It explores the benefits as well as ethical risks and challenges associated with implementing these technologies in areas like healthcare, education, child welfare, and criminal justice. Students will analyze governance strategies, policies, and administrative procedures to promote responsible technology use in government.

Learning Outcomes: 1. Summarize the main forms of digital technology and algorithmic practices (AI) that are being adopted in government operations and decision-making, including automated decision systems, digital public interfaces, and data integration platforms. 2. Analyze emerging trends and developments in the use of AI, automated decision systems, and data analytics in public agencies and governments, in the U.S., internationally, and at the local level. 3. Assess the benefits as well as risks and challenges associated with implementing these technologies in the public sector, including how the use of new technology is transforming interactions between

government and citizens, impacting social welfare, and implicating issues of transparency, accountability, discretion, discrimination, and public trust. 4. Evaluate ethical concerns, biases, and risks to social welfare that may arise from the use of AI and automated decision systems in administering public programs and services and demonstrate the ability to examine issues from multiple stakeholder perspectives. 5. Propose governance strategies, policy solutions, and administrative procedures to ensure responsible and ethical use of AI and other emerging technologies in the public sector, such as best practices for procurement, implementation, auditing, and public engagement. Credits: 3.00

POL 52701 - Local To Global Governance Of Data, AI, And Emerging Technology

Credit Hours: 3.00. This course introduces students to the institutions and governing systems at the subnational, national, supranational, and international levels that regulate emerging technology, AI, and data. Focusing on laws, standards, and best practices, students will examine comparative case studies of regulation of big tech in differing governing environments. Students will explore how social, economic, and political factors shape differences in technology regulation across the globe.

Learning Outcomes: 1. Summarize the main policy institutions, stakeholders, and regulatory actors in subnational, national, supranational, and international settings as applied to area of emerging technology, AI, and data. 2. Analyze the current state of policy and its implementation in one or more regions or states as applied to areas of emerging technology, AI, and data. 3. Develop a proposal for best practices for managing the use of AI, data resources, or other emerging technology in a private, public, or non-profit setting. 4. Compare and contrast differences in technology regulation across the globe and explain common sources for these differences. Credits: 3.00

D. Advanced Policy Experience (Internship, Practicum, Experiential Learning, Graduate-level coursework) - Select one course (3 credits)

POL 40300 - Field Experience In Political Science

Credit Hours: 1.00 to 9.00. Students are able to earn credit for internships in federal, state, and local government offices as well as with political parties, campaign organizations, nonprofit organizations, legislative bodies, and interest groups. Credit and course requirements to be arranged with the instructor. Permission of instructor required.

Credits: 1.00 to 9.00

POL 49500 - Undergraduate Research Experience

Credit Hours: 1.00 to 3.00. Students are able to earn credit by working on a research project with a faculty member. Students will become familiar with all phases of the research process. Credit and course requirements are arranged with the instructor. Permission of instructor required.

Credits: 1.00 to 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

POL 52101 - Applied Public Policy: Institutions, Processes, Practices

Credit Hours: 3.00. Applied introduction to the institutions, processes, and practices in the field of public policy. Students will examine the role of government institutions, standards organizations, corporate actors, and non-governmental organizations, policymakers, regulators, and the public in the policy process. The course will draw examples from one or more applied policy areas such as economic development, emerging technology policy, sustainability policy, energy, foreign policy, or social policy.

Learning Outcomes: 1. Summarize and describe the institutions, actors, and policy process for different political systems. 2. Compare and contrast the role of political analysis and policy analysis for analyzing the viability and success of policy. 3. Evaluate a policy area and write a policy brief describing the history of the policy, current stakeholders in the area, the current state of policy, and emerging policy challenges or prospective changes. 4. Design translational communication materials to convey policy information to different audiences including specialists and non-specialists. Credits: 3.00

Notes

Quantum Information Science and Technology Certificate

About the Program

Requirements for the Certificate (16 credits)

Engineering Requirement (1 credit)

ENGR 10301 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small seminars led by faculty designed to introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or assist in their decision of an engineering degree. Permission of department required.

Learning Outcomes: 1. Introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Credits: 1.00

QIST Introduction Courses (3-4 credits)

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model

systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

QIST Fundamental Courses (1-3 credits)

ECE 39595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental

assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

QIST Experience for Undergraduates Selectives (1-6 credits)

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

MA 29000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

MA 39000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 49000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 6.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 6.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct

physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 39000 - Special Assignments

Credit Hours: 1.00 to 4.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Learning Outcomes: 1. Understand physics and physical laws of nature by learning beyond what is offered by currently available fixed-title courses. Credits: 1.00 to 4.00

PHYS 49000 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, laboratory work, or research in special areas of physics. Intended for upperclass students. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 59000 - Reading And Research

Credit Hours: 1.00 to 3.00. (Calumet, Fort Wayne) 1.00 to 6.00 (West Lafayette, IUPUI). Reading and research in Physics. Permission of instructor required.

Credits: 1.00 to 3.00

VIP 17911 - First Year Participation In Vertically Integrated Projects (VIP) I (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17912 - First Year Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a

broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 47920 - Senior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design

experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 37920 - Junior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 17920 - First Year Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team

whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47922 - Senior Design Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 27920 - Sophomore Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Apply engineering

design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47921 - Senior Design Participation In Vertically Integrated Projects (VIP) I

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47930 - Senior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

VIP 37930 - Junior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new

knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

VIP 17910 - First-Year Participation In Vertically Integrated Projects (VIP) Lim (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies, and development tools. Permission of department required.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 27910 - Sophomore Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.
Learning Outcomes: 1. Apply engineering design to create a product that meets the

specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 37910 - Junior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed

judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 47910 - Senior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 27930 - Sophomore Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the

specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 3.00

Certificate Requirements

Electives (2-10 credits)

ECE 39595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 46100 - Quantum Mechanics II Honors

Credit Hours: 3.00. Angular momenta, radial equation, operators, matrices, spin, time-independent perturbation theory, electron-electromagnetic field interaction, hydrogen atom, structure of atoms, molecules, radiation; selected topics in radiative transitions, collision theory, solids, nuclei, elementary particles and their symmetries.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

PHYS 52600 - Physics Of Quantum Computing And Quantum Information

Credit Hours: 3.00. An introduction to the physics of quantum information science. Starting with the concepts of quantum superposition, it defines and describes qubits (quantum bits) and their manipulation by quantum logic gates. The topics of quantum entanglement and the EPR paradox are introduced, and their importance for quantum teleportation, communication, and quantum cryptography are covered. Quantum computing is described in terms of quantum circuits of logic gates, and also in terms of quantum algorithms, such as Deutsch's algorithm, the quantum Fourier transform, Shor's prime factoring algorithm, and Grover's search algorithm. The final topic is quantum decoherence and the limits it places on practical implementations of quantum computing.

Learning Outcomes: 1. Understand the meaning of entanglement and how it distinguishes quantum from classical science. 2. Understand how the rules of quantum measurement are fundamental to quantum cryptography and quantum computing. 3. See how the basics of quantum science enable quantum computing to solve important problems otherwise inaccessible to classical computing. Credits: 3.00

PHYS 54500 - Solid-State Physics

Credit Hours: 3.00. Crystal structure; lattice vibrations and electronic band structure of crystals; electrical, optical, and thermal properties of solids; transport and other nonequilibrium phenomena in uniform and nonuniform materials.

Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

ECE 55200 - Introduction To Lasers

Credit Hours: 3.00. An introduction to lasers and laser applications which does not require a knowledge of quantum mechanics as a prerequisite. Topics include: the theory of laser operation; some specific laser systems; nonlinear optics; optical detection; and applications to optical communications, holography, laser-driven fusion, and integrated optics.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

MSE 50200 - Defects In Solids

Credit Hours: 3.00. Structures and interactions of point, line, and planar defects in solids, with emphasis on properties of defects. Generic basis of defect energies and interactions, with reference to specific materials and material classes as examples. Types of point defects found in crystals, their origins, interactions, and motion. Overview of dislocation theory and point-defect/dislocation interactions. Structural aspects of surfaces and interfaces, including point and line defect interactions.

Credits: 3.00

ME 50100 - Statistical Thermodynamics

Credit Hours: 3.00. The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Introduction to quantum mechanics and molecular spectroscopy. The Maxwell-Boltzmann formulation of statistical mechanics and applications to ideal gases, solids, radiation, and laser diagnostics. The Gibbs formulation of statistical mechanics and application to real gases. Kinetic theory and applications to transport properties and chemical kinetics. Offered in alternate years.

Learning Outcomes: 1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena. 2. Apply concepts and calculate thermodynamic and transport properties of ideal gases. 3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements. Credits: 3.00

ME 50300 - Micro-And-Nano-Scale Energy Transfer Processes

Credit Hours: 3.00. Transport of energy in natural and fabricated micro- and nano-scale structures. Physical nature of energy transport by three carriers-electrons, phonons, and photons. Bulk material properties (e.g., thermal/electrical conductivity) are derived from statistical particle transport theories. Effects of spatial confinement on bulk properties are quantified. Contemporary interdisciplinary engineering applications.

Learning Outcomes: 1. Gain an understanding of the fundamental elements of solid-state physics. 2. Develop skills to derive continuum physical properties from sub-continuum principles. 3. Apply statistical and physical principles to describe energy transport in modern small-scale materials and devices. Credits: 3.00

ECE 30653 - Introduction To Nanotechnology And Quantum Science & Technology

Credit Hours: 3.00. This interdisciplinary course offers an introduction to nanotechnology and quantum science and technology for undergraduate students in science and engineering. The students will develop understanding of interdisciplinary nature of these fields and utilize concepts in physics, chemistry and mechanics to describe and analyze unique properties of quantum and nanoscale objects. The course will provide the opportunity to get exposed to highly interdisciplinary nature of today's most active and rapidly expanding fields of research and technologies.

Learning Outcomes: 1. Define major types of nanoparticles and their sources. 2. Illustrate by simple calculations unique physical properties

of nanoscale objects, e.g. calculate de Broglie wavelength, surface energy, melting point. 3. Describe basic nanostructure measurement methods. 4. Give examples of economic benefits of nano and quantum technology. 5. Describe approaches for managing security, health and environmental risks. Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance and the two Landauer formulas. Credits: 1.00

ECE 50632 - Introduction To Quantum Transport

Credit Hours: 1.00. This course introduces the Schrödinger equation, uses the tight-binding method to discuss the concept of bandstructure and E(k) relations, along with simple quantum transport problems. No prior background in quantum mechanics or statistical mechanics is assumed.

Learning Outcomes: 1. Explain tight-binding model, reciprocal lattice and evaluate dispersion relation. 2. Explain NEGF equations, dephasing, quantum point contact and evaluate quantities like the transmission, the self-energy and spectral functions. 3. Use Pauli spin matrices and evaluate quantities like spin density. Credits: 1.00

ECE 50633 - Boltzmann Law: Physics To Computing

Credit Hours: 1.00. This course introduces the key concepts of equilibrium statistical mechanics leading to the celebrated Boltzmann law and how it leads to Boltzmann machines and related concepts in modern machine learning. No prior background in statistical mechanics is assumed.

Learning Outcomes: 1. Explain the law of equilibrium and entropy. 2. Understand the operation of Boltzmann machines. 3. Understand the operation of quantum circuits. Credits: 1.00

Note

Science and Technology Studies Certificate

About the Certificate

Requirements for the Certificate (15 credits)

Required Course (3 credits)

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

STS Related Courses (9 credits)

Anthropology

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

ANTH 32700 - Environment And Culture

Credit Hours: 3.00. This course provides a general overview to the field of environmental anthropology, and surveys key methods, and theories that anthropologists use to interpret human-environment interactions. Topics include culture ecology, agroecology, ethnobiology, political ecology, and environmental justice.

Learning Outcomes: 1. Identify and explain the key theories in environmental anthropology. 2. Identify several cross-cultural examples of human-environment interactions. 3. Distinguish between anthropological approaches and other disciplines that study the environment. 4. Apply the theories and methods learned in this course to real world environmental issues. 5. Demonstrate professional skills in research, analysis, presentation and peer review. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

ANTH 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ENGL 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish, paraphrase, and translate different disciplinary perspectives on these key environmental and sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

ANTH 25400 - Archaeological Hoaxes, Myths And Frauds

Credit Hours: 3.00. This course examines why the ancient past inspires so many theories about aliens, dark conspiracies, lost civilizations, and apocalyptic predictions. Topics include the popularity of pseudoscientific theories in American culture and the historical contexts in which common pseudoscientific ideas have emerged; why they persist in the face of archaeological evidence; and the role of pseudo-archaeology in the growing antagonism toward scientific expertise. Through an understanding of datasets and methods archaeologists use to evaluate claims about the past, the course goes beyond debunking ancient aliens and Atlantis to develop important critical thinking skills to evaluate evidence and recognize pseudo-scientific arguments in the media.

Learning Outcomes: 1. Evaluate the difference between a scientific and a pseudoscientific claim about the human past. 2. Explain the techniques and scientific methods archaeologists use for evaluating hypotheses or claims about the past. 3. Examine the role and popularity of pseudoscientific theories in American culture and the historical contexts in which popular pseudoscientific ideas have emerged. 4. Articulate how seemingly harmless fringe theories are entangled with larger narratives of cultural memory and erasure among past societies and their descendants. Credits: 3.00

ANTH 30800 - Critical Data Studies

Credit Hours: 3.00. Critical Data Studies (CDS), is an interdisciplinary field that addresses the ethical, legal, socio-cultural, epistemological and political aspects of data science, big data and digital infrastructure. This course focuses on current topics in critical data studies scholarship. Particular emphasis will be given to democratic and participatory approaches to algorithm design and responsible data management, curation and dissemination. Students will develop tools and methods to help scholars think critically and identify issues of concern to Local Communities. This is a research and

writing intensive course.

Learning Outcomes: 1. Engage in current debates surrounding data science, big data and digital infrastructure from an anthropological perspective. 2. Acquire anthropological tools and methods to analyze societal impact of emergent technologies. 3. Learn to demonstrate collaboration, public engagement and scholarly communication skills. 4. Apply anthropological frameworks to novel research problems. Credits: 3.00

ANTH 24000 - Medicine, Science, And Culture

Credit Hours: 3.00. This course explores the intersections of medicine, science, and culture as powerful shapers of our lives and the world today. Anthropology broadly studies the human experience to help explain how our bodies, biologies, and beliefs inform what "medicine," "health," "illness," and "healing" come to mean in diverse and cross-cultural contexts. The course will cover foundations in medical anthropology by exploring a range of topics and applications.

Learning Outcomes: 1. Describe what medical anthropology is and what medical anthropologists do. 2. Analyze the dynamic intersections of medicine, science, and culture. 3. Explain what medical anthropology contributes to understanding the multiple dimensions of health, illness, and healing. 4. Apply anthropological frameworks to real-world examples. Credits: 3.00

ANTH 34600 - Pregnancy, Birth, And Babies

Credit Hours: 3.00. This course examines human universal patterns and cross-cultural variation in pregnancy, birth, and infant care practices, using evolutionary and biocultural perspectives. Students will connect course themes to current events and controversies, such as medical models of birth, public breastfeeding, and parent-infant co-sleeping.

Learning Outcomes: 1. Identify evolutionarily novel aspects of the human reproductive pattern. 2. Compare birthing, infant feeding, and infant care practices across human societies using a biocultural framework. 3. Evaluate contemporary medical controversies surrounding pregnancy, birth, and babies critically. Credits: 3.00

Art and Design

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and

use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

Communication

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 33000 - Theories Of Mass Communication

Credit Hours: 3.00. An examination of mass communication theories and theorists. Readings and discussion of McLuhan, Lippman, De Fleur, Lazarsfeld, Schramm, Stephenson, and other significant contributors.

Credits: 3.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism, political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

English

ENGL 23400 - Literature And The Environment (UCC: STS)

Credit Hours: 3.00. Literary study of nature writing; writing from the natural sciences; and canonical poetry, fiction, and essays through an ecological lens. Introduces students to ecocritical thought and environmental literary history.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and discursive conventions of literature about the environment. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 37300 - Science Fiction And Fantasy (UCC: HUM)

Credit Hours: 3.00. Representative works of science fiction and fantasy examined in relation to both mainstream and popular literature. Emphasis is on technique, theme, and form.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation

and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

ENGL 43300 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants is a professional writing workshop that teaches students to write workplace proposals and grants in for-profit and not-for-profit companies and organizations. Students will also learn how to write business plans, a specialized form of proposal.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Generate new ideas for businesses, products, and services. 3. Organize proposals and grants using various proposal genres. 4. Write in a plain and persuasive style that is appropriate to readers. 5. Design documents in ways that make information accessible. 6. Edit and revise proposals and grants. 7. Work with authors, customers, and funding agencies to sharpen the message of a proposal or grant. Credits: 3.00

ENGL 36700 - Mystery And Detective Fiction (UCC: HUM)

Credit Hours: 3.00. An introduction to the detective genre, examining its origins, its characteristics, and its intersections with empiricism, forensic science, race, class, gender, sex, and empire.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Be familiar with the generic conventions of, and theoretical approaches to, the detective genre. 2. Use detective fiction to improve students' historical, cultural, and global awareness. 3. Practice

analyzing, interpreting, and synthesizing information within and across texts and other media. 4. Practice successful academic writing, including a debatable thesis, as well as appropriately-selected and presented evidence. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

ENGL 22300 - Literature And Technology (UCC: STS)

Credit Hours: 3.00. This class uses literature to explore how technological innovation both enables and constrains creativity. It also explores how technology has been represented in literature, and examines the relationship between literature and new media.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Define technology and its implications. 2. Employ multiple approaches to critical thinking well-suited to cultural complexities. 3. Demonstrate written, visual, and technological literacies while working with diverse media. 4. Demonstrate creativity through remediation (moving information from one medium to another) and iteration. 5. Explain the relationship between information and digital media production. 6. Explain and employ multiple critical approaches to narrative and storytelling. Credits: 3.00

ENGL 22600 - Narrative Medicine (UCC: STS)

Credit Hours: 3.00. "Narrative Medicine" encompasses stories about the interior lives of doctors and medical professionals, the complexities of medicine past and present, and health-care for patients and their families. Ultimately, this course emphasizes the essential role of rhetoric and storytelling in the face of medical crisis and uses stories about illness and disability to explore the human condition.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Explain medicine from a humanistic perspective. 2. Explain contemporary health issues. 3. Define storytelling as an intellectual and empathic discourse. 4. Analyze fictional and factual narratives (stories). Credits: 3.00

Engineering

ENE 55400 - Globalization And Engineering

Credit Hours: 3.00. The focus is on the multifaceted dynamics of globalization, and its impact on engineering practice and the lives and education of engineers. The course emphasizes engineering and globalization from the perspectives of the emerging Asian economies and Europe, as well as the United States. This course is designed for practicing engineers and engineering educators. It is taught within a learner-centric, highly interactive, collaborative learning environment in which students are expected to learn from the experiences and thinking of each other, as well as from the instructor, and other course resources. The course places emphasis on reading, writing, web-based research, and discussion. Students are recommended (but not required) to have a minimum of two years work experience as a practicing engineer and strong communication skills (self-assessed). Permission of instructor is required.

Learning Outcomes: 1. Have increased global awareness. 2. Have knowledge of the dynamics of globalization as an economic and social process including contrasting theories and interpretations of events. 3. Have knowledge of how globalization is studied and characterized by economists, political scientists, and sociologists. 4. Able to interpret studies and research on globalization. 5. Understand the nature and roles of engineering education and

life-long learning within the globalization dynamic. 6. Understand the innovation process within a global enterprise including contrasting theories and the ability to analyze specific cases. 7. Able to lead and innovate within a rapidly globalizing profession. 8. Know the engineering profession, engineering education, and globalization from the perspectives of countries beyond the United States, particularly perspectives from Europe and the emerging economies of Asia. Credits: 3.00

MSE 48900 - Ethics In Engineering Practice

Credit Hours: 3.00. Presentation and discussion of common ethical theories, including ethical egoism, legal positivism, utilitarianism, duties and rights, and virtue ethics. Application of these theories to the practice of engineering, including professionalism, codes of ethics, trust and loyalty, confidentiality, whistle blowing, respect for legitimate authority, risk and reliability, and fraud. Examples of application of ethical theory and case studies drawn from across the engineering profession and include discussion of the interrelated technical and ethical issues.

Learning Outcomes: 1. Identify and discuss common ethical theories. 2. Describe how these theories apply these theories to the practice of engineering. 3. Analyze case studies of failures of engineering products and organizations. Credits: 3.00

ENGR 31000 - Engineering In Global Context (UCC: STS)

Credit Hours: 3.00. This course provides students with opportunities to study how engineering is intertwined with larger economic, social, cultural, and technological dynamics in an era of intensified globalization. Its major goals are to help students understand and appreciate what engineering is, how engineers are trained, what engineers do, and how engineering and society interact. The course approaches these themes through discussion of: the relation and interaction of engineering, science, technology, and society; the historical origins and development of engineering as a profession; diversity issues in engineering and other STEM fields; engineering in cross-national/cultural contexts; and contemporary challenges related to globalization, ethics, and sustainability. In summary, the course is designed to help students understand what it means to identify as, and/or work with, engineers. Recitation sections and/or independent projects (at the instructor's discretion) provide further opportunities for students to expand their knowledge and improve their skills in relation to course themes.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe and evaluate the specific kinds of knowledge and methods typically employed by engineers, including in comparison with other professional fields. 2. Understand the historical development of engineering education and the engineering profession in the United States. 3. Recognize how national differences are important in engineering work, including by comparing and contrasting different national cultures and styles of engineering. 4. Explain the significance of diversity in engineering education and professional practice, including by evaluating competing perspectives on diversity in different historical and sociocultural contexts. 5. Understand contemporary trends and issues related to globalization, ethics, social responsibility, and sustainability, and interpret their significance in relation to engineering education and practice. 6. Demonstrate written communication capabilities at the level of emerging or higher (as defined by the Purdue Core Curriculum guidelines). Credits: 3.00

BME 56400 - Ethical Engineering Of Medical Technologies

Credit Hours: 3.00. This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice.

Learning Outcomes: 1. Recognize and analyze personal and systemic ethical issues and challenges to ethical reasoning and social responsibility. 2. Engage in empathy building activities to enhance their abilities to understand and value the perspectives of other stakeholders. 3. Use a structured, iterative, and

collaborative decision-making process that considers the perspectives of multiple stakeholders in optimizing a design decision when facing an engineering problem in design and development of medical devices or assistive technologies that are ethical and socially responsible. Credits: 3.00

History

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 39400 - Environmental History Of The United States (UCC: HUM)

Credit Hours: 3.00. This is a mid-level survey designed to provide students of environmental science with historical background and students of history with the unique perspective of environmental history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 31505 - American Beauty (UCC: HUM)

Credit Hours: 3.00. This course explores twentieth-century gender history in the United States through the concept of beauty. Ideals about beauty intersect with politics, economics, technological developments, medical innovations, and nation building. A critical examination of beauty as seen through advertising, pageants, and material culture, yields insight about modern womanhood, everyday life, and identify formation in the twentieth-century United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Appreciate the ways that beauty has been pursued by individuals, health practitioners, corporations, and media cultures since 1900. 2. Understand and recognize how assumptions about gender have influenced the way that beauty is constructed and experienced at different places and times. 3. Think historically and critically about the culture consequences of technologies related to beauty. 4. Think historically and critically about approaches to the study of beauty in modern American history. 5. Understand the difference between secondary and primary sources. 6. Analyze and interpret primary documents related to beauty cultures. 7. Understand the competing and conflicting nature of historical interpretation. 8. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

HIST 31405 - Science, Technology, Engineering And Mathematics (STEM) And Gender (UCC: HUM/STS)

Credit Hours: 3.00. Scientific and technological innovation has been a cornerstone of American identity. How science and technology matters to gender, and gender matters to science and technology, will be explored through studying amateur and professional scientists and engineers, industrialization, education, sexual division of labor, and home and work spaces in twentieth-century America. Examining technological, scientific, and engineering innovation through the lens of gender reveals changing relationships between men and women in modern America.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to gender. 2. Understand and recognize how assumptions about gender may influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

HIST 30305 - Food In Modern America (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the kitchen as an architectural space, a place of labor and food production, and an arena for technological innovation in modern American history. Cooking and eating reflect cultural sentiments about modernity, progress, ethnicity, and family, and the politics of how society nourishes bodies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Think historically and critically about the cultural consequences of technologies related to eating and food preparation. 2. Think historically and critically about approaches to the study of national identify and culture expressed through food. 3. Appreciate the circumstances and history of kitchen design in relation to raced and gendered identities, home space, and food preparation. 4. Understand and recognize how assumptions about food production during the late 19th and 20th centuries in the United States reflected notions about labor, modernity, and progress. 5. Understand the difference between secondary and primary sources. Students will analyze and interpret primary documents related to kitchens, cooking, and food preparation. They also will understand the competing and conflicting nature of historical interpretation. 6. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 35205 - Death, Disease And Medicine In Twentieth Century American History (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of disease, dying, and medicine in the United States in the 20th century.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify and explain the relationship between science and culture and interdisciplinarity. 2. Analyze texts and cultural artifacts about medicine. 3. Identify medical practice and how it is informed by context and culture. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

HIST 30805 - History Of Life Sciences

Credit Hours: 3.00. This course will examine the development of life sciences from 1750 to the present, introducing students to critical problems related to biology and society through the study of primary and secondary sources. The "life sciences" include all the sciences that deal with life as an organic entity. A prominent theme in this historical treatment is the impact of social and political ideas on the life sciences. Topics will include theories of life, the origin of life, taxonomy and classification, theories of development, natural selection, genetics, eugenics, science and religion, the evolutionary synthesis, biodiversity, ecology and environmentalism, sociobiology, the discovery of DNA, cognition and the brain, and gender in science. Students will develop crucial skills in the interpretation of primary and secondary sources, research, analysis, and presentation.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical material. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 30905 - History Of Environmental Science

Credit Hours: 3.00. This course introduces students to various approaches to environmental science through time. It considers critical problems related to the environment and society. The "environmental sciences" include all the sciences that deal with the Earth's physical and organic environments.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical materials. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2.

Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 49400 - Science And Society In American Civilization

Credit Hours: 3.00. This course examines the development of science in the United States from colonial times to the present. Emphasis in the earlier periods is placed on comparison and contrast of the American scene with that of Europe. Subsequent treatment deals with industrialization, and maturation of the American scientific community, and the increasing social effects of science. Among those considered are the forces making for urbanization, for greater interdependence among science, industry and government, and for repercussions in intellectual affairs.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 30701 - History Of Artificial Intelligence: Minds And Machines

Credit Hours: 3.00. This course examines the long history of efforts in automating human cognition. Historically, the attempts to automate human cognitive functions - from the mere reckoning of numbers to complex decision-making have been entangled with heated debates about what counts as good, proper, and desirable thinking; whose thinking machines should emulate; and whether the thinking of some humans is inferior to that of machines. In this course, we will examine how the invention of calculating machines - analogue and then digital - has developed in tandem with philosophical and scientific theories of human thinking and intelligence. In their turn, the latter developed as a response to changing social, political, and economic currents.

Learning Outcomes: 1. Critique the epistemological foundations and ethical implications of past and present approaches to the automation of human cognition. 2. Use primary sources to make arguments about the role of social, political, economic, and cultural currents that have historically provided the impulses for research and development in the automation of human cognition. 3. Assess historical scholarly arguments about social, economic, and political power asymmetries surrounding artificial intelligences. 4. Create websites to use text, imagery, and video content and effectively communicate how social factors have historically shaped the development of artificial intelligence. Credits: 3.00

HIST 36105 - History Of Science, Technology, And Environment In Pre-Modern East Asia

Credit Hours: 3.00. This course explores developments in scientific, technological, and ecological history specifically in Pre-modern East Asia. In this class, we will read basic theories and methods in the history of science and technology, as well as basic debates and questions that challenge scholars studying the history of science, technology, and the environment in a non-western pre-modern context. We will explore how society, culture, and politics affect knowledge production and people's engagement with nature, and how these interactions, in turn, shaped society, culture, and politics. All readings are in English. No prior knowledge of East Asia is necessary.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society in pre-modern East Asia. 2. Discuss

examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 3. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 4. Investigate the diversity of human experience in pre-modern East Asia, explain how social factors such as ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, have shaped the development or application of science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. 5. Identify and explain the major themes of the history of science, technology, and environment, write about the role of science in society, and describe ethical implications of technological and scientific developments. Credits: 3.00

Interdisciplinary Studies

AMST 31000 - Invention, Innovation, And Design (UCC: HUM/STS)

Credit Hours: 3.00. This course focuses on the various ways that invention, innovation, and design shape the modern world. We will investigate the forms, uses, and meanings of a diverse set of objects, networks, and systems that influence the ways we live. We will explore these ideas through the concepts of consumption, waste, and "smart" to gain a deeper understanding of how material infrastructures influence human existence. This project-based course will use readings, discussions, and critical reflections to inform a series of hands-on projects to understand our roles as designers, creators, and users of science, technology, and material culture. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms invention, innovation, and design. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through designed objects. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze invention, innovation and design through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 32500 - Sports, Technology, And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines how science, technology, engineering, and data analysis reshape sports. Traditionally, sports have been understood as competitions between humans. However, recent technoscientific developments have altered this arrangement and have changed the ways sports are played. We have reached a place where heated competitions not only take place on the fields of play, but also within scientific and engineering laboratories. The fundamental question this project-based course will address is: how will new and emerging scientific knowledge and technological innovations transform sports? We will explore topics ranging from football, baseball, basketball, and soccer, to e-sports, fantasy sports, and sports analytics.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms sports, technology, and innovation. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through the play and consumption of sports. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze sporting invention, innovation, design, and culture through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate

them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

Languages and Cultures

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice. Credits: 3.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their disciplines. Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

LC 32300 - Global Sustainable Engineering

Credit Hours: 1.00 or 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and

assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 or 3.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

Libraries and School of Information Studies

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

Philosophy

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 35000 - Philosophy And Probability

Credit Hours: 3.00. This course introduces the student to mathematical probability and its philosophical applications. Topics may include theories of probability, Hume's problem of induction, Goodman's paradox, and the foundations of scientific reasoning.

Credits: 3.00

PHIL 42100 - Philosophy Of Science

Credit Hours: 3.00. An examination of central issues in philosophy of science. Topics include theories of explanation, confirmation, reduction, laws, the status of theoretical entities, and the epistemological foundations of scientific theories.

Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading

assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

PHIL 22700 - Science And Religion

Credit Hours: 3.00. Are science and religion irrelevant to each other? Or can one of them challenge, support, shape, presuppose, explain-or explain *away*-the other? This course examines how science in general, as well as specific scientific disciplines such as evolutionary biology, physical cosmology, and cognitive science, are related to religion in general, and to particular religious traditions.

Learning Outcomes: 1. Identify specific ways in which science and religion appear to be in tension and specific ways in which they appear to support one another. 2. Demonstrate familiarity both with attempts to resolve alleged tensions between science and religion and with attempts to challenge claims that science and religion support one another. 3. Present, explain, defend, and evaluate complex philosophical perspectives on the relationship between science and religion, in oral and written communication. 4. Locate, interpret, understand, and evaluate philosophical arguments encountered in complex texts on the relationship science and religion. Credits: 3.00

Political Science

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to

statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

Technology

TECH 53300 - Design Theory And Technology

Credit Hours: 3.00. This course provides an overview of theories and approaches to the transdisciplinary concept of design, spanning multiple disciplines and types of design outputs with a focus on technology. Students will read the work of leading design scholars, and situate their personal approach to design practice and research based on historical and current trends in the literature. Student work will be focused on theoretical and practical outcomes, with two main learning goals: 1) building upon and critiquing theories, methods, and processes of design in their original research; and 2) generating an awareness and representation of their personal design philosophy.

Learning Outcomes: 1. Situate design as a unique epistemology and ontology. 2. Explain key aspects of design activity. 3. Identify scholars, seminal works, and theories relating to design. 4. Distinguish between every day and professional design, craft, and art. 5. Critique theoretical foundations of their own discipline using the language and constructs of design theory. 6. Identify and articulate vital components of their design activity. 7. Synthesize and prioritize their design commitments. 8. Communicate their philosophy of design in multiple discipline-appropriate ways. Credits: 3.00

Anthropology

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

ANTH 32700 - Environment And Culture

Credit Hours: 3.00. This course provides a general overview to

the field of environmental anthropology, and surveys key methods, and theories that anthropologists use to interpret human-environment interactions. Topics include culture ecology, agroecology, ethnobiology, political ecology, and environmental justice.

Learning Outcomes: 1. Identify and explain the key theories in environmental anthropology. 2. Identify several cross-cultural examples of human-environment interactions. 3. Distinguish between anthropological approaches and other disciplines that study the environment. 4. Apply the theories and methods learned in this course to real world environmental issues. 5. Demonstrate professional skills in research, analysis, presentation and peer review. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

ANTH 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ENGL 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish, paraphrase, and translate different disciplinary perspectives on these key environmental and

sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

ANTH 25400 - Archaeological Hoaxes, Myths And Frauds

Credit Hours: 3.00. This course examines why the ancient past inspires so many theories about aliens, dark conspiracies, lost civilizations, and apocalyptic predictions. Topics include the popularity of pseudoscientific theories in American culture and the historical contexts in which common pseudoscientific ideas have emerged; why they persist in the face of archaeological evidence; and the role of pseudo-archaeology in the growing antagonism toward scientific expertise. Through an understanding of datasets and methods archaeologists use to evaluate claims about the past, the course goes beyond debunking ancient aliens and Atlantis to develop important critical thinking skills to evaluate evidence and recognize pseudo-scientific arguments in the media.

Learning Outcomes: 1. Evaluate the difference between a scientific and a pseudoscientific claim about the human past. 2. Explain the techniques and scientific methods archaeologists use for evaluating hypotheses or claims about the past. 3. Examine the role and popularity of pseudoscientific theories in American culture and the historical contexts in which popular pseudoscientific ideas have emerged. 4. Articulate how seemingly harmless fringe theories are entangled with larger narratives of cultural memory and erasure among past societies and their descendants. Credits: 3.00

ANTH 30800 - Critical Data Studies

Credit Hours: 3.00. Critical Data Studies (CDS), is an interdisciplinary field that addresses the ethical, legal, socio-cultural, epistemological and political aspects of data science, big data and digital infrastructure. This course focuses on current topics in critical data studies scholarship. Particular emphasis will be given to democratic and participatory approaches to algorithm design and responsible data management, curation and dissemination. Students will develop tools and methods to help scholars think critically and identify issues of concern to Local Communities. This is a research and writing intensive course.

Learning Outcomes: 1. Engage in current debates surrounding data science, big data and digital infrastructure from an anthropological perspective. 2. Acquire anthropological tools and methods to analyze societal impact of emergent technologies. 3. Learn to demonstrate collaboration, public engagement and scholarly communication skills. 4. Apply anthropological frameworks to novel research problems. Credits: 3.00

ANTH 24000 - Medicine, Science, And Culture

Credit Hours: 3.00. This course explores the intersections of medicine, science, and culture as powerful shapers of our lives and the world today. Anthropology broadly studies the human experience to help explain how our bodies, biologies, and beliefs inform what "medicine," "health," "illness," and "healing" come to mean in diverse and cross-cultural contexts. The course will cover foundations in medical anthropology by exploring a range of topics and applications.

Learning Outcomes: 1. Describe what medical anthropology is and what medical anthropologists do. 2. Analyze the dynamic intersections of medicine, science, and culture. 3. Explain what medical anthropology contributes to understanding the multiple dimensions of health, illness, and healing. 4. Apply anthropological frameworks to real-world examples. Credits: 3.00

ANTH 34600 - Pregnancy, Birth, And Babies

Credit Hours: 3.00. This course examines human universal patterns and cross-cultural variation in pregnancy, birth, and infant care practices, using evolutionary and biocultural perspectives. Students will connect course themes to current events and controversies, such as medical models of birth, public breastfeeding, and parent-infant co-sleeping.

Learning Outcomes: 1. Identify evolutionarily novel aspects of the human reproductive

pattern. 2. Compare birthing, infant feeding, and infant care practices across human societies using a biocultural framework. 3. Evaluate contemporary medical controversies surrounding pregnancy, birth, and babies critically. Credits: 3.00

Hands-On (3 credits)

Required Course (3 credits)

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

Notes

About the Certificate

Semiconductors and Microelectronics Certificate

About the Certificate

Requirements for the Certificate (10 credits)

Required Course (1 credit)

ENGR 10301 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small seminars led by faculty designed to introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or assist in their decision of an engineering degree. Permission of department required.

Learning Outcomes: 1. Introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Credits: 1.00

Semiconductor Experience for Undergraduates

Technical Courses (9 credits)

Semiconductor and Microelectronic Devices

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 45300 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts developed in the last 25 years which constitute the fundamentals of nanoelectronics and mesoscopic physics, assuming a minimal set of prerequisites. Topics covered include the new Ohm's law, conductance quantization, the nanotransistor, spin valves, thermoelectricity, quantum systems and the non-equilibrium Green's function (NEGF) method.

Learning Outcomes: 1. Ability to perform

semiclassical analysis of charge flow in nanoelectonic devices. 2. Ability to perform semiclassical analysis of spin flow and heat flow in nanoelectronic devices. 3. Ability to perform quantum analysis of nanoelectonic devices. Credits: 3.00

PHYS 52600 - Physics Of Quantum Computing And Quantum Information

Credit Hours: 3.00. An introduction to the physics of quantum information science. Starting with the concepts of quantum superposition, it defines and describes qubits (quantum bits) and their manipulation by quantum logic gates. The topics of quantum entanglement and the EPR paradox are introduced, and their importance for quantum teleportation, communication, and quantum cryptography are covered. Quantum computing is described in terms of quantum circuits of logic gates, and also in terms of quantum algorithms, such as Deutsch's algorithm, the quantum Fourier transform, Shor's prime factoring algorithm, and Grover's search algorithm. The final topic is quantum decoherence and the limits it places on practical implementations of quantum computing.

Learning Outcomes: 1. Understand the meaning of entanglement and how it distinguishes quantum from classical science. 2. Understand how the rules of quantum measurement are fundamental to quantum cryptography and quantum computing. 3. See how the basics of quantum science enable quantum computing to solve important problems otherwise inaccessible to classical computing. Credits: 3.00

ECE 55700 - Integrated Circuit Fabrication Laboratory

Credit Hours: 3.00. Laboratory exercises in the fabrication and testing of silicon integrated circuits. Both bipolar and MOS integrated circuit test chips are fabricated and tested. Laboratory technique, the technology of integrated circuit fabrication, and electrical characterization are emphasized. Permission of department required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 50616 - Physics And Manufacturing Of Solar Cells

Credit Hours: 3.00. This course introduces the electronic, optical and material properties and the manufacturing of photovoltaic devices. Topics include electronic charge separation, transportation and recombination; optical concentration, trapping and confinement; material preparations in photovoltaic systems; bulk crystal, thin-film and organic photovoltaic device configurations; energy storage; as well as emerging concepts in photovoltaics. Discussions also involve the process and equipment for the manufacturing of various photovoltaic modules, with special emphasis on driving down the cost of photovoltaic systems.

Learning Outcomes: 1. Understand different market segments for photovoltaics and their key requirements. 2. Understanding of p-n junctions, drift and diffusion of charges, LUMO and HOMO. 3. Extract efficiency from i-v characteristics of photovoltaic cells. Credits: 3.00

ECE 50653 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. The modern smartphone is enabled by a billion-plus nano-transistors, each having an active region that is barely a few hundred atoms long. Interestingly the same amazing technology has also led to a deeper understanding of the nature of current flow on an atomic scale. The aim of this course is to make the fundamentals of nanoelectronics accessible to anyone in any branch of science or engineering, assuming very little background beyond linear algebra and differential equations, although we will be discussing advanced concepts in non-equilibrium statistical mechanics that should be of interest even to specialists. We first introduce a new perspective connecting the quantized conductance of short ballistic conductors to the familiar Ohm's law of long diffusive conductors, along with a brief description of the modern nano-transistor. We then address fundamental conceptual issues related to the meaning of resistance on an atomic scale, the interconversion of electricity and heat, the second law of thermodynamics and the fuel value of information. Finally we introduce the concepts of quantum transport as applied to modern nanoscale electronic devices.

Learning Outcomes: 1. Perform semi-classical analysis of charge flow in nanoelectronic devices. 2. Perform semi-classical analysis of the interconversion of heat and electricity in nanoelectronic devices. 3. Perform quantum analysis of nanoelectronic devices. Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance and the two Landauer formulas. Credits: 1.00

ECE 50632 - Introduction To Quantum Transport

Credit Hours: 1.00. This course introduces the Schrödinger equation, uses the tight-binding method to discuss the concept of bandstructure and E(k) relations, along with simple quantum transport problems. No prior background in quantum mechanics or statistical mechanics is assumed.

Learning Outcomes: 1. Explain tight-binding model, reciprocal lattice and evaluate dispersion relation. 2. Explain NEGF equations, dephasing, quantum point contact and evaluate quantities like the transmission, the self-energy and spectral functions. 3. Use Pauli spin matrices and evaluate quantities like spin density. Credits: 1.00

ECE 50633 - Boltzmann Law: Physics To Computing

Credit Hours: 1.00. This course introduces the key concepts of equilibrium statistical mechanics leading to the celebrated Boltzmann law and how it leads to Boltzmann machines and related concepts in modern machine learning. No prior background in statistical mechanics is assumed.

Learning Outcomes: 1. Explain the law of equilibrium and entropy. 2. Understand the operation of Boltzmann machines. 3. Understand the operation of quantum circuits. Credits: 1.00

Semiconductor Materirals, Characterization, and Processing

CHE 42000 - Process Safety Management And Analysis

Credit Hours: 3.00. Develop knowledge of process safety management and analysis in the process industries, including hazard identification, hazard analysis and risk management.

Learning Outcomes: 1. Demonstrate knowledge and understanding of the elements of process safety management. 2. Apply the techniques, analytical skills, and modern computational tools necessary for performing process safety calculations in the design of safety. 3. Demonstrate an understanding and appreciation of the need for professional integrity and ethical decision making to promote safety in the workplace. 4. Be able to pro-actively identify and analyze safety hazards. 5. Demonstrate an understanding of the detrimental effects of the unsafe operation of chemical facilities on environmental, health, and safety issues and other public interests. Our graduate will be aware of the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 6. Demonstrate knowledge and understanding of risk management tools, programs and processes associated with process safety. Credits: 3.00

CHE 45600 - Process Dynamics And Control

Credit Hours: 3.00. Dynamic response and control of chemical processing equipment, such as heat exchangers, chemical reactors, and absorption towers. Use is made of fundamental techniques of servomechanism theory, such as block diagrams, transfer functions, and frequency response. Introduction to advanced control techniques.

Learning Outcomes: 1. Develop a physically relevant mathematical model as a surrogate for a chemical process. 2. Apply appropriate analytical and computer packages for analyzing

the process control behavior based on the developed model. 3. Design, model, and test a hierarchical control system on a complex process. 4. Describe the role of process control in meeting stringent safety, economic, environmental, societal, and corporate goals. 5. Describe the building blocks of process control and their synthesis for providing complete process control solutions. 6. Work effectively in a team to execute process control computer-based assignments in a professional and ethical manner. Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

IE 38300 - Integrated Production Systems I

Credit Hours: 3.00. Basic concepts in the design and operational control of integrated production systems. Includes topics on facility layout and material handling, material flow and information flow, resource and capacity planning, and shop floor control and scheduling.

Credits: 3.00

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

MSE 49700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

ME 36300 - Principles And Practices Of Manufacturing Processes

Credit Hours: 3.00. Manufacturing processes for engineering materials, both metallic and non-metallic. Fundamentals of manufacturing processes with a "hands-on" laboratory sequence. Analysis and design of processes for various engineering materials and their link to engineering design. Hands-on experiences through laboratory experiments and demonstrations. Not open to students with credit in IE 37000.

Credits: 3.00

NUCL 42001 - Radiation Interaction With Materials And Applications

Credit Hours: 3.00. Fundamental of radiation interaction with materials and applications, types of radiation and radiation sources, physical mechanisms of radiation interaction with solids, radiation damage, ion mixing, applications in nuclear fission and fusion reactors, applications in materials synthesis.

Learning Outcomes: 1. Learn the types and sources of radiation. 2. Understand the physical mechanisms of radiation interaction with materials and model these interactions quantitatively. 3. Understand and model the phenomenon of radiation damage to bulk, surfaces and interfaces. 4. Relate the concepts of radiation damage to neutron interaction with solids in both fission and fusion reactors. 5. Understand the technological applications of

radiation interaction with materials. Credits: 3.00

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

IE 57000 - Manufacturing Process Engineering

Credit Hours: 3.00. Theories and applications of materials forming and removal processes in manufacturing, including product properties, process capabilities, processing equipment design, and economics. A systems approach to all aspects of manufacturing process engineering.

Credits: 3.00

IE 57900 - Design And Control Of Production And Manufacturing Systems

Credit Hours: 3.00. Design and control of discrete part manufacturing systems in contemporary production environments, with emphasis on flexible, demand-driven, product-based manufacturing. Currently used planning and control methodologies, such as MRP, OPT, and JIT are reviewed and integrated with appropriate facility design methodologies, including cellular design algorithms. Introduction to Computer Integrated Manufacturing (CIM) architecture and reference models and relevant control procedures, including basis approaches to appropriate data management methodologies.

Credits: 3.00

IE 58300 - Design And Evaluation Of Material Handling Systems

Credit Hours: 3.00. Analysis for design and evaluation of material handling systems with emphasis on material flow control and storage. Analytic models and simulation used. Economic justification models for material handling systems.

Credits: 3.00

MSE 50200 - Defects In Solids

Credit Hours: 3.00. Structures and interactions of point, line, and planar defects in solids, with emphasis on properties of defects. Generic basis of defect energies and interactions, with reference to specific materials and material classes as examples. Types of point defects found in crystals, their origins, interactions, and motion. Overview of dislocation theory and point-defect/dislocation interactions. Structural aspects of surfaces and interfaces, including point and line defect interactions.

Credits: 3.00

MSE 51000 - Microstructural Characterization Techniques

Credit Hours: 3.00. A broad variety of analytical tools will be presented. The intent is to allow the student to make an educated selection of characterization techniques, or critical analysis of published data, for materials and defect analysis. The techniques will be assessed in terms of the probe type and material response, of what device and specimen requirements are typical, and of what data can or cannot be derived from each type of analysis.

Credits: 3.00

MSE 52300 - Physical Ceramics

Credit Hours: 3.00. Physical and chemical processes responsible for microstructure development in modern ceramic materials, and the relationship between microstructures and physical properties. The material covered is divided into three parts: solid state processes, including structural defects, diffusion, sintering and grain growth, reaction rates, nucleation and growth, and microstructure development; mechanical and thermal behavior, including deformation, strength, thermal properties, and thermal and compositional stresses; and electrical and magnetic behavior, including electrical conductivity, dielectric properties, and magnetic properties. Offered in alternate years.

Credits: 3.00

MSE 54800 - Deposition Processing Of Thin Films And Coatings

Credit Hours: 3.00. Processing and microstructural development of thin films and layered structures. Includes vapor, liquid, and reactive processing, as well as layer modification by annealing and beam techniques. Offered in alternate years.

Learning Outcomes: 1. List the detailed sequence of steps required for CVD (or sputter or MBE) film deposition and quantify the parametric dependence of these steps. 2. Explain the process and film requirements for an epitaxial (or columnar or amorphous) film. 3. Discuss the differences between different evaporation processes. 4. Compare the advantages and disadvantages of techniques used to suppress reactivity (a) of the materials during deposition and (b) of the material with the substrate. 5. Explain the importance of materials and process parameters during laser annealing. 6. List material and process critical

factors for specific films in at least three different functional classes of film applications. 7. Communicate in detail the importance, use, and production method of a particular functional film in a manner understandable by other students. 8. Explain the importance and critical issues involved in the following film deposition processes: CVD, PVD, Electrochemical, thermal spray, lithography. 9. Explain the broad issues involved in processing each different type of material class: metals, ceramics, polymers, semiconductors, composites, and functionally graded materials. Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 55700 - Design For Manufacturability

Credit Hours: 3.00. Introduction to manufacturing concerns, such as efficient design, producibility, and quality, which must be considered early in the engineering design process. Topics include the product development cycle, manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, Taguchi's robust design methodology, life cycle engineering, and reliability. Laboratory projects in the area of tolerancing, assembly, and manufacturability are included along with a project from industry in which the students can disassemble, analyze, and redesign a product while obtaining feedback from industry concerning manufacturability.

Credits: 3.00

NUCL 52000 - Radiation Effects And Reactor Materials

Credit Hours: 3.00. Introduction to radiation effects in solids and a survey of nuclear reactor materials. Radiation interaction mechanisms and effects on properties. Reactor material characteristics, selection criteria, testing, and economic considerations.

Credits: 3.00

NUCL 55300 - Nano-Macro Scale Applications Of Nuclear Technology

Credit Hours: 3.00. Introduction of the principles of nuclear science and engineering for addressing industrial and scientific issues ranging from sub-nano-to-macro scales. Areas to be covered include: propulsion, high-energy density materials, supercooling, medical applications, sonoluminescence, novel detection systems for special nuclear and contraband materials, and advanced nuclear fusion power systems.

Credits: 3.00

CHE 56400 - Organic Electronic Materials And Devices

Credit Hours: 3.00. This course introduces the synthesis, optoelectronic properties, transport physics, and device operation of organic and hybrid electronic materials and devices. This course will review how the molecular architecture of small molecule and polymer semiconductors can be tuned to alter the optoelectronic properties of the materials in solution and in the solid state. A number of relevant materials interactions will be covered, including: photoexcitation and recombination, intermolecular charge transport mechanisms, and energy transfer processes. Additionally, we will observe how these processes are relevant to applications such as organic field-effect transistors (OFETs), organic light-emitting diodes (OLEDs), organic photovoltaic (OPV) devices, and organic memory elements. Finally, a new type of organic-inorganic hybrid material called hybrid halide perovskite will be introduced.

Learning Outcomes: 1. Identify common mechanisms for the synthesis of small molecule and polymer semiconductors. 2. Describe the mechanism of controlled polymerization techniques for macromolecular semiconductors. 3. Interpret spectroscopic, chromatographic, and molecular characterization data in order to predict the structure of the organic semiconductor. 4. Explain how the molecular structure of an organic semiconductor will affect its thermal, structural, and optoelectronic properties. 5. Explain how x-ray and neutron scattering can be utilized to determine the Angstrom and nanometer length scale structural features of the organic semiconductors. 6. Apply principles of electron microscopy to comprehend how to image soft materials. 7. Determine the domain spacing and microstructural architecture of organic semiconductors given a scattering pattern. 8. Explain how molecular orbital levels are related to the optoelectronic properties of organic semiconductors. 9. Distinguish between

different models for charge transport in organic semiconductors. 10. Describe clearly the difference between charge generation and transport in organic and inorganic semiconductors. 11. Explain how organic electronic devices operate and how apply known equations to evaluate device performance. 12. Critique the potential for organic electronic materials to supplement or replace inorganic semiconducting devices. Credits: 3.00

Integrated Circuit & System Design, Electronic Design Automation

ECE 33700 - ASIC Design Laboratory

Credit Hours: 2.00. Introduction to standard cell design of Application Specific Integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and verification.

Learning Outcomes: 1. Design combinational and sequential logic in a variety of styles and awareness of resource usage. 2. Use, modify, create scripts to control logic synthesis. 3. Create a test bench and use it to verify a design that incorporates multiple sequential blocks. 4. Place, route, and verify timing of an ASIC design. 5. Determine the RTL architecture implied by HDL code of moderate complexity. 6. Explain the difference between various ASIC and digital system design approaches - standard cell, full custom, and programmable device. Credits: 2.00

ECE 45500 - Integrated Circuit Engineering

Credit Hours: 3.00. Analysis, design, and fabrication of silicon bipolar and MOSFET monolithic integrated circuits. Consideration of amplifier circuit design and fabrication techniques with circuit simulation using Spice-2. Integrated operational amplifiers with difference amplifiers, current sources, active loads, and voltage references. Design of IC analog circuit building blocks.

Credits: 3.00

ECE 45600 - Digital Integrated Circuit Analysis And Design

Credit Hours: 3.00. As applied t digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential, and dynamic logic circuits are considered. While the focus of the course is on CMOS technology, bipolar, nMOS, and BiCMOS circuits are introduced as well. SPICE is used as both an analysis and design tool. Semiconductor memory circuits are also discussed.

Credits: 3.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system. Credits: 4.00

ECE 51220 - Applied Algorithms

Credit Hours: 3.00. Solving large-scale problems typically rely on many clever data structures and algorithms. This course aims to cover many such useful algorithms for solving large-scale problems. These algorithms include greedy algorithms, dynamic programming and more advanced graph algorithms. The course also aims to demonstrate how such algorithms can be applied to solve optimization problems encountered in engineering applications. In particular, applications in the design of VLSI (very large scale integration) at circuit, layout, or system level will be used to demonstrate how an engineering problem can be formulated as a tree/graph problem and solved using established tree/graph algorithms.

Learning Outcomes: 1. Demonstrate an understanding of greedy algorithms and dynamic programming (ABET outcome 1). 2. Demonstrate an n understanding of advanced graph algorithms (ABET outcome 1). 3. Demonstrate an ability to design and implement appropriate data structures and algorithms for engineering applications (ABET outcomes 1 and 2). Credits: 3.00

Electronics Packaging, Heterogeneous Integration, and Thermal Management

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

Semiconductor Manufacturing and Global Supply Chain Management

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the

results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

IE 38600 - Work Analysis And Design I

Credit Hours: 3.00. Fundamentals of work methods and measurement. Applications of engineering, psychological, and physiological principles to the analysis and design of human work systems.

Credits: 3.00

IE 48400 - Integrated Production Systems II

Credit Hours: 3.00. Extensions of topics on the design and operational control of integrated production systems. Includes production databases, facility layout, material handling, advanced control and scheduling, and physical distribution. Case studies, lab assignments, and projects.

Credits: 3.00

IE 48600 - Work Analysis And Design II

Credit Hours: 3.00. Continuation of IE 38600 . Applications of engineering, computer sciences, information sciences, and psychological principles and methods to the analysis and design of human work systems.

Credits: 3.00

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.

Credits: 1.00 to 6.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 53300 - Industrial Applications Of Statistics

Credit Hours: 3.00. The application of statistics to the effective design and analysis of industrial studies relating to manufacturing and human factors engineering in order to optimize the utilization of equipment and resources. Emphasis on conducting these studies at the least cost.

Credits: 3.00

IE 55800 - Safety Engineering

Credit Hours: 3.00. Application of human factors and engineering practice in accident prevention and the reduction of health hazards are presented. The objective of this course is to provide an understanding of the safety and health practices which fall within the responsibilities of the engineer in industry. Special attention is devoted to the detection and correction of hazards and to contemporary laws and enforcement on occupational safety and health.

Credits: 3.00

IE 56600 - Production Management Control

Credit Hours: 3.00. Background and development of production management, plus current concepts and controls applicable to production management functions. Not open to Industrial Engineering students with a minor in management.

Credits: 3.00

IE 58200 - Advanced Facilities Design

Credit Hours: 3.00. Study of the theoretical and applied aspects of manufacturing systems layout. Emphasis on contemporary manufacturing, including the layout of cellular systems, automated material handling systems, and storage systems.

Credits: 3.00

MGMT 46200 - Advanced Manufacturing Planning And Control Systems

Credit Hours: 3.00. The course examines key concepts in the planning, control, and improvement of processes in manufacturing and service operations. Specific topics covered in the course include: (i) Product/service characteristics that provide value to customers and competitive priorities, (ii) Role of processes and key operations choices to support the competitive priorities, (iii) Process analysis and scheduling, (iv) Throughput principles to deal with adverse impacts of process uncertainties and bottlenecks, (v) Managing capacity and lead times, (vi) Throughput principles to deal with wastes and errors, including the Toyota Production System and Lean Operations, and (vii) Coordinating material/order flows in supply chain - MRP, and Resources and Production Planning - Aggregate Production Planning. The class uses a combination of lectures, cases, simulations, outside speakers, experiential exercises, and student presentations. An important component of the course is a hands-on exercise where students in teams of seven

or eight design and run a production process to meet demand for a quality-conscious customer. The teams then present the lessons learned to the class.

Learning Outcomes: 1. Learn the details of production planning, master scheduling, materials planning, short range capacity planning, production floor execution, and quality control. Credits: 3.00

MGMT 40500 - Six Sigma And Quality Analytics

Credit Hours: 3.00. The course is an undergraduate elective offered as part of the Center for Manufacturing Management Enterprises (CMME) quality initiatives. Provides an overview of various tools and methods for total quality management.

Learning Outcomes: 1. Make data driven conclusions and decisions for quality management operations through working on various business cases. 2. Apply previously gained statistical knowledge to understand and to analyze data. 3. Gain some advanced analytical technics such as Analysis of Variances (ANOVA) and Design of Experiment (DOE) to optimize obtaining data and learnings. 4. Master a simple yet powerful MINITAB software to carry out complex tasks. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

MGMT 26100 - Introduction To Supply Chain Management

Credit Hours: 3.00. This course seeks to introduce general concepts in supply chain management, including procurement, supply planning, demand planning, and logistics. This course is designed around a corporate partnership to provide students with the opportunity to collaborate on solving a large-scale

supply chain challenge. In the first five weeks of the semester, students will be introduced to basics of SCM through lectures, cases, and assignments. Beginning in the sixth week, students will form teams to work on a real-world case presented by the corporate partner, a complex problem broken down into six learning areas, each with a corresponding deliverable.

Learning Outcomes: 1. Define, measure, and recommend improvements to an organization's supply chain. 2. Gain experience in applying these skills to a real-world business problem. 3. Learn about the different aspects of supply chain management. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

Space Engineering Certificate

About the Certificate

Requirements for the Certificate (16 credits)

Space Engineering Seminar (1 credit)

ENGR 10351 - Space Engineering Seminar

Credit Hours: 1.00. The purpose of this course is to help you see and appreciate the multi-disciplinary nature of space engineering, to give you an awareness that will aid you in developing your career. Space engineering includes a vast number of topics where expertise is needed by industry and NASA and a good understanding of this if vital to finding opportunities for your own interest and expertise to start you on a career.

Learning Outcomes: 1. Identify multiple career paths pursued by people in aerospace with various degrees; including those of people still working in aerospace and those of people who used their aerospace engineering degree as a basis for a career in a different field. 2. Recognize the broad range of products, topics, applications and systems on which aerospace engineers work. 3. Understand the variety of topical expertise needed for space commerce and exploration. 4. Have an awareness of issues related to inclusion and intercultural teams. Credits: 1.00

Primary Space Industry (9 credits)

Habitat Design including ISRU

CE 47300 - Reinforced Concrete Design

Credit Hours: 4.00. Design and behavior of reinforced concrete beams, one-way slabs, and columns.

Credits: 4.00

CE 47400 - Structural Analysis II

Credit Hours: 3.00. Determination of deflections by the method of virtual work; analysis of trusses, continuous beams, and frames by direct stiffness method; approximate methods of

analysis.

Credits: 3.00

CE 48300 - Geotechnical Engineering II

Credit Hours: 3.00. Subsurface investigations and techniques for sampling soils, lateral earth pressures, and stability of retaining structures; stability of earth slopes; shallow and deep foundations design.

Credits: 3.00

AAE 55200 - Nondestructive Evaluation Of Structures And Materials

Credit Hours: 3.00. Overview of methods employed for nondestructive evaluation of structures and materials taught in the context of damage tolerant structural analysis. Major inspection topics include: radiography, ultrasonics, eddy current, penetrant, magnetic, and visual/optical techniques. Other new emerging inspection techniques also are discussed. Offered in alternate years.

Credits: 3.00

AAE 55300 - Elasticity In Aerospace Engineering

Credit Hours: 3.00. A basic course in the theory of elasticity with emphasis on understanding the fundamental principles and solution techniques used in the stress analysis of structures. Cartesian tensors. Governing equations for linear elasticity. Rigorous derivation of beam and plate equations from the three-dimensional elasticity equations. Torsion. Thermoelasticity. The stress functions and complex functions approaches to two-dimensional problems. Energy methods and approximate solutions. Three-dimensional problems. Knowledge of differential equations assumed.

Learning Outcomes: 1. Give student an in-depth background in mechanics of solids including large deformation, and the ability to perform stress analyses in elastic bodies, especially two-dimensional bodies. Credits: 3.00

AAE 55400 - Fatigue Of Structures And Materials

Credit Hours: 3.00. Development and application of methods for predicting the fatigue life of structural components. Characterization and response of materials to cyclic loading. Fatigue resistant design of aerospace structures. Both fatigue crack initiation and crack propagation concepts are discussed.

Credits: 3.00

AAE 55800 - Finite Element Methods In Aerospace Structures

Credit Hours: 3.00. Introduction to the use of advanced finite element methods in the calculation of deformation, strain, and stress in aerospace structures. Topics include: 1-D, 2-D, 3-D, and axisymmetric elements, isoperimetric element formulation, convergence, treatment of boundary conditions and constraints. Special topics include stability, dynamic analysis, and nonlinear material behavior. Emphasis is on the theoretical knowledge of the finite element method. Applied experience is gained by solution of aerospace structural analysis problems through use of professional software.

Credits: 3.00

CE 57000 - Advanced Structural Mechanics

Credit Hours: 3.00. Studies of stress and strain, failure theories, and yield criteria; flexure and torsion theories for solid and thin-walled members; and energy methods.

Credits: 3.00

CE 57100 - Earthquake Engineering

Credit Hours: 3.00. The objectives of the course are to: (1) expose the fundamentals of structural design in earthquake regions; (2) explain the functions of linear, nonlinear, and limit analyses with respect to design; (3) describe the complex relationships between ground motion models and structural response models in the linear and nonlinear response ranges; and (4) provide the students perspectives about the behavior of building structures in the earthquake environment.

Credits: 3.00

CE 57300 - Structural Dynamics

Credit Hours: 3.00. Analysis of structural members and systems subject to dynamic loads such as wind and earthquake loads; basic theory for single-degree-of-freedom and multi-degree-of-freedom analytical models of civil engineering structures; free vibration, harmonic and transient excitation, foundation motion, resonance spectrum, Lagrange's equation, modal analysis, lumped parameter methods, computer methods.

Credits: 3.00

CE 57600 - Advanced Reinforced Concrete Design

Credit Hours: 3.00. Design and behavior of columns, two-way slab and slab-beam floor systems, and beam-column joints; strut-and-tie models.

Credits: 3.00

CE 59500 - Finite Elements In Elasticity

Credit Hours: 3.00. Fundamentals of theory of elasticity; variational principles; one-, two-, and three-dimensional elasticity finite elements; interpolation methods; numerical

integration; convergence criteria; stress interpretation.

Credits: 3.00

ME 56200 - Advanced Dynamics

Credit Hours: 3.00. Dynamics of multi-degrees-of-freedom mechanical systems. Holonomic and nonholonomic constraints. Lagrange's equations of motion. Hamilton's principle for holonomic systems. Kinematics and kinetics of rigid body motion, including momentum and energy methods. Linearized equations of motion. Classification of vibratory systems - gyroscopic, circulatory forces. Stability of linear systems - divergence and flutter. Applications to gyroscopes, satellite dynamics, etc.

Learning Outcomes: 1. Develop an understanding of the principles governing the motion of mechanical systems modeled as rigid bodies. 2. Develop an ability to analyze rigid-body kinematics in stationary as well as moving frames of reference. 3. Develop an ability to use Newton-Euler laws of rigid body motion. 4. Develop an understanding of the fundamental concepts in analytical dynamics, and the ability to use them to formulate the equations of motion for rigid bodies and systems. Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different

models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

Habitat Life Support/Thermal

CE 41300 - Building Envelope Design And Thermal Loads

Credit Hours: 3.00. This course discusses the basic thermal processes in buildings and presents comprehensive methods for thermal design of envelope assemblies in commercial and residential buildings. The first part of the course includes steady-state transient conduction through envelope assemblies, convection and radiation heat transfer in buildings, solar radiation and solar gains, thermal performance of windows, internal gains, ventilation and infiltration. The second part of the course considers surface and room energy balance equations and presents analytical and computational models for calculation of hourly heating and cooling loads throughout the year. Climate-based standards, passive solar design, advanced energy guides, and innovative technologies for high performance buildings are discussed. The course also includes a design project on analytical heating/cooling load calculations for a commercial building.

Learning Outcomes: 1. Calculate heat transfer through envelope assemblies for commercial and residential buildings. 2. Solve energy balance equations for building surfaces and room air. 3. Calculate solar and internal gains and predict transient hourly heating and cooling loads for a building throughout the year using analytical and computational models. 4. Design building envelopes according to national standards. 5. Understand principles of passive solar design and the application of innovative envelope technologies. Credits: 3.00

ME 41500 - Energy Systems Engineering

Credit Hours: 3.00. Application of Thermodynamics, fluid mechanics, and heat transfer fundamentals to the design of energy systems. Applications include thermal regulation in buildings, electronic equipment, energy generation, conversion, and storage, manufacturing processes, and combustion processes. Beyond the fundamentals, this course will focus on design and analysis techniques, including analysis of energy costs, economics, and environmental issues.

Credits: 3.00

ME 41800 - Engineering Of Environmental Systems And Equipment

Credit Hours: 3.00. Design and analysis of systems and equipment used in conditioning buildings. Review of fundamentals in thermodynamics, heat transfer, fluid mechanics, economics, non-linear equation solving, optimization. Analysis of building heating and cooling requirements for design and annual energy use. Design and selection of equipment.

Credits: 3.00

CE 51401 - Building Controls

Credit Hours: 3.00. This course is designed to provide students with the knowledge of fundamentals, design, and analysis for building control systems. It primarily consists of three parts. The first part covers basic concepts, terminology, procedures and computations of control systems including block diagrams & transfer function, open-loop & closed-loop control, control system modeling, time response, root locus techniques, design via root locus, and digital control systems. The second part focuses on issues surrounding the building controls: interfacing components such as sensors and actuators, problems encountered, and state-of-the-art solutions for building energy efficiency and thermal comfort. The third part aims to develop students' ability to convert control system concepts into real building control sytems. The course provides a hand-on opportunity for students to complete three projects associated with the three primary components during the semester: indoor environmental quality assessment, building HVAC system commissioning and its control analysis, and new control algorithm development for building energy efficiency, occupant health, and individual productivity.

Learning Outcomes: 1. Demonstrate basic

HVAC processes and explain the function, layout, and operation of commercial HVAC systems. 2. Analyze the function, operating characteristics, and appropriate applications of basic control loops and control modes as found in direct digital, analog electronic, electronic and pneumatic commercial control systems. 3. Understand and program a sequence of control, lay out a control system logic diagram and program it into a DDC controller. 4. Understand the function of network devices and network protocols such as a bridge, router, gateway, hub, firewall, Ethernet, TCP/IP, BacNet, and Lon Talk. 5. Use general-purpose and specific building automation software to monitor and control a building HVAC system. 6. Numerically model a building to define the key control parameters for thermal comfort. 7. Develop and program alternative control algorithms for building HVAC systems in order to enable sustainable buildings. Credits: 3.00

ME 50100 - Statistical Thermodynamics

Credit Hours: 3.00. The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Introduction to quantum mechanics and molecular spectroscopy. The Maxwell-Boltzmann formulation of statistical mechanics and applications to ideal gases, solids, radiation, and laser diagnostics. The Gibbs formulation of statistical mechanics and application to real gases. Kinetic theory and applications to transport properties and chemical kinetics. Offered in alternate years.

Learning Outcomes: 1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena. 2. Apply concepts and calculate thermodynamic and transport properties of ideal gases. 3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements. Credits: 3.00

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 51100 - Heat Transfer In Electronic Systems

Credit Hours: 3.00. This course covers both traditional and more innovative methods for heat extraction in electronic systems and the effectiveness and applicability of these methods over a wide range of scales. Special emphasis is given to industry-related applications with experts often attending and presenting material as part of class instruction.

Learning Outcomes: 1. Introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practicing engineers. 2. Provide an appreciation for the applications of first principles to electronics cooling and packaging problems in

industry. 3. Provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge. Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

Habitat Robotic Construction

CE 48300 - Geotechnical Engineering II

Credit Hours: 3.00. Subsurface investigations and techniques for sampling soils, lateral earth pressures, and stability of retaining structures; stability of earth slopes; shallow and deep foundations design.

Credits: 3.00

ECE 32100 - Electromechanical Motion Devices

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Learning Outcomes: 1. Analyze/design electromagnetic circuits/devices. 2. Understand the concepts and principles of electromagnetic energy conversion. 3. Understand the concept of time-varying transformations in the analysis of time-varying systems. 4. Analyze dc machines. 5. Understand converters for dc drives. 6. Analyze brushless dc machines. 7. Analyze induction machines. Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

EAPS 55700 - Introduction To Seismology

Credit Hours: 3.00. Theory of propagation to seismic waves in elastic media. Solution of wave equations for compressional, shear, and surface waves. Analysis of travel-times, amplitudes, and attenuation of seismic waves in terms of ray and wave theory. Principles of the seismograph. Structure of the earth as determined by seismological studies. Investigation of the causes, effects, distribution, and characteristics of earthquakes. Earthquake prediction.

Credits: 3.00

AAE 55200 - Nondestructive Evaluation Of Structures And Materials

Credit Hours: 3.00. Overview of methods employed for nondestructive evaluation of structures and materials taught in the context of damage tolerant structural analysis. Major inspection topics include: radiography, ultrasonics, eddy current, penetrant, magnetic, and visual/optical techniques. Other new emerging inspection techniques also are discussed. Offered in alternate years.

Credits: 3.00

ME 57200 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. Introduction to the analysis and design of robotic manipulators. Topics include: kinematic configurations, forward and inverse position solution, velocity and acceleration,

path planning, workspace analysis, force and torque solutions, rigid body dynamics, motors and actuators, robot design, sensors and controls, computer simulation, and graphical animation.

Learning Outcomes: 1. Analysis of manipulator motion and forces. 2. Manipulator design including actuator, drive, and sensor issues. 3. Computer simulation to predict motion and forces. Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

Secondary Space Industry (3 credits)

Communications and Cybersecurity in Space

AAE 44000 - Spacecraft Attitude Dynamics

Credit Hours: 3.00. Description of orientation, angular velocity, and angular acceleration in terms of direction cosines, Euler parameters, and angles. Forces and moments acting on space vehicles. Attitude stability of various types of satellites in circular and elliptic orbits. Spin stabilization and gravity gradient torques. Gyroscopic devices and energy dissipation. Introduction to attitude control.

Credits: 3.00

ECE 40400 - Introduction To Computer Security

Credit Hours: 3.00. Introduction to security issues related to the operation of computers and the workings of computer networks. Topics covered include introduction to cryptography, authentication protocols, digital signature algorithms, internet vulnerabilities, worms and virus propagation, denial of service attacks, etc. The students will also learn how to design firewalls to protect a system against unwanted intrusions. Permission of department required.

Credits: 3.00

ECE 43800 - Digital Signal Processing With Applications

Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; short-time spectral analysis and synthesis; linear predictive coding. Image processing: two-dimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credits: 4.00

ECE 44000 - Transmission Of Information

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Learning Outcomes: 1. Recognize and analyze in the time and frequency domain the performance of amplitude and frequency modulated analog communications systems in the presence of noise. 2. Understand the

importance, computation, and measurement using modern test equipment of standard performance measures of analog systems, which include bandwidth and signal to noise ratio. 3. Recognize and analyze in the time and frequency domains the performance of various digital modulation formats, including ASK, QAM, PSK, and FSK in the presence of noise. 4. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of digital systems which include bandwidth and hit error probability. 5. Understand the basics of information theory and error control codes including the effect of error control codes on the bandwidth and bit error probability of digital systems. Credits: 4.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 41500 - Advanced Coding Security

Credit Hours: 3.00. This course allows students to gain proficiency in secure coding principles. Security risks from common coding errors are examined. Techniques for integrating secure coding practices into the development process is detailed with an emphasis on ensuring that applications are designed and implemented with proper security requirements.

Learning Outcomes: 1. Analyze and apply secure coding standards and practices. 2. Understand common programming errors that

lead to software vulnerabilities. 3. Demonstrate independent critical thinking and problem solving skills for effective mitigation strategies of security flaws. 4. Understand and apply systems development methodologies. Credits: 3.00

CNIT 41700 - Critical Infrastructure Security

Credit Hours: 3.00. In the socio-political context of nation state sponsored threat actors and cyber cold wars, critical infrastructure (such as water supply and power generation) is a strategic target for attackers. This course investigates the current threat landscape and vulnerabilities in critical infrastructure. Students then investigate system and network architectural solutions to the problem. Students build a model industrial system and will implement these protections in their model environment.

Learning Outcomes: 1. Assess system architectures of industrial control networks to identify sources of vulnerability. 2. Analyze the threat landscape associated with industrial control environments. 3. Build and validate controls in a model industrial control network. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

Science Missions and Space as a Laboratory

AAE 41800 - Zero-Gravity Flight Experiment

Credit Hours: 3.00. Team-based design-build-test engineering experience to maximize the benefits of student participation in the NASA Reduced Gravity Student Flight Opportunity Program (or similar). Gravity, orbits, and weightlessness. Low-gravity capillary fluid physics, scaling laws, and components. Experiment design for multiple short zero gravity test times. Technical proposal writing, design for manufacturability, experiment fabrication, planning, testing, and execution.

Credits: 3.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and

karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

EAPS 38500 - Principles Of Engineering Geology

Credit Hours: 3.00. Application of geology to evaluation of design and construction problems relating to dams, highways, tunnels, and reservoirs; review of construction material sources and their utilization. A field investigation is required. Prior course work in mineralogy, petrology or geology for engineers is required.

Credits: 3.00

EAPS 55600 - Planetary Surface Processes

Credit Hours: 3.00. The application of petrology and structural geology to other planets. Topics include: theories of star and solar system formation, orbital dynamics and Kepler's laws, petrology and geochemistry of meteorites, age dating techniques, structure and composition of the terrestrial, giant, and icy planets, planetary surfaces, planetary atmospheres, and theories of the formation of the moon. Offered in alternate years. Prior course work in earth materials is required.

Learning Outcomes: 1. Understand the physical and chemical principles behind processes that modify planetary surfaces. 2. Identify planetary surface features in orbital imagery and use observational evidence to postulate their origin and modification histories. 3. Gain field experience with planetary surface processes and landforms at local planetary analog sites. 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic. Credits: 3.00

EAPS 55700 - Introduction To Seismology

Credit Hours: 3.00. Theory of propagation to seismic waves in elastic media. Solution of wave equations for compressional, shear, and surface waves. Analysis of travel-times, amplitudes, and attenuation of seismic waves in terms of ray and wave theory. Principles of the seismograph. Structure of the earth as determined by seismological studies. Investigation of the causes, effects, distribution, and characteristics of earthquakes. Earthquake prediction.

Credits: 3.00

AAE 51800 - Low-Gravity Fluid Dynamics

Credit Hours: 3.00. Theory and design for control of liquid propellants in weightlessness. Gravity and orbits review. Satellite and space-probe acceleration environments. Capillary-dominated fluid dynamics: contact angle, surface tension, curvatures, and solution methods. Industry practice and current topics.

Credits: 3.00

ECE 57700 - Engineering Aspects Of Remote Sensing

Credit Hours: 3.00. Introduction to the concepts of multispectral image data generation and analysis. Basic principles of optical radiation, reflection, and measurement in natural scenes. Fundamentals of multispectral sensor design and data analysis for complex scenes. Application of signal processing and signal design principles and of statistical pattern recognition to these problems. Spatial image processing methods and algorithms as

appropriate to land scene data. Practice with analysis of actual aircraft and spacecraft data in a cross-disciplinary environment. Offered even years.

Learning Outcomes: 1. Knowledge of a number of important technologies based on multispectral/hyperspectral remote sensing and related image processing techniques. 2. Knowledge of machine learning techniques such as deep learning for remote sensing technologies. 3. Knowledge of developments in the areas of statistical analysis for remote sensing. 4. Knowledge of a number of other topics, such as MATLAB and Python for remote sensing algorithms. 5. Ability to utilize the theoretical analysis of topics based statistical pattern recognition and machine learning for various system designs. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.

Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application. Credits: 3.00

EAPS 44500 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the planetary sciences curriculum. Components include analysis methods for preliminary design, development of an initial spacecraft and mission concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with science operation, science objectives, and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Learn how to generate a Science Traceability Matrix. 6. Prioritize design

requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

EAPS 36700 - Survey Of Planetary Atmospheres

Credit Hours: 3.00. This course is intended to serve as an introduction to the diversity of planetary atmospheres in our solar system and beyond for those without an atmospheric science background. Topics to be covered in this class include: The basic structure and properties of an atmosphere, how planetary atmospheres form / are eroded, the balance of radiation and its effect on atmospheric motions, the presence and formation of hazes, clouds, and aerosols, fundamental atmospheric compositions and chemistry, the connections between planetary interiors, surfaces, and atmospheres, and how we measure and interpret observations of exoplanet atmospheres. To achieve this, we will learn about Earth's atmosphere and us our terrestrial template to compare, contrast, and explore the atmospheres of other astronomical bodies.

Learning Outcomes: 1. Gain familiarity with the different types of planetary bodies and the atmospheres that are present on them. 2. Recall the main properties of planetary atmospheres in our solar system. 3. Identify and apply the general properties of the atmospheres. 4. Understand the effect of radiation and distribution of energy in an atmosphere. 5. Recognize the importance of chemical reactions and pathways. 6. Identify the ways in which atmospheres are formed, lost, and evolved. 7. Make simple predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. Credits: 3.00

EAPS 58801 - Impact Cratering

Credit Hours: 3.00. Impact cratering is arguably the most pervasive geologic process in the solar system. In this course, we will study the physical process of impact cratering and its place in planetary science. The course will take a process-oriented approach to understanding impact cratering with firm foundations in geologic observation and impact experiments. To explore the extreme process of impact cratering, we will use continuum/rock mechanics, thermodynamics, numerical modeling, experiments, and observations. Principal topics will include the formation of craters from contact of the projectile to final crater morphology; shock metamorphism; impact ejecta and products; cratered terrains; impacts and planetary evolution; and impact hazards.

Learning Outcomes: 1. Understand the physical principles of impact cratering. 2. Understand how impacts affect target materials. 3. Calculate the effects of the impact (size of crater, volume of melt, etc.). 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic. Credits: 3.00

EAPS 56700 - Planetary Atmospheres

Credit Hours: 3.00. This course is intended to for upper-level undergraduates and graduate students and will provide an in-depth look into the to the diversity of planetary atmospheres in our solar system and beyond. Topics to be covered in this class include: The processes by which atmospheres are constructed and eroded over plants lifetime, radiative balance, general circulation, the formation of hazes, clouds, and aerosols, atmospheric compositions and chemistry, the link between planetary interiors, surfaces, and atmospheres, how we measure and interpret observations of exoplanet atmospheres, and much more. To achieve this, we will briefly introduce the properties and components of an atmosphere, visit the planetary atmospheres in our solar system to learn more, and finally explore exoplanetary atmospheres.

Learning Outcomes: 1. Differentiate between different types of planetary bodies and the atmospheres that are present on them. 2. Recall the main properties of planetary atmospheres in our solar system. 3. Derive underlying physical properties for an atmosphere. 4. Understand and evaluate how atmospheric composition and planet type affect these physical properties. 5. Compare the effect of radiation and the subsequent dynamical motions with the distribution of energy in an atmosphere as a function of stellar type and atmospheric composition. 6. Distinguish the importance of different chemical reactions and pathways (such as those for an oxidizing vs.

reducing atmosphere). 7. Examine the ways in which atmospheres are formed, lost, and evolved, and how this results in the atmospheres we see today. 8. Make detailed predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. 9. Summarize and differentiate between techniques for observing and sampling the planetary atmospheres of our solar system and beyond. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

Space Commerce and Policy

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications

are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

Space Transportation

AAE 33800 - Thermal Sciences

Credit Hours: 3.00. A fundamental course covering a range of topics selected from the disciplines of engineering thermodynamics, fluid mechanics, heat transfer and combustion, with an emphasis on their application to propulsion. This is an entry level course to prepare students for advanced

analysis of propulsion and energy systems. Upon completion of this course, students are expected to be able to apply fundamental principles to perform thermodynamic analysis for thermophysical problems involving fluid flow, heat transfer and combustion.

Learning Outcomes: 1. Identify types of problems from thermo-fluid systems. 2. Perform heat conduction analysis for steady and unsteady problems. 3. Perform analysis for radiation heat transfer. 4. Develop deeper understanding of the laws of thermodynamics and their applications to various problems. 5. Apply fundamentals of fluid mechanics to various fluid flow problems. 6. Analyze convection heat transfer problems. 7. Conduct analysis of simple combustion systems such as adiabatic or chemical equilibrium. 8. Analyze simple thermo-fluid systems using fundamentals we learn from the class. Credits: 3.00

AAE 33900 - Aerospace Propulsion

Credit Hours: 3.00. Survey of air-breathing and rocket propulsion systems for AAE students not in the propulsion option. Thermodynamic cycles, analysis of air-breathing systems and components. Rocket Equation, rocket cycles, liquid and solid propellants, chemical equilibrium.

Learning Outcomes: 1. Knowledge of propulsion applications that use gas turbine engines and rockets. 2. Understanding of the Brayton cycle and ability to calculate enthalpy and work balance. 3. Ability to solve mass, momentum, and energy balances using a control volume approach. 4. Ability to perform top-level performance and sizing calculations of gas turbine engines. 5. Ability to apply Euler's work equation to compressors and turbines to calculate work. 6. Ability to use the Rocket Equation to calculate impulse requirements and size rocket thrusters. Credits: 3.00

AAE 35103 - Aerospace Systems Design

Credit Hours: 3.00. Aerospace system lifecycle and design process. Stakeholder needs elicitation and requirements generation. Quality function deployment and hierarchical objective trees. Concept generation and creativity techniques. Introduction to safety, risk, cost and value analysis. Critical evaluation of the applicability of systems engineering techniques in specific contexts. Application of these techniques to a team semester design project.

Learning Outcomes: 1. Identify appropriate tools, methods and processes to formulate an aerospace system design problem including realistic constraints from technical, economic, social, political, safety, and other relevant contexts. 2. Apply those tools, methods and processes to generate solutions to the aerospace system design problem. Credits: 3.00

AAE 44000 - Spacecraft Attitude Dynamics

Credit Hours: 3.00. Description of orientation, angular velocity, and angular acceleration in terms of direction cosines, Euler parameters, and angles. Forces and moments acting on space vehicles. Attitude stability of various types of satellites in circular and elliptic orbits. Spin stabilization and gravity gradient torques. Gyroscopic devices and energy dissipation. Introduction to attitude control.

Credits: 3.00

AAE 45000 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the aerospace curriculum. Components include analysis methods for preliminary design, development of an initial vehicle concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with spacecraft, rocket and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Demonstrate design viability through testing, both real and virtual. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer

expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

ME 31500 - Heat And Mass Transfer

Credit Hours: 4.00. Fundamentals of heat transfer by conduction, convection, and radiation; mass transfer by convection. Relevance to engineering applications.

Learning Outcomes: 1. Develop the ability to identify the relevant transport processes (heat, momentum and energy) when confronted with a particular problem. [1, 7] 2. Develop the ability to model and analyze heat and mass transfer processes. [1, 2, 3, 5, 7] 3. Augment the ability to design and conduct experiments to solve open-ended engineering problems. [2, 3, 5, 6, 7] 4. Reinforce technical written and oral communication skills through a formal project report. [3, 4, 5] Credits: 4.00

ME 46300 - Engineering Design

Credit Hours: 3.00. Application of the design process to the design of various engineering components and systems. Mathematical modeling in design is emphasized. Design problems from all areas of mechanical engineering are considered.

Learning Outcomes: 1. Reinforce the philosophy that engineering design problems are open-ended and multifaceted. [1, 2, 3, 5] 2. Exercise a collaborative design methodology. [2, 3, 4, 5, 6, 7] 3. Broaden skills in leadership, teamwork, communication, project planning, innovation, design, and entrepreneurship. [3, 5] 4. Experience the application of core course materials, engineering design methods, and testing to practical open-ended design problems. [1, 2, 6] 5. Reinforce a philosophy of professional and ethical behavior. [4] 6. Provide a practical foundation for knowledge acquisition and continued learning as needed in students' future careers. [7] Credits: 3.00

NUCL 35100 - Nuclear Thermal-Hydraulics II

Credit Hours: 3.00. Emphasis is given to the fluid transport of heat from reactor fuel elements. Heat transfer in fluids, analogies, and applications to reactor coolant channel analysis. Two-phase flow and convective boiling. Radiative heat transfer. Applications to safety analysis and reactor design.

Credits: 3.00

NUCL 35500 - Nuclear Thermohydraulics Laboratory

Credit Hours: 3.00. Laboratory course corresponding to NUCL 35000 and NUCL 35100 . Various fluid flow and heat transfer phenomena applied to nuclear reactor systems and design.

Credits: 3.00

AAE 51800 - Low-Gravity Fluid Dynamics

Credit Hours: 3.00. Theory and design for control of liquid propellants in weightlessness. Gravity and orbits review. Satellite and space-probe acceleration environments. Capillary-dominated fluid dynamics: contact angle, surface tension, curvatures, and solution methods. Industry practice and current topics.

Credits: 3.00

AAE 53200 - Orbit Mechanics

Credit Hours: 3.00. Orbit determination of near-earth satellites and various perturbations; libration and attitude control; orbit transfer and interception; lunar theory and interplanetary orbits; ascending mechanics and re-entry.

Credits: 3.00

AAE 53500 - Propulsion Design, Build, Test

Credit Hours: 3.00. Intensive one-semester treatment of the aerospace propulsion component development process. Derivation of design requirements from mission objective to detailed components; the design process. Standard methods for thermostructural, life, performance, and combustion stability design analysis; combustor design. Experimental procedures; fabrication; test. Special topics according to student interest.

Credits: 3.00

AAE 53900 - Advanced Rocket Propulsion

Credit Hours: 3.00. Generalized internal compressible and incompressible flows. Thermochemistry and heat transfer in rocket applications. Advanced topics in solid rocket motor performance and internal ballistics. Liquid rocket engine cycle analysis and turbopump design. Combustion of liquid and solid propellants. Hybrid rockets and thermal-nuclear engines.

Credits: 3.00

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 56200 - Advanced Dynamics

Credit Hours: 3.00. Dynamics of multi-degrees-of-freedom mechanical systems. Holonomic and nonholonomic constraints. Lagrange's equations of motion. Hamilton's principle for holonomic systems. Kinematics and kinetics of rigid body motion, including momentum and energy methods. Linearized equations of motion. Classification of vibratory systems - gyroscopic, circulatory forces. Stability of linear systems - divergence and flutter. Applications to gyroscopes, satellite dynamics, etc.

Learning Outcomes: 1. Develop an understanding of the principles governing the motion of mechanical systems modeled as rigid bodies. 2. Develop an ability to analyze rigid-body kinematics in stationary as well as moving frames of reference. 3. Develop an ability to use Newton-Euler laws of rigid body motion. 4. Develop an understanding of the fundamental concepts in analytical dynamics, and the ability to use them to formulate the equations of motion for rigid bodies and systems. Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and

manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

NUCL 55100 - Mass, Momentum, And Energy Transfer In Energy Systems

Credit Hours: 3.00. Formulations for analyzing complicated thermal-hydraulic phenomena in energy systems. Derivation of two-phase flow field equations and constitutive relations. Thermal-hydraulic modeling of nuclear reactor systems. Analyses of nuclear reactor safety related phenomena based on conservation principles.

Credits: 3.00

AAE 53400 - Spacecraft Electric Propulsion

Credit Hours: 3.00. Spacecraft electric propulsion systems are intended to provide thrust for propelling spacecrafts in interplanetary missions, orbital maneuvers, and attitude control. The course will start with reviewing material on the mechanics and thermodynamics of propulsion, and identifying the niche occupied by the electric propulsion systems. The course will cover elements of plasma physics and electromagnetic theory essential for studying the electric propulsion systems. The core of the course will focus on studying various electric propulsion concepts which utilize electric power produced on-board to generate thrust. Mechanisms of the utilization of the electric power to accelerate gas or plasma and produce thrust will be considered, including electrothermal, electrostatic, electromagnetic, and gasdynamic acceleration mechanisms.

Learning Outcomes: 1. Determine optimal specific impulse of electric propulsion system based on specific mission requirements 2. Demonstrate fundamental understanding of differences between electric and chemical propulsion systems performance and space applications. 3. Calculate basic plasma parameters and characteristics of collisional processes. 4. Demonstrate fundamental understanding of concepts of quasineutrality and collective behavior in plasmas. 5. Perform analysis of electrothermal accelerator at a given frozen flow fraction 6. Apply Maxwell equations in differential and integral forms to solve basic electromagnetism problems 7. Perform analysis of space-charge limited electrostatic accelerator in ion acceleration zone, in deceleration zone, and in neutralization zone. 8. Perform analysis of motion of charged particles in crossed electric and magnetic fields 9. Derive and apply modified forms of Ohm's law in two-component moving plasma in presence of magnetic field. 10. Perform elementary analysis of crossed-field electromagnetic accelerator with small Hall parameter 11. Perform elementary analysis and calculate basic parameters of Hall effect accelerator. 12. Demonstrate fundamental understanding of the differences of acceleration concepts used in Hall effect and in electrostatic accelerators. 13. Calculate body force in magnetoplasmadynamic accelerator. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve

safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

AAE 53300 - Space Traffic Engineering Management

Credit Hours: 3.00. The course teaches the basic techniques and concepts relevant to Space Traffic Management (STM) and Space Situational Awareness (SSA) from a rigorous engineering perspective. The class starts with learning how measurements are collected and processed and then moves on to the non-linear orbital motion and astrodynamics in the near-Earth realm. The focus is on orbit determination and orbit improvement of satellites and space debris to detect new objects and maintain custody of them. Lastly, the class focuses on determining the probability of collision of two resident space objects. At the end of the course, the students are equipped with a fundamental Matlab toolset to investigate their own STM or SSA problems.

Learning Outcomes: 1. Demonstrate fundamental understanding of sustainable use of space. 2. Determine engineering and simulation of information collection for STM. 3. Demonstrate Initial Orbit Determination and Orbit Improvement using passive measurements. 4. Determine Orbital perturbations in the near-Earth and cislunar region. 5. Determine Computation Probability of Collision. Credits: 3.00

In-Space Manufacturing, Assembly, Debris Management

AAE 41800 - Zero-Gravity Flight Experiment

Credit Hours: 3.00. Team-based design-build-test engineering experience to maximize the benefits of student participation in the NASA Reduced Gravity Student Flight Opportunity Program (or similar). Gravity, orbits, and weightlessness. Low-gravity capillary fluid physics, scaling laws, and components. Experiment design for multiple short zero gravity test times. Technical proposal writing, design for manufacturability, experiment fabrication, planning, testing, and execution.

Credits: 3.00

AAE 44000 - Spacecraft Attitude Dynamics

Credit Hours: 3.00. Description of orientation, angular velocity, and angular acceleration in terms of direction cosines, Euler parameters, and angles. Forces and moments acting on space vehicles. Attitude stability of various types of satellites in circular and elliptic orbits. Spin stabilization and gravity gradient torques. Gyroscopic devices and energy dissipation. Introduction to attitude control.

Credits: 3.00

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

IE 48400 - Integrated Production Systems II

Credit Hours: 3.00. Extensions of topics on the design and operational control of integrated production systems. Includes production databases, facility layout, material handling, advanced control and scheduling, and physical distribution. Case studies, lab assignments, and projects.

Credits: 3.00

AAE 53200 - Orbit Mechanics

Credit Hours: 3.00. Orbit determination of near-earth satellites and various perturbations; libration and attitude control; orbit transfer and interception; lunar theory and interplanetary orbits; ascending mechanics and re-entry.

Credits: 3.00

IE 56600 - Production Management Control

Credit Hours: 3.00. Background and development of production management, plus current concepts and controls applicable to production management functions. Not open to Industrial Engineering students with a minor in management.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

IE 58300 - Design And Evaluation Of Material Handling Systems

Credit Hours: 3.00. Analysis for design and evaluation of material handling systems with emphasis on material flow control and storage. Analytic models and simulation used. Economic justification models for material handling systems.

Credits: 3.00

IE 47200 - Imagine, Model, Make

Credit Hours: 3.00. This course develops a holistic view of an initial competency in engineering design by conceiving, designing, manufacturing, and optimizing a system component such as a complex structural part. Activities include hand sketching, CAD modeling, and operation of CNC machining equipment for rapid prototyping. Tolerance requirements will be verified and optimized prior to the fabrication of the part in the laboratory using rapid prototyping techniques. The focus is on the design process itself as well as the complementary roles of human creativity and computational methods and tools.

Learning Outcomes: 1. Create any object using 3D CAD design software (modeling, texturing, and animation). 2. Evaluate and optimize 3D designs for different manufacturing processes and materials. 3. Apply the principles of engineering tolerance to 3D CAD design. 4. Use rapid prototyping techniques (laser cutting, laser engraving, injection molding, and 3D printing) to manufacture 3D CAD designs. Credits: 3.00

AAE 53300 - Space Traffic Engineering Management

Credit Hours: 3.00. The course teaches the basic techniques and concepts relevant to Space Traffic Management (STM) and Space Situational Awareness (SSA) from a rigorous engineering perspective. The class starts with learning how measurements are collected and processed and then moves on to the non-linear orbital motion and astrodynamics in the near-Earth realm. The focus is on orbit determination and orbit improvement of satellites and space debris to detect new objects and maintain custody of them. Lastly, the class focuses on determining the probability of collision of two resident space objects. At the end of the course, the students are equipped with a fundamental Matlab toolset to investigate their own STM or SSA problems.

Learning Outcomes: 1. Demonstrate fundamental understanding of sustainable use of space. 2. Determine engineering and simulation of information collection for STM. 3. Demonstrate Initial Orbit Determination and Orbit Improvement using passive measurements. 4. Determine Orbital perturbations in the near-Earth and cislunar region. 5. Determine Computation Probability of Collision. Credits: 3.00

Required Practical Aerospace Experience (0-3 credits)

Learning Outcomes

Sports Studies and Production Certificate

About the Certificate

Requirements for the Certificate (11 credits)

A. Sports Studies (3 or 6 credits)

AMST 32500 - Sports, Technology, And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines how science, technology, engineering, and data analysis reshape sports. Traditionally, sports have been understood as competitions between humans. However, recent technoscientific developments have altered this arrangement and have changed the ways sports are played. We have reached a place where heated competitions not only take place on the fields of play, but also within scientific and engineering laboratories. The fundamental question this project-based course will address is: how will new and emerging scientific knowledge and technological innovations transform sports? We will explore topics ranging from football, baseball, basketball, and soccer, to e-sports, fantasy sports, and sports analytics.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms sports, technology, and innovation. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through the play and consumption of

sports. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze sporting invention, innovation, design, and culture through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 21000 - Sport In American Culture (UCC: BSS)

Credit Hours: 3.00. This course engages critical questions regarding sport and its role in American culture. It examines the ways sport serves as a key site for the study of larger social issues and social problems, including how race, gender, social class and other social locations are simultaneously reproduced and challenged in and through sport. The course also explores the relationships between sport and other major social institutions, such as the economy, education, politics, and media.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand sport as a social construction. Understand sport as a contested activity. 2. Identify and explain the relationships of sport to other institutions in society, including politics, education, economy, and the media. 3. Explain the role of sport in central social issues, including race/racism, gender/sexism, class, homophobia, and violence. 4. Apply academic theories and concepts to the study of sport. Credits: 3.00

AMST 32000 - Understanding The National Football League

Credit Hours: 3.00. This course counters the cultural myth that sports are "simply a form of entertainment" or "an escape from reality" and takes seriously the notion that sports matter as a social, cultural, and political force. Students will use academically informed inquiry and investigation to examine broader cultural dynamics through a critical examination of the National Football League. Course topics include how the NFL shapes social identities including race, gender, sexuality, and American identity, the connection between football and militarism, the relationship between the NFL and commercialism, the role the NFL plays in the triad of men's violence, among other topics.

Learning Outcomes: 1. At the end of this course you will be able to summarize the evidence and conceptual arguments that the NFL is a cultural institution by which we can understand American society by exploring key topics covered in course in class activities, film response papers, and exams. 2. At the end of the course you will be able to explain how the National Football League matters as a social, political, and cultural force. 3. At the end of the course, you will be able to respond, from a critically informed academic perspective, to common sense beliefs that the NFL is simply "entertainment" or an "escape from reality." Credits: 3.00

HIST 35305 - Sports In America

Credit Hours: 3.00. Today sports virtually dominate American culture. From fantasy leagues and 24-hour a day news shows to business decisions and off-the-field troubles to the games themselves, sports entertain Americans at the same time as they define American culture and social norms. This course will look at the growth of the sport industry in the 20th Century. It will examine the lives and importance of Babe Ruth, Joe Louis, Jackie Robinson, Muhammad Ali, and other athletes, as well as the economic, social, and medical impact of the games we watch.

Learning Outcomes: 1. Comprehend the role that sports has played in American society. 2. Analyze the centrality of race in sports and in America more broadly. 3. Apply their course knowledge to a range of professions in one of the largest industries in America; namely, in television and other media, marketing, management, etc. 4. Hone their active writing skills for effective professional application. Credits: 3.00

COM 49505 - Sports Communication

Credit Hours: 3.00. This class will help students learn to think critically about sports communication, but it will also help students learn to do sports communication. Through the use of sports books and movies, guest speakers, field trips, and case studies, students will learn not only about sports communication

as a field of study and a profession, but also how they can be more thoughtful consumers of sports communication in its various forms.

Learning Outcomes: 1. Describe multiple ways that sports communication constructs and maintains culture. 2. Explain changes in sports communication related to race and gender. 3. List five key events in the last 100 years of sports communication. 4. List and analyze issues related to naming in sports. 5. Create a basic sports crisis communication plan. 6. Frame labor-management sports communication issues from both perspectives. Credits: 3.00

B. Sports Production (3 or 6 credits)

FLM 32200 - Live Production I: Fall/Winter Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Fall/Winter sports include Cross Country, Soccer, Volleyball, Football, Swimming & Diving, Wrestling, Basketball, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 32300 - Live Production I: Winter/Spring Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Winter/Spring sports include Swimming & Diving, Wrestling, Basketball, Baseball, Softball, Tennis, Golf, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

C. Internship (2 credits)

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

A. Sports Studies (3 or 6 credits)

AMST 32500 - Sports, Technology, And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines how science, technology, engineering, and data analysis reshape sports. Traditionally, sports have been understood as competitions between humans. However, recent technoscientific developments have altered this arrangement and have changed the ways sports are played. We have reached a place where heated competitions not only take place on the fields of play, but also within scientific and engineering laboratories. The fundamental question this project-based course will address is: how will new and emerging scientific knowledge and technological innovations transform sports? We will explore topics ranging from football, baseball, basketball, and soccer, to e-sports, fantasy sports, and sports analytics.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms sports, technology, and innovation. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through the play and consumption of sports. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze sporting invention, innovation, design, and culture through the use

of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 21000 - Sport In American Culture (UCC: BSS)

Credit Hours: 3.00. This course engages critical questions regarding sport and its role in American culture. It examines the ways sport serves as a key site for the study of larger social issues and social problems, including how race, gender, social class and other social locations are simultaneously reproduced and challenged in and through sport. The course also explores the relationships between sport and other major social institutions, such as the economy, education, politics, and media.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand sport as a social construction. Understand sport as a contested activity. 2. Identify and explain the relationships of sport to other institutions in society, including politics, education, economy, and the media. 3. Explain the role of sport in central social issues, including race/racism, gender/sexism, class, homophobia, and violence. 4. Apply academic theories and concepts to the study of sport. Credits: 3.00

AMST 32000 - Understanding The National Football League

Credit Hours: 3.00. This course counters the cultural myth that sports are "simply a form of entertainment" or "an escape from reality" and takes seriously the notion that sports matter as a social, cultural, and political force. Students will use academically informed inquiry and investigation to examine broader cultural dynamics through a critical examination of the National Football League. Course topics include how the NFL shapes social identities including race, gender, sexuality, and American identity, the connection between football and militarism, the relationship between the NFL and commercialism, the role the NFL plays in the triad of men's violence, among other topics.

Learning Outcomes: 1. At the end of this course you will be able to summarize the evidence and conceptual arguments that the NFL is a cultural institution by which we can understand American society by exploring key topics covered in course in class activities, film response papers, and exams. 2. At the end of the course you will be able to explain how the National Football League matters as a social, political, and cultural force. 3. At the end of the course, you will be able to respond, from a critically informed academic perspective, to common sense beliefs that the NFL is simply "entertainment" or an "escape from reality." Credits: 3.00

HIST 35305 - Sports In America

Credit Hours: 3.00. Today sports virtually dominate American culture. From fantasy leagues and 24-hour a day news shows to business decisions and off-the-field troubles to the games themselves, sports entertain Americans at the same time as they define American culture and social norms. This course will look at the growth of the sport industry in the 20th Century. It will examine the lives and importance of Babe Ruth, Joe Louis, Jackie Robinson, Muhammad Ali, and other athletes, as well as the economic, social, and medical impact of the games we watch.

Learning Outcomes: 1. Comprehend the role that sports has played in American society. 2. Analyze the centrality of race in sports and in America more broadly. 3. Apply their course knowledge to a range of professions in one of the largest industries in America; namely, in television and other media, marketing, management, etc. 4. Hone their active writing skills for effective professional application. Credits: 3.00

COM 49505 - Sports Communication

Credit Hours: 3.00. This class will help students learn to think critically about sports communication, but it will also help students learn to do sports communication. Through the use of sports books and movies, guest speakers, field trips, and case studies, students will learn not only about sports communication as a field of study and a profession, but also how they can be more thoughtful consumers of sports communication in its various forms.

Learning Outcomes: 1. Describe multiple ways that sports communication constructs and maintains culture. 2. Explain changes in sports

communication related to race and gender. 3. List five key events in the last 100 years of sports communication. 4. List and analyze issues related to naming in sports. 5. Create a basic sports crisis communication plan. 6. Frame labor-management sports communication issues from both perspectives. Credits: 3.00

Notes

About the Certificate

Systems Certificate

About the Certificate

Requirements for the Certificate (15 credits)

Required Courses (9 credits)

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system

using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define models of the interfaces of an engineered system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 30000 - It's A Complex World - Addressing Global Challenges (UCC: STS)

Credit Hours: 3.00. The main goal of this course is to address grand challenges that are of global concern - such as environmental sustainability and energy use, natural and human disasters, and political and economic development - using the ideas and tools of complex adaptive systems. The course exploits the broad expertise of the four faculty members by treating these challenges from diverse disciplinary perspectives, from the biological and physical sciences, to the social sciences, to engineering. By way of a set of case studies, students will analyze the features of these challenges which make them complex, and seek to explain and find solutions to the problems that arise in each case. Their treatment of the cases will be informed by published research and computer simulation. Students will actively participate in discussions regarding these global challenges, and contribute to the progress of the class using oral and written presentations. The course will culminate with a final project completed by teams composed of students from different disciplines.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe global challenges using engineering, biological, physical, and social scientific perspectives, including attention to the interdependence of the different perspectives. 2. Explain the fundamental concepts of 'complex adaptive systems, ' including applications to different global challenges. 3. Develop basic proficiency in applying computer modeling to represent the behavior of complex systems, with applications to the global challenges. 4. Apply the concepts and tools of complexity research to develop a group-based proposal of comprehensive policies/solutions/strategies in a new and unresolved problem area. Credits: 3.00

SYS 35000 - Systems Methods

Credit Hours: 3.00. Introduction to modeling tools and methods for understanding and designing systems. Topics include: defining the problem; defining and validating stakeholders' needs; system modeling and types of models; defining and modeling system behavior; defining and modeling functional, physical and allocated system architectures; and evaluating and modeling the tradeoffs between alternative system designs.

Learning Outcomes: 1. Emphasize patterns of systems thinking. 2. Introduce systems modeling and design processes and methods. 3. Introduce model-based systems analysis and design. 4. Provide practice in using model-based systems tools. Credits: 3.00

SYS 40000 - Systems Praxis (UCC: STS)

Credit Hours: 3.00. Engineers, social scientists, and managers frequently bring people and technology together to address complex problematic situations in an equitable way that benefits people and the environment. Multiple systems concepts and methods have been developed to address these situations, and typical courses in systems focus on a relatively small portion of the rich assortment of available approaches to addressing systems problems. This course introduces students to multiple systems concepts and methods via readings and class lecture. The students then apply these concepts and methods on team-based projects. The course will emphasize critical thinking about how the concepts and methods are applicable to the problematic situations of the projects and how well the project teams were able to perform the required activities.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Learn about group project team formation, operation, and evaluation. 2. Learn and apply the viable

system model in a team environment. 3. Learn and apply critical systems heuristics and soft systems methodology in a team environment. 4. Learn and apply a collection of functionalist systems methods in a team environment. 5. Develop written and oral communication products to present results. Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

Supplemental Courses -Choose Two (6 credits)

Teaching Secondary Education Computational Thinking Certificate

About the Certificate

Requirements for the Certificate (15 credits)

Engineering/Technology Teacher Education Courses (9 credits)

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

TLI 16100 - Prototyping In Engineering/Technology Education

Credit Hours: 3.00. Design, make, and innovate! This course provides basic instruction on the proper and safe use of tools and equipment used to prototype innovative ideas. This includes 3D printers, laser cutters/engravers, fabrication tools/equipment, CNC mills/routers, and microcontrollers/microcomputers.

Learning Outcomes: 1. Demonstrate the technical competencies to properly and safely operate common prototyping equipment and tools. 2. Apply knowledge

of materials properties to select the appropriate materials for a desired prototype. 3. Create operations process flow charts for planning product development. 4. Test prototypes in real situations to gather data related to their performance. Credits: 3.00

TLI 26500 - Teaching The TE Of STEM

Credit Hours: 3.00. A course for teacher education majors that provides rationale and techniques for integrating engineering and technological literacy into the K-12 mathematics and science curriculum. Experiences focus on the engineering design process, mechanisms, robotics, strength of materials, electrical circuits, and electronics.

Learning Outcomes: 1. Describe the national importance of the integrative nature of the K-12 STEM curriculum. 2. Describe how technology and engineering can be integrated into K-12 mathematics and science. 3. Demonstrate hands-on learning activities appropriate to integrate technology and engineering into the K-12 STEM curriculum. Credits: 3.00

TLI 36100 - Engineering And Technology Education Instructional Planning And Evaluation

Credit Hours: 3.00. This course addresses selecting content, writing instructional objectives, planning lessons, preparing a unit of study, and evaluating student progress. Emphasis is placed on evaluating instruction and student achievement to include developing valid, reliable testing instruments as they relate to measuring student achievement in the cognitive, affective, and psychomotor domains.

Learning Outcomes: 1. Demonstrate instructional planning skills related to the delivery of engineering/technology education to both middle-level and high school students. 2. Prepare lesson plans, a unit of study, and evaluation instruments. 3. Appraise instructional material effectiveness and propose revisions for improvement. 4. Prepare appropriate assessment instruments that align with identified learning objectives. Credits: 3.00

Computer Science Courses (6 credits)

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user

interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CGT 21500 - Computer Graphics Programming I

Credit Hours: 3.00. This course focuses on programming fundamentals, logic, and problem solving necessary for advancement into upper level CGT courses. A cross-section of languages and technologies will be introduced and demonstrated.

Learning Outcomes: 1. Understand basic programming concepts such as variables, data types, selection and repetition control structures, arrays, files, and methods and functions. 2. Create simple object-oriented applications. 3. Demonstrate an understanding of the similarities between several different programming or scripting languages. 4. Demonstrate the ability to apply knowledge to different computer graphics software applications. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus

protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

Theatre Lighting Certificate

About the Certificate

Requirements for the Certificate (16 credits)

Foundation Studies: Required Courses (13 credits)

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 56200 - Advanced Light Design

Credit Hours: 3.00. Advanced study of the principles of light design and their application to specific lighting problems.

Credits: 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

Additional Production Courses (3 credits)

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 56800 - Advanced Problems In Design

Credit Hours: 1.00 to 3.00. A described tutorial in theatrical design or design research. Permission of instructor required.

Credits: 1.00 to 3.00

Notes

World Food Cultures Certificate

About this Certificate

Requirements for the Certificate (15 credits)

Required Course (3 credits)

LC 28100 - Introduction To World Food Cultures (UCC: HUM)

Credit Hours: 3.00. This course introduces students to global food culture and world gastronomy. It covers different aspects of food studies such as food representations in art and literature, national identity, culinary traditions, and world trade and migration in respect to food. This course will give students a broad overview of the relation between food and many other disciplines, allowing them to connect the topics addressed to their own fields of study. Conducted in English. No prerequisites.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize the central importance of food in every culture and its relation to other fields of study. 2. Compare food representations in literary texts and other forms of art. 3. Analyze how food contributes to the creation of national identities. 4. Recognize the main challenges of global food production, circulation, and consumption. 5. Examine the food heritage and impact of different cultures in the United States. Credits: 3.00

Languages & Cultures Selective -Choose One or Two Courses (3-6 credits)

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

GER 28000 - German Special Topics

Credit Hours: 3.00. Selected topics on the civilization and culture of German speaking countries. Lectures and readings all in English. No knowledge of German necessary.

Learning Outcomes: 1. Students will explore in depth a particular aspect of life in German-speaking countries, leading to their increased understanding not only of those cultures, but also, by comparison, of their own culture. Credits: 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2.

Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

Selective - Choose Two to Three Courses (6-9 credits)

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33300 - Food Distribution - A Retailing Perspective

Credit Hours: 3.00. Distribution factors that affect the food industry. Particular attention to the food wholesaling and retailing sectors. Presentation of economic tools to evaluate performance in the food industry. Discussion of the relative importance of each of the major departments in the modern supermarket. Discussion of current and future industry prototypes.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by

the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

FS 47000 - Wine Appreciation

Credit Hours: 3.00. A study of wine production and marketing principles with an emphasis upon consumption responsibility. Historical perspectives form the foundations for wine classification systems and traditional serving procedures. Cardinal scale sensory evaluations are conducted in relationship to various food pairings. Must be 21 years of age or older to register for this course. Permission of department required.

Learning Outcomes: 1. Understand the nature of wine - its production, history, uses and related responsibilities. 2. Develop the ability to recognize different classes, types, and origins of wines. 3. Learn proper etiquette and tasting techniques. 4. Gain direct experience, both individually and as part of a team, in adopting these manners and methods. Credits: 3.00

HORT 30600 - History Of Horticulture (UCC: STS)

Credit Hours: 3.00. The origins and development of agriculture, with specific emphasis on horticulture from prehistory to the present in relation to civilization and modern culture.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HORT 40300 - Tropical Horticulture

Credit Hours: 3.00. An introduction to the agriculture of the tropics and subtropics, emphasizing horticultural crops. Offered in even-numbered years.

Credits: 3.00

SFS 31200 - Urban Agriculture

Credit Hours: 1.00. Urban agriculture has the potential to address a range of social, economic and environmental issues including food insecurity, energy conservation, and human health and well-being. During this 5-week course, students will learn about the forces driving urban agriculture as well as the political and biophysical factors constraining it by reading articles, reviewing case studies, and visiting urban farms, vertical farm factories, food pantries, and local food advocacy groups. At the end of this course, students will apply the knowledge they've gained by developing a plan to increase urban agriculture in the greater Lafayette metropolitan area.

Learning Outcomes: 1. Understand the complexity of our global food system and learn how urban agriculture can address social, economic and ecological issues in cities around the world. 2. Develop critical thinking and communication skills through in-class discussions and writing assignments that integrate agroecology, urban planning, and civic engagement as they relate to urban agriculture. 3. Apply relevant theories and examples by developing a plan to facilitate the growth of urban agriculture. Credits: 1.00

SFS 31300 - Farm To Fork

Credit Hours: 1.00. This course will investigate the culinary opportunities of local and seasonal foods and the horticultural demands of producing and marketing them. Dr. Hallett will represent the "farm", giving students a brief overview of the production of local and seasonal foods in Indiana. The "farm" will harvest produce at the student farm and deliver it to the "fork" -- Chef Ambarish Lulay - who will work his culinary magic in the teaching kitchens in the HTM department. The focus, from both "sides" of the course will be the importance of niche marketing for farmers and chefs. This course is going to be tasty and fun!

Learning Outcomes: 1. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 2. Have a broad awareness of the role of agriculture in global society. 3. Understand the advantages and disadvantages of different approaches to food production. 4. Understand the principles of food marketing and sales. 5. Understand the principles of postharvest food storage and pest management. 6. Be able to handle multiple tasks and deadline pressures. 7. Be able to work effectively with individuals from diverse cultures. 8. Have strong professional ethics and integrity. 9. Understand the importance of developing leadership skills. 10. Be able to work effectively in teams. Credits: 1.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an

introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

ANTH 33700 - Human Diet: Origins And Evolution

Credit Hours: 3.00. This course will survey humans evolving relationship with food over the last few million years; from our Plio-pleistocene origins (foraging) through the origins of agriculture to modern industrial food production.

Learning Outcomes: 1. Explain "the human diet," its evolution, and its range of variation. 2. Summarize the role that dietary studies have played in the development of anthropological and biological theory. 3. Identify primate dietary adaptations and explain how these adaptive traits inform human evolution studies. 4. Describe major dietary issues faced by humans today. Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

ASEC 43100 - Planning For International Engagement Methods

Credit Hours: 1.00. A team-based laboratory course for students who seek experience working with international partners to plan and conduct quality service-learning projects. Using established partner relationships, students will work with international partners to address hands-on, real-world, identified challenges to learn the principles of extension methodology and sustainable community development by integrating their discipline knowledge and technical skills from previous courses. Students will also learn the intercultural communication, market analysis, project design and planning, entrepreneurial business planning for micro-credit loans and business ventures, and cultural factors affecting community food security while they work in bi-national teams to determine how best to apply their classroom knowledge and experience to respond to partners' needs and local resource constraints.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their economic and social challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and emotional intelligence in evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate the ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

ASEC 43110 - International Engagement Methods

Credit Hours: 1.00 to 3.00. Using established partner relationships, students will travel to and live in Cap Haitien for 8-10 days and work with Haitian partners and students to learn the principles of extension methodology, sustainable community development, and how to most effectively work with local leaders. Students will also learn the intercultural communication, entrepreneurial business planning, and cultural factors affecting community food security status while they work bi-national teams to determine how best to apply their classroom knowledge and experience.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in

addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate personal growth in cultural worldview and self-awareness to confidently address specific food security-related challenges and belief in their personal ability to succeed in a particular situation. 4. Demonstrate critical thinking, intercultural curiosity, and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 5. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 6. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 7. Demonstrate intercultural openness, empathy, flexibility, and open-mindedness to work constructively as part of a bi-national problem-solving team. Credits: 1.00 to 3.00

ASEC 43120 - Evaluating International Engagement Methods

Credit Hours: 1.00. Designed for students who have just returned from the Engagement Methods for Int'l Food Security course or have previous experience working with our partners. In order to 1) fully comprehend the impact of the experience and 2) foster true long-term relationships with and service to our partners, it is required to work on our projects when we return. Matt McGregor, Former Exec. Dir. of Timmy Global Health, told us that "it's not really about the trip". It is essential that we accomplish: 1) Closure of trip experiences with partners and contacts - thank you's and complete follow-up; 2) Reflection of Purdue student experiences and personal goals/follow-up actions; 3) Promotion of food insecurity realities and opportunities for support; and 4) Planning, recommendations, and promotion of future service learning courses.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

HIST 30305 - Food In Modern America (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the kitchen as an architectural space, a place of labor and food production, and an arena for technological innovation in modern American history. Cooking and eating reflect cultural sentiments about modernity, progress, ethnicity, and family, and the politics of how society nourishes bodies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Think historically and critically about the cultural consequences of technologies related to eating and food preparation. 2. Think historically and critically about approaches to the study of national identify and culture expressed through food. 3. Appreciate the circumstances and history of kitchen design in relation to raced and gendered identities, home space, and food preparation. 4. Understand and recognize how assumptions about food production during the late 19th and 20th centuries in the United States reflected notions about labor, modernity, and progress. 5. Understand the difference between secondary and primary sources. Students will analyze and interpret primary documents related to kitchens, cooking, and food preparation. They also will understand the

competing and conflicting nature of historical interpretation. 6. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

BTNY 28500 - Plants And Civilization (UCC: STS)

Credit Hours: 3.00. This course, intended primarily for non-majors, covers the history of agriculture, with focus on the centers of origin of our major food, fiber, and medicinal plants, and their historical, cultural, and economic relevance. The course also surveys the biology of crop plants, with respect to taxonomy, anatomy, cell structure, physiology, development, and genetics. Discussions also center on the roles plant biotechnology may play in sustainable agriculture and in helping to alleviate problems caused by overpopulation and ecological stress.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Professional preparation, scientific principles, critical thinking, cultural understanding, social science principles and lifelong learning. Credits: 3.00

FS 16300 - Introduction To Fermentation Sciences

Credit Hours: 3.00. This course will provide an overview of the use of microorganisms in the food, pharmaceutical and chemical industries. The course will introduce fundamental concepts associated to the microbiological transformation of various substrates to produce desirable products such as foods, beverages, pharmaceuticals or chemical compounds. As an introductory course, the scientific principles of fermentation processes will be gradually introduced through the analysis of familiar fermented food products, such as bread, cheese, beer, wine, cocoa, coffee, etc. Once the fundamental concepts are learned, examples of advanced fermentation technology for production of pharmaceutical products and fine chemicals will be presented.

Learning Outcomes: 1. Explain the role of microorganisms in the transformation of various substrates into desirable products. 2. Identify the type of microorganism (bacteria, yeast or mold) involved in the production of various fermented foods and beverages. 3. Explain the impact of environmental processing conditions (T, pH, aw, O2) on microbial growth. 4. Recognize the similarities across a wide variety of products made through fermentation. Credits: 3.00

ASEC 55100 - International Engagement And Development Strategies

Credit Hours: 3.00. Sem. S and SS, cr. 3; an overview of cross-disciplinary, cultural, theoretical frameworks, communication tools, and assessment methods applied to international agricultural development and engagement. Lectures, panel discussions, and case studies on appropriate methods of development and engagement, international project planning, intercultural effectiveness, principles of sustainable agricultural, food, community development, and program/project monitoring and evaluation will be the basis of assignments and team work. This eight-week course will provide the theoretical and social frameworks and principles needed to successfully work in multi-agency partnerships on international development projects.

Learning Outcomes: 1. Select the most culturally-appropriate application of disciplinary knowledge and technologies for agriculture, food, natural resources and related sciences in development programs. 2. Deconstruct self biases and intercultural effectiveness and their critical and creative thinking skills for different contexts in appropriate applications of scientific research as creative interventions and evaluation. 3. Differentiate high and low oral and written communication skills, tolerance of cultural ambiguity, and adaptability. 4. Judge the efficacy of applying appropriate theoretical frameworks for engaging stakeholders in projects to create sustainable impact. 5. Determine the relevance of the result of applying principals and applications of ethical decision making and professional development. 6. Reflect on one's progress and abilities to work in multi-disciplinary teams to carryout developing country assessments and conceptualize a viable project proposal under a tight deadline. Credits: 3.00

ANTH 25600 - Archaeology Of Beer

Credit Hours: 3.00. Alcoholic beverages are an important aspect of foodways, the cultural practices and values surrounding food and drink. This course provides an overview of the ancient origins of beer and other alcoholic beverages globally, and examines the cultural context and social role of these innovations through a combination of archaeology,

material culture studies, historical texts, and ethnography. In addition to examining archaeological case studies of the production and consumption of beer and other alcoholic beverages, topics to be covered include: evolution of brewing and fermenting technology, biology and chemistry of brewing and fermentation, residue and materials analysis, origins of agriculture, emergence of social complexity, sexual division of labor, social identity (gender, class, ethnicity), and recent trends in production and consumption.

Learning Outcomes: 1. Identify the role of Anthropology in understanding the production and consumption of alcohol in cultures past and present. 2. Evaluate several different theoretical and methodological approaches within the field of Archaeology. 3. Assess and debate the role that the innovation of alcohol might have played in the origins of agriculture and social complexity in different times and places in the past. 4. Analyze and explain innovations in brewing technology over time. 5. Describe and explain the way in which identity is shaped by the production and consumption of beer. These learning outcomes will be achieved by reading, evaluating, and summarizing course material (lectures, readings, and films) at regular intervals throughout the course and by engaging in regular group discussions. 6. Outcomes will be assessed by examining student performance on quizzes, exams, and article summaries, as well as participation in class discussion. Credits: 3.00

ASEC 53100 - Global Learning For Agriculture, Food And Natural Resources

Credit Hours: 3.00. This is a graduate-level course in which students research, design, and evaluate communication and education methods and theoretical frameworks to apply appropriate cultural, community engagement, targeted outcomes of a population defined by the student. The central experience is an international/intercultural professional development experience immersed in rural and urban communities and cultures. Students will learn and develop global perspectives and effective engagement strategies to address agronomic, cultural, and community engagement realities affecting agriculture, life sciences and natural resources.

Learning Outcomes: 1. Have the skills to distinguish between educational designs needed for different goals and outcomes of global/intercultural learning programs. 2. Understand and apply one's own culture to interact among people with differing cultures, beliefs and values while designing engagement programs. 3. Design an educational intervention/module which is culturally appropriate and meets the needs of the community/learners. 4. Construct meaning from instructional messages, including oral, written and graphic communication applying the intersectionality of Social Identity, Intercultural Sensitivity, and Critical Race theories to engagement situations. 5. Evaluate one's self-awareness and recognition of others such that they can emotionally adapt their thinking and being in global/intercultural engagement efforts. 6. Identify best practices for educational global immersion experience related to food, fiber, and natural resources. Credits: 3.00

ASEC 30100 - Building Intercultural Partnerships (UCC: HUM)

Credit Hours: 3.00. This course uses a combination of readings, videos, experiential activities, presentations, and face-to-face & virtual excursions/engagement with "other/different" international cultural groups to deepen students' ownership of their own learning and to identify and understand both similarities and differences in values and social norms across countries and cultures. Students will enhance their intercultural communication skills, their emotional resilience, and their ability to engage effectively and equitably in conversations and partnerships with people from other countries and cultures.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate that you recognize the relevance of the learning process and the roles you and other play in that process. 2. Recognize and participate in cultural differences in verbal and nonverbal communication and begin to appropriately engage with people from other countries and cultures to negotiate a shared understanding based on those differences. 3. Recognize your own strengths and understand both the values

and social norms across countries and cultures and challenges in adapting and adjusting under stress, and identify practices and techniques for managing your emotions. 4. Analyze substantial connections between the worldviews, experiences, and power structures of multiple cultural groups while incorporating respectful interactions with them. Credits: 3.00

SFS 41200 - Colonialism, Globalization, And Food Justice

Credit Hours: 1.00. This course will uncover the foundations of inequities in access to healthy, nutritious food from the first era of colonization to the modern era of globalization. The course will make students aware of the racial and ethnic inequities in farming and food systems and consider mechanisms of decolonization: resistance against the status quo and the development of new food systems.

Learning Outcomes: 1. Understand the emergence of modern food systems through the eras of colonization and globalization. 2. Analyze the factors that contribute to inequities in access to healthy, nutritious food. 3. Investigate global and local food justice movements. 4. Evaluate the legacies of colonialism in today's food deserts. 5. Investigate local food movements, such as urban agriculture, represent attempts at decolonization. 6. Investigate the activism of indigenous groups around the world seeking decolonization and food justice. 7. Consider policies to reduce inequities in food systems. Credits: 1.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology, processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

Required Course (3 credits)

LC 28100 - Introduction To World Food Cultures (UCC: HUM)

Credit Hours: 3.00. This course introduces students to global food culture and world gastronomy. It covers different aspects of food studies such as food representations in art and literature, national identity, culinary traditions, and world trade and migration in respect to food. This course will give students a broad overview of the relation between food and many other disciplines, allowing them to connect the topics addressed to their own fields of study. Conducted in English. No prerequisites.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize the central importance of food in every culture and its relation to other fields of study. 2. Compare food representations in literary texts and other forms of art. 3. Analyze how food contributes to the creation of national identities. 4. Recognize the main challenges of global food production, circulation, and consumption. 5. Examine the food heritage and impact of different cultures in the United States. Credits: 3.00

Learning Outcomes

About this Certificate

Concentration

Interdisciplinary Genetics Concentration (GR)

About the Program

Program Requirements

Required Courses (xx credits)

Additional Information

Doctoral

Aeronautics and Astronautics, PHD

About the Program

Program Requirements

Required Courses (21-27 credits)*

Primary Area Courses (12 credits)

Aerodynamics

AAE 51100 - Introduction To Fluid Mechanics

Credit Hours: 3.00. The basic conservation equations are derived for a compressible viscous fluid, and then are specialized for applications in potential flow, viscous flow, and gas dynamics.

Learning Outcomes: 1. Use index notation to derive vector and tensor relations. 2. Manipulate and derive governing equations in various forms. 3. Determine streamlines, pathlines, streaklines and timelines for unsteady flow. 4. Determine how vorticity is produced by various mechanisms. 5. Determine the motion of two-dimensional point vortices. 6. Use conformal mapping to find the lift coefficient on an airfoil shape. 7. Use a Schwarz-Christoffel transformation to solve for potential flow with corners. 8. Use three-dimensional potential flow to solve for flow over axisymmetric bodies. 9. Solve for steady and unsteady exact solutions of the Navier-Stokes equations. 10. Derive and use the Stokes drag law for a sphere. 11. Derive boundary layer equations, find self-similar solutions and determine scaling laws. 12. Compute skin friction on an airfoil using an approximate boundary layer method. 13. Determine the qualitative effects of turbulence on a flow. Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 51400 - Intermediate Aerodynamics

Credit Hours: 3.00. Thin airfoil theory and panel methods. Three-dimensional elementary solutions, lifting-line and lifting-surface models. Slender wing and slender body theory. Normal/oblique shock waves. One- and multi-dimensional flows and conical flows. Method of characteristics. Introduction to transonic flow, hypersonic flow, and airfoil design.

Credits: 3.00

AAE 51800 - Low-Gravity Fluid Dynamics

Credit Hours: 3.00. Theory and design for control of liquid propellants in weightlessness. Gravity and orbits review. Satellite and space-probe acceleration environments. Capillary-dominated fluid dynamics: contact angle, surface tension, curvatures, and solution methods. Industry practice and current topics.

Credits: 3.00

AAE 51900 - Hypersonic Aerothermodynamics

Credit Hours: 3.00. Aerodynamics of satellites and planetary re-entry. Continuum hypersonic flow. Inviscid and viscous effects, boundary layers, and heat transfer. Shock and boundary-layer interactions. Equilibrium flow of high-temperature reacting gases. Nonequilibrium effects. Kinetic theory and rarefied flows. Direct simulation Monte Carlo techniques.

Credits: 3.00

AAE 52000 - Experimental Aerodynamics

Credit Hours: 3.00. Theory and application of experimental techniques and instrumentation for aerodynamics and fluid mechanics. Computer data acquisition, wind tunnels, force balances, flow visualization, pressure probes, hot wire anemometry, laser Doppler velocimetry and turbulence measurements.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 61300 - Viscous Flow Theory

Credit Hours: 3.00. Compressible, laminar boundary layer theory; Buseman and Crocco integrals; skin friction and heat transfer. Introduction to turbulent boundary layers and transition phenomena. Advanced boundary layer theory; the method of inner and outer expansions. Boundary layers with chemical reaction; applications to hypersonic flow and combustion. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62400 - Laminar-Turbulent Transition

Credit Hours: 3.00. Instability mechanisms, such as Kelvin-Helmholtz, Tollmien-Schlichting, Gortler, and crossflow. Secondary instabilities. Nonlinear and nonparallel effects; the Parabolized Stability Equations; receptivity; transition prediction. Effects of compressibility, heating, roughness, turbulence, noise, curvature, etc. Turbulent spots and the extent of transitional flow. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62600 - Turbulence And Turbulence Modeling

Credit Hours: 3.00. Physical description of turbulence. Reynolds averaged equations. Scaling of basic turbulent flows. Homogeneous turbulence, spectra and two-point correlations. Hierarchy of turbulence models, including zero-, one-, and two-equation models, Reynolds stress models, large eddy simulations, and direct numerical simulations. Additional topics, such as compressibility effects on turbulence and probability density function methods, as time allows. Prerequisite: AAE 51100.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling

and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 50900 - Intermediate Fluid Mechanics

Credit Hours: 3.00. Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

Learning Outcomes: 1. State basic laws for a control volume in different coordinate systems. 2. Derive the kinematics of fluid flow in problem solving. 3. Derive the equations for frictionless and incompressible flows. 4. Derive the basic equations of motion of viscous flows. 5. Find standard exact solutions of viscous-flow equations and apply them. 6. Derive and solve basic equations of boundary-layer theory. 7. Find lift and drag forces on immersed bodies with simple shapes. 8. Understand concepts of incompressible turbulent flows and wall turbulence. Credits: 3.00

ME 51000 - Gas Dynamics

Credit Hours: 3.00. Flow of compressible fluids. One-dimensional flows including basic concepts, isentropic flow, normal and oblique shock waves, Rayleigh line, Fanno line, and simple waves. Multidimensional flows including general concepts, small perturbation theory for linearized flows and method of characteristics for nonlinear flows. Prerequisite: first course in fluid or aerodynamics.

Credits: 3.00

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8) spray drying. Offered in alternate years.

Credits: 3.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

ME 61000 - Boundary Layer Theory

Credit Hours: 3.00. Fundamentals of continuum fluid mechanics; Navier-Stokes equations. Laminar flow; boundary-

layer concept; similarity solutions; transformation methods; integral and finite difference solution techniques for general pressure gradients. Should be preceded by intermediate fluid mechanics.

Credits: 3.00

ME 61100 - Principles Of Turbulence

Credit Hours: 3.00. Methods of description and basic equations for turbulent flows. Isotropic and homogeneous turbulence, energy spectra, and correlations. Introduction to measurements. Transition theory and experimental evidence. Wall turbulence, engineering calculations of turbulent boundary layers. Free turbulent jets and wakes. Prerequisite: ME 61000 .

Learning Outcomes: 1. Develop the ability (from first principles) to describe the physics of turbulent flows. 2. Comprehend the methods of analysis used in turbulence study. 3. Understand the principles of turbulence simulation and the associated modeling problems. Credits: 3.00

ME 61300 - Advanced Engineering Acoustics

Credit Hours: 3.00. An extension of ME 51300 . Sound transmission between two media. Acoustic resonators and application to muffler theory. Structural radiation and sound. Acoustical measurements and signal processing: sound intensity, surface intensity, coherence and cepstral techniques. Numerical acoustics: finite element analysis, boundary integral equation analysis and statistical energy analysis. Advanced topics. Prerequisite: ME 51300 .

Credits: 3.00

ME 61400 - Computational Fluid Dynamics

Credit Hours: 3.00. Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solution of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Prerequisite: ME 50900 or ME 58100 .

Credits: 3.00

ME 61500 - Aeroacoustics

Credit Hours: 3.00. (AAE 61500) Quantitative measures of sound (decibel scales, spectra, energetics of acoustic motions, and measurement techniques). The wave theory of sound (basic equations and properties, sound propagation in homogeneous and inhomogeneous media, one-, two- and three-dimensional sound fields and distributed sources). Effects of source movement. Aerodynamic noise generation - acoustic analogy (Lighthill's equation and Ffowcs Williams-Hawkings equation). Introduction to Computational Aeroacoustics (CAA). Noise from turbulent shear flows (jet noise, cavity noise, and noise from flow over objects). Noise from turbomachinery, propellers, and rotors. Prerequisite: ME 30900 or ME 51300 or AAE 51100.

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 52100 - Plasma Laboratory

Credit Hours: 3.00. The laboratory course will include lab prep lectures, practical classes and mini-projects. Lab prep lectures will briefly cover topics of the basic plasma physics and diagnostics relevant to the subsequent practical classes. In addition, details of the corresponding lab procedure, instructions and lab report assignment will be discussed. Practical classes will involve students in practical creation and operation of various plasma sources and plasma diagnostics. Specifically, students will operate DC high voltage breakdown facility, electrostatic accelerator (ion thruster), cross-field accelerator (Hall thruster), Atmospheric-Pressure Plasma Jet facility, and will conduct measurements of plasma parameters using Langmuir probes, microwave interferometer and optical spectrometer.

Learning Outcomes: 1. Operate laboratory electronic equipment and conduct basic electrical measurements. 2. Demonstrate fundamental understanding of Paschen breakdown law, and measure breakdown parameters. 3. Demonstrate fundamental understanding of Child-Langmuir law and calculate space-charge limited current density. 4. Operate electrostatic accelerator at different acceleration voltages, and conduct measurements of total ion current carried by the plasma jet using plane Langmuir probe. 5.

Demonstrate fundamental understanding of operation of single electrostatic Langmuir probes, conduct measurements of V-I curves, and calculate plasma parameters based on the measurements. 6. Operate cold atmospheric-pressure plasma jet and conduct spectroscopic measurements of the jet emission using spectrometer. 7. Computationally simulate the emission spectra of the second positive system of nitrogen molecule, and determine vibrational and rotational gas temperatures based on the measured and simulated spectra. 8. Operate Hall-effect accelerator, and measure basic operational parameters. 9. Operate pendulum thrust stand and conduct thrust measurements. 10. Demonstrate fundamental understanding of operation principle of microwave interferometry and construct the interferometer from basic microwave components. 11. Conduct interferometry measurements of phase shift in plasma column and determine plasma density. 12. Conduct search of the journal papers on a given topic, and compare the reported results with that measured in the lab. Credits: 3.00

Aerospace Systems

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55100 - Design Theory And Methods For Aerospace Systems

Credit Hours: 3.00. Introduction to design theory, aerospace design process, design specification and requirements, concept generation and selection, design decomposition, improving designs, process design, and concurrent engineering. Design for assembly/manufacture. Projects allow for application and critical analysis of design methods.

Credits: 3.00

AAE 56000 - System-Of-Systems Modeling And Analysis

Credit Hours: 3.00. Introduction to features of system-of-systems problems; problem definition tools; role of complexity; network topology analysis and agent-based simulation models; architecture analysis; metrics for multi-stakeholder problems; semester team projects allow students to exercise and critique such methods for analyzing system-of-systems problems. Some background in probability and statistics (e.g. random variables, probability density and distributions, sampling methods) is expected.

Learning Outcomes: 1. Introduce to modeling and analysis techniques for system-of-systems (SoS) problems in engineering. 2. Center on students' ability for understanding, modeling, and analyzing SoS problems, which consist of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. These problems are often large-scale and interdisciplinary, involving systems and behaviors found in diverse fields such as engineering, economics, social science, policy, etc. 3. Present developments in addressing system-of-systems problems, describes criteria, lexicon, and analysis methodology for their study, and, through semester-long team projects, allows students to explore the many unknowns that persist in this emerging field. 4. Know the major subjects covered: distinguishing traits of and behaviors of SoS problems, complexity and complex adaptive systems, agent-based modeling, modern network theory and analysis tools, modeling for decision-making, and exploratory modeling. Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis

and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems.
Credits: 3.00

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy.
Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define

models of the interfaces of an engineered system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 59000 - Projects In Systems

Credit Hours: 1.00 to 6.00. This is a Graduate Level variable title course for topics related to Systems (Systems Thinking, Systems Engineering, Systems Dynamics, etc). Graduate students and seniors can enroll in this course to do independent study or individual project with the instructor. Permission of instructor required.

Learning Outcomes: 1. Outcomes will be defined by the syllabus for each proposed instance of the course. Credits: 1.00 to 6.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

Astrodynamics & Space Applications

AAE 50700 - Principles Of Dynamics

Credit Hours: 3.00. Kinematics, fundamental laws of mechanics, constraints, and generalized coordinates. Lagrange's equations, virtual work. Application to particle

dynamics, rigid body motion, and spacecraft dynamics. Knowledge of differential equations required.

Credits: 3.00

AAE 50800 - Optimization In Aerospace Engineering

Credit Hours: 3.00. Formulation of optimization problems encountered in aerospace engineering. Minima of functions and functionals, necessary conditions, calculus of variations, control formulation, two-point boundary-value problems. Applications to typical problems in aerospace engineering, such as optimal launch, minimum time to climb, maximum range, and optimal space trajectories.

Credits: 3.00

AAE 53200 - Orbit Mechanics

Credit Hours: 3.00. Orbit determination of near-earth satellites and various perturbations; libration and attitude control; orbit transfer and interception; lunar theory and interplanetary orbits; ascending mechanics and re-entry.

Credits: 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 60700 - Variational Principles Of Mechanics

Credit Hours: 3.00. Basic concepts of analytical mechanics, calculus of variations, Hamilton's equations, Hamilton-Jacobi theory, canonical transformations. Offered in alternate years. Prerequisite: AAE 50700.

Credits: 3.00

AAE 63200 - Advanced Orbital Dynamics

Credit Hours: 3.00. Discussion of more advanced concepts in astrodynamics. Includes fundamental theories from celestial mechanics, as well as trajectory determination and perturbation analysis with application to the motion of Earth-orbiting and interplanetary spacecraft. Assumes experience with the two-body problem. Offered in alternate years. Prerequisite: AAE 50700, AAE 53200.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.

Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application.

Credits: 3.00

AAE 53300 - Space Traffic Engineering Management

Credit Hours: 3.00. The course teaches the basic techniques and concepts relevant to Space Traffic Management (STM) and Space Situational Awareness (SSA) from a rigorous engineering perspective. The class starts with learning how measurements are collected and processed and then moves on to the non-linear orbital motion and astrodynamics in the near-Earth realm. The focus is on orbit determination and orbit improvement of satellites and space debris to detect new objects and maintain custody of them. Lastly, the class focuses on determining the probability of collision of two resident space objects. At the end of the course, the students are equipped with a fundamental Matlab toolset to investigate their own STM or SSA problems.

Learning Outcomes: 1. Demonstrate fundamental understanding of sustainable use of space. 2. Determine engineering and simulation of information collection for STM. 3. Demonstrate Initial Orbit Determination and Orbit Improvement using passive

measurements. 4. Determine Orbital perturbations in the near-Earth and cislunar region. 5. Determine Computation Probability of Collision. Credits: 3.00

Autonomy & Control

AAE 50700 - Principles Of Dynamics

Credit Hours: 3.00. Kinematics, fundamental laws of mechanics, constraints, and generalized coordinates. Lagrange's equations, virtual work. Application to particle dynamics, rigid body motion, and spacecraft dynamics. Knowledge of differential equations required.

Credits: 3.00

AAE 50800 - Optimization In Aerospace Engineering

Credit Hours: 3.00. Formulation of optimization problems encountered in aerospace engineering. Minima of functions and functionals, necessary conditions, calculus of variations, control formulation, two-point boundary-value problems. Applications to typical problems in aerospace engineering, such as optimal launch, minimum time to climb, maximum range, and optimal space trajectories.

Credits: 3.00

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 56700 - Introduction To Applied Stochastic Processes

Credit Hours: 3.00. An introductory course in the concept of a discrete and continuous stochastic process based upon physical phenomena that originally gave rise to the specific stochastic models that are studies. Spectral analysis, response of time invariant systems to noise inputs. Estimation theory, Kalman and Winer filtering.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 60700 - Variational Principles Of Mechanics

Credit Hours: 3.00. Basic concepts of analytical mechanics, calculus of variations, Hamilton's equations, Hamilton-Jacobi theory, canonical transformations. Offered in alternate years. Prerequisite: AAE 50700.

Credits: 3.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time

and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 67500 - Introduction To Analysis Of Nonlinear Systems

Credit Hours: 3.00. An introduction to modeling of dynamic control systems. State plane and numerical methods for solving modeling equations. Linearization and describing function techniques. Stability concepts. Controller and state estimator design for nonlinear systems. Variable structure sliding mode control. Vector field techniques. Introduction to chaos. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 68000 - Modern Automatic Control

Credit Hours: 3.00. Theoretical methods in optimal control theory. Topics include the calculus of variations and the Pontryagin minimum principle with applications to minimum energy problems. Geometric methods will be applied to the solution of minimum time problems. Computational methods, singular problems, observer theory, and sufficient conditions for existence of solutions are also discussed. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ME 56200 - Advanced Dynamics

Credit Hours: 3.00. Dynamics of multi-degrees-of-freedom mechanical systems. Holonomic and nonholonomic constraints. Lagrange's equations of motion. Hamilton's principle for holonomic systems. Kinematics and kinetics of rigid body motion, including momentum and energy methods. Linearized equations of motion. Classification of vibratory systems - gyroscopic, circulatory forces. Stability of linear systems - divergence and flutter. Applications to gyroscopes, satellite dynamics, etc.

Learning Outcomes: 1. Develop an understanding of the principles governing the motion of mechanical systems modeled as rigid

bodies. 2. Develop an ability to analyze rigid-body kinematics in stationary as well as moving frames of reference. 3. Develop an ability to use Newton-Euler laws of rigid body motion. 4. Develop an understanding of the fundamental concepts in analytical dynamics, and the ability to use them to formulate the equations of motion for rigid bodies and systems. Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 56500 - Vehicle Dynamics

Credit Hours: 3.00. Modeling of wheeled vehicles to predict performance, handling, and ride. Effects of vehicle center of mass, tire characteristics, traction and slip, engine characteristics, and gear ratios on performance. Suspension design. Steady state and transient handling models of four-wheeled vehicles and car-trailer systems to determine oversteer and understeer characteristics, critical speeds, and stability. Multi-degree-of-freedom ride models, including tire and suspension compliance. Computer simulations. Current research topics in vehicle vibration isolation.

Learning Outcomes: 1. Mature in application of modeling techniques to predict the dynamic behavior of highway vehicles. 2. Develop an understanding of the relationships between vehicle design variables and vehicle dynamic behavior (acceleration, braking, handling, and ride). Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 57900 - Fourier Methods In Digital Signal Processing

Credit Hours: 3.00. Fundamentals of signal processing associated with Fourier analyzer systems are presented. Emphasis is on amplitude accuracy and frequency resolution properties necessary for reliable experimental methodologies in system identification, spectrum estimation, and correlation analysis. Deterministic, as well as random, data analyses are presented. Students are required to develop algorithms that significantly expand the utility of Fourier analyzer systems.

Credits: 3.00

ME 58000 - Nonlinear Engineering Systems

Credit Hours: 3.00. Methods of analysis for nonlinear ordinary differential equations arising in engineering systems. Review of linear systems. Stability concepts. Phase plane methods. Perturbation and averaging methods of analysis. Self-excited and parametrically-excited systems. Relaxation oscillations. Systems with more than one degree of freedom.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 66400 - Vibrations Of Continuous Systems

Credit Hours: 3.00. Theory of small oscillations of continuous systems. Love's equations for thin shells, reduction to special cases of shallow shells, plates, beams, etc. Initial stresses; influence of shear; thermal excitation. Initial value problems; forced vibrations; structural damping. The dynamic Green's function, impedance concepts; variational approaches. Experimental procedures, scaling, composite, and stiffened shells. Prerequisite: knowledge of one degree of freedom system vibrations.

Credits: 3.00

ME 67500 - Multivariable Control System Designs

Credit Hours: 3.00. Fundamentals of the frequency response loop shaping methodology for the analysis and design of robust multivariable control systems will be presented. Emphasis is on suitable extensions of the classical Bode-Nyquist design techniques to systems with not only uncertain parameters but also multiple inputs and outputs. Instrument and environmental signal level constraints on the performance of control systems will be critically evaluated. Students are required to develop ability to handle open-ended design issues involving significant multiobjective performance trade-offs. Prerequisite: ME 57500 .

Credits: 3.00

ME 67700 - Nonlinear Feedback Controller Design

Credit Hours: 3.00. Controller design and analysis of nonlinear feedback systems. Topics include the design of linear/nonlinear feedback controllers. Describing Function (DF) techniques for design, Popov and Generalized Circle Criterion for closed-loop stability, functional analysis and Volterra series approaches, and introduction to existing nonlinear controller design tools. Offered in alternate years. Prerequisite: ME 67500 .

Credits: 3.00

ME 68000 - Bifurcations And Chaos

Credit Hours: 3.00. Basic concepts in stability of systems, nonlinear dynamical systems, and bifurcation theory. Algebraic and geometric techniques for local bifurcation analysis. Models governed by difference, ordinary, and particle differential equations. Examples from mechanical, structural, chemical, and electrical systems. Models of chaotic behavior. Techniques for prediction of chaos. Routes to chaos. Offered in alternate years. Prerequisite: ME 58000 .

Credits: 3.00

ME 68900 - Adaptive Control

Credit Hours: 3.00. Theory and application of adaptive control of linear systems in both continuous and discrete time domain. Real-time parameter estimation algorithms, direct and indirect adaptive methods, deterministic self-tuning regulators, Lyapunov stability theory, input-output stability, model-reference adaptive control, stability and convergence of adaptive algorithms, robustness, and implementation issues, with laboratory experiments and demonstrations. Offered in alternate years. Prerequisite: ME 57500 .

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

ME 58400 - System Identification

Credit Hours: 3.00. Theory and application of System Identification methods. Connecting the world of mathematical models to experimental data - least squares methods and difference equation models. Background in probability and analysis: algebra of random variables, law of large numbers, central limit theorem. The ARMA family of models; mapping physics models to generalized ARMAX forms (linear and nonlinear); mapping the parameter estimation problem to the least squares problem (batch and recursive), and numerical solution techniques. Model (in)validation, optimal identification criteria, experiment design and data preprocessing considerations. Issues of signal-to-noise ratio, persistency of excitation, sampling frequency, data accuracy and data sizes.

Learning Outcomes: 1. Interpret data probabilistically and ability to calculate uncertainty propagation. 2. Fit backbox models to data; convert physics models to identifiable forms for least squares formulations. 3. Construction of numerical codes for solving least squares problems and use of MATLAB System ID toolbox. 4. Construct informative experiments for dynamic systems with suitable precision of and accuracy of sensing, data length, persistency of excitation, and sampling frequency. Credits: 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis,

convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

ME 56000 - Kinematics

Credit Hours: 3.00. Geometry of constrained plane motion with applications to linkage design. Type and number synthesis, size synthesis. Path curvature, inflection circle, cubic of stationary curvature. Finite displacements, three and four separated positions. Graphical, analytical, and computer techniques.

Credits: 3.00

Propulsion

ME 50000 - Advanced Thermodynamics

Credit Hours: 3.00. The empirical, physical basis of the laws of thermodynamics. Availability/exergy concepts and applications. Properties and relations between properties in homogeneous and heterogeneous systems. The criteria of equilibrium. Application to a variety of systems and problems, including phase and reaction equilibrium. Offered in alternate years.

Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 53500 - Propulsion Design, Build, Test

Credit Hours: 3.00. Intensive one-semester treatment of the aerospace propulsion component development process. Derivation of design requirements from mission objective to detailed components; the design process. Standard methods for

thermostructural, life, performance, and combustion stability design analysis; combustor design. Experimental procedures; fabrication; test. Special topics according to student interest.

Credits: 3.00

AAE 53700 - Hypersonic Propulsion

Credit Hours: 3.00. Analysis of advanced high speed air breathing propulsion concepts for hypersonic flight. Missions and trajectories. Engine/airframe integration. Aerothermodynamic analysis of ramjets, scramjets, and oblique detonation wave engines. On- and off-design of compression inlets and minimum length nozzles. Cryogenic fuels and skin cooling. Ram accelerator ballistic launch concepts.

Learning Outcomes: 1. Develop understanding of high-speed inlet systems. 2. Develop understanding of mixing systems employed in airbreathing engines. 3. Develop understanding of turbine-based combined cycle systems. 4. Develop understanding of detonative-based propulsion systems. 5. Develop understanding of ducted rockets. 6. Develop understanding of ramjet and scramjet propulsion systems. Credits: 3.00

AAE 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (ME 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

AAE 53900 - Advanced Rocket Propulsion

Credit Hours: 3.00. Generalized internal compressible and incompressible flows. Thermochemistry and heat transfer in rocket applications. Advanced topics in solid rocket motor performance and internal ballistics. Liquid rocket engine cycle analysis and turbopump design. Combustion of liquid and solid propellants. Hybrid rockets and thermal-nuclear engines.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ME 50100 - Statistical Thermodynamics

Credit Hours: 3.00. The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Introduction to quantum mechanics and molecular spectroscopy. The Maxwell-Boltzmann formulation of statistical mechanics and applications to ideal gases, solids, radiation, and laser diagnostics. The Gibbs formulation of statistical mechanics and application to real gases. Kinetic theory and applications to transport properties and chemical kinetics. Offered in alternate years.

Learning Outcomes: 1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena. 2. Apply concepts and calculate thermodynamic and transport properties of ideal gases. 3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements. Credits: 3.00

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and

solve radiation heat transfer problems. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 52500 - Combustion

Credit Hours: 3.00. Physical and chemical aspects of basic combustion phenomena. Chemical energetics and equilibrium. Basic chemical kinetics, chain reactions, and explosions. Chain and thermal ignition. Homogeneous combustion models. Detonations and deflagrations. Laminar flame speed and flame extinction. The Shvab-Zeldovich formulation of the multicomponent conservation equations. Diffusion flames and droplet combustion. Introduction to turbulent combustion.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8) spray drying. Offered in alternate years.

Credits: 3.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (AAE 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, and nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

NUCL 56300 - Direct Energy Conversion

Credit Hours: 3.00. Review of energy sources and study of the basic processes of direct energy conversion and their applications to energy utilization, based on both conventional and nuclear energy conversion schemes. Conventional schemes include thermoelectric, photovoltaic, thermionic, magnetohydrodynamic generators, fuel cell systems, etc.; and nuclear energy conversion schemes correspond to nuclear radiation and fusion energy conversion. Permission of instructor required.

Credits: 3.00

AAE 52100 - Plasma Laboratory

Credit Hours: 3.00. The laboratory course will include lab prep lectures, practical classes and mini-projects. Lab prep lectures will briefly cover topics of the basic plasma physics and diagnostics relevant to the subsequent practical classes. In addition, details of the corresponding lab procedure, instructions and lab report assignment will be discussed. Practical classes will involve students in practical creation and operation of various plasma sources and plasma diagnostics. Specifically, students will operate DC high voltage breakdown facility, electrostatic accelerator (ion thruster), cross-field accelerator (Hall thruster), Atmospheric-Pressure Plasma Jet facility, and will conduct measurements of plasma parameters using Langmuir probes, microwave interferometer and optical spectrometer.

Learning Outcomes: 1. Operate laboratory electronic equipment and conduct basic

electrical measurements. 2. Demonstrate fundamental understanding of Paschen breakdown law, and measure breakdown parameters. 3. Demonstrate fundamental understanding of Child-Langmuir law and calculate space-charge limited current density. 4. Operate electrostatic accelerator at different acceleration voltages, and conduct measurements of total ion current carried by the plasma jet using plane Langmuir probe. 5. Demonstrate fundamental understanding of operation of single electrostatic Langmuir probes, conduct measurements of V-I curves, and calculate plasma parameters based on the measurements. 6. Operate cold atmospheric-pressure plasma jet and conduct spectroscopic measurements of the jet emission using spectrometer. 7. Computationally simulate the emission spectra of the second positive system of nitrogen molecule, and determine vibrational and rotational gas temperatures based on the measured and simulated spectra. 8. Operate Hall-effect accelerator, and measure basic operational parameters. 9. Operate pendulum thrust stand and conduct thrust measurements. 10. Demonstrate fundamental understanding of operation principle of microwave interferometry and construct the interferometer from basic microwave components. 11. Conduct interferometry measurements of phase shift in plasma column and determine plasma density. 12. Conduct search of the journal papers on a given topic, and compare the reported results with that measured in the lab. Credits: 3.00

AAE 53400 - Spacecraft Electric Propulsion

Credit Hours: 3.00. Spacecraft electric propulsion systems are intended to provide thrust for propelling spacecrafts in interplanetary missions, orbital maneuvers, and attitude control. The course will start with reviewing material on the mechanics and thermodynamics of propulsion, and identifying the niche occupied by the electric propulsion systems. The course will cover elements of plasma physics and electromagnetic theory essential for studying the electric propulsion systems. The core of the course will focus on studying various electric propulsion concepts which utilize electric power produced on-board to generate thrust. Mechanisms of the utilization of the electric power to accelerate gas or plasma and produce thrust will be considered, including electrothermal, electrostatic, electromagnetic, and gasdynamic acceleration mechanisms. Learning Outcomes: 1. Determine optimal specific impulse of electric propulsion system based on specific mission requirements 2. Demonstrate fundamental understanding of differences between electric and chemical propulsion systems performance and space applications. 3. Calculate basic plasma parameters and characteristics of collisional processes. 4. Demonstrate fundamental understanding of concepts of quasineutrality and collective behavior in plasmas. 5. Perform analysis of electrothermal accelerator at a given frozen flow fraction 6. Apply Maxwell equations in differential and integral forms to solve basic electromagnetism problems 7. Perform analysis of space-charge limited electrostatic accelerator in ion acceleration zone, in deceleration zone, and in neutralization zone. 8. Perform analysis of motion of charged particles in crossed electric and magnetic fields 9. Derive and apply modified forms of Ohm's law in two-component moving plasma in presence of magnetic field. 10. Perform elementary analysis of crossed-field electromagnetic accelerator with small Hall parameter 11. Perform elementary analysis and calculate basic parameters of Hall effect accelerator. 12. Demonstrate fundamental understanding of the differences of acceleration concepts used in Hall effect and in electrostatic accelerators. 13. Calculate body force in magnetoplasmadynamic accelerator. Credits: 3.00

ME 62000 - Combustion Of Energetic Materials

Credit Hours: 3.00. Students will learn the concepts of how to approach research in the area of Energetic Materials (EM) based on an understanding of the fundamental principles.

Students will learn how energetic materials are fabricated, safety used, as well as understand life cycle issues, homogeneous & heterogenous combustion, and advanced energetic material concepts. Multiphase combustion phenomena will be introduced and emphasized. They will apply these concepts to a literature review and group research project, as well as that includes applying thermochemistry and chemical kinetic software. In addition, six hands-on labs are performed. This material will be covered in the context of real-world applications, with an emphasis on energetic materials, combustion, propulsion, explosives, pyrotechnics, and detonation phenomenon. Pre-requisite: ME 52500 or AAE 53900 or consent of instructor.

Learning Outcomes: 1. Become familiar with the basic terminology, material science, physics & chemistry of energetic materials. 2. Learn how to safely work with energetic materials. 3. Learn how to experimentally or computationally approach research. 4. Learn how to approach literature reviews and form hypotheses for future research. 5. Learn the knowledge and experience needed to understand, model, develop, and experimentally characterize energetic materials, and well as numerous related fields. Credits: 3.00

Structures & Materials

AAE 54600 - Aerospace Structural Dynamics And Stability

Credit Hours: 3.00. Dynamics of continuous systems: rod, beam, frame, and plate structures. General structural principles: virtual work, Hamilton's principle, Lagrange's equation, and Ritz method for discrete approximations. Modal analysis: eigenanalysis, mode shapes, mode superposition, and complex modes. Nonlinear vibrations: phase plane, Poincare, bifurcation plots, and chaos. Stability of the motion: classification of problems, follower loads, aerodynamic loads, divergence, flutter, pulsating compression, and gyroscopic systems.

Credits: 3.00

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55200 - Nondestructive Evaluation Of Structures And Materials

Credit Hours: 3.00. Overview of methods employed for nondestructive evaluation of structures and materials taught in the context of damage tolerant structural analysis. Major inspection topics include: radiography, ultrasonics, eddy current, penetrant, magnetic, and visual/optical techniques. Other new emerging inspection techniques also are discussed. Offered in alternate years.

Credits: 3.00

AAE 55300 - Elasticity In Aerospace Engineering

Credit Hours: 3.00. A basic course in the theory of elasticity with emphasis on understanding the fundamental principles and solution techniques used in the stress analysis of structures. Cartesian tensors. Governing equations for linear elasticity. Rigorous derivation of beam and plate equations from the three-dimensional elasticity equations. Torsion. Thermoelasticity. The stress functions and complex functions approaches to two-dimensional problems. Energy methods and approximate solutions. Three-dimensional problems. Knowledge of differential equations assumed.

Learning Outcomes: 1. Give student an in-depth background in mechanics of solids including large deformation, and the ability to perform stress analyses in elastic bodies, especially two-dimensional bodies. Credits: 3.00

AAE 55400 - Fatigue Of Structures And Materials

Credit Hours: 3.00. Development and application of methods for predicting the fatigue life of structural components. Characterization and response of materials to cyclic loading. Fatigue resistant design of aerospace structures. Both fatigue crack initiation and crack propagation concepts are discussed.

Credits: 3.00

AAE 55500 - Mechanics Of Composite Materials

Credit Hours: 3.00. Current and potential applications of composite materials. Review of elasticity of anisotropic solids. Methods for determining mechanical properties of heterogeneous materials. Static and dynamic analyses of laminated composites. Fracture and fatigue of laminates. Reliability, testing, and design of composites.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 55800 - Finite Element Methods In Aerospace Structures

Credit Hours: 3.00. Introduction to the use of advanced finite element methods in the calculation of deformation, strain, and stress in aerospace structures. Topics include: 1-D, 2-D, 3-D, and axisymmetric elements, isoperimetric element formulation, convergence, treatment of boundary conditions and constraints. Special topics include stability, dynamic analysis, and nonlinear material behavior. Emphasis is on the theoretical knowledge of the finite element method. Applied experience is gained by solution of aerospace structural analysis problems through use of professional software.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 65400 - Fracture Mechanics

Credit Hours: 3.00. Methods of stress analysis in elastic media containing cracks. Fracture criteria. The strain energy release rate and J-integral. Crack tip plasticity. Interface cracks. Cracks in anisotropic solids. Bending of cracked plates. Dynamic crack propagation. Prerequisite: AAE 55300.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

CE 59500 - Finite Elements In Elasticity

Credit Hours: 3.00. Fundamentals of theory of elasticity; variational principles; one-, two-, and three-dimensional elasticity finite elements; interpolation methods; numerical integration; convergence criteria; stress interpretation.

Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 55900 - Micromechanics Of Materials

Credit Hours: 3.00. Prediction of the macroscopie behavior of materials from their microstructure and the design of new materials. Microstructure-property relationships between the macroscopie material behavior and microscopic structure. Application to traditional structure as well as to new engineering materials. Adapting emerging constitutive relations into structure analyses. Introduction of this new approach to materials, its applications in predictive analysis tools, and its importance in simulation-based engineering.

Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 61200 - Continuum Mechanics

Credit Hours: 3.00. A unified and exact mathematical treatment of the mechanics of solids and fluids. Cartesian tensor algebra and calculus; stress tensor, principle stresses and invariants; material and spatial coordinates, deformation gradient, strain and stretch tensors; balance of mass, momentum, and energy; constitutive equations of elasticity, hyperelasticity, viscous fluids

and viscoelasticity.

Credits: 3.00

ME 65000 - Computational Fracture Mechanics

Credit Hours: 3.00. Advanced concepts of methods for the analysis of cracks, of crack propagation and damage evolution. Prediction of the macroscopic behavior of structures as it emerges from the presence of defects such as cracks, voids, or delamination. Linear elastic and nonlinear fracture problems. Rate independent and rate dependent problems. Methods in computational fracture mechanics where material separation emerges as an outcome of the boundary value problem. Demonstrations of how mechanical design can take advantage of the methods of computational fracture mechanics by introducing such concepts into structural analyses. Applications of computations in predictive analysis and its importance in simulation-based engineering. Prerequisites: AAE 55800 or ME 48900, or similar courses in finite element analysis or ME 57000 or ME 61200 or AAE 55300, or similar courses on advanced solid mechanics. Recommended but not required: CEE 597-109 or AAE 65400.

Learning Outcomes: 1. Introduce concepts of computational methods for material damage, fracture and fatigue. 2. Learn continuum mechanics concepts for description of material failure. 3. Learn about advanced constitutive equations for bulk and interface failure. 4. Learn how model material failure processes. 5. Learn how to develop and apply computational mechanics methods. 6. Apply these concepts to analysis of failure at the macro, micro and Nano scale. Credits: 3.00

AAE 54500 - Dynamic Behavior of Materials

Credit Hours: 3.00. Materials' responses to high-rate loading are different from their quasi-static behavior. Applications of materials in structures subjected to impact loading from events such as bird strike require the understanding of dynamic material behavior. Such high-rate materials behavior is not available in standard materials handbooks or design manuals. This course introduces stress wave propagation in solids, which is the foundation to characterization and understanding of high-rate response of materials. Then, the theoretical background and working principles of high-rate experimental methods are presented to characterize the material response under high-rate loading conditions. Finally, rate-dependent material models are introduced to describe the dynamic material behavior and deformation mechanisms.

Learning Outcomes: 1. Express local equations of motion. 2. Derive one dimensional wave equations in solid materials. 3. Calculate elastic wave speeds in solids with and without constraints. 4. Understand and calculate local stresses as an elastic wave passes through an interface. 5. Understand and predict local stress concentrations resulted in from wave interactions. 6. Utilize elastic waves as loading methods and as diagnostic methods. 7. Design experiments to measure dynamic behavior of materials. 8. Determine dynamic yield strength of ductile materials in Taylor impact tests. 9. Determine plastic wave speeds in ductile material under intensive loading. 10. Understand shock wave propagation in solids. 11. Understand physics and calculate shock properties of materials. 12. Understand physical origins of plastic waves and shock waves. 13. Understand rate-dependent material models. 14. Conduct a thorough search of literature on a subject of interest. 15. Understand the critical issues of the subject of interest. 16. Identify research gaps in the subject of interest. 17. Present effectively a summary of the literature survey. Credits: 3.00

AAE 54800 - Mechanical Behavior Of Aerospace Materials

Credit Hours: 3.00. This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smartphones. In fact, breakthroughs with material research are often accompanied by rapid advancements in technology. Thus, it is paramount for all engineers to have an understanding of the structure and behavior of materials. In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and, ultimately, failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms. Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal-material levels and their use in explaining the deformation and failure

characteristics in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of aerospace materials: metal alloys, ceramic-matrix composites, and fiber-reinforced polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, creep, and failure mechanisms; design criteria; special topics. We will attempt to have minimal overlap with AAE 55400, Fatigue of Structures and Materials. Therefore we will not cover fracture, fatigue, or stress concentrators.

Learning Outcomes: 1. Express vector and tensor equations using indicial notation. 2. Express crystallography according to Miller indices and define slip systems in basic crystal structures. 3. Calculate and understand the physical basis of elastic anisotropy. 4. Understand, calculate, and use basic states of stress and yield criteria. 5. Define and understand the physical basis of point, line, and area defects in crystalline materials. 6. Calculate the strain fields, stress fields, and energy of dislocations, in addition forces between dislocations. 7. Understand dislocation motion as well as interactions between dislocations. 8. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 9. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 10. Understand origins of twinning, stacking faults, and the shape memory effects. 11. Understand physics and calculate strengthening influence of solutes, precipitates, grain boundaries, and strain hardening. 12. Understand physical origins of creep, calculate creep using Larson-Miller expressions, and use creep deformation mechanism map. 13. Understand origins of residual stress and apply to constrain problems. 14. Understand and apply statistical approaches to identify probability of failure and property variations. 15. Define and classify polymer structures. 16. Understand viscoelasticity and calculate behavior using classical models. 17. Distinguish physical mechanisms of polymer deformation, crazing, and fracture. 18. Express stiffness and strength of fiber reinforced composite structures. Credits: 3.00

AAE 64800 - Modeling Damage And Strengthening Mechanisms In Materials

Credit Hours: 3.00. The usage of materials is the backbone of engineering practice. Yet, advances in materials have stagnated due to overly conservative approaches, trial-and-error testing, and long qualification times. Material modeling offers tremendous opportunities to address these issues. This class offers advanced modeling strategies at the intersection of mechanics and materials science for both polycrystalline and composite materials. The course topics are defined as follows: First, advanced micromechanics analysis of modern engineering materials with emphasis on relating elastic microstructural phenomena to the mechanics of material behavior, via the Eshelby inclusion problem and its application to fiber reinforced composites. Second, classical plasticity is summarized via phenomenological and mathematical formulation of the constitutive laws, including yielding, yield surface; von Mises, Tresca yield criteria; Drucker's stability postulate; strain or work hardening, normality rule, perfect plasticity, and stress-strain law. Third, crystal plasticity is discussed, specifically physical and mathematical foundation for plasticity in crystalline materials, with a detailed description of the Bishop and Hill implementation of the Taylor model for deformation of polycrystals. Lastly, concepts of dislocations leading to strengthening mechanisms in metals are discussed: (i) by studying the anisotropy of material and elastoplastic properties at crystal level, microstructural basis for deformation in metals, polymers, and ceramics and (ii) failure mechanisms and toughening in metals, with primary emphasis on work/strain hardening, solid solution hardening, precipitate hardening, and grain boundaries. The course will be comprised of three projects, where the student chooses the topic of the third and final project. Prerequisite: AAE 55300 or equivalent.

Learning Outcomes: 1. Express displacement field for an arbitrary elliptical inclusion via a Green's function. 2. Prove the stress/strain fields within inclusion is uniform. 3. Calculate Eshelby interaction tensor for arbitrary shape inclusion. 4. Express the stress/strain fields external to the inclusion. 5. Implement Eshelby problem via Mori-Tanaka approach and apply to stiffness of composites. 6. Express interaction energy of inclusion. 7. Understand physical basis of plasticity. 8. Express yield surface and associated criteria via stress invariants and on

the Pi-plane. 9. Express flow rules for evolution of the yield surface and implement into principal of virtual velocities. 10. Express convexity and normality constraints. 11. Express crystal orientation as a series of rotations and express via a pole figure representation. 12. Identify texture of materials 13. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 14. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 15. Calculate the Taylor factor, geometric hardness of a polycrystalline material. 16. Express grain orientation evolution, via an exponential mapping. 17. Implement the Taylor model within a Bishop and Hill implementation to express texture evolution of polycrystalline materials. 18. Understand and express kinetics (strain rate and temperature) into deformation via thermodynamic expressions. 19. Model work hardening in crystalline materials. 20. Understand the physical origins and model incompatibilities. 21. Define grain boundary structure and their affect on mechanical behavior. 22. Apply concepts learned from this class into a research project of the student's choice. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

Secondary Area Courses (6 credits)

Aerodynamics

AAE 51100 - Introduction To Fluid Mechanics

Credit Hours: 3.00. The basic conservation equations are derived for a compressible viscous fluid, and then are specialized for applications in potential flow, viscous flow, and gas dynamics.

Learning Outcomes: 1. Use index notation to derive vector and tensor relations. 2. Manipulate and derive governing equations in various forms. 3. Determine streamlines, pathlines, streaklines and timelines for unsteady flow. 4. Determine how vorticity is produced by various mechanisms. 5. Determine the motion of two-dimensional point vortices. 6. Use conformal mapping to find the lift coefficient on an airfoil shape. 7. Use a Schwarz-Christoffel transformation to solve for potential flow with corners. 8. Use three-dimensional potential flow to solve for flow over axisymmetric bodies. 9. Solve for steady and unsteady exact solutions of the Navier-Stokes equations. 10. Derive and use the Stokes drag law for a sphere. 11. Derive boundary layer equations, find self-similar solutions and determine scaling laws. 12. Compute skin friction on an airfoil using an approximate boundary layer method. 13. Determine the qualitative effects of turbulence on a flow. Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of

partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 51400 - Intermediate Aerodynamics

Credit Hours: 3.00. Thin airfoil theory and panel methods. Three-dimensional elementary solutions, lifting-line and lifting-surface models. Slender wing and slender body theory. Normal/oblique shock waves. One- and multi-dimensional flows and conical flows. Method of characteristics. Introduction to transonic flow, hypersonic flow, and airfoil design.

Credits: 3.00

AAE 51800 - Low-Gravity Fluid Dynamics

Credit Hours: 3.00. Theory and design for control of liquid propellants in weightlessness. Gravity and orbits review. Satellite and space-probe acceleration environments. Capillary-dominated fluid dynamics: contact angle, surface tension, curvatures, and solution methods. Industry practice and current topics.

Credits: 3.00

AAE 51900 - Hypersonic Aerothermodynamics

Credit Hours: 3.00. Aerodynamics of satellites and planetary re-entry. Continuum hypersonic flow. Inviscid and viscous effects, boundary layers, and heat transfer. Shock and boundary-layer interactions. Equilibrium flow of high-temperature reacting gases. Nonequilibrium effects. Kinetic theory and rarefied flows. Direct simulation Monte Carlo techniques.

Credits: 3.00

AAE 52000 - Experimental Aerodynamics

Credit Hours: 3.00. Theory and application of experimental techniques and instrumentation for aerodynamics and fluid mechanics. Computer data acquisition, wind tunnels, force balances, flow visualization, pressure probes, hot wire anemometry, laser Doppler velocimetry and turbulence measurements.

Credits: 3.00

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55100 - Design Theory And Methods For Aerospace Systems

Credit Hours: 3.00. Introduction to design theory, aerospace design process, design specification and requirements, concept generation and selection, design decomposition, improving designs, process design, and concurrent engineering. Design for assembly/manufacture. Projects allow for application and critical analysis of design methods.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 61300 - Viscous Flow Theory

Credit Hours: 3.00. Compressible, laminar boundary layer theory; Buseman and Crocco integrals; skin friction and heat transfer. Introduction to turbulent boundary layers and transition phenomena. Advanced boundary layer theory; the method of inner and outer expansions. Boundary layers with chemical reaction; applications to hypersonic flow and combustion. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62400 - Laminar-Turbulent Transition

Credit Hours: 3.00. Instability mechanisms, such as Kelvin-Helmholtz, Tollmien-Schlichting, Gortler, and crossflow. Secondary instabilities. Nonlinear and nonparallel effects; the Parabolized Stability Equations; receptivity; transition prediction. Effects of compressibility, heating, roughness, turbulence, noise, curvature, etc. Turbulent spots and the extent of transitional flow. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62600 - Turbulence And Turbulence Modeling

Credit Hours: 3.00. Physical description of turbulence. Reynolds averaged equations. Scaling of basic turbulent flows. Homogeneous turbulence, spectra and two-point correlations. Hierarchy of turbulence models, including zero-, one-, and two-equation models, Reynolds stress models, large eddy simulations, and direct numerical simulations. Additional topics, such as compressibility effects on turbulence and probability density function methods, as time allows. Prerequisite: AAE 51100.

Credits: 3.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 50900 - Intermediate Fluid Mechanics

Credit Hours: 3.00. Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

Learning Outcomes: 1. State basic laws for a control volume in different coordinate systems. 2. Derive the kinematics of fluid flow in problem solving. 3. Derive the equations for frictionless and incompressible flows. 4. Derive the basic equations of motion of viscous flows. 5. Find standard exact solutions of viscous-flow equations and apply them. 6. Derive and solve basic equations of boundary-layer theory. 7. Find lift and drag forces on immersed bodies with simple shapes. 8. Understand concepts of incompressible turbulent flows and wall turbulence. Credits: 3.00

ME 51000 - Gas Dynamics

Credit Hours: 3.00. Flow of compressible fluids. One-dimensional flows including basic concepts, isentropic flow, normal and oblique shock waves, Rayleigh line, Fanno line, and simple waves. Multidimensional flows including general concepts, small perturbation theory for linearized flows and method of characteristics for nonlinear flows. Prerequisite: first course in fluid or aerodynamics.

Credits: 3.00

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8) spray drying. Offered in alternate years.

Credits: 3.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn

common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

ME 61000 - Boundary Layer Theory

Credit Hours: 3.00. Fundamentals of continuum fluid mechanics; Navier-Stokes equations. Laminar flow; boundary-layer concept; similarity solutions; transformation methods; integral and finite difference solution techniques for general pressure gradients. Should be preceded by intermediate fluid mechanics.

Credits: 3.00

ME 61100 - Principles Of Turbulence

Credit Hours: 3.00. Methods of description and basic equations for turbulent flows. Isotropic and homogeneous turbulence, energy spectra, and correlations. Introduction to measurements. Transition theory and experimental evidence. Wall turbulence, engineering calculations of turbulent boundary layers. Free turbulent jets and wakes. Prerequisite: ME 61000 .

Learning Outcomes: 1. Develop the ability (from first principles) to describe the physics of turbulent flows. 2. Comprehend the methods of analysis used in turbulence study. 3. Understand the principles of turbulence simulation and the associated modeling problems. Credits: 3.00

ME 61300 - Advanced Engineering Acoustics

Credit Hours: 3.00. An extension of ME 51300 . Sound transmission between two media. Acoustic resonators and application to muffler theory. Structural radiation and sound. Acoustical measurements and signal processing: sound intensity, surface intensity, coherence and cepstral techniques. Numerical acoustics: finite element analysis, boundary integral equation analysis and statistical energy analysis. Advanced topics. Prerequisite: ME 51300 .

Credits: 3.00

ME 61400 - Computational Fluid Dynamics

Credit Hours: 3.00. Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solution of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Prerequisite: ME 50900 or ME 58100 .

Credits: 3.00

ME 61500 - Aeroacoustics

Credit Hours: 3.00. (AAE 61500) Quantitative measures of sound (decibel scales, spectra, energetics of acoustic motions, and measurement techniques). The wave theory of sound (basic equations and properties, sound propagation in homogeneous and inhomogeneous media, one-, two- and three-dimensional sound fields and distributed sources). Effects of source movement. Aerodynamic noise generation - acoustic analogy (Lighthill's equation and Ffowcs Williams-Hawkings equation). Introduction to Computational Aeroacoustics (CAA). Noise from turbulent shear flows (jet noise, cavity noise, and noise from flow over objects). Noise from turbomachinery, propellers, and rotors. Prerequisite: ME 30900 or ME 51300 or AAE 51100.

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

AAE 52100 - Plasma Laboratory

Credit Hours: 3.00. The laboratory course will include lab prep lectures, practical classes and mini-projects. Lab prep lectures will briefly cover topics of the basic plasma physics and diagnostics relevant to the subsequent practical classes. In addition, details of the corresponding lab procedure, instructions and lab report assignment will be discussed. Practical classes will involve students in practical creation and operation of various plasma sources and plasma diagnostics. Specifically, students will operate DC high voltage breakdown facility, electrostatic accelerator (ion thruster), cross-field accelerator (Hall thruster), Atmospheric-Pressure Plasma Jet facility, and will conduct measurements of plasma parameters using Langmuir probes, microwave interferometer and optical spectrometer.

Learning Outcomes: 1. Operate laboratory electronic equipment and conduct basic electrical measurements. 2. Demonstrate fundamental understanding of Paschen breakdown law, and measure breakdown parameters. 3. Demonstrate fundamental understanding of Child-Langmuir law and calculate space-charge limited current density. 4. Operate electrostatic accelerator at different acceleration voltages, and conduct measurements of total ion current carried by the plasma jet using plane Langmuir probe. 5. Demonstrate fundamental understanding of operation of single electrostatic Langmuir probes, conduct measurements of V-I curves, and calculate plasma parameters based on the measurements. 6. Operate cold atmospheric-pressure plasma jet and conduct spectroscopic measurements of the jet emission using spectrometer. 7. Computationally simulate the emission spectra of the second positive system of nitrogen molecule, and determine vibrational and rotational gas temperatures based on the measured and simulated spectra. 8. Operate Hall-effect accelerator, and measure basic operational parameters. 9. Operate pendulum thrust stand and conduct thrust measurements. 10. Demonstrate fundamental understanding of operation principle of microwave interferometry and construct the interferometer from basic microwave components. 11. Conduct interferometry measurements of phase shift in plasma column and determine plasma density. 12. Conduct search of the journal papers on a given topic, and compare the reported results with that measured in the lab. Credits: 3.00

Aerospace Systems

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques:

approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55100 - Design Theory And Methods For Aerospace Systems

Credit Hours: 3.00. Introduction to design theory, aerospace design process, design specification and requirements, concept generation and selection, design decomposition, improving designs, process design, and concurrent engineering. Design for assembly/manufacture. Projects allow for application and critical analysis of design methods.

Credits: 3.00

AAE 56000 - System-Of-Systems Modeling And Analysis

Credit Hours: 3.00. Introduction to features of system-of-systems problems; problem definition tools; role of complexity; network topology analysis and agent-based simulation models; architecture analysis; metrics for multi-stakeholder problems; semester team projects allow students to exercise and critique such methods for analyzing system-of-systems problems. Some background in probability and statistics (e.g. random variables, probability density and distributions, sampling methods) is expected.

Learning Outcomes: 1. Introduce to modeling and analysis techniques for system-of-systems (SoS) problems in engineering. 2. Center on students' ability for understanding, modeling, and analyzing SoS problems, which consist of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. These problems are often large-scale and interdisciplinary, involving systems and behaviors found in diverse fields such as engineering, economics, social science, policy, etc. 3. Present developments in addressing system-of-systems problems, describes criteria, lexicon, and analysis methodology for their study, and, through semester-long team projects, allows students to explore the many unknowns that persist in this emerging field. 4. Know the major subjects covered: distinguishing traits of and behaviors of SoS problems, complexity and complex adaptive systems, agent-based modeling, modern network theory and analysis tools, modeling for decision-making, and exploratory modeling. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

Astrodynamics & Space Applications

AAE 50700 - Principles Of Dynamics

Credit Hours: 3.00. Kinematics, fundamental laws of mechanics, constraints, and generalized coordinates. Lagrange's equations, virtual work. Application to particle dynamics, rigid body motion, and spacecraft dynamics. Knowledge of differential equations required.

Credits: 3.00

AAE 50800 - Optimization In Aerospace Engineering

Credit Hours: 3.00. Formulation of optimization problems encountered in aerospace engineering. Minima of functions and functionals, necessary conditions, calculus of variations, control formulation, two-point boundary-value problems. Applications to typical problems in aerospace engineering, such as optimal launch, minimum time to climb, maximum range, and optimal space trajectories.

Credits: 3.00

AAE 53200 - Orbit Mechanics

Credit Hours: 3.00. Orbit determination of near-earth satellites and various perturbations; libration and attitude control; orbit transfer and interception; lunar theory and interplanetary orbits; ascending mechanics and re-entry.

Credits: 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 60700 - Variational Principles Of Mechanics

Credit Hours: 3.00. Basic concepts of analytical mechanics, calculus of variations, Hamilton's equations, Hamilton-Jacobi theory, canonical transformations. Offered in alternate years. Prerequisite: AAE 50700.

Credits: 3.00

AAE 63200 - Advanced Orbital Dynamics

Credit Hours: 3.00. Discussion of more advanced concepts in astrodynamics. Includes fundamental theories from celestial mechanics, as well as trajectory determination and perturbation analysis with application to the motion of Earth-orbiting and interplanetary spacecraft. Assumes experience with the two-body problem. Offered in alternate years. Prerequisite: AAE

50700, AAE 53200.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.

Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application. Credits: 3.00

AAE 67500 - Advanced Signals And Systems For Satellite Navigation

Credit Hours: 3.00. Fundamental theory of ranging signal design. Generation of pseudorandom noise. Methods for detecting, tracking, and estimating delay using ranging signals. Probability of detection, probability of false alarm, and tracking threshold derived from a stochastic signal model. Models for multiple access, quantization, clock and multipath errors. Examples drawn from present-day Global Navigation Satellite Systems (GNSS). Prerequisites: ECE 60000, AAE 56700, or equivalent (Random Variables and Stochastic Processes).

Learning Outcomes: 1. Understand current literature in radio navigation signal processing. 2. Develop signal processing algorithms for radio navigation applications. 3. Predict performance of radio navigation signal processing algorithms. 4. Implement radio navigation signal processing algorithms in a software-defined radio, using a programming language such as MATLAB. Credits: 3.00

Autonomy & Control

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 56700 - Introduction To Applied Stochastic Processes

Credit Hours: 3.00. An introductory course in the concept of a discrete and continuous stochastic process based upon physical phenomena that originally gave rise to the specific stochastic models that are studies. Spectral analysis, response of time invariant systems to noise inputs. Estimation theory, Kalman and Winer filtering.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems.

Credits: 3.00

Propulsion

ME 50000 - Advanced Thermodynamics

Credit Hours: 3.00. The empirical, physical basis of the laws of thermodynamics. Availability/exergy concepts and applications. Properties and relations between properties in homogeneous and heterogeneous systems. The criteria of equilibrium. Application to a variety of systems and problems, including phase and reaction equilibrium. Offered in alternate years.

Credits: 3.00

AAE 53500 - Propulsion Design, Build, Test

Credit Hours: 3.00. Intensive one-semester treatment of the aerospace propulsion component development process. Derivation of design requirements from mission objective to detailed components; the design process. Standard methods for thermostructural, life, performance, and combustion stability design analysis; combustor design. Experimental procedures; fabrication; test. Special topics according to student interest.

Credits: 3.00

AAE 53700 - Hypersonic Propulsion

Credit Hours: 3.00. Analysis of advanced high speed air breathing propulsion concepts for hypersonic flight. Missions and trajectories. Engine/airframe integration. Aerothermodynamic analysis of ramjets, scramjets, and oblique detonation wave engines. On- and off-design of compression inlets and minimum length nozzles. Cryogenic fuels and skin cooling. Ram accelerator ballistic launch concepts.

Learning Outcomes: 1. Develop understanding of high-speed inlet systems. 2. Develop understanding of mixing systems employed in airbreathing engines. 3. Develop understanding of turbine-based combined cycle systems. 4. Develop understanding of detonative-based propulsion systems. 5. Develop understanding of ducted rockets. 6. Develop understanding of ramjet and scramjet propulsion systems. Credits: 3.00

AAE 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (ME 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, nozzle. Component matching

and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

AAE 53900 - Advanced Rocket Propulsion

Credit Hours: 3.00. Generalized internal compressible and incompressible flows. Thermochemistry and heat transfer in rocket applications. Advanced topics in solid rocket motor performance and internal ballistics. Liquid rocket engine cycle analysis and turbopump design. Combustion of liquid and solid propellants. Hybrid rockets and thermal-nuclear engines.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ME 50100 - Statistical Thermodynamics

Credit Hours: 3.00. The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Introduction to quantum mechanics and molecular spectroscopy. The Maxwell-Boltzmann formulation of statistical mechanics and applications to ideal gases, solids, radiation, and laser diagnostics. The Gibbs formulation of statistical mechanics and application to real gases. Kinetic theory and applications to transport properties and chemical kinetics. Offered in alternate years.

Learning Outcomes: 1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena. 2. Apply concepts and calculate thermodynamic and transport properties of ideal gases. 3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements. Credits: 3.00

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 52500 - Combustion

Credit Hours: 3.00. Physical and chemical aspects of basic combustion phenomena. Chemical energetics and equilibrium. Basic chemical kinetics, chain reactions, and explosions. Chain and thermal ignition. Homogeneous combustion models. Detonations and deflagrations. Laminar flame speed and flame extinction. The Shvab-Zeldovich formulation of the multicomponent conservation equations. Diffusion flames and droplet combustion. Introduction to turbulent combustion.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between

a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8) spray drying. Offered in alternate years.

Credits: 3.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (AAE 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, and nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

ME 62500 - Advanced Combustion

Credit Hours: 3.00. Coupling of the energy, species, and mass conservation equations with the momentum equation. Statistical treatment of turbulence and the problems of interactions of turbulence with chemistry, radiation, and two-phase flows. Critical study of at least 10 seminal and recent contributions in the combustion literature. Offered in alternate years. Prerequisite: ME 52500 .

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 53400 - Spacecraft Electric Propulsion

Credit Hours: 3.00. Spacecraft electric propulsion systems are intended to provide thrust for propelling spacecrafts in interplanetary missions, orbital maneuvers, and attitude control. The course will start with reviewing material on the mechanics and thermodynamics of propulsion, and identifying the niche occupied by the electric propulsion systems. The course will cover elements of plasma physics and electromagnetic theory essential for studying the electric propulsion systems. The core of the course will focus on studying various electric propulsion concepts which utilize electric power produced on-board to generate thrust. Mechanisms of the utilization of the electric power to accelerate gas or plasma and produce thrust will be considered, including electrothermal, electrostatic, electromagnetic, and gasdynamic acceleration mechanisms.

Learning Outcomes: 1. Determine optimal specific impulse of electric propulsion system based on specific mission requirements 2. Demonstrate fundamental understanding of differences between electric and chemical propulsion systems performance and space applications. 3. Calculate basic plasma parameters and characteristics of collisional processes. 4. Demonstrate fundamental understanding of concepts of quasineutrality and collective behavior in plasmas. 5. Perform analysis of electrothermal accelerator at a given frozen flow fraction 6. Apply Maxwell equations in differential and integral forms to solve basic electromagnetism problems 7. Perform analysis of space-charge limited electrostatic accelerator in ion acceleration zone, in deceleration zone, and in neutralization zone. 8. Perform analysis of motion of charged particles in crossed electric and magnetic fields 9. Derive and apply modified forms of Ohm's law in two-component moving plasma in presence of magnetic field. 10. Perform elementary analysis of crossed-field electromagnetic accelerator with small Hall parameter 11. Perform elementary analysis and calculate basic parameters of Hall effect accelerator. 12. Demonstrate fundamental understanding of the differences of acceleration concepts used in Hall effect and in electrostatic

accelerators. 13. Calculate body force in magnetoplasmadynamic accelerator. Credits: 3.00

Structures & Materials

AAE 54600 - Aerospace Structural Dynamics And Stability

Credit Hours: 3.00. Dynamics of continuous systems: rod, beam, frame, and plate structures. General structural principles: virtual work, Hamilton's principle, Lagrange's equation, and Ritz method for discrete approximations. Modal analysis: eigenanalysis, mode shapes, mode superposition, and complex modes. Nonlinear vibrations: phase plane, Poincare, bifurcation plots, and chaos. Stability of the motion: classification of problems, follower loads, aerodynamic loads, divergence, flutter, pulsating compression, and gyroscopic systems.

Credits: 3.00

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55200 - Nondestructive Evaluation Of Structures And Materials

Credit Hours: 3.00. Overview of methods employed for nondestructive evaluation of structures and materials taught in the context of damage tolerant structural analysis. Major inspection topics include: radiography, ultrasonics, eddy current, penetrant, magnetic, and visual/optical techniques. Other new emerging inspection techniques also are discussed. Offered in alternate years.

Credits: 3.00

AAE 55300 - Elasticity In Aerospace Engineering

Credit Hours: 3.00. A basic course in the theory of elasticity with emphasis on understanding the fundamental principles and solution techniques used in the stress analysis of structures. Cartesian tensors. Governing equations for linear elasticity. Rigorous derivation of beam and plate equations from the three-dimensional elasticity equations. Torsion. Thermoelasticity. The stress functions and complex functions approaches to two-dimensional problems. Energy methods and approximate solutions. Three-dimensional problems. Knowledge of differential equations assumed.

Learning Outcomes: 1. Give student an in-depth background in mechanics of solids including large deformation, and the ability to perform stress analyses in elastic bodies, especially two-dimensional bodies. Credits: 3.00

AAE 55400 - Fatigue Of Structures And Materials

Credit Hours: 3.00. Development and application of methods for predicting the fatigue life of structural components. Characterization and response of materials to cyclic loading. Fatigue resistant design of aerospace structures. Both fatigue crack initiation and crack propagation concepts are discussed.

Credits: 3.00

AAE 55500 - Mechanics Of Composite Materials

Credit Hours: 3.00. Current and potential applications of composite materials. Review of elasticity of anisotropic solids. Methods for determining mechanical properties of heterogeneous materials. Static and dynamic analyses of laminated composites. Fracture and fatigue of laminates. Reliability, testing, and design of composites.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 55800 - Finite Element Methods In Aerospace Structures

Credit Hours: 3.00. Introduction to the use of advanced finite element methods in the calculation of deformation, strain, and stress in aerospace structures. Topics include: 1-D, 2-D, 3-D, and axisymmetric elements, isoperimetric element formulation, convergence, treatment of boundary conditions and constraints. Special topics include stability, dynamic analysis, and nonlinear material behavior. Emphasis is on the theoretical knowledge of the finite element method. Applied experience is gained by solution of aerospace structural analysis problems through use

of professional software.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 64600 - Elastic Wave Propagation

Credit Hours: 3.00. Elastic wave propagation in rods, beams, and plates. Wave motion in semi-infinite bodies; Rayleigh, Lamb and Love waves. Pochhammer-Chree theory for rods. General properties of dispersive waves and approximation techniques. Impact. Wave front and ray methods. Introduction to wave propagation in anelastic and nonhomogenous media, and to large amplitude and shock waves. Prerequisite: AAE 55300 or ME 56300.

Credits: 3.00

AAE 65400 - Fracture Mechanics

Credit Hours: 3.00. Methods of stress analysis in elastic media containing cracks. Fracture criteria. The strain energy release rate and J-integral. Crack tip plasticity. Interface cracks. Cracks in anisotropic solids. Bending of cracked plates. Dynamic crack propagation. Prerequisite: AAE 55300.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ME 55900 - Micromechanics Of Materials

Credit Hours: 3.00. Prediction of the macroscopie behavior of materials from their microstructure and the design of new materials. Microstructure-property relationships between the macroscopie material behavior and microscopic structure. Application to traditional structure as well as to new engineering materials. Adapting emerging constitutive relations into structure analyses. Introduction of this new approach to materials, its applications in predictive analysis tools, and its importance in simulation-based engineering.

Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 61200 - Continuum Mechanics

Credit Hours: 3.00. A unified and exact mathematical treatment of the mechanics of solids and fluids. Cartesian tensor algebra and calculus; stress tensor, principle stresses and invariants; material and spatial coordinates, deformation gradient, strain and stretch tensors; balance of mass, momentum, and energy; constitutive equations of elasticity, hyperelasticity, viscous fluids and viscoelasticity.

Credits: 3.00

AAE 54800 - Mechanical Behavior Of Aerospace Materials

Credit Hours: 3.00. This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smartphones. In fact, breakthroughs with material research are often accompanied by rapid advancements in technology. Thus, it is paramount for all engineers to have an understanding of the structure and behavior of materials. In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and, ultimately, failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms. Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal-material levels and their use in explaining the deformation and failure characteristics in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of aerospace materials: metal alloys, ceramic-matrix composites, and fiber-reinforced polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, creep, and failure mechanisms; design criteria; special topics. We will attempt to have minimal overlap with AAE 55400, Fatigue of Structures and Materials. Therefore we will not cover fracture, fatigue, or stress concentrators.

Learning Outcomes: 1. Express vector and tensor equations using indicial notation. 2. Express crystallography according to Miller indices and define slip systems in basic crystal

structures. 3. Calculate and understand the physical basis of elastic anisotropy. 4. Understand, calculate, and use basic states of stress and yield criteria. 5. Define and understand the physical basis of point, line, and area defects in crystalline materials. 6. Calculate the strain fields, stress fields, and energy of dislocations, in addition forces between dislocations. 7. Understand dislocation motion as well as interactions between dislocations. 8. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 9. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 10. Understand origins of twinning, stacking faults, and the shape memory effects. 11. Understand physics and calculate strengthening influence of solutes, precipitates, grain boundaries, and strain hardening. 12. Understand physical origins of creep, calculate creep using Larson-Miller expressions, and use creep deformation mechanism map. 13. Understand origins of residual stress and apply to constrain problems. 14. Understand and apply statistical approaches to identify probability of failure and property variations. 15. Define and classify polymer structures. 16. Understand viscoelasticity and calculate behavior using classical models. 17. Distinguish physical mechanisms of polymer deformation, crazing, and fracture. 18. Express stiffness and strength of fiber reinforced composite structures. Credits: 3.00

ME 56900 - Mechanical Behavior Of Materials

Credit Hours: 3.00. A study of load and environmental conditions that influence the behavior of materials in service. Elastic and plastic behavior, fracture, fatigue, low and high temperature behavior. Fracture mechanics. Failure analysis case studies emphasis on design.

Credits: 3.00

Math Courses (3-9 credits)*

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 63200 - Linear Operator Methods In Chemical Engineering

Credit Hours: 3.00. Application of the spectral theory of linear self-adjoint and non-self-adjoint operators on abstract Hilbert spaces to problems in chemical engineering. Symmetrizable non-self-adjoint problems in finite and infinite dimensional spaces with applications to physical and chemical rate processes in homogeneous and composite media. Solution of transport equations governing heat and mass transfer in deforming and chemically reacting media. Introduction to non-self-adjoint problems in chemical engineering. Offered in

alternate years. Prerequisite: CHE 63000 .

Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

Dissertation Research (33-39 credits minimum)*

AAE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

AAE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Additional Information

GPA Requirements

Agricultural and Biological Engineering, PHD

About the Program

Program Requirements

Required Courses (42 credits)

Core Courses (6 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate study 2. Complete required training for graduate

student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

ABE 69600 - Graduate Seminar

Credit Hours: 1.00. Best practices for effectively presenting scientific research are taught and practiced. Students will also present a twenty-minute seminar of original research results, as well as provide and receive constructive criticism on presentation form and content for improved future presentations.

Learning Outcomes: 1. Enhance ability of ABE graduate students in presenting graduate research. 2. Improve ability of ABE graduate students to think critically about research and presentation skills of others. 3. Increase student's ability to critique his or her own work. Credits: 1.00

ABE 69700 - Doctoral Professional Development

Credit Hours: 1.00. Discussion of research problems, methods, procedure, and reports. Discussion and practice to improve written and oral communication. Professional development activities.

Learning Outcomes: 1. Improve your ability to write, read and review scientific documents 2. Improve your skills in preparing and presenting scientific presentations 3. Become more familiar with Responsible Conduct of Research 4. Broaden your knowledge by attending and/or planning research seminars and presentations by peers 5. Become familiar with professional development opportunities. Credits: 1.00

ABE/ASM or Concentration Courses (12 credits)

Electives (24 credits)

Core Courses (6 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

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Dissertation Research (48 credits)

ABE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (42 credits)

Core Courses (6 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

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ABE 69600 - Graduate Seminar

Credit Hours: 1.00. Best practices for effectively presenting scientific research are taught and practiced. Students will also present a twenty-minute seminar of original research results, as well as provide and receive constructive criticism on presentation form and content for improved future presentations.

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ABE/ASM or Concentration Courses (12 credits)

Electives (24 credits)

Core Courses (6 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate study 2. Complete required training for graduate student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

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Concentrations

Additional Information

About the Program

Agricultural Economics, PHD

About the Program

Program Requirements

Required Courses (21 credits)

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 65100 - Application Of Quantitative Analysis: Econometrics II

Credit Hours: 3.00. Emphasis is on using advanced econometric techniques. The course covers use of computer software and interpretation and reporting of econometric results. The first part of the course includes general econometric concepts, such as least squares and maximum likelihood estimation, desirable statistical properties, assumptions of the classical linear regression model, Monte Carlo methods, nested and non-nested hypothesis tests. Later, more specialized topics are covered, including multiple equation models, simultaneous equation models, limited dependent variable models, and other topics that are deemed relevant. Prerequisite: AGEC 65000.

Credits: 3.00

AGEC 65200 - Application Of Quantitative Analysis: Mathematical Programming

Credit Hours: 3.00. Recent literature on the theory and application of mathematical programming and agricultural modeling. Model building and analysis techniques with focus on matching solution methods to problems. Prerequisite: AGEC 55200, ECON 61200; a course in matrix algebra.

Credits: 3.00

AGEC 65400 - Economic Dynamics

Credit Hours: 2.00. Focuses on the application of the tools of dynamic optimization to problems in economics. Covers continuous-time and discrete-time dynamic optimization techniques, including the calculus of variations, optimal control theory, and dynamic programming. Applications are drawn from a range of problems in microeconomics and macroeconomics, including current topics in agricultural economics, natural resource economics, and investment theory. Course meets weeks 1 - 10. Prerequisite: AGEC 65200, ECON 60700.

Credits: 2.00

ECON 67000 - Probability And Statistics

Credit Hours: 2.00 or 3.00. An introduction to probability theory and the basic statistical estimation methods. Topics include: axiomatic development of probability theory, counting methods, conditional probability and Bayes' theorem, random variables and distributions, expectation, variance, covariance and correlation, special distributions, statistical inference, maximum likelihood estimators, unbiased estimation, and testing hypotheses. Prerequisite: ECON 61500.

Learning Outcomes: 1. Identify important statistical issues of interest in practical scenarios. 2. Demonstrate the application of state of the art statistical methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. Credits: 2.00 or 3.00

ECON 61500 - Mathematical Analysis For Economists

Credit Hours: 2.00 or 3.00. Topics include constrained optimization, comparative statics, and elementary topics in mathematical analysis. Students should be familiar with calculus, linear algebra, basic probability, and have a grasp of microeconomic theory (such as the material covered in ECON 51100).

Learning Outcomes: 1. Master key mathematical concepts used in advanced (PhD level) Economics courses. 2. Gain the ability to analyze Economics problems using higher level mathematical tools. Credits: 2.00 or 3.00

ECON 60900 - Microeconomics III

Credit Hours: 1.00 to 3.00. An advanced course in game theory and general equilibrium theory. Among the topics covered are: games in strategic form, games in extensive form, games of incomplete information, cooperative games with side payments, mechanism design, consumer choice theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of microeconomic topics, including extensions in game theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. 2. Identify insights game theory provides in translating informal descriptions of multi-person decision situations into formal game-theoretic problems, including the class of games in which the players are tasked to simultaneously distribute limited resources over several objects. 3. Understand the perspective provided by general equilibrium analysis contrasted with particle equilibrium theory. Credits: 1.00 to 3.00

ECON 60700 - Microeconomics II

Credit Hours: 1.00 to 3.00. Building on Microeconomics I, more advanced consumer and producer theory using support functions, risk/uncertainty and information, and basic game theory and oligopoly. Prerequisite: ECON 60600 .

Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

Other Core Courses (3 credits)

AGEC 62500 - Macroeconomic Issues In Agriculture

Credit Hours: 3.00. Studies the nature and importance of linkages between agriculture and the macro economy, and examines theories and methods used to establish or quantify these linkages in agricultural models. Extensions of macroeconomic accounting and theory into an open economy are explored by examining attempts by agricultural economists to estimate macroeconomic linkages and build them into commodity models, and considering consequences of implicit and explicit macroeconomic assumptions in much of our work. The changing role of agriculture in an economy under structural transformation will be key to understanding these linkages and how they evolve, as shown in several new developments seeking to explain both recent events and policy history in macro-theoretical frameworks consistent with observed empirical regularities.

Credits: 3.00

ECON 60800 - Macroeconomic Theory I

Credit Hours: 2.00 or 3.00. An introduction to general equilibrium macroeconomic models in both deterministic and stochastic settings. Topics studied include: static neoclassical models, social planner problems, dynamic programming, growth and capital accumulation, stochastic economies, asset pricing, and overlapping generations models.

Credits: 2.00 or 3.00

Agricultural Economics Courses (18 credits)

Specialty Area Courses (9-18 credits)

Electives (47 credits)

Dissertation Research (24 credits)

AGEC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (21 credits)

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 65100 - Application Of Quantitative Analysis: Econometrics II

Credit Hours: 3.00. Emphasis is on using advanced econometric techniques. The course covers use of computer software and interpretation and reporting of econometric results. The first part of the course includes general econometric concepts, such as least squares and maximum likelihood estimation, desirable statistical properties, assumptions of the classical linear regression model, Monte Carlo methods, nested and non-nested hypothesis tests. Later, more specialized topics are covered, including multiple equation models, simultaneous equation models, limited dependent variable models, and other topics that are deemed relevant. Prerequisite: AGEC 65000.

Credits: 3.00

AGEC 65200 - Application Of Quantitative Analysis: Mathematical Programming

Credit Hours: 3.00. Recent literature on the theory and application of mathematical programming and agricultural modeling. Model building and analysis techniques with focus on matching solution methods to problems. Prerequisite: AGEC 55200, ECON 61200; a course in matrix algebra.

Credits: 3.00

AGEC 65400 - Economic Dynamics

Credit Hours: 2.00. Focuses on the application of the tools of dynamic optimization to problems in economics. Covers continuous-time and discrete-time dynamic optimization techniques, including the calculus of variations, optimal control theory, and dynamic programming. Applications are drawn from a range of problems in microeconomics and macroeconomics, including current topics in agricultural economics, natural resource economics, and investment theory. Course meets weeks 1 - 10. Prerequisite: AGEC 65200, ECON 60700.

Credits: 2.00

ECON 67000 - Probability And Statistics

Credit Hours: 2.00 or 3.00. An introduction to probability theory and the basic statistical estimation methods. Topics include: axiomatic development of probability theory, counting methods, conditional probability and Bayes' theorem, random variables and distributions, expectation, variance, covariance and correlation, special distributions, statistical inference, maximum likelihood estimators, unbiased estimation, and testing hypotheses. Prerequisite: ECON 61500.

Learning Outcomes: 1. Identify important

statistical issues of interest in practical scenarios. 2. Demonstrate the application of state of the art statistical methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. Credits: 2.00 or 3.00

ECON 61500 - Mathematical Analysis For Economists

Credit Hours: 2.00 or 3.00. Topics include constrained optimization, comparative statics, and elementary topics in mathematical analysis. Students should be familiar with calculus, linear algebra, basic probability, and have a grasp of microeconomic theory (such as the material covered in ECON 51100).

Learning Outcomes: 1. Master key mathematical concepts used in advanced (PhD level) Economics courses. 2. Gain the ability to analyze Economics problems using higher level mathematical tools. Credits: 2.00 or 3.00

ECON 60900 - Microeconomics III

Credit Hours: 1.00 to 3.00. An advanced course in game theory and general equilibrium theory. Among the topics covered are: games in strategic form, games in extensive form, games of incomplete information, cooperative games with side payments, mechanism design, consumer choice theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of microeconomic topics, including extensions in game theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. 2. Identify insights game theory provides in translating informal descriptions of multi-person decision situations into formal game-theoretic problems, including the class of games in which the players are tasked to simultaneously distribute limited resources over several objects. 3. Understand the perspective provided by general equilibrium analysis contrasted with particle equilibrium theory. Credits: 1.00 to 3.00

ECON 60700 - Microeconomics II

Credit Hours: 1.00 to 3.00. Building on Microeconomics I, more advanced consumer and producer theory using support functions, risk/uncertainty and information, and basic game theory and oligopoly. Prerequisite: ECON 60600 .

Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

Concentrations

GPA Requirements

About the Program

Agricultural Sciences Education and Communication, PHD

About the Program

Program Requirements

Required Courses (xx credits)

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral

presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects regulations. Credits: 1.00

Dissertation Research (xx credits)

ASEC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (xx credits)

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects regulations. Credits: 1.00

Concentrations

GPA Requirements

About the Program

Agronomy, PHD

About the Program

Program Requirements

Required Courses (36 credits)

Core Courses (xx credits)

AGRY 60100 - Introduction To Graduate Research

Credit Hours: 1.00. This course provides framework for graduate studies. It helps the new graduate student understand the roles and responsibilities in graduate education, providing guidance for scientific reading, writing, and research activities. Topics include understanding ethical issues in science, enhancing their ability to communicate with a broad range of people, and establishing initial perspectives on professional development. Permission of department required.

Learning Outcomes: 1. Prepared to practice good research record keeping. 2. Write a hypotheses for their research. 3. Exemplify integrity and honesty in their research. 4. Choose the appropriate mode of communications based on the expected response of their colleagues. 5. Assess their strengths and weaknesses and plan their student careers informed by potential professional careers. 6. Appreciate the value of diversity and inclusion in their research experience. 7. Consider paths from a wide range of options given their values, abilities and interests. Credits: 1.00

Statistics Courses (6 credits)

AGEC 65500 - Applied Economic Time Series Analysis

Credit Hours: 3.00. This course is designed to improve

students' abilities to estimate and interpret time series models. The course begins with univariate models and progresses to multivariate analysis. Alternative methods for identifying, estimating, and forecasting with time series models will be discussed. In addition, analysis of non-stationary time series and co-integration modeling will be covered in this course. Prerequisite: AGEC 65100 or consent of instructor. Mastery of applied statistics, calculus, and microeconomic theory at the Masters level or higher is desirable.

Learning Outcomes: 1. Translate data and statistical results. 2. Apply knowledge and ethical research to data and data analysis literacy. 3. Integrating economic theory with applied analysis techniques. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

ENTM 64200 - Analysis Of Ecological Data

Credit Hours: 3.00. Intermediate course in analysis options for biological and ecological data. Topics include: univariate, multivariate, parametric and non-parametric analysis and their basis; advanced graphical techniques; basic mapping with and without geographical information systems; simulation modeling; associated coding for open source platforms. A previous graduate-level course in statistics is required. Working knowledge of ANOVA, t-tests, linear regression, and assumptions and distributions of test statistics for these is assumed.

Learning Outcomes: 1. Know data and analysis requirements when planning experiments and

observational studies. 2. Apply several univariate and multivariate statistical analyses. 3. Model or simulate simple biological or ecological systems. 4. Use several different graphing techniques including mapping, three-dimensional plots, and animations. 5. Write code to accomplish 1-4 within open-source software. 6. Develop critical thinking skills. 7. Foster creativity by finding alternative solutions to analytical challenges. 8. Develop both the written and the technical side of communication skills. Credits: 3.00

Seminar Courses (2 credits)

AGRY 59600 - Professional Presentations

Credit Hours: 1.00. Develop confidence and skills in preparing and delivering professional presentations to both peer scientific and student audiences. (el. 7)

Credits: 1.00

AGRY 59700 - Communicating With The Public

Credit Hours: 1.00. This course will prepare students being trained as agronomy professionals to enhance their communication skills so they can successfully interact with the public. (el. 7) Offered in alternate years.

Credits: 1.00

AGRY 69600 - Agronomy Graduate Seminar

Credit Hours: 1.00. Weekly discussion of assigned topics in soil and crop science.

Credits: 1.00

Dissertation Research (xx credits)

AGRY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Additional Information

About the Program

American Studies, PHD

About the Program

Program Requirements

Required Courses (xx credits)*

Seminar Courses (9-xx credits)*

AMST 65000 - Reading Seminar In American Studies

Credit Hours: 3.00. A reading seminar on a selected topic in American Studies, taught by two faculty members from different disciplines, usually one from the humanities and one from the social sciences. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60300 - American Studies Interdisciplinary Project

Credit Hours: 3.00. Students will conduct independent research under faculty supervision towards completion of the Special Field examination for the Ph.D. degree. The project should be an extended, original research essay, based upon interdisciplinary research. The project should aim to produce original findings on a clearly defined topic or problem. In addition to the research and essay, students must produce a statement of methodology in which they explain their choice of sources and how their project contributes to the field of American Studies. To be taken in the final semester of coursework. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60200 - Contemporary Issues In American Studies

Credit Hours: 3.00. An investigation of analytical categories, particularly race, class and gender, the multiple methodologies, and theoretical premises that shape developments in the field of

American Studies. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60100 - Introduction To American Studies

Credit Hours: 3.00. An exploration of the cultural and institutional history of American Studies designed to acquaint students with the interdisciplinary concepts of American Studies by focusing on major canonical texts associated with that history. Prerequisite: Master's student standing and American Studies majors only.

Credits: 3.00

AMST 60500 - Theory And American Culture

Credit Hours: 3.00. This course provides an overview of key foundational texts in social and cultural theory, with a focus on theories of import to scholars in American Studies and related fields. We will explore the various types of theory, examining its internal logic, implications, and critiques. Consider this a brief introduction, meant to give you a general feel for the range and sophistication of available theories in American Studies. Moreover, as the "Cultural Politics" website observes, "Recent theory has reminded us that origin stories are powerful determining forces, and thus these tales of the growth and development of the discipline should be read both for what they say and for what they may leave out, read both for their truths and their partialities." Similarly, the course syllabus itself creates a particular narrative regarding the development of the discipline. As such, students are encouraged to consider the syllabus through this perspective.

Credits: 3.00

AMST 60600 - American Studies Methods

Credit Hours: 3.00. This class is specifically designed to be a survey course on the various methods employed by American Studies scholars from different disciplines. The objective of this course is to approach methods from both an epistemological and empirical perspective. In particular, we will investigate the what, why, and how of conducting research in an interdisciplinary field. As such, the following questions will drive this course: What are American Studies methods? Why are certain methodologies utilized (i.e., for what purpose)? How does one conduct research in American Studies? What method(s) should you use in your own research inquiry? And finally, what are some potential drawbacks in using a certain methodology for your project? This is a graduate seminar, and your active participation in discussions is mandatory. You will be asked to submit weekly discussion questions, lead five seminar discussions on selected topics from the required readings, and complete six assignments. The final assignment will include the background and methodological components of a research proposal.

Learning Outcomes: 1. Formulate critiques of the course readings. 2. Have investigated the readings on topics relevant in American Studies Methods. 3. Completed five total assignments, emphasizing the methodological lens, by drawing from course readings and independent research on your specific research topic.

Credits: 3.00

Major Field (xx credits)

Dissertation Research (xx credits)

AMST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

About the Program

Animal Science, PHD

About the Program

Program Requirements

Required Courses (30 credits)*

Core Courses (xx credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible

research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Seminar Courses (2 credits)

ANSC 68100 - Animal Sciences Graduate Seminar

Credit Hours: 1.00. Instruction and application of concepts for effective oral professional presentations in the field of Animal Sciences. The course will provide students with knowledge for effective oral communication of scientific information and an opportunity to put guidelines into practice. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking skills for graduate students in animal sciences. 2. Enable students with skills needed to organize information from multiple scientific sources into a coherent oral presentation. 3. Enable development of skills for effective oral communication of research and current research concepts to animal science audiences. Credits: 1.00

Educational Delivery Course (xx credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 51800 - The Nature Of Science In Science Teaching

Credit Hours: 3.00. Explores philosophical issues related to the scientific enterprise, such as the production and validation of scientific knowledge; the role of the scientific community; and the influence of gender and culture on doing science. Also examines the implications of these issues for science teaching and learning, as well as for research in science education.

Learning Outcomes: 1. Develop an understanding of various philosophical positions on the nature of science. 2. Develop an understanding of your own views of the nature of science. 3. Develop an understanding of the roles of scientists, the greater society, culture, and gender in the creation and validation of scientific knowledge. 4. Develop an understanding of students' and teachers' ideas about the nature of science. 5. Develop an understanding of the implications of various perspectives on the nature of science teaching and learning. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 56800 - Partnering With Web-Based Tools For Learner Centered Environments

Credit Hours: 3.00. Provides an in-depth look at Web-based digital tools for teaching and learning, with a focus on learner-centered activities and environments. Emphasis is given to applying the knowledge and skills necessary to create a Web-based, student-centered lesson/unit that provides diverse learners with opportunities for formal and informal learning. Course content is applicable to both independent and collaborative learning, as well as use of the Web as the sole educational delivery system or in combination with other approaches, including traditional classroom instruction.

Learning Outcomes: 1. Create a personal vision of 21st century schools or workplace and a personal definition of a 21st century learner. 2. Examine, in depth, a specific student-centered approach (e.g. project-based learning, problem-based learning, inquiry learning, authentic instruction, etc.) and discuss the similarities and differences among different approaches. 3. Create a video tutorial that teaches others how to use a specific Web 2.0 tool. 4. Design a learner-centered lesson that incorporates relevant Web 2.0 tools for the purpose of broadening and/or deepening students' understanding of specific curricular content. 5. Develop an implementation plan and create appropriate assessment measures to determine student learning in your own learner-centered lesson. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself.

Credits: 3.00

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 61900 - Learning Science

Credit Hours: 3.00. The course provides a holistic study of how children and adults learn science; how the learner's ideas, ways of thinking, abilities to do science, and their attitudes towards and beliefs about science learning influence how they learn science.

Learning Outcomes: 1. Develop an increased understanding of the research literature in science education as it pertains to science learners. 2. Gain an appreciation of science learners and the different perspectives about how individuals learn science. 3. Apply science education research about science learners to instructional, curricular, and assessment development. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

Animal Sciences Courses (xx credits)

Dissertation Research (xx credits)

ANSC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Additional Information

About the Program

Animal Science/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (30 credits)*

Core Courses (xx credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Seminar Courses (2 credits)

ANSC 68100 - Animal Sciences Graduate Seminar

Credit Hours: 1.00. Instruction and application of concepts for effective oral professional presentations in the field of Animal Sciences. The course will provide students with knowledge for effective oral communication of scientific information and an opportunity to put guidelines into practice. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking skills for graduate students in animal sciences. 2. Enable students with skills needed to organize information from multiple scientific sources into a coherent oral presentation. 3. Enable development of skills for effective oral communication of research and current research concepts to animal science audiences. Credits: 1.00

Educational Delivery Course (xx credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 51800 - The Nature Of Science In Science Teaching

Credit Hours: 3.00. Explores philosophical issues related to the scientific enterprise, such as the production and validation of scientific knowledge; the role of the scientific community; and the influence of gender and culture on doing science. Also examines the implications of these issues for science teaching and learning, as well as for research in science education.

Learning Outcomes: 1. Develop an understanding of various philosophical positions on the nature of science. 2. Develop an understanding of your own views of the nature of science. 3. Develop an understanding of the roles of scientists, the greater society, culture, and gender in the creation and validation of scientific knowledge. 4. Develop an understanding of students' and teachers' ideas about the nature of science. 5. Develop an understanding of the implications of various perspectives on the nature of science teaching and learning. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various

tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 56800 - Partnering With Web-Based Tools For Learner Centered Environments

Credit Hours: 3.00. Provides an in-depth look at Web-based digital tools for teaching and learning, with a focus on learner-centered activities and environments. Emphasis is given to applying the knowledge and skills necessary to create a Web-based, student-centered lesson/unit that provides diverse learners with opportunities for formal and informal learning. Course content is applicable to both independent and collaborative learning, as well as use of the Web as the sole educational delivery system or in combination with other approaches, including traditional classroom instruction.

Learning Outcomes: 1. Create a personal vision of 21st century schools or workplace and a personal definition of a 21st century learner. 2. Examine, in depth, a specific student-centered approach (e.g. project-based learning, problem-based learning, inquiry learning, authentic instruction, etc.) and discuss the similarities and differences among different approaches. 3. Create a video tutorial that teaches others how to use a specific Web 2.0 tool. 4. Design a learner-centered lesson that incorporates relevant Web 2.0 tools for the purpose of broadening and/or deepening students' understanding of specific curricular content. 5. Develop an implementation plan and create appropriate assessment measures to determine student learning in your own learner-centered lesson. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 61900 - Learning Science

Credit Hours: 3.00. The course provides a holistic study of how children and adults learn science; how the learner's ideas, ways of thinking, abilities to do science, and their attitudes towards and beliefs about science learning influence how they learn science.

Learning Outcomes: 1. Develop an increased understanding of the research literature in science education as it pertains to science learners. 2. Gain an appreciation of science learners and the different perspectives about how individuals learn science. 3. Apply science education research about science learners to instructional, curricular, and assessment development. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

Animal Sciences Courses (xx credits)

Dissertation Research (xx credits)

ANSC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Additional Information

Anthropology, PHD

About the Program

Program Requirements

Required Courses (42-66 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation

in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Methods Courses (6 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials

science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as

procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

Advanced Anthropology Seminar (3 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review

several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Statistics Course (0-3 credits)

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical

methods for single variables or for relationships between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7. Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

Dissertation Research (24-48 credits)

ANTH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ANTH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (0-24 credits)

Non-English Language Requirement

Required Courses (42-66 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their

concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Methods Courses (6 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology

and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability.

Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment.

Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

Advanced Anthropology Seminar (3 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

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ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of

anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

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Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Concentrations and Certificates

GPA Requirements

About the Program

Anthropology/Gerontology, PHD

About the Program

Program Requirements

Required Courses (42-66 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices.

5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Methods Courses (6 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design,

methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

Advanced Anthropology Seminar (3 credits)

Statistics Course (0-3 credits)

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical methods for single variables or for relationships between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7. Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

Dissertation Research (24-48 credits)

ANTH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (0-24 credits)

Non-English Language Requirement

Concentrations

GPA Requirements

Aviation Technology and Management, PHD

About the Program

Program Requirements

Required Courses (45-75 credits)

Core Courses (10 credits)

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College

Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

TECH 60100 - Research Seminar In Technology

Credit Hours: 1.00. This course provides an introduction to the field and scholarship of Technology and the skills necessary for success. Prerequisite: Doctoral student standing.

Credits: 1.00

MET 52700 - Technology From A Global Perspective

Credit Hours: 3.00. Introduction to the challenges faced by the practicing technologist when working and interacting with international technical personnel, both here and abroad, including history, standards, education, and practice of technology outside the United States. Permission of department required.

Learning Outcomes: 1. Awareness and comprehension of cross-cultural factors necessary for international professional practice in technology. 2. Effective research strategies that access what is known about technology development, usage and impact from a global perspective. 3. Knowledge and skill in researching and reporting cultural factors affecting business practices in a variety of independent nation states. 4. Knowledge of procedures, regulations and practices regarding international business. 5. Research skills to identify the natural and technology resources of countries. 6. An ability to contrast the impact of technology infrastructure and use of technology in developed countries to what occurs in underdeveloped countries. 7. Knowledge of the concept and application of ""Appropriate Technology"". 8. Knowledge of the historical development of technology in various modern nations. 9. Informed judgments regarding the influences of cultural and political environments of countries and their technological development. 10. Awareness of the major changes related to current and/or emerging technology in the leading industrial nations of the world. 11. Understanding of the methodologies employed for the effective introduction of technologies into new country or cultural settings. 12. Knowledge of selected International Technology Standards and organizations. Credits: 3.00

Cognate Electives (9-12 credits)

Discover Foundations Electives (9 credits)

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite:

Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Independent Study Course (0-12 credits)

AT 59000 - Special Problems In Aviation Technology

Credit Hours: 1.00 to 12.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 12.00

AT 69000 - Independent Study In Air Transportation

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in air transportation. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Investigate and report on a focused area of air transportation. Credits: 1.00 to 6.00

Dissertation Research (15 credits)

AT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. This course involves intensive research and writing activity associated with a doctoral dissertation. Prerequisite: Doctoral candidate status. Permission of instructor required.

Learning Outcomes: 1. Plan, manage, conduct, and report original research using appropriate design and analytical techniques. Credits: 1.00 to 18.00

Concentrations

GPA Requirements

About the Program

Basic Medical Sciences, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

Concentrations

About the Program

Basic Medical Sciences/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

Biochemistry and Molecular Biology, PHD

About the Program

Program Requirements

Required Courses (22 credits)

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60200 - Critical Thinking And Communication In Biochemistry II

Credit Hours: 2.00. Builds on the skills developed in BCHM 601. Students will continue to enhance their analytical skills, and class discussions will be conducted at a more sophisticated level and will go into greater depth. Class discussions will focus more on the analysis and evaluation of current methodologies and hypotheses in the biochemical and molecular biological literature. Students will be evaluated primarily on their preparation and participation in each class discussion. Prerequisite: BCHM 60100. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 69000 - Seminar In Biochemistry

Credit Hours: 1.00. Seminary In Biochemistry. Permission of instructor required.

Credits: 1.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students

among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 60300 - Introduction To Graduate Research In Biochemistry I

Credit Hours: 6.00. This course is intended to provide the opportunity for in-depth, mentored graduate research in two biochemistry laboratories. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellow. Co-requisites: BCHM 60100 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific

audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 6.00

Selectives (2-3 credits)

BCHM 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (AGRY 64000, BIOL 64000, BTNY 64000 , HORT 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BCHM 61200 - Bioinformatic Analysis Of Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data. Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-

scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

Thesis Research (6-12 credits)

BCHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BCHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (22 credits)

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research.

Credits: 2.00

BCHM 60200 - Critical Thinking And Communication In Biochemistry II

Credit Hours: 2.00. Builds on the skills developed in BCHM 601. Students will continue to enhance their analytical skills, and class discussions will be conducted at a more sophisticated level and will go into greater depth. Class discussions will focus more on the analysis and evaluation of current methodologies and hypotheses in the biochemical and molecular biological literature. Students will be evaluated primarily on their preparation and participation in each class discussion. Prerequisite: BCHM 60100. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research.

Credits: 2.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to

prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 69000 - Seminar In Biochemistry

Credit Hours: 1.00. Seminary In Biochemistry. Permission of instructor required.

Credits: 1.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 60300 - Introduction To Graduate Research In Biochemistry I

Credit Hours: 6.00. This course is intended to provide the opportunity for in-depth, mentored graduate research in two biochemistry laboratories. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellow. Co-requisites: BCHM 60100 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design

experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 6.00

Concentrations

GPA Requirements

About the Program

Biochemistry and Molecular Biology/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (22 credits)

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60200 - Critical Thinking And Communication In Biochemistry II

Credit Hours: 2.00. Builds on the skills developed in BCHM 601. Students will continue to enhance their analytical skills, and class discussions will be conducted at a more sophisticated level and will go into greater depth. Class discussions will focus more on the analysis and evaluation of current methodologies and hypotheses in the biochemical and molecular biological literature. Students will be evaluated primarily on their preparation and participation in each class discussion. Prerequisite: BCHM 60100. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane

proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 69000 - Seminar In Biochemistry

Credit Hours: 1.00. Seminary In Biochemistry. Permission of instructor required.

Credits: 1.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

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Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene

expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 60300 - Introduction To Graduate Research In Biochemistry I

Credit Hours: 6.00. This course is intended to provide the opportunity for in-depth, mentored graduate research in two biochemistry laboratories. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellow. Co-requisites: BCHM 60100 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 6.00

Selectives (2-3 credits)

BCHM 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (AGRY 64000, BIOL 64000, BTNY 64000 , HORT 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary

probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical,

soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BCHM 61200 - Bioinformatic Analysis Of Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data. Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

Thesis Research (6-12 credits)

BCHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Biological Sciences, PHD

About the Program

Program Requirements

Required Courses (5 credits)

Core Courses (1 credit)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate

school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Oher Courses (4 credits)

BIOL 69600 - Seminar

Credit Hours: 1.00. Each semester there are several separate seminar offerings. They will likely be on the following topics: biochemistry, crystallography, ecology and population biology, genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. The student's record will indicate the specific seminars in which he/she has participated. Oral presentations required. At least two credits are required of Ph.D. candidates.

Credits: 1.00

Core Courses (1 credit)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

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Credits: 0.00 to 18.00

Research Areas (37-67 credits)

Biology Education

Cell and Molecular Biology

Ecology and Evolutionary Biology

Microbiology, Immunology, and Infectious Disease

Neuroscience and Physiology

Structural and Computational Biology and Biophysics

Biology Education

Dissertation Research (18 credits)

BIOL 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BIOL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (5 credits)

Core Courses (1 credit)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

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Credits: 0.00 to 18.00

Additional Requirements

Concentrations

GPA Requirements

About the Program

Biological Sciences/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (5 credits)

Core Courses (1 credit)

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Credits: 1.00

Research Areas (37-67 credits)

Biology Education

Cell and Molecular Biology

Ecology and Evolutionary Biology

Microbiology, Immunology, and Infectious Disease

Neuroscience and Physiology

Structural and Computational Biology and Biophysics

Dissertation Research (18 credits)

BIOL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

GPA Requirements

Biomedical Engineering Program, PHD

About the Program

Program Requirements

Required Courses (24 credits)

BME Selectives (6 credits)

Life Sciences Selectives (6 credits)

Quantitative/Analytical Selectives (6 credits)

Ethics Course (1 credit)

Research Fundamentals Courses (0 credits)

Seminar Courses (0 credits)

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four

semesters (respectively) prior to graduation.

Credits: 0.00

Electives (6 credits)

Dissertation Research (66 credits)

BME 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

About the Program

Botany and Plant Pathology, PHD

About the Program

Program Requirements

Required Courses (17-20 credits)

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 66000 - Scientific Writing

Credit Hours: 3.00. This is a course on coping with publication in professional journals. It covers the full range of activities involved in carrying a piece of original research to completion as a primary research article in a refereed journal. Emphasis is on principles of clear and concise technical reporting. Topics include: research and writing goals; journals' policies; data presentations; effective style; organizing, writing, revising, and processing manuscripts; proofreading; peer review; ethics; and grant proposals. Students will use their own data to prepare a manuscript as if for publication. Permission of instructor required.

Learning Outcomes: 1. Convey scientific results and concepts to a broad range of audiences effectively and clearly. 2. Order ideas such that they make logical sense to readers. 3. Understand the distinct requirements of different audiences. 4. Understand the differing requirements of review articles, research reports, and grant proposals. 5. Cite scientific literature effectively. Credits: 3.00

BTNY 69700 - Departmental Seminar Series - Botany And Plant Pathology

Credit Hours: 1.00. This is a weekly seminar course that features both external and Purdue speakers. Exposure to research topics outside of a student's immediate research area is an important part of graduate student education. The goal of the seminar series course is to provide opportunities for graduate students to learn about the latest research advances plant biology, plant pathology, and weed science and to interact with visiting seminar speakers.

Learning Outcomes: 1. Learn about recent research advances in Plant Biology, Plant Pathology, and Weed Science. 2. Learn best practices for asking questions and interacting with seminar speakers. 3. Acquire new ideas for giving effective oral presentations by active listening to seminar presentations. Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with

emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BTNY 69100 - Skills For Success In Grad School

Credit Hours: 1.00. This course is aimed at first year graduate students in the Botany department. Its purpose is to introduce the students to the department, teach them what it takes to be a successful graduate students, and to help them develop effective written and oral communication skills.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 1.00

Electives (xx credits)

Dissertation Research (xx credits)

BTNY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Acquire training in the signature areas of the department of Botany and Plant pathology- Plant biology, plant pathology, and weed science, and their subdisciplines. 2. Understand applied and molecular plant pathology. 3. Learn plant biology from cell biology to evolutionary and developmental biology, ecology. 4. Learn weed control and management, weed biology and related areas. 5. Learn how to communicate scientific ideas in written and oral form. 6. Learn best practices for asking research questions and working as part of a scientific team. Credits: 1.00 to 18.00

Concentrations

Additional Information

GPA Requirements

Chemical Engineering, PHD

About the Program

Program Requirements

Required Courses (18 credits)

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical

thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 62100 - Advanced Transport Phenomena II

Credit Hours: 3.00. Topics included are momentum transfer with interfacial effects, transport in porous and multiphase media, transport in dispersed phase systems, heat transfer, and multicomponent mass transfer. Prerequisite: CHE 62000

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 69000 - Seminar In Chemical Engineering

Credit Hours: 0.00. Required of all graduate students.

Credits: 0.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 65500 - Safety In Chemical Engineering

Credit Hours: 1.00. This course will provide you with necessary safety information to comply with Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. The course will cover general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. The course will provide valuable information on how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc.

Learning Outcomes: 1. Understand necessary safety information to comply with the Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. 2. Understand general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. 3. Understand how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc. Credits: 1.00

CHE 60000 - Approaches To Graduate Research In Chemical Engineering

Credit Hours: 3.00. This course is designed to prepare and enable students to make a rapid start on their research. Additionally, key skills in critical analysis of the literature, technical writing and delivery of oral presentations are included.

Learning Outcomes: 1. Search the scientific literature efficiently. 2. Review the literature. 3. Write for scientific publication. 4. Create a hypothesis and propose how to test it. 5. Make effective technical oral presentations. Credits: 3.00

Electives (18 credits)

Research (60 credits)

CHE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (18 credits)

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 62100 - Advanced Transport Phenomena II

Credit Hours: 3.00. Topics included are momentum transfer with interfacial effects, transport in porous and multiphase media, transport in dispersed phase systems, heat transfer, and multicomponent mass transfer. Prerequisite: CHE 62000

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 69000 - Seminar In Chemical Engineering

Credit Hours: 0.00. Required of all graduate students.

Credits: 0.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 65500 - Safety In Chemical Engineering

Credit Hours: 1.00. This course will provide you with necessary safety information to comply with Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. The course will cover general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. The course will provide

valuable information on how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc.

Learning Outcomes: 1. Understand necessary safety information to comply with the Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. 2. Understand general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. 3. Understand how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc. Credits: 1.00

CHE 60000 - Approaches To Graduate Research In Chemical Engineering

Credit Hours: 3.00. This course is designed to prepare and enable students to make a rapid start on their research. Additionally, key skills in critical analysis of the literature, technical writing and delivery of oral presentations are included.

Learning Outcomes: 1. Search the scientific literature efficiently. 2. Review the literature. 3. Write for scientific publication. 4. Create a hypothesis and propose how to test it. 5. Make effective technical oral presentations. Credits: 3.00

Concentrations

GPA Requirements

Transfer Credit Policy

About the Program

Chemistry, PHD

About the Program

Program Requirements

Required Courses (18 credits)

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 64100 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Survey of main group and transition metal chemistry. Main group special topics, bonding and structure of boron hydrides. Coordination chemistry, bonding models in coordination compounds. Transition metal organometallic chemistry, ligand types and reactivity patterns. Survey of inorganic NMR spectroscopy. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64400 - Solid State Chemistry

Credit Hours: 3.00. The chemistry of solids, including a discussion of ionic crystals, metals, alloys, and binary compounds, and their characterizations by various physical methods. Description of chemical reactions, phase changes,

and catalysis in terms of current theories of the solid state. Prerequisite: CHM 34200 , CHM 37400 .

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 67100 - Advanced Physical Chemistry

Credit Hours: 3.00. Selected topics, including atomic and molecular structure and modern theories underlying thermodynamics and chemical kinetics. Prerequisite: CHM 57800.

Credits: 3.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of current interest.

Credits: 1.00 to 3.00

Seminar (1 credit)

CHM 69500 - Seminar

Credit Hours: 0.00 or 1.00. Groups meeting for review and discussion of important current literature in analytical, biological, inorganic, organic, and physical chemistry. Each graduate student is required to attend the seminar of his or her major subject.

Credits: 0.00 or 1.00

Dissertation Research (30 credits)

CHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (32-41 credits)

Required Courses (18 credits)

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 64100 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Survey of main group and transition metal chemistry. Main group special topics, bonding and structure of boron hydrides. Coordination chemistry, bonding models in coordination compounds. Transition metal organometallic chemistry, ligand types and reactivity patterns. Survey of inorganic NMR spectroscopy. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64400 - Solid State Chemistry

Credit Hours: 3.00. The chemistry of solids, including a discussion of ionic crystals, metals, alloys, and binary compounds, and their characterizations by various physical methods. Description of chemical reactions, phase changes, and catalysis in terms of current theories of the solid state. Prerequisite: CHM 34200 , CHM 37400 .

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 67100 - Advanced Physical Chemistry

Credit Hours: 3.00. Selected topics, including atomic and molecular structure and modern theories underlying thermodynamics and chemical kinetics. Prerequisite: CHM 57800.

Credits: 3.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of

current interest.

Credits: 1.00 to 3.00

Concentrations

GPA Requirements

About the Program

Chemistry/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (18 credits)

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 64100 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Survey of main group and transition metal chemistry. Main group special topics, bonding and structure of boron hydrides. Coordination chemistry, bonding models in coordination compounds. Transition metal organometallic chemistry, ligand types and reactivity patterns. Survey of inorganic NMR spectroscopy. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64400 - Solid State Chemistry

Credit Hours: 3.00. The chemistry of solids, including a discussion of ionic crystals, metals, alloys, and binary compounds, and their characterizations by various physical methods. Description of chemical reactions, phase changes, and catalysis in terms of current theories of the solid state. Prerequisite: CHM 34200 , CHM 37400 .

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 67100 - Advanced Physical Chemistry

Credit Hours: 3.00. Selected topics, including atomic and molecular structure and modern theories underlying thermodynamics and chemical kinetics. Prerequisite: CHM 57800.

Credits: 3.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of current interest.

Credits: 1.00 to 3.00

Seminar (1 credit)

CHM 69500 - Seminar

Credit Hours: 0.00 or 1.00. Groups meeting for review and discussion of important current literature in analytical, biological, inorganic, organic, and physical chemistry. Each graduate student is required to attend the seminar of his or her major subject.

Credits: 0.00 or 1.00

Dissertation Research (30 credits)

CHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (32-41 credits)

GPA Requirements

Civil Engineering, PHD

About the Program

Program Requirements

Required Courses (48 credits*)

Core Courses (xx credits)

Concentrations (xx credits)

Dissertation Research (42 credits)

CE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Clinical Pharmaceutical Sciences, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

Clinical Psychological Sciences, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (6 credits)

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take

additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

Seminar Courses (10 credits)

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Clinical Psychology Courses (xx credits)

PSY 64000 - Survey Of Social Psychology I

Credit Hours: 3.00. An extensive survey of methods, research, and theory in social psychology.

Credits: 3.00

PSY 66800 - Clinical Assessment II

Credit Hours: 4.00. Presentation of methods of clinical assessment including structured and unstructured personality tests, physiological recording, behavioral observation, and interview techniques. Emphasis is placed on laboratory practice in the administration and interpretation of personality tests and training in the basic clinical interview techniques. Permission of instructor required.

Credits: 4.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 61501 - Systems And Behavioral Neuroscience

Credit Hours: 4.00. This course will provide you with a broad introduction to the field of neuroscience and how it can inform our understanding of behavior. First, we will cover neuroanatomy, synaptic communication, and plasticity. Next, we will cover neuroscience research on a range of major topics relevant to behavior: emotion, motivation, attention, learning, decision-making, and social cognition. This course will also provide a brief introduction to a variety of neuroscience research methods that are commonly used in animal and human research (e.g., electroencephalography, magnetic resonance imaging), including tutorials and live demonstrations. Permission of department required.

Learning Outcomes: 1. Know general neural architecture of core systems relevant to behavior. 2. Know behavioral outcomes for each major neural system. 3. Know how brain structure and functioning are studied in animal research. 4. Know how brain structure and functioning are studied in human research. 5. Know how brain functioning undergirds cognition, affect, and social processes. 6. Translate basic neuroscience to clinical and other applied research. Credits: 4.00

PSY 67510 - Research Methods In Clinical Psychological Sciences

Credit Hours: 3.00. This course provides an in-depth introduction to the fundamentals of research methods and design, including the scientific approach and its applicability to the science of psychology to the philosophy of science, the role of theory, and hypothesis testing. Philosophical and theoretical fundamentals are discussed, followed by methodological issues. The course includes content on the replication crisis in psychology, the practices that contributed to it, and the means to overcome it, as well as issues in sampling, measurement, and design. The course will examine nonexperimental research as well as experimental and quasi-experimental approaches. Permission of department required.

Learning Outcomes: 1. Understand Open Science practices, basic psychometrics, experimental design, and nonexperimental approaches and identify bad research practices in published research articles. 2. Evaluate special issues faced when studying psychopathology. 3. Evaluate the factors that contribute to replication concerns in the field (i.e., low statistical power, HARKing, p-hacking, and publication bias). 4. Evaluate correct strategies for calculating reliability and demonstrating validity of a psychological assessment. 5. Create a research study working through sampling, assessment, and design. Credits: 3.00

Clinical Assessment Courses (xx credits)

PSY 66700 - Clinical Assessment I

Credit Hours: 4.00. Presentation of general assessment principles and methods. Supervised practice in general diagnostic and treatment procedures as applied to both children and adults. Emphasis is placed on laboratory practice in the administration and interpretation of intelligence tests; behavioral observation techniques and operant remediation procedures. Permission of instructor required.

Learning Outcomes: 1. Display knowledge of basic psychometric theory as evidenced by performance on examinations. 2. List primary instruments and their strengths and weaknesses. 3. Perform accurate administration, scoring, and interpretation of personality assessment instruments in real-time. 4. Display proficiency in writing integrative assessment reports. 5. Dialogue with professional colleagues regarding the professional practice of assessment and diagnosis. Credits: 4.00

PSY 66800 - Clinical Assessment II

Credit Hours: 4.00. Presentation of methods of clinical assessment including structured and unstructured personality tests, physiological recording, behavioral observation, and interview techniques. Emphasis is placed on laboratory practice in the administration and interpretation of personality tests and training in the basic clinical interview techniques. Permission of instructor required.

Credits: 4.00

PSY 67000 - Principles And Techniques Of Psychological Treatment

Credit Hours: 3.00. Discussion and elaboration of the main theories and techniques of psychotherapy, the application of these techniques to the change of behavior, and the analysis of clinical cases for therapy planning.

Learning Outcomes: 1. Understand basic methodological issues related to psychotherapy research. 2. Describe the distinction between process and outcome in psychotherapy. 3. Understand the contributions of specific and common factors in psychotherapy. 4. Demonstrate basic process skills of active listening, empathic responses, and utilization of the therapeutic relationship in interactions with mock clients. 5. Demonstrate basic skills involved in motivational interviewing. 6. Demonstrate practical skills to document therapeutic interventions (progress notes) and care management (treatment planning). 7. Develop an understanding of the conceptual underpinnings of cognitive behavior therapy, including a) underlying theory of psychopathology; b) proposed mechanisms of change; c) establishment of treatment plans based on mechanisms of change; d) empirical evidence of therapy efficacy and effectiveness. 8. Demonstrate skills to implement basic evidenced-based therapeutic interventions and strategies (CBT). 9. Demonstrate an appreciation for addressing individual differences and diversity in psychotherapy. 10. Demonstrate a sense of self-awareness and ability to relate to diverse clients. Credits: 3.00

PSY 67300 - Psychology Of Behavior Disorders

Credit Hours: 3.00. Advanced abnormal psychology. Consideration will be given to research and theory of psychopathology.

Credits: 3.00

PSY 67900 - Practicum In Clinical Psychology

Credit Hours: 1.00 to 6.00. This is a practicum in clinical psychology, whereby students see individuals for therapy. These cases are supervised by faculty in clinical psychology. This is a requirement for the graduate program, and students must do both adult and child practicum. Students enrolled in this program must register for this course a minimum of four times. Prerequisite: Master's student standing and Psychology majors only. Permission of instructor required.

Credits: 1.00 to 6.00

Practicum Training (19-27 credits)

PSY 67900 - Practicum In Clinical Psychology

Credit Hours: 1.00 to 6.00. This is a practicum in clinical psychology, whereby students see individuals for therapy. These cases are supervised by faculty in clinical psychology. This is a requirement for the graduate program, and students must do both adult and child practicum. Students enrolled in this program must register for this course a minimum of four times. Prerequisite: Master's student standing and Psychology majors only. Permission of instructor required.

Credits: 1.00 to 6.00

Internal Practica Requirements

External Practica Requirements

Clinical Internship (xx credits)

PSY 69700 - Clinical Psychology Internship

Credit Hours: 0.00. Clinical psychology internship. Open only to Clinical Psychology students in approved internship facilities. Permission of instructor required.

Credits: 0.00

Electives (9-36 credits)

Dissertation Research (4-44 credits)

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Learning Outcomes

Additional Information

GPA Requirements

Cognitive Psychology, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (9 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of

their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Seminar Courses (6 credits)

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Cognitive Psychology Courses (12 credits)

PSY 62400 - Human Learning And Memory

Credit Hours: 3.00. Selected survey of important problems in the encoding, storage, and retrieval of laboratory and naturalistic events.

Learning Outcomes: 1. Describe the most common methods and procedures used to carry out research on human learning and memory. 2. Describe and explain foundational findings in the study of human learning and memory. 3. Describe and evaluate key concepts and theories that have been developed to understand the mental processes involved in human learning and memory. Credits: 3.00

PSY 62500 - Complex Cognitive Processes

Credit Hours: 3.00. Surveys research and theory concerned with the nature of the "higher-order" mental processes, including decision making, categorization, problem solving, and language. Fundamental questions regarding the nature of the representations that underlie conceptual and linguistic behavior will be addressed. Permission of instructor required.

Learning Outcomes: 1. Read, critically evaluate, and discuss empirical and theoretical research articles about complex cognitive processes. 2. Integrate learning of course material with their own research interests into a written proposal of a research project, demonstrating effective communication skills and critical thinking skills. Credits: 3.00

PSY 62800 - Perceptual Processes

Credit Hours: 3.00. This course is an advanced introduction to the psychology of perception. The course emphasizes visual and auditory perception, reviewing basic concepts, methodologies, research findings, and theoretical approaches. Theories of direct perception, constructivist perception, and computational vision are discussed in detail.

Credits: 3.00

PSY 63700 - Human Information Processing

Credit Hours: 3.00. This course develops the methodological tools required for an information processing approach to human behavior. These techniques are applied to such topics as reaction time, signal detection, attention, and skilled behavior, with emphasis upon unifying empirical findings. Prerequisite: PSY 60000 , PSY 60100 .

Credits: 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Colloquium (xx credits)

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

Electives (6-10 credits)

Dissertation Research (xx credits)

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

GPA Requirements

Communication/Gerontology, PHD

About the Program

Program Requirements

Required Courses (42-72 credits)

Major Area (18-48 credits)

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the

major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Interpersonal Communication

COM 50800 - Nonverbal Communication In Human Interaction

Credit Hours: 3.00. An examination of theoretical writings and critical studies in selected areas of nonverbal communication, e.g., the environmental influences, space and territory relationships, physical appearance and dress, physical behavior, and vocal cues. One unit will deal specifically with measurement, recording, or transcription methods used in nonverbal study.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

COM 50300 - Cross Cultural Communication

Credit Hours: 3.00. In this course, we examine the scholarly history of intercultural and cross-cultural communication along with conceptual and empirical challenges in doing this type of inquiry. Several contexts will be studied from the point of view of forms of cultural wisdom and variation in practices. Larger questions of idenity, diversity, and intercultural competence will be explored, especially through filters of globalization and ethical issues in intercultural relations. Students will have regular reading assignments, short reaction papers, give oral presentations, and write a final research paper or proposal, depending on their stage in their programs.

Learning Outcomes: 1. Discuss and exemplify how culture is a multimodal, multilayered set of practices, attitudes, and belief. 2. Analyze intercultural communication problems, illustrating the historical, cultural, economic, and political differences that affect their solutions. 3. Recognize a range factors impacting human cultural life, including, but not limited to, class, gender, nation, ethnicity. 4. Develop research ideas and methods to address current problematics in cross-cultural communication. 5. Develop, create, determine how to engage audiences around a global problem. 6. Practice using self-awareness, research, discussion, and peer review to explore cross-cultural challenges. Credits: 3.00

Media, Technology, and Society

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of

communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

Organizational Communication

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 60811 - Leadership And Global Strategic Communication

Credit Hours: 3.00. Over the last decade, the field of strategic communication has grown rapidly. The work of strategic communication professionals requires coordinated responses between distinct organizational units that are often separated by time and space. These conditions necessitate effective leadership. Further complicating leadership in these contexts is the fact that the work of strategic communication has increasingly become global in nature. This course provides students with theoretical background in leadership and global strategic communication, as well as the opportunity to apply what they learn to strategic communication cases and to their own professional experiences. It also encourages them to think proactively about leadership challenges in these contexts and to articulate theoretically-informed analyses and evaluations of leadership in action. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of theories related to leadership and to strategic communication in global contexts. 2. Articulate the relationship between theory and the practice of leadership as it relates to global strategic communication, and apply theoretical concepts and principles to real world contexts. 3. Explain the role of leadership and culture in global strategic communication. 4. Compare and contrast notions of leadership, corporate social responsibility, and negotiation across cultural contexts. 5. Identify the unique challenges experienced when leaders engage in strategic communication practices globally. 6. Evaluate

the current knowledge base and "best practices" in global strategic communication. Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

Public Relations

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication.

Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

Minor Area (15-36 credits)

Thesis Research (18 credits)

COM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Information

Comparative Literature, PHD

About the Program

Program Requirements

Required Courses (33 credits)*

Core Courses (6 credits)

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

CMPL 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (LC 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study.

Credits: 3.00

Seminar Courses (6 credits)

Major Field (9 credits)

Secondary Field (9 credits)

Third Field (3 credits)

Dissertation Research (57 credits)

CMPL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Concentrations

Additional Information

About the Program

Comparative Pathobiology, PHD

About the Program

Program Requirements

Required Courses (4-6 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Dissertation Research (18 credits)

CPB 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CPB 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Area of Study (66-68 credits)

Animal Welfare

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic

study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and

need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

ASEC 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. Topics, requirements, and credits to be determined yearly. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 4.00

Human-Animal Interaction

CPB 69500 - Seminar In Epidemiology

Credit Hours: 1.00. Discussion of recent research in epidemiology, emphasizing study design, analysis, and public health significance. Discussion topics will be selected from the following areas: clinical epidemiology, infectious disease epidemiology, chronic disease epidemiology, and environmental epidemiology. Required of graduate students with a principal field of study in epidemiology. Prerequisite: Course work in Statistics and Epidemiology.

Credits: 1.00

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic

studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century

developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Epidemiology and Public Health

Microbiology and Immunology

Animal Welfare

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

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ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

ASEC 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. Topics, requirements, and credits to be determined yearly. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 4.00

Required Courses (4-6 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Concentrations

GPA Requirements

About the Program

Comparative Pathobiology/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (4-6 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Dissertation Research (18 credits)

CPB 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Area of Study (66-68 credits)

Animal Welfare

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on

computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

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Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

GRAD 59000 - Special Topics

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Credits: 1.00 to 3.00

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Credit Hours: 1.00. Discussion of recent research in epidemiology, emphasizing study design, analysis, and public health significance. Discussion topics will be selected from the following areas: clinical epidemiology, infectious disease epidemiology, chronic disease epidemiology, and environmental epidemiology. Required of graduate students with a principal field of study in epidemiology. Prerequisite: Course work in Statistics and Epidemiology.

Credits: 1.00

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4.

Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

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Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction. Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

PHIL 52400 - Contemporary Ethical Theory

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Credits: 3.00

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Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

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Epidemiology and Public Health

Microbiology and Immunology

GPA Requirements

Comparative Pathobiology/Gerontology, PHD

About the Program

Program Requirements

Required Courses (4-6 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards,

and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Dissertation Research (18 credits)

CPB 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Area of Study (66-68 credits)

Animal Welfare

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

ASEC 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. Topics, requirements, and credits to be determined yearly. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 4.00

Human-Animal Interaction

CPB 69500 - Seminar In Epidemiology

Credit Hours: 1.00. Discussion of recent research in epidemiology, emphasizing study design, analysis, and public health significance. Discussion topics will be selected from the following areas: clinical epidemiology, infectious disease epidemiology, chronic disease epidemiology, and environmental epidemiology. Required of graduate students with a principal field of study in epidemiology. Prerequisite: Course work in Statistics and Epidemiology.

Credits: 1.00

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results,

and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Epidemiology and Public Health

Microbiology and Immunology

GPA Requirements

Computer and Information Science, PHD
Computer and Information Technology, PHD

About the Program

Program Requirements

Required Courses (6 credits)

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in

industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using

qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

CNIT 60100 - Applied Statistics In Information Technology

Credit Hours: 3.00. This course will survey the field of applied statistics in information technology. Students will gain hands-on experience running statistical analyses on samples from a variety of populations. Students will learn the process of data cleaning, data transforming/coding, identifying the appropriate statistical analyses (descriptive and inferential), as well as writing and interpreting the results. Specifically, this course will survey the following statistical approaches: correlations, t-test, analysis of variance, analysis of co-variance, factorial ANOVA, simple regression, multiple regression, logistic regression, chi-square analysis, factor analysis, and nonparametric tests. In this course, students will be able to differentiate statistical analyses and identify appropriate statistical analyses depending on the research question and variables of interest. Permission of instructor required.

Learning Outcomes: 1. Analyze data with different statistical procedure using SPSS. 2. Differentiate between different types of statistical analyses. 3. Evaluate the statistical procedures and results in published journal articles. Credits: 3.00

Foundation Courses (3-15 credits)

CNIT 55000 - Organizational Impact Of Information Technology

Credit Hours: 3.00. An enterprise view of the organizational impact of information technology as the most effective means for achieving "better, faster, cheaper operations" in today's highly competitive business environment. Examines how information technology has enabled new organizational forms and changes in business processes, products, markets, delivery systems, ways of working, and people management issues and challenges. Permission of instructor required.

Learning Outcomes: 1. Articulate methods and algorithms in network security. 2. Evaluate the strengths and weaknesses of different networking security approaches. 3. Describe how to deploy encryption techniques to secure data at rest and in transit. 4. Compare, contrast and critique existing applied research in network security. 5. Propose new ideas/technologies in network security and systematically assess your proposed work. Credits: 3.00

CNIT 55100 - Information Technology Economics

Credit Hours: 3.00. Examines the economics of information systems and information technology as it relates to business performance. Topics include strategic information technology planning, alignment with business planning, value assessment, and performance measurement. Special emphasis is placed on issues relevant to strategic information technology infrastructure management, both for the information technology unit as well as the business as a whole. Permission of instructor required.

Credits: 3.00

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

CNIT 55300 - Quality Management In Information Technology

Credit Hours: 3.00. This course explores quality and productivity models used to ensure quality in information technology systems development processes. Special emphasis is on learning and understanding process metrics and measurement, as well as initiatives such as Total Quality Management, Continuous Process Improvement, Six Sigma, and the Software Engineering Institute Capability Maturity Model. Permission of instructor required.

Learning Outcomes: 1. Use and apply information technology solutions. 2. Understand and apply high-level tools and emerging technologies. 3. Demonstrate independent critical thinking and problem solving skills. 4. Understand and apply information technology application methodologies. 5. Communicate effectively with customers, supervisors and peers, both orally and in writing. 6. Understand the expectations of an information technology professional. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science. Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CS 50100 - Computing For Science And Engineering

Credit Hours: 3.00. Credit in this course may not be used toward a graduate degree in Computer Sciences. Computational concepts, tools, and skills for computational science and engineering scripting for numerical computing, scripting for file processing, high performance computing, and software development. Project may be required.

Learning Outcomes: 1. To prepare graduate students outside Computer Science to write computer programs in support of their studies and research. Credits: 3.00

Electives (21-63 credits)

Dissertation Research (18 credits)

CNIT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 18.00

CNIT 69900 - Research PhD Dissertation

Credit Hours: 1.00 to 18.00. Dissertation-level research (for CIT PhD degree). Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Outcomes will be agreed upon by the instructor and the student. Credits: 1.00 to18.00

Additional Requirements

Required Courses (6 credits)

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying

qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

CNIT 60100 - Applied Statistics In Information Technology

Credit Hours: 3.00. This course will survey the field of applied statistics in information technology. Students will gain hands-on experience running statistical analyses on samples from a variety of populations. Students will learn the process of data cleaning, data transforming/coding, identifying the appropriate statistical analyses (descriptive and inferential), as well as writing and interpreting the results. Specifically, this course will survey the following statistical approaches: correlations, t-test, analysis of variance, analysis of co-variance, factorial ANOVA, simple regression, multiple regression, logistic regression, chi-square analysis, factor analysis, and nonparametric tests. In this course, students will be able to differentiate statistical analyses and identify appropriate statistical analyses depending on the research question and variables of interest. Permission of instructor required.

Learning Outcomes: 1. Analyze data with different statistical procedure using SPSS. 2. Differentiate between different types of statistical analyses. 3. Evaluate the statistical procedures and results in published journal articles. Credits: 3.00

Concentrations

GPA Requirements

About the Program

Computer Science, PHD

About the Program

Program Requirements

Required Courses (7 credits)

Research Orientation Course (1 credit)

CS 59100 - Seminar

Credit Hours: 1.00. A weekly seminar presented by faculty and invited speakers, normally in a specific area.

Credits: 1.00

Core Courses (6 credits)

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks,

synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election, group communication, and replication. Permission of department required.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 63800 - Multimedia Networking And Operating Systems

Credit Hours: 3.00. For graduate students in computer sciences who have a background in networking and operating systems and are interested in research in networked multimedia systems. The course consists of a selection of networking and operating system topics for realizing high performance, predictable, scalable, flexible, and secure multimedia systems. Topics may vary to reflect timely research issues and the current interests of the instructor(s). Students are expected to complete a term project. Presentations also may be required. Undergraduate background in computer science required. Prerequisite: CS 53600 or CS 50300 .

Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

CS 58800 - Randomized Algorithms

Credit Hours: 3.00. The area of randomized algorithms has grown from being a tool in computational number theory to finding widespread application in algorithms in all areas of computer science. Two practical benefits of randomization are its simplicity and speed. Deep and important computational complexity connections have been developed, from bridging the gap between discrete and continuous optimization, bypassing deterministic barriers in online settings, summarizing massive data in polylogarithmic space, probabilistically checkable proofs, privacy enhancing techniques, modeling the web and other large networks, and sparsifying and compressing complicated combinatorial structures such as graphs. Randomization is an essential key ingredient in the algorithmic breakthroughs today and in the future. This course presents the basic concepts in the design and analysis of randomized algorithms and shows how to apply them to algorithms for a wide range of problems. The course covers a broad range of problems benefitting from randomized computation including data structures, graph algorithms, online algorithms, geometric algorithms, streaming algorithms, derandomization techniques, and tools for probabilistic analysis of algorithms.

Learning Outcomes: 1. Describe the main principles underlying the design and analysis of a randomized algorithm. 2. Explain concepts of randomized algorithms used in specific domains; e.g., graph-theory, number theory, and linear algebra problems. 3. Apply measure concentration results from probability theory to analyze a given randomized algorithm. 4. Determine the running times, failure probabilities, and accuracy guarantees of a randomized algorithm. 5. Apply learned design techniques and analysis tools to design and analyze new randomized algorithms. 6. Explain material from published research in the area of randomized algorithms using field-specific language. Credits: 3.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage, communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration

systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3. Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

CS Selectives (12 credits)

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election, group communication, and replication. Permission of department required.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) AIternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping

needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 59100 - Seminar

Credit Hours: 1.00. A weekly seminar presented by faculty and invited speakers, normally in a specific area.

Credits: 1.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

CS 63500 - Capturing And Rendering Real-World Scenes

Credit Hours: 3.00. Advanced techniques for automated modeling and visualization of complex environments, such as rooms, buildings, urban scenes, and landscapes. Topics covered are at the confluence of computer graphics, computer vision and engineering, and include: capture technologies, acquisition device calibration, view registration, panoramic images, 3D reconstruction from images, view morphing, 3D image warping, lightfield modeling and rendering, visual hulls, point-based modeling and rendering, view dependent texture mapping, and application development issues and examples. Prerequisite: CS 58000 , CS 53500 or a solid foundation in computer graphics, programming proficiency in C or C++ and basic linear algebra.

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless

networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 58500 - Theoretical Computer Science Toolkit

Credit Hours: 3.00. This course covers fundamental techniques and a range of mathematical tools that underlie today's research in theoretical computer science. The course material is essential for research in theoretical computer science as well as machine learning theory. The course is targeted at students who plan to pursue research in these areas. Topics will be chosen from four core areas: Convex Analysis and Optimization, Spectral Methods, Concentration Inequalities, and Discrete Fourier Analysis. Depending on student and instructor interest, additional topics will be chosen and may include applied analysis, coding theory, probabilistic proofs, and more advanced topics in discrete Fourier analysis. Students will read papers in theoretical computer science and machine learning theory using, exploring and extending the covered techniques and tools. Students are expected to be proficient in probability theory, have the maturity to follow and carry out basic analysis proofs, and have completed courses in calculus, linear algebra, discrete mathematics, and analysis of algorithms. More specifically, the course expects mastery of the material covered

in Calculus III, Linear Algebra, Probability, Foundations of CS, and Analysis of Algorithms.

Learning Outcomes: 1. Explain and justify the merits and limitations of convex optimization algorithms. 2. Describe the characteristics and the role of convexity in optimization. 3. Formulate mathematically problems that have solutions based on convex optimization or matric analysis tools and analyze them effectively. 4. Predict typicality of the outcome in experiments. 5. Explain how to use and apply concentration bounds, including Chernoff-Hoeffding Bound, Martingales and Azuma's Inequality, and applications of the Talagrand inequality. 6. Develop precise mathematical formulation of problems and analyze using frameworks related to concentration of measure. 7. Apply Discrete Fourier Transform to determine properties of functions. 8. Explain why Fourier Analysis of Boolean Functions is a major tool in theoretical CS and describe application scenarios including property testing, cryptography, complexity, learning theory, pseudorandomness, hardness of approximation, and random graph theory. 9. Identify properties of functions based on the properties of their spectrum. 10. Explain the basic ideas underlying the tradeoff between the amount of redundancy used and the number of errors that can be corrected by a code. 11. Describe achieving the optimal tradeoff between redundancy and error correction for codes that come equipped with efficient encoding and decoding. 12. Illustrate how and why concatenated codes support the construction of asymptotically good codes. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

CS 55800 - Introduction To Robot Learning

Credit Hours: 3.00. Introduction To Robot Learning

Learning Outcomes: 1. Formulate the robot motion planning and control problems and solve them using standard tools. (W, P, E) 2. Identify the robot constraints, define their degree of freedom, and formulate their dynamical models for control. (W, P, E) 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. (W, P, E) 4. Identify limitations in existing classical robot algorithms and understand how to avoid the musing Machine Learning. (W, P) 5. Understand and apply Deep Reinforcement Learning approaches to complex robot systems. (W, P, E) 6. Evaluate and assess current best

practices and mechanisms for robot programming. (W, P) 7. Develop a skill for robot programming from perception to low-level control using state-of-the art methods. (W, P) Credits: 3.00

CS 58700 - Foundations Of Deep Learning

Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning.

Learning Outcomes: 1. Understand statistical Foundations of Deep Learning. 2. Understand feedforward Networks. 3. Understand stochastic optimization of neural network models. 4. Understand Bayesian Neural Networks. 5. Understand invariant & Equivariant Representation Learning. 6. Understand task-invariant representations. 7. Understand meta Learning. 8. Understand multi-task Learning. 9. Understand transfer Learning. 10. Understand implicit generative models (probabilistic models without explicit likelihoods). 11. Understand variational Auto-Encoders. 12. Understand generative Adversarial Networks. 13. Understand stable Diffusion Generative models. 14. Understand how to evaluate the performance of neural networks, as well as formulate and test hypotheses. 15. Understand how theory and algorithmic elements interact to impact performance. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them

to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Research Areas (xx credits)

Artificial Intelligence, Machine Learning, and Natural Language Processing

Bioinformatics and Computational Biology

Computer Architecture

Computational Science and Engineering

Databases and Data Mining

Distributed Systems

Graphics, Visualization, and Geometric Modeling

Human-Computer Interaction

Information Security and Assurance

Networking and Operating Systems

Programming Languages and Compilers

Robotics and Computer Vision

Software Engineering

Theory of Computing, Algorithms, and Quantum Computing

Dissertation Research (xx credits)

CS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. The student is expected to follow safe research practices, to follow ethical research practices, to maintain communication with the instructor, to formulate a set of reasonable semester research progress milestones with instructor, optionally in writing. Permission of instructor required.

Credits: 1.00 to 18.00

CS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. The student is expected to follow safe research practices, to follow ethical research practices, to maintain communication with the instructor, to formulate a set of reasonable semester research progress milestones with instructor, optionally in writing. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Consumer Science, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (9 credits)

HTM 60100 - Research Development And Design

Credit Hours: 3.00. This course will equip doctoral students to think like a scholar and develop the ability to design rigorous

research. Students will learn research philosophy, research idea development, and the development and evaluation of research processes and methods. Emphases are placed on developing students' confidence in conceptualizing, developing, designing, and writing empirical and theoretical research.

Learning Outcomes: 1. Demonstrate an understanding of theoretical, methodological, and ethical issues inherent in conducting research. 2. Evaluate various research processes, methodologies, and recent trends. 3. Develop rigorous research ideas, translate ideas into theory-supported research questions, and formulate analytical strategies to best address research questions. Credits: 3.00

HTM 61400 - Theory Of The Consumer

Credit Hours: 3.00. This course will examine concepts and theories that have been developed for understanding consumer choices and behaviors in society and marketplaces. Students will learn classic and modern consumer theories, such as behavioral economics and applied psychological and sociological theories. It will discuss how these theories can help explain consumer tendencies such as preferences, choices, and other consumption-related behaviors.

Learning Outcomes: 1. Demonstrate an understanding of the scope of consumer theory literature. 2. Evaluate the consumer theories and their implications in society and marketplaces. 3. Apply theories of consumer behavior to research. Credits: 3.00

HTM 61500 - Theory Of The Firm

Credit Hours: 3.00. In this course, students examine concepts, models, and theories developed for the understanding of firm and organizational behavior. This course equips students with knowledge of classic and contemporary theories, such as those related to managerial economics, pricing and price discrimination, organizational structure and culture, employee productivity, firm financial behaviors, marketing management, and operations management.

Learning Outcomes: 1. Demonstrate a foundational understanding of the scope of firm-theory literature. 2. Apply firm theory to research. 3. Analyze and synthesize firm theories with other leading or discipline-specific theories. Credits: 3.00

Professional Course (3 credits)

HTM 60200 - PhD Professional Development Seminar

Credit Hours: 1.00. The goals of this course are to (1) introduce and provide professional development resources, practices, and current trends in the areas of research, learning, and engagement, and (2) empower graduate students to pursue an academic career by developing a continuous growth mindset. Open to PhD students. No pre-requisite.

Learning Outcomes: 1. Explain the expectations for university faculty in research, learning, and engagement. 2. Create a career plan for the first five years as a university faculty. 3. List the resources and skills needed for a successful academic career in the long term. Credits: 1.00

Seminar Courses (6 credits)

Methodology & Statistics Electives (12 credits)

Outside Specialty Electives (6 credits)

Independent Study Course (6 credits)

HTM 69000 - Hospitality And Tourism Research Problems

Credit Hours: 1.00 to 4.00. Development of an individual research project for doctoral students. Projects are designed to broaden understanding of specific research techniques or to add to subject matter knowledge necessary for completion of the doctoral thesis. A paper worthy of submission to a refereed journal is expected upon project completion. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 4.00

Dissertation Research (48 credits)

HTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission

of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

Concentrations

GPA Requirements

About the Program

Consumer Science/Gerontology, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (9 credits)

HTM 60100 - Research Development And Design

Credit Hours: 3.00. This course will equip doctoral students to think like a scholar and develop the ability to design rigorous research. Students will learn research philosophy, research idea development, and the development and evaluation of research processes and methods. Emphases are placed on developing students' confidence in conceptualizing, developing, designing, and writing empirical and theoretical research.

Learning Outcomes: 1. Demonstrate an understanding of theoretical, methodological, and ethical issues inherent in conducting research. 2. Evaluate various research processes, methodologies, and recent trends. 3. Develop rigorous research ideas, translate ideas into theory-supported research questions, and formulate analytical strategies to best address research questions. Credits: 3.00

HTM 61400 - Theory Of The Consumer

Credit Hours: 3.00. This course will examine concepts and theories that have been developed for understanding consumer choices and behaviors in society and marketplaces. Students will learn classic and modern consumer theories, such as behavioral economics and applied psychological and sociological theories. It will discuss how these theories can help explain consumer tendencies such as preferences, choices, and other consumption-related behaviors.

Learning Outcomes: 1. Demonstrate an understanding of the scope of consumer theory literature. 2. Evaluate the consumer theories and their implications in society and marketplaces. 3. Apply theories of consumer behavior to research. Credits: 3.00

HTM 61500 - Theory Of The Firm

Credit Hours: 3.00. In this course, students examine concepts, models, and theories developed for the understanding of firm and organizational behavior. This course equips students with knowledge of classic and contemporary theories, such as those related to managerial economics, pricing and price discrimination, organizational structure and culture, employee productivity, firm financial behaviors, marketing management, and operations management.

Learning Outcomes: 1. Demonstrate a foundational understanding of the scope of firm-theory literature. 2. Apply firm theory to research. 3. Analyze and synthesize firm theories with other leading or discipline-specific theories. Credits: 3.00

Professional Course (3 credits)

HTM 60200 - PhD Professional Development Seminar

Credit Hours: 1.00. The goals of this course are to (1) introduce and provide professional development resources, practices, and current trends in the areas of research, learning, and engagement, and (2) empower graduate students to pursue an academic career by developing a continuous growth mindset. Open to PhD students. No pre-requisite.

Learning Outcomes: 1. Explain the expectations for university faculty in research, learning, and engagement. 2. Create a career plan for the first five years as a university

faculty. 3. List the resources and skills needed for a successful academic career in the long term. Credits: 1.00

Seminar Courses (6 credits)

Methodology & Statistics Electives (12 credits)

Outside Specialty Electives (6 credits)

Independent Study Course (6 credits)

HTM 69000 - Hospitality And Tourism Research Problems

Credit Hours: 1.00 to 4.00. Development of an individual research project for doctoral students. Projects are designed to broaden understanding of specific research techniques or to add to subject matter knowledge necessary for completion of the doctoral thesis. A paper worthy of submission to a refereed journal is expected upon project completion. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 4.00

Dissertation Research (48 credits)

HTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

GPA Requirements

Curriculum and Instruction: Art Education Concentration, PHD

About the Program

Program Requirements

Required Courses (45-55 credits)

Dissertation Research (xx credits)

Curriculum and Instruction: Curriculum Studies Concentration, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (14 credits)

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDCI 62800 - Curriculum And Instruction Doctoral Seminar I

Credit Hours: 1.00. An examination of current issues and concerns related to doctoral study in Curriculum and Instruction. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year of doctoral study.

Learning Outcomes: 1. Reflect on the roles and responsibilities of faculty members. 2. Identify steps to develop personally and professionally. 3. Describe major milestones of doctoral study in the department. 4. Identify ethical standards in the field of education. 5. Practice ethical conduct of research. 6. Identify research topics of personal interest and locate. 7. Locate and begin to review literature relevant to those topics. Credits: 1.00

EDCI 68200 - Contemporary Curriculum Theory

Credit Hours: 3.00. Critical examination of contemporary concepts of curriculum theory. Rational/technical curriculum, social needs/child centered curriculum. Socio-political curriculum theory; curriculum as existential, aesthetic, and phenomenological. Implications for current practice, school reform, and educational research.

Learning Outcomes: 1. Develop an understanding of the social theories and philosophies that inform contemporary curriculum theorizing. 2. Articulate the role of curriculum theorizing in defining and analyzing educational phenomena. 3. To utilize curriculum theory toward the development of educative responses to issues of ethics, equity, power, and privilege. 4. To synthesize the complexity and tensions of various curriculum theories into frameworks for educational research. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

EDCI 63800 - Curriculum And Instruction Doctoral Seminar II

Credit Hours: 1.00. This course consists of an examination of current educational research. EDCI and other faculty will present and lead discussions of their research. Students will be exposed to research within multiple paradigms and perspectives. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year to doctoral study. Permission of instructor required.

Learning Outcomes: 1. Identify and understand contemporary education research concerns. 2. Identify and understand research within multiple paradigms and perspectives. 3. Interact with Purdue faculty about their current research interests. 4. Grow and develop as a

professional. Credits: 1.00

Research Courses (xx credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

Focus Area Electives (15 credits)

Outside Area Elective (3 credits)

Curriculum and Instruction: English Education Concentration, PHD

About the Program

Program Requirements

Required Courses (39 credits)

Core Courses (15 credits)

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine

current theoretical perspectives and instructional practices. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

Research Courses (12 credits)

ANTH 51900 - Introduction To Semiotics

Credit Hours: 3.00. (COM 50700 , ENGL 57000 , LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ANTH 56500 - Sociolinguistics

Credit Hours: 3.00. (SLHS 56500, COM 56500 , ENGL 56500 , LC 56500 , LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDCI 51600 - Seminar In Environmental Education

Credit Hours: 3.00. The seminar covers current research and literature in environmental education, focusing on teaching children and adults about the environment. Topics vary by semester and student interest.

Learning Outcomes: 1. Develop an understanding of the research literature in environmental education pertaining to the topic of study. 2. Develop critical thinking and analysis skills for evaluating environmental education research, programs, and curriculum. 3. Develop an understanding of environmental issues. Credits: 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the

theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

EDCI 62000 - Seminar In Mathematics Education

Credit Hours: 1.00 to 6.00. Selected topics in mathematics education. Typical topics considered are: (1) problem solving; (2) instructional strategies; (3) cognitive structure; (4) current curriculum; (5) current research. Permission of instructor required.

Learning Outcomes: 1. Examine, synthesize, and communicate a view of the state of mathematics education and situate one's research in it. 2. Create knowledge for the field of mathematics education and communicate findings to the professional community. 3. Communicate and act upon professional feedback in the processes of designing and conducting research and writing conference proposals and research reports. 4. Report on various stages and types of research (e.g., project design, data analysis, findings). Credits: 1.00 to 6.00

EDCI 67300 - Issues And Methods In Learning Systems Design Research

Credit Hours: 3.00. Provides preparation to conduct independent research in the field of learning design and technology through direct participation in the research process: critically reviewing research, designing and conducting a research study, synthesizing and presenting results in written and oral formats. Prerequisites: EDPS 53300, EDCI 67600, EDCI 67700.

Learning Outcomes: 1. Describe the role of research in the field of Learning Design and Technology. 2. Design a research study to investigate a problem relevant to the field of Learning Design and Technology. 3. Conduct a research study in an applied (school, hospital, community agency) or experimental (lab, designed) setting. 4. Analyze, interpret, and discuss various sets of data. 5. Write a research report according to APA guidelines. 6. Present the results of a research study according to professional guidelines. Credits: 3.00

ENGL 62400 - Issues In Composition Studies: Modern Period

Credit Hours: 3.00. The course historicizes issues in composition studies from the eighteenth century to the mid-twentieth century. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of

rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important

applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Education Electives (12 credits)

Dissertation Research (xx credits)

Curriculum and Instruction: Learning Design and Technology Concentration, PHD

About the Program

Program Requirements

Required Courses (53-65 credits)

Prerequisite Courses (0-9 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of

the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

Core Courses (21 credits)

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 62700 - Current Topics In Learning Design And Technology

Credit Hours: 3.00. A critical analysis of problems, trends, issues, and programs related to the area of learning design and technology. Prerequisite: EDCI 51300 .

Learning Outcomes: 1. Critically analyze current issues and trends in the field related to a given topic. 2. Identify and discuss advantages and limitations to implementing specific emerging tools, strategies, and /or approaches. 3. Identify strategies for examining the effectiveness of specific emerging tools and strategies. Credits: 3.00

EDCI 66000 - Learning Design And Technology Seminar

Credit Hours: 1.00. This course is an investigation of trends, developments, and issues in learning design and technology with a focus on current practices, problems, and research. This one-credit seminar is designed to help students learn about applications of instructional design and educational technology in various settings and to interact with faculty and guest speakers about topics related to the field and the LDT program.

Learning Outcomes: 1. Become familiar with resources available to support progression through your LDT graduate program. 2. Learn the specifics of the program and its requirements, including reviewing targeted learning competencies, portfolio requirements, program faculty, and the graduate handbook. 3. Identify and work towards fulfilling short and long-term professional goals. 4. Identify a career pathway that is appropriate for you

including the skills, knowledge, and attitudes you will need to be successful. 5. Gain real-world insights into LDT field. Credits: 1.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of learning systems design to real-world educational situations through the in-depth consideration of key instructional design processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

EDCI 67400 - Advanced Instructional Design Theory

Credit Hours: 3.00. Examines the impact of both psychological learning theories and instructional applications upon the development of various instructional design theories. Emphasis is on theory construction, influence of learning and educational principles, and the current and future possibilities of instructional design theory. Prerequisite: EDCI 53100 and 57200.

Learning Outcomes: 1. Identify and consider the key principles and underlying assumptions from several prominent Instructional Design Theories and articulate relationships across these areas. 2. Determine when, why, how, and under what conditions specific ID theoretical principles can be applied to resolve applied learning problems. 3. Assess the effectiveness of specific ID theories, explain their individual strengths and weaknesses, and propose alternative viewpoints, guidelines, and perspectives to enhance learning given specific situations. 4. Develop effective methods for analyzing and articulating sound and logical arguments regarding theoretical, instructional, and technological relationships, positions, and conceptualizations. Credits: 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

EDCI 67700 - Unpacking Research: Writing Research Proposals In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the novice researcher to the process of developing a research problem statement supported by literature resulting in a professional organization conference proposal and a proposal for a funding agency in the field of Learning Design and Technology. Permission of instructor required. Prerequisite: EDCI 67600.

Learning Outcomes: 1. Discuss current research in the LDT field. 2. Formulate a problem statement, purpose statement, and research questions to drive a potential research study. 3. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 4. Analyze and provide feedback to peers through a collaborative learning experience. 5. Develop a research proposal that is ready to be put into place. 6. Identify areas for improvement in the research proposal writing process. Credits: 2.00

EDCI 67600 - Unpacking Research: Writing Literature Reviews In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the learner to the process of analyzing and preparing literature reviews on topics relevant to the field of Learning Design and

Technology. Emphasis is placed on helping the learner to understand, critique, and synthesize the research literature in order to apply it to their own personal research agenda. Course activities and assignments are designed to help the learner develop the knowledge, tools, and strategies needed to become thoughtful consumers and producers of research and to use this knowledge to inform their practice. Learning experiences revolve around two major themes: 1) the examination and thoughtful critique of current research and 2) preparation of a thorough literature review that provides a rationale for continued study. Permission of instructor required.

Learning Outcomes: 1. Formulate a driving question about a specific topic in Learning Design and Technology. 2. Locate published literature (scholarly work) that supports the importance of the question. 3. Critically evaluate published research. 4. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 5. Analyze and provide feedback to peers through a collaborative learning experience. Credits: 2.00

EDCI 67800 - Unpacking Research: Writing For Scholarly Publications In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the novice researcher to the process of publishing research in the field of Learning Design and Technology. Emphasis is placed on practical aspects of the publishing process as well as familiarizing students with the role that editors and reviewers play in that process. Prerequisite courses include: EDCI 67600 Writing Literature Reviews and EDCI 67700 Writing Research Proposals. Students must bring a draft manuscript completed through the methods portion into the course, and students must have completed research and collected data to facilitate completion of a research-based manuscript for publication during the course. Permission of instructor required.

Learning Outcomes: 1. Discuss current research in the LDT field. 2. Formulate a problem statement, purpose statement, and research questions to drive a potential research study. 3. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 4. Analyze and provide feedback to peers through a collaborative learning experience. 5. Develop a research proposal that is ready to be put into place. 6. Identify areas for improvement in the research proposal writing process. Credits: 2.00

Seminar Courses (2 credits)

EDCI 62800 - Curriculum And Instruction Doctoral Seminar I

Credit Hours: 1.00. An examination of current issues and concerns related to doctoral study in Curriculum and Instruction. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year of doctoral study.

Learning Outcomes: 1. Reflect on the roles and responsibilities of faculty members. 2. Identify steps to develop personally and professionally. 3. Describe major milestones of doctoral study in the department. 4. Identify ethical standards in the field of education. 5. Practice ethical conduct of research. 6. Identify research topics of personal interest and locate. 7. Locate and begin to review literature relevant to those topics. Credits: 1.00

EDCI 63800 - Curriculum And Instruction Doctoral Seminar II

Credit Hours: 1.00. This course consists of an examination of current educational research. EDCI and other faculty will present and lead discussions of their research. Students will be exposed to research within multiple paradigms and perspectives. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year to doctoral study. Permission of instructor required.

Learning Outcomes: 1. Identify and understand contemporary education research concerns. 2. Identify and understand research within multiple paradigms and perspectives. 3. Interact with Purdue faculty about their current research interests. 4. Grow and develop as a professional. Credits: 1.00

Research Courses (12 credits)

COM 58200 - Descriptive/Experimental Research In Communication

Credit Hours: 3.00. Introduction to the fundamental tools of

quantitative research in communication, including data analysis, statistical design and methods, basic measurement concepts, and designs for descriptive and experimental research. Individual and/or group research projects are planned, conducted, and reported. Permission of instructor required.

Learning Outcomes: 1. You will be able to understand and critically evaluate published research; 2. Be able to make appropriate choices regarding research design which fit within the assumptions of the proposed hypotheses or research questions; 3. You will be able to use basic statistical analysis procedures; 4. You will be able to utilize four research methods; 5. You will be able to write an effective literature review; 6. You will be able to communicate your results via the web. Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5.

Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60500 - Applied Multivariate Analysis

Credit Hours: 3.00. A survey of the most frequently employed multivariate research techniques, such as multivariate generalizations of univariate tests and analysis of variance, principal components, canonical analysis, and discriminant analysis. A central theme of the course is the general linear model, both univariate and multivariate. A multipurpose program for this model provides the student with practical experience in conducting multivariate research. Some prior exposure to elementary matrix algebra is recommended. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

PSY 68000 - Survey Of Industrial/Organizational Psychology

Credit Hours: 3.00. This two-semester sequence extensively surveys the various areas of industrial/organizational psychology. The first semester surveys those topics generally classified as dealing with industrial psychology (e.g., selection, placement, training, performance appraisal), and the second semester surveys organizational psychology topics (e.g., job satisfaction, motivation, leadership, decision making, role making). Course provides a critical and up-to-date review of recent and classical research in these areas. Prerequisite: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Credits: 3.00

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills by taking advanced quantitative methods courses. Credits: 3.00

Learning Design and Technology Electives (12-15 credits)

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 55600 - Educational Video Game Design

Credit Hours: 3.00. Designed to provide an introduction to the design of educational video games. The focus of the course is on two areas: 1) the learning, instructional design, and game design theories which can inform the design of effective and engage in educational video games, and 2) how to apply those

theories within practical settings.

Learning Outcomes: 1. Become comfortable with the history, concepts, terminology, culture, and classification of educational video and computer games. 2. Explore current research on educational computer and video games. 3. Examine learning, instructional design, and game design theories for relevance to the design of educational computer and video games. 4. Apply theory be designing, developing, and implementing a prototype of an educational computer or video game as teams. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of

distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDCI 62700 - Current Topics In Learning Design And Technology

Credit Hours: 3.00. A critical analysis of problems, trends, issues, and programs related to the area of learning design and technology. Prerequisite: EDCI 51300 .

Learning Outcomes: 1. Critically analyze current issues and trends in the field related to a given topic. 2. Identify and discuss advantages and limitations to implementing specific emerging tools, strategies, and /or approaches. 3. Identify

strategies for examining the effectiveness of specific emerging tools and strategies. Credits: 3.00

EDCI 67500 - Instructional Strategies

Credit Hours: 3.00. Examines and applies the cognitive strategies and tactics that can be used by an instructional designer to improve human learning. Applications of various instructional strategies for specific cognitive tasks (e.g., concepts, mental models, problem solving) will to be covered. Additionally, best practices for a diverse range of instructional methods will be considered, as well as, the strategies for the entire instructional experience. Prerequisite: EDCI 57200. Permission of instructor required.

Learning Outcomes: 1. Identify, synthesize, and summarize practical, research based guidelines that facilitate the development of quality instructional results. 2. Identify, describe, and select relevant cognitive techniques/strategies (e.g., analogies, metaphors, imagery and mnemonics) and cite relevant research to indicate their appropriate use and effectiveness. 3. Identify, describe, and select relevant instructional methods (e.g., case-based instruction, cooperative learning, discussion, simulation, peer mentoring, reciprocal teaching, and discovery) and cite relevant research to indicate their appropriate use and effectiveness. 4. Identify, describe, and select relevant motivational strategies that can be incorporated to increase learner effort in a learning task and cite relevant research to indicate their appropriate use and effectiveness. 5. Given a task to evaluate instructional materials for specific content, identify the type of learning involved, select the appropriate set of instructional techniques, methods and strategies, and utilize those to design and propose an effective instructional outcome. Credits: 3.00

EDCI 63300 - Instructional Design Project Management

Credit Hours: 3.00. This course focuses on the application of project management ideas, concepts, and strategies in instructional design settings. Students will be asked to consider the relationship between instructional design and project management, tools that can assist with managing instructional design projects, and factors influencing the instructional design project management process. Students will explore these topics by creating deliverables for instructional design cases and other interactive assignments.

Learning Outcomes: 1. Explain and reflect upon common project management terminology's role in instructional design projects. 2. Analyze and articulate the relationship between project management and instructional design. 3. Propose and/or develop relevant intervention strategies (instructional design and project management) to real-world instructional design issues that are consistent with arguments and evidence presented. 4. Integrate project management technologies and tools in the development of instructional design project management. 5. Interpret the role of interpersonal skills in and factors impacting project management instructional design initiatives. Credits: 3.00

Outside Area Electives (6 credits)

Dissertation Research (12-15 credits)

Curriculum and Instruction: Literacy and Language Education Concentration, PHD

About the Program

Program Requirements

Required Courses (39 credits)

Core Courses (15 credits)

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

Research Courses (12 credits)

ANTH 51900 - Introduction To Semiotics

Credit Hours: 3.00. (COM 50700 , ENGL 57000 , LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ANTH 56500 - Sociolinguistics

Credit Hours: 3.00. (SLHS 56500, COM 56500 , ENGL 56500 , LC 56500 , LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of

qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

EDCI 62000 - Seminar In Mathematics Education

Credit Hours: 1.00 to 6.00. Selected topics in mathematics education. Typical topics considered are: (1) problem solving; (2) instructional strategies; (3) cognitive structure; (4) current curriculum; (5) current research. Permission of instructor required.

Learning Outcomes: 1. Examine, synthesize, and communicate a view of the state of mathematics education and situate one's research in it. 2. Create knowledge for the field of mathematics education and communicate findings to the professional community. 3. Communicate and act upon professional feedback in the processes of designing and conducting research and writing conference proposals and research reports. 4. Report on various stages and types of research (e.g., project design, data analysis, findings). Credits: 1.00 to 6.00

EDCI 67300 - Issues And Methods In Learning Systems Design Research

Credit Hours: 3.00. Provides preparation to conduct independent research in the field of learning design and technology through direct participation in the research process: critically reviewing research, designing and conducting a research study, synthesizing and presenting results in written and oral formats. Prerequisites: EDPS 53300, EDCI 67600, EDCI 67700.

Learning Outcomes: 1. Describe the role of research in the field of Learning Design and Technology. 2. Design a research study to investigate a problem relevant to the field of Learning Design and Technology. 3. Conduct a research study in an applied (school, hospital, community agency) or experimental (lab, designed) setting. 4. Analyze, interpret, and discuss various sets of data. 5. Write a research report according to APA guidelines. 6. Present the results of a research study according to professional guidelines. Credits: 3.00

ENGL 62400 - Issues In Composition Studies: Modern Period

Credit Hours: 3.00. The course historicizes issues in composition studies from the eighteenth century to the mid-twentieth century. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with

emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Literacy and Language Cluster Area Courses (12 credits)

Cluster Area 1: English Language Learning (ELL) (15-xx credits)

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing

ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

ENGL 51600 - Teaching English As A Second Language: Theoretical Foundations

Credit Hours: 3.00. Survey of theories of learning and teaching English as a second/foreign/international language. Focus is on current theories and their implications for practice.

Learning Outcomes: 1. Demonstrate an understanding of current theories of second-language learning and teaching and their implications. Credits: 3.00

ENGL 51800 - Teaching English As A Second Language: Principles And Practices

Credit Hours: 3.00. Studies of issues and principles in ESL/EFL program development. Emphasis is on practical application of theory in a variety of English learning and teaching contexts in the U.S. and abroad.

Credits: 3.00

ENGL 62900 - Seminar In English As A Second Language

Credit Hours: 3.00. In-depth study of variable subjects relating to the nature of English as a second/foreign/international language and its learning and teaching. Prerequisite: ENGL 51600 .

Credits: 3.00

ENGL 63000 - Seminar In Second Language Writing

Credit Hours: 3.00. An overview and examination of major issues in the theory, research, and practice of writing in English as a second language. Prerequisite: ENGL 51600 or ENGL 59100 .

Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at

the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

Cluster Area 2: Literacy and Human Development (xx credits)

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

EDCI 61200 - Seminar In Literacy

Credit Hours: 3.00. Recent trends and research in literacy. Topics provide in-depth study of literacy acquisition in educational settings.

Learning Outcomes: 1. Investigate a specific topic of interest through readings, written work, and discussion. 2. Develop understandings of a new topic area relevant to the study of literacy and language. Credits: 3.00

Cluster Area 3: English Education (Secondary) (xx credits)

EDCI 55100 - Young Adult Literature

Credit Hours: 3.00. This course is a survey of classic and contemporary young adult texts. Students are introduced to the genre through reading notable young adult texts, applying relevant literary criticism, and investigating effective pedagogical strategies.

Learning Outcomes: 1. Read and respond to selected young adult texts in writing and in class discussion. 2. Explore the extent to which young adult texts portray the complex challenges of teenage life. 3. Explore the extent to which young adult texts, as imaginative narratives, affect teenage identity development. 4. Create a final project synthesizing young adult texts, theories of reading and response, and theories of adolescent development. Credits: 3.00

EDCI 61300 - Seminar In The English Language Arts

Credit Hours: 3.00. Problems in the teaching of English: literature, language, rhetoric. Attention to recent scholarship and to its application in the public schools.

Learning Outcomes: 1. Think critically about historical and/or contemporary research and theory central to the field of English education. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions which encourage critical thought and personal engagement. Credits: 3.00

Seminar Courses (xx credits)

EDCI 61200 - Seminar In Literacy

Credit Hours: 3.00. Recent trends and research in literacy. Topics provide in-depth study of literacy acquisition in educational settings.

Learning Outcomes: 1. Investigate a specific topic of interest through readings, written work, and discussion. 2. Develop understandings of a new topic area relevant to the study of literacy and language. Credits: 3.00

EDCI 61300 - Seminar In The English Language Arts

Credit Hours: 3.00. Problems in the teaching of English: literature, language, rhetoric. Attention to recent scholarship and to its application in the public schools.

Learning Outcomes: 1. Think critically about

historical and/or contemporary research and theory central to the field of English education. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions which encourage critical thought and personal engagement. Credits: 3.00

Dissertation Research (xx credits)

Curriculum and Instruction: Science Education Concentration, PHD

About the Program

Program Requirements

Required Courses (51 credits)

Core Courses (16 credits)

EDCI 51000 - Colloquium In Science And Mathematics Education

Credit Hours: 1.00. Weekly colloquia on individual research topics of interest to science and mathematics education faculty and graduate students. Colloquia will describe research programs in education. Course will be required of first-year graduate students.

Credits: 1.00

EDCI 51700 - Survey Of Science Education

Credit Hours: 3.00. Introduction to current issues and research in science education, broadly organized under themes of learning, teaching, and science curriculum.

Credits: 3.00

EDCI 51800 - The Nature Of Science In Science Teaching

Credit Hours: 3.00. Explores philosophical issues related to the scientific enterprise, such as the production and validation of scientific knowledge; the role of the scientific community; and the influence of gender and culture on doing science. Also examines the implications of these issues for science teaching and learning, as well as for research in science education.

Learning Outcomes: 1. Develop an understanding of various philosophical positions on the nature of science. 2. Develop an understanding of your own views of the nature of science. 3. Develop an understanding of the roles of scientists, the greater society, culture, and gender in the creation and validation of scientific knowledge. 4. Develop an understanding of students' and teachers' ideas about the nature of science. 5. Develop an understanding of the implications of various perspectives on the nature of science teaching and learning. Credits: 3.00

EDCI 56700 - Action Research In Science Education

Credit Hours: 3.00. An introduction to various models and conceptions of teacher action research in science education. Students review literature on action research, participate in small research cohorts, and plan and conduct action research within their respective educational situations.

Learning Outcomes: 1. Develop an understanding of what action research is, how it is conducted, and what role it plays in the construction of teacher knowledge in science education. 2. Plan and conduct action research within your respective educational situation. 3. Examine various models for action research in pre-service, in-service, and independent projects in science education. 4. Gain insight into the role action research plays in science education and science teacher education. Credits: 3.00

EDCI 60500 - Teaching Integrated Science, Technology, Engineering And Math

Credit Hours: 3.00. Analysis of historical developments and present trends in science education; the designing, implementation, and evaluation of science programs; the role of research in present and future developments.

Learning Outcomes: 1. Identify, describe, and explain the fundamental tenets of different constructivist learning theories and their relevancy to STEM education. 2. Clarify and

refine beliefs about teaching and learning in STEM education. 3. Identify and characterize students' ideas about STEM and how they influence learning. 4. Explore students' thinking and understanding of STEM through multiple strategies. 5. Describe ways to assess student learning in STEM. 6. Identify, practice, and reflect upon teaching strategies commensurate with teaching beliefs and knowledge about how students learn STEM through an integrated approach. 7. Compare and evaluate curriculum resources for integrating STEM instruction. 8. Devise a comprehensive lesson plan for integrating STEM instruction based on science and engineering practices and teaching for all learners. 9. Teach and reflect upon an integrated STEM lesson employing multiple instructional strategies. 10. Evaluate student learning in the context of an integrated STEM lesson. Credits: 3.00

EDCI 61800 - Gender And Culture In Science Education

Credit Hours: 3.00. An examination of the different perspectives on issues of gender, culture, and science. Major topics include feminist critiques of scientific theories and methods, the work of women and minorities in science, the role science has played in the construction of race and gender, and topics in science education, such as girls' learning in science and the potential of inclusive practices in the science classroom. Prerequisite: EDCI 51800 or EDCI 58500 .

Learning Outcomes: 1. Develop an in-depth understanding of the role of gender and culture in science and science education. 2. Examine feminist and cross-cultural studies in science and science education. 3. Apply feminist and critical frameworks of analysis to various studies in science education. 4. Identify and evaluate the strengths and limitations of feminist and cultural critiques of science. 5. Synthesize related literature in an effort to gain in-depth knowledge about one or more areas of gender and culture in science and science education. Credits: 3.00

EDCI 61900 - Learning Science

Credit Hours: 3.00. The course provides a holistic study of how children and adults learn science; how the learner's ideas, ways of thinking, abilities to do science, and their attitudes towards and beliefs about science learning influence how they learn science.

Learning Outcomes: 1. Develop an increased understanding of the research literature in science education as it pertains to science learners. 2. Gain an appreciation of science learners and the different perspectives about how individuals learn science. 3. Apply science education research about science learners to instructional, curricular, and assessment development. Credits: 3.00

EDCI 62200 - Seminar In Science Education

Credit Hours: 1.00 to 3.00. Current issues in science education. Typical topics considered are: (1) science curriculum; (2) concept learning; (3) teacher education; (4) intellectual developments; (5) current research. Prerequisite: EDCI 51700 , EDCI 51800 .

Credits: 1.00 to 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Science Education Selectives (6 credits)

CHM 61000 - Topics In Chemical Education

Credit Hours: 2.00 or 3.00. A variable topics course for graduate students in chemistry, chemical engineering, medicinal chemistry, and biochemistry. This course provides an overview of the literature in one of the areas of chemical education, such as: chemistry misconceptions and conceptual change; theories of learning, from Piaget and Vygotsky to radical constructivism; distributed cognition; and developing and assessing instructional materials. Offered in alternate years.

Credits: 2.00 or 3.00

EDCI 50600 - Environmental Education

Credit Hours: 3.00. Synthesis of philosophies, scientific principles and methods for environmental education programs in forests, camps, and schools. Students conduct and summarize literature research on scientific and educational principles. In interdisciplinary teams, they develop, implement, and evaluate curricula for schools, nature centers, interpretive and outdoor education programs.

Learning Outcomes: 1. Become knowledgeable of national environmental educational programs and curriculum. 2. Develop the knowledge and skills to plan, implement, and evaluate environmental education programs, curriculum and materials. 3. Develop an understanding about learners and pedagogical methods for teaching about the environment and assessing learners. Credits: 3.00

EDCI 51600 - Seminar In Environmental Education

Credit Hours: 3.00. The seminar covers current research and literature in environmental education, focusing on teaching children and adults about the environment. Topics vary by semester and student interest.

Learning Outcomes: 1. Develop an understanding of the research literature in environmental education pertaining to the topic of study. 2. Develop critical thinking and analysis skills for evaluating environmental education research, programs, and curriculum. 3. Develop an understanding of environmental issues. Credits: 3.00

EDCI 56700 - Action Research In Science Education

Credit Hours: 3.00. An introduction to various models and conceptions of teacher action research in science education. Students review literature on action research, participate in small research cohorts, and plan and conduct action research within their respective educational situations.

Learning Outcomes: 1. Develop an understanding of what action research is, how it is conducted, and what role it plays in the construction of teacher knowledge in science education. 2. Plan and conduct action research within your respective educational situation. 3. Examine various models for action research in pre-service, in-service, and independent projects in science education. 4. Gain insight into the role action research plays in science education and science teacher education. Credits: 3.00

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 60500 - Teaching Integrated Science, Technology, Engineering And Math

Credit Hours: 3.00. Analysis of historical developments and present trends in science education; the designing, implementation, and evaluation of science programs; the role of research in present and future developments.

Learning Outcomes: 1. Identify, describe, and explain the fundamental tenets of different constructivist learning theories and their relevancy to STEM education. 2. Clarify and refine beliefs about teaching and learning in STEM education. 3. Identify and characterize students' ideas about STEM and how they influence learning. 4. Explore students' thinking and understanding of STEM through multiple strategies. 5. Describe ways to assess student learning in STEM. 6. Identify, practice, and reflect upon teaching strategies commensurate with teaching beliefs and knowledge about how students learn STEM through an integrated approach. 7. Compare and evaluate curriculum resources for integrating STEM instruction. 8. Devise a comprehensive lesson plan for integrating STEM instruction based on science and engineering practices and teaching for all learners. 9. Teach and reflect upon an integrated STEM lesson employing multiple instructional strategies. 10. Evaluate student learning in the context of an integrated STEM lesson. Credits: 3.00

EDCI 61800 - Gender And Culture In Science Education

Credit Hours: 3.00. An examination of the different perspectives on issues of gender, culture, and science. Major topics include feminist critiques of scientific theories and methods, the work of women and minorities in science, the role science has played in the construction of race and gender, and topics in science education, such as girls' learning in science and the potential of inclusive practices in the science classroom. Prerequisite: EDCI 51800 or EDCI 58500 .

Learning Outcomes: 1. Develop an in-depth understanding of the role of gender and culture in science and science education. 2. Examine feminist and cross-cultural studies in science and science education. 3. Apply feminist and critical frameworks of analysis to various studies in science education. 4. Identify and evaluate the strengths and limitations of feminist and cultural critiques of science. 5. Synthesize related literature in an effort to gain in-depth knowledge about one or more areas of gender and culture in science and science education. Credits: 3.00

EDCI 61900 - Learning Science

Credit Hours: 3.00. The course provides a holistic study of how children and adults learn science; how the learner's ideas, ways of thinking, abilities to do science, and their attitudes towards and beliefs about science learning influence how they learn science.

Learning Outcomes: 1. Develop an increased understanding of the research literature in science education as it pertains to science learners. 2. Gain an appreciation of science learners and the different perspectives about how individuals learn science. 3. Apply science education research about science learners to instructional, curricular, and assessment development. Credits: 3.00

EDCI 62000 - Seminar In Mathematics Education

Credit Hours: 1.00 to 6.00. Selected topics in mathematics education. Typical topics considered are: (1) problem solving; (2) instructional strategies; (3) cognitive structure; (4) current curriculum; (5) current research. Permission of instructor required.

Learning Outcomes: 1. Examine, synthesize, and communicate a view of the state of mathematics education and situate one's research in it. 2. Create knowledge for the field of mathematics education and communicate findings to the professional community. 3. Communicate and act upon professional feedback in the processes of designing and conducting research and writing conference proposals and research reports. 4. Report on various stages and types of research (e.g., project design, data analysis, findings). Credits: 1.00 to 6.00

EDCI 53900 - Introduction To K-12 Integrated Science, Technology, Engineering And Mathematics (STEM) Education

Credit Hours: 3.00. This course will provide students with a conceptual understanding of integrated K-12 Science, Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively

and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

Curriculum and Instruction Courses (5 credits)

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 62800 - Curriculum And Instruction Doctoral Seminar I

Credit Hours: 1.00. An examination of current issues and concerns related to doctoral study in Curriculum and Instruction. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year of doctoral study.

Learning Outcomes: 1. Reflect on the roles and responsibilities of faculty members. 2. Identify steps to develop personally and professionally. 3. Describe major milestones of doctoral study in the department. 4. Identify ethical standards in the field of education. 5. Practice ethical conduct of research. 6. Identify research topics of personal interest and locate. 7. Locate and begin to review literature relevant to those topics. Credits: 1.00

EDCI 63800 - Curriculum And Instruction Doctoral Seminar II

Credit Hours: 1.00. This course consists of an examination of current educational research. EDCI and other faculty will present and lead discussions of their research. Students will be exposed to research within multiple paradigms and perspectives. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year to doctoral study. Permission of instructor required.

Learning Outcomes: 1. Identify and understand contemporary education research concerns. 2. Identify and understand research within multiple paradigms and perspectives. 3. Interact with Purdue faculty about their current research interests. 4. Grow and develop as a professional. Credits: 1.00

Education Research Design Courses (12 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze,

and write a research project. Credits: 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and

their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Science Electives (9 credits)

Curriculum and Instruction Elective (3 credits)

Dissertation Research (xx credits)

EDCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Curriculum and Instruction: Social Studies Education Concentration, PHD

About the Program

Program Requirements

Required Courses (56-62 credits)

Core Courses (12 credits)

EDCI 62400 - Seminar In Social Studies Education

Credit Hours: 3.00. An investigation of various aspects of the teaching of the social studies. One topic is dealt with in each enrollment. Master's candidates are expected to complete the first three topics. Areas include: (1) philosophic concepts used in the social studies; (2) curricular analysis and examination of new social studies materials; (3) methods of inquiry in the social studies; (4) research methodology in the social studies.

Credits: 3.00

Curriculum and Instruction Courses (8 credits)

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 62800 - Curriculum And Instruction Doctoral Seminar I

Credit Hours: 1.00. An examination of current issues and concerns related to doctoral study in Curriculum and Instruction. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year of doctoral study.

Learning Outcomes: 1. Reflect on the roles and responsibilities of faculty members. 2. Identify steps to develop personally and professionally. 3. Describe major milestones of doctoral study in the department. 4. Identify ethical standards in the field of education. 5. Practice ethical conduct of research. 6. Identify research topics of personal interest and locate. 7. Locate and begin to review literature relevant to those topics. Credits: 1.00

EDCI 63800 - Curriculum And Instruction Doctoral Seminar II

Credit Hours: 1.00. This course consists of an examination of current educational research. EDCI and other faculty will present and lead discussions of their research. Students will be exposed to research within multiple paradigms and perspectives. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year to doctoral study. Permission of instructor required.

Learning Outcomes: 1. Identify and understand contemporary education research concerns. 2. Identify and understand research within multiple paradigms and perspectives. 3. Interact with Purdue faculty about their current research interests. 4. Grow and develop as a professional. Credits: 1.00

Curriculum and Instruction Elective (3 credits)

Social Studies Electives (9-12 credits)

Cognate Area Electives (9-12 credits)

Research Courses (15 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research.

Credits: 3.00

Dissertation Research (xx credits)

EDCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Earth, Atmospheric, and Planetary Sciences, PHD

About the Program

Program Requirements

Required Courses (6 credits)

EAPS 69100 - Colloquium In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. This course is intended to expose students to the wide range of topics studied throughout the Department of Earth, Atmospheric, and Planetary Sciences, allows for interactions with outside experts and networking, and provides the opportunity for students to synthesize high level topics that may not be directly related to their scientific endeavors.

Learning Outcomes: 1. Gain exposure to new scientific topics. 2. Summarize and discuss potentially new and unfamiliar scientific topics. 3. Identify relevant information from scientific talks and presentations. 4. Engage with the important questions that stimulate discussion and debate in EAPS fields. 5. Listen attentively and actively. 6. Use critical thinking and questioning. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

EAPS 60200 - New Graduate Student Seminar

Credit Hours: 3.00. This course will provide students with the tools to succeed as a graduate student in the Department of Earth, Atmospheric, and Planetary Sciences, which include good communication with their advisors, graduate fellowship proposal writing, giving good talks and posters, giving and receiving critical reviews, an understanding of regulations and graduate timelines, formulating a plan of study, and resources available to help graduate students succeed. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively with their adviser. 2. Understand how to develop a compelling research question. 3. Organize their planned research into a graduate fellowship proposal. 4. Provide and receive constructive criticism to and from colleagues, including understanding peer review. 5. Understand how to give well-organized talks and eye-catching posters for department seminars and national meetings. 6. Assemble an advisory committee, formulate a plan of study, and know the department regulations and what is required to graduate in a timely manner. Credits: 3.00

Concentrations (xx credits)

Dissertation Research (xx credits)

EAPS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Required Courses (6 credits)

EAPS 69100 - Colloquium In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. This course is intended to expose students to the wide range of topics studied throughout the Department of Earth, Atmospheric, and Planetary Sciences, allows for interactions with outside experts and networking, and provides the opportunity for students to synthesize high level topics that may not be directly related to their scientific endeavors.

Learning Outcomes: 1. Gain exposure to new scientific topics. 2. Summarize and discuss potentially new and unfamiliar scientific topics. 3. Identify relevant information from scientific talks and presentations. 4. Engage with the important questions that stimulate discussion and debate in EAPS fields. 5. Listen attentively and actively. 6. Use critical thinking and questioning. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

EAPS 60200 - New Graduate Student Seminar

Credit Hours: 3.00. This course will provide students with the tools to succeed as a graduate student in the Department of Earth, Atmospheric, and Planetary Sciences, which include good communication with their advisors, graduate fellowship proposal writing, giving good talks and posters, giving and receiving critical reviews, an understanding of regulations and graduate timelines, formulating a plan of study, and resources available to help graduate students succeed. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively with their adviser. 2. Understand how to develop a compelling research question. 3. Organize their planned research into a graduate fellowship proposal. 4. Provide and receive constructive criticism to and from colleagues, including understanding peer review. 5. Understand how to give well-organized talks and eye-catching posters for department seminars and national meetings. 6. Assemble an advisory committee, formulate a plan of study, and know the department regulations and what is required to graduate in a timely manner. Credits: 3.00

Concentrations

GPA Requirements

About the Program

Economics, PHD

About the Program

Program Requirements

Required Courses (9 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects

are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

Specialty Areas (12 credits)

Business and Economics Data Analytics Selectives

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Financial Economics Selectives

ECON 58500 - Behavioral Economics

Credit Hours: 2.00 or 3.00. This course explores human economic behavior, with a strong emphasis on laboratory and field experiment methodology used in behavioral economics research. Topics considered include behavior in markets for financial assets and auction markets, and behavior in social dilemmas that arise when people try to provide public goods voluntarily or increase economic surplus through trust. Students will also study how people bargain with and exhibit social preferences towards others. Decision-making and anomalies for risky uncertain choices will also be covered.

Credits: 2.00 or 3.00

ECON 57200 - Econometrics II

Credit Hours: 2.00. This course reviews basic concepts in probability, mathematical statistics and linear algebra in order to obtain a more rigorous understanding of the linear regression model, its representation and assumptions, procedures for estimation and properties associated with the OLS estimator. We move on and apply what we have learned to the linear regression model. We discuss estimation and prediction,

establish properties such as efficiency, unbiasedness, consistency and convergence in mean square. We conclude by considering a few nonlinear models appropriate for modeling binary outcomes. Permission of department required.

Learning Outcomes: 1. A student will be able to apply Econometric analysis to specific economic questions using MATLAB. Credits: 2.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 59100 - Financial Valuation And Decision Making

Credit Hours: 2.00 or 3.00. A comprehensive introduction to finance. The object of this course is to provide the computational framework necessary to appreciate and understand how to make decisions based on sound financial reasoning.

Learning Outcomes: 1. Develop skills in investment decisions and financing decisions. Credits: 2.00 or 3.00

ECON 58400 - Experimental Economics

Credit Hours: 2.00 or 3.00. This course introduces you to the experimental methods used by economists to study human behavior. These methods analyze data collected in controlled laboratory experiments. Throughout the course, we will discuss different types of experiments that have been extensively researched by experimental economists. To help introduce and motivate each topic, you will participate in weekly synchronous experiments with your classmates over the internet. You will then complete an assignment analyzing the data generated by your class in the online experiment. The following lecture will provide an overview of the theoretical framework and experimental predictions. We will also discuss commonly observed behavior and any relevant explanations for such behavior.

Learning Outcomes: 1. Demonstrate an understanding of the experimental methodology used by economists to study human behavior. 2. Evaluate economic behavior by analyzing and interpreting experimental data and its relationship to common economic models. 3. Identify and explain common insights that experiments provide regarding people's behavior in strategic situations. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform

dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 55500 - Economic Forecasting

Credit Hours: 2.00. This course provides an introduction to forecasting methods of current interest in economics. The goal is to equip students with a working knowledge of state-of-the-art techniques that are useful for forecasting macroeconomic variables. The strengths and weaknesses of the techniques will be analyzed and their empirical relevance will be demonstrated through a variety of applications to real data sets. The topics will include univariate prediction models, vector autoregressions, forecasting with large data sets, forecast combinations and forecast evaluation. Particular emphasis will be placed on applications and the issues involved with implementation of the various methods in practice.

Learning Outcomes: 1. Identify the statistical issues involved in forecasting economic data. 2. Analyze the strengths and weaknesses of a variety of forecasting techniques commonly used in economics. 3. Demonstrate the empirical relevance of each forecasting approach through applications to real-world data sets. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Public Economics and Policy Selectives

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

ECON 53800 - International Economics

Credit Hours: 2.00 or 3.00. The course covers selected topics in international trade with a focus on real world applications.

Learning Outcomes: 1. Identify the effects of international trade on wages, prices or products and welfare of nations. 2. Develop models as well as a diverse set of academic papers to discuss current policy debates. Credits: 2.00 or 3.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market

failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities. 3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Business and Economics Data Analytics Selectives

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Specialty Electives (0-6 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

OBHR 69000 - Advanced Problems In Organizational Behavior And Human Resource Management

Credit Hours: 2.00 to 4.00. Advanced investigation in a specific organizational behavior or human resource field at the graduate level.

Credits: 2.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills

using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

General Electives (32 credits)

Dissertation Research (xx credits)

ECON 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (9 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic

theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

About the Program

Educational Studies: Counseling Psychology Concentration, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Selectives (xx credits)

EDPS 50000 - Group Counseling Theories And Techniques

Credit Hours: 3.00. Theoretical and experiential overview of fundamental elements of group work and group counseling processes. Broad topics include purposes and types of groups, therapeutic factors and stages of leadership skills, and multicultural, ethical, and legal aspects of group counseling.

Learning Outcomes: 1. Differentiate among various types and purposes groups and specializations in group work. 2. Identify the essential group dynamics involved in understanding group interactions. 3. Develop an understanding of the principles and challenges associated with planning a group intervention. 4. Develop an understanding of the principles and challenges associated with implementing a group intervention such as recruitment, therapeutic factors, and developmental stages of group. 5. Compare and contrast different perspectives on group leadership. 6. Examine and discuss the ethical considerations unique to group work. 7. Acquire knowledge regarding diversity-competent group practice. 8. Evaluate empirical findings associated with group work. 9. Consider various approaches to evaluating group processes (e.g., program evaluation) and the outcome of group work. Credits: 3.00

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 50700 - Counseling Multicultural And Diverse Populations

Credit Hours: 3.00. Counseling strategies for multicultural and diverse populations encountered by helping professionals. Among the populations considered are ethnic and cultural minorities, older persons, the gifted, and the disabled.

Learning Outcomes: 1. Examine how social and

cultural factors influence the counseling relationship and are reflected in counseling theory and practice. 2. Develop strategies for working with diverse individuals, couples, families, groups, and communities. 3. Develop an awareness of multicultural and pluralistic trends, including characteristics and concerns of specific socially and culturally diverse groups. 4. Examine ethical and legal issues related to counseling diverse populations. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 60000 - Counseling Theories And Techniques

Credit Hours: 3.00. Examination of major counseling theories and counseling techniques, professional and ethical issues. Permission of instructor required.

Learning Outcomes: 1. Utilize theoretical approaches to individual personality, behavior, decision, and life difficulties in clinical settings with clients. 2. Develop and write case conceptualization through active application. 3. Ascertain how counseling theory informs counseling techniques. 4. Theoretically conceptualize client presentations based on the context of diversity-related strengths and limitations of counseling theory (i.e. age, ethnicity, disabilities, language, national origin, race, religion, sexual orientation, and SES). Credits: 3.00

EDPS 60100 - Counseling Theories And Techniques Laboratory

Credit Hours: 3.00. Use of counseling techniques in a supervised laboratory; application of theories and techniques within varying employment settings. Concurrent Prerequisite:

EDPS 60000 .

Learning Outcomes: 1. Identify counselor behaviors and characteristics that influence the helping process, including age, gender, ethnic differences, verbal and nonverbal behaviors, and personal characteristics, orientations, and skills. 2. Demonstrate essential interviewing and counseling skills, establishing appropriate counseling goals, designing intervention strategies, evaluating client outcomes, and successfully terminating the counselor-client relationship. Credits: 3.00

EDPS 60400 - Advanced Counseling Theories And Techniques

Credit Hours: 3.00. Integration of counseling theory, practice, and research. Emphasis on integrating counseling knowledge and skills with major counseling theories and interventions. Prerequisite: EDPS 60000 . Permission of instructor required.

Learning Outcomes: 1. Obtain knowledge of personality theories/concepts for conceptualizing client issues and designing interventions. 2. Understand the context and development of theories. Credits: 3.00

EDPS 61400 - Advanced Counseling Practicum

Credit Hours: 3.00. Supervised use of personal and career counseling techniques applied to complex and difficult client situations. Permission of instructor required.

Learning Outcomes: 1. Display readiness to continue in practicum through exhibiting progress in: professionalism, reflective practice/self-assessment, scientific knowledge and methods, relationships, individual and cultural diversity, ethical and legal standards and policy, interdisciplinary systems, assessment, interventions, research/evaluation, supervision, management-administrative tasks, advocacy. Credits: 3.00

EDPS 61700 - Professional Issues, Ethics, And History Of Counseling Psychology

Credit Hours: 3.00. Three primary areas in counseling psychology: 1) historical development within psychology; 2) American Psychological Association ethics, professional, and legal issues; and 3) the scientist-practitioner training model in counseling psychology identity. Permission of instructor required.

Learning Outcomes: 1. Understand counselling psychology's (a) history, (b) position within the psychology discipline and profession and (c) ethical, legal, and professional standards. 2. Gain a sense of how psychology and counselling psychology are embedded within and influenced by context (i.e., historical, societal, cultural, and economic factors). 3. Begin socialization into (a) the attitudes, values, skills, and activities of a counselling psychologist; and (b) the Purdue Counselling Psychology program. Credits: 3.00

EDPS 61900 - Counseling Psychology Research Practicum

Credit Hours: 3.00. Application of qualitative and quantitative research designs in counseling psychology. Concurrent prerequisite: EDPS 61800(Inactive at PWL) and (PSY 60100 or STAT 50200) and Doctoral student standing enrolled in the Counseling Psychology Program.

Learning Outcomes: 1. Gain knowledge of research methodologies in counseling psychology. 2. Develop the ability to provide an evidentially based rationale for research, including consideration of multicultural issues. 3. Display awareness of counseling psychology research. 4. Demonstrate self-initiative and personal investment (a) in the research process and (b) in efforts to find and use relevant sources of information. 5. Apply the scientific method in critiquing and generating research studies. 6. Present research results in a manuscript that uses APA professional style. 7. Enhance oral and written communication skills through presentation of material in a clear, organized, grammatically correct, and engaging manner. 8. Develop professional writing and editing skills to prepare for careers as a counseling psychologist (e.g., scholarly contribution, reports). Credits: 3.00

EDPS 62100 - Advanced Multicultural Counseling Theory And Practice

Credit Hours: 3.00. Advanced study and clinical application of racial and cultural theories in counseling. Knowledge and practicum components are integrated to facilitate development of awareness and skill competencies central to "Guidelines on Multicultural Education, Training, Research, Practice and Organizational Change for Psychologists" of the American Psychological Association. Prerequisite: EDPS 50700 . Permission of instructor required.

Learning Outcomes: 1. Increase understanding of ICD dimensions, and their intersection within persons, in relation to psycho-social development. 2. Identify and address institutional and social barriers that impede access, equity, and well-being for diverse populations. 3. Develop advanced skill in discussing ICD, comfortably and appropriately, in interpersonal and professional relationships. 4. Demonstrate awareness of potential interactions between cultural beliefs and attitudes and cognitive and affective experiences. Credits: 3.00

EDPS 62200 - Systems Concepts In Counseling And Development

Credit Hours: 3.00. Introduction to the use of systems concepts in the counseling professions. Individuals' development within relationships and family matrix, contemporary person-environment issues, and constructs for research and preventive, developmental, and remedial practice. Prerequisite: EDPS 61700 .

Learning Outcomes: 1. Obtain knowledge of terms, concepts, and principles of systems thinking. 2. Learn to develop systems hypotheses and evaluate their evidence. 3. Understand that the person exists within and is influenced by the socio-economic-historical context. Credits: 3.00

EDPS 62300 - Personality Assessment

Credit Hours: 3.00. Applied introduction to methods of administration, scoring, and interpretation of primarily objective personality assessments. Emphasis is placed on assessment of normative population with attention given to personal strengths, developmental factors, and issues of diversity.

Learning Outcomes: 1. Select appropriate batteries of personality measures based on particular referral situations and/or questions. 2. Administer, score, and interpret results of personality assessments. 3. Incorporate clinical interview and behavioral observation data into their interpretations of personality assessment results. 4. Interpret personality assessment results from developmental and multicultural perspectives. Credits: 3.00

EDPS 62400 - Advanced Off-Site Counseling Practicum And Supervision Theory

Credit Hours: 3.00. Supervised use of personal and/or career counseling and assessment applied to complex and difficult client situations. Critical analysis of counseling supervision theories. Prerequisite: EDPS 61400 . Permission of instructor required.

Learning Outcomes: 1. Demonstrate appropriate professional and ethical behavior in their interactions with agency clients and staff. 2. Design treatment plans that are based on appropriate assessment and conceptualization of client problems. 3. Develop the conceptual and critical thinking skills that are required of a scientist-practitioner, such as the ability to formulate and test hypotheses regarding the bases of client behavior. 4. Utilize interventions that are rooted in theory and research in counselling/psychotherapy, human development, and personality. 5. Demonstrate understanding and respect for clients' cultural values, identities (e.g., racial, gender), and desires for self-determined growth. 6. Demonstrate an increased awareness of clinical strengths as well as areas of growth and professional development. 7. Demonstrate ability to effectively use individual and group supervision. Credits: 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research.

Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDPS 69600 - Internship In Counseling Psychology

Credit Hours: 0.00. A special course in the practice activities of counseling psychology. Provides field experience under the supervision of a licensed psychologist. Permission of instructor required.

Learning Outcomes: 1. Learn advanced skills in psychotherapy. 2. Increase knowledge of psychological assessment. 3. Learn advanced skills in consultation and outreach activities. 4. Increase knowledge of administrative and professional issues. Credits: 0.00

PSY 64000 - Survey Of Social Psychology I

Credit Hours: 3.00. An extensive survey of methods, research, and theory in social psychology.

Credits: 3.00

PSY 67300 - Psychology Of Behavior Disorders

Credit Hours: 3.00. Advanced abnormal psychology. Consideration will be given to research and theory of psychopathology.

Credits: 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in

studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills by taking advanced quantitative methods courses. Credits: 3.00

EDPS 61801 - Intellectual & Neuropsychological Assessment

Credit Hours: 4.00. This course is designed to expose students to the theory and practice of intellectual and neuropsychological assessment. Students will receive instruction on the theoretical, psychometric, and best practice foundations of these types of assessment in the context of a lecture component, which will be followed by laboratory time in which students will gain experience in administering and scoring relevant tests. Although the WAIS-IV and WISC-IV will be the primary foci of this course, other tests of achievement, cognitive ability, and neuropsychological functioning will be covered. Students will also (a) gain experience in preparing written reports of their interpretations of assessment results, (b) develop an understanding of the history and development of cognitive ability and neuropsychological tests, and (c) explore implications for intellectual and neuropsychological assessment with diverse populations. Permission of instructor required. Prerequisite: EDPS 53300, B-.

Learning Outcomes: 1. Develop an understanding of the theoretical, historical, and psychometric foundations of intellectual and neuropsychological assessment. 2. Develop advanced knowledge of the administration, scoring, and interpretation of the major tests of cognitive ability (i.e., WAIS-IV, WISC-IV), and identify strengths and weaknesses of each. 3. Develop understanding of the ethical and multicultural issues associated with intellectual and neuropsychological assessment. 4. Demonstrate ability to select assessment tools appropriate to examinees' developmental and ability levels. 5. Demonstrate competence in reporting results and interpretation of assessment results in written form. Credits: 4.00

Internship Course (0 credits)

EDPS 69600 - Internship In Counseling Psychology

Credit Hours: 0.00. A special course in the practice activities of counseling psychology. Provides field experience under the supervision of a licensed psychologist. Permission of instructor required.

Learning Outcomes: 1. Learn advanced skills in psychotherapy. 2. Increase knowledge of psychological assessment. 3. Learn advanced skills in consultation and outreach activities. 4. Increase knowledge of administrative and professional issues. Credits: 0.00

Dissertation Research (xx credits)

EDPS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Educational Studies: Educational Leadership and Policy Studies Concentration, PHD

About the Program

Program Requirements

Required Courses (45 credits)

Core Courses (21 credits)

EDST 51300 - Educational Facilities Planning

Credit Hours: 3.00. (EDFA 51300) The course utilizes a systems approach as a basis for planning, construction, and utilization of school facilities. The primary audience for which the course is designed is aspiring school superintendents and central office leaders. Emphasis is placed on gaining the performances, dispositions, and knowledge necessary for successfully providing facilities to enhance the teaching/learning processes in meeting the educational needs of diverse learners. It is intended as a practical course oriented toward "tools" and school facilities in the state of Indiana. Permission of instructor required.

Learning Outcomes: 1. Describe the political and economic dimensions associated with the development and acquisition of facilities in Indiana. 2. Describe the various ways to finance renovation and /or new school construction in Indiana. 3. Identify and describe the required procedures for new school construction in Indiana. 4. Describe the involvement of professionals outside of education in the planning and construction of school facilities. 5. Understand terminology related to construction and maintenance of school facilities in Indiana. Credits: 3.00

EDST 60800 - Business Management In Education

Credit Hours: 3.00. (EDFA 60800) This course explores the management and operation of the school business environment, the critical trends and issues in the field, and the internal and external determinants of school fiscal policy. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51400 .

Learning Outcomes: 1. Know the success of managing the organization, operations, and resources of a district in a way that promotes a safe, efficient, and effective learning environment. 2. Act with integrity, fairly, and in an ethical manner. 3. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 61200 - Seminar In Educational Administration And Curriculum

Credit Hours: 3.00. An analysis of current research and theory related to selected topics in educational administration and curriculum. One topic is studied in each enrollment. Permission of instructor required.

Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

EDST 61500 - Educational Policy And Decision Making

Credit Hours: 3.00. This course explores a variety of current legal, political, social, cultural and economic issues as they relate to educational policy and decision making. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders and ELCC/NPBEA standards are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Act with integrity, fairly, and in an ethical manner. 2. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 61600 - Analytical Techniques In Educational Management

Credit Hours: 3.00. This course is a mix of theory and practice concerning planning and implementation of the fiscal responsibilities that a superintendent of schools would engage in at the district level. The course exposes students to some of the key processes and activities related to planning for and implementing the school budget and related activities. The course examines such planning concepts as goal definition, decision-making, and evaluation of planning as it relates to the fiscal issues of a school corporation. A feature of the course is an emphasis on the process of dealing with the elements of change and planning for such as it relates to fiscal issues in educational organizations. Prerequisite: EDST 51400 or EDST 60800 .

Learning Outcomes: 1. Describe various functions of the school district business office. 2. Identify methods of decision making involved in allocating fiscal resources. 3. Identify various methods of budgeting. 4. Demonstrate an

understanding of elementary accounting concepts. 5. Demonstrate an understanding of calculations and functions related to Indiana public school corporation funds. 6. Summarize the ways in which Indiana public school corporations are funded and the most recent legislation that will impact funding. 7. Demonstrate an understanding of the role of business with regard to insurance, transportation, food service, and maintenance. 8. Summarize the balance among expenditures, revenues, and the educational plan. Credits: 3.00

EDST 61400 - Leadership For Community Collaboration And Development

Credit Hours: 3.00. In this course, we will consider how school leaders can help develop and strengthen relationships between districts/corporations and their publics, for the mutual benefit of students, schools, families, and communities. Throughout selected core and supplemental district level educator standards of the Indiana Standards for School Leaders and the National Policy Board for Educational Administration are addressed. Emphasis is on the integration of theory and practice. Permission of instructor required.

Learning Outcomes: 1. Acquire knowledge and ability to foster mutually beneficial family and community connections with school districts. 2. Acquire knowledge and ability to understand needs of diverse families and communities. 3. Acquire knowledge and ability to assess research on school partnerships to identify best practices in their contexts. Credits: 3.00

Internship Course (6 credits)

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

Research Design and Methods Courses (12 credits)

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

Related Area Courses (6 credits)

Electives (0-30 credits)*

Dissertation Research (15 credits)

EDST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Educational Studies: Educational Psychology and Research

Methodology Concentration, PHD

About the Program

Program Requirements

Required Courses (15 credits)

Core Courses (6 credits)

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53600 - Achievement Motivation And Performance

Credit Hours: 3.00. Study of current theory and research on the nature and development of achievement motivation. Motivation for intellectual and academic performance will be emphasized. Applications of theory in educational settings will be considered.

Credits: 3.00

Seminar Courses (9 credits)

Primary Area Electives (12 credits)

Dissertation Research (10-15 credits)

EDST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Educational Studies: Gifted Education Concentration, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (9 credits)

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 53600 - Achievement Motivation And Performance

Credit Hours: 3.00. Study of current theory and research on the nature and development of achievement motivation. Motivation for intellectual and academic performance will be emphasized. Applications of theory in educational settings will be considered.

Credits: 3.00

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

Seminar Courses (9 credits)

EDPS 63100 - Applied Educational Research Design Seminar

Credit Hours: 1.00 to 3.00. This seminar seeks to promote professionalism, research and scholarly productivity and collegial support among graduate students in gifted, creative (GCT), and talented studies, associated graduate students, visiting scholars, and interested others. A secondary purpose involves assisting GCT students, COE students, and associates with successful study and career preparation by focusing on research, grants, thesis preparation, graduate writing, proposal development, professional development, and degree completion. Finally, seminar offers students the opportunity to discuss, learn and "mess" around with current issues in the field and of personal interest. Seminar creates time and incentive for students to become more productive with their scholarship efforts, and offers students credit for work completed and formal support for the professional development and scholarship processes. In this course students should expect to attend, contribute, and participate. A variety of formats will be used, including, but not limited to: discussion, simulations, group work, lecture, guest speakers, and peer feedback. Prerequisite: EDPS 63000 and one graduate course in Statistics.

Learning Outcomes: 1. Engage with IRB process. 2. Write for publication. 3. Critically review and revise writing. 4. Engage in research. 5. Develop a professional vita. 6. Write conference proposals. 7. Create professional presentations. 8. Review relevant literature. Credits: 1.00 to 3.00

EDPS 63200 - Seminar In Research Procedures In Education

Credit Hours: 1.00 to 3.00. Experimental, field study, scientific survey, and prediction study methods in education. Internal and external validity, identification and development of research problems, criteria development, common methodological errors, strategies of analysis, and sources of acceptable educational research literature will be reviewed. Critical analyses of the research methodology of educational research reports in the student's field. Prerequisite: EDPS 63000 or 53300 and course work in Statistics.

Learning Outcomes: 1. Develop specific advanced methodological skills and knowledge that are applicable to education research and practice. Credits: 1.00 to 3.00

EDPS 63300 - Seminar In Educational Psychology

Credit Hours: 1.00 to 3.00. Recent investigations and research in educational psychology. One topic is dealt with in each enrollment. The topics provide an in-depth study of those areas of psychological investigation in educational settings and problems. These areas include: (1) instructional technology and design; (2) individual differences and educational growth; (3) school learning: theory and research; (4) classroom behavior and social processes; (5) educational assessment; and (6) other relevant topics. Prerequisite: EDPS 53000 .

Credits: 1.00 to 3.00

Elective (3 credits)

Additional Requirements

GPA Requirements

Educational Studies: Higher Education Concentration, PHD

About the Program

Program Requirements

Required Courses (42 credits)

Core Courses (40 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

EDST 52000 - Educational Leadership, Governance, And Policy

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of contemporary PK-22 education leadership, administration, and governance. This course will cover the foundational administrative knowledge and skills necessary for transformational leadership at the modern primary, secondary, and post-secondary educational settings. The scope of this course seeks to cultivate an understanding of the functionality of educational systems as organizations within the context of a technologically, socially, and culturally changing world.

Learning Outcomes: 1. Analyze a variety of literature on PK-22 educational leadership, integrating relevant literature from the fields and disciplines of higher education, leadership, business, political science, and sociology. 2. Apply skillfully foundational PK-22 leadership knowledge and skills necessary for middle management and senior-level educational leadership in the context of a rapidly changing, culturally diversifying, technologically dynamic global education field. 3. Understand sustainable transformational education leadership by repeatedly engaging in activities and assignments that: Require a comprehensive analysis and understanding of how the following interface: institutional finance and budgeting, strategic planning and assessment, organizational structure and culture, existing and emerging education policy, and the current social and political climate; Require an understanding and analysis of the common day-to-day and long-term challenges that contemporary PK-22 education

administrators face in strategic decision-making; Require an evaluation of structural and cultural practices and norms in PK-22 education administration for the sake of comparative analysis. Credits: 3.00

EDST 52100 - Foundations In PK-XXII Educational Systems

Credit Hours: 3.00. This survey course broadly explores the complex foundations of U.S. educational systems from pre-kindergarten (PK) through the doctoral level of education (PK-22). Through the lenses of culture, history, politics, and society, this course seeks to examine factors that impact the policies and practices of PK-22 educational systems. From theoretical knowledge to philosophical orientations, the course interrogates the ways schools transform society and ways society transforms schools. The course incorporates a variety of engaged learning activities including discussion prompts, reflective journaling of course readings, and literature review and research writing. As such, this course challenges students to: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems; 2. Examine the interrelationships of culture, politics, and social structures related to educational systems; 3. Analyze and evaluate current issues in PK-22 education systems; 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies.

Learning Outcomes: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems. 2. Examine the interrelationships of culture, politics, and social structures related to educational systems. 3. Analyze and evaluate current issues in PK-22 education systems. 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies. Credits: 3.00

EDST 52200 - Culture And Social Issues In PK-XXII Education

Credit Hours: 3.00. The aim of this course is to engage students in the critical examination of cultural and social issues impacting PK-22 education at the local, state, and federal levels. This course will review the evolving functional role of PK-22 education in a diversifying global society. By way of critical intercultural and intracultural examination and reflection, this course seeks to cultivate a deeper understanding of the ways that education influences and is influenced by issues related to cultural and social change and conflict.

Learning Outcomes: 1. Analyze a variety of literature on cultural and social issues, integrating relevant literature from the fields and disciplines of education, anthropology, sociology, and political science. 2. Examine and evaluate the past and present activity /role of PK-22 entities during periods of social and cultural changes and conflict. 3. Reflect critically on intercultural and intracultural biases, perspectives, and positions, and the way that they might influence day-to-day interactions in educational environments. 4. Apply acquired knowledge and understanding of the corresponding relationship between culture/social issues and PK-22 education, to create comprehensive proposals and recommendations for PK-22 entities to engage with and address issues on diversity. Credits: 3.00

EDST 64000 - Higher Education Law

Credit Hours: 3.00. This course explores the legal framework within which institutions of higher education operate. Course materials, activities, and assignments will give students a deep understanding of how state and federal legislative bodies and courts operate. Students will read statutory materials and case law on legal issues related to higher education, including: free speech, religion, academic freedom, searches and seizures, due process rights, equal protection issues, individuals with disabilities, contracts and employment, torts and university liability. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize case law, and statutory and administrative law materials to create and share a robust understanding of how the varied sources of law inform all interactions at institutions of higher education. 3. Create new knowledge by synthesizing, applying, and communicating how the law can and should be applied in higher education institutions. 4. Learn and apply legal research skills that will empower them to contribute to legal scholarship. 5. Become more fluent in communicating complex legal concepts to stakeholders at different levels

(students, peers, administrators, etc.). Credits: 3.00

EDST 64200 - Cultural Engagement In Higher Education Communities

Credit Hours: 3.00. The influence of culture is of particular import with issues facing the world today and Higher Education institutions (HEIs) are not immune to this reality. HEIs often serve as an institutional base for communities and have a vested interest in meaningful engagement with the communities that surround their campuses. This course is designed to enable learners to confidently communicate, build relationships, and work effectively in culturally diverse communities. Through exploration of a variety of intercultural theories, students will become aware of and be able to navigate the cultural influences in local, state, regional, national, and international higher education communities. As part of the course, students will engage in their communities through experiential, real-world, case study, and project management methods. Permission of instructor required.

Learning Outcomes: 1. Deepen their thinking and practice of community engagement and the positionality of the institution within its community. 2. Demonstrate that as a complex organization, Higher education functions as both a personal and a societal (public and private) benefit. 3. Demonstrate consistent critical attention and critical thinking to their own and others positionality including cultural identities, social and organizational power and privilege, and intercultural competence. 4. Formulate skills to better recognize, prevent, and resolve cross-cultural conflicts. 5. Construct effective cross-cultural relationships and work in an intercultural group setting. 6. Evaluate and summarize intercultural theories as applied to their individual/institutional contexts. 7. Describe a context for examining the organization of knowledge and institutions of higher education in relation to community-based problem solving. 8. Examine complex social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using a variety of community engagement and cultural frameworks. 9. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. 10. Apply theory to practice in a final community engagement research project. Credits: 3.00

EDST 64300 - Higher Education Economics And Finance

Credit Hours: 3.00. This course provides students with an overview of financial issues related to higher education. Students will discuss and evaluate topics such as the public versus private financial benefits of higher education, the financial relationship between institutions of higher education and both state and federal governments, and issues related to labor economics. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize, create, and communicate knowledge. 3. Engage in professional development. 4. Participate actively in the profession. Credits: 3.00

Internship Course (2 credits)

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

Electives (6 credits)

Educational Studies: Special Education Concentration, PHD

About the Program

Program Requirements

Required Courses (21 credits)

Core Courses (9 credits)

EDPS 65000 - Systematic Literature Review

Credit Hours: 3.00. This course is designed for advanced graduate students in special education and related disciplines. The goals of this course are: (a) Understand the principles and methodologies of conducting a systematic literature review. (b) Develop skills in identifying, evaluating, and synthesizing literature in education/special education; (c) Critically review and evaluate education/special education literature and research, and (d) Write a professional, scholarly review of research on a current issue or critical topic in education/special education.

Learning Outcomes: 1. Understand the principles and methodologies of conducting a systematic literature review. 2. Develop skills in identifying, evaluating, and synthesizing relevant literature. 3. Review and evaluate education / special education literature and research critically. 4. Apply the knowledge and write a professional, scholarly review of research on a current issue or critical topic in education/special education. Credits: 3.00

EDPS 66100 - Seminal Research In Special Education

Credit Hours: 3.00. This course is designed to focus on the investigation and research in the field of special education, particularly research and articles that are considered seminal to the field of special education in general as well as various topics of study within special education. The course is meant to be an overview of critical pieces of research and literature in the field to provide students with a breadth view, and how the seminal articles have shaped the field of special education including special education laws and policies.

Learning Outcomes: 1. Comprehend seminal articles/research that have shaped the field of special education. 2. Analyze the impact of seminal research and its relevance to special education laws, policies, and practices. 3. Develop a comprehensive understanding of the field and its implications for educating students with special/diverse needs. 4. Identify and comprehend emerging seminal research in the field of special education/education. 5. Gain an understanding of the range of research conducted by faculty in the special education and related programs. 6. Develop skills in investigating and conducting research in special education. Credits: 3.00

EDPS 66400 - Seminar In Special Education

Credit Hours: 1.00 to 4.00. This seminar is for doctoral students in special education. Its purpose is to contribute to the development of student's professional competencies, including conducting and writing scholarly research, grant writing, university-level teaching, and professional engagement. To facilitate this growth each seminar will culminate in a scholarly product related to the seminar's focus.

Learning Outcomes: 1. Formulate clear and concise research questions and generate one idea for a research project. 2. Develop a comprehensive research plan for their ideas based on a review of the literature. 3. Produce a detailed research project proposal or carry out a research project that aligns with their own research interests. 4. Apply their knowledge in evidence-based practice and lead a session on academic intervention (e.g., reading, math, science, social studies) to effectively support students with diverse needs. Credits: 1.00 to 4.00

Statistics and Research Methods Courses (12 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze,

and write a research project. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills

by taking advanced quantitative methods courses. Credits: 3.00

Electives (9 credits)

Dissertation Research (xx credits)

EDPS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Electrical and Computer Engineering, PHD

About the Program

Program Requirements

Required Courses (15-36 credits)*

Core Courses (0-6 credits)*

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

Related Area Courses (6-9 credits)

Math Courses (6-9 credits)

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include

functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

Research Course (0-2 credits)

Seminar Course (0 credits)

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

Electives (0-13 credits)

Dissertation Research (54 credits)

ECE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ECE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Additional Information

Engineering Education, PHD

About the Program

Program Requirements

Required Courses (15 credits)*

Core Courses (15 credits)

ENE 50200 - History And Philosophy Of Engineering Education

Credit Hours: 3.00. Examines the history and philosophy of engineering education by: (1) exploring the history of engineering education through archival research and historical documents (critical moments, tensions, issues); (2) investigating philosophies of education and the philosophies that have guided engineering as a profession; and (3) critiquing the evolution of engineering education, identifying alternative scenarios, and imagining a future role in engineering education. This course introduces students to the field of engineering education while broadening their views of the roles of interrelationships between teaching and research. Open to students in Engineering Education. Permission of instructor required.

Learning Outcomes: 1. Develop a culture of critical reflection, engagement, and collaborative learning. 2. Provide opportunities for students to identify and understand tools to inquire into the history and philosophy of engineering education and develop the skills for using these tools. 3. Provide opportunities for students to use these inquiry tools to form persuasive arguments about the nature of engineering education. Credits: 3.00

ENE 50300 - Engineering Education Inquiry

Credit Hours: 3.00. This course is conceived as a bridge between beginning graduate students' knowledge of technical

research and modes of inquiry appropriate to the new field of engineering education. It is designed as the entryway to required research method courses taken as part of the students' plan of study. By the end of this survey course, students will be able to critique research in terms of the quality of the authors' argument based on their chain of reasoning, and will recognize that the articulation of a research question, the significance of the question, the choice of methods in regards to the research goals, and the transparency of the explanation of the methodology are all the parts of the chain of reasoning. Permission of instructor required.

Learning Outcomes: 1. Provides a pathway into the discipline that characterizes the diversity of approaches to engineering education research and research topics. 2. Create opportunities to discuss the need for rigorous engineering education research. 3. Develop critical understanding of relationships between research problem, method, and design. 4. Foster community development and collaborative efforts among students and engineering education researchers. 5. Help students identify conceptual hurdles and individual pathways into research activities. 6. Support students' identity development as an engineering education researcher. Credits: 3.00

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 50400 - Leadership, Policy, And Change In Science, Technology, Engineering, And Mathematics (STEM) Education

Credit Hours: 3.00. This course provides a foundation for examining historical and current perspectives of STEM education programs and policy at the secondary and postsecondary levels. Focusing on the relationships among education policy, leadership theories, and models of systemic change, this course will enable students to situate and envision their potential role in shaping engineering education within the context of the larger education landscape. Students will synthesize course readings, examine education policy, and reflect on leadership theories and change, as well as explore how they can influence leadership, policy, and /or organizational change in STEM education through a semester project.

Learning Outcomes: 1. Evaluate leadership theories and the leadership process. 2. Identify and evaluate factors that contribute to effective leadership within organizations. 3. Analyze education policy at local, state, and national levels with a focus on STEM education. 4. Evaluate models of systemic change and diffusion of innovative processes. 5. Understand key aspects, strategies, and applications of systemic change in education. 6. Generate strategies to implement change within STEM education environments. Credits: 3.00

ENE 50500 - Theories Of Development And Engineering Thinking

Credit Hours: 3.00. This course examines theories of human development, learning and epistemology in the context of Engineering Education. A broad survey of readings guides an in-depth study of fundamental theories of development and knowledge generation as it relates to pedagogy and research. A rich body of theoretical literature will be studied in order to explore its relation to engineering education. Work in the course aims to construct answers to the following three questions: (1)

How do theories of human learning, development, and epistemology help us think about engineering? (2) How do they relate to engineering education? (3) How do they inform research method and practice in engineering education? No restrictions. It is helpful, however, for students to have engaged in prior reading-and writing- intensive courses that required them to synthesize large amounts of information. For this reason, it is recommended that students are enrolled currently in a graduate program at Purdue University. Permission of department required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 50101 - Foundations Of Engineering Education

Credit Hours: 3.00. In this course, new doctoral students in engineering education explore their roles within the field of engineering education, create a learning plan that maps to program requirements, and develop habits of mind to support their ongoing professional development. Students learn to write clearly and coherently in an academic context. Students examine research trends and faculty interests so they can make informed choices about advising and program opportunities. Permission of instructor required.

Learning Outcomes: 1. Critically reflect upon personal learning goals, and articulate a learning plan that will eventually result in a professional portfolio. 2. Develop skills in academic writing. 3. Understand the research interests of local faculty members. 4. Identify resources that will facilitate the student's transition into the engineering education community. Credits: 3.00

Seminar Course (0 credits)

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

Engineering Expertise Courses (9 credits)

Specialization Area Courses (9 credits)

Research Preparation Courses (32 credits)

Dissertation Research (25 credits)

ENE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

English: Literature, Theory, Cultural Studies Concentration, PHD

About the Program

Program Requirements

Required Courses (27 credits)

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

ENGL 50600 - Introduction To English And General Linguistics

Credit Hours: 3.00. General study of language and linguistic theory with emphasis on English. Problems and methods in phonology, morphology, syntax, and semantics. Current techniques of linguistics analysis.

Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Seminar (9 credits)

ENGL 60600 - Seminar In Poetry Writing

Credit Hours: 3.00. An advanced course in the writing of poetry. Workshop criticism. Study of the work of established writers. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Enhance active reading skills through the close examination and critique of the poetry, notebooks, and letters of established poets. 2. Enhance feedback skills through thoughtful, frank, tactful, and intelligent critiques of your classmates' poems. 3. Enhance writing skills through intensive writing of original poetry and through structure exercises. Credits: 3.00

ENGL 60900 - Seminar In Fiction Writing

Credit Hours: 3.00. An advanced course in the writing of fiction. Workshop critiques. Prerequisite: Admission to the creative writing program.

Learning Outcomes: 1. Enhance reading skills through close examination of other writers, including classmates and professional writers. 2. Enhance vocabulary for the creative writing discourse community. 3. Enhance feedback skills through thoughtful, frank, tactful, and intelligent discussion of your classmates stories and novel chapters. 4. Expand reading and writing aesthetics, and understanding of what literature is and can be, that will guide your reading and writing in the future. 5. Produce fiction benefitting a third-year thesis. Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62700 - Seminar In Linguistics

Credit Hours: 3.00. Investigation of a topic in advanced linguistics research.

Credits: 3.00

ENGL 62900 - Seminar In English As A Second Language

Credit Hours: 3.00. In-depth study of variable subjects relating to the nature of English as a second/foreign/international language and its learning and teaching. Prerequisite: ENGL 51600 .

Credits: 3.00

ENGL 63000 - Seminar In Second Language Writing

Credit Hours: 3.00. An overview and examination of major issues in the theory, research, and practice of writing in English as a second language. Prerequisite: ENGL 51600 or ENGL 59100 .

Credits: 3.00

ENGL 66800 - Seminar In Interpretation And Cultural Theory

Credit Hours: 3.00. Examination of selected developments in social, cultural, and hermeneutical theories from the eighteenth century to the present.

Credits: 3.00

ENGL 67400 - Seminar In Language Testing

Credit Hours: 3.00. An introduction to the techniques, practices, and history of language testing. Introduces the basic tenets of measurement and the issues and controversies related to the measurement of language ability.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 69600 - Seminar In Literature

Credit Hours: 3.00. Advanced study of special subjects.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Major Field Courses (12 credits)

Other Courses (12 credits)

Electives (6 credits)

Dissertation Research (xx credits)

ENGL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (27 credits)

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

ENGL 50600 - Introduction To English And General Linguistics

Credit Hours: 3.00. General study of language and linguistic theory with emphasis on English. Problems and methods in phonology, morphology, syntax, and semantics. Current techniques of linguistics analysis.

Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Seminar (9 credits)

ENGL 60600 - Seminar In Poetry Writing

Credit Hours: 3.00. An advanced course in the writing of poetry. Workshop criticism. Study of the work of established writers. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Enhance active reading skills through the close examination and critique of the poetry, notebooks, and letters of established poets. 2. Enhance feedback skills through thoughtful, frank, tactful, and intelligent critiques of your classmates' poems. 3. Enhance writing skills through intensive writing of original poetry and through structure exercises. Credits: 3.00

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Learning Outcomes: 1. Enhance reading skills through close examination of other writers, including classmates and professional writers. 2. Enhance vocabulary for the creative writing discourse community. 3. Enhance feedback skills through thoughtful, frank, tactful, and intelligent discussion of your classmates stories and novel chapters. 4. Expand reading and writing aesthetics, and understanding of what literature is and can be, that will guide your reading and writing in the future. 5. Produce fiction benefitting a third-year thesis. Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62700 - Seminar In Linguistics

Credit Hours: 3.00. Investigation of a topic in advanced linguistics research.

Credits: 3.00

ENGL 62900 - Seminar In English As A Second Language

Credit Hours: 3.00. In-depth study of variable subjects relating to the nature of English as a second/foreign/international language and its learning and teaching. Prerequisite: ENGL 51600 .

Credits: 3.00

ENGL 63000 - Seminar In Second Language Writing

Credit Hours: 3.00. An overview and examination of major issues in the theory, research, and practice of writing in English as a second language. Prerequisite: ENGL 51600 or ENGL 59100 .

Credits: 3.00

ENGL 66800 - Seminar In Interpretation And Cultural Theory

Credit Hours: 3.00. Examination of selected developments in social, cultural, and hermeneutical theories from the eighteenth century to the present.

Credits: 3.00

ENGL 67400 - Seminar In Language Testing

Credit Hours: 3.00. An introduction to the techniques, practices, and history of language testing. Introduces the basic tenets of measurement and the issues and controversies related to the measurement of language ability.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 69600 - Seminar In Literature

Credit Hours: 3.00. Advanced study of special subjects.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Language Requirement

GPA Requirements

About the Program

English: Rhetoric and Composition Concentration, PHD

About the Program

Program Requirements

Required Courses (30 credits)

Core Courses (12 credits)

ENGL 59100 - Introduction To Composition Theory

Credit Hours: 3.00. A survey of major contemporary theories of invention and style, including such topics as heuristics; the aims and modes of discourse; stylistics; readability theories; sentence-combining; error analysis; audience; and evaluation. Applications to teaching will be made.

Credits: 3.00

ENGL 62200 - Issues In Composition Studies: Classical Period To The Renaissance

Credit Hours: 3.00. The course historicizes issues in composition studies from the sophists to the Renaissance. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62600 - Postmodernism And Issues In Composition Studies

Credit Hours: 3.00. The course historicizes how various postmodern theories and practices (cultural, political, ethical, philosophical, technological, aesthetic) influence the study and teaching of written discourse. Prerequisite: ENGL 59100 .

Credits: 3.00

Breadth Areas (18 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

ENGL 56900 - Contemporary Criticism And Theory

Credit Hours: 3.00. Study of contemporary criticism and theory generally focused on such schools and movements as structuralism, psychoanalysis, poststructuralism, feminism, new historicism, cultural studies, and gay and lesbian studies.

Credits: 3.00

PHIL 51000 - Phenomenology

Credit Hours: 3.00. A detailed, critical examination of some major issue(s) in phenomenology. Attention will be given to either the historical development or contemporary relevance of phenomenological philosophy. Readings will be drawn from the works of Husserl, Heidegger, Merleau-Ponty, and others.

Credits: 3.00

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic Courses (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Core Courses (12 credits)

ENGL 59100 - Introduction To Composition Theory

Credit Hours: 3.00. A survey of major contemporary theories of invention and style, including such topics as heuristics; the aims and modes of discourse; stylistics; readability theories; sentence-combining; error analysis; audience; and evaluation. Applications to teaching will be made.

Credits: 3.00

ENGL 62200 - Issues In Composition Studies: Classical Period To The Renaissance

Credit Hours: 3.00. The course historicizes issues in composition studies from the sophists to the Renaissance. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62600 - Postmodernism And Issues In Composition Studies

Credit Hours: 3.00. The course historicizes how various postmodern theories and practices (cultural, political, ethical, philosophical, technological, aesthetic) influence the study and teaching of written discourse. Prerequisite: ENGL 59100 .

Credits: 3.00

Secondary Area Courses (18 credits)

Professional, Technical, and Digital Writing and Rhetoric

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

ENGL 60500 - Computers In Language And Rhetoric

Credit Hours: 3.00. Seminar that investigates how computers figure in contemporary theories of text and text making. Typical topics: critiques of technology, hypertext, cyberspace, computer-mediated communication, Internet, electronic writing, online research, pedagogy, and publishing.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

Public and Cultural Rhetorics

ENGL 60500 - Computers In Language And Rhetoric

Credit Hours: 3.00. Seminar that investigates how computers figure in contemporary theories of text and text making. Typical topics: critiques of technology, hypertext, cyberspace, computer-mediated communication, Internet, electronic writing, online research, pedagogy, and publishing.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

Writing Program and Centers

ENGL 60500 - Computers In Language And Rhetoric

Credit Hours: 3.00. Seminar that investigates how computers figure in contemporary theories of text and text making. Typical topics: critiques of technology, hypertext, cyberspace, computer-mediated communication, Internet, electronic writing, online research, pedagogy, and publishing.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

Professional, Technical, and Digital Writing and Rhetoric

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

ENGL 60500 - Computers In Language And Rhetoric

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Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

Electives (6 credits)

Dissertation Research (xx credits)

ENGL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (30 credits)

Core Courses (12 credits)

ENGL 59100 - Introduction To Composition Theory

Credit Hours: 3.00. A survey of major contemporary theories of invention and style, including such topics as heuristics; the aims and modes of discourse; stylistics; readability theories; sentence-combining; error analysis; audience; and evaluation. Applications to teaching will be made.

Credits: 3.00

ENGL 62200 - Issues In Composition Studies: Classical Period To The Renaissance

Credit Hours: 3.00. The course historicizes issues in composition studies from the sophists to the Renaissance. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62600 - Postmodernism And Issues In Composition Studies

Credit Hours: 3.00. The course historicizes how various postmodern theories and practices (cultural, political, ethical, philosophical, technological, aesthetic) influence the study and teaching of written discourse. Prerequisite: ENGL 59100 .

Credits: 3.00

Breadth Areas (18 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

ENGL 56900 - Contemporary Criticism And Theory

Credit Hours: 3.00. Study of contemporary criticism and theory generally focused on such schools and movements as structuralism, psychoanalysis, poststructuralism, feminism, new historicism, cultural studies, and gay and lesbian studies.

Credits: 3.00

PHIL 51000 - Phenomenology

Credit Hours: 3.00. A detailed, critical examination of some major issue(s) in phenomenology. Attention will be given to either the historical development or contemporary relevance of phenomenological philosophy. Readings will be drawn from the works of Husserl, Heidegger, Merleau-Ponty, and others.

Credits: 3.00

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic Courses (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Core Courses (12 credits)

ENGL 59100 - Introduction To Composition Theory

Credit Hours: 3.00. A survey of major contemporary theories of invention and style, including such topics as heuristics; the aims and modes of discourse; stylistics; readability theories; sentence-combining; error analysis; audience; and evaluation. Applications to teaching will be made.

Credits: 3.00

ENGL 62200 - Issues In Composition Studies: Classical Period To The Renaissance

Credit Hours: 3.00. The course historicizes issues in composition studies from the sophists to the Renaissance. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62600 - Postmodernism And Issues In Composition Studies

Credit Hours: 3.00. The course historicizes how various postmodern theories and practices (cultural, political, ethical, philosophical, technological, aesthetic) influence the study and teaching of written discourse. Prerequisite: ENGL 59100 .

Credits: 3.00

Concentrations

RC Preliminary Exam

Language Requirement

GPA Requirements

About the Program

Entomology, PHD

About the Program

Program Requirements

Required Courses (3-5 credits)

ENTM 60000 - Graduate Student Orientation

Credit Hours: 1.00. Introduction and orientation to the requirements and culture of the Department of Entomology, the College of Agriculture, and Purdue University. Intended for graduate students in their first year.

Learning Outcomes: 1. Know the administrative regulations and procedures of Entomology and the Graduate School. 2. Know the history of Entomology. 3. Know the land grant mission and the role of Entomology. 4. Know the University hierarchy. 5. Know the roles, rules and expectations of the apprentice and mentors. 6. Begin creation of a career plan. 7. Develop strategies for effective networking. 8. Learn how to communicate within the discipline through oral and poster presentations. 9. Participate in independent activities. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

GRAD 55000 - Fellowship And Grant Application Writing

Credit Hours: 2.00. Fellowship Application Writing is open to any graduate student who is interested in applying for fellowships and other grant opportunities. Graduate students will be taught how to write personal statements, research

statements, and extended research plans that they can submit for fellowship applications. Organization of research background, methods, and significance will be emphasized. Writing mechanics and addressing grant agency requirements and procedures will also be covered. Additionally, fellowship and grant opportunities will be discussed along with professional communication skills.

Learning Outcomes: 1. Analyze the different types of fellowship opportunities currently available to them as well as form broad knowledge of postdoc and faculty grants. 2. Practice and evaluate proofreading skills to gain experience in editing fellowship application writings and be able to apply advanced proofreading skills to future writing projects. 3. Compose persuasive documents using a grant proposal writing style with appropriate formatting and organization and analyze their writing with grant agency criteria. 4. Synthesize and refine competitive personal statements, research plans, and statements of previous research to use for various fellowship applications. Credits: 2.00

ENTM 60900 - Science Writing

Credit Hours: 1.00. This course is designed for graduate students (MS or PhD) at any stage in their professional career who are seeking formal training in manuscript and grant writing for a scientific audience. Students will be required to attend class and prepare for in-class group discussions and writing activities by reading assigned sections of the text or associated papers. Students will also be required to prepare a written assignment (manuscript or grant) over the course of the semester, which they will use to practice and hone newly acquired skills, as well as participating in peer evaluation of one another's writing. Permission of department required.

Learning Outcomes: 1. Utilize resources and approaches (e.g. online tools, peer-writing groups, time management skills) to develop regular writing habits. 2. Perform critiques of scientific manuscripts and research proposals. 3. Provide constructive criticism to fellow students on writing assignments. 4. Learn steps and basic principles (e.g. language, narrative structure, revision Revised: 08/11/21 process) used to write clear and concise scientific papers for a variety of audiences. 5. Apply principles of science writing to develop a complete draft of a specific section(s) of the MS/PhD research proposal, critical literature review, manuscript or other academic work (with instructor permission). Credits: 1.00

Core Selectives (18-21 credits)

ENTM 52500 - Medical And Veterinary Entomology

Credit Hours: 3.00. Introduction to the biology and control of arthropods of medical and veterinary importance, and coverage of the natural history and abatement of selected arthropod-related diseases, including arboviral encephalitis, filariasis, leishmaniasis, Lyme disease, malaria, plague, spotted fever, trypanosomiasis, and myasis. Offered in odd-numbered years.

Credits: 3.00

ENTM 61100 - Toxicology Of Insecticides

Credit Hours: 3.00. The chemistry, mode of action, and metabolism of insecticides and related compounds in both insect and vertebrate systems. Evaluation of toxic action, principles of selective toxicity, insecticide resistance, and environmental effects are also discussed. A minimal knowledge of entomology is required. Knowledge of biochemistry and neurobiology is useful. Offered in even-numbered years.

Credits: 3.00

ENTM 69200 - Special Topics

Credit Hours: 1.00 to 4.00. Advanced topics in specialties of department members such as, but not limited to: biochemistry and physiology; biological control; insect pest management; veterinary entomology; nematode systematics; pathology; systematics. The field in which work is offered will appear on the student's record. Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 4.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100,

and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

ENTM 50800 - Integrative Insect Taxonomy

Credit Hours: 4.00. A multisource approach to understanding insect taxonomy, morphology, and evolution. We will compare traditional classification schemes with new hypotheses of insect evolutionary relationships based on an array of data sources. Students learn the importance of natural history collections and how to prepare insect specimens for permanent storage. We will explore insect diversity through hands-on laboratory exercises and field research.

Learning Outcomes: 1. Identify insects to family by to sight. 2. Implement field techniques for collecting insect specimens. 3. Demonstrate proper insect collection preparation and curation. 4. Understand the principles of insect morphology, classification, and nomenclature. 5. Understand phylogenetic hypotheses and their implementation in insect taxonomy. 6. Integrate skills through a final class project on insect evolution. Credits: 4.00

ENTM 64200 - Analysis Of Ecological Data

Credit Hours: 3.00. Intermediate course in analysis options for biological and ecological data. Topics include: univariate, multivariate, parametric and non-parametric analysis and their basis; advanced graphical techniques; basic mapping with and without geographical information systems; simulation modeling; associated coding for open source platforms. A previous graduate-level course in statistics is required. Working knowledge of ANOVA, t-tests, linear regression, and assumptions and distributions of test statistics for these is assumed.

Learning Outcomes: 1. Know data and analysis requirements when planning experiments and observational studies. 2. Apply several univariate and multivariate statistical analyses. 3. Model or simulate simple biological or ecological systems. 4. Use several different graphing techniques including mapping, three-dimensional plots, and animations. 5. Write code to accomplish 1-4 within open-source software. 6. Develop critical thinking skills. 7. Foster creativity by finding alternative solutions to analytical challenges. 8. Develop both the written and the technical side of communication skills. Credits: 3.00

ENTM 61000 - Current Trends In Insect Pest Management

Credit Hours: 3.00. Concepts of pest management and dynamics of pest populations, with emphasis on population regulation in theory and practice. The principles of applied ecology that pertain to insects and agricultural crops and systems. Identification, biology, behavior, and relationships of pests of forage, fiber, and vegetable crops. A knowledge of introductory entomology is recommended. Offered in even-numbered years.

Learning Outcomes: 1. Identify key insects in

economically important IPM systems. 2. Design a pest management plan that includes preventive practices, sampling and economic thresholds. 3. Identify gaps in management techniques and propose new research directions. 4. Discuss key IPM concepts. Credits: 3.00

Thesis Research (12 credits)

ENTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (52-57)

Required Courses (3-5 credits)

ENTM 60000 - Graduate Student Orientation

Credit Hours: 1.00. Introduction and orientation to the requirements and culture of the Department of Entomology, the College of Agriculture, and Purdue University. Intended for graduate students in their first year.

Learning Outcomes: 1. Know the administrative regulations and procedures of Entomology and the Graduate School. 2. Know the history of Entomology. 3. Know the land grant mission and the role of Entomology. 4. Know the University hierarchy. 5. Know the roles, rules and expectations of the apprentice and mentors. 6. Begin creation of a career plan. 7. Develop strategies for effective networking. 8. Learn how to communicate within the discipline through oral and poster presentations. 9. Participate in independent activities. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

GRAD 55000 - Fellowship And Grant Application Writing

Credit Hours: 2.00. Fellowship Application Writing is open to any graduate student who is interested in applying for fellowships and other grant opportunities. Graduate students will be taught how to write personal statements, research statements, and extended research plans that they can submit for fellowship applications. Organization of research background, methods, and significance will be emphasized. Writing mechanics and addressing grant agency requirements and procedures will also be covered. Additionally, fellowship and grant opportunities will be discussed along with professional communication skills.

Learning Outcomes: 1. Analyze the different types of fellowship opportunities currently available to them as well as form broad knowledge of postdoc and faculty grants. 2. Practice and evaluate proofreading skills to gain experience in editing fellowship application writings and be able to apply advanced proofreading skills to future writing projects. 3. Compose persuasive documents using a grant proposal writing style with appropriate formatting and organization and analyze their writing with grant agency criteria. 4. Synthesize and refine competitive personal statements, research plans, and statements of previous research to use for various fellowship applications. Credits: 2.00

ENTM 60900 - Science Writing

Credit Hours: 1.00. This course is designed for graduate students (MS or PhD) at any stage in their professional career

who are seeking formal training in manuscript and grant writing for a scientific audience. Students will be required to attend class and prepare for in-class group discussions and writing activities by reading assigned sections of the text or associated papers. Students will also be required to prepare a written assignment (manuscript or grant) over the course of the semester, which they will use to practice and hone newly acquired skills, as well as participating in peer evaluation of one another's writing. Permission of department required.

Learning Outcomes: 1. Utilize resources and approaches (e.g. online tools, peer-writing groups, time management skills) to develop regular writing habits. 2. Perform critiques of scientific manuscripts and research proposals. 3. Provide constructive criticism to fellow students on writing assignments. 4. Learn steps and basic principles (e.g. language, narrative structure, revision Revised: 08/11/21 process) used to write clear and concise scientific papers for a variety of audiences. 5. Apply principles of science writing to develop a complete draft of a specific section(s) of the MS/PhD research proposal, critical literature review, manuscript or other academic work (with instructor permission). Credits: 1.00

Concentrations

About the Program

Environmental and Ecological Engineering, PHD

About the Program

Program Requirements

Required Courses (30-48 credits*)

Core Courses (9 credits)

EEE 69500 - Experimental Courses

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

Electives (21-39 credits)

Seminar (0 credits)

EEE 69000 - Environmental And Ecological Engineering Graduate Seminar

Credit Hours: 0.00. Combination of invited speakers (outside and inside Purdue) including graduate students. Topics will range across environmental and ecological engineering with an emphasis on current topics.

Learning Outcomes: 1. Increased understanding of academic and research topics in Environmental and Ecological Engineering (EEE). 2. Improve ability of EEE graduate students to think critically about research and presentation skills of others. 3. Increased ability to critique his or her own work. Credits: 0.00

Dissertation Research (42-60 credits)

EEE 69900 - Research PhD Dissertation

Credit Hours: 1.00 to 18.00. Research PhD Dissertation. Permission of instructor required.

Learning Outcomes: 1. Learning objectives are student dependent. Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Food Science, PHD

About the Program

Program Requirements

Required Courses (8 credits)

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Basic Food Science Courses (5 credits)

FS 55001 - Food Chemistry

Credit Hours: 1.00. Principles and concepts of the effects of heat, light, oxygen, and water activity on chemical reactions and physical events involved in processing, storage, and preparation of food products and their relationships to nutritional quality, organoleptic quality, stability, and safety. Class meets for 5 weeks.

Learning Outcomes: Students are expected to have a working knowledge of the following topics: 1. Structures and functions of major food components, including water, proteins, carbohydrates, and lipids; Major chemical reactions or structural changes occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 2. Major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 3. Examples of the effects of processing on food constituents and end product quality; Basic principles of dispersed systems: colloids, gels, emulsions, foams; Problem solving using basic food chemistry knowledge. Credits: 1.00

FS 55101 - Food Analysis

Credit Hours: 1.00. Principles and applications of chemical, physical, and sensory techniques to analyze foods. Class meets for 5 weeks.

Learning Outcomes: 1. Identify government regulations that dictate industrial standard practices of food analysis. 2. Describe the principles of the official and rapid methods of analysis of the following food components: moisture, ash, fat, protein. 3. For any given food product, select and justify the use of 1) an official, and 2) a rapid method of analysis for the following food components: moisture, ash, fat, protein. 4. Describe the principles of the methods of analysis for the following food components/properties: individual sugars, starch, total dietary fiber, vitamins, individual minerals, oxygen demand, texture, color, sensory evaluation, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional and functional properties. 5. Relate the various analyses discussed in class to quality assurance of specific food products. 6. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy (including mass spectroscopy and MALDI), enzymatic assays, immuno-based assays. Credits: 1.00

FS 55201 - Nutritional Sciences

Credit Hours: 1.00. Study of perspectives on established nutrition knowledge, concepts, and principles pertinent to the field of food science. Contemporary information about diet as it relates to health and safety issues. Controversies regarding nutrients and functional foods. Class meets 5 weeks.

Learning Outcomes: Students will learn about the scientific principle relevant to: 1. Newly released dietary guideline for Americans 2010, & components in diets and foods. 2. Digestion, absorption and metabolism of macro-nutrients. 3. Digestion, absorption and metabolism of vitamins and minerals frequently used in food processing. 4. Influence of food components on energy balance and body weight management. Credits: 1.00

FS 55301 - Food Microbiology

Credit Hours: 1.00. Principles and applications of the microbiology of foods. Focuses on many of the important conditions that may lead to foodborne illness and food spoilage. Structured in three main sections related to foodborne hazards: 1) identification, 2) control and prevention, and 3) detection. Class meets weeks 1-5.

Learning Outcomes: 1. Identify the major components of food that affect microbial growth. 2. Explain major foodborne pathogens and under what conditions they thrive. 3. Use microbiological information and molecular

techniques to solve practical problems of the food industry. Credits: 1.00

FS 55402 - Food Processing

Credit Hours: 1.00. The Food Processing course will present an overview of the basic food engineering concepts and unit operations involved in the manufacture of various food products. Students will be able to understand the food processing literature and to effectively communicate with food technologists and engineers. Topics to be covered include: physical properties of foods, unit operations commonly found in the food industry, and processing equipment. Permission of department required.

Learning Outcomes: 1. Understand the rationale and principle of operation behind common food processing operations. 2. Identify and explain the unit operations involved in the manufacture of specific food products. 3. Explain how processing parameters will affect quality and safety of processed products. 4. Communicate effectively with food technologists and engineers. 5. Work effectively with team members with various backgrounds. Credits: 1.00

Seminar Course (2 credits)

FS 68400 - Food Science Seminar

Credit Hours: 1.00. Current topics in food science.

Credits: 1.00

Supervised Teaching Course (1 credit)

FS 69700 - Supervised University Teaching In Food Science

Credit Hours: 1.00. Students assist a faculty member in teaching a food science course to obtain training and experience in various aspects of classroom and laboratory teaching. Permission of instructor required.

Credits: 1.00

Concentration (xx credits)

General Program

FS 53000 - Food Ingredient Technology

Credit Hours: 1.00. Identifies functions of ingredients listed on ingredient labels of food products and discusses alternative ingredient choices for food products.

Credits: 1.00

FS 59000 - Special Problems

Credit Hours: 1.00 to 5.00. Specialized study in research laboratories, libraries, or computer laboratories for problems related to food science that are not taught in regular courses. Permission of instructor required.

Credits: 1.00 to 5.00

FS 59100 - Special Topics

Credit Hours: 1.00 to 3.00. Specialized topics not covered in other courses will be offered as one-credit minicourses. Topics, requirements, and credits will be determined yearly. Permission of instructor required.

Credits: 1.00 to 3.00

FS 62000 - Scientific Writing In Food Science

Credit Hours: 2.00. This course covers the essential elements of publishing original research at professional meetings (oral presentations and papers) and in peer-reviewed journals (original research manuscripts). Topics include: ethics in writing, effective reading of the literature, organizing research data, choosing a journal, writing the manuscript (results, materials and methods, introduction, discussion, title, abstract, references), publication process, revising and reviewing, poster presentation, and short oral presentations. Each student will write a paper, prepare a 12-minute oral presentation, and prepare a poster, based on data from his/her graduate research project. Permission of instructor required.

Credits: 2.00

FS 69000 - Special Topics In Food Science

Credit Hours: 1.00 to 3.00. Individual study of specialized materials. Permission of instructor required.

Credits: 1.00 to 3.00

FS 53100 - Science Of Experimental Cuisine

Credit Hours: 3.00. This course brings together culinary arts and the application of food chemistry and ingredient technology principles. Emphasis will be placed on food construction and

deconstruction, using common food preparation and molecular gastronomy techniques.

Learning Outcomes: 1. Develop and use the vocabulary of a professional chef. 2. Understand and intelligently discuss how cooking works. 3. Demonstrate practical proficiency in food preparation skills. 4. Understand and experience food from farm to fork. 5. Compare and contrast home, culinary/food service, and large food industry food production practices. 6. Use common food preparation and molecular gastronomy techniques to manipulate the structure of food ingredients and finished food products. 7. Describe the fundamental structure-function relationships of food ingredients and how each of the applied techniques alters the ingredient structure and/or function. 8. Explore and control common food-related reactions/interactions including: emulsification, Maillard browning, caramelization, gelatinization, gelation, denaturation. 9. Exemplify the scientific process and inquiry driven research by designing, implementing, and analyzing experiments related to food construction and deconstruction. 10. Design and create food textures and products by manipulating fundamental structure-function relationships of food ingredients, and explain the science of how the foods were constructed. Credits: 3.00

Dissertation Research (xx credits)

FS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

FS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (8 credits)

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson,

Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Concentrations

GPA Requirements

Additional Information

About the Program

Food Science/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (8 credits)

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance;

contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Basic Food Science Courses (5 credits)

FS 55001 - Food Chemistry

Credit Hours: 1.00. Principles and concepts of the effects of heat, light, oxygen, and water activity on chemical reactions and physical events involved in processing, storage, and preparation of food products and their relationships to nutritional quality, organoleptic quality, stability, and safety. Class meets for 5 weeks.

Learning Outcomes: Students are expected to have a working knowledge of the following topics: 1. Structures and functions of major food components, including water, proteins, carbohydrates, and lipids; Major chemical reactions or structural changes occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 2. Major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 3. Examples of the effects of processing on food constituents and end product quality; Basic principles of dispersed systems: colloids, gels, emulsions, foams; Problem solving using basic food chemistry knowledge. Credits: 1.00

FS 55101 - Food Analysis

Credit Hours: 1.00. Principles and applications of chemical,

physical, and sensory techniques to analyze foods. Class meets for 5 weeks.

Learning Outcomes: 1. Identify government regulations that dictate industrial standard practices of food analysis. 2. Describe the principles of the official and rapid methods of analysis of the following food components: moisture, ash, fat, protein. 3. For any given food product, select and justify the use of 1) an official, and 2) a rapid method of analysis for the following food components: moisture, ash, fat, protein. 4. Describe the principles of the methods of analysis for the following food components/properties: individual sugars, starch, total dietary fiber, vitamins, individual minerals, oxygen demand, texture, color, sensory evaluation, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional and functional properties. 5. Relate the various analyses discussed in class to quality assurance of specific food products. 6. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy (including mass spectroscopy and MALDI), enzymatic assays, immuno-based assays. Credits: 1.00

FS 55201 - Nutritional Sciences

Credit Hours: 1.00. Study of perspectives on established nutrition knowledge, concepts, and principles pertinent to the field of food science. Contemporary information about diet as it relates to health and safety issues. Controversies regarding nutrients and functional foods. Class meets 5 weeks.

Learning Outcomes: Students will learn about the scientific principle relevant to: 1. Newly released dietary guideline for Americans 2010, & components in diets and foods. 2. Digestion, absorption and metabolism of macro-nutrients. 3. Digestion, absorption and metabolism of vitamins and minerals frequently used in food processing. 4. Influence of food components on energy balance and body weight management. Credits: 1.00

FS 55301 - Food Microbiology

Credit Hours: 1.00. Principles and applications of the microbiology of foods. Focuses on many of the important conditions that may lead to foodborne illness and food spoilage. Structured in three main sections related to foodborne hazards: 1) identification, 2) control and prevention, and 3) detection. Class meets weeks 1-5.

Learning Outcomes: 1. Identify the major components of food that affect microbial growth. 2. Explain major foodborne pathogens and under what conditions they thrive. 3. Use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 1.00

FS 55402 - Food Processing

Credit Hours: 1.00. The Food Processing course will present an overview of the basic food engineering concepts and unit operations involved in the manufacture of various food products. Students will be able to understand the food processing literature and to effectively communicate with food technologists and engineers. Topics to be covered include: physical properties of foods, unit operations commonly found in the food industry, and processing equipment. Permission of department required.

Learning Outcomes: 1. Understand the rationale and principle of operation behind common food processing operations. 2. Identify and explain the unit operations involved in the manufacture of specific food products. 3. Explain how processing parameters will affect quality and safety of processed products. 4. Communicate effectively with food technologists and engineers. 5. Work effectively with team members with various backgrounds. Credits: 1.00

Seminar Course (2 credits)

FS 68400 - Food Science Seminar

Credit Hours: 1.00. Current topics in food science.

Credits: 1.00

Supervised Teaching Course (1 credit)

FS 69700 - Supervised University Teaching In Food Science

Credit Hours: 1.00. Students assist a faculty member in teaching a food science course to obtain training and experience in various aspects of classroom and laboratory teaching. Permission of instructor required.

Credits: 1.00

Concentration (xx credits)

General Program

FS 53000 - Food Ingredient Technology

Credit Hours: 1.00. Identifies functions of ingredients listed on ingredient labels of food products and discusses alternative ingredient choices for food products.

Credits: 1.00

FS 59000 - Special Problems

Credit Hours: 1.00 to 5.00. Specialized study in research laboratories, libraries, or computer laboratories for problems related to food science that are not taught in regular courses. Permission of instructor required.

Credits: 1.00 to 5.00

FS 59100 - Special Topics

Credit Hours: 1.00 to 3.00. Specialized topics not covered in other courses will be offered as one-credit minicourses. Topics, requirements, and credits will be determined yearly. Permission of instructor required.

Credits: 1.00 to 3.00

FS 62000 - Scientific Writing In Food Science

Credit Hours: 2.00. This course covers the essential elements of publishing original research at professional meetings (oral presentations and papers) and in peer-reviewed journals (original research manuscripts). Topics include: ethics in writing, effective reading of the literature, organizing research data, choosing a journal, writing the manuscript (results, materials and methods, introduction, discussion, title, abstract, references), publication process, revising and reviewing, poster presentation, and short oral presentations. Each student will write a paper, prepare a 12-minute oral presentation, and prepare a poster, based on data from his/her graduate research project. Permission of instructor required.

Credits: 2.00

FS 69000 - Special Topics In Food Science

Credit Hours: 1.00 to 3.00. Individual study of specialized materials. Permission of instructor required.

Credits: 1.00 to 3.00

FS 53100 - Science Of Experimental Cuisine

Credit Hours: 3.00. This course brings together culinary arts and the application of food chemistry and ingredient technology principles. Emphasis will be placed on food construction and deconstruction, using common food preparation and molecular gastronomy techniques.

Learning Outcomes: 1. Develop and use the vocabulary of a professional chef. 2. Understand and intelligently discuss how cooking works. 3. Demonstrate practical proficiency in food preparation skills. 4. Understand and experience food from farm to fork. 5. Compare and contrast home, culinary/food service, and large food industry food production practices. 6. Use common food preparation and molecular gastronomy techniques to manipulate the structure of food ingredients and finished food products. 7. Describe the fundamental structure-function relationships of food ingredients and how each of the applied techniques alters the ingredient structure and/or function. 8. Explore and control common food-related reactions/interactions including: emulsification, Maillard browning, caramelization, gelatinization, gelation, denaturation. 9. Exemplify the scientific process and inquiry driven research by designing, implementing, and analyzing experiments related to food construction and deconstruction. 10. Design and create food textures and products by manipulating fundamental structure-function relationships of food ingredients, and explain the science of how the foods were constructed. Credits: 3.00

Dissertation Research (xx credits)

FS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Additional Information

Concentrations

Forestry and Natural Resources, PHD

About the Program

Program Requirements

Required Courses (24-36 credits)*

Core Courses (0-5 credits)*

FNR 59800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

FNR 50600 - Theory And Application Of Natural Resource Extension Programming

Credit Hours: 1.00. This course will provide an opportunity for students to develop and implement extension activities based on their research interests. The course will focus on important natural resources issues, identify common target audiences, provide examples of extension programming, discuss outputs developed from various extension programs, and outline metrics used to evaluate program impact.

Learning Outcomes: 1. Be familiar with the breadth of natural resource extension programs. 2. Create a logic model based on student research and extension interests. 3. Develop a plan that outlines student extension goals. 4. Communicate technical information to non-scientific audiences. Credits: 1.00

Research Areas (24-31 credits)

Dissertation Research (15-60 credits)

FNR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Integrate and synthesize relevant literature, theories, methods from their field of study into a cohesive thesis or manuscript framework that showcases their understanding of existing research and identifying gaps that would benefit from future studies or research. 2. Construct and articulate clear, coherent research objectives, hypotheses, and/or predictions and develop methods that will address these. 3. Conduct research and collect data on thesis topic. Credits: 1.00 to 18.00

FNR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Integrate and synthesize relevant literature, theories, methods from their field of study into a cohesive dissertation or manuscript framework that showcases their understanding of existing research and identifying gaps that would benefit from future studies or research. 2. Construct and articulate clear, coherent research objectives, hypotheses, and/or predictions and develop methods that will address these. 3. Conduct research and collect data on dissertation topic. Credits: 1.00 to 18.00

Additional Requirements

FNR 50600 - Theory And Application Of Natural Resource Extension Programming

Credit Hours: 1.00. This course will provide an opportunity for students to develop and implement extension activities based on their research interests. The course will focus on important natural resources issues, identify common target audiences, provide examples of extension programming, discuss outputs developed from various extension programs, and outline metrics used to evaluate program impact.

Learning Outcomes: 1. Be familiar with the breadth of natural resource extension programs. 2. Create a logic model based on student research and extension interests. 3. Develop a plan that outlines student extension goals. 4. Communicate technical information to non-scientific audiences. Credits: 1.00

Concentrations

Program Learning Outcomes

GPA Requirements

Additional Information

Health and Kinesiology, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

Concentrations

Health and Kinesiology/Gerontology, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

Concentrations

Health Physics, PhD

About the Program

Program Requirements

Required Courses (23 credits)*

Core Courses (20 credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical

physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 51500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. This course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the State and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. The integration of safety and security and the use of alternative technologies will also be covered. Group exercises and simulations in applied nuclear security scenarios will complement lectures given by a number of national and international experts. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. To introduce students to the basic concept of nuclear security. 2. To introduce students to the basics of nuclear security planning at the facility and state level. 3. Introduce students to proliferation efforts, framing them within the historical and security-related context. 4. Create a foundational understanding of relevant security, safeguards and nonproliferation treaties and agreements. 5. Leverage existing technical knowledge in coming to policy conclusions. 6. Develop both a regime and state specific knowledge base. 7. Illustrate understanding through technical and policy oriented exercises. 8. Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts. Credits: 3.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

Professional Course (1 credit)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take

this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (2 credits)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Statistics Selective (3 credits)*

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data

analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

Electives (4-7 credits)*

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of

noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system.
Credits: 4.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies.
Credits: 3.00

HSCI 55100 - Physical Agents In Environmental Health

Credit Hours: 3.00. Physical characterization and biological interactions of non-ionizing radiation with emphasis on the adverse effects of human exposure. Topics include source characterization, environmental exposure assessment, measurement instrumentation, toxicological and epidemiological findings, control strategies.

Credits: 3.00

HSCI 55200 - Introduction To Aerosol Science

Credit Hours: 3.00. The principles of aerosol behavior and sampling, with particular emphasis on applications in the health sciences. Topics include aerosol aerodynamics, aerosol filtration, pulmonary deposition of aerosols, methods of environmental sampling, and generation of laboratory aerosols.

Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 69000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

NUCL 50100 - Nuclear Engineering Principles

Credit Hours: 3.00. A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science or engineering. The course is structured in four parts: (1) Nuclear structure and radiation, biological effects and medical applications of radiation. (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality. (3) Nuclear materials and waste. (4) Reactor systems and safety.

Credits: 3.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms

of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered

include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

Dissertation Research (6-xx credits)

HSCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Health Services, Outcomes, and Policy, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

History, PHD

About the Program

Program Requirements

Required Courses (6 credits)

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical

scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

Major Research Area (xx credits)

HIST 51200 - England Under The Stuarts

Credit Hours: 3.00. This intensive study of seventeenth-century England focuses on the political, religious, and economic tensions under the early Stuarts; the Civil War; Cromwell's Protectorate; and The Glorious Revolution. Topics discussed include parliament, puritanism, radicalism, the Restoration, and the Whig Oligarchy.

Credits: 3.00

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 57700 - Contemporary Latin America

Credit Hours: 3.00. A topical and regional approach to recent political, social, and economic movements in Latin America.

Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

HIST 60100 - Reading Seminar In European History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields of topics in European history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 60200 - Seminar In European History

Credit Hours: 3.00. Individual and group study of topics in European history from the medieval period to the modern era. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64100 - Reading Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64200 - Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 65000 - Teaching The History Survey Course

Credit Hours: 3.00. This course provides an introduction to the literature on teaching history at the college level, especially the literature on pedagogy, theory, and conceptualization needed for the undergraduate survey course. Students will become familiar with the professional literature, develop their own syllabus for the survey course, and produce an extensive historiographical essay supporting and justifying the contents of the syllabus. Class discussions will expose students to a number of teaching strategies, concepts, and exercises.

Prerequisite: Master's student standing. Permission of instructor required.

Learning Outcomes: 1. Have effective communication through written and oral modes. 2. Have critical and creative thinking skills in acquiring a broad base of knowledge and applying it to complex issues. 3. Have competence in a major area of study. 4. Have appreciation for and understanding of an expanded world perspective by engaging respectfully with a diverse range of individuals, communities and viewpoints. Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 65200 - Seminar In American History

Credit Hours: 3.00. Individual and group study of topics in American history from the colonial period to the present. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 67000 - Seminar In Latin American History

Credit Hours: 3.00. Research or reading seminar in Latin American History on a selected topic in colonial or national period of Latin American History. Topics vary. It may be repeated once with change of topic. Students must have been admitted into M.A. or Ph.D. history programs or any other graduate program at Purdue. Also, adequate knowledge of languages pertinent to research topic is expected. No prior knowledge of Latin American History is required.

Learning Outcomes: 1. Become familiarized with the historical process in Latin America from 1492 to the present. 2. Understand the complexities of doing research in the area (e.g., the type of documentation, archives, and scholarly community that exist in Latin America). 3. Develop critical thinking and research abilities. Credits: 3.00

Major Reading Area (xx credits)

Minor Research Area (xx credits)

Dissertation Research (xx credits)

HIST 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HIST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (6 credits)

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context

of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

Concentrations

GPA Requirements

Additional Information

About the Program

Horticulture, PHD

About the Program

Program Requirements

Required Courses (5 credits)

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60200 - Horticulture Research Seminar

Credit Hours: 1.00. Weekly attendance at the Horticulture and Landscape Architecture Departmental seminars to help graduate students develop an appreciation for attending seminars and learning appropriate and effective presentation skills. HORT 602 compliments HORT 60100 and HORT 60300 by extending the presentation and project development approaches learned, so that students are better ready to prepare and defend their project proposals in HORT 60300. Prerequisite: BCHM 56100.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

HORT 69500 - Horticulture Seminar

Credit Hours: 0.00. Topics of current interest to staff and students.

Credits: 0.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Analytical Tools Courses (5 credits)

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

AGEC 65100 - Application Of Quantitative Analysis: Econometrics II

Credit Hours: 3.00. Emphasis is on using advanced econometric techniques. The course covers use of computer software and interpretation and reporting of econometric results. The first part of the course includes general econometric concepts, such as least squares and maximum likelihood estimation, desirable statistical properties, assumptions of the classical linear regression model, Monte Carlo methods, nested and non-nested hypothesis tests. Later, more specialized topics are covered, including multiple equation models, simultaneous equation models, limited dependent variable models, and other topics that are deemed relevant. Prerequisite: AGEC 65000.

Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to

analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

ECON 67400 - Microeconometrics

Credit Hours: 1.00 to 3.00. This advanced course covers the econometrics and statistical methods needed to study data on individual agents in general qualitative response models and models of limited dependent variables. Special emphasis is placed on applying the alternate estimation and inference techniques to actual or simulated datasets. Topics include: univariate binary models, multinomial and multivariate qualitative response models, choice based sampling, distribution-free estimation methods, and Tobit models. Prerequisite: ECON 67200 .

Credits: 1.00 to 3.00

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 67100 - Econometrics I

Credit Hours: 1.00 to 3.00. An introduction to the modern techniques of econometrics and their applications. Topics include: the classical linear regression model (specification, estimation, inference, and prediction), specification analysis, functional form, heteroscedasticity, and autocorrelation. Prerequisite: ECON 67000.

Learning Outcomes: 1. Investigate the properties of econometric estimators under a variety of conditions. 2. Explain econometric techniques for estimating causal effects. 3. Explain the principles and purpose of Monte Carlo simulation methods. 4. Conduct basic empirical analyses of cross sectional data. Credits: 1.00 to 3.00

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ENTM 69200 - Special Topics

Credit Hours: 1.00 to 4.00. Advanced topics in specialties of department members such as, but not limited to: biochemistry and physiology; biological control; insect pest management; veterinary entomology; nematode systematics; pathology; systematics. The field in which work is offered will appear on the student's record. Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 4.00

FNR 58000 - Research Methods For Natural Resource Social Science

Credit Hours: 3.00. This class covers basic elements of research design for social scientists, with an emphasis on issues pertinent to natural resource management. Topics to be covered include the role of theories and paradigms in designing sound research, writing research questions and hypotheses, and the importance of validity and reliability in research design. Qualitative, quantitative, and mixed methods designs are presented and discussed.

Learning Outcomes: 1. Understand fundamental concepts such as theories and paradigms that are essential precursors to designing sound research. 2. Able to articulate clear research questions and testable hypotheses. 3. Differentiate between different research designs and know which are appropriate under which circumstances. 4 Understand overarching issues such as validity and reliability. 5. Know under which circumstances qualitative, quantitative or mixed methods are appropriate. 6. Demonstrate knowledge of a variety of commonly-used research methods. 7. Articulate basic steps involved in analyzing qualitative and quantitative data. 8. Demonstrate the ability to write a research proposal. Credits: 3.00

FNR 64700 - Quantitative Methods For Ecologists

Credit Hours: 3.00. Examines the assumptions and utility of statistical and other data analytic techniques that are encountered commonly or increasingly being used in ecological research. Emphasis is placed on the potential applications of these quantitative methods in an ecological context. Topics include traditional multivariate methods (cluster analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling, correspondence analysis), generalized linear models (logistic Poisson, and ordinal regression and derivatives), randomization methods, information-theoretic model selection and inference, and hierarchical models. An introduction to Bayesian analysis is provided for generalized linear (and mixed) models, with applications to (meta) population and (meta) community ecology. Prerequisite: BIOL 58210 or ENTM 64200 or STAT 51200 , or consent of instructor. Knowledge of linear algebra and experience with R is desirable but not essential.

Learning Outcomes: 1. Determine the appropriate statistical tool to use when confronted with most questions and data types. 2. Be familiar with the assumptions underlying these methods. 3. Have some familiarity with software required to apply the methods. 4. Offer a basic interpretation of results provided. Credits: 3.00

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100,

and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions,

expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

ASEC 59000 - Special Problems

Credit Hours: 1.00 to 6.00. A study of special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which

DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

Primary Area Courses (32-62 credits)

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn care companies, and sod production facilities in an efficient and environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 55100 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in

presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

LA 50100 - Research Methods For Design Applications

Credit Hours: 1.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 1.00

Dissertation Research (xx credits)

HORT 69500 - Horticulture Seminar

Credit Hours: 0.00. Topics of current interest to staff and students.

Credits: 0.00

HORT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HORT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (5 credits)

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60200 - Horticulture Research Seminar

Credit Hours: 1.00. Weekly attendance at the Horticulture and Landscape Architecture Departmental seminars to help graduate students develop an appreciation for attending seminars and learning appropriate and effective presentation skills. HORT 602 compliments HORT 60100 and HORT 60300 by extending the presentation and project development approaches learned, so that students are better ready to prepare and defend their project proposals in HORT 60300. Prerequisite: BCHM 56100.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

HORT 69500 - Horticulture Seminar

Credit Hours: 0.00. Topics of current interest to staff and students.

Credits: 0.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Concentrations

GPA Requirements

About the Program

Hospitality and Tourism Management, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (9 credits)

HTM 60100 - Research Development And Design

Credit Hours: 3.00. This course will equip doctoral students to think like a scholar and develop the ability to design rigorous research. Students will learn research philosophy, research idea development, and the development and evaluation of research processes and methods. Emphases are placed on developing students' confidence in conceptualizing, developing, designing, and writing empirical and theoretical research.

Learning Outcomes: 1. Demonstrate an understanding of theoretical, methodological, and ethical issues inherent in conducting research. 2. Evaluate various research processes, methodologies, and recent trends. 3. Develop rigorous research ideas, translate ideas into theory-supported research questions, and formulate analytical strategies to best address research questions. Credits: 3.00

HTM 61400 - Theory Of The Consumer

Credit Hours: 3.00. This course will examine concepts and theories that have been developed for understanding consumer choices and behaviors in society and marketplaces. Students will learn classic and modern consumer theories, such as behavioral economics and applied psychological and sociological theories. It will discuss how these theories can help explain consumer tendencies such as preferences, choices, and other consumption-related behaviors.

Learning Outcomes: 1. Demonstrate an understanding of the scope of consumer theory literature. 2. Evaluate the consumer theories and their implications in society and marketplaces. 3. Apply theories of consumer behavior to research. Credits: 3.00

HTM 61500 - Theory Of The Firm

Credit Hours: 3.00. In this course, students examine concepts, models, and theories developed for the understanding of firm and organizational behavior. This course equips students with knowledge of classic and contemporary theories, such as those related to managerial economics, pricing and price discrimination, organizational structure and culture, employee productivity, firm financial behaviors, marketing management, and operations management.

Learning Outcomes: 1. Demonstrate a foundational understanding of the scope of firm-theory literature. 2. Apply firm theory to research. 3. Analyze and synthesize firm theories with other leading or discipline-specific theories. Credits: 3.00

Professional Course (3 credits)

HTM 60200 - PhD Professional Development Seminar

Credit Hours: 1.00. The goals of this course are to (1) introduce and provide professional development resources, practices, and current trends in the areas of research, learning, and engagement, and (2) empower graduate students to pursue an academic career by developing a continuous growth mindset. Open to PhD students. No pre-requisite.

Learning Outcomes: 1. Explain the expectations for university faculty in research, learning, and engagement. 2. Create a career plan for the first five years as a university faculty. 3. List the resources and skills needed for a successful academic career in the long term. Credits: 1.00

Seminar Courses (6 credits)

Methodology & Statistics Electives (12 credits)

Outside Specialty Electives (6 credits)

Independent Study Course (6 credits)

HTM 69000 - Hospitality And Tourism Research Problems

Credit Hours: 1.00 to 4.00. Development of an individual research project for doctoral students. Projects are designed to broaden understanding of specific research techniques or to add to subject matter knowledge necessary for completion of the doctoral thesis. A paper worthy of submission to a refereed journal is expected upon project completion. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the

nature of the course. Credits: 1.00 to 4.00

Dissertation Research (48 credits)

HTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

GPA Requirements

Hospitality and Tourism Management/Gerontology, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (9 credits)

HTM 60100 - Research Development And Design

Credit Hours: 3.00. This course will equip doctoral students to think like a scholar and develop the ability to design rigorous research. Students will learn research philosophy, research idea development, and the development and evaluation of research processes and methods. Emphases are placed on developing students' confidence in conceptualizing, developing, designing, and writing empirical and theoretical research.

Learning Outcomes: 1. Demonstrate an understanding of theoretical, methodological, and ethical issues inherent in conducting research. 2. Evaluate various research processes, methodologies, and recent trends. 3. Develop rigorous research ideas, translate ideas into theory-supported research questions, and formulate analytical strategies to best address research questions. Credits: 3.00

HTM 61400 - Theory Of The Consumer

Credit Hours: 3.00. This course will examine concepts and theories that have been developed for understanding consumer choices and behaviors in society and marketplaces. Students will learn classic and modern consumer theories, such as behavioral economics and applied psychological and sociological theories. It will discuss how these theories can help explain consumer tendencies such as preferences, choices, and other consumption-related behaviors.

Learning Outcomes: 1. Demonstrate an understanding of the scope of consumer theory literature. 2. Evaluate the consumer theories and their implications in society and marketplaces. 3. Apply theories of consumer behavior to research. Credits: 3.00

HTM 61500 - Theory Of The Firm

Credit Hours: 3.00. In this course, students examine concepts, models, and theories developed for the understanding of firm and organizational behavior. This course equips students with knowledge of classic and contemporary theories, such as those related to managerial economics, pricing and price discrimination, organizational structure and culture, employee productivity, firm financial behaviors, marketing management, and operations management.

Learning Outcomes: 1. Demonstrate a foundational understanding of the scope of firm-theory literature. 2. Apply firm theory to research. 3. Analyze and synthesize firm theories with other leading or discipline-specific theories. Credits: 3.00

Professional Course (3 credits)

HTM 60200 - PhD Professional Development Seminar

Credit Hours: 1.00. The goals of this course are to (1) introduce and provide professional development resources, practices, and current trends in the areas of research, learning, and engagement, and (2) empower graduate students to pursue an academic career by developing a continuous growth mindset. Open to PhD students. No pre-requisite.

Learning Outcomes: 1. Explain the expectations for university faculty in research, learning, and engagement. 2. Create a career plan for the first five years as a university

faculty. 3. List the resources and skills needed for a successful academic career in the long term. Credits: 1.00

Seminar Courses (6 credits)

Methodology & Statistics Electives (12 credits)

Outside Specialty Electives (6 credits)

Independent Study Course (6 credits)

HTM 69000 - Hospitality And Tourism Research Problems

Credit Hours: 1.00 to 4.00. Development of an individual research project for doctoral students. Projects are designed to broaden understanding of specific research techniques or to add to subject matter knowledge necessary for completion of the doctoral thesis. A paper worthy of submission to a refereed journal is expected upon project completion. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 4.00

Dissertation Research (48 credits)

HTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

GPA Requirements

Human Development and Family Studies, PHD

About the Program

Program Requirements

Required Courses (22 credits)

Core Courses (6 credits)

HDFS 60100 - Advanced Child Development

Credit Hours: 3.00. This course provides an overview of foundational and current developmental research on changes that occur within the individual throughout infancy, childhood, and early adolescence. Emphasis is given to processes and mechanisms that have been proposed to explain developmental changes. This course includes attention to social and cultural contexts within which individuals develop. Prerequisite: Graduate-level coursework in Child Development or Psychology.

Credits: 3.00

HDFS 60200 - Advanced Family Science

Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

Learning Outcomes: 1. Describe and critique classic and emerging theoretical and conceptual frameworks in family science, with attention to refinements over time. 2. Demonstrate critical thinking skills through exploring and discussing diverse theoretical viewpoints and recent research in family science. 3. Apply theoretical and conceptual frameworks when developing empirical research in family science. Credits: 3.00

HDFS 60400 - Developmental And Family Approaches To Diversity And Oppression

Credit Hours: 3.00. In this course, we will utilize an intersectional lens throughout the course to critically examine the development of individuals oppressed due to their minority status in the United States. We will review current research and literature across disciplines to: 1) understand the origin, meaning, and purpose of race and racism; 2) learn about the history of oppression and resilience of minoritized groups; 3) analyze systems of discrimination; 4) introduce theoretical

frameworks for studying the unique, intersectional experiences of minoritized populations and examples of their application to empirical research, and 5) discuss how research can be used to advance social justice. Permission of department required.

Learning Outcomes: 1. Define concepts such as discrimination, race, racism, gender (beyond binary definitions), cissexism, heterosexism, neurodiversity, and ableism as they pertain to diverse populations in the U.S. 2. Present their own intersectionality and demonstrate how personal intersections can inform bias and actions. 3. Discuss the diversity that exists in the US and identify systemic factors that interact with this diversity (including but not limited to socioeconomic factors). 4. Explain the major concerns regarding minoritized groups' experiences and the factors that promote positive outcomes for marginalized individuals and families. 5. Evaluate critically the theoretical foundation of empirical studies conducted with diverse individuals/families and apply diversity-focused theory to student research content areas of interest. Credits: 3.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to diversity in developmental influences and trajectories, including atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

Colloquium (4 credits)

HDFS 69700 - Graduate Student Colloquium

Credit Hours: 1.00. Research presentations by faculty members, graduate students, and invited speakers. Includes attention to: (1) the responsible conduct of research, (2) professional/scholarly and teaching development, and (3) diversity, equity, and inclusion.

Learning Outcomes: 1. Expose students to a wide swath of HDFS-related research across the life course. 2. Provide a rotation of professional development trainings (e. g., vita, job talk, and conference presentation development). 3. Foster teaching development through presentations, workshops, or trainings. 4. Generate internal and external networking opportunities for graduate students. 5. Address issues of diversity, equity, and inclusion (DEI) in HDFS by (a) providing a platform for increased representation in presenters, (b) critically considering how research in HDFS serves diverse (i. e., underrepresented/underserved/historically marginalized) populations, and (c) increasing our competencies related to DEI as part of professional development. Credits: 1.00

Quantitative/Research Methods Courses (12 credits)

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical

methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

HDFS 61700 - Quantitative Methods II: Regression

Credit Hours: 4.00. This course has two primary goals: 1) provide students with foundational knowledge related to linear regression statistical analyses, and 2) provide students with the opportunity to practice writing, interpreting, and presenting regression analyses for the purposes of dissemination. Prerequisite: HDFS 61300 or PUBH 60100 or STAT 50100 or PSY 64600. Permission of instructor required.

Learning Outcomes: 1. Understand the foundations of linear regression statistical analyses, including multiple regression. 2. Understand mediation and moderation hypotheses and associated testing in linear regression. 3. Derive research questions and hypotheses testable in linear regression. 4. Analyze data using linear regression modeling and statistical software. 5. Properly interpret the statistical estimates and tests covered in the course. 6. Apply regression modeling to your research questions using empirical data. 7. Produce written communication of analytic methods and interpretation of results. Credits: 4.00

PSY 68100 - Seminar In Research Methodologies Of Industrial/Organizational Psychology

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings.

Learning Outcomes: 1. Develop an understanding of quantitative research methods employed in psychology, including their strengths and limitations in addressing validity concerns. 2. Apply quantitative research methods to your own research. 3. Have critical thinking skills and good professional judgment regarding research, theory, and methods. 4. Have written and oral skills. 5. Understand and able to apply professional and ethical values of psychology. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using

various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

PSY 68800 - Research Methods In Social Psychology

Credit Hours: 3.00. This course provides a broad and rigorous, graduate-level overview of contemporary research methodology in social psychology and personality. The course follows a discussion seminar format. Permission of department required.

Learning Outcomes: 1. Understand the specific rationale for using different methodological techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

Dissertation Research (18 credits)

HDFS 69000 - Directed Research In HDFS

Credit Hours: 1.00 to 4.00. Directed research and supervised research on a topic in student's area of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

HDFS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HDFS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Additional Information

Human Development and Family Studies/Gerontology, PHD

About the Program

Program Requirements

Required Courses (22 credits)

Core Courses (6 credits)

HDFS 60100 - Advanced Child Development

Credit Hours: 3.00. This course provides an overview of foundational and current developmental research on changes that occur within the individual throughout infancy, childhood, and early adolescence. Emphasis is given to processes and mechanisms that have been proposed to explain developmental changes. This course includes attention to social and cultural contexts within which individuals develop. Prerequisite: Graduate-level coursework in Child Development or Psychology.

Credits: 3.00

HDFS 60200 - Advanced Family Science

Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

Learning Outcomes: 1. Describe and critique classic and emerging theoretical and conceptual frameworks in family science, with attention to

refinements over time. 2. Demonstrate critical thinking skills through exploring and discussing diverse theoretical viewpoints and recent research in family science. 3. Apply theoretical and conceptual frameworks when developing empirical research in family science. Credits: 3.00

Colloquium (4 credits)

HDFS 69700 - Graduate Student Colloquium

Credit Hours: 1.00. Research presentations by faculty members, graduate students, and invited speakers. Includes attention to: (1) the responsible conduct of research, (2) professional/scholarly and teaching development, and (3) diversity, equity, and inclusion.

Learning Outcomes: 1. Expose students to a wide swath of HDFS-related research across the life course. 2. Provide a rotation of professional development trainings (e. g., vita, job talk, and conference presentation development). 3. Foster teaching development through presentations, workshops, or trainings. 4. Generate internal and external networking opportunities for graduate students. 5. Address issues of diversity, equity, and inclusion (DEI) in HDFS by (a) providing a platform for increased representation in presenters, (b) critically considering how research in HDFS serves diverse (i. e., underrepresented/underserved/historically marginalized) populations, and (c) increasing our competencies related to DEI as part of professional development. Credits: 1.00

Quantitative/Research Methods Courses (12 credits)

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

PSY 68100 - Seminar In Research Methodologies Of Industrial/Organizational Psychology

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings.

Learning Outcomes: 1. Develop an understanding of quantitative research methods employed in psychology, including their strengths and limitations in addressing validity concerns. 2. Apply quantitative research methods to your own research. 3. Have critical thinking skills and good professional judgment regarding research, theory, and methods. 4. Have written and oral skills. 5. Understand and able to apply professional and ethical values of psychology. Credits: 3.00

PSY 68800 - Research Methods In Social Psychology

Credit Hours: 3.00. This course provides a broad and rigorous, graduate-level overview of contemporary research methodology in social psychology and personality. The course follows a discussion seminar format. Permission of department required.

Learning Outcomes: 1. Understand the specific rationale for using different methodological

techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

Dissertation Research (xx credits)

HDFS 69000 - Directed Research In HDFS

Credit Hours: 1.00 to 4.00. Directed research and supervised research on a topic in student's area of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

HDFS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HDFS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Additional Information

Imaging Sciences, PhD

About the Program

Program Requirements

Required Courses (18 credits)*

Core Courses (6 credits)

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop

a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

Professional Course (1 credit)

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (2 credits)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Internship Courses (6 credits)

HSCI 67200 - MRI Quality Assurance Internship I

Credit Hours: 3.00. This internship course provides didactic training and practical experience in clinical diagnostic medical physics. Students will spend 3-4 hours per week learning the responsibilities of a medical physicist in MRI quality assurance (QA) such as MRI system performance testing, setting up weekly MRI QA procedures, analysis of MRI QA data, and annual clinical system evaluations. In Part I students will observe and review the weekly MRI QA tests performed by the MR Technologists on clinical MRI scanners and be involved with data analysis of these tests (image quality assessment, reporting). Annual MRI system performance evaluations of different clinical scanners will be observed and discussed. This includes assessing magnetic field homogeneity, slice position accuracy and slice thickness accuracy, and performance of radio frequency coil tests on the various coils available at different clinical MRI sites in the Indianapolis area. Students will also work as a team with the instructors on a course project to develop and evaluate advanced MR QA methods and procedures. Prerequisites: HSCI 57000. Having documented experience in running an MRI scanner, e.g., having primary operator status on one of the research scanners at Purdue or IU. Level II MRI Safety Training: http://www.indiana.edu/~mri/safety_nonIU/safety.html. Permission of instructor required.

Learning Outcomes: 1. Understand the basic elements and clinical rationale in the QA program for MRI scanners. 2. Understand the significance of frequency and transmitter gain stability, geometric accuracy, slice position accuracy, high contrast resolution, low contrast detectability and artifacts, etc. 3. Understand the requirements for weekly and annual QA tests as required by ACR. Credits: 3.00

HSCI 67400 - Radiological Diagnostic Imaging Internship

Credit Hours: 3.00. This internship course provides the student with hands-on experience with clinical imaging equipment, lectures on the fundamental operation of the equipment, and quality assurance/control methods/assessment of this

equipment. Students will learn the safety and imaging performance of flat panel digital x-ray system, fluoroscopy, CT scanner, Ultrasound system, and MRI scanner. Lectures will provide fundamental physics and operation of each system, perform quality assurance methods employed by board certified Medical Physics, and subsequent analysis of these methods. This course is to be delivered as a 50-minute lecture, a 150-minute lab, which includes additional time for image analysis (computational lab). The goal of this course is to provide the necessary information as part of CAMPEP/ABR and ACVR. Prerequisite: HSCI 570 Introduction to Medical Imaging.

Learning Outcomes: 1. Communicate results to the faculty in charge, both verbally and in writing through their lab report. 2. Develop procedures that will provide the required measurement. The protocol they implement will require careful consideration and have a physical understanding of the result. 3. Understanding the quality of the measurements and potential procedural errors. 4. Synthesize many forms of information to understand image artifacts, characterize the cause of these artifacts, and a means to remediate them. 5. Resolve problems, requiring research and ultimately improvements in procedure or protocol. Credits: 3.00

Statistics Selective (3 credits)

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and

implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

Electives (12-xx credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological

basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 30500 - Basics Of Oncology

Credit Hours: 3.00. This course will introduce the student to the biology of cancer and some basics of oncology. Focus will be placed on what makes cancer different from normal tissues and how those differences can be leveraged for diagnostic and treatment purposes. This course will touch on topics of epidemiology, cancer biology, common therapeutic and diagnostic approaches, and other considerations of cancer care.

Learning Outcomes: 1. Identify the major risk factors of cancer. 2. Understand the difference between cancer and normal tissue. 3. Enumerate the major hallmarks of cancer. 4. Explain the link between cancer biology and diagnostic imaging. 5. Describe how cancer therapies target the hallmarks of cancer. Credits: 3.00

HSCI 51600 - Molecular Imaging-Nuclear Medicine

Credit Hours: 2.00. This course is related to molecular imaging by SPECT (single-photon emission computed tomography) and/or PET (positron emission tomography). This course is particularly useful for graduate and senior undergraduate students in the medical physics programs. It has been offered to MP and HP graduate students over the last 4 years (2014 - 2018) as a part of the 3-credit molecular imaging course with magnetic resonance spectroscopy (MRS: 1-credit) taught by Dr. Ulrike Dydak, computed tomography (CT: 1-credit) taught by Dr. Keith Stantz, and nuclear medicine (NM: 1-credit) taught by Dr. Shuang Liu. In the future, it will be expanded the "Nuclear Medicine" section as a 2-credit course on the basis on the previous lectures. This course focuses on recent development in nuclear medicine techniques for noninvasive imaging of brain diseases, cancer, and heart diseases. This course is delivered as 50-min lectures twice a week. Students are expected to spend more time for homework and literature reading.

Learning Outcomes: 1. Understand the basic concept of molecular imaging, techniques for isotope production, and the use of radiolabeled biomolecules (e.g. antibodies and small biomolecules) for diagnosis of brain diseases, cancer and heart diseases, and for target-specific radiotherapy with the receptor-based radiotracers. Credits: 2.00

BME 51500 - Practical MRI And Applications

Credit Hours: 1.00. This course covers basic theory and practical training for magnetic resonance imaging (MRI). Weekly labs allow students to directly train on an MRI system within the Purdue MRI Facility. Weekly lectures are provided on a broad range of applied and relevant topics, including image formation and contrast, pulse sequence basics, artifacts, advanced sequences, and safety. The course is ideally designed for students who want to make use of MRI to advance their research.

Learning Outcomes: 1. Describe the fundamentals of magnetic resonance imaging. 2. Understand safety concerns associated with operating an MRI system. 3. Demonstrate proficiency in the operation of one of the MRI systems on campus. Credits: 1.00

HSCI 54100 - Human Sectional Anatomy

Credit Hours: 2.00. This course connects anatomy and physiology with medical imaging. The primary focus is on

anatomic imaging methods such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) but includes Positron Emission Tomography (PET) and Ultrasound (US) images when applicable or are in common use as part of clinical care.

Learning Outcomes: 1. Identify and label the anatomy associated with the topical outline in diagnostic CT/MRI images. 2. Critique CT/MRI images for the presence or absence of anatomy and pathology to decide whether the image is appropriately positioned and diagnostic for radiological assessment. 3. Locate anatomical systems and possible pathology based on background knowledge of typical anatomical locations and identify normal course of system function for appropriate positioning, patient instructions, and CT/MRI imaging. Credits: 2.00

Dissertation Research (6-xx credits)

HSCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Industrial and Molecular Pharmaceutics, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (13 credits)

IMPH 58300 - Advanced Biopharmaceutics

Credit Hours: 3.00. A comprehensive course dealing with the interaction of biological and physicochemical considerations relating to drug effectiveness and dosage form design.

Credits: 3.00

IMPH 58000 - Physical Chemical Principles

Credit Hours: 3.00. Applications of physical chemical principles to pharmaceutical systems.

Credits: 3.00

IMPH 56200 - Introduction To Pharmaceutical Manufacturing Processes

Credit Hours: 4.00. A course intended to provide the student with basic understanding of both the theoretical and practical aspects of pharmaceutical manufacturing by combining a thorough classroom treatment of the underlying principles of each pharmaceutical unit operation with hands-on execution of these activities in the laboratory. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to effectively communicate their field of study. 2. Demonstrate ability to conduct research in an ethical and responsible manner. 3. Demonstrate ability to think critically, creatively, and solve problems in their field of study. 4. Demonstrate ability to identify and conduct original research, scholarship, and creative endeavors. Credits: 4.00

IMPH 57400 - Pharmaceutical Biotechnology

Credit Hours: 3.00. Pharmaceutical biotechnology is the array of scientific and engineering principles used to develop, manufacture, and regulate biologic drugs. Biologic drugs - also known as "biologics", "biopharmaceuticals", or "large molecule drugs" - are medicinal agents derived from living systems, in contrast to more conventional "small molecule drugs" produced by organic chemical synthesis. Since the approval of the first recombinant human insulin in 1982, biologics have grown from niche products to occupy a prominent place in the pharmaceutical armamentarium. Today, biologics provide innovative treatments for a host of previously intractable diseases, including cancers, autoimmune disorders, and diabetes. The global biologics market was more than $300 billion in 2019, accounting for 20-25% of all pharmaceutical sales. This course introduces students to pharmaceutical biotechnology. The five didactic sections of the course present: (i) the biotech drug market, (ii) cellular and molecular biology

foundations, (iii) formulation and stability of biotech drug products, (iv) analytical methods for quality assurance, and (v) manufacturing methods. In the sixth and final section of the course, students will present case studies on currently approved biotech drugs, integrating and applying what they've learned. The course is intended for beginning graduate students in the Departments of Industrial and Physical Pharmacy, Chemical Engineering, and Biomedical Engineering. The course may also be suitable for well-qualified upper-division undergraduates. Permission of department required.

Learning Outcomes: 1. Understand and be able to describe the current state of the biopharmaceutical industry, including major drug classes, top-selling biotech drugs, innovative biotech drugs under development, and leading pharma biotech companies. 2. Understand and be able to describe the fundamental cellular and molecular biology principles and interrelationships that undergird pharmaceutical biotechnology, including (e.g.) the roles of cells as protein factories, drug targets, and vehicles for gene delivery; the roles of viral vectors as drug delivery and cell transfection agents; the roles of proteins as drugs, drug targets, and products of mRNA vaccines. 3. Understand and be able to describe the mechanisms of chemical and physical degradation of peptide/protein and nucleotide therapeutics. Be able to suggest formulation strategies to control various types of degradation. 4. Understand and be able to describe various chromatographic and electrophoretic methods used to analyze biologics. Be familiar with other types of chemical and biophysical methods used for these drugs. 5. Understand and be able to describe the manufacturing methods used for different classes of biologics, with a more detailed understanding of the methods used for recombinant proteins. 6. Develop a detailed knowledge of one current biotech drug product, including methods of manufacturing, analytical methods for quality control and assurance, formulation approaches and any instabilities, indications, and current market. Credits: 3.00

Seminar Course (xx credits)

IMPH 69600 - Seminar In Industrial And Physical Pharmacy

Credit Hours: 0.00 or 1.00. Discussion of recent research developments in physical pharmacy, industrial pharmacy, and biopharmaceutics related to the physicochemical properties, availability, effectiveness, and safety of drugs and drug products. Topics are presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Research Areas (xx credits)

Delivery and Biopharmaceutics

Formulation

Manufacturing

Dissertation Research (xx credits)

Concentrations

Industrial and Molecular Pharmaceutics/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (13 credits)

IMPH 58300 - Advanced Biopharmaceutics

Credit Hours: 3.00. A comprehensive course dealing with the interaction of biological and physicochemical considerations

relating to drug effectiveness and dosage form design.

Credits: 3.00

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Credit Hours: 3.00. Applications of physical chemical principles to pharmaceutical systems.

Credits: 3.00

IMPH 56200 - Introduction To Pharmaceutical Manufacturing Processes

Credit Hours: 4.00. A course intended to provide the student with basic understanding of both the theoretical and practical aspects of pharmaceutical manufacturing by combining a thorough classroom treatment of the underlying principles of each pharmaceutical unit operation with hands-on execution of these activities in the laboratory. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to effectively communicate their field of study. 2. Demonstrate ability to conduct research in an ethical and responsible manner. 3. Demonstrate ability to think critically, creatively, and solve problems in their field of study. 4. Demonstrate ability to identify and conduct original research, scholarship, and creative endeavors. Credits: 4.00

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Learning Outcomes: 1. Understand and be able to describe the current state of the biopharmaceutical industry, including major drug classes, top-selling biotech drugs, innovative biotech drugs under development, and leading pharma biotech companies. 2. Understand and be able to describe the fundamental cellular and molecular biology principles and interrelationships that undergird pharmaceutical biotechnology, including (e.g.) the roles of cells as protein factories, drug targets, and vehicles for gene delivery; the roles of viral vectors as drug delivery and cell transfection agents; the roles of proteins as drugs, drug targets, and products of mRNA vaccines. 3. Understand and be able to describe the mechanisms of chemical and physical degradation of peptide/protein and nucleotide therapeutics. Be able to suggest formulation strategies to control various types of degradation. 4. Understand and be able to describe various chromatographic and electrophoretic methods used to analyze biologics. Be familiar with other types of chemical and biophysical methods used for these drugs. 5. Understand and be able to describe the manufacturing methods used for different classes of biologics, with a more detailed understanding of the methods used for recombinant proteins. 6. Develop a detailed knowledge of one current biotech drug product, including methods of manufacturing, analytical methods for quality control and assurance, formulation approaches and any instabilities, indications, and current market. Credits: 3.00

Seminar Course (xx credits)

IMPH 69600 - Seminar In Industrial And Physical Pharmacy

Credit Hours: 0.00 or 1.00. Discussion of recent research developments in physical pharmacy, industrial pharmacy, and biopharmaceutics related to the physicochemical properties, availability, effectiveness, and safety of drugs and drug products. Topics are presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Research Areas (xx credits)

Delivery and Biopharmaceutics

Formulation

Manufacturing

Dissertation Research (xx credits)

Industrial Engineering, PHD

About the Program

Program Requirements

Required Courses (24-45 credits)*

Core Courses (12-18 credits)*

IE 53500 - Linear Programming

Credit Hours: 3.00. Optimization of linear objective functions subject to linear constraints. Development of theory and algorithmic strategies for solving linear programming problems.

Credits: 3.00

IE 53600 - Stochastic Models In Operations Research I

Credit Hours: 3.00. An introduction to techniques for modeling random processes used in operations research. Markov chains, continuous time Markov processes, Markovian queues, reliability and inventory models.

Credits: 3.00

IE 53700 - Discrete Optimization Models And Algorithms

Credit Hours: 3.00. An introduction to classic models and algorithms for discrete optimization. Basic theory and computational strategies for exact and heuristic solution of integer, combinational, and network problems in the context of classic models.

Credits: 3.00

IE 53800 - Nonlinear Optimization Algorithms And Models

Credit Hours: 3.00. Survey of computational tools for solving constrained and unconstrained nonlinear optimization problems. Emphasis on algorithmic strategies and characteristic structures of nonlinear problems.

Credits: 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

IE 55600 - Job Design

Credit Hours: 3.00. (PSY 55600) Task analysis, personnel selection and training, job and organization design, and criteria development and use. Human factors related to job design in order to increase job satisfaction and productivity.

Credits: 3.00

IE 55800 - Safety Engineering

Credit Hours: 3.00. Application of human factors and engineering practice in accident prevention and the reduction of health hazards are presented. The objective of this course is to provide an understanding of the safety and health practices which fall within the responsibilities of the engineer in industry. Special attention is devoted to the detection and correction of hazards and to contemporary laws and enforcement on occupational safety and health.

Credits: 3.00

IE 55900 - Cognitive Engineering Of Interactive Software

Credit Hours: 3.00. Theory and applications of software design to improve productivity and job satisfaction on information processing and cognitive tasks in the workplace. Human information processing models and cognitive theories will be used to provide a theoretical basis for how to choose and display information to the user. Other topics include user-friendly displays and empirical approaches to software design. Applications of the design theory are stressed by class projects.

Credits: 3.00

IE 56600 - Production Management Control

Credit Hours: 3.00. Background and development of production management, plus current concepts and controls applicable to production management functions. Not open to Industrial Engineering students with a minor in management.

Credits: 3.00

IE 57000 - Manufacturing Process Engineering

Credit Hours: 3.00. Theories and applications of materials forming and removal processes in manufacturing, including product properties, process capabilities, processing equipment design, and economics. A systems approach to all aspects of manufacturing process engineering.

Credits: 3.00

IE 57900 - Design And Control Of Production And Manufacturing Systems

Credit Hours: 3.00. Design and control of discrete part manufacturing systems in contemporary production environments, with emphasis on flexible, demand-driven, product-based manufacturing. Currently used planning and control methodologies, such as MRP, OPT, and JIT are reviewed and integrated with appropriate facility design methodologies, including cellular design algorithms. Introduction to Computer Integrated Manufacturing (CIM) architecture and reference models and relevant control procedures, including basis approaches to appropriate data management methodologies.

Credits: 3.00

IE 58000 - Systems Simulation

Credit Hours: 3.00. Philosophy and elements of digital simulation language. Practical application of simulation to diverse systems. Computer simulation exercises and applications are required.

Credits: 3.00

IE 58100 - Simulation Design And Analysis

Credit Hours: 3.00. An introduction to simulation of stochastic systems on digital computers. Emphasis is on the fundamentals of simulation as a statistical experiment. Topics include uniform random numbers, input modeling, random variate generation, output analysis, variance reduction, and optimization.

Credits: 3.00

IE 58800 - e-Work And e-Service

Credit Hours: 3.00. e-Work is defined as the collaborative, computer-and-communication-supported work in highly distributed organizations of humans/robots/autonomous systems. This course is devoted to learning the basic principles, theories, and applications for the design of effective e-Work and e-Service systems. Relevant discoveries at Purdue and elsewhere are also presented.

Learning Outcomes: 1. Understand fully the theory and design principles of collaborative e-Work and e-Service systems. 2. Model correctly workflow, protocols and agents for e-Work and e-Service systems. 3. Design, specify, evaluate and optimize e-Work and e-Service applications correctly. 4. Discuss benefits, limitations, and emerging trends of e-Work and e-Service systems critically and correctly. Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

IE 57800 - Applied Ergonomics

Credit Hours: 3.00. Analysis, modeling, and design of jobs and systems to be consistent with human factors and ergonomic principles.

Learning Outcomes: 1. Analyze and design work to fit human anthropometric requirements.

2. Analyze and design work to meet human physiological limitations, including lifting tasks. 3. Conduct time studies and use predetermined time system modeling. 4. Perform task analysis and process mapping. 5. Analyze and design work to meet human cognitive limitations. 6. Determine function allocation between automation and human tasks. 7. Model basic human performance at movement, detection, and control tasks. 8. Identify common human errors and perform human reliability analysis. 9. Design displays that meet basic human-computer interaction principles. 10. Write technical reports describing the results of human factors analysis. 11. Present technical material describing the results of human factors analysis. Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

Advanced IE Electives (6-21 credits)

Electives (6-21 credits)

Dissertation Research (36-45 credits)

IE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Concentrations

GPA Requirements

Industrial-Organizational Psychology, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (6 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and

critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and

within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Seminar Course (xx credits)

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Industrial-Organizational Psychology Seminar (6 credits)

Industrial-Organizational Psychology Courses (12 credits)

PSY 68010 - Survey Of Industrial Psychology

Credit Hours: 3.00. This seminar is designed to familiarize doctoral students with the basic areas of Industrial Psychology and Human Resource Management. The course will include a discussion and analysis of book chapters and journal articles related to key topics. The goal of this seminar is to help students develop frameworks for organizing the myriad conceptual, professional, and technical issues associated with Industrial Psychology / Human Resource Management. Development of these frameworks is requisite for effective acquisition and integration of information provided in future seminars and development of research ideas. Permission of department required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Organizational Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3. Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Organizational Psychology. Credits: 3.00

PSY 68020 - Survey Of Organizational Psychology

Credit Hours: 3.00. The main objective of this course is to introduce doctoral students in the Industrial and Organizational Psychology program (and related disciplines) to the major areas of research in the field of organizational psychology. Additionally, the course aims to provide students an opportunity to: (1) hone their analytic and information presentation skills, and (2) gain practice in developing research ideas. We will discuss classical and contemporary issues in light of both their theoretical and practical implications for the field. The course will include presentations and (synchronous and asynchronous) discussions of assigned readings. Permission of department required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Industrial Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3. Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Industrial Psychology. Credits: 3.00

PSY 68120 - Research Methods In Industrial-Organizational Psychology II

Credit Hours: 3.00. This course is the second part of a two-semester sequence that covers core research methods in the social sciences focusing on Industrial/Organizational psychology, Organizational Behavior, and allied fields of Social and Personality psychology. This course sequence is designed for doctoral students who intend to conduct quantitative empirical research publishable in scholarly journals. This course begins with the philosophy of science, developing and evaluating theory, reviewing and summarizing relevant research. Topics include the examination of research methods applicable to survey data, multilevel data, and longitudinal data. The course concludes with a discussion of 'methods'

(strategies) for publishing in scholarly journals. Permission from department required. Prerequisites: PSY 68110, Research Methods in Industrial-Organizational Psychology I (or equivalent) and Basic Statistics.

Learning Outcomes: 1. Articulate the importance of research methods for science. Method of evaluation: class discussions. 2. Develop and apply research methods to their research, including designing of studies that employ a particular method. Method of evaluation: written research proposal. 3. Identify the strengths/weaknesses of each method. Method of evaluation: weekly reading summaries. 4. Explain empirical research findings to scholars in their field. Method of evaluation: research presentation. 5. Evaluate research methods used in empirical studies. Method of evaluation: class discussions.
Credits: 3.00

PSY 68110 - Research Methods In Industrial-Organizational Psychology I

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings. This course is the first part of a two-semester sequence which covers issues in research design and data analysis techniques common to I-O psychology and other applied fields. We will review the overall research process and various types of research. We will review the various threats to the validity of conclusions that can be drawn from quantitative research and how design features can help address these threats. We will spend time in class critiquing research articles. Permission of department required.

Learning Outcomes: 1. Evaluate the conceptual and methodological strengths and limitations of quantitative research in psychology. 2. Write a research proposal that effectively integrates best practices in quantitative research (e.g., scientific contribution, measurement, reliability, validity, open science). 3. Critically evaluate the rigor and reproducibility of quantitative research in psychology. 4. Run and interpret basic descriptive statistics, correlations, and linear regression models using R. Credits: 3.00

Dissertation Research (xx credits)

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (9 credits)

GPA Requirements

Additional Information

Information Security, PHD

About the Program

Program Requirements

Required Courses (60 credits)

Area A Courses (24 credits)

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Acquire a thorough

understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

Area B Courses (18 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

PHIL 49000 - Advanced Topics In Philosophy

Credit Hours: 1.00 to 3.00. An advanced study of a significant topic in philosophy.

Learning Outcomes: 1. Demonstrate familiarity with several advanced problems of philosophy. 2. Develop the ability to present, explain, defend and critically evaluate advanced philosophical ideas, theories, and perspectives, in oral and written communication. 3. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 4. Develop critical thinking and writing skills. Credits: 1.00 to 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

CNIT 42100 - Mobile Forensics

Credit Hours: 3.00. This course will help students understand the issues, techniques, and vulnerabilities of small scale digital device forensics. Emphasis will be placed on the forensically sound acquisition, preservation, analysis and presentation of small scale digital devices as evidence. Specific investigations will cover devices such as Personal Digital Assistants (PDA's), Cell Phones, and Smart Phones.

Learning Outcomes: 1. Identify various mobile devices. 2. Compare the characteristics of mobile devices. 3. Distinguish potential evidence found on mobile devices and ubiquitous systems. 4. Inspect forensically sound evidence from mobile devices and ubiquitous systems. 5. Produce a report for a courtroom presentation. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3.

Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 49900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Possible individual study under directed leadership of professor. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

AGEC 69100 - Topical Research In Agricultural Economics

Credit Hours: 1.00 to 6.00. Topics of interest to the student. Designed to give training in research. Credit dependent upon amount of work done. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for specialized topic areas in agricultural systems management for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland

security principles. Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science. Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

CNIT 55800 - Bioinformatics Computing And Systems Integration

Credit Hours: 3.00. This is a graduate-level course for students interested in the application of computational methods and information technology in the pharmaceutical, biotechnology, and life sciences arena. An overall understanding of information technology and systems is assumed, as well as an in-depth knowledge of one or more areas of information technology. Permission of instructor required.

Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 69000 - Seminar On Topics In Computer Sciences

Credit Hours: 0.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 5.00

CSR 63100 - Consumer Behavior Theories

Credit Hours: 3.00. An examination of research methods, principles, and theories of social science as they apply to the study of consumer behavior and marketing sciences. Prerequisite: STAT 50100 , STAT 50200 , or PSY 60000 , PSY 60100 .

Credits: 3.00

ECON 61000 - Advanced Game Theory

Credit Hours: 1.00 to 3.00. An advanced course in game theory and its applications. Among the topics covered are: extensive form games, normal form games, Nash equilibrium, mixed strategies equilibrium, subgame perfect equilibrium, learning and equilibrium, games with incomplete information, repeated games, cooperative games, noncooperative bargaining, and auctions. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of game theory and strategic thinking, including concepts such as dominance, backward induction, equilibrium, commitment, extensive form games, and asymmetric information. 2. Understand the perspective provided by game theory for a variety of games played in economic and political settings. 3. Identify insights game theory provides in translating an informal description of a multi-person decision situation into a formal game-theoretic problem. Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the

continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

ENGL 62800 - Natural Language Processing

Credit Hours: 3.00. (ECE 66900) This course focuses on keyword-driven question answering systems; transition networks; parsing procedures for context-free grammars; theory of transformational grammars; implementation of recursive transition networks; implementation of augmented transition networks; representation of conceptual dependencies; surface semantic conceptual analysis; conceptual dependency parsing; generating natural language from a conceptual base; scripts, plans, and goals; building conversationalist programs. Prerequisite: ENGL 50600 or ECE 57000 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

PSY 57700 - Human Factors In Engineering

Credit Hours: 3.00. (IE 57700) Survey of human factors in engineering, with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments. Primarily for engineers and other non-psychology majors.

Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A

quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 65900 - Human Aspects In Computing

Credit Hours: 3.00. Advanced topics in ergonomic, cognitive, and social aspects of using computerized systems are discussed with regard to comfort and user satisfaction, ease and productive use of computerized systems, and effective implementation of computerized technologies in the workplace. Prerequisite: IE 55900 .

Credits: 3.00

IE 67400 - Cyber Methods For Advanced Production Control

Credit Hours: 3.00. The study of the theoretical foundation and relevance of advanced cyber methods in the planning and control of intelligent production operations; manufacturing operating systems; synchronization in decentralized systems; recovery in decentralized systems; parallel processing; distributed databases; factory networks; reasoning and logic for production control. Prerequisite: IE 57400 or 57500 or 57900.

Learning Outcomes: 1. Know theoretical foundation and relevance of advanced cyber, real-time control, computing, communication, and brain models for robotics. 2. Know automation of planning and decisions in distributed production and supply installations, global supply, logistics, and service systems/networks. 3. Know the current and emerging functions, algorithms, protocols, and models and how to apply them to research projects and presentations in the field. Credits: 3.00

IT 54500 - Biometrics Technology And Applications

Credit Hours: 3.00. Examines biometrics technology as it relates to security, access control, and the authentication of individuals. The course will examine biometric technologies including iris, face, finger, hand geometry, dynamic signature verification, skin print analysis, and voice recognition. Permission of instructor required.

Credits: 3.00

IT 54000 - Biometric Performance And Usability Analysis

Credit Hours: 3.00. An introduction of test methodologies from disciplines outside of biometrics, which include: usability, ergonomics, human factors, and human-computer interaction, in order to demonstrate how biometric data analysis can benefit from understanding how humans interact with biometric sensors during the testing and evaluation of biometric systems. The course explores test methods, case studies, and prior biometric testing reports in order to develop a test methodology that includes information on how users interact with biometric systems. Permission of department required.

Learning Outcomes: 1. Understand the operation of biometric systems. 2. Understand how people use biometric systems in operational settings (both controlled and uncontrolled). 3. Understand traditional technology, scenario, and operational testing methodologies. 4. Understand traditional ergonomic and usability testing methodologies. 5. Understand and analyze the limitations of biometric systems. 6. Understand basics of quantitative and qualitative research. 7. Evaluate the issues in designing a biometric system, including but not limited to: the impact

of language and culture (instructions and symbols), ergonomics and anthropometrics (heights-angles, positioning), training and habituation or accessibility, affordance, and perception. 8. Interpret results from reports on: biometric technologies evaluation methods, ergonomic and usability methods, and statistical methods. 9. Appraise and critically evaluate prior scenario and operational test reports and case studies of biometric technologies to examine where the application of Human-Biometric Sensor Interaction principles, such as usability, human factors, and ergonomics could have provided additional data on system performance. 10. Transfer knowledge and understanding of usability, ergonomic, and usability evaluation methodologies to the testing and evaluate biometric devices and systems. 11. Establish a test methodology and collect data using a Human-Biometric Sensor Interaction based methodology (usability, ergonomic, human factors) to investigate a current problem facing industry. 12. Perform the appropriate data analysis and report findings in a report. 13. Students will produce final reports, conference papers, etc., based on their course project. Credits: 3.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 54700 - Computer Communications Systems

Credit Hours: 3.00. Explores the convergence of telecommunications and computer technology, framed in terms of their strategic impact in the business environment. Components of computer communication systems are surveyed. Major design and analysis issues in the development, implementation, and management of computer communication systems are examined. Relevant emerging trends are highlighted. The course is devoted to technical issues, applications, and case studies covering telecommunication systems used in business.

Learning Outcomes: 1. Learn the infrastructure of telecommunication systems. 2. Learn how telecommunications systems work. 3. Learn applications of telecommunication systems. 4. Learn how to create strategic advantage by using telecommunication systems. Credits: 3.00

OBHR 68300 - Individual Behavior In Organizations

Credit Hours: 1.00 to 3.00. This seminar provides an analysis of theory and research on individual and group behavior in organizations. Readings and discussion focus on motivation, attitudes and job satisfaction, employee participation and turnover, stress, leadership, group processes, and other issues.

Learning Outcomes: 1. Identify and define organizational behavior concepts. 2. Apply those concepts to improve your understanding of your own work attitudes and behaviors. 3. Apply those concepts to improve the functioning of your organizational unit. Credits: 1.00 to 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software

systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3.

Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who

wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Area C Courses (12 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

COM 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 3.00. Directed study of special problems. Permission of instructor required.

Credits: 1.00 to 3.00

COM 60000 - Foundations Of Human Communication Inquiry I

Credit Hours: 3.00. Introduces doctoral students to major and emerging approaches to understanding human communication and provides them with the theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims.

Credits: 3.00

COM 60100 - Foundations Of Human Communication Inquiry II

Credit Hours: 3.00. Following COM 60000 , this course continues to introduce doctoral students to major and emerging approaches to understanding human communication and provides theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims. Prerequisite: COM 60000 .

Credits: 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the

implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

POL 62200 - Research Seminar In Public Policy And Public Administration

Credit Hours: 3.00. Investigation in depth of a substantive aspect of public policy such as energy policy or social policy, or of a theoretical topic, for example, policy formulation, enactment, implementation, impact, or evaluation. Permission of instructor required.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECET 58100 - Workshop In Electrical And Computer Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering.

Credits: 0.00 to 8.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies

and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 60100 - Managerial Accounting

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (North Central). Oriented to managers, the course examines the firm's internal systems for costing products or services and their interpretation. A variety of manufacturing and service industries are studies to demonstrate design of flexible cost systems to match the firm's technological, competitive and/or multinational environments. Applications to budgeting, variance analysis, pricing models, performance evaluation and incentives are demonstrated. Case discussion and analytical "what if" modes of instruction are used to enhance managerial skills of students. Design and use of accounting data are linked to other subjects in the program core and to ethical aspects of accounting policy issues. Prerequisite: MGMT 60000 .

Learning Outcomes: 1. Master basic service and product costing methods. 2. Develop analytic skills to help businesses use the different types of costing information to make better business decisions and to formulate better business models. 3. To understand and

analyze the variety and the use of accounting performance evaluation methods and the role of incentives in a business environment. Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 54500 - Systems Development

Credit Hours: 3.00. Focuses on information systems development theories, practices, and tools for rapid adaptation and management of leading-edge as well as emerging computing paradigms. MGMT 54400 Database Management is highly recommended. Permission of department required.

Learning Outcomes: 1. Define the essential processes involved in information systems development. 2. Analyze and represent business processes. 3. Develop and validate systems models and design specifications for an information system application. 4. Understand database concepts and design relational databases based on data models. 5. Effectively use and maintain databases through hands-on experience with Structured Query Language (SQL). 6. Work effectively on a team to successfully complete team projects. 7. Proficiently use various tools used in systems analysis and design. Credits: 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3.

Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

Area A Courses (24 credits)

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems,

including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

Thesis Research (30 credits)

Required Courses (60 credits)

Area A Courses (24 credits)

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant

issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their

application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

Area B Courses (18 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

PHIL 49000 - Advanced Topics In Philosophy

Credit Hours: 1.00 to 3.00. An advanced study of a significant topic in philosophy.

Learning Outcomes: 1. Demonstrate familiarity with several advanced problems of philosophy. 2. Develop the ability to present, explain, defend and critically evaluate advanced philosophical ideas, theories, and perspectives, in oral and written communication. 3. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 4. Develop critical thinking and writing skills. Credits: 1.00 to 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

CNIT 42100 - Mobile Forensics

Credit Hours: 3.00. This course will help students understand the issues, techniques, and vulnerabilities of small scale digital device forensics. Emphasis will be placed on the forensically sound acquisition, preservation, analysis and presentation of small scale digital devices as evidence. Specific investigations will cover devices such as Personal Digital Assistants (PDA's), Cell Phones, and Smart Phones.

Learning Outcomes: 1. Identify various mobile devices. 2. Compare the characteristics of mobile devices. 3. Distinguish potential evidence found on mobile devices and ubiquitous systems. 4. Inspect forensically sound evidence from mobile devices and ubiquitous systems. 5. Produce a report for a courtroom presentation. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data

networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 49900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Possible individual study under directed leadership of professor. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

AGEC 69100 - Topical Research In Agricultural Economics

Credit Hours: 1.00 to 6.00. Topics of interest to the student. Designed to give training in research. Credit dependent upon amount of work done. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for specialized topic areas in agricultural systems management for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team

building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science. Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

CNIT 55800 - Bioinformatics Computing And Systems Integration

Credit Hours: 3.00. This is a graduate-level course for students interested in the application of computational methods and information technology in the pharmaceutical, biotechnology, and life sciences arena. An overall understanding of information technology and systems is assumed, as well as an in-depth knowledge of one or more areas of information technology. Permission of instructor required.

Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as

examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 69000 - Seminar On Topics In Computer Sciences

Credit Hours: 0.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 5.00

CSR 63100 - Consumer Behavior Theories

Credit Hours: 3.00. An examination of research methods, principles, and theories of social science as they apply to the study of consumer behavior and marketing sciences. Prerequisite: STAT 50100 , STAT 50200 , or PSY 60000 , PSY 60100 .

Credits: 3.00

ECON 61000 - Advanced Game Theory

Credit Hours: 1.00 to 3.00. An advanced course in game theory and its applications. Among the topics covered are: extensive form games, normal form games, Nash equilibrium, mixed strategies equilibrium, subgame perfect equilibrium, learning and equilibrium, games with incomplete information, repeated games, cooperative games, noncooperative bargaining, and auctions. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of game theory and strategic thinking, including concepts such as dominance, backward induction, equilibrium, commitment, extensive form games, and asymmetric information. 2. Understand the perspective provided by game theory for a variety of games played in economic and political settings. 3. Identify insights game

theory provides in translating an informal description of a multi-person decision situation into a formal game-theoretic problem. Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

ENGL 62800 - Natural Language Processing

Credit Hours: 3.00. (ECE 66900) This course focuses on keyword-driven question answering systems; transition networks; parsing procedures for context-free grammars; theory of transformational grammars; implementation of recursive transition networks; implementation of augmented transition networks; representation of conceptual dependencies; surface semantic conceptual analysis; conceptual dependency parsing; generating natural language from a conceptual base; scripts, plans, and goals; building conversationalist programs. Prerequisite: ENGL 50600 or ECE 57000 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

PSY 57700 - Human Factors In Engineering

Credit Hours: 3.00. (IE 57700) Survey of human factors in engineering, with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments. Primarily for engineers and other non-psychology majors.

Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 65900 - Human Aspects In Computing

Credit Hours: 3.00. Advanced topics in ergonomic, cognitive, and social aspects of using computerized systems are discussed with regard to comfort and user satisfaction, ease and productive use of computerized systems, and effective implementation of computerized technologies in the workplace. Prerequisite: IE 55900 .

Credits: 3.00

IE 67400 - Cyber Methods For Advanced Production Control

Credit Hours: 3.00. The study of the theoretical foundation and relevance of advanced cyber methods in the planning and control of intelligent production operations; manufacturing operating systems; synchronization in decentralized systems; recovery in decentralized systems; parallel processing; distributed databases; factory networks; reasoning and logic for production control. Prerequisite: IE 57400 or 57500 or 57900.

Learning Outcomes: 1. Know theoretical foundation and relevance of advanced cyber, real-time control, computing, communication, and brain models for robotics. 2. Know automation of planning and decisions in distributed production and supply installations, global supply, logistics, and service systems/networks. 3. Know the current and emerging functions, algorithms, protocols, and models and how to apply them to research projects and presentations in the field. Credits: 3.00

IT 54500 - Biometrics Technology And Applications

Credit Hours: 3.00. Examines biometrics technology as it relates to security, access control, and the authentication of individuals. The course will examine biometric technologies including iris, face, finger, hand geometry, dynamic signature verification, skin print analysis, and voice recognition. Permission of instructor required.

Credits: 3.00

IT 54000 - Biometric Performance And Usability Analysis

Credit Hours: 3.00. An introduction of test methodologies from disciplines outside of biometrics, which include: usability, ergonomics, human factors, and human-computer interaction, in order to demonstrate how biometric data analysis can benefit from understanding how humans interact with biometric sensors during the testing and evaluation of biometric systems. The course explores test methods, case studies, and prior biometric testing reports in order to develop a test methodology that includes information on how users interact with biometric systems. Permission of department required.

Learning Outcomes: 1. Understand the operation of biometric systems. 2. Understand how people use biometric systems in operational settings (both controlled and uncontrolled). 3. Understand traditional

technology, scenario, and operational testing methodologies. 4. Understand traditional ergonomic and usability testing methodologies. 5. Understand and analyze the limitations of biometric systems. 6. Understand basics of quantitative and qualitative research. 7. Evaluate the issues in designing a biometric system, including but not limited to: the impact of language and culture (instructions and symbols), ergonomics and anthropometrics (heights-angles, positioning), training and habituation or accessibility, affordance, and perception. 8. Interpret results from reports on: biometric technologies evaluation methods, ergonomic and usability methods, and statistical methods. 9. Appraise and critically evaluate prior scenario and operational test reports and case studies of biometric technologies to examine where the application of Human-Biometric Sensor Interaction principles, such as usability, human factors, and ergonomics could have provided additional data on system performance. 10. Transfer knowledge and understanding of usability, ergonomic, and usability evaluation methodologies to the testing and evaluate biometric devices and systems. 11. Establish a test methodology and collect data using a Human-Biometric Sensor Interaction based methodology (usability, ergonomic, human factors) to investigate a current problem facing industry. 12. Perform the appropriate data analysis and report findings in a report. 13. Students will produce final reports, conference papers, etc., based on their course project. Credits: 3.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 54700 - Computer Communications Systems

Credit Hours: 3.00. Explores the convergence of telecommunications and computer technology, framed in terms of their strategic impact in the business environment. Components of computer communication systems are surveyed. Major design and analysis issues in the development, implementation, and management of computer communication systems are examined. Relevant emerging trends are highlighted. The course is devoted to technical issues, applications, and case studies covering telecommunication systems used in business.

Learning Outcomes: 1. Learn the infrastructure of telecommunication systems. 2. Learn how telecommunications systems work. 3. Learn applications of telecommunication systems. 4. Learn how to create strategic advantage by using telecommunication systems. Credits: 3.00

OBHR 68300 - Individual Behavior In Organizations

Credit Hours: 1.00 to 3.00. This seminar provides an analysis of theory and research on individual and group behavior in organizations. Readings and discussion focus on motivation, attitudes and job satisfaction, employee participation and

turnover, stress, leadership, group processes, and other issues.

Learning Outcomes: 1. Identify and define organizational behavior concepts. 2. Apply those concepts to improve your understanding of your own work attitudes and behaviors. 3. Apply those concepts to improve the functioning of your organizational unit. Credits: 1.00 to 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most

common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear

algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Area C Courses (12 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

COM 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 3.00. Directed study of special problems. Permission of instructor required.

Credits: 1.00 to 3.00

COM 60000 - Foundations Of Human Communication Inquiry I

Credit Hours: 3.00. Introduces doctoral students to major and emerging approaches to understanding human communication and provides them with the theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims.

Credits: 3.00

COM 60100 - Foundations Of Human Communication Inquiry II

Credit Hours: 3.00. Following COM 60000 , this course continues to introduce doctoral students to major and emerging approaches to understanding human communication and provides theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims. Prerequisite: COM 60000 .

Credits: 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic

coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

POL 62200 - Research Seminar In Public Policy And Public Administration

Credit Hours: 3.00. Investigation in depth of a substantive aspect of public policy such as energy policy or social policy, or of a theoretical topic, for example, policy formulation, enactment, implementation, impact, or evaluation. Permission of instructor required.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECET 58100 - Workshop In Electrical And Computer Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering.

Credits: 0.00 to 8.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial,

truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 60100 - Managerial Accounting

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (North Central). Oriented to managers, the course examines the firm's internal systems for costing products or services and their interpretation. A variety of manufacturing and service industries are studies to demonstrate design of flexible cost systems to match the firm's technological, competitive and/or multinational environments. Applications to budgeting, variance analysis, pricing models, performance evaluation and incentives are demonstrated. Case discussion and analytical "what if" modes of instruction are used to enhance managerial skills of students. Design and use of accounting data are linked to other subjects

in the program core and to ethical aspects of accounting policy issues. Prerequisite: MGMT 60000 .

Learning Outcomes: 1. Master basic service and product costing methods. 2. Develop analytic skills to help businesses use the different types of costing information to make better business decisions and to formulate better business models. 3. To understand and analyze the variety and the use of accounting performance evaluation methods and the role of incentives in a business environment. Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 54500 - Systems Development

Credit Hours: 3.00. Focuses on information systems development theories, practices, and tools for rapid adaptation and management of leading-edge as well as emerging computing paradigms. MGMT 54400 Database Management is highly recommended. Permission of department required.

Learning Outcomes: 1. Define the essential processes involved in information systems development. 2. Analyze and represent business processes. 3. Develop and validate systems models and design specifications for an information system application. 4. Understand database concepts and design relational databases based on data models. 5. Effectively use and maintain databases through hands-on experience with Structured Query Language (SQL). 6. Work effectively on a team to successfully complete team projects. 7. Proficiently use various tools used in systems analysis and design. Credits: 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining

and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

Area A Courses (24 credits)

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation

and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

Additional Requirements

GPA Requirements

About the Program

Additional Information

Interdisciplinary Biomedical Sciences, PHD

About the Program

Program Requirements

Required Courses (31 credits)

Science Courses (12 credits)

IMPH 58300 - Advanced Biopharmaceutics

Credit Hours: 3.00. A comprehensive course dealing with the interaction of biological and physicochemical considerations relating to drug effectiveness and dosage form design.

Credits: 3.00

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

BMS 60200 - Special Topics In Basic Medical Sciences

Credit Hours: 0.50 to 8.00. Advanced studies of organismic, cellular, and molecular processes in the basic medical sciences of man and domestic animals. Permission of instructor required.

Credits: 0.50 to 8.00

ABE 69100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for advanced specialized topic areas in agricultural and biological engineering for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis

on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong

focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BIOL 64700 - Membrane Protein Structural Biology

Credit Hours: 2.00. This course focuses on the structural basis of the functions and dysfunctions of diverse membrane proteins, analyzed by X-ray, electron microscopy, and spectroscopy. The functions include transport, biogenesis, and transmembrane signaling. Unique problems associated with the structure analysis of integral membrane proteins are discussed.

Credits: 2.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

CHM 53800 - Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 63800 - Biophysical Chemistry

Credit Hours: 3.00. Applications of the principles and methods of physical chemistry in biochemistry with emphasis on the behavior of macromolecules in solution. Protein engineering. Offered in alternate years. Prerequisite: CHM 57800, CHM 63400 .

Credits: 3.00

CHM 64800 - Bioinorganic Chemistry

Credit Hours: 3.00. Provides a detailed perspective on the roles of metals in biology. Emphasis is placed upon principles guiding the field. The basics of biochemistry and inorganic chemistry are provided such that students from diverse backgrounds may participate. Readings are from the research literature. Offered in alternate years.

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 65200 - Synthetic Organic Chemistry

Credit Hours: 3.00. An advanced treatment of methods for preparing major types of organic functionalities and bonds, stressing stereochemical control and involving mechanisms for understanding the reactions employed. Prerequisite: CHM 65100 .

Credits: 3.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of current interest.

Credits: 1.00 to 3.00

HK 59000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for graduate

students. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes vary due to special topics nature of course. Credits: 1.00 to 3.00

NUTR 59000 - Special Problems In Nutrition

Credit Hours: 1.00 to 4.00. Individual problems dealing with various aspects of nutrition. Permission of instructor required.

Credits: 1.00 to 4.00

PSY 60300 - Psychopharmacology

Credit Hours: 3.00. This course will cover core pharmacology concepts and principles, such as neurotransmitters, receptors, drug classes, and mechanisms of drug action, while highlighting recent findings related to pharmacogenetics and sex/gender differences in psychopharmacology. There will also be a primary focus on drug therapy for major psychiatric disorders including addiction, depression, anxiety and schizophrenia. Prerequisites: (BIOL 56200 and PSY 51200) or PSY 61500 or MCMP 57000.

Learning Outcomes: 1. Acquire knowledge about the primary biological systems through which drugs act to produce changes in behavior. 2. Learn basic principles of pharmacokinetics and pharmacodynamics. 3. Learn the primary signs/symptoms of major mental disorders and how these disorders are classified with the DSM. 4. Discuss and differentiate the primary methods currently used to treat mental disorders. 5. Critically evaluate the strengths and weaknesses of primary research papers in psychopharmacology. 6. Explain the use of animal models in psychopharmacology. 7. Explain and discuss the methods used in the "drug discovery pipeline", from target identification to FDA approval and beyond and model the application of new drugs through this pipeline.. 8. Communicate proficient knowledge about a single psychiatric disorder and its pharmacological treatment through oral presentation and writing (white-paper style). Credits: 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 56100 - Medical Audiology

Credit Hours: 3.00. Study of the etiology, pathogenesis, symptomology, epidemiology, diagnosis and treatment of diseases, and injuries to the auditory system.

Learning Outcomes: 1. Apply knowledge about the development of human anatomical and physiological systems generally to the development of the auditory system and ear specifically in order to describe relationships between pathologies across systems. 2. Evaluate the effects on auditory function caused by environmental and hereditary factors that are related to systemic disease. 3. Differentiate between genetic and non-genetic disorders that are related to congenital and delayed-onset hearing loss. Apply this knowledge to cattegorize disorders that are unique to children, unique to adults, and common to all ages. 4. Justify the importance of Early Hearing Loss Detection and Intervention (EHDI) programs using knowledge about risk indicators, adverse consequences of hearing loss, and the benefits of early detection. Credits: 3.00

BME 55100 - Tissue Engineering

Credit Hours: 3.00. (BMS 52300) Integrates the principles and methods of engineering and life sciences toward the fundamental understanding of structure-function relationships in normal and pathological mammalian tissues, especially as they relate to the development of biological substitutes to restore, maintain, or improve tissue/organ function. Current concepts and strategies, including drug delivery, tissue and cell transplantation, bioartificial organs, and in vivo tissue

regeneration are introduced, as well as their respective clinical applications. Permission of instructor required.

Credits: 3.00

BME 59500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 69500 - Advanced Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of an advanced course. Permission of instructor required.

Credits: 1.00 to 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies.
Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

BMS 53400 - Systemic Mammalian Physiology

Credit Hours: 4.00. This course is a 4 credit hour course that provides fundamental concepts of mammalian physiology in nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems. The major physiological functions of these systems will be explained at the organ as well as the cellular level. The structure and function relationships will be studied in detail. At the end of the course, the students are expected to have a solid understanding of basic functions of the human body. In addition, the student will

be exposed to the current topics and key concepts of experimental research. This course offers an excellent opportunity for those students who are looking to either learn or refresh their physiological knowledge that can benefit a variety academic and professional career goals.

Learning Outcomes: 1. Describe the fundamental concepts of nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems in mammals. 2. Examine the functional relationship among different systems. 3. Apply physiological principles as they relate to the etiology of common diseases. Credits: 4.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be

affected by drug therapy. Credits: 3.00

BME 55600 - Introduction To Clinical Medicine For Engineering Solutions

Credit Hours: 3.00. This course introduces students to the physiology and medicine underlying major human diseases likely to become research targets in biomedical engineering and medical device development. It encourages students to upgrade research target selection to include projects that promise to improve patient care, with a major emphasis on pathophysiology and disease mechanisms. The information and intellectual approach offered will help students recognize needs for engineering solutions to current challenges in medicine. The course also previews the intellectual content of medical school, including rigor and level of detail, for engineering students considering designing medical solutions or translational engineering research as a career, emphasizing the key "11-points" necessary for practical understanding of any disease: definition of the condition, causes, functional abnormalities, structural abnormalities, early signs, history and physical findings, differential diagnosis, special studies (lab, imaging, etc.), treatment strategy, specific steps of treatment, and follow up, as well as current clinical needs for innovation and research opportunities for the future. To avoid possible redundancy with the Weldon School undergraduate curriculum, focal areas of the course include topics and body systems not covered in BME 25600, including infectious diseases, cardiopulmonary diseases, hematology-oncology, and gastrointestinal diseases.

Learning Outcomes: 1. Describe the pathogenesis of selected diseases, including causes, abnormal anatomy, and abnormal physiology. 2. Describe the diagnosis of selected diseases, including the history, physical findings, laboratory workup, imaging, and special procedures. 3. Describe the treatment for selected diseases, including strategy, specific steps, drugs, surgery, and follow-up. Credits: 3.00

BME 68300 - Polymers In Biomedical And Pharmaceutical Systems

Credit Hours: 3.00. This course is designed to provide backgrounds in basic polymer chemistry, synthesis, characterization, solution properties, and recent advances in polymers for applications in drug delivery, biomedical devices, tissue engineering, biotechnology, and nanotechnology.

Learning Outcomes: 1. Understand polymer synthesis and characterization techniques. 2. Utilize Flory-Huggins theory of solutions to describe the polymer free entropy and enthalpy. 3. Use thermodynamics to describe the design of smart polymer systems. 4. Describe the properties that make a material biocompatible. 5. Understand how to design drug delivery systems. 6. Design experiments to characterize nano-scale polymeric platforms. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BME 53000 - Imaging Diagnostic Technologies For Medical And Biological Applications

Credit Hours: 3.00. This gateway course teaches the physics, engineering techniques associated with modern imaging and diagnostic tools for biological and medical applications. The course covers fundamental principles of radiology, optics, contrast generation (including genetically encoded probes and physiological indicators), image formation, detection, and analysis. The specific biomedical imaging modalities covered

include: x-ray, computed tomography, nuclear medicine imaging, ultrasound, optical microscopy and tomography, and MRI. The specific biological microscopy modalities covered include: phase contrast, DIC, confocal microscopy, two-photon microscopy and super-resolution microscopy. The course also teaches the principle concepts of adaptive optics, light sheet microscopy, 4Pi microscopy, and modern super-resolution microscopy techniques (PALM/STORM, STED and ISM). To bridge the technology and physics with the latest diagnostic advances and biomedical discoveries, research progresses in specific biomedical applications are presented by leading experts in their respective biomedical field such as OCT, ultrasound, MRI, fluorescence microscopy, electron microscopy, concurrent MRI and optical functional imaging, and super-resolution fluorescence microscopy. This course also includes a crash sub-course on MATLAB programming including both introductory content and contents of MATLAB-C API and MATLAB-C-CUDA (GPU computing).

Learning Outcomes: 1. Describe fundamental principles, such as atomic structure, particle and tissue interactions, light and sound propagation, Huygen's principle, refraction, interference, diffraction and abbe's fundamental resolution limit, wave propagation of light and sound, Fresnel and Fraunhofer diffraction principles. 2. Describe the general concept of signal detection, principles of detectors, noise sources and leading development trend of detectors such as APD, PMT, CCD, CMOS, EMCCD and sCMOS. 3. Describe physical principles and considerations of instrumentation design in planar radiography, fluoroscopy, computed tomography (CT), positron emission tomography (PET), single photon emission computed tomography, ultrasound imaging and magnetic resonance imaging. 4. Understand, design and draw basic optical sketches for a simplified imaging system in either wide-field, or focused optical geometry. These imaging systems includes: Widefield, Phase Contrast, DIC, Confocal, Two photon, Adaptive optics (AO) two photon, 4Pi, I5M, SIM, RESOLFT, STED and PALM/STORM microscopy techniques. Credits: 3.00

BME 51000 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Engineering Courses (6 credits)

BME 52800 - Measurement And Stimulation Of The Nervous System

Credit Hours: 3.00. (ECE 52800) Engineering principles addressing questions of clinical significance in the nervous system: neuroanatomy, fundamental properties of excitable tissues, hearing, vision, motor function, electrical and magnetic stimulation, functional neuroimaging, disorders of the nervous system, development and refinement of sensory prostheses.

Learning Outcomes: 1. The ability to design and utilize models of neural systems to explain or

predict physiologic behavior. 2. The ability to verbally present information related to measurement of the nervous system. 3. A systems-level understanding of the organization and operation of vision, audition, and motor function. Credits: 3.00

BME 54000 - Biomechanics

Credit Hours: 3.00. Application of engineering mechanics to the study of normal and diseased musculoskeletal systems, including bone and soft tissue biology, musculoskeletal statics and dynamics, mechanical properties of biological tissues, and structural analysis of bone-implant systems. Permission of instructor required.

Learning Outcomes: 1. Explain how concepts in continuum mechanics and constitutive models apply to tissue biomechanics. 2. Solve basic biomechanics problems related to health and disease in bone and soft musculoskeletal tissues. 3. Investigate appropriate constitutive models based on tissue structure, physiology, and relevant assumptions. 4. Design a simplified computational biomechanics model of a tissue system of biomedical relevance. Credits: 3.00

BME 55100 - Tissue Engineering

Credit Hours: 3.00. (BMS 52300) Integrates the principles and methods of engineering and life sciences toward the fundamental understanding of structure-function relationships in normal and pathological mammalian tissues, especially as they relate to the development of biological substitutes to restore, maintain, or improve tissue/organ function. Current concepts and strategies, including drug delivery, tissue and cell transplantation, bioartificial organs, and in vivo tissue regeneration are introduced, as well as their respective clinical applications. Permission of instructor required.

Credits: 3.00

BME 58100 - Bio-Micro-Electro-Mechanical Systems (BioMEMS) & Biomedical Microsystems

Credit Hours: 3.00. This course covers key topics in bio-micro-electro-mechanical systems (BioMEMS) and micro-integrated systems. Properties of useful materials will be discussed in context to BioMEMS. Micro-electronics process modules used in the design and fabrication of BioMEMS and micro-integrated systems will be presented. Applications of these systems in a variety of medical practices will be discussed in detail.

Learning Outcomes: 1. Apply advanced engineering principles to model, solve, or analyze biomedical engineering problems. 2. Formulate appropriate and quantitative design specifications and evaluate potential design solutions in terms of realistic constraints. 3. Describe the challenges associated with interactions between bio-MEMS devices/strategies and living biology to address current unmet clinical needs. Credits: 3.00

BME 59500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 69500 - Advanced Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of an advanced course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 50100 - Multivariate Analyses In Biostatistics

Credit Hours: 3.00. This course focuses on fundamental principles of multivariate statistical analyses in biostatistics, including multiple linear regression, multiple logistic regression, analysis of variance, and basic epidemiology. The fundamental theories are applied to analyze various biomedical applications ranging from laboratory data to large-scale epidemiological data.

Learning Outcomes: 1. Understand fundamental concepts in multivariate regression analyses. 2. Translate research questions into suitable multivariate frameworks. 3. Design studies with appropriate statistical power. 4. Compute and interpret appropriate statistical estimates from multivariate analyses. 5. Use a major statistical software package (e.g. STATA, SAS, SPSS, and R) to perform large-size data analyses.

Credits: 3.00

BME 51100 - Biomedical Signal Processing

Credit Hours: 3.00. An introduction to the application of digital signal processing to practical problems involving biomedical signals and systems. Topics include: overview of biomedical signals; filtering to remove artifacts; event detection; analysis of waveshape and waveform complexity; frequency domain characterization; modeling biomedical signal-generating systems; analysis of non-stationary signals; pattern classification and diagnostic decisions, MATLAB is used throughout to apply the theory and techniques discussed to biomedical signals.

Learning Outcomes: 1. Understand practical problems faced in objective analyses of biomedical signals. 2. Understand the underlying physiological and anatomical factors that are relevant for numerous types of biomedical signals. 3. Understand the theoretical background underlying the use of digital signal processing for biomedical applications. 4. Understand the practical benefits and limitations of various digital signal processing approaches and identify the best solution for specific problems. 5. Implement appropriate signal processing algorithms for practical problems involving biomedical signals and systems 6. Propose, carry out, orally present, and write up in a conference proceedings format a biomedical-research mini project using- signal processing algorithms. Credits: 3.00

BME 68300 - Polymers In Biomedical And Pharmaceutical Systems

Credit Hours: 3.00. This course is designed to provide backgrounds in basic polymer chemistry, synthesis, characterization, solution properties, and recent advances in polymers for applications in drug delivery, biomedical devices, tissue engineering, biotechnology, and nanotechnology.

Learning Outcomes: 1. Understand polymer synthesis and characterization techniques. 2. Utilize Flory-Huggins theory of solutions to describe the polymer free entropy and enthalpy. 3. Use thermodynamics to describe the design of smart polymer systems. 4. Describe the properties that make a material biocompatible. 5. Understand how to design drug delivery systems. 6. Design experiments to characterize nano-scale polymeric platforms. Credits: 3.00

BME 64600 - Deep Learning - Theory And Practice Of Deep Neural Networks

Credit Hours: 3.00. This course teaches the theory and practice of deep neural networks from basic principles through state-of-the-art methods. The class blends hands-on programming, using a variety of state-of-the-art programming frameworks, with theoretical treatment based on current literature. Implementation will emphasize the use of the Pytorch language and the use of dynamic computational graphs. Some previous experience with optimization techniques is important for success in the course.

Learning Outcomes: 1. Understand how to design a neural network architecture that is appropriate for a wide range of specific applications. 2. Create an efficient implementation of a wide range of standard neural network architectures in Pytorch. 3. Use neural networks to solve applications problems in classification, regression and data generation. 4. Understand how the fundamental theory of optimization can be used to efficiently train neural networks. 5. Understand the trade-offs between optimization techniques and how these techniques can be selected to achieve the best neural network training. 6. Understand and use current theory of neural network performance. 7. Understand the limitation of existing neural network theory and the likely directions of future research. Credits: 3.00

BME 53000 - Imaging Diagnostic Technologies For Medical And Biological Applications

Credit Hours: 3.00. This gateway course teaches the physics, engineering techniques associated with modern imaging and diagnostic tools for biological and medical applications. The course covers fundamental principles of radiology, optics, contrast generation (including genetically encoded probes and physiological indicators), image formation, detection, and analysis. The specific biomedical imaging modalities covered include: x-ray, computed tomography, nuclear medicine imaging, ultrasound, optical microscopy and tomography, and MRI. The specific biological microscopy modalities covered

include: phase contrast, DIC, confocal microscopy, two-photon microscopy and super-resolution microscopy. The course also teaches the principle concepts of adaptive optics, light sheet microscopy, 4Pi microscopy, and modern super-resolution microscopy techniques (PALM/STORM, STED and ISM). To bridge the technology and physics with the latest diagnostic advances and biomedical discoveries, research progresses in specific biomedical applications are presented by leading experts in their respective biomedical field such as OCT, ultrasound, MRI, fluorescence microscopy, electron microscopy, concurrent MRI and optical functional imaging, and super-resolution fluorescence microscopy. This course also includes a crash sub-course on MATLAB programming including both introductory content and contents of MATLAB-C API and MATLAB-C-CUDA (GPU computing).

Learning Outcomes: 1. Describe fundamental principles, such as atomic structure, particle and tissue interactions, light and sound propagation, Huygen's principle, refraction, interference, diffraction and abbe's fundamental resolution limit, wave propagation of light and sound, Fresnel and Fraunhofer diffraction principles. 2. Describe the general concept of signal detection, principles of detectors, noise sources and leading development trend of detectors such as APD, PMT, CCD, CMOS, EMCCD and sCMOS. 3. Describe physical principles and considerations of instrumentation design in planar radiography, fluoroscopy, computed tomography (CT), positron emission tomography (PET), single photon emission computed tomography, ultrasound imaging and magnetic resonance imaging. 4. Understand, design and draw basic optical sketches for a simplified imaging system in either wide-field, or focused optical geometry. These imaging systems includes: Widefield, Phase Contrast, DIC, Confocal, Two photon, Adaptive optics (AO) two photon, 4Pi, I5M, SIM, RESOLFT, STED and PALM/STORM microscopy techniques. Credits: 3.00

BME 54200 - Cell & Tissue Mechanics

Credit Hours: 3.00. This course develops and applies scaling approaches and simplified models to biomechanical phenomena at molecular, cellular, and tissue level. Topics include: Molecular forces; Viscous drag; Brownian motion; Diffusion; Polymer mechanics; Polymer dynamics; Molecular motors; Cytoskeleton; Viscoelasticity; Membrane; Cell migration; Cell adhesion; Mechanobiology; Mechanotransduction; Elastic, viscoelastic. and poroelastic behavior or tissues & Cell-matrix interaction.

Learning Outcomes: 1. Solve analytically basic biomechanics problems or estimate their approximate solutions. 2. Utilize gained knowledge to interpret experimental results related to biomechanics and characterize them in the form of equations. 3. Develop computational models for biological systems or design experiments. Credits: 3.00

Math/Statistics Courses (6 credits)

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

MA 51000 - Vector Calculus

Credit Hours: 3.00. Calculus of functions of several variables and of vector fields in orthogonal coordinate systems. Optimization problems, implicit function theorem, Green's theorem, Stokes' theorem, divergence theorems. Applications to engineering and the physical sciences. Not open to students with credit in MA 36200 or MA 41000.

Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

MA 52500 - Introduction To Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; applications. Not open to students with credit in MA 42500.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations.

Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory.

Credits: 3.00

MA 59800 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and

contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

STAT 52900 - Applied Decision Theory And Bayesian Statistics

Credit Hours: 3.00. Bayesian and decision-theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; Bayesian design and sequential analysis; comparisons of statistical paradigms.

Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

AAE 55400 - Fatigue Of Structures And Materials

Credit Hours: 3.00. Development and application of methods for predicting the fatigue life of structural components. Characterization and response of materials to cyclic loading. Fatigue resistant design of aerospace structures. Both fatigue crack initiation and crack propagation concepts are discussed.

Credits: 3.00

BME 59500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 69500 - Advanced Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of an advanced course. Permission of instructor required.

Credits: 1.00 to 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening,

interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 64100 - Model Based Image And Signal Processing

Credit Hours: 3.00. An advanced treatment of the methods in model-based signal and image processing including stochastic modeling of multidimensional signals, Bayesian estimation, inverse methods, doubly stochastic models, regularized inversion, the EM algorithm, Bayesian networks, Markov chains, optimization, convexity, majorization techniques, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation. Prerequisite: ECE 60000, 63700.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 64500 - Estimation Theory

Credit Hours: 3.00. This course presents the basics of estimation and detection theory that are commonly applied in communications and signal processing systems. Applications in communications and signal processing will be considered throughout. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

IE 53300 - Industrial Applications Of Statistics

Credit Hours: 3.00. The application of statistics to the effective design and analysis of industrial studies relating to manufacturing and human factors engineering in order to optimize the utilization of equipment and resources. Emphasis on conducting these studies at the least cost.

Credits: 3.00

IE 58000 - Systems Simulation

Credit Hours: 3.00. Philosophy and elements of digital simulation language. Practical application of simulation to diverse systems. Computer simulation exercises and applications are required.

Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 58000 - Nonlinear Engineering Systems

Credit Hours: 3.00. Methods of analysis for nonlinear ordinary differential equations arising in engineering systems. Review of linear systems. Stability concepts. Phase plane methods. Perturbation and averaging methods of analysis. Self-excited and parametrically-excited systems. Relaxation oscillations. Systems with more than one degree of freedom.

Credits: 3.00

ME 58700 - Engineering Optics

Credit Hours: 3.00. Fundamentals of geometrical and physical optics as related to problems in engineering design and research. Characteristics of imaging systems; properties of light sources; optical properties of materials. Diffraction, interference, polarization, and scattering phenomena as related to optical measurement techniques. Introduction to lasers and holography. (Laboratory work can be undertaken for additional credit by special arrangement.).

Credits: 3.00

ME 61200 - Continuum Mechanics

Credit Hours: 3.00. A unified and exact mathematical treatment of the mechanics of solids and fluids. Cartesian tensor algebra and calculus; stress tensor, principle stresses and invariants; material and spatial coordinates, deformation gradient, strain and stretch tensors; balance of mass, momentum, and energy; constitutive equations of elasticity, hyperelasticity, viscous fluids and viscoelasticity.

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

STAT 55300 - Theory Of Linear Models And Analysis Of Experimental Designs

Credit Hours: 3.00. Least squares analysis of linear models. Gauss Markov Theorem. Estimability and testability of parameters. Confidence regions and prediction regions. Introduction to design of experiments. Analysis of variance. Factorial and block designs. Analysis of random, fixed, and mixed models. Components of variance. Distribution of linear and quadratic forms in normal vectors. A firm background in matrix algebra and some previous exposure to linear models or analysis of variance is desirable.

Credits: 3.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

BME 50100 - Multivariate Analyses In Biostatistics

Credit Hours: 3.00. This course focuses on fundamental principles of multivariate statistical analyses in biostatistics, including multiple linear regression, multiple logistic regression, analysis of variance, and basic epidemiology. The fundamental theories are applied to analyze various biomedical applications ranging from laboratory data to large-scale epidemiological data.

Learning Outcomes: 1. Understand fundamental concepts in multivariate regression analyses. 2. Translate research questions into suitable multivariate frameworks. 3. Design studies with appropriate statistical power. 4. Compute and interpret appropriate statistical estimates from multivariate analyses. 5. Use a major statistical software package (e.g. STATA, SAS, SPSS, and R) to perform large-size data analyses.
Credits: 3.00

BME 51100 - Biomedical Signal Processing

Credit Hours: 3.00. An introduction to the application of digital signal processing to practical problems involving biomedical signals and systems. Topics include: overview of biomedical signals; filtering to remove artifacts; event detection; analysis of waveshape and waveform complexity; frequency domain characterization; modeling biomedical signal-generating systems; analysis of non-stationary signals; pattern classification and diagnostic decisions, MATLAB is used throughout to apply the theory and techniques discussed to biomedical signals.

Learning Outcomes: 1. Understand practical problems faced in objective analyses of biomedical signals. 2. Understand the underlying physiological and anatomical factors that are relevant for numerous types of biomedical signals. 3. Understand the theoretical background underlying the use of digital signal processing for biomedical applications. 4. Understand the practical benefits and limitations of various digital signal processing approaches and identify the best solution for specific problems. 5. Implement appropriate signal processing algorithms for practical problems involving biomedical signals and systems 6. Propose, carry out, orally present, and write up in a conference proceedings format a biomedical-research mini project using- signal processing algorithms.
Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by

implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

ECE 60141 - Foundations Of Computational Imaging

Credit Hours: 3.00. This class presents a collection of mathematical and statistical methods that form the foundation of modern computational imaging research and applications. Computational imaging seeks to form images from sensor data and is widely used in applications including consumer imaging, scientific imaging, industrial inspection, and security imaging. This class provides an advanced treatment of computational imaging based on an inverse-problems framework and blends perspectives from applied math, statistics, physics, and applications. The topics covered include stochastic modeling of images, Bayesian estimation, inverse methods, optimization, convexity, majorization techniques, constrained optimization and proximal methods, plug-and-play methods for advance prior models, the EM algorithm, Bayesian networks, Markov chains, hidden Markov models, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

Ethics Course (1 credit)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Research Courses (2 credits)

Seminar Course (2 credits)

BMS 69200 - Seminar In Basic Medical Sciences

Credit Hours: 0.00 or 1.00. Oral presentation of assigned or selected topics pertaining to physiology and pharmacology.

Credits: 0.00 or 1.00

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

BME Seminar Course (2 credits)

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

BME 50000 - Biomedical Engineering Graduate Seminar

Credit Hours: 0.00. A -0- credit hour graduate seminar course

consisting of weekly, one hour technical presentations by Department of Biomedical Engineering and other engineering faculty at IUPUI, researchers from local and national academia, representatives from industry and peer graduate students in the BME Department. These seminars introduce graduate BME students to a wide variety of bioengineering related topics in academic research and commercial industries. The students are exposed to research questions, methodologies and technical developments both inside and outside of their topical concentration areas. Through open inquiry, discourse and application of the Socratic method the course moderator helps the BME graduate students enhance and refine their critical thinking and technical presentation skills. Permission of department required.

Credits: 0.00

Dissertation Research (59 credits)

BME 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Additional Information

GPA Requirements

About the Program

Interdisciplinary Engineering, DEng (OL)

About the Program

Program Requirements

Required Courses (12 credits)

Core Courses (6 credits)

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

IE 69700 - Seminar

Credit Hours: 0.00. Industrial engineering problems with particular emphasis on current research.

Credits: 0.00

ECE 69401 - Electrical And Computer Engineering Graduate Seminar

Credit Hours: 0.00. Seminar presentations by members of the faculty of the Department of Electrical and Computer Engineering, staff and other faculty of IUPUI, researchers from academia, and representatives from industry. The presentations introduce the student to a wide variety of current topics relevant to the technical, educational and career aspects of electrical and computer engineering. This course cannot be used to satisfy the PhD seminar requirement. Permission of department required.

Credits: 0.00

ENGR 60100 - Doctor Of Engineering Fundamentals

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations as part of the Doctor of Engineering (D.Eng.) program. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. The course will also detail the differences between a professional doctorate (D.Eng) and a PhD program. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives. As the foundational course for the Doctor of Engineering program, students are expected to take this course during their first year of the program.

Learning Outcomes: 1. Create an individual development plan (IDE). 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow and plan for your studies. 4. Critique your individual development plan. 5. Establish professional and academic connections with students and faculty in the D.Eng. program. 6. Identify and engage with potential faculty advisor(s) and dissertation committee members. Credits: 1.00

ENGR 60200 - Engineering Research Fundamentals

Credit Hours: 3.00. This course is designed to teach students basic research fundamentals, including critical analysis of scientific literature, scientific communication, hypothesis development and basics of scientific writing. At the course's end, students will be able to critically review literature and present their scientific thoughts and findings in both written and oral forms. Students will also have opportunities to implement writing, presentation, and networking strategies that are key to success beyond graduate school. An introduction to ethical research practices will also be provided. Finally, students are expected to provide feedback to peers and improve their scientific writing and editing skills through weekly writing sessions. Through self-guided reading and online discussions, students will master the art of analyzing scientific literature, communicating their arguments, and offering peer feedback to colleagues.

Learning Outcomes: 1. Understand and comprehend the basics in research methodology and applying them in research/ project work. 2. Find literature relevant to a research problem, analyze research and retain and retrieve its content for future use. 3. Apply research guidelines regarding record keeping. 4. Apply approaches for the development and formulation of research questions, objectives, and hypotheses. 5. Apply approaches to good writing for research proposals, papers, and theses. 6. Communicate research plans to peers and non-expert audiences, including oral and poster presentations. 7. Identify common ethical issues in research. Credits: 3.00

ENGR 60300 - Doctor Of Engineering Seminar

Credit Hours: 1.00. The graduate seminar is designed to provide students with the opportunity to explore and engage with current research topics, trends, and developments within engineering. The seminar will feature a different guest speaker each week. Here are the benefits of participating in the seminar: Knowledge expansion: You will gain insights into cutting-edge research; Exposure to diverse research areas: You will be exposed to a broader range of topics and research areas. This exposure will help you gain a more comprehensive understanding of current cutting-edge research topics and techniques. It can also inspire new research ideas and perspectives that you may not have considered previously; Developing critical thinking skills: You will refine your critical thinking by asking questions and participating in discussions during the seminars; Developing presentation skills: You will observe different presentation styles and effective communication techniques that you can use as examples to develop your own; Networking: You will be able to interact with professors, researchers, and peers from within and outside your program.

Learning Outcomes: 1. List critical areas and

topics being investigated across a variety of engineering disciplines and areas. 2. Summarize a research presentation. 3. Identify improvements for current research practices. 4. Identify effective presentation styles and effective communication techniques. 5. Network with your peers and provide feedback. Credits: 1.00

Foundational Courses (6 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations. Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation

and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the

maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

Core Courses (6 credits)

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

IE 69700 - Seminar

Credit Hours: 0.00. Industrial engineering problems with particular emphasis on current research.

Credits: 0.00

ECE 69401 - Electrical And Computer Engineering Graduate Seminar

Credit Hours: 0.00. Seminar presentations by members of the faculty of the Department of Electrical and Computer Engineering, staff and other faculty of IUPUI, researchers from academia, and representatives from industry. The presentations introduce the student to a wide variety of current topics relevant to the technical, educational and career aspects of electrical and computer engineering. This course cannot be used to satisfy the PhD seminar requirement. Permission of department required.

Credits: 0.00

ENGR 60100 - Doctor Of Engineering Fundamentals

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations as part of the Doctor of Engineering (D.Eng.) program. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. The course will also detail the differences between a professional doctorate (D.Eng) and a PhD program. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives. As the foundational course for the Doctor of Engineering program, students are expected to take this course during their first year of the program.

Learning Outcomes: 1. Create an individual development plan (IDE). 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow and plan for your studies. 4. Critique your individual development plan. 5. Establish professional and academic connections with students and faculty in the D.Eng. program. 6. Identify and engage with potential faculty advisor(s) and dissertation committee members. Credits: 1.00

ENGR 60200 - Engineering Research Fundamentals

Credit Hours: 3.00. This course is designed to teach students basic research fundamentals, including critical analysis of scientific literature, scientific communication, hypothesis development and basics of scientific writing. At the course's end, students will be able to critically review literature and present their scientific thoughts and findings in both written and oral forms. Students will also have opportunities to implement writing, presentation, and networking strategies that are key to success beyond graduate school. An introduction to ethical research practices will also be provided. Finally, students are expected to provide feedback to peers and improve their scientific writing and editing skills through weekly writing sessions. Through self-guided reading and online discussions, students will master the art of analyzing scientific literature, communicating their arguments, and offering peer feedback to colleagues.

Learning Outcomes: 1. Understand and comprehend the basics in research methodology and applying them in research/ project work. 2. Find literature relevant to a research problem, analyze research and retain and retrieve its content for future use. 3. Apply research guidelines regarding record keeping. 4. Apply approaches for the development and formulation of research questions, objectives, and hypotheses. 5. Apply approaches to good writing for research proposals, papers, and theses. 6. Communicate research plans to peers and non-expert audiences, including oral and poster presentations. 7. Identify common ethical issues in research. Credits: 3.00

ENGR 60300 - Doctor Of Engineering Seminar

Credit Hours: 1.00. The graduate seminar is designed to provide students with the opportunity to explore and engage with current research topics, trends, and developments within engineering. The seminar will feature a different guest speaker each week. Here are the benefits of participating in the seminar: Knowledge expansion: You will gain insights into cutting-edge research; Exposure to diverse research areas: You will be exposed to a broader range of topics and research areas. This exposure will help you gain a more comprehensive understanding of current cutting-edge research topics and techniques. It can also inspire new research ideas and perspectives that you may not have considered previously; Developing critical thinking skills: You will refine your critical thinking by asking questions and participating in discussions during the seminars; Developing presentation skills: You will observe different presentation styles and effective communication techniques that you can use as examples to develop your own; Networking: You will be able to interact with professors, researchers, and peers from within and outside your program.

Learning Outcomes: 1. List critical areas and topics being investigated across a variety of engineering disciplines and areas. 2. Summarize a research presentation. 3. Identify improvements for current research practices. 4. Identify effective presentation styles and effective communication techniques. 5. Network with your peers and provide feedback. Credits: 1.00

Technical Depth Courses (27 credits)

Professional and Applied Courses (12 credits)

Research Course (30 credits)

Electives (9 credits)

Required Courses (12 credits)

Core Courses (6 credits)

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical

and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

IE 69700 - Seminar

Credit Hours: 0.00. Industrial engineering problems with particular emphasis on current research.

Credits: 0.00

ECE 69401 - Electrical And Computer Engineering Graduate Seminar

Credit Hours: 0.00. Seminar presentations by members of the faculty of the Department of Electrical and Computer Engineering, staff and other faculty of IUPUI, researchers from academia, and representatives from industry. The presentations introduce the student to a wide variety of current topics relevant to the technical, educational and career aspects of electrical and computer engineering. This course cannot be used to satisfy the PhD seminar requirement. Permission of department required.

Credits: 0.00

ENGR 60100 - Doctor Of Engineering Fundamentals

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations as part of the Doctor of Engineering (D.Eng.) program. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. The course will also detail the differences between a professional doctorate (D.Eng) and a PhD program. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives. As the foundational course for the Doctor of Engineering program, students are expected to take this course during their first year of the program.

Learning Outcomes: 1. Create an individual development plan (IDE). 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow and plan for your studies. 4. Critique your individual development plan. 5. Establish professional and academic connections with students and faculty in the D.Eng. program. 6. Identify and engage with potential faculty advisor(s) and dissertation committee members. Credits: 1.00

ENGR 60200 - Engineering Research Fundamentals

Credit Hours: 3.00. This course is designed to teach students basic research fundamentals, including critical analysis of scientific literature, scientific communication, hypothesis development and basics of scientific writing. At the course's end, students will be able to critically review literature and present their scientific thoughts and findings in both written and oral forms. Students will also have opportunities to implement writing, presentation, and networking strategies that are key to success beyond graduate school. An introduction to ethical research practices will also be provided. Finally, students are expected to provide feedback to peers and improve their scientific writing and editing skills through weekly writing sessions. Through self-guided reading and online discussions, students will master the art of analyzing scientific literature, communicating their arguments, and offering peer feedback to colleagues.

Learning Outcomes: 1. Understand and comprehend the basics in research methodology and applying them in research/ project work. 2. Find literature relevant to a research problem, analyze research and retain and retrieve its content for future use. 3. Apply

research guidelines regarding record keeping. 4. Apply approaches for the development and formulation of research questions, objectives, and hypotheses. 5. Apply approaches to good writing for research proposals, papers, and theses. 6. Communicate research plans to peers and non-expert audiences, including oral and poster presentations. 7. Identify common ethical issues in research. Credits: 3.00

ENGR 60300 - Doctor Of Engineering Seminar

Credit Hours: 1.00. The graduate seminar is designed to provide students with the opportunity to explore and engage with current research topics, trends, and developments within engineering. The seminar will feature a different guest speaker each week. Here are the benefits of participating in the seminar: Knowledge expansion: You will gain insights into cutting-edge research; Exposure to diverse research areas: You will be exposed to a broader range of topics and research areas. This exposure will help you gain a more comprehensive understanding of current cutting-edge research topics and techniques. It can also inspire new research ideas and perspectives that you may not have considered previously; Developing critical thinking skills: You will refine your critical thinking by asking questions and participating in discussions during the seminars; Developing presentation skills: You will observe different presentation styles and effective communication techniques that you can use as examples to develop your own; Networking: You will be able to interact with professors, researchers, and peers from within and outside your program.

Learning Outcomes: 1. List critical areas and topics being investigated across a variety of engineering disciplines and areas. 2. Summarize a research presentation. 3. Identify improvements for current research practices. 4. Identify effective presentation styles and effective communication techniques. 5. Network with your peers and provide feedback. Credits: 1.00

Foundational Courses (6 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations. Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors,

credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and

continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

Core Courses (6 credits)

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

IE 69700 - Seminar

Credit Hours: 0.00. Industrial engineering problems with particular emphasis on current research.

Credits: 0.00

ECE 69401 - Electrical And Computer Engineering Graduate Seminar

Credit Hours: 0.00. Seminar presentations by members of the faculty of the Department of Electrical and Computer Engineering, staff and other faculty of IUPUI, researchers from academia, and representatives from industry. The presentations introduce the student to a wide variety of current topics relevant to the technical, educational and career aspects of electrical and computer engineering. This course cannot be used to satisfy the PhD seminar requirement. Permission of department required.

Credits: 0.00

ENGR 60100 - Doctor Of Engineering Fundamentals

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations as part of the Doctor of Engineering (D.Eng.) program. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. The course will also detail the differences between a professional doctorate (D.Eng) and a PhD program. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives. As the foundational course for the Doctor of Engineering program, students are expected to take this course during their first year of the program.

Learning Outcomes: 1. Create an individual development plan (IDE). 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow and plan for your studies. 4. Critique your individual development plan. 5. Establish professional and academic connections with students and faculty in the D.Eng. program. 6. Identify and engage with potential faculty advisor(s) and dissertation committee members. Credits: 1.00

ENGR 60200 - Engineering Research Fundamentals

Credit Hours: 3.00. This course is designed to teach students basic research fundamentals, including critical analysis of scientific literature, scientific communication, hypothesis development and basics of scientific writing. At the course's end, students will be able to critically review literature and present their scientific thoughts and findings in both written and oral forms. Students will also have opportunities to implement writing, presentation, and networking strategies that are key to success beyond graduate school. An introduction to ethical research practices will also be provided. Finally, students are expected to provide feedback to peers and improve their scientific writing and editing skills through weekly writing sessions. Through self-guided reading and online discussions, students will master the art of analyzing scientific literature, communicating their arguments, and offering peer feedback to colleagues.

Learning Outcomes: 1. Understand and comprehend the basics in research methodology and applying them in research/ project work. 2. Find literature relevant to a research problem, analyze research and retain and retrieve its content for future use. 3. Apply research guidelines regarding record keeping. 4. Apply approaches for the development and formulation of research questions, objectives, and hypotheses. 5. Apply approaches to good writing for research proposals, papers, and theses. 6. Communicate research plans to peers and non-expert audiences, including oral and poster presentations. 7. Identify common ethical issues in research. Credits: 3.00

ENGR 60300 - Doctor Of Engineering Seminar

Credit Hours: 1.00. The graduate seminar is designed to provide students with the opportunity to explore and engage with current research topics, trends, and developments within engineering. The seminar will feature a different guest speaker each week. Here are the benefits of participating in the seminar: Knowledge expansion: You will gain insights into cutting-edge research; Exposure to diverse research areas: You will be exposed to a broader range of topics and research areas. This exposure will help you gain a more comprehensive understanding of current cutting-edge research topics and techniques. It can also inspire new research ideas and perspectives that you may not have considered previously; Developing critical thinking skills: You will refine your critical thinking by asking questions and participating in discussions during the seminars; Developing presentation skills: You will observe different presentation styles and effective communication techniques that you can use as examples to develop your own; Networking: You will be able to interact with professors, researchers, and peers from within and outside your program.

Learning Outcomes: 1. List critical areas and topics being investigated across a variety of engineering disciplines and areas. 2. Summarize a research presentation. 3. Identify improvements for current research practices. 4. Identify effective presentation styles and effective communication techniques. 5. Network with your peers and provide feedback. Credits: 1.00

Program Learning Outcomes

About the Program

Languages and Cultures, PHD

About the Program

Program Requirements

Required Courses (30-60 credits)*

Primary Area Courses (21-60 credits)*

Comparative Literature

LC 51900 - Teaching Of Foreign Languages

Credit Hours: 3.00. A basic course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

LC 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (CMPL 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study. Required of all students in the Comparative Literature Program.

Credits: 3.00

French

FR 51900 - Teaching College French

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of department required.

Credits: 3.00

FR 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research: the basic concepts and terminology of literary criticism. Required of all MA candidates in French.

Credits: 3.00

German

Japanese

Spanish

SPAN 51900 - Teaching College Spanish

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

SPAN 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in Spanish.

Credits: 3.00

Related Area Courses (0-9 credits)

Dissertation Research (30 credits)

LC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Concentrations

GPA Requirements

Additional Information

Linguistics, PHD

About the Program

Program Requirements

Required Courses (30-60 credits)*

Core Courses (9-27 credits)*

LING 59800 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Investigation of an advanced topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 1.00 to 4.00

LING 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Learning Outcomes: 1. Able to discuss the relationship between language and society and identify the roles of language in its social and cultural context. 2. Able to critique current theories in sociolinguistics using data sets provided in course texts. 3. Able to identify the major models for sociolinguistic analysis and suggest reformulations and refinements necessary for various societies and cultures. 4. Able to recognize the sociolinguist's responsibility in the ethical treatment of human subjects and collected data. Credits: 3.00

LING 54100 - Historical Linguistics And Language Change

Credit Hours: 3.00. A general examination of the ways in which languages and their subsystems change over time and of the forces that produce change. The comparative method; internal reconstruction; geographical variation; and social variation. Overview of world language families and genetic relationships. Offered in conjunction with ENGL 56300 or LC 56300 .

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

LING 51100 - Phonology I: Descriptive Analysis

Credit Hours: 3.00. Foundations of phonological analysis. Development of concepts and methods for the analysis of phonological data and the phonological structures of natural languages within the framework of generative phonology. Focuses on problem solving and linguistic argumentation. Offered in conjunction with ENGL 51300 .

Credits: 3.00

LING 56300 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central

issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual develpment.

Learning Outcomes: 1. Understand how languages are acquired and developmental stages of main linguistic components. 2. Understand major concepts and issues relative to child language development. 3. Understand major concepts and issues relative to bilingual first-language acquisition. 4. Understand knowledge of main sociocultural constructs related to language development. 5. Understand main issues relative to methodological issues in language acquisition. 6. Understand main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

Preliminary Project Seminar (6 credits)

LING 69000 - Individual Seminar

Credit Hours: 1.00 to 3.00. Under the individual guidance and supervision of a faculty member, students will select and investigate a topic and will produce a paper of professional caliber on the subject. Prerequisite: Doctoral student standing and Linguistics majors only. Permission of instructor required.

Credits: 1.00 to 3.00

Area Specific Courses (24 credits)*

Language Documentation

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

LING 61900 - Seminar In Phonology

Credit Hours: 3.00. Intensive study and research on a selected topic in phonology. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 57600 - Latin American Indigenous Languages And Cultures

Credit Hours: 3.00. This course will help students to learn the importance of understanding the diversity of Latin American indigenous languages and cultures as well as the intercultural understandings gained when these indigenous languages are valued within the global context. Moreover, this course will provide a general cultural and linguistic framework to understand the sociolinguistic status of the language within the context where it exists. In this course, students will deepen their knowledge of Latin American indigenous cultures and their historics, as a means to achieving a greater understanding of both a shared humanity and the variety of human experiences.

Learning Outcomes: 1. Acquire in-depth knowledge in a chosen, specific indigenous people while demonstrating panoramic understanding of Latin American indigenous groups. 2. Explain the brief history of US interaction with a particular Latin American country of this course topic. 3. Show basic oral and auditory competency in the language; will demonstrate how to express and understand basic statements, greetings, requests for directions, for food, and general courtesy interactions in the particular language. 4. Identify the particular complex interactions of the indigenous language within the context of

the dominant colonial language. 5. Identify the linguistic position of the language within the context of indigenous languages of the Americas. 6. Identify basic cultural characteristics associated with the language speaking community. Credits: 3.00

LING 57000 - Field Methods In Linguistics

Credit Hours: 4.00. This course deals with the basic techniques for collecting language data, and is designed to reproduce and explore the conditions and methods of linguistic fieldwork in a classroom. The course also addresses questions related to the ethics of retrieving linguistic data, the relations between the linguist and the speaking communities, and the use of the collected data. A non-Indoeuropean lesser-studied language will be examined with the help of a native speaker of the language. The main area of its grammar will be covered: phonetic and phonological system, inflectional and derivational morphology, basic syntactic structures and basic semantic phenomena. The final goal is to obtain a basic grammatical description of the language. Lab sessions will be directed towards the training in the software and audio and video tools used for the trade.

Learning Outcomes: 1. Identify the key parts of the grammar of language. 2. Formulate questions about the language that (a) can reveal the structure of language and (b) can be answered by a speaker with no knowledge of linguistics. 3. Use the tools of the trade (software, equipment, etc.) 4. Develop methodologies based on a Participatory Action Research approach. 5. Develop sensitivity about what is of relevance to the speaking community and how to interact with the community in general and the speakers in particular. 6. Develop skills on how to transfer newly discovered scientific knowledge of the language back to the speaking community. Credits: 4.00

LING 52200 - Syntax II: Issues In Syntax

Credit Hours: 3.00. Deeper examination of a wider range of syntactic phenomena and evaluation of competing theoretical analyses proposed to account for them. Constructing theoretical analyses and evaluating their explanatory adequacy for Universal Grammar. Topics include LF phenomena, functional projections, and structural representations.

Credits: 3.00

LING 51200 - Phonology II: Theoretical Approaches

Credit Hours: 3.00. Examination, comparison, and evaluation of contemporary phonological theories, with focus on the contribution of each theory to our understanding of representations and operations in phonological analysis. Primary emphasis is on autosegmental phonology, metrical phonology, lexical phonology, and optimality theory.

Credits: 3.00

Theoretical Linguistics

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52200 - Syntax II: Issues In Syntax

Credit Hours: 3.00. Deeper examination of a wider range of syntactic phenomena and evaluation of competing theoretical analyses proposed to account for them. Constructing theoretical analyses and evaluating their explanatory adequacy for Universal Grammar. Topics include LF phenomena, functional projections, and structural representations.

Credits: 3.00

LING 51200 - Phonology II: Theoretical Approaches

Credit Hours: 3.00. Examination, comparison, and evaluation of contemporary phonological theories, with focus on the contribution of each theory to our understanding of representations and operations in phonological analysis. Primary emphasis is on autosegmental phonology, metrical phonology, lexical phonology, and optimality theory.

Credits: 3.00

French Linguistics

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

LC 59600 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Special topics in Linguistics. Permission of instructor required.

Credits: 1.00 to 4.00

German Linguistics

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

Japanese Linguistics

JPNS 56000 - Survey Of Japanese Linguistics

Credit Hours: 3.00. This course is intended to provide the student with a systematic overview of the Japanese language. It covers most major areas of linguistics, from phonetics to pragmatics. Conducted in Japanese.

Credits: 3.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

Spanish Linguistics

SPAN 56100 - The Structure Of Spanish I: Phonetics, Phonology, And Dialectology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of

these topics will be approached from a theoretical and contrastive Spanish/English perspective.

Learning Outcomes: 1. Understand, recall, and discuss the main concepts in the fields of phonetics and phonology. 2. Apply and adapt the fundamental concepts of phonetics and phonology to multiple varieties of Spanish. 3. Examine and critically assess current research in the field. 4. Design and conduct original research in the field of Spanish phonetics and phonology. Credits: 3.00

SPAN 56200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Have knowledge and understanding of basic notions of Spanish syntax including syntagmatic structure, X-bar theory, thematic roles, argument structure, constituents and hierarchical representation, and syntactic operations (e.g., wh-movement). 2. Be able to observe, describe, and formulate abstract theoretical concepts in relation to the syntactic structure of Spanish. 3. Be able to relate theoretical analysis to experimental syntax, specifically in relation to the acquisition of Spanish syntax and semantics among second language learners and heritage speakers. Credits: 3.00

SPAN 56300 - History Of The Spanish Language

Credit Hours: 3.00. Development of Spanish since the Ancient Latin period, taking into account influences of other cultures and languages; Spanish in relation to Latin and other Romance languages; basic principles of language change; language change underlying differences between American and Peninsular Spanish.

Learning Outcomes: 1. Have a perspective of the evolution of Spanish and being able to identify the basic features of Spanish through its history, as well as understanding the influence of external influences in the evolution of the language. 2. Understand the configuration of the different varieties of Spanish in the different areas (peninsular Spanish and Spanish in America). 3. Read publications on general aspects of History of Spanish Language with critical sense and understanding basic problems of diachronic studies and basic principles of language change. 4. Able to read, understand and linguistically analyze texts from all the stages of Spanish. Credits: 3.00

SPAN 56401 - Spanish Sociolinguistics

Credit Hours: 3.00. This course addresses the linguistic variation found at all linguistic levels of Spanish (e.g., phonetics, morphology, syntax) that is explained through social variation (e.g., socio-economic status, race, gender). Regional varieties of Spanish in Latin America, the U.S., and Peninsular societies will be studied. Related topics are style and identity, language attitudes, discourse analysis, and pragmatics. All classes will be conducted in Spanish.

Learning Outcomes: 1. Define and express main understandings about language, the study of linguistics, and language variation. 2. Analyze and discuss specific examples of Spanish variation analyzed through use of various methods. 3. Identify and evaluate the pros and cons of various sociolinguistic methods of research. 4. Reflect on the relationships among social factors, language, diversity, and power in society. 5. Use previous investigations to demonstrate the need for additional research in a specific area, thereby identifying a research topic. 6. Consider one's own perspective of language use in social settings and reflect on any changes in that perspective that resulted from interaction with the course. 7. Speak, read, write, and comprehend Spanish to communicate about the course topics. Credits: 3.00

Dissertation Research (30-60 credits)

LING 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Linguistic Selectives (xx credits)

Concentrations

Additional Information

GPA Requirements

Management, PHD

Materials Engineering, PHD

About the Program

Program Requirements

Required Courses (30 credits)*

Core Courses (0-15 credits)

MSE 60000 - Materials Engineering Fundamentals

Credit Hours: 3.00. Fundamental relationships between the internal structure, properties and processing in all classes of engineering materials. Comprehensive coverage spanning physical, chemical, thermal, mechanical, electrical, magnetic, and optical responses. The course is intended for materials researchers from all backgrounds, as well as engineers working in product design, development and manufacturing who seek a deeper understanding of the full spectrum of engineering materials.

Learning Outcomes: 1. Perform calculations to quantify material properties and microstructural characteristics. Example: Calculate the interplanar spacing of a family of atomic planes given a x-ray diffraction pattern. 2. Recognize the effect of composition and microstructure on material properties. Example: The effect of dislocation density on yield strength and electrical conductivity. 3. Take information from a known situation and apply it to a new situation. Example: Effect of temperature and applied stress on the peak positions in a XRD pattern. 4. Predict property response or microstructural changes based on imposed conditions. Example: Effects of temperature and alloying on the resistivity of metals. 5. Assess the interplay of two or more material properties. Example: Assess the effect of atomic bond strength on Young's modulus, coefficient of thermal expansion and melting temperature.

Credits: 3.00

Hard Materials (Metals and Ceramics) Courses (0-9)

MSE 50200 - Defects In Solids

Credit Hours: 3.00. Structures and interactions of point, line, and planar defects in solids, with emphasis on properties of defects. Generic basis of defect energies and interactions, with reference to specific materials and material classes as examples. Types of point defects found in crystals, their origins, interactions, and motion. Overview of dislocation theory and point-defect/dislocation interactions. Structural aspects of surfaces and interfaces, including point and line defect interactions.

Credits: 3.00

MSE 50800 - Phase Transformations In Solids

Credit Hours: 3.00. Description of stress effects on transforming systems. Development of classical models for nucleation and growth and spinodal decomposition. Application of models to discontinuous precipitation, bainite formation, and martensitic transformations.

Credits: 3.00

MSE 53100 - Quantitative Analysis Of Microstructure

Credit Hours: 3.00. A review will be presented of basic

probability theory and statistical analysis, with particular emphasis on terms and definitions of a microstructure. The properties accessible to quantification, the basic stereological relationships and the mathematical foundations, and the microstructural tools needed to quantify the structure will be emphasized. The last one-third of the course will cover applications of quantitative metallography to problems in failure analysis, solidification, heat treatment, phase equilibria, and deformation behavior. Offered in alternate years.

Credits: 3.00

MSE 55900 - Phase Equilibria In Multicomponent Systems

Credit Hours: 3.00. A detailed examination of the thermodynamics of phase equilibria in multicomponent systems, experimental methods of determining these equilibria by measurements of thermodynamic activity and graphical method of representing the equilibria. This is followed by an examination of theoretical models of the behavior of solutions and an examination of the extent to which observed phenomena can be understood and predicted in terms of the models. Offered in alternate years.

Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

Soft Materials (Polymers) Courses (0-6 credits)

MSE 52500 - Struct-Property Relationships Of Engineering Polymers

Credit Hours: 3.00. Structure-property relationships developed for commodity and engineering resins. Focus on connecting bonding and polymer structure (i.e., molecular weight, tacticity, crystallinity as it regards spherulites) to mechanical (yield phenomena and fracture) and thermomechanical behavior (viscoelasticity). Thermal characterization techniques, including DSC, TGA, TMA, and DMTA. Flow of polymer melts related to common melt processing techniques (i.e., extrusion and injection molding). Offered in alternate years.

Learning Outcomes: 1. Identify microstructural differences between thermoplastic, thermosetting, and elastomeric polymers and how these affect thermal and mechanical properties. 2. Discuss the crystalline structures of thermoplastic polymers, including nucleation and growth of spherulitic structures and how molecular weight, tacticity, and cooling rate affect the morphology of the crystals. 3. Discuss entropy elasticity as it relates to elastomeric behavior. 4. Compare and contrast the yield and fracture behavior of polymers with metallic and ceramics materials. 5. Explain viscoelasticity from a microstructural viewpoint, and its manifestations in polymeric mechanical behavior, including mathematical modeling of creep and stress relaxation behaviors of simple and complex systems. 6. Interpret the results from common thermal characterization (TGA, DSC, DMA) techniques and relate them to polymer structure. 7. Discuss polymer melt-processing techniques of extrusion and injection molding, and how polymer chain morphology affects processing. Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

Electives (15-30 credits)

Dissertation Research (60 credits)

MSE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

MSE 69700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Prerequisite: two upper-division mathematics courses: one on linear algebra and one on abstract algebra. Permission of instructor required.

Credits: 0.00 to 18.00

Concentrations

Additional Information

Mathematical and Computational Psychology, PHD

About the Program

Program Requirements

Required Courses (27 credits)

Statistics Courses (9 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important

applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Computational Methods Courses (6 credits)

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general

purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

STAT 54600 - Computational Statistics

Credit Hours: 3.00. The course focuses on two fundamental aspects in computational statistics: (1) what to compute and (2) how to compute. The first is covered with a brief review of advanced topics in statistical inference, including Fisher's fiducial inference, Bayesian and frequenstist methods, and the Dempster-Shafer (DS) Theory. The second is discussed in detail by examining exact, approximation, and interactive simulation methods for statistical inference with a variety of commonly used statistical models. The emphasis is on the EM-type and quasi-Newton algorithms, numerical differentiation and integration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Master commonly used numerical matrix operations, including the sweep operator, Cholesky decomposition, eigenvalue decomposition, and single value decomposition. 2. Understand statistical thinking in development of interactive numerical methods. 3. Apply optimization algorithms such as quasi-Newton and conjugate gradient methods. 4. Implement EM-type algorithms for maximum likelihood estimation when expanded complete-data models are available, including commonly used statistical models. 5. Create random number generators. 6. Implement the Gibbs sampler and Metropolis-Hastings algorithms for Bayesian data analysis. Credits: 3.00

PSY 51300 - Introduction To Computational Cognitive Neuroscience

Credit Hours: 3.00. Computational cognitive neuroscience is a new field of study that lies at the intersection of computational neuroscience and the similar fields of machine learning, neural network theory, connectionism, and artificial intelligence. Like computational neuroscience, computational cognitive neuroscience strives for neurobiological accuracy and like connectionism, a major goal is to account for behavior. Covered topics include feature extraction / optimization, connectionism, computational neuroscience, and computational cognitive neuroscience applications. Permission of department required.

Learning Outcomes: 1. Understand critically existing computational models. 2. Master important computational modeling methods. 3. Implement and simulate computational models. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Mathematics Courses (9 credits)

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

Mathematical Psychology Course (3 credits)

PSY 51100 - Psychophysics

Credit Hours: 3.00. (ECE 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of instructor required.

Credits: 3.00

PSY 51400 - Introduction To Mathematical Psychology

Credit Hours: 3.00. This course introduces the student to the field of mathematical modeling of psychological processes. Mathematical techniques employed in modeling are learned, and a number of mathematical models and theories that have been developed and employed in various important areas of experimental psychology are explained. An introduction to problems in theory and model testability also is given.

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

ECE 51100 - Psychophysics

Credit Hours: 3.00. (PSY 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of department required.

Credits: 3.00

Electives (9 credits)

Dissertation Research (xx credits)

PSY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

GPA Requirements

Additional Information

Concentrations

Mathematics, PHD

About the Program

Program Requirements

Required Courses (42 credits)

Core Courses (12 credits)

MA 53000 - Functions Of A Complex Variable I

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; special topics. More mathematically rigorous than MA 52500.

Credits: 3.00

MA 54400 - Real Analysis And Measure Theory

Credit Hours: 3.00. Metric space topology; continuity, convergence; equicontinuity; compactness; bounded variation, Helly selection theorem; Riemann-Stieltjes integral; Lebesgue measure; abstract measure spaces; LP-spaces; Holder and Minkowski inequalities; Riesz-Fischer theorem.

Credits: 3.00

MA 55300 - Introduction To Abstract Algebra

Credit Hours: 3.00. Group theory: Sylow theorems, Jordan Holder theorem, solvable groups. Ring theory: unique factorization in polynomial rings and principal ideal domains. Field theory: ruler and compass constructions, roots of unity, finite fields, Galois theory, solvability of equations by radicals.

Credits: 3.00

MA 55400 - Linear Algebra

Credit Hours: 3.00. Review of basics: vector spaces, dimension, linear maps, matrices determinants, linear equations. Bilinear forms; inner product spaces; spectral theory; eigenvalues. Modules over a principal ideal domain; finitely generated abelian groups; Jordan and rational canonical forms for a linear transformation.

Credits: 3.00

Selectives (6 credits)

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

MA 52300 - Introduction To Partial Differential Equations

Credit Hours: 3.00. First order quasi-linear equations and their applications to physical and social sciences; the Cauchy-Kovalevsky theorem; characteristics, classification and canonical forms of linear equations; equations of mathematical physics; study of Laplace, wave and heat equations; methods of solution.

Credits: 3.00

MA 53800 - Probability Theory I

Credit Hours: 3.00. (STAT 53800) Mathematically rigorous, measure-theoretic introduction to probability spaces, random variables, independence, weak and strong laws of large numbers, conditional expectations, and martingales.

Credits: 3.00

MA 56200 - Introduction To Differential Geometry And Topology

Credit Hours: 3.00. Smooth manifolds; tangent vectors; inverse and implicit function theorems; submanifolds; vector fields; integral curves; differential forms; the exterior derivative; DeRham cohomology groups; surfaces in E3., Gaussian curvature; two dimensional Riemannian geometry; Gauss-Bonnet and Poincare theorems on vector fields.

Credits: 3.00

MA 57100 - Elementary Topology

Credit Hours: 3.00. Fundamentals of point set topology with a brief introduction to the fundamental group and related topics, topological and metric spaces, compactness, connectedness, separation properties, local compactness, introduction to function spaces, basic notions involving deformations of continuous paths.

Credits: 3.00

MA 57200 - Introduction In Algebraic Topology

Credit Hours: 3.00. Singular homology theory; Eilenberg-Steenrod axioms; simplicial and cell complexes; elementary homotopy theory; Lefschetz fixed point theorem.

Credits: 3.00

Electives (9-24 credits)

Dissertation Research (48 credits)

MA 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Mechanical Engineering, PHD

About the Program

Program Requirements

Required Courses (42 credits)*

Applied Mathematics Courses (3-9 credits)*

ME & Non-ME Courses (21-33 credits)*

Dissertation Research (48 credits)

ME 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Additional Information

Medical Physics, PHD

About the Program

Program Requirements

Required Courses (26 credits)*

Core Courses (24 credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9.

Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical

environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

HSCI 54100 - Human Sectional Anatomy

Credit Hours: 2.00. This course connects anatomy and physiology with medical imaging. The primary focus is on anatomic imaging methods such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) but includes Positron Emission Tomography (PET) and Ultrasound (US) images when applicable or are in common use as part of clinical care.

Learning Outcomes: 1. Identify and label the anatomy associated with the topical outline in diagnostic CT/MRI images. 2. Critique CT/MRI images for the presence or absence of anatomy and pathology to decide whether the image is appropriately positioned and diagnostic for radiological assessment. 3. Locate anatomical systems and possible pathology based on background knowledge of typical anatomical locations and identify normal course of system function for appropriate positioning, patient instructions, and CT/MRI imaging. Credits: 2.00

Professional Course (1 credit)

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (2 credits)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Medical Physics Selectives (9 credits)*

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting

and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation

when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 30500 - Basics Of Oncology

Credit Hours: 3.00. This course will introduce the student to the biology of cancer and some basics of oncology. Focus will be placed on what makes cancer different from normal tissues and how those differences can be leveraged for diagnostic and treatment purposes. This course will touch on topics of epidemiology, cancer biology, common therapeutic and diagnostic approaches, and other considerations of cancer care.

Learning Outcomes: 1. Identify the major risk factors of cancer. 2. Understand the difference between cancer and normal tissue. 3.

Enumerate the major hallmarks of cancer. 4. Explain the link between cancer biology and diagnostic imaging. 5. Describe how cancer therapies target the hallmarks of cancer. Credits: 3.00

HSCI 67200 - MRI Quality Assurance Internship I

Credit Hours: 3.00. This internship course provides didactic training and practical experience in clinical diagnostic medical physics. Students will spend 3-4 hours per week learning the responsibilities of a medical physicist in MRI quality assurance (QA) such as MRI system performance testing, setting up weekly MRI QA procedures, analysis of MRI QA data, and annual clinical system evaluations. In Part I students will observe and review the weekly MRI QA tests performed by the MR Technologists on clinical MRI scanners and be involved with data analysis of these tests (image quality assessment, reporting). Annual MRI system performance evaluations of different clinical scanners will be observed and discussed. This includes assessing magnetic field homogeneity, slice position accuracy and slice thickness accuracy, and performance of radio frequency coil tests on the various coils available at different clinical MRI sites in the Indianapolis area. Students will also work as a team with the instructors on a course project to develop and evaluate advanced MR QA methods and procedures. Prerequisites: HSCI 57000. Having documented experience in running an MRI scanner, e.g., having primary operator status on one of the research scanners at Purdue or IU. Level II MRI Safety Training: http://www.indiana.edu/~mri/safety_nonIU/safety.html. Permission of instructor required.

Learning Outcomes: 1. Understand the basic elements and clinical rationale in the QA program for MRI scanners. 2. Understand the significance of frequency and transmitter gain stability, geometric accuracy, slice position accuracy, high contrast resolution, low contrast detectability and artifacts, etc. 3. Understand the requirements for weekly and annual QA tests as required by ACR. Credits: 3.00

HSCI 51600 - Molecular Imaging-Nuclear Medicine

Credit Hours: 2.00. This course is related to molecular imaging by SPECT (single-photon emission computed tomography) and/or PET (positron emission tomography). This course is particularly useful for graduate and senior undergraduate students in the medical physics programs. It has been offered to MP and HP graduate students over the last 4 years (2014 - 2018) as a part of the 3-credit molecular imaging course with magnetic resonance spectroscopy (MRS: 1-credit) taught by Dr. Ulrike Dydak, computed tomography (CT: 1-credit) taught by Dr. Keith Stantz, and nuclear medicine (NM: 1-credit) taught by Dr. Shuang Liu. In the future, it will be expanded the "Nuclear Medicine" section as a 2-credit course on the basis on the previous lectures. This course focuses on recent development in nuclear medicine techniques for noninvasive imaging of brain diseases, cancer, and heart diseases. This course is delivered as 50-min lectures twice a week. Students are expected to spend more time for homework and literature reading.

Learning Outcomes: 1. Understand the basic concept of molecular imaging, techniques for isotope production, and the use of radiolabeled biomolecules (e.g. antibodies and small biomolecules) for diagnosis of brain diseases, cancer and heart diseases, and for target-specific radiotherapy with the receptor-based radiotracers. Credits: 2.00

HSCI 67400 - Radiological Diagnostic Imaging Internship

Credit Hours: 3.00. This internship course provides the student with hands-on experience with clinical imaging equipment, lectures on the fundamental operation of the equipment, and quality assurance/control methods/assessment of this equipment. Students will learn the safety and imaging performance of flat panel digital x-ray system, fluoroscopy, CT scanner, Ultrasound system, and MRI scanner. Lectures will provide fundamental physics and operation of each system, perform quality assurance methods employed by board certified Medical Physics, and subsequent analysis of these methods. This course is to be delivered as a 50-minute lecture, a 150-minute lab, which includes additional time for image analysis (computational lab). The goal of this course is to provide the necessary information as part of CAMPEP/ABR and ACVR. Prerequisite: HSCI 570 Introduction to Medical Imaging.

Learning Outcomes: 1. Communicate results to the faculty in charge, both verbally and in writing through their lab report. 2. Develop procedures that will provide the required measurement. The protocol they implement will require careful consideration and have a physical understanding of the result. 3. Understanding the quality of the measurements and potential procedural errors. 4. Synthesize many forms of information to understand image artifacts, characterize the cause of these artifacts, and a means to remediate them. 5. Resolve problems,

requiring research and ultimately improvements in procedure or protocol. Credits: 3.00

BME 51500 - Practical MRI And Applications

Credit Hours: 1.00. This course covers basic theory and practical training for magnetic resonance imaging (MRI). Weekly labs allow students to directly train on an MRI system within the Purdue MRI Facility. Weekly lectures are provided on a broad range of applied and relevant topics, including image formation and contrast, pulse sequence basics, artifacts, advanced sequences, and safety. The course is ideally designed for students who want to make use of MRI to advance their research.

Learning Outcomes: 1. Describe the fundamentals of magnetic resonance imaging. 2. Understand safety concerns associated with operating an MRI system. 3. Demonstrate proficiency in the operation of one of the MRI systems on campus. Credits: 1.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

HSCI 67600 - Radiation Therapy Clinical Competencies I

Credit Hours: 3.00. The course is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue-Indiana University School of Medicine joint CAMPEP accredited program. Students will spend approximately 4 hours in the clinic on a weekly basis for 10 weeks. Prerequisite: HSCI 57200.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology clinic. 2. Perform specific quality assurance tasks with limited supervision. 3. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

HSCI 67700 - Radiation Therapy Clinical Competencies II

Credit Hours: 3.00. This is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue CAMPEP accredited program. Students enrolled in this course will participate in the Radiation Oncology clinic, which will provide similar experiences as junior medical physicists in training. Students will meet with the course instructor prior to spending time in the clinic to be assigned mentors and to arrange schedules. Students will spend approximately 3 hours in the clinic on a weekly basis. Absences/vacations are allowed but must be arranged with approved by the mentor with sufficient notice. Prerequisite: HSCI 67600.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology clinic. 2. Perform quality assurance tasks with limited supervision. 3. Understand the roles of other professionals in the Radiation Oncology clinic. 4. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

Electives (xx credits)*

Dissertation Research (6-xx credits)

HSCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Medicinal Chemistry and Molecular Pharmacy, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Biochemistry and Chemistry Courses (0-9 credits)

PHRM 83600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. This course provides instruction in biochemistry that builds on basic knowledge by presenting content on advanced aspects of human biochemistry for students in pharmaceutical sciences. The content emphasizes the integration of biochemical knowledge and the application of biochemical understanding to medically relevant situations including disease etiology, medical diagnosis, disease research, drug discovery, drug and toxin mechanisms of action, and mechanism of drug metabolism.

Learning Outcomes: 1. Understanding and knowledge of biochemistry to an advanced level and to increase the ability to apply that understanding and knowledge to pharmaceutical sciences and the practice of pharmacy. 2. Advanced understanding of biochemistry includes integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Application of biochemical understanding and knowledge includes understanding the molecular basis of many idopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseases of aberrant molecular transport. It also includes the mechanisms of DNA damage and repair and the mechanisms of action of anti-metabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented in this course, as well as demonstrate understanding of the concepts in each content area presented in this course ta is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be

able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

Core Courses (8 credits)

MCMP 69000 - Special Topics In Medicinal Chemistry And Molecular Pharmacology

Credit Hours: 0.00 to 6.00. Special topics, projects, or laboratory exercises in selected areas of medicinal chemistry and molecular pharmacology. Permission of instructor required.

Credits: 0.00 to 6.00

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

MCMP 59800 - Introduction To Research

Credit Hours: 1.00 to 3.00. Introduction to research in synthetic and analytical medicinal chemistry, pharmacognosy, and natural products under the direction of a member of the graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Dissertation Research (xx credits)

MCMP 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

About the Program

Medicinal Chemistry and Molecular Pharmacy/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Biochemistry and Chemistry Courses (0-9 credits)

PHRM 83600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. This course provides instruction in biochemistry that builds on basic knowledge by presenting content on advanced aspects of human biochemistry for students in pharmaceutical sciences. The content emphasizes the integration of biochemical knowledge and the application of biochemical understanding to medically relevant situations including disease etiology, medical diagnosis, disease research, drug discovery, drug and toxin mechanisms of action, and mechanism of drug metabolism.

Learning Outcomes: 1. Understanding and knowledge of biochemistry to an advanced level and to increase the ability to apply that understanding and knowledge to pharmaceutical sciences and the practice of pharmacy. 2. Advanced understanding of biochemistry includes integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Application of biochemical understanding and knowledge includes understanding the molecular basis of many idopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseases of aberrant molecular transport. It also includes the mechanisms of DNA damage and repair and the mechanisms of action of anti-metabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented in this course, as well as demonstrate understanding of the concepts in each content area presented in this course ta is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of

our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment.

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

Core Courses (8 credits)

MCMP 69000 - Special Topics In Medicinal Chemistry And Molecular Pharmacology

Credit Hours: 0.00 to 6.00. Special topics, projects, or laboratory exercises in selected areas of medicinal chemistry and molecular pharmacology. Permission of instructor required.

Credits: 0.00 to 6.00

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

MCMP 59800 - Introduction To Research

Credit Hours: 1.00 to 3.00. Introduction to research in synthetic and analytical medicinal chemistry, pharmacognosy, and natural products under the direction of a member of the graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Dissertation Research (xx credits)

MCMP 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Neuroscience and Behavior, PHD

About the Program

Program Requirements

Required Courses (46 credits)

Statistics Courses (6 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite:

Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Ethics Course (3 credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

PSY 58100 - Neuroethics

Credit Hours: 3.00. Neuroscience research has led to a better understanding of the neuronal basis of behavior. The knowledge, together with new technological approaches that can predict and even control some aspects of human behavior, can have a major impact on social and legal policies. The course explores ethical, social, and legal implications of the use of new technological and pharmacological advances in brain research. Permission of department required.

Learning Outcomes: 1. Learn some of the technology and pharmocology that is currently used to study/manipulate the human mind and behavior. 2. Critically evaluate ethical arguments/dilemmas surrounding the use of such scientific advances. 3. Research in depth a real-world topic in Neuroethics that may have social and/or legal implications at the present time. Credits: 3.00

Seminar Course (20 credits)

PSY 69600 - Seminar In Neuroscience

Credit Hours: 2.00. The course is designed to expose graduate students to diverse areas of most up-to-date research and hone their skills in understanding conceptual issues and tools used to study neuroscience. The students help host speakers and introduce speakers before their colloquium talk. The students will also formally present their own research to the area faculty and students once each year, at a level appropriate to their years in the program. Lastly, each student will write a "journal club" style paper on a recently published empirical study. Permission of instructor required.

Learning Outcomes: 1. Present own research to a broad audience. 2. Evaluate and provide constructive feedback of peer's oral presentations. 3. Comprehend, summarize, and lead a discussion on current research. 4. Network and meet with external speakers and eloquently articulate your research interests.
Credits: 2.00

Methods Courses (6 credits)

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

PSY 60300 - Psychopharmacology

Credit Hours: 3.00. This course will cover core pharmacology concepts and principles, such as neurotransmitters, receptors, drug classes, and mechanisms of drug action, while highlighting recent findings related to pharmacogenetics and sex/gender differences in psychopharmacology. There will also be a primary focus on drug therapy for major psychiatric disorders including addiction, depression, anxiety and schizophrenia. Prerequisites: (BIOL 56200 and PSY 51200) or PSY 61500 or MCMP 57000.

Learning Outcomes: 1. Acquire knowledge about the primary biological systems through which drugs act to produce changes in behavior. 2. Learn basic principles of pharmacokinetics and pharmacodynamics. 3. Learn the primary signs/symptoms of major mental disorders and how these disorders are classified with the DSM. 4. Discuss and differentiate the primary methods currently used to treat mental disorders. 5. Critically evaluate the strengths and weaknesses of primary research papers in psychopharmacology. 6. Explain the use of animal models in psychopharmacology. 7. Explain and discuss the methods used in the "drug discovery pipeline", from target identification to FDA approval and beyond and model the application of new drugs through this pipeline.. 8. Communicate proficient knowledge about a single psychiatric disorder and its pharmacological treatment through oral presentation and writing (white-paper style).
Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data.
Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general

purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

PSY 62901 - fMRI Design And Analysis

Credit Hours: 3.00. Introduces students to the design of fMRI experiments and fMRI data analysis. Covered topics include an introduction to MR physics, block designs, rapid-event related designs, data preprocessing, and standard analyses using the general linear model. Advanced analysis techniques such as functional connectivity and multivariate pattern analysis and common pitfalls in design and analysis will also be covered. Prerequisites: Required: Basic knowledge of inferential statistics. Recommended: Familiarity with the general linear mode (GLM) and signal processing. Permission of department required.

Learning Outcomes: 1. Understand how to design fMRI experiments. 2. Perform fMRI analysis. 3. Interpret the results of fMRI data analysis. 4. Understand and avoid pitfalls related to fMRI data analysis. Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

PSY 51300 - Introduction To Computational Cognitive Neuroscience

Credit Hours: 3.00. Computational cognitive neuroscience is a new field of study that lies at the intersection of computational neuroscience and the similar fields of machine learning, neural network theory, connectionism, and artificial intelligence. Like computational neuroscience, computational cognitive neuroscience strives for neurobiological accuracy and like connectionism, a major goal is to account for behavior. Covered topics include feature extraction / optimization, connectionism, computational neuroscience, and computational cognitive neuroscience applications. Permission of department required.

Learning Outcomes: 1. Understand critically existing computational models. 2. Master important computational modeling methods. 3. Implement and simulate computational models. Credits: 3.00

Neuroscience and Behavior Courses (11 credits)

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 61501 - Systems And Behavioral Neuroscience

Credit Hours: 4.00. This course will provide you with a broad introduction to the field of neuroscience and how it can inform our understanding of behavior. First, we will cover neuroanatomy, synaptic communication, and plasticity. Next, we will cover neuroscience research on a range of major topics relevant to behavior: emotion, motivation, attention, learning, decision-making, and social cognition. This course will also provide a brief introduction to a variety of neuroscience research methods that are commonly used in animal and human research (e.g., electroencephalography, magnetic resonance imaging), including tutorials and live demonstrations. Permission of department required.

Learning Outcomes: 1. Know general neural architecture of core systems relevant to behavior. 2. Know behavioral outcomes for each major neural system. 3. Know how brain structure and functioning are studied in animal research. 4. Know how brain structure and functioning are studied in human research. 5. Know how brain functioning undergirds cognition, affect, and social processes. 6. Translate basic neuroscience to clinical and other applied research. Credits: 4.00

PSY 61601 - Neurobiology Of Brain Disorders

Credit Hours: 4.00. This course covers cellular and molecular mechanisms associated with alterations in brain function and human behavior linked to the most common neurological and psychiatric disorders. Students will learn about genetic, pharmacological, and physiological mechanisms related to the etiology, expression, and treatment of brain disorders. Permission of department required.

Learning Outcomes: 1. Acquire knowledge of the molecular and cellular mechanisms and behavioral components of major brain disorders. 2. Acquire knowledge about the methods and models used to study brain disorders with a focus on translation. 3. Demonstrate proficiency in critically evaluating primary literature. 4. Demonstrate in-depth knowledge of the underlying mechanisms and treatments for a specific brain disorder. Credits: 4.00

Selectives (6-xx credits)

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and

developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

PSY 51100 - Psychophysics

Credit Hours: 3.00. (ECE 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of instructor required.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 60300 - Psychopharmacology

Credit Hours: 3.00. This course will cover core pharmacology concepts and principles, such as neurotransmitters, receptors, drug classes, and mechanisms of drug action, while highlighting recent findings related to pharmacogenetics and sex/gender differences in psychopharmacology. There will also be a primary focus on drug therapy for major psychiatric disorders including addiction, depression, anxiety and schizophrenia. Prerequisites: (BIOL 56200 and PSY 51200) or PSY 61500 or MCMP 57000.

Learning Outcomes: 1. Acquire knowledge about the primary biological systems through which drugs act to produce changes in behavior. 2. Learn basic principles of pharmacokinetics and pharmacodynamics. 3. Learn the primary signs/symptoms of major mental disorders and how these disorders are classified with the DSM. 4. Discuss and differentiate the primary methods currently used to treat mental disorders. 5. Critically evaluate the strengths and weaknesses of primary research papers in psychopharmacology. 6. Explain the use of animal models in psychopharmacology. 7. Explain and discuss the methods used in the "drug discovery pipeline", from target identification to FDA approval and beyond and model the application of new drugs through this pipeline.. 8. Communicate proficient knowledge about a single psychiatric disorder and its pharmacological treatment through oral presentation and writing (white-paper style). Credits: 3.00

PSY 62800 - Perceptual Processes

Credit Hours: 3.00. This course is an advanced introduction to the psychology of perception. The course emphasizes visual and auditory perception, reviewing basic concepts, methodologies, research findings, and theoretical approaches. Theories of direct perception, constructivist perception, and computational vision are discussed in detail.

Credits: 3.00

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 58100 - Neuroethics

Credit Hours: 3.00. Neuroscience research has led to a better understanding of the neuronal basis of behavior. The knowledge, together with new technological approaches that can predict and even control some aspects of human behavior, can have a major impact on social and legal policies. The course explores ethical, social, and legal implications of the use of new technological and pharmacological advances in brain research. Permission of department required.

Learning Outcomes: 1. Learn some of the technology and pharmocology that is currently used to study/manipulate the human mind and behavior. 2. Critically evaluate ethical arguments/dilemmas surrounding the use of such scientific advances. 3. Research in depth

a real-world topic in Neuroethics that may have social and/or legal implications at the present time. Credits: 3.00

PSY 51500 - Neuroscience Of Consciousness

Credit Hours: 3.00. How does your brain generate your uniquely subjective experience of the world? Is it possible to identify distinct neurophysiological markers of your awareness of a particular sight, sound, taste, or touch? What is the cortical basis of your sense of being a self with a first-person point of view that is spatiotemporally grounded in a body? How does consciousness relate to attention and working memory? Does consciousness have an adaptive function? Might a person in a coma or a vegetative state still have some form of awareness? Could a computer or a robot ever have what we would consider to be genuine experiences? During the past few decades, these and other questions about the nature of consciousness have been the focus of increasing empirical and theoretical research in neuroscience and other disciplines. The main purpose of the course is to introduce students to this exciting field of inquiry by exposing them to a variety of representative books and articles in the literature. The "backbone" of the course will be Stanislas Dehaene's Consciousness and the brain: Deciphering how the brain codes our thoughts (2014). As we go through the course, we will use each successive chapter in this book as the starting point for a deeper and wider exploration of the given topic(s), bringing into our discussion relevant experimental findings and philosophical perspectives from other investigators. Requirements: Students will take turns guiding discussions and will also write 1-2 page "response papers" to the weekly readings. Permission of department required.

Learning Outcomes: 1. Learn historically relevant and current research - both theoretical and empirical - on the neuroscience of consciousness. 2. Understand theoretical and empirical approaches used to study the neuroscience of consciousness. 3. Gain background knowledge and experience needed to understand and critically evaluate theoretical and empirical research on the neuroscience of consciousness. Credits: 3.00

PSY 62101 - Genes, Brain And Behavior

Credit Hours: 3.00. This course examines how genes regulate development and function of the brain to ultimately influence behavior. Genetics has come to be an important aspect of research in almost every field of Neuroscience and Psychology ranging from neural development to cognitive function and dysfunction. However, many students have not had the opportunity to explore this in their studies to date. Therefore, the goal of this course is to provide students with the background needed to understand and think critically about the genetic components of Neuroscience and behavioral research. Numerous questions will be explored mainly through discussion of research papers. Lectures by the professor will fill in background knowledge needed to understand the readings. The questions explored will include: What are chromosomes and genes? What do they do? How do they do it? How do genes control development of the brain? How are single genes manipulated in animals to study their effects on behavior? How can genes associated with normal or abnormal behavior be identified? What has been learned from gene-behavior studies in animals? in humans? What do these studies tell us about the nature-nurture controversy? In addition to exploring these more traditional aspects of behavioral genetics we will address the three most exciting recent developments. These include the use of transgenic primate models, selective remote control of specific neural circuits using optogenetics and chemogenetics, and epigenetics, which helps explain how environmental factors and behavior itself can change gene activity and how these changes may be transmitted from one generation to the next. Many behaviors could be used to explore the principles these questions address. The readings will be selected from papers that focus on learning & memory and mental illness. However, if students are interested in other behaviors, papers that involve those behaviors and serve our purposes can be substituted. Grading will be based mainly on informal presentations of papers and participation in discussions of these papers. Permission of department required.

Learning Outcomes: 1. Understand historically relevant and current research on how genes influence behavior. 2. Become familiar with approaches used to study how genes influence behavior. 3. Gain background knowledge and experience needed to understand and critically evaluate research on the influence of genes on behavior. Credits: 3.00

Dissertation Research (xx credits)

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Nuclear Engineering, PHD

About the Program

Program Requirements

Required Courses (48 credits)*

Core Courses (15 credits)

NUCL 50100 - Nuclear Engineering Principles

Credit Hours: 3.00. A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science or engineering. The course is structured in four parts: (1) Nuclear structure and radiation, biological effects and medical applications of radiation. (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality. (3) Nuclear materials and waste. (4) Reactor systems and safety.

Credits: 3.00

NUCL 50400 - Nuclear Engineering Experiments

Credit Hours: 3.00. A laboratory course that, when coupled with NUCL 50100 , produces a sequence that contains both the theoretical and engineering aspects of nuclear engineering. Topics include radiation detection and analysis, neutronics, and nuclear reactor experiments.

Credits: 3.00

NUCL 51000 - Nuclear Reactor Theory I

Credit Hours: 3.00. Methodologies of neutron flux calculations, diffusion and slowing down theory, flux separation, material buckling, resonance absorption, Doppler effect, 2-group and multi-group theories, and reactivity balances for design and operation. Introduction to reactor kinetics, delayed neutrons, point reactor kinetics, transient behavior, load changes, reactivity feedback, and safety implications.

Credits: 3.00

NUCL 52000 - Radiation Effects And Reactor Materials

Credit Hours: 3.00. Introduction to radiation effects in solids and a survey of nuclear reactor materials. Radiation interaction mechanisms and effects on properties. Reactor material characteristics, selection criteria, testing, and economic considerations.

Credits: 3.00

NUCL 55500 - Thermal Hydraulics Measurement And Instrumentation

Credit Hours: 3.00. Measurement techniques in fluid flow, heat transfer, and multi-phase flow. The principle and practice of measurement of temperature, flow, level, pressure, and void fraction (in two-phase flow systems) as applied to nuclear reactor systems. Instrument error and measurement errors, and data acquisition system using PC. Hands-on experience in the laboratory with instruments.

Learning Outcomes: 1. Demonstrate an understanding of the principles of instruments. 2. Demonstrate an ability to design an application of the instrument in fluid system. 3. Understand design concepts, design evaluation and application of a measurement system to practical systems. Credits: 3.00

Technical Electives (33 credits)*

Dissertation Research (42-48 credits)*

NUCL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Additional Information

GPA Requirements

Nursing, DNP

About the Program

Program Requirements - APRN

Required Courses (40 credits)

Core Courses (29 credits)

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 62400 - Evidence-Based Practice

Credit Hours: 3.00. This course focuses on discovery and utilization of evidence-based care to produce the best outcomes for patients. The student develops a problem statement, performs a comprehensive literature search, and critically evaluates the evidence to determine best practice and formulate recommendations. The implementation of evidence-based practice (EBP) practical strategies, and analysis of components of EBP are examined throughout the course. Prerequisite: and either an undergraduate or graduate statistics course within the last five years. is recommended.

Credits: 3.00

NUR 62600 - Applied Biostatistics For Outcome Evaluation

Credit Hours: 3.00. This course applied biostatistical methods commonly used in epidemiologic research to large data sets. Students learn to use statistical software to compute descriptive, bivariate, and multivariate statistics. Students translate statistical findings into conclusions relevant to the delivery of health care. Prerequisites: NUR 51000 and an undergraduate statistics course within the last five years.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 64000 - Human Factors In Healthcare Engineering

Credit Hours: 3.00. This course provides an introduction to human factors and ergonomics with a focus on healthcare applications. Fundamental principles will be introduced including the cognitive, physical, and social considerations that comprise human factors engineering. By course completion, students should be able to formulate studies of and/or evaluate the healthcare domain using these fundamentals principles of human factors engineering. Permission of instructor required. Prerequisites: NUR 51000 or equivalent and Undergraduate Statistics course within the past five years.

Learning Outcomes: 1. Identify human factors relevant to healthcare engineering. 2. Describe

ergonomic concepts applicable to healthcare engineering. 3. Interpret research applicable to human factors and engineering. 4. Apply the fundamental physical, cognitive, and organizational principles to the healthcare setting. Credits: 3.00

NUR 64200 - Systems Approaches In Healthcare

Credit Hours: 3.00. Students are introduced to the fundamentals of systems engineering tools and approaches through hands-on problem-solving exercises. Systems Engineering tools/methods are applied to a clinical problem. Upon completion of this course, the participants will have had exposure to system engineering tools and approaches such as process mapping, bottle-neck analysis, queuing, lean engineering, simulation, optimization, dealing with uncertainty, what-if analysis, quality control and performance monitoring techniques. Permission of instructor required.

Learning Outcomes: 1. Discuss the applicability of systems engineering in a healthcare setting. 2. Develop familiarity with systems engineering tools and approaches. 3. Recognize opportunities for improvement where systems engineering can be employed. 4. Identify a specific clinical problem in a real-world setting that can be analyzed using systems engineering. 5. Conduct an in-depth analysis of a clinical problem using one of the tools/approaches presented. Credits: 3.00

NUR 67800 - Healthcare Economics And Finance

Credit Hours: 3.00. This class will provide an introduction to the application of health economics principles as it relates to various health care systems, health care stakeholders and health policy issues in the United States. The course will explore the allocation and distribution of resources in the health care industry and the nature of the constantly changing relationship between health care and its major constituencies. Topics include the demand for health care, access to care, health care parity, health care reimbursement, economic evaluation, health care delivery models, and health care professionals' services.

Credits: 3.00

NUR 64100 - Principles Of Epidemiology

Credit Hours: 3.00. This course will provide the student with an introduction to epidemiology - the study of the distribution and determinants of health status. This course focuses on application of epidemiologic descriptive and analytic study as it relates to the distribution and determinants of health status. Topics will include the scope and history of epidemiology, basic quantitative methods and measures used in the field, and an introduction to the design and implementation of epidemiological studies. The course will also include the examination of cases from infectious disease, various forms of applied epidemiology (e.g., clinical and field epidemiology), surveillance/screening tests, types of epidemiological studies, concepts of disease transmission, and causality. Prerequisites: At least one undergraduate or graduate level statistics course. Permission of department required.

Credits: 3.00

Residency Courses (11 credits)

NUR 67300 - DNP Health Policy Residency

Credit Hours: 2.00. This residency course provides an opportunity for students to gain greater understanding of how public policy affects state, national, and international health-care delivery systems and resources. Students will interact with top policy makers at the local, state, national, and/or international level to explore the many forces, including political, economic, social, and technological, that influence current policy and the policy-making process. Prerequisite: NUR 65600.

Credits: 2.00

NUR 68000 - DNP Cognate Residency: Direct Practice/Systems Management I

Credit Hours: 3.00. This is the first in a series of two courses that applies knowledge and skill to improve healthcare outcomes in systems. The emphasis is the application of engineering principles to health care including human factors, systems analysis and design, and optimal use of information technology and simulation. Residency activities provide students with opportunities to participate in professional service activities, attend institutes and conferences to expand their area of research or clinical interest and/or develop significant scholarly pursuits. The focus is on creating change in the healthcare system through analysis, synthesis, critique, and application of evidence-based practice to support accessible high quality, safe, efficient, and effective health care. Prerequisites: NUR 68700 .

Credits: 3.00

NUR 68700 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice I

Credit Hours: 3.00. This course is first of a two part series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and

systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 51000 , NUR 62600 , NUR 62400 and Cognate Residencies.

Credits: 3.00

NUR 68900 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice II

Credit Hours: 3.00. This course is second in the series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 68700 and Cognate Residencies.

Credits: 3.00

Program Requirements - Non-APRN

Required Courses (48 credits)

Core Courses (34 credits)

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50200 - Pharmacotherapeutics For Advanced Practice Nursing

Credit Hours: 3.00. Course includes pharmacodynamics, pharmacokinetics, and pharmacotherapeutics of broad categories of pharmacologic agents. Students apply these principles and also consider the role of best available evidence and patient preferences as a basis for managing pharmacologic regimens. Students review regulations relevant to prescriptive authority for advanced practice nurses.

Credits: 3.00

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 50700 - Physiologic Concepts For Advanced Practice Nursing

Credit Hours: 4.00. Students examine the principles of physiologic function at all levels of organization from cells to organ systems as they affect human function. The course uses homeostasis as a model to account for regulatory and compensatory functions in health. Students develop the necessary theoretical and empirical foundation for subsequent understanding of the diagnosis and management of human responses to disease and non-disease based etiologies.

Credits: 4.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 62400 - Evidence-Based Practice

Credit Hours: 3.00. This course focuses on discovery and utilization of evidence-based care to produce the best outcomes for patients. The student develops a problem statement, performs a comprehensive literature search, and critically evaluates the evidence to determine best practice and formulate recommendations. The implementation of evidence-based practice (EBP) practical strategies, and analysis of components of EBP are examined throughout the course. Prerequisite: and either an undergraduate or graduate statistics course within the last five years. is recommended.

Credits: 3.00

NUR 62600 - Applied Biostatistics For Outcome Evaluation

Credit Hours: 3.00. This course applied biostatistical methods commonly used in epidemiologic research to large data sets. Students learn to use statistical software to compute descriptive, bivariate, and multivariate statistics. Students translate statistical findings into conclusions relevant to the delivery of health care. Prerequisites: NUR 51000 and an undergraduate statistics course within the last five years.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 64000 - Human Factors In Healthcare Engineering

Credit Hours: 3.00. This course provides an introduction to human factors and ergonomics with a focus on healthcare applications. Fundamental principles will be introduced including the cognitive, physical, and social considerations that comprise human factors engineering. By course completion, students should be able to formulate studies of and/or evaluate the healthcare domain using these fundamentals principles of human factors engineering. Permission of instructor required. Prerequisites: NUR 51000 or equivalent and Undergraduate Statistics course within the past five years.

Learning Outcomes: 1. Identify human factors relevant to healthcare engineering. 2. Describe ergonomic concepts applicable to healthcare engineering. 3. Interpret research applicable to human factors and engineering. 4. Apply the fundamental physical, cognitive, and organizational principles to the healthcare setting. Credits: 3.00

NUR 64200 - Systems Approaches In Healthcare

Credit Hours: 3.00. Students are introduced to the fundamentals of systems engineering tools and approaches through hands-on problem-solving exercises. Systems Engineering tools/methods are applied to a clinical problem. Upon completion of this course, the participants will have had exposure to system engineering tools and approaches such as process mapping, bottle-neck analysis, queuing, lean engineering, simulation, optimization, dealing with uncertainty, what-if analysis, quality control and performance monitoring techniques. Permission of instructor required.

Learning Outcomes: 1. Discuss the applicability of systems engineering in a healthcare setting. 2. Develop familiarity with systems engineering tools and approaches. 3. Recognize opportunities for improvement where systems engineering can be employed. 4. Identify a specific clinical problem in a real-world setting that can be analyzed using systems engineering. 5. Conduct an in-depth analysis of a clinical problem using one of the tools/approaches presented. Credits: 3.00

NUR 67800 - Healthcare Economics And Finance

Credit Hours: 3.00. This class will provide an introduction to the application of health economics principles as it relates to various health care systems, health care stakeholders and health policy issues in the United States. The course will explore the allocation and distribution of resources in the health care industry and the nature of the constantly changing relationship between health care and its major constituencies. Topics include the demand for health care, access to care, health care parity, health care reimbursement, economic evaluation, health care delivery models, and health care professionals' services.

Credits: 3.00

NUR 64100 - Principles Of Epidemiology

Credit Hours: 3.00. This course will provide the student with an introduction to epidemiology - the study of the distribution and determinants of health status. This course focuses on application of epidemiologic descriptive and analytic study as it relates to the distribution and determinants of health status. Topics will include the scope and history of epidemiology, basic quantitative methods and measures used in the field, and an introduction to the design and implementation of epidemiological studies. The course will also include the examination of cases from infectious disease, various forms of applied epidemiology (e.g., clinical and field epidemiology), surveillance/screening tests, types of epidemiological studies, concepts of disease transmission, and causality. Prerequisites: At least one undergraduate or graduate level statistics course. Permission of department required.

Credits: 3.00

Residency Courses (14 credits)

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 67300 - DNP Health Policy Residency

Credit Hours: 2.00. This residency course provides an opportunity for students to gain greater understanding of how public policy affects state, national, and international health-care delivery systems and resources. Students will interact with top policy makers at the local, state, national, and/or international level to explore the many forces, including political, economic, social, and technological, that influence current policy and the policy-making process. Prerequisite: NUR 65600.

Credits: 2.00

NUR 68000 - DNP Cognate Residency: Direct Practice/Systems Management I

Credit Hours: 3.00. This is the first in a series of two courses that applies knowledge and skill to improve healthcare outcomes in systems. The emphasis is the application of engineering principles to health care including human factors, systems analysis and design, and optimal use of information technology and simulation. Residency activities provide students with opportunities to participate in professional service activities, attend institutes and conferences to expand their area of research or clinical interest and/or develop significant scholarly pursuits. The focus is on creating change in the healthcare system through analysis, synthesis, critique, and application of evidence-based practice to support accessible high quality, safe, efficient, and effective health care. Prerequisites: NUR 68700 .

Credits: 3.00

NUR 68700 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice I

Credit Hours: 3.00. This course is first of a two part series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 51000 , NUR 62600 , NUR 62400 and Cognate Residencies.

Credits: 3.00

NUR 68900 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice II

Credit Hours: 3.00. This course is second in the series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 68700 and Cognate Residencies.

Credits: 3.00

Concentrations

Program Learning Outcomes

About the Program

Nursing, PHD

About the Program

Program Requirements

Required Courses (60-90 credits)*

Core Courses (13-21 credits)*

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role.

Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 53200 - Acute Illness: Adult Health Practice

Credit Hours: 3.00. Examination of pathophysiological alterations and clinical management of acute conditions in adolescents and adults. Students will synthesize knowledge of physiological, psychological, and sociocultural factors in the assessment and management of acute illness. Focus is on the differential diagnosis, clinical management, patient and family education within the context of primary care. Health promotion models, as well as biopsychosocial and cultural theories are integrated throughout the course. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 69010 - Research Seminar

Credit Hours: 1.00. The Seminar in Nursing Research is a discussion-based course intended to socialize the nursing student to the role of an independent scholar. Discussion concentrates upon current topics and issues in nursing research, with an emphasis on targeting the most supportive trajectories for individual student research foci. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69020 - Leadership Seminar

Credit Hours: 1.00. The nurse as leader is deconstructed and reconstructed within the realms of scientific knowledge, theory, education, and healthcare delivery. Nurse leaders as members of collaborative teams and the influence of nursing intelligence on research teams are examined. Historical and societal influences affecting nurse leaders are examined, including media portrayals of nursing, transformational leadership, critical theory and feminist theory. Models of leadership are explored within the context of scientific work; the student is challenged to evaluate themselves as present and future leaders and members of nursing's academe. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69030 - Communication Seminar

Credit Hours: 1.00. Original research findings, using a global framework, are analyzed. The effectiveness of communication to implement and evaluate programs designed to promote innovative change in healthcare is critiqued. Communication as a mechanism to develop pathways to ensure accuracy of scientific information transfer, and as a necessary component of policy and major public health events is appraised. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to

graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69040 - Collaboration Seminar

Credit Hours: 1.00. Principles of collaboration to generate scientific knowledge, which is used to improve nursing and healthcare practice, education, policy, and outcomes, are discussed. Evidence generated from transdisciplinary teams is analyzed with attention given to specific professions contributions and roles. The specific role of the nurse scientist and the value of nursing intelligence within the context of collaborative projects are discussed. Best practices in collaboration as exemplified by select research teams are presented. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69050 - Implementing Theory In Healthcare Research

Credit Hours: 3.00. Historical and contemporary social, ethical, educational, scientific, and professional influences on the development of theoretical knowledge in nursing and health research are analyzed. Various methods of theory development are reviewed. Selected biological/physiological, behavioral, and health service theories that form the basis of nursing science are critically evaluated. Skills needed for theory analysis and theory development are emphasized. The role of theoretical knowledge to innovation in nursing science and healthcare is presented. Scientific bridges between theoretical frameworks and research methods are appraised. Selected nursing and healthcare scientists communicate the theoretical aspects of their programs of research with an emphasis on collaboration between disciplines. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 3.00

NUR 69060 - Innovative Care/Innovations In Healthcare Delivery

Credit Hours: 3.00. Historical, ethical, financial, and social influences on contemporary innovations in healthcare practices and delivery systems are analyzed. The genesis and diffusion of both micro- and macro-level innovations are reconstructed with the use of theories, organizational and transdisciplinary factors, and effective processes. Quality of care issues are synthesized utilizing innovations in care and health delivery systems as a framework. With innovative care and innovations in healthcare delivery systems as frameworks, quality of care issues are appraised. Selected exemplars of successful innovations, with an emphasis on strategies to evaluate dissemination and impact, are analyzed. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 3.00

NUR 60400 - PhD Seminar

Credit Hours: 0.00. This seminar is taken by Ph.D. nursing students each semester to integrate themselves to the academic and professional roles of the Ph.D. prepared nurse. This seminar will facilitate students to share their research ideas and progress through networking and collegial discourse. It also provides a low-stake forum where students can give and receive feedback on each other's research. Seminar goals include improving students' presentation and writing skills, teaching how to give constructive criticism, and advising on the academic and professional job market.

Credits: 0.00

Research Courses (13-22 credits)*

HK 46500 - Research Methods

Credit Hours: 3.00. This course will be conducted in a lecture/lab format. The lectures will introduce the basic knowledge necessary to understanding the entire research process as it is found in health and kinesiology. The laboratories will be designed to give students practice in discovering research questions, preparing research proposals, evaluating existing research, and applying research to practical problems.

Learning Outcomes: 1. Describe the nature of research and the scientific method. 2. Describe the different types of research conducted within health and kinesiology, and the value of each type of research. 3. Provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating research in basic and applied settings. 4. Identify a potential topic/issue to examine and conduct a review of the existing research literature and summarize and critically evaluate a research article. 5. Describe the steps involved in developing a research proposal, collecting and analyzing data, and reporting the results of a research project.

Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

NUR 51000 - Research And Evidence Based Nursing Practice

Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 62600 - Applied Biostatistics For Outcome Evaluation

Credit Hours: 3.00. This course applied biostatistical methods commonly used in epidemiologic research to large data sets. Students learn to use statistical software to compute descriptive, bivariate, and multivariate statistics. Students translate statistical findings into conclusions relevant to the delivery of health care. Prerequisites: NUR 51000 and an undergraduate statistics course within the last five years.

Credits: 3.00

NUR 69100 - Health Care Research Methods

Credit Hours: 3.00. This course advances knowledge and skill in quantitative research methods for health program evaluation, population health, healthcare quality improvement, and other healthcare research applications. Topics include design of experimental, quasi-experimental, and observational studies; primary data collection through surveys and other techniques; use of clinical, administrative, and other secondary data sources; and data analysis strategies appropriate to each design and type of data. The course addresses basic issues of sampling, measurement, and validity and reliability, as well as practical issues that arise in healthcare research.

Credits: 3.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

Electives (12-18 credits)*

Dissertation Research (27-30 credits)

NUR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Learning Outcomes

Additional Information

GPA Requirements

Nursing/Gerontology, PHD

About the Program

Program Requirements

Required Courses (60-90 credits)*

Core Courses (13-21 credits)*

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced

practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 69010 - Research Seminar

Credit Hours: 1.00. The Seminar in Nursing Research is a discussion-based course intended to socialize the nursing student to the role of an independent scholar. Discussion concentrates upon current topics and issues in nursing research, with an emphasis on targeting the most supportive trajectories for individual student research foci. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69020 - Leadership Seminar

Credit Hours: 1.00. The nurse as leader is deconstructed and reconstructed within the realms of scientific knowledge, theory, education, and healthcare delivery. Nurse leaders as members of collaborative teams and the influence of nursing intelligence on research teams are examined. Historical and societal influences affecting nurse leaders are examined, including media portrayals of nursing, transformational leadership, critical theory and feminist theory. Models of leadership are explored within the context of scientific work; the student is challenged to evaluate themselves as present and future leaders and members of nursing's academe. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

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Credit Hours: 1.00. Original research findings, using a global framework, are analyzed. The effectiveness of communication to implement and evaluate programs designed to promote innovative change in healthcare is critiqued. Communication as a mechanism to develop pathways to ensure accuracy of scientific information transfer, and as a necessary component of policy and major public health events is appraised. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

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collaborative projects are discussed. Best practices in collaboration as exemplified by select research teams are presented. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

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Credits: 3.00

NUR 69060 - Innovative Care/Innovations In Healthcare Delivery

Credit Hours: 3.00. Historical, ethical, financial, and social influences on contemporary innovations in healthcare practices and delivery systems are analyzed. The genesis and diffusion of both micro- and macro-level innovations are reconstructed with the use of theories, organizational and transdisciplinary factors, and effective processes. Quality of care issues are synthesized utilizing innovations in care and health delivery systems as a framework. With innovative care and innovations in healthcare delivery systems as frameworks, quality of care issues are appraised. Selected exemplars of successful innovations, with an emphasis on strategies to evaluate dissemination and impact, are analyzed. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

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Credit Hours: 0.00. This seminar is taken by Ph.D. nursing students each semester to integrate themselves to the academic and professional roles of the Ph.D. prepared nurse. This seminar will facilitate students to share their research ideas and progress through networking and collegial discourse. It also provides a low-stake forum where students can give and receive feedback on each other's research. Seminar goals include improving students' presentation and writing skills, teaching how to give constructive criticism, and advising on the academic and professional job market.

Credits: 0.00

Research Courses (13-22 credits)*

HK 46500 - Research Methods

Credit Hours: 3.00. This course will be conducted in a lecture/lab format. The lectures will introduce the basic knowledge necessary to understanding the entire research process as it is found in health and kinesiology. The laboratories will be designed to give students practice in discovering research questions, preparing research proposals, evaluating existing research, and applying research to practical problems.

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Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

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Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 62600 - Applied Biostatistics For Outcome Evaluation

Credit Hours: 3.00. This course applied biostatistical methods commonly used in epidemiologic research to large data sets. Students learn to use statistical software to compute descriptive, bivariate, and multivariate statistics. Students translate statistical findings into conclusions relevant to the delivery of health care. Prerequisites: NUR 51000 and an undergraduate statistics course within the last five years.

Credits: 3.00

NUR 69100 - Health Care Research Methods

Credit Hours: 3.00. This course advances knowledge and skill in quantitative research methods for health program evaluation, population health, healthcare quality improvement, and other healthcare research applications. Topics include design of experimental, quasi-experimental, and observational studies; primary data collection through surveys and other techniques; use of clinical, administrative, and other secondary data sources; and data analysis strategies appropriate to each design and type of data. The course addresses basic issues of sampling, measurement, and validity and reliability, as well as practical issues that arise in healthcare research.

Credits: 3.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

Electives (12-18 credits)*

Dissertation Research (27-30 credits)

NUR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Learning Outcomes

Additional Information

GPA Requirements

Nutrition Science/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (25 credits)

NUTR 60500 - Nutritional Biochemistry And Physiology I

Credit Hours: 4.00. (ANSC 62500) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing interactions in bone and gut metabolism and physiology. Permission of instructor required.

Credits: 4.00

NUTR 60600 - Nutritional Biochemistry And Physiology II

Credit Hours: 2.00. (ANSC 62600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules, emphasizing integrative metabolism in liver, muscle and adipose tissues. Offered weeks 1 - 8. Prerequisite: NUTR 60500.

Credits: 2.00

NUTR 60700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (ANSC 62700) Integration of biochemical and physiological functions of nutrients in humans and animals, emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9 - 16. Prerequisite: NUTR 60600.

Credits: 2.00

NUTR 69000 - Interdepartmental Nutrition Program Grant Writing

Credit Hours: 1.00. Fulfillment of grant writing requirements for graduate students enrolled in the Interdepartmental Nutrition Program. Prerequisite: Interdepartmental Nutrition Program graduate students status. Permission of instructor required.

Credits: 1.00

NUTR 69400 - Introductory Presentation Skills In Nutrition Science

Credit Hours: 1.00. Introductory training and application of concepts for effective communication through oral and poster presentations in the field of nutrition science.

Credits: 1.00

NUTR 69500 - Interdepartmental Nutrition Program Seminar

Credit Hours: 0.00 or 1.00. Develop and strengthen skills in organization, preparation, and presentation of scientific information relevant to nutrition science to an audience of scientists.

Credits: 0.00 or 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

NUTR 62600 - Advanced Presentation Skills

Credit Hours: 1.00. This course will teach graduate students how to synthesize information from multiple scientific studies and then communicate that information effectively to others in the form of a 40 minute long scientific seminar. The course is

designed to provide students with clear guidelines for effective long-form oral communication of scientific information and then give students an opportunity to put those guidelines into practice. Prerequisites: Graduate standing past the first year. NUTR 69400 or equivalent course (determined by instructor review). For PhD students; INP Scientific Writing Course NUTR 62700. For MS students; a statement from the research mentor that the student has a clear thesis topic, that the student has completed the majority of work on the thesis, and that the student has conducted background reading on the thesis topic.

Credits: 1.00

NUTR 62700 - Scientific Writing In Nutrition Science

Credit Hours: 1.00. The goal of this course is to develop and practice skills for clear scientific writing. The course is designed to introduce and practice the building blocks of scientific writing, including word choice, sentence structure and paragraph structure. In addition, students will be introduced to components of a hypothesis testing biomedical research paper in order to communicate a storyline. In addition, the publication cycle will be discussed. Prerequisites: Graduate standing past the first year. NUTR 60500 and NUTR 60600 and NUTR 60700. Other students can be approved for entry by permission of the instructor.

Credits: 1.00

Specialty Area Courses (4 credits)

Animal Health, Growth, and Development

Biochemical and Molecular Nutrition

Human and Clinical Nutrition

Population Nutrition and Health Promotion

Dissertation Research (xx credits)

NUTR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Nutrition Science/Gerontology, PHD

About the Program

Program Requirements

Required Courses (25 credits)

NUTR 60500 - Nutritional Biochemistry And Physiology I

Credit Hours: 4.00. (ANSC 62500) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing interactions in bone and gut metabolism and physiology. Permission of instructor required.

Credits: 4.00

NUTR 60600 - Nutritional Biochemistry And Physiology II

Credit Hours: 2.00. (ANSC 62600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules, emphasizing integrative metabolism in liver, muscle and adipose tissues. Offered weeks 1 - 8. Prerequisite: NUTR 60500.

Credits: 2.00

NUTR 60700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (ANSC 62700) Integration of biochemical and physiological functions of nutrients in humans and animals, emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9 - 16. Prerequisite: NUTR 60600.

Credits: 2.00

NUTR 69000 - Interdepartmental Nutrition Program Grant Writing

Credit Hours: 1.00. Fulfillment of grant writing requirements for graduate students enrolled in the Interdepartmental Nutrition Program. Prerequisite: Interdepartmental Nutrition Program graduate students status. Permission of instructor required.

Credits: 1.00

NUTR 69400 - Introductory Presentation Skills In Nutrition Science

Credit Hours: 1.00. Introductory training and application of concepts for effective communication through oral and poster presentations in the field of nutrition science.

Credits: 1.00

NUTR 69500 - Interdepartmental Nutrition Program Seminar

Credit Hours: 0.00 or 1.00. Develop and strengthen skills in organization, preparation, and presentation of scientific information relevant to nutrition science to an audience of scientists.

Credits: 0.00 or 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

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NUTR 62600 - Advanced Presentation Skills

Credit Hours: 1.00. This course will teach graduate students how to synthesize information from multiple scientific studies and then communicate that information effectively to others in the form of a 40 minute long scientific seminar. The course is designed to provide students with clear guidelines for effective long-form oral communication of scientific information and then give students an opportunity to put those guidelines into practice. Prerequisites: Graduate standing past the first year. NUTR 69400 or equivalent course (determined by instructor review). For PhD students; INP Scientific Writing Course NUTR 62700. For MS students; a statement from the research mentor that the student has a clear thesis topic, that the student has completed the majority of work on the thesis, and that the student has conducted background reading on the thesis topic.

Credits: 1.00

NUTR 62700 - Scientific Writing In Nutrition Science

Credit Hours: 1.00. The goal of this course is to develop and practice skills for clear scientific writing. The course is designed to introduce and practice the building blocks of scientific writing, including word choice, sentence structure and paragraph structure. In addition, students will be introduced to components of a hypothesis testing biomedical research paper in order to communicate a storyline. In addition, the publication cycle will be discussed. Prerequisites: Graduate standing past the first year. NUTR 60500 and NUTR 60600 and NUTR 60700. Other students can be approved for entry by permission of the instructor.

Credits: 1.00

Specialty Area Courses (4 credits)

Animal Health, Growth, and Development

Biochemical and Molecular Nutrition

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Population Nutrition and Health Promotion

Dissertation Research (xx credits)

NUTR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Nutrition, PHD

About the Program

Program Requirements

Required Courses (25 credits)

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Credit Hours: 2.00. (ANSC 62600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules, emphasizing integrative metabolism in liver, muscle and adipose tissues. Offered weeks 1 - 8. Prerequisite: NUTR 60500.

Credits: 2.00

NUTR 60700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (ANSC 62700) Integration of biochemical and physiological functions of nutrients in humans and animals, emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9 - 16. Prerequisite: NUTR 60600.

Credits: 2.00

NUTR 69000 - Interdepartmental Nutrition Program Grant Writing

Credit Hours: 1.00. Fulfillment of grant writing requirements for graduate students enrolled in the Interdepartmental Nutrition Program. Prerequisite: Interdepartmental Nutrition Program graduate students status. Permission of instructor required.

Credits: 1.00

NUTR 69400 - Introductory Presentation Skills In Nutrition Science

Credit Hours: 1.00. Introductory training and application of concepts for effective communication through oral and poster presentations in the field of nutrition science.

Credits: 1.00

NUTR 69500 - Interdepartmental Nutrition Program Seminar

Credit Hours: 0.00 or 1.00. Develop and strengthen skills in organization, preparation, and presentation of scientific information relevant to nutrition science to an audience of scientists.

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Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

NUTR 62600 - Advanced Presentation Skills

Credit Hours: 1.00. This course will teach graduate students how to synthesize information from multiple scientific studies and then communicate that information effectively to others in the form of a 40 minute long scientific seminar. The course is designed to provide students with clear guidelines for effective long-form oral communication of scientific information and then give students an opportunity to put those guidelines into practice. Prerequisites: Graduate standing past the first year. NUTR 69400 or equivalent course (determined by instructor review). For PhD students; INP Scientific Writing Course NUTR 62700. For MS students; a statement from the research mentor that the student has a clear thesis topic, that the student has completed the majority of work on the thesis, and that the student has conducted background reading on the thesis topic.

Credits: 1.00

NUTR 62700 - Scientific Writing In Nutrition Science

Credit Hours: 1.00. The goal of this course is to develop and practice skills for clear scientific writing. The course is designed to introduce and practice the building blocks of scientific writing, including word choice, sentence structure and paragraph structure. In addition, students will be introduced to components of a hypothesis testing biomedical research paper in order to communicate a storyline. In addition, the publication cycle will be discussed. Prerequisites: Graduate standing past the first year. NUTR 60500 and NUTR 60600 and NUTR 60700. Other students can be approved for entry by permission of the instructor.

Credits: 1.00

Specialty Area Courses (4 credits)

Animal Health, Growth, and Development

Biochemical and Molecular Nutrition

Human and Clinical Nutrition

Population Nutrition and Health Promotion

Dissertation Research (xx credits)

NUTR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

NUTR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Occupational and Environmental Health Sciences, PhD

About the Program

Program Requirements

Required Courses (18 credits)*

Core Courses (15 credits)

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment.

Credits: 3.00

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies.

Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

Professional Course (1 credit)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (2 credits)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Statistics Selectives (6 credits)*

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques. Students will acquire the ability to utilize statistical software as a tool to facilitate the processing, editing, storing, displaying, analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical

methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

HDFS 61700 - Quantitative Methods II: Regression

Credit Hours: 4.00. This course has two primary goals: 1) provide students with foundational knowledge related to linear regression statistical analyses, and 2) provide students with the opportunity to practice writing, interpreting, and presenting regression analyses for the purposes of dissemination. Prerequisite: HDFS 61300 or PUBH 60100 or STAT 50100 or PSY 64600. Permission of instructor required.

Learning Outcomes: 1. Understand the foundations of linear regression statistical analyses, including multiple regression. 2. Understand mediation and moderation hypotheses and associated testing in linear regression. 3. Derive research questions and hypotheses testable in linear regression. 4. Analyze data using linear regression modeling and statistical software. 5. Properly interpret the statistical estimates and tests covered in the course. 6. Apply regression modeling to your research questions using empirical data. 7. Produce written communication of analytic methods and interpretation of results. Credits: 4.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and

their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

OEHS Selectives (6-9 credits)*

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 4.00

HSCI 55100 - Physical Agents In Environmental Health

Credit Hours: 3.00. Physical characterization and biological interactions of non-ionizing radiation with emphasis on the adverse effects of human exposure. Topics include source characterization, environmental exposure assessment, measurement instrumentation, toxicological and epidemiological findings, control strategies.

Credits: 3.00

HSCI 55200 - Introduction To Aerosol Science

Credit Hours: 3.00. The principles of aerosol behavior and sampling, with particular emphasis on applications in the health sciences. Topics include aerosol aerodynamics, aerosol filtration, pulmonary deposition of aerosols, methods of environmental sampling, and generation of laboratory aerosols.

Credits: 3.00

HSCI 58000 - Occupational Biomechanics And Ergonomics

Credit Hours: 2.00. Occupational safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. Occupational ergonomics is a branch of science that focuses on optimizing the relationships between workers and their work environment. This course focuses on the principles and applications of safety and ergonomics as it applies to workers. The first part of the course will consist of lectures on the fundamentals of safety standards and liability and the development of work-related musculoskeletal disorders, ergonomic risk factors including work practices, tools and workstation design. The last part will consist of identification and use of safety and ergonomic controls to reduce and prevent work-related fatalities, injuries, and musculoskeletal disorders.

Learning Outcomes: 1. Describe ergonomic risk factors in the workplace. 2. Analyze work stations and identify ergonomic risk factors. 3. Develop solutions to minimize identified ergonomic risk factors. 4. Describe cumulative trauma disorders which may occur due to exposure to poor ergonomic conditions. 5. Explain how people perceive & understand information, and use this knowledge to improve work flow. Credits: 2.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used

as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 55300 - Advanced Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization, protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front line employees. As such, the successful health and safety manager needs to skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the front line employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the front line employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the front line employees and upper management together in their vision of a safe and health workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. Credits: 3.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the

components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 3.00

HSCI 58001 - Occupational Biomechanics And Ergonomics Laboratory

Credit Hours: 1.00. This course will be the laboratory component for HSCI 58000. Occupational Biomechanics and Ergonomics. Laboratory exercises will accompany and illustrate each topic discussed during the lecture course. An ergonomic project will allow the students to evaluate an individual performing a job and provide ergonomic recommendations to improve the work situation. The course will also emphasize report writing, teamwork, and communication skills.

Learning Outcomes: 1. Evaluate scientific literature to identify the strengths & weaknesses of study designs, interpretation of results, and implications for the future. 2. Display techniques for performing ergonomic measurements. 3. Evaluate ergonomic hazards of the workplace and make recommendations to correct the identified hazards. 4. Write professional quality reports summarizing laboratory procedures, clearly display experiment results, and interpret those results in the context of the principles learned in the HSCI 58000 lectures. Credits: 1.00

Dissertation Research (57-60 credits)

HSCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Additional Information

GPA Requirements

Organizational Behavior and Human Resource Management, PHD

About the Program

Program Requirements

Required Courses (24 credits)

Research Methods Courses (18 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

EDPS 63500 - Psychometric Theory And Application

Credit Hours: 3.00. Advanced classical test theory and application of psychometric methods to study technical

properties of tests. Prerequisite: (EDPS 53100 and STAT 50200), or (PSY 60100 or PSY 51200) or consent of Instructor.

Learning Outcomes: 1. Demonstrate an understanding of mathematical and statistical concepts in various measurements principles. 2. Apply understanding of reliability and validity in both classical and modern measurement theory frameworks to solve practical measurement problems. 3. Demonstrate knowledge of psychometric theories in scale development. 4. Read the literature related to psychometrics in their own substantive areas more critically. 5. Use measurement or scales more intelligently in research. 6. Explain different models of modern test theory. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

OBHR 60500 - Research Methods I

Credit Hours: 3.00. An introduction to research methods. This seminar examines the use of research methods to develop empirical tests for theoretical and practical issues. It includes readings and discussions on the philosophy of science, reliability, validity, research design, threats to research, ethics, and other issues in research methodology. Students formulate hypotheses and an original research design to test their hypotheses.

Learning Outcomes: 1. Identify key decisions organizational researchers must make when crafting research proposals and conducting studies. 2. Demonstrate ability to generate a sound research proposal, based on course concepts and key research decisions discussed throughout the course. 3. Criticize the research methods employed in prior published works in the organizational literature, comparing and contrasting exemplary versus less-than-exemplary approaches. Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2.

Critically read and evaluate empirical journal articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

Managerial Skills Courses (6 credits)

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

Major Specialization Courses (16 credits)

OBHR 60600 - Research Practicum

Credit Hours: 2.00 or 3.00. Independent empirical research in organizational behavior and human resource management, including the submission of a written report. Prerequisite: OBHR 60500 . Permission of instructor required.

Credits: 2.00 or 3.00

Electives (6 credits)

Pharmacy Practice/Gerontology, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

Pharmacy, Pharm.D

About the Program

Program Requirements

Required Courses (121 credits)

Didactic Courses (84 credits)

PHRM 82000 - Professional Skills Laboratory I

Credit Hours: 2.00. Experiments, computer simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82100 - Professional Skills Laboratory II

Credit Hours: 2.00. Continuation of PHRM 82000 with emphasis upon modules that provide laboratory practice experience designed to integrate basic science concepts and practice applications. Small group problem-solving methodology will be utilized as appropriate.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply

pharmacotherapeutics to the practice of pharmacy. Prerequisite: MCMP 20400, 20500, 20800, and BIOL 20300, 20400 or 30100, 30200. Departmental permission required.

Learning Outcomes: 1. Conceptual Competence: Pathophysiology, Principles of pharmacology. 2. Scientific Comprehension: Basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Critical Thinking and Decision Making Abilities: Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Communication Skills and Abilities: Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Responsible use of Professional Values and Ethical Principles: Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Professional Abilities and Habits: Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHRM 82800 - Dosage Forms I

Credit Hours: 3.00. The purpose of Dosage Forms I is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Explain the basic scientific principles involved in drug delivery such as dissolution, chemical stability, physical stability, content uniformity, and bioavailability. 2. Describe the essential scientific principles involved in the design of solutions, emulsions, suspensions, as well as dermatological and ophthalmic dosage forms. 3. Evaluate the quality parameters of dosage forms that are involved in product selection. 4. Analyze and interpret the results of bioequivalence studies that are important in product selection. 5. Advise patients on the proper use and storage of liquid dosage forms. Credits: 3.00

PHRM 82900 - Dosage Forms II

Credit Hours: 2.00. Education in the use of dosage forms to deliver drugs. Collaboration with peers and other members of the health care team regarding the proper use of the various dosage forms so that the desired therapeutic objective is achieved.

Learning Outcomes: 1. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and isoosmolality, IV bags and drip sets. 2. Explain the basic scientific principles involved in the performance of solid dosage forms, including amorphous and crystalline solids, polymorphism, dissolution, diffusion, chemical and physical stability, bioequivalence and bioavailability. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including oral, buccal, rectal, subcutaneous and transdermal routes. 4. Evaluate quality parameters for solid dosage forms, as an aid to product selection. 5. Advise patients on the proper use and storage of solid dosage forms, and understand the relationship of dosage form selection to clinical outcomes. 6. Explain the factors involved in the

use of generic versions of solid dosage forms and their influence on therapeutic outcomes, including the ability to identify drugs for which switching to a generic form should be approached with caution. Credits: 2.00

PHRM 83400 - Pharmaceutical Calculations

Credit Hours: 1.00. Mastery of pharmaceutical calculation skills is vital and PHRM 83400 prepares students to apply calculation problem solving skills to clinical practice. PHRM 83400 prepares students to perform pharmaceutical calculations necessary for prescription/drug order preparation, compounding dosage forms, and medication dosage calculations based on patient specific factors. Pharmacists must perform error-free pharmaceutical calculations. Correct calculations contribute as much to pharmaceutical care as the newest methods/guidelines for diagnosis, treatment, and prevention. The development of problem solving skills with pharmaceutical calculations is an important component of this course. In addition, practice and repetition of problems is necessary to develop confidence as well as accuracy. Appropriate documentation of work/set up and numerical answers (including units) is required. Approaches to minimize errors and maximize accuracy with pharmaceutical calculations are emphasized.

Learning Outcomes: 1. Describe the role of pharmaceutical calculations in the provision of pharmaceutical care. 2. Perform accurate/error-free pharmaceutical calculations in an organized, clear, and appropriately documented format. 3. Express numerical answers in a clear manner which includes units and appropriate use of zeros with decimal points. 4. Interpret abbreviations and professional nomenclature in prescriptions/drug orders. 5. List the equivalents/conversion factors for the systems of measurement used in pharmacy (i.e., metric, apothecary, avoirdupois, and household). 6. Convert from one unit to another between and within the various systems of measurement used in pharmacy. 7. Calculate quantities of ingredients necessary to reduce or enlarge a pharmaceutical formula. 8. Define and appropriately utilize specific gravity in pharmaceutical calculations. 9. Define and perform pharmaceutical calculations using various expressions of concentration [i.e., percentage (i.e., W/V, V/V, W/W), ratio strength, milligram percent, parts per million] used in pharmacy. 10. Calculate a patient's body surface area (BSA) utilizing a nomogram and/or BSA formula and apply in dose determinations. 11. Calculate ideal body weight (IBW) and estimated creatinine clearance (CrCl) rates and apply in dose determinations. 12. Calculate body mass index (BMI) from a standard formula. 13. Calculate appropriate medication dosages based on patient specific factors. 14. Calculate admixed intravenous (IV) solution quantities/volumes. 15. Calculate intravenous (IV) solution flow rate. 16. Perform the calculations necessary to prepare isotonic compounded solutions. 17. Perform calculations for the preparation and use of stock solutions. 18. Perform calculations for altering product strength by dilution or concentration. 19. Solve problems associated with compounding in contemporary practice. Credits: 1.00

PHRM 83600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. This course provides instruction in biochemistry that builds on basic knowledge by presenting content on advanced aspects of human biochemistry for students in pharmaceutical sciences. The content emphasizes the integration of biochemical knowledge and the application of biochemical understanding to medically relevant situations including disease etiology, medical diagnosis, disease research, drug discovery, drug and toxin mechanisms of action, and mechanism of drug metabolism.

Learning Outcomes: 1. Understanding and knowledge of biochemistry to an advanced level and to increase the ability to apply that understanding and knowledge to pharmaceutical sciences and the practice of pharmacy. 2. Advanced understanding of biochemistry includes integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts;

the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Application of biochemical understanding and knowledge includes understanding the molecular basis of many idopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseases of aberrant molecular transport. It also includes the mechanisms of DNA damage and repair and the mechanisms of action of anti-metabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented in this course, as well as demonstrate understanding of the concepts in each content area presented in this course ta is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHRM 84000 - Professional Skills Laboratory III

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as the development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84100 - Professional Skills Laboratory IV

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts form the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84700 - Principles Of Pharmacogenomics

Credit Hours: 2.00. This course is designed to introduce the theory and concepts of pharmacogenetics, pharmacogenomics, and precision medicine. The course will provide the student learner broad knowledge for advanced integrated therapeutic strategy based on a patient's genetic information. The learner will develop expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized data and pharmacogenomic information. This course offers a platform for shaping next-generation pharmacists into an era of precision medicine.

Learning Outcomes: 1. Broad knowledge for advanced integrated therapeutic strategy on patient's genetic information. 2. Develop expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized data and pharmacogenomics information. Credits: 2.00

PHRM 84800 - Principles Of Drug Information And Literature Evaluation

Credit Hours: 3.00. This course is designed to provide students with the fundamental skills needed for the provision of drug information in pharmacy practice. Emphasis is placed on the evaluation, interpretation, and practical implications of primary medical literature on the delivery of pharmaceutical care. Four recently published clinical trials will be reviewed and discussed throughout the semester to illustrate contemporary issues in the interpretation of biomedical research.

Learning Outcomes: 1. Discuss the fundamentals and importance of drug information skills for all pharmacists. 2.

Demonstrate effective verbal communication skills in obtaining pertinent background and patient-specific information when receiving drug information requests. 3. Demonstrate effective written communication of drug information. 4. Demonstrate familiarity with contemporary drug information retrieval technology and the ability to conduct a thorough and systematic search of the tertiary and primary literature. 5. Demonstrate the ability to judge the reliability of various tertiary sources of drug information. 6. Demonstrate an understanding of the role of the Internet in providing accurate and timely drug information. 7. Demonstrate the ability to incorporate drug information, patient-specific factors, and other pertinent information in the delivery of pharmaceutical care. 8. Describe the hierarchy of study designs as it relates to level of evidence. 9. Explain the general principles of observational and experimental research designs used to answer drug information questions. 10. Explain fundamental regulatory and ethical principles involved in human subjects research. 11. Differentiate between internal and external validity of clinical trial results. 12. Apply the principles of literature evaluation to analyze recent clinical trial results. 13. Understand and interpret statistical tests commonly used in contemporary biomedical literature. 14. Delineate between statistical significance and clinical significance. 15. Interpret the usefulness of clinical trial data for making evidence-based practice decisions. Credits: 3.00

PHRM 86000 - Professional Skills Laboratory V

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care.

Learning Outcomes: 1. Synthesize information in order to draw logical conclusions. 2. Provide evidence-based support for arguments, recommendations, and solutions. 3. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86600 - Biotech/Advanced Parenteral Dosage Forms

Credit Hours: 2.00. This course covers the different types of parenteral products derived from biotechnology. The lectures encompass the origin, chemical characteristics and therapeutic use of biopharmaceuticals. This course builds on the concepts and skills gained by the student from taking Dosage Forms II (PHRM 82900) and Professional Program Laboratory II (PHRM 82100).

Learning Outcomes: 1. List and describe the different types of biotechnology derived therapies. 2. Ability to describe the different types of pharmaceutical products in this area, their origin, and the delicate connection that exists between the proper handling and compounding of biotech based products and their therapeutic activity. 3. List and identify the advanced systems used in hospitals for the delivery of biotech products as well as parenteral products in general. Credits: 2.00

PHRM 86800 - Patient Safety And Informatics

Credit Hours: 3.00. This course provides core knowledge and skills needed by pharmacists to promote patient safety and use the tools of healthcare informatics; understand the landscape, epidemiology and culture of patient safety data privacy and security. Case studies will address disclosure of medication errors and reporting adverse events. Informatics tools such as computer order entry, electronic medical record systems, health information exchanges, and decision support will be explained. The use of informatics tools to promote patient safety will be emphasized.

Learning Outcomes: 1. Conceptual competency. 2. Integrative competence. 3. Critical thinking and decision making. 4. Communication skills and abilities. 5.

Responsible use of professional values and ethical principles. 6. Social awareness and social responsibility. 7. Professional abilities and habits. Credits: 3.00

PHRM 87000 - Health Policy Applications

Credit Hours: 1.00. This course will explore policy issues that influence health care. The course will provide students opportunities to apply material from prior courses in Health Systems, Population Health Management, and Public Health as it relates to the impact of health policy. Students will gain an understanding of how policy development must address competing interests and goals, and how policy can influence the scope of pharmacist's professional roles. Timely materials on current policy, current policy debates, and professional advocacy will be discussed.

Learning Outcomes: 1. Discuss health policy drivers that impact the current healthcare market. 2. Discuss the impact of various national and state health policies influence on how health care is organized, delivered, and financed. 3. Evaluate potential consequences of specific national, state, and local health policies on health systems, providers, and patients. 4. Identify the process and challenges regarding pursing state legislative health policy change. 5. Analyze healthcare policies and identify opportunities to modify policy to advance the profession of pharmacy. 6. Generate and evaluate policy development strategies to affect health care access, health care quality, and health care cost. Credits: 1.00

PHRM 86100 - Professional Skills Laboratory VI

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care. It serves as a one credit hour course. In accordance with university policy, this course may require up to three hours of work weekly outside of the arranged class time.

Learning Outcomes: 1. Synthesize information in order to draw logical solutions. 2. Provide evidence-based support for arguments, recommendations, and solutions. 3. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86700 - Introduction To The Advanced Pharmacy Practice Experience

Credit Hours: 1.00. The Introduction to Advanced Pharmacy Practice Experience (APPE) course was designed to provide students with the tools needed to be successful clerkship students. Students will participate in a variety of activities, including case studies, group work, evaluations and assessment, review of therapeutic topics, and student/preceptor panel interactions. Activities will be supplemented by didactic lecturing for each topic. The activities and lecture topics were selected based on feedback from previous clerkship students, preceptors, and faculty, and are intended to de-mystify the clerkship experience. This course prepares students to enter the clerkship year with the ability to successfully submit required clerkship forms, evaluate preceptors and peers, avoid common clerkship student mistakes, document clinical interventions, review medical charts, and prepare for therapeutic and pharmacokinetic responsibilities.

Learning Outcomes: 1. Explain how to register for rotations. 2. Recall clerkship policies and procedures. 3. List the forms which should be submitted to the Office of Experiential Learning after each rotation. 4. Critique preceptors and rotations constructively and assess peer performance on oral and written work. 5. Apply strategies to maximize the clerkship experience to each assigned rotation. 6. Cite the rotation portfolio requirements. 7. List handy drug information resources to use during rotations. 8. Explain ways to handle "tough situations" during rotations. 9. Document complete clinical interventions using Clinical Measures software. 10. Provide pharmacokinetic recommendations using provided equations and tools. 11. List ways to succeed on non-patient-care rotations. 12. List ways to prepare for post-graduate training during rotations. 13. Recall important information from common disease states encountered while on rotation. Credits: 1.00

PHRM 86900 - Practice Management And Marketing Of Professional Services

Credit Hours: 2.00. Introduces essential pharmacy practice managerial skills including personnel management, addressing conflict, CQI, change management and leadership. Builds upon these skills in the development of a business plan to implement an innovative pharmacy service.

Learning Outcomes: 1. Explain key concepts and legal stipulations related to hiring, performance assessment and communicating with work associates and employees. 2. Explain the characteristics that best describe themselves in a work setting (DiSC) and how these affect individual and team work. 3. Describe the four steps in LEAN theory and apply it to a variety of health care settings and its place in overall quality improvement measures. 4. Ascertain data and statistics about the practices and populations of a specific health care market. 5. Develop marketing materials based on a target audience(s). 6. Conceptualize and project the financial and clinical impact of a new product or service on an existing organization/system. 7. Justify and defend an innovative service or product. 8. Write a complete business plan addressing, at minimum, an executive summary, purpose, background, program description, financial projections and conclusion/summary. 9. Present on an innovative pharmacy service covering pertinent and persuasive information. 10. Justify and defend an innovative service or product. Credits: 2.00

PHRM 87100 - Jurisprudence

Credit Hours: 2.00. An in depth study of federal and Indiana laws, regulations, and rules affecting pharmacy practice. Primary emphasis is on Retail and Hospital Pharmacy settings. Lecture is supported by an instructor-created text covering the Food, Drug, and Cosmetic Act (21 USC), the Controlled Substances Act 21 CFR 1300 et. seq. and Indiana Food and Drug law IC 25-26-13 et. seq. and Indiana rules 856 IAC-1-43.

Learning Outcomes: 1. Identify acts that are covered by statute, regulation, and/or rule, and what and where those are. 2. Passing the national licensing examination on laws (MPJE "Multistate Pharmacy Jurisprudence Examination" developed, administered and graded by the National Association of Boards of Pharmacy). Credits: 2.00

PHRM 85200 - Public Health Pharmacy

Credit Hours: 3.00. The course is designed to provide the pharmacy student with a comprehensive overview of key public health and wellness principles and related to self-care and nonprescription products as they impinge upon the ability of patients to assume active roles and function effectively on their own behalf in health promotion and disease prevention, detection, and treatment.

Learning Outcomes: 1. Identify key public health issues. 2. Describe the profession of pharmacy's role in public health initiatives. 3. Retrieve information about various aspects of key public health issues. 4. Interpret information about various aspects of key public health issues. 5. Educate others about various aspects of key public health issues. Credits: 3.00

PHRM 83500 - Principles Of Pharmacokinetics

Credit Hours: 3.00. This course introduces the theory and concepts of pharmacokinetics and biopharmaceutics. It provides the student with a foundation for more advanced therapeutic concepts in subsequent courses. The learner will develop expertise in quantifying drug absorption, distribution and elimination from concentration vs. time data or urinary drug excretion vs. time data to estimate primary pharmacokinetic parameters. Use of these parameters is required to design and modify individual drug-dosing regimens.

Learning Outcomes: 1. Describe the general physiological processes and factors that influence drug dissolution, absorption, distribution, metabolism and excretion. 2. Define and describe the pharmacokinetic features of parallel, sequential, and reversible first-order processes. Define and describe the pharmacokinetic features of zero-order and first-order, and Michaelis-Menten processes. 3. Anticipate the effects of altering rate and extent of absorption, clearance, volume of distribution

on the amount of drug in the body following an oral dose. 4. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance dose of drugs eliminated by first-order kinetics. 5. Collect relevant patient information and relevant drug information data in order to calculate the appropriate loading and maintenance dose of a drug. 6. Design and modify dosing regimens given patient-derived information such as plasma concentration vs. time data and dosing regimen. 7. Quantitatively draw the concentration vs. time curves when clearance, volume of distribution or bioavailability changes and explain how the curves have changed. 8. Define and describe relative and absolute bioavailability the factors controlling bioavailability from various routes of administration. Determine if absorption or elimination rate-limits drug absorption kinetics. 9. Describe the pharmacokinetic parameters that determine the time course of active metabolite disposition. Determine if formation or elimination rate-limits active metabolite kinetics. 10. Describe drug disposition based upon physiological determinants in terms such as organ perfusion, unbound intrinsic clearance, free fraction in plasma and in tissue. 11. Describe, with examples, how altered physiology (e.g., renal disease, liver disease, pregnancy, advanced age) affects the disposition of drugs. Define and describe the principles of hemodialysis and how this alters the disposition of drugs. 12. Define steady-state concentration and describe the controlling factors following a constant rate intravenous infusion. Use pharmacokinetic parameters to predict drug concentrations during and after a constant rate infusion, with or without a bolus dose. 13. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance doses of drugs. Predict the rate and extent of drug accumulation for a given regimen of fixed dose and interval. 14. Define and describe the basic models used to characterize the kinetics of effect (pharmacodynamics). Credits: 3.00

PHRM 81000 - Basics Of Immunology

Credit Hours: 1.00. The goal of PHRM 81000 (Basics of Immunology) is to expose the student to the basic principles of immunology and enable the student to use these principles to understand how the immune system combats infections. This goal will be achieved through online recorded lecture and out of class reading assignments and quizzes. The student will be expected to understand basic immunological concepts and apply this knowledge to solving problems involving the integration of the various components of the immune system.
Learning Outcomes: 1. Discuss the basic components of the immune system and their roles in innate and adaptive immunity. 2. Discuss the development and function of lymphocytes in adaptive immunity. 3. Discuss the molecular basis of antibody diversity. 4. Discuss how antigens are recognized by T cells. 5. Discuss how B cells develop and function in the body. 6. Discuss how T cells develop in the body and differentiate into specialized subsets. 7. Discuss how lymphocytes undergo positive and negative selection. 8. Discuss how B cells and T cells are activated and participate in adaptive immunity. 9. Discuss the basis of MHC polymorphism and the role in the immune response. 10. Discuss how the complement system is activated and plays a its role in immune responses. 11. Discuss how the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12.

Discuss how the body remembers a previous infection. Credits: 1.00

PHRM 81600 - Introduction To Patient-Centered Care

Credit Hours: 2.00. This course teaches students the key communication principles and skills necessary to deliver direct patient care and interact with other health care professionals. This includes developing cultural self-awareness, evaluating patient comprehension, and improving personal communication skills.

Learning Outcomes: 1. Apply the steps of the PPCP to collect and analyze patient-specific information, assess the information, develop and implement a patient-centered plan, and follow-up once the plan has been implemented. 2. Identify patient-specific factors and incorporate these aspects into patient care. 3. Demonstrate effective communication skills for patients, caregivers, peers, and other healthcare providers. 4. Develop strategies to appropriately adjust behavior or communication style based on cultural and communication considerations to optimize patient care. 5. Begin to develop a structured clinical thought process when presented with a patient case. 6. Work effectively within a group of peers to evaluate a patient's case and complete clinical documentation. Credits: 2.00

PHRM 81700 - Introduction To Self-Care

Credit Hours: 2.00. This course introduces students to the principles and practices of self-care and over-the-counter (OTC) medications. Students will learn to assess and recommend appropriate self-care treatments for common conditions, considering patient-specific factors. The course covers nonprescription medications, including their pharmacology, indications, contraindications, and proper use. It also teaches techniques for evaluating patient symptoms and determining when self-care is appropriate versus when to refer to a healthcare provider. Additionally, students will explore strategies for educating patients on lifestyle modifications and preventive measures to maintain health and well-being. By the end of the course, students will be equipped with the knowledge and skills to confidently guide patients in self-care practices and make informed recommendations for OTC therapies.

Learning Outcomes: 1. Identify common self-care conditions and describe both non-therapeutic and therapeutic treatment options for non-prescription management of self-care conditions. 2. Apply therapeutic knowledge to patient care. By the end of this course, students will be able to effectively apply the Pharmacist Patient Care Process (PPCP) to gather and assess patient information, identify patient-specific factors, and make informed decisions regarding self-care and non-prescription therapies. 3. Demonstrate advanced communication and drug information skills. Credits: 2.00

PHRM 81800 - Professional Identity Formation And Leadership

Credit Hours: 1.00. This course is designed to enhance the PharmD P-1 student's professional skills, career exploration and prepare for internships, post-graduation employment or continuing education plans. It provides academic content to link experiences in professional fields to study in pharmacy as well as social, economic and intellectual attitudes that shape views and work experiences. It also introduces Professional Identity Formation (PIF), which is defined as "a complex and transformational process of internalizing a profession 's core knowledge, skills, values and beliefs, resulting in an individual "thinking, acting and feeling" like a member of that professional community." (AACP) The course will build the student's professional skills and attitudes, with activities and experiences, intended to advance professional, personal, and career development. The topics and activities are purposely designed and implemented to ensure an array of opportunities for students to document competency of advocacy, self- awareness, leadership, and professionalism.

Learning Outcomes: 1. Prepare for a transition to a professional career setting after graduation through self-reflection, self-assessment of performance, and goal setting, while learning tools and strategies to navigate personal and professional values and interests. 2. Understand the importance of on-the-job training and experiential opportunities; and learn how to develop and cultivate professional skills and relationships. 3. Articulate professional expectations and learn how to navigate ethical issues involved with being a professional. 4. Identify personal leadership traits and skills

while understanding multiple leadership and communication styles. 5. Identify career interests or goals and understand the pathways to different careers in pharmacy. Credits: 1.00

PHRM 81100 - Integrated Case Studies I

Credit Hours: 1.00. This is the first course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81200 - Integrated Case Studies II

Credit Hours: 1.00. This is the second course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use

in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81300 - Integrated Case Studies III

Credit Hours: 1.00. This is the third course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own

standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81400 - Integrated Case Studies IV

Credit Hours: 1.00. This is the fourth course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81500 - Integrated Case Studies V

Credit Hours: 1.00. This is the fifth course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use

in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 80000 - Integrated Pharmacotherapy I

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80100 - Integrated Pharmacotherapy II

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic,

endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80200 - Integrated Pharmacotherapy III

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to

solve patient therapeutic problems. Credits: 2.50

PHRM 80300 - Integrated Pharmacotherapy IV

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80400 - Integrated Pharmacotherapy V

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when

needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80500 - Integrated Pharmacotherapy VI

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80600 - Integrated Pharmacotherapy VII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug

therapy related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80700 - Integrated Pharmacotherapy VIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80800 - Integrated Pharmacotherapy VIIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the

effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80900 - Integrated Pharmacotherapy X

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 84300 - Population Health Management

Credit Hours: 3.00. Pharmacists are increasingly called upon to participate in the management of large population-based programs requiring managed care principles and a basic understanding of the healthcare system models, healthcare payment models, and the principles of pharmaceutical outcome research. These activities require knowledge and skills relative to comparative effectiveness research, pharmacoepidemiology, and Pharmacoeconomics. The core content of this three-credit hour course will include managed care principles, health care disparities, health care financing, actual and potential pharmacist roles in health systems and managed care, and specialty pharmacy.

Learning Outcomes: 1. Describe the foundations of population health and the related factors influencing the health and wellness of a defined community. 2. Compare and contrast population health and public health. 3. Define and employ the terminology associated with population health. 4. Identify and stratify perspective populations used in providing healthcare. 5. Describe epidemiologic principles used in the provision of population health. 6. Compare the similarities and differences, and potential conflict in providing individual versus population health. 7. Locate, interpret, and evaluate demographic and population health data. 8. Describe the importance of population health to pharmacy and in providing healthcare to communities and within healthcare systems. 9. Identify the inequities in the provision of healthcare in the US and in certain sub-populations. 10. Describe key factors responsible for the inequities in healthcare. 11. Describe and contrast the delivery of and resources utilized in providing healthcare across the life span. 12. Describe how insurance coverage impacts the access to healthcare in the US. 13. Analyze the link between social factors and health outcomes. 14. Describe and evaluate management strategies and tools used to provide healthcare to populations of patients. 15. Recognize and apply the theoretical foundations of Pharmacoeconomics, pharmacoepidemiology, and health outcomes research to the provision of healthcare and pharmacy services within population health. 16. Describe the importance of a robust primary care foundation in the provision of population health. 17. Describe the components and potential vulnerabilities of the pharmaceutical supply chain and the role that pharmacists play in maintaining a safe and robust supply of pharmaceutical and medical supplies to all patient groups. 18. Formulate strategies for engaging stakeholders in population health interventions. 19. Describe the principles of managed care and select those strategies most appropriate for populations of patients. 20. Discuss key components of integrated population health management and how value-based care payment models are being used to influence provider and patient behaviors. 21. Describe the role of specialty pharmacy in the provision of healthcare services. 22. Describe the role of digital innovation in the provision of population healthcare services. 23. Interpret the data set to suggest management strategies, given a scenario with population data. 24. Analyze the application of population health interventions in real-world settings. 25. Describe key leadership strategies that pharmacists and use to build teams, lead, and implement population health initiatives. Credits: 3.00

Experiential Courses (37 credits)

PHRM 82200 - Pharmacy Skills And Patient Counseling

Credit Hours: 2.00. Pharmacy Skills and Patient Counseling is a two credit hour, required first professional year experiential course combining practical experience in the Purdue University Pharmacy with lecture. Students are monitored by faculty instructors, staff pharmacists and Advanced Pharmacy Practice Experience (APPE) students. Students must have a valid Social Security number the first week of class.

Learning Outcomes: 1. Recall and apply brand and generic names, common uses, strengths, doses, side effects and counseling points of commonly used medications. 2. Recall and apply federal and state laws. 3. Obtain pertinent patient information during the prescription intake process. 4. Recall and apply commonly used pharmacy abbreviations, conversions, and computer software functions. 5. Process and dispense new and refilled prescriptions according to federal and state law requirements.

Credits: 2.00

PHRM 84200 - Community Pharmacy IPPE

Credit Hours: 3.00. A 3-credit hour required experiential course in the summer before the 2nd year of professional Doctor of Pharmacy program. Students learn community pharmacy operations and patient counseling skills.

Learning Outcomes: 1. Perform basic functions and skills in a community practice setting. 2. Document a minimum of 160 hours of performance-based experience in a community pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in community practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the community pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in community pharmacy. 12. Reflect on new information learned. 13. Describe and reflect on the community pharmacy work environment and staffing. 14. Describe and reflect on the steps involved in the prescription filling and dispensing. 15. Formulate and describe opinions on the quality of patient care. 16. Describe and reflect on common causes of medication errors and methods of prevention and apply knowledge to suggest system improvements. 17. Conduct an effective, conversational interview with a patient about medication use. 18. Review the patient's medications in relation to their condition(s) or disease(s). 19. Describe common problems/barriers patients encounter with medications. 20. Utilize pharmacy references and document sources of information. 21. Formulate an opinion on the value of pharmacists' involvement in patient care. 22. Prepare a formal recommendation letter to a healthcare provider. 23. Reflect on successes of the assignment and self-assess the need for improvement. Credits: 3.00

PHRM 86200 - Institutional Pharmacy Introductory Pharmacy Practice Experience

Credit Hours: 2.50. A 2.5-credit hour required experiential course in the summer prior to the third year of the professional Doctor of Pharmacy program. Students learn basic institutional pharmacy operations and sterile product compounding.

Learning Outcomes: 1. Perform basic functions and skills in an actual practice setting. 2. Document a minimum of 160 hours of performance-based experience in an institutional pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on the degree of professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in institutional practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the institutional pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in institutional pharmacy. 12. Reflect on new information learned. 13. Describe the institutional pharmacy work environment and staffing. 14. Describe the steps involved in the medication order filling and

dispensing process. 15. Formulate an opinion on the quality of patient care. 16. Review common causes of medication errors and methods of prevention. Credits: 2.50

PHRM 88000 - Advanced Pharmacy Practice Experience

Credit Hours: 3.00. This final year begins in May and continues through the following April. The 36 weeks of rotation are broken down as follows: 4 weeks Hospital Operations 2, 4 weeks Community Pharmacy Operations 2, 8 weeks Ambulatory rotations, 4 weeks inpatient rotations, and 16 weeks General Electives (4 of which must be additional patient care rotation).

Learning Outcomes: 1. The purposes, uses, and effects of their medications and related therapy. 2. Achievable therapeutic outcomes with estimated time frame. 3. Drug cautions and side effects in relation to the patient's condition. 4. Medication cost issues. 5. Relevant lifestyle modifications (i.e. weight loss and smoking cessation) and non-drug therapies. 6. Use, storage, side effects, and dosage of nonprescription drugs. 7. The appropriate selection of over-the-counter medications in response to patient's condition/needs. 8. Appropriate patient's comprehension of student's counseling (i.e. final verification step). Credits: 3.00

PHRM 83800 - Interprofessional Education (IPE) Experience I

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Describe the role of team-based care in helping patients or clients to navigate the complexity of the healthcare system. 2. Explain roles and responsibilities of team members represented at the learning event. 3. Recognize the value of interprofessional team practice. 4. Recognize the value of actively seeking the contributions of other professions and perspectives. Credits: 0.50

PHRM 83900 - Interprofessional Education (IPE) Experience II

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Use specific communication tools and methods within a team setting. 2. Describe the roles within the team and how they relate to the team as a whole. 3. Assess their role within the team and ways to improve their contributions to the team. 4. Identify ways to improve team effectiveness and performance. Credits: 0.50

PHRM 85400 - Interprofessional Education (IPE) Experience III

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Recognize similarities and differences in the "Code of Ethics" for two or more different professions. 2. Consider how similarities and differences across professions influence caregivers' decisions and understanding of health and heath care priorities. 3. Describe health and healthcare as inclusive of people, populations, and

communities. 4. Explain how everyone in the healthcare team shares accountability to improve prevention and healthcare outcomes. 5. Demonstrate effective methods of communicating with team members to clarify each person's role and responsibilities. 6. Discuss the importance of teamwork in person-centered and community-focused care. 7. Demonstrate active listening, while encouraging ideas and opinions of others. 8. Identify ways to improve team performance. Credits: 0.50

PHRM 85500 - Interprofessional Education (IPE) Experience IV

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e., medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 87400 - Interprofessional Education (IPE) Experience V

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

Electives (10 credits)

GPA Requirements

Additional Information

Four-Year Plan

Professional First Year (P1) - Fall

PHRM 82000 - Professional Skills Laboratory I

Credit Hours: 2.00. Experiments, computer simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82200 - Pharmacy Skills And Patient Counseling

Credit Hours: 2.00. Pharmacy Skills and Patient Counseling is a two credit hour, required first professional year experiential course combining practical experience in the Purdue University Pharmacy with lecture. Students are monitored by faculty instructors, staff pharmacists and Advanced Pharmacy Practice Experience (APPE) students. Students must have a valid Social Security number the first week of class.

Learning Outcomes: 1. Recall and apply brand and generic names, common uses, strengths, doses, side effects and counseling points of commonly used medications. 2. Recall and apply federal and state laws. 3. Obtain pertinent patient information during the prescription intake process. 4. Recall and apply commonly used pharmacy abbreviations, conversions, and computer software functions. 5. Process and dispense new and refilled prescriptions according to federal and state law requirements. Credits: 2.00

PHRM 82400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy. Prerequisite: MCMP 20400, 20500, 20800, and BIOL 20300, 20400 or 30100, 30200. Departmental permission required.

Learning Outcomes: 1. Conceptual Competence: Pathophysiology, Principles of pharmacology. 2. Scientific Comprehension: Basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Critical Thinking and Decision Making Abilities: Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Communication Skills and Abilities: Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Responsible use of

Professional Values and Ethical Principles: Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Professional Abilities and Habits: Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHRM 82800 - Dosage Forms I

Credit Hours: 3.00. The purpose of Dosage Forms I is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Explain the basic scientific principles involved in drug delivery such as dissolution, chemical stability, physical stability, content uniformity, and bioavailability. 2. Describe the essential scientific principles involved in the design of solutions, emulsions, suspensions, as well as dermatological and ophthalmic dosage forms. 3. Evaluate the quality parameters of dosage forms that are involved in product selection. 4. Analyze and interpret the results of bioequivalence studies that are important in product selection. 5. Advise patients on the proper use and storage of liquid dosage forms. Credits: 3.00

PHRM 83400 - Pharmaceutical Calculations

Credit Hours: 1.00. Mastery of pharmaceutical calculation skills is vital and PHRM 83400 prepares students to apply calculation problem solving skills to clinical practice. PHRM 83400 prepares students to perform pharmaceutical calculations necessary for prescription/drug order preparation, compounding dosage forms, and medication dosage calculations based on patient specific factors. Pharmacists must perform error-free pharmaceutical calculations. Correct calculations contribute as much to pharmaceutical care as the newest methods/guidelines for diagnosis, treatment, and prevention. The development of problem solving skills with pharmaceutical calculations is an important component of this course. In addition, practice and repetition of problems is necessary to develop confidence as well as accuracy. Appropriate documentation of work/set up and numerical answers (including units) is required. Approaches to minimize errors and maximize accuracy with pharmaceutical calculations are emphasized.

Learning Outcomes: 1. Describe the role of pharmaceutical calculations in the provision of pharmaceutical care. 2. Perform accurate/error-free pharmaceutical calculations in an organized, clear, and appropriately documented format. 3. Express numerical answers in a clear manner which includes units and appropriate use of zeros with decimal points. 4. Interpret abbreviations and professional nomenclature in prescriptions/drug orders. 5. List the equivalents/conversion factors for the systems of measurement used in pharmacy (i.e., metric, apothecary, avoirdupois, and household). 6. Convert from one unit to another between and within the various systems of measurement used in pharmacy. 7. Calculate quantities of ingredients necessary to reduce or enlarge a pharmaceutical formula. 8. Define and appropriately utilize specific gravity in pharmaceutical calculations. 9. Define and perform pharmaceutical calculations using various expressions of concentration [i.e., percentage (i.e., W/V, V/V, W/W), ratio strength, milligram percent, parts per million] used in pharmacy. 10. Calculate a patient's body surface area (BSA) utilizing a nomogram and/or BSA formula and apply in dose determinations. 11. Calculate ideal body weight (IBW) and estimated creatinine clearance (CrCl) rates and apply in dose determinations. 12. Calculate body mass index (BMI) from a standard formula. 13. Calculate appropriate medication

dosages based on patient specific factors. 14. Calculate admixed intravenous (IV) solution quantities/volumes. 15. Calculate intravenous (IV) solution flow rate. 16. Perform the calculations necessary to prepare isotonic compounded solutions. 17. Perform calculations for the preparation and use of stock solutions. 18. Perform calculations for altering product strength by dilution or concentration. 19. Solve problems associated with compounding in contemporary practice. Credits: 1.00

PHRM 83600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. This course provides instruction in biochemistry that builds on basic knowledge by presenting content on advanced aspects of human biochemistry for students in pharmaceutical sciences. The content emphasizes the integration of biochemical knowledge and the application of biochemical understanding to medically relevant situations including disease etiology, medical diagnosis, disease research, drug discovery, drug and toxin mechanisms of action, and mechanism of drug metabolism.

Learning Outcomes: 1. Understanding and knowledge of biochemistry to an advanced level and to increase the ability to apply that understanding and knowledge to pharmaceutical sciences and the practice of pharmacy. 2. Advanced understanding of biochemistry includes integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Application of biochemical understanding and knowledge includes understanding the molecular basis of many idopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseases of aberrant molecular transport. It also includes the mechanisms of DNA damage and repair and the mechanisms of action of anti-metabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented in this course, as well as demonstrate understanding of the concepts in each content area presented in this course ta is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHRM 83800 - Interprofessional Education (IPE) Experience I

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Describe the role of team-based care in helping patients or clients to navigate the complexity of the healthcare system. 2. Explain roles and responsibilities of team members represented at the learning event. 3. Recognize the value of interprofessional team practice. 4. Recognize the value of actively seeking the contributions of other professions and perspectives. Credits: 0.50

PHRM 81000 - Basics Of Immunology

Credit Hours: 1.00. The goal of PHRM 81000 (Basics of Immunology) is to expose the student to the basic principles of immunology and enable the student to use these principles to understand how the immune system combats

infections. This goal will be achieved through online recorded lecture and out of class reading assignments and quizzes. The student will be expected to understand basic immunological concepts and apply this knowledge to solving problems involving the integration of the various components of the immune system.
Learning Outcomes: 1. Discuss the basic components of the immune system and their roles in innate and adaptive immunity. 2. Discuss the development and function of lymphocytes in adaptive immunity. 3. Discuss the molecular basis of antibody diversity. 4. Discuss how antigens are recognized by T cells. 5. Discuss how B cells develop and function in the body. 6. Discuss how T cells develop in the body and differentiate into specialized subsets. 7. Discuss how lymphocytes undergo positive and negative selection. 8. Discuss how B cells and T cells are activated and participate in adaptive immunity. 9. Discuss the basis of MHC polymorphism and the role in the immune response. 10. Discuss how the complement system is activated and plays a its role in immune responses. 11. Discuss how the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. Discuss how the body remembers a previous infection. Credits: 1.00

PHRM 81600 - Introduction To Patient-Centered Care

Credit Hours: 2.00. This course teaches students the key communication principles and skills necessary to deliver direct patient care and interact with other health care professionals. This includes developing cultural self-awareness, evaluating patient comprehension, and improving personal communication skills.

Learning Outcomes: 1. Apply the steps of the PPCP to collect and analyze patient-specific information, assess the information, develop and implement a patient-centered plan, and follow-up once the plan has been implemented. 2. Identify patient-specific factors and incorporate these aspects into patient care. 3. Demonstrate effective communication skills for patients, caregivers, peers, and other healthcare providers. 4. Develop strategies to appropriately adjust behavior or communication style based on cultural and communication considerations to optimize patient care. 5. Begin to develop a structured clinical thought process when presented with a patient case. 6. Work effectively within a group of peers to evaluate a patient's case and complete clinical documentation. Credits: 2.00

PHRM 81700 - Introduction To Self-Care

Credit Hours: 2.00. This course introduces students to the principles and practices of self-care and over-the-counter (OTC) medications. Students will learn to assess and recommend appropriate self-care treatments for common conditions, considering patient-specific factors. The course covers nonprescription medications, including their pharmacology, indications, contraindications, and proper use. It also teaches techniques for evaluating patient symptoms and determining when self-care is appropriate versus when to refer to a healthcare provider. Additionally, students will explore strategies for educating patients on lifestyle modifications and preventive measures to maintain health and well-being. By the end of the course, students will be equipped with the knowledge and skills to confidently guide patients in self-care practices and make informed recommendations for OTC therapies.

Learning Outcomes: 1. Identify common self-care conditions and describe both non-therapeutic and therapeutic treatment options for non-prescription management of self-care conditions. 2. Apply therapeutic knowledge to patient care. By the end of this course, students will be able to effectively apply the Pharmacist Patient Care Process (PPCP) to gather and assess patient information, identify patient-specific factors, and make informed decisions regarding self-care and non-prescription therapies. 3. Demonstrate advanced communication and drug information skills. Credits: 2.00

18.5 Credits

Professional First Year (P1) - Spring

PHRM 82100 - Professional Skills Laboratory II

Credit Hours: 2.00. Continuation of PHRM 82000 with emphasis upon modules that provide laboratory practice experience designed to integrate basic science concepts and practice applications. Small group problem-solving methodology will be utilized as appropriate.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82900 - Dosage Forms II

Credit Hours: 2.00. Education in the use of dosage forms to deliver drugs. Collaboration with peers and other members of the health care team regarding the proper use of the various dosage forms so that the desired therapeutic objective is achieved.

Learning Outcomes: 1. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and isoosmolality, IV bags and drip sets. 2. Explain the basic scientific principles involved in the performance of solid dosage forms, including amorphous and crystalline solids, polymorphism, dissolution, diffusion, chemical and physical stability, bioequivalence and bioavailability. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including oral, buccal, rectal, subcutaneous and transdermal routes. 4. Evaluate quality parameters for solid dosage forms, as an aid to product selection. 5. Advise patients on the proper use and storage of solid dosage forms, and understand the relationship of dosage form selection to clinical outcomes. 6. Explain the factors involved in the use of generic versions of solid dosage forms and their influence on therapeutic outcomes, including the ability to identify drugs for which switching to a generic form should be approached with caution. Credits: 2.00

PHRM 83900 - Interprofessional Education (IPE) Experience II

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Use specific communication tools and methods within a team setting. 2. Describe the roles within the team and how they relate to the team as a whole. 3. Assess their role within the team and ways to improve their contributions to the team. 4. Identify ways to improve team effectiveness and performance. Credits: 0.50

PHRM 83500 - Principles Of Pharmacokinetics

Credit Hours: 3.00. This course introduces the theory and concepts of pharmacokinetics and biopharmaceutics. It provides the student with a foundation for more advanced therapeutic concepts in subsequent courses. The learner will develop expertise in quantifying drug absorption, distribution and elimination from concentration vs. time data or urinary drug excretion vs. time data to estimate primary pharmacokinetic parameters. Use of these parameters is required to design and

modify individual drug-dosing regimens.

Learning Outcomes: 1. Describe the general physiological processes and factors that influence drug dissolution, absorption, distribution, metabolism and excretion. 2. Define and describe the pharmacokinetic features of parallel, sequential, and reversible first-order processes. Define and describe the pharmacokinetic features of zero-order and first-order, and Michaelis-Menten processes. 3. Anticipate the effects of altering rate and extent of absorption, clearance, volume of distribution on the amount of drug in the body following an oral dose. 4. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance dose of drugs eliminated by first-order kinetics. 5. Collect relevant patient information and relevant drug information data in order to calculate the appropriate loading and maintenance dose of a drug. 6. Design and modify dosing regimens given patient-derived information such as plasma concentration vs. time data and dosing regimen. 7. Quantitatively draw the concentration vs. time curves when clearance, volume of distribution or bioavailability changes and explain how the curves have changed. 8. Define and describe relative and absolute bioavailability the factors controlling bioavailability from various routes of administration. Determine if absorption or elimination rate-limits drug absorption kinetics. 9. Describe the pharmacokinetic parameters that determine the time course of active metabolite disposition. Determine if formation or elimination rate-limits active metabolite kinetics. 10. Describe drug disposition based upon physiological determinants in terms such as organ perfusion, unbound intrinsic clearance, free fraction in plasma and in tissue. 11. Describe, with examples, how altered physiology (e.g., renal disease, liver disease, pregnancy, advanced age) affects the disposition of drugs. Define and describe the principles of hemodialysis and how this alters the disposition of drugs. 12. Define steady-state concentration and describe the controlling factors following a constant rate intravenous infusion. Use pharmacokinetic parameters to predict drug concentrations during and after a constant rate infusion, with or without a bolus dose. 13. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance doses of drugs. Predict the rate and extent of drug accumulation for a given regimen of fixed dose and interval. 14. Define and describe the basic models used to characterize the kinetics of effect (pharmacodynamics). Credits: 3.00

PHRM 81800 - Professional Identity Formation And Leadership

Credit Hours: 1.00. This course is designed to enhance the PharmD P-1 student's professional skills, career exploration and prepare for internships, post-graduation employment or continuing education plans. It provides academic content to link experiences in professional fields to study in pharmacy as well as social, economic and intellectual attitudes that shape views and work experiences. It also introduces Professional Identity Formation (PIF), which is defined as "a complex and transformational process of internalizing a profession 's core knowledge, skills, values and beliefs, resulting in an individual "thinking, acting and feeling" like a member of that professional community." (AACP) The course will build the student's professional skills and attitudes, with activities and experiences, intended to advance professional, personal, and career development. The topics and activities are purposely designed and implemented to ensure an array of opportunities for students to document competency of advocacy, self- awareness, leadership, and professionalism.

Learning Outcomes: 1. Prepare for a transition to a professional career setting after graduation through self-reflection, self-assessment of performance, and goal setting, while learning tools and strategies to navigate personal and professional values and interests. 2. Understand the importance of on-the-job training and experiential opportunities; and learn how to develop and cultivate professional skills

and relationships. 3. Articulate professional expectations and learn how to navigate ethical issues involved with being a professional. 4. Identify personal leadership traits and skills while understanding multiple leadership and communication styles. 5. Identify career interests or goals and understand the pathways to different careers in pharmacy. Credits: 1.00

PHRM 81100 - Integrated Case Studies I

Credit Hours: 1.00. This is the first course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 80000 - Integrated Pharmacotherapy I

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the

effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80100 - Integrated Pharmacotherapy II

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

14.5 Credits

Professional Second Year (P2)

PHRM 84200 - Community Pharmacy IPPE

Credit Hours: 3.00. A 3-credit hour required experiential course in the summer before the 2nd year of professional Doctor of Pharmacy program. Students learn community pharmacy operations and patient counseling skills.

Learning Outcomes: 1. Perform basic functions

and skills in a community practice setting. 2. Document a minimum of 160 hours of performance-based experience in a community pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in community practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the community pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in community pharmacy. 12. Reflect on new information learned. 13. Describe and reflect on the community pharmacy work environment and staffing. 14. Describe and reflect on the steps involved in the prescription filling and dispensing. 15. Formulate and describe opinions on the quality of patient care. 16. Describe and reflect on common causes of medication errors and methods of prevention and apply knowledge to suggest system improvements. 17. Conduct an effective, conversational interview with a patient about medication use. 18. Review the patient's medications in relation to their condition(s) or disease(s). 19. Describe common problems/barriers patients encounter with medications. 20. Utilize pharmacy references and document sources of information. 21. Formulate an opinion on the value of pharmacists' involvement in patient care. 22. Prepare a formal recommendation letter to a healthcare provider. 23. Reflect on successes of the assignment and self-assess the need for improvement. Credits: 3.00

3 Credits

Professional Second Year (P2) - Fall

PHRM 84000 - Professional Skills Laboratory III

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as the development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84800 - Principles Of Drug Information And Literature Evaluation

Credit Hours: 3.00. This course is designed to provide students with the fundamental skills needed for the provision of drug information in pharmacy practice. Emphasis is placed on the evaluation, interpretation, and practical implications of primary medical literature on the delivery of pharmaceutical care. Four recently published clinical trials will be reviewed and discussed throughout the semester to illustrate contemporary issues in the interpretation of biomedical research.

Learning Outcomes: 1. Discuss the fundamentals and importance of drug information skills for all pharmacists. 2. Demonstrate effective verbal communication skills in obtaining pertinent background and patient-specific information when receiving drug information requests. 3. Demonstrate effective written communication of drug information. 4. Demonstrate familiarity with contemporary drug information retrieval technology and the ability to conduct a thorough and systematic search of

the tertiary and primary literature. 5. Demonstrate the ability to judge the reliability of various tertiary sources of drug information. 6. Demonstrate an understanding of the role of the Internet in providing accurate and timely drug information. 7. Demonstrate the ability to incorporate drug information, patient-specific factors, and other pertinent information in the delivery of pharmaceutical care. 8. Describe the hierarchy of study designs as it relates to level of evidence. 9. Explain the general principles of observational and experimental research designs used to answer drug information questions. 10. Explain fundamental regulatory and ethical principles involved in human subjects research. 11. Differentiate between internal and external validity of clinical trial results. 12. Apply the principles of literature evaluation to analyze recent clinical trial results. 13. Understand and interpret statistical tests commonly used in contemporary biomedical literature. 14. Delineate between statistical significance and clinical significance. 15. Interpret the usefulness of clinical trial data for making evidence-based practice decisions. Credits: 3.00

PHRM 85200 - Public Health Pharmacy

Credit Hours: 3.00. The course is designed to provide the pharmacy student with a comprehensive overview of key public health and wellness principles and related to self-care and nonprescription products as they impinge upon the ability of patients to assume active roles and function effectively on their own behalf in health promotion and disease prevention, detection, and treatment.

Learning Outcomes: 1. Identify key public health issues. 2. Describe the profession of pharmacy's role in public health initiatives. 3. Retrieve information about various aspects of key public health issues. 4. Interpret information about various aspects of key public health issues. 5. Educate others about various aspects of key public health issues. Credits: 3.00

PHRM 85400 - Interprofessional Education (IPE) Experience III

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Recognize similarities and differences in the "Code of Ethics" for two or more different professions. 2. Consider how similarities and differences across professions influence caregivers' decisions and understanding of health and heath care priorities. 3. Describe health and healthcare as inclusive of people, populations, and communities. 4. Explain how everyone in the healthcare team shares accountability to improve prevention and healthcare outcomes. 5. Demonstrate effective methods of communicating with team members to clarify each person's role and responsibilities. 6. Discuss the importance of teamwork in person-centered and community-focused care. 7. Demonstrate active listening, while encouraging ideas and opinions of others. 8. Identify ways to improve team performance. Credits: 0.50

PHRM 81200 - Integrated Case Studies II

Credit Hours: 1.00. This is the second course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will

include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 80200 - Integrated Pharmacotherapy III

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and

apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80300 - Integrated Pharmacotherapy IV

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

16.5 Credits

Professional Second Year (P2) - Spring

PHRM 84100 - Professional Skills Laboratory IV

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts form the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84700 - Principles Of Pharmacogenomics

Credit Hours: 2.00. This course is designed to introduce the theory and concepts of pharmacogenetics, pharmacogenomics, and precision medicine. The course will provide the student learner broad knowledge for advanced integrated therapeutic strategy based on a patient's genetic information. The learner will develop expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized data and pharmacogenomic information. This course offers a platform for shaping next-generation pharmacists into an era of precision medicine.

Learning Outcomes: 1. Broad knowledge for advanced integrated therapeutic strategy on patient's genetic information. 2. Develop

expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized data and pharmacogenomics information. Credits: 2.00

PHRM 85500 - Interprofessional Education (IPE) Experience IV

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e., medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 81300 - Integrated Case Studies III

Credit Hours: 1.00. This is the third course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of

health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 80400 - Integrated Pharmacotherapy V

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80500 - Integrated Pharmacotherapy VI

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and

terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 84300 - Population Health Management

Credit Hours: 3.00. Pharmacists are increasingly called upon to participate in the management of large population-based programs requiring managed care principles and a basic understanding of the healthcare system models, healthcare payment models, and the principles of pharmaceutical outcome research. These activities require knowledge and skills relative to comparative effectiveness research, pharmacoepidemiology, and Pharmacoeconomics. The core content of this three-credit hour course will include managed care principles, health care disparities, health care financing, actual and potential pharmacist roles in health systems and managed care, and specialty pharmacy.

Learning Outcomes: 1. Describe the foundations of population health and the related factors influencing the health and wellness of a defined community. 2. Compare and contrast population health and public health. 3. Define and employ the terminology associated with population health. 4. Identify and stratify perspective populations used in providing healthcare. 5. Describe epidemiologic principles used in the provision of population health. 6. Compare the similarities and differences, and potential conflict in providing individual versus population health. 7. Locate, interpret, and evaluate demographic and population health data. 8. Describe the importance of population health to pharmacy and in providing healthcare to communities and within healthcare systems. 9. Identify the inequities in the provision of healthcare in the US and in certain sub-populations. 10. Describe key factors responsible for the inequities in healthcare. 11. Describe and contrast the delivery of and resources utilized in providing healthcare across the life span. 12. Describe how insurance coverage impacts the access to healthcare in the US. 13. Analyze the link between social factors and health outcomes. 14. Describe and evaluate management strategies and tools used to provide healthcare to populations of patients. 15. Recognize and apply the theoretical foundations of Pharmacoeconomics, pharmacoepidemiology, and health outcomes research to the provision of healthcare and pharmacy services within population health. 16. Describe the importance of a robust primary care foundation in the provision of population health. 17. Describe the components and potential vulnerabilities of the pharmaceutical supply chain and the role that pharmacists play in maintaining a safe and robust supply of pharmaceutical and medical supplies to all patient groups. 18. Formulate strategies for engaging stakeholders in population health interventions. 19. Describe the principles of managed care and select those strategies most appropriate for populations of patients. 20. Discuss key components of integrated population health management and how value-based care payment models are being used to

influence provider and patient behaviors. 21. Describe the role of specialty pharmacy in the provision of healthcare services. 22. Describe the role of digital innovation in the provision of population healthcare services. 23. Interpret the data set to suggest management strategies, given a scenario with population data. 24. Analyze the application of population health interventions in real-world settings. 25. Describe key leadership strategies that pharmacists and use to build teams, lead, and implement population health initiatives. Credits: 3.00

17.5 Credits

Professional Third Year (P3)

PHRM 86200 - Institutional Pharmacy Introductory Pharmacy Practice Experience

Credit Hours: 2.50. A 2.5-credit hour required experiential course in the summer prior to the third year of the professional Doctor of Pharmacy program. Students learn basic institutional pharmacy operations and sterile product compounding.

Learning Outcomes: 1. Perform basic functions and skills in an actual practice setting. 2. Document a minimum of 160 hours of performance-based experience in an institutional pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on the degree of professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in institutional practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the institutional pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in institutional pharmacy. 12. Reflect on new information learned. 13. Describe the institutional pharmacy work environment and staffing. 14. Describe the steps involved in the medication order filling and dispensing process. 15. Formulate an opinion on the quality of patient care. 16. Review common causes of medication errors and methods of prevention. Credits: 2.50

PHRM 87400 - Interprofessional Education (IPE) Experience V

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and

population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

3 Credits

Professional Third Year (P3) - Fall

PHRM 86000 - Professional Skills Laboratory V

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care.

Learning Outcomes: 1. Synthesize information in order to draw logical conclusions. 2. Provide evidence-based support for arguments, recommendations, and solutions. 3. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86600 - Biotech/Advanced Parenteral Dosage Forms

Credit Hours: 2.00. This course covers the different types of parenteral products derived from biotechnology. The lectures encompass the origin, chemical characteristics and therapeutic use of biopharmaceuticals. This course builds on the concepts and skills gained by the student from taking Dosage Forms II (PHRM 82900) and Professional Program Laboratory II (PHRM 82100).

Learning Outcomes: 1. List and describe the different types of biotechnology derived therapies. 2. Ability to describe the different types of pharmaceutical products in this area, their origin, and the delicate connection that exists between the proper handling and compounding of biotech based products and their therapeutic activity. 3. List and identify the advanced systems used in hospitals for the delivery of biotech products as well as parenteral products in general. Credits: 2.00

PHRM 86800 - Patient Safety And Informatics

Credit Hours: 3.00. This course provides core knowledge and skills needed by pharmacists to promote patient safety and use the tools of healthcare informatics; understand the landscape, epidemiology and culture of patient safety data privacy and security. Case studies will address disclosure of medication errors and reporting adverse events. Informatics tools such as computer order entry, electronic medical record systems, health information exchanges, and decision support will be explained. The use of informatics tools to promote patient safety will be emphasized.

Learning Outcomes: 1. Conceptual competency. 2. Integrative competence. 3. Critical thinking and decision making. 4. Communication skills and abilities. 5. Responsible use of professional values and ethical principles. 6. Social awareness and social responsibility. 7. Professional abilities and habits. Credits: 3.00

PHRM 87000 - Health Policy Applications

Credit Hours: 1.00. This course will explore policy issues that influence health care. The course will provide students opportunities to apply material from prior courses in Health Systems, Population Health Management, and Public Health as it relates to the impact of health policy. Students will gain an understanding of how policy development must address competing interests and goals, and how policy can influence the scope of pharmacist's professional roles. Timely materials on current policy, current policy debates, and professional advocacy will be discussed.

Learning Outcomes: 1. Discuss health policy drivers that impact the current healthcare market. 2. Discuss the impact of various national and state health policies influence on how health care is organized, delivered, and financed. 3. Evaluate potential consequences of specific national, state, and local health policies on health systems, providers, and patients. 4. Identify the process and challenges regarding pursing state legislative health policy change. 5. Analyze healthcare policies and identify opportunities to modify policy to advance the

profession of pharmacy. 6. Generate and evaluate policy development strategies to affect health care access, health care quality, and health care cost. Credits: 1.00

PHRM 81400 - Integrated Case Studies IV

Credit Hours: 1.00. This is the fourth course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 80600 - Integrated Pharmacotherapy VII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and

terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80700 - Integrated Pharmacotherapy VIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

16 Credits

Professional Third Year (P3) - Spring

PHRM 86100 - Professional Skills Laboratory VI

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care. It serves as a one credit hour course. In accordance with university policy, this course may require up to three hours of work weekly outside of the arranged class time.

Learning Outcomes: 1. Synthesize information in order to draw logical solutions. 2. Provide evidence-based support for arguments, recommendations, and solutions. 3.

Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86700 - Introduction To The Advanced Pharmacy Practice Experience

Credit Hours: 1.00. The Introduction to Advanced Pharmacy Practice Experience (APPE) course was designed to provide students with the tools needed to be successful clerkship students. Students will participate in a variety of activities, including case studies, group work, evaluations and assessment, review of therapeutic topics, and student/preceptor panel interactions. Activities will be supplemented by didactic lecturing for each topic. The activities and lecture topics were selected based on feedback from previous clerkship students, preceptors, and faculty, and are intended to de-mystify the clerkship experience. This course prepares students to enter the clerkship year with the ability to successfully submit required clerkship forms, evaluate preceptors and peers, avoid common clerkship student mistakes, document clinical interventions, review medical charts, and prepare for therapeutic and pharmacokinetic responsibilities.

Learning Outcomes: 1. Explain how to register for rotations. 2. Recall clerkship policies and procedures. 3. List the forms which should be submitted to the Office of Experiential Learning after each rotation. 4. Critique preceptors and rotations constructively and assess peer performance on oral and written work. 5. Apply strategies to maximize the clerkship experience to each assigned rotation. 6. Cite the rotation portfolio requirements. 7. List handy drug information resources to use during rotations. 8. Explain ways to handle "tough situations" during rotations. 9. Document complete clinical interventions using Clinical Measures software. 10. Provide pharmacokinetic recommendations using provided equations and tools. 11. List ways to succeed on non-patient-care rotations. 12. List ways to prepare for post-graduate training during rotations. 13. Recall important information from common disease states encountered while on rotation. Credits: 1.00

PHRM 86900 - Practice Management And Marketing Of Professional Services

Credit Hours: 2.00. Introduces essential pharmacy practice managerial skills including personnel management, addressing conflict, CQI, change management and leadership. Builds upon these skills in the development of a business plan to implement an innovative pharmacy service.

Learning Outcomes: 1. Explain key concepts and legal stipulations related to hiring, performance assessment and communicating with work associates and employees. 2. Explain the characteristics that best describe themselves in a work setting (DiSC) and how these affect individual and team work. 3. Describe the four steps in LEAN theory and apply it to a variety of health care settings and its place in overall quality improvement measures. 4. Ascertain data and statistics about the practices and populations of a specific health care market. 5. Develop marketing materials based on a target audience(s). 6. Conceptualize and project the financial and clinical impact of a new product or service on an existing organization/system. 7. Justify and defend an innovative service or product. 8. Write a complete business plan addressing, at minimum, an executive summary, purpose, background, program description, financial projections and conclusion/summary. 9. Present on an innovative pharmacy service covering pertinent and persuasive information. 10. Justify and defend an innovative service or product. Credits: 2.00

PHRM 87100 - Jurisprudence

Credit Hours: 2.00. An in depth study of federal and Indiana laws, regulations, and rules affecting pharmacy practice. Primary emphasis is on Retail and Hospital Pharmacy settings. Lecture is supported by an instructor-created text covering the Food, Drug, and Cosmetic Act (21 USC), the Controlled Substances Act 21 CFR 1300 et. seq. and Indiana Food and Drug law IC 25-26-13 et. seq. and Indiana rules 856 IAC-1-43.

Learning Outcomes: 1. Identify acts that are

covered by statute, regulation, and/or rule, and what and where those are. 2. Passing the national licensing examination on laws (MPJE "Multistate Pharmacy Jurisprudence Examination" developed, administered and graded by the National Association of Boards of Pharmacy). Credits: 2.00

PHRM 81500 - Integrated Case Studies V

Credit Hours: 1.00. This is the fifth course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 80800 - Integrated Pharmacotherapy VIIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical

and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80900 - Integrated Pharmacotherapy X

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

15 Credits

Professional Fourth Year (P4)

PHRM 88000 - Advanced Pharmacy Practice Experience

Credit Hours: 3.00. This final year begins in May and continues through the following April. The 36 weeks of rotation are broken down as follows: 4 weeks Hospital Operations 2, 4 weeks Community Pharmacy Operations 2, 8 weeks Ambulatory rotations, 4 weeks inpatient rotations, and 16 weeks General Electives (4 of which must be additional patient care rotation).

Learning Outcomes: 1. The purposes, uses,

and effects of their medications and related therapy. 2. Achievable therapeutic outcomes with estimated time frame. 3. Drug cautions and side effects in relation to the patient's condition. 4. Medication cost issues. 5. Relevant lifestyle modifications (i.e. weight loss and smoking cessation) and non-drug therapies. 6. Use, storage, side effects, and dosage of nonprescription drugs. 7. The appropriate selection of over-the-counter medications in response to patient's condition/needs. 8. Appropriate patient's comprehension of student's counseling (i.e. final verification step). Credits: 3.00

27 Credits

Philosophy and Literature, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Additional Information

GPA Requirements

Philosophy, PHD

About the Program

Program Requirements

Required Courses (24 credits)

Metaphysics, Epistemology, and Science Courses (9 credits)

PHIL 50600 - Advanced Philosophy Of Religion

Credit Hours: 3.00. A detailed critical investigation of some central problems in a philosophical approach to religion. Readings will be selected from leading representatives of traditional theism and various contemporary schools. The thought of the representative thinkers will be analyzed, discussed, and critically evaluated. The problems discussed will be selected from the existence of God, the problem of evil, freedom and determinism, the problem of immortality, and the nature of religious language. Variable content.

Credits: 3.00

PHIL 51000 - Phenomenology

Credit Hours: 3.00. A detailed, critical examination of some major issue(s) in phenomenology. Attention will be given to either the historical development or contemporary relevance of phenomenological philosophy. Readings will be drawn from the works of Husserl, Heidegger, Merleau-Ponty, and others.

Credits: 3.00

PHIL 52500 - Studies In Metaphysics

Credit Hours: 3.00. An intensive and critical examination of one or more of the basic problems of ontology and cosmology, such as substance, existence, causality, change, time, space, teleology, freedom, and universals. Variable content.

Credits: 3.00

PHIL 53200 - Studies In Theory Of Knowledge

Credit Hours: 3.00. An intensive examination of selected problems concerning the nature of human knowledge, its scope and limits, its relation to sense-perception and memory. Variable content.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 55100 - Philosophy Of The Natural Sciences

Credit Hours: 3.00. A survey of issues and theories in contemporary philosophy of science. Variable content.

Credits: 3.00

PHIL 55200 - Philosophy Of The Social Sciences

Credit Hours: 3.00. An exploration of the nature of the concepts in the social sciences, and a study of the ways in which they have been and are employed.

Credits: 3.00

PHIL 66500 - Philosophy Of Language

Credit Hours: 3.00. An introduction to some of the main concepts and problems in the philosophy of language, such as meaning, reference, and private languages, through readings in the chief contributors to the field. Prerequisite: 6 credit hours in Philosophy.

Credits: 3.00

History of Philosophy Courses (6 credits)

PHIL 50100 - Studies In Greek Philosophy

Credit Hours: 3.00. The subject matter will alternate between the intensive study of some fairly specific topic in Greek philosophy (e.g., Plato's theory of knowledge, Aristotle's ethics, etc.) and a general study of either the philosophy of Plato or the philosophy of Aristotle.

Credits: 3.00

PHIL 50200 - Studies In Medieval Philosophy

Credit Hours: 3.00. An intensive study of some central topics in the thought of major medieval philosophers. Subject matter will vary. Philosophers most often studied are Augustine, Thomas Aquinas, Duns Scotus, and Ockham.

Credits: 3.00

PHIL 50300 - Studies In Early Modern Philosophy

Credit Hours: 3.00. A detailed study of either: 1) one or more central philosophical themes or 2) one or more major figures (typically, but not restricted to, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and/or Kant) in the early modern period. Offered in alternate years.

Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the human good, the nature of God, and divine language.

Credits: 3.00

PHIL 51400 - Twentieth-Century Analytical Philosophy I

Credit Hours: 3.00. A detailed study of the origins and development of contemporary philosophical analysis, and how it was pursued in movements such as logical atomism, logical positivism, ordinary language philosophy, and others. Readings will cover a selection of the writings of Frege, Russell, Moore, Wittgenstein, Ayer, Ryle, Austin, and others. Need not be followed by PHIL 51500.

Learning Outcomes: 1. Develop an appreciation for and understanding of central problems, texts, and ideas in the history of analytic philosophy. 2. Identify and reconstruct philosophical arguments. 3. Discriminate between metaphysical and epistemological issues. Credits: 3.00

PHIL 68300 - Studies In Continental Rationalism

Credit Hours: 3.00. An intensive study of Descartes, Spinoza, or Leibniz, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68400 - Studies In British Empiricism

Credit Hours: 3.00. An intensive study of Locke, Berkeley, or Hume, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68500 - The Philosophy Of Kant

Credit Hours: 3.00. This course will be concerned with the critical philosophy as a whole. Primary emphasis, however, will be on the theories of knowledge and metaphysics as developed in the Critique of Pure Reason. Lesser attention will be paid to Kant's ethics and the principles of judgment as time permits. Prerequisite: PHIL 30300 .

Credits: 3.00

Value Theory Courses (6 credits)

PHIL 52000 - Existentialism

Credit Hours: 3.00. A detailed exploration and examination of

the existentialist movement in modern thought, including its historical roots, its philosophical formulations, and its influence and expression in and relation to art, literature, psychology, social criticism, and religion. Readings will be from at least some of the major existentialists: Kierkegaard, Nietzsche, Jaspers, Heidegger, and Sartre. In addition, texts from existentialist thinkers in other areas will be used.

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 54000 - Studies In Social And Political Philosophy

Credit Hours: 3.00. A detailed study of one or more important concepts in social or political philosophy, such as natural rights, revolution, law, freedom, justice, or political obligation. Variable content.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

Formal Methods Course (3 credits)

PHIL 55300 - Mathematical Logic

Credit Hours: 3.00. This class is an introduction to various logical foundations of mathematics as well as the basics of logical metatheory.

Learning Outcomes: 1. Understand some of the more advanced methods employed in logical analysis. 2. Explain important problems and issues in foundational mathematical logic and express them in clear and precise terms. 3. Analyze and assess foundational results in mathematical logic. 4. Explain, apply, and appraise the use of formal languages. 5. Assess and construct precise, abstract arguments using the tools of mathematical logic. (This will help students engage in better written and oral communication, in particular in circumstances where perspicuity and logicality are of special importance.) Credits: 3.00

Electives (12 credits)

Dissertation Research (xx credits)

PHIL 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHIL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Foreign Language Requirement

GPA Requirements

Physics, PHD

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (12 credits)

PHYS 61700 - Statistical Mechanics

Credit Hours: 3.00. Classical and quantum statistical mechanics. Prerequisite: PHYS 66000 .

Credits: 3.00

PHYS 63000 - Advanced Theory Of Electricity And Magnetism

Credit Hours: 3.00. The experimental origins of Maxwell's equations. Electrostatics and magnetostatics; solution of boundary value problems. Quasi-static currents. Electromagnetic energy and momentum and the Maxwell stress tensor. Foundations of optics. Radiation from antennas, multi-pole expansion; waveguides. Prerequisite: PHYS 53000 , PHYS 60000 .

Credits: 3.00

PHYS 66000 - Quantum Mechanics I

Credit Hours: 3.00. Origins of the quantum theory, the uncertainty and complementarity principles. The Schrodinger equation and its solutions for simple physical systems. Mathematical formulation of the quantum theory. Applications: simple harmonic oscillator, theory of angular momentum, the hydrogen atom. Time-independent and time-dependent perturbation theory. The Pauli exclusion principle. Spin of the electron. Elementary theory of scattering. Prerequisite: PHYS 53000 , PHYS 55000 , PHYS 60000 , PHYS 61000 . Corequisite: PHYS 60100 .

Credits: 3.00

PHYS 66100 - Quantum Mechanics II

Credit Hours: 3.00. Symmetry and conservation laws. The Klein-Gordon and Dirac equations. Interaction of radiation with matter. Applications of quantum mechanics to atomic structure. Scattering theory. Prerequisite: PHYS 60100 , PHYS 63000 , PHYS 66000 .

Credits: 3.00

Mathematics Courses (6 credits)

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

Optional Refresher Courses (0-12 credits)

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents,

electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

Specialty Courses (12 credits)

Electives (0-3 credits)

Dissertation Research (xx credits)

PHYS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHYS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

PHYS 60500 - Pedagogical Methods For Physics Graduate Students

Credit Hours: 2.00. This course prepares physics graduate students for classroom and laboratory teaching assignments. Through 100 minutes per week of lectures and hands-on recitations, it provides an intensive survey of basic pedagogical methods, both theoretically and in practice. Students will learn and practice teaching techniques via various forms and microteaching, reading, and class discussion. A broad range of results from physics education research will be studied in detail. Additional topics include grading and assessment, responsible conduct in teaching related to issues such as gender, culture and ethnicity, students with disabilities, and ethics in academia, generally, including ethical conduct of research.

Credits: 2.00

Concentrations

Additional Information

GPA Requirements

Political Science, PHD

About the Program

Program Requirements

Required Courses (15 credits)

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

POL 60000 - Political Science: Discipline And Profession

Credit Hours: 3.00. An exploration of the scope of political science and of its development as a profession, with a focus on what American political scientists do as disciplinary professionals. Analysis of major approaches to the study of politics and of current developments. Prerequisite: 6 credit hours in Political Science.

Credits: 3.00

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field.

Prerequisite: POL 50100 .

Credits: 3.00

POL 60800 - Qualitative Methods In Political Science

Credit Hours: 3.00. This course is an introduction to the use of qualitative methods in political science. In addition to a detailed consideration of several leading qualitative approaches to political research, the course will also consider the distinctive issues of research design for qualitative research as well as the relationship of qualitative and quantitative methods. Prerequisite: POL 50100 Political Science Methodology or equivalent or consent of instructor.

Learning Outcomes: 1. Know and understand the different perspectives and epistemologies related to qualitative research. 2. Know and understand the primary components of qualitative research design. 3. Recognize and apply the common tools for the collection and analysis of qualitative data. 4. Understand the distinctive ethical issues that can arise in qualitative research. 5. Create and compose a research proposal with a substantial qualitative methods component. Credits: 3.00

POL 60900 - Advanced Applied Research Design

Credit Hours: 3.00. The main goal of this seminar is to guide graduate students when preparing their Ph.D. dissertation proposals. The seminar aims to do two things. The first is to provide an overview of the crucial research design tools and research planning considerations that can help students plan and carry out better dissertation projects. The second is to offer a structured forum where students can present and receive feedback on their dissertation proposals. With permission from the Director of Graduate Studies, this course may be repeated and used to support the development of a grant proposal or research publication. Pre-requisite: POL 60000 with a grade B or better.

Learning Outcomes: 1. Communicate clearly a research question, its scientific merit, and broader impacts. 2. Connect a theory and its concepts to a suitable research design. 3. Estimate and describe a research project's feasibility. 4. Produce a defensible prospectus or other research product suitable for submission to an evaluative body. 5. Respond effectively to reviewer feedback in revising work. Credits: 3.00

Major Field Courses (12 credits)

Minor Field Courses (9 credits)

Electives (9 credits)

Dissertation Research (30 credits)

Required Courses (15 credits)

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

POL 60000 - Political Science: Discipline And Profession

Credit Hours: 3.00. An exploration of the scope of political science and of its development as a profession, with a focus on what American political scientists do as disciplinary professionals. Analysis of major approaches to the study of politics and of current developments. Prerequisite: 6 credit hours in Political Science.

Credits: 3.00

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

POL 60800 - Qualitative Methods In Political Science

Credit Hours: 3.00. This course is an introduction to the use of qualitative methods in political science. In addition to a detailed consideration of several leading qualitative approaches to political research, the course will also consider the distinctive

issues of research design for qualitative research as well as the relationship of qualitative and quantitative methods. Prerequisite: POL 50100 Political Science Methodology or equivalent or consent of instructor.

Learning Outcomes: 1. Know and understand the different perspectives and epistemologies related to qualitative research. 2. Know and understand the primary components of qualitative research design. 3. Recognize and apply the common tools for the collection and analysis of qualitative data. 4. Understand the distinctive ethical issues that can arise in qualitative research. 5. Create and compose a research proposal with a substantial qualitative methods component. Credits: 3.00

POL 60900 - Advanced Applied Research Design

Credit Hours: 3.00. The main goal of this seminar is to guide graduate students when preparing their Ph.D. dissertation proposals. The seminar aims to do two things. The first is to provide an overview of the crucial research design tools and research planning considerations that can help students plan and carry out better dissertation projects. The second is to offer a structured forum where students can present and receive feedback on their dissertation proposals. With permission from the Director of Graduate Studies, this course may be repeated and used to support the development of a grant proposal or research publication. Pre-requisite: POL 60000 with a grade B or better.

Learning Outcomes: 1. Communicate clearly a research question, its scientific merit, and broader impacts. 2. Connect a theory and its concepts to a suitable research design. 3. Estimate and describe a research project's feasibility. 4. Produce a defensible prospectus or other research product suitable for submission to an evaluative body. 5. Respond effectively to reviewer feedback in revising work. Credits: 3.00

Concentrations

About the Program

Public Health, PHD

About the Program

Program Requirements

Required Courses (31-32 credits)

Core Courses (18-19 credits)

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques. Students will acquire the ability to utilize statistical software as a tool to facilitate the processing, editing, storing, displaying, analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

PUBH 50000 - Introduction To Public Health

Credit Hours: 1.00 to 3.00. This Public Health course covers a variety of issues related to the profession of public health. The Introduction to Public Health provides the graduate student with an overview of the history, science, mission, practice and future of public health. The core public health principles and services, and the expected competencies of the professional public health practitioner, are discussed. Current issues in public health are also presented for discussion and analysis.

Learning Outcomes: 1. Describe factors affecting the health of a community (e.g., equity, income, education, and environment). 2. Apply ethical principles in accessing, collecting, analyzing, using, maintaining, and disseminating data and information. 3. Identify current trends (e.g., health, fiscal, social, political, environmental) affecting the health of a community. 4. Communicate in writing and orally with linguistic and cultural proficiency (e.g., using age-appropriate materials, incorporating images). 5. Describe the roles of governmental public health, health care, and other partners in improving the health of a community. 6. Describe the diversity of individuals and populations in a community. 7. Describe the effects of policies, programs, and services on different populations in a community. Credits: 1.00 to 3.00

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and

analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

Seminar Course (0 credits)

PUBH 69400 - Graduate Seminar In Public Health

Credit Hours: 0.00. Seminar course covering a broad range of current research topics in public health and related fields of study. Seminar presentations by representatives from academia, industry, government, other external institutions and organizations, and members of the Purdue University community. Intensive analysis of application of various research and statistical methodologies to the study of public health.

Learning Outcomes: 1. Acquire an understanding and appreciation of research conducted on topics relevant to the field of public health. 2. Develop a working knowledge of how research topics are determined, hypotheses are formed, methodologies are designed and implemented, data are collected, and conclusions are drawn. 3. Apply knowledge of research and statistical design to student' own research projects. Credits: 0.00

Research Course (1 credit)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis

research in their home department.

Credits: 1.00

Public Health Selectives (6 credits)

PUBH 51100 - Foundations Of Global Health

Credit Hours: 3.00. Global disparities in the health and well-being of diverse populations, across and within borders, has never been greater. Profound and rapid changes in demographics, from population growth to urbanization, along with unprecedented shifts in patterns of disease and risks, are coupled with game-changing advances in knowledge, technology, and innovation. This course will introduce students to current challenges and efforts at solutions in global health, with a focus on low- and middle-income countries. It will provide an interdisciplinary overview of topics that include measures of health and disease, communicable diseases such as HIV/AIDS and malaria, non-communicable diseases such as diabetes and cardiovascular disease, women's health, maternal and child health, food systems and nutrition, health systems, and health care delivery. In addition to lectures, the course will include interactive discussions of case studies and specific country examples, aimed at immersing students in the debates and challenges facing global health leaders and decision makers.

Learning Outcomes: 1. Identify major shifts and trends in health patterns, burden of disease, population dynamics, and globalization. 2. Understand the historical context of global health and current evolving agendas. 3. Analyze diverse global health challenges, incorporating ethical, environmental, political, historical, and societal perspectives, with a focus on low- and middle-income countries. 4. Evaluate global health research to assess how conclusions arise from evidence and analysis. 5. Formulate evidence-based arguments for/against diverse global health policies or interventions. Credits: 3.00

PUBH 50100 - Introduction To Health Equity

Credit Hours: 3.00. This course introduces the participants to graduate level research in health disparities and the various theoretical and analytical skills needed to be a good health disparities researcher. It will take the course participants through the axiological, ontological and epistemological questions that we are confronted within social scientific research. This course will walk the participants through the various research paradigms and the critical debates associated with it so that they can reflect and possibly make an informed choice about their own research priorities. Permission of department required.

Learning Outcomes: 1. Develop students understanding of the fundamental assumptions underlying different approaches to health disparities research and in turn how these inform the field. 2. Develop students' capacities to describe, and to compare and contrast, the prominent approaches used to understand Health Disparities. 3. Encourage the student participants to critically evaluate different research and approaches to health disparities and comment on the suitability of these in advancing health disparities research. 4. Learn to write for academic audiences. Credits: 3.00

PUBH 69500 - Public Health Independent Research Or Study

Credit Hours: 1.00 to 9.00. Investigation of various public health topics as determined by the interest of the individual public health graduate student and faculty mentor. Permission of department required.

Learning Outcomes: 1. Reinforce one or more of the student's graduate program competencies. Credits: 1.00 to 9.00

PUBH 54300 - Physical Activity And Public Health

Credit Hours: 3.00. In this course students will be exposed to epidemiological, behavioral, and public health issues relevant to effective promotion of physical activity. The course is appropriate for students training to be practitioners or researchers from a range of disciplines including exercise science, nutrition, psychology, and public health. Major topic areas will include physical activity epidemiology, determinants of physical activity in youth and adults, and current evidence for physical activity interventions ranging from individual, behavioral strategies, to environmental or policy approaches.

Learning Outcomes: 1. Differentiate between various definitions of physical activity, exercise, and physical fitness. 2. Describe and identify strengths and weaknesses of different approaches used to measure physical activity, including surveys, and objective methods using pedometers and accelerometers. 3. Discuss epidemiological evidence on relationships

between physical activity and all-cause mortality, cardiovascular disease, cancers, diabetes, obesity, and overweight. 4. Describe and critically evaluate the physical activity determinants literature in children, youth, and adults, and the current determinants research focus in these populations. 5. Describe and critically evaluate physical activity intervention literature, including currently recommended approaches for children, youth, and adults (e.g., based on the Community Guide to P{Preventive Services). Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Methods/Statistics Selectives (6 credits)

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 54700 - Public Health Program And Policy Evaluation

Credit Hours: 3.00. This course provides an overview of the methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs, and the process for applying and tailoring these designs to program and policy evaluations. In addition, we will focus on the process of engaging communities and stakeholders in program evaluation efforts. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Create an evaluation design that considers the budget, time, data, and environmental constraints of the context to public health interventions. 2. Discuss the role of formative, process, outcome, and cost evaluation across the program lifecycle. 3. Interpret and critique the quality of evaluation research case studies and reports. 4. Explain and defend evaluation design decisions to

expert and lay audiences. 5. Recognize and critically reflect upon one's own cultural biases and their impact of evaluation design development and implementation. Credits: 3.00

Dissertation Research (15-59 credits)

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

PUBH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis.

Learning Outcomes: 1. Develop MS level research skills in Public Health. Credits: 1.00 to 18.00

Program Learning Outcomes

Concentrations

Purdue University Interdisciplinary Life Science (PULSe), MS or PHD

About the Program

Program Requirements

Required Courses (12 credits)

Seminar Course (1 credit)

Lab Rotations Course (4 credits)

General Courses (7 credits)

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data

reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 66200 - Pattern Recognition And Decision-Making Processes

Credit Hours: 3.00. (ECE 66200) Introduction to the basic concepts and various approaches of pattern recognition and decision-making processes. Topics include various classifier designs, evaluation of classifiability, learning machines, feature extraction, and modeling. Prerequisite: ECE 30200 .

Credits: 3.00

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common

data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 50100 - PULSe Scientific Communications

Credit Hours: 1.00. To begin to create an atmosphere in which students learn to communicate across disciplinary lines by providing the opportunity to develop skills in presenting and evaluating research results. Students will develop short scientific presentations, an abstract, and a poster and learn to present their findings to others and to ask and answer questions from their peers. Permission of department required.

Learning Outcomes: 1. To improve your ability to organize and present research presentation. 2. To gain experience with the skills required to prepare material for presentation. 3. To learn more about the faculty and students in PULSe. Credits: 1.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Seminar Course (1 credit)

Training Group Courses (4-7 credits)

Biomolecular Structure and Biophysics Courses

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science

that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

CHM 61500 - Principles Of NMR Spectroscopy

Credit Hours: 3.00. The course is intended to provide in-depth coverage of fundamental concepts in modern NMR spectroscopy. Included are the vector model of spin resonance, topics in signal processing, product operator formalism, discussion of important 2D experiments, Redfield relaxation theory, and methods for molecular structure determination. The emphasis is on general spectroscopic concepts, also used outside spin resonance spectroscopy. Spectrometer operation and data processing are also demonstrated. Prerequisite: Undergraduate degree or completed advanced coursework in chemistry, physics, biology, or engineering. Basic knowledge of NMR is expected, but not required.

Credits: 3.00

CHM 63100 - Magnetic Resonance Spectroscopy

Credit Hours: 2.00. Theory, experimental practice, and current applications to biological systems of nuclear magnetic resonance spectroscopy and, to a lesser extent, electron paramagnetic resonance spectroscopy. Offered in alternate years. Prerequisite: CHM 53300, 56100, 57700, 57800.

Credits: 2.00

CHM 63200 - Membranes: Structure And Function

Credit Hours: 3.00. The structure and molecular properties of biological membranes and appropriate model systems. Offered in alternate years.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 63800 - Biophysical Chemistry

Credit Hours: 3.00. Applications of the principles and methods of physical chemistry in biochemistry with emphasis on the behavior of macromolecules in solution. Protein engineering. Offered in alternate years. Prerequisite: CHM 57800, CHM 63400 .

Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Biotechnology Courses

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

ABE 56000 - Biosensors: Fundamentals And Applications

Credit Hours: 3.00. (BME 52100) An introduction to the field of biosensors and an in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and biosecurity applications.

Credits: 3.00

ABE 62700 - Colloidal Phenomena In Bioprocessing

Credit Hours: 3.00. The structure, stability, and rheology of biological dispersions, emulsions, and foams are explained in terms of the principles of electrostatics, hydrodynamics, thermodynamics, and statistical mechanics. Additional topics include colloidal phenomena in downstream bioprocessing, as well as colloidal aspects of some food systems. Prerequisite: Thermodynamics and physical chemistry.

Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and

nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

CS 50100 - Computing For Science And Engineering

Credit Hours: 3.00. Credit in this course may not be used toward a graduate degree in Computer Sciences. Computational concepts, tools, and skills for computational science and engineering scripting for numerical computing, scripting for file processing, high performance computing, and software development. Project may be required.

Learning Outcomes: 1. To prepare graduate students outside Computer Science to write computer programs in support of their studies and research. Credits: 3.00

FNR 64700 - Quantitative Methods For Ecologists

Credit Hours: 3.00. Examines the assumptions and utility of statistical and other data analytic techniques that are encountered commonly or increasingly being used in ecological research. Emphasis is placed on the potential applications of these quantitative methods in an ecological context. Topics include traditional multivariate methods (cluster analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling, correspondence analysis), generalized linear models (logistic Poisson, and ordinal regression and derivatives), randomization methods, information-theoretic model selection and inference, and hierarchical models. An introduction to Bayesian analysis is provided for generalized linear (and mixed) models, with applications to (meta) population and (meta) community ecology. Prerequisite: BIOL 58210 or ENTM 64200 or STAT 51200 , or consent of instructor. Knowledge of linear algebra and experience with R is desirable but not essential.

Learning Outcomes: 1. Determine the appropriate statistical tool to use when confronted with most questions and data types. 2. Be familiar with the assumptions underlying these methods. 3. Have some familiarity with software required to apply the methods. 4. Offer a basic interpretation of results provided. Credits: 3.00

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where

they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

BME 52100 - Biosensors: Fundamentals And Applications

Credit Hours: 3.00. (ABE 56000) An introduction to the field of biosensors and an in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and biosecurity applications.

Credits: 3.00

Chemical Biology Courses

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern

pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

MCMP 54400 - Drug Classes And Mechanisms

Credit Hours: 3.00. The course will integrate basic principles of medicinal chemistry and pharmacology to achieve an understanding of drug mechanisms as applied to autonomic/endocrine, cardiovascular/renal, CNS, and chemotherapy/infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease.

Learning Outcomes: 1. Knowledge and understanding of the major drug classes. 2. Knowledge of the relationships between mechanism of action with drug interactions and adverse reactions. 3. Development of an introductory-level ability to critically evaluate primary literature. 4. An appreciation for the relevant research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. 5. A broad knowledge of pharmaceutical and related sciences. 6. An understanding of drug discovery, development, and commercialization. 7. Effective written and oral communication skills. 8. An ability to integrate and apply knowledge to solve problems. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to

visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BIOL 64700 - Membrane Protein Structural Biology

Credit Hours: 2.00. This course focuses on the structural basis of the functions and dysfunctions of diverse membrane proteins, analyzed by X-ray, electron microscopy, and spectroscopy. The functions include transport, biogenesis, and transmembrane signaling. Unique problems associated with the structure analysis of integral membrane proteins are discussed.

Credits: 2.00

CHM 63200 - Membranes: Structure And Function

Credit Hours: 3.00. The structure and molecular properties of biological membranes and appropriate model systems. Offered in alternate years.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 63500 - Biochemistry: Dynamic Aspects

Credit Hours: 3.00. Enzymes, metabolism, and protein and nucleic acid biosynthesis. Prerequisite: CHM 63400 .

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized

design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

Chromation and Regulation of Gene Expression Courses

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific

method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research. Credits: 2.00

BIOL 55001 - Eukaryotic Molecular Biology

Credit Hours: 4.00. This is a general survey course intended for advanced undergrads and beginning grad students. The course will draw upon examples from the plant, animal, and fungal kingdoms, and will familiarize students with the basic principles of molecular biology analyses as they apply to eukaryotic organisms. By the end of the course students should have knowledge of these molecular processes and should be able to design and analyze experiments dealing with these topics. This is not a first course in molecular biology. Permission of department required.

Learning Outcomes: 1. Have knowledge of molecular processes. 2. Be able to design and analyze experiments dealing with these topics. Credits: 4.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Computational and Systems Biology Courses

CPB 62000 - Advanced Immunology

Credit Hours: 2.00. Teaches advanced concepts in basic immunology and applications to disease prevention and therapy. Emphasis is on recent developments and experimental approaches in this rapidly evolving discipline. Topics include antigen presentation, T-cell development, signal transduction in B and T lymphocytes, immunoglobulin structure, type I hypersensitivity (asthma), neuroendocrine regulation of the immune response, immune response in viral infections (influenza and HIV), and tumor immunology. Permission of instructor required.

Credits: 2.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between

chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research.

Credits: 2.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CS 50100 - Computing For Science And Engineering

Credit Hours: 3.00. Credit in this course may not be used toward a graduate degree in Computer Sciences. Computational concepts, tools, and skills for computational science and engineering scripting for numerical computing, scripting for file processing, high performance computing, and software development. Project may be required.

Learning Outcomes: 1. To prepare graduate students outside Computer Science to write computer programs in support of their studies and research. Credits: 3.00

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2.

Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Integrative Neuroscience Courses

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the

molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

PSY 51200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, BIOL 56200) Background in cell biology, psychobiology, physiology, or anatomy is recommended. Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Permission of instructor required.

Credits: 3.00

SLHS 50100 - Neural Bases Of Speech And Hearing

Credit Hours: 3.00. Study of normal human neuroanatomy and neurophysiology related to speech, language, and hearing functions. Includes material concerning normal and abnormal neurological development over the lifespan.

Credits: 3.00

SLHS 50300 - Auditory Perception

Credit Hours: 3.00. Behavioral measurement of the capabilities of the normal and impaired auditory system. The laboratory experience includes an exposure to the measures and methods of hearing science.

Credits: 3.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Membrane Biology Courses

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written

communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research.
Credits: 2.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

BIOL 64700 - Membrane Protein Structural Biology

Credit Hours: 2.00. This course focuses on the structural basis of the functions and dysfunctions of diverse membrane proteins, analyzed by X-ray, electron microscopy, and spectroscopy. The functions include transport, biogenesis, and transmembrane signaling. Unique problems associated with the structure analysis of integral membrane proteins are discussed.

Credits: 2.00

CHM 53300 - Introductory Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry.

Credits: 3.00

CHM 63200 - Membranes: Structure And Function

Credit Hours: 3.00. The structure and molecular properties of biological membranes and appropriate model systems. Offered in alternate years.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 63500 - Biochemistry: Dynamic Aspects

Credit Hours: 3.00. Enzymes, metabolism, and protein and nucleic acid biosynthesis. Prerequisite: CHM 63400 .

Credits: 3.00

CHM 63800 - Biophysical Chemistry

Credit Hours: 3.00. Applications of the principles and methods of physical chemistry in biochemistry with emphasis on the behavior of macromolecules in solution. Protein engineering. Offered in alternate years. Prerequisite: CHM 57800, CHM 63400 .

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical

methods. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

Microbiology, Immunology, and Infectious Diseases Courses

CPB 62000 - Advanced Immunology

Credit Hours: 2.00. Teaches advanced concepts in basic immunology and applications to disease prevention and therapy. Emphasis is on recent developments and experimental approaches in this rapidly evolving discipline. Topics include antigen presentation, T-cell development, signal transduction in B and T lymphocytes, immunoglobulin structure, type I hypersensitivity (asthma), neuroendocrine regulation of the immune response, immune response in viral infections (influenza and HIV), and tumor immunology. Permission of instructor required.

Credits: 2.00

AGRY 64900 - Molecular Microbial Ecology

Credit Hours: 3.00. Focuses on the application of various molecular genetic techniques for studying micro-organisms from and in the environment. The method, theoretical basis of each method, and interpretation of results are covered. The major areas discussed are the application of molecular genetic techniques to study: (1) total microbial communities; (2) diversity of micro-organisms in a community; and (3) biotechnological uses of micro-organisms. Prerequisite: AGRY 32000 or AGRY 58000 or BCHM 56200 or BIOL 24100 or BIOL 43800 or BIOL 54900.

Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research. Credits: 2.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 54900 - Microbial Ecology

Credit Hours: 2.00. A study of microbial interactions with other organisms and the environment. Aquatic and terrestrial ecosystems as well as interactions between nonpathogenic microbes and plants and animals will be discussed. Offered in alternate years.

Credits: 2.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

CHM 53300 - Introductory Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

FS 56500 - Microbial Foodborne Pathogens

Credit Hours: 3.00. The primary focus is to study the microbial pathogens involved with foodborne diseases. Course emphasis is on molecular and genetic basis of virulence of foodborne pathogens and host-parasite interactions. Topics include incidence and source of pathogens, immune response to infection, virulence factors, and mechanism of pathogenesis of specific infectious and intoxicating foodborne bacteria, mycotoxins, viruses and parasites. Typically offered odd years.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription,

messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

Molecular Signaling and Cancer Biology Courses

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order

structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research.

Credits: 2.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and

draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 61501 - Pathways

Credit Hours: 3.00. An advanced level cell biology course offered to first or second year graduate students. Students will learn the major intracellular signaling pathways and cell cycle regulation of eukaryotes. Readings will be from the primary literature. Prerequisites: BCHM 65100 and BCHM 56200; or, BCHM 60501 (can be taken concurrently).

Learning Outcomes: 1. Know the molecular mechanisms in signal transduction and cell cycle. 2. Appreciate how protein modules within signaling molecules impart selective responses, how protein-protein interactions are used to build signaling pathways, and the methods commonly used to analyze signal transduction processes. 3. Appreciate cell cycle is carefully regulated to maintain genomic stability. 4. Enhance oral and written communication skills. 5. Master reading and interpreting scientific literature in signal transduction and cell cycle fields. 6. Develop critical thinking and creativity in signal transduction and cell cycle research. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Plant Biology Courses

AGRY 53000 - Advanced Plant Genetics

Credit Hours: 3.00. Advanced treatment of principles and recent advances in plant genetics including: mutagenesis; cell, molecular and direct approaches to genetic analysis and genetic interactions; haploidy; chromosomal organization and aberrations; transposable elements; mutations, para mutation and epigenetics in higher plants; extra nuclear inheritance; cytogenetic and molecular affinities between crop plants and their wild relatives; genetic manipulations; gene discovery; genetic approaches to understanding agriculturally useful plant traits. ESTs and global gene expression analysis, proteomics, metabolic profiling, comparative genomics and genome evolution. Offered in odd-numbered years.

Credits: 3.00

AGRY 59800 - Special Problems

Credit Hours: 1.00 to 6.00. Research on agronomic problems conducted in laboratory, field, or library; report required; arrange with an agronomy staff member before registering. Permission of instructor required.

Credits: 1.00 to 6.00

AGRY 60000 - Genomics

Credit Hours: 3.00. An introduction to the technologies and analytical methods used in studying genomes, their functions and systems biology. This course prepares graduate students for further study of these techniques in additional courses and in their research. Students with an understanding of introductory genetics and statistics will be suitably prepared for this course. Offered in even-numbered years.

Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research. Credits: 2.00

BCHM 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (AGRY 64000, BIOL 64000, BTNY 64000 , HORT 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available

in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BTNY 55300 - Plant Growth And Development

Credit Hours: 3.00. Topics include seed dormancy, cell expansion and plant growth, pattern formation, phase transition, flowering, pollination and fertilization, seed development, fruit development, and senescence. This course is the second in a series of team-taught courses in the core curriculum of the Purdue Plant Biology Program.

Credits: 3.00

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

CHM 63800 - Biophysical Chemistry

Credit Hours: 3.00. Applications of the principles and methods of physical chemistry in biochemistry with emphasis on the behavior of macromolecules in solution. Protein engineering. Offered in alternate years. Prerequisite: CHM 57800, CHM 63400 .

Credits: 3.00

HORT 55100 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

HORT 59000 - Special Studies In Horticulture

Credit Hours: 1.00 to 3.00. Special studies in horticulture not covered in regular coursework. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Biomolecular Structure and Biophysics Courses

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide

variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

CHM 61500 - Principles Of NMR Spectroscopy

Credit Hours: 3.00. The course is intended to provide in-depth coverage of fundamental concepts in modern NMR spectroscopy. Included are the vector model of spin resonance, topics in signal processing, product operator formalism, discussion of important 2D experiments, Redfield relaxation theory, and methods for molecular structure determination. The emphasis is on general spectroscopic concepts, also used outside spin resonance spectroscopy. Spectrometer operation and data processing are also demonstrated. Prerequisite: Undergraduate degree or completed advanced coursework in chemistry, physics, biology, or engineering. Basic knowledge of NMR is expected, but not required.

Credits: 3.00

CHM 63100 - Magnetic Resonance Spectroscopy

Credit Hours: 2.00. Theory, experimental practice, and current applications to biological systems of nuclear magnetic resonance spectroscopy and, to a lesser extent, electron paramagnetic resonance spectroscopy. Offered in alternate years. Prerequisite: CHM 53300, 56100, 57700, 57800.

Credits: 2.00

CHM 63200 - Membranes: Structure And Function

Credit Hours: 3.00. The structure and molecular properties of biological membranes and appropriate model systems. Offered in alternate years.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 63800 - Biophysical Chemistry

Credit Hours: 3.00. Applications of the principles and methods of physical chemistry in biochemistry with emphasis on the behavior of macromolecules in solution. Protein engineering. Offered in alternate years. Prerequisite: CHM 57800, CHM 63400 .

Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug.

3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Required Courses (12 credits)

Seminar Course (1 credit)

Lab Rotations Course (4 credits)

General Courses (7 credits)

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology.

8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 66200 - Pattern Recognition And Decision-Making Processes

Credit Hours: 3.00. (ECE 66200) Introduction to the basic concepts and various approaches of pattern recognition and decision-making processes. Topics include various classifier designs, evaluation of classifiability, learning machines, feature extraction, and modeling. Prerequisite: ECE 30200 .

Credits: 3.00

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing

probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 50100 - PULSe Scientific Communications

Credit Hours: 1.00. To begin to create an atmosphere in which students learn to communicate across disciplinary lines by providing the opportunity to develop skills in presenting and evaluating research results. Students will develop short scientific presentations, an abstract, and a poster and learn to present their findings to others and to ask and answer questions from their peers. Permission of department required.

Learning Outcomes: 1. To improve your ability to organize and present research presentation. 2. To gain experience with the skills required to prepare material for presentation. 3. To learn more about the faculty and students in PULSe. Credits: 1.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Seminar Course (1 credit)

Program Learning Outcomes

GPA Requirements

Additional Information

About the Program

Robotics Technology, PHD

About the Program

Program Requirements

Required Courses (16 credits)

Math Courses (6 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear

transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

MET 50300 - Applied Optimization

Credit Hours: 3.00. This course will introduce technology graduate students and senior undergraduates to the basic concepts of optimization methods with particular emphasis on applications in product and process design. Unconstrained nonlinear problems will be presented and solved using steepest descent and conjugate directions. Constrained problems will be solved using exterior penalty functions. Permission of department required.

Learning Outcomes: 1. Recognize optimization problems and cast them in standard form. 2. Identify objective functions and constraints. 3. Use commercial software to solve formal optimization problems. 4. Correctly identify

global and local optimum solutions. 5. Use basic calculus concepts to calculate design sensitivities. 6. Understand the geometric concept of design space and be able to plot design space for a constrained problem with two design variables. Credits: 3.00

Systems Course (3 credits)

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

CNIT 54600 - The Internet Of Things For Information Technology

Credit Hours: 3.00. This course will explore the emergence of technologies and vertical solutions in the Internet of Things (IoT) domain. The course explores the top-level problems that IoT promises to solve, the business drivers, the attributes of IoT-enabled enterprise and consumer markets, and how IoT is different from the contemporary Internet. The course will discuss and apply IoT components such as the "things", the data, the people, and the processes, as well as vertical markets. Emphasis will be placed on types of architecture, reference models, and standards (both open and proprietary), underlying technologies, commercial products, issues (such as security), and research efforts in the Internet of Things. The lab component will focus on the complete IoT ecosystem (sensors, actuators, networks, etc.), but will specifically emphasize the functionality of IoT cloud platforms. Permission of instructor is required.

Learning Outcomes: 1. Explain and demonstrate the main functions of a complete Internet of Things (IoT) system. 2. Research and explain a specific student area of interest in the IoT realm. 3. Analyze and discuss current topics, problems and research related to IoT. Credits: 3.00

Perception/Cognition/Actuation Courses (9 credits)

MET 43200 - Hydraulic Motion Control Systems

Credit Hours: 3.00. Hydraulic feedback motion control systems, types, and applications are studied. Simulation and performance of closed loop control systems with single and multiple signal paths are emphasized. Dynamic system performance is predicted and evaluated. System parameters including accuracy, response speed, fluid compressibility effects, load disturbances, and nonlinear behavior of the components are studied.

Learning Outcomes: 1. Identify the origins, development and applications of servo mechanisms. 2. Explain hydraulic system and component nonlinearities such as friction, deadband, backlash, and hysteresis. 3. Recognize control terms, definitions, and fluid power components of a hydraulic system. 4. Evaluate transfer functions and their use in predicting the performance of a system. 5. Utilize computer software simulation tools to investigate the dynamic performance of simple control loops. 6. Develop methods for improving hydraulic system stability through the use of simulation tools. Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The

emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECET 53600 - Embedded Systems Security

Credit Hours: 3.00. This course focuses on the implementation and application of cryptographic algorithms and protocols in embedded systems. An overview of the security problem and the science of cryptography and cryptanalysis is presented. The notion of the security perimeter in terms of physical access to assets in embedded hardware subsystems is studied. Students implement and apply various ciphers on 8-bit to 32-bit embedded platforms, comparing and contrasting computational and data throughout performance. Permission of instructor required.

Learning Outcomes: 1. Identify and describe cryptography, cryptanalysis, and security perimeters of embedded systems. 2. Identify and describe key performance issues and tradeoffs in the design and application of cryptographic algorithms and protocols in embedded systems. 3. Identify and describe the main areas of research focus in embedded system security and whey they are important. 4. Identify, describe, and apply tools used in cryptographic analysis and performance characterization of embedded systems. 5. Identify, describe, analyze and apply cryptographic algorithms and protocols including but not limited random number and key generators, private-key and public-key ciphers and protocols, and one-way hash functions. Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

CS 55800 - Introduction To Robot Learning

Credit Hours: 3.00. Introduction To Robot Learning

Learning Outcomes: 1. Formulate the robot motion planning and control problems and solve them using standard tools. (W, P, E) 2. Identify the robot constraints, define their degree of freedom, and formulate their dynamical models for control. (W, P, E) 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. (W, P, E) 4. Identify limitations in existing classical robot algorithms and understand how to avoid the musing Machine Learning. (W, P) 5. Understand and apply Deep Reinforcement Learning approaches to complex robot systems. (W, P, E) 6. Evaluate and assess current best practices and mechanisms for robot programming. (W, P) 7. Develop a skill for robot programming from perception to low-level control using state-of-the art methods. (W, P)
Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image

analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Seminar Course (1 credit)

ENGT 50100 - Graduate Research Seminar

Credit Hours: 0.00 or 1.00. This course is intended to orient new graduate students to the Engineering Technology (ET) program and faculty. This includes PhD students and students pursuing a Master's degree through a thesis or directed project option. This does not include students pursuing a Master's degree with coursework only. Research activities within ET and throughout Purdue University are discussed. Student resources and opportunities are reviewed to give the students the tools they need to be successful. In addition, this course provides a way to develop a natural cohort of graduate students. This course is a graduate seminar course focused on the ET program. Graduate status or upper-division undergraduate. Permission of department required.

Learning Outcomes: 1. Summarize research interests of ET graduate faculty. 2. Interpret Purdue University research activities and resources and apply this knowledge to their particular research plan. 3. Generate MS or PhD preliminary documents based on ET specific requirements. 4. Implement effective use of library resources and ability to write scholarly information in accepted format styles. Credits: 0.00 or 1.00

MFET 44100 - Robotics and IoT Seminar

Credit Hours: 0.00 or 1.00. The Robotics Seminar is a series of lectures from eminent local, national and international researchers in the field of robotics and the internet of things (IoT) and related areas, such as computer vision, autonomy, cyber-physical systems, wearables, etc.

Learning Outcomes: 1. Conduct a search of published papers, articles and materials on the web of relevance to a seminar topic. 2. Analyze a presentation in the context of prior published papers and materials on the web. 3. Evaluate the claims of a presentation with respect to researched material. Credits: 0.00 or 1.00

Focus Area Electives (xx credits)

AI and Data Science

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

CNIT 56400 - Assistive Technology And Robotics

Credit Hours: 3.00. The purpose of this graduate-level course is to equip students with the practical skills required to engage in effective and impactful research within the realm of assistive technologies and assistive robotics. The course encompasses a comprehensive exploration of key topics and research areas in assistive robotics and related technology fields, including mobility, vision, hearing, speech, and cognitive aids. Throughout the course, students will acquire a strong foundation in the essential components of conducting research in these domains. This includes conducting needs assessments, conducting comprehensive literature reviews, implementing user testing and iterative solution development processes, evaluating solutions, and engaging in prototyping activities. Emphasizing a holistic approach to learning, students will actively participate in dynamic discussions and debates, engage in insightful site visits, interact with guest speakers, and collaborate on both team and individual projects. A pivotal aspect of the course involves the practical application of acquired knowledge in a research project. Students will have the opportunity to design, implement, and/or evaluate assistive technologies or robots tailored to address specific challenges faced by individuals with disabilities and the elderly. This hands-on experience will enable students to put theory into practice and contribute meaningfully to the advancement of assistive technology solutions.

Learning Outcomes: 1. Demonstrate an understanding of the key topics and trends in assistive robotics and technology areas. 2. Demonstrate the ability to access and analyze current literature relevant to assistive technology and robotics, and identify ways in which computing and robotic technology can positively impact the lives of individuals with disabilities. 3. Identify the essential components of research, including conducting needs assessments, conducting thorough literature reviews, engaging in iterative design and development processes, conducting user testing and evaluation, and proficiently creating prototypes. 4. Develop proficiency in delivering effective oral presentations and written communication, effectively addressing research problems, methodologies, and findings. Credits: 3.00

Autonomous Systems

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary

robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

Cyber-Animal Systems and AgRobotics

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

IE 69000 - Advanced Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Advanced study in various fields of industrial engineering for graduate students. Credits and hours to be arranged. Permission of instructor required.

Credits: 1.00 to 6.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security

problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

ENGT 54200 - Cyber-Animal Systems I: Technology-Enhanced Animal Welfare

Credit Hours: 3.00. Cyber-Animal Systems is an interdisciplinary course involving hardware science, software science, and animal science students, who will study the interaction of animals and computer-controlled systems. The course addresses recent advances in robotics, data science, and animal husbandry that combine to create collaborative robots, wearable devices, and biological and environmental sensing systems that improve the practice of precision animal agriculture. Topics include case studies of technology adoption in animal agriculture, impacts of animal welfare on farm production and climate, and the importance of animal societies, confounding variables in animal studies, and animal anxiety on the design of experiments for technology integration. All students will learn mentoring techniques for tutoring other students from different disciplines so they develop skills in "lifelong teaching".

Learning Outcomes: 1. Explain the needs of farmers and technologists related to agricultural animal welfare. 2. Create and apply mentoring plans to support peers who are not familiar with your area of expertise. 3. Define animal welfare and apply the procedures of a basic animal welfare assessment. 4. Critically evaluate sensors, processing techniques and systems used to monitor and measure animal welfare and production. 5. Analyze measurement systems for data integrity and availability in a networked environment. 6. Apply design-of-experiments techniques that balance data requirements with the ethics of animal use and animals' needs. 7. Synthesize critiques from reviewing contemporary animal science and IoT literature. Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Cyber-Human Systems and Assistive Robotics

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

IE 69000 - Advanced Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Advanced study in various fields of industrial engineering for graduate students. Credits and hours to be arranged. Permission of instructor required.

Credits: 1.00 to 6.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different

computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Internet of Things

CNIT 44600 - Advanced Wireless Networks

Credit Hours: 3.00. This course is an advanced course in wireless networking. Building on knowledge gained from the introductory wireless local area network course, this course addresses wireless network design and implementation on a large scale. Topics include mesh networking, broadband wireless access, backhauling, WiMAX and cellular systems. The laboratory portion of the course includes implementing and simulating these technologies in an outdoor setting.

Learning Outcomes: 1. Understand current WLAN, WMAN and WWAN design and implementation strategies. 2. Understand the increasing roles that WLANs, WMANs, WWANs are playing to increase mobility and augment wire line high throughout technologies. 3. Design and configure Metropolitan and Wide Area scaled wireless networks based on a given business scenario or problem. 4. Understand wireless data and telecommunications terminology and jargon. 5. Understand the basic underpinnings of important wireless technologies and wireless internet provider management issues. 6. Conduct successful outdoor site surveys with different equipment and standards. 7. Be able to discuss wireless data and telecommunication issues with professionals in an informed and intelligent manner. 8. Formulate a checklist regarding existing and/or new wireless data/telecommunication systems and infrastructure. Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECET 53600 - Embedded Systems Security

Credit Hours: 3.00. This course focuses on the implementation and application of cryptographic algorithms and protocols in embedded systems. An overview of the security problem and the science of cryptography and cryptanalysis is presented. The notion of the security perimeter in terms of physical access to assets in embedded hardware subsystems is studied. Students implement and apply various ciphers on 8-bit to 32-bit embedded platforms, comparing and contrasting computational and data throughout performance. Permission of instructor required.

Learning Outcomes: 1. Identify and describe cryptography, cryptanalysis, and security perimeters of embedded systems. 2. Identify and describe key performance issues and tradeoffs in the design and application of cryptographic algorithms and protocols in embedded systems. 3. Identify and describe the main areas of research focus in embedded system security and whey they are important. 4. Identify, describe, and apply tools used in cryptographic analysis and performance characterization of embedded systems. 5. Identify, describe, analyze and apply cryptographic algorithms and protocols including but not limited random number and key generators, private-key and public-key ciphers and protocols, and one-way hash functions. Credits: 3.00

ECET 63800 - Selected Topics In Sensor Networks

Credit Hours: 3.00. This course examines general sensor network concepts, with a focus on a particular area of research and development. Current applications are studied, culminating with the analysis, characterization and/or examination of a sensor network. Permission of instructor required.

Learning Outcomes: 1. Identify and describe sensor network applications. 2. Identify and describe key performance issues and tradeoffs in the design and application of sensor networks. 3. Identify and describe the main areas of research focus in sensor networks and whey they are important. 4. Identify, describe, and apply tools used in sensor network analysis, simulation, characterization, control, and information retrieval. 5. Analyze, calculate and simulate or measure critical performance metrics of sensor networks and their components (nodes, gateways, etc.). Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Manipulation and Manufacturing

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

MET 54600 - Industrial Applications Of Computer Integrated Manufacturing

Credit Hours: 3.00. A study of the development of CIM (computer integrated manufacturing) from the application of basic automation to a fully integrated system for the operation of the business enterprise. Emphasis is placed on the technology, systems, and human resources, which are integrated to accomplish the objectives of the company. Permission of instructor required.

Credits: 3.00

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3. Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

MFET 55700 - Smart Manufacturing Enterprise: Exploring The Applied Technologies

Credit Hours: 3.00. The core foundations of digital transformation in manufacturing for making all things digital, making all things smart, and making all things connected to drive business value.

Learning Outcomes: 1. Analyze how the nine enabling technologies of Industry 4.0 is transforming the manufacturing industry. 2. Demonstrate understanding of the socio-economic impact of Industrial IoT and cyber-physical manufacturing systems will have on human workforce and the manufacturing industry alike. 3. Demonstrate how digital and data assisted systems in manufacturing is used for decision making and augmenting human capabilities in manufacturing. 4. Analyze how information is acquired, exchanged, managed, and leveraged across manufacturing value chain. Credits: 3.00

Mechatronics and Control

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with

respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

Sensing and Computer Vision

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 64100 - Model Based Image And Signal Processing

Credit Hours: 3.00. An advanced treatment of the methods in model-based signal and image processing including stochastic modeling of multidimensional signals, Bayesian estimation, inverse methods, doubly stochastic models, regularized inversion, the EM algorithm, Bayesian networks, Markov chains, optimization, convexity, majorization techniques, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation. Prerequisite: ECE 60000, 63700.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Dissertation Research (xx credits)

Social Psychology, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (6 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite:

Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Social Psychology Colloquium (xx credits)

Social Psychology Courses (21 credits)

PSY 64000 - Survey Of Social Psychology I

Credit Hours: 3.00. An extensive survey of methods, research, and theory in social psychology.

Credits: 3.00

PSY 68800 - Research Methods In Social Psychology

Credit Hours: 3.00. This course provides a broad and rigorous, graduate-level overview of contemporary research methodology in social psychology and personality. The course follows a discussion seminar format. Permission of department required.

Learning Outcomes: 1. Understand the specific rationale for using different methodological techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

PSY 50600 - Professional Issues And Trends In Social Psychology

Credit Hours: 3.00. This course is designed to help students acculturate to and acquire a broad knowledge of social psychological research. Topics to be covered include but are not limited to: how to apply for academic jobs, how to present your program of research, how to network at conferences, how to develop a website presence, how to approach potential collaborators, and how to structure your research questions in an appropriate manner for grant applications. Permission of department required.

Learning Outcomes: 1. Learn strategies to professionally present themselves, their

interests, and their accomplishments on paper and in person. Credits: 3.00

PSY 50700 - Current Readings In Social Psychology

Credit Hours: 3.00. This course is designed to expose students to a variety of readings, discussions, and presentations. The seminar examines a diverse assortment of social psychological topics. Students benefit from exposure to current research and methods in the field. Students also benefit from becoming increasingly conversant regarding the latest empirical advances in the field. Permission of department required.

Learning Outcomes: 1. Understand and interpret a host of different designs and analyses regarding a large variety of key areas in social psychological research. Credits: 3.00

Selectives (9 credits)

PSY 63000 - Stereotyping And Prejudice

Credit Hours: 3.00. Provides an in-depth examination of issues related to stereotyping, prejudice, and discrimination. After a general introduction and historical overview, students will be exposed to a detailed study of the social psychological foundations of stereotyping and prejudice to include their impact and reduction strategies. Permission of instructor required.

Learning Outcomes: 1. Facilitate oral and written communication skills and critical thinking skills. 2. Acquire greater appreciation of research ethics, methodology, design, and data analysis. 3. Gain appreciation through careful consideration of original empirical works. Credits: 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

PSY 68200 - Advanced Seminar In Industrial Organizational Psychology

Credit Hours: 3.00. Special topics in industrial and organizational psychology are offered on a two-year rotating basis. The special topics are: work motivation, leadership, advanced selection and placement, and performance appraisal. One topic will be treated each semester.

Credits: 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 66900 - Prosocial Behavior

Credit Hours: 3.00. This course is designed to provide a broad and rigorous, graduate-level overview of contemporary scientific research on prosocial processes from the perspective of personality and social psychology. Permission of department required.

Learning Outcomes: 1. Have a comprehensive mastery of the mechanisms and processes associated with prosocial behavior. 2. Learn how to plan and conduct research on prosocial behavior. 3. Learn to integrate prosocial processes with more general interpersonal processes and social relation research. Credits: 3.00

Electives (9 credits)

Dissertation Research (xx credits)

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Additional Information

Sociology, PHD

About the Program

Program Requirements

Required Courses (6-17 credits)

Advanced Research Methods Courses (6-15 credits)

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 60000 - Development Of Sociological Theory

Credit Hours: 3.00. The development of sociological thought in Western Europe and subsequently in the United States from the publication of Marx's early manuscripts through the sociological writings of the 1940s.

Credits: 3.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

Seminar Course (2 credits)

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

Areas of Specialization Electives (18-36 credits)

Family

Health, Aging, and the Life Course

Law and Society

Social Inequality: Class, Gender, Race/Ethnicity, and Sexuality

Social Movements and Political Sociology

Sociology of Religion

Work and Organizations

General Electives (0-18 credits)

Concentrations

Additional Information

GPA Requirements

Sociology/Gerontology, PHD

About the Program

Program Requirements

Required Courses (6-17 credits)

Advanced Research Methods Courses (6-15 credits)

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 60000 - Development Of Sociological Theory

Credit Hours: 3.00. The development of sociological thought in Western Europe and subsequently in the United States from the publication of Marx's early manuscripts through the sociological writings of the 1940s.

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Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

Seminar Course (2 credits)

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

Areas of Specialization Electives (18-36 credits)

Family

Health, Aging, and the Life Course

Law and Society

Social Inequality: Class, Gender, Race/Ethnicity, and Sexuality

Social Movements and Political Sociology

Sociology of Religion

Work and Organizations

General Electives (0-18 credits)

Concentrations

Additional Information

GPA Requirements

Speech, Language, and Hearing Sciences, DAUD

About the Program

Program Requirements

Required Courses (52 credits)

Core Courses (41 credits)

SLHS 50300 - Auditory Perception

Credit Hours: 3.00. Behavioral measurement of the capabilities of the normal and impaired auditory system. The laboratory experience includes an exposure to the measures and methods of hearing science.

Credits: 3.00

SLHS 51800 - Counseling In Speech-Language Pathology And Audiology

Credit Hours: 2.00. Application of counseling models, theories, and methods to persons with communicative disorders and their families. Permission of instructor required.

Credits: 2.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 55300 - Implantable Devices

Credit Hours: 3.00. Provides fundamental principles to assist audiologists and speech-language pathologists in the understanding of candidacy, principles of signal processing, and audiologic rehabilitation for children and adults who use cochlear implants.

Credits: 3.00

SLHS 56000 - Audiologic Diagnostics

Credit Hours: 3.00. Audiometers, audiometric standards, and the use of pure tone and speech signals in the measurement of auditory abilities. Laboratory provides practical instruction in the procedures discussed in class.

Credits: 3.00

SLHS 56100 - Medical Audiology

Credit Hours: 3.00. Study of the etiology, pathogenesis, symptomology, epidemiology, diagnosis and treatment of diseases, and injuries to the auditory system.

Learning Outcomes: 1. Apply knowledge about the development of human anatomical and physiological systems generally to the development of the auditory system and ear specifically in order to describe relationships between pathologies across systems. 2. Evaluate the effects on auditory function caused by environmental and hereditary factors that are related to systemic disease. 3. Differentiate between genetic and non-genetic disorders that are related to congenital and delayed-onset hearing loss. Apply this knowledge to cattegorize disorders that are unique to children, unique to adults, and common to all ages. 4. Justify the importance of Early Hearing Loss Detection and Intervention (EHDI) programs using knowledge about risk indicators, adverse consequences of hearing loss, and the benefits of early detection. Credits: 3.00

SLHS 56300 - Pediatric Audiology

Credit Hours: 3.00. Examination of protocols for the identification and evaluation of infants and children with hearing loss, using behavioral, physiologic, and electro-physiologic assessment methods. Course content places an emphasis on clinical decision-making and problem-solving skills.

Learning Outcomes: 1. Provide a scientific foundation focused on the assessment and management of hearing loss in infants, toddlers, young children and adolescents. Credits: 3.00

SLHS 56400 - Hearing Aids I

Credit Hours: 3.00. An examination of amplification systems as applied in audiological rehabilitation; acoustic, electroacoustic, electronic, and clinical considerations. Laboratory exercises in measurement, modifications, maintenance, selection, and dispensing of hearing aid systems.

Credits: 3.00

SLHS 56700 - Auditory Evoked Responses I

Credit Hours: 3.00. Evaluation of peripheral and brainstem auditory system function using evoked potentials.

Credits: 3.00

SLHS 65900 - Audiology Practice Management

Credit Hours: 2.00. An examination of business and professional issues related to audiology. Practice management topics include conducting a feasibility analysis, writing a business plan, employee management, marketing, reimbursement, and practice growth. Professional issues include licensing, certification, liability issues, and career planning. Prerequisite: SLHS 57900 and Doctor of Audiology majors only.

Credits: 2.00

SLHS 57000 - Hearing Conservation

Credit Hours: 2.00. A study of noise as a health hazard and as a nuisance; an examination of the ways in which hearing problems related to noise may be reduced. Permission of instructor required.

Credits: 2.00

SLHS 50401 - The Auditory Periphery

Credit Hours: 3.00. Acoustics and Fourier analysis; outer-ear resonance and interaural differences; middle-ear impedance and structure; inner-ear mechanical responses; hair-cell transduction, electrophysiology, motility; cochlear potentials; cochlear amplifier; suppression; otoacoustic emissions; efferent feedback to the cochlea; damage to the ear; treatments for damaged ears. Permission of department required.

Learning Outcomes: 1. Understand the application of signals and systems theory to experimental characterizations of the peripheral auditory system. 2. Understand the anatomical and physiological bases for normal hearing in the peripheral auditory system. 3. Understand the anatomical and physiological bases for conductive and sensorineural hearing loss, and associated diagnostics. 4. Understand the general approaches to treating peripheral hearing loss, and the anatomical and physiological limitations in doing so. 5. Read primary journal articles. 6. Communicate scientific information orally. 7. Communicate scientific results with laypeople (e.g., patients, spouses, family members). Credits: 3.00

SLHS 57401 - Hearing Aids II

Credit Hours: 2.00. The focus of this course is on the evolving technology in hearing aids with an emphasis on the information students will need to make efficacious clinical decisions not only for the hearing aids of today but also for the hearing aids of tomorrow. For each of the hearing aid features that are discussed, we review (1) the need or potential benefit to the patient, (2) the engineering behind the feature, (3) research supporting its efficacy and effectiveness, (4) its limitations, and (5) how to conduct routine clinical measurements to document its functioning.

Learning Outcomes: 1. Evaluate critically manufacturers' claims by developing an understanding of the mechanisms, advantages, and disadvantages of different hearing aid features. 2. Select the most cost effective hearing aid technology for your patients. 3. Inform patients, families, other appropriate individuals, and professionals the reasons of choosing the hearing aid features for a patient, and how to use these advanced features effectively. 4. Perform appropriate tests to check hearing aid features and assess the functionality of these features. 5. Attain knowledge and thinking skills to understand and evaluate new hearing aid features. Credits: 2.00

SLHS 66100 - Advanced Medical Audiology

Credit Hours: 3.00. The clinical practice of audiology encompasses the audiological assessment and habilitation/rehabilitation of hearing loss arising from a wide variety of medical and environmental etiologies. It is essential that audiologists have a firm understanding of the most common causes and medical treatments of hearing impairment for all age groups. Additionally, the future clinician will be better served by recognizing the how rapidly information changes in this arena

and becoming comfortable with reliable educational resources that are available for life-long learning in this area. Audiologists also practice in a medical setting and thus must be comfortable with the medical approaches and terminology used by otolaryngologists, otologists, neuro-otologists, pediatricians, radiologists, anesthesiologists and other physicians. Additionally, audiologists may be the first contact with a hearing-impaired patient and their role in the referral process will be emphasized.

Learning Outcomes: 1. Explain the anatomical and physiological bases for normal hearing in the peripheral auditory system. 2. Describe the anatomical and physiological bases of conductive and sensorineural hearing loss, and their associated diagnostics. 3. Compare and contrast the main approaches to treat peripheral hearing loss. 4. Assess the quality of primary journal articles. 5. Summarize scientific information effectively. Credits: 3.00

SLHS 68800 - Research Integration And Dissemination For Evidence Based Practice

Credit Hours: 2.00. The focus of this course is on developing skills integrating current research and communicating about research in clinical practice. Students complete a comprehensive project involving a literature review, clinical decision and poster. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in scientific communication in a variety of modes, including developing an oral pitch, preparing a literature review and evaluation, and creating and delivering a poster and writing a research abstract. Pre-Requisite: Students must complete Evaluating Research - currently offered as SLHS 51900.

Learning Outcomes: 1. Evaluate and synthesize findings from the literature into a written and oral comprehensive review. 2. Refine scientific communication skills. 3. Understand principles of evidence-based practice guides and apply them to clinical decision making. Credits: 2.00

SLHS 50601 - Neural Bases Of Hearing

Credit Hours: 3.00. **Section I.** Neuroanatomy. Anatomy terminology, overview of cochlear neuroanatomy; afferent and efferent cochlear innervation; auditory nerve formation and termination points in the cochlear nucleus; Neuroanatomy of Cochlear Nucleus, Superior Olivary complex, Nuclei of Lateral lemniscus, Inferior colliculus, Medial geniculate body and the auditory cortex, corticofugal efferent pathways complex. **Section II.** Physiology Neuronal Physiology; response properties of the auditory nerve, cochlear nucleus, superior olivary complex, inferior colliculus, medial geniculate body and auditory cortex, rate-place and temporal-place neural encoding schemes in the auditory nerve, intensity encoding, frequency tuning in normal and cochlear loss, binaural processing in the superior olivary complex and inferior colliculus, feature maps in the inferior colliculus and medial geniculate body and serial, parallel, hierarchical processing in the auditory cortex and role of cortico thalamic and corticocollicular pathways in shaping subcortical neural representation.

Learning Outcomes: 1. Remember and integrate the neuroanatomical organization of nuclei and tracts along the central auditory ascending and descending pathways. 2. Evaluate and integrate the functional properties of different neurons in each nucleus along the central auditory pathway and apply to understand how they contribute to the neural mechanisms for encoding stimulus features important for perception. 3. Understand and integrate the anatomical and physiological bases for normal hearing processes along the auditory pathway and apply knowledge to evaluate how structural lesions can impair hearing processes in the central auditory system and its relationship to lesions in the peripheral auditory system. 4. Evaluate and analyze the anatomical and physiological bases of sensorineural hearing loss, and central auditory processing deficits. 5. Understand and evaluate the general structure function relationship in the central auditory system and learn to predict the perceptual consequences of structural lesions. 6. Apply knowledge of the relationship between structure and function as a rationale for the creation/development of clinical diagnostic tests. Credits: 3.00

SLHS 56501 - Vestibular Assessment And Rehabilitation

Credit Hours: 3.00. This course will review anatomy and physiology of the vestibular system. Diagnostic assessment, interpretation and proper recommendation techniques will be discussed. Current research addressing dizziness and balance issues will be reviewed as well as case history discussions to help prepare students to see these patients in a clinic setting.

The clinical practice of audiology encompasses the assessment and habilitation/rehabilitation vestibular and balance disorders arising from a wide variety of medical and environmental etiologies. It is essential that audiologists have a firm understanding of the most common causes and medical treatments of vestibular disorders for all age groups. Additionally, vestibular assessment and treatment options are expanding rapidly in the past 5-10 years. Student clinicians need exposure to this area of care so that they may grow as research and technology change. Audiologists practice in a medical setting and thus must be comfortable with the medical approaches and terminology used by otolaryngologists, otologists, neuro-otologists, pediatricians, physical therapists and other allied health professions.

Learning Outcomes: 1. Perform a detailed case history for dizzy patients and understand basic concepts for report writing. 2. Understand and discuss many common disorders that lead to vestibular problems and how to diagnose these disorders properly. 3. Have a working knowledge of anatomy and physiology of the vestibular system in order to properly diagnose dysfunction. 4. Analyze test results from a vestibular test battery to diagnose disorders and to make recommendations for follow-up care. 5. Understand the need for interprofessional collaborative care by discussing current techniques for vestibular rehabilitation. Credits: 3.00

SLHS 58800 - Evaluating Research In Evidence-Based Practice

Credit Hours: 2.00. The focus of this course is on developing the skills necessary to critically consume literature and apply it to clinical practice as speech-language pathologists and audiologists. Students complete a comprehensive evidence-based practice project, which includes developing a clinical question, conducting a literature review, and critiquing acquired research articles. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in appraising research necessary for evidence-based practice.

Learning Outcomes: 1. Learn to read and critique research literature. 2. Understand the basis for evidence-based practice. 3. Apply evidence-based practice to clinical questions. 4. Consider how to further our literature base about clinical questions. Credits: 2.00

Seminar (2 credits)

SLHS 61900 - Advanced Topics In Audiology And Speech Pathology

Credit Hours: 0.00 to 3.00. Study of advanced topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary based on topics covered. Credits: 0.00 to 3.00

Integrative Audiology Course (4 credits)

SLHS 67000 - Integrative Audiology Grand Rounds

Credit Hours: 1.00. This course provides advanced audiology students an opportunity to share and think deeply about the complex cases they are experiencing on off-campus placements. Students share cases online with their peer students who will provide thoughtful responses and reflections based on their own experiences. This course also provides a summative assessment of the students' knowledge in the final two years of their education. Due to the highly complex nature of the cases, students must use past clinical experiences and knowledge learned in multiple courses in order to successfully present cases and to respond in thoughtful ways that contribute to the online learning environment. Permission of department required; must also be currently enrolled in SLHS 57900 or SLHS 67900 completing an audiology externship.

Learning Outcomes: 1. Discuss complicated audiology cases with their fellow classmates and faculty members. 2. Share best practices in their case presentations. 3. Examine cases from different perspectives (medical model, professional issues, patient's rights, ethical considerations, etc.). Credits: 1.00

School-Clinical Methods (1 credit)

SLHS 54400 - Clinical School Methods For Communication Disorders

Credit Hours: 2.00. Organization, materials, and methods for conducting speech, language, and hearing services in elementary and secondary schools. Permission of instructor required.

Credits: 2.00

Capstone Project (4 credits)

Directed Research Study (0-1 credits)

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

Electives (4 credits)

Clinical Requirement (49 credits)

Clinical Practicum (37 credits)

SLHS 57900 - Clinical Practice In Audiology

Credit Hours: 1.00 to 12.00. Supervised clinical practicum in evaluation of hearing and communication status and in remediation of communication problems. Clinical practices include, but are not limited to, auditory site of lesion, sensory aid selection, fitting and evaluation and communication training for children and adults. Clinical practicum is available in the M. D. Steer Audiology Center and off-campus facilities. Permission of instructor required.

Credits: 1.00 to 12.00

Advanced Clinical Practice (12 credits)

SLHS 67900 - Advanced Clinical Practice In Audiology

Credit Hours: 4.00. An advanced-level clinical practicum in audiology. Permission of instructor required.

Learning Outcomes: 1. Documented clinical experiences that cover the depth and breadth of the scope of practice of audiology. 2. Meet the knowledge and skills associated with certification standards of the American Speech-Language-Hearing Association. Credits: 4.00

Program Learning Outcomes

GPA Requirements

About the Program

Speech, Language, and Hearing Sciences, PHD

About the Program

Program Requirements

Required Courses (24 credits)

Proseminar (8 credits)

SLHS 54600 - Clinical Seminar In Speech-Language Pathology

Credit Hours: 1.00. This is a clinical seminar course designed to support students' ability to meet knowledge and skills standards related to the scope of practice of speech-language pathologists. This course provides supplemental learning opportunities and support for students as they complete their hands-on clinical practice each semester by taking a more in-depth look at conditions within the nine areas of practice as well as cultural and linguistically diverse families, ethical standards in clinical practice, professional issues and trends within communication sciences and disorders, and interprofessional education and practice. The course is offered each semester and objectives vary to advance the knowledge and skills required to meet the program and ASHA/CAA guidelines for completion of the program as well as certification standards as indicated by the CFCC.

Learning Outcomes: 1. Assess the interaction of cultural and linguistic variables between caregivers and the individual served. 2. Reflect on the impact of both implicit and explicit bias in clinical service delivery and actively explore individual biases and how they relate to clinical services. 3. Deconstruct the social determinants of health and environmental factors for individuals served and how these determinants

relate to clinical services. 4. Distinguish the roles and importance of interdisciplinary/interprofessional assessment and intervention and connecting one's own role and those of other professions to appropriately assess and address the needs of the individuals and populations served. 5. Justify the importance of individual and collective (e.g., local, national organizations) advocacy for clients/patients/students' right to care. 6. Explore contemporary professional issues that affect Speech-Language Pathology, entry-level and advanced certifications, licensure, and other relevant professional credentials, as well as local, state, and national regulations and policies relevant to professional practice. 7. Interpret Professional code of ethics and professional fiduciary responsibility. 8. Develop leadership and mentoring skills related to the supervisory process. 9. Prioritize continuous learning in speech, language, and hearing sciences. Credits: 1.00

Statistics/Methodology (6 credits)

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study

objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or

more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Writing Courses (6 credits)

Ethics Course (3 credits)

Teaching Requirement (1 credit)

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

Research Project (18-24 credits)

SLHS 69000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SLHS 68800 - Research Integration And Dissemination For Evidence Based Practice

Credit Hours: 2.00. The focus of this course is on developing skills integrating current research and communicating about research in clinical practice. Students complete a comprehensive project involving a literature review, clinical decision and poster. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in scientific communication in a variety of modes, including developing an oral pitch, preparing a literature review and evaluation, and creating and delivering a poster and writing a research abstract. Pre-Requisite: Students must complete Evaluating Research - currently offered as SLHS 51900.

Learning Outcomes: 1. Evaluate and synthesize findings from the literature into a written and oral comprehensive review. 2. Refine scientific communication skills. 3. Understand principles of evidence-based practice guides and apply them to clinical decision making. Credits: 2.00

Electives (17-60 credits)

SLHS 51800 - Counseling In Speech-Language Pathology And Audiology

Credit Hours: 2.00. Application of counseling models, theories, and methods to persons with communicative disorders and their families. Permission of instructor required.

Credits: 2.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 52900 - Stuttering: Nature, Diagnosis, And Treatment

Credit Hours: 2.00. Reviews applications of research findings and theoretical developments to our understanding of the onset, development, perpetuation, and amelioration of stuttering. Demonstrates and discusses methods and procedures for diagnosing and treating stuttering across the lifespan.

Learning Outcomes: 1. Students will learn the characteristics of stuttering in preschool and school-age children, adolescents, and adults. 2. Students will learn assessment and treatment procedures for preschool children, school age children, adolescents, and adults who stutter. 3. Students will become familiar with the major theoretical and clinical approaches to stuttering treatment. 4. Students will learn how to read research articles in the area of fluency and will be familiar with the major research findings in the field. 5. Students will learn about the nature and treatment of stuttering in diverse populations and will learn to use clinical methods that are sensitive to developmental and cultural differences Credits: 2.00

SLHS 53300 - Medical Speech-Language Pathology

Credit Hours: 2.00. Introduces the graduate speech-language pathology student to issues encountered in the medical environment in preparation for a healthcare externship and a career in the healthcare setting. Topics will include collaborative models in the medical setting, clinical documentation, ethical issues, equipment and instrumentation, medications, among others.

Learning Outcomes: 1. Increase understanding of the medical speech-language pathology environment. 2. Learn about various departments, professionals, and their collaborative roles with speech-language pathologists. 3. Develop an understanding of solutions to ethical dilemmas related to the medical field. 4. Understand and explain medications and their effects on swallowing and communication disordered individuals. 5. Become familiar with equipment, instrumentation, and medical tests in the intensive care unit and other acute care settings. 6. Discuss future trends related to the medical and speech pathology healthcare arena. 7. Comprehend and explain information obtained from a medical record. Credits: 2.00

SLHS 61900 - Advanced Topics In Audiology And Speech Pathology

Credit Hours: 0.00 to 3.00. Study of advanced topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary based on topics covered. Credits: 0.00 to 3.00

SLHS 53200 - Voice Disorders

Credit Hours: 2.00. Principles of differential diagnosis and clinical management for children and adults presenting voice disorders, based on a working knowledge of normal laryngeal structure and function.

Credits: 2.00

SLHS 54300 - Assessment And Treatment Of Literacy Disorders

Credit Hours: 2.00. An introduction to the characteristics, definitions, etiologies, and assessment of literacy development in school-aged children (4-18 years of age). Emphasis is placed on the scope of practice for speech-language pathologists in the assessment and intervention process for children diagnosed with language-based literacy disorders.

Learning Outcomes: 1. Differentiate between normal and disordered literacy development. 2. Identify formal and informal assessment tools in each of the following areas: phonological processing, decoding, encoding, oral reading fluency, reading comprehension. 3. Summarize literacy strengths and weaknesses in clients with various profiles. 4. Identify appropriate strategies / techniques to remediate client weaknesses. 5. Identify various organizations, websites, programs, and supporting research for parents and educators. Credits: 2.00

SLHS 54401 - School-Clinical Methods In Communication Disorders

Credit Hours: 1.00. The focus of this course is on the implementation of speech, language, and hearing services with preschool to secondary (P-12) school-aged children. Students develop a working knowledge of special education law, disability law, and other resources for school-aged children.

Learning Outcomes: 1. Implement special education and disability laws. 2. Select the most effective instructional strategies for English Language Learners. 3. Explain the professional qualifications, roles and responsibilities related to speech-language pathology and audiology in a school setting. 4. Describe tasks required for the provision of speech, language, and hearing services in a school setting. 5. Have the knowledge and thinking skills to understand and evaluate research to incorporate evidence based strategies into clinical practice. Credits: 1.00

SLHS 54001 - Augmentative And Alternative Communication (AAC)

Credit Hours: 2.00. This course will orient students to the use of augmentative and alternative communication (AAC) across the lifespan. Assessment and evidence-based intervention for people who cannot meet their daily communication needs via natural speech and/or writing and who need AAC will be covered. AAC is neither disorder- nor age-specific. As such, AAC strategies, techniques, and options may be used across the lifespan and with people who have severe communication disorders that interfere with expressive and/or receptive speech and/or language. In that way, AAC can have broad applicability across settings and populations.

Learning Outcomes: 1. Demonstrate knowledge of hardware, software, feature matching, and evidence related to use of AAC and SGD with

individuals with complex communication needs (CCNs). 2. Demonstrate knowledge related to the assessment and intervention for various people for whom AAC might be appropriate. 3. Apply and integrate evidence-based knowledge of typical language development toward the assessment and intervention for individuals with complex communication needs (CCNs). 4. Acquire knowledge and evaluate information about a range of augmentative and alternative communication (AAC) modalities as it applies to the assessment and intervention for individuals with complex communication needs (CCN) across the lifespan. 5. Acquire familiarity with and demonstrate use of AAC app evaluation rubrics used in decision-making regarding a range of complex communication needs (CCN). 6. Acquire, evaluate, and effectively present evidence-based knowledge on a specific topic within the scope of augmentative and alternative communication modalities. Credits: 2.00

General Electives (8-51 credits)

Related Area Electives (9-52 credits)

Dissertation Research (xx credits)

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

SLHS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

SLHS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Additional Information

GPA Requirements

Speech, Language, and Hearing Sciences/Gerontology, PHD

About the Program

Program Requirements

Required Courses (24 credits)

Proseminar (8 credits)

SLHS 54600 - Clinical Seminar In Speech-Language Pathology

Credit Hours: 1.00. This is a clinical seminar course designed to support students' ability to meet knowledge and skills standards related to the scope of practice of speech-language pathologists. This course provides supplemental learning opportunities and support for students as they complete their hands-on clinical practice each semester by taking a more in-depth look at conditions within the nine areas of practice as well as cultural and linguistically diverse families, ethical standards in clinical practice, professional issues and trends within communication sciences and disorders, and interprofessional education and practice. The course is offered each semester and objectives vary to advance the knowledge and skills required to meet the program and ASHA/CAA guidelines for completion of the program as well as certification standards as indicated by the CFCC.

Learning Outcomes: 1. Assess the interaction of cultural and linguistic variables between caregivers and the individual served. 2. Reflect on the impact of both implicit and explicit bias in clinical service delivery and actively explore

individual biases and how they relate to clinical services. 3. Deconstruct the social determinants of health and environmental factors for individuals served and how these determinants relate to clinical services. 4. Distinguish the roles and importance of interdisciplinary/interprofessional assessment and intervention and connecting one's own role and those of other professions to appropriately assess and address the needs of the individuals and populations served. 5. Justify the importance of individual and collective (e.g., local, national organizations) advocacy for clients/patients/students' right to care. 6. Explore contemporary professional issues that affect Speech-Language Pathology, entry-level and advanced certifications, licensure, and other relevant professional credentials, as well as local, state, and national regulations and policies relevant to professional practice. 7. Interpret Professional code of ethics and professional fiduciary responsibility. 8. Develop leadership and mentoring skills related to the supervisory process. 9. Prioritize continuous learning in speech, language, and hearing sciences. Credits: 1.00

Statistics/Methodology (6 credits)

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical

journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and

what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Writing Courses (6 credits)

Ethics Course (3 credits)

Teaching Requirement (1 credit)

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

Research Project (18-24 credits)

SLHS 69000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

Electives (17-60 credits)

SLHS 51800 - Counseling In Speech-Language Pathology And Audiology

Credit Hours: 2.00. Application of counseling models, theories, and methods to persons with communicative disorders and their families. Permission of instructor required.

Credits: 2.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 52900 - Stuttering: Nature, Diagnosis, And Treatment

Credit Hours: 2.00. Reviews applications of research findings and theoretical developments to our understanding of the onset, development, perpetuation, and amelioration of stuttering. Demonstrates and discusses methods and procedures for diagnosing and treating stuttering across the lifespan.

Learning Outcomes: 1. Students will learn the characteristics of stuttering in preschool and school-age children, adolescents, and adults. 2. Students will learn assessment and treatment procedures for preschool children, school age children, adolescents, and adults who stutter. 3. Students will become familiar with the major theoretical and clinical approaches to stuttering treatment. 4. Students will learn how to read research articles in the area of fluency and will be familiar with the major research findings in the field. 5. Students will learn about the nature and treatment of stuttering in diverse populations and will learn to use clinical methods that are sensitive to developmental and cultural differences Credits: 2.00

SLHS 53300 - Medical Speech-Language Pathology

Credit Hours: 2.00. Introduces the graduate speech-language pathology student to issues encountered in the medical environment in preparation for a healthcare externship and a career in the healthcare setting. Topics will include collaborative models in the medical setting, clinical documentation, ethical issues, equipment and instrumentation, medications, among others.

Learning Outcomes: 1. Increase understanding of the medical speech-language pathology environment. 2. Learn about various departments, professionals, and their collaborative roles with speech-language pathologists. 3. Develop an understanding of solutions to ethical dilemmas related to the medical field. 4. Understand and explain medications and their effects on swallowing and communication disordered individuals. 5. Become familiar with equipment, instrumentation, and medical tests in the intensive care unit and other acute care settings. 6. Discuss future trends related to the

medical and speech pathology healthcare arena. 7. Comprehend and explain information obtained from a medical record. Credits: 2.00

SLHS 61900 - Advanced Topics In Audiology And Speech Pathology

Credit Hours: 0.00 to 3.00. Study of advanced topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary based on topics covered. Credits: 0.00 to 3.00

SLHS 53200 - Voice Disorders

Credit Hours: 2.00. Principles of differential diagnosis and clinical management for children and adults presenting voice disorders, based on a working knowledge of normal laryngeal structure and function.

Credits: 2.00

SLHS 54300 - Assessment And Treatment Of Literacy Disorders

Credit Hours: 2.00. An introduction to the characteristics, definitions, etiologies, and assessment of literacy development in school-aged children (4-18 years of age). Emphasis is placed on the scope of practice for speech-language pathologists in the assessment and intervention process for children diagnosed with language-based literacy disorders.

Learning Outcomes: 1. Differentiate between normal and disordered literacy development. 2. Identify formal and informal assessment tools in each of the following areas: phonological processing, decoding, encoding, oral reading fluency, reading comprehension. 3. Summarize literacy strengths and weaknesses in clients with various profiles. 4. Identify appropriate strategies / techniques to remediate client weaknesses. 5. Identify various organizations, websites, programs, and supporting research for parents and educators. Credits: 2.00

SLHS 54401 - School-Clinical Methods In Communication Disorders

Credit Hours: 1.00. The focus of this course is on the implementation of speech, language, and hearing services with preschool to secondary (P-12) school-aged children. Students develop a working knowledge of special education law, disability law, and other resources for school-aged children.

Learning Outcomes: 1. Implement special education and disability laws. 2. Select the most effective instructional strategies for English Language Learners. 3. Explain the professional qualifications, roles and responsibilities related to speech-language pathology and audiology in a school setting. 4. Describe tasks required for the provision of speech, language, and hearing services in a school setting. 5. Have the knowledge and thinking skills to understand and evaluate research to incorporate evidence based strategies into clinical practice. Credits: 1.00

SLHS 54001 - Augmentative And Alternative Communication (AAC)

Credit Hours: 2.00. This course will orient students to the use of augmentative and alternative communication (AAC) across the lifespan. Assessment and evidence-based intervention for people who cannot meet their daily communication needs via natural speech and/or writing and who need AAC will be covered. AAC is neither disorder- nor age-specific. As such, AAC strategies, techniques, and options may be used across the lifespan and with people who have severe communication disorders that interfere with expressive and/or receptive speech and/or language. In that way, AAC can have broad applicability across settings and populations.

Learning Outcomes: 1. Demonstrate knowledge of hardware, software, feature matching, and evidence related to use of AAC and SGD with individuals with complex communication needs (CCNs). 2. Demonstrate knowledge related to the assessment and intervention for various people for whom AAC might be appropriate. 3. Apply and integrate evidence-based knowledge of typical language development toward the assessment and intervention for individuals with complex communication needs (CCNs). 4. Acquire knowledge and evaluate information about a range of augmentative and alternative communication (AAC) modalities as it applies to the assessment and intervention for individuals with complex communication needs (CCN) across the lifespan. 5. Acquire familiarity with

and demonstrate use of AAC app evaluation rubrics used in decision-making regarding a range of complex communication needs (CCN). 6. Acquire, evaluate, and effectively present evidence-based knowledge on a specific topic within the scope of augmentative and alternative communication modalities. Credits: 2.00

General Electives (8-51 credits)

Related Area Electives (9-52 credits)

Dissertation Research (xx credits)

SLHS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Information

GPA Requirements

Statistics, PHD

About the Program

Program Requirements

Required Courses (xx credits)

Dissertation Research (xx credits)

Concentrations

Additional Information

Technology, DTECH

About the Program

Program Requirements

Technology Core Courses (22 credits)

Required Courses (19 credits)

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

TECH 62700 - Digital Leadership

Credit Hours: 3.00. This course will provide an overview of the strategic use and management of social media by technology leaders. In the digital age, technology and data transform every step of the business process, generating a need for new digital tools across all industries and capabilities. Technology innovation leaders and enterprise leaders must be conversant in current and emerging technologies, particularly the growing influence of social media, to identify opportunities and create competitive advantage. Permission of department required.

Learning Outcomes: 1. Identify the types and purposes of social media platforms to create strategic advantage. 2. Demonstrate the ability to create, manage, and/or update a social media presence for a business or organization. 3. Outline a strategic marketing plan for a business or organization. 4. Develop a Digital Portfolio to chronicle the social media research project. 5. Evaluate strategies for leveraging digital opportunities for more effective

leadership. 6. Describe the six competencies that technology leaders need to lead effectively in the era of social media. Credits: 3.00

TECH 62800 - Technology Research And Use Of Data Analytics

Credit Hours: 3.00. Examines concepts, models and methods useful for applying data analytics in business environments. Focusing on Hypothesis generation, the capturing, storage and expression of data, analysis for research and visualization. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking abilities and analytical thought. 2. Identify a variety of data types and storage strategies. 3. Source, cleanse, join, and analyze a set of data yielding actionable insights that can be applied to research or business. 4. Discuss aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

TECH 62900 - Global Supply Chain Analysis & Optimization

Credit Hours: 3.00. This course will provide an overview to supply chain management including history of supply chain, elements of supply chain, interactions of supply chain elements, and factors that impact supply chain success.

Learning Outcomes: 1. Identify supply chain organizations and current trends in supply chain. 2. Demonstrate the demand planning elements of a product lifecycle and how to compute material requirements planning explosions. 3. Calculate forecasts using different approaches such as moving average and weighted moving average. 4. Offer critiqued solutions for impact to supply chain effectiveness. 5. Design a supply chain performance management system. Credits: 3.00

TECH 63000 - Leadership Of Cybersecurity & Cyberforensics

Credit Hours: 3.00. This course will provide an overview of cybersecurity for technology leaders. The digital age is ever changing and provides new challenges, threats and opportunities to the technologies that we use. As leaders, we need to learn the considerations of the impact of our decisions on the stakeholders in our environment and the risks they expose. In this course, we will analyze current trends and threats in the information security space. In addition, the course will also force the analysis of current computing environments and the unique challenges they can bring. Permission of department required.

Learning Outcomes: 1. Identify and analyze computing information security models and summarize their purpose. 2. Have the ability to identify and understand the concepts of Frameworks, Computing Environments, Cybercrime, Computing warfare and the internet as a holistic entity. 3. Critically assess their network environment and contrast it to various models of effective cybersecurity. 4. Identify and analyze common information security threats and demonstrate how these threats and threat actors relate to their network environment. 5. Analyze the current information security controls for their network environment. Credits: 3.00

TECH 63100 - Global Perspectives On Emerging Technologies

Credit Hours: 3.00. This course centers on an in-depth treatment of the discipline of technology and its intersections with culture, innovation and economics. Systematic analysis of technology and its international dimensions will be required as is horizon scanning, both nationally and internationally. Proficient written and oral communication is necessary for success. Permission of department required.

Learning Outcomes: 1. Develop and report an informed analysis of the influence (psychological, sociological and other) of technology on the culture, education, economy, lifestyle, standard of living of countries. 2. Compare and contrast selected country practices of technological human resource development/education and evaluate their capability to provide technically proficient personnel. 3. Advance and synthesize their international perspectives on the impacts that current and emerging technologies have on the

economies, supply chain, culture, governance, environments and political character of developed and developing nations. 4. Perform a systematic horizon scan to identify, evaluate and synthesize key resources, i.e., publications, associations, agencies, etc., of relevance to advancing their practice of technology development, leadership and education. 5. Employ technology systems analysis procedures to explain the evolution trajectory of a historical or emerging technology. 6. Analyze and evaluate selected strategies for promotion and advancement of technological innovation capabilities of individuals, enterprises and nations. 7. Research, and describe cultural considerations necessary for international business and professional practice in technology in a variety of nations and regions. 8. Demonstrate scholarly proficiency in assembling thoughts and writing and presenting on a topic of relevance to technology, culture and innovation. Credits: 3.00

TECH 63200 - Demographic Leadership

Credit Hours: 3.00. This course addresses the major underlying changes redefining the United States. It directly yet sensitively examines how we as individuals can more readily deal with demographic shifts, and in the end, how changes in racial and ethnic diversity and age distribution present us all an opportunity to be our better selves. Permission of department required.

Learning Outcomes: 1. Students will be able to synthesize and report on the ability to differentiate, question and analyze the changing demographics of our society and support or question conclusions. 2. Students will have the ability to synthesize, interpret and report on the concepts of unconscious/implicit bias. Additionally, the student will demonstrate proficiency in methodology in evaluating studies on this concept to create informed decisions. 3. Students will be able to critically assess demographic data and trends to formulate strategies for better decision making. Credits: 3.00

TCM 51000 - Effective Workplace Technical Communication

Credit Hours: 3.00. Students from a variety of majors will blend theory and practice as they analyze variables in workplace communication contexts, apply iterative processes of creating effective technical communication, and produce publications within typical workplace technical communication genres.

Learning Outcomes: 1. Analyze workplace technical communication problems and recommend appropriate changes using arguments shaped by synthesis of secondary research findings. 2. Research, evaluate, select, organize, and present technical knowledge effectively to specific audiences in organizational settings. 3. Design communication that uses language and visual elements appropriately for the audience and circumstances in business and industry contexts. 4. Manage communication processes in individual and collaborative projects. 5. Evaluate relevant software to create and respond to technical communication. Credits: 3.00

TECH 67600 - Analysis Of Research Methods

Credit Hours: 3.00. Analysis of research and evaluation of research reports and funding - emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, business, and government environments.

Learning Outcomes: 1. Identify descriptive statistics appropriate to sampling used. 2. Evaluate appropriate use of inferential statistics. 3. Determine when data favor nonparametric vis-a-vis parametric statistical analysis. 4. Use manual and library database methods to find appropriate research and write an appropriate research report that will add to your body of knowledge. 5. Explain procedures for computer-aided data base searches of published research. 6. Identify descriptive research, surveys, and prediction studies. 7. Differentiate between experimental and quasi-experimental

studies. 8. Identify common errors in research. 9. Develop a working knowledge or basic vocabulary and concepts or research methods (quant and qual). 10. Evaluate and critique research studies and articles. 11. Be familiar with a multitude of different types of research. 12. Differentiate between varying qualities of research studies and reports. 13. Understand how and why a university does research and how it is funded. 14. Have tools and knowledge to build and/or enhance the framework of your proposal or thesis. Credits: 3.00

TECH 60300 - Graduate Seminar - Planning

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives.

Learning Outcomes: 1. Create an Individual Development Plan. 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow for your studies. 4. Reflect on your progress to your future. 5. Critique your individual development plan. Credits: 1.00

Technical Selectives (3 credits)

ENGT 60500 - Engineering Technology Research Writing Strategies

Credit Hours: 2.00 to 3.00. The stated Master of Science in Engineering Technology graduate course teaches research literature mining and analysis found in Purdue licensed databases. Focuses on detail, a measurable topic, literature review, reporting, citation, data visualization using APA. Requires research paper writing aligned with ARWE specifications for in-depth research preparation and reporting. Students will research a topic relevant to a workplace problem in their industry. For example, a new technology, a process (Giga Casting for example), a material, supply chain, digitization, industry 4/5.0, sustainability, workforce diversity, aging workforce, ethics in the workplace, offshoring vs. onshoring, direct part marking, inventory/project management, cybersecurity risks, facility management, energy management, patents/intellectual property or environmental compliance. Keep in mind, Before You Start, that whichever topic you choose, the problem must be measurable. Measurable either from a quantitative or qualitative statistic perspective. Your topic will have to be tied to a global grand engineering challenge we face as a society and/or industry.

Learning Outcomes: 1. Evaluate the data you collected by completing the Workplace Information Literacy Strategies (WILS) activity to determine your research topic. 2. Analyze research topic/focus gained from the WILS, correlate a measurable research problem statement, and relate it to one of the 14 global, grand engineering challenges. 3. Create an Introduction to the problem statement. 4. Synthesize collected data by writing a review of the literature which supports the research problem topic. 5. Evaluate different research measures for the problem, choosing one to assess the problem. 6. Analyze the research measure(s) by using ChatGPT to help determine optimum research measure to write up. 7. Create a research methodology by writing a detailed script on how you intend to measure the research problem. 8. Submit expected deliverables in a timely manner after evaluating your final analysis report, synthesizing the introduction, research problem statement, review of literature, and research measure. 9. Present a compelling oration of your research topic and significance as to why the topic should be pursued or funded. The creation of a three-minute video debriefing is not an exercise in "watering down" research but forcing you to consolidate your ideas and concisely explain your research discoveries for senior leadership approval and funding. 10. Complete written assignments using APA format and NO passive wording or adverbs.

Adhere to the MET 527 Academic Research Writing Expectations (ARWE) handout document. Failure to not read and follow the ARWE document will prove to be an unsuccessful assignment/course experience. 11. Perform individually AND not fall into the plagiarism trap. Credits: 2.00 to 3.00

TCM 55000 - Advanced Research Approaches For Technical And Professional Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of conducting applied research in technical and/or professional communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Generate effective research questions, suitable for workplace technical/professional communication research into audience, content, and communication approaches. 2. Conduct and report on results of secondary research relevant to technical/professional communication. 3. Design, conduct, and report on the results of primary research relevant to technical/professional communication. 4. Analyze reports of technical/professional communication research. 5. Explain the rationale for technical/professional research approaches, based on sound concepts and noting the capabilities and limitations of various approaches. Credits: 3.00 or 4.00

Selectives (53 credits)*

TECH 62700 - Digital Leadership

Credit Hours: 3.00. This course will provide an overview of the strategic use and management of social media by technology leaders. In the digital age, technology and data transform every step of the business process, generating a need for new digital tools across all industries and capabilities. Technology innovation leaders and enterprise leaders must be conversant in current and emerging technologies, particularly the growing influence of social media, to identify opportunities and create competitive advantage. Permission of department required.

Learning Outcomes: 1. Identify the types and purposes of social media platforms to create strategic advantage. 2. Demonstrate the ability to create, manage, and/or update a social media presence for a business or organization. 3. Outline a strategic marketing plan for a business or organization. 4. Develop a Digital Portfolio to chronicle the social media research project. 5. Evaluate strategies for leveraging digital opportunities for more effective leadership. 6. Describe the six competencies that technology leaders need to lead effectively in the era of social media. Credits: 3.00

TECH 62800 - Technology Research And Use Of Data Analytics

Credit Hours: 3.00. Examines concepts, models and methods useful for applying data analytics in business environments. Focusing on Hypothesis generation, the capturing, storage and expression of data, analysis for research and visualization. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking abilities and analytical thought. 2. Identify a variety of data types and storage strategies. 3. Source, cleanse, join, and analyze a set of data yielding actionable insights that can be applied to research or business. 4. Discuss aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

TECH 62900 - Global Supply Chain Analysis & Optimization

Credit Hours: 3.00. This course will provide an overview to supply chain management including history of supply chain, elements of supply chain, interactions of supply chain elements, and factors that impact supply chain success.

Learning Outcomes: 1. Identify supply chain organizations and current trends in supply chain. 2. Demonstrate the demand planning elements of a product lifecycle and how to compute material requirements planning explosions. 3. Calculate forecasts using

different approaches such as moving average and weighted moving average. 4. Offer critiqued solutions for impact to supply chain effectiveness. 5. Design a supply chain performance management system. Credits: 3.00

TECH 63000 - Leadership Of Cybersecurity & Cyberforensics

Credit Hours: 3.00. This course will provide an overview of cybersecurity for technology leaders. The digital age is ever changing and provides new challenges, threats and opportunities to the technologies that we use. As leaders, we need to learn the considerations of the impact of our decisions on the stakeholders in our environment and the risks they expose. In this course, we will analyze current trends and threats in the information security space. In addition, the course will also force the analysis of current computing environments and the unique challenges they can bring. Permission of department required.

Learning Outcomes: 1. Identify and analyze computing information security models and summarize their purpose. 2. Have the ability to identify and understand the concepts of Frameworks, Computing Environments, Cybercrime, Computing warfare and the internet as a holistic entity. 3. Critically assess their network environment and contrast it to various models of effective cybersecurity. 4. Identify and analyze common information security threats and demonstrate how these threats and threat actors relate to their network environment. 5. Analyze the current information security controls for their network environment. Credits: 3.00

TECH 63100 - Global Perspectives On Emerging Technologies

Credit Hours: 3.00. This course centers on an in-depth treatment of the discipline of technology and its intersections with culture, innovation and economics. Systematic analysis of technology and its international dimensions will be required as is horizon scanning, both nationally and internationally. Proficient written and oral communication is necessary for success. Permission of department required.

Learning Outcomes: 1. Develop and report an informed analysis of the influence (psychological, sociological and other) of technology on the culture, education, economy, lifestyle, standard of living of countries. 2. Compare and contrast selected country practices of technological human resource development/education and evaluate their capability to provide technically proficient personnel. 3. Advance and synthesize their international perspectives on the impacts that current and emerging technologies have on the economies, supply chain, culture, governance, environments and political character of developed and developing nations. 4. Perform a systematic horizon scan to identify, evaluate and synthesize key resources, i.e., publications, associations, agencies, etc., of relevance to advancing their practice of technology development, leadership and education. 5. Employ technology systems analysis procedures to explain the evolution trajectory of a historical or emerging technology. 6. Analyze and evaluate selected strategies for promotion and advancement of technological innovation capabilities of individuals, enterprises and nations. 7. Research, and describe cultural considerations necessary for international business and professional practice in technology in a variety of nations and regions. 8. Demonstrate scholarly proficiency in assembling thoughts and writing and presenting on a topic of relevance to technology, culture and innovation. Credits: 3.00

TECH 63200 - Demographic Leadership

Credit Hours: 3.00. This course addresses the major underlying changes redefining the United States. It directly yet sensitively examines how we as individuals can more readily deal with demographic shifts, and in the end, how changes in racial and ethnic diversity and age distribution present us all an opportunity to be our better selves. Permission of department required.

Learning Outcomes: 1. Students will be able to synthesize and report on the ability to differentiate, question and analyze the changing demographics of our society and support or question conclusions. 2. Students will have the

ability to synthesize, interpret and report on the concepts of unconscious/implicit bias. Additionally, the student will demonstrate proficiency in methodology in evaluating studies on this concept to create informed decisions. 3. Students will be able to critically assess demographic data and trends to formulate strategies for better decision making. Credits: 3.00

TECH 63800 - Leading & Managing Tech Organizations

Credit Hours: 3.00. This course will provide an overview of many Issues in leadership to include topics such as but not limited to Leadership framework, strategies, and an overview of critical business processes. Leading organizations and the teams within are elements of this course that will be addressed and demonstrated throughout the books and exercises in this course. We will focus on what is needed to be a great leader in various situations, and paths to improving leadership trust and leader thinking skills.

Learning Outcomes: 1. Identify issues in technology-focused places of work (to include problem-solving plans), determine the potential impacts of leader actions, critically analyze process changes (pros/cons) and possible further actions for improvement. 2. Demonstrate the ability to create a positive work environment (with peer review), analyze the work environment (company culture and impact on others), and review/revise for follow-up and further improvement. 3. Outline a plan to improve training in a technology-based workplace, with a focus on development of continuous self-improvement of critical thinking skills, along with analysis of other areas for improvement. (Teamwork (peer-reviewed), feedback, analysis, and reporting is required throughout this course.) Credits: 3.00

TECH 63400 - Global, Legal, Ethical Issues For Technology Leaders

Credit Hours: 3.00. In this course, the nature of contemporary ethical, legal, and technological issues facing organizational leaders are examined. Effective organizational leadership strategies will be explored through a series of readings, discussions, case studies and reflective practice, and organizational effectiveness will be discussed in terms of topics such as ethical decision-making, corporate social responsibility, codes of ethics, public policies/government regulations, the global environment, technological innovation, risk management, and specific areas of law covering health and safety, contracts, warranties and liabilities, intellectual property, technology, and international laws and regulations. Strategies for effective leadership within the framework of managerial decision-making in an ethical context will be examined. Graduate student standing or senior status with consent of instructor.

Learning Outcomes: 1. Interpret the various ways that technology is pervasive in contemporary society. 2. Analyze international ethical, legal, and technological issues in organizational settings through the case study methodology. 3. Apply ethical and legal principles to organizational and governmental processes related to technological change. 4. Engage in reflective practice, applying course theory to practical situations. 5. Create an academic research paper that addresses a topic of interest related to the intersection of global, legal, ethical issues for technology leaders utilizing appropriate techniques for academic research writing. Credits: 3.00

TECH 63300 - Strategic Management Of Technology Innovation

Credit Hours: 3.00. This course looks at how organizations manage the technology innovation process and the function of new product development teams. We discuss idea generation, new product research and development, management of the innovation process, strategies for successful deployment and marketing of technology innovation, applicable laws, and regulations, and return on investment. We will take a broad look at industry though three lenses: 1 - large public companies, 2 - mid-sized family and privately controlled enterprises, and 3 - entrepreneurially led startups.

Learning Outcomes: 1. Identify the drivers of technological innovation. 2. Describe the idea generation process leading to the development of a new product or service, taking it from concept through the patent process toward commercialization. 3. Articulate successful strategies and tactics to lead and manage the innovation process. 4. Investigate how different

dimensions of organizational structure affect a firm's ability to innovate. 5. Discuss the role of team leadership and administration in ensuring the team has access to the resources it needs and that team members feel committed to team goals. 6. Identify the key elements of deployment including timing, licensing and compatibility, pricing, distribution, and marketing. Credits: 3.00

TECH 58400 - Financial Analysis For Smart Manufacturing

Credit Hours: 3.00. The course will provide manufacturing professionals with foundational tools needed to conduct financial analysis for planning, implementing, and assessing Industry 4.0 projects focused on the application of technology for the integration of the smart manufacturing enterprise. The course begins with basic financial topics including financial statements, financial ratio analysis, and the strategic profit model, and then moves into concepts needed to address typical investment projects for Industry 4.0. Particular attention will be paid to asset lifecycle management models and the priorities that are important in the application of Industry 4.0 technologies to achieve performance improvements. Focus areas will include digital cost reduction efforts such as cost, level of effort, and impact needed to drive capital efficiencies and lower organizational costs. Project budgeting, savings and return on investment models, and project scalability and repeatability will all be discussed. A final corporate financial investment project is required.

Learning Outcomes: 1. Use key financial statements including income statements and balance sheets, statements of retained earnings and statements of cash flows. 2. Use common financial tools to your advantage: ratio analysis, common-sized (percentage) statements, pro-forma statements, and time value associated with money. 3. Calculate a variety of financial ratios important in manufacturing productivity and asset management. 4. Identify the impact of the application of Industry 4.0 technologies on both the balance sheet and income statement of the organization. 5. Evaluate and select the best application of Industry 4.0 technologies, and finance it using appropriate capital investment opportunities. Credits: 3.00

TECH 58300 - Smart Manufacturing Applied Technologies

Credit Hours: 3.00. This course addresses new content focusing on the 9 core capabilities and technologies that are at the forefront of digital transformation in the manufacturing industry. It also discusses the three core principles driving this transformation, particularly with the use of the Internet of Things (IoT) to create digital, smart, and connected systems using data to optimize key business drivers and objectives in manufacturing. The goal is to enable faster, flexible, and more efficient processes to produce higher-quality goods, reduce manufacturing costs, increase productivity, and foster industrial growth. These new concepts have not been previously taught at Purdue.

Learning Outcomes: 1. Analyze how the nine enabling technologies of Industry 4.0 are transforming the manufacturing industry. 2. Demonstrate understanding of the socio-economic impact of Industrial IoT and cyber-physical manufacturing systems will have on human workforce and the manufacturing industry alike. 3. Demonstrate how digital and data-assisted systems in manufacturing can be used for decision-making and augmenting human capabilities in manufacturing. 4. Analyze how information is acquired, exchanged, managed, and leveraged across manufacturing value chains. Credits: 3.00

TECH 60300 - Graduate Seminar - Planning

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives.

Learning Outcomes: 1. Create an Individual Development Plan. 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow for your studies. 4. Reflect on your progress to your future. 5. Critique your individual development

plan. Credits: 1.00

Dissertation Research (15 credits)

TECH 64000 - Research DTech Thesis

Credit Hours: 1.00 to 18.00. This course will be the research course for Online Doctor of Technology (DTech) students. This research dissertation course is to reflect the student's work to prepare and pass the preliminary examination, prepare and pass the dissertation proposal and successfully defend and pass the DTech dissertation.

Learning Outcomes: 1. Acquire skills involved with conducting academic and scholarly research in a rigorous manner. 2. Learning objectives will be specific and unique to the student's research area as outlined by the student's major professor and advisory committee. Credits: 1.00 to 18.00

Concentrations

Program Learning Outcomes

About the Program

Technology, PHD

About the Program

Program Requirements

Required Courses (45-51 credits)*

Technology Courses (21-30 credits)*

Core Courses (14 credits)

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

TECH 60100 - Research Seminar In Technology

Credit Hours: 1.00. This course provides an introduction to the field and scholarship of Technology and the skills necessary for success. Prerequisite: Doctoral student standing.

Credits: 1.00

MET 52700 - Technology From A Global Perspective

Credit Hours: 3.00. Introduction to the challenges faced by the practicing technologist when working and interacting with international technical personnel, both here and abroad, including history, standards, education, and practice of technology outside the United States. Permission of department required.

Learning Outcomes: 1. Awareness and comprehension of cross-cultural factors necessary for international professional practice in technology. 2. Effective research strategies that access what is known about technology development, usage and impact from a global

perspective. 3. Knowledge and skill in researching and reporting cultural factors affecting business practices in a variety of independent nation states. 4. Knowledge of procedures, regulations and practices regarding international business. 5. Research skills to identify the natural and technology resources of countries. 6. An ability to contrast the impact of technology infrastructure and use of technology in developed countries to what occurs in underdeveloped countries. 7. Knowledge of the concept and application of ""Appropriate Technology"". 8. Knowledge of the historical development of technology in various modern nations. 9. Informed judgments regarding the influences of cultural and political environments of countries and their technological development. 10. Awareness of the major changes related to current and/or emerging technology in the leading industrial nations of the world. 11. Understanding of the methodologies employed for the effective introduction of technologies into new country or cultural settings. 12. Knowledge of selected International Technology Standards and organizations. Credits: 3.00

TECH 67600 - Analysis Of Research Methods

Credit Hours: 3.00. Analysis of research and evaluation of research reports and funding - emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, business, and government environments.

Learning Outcomes: 1. Identify descriptive statistics appropriate to sampling used. 2. Evaluate appropriate use of inferential statistics. 3. Determine when data favor nonparametric vis-a-vis parametric statistical analysis. 4. Use manual and library database methods to find appropriate research and write an appropriate research report that will add to your body of knowledge. 5. Explain procedures for computer-aided data base searches of published research. 6. Identify descriptive research, surveys, and prediction studies. 7. Differentiate between experimental and quasi-experimental studies. 8. Identify common errors in research. 9. Develop a working knowledge or basic vocabulary and concepts or research methods (quant and qual). 10. Evaluate and critique research studies and articles. 11. Be familiar with a multitude of different types of research. 12. Differentiate between varying qualities of research studies and reports. 13. Understand how and why a university does research and how it is funded. 14. Have tools and knowledge to build and/or enhance the framework of your proposal or thesis. Credits: 3.00

TECH 60300 - Graduate Seminar - Planning

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives.

Learning Outcomes: 1. Create an Individual Development Plan. 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow for your studies. 4. Reflect on your progress to your future. 5. Critique your individual development plan. Credits: 1.00

Concentration (9 credits)

Discovery Foundations Courses (12-18 credits)*

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general

linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Cognate Electives (12-27 credits)*

Dissertation Research (15 credits)

TECH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Concentrations

Program Learning Outcomes

GPA Requirements

Additional Information

Toxicology, PhD

About the Program

Program Requirements

Required Courses (22 credits)*

Core Courses (18 credits)

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of

statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 56200 - Analytical Toxicology And Pathology

Credit Hours: 3.00. Historically, toxicology has been defined as the study of the adverse effects of xenobiotics. Today, toxicology encompasses much broader areas, including the study of endogenous compounds, physical agents, and even using toxicants as research tools. Basic and introductory toxicology courses cover the principles of toxicant metabolism and target organ toxicity. This course, Analytical Toxicology and Toxicologic Pathology is focused on the research and clinical applications of these principles. Two major areas will be covered: (1) principles of toxicant detection in biological matrices and (2) the assessment of pathological effects caused by toxicant exposure in biological systems. Laboratory sessions associated with each major topic allow students to have hands-on experience in these advanced analytical and pathological technologies. This course provides a unique opportunity for students to learn techniques that research and clinical toxicologists use daily in scientific or clinical laboratories. The course is suitable to both graduate and upper-class undergraduate students who are interested in toxicology, forensic science, veterinary medicine, environmental and occupational health, food toxicity, pharmaceutical drug testing, medical laboratory science, and general human and children's health.

Learning Outcomes: 1. Have a basic understanding of how to measure toxicant levels. 2. Have essential knowledge in evaluating histopathological alterations of major organs and tissues upon exposure to typical toxicants. 3. Be able to assess and interpret the adverse effects of toxicants in mammalian systems. Credits: 3.00

HSCI 67100 - Biochemical Toxicology

Credit Hours: 2.00. Toxicologists in all fields are concerned with mechanism of action or how a specific toxicant or class of toxicants produces toxicity. Introductory toxicology courses typically focus on the adverse effects exerted by a specific compound, with some examination of mechanisms. The entire focus of this upper-level graduate course is on the "how" and the "why", or a detailed examination of biochemical mechanism of toxicity. There will be some lectures, but the majority of the course will consist of student-led discussions on specific mechanisms of action. Further, students will write a review-style article on a chosen mechanism of action. Prerequisite: HSCI 56000 .

Learning Outcomes: 1. Orally describe mechanisms of action for major classes of toxicants. 2. Draft a written manuscript that critically assesses data on a specific mechanism of action. Credits: 2.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2.

Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

Professional Courses (2 credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (2 credits)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Selectives (2-3 credits)*

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills

needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

ENTM 61100 - Toxicology Of Insecticides

Credit Hours: 3.00. The chemistry, mode of action, and metabolism of insecticides and related compounds in both insect and vertebrate systems. Evaluation of toxic action, principles of selective toxicity, insecticide resistance, and environmental effects are also discussed. A minimal knowledge of entomology is required. Knowledge of biochemistry and neurobiology is useful. Offered in even-numbered years.

Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

BMS 53400 - Systemic Mammalian Physiology

Credit Hours: 4.00. This course is a 4 credit hour course that provides fundamental concepts of mammalian physiology in nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems. The major physiological functions of these systems will be explained at the organ as well as the cellular level. The structure and function relationships will be studied in detail. At the end of the course, the students are expected to have a solid understanding of basic functions of the human body. In addition, the student will be exposed to the current topics and key concepts of experimental research. This course offers an excellent opportunity for those students who are looking to either learn or refresh their physiological knowledge that can benefit a variety academic and professional career goals.

Learning Outcomes: 1. Describe the fundamental concepts of nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems in mammals. 2. Examine the functional relationship among different systems. 3. Apply physiological principles as they relate to the etiology of common diseases. Credits: 4.00

Dissertation Research (65-66 credits)

HSCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Additional Information

GPA Requirements

Veterinary Clinical Science, PHD

About the Program

Program Requirements

Required Courses (17-21 credits)

Core Courses (1-2 credits)

VCS 60300 - Introduction To Clinical Research, Trials and Translational Research

Credit Hours: 1.00. This course is designed for students entering the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which introduce students to the elements and scope of clinical research, including the methods used in clinical research, trials and translational research. Topics covered will explain the principles of safe and ethical conduct of clinical research. Students will also be introduced to the principles of data collection, management and interpretation. Permission of instructor required.

Learning Outcomes: 1. To help students understand the elements and scope of clinical research. 2. To expose students to the methods used in clinical research, trials and translational research. 3. To understand the principles of safe and ethical conduct of clinical research. 4. To understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60400 - Animal Models In Translational Research

Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 63000 - Current Topics In Veterinary Clinical Sciences

Credit Hours: 1.00 to 6.00. One-two hour sessions organized and conducted weekly by VCS residents, with input/discussion from the attending VCS faculty. Alternating weekly topic sessions may include journal club and morbidity and mortality patient rounds or other topics appropriate to the specialty. Permission of instructor required.

Credits: 1.00 to 6.00

Biostatistics Courses (5-6 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Seminars (2-3 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

VCS 62000 - Seminar In Clinical Medicine And Surgery

Credit Hours: 1.00 to 3.00. Seminars provide a forum for discussion of current concepts and research results in clinical medicine and surgery, and other aspects of veterinary medicine. Permission of instructor required.

Credits: 1.00 to 3.00

Research courses (8 credits)

VCS 60300 - Introduction To Clinical Research, Trials and Translational Research

Credit Hours: 1.00. This course is designed for students entering the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which introduce students to the elements and scope of clinical research, including the methods used in clinical research, trials and translational research. Topics covered will explain the principles of safe and ethical conduct of clinical research. Students will also be introduced to the principles of data collection, management and interpretation. Permission of instructor required.

Learning Outcomes: 1. To help students understand the elements and scope of clinical research. 2. To expose students to the methods used in clinical research, trials and translational research. 3. To understand the principles of safe and ethical conduct of clinical research. 4. To understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60400 - Animal Models In Translational Research

Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of

using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

Grant Writing Course (1 credit)

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

Area of Study (xx credits)

Dissertation Research (xx credits)

PSY 46400 - Research Ethics In Psychological Sciences

Credit Hours: 3.00. Research Ethics broadly refers to the application of everyday values, such as fairness, honesty, and objectivity to scientific research. This course is designed to provide broad coverage of the ethical standards that research scientists must follow and allow exploration of various real-world ethical issues in the psychological sciences.

Credits: 3.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

VCS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Additional Requirements

Concentrations

Program Learning Outcomes

GPA Requirements

Veterinary Clinical Science/Cancer Research, PHD

About the Program

Program Requirements

Required Courses (17-21 credits)

Core Courses (1-2 credits)

VCS 63000 - Current Topics In Veterinary Clinical Sciences

Credit Hours: 1.00 to 6.00. One-two hour sessions organized and conducted weekly by VCS residents, with input/discussion from the attending VCS faculty. Alternating weekly topic sessions may include journal club and morbidity and mortality patient rounds or other topics appropriate to the specialty. Permission of instructor required.

Credits: 1.00 to 6.00

Biostatistics Courses (5-6 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Seminars (2-3 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

VCS 62000 - Seminar In Clinical Medicine And Surgery

Credit Hours: 1.00 to 3.00. Seminars provide a forum for discussion of current concepts and research results in clinical medicine and surgery, and other aspects of veterinary medicine. Permission of instructor required.

Credits: 1.00 to 3.00

Research courses (8 credits)

VCS 60300 - Introduction To Clinical Research, Trials and Translational Research

Credit Hours: 1.00. This course is designed for students entering the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which introduce students to the elements and scope of clinical research, including the methods used in clinical research, trials and translational research. Topics covered will explain the principles of safe and ethical conduct of clinical research. Students will also be introduced to the principles of data collection, management and interpretation. Permission of instructor required.

Learning Outcomes: 1. To help students understand the elements and scope of clinical research. 2. To expose students to the methods used in clinical research, trials and translational research. 3. To understand the principles of safe and ethical conduct of clinical research. 4. To understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60400 - Animal Models In Translational Research

Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

Grant Writing Course (1 credit)

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

Area of Study (xx credits)

Dissertation Research (xx credits)

PSY 46400 - Research Ethics In Psychological Sciences

Credit Hours: 3.00. Research Ethics broadly refers to the application of everyday values, such as fairness, honesty, and objectivity to scientific research. This course is designed to provide broad coverage of the ethical standards that research scientists must follow and allow exploration of various real-world ethical issues in the psychological sciences.

Credits: 3.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

VCS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Additional Requirements

Program Learning Outcomes

GPA Requirements

Veterinary Clinical Science/Gerontology, PHD

About the Program

Program Requirements

Required Courses (17-21 credits)

Core Courses (1-2 credits)

VCS 63000 - Current Topics In Veterinary Clinical Sciences

Credit Hours: 1.00 to 6.00. One-two hour sessions organized and conducted weekly by VCS residents, with input/discussion from the attending VCS faculty. Alternating weekly topic sessions may include journal club and morbidity and mortality patient rounds or other topics appropriate to the specialty. Permission of instructor required.

Credits: 1.00 to 6.00

Biostatistics Courses (5-6 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Seminars (2-3 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

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Credit Hours: 1.00 to 3.00. Seminars provide a forum for discussion of current concepts and research results in clinical medicine and surgery, and other aspects of veterinary medicine. Permission of instructor required.

Credits: 1.00 to 3.00

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Learning Outcomes: 1. To help students understand the elements and scope of clinical research. 2. To expose students to the methods used in clinical research, trials and translational research. 3. To understand the principles of safe and ethical conduct of clinical research. 4. To understand the principles of data collection, management and interpretation. Credits: 1.00

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Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

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Credits: 1.00

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Credits: 2.00 or 3.00

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Credits: 1.00 to 18.00

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Credits: 1.00

Additional Requirements

Program Learning Outcomes

GPA Requirements

Veterinary Medicine, DVM

About the Program

Program Requirements

Core Courses (112.5 credits)

Basic Medical Sciences (28 credits)

BMS 81500 - Veterinary Neuroscience

Credit hours: 2.00. This course provides an introduction to neuroscience and its diagnostic application in veterinary medicine. Students will acquire terminology describing the anatomy and basic physiology that characterize neural systems. Integration of function/structure relationships will be introduced in lectures and laboratories, by reference to case studies, and by problem-solving.

Learning Outcomes: 1. Acquire of basic knowledge in neuroscience that will enable insightful diagnosis of diseases affecting the nervous system. 2. Know the parts of the nervous system described in each lecture/lab by their name, location, anatomic relationship to other parts and structures and their integrative function. Students will be able to describe how the nervous system of domestic mammals is organized and how these components contribute to nervous system function. 3. Acquire the ability to communicate this information effectively. 4. Know or logically theorize the physiological basis for any dysfunction that might arise due to specific pathological processes and anatomical lesions in the nervous system. The student will begin to develop an appreciation for the clinical signs and altered behavior that occurs following damage to or disorders of nervous system

components. 5. Provide an introduction to the utility of the basic Neurological Exam in the diagnosis of nervous system disease. Credits: 2.00

BMS 81200 - Physiology Of Domestic Animals II

Credit Hours: 4.00. Continuation of Physiology of Domestic Animals I (BMS 81100). Survey of the principles, concepts and mechanisms of physiological processes with special emphasis on interactions between large populations of cells, tissues, organ systems and integrated functions of domestic animals of importance to veterinary medicine. The organ systems covered are respiratory, renal, digestive, endocrine, and reproductive.

Learning Outcomes: 1. Regulation of functions of the lungs, kidneys, stomach, digestive system, endocrine glands & gonads. 2. Processes and regulation of gas exchange in the lungs. 3. Roles of electrolytes and the regulation of acid-base. 4. Regulation of physiological & biochemical processes in stomach, small and large intestines. 5. Hormonal regulation of metabolic processes. 6. Regulation of reproduction. Credits: 4.00

BMS 81100 - Physiology Of Domestic Animals I

Credit Hours: 3.00. General physiological process of mammals with special emphasis on domestic animals; normal interactions between large populations of cells, organs, organ systems and integrated functions of an entire animal; homeostatic mechanisms, physiology of body fluids and blood formed elements, muscle and cardiovascular systems.

Learning Outcomes: 1. Provide an overview of physiology of mammalian body systems (Body fluids, blood, muscle, cardiovascular system) and general physiological processes (e.g. homeostasis), with emphasis on domestic animals 2. Provide an overview of the integrated function of the different physiological systems and how they are regulated. 3. Familiarize the student with the organization of cells and the functions of the blood, muscle, and cardiovascular system. Credits: 3.00

BMS 80800 - Veterinary Cell And Tissue Biology Design II

Credit Hours: 2.00. All lectures will focus on mammalian microanatomy with species differences and aim to include also a brief comparative description for Avian microanatomy when applicable. Structural and molecular basis of cellular processes that are the foundation of fertilization, embryogenesis, histogenesis, and basic tissue specialization in domesticated animals. Structure and function of macromolecules and organelles that mediate signal transduction, differentiation, and integration within a whole animal.

Learning Outcomes: 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine; 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine. 2. An understanding of the relationship of development to normal microscopic structure. 3. An understanding of the molecular mechanisms of fundamental biological phenomena that signal and result in expression of the structures that underlie normal development and cellular physiology. 4. An understanding of the relationships of cellular organelles and inclusions to tissue, organ, and whole-animal physiology. 5. The skills to effectively use the light microscope for critical observation, analysis, and identification of cell, tissue, organ, and embryonic microstructure. 6. An awareness of selected species characteristics as well as structural variation representing physiology, artifact, gerontology, and pathology. 7. An awareness of significant links of cellular and tissue design to other disciplines of veterinary medicine and biomedical sciences. 8. An appreciation of the utility and necessity of the active learning process for developing and maintaining competency as a veterinarian and/or biomedical scientist. Credits: 2.00

BMS 80700 - Veterinary Cell And Tissue Biology Design I

Credit hours: 2.50. The first of a two-semester sequence of courses, emphasizing developmental and microstructural foundations of structural differentiation of cell, tissue, and organ

systems. Emphasis is placed upon principles, fundamental concepts, and applicable details as well as comparative aspects of general importance for veterinary medicine and biomedical research. That you have some background in biochemistry and cell biology is assumed.

Learning Outcomes: 1. Recognize and interpret normal microscopic structure, using the language and conventions of medicine. 2. Understand development resulting in normal structure. 3. Understand relationships of cellular organelles and inclusions to cellular, tissue, organ, and whole animal physiology. 4. Develop skills to effectively use a light microscope for critical observation, identification, and analysis, of cell, tissue, organ, and embryonic microstructure. 5. Develop an awareness of species characteristics and variations of structure that reflect physiology, artifact, gerontology, and pathology. 6. Develop an awareness of links between cellular and tissue structure to other disciplines of veterinary medicine and biomedical sciences (e.g. physiology, gross anatomy). 7. Develop approaches to nurture the "active learning" process required to develop and maintain competency as a veterinarian and/or biomedical scientist. Credits: 2.50

BMS 80200 - Comparative Anatomy

Credit Hours: 4.00. A comparative study of the body systems and the topographic relationships of the major domestic species. This course is an extension of BMS 80100 and will continue to build on anatomical knowledge so that it may be applied to multiple domestic species.

Learning Outcomes: 1. Describe major anatomical principles of structure and function and identify and describe major anatomical structures which are common among domestic species; demonstrate the ability to translate and apply that knowledge to other species. 2. Use specific topographical and palpable landmarks in horses, ruminant species, and pigs to locate clinically important underlying structures and viscera for purposes of physical examination, imaging and other diagnostics, and therapeutic procedures. 3. Be able to identify major and clinically important anatomical structures on skeletal and other anatomical models; radiographs; cadavers; and live domestic animals (horses, ruminant species, pigs). 4. Identify and describe the major structural components of birds, using domestic poultry as a model, and demonstrate an understanding of structure-function inter-relationships in the avian body. Credits: 4.00

BMS 80100 - Gross Anatomy Of The Dog And Cat

Credit Hours: 3.50. Study of the anatomy of the body systems and the topographic relationships of the dog and cat.

Learning Outcomes: 1. Obtain a basic understanding of principles that can be transferred to the anatomical structures of the live dog. 2. Develop mental images of the animal to assist in positioning and orientation of structures in the living animal. To assist in diagnostic procedures and evaluating the results obtained from imaging techniques. 3. Be able to identify anatomical structures on dissected specimens, skeletons, radiographs, and anatomical models. Credits: 3.50

BMS 81401 - Pharmacology Principles And Applications

Credit Hours: 4.00. This is the first of two pharmacology courses in the DVM curriculum. The first part of this course encompasses an introduction to basic concepts necessary to understand and optimally administer and deliver therapeutic drugs, such as pharmacokinetics, pharmacodynamics, dose forms, dosing regimen and prescriptions. In the second part of the course, drugs are studied not only based on their pharmacological class, but also based on the organs and systems on which they act (e.g., heart and vascular system, lungs, autonomous neuronal pathways, respiratory system, endocrine system, etc.). This course also covers the pharmacology of cancer therapy and drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics). Journal club sessions are included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of

drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make informed decisions regarding administration (dosage, duration of treatment, combination with other drugs) of a class of drugs or a specific drug as appropriate, depending on the patient's vital and pathological characteristics and mechanisms of action of specific drugs or drug classes. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Discuss how drugs used for a particular disease might have an impact on the development of another disease. 5. Discuss the principles and issues behind drug tolerance and addiction and the risk of abuse. 6. Explain the methods of drug delivery developed to reduce drug toxicity and/or improve efficacy. Credits: 4.00

BMS 81000 - Foundations In Basic Medical Sciences

Credit Hours: 1.50. The overall objective of this course is to provide the incoming first year DVM students the basic, foundational science principles upon which they will base study of the DVM curriculum. Emphasis is upon basic principles and fundamental concepts of: animal body organization and terminology; cellular and whole body metabolism; macromolecules, membranes, transport, biosynthetic processes, cellular communication/signal transduction, cell cycle and growth regulation, gene expression and embryonic development.

Learning Outcomes: 1. Know the terms of position and orientation of the animal body. 2. Know basic principles of cellular and whole body metabolism, including anabolism, catabolism and homeostasis. 3. Know the properties and composition of key cellular molecules. 4. Know the structure and function of biological membranes, mechanisms of cellular transport and generation of action potential. 5. Know the mechanisms of cellular communication and signal transduction, including types of secreted signals, structure/function of various receptors, and key mechanisms by which the signal elicits a cellular response. 6. Know the growth factor signaling and the cell cycle; the terms oncogene and tumor suppressor. 7. Know the basic principles of transcription, organization of the animal genome, epigenetic regulation, and molecular mechanisms involved in embryonic development. 8. Know the basic stages of embryogenesis, and genesis of four basic tissues. 9. Know the identify by light and electron microscopy key components of animal cell structure, epithelial cell modifications, and structures/organs of the 10 mm embryo. Credits: 1.50

BMS 81600 - Applied Pharmacology II

Credit Hours: 1.50. This DVM curriculum course covers drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics), and drugs for immunomodulation and cancer therapy. New topics are introduced according to upcoming developments in drug use such as pharmacogenomics. A journal club session is included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make an informed decision regarding the administration (dosage, duration of treatment, combination with other drugs) of a class of drugs or a specific drug as appropriate, depending on the patient vital and pathological characteristics. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Understand, anticipate and resolve (whenever possible) resistance to drugs. 5. Apply principles behind the interaction between environment and the organism that guide precision medicine. Credits: 1.50

Comparative Pathobiology (29 credits)

CPB 86900 - Veterinary Public Health And Zoonoses

Credit Hours: 2.00. A survey of fundamental topics on diseases that are caused by viral, bacterial, rickettsial, and parasitic agents and are known to be transmissible from animals to humans, as well as those diseases that are common to humans and animals. Topics emphasize the epidemiology and methods for prevention and control of these diseases in animal and human populations. Food safety and foodborne diseases, with particular emphasis on foods of animal origin, are discussed. Risk assessment of occupational and environmental health conditions to which veterinarians are likely to be exposed in training or the workplace also is covered.

Learning Outcomes: 1. Identify and mitigate risks to human and animal health encountered by the veterinary profession and by others through direct and indirect animal contacts (e.g., food, meat, milk). 2. Communicate about risks pertaining to environmental hazards and zoonotic diseases to professional and lay audiences. 3. Evaluate data and scientific reports related to one health critically. 4. Identify emerging and exotic diseases of animals and understand appropriate responses to them. Credits: 2.00

CPB 86100 - Veterinary Clinical Chemistry

Credit Hours: 2.00. Laboratory techniques and interpretation of laboratory data as profiled by organ system are presented. Integration of data to explain pathophysiologic changes as an aid to diagnosis, prognosis and progression of disease is emphasized.

Learning Outcomes: 1. Organize routine tests appropriately into diagnostic profiles that best characterize abnormalities in acid-base, the urinary system, the hepatobiliary system, exocrine pancreas (pancreatitis), muscle, endocrine pancreas, adrenal gland, thyroid gland and parathyroid gland. 2. Describe relevant physiology for each test involved in biochemical profiling, describe relevant mechanisms for alterations from normal, list differentials and prioritize differential lists based on other laboratory and clinical information. 3. Recommend follow-up testing that may lead to a definitive diagnosis where appropriate. 4. Integrate CBC data interpretations (e.g., from CPB 85500 - Veterinary Hematology & Cytology) with biochemical profiling results. 5. Characterize and diagnose disorders of hemostasis based on integration of clinical findings with hemostasis-specific and associated laboratory testing. The student will be able to: Explain the physiology of primary, secondary, & tertiary hemostasis, and anticoagulation, including the correct association of the "key elements" of hemostasis with each process; Correctly associate assays for hemostasis with the stage/process that they evaluate and interpret abnormal results. Credits: 2.00

CPB 86000 - Veterinary Virology

Credit Hours: 3.00. Principles of medical virology and discussions of important viral diseases of animals.

Learning Outcomes: 1. Know the definition of the diseases. 2. Describe brief history of the disease including current geographical distribution and importance. 3. Describe the virus as to classification, host range, important aspects of replication, and resistance to environment. 4. Outline the signs of the disease. 5. Understand pathogenesis, distribution and fate of virus, immunological responses. 6. Provide description of important gross and histological lesions that may explain pathogenesis. 7. Understand methods used to make presumptive and specific diagnoses. 8. Describe epidemiology - important methods of spread, vectors if involved, seasonality, etc. 9. Describe immunity - as it relates to vaccination, types of vaccines, and their use. 10. Recognize public health significance, if any. 11. Control of the disease including area (state, national, or international) control programs and "on the

farm" control where pertinent. Credits: 3.00

CPB 85700 - Veterinary Systemic Pathology

Credit Hours: 5.00. Provides coverage of system specific pathologic terminology and characteristic pathologic responses of the various body systems to injury. This is followed by presentation of representative examples of diseases of various etiologies, including, but not limited to, infectious and noninfectious diseases.

Learning Outcomes: 1. Recognize and describe diseased tissue grossly and microscopically, explain the sequence of events in the development and outcome of observed lesions, explain the interplay among different organs or tissues, and predict the effect of the response to injury on the host. 2. Correlate clinical and pathologic findings. Predict the organ/tissue site and nature of expected lesions when given the clinical presentation. Predict clinical signs when given the gross or microscopic lesions. 3. Correlate gross lesions (or lack thereof!) with histologic, cytologic, and molecular changes. 4. Categorize lesions as degeneration or necrosis, inflammation, circulatory disturbance, or disturbance of growth. Recognize that a given lesion may (and often does) fall into more than one category. 5. Formulate a logical and practical differential diagnosis based on the host signalment, the affected organ or tissue, the lesion categorization, and environmental influences (risk factors, seasonal or geographical influences, etc.). Credits: 5.00

CPB 85500 - Veterinary Hematology And Cytology

Credit Hours: 2.00. Provides an overview of veterinary hematology and cytology. Normal morphology and function of the cells of the hematopoietic system are reviewed. Laboratory analyses of the different cell types are discussed. The responses of the hematopoietic cells that can be seen during different disease processes are presented. Fundamentals of veterinary diagnostic cytology are introduced.

Learning Outcomes: 1. Explain the development of hematopoietic cells, their function, and control of hematopoiesis, emphasizing features and growth factors that are clinically significant. Apply these concepts, in conjunction with clinical & physical findings, to interpret laboratory data (CBC and bone marrow findings). 2. Name and explain the characteristic findings or 'patterns' anticipated on CBC and bone marrow response for common hematologic disorders in domestic animals and their etiology. 3. Discuss the characteristic features of reactive (benign) and malignant disorders of red blood cells, white blood cells, and platelets with respect to their diagnosis, etiology, and prognosis. 4. Develop microscopic skills including estimating cell density or counts and identification of normal and abnormal blood cells, morphologic changes and inclusions within these cells. 5. Demonstrate use microscope to evaluate a cytology specimen. Describe features that suggest an inflammatory, hyperplasia, versus a specific neoplasia process. Explain the type of inflammatory response seen with various infectious or non-infectious etiologies and be able to identify agents. Observe and describe general cytologic features of malignancy and of different malignant cell populations (round cell, mesenchymal, or epithelial). Credits: 2.00

CPB 85300 - Principles Of Veterinary Immunology

Credit Hours: 2.00. An overview of the fundamental concepts of immunology, with an emphasis on the immune system of domestic animals and comparative immunology. Focuses on the interactions between the host and microbial pathogens and on mechanisms that underlie hypersensitivity reactions, autoimmune diseases, and immune deficiencies. Discusses the principles of vaccination and serologic tests.

Learning Outcomes: 1. Explain the basic principles by which the immune system functions. 2. Describe the mechanisms by which the immune system protects the host against infectious diseases and can be mobilized to treat cancer. 3. Explain the role of aberrant immune responses in hypersensitivity reactions,

allergies and in autoimmune diseases. 4. Outline the immunological principles of vaccines and vaccination. 5. Identify the principles of immunoassays. 6. Explain the mechanisms of action of drugs that inhibit immune responses and drugs that target specific immune mechanisms. Credits: 2.00

CPB 85100 - General Pathology

Credit Hours: 3.00. An overview of the basic cellular reactions that develop in response to injurious agents. Focuses on the gross and microscopic alterations in tissues, events leading to the development of those alterations, and the consequences of those changes on the health of animals. Includes degenerative, necrotic, inflammatory, and neoplastic changes in various animal species.

Learning Outcomes: 1. Understand the events involved in the development and outcome of disease in animals. 2. Master a medical vocabulary, by using the language of medicine and pathology in both written and oral forms. 3. Recognize diseased tissue both grossly and microscopically, offer a reasonable explanation of the sequence of events that led to the development of these tissue changes, and predict the effect of these changes on the life of the host. 4. Identify the types of injury that may affect the host and describe the range of pathologic alterations that occur in response to these injuries. 5. Develop diagnostic thinking skills and learning skills. 6. Recognize the importance of a solid knowledge of pathology as a basis for veterinary medicine and surgery, and other fields of veterinary medicine. 7. Observe examples of normal and diseased organs and tissues. 8. Learn to use medical terminology (including pathologic terms) in an appropriate manner. 9. Examine examples of the histopathologic alterations discussed in lecture. 10. Use of histopathology as a basis for inquiry on various aspects of a disease or pathologic condition. 11. Correlate gross pathologic lesions with the expected microscopic alterations. (Describe the anticipated microscopic lesions, if given the gross alterations and vice versa.) Credits: 3.00

CPB 81900 - Veterinary Toxicology

Credit Hours: 2.00. This course will provide an introduction to small and large animal toxicology. It will cover the most common toxicoses encountered in veterinary medicine with emphasis on recognizing clinical signs of toxicoses, discerning differential diagnoses for these cases, and assigning appropriate diagnostic tests. Prerequisites: Completion of first year in the DVM program.

Learning Outcomes: 1. Recognize the most common toxicoses encountered in veterinary toxicology. 2. Identify sources of exposure for the most common toxicoses encountered in veterinary toxicology. 3. Explain the mechanisms of toxicity for the most common toxicoses encountered in veterinary medicine. 4. Identify the best samples to submit for diagnostic toxicology tests. 5. Formulate differential diagnoses for toxicoses based on clinical signs, blood chemistries, and diagnostic tests through critical thinking. 6. Explain the typical treatments (symptomatic and supportive) and antidotes that can be given to animals exposed to toxins/toxicants. Credits: 2.00

CPB 85204 - Veterinary Parasitology

Credit Hours: 3.00. Covers the important helminth, protozoal and arthropod diseases of animals. Emphasis is placed on the pathogenesis, epidemiology, clinical features, diagnosis, control, and zoonotic implications of protozoal and arthropod infections in this semester of the course.

Learning Outcomes: 1. Master a medical terminology for parasites, by using the language of medicine, pathology and parasitology in both written and oral forms. 2. Understand general aspects of veterinary parasitology including life cycles, pathogenesis, diagnostic methods, and anthelmintic drugs. 3. Explain how the important parasites are transmitted and maintained in nature and/or domestic environments. 4. Identify the types of clinical problems and

pathology caused by the various parasites and be able to explain the basic pathogenesis of these changes for the parasites. Correlate clinical and gross and microscopic pathologic findings due to these parasites. 5. For important parasites, predict the clinical presentation if given the pathologic lesions. Identify the expected pathologic lesions if given the clinical presentation. 6. Recognize important parasites grossly and/or microscopically, focusing especially on clinical parasitology diagnostics, i.e. recognition of helminth eggs, larvae, cysts, oocysts, etc. in fecal or other samples. 7. Explain the methods and rationale for treatment and control of parasitic infections. 8. Understand the zoonotic importance of certain parasites, and how they are dealt with from a veterinary public health standpoint. 9. Develop diagnostic thinking skills, computer literacy skills, and learning skills. 10. Recognize the importance of a solid knowledge of parasitology in the practice of veterinary medicine and surgery, and other fields of veterinary medicine. Credits: 3.00

CPB 85401 - Epidemiology And Evidence-Based Veterinary Medicine

Credit Hours: 2.00. The fundamentals of descriptive and analytical epidemiology will be developed as they relate to problems in veterinary and comparative medicine. A primary goal of the course is to expose future health professionals to the information and thought processes that are essential for critically evaluating the medical literature and for making decisions regarding health care for individuals and populations.

Learning Outcomes: 1. Characterize different epidemiological study designs, including experimental studies, clinical trials, and commonly used observational studies such as cross-sectional, cohort, and case-control studies. 2. Interpret basic epidemiologic measures, including prevalence and incidence measures for disease occurrence and ratio and difference measures for association. 3. Implement causal thinking by assessing potential bias, confounding and random error. 4. Understand basic terminology of infectious disease epidemiology. 5. Understand methods of disease surveillance and their corresponding strengths and weaknesses 6. Describe the steps in an outbreak investigation. 7. Define sensitivity, specificity, false positive fraction and false negative fraction and use them to compare discriminative performance of different diagnostic tests. 8. Interpret numeric results commonly presented in journal articles such as odds ratio, 95% CI, and p-value. 9. Critically appraise evidence presented in clinical studies and scientific research articles. Credits: 2.00

CPB 85603 - Veterinary Bacteriology And Mycology

Credit Hours: 3.00. An overview of bacterial and fungal pathogens of veterinary species. Topics will include discriminating features of the organisms, the pathogenesis of diseases caused by these agents, diagnostics, management and therapeutics.

Learning Outcomes: 1. Compile a list of differential diagnoses based on clinical presentation and signalment. In other words, associate specific bacterial and fungal agents with animal species and affected body sites. 2. Evaluate the properties of organisms (Gram pos/neg; Cocci/rod; Anaerobes/aerobes, etc.) on the differential diagnoses list in order to develop a diagnostic plan. 3. Describe laboratory test methods used in diagnosis of bacterial and fungal diseases. 4. Recognize bacterial and fungal pathogens that are zoonotic or reportable. 5. Outline the pathogenesis of an organism from the host encounter, entry/multiplication/spread to damage to the host. 6. Understand basic mechanisms of action, basic spectrum of activity, and major safety and legal concerns of antibacterial and antifungal therapeutics and disinfectants. 7. Select appropriate therapy and

control/prevention based on understanding of pathogens and therapeutic agents. Credits: 3.00

Veterinary Clinical Sciences (48.5 credits)

VCS 80400 - Behavior In Domestic Animals

Credit Hours: 1.00. Instruction in basic principles of behavior; factors determining normal and abnormal behavior; and the different types of learning. The main domestic species will be characterized in terms of their normal behavior with which behavior problems are most important in the different species.

Learning Outcomes: 1. Apply the principles of learning to behavior analysis and modification. 2. Characterize the domestic species in terms of their normal behavior. 3. Identify environmental factors contributing to abnormal behavior and compromising their welfare. 4. Utilize knowledge on behavioral development and environmental and management effects on behavior for problem prevention and strengthening the human-animal bond. 5. Integrate behavioral knowledge into veterinary medicine and its practice. Credits: 1.00

VCS 81500 - Ophthalmology

Credit Hours: 1.00. This course is an introduction to veterinary comparative ophthalmology. It covers the anatomy of the eye, diagnosis, pathophysiology, and treatment of the ocular diseases commonly seen in companion and food animal species: canine, feline, equine, avian, bovine, caprine, ovine, porcine, lagomorphs. Covers pharmacology as it relates to medications used to treat ocular disease.

Learning Outcomes: 1. Acquire basics of normal ocular anatomy and physiology, common ophthalmic diseases in all species for general practice, including their pathophysiology clinical presentations, therapies, and prognoses. 2. Become familiar with ophthalmic terminology. 3. Gain a basic knowledge of the diseases of the anterior and posterior segments of the eye, the eyelids, and the globe. 4. Use correct ophthalmic terminology to describe ocular conditions. 5. Recognize common ocular conditions involving the adnexa, globe, and orbit. 6. Create a list of differential diagnoses for the conditions covered in class. 7. Determine appropriate diagnostic plans for the conditions covered in class. 8. Determine appropriate treatment plans and give an accurate prognosis for the conditions covered in class. 9. Learn the ocular medications listed on the ocular pharmacology sheet handed out in class and will know indications, contra-indications, and frequency for all medications. Credits: 1.00

VCS 81700 - Achieving Success In Private Practice

Credit Hours: 1.50. Provides a foundation for the application of practice management principles. Focuses on operations management, financial management, human resource management, and marketing management.

Learning Outcomes: 1. Improve communication skills - clients, staff, public speaking, listening, team building. 2. Gain financial skills - personal (financial awareness, educational debt management) and business (cost controls, compensation). 3. Increase career skills - interviewing, resume development, job search, jurisprudence of the profession. 4. Gain business skills - value management, marketing techniques, human resources, inventory. 5. Develop risk management skills - establishing policies/practices consistent with medical laws, practice best practices to ensure patient safety (i.e., appropriate medication calculations/dosing and administration). Credits: 1.50

VCS 80110 - Veterinary Skills And Competencies I

Credit Hours: 2.50. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism, and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate basic safety, husbandry, and restraint of dogs, cats,

food animals, and horses. 2. Demonstrate basic principles of hygiene and bio-security. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications per oz. to dogs, cats, food animals, and horses. 5. Demonstrate correct calculation of IV fluid dosing. 6. Demonstrate knowledge of basic medical equipment use. 7. Demonstrate knowledge of surgical instrumentation, needles, and suture material. 8. Demonstrate ability to perform complete basic physical examination of a dog, cat, food animal, and horse. 9. Demonstrate effective use of non-verbal communication. 10. Demonstrate an understanding of stress management techniques. 11. Demonstrate an understanding of social media's impact on a professional career and client relationships. 12. Demonstrate an understanding of the principles of collegiality with respect to competition and the impact of dishonesty in a professional setting. 13. Demonstrate an awareness of the risks for and methods for prevention of suicide. 14. Demonstrate an understanding of the definition of cyberbullying and methods to protect yourself. 15. Demonstrate an ability to manage conflict within the veterinary team. 16. Demonstrate an understanding of the laws and policies of veterinary medicine. 17. Demonstrate an understanding of USDA identification techniques. Credits: 2.50

VCS 80130 - Introduction To Population Medicine And Veterinary Ethics

Credit Hours: 2.00. This course will introduce first year veterinary students to the fundamental principles of population medicine. This will include concepts behind population versus individual animal medicine, population animal industries and their management practices, population animal diseases, outbreak investigation, regulatory medicine, and interactions between wild and domestic animals. Following an introduction to population medicine, students will shift to a discussion of veterinary ethics and its application to various animal industries. Students will explore basic concepts in animal use ethics and welfare, ethical and moral reasoning, and critical thinking and problem solving in population medicine.

Learning Outcomes: 1. Develop an understanding of the concepts of population medicine and compare and contrast those to individual animal medicine. 2. Acquire a basic understanding of the production animal industries and management practices employed by those industries. 3. Attain a familiarity of the major disease challenges common to each of the animal populations presented. 4. Be able to intelligently approach a disease outbreak investigation and recommend sound basic sampling, management, and treatment options. 5. Understand and appreciate the role of regulatory medicine in disease control. 6. Understand and appreciate the wild and domestic animal interactions and challenges. 7. Review basic concepts in ethics of animal use and animal welfare science. 8. Illustrate how ethics and moral reasoning may be used to resolve contentious animal issues of relevance to veterinary medicine. 9. Develop skills in critical thinking and collaborative problem solving relative to population medicine. 10. Enhance information gathering, assimilation, and communication skills. Credits: 2.00

VCS 80120 - Veterinary Skills And Competencies II

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate competency in the advanced restraint of dogs, cats, food animals, and horses. 2. Demonstrate basic safety, husbandry, and restraint of avian

and exotic species. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses. 5. Demonstrate ability to safely and appropriately perform jugular venipuncture of cats, dogs, food animals, and horses using models. 6. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a cat, dog, food animal, and horse. 7. Demonstrate ability to perform a FNA and prepare a slide for cytology. 8. Demonstrate ability to collect specimens for diagnostic lab submission. 9. Demonstrate ability to operate radiographic equipment. 10. Demonstrate ability to position for abdominal radiographs in small animals. 11. Demonstrate ability to perform PCV/TP, blood glucose, I-Stat, and USG diagnostics. 12. Demonstrate ability to create understandable discharge instructions which foster client compliance. 13. Demonstrate an understanding of student loan information and re-payment options. 14. Demonstrate effective communication within the veterinary team. 15. Demonstrate effective communication with owners about finances and be able to provide estimates for medical recommendations. Credits: 2.00

VCS 80210 - Veterinary Skills And Competencies III

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses (using cadavers). 2. Demonstrate safe and appropriate jugular and peripheral venipuncture of dogs, cats, food animals, and horses (using models). 3. Demonstrate ability to collect and submit venous samples for hematology and chemistry. 4. Demonstrate ability to collect and submit voided urine samples. 5. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a dog, cat, food animal, and horse. 6. Demonstrate ability to perform a cardiologic examination in dogs, cats, food animals, and horses. 7. Demonstrate ability to perform a neurologic examination in dogs, cats, food animals, and horses. 8. Demonstrate four techniques for oxygen administration. 9. Demonstrate ability to correctly and aseptically place an IV catheter (in models) of large and small animals. 10. Demonstrate intubation of dogs and cats. 11. Demonstrate understanding of regulatory paperwork, the completion of the USDA accreditation modules, and the ability to perform tuberculosis and brucellosis testing. 12. Demonstrate ability to measure systemic blood pressure using both Doppler and oscillometric techniques. 13. Demonstrate ability to perform a bone marrow aspirate and bone marrow core biopsy. 14. Demonstrate ability to correctly set up and position for thoracic radiographs. 15. Demonstrate ability to complete one- and two-hand ties, instrument ties and square knots. 16. Demonstrate ability to prepare Diff-quick staining on cytologic samples. 17. Demonstrate understanding of the principles of OR conduct and correct gowning and gloving protocols. 18. Demonstrate ability to measure SpO2 via pulse oximetry. 19. Demonstrate ability to perform a diagnostic and 10 lead EKG. 20. Demonstrate

appropriate telephone communication and etiquette with owners and fellow veterinarians. 21. Demonstrate understanding communication strategies to improve treatment compliance. 22. Demonstrate understanding of their personal credit score-both its calculation and impact. 23. Demonstrate knowledge of Veterinary Teaching Hospital protocols for patients in ICU and wards. 24. Demonstrate understanding of the use of the Omincell. 25. Demonstrate ability to complete patient rounds with ICU technicians. 26. Demonstrate knowledge of Veterinary Teaching Hospital and Animal Disease Diagnostic Lab forms and protocols for sample submission. 27. Demonstrate ability to perform and interpret SNAP tests. 28. Demonstrate ability to complete drug calculations, write prescriptions for medications, and write a veterinary feed directive. Credits: 2.00

VCS 80220 - Veterinary Skills And Competencies IV

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via IV to dogs, cats, food animals, and horses. 2. Demonstrate ability to perform biopsies of dogs, cats, food animals, and horses and to submit specimen to the diagnostic laboratory. 3. Demonstrate ability to perform basic regional anesthetic techniques. 4. Demonstrate understanding of the anatomy of, types of, and testing of anesthetic machines. 5. Demonstrate understanding and use of various feeding tubes in small animals. 6. Demonstrate ability to properly position small animals for radiographs of limbs. 7. Demonstrate ability to correctly operate fluid and syringe pumps. 8. Demonstrate understanding of FAMACHA scoring. 9. Demonstrate ability to place nasal oxygen cannula, perform nebulization, and coupage. 10. Demonstrate ability to perform end-tidal CO2 monitoring. 11. Demonstrate ability to pass orogastric tubes and esophageal feeders on ruminant models. 12. Demonstrate ability to perform injections and venipuncture on live animals both small and large. 13. Demonstrate ability to establish rapport with a client in an emergency situation. 14. Demonstrate ability to communicate appropriately in situations involving ethical issues. 15. Demonstrate understanding of educational debt to income level and options to manage educational debt repayment. 16. Demonstrate understanding of appropriate reporting of reportable diseases and foreign animal disease investigations. Credits: 2.00

VCS 80310 - Veterinary Skills And Competencies V

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective compassionate communication with clients about euthanasia. 2. Demonstrate ability to pass nasoesophageal, nasogastric, orogastric, and esophageal feeders in various species. 3. Demonstrate ability to safely perform enteral feeding with a syringe and syringe pump. 4. Demonstrate ability to perform equine dental examination and dental float. 5. Demonstrate ability to administer, monitor, and prepare

transfusions with various blood products. 6. Demonstrate ability to place intraosseous and multiple lumen jugular catheters in small animals. 7. Demonstrate ability to perform urinary catheterization and use a closed urinary collection system. 8. Demonstrate ability to perform a complete ophthalmic examination in dogs, cats, food animals, and horses. 9. Demonstrate ability to perform a complete orthopedic examination in small animals. 10. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 11. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 80610 - Small Animal Medicine I

Credit Hours: 3.50. This course is the first in a series that provides an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 3.50

VCS 80630 - Small Animal Surgery

Credit Hours: 2.50. This course will teach basic surgical principles applicable across species such as suture materials and patterns and principles of hemostasis. Common surgical diseases affecting the various body systems of dogs and cats will be discussed with a focus on pre- and postoperative care. Routinely performed surgical procedures (neuter, spay, C-section) will be discussed. Orthopedic topics will include bone healing, management of musculoskeletal trauma, fracture management, and fundamentals of external and internal fracture stabilization techniques for dogs and cats. The course will conclude with discussions of select musculotendinous conditions, principles of amputation and joint and limb salvage, and an introduction to principles of physical therapy.

Learning Outcomes: 1. Explain correct preparation of the surgical site, draping and procedures for maintaining aseptic technique. 2. Identify commonly used surgical instruments, suture materials, and suture patterns and explain the indications for their use. 3. Explain the indications, procedures and complications of surgical procedures common in general practice such as ovariectomy, ovariohysterectomy, castration, cesarean-section/hysterotomy, enterotomy, gastrotomy, and cystotomy. 4. Recognize the clinical signs associated with common surgical diseases of the upper airway, ear, gastrointestinal tract, and urinary tract and formulate appropriate diagnostic and treatment plans. 5. Explain principles for surgical management of tumors. 6. Recognize different types of wounds and recommend appropriate steps for initial wound management. 7. Describe the process of bone healing and explain the principles of fracture fixation to optimize bone healing. 8. Describe fractures based on type, classification and location. 9. Explain the diagnosis, perioperative management, and treatment options for common fractures and joint injuries involving appendicular bones and mandible. 10. Formulate a diagnostic plan for common orthopedic diseases. 11. Explain the etiology, pathophysiology, diagnosis, and medical and surgical treatment of developmental and degenerative joint diseases of dogs. 12. Explain the etiology, pathophysiology, diagnosis, and treatment of developmental and acquired multicentric diseases of the long bones of dogs. 13. Explain

the etiology, pathophysiology, diagnosis, and treatment of more common musculotendinous conditions. 14. Explain the indications, principles and anticipated outcomes for amputations, arthrodesis, and limb salvage procedures. 15. Describe the basic principles, modalities, goals, and anticipated outcomes of current physical therapy and rehabilitation therapies. Credits: 2.50

VCS 80910 - Food Animal Medicine

Credit Hours: 4.00. This course focuses on the major infectious, metabolic, and parasitic diseases of ruminants, camelids, swine, poultry and other avian flocks. The pathogenesis, diagnosis, and treatment of these conditions or syndromes will be reviewed. Additionally, the course will cover proper management, including vaccinations and animal husbandry, to prevent the development of these conditions.

Learning Outcomes: 1. List the names of the common diseases of ruminants, the causal agent(s) or predisposing factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems in ruminants/camelids. 3. Describe management changes or therapeutic methods that are used to treat and control common diseases of ruminants. 4. Discuss the important issues of food safety, quality assurance, and health regulations as they relate to the ruminant industries. Swine 5. List the names of the common diseases of swine and their causal agent(s), predisposing factors, and where possible, underlying mechanisms. 6. Develop a differential diagnosis list and select a suitable diagnostic plan to determine the definitive diagnosis. 7. Describe management changes or therapeutic methods to prevent, control, and treat common swine diseases/problems. Poultry 8. Provide students with a basic practical knowledge of avian medicine. After completing this course, students are expected to be able to: 9. Identify the economical and public health diseases of flocks. 10. Identify the proper diagnostic tests needed to diagnose each disease. 11. Explain the economic and public health consequences of each disease. 12. Design treatment and prevention strategies for each disease. Credits: 4.00

VCS 81410 - Comparative Theriogenology

Credit Hours: 2.00. This course develops a broad clinical knowledge of common reproductive management strategies and clinical conditions associated with reproduction in the major domestic species. It provides information and strategies for the conduct of breeding soundness examinations and infertility work-ups in the male; estrous cycle characteristics, diagnostics and control in females; breeding management strategies, pregnancy diagnosis, and management of gestation; investigation and control strategies for pregnancy loss; management of parturition and treatment of dystocia; normal postpartum changes and diseases of the peripartum period and the pathophysiology and treatment of uterine infections. Material will be presented in both comparative and species-specific manner. Students should review reproductive anatomy and physiology notes in preparation for this course.

Learning Outcomes: 1. Be conversant with core reproductive principles of all major species (bovine, equine, small animals with canine as the model, porcine, small ruminants). 2. Understand similarities and differences in the physiological basis of key reproductive events across species. 3. Integrate knowledge from various disciplines to understand clinical situations pertaining to the reproductive health of animals on an individual or herd basis. 4. Understand the pathophysiology, clinical presentations, therapies, and prognoses for clinical issues pertaining to the reproductive health of animals on an individual or herd basis. Credits: 2.00

VCS 80620 - Small Animal Medicine II

Credit Hours: 1.50. This is the second course in a series providing an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of

common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 1.50

VCS 80920 - Large Animal Surgery

Credit Hours: 2.50. This course will cover the core fundamentals of surgical diseases of multiple large animal species, including the horse, bovine, small ruminants and camelids. Case management approaches are utilized to provide examples of disease conditions affecting these large animal species.

Learning Outcomes: 1. Present core large animal surgical diseases of horses, cattle, small ruminants, pigs, and camelids. 2. Present surgical management of large animal diseases. Credits: 2.50

VCS 81210 - Small Animal Primary Care And Wellness

Credit Hours: 2.00. This course will discuss conditions that are commonly treated in small animal primary care practice. Topics will include wellness and preventative care for dogs and cats at all lifestages, dental care, diagnosis and management of common oral and skin diseases, and emergency medicine. Humane euthanasia and palliative care will also be discussed.

Learning Outcomes: 1. Explain the role the primary care veterinarian has developing and implementing lifestage wellness programs. 2. Describe the key goals of a wellness program for each lifestage. 3. Describe vaccine and infectious disease screening programs for both cat and dog including available preventative medications. 3. Demonstrate standard procedure for oral evaluation, oral care to include dental cleaning and extractions. 4. Recognize common dermatologic diseases in the dog and cat and describe treatment to resolve these medical problems. 5. Demonstrate common dermatologic diagnostics procedures. 6. Explain key concepts of companion animal patients presenting as a primary care emergency patient: shock, coagulation abnormalities, oxygenation abnormalities, and sepsis. 7. Solve common fluid therapy problems addressed in both primary care hospitals and in primary care emergency practices. 8. Explain key concepts of palliative care, humane euthanasia, and natural death. Credits: 2.00

VCS 80320 - Veterinary Skills And Competencies VI

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective communication regarding medical errors. 2. Demonstrate ability to perform transtracheal wash in small animals. 3. Demonstrate ability to perform a dermatologic exam and intradermal skin testing in large and small animals. 4. Demonstrate ability to perform ultrasound examinations of limbs. 5. Demonstrate ability to perform ultrasound guided cystocentesis. 6. Demonstrate ability to perform abdominocentesis, periocardiocentesis, and thoracocentesis in large and small animals. 7. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 8. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 80801 - Equine Medicine

Credit Hours: 2.50. Core course focused on the major equine diseases and preventive medicine/herd health (biosecurity, vaccination, parasite control, dental disease). The course will cover pathogenesis, diagnosis, and treatment/management of these conditions or syndromes.

Learning Outcomes: 1. List the names of the common diseases affecting equines, the causal agent(s) or predisposing/risk factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems affecting equines. 3. Identify clinically relevant and practical management changes or therapies that are used to treat and control common diseases of equines. 4. Formulate a biosecurity plan for a farm dealing with an outbreak of a contagious equine disease. 5. Critically evaluate current literature and apply evidence-based medicine (EBM) to equine cases and clinical decision making. Credits: 2.50

VCS 81101 - Small Animal Surgery Lab I

Credit Hours: 1.50. Introduction to basic skills in surgery and anesthesia. Models are used to learn basic skills of instrument use, ligation, dissection, and suturing. Students will progress to common anesthetic and surgical procedures on live and cadaver animals. The live animal surgery will teach physical examination, formulating an anesthetic plan, anesthetic induction, maintenance and recovery, as well as feline spay and neuter.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Scrub, gown and glove correctly, and maintain aseptic technique in the operating room. 5. Prepare the surgical site and drape correctly. 6. Name and correctly use each general surgical instrument. 7. Efficiently perform one-handed ties, two-handed ties, and instrument ties to make square knots. 8. Correctly place basic suture patterns. 9. Correctly and gently handle tissues and apply appropriate hemostatic techniques. 10. Open the abdomen through a ventral midline abdominal incision and close it properly. 11. Correctly and safely perform ovariohysterectomy and castration in cats. 12. Perform the emergency procedures of chest tube placement and tracheotomy tube placement. 13. Induce and maintain general anesthesia and monitor the anesthetized patient. 14. Safely recover an animal from general anesthesia. 15. Perform cardiopulmonary resuscitation. 16. Administer postoperative care, including analgesic therapy, and detect postoperative complications. 17. Keep appropriate medical records. Credits: 1.50

VCS 81201 - Principles Of Veterinary Anesthesiology

Credit Hours: 2.00. Introduction to basic principles of anesthesiology. Pharmacology of anesthesia and analgesic drugs, anesthetic equipment, monitoring, regional and local anesthetic techniques, pain management and anesthesia care of multiple species and special disease considerations will be covered.

Learning Outcomes: 1. Learn the pharmacology and clinical effects of (and indications and contraindications for) common preanesthetic agents, including anticholinergic agents, tranquilizers and sedatives. 2. Learn the basic principles of general anesthesia of small and large animals. 3. Understand the pharmacology and clinical effects of (and indications and contraindications for) various injectable and inhalant anesthetics. 4. Learn the principles of local and regional anesthesia and understand how they are applied in the clinical setting. To learn the pharmacology of local anesthetic drugs 5. Learn how to evaluate a patient preoperatively and determine the appropriate choice of anesthetic, monitor the patient during general anesthesia and recovery, and recognize

and treat emergencies. 6. Learn anesthetic techniques suitable for a variety of species and how to apply them in various clinical settings. 7. Learn how to anesthetize patients with a variety of medical conditions. 8. Learn the principles of pain management and apply them to a variety of clinical situations. Credits: 2.00

VCS 81802 - Small Animal Surgery Laboratory II

Credit Hours: 1.50. This course will build on VCS 81100 by emphasizing the importance of proper basic surgical skills (instrument carriage, suturing, knot tying). Surgical skills will be expanded by performing several procedures on cadaveric tissue: abdominal approaches, gastrointestinal surgery, urogenital surgery, wound management, amputations. One lab will be dedicated to ophthalmologic procedures. Ovariohysterectomies and castrations will be performed on live dogs and cats to further develop the students' surgical skills as well as skills in physical examination, formulating an anesthetic plan, anesthetic induction, maintenance & recovery and postoperative care.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Safely perform elective surgery on patients using aseptic techniques for surgeon and patient, gentle tissue handling and dissection, secure vessel ligation, good hemostasis and appropriate suturing technique and patterns; and instrument carriage. 5. Be proficient at opening and closing abdominal incisions. 6. Explain common soft tissue surgical procedures performed in small animals. 7. Safely anesthetize, monitor and recover a small animal patient from anesthesia. 8. Explain the indications and general techniques for basic ophthalmic procedures. Credits: 1.50

VCS 82701 - Diagnostic Imaging

Credit Hours: 3.00. This course covers basic mechanisms of image generation and interpretation. The first half of the course deals with principles of image formation and the introduction to advanced imaging modalities. A synopsis of the principles of radiobiology and radiation safety is offered. The second part of the course features imaging interpretation based on previously mastered imaging principles. The third part of the course builds the foundation of film reading and interpretation such as radiographic anatomy and radiographic signs of specific disease conditions. This course serves as a foundation for the fourth-year diagnostic radiology rotation.

Learning Outcomes: 1. Describe the basic operation of an x-ray machine, including the components of the x-ray tube. 2. Understand the relationship of kVp, mAs and exposure time to x-ray production. 3. Know the fundamental properties of x-rays and gamma rays. 4. Know technical factors that affect detail, density, distortion and contrast in the generation of the x-ray image. 5. Know the reason for using a grid and the construction of a grid. See textbook. 6. Understand the terms latitude and scale of contrast as they relate to radiographic exposure. 7. Describe the differences between and applications of medium (par), high speed and slow speed intensifying screens. 8. Know the advantages and disadvantages of using digital versus conventional radiography. 9. Know the basics of analog radiographic processing-what happens during development, rinse, fixation and washing. 10. Know the common artifacts that are produced in the darkroom, i.e., fixer versus developer spills, exhausted developer, static electricity, light leakage, improper temperature or mixing of chemicals and screen-based problems. See textbook. 11. Be familiar with the basic radiation protection measures used by veterinary workers. 12. Know the major effects (cancer induction, teratogenesis, etc.) of ionizing radiation and cellular mechanisms (free radical production, DNA damage, and mutation) involved in radiation injury. 13. Have a working knowledge of how an ultrasound machine functions and how ultrasonic images are interpreted (terminology). 14. Be familiar with imaging principles and advantages of nuclear

medicine imaging. 15. Understand the difference between CT and MR imaging, and their relative indications in veterinary medicine. 16. Know the advantages and disadvantages of CT and MR imaging over radiography. 17. Know which imaging modalities are used to provide physiologic information. 18. Know how to name x-ray projections. 19. Understand the concept of "windowing" as it relates to digital forms of imaging. 20. Understand differences between file types for digital imaging, e.g., DICOM (.dcm), TIFF (.tif), JPEG (.jpg). 21. Recognize abnormal radiographic findings of commonly seen disease conditions in small animals. 22. Describe radiological findings according to Roentgen signs. 23. Formulate a meaningful differential diagnosis for commonly seen radiographic abnormalities in small animals. Credits: 3.00

VCS 80140 - Fundamental Principles Of Comparative Nutrition

Credit Hours: 2.00. This course will cover fundamental aspects of comparative nutrition building on knowledge from veterinary comparative anatomy and physiology courses. Multiple species will be discussed to provide the student a broad-based foundational knowledge in key nutritional concepts, including feeds and feeding assessment and the animal's physiologic state/lifestage. The student will learn how physiologic status will impacts energy needs and nutritional adequacy, on an individual and/or group basis. The student will also develop skills in forage identification, pet food assessment, and when the individual/group is at risk of nutrient deficiency.

Learning Outcomes: 1. Discuss with the owner/client the nutritional assessment of the animal/herd, incorporating physiologic state and concerns involving environment, food, or feeding management. 2. Identify and assess common feeds and forages. 3. Explain the role of nutrition throughout the lifecycle for health to support growth, lactation, and gestation as well as adult maintenance to include aging. 4. Complete a nutritional history, whether herd or individual, to be used in assessment of health status and likelihood of risk for nutritional deficiencies or toxicities. 5. Calculate energy needs based on lifestage or physiologic status. 6. Perform assessment of pet foods to determine nutritional adequacy. 7. List the unique dietary requirements of small mammals and reptiles. Credits: 2.00

Problem Based Learning and Seminar (6 credits)

VM 82000 - Applications And Integrations I

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, but not limited to, tutorial group evaluation, peer evaluation, self-evaluation, and comprehensive content and process examinations. Introductory session on hematology, clinical chemistry and radiography will be included to facilitate student interpretation of testing used in the cases.

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the students understanding of how the basic science material provides the foundation for solving problems, thereby increasing the student's perception of relevance, motivation, and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Develop the skills of acquiring and integrating information and applying the information to

solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VM 83000 - Applications And Integrations II

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials and research problems. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include material from VM 82000 and other current DVM courses (anatomy, physiology, etc.).

Learning Outcomes: 1. Improve the student's retention of learned information and continue to build a working knowledge base that the student will expand and utilize to solve clinical problems throughout his/her career. 2. Increase the students responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis-formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills including utilizing appropriate resources to adequately. 9.

Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 84000 - Applications And Integrations III

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include materials from previous classes (VM 82000/83000 and other freshman DVM courses) as well as the current DVM coursework (hematology, parasitology, bacteriology, pharmacology and pathology).

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

Specialized Track Courses (48 credits)

Selectives (5 credits)

BMS 80500 - Applied Anatomy Of Production Animals

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 120-to-150-minute laboratory sessions, plus a comprehensive final exam. Course material is based upon clinical conditions of the production animals that have an anatomical basis or emphasis. Laboratory sessions include topographical anatomy; joint and nerve injections and performance or other clinical procedures; use of multimedia learning aids; and dissection of the head, neck, viscera, and legs.

Learning Outcomes: 1. Recognize, describe and demonstrate the features, positions, and topographical locations of normal anatomical structures which are necessary for conduct of physical examination, including rectal palpation; diagnostic procedures, including contemporary imaging procedures; medical and surgical treatment of common disorders; and necropsy examination of mammalian production animals. 2. Describe structure-function inter-relationships of clinically important organs and structures in production animals, particularly as they relate to

commonly encountered clinical abnormalities and disorders. 3. Recognize and describe anatomical structures associated with commonly encountered surgical disorders in production animals. 4. Identify relevant landmarks and be able to perform the most commonly conducted procedures to accomplish local and regional anesthesia in production animals. Explain the anatomical basis of each procedure, as well as the rationale underlying the procedures, and the level of diagnostic and therapeutic specificity of each procedure. Credits: 1.00

CPB 87000 - Diagnostic Veterinary Cytology

Credit Hours: 1.00. A combination of didactic and wet laboratory microscopic sessions are used to demonstrate applications of diagnostic cytology. Consists of weekly sessions with a brief lecture overview of the basic cytologic features of a particular organ system followed by microscopic review of collected cytology material from that particular organ system. The didactic and laboratory sessions are supplemented by Internet-based and digital-format archived images for student review.

Learning Outcomes: 1. Evaluate a cytology slide including, but not limited to, inflammatory and neoplastic lesions. 2. Describe the features of the slide in such a way as to clearly convey thoughts and justify provided interpretation. 3. Understand the limitations of cytology and provide medically sound comments to advance the case. Credits: 1.00

VCS 80500 - Small Animal Behavioral Therapy

Credit Hours: 1.00. Provides information on the diagnosis, treatment, and prevention of behavior problems of dogs and cats, with emphasis on differential diagnosis of behavioral problems and behavioral pharmacology. Topics include aggression, anxiety related problems, inappropriate elimination, client counseling, and problem prevention. Client interaction and the question of euthanasia for behavioral problems is also discussed.

Learning Outcomes: 1. Identify stress signs as well as the mood (positive or negative) in dogs and cats by reading their body language. 2. Apply behavior knowledge into veterinary practice. 3. Formulate a diagnostic work-up for the more common behavior problems in companion animals and arrive at a list of differential diagnoses. 4. Choose the appropriate behavior modification techniques to prevent developing behavior problems. 5. Compare and contrast the various FDA approved drugs and dosing regimen to treat the more common behavior problems in companion animals. 6. Interact efficiently and compassionately with owners of patients with a behavior problem and discuss the question of behavior-related euthanasia. 7. Discuss welfare topics relating to small animals intelligently. Credits: 1.00

VCS 80616 - Small Animal Clinical Nutrition

Credit Hours: 1.00. This nutrition course presents the established knowledge of metabolism and physiological chemistry pertaining to nutrients and the control of biochemical pathways at the gene, cell, organ, and system level. The goal of this course is to provide the fundamentals of nutrient metabolism while discussing nutritional modification in the management of disease. At the completion of this course, the veterinary student should be proficient in recognizing a nutrition-related problem in a clinical patient, conducting a thorough nutritional assessment, and constructing appropriate nutritional strategies for both the pet and client. The veterinary student will achieve an understanding of systemic metabolism that can be applied to the contemporary practice of veterinary medicine.

Learning Outcomes: 1. Explain the role of the practitioner in incorporating evidence-based nutrition plans for all life stages. 2. List the components of a complete nutritional assessment for both dogs and cats. 3. Define the role of nutrition throughout the lifecycle for health to support proper growth, maturation, aging, lactation, and gestation. 4. Describe the impact of nutrient deficiency for each lifestage. 5. Demonstrate ability to calculate daily energy needs for all lifestages, during illness, and for weight loss programs. 6. Identify key nutrients of concern in common diseases and identify the

key characteristics found in the nutrient profile of an appropriate therapeutic diet. 7. Develop a nutritional plan for common nutritional problems presented to a small animal practitioner. 8. List options for assisted-feeding to include potential limitations for each technique. Credits: 1.00

VCS 82200 - Large Animal Surgery I

Credit Hours: 0.50. Basic surgical training in large animals, including both soft tissue and orthopedic procedures.

Learning Outcomes: 1. Provide students with the opportunity to develop their basic skills and knowledge in large animal surgery through performance of common surgical procedures, preoperative evaluation and post-operative case management. 2. Enhance the students' clinical application of large animal surgery principles and techniques taught in didactic courses. Credits: 0.50

VCS 82300 - Large Animal Surgery II

Credit Hours: 0.50. More advanced surgical training in large animals, including both soft tissue and orthopedic procedures.

Learning Outcomes: 1. Provide students with the opportunity to develop their basic skills and knowledge in large animal surgery through performance of common surgical procedures, preoperative evaluation and post-operative case management. 2. Enhance the students' clinical application of large animal surgery principles and techniques taught in didactic courses. Credits: 0.50

VCS 83700 - Clinical Nutrition For Ruminants And Swine

Credit Hours: 1.00. Current information on nutritional requirements of cattle and pigs, along with the relationships between nutrients and outcomes when nutrients are under- or oversupplied in different phases of the life cycle of cattle and pigs. Specific rations and nutritional requirements of cattle and pigs. Students will be expected to evaluate nutritional problems.

Credits: 1.00

VCS 83800 - Swine Production Medicine

Credit Hours: 1.00. Introduction to production and health management in swine herds. The concept of the model herd is introduced, and the use of records in the diagnosis of problems and maximizing production efficiency is covered. The focus is herd-based and includes problem-solving.

Credits: 1.00

VCS 84300 - Successful Practice Skills

Credit Hours: 0.50. Builds upon the foundation for the application of practice management principles learned in VCS 51700. Focus is in the areas of communications and relationships with clients, staff, and colleagues; leadership development; and key essentials of practice operation for the prospective associate (or practice director).

Learning Outcomes: 1. Develop a vision for your career and understand the process of goal setting. 2. Understand types of practice ownership and the process to become an owner/partner. 3. Explain key ingredients for practice growth and financial success. Credits: 0.50

VCS 84800 - Advanced Small Animal Surgery

Credit Hours: 1.50. An advanced course dealing with selected surgical diseases of dogs and cats. Designed for the student who will be practicing on small animals (small animal, companion animal, or mixed animal track). A systems approach is used to teach important concepts of surgical diseases and procedures affecting each body system. Focuses on the diagnosis and treatment of diseases commonly encountered in small animal practice.

Learning Outcomes: 1. Identify minimally invasive surgical equipment. 2. Explain the diagnostic and therapeutic approaches to hepatic and biliary surgical disease. 3. Discuss special considerations with thoracic surgery and surgical management of more common intrathoracic diseases. 4. Explain wound reconstruction options for various types of wounds including the advantages and disadvantages of each technique. 5. Develop a diagnostic and treatment plans for dogs and cats with common fractures and joint injuries involving appendicular bones and mandible. 6. Describe the etiology, pathophysiology, diagnosis, and treatment of more common musculotendinous conditions. 7. Explain the

basic principles, modalities, goals, and anticipated outcomes of current physical therapy and rehabilitation therapies. 8. List currently available physical therapy modalities and identify commonly used equipment. Credits: 1.50

VCS 85100 - Medicine And Surgery Of Nontraditional Pets

Credit Hours: 2.00. An overview of clinical approach to common medical and surgical diseases of nontraditional pets. Focuses on diagnosis and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop an understanding of problem-solving approaches to medical and surgical problems in exotic pets. 2. Develop an understanding of common husbandry and nutritional needs of various exotic pets. 3. Develop an integrated knowledge base of common medical and surgical diseases. 4. Problem-solve using an integrated understanding of anatomy, physiology, pathology, pathophysiology, clinical pathology, pharmacology, parasitology, bacteriology, virology, immunology, diagnostic imaging, and physical diagnostic techniques. Credits: 2.00

VCS 89200 - Veterinary Forensic Medicine

Credit Hours: 1.00. The definition of forensic medicine is a science that deals with the relation and application of medical facts to legal problems. The primary role of a forensic specialist is to provide law enforcement officials, judges, and jury members with the information necessary to make decisions (decision to prosecute, render a verdict, etc.) regarding a case. This elective course is designed to expose students to the many situations where veterinary medicine and the law intersect.

Learning Outcomes: 1. Introduce students to the scope of interaction between legal authorities and veterinary medicine. 2. Understand how to collect materials and write reports that can be used in a legal case. 3. Know about the use of forensic investigation to document animal neglect and cruelty. Credits: 1.00

VCS 82501 - Ruminant Theriogenology

Credit Hours: 1.50. This course will cover clinically pertinent aspects of ruminant reproduction in more detail than prerequisite courses, including obstetrics and genital diseases on an individual and group basis. The laboratory portion will teach the proper techniques for rectal palpation and reproductive ultrasound in ruminants. Principles of embryo recovery and transfer will be practiced.

Learning Outcomes: 1. Recognize normal and abnormal reproductive function in the individual animal and herd. 2. Develop reasonable corrective actions for abnormal reproductive function and prognosis for return to normal. 3. Understand how to manipulate the reproductive cycle, and apply appropriate manipulations to various clinical scenarios. 4. Recognize dystocia and outline a plan to correct the dystocia. 5. Recognize common peripartum complications and create a plan to correct the abnormalities. 6. Understand the basics of assisted reproductive technologies in the bovine. Credits: 1.50

VCS 83903 - Cattle Production Medicine

Credit Hours: 1.50. "Production medicine" is an important part of modern bovine veterinary practice. This course will demonstrate this role of production medicine in bovine practice and the potential value to the producer and veterinarian. Topics discussed during the class will include cattle nutrition (including exposure to ration balancing programs), calf nutrition and management, records analysis including the use of computer programs, mastitis and milk quality measurements, economics, and animal welfare evaluations exposure to different facets of the beef industry (cow/calf, stocker, feedlot) and the differences in management in those systems, genomics, and immunology/vaccinology. Additionally, students will be exposed to team troubleshooting and performing farm evaluations. Outside speakers may be used as content experts.

Credits: 1.50

VCS 85300 - Small Animal Emergency And Critical Care

Credit Hours: 1.00. The emergently-ill pet is a frequent scenario for both primary care private practices and the primary emergency care center. Due to the unpredictable nature of these clinical scenarios, this course provides the veterinary student the knowledge to quickly assess and stabilize pets using standard of care protocols. Common presentations and

diseases are used to reinforce key concepts in emergency and critical care medicine.

Learning Outcomes: 1. Describe the fundamental approach to triage for the emergent patient. 2. Recognize and describe common emergency scenarios in small animal practice. 3. Interpret clinical data in a case scenario and create identify appropriate stabilization plan. 4. List the Rule of 20 used in assessing and monitoring critical patients. 5. Identify different point-of-care instruments used for patient assessment and monitoring. Credits: 1.00

VCS 84601 - Small Animal Medicine III

Credit Hours: 2.00. An advanced elective course focused on selected diseases of dogs and cats. Designed for the student who is considering entering either small animal exclusive practice, mixed animal practice, or companion animal practice. A systems approach is used to teach the major concepts of diseases affecting each body system while developing a deeper understanding of common diseases in the dog and cat. This course will concentrate on the diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics in this elective include nephrology, urology, oncology, endocrinology, infectious diseases, cardiology, gastroenterology (includes liver and pancreas).

Learning Outcomes: 1. List clinical signs for selected medical diseases in the dog and cat. 2. Explain diagnoses for dogs and cats in each organ system. 3. Describe treatment of selected medical diseases in the dog and cat. 4. Apply a problem-based approach to selected medical diseases in the dog and cat. 5. Describe diagnostic approach for selected medical diseases in the dog and cat. 6. Integrate knowledge obtained in core small animal medicine courses with selected diseases to develop an expanded differential diagnoses list for common clinical presentations. 7. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. Credits: 2.00

VCS 84701 - Small Animal Medicine IV

Credit Hours: 2.00. An advanced elective course focused on selected diseases of dogs and cats. Designed for the student who is considering entering either small animal exclusive practice, mixed animal practice, or companion animal practice, following graduation. A systems approach is used to teach the major concepts of diseases affecting each body system while developing a deeper understanding of common diseases in the dog and cat. This course will concentrate on the diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics in this elective include neurology, respiratory, oncology, dermatology, and immune-mediated diseases.

Learning Outcomes: 1. List clinical signs for selected medical diseases in the dog and cat. 2. Explain diagnoses for dogs and cats in each organ system. 3. Describe treatment of selected medical diseases in the dog and cat. 4. Apply a problem-based approach to selected medical diseases in the dog and cat. 5. Describe diagnostic approach for selected medical diseases in the dog and cat. 6. Integrate knowledge obtained in core small animal medicine courses with selected diseases to develop an expanded differential diagnoses list for common clinical presentations. 7. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. Credits: 2.00

CPB 84100 - Use And Care Of Laboratory Animals II

Credit Hours: 1.00. Priority will be given to students that have completed CPB 84000. This course teaches skills useful for the role of a laboratory animal veterinarian. Course is project-based and includes hands-on techniques in laboratory rodents.

Learning Outcomes: 1. Understand basics of rodent health monitoring, facility design and protocol review. 2. Gain hands-on experience in handling rodents and performing techniques. 3. Understand common research procedures in non-rodent species. 4. Use critical thinking to work through clinical cases. Credits: 1.00

VCS 83201 - Equine Lameness

Credit Hours: 2.00. Advanced study of equine lameness with a focus on the performance/sport horse. Physical examination of the locomotor system (axial and appendicular), diagnosis,

treatment, and establishment of a prognosis are emphasized through lecture and laboratory sessions.

Learning Outcomes: 1. Examine a horse for lameness and be able to identify which limb is lame and then formulate and execute a diagnostic plan to be able to reach a definitive diagnosis and then develop a treatment plan and prognosis. 2. Recognize the pathognomonic abnormal gaits for the forelimb and hind limb in horses. 3. Examine equine radiographs and identify common diseases of the joints and explain the difference between the various advanced imaging modalities and when would be appropriate to utilize them. 4. Explain the importance and basic principles of farriery and demonstrate how to properly remove a shoe from a hoof. 5. Recognize the common lameness conditions in horses and describe their basic treatment options and prognoses. Credits: 2.00

Non-Course Requirements

Pre-clinical Electives

BMS 81900 - Endocrine And Neural Basis Of Seasonal Activities Of Birds And Mammals In The Wild

Credit Hours: 1.00. This one-credit elective course will be offered to first and second year veterinary students annually (third year students may also take it). The course will explore the physiological basis of seasonal activities of mammals and birds in the wild. An emphasis will be placed on the neural and endocrine changes that are associated with the seasonal and cyclical activities including breeding, hibernation, migration, etc.

Learning Outcomes: 1. Understand the influences of environmental factors and cues by being exposed to the several activities of mammals and birds in the wild such activities. 2. Learn theendocrine and neural pathways that mediate the dictates of the environment. Credits: 1.00

BMS 80400 - Applied Anatomy Of The Horse

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 120-to-150-minute laboratory sessions, plus a comprehensive final exam. Course material is based upon clinical conditions of the horse that have an anatomical basis or emphasis. Laboratory sessions include topographical anatomy; joint and nerve injections and performance of other clinical procedures; use of multimedia learning aids; and dissection of the head, neck, viscera, and legs.

Learning Outcomes: 1. Recognize, describe and demonstrate the features, positions, and topographical locations of normal anatomical structures which are necessary for conduct of physical examination, including rectal palpation; diagnostic procedures, including contemporary imaging procedures; medical and surgical treatment of common disorders; and necropsy examination of equid animals. 2. Identify relevant landmarks and be able to perform the most commonly conducted intra-articular injections; intra-synovial injections; and desensitization of nerves to produce of local and regional anesthesia ("nerve blocks") in horses. Explain the anatomical basis of each procedure, as well as the rationale underlying the procedures, and the level of diagnostic and therapeutic specificity of each procedure. 3. Describe structure-function inter-relationships of clinically important organs and structures in horses, particularly as they relate to commonly encountered clinical abnormalities. Credits: 1.00

CPB 84000 - Use And Care Of Laboratory Animals

Credit Hours: 1.00. Topics will include the history of animal use in research; ethical thought related to animal use in research; alternatives; government regulatory requirements; statistical considerations in designing animal studies; animal models; use of the National Agricultural Library Animal Welfare Information Center; biology, husbandry, techniques, and diseases of common laboratory animal species; hygiene and occupational health; biohazard control; perioperative care and aseptic surgical techniques; anesthesia; analgesia; and euthanasia.

Learning Outcomes: 1. Understand the basics of animal research regulations. 2. Understand the difference between animal welfare vs. animal rights. 3. Know the use, important

anatomy/physiology, care, and diseases of common animal species used in research. Credits: 1.00

VCS 83100 - Equine Theriogenology Laboratory

Credit Hours: 1.00. This elective course provides the student with the opportunity to become proficient in all aspects of mare reproductive management. Palpation of the mare's reproductive tract will be emphasized. It also allows students to enhance their abilities to recognize reproductive problems and to formulate and carry out a diagnostic and therapeutic plan.

Learning Outcomes: 1. Safely and competently perform a transrectal palpation and ultrasound of the reproductive tract of the mare. 2. Acquire basic understanding of managing the mares estrous cycle for breeding based on transrectal and ultrasound findings. 3. Obtain entry level knowledge of common procedures including caslick, vaginoscopy, endometrial biopsy, uterine culture and cytology, artificial insemination, uterine lavage and flushing. Credits: 1.00

VCS 89200 - Veterinary Forensic Medicine

Credit Hours: 1.00. The definition of forensic medicine is a science that deals with the relation and application of medical facts to legal problems. The primary role of a forensic specialist is to provide law enforcement officials, judges, and jury members with the information necessary to make decisions (decision to prosecute, render a verdict, etc.) regarding a case. This elective course is designed to expose students to the many situations where veterinary medicine and the law intersect.

Learning Outcomes: 1. Introduce students to the scope of interaction between legal authorities and veterinary medicine. 2. Understand how to collect materials and write reports that can be used in a legal case. 3. Know about the use of forensic investigation to document animal neglect and cruelty. Credits: 1.00

VCS 89300 - Shelter Animal Medicine

Credit Hours: 1.00. The Shelter Animal medicine course will be offered to second and third year veterinary students. The course will cover topics essential to understanding the complexity of population medicine in a shelter environment and related welfare issues. Topics to be covered include animal shelter models (no-kill/adoption guarantee, tradition, etc.), population medicine and disease control as it relates to the environment and the animals, critical care in a shelter environment, foster care, neonatal care of shelter animals, population statistics, animal behavior and relinquishment issues, abuse and cruelty, legal and ethical issues, euthanasia, and developing and implementing animal disaster plans.

Learning Outcomes: 1. Develop a clear understanding of shelter population management and factors that affect it. 2. Be familiarized with the medical aspect of caring for animals in a shelter environment. 3. Recognize and understand the factors surrounding animal relinquishment and the challenges faced caring for them. 4. Incorporate acquired knowledge and apply it to a real-life shelter situation. Credits: 1.00

VM 80900 - International Veterinary Medicine

Credit Hours: 0.50 or 1.00. The course will consist of eight lectures addressing international aspects of the following topics: zoonotic diseases, food hygiene, biosecurity, animal welfare, animal husbandry, infectious diseases, cultural competence, veterinary medical education, and role of international organizations in animal health. Participating students will be required to choose an internationally relevant topic of interest to research. The last session of the course will be a poster session in which each student will present and discuss a poster. The posters will be evaluated by a panel of 3-4 faculty members and a grade assessed. Permission of Department required.

Learning Outcomes: 1. Students should be familiar with the international issues that impact the veterinary profession. 2. Understand the role that veterinarians play in global health and education. 3. Have respect for diverse people and cultures and develop skills for working across cultures. 4. Students gain skills and knowledge to keep themselves safe when traveling overseas. Credits: 0.50 or 1.00

Additional Information

4-Year Plan

Fall 1st Year

BMS 81100 - Physiology Of Domestic Animals I

Credit Hours: 3.00. General physiological process of mammals with special emphasis on domestic animals; normal interactions between large populations of cells, organs, organ systems and integrated functions of an entire animal; homeostatic mechanisms, physiology of body fluids and blood formed elements, muscle and cardiovascular systems.

Learning Outcomes: 1. Provide an overview of physiology of mammalian body systems (Body fluids, blood, muscle, cardiovascular system) and general physiological processes (e.g. homeostasis), with emphasis on domestic animals 2. Provide an overview of the integrated function of the different physiological systems and how they are regulated. 3. Familiarize the student with the organization of cells and the functions of the blood, muscle, and cardiovascular system. Credits: 3.00

BMS 80700 - Veterinary Cell And Tissue Biology Design I

Credit hours: 2.50. The first of a two-semester sequence of courses, emphasizing developmental and microstructural foundations of structural differentiation of cell, tissue, and organ systems. Emphasis is placed upon principles, fundamental concepts, and applicable details as well as comparative aspects of general importance for veterinary medicine and biomedical research. That you have some background in biochemistry and cell biology is assumed.

Learning Outcomes: 1. Recognize and interpret normal microscopic structure, using the language and conventions of medicine. 2. Understand development resulting in normal structure. 3. Understand relationships of cellular organelles and inclusions to cellular, tissue, organ, and whole animal physiology. 4. Develop skills to effectively use a light microscope for critical observation, identification, and analysis, of cell, tissue, organ, and embryonic microstructure. 5. Develop an awareness of species characteristics and variations of structure that reflect physiology, artifact, gerontology, and pathology. 6. Develop an awareness of links between cellular and tissue structure to other disciplines of veterinary medicine and biomedical sciences (e.g. physiology, gross anatomy). 7. Develop approaches to nurture the "active learning" process required to develop and maintain competency as a veterinarian and/or biomedical scientist. Credits: 2.50

BMS 80100 - Gross Anatomy Of The Dog And Cat

Credit Hours: 3.50. Study of the anatomy of the body systems and the topographic relationships of the dog and cat.

Learning Outcomes: 1. Obtain a basic understanding of principles that can be transferred to the anatomical structures of the live dog. 2. Develop mental images of the animal to assist in positioning and orientation of structures in the living animal. To assist in diagnostic procedures and evaluating the results obtained from imaging techniques. 3. Be able to identify anatomical structures on dissected specimens, skeletons, radiographs, and anatomical models. Credits: 3.50

VCS 80400 - Behavior In Domestic Animals

Credit Hours: 1.00. Instruction in basic principles of behavior; factors determining normal and abnormal behavior; and the different types of learning. The main domestic species will be characterized in terms of their normal behavior with which behavior problems are most important in the different species.

Learning Outcomes: 1. Apply the principles of learning to behavior analysis and modification. 2. Characterize the domestic species in terms of their normal behavior. 3. Identify environmental factors contributing to abnormal behavior and compromising their welfare. 4. Utilize knowledge on behavioral development and environmental and management effects on behavior for problem prevention and strengthening the human-animal bond. 5. Integrate behavioral knowledge into veterinary medicine and its practice. Credits: 1.00

VM 82000 - Applications And Integrations I

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, but not limited to, tutorial group evaluation, peer evaluation, self-evaluation, and comprehensive content and process examinations. Introductory session on hematology, clinical chemistry and radiography will be included to facilitate student interpretation of testing used in the cases.

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the students understanding of how the basic science material provides the foundation for solving problems, thereby increasing the student's perception of relevance, motivation, and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VM 89000 - Topics In Veterinary Medicine

Credit Hours: 0.50 to 5.00. Advanced study in the field of animal health and practice of veterinary medicine. Permission of instructor required.

Credits: 0.50 to 5.00

BMS 81000 - Foundations In Basic Medical Sciences

Credit Hours: 1.50. The overall objective of this course is to provide the incoming first year DVM students the basic, foundational science principles upon which they will base study of the DVM curriculum. Emphasis is upon basic principles and fundamental concepts of: animal body organization and terminology; cellular and whole body metabolism; macromolecules, membranes, transport, biosynthetic processes, cellular communication/signal transduction, cell

cycle and growth regulation, gene expression and embryonic development.

Learning Outcomes: 1. Know the terms of position and orientation of the animal body. 2. Know basic principles of cellular and whole body metabolism, including anabolism, catabolism and homeostasis. 3. Know the properties and composition of key cellular molecules. 4. Know the structure and function of biological membranes, mechanisms of cellular transport and generation of action potential. 5. Know the mechanisms of cellular communication and signal transduction, including types of secreted signals, structure/function of various receptors, and key mechanisms by which the signal elicits a cellular response. 6. Know the growth factor signaling and the cell cycle; the terms oncogene and tumor suppressor. 7. Know the basic principles of transcription, organization of the animal genome, epigenetic regulation, and molecular mechanisms involved in embryonic development. 8. Know the basic stages of embryogenesis, and genesis of four basic tissues. 9. Know the identify by light and electron microscopy key components of animal cell structure, epithelial cell modifications, and structures/organs of the 10 mm embryo. Credits: 1.50

VCS 80110 - Veterinary Skills And Competencies I

Credit Hours: 2.50. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism, and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate basic safety, husbandry, and restraint of dogs, cats, food animals, and horses. 2. Demonstrate basic principles of hygiene and bio-security. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications per oz. to dogs, cats, food animals, and horses. 5. Demonstrate correct calculation of IV fluid dosing. 6. Demonstrate knowledge of basic medical equipment use. 7. Demonstrate knowledge of surgical instrumentation, needles, and suture material. 8. Demonstrate ability to perform complete basic physical examination of a dog, cat, food animal, and horse. 9. Demonstrate effective use of non-verbal communication. 10. Demonstrate an understanding of stress management techniques. 11. Demonstrate an understanding of social media's impact on a professional career and client relationships. 12. Demonstrate an understanding of the principles of collegiality with respect to competition and the impact of dishonesty in a professional setting. 13. Demonstrate an awareness of the risks for and methods for prevention of suicide. 14. Demonstrate an understanding of the definition of cyberbullying and methods to protect yourself. 15. Demonstrate an ability to manage conflict within the veterinary team. 16. Demonstrate an understanding of the laws and policies of veterinary medicine. 17. Demonstrate an understanding of USDA identification techniques. Credits: 2.50

VCS 80130 - Introduction To Population Medicine And Veterinary Ethics

Credit Hours: 2.00. This course will introduce first year veterinary students to the fundamental principles of population medicine. This will include concepts behind population versus individual animal medicine, population animal industries and their management practices, population animal diseases, outbreak investigation, regulatory medicine, and interactions between wild and domestic animals. Following an introduction to population medicine, students will shift to a discussion of veterinary ethics and its application to various animal industries. Students will explore basic concepts in animal use ethics and

welfare, ethical and moral reasoning, and critical thinking and problem solving in population medicine.

Learning Outcomes: 1. Develop an understanding of the concepts of population medicine and compare and contrast those to individual animal medicine. 2. Acquire a basic understanding of the production animal industries and management practices employed by those industries. 3. Attain a familiarity of the major disease challenges common to each of the animal populations presented. 4. Be able to intelligently approach a disease outbreak investigation and recommend sound basic sampling, management, and treatment options. 5. Understand and appreciate the role of regulatory medicine in disease control. 6. Understand and appreciate the wild and domestic animal interactions and challenges. 7. Review basic concepts in ethics of animal use and animal welfare science. 8. Illustrate how ethics and moral reasoning may be used to resolve contentious animal issues of relevance to veterinary medicine. 9. Develop skills in critical thinking and collaborative problem solving relative to population medicine. 10. Enhance information gathering, assimilation, and communication skills. Credits: 2.00

VCS 80140 - Fundamental Principles Of Comparative Nutrition

Credit Hours: 2.00. This course will cover fundamental aspects of comparative nutrition building on knowledge from veterinary comparative anatomy and physiology courses. Multiple species will be discussed to provide the student a broad-based foundational knowledge in key nutritional concepts, including feeds and feeding assessment and the animal's physiologic state/lifestage. The student will learn how physiologic status will impacts energy needs and nutritional adequacy, on an individual and/or group basis. The student will also develop skills in forage identification, pet food assessment, and when the individual/group is at risk of nutrient deficiency.

Learning Outcomes: 1. Discuss with the owner/client the nutritional assessment of the animal/herd, incorporating physiologic state and concerns involving environment, food, or feeding management. 2. Identify and assess common feeds and forages. 3. Explain the role of nutrition throughout the lifecycle for health to support growth, lactation, and gestation as well as adult maintenance to include aging. 4. Complete a nutritional history, whether herd or individual, to be used in assessment of health status and likelihood of risk for nutritional deficiencies or toxicities. 5. Calculate energy needs based on lifestage or physiologic status. 6. Perform assessment of pet foods to determine nutritional adequacy. 7. List the unique dietary requirements of small mammals and reptiles. Credits: 2.00

20 Credits

Spring 1st Year

BMS 81500 - Veterinary Neuroscience

Credit hours: 2.00. This course provides an introduction to neuroscience and its diagnostic application in veterinary medicine. Students will acquire terminology describing the anatomy and basic physiology that characterize neural systems. Integration of function/structure relationships will be introduced in lectures and laboratories, by reference to case studies, and by problem-solving.

Learning Outcomes: 1. Acquire of basic knowledge in neuroscience that will enable insightful diagnosis of diseases affecting the nervous system. 2. Know the parts of the nervous system described in each lecture/lab by their name, location, anatomic relationship to other parts and structures and their integrative function. Students will be able to describe how the nervous system of domestic mammals is organized and how these components contribute to nervous system function. 3. Acquire the ability to communicate this information effectively. 4. Know or logically theorize the physiological basis for any dysfunction that might arise due to specific

pathological processes and anatomical lesions in the nervous system. The student will begin to develop an appreciation for the clinical signs and altered behavior that occurs following damage to or disorders of nervous system components. 5. Provide an introduction to the utility of the basic Neurological Exam in the diagnosis of nervous system disease. Credits: 2.00

BMS 81200 - Physiology Of Domestic Animals II

Credit Hours: 4.00. Continuation of Physiology of Domestic Animals I (BMS 81100). Survey of the principles, concepts and mechanisms of physiological processes with special emphasis on interactions between large populations of cells, tissues, organ systems and integrated functions of domestic animals of importance to veterinary medicine. The organ systems covered are respiratory, renal, digestive, endocrine, and reproductive.

Learning Outcomes: 1. Regulation of functions of the lungs, kidneys, stomach, digestive system, endocrine glands & gonads. 2. Processes and regulation of gas exchange in the lungs. 3. Roles of electrolytes and the regulation of acid-base. 4. Regulation of physiological & biochemical processes in stomach, small and large intestines. 5. Hormonal regulation of metabolic processes. 6. Regulation of reproduction. Credits: 4.00

BMS 80800 - Veterinary Cell And Tissue Biology Design II

Credit Hours: 2.00. All lectures will focus on mammalian microanatomy with species differences and aim to include also a brief comparative description for Avian microanatomy when applicable. Structural and molecular basis of cellular processes that are the foundation of fertilization, embryogenesis, histogenesis, and basic tissue specialization in domesticated animals. Structure and function of macromolecules and organelles that mediate signal transduction, differentiation, and integration within a whole animal.

Learning Outcomes: 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine; 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine. 2. An understanding of the relationship of development to normal microscopic structure. 3. An understanding of the molecular mechanisms of fundamental biological phenomena that signal and result in expression of the structures that underlie normal development and cellular physiology. 4. An understanding of the relationships of cellular organelles and inclusions to tissue, organ, and whole-animal physiology. 5. The skills to effectively use the light microscope for critical observation, analysis, and identification of cell, tissue, organ, and embryonic microstructure. 6. An awareness of selected species characteristics as well as structural variation representing physiology, artifact, gerontology, and pathology. 7. An awareness of significant links of cellular and tissue design to other disciplines of veterinary medicine and biomedical sciences. 8. An appreciation of the utility and necessity of the active learning process for developing and maintaining competency as a veterinarian and/or biomedical scientist. Credits: 2.00

BMS 80200 - Comparative Anatomy

Credit Hours: 4.00. A comparative study of the body systems and the topographic relationships of the major domestic species. This course is an extension of BMS 80100 and will continue to build on anatomical knowledge so that it may be applied to multiple domestic species.

Learning Outcomes: 1. Describe major anatomical principles of structure and function and identify and describe major anatomical structures which are common among domestic species; demonstrate the ability to translate and apply that knowledge to other species. 2. Use specific topographical and palpable landmarks in horses, ruminant species, and pigs to locate clinically important underlying structures and viscera for purposes of physical examination, imaging and other diagnostics, and therapeutic

procedures. 3. Be able to identify major and clinically important anatomical structures on skeletal and other anatomical models; radiographs; cadavers; and live domestic animals (horses, ruminant species, pigs). 4. Identify and describe the major structural components of birds, using domestic poultry as a model, and demonstrate an understanding of structure-function inter-relationships in the avian body. Credits: 4.00

CPB 85300 - Principles Of Veterinary Immunology

Credit Hours: 2.00. An overview of the fundamental concepts of immunology, with an emphasis on the immune system of domestic animals and comparative immunology. Focuses on the interactions between the host and microbial pathogens and on mechanisms that underlie hypersensitivity reactions, autoimmune diseases, and immune deficiencies. Discusses the principles of vaccination and serologic tests.

Learning Outcomes: 1. Explain the basic principles by which the immune system functions. 2. Describe the mechanisms by which the immune system protects the host against infectious diseases and can be mobilized to treat cancer. 3. Explain the role of aberrant immune responses in hypersensitivity reactions, allergies and in autoimmune diseases. 4. Outline the immunological principles of vaccines and vaccination. 5. Identify the principles of immunoassays. 6. Explain the mechanisms of action of drugs that inhibit immune responses and drugs that target specific immune mechanisms. Credits: 2.00

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VM 83000 - Applications And Integrations II

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials and research problems. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include material from VM 82000 and other current DVM courses (anatomy, physiology, etc.).

Learning Outcomes: 1. Improve the student's retention of learned information and continue to build a working knowledge base that the student will expand and utilize to solve clinical problems throughout his/her career. 2. Increase the students responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem

early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis-formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills including utilizing appropriate resources to adequately. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VCS 80120 - Veterinary Skills And Competencies II

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate competency in the advanced restraint of dogs, cats, food animals, and horses. 2. Demonstrate basic safety, husbandry, and restraint of avian and exotic species. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses. 5. Demonstrate ability to safely and appropriately perform jugular venipuncture of cats, dogs, food animals, and horses using models. 6. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a cat, dog, food animal, and horse. 7. Demonstrate ability to perform a FNA and prepare a slide for cytology. 8. Demonstrate ability to collect specimens for diagnostic lab submission. 9. Demonstrate ability to operate radiographic equipment. 10. Demonstrate ability to position for abdominal radiographs in small animals. 11. Demonstrate ability to perform PCV/TP, blood glucose, I-Stat, and USG diagnostics. 12. Demonstrate ability to create understandable discharge instructions which foster client compliance. 13. Demonstrate an understanding of student loan information and re-payment options. 14. Demonstrate effective communication within the veterinary team. 15. Demonstrate effective communication with owners about finances and be able to provide estimates for medical recommendations. Credits: 2.00

18 Credits

Fall 2nd Year

CPB 85500 - Veterinary Hematology And Cytology

Credit Hours: 2.00. Provides an overview of veterinary hematology and cytology. Normal morphology and function of the cells of the hematopoietic system are reviewed. Laboratory analyses of the different cell types are discussed. The responses of the hematopoietic cells that can be seen during different disease processes are presented. Fundamentals of veterinary diagnostic cytology are introduced.

Learning Outcomes: 1. Explain the development of hematopoietic cells, their function, and control of hematopoiesis, emphasizing features and growth factors that are clinically significant. Apply these concepts, in conjunction with clinical & physical findings, to interpret laboratory data (CBC and bone marrow findings). 2. Name and explain the characteristic

findings or 'patterns' anticipated on CBC and bone marrow response for common hematologic disorders in domestic animals and their etiology. 3. Discuss the characteristic features of reactive (benign) and malignant disorders of red blood cells, white blood cells, and platelets with respect to their diagnosis, etiology, and prognosis. 4. Develop microscopic skills including estimating cell density or counts and identification of normal and abnormal blood cells, morphologic changes and inclusions within these cells. 5. Demonstrate use microscope to evaluate a cytology specimen. Describe features that suggest an inflammatory, hyperplasia, versus a specific neoplasia process. Explain the type of inflammatory response seen with various infectious or non-infectious etiologies and be able to identify agents. Observe and describe general cytologic features of malignancy and of different malignant cell populations (round cell, mesenchymal, or epithelial). Credits: 2.00

CPB 85100 - General Pathology

Credit Hours: 3.00. An overview of the basic cellular reactions that develop in response to injurious agents. Focuses on the gross and microscopic alterations in tissues, events leading to the development of those alterations, and the consequences of those changes on the health of animals. Includes degenerative, necrotic, inflammatory, and neoplastic changes in various animal species.

Learning Outcomes: 1. Understand the events involved in the development and outcome of disease in animals. 2. Master a medical vocabulary, by using the language of medicine and pathology in both written and oral forms. 3. Recognize diseased tissue both grossly and microscopically, offer a reasonable explanation of the sequence of events that led to the development of these tissue changes, and predict the effect of these changes on the life of the host. 4. Identify the types of injury that may affect the host and describe the range of pathologic alterations that occur in response to these injuries. 5. Develop diagnostic thinking skills and learning skills. 6. Recognize the importance of a solid knowledge of pathology as a basis for veterinary medicine and surgery, and other fields of veterinary medicine. 7. Observe examples of normal and diseased organs and tissues. 8. Learn to use medical terminology (including pathologic terms) in an appropriate manner. 9. Examine examples of the histopathologic alterations discussed in lecture. 10. Use of histopathology as a basis for inquiry on various aspects of a disease or pathologic condition. 11. Correlate gross pathologic lesions with the expected microscopic alterations. (Describe the anticipated microscopic lesions, if given the gross alterations and vice versa.) Credits: 3.00

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VM 84000 - Applications And Integrations III

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues,

resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include materials from previous classes (VM 82000/83000 and other freshman DVM courses) as well as the current DVM coursework (hematology, parasitology, bacteriology, pharmacology and pathology).

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

BMS 81401 - Pharmacology Principles And Applications

Credit Hours: 4.00. This is the first of two pharmacology courses in the DVM curriculum. The first part of this course encompasses an introduction to basic concepts necessary to understand and optimally administer and deliver therapeutic drugs, such as pharmacokinetics, pharmacodynamics, dose forms, dosing regimen and prescriptions. In the second part of the course, drugs are studied not only based on their pharmacological class, but also based on the organs and systems on which they act (e.g., heart and vascular system, lungs, autonomous neuronal pathways, respiratory system, endocrine system, etc.). This course also covers the pharmacology of cancer therapy and drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics). Journal club sessions are included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make informed decisions regarding administration (dosage, duration of treatment, combination with other drugs) of a class of drugs or a specific drug as appropriate, depending on the patient's vital and pathological characteristics and mechanisms of action of specific drugs or drug classes. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Discuss how drugs used for a particular disease might have an impact on the development of another disease. 5. Discuss the principles and issues behind drug tolerance and addiction and the risk of abuse. 6. Explain the methods of drug delivery developed to reduce drug toxicity and/or improve efficacy. Credits: 4.00

VCS 80210 - Veterinary Skills And Competencies III

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses (using cadavers). 2. Demonstrate safe and appropriate jugular and peripheral venipuncture of dogs, cats, food animals, and horses (using models). 3. Demonstrate ability to collect and submit venous samples for hematology and chemistry. 4. Demonstrate ability to collect and submit voided urine samples. 5. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a dog, cat, food animal, and horse. 6. Demonstrate ability to perform a cardiologic examination in dogs, cats, food animals, and horses. 7. Demonstrate ability to perform a neurologic examination in dogs, cats, food animals, and horses. 8. Demonstrate four techniques for oxygen administration. 9. Demonstrate ability to correctly and aseptically place an IV catheter (in models) of large and small animals. 10. Demonstrate intubation of dogs and cats. 11. Demonstrate understanding of regulatory paperwork, the completion of the USDA accreditation modules, and the ability to perform tuberculosis and brucellosis testing. 12. Demonstrate ability to measure systemic blood pressure using both Doppler and oscillometric techniques. 13. Demonstrate ability to perform a bone marrow aspirate and bone marrow core biopsy. 14. Demonstrate ability to correctly set up and position for thoracic radiographs. 15. Demonstrate ability to complete one- and two-hand ties, instrument ties and square knots. 16. Demonstrate ability to prepare Diff-quick staining on cytologic samples. 17. Demonstrate understanding of the principles of OR conduct and correct gowning and gloving protocols. 18. Demonstrate ability to measure SpO2 via pulse oximetry. 19. Demonstrate ability to perform a diagnostic and 10 lead EKG. 20. Demonstrate appropriate telephone communication and etiquette with owners and fellow veterinarians. 21. Demonstrate understanding communication strategies to improve treatment compliance. 22. Demonstrate understanding of their personal credit score-both its calculation and impact. 23. Demonstrate knowledge of Veterinary Teaching Hospital protocols for patients in ICU and wards. 24. Demonstrate understanding of the use of the Omincell. 25. Demonstrate ability to complete patient rounds with ICU technicians. 26. Demonstrate knowledge of Veterinary Teaching Hospital and Animal Disease Diagnostic Lab forms and protocols for sample submission. 27. Demonstrate ability to perform and interpret SNAP tests. 28. Demonstrate ability to complete drug calculations, write prescriptions for medications, and write a veterinary feed directive. Credits: 2.00

CPB 85204 - Veterinary Parasitology

Credit Hours: 3.00. Covers the important helminth, protozoal and arthropod diseases of animals. Emphasis is placed on the pathogenesis, epidemiology, clinical features, diagnosis, control, and zoonotic implications of protozoal and arthropod infections in this semester of the course.

Learning Outcomes: 1. Master a medical terminology for parasites, by using the language of medicine, pathology and parasitology in both written and oral forms. 2. Understand general aspects of veterinary parasitology including life cycles, pathogenesis, diagnostic methods, and anthelmintic drugs. 3. Explain how the important

parasites are transmitted and maintained in nature and/or domestic environments. 4. Identify the types of clinical problems and pathology caused by the various parasites and be able to explain the basic pathogenesis of these changes for the parasites. Correlate clinical and gross and microscopic pathologic findings due to these parasites. 5. For important parasites, predict the clinical presentation if given the pathologic lesions. Identify the expected pathologic lesions if given the clinical presentation. 6. Recognize important parasites grossly and/or microscopically, focusing especially on clinical parasitology diagnostics, i.e. recognition of helminth eggs, larvae, cysts, oocysts, etc. in fecal or other samples. 7. Explain the methods and rationale for treatment and control of parasitic infections. 8. Understand the zoonotic importance of certain parasites, and how they are dealt with from a veterinary public health standpoint. 9. Develop diagnostic thinking skills, computer literacy skills, and learning skills. 10. Recognize the importance of a solid knowledge of parasitology in the practice of veterinary medicine and surgery, and other fields of veterinary medicine. Credits: 3.00

CPB 85603 - Veterinary Bacteriology And Mycology

Credit Hours: 3.00. An overview of bacterial and fungal pathogens of veterinary species. Topics will include discriminating features of the organisms, the pathogenesis of diseases caused by these agents, diagnostics, management and therapeutics.

Learning Outcomes: 1. Compile a list of differential diagnoses based on clinical presentation and signalment. In other words, associate specific bacterial and fungal agents with animal species and affected body sites. 2. Evaluate the properties of organisms (Gram pos/neg; Cocci/rod; Anaerobes/aerobes, etc.) on the differential diagnoses list in order to develop a diagnostic plan. 3. Describe laboratory test methods used in diagnosis of bacterial and fungal diseases. 4. Recognize bacterial and fungal pathogens that are zoonotic or reportable. 5. Outline the pathogenesis of an organism from the host encounter, entry/multiplication/spread to damage to the host. 6. Understand basic mechanisms of action, basic spectrum of activity, and major safety and legal concerns of antibacterial and antifungal therapeutics and disinfectants. 7. Select appropriate therapy and control/prevention based on understanding of pathogens and therapeutic agents. Credits: 3.00

19 Credits

Spring 2nd Year

CPB 86900 - Veterinary Public Health And Zoonoses

Credit Hours: 2.00. A survey of fundamental topics on diseases that are caused by viral, bacterial, rickettsial, and parasitic agents and are known to be transmissible from animals to humans, as well as those diseases that are common to humans and animals. Topics emphasize the epidemiology and methods for prevention and control of these diseases in animal and human populations. Food safety and foodborne diseases, with particular emphasis on foods of animal origin, are discussed. Risk assessment of occupational and environmental health conditions to which veterinarians are likely to be exposed in training or the workplace also is covered.

Learning Outcomes: 1. Identify and mitigate risks to human and animal health encountered by the veterinary profession and by others through direct and indirect animal contacts (e.g., food, meat, milk). 2. Communicate about risks pertaining to environmental hazards and zoonotic diseases to professional and lay audiences. 3. Evaluate data and scientific reports related to one health critically. 4. Identify emerging and exotic diseases of animals and understand appropriate responses to them. Credits: 2.00

CPB 86100 - Veterinary Clinical Chemistry

Credit Hours: 2.00. Laboratory techniques and interpretation of laboratory data as profiled by organ system are presented. Integration of data to explain pathophysiologic changes as an aid to diagnosis, prognosis and progression of disease is emphasized.

Learning Outcomes: 1. Organize routine tests appropriately into diagnostic profiles that best characterize abnormalities in acid-base, the urinary system, the hepatobiliary system, exocrine pancreas (pancreatitis), muscle, endocrine pancreas, adrenal gland, thyroid gland and parathyroid gland. 2. Describe relevant physiology for each test involved in biochemical profiling, describe relevant mechanisms for alterations from normal, list differentials and prioritize differential lists based on other laboratory and clinical information. 3. Recommend follow-up testing that may lead to a definitive diagnosis where appropriate. 4. Integrate CBC data interpretations (e.g., from CPB 85500 - Veterinary Hematology & Cytology) with biochemical profiling results. 5. Characterize and diagnose disorders of hemostasis based on integration of clinical findings with hemostasis-specific and associated laboratory testing. The student will be able to: Explain the physiology of primary, secondary, & tertiary hemostasis, and anticoagulation, including the correct association of the "key elements" of hemostasis with each process; Correctly associate assays for hemostasis with the stage/process that they evaluate and interpret abnormal results. Credits: 2.00

CPB 86000 - Veterinary Virology

Credit Hours: 3.00. Principles of medical virology and discussions of important viral diseases of animals.

Learning Outcomes: 1. Know the definition of the diseases. 2. Describe brief history of the disease including current geographical distribution and importance. 3. Describe the virus as to classification, host range, important aspects of replication, and resistance to environment. 4. Outline the signs of the disease. 5. Understand pathogenesis, distribution and fate of virus, immunological responses. 6. Provide description of important gross and histological lesions that may explain pathogenesis. 7. Understand methods used to make presumptive and specific diagnoses. 8. Describe epidemiology - important methods of spread, vectors if involved, seasonality, etc. 9. Describe immunity - as it relates to vaccination, types of vaccines, and their use. 10. Recognize public health significance, if any. 11. Control of the disease including area (state, national, or international) control programs and "on the farm" control where pertinent. Credits: 3.00

CPB 85700 - Veterinary Systemic Pathology

Credit Hours: 5.00. Provides coverage of system specific pathologic terminology and characteristic pathologic responses of the various body systems to injury. This is followed by presentation of representative examples of diseases of various etiologies, including, but not limited to, infectious and noninfectious diseases.

Learning Outcomes: 1. Recognize and describe diseased tissue grossly and microscopically, explain the sequence of events in the development and outcome of observed lesions, explain the interplay among different organs or tissues, and predict the effect of the response to injury on the host. 2. Correlate clinical and pathologic findings. Predict the organ/tissue site and nature of expected lesions when given the clinical presentation. Predict clinical signs when given the gross or microscopic lesions. 3. Correlate gross lesions (or lack thereof!) with histologic, cytologic, and molecular changes. 4. Categorize lesions as degeneration or necrosis, inflammation, circulatory disturbance, or disturbance of growth. Recognize that a given lesion may (and often does) fall into more than

one category. 5. Formulate a logical and practical differential diagnosis based on the host signalment, the affected organ or tissue, the lesion categorization, and environmental influences (risk factors, seasonal or geographical influences, etc.). Credits: 5.00

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

CPB 81900 - Veterinary Toxicology

Credit Hours: 2.00. This course will provide an introduction to small and large animal toxicology. It will cover the most common toxicoses encountered in veterinary medicine with emphasis on recognizing clinical signs of toxicoses, discerning differential diagnoses for these cases, and assigning appropriate diagnostic tests. Prerequisites: Completion of first year in the DVM program.

Learning Outcomes: 1. Recognize the most common toxicoses encountered in veterinary toxicology. 2. Identify sources of exposure for the most common toxicoses encountered in veterinary toxicology. 3. Explain the mechanisms of toxicity for the most common toxicoses encountered in veterinary medicine. 4. Identify the best samples to submit for diagnostic toxicology tests. 5. Formulate differential diagnoses for toxicoses based on clinical signs, blood chemistries, and diagnostic tests through critical thinking. 6. Explain the typical treatments (symptomatic and supportive) and antidotes that can be given to animals exposed to toxins/toxicants. Credits: 2.00

BMS 81600 - Applied Pharmacology II

Credit Hours: 1.50. This DVM curriculum course covers drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics), and drugs for immunomodulation and cancer therapy. New topics are introduced according to upcoming developments in drug use such as pharmacogenomics. A journal club session is included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make an informed decision regarding the administration (dosage, duration of treatment, combination with other drugs) of a class of drugs or a specific drug as appropriate, depending on the patient vital and pathological characteristics. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Understand, anticipate and resolve (whenever possible) resistance to drugs. 5. Apply principles behind the interaction between environment and the organism that guide precision medicine. Credits: 1.50

VCS 80220 - Veterinary Skills And Competencies IV

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via IV to dogs, cats, food animals, and horses. 2. Demonstrate ability to perform biopsies of dogs, cats, food animals, and horses and to submit specimen to the diagnostic laboratory. 3. Demonstrate ability to perform basic regional anesthetic techniques. 4. Demonstrate understanding of the anatomy of, types of, and testing of anesthetic machines. 5. Demonstrate understanding and use of various feeding tubes in small animals. 6. Demonstrate ability to properly position small animals for radiographs of limbs. 7. Demonstrate ability to correctly operate fluid and syringe pumps. 8. Demonstrate understanding of FAMACHA scoring. 9. Demonstrate ability to place nasal oxygen cannula, perform nebulization, and coupage. 10. Demonstrate ability to perform end-tidal CO2 monitoring. 11. Demonstrate ability to pass orogastric tubes and esophageal feeders on ruminant models. 12. Demonstrate ability to perform injections and venipuncture on live animals both small and large. 13. Demonstrate ability to establish rapport with a client in an emergency situation. 14. Demonstrate ability to communicate appropriately in situations involving ethical issues. 15. Demonstrate understanding of educational debt to income level and options to manage educational debt repayment. 16. Demonstrate understanding of appropriate reporting of reportable diseases and foreign animal disease investigations. Credits: 2.00

CPB 85401 - Epidemiology And Evidence-Based Veterinary Medicine

Credit Hours: 2.00. The fundamentals of descriptive and analytical epidemiology will be developed as they relate to problems in veterinary and comparative medicine. A primary goal of the course is to expose future health professionals to the information and thought processes that are essential for critically evaluating the medical literature and for making decisions regarding health care for individuals and populations.

Learning Outcomes: 1. Characterize different epidemiological study designs, including experimental studies, clinical trials, and commonly used observational studies such as cross-sectional, cohort, and case-control studies. 2. Interpret basic epidemiologic measures, including prevalence and incidence measures for disease occurrence and ratio and difference measures for association. 3. Implement causal thinking by assessing potential bias, confounding and random error. 4. Understand basic terminology of infectious disease epidemiology. 5. Understand methods of disease surveillance and their corresponding strengths and weaknesses 6. Describe the steps in an outbreak investigation. 7. Define sensitivity, specificity, false positive fraction and false negative fraction and use them to compare discriminative performance of different diagnostic tests. 8. Interpret numeric results commonly presented in journal articles such as odds ratio, 95% CI, and p-value. 9. Critically appraise evidence presented in clinical studies and scientific research articles. Credits: 2.00

19.5 Credits

Fall 3rd Year

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to

veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VCS 80310 - Veterinary Skills And Competencies V

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective compassionate communication with clients about euthanasia. 2. Demonstrate ability to pass nasoesophageal, nasogastric, orogastric, and esophageal feeders in various species. 3. Demonstrate ability to safely perform enteral feeding with a syringe and syringe pump. 4. Demonstrate ability to perform equine dental examination and dental float. 5. Demonstrate ability to administer, monitor, and prepare transfusions with various blood products. 6. Demonstrate ability to place intraosseous and multiple lumen jugular catheters in small animals. 7. Demonstrate ability to perform urinary catheterization and use a closed urinary collection system. 8. Demonstrate ability to perform a complete ophthalmic examination in dogs, cats, food animals, and horses. 9. Demonstrate ability to perform a complete orthopedic examination in small animals. 10. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 11. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 80610 - Small Animal Medicine I

Credit Hours: 3.50. This course is the first in a series that provides an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 3.50

VCS 80630 - Small Animal Surgery

Credit Hours: 2.50. This course will teach basic surgical principles applicable across species such as suture materials and patterns and principles of hemostasis. Common surgical diseases affecting the various body systems of dogs and cats will be discussed with a focus on pre- and postoperative care. Routinely performed surgical procedures (neuter, spay, C-section) will be discussed. Orthopedic topics will include bone healing, management of musculoskeletal trauma, fracture management, and fundamentals of external and internal fracture stabilization techniques for dogs and cats. The course will conclude with discussions of select musculotendinous conditions, principles of amputation and joint and limb salvage, and an introduction to principles of physical therapy.

Learning Outcomes: 1. Explain correct preparation of the surgical site, draping and procedures for maintaining aseptic technique. 2. Identify commonly used surgical instruments, suture materials, and suture patterns and explain the indications for their use. 3. Explain the indications, procedures and complications of

surgical procedures common in general practice such as ovariectomy, ovariohysterectomy, castration, cesarean-section/hysterotomy, enterotomy, gastrotomy, and cystotomy. 4. Recognize the clinical signs associated with common surgical diseases of the upper airway, ear, gastrointestinal tract, and urinary tract and formulate appropriate diagnostic and treatment plans. 5. Explain principles for surgical management of tumors. 6. Recognize different types of wounds and recommend appropriate steps for initial wound management. 7. Describe the process of bone healing and explain the principles of fracture fixation to optimize bone healing. 8. Describe fractures based on type, classification and location. 9. Explain the diagnosis, perioperative management, and treatment options for common fractures and joint injuries involving appendicular bones and mandible. 10. Formulate a diagnostic plan for common orthopedic diseases. 11. Explain the etiology, pathophysiology, diagnosis, and medical and surgical treatment of developmental and degenerative joint diseases of dogs. 12. Explain the etiology, pathophysiology, diagnosis, and treatment of developmental and acquired multicentric diseases of the long bones of dogs. 13. Explain the etiology, pathophysiology, diagnosis, and treatment of more common musculotendinous conditions. 14. Explain the indications, principles and anticipated outcomes for amputations, arthrodesis, and limb salvage procedures. 15. Describe the basic principles, modalities, goals, and anticipated outcomes of current physical therapy and rehabilitation therapies. Credits: 2.50

VCS 80910 - Food Animal Medicine

Credit Hours: 4.00. This course focuses on the major infectious, metabolic, and parasitic diseases of ruminants, camelids, swine, poultry and other avian flocks. The pathogenesis, diagnosis, and treatment of these conditions or syndromes will be reviewed. Additionally, the course will cover proper management, including vaccinations and animal husbandry, to prevent the development of these conditions.

Learning Outcomes: 1. List the names of the common diseases of ruminants, the causal agent(s) or predisposing factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems in ruminants/camelids. 3. Describe management changes or therapeutic methods that are used to treat and control common diseases of ruminants. 4. Discuss the important issues of food safety, quality assurance, and health regulations as they relate to the ruminant industries. Swine 5. List the names of the common diseases of swine and their causal agent(s), predisposing factors, and where possible, underlying mechanisms. 6. Develop a differential diagnosis list and select a suitable diagnostic plan to determine the definitive diagnosis. 7. Describe management changes or therapeutic methods to prevent, control, and treat common swine diseases/problems. Poultry 8. Provide students with a basic practical knowledge of avian medicine. After completing this course, students are expected to be able to: 9. Identify the economical and public health diseases of flocks. 10. Identify the proper diagnostic tests needed to diagnose each disease. 11. Explain the economic and public health consequences of each disease. 12. Design treatment and prevention strategies for each disease. Credits: 4.00

VCS 81410 - Comparative Theriogenology

Credit Hours: 2.00. This course develops a broad clinical knowledge of common reproductive management strategies and clinical conditions associated with reproduction in the major domestic species. It provides information and strategies for the conduct of breeding soundness examinations and infertility work-ups in the male; estrous cycle characteristics, diagnostics and control in females; breeding management strategies,

pregnancy diagnosis, and management of gestation; investigation and control strategies for pregnancy loss; management of parturition and treatment of dystocia; normal postpartum changes and diseases of the peripartum period and the pathophysiology and treatment of uterine infections. Material will be presented in both comparative and species-specific manner. Students should review reproductive anatomy and physiology notes in preparation for this course.

Learning Outcomes: 1. Be conversant with core reproductive principles of all major species (bovine, equine, small animals with canine as the model, porcine, small ruminants). 2. Understand similarities and differences in the physiological basis of key reproductive events across species. 3. Integrate knowledge from various disciplines to understand clinical situations pertaining to the reproductive health of animals on an individual or herd basis. 4. Understand the pathophysiology, clinical presentations, therapies, and prognoses for clinical issues pertaining to the reproductive health of animals on an individual or herd basis. Credits: 2.00

VCS 80801 - Equine Medicine

Credit Hours: 2.50. Core course focused on the major equine diseases and preventive medicine/herd health (biosecurity, vaccination, parasite control, dental disease). The course will cover pathogenesis, diagnosis, and treatment/management of these conditions or syndromes.

Learning Outcomes: 1. List the names of the common diseases affecting equines, the causal agent(s) or predisposing/risk factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems affecting equines. 3. Identify clinically relevant and practical management changes or therapies that are used to treat and control common diseases of equines. 4. Formulate a biosecurity plan for a farm dealing with an outbreak of a contagious equine disease. 5. Critically evaluate current literature and apply evidence-based medicine (EBM) to equine cases and clinical decision making. Credits: 2.50

VCS 81101 - Small Animal Surgery Lab I

Credit Hours: 1.50. Introduction to basic skills in surgery and anesthesia. Models are used to learn basic skills of instrument use, ligation, dissection, and suturing. Students will progress to common anesthetic and surgical procedures on live and cadaver animals. The live animal surgery will teach physical examination, formulating an anesthetic plan, anesthetic induction, maintenance and recovery, as well as feline spay and neuter.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Scrub, gown and glove correctly, and maintain aseptic technique in the operating room. 5. Prepare the surgical site and drape correctly. 6. Name and correctly use each general surgical instrument. 7. Efficiently perform one-handed ties, two-handed ties, and instrument ties to make square knots. 8. Correctly place basic suture patterns. 9. Correctly and gently handle tissues and apply appropriate hemostatic techniques. 10. Open the abdomen through a ventral midline abdominal incision and close it properly. 11. Correctly and safely perform ovariohysterectomy and castration in cats. 12. Perform the emergency procedures of chest tube placement and tracheotomy tube placement. 13. Induce and maintain general anesthesia and monitor the anesthetized patient. 14. Safely recover an animal from general anesthesia. 15. Perform cardiopulmonary resuscitation. 16. Administer postoperative care, including analgesic therapy, and detect postoperative complications. 17. Keep appropriate medical records. Credits: 1.50

VCS 81201 - Principles Of Veterinary Anesthesiology

Credit Hours: 2.00. Introduction to basic principles of anesthesiology. Pharmacology of anesthesia and analgesic drugs, anesthetic equipment, monitoring, regional and local anesthetic techniques, pain management and anesthesia care of multiple species and special disease considerations will be covered.

Learning Outcomes: 1. Learn the pharmacology and clinical effects of (and indications and contraindications for) common preanesthetic agents, including anticholinergic agents, tranquilizers and sedatives. 2. Learn the basic principles of general anesthesia of small and large animals. 3. Understand the pharmacology and clinical effects of (and indications and contraindications for) various injectable and inhalant anesthetics. 4. Learn the principles of local and regional anesthesia and understand how they are applied in the clinical setting. To learn the pharmacology of local anesthetic drugs 5. Learn how to evaluate a patient preoperatively and determine the appropriate choice of anesthetic, monitor the patient during general anesthesia and recovery, and recognize and treat emergencies. 6. Learn anesthetic techniques suitable for a variety of species and how to apply them in various clinical settings. 7. Learn how to anesthetize patients with a variety of medical conditions. 8. Learn the principles of pain management and apply them to a variety of clinical situations. Credits: 2.00

20 Credits

Spring 3rd Year

VCS 81500 - Ophthalmology

Credit Hours: 1.00. This course is an introduction to veterinary comparative ophthalmology. It covers the anatomy of the eye, diagnosis, pathophysiology, and treatment of the ocular diseases commonly seen in companion and food animal species: canine, feline, equine, avian, bovine, caprine, ovine, porcine, lagomorphs. Covers pharmacology as it relates to medications used to treat ocular disease.

Learning Outcomes: 1. Acquire basics of normal ocular anatomy and physiology, common ophthalmic diseases in all species for general practice, including their pathophysiology clinical presentations, therapies, and prognoses. 2. Become familiar with ophthalmic terminology. 3. Gain a basic knowledge of the diseases of the anterior and posterior segments of the eye, the eyelids, and the globe. 4. Use correct ophthalmic terminology to describe ocular conditions. 5. Recognize common ocular conditions involving the adnexa, globe, and orbit. 6. Create a list of differential diagnoses for the conditions covered in class. 7. Determine appropriate diagnostic plans for the conditions covered in class. 8. Determine appropriate treatment plans and give an accurate prognosis for the conditions covered in class. 9. Learn the ocular medications listed on the ocular pharmacology sheet handed out in class and will know indications, contra-indications, and frequency for all medications. Credits: 1.00

VCS 81700 - Achieving Success In Private Practice

Credit Hours: 1.50. Provides a foundation for the application of practice management principles. Focuses on operations management, financial management, human resource management, and marketing management.

Learning Outcomes: 1. Improve communication skills - clients, staff, public speaking, listening, team building. 2. Gain financial skills - personal (financial awareness, educational debt management) and business (cost controls, compensation). 3. Increase career skills - interviewing, resume development, job search, jurisprudence of the profession. 4. Gain business skills - value management, marketing techniques, human resources, inventory. 5. Develop risk management skills - establishing policies/practices consistent with medical laws, practice best practices to ensure patient safety (i.e., appropriate medication calculations/dosing

and administration). Credits: 1.50

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VCS 80620 - Small Animal Medicine II

Credit Hours: 1.50. This is the second course in a series providing an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 1.50

VCS 80920 - Large Animal Surgery

Credit Hours: 2.50. This course will cover the core fundamentals of surgical diseases of multiple large animal species, including the horse, bovine, small ruminants and camelids. Case management approaches are utilized to provide examples of disease conditions affecting these large animal species.

Learning Outcomes: 1. Present core large animal surgical diseases of horses, cattle, small ruminants, pigs, and camelids. 2. Present surgical management of large animal diseases. Credits: 2.50

VCS 81210 - Small Animal Primary Care And Wellness

Credit Hours: 2.00. This course will discuss conditions that are commonly treated in small animal primary care practice. Topics will include wellness and preventative care for dogs and cats at all lifestages, dental care, diagnosis and management of common oral and skin diseases, and emergency medicine. Humane euthanasia and palliative care will also be discussed.

Learning Outcomes: 1. Explain the role the primary care veterinarian has developing and implementing lifestage wellness programs. 2. Describe the key goals of a wellness program for each lifestage. 3. Describe vaccine and infectious disease screening programs for both cat and dog including available preventative medications. 3. Demonstrate standard procedure for oral evaluation, oral care to include dental cleaning and extractions. 4. Recognize common dermatologic diseases in the dog and cat and describe treatment to resolve these medical problems. 5. Demonstrate common dermatologic diagnostics procedures. 6. Explain key concepts of companion animal patients presenting as a primary care emergency patient: shock, coagulation abnormalities, oxygenation abnormalities, and sepsis. 7. Solve common fluid therapy problems addressed in both primary care hospitals and in primary care emergency practices. 8. Explain key concepts of palliative care, humane euthanasia, and

natural death. Credits: 2.00

VCS 80320 - Veterinary Skills And Competencies VI

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective communication regarding medical errors. 2. Demonstrate ability to perform transtracheal wash in small animals. 3. Demonstrate ability to perform a dermatologic exam and intradermal skin testing in large and small animals. 4. Demonstrate ability to perform ultrasound examinations of limbs. 5. Demonstrate ability to perform ultrasound guided cystocentesis. 6. Demonstrate ability to perform abdominocentesis, periocardiocentesis, and thoracocentesis in large and small animals. 7. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 8. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 81802 - Small Animal Surgery Laboratory II

Credit Hours: 1.50. This course will build on VCS 81100 by emphasizing the importance of proper basic surgical skills (instrument carriage, suturing, knot tying). Surgical skills will be expanded by performing several procedures on cadaveric tissue: abdominal approaches, gastrointestinal surgery, urogenital surgery, wound management, amputations. One lab will be dedicated to ophthalmologic procedures. Ovariohysterectomies and castrations will be performed on live dogs and cats to further develop the students' surgical skills as well as skills in physical examination, formulating an anesthetic plan, anesthetic induction, maintenance & recovery and postoperative care.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Safely perform elective surgery on patients using aseptic techniques for surgeon and patient, gentle tissue handling and dissection, secure vessel ligation, good hemostasis and appropriate suturing technique and patterns; and instrument carriage. 5. Be proficient at opening and closing abdominal incisions. 6. Explain common soft tissue surgical procedures performed in small animals. 7. Safely anesthetize, monitor and recover a small animal patient from anesthesia. 8. Explain the indications and general techniques for basic ophthalmic procedures. Credits: 1.50

VCS 82701 - Diagnostic Imaging

Credit Hours: 3.00. This course covers basic mechanisms of image generation and interpretation. The first half of the course deals with principles of image formation and the introduction to advanced imaging modalities. A synopsis of the principles of radiobiology and radiation safety is offered. The second part of the course features imaging interpretation based on previously mastered imaging principles. The third part of the course builds the foundation of film reading and interpretation such as radiographic anatomy and radiographic signs of specific disease conditions. This course serves as a foundation for the fourth-year diagnostic radiology rotation.

Learning Outcomes: 1. Describe the basic operation of an x-ray machine, including the components of the x-ray tube. 2. Understand the relationship of kVp, mAs and exposure time to x-ray production. 3. Know the fundamental properties of x-rays and gamma rays. 4. Know technical factors that affect detail, density, distortion and contrast in the generation of the x-ray image. 5. Know the reason for using a grid and the construction of a grid. See textbook. 6. Understand the terms latitude and scale of contrast as they relate to radiographic exposure. 7. Describe the differences between and applications of medium (par), high speed and slow speed intensifying screens. 8. Know the advantages and disadvantages of using digital versus conventional radiography. 9.

Know the basics of analog radiographic processing-what happens during development, rinse, fixation and washing. 10. Know the common artifacts that are produced in the darkroom, i.e., fixer versus developer spills, exhausted developer, static electricity, light leakage, improper temperature or mixing of chemicals and screen-based problems. See textbook. 11. Be familiar with the basic radiation protection measures used by veterinary workers. 12. Know the major effects (cancer induction, teratogenesis, etc.) of ionizing radiation and cellular mechanisms (free radical production, DNA damage, and mutation) involved in radiation injury. 13. Have a working knowledge of how an ultrasound machine functions and how ultrasonic images are interpreted (terminology). 14. Be familiar with imaging principles and advantages of nuclear medicine imaging. 15. Understand the difference between CT and MR imaging, and their relative indications in veterinary medicine. 16. Know the advantages and disadvantages of CT and MR imaging over radiography. 17. Know which imaging modalities are used to provide physiologic information. 18. Know how to name x-ray projections. 19. Understand the concept of "windowing" as it relates to digital forms of imaging. 20. Understand differences between file types for digital imaging, e.g., DICOM (.dcm), TIFF (.tif), JPEG (.jpg). 21. Recognize abnormal radiographic findings of commonly seen disease conditions in small animals. 22. Describe radiological findings according to Roentgen signs. 23. Formulate a meaningful differential diagnosis for commonly seen radiographic abnormalities in small animals. Credits: 3.00

20 Credits

Year 4

48 Credits

Educational Specialist

Curriculum and Instruction, EDS

About the Program

Program Requirements

Required Courses (27 credits)

EDST 51300 - Educational Facilities Planning

Credit Hours: 3.00. (EDFA 51300) The course utilizes a systems approach as a basis for planning, construction, and utilization of school facilities. The primary audience for which the course is designed is aspiring school superintendents and central office leaders. Emphasis is placed on gaining the performances, dispositions, and knowledge necessary for successfully providing facilities to enhance the teaching/learning processes in meeting the educational needs of diverse learners. It is intended as a practical course oriented toward "tools" and school facilities in the state of Indiana. Permission of instructor required.

Learning Outcomes: 1. Describe the political and economic dimensions associated with the development and acquisition of facilities in Indiana. 2. Describe the various ways to finance renovation and /or new school construction in Indiana. 3. Identify and describe the required procedures for new school construction in Indiana. 4. Describe the involvement of professionals outside of education in the planning and construction of school facilities. 5. Understand terminology related to construction and maintenance of school facilities in Indiana. Credits: 3.00

EDST 60800 - Business Management In Education

Credit Hours: 3.00. (EDFA 60800) This course explores the

management and operation of the school business environment, the critical trends and issues in the field, and the internal and external determinants of school fiscal policy. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51400 .

Learning Outcomes: 1. Know the success of managing the organization, operations, and resources of a district in a way that promotes a safe, efficient, and effective learning environment. 2. Act with integrity, fairly, and in an ethical manner. 3. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 61200 - Seminar In Educational Administration And Curriculum

Credit Hours: 3.00. An analysis of current research and theory related to selected topics in educational administration and curriculum. One topic is studied in each enrollment. Permission of instructor required.

Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

EDST 61500 - Educational Policy And Decision Making

Credit Hours: 3.00. This course explores a variety of current legal, political, social, cultural and economic issues as they relate to educational policy and decision making. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders and ELCC/NPBEA standards are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Act with integrity, fairly, and in an ethical manner. 2. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 61600 - Analytical Techniques In Educational Management

Credit Hours: 3.00. This course is a mix of theory and practice concerning planning and implementation of the fiscal responsibilities that a superintendent of schools would engage in at the district level. The course exposes students to some of the key processes and activities related to planning for and implementing the school budget and related activities. The course examines such planning concepts as goal definition, decision-making, and evaluation of planning as it relates to the fiscal issues of a school corporation. A feature of the course is an emphasis on the process of dealing with the elements of change and planning for such as it relates to fiscal issues in educational organizations. Prerequisite: EDST 51400 or EDST 60800 .

Learning Outcomes: 1. Describe various functions of the school district business office. 2. Identify methods of decision making involved in allocating fiscal resources. 3. Identify various methods of budgeting. 4. Demonstrate an understanding of elementary accounting concepts. 5. Demonstrate an understanding of calculations and functions related to Indiana public school corporation funds. 6. Summarize the ways in which Indiana public school corporations are funded and the most recent legislation that will impact funding. 7. Demonstrate an understanding of the role of business with regard to insurance, transportation, food service, and maintenance. 8. Summarize the balance among expenditures, revenues, and the educational plan. Credits: 3.00

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

EDST 61400 - Leadership For Community Collaboration And Development

Credit Hours: 3.00. In this course, we will consider how school

leaders can help develop and strengthen relationships between districts/corporations and their publics, for the mutual benefit of students, schools, families, and communities. Throughout selected core and supplemental district level educator standards of the Indiana Standards for School Leaders and the National Policy Board for Educational Administration are addressed. Emphasis is on the integration of theory and practice. Permission of instructor required.

Learning Outcomes: 1. Acquire knowledge and ability to foster mutually beneficial family and community connections with school districts. 2. Acquire knowledge and ability to understand needs of diverse families and communities. 3. Acquire knowledge and ability to assess research on school partnerships to identify best practices in their contexts. Credits: 3.00

Selective (3 credits)

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54200 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to the curriculum development and program design for meeting the needs of gifted, creative, and talented students. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students.

Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 66300 - Organization And Administration Of Special Education

Credit Hours: 3.00. (EDST 66300) A comprehensive course in the organization and administration of special education including the organizational arrangements, identification, placement and service delivery, tests and assessments, program evaluation, personnel, and school/community relations.

Learning Outcomes: 1. Examine, discuss, and gain an understanding of the role of the special education director. 2. Apply the federal and state rules and regulations for special education in school settings. 3. Understand the role of litigation in the field of special education. 4. Understand special education funding options, identify budget preparation strategies and fund management. 5. Demonstrate ways to ensure parent involvement. 6. Discuss current trends and issues in educating children with disabilities, including ethnic and cultural diversity, discipline, suspension and expulsion. Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 68200 - Contemporary Curriculum Theory

Credit Hours: 3.00. Critical examination of contemporary concepts of curriculum theory. Rational/technical curriculum, social needs/child centered curriculum. Socio-political curriculum theory; curriculum as existential, aesthetic, and phenomenological. Implications for current practice, school reform, and educational research.

Learning Outcomes: 1. Develop an understanding of the social theories and philosophies that inform contemporary curriculum theorizing. 2. Articulate the role of curriculum theorizing in defining and analyzing educational phenomena. 3. To utilize curriculum theory toward the development of educative responses to issues of ethics, equity, power, and privilege. 4. To synthesize the complexity and tensions of various curriculum theories into frameworks for educational research. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

Concentrations

Program Learning Outcomes

GPA Requirements

Educational Studies: Educational Leadership and Policy Studies

Concentration, EDS

About the Program

Program Requirements

Required Courses (27 credits)

EDST 51300 - Educational Facilities Planning

Credit Hours: 3.00. (EDFA 51300) The course utilizes a systems approach as a basis for planning, construction, and utilization of school facilities. The primary audience for which the course is designed is aspiring school superintendents and central office leaders. Emphasis is placed on gaining the performances, dispositions, and knowledge necessary for successfully providing facilities to enhance the teaching/learning processes in meeting the educational needs of diverse learners. It is intended as a practical course oriented toward "tools" and school facilities in the state of Indiana. Permission of instructor required.

Learning Outcomes: 1. Describe the political and economic dimensions associated with the development and acquisition of facilities in Indiana. 2. Describe the various ways to finance renovation and /or new school construction in Indiana. 3. Identify and describe the required procedures for new school construction in Indiana. 4. Describe the involvement of professionals outside of education in the planning and construction of school facilities. 5. Understand terminology related to construction and maintenance of school facilities in Indiana. Credits: 3.00

EDST 60800 - Business Management In Education

Credit Hours: 3.00. (EDFA 60800) This course explores the management and operation of the school business environment, the critical trends and issues in the field, and the internal and external determinants of school fiscal policy. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51400 .

Learning Outcomes: 1. Know the success of managing the organization, operations, and resources of a district in a way that promotes a safe, efficient, and effective learning environment. 2. Act with integrity, fairly, and in an ethical manner. 3. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 61200 - Seminar In Educational Administration And Curriculum

Credit Hours: 3.00. An analysis of current research and theory related to selected topics in educational administration and curriculum. One topic is studied in each enrollment. Permission of instructor required.

Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

EDST 61500 - Educational Policy And Decision Making

Credit Hours: 3.00. This course explores a variety of current legal, political, social, cultural and economic issues as they relate to educational policy and decision making. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders and ELCC/NPBEA standards are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51200 .

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EDST 61600 - Analytical Techniques In Educational Management

Credit Hours: 3.00. This course is a mix of theory and practice concerning planning and implementation of the fiscal responsibilities that a superintendent of schools would engage in at the district level. The course exposes students to some of the key processes and activities related to planning for and implementing the school budget and related activities. The course examines such planning concepts as goal definition,

decision-making, and evaluation of planning as it relates to the fiscal issues of a school corporation. A feature of the course is an emphasis on the process of dealing with the elements of change and planning for such as it relates to fiscal issues in educational organizations. Prerequisite: EDST 51400 or EDST 60800 .

Learning Outcomes: 1. Describe various functions of the school district business office. 2. Identify methods of decision making involved in allocating fiscal resources. 3. Identify various methods of budgeting. 4. Demonstrate an understanding of elementary accounting concepts. 5. Demonstrate an understanding of calculations and functions related to Indiana public school corporation funds. 6. Summarize the ways in which Indiana public school corporations are funded and the most recent legislation that will impact funding. 7. Demonstrate an understanding of the role of business with regard to insurance, transportation, food service, and maintenance. 8. Summarize the balance among expenditures, revenues, and the educational plan. Credits: 3.00

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

EDST 61400 - Leadership For Community Collaboration And Development

Credit Hours: 3.00. In this course, we will consider how school leaders can help develop and strengthen relationships between districts/corporations and their publics, for the mutual benefit of students, schools, families, and communities. Throughout selected core and supplemental district level educator standards of the Indiana Standards for School Leaders and the National Policy Board for Educational Administration are addressed. Emphasis is on the integration of theory and practice. Permission of instructor required.

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Learning Outcomes: 1. Describe various functions of the school district business office. 2. Identify methods of decision making involved in allocating fiscal resources. 3. Identify various methods of budgeting. 4. Demonstrate an understanding of elementary accounting concepts. 5. Demonstrate an understanding of calculations and functions related to Indiana public school corporation funds. 6. Summarize the ways in which Indiana public school corporations are funded and the most recent legislation that will impact funding. 7. Demonstrate an understanding of the role of business with regard to insurance, transportation, food service, and maintenance. 8. Summarize the balance among expenditures, revenues, and the educational plan. Credits: 3.00

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Concentrations

Program Learning Outcomes

About the Program

Major Change (CODO) Requirements

Pre-Economics (Liberal Arts) Major Change (CODO) Requirements

Majors

General Requirements

Course Requirements

Other Requirements

Advising Website

Student Next Steps

Master's

Aeronautics and Astronautics, MSAAE

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (21-24 credits)

Primary Area Courses (9-12 credits)

Aerodynamics

AAE 51100 - Introduction To Fluid Mechanics

Credit Hours: 3.00. The basic conservation equations are derived for a compressible viscous fluid, and then are specialized for applications in potential flow, viscous flow, and gas dynamics.

Learning Outcomes: 1. Use index notation to derive vector and tensor relations. 2. Manipulate and derive governing equations in various forms. 3. Determine streamlines, pathlines, streaklines and timelines for unsteady flow. 4. Determine how vorticity is produced by various mechanisms. 5. Determine the motion of two-dimensional point vortices. 6. Use conformal mapping to find the lift coefficient on an airfoil shape. 7. Use a Schwarz-Christoffel transformation to solve for potential flow with corners. 8. Use three-dimensional potential flow to solve for flow over axisymmetric bodies. 9. Solve for steady and unsteady exact solutions of the Navier-Stokes equations. 10. Derive and use the Stokes drag law for a sphere. 11. Derive boundary layer equations, find self-similar solutions and determine scaling laws. 12. Compute skin friction on an airfoil using an approximate boundary layer method. 13. Determine the qualitative effects of turbulence on a flow. Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 51400 - Intermediate Aerodynamics

Credit Hours: 3.00. Thin airfoil theory and panel methods. Three-dimensional elementary solutions, lifting-line and lifting-surface models. Slender wing and slender body theory. Normal/oblique shock waves. One- and multi-dimensional flows and conical flows. Method of characteristics. Introduction to transonic flow, hypersonic flow, and airfoil design.

Credits: 3.00

AAE 51800 - Low-Gravity Fluid Dynamics

Credit Hours: 3.00. Theory and design for control of liquid propellants in weightlessness. Gravity and orbits review. Satellite and space-probe acceleration environments. Capillary-dominated fluid dynamics: contact angle, surface tension, curvatures, and solution methods. Industry practice and current topics.

Credits: 3.00

AAE 51900 - Hypersonic Aerothermodynamics

Credit Hours: 3.00. Aerodynamics of satellites and planetary re-entry. Continuum hypersonic flow. Inviscid and viscous effects, boundary layers, and heat transfer. Shock and boundary-layer interactions. Equilibrium flow of high-temperature reacting gases. Nonequilibrium effects. Kinetic theory and rarefied flows. Direct simulation Monte Carlo techniques.

Credits: 3.00

AAE 52000 - Experimental Aerodynamics

Credit Hours: 3.00. Theory and application of experimental techniques and instrumentation for aerodynamics and fluid mechanics. Computer data acquisition, wind tunnels, force balances, flow visualization, pressure probes, hot wire anemometry, laser Doppler velocimetry and turbulence measurements.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 61300 - Viscous Flow Theory

Credit Hours: 3.00. Compressible, laminar boundary layer theory; Buseman and Crocco integrals; skin friction and heat transfer. Introduction to turbulent boundary layers and transition phenomena. Advanced boundary layer theory; the method of inner and outer expansions. Boundary layers with chemical reaction; applications to hypersonic flow and combustion. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62400 - Laminar-Turbulent Transition

Credit Hours: 3.00. Instability mechanisms, such as Kelvin-Helmholtz, Tollmien-Schlichting, Gortler, and crossflow. Secondary instabilities. Nonlinear and nonparallel effects; the Parabolized Stability Equations; receptivity; transition prediction. Effects of compressibility, heating, roughness, turbulence, noise, curvature, etc. Turbulent spots and the extent of transitional flow. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62600 - Turbulence And Turbulence Modeling

Credit Hours: 3.00. Physical description of turbulence. Reynolds averaged equations. Scaling of basic turbulent flows. Homogeneous turbulence, spectra and two-point correlations. Hierarchy of turbulence models, including zero-, one-, and two-equation models, Reynolds stress models, large eddy simulations, and direct numerical simulations. Additional topics, such as compressibility effects on turbulence and probability density function methods, as time allows. Prerequisite: AAE 51100.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 50900 - Intermediate Fluid Mechanics

Credit Hours: 3.00. Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

Learning Outcomes: 1. State basic laws for a control volume in different coordinate systems. 2. Derive the kinematics of fluid flow in problem solving. 3. Derive the equations for frictionless and incompressible flows. 4. Derive the basic equations of motion of viscous flows. 5. Find standard exact solutions of viscous-flow equations and apply them. 6. Derive and solve basic equations of boundary-layer theory. 7. Find lift and drag forces on immersed bodies with simple shapes. 8. Understand concepts of incompressible turbulent flows and wall turbulence. Credits: 3.00

ME 51000 - Gas Dynamics

Credit Hours: 3.00. Flow of compressible fluids. One-dimensional flows including basic concepts, isentropic flow, normal and oblique shock waves, Rayleigh line, Fanno line, and simple waves. Multidimensional flows including general concepts, small perturbation theory for linearized flows and method of characteristics for nonlinear flows. Prerequisite: first course in fluid or aerodynamics.

Credits: 3.00

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8) spray drying. Offered in alternate years.

Credits: 3.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

ME 61000 - Boundary Layer Theory

Credit Hours: 3.00. Fundamentals of continuum fluid mechanics; Navier-Stokes equations. Laminar flow; boundary-layer concept; similarity solutions; transformation methods; integral and finite difference solution techniques for general

pressure gradients. Should be preceded by intermediate fluid mechanics.

Credits: 3.00

ME 61100 - Principles Of Turbulence

Credit Hours: 3.00. Methods of description and basic equations for turbulent flows. Isotropic and homogeneous turbulence, energy spectra, and correlations. Introduction to measurements. Transition theory and experimental evidence. Wall turbulence, engineering calculations of turbulent boundary layers. Free turbulent jets and wakes. Prerequisite: ME 61000 .

Learning Outcomes: 1. Develop the ability (from first principles) to describe the physics of turbulent flows. 2. Comprehend the methods of analysis used in turbulence study. 3. Understand the principles of turbulence simulation and the associated modeling problems. Credits: 3.00

ME 61300 - Advanced Engineering Acoustics

Credit Hours: 3.00. An extension of ME 51300 . Sound transmission between two media. Acoustic resonators and application to muffler theory. Structural radiation and sound. Acoustical measurements and signal processing: sound intensity, surface intensity, coherence and cepstral techniques. Numerical acoustics: finite element analysis, boundary integral equation analysis and statistical energy analysis. Advanced topics. Prerequisite: ME 51300 .

Credits: 3.00

ME 61400 - Computational Fluid Dynamics

Credit Hours: 3.00. Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solution of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Prerequisite: ME 50900 or ME 58100 .

Credits: 3.00

ME 61500 - Aeroacoustics

Credit Hours: 3.00. (AAE 61500) Quantitative measures of sound (decibel scales, spectra, energetics of acoustic motions, and measurement techniques). The wave theory of sound (basic equations and properties, sound propagation in homogeneous and inhomogeneous media, one-, two- and three-dimensional sound fields and distributed sources). Effects of source movement. Aerodynamic noise generation - acoustic analogy (Lighthill's equation and Ffowcs Williams-Hawkings equation). Introduction to Computational Aeroacoustics (CAA). Noise from turbulent shear flows (jet noise, cavity noise, and noise from flow over objects). Noise from turbomachinery, propellers, and rotors. Prerequisite: ME 30900 or ME 51300 or AAE 51100.

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 52100 - Plasma Laboratory

Credit Hours: 3.00. The laboratory course will include lab prep lectures, practical classes and mini-projects. Lab prep lectures will briefly cover topics of the basic plasma physics and diagnostics relevant to the subsequent practical classes. In addition, details of the corresponding lab procedure, instructions and lab report assignment will be discussed. Practical classes will involve students in practical creation and operation of various plasma sources and plasma diagnostics. Specifically, students will operate DC high voltage breakdown facility, electrostatic accelerator (ion thruster), cross-field accelerator (Hall thruster), Atmospheric-Pressure Plasma Jet facility, and will conduct measurements of plasma parameters using Langmuir probes, microwave interferometer and optical spectrometer.

Learning Outcomes: 1. Operate laboratory electronic equipment and conduct basic electrical measurements. 2. Demonstrate fundamental understanding of Paschen breakdown law, and measure breakdown parameters. 3. Demonstrate fundamental understanding of Child-Langmuir law and calculate space-charge limited current density. 4. Operate electrostatic accelerator at different acceleration voltages, and conduct measurements of total ion current carried by the plasma jet using plane Langmuir probe. 5. Demonstrate fundamental understanding of

operation of single electrostatic Langmuir probes, conduct measurements of V-I curves, and calculate plasma parameters based on the measurements. 6. Operate cold atmospheric-pressure plasma jet and conduct spectroscopic measurements of the jet emission using spectrometer. 7. Computationally simulate the emission spectra of the second positive system of nitrogen molecule, and determine vibrational and rotational gas temperatures based on the measured and simulated spectra. 8. Operate Hall-effect accelerator, and measure basic operational parameters. 9. Operate pendulum thrust stand and conduct thrust measurements. 10. Demonstrate fundamental understanding of operation principle of microwave interferometry and construct the interferometer from basic microwave components. 11. Conduct interferometry measurements of phase shift in plasma column and determine plasma density. 12. Conduct search of the journal papers on a given topic, and compare the reported results with that measured in the lab. Credits: 3.00

Aerospace Systems

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55100 - Design Theory And Methods For Aerospace Systems

Credit Hours: 3.00. Introduction to design theory, aerospace design process, design specification and requirements, concept generation and selection, design decomposition, improving designs, process design, and concurrent engineering. Design for assembly/manufacture. Projects allow for application and critical analysis of design methods.

Credits: 3.00

AAE 56000 - System-Of-Systems Modeling And Analysis

Credit Hours: 3.00. Introduction to features of system-of-systems problems; problem definition tools; role of complexity; network topology analysis and agent-based simulation models; architecture analysis; metrics for multi-stakeholder problems; semester team projects allow students to exercise and critique such methods for analyzing system-of-systems problems. Some background in probability and statistics (e.g. random variables, probability density and distributions, sampling methods) is expected.

Learning Outcomes: 1. Introduce to modeling and analysis techniques for system-of-systems (SoS) problems in engineering. 2. Center on students' ability for understanding, modeling, and analyzing SoS problems, which consist of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. These problems are often large-scale and interdisciplinary, involving systems and behaviors found in diverse fields such as engineering, economics, social science, policy, etc. 3. Present developments in addressing system-of-systems problems, describes criteria, lexicon, and analysis methodology for their study, and, through semester-long team projects, allows students to explore the many unknowns that persist in this emerging field. 4. Know the major subjects covered: distinguishing traits of and behaviors of SoS problems, complexity and complex adaptive systems, agent-based modeling, modern network theory and analysis tools, modeling for decision-making, and exploratory modeling. Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course

include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define models of the interfaces of an engineered

system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 59000 - Projects In Systems

Credit Hours: 1.00 to 6.00. This is a Graduate Level variable title course for topics related to Systems (Systems Thinking, Systems Engineering, Systems Dynamics, etc). Graduate students and seniors can enroll in this course to do independent study or individual project with the instructor. Permission of instructor required.

Learning Outcomes: 1. Outcomes will be defined by the syllabus for each proposed instance of the course. Credits: 1.00 to 6.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

Astrodynamics & Space Applications

AAE 50700 - Principles Of Dynamics

Credit Hours: 3.00. Kinematics, fundamental laws of mechanics, constraints, and generalized coordinates. Lagrange's equations, virtual work. Application to particle dynamics, rigid body motion, and spacecraft dynamics.

Knowledge of differential equations required.

Credits: 3.00

AAE 50800 - Optimization In Aerospace Engineering

Credit Hours: 3.00. Formulation of optimization problems encountered in aerospace engineering. Minima of functions and functionals, necessary conditions, calculus of variations, control formulation, two-point boundary-value problems. Applications to typical problems in aerospace engineering, such as optimal launch, minimum time to climb, maximum range, and optimal space trajectories.

Credits: 3.00

AAE 53200 - Orbit Mechanics

Credit Hours: 3.00. Orbit determination of near-earth satellites and various perturbations; libration and attitude control; orbit transfer and interception; lunar theory and interplanetary orbits; ascending mechanics and re-entry.

Credits: 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 60700 - Variational Principles Of Mechanics

Credit Hours: 3.00. Basic concepts of analytical mechanics, calculus of variations, Hamilton's equations, Hamilton-Jacobi theory, canonical transformations. Offered in alternate years. Prerequisite: AAE 50700.

Credits: 3.00

AAE 63200 - Advanced Orbital Dynamics

Credit Hours: 3.00. Discussion of more advanced concepts in astrodynamics. Includes fundamental theories from celestial mechanics, as well as trajectory determination and perturbation analysis with application to the motion of Earth-orbiting and interplanetary spacecraft. Assumes experience with the two-body problem. Offered in alternate years. Prerequisite: AAE 50700, AAE 53200.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.

Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application.

Credits: 3.00

AAE 53300 - Space Traffic Engineering Management

Credit Hours: 3.00. The course teaches the basic techniques and concepts relevant to Space Traffic Management (STM) and Space Situational Awareness (SSA) from a rigorous engineering perspective. The class starts with learning how measurements are collected and processed and then moves on to the non-linear orbital motion and astrodynamics in the near-Earth realm. The focus is on orbit determination and orbit improvement of satellites and space debris to detect new objects and maintain custody of them. Lastly, the class focuses on determining the probability of collision of two resident space objects. At the end of the course, the students are equipped with a fundamental Matlab toolset to investigate their own STM or SSA problems.

Learning Outcomes: 1. Demonstrate fundamental understanding of sustainable use of space. 2. Determine engineering and simulation of information collection for STM. 3. Demonstrate Initial Orbit Determination and Orbit Improvement using passive measurements. 4. Determine Orbital

perturbations in the near-Earth and cislunar region. 5. Determine Computation Probability of Collision. Credits: 3.00

Autonomy & Control

AAE 50700 - Principles Of Dynamics

Credit Hours: 3.00. Kinematics, fundamental laws of mechanics, constraints, and generalized coordinates. Lagrange's equations, virtual work. Application to particle dynamics, rigid body motion, and spacecraft dynamics. Knowledge of differential equations required.

Credits: 3.00

AAE 50800 - Optimization In Aerospace Engineering

Credit Hours: 3.00. Formulation of optimization problems encountered in aerospace engineering. Minima of functions and functionals, necessary conditions, calculus of variations, control formulation, two-point boundary-value problems. Applications to typical problems in aerospace engineering, such as optimal launch, minimum time to climb, maximum range, and optimal space trajectories.

Credits: 3.00

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 56700 - Introduction To Applied Stochastic Processes

Credit Hours: 3.00. An introductory course in the concept of a discrete and continuous stochastic process based upon physical phenomena that originally gave rise to the specific stochastic models that are studies. Spectral analysis, response of time invariant systems to noise inputs. Estimation theory, Kalman and Winer filtering.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 60700 - Variational Principles Of Mechanics

Credit Hours: 3.00. Basic concepts of analytical mechanics, calculus of variations, Hamilton's equations, Hamilton-Jacobi theory, canonical transformations. Offered in alternate years. Prerequisite: AAE 50700.

Credits: 3.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and

estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 67500 - Introduction To Analysis Of Nonlinear Systems

Credit Hours: 3.00. An introduction to modeling of dynamic control systems. State plane and numerical methods for solving modeling equations. Linearization and describing function techniques. Stability concepts. Controller and state estimator design for nonlinear systems. Variable structure sliding mode control. Vector field techniques. Introduction to chaos. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 68000 - Modern Automatic Control

Credit Hours: 3.00. Theoretical methods in optimal control theory. Topics include the calculus of variations and the Pontryagin minimum principle with applications to minimum energy problems. Geometric methods will be applied to the solution of minimum time problems. Computational methods, singular problems, observer theory, and sufficient conditions for existence of solutions are also discussed. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ME 56200 - Advanced Dynamics

Credit Hours: 3.00. Dynamics of multi-degrees-of-freedom mechanical systems. Holonomic and nonholonomic constraints. Lagrange's equations of motion. Hamilton's principle for holonomic systems. Kinematics and kinetics of rigid body motion, including momentum and energy methods. Linearized equations of motion. Classification of vibratory systems - gyroscopic, circulatory forces. Stability of linear systems - divergence and flutter. Applications to gyroscopes, satellite dynamics, etc.

Learning Outcomes: 1. Develop an understanding of the principles governing the motion of mechanical systems modeled as rigid bodies. 2. Develop an ability to analyze rigid-

body kinematics in stationary as well as moving frames of reference. 3. Develop an ability to use Newton-Euler laws of rigid body motion. 4. Develop an understanding of the fundamental concepts in analytical dynamics, and the ability to use them to formulate the equations of motion for rigid bodies and systems. Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 56500 - Vehicle Dynamics

Credit Hours: 3.00. Modeling of wheeled vehicles to predict performance, handling, and ride. Effects of vehicle center of mass, tire characteristics, traction and slip, engine characteristics, and gear ratios on performance. Suspension design. Steady state and transient handling models of four-wheeled vehicles and car-trailer systems to determine oversteer and understeer characteristics, critical speeds, and stability. Multi-degree-of-freedom ride models, including tire and suspension compliance. Computer simulations. Current research topics in vehicle vibration isolation.

Learning Outcomes: 1. Mature in application of modeling techniques to predict the dynamic behavior of highway vehicles. 2. Develop an understanding of the relationships between vehicle design variables and vehicle dynamic behavior (acceleration, braking, handling, and ride). Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 57900 - Fourier Methods In Digital Signal Processing

Credit Hours: 3.00. Fundamentals of signal processing associated with Fourier analyzer systems are presented. Emphasis is on amplitude accuracy and frequency resolution properties necessary for reliable experimental methodologies in system identification, spectrum estimation, and correlation analysis. Deterministic, as well as random, data analyses are presented. Students are required to develop algorithms that significantly expand the utility of Fourier analyzer systems.

Credits: 3.00

ME 58000 - Nonlinear Engineering Systems

Credit Hours: 3.00. Methods of analysis for nonlinear ordinary differential equations arising in engineering systems. Review of linear systems. Stability concepts. Phase plane methods. Perturbation and averaging methods of analysis. Self-excited and parametrically-excited systems. Relaxation oscillations. Systems with more than one degree of freedom.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 66400 - Vibrations Of Continuous Systems

Credit Hours: 3.00. Theory of small oscillations of continuous

systems. Love's equations for thin shells, reduction to special cases of shallow shells, plates, beams, etc. Initial stresses; influence of shear; thermal excitation. Initial value problems; forced vibrations; structural damping. The dynamic Green's function, impedance concepts; variational approaches. Experimental procedures, scaling, composite, and stiffened shells. Prerequisite: knowledge of one degree of freedom system vibrations.

Credits: 3.00

ME 67500 - Multivariable Control System Designs

Credit Hours: 3.00. Fundamentals of the frequency response loop shaping methodology for the analysis and design of robust multivariable control systems will be presented. Emphasis is on suitable extensions of the classical Bode-Nyquist design techniques to systems with not only uncertain parameters but also multiple inputs and outputs. Instrument and environmental signal level constraints on the performance of control systems will be critically evaluated. Students are required to develop ability to handle open-ended design issues involving significant multiobjective performance trade-offs. Prerequisite: ME 57500 .

Credits: 3.00

ME 67700 - Nonlinear Feedback Controller Design

Credit Hours: 3.00. Controller design and analysis of nonlinear feedback systems. Topics include the design of linear/nonlinear feedback controllers. Describing Function (DF) techniques for design, Popov and Generalized Circle Criterion for closed-loop stability, functional analysis and Volterra series approaches, and introduction to existing nonlinear controller design tools. Offered in alternate years. Prerequisite: ME 67500 .

Credits: 3.00

ME 68000 - Bifurcations And Chaos

Credit Hours: 3.00. Basic concepts in stability of systems, nonlinear dynamical systems, and bifurcation theory. Algebraic and geometric techniques for local bifurcation analysis. Models governed by difference, ordinary, and particle differential equations. Examples from mechanical, structural, chemical, and electrical systems. Models of chaotic behavior. Techniques for prediction of chaos. Routes to chaos. Offered in alternate years. Prerequisite: ME 58000 .

Credits: 3.00

ME 68900 - Adaptive Control

Credit Hours: 3.00. Theory and application of adaptive control of linear systems in both continuous and discrete time domain. Real-time parameter estimation algorithms, direct and indirect adaptive methods, deterministic self-tuning regulators, Lyapunov stability theory, input-output stability, model-reference adaptive control, stability and convergence of adaptive algorithms, robustness, and implementation issues, with laboratory experiments and demonstrations. Offered in alternate years. Prerequisite: ME 57500 .

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

ME 58400 - System Identification

Credit Hours: 3.00. Theory and application of System Identification methods. Connecting the world of mathematical models to experimental data - least squares methods and difference equation models. Background in probability and analysis: algebra of random variables, law of large numbers, central limit theorem. The ARMA family of models; mapping physics models to generalized ARMAX forms (linear and nonlinear); mapping the parameter estimation problem to the least squares problem (batch and recursive), and numerical solution techniques. Model (in)validation, optimal identification criteria, experiment design and data preprocessing considerations. Issues of signal-to-noise ratio, persistency of excitation, sampling frequency, data accuracy and data sizes.

Learning Outcomes: 1. Interpret data probabilistically and ability to calculate uncertainty propagation. 2. Fit backbox models to data; convert physics models to identifiable forms for least squares formulations. 3. Construction of numerical codes for solving least squares problems and use of MATLAB System ID toolbox. 4. Construct informative experiments for dynamic systems with suitable precision of and accuracy of sensing, data length, persistency of excitation, and sampling frequency. Credits: 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex

optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

ME 56000 - Kinematics

Credit Hours: 3.00. Geometry of constrained plane motion with applications to linkage design. Type and number synthesis, size synthesis. Path curvature, inflection circle, cubic of stationary curvature. Finite displacements, three and four separated positions. Graphical, analytical, and computer techniques.

Credits: 3.00

Propulsion

ME 50000 - Advanced Thermodynamics

Credit Hours: 3.00. The empirical, physical basis of the laws of thermodynamics. Availability/exergy concepts and applications. Properties and relations between properties in homogeneous and heterogeneous systems. The criteria of equilibrium. Application to a variety of systems and problems, including phase and reaction equilibrium. Offered in alternate years.

Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 53500 - Propulsion Design, Build, Test

Credit Hours: 3.00. Intensive one-semester treatment of the aerospace propulsion component development process. Derivation of design requirements from mission objective to detailed components; the design process. Standard methods for thermostructural, life, performance, and combustion stability design analysis; combustor design. Experimental procedures; fabrication; test. Special topics according to student interest.

Credits: 3.00

AAE 53700 - Hypersonic Propulsion

Credit Hours: 3.00. Analysis of advanced high speed air breathing propulsion concepts for hypersonic flight. Missions and trajectories. Engine/airframe integration. Aerothermodynamic analysis of ramjets, scramjets, and oblique detonation wave engines. On- and off-design of compression inlets and minimum length nozzles. Cryogenic fuels and skin cooling. Ram accelerator ballistic launch concepts.

Learning Outcomes: 1. Develop understanding of high-speed inlet systems. 2. Develop understanding of mixing systems employed in airbreathing engines. 3. Develop understanding of turbine-based combined cycle systems. 4. Develop understanding of detonative-based propulsion systems. 5. Develop understanding of ducted rockets. 6. Develop understanding of ramjet and scramjet propulsion systems. Credits: 3.00

AAE 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (ME 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

AAE 53900 - Advanced Rocket Propulsion

Credit Hours: 3.00. Generalized internal compressible and incompressible flows. Thermochemistry and heat transfer in rocket applications. Advanced topics in solid rocket motor performance and internal ballistics. Liquid rocket engine cycle analysis and turbopump design. Combustion of liquid and solid propellants. Hybrid rockets and thermal-nuclear engines.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ME 50100 - Statistical Thermodynamics

Credit Hours: 3.00. The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Introduction to quantum mechanics and molecular spectroscopy. The Maxwell-Boltzmann formulation of statistical mechanics and applications to ideal gases, solids, radiation, and laser diagnostics. The Gibbs formulation of statistical mechanics and application to real gases. Kinetic theory and applications to transport properties and chemical kinetics. Offered in alternate years.

Learning Outcomes: 1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena. 2. Apply concepts and calculate thermodynamic and transport properties of ideal gases. 3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements. Credits: 3.00

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 52500 - Combustion

Credit Hours: 3.00. Physical and chemical aspects of basic combustion phenomena. Chemical energetics and equilibrium. Basic chemical kinetics, chain reactions, and explosions. Chain and thermal ignition. Homogeneous combustion models. Detonations and deflagrations. Laminar flame speed and flame extinction. The Shvab-Zeldovich formulation of the multicomponent conservation equations. Diffusion flames and droplet combustion. Introduction to turbulent combustion.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8) spray drying. Offered in alternate years.

Credits: 3.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (AAE 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, and nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

NUCL 56300 - Direct Energy Conversion

Credit Hours: 3.00. Review of energy sources and study of the basic processes of direct energy conversion and their applications to energy utilization, based on both conventional and nuclear energy conversion schemes. Conventional schemes include thermoelectric, photovoltaic, thermionic, magnetohydrodynamic generators, fuel cell systems, etc.; and nuclear energy conversion schemes correspond to nuclear radiation and fusion energy conversion. Permission of instructor required.

Credits: 3.00

AAE 52100 - Plasma Laboratory

Credit Hours: 3.00. The laboratory course will include lab prep lectures, practical classes and mini-projects. Lab prep lectures will briefly cover topics of the basic plasma physics and diagnostics relevant to the subsequent practical classes. In addition, details of the corresponding lab procedure, instructions and lab report assignment will be discussed. Practical classes will involve students in practical creation and operation of various plasma sources and plasma diagnostics. Specifically, students will operate DC high voltage breakdown facility, electrostatic accelerator (ion thruster), cross-field accelerator (Hall thruster), Atmospheric-Pressure Plasma Jet facility, and will conduct measurements of plasma parameters using Langmuir probes, microwave interferometer and optical spectrometer.

Learning Outcomes: 1. Operate laboratory electronic equipment and conduct basic electrical measurements. 2. Demonstrate fundamental understanding of Paschen

breakdown law, and measure breakdown parameters. 3. Demonstrate fundamental understanding of Child-Langmuir law and calculate space-charge limited current density. 4. Operate electrostatic accelerator at different acceleration voltages, and conduct measurements of total ion current carried by the plasma jet using plane Langmuir probe. 5. Demonstrate fundamental understanding of operation of single electrostatic Langmuir probes, conduct measurements of V-I curves, and calculate plasma parameters based on the measurements. 6. Operate cold atmospheric-pressure plasma jet and conduct spectroscopic measurements of the jet emission using spectrometer. 7. Computationally simulate the emission spectra of the second positive system of nitrogen molecule, and determine vibrational and rotational gas temperatures based on the measured and simulated spectra. 8. Operate Hall-effect accelerator, and measure basic operational parameters. 9. Operate pendulum thrust stand and conduct thrust measurements. 10. Demonstrate fundamental understanding of operation principle of microwave interferometry and construct the interferometer from basic microwave components. 11. Conduct interferometry measurements of phase shift in plasma column and determine plasma density. 12. Conduct search of the journal papers on a given topic, and compare the reported results with that measured in the lab. Credits: 3.00

AAE 53400 - Spacecraft Electric Propulsion

Credit Hours: 3.00. Spacecraft electric propulsion systems are intended to provide thrust for propelling spacecrafts in interplanetary missions, orbital maneuvers, and attitude control. The course will start with reviewing material on the mechanics and thermodynamics of propulsion, and identifying the niche occupied by the electric propulsion systems. The course will cover elements of plasma physics and electromagnetic theory essential for studying the electric propulsion systems. The core of the course will focus on studying various electric propulsion concepts which utilize electric power produced on-board to generate thrust. Mechanisms of the utilization of the electric power to accelerate gas or plasma and produce thrust will be considered, including electrothermal, electrostatic, electromagnetic, and gasdynamic acceleration mechanisms. Learning Outcomes: 1. Determine optimal specific impulse of electric propulsion system based on specific mission requirements 2. Demonstrate fundamental understanding of differences between electric and chemical propulsion systems performance and space applications. 3. Calculate basic plasma parameters and characteristics of collisional processes. 4. Demonstrate fundamental understanding of concepts of quasineutrality and collective behavior in plasmas. 5. Perform analysis of electrothermal accelerator at a given frozen flow fraction 6. Apply Maxwell equations in differential and integral forms to solve basic electromagnetism problems 7. Perform analysis of space-charge limited electrostatic accelerator in ion acceleration zone, in deceleration zone, and in neutralization zone. 8. Perform analysis of motion of charged particles in crossed electric and magnetic fields 9. Derive and apply modified forms of Ohm's law in two-component moving plasma in presence of magnetic field. 10. Perform elementary analysis of crossed-field electromagnetic accelerator with small Hall parameter 11. Perform elementary analysis and calculate basic parameters of Hall effect accelerator. 12. Demonstrate fundamental understanding of the differences of acceleration concepts used in Hall effect and in electrostatic accelerators. 13. Calculate body force in magnetoplasmadynamic accelerator. Credits: 3.00

ME 62000 - Combustion Of Energetic Materials

Credit Hours: 3.00. Students will learn the concepts of how to approach research in the area of Energetic Materials (EM) based on an understanding of the fundamental principles. Students will learn how energetic materials are fabricated, safety used, as well as understand life cycle issues, homogeneous & heterogenous combustion, and advanced

energetic material concepts. Multiphase combustion phenomena will be introduced and emphasized. They will apply these concepts to a literature review and group research project, as well as that includes applying thermochemistry and chemical kinetic software. In addition, six hands-on labs are performed. This material will be covered in the context of real-world applications, with an emphasis on energetic materials, combustion, propulsion, explosives, pyrotechnics, and detonation phenomenon. Pre-requisite: ME 52500 or AAE 53900 or consent of instructor.

Learning Outcomes: 1. Become familiar with the basic terminology, material science, physics & chemistry of energetic materials. 2. Learn how to safely work with energetic materials. 3. Learn how to experimentally or computationally approach research. 4. Learn how to approach literature reviews and form hypotheses for future research. 5. Learn the knowledge and experience needed to understand, model, develop, and experimentally characterize energetic materials, and well as numerous related fields. Credits: 3.00

Structures & Materials

AAE 54600 - Aerospace Structural Dynamics And Stability

Credit Hours: 3.00. Dynamics of continuous systems: rod, beam, frame, and plate structures. General structural principles: virtual work, Hamilton's principle, Lagrange's equation, and Ritz method for discrete approximations. Modal analysis: eigenanalysis, mode shapes, mode superposition, and complex modes. Nonlinear vibrations: phase plane, Poincare, bifurcation plots, and chaos. Stability of the motion: classification of problems, follower loads, aerodynamic loads, divergence, flutter, pulsating compression, and gyroscopic systems.

Credits: 3.00

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55200 - Nondestructive Evaluation Of Structures And Materials

Credit Hours: 3.00. Overview of methods employed for nondestructive evaluation of structures and materials taught in the context of damage tolerant structural analysis. Major inspection topics include: radiography, ultrasonics, eddy current, penetrant, magnetic, and visual/optical techniques. Other new emerging inspection techniques also are discussed. Offered in alternate years.

Credits: 3.00

AAE 55300 - Elasticity In Aerospace Engineering

Credit Hours: 3.00. A basic course in the theory of elasticity with emphasis on understanding the fundamental principles and solution techniques used in the stress analysis of structures. Cartesian tensors. Governing equations for linear elasticity. Rigorous derivation of beam and plate equations from the three-dimensional elasticity equations. Torsion. Thermoelasticity. The stress functions and complex functions approaches to two-dimensional problems. Energy methods and approximate solutions. Three-dimensional problems. Knowledge of differential equations assumed.

Learning Outcomes: 1. Give student an in-depth background in mechanics of solids including large deformation, and the ability to perform stress analyses in elastic bodies, especially two-dimensional bodies. Credits: 3.00

AAE 55400 - Fatigue Of Structures And Materials

Credit Hours: 3.00. Development and application of methods for predicting the fatigue life of structural components. Characterization and response of materials to cyclic loading. Fatigue resistant design of aerospace structures. Both fatigue crack initiation and crack propagation concepts are discussed.

Credits: 3.00

AAE 55500 - Mechanics Of Composite Materials

Credit Hours: 3.00. Current and potential applications of composite materials. Review of elasticity of anisotropic solids. Methods for determining mechanical properties of heterogeneous materials. Static and dynamic analyses of laminated composites. Fracture and fatigue of laminates. Reliability, testing, and design of composites.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 55800 - Finite Element Methods In Aerospace Structures

Credit Hours: 3.00. Introduction to the use of advanced finite element methods in the calculation of deformation, strain, and stress in aerospace structures. Topics include: 1-D, 2-D, 3-D, and axisymmetric elements, isoperimetric element formulation, convergence, treatment of boundary conditions and constraints. Special topics include stability, dynamic analysis, and nonlinear material behavior. Emphasis is on the theoretical knowledge of the finite element method. Applied experience is gained by solution of aerospace structural analysis problems through use of professional software.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 65400 - Fracture Mechanics

Credit Hours: 3.00. Methods of stress analysis in elastic media containing cracks. Fracture criteria. The strain energy release rate and J-integral. Crack tip plasticity. Interface cracks. Cracks in anisotropic solids. Bending of cracked plates. Dynamic crack propagation. Prerequisite: AAE 55300.

Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

CE 59500 - Finite Elements In Elasticity

Credit Hours: 3.00. Fundamentals of theory of elasticity; variational principles; one-, two-, and three-dimensional elasticity finite elements; interpolation methods; numerical integration; convergence criteria; stress interpretation.

Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 55900 - Micromechanics Of Materials

Credit Hours: 3.00. Prediction of the macroscopie behavior of materials from their microstructure and the design of new materials. Microstructure-property relationships between the macroscopie material behavior and microscopic structure. Application to traditional structure as well as to new engineering materials. Adapting emerging constitutive relations into structure analyses. Introduction of this new approach to materials, its applications in predictive analysis tools, and its importance in simulation-based engineering.

Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 61200 - Continuum Mechanics

Credit Hours: 3.00. A unified and exact mathematical treatment of the mechanics of solids and fluids. Cartesian tensor algebra and calculus; stress tensor, principle stresses and invariants; material and spatial coordinates, deformation gradient, strain and stretch tensors; balance of mass, momentum, and energy; constitutive equations of elasticity, hyperelasticity, viscous fluids and viscoelasticity.

Credits: 3.00

ME 65000 - Computational Fracture Mechanics

Credit Hours: 3.00. Advanced concepts of methods for the analysis of cracks, of crack propagation and damage evolution. Prediction of the macroscopic behavior of structures as it emerges from the presence of defects such as cracks, voids, or delamination. Linear elastic and nonlinear fracture problems. Rate independent and rate dependent problems. Methods in computational fracture mechanics where material separation emerges as an outcome of the boundary value problem. Demonstrations of how mechanical design can take advantage of the methods of computational fracture mechanics by introducing such concepts into structural analyses. Applications of computations in predictive analysis and its importance in simulation-based engineering. Prerequisites: AAE 55800 or ME 48900, or similar courses in finite element analysis or ME 57000 or ME 61200 or AAE 55300, or similar courses on advanced solid mechanics. Recommended but not required: CEE 597-109 or AAE 65400.

Learning Outcomes: 1. Introduce concepts of computational methods for material damage, fracture and fatigue. 2. Learn continuum mechanics concepts for description of material failure. 3. Learn about advanced constitutive equations for bulk and interface failure. 4. Learn how model material failure processes. 5. Learn how to develop and apply computational mechanics methods. 6. Apply these concepts to analysis of failure at the macro, micro and Nano scale. Credits: 3.00

AAE 54500 - Dynamic Behavior of Materials

Credit Hours: 3.00. Materials' responses to high-rate loading are different from their quasi-static behavior. Applications of materials in structures subjected to impact loading from events such as bird strike require the understanding of dynamic material behavior. Such high-rate materials behavior is not available in standard materials handbooks or design manuals. This course introduces stress wave propagation in solids, which is the foundation to characterization and understanding of high-rate response of materials. Then, the theoretical background and working principles of high-rate experimental methods are presented to characterize the material response under high-rate loading conditions. Finally, rate-dependent material models are introduced to describe the dynamic material behavior and deformation mechanisms.

Learning Outcomes: 1. Express local equations of motion. 2. Derive one dimensional wave equations in solid materials. 3. Calculate elastic wave speeds in solids with and without constraints. 4. Understand and calculate local stresses as an elastic wave passes through an interface. 5. Understand and predict local stress concentrations resulted in from wave interactions. 6. Utilize elastic waves as loading methods and as diagnostic methods. 7. Design experiments to measure dynamic behavior of materials. 8. Determine dynamic yield strength of ductile materials in Taylor impact tests. 9. Determine plastic wave speeds in ductile material under intensive loading. 10. Understand shock wave propagation in solids. 11. Understand physics and calculate shock properties of materials. 12. Understand physical origins of plastic waves and shock waves. 13. Understand rate-dependent material models. 14. Conduct a thorough search of literature on a subject of interest. 15. Understand the critical issues of the subject of interest. 16. Identify research gaps in the subject of interest. 17. Present effectively a summary of the literature survey. Credits: 3.00

AAE 54800 - Mechanical Behavior Of Aerospace Materials

Credit Hours: 3.00. This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smartphones. In fact, breakthroughs with material research are often accompanied by rapid advancements in technology. Thus, it is paramount for all engineers to have an understanding of the structure and behavior of materials. In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and, ultimately, failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms. Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal-material levels and their use in explaining the deformation and failure characteristics in metals, polymers, and ceramics; failure

mechanisms and toughening in composites; structure and behavior of aerospace materials: metal alloys, ceramic-matrix composites, and fiber-reinforced polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, creep, and failure mechanisms; design criteria; special topics. We will attempt to have minimal overlap with AAE 55400, Fatigue of Structures and Materials. Therefore we will not cover fracture, fatigue, or stress concentrators.

Learning Outcomes: 1. Express vector and tensor equations using indicial notation. 2. Express crystallography according to Miller indices and define slip systems in basic crystal structures. 3. Calculate and understand the physical basis of elastic anisotropy. 4. Understand, calculate, and use basic states of stress and yield criteria. 5. Define and understand the physical basis of point, line, and area defects in crystalline materials. 6. Calculate the strain fields, stress fields, and energy of dislocations, in addition forces between dislocations. 7. Understand dislocation motion as well as interactions between dislocations. 8. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 9. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 10. Understand origins of twinning, stacking faults, and the shape memory effects. 11. Understand physics and calculate strengthening influence of solutes, precipitates, grain boundaries, and strain hardening. 12. Understand physical origins of creep, calculate creep using Larson-Miller expressions, and use creep deformation mechanism map. 13. Understand origins of residual stress and apply to constrain problems. 14. Understand and apply statistical approaches to identify probability of failure and property variations. 15. Define and classify polymer structures. 16. Understand viscoelasticity and calculate behavior using classical models. 17. Distinguish physical mechanisms of polymer deformation, crazing, and fracture. 18. Express stiffness and strength of fiber reinforced composite structures. Credits: 3.00

AAE 64800 - Modeling Damage And Strengthening Mechanisms In Materials

Credit Hours: 3.00. The usage of materials is the backbone of engineering practice. Yet, advances in materials have stagnated due to overly conservative approaches, trial-and-error testing, and long qualification times. Material modeling offers tremendous opportunities to address these issues. This class offers advanced modeling strategies at the intersection of mechanics and materials science for both polycrystalline and composite materials. The course topics are defined as follows: First, advanced micromechanics analysis of modern engineering materials with emphasis on relating elastic microstructural phenomena to the mechanics of material behavior, via the Eshelby inclusion problem and its application to fiber reinforced composites. Second, classical plasticity is summarized via phenomenological and mathematical formulation of the constitutive laws, including yielding, yield surface; von Mises, Tresca yield criteria; Drucker's stability postulate; strain or work hardening, normality rule, perfect plasticity, and stress-strain law. Third, crystal plasticity is discussed, specifically physical and mathematical foundation for plasticity in crystalline materials, with a detailed description of the Bishop and Hill implementation of the Taylor model for deformation of polycrystals. Lastly, concepts of dislocations leading to strengthening mechanisms in metals are discussed: (i) by studying the anisotropy of material and elastoplastic properties at crystal level, microstructural basis for deformation in metals, polymers, and ceramics and (ii) failure mechanisms and toughening in metals, with primary emphasis on work/strain hardening, solid solution hardening, precipitate hardening, and grain boundaries. The course will be comprised of three projects, where the student chooses the topic of the third and final project. Prerequisite: AAE 55300 or equivalent.

Learning Outcomes: 1. Express displacement field for an arbitrary elliptical inclusion via a Green's function. 2. Prove the stress/strain fields within inclusion is uniform. 3. Calculate Eshelby interaction tensor for arbitrary shape inclusion. 4. Express the stress/strain fields external to the inclusion. 5. Implement Eshelby problem via Mori-Tanaka approach and apply to stiffness of composites. 6. Express interaction energy of inclusion. 7. Understand physical basis of plasticity. 8. Express yield surface and associated criteria via stress invariants and on the Pi-plane. 9. Express flow rules for evolution

of the yield surface and implement into principal of virtual velocities. 10. Express convexity and normality constraints. 11. Express crystal orientation as a series of rotations and express via a pole figure representation. 12. Identify texture of materials 13. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 14. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 15. Calculate the Taylor factor, geometric hardness of a polycrystalline material. 16. Express grain orientation evolution, via an exponential mapping. 17. Implement the Taylor model within a Bishop and Hill implementation to express texture evolution of polycrystalline materials. 18. Understand and express kinetics (strain rate and temperature) into deformation via thermodynamic expressions. 19. Model work hardening in crystalline materials. 20. Understand the physical origins and model incompatibilities. 21. Define grain boundary structure and their affect on mechanical behavior. 22. Apply concepts learned from this class into a research project of the student's choice. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

Secondary Area Courses (6 credits)

Math Courses (3-6 credits)

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 63200 - Linear Operator Methods In Chemical Engineering

Credit Hours: 3.00. Application of the spectral theory of linear self-adjoint and non-self-adjoint operators on abstract Hilbert spaces to problems in chemical engineering. Symmetrizable non-self-adjoint problems in finite and infinite dimensional spaces with applications to physical and chemical rate processes in homogeneous and composite media. Solution of transport equations governing heat and mass transfer in deforming and chemically reacting media. Introduction to non-self-adjoint problems in chemical engineering. Offered in alternate years. Prerequisite: CHE 63000 .

Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

Thesis Research (9 credits)

AAE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Technical Electives (6 credits)

Concentrations

GPA Requirements

About the Program

Agricultural and Biological Engineering, MSABE or MSENGR or MS

About the Program

Program Requirements - Thesis

Required Courses (3 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate

study 2. Complete required training for graduate student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

ABE 69600 - Graduate Seminar

Credit Hours: 1.00. Best practices for effectively presenting scientific research are taught and practiced. Students will also present a twenty-minute seminar of original research results, as well as provide and receive constructive criticism on presentation form and content for improved future presentations.

Learning Outcomes: 1. Enhance ability of ABE graduate students in presenting graduate research. 2. Improve ability of ABE graduate students to think critically about research and presentation skills of others. 3. Increase student's ability to critique his or her own work. Credits: 1.00

ABE/ASM or Concentration Courses (6 credits)

Thesis Research (9 credits)

ABE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (12 credits)

Required Courses (3 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate study 2. Complete required training for graduate student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

ABE 69600 - Graduate Seminar

Credit Hours: 1.00. Best practices for effectively presenting scientific research are taught and practiced. Students will also present a twenty-minute seminar of original research results, as well as provide and receive constructive criticism on presentation form and content for improved future presentations.

Learning Outcomes: 1. Enhance ability of ABE graduate students in presenting graduate research. 2. Improve ability of ABE graduate students to think critically about research and presentation skills of others. 3. Increase student's ability to critique his or her own work. Credits: 1.00

Program Requirements - Non-Thesis

Required Courses (3 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity

briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate study 2. Complete required training for graduate student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

ABE/ASM or Concentration Courses (6 credits)

Electives (21 credits)

Required Courses (3 credits)

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate study 2. Complete required training for graduate student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

Concentrations

About the Program

Agricultural Economics, MS

About the Program

Program Requirements - Thesis

Required Courses (15 credits)

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

ECON 51200 - Intermediate Economics II

Credit Hours: 3.00. Course content includes money and banking, national income and aggregative economics; the analysis of the determination of national income, employment, the price level, and the balance of payments. Consideration of both theory and economic policy. Not open to students with credit in ECON 35200 .

Credits: 3.00

ECON 51100 - Intermediate Economics I

Credit Hours: 3.00. Consumer behavior and demand, production and cost, factor demand, market structure, general equilibrium and welfare. Emphasis on the tools used to analyze the behavior of individual economic units. Not open to students with credit in ECON 34000 .

Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Thesis Research (12 credits)

Selectives (18 credits)

AGEC 52400 - Agricultural Finance

Credit Hours: 3.00. Designed to provide students the concepts and tools to apply financial management principles to farm businesses. Topics include financing alternatives, preparation and interpretation of financial statements, and capital investment analysis using discounted cash flows.

Learning Outcomes: 1. Prepare, interpret, and analyze financial statements used for agricultural businesses. 2. Analyze and suggest methods to improve the financial performance of agricultural businesses. 3. Evaluate capital investments using discounted cash flow methods. 4. Describe and analyze the risk and returns faced by agricultural businesses. Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

AGEC 52600 - International Food And Agribusiness Marketing Strategy

Credit Hours: 3.00. Students will develop their analytical, decision-making, and communication skills related to marketing management of food systems in the world economy. They will analyze a foreign market's potential and market entry strategies; compare consumer differences and similarities across markets; define issues related to marketing mix standardization or adaptation; and evaluate effects of economic, social, and legal environments on marketing strategy.

Credits: 3.00

AGEC 53000 - Strategic Agribusiness Management

Credit Hours: 3.00. Addresses issues in the strategic management of agricultural and food businesses. Emphasis is on developing a framework for formulating strategy, making strategic choices in a variety of business environments, and implementing strategy. Extensive use of management case studies and a major term project with an agribusiness firm focus on developing managerial problem-solving skills.

Credits: 3.00

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market

equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

AGEC 60000 - Agricultural Finance

Credit Hours: 3.00. Advanced capital budgeting topics including: tax policy, inflation, optimal replacement, bid models, and inclusion of financing flows; application of expected utility theory and mathematical programming to optimal capital structure decisions of proprietors; farmland investment, pricing, and dynamics; pricing contingent claims. Prerequisite: AGEC 52400; AGEC 55200 suggested.

Credits: 3.00

AGEC 60500 - Agricultural Markets And Price Analysis

Credit Hours: 3.00. Agricultural markets are multi-faceted, having been studied using a wide range of analytical tools. This graduate-level course emphasizes charactering demand and supply of agricultural markets and understanding forces that determine commodity and food prices. It also aims to cover a set of economic studies of prices and assist students in applying theoretical frameworks and time-series econometrics to empirical analysis of agricultural prices. In addition to studying prices in perfectly competitive markets, the first half of the course highlights several classic models of consumer demand and agricultural supply, prices under imperfect competition, price spreads (marketing margins), and the economics of information. The second half of the course focuses on empirical price analysis. Popular time-series econometric tools are introduced to study price relationships over space and time, price discovery mechanisms, and functions of futures markets.

Learning Outcomes: 1. Work with classic demand and supply models in the context of agricultural markets. 2. Derive classic models of price setting and marketing margins. 3. Understand econometrics of time-series models. 4. Apply time-series models to agricultural price data. Credits: 3.00

AGEC 61300 - Introduction To Economics Of Risk

Credit Hours: 3.00. A background in expected utility theory and applications. EUH axioms, risk aversion, utility elicitation, expected utility and moments, stochastic dominance, mean-variance, risk free asset, diversification, single index model, increasing risk, production under risk, programming models and applications. Prerequisite: AGEC 55200, ECON 51100, STAT 51100.

Credits: 3.00

AGEC 61400 - Advanced Agricultural Production Economics

Credit Hours: 3.00. Course covers advanced techniques for economic analysis of agricultural production economics. Students are required to produce a course project demonstrating competency at the applied research frontier of the field and participate in presentation, discussion, and peer review of course members' work. Prerequisites: AGEC 61200 and ECON 60700 or Consent of Instructor.

Learning Outcomes: 1. Demonstrate knowledge. 2. Demonstrate applied research methods. 3. Demonstrate critical thinking. 4. Demonstrate communication. Credits: 3.00

AGEC 61600 - Resource Economics And Policy

Credit Hours: 3.00. Natural resource development and allocation in both static and dynamic contexts. Analysis of scarcity and growth issues, equity considerations, derivation of optimal pricing and depletion rules. Application of advanced production concepts to national resource problems. Prerequisite: AGEC 60400, ECON 51100.

Credits: 3.00

AGEC 62200 - Food System Organization And Policy

Credit Hours: 3.00. Development of framework to study food system organization and policy; survey of measurement and empirical testing problems in industrial-organization research on food-system market structure and performance; review of competition policies and evaluation of policy alternatives. Prerequisite: Graduate courses in microeconomic theory and marketing.

Credits: 3.00

AGEC 63000 - Urban And Regional Economics

Credit Hours: 3.00. The literature discussed in this urban and regional economics course covers theoretical texts, conceptual as well as statistical, and empirical applications in order to introduce the student to the economist's view on spatial variation in economic outcomes. This ranges from coverage of the theory of industrial location choice, through theoretical and empirical analysis of the spatial distribution of economic activities (agglomeration theory, industrial clusters, central place theory), to theoretical and empirical explanations for the spatial structure of cities, the working of regional labor markets and migration. The course covers various empirical tools utilized in spatial data analysis (spatial econometrics) and modeling of regional economies and their interrelations (interregional input-output analysis). Prerequisites: AGEC 20300 or ECON 34000 or ECON 51100.

Credits: 3.00

AGEC 63100 - The Theory And Practice Of Spatial Econometrics

Credit Hours: 3.00. This course deals with the analysis of spatial data and centers on both exploratory tools developed in spatial statistics and GIScience, as well as on econometric models that have been the main focus in spatial econometrics. During the course, the theoretical basis for the analysis of spatial data and spatial models will be covered. This theoretical angle will be combined with ample opportunities to acquire hands-on experience in the analysis of spatial data. To the effect, up-to-date software, such as GeoDa, R, Stata, and MATLAB will be used. A good working knowledge of basic statistics and regression techniques is needed. Prior experience with GIS is helpful but not required. Prerequisites: AGEC 45100 or AGEC 65000 or ECON 67100 or STAT 41700 or STAT 51200 or STAT 51700.

Credits: 3.00

AGEC 63300 - Advanced Topics In Space, Health, And Population Economics

Credit Hours: 1.00. This course is designed to introduce students to advanced research in space, health, and population economics. It is designed to introduce both topical content and state-of-the-art research tools to students through a combination of guest speakers, faculty presentations, and discussions. The seminar also serves as a forum for students to present their own work and receive critical commentary from faculty and peers. The course is organized as a graduate seminar and gives students a chance to actively explore their own research ideas.

Credits: 1.00

AGEC 64000 - Agricultural Policy

Credit Hours: 3.00. Policy analysis for agriculture in the world economy. Emphasis on application of economic theory to analyze commodity programs, international trade, environmental concerns, and investment in human capital and agricultural research. Prerequisite: AGEC 41000, AGEC 60400.

Credits: 3.00

AGEC 64300 - Theory Of Economic Development

Credit Hours: 3.00. The economic theories behind the predominant approaches to economic development are reviewed. Both the sources of growth and problems in the development process are stressed. Emphasis is on the analysis and evolution of the models supporting the different approaches and the empirical analysis leading to changes in the paradigms. The role of agriculture in the economic development process is one of the topics. Other important issues are technological change, income distribution, structural adjustment, and the debt problem. Prerequisite: ECON 51100 , ECON 51200 .

Credits: 3.00

AGEC 64400 - International Agricultural Trade

Credit Hours: 3.00. International trade theory relevant to understanding world agricultural trade and the problems of agriculture in an open economy. Models for analyzing the effects of trade policy and market conditions on the agricultural sector. Welfare analysis of restrictions on trade. Prerequisite: ECON 51100 , ECON 51200

Credits: 3.00

AGEC 65200 - Application Of Quantitative Analysis: Mathematical Programming

Credit Hours: 3.00. Recent literature on the theory and application of mathematical programming and agricultural modeling. Model building and analysis techniques with focus on matching solution methods to problems. Prerequisite: AGEC 55200, ECON 61200; a course in matrix algebra.

Credits: 3.00

AGEC 53200 - World Food Problems

Credit Hours: 3.00. This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Learning Outcomes: 1. Understand global food production and consumption, food trade and its history including: the major plants produced and consumed; where they are grown; patterns and extent of global food trade; major food animals and animal production systems; countries involved in food trade; urbanization and food transportation; and effects of post-harvest processing on food trade and availability. 2. Understand basics of world population growth and its relationship to past and future food production and consumption globally. 3. Understand what malnutrition looks like, where it occurs, how it is measured, and the interactions between malnutrition (both under nutrition and obesity) and human health. 4. Understand the basic economic principles that

affect consumer food costs and consumption patterns globally. 5. Understand how culture, communication and politics influence food availability, world food problems and malnutrition. 6. Predict, based on available information, likely scenarios for the future of world food problems and malnutrition. Credits: 3.00

AGEC 60900 - Applied Welfare Analysis

Credit Hours: 3.00. This course develops the theory and methods used to assess the benefits and costs of economic policies and projects. Topics include benefit-cost analysis, economic impact analysis, nonmarket valuation, and analysis of risk and uncertainty. Prerequisites: A graduate course in microeconomic theory; a graduate course in regression analysis.

Learning Outcomes: 1. Estimate a project's benefit's and costs, including shadow pricing project inputs and outputs and valuing non-market goods and services. 2. Appropriate apportion various benefits and cost across different project stakeholders to estimate the distribution of project benefits and costs across society. 3. Derive and interpret economic measures of project performance, including net present value, internal rate of return, and benefit-cost ratios. 4. Incorporate risk and uncertainty into project analysis. Credits: 3.00

Required Courses (15 credits)

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

ECON 51200 - Intermediate Economics II

Credit Hours: 3.00. Course content includes money and banking, national income and aggregative economics; the analysis of the determination of national income, employment, the price level, and the balance of payments. Consideration of both theory and economic policy. Not open to students with credit in ECON 35200 .

Credits: 3.00

ECON 51100 - Intermediate Economics I

Credit Hours: 3.00. Consumer behavior and demand, production and cost, factor demand, market structure, general equilibrium and welfare. Emphasis on the tools used to analyze the behavior of individual economic units. Not open to students with credit in ECON 34000 .

Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for

regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Program Requirements - Non-Thesis

Required Courses (15 credits)

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

ECON 51200 - Intermediate Economics II

Credit Hours: 3.00. Course content includes money and banking, national income and aggregative economics; the analysis of the determination of national income, employment, the price level, and the balance of payments. Consideration of both theory and economic policy. Not open to students with credit in ECON 35200 .

Credits: 3.00

ECON 51100 - Intermediate Economics I

Credit Hours: 3.00. Consumer behavior and demand, production and cost, factor demand, market structure, general equilibrium and welfare. Emphasis on the tools used to analyze the behavior of individual economic units. Not open to students with credit in ECON 34000 .

Credits: 3.00

Other Core Courses (6 credits)

AGEC 57100 - Global Issues In International Agribusiness

Credit Hours: 1.00. This is the first course in a required three-course sequence designed for students in the "Professional Masters in International Agribusiness" concentration in the Department of Agricultural Economics. The course objective is to expose students to a wide range of global issues directly and indirectly related to the production, processing, and marketing of agricultural products (food, fuel, fiber). Topics vary and may include food security, malnutrition, food safety, biofuels, the environment, trade and agricultural policy, emerging agricultural technologies, and climate change. Prerequisites: Enrollment in Professional Masters in International Agribusiness or permission of instructor required.

Learning Outcomes: 1. Understand key global issues affecting the business environment for international agribusiness. 2. Understand the structure and function of international agribusiness firms. 3. Reinforce foundational learning of topics through study and written assignments. 4. Facilitate their training as professionals. Credits: 1.00

AGEC 57200 - International Agribusiness Market Opportunities

Credit Hours: 2.00. This is the second course in a required three-course sequence designed for students in the "Professional Masters in International Agribusiness" concentration in the Department of Agricultural Economics. The course objective is to assist students in identifying and exploring market opportunities in international agribusiness, including those related to the production, processing, and marketing of agricultural products including food, fuel, and fiber. The course combines lectures with discussion and project-based learning and group activities.

Learning Outcomes: 1. Understand key

business opportunities for international agribusiness. 2. Reinforce foundational learning of topics through case studies, written assignments and oral presentations and discussion. 3. Facilitate their training as professionals. Credits: 2.00

AGEC 57300 - International Business Analysis

Credit Hours: 3.00. This is the third course in a required three-course sequence designed for students in the Professional Masters in International Agribusiness concentration in the Department of Agricultural Economics. The course objective is to assist students in conducting a professional business analysis focusing on either a market opportunity, financial management, or other management issue in international agribusiness. The course is project-based and includes group activities and written and oral presentations.

Learning Outcomes: 1. Develop hands on experience to facilitate their training as professionals. 2. Develop report writing and oral presentation skills. Credits: 3.00

Research Course (3 credits)

Selectives (30 credits)

Required Courses (15 credits)

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

ECON 51200 - Intermediate Economics II

Credit Hours: 3.00. Course content includes money and banking, national income and aggregative economics; the analysis of the determination of national income, employment, the price level, and the balance of payments. Consideration of both theory and economic policy. Not open to students with credit in ECON 35200 .

Credits: 3.00

ECON 51100 - Intermediate Economics I

Credit Hours: 3.00. Consumer behavior and demand, production and cost, factor demand, market structure, general equilibrium and welfare. Emphasis on the tools used to analyze the behavior of individual economic units. Not open to students with credit in ECON 34000 .

Credits: 3.00

Concentrations

GPA Requirements

About the Program

Agricultural Sciences Education and Communication, MS

About the Program

Program Requirements - Thesis

Required Courses (24-27 credits)

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects regulations. Credits: 1.00

Thesis Research (6-9 credits)

ASEC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (24-27 credits)

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects regulations. Credits: 1.00

Program Requirements - Non-Thesis

Required Courses (30 credits)

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects regulations. Credits: 1.00

Required Courses (30 credits)

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects

regulations. Credits: 1.00

Concentrations

GPA Requirements

About the Program

Agriculture, MAGR

About the Program

Program Requirements

Required Courses (xx credits)

Concentrations

GPA Requirements

Agronomy, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (24-30 credits)

Core Courses (xx credits)

AGRY 60100 - Introduction To Graduate Research

Credit Hours: 1.00. This course provides framework for graduate studies. It helps the new graduate student understand the roles and responsibilities in graduate education, providing guidance for scientific reading, writing, and research activities. Topics include understanding ethical issues in science, enhancing their ability to communicate with a broad range of people, and establishing initial perspectives on professional development. Permission of department required.

Learning Outcomes: 1. Prepared to practice good research record keeping. 2. Write a hypotheses for their research. 3. Exemplify integrity and honesty in their research. 4. Choose the appropriate mode of communications based on the expected response of their colleagues. 5. Assess their strengths and weaknesses and plan their student careers informed by potential professional careers. 6. Appreciate the value of diversity and inclusion in their research experience. 7. Consider paths from a wide range of options given their values, abilities and interests. Credits: 1.00

Statistics Courses (6 credits)

AGEC 65500 - Applied Economic Time Series Analysis

Credit Hours: 3.00. This course is designed to improve students' abilities to estimate and interpret time series models. The course begins with univariate models and progresses to multivariate analysis. Alternative methods for identifying, estimating, and forecasting with time series models will be discussed. In addition, analysis of non-stationary time series and co-integration modeling will be covered in this course. Prerequisite: AGEC 65100 or consent of instructor. Mastery of applied statistics, calculus, and microeconomic theory at the Masters level or higher is desirable.

Learning Outcomes: 1. Translate data and statistical results. 2. Apply knowledge and ethical research to data and data analysis literacy. 3. Integrating economic theory with applied analysis techniques. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had

calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and

fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

ENTM 64200 - Analysis Of Ecological Data

Credit Hours: 3.00. Intermediate course in analysis options for biological and ecological data. Topics include: univariate, multivariate, parametric and non-parametric analysis and their basis; advanced graphical techniques; basic mapping with and without geographical information systems; simulation modeling; associated coding for open source platforms. A previous graduate-level course in statistics is required. Working knowledge of ANOVA, t-tests, linear regression, and assumptions and distributions of test statistics for these is assumed.

Learning Outcomes: 1. Know data and analysis requirements when planning experiments and observational studies. 2. Apply several univariate and multivariate statistical analyses. 3. Model or simulate simple biological or ecological systems. 4. Use several different graphing techniques including mapping, three-dimensional plots, and animations. 5. Write code to accomplish 1-4 within open-source software. 6. Develop critical thinking skills. 7. Foster creativity by finding alternative solutions to analytical challenges. 8. Develop both the written and the technical side of communication skills. Credits: 3.00

Seminar Course (1 credit)

AGRY 59600 - Professional Presentations

Credit Hours: 1.00. Develop confidence and skills in preparing and delivering professional presentations to both peer scientific and student audiences. (el. 7)

Credits: 1.00

AGRY 59700 - Communicating With The Public

Credit Hours: 1.00. This course will prepare students being trained as agronomy professionals to enhance their communication skills so they can successfully interact with the public. (el. 7) Offered in alternate years.

Credits: 1.00

AGRY 69600 - Agronomy Graduate Seminar

Credit Hours: 1.00. Weekly discussion of assigned topics in soil and crop science.

Credits: 1.00

Thesis Research (6 credits)

AGRY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Special Problems Course (3 credits)

Concentrations

GPA Requirements

Additional Information

About the Program

American Studies, MA

About the Program

Program Requirements

Required Courses (36 credits)

Seminar Courses (12 credits)

AMST 60300 - American Studies Interdisciplinary Project

Credit Hours: 3.00. Students will conduct independent research under faculty supervision towards completion of the Special Field examination for the Ph.D. degree. The project should be an extended, original research essay, based upon interdisciplinary research. The project should aim to produce original findings on a clearly defined topic or problem. In addition to the research and essay, students must produce a statement of methodology in which they explain their choice of sources and how their project contributes to the field of American Studies. To be taken in the final semester of coursework. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60200 - Contemporary Issues In American Studies

Credit Hours: 3.00. An investigation of analytical categories, particularly race, class and gender, the multiple methodologies, and theoretical premises that shape developments in the field of American Studies. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60100 - Introduction To American Studies

Credit Hours: 3.00. An exploration of the cultural and institutional history of American Studies designed to acquaint students with the interdisciplinary concepts of American Studies by focusing on major canonical texts associated with that history. Prerequisite: Master's student standing and American Studies majors only.

Credits: 3.00

AMST 60500 - Theory And American Culture

Credit Hours: 3.00. This course provides an overview of key foundational texts in social and cultural theory, with a focus on theories of import to scholars in American Studies and related fields. We will explore the various types of theory, examining its internal logic, implications, and critiques. Consider this a brief introduction, meant to give you a general feel for the range and sophistication of available theories in American Studies. Moreover, as the "Cultural Politics" website observes, "Recent theory has reminded us that origin stories are powerful determining forces, and thus these tales of the growth and development of the discipline should be read both for what they say and for what they may leave out, read both for their truths and their partialities." Similarly, the course syllabus itself creates a particular narrative regarding the development of the discipline. As such, students are encouraged to consider the syllabus through this perspective.

Credits: 3.00

AMST 60600 - American Studies Methods

Credit Hours: 3.00. This class is specifically designed to be a survey course on the various methods employed by American Studies scholars from different disciplines. The objective of this course is to approach methods from both an epistemological and empirical perspective. In particular, we will investigate the what, why, and how of conducting research in an interdisciplinary field. As such, the following questions will drive this course: What are American Studies methods? Why are certain methodologies utilized (i.e., for what purpose)? How does one conduct research in American Studies? What method(s) should you use in your own research inquiry? And finally, what are some potential drawbacks in using a certain methodology for your project? This is a graduate seminar, and your active participation in discussions is mandatory. You will be asked to submit weekly discussion questions, lead five seminar discussions on selected topics from the required readings, and complete six assignments. The final assignment will include the background and methodological components of a research proposal.

Learning Outcomes: 1. Formulate critiques of the course readings. 2. Have investigated the readings on topics relevant in American Studies Methods. 3. Completed five total assignments, emphasizing the methodological lens, by drawing from course readings and independent research on your specific research topic.

Credits: 3.00

Major Field (15 credits)

Minor Field (9 credits)

Concentrations

GPA Requirements

About the Program

Animal Science, MS

About the Program

Program Requirements -Thesis & Non-thesis

Required Courses (24-30 credits)

Core courses (xx credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Seminar Courses (1 credit)

ANSC 68100 - Animal Sciences Graduate Seminar

Credit Hours: 1.00. Instruction and application of concepts for effective oral professional presentations in the field of Animal Sciences. The course will provide students with knowledge for effective oral communication of scientific information and an opportunity to put guidelines into practice. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking skills for graduate students in animal sciences. 2. Enable students with skills needed to organize information from multiple scientific sources into a coherent oral presentation. 3. Enable development of skills for effective oral communication of research and current research concepts to animal science audiences.

Credits: 1.00

Seminar Courses (1 credit)

ANSC 68100 - Animal Sciences Graduate Seminar

Credit Hours: 1.00. Instruction and application of concepts for effective oral professional presentations in the field of Animal Sciences. The course will provide students with knowledge for effective oral communication of scientific information and an opportunity to put guidelines into practice. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking skills for graduate students in animal sciences. 2. Enable students with skills needed to organize information from multiple scientific sources into a coherent oral presentation. 3. Enable development of skills for effective oral communication of research and current research concepts to animal science audiences.

Credits: 1.00

Animal Sciences Courses (xx credits)

Electives (12 credits)

Thesis Research (6 credits)

ANSC 69100 - Topical Research Problems

Credit Hours: 1.00 to 4.00. To be arranged with individual staff members prior to registration. Requires approval of the department head. Supervised individual research projects. Written reports required. Permission of instructor required.

Credits: 1.00 to 4.00

ANSC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Topical Research Course (0-6 credits)

ANSC 69100 - Topical Research Problems

Credit Hours: 1.00 to 4.00. To be arranged with individual staff members prior to registration. Requires approval of the department head. Supervised individual research projects. Written reports required. Permission of instructor required.

Credits: 1.00 to 4.00

Concentrations

GPA Requirements

Additional Information

About the Program

Anthropology, MS

About the Program

Program Requirements -Thesis

Required Courses (18 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies

that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical

positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Methods Courses (6 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for

understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

Advanced Anthropology Seminar (3 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the

human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3.

Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Statistics Course (0-3 credits)

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical methods for single variables or for relationships between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7. Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

Thesis Research (6 credits)

ANTH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Electives (9-12 credits)

Required Courses (18 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of

interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical

research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Methods Courses (6 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other

scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

Advanced Anthropology Seminar (3 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the

archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Program Requirements - Non-Thesis

Required Courses (18 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

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ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn

about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

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ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

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Methods Courses (6 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology

are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

Advanced Anthropology Seminar (3 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge,

communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Option A: Applied and Practicing Anthropology Courses (9 credits)

ANTH 64000 - Foundations And Frameworks: Applying Anthropology

Credit Hours: 3.00. This course focuses on using anthropology to address social issues. The course examines topics including: the history of anthropologists working in applied settings, the relationship between theory and practice, professional ethics, job opportunities, and skills needed as anthropological practitioners. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Identify key questions and concerns in applied anthropology. 2. Speak about the relationship of anthropological theory and practice and how that relationship has been discussed in the discipline. 3. Know about a series of anthropological practice areas and their progression over time. 4. Analyze your own development as an anthropologist by doing career related research and self-reflexive writing in the course. Credits: 3.00

ANTH 64200 - Public Engagement: Using Anthropological Knowledge

Credit Hours: 3.00. This course is about using and communicating anthropological knowledge. We will discuss what it means to work as an anthropologist and public intellectual. Effectively working with stakeholders, presenting information, offering solutions for addressing problems and implementing change are addressed. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Know how to convey your anthropological ideas and findings for multiple purposes and audiences. 2. Be familiar with how some well-known anthropologists have had broad influence inside and outside our discipline. 3. Prepare your anthropological data and information for disseminating to different audiences and outlets. 4. Develop your anthropological critical thinking, writing and presentation skills to become a more effective anthropological communicator. 5. Consider the most successful ways for being an engaged anthropologist in your own areas of interests. Credits: 3.00

ANTH 64100 - Discovery And Design: Making Projects Work

Credit Hours: 3.00. This course is about using anthropology to make projects work. Students will learn anthropological approaches and methods to discover salient aspects of a design problem and use this understanding to devise responses. Anthropological discovery, design and delivery processes are demonstrated. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Be able to use Rapid Assessment Procedures (RAP), the Delphi Technique, Domain Analysis and Cross-Cultural Survey Design. 2. Understand how community projects are put together from goals and objectives, strategies implementation plans and monitoring and evaluation and be able to use that knowledge in effectively designing projects. 3. Write a funding proposal that clearly explains the purpose, impact, and essential features of the project in order to secure funding or other essential support. 4. Apply the skills of anthropological discovery and design in your own practice area of interest. Credits: 3.00

Statistics Course (0-3 credits)

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical methods for single variables or for relationships between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7.

Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

Electives (6-18 credits)

Additional Requirements - Option A: Applied and Practicing Anthropology

Additional Requirements - Option B: Doctoral Pre-Proposal

Required Courses (18 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

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ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Methods Courses (6 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology.

3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

Advanced Anthropology Seminar (3 credits)

Core Courses (9 credits)

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case

studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Concentrations and Certificates

GPA Requirements

About the Program

Applied Geospatial Analytics, MS

About the Program

Program Requirements

Required Courses (30 credits)

Core Courses (24 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and

implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and

supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

FNR 58700 - Advanced Spatial Ecology And GIS

Credit Hours: 3.00. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales. The lab will focus on the use and application of these databases that are common in natural resource management settings.

Learning Outcomes: 1. Apply the principles of landscape ecology to the analysis of spatial change in urban, agricultural and forested landscapes for the purposes of natural resource management. 2. Calculate change in landscape patterns using a variety of geospatial tools such as geographic information systems, spatial models, and geostatistics. 3. Prepare reports using the traditional scientific journal article format, on the analysis of landscape-scale change, focusing on problems common to watershed management. 4. Compare and contrast the ways that biodiversity can be calculated using standard indices of organismal diversity. 5. Calculate ecological footprints and evaluate why these vary across geopolitical and/or ecological units. Credits: 3.00

CNIT 51000 - Data Literacy

Credit Hours: 3.00. This course examines concepts, models, and methods useful for applying data analytics in business environments. Focusing on hypothesis generation, the capturing, storage and expression of data, analysis for research and visualizations.

Learning Outcomes: 1. Apply critical thinking abilities and analytical thought. 2. Recognize diverse range of data types/storage strategies and demonstrate the ability to analyze and debate the applications of each proficiently. 3. Examine aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 4. Analyze a set of data yielding actionable insights that can be applied to research or business. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

CNIT 57500 - Data Analysis

Credit Hours: 3.00. This course will teach students how data analysis can inform decision-making. Students will develop analytical skills and focus is placed on predictive analysis to evaluate business decision. Students will develop logical reasoning and communication skills related to quantitative outputs. This course will also develop the ability to collect large datasets, organize, and combine them using Tableau software.

Learning Outcomes: 1. Recognize the pervasiveness and breadth of data collection options available in today's world. 2. Discern

and defend ethical applications of how collected data can be used for marketing. 3. Discuss how to find, download, clean and combine data sets. 4. Identify and evaluate trends in data sets. 5. Build models to make predictions about future events based upon historic data. Credits: 3.00

Selectives (6 credits)

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a

communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

Program Learning Outcomes

About the Program

Art: Studio Arts Concentration, MFA

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (27 credits)

AD 60300 - Theory In Art Seminar

Credit Hours: 3.00. Study of critical issues in modern and postmodern art and relevant methodologies: formalism, iconography, biography and autobiography. Marxism (cultural studies), semiotics, and psychoanalyses. Elements of contemporary professional art practice discussed, including writing of artists' and designers' statements, biographies, and resumes. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

AD 59200 - Graduate Seminar In Art Or Design History

Credit Hours: 3.00. This is a graduate seminar that focuses on a particular theme, period, or movement in the history of art or design. Permission from department required.

Learning Outcomes: 1. Analyze and discuss scholarly readings related to the history of art and design. 2. Analyze primary sources, artifacts, images, and other such materials related to the theme of the term. 3. Conduct original primary and scholarly research on a topic related to the seminar and present that research in written, visual, or oral forms. 4. Understand the social, cultural, and/or political context of art and design history. Credits: 3.00

Research Methods Course (3 credits)

AD 55000 - Research Methods In Art And Design

Credit Hours: 3.00. An intensive course in research methods to assist students in developing a topic for directed study. Introduction to various research tools; exercises exploring issues of style, content, and organization; research methods and how they pertain to art and design. Permission of department required.

Learning Outcomes: 1. Identify and develop effective research skills and methods as they apply to individual thesis projects. 2. Analyze and critique existing scholarship. 3. Design an effective thesis statement, devise a research plan and begin conducting research. 4. Practice critical writing skills through peer review of section drafts. Credits: 3.00

Graduate Critique Course (0-3 credits)

AD 61400 - Graduate Installation And Critique

Credit Hours: 3.00. A seminar for all graduate students in the studio arts incorporating the process of installation art to facilitate the exchange of ideas and professional criticism.

Credits: 3.00

Electives (9-12 credits)

Directed Project Research (9 credits)

AD 55800 - Directed Project Research In Studio Arts

Credit Hours: 1.00 to 3.00. Initial M.F.A. project research and production in studio arts. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of

the course. Credits: 1.00 to 3.00

AD 56800 - Directed Project Research In Design

Credit Hours: 1.00 to 3.00. Initial M.F.A. project research and production in design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 65800 - MFA Project Research In Studio Arts

Credit Hours: 1.00 to 6.00. Intensive M.F.A. project production and thesis research in studio arts. Prerequisite: Three credit hours of AD 55800 with a minimum B- grade. Permission of instructor required.

Credits: 1.00 to 6.00

AD 66800 - MFA Project Research In Design

Credit Hours: 1.00 to 6.00. Intensive M.F.A. project production and thesis research in design. Prerequisite: Three credit hours of AD 56800 with a minimum B- grade. Permission of instructor required.

Credits: 1.00 to 12.00

Thesis Research (6 credits)

AD 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

MFA Exhibition (3 credits)

AD 69700 - MFA Graduate Exhibition

Credit Hours: 3.00. Completion of M.F.A. thesis, oral defense, gallery installation of M.F.A. exhibition, public presentation, and documentation of exhibition. Prerequisite: Admission to the M.F.A. program in Art and Design. Concurrent Prerequisite: Must complete 12 credit hours of AD 65800 or AD 66800 during the same or prior session. Only open to M.F.A. graduate students in Art and Design. Permission of instructor required.

Credits: 3.00

GPA Requirements

Artificial Intelligence and Machine Learning, MSAI (OL)

About the Program

Program Requirements

Required Courses (27 credits)

Core Courses (10 credits)

SCLA 52200 - Artificial Intelligence Policy, Governance, And Ethics

Credit Hours: 3.00. This course provides students with a strong grounding in the policy, ethical, and legal regulatory dimensions and environment that shape the governance of AI. Students will analyze current and emerging laws, regulations, and governance strategies shaping the AI landscape across multiple jurisdictions and sectors. The course will help students gain an interdisciplinary understanding of the core ethical principles and values that guide AI.

Learning Outcomes: 1. Describe key stakeholders, institutions, and strategies involved in AI policymaking across multiple levels of government (local to global) in multiple fields and explain their roles in governing AI systems. 2. Evaluate the legal, regulatory, and other governance strategies that have been proposed or adopted by governments, firms, and civil society organizations, such as model cards, liability frameworks, standards, and impact assessments. 3. Analyze ethical and social issues related to the development and application of AI systems within multiple fields, including power, model bias, transparency, accountability, worker well-being, and privacy, as well as the translation of ethical values into technical aspects of AI governance practices within public and private, and non-profit sector organizations. 4. Synthesize, analyze, and communicate information about emerging policy issues in AI and the associated ethical and

social dimensions, identify stakeholder perspectives, and summarize proposed solutions. 5. Assess current and evolving trends, debates, and solutions in AI governance and ethics through case studies, contemporary issues, and comparative analysis. Credits: 3.00

SCLA 52100 - Societal Impacts Of Artificial Intelligence

Credit Hours: 3.00. Students in this course will draw upon knowledge from multiple fields to understand how AI is transforming social, political, and economic practices in institutions and in society. They will utilize interdisciplinary theories and methodological tools to measure and evaluate the societal impacts of AI. The utilizes a mix of case and source data and recent research in the field of AI to create opportunities for shared communication and learning among those in technical and non-technical fields that utilize artificial intelligence. Students will engage in systematic analysis of societal impact.

Learning Outcomes: 1. Describe how AI is transforming social, political, and economic institutions, practices and employment in multiple sectors, including healthcare, education, finance, communications, criminal justice and others. 2. Explain the nature of risks of AI in society and outline common strategies to manage risks. 3. Evaluate core theories used to understand AI's potential societal impact on connectedness, trust, creativity, and conflict. 4. Assess and communicate AI impacts by applying interdisciplinary tools drawing from social sciences, humanities, and STEM fields. 5. Identify the human rights implications of AI and understand potential mitigation practices. Credits: 3.00

GRAD 50200 - Interdisciplinary AI Fundamentals: Bridging Knowledge

Credit Hours: 1.00. This course provides foundational concepts for AI for those in both MSAI majors. This course covers the history of AI, the foundations of artificial reasoning and knowledge, and practical skills for communicating about AI technology, projects, and workflow. This graduate course, designed to be accessible to learners with diverse backgrounds, serves as a foundational introduction to the field of AI. Whether you come from a technical or non-technical background, this course will provide you with a solid grasp of AI concepts, principles, and their real-world applications. To be successful in this course, we encourage students to know math (e.g., algebra and calculus) and a basic understanding of programming (e.g., R, Python, or Java).

Learning Outcomes: 1. Describe the foundations of artificial reasoning, knowledge, and trace the historical development of AI. 2. Explain the basic concepts, terminologies, and applications of different AI algorithms, developing a problem-solving mindset applicable to various domains. 3. Examine the diverse range of AI applications across varied industries. 4. Explain the role human factors and social context play in the development of artificial intelligence. Credits: 1.00

GRAD 50400 - Advanced AI Fundamentals For Technical Professional

Credit Hours: 2.00. Artificial Intelligence (AI) is the driving force behind the transformation of industries, research, and technology. For students with a highly technical background, this 2-credit hour graduate course offers a deep dive into the fundamental principles, theories, and applications of AI. Specifically, this course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focus on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation. To be successful in this course students should have experience with programming such as Python and R and have a background that includes calculus, linear algebra, algorithms, and probability theory.

Learning Outcomes: 1. Identify key elements of Artificial Intelligence (AI) and Machine Learning (ML) algorithms. 2. Understand how to choose AI/ML algorithms for different analysis tasks. 3. Analyze data in both an exploratory and targeted manner using AI and ML approaches. 4. Implement and apply basic AI/ML algorithms for supervised and unsupervised learning. 5. Accurately evaluate the performance of AI/ML algorithms, as well as formulate and test hypotheses. Credits: 2.00

GRAD 58900 - Master Of Science In Artificial Intelligence Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a realistic or real-world artificial intelligence problem, with an emphasis on the application domain. The capstone course for the MSAI provides students with practical experience applying the collective set of skills developed through the MSAI program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams, will select a target beneficiary, arrange a consultation, develop a problem statement, a project plan that will yield benefits, and a strategy for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using AI that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

Major Courses (8 credits)

Required Major Course (2 credits)

GRAD 50400 - Advanced AI Fundamentals For Technical Professional

Credit Hours: 2.00. Artificial Intelligence (AI) is the driving force behind the transformation of industries, research, and technology. For students with a highly technical background, this 2-credit hour graduate course offers a deep dive into the fundamental principles, theories, and applications of AI. Specifically, this course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focus on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation. To be successful in this course students should have experience with programming such as Python and R and have a background that includes calculus, linear algebra, algorithms, and probability theory.

Learning Outcomes: 1. Identify key elements of Artificial Intelligence (AI) and Machine Learning (ML) algorithms. 2. Understand how to choose AI/ML algorithms for different analysis tasks. 3. Analyze data in both an exploratory and targeted manner using AI and ML approaches. 4. Implement and apply basic AI/ML algorithms for supervised and unsupervised learning. 5. Accurately evaluate the performance of AI/ML algorithms, as well as formulate and test hypotheses. Credits: 2.00

Artificial Intelligence/Machine Learning Courses (2-6 credits)

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized

instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component

analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

Data Mining Courses (1-6 credits)

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

MA 59800 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

CS 50023 - Data Engineering I

Credit Hours: 1.00. The course introduces students to the fundamentals of Data Engineering with a focus on tools and computational techniques to gather, construct, manipulate, summarize, and visualize data sets as a means to extract knowledge from the underlying data. Python and Python libraries are used. Completion of the course will allow learners to perform basic data analysis on data sets. Experience in Python Programming and Linear Algebra is required. The course also prepares learners for additional instruction in the courses Data Engineering II and Foundations of Decision Making.

Learning Outcomes: 1. Identify key file types (TXT, CSV, HTML) and their characteristics. Using Python, read data in these formats. 2. Create and execute Python scripts to parse, select, transform, summarize, and visualize data. 3. Explain how to identify and fill in missing values in data values. 4. Create informative visualizations from given data and recognize the key qualities of good visualizations. 5. Apply Pandas functions to

slice, dice, and summarize datasets. 6. Apply the process of sampling data and sample probabilistically. 7. Demonstrate how to transform and construct features (e.g., standardization, distances). 8. Compute summary statistics from data (e.g., covariance, correlation). 9. Explain how to solve simple data analysis problems. Credits: 1.00

CS 50024 - Data Engineering II

Credit Hours: 1.00. This course introduces students to the fundamentals of database management systems (DBMS) from a user's perspective. The principles of modeling an enterprise using Entity-Relationship diagrams and transforming the model into a relational or NoSQL database are illustrated through a range of examples. The SQL language is used to create, query, aggregate, and update a relational database. NOSQL databases and the related data models (column, graph, and document-based) are introduced. Experience in Python Programming is required.

Learning Outcomes: 1. Carry out database design steps from conceptual to logical to physical design. 2. Use SQL commands to define the structure of a relational database, populate, update and delete data in the database, retrieve data having specified characteristics, and specify access control. 3. Explain the differences, advantages, and disadvantages of relational and NOSQL databases. 4. Describe features of relational databases not needed in big data applications. 5. Create a document-based, NOSQL database like mongoDB and movie data from an SQL to a NOSQL database. 6. Understand the benefits and downsides of creating index structures on query performance for relational, and NOSQL databases. 7. Explain the difference between hash indices and B-tree indices. 8. Analyze large data sets created from piecing together multiple data files through the application of SQL queries. Credits: 1.00

CS 50025 - Foundations Of Decision Making

Credit Hours: 1.00. This course provides an overview of data science methods used for data-driven discovery, extraction of knowledge, and informed decision making. The course covers fundamental computational methods and statistical techniques used to correctly reason about uncertainty, conduct hypothesis tests, infer causal relationships, and apply and evaluate predictive models. The course highlights how sampling biases can impact fairness in decision making. Throughout, students get hands-on experience on how to make correct and explainable inferences from data. Experience in Python Progamming, Probability, Statistics and Linear Algebra is required.

Learning Outcomes: 1. Support and justify claims with evidence from data and discuss how human biases can impact interpretations. 2. Recognize the basic approach to formulating statistical hypothesis tests and apply parametric hypothesis tests for both discrete and continuous data. 3. Interpret p-values and apply them effectively to support claims about data. 4. Formulate and test conjectures with controlled experiments, including A/B testing. 5. Recognize the types of errors encountered when conducting multiple hypothesis tests. 6. Use computational approaches based on randomization for hypothesis testing and uncertainty quantification. 7. Discuss ethical issues such as privacy and fairness that can be associated with automating decisions based on machine learning methods. 8. Apply the basic components of classification methods using Python libraries. 9. Evaluate the performance of learned models with learning curves and k-fold cross validation and assess significance with hypothesis tests. Credits: 1.00

ECE 50836 - Introduction To Data Mining

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, i.e., the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering, classification, anomaly detection, recommendation and graph analysis. Students are expected to gain the skills to formulate data mining problems, solve the problems using data mining techniques and interpret the output.

Learning Outcomes: 1. Describe and explain

the process of data mining. 2. Formulate problems in real-world applications into data mining tasks and solve the problems using data mining techniques. 3. Implement software programs that conduct data mining and evaluate the output of data mining programs. 4. Present data mining solutions to people in scientific and other disciplines. Credits: 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

ILS 65100 - Introduction To Natural Language Processing

Credit Hours: 3.00. This course provides a comprehensive overview of the fundamental concepts, techniques, and applications in the field of natural language processing. Using Python programming, students will learn to implement NLP tasks from basic text processing to advanced techniques, including sentiment analysis to discern emotions from text and topic modeling to uncover latent themes within large datasets. Additionally, students will explore emerging technologies such as generative AI and Large Language Models (LLMs) and their implications for NLP. By the end of this course, students will emerge with a solid understanding of NLP principles, proficiency in Python programming for NLP tasks, and the ability to apply these skills to address diverse NLP challenges.

Learning Outcomes: 1. Describe Natural Language Processing (NLP) and its applications. 2. Apply Python programming to Natural Language Processing tasks. 3. Implement text analysis to extract information from text data. 4. Create solutions for sentiment analysis problems. 5. Build solutions for topic modeling tasks. 6. Describe generative AI and Large Language Models (LLMs) and their use cases. Credits: 3.00

Selectives (9 credits)

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to

analyze publicly available data. Credits: 3.00

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

MA 59800 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

OLS 58100 - Workshop In Organizational Leadership And Supervision

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education. Course may be offered in traditional, distance, or blended format. Course format may vary, depending upon topic of course.

Credits: 0.00 to 8.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.

Credits: 3.00

OLS 57900 - Emerging World-Class Leadership Strategies

Credit Hours: 3.00. Exposes graduate students to the theoretical foundation and empirical research associated with emerging strategies and theories in the study of world-class leadership. The structure of the course is four fold: the discovery of critical leadership skills and behaviors, discovery of critical world-class leadership strategies, encouragement of self analysis, discovery of leadership strengths, and conducting research on leadership issues. Permission of instructor required.

Credits: 3.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

CNIT 58500 - Organizational Change Management For IT Projects

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to manage the "people" side of organizational change that results from IT projects that implement new technologies, systems, services, and products into the workplace. This is sometimes called stakeholder management. The course reviews research of best practices in change management and their impact on project metrics such as schedule, budget, scope, stakeholder satisfaction. Students also learn how to identify and document the organizational and people impacts of new information technology solutions, and then develop a formal project plan to manage the organizational change. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for organizational change management into information technology projects. 2. Pro-actively apply an organizational change management framework and principles to a business situation, ideally an

information technology project. 3. Discuss, in intelligent discourse, the types of disruptive organizational change and how they can be caused by information technology projects. 4. Accurately document, and communicate IT-enabled changes to existing business processes. 5. Select, defend and utilize organizational change management tools and techniques in the context of information technology projects and management. 6. For residential, thesis students, research and contribute to the organizational change management body of knowledge as it can be applied to information technology projects. Credits: 3.00

IT 57100 - Project Management In Industry And Technology

Credit Hours: 3.00. The factors influencing decisions during the initiation, implementation, and termination of industrial and manufacturing projects are examined. Students work as project teams, using project management tools to develop implementation strategies. Permission of instructor required.

Learning Outcomes: 1. Understand and learn latest tools and techniques used in projects. 2. Develop a system perspective for understanding projects. 3. Align projects with strategic objectives. 4. Develop and think analytically in order to successfully apply knowledge and technical expertise to the solution of real business problems. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

SCLA 53000 - Strategic Foresight And Leadership

Credit Hours: 3.00. This course provides emerging leaders with strategic foresight tools and skills to understand and make decisions regarding long-term future operational defense-related environments. Strategic foresight is the ability to create and sustain a variety of high-quality long-term views and apply emerging insights in organizationally adaptive ways. Strategic foresight produces scenarios that are the basis for strategies and plans to help defense or industry organizations remain competitive into the foreseeable future.

Learning Outcomes: 1. Define and explain strategic foresight. 2. Distinguish the difference between a growth, fixed, and futures mindset in strategic foresight. 3. Make use of specific strategic foresight methodologies: horizon scanning, signals and drivers of change, the 2 x 2 matrix and archetype methods. 4. Make use of vision and alignment in executing a strategic foresight model. 5. Argue the importance of vision for strategic leadership. Credits: 3.00

GRAD 50600 - Big Data Tools And Technologies

Credit Hours: 3.00. This course is designed to equip students with the essential skills to handle big data effectively. It covers proficiency in big data technologies, scalable data processing techniques, and the integration of big data tools into data science workflows.

Learning Outcomes: 1. Demonstrate proficiency in big data technologies. 2. Apply scalable data processing techniques to handle large datasets. 3. Integrate big data tools into comprehensive data science workflows. 4. Demonstrate proficiency with cloud computing. Credits: 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and

sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

SCLA 50900 - Strategic Intelligence: Organizations, Technologies, Procedures, Policies

Credit hours: 3.00. The present course will examine all facets of strategic intelligence, anchoring the investigation around specific organizations and processes, from the major civilian to the major military-strategic intelligence agencies, the legislation that directs their work, and the supervisory bodies. The course will also include case studies that analyze and operationalize how intelligence agencies contribute to national security. The course aims to provide the students with a rounded and practical education in strategic intelligence, describing who is responsible for its deployment and exploitation and what its benefits are for national security.

Learning Outcomes: 1. Analyze the diplomatic, economic, informational, military, and political elements influencing national strategic intelligence. 2. Evaluate key agencies, institutions, and legislative frameworks that shape U.S. strategic intelligence collection, analysis, and dissemination. 3. Differentiate between various strategic intelligence organizations - civilian and military - and understand their unique contributions and limitations. 4. Assess how political, institutional, and cultural factors affect the development and execution of national strategic intelligence policies. 5. Formulate recommendations for improving strategic intelligence oversight, policymaking, and response mechanisms to current and emerging global threats. Credits: 3.00

OLS 58200 - Leadership and Organizational Change

Credit Hours: 3.00. Explores issues in leadership and organizational change. Included are change theories, utilizing resistance to change, contemporary approaches to change, the future workplace, and researching best practices in organizational change.

Learning Outcomes: 1. Attain an understanding of the major models of change theory. 2. Gain skills in managing change through pragmatic applications of change theories. 3. Complete a major change research project in which they investigate a change initiative, gather data, and make recommendations for successfully implementing the change. Credits: 3.00

Electives (3 credits)

Program Learning Outcomes

About the Program

Artificial Intelligence Management and Policy, MSAI (OL)

About the Program

Program Requirements

Required Courses (27 credits)

Core Courses (10 credits)

SCLA 52200 - Artificial Intelligence Policy, Governance, And Ethics

Credit Hours: 3.00. This course provides students with a strong grounding in the policy, ethical, and legal regulatory dimensions and environment that shape the governance of AI. Students will analyze current and emerging laws, regulations, and governance strategies shaping the AI landscape across multiple jurisdictions and sectors. The course will help students gain an interdisciplinary understanding of the core ethical principles and values that guide AI.

Learning Outcomes: 1. Describe key stakeholders, institutions, and strategies involved in AI policymaking across multiple levels of government (local to global) in multiple fields and explain their roles in governing AI systems. 2. Evaluate the legal, regulatory, and other governance strategies that have been proposed or adopted by governments, firms, and civil society organizations, such as model cards, liability frameworks, standards, and impact assessments. 3. Analyze ethical and social issues related to the development and application of AI systems within multiple fields, including power, model bias, transparency, accountability, worker well-being, and privacy, as well as the translation of ethical values into technical aspects of AI governance practices within public and private, and non-profit sector organizations. 4. Synthesize, analyze, and communicate information about emerging policy issues in AI and the associated ethical and social dimensions, identify stakeholder perspectives, and summarize proposed solutions. 5. Assess current and evolving trends, debates, and solutions in AI governance and ethics through case studies, contemporary issues, and comparative analysis. Credits: 3.00

SCLA 52100 - Societal Impacts Of Artificial Intelligence

Credit Hours: 3.00. Students in this course will draw upon knowledge from multiple fields to understand how AI is transforming social, political, and economic practices in institutions and in society. They will utilize interdisciplinary theories and methodological tools to measure and evaluate the societal impacts of AI. The utilizes a mix of case and source data and recent research in the field of AI to create opportunities for shared communication and learning among those in technical and non-technical fields that utilize artificial intelligence. Students will engage in systematic analysis of societal impact.

Learning Outcomes: 1. Describe how AI is transforming social, political, and economic institutions, practices and employment in multiple sectors, including healthcare, education, finance, communications, criminal justice and others. 2. Explain the nature of risks of AI in society and outline common strategies to manage risks. 3. Evaluate core theories used to understand AI's potential societal impact on connectedness, trust, creativity, and conflict. 4. Assess and communicate AI impacts by applying interdisciplinary tools drawing from social sciences, humanities, and STEM fields. 5. Identify the human rights implications of AI and understand potential mitigation practices. Credits: 3.00

GRAD 50200 - Interdisciplinary AI Fundamentals: Bridging Knowledge

Credit Hours: 1.00. This course provides foundational concepts for AI for those in both MSAI majors. This course covers the history of AI, the foundations of artificial reasoning and knowledge, and practical skills for communicating about AI technology, projects, and workflow. This graduate course, designed to be accessible to learners with diverse backgrounds, serves as a foundational introduction to the field of AI. Whether you come from a technical or non-technical background, this course will provide you with a solid grasp of AI concepts, principles, and their real-world applications. To be successful in

this course, we encourage students to know math (e.g., algebra and calculus) and a basic understanding of programming (e.g., R, Python, or Java).

Learning Outcomes: 1. Describe the foundations of artificial reasoning, knowledge, and trace the historical development of AI. 2. Explain the basic concepts, terminologies, and applications of different AI algorithms, developing a problem-solving mindset applicable to various domains. 3. Examine the diverse range of AI applications across varied industries. 4. Explain the role human factors and social context play in the development of artificial intelligence. Credits: 1.00

GRAD 50300 - AI Essentials: A Non-Technical Introduction

Credit Hours: 2.00. This course provides students on the translator track a foundation in the principles and methodologies of Artificial Intelligence (AI) to empower them to actively engage in interdisciplinary collaborations. With a focus on the essentials of AI, machine learning, and natural language processing, students will gain the knowledge and skills needed to bridge the gap between language and technology. Students will leverage AI tools and techniques to enhance translation efficiency, accuracy, and engagement in the ever-evolving digital landscape. Students will have a foundation in the methodology so they can effectively participate in interdisciplinary collaborations, serving as a valuable resource for industries where language and technology converge.

Learning Outcomes: 1. Explain the basic concepts and applications of different AI algorithms and how they apply for specific fields for application or research purposes. 2. Describe the types of data inputs and outputs used in different AI applications. 3. Define a project and apply basic AI approaches in a programming environment. 4. Communicate methods and results of an AI project to specialists and non-specialists. Credits: 2.00

GRAD 58900 - Master Of Science In Artificial Intelligence Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a realistic or real-world artificial intelligence problem, with an emphasis on the application domain. The capstone course for the MSAI provides students with practical experience applying the collective set of skills developed through the MSAI program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams, will select a target beneficiary, arrange a consultation, develop a problem statement, a project plan that will yield benefits, and a strategy for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using AI that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

Major Courses (8 credits)

GRAD 50400 - Advanced AI Fundamentals For Technical Professional

Credit Hours: 2.00. Artificial Intelligence (AI) is the driving force behind the transformation of industries, research, and technology. For students with a highly technical background, this 2-credit hour graduate course offers a deep dive into the fundamental principles, theories, and applications of AI. Specifically, this course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focus on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation. To be successful in this course students should have experience with programming such as Python and R and have a background that includes calculus, linear algebra, algorithms, and probability theory.

Learning Outcomes: 1. Identify key elements of Artificial Intelligence (AI) and Machine Learning (ML) algorithms. 2. Understand how to choose

AI/ML algorithms for different analysis tasks. 3. Analyze data in both an exploratory and targeted manner using AI and ML approaches. 4. Implement and apply basic AI/ML algorithms for supervised and unsupervised learning. 5. Accurately evaluate the performance of AI/ML algorithms, as well as formulate and test hypotheses. Credits: 2.00

GRAD 50300 - AI Essentials: A Non-Technical Introduction

Credit Hours: 2.00. This course provides students on the translator track a foundation in the principles and methodologies of Artificial Intelligence (AI) to empower them to actively engage in interdisciplinary collaborations. With a focus on the essentials of AI, machine learning, and natural language processing, students will gain the knowledge and skills needed to bridge the gap between language and technology. Students will leverage AI tools and techniques to enhance translation efficiency, accuracy, and engagement in the ever-evolving digital landscape. Students will have a foundation in the methodology so they can effectively participate in interdisciplinary collaborations, serving as a valuable resource for industries where language and technology converge.

Learning Outcomes: 1. Explain the basic concepts and applications of different AI algorithms and how they apply for specific fields for application or research purposes. 2. Describe the types of data inputs and outputs used in different AI applications. 3. Define a project and apply basic AI approaches in a programming environment. 4. Communicate methods and results of an AI project to specialists and non-specialists. Credits: 2.00

Applications of AI in Business, Non-Profit, & Public Sectors Courses

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops,

and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

POL 52601 - Technology, AI, And Ethics In Public Policy And Public Administration

Credit Hours: 3.00. Examines how emerging technologies like artificial intelligence (AI), automated decision systems, and digital platforms are being adopted in the public sector. It explores the benefits as well as ethical risks and challenges associated with implementing these technologies in areas like healthcare, education, child welfare, and criminal justice. Students will analyze governance strategies, policies, and administrative procedures to promote responsible technology use in government.

Learning Outcomes: 1. Summarize the main forms of digital technology and algorithmic practices (AI) that are being adopted in government operations and decision-making, including automated decision systems, digital public interfaces, and data integration platforms. 2. Analyze emerging trends and developments in the use of AI, automated decision systems, and data analytics in public agencies and governments, in the U.S., internationally, and at the local level. 3. Assess the benefits as well as risks and challenges associated with implementing these technologies in the public sector, including how the use of new technology is transforming interactions between government and citizens, impacting social welfare, and implicating issues of transparency, accountability, discretion, discrimination, and public trust. 4. Evaluate ethical concerns, biases, and risks to social welfare that may arise from the use of AI and automated decision systems in administering public programs and services and demonstrate the ability to examine issues from multiple stakeholder perspectives. 5. Propose governance strategies, policy solutions, and administrative procedures to ensure responsible and ethical use of AI and other emerging technologies in the public sector, such as best practices for procurement, implementation, auditing, and public engagement. Credits: 3.00

POL 52701 - Local To Global Governance Of Data, AI, And Emerging Technology

Credit Hours: 3.00. This course introduces students to the institutions and governing systems at the subnational, national, supranational, and international levels that regulate emerging technology, AI, and data. Focusing on laws, standards, and best practices, students will examine comparative case studies of regulation of big tech in differing governing environments. Students will explore how social, economic, and political factors shape differences in technology regulation across the globe.

Learning Outcomes: 1. Summarize the main policy institutions, stakeholders, and regulatory actors in subnational, national, supranational, and international settings as applied to area of emerging technology, AI, and data. 2. Analyze the current state of policy and its implementation in one or more regions or states as applied to areas of emerging technology, AI, and data. 3. Develop a proposal for best practices for managing the use of AI, data resources, or other emerging technology in a private, public, or non-profit setting. 4. Compare and contrast differences in technology regulation across the globe and explain common sources for these differences. Credits: 3.00

POL 50601 - Data, Machine Learning, And Artificial Intelligence For The Public Sector

Credit Hours: 3.00. This course examines how machine learning algorithms and tools related to artificial intelligence can be used to advance our understanding in public sector domains. Students will develop a comprehensive understanding of how to apply AI and various machine learning algorithms, focusing on practical applications and hands-on experience. It provides an overview public sector data sources and addresses ethical and privacy issues associated with this type of data.

Learning Outcomes: 1. Identify, construct, and manipulate public data ethically and appropriately for use in AI and machine learning applications. 2. Explain privacy and ethical considerations associated with the use of public sector data, including issues that arise when combining public and private sector data. 3. Demonstrate a comprehensive understanding of popular AI and machine learning algorithms, including supervised and unsupervised learning techniques. 4. Apply AI and machine learning techniques to real-world data sets, emphasizing those techniques commonly used in government, policy, and political settings. 5. Assess, interpret, and report AI and machine learning output to audiences commonly found in government, policy, and political settings. Credits: 3.00

PHRM 50000 - Artificial Intelligence And Its Use In Clinical Care

Credit Hours: 2.00. The course comprehensively covers key topics such as the mechanisms behind how AI functions, the capabilities and limitations of current technologies, and important considerations around data privacy, bias, and health equity. Ethical issues are also explored through analyses of real-world case studies. The course equips participants with a solid foundation to thoughtfully engage with, evaluate, and contribute to the ongoing integration of AI into clinical practice and beyond.

Learning Outcomes: 1. Identify various applications and settings where AI is being utilized in healthcare today and where it will migrate to in the future. 2. Describe the technical underpinnings of how AI tools are built and function. 3. Analyze the clinical and social impacts of AI for patient care including how patients are using these tools as well as various ethical and regulatory issues. 4. Synthesize a solution to clinical cases using AI tools to improve your skills in the healthcare industry. Credits: 2.00

EDCI 55201 - AI Integration In Education

Credit Hours: 3.00. This course aims to provide students with the knowledge and skills needed to understand and utilize Generative AI in education. Students will acquire fundamental coding skills and develop technical expertise in using and comprehending AI. By engaging in hands-on activities and analyzing real-world case studies, students will design and create their own AI applications using Google Teachable Machine to solve a specific problem of their choosing. Additionally, the course will examine ethical issues related to AI/GenAI, allowing students to establish guidelines for the meaningful integration of AI/GenAI in teaching and learning.

Learning Outcomes: 1. Define AI/GenAI and discuss its potential integration into education. 2. Create an innovative AI/Gen application using Google Teachable Machine. 3. Develop a learning activity using GenAI that caters to different learning preferences and needs. 4. Analyze and discuss the ethical issues surrounding the use of AI, specifically GenAI, in education from the perspectives of both learners and educators. Credits: 3.00

Data Management, Analysis, & Communication Courses

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2.

Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills by taking advanced quantitative methods courses. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data

management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 69500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive

web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

CNIT 51000 - Data Literacy

Credit Hours: 3.00. This course examines concepts, models, and methods useful for applying data analytics in business environments. Focusing on hypothesis generation, the capturing, storage and expression of data, analysis for research and visualizations.

Learning Outcomes: 1. Apply critical thinking abilities and analytical thought. 2. Recognize diverse range of data types/storage strategies and demonstrate the ability to analyze and debate the applications of each proficiently. 3. Examine aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 4. Analyze a set of data yielding actionable insights that can be applied to research or business. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

CNIT 57500 - Data Analysis

Credit Hours: 3.00. This course will teach students how data analysis can inform decision-making. Students will develop analytical skills and focus is placed on predictive analysis to evaluate business decision. Students will develop logical reasoning and communication skills related to quantitative outputs. This course will also develop the ability to collect large datasets, organize, and combine them using Tableau software.

Learning Outcomes: 1. Recognize the pervasiveness and breadth of data collection options available in today's world. 2. Discern and defend ethical applications of how collected data can be used for marketing. 3. Discuss how to find, download, clean and combine data sets. 4. Identify and evaluate trends in data sets. 5. Build models to make predictions about future events based upon historic data. Credits: 3.00

POL 52801 - Organizational Governance Of Technology And AI

Credit Hours: 3.00. This course examines the impact of technology policy on organizations and their organizational governance strategies for AI and technology. It explores the incentives, strategies, and activities of the private and non-profit sector in governing AI, as well as the relationship between the private, public, and non-governmental sectors.

Learning Outcomes: 1. Describe and evaluate the impact of legal, regulatory, and ethical frameworks (soft laws and hard laws) on organizational governance of AI, including how legal, technological, and social factors can advance and hinder AI governance in organizations. 2. Analyze different considerations for companies using and governing AI, depending on their size and stage, industry, and jurisdiction. 3. Evaluate strategies that AI practitioners in AI governance functions of organizations have used to manage AI systems and their risks. 4. Develop and communicate strategies to advance AI governance objectives in different organizational contexts, including through policies, assessments, procurement strategies, and/or education. Credits: 3.00

Selectives (9 credits)

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

MA 59800 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

OLS 58100 - Workshop In Organizational Leadership And Supervision

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education. Course may be offered in traditional, distance, or blended format. Course format may vary, depending upon topic of course.

Credits: 0.00 to 8.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.

Credits: 3.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain.

Credits: 2.00

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and

guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

CNIT 58500 - Organizational Change Management For IT Projects

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to manage the "people" side of organizational change that results from IT projects that implement new technologies, systems, services, and products into the workplace. This is sometimes called stakeholder management. The course reviews research of best practices in change management and their impact on project metrics such as schedule, budget, scope, stakeholder satisfaction. Students also learn how to identify and document the organizational and people impacts of new information technology solutions, and then develop a formal project plan to manage the organizational change. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for organizational change management into information technology projects. 2. Pro-actively apply an organizational change management framework and principles to a business situation, ideally an information technology project. 3. Discuss, in intelligent discourse, the types of disruptive organizational change and how they can be caused by information technology projects. 4. Accurately document, and communicate IT-enabled changes to existing business processes. 5. Select, defend and utilize organizational change management tools and techniques in the context of information technology projects and management. 6. For residential, thesis students, research and contribute to the organizational change management body of knowledge as it can be applied to information technology projects. Credits: 3.00

IT 57100 - Project Management In Industry And Technology

Credit Hours: 3.00. The factors influencing decisions during the initiation, implementation, and termination of industrial and manufacturing projects are examined. Students work as project teams, using project management tools to develop implementation strategies. Permission of instructor required.

Learning Outcomes: 1. Understand and learn latest tools and techniques used in projects. 2. Develop a system perspective for understanding projects. 3. Align projects with strategic objectives. 4. Develop and think analytically in order to successfully apply knowledge and technical expertise to the solution of real business problems. Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

SCLA 53000 - Strategic Foresight And Leadership

Credit Hours: 3.00. This course provides emerging leaders with strategic foresight tools and skills to understand and make decisions regarding long-term future operational defense-related environments. Strategic foresight is the ability to create and sustain a variety of high-quality long-term views and apply emerging insights in organizationally adaptive ways. Strategic foresight produces scenarios that are the basis for strategies and plans to help defense or industry organizations remain competitive into the foreseeable future.

Learning Outcomes: 1. Define and explain strategic foresight. 2. Distinguish the difference between a growth, fixed, and futures mindset in strategic foresight. 3. Make use of specific strategic foresight methodologies: horizon scanning, signals and drivers of change, the 2 x 2 matrix and archetype methods. 4. Make use of vision and alignment in executing a strategic foresight model. 5. Argue the importance of vision for strategic leadership. Credits: 3.00

POL 50601 - Data, Machine Learning, And Artificial Intelligence For The Public Sector

Credit Hours: 3.00. This course examines how machine learning algorithms and tools related to artificial intelligence can be used to advance our understanding in public sector domains. Students will develop a comprehensive understanding of how to apply AI and various machine learning algorithms, focusing on practical applications and hands-on experience. It provides an overview public sector data sources and addresses ethical and privacy issues associated with this type of data.

Learning Outcomes: 1. Identify, construct, and manipulate public data ethically and appropriately for use in AI and machine learning applications. 2. Explain privacy and ethical considerations associated with the use of public sector data, including issues that arise when combining public and private sector data. 3. Demonstrate a comprehensive understanding of popular AI and machine learning algorithms, including supervised and unsupervised learning techniques. 4. Apply AI and machine learning techniques to real-world data sets, emphasizing those techniques commonly used in government, policy, and political settings. 5. Assess, interpret, and report AI and machine learning output to audiences commonly found in government, policy, and political settings. Credits: 3.00

GRAD 50600 - Big Data Tools And Technologies

Credit Hours: 3.00. This course is designed to equip students with the essential skills to handle big data effectively. It covers proficiency in big data technologies, scalable data processing techniques, and the integration of big data tools into data science workflows.

Learning Outcomes: 1. Demonstrate proficiency in big data technologies. 2. Apply scalable data processing techniques to handle large datasets. 3. Integrate big data tools into comprehensive data science workflows. 4. Demonstrate proficiency with cloud computing. Credits: 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

PHIL 50000 - Advanced Ethics For Technology, Engineering, And Design

Credit Hours: 3.00. This graduate seminar is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen.

Learning Outcomes: 1. Recall and describe key concepts of professional and ethical responsibilities in national, international, and cross-cultural environments. 2. Apply the general ethical framework to analyze and resolve specific, concrete cases in engineering. 3. Develop a well-researched original case study that integrates professional and ethical considerations, informed by personal experiences and future aspirations in engineering. Credits: 3.00

PHIL 50800 - Advanced Ethics Of Data Science

Credit Hours: 3.00. This graduate seminar is designed to examine the new and important ethical issues that are arising as the applications of data science permeate more and more aspects of our lives. Because we're entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

Learning Outcomes: 1. Explain the conceptual framework for ethical reasoning in professional settings as it applies to data science. 2. Analyze case studies to identify and evaluate ethical issues arising from the applications of data science. 3. Assess critically the ethical implications of data science applications and propose well-reasoned solutions. Credits: 3.00

SCLA 50900 - Strategic Intelligence: Organizations, Technologies, Procedures, Policies

Credit hours: 3.00. The present course will examine all facets of strategic intelligence, anchoring the investigation around specific organizations and processes, from the major civilian to the major military-strategic intelligence agencies, the legislation that directs their work, and the supervisory bodies. The course will also include case studies that analyze and operationalize how intelligence agencies contribute to national security. The course aims to provide the students with a rounded and practical education in strategic intelligence, describing who is responsible for its deployment and exploitation and what its benefits are for national security.

Learning Outcomes: 1. Analyze the diplomatic, economic, informational, military, and political elements influencing national strategic intelligence. 2. Evaluate key agencies, institutions, and legislative frameworks that shape U.S. strategic intelligence collection, analysis, and dissemination. 3. Differentiate between various strategic intelligence organizations - civilian and military - and understand their unique contributions and limitations. 4. Assess how political, institutional, and cultural factors affect the development and execution of national strategic intelligence policies. 5. Formulate recommendations for improving strategic intelligence oversight, policymaking, and response mechanisms to current and emerging global threats. Credits: 3.00

OLS 58200 - Leadership and Organizational Change

Credit Hours: 3.00. Explores issues in leadership and organizational change. Included are change theories, utilizing resistance to change, contemporary approaches to change, the future workplace, and researching best practices in organizational change.

Learning Outcomes: 1. Attain an understanding of the major models of change theory. 2. Gain skills in managing change through pragmatic applications of change theories. 3. Complete a major change research project in which they investigate a change initiative, gather data, and

make recommendations for successfully implementing the change. Credits: 3.00

Electives (3 credits)

Program Learning Outcomes

About the Program

Athletic Training, MSAT

About the Program

Program Requirements

Required Courses (69 credits)

HK 59000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for graduate students. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes vary due to special topics nature of course. Credits: 1.00 to 3.00

HK 50000 - Introduction To Athletic Training Practice

Credit Hours: 3.00. This course covering the roles and responsibilities of an athletic trainer as well as the history, governance structure, and regulation of the athletic training profession. Instruction and practical application of taping, wrapping, bracing techniques, and protective equipment is also included. Permission of department required.

Learning Outcomes: 1. Identify and evaluate the role of the NATA, BOC, CAATE, Foundation, and state practice acts in athletic training governance and practice regulation. 2. Compare and differentiate the role of a certified athletic trainer and other professionals in the health care of patients and in the broader health care system. 3. Describe and critique safe athletic training practices (e.g. OSHA standards). 4. Evaluate the fundamental role of evidence-based practice as it relates to athletic training and its use in the clinical decision making process. 5. Explain the theoretical foundation of clinical outcomes assessment (e.g., disablement, health related quality of life) and apply common methods of outcomes assessment in athletic training clinical practice (generic, disease-specific, region-specific, and dimension-specific outcomes instruments). 6. Analyze mechanisms of injury/etiology, recognition, and treatment associated with common injuries and illnesses. 7. Develop skills in adhesive taping and acute injury management. 8. Develop skills in protective pad fabrication and implementation. 9. Develop technical skills in the appropriate management of athletic medical emergencies. 10. Have a working understanding of athletic and medical protective equipment/materials and be able to evaluate patient needs in athletic medical situations. 11. Construct a preparticipation examination as it pertain to the prevention of injuries. Credits: 3.00

HK 50600 - Evidence Based Practice In Athletic Training

Credit Hours: 2.00. Introduction to research methodology, and qualitative and quantitative data analysis as related to evidence-based practice of athletic training. The course addresses formulating clinical questions; searching, reading and appraising research; understanding levels of evidence; and citing and referencing works to become consumers of and designers of evidence. The course introduces students to the selection, application, and interpretation of basic descriptive, correlational, and interferential statistics. Permission of department required.

Learning Outcomes: 1. Understand and compare the types of research commonly undertaken by researchers within the field of athletic training. 2. Appreciate and understand the ethical considerations within the research process. 3. Conduct a review of literature on the research topic allowing the student to organize

and interpret the findings while writing of the review of literature of a paper for publication. 4. Consider the mechanics of designing the research process which allows the student to begin writing an introduction of a paper for publication. 5. Evaluate the concepts of internal and external validity of research design. 6. Weigh the importance of reliable and valid measurements in athletic training research. 7. Distinguish between experimental and non-experimental research designs and the advantages and disadvantages with each type of design. 8. Critique the typical measures utilized by athletic training researchers to report strength, proprioception and kinesthesia, balance, stability, range of motion, etc. results in athletic training research. 9. Create all the different components of the research design concluding with the writing of a methods section of a paper for publication. 10. Understand and apply basic statistical measures such as: descriptive, inferential and probability statistics. 11. Understand and apply the common applied statistical decision making techniques in athletic training research analysis of variance, repeated measures analysis of variance, and correlation analysis, etc. 12. Organize and construct the results section of the research project for both thesis chapter and manuscript formats. 13. Understand the importance of and methods associated with obtaining research funding through grant writing and other mechanisms. Credits: 2.00

HK 51500 - Emergency Medical Management In Athletic Training

Credit Hours: 4.00. This course is designed to teach management concepts and skills used by athletic trainers in emergency situations. Topics addressing prevention, recognition, and management of life-threatening and/or severe injury and illness are included. Application of skills that include the environment, CPR/AED, airway management, immobilization, bleeding control and sudden illness management are also addressed. Students will become certified in CPR/AED. Permission of department required.

Learning Outcomes: 1. Analyze typical administrative policies and procedures that govern first aid and emergency care. 2. Distinguish the different hospital trauma levels and the role of the system in the transportation decision making process. 3. Perform a primary and secondary patient assessment, as well as an assessment of the scene. 4. Obtain and interpret vital signs including pulse, respirations, blood pressure, core body temperature, and oxygen saturation. 5. Distinguish the different types of airway adjuncts and demonstrate airway management skills. 6. Evaluate the indications, application, and treatment parameters for supplemental oxygen administration for emergency situations, and be able to administer supplemental oxygen. 7. Apply proper management strategies for external hemorrhage. 8. Compare different proper positioning, immobilization and transfer techniques for a patient using a spine board. 9. Evaluate and select proper techniques for removing equipment and clothing to access an airway or evaluate an injured part. 10. Evaluate and choose techniques to immobilize injuries to the extremities. 11. Explain and demonstrate the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 12. Recommend strategies to manage environmental emergencies. 13. Distinguish and recommend techniques for infectious control regulations including Universal Precautions. 14. Attain Basic Life Support for Healthcare Providers certification. Credits: 4.00

HK 52000 - Evaluation And Management Of The Lower Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the lower extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as

identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the lower extremities. 2. Apply different methods of prevention for many injuries commonly seen in the lower extremities. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the lower extremities. 5. Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the lower extremities. 7. Summarize the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the lower extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question.
Credits: 3.00

HK 53000 - Evaluation And Management Of The Upper Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the upper extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the upper extremities. 2. Apply different methods of prevention for many injuries commonly seen in the upper extremities. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the upper extremities. 5. Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the upper extremities. 7. Summarize the role and function of commonly used prescription and non prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the upper extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of upper extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question.
Credits: 3.00

HK 54000 - Evaluation And Management Of The Spine And Head

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the spine and head, including

joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the spine and head. 2. Apply different methods of prevention for many injuries commonly seen in the spine and head. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the spine and head. 5. Consider anatomical growth and development characteristics of males and females in the following stages: pre-adolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the spine and head. 7. Summarize the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the spine and head. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics -validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 55000 - Evaluation And Management Of Medical Conditions

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the thorax and abdomen, including the cardiovascular, digestive, urinary, reproductive, endocrine, and lymphatic systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering injury assessment techniques of common illnesses and disease most often encountered by allied healthcare professionals will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the thorax and abdomen. 2. Apply different methods of prevention for many injuries commonly seen in the thorax and abdomen. 3. Differentiate general treatment and rehabilitation protocols to use with injuries in the thorax and abdomen. 4. Identify the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the thorax and abdomen. 5. Demonstrate through low fidelity simulation sound evaluation techniques of the thorax and abdomen. 6. Explain modifiable and non-modifiable risk factors pertaining to general medical conditions across the life span in the physically active and special populations. 7. Explain and identify the etiology, prevention, recognition and management of conditions leading to sudden death. 8. Explain and identify the etiology, prevention, recognition and management of general medical conditions associated with the systems of the body across the life span in the physically active and special populations. 9. Demonstrate the ability to assess and interpret findings in the evaluation of general medical conditions, using diagnostic accuracy and clinical prediction rules, associated with the systems of the body. 10. Explain the general therapeutic strategy, including drug categories for the treatment of general medical conditions. 11. Use available resources to identify indications, contraindications, precautions, and adverse

reactions of prescription and non-prescription medications. 12. Develop a clinical question, search for, assess, and synthesize evidence related to general medication conditions and pharmacology. Credits: 3.00

HK 66000 - Diagnostic Imaging In Athletic Training

Credit Hours: 1.00. This course provides students with an intensive study of radiology. Students will understand the types of diagnostic images commonly used in sports medicine, as well as basic interpretive techniques used in radiology. The course will emphasize the systematic approach for diagnostic images and interpretation of various diagnostic reports. Permission of department required. Prerequisite: HK 58000 with B- or better.

Learning Outcomes: 1. Understand the importance of imaging technology used in musculoskeletal care. 2. Evaluate the differences and capabilities of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 3. Understand the importance of communicating with other healthcare providers regarding radiological studies. 4. Describe a radiological report and evaluate the findings related to a rehabilitative plan of care. 5. Use terms commonly found in diagnostic radiography, MRI, CT, bone scintigraphy, and ultrasonography. 6. Summarize the fundamental physical principles of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 7. Categorize basic positions utilized for radiography. 8. Identify basic anatomy in routine radiography, MRI, CT, bone scintigraphy, and ultrasonography. 9. Compare the three types of densities usually seen on a radiograph and their significance. 10. Discuss the importance of correlating the study with the patient's history and physical exam. 11. Describe and then compare the different patterns of pathologic processes; including fractures, sprains, strains, effusions, stress reactions, DVT. 12. Differentiate the genetic anomalies commonly seen on radiographs. 13. Interpret routine radiographs and identify abnormalities. Credits: 1.00

HK 53500 - Athletic Training Interventions

Credit Hours: 3.00. This course is designed to provide the student with the foundational theory and techniques related to injury and illness intervention. Included are topics addressing tissue healing, theories of pain and pain control, concepts of kinetic chain stability and mobility, as well as principles related to the use of therapeutic medications. Students will discover how to plan and implement a comprehensive reconditioning program for injuries and conditions sustained by physically active individuals. Permission of department required.

Learning Outcomes: 1. Distinguish the role and types of clinical outcome assessments/measures utilized in clinical practice to determine patient progress. 2. Compare the phases of tissue healing and its implications on intervention design, implementation and progress. 3. Compare common pain control theories and evaluate methods to control pain. 4. Evaluate common indications and contraindications to common therapeutic interventions. 5. Compose a comprehensive rehabilitation program including: determination of therapeutic goals and objectives, selection of therapeutic modalities and exercise, methods of evaluation and documenting rehabilitation progress, and development of criteria for progression and return to activity. 6. Demonstrate and instruct therapeutic exercises and implement a rehabilitation plan. 7. Analyze local, state, and federal standards/law for the safe application of therapeutic modalities, rehabilitation equipment and medications. 8. Generalize concepts related to the administration of therapeutic administration of medication. 9. Use peer reviewed resources to examine a common condition presented to a rehabilitation professional and construct an evidence based injury rehabilitation protocol for return to competitive activities. 10. Perform a professional oral presentation using

professional communication skills. Credits: 3.00

HK 54500 - Therapeutic Modalities

Credit Hours: 3.00. Course covering the physiological effects, indications, contraindications, and precautions of contemporary therapeutic modalities. Students will design and plan therapeutic interventions. Focus will be on the application of therapeutic modalities according to evidence-based protocols. Included in this course will be the role of equipment safety and maintenance of therapeutic modalities. Permission of department required.

Learning Outcomes: 1. Explain the inflammatory response to acute and chronic injury. 2. Select the appropriate modality according to treatment goals and objectives. 3. Compare the prevailing pain control theories and associated rationale for the selection and use of therapeutic modalities for the control of acute and chronic pain. 4. Evaluate the physical properties, biophysics, set-up, indications, contraindications, and specific physiological effects associated with the application of superficial cold and heat; stimulating electrical currents; diathermy; therapeutic ultrasound; intermittent compression units; iontophoresis; traction; massage; biofeedback; and LASER. 5. Administer contemporary therapeutic modalities to a patient using clinically acceptable procedures including patient preparation, set-up, determination of dosage, and operational procedures according to established guidelines. 6. Inspect therapeutic equipment and the treatment environment. 7. Identify various standards that influence the approval, operation, inspection, maintenance and safe application of therapeutic equipment. 8. Use a systemic approach to create and answer a clinical question. 9. Summarize differences between narrative reviews, systematic reviews, and meta-analysis. 10. Search for, find, and document the best evidence to support a problem or clinical problem. 11. Develop a Critically Appraised Topic (CAT) that includes a PICO, creating a search strategy (search terms), using databases to find evidence, appraising evidence, determining levels of evidence, analyzing and synthesizing evidence, and determining a clinical bottom line. 12. Present a Critically Appraised Topic using professional communication skills. Credits: 3.00

HK 55500 - Principles Of Manual Medicine

Credit Hours: 2.00. This course will provide students with the theory, skills, and clinical application of manual medicine. The emphasis will be placed on passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. All skills will be introduced through onsite demonstration and hands-on practice. Permission of department required.

Learning Outcomes: 1. Describe the basic theories and principles of various types of manual medicine. 2. Evaluate the patient indications and contraindications, treatment efficacy, and clinical applications of each kind of manual medicine technique. 3. Summarize and select appropriate manual medicine techniques to match injury pathophysiology. 4. Choose and apply manual medicine treatment techniques, including passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. 5. Create a plan of care including manual medicine in preparation for exercise and recovery from exercise. 6. Compare the role of manual medicine in a multi-disciplinary approach to treatment of soft tissue injuries. Credits: 2.00

HK 56000 - Advanced Procedures In Athletic Training

Credit Hours: 2.00. This course aims to provide students with advanced psychomotor skills in athletic training, such as wound closure, orthopedic casting, orthotic fabrication, biometrics and other emerging techniques and technologies. Skill integration into practice will be considered and practice act concerns will be discussed. Permission of department required.

Learning Outcomes: 1. Recognize different types of wounds and which require advanced management, including wound closure. 2. Compare wound closure techniques to determine appropriate applications. 3. Summarize the differences between casting methods. 4. Evaluate casting techniques relative to patient indications and pathology present. 5. Explain the purpose of foot orthotics as related to the pathomechanical model. 6. Apply wound closure techniques, orthopedic castings, and fabricate orthotics in simulated patients. 7. Consider and summarize emerging technologies and practices in athletic training, such as the use of biometrics to determine use and efficacy in a clinical setting. Credits: 2.00

HK 63000 - Administration Of Athletic Training Programs

Credit Hours: 2.00. Course covering management and supervision of personnel, financial resources, as well as the preparation in planning, designing, developing, organizing, implementing, directing, and evaluating an athletic training health care program and facility. Legal concerns, risk management, insurance, and reimbursement will be discussed. Prerequisites: Completion of HK 50000 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Summarize the components associated with professional development and regulation of athletic trainers. 2. Distinguish the roles and responsibilities of health care professionals in the field of sports medicine. 3. Compare the current initiatives, missions, objectives, and professional activities of other allied health and medical organizations and professions. 4. Analyze the major elements of the National Athletic Trainers Association (NATA) Code of Ethics against published case report. 5. Recognize the importance and complexity of the ethical and legal issues associated with medical information, authorization to participate, record keeping, and confidentiality. 6. Appraise and recommend medical and professional liability insurance policies. 7. Develop administrative policy and procedures for operation of an athletic medical facility. 8. Develop a system of records for athletes and general facility operations. 9. Develop a comprehensive pre-participation medical exam. 10. Develop a basic architectural design of an athletic medical facility that is safe and efficient. 11. Develop a budget for operation of an athletic medical facility. Credits: 2.00

HK 63500 - Injury Prevention And Health Promotion

Credit Hours: 3.00. This course emphasizes theory and strategies for behavioral change relating to healthy lifestyles and specific health conditions. Analyses of major injury problems affecting patients in the workplace, community, at home, and in activity along with basic principles of nutrition and exercise as they pertain to individual health and activity are included. Prerequisite: HK 53500 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Develop and implement strategies to mitigate the risk for long-term health conditions across the lifespan. 2. Develop, implement, and assess the effectiveness of programs to reduce injury risk. 3. Plan and implement a comprehensive pre-participation examination process to affect health outcomes. 4. Develop, implement, and supervise comprehensive programs to maximize sport performance that are safe and specific to the clients activity. 5. Educate and make recommendations to clients/patients on fluids and nutrients to ingest prior to activity, during activity, and during recovery for a variety of activities and environmental conditions. 6. Educate clients/patients about the effects, participation consequences, and risks of misuse and abuse of alcohol, tobacco, performance-enhancing drugs/substances, and over-the-counter, prescription, and recreational drugs. Credits: 3.00

HK 64000 - Leadership In Athletic Training

Credit Hours: 2.00. This course is designed to prepare students to embark on paths of personal leadership development. The

course will examine leadership theory and research and emphasize the development of leadership and interpersonal skills. Understanding various methods of bringing about change will be provided and researched by learners, and then discussed in our time together. Students in this course will apply foundational business concepts in athletic training through self-assessment case studies and professional experiential exercises. Permission of department required. Prerequisite: HK 63000 with B- or better.

Learning Outcomes: 1. Compare key organizational behavior theories and concepts related to leadership and management. 2. Evaluate the unique of structures, processes, and interactions in health care organizations as they relate to leadership, management and policy. 3. Distinguish the different roles and specific challenges for leadership and management in health care. 4. Differentiate personal leadership orientation, styles and strengths. 5. Practice, hone, and demonstrate teamwork skills (e.g., leadership, collaboration, communication, etc.) in consulting team assignments and case analyses. 6. Develop a professional development plan for long term development as a professional. 7. Evaluate the value model to develop a business case to supply athletic training services. Credits: 2.00

HK 64500 - Psychosocial Interventions In Athletic Training

Credit Hours: 2.00. The focus of this course is on identification, referral, and treatment options for patients with organic and non-organic mental health conditions commonly seen in athletic training. The course will also address cultural competence in patient care and the role of various mental healthcare providers that comprise the mental health referral network. Permission of department required. Prerequisite: HK 535 with B- or better.

Learning Outcomes: 1. Explain the theoretical background of psychological and emotional response to injury and forced inactivity. 2. Identify and select psychosocial techniques into a patients treatment or rehabilitation program. 3. Evaluate which psychosocial techniques are appropriate for a patient in a given clinical scenario. 4. Identify at-risk individuals with psychosocial disorders and/or mental health emergencies. 5. Distinguish appropriate patients requiring referral to mental health care providers. 6. Develop a management plan for at-risk individuals. 7. Explain and demonstrate processes of effective interpersonal and cross-cultural communication. 8. Construct psychological techniques and interventions that are used to facilitate and motivate the patient for return to play. 9. Summarize the importance of Cultural Competence when providing healthcare. 10. Evaluate how psychosocial considerations affect clinical decision-making related to return to activity or participation. Credits: 2.00

HK 65000 - Seminar In Athletic Training

Credit Hours: 3.00. This course is a culminating experience in athletic training that will provide the student with a comprehensive review of athletic training foundational and specific knowledge regarding the Domains of Athletic Training. This course will help the student to prepare for athletic training practice. Permission of department required. Prerequisite: HK 53000 with B- or better.

Learning Outcomes: 1. Access, analyze, and differentiate between the essential documents of the national governing and regulatory bodies, including, but not limited to, the NATA Athletic Training Educational Competencies, BOC Standards of Professional Practice, the NATA Code of Ethics, and the BOC Role Delineation Study/Practice Analysis. 2. Produce a self-assessment of professional competence and create a professional development plan to maintain necessary credentials and promote life-long learning. 3. Summarize the tasks required for entry-level proficiency of athletic trainers within the five domains of the BOC Role Delineation Study/Practice Analysis. 4. Evaluate the recommendations found in the NATA Position Statements, Official Statements, and Consensus Statements against current practice patterns. 5. Appraise current trends at the state, district and national level in athletic training

involving clinical practice and education. Credits: 3.00

HK 54100 - Athletic Training Practicum I

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 17. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 18. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 19. Demonstrate the ability to evaluate a patient with an emergency injury or condition. Credits: 2.00

HK 54200 - Athletic Training Practicum II

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate

professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Educate others using relevant and effective teaching methods. 20. Produce quality documentation in a timely manner to support the delivery of athletic training services. 21. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 22. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 23. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 24. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 25. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 54300 - Athletic Training Practicum III

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management.

15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyzes data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 29. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 30. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 64100 - Athletic Training Practicum IV

Credit Hours: 8.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required. Prerequisite: HK 54300.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional

performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to screen a medical record(s) or an individual or group of individuals to allow for safe physical activity and make appropriate recommendation and/or referrals as necessary. 29. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 30. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 31. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 32. Locate community-based resources for psychosocial intervention. 33 Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 34. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 8.00

HK 64200 - Athletic Training Practicum V

Credit Hours: 6.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5.

Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management. 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 29. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 30. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 31. Locate community-based resources for psychosocial intervention. 32. Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 33. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 6.00

HK 58300 - Patient Care Simulation In Athletic Training I

Credit Hours: 2.00. This course is designed to refine psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care

decisions. Permission of department required.

Learning Outcomes: 1. Evaluate a patient and then select and apply appropriate taping applications for injury reduction and prevention. 2. Select and apply protective equipment for use by active individuals participating in sport. 3. Apply specialty taping procedures in response to patient indications and treatment goals. 4. Perform a primary and secondary patient assessment for a patient in an emergency situation. 5. Obtain and evaluate vital signs including pulse, respirations, blood pressure, core body temperature, and oxygen saturation. 6. Differentiate and select from the different types of airway adjuncts to demonstrate airway management. 7. Use the indications and treatment parameters in an emergency situation to determine appropriateness of supplemental oxygen administration. 8. Administer supplemental oxygen to patients in an emergency situation. 9. Create a management plan of external hemorrhage and apply this emergent and non-emergent situations. 10. Consider and select proper immobilization and transfer techniques for a patient using a spine board. 11. Evaluate techniques for removing equipment and clothing to access an airway or evaluate an injured part and select the most appropriate for a given situation. 12. Apply corrective intervention techniques for the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 13. Analyze patients and institute a management plan for patients in an environmental emergency. Credits: 2.00

HK 68300 - Patient Care Simulation In Athletic Training II

Credit Hours: 3.00. This course is designed to refine psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care decisions. Permission of department required. Prerequisite: HK 56300 with a B- or higher.

Learning Outcomes: 1. Evaluate common orthopedic conditions of the axial and appendicular skeleton, formulate a differential diagnosis, and recommend appropriate treatment strategies. 2. Evaluate patients with medical conditions involving the cardiovascular system, gastrointestinal system, dermatological system, endocrine system and determine a differential diagnosis with appropriate interventions, including potential for referral. 3. Evaluate general medical conditions and common non-orthopedic conditions of the head and face and determine a differential diagnosis with appropriate interventions, including potential for referral. 4. Screen a patients' general health and wellness, fitness, nutrition, gait, posture, and movement to address deficiencies in order to develop treatment strategies and referrals (where indicated). 5. Design an overall program to include fitness and wellness, nutrition, and general injury prevention strategies (including ergonomics). 6. Use baseline evaluation data of mobility, stability, strength, and balance to compose a therapeutic exercise program to address known deficits. 7. Select and incorporate therapeutic modalities into the rehabilitation plan of care. 8. Formulate a progressive rehabilitation plan using evidence-based interventions for common musculoskeletal injuries and conditions. 9. Instruct a patient in corrective exercise and a home exercise program. 10. Use patient and clinician oriented outcomes to make clinical decisions, including recommended interventions, activity progressions, and return to play decisions. 11. Educate and instruct a patient on general health and wellness

behaviors and in the program to address deficiencies identified on a comprehensive fitness evaluation. 12. Communicate patient care status with stakeholders involved on the healthcare team (other providers, parents, coaches, administrators). Credits: 3.00

Required Courses (69 credits)

HK 59000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for graduate students. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes vary due to special topics nature of course. Credits: 1.00 to 3.00

HK 50000 - Introduction To Athletic Training Practice

Credit Hours: 3.00. This course covering the roles and responsibilities of an athletic trainer as well as the history, governance structure, and regulation of the athletic training profession. Instruction and practical application of taping, wrapping, bracing techniques, and protective equipment is also included. Permission of department required.

Learning Outcomes: 1. Identify and evaluate the role of the NATA, BOC, CAATE, Foundation, and state practice acts in athletic training governance and practice regulation. 2. Compare and differentiate the role of a certified athletic trainer and other professionals in the health care of patients and in the broader health care system. 3. Describe and critique safe athletic training practices (e.g. OSHA standards). 4. Evaluate the fundamental role of evidence-based practice as it relates to athletic training and its use in the clinical decision making process. 5. Explain the theoretical foundation of clinical outcomes assessment (e.g., disablement, health related quality of life) and apply common methods of outcomes assessment in athletic training clinical practice (generic, disease-specific, region-specific, and dimension-specific outcomes instruments). 6. Analyze mechanisms of injury/etiology, recognition, and treatment associated with common injuries and illnesses. 7. Develop skills in adhesive taping and acute injury management. 8. Develop skills in protective pad fabrication and implementation. 9. Develop technical skills in the appropriate management of athletic medical emergencies. 10. Have a working understanding of athletic and medical protective equipment/materials and be able to evaluate patient needs in athletic medical situations. 11. Construct a preparticipation examination as it pertain to the prevention of injuries. Credits: 3.00

HK 50600 - Evidence Based Practice In Athletic Training

Credit Hours: 2.00. Introduction to research methodology, and qualitative and quantitative data analysis as related to evidence-based practice of athletic training. The course addresses formulating clinical questions; searching, reading and appraising research; understanding levels of evidence; and citing and referencing works to become consumers of and designers of evidence. The course introduces students to the selection, application, and interpretation of basic descriptive, correlational, and interferential statistics. Permission of department required.

Learning Outcomes: 1. Understand and compare the types of research commonly undertaken by researchers within the field of athletic training. 2. Appreciate and understand the ethical considerations within the research process. 3. Conduct a review of literature on the research topic allowing the student to organize and interpret the findings while writing of the review of literature of a paper for publication. 4. Consider the mechanics of designing the research process which allows the student to begin writing an introduction of a paper for publication. 5. Evaluate the concepts of internal and external validity of research design. 6. Weigh the importance of reliable and valid measurements in athletic training research. 7. Distinguish between experimental and non-experimental research designs and the

advantages and disadvantages with each type of design. 8. Critique the typical measures utilized by athletic training researchers to report strength, proprioception and kinesthesia, balance, stability, range of motion, etc. results in athletic training research. 9. Create all the different components of the research design concluding with the writing of a methods section of a paper for publication. 10. Understand and apply basic statistical measures such as: descriptive, inferential and probability statistics. 11. Understand and apply the common applied statistical decision making techniques in athletic training research analysis of variance, repeated measures analysis of variance, and correlation analysis, etc. 12. Organize and construct the results section of the research project for both thesis chapter and manuscript formats. 13. Understand the importance of and methods associated with obtaining research funding through grant writing and other mechanisms. Credits: 2.00

HK 51500 - Emergency Medical Management In Athletic Training

Credit Hours: 4.00. This course is designed to teach management concepts and skills used by athletic trainers in emergency situations. Topics addressing prevention, recognition, and management of life-threatening and/or severe injury and illness are included. Application of skills that include the environment, CPR/AED, airway management, immobilization, bleeding control and sudden illness management are also addressed. Students will become certified in CPR/AED. Permission of department required.

Learning Outcomes: 1. Analyze typical administrative policies and procedures that govern first aid and emergency care. 2. Distinguish the different hospital trauma levels and the role of the system in the transportation decision making process. 3. Perform a primary and secondary patient assessment, as well as an assessment of the scene. 4. Obtain and interpret vital signs including pulse, respirations, blood pressure, core body temperature, and oxygen saturation. 5. Distinguish the different types of airway adjuncts and demonstrate airway management skills. 6. Evaluate the indications, application, and treatment parameters for supplemental oxygen administration for emergency situations, and be able to administer supplemental oxygen. 7. Apply proper management strategies for external hemorrhage. 8. Compare different proper positioning, immobilization and transfer techniques for a patient using a spine board. 9. Evaluate and select proper techniques for removing equipment and clothing to access an airway or evaluate an injured part. 10. Evaluate and choose techniques to immobilize injuries to the extremities. 11. Explain and demonstrate the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 12. Recommend strategies to manage environmental emergencies. 13. Distinguish and recommend techniques for infectious control regulations including Universal Precautions. 14. Attain Basic Life Support for Healthcare Providers certification. Credits: 4.00

HK 52000 - Evaluation And Management Of The Lower Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the lower extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the lower extremities. 2. Apply different methods of prevention for many injuries commonly seen in the lower extremities. 3. Differentiate common

risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the lower extremities. 5. Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the lower extremities. 7. Summarize the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the lower extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 53000 - Evaluation And Management Of The Upper Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the upper extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the upper extremities. 2. Apply different methods of prevention for many injuries commonly seen in the upper extremities. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the upper extremities. 5. Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the upper extremities. 7. Summarize the role and function of commonly used prescription and non prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the upper extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of upper extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 54000 - Evaluation And Management Of The Spine And Head

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the spine and head, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the spine and head. 2. Apply different methods of prevention

for many injuries commonly seen in the spine and head. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the spine and head. 5. Consider anatomical growth and development characteristics of males and females in the following stages: pre-adolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the spine and head. 7. Summarize the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the spine and head. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics -validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 55000 - Evaluation And Management Of Medical Conditions

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the thorax and abdomen, including the cardiovascular, digestive, urinary, reproductive, endocrine, and lymphatic systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering injury assessment techniques of common illnesses and disease most often encountered by allied healthcare professionals will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the thorax and abdomen. 2. Apply different methods of prevention for many injuries commonly seen in the thorax and abdomen. 3. Differentiate general treatment and rehabilitation protocols to use with injuries in the thorax and abdomen. 4. Identify the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the thorax and abdomen. 5. Demonstrate through low fidelity simulation sound evaluation techniques of the thorax and abdomen. 6. Explain modifiable and non-modifiable risk factors pertaining to general medical conditions across the life span in the physically active and special populations. 7. Explain and identify the etiology, prevention, recognition and management of conditions leading to sudden death. 8. Explain and identify the etiology, prevention, recognition and management of general medical conditions associated with the systems of the body across the life span in the physically active and special populations. 9. Demonstrate the ability to assess and interpret findings in the evaluation of general medical conditions, using diagnostic accuracy and clinical prediction rules, associated with the systems of the body. 10. Explain the general therapeutic strategy, including drug categories for the treatment of general medical conditions. 11. Use available resources to identify indications, contraindications, precautions, and adverse reactions of prescription and non-prescription medications. 12. Develop a clinical question, search for, assess, and synthesize evidence related to general medication conditions and pharmacology. Credits: 3.00

HK 66000 - Diagnostic Imaging In Athletic Training

Credit Hours: 1.00. This course provides students with an intensive study of radiology. Students will understand the types of diagnostic images commonly used in sports medicine, as well

as basic interpretive techniques used in radiology. The course will emphasize the systematic approach for diagnostic images and interpretation of various diagnostic reports. Permission of department required. Prerequisite: HK 58000 with B- or better.

Learning Outcomes: 1. Understand the importance of imaging technology used in musculoskeletal care. 2. Evaluate the differences and capabilities of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 3. Understand the importance of communicating with other healthcare providers regarding radiological studies. 4. Describe a radiological report and evaluate the findings related to a rehabilitative plan of care. 5. Use terms commonly found in diagnostic radiography, MRI, CT, bone scintigraphy, and ultrasonography. 6. Summarize the fundamental physical principles of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 7. Categorize basic positions utilized for radiography. 8. Identify basic anatomy in routine radiography, MRI, CT, bone scintigraphy, and ultrasonography. 9. Compare the three types of densities usually seen on a radiograph and their significance. 10. Discuss the importance of correlating the study with the patient's history and physical exam. 11. Describe and then compare the different patterns of pathologic processes; including fractures, sprains, strains, effusions, stress reactions, DVT. 12. Differentiate the genetic anomalies commonly seen on radiographs. 13. Interpret routine radiographs and identify abnormalities. Credits: 1.00

HK 53500 - Athletic Training Interventions

Credit Hours: 3.00. This course is designed to provide the student with the foundational theory and techniques related to injury and illness intervention. Included are topics addressing tissue healing, theories of pain and pain control, concepts of kinetic chain stability and mobility, as well as principles related to the use of therapeutic medications. Students will discover how to plan and implement a comprehensive reconditioning program for injuries and conditions sustained by physically active individuals. Permission of department required.

Learning Outcomes: 1. Distinguish the role and types of clinical outcome assessments/measures utilized in clinical practice to determine patient progress. 2. Compare the phases of tissue healing and its implications on intervention design, implementation and progress. 3. Compare common pain control theories and evaluate methods to control pain. 4. Evaluate common indications and contraindications to common therapeutic interventions. 5. Compose a comprehensive rehabilitation program including: determination of therapeutic goals and objectives, selection of therapeutic modalities and exercise, methods of evaluation and documenting rehabilitation progress, and development of criteria for progression and return to activity. 6. Demonstrate and instruct therapeutic exercises and implement a rehabilitation plan. 7. Analyze local, state, and federal standards/law for the safe application of therapeutic modalities, rehabilitation equipment and medications. 8. Generalize concepts related to the administration of therapeutic administration of medication. 9. Use peer reviewed resources to examine a common condition presented to a rehabilitation professional and construct an evidence based injury rehabilitation protocol for return to competitive activities. 10. Perform a professional oral presentation using professional communication skills. Credits: 3.00

HK 54500 - Therapeutic Modalities

Credit Hours: 3.00. Course covering the physiological effects, indications, contraindications, and precautions of contemporary therapeutic modalities. Students will design and plan therapeutic interventions. Focus will be on the application of therapeutic modalities according to evidence-based protocols. Included in this course will be the role of equipment safety and maintenance of therapeutic modalities. Permission of department required.

Learning Outcomes: 1. Explain the inflammatory

response to acute and chronic injury. 2. Select the appropriate modality according to treatment goals and objectives. 3. Compare the prevailing pain control theories and associated rationale for the selection and use of therapeutic modalities for the control of acute and chronic pain. 4. Evaluate the physical properties, biophysics, set-up, indications, contraindications, and specific physiological effects associated with the application of superficial cold and heat; stimulating electrical currents; diathermy; therapeutic ultrasound; intermittent compression units; iontophoresis; traction; massage; biofeedback; and LASER. 5. Administer contemporary therapeutic modalities to a patient using clinically acceptable procedures including patient preparation, set-up, determination of dosage, and operational procedures according to established guidelines. 6. Inspect therapeutic equipment and the treatment environment. 7. Identify various standards that influence the approval, operation, inspection, maintenance and safe application of therapeutic equipment. 8. Use a systemic approach to create and answer a clinical question. 9. Summarize differences between narrative reviews, systematic reviews, and meta-analysis. 10. Search for, find, and document the best evidence to support a problem or clinical problem. 11. Develop a Critically Appraised Topic (CAT) that includes a PICO, creating a search strategy (search terms), using databases to find evidence, appraising evidence, determining levels of evidence, analyzing and synthesizing evidence, and determining a clinical bottom line. 12. Present a Critically Appraised Topic using professional communication skills. Credits: 3.00

HK 55500 - Principles Of Manual Medicine

Credit Hours: 2.00. This course will provide students with the theory, skills, and clinical application of manual medicine. The emphasis will be placed on passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. All skills will be introduced through onsite demonstration and hands-on practice. Permission of department required.

Learning Outcomes: 1. Describe the basic theories and principles of various types of manual medicine. 2. Evaluate the patient indications and contraindications, treatment efficacy, and clinical applications of each kind of manual medicine technique. 3. Summarize and select appropriate manual medicine techniques to match injury pathophysiology. 4. Choose and apply manual medicine treatment techniques, including passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. 5. Create a plan of care including manual medicine in preparation for exercise and recovery from exercise. 6. Compare the role of manual medicine in a multi-disciplinary approach to treatment of soft tissue injuries. Credits: 2.00

HK 56000 - Advanced Procedures In Athletic Training

Credit Hours: 2.00. This course aims to provide students with advanced psychomotor skills in athletic training, such as wound closure, orthopedic casting, orthotic fabrication, biometrics and other emerging techniques and technologies. Skill integration into practice will be considered and practice act concerns will be discussed. Permission of department required.

Learning Outcomes: 1. Recognize different types of wounds and which require advanced management, including wound closure. 2. Compare wound closure techniques to determine appropriate applications. 3. Summarize the differences between casting methods. 4. Evaluate casting techniques relative to patient indications and pathology present. 5. Explain the purpose of foot orthotics

as related to the pathomechanical model. 6. Apply wound closure techniques, orthopedic castings, and fabricate orthotics in simulated patients. 7. Consider and summarize emerging technologies and practices in athletic training, such as the use of biometrics to determine use and efficacy in a clinical setting. Credits: 2.00

HK 63000 - Administration Of Athletic Training Programs

Credit Hours: 2.00. Course covering management and supervision of personnel, financial resources, as well as the preparation in planning, designing, developing, organizing, implementing, directing, and evaluating an athletic training health care program and facility. Legal concerns, risk management, insurance, and reimbursement will be discussed. Prerequisites: Completion of HK 50000 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Summarize the components associated with professional development and regulation of athletic trainers. 2. Distinguish the roles and responsibilities of health care professionals in the field of sports medicine. 3. Compare the current initiatives, missions, objectives, and professional activities of other allied health and medical organizations and professions. 4. Analyze the major elements of the National Athletic Trainers Association (NATA) Code of Ethics against published case report. 5. Recognize the importance and complexity of the ethical and legal issues associated with medical information, authorization to participate, record keeping, and confidentiality. 6. Appraise and recommend medical and professional liability insurance policies. 7. Develop administrative policy and procedures for operation of an athletic medical facility. 8. Develop a system of records for athletes and general facility operations. 9. Develop a comprehensive pre-participation medical exam. 10. Develop a basic architectural design of an athletic medical facility that is safe and efficient. 11. Develop a budget for operation of an athletic medical facility. Credits: 2.00

HK 63500 - Injury Prevention And Health Promotion

Credit Hours: 3.00. This course emphasizes theory and strategies for behavioral change relating to healthy lifestyles and specific health conditions. Analyses of major injury problems affecting patients in the workplace, community, at home, and in activity along with basic principles of nutrition and exercise as they pertain to individual health and activity are included. Prerequisite: HK 53500 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Develop and implement strategies to mitigate the risk for long-term health conditions across the lifespan. 2. Develop, implement, and assess the effectiveness of programs to reduce injury risk. 3. Plan and implement a comprehensive pre-participation examination process to affect health outcomes. 4. Develop, implement, and supervise comprehensive programs to maximize sport performance that are safe and specific to the clients activity. 5. Educate and make recommendations to clients/patients on fluids and nutrients to ingest prior to activity, during activity, and during recovery for a variety of activities and environmental conditions. 6. Educate clients/patients about the effects, participation consequences, and risks of misuse and abuse of alcohol, tobacco, performance-enhancing drugs/substances, and over-the-counter, prescription, and recreational drugs. Credits: 3.00

HK 64000 - Leadership In Athletic Training

Credit Hours: 2.00. This course is designed to prepare students to embark on paths of personal leadership development. The course will examine leadership theory and research and emphasize the development of leadership and interpersonal skills. Understanding various methods of bringing about change will be provided and researched by learners, and then discussed in our time together. Students in this course will apply foundational business concepts in athletic training through self-assessment case studies and professional experiential exercises. Permission of department required. Prerequisite: HK 63000 with B- or better.

Learning Outcomes: 1. Compare key organizational behavior theories and concepts

related to leadership and management. 2. Evaluate the unique of structures, processes, and interactions in health care organizations as they relate to leadership, management and policy. 3. Distinguish the different roles and specific challenges for leadership and management in health care. 4. Differentiate personal leadership orientation, styles and strengths. 5. Practice, hone, and demonstrate teamwork skills (e.g., leadership, collaboration, communication, etc.) in consulting team assignments and case analyses. 6. Develop a professional development plan for long term development as a professional. 7. Evaluate the value model to develop a business case to supply athletic training services. Credits: 2.00

HK 64500 - Psychosocial Interventions In Athletic Training

Credit Hours: 2.00. The focus of this course is on identification, referral, and treatment options for patients with organic and non-organic mental health conditions commonly seen in athletic training. The course will also address cultural competence in patient care and the role of various mental healthcare providers that comprise the mental health referral network. Permission of department required. Prerequisite: HK 535 with B- or better.

Learning Outcomes: 1. Explain the theoretical background of psychological and emotional response to injury and forced inactivity. 2. Identify and select psychosocial techniques into a patients treatment or rehabilitation program. 3. Evaluate which psychosocial techniques are appropriate for a patient in a given clinical scenario. 4. Identify at-risk individuals with psychosocial disorders and/or mental health emergencies. 5. Distinguish appropriate patients requiring referral to mental health care providers. 6. Develop a management plan for at-risk individuals. 7. Explain and demonstrate processes of effective interpersonal and cross-cultural communication. 8. Construct psychological techniques and interventions that are used to facilitate and motivate the patient for return to play. 9. Summarize the importance of Cultural Competence when providing healthcare. 10. Evaluate how psychosocial considerations affect clinical decision-making related to return to activity or participation. Credits: 2.00

HK 65000 - Seminar In Athletic Training

Credit Hours: 3.00. This course is a culminating experience in athletic training that will provide the student with a comprehensive review of athletic training foundational and specific knowledge regarding the Domains of Athletic Training. This course will help the student to prepare for athletic training practice. Permission of department required. Prerequisite: HK 53000 with B- or better.

Learning Outcomes: 1. Access, analyze, and differentiate between the essential documents of the national governing and regulatory bodies, including, but not limited to, the NATA Athletic Training Educational Competencies, BOC Standards of Professional Practice, the NATA Code of Ethics, and the BOC Role Delineation Study/Practice Analysis. 2. Produce a self-assessment of professional competence and create a professional development plan to maintain necessary credentials and promote life-long learning. 3. Summarize the tasks required for entry-level proficiency of athletic trainers within the five domains of the BOC Role Delineation Study/Practice Analysis. 4. Evaluate the recommendations found in the NATA Position Statements, Official Statements, and Consensus Statements against current practice patterns. 5. Appraise current trends at the state, district and national level in athletic training involving clinical practice and education. Credits: 3.00

HK 54100 - Athletic Training Practicum I

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality

improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 17. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 18. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 19. Demonstrate the ability to evaluate a patient with an emergency injury or condition. Credits: 2.00

HK 54200 - Athletic Training Practicum II

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge,

theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Educate others using relevant and effective teaching methods. 20. Produce quality documentation in a timely manner to support the delivery of athletic training services. 21. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 22. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 23. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 24. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 25. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 54300 - Athletic Training Practicum III

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based.

20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyzes data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 29. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 30. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 64100 - Athletic Training Practicum IV

Credit Hours: 8.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required. Prerequisite: HK 54300.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish

an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to screen a medical record(s) or an individual or group of individuals to allow for safe physical activity and make appropriate recommendation and/or referrals as necessary. 29. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 30. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 31. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 32. Locate community-based resources for psychosocial intervention. 33 Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 34. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 8.00

HK 64200 - Athletic Training Practicum V

Credit Hours: 6.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with

consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management. 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 29. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 30. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 31. Locate community-based resources for psychosocial intervention. 32. Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 33. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 6.00

HK 58300 - Patient Care Simulation In Athletic Training I

Credit Hours: 2.00. This course is designed to refine psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care decisions. Permission of department required.

Learning Outcomes: 1. Evaluate a patient and then select and apply appropriate taping applications for injury reduction and prevention. 2. Select and apply protective equipment for use by active individuals participating in sport. 3. Apply specialty taping procedures in response to patient indications and treatment goals. 4. Perform a primary and secondary patient assessment for a patient in an emergency situation. 5. Obtain and evaluate vital signs including pulse, respirations, blood

pressure, core body temperature, and oxygen saturation. 6. Differentiate and select from the different types of airway adjuncts to demonstrate airway management. 7. Use the indications and treatment parameters in an emergency situation to determine appropriateness of supplemental oxygen administration. 8. Administer supplemental oxygen to patients in an emergency situation. 9. Create a management plan of external hemorrhage and apply this emergent and non-emergent situations. 10. Consider and select proper immobilization and transfer techniques for a patient using a spine board. 11. Evaluate techniques for removing equipment and clothing to access an airway or evaluate an injured part and select the most appropriate for a given situation. 12. Apply corrective intervention techniques for the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 13. Analyze patients and institute a management plan for patients in an environmental emergency. Credits: 2.00

HK 68300 - Patient Care Simulation In Athletic Training II

Credit Hours: 3.00. This course is designed to refine psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care decisions. Permission of department required. Prerequisite: HK 56300 with a B- or higher.

Learning Outcomes: 1. Evaluate common orthopedic conditions of the axial and appendicular skeleton, formulate a differential diagnosis, and recommend appropriate treatment strategies. 2. Evaluate patients with medical conditions involving the cardiovascular system, gastrointestinal system, dermatological system, endocrine system and determine a differential diagnosis with appropriate interventions, including potential for referral. 3. Evaluate general medical conditions and common non-orthopedic conditions of the head and face and determine a differential diagnosis with appropriate interventions, including potential for referral. 4. Screen a patients' general health and wellness, fitness, nutrition, gait, posture, and movement to address deficiencies in order to develop treatment strategies and referrals (where indicated). 5. Design an overall program to include fitness and wellness, nutrition, and general injury prevention strategies (including ergonomics). 6. Use baseline evaluation data of mobility, stability, strength, and balance to compose a therapeutic exercise program to address known deficits. 7. Select and incorporate therapeutic modalities into the rehabilitation plan of care. 8. Formulate a progressive rehabilitation plan using evidence-based interventions for common musculoskeletal injuries and conditions. 9. Instruct a patient in corrective exercise and a home exercise program. 10. Use patient and clinician oriented outcomes to make clinical decisions, including recommended interventions, activity progressions, and return to play decisions. 11. Educate and instruct a patient on general health and wellness behaviors and in the program to address deficiencies identified on a comprehensive fitness evaluation. 12. Communicate patient care status with stakeholders involved on the healthcare team (other providers, parents, coaches, administrators). Credits: 3.00

Additional Information

GPA Requirements

About the Program

Autonomy/Interdisciplinary Engineering, MSE or MS

About the Program

Program Requirements

Required Courses (27 credits)

Core Selectives (9 credits)

Major Courses (9 credits)

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of

convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

Professional Skills Courses (9 credits)

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of

convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

CE 56401 - Data Science For Smart Cities

Credit Hours: 3.00. The availability of low-cost and ubiquitous sensors in city infrastructure provides high granular data at unprecedented spatiotemporal scales. "Smart Cities" is a concept to utilize this data to provide a healthy, happy and sustainable urban ecosystem by integrating the information and communication technology, Internet of things, and citizen participation to effectively manage and utilize city's infrastructure and services. 'Data science' is an interdisciplinary field of scientific methods, processes, algorithms, and systems to extract knowledge from data in various forms. This course will introduce techniques that will allow the analysis, inference, and prediction of large-scale data (e.g., GPS trajectories, individual social networks, etc.) that are present in urban networks. The course will focus both on the methods and their application to smart city problems. Python will be used to demonstrate the application of each method on datasets available to the instructor. Examples of applications that will be discussed as an example of applications of data science for smart city applications include: ridesharing platforms, energy modeling, smart and energy-efficient buildings, evacuation modeling, decision-making during extreme events, and urban resilience.

Learning Outcomes: 1. Understand the different types of data generated by smart cities. 2. Understand the basics of various data mining techniques. 3. Understand what type of data mining analysis is appropriate for various smart city applications. 4. Gain basic knowledge of using Python for data analytics and results visualization. 5. Apply the methods and techniques learned in this course to an applied smart city project. Credits: 3.00

CE 56601 - Network Models For Connected And Autonomous Vehicles

Credit Hours: 3.00. This course provides an introduction to mathematical foundations of the analysis of transportation networks. The course will be divided into two main sections. Section 1 will introduce the basic foundations of network routing problems including user equilibrium (selfish routing) and system optimal games on networks. Various optimization-based formulations, algorithms and extensions will be discussed. A particular emphasis will be on devising efficient algorithms and computation on city networks. Students will be expected to know how to design efficient algorithms for network analysis and implement them on various datasets. The second half of the course will tailor the network models learned in the first half to understanding the impacts of connected and autonomous vehicles (CAVs). This will be done by taking specific example problems such as autonomous intersection control, parking design, network design for CAVs, etc. Recent research papers will form the basis for developing these models. Extensive use of intuitive arguments, counterintuitive phenomenon (paradoxes) and network structures will be utilized to illustrate many situations graphically. In addition, computing the solutions efficiently using various network algorithms will be discussed. The course is research based and students in addition to learning the concepts will extend the concepts to a research project to be finished within the semester.

Learning Outcomes: 1. Analyze transportation systems using game theory and optimization by drawing on analogies between the interactions of supply and demand in economic markets.

Define selfish routing (user equilibrium) and system optimal problems; Develop solution algorithms for large scale networks. 2. Apply specialized network structures to solve selfish routing games efficiently. 3. Formulate and apply various extensions of the selfish routing game rigorously - traffic assignment with elasticity, stochastic user equilibrium, network design and OD estimation. 4. Understand the basic concepts of Connected and Autonomous vehicles (CAVs). 5. Apply the static network models to CAV planning and operations problems. 6. Use software to analyze various large-scale transportation networks and understand issues from real-world practitioners. Credits: 3.00

Core Selectives (9 credits)

Required Courses (27 credits)

Core Selectives (9 credits)

Major Courses (9 credits)

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor

required.

Credits: 1.00 to 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

Professional Skills Courses (9 credits)

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Credits: 3.00

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Credits: 3.00

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Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

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Learning Outcomes: 1. Understand the different types of data generated by smart cities. 2. Understand the basics of various data mining techniques. 3. Understand what type of data mining analysis is appropriate for various smart city applications. 4. Gain basic knowledge of using Python for data analytics and results visualization. 5. Apply the methods and techniques learned in this course to an applied smart city project. Credits: 3.00

CE 56601 - Network Models For Connected And Autonomous Vehicles

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of intuitive arguments, counterintuitive phenomenon (paradoxes) and network structures will be utilized to illustrate many situations graphically. In addition, computing the solutions efficiently using various network algorithms will be discussed. The course is research based and students in addition to learning the concepts will extend the concepts to a research project to be finished within the semester.

Learning Outcomes: 1. Analyze transportation systems using game theory and optimization by drawing on analogies between the interactions of supply and demand in economic markets. Define selfish routing (user equilibrium) and system optimal problems; Develop solution algorithms for large scale networks. 2. Apply specialized network structures to solve selfish routing games efficiently. 3. Formulate and apply various extensions of the selfish routing game rigorously - traffic assignment with elasticity, stochastic user equilibrium, network design and OD estimation. 4. Understand the basic concepts of Connected and Autonomous vehicles (CAVs). 5. Apply the static network models to CAV planning and operations problems. 6. Use software to analyze various large-scale transportation networks and understand issues from real-world practitioners. Credits: 3.00

Core Selectives (9 credits)

Selective (3 credits)

About the Program

Aviation Technology, MSAAM

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (24-30 credits)

Core Course (3 credits)

AT 50500 - Research Methods In Aviation

Credit Hours: 3.00. This course explores the practical approach to research as it applies to identifying and exploring pragmatic problems in aviation industry settings. Industry based problems and issues often require a diversity of research skills, both quantitative and qualitative, in order to effectively address dynamic problems in complex and often high-risk work environments. This course offers an overview of mixed research methods which lends itself well to practical problem solving in industry. This course may also be offered in an online format. Permission of instructor required.

Learning Outcomes: 1. Select and develop an appropriate design and investigative methodology for commonly-encountered aviation research problems. 2. Perform, and properly interpret, elementary descriptive statistical analysis. 3. Determine the need for, and correctly apply, appropriate inferential statistical tests for a variety of data. 4. Test research and null hypotheses. 5. Prepare well-written scholarly papers, using specific style instructions. 6. Prepare survey instruments appropriate to differing aviation settings. 7. Utilize an accepted style/publication manual in preparation or written work. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

Statistics Course (3 credits)

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

AT 50700 - Quantitative Research Methodologies In Transportation

Credit Hours: 3.00. This course provides an introduction to business statistics with a specific focus on data analyses and managerial decision making in the transportation industry. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis.

Students use software to perform their own analyses. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the use of statistics to describe transportation processes. 2. Employ inferential statistics to facilitate transportation managerial decision making. 3. Demonstrate proficiency in the use of software tools to facilitate statistical analyses. Credits: 3.00

Electives (18-24 credits)

AT 50800 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. (IT 50800) Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology.

Learning Outcomes: 1. Evaluate the key dimensions of quality and their implications for manufacturing and service industries. 2. Assess the philosophies and contributions of prominent thought leaders to the field of quality and productivity critically. 3. Apply core principles of Total Quality Management (TQM) to analyze and improve quality assurance programs. 4. Design and implement process management and improvement methodologies, such as Six Sigma, Lean, and Value Stream Analysis, to enhance productivity. Credits: 3.00

AT 52000 - Operational Assessment And Improvement

Credit Hours: 3.00. This course focuses on developing the skills to analyze, formulate, and apply techniques for work task improvement. Concepts to be studied include workflow enhancement, critical element streamlining, and value added analysis. Students will explore process map construction, process ownership, measurement system validation, standards creation, and decision factors. An industry project will be assigned and used to facilitate course objectives. Permission of instructor required.

Learning Outcomes: 1. Analyze workflows and critical elements using tools such as SWOT analysis, mind mapping, and process map construction to identify opportunities for improvement. 2. Evaluate and validate measurement systems, establish process ownership, and develop standards to support operational efficiency. 3. Calculate and interpret process time, labor costs, and total process costs to inform decision-making and improvement strategies. 4. Develop and justify improvement targets, impact analysis, and value-added analysis to enhance operational effectiveness. 5. Design and implement a comprehensive cycle time analysis, metrics framework, and testing and implementation plan for workflow enhancements. Credits: 3.00

AT 52500 - Process Improvement And Simulation

Credit Hours: 3.00. This course explores process modeling and simulation as applied to decision-making for process design and improvement. Emphasis is placed on understanding the application of process simulations to business problems including using fundamental statistical methods in the solution of an industry relevant problem. By planning and executing a computer-based simulation supporting an aviation or aerospace process design and improvement project, students improve analysis and project management skills. In addition to simulation, preparing visualizations of the process is also included for increased understanding of process interactions.

Learning Outcomes: 1. The student will have the knowledge and skills required to plan and execute a process improvement and simulation project. 2. The student will be able to compose and evaluate process models and simulations in terms of validity, verification, and usefulness in decision-making. 3. The student will be proficient in Arena or another appropriate process modeling and simulation computer application, as assigned. 4. The student will demonstrate appropriate use of process modeling techniques and data collection required to support the models. 5. The student will prepare and present a formal report describing a process design and improvement project, the methodology used in the project,

and the results. 6. Assessment of the objectives is done by: Student's project plan and report; Individual test scores; and Participation in discussion and collaboration with other graduate students. Credits: 3.00

AT 52600 - Aviation Leadership

Credit Hours: 3.00. This course is intended for future aviation and aerospace managers. Using foundational readings, case studies, and critical analysis techniques, the contribution of past and contemporary aviation leaders will be reviewed. Permission of department required.

Learning Outcomes: 1. Perform a situational analysis of an aviation enterprise management or leadership challenge and recommend appropriate courses of action. 2. Form, lead, and support a team in an aeronautical work setting. 3. Distinguish management roles and actions from leadership roles and actions in both an air carrier organization as well as in a general aviation company. 4. Apply appropriate theories of leadership to realistic organizational situations such as an aviation manufacturing company, a corporate flight department, or aerospace industry organization. 5. Identify salient characteristics of individual and organizational behavior; plan courses of action for organizational change. 6. Identify the competencies of past successful airline leaders; plan a leadership development program for an individual leader in a current aeronautical position. 7. Determine the viability and sustainability of vision strategies as they relate to activities such as flight training schools, fixed-base operator, or airport administration. 8. Recognize global cultural differences and assess the impact of those differences on appropriate leadership styles and organizational change initiatives in selected emerging aeronautical enterprises. Credits: 3.00

AT 52800 - Management And Design Of Training Systems

Credit Hours: 3.00. This course will examine the practical applications of managing the training process in industry and educational settings, including the development of instructional materials from an adult learner perspective. Curriculum design using various forms of media and delivery strategies will be emphasized. This course may also be delivered in an online format. Permission of department required.

Learning Outcomes: 1. Gain management knowledge and skills required to develop a training program for industry or education. 2. Able to design a learning module using instructional design principles in his/her interest area. 3. Able to assess the effectiveness of the training design process. 4. Write a comprehensive training plan in an area of his/her field of study. Credits: 3.00

AT 53000 - Multi-Cultural Issues In Team Operations

Credit Hours: 3.00. This course explores the nature and origins of professional, national, and organizational culture and their role in multi-disciplinary team activities. Power distance, individualism/collectivism, gender differences, and uncertainty avoidance are examined in terms of research by Hofstede. Management studies of several international air carriers will be utilized to highlight how cultural differences can affect perceptions. Permission of department required.

Learning Outcomes: 1. Examine the effects of professional, national, and organizational cultures on team dynamics, with an emphasis on aviation operations. 2. Investigate how cultural dimensions, including power distance, individualism versus collectivism, gender roles, and uncertainty avoidance, shape perceptions and influence collaboration. 3. Explore the ways cultural diversity can either support or hinder effective communication and teamwork in multi-disciplinary settings. 4. Implement error management strategies to mitigate the risks of cultural misunderstandings and improve team performance in diverse operational contexts. 5. Assess the implications of globalization on cultural norms and behaviors, particularly in professional environments. 6. Engage with peers in multi-cultural group projects to critically analyze industry challenges and recommend actionable solutions. Credits: 3.00

AT 53100 - International Civil Aviation Regulatory Systems

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Discuss the history, organization, and interdependence of international, regional and national civil aviation regulatory systems. 2. Discuss the partnerships and alliances between government, industry, stakeholders and financial organizations to support international civil aviation. 3. Discuss transparency and access to international aviation regulatory oversight programs and efforts to mitigate deficiencies and support efficiency. 4. Identify and conduct research on emerging international aviation issues. 5. Demonstrate critical thinking in developing presentations on emerging international aviation regulatory topics. Credits: 3.00

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

AT 54200 - Aviation Fuels And Exhaust Emissions

Credit Hours: 3.00. This course focuses on aviation fuels, including engine operation with fuel, combustion principles, chemistry, exhaust emissions, and fuel testing procedures. Additionally, the topics of greenhouse gases, global warming, oil reserves, fuel costs, and other factors driving the development of alternative aviation fuels will be covered. Current research in these areas will be discussed and testing procedures will be studied. Students will research new fuels in development, and will analyze the sustainability and potential for success promised by the new technologies in comparison with existing fuels.

Learning Outcomes: 1. Evaluate the relationship of fuel chemistry, properties, and characteristics to the extent necessary to predict impact on performance. 2. Analyze and differentiate the steps in the refining process to determine the characteristics and costs of the various grades of aviation fuels. 3. Analyze fuel test results to predict engine performance utilizing this information. 4. Analyze and compare the exhaust emissions produced by current and new aviation fuels in relation to current and emerging air pollution regulations and policies. 5. Evaluate new fuels and fuel production processes to determine overall sustainability and projected costs under the European Union Emissions Tax Scheme. 6. Analyze the distribution requirements for new fuels in comparison with the existing infrastructure to determine the modifications or accommodations required for system-wide delivery and implementation. Credits: 3.00

AT 54600 - Aviation Financial Instruments And Operations

Credit Hours: 3.00. The course concentrates on increasing the understanding of financial expertise in analyzing trading and hedging programs for application in reducing aviation operational risk exposure. The studies include research into the development and use of operational indexes and their possible

relation to hedging with commodity and security instruments. Emphasis will be placed on the understanding of current operational measurements and correlations to trading and hedging financial instruments in providing improved risk management in operational environments.

Learning Outcomes: 1. Propose and defend an analysis using operational data, trading, and hedging programs to reduce financial and operational risk in a specific business area in airline operations. 2. Collect, assess, organize, and present the relationships between operational data, financial data, and commodity volatility. 3. Develop and present the impact of complexity on airline business operations. Credits: 3.00

AT 55000 - Critical Systems Thinking

Credit Hours: 3.00. This course explores the application of critical systems thinking to complex problems. Using systems theory and case studies developed by technology visionaries, students will investigate alternative solutions to difficult industrial problems with global impact. Outcomes for this course include written assignments, oral presentations, and a final project that addresses a major industrial problem.

Learning Outcomes: 1. Understand how to frame complex issues in terms of systems thinking methodologies. 2. Able to synthesize information from different sources to develop a comprehensive aviation strategy. 3. Critically evaluate options and alternative solutions to complex problems. 4. Develop an appreciation for key aviation industry concerns as visionary aviation industry leaders. 5. Develop an eye to see and seize opportunities for innovation within industry. 6. Effectively articulate solutions to complex systems problems. Credits: 3.00

AT 57200 - Human Error And Safety

Credit Hours: 3.00. Explores the definition and nature of human error, error chains, and causal factors in error generation. Error taxonomies are reviewed in order to provide a classification scheme for grouping errors and assessing error criticality. Methods for assessing risk and predicting error generation potentials are learned, as well as strategies for controlling or eliminating errors. Case studies are utilized throughout the course to illustrate course concepts. Permission of instructor required.

Learning Outcomes: 1. Classify and evaluate types of human error using established taxonomies and assess their criticality in complex systems. 2. Analyze the antecedents and causal factors of human error, including those related to equipment, operators, organizational practices, regulatory frameworks, and cultural influences. 3. Apply error investigation methods, including data collection and analysis, to identify patterns and inform risk reduction strategies. 4. Examine case studies critically to propose evidence-based strategies for mitigating error incidents and improving safety outcomes. 5. Develop and present a scholarly research project on a contemporary human factors issue, demonstrating effective written and oral communication skills for professional contexts. Credits: 3.00

AT 57300 - Managing The Risk Of Organizational Accidents

Credit Hours: 3.00. Examines strategies various industries use to assess the risk of organizational accidents and to develop safety management programs to prevent, capture, and recover from conditions that lead to disastrous outcomes. Strategies such as High Reliability Organizations, Operational Risk Management, Behavioral Based Safety, Tripod Delta, and Safety Cultures are explored as successful methods for improving organizational safety in high-risk environments and endeavors. Permission of instructor required.

Learning Outcomes: 1. Explain Reason's model of Organizational Accidents (OA) and its application in understanding accident causation and prevention. 2. Analyze everyday operational events through the lens of the OA model to identify latent risks and contributory factors. 3. Evaluate best practices from safety frameworks such as High Reliability Organizations, Operational Risk Management, and Safety Cultures to mitigate the risk of organizational accidents. 4. Develop a detailed, evidence-based analysis of selected aviation accidents or incidents, incorporating the principles of the OA model. 5. Propose

strategies to enhance organizational safety by integrating behavioral-based safety and proactive risk management techniques into safety management systems. Credits: 3.00

AT 57400 - Exploratory Studies In Aviation Human Factors

Credit Hours: 3.00. Exploration of contemporary issues and research related to human factors theory and program strategies as they relate to the aviation industry. The course ventures beyond ergonomic issues into more diverse human factors considerations, while discussing an industry-wide and organizational perspective. The course utilizes a combination of lecture, group discussion, and independent study into issues relevant to student interests and career goals. Permission of instructor required.

Learning Outcomes: 1. Examine emerging human factors concepts and issues of critical concern within the aviation industry, beyond traditional ergonomic considerations. 2. Identify and evaluate human factors models and frameworks, such as the Human Factors Analysis and Classification System (HFACS), for investigating safety events. 3. Conduct and present independent exploratory research on a human factors topic, demonstrating analytical, written, and oral communication skills relevant to aviation professionals. 4. Design aviation workspace requirements that integrate human factors principles to enhance safety, performance, and usability. 5. Analyze contemporary aviation safety challenges from organizational and industry-wide perspectives, incorporating insights from human factors theory and program strategies. Credits: 3.00

AT 58100 - Workshop In Aviation Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 0.00 to 8.00

AT 59000 - Special Problems In Aviation Technology

Credit Hours: 1.00 to 12.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 12.00

AT 69000 - Independent Study In Air Transportation

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in air transportation. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Investigate and report on a focused area of air transportation. Credits: 1.00 to 6.00

AT 64000 - Aviation And Aerospace Sustainability

Credit Hours: 3.00. This course explores sustainability as applied to aviation and aerospace industries and agencies, both in the private sector and public sector. Emphasis is placed on understanding aviation and aerospace sustainability academic literature and on connecting the global and national policies that lead to the regulations and practices. Aviation sustainability is comprised of multiple areas of impact such as economic, environmental, operational, and social. Students develop an understanding of existing sustainability assessment frameworks such as GRI that have general sustainability assessments along with specialized aviation industry frameworks. Using a multiple attribute analysis approach, students develop metrics and analyze the potential impact of sustainability initiatives in the aviation and aerospace industry. Prerequisites: STAT 30100 or STAT 31100 or STAT 50100 or STAT 51100 or IT 50700 or an instructor-approved statistical foundations course. Proficiency in statistical foundations is required to understand and evaluate environmental, economic and social sustainability data, information and methods presented in this course.

Learning Outcomes: 1. Create a well-founded set of metrics for assessing sustainability that consider economic, environmental, social and operational viewpoints. 2. Evaluate projects or initiatives affecting aviation and aerospace sustainability using multi-attribute analysis techniques. 3. Collect, assess, organize and present sustainability information. 4. Demonstrate understanding of sustainability terms, policies, and concepts. 5. Develop, communicate and defend an analysis of a sustainability initiative in the aviation or

aerospace industry. Credits: 3.00

AT 67500 - Aviation Safety Program Development

Credit Hours: 3.00. This course is designed to provide graduate students with essential information and practical activities necessary to develop and manage effective and comprehensive safety programs for a wide variety of aviation operations. Students will conduct safety research, analyze data, and make presentations based on developed safety systems. Instructor permission required.

Learning Outcomes: 1. Describe the regulatory and risk environment in which airline safety offices exist. 2. Describe safety theories and models. 3. Describe human factors and accident causation. 4. Collect and analyze safety related data. 5. Process and disseminate information related to accident prevention and risk minimization. 6. Manage an airline safety office and implement procedures. 7. Design a safety management program for an air career or FBO. Credits: 3.00

AT 53300 - Aviation Graduate Professional Practice Internship

Credit Hours: 1.00 to 3.00. This course involves a practical internship experience within the aviation industry that provides exposure to the roles and duties commensurate with the student's graduate program focus. Prerequisite: Completion of one term of graduate studies and the instructor will validate that the student has an offer letter from an approved company. Permission of assigned graduate chair is required. Permission of instructor required.

Learning Outcomes: 1. Experience and understand aviation workplace roles and responsibilities. Credits: 1.00 to 3.00

AT 54700 - Airline Revenue Management

Credit Hours: 3.00. This course aims to provide students with experience in airline revenue management applications. Primarily focusing on the commercial operation of airlines, this course covers various contemporary topics such as the segmentation, inventory control, forecasting, budgeting and pricing. This course will use simulations to enhance the overall learning-teaching experience.

Learning Outcomes: 1. Summarize the development of revenue management in the airline industry, and explain the importance of revenue management to business operation of airlines. 2. Interpret concepts such as segmentation, forecasting, budgeting, pricing, revenue management, and yield in the domain of the airlines industry and the broader hospitality sector. 3. Evaluate pricing schemes used by airlines on different markets (for instance, long-haul & short-haul, domestic & international, competitive & dominant, peak season & low season) in real world. 4. Implement inventory control in a simulated environment to respond to the dynamic and complex market conditions. 5. Develop appropriate strategies to optimize revenue for a specific airline (either full-service carrier or low-cost carrier) in a certain market (simulated environment). Credits: 3.00

AT 60700 - Aviation Applications Of Bayesian Inference

Credit Hours: 3.00. This course provides a critical foundation necessary for understanding Bayesian theory and employing that theory in the analysis of typical data generated in industry. The course will focus specifically on solutions of aviation-related problems through data analysis. Material includes overview and implementation of relevant statistical software applications. Practical skills in presenting advanced analyses to both professional and scientific audiences is a key component of the course. Prerequisites: AT 50700 OR IT 50700 OR STAT 30100 OR STAT 50100 OR STAT 51100. Permission of instructor required.

Learning Outcomes: 1. Articulate and define basic concepts in probability theory, modeling, and Bayesian reasoning. 2. Create hierarchical models using Bayesian concepts and use appropriate software to implement those models. 3. Demonstrate the differences between Bayesian modeling and null hypothesis significance testing. 4. Apply Bayesian models to solve specific aviation problems using realistic data. Credits: 3.00

AT 54800 - Aircraft Asset Management

Credit Hours: 3.00. This course provides the student with a detailed exploration of aircraft asset management programs in both airlines and business aviation organizations. Students

analyze and study the critical components of an asset management program, the financial methods in aircraft asset management, acquisition proposals, and development plans of aircraft acquisitions in this course. An airline industry-relevant project is used to improve student reasoning and application of industry standard aircraft asset management analysis procedures to include forecasting techniques, present value calculations, and benefit-cost analyses. This course serves as the foundational knowledge required for AT 54900.

Learning Outcomes: 1. Review critically, synthesize, document and summarize relevant research literature in the field of aircraft asset management, expressing themselves clearly and concisely in writing and oral presentation. 2. Recognize the critical components of an aircraft asset management program, thoroughly develop a business case for aircraft acquisition, and manage an in-service fleet of aircraft. 3. Develop a simulated asset management team and work effectively and collaboratively as part of the team. 4. Produce a high-quality airline industry aircraft asset management project, conduct financial analyses of aircraft assets, document findings in a paper, and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 54900 - Aircraft Leasing

Credit Hours: 3.00. This course provides students with training and experience managing aircraft leases using financial and risk management methodologies specific to the airline and business aviation industries. Students conduct financial evaluations of leasing versus ownership programs of airlines, as well as analyze debt, equity and capital markets for aircraft financing. The course includes an examination of taxation issues related to aircraft leasing, maintenance reserves, and auditing of aircraft financial performance. The prerequisite for this course is AT 54800.

Learning Outcomes: 1. Review critically, synthesize, document and present relevant research literature in the field of aircraft leasing and financing, expressing themselves clearly and concisely in writing and oral presentation. 2. Explain the necessary components of an aircraft lease, audit in-service aircraft financial performance, thoroughly analyze aircraft maintenance reserves, and summarize taxation issues with aircraft assets. 3. Develop a simulated aircraft leasing management team and work effectively and collaboratively as part of the team. 4. Generate a high-quality aircraft asset leasing project, conduct financial evaluations of leasing and owning options, document findings in a paper and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 54300 - Contemporary Issues In Airport & Airline Finance

Credit Hours: 3.00. This course provides an overview of aviation financial management and is intended for current and future aviation and aerospace leaders and managers. Taking a global view, the course opens with the tremendous economic impact of the aviation sector that both drives and enables the interdependent global economy. The course material covers the unique business models and best practices in financial management for both the airport and airline industries and analyzes the relationship between the two (including the complications implicit in highly divergent planning horizons). The complexity of aircraft financing decisions is covered that lead up to building a fleet to serve the airlines' forecast growth. The course uses relevant readings and case studies as well as statistical data in time series to demonstrate the way financial management has evolved to improve performance in both the airport and airline industries. Permission of department required.

Learning Outcomes: 1. Recognize the impact of the COVID-19 pandemic on the global aviation sector and impacts on industry finance. 2. Describe the essential link between the enterprise's strategic vision and mission and prudent financial management. 3. Recognize the strengths and weaknesses of an aviation enterprise through an analysis of the balance sheet and income statements. 4. Understand the complexity and the sometimes adversarial nature of the airport/airline relationship. 5. Recognize the changes in the airline business model which have delivered improved financial performance in North America since 2014. 6. Describe the steps involved in re-inventing and rebranding an airport taking the Cincinnati Airport as an example. 7. Understand why

privatization of airports, so common in Europe and Asia, has not caught on in the U.S. 8. Enumerate the hurdles to building new infrastructure. 9. Develop an appreciation for the FAA's role in oversight of the U.S. aviation system. 10. Become familiar with the basic elements of aircraft financing including various scenarios for investing in new aircraft to meet future demand. 11. Discuss the applications of new technology in North American air traffic management. This will focus on both the FAA and NAVCAN. 12. Know the basic roles of key players in aviation including Airports Council International (ACI), International Air Transport Association (IATA), the UN International Civil Aviation Organization (ICAO). Credits: 3.00

AT 51900 - Aviation Geographic Information Science Applications

Credit Hours: 3.00. This course provides a core set of skills essential for understanding geospatial science and using Geographic Information Systems as a tool to conduct research with a spatial component. The student will learn how to acquire, process, analyze, and interpret geospatial data using real-world data sets in applied situations.

Learning Outcomes: 1. Acquire core geospatial and remote sensing technology concepts. 2. Demonstrate an ability to apply GIS data to real-world applied situations. 3. Demonstrate a fundamental understanding of cartography through the creation of map layouts in a GIS. Credits: 3.00

Thesis Research (6 credits)

AT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Plan, manage, conduct, and report original research using appropriate design and analytical techniques. Credits: 1.00 to 18.00

Concentrations

GPA Requirements

About the Program

Aviation Technology, MSAAM (OL)

About the Program

Program Requirements

Selectives (30 credits)

AT 50500 - Research Methods In Aviation

Credit Hours: 3.00. This course explores the practical approach to research as it applies to identifying and exploring pragmatic problems in aviation industry settings. Industry based problems and issues often require a diversity of research skills, both quantitative and qualitative, in order to effectively address dynamic problems in complex and often high-risk work environments. This course offers an overview of mixed research methods which lends itself well to practical problem solving in industry. This course may also be offered in an online format. Permission of instructor required.

Learning Outcomes: 1. Select and develop an appropriate design and investigative methodology for commonly-encountered aviation research problems. 2. Perform, and properly interpret, elementary descriptive statistical analysis. 3. Determine the need for, and correctly apply, appropriate inferential statistical tests for a variety of data. 4. Test research and null hypotheses. 5. Prepare well-written scholarly papers, using specific style instructions. 6. Prepare survey instruments appropriate to differing aviation settings. 7. Utilize an accepted style/publication manual in

preparation or written work. Credits: 3.00

AT 50800 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. (IT 50800) Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology.

Learning Outcomes: 1. Evaluate the key dimensions of quality and their implications for manufacturing and service industries. 2. Assess the philosophies and contributions of prominent thought leaders to the field of quality and productivity critically. 3. Apply core principles of Total Quality Management (TQM) to analyze and improve quality assurance programs. 4. Design and implement process management and improvement methodologies, such as Six Sigma, Lean, and Value Stream Analysis, to enhance productivity. Credits: 3.00

AT 52000 - Operational Assessment And Improvement

Credit Hours: 3.00. This course focuses on developing the skills to analyze, formulate, and apply techniques for work task improvement. Concepts to be studied include workflow enhancement, critical element streamlining, and value added analysis. Students will explore process map construction, process ownership, measurement system validation, standards creation, and decision factors. An industry project will be assigned and used to facilitate course objectives. Permission of instructor required.

Learning Outcomes: 1. Analyze workflows and critical elements using tools such as SWOT analysis, mind mapping, and process map construction to identify opportunities for improvement. 2. Evaluate and validate measurement systems, establish process ownership, and develop standards to support operational efficiency. 3. Calculate and interpret process time, labor costs, and total process costs to inform decision-making and improvement strategies. 4. Develop and justify improvement targets, impact analysis, and value-added analysis to enhance operational effectiveness. 5. Design and implement a comprehensive cycle time analysis, metrics framework, and testing and implementation plan for workflow enhancements. Credits: 3.00

AT 52600 - Aviation Leadership

Credit Hours: 3.00. This course is intended for future aviation and aerospace managers. Using foundational readings, case studies, and critical analysis techniques, the contribution of past and contemporary aviation leaders will be reviewed. Permission of department required.

Learning Outcomes: 1. Perform a situational analysis of an aviation enterprise management or leadership challenge and recommend appropriate courses of action. 2. Form, lead, and support a team in an aeronautical work setting. 3. Distinguish management roles and actions from leadership roles and actions in both an air carrier organization as well as in a general aviation company. 4. Apply appropriate theories of leadership to realistic organizational situations such as an aviation manufacturing company, a corporate flight department, or aerospace industry organization. 5. Identify salient characteristics of individual and organizational behavior; plan courses of action for organizational change. 6. Identify the competencies of past successful airline leaders; plan a leadership development program for an individual leader in a current aeronautical position. 7. Determine the viability and sustainability of vision strategies as they relate to activities such as flight training schools, fixed-base operator, or airport administration. 8. Recognize global cultural differences and assess the impact of those differences on appropriate leadership styles and organizational change initiatives in selected emerging aeronautical enterprises. Credits: 3.00

AT 52800 - Management And Design Of Training Systems

Credit Hours: 3.00. This course will examine the practical

applications of managing the training process in industry and educational settings, including the development of instructional materials from an adult learner perspective. Curriculum design using various forms of media and delivery strategies will be emphasized. This course may also be delivered in an online format. Permission of department required.

Learning Outcomes: 1. Gain management knowledge and skills required to develop a training program for industry or education. 2. Able to design a learning module using instructional design principles in his/her interest area. 3. Able to assess the effectiveness of the training design process. 4. Write a comprehensive training plan in an area of his/her field of study. Credits: 3.00

AT 53100 - International Civil Aviation Regulatory Systems

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Discuss the history, organization, and interdependence of international, regional and national civil aviation regulatory systems. 2. Discuss the partnerships and alliances between government, industry, stakeholders and financial organizations to support international civil aviation. 3. Discuss transparency and access to international aviation regulatory oversight programs and efforts to mitigate deficiencies and support efficiency. 4. Identify and conduct research on emerging international aviation issues. 5. Demonstrate critical thinking in developing presentations on emerging international aviation regulatory topics. Credits: 3.00

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

AT 54600 - Aviation Financial Instruments And Operations

Credit Hours: 3.00. The course concentrates on increasing the understanding of financial expertise in analyzing trading and hedging programs for application in reducing aviation operational risk exposure. The studies include research into the development and use of operational indexes and their possible relation to hedging with commodity and security instruments. Emphasis will be placed on the understanding of current operational measurements and correlations to trading and hedging financial instruments in providing improved risk management in operational environments.

Learning Outcomes: 1. Propose and defend an analysis using operational data, trading, and hedging programs to reduce financial and operational risk in a specific business area in airline operations. 2. Collect, assess, organize, and present the relationships between operational data, financial data, and commodity volatility. 3. Develop and present the impact of complexity on airline business operations. Credits: 3.00

AT 57200 - Human Error And Safety

Credit Hours: 3.00. Explores the definition and nature of human error, error chains, and causal factors in error generation. Error taxonomies are reviewed in order to provide a classification scheme for grouping errors and assessing error criticality.

Methods for assessing risk and predicting error generation potentials are learned, as well as strategies for controlling or eliminating errors. Case studies are utilized throughout the course to illustrate course concepts. Permission of instructor required.

Learning Outcomes: 1. Classify and evaluate types of human error using established taxonomies and assess their criticality in complex systems. 2. Analyze the antecedents and causal factors of human error, including those related to equipment, operators, organizational practices, regulatory frameworks, and cultural influences. 3. Apply error investigation methods, including data collection and analysis, to identify patterns and inform risk reduction strategies. 4. Examine case studies critically to propose evidence-based strategies for mitigating error incidents and improving safety outcomes. 5. Develop and present a scholarly research project on a contemporary human factors issue, demonstrating effective written and oral communication skills for professional contexts. Credits: 3.00

AT 57300 - Managing The Risk Of Organizational Accidents

Credit Hours: 3.00. Examines strategies various industries use to assess the risk of organizational accidents and to develop safety management programs to prevent, capture, and recover from conditions that lead to disastrous outcomes. Strategies such as High Reliability Organizations, Operational Risk Management, Behavioral Based Safety, Tripod Delta, and Safety Cultures are explored as successful methods for improving organizational safety in high-risk environments and endeavors. Permission of instructor required.

Learning Outcomes: 1. Explain Reason's model of Organizational Accidents (OA) and its application in understanding accident causation and prevention. 2. Analyze everyday operational events through the lens of the OA model to identify latent risks and contributory factors. 3. Evaluate best practices from safety frameworks such as High Reliability Organizations, Operational Risk Management, and Safety Cultures to mitigate the risk of organizational accidents. 4. Develop a detailed, evidence-based analysis of selected aviation accidents or incidents, incorporating the principles of the OA model. 5. Propose strategies to enhance organizational safety by integrating behavioral-based safety and proactive risk management techniques into safety management systems. Credits: 3.00

AT 57400 - Exploratory Studies In Aviation Human Factors

Credit Hours: 3.00. Exploration of contemporary issues and research related to human factors theory and program strategies as they relate to the aviation industry. The course ventures beyond ergonomic issues into more diverse human factors considerations, while discussing an industry-wide and organizational perspective. The course utilizes a combination of lecture, group discussion, and independent study into issues relevant to student interests and career goals. Permission of instructor required.

Learning Outcomes: 1. Examine emerging human factors concepts and issues of critical concern within the aviation industry, beyond traditional ergonomic considerations. 2. Identify and evaluate human factors models and frameworks, such as the Human Factors Analysis and Classification System (HFACS), for investigating safety events. 3. Conduct and present independent exploratory research on a human factors topic, demonstrating analytical, written, and oral communication skills relevant to aviation professionals. 4. Design aviation workspace requirements that integrate human factors principles to enhance safety, performance, and usability. 5. Analyze contemporary aviation safety challenges from organizational and industry-wide perspectives, incorporating insights from human factors theory and program strategies. Credits: 3.00

AT 67500 - Aviation Safety Program Development

Credit Hours: 3.00. This course is designed to provide graduate students with essential information and practical activities necessary to develop and manage effective and comprehensive safety programs for a wide variety of aviation operations. Students will conduct safety research, analyze data, and make presentations based on developed safety systems. Instructor

permission required.

Learning Outcomes: 1. Describe the regulatory and risk environment in which airline safety offices exist. 2. Describe safety theories and models. 3. Describe human factors and accident causation. 4. Collect and analyze safety related data. 5. Process and disseminate information related to accident prevention and risk minimization. 6. Manage an airline safety office and implement procedures. 7. Design a safety management program for an air career or FBO. Credits: 3.00

AT 50700 - Quantitative Research Methodologies In Transportation

Credit Hours: 3.00. This course provides an introduction to business statistics with a specific focus on data analyses and managerial decision making in the transportation industry. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to perform their own analyses. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the use of statistics to describe transportation processes. 2. Employ inferential statistics to facilitate transportation managerial decision making. 3. Demonstrate proficiency in the use of software tools to facilitate statistical analyses. Credits: 3.00

AT 54700 - Airline Revenue Management

Credit Hours: 3.00. This course aims to provide students with experience in airline revenue management applications. Primarily focusing on the commercial operation of airlines, this course covers various contemporary topics such as the segmentation, inventory control, forecasting, budgeting and pricing. This course will use simulations to enhance the overall learning-teaching experience.

Learning Outcomes: 1. Summarize the development of revenue management in the airline industry, and explain the importance of revenue management to business operation of airlines. 2. Interpret concepts such as segmentation, forecasting, budgeting, pricing, revenue management, and yield in the domain of the airlines industry and the broader hospitality sector. 3. Evaluate pricing schemes used by airlines on different markets (for instance, long-haul & short-haul, domestic & international, competitive & dominant, peak season & low season) in real world. 4. Implement inventory control in a simulated environment to respond to the dynamic and complex market conditions. 5. Develop appropriate strategies to optimize revenue for a specific airline (either full-service carrier or low-cost carrier) in a certain market (simulated environment). Credits: 3.00

AT 54800 - Aircraft Asset Management

Credit Hours: 3.00. This course provides the student with a detailed exploration of aircraft asset management programs in both airlines and business aviation organizations. Students analyze and study the critical components of an asset management program, the financial methods in aircraft asset management, acquisition proposals, and development plans of aircraft acquisitions in this course. An airline industry-relevant project is used to improve student reasoning and application of industry standard aircraft asset management analysis procedures to include forecasting techniques, present value calculations, and benefit-cost analyses. This course serves as the foundational knowledge required for AT 54900.

Learning Outcomes: 1. Review critically, synthesize, document and summarize relevant research literature in the field of aircraft asset management, expressing themselves clearly and concisely in writing and oral presentation. 2. Recognize the critical components of an aircraft asset management program, thoroughly develop a business case for aircraft acquisition, and manage an in-service fleet of aircraft. 3. Develop a simulated asset management team and work effectively and collaboratively as part of the team. 4. Produce a high-quality airline industry aircraft asset management project, conduct financial analyses of aircraft assets, document findings in a paper, and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 54900 - Aircraft Leasing

Credit Hours: 3.00. This course provides students with training and experience managing aircraft leases using financial and risk management methodologies specific to the airline and business aviation industries. Students conduct financial evaluations of leasing versus ownership programs of airlines, as well as analyze debt, equity and capital markets for aircraft financing. The course includes an examination of taxation issues related to aircraft leasing, maintenance reserves, and auditing of aircraft financial performance. The prerequisite for this course is AT 54800.

Learning Outcomes: 1. Review critically, synthesize, document and present relevant research literature in the field of aircraft leasing and financing, expressing themselves clearly and concisely in writing and oral presentation. 2. Explain the necessary components of an aircraft lease, audit in-service aircraft financial performance, thoroughly analyze aircraft maintenance reserves, and summarize taxation issues with aircraft assets. 3. Develop a simulated aircraft leasing management team and work effectively and collaboratively as part of the team. 4. Generate a high-quality aircraft asset leasing project, conduct financial evaluations of leasing and owning options, document findings in a paper and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

Concentrations

Basic Medical Sciences, MS

About the Program

Program Requirements

Required Courses (xx credits)

Thesis Research (xx credits)

Concentrations

About the Program

Biochemistry and Molecular Biology, MS

About the Program

Program Requirements

Required Courses (22 credits)

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60200 - Critical Thinking And Communication In Biochemistry II

Credit Hours: 2.00. Builds on the skills developed in BCHM 601. Students will continue to enhance their analytical skills, and

class discussions will be conducted at a more sophisticated level and will go into greater depth. Class discussions will focus more on the analysis and evaluation of current methodologies and hypotheses in the biochemical and molecular biological literature. Students will be evaluated primarily on their preparation and participation in each class discussion. Prerequisite: BCHM 60100. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 69000 - Seminar In Biochemistry

Credit Hours: 1.00. Seminary In Biochemistry. Permission of instructor required.

Credits: 1.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences

research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 60300 - Introduction To Graduate Research In Biochemistry I

Credit Hours: 6.00. This course is intended to provide the opportunity for in-depth, mentored graduate research in two biochemistry laboratories. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellow. Co-requisites: BCHM 60100 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 6.00

Selectives (2-3 credits)

BCHM 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (AGRY 64000, BIOL 64000, BTNY 64000 , HORT 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological

membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry

course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BCHM 61200 - Bioinformatic Analysis Of Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data. Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

Thesis Research (5-6 credits)

BCHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (22 credits)

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the

semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60200 - Critical Thinking And Communication In Biochemistry II

Credit Hours: 2.00. Builds on the skills developed in BCHM 601. Students will continue to enhance their analytical skills, and class discussions will be conducted at a more sophisticated level and will go into greater depth. Class discussions will focus more on the analysis and evaluation of current methodologies and hypotheses in the biochemical and molecular biological literature. Students will be evaluated primarily on their preparation and participation in each class discussion. Prerequisite: BCHM 60100. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 69000 - Seminar In Biochemistry

Credit Hours: 1.00. Seminary In Biochemistry. Permission of instructor required.

Credits: 1.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical

methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 60300 - Introduction To Graduate Research In Biochemistry I

Credit Hours: 6.00. This course is intended to provide the opportunity for in-depth, mentored graduate research in two biochemistry laboratories. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellow. Co-requisites: BCHM 60100 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 6.00

Concentrations

GPA Requirements

About the Program

Biological Sciences, MS

About the Program

Program Requirements - Thesis

Required Courses (5 credits)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Core Courses (1 credit)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Other Courses (4 credits)

BIOL 69600 - Seminar

Credit Hours: 1.00. Each semester there are several separate seminar offerings. They will likely be on the following topics: biochemistry, crystallography, ecology and population biology, genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. The student's record will indicate the specific seminars in which he/she has participated. Oral presentations required. At least two credits are required of Ph.D. candidates.

Credits: 1.00

Core Courses (1 credit)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Research Areas (16 credits)

Biology Education

Cell and Molecular Biology

Ecology and Evolutionary Biology

Microbiology, Immunology, and Infectious Disease

Neuroscience and Physiology

Structural and Computational Biology and Biophysics

Biology Education

Thesis Research (9 credits)

BIOL 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (5 credits)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Core Courses (1 credit)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Other Courses (4 credits)

BIOL 69600 - Seminar

Credit Hours: 1.00. Each semester there are several separate seminar offerings. They will likely be on the following topics: biochemistry, crystallography, ecology and population biology, genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. The student's record will indicate the specific seminars in which he/she has participated. Oral presentations required. At least two credits are required of Ph.D. candidates.

Credits: 1.00

Core Courses (1 credit)

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Program Requirements - Non-Thesis

Required Courses (12 credits)

Core Courses (8 credits)

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various

guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Other Courses (4 credits)

BIOL 69600 - Seminar

Credit Hours: 1.00. Each semester there are several separate seminar offerings. They will likely be on the following topics: biochemistry, crystallography, ecology and population biology, genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. The student's record will indicate the specific seminars in which he/she has participated. Oral presentations required. At least two credits are required of Ph.D. candidates.

Credits: 1.00

Core Courses (8 credits)

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Research Areas (18 credits)

Required Courses (12 credits)

Core Courses (8 credits)

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Other Courses (4 credits)

BIOL 69600 - Seminar

Credit Hours: 1.00. Each semester there are several separate seminar offerings. They will likely be on the following topics: biochemistry, crystallography, ecology and population biology, genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. The student's record will indicate the specific seminars in which he/she has participated. Oral presentations required. At least two credits are required of Ph.D. candidates.

Credits: 1.00

Core Courses (8 credits)

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students

among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

Concentrations

GPA Requirements

About the Program

Biomedical Engineering Program, MSBME

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (12 credits)

BME Selectives (6 credits)

Life Sciences Selective (3 credits)

Quantitative/Analytical Selective (3 credits)

Seminar Courses (0 credits)

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

Electives (6-9 credits)*

Thesis Research (9 credits)

BME 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Regulator Affairs Selectives (12 credits)

Concentrations

GPA Requirements

About the Program

Botany and Plant Pathology, MS

About the Program

Program Requirements - Thesis

Required Courses (11-12 credits)

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 66000 - Scientific Writing

Credit Hours: 3.00. This is a course on coping with publication in professional journals. It covers the full range of activities involved in carrying a piece of original research to completion as a primary research article in a refereed journal. Emphasis is on principles of clear and concise technical reporting. Topics include: research and writing goals; journals' policies; data presentations; effective style; organizing, writing, revising, and processing manuscripts; proofreading; peer review; ethics; and grant proposals. Students will use their own data to prepare a manuscript as if for publication. Permission of instructor required.

Learning Outcomes: 1. Convey scientific results and concepts to a broad range of audiences effectively and clearly. 2. Order ideas such that they make logical sense to readers. 3. Understand the distinct requirements of different audiences. 4. Understand the differing requirements of review articles, research reports, and grant proposals. 5. Cite scientific literature effectively. Credits: 3.00

BTNY 69700 - Departmental Seminar Series - Botany And Plant Pathology

Credit Hours: 1.00. This is a weekly seminar course that features both external and Purdue speakers. Exposure to research topics outside of a student's immediate research area is an important part of graduate student education. The goal of the seminar series course is to provide opportunities for graduate students to learn about the latest research advances plant biology, plant pathology, and weed science and to interact with visiting seminar speakers.

Learning Outcomes: 1. Learn about recent research advances in Plant Biology, Plant Pathology, and Weed Science. 2. Learn best practices for asking questions and interacting with seminar speakers. 3. Acquire new ideas for giving effective oral presentations by active listening to seminar presentations. Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that

they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BTNY 69100 - Skills For Success In Grad School

Credit Hours: 1.00. This course is aimed at first year graduate students in the Botany department. Its purpose is to introduce the students to the department, teach them what it takes to be a successful graduate students, and to help them develop effective written and oral communication skills.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 1.00

Electives (12-13 credits)

Thesis Research (6 credits)

BTNY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Acquire training in the signature areas of the department of Botany and Plant pathology: plant biology, plant pathology, and weed science, and their subdisciplines. 2. Understand applied and molecular plant pathology. 3. Learn plant biology from cell biology to evolutionary and developmental biology, ecology. 4. Learn weed control and management, weed biology and related areas. 5. Learn how to communicate scientific ideas in written and oral form. 6. Learn best practices for asking research questions and working as part of a scientific team. Credits: 1.00 to 18.00

Required Courses (11-12 credits)

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 66000 - Scientific Writing

Credit Hours: 3.00. This is a course on coping with publication in professional journals. It covers the full range of activities involved in carrying a piece of original research to completion as a primary research article in a refereed journal. Emphasis is on principles of clear and concise technical reporting. Topics include: research and writing goals; journals' policies; data presentations; effective style; organizing, writing, revising, and processing manuscripts; proofreading; peer review; ethics; and grant proposals. Students will use their own data to prepare a manuscript as if for publication. Permission of instructor required.

Learning Outcomes: 1. Convey scientific results and concepts to a broad range of audiences effectively and clearly. 2. Order ideas such that they make logical sense to readers. 3. Understand the distinct requirements of different audiences. 4. Understand the differing requirements of review articles, research reports, and grant proposals. 5. Cite scientific literature effectively. Credits: 3.00

BTNY 69700 - Departmental Seminar Series - Botany And Plant Pathology

Credit Hours: 1.00. This is a weekly seminar course that features both external and Purdue speakers. Exposure to research topics outside of a student's immediate research area is an important part of graduate student education. The goal of the seminar series course is to provide opportunities for graduate students to learn about the latest research advances plant biology, plant pathology, and weed science and to interact with visiting seminar speakers.

Learning Outcomes: 1. Learn about recent research advances in Plant Biology, Plant Pathology, and Weed Science. 2. Learn best practices for asking questions and interacting with seminar speakers. 3. Acquire new ideas for giving effective oral presentations by active listening to seminar presentations. Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BTNY 69100 - Skills For Success In Grad School

Credit Hours: 1.00. This course is aimed at first year graduate students in the Botany department. Its purpose is to introduce the students to the department, teach them what it takes to be a successful graduate students, and to help them develop effective written and oral communication skills.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 1.00

Program Requirements - Non-Thesis

Required Courses (11-12 credits)

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 66000 - Scientific Writing

Credit Hours: 3.00. This is a course on coping with publication in professional journals. It covers the full range of activities involved in carrying a piece of original research to completion as a primary research article in a refereed journal. Emphasis is on principles of clear and concise technical reporting. Topics include: research and writing goals; journals' policies; data presentations; effective style; organizing, writing, revising, and processing manuscripts; proofreading; peer review; ethics; and grant proposals. Students will use their own data to prepare a manuscript as if for publication. Permission of instructor required.

Learning Outcomes: 1. Convey scientific results and concepts to a broad range of audiences effectively and clearly. 2. Order ideas such that they make logical sense to readers. 3. Understand the distinct

requirements of different audiences. 4. Understand the differing requirements of review articles, research reports, and grant proposals. 5. Cite scientific literature effectively. Credits: 3.00

BTNY 69700 - Departmental Seminar Series - Botany And Plant Pathology

Credit Hours: 1.00. This is a weekly seminar course that features both external and Purdue speakers. Exposure to research topics outside of a student's immediate research area is an important part of graduate student education. The goal of the seminar series course is to provide opportunities for graduate students to learn about the latest research advances plant biology, plant pathology, and weed science and to interact with visiting seminar speakers.

Learning Outcomes: 1. Learn about recent research advances in Plant Biology, Plant Pathology, and Weed Science. 2. Learn best practices for asking questions and interacting with seminar speakers. 3. Acquire new ideas for giving effective oral presentations by active listening to seminar presentations. Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BTNY 69100 - Skills For Success In Grad School

Credit Hours: 1.00. This course is aimed at first year graduate students in the Botany department. Its purpose is to introduce the students to the department, teach them what it takes to be a successful graduate students, and to help them develop effective written and oral communication skills.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 1.00

Electives (20-21 credits)

Required Courses (11-12 credits)

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 66000 - Scientific Writing

Credit Hours: 3.00. This is a course on coping with publication in professional journals. It covers the full range of activities involved in carrying a piece of original research to completion as a primary research article in a refereed journal. Emphasis is on principles of clear and concise technical reporting. Topics include: research and writing goals; journals' policies; data presentations; effective style; organizing, writing, revising, and processing manuscripts; proofreading; peer review; ethics; and grant proposals. Students will use their own data to prepare a manuscript as if for publication. Permission of instructor required.

Learning Outcomes: 1. Convey scientific results and concepts to a broad range of audiences effectively and clearly. 2. Order ideas such that they make logical sense to readers. 3. Understand the distinct requirements of different audiences. 4. Understand the differing requirements of review articles, research reports, and grant proposals. 5. Cite scientific literature effectively. Credits: 3.00

BTNY 69700 - Departmental Seminar Series - Botany And Plant Pathology

Credit Hours: 1.00. This is a weekly seminar course that features both external and Purdue speakers. Exposure to research topics outside of a student's immediate research area is an important part of graduate student education. The goal of the seminar series course is to provide opportunities for graduate students to learn about the latest research advances plant biology, plant pathology, and weed science and to interact with visiting seminar speakers.

Learning Outcomes: 1. Learn about recent research advances in Plant Biology, Plant Pathology, and Weed Science. 2. Learn best practices for asking questions and interacting with seminar speakers. 3. Acquire new ideas for giving effective oral presentations by active listening to seminar presentations. Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

BTNY 69100 - Skills For Success In Grad School

Credit Hours: 1.00. This course is aimed at first year graduate students in the Botany department. Its purpose is to introduce the students to the department, teach them what it takes to be a successful graduate students, and to help them develop effective written and oral communication skills.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 1.00

Concentrations

GPA Requirements

About the Program

Business Administration, MBA

About the Program

Program Requirements

Required Courses (31 credits)

Foundational Courses (9 credits)

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60600 - Seminar In External Reporting I

Credit Hours: 2.00 to 4.00. Seminar examines research issues on the production, dissemination, and use of financial accounting information for economic decisions by external users. The materials covered are primarily empirically oriented. The aim is to expose students to these issues as they are covered in the accounting and related literature. Prerequisite: ECON 60000 .

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

Core Courses (22 credits)

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.
Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and

resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

ECON 54100 - Managerial Economics & Business Strategy

Credit Hours: 1.00. The course covers topics such as monopolies (price discrimination, optimal pricing strategies), advanced strategic decision-making and imperfect competition (optimal pricing and production), new product introductions, product variety offered on the market, and entry deterrence strategies. The main goal of this course is to provide a basis for a good understanding of the logical mechanics, and to provide a good intuition in managerial economics and business decision-making processes that facilitate the understanding of daily business problems.

Learning Outcomes: 1. Identify and explain logical mechanics that determine individuals' choices and decisions. 2. Evaluate managerial economic problems to better identify daily business problems. 3. Apply key aspects such as marginal concepts and countervailing effects when proposing solutions. 4. Illustrate main mechanisms using graphs and apply basic knowledge of algebra and calculus to business problems. Credits: 1.00

Specialization Courses (6-9 credits)

Finance and Economics

Computational Finance (8 credits)

MGMT 61400 - Investments

Credit Hours: 2.00 to 4.00. Examination of the process of asset valuation. Emphasis on portfolio analysis, security selection, risk-return relationships, and performance evaluation. Additional topics considered include security analysis, option pricing and analysis, futures contracts, and security market operations.

Learning Outcomes: 1. Develop a sound foundation for the main concepts in investment management and portfolio theory. 2. Understand how stock, bond, and option prices are determined. 3. Learn the analytical tools and financial theory necessary to understand how financial assets are used for investment decisions. 4. Take a critical look at the process of investing and relate the topics covered to current real-world problems relevant to practitioners. 5. Prepare students for more advanced courses in investments, portfolio management, and corporate finance. Credits: 2.00 to 4.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

Corporate Finance (8 credits)

MGMT 64500 - Mergers, Acquisitions, And Corporate Control

Credit Hours: 2.00 to 4.00. Focuses on firms' internal governance structures and on pressure from the external market for corporate control, including executive compensation, board of directors' composition, shareholder activism, mergers, and takeovers. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 61400 - Investments

Credit Hours: 2.00 to 4.00. Examination of the process of asset valuation. Emphasis on portfolio analysis, security selection, risk-return relationships, and performance evaluation. Additional topics considered include security analysis, option pricing and analysis, futures contracts, and security market operations.

Learning Outcomes: 1. Develop a sound foundation for the main concepts in investment management and portfolio theory. 2. Understand how stock, bond, and option prices are determined. 3. Learn the analytical tools and financial theory necessary to understand how financial assets are used for investment decisions. 4. Take a critical look at the process of investing and relate the topics covered to current real-world problems relevant to practitioners. 5. Prepare students for more advanced courses in investments, portfolio management, and corporate finance. Credits: 2.00 to 4.00

MGMT 61100 - Advanced Corporate Finance

Credit Hours: 2.00 to 4.00 (West Lafayette, Calumet) 3.00 (North Central). Long-term capital structure planning, capital budgeting, treatment of uncertainty in investment decisions, security underwriting, dividend policies, and mergers. Prerequisite: MGMT 61000.

Learning Outcomes: 1. Outline and describe Corporate Financial Policies and understand their potential impact of firm value. 2. Value real options in capital budgeting projects using the Black Scholes, the risk-neutral probability and the duplicating portfolio models. 3. Understand the use of and characteristics of various alternatives to corporate finance including leasing, convertible bonds, and structured finance. Credits: 2.00 to 4.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

Financial Economics (8 credits)

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

ECON 53800 - International Economics

Credit Hours: 2.00 or 3.00. The course covers selected topics in international trade with a focus on real world applications.

Learning Outcomes: 1. Identify the effects of international trade on wages, prices or products and welfare of nations. 2. Develop models as well as a diverse set of academic papers to discuss current policy debates. Credits: 2.00 or 3.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

Supply Chain Management

Supply Chain Strategy (10 credits)

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement

strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 56900 - Ethical And Sustainable Supply Chain Management

Credit Hours: 2.00 or 3.00. This course provides students with knowledge and skills for building and analyzing ethical and sustainable practices in supply chains, taking a holistic view of the interaction between businesses, the environment, and society.

Learning Outcomes: 1. Run life-cycle analysis (LCA) and interpret findings. 2. Analyze product and process performance through life-cycle thinking. 3. Understand the Tragedy of the Commons in the business context and identify the underlying reasons. 4. Assess pros and cons of various solutions to the Tragedy of the Commons problem in business context. 5. Identify and explain various product stewardship practices and their pros and cons. 6. Identify innovative business models, such as Servicizing, based on sustainable use of products and services. 7. Compare and contrast traditional supply chain with closed-loop supply chain. 8. Compare and contrast different types of contracts and practices for incentivizing compliance with ethical and sustainable conduct throughout the supply chain. 9. Identify and analyze opportunities and constraints in building ethical and sustainable supply chains. 10. Compare and contrast alternative ways of complying with environmental and social regulations such as carbon trading. Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

Supply Chain Analytics (10 credits)

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

Leadership

Leadership Fundamentals (6 credits)

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

Leading Change and Innovation (8 credits)

MGMT 64500 - Mergers, Acquisitions, And Corporate Control

Credit Hours: 2.00 to 4.00. Focuses on firms' internal governance structures and on pressure from the external market for corporate control, including executive compensation, board of directors' composition, shareholder activism, mergers, and takeovers. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 35500 - Consulting Tools And Skills

Credit Hours: 3.00. This novel course will provide an opportunity for motivated students to gain exposure to the skills and tools necessary to succeed in the consulting industry. There will be a chance to work in small teams to define client problems, collect and analyze data, develop solution proposals, and implement recommendations. Students will also be given an insider's look into the history of consulting, common types of consulting, and professional standards in this specialized area of management. Honing skills in project management, presentation delivery, storytelling, and stakeholder engagement will form the foundation of the tools used to solve client challenges.

Learning Outcomes: 1. Effectively and confidently use specific consulting business language. 2. Critically analyze resumes and case interviews. 3. Effectively research businesses and unfamiliar industries. 4. Use a consulting approach to problem solving. 5. Present a professional, engaging, and authentic persona. Credits: 3.00

MGMT 65330 - HR Strategy

Credit Hours: 2.00 to 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Learning Outcomes: 1. Understand the history of human resource management and how it has evolved to the strategic level. 2. Understand what strategic Human Resource Management means and entails. 3. Understand and complete a Human Resource Management Strategic plan. 4. Make yourself an invaluable resource to upper level management and the CEO by demonstrating the extreme importance and value of Strategic Human Resource management. Credits: 2.00 to 3.00

Leading Technical Teams (8-9 credits)

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

Analytics

Business Analytics Fundamentals (21 credits)

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's

participation in and contribution to group work. Credits: 2.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

Marketing Analytics (9 credits)

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

ECON 53800 - International Economics

Credit Hours: 2.00 or 3.00. The course covers selected topics in international trade with a focus on real world applications.

Learning Outcomes: 1. Identify the effects of international trade on wages, prices or products and welfare of nations. 2. Develop models as well as a diverse set of academic papers to discuss current policy debates. Credits: 2.00 or 3.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

Capstone Project (2 credits)

Electives (6 credits)

About the Program

Business Analytics, MS

About the Program

Program Requirements

Required Courses (11 credits)

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and

interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.
Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

General Business Selectives (5 credits)

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level

economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

ECON 54100 - Managerial Economics & Business Strategy

Credit Hours: 1.00. The course covers topics such as monopolies (price discrimination, optimal pricing strategies), advanced strategic decision-making and imperfect competition (optimal pricing and production), new product introductions, product variety offered on the market, and entry deterrence strategies. The main goal of this course is to provide a basis for a good understanding of the logical mechanics, and to provide a good intuition in managerial economics and business decision-making processes that facilitate the understanding of daily business problems.

Learning Outcomes: 1. Identify and explain logical mechanics that determine individuals' choices and decisions. 2. Evaluate managerial economic problems to better identify daily business problems. 3. Apply key aspects such as marginal concepts and countervailing effects when proposing solutions. 4. Illustrate main mechanisms using graphs and apply basic knowledge of algebra and calculus to business problems. Credits: 1.00

Business Analytics Selectives (10 credits)

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work. Credits: 2.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information

and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 58700 - Advanced Quantitative Economics With Python

Credit Hours: 3.00. The main goal of this course is to extend the computational and programming toolkit developed in Quantitative Economics with Python course. In particular, we will cover advanced methods for working with, visualizing and analyzing data in Python. In addition, we will consider more advanced programming techniques including stochastic optimization and dynamic programming. Throughout the course, we will consider a number of applications related to microeconomics, macroeconomics, and econometrics covered in the MS Econ program curriculum.

Learning Outcomes: 1. Gain working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Understand numerical methods used to solve economic models. 4. Use visualization tools to communicate

computational results. Credits: 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Electives (4 credits)

Business and Technology, MBT

About the Program

Program Requirements

Required Courses (26 credits)

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current

business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 68000 - Economic Analysis Of Technology Markets

Credit Hours: 0.00 to 3.00. The core models of microeconomics are fundamental to day-to-day management decisions. This course will cover economic models that describe firm production, pricing, entry/exit decisions, market efficiency, and welfare. Such economic models will be applied to the analyses of a variety of market conditions, including monopoly, oligopoly, and monopolistic competition. It will provide students with an understanding of the implications of economic theory on technology products, firms, markets, and consumers.

Learning Outcomes: 1. Be able to use economic models to analyze technology markets and make optimal managerial decisions. Credits: 0.00 to 3.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic

components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 68200 - Digital Product Design

Credit Hours: 2.00. This course is a comprehensive exploration of designing digital products that can improve the quality of people's daily lives. It covers value creation with technology and a human-centered design process including improv brainstorming, storyboarding, interviewing, sketches, and selling. Students will learn how to ideate and how to iteratively refine ideas with real users. Students will consider factors driving technology product design decisions such as the unique economic characteristics of today's technology-intensive markets and their impact on strategic interactions among firms and consumers. Students will also learn to discover unmet user needs, reframe problematic situations, envision multiple possible product concepts, and assess their feasibility, viability, and desirability. The course culminates in the creation of a business model, a product sketch, and a plan for taking the product to market.

Learning Outcomes: 1. Apply digital business methods and digital information strategies. Credits: 2.00

MGMT 65730 - Technology Strategy

Credit Hours: 2.00 or 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage. We take an in-depth look at how technological innovation affects the competitive dynamics of markets, how firms can strategically manage these dynamics, and how firms can create and implement strategies to maximize their likelihood of success. The course introduces tools, concepts, and analytical frameworks that will enhance your ability to define and analyze strategic problems that stem from innovation and technological change, and to identify sources of competitive advantage from both an industry and firm-level perspective. Permission of department required.

Learning Outcomes: 1. Assess the degree to which a firm or industry is subject to technological factors. 2. Evaluate the temporal dynamics of an industry, lifecycles and s-curves from both a technological maturity and adoption (installed customer base) perspective. 3. Design firm strategies to capitalize on internal technological capabilities and external opportunities. 4. Formulate collaboration strategies and strategies for protecting innovation. Credits: 2.00 or 3.00

Focus Areas (10 credits)

Concentrations

About the Program

Business and Technology, MBT (OL)

About the Program

Program Requirements

Required Courses (26 credits)

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.
Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 68000 - Economic Analysis Of Technology Markets

Credit Hours: 0.00 to 3.00. The core models of microeconomics are fundamental to day-to-day management decisions. This course will cover economic models that describe firm production, pricing, entry/exit decisions, market efficiency, and welfare. Such economic models will be applied to the analyses of a variety of market conditions, including monopoly, oligopoly, and monopolistic competition. It will provide students with an understanding of the implications of economic theory on technology products, firms, markets, and consumers.
Learning Outcomes: 1. Be able to use economic models to analyze technology markets and make optimal managerial decisions. Credits: 0.00 to 3.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.
Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.
Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2.

Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 68200 - Digital Product Design

Credit Hours: 2.00. This course is a comprehensive exploration of designing digital products that can improve the quality of people's daily lives. It covers value creation with technology and a human-centered design process including improv brainstorming, storyboarding, interviewing, sketches, and selling. Students will learn how to ideate and how to iteratively refine ideas with real users. Students will consider factors driving technology product design decisions such as the unique

economic characteristics of today's technology-intensive markets and their impact on strategic interactions among firms and consumers. Students will also learn to discover unmet user needs, reframe problematic situations, envision multiple possible product concepts, and assess their feasibility, viability, and desirability. The course culminates in the creation of a business model, a product sketch, and a plan for taking the product to market.

Learning Outcomes: 1. Apply digital business methods and digital information strategies.

Credits: 2.00

MGMT 65730 - Technology Strategy

Credit Hours: 2.00 or 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage. We take an in-depth look at how technological innovation affects the competitive dynamics of markets, how firms can strategically manage these dynamics, and how firms can create and implement strategies to maximize their likelihood of success. The course introduces tools, concepts, and analytical frameworks that will enhance your ability to define and analyze strategic problems that stem from innovation and technological change, and to identify sources of competitive advantage from both an industry and firm-level perspective. Permission of department required.

Learning Outcomes: 1. Assess the degree to which a firm or industry is subject to technological factors. 2. Evaluate the temporal dynamics of an industry, lifecycles and s-curves from both a technological maturity and adoption (installed customer base) perspective. 3. Design firm strategies to capitalize on internal technological capabilities and external opportunities. 4. Formulate collaboration strategies and strategies for protecting innovation. Credits: 2.00 or 3.00

Electives (10 Credits)

Program Learning Outcomes

Chemical Engineering, MSCHE

About the Program

Program Requirements - Thesis

Required Courses (15 credits)

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 54300 - Polymerization Reaction Engineering And Reactor Analysis

Credit Hours: 3.00. Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, copolymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, Z-transforms, batch, CSTR and tubular reactors, stability analysis, computer control, separation, and drying.

Credits: 3.00

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

Thesis Research (15 credits)

CHE 69000 - Seminar In Chemical Engineering

Credit Hours: 0.00. Required of all graduate students.

Credits: 0.00

CHE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHE 65500 - Safety In Chemical Engineering

Credit Hours: 1.00. This course will provide you with necessary safety information to comply with Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. The course will cover general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. The course will provide valuable information on how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc.

Learning Outcomes: 1. Understand necessary safety information to comply with the Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. 2. Understand general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. 3. Understand how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc. Credits: 1.00

Required Courses (15 credits)

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 54300 - Polymerization Reaction Engineering And Reactor Analysis

Credit Hours: 3.00. Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, copolymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, Z-transforms, batch, CSTR and tubular reactors, stability analysis, computer control, separation, and drying.

Credits: 3.00

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

Program Requirements - Non-Thesis

Required Courses (6 credits)

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 54300 - Polymerization Reaction Engineering And Reactor Analysis

Credit Hours: 3.00. Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, copolymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, Z-transforms, batch, CSTR and tubular reactors, stability analysis, computer control, separation, and drying.

Credits: 3.00

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

Electives (24 credits)

Required Courses (6 credits)

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 54300 - Polymerization Reaction Engineering And Reactor Analysis

Credit Hours: 3.00. Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, copolymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, Z-transforms, batch, CSTR and tubular reactors, stability analysis, computer control, separation, and drying.

Credits: 3.00

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

Program Requirements - Professional Master's

Required Courses (6 credits)

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

Management Courses (9 credits)

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

Capstone Project (6 credits)

Concentration Selectives (9 credits)

Required Courses (6 credits)

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

Concentrations

GPA Requirements

About the Program

Chemistry, MS

About the Program

Program Requirements

Required Courses (18 credits)

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 64100 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Survey of main group and transition metal chemistry. Main group special topics, bonding and structure of boron hydrides. Coordination chemistry, bonding models in coordination compounds. Transition metal organometallic chemistry, ligand types and reactivity patterns. Survey of inorganic NMR spectroscopy. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64400 - Solid State Chemistry

Credit Hours: 3.00. The chemistry of solids, including a discussion of ionic crystals, metals, alloys, and binary compounds, and their characterizations by various physical methods. Description of chemical reactions, phase changes, and catalysis in terms of current theories of the solid state. Prerequisite: CHM 34200 , CHM 37400 .

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 67100 - Advanced Physical Chemistry

Credit Hours: 3.00. Selected topics, including atomic and molecular structure and modern theories underlying thermodynamics and chemical kinetics. Prerequisite: CHM 57800.

Credits: 3.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of current interest.

Credits: 1.00 to 3.00

Thesis Research (12 credits)

CHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (18 credits)

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 64100 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Survey of main group and transition metal chemistry. Main group special topics, bonding and structure of boron hydrides. Coordination chemistry, bonding models in coordination compounds. Transition metal organometallic chemistry, ligand types and reactivity patterns. Survey of inorganic NMR spectroscopy. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64400 - Solid State Chemistry

Credit Hours: 3.00. The chemistry of solids, including a discussion of ionic crystals, metals, alloys, and binary compounds, and their characterizations by various physical methods. Description of chemical reactions, phase changes, and catalysis in terms of current theories of the solid state. Prerequisite: CHM 34200 , CHM 37400 .

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 67100 - Advanced Physical Chemistry

Credit Hours: 3.00. Selected topics, including atomic and molecular structure and modern theories underlying thermodynamics and chemical kinetics. Prerequisite: CHM 57800.

Credits: 3.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of

current interest.

Credits: 1.00 to 3.00

Concentrations

GPA Requirements

About the Program

Civil Engineering, MSCE

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (xx credits)

Concentrations (18-30 credits)

Thesis Research (9 credits)

CE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

About the Program

Civil Engineering, MSCE (OL)

About the Program

Program Requirements

Required Courses (30 credits)

Applied Math/Statistics Courses (6 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations.

Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of

vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

CE Electives (15 credits)

Technical Electives (9 credits)

Concentrations

GPA Requirements

Clinical Pharmaceutical Sciences, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (xx credits)

Thesis Research (6 credits)

Non-thesis Requirements (6 credits)

About the Program

Clinical Psychological Sciences, MS

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (6 credits)

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

Seminar Courses (6 credits)

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Clinical Psychology Courses (xx credits)

PSY 64000 - Survey Of Social Psychology I

Credit Hours: 3.00. An extensive survey of methods, research, and theory in social psychology.

Credits: 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 61501 - Systems And Behavioral Neuroscience

Credit Hours: 4.00. This course will provide you with a broad introduction to the field of neuroscience and how it can inform our understanding of behavior. First, we will cover neuroanatomy, synaptic communication, and plasticity. Next, we will cover neuroscience research on a range of major topics relevant to behavior: emotion, motivation, attention, learning, decision-making, and social cognition. This course will also provide a brief introduction to a variety of neuroscience research methods that are commonly used in animal and human research (e.g., electroencephalography, magnetic resonance imaging), including tutorials and live demonstrations. Permission of department required.

Learning Outcomes: 1. Know general neural architecture of core systems relevant to behavior. 2. Know behavioral outcomes for

each major neural system. 3. Know how brain structure and functioning are studied in animal research. 4. Know how brain structure and functioning are studied in human research. 5. Know how brain functioning undergirds cognition, affect, and social processes. 6. Translate basic neuroscience to clinical and other applied research. Credits: 4.00

PSY 67510 - Research Methods In Clinical Psychological Sciences

Credit Hours: 3.00. This course provides an in-depth introduction to the fundamentals of research methods and design, including the scientific approach and its applicability to the science of psychology to the philosophy of science, the role of theory, and hypothesis testing. Philosophical and theoretical fundamentals are discussed, followed by methodological issues. The course includes content on the replication crisis in psychology, the practices that contributed to it, and the means to overcome it, as well as issues in sampling, measurement, and design. The course will examine nonexperimental research as well as experimental and quasi-experimental approaches. Permission of department required.

Learning Outcomes: 1. Understand Open Science practices, basic psychometrics, experimental design, and nonexperimental approaches and identify bad research practices in published research articles. 2. Evaluate special issues faced when studying psychopathology. 3. Evaluate the factors that contribute to replication concerns in the field (i.e., low statistical power, HARKing, p-hacking, and publication bias). 4. Evaluate correct strategies for calculating reliability and demonstrating validity of a psychological assessment. 5. Create a research study working through sampling, assessment, and design. Credits: 3.00

Clinical Assessment Courses (xx credits)

PSY 66700 - Clinical Assessment I

Credit Hours: 4.00. Presentation of general assessment principles and methods. Supervised practice in general diagnostic and treatment procedures as applied to both children and adults. Emphasis is placed on laboratory practice in the administration and interpretation of intelligence tests; behavioral observation techniques and operant remediation procedures. Permission of instructor required.

Learning Outcomes: 1. Display knowledge of basic psychometric theory as evidenced by performance on examinations. 2. List primary instruments and their strengths and weaknesses. 3. Perform accurate administration, scoring, and interpretation of personality assessment instruments in real-time. 4. Display proficiency in writing integrative assessment reports. 5. Dialogue with professional colleagues regarding the professional practice of assessment and diagnosis. Credits: 4.00

PSY 66800 - Clinical Assessment II

Credit Hours: 4.00. Presentation of methods of clinical assessment including structured and unstructured personality tests, physiological recording, behavioral observation, and interview techniques. Emphasis is placed on laboratory practice in the administration and interpretation of personality tests and training in the basic clinical interview techniques. Permission of instructor required.

Credits: 4.00

PSY 67000 - Principles And Techniques Of Psychological Treatment

Credit Hours: 3.00. Discussion and elaboration of the main theories and techniques of psychotherapy, the application of these techniques to the change of behavior, and the analysis of clinical cases for therapy planning.

Learning Outcomes: 1. Understand basic methodological issues related to psychotherapy research. 2. Describe the distinction between process and outcome in psychotherapy. 3. Understand the contributions of specific and common factors in psychotherapy. 4. Demonstrate basic process skills of active listening, empathic responses, and utilization of the therapeutic relationship in interactions with mock clients. 5. Demonstrate basic skills involved in motivational interviewing. 6. Demonstrate practical skills to document

therapeutic interventions (progress notes) and care management (treatment planning). 7. Develop an understanding of the conceptual underpinnings of cognitive behavior therapy, including a) underlying theory of psychopathology; b) proposed mechanisms of change; c) establishment of treatment plans based on mechanisms of change; d) empirical evidence of therapy efficacy and effectiveness. 8. Demonstrate skills to implement basic evidenced-based therapeutic interventions and strategies (CBT). 9. Demonstrate an appreciation for addressing individual differences and diversity in psychotherapy. 10. Demonstrate a sense of self-awareness and ability to relate to diverse clients. Credits: 3.00

PSY 67300 - Psychology Of Behavior Disorders

Credit Hours: 3.00. Advanced abnormal psychology. Consideration will be given to research and theory of psychopathology.

Credits: 3.00

PSY 67900 - Practicum In Clinical Psychology

Credit Hours: 1.00 to 6.00. This is a practicum in clinical psychology, whereby students see individuals for therapy. These cases are supervised by faculty in clinical psychology. This is a requirement for the graduate program, and students must do both adult and child practicum. Students enrolled in this program must register for this course a minimum of four times. Prerequisite: Master's student standing and Psychology majors only. Permission of instructor required.

Credits: 1.00 to 6.00

Practicum Training (12 credits)

PSY 67900 - Practicum In Clinical Psychology

Credit Hours: 1.00 to 6.00. This is a practicum in clinical psychology, whereby students see individuals for therapy. These cases are supervised by faculty in clinical psychology. This is a requirement for the graduate program, and students must do both adult and child practicum. Students enrolled in this program must register for this course a minimum of four times. Prerequisite: Master's student standing and Psychology majors only. Permission of instructor required.

Credits: 1.00 to 6.00

Internal Practica Requirements

Electives (9-24 credits)

Thesis Research (6-12 credits)

PSY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Learning Outcomes

Additional Information

GPA Requirements

Cognitive Psychology, MS

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (6 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures

for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Seminar Courses (0-3 credits)

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Cognitive Psychology Courses (6-9 credits)

PSY 62400 - Human Learning And Memory

Credit Hours: 3.00. Selected survey of important problems in the encoding, storage, and retrieval of laboratory and naturalistic events.

Learning Outcomes: 1. Describe the most common methods and procedures used to carry out research on human learning and memory. 2. Describe and explain foundational findings in the study of human learning and memory. 3. Describe and evaluate key concepts and theories that have been developed to understand the mental processes involved in human learning and memory. Credits: 3.00

PSY 62500 - Complex Cognitive Processes

Credit Hours: 3.00. Surveys research and theory concerned with the nature of the "higher-order" mental processes, including decision making, categorization, problem solving, and language. Fundamental questions regarding the nature of the representations that underlie conceptual and linguistic behavior will be addressed. Permission of instructor required.

Learning Outcomes: 1. Read, critically evaluate, and discuss empirical and theoretical research articles about complex cognitive processes. 2. Integrate learning of course material with their own research interests into a written proposal of a research project, demonstrating effective communication skills and critical thinking skills. Credits: 3.00

PSY 62800 - Perceptual Processes

Credit Hours: 3.00. This course is an advanced introduction to the psychology of perception. The course emphasizes visual and auditory perception, reviewing basic concepts, methodologies, research findings, and theoretical approaches. Theories of direct perception, constructivist perception, and computational vision are discussed in detail.

Credits: 3.00

PSY 63700 - Human Information Processing

Credit Hours: 3.00. This course develops the methodological tools required for an information processing approach to human behavior. These techniques are applied to such topics as reaction time, signal detection, attention, and skilled behavior, with emphasis upon unifying empirical findings. Prerequisite: PSY 60000 , PSY 60100 .

Credits: 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change

from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Colloquium (xx credits)

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

Electives (6-10 credits)

Thesis Research (xx credits)

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

GPA Requirements

Communication, MA

About the Program

Program Requirements

Program Learning Outcomes

Concentrations

About the Program

Communication, MS

About the Program

Program Requirements - Thesis

Required Courses (24 credits)

Major Area (12-15 credits)

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Interpersonal Communication

COM 50800 - Nonverbal Communication In Human Interaction

Credit Hours: 3.00. An examination of theoretical writings and critical studies in selected areas of nonverbal communication, e.g., the environmental influences, space and territory relationships, physical appearance and dress, physical behavior, and vocal cues. One unit will deal specifically with measurement, recording, or transcription methods used in nonverbal study.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to

improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

COM 50300 - Cross Cultural Communication

Credit Hours: 3.00. In this course, we examine the scholarly history of intercultural and cross-cultural communication along with conceptual and empirical challenges in doing this type of inquiry. Several contexts will be studied from the point of view of forms of cultural wisdom and variation in practices. Larger questions of idenity, diversity, and intercultural competence will be explored, especially through filters of globalization and ethical issues in intercultural relations. Students will have regular reading assignments, short reaction papers, give oral presentations, and write a final research paper or proposal, depending on their stage in their programs.

Learning Outcomes: 1. Discuss and exemplify how culture is a multimodal, multilayered set of practices, attitudes, and belief. 2. Analyze intercultural communication problems, illustrating the historical, cultural, economic, and political differences that affect their solutions. 3. Recognize a range factors impacting human cultural life, including, but not limited to, class, gender, nation, ethnicity. 4. Develop research ideas and methods to address current problematics in cross-cultural communication. 5. Develop, create, determine how to engage audiences around a global problem. 6. Practice using self-awareness, research, discussion, and peer review to explore cross-cultural challenges. Credits: 3.00

Media, Technology, and Society

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games

on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

Organizational Communication

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 60811 - Leadership And Global Strategic Communication

Credit Hours: 3.00. Over the last decade, the field of strategic communication has grown rapidly. The work of strategic communication professionals requires coordinated responses between distinct organizational units that are often separated by time and space. These conditions necessitate effective leadership. Further complicating leadership in these contexts is the fact that the work of strategic communication has increasingly become global in nature. This course provides students with theoretical background in leadership and global strategic communication, as well as the opportunity to apply what they learn to strategic communication cases and to their own professional experiences. It also encourages them to think proactively about leadership challenges in these contexts and to articulate theoretically-informed analyses and evaluations of leadership in action. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of theories related to leadership and to strategic communication in global contexts. 2. Articulate the relationship between theory and the practice of leadership as it relates to global strategic communication, and apply theoretical concepts and principles to real world contexts. 3. Explain the role of leadership and culture in global strategic communication. 4. Compare and contrast notions of leadership, corporate social responsibility, and negotiation across cultural contexts. 5. Identify the unique challenges experienced when leaders engage in strategic communication practices globally. 6. Evaluate the current knowledge base and "best practices" in global strategic communication. Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories

and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

Public Relations

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general

strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must

be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Minor Area (9-12 credits)

Major Area (12-15 credits)

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and

everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the

U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Interpersonal Communication

COM 50800 - Nonverbal Communication In Human Interaction

Credit Hours: 3.00. An examination of theoretical writings and critical studies in selected areas of nonverbal communication, e.g., the environmental influences, space and territory relationships, physical appearance and dress, physical behavior, and vocal cues. One unit will deal specifically with measurement, recording, or transcription methods used in nonverbal study.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval,

collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

COM 50300 - Cross Cultural Communication

Credit Hours: 3.00. In this course, we examine the scholarly history of intercultural and cross-cultural communication along with conceptual and empirical challenges in doing this type of inquiry. Several contexts will be studied from the point of view of forms of cultural wisdom and variation in practices. Larger questions of idenity, diversity, and intercultural competence will be explored, especially through filters of globalization and ethical issues in intercultural relations. Students will have regular reading assignments, short reaction papers, give oral presentations, and write a final research paper or proposal, depending on their stage in their programs.

Learning Outcomes: 1. Discuss and exemplify how culture is a multimodal, multilayered set of practices, attitudes, and belief. 2. Analyze intercultural communication problems, illustrating the historical, cultural, economic, and political differences that affect their solutions. 3. Recognize a range factors impacting human cultural life, including, but not limited to, class, gender, nation, ethnicity. 4. Develop research ideas and methods to address current problematics in cross-cultural communication. 5. Develop, create, determine how to engage audiences around a global problem. 6. Practice using self-awareness, research, discussion, and peer review to explore cross-cultural challenges. Credits: 3.00

Media, Technology, and Society

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that

inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

Organizational Communication

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 60811 - Leadership And Global Strategic Communication

Credit Hours: 3.00. Over the last decade, the field of strategic communication has grown rapidly. The work of strategic communication professionals requires coordinated responses between distinct organizational units that are often separated by time and space. These conditions necessitate effective leadership. Further complicating leadership in these contexts is the fact that the work of strategic communication has increasingly become global in nature. This course provides students with theoretical background in leadership and global strategic communication, as well as the opportunity to apply what they learn to strategic communication cases and to their own professional experiences. It also encourages them to think proactively about leadership challenges in these contexts and to articulate theoretically-informed analyses and evaluations of leadership in action. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of theories related to leadership and to strategic communication in global contexts. 2. Articulate the relationship between theory and the practice of leadership as it relates to global strategic communication, and apply theoretical concepts and principles to real world contexts. 3. Explain the role of leadership and culture in global strategic communication. 4. Compare and contrast notions of leadership, corporate social responsibility, and negotiation across cultural contexts. 5. Identify the unique challenges experienced when leaders engage in strategic communication practices globally. 6. Evaluate the current knowledge base and "best practices" in global strategic communication. Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive

internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

Public Relations

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will

cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must

be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Thesis Research (6 credits)

COM 69800 - Research MA Or MS Thesis

Credit Hours: 1.00 to 18.00. Research MA Or MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (24 credits)

Major Area (12-15 credits)

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis

research in their home department.

Credits: 1.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and

implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Interpersonal Communication

COM 50800 - Nonverbal Communication In Human Interaction

Credit Hours: 3.00. An examination of theoretical writings and critical studies in selected areas of nonverbal communication, e.g., the environmental influences, space and territory relationships, physical appearance and dress, physical behavior, and vocal cues. One unit will deal specifically with measurement, recording, or transcription methods used in nonverbal study.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research,

ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

COM 50300 - Cross Cultural Communication

Credit Hours: 3.00. In this course, we examine the scholarly history of intercultural and cross-cultural communication along with conceptual and empirical challenges in doing this type of inquiry. Several contexts will be studied from the point of view of forms of cultural wisdom and variation in practices. Larger questions of idenity, diversity, and intercultural competence will be explored, especially through filters of globalization and ethical issues in intercultural relations. Students will have regular reading assignments, short reaction papers, give oral presentations, and write a final research paper or proposal, depending on their stage in their programs.

Learning Outcomes: 1. Discuss and exemplify how culture is a multimodal, multilayered set of practices, attitudes, and belief. 2. Analyze intercultural communication problems, illustrating the historical, cultural, economic, and political differences that affect their solutions. 3. Recognize a range factors impacting human cultural life, including, but not limited to, class, gender, nation, ethnicity. 4. Develop research ideas and methods to address current problematics in cross-cultural communication. 5. Develop, create, determine how to engage audiences around a global problem. 6. Practice using self-awareness, research, discussion, and peer review to explore cross-cultural challenges. Credits: 3.00

Media, Technology, and Society

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media

psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

Organizational Communication

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 60811 - Leadership And Global Strategic Communication

Credit Hours: 3.00. Over the last decade, the field of strategic communication has grown rapidly. The work of strategic communication professionals requires coordinated responses between distinct organizational units that are often separated by time and space. These conditions necessitate effective leadership. Further complicating leadership in these contexts is the fact that the work of strategic communication has increasingly become global in nature. This course provides students with theoretical background in leadership and global strategic communication, as well as the opportunity to apply what they learn to strategic communication cases and to their own professional experiences. It also encourages them to think proactively about leadership challenges in these contexts and to articulate theoretically-informed analyses and evaluations of leadership in action. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of theories related to leadership and to strategic communication in global contexts. 2. Articulate the relationship between theory and the practice of leadership as it relates to global strategic communication, and apply theoretical concepts and principles to real world contexts. 3. Explain the role of leadership and culture in global strategic communication. 4. Compare and contrast notions of leadership, corporate social responsibility, and negotiation across cultural contexts. 5. Identify the unique challenges experienced when leaders engage in strategic communication practices globally. 6. Evaluate the current knowledge base and "best practices" in global strategic communication. Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in

their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

Public Relations

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in

part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across

each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-

provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Minor Area (9-12 credits)

Major Area (12-15 credits)

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Health and Risk Communication

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

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be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

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Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Interpersonal Communication

COM 50800 - Nonverbal Communication In Human Interaction

Credit Hours: 3.00. An examination of theoretical writings and critical studies in selected areas of nonverbal communication, e.g., the environmental influences, space and territory relationships, physical appearance and dress, physical behavior, and vocal cues. One unit will deal specifically with measurement, recording, or transcription methods used in nonverbal study.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research

in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

COM 50300 - Cross Cultural Communication

Credit Hours: 3.00. In this course, we examine the scholarly history of intercultural and cross-cultural communication along with conceptual and empirical challenges in doing this type of inquiry. Several contexts will be studied from the point of view of forms of cultural wisdom and variation in practices. Larger questions of idenity, diversity, and intercultural competence will be explored, especially through filters of globalization and ethical issues in intercultural relations. Students will have regular reading assignments, short reaction papers, give oral presentations, and write a final research paper or proposal, depending on their stage in their programs.

Learning Outcomes: 1. Discuss and exemplify how culture is a multimodal, multilayered set of practices, attitudes, and belief. 2. Analyze intercultural communication problems, illustrating the historical, cultural, economic, and political differences that affect their solutions. 3. Recognize a range factors impacting human cultural life, including, but not limited to, class, gender, nation, ethnicity. 4. Develop research ideas and methods to address current problematics in cross-cultural communication. 5. Develop, create, determine how to engage audiences around a global problem. 6. Practice using self-awareness, research, discussion, and peer review to explore cross-cultural challenges. Credits: 3.00

Media, Technology, and Society

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include

the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

Organizational Communication

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that are useful in everyday life and work contexts. Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 60811 - Leadership And Global Strategic Communication

Credit Hours: 3.00. Over the last decade, the field of strategic communication has grown rapidly. The work of strategic communication professionals requires coordinated responses between distinct organizational units that are often separated by time and space. These conditions necessitate effective leadership. Further complicating leadership in these contexts is the fact that the work of strategic communication has increasingly become global in nature. This course provides students with theoretical background in leadership and global strategic communication, as well as the opportunity to apply what they learn to strategic communication cases and to their own professional experiences. It also encourages them to think proactively about leadership challenges in these contexts and to articulate theoretically-informed analyses and evaluations of leadership in action. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of theories related to leadership and to strategic communication in global contexts. 2. Articulate the relationship between theory and the practice of leadership as it relates to global strategic communication, and apply theoretical concepts and principles to real world contexts. 3. Explain the role of leadership and culture in global strategic communication. 4. Compare and contrast notions of leadership, corporate social responsibility, and negotiation across cultural contexts. 5. Identify the unique challenges experienced when leaders engage in strategic communication practices globally. 6. Evaluate the current knowledge base and "best practices" in global strategic communication. Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories

and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

Public Relations

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

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Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general

strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

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Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

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Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

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Credits: 3.00

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Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must

be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

Program Requirements - Non-Thesis

Required Courses (36 credits)

COM 60000 - Foundations Of Human Communication Inquiry I

Credit Hours: 3.00. Introduces doctoral students to major and emerging approaches to understanding human communication and provides them with the theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims.

Credits: 3.00

Major Area (18-27 credits)

Minor Area (9-18 credits)

Internship Option (6 credits)

COM 69500 - Curricular Practical Training

Credit Hours: 1.00 to 3.00. Internship providing practical field experience under professional supervision in selected situations related to the student's area of specialization. Good standing in the graduate program of the Department of Communication and an approved plan of study including the internship. Permission of instructor required.

Learning Outcomes: 1. Apply communication concepts to industry or sector-specific communication problems and projects. 2. Develop communication skills specific to work in a specific sector or industry. 3. Gain valuable experience working alongside communication

and industry leaders in the workplace. Credits: 1.00 to 3.00

Major Area (18-27 credits)

Required Courses (36 credits)

COM 60000 - Foundations Of Human Communication Inquiry I

Credit Hours: 3.00. Introduces doctoral students to major and emerging approaches to understanding human communication and provides them with the theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims.

Credits: 3.00

Major Area (18-27 credits)

Minor Area (9-18 credits)

Internship Option (6 credits)

COM 69500 - Curricular Practical Training

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Learning Outcomes: 1. Apply communication concepts to industry or sector-specific communication problems and projects. 2. Develop communication skills specific to work in a specific sector or industry. 3. Gain valuable experience working alongside communication and industry leaders in the workplace. Credits: 1.00 to 3.00

Major Area (18-27 credits)

Concentrations

Additional Information

About the Program

Communication, MS (OL)

About the Program

Program Requirements

Required Courses (9 credits)

Core Courses (9 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments.

Credits: 3.00

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

COM 61011 - Strategic Communication And Ethics

Credit Hours: 3.00. This graduate course introduces the application of ethical principles and decision making. In this course, students will study both philosophical and practical ethical questions related to strategic communication. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of diverse philosophical perspectives on ethics. 2. Compare and contrast insights offered by different perspectives when applied to concrete dilemmas encountered in students' own work experience. 3. Synthesize ethical principles embedded in professional codes of ethics, and their implications for the practice of strategic communication. 4. Highlight ethical principles pertaining to working in organizational teams. 5. Evaluate ethical guidelines for gathering, analyzing, and presenting research data. 6. Identify challenges that occur when evaluating what constitutes ethical strategic communication across cultures. 7. Articulate possible relationships between ethical and effective strategic communication. 8. Evaluate new ethical questions about the practice of strategic communication arising from the emergence of new social media. Credits: 3.00

Concentration (0-18 credits)

Selectives (3-21 credits)

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60511 - Strategic Communication And Professional Writing

Credit Hours: 3.00. This graduate course covers topics related to professional writing and strategic communication. Topics include grammar basics, audience considerations, credibility

and ethics, and documentation style. In addition, writing will be discussed in a variety of contexts such as media, public relations, advertising, and business communication. Permission of department required.

Learning Outcomes: 1. Demonstrate mastery of writing, grammar, and style as well as various guidelines for academic and professional writing. 2. Articulate the role of credibility and ethics in professional writing. 3. Explain the importance of research and audience analysis in professional writing. 4. Analyze the unique challenges of writing in different contexts (e.g., advertising, public relations, media, business communication, print and online). 5. Evaluate strengths and weaknesses of various forms of written communication. 6. Produce various types of documents related to strategic communication. Credits: 3.00

COM 60711 - Strategic Communication And Fundraising Management

Credit Hours: 3.00. This graduate course serves as an introduction to the concepts, elements, and best practices of fundraising. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of communication theory related to fundraising management. 2. Identify best practices of fundraising. 3. Analyze the importance of message design and mediums when creating fundraising campaigns. 4. Assess the implications of an organization's relationships with multiple publics/stakeholder groups for fundraising. 5. Evaluate case studies of fundraising in light of theory and best practices. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health

interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

PUBH 60400 - Public Health Administration

Credit Hours: 3.00. An introduction to the principals of management as applied to public health organizations, particularly local health departments. Topics include the organization of the U.S. public health system, legal and ethical obligations of public health administrators, the public health workforce and human resource issues, public health budgeting and finance, and leadership in the public health agency. The course is designed to introduce master's level students in public health to the management skills necessary to successfully implement a public health program.

Learning Outcomes: 1. Understand the transforming integrated health delivery system in the United States to build collaborative network of care providers. 2. Formulate action plans for process improvement that addresses gaps of public health service areas. 3. Appraise effectiveness of initiatives and programs to determine best practices and benchmarks for delivering public health services. Credits: 3.00

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of

IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 64011 - Seminar In Advertising

Credit Hours: 3.00. This course provides an overview of the strategic planning process for advertising including identifying the target audience, determining a positioning strategy and developing a communication media strategy. The course will provide information on theory and best practices that inform the planning and implementation process for successful advertising campaigns.

Learning Outcomes: 1. Create a strategic advertising plan. 2. Identify key aspects of a target audience. 3. Develop a positioning strategy. 4. Articulate communication objectives. 5. Determine a media strategy. Credits: 3.00

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive

internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 64600 - Strategic Corporate Branding

Credit Hours: 3.00. This graduate course will survey the theories and processes of business brand design, development, and implementation. The course will examine best practices, trends, and creative strategies used in contemporary business branding. An emphasis will be placed on experiential learning, case study analysis, and the application of relevant theory to provide an in-depth understanding of the development, planning, execution, and evaluation of business brands.

Learning Outcomes: 1. Develop a strong conceptual foundation for formulating creative, meaningful, and effective business brands. 2. Apply strategic branding concepts to a variety of business needs and applications. 3. Demonstrate an understanding of various branding principles, theories, tools, techniques, and models. 4. Critique real-world brands for their efficacy, impact, and creativity. 5. Develop and present a business branding campaign. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

COM 65200 - Communication Education And Training

Credit Hours: 3.00. This course is designed to introduce fundamental concepts related to learning theory and learning design as applied to training and educational settings. The course will examine best practices and strategies with a focus on assessing and enhancing communication-related skills.

Learning Outcomes: 1. Define key communication skills and vocabulary. 2. Understand and apply the basic tenets of learning theory. 3. Design, develop, and evaluate an effective educational workshop or course. Credits: 3.00

PUBH 53500 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality.

Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

SCLA 52000 - Social And Digital Media Analytics For Strategic Communication

Credit Hours: 3.00. This course provides an overview of how to transform social media and digital media information into business intelligence and actionable insight. Although students are not expected to know a programming language prior to taking the course, students are expected to understand basic statistics and to have a desire to learn the processes, procedures and vocabulary used by data analysts in modern organizations. The goal is not to train them as practicing data scientists, but as knowledgeable data analytics consumers and as informed teammates and leaders of cross-functional teams tasked to make decisions using data.

Learning Outcomes: 1. Differentiate between the opportunities and limitations with social media data. 2. Identify methods for using ready and custom-made tools to transform information into insight, from data collection to analysis, interpretation, and recommendation. 3. Sharpen their quantitative and business analytical skills using spreadsheets and online tools. 4. Write effective reports and draft scorecards. 5. Be prepared to interact with data scientists by speaking their language and understanding their processes for data mining and business intelligence. Credits: 3.00

SCLA 51000 - Data And AI Storytelling

Credit Hours: 3.00. The primary assumption of our course is that the goal of communicating with data is ultimately to identify causal mechanisms and change the status quo due to the obtained insights. All audiences have previous understandings of the world, and meaningful data stories should challenge their assumptions about that world. The communication of this data-based new knowledge violates prior assumptions, shares memorable new information and moves the audience to act based on the new knowledge. This is best accomplished through a story. In other words, this communication assumes the form of a story, which is defined as the narrative of how an unexpected cause creates an effect.

Learning Outcomes: 1. Provide high-quality data story examples and justify why they meet the good story criteria. 2. Identify and extrapolate core relationships between research design and story-building. 3. Generate hypotheses based on data. 4. Create specific data visualizations which maintain casual narratives. 5. Identify story elements that map onto the five tenets of What is a Data Story? 6. Identify in examples the adherence or violation of data transparency, validity and ethics. Credits: 3.00

COM 66111 - Sports Communications

Credit Hours: 3.00. This course provides students a strategic and holistic sports communication approach and framework to solve for communications challenges. The course focuses on understanding the ever-increasingly competitive athletic landscape - collegiate and professional (though the lines are blurring) -- to aid the sports communicator in crafting a strategic communication plan based on quantifiable objectives and desired outcomes. Special topics include crisis and reputation management, leveraging social media, the emergence of AI, and athletes and culture.

Learning Outcomes: 1. Develop a strategic sports communication plan. 2. Integrate social media and AI into strategic communication planning. 3. Apply effective strategies to engage productively with collegiate and professional sports media. 4. Analyze a crisis event to develop strategies for advancing organizational reputation. 5. Articulate the role of sports in culture. Credits: 3.00

COM 66211 - Strategic Sports Media Relations

Credit Hours: 3.00. This course explores how to navigate a media landscape that is evolving at light-speed both in collegiate and professional sports. The course offers students

the tools to engage productively with media members and places particular emphasis on the communicator/media relationship, how media prefer to receive content and the role of the communications leader. Strategic Sports Media Relations also delves into media interaction during crisis events and the rise of AI.

Learning Outcomes: 1. Articulate how sports media relations have evolved across print, radio, TV, online and social media. 2. Explain the roles of collegiate and professional athletics communicators. 3. Demonstrate the ability to facilitate interviews and pitch/write in the sports media relations setting. 4. Respond to crisis and reputation management events. 5. Discuss sports media relations ethics/law and AI's impacts. Credits: 3.00

COM 64400 - Strategic Personal Branding

Credit Hours: 3.00. This graduate course will examine the theories and processes of personal brand development and self-marketing. The course will examine best practices, trends, and creative strategies used in contemporary personal branding. An emphasis will be placed on experiential learning, self-awareness, image and perceptual management, career development, self-promotion, brainstorming, and effective communication.

Learning Outcomes: 1. Convey deep understanding of personal mission, vision, values, personality, skills, and other key attributes and differentiators. 2. Develop a strong conceptual foundation for formulating distinctive, professional, and effective personal brands. 3. Demonstrate an understanding of various personal branding principles, theories, tools, techniques, and models. 4. Critique real-world personal brands for their authenticity, impact, and effectiveness. 5. Develop and present a personal branding and self-marketing campaign. Credits: 3.00

Concentrations

Program Learning Outcomes

GPA Requirements

Comparative Literature, MA

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (27 credits)

Core Course (3 credits)

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

CMPL 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (LC 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study.

Credits: 3.00

Major Field (12 credits)

Secondary Field (9 credits)

Third Field (3 credits)

Thesis Research (3 credits)

Additional Requirements

Concentrations

Additional Information

About the Program

Comparative Pathobiology, MS

About the Program

Program Requirements -Thesis

Required Courses (4-6 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Thesis Research (6 credits)

CPB 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Areas of Study (18-20 credits)

Animal Welfare

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological

problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

ASEC 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. Topics, requirements, and credits to be determined yearly. To be arranged with the instructor or departmental representative prior to registering. Permission of

instructor required.

Credits: 1.00 to 4.00

Human-Animal Interaction

CPB 69500 - Seminar In Epidemiology

Credit Hours: 1.00. Discussion of recent research in epidemiology, emphasizing study design, analysis, and public health significance. Discussion topics will be selected from the following areas: clinical epidemiology, infectious disease epidemiology, chronic disease epidemiology, and environmental epidemiology. Required of graduate students with a principal field of study in epidemiology. Prerequisite: Course work in Statistics and Epidemiology.

Credits: 1.00

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving

biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Epidemiology and Public Health

Microbiology and Immunology

Animal Welfare

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

ASEC 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. Topics, requirements, and credits to be determined yearly. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 4.00

Required Courses (4-6 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction

to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Program Requirements - Non-Thesis in Anatomic Pathology

Required Courses (16-24 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 69100 - Seminar In Veterinary Pathology

Credit Hours: 0.00 to 2.00. Discussions of selected current disease problems with emphasis on gross and microscopic tissue changes and pathogenesis. Required of all graduate students in veterinary pathology each semester in residence.

Credits: 0.00 to 2.00

CPB 68000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 60400 - Neoplastic Diseases Of Animals

Credit Hours: 3.00. Histogenesis and structure of neoplasms of animals; consideration of clinical and pathological entities within groups of neoplasms. Prerequisite: CPB 55600.

Credits: 3.00

CPB 60300 - Graduate Teaching Practicum

Credit Hours: 1.00. Graduate students assist in running the laboratory sessions in a sophomore DVM course. They also grade exams and may give one lecture in or make a scholarly contribution to the course. Permission of instructor required.

Credits: 1.00

CPB 60200 - Advanced Veterinary Anatomic Pathology

Credit Hours: 0.00 to 8.00. Comparative gross and microscopic pathology in the diagnosis of diseases of animals. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.00 to 8.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

CPB 61100 - Veterinary Pathology Literature Review Seminar

Credit Hours: 1.00. Understanding of principles of veterinary pathology is required. The class will provide the graduate students with in-depth knowledge in current pathology research and diagnostics. Permission of department required.

Learning Outcomes: 1. Retain new knowledge and be aware of current findings in the veterinary medicine and pathology literature. 2. Critique and appraise data and technical approaches. 3. Formulate an evaluation of the merits of a study and to evaluate its applicability to pathology practice. Credits: 1.00

Selectives List #1 (3 credits)

CPB 68000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 61400 - Topics In Advanced General Pathology

Credit Hours: 0.50 or 1.00. Discussion of current topics in the following areas of general pathology: cellular injury, fluid and hemodynamic alterations, inflammation, immunopathology, neoplasia, genetic and developmental disorders, pathogenesis of infectious diseases, and nutritional disorders. Class meets one hour in alternate weeks. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.50 or 1.00

VCS 60400 - Animal Models In Translational Research

Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of

translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

Selectives List #2 (3-11 credits)

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CPB 62000 - Advanced Immunology

Credit Hours: 2.00. Teaches advanced concepts in basic immunology and applications to disease prevention and therapy. Emphasis is on recent developments and experimental approaches in this rapidly evolving discipline. Topics include antigen presentation, T-cell development, signal transduction in B and T lymphocytes, immunoglobulin structure, type I hypersensitivity (asthma), neuroendocrine regulation of the immune response, immune response in viral infections (influenza and HIV), and tumor immunology. Permission of instructor required.

Credits: 2.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2.

Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 65001 - Techniques In Molecular Biology

Credit Hours: 1.00. Techniques in Molecular Biology will introduce graduate students to the theory and practice of many commonly used methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth 600-level scientific courses, for their rotations, and for future laboratory work. Exams will be "experimental" in nature (e.g., "design and experiment to do something..." or "in this type of situation, which technique/vector/etc. would best be used, and why...").

Learning Outcomes: 1. Students are expected to learn the theoretical basis for many commonly used molecular biology techniques. An emphasis is placed on how correctly to use these techniques in real-life laboratory situations, and the limitations of each technique. Credits: 1.00

Additional Requirements

Required Courses (16-24 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 69100 - Seminar In Veterinary Pathology

Credit Hours: 0.00 to 2.00. Discussions of selected current disease problems with emphasis on gross and microscopic tissue changes and pathogenesis. Required of all graduate students in veterinary pathology each semester in residence.

Credits: 0.00 to 2.00

CPB 68000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of

the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 60400 - Neoplastic Diseases Of Animals

Credit Hours: 3.00. Histogenesis and structure of neoplasms of animals; consideration of clinical and pathological entities within groups of neoplasms. Prerequisite: CPB 55600.

Credits: 3.00

CPB 60300 - Graduate Teaching Practicum

Credit Hours: 1.00. Graduate students assist in running the laboratory sessions in a sophomore DVM course. They also grade exams and may give one lecture in or make a scholarly contribution to the course. Permission of instructor required.

Credits: 1.00

CPB 60200 - Advanced Veterinary Anatomic Pathology

Credit Hours: 0.00 to 8.00. Comparative gross and microscopic pathology in the diagnosis of diseases of animals. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.00 to 8.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

CPB 61100 - Veterinary Pathology Literature Review Seminar

Credit Hours: 1.00. Understanding of principles of veterinary pathology is required. The class will provide the graduate students with in-depth knowledge in current pathology research and diagnostics. Permission of department required.

Learning Outcomes: 1. Retain new knowledge and be aware of current findings in the veterinary medicine and pathology literature. 2. Critique and appraise data and technical approaches. 3. Formulate an evaluation of the merits of a study and to evaluate its applicability to pathology practice. Credits: 1.00

Program Requirements - Non-Thesis in Comparative Medicine

Required Courses (30 credits)

Required Courses (30 credits)

Concentrations

GPA Requirements

About the Program

Computer and Information Technology, MS

About the Program

Program Requirements - Thesis

Required Courses (6 credits)

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between

discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

CNIT 60100 - Applied Statistics In Information Technology

Credit Hours: 3.00. This course will survey the field of applied statistics in information technology. Students will gain hands-on experience running statistical analyses on samples from a variety of populations. Students will learn the process of data cleaning, data transforming/coding, identifying the appropriate statistical analyses (descriptive and inferential), as well as writing and interpreting the results. Specifically, this course will survey the following statistical approaches: correlations, t-test, analysis of variance, analysis of co-variance, factorial ANOVA, simple regression, multiple regression, logistic regression, chi-square analysis, factor analysis, and nonparametric tests. In this course, students will be able to differentiate statistical analyses and identify appropriate statistical analyses depending on the research question and variables of interest. Permission of instructor required.

Learning Outcomes: 1. Analyze data with different statistical procedure using SPSS. 2. Differentiate between different types of statistical analyses. 3. Evaluate the statistical procedures and results in published journal articles. Credits: 3.00

Foundation Courses (3-15 credits)

CNIT 55000 - Organizational Impact Of Information Technology

Credit Hours: 3.00. An enterprise view of the organizational impact of information technology as the most effective means for achieving "better, faster, cheaper operations" in today's highly competitive business environment. Examines how information technology has enabled new organizational forms and changes in business processes, products, markets, delivery systems, ways of working, and people management issues and challenges. Permission of instructor required.

Learning Outcomes: 1. Articulate methods and algorithms in network security. 2. Evaluate the strengths and weaknesses of different networking security approaches. 3. Describe how to deploy encryption techniques to secure data at rest and in transit. 4. Compare, contrast and critique existing applied research in network security. 5. Propose new ideas/technologies in

network security and systematically assess your proposed work. Credits: 3.00

CNIT 55100 - Information Technology Economics

Credit Hours: 3.00. Examines the economics of information systems and information technology as it relates to business performance. Topics include strategic information technology planning, alignment with business planning, value assessment, and performance measurement. Special emphasis is placed on issues relevant to strategic information technology infrastructure management, both for the information technology unit as well as the business as a whole. Permission of instructor required.

Credits: 3.00

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

CNIT 55300 - Quality Management In Information Technology

Credit Hours: 3.00. This course explores quality and productivity models used to ensure quality in information technology systems development processes. Special emphasis is on learning and understanding process metrics and measurement, as well as initiatives such as Total Quality Management, Continuous Process Improvement, Six Sigma, and the Software Engineering Institute Capability Maturity Model. Permission of instructor required.

Learning Outcomes: 1. Use and apply information technology solutions. 2. Understand and apply high-level tools and emerging technologies. 3. Demonstrate independent critical thinking and problem solving skills. 4. Understand and apply information technology application methodologies. 5. Communicate effectively with customers, supervisors and peers, both orally and in writing. 6. Understand the expectations of an information technology professional. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science. Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CS 50100 - Computing For Science And Engineering

Credit Hours: 3.00. Credit in this course may not be used toward a graduate degree in Computer Sciences. Computational concepts, tools, and skills for computational

science and engineering scripting for numerical computing, scripting for file processing, high performance computing, and software development. Project may be required.

Learning Outcomes: 1. To prepare graduate students outside Computer Science to write computer programs in support of their studies and research. Credits: 3.00

Electives (6-18 credits)

Thesis Research (6-8 credits)

CNIT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 18.00

Additional Requirements

Required Courses (6 credits)

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5.

Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

CNIT 60100 - Applied Statistics In Information Technology

Credit Hours: 3.00. This course will survey the field of applied statistics in information technology. Students will gain hands-on experience running statistical analyses on samples from a variety of populations. Students will learn the process of data cleaning, data transforming/coding, identifying the appropriate statistical analyses (descriptive and inferential), as well as writing and interpreting the results. Specifically, this course will survey the following statistical approaches: correlations, t-test, analysis of variance, analysis of co-variance, factorial ANOVA, simple regression, multiple regression, logistic regression, chi-square analysis, factor analysis, and nonparametric tests. In this course, students will be able to differentiate statistical analyses and identify appropriate statistical analyses depending on the research question and variables of interest. Permission of instructor required.

Learning Outcomes: 1. Analyze data with different statistical procedure using SPSS. 2. Differentiate between different types of statistical analyses. 3. Evaluate the statistical procedures and results in published journal articles. Credits: 3.00

Program Requirements - Non-Thesis/Directed Project

Required Courses (6 credits)

Foundation Courses (3-15 credits)

Electives (6-21 credits)

Additional Requirements

Required Courses (6 credits)

Program Requirements - Non-thesis & No Directed Project

Required Courses (3 credits)

Foundation Courses (9 credits)

Electives (24 credits)

Additional Requirements

Required Courses (3 credits)

Concentrations

GPA Requirements

About the Program

Computer and Information Technology, MS (OL)

About the Program

Program Requirements

Required Courses (12 credits)

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.

Credits: 3.00

CNIT 53600 - IT Policy, Law, And Ethics

Credit Hours: 3.00. This course examines the policy, legal, and ethical aspects of information technology. Issues covered include ethical decision making, policy development, professionalism, privacy, freedom of expression, intellectual property, liability, and social responsibility. Included will be the philosophical ethical theories that underpin ethical decision making in the context of executing IT based projects.

Learning Outcomes: 1. Research and assess current related legislation affecting IT and IT based projects (SOX, HIPAA, etc.). 2. Research and assess the importance of Intellectual Property and Copyrights. 3. Research and analyze the key components of process improvement and product quality as related to ethical software development. 4. Research and assess the importance of employee and organizational liability. 5. Discuss the pros and cons in intelligent discourse concerning ethics and acting ethically for both individuals and organizations. 6. Discuss, in intelligent discourse, personal and societal impact of information privacy issues.

Credits: 3.00

CNIT 53700 - Professional Research And Communication

Credit Hours: 1.00. This course explores aspects of research and communications that pertains to technology-based projects and professions as well as informed changes in business process. Specifically, the methods involved in objective driven research within and across technology and business domains, as well as the use of rationale for a concisely written summary of research methods and findings for a working professional.

Learning Outcomes: 1. Explore and discuss in intelligent discourse, the rationale and challenges in contemporary research and communications. 2. Develop, describe, and utilize a research/assessment methodology and understand the techniques used in technical

based industrial research and communications. 3. Apply concepts and techniques common to current employer's practices with emphasis on concise technical writing and formatting.
Credits: 1.00

Concentration (22 credits)

Required Courses (12 credits)

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.
Credits: 3.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.
Credits: 3.00

CNIT 53600 - IT Policy, Law, And Ethics

Credit Hours: 3.00. This course examines the policy, legal, and ethical aspects of information technology. Issues covered include ethical decision making, policy development, professionalism, privacy, freedom of expression, intellectual property, liability, and social responsibility. Included will be the philosophical ethical theories that underpin ethical decision making in the context of executing IT based projects.
Learning Outcomes: 1. Research and assess current related legislation affecting IT and IT based projects (SOX, HIPAA, etc.). 2. Research and assess the importance of Intellectual Property and Copyrights. 3. Research and analyze the key components of process improvement and product quality as related to ethical software development. 4. Research and assess the importance of employee and organizational liability. 5. Discuss the pros and cons in intelligent discourse concerning ethics and acting ethically for both individuals and organizations. 6. Discuss, in intelligent discourse, personal and societal impact of information privacy issues.
Credits: 3.00

CNIT 53700 - Professional Research And Communication

Credit Hours: 1.00. This course explores aspects of research and communications that pertains to technology-based projects and professions as well as informed changes in business process. Specifically, the methods involved in objective driven research within and across technology and business domains, as well as the use of rationale for a concisely written summary of research methods and findings for a working professional.
Learning Outcomes: 1. Explore and discuss in intelligent discourse, the rationale and challenges in contemporary research and communications. 2. Develop, describe, and utilize a research/assessment methodology and understand the techniques used in technical based industrial research and communications. 3. Apply concepts and techniques common to current employer's practices with emphasis on concise technical writing and formatting.
Credits: 1.00

Concentrations

Program Learning Outcomes

GPA Requirements

About the Program

Computer Graphics Technology, MS

About the Program

Program Requirements

Required Courses (9 credits)

CGT 50100 - Seminar In Computer Graphics Technology

Credit Hours: 0.00 to 3.00. A variable topics course that addresses contemporary problems and issues related to M.S. students in Computer Graphics Technology. Permission of instructor required.

Learning Outcomes: 1. Understand the transition from undergraduate to graduate study (course approaches, studying, research, assistantship responsibilities). 2. Understand and apply ethics in research and writing. 3. Understand the grant process and agencies that offer grants. 4. Understand the publishing process relative to articles and proceedings. 5. Understand the various publishing formats and methods of citations (APA, Chicago, and MLA versus organizational approaches). 6. Understand the IRB process and method of research approval. 7. Develop a plan of study. 8. Establish a graduate committee. 9. Understand the process for obtaining the MS. 10. Accept grand challenges in Computer Graphics Technology. Credits: 0.00 to 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

Concentration (9 credits)

Information Visualization

CGT 51100 - The Development Of Graphics In Technology

Credit Hours: 3.00. An introduction to the historical development of visual science in western civilization and its effect on computer graphics techniques and practices. Topics include the historical, contemporary, and future developments in computer graphics. Emphasizes the study of visual science and the significance of computer graphics as a communications medium.

Learning Outcomes: 1. Apply the principles attained from course material. Lectures, readings and discussions will be structured around developments and shifts in the selected computer graphics topics. 2. Provide an understanding in research methodologies that are related to different areas in computer graphics. 3. Understand key concepts and techniques of computer graphics. 4. Design and conduct academic research in computer graphics. Credits: 3.00

CGT 58100 - Workshop In Computer Graphics Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 8.00

CGT 61000 - Visual Intelligence And Perception

Credit Hours: 3.00. This course focuses on the fundamentals of perception and cognition relative to vision and its implications to the field of computer graphics technology and the creation of graphics. Students will examine the foundations of human perception of form, shape, color, and motion, developing an understanding of why and how humans perceive visual information. Permission of instructor required.

Learning Outcomes: 1. Discover the history of investigations into visual perception. 2. Understand how the human vision system constructs an understanding of the 3D world. 3. Know the visual rules that govern the interpretation of form, shape, color and motion. 4. Understand the clinical aspects relative to vision and perception. 5. Learn to apply visual rules in the planning, creation and evaluation of all graphics. Credits: 3.00

CGT 67000 - Applications In Visual Analytics

Credit Hours: 3.00. Visual Analytics (VA) provides a fast way for people to make sense of large number of data, and has applications in many sectors. This course will introduce Visual Analytics through foundational theories and a broad range of techniques and tools, focusing on using visualization methods to reason and solve complex problems in a wide variety of applications. Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces that synthesize human and computational ability to attack large complex problems. It is concerned with analytical reasoning, interaction, data transformations, data visualization, analytic reporting, and technology transition. While the different visual analytics applications share common theories and strategies, each of them has its unique data composition, visual representations, and analytical needs and strategies. Through survey and study a broad range of visual analytics applications, students will be able to apply visual analytics on their own applications, analyze and break down a complex analytical problem into proper components and steps, evaluate different visual analytic techniques and strategies, and finally design and develop an effective visual analytics solution toward the problem.

Learning Outcomes: 1. Describe the purposes, foundational theories, research components, and process of visual analytics. 2. Select proper visualization forms from visual analytics tools to answer specific reasoning questions. 3. Apply information visualization and visual analytics approaches to analyze complex problems from data processing, transformation, to visualization, and analysis. 4. Compare, analyze and assess different visual analytics approaches from various aspects such as effectiveness, efficiency, scalability, learnability, and user experience. 5. Develop a visual analytics solution and evaluate its efficacy in solving a complex domain problem. Credits: 3.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for

creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

Other Areas

Related Area Courses (12 credits)

Thesis Research or Non-thesis Capstone (6 credits)

CGT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 18.00

CGT 59700 - Directed MS Capstone

Credit Hours: 3.00 to 6.00. An original investigation of a particular problem under the guidance of the instructor(s). The resulting product is a substantial project report with an evaluation or research component. Not applicable to a thesis option plan of study. Enrollment for a total of six credits is required. Permission of department required.

Learning Outcomes: 1. Independently identify a problem or opportunity and conduct a substantial project relevant to the student's focus area. 2. Iteratively evaluate project outcomes using appropriate research methods. 3. Communicate project process, outcomes, and relevant forms of evaluation through written and oral outputs. Credits: 3.00 to 6.00

Required Courses (9 credits)

CGT 50100 - Seminar In Computer Graphics Technology

Credit Hours: 0.00 to 3.00. A variable topics course that addresses contemporary problems and issues related to M.S. students in Computer Graphics Technology. Permission of instructor required.

Learning Outcomes: 1. Understand the transition from undergraduate to graduate study (course approaches, studying, research, assistantship responsibilities). 2. Understand and apply ethics in research and writing. 3. Understand the grant process and agencies that offer grants. 4. Understand the publishing process relative to articles and proceedings. 5. Understand the various publishing formats and methods of citations (APA, Chicago, and MLA versus organizational approaches). 6. Understand the IRB process and method of research approval. 7. Develop a plan of study. 8. Establish a graduate committee. 9. Understand the process for obtaining the MS. 10. Accept grand challenges in Computer Graphics Technology. Credits: 0.00 to 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or

engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

Concentrations

GPA Requirements

About the Program

Computer Science, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (21 credits)

Core Courses (9 credits)

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 63800 - Multimedia Networking And Operating Systems

Credit Hours: 3.00. For graduate students in computer sciences who have a background in networking and operating systems and are interested in research in networked multimedia systems. The course consists of a selection of networking and operating system topics for realizing high performance, predictable, scalable, flexible, and secure multimedia systems. Topics may vary to reflect timely research issues and the current interests of the instructor(s). Students are expected to complete a term project. Presentations also may be required. Undergraduate background in computer science required. Prerequisite: CS 53600 or CS 50300 .

Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation,

abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

CS 58800 - Randomized Algorithms

Credit Hours: 3.00. The area of randomized algorithms has grown from being a tool in computational number theory to finding widespread application in algorithms in all areas of computer science. Two practical benefits of randomization are its simplicity and speed. Deep and important computational complexity connections have been developed, from bridging the gap between discrete and continuous optimization, bypassing deterministic barriers in online settings, summarizing massive data in polylogarithmic space, probabilistically checkable proofs, privacy enhancing techniques, modeling the web and other large networks, and sparsifying and compressing complicated combinatorial structures such as graphs. Randomization is an essential key ingredient in the algorithmic breakthroughs today and in the future. This course presents the basic concepts in the design and analysis of randomized algorithms and shows how to apply them to algorithms for a wide range of problems. The course covers a broad range of problems benefitting from randomized computation including data structures, graph algorithms, online algorithms, geometric algorithms, streaming algorithms, derandomization techniques, and tools for probabilistic analysis of algorithms.

Learning Outcomes: 1. Describe the main principles underlying the design and analysis of a randomized algorithm. 2. Explain concepts of randomized algorithms used in specific domains; e.g., graph-theory, number theory, and linear algebra problems. 3. Apply measure concentration results from probability theory to analyze a given randomized algorithm. 4. Determine the running times, failure probabilities, and accuracy guarantees of a randomized algorithm. 5. Apply learned design techniques and analysis tools to design and analyze new randomized algorithms. 6. Explain material from published research in the area of randomized algorithms using field-specific language. Credits: 3.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage, communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3. Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

Selectives (12 credits)

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election,

group communication, and replication. Permission of department required.

Credits: 3.00

CS 51000 - Software Engineering

Credit Hours: 3.00. Software life cycles, requirements engineering, software design, design of distributed systems, verification and validation, software architecture, process metrics and models, and research methods in software engineering.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6.

Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 53100 - Computational Geometry

Credit Hours: 3.00. Computational geometry studies how to compute with and reason about geometric objects. The subject is playing an increasingly important role in computer graphics, game software, geometric modeling, geographic information systems, and many other applications. Course topics include convex hull, segment manipulations, triangulations, range searching, Voronoi diagrams, window queries, Delaunay triangulation, and duality. Some key algorithms are implemented. Questions of floating-point accuracy and robust algorithm design are considered throughout the course.

Credits: 3.00

CS 53500 - Interactive Computer Graphics

Credit Hours: 3.00. The principles of computer graphics and interactive graphical methods for problem solving. Emphasis placed on both development and use of graphical tools for various display devices. Several classes of graphics hardware considered in detail. Topics include pen plotting, storage tubes, refresh, dynamic techniques, three dimensions, color, modeling of geometry, and hidden surface removal. Part of the laboratory involves use of an interactive minicomputer graphics system. Knowledge of programming required.

Learning Outcomes: 1. Learn the algorithms underlying the interactive graphics pipeline, including algorithms for geometric modeling, projection, rasterization, shading, lighting, texture mapping, projective texture mapping, shadow mapping, and environment mapping. 2. Gain experience implementing the interactive graphics pipeline through projects. 3. Gain initial experience programming Graphics Processing units through shaders. 4. Learn and implement algorithms for advanced rendering techniques. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 54300 - Introduction To Simulation And Modeling Of Computer Systems

Credit Hours: 3.00. Simulation: discrete event simulation, process oriented simulation, generating random numbers, simulation languages, simulation examples of complex systems. Nondeterministic models: random variables, Poisson process, moment generating functions, statistical inference and data analysis. Modeling: elementary queuing models, networks of queues, applications to performance evaluation of computer systems.

Credits: 3.00

CS 54701 - Information Retrieval

Credit Hours: 3.00. Basic principles and practical algorithms used for information retrieval and text mining: statistical characteristics of text, several important retrieval models, text categorization, recommendation system, clustering, federated text search, link analysis, etc.

Learning Outcomes: 1. Learn the theories and techniques behind Web search engines, E-commerce recommendation systems, etc. 2. Get hands on project experience by developing real-world applications, such as intelligent tools for improving search accuracy from user feedback, email spam detection, recommendation system, or scientific literature

organization and mining. 3. Learn tools and techniques to do cutting-edge research in the area of information retrieval or text mining. Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

CS 57900 - Bioinformatics Algorithms

Credit Hours: 3.00. Review of Genomes, DNA, RNA, proteins, proteomes. Biological Sequences: dynamic programming; pairwise global, local, and semi-global alignments of genes and proteins; constant, affine, and general gap penalties; RNA alignments; BLOSUM and PAM scoring matrices. Multiple alignment of proteins: approximation algorithms; iterative and progressive alignment methods. Database search for sequences: BLAST and variants. Phylogenetic Trees: distance-based methods, ultrametric and additive distance functions; parsimony, and maximum likelihood methods. Whole Genome Alignment: suffix trees and suffix arrays. Systems Biology: Module discovery in biological networks, spectral algorithms for graph clustering. Network alignment: quadratic programming formulations and graph matching. Genetic Variation: haplotype inference, the perfect phylogeny problem and chordal graphs. Additional topics such as next-generation sequencing, analysis of multidimensional data from flow cytometry, and gene expression data, if time permits.

Learning Outcomes: 1. Students will learn how to design algorithms. 2. Students will learn how to solve computational problems from the new biology, the data-rich field that biological sciences is becoming. Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 64100 - Multimedia Database Systems

Credit Hours: 3.00. Prepares students for research in multimedia database systems. Students are exposed to a variety of emerging innovative techniques to store, manipulate,

communicate, visualize, and reason with multimedia systems. Prerequisite: CS 54100 or CS 54200 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field.

Credits: 3.00

CS 57100 - Artificial Intelligence

Credit Hours: 3.00. Artificial Intelligence (AI) systems are increasingly being deployed in many real-world tasks. This course provides an introduction to the fundamental principles and applications of AI. The course covers classic material including search-based methods, probabilistic reasoning, game playing, decision making, exact and approximate inference, causal learning, and reinforcement learning as well as selected advanced topics. The focus of the course is on foundational methods and current techniques for building AI systems that exhibit 'intelligent' behavior and can 'learn' from experience. The course assumes students are familiar with basic concepts in analysis, linear algebra, optimization, discrete mathematics, elementary probability, statistics, data structures, and algorithms. Students are expected to have good programming and software development skills and have a working knowledge of Python and Java.

Learning Outcomes: 1. Assess and explain the applicability, strengths, and weaknesses of the basic knowledge representation, problem-solving, and learning methods in solving a particular problem. (E,W) 2. Predict the behavior and estimate the cost (in time and space) of different heuristic and optimal search methods, and choose the appropriate method for particular problems. (W,P) 3. Develop small logic-based, rule-based, and search-based systems; be able to predict performance characteristics. (P) 4. Predict the behavior of basic machine-learning methods, and choose the appropriate method for particular problems. (W,P) 5. Communicate critical key issues in AI-related to knowledge representation, problem-solving, and learning for a specific problem. (W) 6. Propose, evaluate, and implement effective solutions to problems requiring AI techniques. (P) 7. Articulate key problems, both technical and philosophical, in the development of artificial intelligence systems. (E,W) Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning

methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Core Courses (9 credits)

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 63800 - Multimedia Networking And Operating Systems

Credit Hours: 3.00. For graduate students in computer sciences who have a background in networking and operating systems and are interested in research in networked multimedia systems. The course consists of a selection of networking and operating system topics for realizing high performance, predictable, scalable, flexible, and secure multimedia systems. Topics may vary to reflect timely research issues and the current interests of the instructor(s). Students are expected to complete a term project. Presentations also may be required.

Undergraduate background in computer science required. Prerequisite: CS 53600 or CS 50300 .

Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

CS 58800 - Randomized Algorithms

Credit Hours: 3.00. The area of randomized algorithms has grown from being a tool in computational number theory to finding widespread application in algorithms in all areas of computer science. Two practical benefits of randomization are its simplicity and speed. Deep and important computational complexity connections have been developed, from bridging the gap between discrete and continuous optimization, bypassing deterministic barriers in online settings, summarizing massive data in polylogarithmic space, probabilistically checkable proofs, privacy enhancing techniques, modeling the web and other large networks, and sparsifying and compressing complicated combinatorial structures such as graphs. Randomization is an essential key ingredient in the algorithmic breakthroughs today and in the future. This course presents the basic concepts in the design and analysis of randomized algorithms and shows how to apply them to algorithms for a wide range of problems. The course covers a broad range of problems benefitting from randomized computation including data structures, graph algorithms, online algorithms, geometric algorithms, streaming algorithms, derandomization techniques, and tools for probabilistic analysis of algorithms.

Learning Outcomes: 1. Describe the main principles underlying the design and analysis of a randomized algorithm. 2. Explain concepts of randomized algorithms used in specific domains; e.g., graph-theory, number theory, and linear algebra problems. 3. Apply measure concentration results from probability theory to analyze a given randomized algorithm. 4. Determine the running times, failure probabilities, and accuracy guarantees of a randomized algorithm. 5. Apply learned design techniques and analysis tools to design and analyze new randomized algorithms. 6. Explain material from published research in the area of randomized algorithms using field-specific language. Credits: 3.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage,

communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3. Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

Electives (3-9 credits)

CS Courses

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election, group communication, and replication. Permission of department required.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform

the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 59100 - Seminar

Credit Hours: 1.00. A weekly seminar presented by faculty and invited speakers, normally in a specific area.

Credits: 1.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

CS 63500 - Capturing And Rendering Real-World Scenes

Credit Hours: 3.00. Advanced techniques for automated modeling and visualization of complex environments, such as rooms, buildings, urban scenes, and landscapes. Topics covered are at the confluence of computer graphics, computer vision and engineering, and include: capture technologies, acquisition device calibration, view registration, panoramic images, 3D reconstruction from images, view morphing, 3D image warping, lightfield modeling and rendering, visual hulls, point-based modeling and rendering, view dependent texture mapping, and application development issues and examples. Prerequisite: CS 58000 , CS 53500 or a solid foundation in computer graphics, programming proficiency in C or C++ and basic linear algebra.

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2.

Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 59200 - Computer Science Seminar

Credit Hours: 3.00. A seminar course for in-depth exploration of a specific topic. Topics vary. Classes consist of both instructor and student presentations. Students read, present and discuss research papers, and may complete and present a research project in the area. For each offering, inclusion on a plan of study is determined by the CS Graduate Study Committee. If approved, may be included on a CS MS or PhD plan of study according to relevant ruleset.

Learning Outcomes: 1. Vary due to nature of

course. Credits: 3.00

CS 58500 - Theoretical Computer Science Toolkit

Credit Hours: 3.00. This course covers fundamental techniques and a range of mathematical tools that underlie today's research in theoretical computer science. The course material is essential for research in theoretical computer science as well as machine learning theory. The course is targeted at students who plan to pursue research in these areas. Topics will be chosen from four core areas: Convex Analysis and Optimization, Spectral Methods, Concentration Inequalities, and Discrete Fourier Analysis. Depending on student and instructor interest, additional topics will be chosen and may include applied analysis, coding theory, probabilistic proofs, and more advanced topics in discrete Fourier analysis. Students will read papers in theoretical computer science and machine learning theory using, exploring and extending the covered techniques and tools. Students are expected to be proficient in probability theory, have the maturity to follow and carry out basic analysis proofs, and have completed courses in calculus, linear algebra, discrete mathematics, and analysis of algorithms. More specifically, the course expects mastery of the material covered in Calculus III, Linear Algebra, Probability, Foundations of CS, and Analysis of Algorithms.

Learning Outcomes: 1. Explain and justify the merits and limitations of convex optimization algorithms. 2. Describe the characteristics and the role of convexity in optimization. 3. Formulate mathematically problems that have solutions based on convex optimization or matric analysis tools and analyze them effectively. 4. Predict typicality of the outcome in experiments. 5. Explain how to use and apply concentration bounds, including Chernoff-Hoeffding Bound, Martingales and Azuma's Inequality, and applications of the Talagrand inequality. 6. Develop precise mathematical formulation of problems and analyze using frameworks related to concentration of measure. 7. Apply Discrete Fourier Transform to determine properties of functions. 8. Explain why Fourier Analysis of Boolean Functions is a major tool in theoretical CS and describe application scenarios including property testing, cryptography, complexity, learning theory, pseudorandomness, hardness of approximation, and random graph theory. 9. Identify properties of functions based on the properties of their spectrum. 10. Explain the basic ideas underlying the tradeoff between the amount of redundancy used and the number of errors that can be corrected by a code. 11. Describe achieving the optimal tradeoff between redundancy and error correction for codes that come equipped with efficient encoding and decoding. 12. Illustrate how and why concatenated codes support the construction of asymptotically good codes. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

CS 55800 - Introduction To Robot Learning

Credit Hours: 3.00. Introduction To Robot Learning

Learning Outcomes: 1. Formulate the robot motion planning and control problems and solve them using standard tools. (W, P, E) 2. Identify the robot constraints, define their degree of freedom, and formulate their dynamical models for control. (W, P, E) 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. (W, P, E) 4. Identify limitations in existing classical robot algorithms and understand how to avoid the musing Machine Learning. (W, P) 5. Understand and apply Deep Reinforcement Learning approaches to complex robot systems. (W, P, E) 6. Evaluate and assess current best practices and mechanisms for robot programming. (W, P) 7. Develop a skill for robot programming from perception to low-level control using state-of-the art methods. (W, P) Credits: 3.00

CS 58700 - Foundations Of Deep Learning

Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning.

Learning Outcomes: 1. Understand statistical Foundations of Deep Learning. 2. Understand feedforward Networks. 3. Understand stochastic optimization of neural network models. 4. Understand Bayesian Neural Networks. 5. Understand invariant & Equivariant Representation Learning. 6. Understand task-invariant representations. 7. Understand meta Learning. 8. Understand multi-task Learning. 9. Understand transfer Learning. 10. Understand implicit generative models (probabilistic models without explicit likelihoods). 11. Understand variational Auto-Encoders. 12. Understand generative Adversarial Networks. 13. Understand stable Diffusion Generative models. 14. Understand how to evaluate the

performance of neural networks, as well as formulate and test hypotheses. 15. Understand how theory and algorithmic elements interact to impact performance. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Non-CS Courses

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of current interest.

Credits: 1.00 to 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

MA 52000 - Boundary Value Problems Of Differential Equations

Credit Hours: 3.00. Separation of variables; Fourier series; boundary value problems; Fourier transforms; Bessel functions; Legendre polynomials.

Credits: 3.00

MA 52300 - Introduction To Partial Differential Equations

Credit Hours: 3.00. First order quasi-linear equations and their applications to physical and social sciences; the Cauchy-Kovalevsky theorem; characteristics, classification and canonical forms of linear equations; equations of mathematical physics; study of Laplace, wave and heat equations; methods of solution.

Credits: 3.00

MA 52500 - Introduction To Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; applications. Not open to students with credit in MA 42500.

Credits: 3.00

MA 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (STAT 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

MA 58500 - Mathematical Logic I

Credit Hours: 3.00. Propositional and predicate calculus; the Gdel completeness and compactness theorem, primitive recursive and recursive functions; the Gdel incompleteness theorem; Tarski's theorem; Church's theorem; recursive undecidability; special topics such as nonstandard analysis.

Credits: 3.00

MA 59800 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

MA 61100 - Methods Of Applied Mathematics I

Credit Hours: 3.00. Banach and Hilbert spaces; linear operators; spectral theory of compact linear operators; applications to linear integral equations and to regular Sturm-Liouville problems for ordinary differential equations. Prerequisite: MA 51100, MA 54400.

Credits: 3.00

MA 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (CS 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicholson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: MA 51400, MA 52300.

Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid

conclusions, and presenting the results concisely. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

STAT 52900 - Applied Decision Theory And Bayesian Statistics

Credit Hours: 3.00. Bayesian and decision-theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; Bayesian design and sequential analysis; comparisons of statistical paradigms.

Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

ECE 54700 - Introduction To Computer Communication Networks

Credit Hours: 3.00. A qualitative and quantitative study of the issues in design, analysis, and operation of computer communication and telecommunication networks as they evolve toward the integrated networks of the future, employing both packet and circuit switching technology. The course covers packet and circuit switching, the OSI standards architecture and protocols, elementary queuing theory for performance evaluation, random access techniques, local area networks, reliability and error recovery, and integrated networks.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental principles underlying computer communication networks. [1,3,4;a,e] 2. Demonstrate an ability to obtain mathematical models of networking systems. [1,2,4;a,e] 3. Demonstrate an ability to perform queueing analysis of simpler queueing networks, convergence analysis of routing protocols, and stability analysis of random access mechanisms. [1,2,4;a,e,k] 4. Demonstrate an ability to solve simple network design and optimization problems to meet specifications in though put and delay. [1,4;a,c,e,k] 5. Demonstrate an ability to use simulation tools for network analysis and design. [1,3,4;a,c,e,k] Credits: 3.00

ECE 56300 - Programming Parallel Machines

Credit Hours: 3.00. This course presents methods and techniques for programming parallel computers, such as multicore and high-end parallel architectures. Various parallel algorithms will be presented to demonstrate different techniques for identifying parallel tasks and mapping them onto parallel machines. Realistic science/engineering applications and their characteristics will be discussed. Parallel architectures to be considered are shared-memory and distributed-memory multiprocessor systems. Programming paradigms for these machines will be compared, including directive-based (OpenMP), message passing (MPI) and thread-based (Posix threads) methods. Methodologies for analyzing and improving the performance of parallel programs will be discussed. There will be a class project in which each student parallelizes and tunes the performance of a large computation application or develops/improves a tool that helps this process. Each student will prepare one lecture for a selected topic. Offered during odd years.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in

designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 62900 - Introduction To Neural Networks

Credit Hours: 3.00. Information processing with neural networks, biological and engineering implications, learning algorithms, current neural network models and architectures, implementational topics, applications in areas such as signal/image processing, pattern recognition, optimization, simulation, system identification, nonlinear prediction, communications, and control. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECE 67300 - Distributed Computing Systems

Credit Hours: 3.00. Discussions of the design issues of distributed computing systems (DCS). The general theory of distributed transaction management, reliability, and resource management is discussed. Various algorithms and specification methodologies for DCS are introduced. A general coverage of the three major areas of DCS, namely: distributed operating systems, distributed databases, and distributed AI is provided. The discussion is augmented with various case studies. Prerequisite: ECE 46900 or introductory course in operating systems.

Credits: 3.00

IE 53500 - Linear Programming

Credit Hours: 3.00. Optimization of linear objective functions subject to linear constraints. Development of theory and algorithmic strategies for solving linear programming problems.

Credits: 3.00

IE 53800 - Nonlinear Optimization Algorithms And Models

Credit Hours: 3.00. Survey of computational tools for solving constrained and unconstrained nonlinear optimization problems. Emphasis on algorithmic strategies and characteristic structures of nonlinear problems.

Credits: 3.00

IE 58000 - Systems Simulation

Credit Hours: 3.00. Philosophy and elements of digital simulation language. Practical application of simulation to diverse systems. Computer simulation exercises and applications are required.

Credits: 3.00

IE 63500 - Theoretical Foundations Of Optimization

Credit Hours: 3.00. An advanced course in theoretical foundations of mathematical programming. Convex analysis, global and local duality and optimality, general algorithmic convergence. Offered in alternate years. Prerequisite: IE 53500 .

Credits: 3.00

IE 67400 - Cyber Methods For Advanced Production Control

Credit Hours: 3.00. The study of the theoretical foundation and relevance of advanced cyber methods in the planning and control of intelligent production operations; manufacturing operating systems; synchronization in decentralized systems; recovery in decentralized systems; parallel processing; distributed databases; factory networks; reasoning and logic for production control. Prerequisite: IE 57400 or 57500 or 57900.

Learning Outcomes: 1. Know theoretical foundation and relevance of advanced cyber, real-time control, computing, communication, and brain models for robotics. 2. Know automation of planning and decisions in distributed production and supply installations, global supply, logistics, and service systems/networks. 3. Know the current and emerging functions, algorithms, protocols, and models and how to apply them to research projects and presentations in the field. Credits: 3.00

LING 59300 - Special Topics In Semantics

Credit Hours: 3.00. Investigation of an advanced topic in semantics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

STAT 54600 - Computational Statistics

Credit Hours: 3.00. The course focuses on two fundamental aspects in computational statistics: (1) what to compute and (2) how to compute. The first is covered with a brief review of advanced topics in statistical inference, including Fisher's fiducial inference, Bayesian and frequenstist methods, and the Dempster-Shafer (DS) Theory. The second is discussed in detail by examining exact, approximation, and interactive simulation methods for statistical inference with a variety of commonly used statistical models. The emphasis is on the EM-type and quasi-Newton algorithms, numerical differentiation and integration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Master commonly used numerical matrix operations, including the sweep operator, Cholesky decomposition, eigenvalue decomposition, and single value decomposition. 2. Understand statistical thinking in development of interactive numerical methods. 3. Apply optimization algorithms such as quasi-Newton and conjugate gradient methods. 4. Implement EM-type algorithms for maximum likelihood estimation when expanded complete-data models are available, including commonly used statistical models. 5. Create random number generators. 6. Implement the Gibbs sampler and Metropolis-Hastings algorithms for Bayesian data analysis. Credits: 3.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 51012 - Electromechanics

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of dc, induction, brushless dc, and stepper motors used in control applications are presented. Prerequisite by Topic: Basic circuit analysis; Elementary electromagnetics; Elementary mechanics.

Learning Outcomes: 1. Acquire knowledge of magnetics and magnetic materials as it relates to electromechanical devices. 2. Understand the energy conversion process including field energy, co-energy, force and torque production. 3. Be familiar with the use in reference frame theory in the analysis of rotational electromechanical devices. 4. Understand the operation of rotating electric machines including stepper motors, permanent magnet ac machine, and induction machines. 5. Understand the acceptable and unacceptable practice with regard to taking exams, working on homework, working on the project, and the implications of unacceptable practices. Credits: 3.00

ECE 60872 - Reliable And Secure Computer Systems

Credit Hours: 3.00. The course provides an introduction to the hardware and software methodologies for specifying, modeling and designing fault-tolerant systems supported by case studies of real systems. The material presents a broad spectrum of hardware and software error detection and recovery techniques that can be used to build reliable networked systems. The lectures discuss how the hardware and software techniques interplay, what techniques can be provided in COTS hardware, what can be embedded into operating system and network communication layers, and what can be provided via a distributed software layer and in the application itself. Prerequisite by Topic: Any one high level programming language experience; A basic background in probability.

Learning Outcomes: 1. Formulate design principles for dependable systems. 2. Analyze mathematically a system for its dependability properties. 3. Understand and apply hardware dependability techniques. 4. Understand and apply software dependability techniques. 5. Understand and apply networking dependability techniques. 6. Design, develop, and present an innovative project on dependable systems. Credits: 3.00

MA 57500 - Graph Theory

Credit Hours: 3.00. Introduction to graph theory with applications.

Credits: 3.00

ME 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and recognize the technologies available for each component. 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

CS Courses

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program

quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election, group communication, and replication. Permission of department required.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The

socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 59100 - Seminar

Credit Hours: 1.00. A weekly seminar presented by faculty and invited speakers, normally in a specific area.

Credits: 1.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

CS 63500 - Capturing And Rendering Real-World Scenes

Credit Hours: 3.00. Advanced techniques for automated modeling and visualization of complex environments, such as rooms, buildings, urban scenes, and landscapes. Topics covered are at the confluence of computer graphics, computer vision and engineering, and include: capture technologies, acquisition device calibration, view registration, panoramic images, 3D reconstruction from images, view morphing, 3D image warping, lightfield modeling and rendering, visual hulls, point-based modeling and rendering, view dependent texture mapping, and application development issues and examples. Prerequisite: CS 58000 , CS 53500 or a solid foundation in computer graphics, programming proficiency in C or C++ and basic linear algebra.

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the

role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 59200 - Computer Science Seminar

Credit Hours: 3.00. A seminar course for in-depth exploration of a specific topic. Topics vary. Classes consist of both instructor and student presentations. Students read, present and discuss research papers, and may complete and present a research project in the area. For each offering, inclusion on a plan of study is determined by the CS Graduate Study Committee. If approved, may be included on a CS MS or PhD plan of study according to relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

CS 58500 - Theoretical Computer Science Toolkit

Credit Hours: 3.00. This course covers fundamental techniques and a range of mathematical tools that underlie today's research in theoretical computer science. The course material is essential for research in theoretical computer science as well as machine learning theory. The course is targeted at students who plan to pursue research in these areas. Topics will be chosen from four core areas: Convex Analysis and Optimization, Spectral Methods, Concentration Inequalities, and Discrete Fourier Analysis. Depending on student and instructor interest, additional topics will be chosen and may include applied analysis, coding theory, probabilistic proofs, and more advanced topics in discrete Fourier analysis. Students will read papers in theoretical computer science and machine learning theory using, exploring and extending the covered techniques and tools. Students are expected to be proficient in probability theory, have the maturity to follow and carry out basic analysis proofs, and have completed courses in calculus, linear algebra, discrete mathematics, and analysis of algorithms. More specifically, the course expects mastery of the material covered in Calculus III, Linear Algebra, Probability, Foundations of CS, and Analysis of Algorithms.

Learning Outcomes: 1. Explain and justify the merits and limitations of convex optimization algorithms. 2. Describe the characteristics and the role of convexity in optimization. 3. Formulate mathematically problems that have solutions based on convex optimization or matric analysis tools and analyze them effectively. 4. Predict typicality of the outcome in experiments. 5. Explain how to use and apply concentration bounds, including Chernoff-Hoeffding Bound, Martingales and Azuma's Inequality, and applications of the Talagrand inequality. 6. Develop precise mathematical formulation of problems and analyze using frameworks related to concentration of measure. 7. Apply Discrete Fourier Transform to determine properties of functions. 8. Explain why Fourier Analysis of Boolean Functions is a

major tool in theoretical CS and describe application scenarios including property testing, cryptography, complexity, learning theory, pseudorandomness, hardness of approximation, and random graph theory. 9. Identify properties of functions based on the properties of their spectrum. 10. Explain the basic ideas underlying the tradeoff between the amount of redundancy used and the number of errors that can be corrected by a code. 11. Describe achieving the optimal tradeoff between redundancy and error correction for codes that come equipped with efficient encoding and decoding. 12. Illustrate how and why concatenated codes support the construction of asymptotically good codes. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

CS 55800 - Introduction To Robot Learning

Credit Hours: 3.00. Introduction To Robot Learning

Learning Outcomes: 1. Formulate the robot motion planning and control problems and solve them using standard tools. (W, P, E) 2. Identify the robot constraints, define their degree of freedom, and formulate their dynamical models for control. (W, P, E) 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. (W, P, E) 4. Identify limitations in existing classical robot algorithms and understand how to avoid the musing Machine Learning. (W, P) 5. Understand and apply Deep Reinforcement Learning approaches to complex robot systems. (W, P, E) 6. Evaluate and assess current best practices and mechanisms for robot programming. (W, P) 7. Develop a skill for robot programming from perception to low-level control using state-of-the art methods. (W, P) Credits: 3.00

CS 58700 - Foundations Of Deep Learning

Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory,

and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning.

Learning Outcomes: 1. Understand statistical Foundations of Deep Learning. 2. Understand feedforward Networks. 3. Understand stochastic optimization of neural network models. 4. Understand Bayesian Neural Networks. 5. Understand invariant & Equivariant Representation Learning. 6. Understand task-invariant representations. 7. Understand meta Learning. 8. Understand multi-task Learning. 9. Understand transfer Learning. 10. Understand implicit generative models (probabilistic models without explicit likelihoods). 11. Understand variational Auto-Encoders. 12. Understand generative Adversarial Networks. 13. Understand stable Diffusion Generative models. 14. Understand how to evaluate the performance of neural networks, as well as formulate and test hypotheses. 15. Understand how theory and algorithmic elements interact to impact performance. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Specialization: Information and Cybersecurity (30 credits)

Required Courses (12 credits)

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models;

protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 50010 - Foundational Principles Of Information Security

Credit Hours: 3.00. This course covers foundational principles relevant to information security including data structures, algorithm design, computational complexity, probability theory, number theory, and basics of cryptography. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Professionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Identify and explain the basic data structures. 2. Identify and explain algorithm design techniques. 3. Explain computational complexity and decidability concepts and their relevance to information security. 4. Apply basic probability tools to analyze problems involving uncertainty and randomness. 5. Explain basic concepts of modular arithmetic and their application to cryptography. Credits: 3.00

CS 50011 - Introduction To Systems For Information Security

Credit Hours: 3.00. The course covers computer systems principles relevant to information security and it serves as a prerequisite for the later courses in the MS in IS program. The material includes features in the C/C++ programming languages for understanding security-critical software vulnerabilities, basic knowledge in computer architecture and assembly languages, knowledge of the compiling process, operating systems, networking, databases, and web applications relevant to information security. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Processionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Understand C/C++ code with security-relevant features such as pointers, string operations, function pointers, dynamic memory allocation, etc., laying the foundations for understanding software vulnerabilities in C/C++. 2. Explain common programming errors in C/C++ programs. 3. Explain how C/C++ programs are compiled into assembly and how call stack works in function calls, laying the foundation for understanding stack based buffer overflow. 4. Explain basic concepts in computer architecture, such as instruction set, assembly code, CPU modes, registers, MMU, paging. 5. Explain basic concepts in operating systems, such as processes, system calls, virtual memory, file system structure. 6. Explain basic concepts in networking, databases, and web applications. Credits: 3.00

Selectives (12 credits)

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and

skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as

classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

Electives (6 credits)

Required Courses (12 credits)

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 50010 - Foundational Principles Of Information Security

Credit Hours: 3.00. This course covers foundational principles relevant to information security including data structures, algorithm design, computational complexity, probability theory, number theory, and basics of cryptography. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Professionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Identify and explain the basic data structures. 2. Identify and explain algorithm design techniques. 3. Explain computational complexity and decidability concepts and their relevance to information security. 4. Apply basic probability tools to analyze problems involving uncertainty and randomness. 5. Explain basic concepts of modular arithmetic and their application to cryptography. Credits: 3.00

CS 50011 - Introduction To Systems For Information Security

Credit Hours: 3.00. The course covers computer systems principles relevant to information security and it serves as a prerequisite for the later courses in the MS in IS program. The material includes features in the C/C++ programming languages for understanding security-critical software vulnerabilities, basic knowledge in computer architecture and assembly languages, knowledge of the compiling process, operating systems, networking, databases, and web applications relevant to information security. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Processionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Understand C/C++ code with security-relevant features such as pointers, string operations, function pointers, dynamic memory allocation, etc., laying the foundations for understanding software vulnerabilities in C/C++. 2. Explain common programming errors in C/C++ programs. 3. Explain how C/C++ programs are compiled into assembly and how call stack works in function calls, laying the foundation for understanding stack based buffer overflow. 4. Explain basic concepts in computer architecture, such as instruction set, assembly code, CPU modes, registers, MMU, paging. 5. Explain basic concepts in operating systems, such as processes, system calls, virtual memory, file system structure. 6. Explain basic concepts in networking, databases, and web applications. Credits: 3.00

Thesis Research (6 credits)

CS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. The student is expected to follow safe research practices, to follow ethical research practices, to maintain communication with the instructor, to formulate a set of reasonable semester research progress milestones with instructor, optionally in writing. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (21 credits)

Core Courses (9 credits)

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the

use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 63800 - Multimedia Networking And Operating Systems

Credit Hours: 3.00. For graduate students in computer sciences who have a background in networking and operating systems and are interested in research in networked multimedia systems. The course consists of a selection of networking and operating system topics for realizing high performance, predictable, scalable, flexible, and secure multimedia systems. Topics may vary to reflect timely research issues and the current interests of the instructor(s). Students are expected to complete a term project. Presentations also may be required. Undergraduate background in computer science required. Prerequisite: CS 53600 or CS 50300 .

Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are

expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

CS 58800 - Randomized Algorithms

Credit Hours: 3.00. The area of randomized algorithms has grown from being a tool in computational number theory to finding widespread application in algorithms in all areas of computer science. Two practical benefits of randomization are its simplicity and speed. Deep and important computational complexity connections have been developed, from bridging the gap between discrete and continuous optimization, bypassing deterministic barriers in online settings, summarizing massive data in polylogarithmic space, probabilistically checkable proofs, privacy enhancing techniques, modeling the web and other large networks, and sparsifying and compressing complicated combinatorial structures such as graphs. Randomization is an essential key ingredient in the algorithmic breakthroughs today and in the future. This course presents the basic concepts in the design and analysis of randomized algorithms and shows how to apply them to algorithms for a wide range of problems. The course covers a broad range of problems benefitting from randomized computation including data structures, graph algorithms, online algorithms, geometric algorithms, streaming algorithms, derandomization techniques, and tools for probabilistic analysis of algorithms.

Learning Outcomes: 1. Describe the main principles underlying the design and analysis of a randomized algorithm. 2. Explain concepts of randomized algorithms used in specific domains; e.g., graph-theory, number theory, and linear algebra problems. 3. Apply measure concentration results from probability theory to analyze a given randomized algorithm. 4. Determine the running times, failure probabilities, and accuracy guarantees of a randomized algorithm. 5. Apply learned design techniques and analysis tools to design and analyze new randomized algorithms. 6. Explain material from published research in the area of randomized algorithms using field-specific language. Credits: 3.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage, communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3.

Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

Selectives (12 credits)

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election, group communication, and replication. Permission of department required.

Credits: 3.00

CS 51000 - Software Engineering

Credit Hours: 3.00. Software life cycles, requirements engineering, software design, design of distributed systems, verification and validation, software architecture, process metrics and models, and research methods in software engineering.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and

physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 53100 - Computational Geometry

Credit Hours: 3.00. Computational geometry studies how to compute with and reason about geometric objects. The subject is playing an increasingly important role in computer graphics, game software, geometric modeling, geographic information systems, and many other applications. Course topics include convex hull, segment manipulations, triangulations, range searching, Voronoi diagrams, window queries, Delaunay triangulation, and duality. Some key algorithms are implemented. Questions of floating-point accuracy and robust algorithm design are considered throughout the course.

Credits: 3.00

CS 53500 - Interactive Computer Graphics

Credit Hours: 3.00. The principles of computer graphics and interactive graphical methods for problem solving. Emphasis placed on both development and use of graphical tools for various display devices. Several classes of graphics hardware considered in detail. Topics include pen plotting, storage tubes, refresh, dynamic techniques, three dimensions, color, modeling of geometry, and hidden surface removal. Part of the laboratory involves use of an interactive minicomputer graphics system. Knowledge of programming required.

Learning Outcomes: 1. Learn the algorithms underlying the interactive graphics pipeline, including algorithms for geometric modeling, projection, rasterization, shading, lighting, texture mapping, projective texture mapping, shadow mapping, and environment mapping. 2. Gain experience implementing the interactive graphics pipeline through projects. 3. Gain initial experience programming Graphics Processing units through shaders. 4. Learn and implement algorithms for advanced rendering techniques. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 54300 - Introduction To Simulation And Modeling Of Computer Systems

Credit Hours: 3.00. Simulation: discrete event simulation, process oriented simulation, generating random numbers, simulation languages, simulation examples of complex systems. Nondeterministic models: random variables, Poisson process, moment generating functions, statistical inference and data analysis. Modeling: elementary queuing models, networks of

queues, applications to performance evaluation of computer systems.

Credits: 3.00

CS 54701 - Information Retrieval

Credit Hours: 3.00. Basic principles and practical algorithms used for information retrieval and text mining: statistical characteristics of text, several important retrieval models, text categorization, recommendation system, clustering, federated text search, link analysis, etc.

Learning Outcomes: 1. Learn the theories and techniques behind Web search engines, E-commerce recommendation systems, etc. 2. Get hands on project experience by developing real-world applications, such as intelligent tools for improving search accuracy from user feedback, email spam detection, recommendation system, or scientific literature organization and mining. 3. Learn tools and techniques to do cutting-edge research in the area of information retrieval or text mining. Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics.

Credits: 3.00

CS 57900 - Bioinformatics Algorithms

Credit Hours: 3.00. Review of Genomes, DNA, RNA, proteins, proteomes. Biological Sequences: dynamic programming; pairwise global, local, and semi-global alignments of genes and proteins; constant, affine, and general gap penalties; RNA alignments; BLOSUM and PAM scoring matrices. Multiple alignment of proteins: approximation algorithms; iterative and progressive alignment methods. Database search for sequences: BLAST and variants. Phylogenetic Trees: distance-based methods, ultrametric and additive distance functions; parsimony, and maximum likelihood methods. Whole Genome Alignment: suffix trees and suffix arrays. Systems Biology: Module discovery in biological networks, spectral algorithms for graph clustering. Network alignment: quadratic programming formulations and graph matching. Genetic Variation: haplotype inference, the perfect phylogeny problem and chordal graphs. Additional topics such as next-generation sequencing, analysis of multidimensional data from flow cytometry, and gene expression data, if time permits.

Learning Outcomes: 1. Students will learn how to design algorithms. 2. Students will learn how to solve computational problems from the new biology, the data-rich field that biological sciences is becoming. Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum

principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 64100 - Multimedia Database Systems

Credit Hours: 3.00. Prepares students for research in multimedia database systems. Students are exposed to a variety of emerging innovative techniques to store, manipulate, communicate, visualize, and reason with multimedia systems. Prerequisite: CS 54100 or CS 54200 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques,

and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 57100 - Artificial Intelligence

Credit Hours: 3.00. Artificial Intelligence (AI) systems are increasingly being deployed in many real-world tasks. This course provides an introduction to the fundamental principles and applications of AI. The course covers classic material including search-based methods, probabilistic reasoning, game playing, decision making, exact and approximate inference, causal learning, and reinforcement learning as well as selected advanced topics. The focus of the course is on foundational methods and current techniques for building AI systems that exhibit 'intelligent' behavior and can 'learn' from experience. The course assumes students are familiar with basic concepts in analysis, linear algebra, optimization, discrete mathematics, elementary probability, statistics, data structures, and algorithms. Students are expected to have good programming and software development skills and have a working knowledge of Python and Java.

Learning Outcomes: 1. Assess and explain the applicability, strengths, and weaknesses of the basic knowledge representation, problem-solving, and learning methods in solving a particular problem. (E,W) 2. Predict the behavior and estimate the cost (in time and space) of different heuristic and optimal search methods, and choose the appropriate method for particular problems. (W,P) 3. Develop small logic-based, rule-based, and search-based systems; be able to predict performance characteristics. (P) 4. Predict the behavior of basic machine-learning methods, and choose the appropriate method for particular problems. (W,P) 5. Communicate critical key issues in AI-related to knowledge representation, problem-solving, and learning for a specific problem. (W) 6. Propose, evaluate, and implement effective solutions to problems requiring AI techniques. (P) 7. Articulate key problems, both technical and philosophical, in the development of artificial intelligence systems. (E,W) Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits:

3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Core Courses (9 credits)

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 63800 - Multimedia Networking And Operating Systems

Credit Hours: 3.00. For graduate students in computer sciences who have a background in networking and operating systems and are interested in research in networked multimedia systems. The course consists of a selection of networking and operating system topics for realizing high performance, predictable, scalable, flexible, and secure multimedia systems. Topics may vary to reflect timely research issues and the current interests of the instructor(s). Students are expected to complete a term project. Presentations also may be required. Undergraduate background in computer science required. Prerequisite: CS 53600 or CS 50300 .

Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

CS 58800 - Randomized Algorithms

Credit Hours: 3.00. The area of randomized algorithms has grown from being a tool in computational number theory to finding widespread application in algorithms in all areas of computer science. Two practical benefits of randomization are its simplicity and speed. Deep and important computational complexity connections have been developed, from bridging the gap between discrete and continuous optimization, bypassing deterministic barriers in online settings, summarizing massive data in polylogarithmic space, probabilistically checkable proofs, privacy enhancing techniques, modeling the web and other large networks, and sparsifying and compressing complicated combinatorial structures such as graphs. Randomization is an essential key ingredient in the algorithmic breakthroughs today and in the future. This course presents the basic concepts in the design and analysis of randomized algorithms and shows how to apply them to algorithms for a wide range of problems. The course covers a broad range of problems benefitting from randomized computation including data structures, graph algorithms, online algorithms, geometric algorithms, streaming algorithms, derandomization techniques, and tools for probabilistic analysis of algorithms.

Learning Outcomes: 1. Describe the main principles underlying the design and analysis of

a randomized algorithm. 2. Explain concepts of randomized algorithms used in specific domains; e.g., graph-theory, number theory, and linear algebra problems. 3. Apply measure concentration results from probability theory to analyze a given randomized algorithm. 4. Determine the running times, failure probabilities, and accuracy guarantees of a randomized algorithm. 5. Apply learned design techniques and analysis tools to design and analyze new randomized algorithms. 6. Explain material from published research in the area of randomized algorithms using field-specific language. Credits: 3.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage, communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3. Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

Concentrations

GPA Requirements

About the Program

Construction Management Technology, MSCMT

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (15 credits)

Statistics Course (3 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

Primary Area Selectives (12 credits)

CM 51000 - Topics In Environmentally Sustainable Construction, Design And Development

Credit Hours: 3.00. This course explores environmental sustainability in all its forms, starting with the historical and theoretical basis and continuing through an understanding of sustainable building construction, design, development, and renewable energy strategies/management tools and how these can be applied in practice.

Learning Outcomes: 1. Recognize human population trends and their effects on associated resource demands. 2. Identify and evaluate energy use trends, including status quo, business-as-usual (BAU) and alternative production and delivery approaches. 3. Interpret and analyze regional and global climate trends and implications, including policy alternatives. 4. Illustrate economic and social drivers, including triple bottom line business practices. 5. Discuss trends and management alternatives in land and ocean ecosystems. 6. Examine food and water security issues including production, management, and distribution alternatives. 7. Distinguish behavior psychology including examination of constraints and opportunities for sustainable practices. 8. Compare market and other incentives designed to stimulate best practices for building design and community planning. 9. Demonstrate knowledge of the conceptual history and controversies involving sustainability. 10. Apply current sustainability principles. 11. Debate common sustainability issues from multiple perspectives. 12. Recognize uncertainty envelopes and constraints on predictive knowledge. 13. Apply best practices in sustainability to their specific field of interest. 14. Employ interdisciplinary approaches to sustainability outside of their own field. 15. Recognize the challenges and opportunities of applying science and technology to governance. 16. Formulate messaging skills needed to deliver scientific information to popular audiences. 17. Practice abstract theoretical evaluation of sustainability challenges and solutions. 18. Employ critical reading and writing skills within scientific, policy and popular media. 19. Prepare action research projects to transform sector-specific practices

for sustainability. 20. Construct a broad range of delivery and assessment strategies to support change for sustainability. Credits: 3.00

CM 51100 - Energy Conserving Building Retrofit

Credit Hours: 3.00. This course introduces energy related reconstruction of buildings with an emphasis on light commercial buildings. Retrofit topics include: Basic thermodynamics, Energy conserving technologies, Impact of site characteristics, Indoor air quality, Water conservation measures, Measuring and benchmarking energy performance, Cost/Benefit Analysis, Financing energy improvements, as well as Building operation and management to reduce energy and water use.

Learning Outcomes: 1. Identify and describe opportunities for energy conservation in existing light commercial buildings through energy related reconstruction activities, commissioning, onsite power generation, as well as building operation and management strategies. 2. Apply basic thermodynamics to energy related retrofit strategies. 3. Identify, classify, and describe techniques and technologies that can be utilized in building envelop, building site, or HVAC systems for energy or water conservation. 4. Apply problem solving and decision making for cost vs. benefit analysis of retrofit strategies. 5. Apply basic energy measurement and benchmarking simulation models. 6. Identify the ways indoor air quality is impacted by vent. Credits: 3.00

CM 52000 - Preconstruction Project Management

Credit Hours: 3.00. Management and control of projects from authorization to start of construction. Project success factors, conceptual and parametric estimating, design planning and management constructability review techniques and value engineering methods. Real estate transactions. Land zoning, platting, development and pro forma calculations.

Learning Outcomes: 1. Appreciate the real estate site selection process. 2. Understand the zoning and platting process. 3. Develop an understanding of the real estate transaction process. 4. Compare and contrast project delivery systems. 5. Understand the design process. 6. Identify project success factors. 7. Utilize value engineering and constructability concepts. 8. Understand the role of preconstruction in the project life cycle. 9. Employ early estimating techniques. 10. Analyze projects from a time-value of money perspective. 11. Evaluate the viability of a construction project before authorization. 12. Appreciate roles played by the various participants in the preconstruction process. 13. Ensure adequate risk management measures have been employed. 14. Apply real estate development rules and consider regulatory issues. Credits: 3.00

CM 52500 - Managing Construction Quality And Production

Credit Hours: 3.00. Advanced techniques for assessing the success of construction project management including schedule cost, safety and quality measurements. Impacts of pre planning, human factors, and communication systems on quality and productivity. Statistical methods for analysis of construction operations.

Learning Outcomes: 1. Define construction productivity and quality. 2. Understand the project owner's role, the designer's role, and the construction firm's role in construction, productivity and quality. 3. Demonstrate the ability to manage productivity at the following enterprise levels - company, project, and construction site. 4. Demonstrate the ability to manage construction labor productivity, equipment productivity, and subcontractor productivity. 5. Measure construction labor productivity. 6. Understand the impact that changes have on productivity. 7. Quantify lost productivity. 8. Implement a Total Quality Management (TQM) system. Credits: 3.00

CM 53000 - Construction Operations And Strategic Management

Credit Hours: 3.00. Principles of construction company business management for U.S. companies. Executive-level construction functions including strategic planning, organizational structure, and ownership structure including

succession planning.

Learning Outcomes: 1. Undertake company strategic planning. 2. Prepare a company business plan. 3. Create organizational structure. 4. Develop policies and procedures. 5. Manage change. 6. Manage equipment utilization. 7. Ensure contract profitability. 8. Identify and manage other operational concerns. 9. Develop succession plans. 10. Implement succession plans. Credits: 3.00

CM 53500 - Construction Accounting And Financial Management

Credit Hours: 3.00. Accounting techniques, financial methods, and financial management for construction firm management. Analysis techniques for contemporary construction company accounting and finance practice with an emphasis on cash flow analysis and cash management.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction company. 2. Explain the progress billing terms retainage and front loading and discuss the reasons for and against such practice. 3. Identify the accounts applied and their use when the percentage of completion method of accounting is applied. 4. Explain the difference between underbilling and overbilling, discuss why they occur and their impact on cash flow. 5. Apply the following financial analysis techniques to financial statements: line-item analysis, horizontal analysis, vertical analysis, use-source analysis, ratio analysis, cost-volume-profit analysis, and profit center analysis. 6. Prepare the budgeted income statement and develop rates for overhead and profit mark-up, exercise control over company cost, and prepare a cash plan. 7. Apply time value of money principles to various decision making tools when seeking company and project financing and the acquisition of capital assets. Credits: 3.00

CM 54000 - Law For Construction Managers

Credit Hours: 3.00. A study of the legal system and its impact on the construction process. The focus is on the legal obligations, rights and remedies pertaining to the construction company. Topics include bidding, contracts, and construction changes.

Learning Outcomes: 1. Describe agency relationships, contracts, torts, professional liability, risk management, indemnification, risk sharing and surety bonds. 2. Explain the concept of the design professional as judge. 3. Recognize the procedures for legally terminating a construction contract. 4. Plan the project with a contract law viewpoint. 5. Comply with the legal requirements for competitive bidding. 6. Create as well as to comply with the rights & duties of the construction contract. 7. Demonstrate the ability to apply construction law concepts to subcontracting, changes, payments, performance problems, defects, subsurface problems, time and claims. Credits: 3.00

CM 54500 - Construction Management Training And Development

Credit Hours: 3.00. Identification, training and development of future company leaders. Mentorship as a required, managerial activity, effective delegation of responsibility, and empowerment of subordinates to take initiative.

Learning Outcomes: 1. Interpret the role of the training department in meeting an organization's strategic goals. 2. Analyze the broader organizational context and business environment in order to ensure that training meets business needs and achieves stakeholder support. 3. Use effective investigative and analytical methods to advise and assist clients in identifying needs, at organizational levels, to which training is the most appropriate response. 4. Work with stakeholders to design training events (including formal programs) that are grounded in the principles of learning, are accessible, effective and make timely use of available resources. 5. Incorporate new technology as appropriate into

both training and learning processes, and the effective management of the training and development function. 6. Carry out appropriate monitoring and evaluation of training programs, and coordinate with stakeholders on any necessary changes to training provision and practice. 7. Explore models and research relating to the core competencies and behavioral characteristics of effective trainers. Credits: 3.00

CM 55000 - Risk Management In Construction

Credit Hours: 3.00. Analysis of the depth and breadth of risk in construction. Defining key terms and concepts used in various risk management arenas - legal statutes, precedent and case studies relevant to construction risk management, insurance, and surety bonding. Subjects include: contracts, torts, insurance, surety, safety laws, quality, and risk management models. Analysis of case studies to utilize risk management tools and identify issues and possible approaches. Project risk control including management of foreseeable hazards as well as unforeseen conditions.

Learning Outcomes: 1. Overview of risk fundamentals - and how liability drives outcomes. 2. Understand the relationships between insurance, sureties, contractual risk transfer and risk financing. 3. Understand how safety covers direct employees, other parties, and member of the public. 4. Understand the role of incident investigation, and management of claims of various types. 5. Understand quality and how to deliver acceptable project results. 6. Understand the value of Business Continuity Planning and other Crisis Management methods and tools. 7. Understand the value of corporate compliance programs for satisfaction of regulatory and other legal requirements. 8. Understand standards of care, and their evolutionary nature, compelling "compliance as you go." 9. Ability to critically evaluate existing risk management approaches, and apply risk management models to promote successful project outcomes. Credits: 3.00

CM 55500 - Construction Leadership And Marketing

Credit Hours: 3.00. Analysis of organizational leadership at the executive level. The goals of this course are to introduce and stimulate thought and discussion of leadership theories, characteristics and behaviors of successful leaders, contextual factors affecting leader effectiveness, dynamics of leader-follower relationships, communication, decision-making and contemporary challenges confronting organizational leaders as well as marketing theory, marketing vs. business development, the marketing process, and an introduction to a construction marketing dashboard.

Learning Outcomes: 1. Understand the essential principles of leadership theories and apply the theories in construction management. 2. Comprehend the characteristics and behaviors of successful leaders in the field of construction. 3. Grasp the main contextual factors affecting leader effectiveness. 4. Apply the dynamics of leader-follower relationships in daily operations. 5. Acquire communication, decision-making and other key leadership skills. 6. Recognize the contemporary challenges confronting organizational leaders. 7. Understand the marketing theory, the market process, and marketing vs. business development. 8. Understand and utilize construction marketing dashboard. Credits: 3.00

CM 57000 - Analysis Of Research In Construction

Credit Hours: 4.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of business research procedures including fundamental statistical methods in the solution of a construction industry relevant problem.

Learning Outcomes: 1. Acquire research knowledge and skills required to produce scholarly work for the construction industry. 2. Adapt the scientific research model to solve problems in a construction company. 3. Demonstrate proficiency at library usage, EndNote, and citing references using APA format. 4. Demonstrate related academic writing through individual and group exercises suitable to their individual research. 5. Demonstrate

appropriate samples of academic writing though sample reports on the Purdue College of Technology Epubs. 6. Advance expectations of academic writing. Credits: 4.00

CM 59000 - Special Problems In Building Construction Management Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required

Learning Outcomes: 1. Develop an increased knowledge in select topics related design and/or construction management. Credits: 1.00 to 6.00

CM 52600 - Value Engineering - Functional Analysis Of Systems And Techniques

Credit Hours: 3.00. This course applies value engineering principles and life cycle costs to the built environment with particular focus on the effect of the decisions made in the design, construction, operation and maintenance of the built environment on the quality and cost.

Learning Outcomes: 1. Synthesize and articulate the core principles of life cycle cost and apply engineering economics principles to calculate costs. 2. Synthesize and articulate the core principles of functional analysis of systems and techniques (FAST) methodology. 3. Conduct analysis of systems, articulate client needs and problems, define problem statements, compare design alternatives, and suggest solutions that address the issues in the problem statement. 4. Develop weighting criteria for decision making to meet problem statement and demonstrate advantages of proposed solution in comparison with initial design. Credits: 3.00

CM 51800 - Building Information Modeling And Sustainability

Credit Hours: 3.00. This course explores environmental sustainability in all its forms, starting with the historical and theoretical basis and continuing through an understanding of sustainable building construction, design, development, and renewable energy strategies/management tools. In this course students explore Building Information modeling technology to assess and compare the design impact on the environment.

Learning Outcomes: 1. Explain and apply LEED Principles. 2. Explain and apply Life Cycle Analysis principles. 3. Compare design alternatives. 4. Solve a real construction problem. Credits: 3.00

CM 54700 - Collaborative Project Delivery Models And Practices

Credit Hours: 3.00. A project-focused course covering advanced topics on collaborative project delivery models such as Integrated Project Delivery (IPD), Design-Build (DB), and Partnering. Collaborative project delivery methodologies aim to integrate project teams, stakeholders, systems, business structures, and practices to facilitate collaboration at all levels within a project and to produce the most optimal project outcomes. Students will develop and expand their interdisciplinary collaborative team working skills, communication, and understanding of essential elements underlying collaborative project delivery models.

Learning Outcomes: 1. Describe, analyze, and select the most appropriate delivery method for a project. 2. Engage in team-building processes and analyses that are intended to establish collaborative working environments. 3. Analyze case study documents including RFP's, RFQ's, contracts, and other managerial documents used in collaborative project delivery practices. 4. Research and analyze construction management processes to develop collaborative project teams and collaborative work environments. Credits: 3.00

CM 54900 - Advanced Topics In Mechanical And Electrical Construction

Credit Hours: 3.00. A project-focused course covering advanced topics on mechanical and electrical construction installation practices and processes. This course teaches the student how to plan, organize, and execute mechanical and electrical construction operations. Students will develop and expand their knowledge about mechanical and electrical work sequencing, coordination, commissioning, and relationship to facility operations and management.

Learning Outcomes: 1. Describe and analyze mechanical and electrical scopes of work. 2. Engage in team-building processes and analyses that involve developing work sequencing and coordination. 3. Analyze case

study documents including construction schedules to determine best practices and recommendations for improvement. 4. Research and analyze commissioning programs to develop key performance indicators and implementation strategies. Credits: 3.00

CM 50500 - Construction Finance And Company Management

Credit Hours: 3.00. This course provides students with knowledge and research training to construction finance and company management.

Learning Outcomes: 1. Learn about concepts, principles, and practices of construction finance. 2. Learn about company marketing, customer relationship and trust development. 3. Learn about the methods, technologies and statistical approaches used for construction finance and company management. 4. Apply the accounting knowledge to prepare and analyze financial statements. 5. Become a critical thinker of current company management practices and apply what they have learnt to identify and solve challenges of construction management. Credits: 3.00

CM 53600 - Highway Construction And Quality Control

Credit Hours: 3.00. This course provides students with knowledge of methods, materials, equipment, and procedures in construction of highways. Students will acquire the concepts and applications of quality control and quality assurance in construction of highways. Students will learn to design appropriate work zones to improve efficiency and safety of highway construction. This course will provide graduate students with a much-needed venue to gain the theory, technology, and practice of highway construction, rehabilitation, maintenance, and quality control.

Learning Outcomes: 1. Acquire the characteristics of various types of highway materials and highway designs and highway construction specifications. 2. Acquire the quality control and assurance principles, and techniques, and methods. 3. Determine the optimal strategy for pavement preservation. 4. Apply quality control and safety improvement techniques in highway construction. 5. Design work zones to improve efficiency and safety of highway construction. Credits: 3.00

CM 53800 - Roadway Infrastructure Management

Credit Hours: 3.00. This course provides students with theories and practices of managing roadways to achieve maximum benefit in the system and network level with limited available funds and resources. Students will learn the concepts of roadway performance measures in terms of physical conditions, service levels, and safety. As a graduate level course, this course will introduce basic methods to find optimal solutions for real-world problems and provide graduate students analytical and mathematical tools for effectively conducting research related to problem formulation, optimal decision-making, and maximizing benefits/effectiveness and minimizing costs.

Learning Outcomes: 1. Acquire roadway systems and performance measures. 2. Acquire the frameworks and principles of management systems. 3. Conduct data analysis and establish condition prediction models. 4. Perform life cycle benefit/cost analysis of infrastructure projects. 5. Create decision-making models to maximize benefit of infrastructure systems with limited resources. Credits: 3.00

CM 50800 - Human Factors In Construction And Transportation

Credit Hours: 3.00. This course provides students with knowledge and research training to identify and solve design problems and safety issues of human factors specifically in construction and transportation.

Learning Outcomes: 1. Learn the concepts, theories, methods and technologies of human factors (HF), human information processing, and cognitive psychology. 2. Apply the HF knowledge to study and discuss HF issues in the design and safety of construction and transportation. 3. Develop critical thinking ability to identify HF issues and factors in research and real world. 4. Apply HF knowledge to explore, research and solve the problems in the areas of their interests in construction and transportation. 5. Communicate the design and safety from HF perspective. Credits: 3.00

Research Courses (3 credits)

CM 56000 - Academic Writing Seminar I

Credit Hours: 1.00. Analysis of the requirements of research reports. Emphasis on research methods and concepts, identifying major issues, academic literature reviews, data collection and presentation methods, and selecting a research topic.

Learning Outcomes: "1. Increase the student's skills related to research and academic writing through the introduction of resources available through the Purdue Library System and the Purdue Online Writing Lab (OWL). 2. Demonstrate appropriate samples of academic writing through sample reports on the Purdue College of Technology EPubs. 3. Develop the student's knowledge and application of PAP version 6 formatting. 4. Advance the student's expectations of academic writing. Credits: 1.00

CM 56500 - Academic Writing Seminar II

Credit Hours: 1.00. Provides a higher level understanding of scholarly writing as it is applied to the individual student's research. Students also learn to present his or her technical work to an audience in a clear, easily understandable form.

Learning Outcomes: 1. Demonstrate develop of the student's skills related to academic writing through individual and group exercises related to their individual research. 2. Demonstrate appropriate samples of academic writing through sample reports on the Purdue College of Technology Epubs. 3. Appropriate student knowledge and application of APA version 6 formatting. 4. Advance the student's expectations of academic writing. 5. Increase the rate of successful completion of the masters program scholarly writing requirements. Credits: 1.00

CM 58100 - Workshop In Building Construction Management Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 8.00

Thesis Research (6 credits)

CM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 18.00

Related Area Electives (9-18 credits)

Concentrations

GPA Requirements

About the Program

Construction Management Technology, MSCMT (OL)

About the Program

Program Requirements

Required Courses (33 credits)

CM 52000 - Preconstruction Project Management

Credit Hours: 3.00. Management and control of projects from authorization to start of construction. Project success factors, conceptual and parametric estimating, design planning and management constructability review techniques and value engineering methods. Real estate transactions. Land zoning, platting, development and pro forma calculations.

Learning Outcomes: 1. Appreciate the real estate site selection process. 2. Understand the

zoning and platting process. 3. Develop an understanding of the real estate transaction process. 4. Compare and contrast project delivery systems. 5. Understand the design process. 6. Identify project success factors. 7. Utilize value engineering and constructability concepts. 8. Understand the role of preconstruction in the project life cycle. 9. Employ early estimating techniques. 10. Analyze projects from a time-value of money perspective. 11. Evaluate the viability of a construction project before authorization. 12. Appreciate roles played by the various participants in the preconstruction process. 13. Ensure adequate risk management measures have been employed. 14. Apply real estate development rules and consider regulatory issues. Credits: 3.00

CM 52500 - Managing Construction Quality And Production

Credit Hours: 3.00. Advanced techniques for assessing the success of construction project management including schedule cost, safety and quality measurements. Impacts of pre planning, human factors, and communication systems on quality and productivity. Statistical methods for analysis of construction operations.

Learning Outcomes: 1. Define construction productivity and quality. 2. Understand the project owner's role, the designer's role, and the construction firm's role in construction, productivity and quality. 3. Demonstrate the ability to manage productivity at the following enterprise levels - company, project, and construction site. 4. Demonstrate the ability to manage construction labor productivity, equipment productivity, and subcontractor productivity. 5. Measure construction labor productivity. 6. Understand the impact that changes have on productivity. 7. Quantify lost productivity. 8. Implement a Total Quality Management (TQM) system. Credits: 3.00

CM 53000 - Construction Operations And Strategic Management

Credit Hours: 3.00. Principles of construction company business management for U.S. companies. Executive-level construction functions including strategic planning, organizational structure, and ownership structure including succession planning.

Learning Outcomes: 1. Undertake company strategic planning. 2. Prepare a company business plan. 3. Create organizational structure. 4. Develop policies and procedures. 5. Manage change. 6. Manage equipment utilization. 7. Ensure contract profitability. 8. Identify and manage other operational concerns. 9. Develop succession plans. 10. Implement succession plans. Credits: 3.00

CM 53500 - Construction Accounting And Financial Management

Credit Hours: 3.00. Accounting techniques, financial methods, and financial management for construction firm management. Analysis techniques for contemporary construction company accounting and finance practice with an emphasis on cash flow analysis and cash management.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction company. 2. Explain the progress billing terms retainage and front loading and discuss the reasons for and against such practice. 3. Identify the accounts applied and their use when the percentage of completion method of accounting is applied. 4. Explain the difference between underbilling and overbilling, discuss why they occur and their impact on cash flow. 5. Apply the following financial analysis techniques to financial statements: line-item analysis, horizontal analysis, vertical analysis, use-source analysis, ratio analysis, cost-volume-profit analysis, and profit center analysis. 6. Prepare the budgeted income statement and develop rates for overhead and profit mark-up, exercise control over company cost, and prepare a cash plan. 7. Apply time value of money principles to various

decision making tools when seeking company and project financing and the acquisition of capital assets. Credits: 3.00

CM 54000 - Law For Construction Managers

Credit Hours: 3.00. A study of the legal system and its impact on the construction process. The focus is on the legal obligations, rights and remedies pertaining to the construction company. Topics include bidding, contracts, and construction changes.

Learning Outcomes: 1. Describe agency relationships, contracts, torts, professional liability, risk management, indemnification, risk sharing and surety bonds. 2. Explain the concept of the design professional as judge. 3. Recognize the procedures for legally terminating a construction contract. 4. Plan the project with a contract law viewpoint. 5. Comply with the legal requirements for competitive bidding. 6. Create as well as to comply with the rights & duties of the construction contract. 7. Demonstrate the ability to apply construction law concepts to subcontracting, changes, payments, performance problems, defects, subsurface problems, time and claims. Credits: 3.00

CM 54500 - Construction Management Training And Development

Credit Hours: 3.00. Identification, training and development of future company leaders. Mentorship as a required, managerial activity, effective delegation of responsibility, and empowerment of subordinates to take initiative.

Learning Outcomes: 1. Interpret the role of the training department in meeting an organization's strategic goals. 2. Analyze the broader organizational context and business environment in order to ensure that training meets business needs and achieves stakeholder support. 3. Use effective investigative and analytical methods to advise and assist clients in identifying needs, at organizational levels, to which training is the most appropriate response. 4. Work with stakeholders to design training events (including formal programs) that are grounded in the principles of learning, are accessible, effective and make timely use of available resources. 5. Incorporate new technology as appropriate into both training and learning processes, and the effective management of the training and development function. 6. Carry out appropriate monitoring and evaluation of training programs, and coordinate with stakeholders on any necessary changes to training provision and practice. 7. Explore models and research relating to the core competencies and behavioral characteristics of effective trainers. Credits: 3.00

CM 55000 - Risk Management In Construction

Credit Hours: 3.00. Analysis of the depth and breadth of risk in construction. Defining key terms and concepts used in various risk management arenas - legal statutes, precedent and case studies relevant to construction risk management, insurance, and surety bonding. Subjects include: contracts, torts, insurance, surety, safety laws, quality, and risk management models. Analysis of case studies to utilize risk management tools and identify issues and possible approaches. Project risk control including management of foreseeable hazards as well as unforeseen conditions.

Learning Outcomes: 1. Overview of risk fundamentals - and how liability drives outcomes. 2. Understand the relationships between insurance, sureties, contractual risk transfer and risk financing. 3. Understand how safety covers direct employees, other parties, and member of the public. 4. Understand the role of incident investigation, and management of claims of various types. 5. Understand quality and how to deliver acceptable project results. 6. Understand the value of Business Continuity Planning and other Crisis Management methods and tools. 7. Understand the value of corporate compliance programs for satisfaction of regulatory and other legal requirements. 8. Understand standards of care, and their evolutionary nature, compelling "compliance as

you go." 9. Ability to critically evaluate existing risk management approaches, and apply risk management models to promote successful project outcomes. Credits: 3.00

CM 55500 - Construction Leadership And Marketing

Credit Hours: 3.00. Analysis of organizational leadership at the executive level. The goals of this course are to introduce and stimulate thought and discussion of leadership theories, characteristics and behaviors of successful leaders, contextual factors affecting leader effectiveness, dynamics of leader-follower relationships, communication, decision-making and contemporary challenges confronting organizational leaders as well as marketing theory, marketing vs. business development, the marketing process, and an introduction to a construction marketing dashboard.

Learning Outcomes: 1. Understand the essential principles of leadership theories and apply the theories in construction management. 2. Comprehend the characteristics and behaviors of successful leaders in the field of construction. 3. Grasp the main contextual factors affecting leader effectiveness. 4. Apply the dynamics of leader-follower relationships in daily operations. 5. Acquire communication, decision-making and other key leadership skills. 6. Recognize the contemporary challenges confronting organizational leaders. 7. Understand the marketing theory, the market process, and marketing vs. business development. 8. Understand and utilize construction marketing dashboard. Credits: 3.00

CM 58100 - Workshop In Building Construction Management Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 8.00

Consumer Science, MS

About the Program

Program Requirements - Thesis

Required Courses (27 credits)

Core Courses (21 credits)

HTM 51400 - Business Analytics For Service Industries

Credit Hours: 3.00. In today's highly dynamic business environment, decision-makers often encounter problems that are complex and data intensive. This course focuses on a variety of techniques from the field of business statistics and exposes students to statistical and decision analytics to solve data-driven decision-making problems. The course adopts a practical spreadsheet-based approach to facilitate decision-making and explores the practical applications of these techniques across various functional fields, with a specific focus on service industries.

Learning Outcomes: 1. Identify and evaluate managerial problems requiring data-based decision-making. 2. Apply quantitative methods to model and analyze real-world situations. 3. Employ analytic software tools to solve problems from various functional fields. 4. Communicate solutions and managerial implications across different stakeholders. Credits: 3.00

HTM 50800 - Cultivating A Service Excellence Mindset

Credit Hours: 3.00. Understanding the fundamental principles of service management is essential to successfully manage service organizations in a complex market environment. This course utilizes major theoretical frameworks, such as Service-Dominant Logic, to address key issues in managing service organizations, including creating service culture, motivating a service-minded workforce, co-creating service value, and achieving service excellence. Students develop managerial skills through a thorough understanding of service strategies, systems, and processes to optimize service value.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the service experience. 2. Explain the critical role of managing the employee-customer interface in the service delivery process. 3.

Evaluate various service management strategies to enhance service excellence. 4. Construct key service management systems and processes to solve issues in complex service environments. Credits: 3.00

HTM 50600 - Leading People In Service Industries

Credit Hours: 3.00. Leadership requires an understanding of human behavior, organizational culture, and strategy. In this class, students are exposed to leadership theory through the extant literature. Facilitated by readings and class discussion, students develop critical and analytical understanding of how theory informs and connects to practice. The course topics include human resources functions, organizational and human behavior, human values and motivations, team dynamics, decision-making, and change management. This course takes an interdisciplinary approach, with student learning drawn from different fields.

Learning Outcomes: 1. Understand the role of leadership in successful organizations. 2. Explain how human resource practices contribute to organizational effectiveness. 3. Analyze theories and practices in human resources, organizational behaviors, and leadership. 4. Connect leadership theories to organizational practices. 5. Synthesize different theoretical perspectives within/across service industries. Credits: 3.00

HTM 50700 - Integrated Marketing Communications For Service Industries

Credit Hours: 3.00. This course addresses the unique challenges and opportunities in marketing the intangible, inseparable, variable, and perishable service products. Balancing theoretical research and practical applications, this course provides a systematic review of key components and processes for an effective integrated marketing communication for service industries. Students will learn how to leverage both long-standing and emerging marketing communication approaches (e.g., strategic marketing and promotion, branding, public relations, digital marketing, social media, influencer marketing and artificial intelligence application) to create customer awareness, manage customer expectations, build customer relationships, and ensure customer satisfaction and loyalty.

Learning Outcomes: 1. Evaluate the role of marketing communications in achieving success for service organizations. 2. Identify critical metrics to understand customer expectations and manage customer perceptions. 3. Apply customer-centric approach to leverage various marketing communication methods and tools to meet customer needs, wants and demands. 4. Develop, promote, and manage service promises through both external and internal marketing. Credits: 3.00

HTM 50900 - Service Experience Design

Credit Hours: 3.00. The success of service organizations requires well-planned design of the service environment and customer experience journey to enhance operational efficiency and excellence, drive customer satisfaction and loyalty, and differentiate from competitors. Addressing the importance of developing and providing optimal customer experience in service industries, this course aims to inspire a design-thinking approach to create contemporary customer experiences in various service settings. By gaining insights from the service design theories, students will gain knowledge to effectively manage the physical environment, service interactions, and service delivery processes to enhance the overall service experience quality. Learning by practice, students will apply the learned design tools to envisage, blueprint, and devise innovative service experience solutions.

Learning Outcomes: 1. Articulate the role of service experience design for the strategic success of service organizations in the marketplace. 2. Conduct critical quantitative and qualitative analyses of customer service experience. 3. Design service experiences for customers by utilizing various experience design tools. 4. Communicate the service design process to service industry professionals and relevant stakeholders. Credits: 3.00

HTM 51300 - Strategy In Service Industries

Credit Hours: 3.00. Strategic management plays a pivotal role in helping industry leaders gain a competitive advantage and accomplish business goals in an ever-changing marketplace. This course centers on the exploration of various theories, frameworks, and models to understand contemporary issues and challenges in service industries. Through the application of strategic management principles and strategy-oriented tasks, students comprehend essential topics in strategic management, including environmental and competitor analysis, strategic planning, strategy formulation, strategy execution, and strategic evaluation and control.

Learning Outcomes: 1. Articulate the theoretical principles and tactical practices in strategy management. 2. Analyze external and internal factors to effectively manage service organizations. 3. Evaluate the strategic planning process for service organizations. 4. Apply strategic theories, frameworks, and models to management practices in service organizations. Credits: 3.00

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating customer satisfaction, engagement, and enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

Statistics Courses (6 credits)

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson,

hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Thesis Research (6 credits)

HTM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

Additional Requirements (0-1 credit)

HTM 59001 - Graduate Professional Industry Internship

Credit Hours: 1.00. The Graduate Professional Industry Internship allows graduate students to gain valuable experience through paid employment with a company in the hospitality and tourism industry or a related industry. In addition, each student will research an issue and provide a potential solution to a problem faced by the employer. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from Graduate Professional Industry Internship Coordinator is required to enroll in this course. Permission of instructor required.

Learning Outcomes: 1. Understand how to effectively manage a service industry business. 2. Develop critical thinking, creativity, and problem solving skills. Credits: 1.00

Program Requirements - Non-Thesis

Required Courses (21 credits)

Core Courses (21 credits)

HTM 51400 - Business Analytics For Service Industries

Credit Hours: 3.00. In today's highly dynamic business

environment, decision-makers often encounter problems that are complex and data intensive. This course focuses on a variety of techniques from the field of business statistics and exposes students to statistical and decision analytics to solve data-driven decision-making problems. The course adopts a practical spreadsheet-based approach to facilitate decision-making and explores the practical applications of these techniques across various functional fields, with a specific focus on service industries.

Learning Outcomes: 1. Identify and evaluate managerial problems requiring data-based decision-making. 2. Apply quantitative methods to model and analyze real-world situations. 3. Employ analytic software tools to solve problems from various functional fields. 4. Communicate solutions and managerial implications across different stakeholders. Credits: 3.00

HTM 50800 - Cultivating A Service Excellence Mindset

Credit Hours: 3.00. Understanding the fundamental principles of service management is essential to successfully manage service organizations in a complex market environment. This course utilizes major theoretical frameworks, such as Service-Dominant Logic, to address key issues in managing service organizations, including creating service culture, motivating a service-minded workforce, co-creating service value, and achieving service excellence. Students develop managerial skills through a thorough understanding of service strategies, systems, and processes to optimize service value.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the service experience. 2. Explain the critical role of managing the employee-customer interface in the service delivery process. 3. Evaluate various service management strategies to enhance service excellence. 4. Construct key service management systems and processes to solve issues in complex service environments. Credits: 3.00

HTM 50600 - Leading People In Service Industries

Credit Hours: 3.00. Leadership requires an understanding of human behavior, organizational culture, and strategy. In this class, students are exposed to leadership theory through the extant literature. Facilitated by readings and class discussion, students develop critical and analytical understanding of how theory informs and connects to practice. The course topics include human resources functions, organizational and human behavior, human values and motivations, team dynamics, decision-making, and change management. This course takes an interdisciplinary approach, with student learning drawn from different fields.

Learning Outcomes: 1. Understand the role of leadership in successful organizations. 2. Explain how human resource practices contribute to organizational effectiveness. 3. Analyze theories and practices in human resources, organizational behaviors, and leadership. 4. Connect leadership theories to organizational practices. 5. Synthesize different theoretical perspectives within/across service industries. Credits: 3.00

HTM 50700 - Integrated Marketing Communications For Service Industries

Credit Hours: 3.00. This course addresses the unique challenges and opportunities in marketing the intangible, inseparable, variable, and perishable service products. Balancing theoretical research and practical applications, this course provides a systematic review of key components and processes for an effective integrated marketing communication for service industries. Students will learn how to leverage both long-standing and emerging marketing communication approaches (e.g., strategic marketing and promotion, branding, public relations, digital marketing, social media, influencer marketing and artificial intelligence application) to create customer awareness, manage customer expectations, build customer relationships, and ensure customer satisfaction and loyalty.

Learning Outcomes: 1. Evaluate the role of marketing communications in achieving success for service organizations. 2. Identify critical metrics to understand customer expectations and manage customer perceptions. 3. Apply customer-centric approach to leverage various marketing communication methods and tools to meet customer needs, wants and demands. 4. Develop, promote, and manage service promises through both external and internal marketing. Credits: 3.00

HTM 50900 - Service Experience Design

Credit Hours: 3.00. The success of service organizations

requires well-planned design of the service environment and customer experience journey to enhance operational efficiency and excellence, drive customer satisfaction and loyalty, and differentiate from competitors. Addressing the importance of developing and providing optimal customer experience in service industries, this course aims to inspire a design-thinking approach to create contemporary customer experiences in various service settings. By gaining insights from the service design theories, students will gain knowledge to effectively manage the physical environment, service interactions, and service delivery processes to enhance the overall service experience quality. Learning by practice, students will apply the learned design tools to envisage, blueprint, and devise innovative service experience solutions.

Learning Outcomes: 1. Articulate the role of service experience design for the strategic success of service organizations in the marketplace. 2. Conduct critical quantitative and qualitative analyses of customer service experience. 3. Design service experiences for customers by utilizing various experience design tools. 4. Communicate the service design process to service industry professionals and relevant stakeholders. Credits: 3.00

HTM 51300 - Strategy In Service Industries

Credit Hours: 3.00. Strategic management plays a pivotal role in helping industry leaders gain a competitive advantage and accomplish business goals in an ever-changing marketplace. This course centers on the exploration of various theories, frameworks, and models to understand contemporary issues and challenges in service industries. Through the application of strategic management principles and strategy-oriented tasks, students comprehend essential topics in strategic management, including environmental and competitor analysis, strategic planning, strategy formulation, strategy execution, and strategic evaluation and control.

Learning Outcomes: 1. Articulate the theoretical principles and tactical practices in strategy management. 2. Analyze external and internal factors to effectively manage service organizations. 3. Evaluate the strategic planning process for service organizations. 4. Apply strategic theories, frameworks, and models to management practices in service organizations. Credits: 3.00

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating customer satisfaction, engagement, and enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

Electives (9 credits)

Additional Requirements

HTM 59001 - Graduate Professional Industry Internship

Credit Hours: 1.00. The Graduate Professional Industry Internship allows graduate students to gain valuable experience through paid employment with a company in the hospitality and tourism industry or a related industry. In addition, each student will research an issue and provide a potential solution to a problem faced by the employer. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from Graduate Professional Industry Internship Coordinator is required to enroll

in this course. Permission of instructor required.

Learning Outcomes: 1. Understand how to effectively manage a service industry business. 2. Develop critical thinking, creativity, and problem solving skills. Credits: 1.00

Concentrations

GPA Requirements

About the Program

Corporate Training and Communication, MS

About the Program

Program Requirements

Required Courses (30 credits)

Learning Design and Technology Courses (12 credits)

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

Communication Courses (15 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60511 - Strategic Communication And Professional Writing

Credit Hours: 3.00. This graduate course covers topics related to professional writing and strategic communication. Topics include grammar basics, audience considerations, credibility and ethics, and documentation style. In addition, writing will be discussed in a variety of contexts such as media, public relations, advertising, and business communication. Permission of department required.

Learning Outcomes: 1. Demonstrate mastery of writing, grammar, and style as well as various guidelines for academic and professional writing. 2. Articulate the role of credibility and ethics in professional writing. 3. Explain the importance of research and audience analysis in professional writing. 4. Analyze the unique challenges of writing in different contexts (e.g., advertising, public relations, media, business communication, print and online). 5. Evaluate strengths and weaknesses of various forms of written communication. 6. Produce various types of documents related to strategic communication. Credits: 3.00

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses,

strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

Practicum Course (3 credits)

EDCI 57300 - Instructional Development Practicum

Credit Hours: 2.00 or 3.00. Provides supervised field experience in programs involving instructional design development activities. Students participate in ongoing projects in the design, development, and evaluation of instructional materials and training programs in business and industry, medical facilities, or other settings deemed appropriate. Recommended prerequisites: EDCI 56900, EDCI 57200, and EDCI 67200. Permission of instructor required.

Learning Outcomes: 1. Design, develop, and evaluate a major instructional design project within a professional work setting/environment. 2. Create and manage an instructional design project within a professional setting following a specific timeline. Management of the process may require collaboration with supervisors, subject matter experts, and others to complete the project in the most effective manner. Credits: 2.00 or 3.00

Program Learning Outcomes

About the Program

Curriculum and Instruction: Agricultural and Extension Education Concentration, MSED or MS or PHD

About the Program

Program Requirements

Required Courses (15 credits)

Core Courses (9 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

ASEC 52000 - Foundations Of Agricultural Education, Extension, And Communication

Credit Hours: 3.00. Critical analysis of the historical and philosophical assumptions, current strategic intents and relevant policies underpinning the discipline of agricultural education - inclusive of Extension education and agricultural communication - and project the impact existing economic, social and political issues may have in this field in the next 15 to 25 years. Instructor permission required.

Learning Outcomes: 1. Explain how social and economic conditions in the 19th century helped shape AEEC. 2. Identify and discuss how key events, leaders, driving forces, and policies (i.e., legislation) that shaped AEEC. 3. Compare and contrast similarities and differences among school-based agricultural education, non-formal (Extension) education, and agricultural communication regarding their purpose, development as a field, structure and stakeholders. 4. Discuss the philosophies of pragmatism, behaviorism, and constructivism, and how these philosophical assumptions influenced the policies and practices of AEEC. 5. Identify leaders and what role they played in helping shape AEEC. 6. Discuss how principles of community-based education support the development of human, cultural and social capital in AEEC. 7. Examine current trends regarding existing organizational structures, enrollment, funding, and collaborative partners of AEEC, and project how current social and economic conditions in the 21st century may impact AEEC. 8. Discuss contemporary leadership and program models for the next 25 years, and analyze visions in AEEC are positioned to address grand challenges visions in AEEC. Credits: 3.00

Selectives (6 credits)

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and

learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDST 60000 - Seminar In The Foundations Of Education

Credit Hours: 3.00. Recommended for those who have had a prior foundations course. Specialized studies in such areas as educational history, educational philosophy, educational sociology, religion and public education, current educational issues, and classical literature of education.

Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

AEE Electives (9 credits)

Electives (6 credits)

Curriculum and Instruction: Career and Technical Education Concentration, MSED or MS or PHD

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (xx credits)

EDCI 54100 - Contemporary Issues In Career And Technical Education

Credit Hours: 3.00. Identification, analysis, synthesis, and implications of current issues and problems in career and technical education at the elementary, secondary, postsecondary, and adult levels; policy and literature review; formulation of alternatives and solutions.

Learning Outcomes: 1. Identify and analyze existing policy and programmatic problems and issues in career and technical education and related disciplines and fields. 2. Synthesize and summarize contemporary literature relating to problems and issues. 3. Formulate alternatives and solutions to existing problems and issues. 4. Examine the implications and potential impact (short- and long-range) of problems and issues in career and technical education for society and education in general. Credits: 3.00

EDCI 55000 - Career Education

Credit Hours: 3.00. An overview of contemporary legislation, educational reform, trends, and issues; career education program models; vocational and technical education, technology prep, and school-to-work systems; partnerships; foundations of career education; career development; curriculum; career guidance and counseling; career assessment; career planning practices; learning styles and instructional strategies; career information sources and resources; exemplary programs; and special needs populations and practices.

Learning Outcomes: 1. Describe the major legislative provisions and educational reforms affecting the delivery of career education. 2. Evaluate significant trends in career education, and professional and social issues. 3. Identify and adapt (a) career education model(s). 4. Describe the Career and Technical Education, Tech Prep, Career Pathways, and School-to-Career delivery systems. 5. Discuss effective partnerships between and among the school, the community, and business and industry. 6. Describe the foundations of career education. 7. Explain the career development process. 8. Identify the roles of elementary, middle, high school, postsecondary, and adult education; and business and industry in career education. 9. Develop career education curriculum; career clusters and pathways; and occupational, job, and task analysis. 10. Apply career guidance and counseling practices and procedures. 11. Utilize career assessment strategies. 12. Implement career planning practices and procedures. 13. Adapt appropriate learning styles and instructional strategies for individual learners. 14. Locate and use career information sources. 15. Identify, select, and utilize appropriate career information resources related to the school, community, governmental agency, occupational, and professional resources. 16. Identify, compare, contrast, and adapt exemplary career education programs. 17. Identify special needs populations and effective practices. Credits: 3.00

EDCI 64500 - Organization And Administration Of Career And Technical Education

Credit Hours: 3.00. Organizational structure and delivery systems at the national, regional, state, and local levels; program areas and services; legislative initiatives; federal, state, and local planning; administrative functions and practices; leadership development; trends; and issues.

Learning Outcomes: 1. Develop an understanding of the organizational structure and delivery systems at the national, regional, state, and local levels in career and technical education (CTE). 2. Provide an overview of the CTE program areas, career clusters, career pathways, and services and their relationships

to academic and special education. 3. Review federal and state legislation related to CTE. 4. Examine federal, state, regional, and local planning and funding activities. 5. Analyze administrative functions and practices and management systems. 6. Critique leadership and staff development initiatives in CTE. 7. Evaluate current trends and issues in the field. Credits: 3.00

Curriculum and Instruction Courses (xx credits)

EDCI 54300 - Instruction In Career And Technical Education

Credit Hours: 3.00. Contemporary trends and methods in teaching career and technical programs, learning styles and teaching styles, and a variety of creative instructional strategies for different educational contexts will be identified and analyzed.

Learning Outcomes: 1. Develop an understanding of the instructional process and learning theory in career and technical education and business and industry training. 2. Provide an overview of the major influences on learning and learning environments. 3. Acquire skills in instructional planning, implementation, and evaluation. 4. Analyze a variety of instructional strategies and resources in career and technical education and training. 5. Review and analyze instructional literature and research in career and technical education. 6. Gain experience in instructional planning and delivery. Credits: 3.00

EDCI 54400 - Career And Technical Education For Special Needs Learners

Credit Hours: 3.00. Legislative initiatives; identification of special needs learners at the elementary, secondary, postsecondary, and adult levels; learning characteristics; assessment; individualized planning; instructional adaptations; school and community resources; exemplary program models; research, trends, and issues; and evaluation.

Learning Outcomes: 1. Describe the major historical and contemporary legislative provisions affecting the delivery of career and technical education to special needs learners. 2. Identify and describe the educational characteristics of special needs learners, including students with disabilities, disadvantaged students, gifted and talented learners, non-traditional learners, and limited-English proficient speakers. 3. Describe and use appropriate strategies for assessment of the career needs, learning styles, and progress of special needs learners. 4. Develop and evaluate individualized education, career, and transition plans for a special needs learner. 5. Select and use appropriate instructional strategies, procedures, and materials. 6. Identify and select appropriate community, business, industry, school, governmental agency, occupational, and professional resources. 7. Compare and contrast various exemplary program models for special needs learners. 8. Evaluate the major professional trends, issues, and implications for career and technical education programs for special needs learners. Credits: 3.00

EDCI 55200 - Generalizable Skills Instruction In Career And Technical Education

Credit Hours: 3.00. Curriculum, assessment, planning, implementation, and evaluation relating to generalizable skills (also known as generic, transferable, or workplace skills) in career and technical education, other content areas, and special education programs; philosophical, historical, social, economic, political, and educational influencing factors; analysis and synthesis of current research and conceptual models; practical applications for programs; instructional strategies; resources and support services, interdisciplinary collaboration approaches; applications for special needs learners; learning styles and characteristics.

Learning Outcomes: 1. Identify and analyze the philosophical, historical, social, economic, political, and educational factors influencing generalizable skills instruction in career and technical education programs. 2. Locate, analyze, and synthesize contemporary generalizable skills literature and research and its application in career and technical programs.

3. Identify, analyze, and apply a conceptual model for generalizable skills instruction regarding curriculum, assessment, planning, implementation, and evaluation. 4. Identify generalizable skills curriculum. 5. Examine and apply methods of generalizable skills curriculum development and revision. 6. Review and analyze functional, curriculum-based assessment, instruments, strategies, and procedures. 7. Describe and use procedures for using generalizable skills assessment data/information in individualized educational planning. 8. Identify the individual learning styles and characteristics of, and apply appropriate instructional approaches for, individual students in career and technical programs. 9. Identify, locate, select, and evaluate instructional resource materials and support services useful in generalizable skills instruction. 10. Identify, adapt, and develop methods for teaching generalizable skills in career and technical programs. 11. Develop and implement interagency collaboration strategies among career and technical education, special education, support/remedial services, and content related (e.g., mathematics, reading) school personnel. 12. Identify and select appropriate evaluation methods and procedures for determining the adequacy, quality, and effectiveness of generalizable skills instruction and support services in career and technical education programs. Credits: 3.00

EDCI 64800 - Curriculum In Career And Technical Education

Credit Hours: 3.00. Overview of curriculum in career and technical education programs; business and industry training programs; curriculum planning, development, implementation, and evaluation; review and analysis of curriculum models.

Learning Outcomes: 1. Develop an understanding of curriculum and its relationship to other instructional phases in career and technical education and training. 2. Provide an overview of curriculum processes and procedures in career and technical education and business and industry training programs. 3. Review and analyze curriculum development research in career and technical education. 4. Acquire skills in curriculum needs assessment, planning, implementation, and evaluation. 5. Explore the theoretical, ethical, political, social, and economic factors related to curriculum development in career and technical education and training. 6. Gain experience in designing a curriculum plan and curriculum development. Credits: 3.00

EDCI 65300 - Seminar In Career And Technical Education

Credit Hours: 1.00 to 9.00. Current trends, theory, and practices related to educational contexts and careers.

Learning Outcomes: 1. Review, synthesize, analyze, and critique current research in education, career and technical education, and related fields and disciplines. 2. Identify significant research problem areas and researchable problems in education. 3. Examine and evaluate research methods used and applicable in education fields and related disciplines. 4. Explore various research dissemination strategies. 5. Network with researchers in education and related fields. Credits: 1.00 to 9.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Administration and Policy Courses (xx credits)

EDCI 54500 - Planning In Career And Technical Education

Credit Hours: 3.00. Principles and strategies in planning new

and improving existing career and technical education programs, strategic planning, needs assessment, community and workforce market research, information and data analysis, program improvement. Permission of Department required.

Learning Outcomes: 1. Develop an understanding of the principles and strategies in planning CTE and workforce education programs. 2. Provide an overview of the CTE district program plan. 3. Review Federal CTE and workforce education legislative planning regulations and guidelines. 4. Examine State CTE and workforce education legislative planning regulations and guidelines. 5. Critique various strategic planning models, strategies, and procedures. 6. Describe strategies for advocating for diversity and access and equity for special needs populations in CTE program planning policy and practice. 7. Evaluate local and CTE district planning factors and considerations. 8. Discuss community needs assessment and workforce market research, information and data analysis, and use of findings in decision-making. 9. Describe strategies for organizing and collaborating with program advisory committees. 10. Explain continuous program evaluation and improvement. Credits: 3.00

EDCI 55300 - Leadership Development In Career And Technical Education

Credit Hours: 3.00. Design, development, implementation, and evaluation of systems and strategies for enhancing the skills and knowledge of personnel seeking to become leaders in the field of Career and Technical Education (CTE); research related to critical and emerging leadership issues, strategies, policies, and resources are examined and applied to program improvement initiatives in schools, the workplace, agencies, and other organizations that serve a wide variety of youth, adolescents, young adults, and adults.

Learning Outcomes: 1. Identify and adapt models of staff development, in-service education, and program improvement. 2. Use organizational, adult learning, motivational, leadership, and social systems therapy in staff development and school-or agency-based program improvement activities. 3. Develop and implement organizational communications and group-related interactions effectively. 4. Evaluate the principles related to leadership style; organizational development, initiation and management of change, needs analysis, and consultation strategies; and program improvement activities. 5. Locate current and emerging funding sources, as well as effective procedures for developing grant seeking and project management strategies. 6. Implement comprehensive strategies for developing assessing and improving programs, policies, practices, and services related to career and technical education programs. 7. Design and implement effective interagency collaboration initiatives. Credits: 3.00

EDCI 64400 - Legal Issues In Career And Technical Education

Credit Hours: 3.00. Comprehensive examination of contemporary federal, state, and local legislation; rules, policy, regulations, provisions, guidelines, and initiatives affecting the nature, establishment, and implementation of state and local programs at the secondary and postsecondary levels in career and technical education; need for legislation and initiatives and the reauthorization of existing legislation; social, political, and economic aspects of legislation; advocacy for legislation; and public policy and policy development. Approval of Department required.

Learning Outcomes: 1. Discuss the importance and impact of statutory law on the development and nature of career and technical education in the United States. 2. Describe and contrast the legislative process and policies at the national and state levels. 3. Review, articulate, and analyze critically the history of CTE and related legislation from 1862 to the present. 4. Explain and apply the major provisions of the current CTE and workforce federal legislation. 5. Relate and apply the content of the current Indiana State Plan for CTE to the provisions, requirements, and legal interpretation of Federal CTE legislation. 6. Examine critically and apply Indiana legislation and initiatives that provide

authority, support, structure, and administration for CTE in the State. 7. Refine conceptual, analysis, synthesis, and evaluation skills. 8. Enhance their written and oral communication skills. Credits: 3.00

EDCI 64600 - Supervision In Career And Technical Education

Credit Hours: 3.00. Purposes, principles, strategies, and procedures of supervision and management in career and technical education and related workforce education and development contexts: theory and practice: human resource development: environment, education, and management. Approval of Department required.

Learning Outcomes: 1. Define and describe contemporary supervision concepts. 2. Identify and explain principles of educational supervision. 3. Relate and analyze critically emerging concepts in supervision to social, political, economic, and cultural factors. 4. Describe and discuss a sequence of (clinical) experiences that provide optimum opportunity for developing educator competencies. 5. Identify and apply best practices experiences that have potential for practica, internships, and other work-based learning programs. 6. Identify and describe the stages of supervision. 7. Identify, evaluate, select, and apply techniques and strategies appropriate to the implementation of each stage of supervision. 8. Implement methods of supervision in pre-observation, conference, observation, analysis and strategy, conference, and post-conference contexts. 9. Develop awareness and participate in professional development opportunities in CTE and education. Credits: 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Disciplined Inquiry Courses (xx credits)

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDCI 64700 - Research In Career And Technical Education

Credit Hours: 3.00. Rationale for and history of research in career and technical education; analysis of the research process and research methods; examination of the environment and support required for research; proposal development, and strategies for dissemination and utilization of research. Offered in alternate years.

Learning Outcomes: 1. Develop a rationale for disciplined inquiry in career and technical education. 2. Examine the history of research in career and technical education. 3. Analyze the research process and research methods. 4. Identify the environment and support required for research. 5. Describe strategies for the dissemination, utilization, and evaluation of research. Credits: 3.00

EDCI 64900 - Assessment In Career And Technical Education

Credit Hours: 3.00. Goals and rationale for evaluation in

education and work training contexts; assessment and measurement methods, techniques, and procedures; reliability, validity, and accuracy; construction and selection of instruments; data and information collection, analysis, and interpretation; meta evaluation; adaptations and modifications for special needs populations; and using assessment data and information.

Learning Outcomes: 1. Provide an overview of assessment in career and technical education and training programs. 2. Identify goals and a rationale for evaluation. 3. Explore contemporary assessment trends and practices. 4. Develop an understanding of career assessment and measurement methods, techniques, and procedures in career and technical education and training. 5. Examine several methods for estimating instrument reliability, validity, and accuracy. 6. Develop skills in the construction, analysis, and selection of assessment and measurement instruments and procedures in career and technical education and training programs. 7. Explore the ethical, psychological, political, social, economic, and educational issues related to assessment in career and technical education and training. 8. Gain experience in the collection and analysis of assessment data and information. 9. Develop skills in the evaluation of assessment and measurement instruments. 10. Explore a variety of appropriate procedures to interpret, disseminate, and use assessment data and information in career and technical education and training programs. Credits: 3.00

EDCI 65000 - Program Evaluation In Career And Technical Education

Credit Hours: 3.00. Goals and objectives of, and criteria for, program evaluation in career and technical education; evaluation models and methods; design and planning; issues; development and selection of instruments and procedures; data and information collection and analysis; preparing program evaluation reports; and using program evaluation results for program improvement.

Learning Outcomes: 1. Provide an overview of program evaluation. 2. Develop an understanding of the major concepts, principles, models, theories, and techniques of evaluation. 3. Acquire knowledge and skills in designing and planning program evaluations. 4. Explore the ethical, political, social, and economic issues related to evaluation. 5. Experience implementing the methods, procedures, and activities of a program evaluation plan. 6. Participate in the reporting, dissemination, and use of findings of program evaluations. Credits: 3.00

EDCI 65300 - Seminar In Career And Technical Education

Credit Hours: 1.00 to 9.00. Current trends, theory, and practices related to educational contexts and careers.

Learning Outcomes: 1. Review, synthesize, analyze, and critique current research in education, career and technical education, and related fields and disciplines. 2. Identify significant research problem areas and researchable problems in education. 3. Examine and evaluate research methods used and applicable in education fields and related disciplines. 4. Explore various research dissemination strategies. 5. Network with researchers in education and related fields. Credits: 1.00 to 9.00

EDCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EDCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Curriculum and Instruction: Curriculum Studies

Concentration, MSED or MS

About the Program

Program Requirements - Thesis

Required Courses (9 credits)

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDCI 68200 - Contemporary Curriculum Theory

Credit Hours: 3.00. Critical examination of contemporary concepts of curriculum theory. Rational/technical curriculum, social needs/child centered curriculum. Socio-political curriculum theory; curriculum as existential, aesthetic, and phenomenological. Implications for current practice, school reform, and educational research.

Learning Outcomes: 1. Develop an understanding of the social theories and philosophies that inform contemporary curriculum theorizing. 2. Articulate the role of curriculum theorizing in defining and analyzing educational phenomena. 3. To utilize curriculum theory toward the development of educative responses to issues of ethics, equity, power, and privilege. 4. To synthesize the complexity and tensions of various curriculum theories into frameworks for educational research. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

Curriculum Studies Electives (12 credits)

Humanities/Social Science Elective (3 credits)

Thesis Research (9 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Requirements - Non-thesis

Required Courses (9 credits)

Curriculum Studies Electives (15 credits)

Humanities/Social Science Elective (3 credits)

Portfolio Research (3 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

Curriculum and Instruction: Educational Technology Concentration, MSED

About the Program

Program Requirements

Required Courses (23 credits)

Core Courses (11 credits)

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 52001 - Curriculum And Instruction Online MS Seminar I

Credit Hours: 1.00. This boot camp is designed to help you to understand the knowledge and skills necessary for your

successful online learning in the Curriculum and Instruction program. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn about various learning strategies and online resources that you can utilize in your courses. In this seminar, you will be responsible for completing all assignments on time over the course of the semester. Read the guidelines for each week and complete the assignments. NOTE: This course is a core course in the C&I online masters program. A grade of B- or better is required (if a lower grade is received, the course must be retaken). Permission of department required.

Learning Outcomes: 1. Exhibit knowledge of academic integrity by completing plagiarism, statement of commitment, and APA tutorials. 2. Effectively explain your professional goals for the program by writing an initial reflection. 3. Identify essential components of the Curriculum and Instruction Handbook, including what is required for the final portfolio. 4. Develop and apply group project skills and management techniques to make you successful in future courses and your career. 5. Demonstrate digital skills and competence with various digital tools (i.e., blogs, screencasting, Google docs, file sharing). 6. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 1.00

EDCI 52002 - Curriculum And Instruction Online MS Seminar II

Credit Hours: 1.00. This seminar is designed to help you to understand the knowledge and skills necessary for your success throughout the Curriculum and Instruction program. In addition to providing you with information that will help you succeed in the program, you are also asked to think about ways to make yourself more marketable to current and future employers. Permission of department required.

Learning Outcomes: 1. Investigate the skills and knowledge needed to be successful in a relevant career within the C&I field. 2. Describe program and career goals. 3. Apply research skills required to compose an annotated bibliography. 4. Create the foundation of a C&I portfolio displaying programmatic achievements and course competencies. Credits: 1.00

EDCI 52003 - Theories And Trends In Curriculum And Instruction

Credit Hours: 3.00. This course focuses on current theories and trends influencing curriculum and instruction. A theory is a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena. It is a belief, policy, or procedure proposed or followed as the basis of action. A trend, on the other hand, is a pattern of gradual change in a condition, output, or process. It reflects a general tendency of a series of moves in a certain direction over time. We will focus on understanding sources of current theories and trends and how they may influence work in curriculum and instruction. Permission of department required.

Learning Outcomes: 1. Examine and clarify the educational beliefs, values, and knowledge guiding your curricular and instructional decisions. 2. Utilize and evaluate multiple appropriate sources in researching current curriculum and instruction trends and issues. 3. Interpret, critique, and synthesize relevant research related to current curriculum and instruction trends. 4. Assess the implications of research relative to your curricular and instructional practices. 5. Interpret, critique, and synthesize relevant educational theories related to current curriculum and instruction trends. 6. Assess the implications of educational theories relative to your curricular and instructional practices. 7. Interpret, critique, and synthesize relevant state and national policy decisions related to current curriculum and instruction trends. 8. Assess the implications of state and national policy decisions relative to your curricular and instructional practices. 9. Communicate effectively in oral and written formats. 10. Demonstrate the disposition for life-long learning and continuous professional development. 11. Identify communities of practice within discipline and participate within these communities according to the ethical standards of the discipline. 12. Examine and clarify how your educational beliefs, values, and knowledge guide your curricular and

instructional decisions address the diversity of students, schools, and communities. 13. Advocate for values of diversity, inclusivity, and social justice. Credits: 3.00

EDCI 52004 - Teachers As Leaders

Credit Hours: 3.00. This course focuses on teacher leadership in instruction. Participants will examine the history of teacher leadership. Instructional coaching models will be examined and compared. Students will identify the various theories that support each coaching model and examine what is most present in their school contexts. Permission of department required.

Learning Outcomes: 1. Investigate the construct of school leadership. 2. Evaluate potential leadership roles in classrooms, schools, or other organizations. 3. Research teacher leadership praxis to impact future praxis. 4. Synthesize leadership research in conjunction with theories of social justice and equity. 5. Analyze the skills of effective teacher leadership through collaboration and inquiry. 6. Explore the critical role teachers play in creating conditions for continuous and systematic improvements in education. Credits: 3.00

Educational Technology Courses (12 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate,

collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

Selective (3 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education

and Instructional Design. Credits: 3.00

EDPS 55500 - Differentiating Curriculum & Instruction

Credit Hours: 3.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online class meetings and discussions, case studies, differentiated instruction examples, direct application, and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative, and summative assessments to inform instructional decision-making; and c) flexible grouping; addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn and are motivated; understanding that the process of differentiation involves modifying content, process, product, learning environment, and/or affect; incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development; understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (RTI), and Multi-Tiered System of Support (MTSS).

Learning Outcomes: 1. Deconstruct the concept of differentiation as a response to the readiness levels; interests; learning preferences and strengths; and academic, social, emotional needs of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Assess students' readiness, interests, and learning profiles to create differentiated lessons that utilize instructional strategies and technologies that motivate and engage students in learning, including those from special populations. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and your plan to implement differentiation knowledge and skills gained in this course. Credits: 3.00

Portfolio Course (1 credit)

EDCI 68000 - Curriculum & Instruction MS Portfolio

Credit Hours: 1.00. This course was created to help guide C&I students near completion of their coursework to develop their competency portfolio. A competency portfolio reflects the depth and breadth of a student's educational growth since entering the graduate program. The purpose of the C&I competency portfolio is to demonstrate that students have mastered the graduate competencies for the C&I online Master's program. The portfolio will contain student projects aligned with C&I competencies and will be reviewed by committee members. The competencies are based on the Curriculum & Instruction departmental competencies and several program-specific competencies. The competency portfolio is a requirement for graduation from the C&I Master's program. (Multiple media are welcome.) Permission of department required.

Learning Outcomes: 1. Develop an online version of your competency portfolio based on artifacts as evidence. 2. Compose reflective narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00

Capstone Course (3 credits)

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department

required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders. Credits: 3.00

GPA Requirements

Curriculum and Instruction: English Education Concentration, MSED or MS or EDS

About the Program

Program Requirements

Required Courses (15 credits)

Core Courses (9 credits)

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

Selectives (6 credits)

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDST 60000 - Seminar In The Foundations Of Education

Credit Hours: 3.00. Recommended for those who have had a prior foundations course. Specialized studies in such areas as educational history, educational philosophy, educational sociology, religion and public education, current educational issues, and classical literature of education.

Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and

philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

Literacy and Language English Electives (9 credits)

Electives (0-6 credits)

Thesis Research (3-6 credits)

EDCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Curriculum and Instruction: English Language Learning Concentration, MSED

About the Program

Program Requirements

Required Courses (26 credits)

Core Courses (11 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is

designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

EDCI 52001 - Curriculum And Instruction Online MS Seminar I

Credit Hours: 1.00. This boot camp is designed to help you to understand the knowledge and skills necessary for your

successful online learning in the Curriculum and Instruction program. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn about various learning strategies and online resources that you can utilize in your courses. In this seminar, you will be responsible for completing all assignments on time over the course of the semester. Read the guidelines for each week and complete the assignments. NOTE: This course is a core course in the C&I online masters program. A grade of B- or better is required (if a lower grade is received, the course must be retaken). Permission of department required.

Learning Outcomes: 1. Exhibit knowledge of academic integrity by completing plagiarism, statement of commitment, and APA tutorials. 2. Effectively explain your professional goals for the program by writing an initial reflection. 3. Identify essential components of the Curriculum and Instruction Handbook, including what is required for the final portfolio. 4. Develop and apply group project skills and management techniques to make you successful in future courses and your career. 5. Demonstrate digital skills and competence with various digital tools (i.e., blogs, screencasting, Google docs, file sharing). 6. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 1.00

EDCI 52002 - Curriculum And Instruction Online MS Seminar II

Credit Hours: 1.00. This seminar is designed to help you to understand the knowledge and skills necessary for your success throughout the Curriculum and Instruction program. In addition to providing you with information that will help you succeed in the program, you are also asked to think about ways to make yourself more marketable to current and future employers. Permission of department required.

Learning Outcomes: 1. Investigate the skills and knowledge needed to be successful in a relevant career within the C&I field. 2. Describe program and career goals. 3. Apply research skills required to compose an annotated bibliography. 4. Create the foundation of a C&I portfolio displaying programmatic achievements and course competencies. Credits: 1.00

EDCI 52003 - Theories And Trends In Curriculum And Instruction

Credit Hours: 3.00. This course focuses on current theories and trends influencing curriculum and instruction. A theory is a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena. It is a belief, policy, or procedure proposed or followed as the basis of action. A trend, on the other hand, is a pattern of gradual change in a condition, output, or process. It reflects a general tendency of a series of moves in a certain direction over time. We will focus on understanding sources of current theories and trends and how they may influence work in curriculum and instruction. Permission of department required.

Learning Outcomes: 1. Examine and clarify the educational beliefs, values, and knowledge guiding your curricular and instructional decisions. 2. Utilize and evaluate multiple appropriate sources in researching current curriculum and instruction trends and issues. 3. Interpret, critique, and synthesize relevant research related to current curriculum and instruction trends. 4. Assess the implications of research relative to your curricular and instructional practices. 5. Interpret, critique, and synthesize relevant educational theories related to current curriculum and instruction trends. 6. Assess the implications of educational theories relative to your curricular and instructional practices. 7. Interpret, critique, and synthesize relevant state and national policy decisions related to current curriculum and instruction trends. 8. Assess the implications of state and national policy decisions relative to your curricular and instructional practices. 9. Communicate effectively in oral and written formats. 10. Demonstrate the disposition for life-long learning and continuous professional development. 11. Identify communities of practice within discipline and participate within these communities according to the ethical standards of the discipline. 12. Examine and clarify how your educational beliefs, values, and knowledge guide your curricular and

instructional decisions address the diversity of students, schools, and communities. 13. Advocate for values of diversity, inclusivity, and social justice. Credits: 3.00

EDCI 52004 - Teachers As Leaders

Credit Hours: 3.00. This course focuses on teacher leadership in instruction. Participants will examine the history of teacher leadership. Instructional coaching models will be examined and compared. Students will identify the various theories that support each coaching model and examine what is most present in their school contexts. Permission of department required.

Learning Outcomes: 1. Investigate the construct of school leadership. 2. Evaluate potential leadership roles in classrooms, schools, or other organizations. 3. Research teacher leadership praxis to impact future praxis. 4. Synthesize leadership research in conjunction with theories of social justice and equity. 5. Analyze the skills of effective teacher leadership through collaboration and inquiry. 6. Explore the critical role teachers play in creating conditions for continuous and systematic improvements in education. Credits: 3.00

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders. Credits: 3.00

ELL Courses (15 credits)

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language

learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

Portfolio Course (1 credit)

EDCI 68000 - Curriculum & Instruction MS Portfolio

Credit Hours: 1.00. This course was created to help guide C&I students near completion of their coursework to develop their competency portfolio. A competency portfolio reflects the depth and breadth of a student's educational growth since entering the graduate program. The purpose of the C&I competency portfolio is to demonstrate that students have mastered the graduate competencies for the C&I online Master's program. The portfolio will contain student projects aligned with C&I competencies and will be reviewed by committee members. The competencies are based on the Curriculum & Instruction departmental competencies and several program-specific competencies. The competency portfolio is a requirement for graduation from the C&I Master's program. (Multiple media are welcome.) Permission of department required.

Learning Outcomes: 1. Develop an online version of your competency portfolio based on artifacts as evidence. 2. Compose reflective narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00

Capstone Course (3 credits)

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders. Credits: 3.00

GPA Requirements

Curriculum and Instruction: Gifted, Creative, and Talented Studies Concentration, MSED

About the Program

Program Requirements

Required Courses (23 credits)

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting

gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54200 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to the curriculum development and program design for meeting the needs of gifted, creative, and talented students. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students.

Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Learning Outcomes: 1. Measure and evaluate one's professional growth and case conceptualization skills through use of audio tapes and case notes. 2. Demonstrate respect, understanding, and tolerance of multicultural and diversity issues as they relate to clients' need and concerns. 3. Demonstrate ethical and professional behavior in accord with the ACA Code of Ethics. Credits: 1.00 to 10.00

Core Courses (11 credits)

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 52001 - Curriculum And Instruction Online MS Seminar I

Credit Hours: 1.00. This boot camp is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Curriculum and Instruction

program. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn about various learning strategies and online resources that you can utilize in your courses. In this seminar, you will be responsible for completing all assignments on time over the course of the semester. Read the guidelines for each week and complete the assignments. NOTE: This course is a core course in the C&I online masters program. A grade of B- or better is required (if a lower grade is received, the course must be retaken). Permission of department required.

Learning Outcomes: 1. Exhibit knowledge of academic integrity by completing plagiarism, statement of commitment, and APA tutorials. 2. Effectively explain your professional goals for the program by writing an initial reflection. 3. Identify essential components of the Curriculum and Instruction Handbook, including what is required for the final portfolio. 4. Develop and apply group project skills and management techniques to make you successful in future courses and your career. 5. Demonstrate digital skills and competence with various digital tools (i.e., blogs, screencasting, Google docs, file sharing). 6. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 1.00

EDCI 52002 - Curriculum And Instruction Online MS Seminar II

Credit Hours: 1.00. This seminar is designed to help you to understand the knowledge and skills necessary for your success throughout the Curriculum and Instruction program. In addition to providing you with information that will help you succeed in the program, you are also asked to think about ways to make yourself more marketable to current and future employers. Permission of department required.

Learning Outcomes: 1. Investigate the skills and knowledge needed to be successful in a relevant career within the C&I field. 2. Describe program and career goals. 3. Apply research skills required to compose an annotated bibliography. 4. Create the foundation of a C&I portfolio displaying programmatic achievements and course competencies. Credits: 1.00

EDCI 52003 - Theories And Trends In Curriculum And Instruction

Credit Hours: 3.00. This course focuses on current theories and trends influencing curriculum and instruction. A theory is a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena. It is a belief, policy, or procedure proposed or followed as the basis of action. A trend, on the other hand, is a pattern of gradual change in a condition, output, or process. It reflects a general tendency of a series of moves in a certain direction over time. We will focus on understanding sources of current theories and trends and how they may influence work in curriculum and instruction. Permission of department required.

Learning Outcomes: 1. Examine and clarify the educational beliefs, values, and knowledge guiding your curricular and instructional decisions. 2. Utilize and evaluate multiple appropriate sources in researching current curriculum and instruction trends and issues. 3. Interpret, critique, and synthesize relevant research related to current curriculum and instruction trends. 4. Assess the implications of research relative to your curricular and instructional practices. 5. Interpret, critique, and synthesize relevant educational theories related to current curriculum and instruction trends. 6. Assess the implications of educational theories relative to your curricular and instructional practices. 7. Interpret, critique, and synthesize relevant state and national policy decisions related to current curriculum and instruction trends. 8. Assess the implications of state and national policy decisions relative to your curricular and instructional practices. 9. Communicate effectively in oral and written formats. 10. Demonstrate the disposition for life-long learning and continuous professional development. 11. Identify communities of practice within discipline and participate within these communities according to the ethical standards of the discipline. 12. Examine and clarify how your educational beliefs, values, and knowledge guide your curricular and

instructional decisions address the diversity of students, schools, and communities. 13. Advocate for values of diversity, inclusivity, and social justice. Credits: 3.00

EDCI 52004 - Teachers As Leaders

Credit Hours: 3.00. This course focuses on teacher leadership in instruction. Participants will examine the history of teacher leadership. Instructional coaching models will be examined and compared. Students will identify the various theories that support each coaching model and examine what is most present in their school contexts. Permission of department required.

Learning Outcomes: 1. Investigate the construct of school leadership. 2. Evaluate potential leadership roles in classrooms, schools, or other organizations. 3. Research teacher leadership praxis to impact future praxis. 4. Synthesize leadership research in conjunction with theories of social justice and equity. 5. Analyze the skills of effective teacher leadership through collaboration and inquiry. 6. Explore the critical role teachers play in creating conditions for continuous and systematic improvements in education. Credits: 3.00

Gifted, Creative, and Talented Courses (12 credits)

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54200 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to the curriculum development and program design for meeting the needs of gifted, creative, and talented students. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students.

Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs

of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Learning Outcomes: 1. Measure and evaluate one's professional growth and case conceptualization skills through use of audio tapes and case notes. 2. Demonstrate respect, understanding, and tolerance of multicultural and diversity issues as they relate to clients' need and concerns. 3. Demonstrate ethical and professional behavior in accord with the ACA Code of Ethics. Credits: 1.00 to 10.00

Selective (3 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and

integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDPS 55500 - Differentiating Curriculum & Instruction

Credit Hours: 3.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online class meetings and discussions, case studies, differentiated instruction examples, direct application, and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative, and summative assessments to inform instructional decision-making; and c) flexible grouping; addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn and are motivated;

understanding that the process of differentiation involves modifying content, process, product, learning environment, and/or affect; incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development; understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (RTI), and Multi-Tiered System of Support (MTSS).

Learning Outcomes: 1. Deconstruct the concept of differentiation as a response to the readiness levels; interests; learning preferences and strengths; and academic, social, emotional needs of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Assess students' readiness, interests, and learning profiles to create differentiated lessons that utilize instructional strategies and technologies that motivate and engage students in learning, including those from special populations. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and your plan to implement differentiation knowledge and skills gained in this course. Credits: 3.00

Portfolio Course (1 credit)

EDCI 68000 - Curriculum & Instruction MS Portfolio

Credit Hours: 1.00. This course was created to help guide C&I students near completion of their coursework to develop their competency portfolio. A competency portfolio reflects the depth and breadth of a student's educational growth since entering the graduate program. The purpose of the C&I competency portfolio is to demonstrate that students have mastered the graduate competencies for the C&I online Master's program. The portfolio will contain student projects aligned with C&I competencies and will be reviewed by committee members. The competencies are based on the Curriculum & Instruction departmental competencies and several program-specific competencies. The competency portfolio is a requirement for graduation from the C&I Master's program. (Multiple media are welcome.) Permission of department required.

Learning Outcomes: 1. Develop an online version of your competency portfolio based on artifacts as evidence. 2. Compose reflective narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00

Capstone Course (3 credits)

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders.

Credits: 3.00

GPA Requirements

Curriculum and Instruction: Integrated STEM Education Concentration, MSED

About the Concentration

Required Courses (12 credits)

EDCI 54900 - Assessment In STEM Education

Credit Hours: 3.00. This course is designed to help teachers of STEM recognize the link between productive assessment and productive instruction, using the STEM education standards for teacher competence in educational assessment. This course is designed to help teachers meet those professional standards and understand the public pressure as well as instructional need for effective formative and summative assessment.

Learning Outcomes: 1. Choose appropriate assessment methods. 2. Develop appropriate assessment methods. 3. Administer scoring and interpreting assessment results. 4. Use assessment results to make decisions about individual students, plan teaching and develop curriculum. 5. Communicate assessment results to students, parents, and other educators. 6. Recognize inappropriate assessment methods and uses of assessment information. Credits: 3.00

EDCI 53900 - Introduction To K-12 Integrated Science, Technology, Engineering And Mathematics (STEM) Education

Credit Hours: 3.00. This course will provide students with a conceptual understanding of integrated K-12 Science, Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDCI 55850 - Introduction To Teaching Engineering And Technology Design In The Context Of K-12 Integrated STEM

Credit Hours: 3.00. Engineering and technology design has gained considerable traction in many K-12 schools. In this course, we will examine principals of engineering design and technology as well as where and how engineering and technology design best fits in a K-12 integrated STEM curriculum. Course participants will engage in authentic engineering and technology design experiences. Course participants will also design, develop, deliver integrated lessons that help K-12 students develop the knowledge, skills, and practices of engineering and technology design.

Learning Outcomes: 1. Demonstrate a broad understanding of engineering and technology education disciplines and concepts. 2. Scaffold engineering practices that support diverse learners and describe conceptual understanding and content knowledge of engineering and technology design skills through problem-based learning in i-STEM environments. 3. Comprehend and elaborate data-driven decision-making skills as practiced by engineering and technology professionals to develop solutions to design briefs that support K-12 learning in diverse learning environments. 4. Examine and evaluate the engineering design process in the context of integrated STEM education at the K-12 learning. 5. Collaborate and prepare pedagogical practices in integrated engineering and technology design through integrated STEM that support K-12 learning for a diverse group of learners. Credits: 3.00

Curriculum and Instruction: Learning Design and Technology Concentration, MSED or MS

About the Program

Program Requirements

Required Courses (24 credits)

Prerequisite Courses (0-9 credits)

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of learning systems design to real-world educational situations through the in-depth consideration of key instructional design

processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

Core Courses (24 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 57300 - Instructional Development Practicum

Credit Hours: 2.00 or 3.00. Provides supervised field experience in programs involving instructional design development activities. Students participate in ongoing projects in the design, development, and evaluation of instructional materials and training programs in business and industry, medical facilities, or other settings deemed appropriate. Recommended prerequisites: EDCI 56900, EDCI 57200, and EDCI 67200. Permission of instructor required.

Learning Outcomes: 1. Design, develop, and evaluate a major instructional design project within a professional work setting/environment.

2. Create and manage an instructional design project within a professional setting following a specific timeline. Management of the process may require collaboration with supervisors, subject matter experts, and others to complete the project in the most effective manner. Credits: 2.00 or 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

EDCI 66000 - Learning Design And Technology Seminar

Credit Hours: 1.00. This course is an investigation of trends, developments, and issues in learning design and technology with a focus on current practices, problems, and research. This one-credit seminar is designed to help students learn about applications of instructional design and educational technology in various settings and to interact with faculty and guest speakers about topics related to the field and the LDT program.

Learning Outcomes: 1. Become familiar with resources available to support progression through your LDT graduate program. 2. Learn the specifics of the program and its requirements, including reviewing targeted learning competencies, portfolio requirements, program faculty, and the graduate handbook. 3. Identify and work towards fulfilling short and long-term professional goals. 4. Identify a career pathway that is appropriate for you including the skills, knowledge, and attitudes you will need to be successful. 5. Gain real-world insights into LDT field. Credits: 1.00

EDCI 67000 - Learning Design And Technology Portfolio

Credit Hours: 1.00 to 2.00. This course was created to help guide LDT students near completion of their coursework to develop their competency portfolio. The competency portfolio is a requirement for graduation from the traditional LDT Master's program.

Learning Outcomes: 1. Develop an electronic version of your competency portfolio based on artifacts as evidence. 2. Compose narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00 or 2.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of learning systems design to real-world educational situations through the in-depth consideration of key instructional design processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a

case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

Selectives (9 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 53300 - Teaching And Learning Number And Operations

Credit Hours: 3.00. This course is designed to provide opportunities for mathematics educators to develop understanding of teaching and learning in the domain of number and operation. Central to this work is the construction of models of learners' understanding of number and operation and the use of those models to build and select curriculum. While curricular efforts have historically taken as central a formal view of mathematics and its construction, more recently curriculum has been written to engage learners and to build from knowledge of learners' understanding. In this course we will develop models of learner's understandings of different facets of number and operation and then use those models and our emerging understanding of curriculum to explore challenges in teaching and learning.

Learning Outcomes: 1. Develop models of learner's understandings of number and operation. 2. Use models of learner's understandings of number and operation to design and select appropriate and productive learning opportunities. 3. Develop knowledge of key curricular development in mathematics education in the United States. 4. Associate teaching and curriculum with understandings of

number and operation they might generate. 5. Use technology to support the development of ideas in number and operation. 6. Synthesize existing research to support inquiry in the teaching and learning of number operation. Credits: 3.00

EDCI 55600 - Educational Video Game Design

Credit Hours: 3.00. Designed to provide an introduction to the design of educational video games. The focus of the course is on two areas: 1) the learning, instructional design, and game design theories which can inform the design of effective and engage in educational video games, and 2) how to apply those theories within practical settings.

Learning Outcomes: 1. Become comfortable with the history, concepts, terminology, culture, and classification of educational video and computer games. 2. Explore current research on educational computer and video games. 3. Examine learning, instructional design, and game design theories for relevance to the design of educational computer and video games. 4. Apply theory be designing, developing, and implementing a prototype of an educational computer or video game as teams. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational

computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 56800 - Partnering With Web-Based Tools For Learner Centered Environments

Credit Hours: 3.00. Provides an in-depth look at Web-based digital tools for teaching and learning, with a focus on learner-centered activities and environments. Emphasis is given to applying the knowledge and skills necessary to create a Web-based, student-centered lesson/unit that provides diverse learners with opportunities for formal and informal learning. Course content is applicable to both independent and collaborative learning, as well as use of the Web as the sole educational delivery system or in combination with other approaches, including traditional classroom instruction.

Learning Outcomes: 1. Create a personal vision of 21st century schools or workplace and a personal definition of a 21st century learner. 2. Examine, in depth, a specific student-centered approach (e.g. project-based learning, problem-based learning, inquiry learning, authentic instruction, etc.) and discuss the similarities and differences among different approaches. 3. Create a video tutorial that teaches others how to use a specific Web 2.0 tool. 4. Design a learner-centered lesson that incorporates relevant Web 2.0 tools for the purpose of broadening and/or deepening students' understanding of specific curricular content. 5. Develop an implementation plan and create appropriate assessment measures to determine student learning in your own learner-centered lesson. Credits: 3.00

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of

learning systems design to real-world educational situations through the in-depth consideration of key instructional design processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

Curriculum and Instruction: Learning Design and Technology Concentration, MSED or MS (OL)

About the Program

Program Requirements

Required Courses (26 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 57300 - Instructional Development Practicum

Credit Hours: 2.00 or 3.00. Provides supervised field experience in programs involving instructional design development activities. Students participate in ongoing projects in the design, development, and evaluation of instructional materials and training programs in business and industry, medical facilities, or other settings deemed appropriate. Recommended prerequisites: EDCI 56900, EDCI 57200, and EDCI 67200. Permission of instructor required.

Learning Outcomes: 1. Design, develop, and evaluate a major instructional design project within a professional work setting/environment. 2. Create and manage an instructional design project within a professional setting following a specific timeline. Management of the process may require collaboration with supervisors, subject matter experts, and others to complete the project in the most effective manner. Credits: 2.00 or 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of learning systems design to real-world educational situations through the in-depth consideration of key instructional design processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a

case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

EDCI 60001 - Intro To Demonstrating Professional Competencies In LDT

Credit Hours: 1.00. This course is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Learning Design and Technology program, with a focus on the process of earning digital badges aligned with professional competencies. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn and apply the process of both earning digital badges within the program and evaluating your peers' work as part of the badge earning process.

Learning Outcomes: 1. Students will learn the specifics of the LDT Master's program and its requirements familiarize yourself with resources, review targeted learning competencies, and program requirements. 2. Students will examine skills and approaches to obtain competency badges critical to your success as a student in the online program, including peer review, self-editing, effective time management, avoiding plagiarism, utilizing proper online etiquette and incorporating a positive disposition in your interactions with peer students, faculty and staff. 3. Students will become familiar with the badge earning process in LDT and progress in earning your first digital badges. Credits: 1.00

EDCI 60003 - LDT Professional Competencies Portfolio

Credit Hours: 1.00. This course will focus on completion of the competency portfolio reflecting on the depth and breadth of your educational growth since entering the Master's program. The purpose of the LDT competency portfolio is to demonstrate that you have mastered the graduate competencies. The portfolio will contain student evidence aligned with LDT competencies and will be reviewed by your committee. The completed competency portfolio is a requirement for graduation from the LDT Master's program. Prerequisites: EDCI 60001 and 60002.

Learning Outcomes: 1. Finalize students' competency-based portfolio. 2. Compose reflective narratives on Professional Foundations of LDT, Planning and Analysis, Design and Development, and Evaluation and Implementation. 3. Update and finalize resume or vita suitable for job searching. Credits: 1.00

Technology Selective (3-6 credits)

EDCI 55600 - Educational Video Game Design

Credit Hours: 3.00. Designed to provide an introduction to the design of educational video games. The focus of the course is on two areas: 1) the learning, instructional design, and game design theories which can inform the design of effective and engage in educational video games, and 2) how to apply those theories within practical settings.

Learning Outcomes: 1. Become comfortable with the history, concepts, terminology, culture, and classification of educational video and computer games. 2. Explore current research on educational computer and video games. 3. Examine learning, instructional design, and game design theories for relevance to the design of educational computer and video games. 4. Apply theory be designing, developing, and implementing a prototype of an

educational computer or video game as teams. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

General Selective (0-3 credits)

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common

distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDCI 63300 - Instructional Design Project Management

Credit Hours: 3.00. This course focuses on the application of project management ideas, concepts, and strategies in instructional design settings. Students will be asked to consider the relationship between instructional design and project management, tools that can assist with managing instructional design projects, and factors influencing the instructional design project management process. Students will explore these topics by creating deliverables for instructional design cases and other interactive assignments.

Learning Outcomes: 1. Explain and reflect upon common project management terminology's role in instructional design projects. 2. Analyze and articulate the relationship between project management and instructional design. 3. Propose and/or develop relevant intervention strategies (instructional design and project management) to real-world instructional design issues that are consistent with arguments and evidence presented. 4. Integrate project management technologies and tools in the development of instructional design project management. 5. Interpret the role of interpersonal skills in and factors impacting project management instructional design initiatives. Credits: 3.00

Curriculum and Instruction: Literacy and Language Education Concentration, MSED or MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (15 credits)

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs

of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural

theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

Literacy and Language Electives (9 credits)

Electives (0-6 credits)

Thesis Research (6 credits)

Curriculum and Instruction: Mathematics Education Concentration, MSED or MS or PHD

About the Program

Program Requirements

Required Courses (26 credits)

Core Courses (11 credits)

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.
Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 52001 - Curriculum And Instruction Online MS Seminar I

Credit Hours: 1.00. This boot camp is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Curriculum and Instruction program. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn about various learning strategies and online resources that you can utilize in your courses. In this seminar, you will be responsible for completing all assignments on time over the course of the semester. Read the guidelines for each week and complete the assignments. NOTE: This course is a core course in the C&I online masters program. A grade of B- or better is required (if a lower grade is received, the course must be retaken). Permission of department required.
Learning Outcomes: 1. Exhibit knowledge of academic integrity by completing plagiarism, statement of commitment, and APA tutorials. 2. Effectively explain your professional goals for the program by writing an initial reflection. 3. Identify essential components of the Curriculum and Instruction Handbook, including what is required for the final portfolio. 4. Develop and apply group project skills and management techniques to make you successful in future courses and your career. 5. Demonstrate digital skills and competence with various digital tools (i.e., blogs, screencasting, Google docs, file sharing). 6. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 1.00

EDCI 52002 - Curriculum And Instruction Online MS Seminar II

Credit Hours: 1.00. This seminar is designed to help you to understand the knowledge and skills necessary for your success throughout the Curriculum and Instruction program. In addition to providing you with information that will help you succeed in the program, you are also asked to think about ways to make yourself more marketable to current and future employers. Permission of department required.
Learning Outcomes: 1. Investigate the skills and knowledge needed to be successful in a relevant career within the C&I field. 2. Describe program and career goals. 3. Apply research skills required to compose an annotated bibliography. 4. Create the foundation of a C&I portfolio displaying programmatic achievements and course competencies. Credits: 1.00

EDCI 52003 - Theories And Trends In Curriculum And Instruction

Credit Hours: 3.00. This course focuses on current theories and trends influencing curriculum and instruction. A theory is a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena. It is a belief, policy, or procedure proposed or followed as the basis of action. A trend, on the other hand, is a pattern of gradual change in a condition, output, or process. It reflects a general tendency of a series of moves in a certain direction over time. We will focus on understanding sources of current theories and trends and how they may influence work in curriculum and instruction. Permission of department required.

Learning Outcomes: 1. Examine and clarify the educational beliefs, values, and knowledge guiding your curricular and instructional decisions. 2. Utilize and evaluate multiple appropriate sources in researching current curriculum and instruction trends and issues. 3. Interpret, critique, and synthesize relevant research related to current curriculum and instruction trends. 4. Assess the implications of research relative to your curricular and instructional practices. 5. Interpret, critique, and synthesize relevant educational theories related to current curriculum and instruction trends. 6. Assess the implications of educational theories relative to your curricular and instructional practices. 7. Interpret, critique, and synthesize relevant state and national policy decisions related to current curriculum and instruction trends. 8. Assess the implications of state and national policy decisions relative to your curricular and instructional practices. 9. Communicate effectively in oral and written formats. 10. Demonstrate the disposition for life-long learning and continuous professional development. 11. Identify communities of practice within discipline and participate within these communities according to the ethical standards of the discipline. 12. Examine and clarify how your educational beliefs, values, and knowledge guide your curricular and instructional decisions address the diversity of students, schools, and communities. 13. Advocate for values of diversity, inclusivity, and social justice. Credits: 3.00

EDCI 52004 - Teachers As Leaders

Credit Hours: 3.00. This course focuses on teacher leadership in instruction. Participants will examine the history of teacher leadership. Instructional coaching models will be examined and compared. Students will identify the various theories that support each coaching model and examine what is most present in their school contexts. Permission of department required.

Learning Outcomes: 1. Investigate the construct of school leadership. 2. Evaluate potential leadership roles in classrooms, schools, or other organizations. 3. Research teacher leadership praxis to impact future praxis. 4. Synthesize leadership research in conjunction with theories of social justice and equity. 5. Analyze the skills of effective teacher leadership through collaboration and inquiry. 6. Explore the critical role teachers play in creating conditions for continuous and systematic improvements in education. Credits: 3.00

Mathematics Education Courses (15 credits)

EDCI 53300 - Teaching And Learning Number And Operations

Credit Hours: 3.00. This course is designed to provide opportunities for mathematics educators to develop understanding of teaching and learning in the domain of number and operation. Central to this work is the construction of models of learners' understanding of number and operation and the use of those models to build and select curriculum. While curricular efforts have historically taken as central a formal view of mathematics and its construction, more recently curriculum has been written to engage learners and to build from knowledge of learners' understanding. In this course we will develop models of learner's understandings of different facets of number and operation and then use those models and our emerging understanding of curriculum to explore challenges in teaching and learning.

Learning Outcomes: 1. Develop models of learner's understandings of number and operation. 2. Use models of learner's

understandings of number and operation to design and select appropriate and productive learning opportunities. 3. Develop knowledge of key curricular development in mathematics education in the United States. 4. Associate teaching and curriculum with understandings of number and operation they might generate. 5. Use technology to support the development of ideas in number and operation. 6. Synthesize existing research to support inquiry in the teaching and learning of number operation. Credits: 3.00

EDCI 53400 - Teaching And Learning Geometry And Measurement

Credit Hours: 3.00. This course is designed to provide opportunities for mathematics educators to develop understanding of teaching and learning in the related domains of geometry and measurement. Central to this work is the construction of models of learners' understandings of geometry and measurement and the use of models to design instruction. Geometry, as a discipline in school mathematics, has historically and more currently been debated. In this course we will explore research in the teaching and learning of geometry and measurement. A synthesis of select literature will inform our efforts to develop models of learners' geometric reasoning and understanding of measurement. We will move past the development of models to the design of instruction meant to support understandings of concepts that utilizes technology.

Learning Outcomes: 1. Develop models of learner's understanding of measurement and concepts in geometry. 2. Use models of learner's understanding to design and select appropriate and productive learning opportunities. 3. Develop knowledge of the history of geometry as a school mathematics subject in the United States. 4. Develop and articulate a perspective on teaching and learning geometry and measurement with technology. 5. Synthesize existing research to support inquiry in the teaching and learning of geometry and measurement. Credits: 3.00

EDCI 53500 - Teaching And Learning Algebra And Functions

Credit Hours: 3.00. This is a course for current or prospective mathematics teachers wishing to explore ways of teaching algebra with a focus on addressing concerns related to student performance in algebra and increasing algebraic reasoning skills in the classroom. The course includes experiences with inquiry-based learning by engaging participants in algebra activities from two secondary National Council of Teachers of Mathematics (NCTM) standards-based curricula. The course will provide opportunities for participants to collaborate on the development of algebraic thinking in mathematics classrooms and will address pedagogical approaches to students' learning of algebra.

Learning Outcomes: 1. Content and pedagogical knowledge for teaching algebra. 2. Familiarity with NCTM standards-based mathematics curricular. 3. Disposition that values students' contributions and desires to motivate students to learn algebra using a variety of strategies, including engaging them in making sense of algebraic concepts and making use of their life experiences to find relevant contexts for algebra. Credits: 3.00

EDCI 53600 - Teaching And Learning Data Analysis And Probability

Credit Hours: 3.00. This course will provide opportunities for the growth of middle school mathematics teachers understanding of data analysis and probability as a means to help analyze and interpret experienced events. The course will address the following: selecting and using appropriate statistical methods to analyze data, developing and evaluating inferences and predictions that are based on data, and understanding and applying the basic concepts of probability. This course will also address pedagogical approaches to students' learning of data analysis and probability.

Learning Outcomes: 1. Employ research-based instructional strategies to develop statistical understanding in middle, secondary and tertiary settings, and for teacher professional development. 2. Develop tasks, questions, and lessons that can be used to assess as well as further develop students' understanding of statistics and probability. 3. Read and interpret research results and classroom-based articles that describe students' statistical and probabilistic reasoning. 4. Reflect on course readings and their practical teaching experience to consider how to best teach statistical and probability concepts. Credits: 3.00

EDCI 54800 - Teaching Mathematics To Diverse Learners

Credit Hours: 3.00. This course is designed to provide opportunities for in-service teachers to engage around issues of equity in mathematics education. Equity here is used as a broad construct intended to help us think about how to provide meaningful opportunities to learn for all the students in our mathematics classrooms. The notion of "diverse" here is also taken broadly. All students have special needs, but it is sometimes helpful to think about the needs of particular groups of students while at the same time avoiding reducing differences among students to stereotypes. Issues of diversity here include, but are not limited to race, culture, gender, disabilities, language, SES, and sexual orientation.

Learning Outcomes: 1. Increased awareness of diverse learners' challenges in mathematics education. 2. Developed discourse for equity issues in mathematics education. 3. Knowledge of strategies to facilitate diverse learners' mathematical learning. Credits: 3.00

EDCI 54900 - Assessment In STEM Education

Credit Hours: 3.00. This course is designed to help teachers of STEM recognize the link between productive assessment and productive instruction, using the STEM education standards for teacher competence in educational assessment. This course is designed to help teachers meet those professional standards and understand the public pressure as well as instructional need for effective formative and summative assessment.

Learning Outcomes: 1. Choose appropriate assessment methods. 2. Develop appropriate assessment methods. 3. Administer scoring and interpreting assessment results. 4. Use assessment results to make decisions about individual students, plan teaching and develop curriculum. 5. Communicate assessment results to students, parents, and other educators. 6. Recognize inappropriate assessment methods and uses of assessment information. Credits: 3.00

Selective (0-3 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such

technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDPS 55500 - Differentiating Curriculum & Instruction

Credit Hours: 3.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that

effectively meet the diverse needs of all learners. Through readings, online class meetings and discussions, case studies, differentiated instruction examples, direct application, and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative, and summative assessments to inform instructional decision-making; and c) flexible grouping; addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn and are motivated; understanding that the process of differentiation involves modifying content, process, product, learning environment, and/or affect; incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development; understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (RTI), and Multi-Tiered System of Support (MTSS).

Learning Outcomes: 1. Deconstruct the concept of differentiation as a response to the readiness levels; interests; learning preferences and strengths; and academic, social, emotional needs of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Assess students' readiness, interests, and learning profiles to create differentiated lessons that utilize instructional strategies and technologies that motivate and engage students in learning, including those from special populations. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and your plan to implement differentiation knowledge and skills gained in this course. Credits: 3.00

Portfolio Course (1 credit)

EDCI 68000 - Curriculum & Instruction MS Portfolio

Credit Hours: 1.00. This course was created to help guide C&I students near completion of their coursework to develop their competency portfolio. A competency portfolio reflects the depth and breadth of a student's educational growth since entering the graduate program. The purpose of the C&I competency portfolio is to demonstrate that students have mastered the graduate competencies for the C&I online Master's program. The portfolio will contain student projects aligned with C&I competencies and will be reviewed by committee members. The competencies are based on the Curriculum & Instruction departmental competencies and several program-specific competencies. The competency portfolio is a requirement for graduation from the C&I Master's program. (Multiple media are welcome.) Permission of department required.

Learning Outcomes: 1. Develop an online version of your competency portfolio based on artifacts as evidence. 2. Compose reflective narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00

Capstone Course (3 credits)

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical

practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders. Credits: 3.00

GPA Requirements

Curriculum and Instruction: Science Education Concentration, MSED or MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (13 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDCI 51000 - Colloquium In Science And Mathematics Education

Credit Hours: 1.00. Weekly colloquia on individual research topics of interest to science and mathematics education faculty and graduate students. Colloquia will describe research programs in education. Course will be required of first-year graduate students.

Credits: 1.00

EDCI 51700 - Survey Of Science Education

Credit Hours: 3.00. Introduction to current issues and research in science education, broadly organized under themes of learning, teaching, and science curriculum.

Credits: 3.00

EDCI 51800 - The Nature Of Science In Science Teaching

Credit Hours: 3.00. Explores philosophical issues related to the scientific enterprise, such as the production and validation of scientific knowledge; the role of the scientific community; and the influence of gender and culture on doing science. Also examines the implications of these issues for science teaching and learning, as well as for research in science education.

Learning Outcomes: 1. Develop an understanding of various philosophical positions on the nature of science. 2. Develop an understanding of your own views of the nature of science. 3. Develop an understanding of the roles of scientists, the greater society, culture, and gender in the creation and validation of scientific knowledge. 4. Develop an understanding of students' and teachers' ideas about the nature of science. 5. Develop an understanding of the implications of various perspectives on the nature of science teaching and learning. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other

fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

Science Education Selectives (6 credits)

CHM 61000 - Topics In Chemical Education

Credit Hours: 2.00 or 3.00. A variable topics course for graduate students in chemistry, chemical engineering, medicinal chemistry, and biochemistry. This course provides an overview of the literature in one of the areas of chemical education, such as: chemistry misconceptions and conceptual change; theories of learning, from Piaget and Vygotsky to radical constructivism; distributed cognition; and developing and assessing instructional materials. Offered in alternate years.

Credits: 2.00 or 3.00

EDCI 50600 - Environmental Education

Credit Hours: 3.00. Synthesis of philosophies, scientific principles and methods for environmental education programs in forests, camps, and schools. Students conduct and summarize literature research on scientific and educational principles. In interdisciplinary teams, they develop, implement, and evaluate curricula for schools, nature centers, interpretive and outdoor education programs.

Learning Outcomes: 1. Become knowledgeable of national environmental educational programs and curriculum. 2. Develop the knowledge and skills to plan, implement, and evaluate environmental education programs, curriculum and materials. 3. Develop an understanding about learners and pedagogical methods for teaching about the environment and assessing learners. Credits: 3.00

EDCI 51600 - Seminar In Environmental Education

Credit Hours: 3.00. The seminar covers current research and literature in environmental education, focusing on teaching children and adults about the environment. Topics vary by semester and student interest.

Learning Outcomes: 1. Develop an understanding of the research literature in environmental education pertaining to the topic of study. 2. Develop critical thinking and analysis skills for evaluating environmental education research, programs, and curriculum. 3. Develop an understanding of environmental issues. Credits: 3.00

EDCI 56700 - Action Research In Science Education

Credit Hours: 3.00. An introduction to various models and conceptions of teacher action research in science education. Students review literature on action research, participate in small research cohorts, and plan and conduct action research within their respective educational situations.

Learning Outcomes: 1. Develop an understanding of what action research is, how it is conducted, and what role it plays in the construction of teacher knowledge in science education. 2. Plan and conduct action research within your respective educational situation. 3. Examine various models for action research in pre-service, in-service, and independent projects in science education. 4. Gain insight into the role action research plays in science education and science teacher education. Credits: 3.00

EDCI 60500 - Teaching Integrated Science, Technology, Engineering And Math

Credit Hours: 3.00. Analysis of historical developments and present trends in science education; the designing, implementation, and evaluation of science programs; the role of research in present and future developments.

Learning Outcomes: 1. Identify, describe, and explain the fundamental tenets of different constructivist learning theories and their relevancy to STEM education. 2. Clarify and refine beliefs about teaching and learning in STEM education. 3. Identify and characterize students' ideas about STEM and how they influence learning. 4. Explore students' thinking and understanding of STEM through multiple strategies. 5. Describe ways to assess student learning in STEM. 6. Identify, practice, and reflect upon teaching strategies commensurate with teaching beliefs and knowledge about how

students learn STEM through an integrated approach. 7. Compare and evaluate curriculum resources for integrating STEM instruction. 8. Devise a comprehensive lesson plan for integrating STEM instruction based on science and engineering practices and teaching for all learners. 9. Teach and reflect upon an integrated STEM lesson employing multiple instructional strategies. 10. Evaluate student learning in the context of an integrated STEM lesson. Credits: 3.00

EDCI 61800 - Gender And Culture In Science Education

Credit Hours: 3.00. An examination of the different perspectives on issues of gender, culture, and science. Major topics include feminist critiques of scientific theories and methods, the work of women and minorities in science, the role science has played in the construction of race and gender, and topics in science education, such as girls' learning in science and the potential of inclusive practices in the science classroom. Prerequisite: EDCI 51800 or EDCI 58500 .

Learning Outcomes: 1. Develop an in-depth understanding of the role of gender and culture in science and science education. 2. Examine feminist and cross-cultural studies in science and science education. 3. Apply feminist and critical frameworks of analysis to various studies in science education. 4. Identify and evaluate the strengths and limitations of feminist and cultural critiques of science. 5. Synthesize related literature in an effort to gain in-depth knowledge about one or more areas of gender and culture in science and science education. Credits: 3.00

EDCI 61900 - Learning Science

Credit Hours: 3.00. The course provides a holistic study of how children and adults learn science; how the learner's ideas, ways of thinking, abilities to do science, and their attitudes towards and beliefs about science learning influence how they learn science.

Learning Outcomes: 1. Develop an increased understanding of the research literature in science education as it pertains to science learners. 2. Gain an appreciation of science learners and the different perspectives about how individuals learn science. 3. Apply science education research about science learners to instructional, curricular, and assessment development. Credits: 3.00

EDCI 62000 - Seminar In Mathematics Education

Credit Hours: 1.00 to 6.00. Selected topics in mathematics education. Typical topics considered are: (1) problem solving; (2) instructional strategies; (3) cognitive structure; (4) current curriculum; (5) current research. Permission of instructor required.

Learning Outcomes: 1. Examine, synthesize, and communicate a view of the state of mathematics education and situate one's research in it. 2. Create knowledge for the field of mathematics education and communicate findings to the professional community. 3. Communicate and act upon professional feedback in the processes of designing and conducting research and writing conference proposals and research reports. 4. Report on various stages and types of research (e.g., project design, data analysis, findings). Credits: 1.00 to 6.00

EDCI 53900 - Introduction To K-12 Integrated Science, Technology, Engineering And Mathematics (STEM) Education

Credit Hours: 3.00. This course will provide students with a conceptual understanding of integrated K-12 Science, Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching

and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

Science Elective (6 credits)

Curriculum and Instruction Elective (3 credits)

Thesis Research (0-6 credits)

EDCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Portfolio Research (0-6 credits)

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

Curriculum and Instruction: Special Education Concentration, MSED or MS (OL)

About the Program

Program Requirements

Required Courses (26 credits)

Core Courses (11 credits)

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 52001 - Curriculum And Instruction Online MS Seminar I

Credit Hours: 1.00. This boot camp is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Curriculum and Instruction program. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn about various learning strategies and online resources that you can utilize in your courses. In this seminar, you will be responsible for completing all assignments on time over the course of the semester. Read the guidelines for each week and complete the assignments. NOTE: This course is a core course in the C&I online masters program. A grade of B- or better is required (if a lower grade is received, the course must be retaken). Permission of department required.

Learning Outcomes: 1. Exhibit knowledge of academic integrity by completing plagiarism, statement of commitment, and APA tutorials. 2. Effectively explain your professional goals for the program by writing an initial reflection. 3. Identify essential components of the Curriculum and Instruction Handbook, including what is required for the final portfolio. 4. Develop and apply group project skills and management techniques to make you successful in future courses and your career. 5. Demonstrate digital skills and competence with various digital tools (i.e., blogs, screencasting, Google docs, file sharing). 6. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 1.00

EDCI 52002 - Curriculum And Instruction Online MS Seminar II

Credit Hours: 1.00. This seminar is designed to help you to understand the knowledge and skills necessary for your success throughout the Curriculum and Instruction program. In addition to providing you with information that will help you succeed in the program, you are also asked to think about ways to make yourself more marketable to current and future employers. Permission of department required.

Learning Outcomes: 1. Investigate the skills and knowledge needed to be successful in a relevant career within the C&I field. 2. Describe program and career goals. 3. Apply research skills required to compose an annotated bibliography. 4. Create the foundation of a C&I portfolio displaying programmatic achievements and course competencies. Credits: 1.00

EDCI 52003 - Theories And Trends In Curriculum And Instruction

Credit Hours: 3.00. This course focuses on current theories and trends influencing curriculum and instruction. A theory is a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena. It is a belief, policy, or procedure proposed or followed as the basis of action. A trend, on the other hand, is a pattern of gradual change in a condition, output, or process. It reflects a general tendency of a series of moves in a certain direction over time. We will focus on understanding sources of current theories and trends and how they may influence work in curriculum and instruction. Permission of department required.

Learning Outcomes: 1. Examine and clarify the educational beliefs, values, and knowledge guiding your curricular and instructional decisions. 2. Utilize and evaluate multiple appropriate sources in researching current curriculum and instruction trends and issues. 3. Interpret, critique, and synthesize relevant research related to current curriculum and instruction trends. 4. Assess the implications of research relative to your curricular and instructional practices. 5. Interpret, critique, and synthesize relevant educational theories related to current curriculum and instruction trends. 6. Assess the implications of educational theories relative to your curricular and instructional practices. 7. Interpret, critique, and synthesize relevant state and national policy decisions related to current curriculum and instruction trends. 8. Assess the implications of state and national policy decisions relative to your curricular and instructional practices. 9. Communicate effectively in oral and written formats. 10. Demonstrate the disposition for life-long learning and continuous professional development. 11. Identify communities of practice within discipline and participate within these communities according to the ethical

standards of the discipline. 12. Examine and clarify how your educational beliefs, values, and knowledge guide your curricular and instructional decisions address the diversity of students, schools, and communities. 13. Advocate for values of diversity, inclusivity, and social justice. Credits: 3.00

EDCI 52004 - Teachers As Leaders

Credit Hours: 3.00. This course focuses on teacher leadership in instruction. Participants will examine the history of teacher leadership. Instructional coaching models will be examined and compared. Students will identify the various theories that support each coaching model and examine what is most present in their school contexts. Permission of department required.

Learning Outcomes: 1. Investigate the construct of school leadership. 2. Evaluate potential leadership roles in classrooms, schools, or other organizations. 3. Research teacher leadership praxis to impact future praxis. 4. Synthesize leadership research in conjunction with theories of social justice and equity. 5. Analyze the skills of effective teacher leadership through collaboration and inquiry. 6. Explore the critical role teachers play in creating conditions for continuous and systematic improvements in education. Credits: 3.00

Special Education Courses (15 credits)

EDPS 51500 - Foundations Of Applied Behavioral Analysis In School Settings

Credit Hours: 3.00. Application of learning theory, measurement procedures, verification of functional relationships, and developing knowledge of current significant research in applied behavior analysis.

Learning Outcomes: 1. Introduced to specific methods and teaching strategies for working with children with emotional and behavioral disabilities. 2. Prepared to systematically monitor student performance. 3. Prepare teachers to devise and implement usable functional behavior analysis and behavior management plans for students with emotional and behavioral disabilities. Credits: 3.00

EDPS 56800 - Social, Legal, And Ethical Issues Across The Lifespan

Credit Hours: 3.00. Survey of difference and similarities of children with exceptionality, including their nature and characteristics related to their developmental and educational needs. Analysis and practical application of social, legal, and ethical issues in the field of special education.

Learning Outcomes: 1. Explain the historical perspectives and foundations of general and special education policy, current issues, and research (REPA 1.1, 1.2; CEC Int. 1.1; CEC Adv. 3.3, 4.2, 6.1). 2. Apply ethical guidelines, state and federal laws and policies, and utilize the rights, roles, and responsibilities of stakeholders and organizations concerning the education of students with exceptionalities (REPA 1.3, 1.4, 1.5; CEC Int. 1.1, 2.2; CEC Adv 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 3. Evaluate the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals from diverse groups. (REPA 2.8.; CEC Int. 1.2, 2.2; CEC Adv. 2.3, 3.2, 4.2, 5.2). 4. Examine the roles and responsibilities of team members (RtI, multidisciplinary, Case Conference Committee (CCC), families, student) to facilitate in developing, implementing, monitoring, and amending individualized programs for students with exceptionalities (IEPs, transition plans, health-care plans, and behavioral and academic intervention plans) setting goals, and monitoring progress toward goal each grading period. (REPA 4.3, 4.4, 4.5; CEC Int. 2.1, 2.2, 2.3, 7.1; CEC Adv. 4.2, 5.3). 5. Evaluate eligibility (including students from culturally and/or linguistically diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and

evaluating individualized learning objectives), and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with mild and/or intense exceptional needs. (REPA 4.1, 4.2, 4.7; CEC Int. 1.1, 1.2, 2.1, 2.3, 3.1, 3.2; CEC Adv 4.2, 5.1, 5.2). 6. Engage in professional development activities and professional organizations relevant to teaching students with exceptional needs, and knowledge of professional resources, organizations, and publications for enhancing one's professional skills and for engaging in lifelong professional development (REPA 10.4/10.5; CEC Int 1.2; CEC Adv. 5.4, 5.5, 6.4, 6.5). 7. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth (REPA 10.6/10.7; CEC Int 2.2, 2.3, 4.2, 5.1; CEC Adv. 6.3, 7.1). Credits: 3.00

EDPS 52400 - Effective Instruction For Students With Significant Reading Difficulties

Credit Hours: 3.00. This course will explore significant reading difficulties, such as dyslexia, and essential components of effective reading instruction. This course will investigate scientifically-based reading research (SBRR), evidence-based and developmentally appropriate reading instruction and interventions to support students with exceptionalities.

Learning Outcomes: 1. Identify the foundations of language acquisition and literacy development, including cognitive, linguistic, cultural, social, and motivational factors that affect language acquisition and literacy development; and major components of reading development, including phonemic awareness, phonics, fluency, vocabulary, and text comprehension. 2. Explore the history, origins, and underlying causes of significant reading difficulties, including dyslexia. 3. Synthesize principles of scientifically based reading research (SBRR) and evidence-based reading instruction and intervention, such as applying data-based decision making, setting individual student learning goals, and using instruction grounded in SBRR. 4. Explain key concepts of phonemic awareness: the critical role of phonemic awareness in learning to read an alphabetic language; the distinction between phonological awareness (i.e., the awareness that oral language is composed of smaller units, such as spoken words and syllables) and phonemic awareness (i.e., a specific type of phonological awareness involving the ability to distinguish the separate phonemes in spoken words); and knowledge of the continuum of phonological- and phonemic-awareness skills development. 5. Summarize key concepts of phonics in developing accurate decoding and automaticity in word recognition; the importance of sequencing phonics instruction according to the increasing complexity of linguistic units; the reciprocity between decoding and encoding; and the continuum of phonics skills. 6. Create SBRR-based, evidence-based, and developmentally appropriate assessment, instruction, intervention, or extension lesson plan, and ongoing progress monitoring in phonemic awareness, phonics, fluency, vocabulary and academic language, comprehension and analysis of informational, persuasive, and literary texts, including response to literature. Credits: 3.00

EDPS 52700 - Literacy Curricula For Learners With Exceptionalities

Credit Hours: 3.00. This course will explore research-supported general and specialized literacy curricula to prepare candidates to design and/or adapt instructional lessons and materials to meet the needs of students with exceptionalities.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 2. Evaluate research-supported instructional strategies and materials appropriate to the strengths, needs, and characteristics of students with exceptionalities within the areas of literacy development, reading fluency, concepts of vocabulary and academic language, and comprehension and analysis of informational, persuasive, and literary text. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and the students' learning environment. 4. Create lesson plans, based on national, state, and/or local curricula standards and the scope and sequence of grade-level/chronologically-aged appropriate general education content-area curriculum that incorporate UDL, research-supported instructional strategies and materials, and provide meaning-filled learning opportunities. 5. Design lesson plans that incorporate UDL and apply research-supported strategies to provide specially designed reading and writing instruction, including strategies for providing explicit and systematic instruction and strategies for using technology to support various aspects of the reading and writing process and include instructional and assistive strategies to teach students to monitor errors in reading comprehension and writing. 6. Evaluate instruction, monitor progress, and make instructional changes to support student learning. Credits: 3.00

EDPS 55800 - Transition Education And Services

Credit Hours: 3.00. This course will explore a variety of resources, strategies, and techniques for promoting successful life transitions for students with mild and intense intervention needs before and throughout the school years and into postsecondary and adult settings.

Learning Outcomes: 1. Apply ethical guidelines, state and federal transition laws and policies (REPA 9.6, 9.7; CEC Int 1.1, 2.3: CEC Adv 2.2, 2.3, 3.3, 4.1, 5.1, 5.2, 6.1) 2. Evaluate state, school, and private resources (e.g. Individual Family Service Plans, Medicaid Waivers, Vocational Rehabilitation, Special Needs Trusts, Issues of Guardianship, Bureau of Developmental Disability Services) that promote successful life transitions (REPA 9.6, 9.7; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 3. Examine the rights, roles, and responsibilities of stakeholders and organizational resources concerning the transition process of students with exceptionalities (REPA 1.3, 1.4, 1.5, 9.6, 9.7; CEC Int. 1.1, 2.2, 2.3; CEC Adv 2.2, 2.3, 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 4. Create a transition-related lesson/activity to support positive, life-long transition outcomes (REPA 3.9, 9.2, 9.4, 9.5; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 5. Apply strategies to collaborate effectively with general education teachers, support staff, families and community/organizational resources to identify services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and promote positive transition outcomes. (REPA 4.6, 4.8, 9.3, 9.4, 9.5; CEC Int 1.1, 1.2, 2.3, 3.2, 4.2, 4.3, 5.2, 7.1, 7.2, 7.3; CEC Adv 1.1, 2.3, 3.2, 3.3, 4.2, 5.1, 5.2, 5.3, 6.2, 6.3, 7.1, 7.2, 7.3). 6. Apply strategies to support students with exceptionalities to develop and strengthen self-determination skills (REPA 7.8; CEC Int 1.1, 1.2, 2.1, 2.2, 2.3, 3.2, 5.2, 5.6, 6.1, 6.2; CEC Adv 1.1, 2.3, 3.2, 3.3,

3.4, 4.2, 5.1, 5.2, 6.2, 6.3). Credits: 3.00

Portfolio Course (1 credit)

EDCI 68000 - Curriculum & Instruction MS Portfolio

Credit Hours: 1.00. This course was created to help guide C&I students near completion of their coursework to develop their competency portfolio. A competency portfolio reflects the depth and breadth of a student's educational growth since entering the graduate program. The purpose of the C&I competency portfolio is to demonstrate that students have mastered the graduate competencies for the C&I online Master's program. The portfolio will contain student projects aligned with C&I competencies and will be reviewed by committee members. The competencies are based on the Curriculum & Instruction departmental competencies and several program-specific competencies. The competency portfolio is a requirement for graduation from the C&I Master's program. (Multiple media are welcome.) Permission of department required.

Learning Outcomes: 1. Develop an online version of your competency portfolio based on artifacts as evidence. 2. Compose reflective narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00

Capstone Course (3 credits)

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders. Credits: 3.00

GPA Requirements

Cybersecurity and Trusted Systems, MS (Indianapolis)

About the Program

Program Requirements - Non-Thesis/Coursework Only & Directed Project Track

Required Courses (18 credits)

Statistics or Quantitative Methods Course (3 credits)

CIT 50700 - Measurement And Evaluation In Industry And Technology

Credit Hours: 3.00. This course is an introduction to measurement strategies and evaluation of data in industry and technology within the context of research design and implementation. Students will learn not only basic statistics in this course but will also learn about the research process by designing, conducting, and analyzing the data for a small empirical research project using real world data. The material in this course is directly relevant to student professional

development. Data collection and interpretation are key day-to-day aspects of social and behavioral science, humanities, communication, economics, physical science, biological and medical science, technology, education, psychology, business, environmental science, education and government. In addition, the ability to use computers and other technologies around data has become a critical element in most professional decision-making processes.

Credits: 3.00

Foundation Courses (15 credits)

CIT 51600 - Database Security

Credit Hours: 3.00. This course provides a strong foundation in database security and auditing. It will cover topics on security, profiles, password policies, privileges and roles, Virtual Private Databases, and auditing. The course also covers advanced topics such as SQL injection, database management security issues such as securing the DBMS, enforcing access controls, and related issues. Permission of instructor required.

Credits: 3.00

CIT 52800 - Information Security Risk Assessment

Credit Hours: 3.00. (CNIT 52800) Covers information security risk assessment, including the following topics: steps in performing information security risk assessment, threats to information security, technical, managerial, and operational vulnerabilities, methods for analyzing controls, methods for determining likelihood of and impact from an information security breach, and methods for determining risk. Emphasizes the development and utilization of security metrics in the risk assessment process.

Credits: 3.00

CIT 53200 - Wireless Security And Technology

Credit Hours: 3.00. This course will provide in-depth coverage of wireless communications and security. Fundamentals and state of the art developments in the wireless security area will be covered, including advances in cellular, personal communications systems (PCS), wireless LANs, and fixed wireless networks. Significant details of wireless devices and corresponding security issues will be addressed. Emerging challenges and solutions in wireless vulnerabilities, attacks, and solutions at various layers of the protocol stack, spanning the stack from aspects of physical communication to application and service security issues, will also be covered.

Credits: 3.00

Electives (9 or 12 credits)*

Directed Project Course (3 credits)

CNIT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1.

Varies due to nature of the course. Credits: 1.00 to 3.00

GPA Requirements

Data Science in Finance, MS

About the Program

Program Requirements

Required Courses (27 credits)

Core Courses (15 credits)

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform

optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what

elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

Computational Finance Courses (6 credits)

STAT 54000 - Computational Finance I

Credit Hours: 3.00. An introduction to the mathematical tools and techniques of modern finance theory, in the context of Black-Scholes option pricing. Brownian motion and its stochastic calculus, Ito's formula, and Feynman-Kac formula. Pricing and hedging of claims on Black-Scholes assets. Incomplete markets. Path-dependent options. Stochastic portfolio optimization.

Learning Outcomes: 1. Obtain necessary mathematical background necessary to study quantitative methods in finance. 2. Understand mathematical models of modern financial markets. Credits: 3.00

STAT 54100 - Computational Finance II

Credit Hours: 3.00. Stochastic interest rate models. American options from the probabilistic and PDE points of view. Numerical methods for European and American options, including binomial, trinomial, and Monte-Carlo methods.

Learning Outcomes: 1. Learn advanced topics in quantitative finance. Credits: 3.00

Data Science in Finance Courses (6 credits)

STAT 57900 - Foundations Of Statistical Machine Learning

Credit Hours: 3.00. This course provides a comprehensive treatment of modern statistical machine learning topics. These include linear regression, kernel method, trees, boosting, and deep neural networks. We understand these subjects from a statistical perspective with some mathematical rigorousness.

Learning Outcomes: 1. Understand classical supervised learning methods such as linear regression, nonlinear regression, random forest, and boosting. 2. Understand classical unsupervised learning methods such as K-means clustering and PCA. 3. Understand modern AI techniques using deep neural networks, such as manifold learning and deep generative models. 4. Practice complex and high dimensional data analysis using the methodology and software packages. Credits: 3.00

STAT 58700 - Machine Learning In Finance

Credit Hours: 3.00. This graduate course on Machine Learning in Finance explores contemporary topics in quantitative finance, including optimal execution, dynamics of limit order books, optimal portfolio selection, and more. The course focuses on illustrating how machine learning methods are applied in these specific areas.

Learning Outcomes: 1. Gain a comprehensive understanding of the latest advancements in machine learning methodologies. 2. Apply these methodologies using practical applications within the context of financial markets. Credits: 3.00

Selectives (6 credits)

CS 54300 - Introduction To Simulation And Modeling Of Computer Systems

Credit Hours: 3.00. Simulation: discrete event simulation, process oriented simulation, generating random numbers, simulation languages, simulation examples of complex systems. Nondeterministic models: random variables, Poisson process, moment generating functions, statistical inference and data analysis. Modeling: elementary queuing models, networks of queues, applications to performance evaluation of computer systems.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including

classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

STAT 54600 - Computational Statistics

Credit Hours: 3.00. The course focuses on two fundamental aspects in computational statistics: (1) what to compute and (2) how to compute. The first is covered with a brief review of advanced topics in statistical inference, including Fisher's fiducial inference, Bayesian and frequenstist methods, and the Dempster-Shafer (DS) Theory. The second is discussed in detail by examining exact, approximation, and interactive simulation methods for statistical inference with a variety of commonly used statistical models. The emphasis is on the EM-type and quasi-Newton algorithms, numerical differentiation and integration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Master commonly used numerical matrix operations, including the sweep operator, Cholesky decomposition, eigenvalue decomposition, and single value decomposition. 2. Understand statistical thinking in development of interactive numerical methods. 3. Apply optimization algorithms such as quasi-Newton and conjugate gradient methods. 4. Implement EM-type algorithms for maximum likelihood estimation when expanded complete-data models are available, including commonly used statistical models. 5. Create random number generators. 6. Implement the Gibbs sampler and Metropolis-Hastings algorithms for Bayesian data analysis. Credits: 3.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 57900 - Foundations Of Statistical Machine Learning

Credit Hours: 3.00. This course provides a comprehensive treatment of modern statistical machine learning topics. These include linear regression, kernel method, trees, boosting, and deep neural networks. We understand these subjects from a statistical perspective with some mathematical rigorousness.

Learning Outcomes: 1. Understand classical supervised learning methods such as linear regression, nonlinear regression, random forest, and boosting. 2. Understand classical unsupervised learning methods such as K-means clustering and PCA. 3. Understand modern AI techniques using deep neural networks, such as manifold learning and deep generative models. 4. Practice complex and high dimensional data analysis using the methodology and software packages. Credits: 3.00

STAT 58700 - Machine Learning In Finance

Credit Hours: 3.00. This graduate course on Machine Learning in Finance explores contemporary topics in quantitative finance, including optimal execution, dynamics of limit order books, optimal portfolio selection, and more. The course focuses on illustrating how machine learning methods are applied in these specific areas.

Learning Outcomes: 1. Gain a comprehensive understanding of the latest advancements in machine learning methodologies. 2. Apply these methodologies using practical applications within the context of financial markets. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

About the Program

Data Science, MSDS (OL)

About the Program

Program Requirements

Required Courses (30 credits)

Core Courses (15 credits)

GRAD 58900 - Master Of Science In Artificial Intelligence Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a realistic or real-world artificial intelligence problem, with an emphasis on the application domain. The capstone course for the MSAI provides students with practical experience applying the collective set of skills developed through the MSAI program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams, will select a target beneficiary, arrange a consultation, develop a problem statement, a project plan that will yield benefits, and a strategy for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using AI that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

GRAD 58800 - Online Master Of Science In Data Science-Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a real-world data science problem, with an emphasis on the application domain. The capstone course for the OMSDS provides students with practical experience applying the collective set of skills developed through the OMSDS program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams of 3-5 students each, will work with a product owner to scope out the project via a project charter that will include a timeline, milestones, and metrics that will yield benefits and a strategy for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using data science that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational

communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

GRAD 50600 - Big Data Tools And Technologies

Credit Hours: 3.00. This course is designed to equip students with the essential skills to handle big data effectively. It covers proficiency in big data technologies, scalable data processing techniques, and the integration of big data tools into data science workflows.

Learning Outcomes: 1. Demonstrate proficiency in big data technologies. 2. Apply scalable data processing techniques to handle large datasets. 3. Integrate big data tools into comprehensive data science workflows. 4. Demonstrate proficiency with cloud computing. Credits: 3.00

GRAD 50500 - Foundations In Data Science

Credit Hours: 3.00. This course is the inaugural course in the Master of Science in Data Science program. Tailored for students with a technical background, this course provides a comprehensive introduction to key concepts, statistical techniques, and tools foundational to the field of data science. The syllabus integrates hands-on experience, ethical considerations, programming refresher, and agile project management principles to equip students with a robust foundation for their data science journey.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of core data science concepts and articulate the significance of data in various domains. 2. Acquire skills to perform exploratory data analysis, identify patterns, and make informed decisions based on statistical inference. 3. Analyze ethical dilemmas arising in data-driven contexts, apply ethical decision-making models, and navigate the legal implications of data handling and analysis. 4. Demonstrate a comprehensive understanding of programming fundamentals and the application of agile methodologies to manage and execute data science projects. 5. Access, navigate, and employ Purdue's computing resources available through Purdue's Rosen Center for Advanced Computing (RCAC). Credits: 3.00

GRAD 50700 - Cross Domain Data Communication And Visualization

Credit Hours: 3.00. This course focuses on the proficient use of data communication strategies and competencies. The course will focus on identifying data narratives, generating stories from data, illustrating with powerful and self-explanatory visualization, and basic principles of ethical use of non-data narrative frames for data communication. Designed for students with a technical background pursuing a Master of Science in Data Science, this course aims to enhance students' ability to extract and communicate meaning and narratives from raw data and visually represent it.

Learning Outcomes: 1. Create effective and aesthetically pleasing data visualizations. 2. Communicate complex data findings clearly to diverse audiences. 3. Utilize interactive visualization techniques for dynamic exploration of datasets. 4. Develop the ability to integrate ethics and data privacy considerations effectively when communicating with data. Credits: 3.00

GRAD 50800 - Data Analytics

Credit Hours: 3.00. This course provides an in-depth exploration of advanced data analysis techniques, predictive modeling, ensemble methods, and proficiency in data manipulation and transformation. It is designed for students with a technical background pursuing a Master of Science in Data Science.

Learning Outcomes: 1. Apply advanced data analysis techniques to extract meaningful insights from complex datasets. 2. Implement predictive modeling and ensemble methods for accurate data-driven predictions. 3. Demonstrate proficiency in data manipulation and transformation techniques. Credits: 3.00

GRAD 50900 - Applied Machine Learning: From Foundations To Latest Advances

Credit Hours: 3.00. This course provides an in-depth exploration of machine learning algorithms and data mining techniques, building on the foundational concepts introduced in the Foundations of Data Science course. Students will develop a comprehensive understanding of various machine learning algorithms, focusing on practical applications and hands-on experience. Additionally, the course will cover data mining techniques for dimension reduction and pattern discovery.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of popular machine learning algorithms, including supervised and unsupervised learning techniques. 2. Demonstrate the ability to analyze mathematical foundations and principles behind machine learning models. 3. Understand the nuances of applying various machine learning models, emphasizing the trade-offs between performance, computational complexity, and interpretability. 4. Students will actively explore unsupervised learning techniques, emphasizing clustering algorithms, and recognizing their vital role in solving real-world challenges. 5. Demonstrate proficiency into the fundamental principles of deep learning and investigate recent advancements, such as optimization using diffusion models, learning from unlabeled data using consistency models, and decentralized data processing through federated learning. Credits: 3.00

Data Visualization Course (2-3 credits)

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

SCLA 51000 - Data And AI Storytelling

Credit Hours: 3.00. The primary assumption of our course is that the goal of communicating with data is ultimately to identify causal mechanisms and change the status quo due to the obtained insights. All audiences have previous understandings of the world, and meaningful data stories should challenge their assumptions about that world. The communication of this data-based new knowledge violates prior assumptions, shares memorable new information and moves the audience to act based on the new knowledge. This is best accomplished through a story. In other words, this communication assumes the form of a story, which is defined as the narrative of how an unexpected cause creates an effect.

Learning Outcomes: 1. Provide high-quality data story examples and justify why they meet the good story criteria. 2. Identify and extrapolate core relationships between research design and story-building. 3. Generate hypotheses based on data. 4. Create specific data visualizations which maintain casual narratives. 5. Identify story elements that map onto the five tenets of What is a Data Story? 6. Identify in examples the adherence or violation of data transparency, validity and ethics. Credits: 3.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Industry Aligned Focus Areas (0-12 credits)

Selectives (0-12 credits)

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

AGEC 68700 - Problem Solving And Project Management For Decision Makers

Credit Hours: 3.00. Develops a structured approach to problem solving, including problem definition, development of alternatives, identifying consequences, assessing trade-offs, and making informed choices. Research methods and project management concepts will be addressed. A major business analysis project will be framed during the course, to be completed as part of the capstone course in business analysis. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on

spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

STAT 58200 - Statistical Consulting And Collaboration

Credit Hours: 3.00. This course is designed to emphasize and develop the skills needed by a statistical consultant/collaborator. Topics include: problem solving, consulting session management, written and oral communication, research ethics, design of experiments, collection of data, and application of statistical methods to real problems. Class activities include actively participating in consulting sessions held by the Statistical Consulting Service, small group projects, short papers, and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Be aware of the skills necessary to be an effective statistical consultant/collaborator. These skills include consulting session management, written and oral communication with clients, interpreting facial and body language, handling personality conflicts, practicing sound research ethics, properly designing an experiment and determining an appropriate sample size, and choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 2. Know how to recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

ILS 69500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information

science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

FNR 58700 - Advanced Spatial Ecology And GIS

Credit Hours: 3.00. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales. The lab will focus on the use and application of these databases that are common in natural resource management settings.

Learning Outcomes: 1. Apply the principles of landscape ecology to the analysis of spatial change in urban, agricultural and forested landscapes for the purposes of natural resource management. 2. Calculate change in landscape

patterns using a variety of geospatial tools such as geographic information systems, spatial models, and geostatistics. 3. Prepare reports using the traditional scientific journal article format, on the analysis of landscape-scale change, focusing on problems common to watershed management. 4. Compare and contrast the ways that biodiversity can be calculated using standard indices of organismal diversity. 5. Calculate ecological footprints and evaluate why these vary across geopolitical and/or ecological units. Credits: 3.00

CS 50023 - Data Engineering I

Credit Hours: 1.00. The course introduces students to the fundamentals of Data Engineering with a focus on tools and computational techniques to gather, construct, manipulate, summarize, and visualize data sets as a means to extract knowledge from the underlying data. Python and Python libraries are used. Completion of the course will allow learners to perform basic data analysis on data sets. Experience in Python Programming and Linear Algebra is required. The course also prepares learners for additional instruction in the courses Data Engineering II and Foundations of Decision Making.

Learning Outcomes: 1. Identify key file types (TXT, CSV, HTML) and their characteristics. Using Python, read data in these formats. 2. Create and execute Python scripts to parse, select, transform, summarize, and visualize data. 3. Explain how to identify and fill in missing values in data values. 4. Create informative visualizations from given data and recognize the key qualities of good visualizations. 5. Apply Pandas functions to slice, dice, and summarize datasets. 6. Apply the process of sampling data and sample probabilistically. 7. Demonstrate how to transform and construct features (e.g., standardization, distances). 8. Compute summary statistics from data (e.g., covariance, correlation). 9. Explain how to solve simple data analysis problems. Credits: 1.00

CS 50025 - Foundations Of Decision Making

Credit Hours: 1.00. This course provides an overview of data science methods used for data-driven discovery, extraction of knowledge, and informed decision making. The course covers fundamental computational methods and statistical techniques used to correctly reason about uncertainty, conduct hypothesis tests, infer causal relationships, and apply and evaluate predictive models. The course highlights how sampling biases can impact fairness in decision making. Throughout, students get hands-on experience on how to make correct and explainable inferences from data. Experience in Python Progamming, Probability, Statistics and Linear Algebra is required.

Learning Outcomes: 1. Support and justify claims with evidence from data and discuss how human biases can impact interpretations. 2. Recognize the basic approach to formulating statistical hypothesis tests and apply parametric hypothesis tests for both discrete and continuous data. 3. Interpret p-values and apply them effectively to support claims about data. 4. Formulate and test conjectures with controlled experiments, including A/B testing. 5. Recognize the types of errors encountered when conducting multiple hypothesis tests. 6. Use computational approaches based on randomization for hypothesis testing and uncertainty quantification. 7. Discuss ethical issues such as privacy and fairness that can be associated with automating decisions based on machine learning methods. 8. Apply the basic components of classification methods using Python libraries. 9. Evaluate the performance of learned models with learning curves and k-fold cross validation and assess significance with hypothesis tests. Credits: 1.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques

including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

STAT 52700 - Introduction To Computing For Statistics

Credit Hours: 3.00. This course provides a thorough introduction to the R programming language, and its use for statistical computing and data science. The course will first look at the fundamentals of R, including different data-structures, control-flow, and the basic vocabulary. An emphasis will be placed on learning idiomatic and efficient R, covering ideas such as recycling, vectorization and functional programming. The course will then look at principles and tools for tasks like organizing data ('tidy data'), manipulating data ('data carpentry'), querying data (through topics like regular expressions) as well as visualizing data (including interactive visualizations). The material and the homework will encourage development of modular reusable code and reproducible research through ideas such as object-oriented programming and dynamic documents in R Markdown. The last part of the course will study statistical procedures such as least-squares regression, LASSO, Monte Carlo sampling and Markov chain Monte Carlo. Besides exams and homeworks, the course will involve a final project that students can collaborate together on.

Learning Outcomes: 1. Read and write idiomatic R code. 2. Be familiar with the entire data science pipeline, from organizing, manipulating, querying and visualizing data. 3. Introduce computational tools like optimization and simulation in the context of statistical algorithms. Credits: 3.00

SCLA 52000 - Social And Digital Media Analytics For Strategic Communication

Credit Hours: 3.00. This course provides an overview of how to transform social media and digital media information into business intelligence and actionable insight. Although students are not expected to know a programming language prior to taking the course, students are expected to understand basic statistics and to have a desire to learn the processes, procedures and vocabulary used by data analysts in modern organizations. The goal is not to train them as practicing data scientists, but as knowledgeable data analytics consumers and as informed teammates and leaders of cross-functional teams tasked to make decisions using data.

Learning Outcomes: 1. Differentiate between the opportunities and limitations with social media data. 2. Identify methods for using ready and custom-made tools to transform information into insight, from data collection to analysis, interpretation, and recommendation. 3. Sharpen their quantitative and business analytical skills using spreadsheets and online tools. 4. Write effective reports and draft scorecards. 5. Be prepared to interact with data scientists by speaking their language and understanding their processes for data mining and business intelligence. Credits: 3.00

SCLA 51000 - Data And AI Storytelling

Credit Hours: 3.00. The primary assumption of our course is that the goal of communicating with data is ultimately to identify causal mechanisms and change the status quo due to the obtained insights. All audiences have previous understandings of the world, and meaningful data stories should challenge their assumptions about that world. The communication of this data-based new knowledge violates prior assumptions, shares memorable new information and moves the audience to act based on the new knowledge. This is best accomplished through a story. In other words, this communication assumes the form of a story, which is defined as the narrative of how an unexpected cause creates an effect.

Learning Outcomes: 1. Provide high-quality data story examples and justify why they meet the good story criteria. 2. Identify and extrapolate core relationships between research design and story-building. 3. Generate hypotheses based on data. 4. Create specific data visualizations which maintain casual narratives. 5. Identify story elements that map onto the five tenets of What is a Data Story? 6. Identify in examples the adherence or violation of data transparency, validity and ethics. Credits: 3.00

GRAD 50200 - Interdisciplinary AI Fundamentals: Bridging Knowledge

Credit Hours: 1.00. This course provides foundational concepts for AI for those in both MSAI majors. This course covers the history of AI, the foundations of artificial reasoning and knowledge, and practical skills for communicating about AI technology, projects, and workflow. This graduate course, designed to be accessible to learners with diverse backgrounds, serves as a foundational introduction to the field of AI. Whether you come from a technical or non-technical background, this course will provide you with a solid grasp of AI concepts,

principles, and their real-world applications. To be successful in this course, we encourage students to know math (e.g., algebra and calculus) and a basic understanding of programming (e.g., R, Python, or Java).

Learning Outcomes: 1. Describe the foundations of artificial reasoning, knowledge, and trace the historical development of AI. 2. Explain the basic concepts, terminologies, and applications of different AI algorithms, developing a problem-solving mindset applicable to various domains. 3. Examine the diverse range of AI applications across varied industries. 4. Explain the role human factors and social context play in the development of artificial intelligence. Credits: 1.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

POL 50601 - Data, Machine Learning, And Artificial Intelligence For The Public Sector

Credit Hours: 3.00. This course examines how machine learning algorithms and tools related to artificial intelligence can be used to advance our understanding in public sector domains. Students will develop a comprehensive understanding of how to apply AI and various machine learning algorithms, focusing on practical applications and hands-on experience. It provides an overview public sector data sources and addresses ethical and privacy issues associated with this type of data.

Learning Outcomes: 1. Identify, construct, and manipulate public data ethically and appropriately for use in AI and machine learning applications. 2. Explain privacy and ethical considerations associated with the use of public sector data, including issues that arise when combining public and private sector data. 3. Demonstrate a comprehensive understanding of popular AI and machine learning algorithms, including supervised and unsupervised learning techniques. 4. Apply AI and machine learning techniques to real-world data sets, emphasizing those techniques commonly used in government, policy, and political settings. 5. Assess, interpret, and report AI and machine learning output to audiences commonly found in government, policy, and political settings. Credits: 3.00

CNIT 51000 - Data Literacy

Credit Hours: 3.00. This course examines concepts, models, and methods useful for applying data analytics in business environments. Focusing on hypothesis generation, the capturing, storage and expression of data, analysis for research and visualizations.

Learning Outcomes: 1. Apply critical thinking abilities and analytical thought. 2. Recognize diverse range of data types/storage strategies and demonstrate the ability to analyze and debate the applications of each proficiently. 3. Examine aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 4. Analyze a set of data yielding actionable insights that can be applied to research or business. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

CNIT 57500 - Data Analysis

Credit Hours: 3.00. This course will teach students how data analysis can inform decision-making. Students will develop analytical skills and focus is placed on predictive analysis to evaluate business decision. Students will develop logical reasoning and communication skills related to quantitative

outputs. This course will also develop the ability to collect large datasets, organize, and combine them using Tableau software.

Learning Outcomes: 1. Recognize the pervasiveness and breadth of data collection options available in today's world. 2. Discern and defend ethical applications of how collected data can be used for marketing. 3. Discuss how to find, download, clean and combine data sets. 4. Identify and evaluate trends in data sets. 5. Build models to make predictions about future events based upon historic data. Credits: 3.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

PHRM 50000 - Artificial Intelligence And Its Use In Clinical Care

Credit Hours: 2.00. The course comprehensively covers key topics such as the mechanisms behind how AI functions, the capabilities and limitations of current technologies, and important considerations around data privacy, bias, and health equity. Ethical issues are also explored through analyses of real-world case studies. The course equips participants with a solid foundation to thoughtfully engage with, evaluate, and contribute to the ongoing integration of AI into clinical practice and beyond.

Learning Outcomes: 1. Identify various applications and settings where AI is being utilized in healthcare today and where it will migrate to in the future. 2. Describe the technical underpinnings of how AI tools are built and function. 3. Analyze the clinical and social impacts of AI for patient care including how patients are using these tools as well as various ethical and regulatory issues. 4. Synthesize a solution to clinical cases using AI tools to improve your skills in the healthcare industry. Credits: 2.00

PHIL 50000 - Advanced Ethics For Technology, Engineering, And Design

Credit Hours: 3.00. This graduate seminar is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen.

Learning Outcomes: 1. Recall and describe key concepts of professional and ethical responsibilities in national, international, and cross-cultural environments. 2. Apply the general ethical framework to analyze and resolve specific, concrete cases in engineering. 3. Develop a well-researched original case study that integrates professional and ethical considerations, informed by personal experiences and future aspirations in engineering. Credits: 3.00

PHIL 50800 - Advanced Ethics Of Data Science

Credit Hours: 3.00. This graduate seminar is designed to examine the new and important ethical issues that are arising as the applications of data science permeate more and more

aspects of our lives. Because we're entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

Learning Outcomes: 1. Explain the conceptual framework for ethical reasoning in professional settings as it applies to data science. 2. Analyze case studies to identify and evaluate ethical issues arising from the applications of data science. 3. Assess critically the ethical implications of data science applications and propose well-reasoned solutions. Credits: 3.00

POL 52801 - Organizational Governance Of Technology And AI

Credit Hours: 3.00. This course examines the impact of technology policy on organizations and their organizational governance strategies for AI and technology. It explores the incentives, strategies, and activities of the private and non-profit sector in governing AI, as well as the relationship between the private, public, and non-governmental sectors.

Learning Outcomes: 1. Describe and evaluate the impact of legal, regulatory, and ethical frameworks (soft laws and hard laws) on organizational governance of AI, including how legal, technological, and social factors can advance and hinder AI governance in organizations. 2. Analyze different considerations for companies using and governing AI, depending on their size and stage, industry, and jurisdiction. 3. Evaluate strategies that AI practitioners in AI governance functions of organizations have used to manage AI systems and their risks. 4. Develop and communicate strategies to advance AI governance objectives in different organizational contexts, including through policies, assessments, procurement strategies, and/or education. Credits: 3.00

SCLA 50900 - Strategic Intelligence: Organizations, Technologies, Procedures, Policies

Credit hours: 3.00. The present course will examine all facets of strategic intelligence, anchoring the investigation around specific organizations and processes, from the major civilian to the major military-strategic intelligence agencies, the legislation that directs their work, and the supervisory bodies. The course will also include case studies that analyze and operationalize how intelligence agencies contribute to national security. The course aims to provide the students with a rounded and practical education in strategic intelligence, describing who is responsible for its deployment and exploitation and what its benefits are for national security.

Learning Outcomes: 1. Analyze the diplomatic, economic, informational, military, and political elements influencing national strategic intelligence. 2. Evaluate key agencies, institutions, and legislative frameworks that shape U.S. strategic intelligence collection, analysis, and dissemination. 3. Differentiate between various strategic intelligence organizations - civilian and military - and understand their unique contributions and limitations. 4. Assess how political, institutional, and cultural factors affect the development and execution of national strategic intelligence policies. 5. Formulate recommendations for improving strategic intelligence oversight, policymaking, and response mechanisms to current and emerging global threats. Credits: 3.00

Concentrations

Program Learning Outcomes

About the Program

Design, Art, and Performance, MA

About the Program

Program Requirements

Required Courses (xx credits)

Concentrations

GPA Requirements

Design, MFA

About the Program

Program Requirements - Thesis

Required Courses (24 credits)

Core Courses (6 credits)

AD 55000 - Research Methods In Art And Design

Credit Hours: 3.00. An intensive course in research methods to assist students in developing a topic for directed study. Introduction to various research tools; exercises exploring issues of style, content, and organization; research methods and how they pertain to art and design. Permission of department required.

Learning Outcomes: 1. Identify and develop effective research skills and methods as they apply to individual thesis projects. 2. Analyze and critique existing scholarship. 3. Design an effective thesis statement, devise a research plan and begin conducting research. 4. Practice critical writing skills through peer review of section drafts. Credits: 3.00

AD 60300 - Theory In Art Seminar

Credit Hours: 3.00. Study of critical issues in modern and postmodern art and relevant methodologies: formalism, iconography, biography and autobiography. Marxism (cultural studies), semiotics, and psychoanalyses. Elements of contemporary professional art practice discussed, including writing of artists' and designers' statements, biographies, and resumes. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

Directed Project Courses (18 credits)

AD 56800 - Directed Project Research In Design

Credit Hours: 1.00 to 3.00. Initial M.F.A. project research and production in design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 66800 - MFA Project Research In Design

Credit Hours: 1.00 to 6.00. Intensive M.F.A. project production and thesis research in design. Prerequisite: Three credit hours of AD 56800 with a minimum B- grade. Permission of instructor required.

Credits: 1.00 to 12.00

AD 69700 - MFA Graduate Exhibition

Credit Hours: 3.00. Completion of M.F.A. thesis, oral defense, gallery installation of M.F.A. exhibition, public presentation, and documentation of exhibition. Prerequisite: Admission to the M.F.A. program in Art and Design. Concurrent Prerequisite: Must complete 12 credit hours of AD 65800 or AD 66800 during the same or prior session. Only open to M.F.A. graduate students in Art and Design. Permission of instructor required.

Credits: 3.00

Art History Electives (6 credits)

Concentration Courses (18 credits)

Studio and Lecture Electives (12 credits)

Thesis Research (6 credits)

AD 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Requirements - Non-Thesis

Core Courses (6 credits)

Directed Project Courses (18 credits)

Concentration Courses (18 credits)

Art History Electives (6 credits)

Studio and Lecture Electives (12 credits)

Concentrations

About the Program

Developmental Testing and Innovation, MS (OL)

About the Program

Program Requirements

Required Courses (10 credits)

Core Courses (7 credits)

ENGT 50100 - Graduate Research Seminar

Credit Hours: 0.00 or 1.00. This course is intended to orient new graduate students to the Engineering Technology (ET) program and faculty. This includes PhD students and students pursuing a Master's degree through a thesis or directed project option. This does not include students pursuing a Master's degree with coursework only. Research activities within ET and throughout Purdue University are discussed. Student resources and opportunities are reviewed to give the students the tools they need to be successful. In addition, this course provides a way to develop a natural cohort of graduate students. This course is a graduate seminar course focused on the ET program. Graduate status or upper-division undergraduate. Permission of department required.

Learning Outcomes: 1. Summarize research interests of ET graduate faculty. 2. Interpret Purdue University research activities and resources and apply this knowledge to their particular research plan. 3. Generate MS or PhD preliminary documents based on ET specific requirements. 4. Implement effective use of library resources and ability to write scholarly information in accepted format styles.

Credits: 0.00 or 1.00

ENGT 59000 - Special Problems In Engineering Technology

Credit Hours: 1.00 to 3.00. The ENGT 59000 course code is intended primarily for students to undertake targeted study or projects to develop depth in an area related to their area of research, where no other comparable course is available at Purdue or conveniently elsewhere. You may take up to 9 credits of ENGT 59000 as part of your Plan of Study. Requests to extend the number of credits must be decided within your graduate committee and documented with the Graduate Chair. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering.

Credits: 1.00 to 3.00

ENGT 58300 - Applied Engineering Statistics For Industry

Credit Hours: 3.00. The purpose of this course is to teach the practitioner how to use and make better-informed decisions as a manager for making optimum process, business, or personnel decisions. Emphasis will be placed on Verification, Validation in R&D, Manufacturing, QA/QC, basic probability, Summarizing Data, Basic Tools (flowcharts, fishbone diagrams, Pareto charts), Process Capability - Cp/Cpk. Upper and lower control limits/charts, Use of Control Charts for Continual Improvement, Six Sigma, Design of Experiments, Taguchi Methodology and Data Analytics will also be covered.

Learning Outcomes: 1. Demonstrate the importance of the Central Limit Theorem and its

application. 2. Evaluate the capability of a process using the process capability index (CPI). 3. Analyze variation reduction in relation to process capability and design of experiments. 4. Articulate how single-piece flow, standard work, and continuous improvement processes enable variation reduction. 5. Determine the expected number of defects from a given process. 6. Explain the statistical meaning of Six Sigma. 7. Differentiate between Type I and Type II errors. 8. Calculate the sample size based on specified Type I and Type II Error. 9. Calculate a confidence interval. 10. Define direct run rate I first time through and its calculation. 11. Develop a hypothesis test. 12. Calculate regression and correlation of data and distinguish between correlation and causation. 13. Select and evaluate the test statistic for different kinds of hypothesis tests and make statistical inference decisions. 14. Construct and evaluate an ANOVA table and make statistical inference decisions. 15. Differentiate among different types of experimental designs and design an experiment. 16. Demonstrate the Taguchi quality loss function and how to make quality loss calculations. 17. Classify the procedural errors that can occur in experimental design, such as confirmation bias. 18. Explain data mining and Big Data and their role in the future of experimental design. Credits: 3.00

ENGT 60500 - Engineering Technology Research Writing Strategies

Credit Hours: 2.00 to 3.00. The stated Master of Science in Engineering Technology graduate course teaches research literature mining and analysis found in Purdue licensed databases. Focuses on detail, a measurable topic, literature review, reporting, citation, data visualization using APA. Requires research paper writing aligned with ARWE specifications for in-depth research preparation and reporting. Students will research a topic relevant to a workplace problem in their industry. For example, a new technology, a process (Giga Casting for example), a material, supply chain, digitization, industry 4/5.0, sustainability, workforce diversity, aging workforce, ethics in the workplace, offshoring vs. onshoring, direct part marking, inventory/project management, cybersecurity risks, facility management, energy management, patents/intellectual property or environmental compliance. Keep in mind, Before You Start, that whichever topic you choose, the problem must be measurable. Measurable either from a quantitative or qualitative statistic perspective. Your topic will have to be tied to a global grand engineering challenge we face as a society and/or industry.

Learning Outcomes: 1. Evaluate the data you collected by completing the Workplace Information Literacy Strategies (WILS) activity to determine your research topic. 2. Analyze research topic/focus gained from the WILS, correlate a measurable research problem statement, and relate it to one of the 14 global, grand engineering challenges. 3. Create an Introduction to the problem statement. 4. Synthesize collected data by writing a review of the literature which supports the research problem topic. 5. Evaluate different research measures for the problem, choosing one to assess the problem. 6. Analyze the research measure(s) by using ChatGPT to help determine optimum research measure to write up. 7. Create a research methodology by writing a detailed script on how you intend to measure the research problem. 8. Submit expected deliverables in a timely manner after evaluating your final analysis report, synthesizing the introduction, research problem statement, review of literature, and research measure. 9. Present a compelling oration of your research topic and significance as to why the topic should be pursued or funded. The creation of a three-minute video debriefing is not an exercise in "watering down" research but forcing you to consolidate your ideas and concisely explain your research discoveries for senior leadership approval and funding. 10. Complete written assignments using APA format and NO passive wording or adverbs. Adhere to the MET 527 Academic Research Writing Expectations (ARWE) handout

document. Failure to not read and follow the ARWE document will prove to be an unsuccessful assignment/course experience. 11. Perform individually AND not fall into the plagiarism trap. Credits: 2.00 to 3.00

ENGT 50200 - Developmental Testing And Innovation Seminar

Credit Hours: 0.50 or 1.00. The course introduces Engineering Technology and the requirements to fulfill the master's and/or Ph.D. Technology degrees. The seminar can include graduate faculty from the SoET, the NAVY, and other Engineering and Technology related disciplines from the Purdue Polytechnic, College of Engineering, and other STEM-related disciplines across campus.

Learning Outcomes: 1. Interpret Purdue University and Navy research activities and resources applying the knowledge to their particular research plan. 2. Generate M.S. or Ph.D. preliminary documents based on Engineering Technology or NAVY-specific research requirements. 3. Implement effective intellectual use of Purdue library and Navy resources for the ability to write scholarly information in accepted university and/or Navy format styles. Credits: 0.50 or 1.00

Math Course (3 credits)

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations. Credits: 3.00

Capstone Course (2 credits)

ENGT 59000 - Special Problems In Engineering Technology

Credit Hours: 1.00 to 3.00. The ENGT 59000 course code is intended primarily for students to undertake targeted study or projects to develop depth in an area related to their area of research, where no other comparable course is available at Purdue or conveniently elsewhere. You may take up to 9 credits of ENGT 59000 as part of your Plan of Study. Requests to extend the number of credits must be decided within your graduate committee and documented with the Graduate Chair. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

Electives (18 credits)

GPA Requirements

Earth, Atmospheric, and Planetary Sciences, MS

About the Program

Program Requirements

Required Courses (6 credits)

EAPS 52100 - Atmospheric Chemistry

Credit Hours: 3.00. An introduction to the chemistry of the earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

EAPS 52600 - Introductory Geofluid Dynamics

Credit Hours: 3.00. Provides a fluid dynamics background for graduate students interested in atmospheric sciences,

oceanography, mantle convection, hydrology, turbulence, or pollution. Topics covered include: basic assumptions and deviations of Navier Stokes equations, conservation laws, vorticity, divergence, waves, and applications in atmosphere, ocean, and geophysics.

Learning Outcomes: 1. Provide students a rigorous foundation in geofluid dynamics as well as the connections among math, physics, and real natural phenomena. 2. Students will become accustomed to applying the physical equations to real phenomena, and to presenting them in a concise way. 3. Understand the basic equations and physics in existing models which provides a broader and deeper understanding of the earth sciences. Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

EAPS 69100 - Colloquium In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. This course is intended to expose students to the wide range of topics studied throughout the Department of Earth, Atmospheric, and Planetary Sciences, allows for interactions with outside experts and networking, and provides the opportunity for students to synthesize high level topics that may not be directly related to their scientific endeavors.

Learning Outcomes: 1. Gain exposure to new scientific topics. 2. Summarize and discuss potentially new and unfamiliar scientific topics. 3. Identify relevant information from scientific talks and presentations. 4. Engage with the important questions that stimulate discussion and debate in EAPS fields. 5. Listen attentively and actively. 6. Use critical thinking and questioning. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 60200 - New Graduate Student Seminar

Credit Hours: 3.00. This course will provide students with the tools to succeed as a graduate student in the Department of Earth, Atmospheric, and Planetary Sciences, which include good communication with their advisors, graduate fellowship proposal writing, giving good talks and posters, giving and receiving critical reviews, an understanding of regulations and graduate timelines, formulating a plan of study, and resources available to help graduate students succeed. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively

with their adviser. 2. Understand how to develop a compelling research question. 3. Organize their planned research into a graduate fellowship proposal. 4. Provide and receive constructive criticism to and from colleagues, including understanding peer review. 5. Understand how to give well-organized talks and eye-catching posters for department seminars and national meetings. 6. Assemble an advisory committee, formulate a plan of study, and know the department regulations and what is required to graduate in a timely manner. Credits: 3.00

Concentration (18 credits)

Thesis Research (6 credits)

EAPS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (6 credits)

EAPS 52100 - Atmospheric Chemistry

Credit Hours: 3.00. An introduction to the chemistry of the earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

EAPS 52600 - Introductory Geofluid Dynamics

Credit Hours: 3.00. Provides a fluid dynamics background for graduate students interested in atmospheric sciences, oceanography, mantle convection, hydrology, turbulence, or pollution. Topics covered include: basic assumptions and deviations of Navier Stokes equations, conservation laws, vorticity, divergence, waves, and applications in atmosphere, ocean, and geophysics.

Learning Outcomes: 1. Provide students a rigorous foundation in geofluid dynamics as well as the connections among math, physics, and real natural phenomena. 2. Students will become accustomed to applying the physical equations to real phenomena, and to presenting them in a concise way. 3. Understand the basic equations and physics in existing models which provides a broader and deeper understanding of the earth sciences. Credits: 3.00

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Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

EAPS 69100 - Colloquium In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. This course is intended to expose students to the wide range of topics studied throughout the Department of Earth, Atmospheric, and Planetary Sciences, allows for interactions with outside experts and networking, and provides the opportunity for students to synthesize high level topics that may not be directly related to their scientific endeavors.

Learning Outcomes: 1. Gain exposure to new scientific topics. 2. Summarize and discuss potentially new and unfamiliar scientific topics. 3. Identify relevant information from scientific talks and presentations. 4. Engage with the important questions that stimulate discussion

and debate in EAPS fields. 5. Listen attentively and actively. 6. Use critical thinking and questioning. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 60200 - New Graduate Student Seminar

Credit Hours: 3.00. This course will provide students with the tools to succeed as a graduate student in the Department of Earth, Atmospheric, and Planetary Sciences, which include good communication with their advisors, graduate fellowship proposal writing, giving good talks and posters, giving and receiving critical reviews, an understanding of regulations and graduate timelines, formulating a plan of study, and resources available to help graduate students succeed. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively with their adviser. 2. Understand how to develop a compelling research question. 3. Organize their planned research into a graduate fellowship proposal. 4. Provide and receive constructive criticism to and from colleagues, including understanding peer review. 5. Understand how to give well-organized talks and eye-catching posters for department seminars and national meetings. 6. Assemble an advisory committee, formulate a plan of study, and know the department regulations and what is required to graduate in a timely manner. Credits: 3.00

Concentrations

GPA Requirements

About the Program

Economics, MAT

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Economics, MS

About the Program

Program Requirements

Required Courses (9 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the

statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 53300 - Econometrics

Credit Hours: 2.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economic data. The course examines the statistical techniques used in testing economic theories, estimating causal effects, and making predictions. Emphasis is placed on estimating a single equation and the problems associated with such estimation. In addition to multivariate OLS regression, students will be introduced to other regression methods including: instrumental variables estimation, time series estimation, and panel data methods. As part of the course, students will use Stata, a statistical software package.

Learning Outcomes: 1. Understand the theoretical foundations of linear regression methods. 2. Estimate linear regression model parameters and perform basic tests using Stata. 3. Interpret regression results and identify the sources of estimation bias. Credits: 2.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

ECON 51600 - Introduction To Mathematics For Economics

Credit Hours: 2.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. The content covers a review of algebra, univariate and multivariate calculus, and constrained optimization methods, e.g., LaGrange multipliers. Mastering these methods is instrumental to preparing for ECON 51100 & 51200 (micro and macro theory).

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00

Specialty Areas (13-21 credits)

Business and Economics Data Analytics Selectives

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Financial Economics Selectives

ECON 58500 - Behavioral Economics

Credit Hours: 2.00 or 3.00. This course explores human economic behavior, with a strong emphasis on laboratory and field experiment methodology used in behavioral economics research. Topics considered include behavior in markets for financial assets and auction markets, and behavior in social dilemmas that arise when people try to provide public goods voluntarily or increase economic surplus through trust. Students will also study how people bargain with and exhibit social preferences towards others. Decision-making and anomalies for risky uncertain choices will also be covered.

Credits: 2.00 or 3.00

ECON 57200 - Econometrics II

Credit Hours: 2.00. This course reviews basic concepts in probability, mathematical statistics and linear algebra in order to obtain a more rigorous understanding of the linear regression model, its representation and assumptions, procedures for estimation and properties associated with the OLS estimator. We move on and apply what we have learned to the linear regression model. We discuss estimation and prediction, establish properties such as efficiency, unbiasedness, consistency and convergence in mean square. We conclude by considering a few nonlinear models appropriate for modeling binary outcomes. Permission of department required.

Learning Outcomes: 1. A student will be able to apply Econometric analysis to specific economic questions using MATLAB. Credits: 2.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 59100 - Financial Valuation And Decision Making

Credit Hours: 2.00 or 3.00. A comprehensive introduction to finance. The object of this course is to provide the computational framework necessary to appreciate and understand how to make decisions based on sound financial

reasoning.

Learning Outcomes: 1. Develop skills in investment decisions and financing decisions. Credits: 2.00 or 3.00

ECON 58400 - Experimental Economics

Credit Hours: 2.00 or 3.00. This course introduces you to the experimental methods used by economists to study human behavior. These methods analyze data collected in controlled laboratory experiments. Throughout the course, we will discuss different types of experiments that have been extensively researched by experimental economists. To help introduce and motivate each topic, you will participate in weekly synchronous experiments with your classmates over the internet. You will then complete an assignment analyzing the data generated by your class in the online experiment. The following lecture will provide an overview of the theoretical framework and experimental predictions. We will also discuss commonly observed behavior and any relevant explanations for such behavior.

Learning Outcomes: 1. Demonstrate an understanding of the experimental methodology used by economists to study human behavior. 2. Evaluate economic behavior by analyzing and interpreting experimental data and its relationship to common economic models. 3. Identify and explain common insights that experiments provide regarding people's behavior in strategic situations. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 55500 - Economic Forecasting

Credit Hours: 2.00. This course provides an introduction to forecasting methods of current interest in economics. The goal is to equip students with a working knowledge of state-of-the-art techniques that are useful for forecasting macroeconomic variables. The strengths and weaknesses of the techniques will be analyzed and their empirical relevance will be demonstrated through a variety of applications to real data sets. The topics will include univariate prediction models, vector autoregressions, forecasting with large data sets, forecast combinations and forecast evaluation. Particular emphasis will be placed on applications and the issues involved with implementation of the various methods in practice.

Learning Outcomes: 1. Identify the statistical issues involved in forecasting economic data. 2. Analyze the strengths and weaknesses of a variety of forecasting techniques commonly used in economics. 3. Demonstrate the empirical relevance of each forecasting approach through applications to real-world data sets. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices.

Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Public Economics and Policy Selectives

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

ECON 53800 - International Economics

Credit Hours: 2.00 or 3.00. The course covers selected topics in international trade with a focus on real world applications.

Learning Outcomes: 1. Identify the effects of international trade on wages, prices or products and welfare of nations. 2. Develop models as well as a diverse set of academic papers to discuss current policy debates. Credits: 2.00 or 3.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities. 3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Business and Economics Data Analytics Selectives

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

Electives (0-8 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in

improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

OBHR 69000 - Advanced Problems In Organizational Behavior And Human Resource Management

Credit Hours: 2.00 to 4.00. Advanced investigation in a specific organizational behavior or human resource field at the graduate level.

Credits: 2.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

Required Courses (9 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects

are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 53300 - Econometrics

Credit Hours: 2.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economic data. The course examines the statistical techniques used in testing economic theories, estimating causal effects, and making predictions. Emphasis is placed on estimating a single equation and the problems associated with such estimation. In addition to multivariate OLS regression, students will be introduced to other regression methods including: instrumental variables estimation, time series estimation, and panel data methods. As part of the course, students will use Stata, a statistical software package.

Learning Outcomes: 1. Understand the theoretical foundations of linear regression methods. 2. Estimate linear regression model parameters and perform basic tests using Stata. 3. Interpret regression results and identify the sources of estimation bias. Credits: 2.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

ECON 51600 - Introduction To Mathematics For Economics

Credit Hours: 2.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. The content covers a review of algebra, univariate and multivariate calculus, and constrained optimization methods, e.g., LaGrange multipliers. Mastering these methods is instrumental to preparing for ECON 51100 & 51200 (micro and macro theory).

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3.

Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00

Concentrations

Additional Information

About the Program

Educational Studies: Applied Behavior Analysis Accelerated Professional Concentration, MSED

About the Program

Program Requirements

Required Courses (39 credits)

Core Courses (33 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 61200 - Advanced Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to expand knowledge and understanding of advanced applied behavior analytic theories and interventions. Specifically, this course will focus on interventions aimed at developing new skills as well as increasing and decreasing behaviors. Procedures for identifying and designing function based interventions will be addressed. Prerequisite: EDPS 36200 or 51500 and EDPS 58800.

Learning Outcomes: 1. Demonstrate knowledge of methods for increasing and decreasing behaviors such as antecedent and consequence-based interventions and group contingencies. 2. Demonstrate knowledge and skill in developing new behaviors through advanced techniques such as shaping, chaining, and differential reinforcement procedures. 3. Demonstrate knowledge and skill in procedures for assessing the function of behaviors including function based assessment and functional analysis. 4. Demonstrate knowledge of guiding principles and procedures to program for maintenance and generalization of behaviors. Credits: 3.00

EDPS 68800 - Single Subject Research Design

Credit Hours: 0.00 to 3.00. Designed to introduce advanced level students to single subject research methodology in context of a science of human behavior, including design theory and application, measurement, experimental validity, applied behavior analysis, and data analysis procedures.

Learning Outcomes: 1. Demonstrate knowledge about the various single subject research designs and variations of each. 2. Demonstrate the ability to conduct reliable visual analysis, understand value of effect size for single subject design, and calculate effect size. 3. Demonstrate knowledge of the criteria for designing and evaluating high-quality, rigorous single subject design studies. 4. Demonstrate knowledge of the application of single subject research methodology in clinical and educational settings including designing,

conducting, and analyzing a single subject study. Credits: 0.00 to 3.00

EDPS 54700 - Foundations And Principles Of Applied Behavior Analysis

Credit Hours: 3.00. This course will provide a historical perspective of Applied Behavior Analysis as well as the core principles of ABA. The learner will be exposed to the foundational concepts and methods of ABA including defining behaviors, collecting data, and understanding the three-term contingency of behavior. Permission of instructor required.

Learning Outcomes: 1. Identify and define the basic concepts of applied behavior analysis including the foundations of ABA, interrelated domains, and dimensions of ABA. 2. Identify factors to consider when selecting target goals including client and environmental factors. 3. Define behavior utilizing observable and measurable terms including all components of an appropriate behavior goal. 4. Identify measurable dimensions of behavior and appropriate measurement procedures, including advantages and disadvantages of each. 5. Construct and interpret graphic displays of behavioral data. 6. Describe the key components of visual analysis and a strong experimental design including interobserver agreement and treatment fidelity. 7. Define reinforcement and punishment including application procedures, schedules of delivery, and key considerations. 8. Identify the types of preference assessments including similarity and differences in procedures. Credits: 3.00

EDPS 54800 - Ethics And Professional Practice Of Applied Behavior Analysis

Credit Hours: 3.00. This course will address the professional and ethical responsibilities of behavior analysts. Key issues of responsible conduct as it relates to areas such as confidentiality, consent, consultation, treatment planning, and research will be discussed and applied through case studies. Learners will be able to apply ABA techniques within the bounds of both legal and ethical frameworks. Permission of instructor required.

Learning Outcomes: 1. Demonstrate understanding of BACB guidelines for the responsible conduct of applied behavior analysis. 2. Discuss scenarios involving ethical issues and describe appropriate solutions using BACB guidelines. 3. Identify appropriate ethical practices in ABA research. 4. Demonstrate and describe methods used to protect client/student confidentiality. 5. Demonstrate understanding of empirically validated practices vs. pseudoscience and non- validated practices within the context of service delivery. Credits: 3.00

EDPS 54900 - Verbal Behavior And Social Communication

Credit Hours: 3.00. This course will explore the development of verbal and social behavior as explained through tenets of applied behavior analysis. Students will identify the similarities and differences between verbal operants as well as appropriate function-based interventions to develop each including augmentative communication systems and functional communication training. Measurement and intervention for more complex social-communication skills will also be addressed. Permission of instructor required.

Learning Outcomes: 1. Understand and describe the historical perspective of Verbal Behavior in relation to Applied Behavior Analysis including differences between structural and functional approaches. 2. Describe verbal behavior in terms of the three term contingencies. 3. Define, describe, and differentiate the basic verbal operants. 4. Assess, interpret results and develop appropriate treatment plan to address target skills utilizing the VB-MAPP. 5. Identify and describe evidence-based practices for addressing communication for individuals with complex communication needs 6. Identify and describe evidence-based practices for increasing social-communication skills including intraverbal and listener behaviors. 7. Summarize and critically evaluate research on verbal and communication interventions for individuals with disabilities. Credits: 3.00

EDPS 55100 - Practicum In Applied Behavior Analysis

Credit Hours: 3.00. University-supervised fieldwork in applied behavior analysis. This practicum will facilitate development and fluency of essential professional and ethical skills necessary for the delivery of high-quality ABA services. Permission of instructor required.

Learning Outcomes: 1. Conduct assessment to determine the need for ABA services and guide intervention decision-making. 2. Design, implement, and monitor applied behavior interventions designed to increase or reduce target behaviors. 3. Explain, both verbally and in writing, behavioral analytic techniques, in technical and non-technical language appropriate for the audience. 4. Consult with and provide behavior skills training for behavior-change agents responsible for carrying out ABA program. 5. Demonstrate ability to analyze the incorporate findings from research into applied settings. Credits: 3.00

EDPS 55200 - Basic Concepts Of Applied Behavior Analysis

Credit Hours: 3.00. This course is the first in a sequence of courses for the Applied Behavior Analysis Certificate Program. This course, in combination with the other courses, will provide fundamental knowledge and experiences for understanding Applied Behavior Analysis principles, concepts, and techniques, including observational analysis, data-based instruction, and social validity to increase students' social and task related behavior. Students learn procedures to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. Permission of instructor required.

Learning Outcomes: 1. Identify the goals of behavior analysis as a science (i.e., description, prediction, control) (A-1). 2. Explain the philosophical assumptions underlying the science of behavior analysis (e.g., selectionism, determinism, empiricism, parsimony, pragmatism) (A-2). 3. Describe and explain behavior from the perspective of radical behaviorism (A-3). 4. Distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis (A-4). 5. Describe and define the dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968) (A-5). 6. Define and provide examples of behavior, response, and response class (B-1). 7. Define and provide examples of stimulus and stimulus class (B-2). 8. Define and provide examples of respondent and operant conditioning (B-3). 9. Define and provide examples of positive and negative reinforcement contingencies (B-4). 10. Define and provide examples of schedules of reinforcement (B-5). 11. Define and provide examples of positive and negative punishment contingencies (B-6). 12. Define and provide examples of automatic and socially mediated contingencies (B-7). 13. Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers (B-8). 14. Define and provide examples of operant extinction (B-9). 15. Define and provide examples of stimulus control (B-10). 16. Define and provide examples of discrimination, generalization, and maintenance (B-11). 17. Define and provide examples of motivating operations (B-12). 18. Define and provide examples of rule-governed and contingency-shaped behavior (B-13). 19. Define and provide examples of the verbal operants (B-14). 20. Define and provide examples of derived stimulus relations (B-15). Credits: 3.00

EDPS 55300 - Application Of Applied Behavior Analysis To Manage And Support Personnel

Credit Hours: 3.00. This course will teach students how to use applied behavior analysis to maximize the potential of an organization. Students will learn the role of a Behavior Analyst in implementing principles of applied behavior analysis to motivate employees, intervene with challenges in the organization, evaluate the program, and collect and deliver ongoing performance feedback. Permission of instructor required.

Learning Outcomes: 1. Define Organizational Behavior Management (OBM) and explain how

it differs from other management approaches. 2. State three specialty areas of application of OBM. 3. Define Pinpoint and state the four components of behavior pinpointing. 4. Describe methods and tools for measurement in OBM. 5. Describe types of analysis in OBM. 6. State common intervention procedures used in organizations. 7. Apply OBM knowledge to assess targeted concern(s) and provide recommendations within an organization. 8. State characteristics of effective feedback. 9. Describe steps for evaluating reinforcers and delivering reinforcers. 10. Describe tools for evaluating performance change. Credits: 3.00

EDPS 62800 - The Behavior Analyst As Supervisor

Credit Hours: 0.00 to 3.00. This course will address the provision of supervision of behavior analysis trainees and technicians utilizing principles and procedures of applied behavior analysis. Application of goal development, behavioral skills training, and progress monitoring within a behavioral analytic framework will be explored. Must be enrolled in ABA Certificate or Masters Program. Pre-requisite: EDPS 61200. Permission of instructor required.

Learning Outcomes: 1. Describe reasons for effective evidence-based supervision and outcomes of ineffective supervision. 2. Describe necessary components of the supervisory relationship. 3. Assess and select performance expectations for the supervisee and supervisor. 4. Describe components of behavioral skills training. 5. Apply supervision skills to teach assessment and intervention procedures as relevant to task list competencies. 6. State features of performance monitoring and performance feedback . 7. Evaluate supervisor effectiveness. 8. Describe ethics of and methods for providing ongoing professional development. Credits: 0.00 to 3.00

EDPS 50800 - Cultural And Linguistic Diversity In Special Education Programs

Credit Hours: 3.00. Living in a diverse society provides special education teachers and support personnel the opportunity to encounter a wide array of cultures in their educational settings. The course, designed for special education stakeholders (i.e., teachers, staff, support personnel, administrators), considers issues of human diversity, broadly defined to include ability, ethnicity, culture, gender identity, linguistic background, race, religion, socioeconomic status, and sexual orientation. This course challenges biased assumptions that influence the provision of educational services, and examines issues related to promoting equal learning opportunities in the classroom and other educational settings. It is designed to facilitate student examination of how diversity and diverse experiences shape systems that affect individuals, families, communities, and society. It allows students to explore their own cultures and the biases and internalized messages about those who are different from themselves. Students will be introduced to specific approaches to practice, and frameworks for equity, advocacy, and empowerment to support students who receive special education and/or applied behavior analysis (ABA) service, as well as their families. The course also includes information and discussion topics pertaining to the culturo-behavior science (CBS) specialization of the Association for Behavior Analysis International (ABAI) and to interpersonal communication skills - to include speaking, listening, reading, and writing - and their effect on students and families. Permission of instructor required.

Learning Outcomes: 1. Demonstrate a conscious awareness and working knowledge of diverse populations within education settings. 2. Demonstrate the knowledge to create safe, inclusive, culturally responsive learning environments and classroom management systems. 3. Demonstrate the ability to identify funds of knowledge and how they interact to form meaningful relationships with students and families. 4. Engage with others around identity and difference, and apply self-awareness to identify and manage the influence of personal biases and values in working in diverse settings. 5. Analyze and interpret historical and contemporary dynamics of privilege and oppression in society that lead to inequalities in access to educational resources. 6. Analyze, evaluate, and propose solutions to contemporary social problems found in schools, school districts, and ABA settings (E.g., culturally responsive PB IS, restorative justice, etc. 7. Implement strategies that encourage students' to value their own heritage; value

richness of cultural diversity and commonality; respect diverse cultural groups; and reduce stereotyping. Credits: 3.00

EDPS 59200 - Principles & Philosophy Of Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to provide students with a working understanding of the conceptual framework of behavior analysis and the underlying theoretical and philosophical foundation of behavior analysis. The course will provide advanced coverage of the history, philosophical underpinnings, and advanced concepts and principles of behaviorism and behavior analysis. Permission of instructor required.

Learning Outcomes: 1. Identify and evaluate the goals of behavior analysis as a science. 2. Synthesize the philosophical assumptions underlying the science of behavior analysis. 3. Analyze behavior from the perspective of radical behaviorism. 4. Differentiate among the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. 5. Distinguish the dimensions of applied behavior analysis. Credits: 3.00

Practicum Course (6 credits)

EDPS 55100 - Practicum In Applied Behavior Analysis

Credit Hours: 3.00. University-supervised fieldwork in applied behavior analysis. This practicum will facilitate development and fluency of essential professional and ethical skills necessary for the delivery of high-quality ABA services. Permission of instructor required.

Learning Outcomes: 1. Conduct assessment to determine the need for ABA services and guide intervention decision-making. 2. Design, implement, and monitor applied behavior interventions designed to increase or reduce target behaviors. 3. Explain, both verbally and in writing, behavioral analytic techniques, in technical and non-technical language appropriate for the audience. 4. Consult with and provide behavior skills training for behavior-change agents responsible for carrying out ABA program. 5. Demonstrate ability to analyze the incorporate findings from research into applied settings. Credits: 3.00

GPA Requirements

Educational Studies: Applied Behavior Analysis Concentration, MSED

About the Program

Program Requirements

Selectives (33 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 61200 - Advanced Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to expand knowledge and understanding of advanced applied behavior analytic theories and interventions. Specifically, this course will focus on interventions aimed at developing new skills as well as increasing and decreasing behaviors. Procedures for identifying and designing function based interventions will be addressed. Prerequisite: EDPS 36200 or 51500 and EDPS 58800.

Learning Outcomes: 1. Demonstrate knowledge

of methods for increasing and decreasing behaviors such as antecedent and consequence-based interventions and group contingencies. 2. Demonstrate knowledge and skill in developing new behaviors through advanced techniques such as shaping, chaining, and differential reinforcement procedures. 3. Demonstrate knowledge and skill in procedures for assessing the function of behaviors including function based assessment and functional analysis. 4. Demonstrate knowledge of guiding principles and procedures to program for maintenance and generalization of behaviors. Credits: 3.00

EDPS 68800 - Single Subject Research Design

Credit Hours: 0.00 to 3.00. Designed to introduce advanced level students to single subject research methodology in context of a science of human behavior, including design theory and application, measurement, experimental validity, applied behavior analysis, and data analysis procedures.

Learning Outcomes: 1. Demonstrate knowledge about the various single subject research designs and variations of each. 2. Demonstrate the ability to conduct reliable visual analysis, understand value of effect size for single subject design, and calculate effect size. 3. Demonstrate knowledge of the criteria for designing and evaluating high-quality, rigorous single subject design studies. 4. Demonstrate knowledge of the application of single subject research methodology in clinical and educational settings including designing, conducting, and analyzing a single subject study. Credits: 0.00 to 3.00

EDPS 54700 - Foundations And Principles Of Applied Behavior Analysis

Credit Hours: 3.00. This course will provide a historical perspective of Applied Behavior Analysis as well as the core principles of ABA. The learner will be exposed to the foundational concepts and methods of ABA including defining behaviors, collecting data, and understanding the three-term contingency of behavior. Permission of instructor required.

Learning Outcomes: 1. Identify and define the basic concepts of applied behavior analysis including the foundations of ABA, interrelated domains, and dimensions of ABA. 2. Identify factors to consider when selecting target goals including client and environmental factors. 3. Define behavior utilizing observable and measurable terms including all components of an appropriate behavior goal. 4. Identify measurable dimensions of behavior and appropriate measurement procedures, including advantages and disadvantages of each. 5. Construct and interpret graphic displays of behavioral data. 6. Describe the key components of visual analysis and a strong experimental design including interobserver agreement and treatment fidelity. 7. Define reinforcement and punishment including application procedures, schedules of delivery, and key considerations. 8. Identify the types of preference assessments including similarity and differences in procedures. Credits: 3.00

EDPS 54800 - Ethics And Professional Practice Of Applied Behavior Analysis

Credit Hours: 3.00. This course will address the professional and ethical responsibilities of behavior analysts. Key issues of responsible conduct as it relates to areas such as confidentiality, consent, consultation, treatment planning, and research will be discussed and applied through case studies. Learners will be able to apply ABA techniques within the bounds of both legal and ethical frameworks. Permission of instructor required.

Learning Outcomes: 1. Demonstrate understanding of BACB guidelines for the responsible conduct of applied behavior analysis. 2. Discuss scenarios involving ethical issues and describe appropriate solutions using BACB guidelines. 3. Identify appropriate ethical practices in ABA research. 4. Demonstrate and describe methods used to protect client/student confidentiality. 5. Demonstrate understanding of empirically validated practices vs. pseudoscience and non- validated practices

within the context of service delivery. Credits: 3.00

EDPS 55100 - Practicum In Applied Behavior Analysis

Credit Hours: 3.00. University-supervised fieldwork in applied behavior analysis. This practicum will facilitate development and fluency of essential professional and ethical skills necessary for the delivery of high-quality ABA services. Permission of instructor required.

Learning Outcomes: 1. Conduct assessment to determine the need for ABA services and guide intervention decision-making. 2. Design, implement, and monitor applied behavior interventions designed to increase or reduce target behaviors. 3. Explain, both verbally and in writing, behavioral analytic techniques, in technical and non-technical language appropriate for the audience. 4. Consult with and provide behavior skills training for behavior-change agents responsible for carrying out ABA program. 5. Demonstrate ability to analyze the incorporate findings from research into applied settings. Credits: 3.00

EDPS 55200 - Basic Concepts Of Applied Behavior Analysis

Credit Hours: 3.00. This course is the first in a sequence of courses for the Applied Behavior Analysis Certificate Program. This course, in combination with the other courses, will provide fundamental knowledge and experiences for understanding Applied Behavior Analysis principles, concepts, and techniques, including observational analysis, data-based instruction, and social validity to increase students' social and task related behavior. Students learn procedures to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. Permission of instructor required.

Learning Outcomes: 1. Identify the goals of behavior analysis as a science (i.e., description, prediction, control) (A-1). 2. Explain the philosophical assumptions underlying the science of behavior analysis (e.g., selectionism, determinism, empiricism, parsimony, pragmatism) (A-2). 3. Describe and explain behavior from the perspective of radical behaviorism (A-3). 4. Distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis (A-4). 5. Describe and define the dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968) (A-5). 6. Define and provide examples of behavior, response, and response class (B-1). 7. Define and provide examples of stimulus and stimulus class (B-2). 8. Define and provide examples of respondent and operant conditioning (B-3). 9. Define and provide examples of positive and negative reinforcement contingencies (B-4). 10. Define and provide examples of schedules of reinforcement (B-5). 11. Define and provide examples of positive and negative punishment contingencies (B-6). 12. Define and provide examples of automatic and socially mediated contingencies (B-7). 13. Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers (B-8). 14. Define and provide examples of operant extinction (B-9). 15. Define and provide examples of stimulus control (B-10). 16. Define and provide examples of discrimination, generalization, and maintenance (B-11). 17. Define and provide examples of motivating operations (B-12). 18. Define and provide examples of rule-governed and contingency-shaped behavior (B-13). 19. Define and provide examples of the verbal operants (B-14). 20. Define and provide examples of derived stimulus relations (B-15). Credits: 3.00

EDPS 55300 - Application Of Applied Behavior Analysis To Manage And Support Personnel

Credit Hours: 3.00. This course will teach students how to use applied behavior analysis to maximize the potential of an organization. Students will learn the role of a Behavior Analyst in implementing principles of applied behavior analysis to motivate employees, intervene with challenges in the organization, evaluate the program, and collect and deliver ongoing performance feedback. Permission of instructor required.

Learning Outcomes: 1. Define Organizational Behavior Management (OBM) and explain how it differs from other management approaches. 2. State three specialty areas of application of OBM. 3. Define Pinpoint and state the four components of behavior pinpointing. 4. Describe methods and tools for measurement in OBM. 5. Describe types of analysis in OBM. 6. State common intervention procedures used in organizations. 7. Apply OBM knowledge to assess targeted concern(s) and provide recommendations within an organization. 8. State characteristics of effective feedback. 9. Describe steps for evaluating reinforcers and delivering reinforcers. 10. Describe tools for evaluating performance change. Credits: 3.00

EDPS 62800 - The Behavior Analyst As Supervisor

Credit Hours: 0.00 to 3.00. This course will address the provision of supervision of behavior analysis trainees and technicians utilizing principles and procedures of applied behavior analysis. Application of goal development, behavioral skills training, and progress monitoring within a behavioral analytic framework will be explored. Must be enrolled in ABA Certificate or Masters Program. Pre-requisite: EDPS 61200. Permission of instructor required.

Learning Outcomes: 1. Describe reasons for effective evidence-based supervision and outcomes of ineffective supervision. 2. Describe necessary components of the supervisory relationship. 3. Assess and select performance expectations for the supervisee and supervisor. 4. Describe components of behavioral skills training. 5. Apply supervision skills to teach assessment and intervention procedures as relevant to task list competencies. 6. State features of performance monitoring and performance feedback . 7. Evaluate supervisor effectiveness. 8. Describe ethics of and methods for providing ongoing professional development. Credits: 0.00 to 3.00

EDPS 50800 - Cultural And Linguistic Diversity In Special Education Programs

Credit Hours: 3.00. Living in a diverse society provides special education teachers and support personnel the opportunity to encounter a wide array of cultures in their educational settings. The course, designed for special education stakeholders (i.e., teachers, staff, support personnel, administrators), considers issues of human diversity, broadly defined to include ability, ethnicity, culture, gender identity, linguistic background, race, religion, socioeconomic status, and sexual orientation. This course challenges biased assumptions that influence the provision of educational services, and examines issues related to promoting equal learning opportunities in the classroom and other educational settings. It is designed to facilitate student examination of how diversity and diverse experiences shape systems that affect individuals, families, communities, and society. It allows students to explore their own cultures and the biases and internalized messages about those who are different from themselves. Students will be introduced to specific approaches to practice, and frameworks for equity, advocacy, and empowerment to support students who receive special education and/or applied behavior analysis (ABA) service, as well as their families. The course also includes information and discussion topics pertaining to the culturo-behavior science (CBS) specialization of the Association for Behavior Analysis International (ABAI) and to interpersonal communication skills - to include speaking, listening, reading, and writing - and their effect on students and families. Permission of instructor required.

Learning Outcomes: 1. Demonstrate a conscious awareness and working knowledge of diverse populations within education settings. 2. Demonstrate the knowledge to create safe, inclusive, culturally responsive learning environments and classroom management systems. 3. Demonstrate the ability to identify funds of knowledge and how they interact to form meaningful relationships with students and families. 4. Engage with others around identity and difference, and apply self-awareness to identify and manage the influence of personal biases and values in working in diverse settings. 5. Analyze and interpret historical and contemporary dynamics of privilege and oppression in society that lead to inequalities in access to educational resources. 6. Analyze, evaluate, and propose solutions to contemporary social problems found in schools, school districts, and ABA settings (E.g., culturally responsive PB IS, restorative justice,

etc. 7. Implement strategies that encourage students' to value their own heritage; value richness of cultural diversity and commonality; respect diverse cultural groups; and reduce stereotyping. Credits: 3.00

EDPS 59200 - Principles & Philosophy Of Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to provide students with a working understanding of the conceptual framework of behavior analysis and the underlying theoretical and philosophical foundation of behavior analysis. The course will provide advanced coverage of the history, philosophical underpinnings, and advanced concepts and principles of behaviorism and behavior analysis. Permission of instructor required.

Learning Outcomes: 1. Identify and evaluate the goals of behavior analysis as a science. 2. Synthesize the philosophical assumptions underlying the science of behavior analysis. 3. Analyze behavior from the perspective of radical behaviorism. 4. Differentiate among the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. 5. Distinguish the dimensions of applied behavior analysis. Credits: 3.00

EDPS 55900 - Introduction To The Experimental Analysis Of Behavior

Credit Hours: 3.00. This course introduces students to the theories, principles, and research conducted in experimental analysis of behavior (EAB). EAB began with highly controlled animal studies and has expanded to translational work with humans. Applied Behavior Analysis (ABA), the study of human behavior and the application of behavioral principles on socially significant behavior has evolved from EAB. Permission of instructor required.

Learning Outcomes: 1. Identify and analyze the major conceptual frameworks from the Experimental Analysis of Behavior (EAB). 2. Analyze areas of overlap between EAB and applied behavior analysis. 3. Apply the process of reading and extracting critical information from peer-reviewed empirical and conceptual papers in EAB. 4. Differentiate among the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. 5. Evaluate research methods used in EAB and how these are utilized to examine environmental determinants of behavior under experimental conditions. Credits: 3.00

GPA Requirements

Educational Studies: Educational Leadership and Policy Studies Concentration, MSED or MS

About the Program

Program Requirements

Required Courses (24 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

Course Set One (7 credits)

EDST 60200 - Seminar: The School Principalship

Credit Hours: 3.00. Individual exploration in depth of selected

aspects of the school principalship and critical analysis of related issues. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the students acquiring proficiency in: Leadership, Supervision, Vision and Mission, Change, Staff Recruitment & Selection, Staff Evaluation, Staff/Administrative Relations, Curriculum Leadership and Management, Student Discipline, Pupil Personnel Services, Professional Development, Ethics, Decision Making, Planning, Time Management and Teaching and Learning. Credits: 3.00

EDST 60700 - Administration Of Educational Systems

Credit Hours: 3.00. An examination of administrative function, process, structure, and practice. Special emphasis given to theory development in administration. Exploration of system analysis applications to educational administration. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana Standards focused on students acquiring proficiency in organizational and resource management, including using data to identify needs and priorities within the organization; identifying and addressing organizational barriers to student achievement; using technological tools to manage information and support effective management of the organization; and using practices for the safe, efficient and effective operation of school's physical plant, equipment and auxiliary services. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Course Set Two (7 credits)

EDST 60900 - Legal Aspects Of American Education

Credit Hours: 3.00. (EDFA 60900) Legal foundations of education as established by constitutional provisions, court decisions, opinions of attorney generals, administrative rulings, and executive directives. Emphasis on legal theory and principles currently in state of change. Stress of case study method of investigation into educational law. Prerequisite: 9 credit hours in Education.

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the student acquiring proficiency in human resource management; equity and access to educational programs, curricula and available supports; behavior management systems; school safety and emergency preparedness; student safety and welfare; and the rights and responsibilities of students, families, and school staff. Credits: 3.00

EDST 61000 - Supervision Of Instruction And Instructional Personnel

Credit Hours: 3.00. (EDFA 61000) A comprehensive approach

to supervision and instruction that develops the knowledge, interpersonal, and leadership skills, which are then applied in a school setting for the purpose of instructional improvement. Models of supervision, leadership and evaluation will be examined to gain knowledge in order to apply effective strategies for diverse situations. The study of transformational change in today's schools will guide leadership knowledge to the task of direct assistance, collegiality, collaboration, culture of trust, professional development, dialectic inquiry, curriculum development and action research. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Recognize the temper of diverse situations within their instructional leadership role and appropriately apply strategies that will address the situations. 2. Use the understanding and experience of instructional supervision concepts explored throughout this course and apply supervisory principles to the daily functions and responsibilities of an education administrator. 3. Demonstrate the ability to correctly apply various leadership concepts to various fact-based situations and formulate a plan of action to address each situation. 4. Accurately interpret the characteristics of a healthy organization (campus, district, etc.). 5. Evaluate the results of teacher and administrator interviews regarding system and recommend a teacher appraisal system that may improve the equality of observations and appraisals. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Course Set Three (7 credits)

EDST 51400 - Economics Of Education

Credit Hours: 3.00. A general course in financing education, including current economic theories, sources of revenues, and trends in fiscal structure and operations in education.

Learning Outcomes: 1. Develop and understand the goals of public education, why states invest in education, and the legal basis for financing public education. 2. Develop and understand the sources of revenues for public education and the approaches used to raise and distribute funds for school district operations. 3. Develop and understand the concepts of equity and adequacy and how these ideas are reflected in current state education policy and educational leadership practices. 4. Develop and understand budgeting strategies and procedures used by educational leaders to influence student achievement outcomes and realize other school-based goals. Credits: 3.00

EDST 51600 - School-Community Relations

Credit Hours: 3.00. (EDFA 51600) This course will stress concepts and principles relevant to school-community interaction. It will focus on the new roles of the public in education and will deal with problems encountered by educators in communicating with the public.

Learning Outcomes: 1. Design their commitment to build stronger family and community relationships with schools. 2. Understand important analytical, policy-relevant, and practice-oriented perspectives on family and community involvement in education 3. Develop skills and strategies for fostering mutually beneficial family and community connections with schools. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Course Set One (7 credits)

EDST 60200 - Seminar: The School Principalship

Credit Hours: 3.00. Individual exploration in depth of selected aspects of the school principalship and critical analysis of related issues. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the students acquiring proficiency in: Leadership, Supervision, Vision and Mission, Change, Staff Recruitment & Selection, Staff Evaluation, Staff/Administrative Relations, Curriculum Leadership and Management, Student Discipline, Pupil Personnel Services, Professional Development, Ethics, Decision Making, Planning, Time Management and Teaching and Learning. Credits: 3.00

EDST 60700 - Administration Of Educational Systems

Credit Hours: 3.00. An examination of administrative function, process, structure, and practice. Special emphasis given to theory development in administration. Exploration of system analysis applications to educational administration. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana Standards focused on students acquiring proficiency in organizational and resource management, including using data to identify needs and priorities within the organization; identifying and addressing organizational barriers to student achievement; using technological tools to manage information and support effective management of the organization; and using practices for the safe, efficient and effective operation of school's physical plant, equipment and auxiliary services. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Selectives (6 credits)

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted

subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 66300 - Organization And Administration Of Special Education

Credit Hours: 3.00. (EDST 66300) A comprehensive course in the organization and administration of special education including the organizational arrangements, identification, placement and service delivery, tests and assessments, program evaluation, personnel, and school/community relations.

Learning Outcomes: 1. Examine, discuss, and gain an understanding of the role of the special education director. 2. Apply the federal and state rules and regulations for special education in school settings. 3. Understand the role of litigation in the field of special education. 4. Understand special education funding options, identify budget preparation strategies and fund management. 5. Demonstrate ways to ensure parent involvement. 6. Discuss current trends and issues in educating children with disabilities, including ethnic and cultural diversity, discipline, suspension and expulsion. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDPS 55500 - Differentiating Curriculum & Instruction

Credit Hours: 3.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online class meetings and discussions, case studies, differentiated instruction examples, direct application, and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative, and summative assessments to inform instructional decision-making; and c) flexible grouping; addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn and are motivated; understanding that the process of differentiation involves modifying content, process, product, learning environment, and/or affect; incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development; understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (RTI), and Multi-Tiered System of Support (MTSS).

Learning Outcomes: 1. Deconstruct the concept of differentiation as a response to the readiness levels; interests; learning preferences and strengths; and academic, social, emotional needs of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Assess students' readiness, interests, and learning profiles to create differentiated lessons that utilize instructional strategies and technologies that motivate and engage students in learning, including those from special

populations. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and your plan to implement differentiation knowledge and skills gained in this course. Credits: 3.00

Required Courses (24 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

Course Set One (7 credits)

EDST 60200 - Seminar: The School Principalship

Credit Hours: 3.00. Individual exploration in depth of selected aspects of the school principalship and critical analysis of related issues. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the students acquiring proficiency in: Leadership, Supervision, Vision and Mission, Change, Staff Recruitment & Selection, Staff Evaluation, Staff/Administrative Relations, Curriculum Leadership and Management, Student Discipline, Pupil Personnel Services, Professional Development, Ethics, Decision Making, Planning, Time Management and Teaching and Learning. Credits: 3.00

EDST 60700 - Administration Of Educational Systems

Credit Hours: 3.00. An examination of administrative function, process, structure, and practice. Special emphasis given to theory development in administration. Exploration of system analysis applications to educational administration. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana Standards focused on students acquiring proficiency in organizational and resource management, including using data to identify needs and priorities within the organization; identifying and addressing organizational barriers to student achievement; using technological tools to manage information and support effective management of the organization; and using practices for the safe, efficient and effective operation of school's physical plant, equipment and auxiliary services. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Course Set Two (7 credits)

EDST 60900 - Legal Aspects Of American Education

Credit Hours: 3.00. (EDFA 60900) Legal foundations of education as established by constitutional provisions, court decisions, opinions of attorney generals, administrative rulings, and executive directives. Emphasis on legal theory and principles currently in state of change. Stress of case study method of investigation into educational law. Prerequisite: 9 credit hours in Education.

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the student acquiring proficiency in human resource management; equity and access to educational programs, curricula and available supports; behavior management systems; school safety and emergency preparedness; student safety and welfare; and the rights and responsibilities of students, families, and school staff. Credits: 3.00

EDST 61000 - Supervision Of Instruction And Instructional Personnel

Credit Hours: 3.00. (EDFA 61000) A comprehensive approach to supervision and instruction that develops the knowledge, interpersonal, and leadership skills, which are then applied in a school setting for the purpose of instructional improvement. Models of supervision, leadership and evaluation will be examined to gain knowledge in order to apply effective strategies for diverse situations. The study of transformational change in today's schools will guide leadership knowledge to the task of direct assistance, collegiality, collaboration, culture of trust, professional development, dialectic inquiry, curriculum development and action research. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Recognize the temper of diverse situations within their instructional leadership role and appropriately apply strategies that will address the situations. 2. Use the understanding and experience of instructional supervision concepts explored throughout this course and apply supervisory principles to the daily functions and responsibilities of an education administrator. 3. Demonstrate the ability to correctly apply various leadership concepts to various fact-based situations and formulate a plan of action to address each situation. 4. Accurately interpret the characteristics of a healthy organization (campus, district, etc.). 5. Evaluate the results of teacher and administrator interviews regarding system and recommend a teacher appraisal system that may improve the equality of observations and appraisals. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Course Set Three (7 credits)

EDST 51400 - Economics Of Education

Credit Hours: 3.00. A general course in financing education, including current economic theories, sources of revenues, and trends in fiscal structure and operations in education.

Learning Outcomes: 1. Develop and understand the goals of public education, why states invest in education, and the legal basis for financing public education. 2. Develop and understand the sources of revenues for public education and the approaches used to raise and distribute funds for school district operations. 3. Develop and understand the concepts of equity and adequacy and how these ideas are reflected in current state education policy and educational

leadership practices. 4. Develop and understand budgeting strategies and procedures used by educational leaders to influence student achievement outcomes and realize other school-based goals. Credits: 3.00

EDST 51600 - School-Community Relations

Credit Hours: 3.00. (EDFA 51600) This course will stress concepts and principles relevant to school-community interaction. It will focus on the new roles of the public in education and will deal with problems encountered by educators in communicating with the public.

Learning Outcomes: 1. Design their commitment to build stronger family and community relationships with schools. 2. Understand important analytical, policy-relevant, and practice-oriented perspectives on family and community involvement in education 3. Develop skills and strategies for fostering mutually beneficial family and community connections with schools. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Course Set One (7 credits)

EDST 60200 - Seminar: The School Principalship

Credit Hours: 3.00. Individual exploration in depth of selected aspects of the school principalship and critical analysis of related issues. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the students acquiring proficiency in: Leadership, Supervision, Vision and Mission, Change, Staff Recruitment & Selection, Staff Evaluation, Staff/Administrative Relations, Curriculum Leadership and Management, Student Discipline, Pupil Personnel Services, Professional Development, Ethics, Decision Making, Planning, Time Management and Teaching and Learning. Credits: 3.00

EDST 60700 - Administration Of Educational Systems

Credit Hours: 3.00. An examination of administrative function, process, structure, and practice. Special emphasis given to theory development in administration. Exploration of system analysis applications to educational administration. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana Standards focused on students acquiring proficiency in organizational and resource management, including using data to identify needs and priorities within the organization; identifying and addressing organizational barriers to student achievement; using technological tools to manage information and support effective management of the organization; and using practices for the safe, efficient and effective operation of school's physical plant, equipment and auxiliary services. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration.

Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

Concentrations

About the Program

Educational Studies: Educational Psychology and Research Methodology Concentration, MSED or MS

About the Program

Program Requirements - Thesis

Required Courses (16 credits)

Foundation Course (3 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

Primary Area Courses (6 credits)

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score

interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

Seminar Courses (4 credits)

EDPS 63100 - Applied Educational Research Design Seminar

Credit Hours: 1.00 to 3.00. This seminar seeks to promote professionalism, research and scholarly productivity and collegial support among graduate students in gifted, creative (GCT), and talented studies, associated graduate students, visiting scholars, and interested others. A secondary purpose involves assisting GCT students, COE students, and associates with successful study and career preparation by focusing on research, grants, thesis preparation, graduate writing, proposal development, professional development, and degree completion. Finally, seminar offers students the opportunity to discuss, learn and "mess" around with current issues in the field and of personal interest. Seminar creates time and incentive for students to become more productive with their scholarship efforts, and offers students credit for work completed and formal support for the professional development and scholarship processes. In this course students should expect to attend, contribute, and participate. A variety of formats will be used, including, but not limited to: discussion, simulations, group work, lecture, guest speakers, and peer feedback. Prerequisite: EDPS 63000 and one graduate course in Statistics.

Learning Outcomes: 1. Engage with IRB process. 2. Write for publication. 3. Critically review and revise writing. 4. Engage in research. 5. Develop a professional vita. 6. Write conference proposals. 7. Create professional presentations. 8. Review relevant literature. Credits: 1.00 to 3.00

EDPS 63200 - Seminar In Research Procedures In Education

Credit Hours: 1.00 to 3.00. Experimental, field study, scientific survey, and prediction study methods in education. Internal and external validity, identification and development of research problems, criteria development, common methodological errors, strategies of analysis, and sources of acceptable educational research literature will be reviewed. Critical analyses of the research methodology of educational research reports in the student's field. Prerequisite: EDPS 63000 or 53300 and course work in Statistics.

Learning Outcomes: 1. Develop specific advanced methodological skills and knowledge that are applicable to education research and practice. Credits: 1.00 to 3.00

EDPS 63300 - Seminar In Educational Psychology

Credit Hours: 1.00 to 3.00. Recent investigations and research in educational psychology. One topic is dealt with in each enrollment. The topics provide an in-depth study of those areas of psychological investigation in educational settings and problems. These areas include: (1) instructional technology and design; (2) individual differences and educational growth; (3) school learning: theory and research; (4) classroom behavior and social processes; (5) educational assessment; and (6) other relevant topics. Prerequisite: EDPS 53000 .

Credits: 1.00 to 3.00

Statistics Course (3 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

Primary Area Electives (9 credits)

Thesis Research (12 credits)

EDPS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Requirements - Non-thesis

Required Courses (16 credits)

Research Problems Course (3 credits)

EDPS 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

Primary Area Electives (9 credits)

Related Area Electives (6 credits)

Educational Studies: Gifted Education Concentration, MSED or MS

About the Program

Program Requirements - Thesis

Required Courses (25 credits)

Foundation Course (3 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

Core Courses (6 credits)

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 53600 - Achievement Motivation And Performance

Credit Hours: 3.00. Study of current theory and research on the nature and development of achievement motivation. Motivation for intellectual and academic performance will be emphasized. Applications of theory in educational settings will be considered.

Credits: 3.00

Seminar Courses (4 credits)

EDPS 63100 - Applied Educational Research Design Seminar

Credit Hours: 1.00 to 3.00. This seminar seeks to promote professionalism, research and scholarly productivity and collegial support among graduate students in gifted, creative (GCT), and talented studies, associated graduate students, visiting scholars, and interested others. A secondary purpose involves assisting GCT students, COE students, and associates with successful study and career preparation by focusing on research, grants, thesis preparation, graduate writing, proposal development, professional development, and degree completion. Finally, seminar offers students the opportunity to discuss, learn and "mess" around with current issues in the field and of personal interest. Seminar creates time and incentive for students to become more productive with their scholarship efforts, and offers students credit for work completed and formal support for the professional development and scholarship processes. In this course students should expect to attend, contribute, and participate. A variety of formats will be used, including, but not limited to: discussion, simulations, group work, lecture, guest speakers, and peer feedback. Prerequisite: EDPS 63000 and one graduate course in Statistics.

Learning Outcomes: 1. Engage with IRB process. 2. Write for publication. 3. Critically review and revise writing. 4. Engage in research. 5. Develop a professional vita. 6. Write conference proposals. 7. Create professional presentations. 8. Review relevant literature. Credits: 1.00 to 3.00

EDPS 63200 - Seminar In Research Procedures In Education

Credit Hours: 1.00 to 3.00. Experimental, field study, scientific survey, and prediction study methods in education. Internal and external validity, identification and development of research problems, criteria development, common methodological errors, strategies of analysis, and sources of acceptable educational research literature will be reviewed. Critical analyses of the research methodology of educational research reports in the student's field. Prerequisite: EDPS 63000 or 53300 and course work in Statistics.

Learning Outcomes: 1. Develop specific advanced methodological skills and knowledge that are applicable to education research and practice. Credits: 1.00 to 3.00

EDPS 63300 - Seminar In Educational Psychology

Credit Hours: 1.00 to 3.00. Recent investigations and research in educational psychology. One topic is dealt with in each enrollment. The topics provide an in-depth study of those areas of psychological investigation in educational settings and problems. These areas include: (1) instructional technology and design; (2) individual differences and educational growth; (3) school learning: theory and research; (4) classroom behavior and social processes; (5) educational assessment; and (6) other relevant topics. Prerequisite: EDPS 53000 .

Credits: 1.00 to 3.00

Statistics Course (3 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

Primary Area Courses (9 credits)

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the

school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54200 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to the curriculum development and program design for meeting the needs of gifted, creative, and talented students. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students.

Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

Related Area Electives (6 credits)

Thesis Research (6 credits)

Program Requirements - Non-Thesis

Required Courses (22 credits)

Foundation Course (3 credits)

Core Courses (6 credits)

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central

components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

Seminar Courses (4 credits)

Primary Area Courses (9 credits)

Research Problems Course (3 credits)

EDPS 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

Related Area Electives (6 credits)

Educational Studies: Higher Education Systems, Policy, and Leadership Concentration, MSED

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (xx credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research

area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

EDST 52000 - Educational Leadership, Governance, And Policy

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of contemporary PK-22 education leadership, administration, and governance. This course will cover the foundational administrative knowledge and skills necessary for transformational leadership at the modern primary, secondary, and post-secondary educational settings. The scope of this course seeks to cultivate an understanding of the functionality of educational systems as organizations within the context of a technologically, socially, and culturally changing world.

Learning Outcomes: 1. Analyze a variety of literature on PK-22 educational leadership, integrating relevant literature from the fields and disciplines of higher education, leadership, business, political science, and sociology. 2. Apply skillfully foundational PK-22 leadership knowledge and skills necessary for middle management and senior-level educational leadership in the context of a rapidly changing, culturally diversifying, technologically dynamic global education field. 3. Understand sustainable transformational education leadership by repeatedly engaging in activities and assignments that: Require a comprehensive analysis and understanding of how the following interface: institutional finance and budgeting, strategic planning and assessment, organizational structure and culture, existing and emerging education policy, and the current social and political climate; Require an understanding and analysis of the common day-to-day and long-term challenges that contemporary PK-22 education administrators face in strategic decision-making; Require an evaluation of structural and cultural practices and norms in PK-22 education administration for the sake of comparative analysis. Credits: 3.00

EDST 52100 - Foundations In PK-XXII Educational Systems

Credit Hours: 3.00. This survey course broadly explores the complex foundations of U.S. educational systems from pre-kindergarten (PK) through the doctoral level of education (PK-22). Through the lenses of culture, history, politics, and society, this course seeks to examine factors that impact the policies and practices of PK-22 educational systems. From theoretical knowledge to philosophical orientations, the course interrogates the ways schools transform society and ways society transforms schools. The course incorporates a variety of engaged learning activities including discussion prompts, reflective journaling of course readings, and literature review and research writing. As such, this course challenges students to: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems; 2. Examine the interrelationships of culture, politics, and social structures related to educational systems; 3. Analyze and evaluate current issues in PK-22 education systems; 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies.

Learning Outcomes: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems. 2. Examine the interrelationships of culture, politics, and social structures related to educational systems. 3. Analyze and evaluate current issues in PK-22 education systems. 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies. Credits: 3.00

EDST 52200 - Culture And Social Issues In PK-XXII Education

Credit Hours: 3.00. The aim of this course is to engage

students in the critical examination of cultural and social issues impacting PK-22 education at the local, state, and federal levels. This course will review the evolving functional role of PK-22 education in a diversifying global society. By way of critical intercultural and intracultural examination and reflection, this course seeks to cultivate a deeper understanding of the ways that education influences and is influenced by issues related to cultural and social change and conflict.

Learning Outcomes: 1. Analyze a variety of literature on cultural and social issues, integrating relevant literature from the fields and disciplines of education, anthropology, sociology, and political science. 2. Examine and evaluate the past and present activity /role of PK-22 entities during periods of social and cultural changes and conflict. 3. Reflect critically on intercultural and intracultural biases, perspectives, and positions, and the way that they might influence day-to-day interactions in educational environments. 4. Apply acquired knowledge and understanding of the corresponding relationship between culture/social issues and PK-22 education, to create comprehensive proposals and recommendations for PK-22 entities to engage with and address issues on diversity. Credits: 3.00

EDST 64000 - Higher Education Law

Credit Hours: 3.00. This course explores the legal framework within which institutions of higher education operate. Course materials, activities, and assignments will give students a deep understanding of how state and federal legislative bodies and courts operate. Students will read statutory materials and case law on legal issues related to higher education, including: free speech, religion, academic freedom, searches and seizures, due process rights, equal protection issues, individuals with disabilities, contracts and employment, torts and university liability. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize case law, and statutory and administrative law materials to create and share a robust understanding of how the varied sources of law inform all interactions at institutions of higher education. 3. Create new knowledge by synthesizing, applying, and communicating how the law can and should be applied in higher education institutions. 4. Learn and apply legal research skills that will empower them to contribute to legal scholarship. 5. Become more fluent in communicating complex legal concepts to stakeholders at different levels (students, peers, administrators, etc.). Credits: 3.00

EDST 64200 - Cultural Engagement In Higher Education Communities

Credit Hours: 3.00. The influence of culture is of particular import with issues facing the world today and Higher Education institutions (HEIs) are not immune to this reality. HEIs often serve as an institutional base for communities and have a vested interest in meaningful engagement with the communities that surround their campuses. This course is designed to enable learners to confidently communicate, build relationships, and work effectively in culturally diverse communities. Through exploration of a variety of intercultural theories, students will become aware of and be able to navigate the cultural influences in local, state, regional, national, and international higher education communities. As part of the course, students will engage in their communities through experiential, real-world, case study, and project management methods. Permission of instructor required.

Learning Outcomes: 1. Deepen their thinking and practice of community engagement and the positionality of the institution within its community. 2. Demonstrate that as a complex organization, Higher education functions as both a personal and a societal (public and private) benefit. 3. Demonstrate consistent critical attention and critical thinking to their own and others positionality including cultural identities, social and organizational power and privilege, and intercultural competence. 4. Formulate skills to better recognize, prevent, and resolve cross-cultural conflicts. 5. Construct effective cross-cultural relationships and work in an intercultural group setting. 6. Evaluate and summarize intercultural theories as applied to their individual/institutional contexts. 7. Describe a context for examining the organization of knowledge and institutions of higher education

in relation to community-based problem solving. 8. Examine complex social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using a variety of community engagement and cultural frameworks. 9. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. 10. Apply theory to practice in a final community engagement research project. Credits: 3.00

EDST 64300 - Higher Education Economics And Finance

Credit Hours: 3.00. This course provides students with an overview of financial issues related to higher education. Students will discuss and evaluate topics such as the public versus private financial benefits of higher education, the financial relationship between institutions of higher education and both state and federal governments, and issues related to labor economics. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize, create, and communicate knowledge. 3. Engage in professional development. 4. Participate actively in the profession. Credits: 3.00

Internship Course (xx credits)

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

Core Courses (xx credits)

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Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

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EDST 52000 - Educational Leadership, Governance, And Policy

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of contemporary PK-22 education leadership, administration, and governance. This course will cover the foundational administrative knowledge and skills necessary for transformational leadership at the modern primary, secondary, and post-secondary educational settings. The scope of this course seeks to cultivate an understanding of the functionality of educational systems as organizations within the context of a technologically, socially, and culturally changing world.

Learning Outcomes: 1. Analyze a variety of literature on PK-22 educational leadership, integrating relevant literature from the fields and disciplines of higher education, leadership, business, political science, and sociology. 2. Apply skillfully foundational PK-22 leadership knowledge and skills necessary for middle management and senior-level educational leadership in the context of a rapidly changing, culturally diversifying, technologically dynamic global education field. 3. Understand

sustainable transformational education leadership by repeatedly engaging in activities and assignments that: Require a comprehensive analysis and understanding of how the following interface: institutional finance and budgeting, strategic planning and assessment, organizational structure and culture, existing and emerging education policy, and the current social and political climate; Require an understanding and analysis of the common day-to-day and long-term challenges that contemporary PK-22 education administrators face in strategic decision-making; Require an evaluation of structural and cultural practices and norms in PK-22 education administration for the sake of comparative analysis. Credits: 3.00

EDST 52100 - Foundations In PK-XXII Educational Systems

Credit Hours: 3.00. This survey course broadly explores the complex foundations of U.S. educational systems from pre-kindergarten (PK) through the doctoral level of education (PK-22). Through the lenses of culture, history, politics, and society, this course seeks to examine factors that impact the policies and practices of PK-22 educational systems. From theoretical knowledge to philosophical orientations, the course interrogates the ways schools transform society and ways society transforms schools. The course incorporates a variety of engaged learning activities including discussion prompts, reflective journaling of course readings, and literature review and research writing. As such, this course challenges students to: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems; 2. Examine the interrelationships of culture, politics, and social structures related to educational systems; 3. Analyze and evaluate current issues in PK-22 education systems; 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies.

Learning Outcomes: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems. 2. Examine the interrelationships of culture, politics, and social structures related to educational systems. 3. Analyze and evaluate current issues in PK-22 education systems. 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies. Credits: 3.00

EDST 52200 - Culture And Social Issues In PK-XXII Education

Credit Hours: 3.00. The aim of this course is to engage students in the critical examination of cultural and social issues impacting PK-22 education at the local, state, and federal levels. This course will review the evolving functional role of PK-22 education in a diversifying global society. By way of critical intercultural and intracultural examination and reflection, this course seeks to cultivate a deeper understanding of the ways that education influences and is influenced by issues related to cultural and social change and conflict.

Learning Outcomes: 1. Analyze a variety of literature on cultural and social issues, integrating relevant literature from the fields and disciplines of education, anthropology, sociology, and political science. 2. Examine and evaluate the past and present activity /role of PK-22 entities during periods of social and cultural changes and conflict. 3. Reflect critically on intercultural and intracultural biases, perspectives, and positions, and the way that they might influence day-to-day interactions in educational environments. 4. Apply acquired knowledge and understanding of the corresponding relationship between culture/social issues and PK-22 education, to create comprehensive proposals and recommendations for PK-22 entities to engage with and address issues on diversity. Credits: 3.00

EDST 64000 - Higher Education Law

Credit Hours: 3.00. This course explores the legal framework within which institutions of higher education operate. Course materials, activities, and assignments will give students a deep understanding of how state and federal legislative bodies and courts operate. Students will read statutory materials and case law on legal issues related to higher education, including: free speech, religion, academic freedom, searches and seizures, due process rights, equal protection issues, individuals with disabilities, contracts and employment, torts and university liability. Permission of instructor required.

Learning Outcomes: 1. Think critically and

reflectively. 2. Synthesize case law, and statutory and administrative law materials to create and share a robust understanding of how the varied sources of law inform all interactions at institutions of higher education. 3. Create new knowledge by synthesizing, applying, and communicating how the law can and should be applied in higher education institutions. 4. Learn and apply legal research skills that will empower them to contribute to legal scholarship. 5. Become more fluent in communicating complex legal concepts to stakeholders at different levels (students, peers, administrators, etc.). Credits: 3.00

EDST 64200 - Cultural Engagement In Higher Education Communities

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Learning Outcomes: 1. Deepen their thinking and practice of community engagement and the positionality of the institution within its community. 2. Demonstrate that as a complex organization, Higher education functions as both a personal and a societal (public and private) benefit. 3. Demonstrate consistent critical attention and critical thinking to their own and others positionality including cultural identities, social and organizational power and privilege, and intercultural competence. 4. Formulate skills to better recognize, prevent, and resolve cross-cultural conflicts. 5. Construct effective cross-cultural relationships and work in an intercultural group setting. 6. Evaluate and summarize intercultural theories as applied to their individual/institutional contexts. 7. Describe a context for examining the organization of knowledge and institutions of higher education in relation to community-based problem solving. 8. Examine complex social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using a variety of community engagement and cultural frameworks. 9. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. 10. Apply theory to practice in a final community engagement research project. Credits: 3.00

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Program Requirements

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EDST 52100 - Foundations In PK-XXII Educational Systems

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EDST 52200 - Culture And Social Issues In PK-XXII Education

Credit Hours: 3.00. The aim of this course is to engage students in the critical examination of cultural and social issues impacting PK-22 education at the local, state, and federal levels. This course will review the evolving functional role of PK-22 education in a diversifying global society. By way of critical intercultural and intracultural examination and reflection, this course seeks to cultivate a deeper understanding of the ways that education influences and is influenced by issues related to cultural and social change and conflict.

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EDST 64000 - Higher Education Law

Credit Hours: 3.00. This course explores the legal framework within which institutions of higher education operate. Course materials, activities, and assignments will give students a deep understanding of how state and federal legislative bodies and courts operate. Students will read statutory materials and case law on legal issues related to higher education, including: free speech, religion, academic freedom, searches and seizures, due process rights, equal protection issues, individuals with disabilities, contracts and employment, torts and university liability. Permission of instructor required.

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Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

Core Courses (xx credits)

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EDST 64000 - Higher Education Law

Credit Hours: 3.00. This course explores the legal framework within which institutions of higher education operate. Course materials, activities, and assignments will give students a deep understanding of how state and federal legislative bodies and courts operate. Students will read statutory materials and case law on legal issues related to higher education, including: free speech, religion, academic freedom, searches and seizures, due process rights, equal protection issues, individuals with disabilities, contracts and employment, torts and university liability. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize case law, and statutory and administrative law materials to create and share a robust understanding of how the varied sources of law inform all interactions at institutions of higher education. 3. Create new knowledge by synthesizing, applying, and communicating how the law can and should be applied in higher education institutions. 4. Learn and apply legal research skills that will empower them to contribute to legal scholarship. 5. Become more fluent in communicating complex legal concepts to stakeholders at different levels (students, peers, administrators, etc.). Credits: 3.00

EDST 64200 - Cultural Engagement In Higher Education Communities

Credit Hours: 3.00. The influence of culture is of particular import with issues facing the world today and Higher Education institutions (HEIs) are not immune to this reality. HEIs often serve as an institutional base for communities and have a vested interest in meaningful engagement with the communities that surround their campuses. This course is designed to enable learners to confidently communicate, build relationships, and work effectively in culturally diverse communities. Through exploration of a variety of intercultural theories, students will become aware of and be able to navigate the cultural influences in local, state, regional, national, and international higher education communities. As part of the course, students will engage in their communities through experiential, real-world, case study, and project management methods. Permission of instructor required.

Learning Outcomes: 1. Deepen their thinking and practice of community engagement and the positionality of the institution within its community. 2. Demonstrate that as a complex organization, Higher education functions as both a personal and a societal (public and private) benefit. 3. Demonstrate consistent critical attention and critical thinking to their own and others positionality including cultural identities, social and organizational power and privilege, and intercultural competence. 4. Formulate skills to better recognize, prevent, and resolve cross-cultural conflicts. 5. Construct effective cross-cultural relationships and work in an intercultural group setting. 6. Evaluate and summarize intercultural theories as applied to their individual/institutional contexts. 7. Describe a context for examining the organization of knowledge and institutions of higher education in relation to community-based problem solving. 8. Examine complex social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using a variety of community engagement and cultural frameworks. 9. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. 10. Apply theory to practice in a final community engagement research project. Credits: 3.00

EDST 64300 - Higher Education Economics And Finance

Credit Hours: 3.00. This course provides students with an overview of financial issues related to higher education. Students will discuss and evaluate topics such as the public versus private financial benefits of higher education, the financial relationship between institutions of higher education and both state and federal governments, and issues related to labor economics. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize, create, and communicate knowledge. 3. Engage in professional development. 4. Participate actively in the profession. Credits: 3.00

Educational Studies: Special Education Concentration, MSED or MS

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (28 credits)

EDPS 51500 - Foundations Of Applied Behavioral Analysis In School Settings

Credit Hours: 3.00. Application of learning theory, measurement procedures, verification of functional relationships, and developing knowledge of current significant research in applied behavior analysis.

Learning Outcomes: 1. Introduced to specific methods and teaching strategies for working with children with emotional and behavioral disabilities. 2. Prepared to systematically monitor student performance. 3. Prepare teachers to devise and implement usable functional behavior analysis and behavior management plans for students with emotional and behavioral disabilities. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 56300 - Data-Based Decision Making For Learners With Exceptionalities

Credit Hours: 3.00. Advanced procedures for educational assessment of exceptional individuals: norm-referenced and curriculum-based measurement, error analyses, and observational ratings. Adaptations and selections of tests for sensory impairments, behavioral styles, different intelligence levels and ages.

Learning Outcomes: 1. Apply terminology, theory, and the implications of measurement theory to select, administer, and score and interpret formal, informal, and/or curriculum-based assessment results for key stakeholders to make data-based decisions. 2. Apply principles of UDL to make decisions regarding selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 3. Apply knowledge of the referral and classification procedures and interpret, report, and communicate results to stakeholders via paper and/or digitally. 4. Evaluate eligibility (including students from culturally and/or linguistically diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and evaluating individualized learning objectives), and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with exceptionalities. 5. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional

growth. Credits: 3.00

EDPS 56500 - Math Curricula For Learners With Exceptionalities

Credit Hours: 3.00. This course will explore research-supported general and specialized math curricula to prepare candidates to design and/or adapt math lessons and instructional materials to meet the math needs of students with exceptionalities.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying math assessments to accommodate student(s) with exceptionalities, including students who are nonverbal, have intense intervention needs, or are English Learners. 2. Evaluate research-supported math instructional strategies and materials appropriate to the strength, needs, and characteristics of students with exceptionalities. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate students' math learning and the students' learning environment. 4. Create math lesson plans, based on national, state and/or local math curricula standards, and the scope of sequence of grade-level/chronologically-aged appropriate general education math curriculum that incorporate UDL, research-supported math instructional strategies and materials, and provide meaning-filled math learning opportunities that facilitate student's ability to make connections (e.g., learning mathematics in the context of cooking and art). 5. Create math lesson plans that incorporate UDL and apply research-supported strategies to provide specially designed mathematics instruction, including strategies for problems and meaning-filled math learning opportunities that facilitate students' ability to make connections (e.g., learning mathematics in the context of cooking and art). 6. Evaluate math instruction, monitor progress, and make instructional changes to support students' math learning. Credits: 3.00

EDPS 56800 - Social, Legal, And Ethical Issues Across The Lifespan

Credit Hours: 3.00. Survey of difference and similarities of children with exceptionality, including their nature and characteristics related to their developmental and educational needs. Analysis and practical application of social, legal, and ethical issues in the field of special education.

Learning Outcomes: 1. Explain the historical perspectives and foundations of general and special education policy, current issues, and research (REPA 1.1, 1.2; CEC Int. 1.1; CEC Adv. 3.3, 4.2, 6.1). 2. Apply ethical guidelines, state and federal laws and policies, and utilize the rights, roles, and responsibilities of stakeholders and organizations concerning the education of students with exceptionalities (REPA 1.3, 1.4, 1.5; CEC Int. 1.1, 2.2; CEC Adv 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 3. Evaluate the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals from diverse groups. (REPA 2.8.; CEC Int. 1.2, 2.2; CEC Adv. 2.3, 3.2, 4.2, 5.2). 4. Examine the roles and responsibilities of team members (RtI, multidisciplinary, Case Conference Committee (CCC), families, student) to facilitate in developing, implementing, monitoring, and amending individualized programs for students with exceptionalities (IEPs, transition plans, health-care plans, and behavioral and academic intervention plans) setting goals, and monitoring progress toward goal each grading period. (REPA 4.3, 4.4, 4.5; CEC Int. 2.1, 2.2, 2.3, 7.1; CEC Adv. 4.2, 5.3). 5. Evaluate eligibility (including students from culturally and/or linguistically diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and evaluating individualized learning objectives),

and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with mild and/or intense exceptional needs. (REPA 4.1, 4.2, 4.7; CEC Int. 1.1, 1.2, 2.1, 2.3, 3.1, 3.2; CEC Adv 4.2, 5.1, 5.2). 6. Engage in professional development activities and professional organizations relevant to teaching students with exceptional needs, and knowledge of professional resources, organizations, and publications for enhancing one's professional skills and for engaging in lifelong professional development (REPA 10.4/10.5; CEC Int 1.2; CEC Adv. 5.4, 5.5, 6.4, 6.5). 7. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth (REPA 10.6/10.7; CEC Int 2.2, 2.3, 4.2, 5.1; CEC Adv. 6.3, 7.1). Credits: 3.00

EDPS 57701 - Development Of Learners With Mild Intervention Needs

Credit Hours: 3.00. This course will explore the 4 areas of child development and the milestones associated with Cognitive, Social/Emotional, Language and Communication, and Movement and Physical development. This foundation in typical development will allow candidates to better understand atypical development in relation to characteristics and etiologies of mild disabilities. Candidates will investigate the multiple impacts systems have on individuals with mild disabilities and their families.

Learning Outcomes: 1. Describe typical and atypical human development, characteristics and etiologies in order to address the educational needs of individuals with mild disabilities. 2. Apply knowledge of the effects of medical conditions, physical and health needs, and common medications (e.g., stimulant, antidepressant, antiepileptic) on students with mild exceptional needs. 3. Analyze the impact of disability on the multiple aspects (education, career, vocation, social relationships, recreation, and adult life) of the life of an individual with mile intervention needs, including the knowledge of the family's role in supporting learning development. 4. Explain the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals with mild intervention needs from diverse groups. 5. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with mild exceptional needs and their families to improve instruction, and to determine personal goals for professional growth. Credits: 3.00

EDPS 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDPS 52400 - Effective Instruction For Students With Significant Reading Difficulties

Credit Hours: 3.00. This course will explore significant reading difficulties, such as dyslexia, and essential components of effective reading instruction. This course will investigate scientifically-based reading research (SBRR), evidence-based and developmentally appropriate reading instruction and interventions to support students with exceptionalities.

Learning Outcomes: 1. Identify the foundations of language acquisition and literacy development, including cognitive, linguistic, cultural, social, and motivational factors that affect language acquisition and literacy development; and major components of reading development, including phonemic awareness,

phonics, fluency, vocabulary, and text comprehension. 2. Explore the history, origins, and underlying causes of significant reading difficulties, including dyslexia. 3. Synthesize principles of scientifically based reading research (SBRR) and evidence-based reading instruction and intervention, such as applying data-based decision making, setting individual student learning goals, and using instruction grounded in SBRR. 4. Explain key concepts of phonemic awareness: the critical role of phonemic awareness in learning to read an alphabetic language; the distinction between phonological awareness (i.e., the awareness that oral language is composed of smaller units, such as spoken words and syllables) and phonemic awareness (i.e., a specific type of phonological awareness involving the ability to distinguish the separate phonemes in spoken words); and knowledge of the continuum of phonological- and phonemic-awareness skills development. 5. Summarize key concepts of phonics in developing accurate decoding and automaticity in word recognition; the importance of sequencing phonics instruction according to the increasing complexity of linguistic units; the reciprocity between decoding and encoding; and the continuum of phonics skills. 6. Create SBRR-based, evidence-based, and developmentally appropriate assessment, instruction, intervention, or extension lesson plan, and ongoing progress monitoring in phonemic awareness, phonics, fluency, vocabulary and academic language, comprehension and analysis of informational, persuasive, and literary texts, including response to literature. Credits: 3.00

EDPS 52700 - Literacy Curricula For Learners With Exceptionalities

Credit Hours: 3.00. This course will explore research-supported general and specialized literacy curricula to prepare candidates to design and/or adapt instructional lessons and materials to meet the needs of students with exceptionalities.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 2. Evaluate research-supported instructional strategies and materials appropriate to the strengths, needs, and characteristics of students with exceptionalities within the areas of literacy development, reading fluency, concepts of vocabulary and academic language, and comprehension and analysis of informational, persuasive, and literary text. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and the students' learning environment. 4. Create lesson plans, based on national, state, and/or local curricula standards and the scope and sequence of grade-level/chronologically-aged appropriate general education content-area curriculum that incorporate UDL, research-supported instructional strategies and materials, and provide meaning-filled learning opportunities. 5. Design lesson plans that incorporate UDL and apply research-supported strategies to provide specially designed reading and writing instruction, including strategies for providing explicit and systematic instruction and strategies for using technology to support various aspects of the reading and writing process and include instructional and assistive strategies to teach students to monitor errors in reading comprehension and writing. 6. Evaluate instruction, monitor progress, and make instructional changes to support student learning. Credits: 3.00

EDPS 55800 - Transition Education And Services

Credit Hours: 3.00. This course will explore a variety of resources, strategies, and techniques for promoting successful life transitions for students with mild and intense intervention needs before and throughout the school years and into postsecondary and adult settings.

Learning Outcomes: 1. Apply ethical guidelines, state and federal transition laws and policies (REPA 9.6, 9.7; CEC Int 1.1, 2.3: CEC Adv 2.2, 2.3, 3.3, 4.1, 5.1, 5.2, 6.1) 2. Evaluate state, school, and private resources (e.g. Individual Family Service Plans, Medicaid Waivers, Vocational Rehabilitation, Special Needs Trusts, Issues of Guardianship, Bureau of Developmental Disability Services) that promote successful life transitions (REPA 9.6, 9.7; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 3. Examine the rights, roles, and responsibilities of stakeholders and organizational resources concerning the transition process of students with exceptionalities (REPA 1.3, 1.4, 1.5, 9.6, 9.7; CEC Int. 1.1, 2.2, 2.3; CEC Adv 2.2, 2.3, 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 4. Create a transition-related lesson/activity to support positive, life-long transition outcomes (REPA 3.9, 9.2, 9.4, 9.5; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 5. Apply strategies to collaborate effectively with general education teachers, support staff, families and community/organizational resources to identify services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and promote positive transition outcomes. (REPA 4.6, 4.8, 9.3, 9.4, 9.5; CEC Int 1.1, 1.2, 2.3, 3.2, 4.2, 4.3, 5.2, 7.1, 7.2, 7.3; CEC Adv 1.1, 2.3, 3.2, 3.3, 4.2, 5.1, 5.2, 5.3, 6.2, 6.3, 7.1, 7.2, 7.3). 6. Apply strategies to support students with exceptionalities to develop and strengthen self-determination skills (REPA 7.8; CEC Int 1.1, 1.2, 2.1, 2.2, 2.3, 3.2, 5.2, 5.6, 6.1, 6.2; CEC Adv 1.1, 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2, 6.2, 6.3). Credits: 3.00

Concentrations

Electrical and Computer Engineering, MSECE

About the Program

Program Requirements - Thesis

Required Courses (9 credits)

Core Courses (6 credits)

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence,

correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

Math Course (3 credits)

Seminar Course (0 credits)

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

Electives (9-15 credits)

Thesis Research (6-12 credits)

ECE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Requirements - Non-thesis Innovation Track

Required Courses (9-10 credits)

Core Course (3 credits)

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix

multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

Project Track Courses (3-4 credits)

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7.

Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

ENGR 50200 - Engineering Leadership

Credit Hours: 3.00. Engineering leadership is the ability to inspire and guide engineering and technology-focused teams and organizations to achieve strategic outcomes. The successful engineering leader creates value at the intersection of technical systems and human systems. This course introduces students to evidence-based, practice-proven frameworks and tools related to (1) leadership presence, (2) cognitive diversity and psychological safety in teams, and (3) designing and transforming organizations and ecosystems.

Learning Outcomes: 1. Describe characteristics of effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

Math Course (3 credits)

Electives (14-15 credits)

Innovation Project Courses (6 credits)

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

Program Requirements - Non-thesis Implementation Track

Required Courses (16 credits)

Core Courses (7 credits)

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer

functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

Professional Development & Implementation Courses (9 credits)

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

ECE 52600 - Fundamentals Of MEMS And Micro-Integrated Systems

Credit Hours: 3.00. (BME 58100) Key topics in micro-electro-mechanical systems (MEMS) and biological micro-integrated systems; properties of materials for MEMS; microelectronic process modules for design and fabrication. Students will prepare a project report on the design of a biomedical MEMS-based micro-integrated system. Offered in alternate years. Permission of department required.

Credits: 3.00

ECE 53800 - Digital Signal Processing I

Credit Hours: 3.00. Theory and algorithms for processing of deterministic and stochastic signals. Topics include discrete signals, systems, and transforms, linear filtering, fast Fourier transform, nonlinear filtering, spectrum estimation, linear prediction, adaptive filtering, and array signal processing.

Learning Outcomes: 1. Understand the autocorrelation and covariance methods of estimating the correlation matrix. 2. Know the Discrete Time Fourier Transform (DTFT) and its relationship to the Discrete Fourier Transform (DFT). 3. Comprehend of parametric methods of spectrum estimation, including autoregressive modeling, minimum variance, linear prediction, and eigendecomposition-based methods. 4. Understand nonparametric methods of spectrum estimation, including the periodogram and the correlogram. 5. Understand of linear filters, including the Wiener filter, as applied stochastic to signals. 6. Introduce to adaptive filters, including the method of steepest descent and the least-mean-square (LMS) algorithms. Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 54700 - Introduction To Computer Communication Networks

Credit Hours: 3.00. A qualitative and quantitative study of the issues in design, analysis, and operation of computer communication and telecommunication networks as they evolve toward the integrated networks of the future, employing both packet and circuit switching technology. The course covers packet and circuit switching, the OSI standards architecture and protocols, elementary queuing theory for performance evaluation, random access techniques, local area networks, reliability and error recovery, and integrated networks.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental principles underlying computer communication networks. [1,3,4;a,e] 2. Demonstrate an ability to obtain mathematical models of networking systems. [1,2,4;a,e] 3. Demonstrate an ability to perform queueing analysis of simpler queueing networks, convergence analysis of routing protocols, and stability analysis of random access mechanisms. [1,2,4;a,e,k] 4. Demonstrate an ability to solve simple network design and optimization problems to meet specifications in though put and delay. [1,4;a,c,e,k] 5. Demonstrate an ability to use simulation tools for network analysis and design. [1,3,4;a,c,e,k] Credits: 3.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The

lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 62400 - Multimedia Systems

Credit Hours: 3.00. Provides a general coverage of three major areas that include multimedia data management (logical and physical modeling), broadband network architectures and protocols for distributed multimedia communication, and user interface environments. Various models and specification methodologies in these areas are introduced. The discussion is augmented with various case studies. Prerequisite: ECE 54700 , ECE 56200 .

Credits: 3.00

ECE 62900 - Introduction To Neural Networks

Credit Hours: 3.00. Information processing with neural networks, biological and engineering implications, learning algorithms, current neural network models and architectures, implementational topics, applications in areas such as signal/image processing, pattern recognition, optimization, simulation, system identification, nonlinear prediction, communications, and control. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63400 - Digital Video Systems

Credit Hours: 3.00. Digital video systems. Characteristics of basic analog video systems, including bandwidth constraints, color encoding, and composite signal formation. Digital video concepts with emphasis on processing of time-varying images. Topics include: filtering, enhancement, restoration, and motion estimation and prediction. Digital video compression techniques, including intraframe coding approaches, with particular emphasis on JPEG. MPEG1 and MPEG2 video compression standards. Low bit rate approaches, including H.261, H.263, and MPEG4. Applications include: video servers, transmission systems, high definition television, multimedia systems, and videoconferencing systems. Offered in alternate years. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 63900 - Error Control Coding

Credit Hours: 3.00. The theory and practice of error control coding is examined. The study includes the arithmetic of Galois fields as well as linear block, cyclic, and convolutional codes. Some applications of codes in digital communication systems and in computer systems are presented. Offered every third semester. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 64100 - Model Based Image And Signal Processing

Credit Hours: 3.00. An advanced treatment of the methods in model-based signal and image processing including stochastic modeling of multidimensional signals, Bayesian estimation, inverse methods, doubly stochastic models, regularized inversion, the EM algorithm, Bayesian networks, Markov chains, optimization, convexity, majorization techniques, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation. Prerequisite: ECE 60000, 63700.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

ECE 50863 - Computer Network Systems

Credit Hours: 3.00. The goal of this course is to provide students with a proper grounding in the basic concepts and seminal work in computer network protocols and systems, and to introduce students to research in the field. The course will cover classical concepts such as network architecture, switching, routing, congestion control, and quality-of-service, and discuss recent developments in these areas. The course will also cover new developments in networking such as network measurements, network management, overlay networking and peer-to-peer systems, network security, and new network architectures. The course will emphasize a system-oriented and empirical view of internet architecture. Graduate standing or consent of instructor.

Learning Outcomes: 1. Understand the architectural principles underlying internet design. 2. Understand LAN interconnects, routing algorithms, and congestion control algorithms. 3. Identify, formulate, and solve problems encountered in the design of networks. 4. Implement networking systems and rigorously evaluate them using systematic empirical methods. Credits: 3.00

ECE 51018 - Hybrid Electric Vehicles

Credit Hours: 3.00. Introduction to architectures and technologies associated with electric and hybrid electric vehicles including their constituent components. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization. Prerequisite by Topic: Energy conversion and power electronics.

Learning Outcomes: 1. Understand the principal architectures of electric and hybrid electric vehicles. 2. Analyze performance characteristics and understand limitations of each architecture. 3. Understand the principal components of an HEV including the energy storage, conversion, transmission, and control subsystems. 4. Integrate disparate subsystem models to form end-to-end vehicle model. Credits: 3.00

ECE 60872 - Reliable And Secure Computer Systems

Credit Hours: 3.00. The course provides an introduction to the hardware and software methodologies for specifying, modeling and designing fault-tolerant systems supported by case studies of real systems. The material presents a broad spectrum of hardware and software error detection and recovery techniques that can be used to build reliable networked systems. The lectures discuss how the hardware and software techniques interplay, what techniques can be provided in COTS hardware, what can be embedded into operating system and network communication layers, and what can be provided via a distributed software layer and in the application itself. Prerequisite by Topic: Any one high level programming language experience; A basic background in probability.

Learning Outcomes: 1. Formulate design principles for dependable systems. 2. Analyze mathematically a system for its dependability properties. 3. Understand and apply hardware dependability techniques. 4. Understand and apply software dependability techniques. 5. Understand and apply networking dependability techniques. 6. Design, develop, and present an innovative project on dependable systems. Credits: 3.00

ECE 61016 - Power Electronic Converters And Systems

Credit Hours: 3.00. The objective of this course is to educate students in the operation, detailed modeling, average-value modeling, and control design of power electronics converters and systems of converters. Prerequisite by Topic: Basic knowledge of ordinary differential equations, solution of ODEs using numerical methods, state-space system representation, basic feedback control design with frequency domain methods,

reference frame theory, some knowledge of rotating electric machinery. Permission of instructor required. Prerequisites: ECE 61010. Concurrent prerequisites: ECE 61000 and ECE 38200. Concurrent prerequisites by topic: synchronous machines (wound rotor and permanent magnet), reference frame theory, three-phase inverters, basic frequency domain control techniques, state-space representation of systems.

Learning Outcomes: 1. Understand switched circuits. 2. Understand average-value analysis techniques. 3. Understand feedforward/feedback control of power electronic converters. 4. Understand waveform level and average-value simulation techniques for switched systems. 5. Understand several ac-dc, dc-ac, and dc-dc power conversion topologies. 6. Understand inverter modulation techniques. 7. Understand ethical homework and project practices, and implication of failure to adhere to these. 8. Understand how to effectively present project results. Credits: 3.00

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

ECE 60827 - Programmable Accelerator Architectures

Credit Hours: 3.00. Programmable hardware accelerators seek to fulfill the promise of continued performance and energy-efficiency gains in the era of a slowing Moore's law, larger problem sizes and an increased focused on energy-efficiency. These factors have caused hardware acceleration to become ubiquitous in today's computing world and critically important in computing's future. This class will introduce students to the architectures of programmable accelerators. We will delve deeply into the architectures of modern massively parallel accelerators like GPUs, culminating in a course project. General topics in hardware acceleration will be discussed, including but not limited to GPGPU and massively parallel computing, approximate accelerators, reconfigurable hardware and programmable hardware for machine learning. Pre-requisite: ECE 43700 or equivalent and ECE 56500.

Learning Outcomes: 1. Learn knowledge and scholarship. 2. Learn communication. 3. Learn critical thinking. 4. Learn ethical and responsible research. 5. Have professionalism. Credits: 3.00

ECE 60146 - Deep Learning - Theory And Practice Of Deep Neural Networks

Credit Hours: 3.00. This course teaches the theory and practice of deep neural networks from basic principles through state-of-the-art methods. The class blends hands-on programming, using a variety of state-of-the-art programming frameworks, with theoretical treatment based on current literature. Implementation will emphasize the use of the Pytorch language and the use of dynamic computational graphs. Some previous experience with optimization techniques is important for success in the course.

Learning Outcomes: 1. Understand how to design a neural network architecture that is appropriate for a wide range of specific applications. 2. Create an efficient implementation of a wide range of standard neural network architectures in Pytorch. 3. Use neural networks to solve applications problems in classification, regression and data generation. 4. Understand how the fundamental theory of optimization can be used to efficiently train neural networks. 5. Understand the trade-offs between optimization techniques and how these techniques can be selected to achieve the best neural network training. 6. Understand and use current theory of neural network performance. 7. Understand the limitation of existing neural network theory and the likely directions of future research. Credits: 3.00

ECE 51216 - Digital Systems Design Automation

Credit Hours: 3.00. This course will provide an introduction to the tools used to design and analyze circuits at the logic level of abstraction (where circuits are composed of gates and flip-flops). Most digital chips used in computing and electronic systems (including microprocessors, graphics processors, chips used in network routers, cell phones, digital audio/video appliances, automotive electronics) are entirely or largely designed using EDA tools. This course will focus on the foundations of logic-level EDA tools, including the design of exact and heuristic algorithms that form the basis for VLSI Computer-Aided Design. Topics covered include an overview of the IC design flow and levels of abstraction, synthesis of two-level (AND-OR / PLA) circuits, multi-level logic synthesis and technology mapping, sequential circuit synthesis, Logic-level verification using Boolean Satisfiability and BDDs, Timing Analysis, Power analysis and Reduction, and design techniques for emerging nanoscale technologies.

Learning Outcomes: 1. Design minimal combinational logic circuits. 2. Design minimal finite-state machines. Credits: 3.00

ECE 60270 - Structure And Dynamics Of Large-Scale Networks

Credit Hours: 3.00. Large-scale networks are prevalent in both engineered systems (e.g., the Internet, the power grid, industrial control networks, large robotic swarms and sensor networks) and in natural systems (e.g., genetic networks, ecological networks, social and economic networks). While the specific details of such networks will depend on the application, the last few decades have seen the emergence of an underlying "science" of networks, comprised of a common language (graph theory) for representing large-scale networks, along with mathematical models and analytical techniques for studying structure and dynamics. This course will provide a detailed introduction to the field of network science. It will develop common mathematical representations of networks, metrics for identifying important features of networks, generative mechanisms for networks (including both random-graph and strategic network formation perspectives), and tools for studying dynamical processes on networks (such as information cascades, opinion dynamics and interconnected dynamical systems). This is an introductory course that establishes several of the fundamental tools and concepts in network science, and requires only an undergraduate background in probability and linear algebra.

Learning Outcomes: 1. Characterize networks based on degree distributions, clustering coefficients, diameter, etc. 2. Identify influential nodes via centrality metrics. 3. Analyze random and strategic (game-theoretic) models for large-scale networks. 4. Analyze dynamical processes and stability of interconnected dynamical systems on networks. Credits: 3.00

ECE 51032 - Computational Methods For Power System Analysis

Credit Hours: 3.00. System modeling of power networks. Description of modern electricity markets. Analysis of the economic dispatch problem using optimality conditions. Planning of distributed energy resources. Smart grid

applications. Machine learning applications to power systems (forecasting, demand-side management, and fault detection). Assigned projects will involve implementing some of the methods using realistic power system models.

Learning Outcomes: 1. Explain how electricity markets work and how various computational methods are used in power system operations and planning. 2. Understand formulation and solution techniques applied to normal operation of large power systems. 3. Implement existing optimization packages to solve power system problems. 4. Use machine learning methods to answer questions about power system operations. Credits: 3.00

ECE 60283 - Epidemic Processes Over Networks

Credit Hours: 1.00. This course presents a class of epidemic models from a network science, control theoretic, and data science perspective. Networked epidemiological ideas will be explored combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn the behavior from data, and design mitigation techniques. Namely, the course consists of three modules: 1) Networked Virus Models, 2) Limiting Behavior of Networked Virus Models, and 3) Parameter Identification & Mitigation Algorithms. Prerequisites: ECE 60281 and ECE 60282.

Learning Outcomes: 1. Differentiate between distinct networked compartmental models for epidemics (SI, SIS, SIR, etc.) in order to identify the best model for a given scenario. 2. Analyze the limiting behavior of networked models for epidemic processes by identifying the different possible equilibria of the models and specifying conditions for converging to different equilibria. 3. Estimate model parameters from data for the different networked epidemic models. 4. Employ the estimated model parameters to forecast the spread of an outbreak. 5. Choose the best networked model for a given scenario/dataset by employing their knowledge of the epidemic models and by comparing the fit from the estimated parameters and the forecast accuracy. 6. Develop and implement mitigation algorithms for the different models of epidemic processes. 7. Leverage the advantages and disadvantages of using networked models of epidemics processes versus group models in a given situation. Credits: 1.00

ECE 60432 - Nanophotonic Modeling

Credit Hours: 1.00. This course is an introduction to photonic materials and devices structured on the wavelength scale. Generally, these systems will be characterized as having critical dimensions at the nanometer scale. These can include nanophotonic, plasmonic, and metamaterials components and systems. Co-requisite: ECE 60400 or equivalent.

Learning Outcomes: 1. Write down photonic modes using Bloch's theorem. 2. Calculate standing wave modes at the band edge of a 1D periodic photonic crystal. 3. Calculate TE and TM modes at the band edge of a 2D square-periodic photonic crystal. 4. Draw the irreducible Brillouin zone for a 2D triangular lattice photonic crystal. 5. Calculate the band structure of a 2D triangular lattice photonic crystal for the lowest 8 bands using MIT Photonic Bands. 6. Identify the lowest-energy photonic bandgap in TE and TM polarizations associated with a 2D triangular lattice photonic crystal. 7. Use a ray-optics transfer matrix to calculate the reflection and transmission associated with multiple optical elements. 8. Use a wave-optics T-matrix to calculate transmission and reflection through several dielectric layers arranged in a 1D stack. 9. Use a wave-optics S-matrix to calculate transmission and reflection through several dielectric layers arranged in a 1D stack. 10. Use Singular Value Decomposition in CAMFR to calculate the eigenmodes associated with a photonic crystal waveguide structure consisting of a row of defects. 11. Calculate the quality factor of a resonant mode using the FDTD method. 12. Calculate the band structure of a 2D periodic structure using the FDTD method. 13. Calculate the relative enhancement in the local density of photonic states associated with a defect in a 2D photonic crystal using the FDTD method. 14. Calculate a transmission

spectrum using the Finite Element Method. 15. Calculate a transmission spectrum for a waveguide using the Beam Propagation Method. 16. Calculate the emission spectrum of a photonic emitter using the Finite Element Method. Credits: 1.00

ECE 50836 - Introduction To Data Mining

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, i.e., the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering, classification, anomaly detection, recommendation and graph analysis. Students are expected to gain the skills to formulate data mining problems, solve the problems using data mining techniques and interpret the output.

Learning Outcomes: 1. Describe and explain the process of data mining. 2. Formulate problems in real-world applications into data mining tasks and solve the problems using data mining techniques. 3. Implement software programs that conduct data mining and evaluate the output of data mining programs. 4. Present data mining solutions to people in scientific and other disciplines. Credits: 3.00

ECE 61025 - Finite Element Analysis Of Electric Machines

Credit Hours: 3.00. Application of advanced numerical methods for the characterization of the steady-state and dynamic characteristics of electromechanical energy conversion devices including solenoids, synchronous, induction, and permanent-magnet machines.

Learning Outcomes: 1. Apply basic concepts of vector calculus to quantify and correlate the physical variables of electromagnetic fields. 2. Interpret Maxwell's equations in the context of electric machinery. 3. Recognize how variational calculus can be used to reformulate the partial differential equations governing the magnetic field. 4. Solve linear and nonlinear quasi-magnetostatic problems of electromechanical energy conversion devices numerically using the finite element method. 5. Develop custom-made software for conducting finite element analysis of electric machinery. Credits: 3.00

ENGR 50200 - Engineering Leadership

Credit Hours: 3.00. Engineering leadership is the ability to inspire and guide engineering and technology-focused teams and organizations to achieve strategic outcomes. The successful engineering leader creates value at the intersection of technical systems and human systems. This course introduces students to evidence-based, practice-proven frameworks and tools related to (1) leadership presence, (2) cognitive diversity and psychological safety in teams, and (3) designing and transforming organizations and ecosystems.

Learning Outcomes: 1. Describe characteristics of effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

Seminar Course (0 credits)

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

Electives (14 credits)

ECE 69600 - Advanced Electrical Engineering Projects

Credit Hours: 0.00 to 18.00. Individual research projects to be

approved by the supervising faculty member before registering for the course. An approved written report must be filed before credit is accepted. Permission of instructor required.

Credits: 0.00 to 18.00

ECE 69700 - Directed Reading In Electrical Engineering

Credit Hours: 1.00 to 3.00. Individualized reading course supervised by an appropriate faculty member and pertaining to a topic not intended for a subsequent project or thesis done by that student. Approval for each reading course must be obtained from the department prior to registration. Permission of instructor required.

Credits: 1.00 to 3.00

Concentrations

Electrical and Computer Engineering, MSECE (OL)

About the Program

Program Requirements

Required Courses (12 credits)

Core Courses (6 credits)

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

Math/Statistics Courses (6 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations. Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand

statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several

random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 54000 - Computational Finance I

Credit Hours: 3.00. An introduction to the mathematical tools and techniques of modern finance theory, in the context of Black-Scholes option pricing. Brownian motion and its stochastic calculus, Ito's formula, and Feynman-Kac formula. Pricing and hedging of claims on Black-Scholes assets. Incomplete markets. Path-dependent options. Stochastic portfolio optimization.

Learning Outcomes: 1. Obtain necessary mathematical background necessary to study quantitative methods in finance. 2. Understand mathematical models of modern financial markets. Credits: 3.00

Electives (18 credits)

Concentrations

GPA Requirements

Engineering Education, MSENE, MSE, or MS

About the Program

Program Requirements

Required Courses (15 credits)

Core Courses (15 credits)

ENE 50200 - History And Philosophy Of Engineering Education

Credit Hours: 3.00. Examines the history and philosophy of engineering education by: (1) exploring the history of engineering education through archival research and historical documents (critical moments, tensions, issues); (2) investigating philosophies of education and the philosophies that have guided engineering as a profession; and (3) critiquing the evolution of engineering education, identifying alternative scenarios, and imagining a future role in engineering education. This course introduces students to the field of engineering education while broadening their views of the roles of interrelationships between teaching and research. Open to students in Engineering Education. Permission of instructor required.

Learning Outcomes: 1. Develop a culture of critical reflection, engagement, and collaborative learning. 2. Provide opportunities for students to identify and understand tools to inquire into the history and philosophy of engineering education and develop the skills for using these tools. 3. Provide opportunities for students to use these inquiry tools to form persuasive arguments about the nature of engineering education. Credits: 3.00

ENE 50300 - Engineering Education Inquiry

Credit Hours: 3.00. This course is conceived as a bridge between beginning graduate students' knowledge of technical research and modes of inquiry appropriate to the new field of

engineering education. It is designed as the entryway to required research method courses taken as part of the students' plan of study. By the end of this survey course, students will be able to critique research in terms of the quality of the authors' argument based on their chain of reasoning, and will recognize that the articulation of a research question, the significance of the question, the choice of methods in regards to the research goals, and the transparency of the explanation of the methodology are all the parts of the chain of reasoning. Permission of instructor required.

Learning Outcomes: 1. Provides a pathway into the discipline that characterizes the diversity of approaches to engineering education research and research topics. 2. Create opportunities to discuss the need for rigorous engineering education research. 3. Develop critical understanding of relationships between research problem, method, and design. 4. Foster community development and collaborative efforts among students and engineering education researchers. 5. Help students identify conceptual hurdles and individual pathways into research activities. 6. Support students' identity development as an engineering education researcher. Credits: 3.00

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 50400 - Leadership, Policy, And Change In Science, Technology, Engineering, And Mathematics (STEM) Education

Credit Hours: 3.00. This course provides a foundation for examining historical and current perspectives of STEM education programs and policy at the secondary and postsecondary levels. Focusing on the relationships among education policy, leadership theories, and models of systemic change, this course will enable students to situate and envision their potential role in shaping engineering education within the context of the larger education landscape. Students will synthesize course readings, examine education policy, and reflect on leadership theories and change, as well as explore how they can influence leadership, policy, and /or organizational change in STEM education through a semester project.

Learning Outcomes: 1. Evaluate leadership theories and the leadership process. 2. Identify and evaluate factors that contribute to effective leadership within organizations. 3. Analyze education policy at local, state, and national levels with a focus on STEM education. 4. Evaluate models of systemic change and diffusion of innovative processes. 5. Understand key aspects, strategies, and applications of systemic change in education. 6. Generate strategies to implement change within STEM education environments. Credits: 3.00

ENE 50500 - Theories Of Development And Engineering Thinking

Credit Hours: 3.00. This course examines theories of human development, learning and epistemology in the context of Engineering Education. A broad survey of readings guides an in-depth study of fundamental theories of development and knowledge generation as it relates to pedagogy and research. A rich body of theoretical literature will be studied in order to explore its relation to engineering education. Work in the course aims to construct answers to the following three questions: (1) How do theories of human learning, development, and epistemology help us think about engineering? (2) How do they

relate to engineering education? (3) How do they inform research method and practice in engineering education? No restrictions. It is helpful, however, for students to have engaged in prior reading-and writing- intensive courses that required them to synthesize large amounts of information. For this reason, it is recommended that students are enrolled currently in a graduate program at Purdue University. Permission of department required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 50101 - Foundations Of Engineering Education

Credit Hours: 3.00. In this course, new doctoral students in engineering education explore their roles within the field of engineering education, create a learning plan that maps to program requirements, and develop habits of mind to support their ongoing professional development. Students learn to write clearly and coherently in an academic context. Students examine research trends and faculty interests so they can make informed choices about advising and program opportunities. Permission of instructor required.

Learning Outcomes: 1. Critically reflect upon personal learning goals, and articulate a learning plan that will eventually result in a professional portfolio. 2. Develop skills in academic writing. 3. Understand the research interests of local faculty members. 4. Identify resources that will facilitate the student's transition into the engineering education community. Credits: 3.00

Seminar Course (0 credits)

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

Selectives (6 credits)

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (CHE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Student must be admitted into a Ph.D. program in Engineering or other technical discipline (Finished with MS or MS-bypass). Not open to students who have taken PSY 69500/EDPS 63400. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering

thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

ENE 68700 - Mentored Teaching In Engineering

Credit Hours: 1.00 or 3.00. Mentored experience in the teaching of engineering, with structured opportunities for individual reflection. All students create a scholarly teaching portfolio. Students who register for three credits conduct a scholarship of teaching and learning project. Prerequisites: Significant concurrent responsibility for teaching an engineering course. Registration in or completion of ENE 50600 (Content, Assessment And Pedagogy) or ENE 68500 (Educational Methods In Engineering); or instructor permission required.

Learning Outcomes: 1. Think critically about the relationships between your teaching experiences and the readings in this course and the prerequisite courses. 2. Use reflection, mentoring, and student feedback to learn from teaching experiences. 3. Explain the reasons for choices of teaching methods. 4. Analyze evidence of student learning. 5. Identify and address ethical issues in teaching situations. 6. Plan and carry out a scholarly investigation of teaching and learning through the SoTL project. Credits: 1.00 or 3.00

ENE 50400 - Leadership, Policy, And Change In Science, Technology, Engineering, And Mathematics (STEM) Education

Credit Hours: 3.00. This course provides a foundation for examining historical and current perspectives of STEM education programs and policy at the secondary and postsecondary levels. Focusing on the relationships among education policy, leadership theories, and models of systemic change, this course will enable students to situate and envision their potential role in shaping engineering education within the context of the larger education landscape. Students will synthesize course readings, examine education policy, and reflect on leadership theories and change, as well as explore how they can influence leadership, policy, and /or organizational change in STEM education through a semester project.

Learning Outcomes: 1. Evaluate leadership theories and the leadership process. 2. Identify and evaluate factors that contribute to effective leadership within organizations. 3. Analyze education policy at local, state, and national levels with a focus on STEM education. 4. Evaluate models of systemic change and diffusion of innovative processes. 5. Understand key aspects, strategies, and applications of systemic change in education. 6. Generate strategies to implement change within STEM education environments. Credits: 3.00

ENE 50500 - Theories Of Development And Engineering Thinking

Credit Hours: 3.00. This course examines theories of human development, learning and epistemology in the context of Engineering Education. A broad survey of readings guides an in-depth study of fundamental theories of development and knowledge generation as it relates to pedagogy and research. A rich body of theoretical literature will be studied in order to explore its relation to engineering education. Work in the course aims to construct answers to the following three questions: (1) How do theories of human learning, development, and epistemology help us think about engineering? (2) How do they relate to engineering education? (3) How do they inform research method and practice in engineering education? No restrictions. It is helpful, however, for students to have engaged in prior reading-and writing- intensive courses that required them to synthesize large amounts of information. For this reason, it is recommended that students are enrolled currently in a graduate program at Purdue University. Permission of department required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering

thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

Electives (9 credits)

Concentrations

Engineering Management, MSE or MS

About the Program

Program Requirements

Required Courses (18 credits)

Engineering Courses (9 credits)

Systems Engineering Courses (9 credits)

Management Selectives (9 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

Elective (3 credits)

Concentrations

GPA Requirements

Engineering Technology, MS

About the Program

Program Requirements - Thesis

Required Courses (16 credits)

Core Courses (13 credits)

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

MET 50300 - Applied Optimization

Credit Hours: 3.00. This course will introduce technology graduate students and senior undergraduates to the basic concepts of optimization methods with particular emphasis on applications in product and process design. Unconstrained nonlinear problems will be presented and solved using steepest descent and conjugate directions. Constrained problems will be solved using exterior penalty functions. Permission of department required.

Learning Outcomes: 1. Recognize optimization problems and cast them in standard form. 2. Identify objective functions and constraints. 3. Use commercial software to solve formal optimization problems. 4. Correctly identify global and local optimum solutions. 5. Use basic calculus concepts to calculate design sensitivities. 6. Understand the geometric concept of design space and be able to plot design space for a constrained problem with two design variables. Credits: 3.00

MET 52700 - Technology From A Global Perspective

Credit Hours: 3.00. Introduction to the challenges faced by the practicing technologist when working and interacting with international technical personnel, both here and abroad, including history, standards, education, and practice of technology outside the United States. Permission of department required.

Learning Outcomes: 1. Awareness and comprehension of cross-cultural factors necessary for international professional practice in technology. 2. Effective research strategies that access what is known about technology development, usage and impact from a global perspective. 3. Knowledge and skill in researching and reporting cultural factors affecting business practices in a variety of independent nation states. 4. Knowledge of procedures, regulations and practices regarding international business. 5. Research skills to identify the natural and technology resources of countries. 6. An ability to contrast the impact of technology infrastructure and use of technology in developed countries to what occurs in underdeveloped countries. 7. Knowledge of the concept and application of ""Appropriate Technology"". 8. Knowledge of the historical development of technology in various modern nations. 9. Informed judgments regarding the influences of cultural and political environments of countries and their technological development. 10. Awareness of the major changes related to current and/or emerging technology in the leading industrial nations of the world. 11. Understanding of the methodologies employed for the effective introduction of technologies into new country or cultural settings. 12. Knowledge of selected International Technology Standards and organizations. Credits: 3.00

ENGT 50100 - Graduate Research Seminar

Credit Hours: 0.00 or 1.00. This course is intended to orient new graduate students to the Engineering Technology (ET) program and faculty. This includes PhD students and students pursuing a Master's degree through a thesis or directed project option. This does not include students pursuing a Master's degree with coursework only. Research activities within ET and throughout Purdue University are discussed. Student resources and opportunities are reviewed to give the students the tools they need to be successful. In addition, this course provides a way to develop a natural cohort of graduate students. This course is a graduate seminar course focused on the ET program. Graduate status or upper-division undergraduate. Permission of department required.

Learning Outcomes: 1. Summarize research interests of ET graduate faculty. 2. Interpret Purdue University research activities and resources and apply this knowledge to their particular research plan. 3. Generate MS or PhD preliminary documents based on ET specific requirements. 4. Implement effective use of library resources and ability to write scholarly information in accepted format styles. Credits: 0.00 or 1.00

ENGT 58100 - Workshop In Engineering Technology

Credit Hours: 1.00 to 21.00. This course number is used to pilot and develop new graduate level courses. Each 58100 course number is followed by either a unique alphabetic suffix (e.g., ABC) or numeric suffix (e.g., 123) and is given a unique title and course description. These courses can be included in a graduate plan of study with the usual condition that they must be approved by the student's graduate committee. Accordingly, it is important to discuss these courses with your faculty advisor and committee prior to registration. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 21.00

Statistics Course (3 credits)

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables.

Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Electives (5 credits)

Thesis Research (9 credits)

Program Requirements - Non-Thesis

Required Courses (9 credits)

Core Courses (6 credits)

MET 50300 - Applied Optimization

Credit Hours: 3.00. This course will introduce technology graduate students and senior undergraduates to the basic

concepts of optimization methods with particular emphasis on applications in product and process design. Unconstrained nonlinear problems will be presented and solved using steepest descent and conjugate directions. Constrained problems will be solved using exterior penalty functions. Permission of department required.

Learning Outcomes: 1. Recognize optimization problems and cast them in standard form. 2. Identify objective functions and constraints. 3. Use commercial software to solve formal optimization problems. 4. Correctly identify global and local optimum solutions. 5. Use basic calculus concepts to calculate design sensitivities. 6. Understand the geometric concept of design space and be able to plot design space for a constrained problem with two design variables. Credits: 3.00

MET 52700 - Technology From A Global Perspective

Credit Hours: 3.00. Introduction to the challenges faced by the practicing technologist when working and interacting with international technical personnel, both here and abroad, including history, standards, education, and practice of technology outside the United States. Permission of department required.

Learning Outcomes: 1. Awareness and comprehension of cross-cultural factors necessary for international professional practice in technology. 2. Effective research strategies that access what is known about technology development, usage and impact from a global perspective. 3. Knowledge and skill in researching and reporting cultural factors affecting business practices in a variety of independent nation states. 4. Knowledge of procedures, regulations and practices regarding international business. 5. Research skills to identify the natural and technology resources of countries. 6. An ability to contrast the impact of technology infrastructure and use of technology in developed countries to what occurs in underdeveloped countries. 7. Knowledge of the concept and application of ""Appropriate Technology"". 8. Knowledge of the historical development of technology in various modern nations. 9. Informed judgments regarding the influences of cultural and political environments of countries and their technological development. 10. Awareness of the major changes related to current and/or emerging technology in the leading industrial nations of the world. 11. Understanding of the methodologies employed for the effective introduction of technologies into new country or cultural settings. 12. Knowledge of selected International Technology Standards and organizations. Credits: 3.00

ENGT 56100 - Metrology Concepts And Applications

Credit Hours: 3.00. Metrology is a fundamental concept required for obtaining scientific data and understanding instrumentation. This course introduces the concepts of metrology associated with measurement systems: sensors, signal conditioning, data acquisition and analysis, as well as the error propagation. System and environmental noise are investigated along with methods to mitigate influences of noise. Standards and calibration of instrumentation are also studied. Concepts of metrology for the seven basic units of measurements are described from the macro to nano-scale.

Learning Outcomes: 1. Classify instrumentation necessary to make measurements of interest. 2. Summarize standards and calibration associated with measurements. 3. Implement various methods of reducing system and environmental noise. 4. Calculate errors budgets and adjust instrumentation to meet error budgets. 5. Identify ethical and international aspects of measurement science. Credits: 3.00

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and

guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

Statistics Course (3 credits)

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial

regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Electives (21 credits)

Concentrations

Engineering Technology, MS (OL)

About the Program

Program Requirements

Required Courses (30 credits)

MET 52700 - Technology From A Global Perspective

Credit Hours: 3.00. Introduction to the challenges faced by the practicing technologist when working and interacting with international technical personnel, both here and abroad, including history, standards, education, and practice of technology outside the United States. Permission of department required.

Learning Outcomes: 1. Awareness and comprehension of cross-cultural factors necessary for international professional practice in technology. 2. Effective research strategies that access what is known about technology development, usage and impact from a global perspective. 3. Knowledge and skill in researching and reporting cultural factors affecting business practices in a variety of independent nation states. 4. Knowledge of procedures, regulations and practices regarding international business. 5. Research skills to identify the natural and technology resources of

countries. 6. An ability to contrast the impact of technology infrastructure and use of technology in developed countries to what occurs in underdeveloped countries. 7. Knowledge of the concept and application of ""Appropriate Technology"". 8. Knowledge of the historical development of technology in various modern nations. 9. Informed judgments regarding the influences of cultural and political environments of countries and their technological development. 10. Awareness of the major changes related to current and/or emerging technology in the leading industrial nations of the world. 11. Understanding of the methodologies employed for the effective introduction of technologies into new country or cultural settings. 12. Knowledge of selected International Technology Standards and organizations. Credits: 3.00

MET 53000 - Facilities Engineering Technology

Credit Hours: 3.00. A study of the application of the engineering sciences and technology to the solution of problems associated with mechanical and electrical systems in buildings. Emphasizes commercial and industrial facilities. Identifying energy conservation measures for both mechanical and electrical systems and evaluating their economic impact are an important focus of the course.

Learning Outcomes: 1. Explain building energy trends and related policy. 2. Explain the organizations and personnel supporting the built environment. 3. Use building automation systems to monitor and control building operation. 4. Quantify energy use in building systems. 5. Use accepted professional practice for technical computations and writing. 6. Calculate the economic impact of energy and resource conservation measures for buildings. 7. Compute the impact of solar energy use for a building. 8. Apply strategies for maintaining Indoor Air Quality in buildings. 9. Evaluate the performance of mechanical or electrical systems in buildings. Credits: 3.00

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

ENGT 58300 - Applied Engineering Statistics For Industry

Credit Hours: 3.00. The purpose of this course is to teach the practitioner how to use and make better-informed decisions as a manager for making optimum process, business, or personnel decisions. Emphasis will be placed on Verification, Validation in R&D, Manufacturing, QA/QC, basic probability, Summarizing Data, Basic Tools (flowcharts, fishbone diagrams, Pareto charts), Process Capability - Cp/Cpk. Upper and lower control limits/charts, Use of Control Charts for Continual Improvement, Six Sigma, Design of Experiments, Taguchi Methodology and Data Analytics will also be covered.

Learning Outcomes: 1. Demonstrate the importance of the Central Limit Theorem and its application. 2. Evaluate the capability of a process using the process capability index (CPI). 3. Analyze variation reduction in relation to process capability and design of experiments. 4. Articulate how single-piece flow, standard work, and continuous improvement processes enable variation reduction. 5. Determine the expected number of defects from a given

process. 6. Explain the statistical meaning of Six Sigma. 7. Differentiate between Type I and Type II errors. 8. Calculate the sample size based on specified Type I and Type II Error. 9. Calculate a confidence interval. 10. Define direct run rate I first time through and its calculation. 11. Develop a hypothesis test. 12. Calculate regression and correlation of data and distinguish between correlation and causation. 13. Select and evaluate the test statistic for different kinds of hypothesis tests and make statistical inference decisions. 14. Construct and evaluate an ANOVA table and make statistical inference decisions. 15. Differentiate among different types of experimental designs and design an experiment. 16. Demonstrate the Taguchi quality loss function and how to make quality loss calculations. 17. Classify the procedural errors that can occur in experimental design, such as confirmation bias. 18. Explain data mining and Big Data and their role in the future of experimental design. Credits: 3.00

ENGT 55000 - Manufacturing System Design For Sustainability

Credit Hours: 3.00. This course prepares manufacturing and information technology leaders to design and analyze manufacturing processes to achieve manufacturing system objectives that meet internal and external customers quality, cost and delivery requirements within a safe environment. The course project covers major aspects of manufacturing system design and Industry 4.0 in the context of meeting customer needs. Technology leaders and entrepreneurs learn how to work with others to develop the design of manufacturing systems that are sustainable (business, ecological, social, technological) for the long term. When to use lean and six-sigma techniques in the context of the manufacturing enterprise system design to meet customer needs will be assessed from a system design perspective, through analytical and computer simulation techniques, and through the use of physical modeling tools.

Learning Outcomes: 1. Relate why and how the design of manufacturing processes/equipment that support manufacturing system requirements enables lower cost, high quality, on-time delivery, volume and mix flexibility, sustainability, and continuous improvement. 2. Determine why our tone affects the ability to make systems improvements; realize that the origin of at least 90 percent of all issues is due to the system design and implementation and not the people. 3. Apply a structured approach and language to identify, describe, and relate system design thinking to implementation structure and work - i.e. Lean is an outcome of effective system design. 4. Align performance measures to reinforce manufacturing system design requirements with the knowledge that total cost results from the system design. 5. Design a manufacturing system and the included manufacturing processes to establish product flow, part families and takt time -- time per unit (average pace of customer demand). 6. Create a controllable, robust system design, i.e., a manufacturing system that meets customer quality and delivery expectations in spite of disruptions. 7. Reduce the 5 Delays that increase manufacturing lead time by using manufacturing system design. 8. Apply methods to evaluate and develop Manufacturing Systems, including the Manufacturing System Design Decomposition (MSDD), Capability Maturity Model Integration (CMMI), Six Sigma (DMAIC) Process. 9. Describe why Tone, Plan Do Check Act (PDCA), Standard Work, Takt Time and a Robust / Controllable System Design are necessary for continuous improvement and sustainability. 10. Develop an organizational structure to sustain and improve the manufacturing system. Credits: 3.00

ENGT 54000 - Change Management For Enterprise Sustainability

Credit Hours: 3.00. Change management is at the core of an engineering organization's processes and data, and it affects every member of the enterprise. Change management provides a method for identifying, analyzing, preparing, implementing, validating, and documenting engineering changes throughout a product's lifecycle, to ensure everyone in the organization is

working from the same product record and changes are communicated in real-time. In this course, the core elements, data structures, stakeholders, and workflows of change management and their role as enablers of the digital thread and the digital enterprise are discussed. The application of the industry standard CM2 methodology is emphasized as a strategy to provide control, maintain data integrity, and improve visibility and traceability of changes.

Learning Outcomes: 1. Summarize the challenges that engineering and manufacturing organizations face when managing quality, options, and variants throughout a product lifecycle. 2. Construct and justify a product hierarchy and its associated datasets. 3. Estimate the magnitude of corrective action for a given change and compare it to the application of conformance measurements. 4. Assess the impact of an engineering change. 5. Evaluate and interpret the CM2 model, an industry-standard closed-loop change management process. 6. Differentiate and prepare the main change objects for authorizing and managing work. 7. Summarize the challenges and complexities of lifecycle sustainment and assess how they differ from those in product development. 8. Prepare a detailed change implementation plan. Credits: 3.00

ENGT 60500 - Engineering Technology Research Writing Strategies

Credit Hours: 2.00 to 3.00. The stated Master of Science in Engineering Technology graduate course teaches research literature mining and analysis found in Purdue licensed databases. Focuses on detail, a measurable topic, literature review, reporting, citation, data visualization using APA. Requires research paper writing aligned with ARWE specifications for in-depth research preparation and reporting. Students will research a topic relevant to a workplace problem in their industry. For example, a new technology, a process (Giga Casting for example), a material, supply chain, digitization, industry 4/5.0, sustainability, workforce diversity, aging workforce, ethics in the workplace, offshoring vs. onshoring, direct part marking, inventory/project management, cybersecurity risks, facility management, energy management, patents/intellectual property or environmental compliance. Keep in mind, Before You Start, that whichever topic you choose, the problem must be measurable. Measurable either from a quantitative or qualitative statistic perspective. Your topic will have to be tied to a global grand engineering challenge we face as a society and/or industry.

Learning Outcomes: 1. Evaluate the data you collected by completing the Workplace Information Literacy Strategies (WILS) activity to determine your research topic. 2. Analyze research topic/focus gained from the WILS, correlate a measurable research problem statement, and relate it to one of the 14 global, grand engineering challenges. 3. Create an Introduction to the problem statement. 4. Synthesize collected data by writing a review of the literature which supports the research problem topic. 5. Evaluate different research measures for the problem, choosing one to assess the problem. 6. Analyze the research measure(s) by using ChatGPT to help determine optimum research measure to write up. 7. Create a research methodology by writing a detailed script on how you intend to measure the research problem. 8. Submit expected deliverables in a timely manner after evaluating your final analysis report, synthesizing the introduction, research problem statement, review of literature, and research measure. 9. Present a compelling oration of your research topic and significance as to why the topic should be pursued or funded. The creation of a three-minute video debriefing is not an exercise in "watering down" research but forcing you to consolidate your ideas and concisely explain your research discoveries for senior leadership approval and funding. 10. Complete written assignments using APA format and NO passive wording or adverbs. Adhere to the MET 527 Academic Research Writing Expectations (ARWE) handout document. Failure to not read and follow the ARWE document will prove to be an unsuccessful assignment/course experience. 11. Perform individually AND not fall into the

plagiarism trap. Credits: 2.00 to 3.00

MFET 55800 - Smart Manufacturing & Global Supply Chain

Credit Hours: 3.00. Progressive manufacturing uses innovative technology to improve products or processes through the Internet of Things. Smart manufacturing is not limited to emerging technologies; rather, it is composed of efficient, productive, highly integrated, tightly controlled processes across a spectrum of globally competitive U.S. manufacturers and suppliers, including the facilities themselves. The course will examine the selection, characteristics, and optimization of materials, processes, big data, cloud analysis of design data, control and adaptive theories, and personnel in a production environment. Examining global manufacturing issues through a variety of business examples, you will study the framework that explains the characteristics and challenges surrounding global supply chain management and investigate the impact on suppliers, manufacturers, and customers.

Learning Outcomes: 1. Evaluate and design automation and control strategies in manufacturing operations. 2. Assess data collection, analysis, and sharing attributes of manufacturing systems and subsystems. 3. Plan and apply strategies for managing data from multiple sources. 4. Analyze and appraise variables significant for global supply chain management. Credits: 3.00

ENGT 51000 - Internet Of Things And Cybersecurity For Engineering And Technology

Credit Hours: 3.00. The internet has brought about the ability to embed computing into everyday devices to allow them to send and receive information. These devices, known as the Internet of Things (IoT), will require management at all levels to understand the inherent security risks due to the interconnection via the internet. Illegally accessing (hacking) IoT is increasingly becoming the most pervasive form of industrial espionage in use today. Understanding the threats aimed at IoT and how to protect IoT will be the key to keeping sensitive corporate information and secrets secure and private, and will require everyone's participation, not just the IT department. For this course students will learn the basics of research of and into cybersecurity, and the techniques used to commit industrial related crimes; how to detect these potentially catastrophic crimes; and the means to protect one of the company's most important assets...its systems and data.

Learning Outcomes: 1. Analyze security regulations relevant to their industry. 2. Apply a cybersecurity framework based upon industry regulations. 3. Analyze privacy issues with Internet of Things. 4. Analyze the difference between threats, vulnerabilities and risks as it relates to Internet of Things. 5. Apply techniques to mitigate risk to Internet of Things. 6. Evaluate the inherent benefits of using IoT, potential risks to IoT, and how to use a cybersecurity framework to help mitigate risk to IoT. Credits: 3.00

Concentrations

Program Learning Outcomes

English, MA

About the Program

Program Requirements - Thesis and Non-thesis

Required Courses (15 credits)

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic Courses (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Seminar (3 credits)

ENGL 60600 - Seminar In Poetry Writing

Credit Hours: 3.00. An advanced course in the writing of poetry. Workshop criticism. Study of the work of established writers. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Enhance active reading skills through the close examination and critique of the poetry, notebooks, and letters of established poets. 2. Enhance feedback skills through thoughtful, frank, tactful, and intelligent critiques of your classmates' poems. 3. Enhance writing skills through intensive writing of original poetry and through structure exercises. Credits: 3.00

ENGL 60900 - Seminar In Fiction Writing

Credit Hours: 3.00. An advanced course in the writing of fiction. Workshop critiques. Prerequisite: Admission to the creative writing program.

Learning Outcomes: 1. Enhance reading skills through close examination of other writers, including classmates and professional writers. 2. Enhance vocabulary for the creative writing discourse community. 3. Enhance feedback skills through thoughtful, frank, tactful, and intelligent discussion of your classmates stories and novel chapters. 4. Expand reading and writing aesthetics, and understanding of what literature is and can be, that will guide your reading and writing in the future. 5. Produce fiction benefitting a third-year thesis. Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62700 - Seminar In Linguistics

Credit Hours: 3.00. Investigation of a topic in advanced linguistics research.

Credits: 3.00

ENGL 62900 - Seminar In English As A Second Language

Credit Hours: 3.00. In-depth study of variable subjects relating to the nature of English as a second/foreign/international language and its learning and teaching. Prerequisite: ENGL 51600 .

Credits: 3.00

ENGL 63000 - Seminar In Second Language Writing

Credit Hours: 3.00. An overview and examination of major issues in the theory, research, and practice of writing in English as a second language. Prerequisite: ENGL 51600 or ENGL 59100 .

Credits: 3.00

ENGL 66800 - Seminar In Interpretation And Cultural Theory

Credit Hours: 3.00. Examination of selected developments in social, cultural, and hermeneutical theories from the eighteenth century to the present.

Credits: 3.00

ENGL 67400 - Seminar In Language Testing

Credit Hours: 3.00. An introduction to the techniques, practices, and history of language testing. Introduces the basic tenets of measurement and the issues and controversies related to the measurement of language ability.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 69600 - Seminar In Literature

Credit Hours: 3.00. Advanced study of special subjects.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic Courses (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Electives (12-15 credits)

Thesis Research (0-3 credits)

ENGL 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Or MFA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

LTC Exam Requirements

Required Courses (15 credits)

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic Courses (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Seminar (3 credits)

ENGL 60600 - Seminar In Poetry Writing

Credit Hours: 3.00. An advanced course in the writing of poetry. Workshop criticism. Study of the work of established writers. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Enhance active reading skills through the close examination and critique of the poetry, notebooks, and letters of established poets. 2. Enhance feedback skills through thoughtful, frank, tactful, and intelligent critiques of your classmates' poems. 3. Enhance writing skills through intensive writing of original poetry and through structure exercises. Credits: 3.00

ENGL 60900 - Seminar In Fiction Writing

Credit Hours: 3.00. An advanced course in the writing of fiction. Workshop critiques. Prerequisite: Admission to the creative writing program.

Learning Outcomes: 1. Enhance reading skills through close examination of other writers, including classmates and professional writers. 2. Enhance vocabulary for the creative writing discourse community. 3. Enhance feedback

skills through thoughtful, frank, tactful, and intelligent discussion of your classmates stories and novel chapters. 4. Expand reading and writing aesthetics, and understanding of what literature is and can be, that will guide your reading and writing in the future. 5. Produce fiction benefitting a third-year thesis. Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62700 - Seminar In Linguistics

Credit Hours: 3.00. Investigation of a topic in advanced linguistics research.

Credits: 3.00

ENGL 62900 - Seminar In English As A Second Language

Credit Hours: 3.00. In-depth study of variable subjects relating to the nature of English as a second/foreign/international language and its learning and teaching. Prerequisite: ENGL 51600 .

Credits: 3.00

ENGL 63000 - Seminar In Second Language Writing

Credit Hours: 3.00. An overview and examination of major issues in the theory, research, and practice of writing in English as a second language. Prerequisite: ENGL 51600 or ENGL 59100 .

Credits: 3.00

ENGL 66800 - Seminar In Interpretation And Cultural Theory

Credit Hours: 3.00. Examination of selected developments in social, cultural, and hermeneutical theories from the eighteenth century to the present.

Credits: 3.00

ENGL 67400 - Seminar In Language Testing

Credit Hours: 3.00. An introduction to the techniques, practices, and history of language testing. Introduces the basic tenets of measurement and the issues and controversies related to the measurement of language ability.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 69600 - Seminar In Literature

Credit Hours: 3.00. Advanced study of special subjects.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

Breadth Areas (12 credits)

Medieval and Early Modern Courses (3 credits)

Transatlantic and Early Atlantic Courses (3 credits)

20th and 21st Century Literary Courses (3 credits)

Theory and Cultural Courses (3 credits)

Medieval and Early Modern Courses (3 credits)

Concentrations

GPA Requirements

About the Program

English: Creative Writing Concentration, MFA

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Entomology, MS

About the Program

Program Requirements - Thesis & Non-Thesis

Required Courses (3-5 credits)

ENTM 60000 - Graduate Student Orientation

Credit Hours: 1.00. Introduction and orientation to the requirements and culture of the Department of Entomology, the College of Agriculture, and Purdue University. Intended for graduate students in their first year.

Learning Outcomes: 1. Know the administrative regulations and procedures of Entomology and the Graduate School. 2. Know the history of Entomology. 3. Know the land grant mission and the role of Entomology. 4. Know the University hierarchy. 5. Know the roles, rules and expectations of the apprentice and mentors. 6. Begin creation of a career plan. 7. Develop strategies for effective networking. 8. Learn how to communicate within the discipline through oral and poster presentations. 9. Participate in independent activities. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

GRAD 55000 - Fellowship And Grant Application Writing

Credit Hours: 2.00. Fellowship Application Writing is open to any graduate student who is interested in applying for fellowships and other grant opportunities. Graduate students will be taught how to write personal statements, research statements, and extended research plans that they can submit for fellowship applications. Organization of research background, methods, and significance will be emphasized. Writing mechanics and addressing grant agency requirements and procedures will also be covered. Additionally, fellowship and grant opportunities will be discussed along with professional communication skills.

Learning Outcomes: 1. Analyze the different types of fellowship opportunities currently available to them as well as form broad knowledge of postdoc and faculty grants. 2. Practice and evaluate proofreading skills to gain experience in editing fellowship application writings and be able to apply advanced proofreading skills to future writing projects. 3. Compose persuasive documents using a grant proposal writing style with appropriate formatting and organization and analyze their writing with grant agency criteria. 4. Synthesize and refine competitive personal statements, research plans, and statements of previous research to use for various fellowship

applications. Credits: 2.00

ENTM 60900 - Science Writing

Credit Hours: 1.00. This course is designed for graduate students (MS or PhD) at any stage in their professional career who are seeking formal training in manuscript and grant writing for a scientific audience. Students will be required to attend class and prepare for in-class group discussions and writing activities by reading assigned sections of the text or associated papers. Students will also be required to prepare a written assignment (manuscript or grant) over the course of the semester, which they will use to practice and hone newly acquired skills, as well as participating in peer evaluation of one another's writing. Permission of department required.

Learning Outcomes: 1. Utilize resources and approaches (e.g. online tools, peer-writing groups, time management skills) to develop regular writing habits. 2. Perform critiques of scientific manuscripts and research proposals. 3. Provide constructive criticism to fellow students on writing assignments. 4. Learn steps and basic principles (e.g. language, narrative structure, revision Revised: 08/11/21 process) used to write clear and concise scientific papers for a variety of audiences. 5. Apply principles of science writing to develop a complete draft of a specific section(s) of the MS/PhD research proposal, critical literature review, manuscript or other academic work (with instructor permission). Credits: 1.00

Core Selectives (12-13 credits)

ENTM 52500 - Medical And Veterinary Entomology

Credit Hours: 3.00. Introduction to the biology and control of arthropods of medical and veterinary importance, and coverage of the natural history and abatement of selected arthropod-related diseases, including arboviral encephalitis, filariasis, leishmaniasis, Lyme disease, malaria, plague, spotted fever, trypanosomiasis, and myasis. Offered in odd-numbered years.

Credits: 3.00

ENTM 61100 - Toxicology Of Insecticides

Credit Hours: 3.00. The chemistry, mode of action, and metabolism of insecticides and related compounds in both insect and vertebrate systems. Evaluation of toxic action, principles of selective toxicity, insecticide resistance, and environmental effects are also discussed. A minimal knowledge of entomology is required. Knowledge of biochemistry and neurobiology is useful. Offered in even-numbered years.

Credits: 3.00

ENTM 69200 - Special Topics

Credit Hours: 1.00 to 4.00. Advanced topics in specialties of department members such as, but not limited to: biochemistry and physiology; biological control; insect pest management; veterinary entomology; nematode systematics; pathology; systematics. The field in which work is offered will appear on the student's record. Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 4.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual

understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

ENTM 50800 - Integrative Insect Taxonomy

Credit Hours: 4.00. A multisource approach to understanding insect taxonomy, morphology, and evolution. We will compare traditional classification schemes with new hypotheses of insect evolutionary relationships based on an array of data sources. Students learn the importance of natural history collections and how to prepare insect specimens for permanent storage. We will explore insect diversity through hands-on laboratory exercises and field research.

Learning Outcomes: 1. Identify insects to family by to sight. 2. Implement field techniques for collecting insect specimens. 3. Demonstrate proper insect collection preparation and curation. 4. Understand the principles of insect morphology, classification, and nomenclature. 5. Understand phylogenetic hypotheses and their implementation in insect taxonomy. 6. Integrate skills through a final class project on insect evolution. Credits: 4.00

ENTM 64200 - Analysis Of Ecological Data

Credit Hours: 3.00. Intermediate course in analysis options for biological and ecological data. Topics include: univariate, multivariate, parametric and non-parametric analysis and their basis; advanced graphical techniques; basic mapping with and without geographical information systems; simulation modeling; associated coding for open source platforms. A previous graduate-level course in statistics is required. Working knowledge of ANOVA, t-tests, linear regression, and assumptions and distributions of test statistics for these is assumed.

Learning Outcomes: 1. Know data and analysis requirements when planning experiments and observational studies. 2. Apply several univariate and multivariate statistical analyses. 3. Model or simulate simple biological or ecological systems. 4. Use several different graphing techniques including mapping, three-dimensional plots, and animations. 5. Write code to accomplish 1-4 within open-source software. 6. Develop critical thinking skills. 7. Foster creativity by finding alternative solutions to analytical challenges. 8. Develop both the written and the technical side of communication skills. Credits: 3.00

ENTM 61000 - Current Trends In Insect Pest Management

Credit Hours: 3.00. Concepts of pest management and dynamics of pest populations, with emphasis on population regulation in theory and practice. The principles of applied ecology that pertain to insects and agricultural crops and systems. Identification, biology, behavior, and relationships of pests of forage, fiber, and vegetable crops. A knowledge of introductory entomology is recommended. Offered in even-numbered years.

Learning Outcomes: 1. Identify key insects in economically important IPM systems. 2. Design a pest management plan that includes preventive practices, sampling and economic thresholds. 3. Identify gaps in management techniques and propose new research directions. 4. Discuss key IPM concepts. Credits: 3.00

Thesis Research (6 credits)

ENTM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Non-Thesis Project

Electives (6-15 credits)

Required Courses (3-5 credits)

ENTM 60000 - Graduate Student Orientation

Credit Hours: 1.00. Introduction and orientation to the requirements and culture of the Department of Entomology, the College of Agriculture, and Purdue University. Intended for graduate students in their first year.

Learning Outcomes: 1. Know the administrative regulations and procedures of Entomology and the Graduate School. 2. Know the history of Entomology. 3. Know the land grant mission and the role of Entomology. 4. Know the University hierarchy. 5. Know the roles, rules and expectations of the apprentice and mentors. 6. Begin creation of a career plan. 7. Develop strategies for effective networking. 8. Learn how to communicate within the discipline through oral and poster presentations. 9. Participate in independent activities. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

GRAD 55000 - Fellowship And Grant Application Writing

Credit Hours: 2.00. Fellowship Application Writing is open to any graduate student who is interested in applying for fellowships and other grant opportunities. Graduate students will be taught how to write personal statements, research statements, and extended research plans that they can submit for fellowship applications. Organization of research background, methods, and significance will be emphasized. Writing mechanics and addressing grant agency requirements and procedures will also be covered. Additionally, fellowship and grant opportunities will be discussed along with professional communication skills.

Learning Outcomes: 1. Analyze the different types of fellowship opportunities currently available to them as well as form broad knowledge of postdoc and faculty grants. 2. Practice and evaluate proofreading skills to gain experience in editing fellowship application writings and be able to apply advanced proofreading skills to future writing projects. 3. Compose persuasive documents using a grant proposal writing style with appropriate formatting and organization and analyze their writing with grant agency criteria. 4. Synthesize and refine competitive personal statements, research plans, and statements of previous research to use for various fellowship applications. Credits: 2.00

ENTM 60900 - Science Writing

Credit Hours: 1.00. This course is designed for graduate students (MS or PhD) at any stage in their professional career who are seeking formal training in manuscript and grant writing for a scientific audience. Students will be required to attend class and prepare for in-class group discussions and writing activities by reading assigned sections of the text or associated papers. Students will also be required to prepare a written assignment (manuscript or grant) over the course of the semester, which they will use to practice and hone newly acquired skills, as well as participating in peer evaluation of one another's writing. Permission of department required.

Learning Outcomes: 1. Utilize resources and approaches (e.g. online tools, peer-writing groups, time management skills) to develop regular writing habits. 2. Perform critiques of scientific manuscripts and research proposals. 3. Provide constructive criticism to fellow students on writing assignments. 4. Learn steps and basic principles (e.g. language, narrative structure, revision Revised: 08/11/21 process) used to write clear and concise scientific papers

for a variety of audiences. 5. Apply principles of science writing to develop a complete draft of a specific section(s) of the MS/PhD research proposal, critical literature review, manuscript or other academic work (with instructor permission). Credits: 1.00

Concentrations

About the Program

Environmental and Ecological Engineering, MSEEE

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (18-30 credits)

Core Courses (9 credits)

EEE 69500 - Experimental Courses

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

Electives (9-21 credits)

Seminar (0 credits)

EEE 69000 - Environmental And Ecological Engineering Graduate Seminar

Credit Hours: 0.00. Combination of invited speakers (outside and inside Purdue) including graduate students. Topics will range across environmental and ecological engineering with an emphasis on current topics.

Learning Outcomes: 1. Increased understanding of academic and research topics in Environmental and Ecological Engineering (EEE). 2. Improve ability of EEE graduate students to think critically about research and presentation skills of others. 3. Increased ability to critique his or her own work. Credits: 0.00

Thesis Research (12 credits)

EEE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Learning objectives vary per student. Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Finance, MS

About the Program

Program Requirements

Required Courses (14 credits)

MGMT 64300 - Financial Risk Management

Credit Hours: 2.00 to 4.00. Provides a foundation for understanding ways in which financial institutions and industrial firms can optimally manage financial risks. Concentrates on various "functional" risk measurement problems related to interest rate risk, default risk, exchange rates, and commodity prices. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64200 - Portfolio Management

Credit Hours: 2.00 to 4.00. Methods of analysis of common stocks and bonds for individual and institutional portfolios. Review of the empirical evidence of security market efficiency, and implications of that evidence for various methods of security

analysis. Team projects to analyze the economy, the particular industry or sector, and selected firms within the industry or sector, and to make specific buy-hold-sell recommendations for the stocks and bonds of those firms. Prerequisite:MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 61400 - Investments

Credit Hours: 2.00 to 4.00. Examination of the process of asset valuation. Emphasis on portfolio analysis, security selection, risk-return relationships, and performance evaluation. Additional topics considered include security analysis, option pricing and analysis, futures contracts, and security market operations.

Learning Outcomes: 1. Develop a sound foundation for the main concepts in investment management and portfolio theory. 2. Understand how stock, bond, and option prices are determined. 3. Learn the analytical tools and financial theory necessary to understand how financial assets are used for investment decisions. 4. Take a critical look at the process of investing and relate the topics covered to current real-world problems relevant to practitioners. 5. Prepare students for more advanced courses in investments, portfolio management, and corporate finance. Credits: 2.00 to 4.00

MGMT 61100 - Advanced Corporate Finance

Credit Hours: 2.00 to 4.00 (West Lafayette, Calumet) 3.00 (North Central). Long-term capital structure planning, capital budgeting, treatment of uncertainty in investment decisions, security underwriting, dividend policies, and mergers. Prerequisite: MGMT 61000.

Learning Outcomes: 1. Outline and describe Corporate Financial Policies and understand their potential impact of firm value. 2. Value real options in capital budgeting projects using the Black Scholes, the risk-neutral probability and the duplicating portfolio models. 3. Understand the use of and characteristics of various alternatives to corporate finance including leasing, convertible bonds, and structured finance. Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60200 - Valuation And Financial Statement Analysis

Credit Hours: 2.00. Establishes how to use accounting information to make business and investment decisions. Internally, the information is used to assess performance of units, to evaluate performance of upper-level management, to monitor the firm's investment and financing decisions, and for comparison purposes with the firm's rivals. Externally, accounting information is used by financial analysts, investors and (potential) acquirers to assess the value of the firm, by creditors to assess its credit-worthiness, and by regulators. Prerequisite: MGMT 60000 , MGMT 60100 .

Learning Outcomes: 1. Demonstrate ability to understand financial statements and related information. 2. Practice communicating decisions and ideas through written and oral communication. Credits: 2.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet,

North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59100 - Launching Global Leaders

Credit Hours: 0.00 to 2.00. Capitalizing on the unique personal and professional backgrounds of each student in our program, the Launching Global Leaders course provides a comprehensive and customizable leadership development curriculum. In this year long course, students will engage in a 360 assessment of strategically identified professional competencies critical to success in the contemporary workforce. Using these target areas as a guide, students will then customize their leadership development experience by selectively engaging in a variety of program offerings, including: interactive industry simulations, personal and team performance enhancement tools, professional coaching, interactive learning sessions with industry leaders, and workshops in developing intercultural competency, personal branding and career management.

Learning Outcomes: 1. Comprehensively assess their individual leadership strengths and areas of development along the Launching Global Leaders competency model. 2. Gain exposure to a variety of leadership styles and strategies from successful industry leaders. 3. Gain an awareness of contemporary issues facing leaders of global organizations, and strategies for future. 4. Gain exposure to tools and concepts currently utilized in industry that inspire continuous self-improvement. Credits: 0.00 to 2.00

Specialty Tracks (22 credits)

General Finance

Core Courses (12 credits)

MGMT 64400 - Venture Capital And Investment Banking

Credit Hours: 2.00 to 4.00. Examines the process of corporate value creation through financial policy choices. The sequence of topics roughly parallels the life cycle of a typical corporation. Begins by studying the financing of entrepreneurial companies. Then studies the investment banking and capital acquisition process employed for public securities issues. Also examines capital acquisition and reorganization decisions, such as the use of hybrid securities like convertible debt and PIPEs, project financing bankruptcy reorganizations, and equity structurings. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 51100 - Fixed Income Securities

Credit Hours: 2.00. Introduction to fixed income securities. Discusses a variety of contracts-starting with pure discount bonds, coupon bonds, and callable bonds. Continues with options on bonds, caps, floors, and interest rate swaps. Introduces the theory of the term structure and present models for pricing fixed income securities. Topics include: spot and forward markets for debt instruments, simple models for interest rate risk management, duration, convexity, organized exchange-traded interest rate contracts, interest rate swaps, pricing relationships and the theory of the term structure, and single factor models for pricing interest rate claims.

Learning Outcomes: 1. Identify how to value and hedge commonly traded fixed income securities. 2. Demonstrate understanding of underlying economic determinants and behavior of fixed income securities. 3. Outline and structure such securities. Credits: 2.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments

and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Selectives (10 credits)

MGMT 61500 - International Financial Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Integrative course dealing with the management of firms doing business internationally. Emphasis on decision making. Will draw upon, and adapt, managerial decision models developed for domestic operations, as well as cover appropriate international institutional material. Particular focus on finance and strategic management. Prerequisites: ECON 51500.

Learning Outcomes: 1. Evaluate how changes in the exchange rates affect a firm's cash flows and value. 2. Evaluate how international capital budgeting decisions are affected by the complications due to currency considerations. 3. Evaluate how international capital budgeting decisions are affected by the complications due to tax considerations. 4. Evaluate how international capital budgeting decisions are affected by the complications due to country risk considerations. Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 51300 - Student Managed Investment Fund

Credit Hours: 0.00 to 3.00. This course provides undergraduate and graduate students with hands-on portfolio management experience by investing a $300,000 (as of 2017) portfolio in the stock market. This student-managed fund is a large time commitment, and this course is a way to give students class credit for their experiential learning through SMIF.

Learning Outcomes: 1. Gain knowledge about investing through experiential learning by managing real money. 2. Learn how to analyze stocks and create buy or sell recommendations through team meetings and presentations. 3. Gain teamwork experience and in-depth knowledge by working with industry-specific teams for stock research. Credits: 0.00 to 3.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel. The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial

applications. Credits: 2.00 or 3.00

MGMT 64700 - Financial Engineering

Credit Hours: 2.00 or 3.00. The objective of this course is to provide students with the necessary skills to value and hedge a wide variety of derivatives contracts used in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous-time. Some basic knowledge of stochastic processes would be helpful, but not essential: we will cover what we need in class. The course covers valuation of securities using modern martingale methods as well as the necessary parameter estimation and numerical methods such as Monte Carlo simulations. Applications will include derivatives such as options on stocks, bonds and currencies, as well as valuation of defaultable securities, and modeling the term structure of interest rates and risk management with Value-at-Risk. Prerequisites: MGMT 61400, or similar coursework with instructor permission.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Understand the underlying economic determination and behavior of financial derivatives. 3. Design and structure such financial derivatives. Credits: 2.00 or 3.00

Corporate Finance

Core Courses (7 credits)

MGMT 51100 - Fixed Income Securities

Credit Hours: 2.00. Introduction to fixed income securities. Discusses a variety of contracts-starting with pure discount bonds, coupon bonds, and callable bonds. Continues with options on bonds, caps, floors, and interest rate swaps. Introduces the theory of the term structure and present models for pricing fixed income securities. Topics include: spot and forward markets for debt instruments, simple models for interest rate risk management, duration, convexity, organized exchange-traded interest rate contracts, interest rate swaps, pricing relationships and the theory of the term structure, and single factor models for pricing interest rate claims.

Learning Outcomes: 1. Identify how to value and hedge commonly traded fixed income securities. 2. Demonstrate understanding of underlying economic determinants and behavior of fixed income securities. 3. Outline and structure such securities. Credits: 2.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Selectives (15 credits)

MGMT 61500 - International Financial Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Integrative course dealing with the management of firms doing business internationally. Emphasis on decision making. Will draw upon, and adapt, managerial decision models developed for domestic operations, as well as cover appropriate international institutional material. Particular focus on finance and strategic management. Prerequisites: ECON 51500.

Learning Outcomes: 1. Evaluate how changes in the exchange rates affect a firm's cash flows and value. 2. Evaluate how international capital budgeting decisions are affected by the complications due to currency considerations. 3.

Evaluate how international capital budgeting decisions are affected by the complications due to tax considerations. 4. Evaluate how international capital budgeting decisions are affected by the complications due to country risk considerations. Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

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Credit Hours: 0.00 to 3.00. This course provides undergraduate and graduate students with hands-on portfolio management experience by investing a $300,000 (as of 2017) portfolio in the stock market. This student-managed fund is a large time commitment, and this course is a way to give students class credit for their experiential learning through SMIF.

Learning Outcomes: 1. Gain knowledge about investing through experiential learning by managing real money. 2. Learn how to analyze stocks and create buy or sell recommendations through team meetings and presentations. 3. Gain teamwork experience and in-depth knowledge by working with industry-specific teams for stock research. Credits: 0.00 to 3.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel. The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial applications. Credits: 2.00 or 3.00

MGMT 64700 - Financial Engineering

Credit Hours: 2.00 or 3.00. The objective of this course is to provide students with the necessary skills to value and hedge a wide variety of derivatives contracts used in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous-time. Some basic knowledge of stochastic processes would be helpful, but not essential: we will cover what we need in class. The course covers valuation of securities using modern martingale methods as well as the necessary parameter estimation and numerical methods such as Monte Carlo simulations. Applications will include derivatives such as options on stocks, bonds and currencies, as well as valuation of defaultable securities, and modeling the term structure of interest rates and risk management with Value-at-Risk. Prerequisites: MGMT 61400, or similar coursework with instructor permission.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Understand the underlying economic determination and behavior of financial derivatives. 3. Design and structure such financial derivatives. Credits: 2.00 or 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision

support, prediction, forecasting, and estimation.

Credits: 2.00

Financial Analytics

Core Courses (6 credits)

MGMT 51100 - Fixed Income Securities

Credit Hours: 2.00. Introduction to fixed income securities. Discusses a variety of contracts-starting with pure discount bonds, coupon bonds, and callable bonds. Continues with options on bonds, caps, floors, and interest rate swaps. Introduces the theory of the term structure and present models for pricing fixed income securities. Topics include: spot and forward markets for debt instruments, simple models for interest rate risk management, duration, convexity, organized exchange-traded interest rate contracts, interest rate swaps, pricing relationships and the theory of the term structure, and single factor models for pricing interest rate claims.

Learning Outcomes: 1. Identify how to value and hedge commonly traded fixed income securities. 2. Demonstrate understanding of underlying economic determinants and behavior of fixed income securities. 3. Outline and structure such securities. Credits: 2.00

MGMT 64700 - Financial Engineering

Credit Hours: 2.00 or 3.00. The objective of this course is to provide students with the necessary skills to value and hedge a wide variety of derivatives contracts used in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous-time. Some basic knowledge of stochastic processes would be helpful, but not essential: we will cover what we need in class. The course covers valuation of securities using modern martingale methods as well as the necessary parameter estimation and numerical methods such as Monte Carlo simulations. Applications will include derivatives such as options on stocks, bonds and currencies, as well as valuation of defaultable securities, and modeling the term structure of interest rates and risk management with Value-at-Risk. Prerequisites: MGMT 61400, or similar coursework with instructor permission.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Understand the underlying economic determination and behavior of financial derivatives. 3. Design and structure such financial derivatives. Credits: 2.00 or 3.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Selectives (16 credits)

MGMT 64400 - Venture Capital And Investment Banking

Credit Hours: 2.00 to 4.00. Examines the process of corporate value creation through financial policy choices. The sequence of topics roughly parallels the life cycle of a typical corporation. Begins by studying the financing of entrepreneurial companies. Then studies the investment banking and capital acquisition process employed for public securities issues. Also examines capital acquisition and reorganization decisions, such as the use of hybrid securities like convertible debt and PIPEs, project financing bankruptcy reorganizations, and equity structurings. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 61500 - International Financial Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Integrative course dealing with the management of firms doing business internationally. Emphasis on decision making. Will draw upon, and adapt, managerial decision models developed for domestic operations, as well as cover appropriate international institutional material. Particular focus on finance and strategic management. Prerequisites: ECON 51500.

Learning Outcomes: 1. Evaluate how changes in the exchange rates affect a firm's cash flows and value. 2. Evaluate how international capital budgeting decisions are affected by the complications due to currency considerations. 3. Evaluate how international capital budgeting decisions are affected by the complications due to tax considerations. 4. Evaluate how international capital budgeting decisions are affected by the complications due to country risk considerations. Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate

students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 58200 - Management Of Organizational Data

Credit Hours: 2.00. Provides the basic concepts and skills needed to analyze and organize business data, as well as to utilize the organized data to answer a variety of business queries. After successful completion, students will have an understanding of why database management is important and what it entails, how to analyze the data requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams, translate an ER diagram into normalized relations for a relational database management system, write simple and relatively complex data retrieval commands in the SQL language for an Oracle database, use Microsoft Access as a front end to a server database in Oracle, be familiar with several selected topics of current interest in the data management arena.

Credits: 2.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

MGMT 51300 - Student Managed Investment Fund

Credit Hours: 0.00 to 3.00. This course provides undergraduate and graduate students with hands-on portfolio management experience by investing a $300,000 (as of 2017) portfolio in the stock market. This student-managed fund is a large time commitment, and this course is a way to give students class credit for their experiential learning through SMIF.

Learning Outcomes: 1. Gain knowledge about investing through experiential learning by managing real money. 2. Learn how to analyze stocks and create buy or sell recommendations through team meetings and presentations. 3. Gain teamwork experience and in-depth knowledge by working with industry-specific teams for stock research. Credits: 0.00 to 3.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel. The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial applications. Credits: 2.00 or 3.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

Wealth and Asset Management

Core Courses (11 credits)

MGMT 64400 - Venture Capital And Investment Banking

Credit Hours: 2.00 to 4.00. Examines the process of corporate value creation through financial policy choices. The sequence of topics roughly parallels the life cycle of a typical corporation. Begins by studying the financing of entrepreneurial companies. Then studies the investment banking and capital acquisition process employed for public securities issues. Also examines capital acquisition and reorganization decisions, such as the use of hybrid securities like convertible debt and PIPEs, project financing bankruptcy reorganizations, and equity structurings. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 51100 - Fixed Income Securities

Credit Hours: 2.00. Introduction to fixed income securities. Discusses a variety of contracts-starting with pure discount bonds, coupon bonds, and callable bonds. Continues with options on bonds, caps, floors, and interest rate swaps. Introduces the theory of the term structure and present models for pricing fixed income securities. Topics include: spot and forward markets for debt instruments, simple models for interest rate risk management, duration, convexity, organized exchange-traded interest rate contracts, interest rate swaps, pricing relationships and the theory of the term structure, and single factor models for pricing interest rate claims.

Learning Outcomes: 1. Identify how to value and hedge commonly traded fixed income securities. 2. Demonstrate understanding of underlying economic determinants and behavior of fixed income securities. 3. Outline and structure such securities. Credits: 2.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 64700 - Financial Engineering

Credit Hours: 2.00 or 3.00. The objective of this course is to provide students with the necessary skills to value and hedge a

wide variety of derivatives contracts used in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous-time. Some basic knowledge of stochastic processes would be helpful, but not essential: we will cover what we need in class. The course covers valuation of securities using modern martingale methods as well as the necessary parameter estimation and numerical methods such as Monte Carlo simulations. Applications will include derivatives such as options on stocks, bonds and currencies, as well as valuation of defaultable securities, and modeling the term structure of interest rates and risk management with Value-at-Risk. Prerequisites: MGMT 61400, or similar coursework with instructor permission.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Understand the underlying economic determination and behavior of financial derivatives. 3. Design and structure such financial derivatives. Credits: 2.00 or 3.00

Selectives (11 credits)

MGMT 61500 - International Financial Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Integrative course dealing with the management of firms doing business internationally. Emphasis on decision making. Will draw upon, and adapt, managerial decision models developed for domestic operations, as well as cover appropriate international institutional material. Particular focus on finance and strategic management. Prerequisites: ECON 51500.

Learning Outcomes: 1. Evaluate how changes in the exchange rates affect a firm's cash flows and value. 2. Evaluate how international capital budgeting decisions are affected by the complications due to currency considerations. 3. Evaluate how international capital budgeting decisions are affected by the complications due to tax considerations. 4. Evaluate how international capital budgeting decisions are affected by the complications due to country risk considerations. Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 51300 - Student Managed Investment Fund

Credit Hours: 0.00 to 3.00. This course provides undergraduate and graduate students with hands-on portfolio management experience by investing a $300,000 (as of 2017) portfolio in the stock market. This student-managed fund is a large time commitment, and this course is a way to give students class credit for their experiential learning through SMIF.

Learning Outcomes: 1. Gain knowledge about investing through experiential learning by managing real money. 2. Learn how to analyze stocks and create buy or sell recommendations through team meetings and presentations. 3. Gain teamwork experience and in-depth knowledge by working with industry-specific teams for stock research. Credits: 0.00 to 3.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel. The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial applications. Credits: 2.00 or 3.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat

money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Food Science, MS

About the Program

Program Requirements - Thesis

Required Courses (5 credits)

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central

Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Basic Food Science Courses (5 credits)

FS 55001 - Food Chemistry

Credit Hours: 1.00. Principles and concepts of the effects of heat, light, oxygen, and water activity on chemical reactions and physical events involved in processing, storage, and preparation of food products and their relationships to nutritional quality, organoleptic quality, stability, and safety. Class meets for 5 weeks.

Learning Outcomes: Students are expected to have a working knowledge of the following topics: 1. Structures and functions of major food components, including water, proteins, carbohydrates, and lipids; Major chemical reactions or structural changes occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 2. Major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 3. Examples of the effects of processing on food constituents and end product quality; Basic principles of dispersed systems: colloids, gels, emulsions, foams; Problem solving using basic food chemistry knowledge. Credits: 1.00

FS 55101 - Food Analysis

Credit Hours: 1.00. Principles and applications of chemical, physical, and sensory techniques to analyze foods. Class meets for 5 weeks.

Learning Outcomes: 1. Identify government regulations that dictate industrial standard practices of food analysis. 2. Describe the principles of the official and rapid methods of analysis of the following food components: moisture, ash, fat, protein. 3. For any given food product, select and justify the use of 1) an official, and 2) a rapid method of analysis for the following food components: moisture, ash, fat, protein. 4. Describe the principles of the methods of analysis for the following food components/properties: individual sugars, starch, total dietary fiber, vitamins, individual minerals, oxygen demand, texture, color, sensory evaluation, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional and functional properties. 5. Relate the various analyses discussed in class to quality assurance of specific food products. 6. Explain the principles and applications of the

following techniques in food analysis: chromatography, electrophoresis, spectroscopy (including mass spectroscopy and MALDI), enzymatic assays, immuno-based assays. Credits: 1.00

FS 55201 - Nutritional Sciences

Credit Hours: 1.00. Study of perspectives on established nutrition knowledge, concepts, and principles pertinent to the field of food science. Contemporary information about diet as it relates to health and safety issues. Controversies regarding nutrients and functional foods. Class meets 5 weeks.

Learning Outcomes: Students will learn about the scientific principle relevant to: 1. Newly released dietary guideline for Americans 2010, & components in diets and foods. 2. Digestion, absorption and metabolism of macro-nutrients. 3. Digestion, absorption and metabolism of vitamins and minerals frequently used in food processing. 4. Influence of food components on energy balance and body weight management. Credits: 1.00

FS 55301 - Food Microbiology

Credit Hours: 1.00. Principles and applications of the microbiology of foods. Focuses on many of the important conditions that may lead to foodborne illness and food spoilage. Structured in three main sections related to foodborne hazards: 1) identification, 2) control and prevention, and 3) detection. Class meets weeks 1-5.

Learning Outcomes: 1. Identify the major components of food that affect microbial growth. 2. Explain major foodborne pathogens and under what conditions they thrive. 3. Use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 1.00

FS 55402 - Food Processing

Credit Hours: 1.00. The Food Processing course will present an overview of the basic food engineering concepts and unit operations involved in the manufacture of various food products. Students will be able to understand the food processing literature and to effectively communicate with food technologists and engineers. Topics to be covered include: physical properties of foods, unit operations commonly found in the food industry, and processing equipment. Permission of department required.

Learning Outcomes: 1. Understand the rationale and principle of operation behind common food processing operations. 2. Identify and explain the unit operations involved in the manufacture of specific food products. 3. Explain how processing parameters will affect quality and safety of processed products. 4. Communicate effectively with food technologists and engineers. 5. Work effectively with team members with various backgrounds. Credits: 1.00

Seminar Course (1 credit)

FS 68400 - Food Science Seminar

Credit Hours: 1.00. Current topics in food science.

Credits: 1.00

Research Areas (4-13 credits)

General Program

FS 53000 - Food Ingredient Technology

Credit Hours: 1.00. Identifies functions of ingredients listed on ingredient labels of food products and discusses alternative ingredient choices for food products.

Credits: 1.00

FS 59000 - Special Problems

Credit Hours: 1.00 to 5.00. Specialized study in research laboratories, libraries, or computer laboratories for problems related to food science that are not taught in regular courses. Permission of instructor required.

Credits: 1.00 to 5.00

FS 59100 - Special Topics

Credit Hours: 1.00 to 3.00. Specialized topics not covered in other courses will be offered as one-credit minicourses. Topics, requirements, and credits will be determined yearly. Permission of instructor required.

Credits: 1.00 to 3.00

FS 62000 - Scientific Writing In Food Science

Credit Hours: 2.00. This course covers the essential elements of publishing original research at professional meetings (oral presentations and papers) and in peer-reviewed journals (original research manuscripts). Topics include: ethics in writing, effective reading of the literature, organizing research data, choosing a journal, writing the manuscript (results, materials and methods, introduction, discussion, title, abstract, references), publication process, revising and reviewing, poster presentation, and short oral presentations. Each student will write a paper, prepare a 12-minute oral presentation, and prepare a poster, based on data from his/her graduate research project. Permission of instructor required.

Credits: 2.00

FS 69000 - Special Topics In Food Science

Credit Hours: 1.00 to 3.00. Individual study of specialized materials. Permission of instructor required.

Credits: 1.00 to 3.00

FS 53100 - Science Of Experimental Cuisine

Credit Hours: 3.00. This course brings together culinary arts and the application of food chemistry and ingredient technology principles. Emphasis will be placed on food construction and deconstruction, using common food preparation and molecular gastronomy techniques.

Learning Outcomes: 1. Develop and use the vocabulary of a professional chef. 2. Understand and intelligently discuss how cooking works. 3. Demonstrate practical proficiency in food preparation skills. 4. Understand and experience food from farm to fork. 5. Compare and contrast home, culinary/food service, and large food industry food production practices. 6. Use common food preparation and molecular gastronomy techniques to manipulate the structure of food ingredients and finished food products. 7. Describe the fundamental structure-function relationships of food ingredients and how each of the applied techniques alters the ingredient structure and/or function. 8. Explore and control common food-related reactions/interactions including: emulsification, Maillard browning, caramelization, gelatinization, gelation, denaturation. 9. Exemplify the scientific process and inquiry driven research by designing, implementing, and analyzing experiments related to food construction and deconstruction. 10. Design and create food textures and products by manipulating fundamental structure-function relationships of food ingredients, and explain the science of how the foods were constructed. Credits: 3.00

Thesis Research (6 credits)

FS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (5 credits)

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem.

Credits: 1.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing

hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Program Requirements - Non-Thesis

Required Courses (4 credits)

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance;

contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Seminar Course (1 credit)

FS 68400 - Food Science Seminar

Credit Hours: 1.00. Current topics in food science.

Credits: 1.00

Concentration (15 credits)

Research Project Course (3-6 credits)

Electives (16-19 credits)

Required Courses (4 credits)

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing

hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

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STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Concentrations

GPA Requirements

Additional Information

About the Program

Forestry and Natural Resources, MSF or MS

About the Program

Program Requirements - Thesis and Non-thesis

Required Courses (24-30 credits)

Core Courses (5 credits)

FNR 59800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice

application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

FNR 50600 - Theory And Application Of Natural Resource Extension Programming

Credit Hours: 1.00. This course will provide an opportunity for students to develop and implement extension activities based on their research interests. The course will focus on important natural resources issues, identify common target audiences, provide examples of extension programming, discuss outputs developed from various extension programs, and outline metrics used to evaluate program impact.

Learning Outcomes: 1. Be familiar with the breadth of natural resource extension programs. 2. Create a logic model based on student research and extension interests. 3. Develop a plan that outlines student extension goals. 4. Communicate technical information to non-scientific audiences. Credits: 1.00

FNR 59000 - Introduction To Teaching In Natural Resources

Credit Hours: 1.00. This applied course introduces topics related to teaching science courses to facilitate and support the success of teaching assistants in Forestry and Natural Resources. Students will read and review assigned readings and then participate in a discussion at a weekly class meeting. Students also will have an opportunity to practice and apply concepts through development and presentation of a lesson plan. Permission of instructor required.

Learning Outcomes: 1. Learn evaluated and applied methods to effectively engage and support diverse student populations in formal and informal classrooms. 2. Develop skills to communicate effectively while teaching natural resource topics. 3. Connect ethical teaching practices to teaching actions. 4. Develop a personal teaching philosophy and an associated formal statement. 5. Create materials for a 50 min lecture period lesson plan on a topic of their choice that incorporates concepts from the semester. Credits: 1.00

Research Areas (19-25 credits)

Core Courses (5 credits)

FNR 59800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

FNR 50600 - Theory And Application Of Natural Resource Extension Programming

Credit Hours: 1.00. This course will provide an opportunity for students to develop and implement extension activities based on their research interests. The course will focus on important natural resources issues, identify common target audiences, provide examples of extension programming, discuss outputs developed from various extension programs, and outline metrics used to evaluate program impact.

Learning Outcomes: 1. Be familiar with the breadth of natural resource extension programs. 2. Create a logic model based on student research and extension interests. 3. Develop a plan that outlines student extension goals. 4. Communicate technical information to non-scientific audiences. Credits: 1.00

FNR 59000 - Introduction To Teaching In Natural Resources

Credit Hours: 1.00. This applied course introduces topics related to teaching science courses to facilitate and support the success of teaching assistants in Forestry and Natural Resources. Students will read and review assigned readings and then participate in a discussion at a weekly class meeting. Students also will have an opportunity to practice and apply

concepts through development and presentation of a lesson plan. Permission of instructor required.

Learning Outcomes: 1. Learn evaluated and applied methods to effectively engage and support diverse student populations in formal and informal classrooms. 2. Develop skills to communicate effectively while teaching natural resource topics. 3. Connect ethical teaching practices to teaching actions. 4. Develop a personal teaching philosophy and an associated formal statement. 5. Create materials for a 50 min lecture period lesson plan on a topic of their choice that incorporates concepts from the semester. Credits: 1.00

Thesis Research (6 credits)

FNR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Integrate and synthesize relevant literature, theories, methods from their field of study into a cohesive thesis or manuscript framework that showcases their understanding of existing research and identifying gaps that would benefit from future studies or research. 2. Construct and articulate clear, coherent research objectives, hypotheses, and/or predictions and develop methods that will address these. 3. Conduct research and collect data on thesis topic. Credits: 1.00 to 18.00

Non-Thesis Project

Additional Requirements

FNR 50600 - Theory And Application Of Natural Resource Extension Programming

Credit Hours: 1.00. This course will provide an opportunity for students to develop and implement extension activities based on their research interests. The course will focus on important natural resources issues, identify common target audiences, provide examples of extension programming, discuss outputs developed from various extension programs, and outline metrics used to evaluate program impact.

Learning Outcomes: 1. Be familiar with the breadth of natural resource extension programs. 2. Create a logic model based on student research and extension interests. 3. Develop a plan that outlines student extension goals. 4. Communicate technical information to non-scientific audiences. Credits: 1.00

Concentrations

Program Learning Outcomes

GPA Requirements

About the Program

Global Supply Chain Management, MS

About the Program

Program Requirements

Required Courses (12 credits)

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage

uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need

access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

General Business Selectives (0-18 credits)

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 64200 - Portfolio Management

Credit Hours: 2.00 to 4.00. Methods of analysis of common stocks and bonds for individual and institutional portfolios. Review of the empirical evidence of security market efficiency, and implications of that evidence for various methods of security analysis. Team projects to analyze the economy, the particular industry or sector, and selected firms within the industry or sector, and to make specific buy-hold-sell recommendations for the stocks and bonds of those firms. Prerequisite:MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 63800 - Pricing Strategies And Algorithms

Credit Hours: 2.00. The course enables participants to formulate a systematic framework for approaching the problem of pricing a product, and more generally, a product line. The concepts and analytical methods necessary to develop such a framework are explored and incorporate marketing, competitive, and legal aspects. The course will use a combination of lectures, case discussions and exercises. Prerequisite: MGMT 62000.

Learning Outcomes: 1. Adopt a systematic framework to approach the problem of pricing a product or service. 2. Understand various approaches to estimate value of a product or service to users. 3. Understand the tradeoff between price and sales volume and its relation to price elasticity. 4. Understand segmented pricing and psychological aspects of pricing. 5. Understand the implications of pricing in a competitive environment and the importance of price policy. 6. Appreciate pricing issues when selling through an intermediary. 7. Be introduced to legal aspects of pricing. Credits: 2.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61400 - Investments

Credit Hours: 2.00 to 4.00. Examination of the process of asset valuation. Emphasis on portfolio analysis, security selection, risk-return relationships, and performance evaluation. Additional topics considered include security analysis, option pricing and analysis, futures contracts, and security market operations.

Learning Outcomes: 1. Develop a sound foundation for the main concepts in investment management and portfolio theory. 2. Understand how stock, bond, and option prices are determined. 3. Learn the analytical tools and financial theory necessary to understand how financial assets are used for investment decisions. 4. Take a critical look at the process of investing and relate the topics covered to

current real-world problems relevant to practitioners. 5. Prepare students for more advanced courses in investments, portfolio management, and corporate finance. Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel.

The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial applications. Credits: 2.00 or 3.00

MGMT 58100 - Big Data Technologies

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn visualization techniques using Tableau to query large datasets and gain insights from it. 2. Learn to deploy big data technologies such as Cloudera Hadoop on Virtual Box. 3. Learn to collect data using open APIs to access streaming data from sites like Twitter, Quandl, Buzzfeed, etc. 4. Learn to architect a big data platform for analysis. Credits: 2.00

MGMT 59800 - Analyzing Unstructured Data

Credit Hours: 2.00. This course prepares master students with the advanced and frontier technique for analyzing unstructured data that is built on the prerequisite of basic data analysis on structured data (e.g., data mining using python). Upon completion, students are expected to be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and TensorFlow); students should at least be proficient to design and lead industry-level practical projects conceptually when working with data scientist. We take text and image as examples for illustration and cover applications of: Text mining and feature extraction (e.g., sentiment, topic, readability, etc.); Image classification (e.g., recognition, etc.); Advanced applications (e.g., translations, chatbot, image expression, etc.) The course is formatted as a combination of seminars and hands-on coding practices in class. Students are expected to code (and debug) in the class. The main method topics covered include: Crawling unstructured data using scrapy. Representation and embedding of text and image. Unsupervised learning for unstructured data (e.g., LDA topic modeling, clustering, etc.) Supervised learning for unstructured data (e.g., classic ML models, A/D/C/RNN, LSTM, etc.). Permission of instructor required.

Learning Outcomes: 1. Be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and TensorFlow). 2. Design and lead industry-level practical projects in joint with data scientist. Credits: 2.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

GSCM Selectives (0-18 credits)

MGMT 67200 - Advanced Business Analytics

Credit Hours: 2.00. Quantitative decision procedures under uncertainty applied to business problems. Basic concepts in econometrics and multivariate analysis are studied. Several managerial-oriented case studies are used to illustrate estimation, testing, and regression procedures. Master's student standing and Management majors only.

Learning Outcomes: 1. Review of Multiple Linear Regression. 2. Analysis of Variance (ANOVA): A Regression Approach. 3. Qualitative Independent Variables. 4. Qualitative or Discrete Dependent Variables. 5. Univariate Time Series Models for the Mean. 6. Univariate Time Series Models for Volatility. Credits: 2.00

MGMT 65700 - Manufacturing Strategy And Process Innovation

Credit Hours: 2.00. In recent years many firms have rediscovered manufacturing and operations as a potential source of strategic advantage. In general, these firms have sought to develop capabilities in operations which provide a sustainable advantage in the marketplace. In addition, successful firms have developed processes for understanding the cross-functional implications of product and process choices. In this course, we will seek to understand the circumstances under which particular operating capabilities are most beneficial and how such capabilities can be developed so that operations can be exploited for competitive advantage. Concurrent Prerequisite: MGMT 61000, 65000, 66000.

Learning Outcomes: 1. Identify a fit between Competitive Priorities and Operational Choices by showing how such a fit is accomplished in case analysis and write-ups and understanding pressures to change competitive priorities or operational choices. 2. Establish how capabilities emerge over time and enable a trajectory of competitive advantage by showing how capabilities create options to change tradeoffs in competitive priorities in case analysis and write-ups and identifying financial implications of pursuing one competitive priority vs another. 3. Use financial analysis and discussion of capabilities to argue for investment choices in case analysis. 4. Understand benefits of different approaches to supplier alliances. Consider tradeoffs in governance cost, production cost, long term efficiency and responsiveness in arms length, vertically integrated, and third way supplier partnerships in case analysis. Credits: 2.00

MGMT 58200 - Management Of Organizational Data

Credit Hours: 2.00. Provides the basic concepts and skills needed to analyze and organize business data, as well as to utilize the organized data to answer a variety of business queries. After successful completion, students will have an understanding of why database management is important and what it entails, how to analyze the data requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams, translate an ER diagram into normalized relations for a relational database management system, write simple and relatively complex data retrieval commands in the SQL language for an Oracle database, use Microsoft Access as a front end to a server database in Oracle, be familiar with several selected topics of current interest in the data management arena.

Credits: 2.00

MGMT 56400 - Management Of Service Operations

Credit Hours: 2.00. Special characteristics of services require an interdisciplinary approach to analyzing operations. This course draws upon concepts from accounting, management science, and marketing. Differences and similarities between the service and manufacturing organizations are analyzed. Case studies of service organizations are used extensively. Prerequisite: MGMT 66000 (if Graduate student status) or else MGMT 36100 (if Undergraduate student status).

Credits: 2.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic

programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 56900 - Ethical And Sustainable Supply Chain Management

Credit Hours: 2.00 or 3.00. This course provides students with knowledge and skills for building and analyzing ethical and sustainable practices in supply chains, taking a holistic view of the interaction between businesses, the environment, and society.

Learning Outcomes: 1. Run life-cycle analysis (LCA) and interpret findings. 2. Analyze product and process performance through life-cycle thinking. 3. Understand the Tragedy of the Commons in the business context and identify the underlying reasons. 4. Assess pros and cons of various solutions to the Tragedy of the Commons problem in business context. 5. Identify and explain various product stewardship practices and their pros and cons. 6. Identify innovative business models, such as Servicizing, based on sustainable use of products and services. 7. Compare and contrast traditional supply chain with closed-loop supply chain. 8. Compare and contrast different types of contracts and practices for incentivizing compliance with ethical and sustainable conduct throughout the supply chain. 9. Identify and analyze opportunities and constraints in building ethical and sustainable supply chains. 10. Compare and contrast alternative ways of complying with environmental and social regulations such as carbon trading. Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 56000 - Manufacturing Planning And Control

Credit Hours: 2.00 or 3.00. An advanced course in manufacturing planning and control systems, emphasizing the integration of demand forecasting, inventory control, production scheduling, and production control. Topics are linked through case studies and an elaborate manufacturing computer simulation game.

Learning Outcomes: 1. Master the major concepts, techniques and models of process design and analysis, and the ability to apply them to contexts beyond manufacturing. 2. Master the major tools for conformance quality control and performance quality improvement. 3. Understand the trend in manufacturing management and the advanced skills needed. 4. Acquire the analytical capabilities to uncover problems and improvement opportunities in manufacturing management. Credits: 2.00 or 3.00

Global Supply Chain Management, MS (OL)

About the Program

Program Requirements

Required Courses (17 credits)

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization,

simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

MGMT 56900 - Ethical And Sustainable Supply Chain Management

Credit Hours: 2.00 or 3.00. This course provides students with knowledge and skills for building and analyzing ethical and sustainable practices in supply chains, taking a holistic view of the interaction between businesses, the environment, and society.

Learning Outcomes: 1. Run life-cycle analysis (LCA) and interpret findings. 2. Analyze product and process performance through life-cycle thinking. 3. Understand the Tragedy of the Commons in the business context and identify the underlying reasons. 4. Assess pros and cons of various solutions to the Tragedy of the Commons problem in business context. 5. Identify and explain various product stewardship practices and their pros and cons. 6. Identify innovative business models, such as Servicizing, based on sustainable use of products and services. 7. Compare and contrast traditional supply chain with closed-loop supply chain. 8. Compare and contrast different types of contracts and practices for incentivizing compliance with ethical and sustainable conduct throughout the supply chain. 9. Identify and analyze opportunities and constraints in building ethical and sustainable supply chains. 10. Compare and contrast alternative ways of complying with environmental and social regulations such as carbon trading. Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

Electives (13 credits)

MGMT 67200 - Advanced Business Analytics

Credit Hours: 2.00. Quantitative decision procedures under uncertainty applied to business problems. Basic concepts in econometrics and multivariate analysis are studied. Several managerial-oriented case studies are used to illustrate estimation, testing, and regression procedures. Master's student standing and Management majors only.

Learning Outcomes: 1. Review of Multiple Linear Regression. 2. Analysis of Variance (ANOVA): A Regression Approach. 3. Qualitative Independent Variables. 4. Qualitative or Discrete Dependent Variables. 5. Univariate Time Series Models for the Mean. 6. Univariate Time Series Models for Volatility. Credits: 2.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

Graduate Studies, MS

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Health and Kinesiology, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (24-27 credits)

Thesis Research (6 credits)

HK 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Non-thesis Independent Study (3 credits)

HK 60000 - Individual Research And Study

Credit Hours: 1.00 to 3.00. Each student studies a problem of interest related to physical education, health, or recreation. Permission of instructor required.

Credits: 1.00 to 3.00

Required Courses (24-27 credits)

Thesis Research (6 credits)

HK 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Concentrations

Health Physics, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (21 credits)

Core Courses (19 credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological

sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 51500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. This course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the State and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. The integration of safety and security and the use of alternative technologies will also be covered. Group exercises and simulations in applied nuclear security scenarios will complement lectures given by a number of national and international experts. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. To introduce students to the basic concept of nuclear security. 2. To introduce students to the basics of nuclear security planning at the facility and state level. 3. Introduce students to proliferation efforts,

framing them within the historical and security-related context. 4. Create a foundational understanding of relevant security, safeguards and nonproliferation treaties and agreements. 5. Leverage existing technical knowledge in coming to policy conclusions. 6. Develop both a regime and state specific knowledge base. 7. Illustrate understanding through technical and policy oriented exercises. 8. Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts. Credits: 3.00

Professional Course (1 credit)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (1 credit)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Statistics Selective (3 credits)

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables.

Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

Thesis Research (6 credits)

HSCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Project Course (3 credits)

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 69000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

Electives (3-6 credits)

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 4.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate

between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 55100 - Physical Agents In Environmental Health

Credit Hours: 3.00. Physical characterization and biological interactions of non-ionizing radiation with emphasis on the adverse effects of human exposure. Topics include source characterization, environmental exposure assessment, measurement instrumentation, toxicological and epidemiological findings, control strategies.

Credits: 3.00

HSCI 55200 - Introduction To Aerosol Science

Credit Hours: 3.00. The principles of aerosol behavior and sampling, with particular emphasis on applications in the health sciences. Topics include aerosol aerodynamics, aerosol filtration, pulmonary deposition of aerosols, methods of environmental sampling, and generation of laboratory aerosols.

Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 69000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

NUCL 50100 - Nuclear Engineering Principles

Credit Hours: 3.00. A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science or engineering. The course is structured in four parts: (1) Nuclear structure and radiation, biological effects and medical applications of radiation. (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality. (3) Nuclear materials and waste. (4) Reactor systems and safety.

Credits: 3.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of

exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active

discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

Concentrations

GPA Requirements

Health Services, Outcomes, and Policy, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (xx credits)

Thesis Research (6 credits)

Non-thesis Requirements (6 credits)

History, MA

About the Program

Program Requirements - Thesis

Required Courses (6 credits)

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 60100 - Reading Seminar In European History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields of topics in European history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to

whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

HIST 64100 - Reading Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 67000 - Seminar In Latin American History

Credit Hours: 3.00. Research or reading seminar in Latin American History on a selected topic in colonial or national period of Latin American History. Topics vary. It may be repeated once with change of topic. Students must have been admitted into M.A. or Ph.D. history programs or any other graduate program at Purdue. Also, adequate knowledge of languages pertinent to research topic is expected. No prior knowledge of Latin American History is required.

Learning Outcomes: 1. Become familiarized with the historical process in Latin America from 1492 to the present. 2. Understand the complexities of doing research in the area (e.g., the type of documentation, archives, and scholarly community that exist in Latin America). 3. Develop critical thinking and research abilities. Credits: 3.00

Major Research Area (15 credits)

HIST 51200 - England Under The Stuarts

Credit Hours: 3.00. This intensive study of seventeenth-century England focuses on the political, religious, and economic tensions under the early Stuarts; the Civil War; Cromwell's Protectorate; and The Glorious Revolution. Topics discussed include parliament, puritanism, radicalism, the Restoration, and the Whig Oligarchy.

Credits: 3.00

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 57700 - Contemporary Latin America

Credit Hours: 3.00. A topical and regional approach to recent political, social, and economic movements in Latin America.

Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

HIST 60100 - Reading Seminar In European History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields of topics in European history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 60200 - Seminar In European History

Credit Hours: 3.00. Individual and group study of topics in European history from the medieval period to the modern era. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64100 - Reading Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64200 - Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 65000 - Teaching The History Survey Course

Credit Hours: 3.00. This course provides an introduction to the literature on teaching history at the college level, especially the literature on pedagogy, theory, and conceptualization needed for the undergraduate survey course. Students will become familiar with the professional literature, develop their own syllabus for the survey course, and produce an extensive historiographical essay supporting and justifying the contents of the syllabus. Class discussions will expose students to a number of teaching strategies, concepts, and exercises. Prerequisite: Master's student standing. Permission of instructor required.

Learning Outcomes: 1. Have effective communication through written and oral modes. 2. Have critical and creative thinking skills in acquiring a broad base of knowledge and applying it to complex issues. 3. Have competence in a major area of study. 4. Have appreciation for and understanding of an expanded world perspective by engaging respectfully with a diverse range of individuals, communities and viewpoints. Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 65200 - Seminar In American History

Credit Hours: 3.00. Individual and group study of topics in American history from the colonial period to the present. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 67000 - Seminar In Latin American History

Credit Hours: 3.00. Research or reading seminar in Latin American History on a selected topic in colonial or national period of Latin American History. Topics vary. It may be repeated once with change of topic. Students must have been admitted into M.A. or Ph.D. history programs or any other graduate program at Purdue. Also, adequate knowledge of languages pertinent to research topic is expected. No prior knowledge of Latin American History is required.

Learning Outcomes: 1. Become familiarized with the historical process in Latin America from 1492 to the present. 2. Understand the complexities of doing research in the area (e.g., the type of documentation, archives, and scholarly community that exist in Latin America). 3. Develop critical thinking and research abilities. Credits: 3.00

Minor Research Area (3 credits)

Thesis Research (6 credits)

HIST 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (6 credits)

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 60100 - Reading Seminar In European History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields of topics in European history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

HIST 64100 - Reading Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 67000 - Seminar In Latin American History

Credit Hours: 3.00. Research or reading seminar in Latin American History on a selected topic in colonial or national period of Latin American History. Topics vary. It may be repeated once with change of topic. Students must have been admitted into M.A. or Ph.D. history programs or any other graduate program at Purdue. Also, adequate knowledge of languages pertinent to research topic is expected. No prior knowledge of Latin American History is required.

Learning Outcomes: 1. Become familiarized with the historical process in Latin America from 1492 to the present. 2. Understand the complexities of doing research in the area (e.g., the type of documentation, archives, and scholarly community that exist in Latin America). 3. Develop critical thinking and research abilities. Credits: 3.00

Program Requirements - Non-Thesis

Required Courses (6 credits)

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

Major Research Area (24 credits)

HIST 51200 - England Under The Stuarts

Credit Hours: 3.00. This intensive study of seventeenth-century England focuses on the political, religious, and economic tensions under the early Stuarts; the Civil War; Cromwell's Protectorate; and The Glorious Revolution. Topics discussed

include parliament, puritanism, radicalism, the Restoration, and the Whig Oligarchy.

Credits: 3.00

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 57700 - Contemporary Latin America

Credit Hours: 3.00. A topical and regional approach to recent political, social, and economic movements in Latin America.

Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

HIST 60100 - Reading Seminar In European History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields of topics in European history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 60200 - Seminar In European History

Credit Hours: 3.00. Individual and group study of topics in European history from the medieval period to the modern era. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64100 - Reading Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64200 - Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 65000 - Teaching The History Survey Course

Credit Hours: 3.00. This course provides an introduction to the literature on teaching history at the college level, especially the literature on pedagogy, theory, and conceptualization needed for the undergraduate survey course. Students will become familiar with the professional literature, develop their own syllabus for the survey course, and produce an extensive historiographical essay supporting and justifying the contents of the syllabus. Class discussions will expose students to a number of teaching strategies, concepts, and exercises. Prerequisite: Master's student standing. Permission of instructor required.

Learning Outcomes: 1. Have effective communication through written and oral modes. 2. Have critical and creative thinking skills in acquiring a broad base of knowledge and applying it to complex issues. 3. Have competence in a major area of study. 4. Have appreciation for and understanding of an expanded world perspective by engaging respectfully with a diverse range of individuals, communities and viewpoints. Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 65200 - Seminar In American History

Credit Hours: 3.00. Individual and group study of topics in American history from the colonial period to the present. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the

research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 67000 - Seminar In Latin American History

Credit Hours: 3.00. Research or reading seminar in Latin American History on a selected topic in colonial or national period of Latin American History. Topics vary. It may be repeated once with change of topic. Students must have been admitted into M.A. or Ph.D. history programs or any other graduate program at Purdue. Also, adequate knowledge of languages pertinent to research topic is expected. No prior knowledge of Latin American History is required.

Learning Outcomes: 1. Become familiarized with the historical process in Latin America from 1492 to the present. 2. Understand the complexities of doing research in the area (e.g., the type of documentation, archives, and scholarly community that exist in Latin America). 3. Develop critical thinking and research abilities. Credits: 3.00

Required Courses (6 credits)

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

Concentrations

GPA Requirements

Additional Information

About the Program

Horticulture, MS

About the Program

Program Requirements - Thesis and Non-thesis

Required Courses (3 credits)

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60200 - Horticulture Research Seminar

Credit Hours: 1.00. Weekly attendance at the Horticulture and Landscape Architecture Departmental seminars to help graduate students develop an appreciation for attending seminars and learning appropriate and effective presentation skills. HORT 602 compliments HORT 60100 and HORT 60300 by extending the presentation and project development approaches learned, so that students are better ready to prepare and defend their project proposals in HORT 60300. Prerequisite: BCHM 56100.

Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Analytical Tools Course (3 credits)

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

AGEC 65100 - Application Of Quantitative Analysis: Econometrics II

Credit Hours: 3.00. Emphasis is on using advanced econometric techniques. The course covers use of computer

software and interpretation and reporting of econometric results. The first part of the course includes general econometric concepts, such as least squares and maximum likelihood estimation, desirable statistical properties, assumptions of the classical linear regression model, Monte Carlo methods, nested and non-nested hypothesis tests. Later, more specialized topics are covered, including multiple equation models, simultaneous equation models, limited dependent variable models, and other topics that are deemed relevant. Prerequisite: AGEC 65000.

Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information.

Credits: 3.00

ECON 67400 - Microeconometrics

Credit Hours: 1.00 to 3.00. This advanced course covers the econometrics and statistical methods needed to study data on individual agents in general qualitative response models and models of limited dependent variables. Special emphasis is placed on applying the alternate estimation and inference techniques to actual or simulated datasets. Topics include: univariate binary models, multinomial and multivariate qualitative response models, choice based sampling, distribution-free estimation methods, and Tobit models. Prerequisite: ECON 67200 .

Credits: 1.00 to 3.00

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work.

Credits: 1.00 to 3.00

ECON 67100 - Econometrics I

Credit Hours: 1.00 to 3.00. An introduction to the modern techniques of econometrics and their applications. Topics include: the classical linear regression model (specification, estimation, inference, and prediction), specification analysis, functional form, heteroscedasticity, and autocorrelation. Prerequisite: ECON 67000.

Learning Outcomes: 1. Investigate the

properties of econometric estimators under a variety of conditions. 2. Explain econometric techniques for estimating causal effects. 3. Explain the principles and purpose of Monte Carlo simulation methods. 4. Conduct basic empirical analyses of cross sectional data. Credits: 1.00 to 3.00

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ENTM 69200 - Special Topics

Credit Hours: 1.00 to 4.00. Advanced topics in specialties of department members such as, but not limited to: biochemistry and physiology; biological control; insect pest management; veterinary entomology; nematode systematics; pathology; systematics. The field in which work is offered will appear on the student's record. Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 4.00

FNR 58000 - Research Methods For Natural Resource Social Science

Credit Hours: 3.00. This class covers basic elements of research design for social scientists, with an emphasis on issues pertinent to natural resource management. Topics to be covered include the role of theories and paradigms in designing sound research, writing research questions and hypotheses, and the importance of validity and reliability in research design. Qualitative, quantitative, and mixed methods designs are presented and discussed.

Learning Outcomes: 1. Understand fundamental concepts such as theories and paradigms that are essential precursors to designing sound research. 2. Able to articulate clear research questions and testable hypotheses. 3. Differentiate between different research designs and know which are appropriate under which circumstances. 4 Understand overarching issues such as validity and reliability. 5. Know under which circumstances qualitative, quantitative or mixed methods are appropriate. 6. Demonstrate knowledge of a variety of commonly-used research methods. 7. Articulate basic steps involved in analyzing qualitative and quantitative data. 8. Demonstrate the ability to write a research proposal. Credits: 3.00

FNR 64700 - Quantitative Methods For Ecologists

Credit Hours: 3.00. Examines the assumptions and utility of statistical and other data analytic techniques that are encountered commonly or increasingly being used in ecological research. Emphasis is placed on the potential applications of these quantitative methods in an ecological context. Topics include traditional multivariate methods (cluster analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling, correspondence analysis), generalized linear models (logistic Poisson, and ordinal regression and derivatives), randomization methods, information-theoretic model selection and inference, and hierarchical models. An introduction to Bayesian analysis is provided for generalized linear (and mixed) models, with applications to (meta) population and (meta) community ecology. Prerequisite: BIOL 58210 or ENTM 64200 or STAT 51200 , or consent of instructor. Knowledge of linear algebra and experience with R is desirable but not essential.

Learning Outcomes: 1. Determine the appropriate statistical tool to use when confronted with most questions and data types. 2. Be familiar with the assumptions underlying these methods. 3. Have some familiarity with software required to apply the methods. 4. Offer a basic interpretation of results provided. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and

minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

ASEC 59000 - Special Problems

Credit Hours: 1.00 to 6.00. A study of special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

Primary Area Courses (18-24 credits)

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn care companies, and sod production facilities in an efficient and

environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 55100 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome

sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

LA 50100 - Research Methods For Design Applications

Credit Hours: 1.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 1.00

Thesis Research (6 credits)

HORT 69500 - Horticulture Seminar

Credit Hours: 0.00. Topics of current interest to staff and students.

Credits: 0.00

HORT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Non-thesis Requirement

Required Courses (3 credits)

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60200 - Horticulture Research Seminar

Credit Hours: 1.00. Weekly attendance at the Horticulture and Landscape Architecture Departmental seminars to help graduate students develop an appreciation for attending seminars and learning appropriate and effective presentation skills. HORT 602 compliments HORT 60100 and HORT 60300 by extending the presentation and project development approaches learned, so that students are better ready to prepare and defend their project proposals in HORT 60300.

Prerequisite: BCHM 56100.

Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Concentrations

GPA Requirements

About the Program

Hospitality and Tourism Management, MS

About the Program

Program Requirements - Thesis

Required Courses (27 credits)

Core Courses (21 credits)

HTM 51400 - Business Analytics For Service Industries

Credit Hours: 3.00. In today's highly dynamic business environment, decision-makers often encounter problems that are complex and data intensive. This course focuses on a variety of techniques from the field of business statistics and exposes students to statistical and decision analytics to solve data-driven decision-making problems. The course adopts a practical spreadsheet-based approach to facilitate decision-making and explores the practical applications of these techniques across various functional fields, with a specific focus on service industries.

Learning Outcomes: 1. Identify and evaluate managerial problems requiring data-based decision-making. 2. Apply quantitative methods to model and analyze real-world situations. 3. Employ analytic software tools to solve problems from various functional fields. 4. Communicate solutions and managerial implications across different stakeholders.

Credits: 3.00

HTM 50800 - Cultivating A Service Excellence Mindset

Credit Hours: 3.00. Understanding the fundamental principles of service management is essential to successfully manage service organizations in a complex market environment. This course utilizes major theoretical frameworks, such as Service-Dominant Logic, to address key issues in managing service organizations, including creating service culture, motivating a service-minded workforce, co-creating service value, and achieving service excellence. Students develop managerial skills through a thorough understanding of service strategies, systems, and processes to optimize service value.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the service experience. 2. Explain the critical role of managing the employee-customer interface in the service delivery process. 3. Evaluate various service management strategies to enhance service excellence. 4. Construct key service management systems and processes to solve issues in complex service environments. Credits: 3.00

HTM 50600 - Leading People In Service Industries

Credit Hours: 3.00. Leadership requires an understanding of human behavior, organizational culture, and strategy. In this class, students are exposed to leadership theory through the extant literature. Facilitated by readings and class discussion, students develop critical and analytical understanding of how theory informs and connects to practice. The course topics include human resources functions, organizational and human behavior, human values and motivations, team dynamics, decision-making, and change management. This course takes an interdisciplinary approach, with student learning drawn from different fields.

Learning Outcomes: 1. Understand the role of leadership in successful organizations. 2.

Explain how human resource practices contribute to organizational effectiveness. 3. Analyze theories and practices in human resources, organizational behaviors, and leadership. 4. Connect leadership theories to organizational practices. 5. Synthesize different theoretical perspectives within/across service industries. Credits: 3.00

HTM 50700 - Integrated Marketing Communications For Service Industries

Credit Hours: 3.00. This course addresses the unique challenges and opportunities in marketing the intangible, inseparable, variable, and perishable service products. Balancing theoretical research and practical applications, this course provides a systematic review of key components and processes for an effective integrated marketing communication for service industries. Students will learn how to leverage both long-standing and emerging marketing communication approaches (e.g., strategic marketing and promotion, branding, public relations, digital marketing, social media, influencer marketing and artificial intelligence application) to create customer awareness, manage customer expectations, build customer relationships, and ensure customer satisfaction and loyalty.

Learning Outcomes: 1. Evaluate the role of marketing communications in achieving success for service organizations. 2. Identify critical metrics to understand customer expectations and manage customer perceptions. 3. Apply customer-centric approach to leverage various marketing communication methods and tools to meet customer needs, wants and demands. 4. Develop, promote, and manage service promises through both external and internal marketing. Credits: 3.00

HTM 50900 - Service Experience Design

Credit Hours: 3.00. The success of service organizations requires well-planned design of the service environment and customer experience journey to enhance operational efficiency and excellence, drive customer satisfaction and loyalty, and differentiate from competitors. Addressing the importance of developing and providing optimal customer experience in service industries, this course aims to inspire a design-thinking approach to create contemporary customer experiences in various service settings. By gaining insights from the service design theories, students will gain knowledge to effectively manage the physical environment, service interactions, and service delivery processes to enhance the overall service experience quality. Learning by practice, students will apply the learned design tools to envisage, blueprint, and devise innovative service experience solutions.

Learning Outcomes: 1. Articulate the role of service experience design for the strategic success of service organizations in the marketplace. 2. Conduct critical quantitative and qualitative analyses of customer service experience. 3. Design service experiences for customers by utilizing various experience design tools. 4. Communicate the service design process to service industry professionals and relevant stakeholders. Credits: 3.00

HTM 51300 - Strategy In Service Industries

Credit Hours: 3.00. Strategic management plays a pivotal role in helping industry leaders gain a competitive advantage and accomplish business goals in an ever-changing marketplace. This course centers on the exploration of various theories, frameworks, and models to understand contemporary issues and challenges in service industries. Through the application of strategic management principles and strategy-oriented tasks, students comprehend essential topics in strategic management, including environmental and competitor analysis, strategic planning, strategy formulation, strategy execution, and strategic evaluation and control.

Learning Outcomes: 1. Articulate the theoretical principles and tactical practices in strategy management. 2. Analyze external and internal factors to effectively manage service organizations. 3. Evaluate the strategic planning process for service organizations. 4. Apply strategic theories, frameworks, and models to management practices in service organizations. Credits: 3.00

HTM 51000 - Strategic Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management is a vital strategic tool enabling decision-makers to coordinate various functions leading to company-wide profit maximization. This course empowers students with analytical tools to generate optimal revenue solutions in a competitive marketplace. In the course, students learn economics of pricing and market competition, models and algorithms for capacity allocation, overbooking, and forecasting through a variety of real-world contexts.

Learning Outcomes: 1. Solve for optimal prices given capacity constraints and market segmentation. 2. Calculate optimal protection and overbooking levels. 3. Forecast demand based on time series models and advanced booking models. 4. Formulate strategies to manage consumer responses to revenue management practices across various service industries. 5. Address challenges in revenue management implementation in service industries. Credits: 3.00

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating customer satisfaction, engagement, and enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

Statistics Courses (6 credits)

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Thesis Research (6 credits)

HTM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

Additional Requirements (0-1 credit)

HTM 59001 - Graduate Professional Industry Internship

Credit Hours: 1.00. The Graduate Professional Industry Internship allows graduate students to gain valuable experience through paid employment with a company in the hospitality and tourism industry or a related industry. In addition, each student will research an issue and provide a potential solution to a problem faced by the employer. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from Graduate Professional Industry Internship Coordinator is required to enroll in this course. Permission of instructor required.

Learning Outcomes: 1. Understand how to effectively manage a service industry business. 2. Develop critical thinking, creativity, and problem solving skills. Credits: 1.00

Program Requirements - Non-Thesis

Required Courses (21 credits)

Core Courses (21 credits)

HTM 51400 - Business Analytics For Service Industries

Credit Hours: 3.00. In today's highly dynamic business environment, decision-makers often encounter problems that are complex and data intensive. This course focuses on a variety of techniques from the field of business statistics and exposes students to statistical and decision analytics to solve data-driven decision-making problems. The course adopts a practical spreadsheet-based approach to facilitate decision-making and explores the practical applications of these techniques across various functional fields, with a specific focus on service industries.

Learning Outcomes: 1. Identify and evaluate managerial problems requiring data-based decision-making. 2. Apply quantitative methods to model and analyze real-world situations. 3. Employ analytic software tools to solve problems from various functional fields. 4. Communicate solutions and managerial implications across different stakeholders. Credits: 3.00

HTM 50800 - Cultivating A Service Excellence Mindset

Credit Hours: 3.00. Understanding the fundamental principles of service management is essential to successfully manage service organizations in a complex market environment. This course utilizes major theoretical frameworks, such as Service-Dominant Logic, to address key issues in managing service organizations, including creating service culture, motivating a service-minded workforce, co-creating service value, and achieving service excellence. Students develop managerial skills through a thorough understanding of service strategies, systems, and processes to optimize service value.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the service experience. 2. Explain the critical role of managing the employee-customer interface in the service delivery process. 3. Evaluate various service management strategies to enhance service excellence. 4. Construct key service management systems and processes to solve issues in complex service environments. Credits: 3.00

HTM 50600 - Leading People In Service Industries

Credit Hours: 3.00. Leadership requires an understanding of human behavior, organizational culture, and strategy. In this class, students are exposed to leadership theory through the extant literature. Facilitated by readings and class discussion, students develop critical and analytical understanding of how theory informs and connects to practice. The course topics include human resources functions, organizational and human behavior, human values and motivations, team dynamics, decision-making, and change management. This course takes an interdisciplinary approach, with student learning drawn from different fields.

Learning Outcomes: 1. Understand the role of leadership in successful organizations. 2. Explain how human resource practices contribute to organizational effectiveness. 3. Analyze theories and practices in human resources, organizational behaviors, and leadership. 4. Connect leadership theories to organizational practices. 5. Synthesize different theoretical perspectives within/across service industries. Credits: 3.00

HTM 50700 - Integrated Marketing Communications For Service Industries

Credit Hours: 3.00. This course addresses the unique challenges and opportunities in marketing the intangible, inseparable, variable, and perishable service products. Balancing theoretical research and practical applications, this course provides a systematic review of key components and processes for an effective integrated marketing communication for service industries. Students will learn how to leverage both long-standing and emerging marketing communication approaches (e.g., strategic marketing and promotion, branding, public relations, digital marketing, social media, influencer marketing and artificial intelligence application) to create customer awareness, manage customer expectations, build customer relationships, and ensure customer satisfaction and loyalty.

Learning Outcomes: 1. Evaluate the role of marketing communications in achieving success for service organizations. 2. Identify critical metrics to understand customer expectations and manage customer perceptions. 3. Apply customer-centric approach to leverage various marketing communication methods and tools to meet customer needs, wants and demands. 4. Develop, promote, and manage service promises through both external and internal marketing. Credits: 3.00

HTM 50900 - Service Experience Design

Credit Hours: 3.00. The success of service organizations requires well-planned design of the service environment and customer experience journey to enhance operational efficiency and excellence, drive customer satisfaction and loyalty, and differentiate from competitors. Addressing the importance of developing and providing optimal customer experience in service industries, this course aims to inspire a design-thinking approach to create contemporary customer experiences in various service settings. By gaining insights from the service design theories, students will gain knowledge to effectively manage the physical environment, service interactions, and service delivery processes to enhance the overall service experience quality. Learning by practice, students will apply the learned design tools to envisage, blueprint, and devise innovative service experience solutions.

Learning Outcomes: 1. Articulate the role of service experience design for the strategic success of service organizations in the marketplace. 2. Conduct critical quantitative and qualitative analyses of customer service experience. 3. Design service experiences for customers by utilizing various experience design tools. 4. Communicate the service design process to service industry professionals and relevant stakeholders. Credits: 3.00

HTM 51300 - Strategy In Service Industries

Credit Hours: 3.00. Strategic management plays a pivotal role in helping industry leaders gain a competitive advantage and accomplish business goals in an ever-changing marketplace. This course centers on the exploration of various theories, frameworks, and models to understand contemporary issues and challenges in service industries. Through the application of strategic management principles and strategy-oriented tasks, students comprehend essential topics in strategic management, including environmental and competitor analysis, strategic planning, strategy formulation, strategy execution, and strategic evaluation and control.

Learning Outcomes: 1. Articulate the theoretical principles and tactical practices in strategy management. 2. Analyze external and internal factors to effectively manage service organizations. 3. Evaluate the strategic planning process for service organizations. 4. Apply strategic theories, frameworks, and models to management practices in service organizations. Credits: 3.00

HTM 51000 - Strategic Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management is a vital strategic tool enabling decision-makers to coordinate various functions leading to company-wide profit maximization. This course empowers students with analytical tools to generate optimal revenue solutions in a competitive marketplace. In the course, students learn economics of pricing and market competition, models and algorithms for capacity allocation, overbooking, and forecasting through a variety of real-world contexts.

Learning Outcomes: 1. Solve for optimal prices given capacity constraints and market segmentation. 2. Calculate optimal protection and overbooking levels. 3. Forecast demand based on time series models and advanced booking models. 4. Formulate strategies to manage consumer responses to revenue management practices across various service industries. 5. Address challenges in revenue management implementation in service industries. Credits: 3.00

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating

customer satisfaction, engagement, and enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

Electives (9 credits)

HTM 55300 - Cultivating A Service Excellence Mindset For Healthcare Professionals

Credit Hours: 3.00. Notwithstanding the importance for healthcare services to prioritize clinical outcomes for patients, there is a growing need to think about the patient experience beyond science-driven, evidence-based practices. The healthcare sector is being transformed by consumerism and transparency that demands a more holistic approach to managing the patient experience. In order to promote patient engagement and to enhance their experience, an intentional strategic intent, as reflected in a service excellence mindset, is required. This course seeks to establish the foundation of this mindset for healthcare professionals that are driven to make a difference in their patients' lives. The aim of the course is for students to develop a greater appreciation for the complexity of providing excellent service in the healthcare industry. The course will stimulate students to think differently and more deeply about the patient experience through a service management lens. In doing so they will develop the necessary skills to make effective decisions in the constantly changing patient experience landscape. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the patient experience (patient expectations, drivers of satisfaction, service quality measurement, creating a service culture). 2. Examine the critical role of managing the employee-patient interface in delivering patient-centric services. 3. Recognize and evaluate various service management practices to enhance the patient experience. 4. Recommend key service management systems and practices to improve or solve problems in the complex healthcare environment. Credits: 3.00

HTM 55400 - Designing The Patient Experience For Contemporary Healthcare Systems

Credit Hours: 3.00. In the rapidly evolving healthcare industry, optimizing the patient experience remains a fundamental focus of practice. Addressing the practical challenge and complexity of providing excellent healthcare services, this class aims to inspire a design-thinking approach to reimagine and reinvent the patient experience in the contemporary healthcare systems. Learning by practice, students will apply the design tools to envisage, blueprint, and devise a patient experience solution. Gaining insights on experience-centric innovations in the healthcare domain, students will develop capabilities to better manage the service interactions, facility, and processes to enhance the quality of the patient experience and ease the stress of a hospital stay. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the role of experience design for healthcare organizations' strategic success in the contemporary market environment. 2. Conduct critical quantitative and qualitative analysis of the healthcare service experience. 3. Apply various experience design tools to innovatively design healthcare service experiences for the relevant stakeholders (e.g., patients, service providers). 4. Communicate effectively the design product in both written and verbal manners to healthcare professionals. Credits: 3.00

HTM 55500 - Investing In Healthcare Human Capital

Credit Hours: 3.00. The modern work environment is increasingly focused on working with people in teams - working with people and for people. In seeking to motivate and lead people, it is imperative to acknowledge individuals have different backgrounds, perspectives, and viewpoints. In successfully balancing the challenges of working with people in the labor intensive, diverse and high-stakes nature of the healthcare industry, this class seeks to provide knowledge on organizational behavior concepts (e.g., employee performance, satisfaction, engagement, and motivation; group behavior, teamwork; emotional labor, stress, work-life balance) and the skills to practice this knowledge as a healthcare professional. This course will provide students with the foundational building blocks to adapt to the changing landscape of the work environment, applying theories and exercising critical thinking skills to realize a transformative healthcare workforce experience. Permission of the department required.

Learning Outcomes: 1. Demonstrate an understanding of knowledge, skills, and abilities (KSA's) needed by successful leaders in the healthcare industry. 2. Apply organizational

behavior theories and the role of managers in the context of the healthcare work environment. 3. Evaluate the role of leadership and management of personnel - individuals, groups, and teams - within the healthcare industry. 4. Recommend various leadership and management practices to improve and provide solutions for issues in today's healthcare workforce. Credits: 3.00

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating customer satisfaction, engagement, and enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

HTM 50500 - Hotel Asset Management & Investment

Credit Hours: 3.00. Asset management is an indispensable discipline in the hospitality industry, aimed at maximizing the value of hotel properties in alignment with the owners' and investors' strategic objectives. A competent manager in the industry needs to possess basic understanding of asset management principles and practices for operational and strategic decisions. This course exposes students to the multifaceted world of representing ownership interests in managing hotel investments, and helps students to establish a robust corporate finance foundation to become a competent manager in the industry. Through this course, students develop a nuanced understanding of the intricate interplay among operational issues, real estate management, and financial decisions, and effectively apply the learned knowledge to hotel real estate investment and operation strategies.

Learning Outcomes: 1. Describe the role of an asset manager in the dynamic relationships among various hotel investment stakeholders. 2. Analyze the impacts of operational decisions, such as revenue management, leases, management contract, and franchise agreement, on asset valuation. 3. Explain the effects of development and management of physical assets on hotel operations and valuation. 4. Compare and apply various hotel valuation approaches. 5. Evaluate the effects of capital structure decisions on hotel investment returns. Credits: 3.00

Additional Requirements

HTM 59001 - Graduate Professional Industry Internship

Credit Hours: 1.00. The Graduate Professional Industry Internship allows graduate students to gain valuable experience through paid employment with a company in the hospitality and tourism industry or a related industry. In addition, each student will research an issue and provide a potential solution to a problem faced by the employer. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from Graduate Professional Industry Internship Coordinator is required to enroll in this course. Permission of instructor required.

Learning Outcomes: 1. Understand how to effectively manage a service industry business. 2. Develop critical thinking, creativity, and problem solving skills. Credits: 1.00

GPA Requirements

Hospitality and Tourism

Management, MS (OL)

About the Program

Program Requirements

Required Courses (21 credits)

HTM 51400 - Business Analytics For Service Industries

Credit Hours: 3.00. In today's highly dynamic business environment, decision-makers often encounter problems that are complex and data intensive. This course focuses on a variety of techniques from the field of business statistics and exposes students to statistical and decision analytics to solve data-driven decision-making problems. The course adopts a practical spreadsheet-based approach to facilitate decision-making and explores the practical applications of these techniques across various functional fields, with a specific focus on service industries.

Learning Outcomes: 1. Identify and evaluate managerial problems requiring data-based decision-making. 2. Apply quantitative methods to model and analyze real-world situations. 3. Employ analytic software tools to solve problems from various functional fields. 4. Communicate solutions and managerial implications across different stakeholders. Credits: 3.00

HTM 50800 - Cultivating A Service Excellence Mindset

Credit Hours: 3.00. Understanding the fundamental principles of service management is essential to successfully manage service organizations in a complex market environment. This course utilizes major theoretical frameworks, such as Service-Dominant Logic, to address key issues in managing service organizations, including creating service culture, motivating a service-minded workforce, co-creating service value, and achieving service excellence. Students develop managerial skills through a thorough understanding of service strategies, systems, and processes to optimize service value.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the service experience. 2. Explain the critical role of managing the employee-customer interface in the service delivery process. 3. Evaluate various service management strategies to enhance service excellence. 4. Construct key service management systems and processes to solve issues in complex service environments. Credits: 3.00

HTM 50600 - Leading People In Service Industries

Credit Hours: 3.00. Leadership requires an understanding of human behavior, organizational culture, and strategy. In this class, students are exposed to leadership theory through the extant literature. Facilitated by readings and class discussion, students develop critical and analytical understanding of how theory informs and connects to practice. The course topics include human resources functions, organizational and human behavior, human values and motivations, team dynamics, decision-making, and change management. This course takes an interdisciplinary approach, with student learning drawn from different fields.

Learning Outcomes: 1. Understand the role of leadership in successful organizations. 2. Explain how human resource practices contribute to organizational effectiveness. 3. Analyze theories and practices in human resources, organizational behaviors, and leadership. 4. Connect leadership theories to organizational practices. 5. Synthesize different theoretical perspectives within/across service industries. Credits: 3.00

HTM 50700 - Integrated Marketing Communications For Service Industries

Credit Hours: 3.00. This course addresses the unique challenges and opportunities in marketing the intangible, inseparable, variable, and perishable service products. Balancing theoretical research and practical applications, this course provides a systematic review of key components and processes for an effective integrated marketing communication for service industries. Students will learn how to leverage both long-standing and emerging marketing communication approaches (e.g., strategic marketing and promotion, branding, public relations, digital marketing, social media, influencer marketing and artificial intelligence application) to create customer awareness, manage customer expectations, build customer relationships, and ensure customer satisfaction and loyalty.

Learning Outcomes: 1. Evaluate the role of marketing communications in achieving success

for service organizations. 2. Identify critical metrics to understand customer expectations and manage customer perceptions. 3. Apply customer-centric approach to leverage various marketing communication methods and tools to meet customer needs, wants and demands. 4. Develop, promote, and manage service promises through both external and internal marketing. Credits: 3.00

HTM 50900 - Service Experience Design

Credit Hours: 3.00. The success of service organizations requires well-planned design of the service environment and customer experience journey to enhance operational efficiency and excellence, drive customer satisfaction and loyalty, and differentiate from competitors. Addressing the importance of developing and providing optimal customer experience in service industries, this course aims to inspire a design-thinking approach to create contemporary customer experiences in various service settings. By gaining insights from the service design theories, students will gain knowledge to effectively manage the physical environment, service interactions, and service delivery processes to enhance the overall service experience quality. Learning by practice, students will apply the learned design tools to envisage, blueprint, and devise innovative service experience solutions.

Learning Outcomes: 1. Articulate the role of service experience design for the strategic success of service organizations in the marketplace. 2. Conduct critical quantitative and qualitative analyses of customer service experience. 3. Design service experiences for customers by utilizing various experience design tools. 4. Communicate the service design process to service industry professionals and relevant stakeholders. Credits: 3.00

HTM 51300 - Strategy In Service Industries

Credit Hours: 3.00. Strategic management plays a pivotal role in helping industry leaders gain a competitive advantage and accomplish business goals in an ever-changing marketplace. This course centers on the exploration of various theories, frameworks, and models to understand contemporary issues and challenges in service industries. Through the application of strategic management principles and strategy-oriented tasks, students comprehend essential topics in strategic management, including environmental and competitor analysis, strategic planning, strategy formulation, strategy execution, and strategic evaluation and control.

Learning Outcomes: 1. Articulate the theoretical principles and tactical practices in strategy management. 2. Analyze external and internal factors to effectively manage service organizations. 3. Evaluate the strategic planning process for service organizations. 4. Apply strategic theories, frameworks, and models to management practices in service organizations. Credits: 3.00

HTM 51000 - Strategic Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management is a vital strategic tool enabling decision-makers to coordinate various functions leading to company-wide profit maximization. This course empowers students with analytical tools to generate optimal revenue solutions in a competitive marketplace. In the course, students learn economics of pricing and market competition, models and algorithms for capacity allocation, overbooking, and forecasting through a variety of real-world contexts.

Learning Outcomes: 1. Solve for optimal prices given capacity constraints and market segmentation. 2. Calculate optimal protection and overbooking levels. 3. Forecast demand based on time series models and advanced booking models. 4. Formulate strategies to manage consumer responses to revenue management practices across various service industries. 5. Address challenges in revenue management implementation in service industries. Credits: 3.00

Electives (9 credits)

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts

and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating customer satisfaction, engagement, and enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

HTM 50500 - Hotel Asset Management & Investment

Credit Hours: 3.00. Asset management is an indispensable discipline in the hospitality industry, aimed at maximizing the value of hotel properties in alignment with the owners' and investors' strategic objectives. A competent manager in the industry needs to possess basic understanding of asset management principles and practices for operational and strategic decisions. This course exposes students to the multifaceted world of representing ownership interests in managing hotel investments, and helps students to establish a robust corporate finance foundation to become a competent manager in the industry. Through this course, students develop a nuanced understanding of the intricate interplay among operational issues, real estate management, and financial decisions, and effectively apply the learned knowledge to hotel real estate investment and operation strategies.

Learning Outcomes: 1. Describe the role of an asset manager in the dynamic relationships among various hotel investment stakeholders. 2. Analyze the impacts of operational decisions, such as revenue management, leases, management contract, and franchise agreement, on asset valuation. 3. Explain the effects of development and management of physical assets on hotel operations and valuation. 4. Compare and apply various hotel valuation approaches. 5. Evaluate the effects of capital structure decisions on hotel investment returns. Credits: 3.00

Program Learning Outcomes

Human Development and Family Studies, MS

About the Program

Program Requirements

Required Courses (26 credits)

Core Courses (9 credits)

HDFS 60200 - Advanced Family Science

Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

Learning Outcomes: 1. Describe and critique classic and emerging theoretical and conceptual frameworks in family science, with attention to refinements over time. 2. Demonstrate critical thinking skills through exploring and discussing diverse theoretical viewpoints and recent research in family science. 3. Apply theoretical and conceptual frameworks when developing empirical research in family science. Credits: 3.00

HDFS 60400 - Developmental And Family Approaches To Diversity And Oppression

Credit Hours: 3.00. In this course, we will utilize an intersectional lens throughout the course to critically examine the development of individuals oppressed due to their minority status in the United States. We will review current research and literature across disciplines to: 1) understand the origin, meaning, and purpose of race and racism; 2) learn about the history of oppression and resilience of minoritized groups; 3) analyze systems of discrimination; 4) introduce theoretical frameworks for studying the unique, intersectional experiences

of minoritized populations and examples of their application to empirical research, and 5) discuss how research can be used to advance social justice. Permission of department required.

Learning Outcomes: 1. Define concepts such as discrimination, race, racism, gender (beyond binary definitions), cissexism, heterosexism, neurodiversity, and ableism as they pertain to diverse populations in the U.S. 2. Present their own intersectionality and demonstrate how personal intersections can inform bias and actions. 3. Discuss the diversity that exists in the US and identify systemic factors that interact with this diversity (including but not limited to socioeconomic factors). 4. Explain the major concerns regarding minoritized groups' experiences and the factors that promote positive outcomes for marginalized individuals and families. 5. Evaluate critically the theoretical foundation of empirical studies conducted with diverse individuals/families and apply diversity-focused theory to student research content areas of interest. Credits: 3.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to diversity in developmental influences and trajectories, including atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

Colloquium (4 credits)

HDFS 69700 - Graduate Student Colloquium

Credit Hours: 1.00. Research presentations by faculty members, graduate students, and invited speakers. Includes attention to: (1) the responsible conduct of research, (2) professional/scholarly and teaching development, and (3) diversity, equity, and inclusion.

Learning Outcomes: 1. Expose students to a wide swath of HDFS-related research across the life course. 2. Provide a rotation of professional development trainings (e. g., vita, job talk, and conference presentation development). 3. Foster teaching development through presentations, workshops, or trainings. 4. Generate internal and external networking opportunities for graduate students. 5. Address issues of diversity, equity, and inclusion (DEI) in HDFS by (a) providing a platform for increased representation in presenters, (b) critically considering how research in HDFS serves diverse (i. e., underrepresented/underserved/historically marginalized) populations, and (c) increasing our competencies related to DEI as part of professional development. Credits: 1.00

Quantitative/Research Methods Courses (13 credits)

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical

methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

HDFS 61700 - Quantitative Methods II: Regression

Credit Hours: 4.00. This course has two primary goals: 1) provide students with foundational knowledge related to linear regression statistical analyses, and 2) provide students with the opportunity to practice writing, interpreting, and presenting regression analyses for the purposes of dissemination. Prerequisite: HDFS 61300 or PUBH 60100 or STAT 50100 or PSY 64600. Permission of instructor required.

Learning Outcomes: 1. Understand the foundations of linear regression statistical analyses, including multiple regression. 2. Understand mediation and moderation hypotheses and associated testing in linear regression. 3. Derive research questions and hypotheses testable in linear regression. 4. Analyze data using linear regression modeling and statistical software. 5. Properly interpret the statistical estimates and tests covered in the course. 6. Apply regression modeling to your research questions using empirical data. 7. Produce written communication of analytic methods and interpretation of results. Credits: 4.00

PSY 68100 - Seminar In Research Methodologies Of Industrial/Organizational Psychology

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings.

Learning Outcomes: 1. Develop an understanding of quantitative research methods employed in psychology, including their strengths and limitations in addressing validity concerns. 2. Apply quantitative research methods to your own research. 3. Have critical thinking skills and good professional judgment regarding research, theory, and methods. 4. Have written and oral skills. 5. Understand and able to apply professional and ethical values of psychology. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using

various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

PSY 68800 - Research Methods In Social Psychology

Credit Hours: 3.00. This course provides a broad and rigorous, graduate-level overview of contemporary research methodology in social psychology and personality. The course follows a discussion seminar format. Permission of department required.

Learning Outcomes: 1. Understand the specific rationale for using different methodological techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

Core Courses (9 credits)

HDFS 60200 - Advanced Family Science

Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

Learning Outcomes: 1. Describe and critique classic and emerging theoretical and conceptual frameworks in family science, with attention to refinements over time. 2. Demonstrate critical thinking skills through exploring and discussing diverse theoretical viewpoints and recent research in family science. 3. Apply theoretical and conceptual frameworks when developing empirical research in family science. Credits: 3.00

HDFS 60400 - Developmental And Family Approaches To Diversity And Oppression

Credit Hours: 3.00. In this course, we will utilize an intersectional lens throughout the course to critically examine the development of individuals oppressed due to their minority status in the United States. We will review current research and literature across disciplines to: 1) understand the origin, meaning, and purpose of race and racism; 2) learn about the history of oppression and resilience of minoritized groups; 3) analyze systems of discrimination; 4) introduce theoretical frameworks for studying the unique, intersectional experiences of minoritized populations and examples of their application to empirical research, and 5) discuss how research can be used to advance social justice. Permission of department required.

Learning Outcomes: 1. Define concepts such as discrimination, race, racism, gender (beyond binary definitions), cissexism, heterosexism, neurodiversity, and ableism as they pertain to diverse populations in the U.S. 2. Present their own intersectionality and demonstrate how personal intersections can inform bias and actions. 3. Discuss the diversity that exists in the US and identify systemic factors that interact with this diversity (including but not limited to socioeconomic factors). 4. Explain the major concerns regarding minoritized groups' experiences and the factors that promote positive outcomes for marginalized individuals and families. 5. Evaluate critically the theoretical foundation of empirical studies conducted with diverse individuals/families and apply diversity-focused theory to student research content areas of interest. Credits: 3.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to diversity in developmental influences and trajectories, including

atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

Thesis Research (5 credits)

HDFS 69000 - Directed Research In HDFS

Credit Hours: 1.00 to 4.00. Directed research and supervised research on a topic in student's area of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

HDFS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Required Courses (26 credits)

Core Courses (9 credits)

HDFS 60200 - Advanced Family Science

Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

Learning Outcomes: 1. Describe and critique classic and emerging theoretical and conceptual frameworks in family science, with attention to refinements over time. 2. Demonstrate critical thinking skills through exploring and discussing diverse theoretical viewpoints and recent research in family science. 3. Apply theoretical and conceptual frameworks when developing empirical research in family science. Credits: 3.00

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Credit Hours: 1.00. Research presentations by faculty members, graduate students, and invited speakers. Includes attention to: (1) the responsible conduct of research, (2) professional/scholarly and teaching development, and (3) diversity, equity, and inclusion.

Learning Outcomes: 1. Expose students to a wide swath of HDFS-related research across the life course. 2. Provide a rotation of professional development trainings (e. g., vita, job talk, and conference presentation development). 3. Foster teaching development through presentations, workshops, or trainings. 4. Generate internal and external networking opportunities for graduate students. 5. Address issues of diversity, equity, and inclusion (DEI) in HDFS by (a) providing a platform for increased representation in presenters, (b) critically considering how research in HDFS serves diverse (i. e., underrepresented/underserved/historically marginalized) populations, and (c) increasing our competencies related to DEI as part of professional development. Credits: 1.00

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Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

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Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of

instructor required.

Credits: 4.00

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Credit Hours: 4.00. This course has two primary goals: 1) provide students with foundational knowledge related to linear regression statistical analyses, and 2) provide students with the opportunity to practice writing, interpreting, and presenting regression analyses for the purposes of dissemination. Prerequisite: HDFS 61300 or PUBH 60100 or STAT 50100 or PSY 64600. Permission of instructor required.

Learning Outcomes: 1. Understand the foundations of linear regression statistical analyses, including multiple regression. 2. Understand mediation and moderation hypotheses and associated testing in linear regression. 3. Derive research questions and hypotheses testable in linear regression. 4. Analyze data using linear regression modeling and statistical software. 5. Properly interpret the statistical estimates and tests covered in the course. 6. Apply regression modeling to your research questions using empirical data. 7. Produce written communication of analytic methods and interpretation of results. Credits: 4.00

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Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings.

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Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

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Learning Outcomes: 1. Understand the specific rationale for using different methodological

techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

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Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

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HDFS 60400 - Developmental And Family Approaches To Diversity And Oppression

Credit Hours: 3.00. In this course, we will utilize an intersectional lens throughout the course to critically examine the development of individuals oppressed due to their minority status in the United States. We will review current research and literature across disciplines to: 1) understand the origin, meaning, and purpose of race and racism; 2) learn about the history of oppression and resilience of minoritized groups; 3) analyze systems of discrimination; 4) introduce theoretical frameworks for studying the unique, intersectional experiences of minoritized populations and examples of their application to empirical research, and 5) discuss how research can be used to advance social justice. Permission of department required.

Learning Outcomes: 1. Define concepts such as discrimination, race, racism, gender (beyond binary definitions), cissexism, heterosexism, neurodiversity, and ableism as they pertain to diverse populations in the U.S. 2. Present their own intersectionality and demonstrate how personal intersections can inform bias and actions. 3. Discuss the diversity that exists in the US and identify systemic factors that interact with this diversity (including but not limited to socioeconomic factors). 4. Explain the major concerns regarding minoritized groups' experiences and the factors that promote positive outcomes for marginalized individuals and families. 5. Evaluate critically the theoretical foundation of empirical studies conducted with diverse individuals/families and apply diversity-focused theory to student research content areas of interest. Credits: 3.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to diversity in developmental influences and trajectories, including atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

Concentrations

GPA Requirements

Additional Information

About the Program

Human Resource Management, MS

About the Program

Program Requirements

Required Courses (18 credits)

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class.

Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth).

Credits: 1.00 to 3.00

MGMT 59100 - Launching Global Leaders

Credit Hours: 0.00 to 2.00. Capitalizing on the unique personal and professional backgrounds of each student in our program, the Launching Global Leaders course provides a comprehensive and customizable leadership development curriculum. In this year long course, students will engage in a 360 assessment of strategically identified professional competencies critical to success in the contemporary workforce. Using these target areas as a guide, students will then customize their leadership development experience by selectively engaging in a variety of program offerings, including: interactive industry simulations, personal and team performance enhancement tools, professional coaching, interactive learning

sessions with industry leaders, and workshops in developing intercultural competency, personal branding and career management.

Learning Outcomes: 1. Comprehensively assess their individual leadership strengths and areas of development along the Launching Global Leaders competency model. 2. Gain exposure to a variety of leadership styles and strategies from successful industry leaders. 3. Gain an awareness of contemporary issues facing leaders of global organizations, and strategies for future. 4. Gain exposure to tools and concepts currently utilized in industry that inspire continuous self-improvement. Credits: 0.00 to 2.00

MGMT 65460 - Talent Acquisition

Credit Hours: 2.00 to 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions, and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Design a talent acquisition program in order for an organization's talent to be its competitive advantage. 2. Design a workforce implementation plan and a process to identify issues and continuous refinement of the plan. 3. Create a Recruiting plan that is focused on both external and internal candidates. 4. Design a process for final candidate evaluation. 5. Develop strategies to orient and onboard newly acquired talent. Credits: 2.00 to 3.00

MGMT 65330 - HR Strategy

Credit Hours: 2.00 to 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Learning Outcomes: 1. Understand the history of human resource management and how it has evolved to the strategic level. 2. Understand what strategic Human Resource Management means and entails. 3. Understand and complete a Human Resource Management Strategic plan. 4. Make yourself an invaluable resource to upper level management and the CEO by demonstrating the extreme importance and value of Strategic Human Resource management. Credits: 2.00 to 3.00

MGMT 65470 - Talent Management

Credit Hours: 2.00 to 3.00. This course focuses on the employer-employee relationship and how managers work with employees to improve their performance. Attention is given to Talent, Talent Management, and Performance Management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing talent. Various definitions of Employee Engagement will be explored, along with how it is, measured, and why it is so important to your organization. Finally, various methods to engage employees in the organization will be studied.

Learning Outcomes: 1. Define talent and talent management. 2. Determine talent management strategies to support an organization's objectives and goals. 3. Evaluate talent management models to address organizational needs. 4. Develop and integrate a talent management system into organizations. 5. Define critical elements of a successful performance management system. 6. Identify methods to promote and maintain an engaged workforce. Credits: 2.00 to 3.00

MGMT 65390 - HR Analytics

Credit Hours: 2.00 to 3.00. This course provides an introduction to the field of HR analytics. HR Analytics is an advanced set of data analysis methodologies, tools and metrics for comprehensive workforce performance measurement and improvement. The objective of HR analytics is to drive evidence-based decisions and action in the workplace. In addition to your instructor, you may hear from expert practitioners and corporate leaders who have "been there and done that" leveraging a myriad of HR analytics along the way. We will also review (and hopefully expand) your understanding of handling data including conceptualizing models, identifying key metrics, collecting data,

analyzing data, and presenting data in ways that tell a powerful story. Throughout our course, I will infuse consulting concepts, methodologies, and lessons learned that combined with your analytic skills will help you to effectively serve as an HR Business Partner (internal HR consultant).

Learning Outcomes: 1. Understand how organizations use HR analytics to address business problems, support business decision making and drive business outcomes. 2. Become familiar with methods and processes to design, define and execute workforce research projects in a consulting capacity leveraging consulting models and methodologies and enhancing project management capabilities. 3. Learn how to approach and apply HR analytics methodology. 4. Understand current HR analytics practices, tools and emerging trends. Credits: 2.00 to 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

MGMT 65480 - Total Rewards

Credit Hours: 2.00. This course examines how organizations can optimize financial and relational returns to gain and sustain a competitive advantage in a global environment. We will use theory and cases to develop a sound understanding of the compensation system.

Learning Outcomes: 1. Understand compensation systems and how they can be a catalyst for change and to help organizations execute their business strategies. 2. Know how to attract, engage, and retain top talent effectively. 3. Apply practical management tools for sustaining competitive advantage. 4. Develop technical compensation skills to design pay structures and market pricing systems. 5. Comprehend the importance of rational returns for employees and the role it plays in employee development. Credits: 2.00

Selectives (18 credits)

MGMT 68800 - Developing A Global Business Strategy

Credit Hours: 2.00 to 4.00. Provides an introduction regarding the business and strategy challenges faced by managers in our global economy, regardless of whether the firm is a small domestic company or a large multi-national. Major topics for the course include motivations and challenges of internationalization, international business fundamentals, foreign market entry strategies, organizing across countries, analyzing global industries, building competitive advantage in global industries, and the influence of culture and institutions. Prerequisite: MGMT 65000.

Learning Outcomes: 1. Understand the three foundation characteristics related to foreign market entry - firm, industry, and institutional factors. 2. Analyze country choice for entry and the factors involved in choosing a country. 3. Develop the essential skills to identify and pursue global business opportunities, with a focus on the different modes of entry. 4. Acquire the skills to resolve management decision

problems in global markets, and analyze multi-country organizational structures. Credits: 2.00 to 4.00

MGMT 67200 - Advanced Business Analytics

Credit Hours: 2.00. Quantitative decision procedures under uncertainty applied to business problems. Basic concepts in econometrics and multivariate analysis are studied. Several managerial-oriented case studies are used to illustrate estimation, testing, and regression procedures. Master's student standing and Management majors only.

Learning Outcomes: 1. Review of Multiple Linear Regression. 2. Analysis of Variance (ANOVA): A Regression Approach. 3. Qualitative Independent Variables. 4. Qualitative or Discrete Dependent Variables. 5. Univariate Time Series Models for the Mean. 6. Univariate Time Series Models for Volatility. Credits: 2.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 35500 - Consulting Tools And Skills

Credit Hours: 3.00. This novel course will provide an opportunity for motivated students to gain exposure to the skills and tools necessary to succeed in the consulting industry. There will be a chance to work in small teams to define client problems, collect and analyze data, develop solution proposals, and implement recommendations. Students will also be given an insider's look into the history of consulting, common types of consulting, and professional standards in this specialized area of management. Honing skills in project management, presentation delivery, storytelling, and stakeholder engagement will form the foundation of the tools used to solve client challenges.

Learning Outcomes: 1. Effectively and confidently use specific consulting business language. 2. Critically analyze resumes and case interviews. 3. Effectively research businesses and unfamiliar industries. 4. Use a consulting approach to problem solving. 5. Present a professional, engaging, and authentic persona. Credits: 3.00

MGMT 53600 - Employment & Diversity Law For Managers

Credit Hours: 2.00. Managers, regardless of your industry, will routinely face HR and employment issues that collide with the law. In this course, we will examine many laws and the practical ways you can stay on the right side of the law. Don't worry, you aren't in a law school class and I don't expect you to become employment attorneys. However, I will help you gain a working knowledge of employment laws including: The Civil Rights Act, ADA, ADEA, FMLA, FLSA, and a host of alphabet soup. We will also apply these laws from posting a job description to recruiting to hiring to employee reviews to terminating an employee. While I can't guarantee you will never be sued by a disgruntled current or former employee, I can help you put yourself and your company in the best possible position to defend that suit. And don't worry: we will look at lots of quick case studies (less than a page) to give you context you can easily remember.

Learning Outcomes: 1. Know about the law of the employment process. 2. Know the global principles that apply to corporate managers in the legal context. 3. Know about specific human resource management techniques (or methodologies), and apply some to the techniques. 4. Know about the importance of legal principles as applied to the employment process. Credits: 2.00

MGMT 55500 - Leading Management Of Diversity And Inclusion In Organizations

Credit Hours: 2.00 or 3.00. This course is designed to help participants learn to effectively manage self, peers, teams, clients, and firms in diverse organizational settings and to lead organizational change to foster inclusion, equality, and productive workplaces. The class is designed to develop your skills in leading diversity and inclusion from a multi-level view in the workplace: employee, leader, team member, organizational, and institutional/societal levels. Its goal is to a) improve your ability to work in diverse teams, as well as b) develop your ability to design, and implement strategies to foster cultural and structural change to support the management of an increasingly diverse workforce toward enhanced organizational effectiveness to benefit business, employees, and society. People and leaders in organizations are constantly working with members of different backgrounds, social identities, and experiences, often across distributed and/or digitally connected environments, fostering increased attention to diversity equity and inclusion in transforming employment settings. When understood, supported

and leveraged effectively, these differences in social identities, difference and values can help attract and retain talent, strengthen societal and community economic equality, support organizational and team effectiveness; but when overlooked, or mismanaged, these differences can increase turnover, conflict, stress, talent under-utilization, and harm career and work-life wellbeing, health, and productivity. We will focus on advancing understanding of how intersecting organizational and institutional structures and cultures and their relation to strategies for creating diversity; an inclusive culture and positive climate for inclusion and talent management; and developing and retaining diverse talent to foster innovation and organizational effectiveness across multiple levels of intervention. We discuss how to conduct an organizational diagnosis of the current diversity climate and barriers and facilitators for creating a multicultural workplace and a flexible environment supportive of many identities, and how assumptions of "ideal workers" may vary across industry and cultural contexts. You as a leader will be better able to articulate your own DEI vision and develop understanding of strategies that move from description to evidence-based diagnosis to action strategies and implementation in order to move aspirations into organizational change realities. From an individual leadership perspective, we tackle the question: "Why does diversity, equity and inclusion matter in employing organizations and business, what is the state-of-the-art evidence-based knowledge, and what does it mean to me personally in my career and my leadership beliefs?" Specifically, we focus on the business and social science processes - including attitudes toward in-groups and out-groups, stereotyping, identity, privilege, and power, intersectionality, discrimination, bias, influence opportunity, bystander awareness, allyship, difficult conversations, and perspective taking - these topics relate to how members of different social groups perceive and interact with one another. Since managing social identity increasingly involves managing work-life boundaries and work and non-work public and private selves, we will also learn about authenticity choices and social and public/professional identity boundary management. Further, the opportunity to experience higher well-being and work-life balance is increasingly linked to job and life opportunities reflecting growing work-life inequality in society. From an organizational and group perspective, we address the questions: "What are best practices for successful management of diversity and inclusion? And why does it matter to me as a future leader personally and in business and in the communities and world in which I live."

Learning Outcomes: 1. Evaluate the aspects of your identity and personal experiences that shape how you interact and engage with others and how they interact and engage with you in organizations. 2. Explain how issues of power, privilege, discrimination, bias, equality, and equity influence opportunity and effectiveness in organizations operating both in local, domestic and global contexts. 3. Propose ways to make relationships across cultural and cross-cultural and gender differences in organizations more effective. 4. Describe current perspectives on the relationships among diversity, inclusion, creativity, and innovation in domestic and global organizations. 5. Analyze a company's current approach to leading diversity and use content from this course to propose ways to enhance learning and effectiveness in that company. Credits: 2.00 or 3.00

MGMT 49300 - Storytelling With Data

Credit Hours: 2.00. Business students are trained to be experts in turning data into information. With a strong focus on data visualization, the purpose of this course (Storytelling with Data) is to help students take the next step: Turning that information into action. This course will provide you with helpful frameworks for understanding your audience, insights about how people perceive information best, and effective skills to express your ideas in ways that connect.

Learning Outcomes: 1. Understand the importance of communication context, elements of good storytelling, and basic principles of human information processing as related to data visualization. 2. Apply this understanding to the communication of complex (i.e., data-driven) information. 3. Analyze data visualization design choices. 4. Evaluate the effectiveness of data communication. 5. Create a compelling story using data with the tools and skills taught in this course. Credits: 2.00

MGMT 55360 - Industrial Relations I

Credit Hours: 2.00. An in-depth examination of human resource management in the context of union-management relations. Emphasis is on understanding how and why unions form, the legal context, and changing competitive environment for labor management relations. Covers the dynamics of the collective bargaining process, including the determinants of bargaining power, preparation of labor contract demands, and negotiation tactics. The course culminates with an extended mock negotiation exercise.

Learning Outcomes: 1. Provide you with a sense of US labor history and acquaint you with labor laws essential for managers in multinational corporations. 2. Understand power dynamics not only between unions and management, but between managers and subordinates in everyday situations, in any organization. 3. Familiarize you with the union organizing process and help you understand its relevance for managers in non-unionized firms. 4. Engage you in a mock contract negotiation so that you may experience the dynamics of collective bargaining and negotiation. 5. Improve your conflict management skills. Credits: 2.00

MGMT 65210 - Organizational Development And Consulting Rewards

Credit Hours: 2.00. The course will describe techniques for diagnosing organizations and interventions for improving organizations. Specific interventions will be examined in detail including structural interventions (e.g., organizational design, job design), interpersonal process interventions (e.g., process consultation, team building), and human resource interventions (e.g., performance management, career development). The course will attempt to both build knowledge and provide practice in the various techniques.

Learning Outcomes: 1. Understand the basics principles of the theory and practice of OD. 2. Gain familiarity with the different types of OD interventions, including detailed real-world examples. 3. Introduce the specific OD techniques (or methodologies) and get practice applying some of the techniques. 4. Appreciate the importance of an OD practitioner perspective in understanding and implementing OD. Credits: 2.00

MGMT 65450 - Human Capital Consulting

Credit Hours: 2.00 or 4.00. Working in a team setting, this course provides real-life experience consulting with an organization to solve a real business problem. The focus is on human capital or human resource-related problems. Students work with a client to define the scope of their engagement, identify needs, conduct outside research (benchmark, market analysis), develop solutions, and identify key deliverables. The project culminates with an executive summary presentation with tangible recommendations to the client's senior leadership. This experience prepares students to serve as an HR Business Partner (HRBP).

Learning Outcomes: 1. Identify problems and generate & offer solutions to problems. 2. Conduct benchmarking and other external market analysis. 3. Develop the professionalism and influence skills needed to credibility influence an executive audience. 4. Demonstrate credibility through written and oral presentations. Credits: 2.00 or 4.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a

working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

Human Resource Management, MS (OL)

About the Program

Program Requirements

Required Courses (10 credits)

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65460 - Talent Acquisition

Credit Hours: 2.00 to 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions, and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Design a talent acquisition program in order for an organization's talent to be its competitive advantage. 2. Design a workforce implementation plan and a process to identify issues and continuous refinement of the plan. 3. Create a Recruiting plan that is focused on both external and internal candidates. 4. Design a process for final candidate evaluation. 5. Develop strategies to orient and onboard newly acquired talent. Credits: 2.00 to 3.00

MGMT 65330 - HR Strategy

Credit Hours: 2.00 to 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Learning Outcomes: 1. Understand the history of human resource management and how it has evolved to the strategic level. 2. Understand what strategic Human Resource Management means and entails. 3. Understand and complete a Human Resource Management Strategic plan. 4. Make yourself an invaluable resource to upper level management and the CEO by demonstrating the extreme importance and value of Strategic Human Resource management. Credits: 2.00 to 3.00

MGMT 65470 - Talent Management

Credit Hours: 2.00 to 3.00. This course focuses on the employer-employee relationship and how managers work with employees to improve their performance. Attention is given to Talent, Talent Management, and Performance Management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing talent. Various definitions of Employee Engagement will be explored, along with how it is, measured, and why it is so important to your organization. Finally, various methods to engage employees in the organization will be studied.

Learning Outcomes: 1. Define talent and talent management. 2. Determine talent management strategies to support an organization's objectives and goals. 3. Evaluate talent management models to address organizational needs. 4. Develop and integrate a talent

management system into organizations. 5. Define critical elements of a successful performance management system. 6. Identify methods to promote and maintain an engaged workforce. Credits: 2.00 to 3.00

MGMT 65480 - Total Rewards

Credit Hours: 2.00. This course examines how organizations can optimize financial and relational returns to gain and sustain a competitive advantage in a global environment. We will use theory and cases to develop a sound understanding of the compensation system.

Learning Outcomes: 1. Understand compensation systems and how they can be a catalyst for change and to help organizations execute their business strategies. 2. Know how to attract, engage, and retain top talent effectively. 3. Apply practical management tools for sustaining competitive advantage. 4. Develop technical compensation skills to design pay structures and market pricing systems. 5. Comprehend the importance of rational returns for employees and the role it plays in employee development. Credits: 2.00

Selectives (6 credits)

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often

overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

Electives (14 credits)

Imaging Sciences, MS

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Industrial and Molecular Pharmaceutics, MS

About the Program

Program Requirements

Required Courses (xx credits)

Concentrations

GPA Requirements

Industrial Engineering, MSIE

About the Program

Program Requirements - Thesis

Required Courses (12 credits)

Electives (9 credits)

Thesis Research (9 credits)

IE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Program Requirements - Non-thesis

Required Courses (21 credits)

Electives (9 credits)

Additional Requirements

Program Requirements - Professional Master's

Required Courses (21 credits)

Capstone Project (9 credits)

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

Additional Requirements

Concentrations

GPA Requirements

Industrial-Organizational Psychology, MS

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (6 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using

various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Seminar Course (xx credits)

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

Industrial-Organizational Psychology Seminar (6 credits)

Industrial-Organizational Psychology Courses (12 credits)

PSY 68010 - Survey Of Industrial Psychology

Credit Hours: 3.00. This seminar is designed to familiarize doctoral students with the basic areas of Industrial Psychology and Human Resource Management. The course will include a discussion and analysis of book chapters and journal articles related to key topics. The goal of this seminar is to help students develop frameworks for organizing the myriad conceptual, professional, and technical issues associated with Industrial Psychology / Human Resource Management. Development of these frameworks is requisite for effective acquisition and integration of information provided in future seminars and development of research ideas. Permission of department required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Organizational Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3. Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Organizational Psychology. Credits: 3.00

PSY 68020 - Survey Of Organizational Psychology

Credit Hours: 3.00. The main objective of this course is to introduce doctoral students in the Industrial and Organizational Psychology program (and related disciplines) to the major areas of research in the field of organizational psychology. Additionally, the course aims to provide students an opportunity to: (1) hone their analytic and information presentation skills, and (2) gain practice in developing research ideas. We will discuss classical and contemporary issues in light of both their theoretical and practical implications for the field. The course will include presentations and (synchronous and asynchronous) discussions of assigned readings. Permission of department required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Industrial Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3. Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Industrial Psychology. Credits: 3.00

PSY 68120 - Research Methods In Industrial-Organizational Psychology II

Credit Hours: 3.00. This course is the second part of a two-semester sequence that covers core research methods in the social sciences focusing on Industrial/Organizational psychology, Organizational Behavior, and allied fields of Social and Personality psychology. This course sequence is designed for doctoral students who intend to conduct quantitative empirical research publishable in scholarly journals. This course begins with the philosophy of science, developing and evaluating theory, reviewing and summarizing relevant research. Topics include the examination of research methods applicable to survey data, multilevel data, and longitudinal data. The course concludes with a discussion of 'methods' (strategies) for publishing in scholarly journals. Permission from department required. Prerequisites: PSY 68110, Research Methods in Industrial-Organizational Psychology I (or equivalent) and Basic Statistics.

Learning Outcomes: 1. Articulate the importance of research methods for science. Method of evaluation: class discussions. 2. Develop and apply research methods to their research, including designing of studies that employ a particular method. Method of evaluation: written research proposal. 3. Identify the strengths/weaknesses of each method. Method of evaluation: weekly reading summaries. 4. Explain empirical research findings to scholars in their field. Method of evaluation: research presentation. 5. Evaluate research methods used in empirical studies. Method of evaluation: class discussions. Credits: 3.00

PSY 68110 - Research Methods In Industrial-Organizational Psychology I

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings. This course is the first part of a two-semester sequence which covers issues in research design and data analysis techniques common to I-O psychology and other applied fields. We will review the overall research process and various types of research. We will review the various threats to the validity of conclusions that can be drawn from quantitative

research and how design features can help address these threats. We will spend time in class critiquing research articles. Permission of department required.

Learning Outcomes: 1. Evaluate the conceptual and methodological strengths and limitations of quantitative research in psychology. 2. Write a research proposal that effectively integrates best practices in quantitative research (e.g., scientific contribution, measurement, reliability, validity, open science). 3. Critically evaluate the rigor and reproducibility of quantitative research in psychology. 4. Run and interpret basic descriptive statistics, correlations, and linear regression models using R. Credits: 3.00

Electives (9 credits)

Thesis Research (xx credits)

PSY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Information Security, MS

About the Program

Program Requirements - Thesis

Required Courses (27 credits)

Area A Courses (12 credits)

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

Area B Courses (9 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

PHIL 49000 - Advanced Topics In Philosophy

Credit Hours: 1.00 to 3.00. An advanced study of a significant topic in philosophy.

Learning Outcomes: 1. Demonstrate familiarity with several advanced problems of philosophy. 2. Develop the ability to present, explain, defend and critically evaluate advanced philosophical ideas, theories, and perspectives, in oral and written communication. 3. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 4. Develop critical thinking and writing skills. Credits: 1.00 to 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 3.00. Directed study of special problems. Permission of instructor required.

Credits: 1.00 to 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

CNIT 42100 - Mobile Forensics

Credit Hours: 3.00. This course will help students understand the issues, techniques, and vulnerabilities of small scale digital device forensics. Emphasis will be placed on the forensically sound acquisition, preservation, analysis and presentation of small scale digital devices as evidence. Specific investigations will cover devices such as Personal Digital Assistants (PDA's), Cell Phones, and Smart Phones.

Learning Outcomes: 1. Identify various mobile devices. 2. Compare the characteristics of mobile devices. 3. Distinguish potential evidence found on mobile devices and ubiquitous systems. 4. Inspect forensically sound evidence from mobile devices and ubiquitous systems. 5. Produce a report for a courtroom presentation. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for

typical information technology solutions. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 49900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Possible individual study under directed leadership of professor. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

AGEC 69100 - Topical Research In Agricultural Economics

Credit Hours: 1.00 to 6.00. Topics of interest to the student. Designed to give training in research. Credit dependent upon amount of work done. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for specialized topic areas in agricultural systems management for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional

homeland security communications in students various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science. Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

CNIT 55800 - Bioinformatics Computing And Systems Integration

Credit Hours: 3.00. This is a graduate-level course for students interested in the application of computational methods and information technology in the pharmaceutical, biotechnology, and life sciences arena. An overall understanding of information technology and systems is assumed, as well as an in-depth knowledge of one or more areas of information technology. Permission of instructor required.

Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend

at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 69000 - Seminar On Topics In Computer Sciences

Credit Hours: 0.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 5.00

CSR 63100 - Consumer Behavior Theories

Credit Hours: 3.00. An examination of research methods, principles, and theories of social science as they apply to the study of consumer behavior and marketing sciences. Prerequisite: STAT 50100 , STAT 50200 , or PSY 60000 , PSY 60100 .

Credits: 3.00

ECON 61000 - Advanced Game Theory

Credit Hours: 1.00 to 3.00. An advanced course in game theory

and its applications. Among the topics covered are: extensive form games, normal form games, Nash equilibrium, mixed strategies equilibrium, subgame perfect equilibrium, learning and equilibrium, games with incomplete information, repeated games, cooperative games, noncooperative bargaining, and auctions. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of game theory and strategic thinking, including concepts such as dominance, backward induction, equilibrium, commitment, extensive form games, and asymmetric information. 2. Understand the perspective provided by game theory for a variety of games played in economic and political settings. 3. Identify insights game theory provides in translating an informal description of a multi-person decision situation into a formal game-theoretic problem. Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

ENGL 62800 - Natural Language Processing

Credit Hours: 3.00. (ECE 66900) This course focuses on keyword-driven question answering systems; transition networks; parsing procedures for context-free grammars; theory of transformational grammars; implementation of recursive transition networks; implementation of augmented transition networks; representation of conceptual dependencies; surface semantic conceptual analysis; conceptual dependency parsing; generating natural language from a conceptual base; scripts, plans, and goals; building conversationalist programs. Prerequisite: ENGL 50600 or ECE 57000 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

PSY 57700 - Human Factors In Engineering

Credit Hours: 3.00. (IE 57700) Survey of human factors in engineering, with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments. Primarily for engineers and other non-psychology majors.

Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and

hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 65900 - Human Aspects In Computing

Credit Hours: 3.00. Advanced topics in ergonomic, cognitive, and social aspects of using computerized systems are discussed with regard to comfort and user satisfaction, ease and productive use of computerized systems, and effective implementation of computerized technologies in the workplace. Prerequisite: IE 55900 .

Credits: 3.00

IE 67400 - Cyber Methods For Advanced Production Control

Credit Hours: 3.00. The study of the theoretical foundation and relevance of advanced cyber methods in the planning and control of intelligent production operations; manufacturing operating systems; synchronization in decentralized systems; recovery in decentralized systems; parallel processing; distributed databases; factory networks; reasoning and logic for production control. Prerequisite: IE 57400 or 57500 or 57900.

Learning Outcomes: 1. Know theoretical foundation and relevance of advanced cyber, real-time control, computing, communication, and brain models for robotics. 2. Know automation of planning and decisions in distributed production and supply installations, global supply, logistics, and service systems/networks. 3. Know the current and emerging functions, algorithms, protocols, and models and how to apply them to research projects and presentations in the field. Credits: 3.00

IT 54500 - Biometrics Technology And Applications

Credit Hours: 3.00. Examines biometrics technology as it relates to security, access control, and the authentication of individuals. The course will examine biometric technologies including iris, face, finger, hand geometry, dynamic signature verification, skin print analysis, and voice recognition. Permission of instructor required.

Credits: 3.00

IT 54000 - Biometric Performance And Usability Analysis

Credit Hours: 3.00. An introduction of test methodologies from disciplines outside of biometrics, which include: usability, ergonomics, human factors, and human-computer interaction, in order to demonstrate how biometric data analysis can benefit from understanding how humans interact with biometric sensors during the testing and evaluation of biometric systems. The course explores test methods, case studies, and prior biometric testing reports in order to develop a test methodology that includes information on how users interact with biometric systems. Permission of department required.

Learning Outcomes: 1. Understand the operation of biometric systems. 2. Understand how people use biometric systems in operational settings (both controlled and uncontrolled). 3. Understand traditional technology, scenario, and operational testing methodologies. 4. Understand traditional ergonomic and usability testing methodologies. 5. Understand and analyze the limitations of biometric systems. 6. Understand basics of quantitative and qualitative research. 7. Evaluate the issues in designing a biometric system, including but not limited to: the impact of language and culture (instructions and symbols), ergonomics and anthropometrics (heights-angles, positioning), training and habituation or accessibility, affordance, and perception. 8. Interpret results from reports on: biometric technologies evaluation methods, ergonomic and usability methods, and statistical methods. 9. Appraise and critically evaluate prior scenario and operational test reports and case studies of biometric technologies to examine where the application of Human-Biometric Sensor Interaction principles, such as usability, human factors, and ergonomics could have provided additional data on system performance. 10. Transfer knowledge and understanding of usability, ergonomic, and usability evaluation methodologies to the testing and evaluate biometric devices and systems. 11. Establish a test methodology and collect data using a Human-Biometric Sensor Interaction based methodology (usability, ergonomic, human factors) to investigate a current problem facing industry. 12. Perform the appropriate data analysis and report findings in a report. 13. Students will produce final reports, conference papers, etc., based on their course project. Credits: 3.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 54700 - Computer Communications Systems

Credit Hours: 3.00. Explores the convergence of telecommunications and computer technology, framed in terms of their strategic impact in the business environment. Components of computer communication systems are surveyed. Major design and analysis issues in the development, implementation, and management of computer communication systems are examined. Relevant emerging trends are highlighted. The course is devoted to technical issues, applications, and case studies covering telecommunication systems used in business.

Learning Outcomes: 1. Learn the infrastructure of telecommunication systems. 2. Learn how telecommunications systems work. 3. Learn applications of telecommunication systems. 4. Learn how to create strategic advantage by using telecommunication systems. Credits: 3.00

OBHR 68300 - Individual Behavior In Organizations

Credit Hours: 1.00 to 3.00. This seminar provides an analysis of theory and research on individual and group behavior in organizations. Readings and discussion focus on motivation, attitudes and job satisfaction, employee participation and turnover, stress, leadership, group processes, and other issues.

Learning Outcomes: 1. Identify and define organizational behavior concepts. 2. Apply those concepts to improve your understanding of your own work attitudes and behaviors. 3. Apply those concepts to improve the functioning of your organizational unit. Credits: 1.00 to 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know

vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential

interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant

revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Area C Courses (6 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics

for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

POL 62200 - Research Seminar In Public Policy And Public Administration

Credit Hours: 3.00. Investigation in depth of a substantive aspect of public policy such as energy policy or social policy, or of a theoretical topic, for example, policy formulation, enactment, implementation, impact, or evaluation. Permission of instructor required.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECET 58100 - Workshop In Electrical And Computer Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering.

Credits: 0.00 to 8.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical

rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.
Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.
Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 60100 - Managerial Accounting

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (North Central). Oriented to managers, the course examines the firm's internal systems for costing products or services and their interpretation. A variety of manufacturing and service industries are studies to demonstrate design of flexible cost systems to match the firm's technological, competitive and/or multinational environments. Applications to budgeting, variance analysis, pricing models, performance evaluation and incentives are demonstrated. Case discussion and analytical "what if" modes of instruction are used to enhance managerial skills of students. Design and use of accounting data are linked to other subjects in the program core and to ethical aspects of accounting policy issues. Prerequisite: MGMT 60000 .
Learning Outcomes: 1. Master basic service and product costing methods. 2. Develop analytic skills to help businesses use the different types of costing information to make better business decisions and to formulate better business models. 3. To understand and analyze the variety and the use of accounting performance evaluation methods and the role of incentives in a business environment. Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business

cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 54500 - Systems Development

Credit Hours: 3.00. Focuses on information systems development theories, practices, and tools for rapid adaptation and management of leading-edge as well as emerging computing paradigms. MGMT 54400 Database Management is highly recommended. Permission of department required.

Learning Outcomes: 1. Define the essential processes involved in information systems development. 2. Analyze and represent business processes. 3. Develop and validate systems models and design specifications for an information system application. 4. Understand database concepts and design relational databases based on data models. 5. Effectively use and maintain databases through hands-on experience with Structured Query Language (SQL). 6. Work effectively on a team to successfully complete team projects. 7. Proficiently use various tools used in systems analysis and design. Credits: 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the

concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

Thesis Research (3 credits)

Required Courses (27 credits)

Area A Courses (12 credits)

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

Area B Courses (9 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

PHIL 49000 - Advanced Topics In Philosophy

Credit Hours: 1.00 to 3.00. An advanced study of a significant topic in philosophy.

Learning Outcomes: 1. Demonstrate familiarity with several advanced problems of philosophy. 2. Develop the ability to present, explain, defend and critically evaluate advanced philosophical ideas, theories, and perspectives, in oral and written communication. 3. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 4. Develop critical thinking and writing skills. Credits: 1.00 to 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad

spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 3.00. Directed study of special problems. Permission of instructor required.

Credits: 1.00 to 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

CNIT 42100 - Mobile Forensics

Credit Hours: 3.00. This course will help students understand the issues, techniques, and vulnerabilities of small scale digital device forensics. Emphasis will be placed on the forensically sound acquisition, preservation, analysis and presentation of small scale digital devices as evidence. Specific investigations will cover devices such as Personal Digital Assistants (PDA's), Cell Phones, and Smart Phones.

Learning Outcomes: 1. Identify various mobile devices. 2. Compare the characteristics of mobile devices. 3. Distinguish potential evidence found on mobile devices and ubiquitous systems. 4. Inspect forensically sound evidence from mobile devices and ubiquitous systems. 5. Produce a report for a courtroom presentation. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 49900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Possible individual study under directed

leadership of professor. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

AGEC 69100 - Topical Research In Agricultural Economics

Credit Hours: 1.00 to 6.00. Topics of interest to the student. Designed to give training in research. Credit dependent upon amount of work done. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for specialized topic areas in agricultural systems management for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science.

Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

CNIT 55800 - Bioinformatics Computing And Systems Integration

Credit Hours: 3.00. This is a graduate-level course for students interested in the application of computational methods and information technology in the pharmaceutical, biotechnology, and life sciences arena. An overall understanding of information technology and systems is assumed, as well as an in-depth knowledge of one or more areas of information technology. Permission of instructor required.

Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example

languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following: Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 69000 - Seminar On Topics In Computer Sciences

Credit Hours: 0.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 5.00

CSR 63100 - Consumer Behavior Theories

Credit Hours: 3.00. An examination of research methods, principles, and theories of social science as they apply to the study of consumer behavior and marketing sciences. Prerequisite: STAT 50100 , STAT 50200 , or PSY 60000 , PSY 60100 .

Credits: 3.00

ECON 61000 - Advanced Game Theory

Credit Hours: 1.00 to 3.00. An advanced course in game theory and its applications. Among the topics covered are: extensive form games, normal form games, Nash equilibrium, mixed strategies equilibrium, subgame perfect equilibrium, learning and equilibrium, games with incomplete information, repeated games, cooperative games, noncooperative bargaining, and auctions. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of game theory and strategic thinking, including concepts such as dominance, backward induction, equilibrium, commitment, extensive form games, and asymmetric information. 2. Understand the perspective provided by game theory for a variety of games played in economic and political settings. 3. Identify insights game theory provides in translating an informal description of a multi-person decision situation into a formal game-theoretic problem. Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard

toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

ENGL 62800 - Natural Language Processing

Credit Hours: 3.00. (ECE 66900) This course focuses on keyword-driven question answering systems; transition networks; parsing procedures for context-free grammars; theory of transformational grammars; implementation of recursive transition networks; implementation of augmented transition networks; representation of conceptual dependencies; surface semantic conceptual analysis; conceptual dependency parsing; generating natural language from a conceptual base; scripts, plans, and goals; building conversationalist programs. Prerequisite: ENGL 50600 or ECE 57000 .

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

PSY 57700 - Human Factors In Engineering

Credit Hours: 3.00. (IE 57700) Survey of human factors in engineering, with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments. Primarily for engineers and other non-psychology majors.

Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or

individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 65900 - Human Aspects In Computing

Credit Hours: 3.00. Advanced topics in ergonomic, cognitive, and social aspects of using computerized systems are discussed with regard to comfort and user satisfaction, ease and productive use of computerized systems, and effective implementation of computerized technologies in the workplace. Prerequisite: IE 55900 .

Credits: 3.00

IE 67400 - Cyber Methods For Advanced Production Control

Credit Hours: 3.00. The study of the theoretical foundation and relevance of advanced cyber methods in the planning and control of intelligent production operations; manufacturing operating systems; synchronization in decentralized systems; recovery in decentralized systems; parallel processing; distributed databases; factory networks; reasoning and logic for production control. Prerequisite: IE 57400 or 57500 or 57900.

Learning Outcomes: 1. Know theoretical foundation and relevance of advanced cyber, real-time control, computing, communication, and brain models for robotics. 2. Know automation of planning and decisions in distributed production and supply installations, global supply, logistics, and service systems/networks. 3. Know the current and emerging functions, algorithms, protocols, and models and how to apply them to research projects and presentations in the field. Credits: 3.00

IT 54500 - Biometrics Technology And Applications

Credit Hours: 3.00. Examines biometrics technology as it relates to security, access control, and the authentication of individuals. The course will examine biometric technologies including iris, face, finger, hand geometry, dynamic signature verification, skin print analysis, and voice recognition. Permission of instructor required.

Credits: 3.00

IT 54000 - Biometric Performance And Usability Analysis

Credit Hours: 3.00. An introduction of test methodologies from disciplines outside of biometrics, which include: usability, ergonomics, human factors, and human-computer interaction, in order to demonstrate how biometric data analysis can benefit from understanding how humans interact with biometric sensors during the testing and evaluation of biometric systems. The course explores test methods, case studies, and prior biometric testing reports in order to develop a test methodology that includes information on how users interact with biometric systems. Permission of department required.

Learning Outcomes: 1. Understand the operation of biometric systems. 2. Understand how people use biometric systems in operational settings (both controlled and uncontrolled). 3. Understand traditional technology, scenario, and operational testing methodologies. 4. Understand traditional ergonomic and usability testing methodologies. 5. Understand and analyze the limitations of biometric systems. 6. Understand basics of quantitative and qualitative research. 7. Evaluate the issues in designing a biometric system, including but not limited to: the impact of language and culture (instructions and symbols), ergonomics and anthropometrics (heights-angles, positioning), training and habituation or accessibility, affordance, and perception. 8. Interpret results from reports on: biometric technologies evaluation methods, ergonomic and usability methods, and statistical

methods. 9. Appraise and critically evaluate prior scenario and operational test reports and case studies of biometric technologies to examine where the application of Human-Biometric Sensor Interaction principles, such as usability, human factors, and ergonomics could have provided additional data on system performance. 10. Transfer knowledge and understanding of usability, ergonomic, and usability evaluation methodologies to the testing and evaluate biometric devices and systems. 11. Establish a test methodology and collect data using a Human-Biometric Sensor Interaction based methodology (usability, ergonomic, human factors) to investigate a current problem facing industry. 12. Perform the appropriate data analysis and report findings in a report. 13. Students will produce final reports, conference papers, etc., based on their course project. Credits: 3.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 54700 - Computer Communications Systems

Credit Hours: 3.00. Explores the convergence of telecommunications and computer technology, framed in terms of their strategic impact in the business environment. Components of computer communication systems are surveyed. Major design and analysis issues in the development, implementation, and management of computer communication systems are examined. Relevant emerging trends are highlighted. The course is devoted to technical issues, applications, and case studies covering telecommunication systems used in business.

Learning Outcomes: 1. Learn the infrastructure of telecommunication systems. 2. Learn how telecommunications systems work. 3. Learn applications of telecommunication systems. 4. Learn how to create strategic advantage by using telecommunication systems. Credits: 3.00

OBHR 68300 - Individual Behavior In Organizations

Credit Hours: 1.00 to 3.00. This seminar provides an analysis of theory and research on individual and group behavior in organizations. Readings and discussion focus on motivation, attitudes and job satisfaction, employee participation and turnover, stress, leadership, group processes, and other issues.

Learning Outcomes: 1. Identify and define organizational behavior concepts. 2. Apply those concepts to improve your understanding of your own work attitudes and behaviors. 3. Apply those concepts to improve the functioning of your organizational unit. Credits: 1.00 to 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically

review current research work in the NLP field. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

Area C Courses (6 credits)

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal

articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

POL 62200 - Research Seminar In Public Policy And Public Administration

Credit Hours: 3.00. Investigation in depth of a substantive aspect of public policy such as energy policy or social policy, or of a theoretical topic, for example, policy formulation, enactment, implementation, impact, or evaluation. Permission of instructor required.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECET 58100 - Workshop In Electrical And Computer Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering.
Credits: 0.00 to 8.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.
Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the

legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 60100 - Managerial Accounting

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (North Central). Oriented to managers, the course examines the firm's internal systems for costing products or services and their interpretation. A variety of manufacturing and service industries are studies to demonstrate design of flexible cost systems to match the firm's technological, competitive and/or multinational environments. Applications to budgeting, variance analysis, pricing models, performance evaluation and incentives are demonstrated. Case discussion and analytical "what if" modes of instruction are used to enhance managerial skills of students. Design and use of accounting data are linked to other subjects in the program core and to ethical aspects of accounting policy issues. Prerequisite: MGMT 60000 .

Learning Outcomes: 1. Master basic service and product costing methods. 2. Develop analytic skills to help businesses use the different types of costing information to make better business decisions and to formulate better business models. 3. To understand and analyze the variety and the use of accounting performance evaluation methods and the role of incentives in a business environment. Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 54500 - Systems Development

Credit Hours: 3.00. Focuses on information systems development theories, practices, and tools for rapid adaptation and management of leading-edge as well as emerging computing paradigms. MGMT 54400 Database Management is

highly recommended. Permission of department required.

Learning Outcomes: 1. Define the essential processes involved in information systems development. 2. Analyze and represent business processes. 3. Develop and validate systems models and design specifications for an information system application. 4. Understand database concepts and design relational databases based on data models. 5. Effectively use and maintain databases through hands-on experience with Structured Query Language (SQL). 6. Work effectively on a team to successfully complete team projects. 7. Proficiently use various tools used in systems analysis and design. Credits: 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

Thesis Research (3 credits)

Program Requirements - Non-Thesis

Required Courses (30 credits)

Required Courses (30 credits)

About the Program

Additional Requirements

GPA Requirements

Additional Information

Interdisciplinary Biomedical Sciences, MS

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Interdisciplinary Engineering, MSE or MS

About the Program

Program Requirements

Required Courses (18 credits)

Concentrations (0-30 credits)

Electives (0-12 credits)

Required Courses (18 credits)

Concentrations

About the Program

Interdisciplinary Studies, MS

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Internet of Things/Interdisciplinary Engineering, MSE or MS

About the Program

Program Requirements

Required Courses (27 credits)

Core Selectives (9 credits)

Major Courses (18 credits)

ECE 43700 - Computer Design And Prototyping

Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, datapath design, control strategies, pipelining, memory hierarchy, and I/O interface design.

Credits: 4.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

Core Selectives (9 credits)

Selective (3 credits)

Required Courses (27 credits)

Core Selectives (9 credits)

Major Courses (18 credits)

ECE 43700 - Computer Design And Prototyping

Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, datapath design, control strategies, pipelining,

memory hierarchy, and I/O interface design.

Credits: 4.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

Core Selectives (9 credits)

About the Program

Landscape Systems and Design, MS

About the Program

Program Requirements

Required Courses (6 credits)

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60200 - Horticulture Research Seminar

Credit Hours: 1.00. Weekly attendance at the Horticulture and Landscape Architecture Departmental seminars to help graduate students develop an appreciation for attending seminars and learning appropriate and effective presentation skills. HORT 602 compliments HORT 60100 and HORT 60300 by extending the presentation and project development approaches learned, so that students are better ready to prepare and defend their project proposals in HORT 60300. Prerequisite: BCHM 56100.

Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

LA 50100 - Research Methods For Design Applications

Credit Hours: 1.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 1.00

LA 58200 - Contemporary Issues - Landscape Architecture

Credit Hours: 2.00. Rotating topics that explore focused issues in landscape architecture theory and practice. Analysis and experience of contemporary issues, designs, and designers explored through presentation, discussion, critique, and practice of thematic content. Permission of instructor.

Learning Outcomes: 1. Learning outcomes vary due to nature of special topics course. Credits: 2.00

Analytical Tools Course (3 credits)

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

AGEC 65100 - Application Of Quantitative Analysis: Econometrics II

Credit Hours: 3.00. Emphasis is on using advanced econometric techniques. The course covers use of computer software and interpretation and reporting of econometric results. The first part of the course includes general econometric concepts, such as least squares and maximum likelihood estimation, desirable statistical properties, assumptions of the classical linear regression model, Monte Carlo methods, nested and non-nested hypothesis tests. Later, more specialized topics are covered, including multiple equation models, simultaneous equation models, limited dependent variable models, and other topics that are deemed relevant. Prerequisite: AGEC 65000.

Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

ECON 67400 - Microeconometrics

Credit Hours: 1.00 to 3.00. This advanced course covers the

econometrics and statistical methods needed to study data on individual agents in general qualitative response models and models of limited dependent variables. Special emphasis is placed on applying the alternate estimation and inference techniques to actual or simulated datasets. Topics include: univariate binary models, multinomial and multivariate qualitative response models, choice based sampling, distribution-free estimation methods, and Tobit models. Prerequisite: ECON 67200 .

Credits: 1.00 to 3.00

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 67100 - Econometrics I

Credit Hours: 1.00 to 3.00. An introduction to the modern techniques of econometrics and their applications. Topics include: the classical linear regression model (specification, estimation, inference, and prediction), specification analysis, functional form, heteroscedasticity, and autocorrelation. Prerequisite: ECON 67000.

Learning Outcomes: 1. Investigate the properties of econometric estimators under a variety of conditions. 2. Explain econometric techniques for estimating causal effects. 3. Explain the principles and purpose of Monte Carlo simulation methods. 4. Conduct basic empirical analyses of cross sectional data. Credits: 1.00 to 3.00

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ENTM 69200 - Special Topics

Credit Hours: 1.00 to 4.00. Advanced topics in specialties of department members such as, but not limited to: biochemistry and physiology; biological control; insect pest management; veterinary entomology; nematode systematics; pathology; systematics. The field in which work is offered will appear on the student's record. Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 4.00

FNR 58000 - Research Methods For Natural Resource Social Science

Credit Hours: 3.00. This class covers basic elements of research design for social scientists, with an emphasis on issues pertinent to natural resource management. Topics to be covered include the role of theories and paradigms in designing sound research, writing research questions and hypotheses, and the importance of validity and reliability in research design. Qualitative, quantitative, and mixed methods designs are presented and discussed.

Learning Outcomes: 1. Understand fundamental concepts such as theories and paradigms that are essential precursors to designing sound research. 2. Able to articulate clear research questions and testable hypotheses. 3. Differentiate between different research designs and know which are appropriate under which circumstances. 4 Understand overarching issues such as validity and reliability. 5. Know under which circumstances qualitative, quantitative or mixed methods are appropriate. 6. Demonstrate knowledge of a variety of commonly-used research methods. 7. Articulate basic steps involved in analyzing qualitative and quantitative data. 8. Demonstrate the ability to write a research proposal. Credits: 3.00

FNR 64700 - Quantitative Methods For Ecologists

Credit Hours: 3.00. Examines the assumptions and utility of statistical and other data analytic techniques that are encountered commonly or increasingly being used in ecological research. Emphasis is placed on the potential applications of these quantitative methods in an ecological context. Topics include traditional multivariate methods (cluster analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling, correspondence analysis), generalized linear models (logistic Poisson, and ordinal regression and derivatives), randomization methods, information-theoretic model selection and inference, and hierarchical models. An introduction to Bayesian analysis is provided for generalized linear (and mixed) models, with applications to (meta) population and (meta) community ecology. Prerequisite: BIOL 58210 or ENTM 64200 or STAT 51200 , or consent of instructor. Knowledge of linear algebra and experience with R is desirable but not essential.

Learning Outcomes: 1. Determine the appropriate statistical tool to use when confronted with most questions and data types. 2. Be familiar with the assumptions underlying these methods. 3. Have some familiarity with software required to apply the methods. 4. Offer a basic interpretation of results provided. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite:

Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

ASEC 59000 - Special Problems

Credit Hours: 1.00 to 6.00. A study of special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

Primary Area Courses (15 credits)

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn care companies, and sod production facilities in an efficient and environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 55100 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and

knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

LA 50100 - Research Methods For Design Applications

Credit Hours: 1.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 1.00

Thesis Research (6 credits)

HORT 69500 - Horticulture Seminar

Credit Hours: 0.00. Topics of current interest to staff and students.

Credits: 0.00

HORT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Languages and Cultures, MA

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (24-30 credits)

Primary Area Courses (15-30 credits)

Comparative Literature

LC 51900 - Teaching Of Foreign Languages

Credit Hours: 3.00. A basic course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

LC 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (CMPL 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study. Required of all students in the Comparative Literature Program.

Credits: 3.00

French

FR 51900 - Teaching College French

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of department required.

Credits: 3.00

FR 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research: the basic concepts and terminology of literary criticism. Required of all MA candidates in French.

Credits: 3.00

German

GER 51900 - Teaching College German

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

GER 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in German.

Credits: 3.00

Japanese

GER 51900 - Teaching College German

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

GER 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in German.

Credits: 3.00

Spanish

SPAN 51900 - Teaching College Spanish

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be

enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

SPAN 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in Spanish.

Credits: 3.00

Related Area courses (0-9 credits)

Thesis Research (6 credits)

LC 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

Concentrations

GPA Requirements

Additional Information

Linguistics, MA

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (24-30 credits)

Core Courses (18 credits)

LING 59800 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Investigation of an advanced topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 1.00 to 4.00

LING 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Learning Outcomes: 1. Able to discuss the relationship between language and society and identify the roles of language in its social and cultural context. 2. Able to critique current theories in sociolinguistics using data sets provided in course texts. 3. Able to identify the major models for sociolinguistic analysis and suggest reformulations and refinements necessary for various societies and cultures. 4. Able to recognize the sociolinguist's responsibility in the ethical treatment of human subjects and collected data. Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

LING 51100 - Phonology I: Descriptive Analysis

Credit Hours: 3.00. Foundations of phonological analysis. Development of concepts and methods for the analysis of phonological data and the phonological structures of natural languages within the framework of generative phonology. Focuses on problem solving and linguistic argumentation. Offered in conjunction with ENGL 51300 .

Credits: 3.00

LING 56300 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main

linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual develpment.

Learning Outcomes: 1. Understand how languages are acquired and developmental stages of main linguistic components. 2. Understand major concepts and issues relative to child language development. 3. Understand major concepts and issues relative to bilingual first-language acquisition. 4. Understand knowledge of main sociocultural constructs related to language development. 5. Understand main issues relative to methodological issues in language acquisition. 6. Understand main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

Area Specific Courses (6-12 credits)

Language Documentation

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

LING 61900 - Seminar In Phonology

Credit Hours: 3.00. Intensive study and research on a selected topic in phonology. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 57600 - Latin American Indigenous Languages And Cultures

Credit Hours: 3.00. This course will help students to learn the importance of understanding the diversity of Latin American indigenous languages and cultures as well as the intercultural understandings gained when these indigenous languages are valued within the global context. Moreover, this course will provide a general cultural and linguistic framework to understand the sociolinguistic status of the language within the context where it exists. In this course, students will deepen their knowledge of Latin American indigenous cultures and their historics, as a means to achieving a greater understanding of both a shared humanity and the variety of human experiences.

Learning Outcomes: 1. Acquire in-depth knowledge in a chosen, specific indigenous people while demonstrating panoramic understanding of Latin American indigenous groups. 2. Explain the brief history of US interaction with a particular Latin American country of this course topic. 3. Show basic oral and auditory competency in the language; will demonstrate how to express and understand basic statements, greetings, requests for directions, for food, and general courtesy interactions in the particular language. 4. Identify the particular complex interactions of the indigenous language within the context of the dominant colonial language. 5. Identify the linguistic position of the language within the context of indigenous languages of the Americas. 6. Identify basic cultural characteristics associated with the language speaking community. Credits: 3.00

LING 57000 - Field Methods In Linguistics

Credit Hours: 4.00. This course deals with the basic techniques for collecting language data, and is designed to reproduce and explore the conditions and methods of linguistic fieldwork in a classroom. The course also addresses questions related to the ethics of retrieving linguistic data, the relations between the linguist and the speaking communities, and the use of the collected data. A non-Indoeuropean lesser-studied language will be examined with the help of a native speaker of the language. The main area of its grammar will be covered: phonetic and phonological system, inflectional and derivational morphology, basic syntactic structures and basic semantic phenomena. The final goal is to obtain a basic grammatical description of the language. Lab sessions will be directed towards the training in the software and audio and video tools used for the trade.

Learning Outcomes: 1. Identify the key parts of the grammar of language. 2. Formulate questions about the language that (a) can reveal the structure of language and (b) can be answered by a speaker with no knowledge of linguistics. 3. Use the tools of the trade (software, equipment, etc.) 4. Develop methodologies based on a Participatory Action Research approach. 5. Develop sensitivity about what is of relevance to the speaking community and how to interact with the community in general and the speakers in particular. 6. Develop skills on how to transfer newly discovered scientific knowledge of the language back to the speaking community.

Credits: 4.00

LING 52200 - Syntax II: Issues In Syntax

Credit Hours: 3.00. Deeper examination of a wider range of syntactic phenomena and evaluation of competing theoretical analyses proposed to account for them. Constructing theoretical analyses and evaluating their explanatory adequacy for Universal Grammar. Topics include LF phenomena, functional projections, and structural representations.

Credits: 3.00

LING 51200 - Phonology II: Theoretical Approaches

Credit Hours: 3.00. Examination, comparison, and evaluation of contemporary phonological theories, with focus on the contribution of each theory to our understanding of representations and operations in phonological analysis. Primary emphasis is on autosegmental phonology, metrical phonology, lexical phonology, and optimality theory.

Credits: 3.00

Theoretical Linguistics

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52200 - Syntax II: Issues In Syntax

Credit Hours: 3.00. Deeper examination of a wider range of syntactic phenomena and evaluation of competing theoretical analyses proposed to account for them. Constructing theoretical analyses and evaluating their explanatory adequacy for Universal Grammar. Topics include LF phenomena, functional projections, and structural representations.

Credits: 3.00

LING 51200 - Phonology II: Theoretical Approaches

Credit Hours: 3.00. Examination, comparison, and evaluation of contemporary phonological theories, with focus on the contribution of each theory to our understanding of representations and operations in phonological analysis. Primary emphasis is on autosegmental phonology, metrical phonology, lexical phonology, and optimality theory.

Credits: 3.00

French Linguistics

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

LC 59600 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Special topics in Linguistics. Permission of instructor required.

Credits: 1.00 to 4.00

German Linguistics

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

Japanese Linguistics

JPNS 56000 - Survey Of Japanese Linguistics

Credit Hours: 3.00. This course is intended to provide the student with a systematic overview of the Japanese language. It covers most major areas of linguistics, from phonetics to pragmatics. Conducted in Japanese.

Credits: 3.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

Spanish Linguistics

SPAN 56100 - The Structure Of Spanish I: Phonetics, Phonology, And Dialectology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a theoretical and contrastive Spanish/English perspective.

Learning Outcomes: 1. Understand, recall, and discuss the main concepts in the fields of phonetics and phonology. 2. Apply and adapt the fundamental concepts of phonetics and phonology to multiple varieties of Spanish. 3. Examine and critically assess current research

in the field. 4. Design and conduct original research in the field of Spanish phonetics and phonology. Credits: 3.00

SPAN 56200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Have knowledge and understanding of basic notions of Spanish syntax including syntagmatic structure, X-bar theory, thematic roles, argument structure, constituents and hierarchical representation, and syntactic operations (e.g., wh-movement). 2. Be able to observe, describe, and formulate abstract theoretical concepts in relation to the syntactic structure of Spanish. 3. Be able to relate theoretical analysis to experimental syntax, specifically in relation to the acquisition of Spanish syntax and semantics among second language learners and heritage speakers. Credits: 3.00

SPAN 56300 - History Of The Spanish Language

Credit Hours: 3.00. Development of Spanish since the Ancient Latin period, taking into account influences of other cultures and languages; Spanish in relation to Latin and other Romance languages; basic principles of language change; language change underlying differences between American and Peninsular Spanish.

Learning Outcomes: 1. Have a perspective of the evolution of Spanish and being able to identify the basic features of Spanish through its history, as well as understanding the influence of external influences in the evolution of the language. 2. Understand the configuration of the different varieties of Spanish in the different areas (peninsular Spanish and Spanish in America). 3. Read publications on general aspects of History of Spanish Language with critical sense and understanding basic problems of diachronic studies and basic principles of language change. 4. Able to read, understand and linguistically analyze texts from all the stages of Spanish. Credits: 3.00

SPAN 56401 - Spanish Sociolinguistics

Credit Hours: 3.00. This course addresses the linguistic variation found at all linguistic levels of Spanish (e.g., phonetics, morphology, syntax) that is explained through social variation (e.g., socio-economic status, race, gender). Regional varieties of Spanish in Latin America, the U.S., and Peninsular societies will be studied. Related topics are style and identity, language attitudes, discourse analysis, and pragmatics. All classes will be conducted in Spanish.

Learning Outcomes: 1. Define and express main understandings about language, the study of linguistics, and language variation. 2. Analyze and discuss specific examples of Spanish variation analyzed through use of various methods. 3. Identify and evaluate the pros and cons of various sociolinguistic methods of research. 4. Reflect on the relationships among social factors, language, diversity, and power in society. 5. Use previous investigations to demonstrate the need for additional research in a specific area, thereby identifying a research topic. 6. Consider one's own perspective of language use in social settings and reflect on any changes in that perspective that resulted from interaction with the course. 7. Speak, read, write, and comprehend Spanish to communicate about the course topics. Credits: 3.00

Thesis Research (6 credits)

LING 69800 - Research MA Thesis

Credit Hours: 1.00 to 12.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 12.00

Additional Requirements

Linguistic Selectives (xx credits)

Concentrations

GPA Requirements

Logistics Systems Engineering, MSE or MS

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Management, MBA

About the Program

Program Requirements

Required Courses (31 credits)

Foundational Courses (9 credits)

ECON 51400 - Microeconomics (UCC: BSS)

Credit Hours: 2.00. An introduction to microeconomic theory. Analysis of consumer demand, output and input decisions of firms, price determination, economic efficiency, market structures, and market failure.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate the efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 2.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

Core Courses (22 credits)

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the

macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.
Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.
Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .
Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.
Credits: 2.00 to 4.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.
Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available

remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Capstone Course (2 credits)

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Selectives (6 credits)

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work.

Credits: 2.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class.

Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth).

Credits: 1.00 to 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Electives (9 credits)

Management-Executive, MBA Management: Accounting Concentration, MS

About the Program

Program Requirements

Required Courses (5 credits)

MGMT 63900 - Advanced Auditing And Audit Analytics

Credit Hours: 3.00. This course is designed to help students prepare for their professional careers by strengthening their understanding of the CPA's attest function and familiarizing them with current assurance issues. After finishing the course, students should understand the current state of the Enterprise Risk Management and tools for risk evaluation, be able to identify best practices related to external audit, be prepared to manage an audit group, understand the key aspects of being an audit consultant and be able to work with all levels of internal and external audit professionals. Throughout the course, students will have opportunities to improve their written and oral communication skills, particularly as they relate to communication in the audit setting. The course will also emphasize the impact of recent and current regulatory actions, including the Sarbanes-Oxley Act of 2002, on the audit profession. Prerequisite: MGMT 50600 with a minimum grade of C.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate an understanding of how U.S. audit and securities market regulations affect an audit. They will also use their statistical training in audit planning and evaluation as well as risk assessment. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of ethics as it relates to audit and external reporting. 3. Develop current business technologies and use common business technology and software in essential tasks: Students will use spreadsheets and auditing software in case analyses and assignments. 4. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class participation and the writing and presentation of a team paper. They will also demonstrate effective written communication skills through case write-ups. 5. Achieve depth of understanding and applications of financial reporting: By deepening their understanding of the audit process and techniques and by working through case studies focused on particular reporting and auditing issues, students will develop and demonstrate a deep understanding of reporting regulations and rules. 6. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a research paper on business and audit risks in a specific sector.

Credits: 3.00

MGMT 63410 - Communications For Accountants

Credit Hours: 2.00. Accountants spend much of their time designing and writing reports, memos, etc. and explaining those communications to others. They communicate regularly with external investors and creditors, regulators, clients and fellow professionals. This course is designed to help accounting students prepare for their professional careers by helping them develop their written and oral communication skills. The course begins with an overview of the writing process and then moves to document organization and design and how to write with conciseness and clarity. The last half of the course focuses on

specific forms of written communication (e.g., letters, memos, reports, email, essays on professional exams) and oral presentations.

Learning Outcomes: 1. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of ethical communication as it relates to accounting-related issues. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will study the appropriate and professional use of social media and electronic and written communication mediums in a business setting. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class assignments and the writing and presentation of a team paper. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a report on a pre-specifies accounting topic. Credits: 2.00

MGMT 63400 - Business Law For Accountants

Credit Hours: 2.00 or 3.00. This course is designed to help prepare students for their professional careers by familiarizing them with aspects of the law that are directly relevant to the practice of accounting. These topics are not only at work every day in business but are also tested on professional examinations such as the Uniform Certified Public Accounting (CPA) Exam. Specific topics include, but are not limited to, contract law, relevant provisions of the Uniform Commercial Code, bankruptcy, and the legal liability of accountants. The course will be taught through a mixture of lectures and class discussions. Students are expected to come to class having completed the assigned readings and ready to participate in class discussions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate the ability to apply legal rules and principles to business transactions and the accounting for them. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of business ethics and social responsibility as it relates to the legal aspects of business transactions and reporting. 3. Develop awareness and understanding of global issues relating to financial reporting, tax accounting and business decisions: Students will be able to demonstrate an understanding of international business law and cyber law, both of which affect financial reporting and tax accounting. 4. Develop effective written and oral communication skills: Students will be able to demonstrate effective oral communication skills through class participation and effective written communication skills through the development and writing of a research paper. Credits: 2.00 or 3.00

Foundational Selectives (0-25 credits)

MGMT 60200 - Valuation And Financial Statement Analysis

Credit Hours: 2.00. Establishes how to use accounting information to make business and investment decisions. Internally, the information is used to assess performance of units, to evaluate performance of upper-level management, to monitor the firm's investment and financing decisions, and for comparison purposes with the firm's rivals. Externally, accounting information is used by financial analysts, investors and (potential) acquirers to assess the value of the firm, by creditors to assess its credit-worthiness, and by regulators. Prerequisite: MGMT 60000 , MGMT 60100 .

Learning Outcomes: 1. Demonstrate ability to understand financial statements and related information. 2. Practice communicating decisions and ideas through written and oral communication. Credits: 2.00

MGMT 53200 - Forensic Accounting And Fraud Examination

Credit Hours: 3.00. This course is designed to help students apply their accounting, auditing, information systems and communication skills to detect financial fraud and unauthorized reporting acts to prepare and present a fraud case for criminal proceedings or civil litigation. These skills are highly valued in the rapidly growing field of forensic accounting. Upon completing this course, students will understand the role of forensic accountants in examining financial records for fraud and detecting insurance fraud; in providing litigation support; and in capturing digital evidence. This course will also review material related to the Certified Fraud Examiner (CFE) exam. Throughout the course, students will have opportunities to improve their written and oral communication skills, particularly as they relate to communication in the legal settings associated with investigating accounting.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate their understanding of business functional areas through homework assignments, examinations and team projects that require analysis or development of fraud detection plans and litigation support. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will be able to demonstrate their understanding of how people in organizations use common technology and software to commit fraud through homework assignments, examinations and team projects. They will also be able to demonstrate their ability to use software to detect fraud and other irregular transactions. 3. Become familiar with the ethical issues that individuals face in organizations: Ethical behavior is a key factor in preventing fraud. Students will be able to demonstrate their ability to identify signs of unethical behavior and how it manifests itself in financial fraud through homework assignments, examinations and team projects. 4. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class participation and the writing and presentation of team projects. 5. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present team projects. 6. Achieve depth of understanding and applications of financial reporting. Students will demonstrate their understanding of accounting systems through homework assignments, examinations and team projects that require a deep understanding of accounting rules and procedures and the technology that individuals use to keep financial records. Credits: 3.00

MGMT 53100 - Government/Not-For-Profit Accounting

Credit Hours: 3.00. This course is designed to provide students with a solid understanding of the financial reporting and accounting principles used in the preparation of governmental and not-for-profit entities. Topics include, but are not limited to, fund accounting, city government accounting, state government accounting, special funds, budgetary accounting for the general and special revenue funds, fiduciary funds and government-wide statements, university accounting, accounting for community foundations, not-for-profit accounting, and auditing not-for-profit entities.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions: Students will be able to demonstrate their understanding of generally accepted accounting Principles for government and not-for-profit entities and how accounting information is used in decision-making for those organizations through the completion of multiple projects. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate their understanding of ethics in reporting through team projects that analyze a government or not-for-profit's accounting system. They will also be able to demonstrate their understanding of how to properly account for fiduciary (trust) funds. 3. Students will develop effective written and oral communication skills: Students will be able to

demonstrate oral and written communication skills through class participation and the writing and presentation of team projects. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environmental: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present team projects. 5. Achieve their understanding of generally accepted accounting principles for government and not-for-profit entities through team projects and examination(s). Credits: 3.00

MGMT 63350 - Accounting Data Analytics

Credit Hours: 2.00 or 3.00. The skill set that accountants have needed to perform math and to keep order has evolved from pencil and paper, to calculators, and then to spreadsheets and accounting software. A new skill set that is becoming more important for nearly every aspect of business is that of big data analytics: managing large amounts of data in the database, analyzing them and finding actionable insights and visualizing the results. This course is designed to help accounting students develop an analytical mindset and prepare them to use data analytic programming languages and software like Python, SQL, and Tableau.

Learning Outcomes: 1. Understand the basic syntax and semantics of the Python language. 2. Understand the primitive data types build into Python. 3. Understand the key data visualization principles and techniques. 4. Apply data visualization principles and techniques to real-world business problems. 5. Critically evaluate the design and presentation of complex data or concept. 6. Design innovative static and interactive visualizations to effectively present information and enable data exploration. 7. Analyze a business situation to determine information management needs. 8. Design a database to address those needs. 9. Write SQL queries to retrieve information from a relational database. Credits: 2.00 or 3.00

MGMT 63250 - Advanced International Accounting

Credit Hours: 2.00 or 3.00. This course is designed to help students a) Learn about the development of international accounting movements and implications in a globalized financial market; b) Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS); c) Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event; d) Learn to cope with differences in financial measurement, recognition, and reporting practices; and e) Enhance the students' communication skills. The course should also contribute to the requisite background required for professional examinations such as CPA and to become prepared for a long-range successful accounting, auditing, and/or managerial career.

Learning Outcomes: 1. Learn about the development of international accounting movements and implications in a globalized financial market. 2. Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS). 3. Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event. 4. Learn to cope with differences in financial measurement, recognition, and reporting practices. 5. Enhance the students' communication skills. Credits: 2.00 or 3.00

MGMT 63150 - Accounting For Private Equity

Credit Hours: 2.00 or 3.00. The course offers students with knowledge of private equity services that accounting firms provide to clients. It covers investment banking, buy- and sell-side due diligence, M&A tax services, business valuations, etc.

Learning Outcomes: 1. Gain practical knowledge and skills regarding tools accounting firms use to service Private Equity clients. 2. Improve technical presentation skills, both verbal and written. 3. Simulate the business environment and team approach. Credits: 2.00 or 3.00

MGMT 63550 - Accounting Consulting For Entrepreneurship

Credit Hours: 2.00 or 3.00. This course is an experiential learning experience that is part of the Experiential Learning

Initiative in the Krannert School of Management. The main goal of the course is to provide various accounting services to STEM start-up companies which are based on Purdue's innovations (www.purduefoundry.com) and to established companies in the bigger corporate world. At the same time, we also would like to give our students the opportunity to apply their acquired classroom knowledge and have them exposed to some real-world accounting problems that start-up or established companies typically experience. Our students are expected to provide various accounting support services that are related to financial accounting & reporting, managerial accounting, business planning, and/or tax issues. The format of the course is very open. The first four weeks will be spent in a classroom setting, with presentations on how to professionally manage a client relationship and how to successfully tackle projects in a challenging STEM start-up and/or established corporate environment. Each project will be completed by teams of 3-5 students, which will be formed at the beginning of the semester. After the initial classroom sessions, the project teams will be on their own, with faculty guidance, running the engagement. The teams will meet with the clients to determine their needs and expectations. The students will do the work and deliver the output including a final presentation to the client.

Learning Outcomes: 1. Provide various accounting services to STEM start-up companies which are based on Purdue's innovations (www.purduefoundry.com) and to established companies in the bigger corporate world. Credits: 2.00 or 3.00

MGMT 63650 - Accounting Ethics

Credit Hours: 3.00. This course is designed to introduce students to the foundational elements underlying ethics and ethical behavior, with an emphasis on ethical issues facing professional accountants. The course will provide students with a framework of ethical reasoning, professional values and attitudes for exercising professional skepticism, and other behavior that is in the best interest of the public and accounting profession. The course will also review the core values of integrity, objectivity, and independence as well as rules of professional conduct. This course uses real-world case studies and practical hands-on applications in order to enhance the student's ability to recognize ethical dilemmas and overcome them with sound ethical decision-making. Illinois Board of Examiners ethics course required to apply for taking the Uniform CPA Examination.

Learning Outcomes: 1. Summarize the importance of ethics and ethical reasoning to professional accountants through explaining various ethical models. 2. Paraphrase and implement the core values of integrity, objectivity and independence, the backbone of the accounting profession. 3. Implement the rules of professional conduct included in the AICPA Code of Professional Conduct and TSBPA ethics rules to various case studies from a CPA Exam perspective. 4. Identify situations that might be unethical or a violation of professional standards, perform research and consultations as appropriate, and determine the appropriate action. 5. Recognize potentially unethical behavior of clients and determine the impact on the services being performed. Credits: 3.00

MGMT 63750 - Advanced Taxation

Credit Hours: 2.00 or 3.00. This course is directed at students who wish to learn more about the taxation of business entities beyond the basic principles taught in MGMT 504 Introductory Tax Accounting or an equivalent course. The course will cover broad topics such as tax law sources and tax research; the tax advantages and disadvantages of various business entities as well as how entrepreneurs may choose the optimal entity for tax purposes; taxable and nontaxable methods of mergers, acquisitions, and divestitures; fundamental concepts of consolidated tax returns for C Corporations; and the accounting for income taxes under ASC 740.

Learning Outcomes: 1. Describe various tax planning procedures. 2. Identify the tax law sources and assess the authoritative weight of each. 3. Conduct basic tax research using RIA Checkpoint and communicate results. 4. Understand the basic tax treatment of major operational events for sole proprietorships, partnerships, S Corporations, and C Corporations. 5. Identify the optimal business entity for tax purposes. 6. Understand the basic types of taxable acquisitions of C Corporations and tax planning ideas. 7. Understand the basic types of nontaxable acquisitions of C Corporations and tax planning ideas. 8. Understand the basic types of corporate divestitures and tax planning ideas. 9. Understand fundamental concepts of consolidated tax returns for C Corporations. 10.

Calculate a corporation's income tax provision under ASC 740 and understand how to prepare the required financial statement disclosures. Credits: 2.00 or 3.00

MGMT 63850 - Public Company Reporting And Regulation

Credit Hours: 2.00 or 3.00. This course introduces students to the Securities and Exchange Commission's (SEC) rules and regulations as they apply to U.S. companies and their auditors. Requirements for frequently encountered annual reporting responsibilities (e.g., Forms 10-K, 10-Q, 8-K, proxy statements, etc.) and registration statements are explored and analyzed. Actual SEC filings provide real-world applications and interpretation of the SEC's rules. Rules imposed by the primary U.S.-based stock exchanges are introduced as is the history of the SEC and current trends affecting this rule-making body. Additionally, this course encompasses the enforcement power of the SEC and its implications to companies, their officers, and accountants.

Learning Outcomes: 1. Identify the structure, mission, and limitations of the SEC and key securities laws and statutes impacting U.S. companies and their external auditors. 2. Demonstrate an understanding of the Securities Acts of 1933 and 1934 and The Public Company Accounting Reform and Investor Protection Act of 2002 by identifying required disclosures and associating them with the specific rule requirements. 3. Research specific topics including emerging issues by using online resources supported by the SEC and the stock exchanges. Credits: 2.00 or 3.00

MGMT 51099 - Practicum In Taxation Compliance And Consulting

Credit Hours: 1.00 to 3.00. This is an experiential course to provide real-world experience and significant community service through volunteer tax compliance and consulting. The course partners with the Internal Revenue Service Volunteer Income Tax Assistance Program to provide significant free tax preparation and consulting services to low- and middle-income families in the Greater Lafayette community with an additional focus on providing these services to international students at Purdue. Learning outcomes include technical tax abilities as well as soft skills in a professional services environment.

Learning Outcomes: 1. Develop technical tax preparation skills and apply those skills using tax software. 2. Interact positively with clients through sometimes difficult situations. 3. Explain complex tax issues in an understandable way to clients. 4. Discuss relevant tax and client issues with other students and coordinators. 5. Learn from constructive feedback to improve your tax preparation and client interaction skills. 6. Adapt your role at the site extemporaneously to help mitigate stressful situations. 7. Serve the community through accounting knowledge. Credits: 1.00 to 3.00

General Business Selectives (0-25 credits)

MGMT 64200 - Portfolio Management

Credit Hours: 2.00 to 4.00. Methods of analysis of common stocks and bonds for individual and institutional portfolios. Review of the empirical evidence of security market efficiency, and implications of that evidence for various methods of security analysis. Team projects to analyze the economy, the particular industry or sector, and selected firms within the industry or sector, and to make specific buy-hold-sell recommendations for the stocks and bonds of those firms. Prerequisite:MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64100 - Options And Futures

Credit Hours: 2.00 to 4.00. Rigorous and applied coverage of the pricing and hedging of options and futures contracts with applications. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how

ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 58200 - Management Of Organizational Data

Credit Hours: 2.00. Provides the basic concepts and skills needed to analyze and organize business data, as well as to utilize the organized data to answer a variety of business queries. After successful completion, students will have an understanding of why database management is important and what it entails, how to analyze the data requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams, translate an ER diagram into normalized relations for a relational database management system, write simple and relatively complex data retrieval commands in the SQL language for an Oracle database, use Microsoft Access as a front end to a server database in Oracle, be familiar with several selected topics of current interest in the data management arena.

Credits: 2.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work. Credits: 2.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical

understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel. The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial applications. Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

About the Program

Management: Business Analytics and Information Management Concentration, MS

About the Program

Program Requirements

Required Courses (xx credits)

MGMT 67200 - Advanced Business Analytics

Credit Hours: 2.00. Quantitative decision procedures under uncertainty applied to business problems. Basic concepts in econometrics and multivariate analysis are studied. Several managerial-oriented case studies are used to illustrate estimation, testing, and regression procedures. Master's student standing and Management majors only.

Learning Outcomes: 1. Review of Multiple Linear Regression. 2. Analysis of Variance (ANOVA): A Regression Approach. 3. Qualitative Independent Variables. 4. Qualitative or Discrete Dependent Variables. 5. Univariate Time Series Models for the Mean. 6. Univariate Time Series Models for Volatility. Credits: 2.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 58200 - Management Of Organizational Data

Credit Hours: 2.00. Provides the basic concepts and skills needed to analyze and organize business data, as well as to utilize the organized data to answer a variety of business queries. After successful completion, students will have an understanding of why database management is important and what it entails, how to analyze the data requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams, translate an ER diagram into normalized relations for a relational database management system, write simple and relatively complex data retrieval commands in the SQL language for an Oracle database, use Microsoft Access as a front end to a server database in Oracle, be familiar with several selected topics of current interest in the data management arena.

Credits: 2.00

MGMT 57300 - Optimization Modeling With Spreadsheets

Credit Hours: 2.00. The course emphasizes applications of optimization through cases and computer exercises. The applications are chosen to provide insights into business and economics. Areas covered include linear, network, integer, and nonlinear optimization. At the end of the course, the students should have the ability to model optimization problems work with software to solve optimization problems relate to optimization theory in a variety of application settings develop optimization insights into applications in marketing, finance, and operations and get some basic exposure to EXCEL automation. Prerequisites: Students are expected to have taken a basic MBA (core) course in business analytics (such as the masters core MGMT 67000).

Learning Outcomes: 1. Train the students to write mathematical formulations of business problems and use solvers in excel spreadsheets to solve the problems. It requires critical thinking via the presentation of case assignments.

Credits: 2.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work.

Credits: 2.00

MGMT 59100 - Launching Global Leaders

Credit Hours: 0.00 to 2.00. Capitalizing on the unique personal and professional backgrounds of each student in our program, the Launching Global Leaders course provides a comprehensive and customizable leadership development curriculum. In this year long course, students will engage in a 360 assessment of strategically identified professional competencies critical to success in the contemporary workforce. Using these target areas as a guide, students will then customize their leadership development experience by selectively engaging in a variety of program offerings, including: interactive industry simulations, personal and team performance enhancement tools, professional coaching, interactive learning sessions with industry leaders, and workshops in developing intercultural competency, personal branding and career management.

Learning Outcomes: 1. Comprehensively assess their individual leadership strengths and areas of development along the Launching Global Leaders competency model. 2. Gain exposure to a variety of leadership styles and strategies from successful industry leaders. 3. Gain an awareness of contemporary issues

facing leaders of global organizations, and strategies for future. 4. Gain exposure to tools and concepts currently utilized in industry that inspire continuous self-improvement. Credits: 0.00 to 2.00

MGMT 58500 - Information Technology Project Management

Credit Hours: 2.00. The purpose of this class is to provide students with a basic understanding of the tasks and challenges facing IT and analytics project managers. Students learn about projects, roles and responsibilities of project managers. We start by discussing the skills and approaches commonly used in creating and monitoring project plans and braking complex projects down into manageable segments. We also discuss important areas defined in PMI's PMBOK, like scope, time, cost and quality management. Next we look at how IT projects have traditionally been managed, and move on to the study of agile methods. We go through some of the most important aspects of agile project management, such as user stories, agile teams an agile planning, execution and tracking. In learning these tools and techniques, we take a hands-on approach wherever possible and use project management software, exercises and case studies.

Learning Outcomes: 1. Acquire a good understanding of the most important aspects of general project management such as cost and time management. 2. Define the essential processes involved in information systems development. 3. Work effectively on a team to successfully complete team projects. 4. Understand and explain various approaches to manage IT projects. 5. Use project management tools, MS Project and Atlassian Jira. 6. Explain what agile is and how it is different from waterfall. 7. Work on a team as a scrum master or product owner. 8. Think about and describe how agile could be applied in various contexts. Credits: 2.00

MGMT 68700 - AI For Business Decisions

Credit Hours: 1.00 to 3.00. Leading-edge companies in every industry are relying on data and AI to replace intuition and guesswork in their decision-making. This course prepares students to understand how AI can be utilized to create value and a sustainable competitive advantage. It teaches the scientific process of using AI to transform data into predictions and insights for making better business decisions in a real-world setting. Upon completion, students should be able to identify and evaluate value propositions of AI advances, conduct successful AI implementations, and manage AI-driven digital transformations.

Learning Outcomes: 1. Design and present as a part of the project engagements that take into consideration human instincts and biases. 2. Understand and identify human instincts and biases that are useful for design considerations. 3. Break apart engagements into three parts: mechanics, dynamics, and aesthetics. Credits: 1.00 to 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

Capstone Selectives (xx credits)

General Selectives (xx credits)

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best

managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work. Credits: 2.00

MGMT 58100 - Big Data Technologies

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn visualization techniques using Tableau to query large datasets and gain insights from it. 2. Learn to deploy big data technologies such as Cloudera Hadoop on Virtual Box. 3. Learn to collect data using open APIs to access streaming data from sites like Twitter, Quandl, Buzzfeed, etc. 4. Learn to architect a big data platform for analysis. Credits: 2.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage, communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3. Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

MGMT 54000 - Computing For Analytics

Credit Hours: 2.00 or 3.00. The main goal of this course is to introduce students to algorithmic thinking and computational tools for data analytics. The course will focus on challenges associated with large data sets and how algorithms and data structures can aid in resolving some of those challenges. The course will introduce relevant programming techniques in Python. Permission of department required.

Learning Outcomes: 1. Categorize problems according to their computational complexity. 2. Employ algorithmic techniques to obtain insights about data. 3. Develop algorithms to new problems. 4. Implement the algorithms and methodologies in python. Credits: 2.00 or 3.00

MGMT 59800 - Analyzing Unstructured Data

Credit Hours: 2.00. This course prepares master students with the advanced and frontier technique for analyzing unstructured data that is built on the prerequisite of basic data analysis on structured data (e.g., data mining using python). Upon completion, students are expected to be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and

TensorFlow); students should at least be proficient to design and lead industry-level practical projects conceptually when working with data scientist. We take text and image as examples for illustration and cover applications of: Text mining and feature extraction (e.g., sentiment, topic, readability, etc.); Image classification (e.g., recognition, etc.); Advanced applications (e.g., translations, chatbot, image expression, etc.) The course is formatted as a combination of seminars and hands-on coding practices in class. Students are expected to code (and debug) in the class. The main method topics covered include: Crawling unstructured data using scrapy. Representation and embedding of text and image. Unsupervised learning for unstructured data (e.g., LDA topic modeling, clustering, etc.) Supervised learning for unstructured data (e.g., classic ML models, A/D/C/RNN, LSTM, etc.). Permission of instructor required.

Learning Outcomes: 1. Be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and TensorFlow). 2. Design and lead industry-level practical projects in joint with data scientist. Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

Business Foundation Electives (xx credits)

About the Program

Management: Finance Concentration, MS
Management: Global Entrepreneurship Concentration, MS
Management: Global Supply Chain Management Concentration, MS
Management: Human Resource Management Concentration, MS
Management: Marketing Concentration, MS
Marketing, MS

About the Program

Program Requirements

Required Courses (17 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 63800 - Pricing Strategies And Algorithms

Credit Hours: 2.00. The course enables participants to formulate a systematic framework for approaching the problem of pricing a product, and more generally, a product line. The concepts and analytical methods necessary to develop such a framework are explored and incorporate marketing, competitive, and legal aspects. The course will use a combination of lectures, case discussions and exercises. Prerequisite: MGMT 62000.

Learning Outcomes: 1. Adopt a systematic framework to approach the problem of pricing a product or service. 2. Understand various approaches to estimate value of a product or service to users. 3. Understand the tradeoff between price and sales volume and its relation to price elasticity. 4. Understand segmented pricing and psychological aspects of pricing. 5. Understand the implications of pricing in a competitive environment and the importance of price policy. 6. Appreciate pricing issues when selling through an intermediary. 7. Be introduced to legal aspects of pricing. Credits: 2.00

MGMT 62500 - Marketing Research

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Application of statistical and other quantitative concepts to marketing management problems. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

MGMT 52300 - Digital Marketing Strategy

Credit Hours: 2.00. This course enables students to rethink marketing in the evolving digital age and develop capabilities in developing, implementing, and evaluating digital marketing strategies. Topics include: digital marketing strategy framework, search engine marketing, social media marketing, and location based marketing (mobile).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital and social media age. 2. Understand how digital and social media marketing strategies fit with companies' overall marketing strategy. 3. Learn to develop, implement, and evaluate digital and social media marketing plan. 4. Understand the major tools of digital and social media marketing: online ads, search engine optimization, paid search ads, organic social media, social media ads, web analytics, and social media analytics, and others. 5. Explore the future development of digital marketing. Credits: 2.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on

exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 52900 - Marketing Consulting Projects

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet once a week to review project progress and discuss the next steps generally in the presence of the faculty supervisor. Projects are done in teams, although evaluation is individual.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the findings from a project analysis into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Exposed to the challenges of working in teams to achieve project goals. Credits: 3.00

MGMT 52020 - Analytics For Marketing Managers

Credit Hours: 2.00 or 3.00. The purpose of this course is to learn tools, technologies, applications and practices used to collect, integrate, analyze, and present raw data in order to create insightful visualization and actionable marketing information. It will cover conceptual understanding of marketing performance based on data and statistical methods. Once conceptual understanding is familiarized, students will learn common tools and techniques for marketing managers in today's industry.

Learning Outcomes: 1. Learn how to collect and analyze basic analytical concepts and tools. 2. Gain experience in understanding the importance of visualizations. 3. Learn to become a marketing manager who can provide marketing insights based on analytics. 4. Be exposed to the challenges of resent online platforms of visualization for user interactivities. Credits: 2.00 or 3.00

Selectives (0-13 credits)

General Business Selectives

MGMT 68800 - Developing A Global Business Strategy

Credit Hours: 2.00 to 4.00. Provides an introduction regarding the business and strategy challenges faced by managers in our global economy, regardless of whether the firm is a small domestic company or a large multi-national. Major topics for the course include motivations and challenges of internationalization, international business fundamentals, foreign market entry strategies, organizing across countries, analyzing global industries, building competitive advantage in global industries, and the influence of culture and institutions. Prerequisite: MGMT 65000.

Learning Outcomes: 1. Understand the three foundation characteristics related to foreign market entry - firm, industry, and institutional factors. 2. Analyze country choice for entry and the factors involved in choosing a country. 3. Develop the essential skills to identify and pursue global business opportunities, with a focus on the different modes of entry. 4. Acquire the skills to resolve management decision

problems in global markets, and analyze multi-country organizational structures. Credits: 2.00 to 4.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

Marketing Analytical Selectives

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 52610 - Data And AI-Driven Marketing

Credit Hours: 2.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course introduces modern statistical methods and AI algorithms for marketing using big data. It discusses marketing applications for which we may use statistical and machine learning methods to improve and optimize decisions. Students will use Python to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis.

Learning Outcomes: 1. Apply appropriate modern statistical and machine learning methods required for marketing using big data. 2. Implement the methods in Python using real-world data. Credits: 2.00

MGMT 52710 - Digital Marketing Applications

Credit Hours: 2.00. Companies today expect their marketing professionals to understand what it takes to develop, implement, and evaluate digital marketing strategies and campaigns. The best way for marketing professionals to gain such expertise is for them to actually build and execute specific digital marketing programs/campaigns using various digital and social media platforms for a real world client. This course offers students a unique hands-on learning opportunity with an online marketing project, each student team is given a budget up to $300 to promote a chosen business or non-profit organization via digital advertising platforms including Google AdWords, Bing Ads, Facebook Business, LinkedIn Sponsored Ads, and Twitter Ads. Students are given flexibility in selecting projects of interest. All students are also expected to pass Google Analytics certification and Google AdWords certification.

Learning Outcomes: 1. Gain practical knowledge in web analytics, display advertising, search engine marketing (search engine optimization and pay per click), content marketing, and social media advertising. 2. Gain experience in designing, implementing, and evaluating a consistent digital marketing and social media marketing strategy through the online marketing campaign. 3. Learn how to communicate with clients, how to present an online marketing strategy, and how to deliver the outcome of an online marketing campaign. 4. Exposed to the challenges of working in teams to achieve marketing campaign goals in real world situations. Credits: 2.00

MGMT 53900 - Analytics For Social Media Marketing

Credit Hours: 2.00 or 3.00. The objective of this course is to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Be exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 2.00 or 3.00

MGMT 52800 - Customer Analytics

Credit Hours: 2.00. Customer Relationship Management (CRM) refers to the selection or identification, acquisition, growth and retention of desired customers to maximize profit. CRM requires a shift in mindset from product-centric to customer-centric management and a new set of tools for understanding and predicting the behavior of current customers. This course focuses on analytical CRM: identifying good prospects and customer acquisition, customer development via up-selling, cross-selling and personalization, customer attrition, retention, and customer lifetime value. While traditional marketing relied on the three pillars of segmentation, targeting and positioning

(STP), technological advances have made it possible to obtain customer-level transaction data, and also to target individual customers with a customized marketing mix that is designed to maximize individual customer value. Important strategic questions arise from such a radical shift in marketing mix options, questions such as: How to allocate resources to customer acquisition and to customer retention? Are loyal customers more profitable for firms? Related to these strategic questions are important conceptual and computational issues, such as: What metrics are best used to measure customer profitability? What techniques can be used to identify most profitable customers? How to target profitable customers with customized price, promotion, product, place? This course will equip you with the skills and tools you need to answer such strategic, conceptual and computational questions related to customer relationship management (CRM). Permission of instructor required.

Learning Outcomes: 1. Build your knowledge of a rapidly emerging marketing arena - customer-centric marketing. 2. Develop basic analysis skills using a statistical software package. 3. Increase your analytical skills and expose you to several commonly used advanced modeling techniques. Credits: 2.00

Marketing Knowledge Selectives

MGMT 62300 - Business Marketing

Credit Hours: 2.00 to 4.00. This course deals with the challenges of marketing to commercial enterprises, government organizations, and non-profit institutions. It covers topics including organizational buying behavior, launching and management of new high tech products, beta testing, customer relationship management, and the importance of manufacturing-marketing coordination. Prerequisite: MGMT 62000.

Credits: 2.00 to 4.00

MGMT 52200 - New Product Development

Credit Hours: 2.00. The course covers new product development issues including idea generation, concept testing, prototype development, patent protection, and product launch. Student teams generate a new product idea, test the idea with target customers, and develop a product launch strategy.

Learning Outcomes: 1. Understand New Product Development Process. 2. Analyze New Product Development Cases. 3. Develop and Test a New Product Idea. Credits: 2.00

MGMT 52100 - Brand Management

Credit Hours: 2.00. This course exposes students to the issues and activities in brand management. Topics include developing the brand marketing plan, design and execution of integrated marketing communications, testing, launching, and repositioning of brands, creating and managing brand equity, formulating strategies for leveraging and defending brands, product line and category management.

Learning Outcomes: 1. Identify the components of a firm's brand equity, based on weekly discussions of "Best Practice" cases assigned in the course. 2. Demonstrate an understanding of how a firm formulates, develops, and executes a firm's branding strategy. 3. Demonstrate an understanding of the key components of a firm's branding strategy. 4. Develop an understanding of how a firm manages the issues of building brand equity, measuring brand equity, and understanding how to grow a firm's brands. Credits: 2.00

MGMT 52850 - Consumer Behavior And Marketing

Credit Hours: 2.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, behavior economics and other fields to learn why consumers behave in the ways that they do. The course focuses on three general topics: 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior. Consumer behavior is an applied discipline rooted in other social sciences, and you will therefore learn multiple concepts, frameworks and theories. Your job is to master those concepts and use them to organize, explain, and predict consumers' judgments and choices. Ultimately you should be able to identify a consumer behavior issue, select a relevant theory to examine and explain the issue, and apply the theory properly to aid in a managerial decision. You will also learn how to run basic applied experiments in consumer behavior to test your theories with real consumers.

Learning Outcomes: 1. Master multiple

concepts and use them to organize, explain, and predict consumers' judgments and choices. 2. Identify a consumer behavior issue, select a relevant theory to examine and explain the issue, and apply the theory properly to aid in a managerial decision. 3. Run basic applied experiments in consumer behavior to test your theories with real consumers. Credits: 2.00

Materials Engineering, MSMSE

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (18-30 credits)

Core Courses (0-15 credits)

MSE 60000 - Materials Engineering Fundamentals

Credit Hours: 3.00. Fundamental relationships between the internal structure, properties and processing in all classes of engineering materials. Comprehensive coverage spanning physical, chemical, thermal, mechanical, electrical, magnetic, and optical responses. The course is intended for materials researchers from all backgrounds, as well as engineers working in product design, development and manufacturing who seek a deeper understanding of the full spectrum of engineering materials.

Learning Outcomes: 1. Perform calculations to quantify material properties and microstructural characteristics. Example: Calculate the interplanar spacing of a family of atomic planes given a x-ray diffraction pattern. 2. Recognize the effect of composition and microstructure on material properties. Example: The effect of dislocation density on yield strength and electrical conductivity. 3. Take information from a known situation and apply it to a new situation. Example: Effect of temperature and applied stress on the peak positions in a XRD pattern. 4. Predict property response or microstructural changes based on imposed conditions. Example: Effects of temperature and alloying on the resistivity of metals. 5. Assess the interplay of two or more material properties. Example: Assess the effect of atomic bond strength on Young's modulus, coefficient of thermal expansion and melting temperature. Credits: 3.00

Hard Materials (Metals and Ceramics) Courses (0-9)

MSE 50200 - Defects In Solids

Credit Hours: 3.00. Structures and interactions of point, line, and planar defects in solids, with emphasis on properties of defects. Generic basis of defect energies and interactions, with reference to specific materials and material classes as examples. Types of point defects found in crystals, their origins, interactions, and motion. Overview of dislocation theory and point-defect/dislocation interactions. Structural aspects of surfaces and interfaces, including point and line defect interactions.

Credits: 3.00

MSE 50800 - Phase Transformations In Solids

Credit Hours: 3.00. Description of stress effects on transforming systems. Development of classical models for nucleation and growth and spinodal decomposition. Application of models to discontinuous precipitation, bainite formation, and martensitic transformations.

Credits: 3.00

MSE 52500 - Struct-Property Relationships Of Engineering Polymers

Credit Hours: 3.00. Structure-property relationships developed for commodity and engineering resins. Focus on connecting bonding and polymer structure (i.e., molecular weight, tacticity, crystallinity as it regards spherulites) to mechanical (yield phenomena and fracture) and thermomechanical behavior (viscoelasticity). Thermal characterization techniques, including DSC, TGA, TMA, and DMTA. Flow of polymer melts related to common melt processing techniques (i.e., extrusion and injection molding). Offered in alternate years.

Learning Outcomes: 1. Identify microstructural differences between thermoplastic, thermosetting, and elastomeric polymers and

how these affect thermal and mechanical properties. 2. Discuss the crystalline structures of thermoplastic polymers, including nucleation and growth of spherulitic structures and how molecular weight, tacticity, and cooling rate affect the morphology of the crystals. 3. Discuss entropy elasticity as it relates to elastomeric behavior. 4. Compare and contrast the yield and fracture behavior of polymers with metallic and ceramics materials. 5. Explain viscoelasticity from a microstructural viewpoint, and its manifestations in polymeric mechanical behavior, including mathematical modeling of creep and stress relaxation behaviors of simple and complex systems. 6. Interpret the results from common thermal characterization (TGA, DSC, DMA) techniques and relate them to polymer structure. 7. Discuss polymer melt-processing techniques of extrusion and injection molding, and how polymer chain morphology affects processing. Credits: 3.00

MSE 53100 - Quantitative Analysis Of Microstructure

Credit Hours: 3.00. A review will be presented of basic probability theory and statistical analysis, with particular emphasis on terms and definitions of a microstructure. The properties accessible to quantification, the basic stereological relationships and the mathematical foundations, and the microstructural tools needed to quantify the structure will be emphasized. The last one-third of the course will cover applications of quantitative metallography to problems in failure analysis, solidification, heat treatment, phase equilibria, and deformation behavior. Offered in alternate years.

Credits: 3.00

MSE 55900 - Phase Equilibria In Multicomponent Systems

Credit Hours: 3.00. A detailed examination of the thermodynamics of phase equilibria in multicomponent systems, experimental methods of determining these equilibria by measurements of thermodynamic activity and graphical method of representing the equilibria. This is followed by an examination of theoretical models of the behavior of solutions and an examination of the extent to which observed phenomena can be understood and predicted in terms of the models. Offered in alternate years.

Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 60000 - Materials Engineering Fundamentals

Credit Hours: 3.00. Fundamental relationships between the internal structure, properties and processing in all classes of engineering materials. Comprehensive coverage spanning physical, chemical, thermal, mechanical, electrical, magnetic, and optical responses. The course is intended for materials researchers from all backgrounds, as well as engineers working in product design, development and manufacturing who seek a deeper understanding of the full spectrum of engineering materials.

Learning Outcomes: 1. Perform calculations to quantify material properties and microstructural characteristics. Example: Calculate the interplanar spacing of a family of atomic planes given a x-ray diffraction pattern. 2. Recognize the effect of composition and microstructure on material properties. Example: The effect of dislocation density on yield strength and electrical conductivity. 3. Take information from a known situation and apply it to a new situation. Example: Effect of temperature and applied stress on the peak positions in a XRD pattern. 4. Predict property response or microstructural changes based on imposed conditions. Example: Effects of temperature and alloying on the resistivity of metals. 5. Assess the interplay of two or more material properties. Example: Assess the effect of atomic bond strength on Young's modulus, coefficient of thermal expansion and melting temperature. Credits: 3.00

Soft Materials (Polymers) Courses (0-6 credits)

MSE 52500 - Struct-Property Relationships Of Engineering Polymers

Credit Hours: 3.00. Structure-property relationships developed for commodity and engineering resins. Focus on connecting bonding and polymer structure (i.e., molecular weight, tacticity,

crystallinity as it regards spherulites) to mechanical (yield phenomena and fracture) and thermomechanical behavior (viscoelasticity). Thermal characterization techniques, including DSC, TGA, TMA, and DMTA. Flow of polymer melts related to common melt processing techniques (i.e., extrusion and injection molding). Offered in alternate years.

Learning Outcomes: 1. Identify microstructural differences between thermoplastic, thermosetting, and elastomeric polymers and how these affect thermal and mechanical properties. 2. Discuss the crystalline structures of thermoplastic polymers, including nucleation and growth of spherulitic structures and how molecular weight, tacticity, and cooling rate affect the morphology of the crystals. 3. Discuss entropy elasticity as it relates to elastomeric behavior. 4. Compare and contrast the yield and fracture behavior of polymers with metallic and ceramics materials. 5. Explain viscoelasticity from a microstructural viewpoint, and its manifestations in polymeric mechanical behavior, including mathematical modeling of creep and stress relaxation behaviors of simple and complex systems. 6. Interpret the results from common thermal characterization (TGA, DSC, DMA) techniques and relate them to polymer structure. 7. Discuss polymer melt-processing techniques of extrusion and injection molding, and how polymer chain morphology affects processing. Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

Thesis Research (12 credits)

MSE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Project Course (0-6 credits)

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

Electives (3-30 credits)

Program Requirements - Professional Master's

Required Courses (15 credits)

Core Courses (6 credits)

MSE 53000 - Materials Processing In Manufacturing

Credit Hours: 3.00. Examination of the production/synthesis of engineering materials and the subsequent processing steps required to obtain a desired shape and microstructure. The course covers four major categories of materials processing: primary processing or materials synthesis, solidification processing, deformation processing, and powder processing, and provides specific examples from the processing of polymers, metals, and ceramics. The goal is to connect fundamental principles of materials processing to manufacturing processes. Credit will not be given for both MSE 5300 and MSE 36700 .

Credits: 3.00

MSE 60000 - Materials Engineering Fundamentals

Credit Hours: 3.00. Fundamental relationships between the internal structure, properties and processing in all classes of engineering materials. Comprehensive coverage spanning physical, chemical, thermal, mechanical, electrical, magnetic, and optical responses. The course is intended for materials researchers from all backgrounds, as well as engineers working in product design, development and manufacturing who seek a deeper understanding of the full spectrum of engineering materials.

Learning Outcomes: 1. Perform calculations to quantify material properties and microstructural characteristics. Example: Calculate the

interplanar spacing of a family of atomic planes given a x-ray diffraction pattern. 2. Recognize the effect of composition and microstructure on material properties. Example: The effect of dislocation density on yield strength and electrical conductivity. 3. Take information from a known situation and apply it to a new situation. Example: Effect of temperature and applied stress on the peak positions in a XRD pattern. 4. Predict property response or microstructural changes based on imposed conditions. Example: Effects of temperature and alloying on the resistivity of metals. 5. Assess the interplay of two or more material properties. Example: Assess the effect of atomic bond strength on Young's modulus, coefficient of thermal expansion and melting temperature. Credits: 3.00

Seminar Course (0 credits)

MSE 69000 - Seminar In Materials Engineering

Credit Hours: 0.00. Required of all MSE graduate students.

Learning Outcomes: 1. Students would demonstrate application of academic comprehension in industrial context. Credits: 0.00

Primary Area Courses (9 credits)

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 54300 - Polymerization Reaction Engineering And Reactor Analysis

Credit Hours: 3.00. Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, copolymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, Z-transforms, batch, CSTR and tubular reactors, stability analysis, computer control, separation, and drying.

Credits: 3.00

MSE 50200 - Defects In Solids

Credit Hours: 3.00. Structures and interactions of point, line, and planar defects in solids, with emphasis on properties of defects. Generic basis of defect energies and interactions, with reference to specific materials and material classes as examples. Types of point defects found in crystals, their origins, interactions, and motion. Overview of dislocation theory and point-defect/dislocation interactions. Structural aspects of surfaces and interfaces, including point and line defect interactions.

Credits: 3.00

MSE 51000 - Microstructural Characterization Techniques

Credit Hours: 3.00. A broad variety of analytical tools will be presented. The intent is to allow the student to make an educated selection of characterization techniques, or critical analysis of published data, for materials and defect analysis. The techniques will be assessed in terms of the probe type and material response, of what device and specimen requirements are typical, and of what data can or cannot be derived from each type of analysis.

Credits: 3.00

MSE 51200 - Powder Processing

Credit Hours: 3.00. Processing of engineering materials from powders. Synthesis of metals, ceramics, and polymers in powder form. Characteristics of particulates. Behavior of collections of particles; surface forces, particle agglomeration and dispersion, gelation, particle packing. Consolidation of powders; mechanics of dry flow and compaction, slurry rheology, shaping processes. Densification and microstructural development; geometry, thermodynamics, and kinetics of sintering, liquid-phase sintering, reaction densification, infiltration. Powder processing of composites.

Learning Outcomes: 1. Describe a powder fabrication process from starting reagent to finished powder. interpret a particle size distribution and estimate mean particle size and specific surface area from the data. 2. Review an ASTM standard for particulate materials characterization. 3. Describe the role of van der Waals interactions in determining structure on the colloidal and macroscopic length scales. 4.

Differentiate between processing routes more favorable for processing bulk materials versus routes geared towards processing thin films. 5. Describe when it is appropriate to process dry powders versus processing powders suspended in a liquid medium. 6. Calculate the packing density of bimodal particle size distributions and describe the difference between calculated values and what one might expect to observe in experimental measurements. 7. Describe the effects of particle agglomeration on interparticle forces and the packing density of powder compacts. 8. Calculate the particle size at which gravitational segregation becomes significant during aqueous colloidal processing. 9. Describe how segregation effects may be minimized during aqueous colloidal processing and any advantages and disadvantages associated with the modified process. 10. Describe the effects of interparticle forces on powder compact homogeneity and subsequent effects on compact densification. 11. Describe the effects of furnace atmosphere on the density, the specific surface area, and the microstructure of a powder compact. Credits: 3.00

MSE 53100 - Quantitative Analysis Of Microstructure

Credit Hours: 3.00. A review will be presented of basic probability theory and statistical analysis, with particular emphasis on terms and definitions of a microstructure. The properties accessible to quantification, the basic stereological relationships and the mathematical foundations, and the microstructural tools needed to quantify the structure will be emphasized. The last one-third of the course will cover applications of quantitative metallography to problems in failure analysis, solidification, heat treatment, phase equilibria, and deformation behavior. Offered in alternate years.

Credits: 3.00

CHE 56400 - Organic Electronic Materials And Devices

Credit Hours: 3.00. This course introduces the synthesis, optoelectronic properties, transport physics, and device operation of organic and hybrid electronic materials and devices. This course will review how the molecular architecture of small molecule and polymer semiconductors can be tuned to alter the optoelectronic properties of the materials in solution and in the solid state. A number of relevant materials interactions will be covered, including: photoexcitation and recombination, intermolecular charge transport mechanisms, and energy transfer processes. Additionally, we will observe how these processes are relevant to applications such as organic field-effect transistors (OFETs), organic light-emitting diodes (OLEDs), organic photovoltaic (OPV) devices, and organic memory elements. Finally, a new type of organic-inorganic hybrid material called hybrid halide perovskite will be introduced.

Learning Outcomes: 1. Identify common mechanisms for the synthesis of small molecule and polymer semiconductors. 2. Describe the mechanism of controlled polymerization techniques for macromolecular semiconductors. 3. Interpret spectroscopic, chromatographic, and molecular characterization data in order to predict the structure of the organic semiconductor. 4. Explain how the molecular structure of an organic semiconductor will affect its thermal, structural, and optoelectronic properties. 5. Explain how x-ray and neutron scattering can be utilized to determine the Angstrom and nanometer length scale structural features of the organic semiconductors. 6. Apply principles of electron microscopy to comprehend how to image soft materials. 7. Determine the domain spacing and microstructural architecture of organic semiconductors given a scattering pattern. 8. Explain how molecular orbital levels are related to the optoelectronic properties of organic semiconductors. 9. Distinguish between different models for charge transport in organic semiconductors. 10. Describe clearly the difference between charge generation and transport in organic and inorganic semiconductors. 11. Explain how organic electronic devices operate and how apply known equations to evaluate device performance. 12. Critique the potential for organic electronic materials to supplement or

replace inorganic semiconducting devices. Credits: 3.00

MSE 53500 - Lean Manufacturing Of Materials

Credit Hours: 3.00. This course provides perspectives on materials processing and product innovation with an economic lens on efficiency and elimination of waste. It includes an historical perspective of manufacturing via the transition from mass to lean production in the automotive industry; and extends manufacturing and product development in context of emerging trends in automation (e.g., control and PAT, I4.0), modular design, supply chain, and sustainability. The class covers lean tools, focusing on value stream analyses and optimization using simulations. As an elective, the course accommodates a range of student interest profiles. It includes both individual and interest-based group assignments. The mix of students adds to the effectiveness of group exercises. A term paper enables individuals to do a deeper dive into specific interests. Overall, the course has shown to be adaptable over a broad range of students representing a variety of departments and professional backgrounds.

Learning Outcomes: 1. Understand the distinction between Mass Production and Lean Manufacturing and to analyze a facility's progress in the transition from Mass to Lean. 2. Articulate a case for Lean. Students will be able to present an argument on why Lean is a superior environment to Mass. 3. Compare and contrast the culture, organizational structure and leadership in Mass and Lean environments. 4. List and describe the Types of Waste and why waste elimination is a core component of Lean Manufacturing. 5. List and describe lean functionality (i.e., quality, continuous flow, pull systems, 5S, Visual Control, Task Planning, etc.). 6. Articulate why the "Rules in Use" were a breakthrough in understanding the Toyota Production System. 7. Develop a Value Stream Map of a manufacturing process, and explore optimization thereof using simulations and economic models, including options to mitigate changing conditions or uncertainty. 8. Understand A3 methodology and create an A3 proposal having economic justifications. 9. Understand the similarities and differences between Lean Manufacturing and Product Development. 10. Complete a Matrix exercise. An individual deep-dive survey of a specific interest selected by each student, and a group exercise to synthesize and present elements of individual surveys clustered by topical area. Credits: 3.00

Professional Development Selectives (0-12 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ECON 60800 - Macroeconomic Theory I

Credit Hours: 2.00 or 3.00. An introduction to general equilibrium macroeconomic models in both deterministic and stochastic settings. Topics studied include: static neoclassical models, social planner problems, dynamic programming, growth and capital accumulation, stochastic economies, asset pricing, and overlapping generations models.

Credits: 2.00 or 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ECE 55700 - Integrated Circuit Fabrication Laboratory

Credit Hours: 3.00. Laboratory exercises in the fabrication and testing of silicon integrated circuits. Both bipolar and MOS integrated circuit test chips are fabricated and tested. Laboratory technique, the technology of integrated circuit fabrication, and electrical characterization are emphasized. Permission of department required.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 55800 - Safety Engineering

Credit Hours: 3.00. Application of human factors and engineering practice in accident prevention and the reduction of health hazards are presented. The objective of this course is to provide an understanding of the safety and health practices which fall within the responsibilities of the engineer in industry. Special attention is devoted to the detection and correction of hazards and to contemporary laws and enforcement on occupational safety and health.

Credits: 3.00

IE 57000 - Manufacturing Process Engineering

Credit Hours: 3.00. Theories and applications of materials forming and removal processes in manufacturing, including product properties, process capabilities, processing equipment design, and economics. A systems approach to all aspects of manufacturing process engineering.

Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 52200 - New Product Development

Credit Hours: 2.00. The course covers new product development issues including idea generation, concept testing, prototype development, patent protection, and product launch. Student teams generate a new product idea, test the idea with target customers, and develop a product launch strategy.

Learning Outcomes: 1. Understand New Product Development Process. 2. Analyze New Product Development Cases. 3. Develop and Test a New Product Idea. Credits: 2.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization.

Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 55700 - Design For Manufacturability

Credit Hours: 3.00. Introduction to manufacturing concerns, such as efficient design, producibility, and quality, which must be considered early in the engineering design process. Topics include the product development cycle, manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, Taguchi's robust design methodology, life cycle engineering, and reliability. Laboratory projects in the area of tolerancing, assembly, and manufacturability are included along with a project from industry in which the students can disassemble, analyze, and redesign a product while obtaining feedback from industry concerning manufacturability.

Credits: 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

CE 59801 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and

multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multidisciplinary student teams directly apply cumulative learning to address a real-world complex societal challenge in close collaboration with a partner organization in an experiential learning format. The course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversation methodologies and role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion and retention of new solutions. Credits: 3.00

CS 59300 - New Topics In CS

Credit Hours: 3.00. A variable title course for topics not currently covered in the CS graduate curriculum. Each offering follows a traditional course structure with textbook(s), assignments, exams, and week-by-week content synopsis described in a syllabus. A CS 59300 offering does not imply that a course is intended to become, or will become, a regular course in the CS graduate curriculum. May be included on a CS MS or PhD plan of study according to the relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

MGMT 57500 - Supply Chain Technology

Credit Hours: 2.00. This course will emphasize the use of supply chain technology for planning and control of dynamic manufacturing systems. This requires the simulation of plans and required changes over time. Therefore, the course will revolve around active learning computer simulations in SAP.

Learning Outcomes: 1. Execute end-to-end business scenarios, including Procure-to-Pay, Forecast to Delivery, and Order to Cash, in an Enterprise Resource Planning (ERP) system. 2. Choose among several planning methods and develop initial parameters based on supply chain and production capabilities and market intelligence. 3. Modify system parameters as necessary to address events such as material shortages, lack of cash flow, changes in supply availability, and market changes. 4. Access and analyze operational data from the ERP system. 5. Design a manufacturing planning and control strategy to maximize company value. Credits: 2.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

ENGR 50200 - Engineering Leadership

Credit Hours: 3.00. Engineering leadership is the ability to inspire and guide engineering and technology-focused teams and organizations to achieve strategic outcomes. The successful engineering leader creates value at the intersection of technical systems and human systems. This course introduces students to evidence-based, practice-proven frameworks and tools related to (1) leadership presence, (2) cognitive diversity and psychological safety in teams, and (3) designing and transforming organizations and ecosystems.

Learning Outcomes: 1. Describe characteristics of effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Industrial Practice Electives (6 credits)

Concentrations

Additional Information

Mathematical and Computational Psychology, MS

About the Program

Program Requirements

Required Courses (27 credits)

Statistics Courses (9 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and

sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Computational Methods Courses (6 credits)

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

STAT 54600 - Computational Statistics

Credit Hours: 3.00. The course focuses on two fundamental aspects in computational statistics: (1) what to compute and (2) how to compute. The first is covered with a brief review of advanced topics in statistical inference, including Fisher's fiducial inference, Bayesian and frequenstist methods, and the Dempster-Shafer (DS) Theory. The second is discussed in detail by examining exact, approximation, and interactive simulation methods for statistical inference with a variety of commonly used statistical models. The emphasis is on the EM-type and quasi-Newton algorithms, numerical differentiation and integration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Master commonly used numerical matrix operations, including the sweep operator, Cholesky decomposition, eigenvalue decomposition, and single value decomposition. 2. Understand statistical thinking in development of interactive numerical methods. 3. Apply optimization algorithms such as quasi-Newton and conjugate gradient methods. 4. Implement EM-type algorithms for maximum likelihood estimation when expanded complete-data models are available, including commonly used statistical models. 5. Create random number generators. 6. Implement the Gibbs sampler and Metropolis-Hastings algorithms for Bayesian data analysis. Credits: 3.00

PSY 51300 - Introduction To Computational Cognitive Neuroscience

Credit Hours: 3.00. Computational cognitive neuroscience is a new field of study that lies at the intersection of computational neuroscience and the similar fields of machine learning, neural network theory, connectionism, and artificial intelligence. Like computational neuroscience, computational cognitive neuroscience strives for neurobiological accuracy and like connectionism, a major goal is to account for behavior. Covered topics include feature extraction / optimization, connectionism, computational neuroscience, and computational cognitive neuroscience applications. Permission of department required.

Learning Outcomes: 1. Understand critically existing computational models. 2. Master important computational modeling methods. 3. Implement and simulate computational models. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics

include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Mathematics Courses (9 credits)

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

Mathematical Psychology Course (3 credits)

PSY 51100 - Psychophysics

Credit Hours: 3.00. (ECE 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of instructor required.

Credits: 3.00

PSY 51400 - Introduction To Mathematical Psychology

Credit Hours: 3.00. This course introduces the student to the field of mathematical modeling of psychological processes. Mathematical techniques employed in modeling are learned, and a number of mathematical models and theories that have been developed and employed in various important areas of experimental psychology are explained. An introduction to problems in theory and model testability also is given.

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

ECE 51100 - Psychophysics

Credit Hours: 3.00. (PSY 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of department required.

Credits: 3.00

Electives (9 credits)

Thesis Research (xx credits)

PSY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Additional Requirements

GPA Requirements

Additional Information

Mathematics, MS

About the Program

Program Requirements

Specialty Tracks (18-21 credits)

Pure Mathematics Track (21 credits)

MA 50400 - Real Analysis

Credit Hours: 3.00. Completeness of the real number system, basic topological properties, compactness, sequences and series, absolute convergence of series, rearrangement of series, properties of continuous functions, the Riemann-Stieltjes integral, sequences and series of functions, uniform convergence, the Stone-Weierstrass theorem, equicontinuity, and the Arzela-Ascoli theorem.

Credits: 3.00

MA 52500 - Introduction To Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; applications. Not open to students with credit in MA 42500.

Credits: 3.00

MA 53000 - Functions Of A Complex Variable I

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; special topics. More mathematically rigorous than MA 52500.

Credits: 3.00

MA 53800 - Probability Theory I

Credit Hours: 3.00. (STAT 53800) Mathematically rigorous, measure-theoretic introduction to probability spaces, random variables, independence, weak and strong laws of large numbers, conditional expectations, and martingales.

Credits: 3.00

MA 54400 - Real Analysis And Measure Theory

Credit Hours: 3.00. Metric space topology; continuity, convergence; equicontinuity; compactness; bounded variation, Helly selection theorem; Riemann-Stieltjes integral; Lebesgue measure; abstract measure spaces; LP-spaces; Holder and Minkowski inequalities; Riesz-Fischer theorem.

Credits: 3.00

MA 54500 - Functions Of Several Variables And Related Topics

Credit Hours: 3.00. Differentiation of functions; Besicovitch covering theorem; differentiation of one measure with respect to another; Hardy-Littlewood maximal function; functions of several variables; Sobolev spaces.

Credits: 3.00

MA 55300 - Introduction To Abstract Algebra

Credit Hours: 3.00. Group theory: Sylow theorems, Jordan Holder theorem, solvable groups. Ring theory: unique factorization in polynomial rings and principal ideal domains. Field theory: ruler and compass constructions, roots of unity, finite fields, Galois theory, solvability of equations by radicals.

Credits: 3.00

MA 55400 - Linear Algebra

Credit Hours: 3.00. Review of basics: vector spaces, dimension, linear maps, matrices determinants, linear equations. Bilinear forms; inner product spaces; spectral theory; eigenvalues. Modules over a principal ideal domain; finitely generated abelian groups; Jordan and rational canonical forms for a linear transformation.

Credits: 3.00

MA 55700 - Abstract Algebra I

Credit Hours: 3.00. Review of fundamental structures of algebra (groups, rings, fields, modules, algebras); Jordan-Holder and Sylow theorems; Galois theory; bilinear forms; modules over principal ideal domains; Artinian rings and semisimple modules. Polynomial and power series rings; Noetherian rings and modules; localization; integral dependence; rudiments of algebraic geometry and algebraic number theory; ramification theory.

Credits: 3.00

MA 55800 - Abstract Algebra II

Credit Hours: 3.00. A continuation of MA 55700.

Credits: 3.00

MA 57100 - Elementary Topology

Credit Hours: 3.00. Fundamentals of point set topology with a brief introduction to the fundamental group and related topics, topological and metric spaces, compactness, connectedness, separation properties, local compactness, introduction to function spaces, basic notions involving deformations of continuous paths.

Credits: 3.00

MA 57200 - Introduction In Algebraic Topology

Credit Hours: 3.00. Singular homology theory; Eilenberg-Steenrod axioms; simplicial and cell complexes; elementary homotopy theory; Lefschetz fixed point theorem.

Credits: 3.00

MA 58500 - Mathematical Logic I

Credit Hours: 3.00. Propositional and predicate calculus; the Gdel completeness and compactness theorem, primitive recursive and recursive functions; the Gdel incompleteness theorem; Tarski's theorem; Church's theorem; recursive undecidability; special topics such as nonstandard analysis.

Credits: 3.00

Applied Mathematics Track #1 (18 credits)

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

MA 52300 - Introduction To Partial Differential Equations

Credit Hours: 3.00. First order quasi-linear equations and their applications to physical and social sciences; the Cauchy-Kovalevsky theorem; characteristics, classification and canonical forms of linear equations; equations of mathematical physics; study of Laplace, wave and heat equations; methods of solution.

Credits: 3.00

MA 53000 - Functions Of A Complex Variable I

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; special topics. More mathematically rigorous than MA 52500.

Credits: 3.00

MA 54400 - Real Analysis And Measure Theory

Credit Hours: 3.00. Metric space topology; continuity, convergence; equicontinuity; compactness; bounded variation, Helly selection theorem; Riemann-Stieltjes integral; Lebesgue measure; abstract measure spaces; LP-spaces; Holder and Minkowski inequalities; Riesz-Fischer theorem.

Credits: 3.00

MA 55300 - Introduction To Abstract Algebra

Credit Hours: 3.00. Group theory: Sylow theorems, Jordan Holder theorem, solvable groups. Ring theory: unique factorization in polynomial rings and principal ideal domains. Field theory: ruler and compass constructions, roots of unity, finite fields, Galois theory, solvability of equations by radicals.

Credits: 3.00

MA 55400 - Linear Algebra

Credit Hours: 3.00. Review of basics: vector spaces, dimension, linear maps, matrices determinants, linear equations. Bilinear forms; inner product spaces; spectral theory; eigenvalues. Modules over a principal ideal domain; finitely generated abelian groups; Jordan and rational canonical forms for a linear transformation.

Credits: 3.00

MA 61100 - Methods Of Applied Mathematics I

Credit Hours: 3.00. Banach and Hilbert spaces; linear operators; spectral theory of compact linear operators; applications to linear integral equations and to regular Sturm-Liouville problems for ordinary differential equations. Prerequisite: MA 51100, MA 54400.

Credits: 3.00

MA 64200 - Methods Of Linear And Nonlinear Partial Differential Equations I

Credit Hours: 3.00. Second order elliptic equations including maximum principles, Harnack inequality, Schauder estimates, and Sobolev estimates. Applications of linear theory to nonlinear equations. Prerequisite: MA 52300.

Credits: 3.00

MA 64300 - Methods Of Partial Differential Equations II

Credit Hours: 3.00. Continuation of MA 64200. Topics to be covered are Lp theory for solutions of elliptic equations, including Moser's estimates, Aleksandrov maximum principle, and the Calderon-Zygmund theory. Introduction to evolution problems for parabolic and hyperbolic equations, including Galerkin approximation and semigroup methods. Applications to nonlinear problems. Prerequisite: MA 64200.

Credits: 3.00

Applied Mathematics Track #2 (18 credits)

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

MA 50400 - Real Analysis

Credit Hours: 3.00. Completeness of the real number system, basic topological properties, compactness, sequences and series, absolute convergence of series, rearrangement of series, properties of continuous functions, the Riemann-Stieltjes integral, sequences and series of functions, uniform convergence, the Stone-Weierstrass theorem, equicontinuity, and the Arzela-Ascoli theorem.

Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52300 - Introduction To Partial Differential Equations

Credit Hours: 3.00. First order quasi-linear equations and their applications to physical and social sciences; the Cauchy-Kovalevsky theorem; characteristics, classification and canonical forms of linear equations; equations of mathematical physics; study of Laplace, wave and heat equations; methods of solution.

Credits: 3.00

MA 52500 - Introduction To Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; applications. Not open to students with credit in MA 42500.

Credits: 3.00

MA 53000 - Functions Of A Complex Variable I

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; special topics. More mathematically rigorous than MA 52500.

Credits: 3.00

MA 54400 - Real Analysis And Measure Theory

Credit Hours: 3.00. Metric space topology; continuity, convergence; equicontinuity; compactness; bounded variation, Helly selection theorem; Riemann-Stieltjes integral; Lebesgue measure; abstract measure spaces; LP-spaces; Holder and Minkowski inequalities; Riesz-Fischer theorem.

Credits: 3.00

MA 55400 - Linear Algebra

Credit Hours: 3.00. Review of basics: vector spaces, dimension, linear maps, matrices determinants, linear equations. Bilinear forms; inner product spaces; spectral theory; eigenvalues. Modules over a principal ideal domain; finitely generated abelian groups; Jordan and rational canonical forms for a linear transformation.

Credits: 3.00

MA 51900 - Introduction To Probability

Credit Hours: 3.00. (STAT 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

Selectives (6-12 credits)

Mathematical Methods and Applications

MA 54200 - Theory Of Distributions And Applications

Credit Hours: 3.00. Definition and basic properties of distributions; convolution and Fourier transforms; applications to partial differential equations; Sobolev spaces.

Credits: 3.00

MA 61100 - Methods Of Applied Mathematics I

Credit Hours: 3.00. Banach and Hilbert spaces; linear operators; spectral theory of compact linear operators; applications to linear integral equations and to regular Sturm-Liouville problems for ordinary differential equations. Prerequisite: MA 51100, MA 54400.

Credits: 3.00

MA 62000 - Mathematical Theory Of Optimal Control

Credit Hours: 3.00. Existence theorems; the maximum principle; relationship to the calculus of variations; linear systems with quadratic criteria; applications. Offered in alternate years. Prerequisite: MA 54400.

Credits: 3.00

Numerical Analysis

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear

systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

MA 61100 - Methods Of Applied Mathematics I

Credit Hours: 3.00. Banach and Hilbert spaces; linear operators; spectral theory of compact linear operators; applications to linear integral equations and to regular Sturm-Liouville problems for ordinary differential equations. Prerequisite: MA 51100, MA 54400.

Credits: 3.00

Statistics

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic

understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

STAT 52900 - Applied Decision Theory And Bayesian Statistics

Credit Hours: 3.00. Bayesian and decision-theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; Bayesian design and sequential analysis; comparisons of statistical paradigms.

Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

STAT 55300 - Theory Of Linear Models And Analysis Of Experimental Designs

Credit Hours: 3.00. Least squares analysis of linear models. Gauss Markov Theorem. Estimability and testability of parameters. Confidence regions and prediction regions. Introduction to design of experiments. Analysis of variance. Factorial and block designs. Analysis of random, fixed, and mixed models. Components of variance. Distribution of linear and quadratic forms in normal vectors. A firm background in matrix algebra and some previous exposure to linear models or analysis of variance is desirable.

Credits: 3.00

Discrete Mathematics

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of

applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

MA 55300 - Introduction To Abstract Algebra

Credit Hours: 3.00. Group theory: Sylow theorems, Jordan Holder theorem, solvable groups. Ring theory: unique factorization in polynomial rings and principal ideal domains. Field theory: ruler and compass constructions, roots of unity, finite fields, Galois theory, solvability of equations by radicals.

Credits: 3.00

MA 58500 - Mathematical Logic I

Credit Hours: 3.00. Propositional and predicate calculus; the Gdel completeness and compactness theorem, primitive recursive and recursive functions; the Gdel incompleteness theorem; Tarski's theorem; Church's theorem; recursive undecidability; special topics such as nonstandard analysis.

Credits: 3.00

MA 57500 - Graph Theory

Credit Hours: 3.00. Introduction to graph theory with applications.

Credits: 3.00

Operations Research

MA 52100 - Introduction To Optimization Problems

Credit Hours: 3.00. Necessary and sufficient conditions for local extrema in programming problems and in the calculus of variations. Control problems; statement of maximum principles and applications. Discrete control problems.

Credits: 3.00

MA 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (STAT 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

MA 62000 - Mathematical Theory Of Optimal Control

Credit Hours: 3.00. Existence theorems; the maximum principle; relationship to the calculus of variations; linear systems with quadratic criteria; applications. Offered in alternate years. Prerequisite: MA 54400.

Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

IE 53500 - Linear Programming

Credit Hours: 3.00. Optimization of linear objective functions subject to linear constraints. Development of theory and algorithmic strategies for solving linear programming problems.

Credits: 3.00

IE 53700 - Discrete Optimization Models And Algorithms

Credit Hours: 3.00. An introduction to classic models and algorithms for discrete optimization. Basic theory and computational strategies for exact and heuristic solution of integer, combinational, and network problems in the context of classic models.

Credits: 3.00

IE 53800 - Nonlinear Optimization Algorithms And Models

Credit Hours: 3.00. Survey of computational tools for solving constrained and unconstrained nonlinear optimization problems. Emphasis on algorithmic strategies and characteristic structures of nonlinear problems.

Credits: 3.00

Concentrations

GPA Requirements

Mechanical Engineering, MSME

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (21-30 credits)

Applied Mathematics Courses (6 credits)

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

PHYS 57000 - Selected Topics In Physics

Credit Hours: 3.00. Specialized topics in physics selected from time to time. Permission of instructor required.

Credits: 3.00

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common

data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple

random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 55300 - Elasticity In Aerospace Engineering

Credit Hours: 3.00. A basic course in the theory of elasticity with emphasis on understanding the fundamental principles and solution techniques used in the stress analysis of structures. Cartesian tensors. Governing equations for linear elasticity. Rigorous derivation of beam and plate equations from the three-dimensional elasticity equations. Torsion. Thermoelasticity. The stress functions and complex functions approaches to two-dimensional problems. Energy methods and approximate solutions. Three-dimensional problems. Knowledge of differential equations assumed.

Learning Outcomes: 1. Give student an in-depth background in mechanics of solids including large deformation, and the ability to perform stress analyses in elastic bodies, especially two-dimensional bodies. Credits: 3.00

AAE 55800 - Finite Element Methods In Aerospace Structures

Credit Hours: 3.00. Introduction to the use of advanced finite element methods in the calculation of deformation, strain, and stress in aerospace structures. Topics include: 1-D, 2-D, 3-D, and axisymmetric elements, isoperimetric element formulation, convergence, treatment of boundary conditions and constraints. Special topics include stability, dynamic analysis, and nonlinear material behavior. Emphasis is on the theoretical knowledge of the finite element method. Applied experience is gained by solution of aerospace structural analysis problems through use of professional software.

Credits: 3.00

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

CE 59500 - Finite Elements In Elasticity

Credit Hours: 3.00. Fundamentals of theory of elasticity; variational principles; one-, two-, and three-dimensional elasticity finite elements; interpolation methods; numerical integration; convergence criteria; stress interpretation.

Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

IE 69000 - Advanced Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Advanced study in various fields of industrial engineering for graduate students. Credits and hours to be arranged. Permission of instructor required.

Credits: 1.00 to 6.00

ME 58000 - Nonlinear Engineering Systems

Credit Hours: 3.00. Methods of analysis for nonlinear ordinary differential equations arising in engineering systems. Review of linear systems. Stability concepts. Phase plane methods. Perturbation and averaging methods of analysis. Self-excited and parametrically-excited systems. Relaxation oscillations. Systems with more than one degree of freedom.

Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

ME 61200 - Continuum Mechanics

Credit Hours: 3.00. A unified and exact mathematical treatment of the mechanics of solids and fluids. Cartesian tensor algebra and calculus; stress tensor, principle stresses and invariants; material and spatial coordinates, deformation gradient, strain and stretch tensors; balance of mass, momentum, and energy; constitutive equations of elasticity, hyperelasticity, viscous fluids and viscoelasticity.

Credits: 3.00

ME 61400 - Computational Fluid Dynamics

Credit Hours: 3.00. Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solution of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Prerequisite: ME 50900 or ME 58100 .

Credits: 3.00

ME 68100 - Finite And Boundary Element Methods

Credit Hours: 3.00. The solution of problems in mechanical engineering using the generalized numerical techniques; the finite element method and the boundary element method. Topics include reformulation of partial differential equations into appropriate form for each method. The development and implementation of code and solution of problems. Applications include: acoustics, fluid dynamics, heat transfer, design, mechanics and biomechanics. Prerequisite: ME 58100 .

Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field.

Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent

mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Mechanical Engineering Courses (15-24 credits)

Thesis Research (9 credits)

ME 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Independent Study Course (0-6 credits)

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

Non-ME Electives (0-9 credits)

Program Requirements - Professional Master's

Required Courses (24 credits)

Applied Mathematics Courses (6 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations.

Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory.

Credits: 3.00

Mechanical Engineering Courses (12 credits)

Professional Development Selectives (9 credits)

Electives (6 credits)

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

Concentrations

Mechanical Engineering: Motorsports Engineering Concentration, MSME (Indianapolis)

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (21-30 credits)

Applied Mathematics Courses (6 credits)

Mechanical Engineering Courses (15-24 credits)

Thesis Research (9 credits)

Independent Study Course (0-6 credits)

Non-ME Electives (0-9 credits)

Program Requirements - Professional Master's

Required Courses (24 credits)

Applied Mathematics Courses (6 credits)

Mechanical Engineering Courses (12 credits)

Professional Development Selectives (9 credits)

Electives (6 credits)

Concentrations

Medical Physics, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (25 credits)

Core Courses (23 credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5.

Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 54100 - Human Sectional Anatomy

Credit Hours: 2.00. This course connects anatomy and physiology with medical imaging. The primary focus is on anatomic imaging methods such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) but includes Positron Emission Tomography (PET) and Ultrasound (US) images when applicable or are in common use as part of clinical care.

Learning Outcomes: 1. Identify and label the anatomy associated with the topical outline in diagnostic CT/MRI images. 2. Critique CT/MRI images for the presence or absence of anatomy and pathology to decide whether the image is appropriately positioned and diagnostic for radiological assessment. 3. Locate anatomical systems and possible pathology based on background knowledge of typical anatomical locations and identify normal course of system function for appropriate positioning, patient instructions, and CT/MRI imaging. Credits: 2.00

Professional Course (1 credit)

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (1 credit)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Medical Physics Selectives (9 credits)

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors

in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how

energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary

probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 30500 - Basics Of Oncology

Credit Hours: 3.00. This course will introduce the student to the biology of cancer and some basics of oncology. Focus will be placed on what makes cancer different from normal tissues and how those differences can be leveraged for diagnostic and treatment purposes. This course will touch on topics of epidemiology, cancer biology, common therapeutic and diagnostic approaches, and other considerations of cancer care.

Learning Outcomes: 1. Identify the major risk factors of cancer. 2. Understand the difference between cancer and normal tissue. 3. Enumerate the major hallmarks of cancer. 4. Explain the link between cancer biology and diagnostic imaging. 5. Describe how cancer therapies target the hallmarks of cancer. Credits: 3.00

HSCI 67200 - MRI Quality Assurance Internship I

Credit Hours: 3.00. This internship course provides didactic training and practical experience in clinical diagnostic medical physics. Students will spend 3-4 hours per week learning the responsibilities of a medical physicist in MRI quality assurance (QA) such as MRI system performance testing, setting up

weekly MRI QA procedures, analysis of MRI QA data, and annual clinical system evaluations. In Part I students will observe and review the weekly MRI QA tests performed by the MR Technologists on clinical MRI scanners and be involved with data analysis of these tests (image quality assessment, reporting). Annual MRI system performance evaluations of different clinical scanners will be observed and discussed. This includes assessing magnetic field homogeneity, slice position accuracy and slice thickness accuracy, and performance of radio frequency coil tests on the various coils available at different clinical MRI sites in the Indianapolis area. Students will also work as a team with the instructors on a course project to develop and evaluate advanced MR QA methods and procedures. Prerequisites: HSCI 57000. Having documented experience in running an MRI scanner, e.g., having primary operator status on one of the research scanners at Purdue or IU. Level II MRI Safety Training: http://www.indiana.edu/~mri/safety_nonIU/safety.html. Permission of instructor required.

Learning Outcomes: 1. Understand the basic elements and clinical rationale in the QA program for MRI scanners. 2. Understand the significance of frequency and transmitter gain stability, geometric accuracy, slice position accuracy, high contrast resolution, low contrast detectability and artifacts, etc. 3. Understand the requirements for weekly and annual QA tests as required by ACR. Credits: 3.00

HSCI 51600 - Molecular Imaging-Nuclear Medicine

Credit Hours: 2.00. This course is related to molecular imaging by SPECT (single-photon emission computed tomography) and/or PET (positron emission tomography). This course is particularly useful for graduate and senior undergraduate students in the medical physics programs. It has been offered to MP and HP graduate students over the last 4 years (2014 - 2018) as a part of the 3-credit molecular imaging course with magnetic resonance spectroscopy (MRS: 1-credit) taught by Dr. Ulrike Dydak, computed tomography (CT: 1-credit) taught by Dr. Keith Stantz, and nuclear medicine (NM: 1-credit) taught by Dr. Shuang Liu. In the future, it will be expanded the "Nuclear Medicine" section as a 2-credit course on the basis on the previous lectures. This course focuses on recent development in nuclear medicine techniques for noninvasive imaging of brain diseases, cancer, and heart diseases. This course is delivered as 50-min lectures twice a week. Students are expected to spend more time for homework and literature reading.

Learning Outcomes: 1. Understand the basic concept of molecular imaging, techniques for isotope production, and the use of radiolabeled biomolecules (e.g. antibodies and small biomolecules) for diagnosis of brain diseases, cancer and heart diseases, and for target-specific radiotherapy with the receptor-based radiotracers. Credits: 2.00

HSCI 67400 - Radiological Diagnostic Imaging Internship

Credit Hours: 3.00. This internship course provides the student with hands-on experience with clinical imaging equipment, lectures on the fundamental operation of the equipment, and quality assurance/control methods/assessment of this equipment. Students will learn the safety and imaging performance of flat panel digital x-ray system, fluoroscopy, CT scanner, Ultrasound system, and MRI scanner. Lectures will provide fundamental physics and operation of each system, perform quality assurance methods employed by board certified Medical Physics, and subsequent analysis of these methods. This course is to be delivered as a 50-minute lecture, a 150-minute lab, which includes additional time for image analysis (computational lab). The goal of this course is to provide the necessary information as part of CAMPEP/ABR and ACVR. Prerequisite: HSCI 570 Introduction to Medical Imaging.

Learning Outcomes: 1. Communicate results to the faculty in charge, both verbally and in writing through their lab report. 2. Develop procedures that will provide the required measurement. The protocol they implement will require careful consideration and have a physical understanding of the result. 3. Understanding the quality of the measurements and potential procedural errors. 4. Synthesize many forms of information to understand image artifacts, characterize the cause of these artifacts, and a means to remediate them. 5. Resolve problems, requiring research and ultimately improvements in procedure or protocol. Credits: 3.00

BME 51500 - Practical MRI And Applications

Credit Hours: 1.00. This course covers basic theory and practical training for magnetic resonance imaging (MRI). Weekly labs allow students to directly train on an MRI system within the Purdue MRI Facility. Weekly lectures are provided on a broad range of applied and relevant topics, including image formation and contrast, pulse sequence basics, artifacts, advanced sequences, and safety. The course is ideally designed for students who want to make use of MRI to advance their research.

Learning Outcomes: 1. Describe the fundamentals of magnetic resonance imaging. 2. Understand safety concerns associated with operating an MRI system. 3. Demonstrate proficiency in the operation of one of the MRI systems on campus. Credits: 1.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

HSCI 67600 - Radiation Therapy Clinical Competencies I

Credit Hours: 3.00. The course is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue-Indiana University School of Medicine joint CAMPEP accredited program. Students will spend approximately 4 hours in the clinic on a weekly basis for 10 weeks. Prerequisite: HSCI 57200.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology clinic. 2. Perform specific quality assurance tasks with limited supervision. 3. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

HSCI 67700 - Radiation Therapy Clinical Competencies II

Credit Hours: 3.00. This is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue CAMPEP accredited program. Students enrolled in this course will participate in the Radiation Oncology clinic, which will provide similar experiences as junior medical physicists in training. Students will meet with the course instructor prior to spending time in the clinic to be assigned mentors and to arrange schedules. Students will spend approximately 3 hours in the clinic on a weekly basis. Absences/vacations are allowed but must be arranged with approved by the mentor with sufficient notice. Prerequisite: HSCI 67600.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology clinic. 2. Perform quality assurance tasks with limited supervision. 3. Understand the roles of other professionals in the Radiation Oncology clinic. 4. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

Thesis Research (6 credits)

HSCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Independent Topic Research (6 credits)

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

Concentrations

GPA Requirements

Medicinal Chemistry and Molecular Pharmacy, MS

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Concentrations

About the Program

Microelectronics and Semiconductors, MSE or MS

About the Program

Program Requirements

Required Courses (30 credits)

Core Courses (18 credits)

Circuit Design Courses (0 or 9 credits)

ECE 55200 - Introduction To Lasers

Credit Hours: 3.00. An introduction to lasers and laser applications which does not require a knowledge of quantum mechanics as a prerequisite. Topics include: the theory of laser operation; some specific laser systems; nonlinear optics; optical detection; and applications to optical communications, holography, laser-driven fusion, and integrated optics.

Credits: 3.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 68800 - VLSI Testing And Verification

Credit Hours: 3.00. Discusses different aspects of VLSI testing and formal verification of designs. Design and manufacturing defect models are introduced along with test generation and fault simulation algorithms targeting the different fault models. Both combinational and sequential logic testing are covered, and different synthesis for testability schemes such as BIST (Built-In-Self-Test), scan path design, etc., are introduced. Other new and emerging test and verification techniques also are discussed. Offered every third semester. Prerequisite: ECE 55900 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ME 51100 - Heat Transfer In Electronic Systems

Credit Hours: 3.00. This course covers both traditional and

more innovative methods for heat extraction in electronic systems and the effectiveness and applicability of these methods over a wide range of scales. Special emphasis is given to industry-related applications with experts often attending and presenting material as part of class instruction.

Learning Outcomes: 1. Introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practicing engineers. 2. Provide an appreciation for the applications of first principles to electronics cooling and packaging problems in industry. 3. Provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge. Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 57900 - Fourier Methods In Digital Signal Processing

Credit Hours: 3.00. Fundamentals of signal processing associated with Fourier analyzer systems are presented. Emphasis is on amplitude accuracy and frequency resolution properties necessary for reliable experimental methodologies in system identification, spectrum estimation, and correlation analysis. Deterministic, as well as random, data analyses are presented. Students are required to develop algorithms that significantly expand the utility of Fourier analyzer systems.

Credits: 3.00

ME 68100 - Finite And Boundary Element Methods

Credit Hours: 3.00. The solution of problems in mechanical engineering using the generalized numerical techniques; the finite element method and the boundary element method. Topics include reformulation of partial differential equations into appropriate form for each method. The development and implementation of code and solution of problems. Applications include: acoustics, fluid dynamics, heat transfer, design, mechanics and biomechanics. Prerequisite: ME 58100 .

Credits: 3.00

ECE 60420 - Radio Frequency Integrated Circuits

Credit Hours: 3.00. This course aims at analysis and design of CMOS integrated radio frequency (RF), microwave and mm-wave circuits. Various modules of an RF transceiver are discussed including low noise amplifiers, mixers, oscillators, frequency synthesizers and power amplifiers. A term project on design of an RF to mm-wave module is also required.

Learning Outcomes: 1. Know various wireless standards, modulation techniques and CMOS technology. 2. Know matching network, transmission line effects, scattering parameters. 3. Know analysis and design of CMOS low noise amplifiers from RF to mm-wave frequencies. Credits: 3.00

ME 54100 - Engineering Design: A Decision-Based Perspective

Credit Hours: 3.00. Multi-objective decision making under risk and uncertainty; Group decision making; Sequential decision making; Model-based and data-driven decision making; Heuristics and biases in design decision making. Applications to engineering design including estimation of customer preferences, simulation-based design, and sustainable design.

Learning Outcomes: 1. Formulate design decisions under risk and uncertainty. 2. Apply multi-attribute utility theory to make decisions in engineering design. 3. Evaluate the assumptions and limitations of commonly used decision-making methods. 4. Identify heuristics and biases in design decision making. 5. Adopt an interdisciplinary approach to design across

engineering economics and social sciences. Credits: 3.00

ECE 60422 - Primer On RF Design

Credit Hours: 1.00. This course covers the fundamentals of RF design. It is designed as a first course for students or engineers with limited background in high-frequency electronics. Engineers that need to understand the 'RF language' and gain working knowledge of critical RF concepts will benefit from taking this course. Students in this class will learn the basic RF tools and design principles. By the end of this class students will be able to understand important RF concepts and how these are related to the design of practical RF blocks.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF systems and modules. 2. Use common tools and techniques in the RF design space. Credits: 1.00

ECE 60423 - RF System Design

Credit Hours: 1.00. Following the 'Primer on RF Design' course, this class focuses on system-level issues. We discuss several important design considerations including noise, non-linearity, distortion, sensitivity and dynamic range and their impact in selecting the appropriate system architecture. The course also covers common receiver architectures including superheterodyne and direct-conversion receivers.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF modules and transceivers. 2. Describe and articulate common transceiver architectures. 3. Use tools and analysis techniques to estimate the impact of non-linear effects, noise and interferences on transceivers. Credits: 1.00

ECE 51216 - Digital Systems Design Automation

Credit Hours: 3.00. This course will provide an introduction to the tools used to design and analyze circuits at the logic level of abstraction (where circuits are composed of gates and flip-flops). Most digital chips used in computing and electronic systems (including microprocessors, graphics processors, chips used in network routers, cell phones, digital audio/video appliances, automotive electronics) are entirely or largely designed using EDA tools. This course will focus on the foundations of logic-level EDA tools, including the design of exact and heuristic algorithms that form the basis for VLSI Computer-Aided Design. Topics covered include an overview of the IC design flow and levels of abstraction, synthesis of two-level (AND-OR / PLA) circuits, multi-level logic synthesis and technology mapping, sequential circuit synthesis, Logic-level verification using Boolean Satisfiability and BDDs, Timing Analysis, Power analysis and Reduction, and design techniques for emerging nanoscale technologies.

Learning Outcomes: 1. Design minimal combinational logic circuits. 2. Design minimal finite-state machines. Credits: 3.00

Devices and Manufacturing Courses (0 or 9 credits)

ECE 52600 - Fundamentals Of MEMS And Micro-Integrated Systems

Credit Hours: 3.00. (BME 58100) Key topics in micro-electro-mechanical systems (MEMS) and biological micro-integrated systems; properties of materials for MEMS; microelectronic process modules for design and fabrication. Students will prepare a project report on the design of a biomedical MEMS-based micro-integrated system. Offered in alternate years. Permission of department required.

Credits: 3.00

ECE 55700 - Integrated Circuit Fabrication Laboratory

Credit Hours: 3.00. Laboratory exercises in the fabrication and testing of silicon integrated circuits. Both bipolar and MOS integrated circuit test chips are fabricated and tested. Laboratory technique, the technology of integrated circuit fabrication, and electrical characterization are emphasized. Permission of department required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

MSE 51000 - Microstructural Characterization Techniques

Credit Hours: 3.00. A broad variety of analytical tools will be presented. The intent is to allow the student to make an educated selection of characterization techniques, or critical analysis of published data, for materials and defect analysis. The techniques will be assessed in terms of the probe type and material response, of what device and specimen requirements are typical, and of what data can or cannot be derived from each type of analysis.

Credits: 3.00

MSE 53000 - Materials Processing In Manufacturing

Credit Hours: 3.00. Examination of the production/synthesis of engineering materials and the subsequent processing steps required to obtain a desired shape and microstructure. The course covers four major categories of materials processing: primary processing or materials synthesis, solidification processing, deformation processing, and powder processing, and provides specific examples from the processing of polymers, metals, and ceramics. The goal is to connect fundamental principles of materials processing to manufacturing processes. Credit will not be given for both MSE 5300 and MSE 36700 .

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 68100 - Finite And Boundary Element Methods

Credit Hours: 3.00. The solution of problems in mechanical engineering using the generalized numerical techniques; the finite element method and the boundary element method. Topics include reformulation of partial differential equations into appropriate form for each method. The development and implementation of code and solution of problems. Applications include: acoustics, fluid dynamics, heat transfer, design, mechanics and biomechanics. Prerequisite: ME 58100 .

Credits: 3.00

MSE 60000 - Materials Engineering Fundamentals

Credit Hours: 3.00. Fundamental relationships between the internal structure, properties and processing in all classes of engineering materials. Comprehensive coverage spanning physical, chemical, thermal, mechanical, electrical, magnetic, and optical responses. The course is intended for materials researchers from all backgrounds, as well as engineers working in product design, development and manufacturing who seek a deeper understanding of the full spectrum of engineering materials.

Learning Outcomes: 1. Perform calculations to quantify material properties and microstructural characteristics. Example: Calculate the interplanar spacing of a family of atomic planes given a x-ray diffraction pattern. 2. Recognize the effect of composition and microstructure on material properties. Example: The effect of dislocation density on yield strength and electrical conductivity. 3. Take information from a known situation and apply it to a new situation. Example: Effect of temperature and applied stress on the peak positions in a XRD pattern. 4. Predict property response or microstructural changes based on imposed conditions. Example: Effects of temperature and alloying on the resistivity of metals. 5. Assess the interplay of two or more material properties.

Example: Assess the effect of atomic bond strength on Young's modulus, coefficient of thermal expansion and melting temperature. Credits: 3.00

ME 54100 - Engineering Design: A Decision-Based Perspective

Credit Hours: 3.00. Multi-objective decision making under risk and uncertainty; Group decision making; Sequential decision making; Model-based and data-driven decision making; Heuristics and biases in design decision making. Applications to engineering design including estimation of customer preferences, simulation-based design, and sustainable design.

Learning Outcomes: 1. Formulate design decisions under risk and uncertainty. 2. Apply multi-attribute utility theory to make decisions in engineering design. 3. Evaluate the assumptions and limitations of commonly used decision-making methods. 4. Identify heuristics and biases in design decision making. 5. Adopt an interdisciplinary approach to design across engineering economics and social sciences. Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance and the two Landauer formulas. Credits: 1.00

ECE 50632 - Introduction To Quantum Transport

Credit Hours: 1.00. This course introduces the Schrödinger equation, uses the tight-binding method to discuss the concept of bandstructure and E(k) relations, along with simple quantum transport problems. No prior background in quantum mechanics or statistical mechanics is assumed.

Learning Outcomes: 1. Explain tight-binding model, reciprocal lattice and evaluate dispersion relation. 2. Explain NEGF equations, dephasing, quantum point contact and evaluate quantities like the transmission, the self-energy and spectral functions. 3. Use Pauli spin matrices and evaluate quantities like spin density. Credits: 1.00

ECE 50633 - Boltzmann Law: Physics To Computing

Credit Hours: 1.00. This course introduces the key concepts of equilibrium statistical mechanics leading to the celebrated Boltzmann law and how it leads to Boltzmann machines and related concepts in modern machine learning. No prior background in statistical mechanics is assumed.

Learning Outcomes: 1. Explain the law of equilibrium and entropy. 2. Understand the operation of Boltzmann machines. 3. Understand the operation of quantum circuits. Credits: 1.00

MSE 51800 - Failure Analysis

Credit Hours: 3.00. Introduction to failure analysis and prevention. Concepts of materials failure, root cause analysis, manufacturing aspects of failure, techniques for identifying failure, fracture, corrosion, wear, and case studies. Also includes business and entrepreneurship aspects.

Learning Outcomes: 1. Become familiar with and be able to identify the categories of failure. 2. Recognize types of failure based on microstructural and post-mortem characterization 3. Relate failure to stressors driving failure (mechanical, thermal, electrical, etc.) 4. Communicate results of a failure analysis clearly to professional audiences 5. Estimate stressors driving failure in relationship to materials properties, service conditions, and design constraints. 6. Use or select appropriate characterization tools for failure analysis. 7. Select appropriate inspection criteria to prevent failure. 8. Recommend improvements in

design, service or inspection to prevent failure. Credits: 3.00

Supply Chain Management Courses (0 or 9 credits)

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

MGMT 56900 - Ethical And Sustainable Supply Chain Management

Credit Hours: 2.00 or 3.00. This course provides students with knowledge and skills for building and analyzing ethical and sustainable practices in supply chains, taking a holistic view of the interaction between businesses, the environment, and society.

Learning Outcomes: 1. Run life-cycle analysis (LCA) and interpret findings. 2. Analyze product and process performance through life-cycle thinking. 3. Understand the Tragedy of the

Commons in the business context and identify the underlying reasons. 4. Assess pros and cons of various solutions to the Tragedy of the Commons problem in business context. 5. Identify and explain various product stewardship practices and their pros and cons. 6. Identify innovative business models, such as Servicizing, based on sustainable use of products and services. 7. Compare and contrast traditional supply chain with closed-loop supply chain. 8. Compare and contrast different types of contracts and practices for incentivizing compliance with ethical and sustainable conduct throughout the supply chain. 9. Identify and analyze opportunities and constraints in building ethical and sustainable supply chains. 10. Compare and contrast alternative ways of complying with environmental and social regulations such as carbon trading. Credits: 2.00 or 3.00

MGMT 56000 - Manufacturing Planning And Control

Credit Hours: 2.00 or 3.00. An advanced course in manufacturing planning and control systems, emphasizing the integration of demand forecasting, inventory control, production scheduling, and production control. Topics are linked through case studies and an elaborate manufacturing computer simulation game.

Learning Outcomes: 1. Master the major concepts, techniques and models of process design and analysis, and the ability to apply them to contexts beyond manufacturing. 2. Master the major tools for conformance quality control and performance quality improvement. 3. Understand the trend in manufacturing management and the advanced skills needed. 4. Acquire the analytical capabilities to uncover problems and improvement opportunities in manufacturing management. Credits: 2.00 or 3.00

System Design Courses (0 or 9 credits)

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 68800 - VLSI Testing And Verification

Credit Hours: 3.00. Discusses different aspects of VLSI testing and formal verification of designs. Design and manufacturing defect models are introduced along with test generation and fault simulation algorithms targeting the different fault models. Both combinational and sequential logic testing are covered, and different synthesis for testability schemes such as BIST (Built-In-Self-Test), scan path design, etc., are introduced. Other new and emerging test and verification techniques also are discussed. Offered every third semester. Prerequisite: ECE 55900 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ME 51100 - Heat Transfer In Electronic Systems

Credit Hours: 3.00. This course covers both traditional and more innovative methods for heat extraction in electronic systems and the effectiveness and applicability of these methods over a wide range of scales. Special emphasis is given to industry-related applications with experts often attending and presenting material as part of class instruction.

Learning Outcomes: 1. Introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practicing engineers. 2. Provide an appreciation for the applications of first principles to electronics cooling and packaging problems in industry. 3. Provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge. Credits: 3.00

ME 57900 - Fourier Methods In Digital Signal Processing

Credit Hours: 3.00. Fundamentals of signal processing associated with Fourier analyzer systems are presented. Emphasis is on amplitude accuracy and frequency resolution properties necessary for reliable experimental methodologies in system identification, spectrum estimation, and correlation analysis. Deterministic, as well as random, data analyses are presented. Students are required to develop algorithms that significantly expand the utility of Fourier analyzer systems.

Credits: 3.00

ME 68100 - Finite And Boundary Element Methods

Credit Hours: 3.00. The solution of problems in mechanical engineering using the generalized numerical techniques; the finite element method and the boundary element method. Topics include reformulation of partial differential equations into appropriate form for each method. The development and implementation of code and solution of problems. Applications include: acoustics, fluid dynamics, heat transfer, design, mechanics and biomechanics. Prerequisite: ME 58100 .

Credits: 3.00

ME 54100 - Engineering Design: A Decision-Based Perspective

Credit Hours: 3.00. Multi-objective decision making under risk and uncertainty; Group decision making; Sequential decision making; Model-based and data-driven decision making; Heuristics and biases in design decision making. Applications to engineering design including estimation of customer preferences, simulation-based design, and sustainable design.

Learning Outcomes: 1. Formulate design decisions under risk and uncertainty. 2. Apply multi-attribute utility theory to make decisions in engineering design. 3. Evaluate the assumptions and limitations of commonly used decision-making methods. 4. Identify heuristics and biases in design decision making. 5. Adopt an interdisciplinary approach to design across engineering economics and social sciences. Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of

modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance and the two Landauer formulas. Credits: 1.00

ECE 51220 - Applied Algorithms

Credit Hours: 3.00. Solving large-scale problems typically rely on many clever data structures and algorithms. This course aims to cover many such useful algorithms for solving large-scale problems. These algorithms include greedy algorithms, dynamic programming and more advanced graph algorithms. The course also aims to demonstrate how such algorithms can be applied to solve optimization problems encountered in engineering applications. In particular, applications in the design of VLSI (very large scale integration) at circuit, layout, or system level will be used to demonstrate how an engineering problem can be formulated as a tree/graph problem and solved using established tree/graph algorithms.

Learning Outcomes: 1. Demonstrate an understanding of greedy algorithms and dynamic programming (ABET outcome 1). 2. Demonstrate an n understanding of advanced graph algorithms (ABET outcome 1). 3. Demonstrate an ability to design and implement appropriate data structures and algorithms for engineering applications (ABET outcomes 1 and 2). Credits: 3.00

ECE 51216 - Digital Systems Design Automation

Credit Hours: 3.00. This course will provide an introduction to the tools used to design and analyze circuits at the logic level of abstraction (where circuits are composed of gates and flip-flops). Most digital chips used in computing and electronic systems (including microprocessors, graphics processors, chips used in network routers, cell phones, digital audio/video appliances, automotive electronics) are entirely or largely designed using EDA tools. This course will focus on the foundations of logic-level EDA tools, including the design of exact and heuristic algorithms that form the basis for VLSI Computer-Aided Design. Topics covered include an overview of the IC design flow and levels of abstraction, synthesis of two-level (AND-OR / PLA) circuits, multi-level logic synthesis and technology mapping, sequential circuit synthesis, Logic-level verification using Boolean Satisfiability and BDDs, Timing Analysis, Power analysis and Reduction, and design techniques for emerging nanoscale technologies.

Learning Outcomes: 1. Design minimal combinational logic circuits. 2. Design minimal finite-state machines. Credits: 3.00

SYS 52000 - Systems Engineering Processes And Professional Competencies

Credit Hours: 3.00. This course covers life cycle processes performed by system engineers and soft skills essential to being a successful system engineer. Topics include systems engineering technical processes, technical management processes, organizational strategies and operations supporting system development, tailoring of processes to industry sectors and domains, cross-cutting systems engineering methods, specialty engineering, systems engineering competencies, and relevant soft skills. Permission of instructor required.

Learning Outcomes: 1. Identify the organization, content, and key principles of the INCOSE Systems Engineering Handbook. 2. Critique primary literature on systems engineering practices and competencies and apply these concepts to the practice of systems engineering. 3. Synthesize systems engineering life cycle processes and competencies to create tailored applications of the concepts for an industry or organization. 4. Identify key components of INCOSE systems engineering certification and create a certification application. 5. Create a professional development plan through self-assessment of systems engineering professional competencies. Credits: 3.00

Electives (12 credits)

GPA Requirements

Neuroscience and Behavior, MS

About the Program

Program Requirements

Required Courses (46 credits)

Statistics Courses (6 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for

regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Ethics Course (3 credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

PSY 58100 - Neuroethics

Credit Hours: 3.00. Neuroscience research has led to a better understanding of the neuronal basis of behavior. The knowledge, together with new technological approaches that can predict and even control some aspects of human behavior, can have a major impact on social and legal policies. The course explores ethical, social, and legal implications of the use of new technological and pharmacological advances in brain research. Permission of department required.

Learning Outcomes: 1. Learn some of the technology and pharmocology that is currently used to study/manipulate the human mind and behavior. 2. Critically evaluate ethical arguments/dilemmas surrounding the use of such scientific advances. 3. Research in depth a real-world topic in Neuroethics that may have social and/or legal implications at the present time. Credits: 3.00

Seminar Course (12 credits)

PSY 69600 - Seminar In Neuroscience

Credit Hours: 2.00. The course is designed to expose graduate students to diverse areas of most up-to-date research and hone their skills in understanding conceptual issues and tools used to study neuroscience. The students help host speakers and introduce speakers before their colloquium talk. The students will also formally present their own research to the area faculty and students once each year, at a level appropriate to their

years in the program. Lastly, each student will write a "journal club" style paper on a recently published empirical study. Permission of instructor required.

Learning Outcomes: 1. Present own research to a broad audience. 2. Evaluate and provide constructive feedback of peer's oral presentations. 3. Comprehend, summarize, and lead a discussion on current research. 4. Network and meet with external speakers and eloquently articulate your research interests.

Credits: 2.00

Methods Courses (6 credits)

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

PSY 60300 - Psychopharmacology

Credit Hours: 3.00. This course will cover core pharmacology concepts and principles, such as neurotransmitters, receptors, drug classes, and mechanisms of drug action, while highlighting recent findings related to pharmacogenetics and sex/gender differences in psychopharmacology. There will also be a primary focus on drug therapy for major psychiatric disorders including addiction, depression, anxiety and schizophrenia. Prerequisites: (BIOL 56200 and PSY 51200) or PSY 61500 or MCMP 57000.

Learning Outcomes: 1. Acquire knowledge about the primary biological systems through which drugs act to produce changes in behavior. 2. Learn basic principles of pharmacokinetics and pharmacodynamics. 3. Learn the primary signs/symptoms of major mental disorders and how these disorders are classified with the DSM. 4. Discuss and differentiate the primary methods currently used to treat mental disorders. 5. Critically evaluate the strengths and weaknesses of primary research papers in psychopharmacology. 6. Explain the use of animal models in psychopharmacology. 7. Explain and discuss the methods used in the "drug discovery pipeline", from target identification to FDA approval and beyond and model the application of new drugs through this pipeline.. 8. Communicate proficient knowledge about a single psychiatric disorder and its pharmacological treatment through oral presentation and writing (white-paper style).

Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data.

Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

PSY 62901 - fMRI Design And Analysis

Credit Hours: 3.00. Introduces students to the design of fMRI experiments and fMRI data analysis. Covered topics include an introduction to MR physics, block designs, rapid-event related designs, data preprocessing, and standard analyses using the general linear model. Advanced analysis techniques such as functional connectivity and multivariate pattern analysis and common pitfalls in design and analysis will also be covered. Prerequisites: Required: Basic knowledge of inferential statistics. Recommended: Familiarity with the general linear mode (GLM) and signal processing. Permission of department required.

Learning Outcomes: 1. Understand how to design fMRI experiments. 2. Perform fMRI analysis. 3. Interpret the results of fMRI data analysis. 4. Understand and avoid pitfalls related to fMRI data analysis. Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

PSY 51300 - Introduction To Computational Cognitive Neuroscience

Credit Hours: 3.00. Computational cognitive neuroscience is a new field of study that lies at the intersection of computational neuroscience and the similar fields of machine learning, neural network theory, connectionism, and artificial intelligence. Like computational neuroscience, computational cognitive neuroscience strives for neurobiological accuracy and like connectionism, a major goal is to account for behavior. Covered topics include feature extraction / optimization, connectionism, computational neuroscience, and computational cognitive neuroscience applications. Permission of department required.

Learning Outcomes: 1. Understand critically existing computational models. 2. Master important computational modeling methods. 3. Implement and simulate computational models. Credits: 3.00

Neuroscience and Behavior Courses (11 credits)

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 61501 - Systems And Behavioral Neuroscience

Credit Hours: 4.00. This course will provide you with a broad introduction to the field of neuroscience and how it can inform our understanding of behavior. First, we will cover neuroanatomy, synaptic communication, and plasticity. Next, we will cover neuroscience research on a range of major topics relevant to behavior: emotion, motivation, attention, learning, decision-making, and social cognition. This course will also provide a brief introduction to a variety of neuroscience research methods that are commonly used in animal and human research (e.g., electroencephalography, magnetic resonance imaging), including tutorials and live demonstrations. Permission of department required.

Learning Outcomes: 1. Know general neural architecture of core systems relevant to behavior. 2. Know behavioral outcomes for each major neural system. 3. Know how brain structure and functioning are studied in animal research. 4. Know how brain structure and functioning are studied in human research. 5. Know how brain functioning undergirds cognition, affect, and social processes. 6. Translate basic neuroscience to clinical and other applied research. Credits: 4.00

PSY 61601 - Neurobiology Of Brain Disorders

Credit Hours: 4.00. This course covers cellular and molecular mechanisms associated with alterations in brain function and human behavior linked to the most common neurological and psychiatric disorders. Students will learn about genetic, pharmacological, and physiological mechanisms related to the etiology, expression, and treatment of brain disorders. Permission of department required.

Learning Outcomes: 1. Acquire knowledge of the molecular and cellular mechanisms and behavioral components of major brain disorders. 2. Acquire knowledge about the methods and models used to study brain disorders with a focus on translation. 3. Demonstrate proficiency in critically evaluating primary literature. 4. Demonstrate in-depth knowledge of the underlying mechanisms and treatments for a specific brain disorder. Credits: 4.00

Selectives (6-xx credits)

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits:

3.00

PSY 51100 - Psychophysics

Credit Hours: 3.00. (ECE 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of instructor required.

Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 60300 - Psychopharmacology

Credit Hours: 3.00. This course will cover core pharmacology concepts and principles, such as neurotransmitters, receptors, drug classes, and mechanisms of drug action, while highlighting recent findings related to pharmacogenetics and sex/gender differences in psychopharmacology. There will also be a primary focus on drug therapy for major psychiatric disorders including addiction, depression, anxiety and schizophrenia. Prerequisites: (BIOL 56200 and PSY 51200) or PSY 61500 or MCMP 57000.

Learning Outcomes: 1. Acquire knowledge about the primary biological systems through which drugs act to produce changes in behavior. 2. Learn basic principles of pharmacokinetics and pharmacodynamics. 3. Learn the primary signs/symptoms of major mental disorders and how these disorders are classified with the DSM. 4. Discuss and differentiate the primary methods currently used to treat mental disorders. 5. Critically evaluate the strengths and weaknesses of primary research papers in psychopharmacology. 6. Explain the use of animal models in psychopharmacology. 7. Explain and discuss the methods used in the "drug discovery pipeline", from target identification to FDA approval and beyond and model the application of new drugs through this pipeline.. 8. Communicate proficient knowledge about a single psychiatric disorder and its pharmacological treatment through oral presentation and writing (white-paper style). Credits: 3.00

PSY 62800 - Perceptual Processes

Credit Hours: 3.00. This course is an advanced introduction to the psychology of perception. The course emphasizes visual and auditory perception, reviewing basic concepts, methodologies, research findings, and theoretical approaches. Theories of direct perception, constructivist perception, and computational vision are discussed in detail.

Credits: 3.00

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 58100 - Neuroethics

Credit Hours: 3.00. Neuroscience research has led to a better understanding of the neuronal basis of behavior. The knowledge, together with new technological approaches that can predict and even control some aspects of human behavior, can have a major impact on social and legal policies. The course explores ethical, social, and legal implications of the use of new technological and pharmacological advances in brain research. Permission of department required.

Learning Outcomes: 1. Learn some of the technology and pharmocology that is currently used to study/manipulate the human mind and behavior. 2. Critically evaluate ethical arguments/dilemmas surrounding the use of such scientific advances. 3. Research in depth a real-world topic in Neuroethics that may have social and/or legal implications at the present time. Credits: 3.00

PSY 51500 - Neuroscience Of Consciousness

Credit Hours: 3.00. How does your brain generate your uniquely subjective experience of the world? Is it possible to identify distinct neurophysiological markers of your awareness of a particular sight, sound, taste, or touch? What is the cortical basis of your sense of being a self with a first-person point of view that is spatiotemporally grounded in a body? How does consciousness relate to attention and working memory? Does consciousness have an adaptive function? Might a person in a coma or a vegetative state still have some form of awareness? Could a computer or a robot ever have what we would consider to be genuine experiences? During the past few decades, these and other questions about the nature of consciousness have been the focus of increasing empirical and theoretical research in neuroscience and other disciplines. The main purpose of the course is to introduce students to this exciting field of inquiry by exposing them to a variety of representative books and articles in the literature. The "backbone" of the course will be Stanislas Dehaene's Consciousness and the brain: Deciphering how the brain codes our thoughts (2014). As we go through the course, we will use each successive chapter in this book as the starting point for a deeper and wider exploration of the given topic(s), bringing into our discussion relevant experimental findings and philosophical perspectives from other investigators. Requirements: Students will take turns guiding discussions and will also write 1-2 page "response papers" to the weekly readings. Permission of department required.

Learning Outcomes: 1. Learn historically relevant and current research - both theoretical and empirical - on the neuroscience of consciousness. 2. Understand theoretical and empirical approaches used to study the neuroscience of consciousness. 3. Gain background knowledge and experience needed to understand and critically evaluate theoretical and empirical research on the neuroscience of consciousness. Credits: 3.00

PSY 62101 - Genes, Brain And Behavior

Credit Hours: 3.00. This course examines how genes regulate development and function of the brain to ultimately influence behavior. Genetics has come to be an important aspect of research in almost every field of Neuroscience and Psychology ranging from neural development to cognitive function and dysfunction. However, many students have not had the opportunity to explore this in their studies to date. Therefore, the goal of this course is to provide students with the background needed to understand and think critically about the genetic components of Neuroscience and behavioral research. Numerous questions will be explored mainly through discussion of research papers. Lectures by the professor will fill in background knowledge needed to understand the readings. The questions explored will include: What are chromosomes and genes? What do they do? How do they do it? How do genes control development of the brain? How are single genes manipulated in animals to study their effects on behavior? How can genes associated with normal or abnormal behavior be identified? What has been learned from gene-behavior studies in animals? in humans? What do these studies tell us about the nature-nurture controversy? In addition to exploring these more traditional aspects of behavioral genetics we will address the three most exciting recent developments. These include the use of transgenic primate models, selective remote control of specific neural circuits using optogenetics and chemogenetics, and epigenetics, which helps explain how environmental factors and behavior itself can change gene activity and how these changes may be transmitted from one generation to the next. Many behaviors could be used to explore the principles these questions address. The readings will be selected from papers that focus on learning & memory and mental illness. However, if students are interested in other behaviors, papers that involve those behaviors and serve our purposes can be substituted. Grading will be based mainly on informal presentations of papers and participation in discussions of these papers. Permission of department required.

Learning Outcomes: 1. Understand historically relevant and current research on how genes influence behavior. 2. Become familiar with approaches used to study how genes influence behavior. 3. Gain background knowledge and experience needed to understand and critically evaluate research on the influence of genes on behavior. Credits: 3.00

Thesis Research (xx credits)

PSY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

GPA Requirements

Nuclear Engineering, MNE

About the Program

Program Requirements

Required Courses (9 credits)

Core Courses (9 credits)

NUCL 50100 - Nuclear Engineering Principles

Credit Hours: 3.00. A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science or engineering. The course is structured in four parts: (1) Nuclear structure and radiation, biological effects and medical applications of radiation. (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality. (3) Nuclear materials and waste. (4) Reactor systems and safety.

Credits: 3.00

NUCL 51000 - Nuclear Reactor Theory I

Credit Hours: 3.00. Methodologies of neutron flux calculations, diffusion and slowing down theory, flux separation, material buckling, resonance absorption, Doppler effect, 2-group and multi-group theories, and reactivity balances for design and operation. Introduction to reactor kinetics, delayed neutrons, point reactor kinetics, transient behavior, load changes, reactivity feedback, and safety implications.

Credits: 3.00

NUCL 55100 - Mass, Momentum, And Energy Transfer In Energy Systems

Credit Hours: 3.00. Formulations for analyzing complicated thermal-hydraulic phenomena in energy systems. Derivation of two-phase flow field equations and constitutive relations. Thermal-hydraulic modeling of nuclear reactor systems. Analyses of nuclear reactor safety related phenomena based on conservation principles.

Credits: 3.00

Technical Electives (15-21 credits)

Project Course (0-6 credits)

GPA Requirements

Nuclear Engineering, MSNE

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (15 credits)

Core Courses (15 credits)

NUCL 50100 - Nuclear Engineering Principles

Credit Hours: 3.00. A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science or engineering. The course is structured in four parts: (1) Nuclear structure and radiation, biological effects and medical applications of radiation. (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality. (3) Nuclear materials and waste. (4) Reactor systems and safety.

Credits: 3.00

NUCL 50400 - Nuclear Engineering Experiments

Credit Hours: 3.00. A laboratory course that, when coupled with NUCL 50100 , produces a sequence that contains both the theoretical and engineering aspects of nuclear engineering. Topics include radiation detection and analysis, neutronics, and nuclear reactor experiments.

Credits: 3.00

NUCL 51000 - Nuclear Reactor Theory I

Credit Hours: 3.00. Methodologies of neutron flux calculations, diffusion and slowing down theory, flux separation, material buckling, resonance absorption, Doppler effect, 2-group and multi-group theories, and reactivity balances for design and

operation. Introduction to reactor kinetics, delayed neutrons, point reactor kinetics, transient behavior, load changes, reactivity feedback, and safety implications.

Credits: 3.00

NUCL 52000 - Radiation Effects And Reactor Materials

Credit Hours: 3.00. Introduction to radiation effects in solids and a survey of nuclear reactor materials. Radiation interaction mechanisms and effects on properties. Reactor material characteristics, selection criteria, testing, and economic considerations.

Credits: 3.00

NUCL 55100 - Mass, Momentum, And Energy Transfer In Energy Systems

Credit Hours: 3.00. Formulations for analyzing complicated thermal-hydraulic phenomena in energy systems. Derivation of two-phase flow field equations and constitutive relations. Thermal-hydraulic modeling of nuclear reactor systems. Analyses of nuclear reactor safety related phenomena based on conservation principles.

Credits: 3.00

Technical Electives (9-15 credits)

Thesis Research (6 credits)

NUCL 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Project Course (0-6 credits)

Concentrations

Additional Information

GPA Requirements

Nursing: Adult Gerontology Primary Care Nurse Practitioner Concentration, MS

About the Program

Program Requirements

Required Courses (47 credits)

Core Courses (32 credits)

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50200 - Pharmacotherapeutics For Advanced Practice Nursing

Credit Hours: 3.00. Course includes pharmacodynamics, pharmacokinetics, and pharmacotherapeutics of broad categories of pharmacologic agents. Students apply these principles and also consider the role of best available evidence and patient preferences as a basis for managing pharmacologic regimens. Students review regulations relevant to prescriptive authority for advanced practice nurses.

Credits: 3.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are

encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 50700 - Physiologic Concepts For Advanced Practice Nursing

Credit Hours: 4.00. Students examine the principles of physiologic function at all levels of organization from cells to organ systems as they affect human function. The course uses homeostasis as a model to account for regulatory and compensatory functions in health. Students develop the necessary theoretical and empirical foundation for subsequent understanding of the diagnosis and management of human responses to disease and non-disease based etiologies.

Credits: 4.00

NUR 51000 - Research And Evidence Based Nursing Practice

Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 51200 - Clinical Applications In Pharmacotherapeutics

Credit Hours: 1.00. This course applies information from NUR 50200 to the care of clients through the use of case studies. Emphasis is placed on incorporating information from pharmacology, physiology, and physical assessment.

Credits: 1.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 53200 - Acute Illness: Adult Health Practice

Credit Hours: 3.00. Examination of pathophysiological alterations and clinical management of acute conditions in adolescents and adults. Students will synthesize knowledge of physiological, psychological, and sociocultural factors in the assessment and management of acute illness. Focus is on the differential diagnosis, clinical management, patient and family education within the context of primary care. Health promotion models, as well as biopsychosocial and cultural theories are integrated throughout the course. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions.

Credits: 3.00

NUR 54200 - Chronic And Commonly Recurring Conditions: Adult Health Practice

Credit Hours: 3.00. Examination of pathophysiological alterations and clinical management of chronic conditions and illnesses in adolescents and adults. Students will synthesize knowledge of physiological, psychological, and sociocultural factors in the assessment and management of chronic conditions. Focus is on the differential diagnosis, clinical management, and patient and family education within the context of primary care. Chronic illness and health promotion models, as well as biopsychosocial and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 67500 - Role Transition And Synthesis

Credit Hours: 2.00. This course provides an integration of core, cognate, and specialty knowledge, with an emphasis on role transition and synthesis. Focuses on internal and external healthcare organizational factors at the local, state, national, and international levels. Seminars explore role issues, licensure, credentialing, finances, legislation, healthcare policy, legal issues, ethics, cultural diversity, evidence-based practice, emerging trends in the management of acute and chronic conditions of adults, and independent and collaborative practice. Prerequisite: NUR 53200 , NUR 53300 . Corequisite: NUR 54200 , NUR 54300 , NUR 59800 .

Credits: 2.00

NUR 67400 - Quality Initiatives, Leadership And Advanced Practice Nursing

Credit Hours: 2.00. This course develops concepts of the guiding principles of quality, system and leadership initiatives in the Nurse Practitioner Role. The students explore principles and techniques of health coaching, interprofessional team work, delegation and prioritization that can be used in various healthcare settings. Potential quality initiatives will be identified and an improvement plan will be developed using various quality initiatives modalities in the healthcare system to improve quality care, safety and patient outcomes. Permission of department required.

Credits: 2.00

Clinical Courses (15 credits)

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 51100 - Health Promotion For Advanced Practice In Nursing

Credit Hours: 2.00 to 3.00. Students analyze health promotion/disease prevention, and health education frameworks combined with best available evidence as a foundation for advanced practice in nursing. Students promote the health of diverse client populations by incorporating the Healthy People goals, clinical practice guidelines, risk assessment, epidemiological data and evidence based screening tools into nursing practice. In collaboration with selected clients and/or families, students implement health coaching/teaching through the integration of family, health promotion and health literacy theories.

Credits: 2.00 to 3.00

NUR 51300 - Health Promotion In Special Populations

Credit Hours: 3.00. Examination of wellness and health promotion issues unique to three special populations: clients in rural areas, women, and adolescents. Legal and ethical issues related to practice with special populations is addressed. Evidence-based standards will be utilized.

Credits: 3.00

NUR 53300 - Acute Illness: Adult Health Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of adolescents and adults with acute conditions and the impact of those conditions on family members. Focus is on assessment, deferential diagnosis, clinical decision making and management, as well as patient and family education within the context of primary care. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions. Professional issues, collaboration and scope of practice, and advocacy are emphasized.

Credits: 3.00

NUR 54300 - Chronic Illness: Adult Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of chronic illness and recurring conditions in adolescents and adults and the impact of those conditions on family members. Focus is on the differential diagnosis, clinical decision making and management, as well as patient and family education within the context of primary care. The adult nurse practitioner role is analyzed in the context of caring for persons with chronic conditions. Professional issues, collaboration, scope of practice and advocacy are emphasized.

Credits: 3.00

Program Learning Outcomes

Nursing: Primary Care Family Nurse Practitioner Concentration, MS

About the Program

Program Requirements

Required Courses (49 credits)

Core Courses (32 credits)

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50200 - Pharmacotherapeutics For Advanced Practice Nursing

Credit Hours: 3.00. Course includes pharmacodynamics, pharmacokinetics, and pharmacotherapeutics of broad categories of pharmacologic agents. Students apply these principles and also consider the role of best available evidence and patient preferences as a basis for managing pharmacologic regimens. Students review regulations relevant to prescriptive authority for advanced practice nurses.

Credits: 3.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 50700 - Physiologic Concepts For Advanced Practice Nursing

Credit Hours: 4.00. Students examine the principles of physiologic function at all levels of organization from cells to organ systems as they affect human function. The course uses homeostasis as a model to account for regulatory and compensatory functions in health. Students develop the necessary theoretical and empirical foundation for subsequent understanding of the diagnosis and management of human responses to disease and non-disease based etiologies.

Credits: 4.00

NUR 51000 - Research And Evidence Based Nursing Practice

Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 67500 - Role Transition And Synthesis

Credit Hours: 2.00. This course provides an integration of core, cognate, and specialty knowledge, with an emphasis on role transition and synthesis. Focuses on internal and external healthcare organizational factors at the local, state, national, and international levels. Seminars explore role issues, licensure, credentialing, finances, legislation, healthcare policy, legal issues, ethics, cultural diversity, evidence-based practice, emerging trends in the management of acute and chronic conditions of adults, and independent and collaborative practice. Prerequisite: NUR 53200 , NUR 53300 . Corequisite: NUR 54200 , NUR 54300 , NUR 59800 .

Credits: 2.00

NUR 51601 - Clinical Applications In Pharmacology Family Nurse Practitioner

Credit Hours: 1.00. This course applies information from Pharmacotherapeutics in primary care (NUR 50200) to the care of infants, children, adolescents and adults through the use of case studies. Emphasis is on incorporating from pharmacology, physiology and physical assessment.

Credits: 1.00

NUR 61100 - Primary Care Of The Young Family

Credit Hours: 3.00. Prepares family nurse practitioner students to assume responsibility for the coordination and delivery of culturally appropriate health services to childbearing and childrearing families. Students apply theory and research to the management of pregnancy, well-child care, stable chronic conditions, and acute episodic illnesses commonly encountered in primary care settings. The course emphasizes a sound conceptual basis for practice and an appreciation for evidence-based care. Students continue to integrate health promotion and health maintenance into the primary care of young families.

Credits: 3.00

NUR 62200 - Primary Care Of The Aging Family

Credit Hours: 3.00. Prepares family nurse practitioner students to assume responsibility for the coordination and delivery of culturally appropriate health services to middle-aged and older families. Students learn to manage stable chronic conditions and acute episodic illnesses commonly encountered in primary care settings. The course emphasizes the conceptual basis for practice and an appreciation for evidence-based care. Students continue to integrate health promotion and health maintenance into the primary care of older clients and their families.

Credits: 3.00

NUR 67400 - Quality Initiatives, Leadership And Advanced Practice Nursing

Credit Hours: 2.00. This course develops concepts of the guiding principles of quality, system and leadership initiatives in the Nurse Practitioner Role. The students explore principles and techniques of health coaching, interprofessional team work, delegation and prioritization that can be used in various healthcare settings. Potential quality initiatives will be identified and an improvement plan will be developed using various quality initiatives modalities in the healthcare system to improve quality care, safety and patient outcomes. Permission of department required.

Credits: 2.00

Clinical Courses (17 credits)

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 51100 - Health Promotion For Advanced Practice In Nursing

Credit Hours: 2.00 to 3.00. Students analyze health promotion/disease prevention, and health education frameworks combined with best available evidence as a foundation for advanced practice in nursing. Students promote the health of diverse client populations by incorporating the Healthy People goals, clinical practice guidelines, risk assessment, epidemiological data and evidence based screening tools into nursing practice. In collaboration with selected clients and/or families, students implement health coaching/teaching through the integration of family, health promotion and health literacy theories.

Credits: 2.00 to 3.00

NUR 51300 - Health Promotion In Special Populations

Credit Hours: 3.00. Examination of wellness and health promotion issues unique to three special populations: clients in rural areas, women, and adolescents. Legal and ethical issues related to practice with special populations is addressed. Evidence-based standards will be utilized.

Credits: 3.00

NUR 61500 - Primary Care Of The Young Family Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of the young family with acute and chronic conditions, and the impact of those conditions on family members. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. The Family Nurse Practitioner role is analyzed in the context of caring for the young family with acute and chronic conditions. Professional issues, collaboration and scope of practice, advocacy are emphasized. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 61100.

Credits: 3.00

NUR 62700 - Primary Care Of The Aging Family Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of the aging family with acute and chronic conditions and the impact of those conditions on family members. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. The Family Nurse Practitioner role is analyzed in the context of caring for the aging family with acute and chronic conditions. Professional issues, collaboration and scope of practice, advocacy are emphasized. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 62200.

Credits: 3.00

NUR 63100 - Family Nurse Practitioner Preceptorship Clinical Synthesis

Credit Hours: 2.00 to 3.00. This course assists students to integrate clinical knowledge and skills from prior course work when providing care to patients across the lifespan. The Family Nurse Practitioner role is analyzed in the context of caring for patients of all ages with acute and chronic conditions. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 61100 and NUR 61500 and NUR 62200 and NUR 62700.

Credits: 2.00 to 3.00

Program Learning Outcomes

Nursing: Primary Care Pediatric Nurse Practitioner Concentration, MS

About the Program

Program Requirements

Required Courses (47 credits)

Core Courses (32 credits)

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50200 - Pharmacotherapeutics For Advanced Practice Nursing

Credit Hours: 3.00. Course includes pharmacodynamics, pharmacokinetics, and pharmacotherapeutics of broad categories of pharmacologic agents. Students apply these principles and also consider the role of best available evidence and patient preferences as a basis for managing pharmacologic regimens. Students review regulations relevant to prescriptive authority for advanced practice nurses.

Credits: 3.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 50700 - Physiologic Concepts For Advanced Practice Nursing

Credit Hours: 4.00. Students examine the principles of physiologic function at all levels of organization from cells to

organ systems as they affect human function. The course uses homeostasis as a model to account for regulatory and compensatory functions in health. Students develop the necessary theoretical and empirical foundation for subsequent understanding of the diagnosis and management of human responses to disease and non-disease based etiologies.

Credits: 4.00

NUR 51000 - Research And Evidence Based Nursing Practice

Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 51400 - Clinical Application In Pharmacotherapeutics For Pediatric Nurse Practitioners

Credit Hours: 1.00. Applies information from NUR 50200 , Pharmacotherapeutics in Primary Care, to the care of infants, children, and adolescents through the use of case studies. Emphasis is placed on incorporating information from pharmacology, physiology, and physical assessment.

Credits: 1.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 52800 - Acute Illness: Pediatric Health Practice

Credit Hours: 3.00. A developmentally organized course to provide knowledge and experience to care for acute episodic illnesses of children and adolescents in primary healthcare settings. Examines pathophysiological alterations and clinical management. Students will synthesize knowledge of developmental, physiological, psychological, and sociocultural factors in the assessment and management of acute illness. The focus is on differential diagnosis, clinical management, and child and family education within the context of primary care. Health promotion models, and biopsychosocial, developmental, and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed.

Credits: 3.00

NUR 55200 - Chronic Illness And Commonly Recurring Conditions: Pediatric Health Practice

Credit Hours: 3.00. Examines pathophysiological alterations and clinical management of chronic conditions and illnesses in children and adolescents. Students will synthesize knowledge of developmental, physiological, psychological, and sociocultural factors in the assessment and management of chronic conditions. The focus is on the differential diagnosis, clinical management, and child and family education within the context of primary health care. Chronic illness and health promotion models, as well as biopsychosocial, developmental, and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 67500 - Role Transition And Synthesis

Credit Hours: 2.00. This course provides an integration of core, cognate, and specialty knowledge, with an emphasis on role transition and synthesis. Focuses on internal and external healthcare organizational factors at the local, state, national, and international levels. Seminars explore role issues, licensure, credentialing, finances, legislation, healthcare policy, legal issues, ethics, cultural diversity, evidence-based practice, emerging trends in the management of acute and chronic conditions of adults, and independent and collaborative practice. Prerequisite: NUR 53200 , NUR 53300 . Corequisite: NUR 54200 , NUR 54300 , NUR 59800 .

Credits: 2.00

NUR 67400 - Quality Initiatives, Leadership And Advanced Practice Nursing

Credit Hours: 2.00. This course develops concepts of the guiding principles of quality, system and leadership initiatives in the Nurse Practitioner Role. The students explore principles and techniques of health coaching, interprofessional team work, delegation and prioritization that can be used in various healthcare settings. Potential quality initiatives will be identified and an improvement plan will be developed using various

quality initiatives modalities in the healthcare system to improve quality care, safety and patient outcomes. Permission of department required.

Credits: 2.00

Clinical Courses (15 credits)

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 51100 - Health Promotion For Advanced Practice In Nursing

Credit Hours: 2.00 to 3.00. Students analyze health promotion/disease prevention, and health education frameworks combined with best available evidence as a foundation for advanced practice in nursing. Students promote the health of diverse client populations by incorporating the Healthy People goals, clinical practice guidelines, risk assessment, epidemiological data and evidence based screening tools into nursing practice. In collaboration with selected clients and/or families, students implement health coaching/teaching through the integration of family, health promotion and health literacy theories.

Credits: 2.00 to 3.00

NUR 51500 - Health Promotion In Pediatric Populations

Credit Hours: 3.00. Examines wellness and health promotion issues unique to children from birth through adolescence. Concepts of growth and development are integrated into health promotion activities. Legal and ethical issues related to practice with children and adolescents are addressed. Evidence-based practice standards will be utilized.

Credits: 3.00

NUR 52900 - Acute Illness: Pediatric Health Preceptorship

Credit Hours: 3.00. Assists students to develop and broaden clinical judgment and skills. Content includes the study of primary health care of children and adolescents with acute conditions and the impact of those conditions on family members. The focus is on growth and development, assessment, differential diagnosis, clinical decision making, management, and patient and family education within the context of primary care. Professional issues, collaboration and scope of practice, and advocacy are emphasized. Clinical seminars focus on variations of child health in the context of health promotion and advanced assessment.

Credits: 3.00

NUR 55300 - Chronic Illness And Commonly Recurring Conditions: Pediatric Health Preceptorship

Credit Hours: 3.00. Assists students to develop and broaden clinical judgment and skills. Content includes the study of chronic illness and recurring conditions in children and adolescents and the impact of those conditions on family members. The focus is on growth and development, differential diagnosis, clinical decision making and management, and child and family education within the context of primary care. The pediatric nurse practitioner role is analyzed in the context of caring for children with chronic conditions. Professional issues, collaboration, scope of practice, and advocacy are emphasized.

Credits: 3.00

Program Learning Outcomes

Nursing: Psychiatric Mental Health Nurse Practitioner Concentration, MS

About the Program

Program Requirements

Required Courses (49 credits)

Core Courses (35 credits)

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept

analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50200 - Pharmacotherapeutics For Advanced Practice Nursing

Credit Hours: 3.00. Course includes pharmacodynamics, pharmacokinetics, and pharmacotherapeutics of broad categories of pharmacologic agents. Students apply these principles and also consider the role of best available evidence and patient preferences as a basis for managing pharmacologic regimens. Students review regulations relevant to prescriptive authority for advanced practice nurses.

Credits: 3.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 50700 - Physiologic Concepts For Advanced Practice Nursing

Credit Hours: 4.00. Students examine the principles of physiologic function at all levels of organization from cells to organ systems as they affect human function. The course uses homeostasis as a model to account for regulatory and compensatory functions in health. Students develop the necessary theoretical and empirical foundation for subsequent understanding of the diagnosis and management of human responses to disease and non-disease based etiologies.

Credits: 4.00

NUR 51000 - Research And Evidence Based Nursing Practice

Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 67500 - Role Transition And Synthesis

Credit Hours: 2.00. This course provides an integration of core, cognate, and specialty knowledge, with an emphasis on role transition and synthesis. Focuses on internal and external healthcare organizational factors at the local, state, national, and international levels. Seminars explore role issues, licensure, credentialing, finances, legislation, healthcare policy, legal issues, ethics, cultural diversity, evidence-based practice, emerging trends in the management of acute and chronic conditions of adults, and independent and collaborative practice. Prerequisite: NUR 53200 , NUR 53300 . Corequisite: NUR 54200 , NUR 54300 , NUR 59800 .

Credits: 2.00

NUR 52200 - Psychopharmacology Across The Lifespan

Credit Hours: 2.00. Signs and symptoms of all major psychiatric disorders and the medications used to treat them across the life-span are discussed. Classes of psychiatric medications are considered; including indications, therapeutic uses, neurophysiological mechanism of action and side effects.

Credits: 2.00

NUR 53800 - Psychiatric Mental Health Nurse Practitioner Roles And Psychotherapeutic Framework And Modalities

Credit Hours: 2.00. Scope and standards of practice for psychiatric mental health advanced practice nursing is set forth in this course. Content includes Psychiatric Mental Health Nurse Practitioner (PMHNP) functioning based on the state practice act as well as additional functions of the PMHNP including providing integrative therapy interventions, community interventions, case management, consultation and liaison services, clinical supervision, and policy development. Students will explore principles of evidence-based psychotherapy interventions including individual and group therapy, family and play therapy, and demonstrate competency in two forms of psychotherapeutic interventions.

Credits: 2.00

NUR 54400 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan

Credit Hours: 3.00. Evidence-based treatment methods including principals of psychopharmacology and psychotherapeutic modalities across the life span are examined, evaluated and implemented in clinical practice. Factors, such as culture, neurobiology, developmental level and gender that impact disease expression, therapeutic approaches and treatment response are explored. Mental health assessment including standardized psychiatric assessment tools, including Mental Status Exam, Mood Disorder Questionnaire, Patient Health Questionnaire (PHQ-9), Columbia-Suicide Severity Rating Scale (C-SSRS), DSM V and ICD is presented. In addition, developmental and functional level, and cultural influences are included. Substance use assessment skills and substance use interventions will be examined including how substance use impacts psychiatric symptom expression and response to treatment. Legal and ethical implications of care will be discussed.

Credits: 3.00

NUR 57600 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan II

Credit Hours: 3.00. The practice of Psychiatric Mental Health Nurse Practitioner (PMHNP) is further expanded to include identification and management of the complex patient across the life span. Explore how co-morbid health conditions impact psychiatric disorders and treatment response. Differentiate psychiatric diagnoses, personality disorders, social, family and cultural influences, developmental disorders and how these factors impact treatment. Apply a variety of approaches including inter-and intra-professional resources, and psychopharmacological interventions to the management of complex patients. Legal and ethical implications of care are discussed.

Credits: 3.00

NUR 67400 - Quality Initiatives, Leadership And Advanced Practice Nursing

Credit Hours: 2.00. This course develops concepts of the guiding principles of quality, system and leadership initiatives in the Nurse Practitioner Role. The students explore principles and techniques of health coaching, interprofessional team work, delegation and prioritization that can be used in various healthcare settings. Potential quality initiatives will be identified and an improvement plan will be developed using various quality initiatives modalities in the healthcare system to improve quality care, safety and patient outcomes. Permission of department required.

Credits: 2.00

Clinical Courses (15 credits)

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 51100 - Health Promotion For Advanced Practice In Nursing

Credit Hours: 2.00 to 3.00. Students analyze health promotion/disease prevention, and health education frameworks combined with best available evidence as a foundation for advanced practice in nursing. Students promote the health of diverse client populations by incorporating the Healthy People goals, clinical practice guidelines, risk assessment, epidemiological data and evidence based screening tools into nursing practice. In collaboration with selected clients and/or families, students implement health coaching/teaching through the integration of family, health promotion and health literacy theories.

Credits: 2.00 to 3.00

NUR 53900 - Psychiatric Mental Health Nurse Practitioner Roles And Therapeutic Modalities Preceptorship

Credit Hours: 2.00. Psychotherapeutic frameworks and modalities are analyzed within the role of the PMHNP. Students participate in the application of individual and group psychotherapeutic interventions in a clinical setting by a PMHNP or therapist/clinical social worker.

Credits: 2.00

NUR 54500 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan I Preceptorship

Credit Hours: 3.00. Students engage in the PMHNP role in a clinical setting under the supervision of a Psychiatric Mental Health Nurse Practitioner (PMHNP) or MD. Students implement and evaluate mental health assessment skills, evidenced based treatment interventions and evaluate effectiveness integrating principals of neurobiology, culture, developmental and functional abilities.

Credits: 3.00

NUR 57700 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan II Preceptorship

Credit Hours: 3.00. Students engage in the Psychiatric Mental Health Nurse Practitioner (PMHNP) role in a clinical setting under the supervision of a PMHNP or Medical Doctor. Students continue to develop and broaden clinical judgment, psychiatric assessment skills, and evidenced-based treatment interventions while considering cultural influences, and developmental and functional abilities. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of mental health.

Credits: 3.00

Program Learning Outcomes

Nutrition and Dietetics, MSD

About the Program

Program Requirements

Required Courses (18 credits)

NUTR 52100 - Advanced Medical Nutrition Therapy

Credit Hours: 3.00. Application of the Nutrition Care Process in various disease states and conditions to prepare students for supervised practice.

Credits: 3.00

NUTR 51200 - Dietary Supplements

Credit Hours: 2.00. Provides advanced training to evaluate concepts and issues of dietary supplement use in various populations. Students develop critical thinking skills through activities such as case studies to make appropriate recommendations for nutrition supplementation.

Credits: 2.00

NUTR 51100 - Applied Nutrition Counseling

Credit Hours: 3.00. Field experience in one-on-one nutrition counseling that requires application of prior learning of theory, knowledge and skills.

Credits: 3.00

NUTR 53100 - Ethical Practice And Professionalism In Dietetics

Credit Hours: 1.00. Evaluation of concepts and issues of ethical practice in the dietetics profession and the application of the Scope/ Standards of Practice for Nutrition and Dietetics Practitioners and the Code of Ethics for the Nutrition and Dietetics Profession. Permission of department required.

Credits: 1.00

NUTR 52300 - Trends In Nutrition & Dietetics

Credit Hours: 2.00. Analysis and discussion of current trends in dietetics practice and nutrition including such topics as nutrigenomics, informatics, sustainability, agricultural practices, food policies, and global health. Permission of department required.

Credits: 2.00

NUTR 54400 - Advanced Medical Nutrition Therapy For Special Populations

Credit Hours: 1.00. Application of Medical Nutrition Therapy for special populations including enhanced skills for the practice of dietetics. Lectures and laboratory activities supplement training in various diagnoses and conditions not routinely encountered during supervised practice experiences in NUTR 54300 Medical Nutrition Therapy Experience. Permission of department required.

Learning Outcomes: 1. Apply evidence-based guidelines, systematic reviews and scientific literature. 2. Evaluate emerging research for application in nutrition and dietetics practice. 3. Incorporate critical-thinking skills in overall practice. 4. Practice in compliance with current federal regulations and state statutes and rules, as applicable, and in accordance with accreditation standards and the Scope of Nutrition and Dietetics Practice and Code of Ethics for the Profession of Nutrition and Dietetics. 5. Function as a member of

interprofessional teams. 6. Perform the Nutrition Care Process and use standardized nutrition language for individuals, groups and populations of differing ages and health status, in a variety of settings. 7. Practice routine health screening assessments, including measuring blood pressure and conducting waived point-of-care laboratory testing (such as blood glucose or cholesterol). 8. Perform routing health screening assessments including measuring blood pressure, conducting waived point of care laboratory testing (such as blood glucose or cholesterol), initiating pharmacotherapy plans (such as insulin management), and administering vaccine injections (such as flu shots). 9. Provide instruction for self-monitoring blood glucose, insulin administration and adjusting diabetes medication. 10. Insert nasogastric or nasoenteric feeding tubes. 11. Initiate and conduct bedside swallow screenings. Credits: 1.00

NUTR 51600 - Eating Disorders And Healthy Weight Management

Credit Hours: 3.00. An evidence-based, application-focused exploration of the continuum of healthy eating to eating disorders and the factors that influence body weight. This includes review of each eating disorder diagnosis from an interdisciplinary perspective with emphasis on the role of the registered dietitian nutritionist in prevention, identification, treatment, and recovery.

Learning Outcomes: 1. Describe the prevalence of and relevant biological, environmental, social, and psychological factors associated with the development of overweight, obesity, and eating disorders. 2. Identify the diagnostic characteristics of and understand tailored treatment interventions for anorexia nervosa, bulimia nervosa, binge eating disorder and avoidant/restrictive feeding intake disorder, as well as discuss other specified feeding and eating disorders presentation and treatment. 3. Appreciate the role of the interdisciplinary support/treatment team and various levels of care in eating disorder support and treatment while developing knowledge and aptitude in a range of nutrition therapy interventions. 4. Identify the benefits, potential risks, appropriate target population(s), and medical nutrition therapy components of diet-based, medication-based, and surgical weight management interventions. 5. Understand and be able to apply mindful and intuitive eating and health at every size approach in patient/client care as a method of preventing disordered eating, weight stigma, and body negativity and to support wellbeing and recovery. Credits: 3.00

NUTR 51500 - Nutrition Pathophysiology

Credit Hours: 2.00. A review of the underlying nutritional components and pathophysiology of common human diseases/disorders and current approaches for the prevention, management, and treatment of nutrition-related diseases. Building upon previous coursework in micronutrient and macronutrient metabolism, the focus is on the metabolic disturbances occurring with diseases such as diabetes, GI diseases, obesity kidney diseases, cardiovascular disease, and anemia.

Learning Outcomes: 1. Explain the underlying nutritional aspects of several common diseases. 2. Use current information technologies to locate and apply evidence-based guidelines and protocols. 3. Use principles of pathophysiology to explain the nutritional aspects of diseases, identify nutrition-related problems and determine and evaluate nutrition interventions; this will include the integration of multiple disciplines (e.g., biochemistry, genetics, microbiology, pharmacology, physiology). 4. Have knowledge of prevention theories and guidelines for nutrition-related diseases. Credits: 2.00

NUTR 53500 - Leadership In Dietetics

Credit Hours: 1.00. Evaluation of concepts and development of skills relevant to leadership in dietetics including staff development, budgeting, strategic planning, quality

improvement, regulatory compliance and embracing human diversity.

Learning Outcomes: 1. Apply change management strategies to achieve desired outcomes. 2. Apply management theories to the development of programs or services. 3. Evaluate a budget/financial management plan and interpret financial data. 4. Demonstrate an understanding of the regulation system related to billing and coding, what services are reimbursable by third party payers and how reimbursement may be obtained. 5. Apply the principles of human resource management to different situations. 6. Evaluate data to be used in decision-making for continuous quality improvement. 7. Analyze quality, financial and productivity data for use in planning. 8. Practice resolving differences or dealing with conflicts. 9. Promote team involvement and recognize the skills of each member. Credits: 1.00

Supervised Practice Internship (14 credits)

NUTR 53900 - Foodservice Systems Management Experience

Credit Hours: 4.00. Application of previous knowledge and communication skills in foodservice facilities. Student's performance will ultimately include responsibilities equivalent to staff relief. Must have ServSafe Certification (manager level) prior to enrollment.

Credits: 4.00

NUTR 54300 - Medical Nutrition Therapy Experience

Credit Hours: 4.00. Application of previous knowledge and communication skills of medical nutrition therapy in the hospital/patient care setting to ultimately include responsibilities equivalent to staff relief.

Credits: 4.00

NUTR 54200 - Engagement Experience

Credit Hours: 3.00. Application of previously acquired knowledge and communication skills in a culminating supervised practice experience in one of seven engagement tracks. Placements at professional sites incorporate individual student's preferred track in foodservice, industry, nutrition-fitness-wellness-energy balance, community/public health, long-term care, medical nutrition therapy or research. Students complete a major project demonstrating readiness to practice as an entry-level dietitian.

Credits: 3.00

NUTR 53300 - Community Nutrition Experience

Credit Hours: 3.00. Application of previous knowledge and communication skills in nutrition of community settings, such as school nutrition, health facilities, and federal or state nutrition programs.

Credits: 3.00

GPA Requirements

About the Program

Nutrition, MS

About the Program

Program Requirements

Required Courses (15 credits)

NUTR 60500 - Nutritional Biochemistry And Physiology I

Credit Hours: 4.00. (ANSC 62500) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing interactions in bone and gut metabolism and physiology. Permission of instructor required.

Credits: 4.00

NUTR 60600 - Nutritional Biochemistry And Physiology II

Credit Hours: 2.00. (ANSC 62600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules, emphasizing integrative metabolism in liver, muscle and adipose tissues. Offered weeks 1 - 8. Prerequisite: NUTR 60500.

Credits: 2.00

NUTR 60700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (ANSC 62700) Integration of biochemical and physiological functions of nutrients in humans and animals,

emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9 - 16. Prerequisite: NUTR 60600.

Credits: 2.00

NUTR 69400 - Introductory Presentation Skills In Nutrition Science

Credit Hours: 1.00. Introductory training and application of concepts for effective communication through oral and poster presentations in the field of nutrition science.

Credits: 1.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

NUTR 62600 - Advanced Presentation Skills

Credit Hours: 1.00. This course will teach graduate students how to synthesize information from multiple scientific studies and then communicate that information effectively to others in the form of a 40 minute long scientific seminar. The course is designed to provide students with clear guidelines for effective long-form oral communication of scientific information and then give students an opportunity to put those guidelines into practice. Prerequisites: Graduate standing past the first year. NUTR 69400 or equivalent course (determined by instructor review). For PhD students; INP Scientific Writing Course NUTR 62700. For MS students; a statement from the research mentor that the student has a clear thesis topic, that the student has completed the majority of work on the thesis, and that the student has conducted background reading on the thesis topic.

Credits: 1.00

Specialty Area Courses (2-xx credits)

Animal Health, Growth, and Development

Biochemical and Molecular Nutrition

Human and Clinical Nutrition

Population Nutrition and Health Promotion

Thesis Research (xx credits)

NUTR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Concentrations

Occupational and Environmental Health Sciences, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (29 or 38 credits)

Core Courses (27 or 36 credits)

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation,

recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment.

Credits: 3.00

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system.

Credits: 4.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models

of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 55100 - Physical Agents In Environmental Health

Credit Hours: 3.00. Physical characterization and biological interactions of non-ionizing radiation with emphasis on the adverse effects of human exposure. Topics include source characterization, environmental exposure assessment, measurement instrumentation, toxicological and epidemiological findings, control strategies.

Credits: 3.00

HSCI 55200 - Introduction To Aerosol Science

Credit Hours: 3.00. The principles of aerosol behavior and sampling, with particular emphasis on applications in the health sciences. Topics include aerosol aerodynamics, aerosol filtration, pulmonary deposition of aerosols, methods of environmental sampling, and generation of laboratory aerosols.

Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 58000 - Occupational Biomechanics And Ergonomics

Credit Hours: 2.00. Occupational safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. Occupational ergonomics is a branch of science that focuses on optimizing the relationships between workers and their work environment. This course focuses on the principles and applications of safety and ergonomics as it applies to workers. The first part of the course will consist of lectures on the fundamentals of safety standards and liability and the development of work-related musculoskeletal disorders, ergonomic risk factors including work practices, tools and workstation design. The last part will consist of identification and use of safety and ergonomic controls to reduce and prevent work-related fatalities, injuries, and musculoskeletal disorders.

Learning Outcomes: 1. Describe ergonomic risk factors in the workplace. 2. Analyze work stations and identify ergonomic risk factors. 3. Develop solutions to minimize identified ergonomic risk factors. 4. Describe cumulative trauma disorders which may occur due to exposure to poor ergonomic conditions. 5. Explain how people perceive & understand information, and use this knowledge to improve work flow. Credits: 2.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 55300 - Advanced Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization, protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front line employees. As such, the successful health and safety manager needs to skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the front line employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the front line employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the front line employees and upper management together in their vision of a safe and health workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. Credits: 3.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational

and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 3.00

HSCI 58001 - Occupational Biomechanics And Ergonomics Laboratory

Credit Hours: 1.00. This course will be the laboratory component for HSCI 58000. Occupational Biomechanics and Ergonomics. Laboratory exercises will accompany and illustrate each topic discussed during the lecture course. An ergonomic project will allow the students to evaluate an individual performing a job and provide ergonomic recommendations to improve the work situation. The course will also emphasize report writing, teamwork, and communication skills.

Learning Outcomes: 1. Evaluate scientific literature to identify the strengths & weaknesses of study designs, interpretation of results, and implications for the future. 2. Display techniques for performing ergonomic measurements. 3. Evaluate ergonomic hazards of the workplace and make recommendations to correct the identified hazards. 4. Write professional quality reports summarizing laboratory procedures, clearly display experiment results, and interpret those results in the context of the principles learned in the HSCI 58000 lectures. Credits: 1.00

Professional Course (1 credit)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and

diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (1 credit)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Statistics Selective (3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or

more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply statistical and computational approaches. Credits: 3.00

Electives (0 credits)

HSCI 55100 - Physical Agents In Environmental Health

Credit Hours: 3.00. Physical characterization and biological interactions of non-ionizing radiation with emphasis on the adverse effects of human exposure. Topics include source characterization, environmental exposure assessment, measurement instrumentation, toxicological and epidemiological findings, control strategies.

Credits: 3.00

HSCI 55200 - Introduction To Aerosol Science

Credit Hours: 3.00. The principles of aerosol behavior and sampling, with particular emphasis on applications in the health sciences. Topics include aerosol aerodynamics, aerosol filtration, pulmonary deposition of aerosols, methods of environmental sampling, and generation of laboratory aerosols.

Credits: 3.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

Thesis Research (15 credits)

HSCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Project Course (6 credits)

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 69000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

Concentrations

Additional Information

GPA Requirements

Philosophy, MA

About the Program

Program Requirements - Thesis

Required Courses (24 credits)

Metaphysics, Epistemology, and Science Courses (9 credits)

PHIL 50600 - Advanced Philosophy Of Religion

Credit Hours: 3.00. A detailed critical investigation of some central problems in a philosophical approach to religion. Readings will be selected from leading representatives of traditional theism and various contemporary schools. The thought of the representative thinkers will be analyzed, discussed, and critically evaluated. The problems discussed will be selected from the existence of God, the problem of evil, freedom and determinism, the problem of immortality, and the nature of religious language. Variable content.

Credits: 3.00

PHIL 51000 - Phenomenology

Credit Hours: 3.00. A detailed, critical examination of some major issue(s) in phenomenology. Attention will be given to either the historical development or contemporary relevance of phenomenological philosophy. Readings will be drawn from the works of Husserl, Heidegger, Merleau-Ponty, and others.

Credits: 3.00

PHIL 52500 - Studies In Metaphysics

Credit Hours: 3.00. An intensive and critical examination of one or more of the basic problems of ontology and cosmology, such as substance, existence, causality, change, time, space, teleology, freedom, and universals. Variable content.

Credits: 3.00

PHIL 53200 - Studies In Theory Of Knowledge

Credit Hours: 3.00. An intensive examination of selected problems concerning the nature of human knowledge, its scope

and limits, its relation to sense-perception and memory. Variable content.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 55100 - Philosophy Of The Natural Sciences

Credit Hours: 3.00. A survey of issues and theories in contemporary philosophy of science. Variable content.

Credits: 3.00

PHIL 55200 - Philosophy Of The Social Sciences

Credit Hours: 3.00. An exploration of the nature of the concepts in the social sciences, and a study of the ways in which they have been and are employed.

Credits: 3.00

PHIL 66500 - Philosophy Of Language

Credit Hours: 3.00. An introduction to some of the main concepts and problems in the philosophy of language, such as meaning, reference, and private languages, through readings in the chief contributors to the field. Prerequisite: 6 credit hours in Philosophy.

Credits: 3.00

History of Philosophy Courses (6 credits)

PHIL 50100 - Studies In Greek Philosophy

Credit Hours: 3.00. The subject matter will alternate between the intensive study of some fairly specific topic in Greek philosophy (e.g., Plato's theory of knowledge, Aristotle's ethics, etc.) and a general study of either the philosophy of Plato or the philosophy of Aristotle.

Credits: 3.00

PHIL 50200 - Studies In Medieval Philosophy

Credit Hours: 3.00. An intensive study of some central topics in the thought of major medieval philosophers. Subject matter will vary. Philosophers most often studied are Augustine, Thomas Aquinas, Duns Scotus, and Ockham.

Credits: 3.00

PHIL 50300 - Studies In Early Modern Philosophy

Credit Hours: 3.00. A detailed study of either: 1) one or more central philosophical themes or 2) one or more major figures (typically, but not restricted to, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and/or Kant) in the early modern period. Offered in alternate years.

Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the human good, the nature of God, and divine language.

Credits: 3.00

PHIL 51400 - Twentieth-Century Analytical Philosophy I

Credit Hours: 3.00. A detailed study of the origins and development of contemporary philosophical analysis, and how it was pursued in movements such as logical atomism, logical positivism, ordinary language philosophy, and others. Readings will cover a selection of the writings of Frege, Russell, Moore, Wittgenstein, Ayer, Ryle, Austin, and others. Need not be followed by PHIL 51500.

Learning Outcomes: 1. Develop an appreciation for and understanding of central problems, texts, and ideas in the history of analytic philosophy. 2. Identify and reconstruct philosophical arguments. 3. Discriminate between metaphysical and epistemological issues. Credits: 3.00

PHIL 68300 - Studies In Continental Rationalism

Credit Hours: 3.00. An intensive study of Descartes, Spinoza, or Leibniz, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68400 - Studies In British Empiricism

Credit Hours: 3.00. An intensive study of Locke, Berkeley, or Hume, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68500 - The Philosophy Of Kant

Credit Hours: 3.00. This course will be concerned with the critical philosophy as a whole. Primary emphasis, however, will be on the theories of knowledge and metaphysics as developed in the Critique of Pure Reason. Lesser attention will be paid to Kant's ethics and the principles of judgment as time permits. Prerequisite: PHIL 30300 .

Credits: 3.00

Value Theory Courses (6 credits)

PHIL 52000 - Existentialism

Credit Hours: 3.00. A detailed exploration and examination of the existentialist movement in modern thought, including its historical roots, its philosophical formulations, and its influence and expression in and relation to art, literature, psychology, social criticism, and religion. Readings will be from at least some of the major existentialists: Kierkegaard, Nietzsche, Jaspers, Heidegger, and Sartre. In addition, texts from existentialist thinkers in other areas will be used.

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 54000 - Studies In Social And Political Philosophy

Credit Hours: 3.00. A detailed study of one or more important concepts in social or political philosophy, such as natural rights, revolution, law, freedom, justice, or political obligation. Variable content.

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

Formal Methods Course (3 credits)

PHIL 55300 - Mathematical Logic

Credit Hours: 3.00. This class is an introduction to various logical foundations of mathematics as well as the basics of logical metatheory.

Learning Outcomes: 1. Understand some of the more advanced methods employed in logical analysis. 2. Explain important problems and issues in foundational mathematical logic and express them in clear and precise terms. 3. Analyze and assess foundational results in mathematical logic. 4. Explain, apply, and appraise the use of formal languages. 5. Assess and construct precise, abstract arguments using the tools of mathematical logic. (This will help students engage in better written and oral communication, in particular in circumstances where perspicuity and logicality are of special importance.) Credits: 3.00

Thesis Research (6 credits)

PHIL 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Requirements - Non-Thesis

Required Courses (33 credits)

Concentrations

GPA Requirements

Physics, MS

About the Program

Program Requirements - Thesis

Required Courses (18 credits)

Core Courses (12 credits)

PHYS 61700 - Statistical Mechanics

Credit Hours: 3.00. Classical and quantum statistical mechanics. Prerequisite: PHYS 66000 .

Credits: 3.00

PHYS 63000 - Advanced Theory Of Electricity And Magnetism

Credit Hours: 3.00. The experimental origins of Maxwell's equations. Electrostatics and magnetostatics; solution of boundary value problems. Quasi-static currents. Electromagnetic energy and momentum and the Maxwell stress tensor. Foundations of optics. Radiation from antennas, multi-pole expansion; waveguides. Prerequisite: PHYS 53000 , PHYS 60000 .

Credits: 3.00

PHYS 66000 - Quantum Mechanics I

Credit Hours: 3.00. Origins of the quantum theory, the uncertainty and complementarity principles. The Schrodinger equation and its solutions for simple physical systems. Mathematical formulation of the quantum theory. Applications: simple harmonic oscillator, theory of angular momentum, the hydrogen atom. Time-independent and time-dependent perturbation theory. The Pauli exclusion principle. Spin of the electron. Elementary theory of scattering. Prerequisite: PHYS 53000 , PHYS 55000 , PHYS 60000 , PHYS 61000 . Corequisite: PHYS 60100 .

Credits: 3.00

PHYS 66100 - Quantum Mechanics II

Credit Hours: 3.00. Symmetry and conservation laws. The Klein-Gordon and Dirac equations. Interaction of radiation with matter. Applications of quantum mechanics to atomic structure. Scattering theory. Prerequisite: PHYS 60100 , PHYS 63000 , PHYS 66000 .

Credits: 3.00

Mathematics Courses (6 credits)

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

Optional Refresher Courses (0-12 credits)

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public

knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

Electives (0-3 credits)

Thesis Research (9 credits)

PHYS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Program Requirements - Non-Thesis

Required Courses (18 credits)

Core Courses (12 credits)

PHYS 61700 - Statistical Mechanics

Credit Hours: 3.00. Classical and quantum statistical mechanics. Prerequisite: PHYS 66000 .

Credits: 3.00

PHYS 63000 - Advanced Theory Of Electricity And Magnetism

Credit Hours: 3.00. The experimental origins of Maxwell's equations. Electrostatics and magnetostatics; solution of boundary value problems. Quasi-static currents. Electromagnetic energy and momentum and the Maxwell stress tensor. Foundations of optics. Radiation from antennas, multi-pole expansion; waveguides. Prerequisite: PHYS 53000 , PHYS 60000 .

Credits: 3.00

PHYS 66000 - Quantum Mechanics I

Credit Hours: 3.00. Origins of the quantum theory, the uncertainty and complementarity principles. The Schrodinger equation and its solutions for simple physical systems. Mathematical formulation of the quantum theory. Applications: simple harmonic oscillator, theory of angular momentum, the hydrogen atom. Time-independent and time-dependent perturbation theory. The Pauli exclusion principle. Spin of the electron. Elementary theory of scattering. Prerequisite: PHYS 53000 , PHYS 55000 , PHYS 60000 , PHYS 61000 . Corequisite: PHYS 60100 .

Credits: 3.00

PHYS 66100 - Quantum Mechanics II

Credit Hours: 3.00. Symmetry and conservation laws. The Klein-Gordon and Dirac equations. Interaction of radiation with matter. Applications of quantum mechanics to atomic structure. Scattering theory. Prerequisite: PHYS 60100 , PHYS 63000 , PHYS 66000 .

Credits: 3.00

Mathematics Courses (6 credits)

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

Optional Refresher Courses (0-12 credits)

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

Electives (0-12 credits)

Additional Requirements

PHYS 60500 - Pedagogical Methods For Physics Graduate Students

Credit Hours: 2.00. This course prepares physics graduate students for classroom and laboratory teaching assignments. Through 100 minutes per week of lectures and hands-on recitations, it provides an intensive survey of basic pedagogical methods, both theoretically and in practice. Students will learn and practice teaching techniques via various forms and microteaching, reading, and class discussion. A broad range of results from physics education research will be studied in detail. Additional topics include grading and assessment, responsible conduct in teaching related to issues such as gender, culture and ethnicity, students with disabilities, and ethics in academia, generally, including ethical conduct of research.

Credits: 2.00

Concentrations

Additional Information

GPA Requirements

Political Science, MA

About the Program

Program Requirements

Required Courses (9 credits)

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

POL 60000 - Political Science: Discipline And Profession

Credit Hours: 3.00. An exploration of the scope of political science and of its development as a profession, with a focus on what American political scientists do as disciplinary professionals. Analysis of major approaches to the study of politics and of current developments. Prerequisite: 6 credit hours in Political Science.

Credits: 3.00

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

Major Field Courses (12 credits)

Minor Field Courses (9 credits)

Required Courses (9 credits)

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

POL 60000 - Political Science: Discipline And Profession

Credit Hours: 3.00. An exploration of the scope of political science and of its development as a profession, with a focus on what American political scientists do as disciplinary professionals. Analysis of major approaches to the study of politics and of current developments. Prerequisite: 6 credit hours in Political Science.

Credits: 3.00

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

Concentrations

About the Program

Public Health, MHA

About the Program

Program Requirements

Required Courses (40 credits)

Core Courses (33 credits)

PUBH 57100 - The Business Of Healthcare

Credit Hours: 3.00. This course is designed to help you keep pace with the rapidly changing world health and healthcare. We will (1) explore the drivers of value creation, valuation

approaches, and the differences in capital structures between nonprofit and for-profit healthcare providers; (2) examine horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures, and vertical consolidation and integration between providers and payers; and (3) discuss the ethos of healthcare, disruptive innovation, and emotional intelligence.

Learning Outcomes: 1. Understand the drivers of value creation, valuation approaches, and differences in capital structures between nonprofit and for-profit healthcare providers. 2. Evaluate horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures and vertical consolidation and integrations between providers and payers. 3. Understand the ethos of healthcare and role of disruptive innovation and emotional intelligence in the advancement of healthcare delivery. 4. Analyze the role of healthcare value creation and its connection with hospital ownership and the disruptive innovation in healthcare. 5. Evaluate the intersection of public health, population health, and the business of healthcare delivery. Credits: 3.00

PUBH 57400 - Healthcare Economics, Policy And Law

Credit Hours: 3.00. This course presents an overview of legal regulations and issues related to healthcare delivery and administration in multiple settings. Topics include healthcare legislation and regulation; professional and institutional liability; medical staff credentialing; patient consent requirements; termination of care; confidentiality of medical care; and the roles of federal, state and private stakeholders.

Learning Outcomes: 1. Be able to perform basic legal research. 2. Apply the legal protections afforded to patient health information. 3. Evaluate the forms of legal action that can be brought against public and private health insurance programs. 4. Comprehend the implications of Federal ERISA law on private health insurance. 5. Identify the common organizational and theoretical laws which apply to the health care environment. 6. Identify and articulate aspects and perspectives of highly controversial subjects such as abortion, organ transplant, right to die, physician assisted suicide, informed consent etc. 7. Differentiate between torts, negligence, malpractice, abandonment, and a variety of other legally charged and ethical complex legal terms. 8. Articulate the role of ethics and compliance committees including their structure, goals, functions, and decision-making activities. 9. Analyze and identify specific issues associated with coding, regulatory compliance, and ethical actions of skilled health care professionals and medical providers. 10. Understand and articulate patient rights. 11. Understand their unique role as a health care leader in providing quality patient care. 12. Understand the demands of managing in a highly regulated, transparent and scrutinized field. 13. Identify and bridge the gap between fiscally prudent stewardship and quality patient care. 14. Understand and cultivate relationships between care givers and administration. Credits: 3.00

PUBH 57600 - Workforce Management And Organizational Behavior In Healthcare

Credit Hours: 3.00. The course focuses on the relationships between healthcare administration and human resource management across various health care organizations, including hospitals, long-term care facilities, and community health organizations. Topics include personnel recruitment and training; compensation and benefits; performance evaluations; staffing plans; employee discipline; and credentialing health care professionals. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Identify strategies for the recruitment, selection, development, and retention of quality health care professionals while applying accreditation criteria to human resources practices. 2. Apply human resources management for problem solving and decision-making. 3. Identify various legal issues, which require managerial attention and strategy. 4. Understand the changing workforce dynamics and the issues associated with labor shortages

of skilled professionals in the healthcare industry. 5. Prepare for future challenges and examining future trends in the human resource field within the industry of healthcare. 6. Understand regulatory compliance issues uniquely associated to the field of health care (such as Joint Commission) standards pertaining to safety, emergency preparedness, job analysis, performance appraisals, and employee retention. 7. Analyze employee productivity in patient-centered environments. 8. Put human resource principles, concepts, generalizations, theories and models into practice 9. Analyze the impact human resources management has on strategy formulation and strategy implementation. Credits: 3.00

PUBH 57700 - Strategic Planning And Marketing For Healthcare

Credit Hours: 3.00. This course provides an introduction to the conceptualization, development and implementation of strategic planning and marketing for healthcare organizations across several practice settings. Topics covered in the course include theories of decision-making, strategic planning and resource allocation, consumer behavior and provider comparisons. This course is a core class for the "Healthcare Quality Improvement" certificate program.

Learning Outcomes: 1. Apply the strategic planning process to a health care organization. 2. Understand strategic planning and marketing theories, principles, concepts, terms, methods, tactics, and tools. 3. Integrate strategic planning with marketing. 4. Analyze applications of planning and marketing in health care. 5. Know how strategic planning guides an organization in positioning itself in its defined market. 6. Discuss and define the position of the marketing function within the overall organizational structure of a health care system. 7. Formulate a health services marketing plan. 8. Compare alternative market research methods. 9. Identify the role and responsibility of health system governance in health care marketing. Credits: 3.00

PUBH 58100 - Managing Complex Healthcare Operations

Credit Hours: 3.00. This course focuses on the familiarization of production processes and service systems, and quantitative analysis of problems arising in the management of operations. We consider key performance measures of operations (productivity, flexibility, quality, and response time) as well as important concepts in the planning, design, control, and improvement of processes in healthcare contexts along these dimensions. For this course, students will also acquire the ability to learn ways to conduct operations management through data analysis. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Understand the crucial importance of operations management in the healthcare environment. 2. Enhance analytical skills and the ability to uncover problems and opportunities for improvement in healthcare as well as other production and service processes. Credits: 3.00

PUBH 57500 - Healthcare Accounting & Reimbursement

Credit Hours: 3.00. This course teaches core financial skills of accounting and financial management as they apply to healthcare management systems. Topics include analysis of financial reporting, cost management; reimburse mechanisms, CFO Responsibilities, managed care contracting and fundraising and capital investment. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Apply financial concepts to health care related issues. 2. Assess the performance of healthcare organizations. 3. Use financial data to strategically align planning methodologies to reimbursement issues. 4. Discuss the impact of healthcare reimbursement on the financial solvency of the healthcare system. 5. Explore varying healthcare setting and the differing financial aspects of each. 6. Calculate profit in capitated markets. 7. Accounts receivable and revenue cycles in patient care environments. 8. Estimate cash flows in patient care settings. 9. Identify charge master and medical record and coding. Credits: 3.00

PUBH 57800 - Healthcare Quality And Risk Management

Credit Hours: 3.00. The course explores how to identify quality and complexity issues affecting healthcare organization; how to develop, implement and assess quality improvement programs and strategies in various healthcare settings. Topics include continuous quality improvement; lean management; Six Sigma; IHI Quality Improvement Program; Baldrige criteria; patient safety; and quality tools. This course is a core class for the Healthcare Quality Improvement certificate programs.

Learning Outcomes: 1. Understand the interdependence, drivers and challenges of Quality and Information Management. 2. Learn and practice key aspects of multiple change management models, quality improvement methodologies and tools. Complete a quality improvement project using a basic improvement methodology. 3. Apply health care operations and quality management skills for problem solving and decision making. 4. Integrate the professions of health care operations, quality management and health administration. 5. Understand how health care operations and quality management affect allied health professionals and others. 6. Develop and use new ways of thinking about health care operations and quality management jobs and professions. 7. Analyze the impact health care operations has on quality management strategy formulation and strategy implementation. 8. Be able to integrate health care operations and quality management with organization and performance outcomes. 9. Understand the challenges in creating a culture of safety. 10. Understand the structures and drivers in incentive programs to improve care. Credits: 3.00

PUBH 57900 - Information Powered Patient Care In The 21st Century

Credit Hours: 3.00. This course focuses on the use of computer technology and information science to identify, gather, process, and manage information to help healthcare organizations succeed. Emphasis is placed on technology-based health applications, which support clinical, administrative, research, and educational decision-making that enhance the efficacy of health care administration.

Learning Outcomes: 1. Evaluate computer applications to aggregate and analyze data for evidence- based practice and quality improvement. 2. Describe systems theory and design as applied to health informatics. 3. Identify key trends and regulatory requirements for healthcare information systems. 4. Evaluate the strengths and weaknesses of health information systems in practice. 5. Explain the relationship among information technology, information literacy, and evidence-based practice. 6. Describe and critique taxonomic and terminology systems used in national efforts to enhance interoperability of information systems and knowledge management. 7. Articulate ethical/legal issues that arise in using, designing, and managing healthcare information systems. 8. Analyze the methods used to align a health care information management plan with the corporate and strategic goals of a health care organization. 9. Practice the principles of project management. 10. Understand security and confidentiality issues, as well as health care information management trends and risks. Credits: 3.00

PUBH 57000 - Healthcare In The United States

Credit Hours: 3.00. By the end of this course, you will have a strong foundational understanding of the American healthcare system, along with the basic financial and management skills to make better, well-informed decisions that improve the cost and quality of the healthcare you or your enterprise provides. Understanding the evolution of today's system form the foundation for subsequent learning and leadership. Landmark legislation will also be reviewed including: Hill-Burton Act, Social Security Act, HMO Act, Balanced Budget Act of 1997, PPACA, ARRA. We will focus on a range of healthcare services, including acute care, post-acute care and senior health and housing, ambulatory surgery centers, behavioral health, and medical insurance companies. Permission of instructor required.

Learning Outcomes: 1. Evaluate the current strengths and weakness of the American

healthcare system. 2. Understand the evolution of healthcare during the 20th and 21st centuries. 3. Understand methods to analyze basic financial and management situations driving to improved cost and quality of healthcare. 4. Analyze landmark legislation including Hill-Burton Act, Social Security Act, HMO Act, Balanced Budget Act of 1997, PPACA, and AARA. 5. Evaluate the intersection of healthcare services including acute care, post-acute care, senior health and housing, ambulatory surgery centers, behavioral health, and medical insurance companies. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Seminar Course (3 credits)

PUBH 69400 - Graduate Seminar In Public Health

Credit Hours: 0.00. Seminar course covering a broad range of current research topics in public health and related fields of study. Seminar presentations by representatives from academia, industry, government, other external institutions and organizations, and members of the Purdue University community. Intensive analysis of application of various research and statistical methodologies to the study of public health.

Learning Outcomes: 1. Acquire an understanding and appreciation of research conducted on topics relevant to the field of public health. 2. Develop a working knowledge of how research topics are determined, hypotheses are formed, methodologies are designed and implemented, data are collected, and conclusions are drawn. 3. Apply knowledge of research and statistical design to student' own research projects. Credits: 0.00

Capstone Course (4 credits)

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis.

Learning Outcomes: 1. Develop MS level research skills in Public Health. Credits: 1.00 to 18.00

Certificates

Program Learning Outcomes

Public Health, MPH

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (18 credits)

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques.

Students will acquire the ability to utilize statistical software as a tool to facilitate the processing, editing, storing, displaying, analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the

health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

PUBH 60400 - Public Health Administration

Credit Hours: 3.00. An introduction to the principals of management as applied to public health organizations, particularly local health departments. Topics include the organization of the U.S. public health system, legal and ethical obligations of public health administrators, the public health workforce and human resource issues, public health budgeting and finance, and leadership in the public health agency. The course is designed to introduce master's level students in public health to the management skills necessary to successfully implement a public health program.

Learning Outcomes: 1. Understand the transforming integrated health delivery system in the United States to build collaborative network of care providers. 2. Formulate action plans for process improvement that addresses gaps of public health service areas. 3. Appraise effectiveness of initiatives and programs to determine best practices and benchmarks for delivering public health services. Credits: 3.00

Seminar Course (0 credits)

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 69400 - Graduate Seminar In Public Health

Credit Hours: 0.00. Seminar course covering a broad range of current research topics in public health and related fields of study. Seminar presentations by representatives from academia, industry, government, other external institutions and organizations, and members of the Purdue University community. Intensive analysis of application of various research and statistical methodologies to the study of public health.

Learning Outcomes: 1. Acquire an understanding and appreciation of research conducted on topics relevant to the field of public health. 2. Develop a working knowledge of how research topics are determined, hypotheses are formed, methodologies are designed and implemented, data are collected,

and conclusions are drawn. 3. Apply knowledge of research and statistical design to student' own research projects. Credits: 0.00

Focus Area (15 credits)

Electives (3 credits)

Experiential Courses (6 credits)

PUBH 60700 - Public Health Practicum

Credit Hours: 3.00. This course integrates public health theory and practice in a professional setting. Students have the opportunity to apply concepts from core and concentration courses, conduct projects, and interact with a range of professionals in the designated setting. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the 10 core program competencies. 2. Identify and describe health trends and data. 3. Evaluate and design interventions. Credits: 3.00

PUBH 60800 - Culminating Experience

Credit Hours: 3.00. The MPH degree plans of study require a culminating project to be completed in the final semester of study. The student provides evidence of competency mastery by partnering with a public health related agency, identifying a community problem, proposing an evidence-based solution, and developing an evaluation plan. The final product is in the form of a grant proposal. Guidance for proposal development is achieved through completion of a grant-writing workshop and feedback from a faculty advisor. Permission of department required.

Learning Outcomes: 1. Develop a grant proposal using components introduced. 2. Evaluate peer work, based on best practices in grant writing. 3. Strategically present a grant proposal. Credits: 3.00

Concentrations

Public Health, MPH (OL)

About the Program

Program Requirements

Required Courses (33 credits)

Core Courses (18 credits)

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques. Students will acquire the ability to utilize statistical software as a tool to facilitate the processing, editing, storing, displaying, analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to

identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

PUBH 60400 - Public Health Administration

Credit Hours: 3.00. An introduction to the principals of management as applied to public health organizations, particularly local health departments. Topics include the organization of the U.S. public health system, legal and ethical obligations of public health administrators, the public health workforce and human resource issues, public health budgeting and finance, and leadership in the public health agency. The course is designed to introduce master's level students in public health to the management skills necessary to successfully implement a public health program.

Learning Outcomes: 1. Understand the transforming integrated health delivery system in the United States to build collaborative network of care providers. 2. Formulate action plans for process improvement that addresses gaps of public health service areas. 3. Appraise effectiveness of initiatives and programs to determine best practices and benchmarks for delivering public health services. Credits: 3.00

PUBH 53500 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain

and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

PUBH 58500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

Concentration Courses (15 credits)

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

PUBH 60700 - Public Health Practicum

Credit Hours: 3.00. This course integrates public health theory and practice in a professional setting. Students have the opportunity to apply concepts from core and concentration courses, conduct projects, and interact with a range of professionals in the designated setting. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the 10 core program competencies. 2. Identify and describe health trends and data. 3. Evaluate and design interventions. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for

the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 60800 - Culminating Experience

Credit Hours: 3.00. The MPH degree plans of study require a culminating project to be completed in the final semester of study. The student provides evidence of competency mastery by partnering with a public health related agency, identifying a community problem, proposing an evidence-based solution, and developing an evaluation plan. The final product is in the form of a grant proposal. Guidance for proposal development is achieved through completion of a grant-writing workshop and feedback from a faculty advisor. Permission of department required.

Learning Outcomes: 1. Develop a grant proposal using components introduced. 2. Evaluate peer work, based on best practices in grant writing. 3. Strategically present a grant proposal. Credits: 3.00

PUBH 54750 - Public Health Program And Policy Evaluation

Credit Hours: 3.00. This course provides an overview of the methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs, and the process for applying and tailoring these designs to program and policy evaluations. In addition, we will focus on the process of engaging communities and stakeholders in program evaluation efforts. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Summarize the role of evaluation within the program life cycle. 2. Discuss the basics of formative, process, outcome, and cost evaluation. 3. Build a logic model to guide the evaluation plan and justify the decisions made in the logic model. 4. Interpret and critique the quality of evaluation research case studies and reports. 5. Explain the role of ethics, health equity, and social justice in evaluation planning and implementation. 6. Apply the major evaluation designs to public health interventions that consider the budget, time, data and environmental constraints of the situation. 7. Explain and defend the evaluation plan in lay language. Credits: 3.00

PUBH 51250 - International Health Systems: A Comparative Approach

Credit Hours: 3.00. This course is an introduction to public health priorities from an international perspective, illustrating the interdependent nature of health promotion and disease prevention issues across diverse regions and populations. Coursework examines population health determinants, contrasting industrialized and developing countries and how these influence health goals established by public health institutions, such as the World Health Organization, philanthropic foundations and governmental agencies. International health care needs continue to emerge as interchanges among peoples and nations increase. To effectively address these needs, public health leaders must understand the social, economic, environmental, and political determinants of health and be prepared to respond to challenges related to health and health care at the local, national, and global level. This course examines the historical evolution of international health challenges as well as the future trends that will continue to impact health and health systems worldwide. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Conduct a comparative analysis of international health data and trends impacting health care systems. 2. Analyze international health systems and their emphasis on the global health care market. 3. Assess the impact of health and disease on a nation. 4. Evaluate the role of government and non-government agencies in the provision and management of global health systems. 5. Develop a formal proposal to address a global health challenge. 6. Evaluate how indicators of health care spending and the quality of health service provision vary across global health care systems. Credits: 3.00

PUBH 54250 - Public Health And Nutrition

Credit Hours: 3.00. This course will emphasize development, implementation, and evaluation of nutrition intervention programs from a public health perspective. Students have an

opportunity to practice setting realistic goals that produce outcomes aimed to improve health and support community and public nutrition. Students will explore changing nutritional behavior and the barriers to such change. This course is intended for graduate students interested in developing, implementing, and evaluating community-based nutrition programs The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Evaluate the impact of various nutrition-based public health programs. 2. Construct realistic goals that produce outcomes that improve health and support wellness. 3. Describe the basic elements of program planning in public health. 4. Identify methods for overcoming barriers to program implementation. 5. Describe methods for process, effect, and impact evaluation of nutrition programs. 6. Design a comprehensive community-based nutrition intervention program. Credits: 3.00

Experiential Courses (6 credits)

PUBH 60700 - Public Health Practicum

Credit Hours: 3.00. This course integrates public health theory and practice in a professional setting. Students have the opportunity to apply concepts from core and concentration courses, conduct projects, and interact with a range of professionals in the designated setting. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the 10 core program competencies. 2. Identify and describe health trends and data. 3. Evaluate and design interventions. Credits: 3.00

PUBH 60800 - Culminating Experience

Credit Hours: 3.00. The MPH degree plans of study require a culminating project to be completed in the final semester of study. The student provides evidence of competency mastery by partnering with a public health related agency, identifying a community problem, proposing an evidence-based solution, and developing an evaluation plan. The final product is in the form of a grant proposal. Guidance for proposal development is achieved through completion of a grant-writing workshop and feedback from a faculty advisor. Permission of department required.

Learning Outcomes: 1. Develop a grant proposal using components introduced. 2. Evaluate peer work, based on best practices in grant writing. 3. Strategically present a grant proposal. Credits: 3.00

Selectives (3 credits)

PUBH 57100 - The Business Of Healthcare

Credit Hours: 3.00. This course is designed to help you keep pace with the rapidly changing world health and healthcare. We will (1) explore the drivers of value creation, valuation approaches, and the differences in capital structures between nonprofit and for-profit healthcare providers; (2) examine horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures, and vertical consolidation and integration between providers and payers; and (3) discuss the ethos of healthcare, disruptive innovation, and emotional intelligence.

Learning Outcomes: 1. Understand the drivers of value creation, valuation approaches, and differences in capital structures between nonprofit and for-profit healthcare providers. 2. Evaluate horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures and vertical consolidation and integrations between providers and payers. 3. Understand the ethos of healthcare and role of disruptive innovation and emotional intelligence in the advancement of healthcare delivery. 4. Analyze the role of healthcare value creation and its connection with hospital ownership and the disruptive innovation in healthcare. 5. Evaluate the intersection of public health, population health, and the business of healthcare delivery. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the

specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 54850 - Public Health Law

Credit Hours: 3.00. This course examines the role of law in promoting or impeding positive health outcomes. Students will study the authority and limitations of governments engaging in public health activities as well as the types of legal interventions available to promote public health. Students will apply legal principles to public health case studies on topics such as infectious disease, chronic disease, and violence prevention, among others. Students will also apply public health legal research methodologies to current public health issues and discuss the role of law in public health advocacy. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, law, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Understand the legal system including key definitions and institutions. 2. Discuss public health governance at the federal, state, Tribal, local, and territorial levels. 3. Describe legal interventions available to support public health. 4. Discuss the role of law in applied settings such as infectious disease, chronic disease, environmental health, etc. 5. Apply legal research methods to public health studies. 6. Strategize the role of law in public health advocacy. Credits: 3.00

PUBH 51350 - Global Health Security And Disaster Management

Credit Hours: 3.00. This course is a contemporary examination of the growing threat and potential public health consequences of disasters and the role of climate change. Additionally, we review the variety of public health and environmental health disasters, their consequences and the role of public health agencies health care systems and practitioners in preparedness, response and recovery from a local, national and global perspective. The course is designed to develop proficiency in analyzing and evaluating the public health response to disasters, the linkage to emergency management frameworks and identifying solutions and methods for improvement. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Explore the concepts and tools of public health as it relates to minimizing the effects of disasters in a global context. 2. Compare and contrast past approaches to disease eradication with modern best practices. 3. Examine the impact of natural and man-made disasters, disease, climate change on the public health and medical response infrastructure and the capability to respond effectively in a crisis. 4. Describe public health surveillance and epidemiological forecasting. 5. Evaluate public health emergency management principles and practices that impact Global health security. 6. Analyze the global response to public health issues and crisis. 7. Demonstrate communication skills and strategies for promoting family and community health during times of disaster or public health emergencies. Credits: 3.00

Concentrations

Public Health, MS

About the Program

Program Requirements

Required Courses (18-19 credits)

Core Courses (18-19 credits)

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques. Students will acquire the ability to utilize statistical software as a

tool to facilitate the processing, editing, storing, displaying, analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

PUBH 50000 - Introduction To Public Health

Credit Hours: 1.00 to 3.00. This Public Health course covers a variety of issues related to the profession of public health. The Introduction to Public Health provides the graduate student with an overview of the history, science, mission, practice and future of public health. The core public health principles and services, and the expected competencies of the professional public health practitioner, are discussed. Current issues in public health are also presented for discussion and analysis.

Learning Outcomes: 1. Describe factors affecting the health of a community (e.g., equity, income, education, and environment). 2. Apply ethical principles in accessing, collecting, analyzing, using, maintaining, and disseminating data and information. 3. Identify current trends (e.g., health, fiscal, social, political, environmental) affecting the health of a community. 4. Communicate in writing and orally with linguistic and cultural proficiency (e.g., using age-appropriate materials, incorporating images). 5. Describe the roles of governmental public health, health care, and other partners in improving the health of a community. 6. Describe the diversity of individuals and populations in a community. 7. Describe the effects of policies, programs, and services on different populations in a community. Credits: 1.00 to 3.00

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation,

goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

Seminar Course (0 credits)

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the

specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 69400 - Graduate Seminar In Public Health

Credit Hours: 0.00. Seminar course covering a broad range of current research topics in public health and related fields of study. Seminar presentations by representatives from academia, industry, government, other external institutions and organizations, and members of the Purdue University community. Intensive analysis of application of various research and statistical methodologies to the study of public health.

Learning Outcomes: 1. Acquire an understanding and appreciation of research conducted on topics relevant to the field of public health. 2. Develop a working knowledge of how research topics are determined, hypotheses are formed, methodologies are designed and implemented, data are collected, and conclusions are drawn. 3. Apply knowledge of research and statistical design to student' own research projects. Credits: 0.00

Selectives (5-6 credits)

PUBH 51100 - Foundations Of Global Health

Credit Hours: 3.00. Global disparities in the health and well-being of diverse populations, across and within borders, has never been greater. Profound and rapid changes in demographics, from population growth to urbanization, along with unprecedented shifts in patterns of disease and risks, are coupled with game-changing advances in knowledge, technology, and innovation. This course will introduce students to current challenges and efforts at solutions in global health, with a focus on low- and middle-income countries. It will provide an interdisciplinary overview of topics that include measures of health and disease, communicable diseases such as HIV/AIDS and malaria, non-communicable diseases such as diabetes and cardiovascular disease, women's health, maternal and child health, food systems and nutrition, health systems, and health care delivery. In addition to lectures, the course will include interactive discussions of case studies and specific country examples, aimed at immersing students in the debates and challenges facing global health leaders and decision makers.

Learning Outcomes: 1. Identify major shifts and trends in health patterns, burden of disease, population dynamics, and globalization. 2. Understand the historical context of global health and current evolving agendas. 3. Analyze diverse global health challenges, incorporating ethical, environmental, political, historical, and societal perspectives, with a focus on low- and middle-income countries. 4. Evaluate global health research to assess how conclusions arise from evidence and analysis. 5. Formulate evidence-based arguments for/against diverse global health policies or interventions. Credits: 3.00

PUBH 50100 - Introduction To Health Equity

Credit Hours: 3.00. This course introduces the participants to graduate level research in health disparities and the various theoretical and analytical skills needed to be a good health disparities researcher. It will take the course participants through the axiological, ontological and epistemological questions that we are confronted within social scientific research. This course will walk the participants through the various research paradigms and the critical debates associated with it so that they can reflect and possibly make an informed choice about their own research priorities. Permission of department required.

Learning Outcomes: 1. Develop students understanding of the fundamental assumptions underlying different approaches to health disparities research and in turn how these inform the field. 2. Develop students' capacities to describe, and to compare and contrast, the prominent approaches used to understand Health Disparities. 3. Encourage the student participants to critically evaluate different research and approaches to health disparities and comment on the suitability of these in advancing health disparities research. 4. Learn to write for academic audiences. Credits: 3.00

PUBH 69500 - Public Health Independent Research Or Study

Credit Hours: 1.00 to 9.00. Investigation of various public health topics as determined by the interest of the individual public health graduate student and faculty mentor. Permission of department required.

Learning Outcomes: 1. Reinforce one or more of the student's graduate program

competencies. Credits: 1.00 to 9.00

PUBH 54300 - Physical Activity And Public Health

Credit Hours: 3.00. In this course students will be exposed to epidemiological, behavioral, and public health issues relevant to effective promotion of physical activity. The course is appropriate for students training to be practitioners or researchers from a range of disciplines including exercise science, nutrition, psychology, and public health. Major topic areas will include physical activity epidemiology, determinants of physical activity in youth and adults, and current evidence for physical activity interventions ranging from individual, behavioral strategies, to environmental or policy approaches.

Learning Outcomes: 1. Differentiate between various definitions of physical activity, exercise, and physical fitness. 2. Describe and identify strengths and weaknesses of different approaches used to measure physical activity, including surveys, and objective methods using pedometers and accelerometers. 3. Discuss epidemiological evidence on relationships between physical activity and all-cause mortality, cardiovascular disease, cancers, diabetes, obesity, and overweight. 4. Describe and critically evaluate the physical activity determinants literature in children, youth, and adults, and the current determinants research focus in these populations. 5. Describe and critically evaluate physical activity intervention literature, including currently recommended approaches for children, youth, and adults (e.g., based on the Community Guide to P{Preventive Services). Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Thesis Research (10 credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

PUBH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis.

Learning Outcomes: 1. Develop MS level research skills in Public Health. Credits: 1.00 to 18.00

Program Learning Outcomes

Radiopharmaceutical Manufacturing, MSRPM (OL) and (HY - Hybrid at West Lafayette & Indianapolis)

About the Program

Program Requirements

Required Courses (xx credits)

GPA Requirements

Robotics Technology, MS

About the Program

Program Requirements

Required Courses (16 credits)

Math Courses (6 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

MET 50300 - Applied Optimization

Credit Hours: 3.00. This course will introduce technology

graduate students and senior undergraduates to the basic concepts of optimization methods with particular emphasis on applications in product and process design. Unconstrained nonlinear problems will be presented and solved using steepest descent and conjugate directions. Constrained problems will be solved using exterior penalty functions. Permission of department required.

Learning Outcomes: 1. Recognize optimization problems and cast them in standard form. 2. Identify objective functions and constraints. 3. Use commercial software to solve formal optimization problems. 4. Correctly identify global and local optimum solutions. 5. Use basic calculus concepts to calculate design sensitivities. 6. Understand the geometric concept of design space and be able to plot design space for a constrained problem with two design variables. Credits: 3.00

Systems Course (3 credits)

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

CNIT 54600 - The Internet Of Things For Information Technology

Credit Hours: 3.00. This course will explore the emergence of technologies and vertical solutions in the Internet of Things (IoT) domain. The course explores the top-level problems that IoT promises to solve, the business drivers, the attributes of IoT-enabled enterprise and consumer markets, and how IoT is different from the contemporary Internet. The course will discuss and apply IoT components such as the "things", the data, the people, and the processes, as well as vertical markets. Emphasis will be placed on types of architecture, reference models, and standards (both open and proprietary), underlying technologies, commercial products, issues (such as security), and research efforts in the Internet of Things. The lab component will focus on the complete IoT ecosystem (sensors, actuators, networks, etc.), but will specifically emphasize the functionality of IoT cloud platforms. Permission of instructor is required.

Learning Outcomes: 1. Explain and demonstrate the main functions of a complete Internet of Things (IoT) system. 2. Research and explain a specific student area of interest in the IoT realm. 3. Analyze and discuss current topics, problems and research related to IoT. Credits: 3.00

Perception/Cognition/Actuation Courses (6 credits)

MET 43200 - Hydraulic Motion Control Systems

Credit Hours: 3.00. Hydraulic feedback motion control systems, types, and applications are studied. Simulation and performance of closed loop control systems with single and multiple signal paths are emphasized. Dynamic system performance is predicted and evaluated. System parameters including accuracy, response speed, fluid compressibility effects, load disturbances, and nonlinear behavior of the components are studied.

Learning Outcomes: 1. Identify the origins, development and applications of servo mechanisms. 2. Explain hydraulic system and component nonlinearities such as friction, deadband, backlash, and hysteresis. 3. Recognize control terms, definitions, and fluid power components of a hydraulic system. 4. Evaluate transfer functions and their use in predicting the performance of a system. 5. Utilize computer software simulation tools to investigate the dynamic performance of simple control loops. 6. Develop methods for improving hydraulic system stability through the use of simulation tools. Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECET 53600 - Embedded Systems Security

Credit Hours: 3.00. This course focuses on the implementation and application of cryptographic algorithms and protocols in embedded systems. An overview of the security problem and the science of cryptography and cryptanalysis is presented. The notion of the security perimeter in terms of physical access to assets in embedded hardware subsystems is studied. Students implement and apply various ciphers on 8-bit to 32-bit embedded platforms, comparing and contrasting computational and data throughout performance. Permission of instructor required.

Learning Outcomes: 1. Identify and describe cryptography, cryptanalysis, and security perimeters of embedded systems. 2. Identify and describe key performance issues and tradeoffs in the design and application of cryptographic algorithms and protocols in embedded systems. 3. Identify and describe the main areas of research focus in embedded system security and whey they are important. 4. Identify, describe, and apply tools used in cryptographic analysis and performance characterization of embedded systems. 5. Identify, describe, analyze and apply cryptographic algorithms and protocols including but not limited random number and key generators, private-key and public-key ciphers and protocols, and one-way hash functions. Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

CS 55800 - Introduction To Robot Learning

Credit Hours: 3.00. Introduction To Robot Learning

Learning Outcomes: 1. Formulate the robot motion planning and control problems and solve them using standard tools. (W, P, E) 2. Identify the robot constraints, define their degree of freedom, and formulate their dynamical models for control. (W, P, E) 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. (W, P, E) 4. Identify limitations in existing classical robot algorithms and understand how to avoid the musing Machine Learning. (W, P) 5. Understand and apply Deep Reinforcement Learning approaches to complex robot systems. (W, P, E) 6. Evaluate and assess current best practices and mechanisms for robot programming. (W, P) 7. Develop a skill for robot programming from perception to low-level control using state-of-the art methods. (W, P)

Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

Seminar Course (1 credit)

ENGT 50100 - Graduate Research Seminar

Credit Hours: 0.00 or 1.00. This course is intended to orient new graduate students to the Engineering Technology (ET) program and faculty. This includes PhD students and students pursuing a Master's degree through a thesis or directed project option. This does not include students pursuing a Master's degree with coursework only. Research activities within ET and throughout Purdue University are discussed. Student resources and opportunities are reviewed to give the students the tools they need to be successful. In addition, this course provides a way to develop a natural cohort of graduate students. This course is a graduate seminar course focused on the ET program. Graduate status or upper-division undergraduate. Permission of department required.

Learning Outcomes: 1. Summarize research interests of ET graduate faculty. 2. Interpret Purdue University research activities and resources and apply this knowledge to their particular research plan. 3. Generate MS or PhD preliminary documents based on ET specific requirements. 4. Implement effective use of library resources and ability to write scholarly information in accepted format styles. Credits: 0.00 or 1.00

MFET 44100 - Robotics and IoT Seminar

Credit Hours: 0.00 or 1.00. The Robotics Seminar is a series of lectures from eminent local, national and international researchers in the field of robotics and the internet of things (IoT) and related areas, such as computer vision, autonomy, cyber-physical systems, wearables, etc.

Learning Outcomes: 1. Conduct a search of published papers, articles and materials on the web of relevance to a seminar topic. 2. Analyze a presentation in the context of prior published papers and materials on the web. 3. Evaluate the claims of a presentation with respect to researched material. Credits: 0.00 or 1.00

Focus Area Elective (3 credits)

AI and Data Science

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and

documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

CNIT 56400 - Assistive Technology And Robotics

Credit Hours: 3.00. The purpose of this graduate-level course is to equip students with the practical skills required to engage in effective and impactful research within the realm of assistive technologies and assistive robotics. The course encompasses a comprehensive exploration of key topics and research areas in assistive robotics and related technology fields, including mobility, vision, hearing, speech, and cognitive aids. Throughout the course, students will acquire a strong foundation in the essential components of conducting research in these domains. This includes conducting needs assessments, conducting comprehensive literature reviews, implementing user testing and iterative solution development processes, evaluating solutions, and engaging in prototyping activities. Emphasizing a holistic approach to learning, students will actively participate in dynamic discussions and debates, engage in insightful site visits, interact with guest speakers, and collaborate on both team and individual projects. A pivotal aspect of the course involves the practical application of acquired knowledge in a research project. Students will have the opportunity to design, implement, and/or evaluate assistive technologies or robots tailored to address specific challenges faced by individuals with disabilities and the elderly. This hands-on experience will enable students to put theory into practice and contribute meaningfully to the advancement of assistive technology solutions.

Learning Outcomes: 1. Demonstrate an understanding of the key topics and trends in assistive robotics and technology areas. 2. Demonstrate the ability to access and analyze current literature relevant to assistive technology and robotics, and identify ways in which computing and robotic technology can positively impact the lives of individuals with disabilities. 3. Identify the essential components of research, including conducting needs assessments, conducting thorough literature reviews, engaging in iterative design and development processes, conducting user testing and evaluation, and proficiently creating prototypes. 4. Develop proficiency in delivering effective oral presentations and written communication, effectively addressing research problems, methodologies, and findings. Credits: 3.00

Autonomous Systems

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written

packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

Cyber-Animal Systems and AgRobotics

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

IE 69000 - Advanced Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Advanced study in various fields of industrial engineering for graduate students. Credits and hours to be arranged. Permission of instructor required.

Credits: 1.00 to 6.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and

TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

ENGT 54200 - Cyber-Animal Systems I: Technology-Enhanced Animal Welfare

Credit Hours: 3.00. Cyber-Animal Systems is an interdisciplinary course involving hardware science, software science, and animal science students, who will study the interaction of animals and computer-controlled systems. The course addresses recent advances in robotics, data science, and animal husbandry that combine to create collaborative robots, wearable devices, and biological and environmental sensing systems that improve the practice of precision animal agriculture. Topics include case studies of technology adoption in animal agriculture, impacts of animal welfare on farm production and climate, and the importance of animal societies, confounding variables in animal studies, and animal anxiety on the design of experiments for technology integration. All students will learn mentoring techniques for tutoring other students from different disciplines so they develop skills in "lifelong teaching".

Learning Outcomes: 1. Explain the needs of farmers and technologists related to agricultural animal welfare. 2. Create and apply mentoring plans to support peers who are not familiar with your area of expertise. 3. Define animal welfare and apply the procedures of a basic animal welfare assessment. 4. Critically evaluate sensors, processing techniques and systems used to monitor and measure animal welfare and production. 5. Analyze measurement systems for data integrity and availability in a networked environment. 6. Apply design-of-experiments techniques that balance data requirements with the ethics of animal use and animals' needs. 7. Synthesize critiques from reviewing contemporary animal science and IoT literature. Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Cyber-Human Systems and Assistive Robotics

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

IE 69000 - Advanced Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Advanced study in various fields of industrial engineering for graduate students. Credits and hours to be arranged. Permission of instructor required.

Credits: 1.00 to 6.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues

related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Internet of Things

CNIT 44600 - Advanced Wireless Networks

Credit Hours: 3.00. This course is an advanced course in wireless networking. Building on knowledge gained from the introductory wireless local area network course, this course addresses wireless network design and implementation on a large scale. Topics include mesh networking, broadband wireless access, backhauling, WiMAX and cellular systems. The laboratory portion of the course includes implementing and simulating these technologies in an outdoor setting.

Learning Outcomes: 1. Understand current WLAN, WMAN and WWAN design and implementation strategies. 2. Understand the increasing roles that WLANs, WMANs, WWANs are playing to increase mobility and augment wire line high throughout technologies. 3. Design and configure Metropolitan and Wide Area scaled wireless networks based on a given business scenario or problem. 4. Understand wireless data and telecommunications terminology and jargon. 5. Understand the basic underpinnings of important wireless technologies and wireless internet provider management issues. 6. Conduct successful outdoor site surveys with different equipment and standards. 7. Be able to discuss wireless data and telecommunication issues with professionals in an informed and intelligent manner. 8. Formulate a checklist regarding existing and/or new wireless data/telecommunication systems and infrastructure. Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECET 53600 - Embedded Systems Security

Credit Hours: 3.00. This course focuses on the implementation and application of cryptographic algorithms and protocols in embedded systems. An overview of the security problem and the science of cryptography and cryptanalysis is presented. The notion of the security perimeter in terms of physical access to assets in embedded hardware subsystems is studied. Students implement and apply various ciphers on 8-bit to 32-bit embedded platforms, comparing and contrasting computational and data throughout performance. Permission of instructor required.

Learning Outcomes: 1. Identify and describe cryptography, cryptanalysis, and security perimeters of embedded systems. 2. Identify and describe key performance issues and tradeoffs in the design and application of cryptographic algorithms and protocols in embedded systems. 3. Identify and describe the main areas of research focus in embedded system security and whey they are important. 4. Identify, describe, and apply tools used in cryptographic analysis and performance

characterization of embedded systems. 5. Identify, describe, analyze and apply cryptographic algorithms and protocols including but not limited random number and key generators, private-key and public-key ciphers and protocols, and one-way hash functions. Credits: 3.00

ECET 63800 - Selected Topics In Sensor Networks

Credit Hours: 3.00. This course examines general sensor network concepts, with a focus on a particular area of research and development. Current applications are studied, culminating with the analysis, characterization and/or examination of a sensor network. Permission of instructor required.

Learning Outcomes: 1. Identify and describe sensor network applications. 2. Identify and describe key performance issues and tradeoffs in the design and application of sensor networks. 3. Identify and describe the main areas of research focus in sensor networks and whey they are important. 4. Identify, describe, and apply tools used in sensor network analysis, simulation, characterization, control, and information retrieval. 5. Analyze, calculate and simulate or measure critical performance metrics of sensor networks and their components (nodes, gateways, etc.). Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software

engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Manipulation and Manufacturing

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

MET 54600 - Industrial Applications Of Computer Integrated Manufacturing

Credit Hours: 3.00. A study of the development of CIM (computer integrated manufacturing) from the application of basic automation to a fully integrated system for the operation of the business enterprise. Emphasis is placed on the technology, systems, and human resources, which are integrated to accomplish the objectives of the company. Permission of instructor required.

Credits: 3.00

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3. Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

MFET 55700 - Smart Manufacturing Enterprise: Exploring The Applied Technologies

Credit Hours: 3.00. The core foundations of digital transformation in manufacturing for making all things digital, making all things smart, and making all things connected to drive business value.

Learning Outcomes: 1. Analyze how the nine enabling technologies of Industry 4.0 is transforming the manufacturing industry. 2. Demonstrate understanding of the socio-economic impact of Industrial IoT and cyber-physical manufacturing systems will have on human workforce and the manufacturing industry alike. 3. Demonstrate how digital and data assisted systems in manufacturing is used for decision making and augmenting human capabilities in manufacturing. 4. Analyze how information is acquired, exchanged, managed, and leveraged across manufacturing value chain. Credits: 3.00

Mechatronics and Control

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed. Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given

embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

Sensing and Computer Vision

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 64100 - Model Based Image And Signal Processing

Credit Hours: 3.00. An advanced treatment of the methods in model-based signal and image processing including stochastic modeling of multidimensional signals, Bayesian estimation, inverse methods, doubly stochastic models, regularized inversion, the EM algorithm, Bayesian networks, Markov chains, optimization, convexity, majorization techniques, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation. Prerequisite: ECE 60000, 63700.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

Thesis Research (6 credits)

Robotics/Interdisciplinary Engineering, MSE or MS

About the Program

Program Requirements

Required Courses (27 credits)

Core Selectives (9 credits)

Major Courses (18 credits)

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 67500 - Introduction To Analysis Of Nonlinear Systems

Credit Hours: 3.00. An introduction to modeling of dynamic control systems. State plane and numerical methods for solving modeling equations. Linearization and describing function techniques. Stability concepts. Controller and state estimator design for nonlinear systems. Variable structure sliding mode control. Vector field techniques. Introduction to chaos. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 68000 - Modern Automatic Control

Credit Hours: 3.00. Theoretical methods in optimal control theory. Topics include the calculus of variations and the

Pontryagin minimum principle with applications to minimum energy problems. Geometric methods will be applied to the solution of minimum time problems. Computational methods, singular problems, observer theory, and sufficient conditions for existence of solutions are also discussed. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

ME 57200 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. Introduction to the analysis and design of robotic manipulators. Topics include: kinematic configurations, forward and inverse position solution, velocity and acceleration, path planning, workspace analysis, force and torque solutions, rigid body dynamics, motors and actuators, robot design, sensors and controls, computer simulation, and graphical animation.

Learning Outcomes: 1. Analysis of manipulator motion and forces. 2. Manipulator design including actuator, drive, and sensor issues. 3. Computer simulation to predict motion and forces. Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 67700 - Nonlinear Feedback Controller Design

Credit Hours: 3.00. Controller design and analysis of nonlinear feedback systems. Topics include the design of linear/nonlinear feedback controllers. Describing Function (DF) techniques for design, Popov and Generalized Circle Criterion for closed-loop stability, functional analysis and Volterra series approaches, and introduction to existing nonlinear controller design tools. Offered in alternate years. Prerequisite: ME 67500 .

Credits: 3.00

ME 68900 - Adaptive Control

Credit Hours: 3.00. Theory and application of adaptive control of linear systems in both continuous and discrete time domain. Real-time parameter estimation algorithms, direct and indirect adaptive methods, deterministic self-tuning regulators, Lyapunov stability theory, input-output stability, model-reference adaptive control, stability and convergence of adaptive algorithms, robustness, and implementation issues, with laboratory experiments and demonstrations. Offered in alternate years. Prerequisite: ME 57500 .

Credits: 3.00

IE 54900 - Machine Vision In Intelligent Robotic Systems

Credit Hours: 3.00. Introduction to machine vision and learning algorithms from a human-machine interaction standpoint, and application of machine vision techniques to the design of human-integrated cybernetic systems, such as, robotic systems, flexible automation, and wearable electronics.

Learning Outcomes: 1. Analyze and write computer programs to analyze images for tasks such as filtering, edge detection, segmentation, object recognition, and template matching. 2. Describe and use image filtering methods for image processing. 3. Describe and use edge detection methods for image processing. 4. Use morphological operations to perform shape recognition and template matching. 5. Use optical flow methods to study motion. 6. Apply techniques for object tracking and motion detection to analyze multiple images or video. 7. Apply learning methods such as neural networks, clustering, and linear regression for object recognition. 8. Apply a computer vision technique to the control of a robotic arm. 9. Plan and develop a working prototype machine vision interface. Credits: 3.00

CS 59200 - Computer Science Seminar

Credit Hours: 3.00. A seminar course for in-depth exploration of a specific topic. Topics vary. Classes consist of both instructor and student presentations. Students read, present and discuss research papers, and may complete and present a research project in the area. For each offering, inclusion on a plan of study is determined by the CS Graduate Study Committee. If approved, may be included on a CS MS or PhD plan of study according to relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

Core Selectives (9 credits)

Selective (3 credits)

Required Courses (27 credits)

Core Selectives (9 credits)

Major Courses (18 credits)

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance;

controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 67500 - Introduction To Analysis Of Nonlinear Systems

Credit Hours: 3.00. An introduction to modeling of dynamic control systems. State plane and numerical methods for solving modeling equations. Linearization and describing function techniques. Stability concepts. Controller and state estimator design for nonlinear systems. Variable structure sliding mode control. Vector field techniques. Introduction to chaos. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 68000 - Modern Automatic Control

Credit Hours: 3.00. Theoretical methods in optimal control theory. Topics include the calculus of variations and the Pontryagin minimum principle with applications to minimum energy problems. Geometric methods will be applied to the solution of minimum time problems. Computational methods, singular problems, observer theory, and sufficient conditions for existence of solutions are also discussed. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

ME 57200 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. Introduction to the analysis and design of robotic manipulators. Topics include: kinematic configurations, forward and inverse position solution, velocity and acceleration, path planning, workspace analysis, force and torque solutions, rigid body dynamics, motors and actuators, robot design, sensors and controls, computer simulation, and graphical animation.

Learning Outcomes: 1. Analysis of manipulator motion and forces. 2. Manipulator design including actuator, drive, and sensor issues. 3. Computer simulation to predict motion and forces. Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 67700 - Nonlinear Feedback Controller Design

Credit Hours: 3.00. Controller design and analysis of nonlinear feedback systems. Topics include the design of linear/nonlinear feedback controllers. Describing Function (DF) techniques for design, Popov and Generalized Circle Criterion for closed-loop stability, functional analysis and Volterra series approaches, and introduction to existing nonlinear controller design tools. Offered in alternate years. Prerequisite: ME 67500 .

Credits: 3.00

ME 68900 - Adaptive Control

Credit Hours: 3.00. Theory and application of adaptive control of linear systems in both continuous and discrete time domain. Real-time parameter estimation algorithms, direct and indirect adaptive methods, deterministic self-tuning regulators, Lyapunov stability theory, input-output stability, model-reference adaptive control, stability and convergence of adaptive algorithms, robustness, and implementation issues, with laboratory experiments and demonstrations. Offered in alternate years. Prerequisite: ME 57500 .

Credits: 3.00

IE 54900 - Machine Vision In Intelligent Robotic Systems

Credit Hours: 3.00. Introduction to machine vision and learning algorithms from a human-machine interaction standpoint, and application of machine vision techniques to the design of human-integrated cybernetic systems, such as, robotic systems, flexible automation, and wearable electronics.

Learning Outcomes: 1. Analyze and write computer programs to analyze images for tasks such as filtering, edge detection, segmentation, object recognition, and template matching. 2. Describe and use image filtering methods for image processing. 3. Describe and use edge detection methods for image processing. 4. Use morphological operations to perform shape recognition and template matching. 5. Use optical flow methods to study motion. 6. Apply techniques for object tracking and motion detection to analyze multiple images or video. 7. Apply learning methods such as neural networks, clustering, and linear regression for object recognition. 8. Apply a computer vision technique to the control of a robotic arm. 9. Plan and develop a working prototype machine vision interface. Credits: 3.00

CS 59200 - Computer Science Seminar

Credit Hours: 3.00. A seminar course for in-depth exploration of a specific topic. Topics vary. Classes consist of both instructor and student presentations. Students read, present and discuss research papers, and may complete and present a research project in the area. For each offering, inclusion on a plan of study is determined by the CS Graduate Study Committee. If approved, may be included on a CS MS or PhD plan of study according to relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

Core Selectives (9 credits)

About the Program

Secondary STEM Education with Initial Licensure, MS
Social Psychology, MS

About the Program

Program Requirements

Required Courses (xx credits)

Statistics Courses (6 credits)

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation

and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

Social Psychology Colloquium (xx credits)

Social Psychology Courses (21 credits)

PSY 64000 - Survey Of Social Psychology I

Credit Hours: 3.00. An extensive survey of methods, research, and theory in social psychology.

Credits: 3.00

PSY 68800 - Research Methods In Social Psychology

Credit Hours: 3.00. This course provides a broad and rigorous, graduate-level overview of contemporary research methodology in social psychology and personality. The course follows a discussion seminar format. Permission of department required.

Learning Outcomes: 1. Understand the specific rationale for using different methodological techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

PSY 50600 - Professional Issues And Trends In Social Psychology

Credit Hours: 3.00. This course is designed to help students acculturate to and acquire a broad knowledge of social

psychological research. Topics to be covered include but are not limited to: how to apply for academic jobs, how to present your program of research, how to network at conferences, how to develop a website presence, how to approach potential collaborators, and how to structure your research questions in an appropriate manner for grant applications. Permission of department required.

Learning Outcomes: 1. Learn strategies to professionally present themselves, their interests, and their accomplishments on paper and in person. Credits: 3.00

PSY 50700 - Current Readings In Social Psychology

Credit Hours: 3.00. This course is designed to expose students to a variety of readings, discussions, and presentations. The seminar examines a diverse assortment of social psychological topics. Students benefit from exposure to current research and methods in the field. Students also benefit from becoming increasingly conversant regarding the latest empirical advances in the field. Permission of department required.

Learning Outcomes: 1. Understand and interpret a host of different designs and analyses regarding a large variety of key areas in social psychological research. Credits: 3.00

Selectives (9 credits)

PSY 63000 - Stereotyping And Prejudice

Credit Hours: 3.00. Provides an in-depth examination of issues related to stereotyping, prejudice, and discrimination. After a general introduction and historical overview, students will be exposed to a detailed study of the social psychological foundations of stereotyping and prejudice to include their impact and reduction strategies. Permission of instructor required.

Learning Outcomes: 1. Facilitate oral and written communication skills and critical thinking skills. 2. Acquire greater appreciation of research ethics, methodology, design, and data analysis. 3. Gain appreciation through careful consideration of original empirical works. Credits: 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

PSY 68200 - Advanced Seminar In Industrial Organizational Psychology

Credit Hours: 3.00. Special topics in industrial and organizational psychology are offered on a two-year rotating basis. The special topics are: work motivation, leadership, advanced selection and placement, and performance appraisal. One topic will be treated each semester.

Credits: 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 66900 - Prosocial Behavior

Credit Hours: 3.00. This course is designed to provide a broad and rigorous, graduate-level overview of contemporary scientific research on prosocial processes from the perspective of personality and social psychology. Permission of department required.

Learning Outcomes: 1. Have a comprehensive mastery of the mechanisms and processes associated with prosocial behavior. 2. Learn how to plan and conduct research on prosocial behavior. 3. Learn to integrate prosocial processes with more general interpersonal processes and social relation research. Credits: 3.00

Electives (9 credits)

Thesis Research (xx credits)

PSY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission

of instructor required.

Credits: 1.00 to 18.00

GPA Requirements

Additional Information

Sociology, MS

About the Program

Program Requirements

Required Courses (17 credits)

Core Courses (15 credits)

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 60000 - Development Of Sociological Theory

Credit Hours: 3.00. The development of sociological thought in Western Europe and subsequently in the United States from the publication of Marx's early manuscripts through the sociological writings of the 1940s.

Credits: 3.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

Seminar Course (2 credits)

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

Areas of Specialization Electives (15 credits)

Family

Health, Aging, and the Life Course

Law and Society

Social Inequality: Class, Gender, Race/Ethnicity, and Sexuality

Social Movements and Political Sociology

Sociology of Religion

Work and Organizations

Analytic Project Course (6 credits)

SOC 69500 - Analytic Project In Sociology

Credit Hours: 3.00 or 6.00. Designed to provide experience in defining a research problem, in assessing knowledge and research about the problem, and in analysis. Prerequisite: SOC 58000 , SOC 58100 . Permission of instructor required.

Credits: 3.00 or 6.00

Concentrations

GPA Requirements

Software Engineering, MSSWE

About the Program

Program Requirements

Required Courses (9 credits)

Core Courses (6 credits)

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

Math Course (3 credits)

Focus Area Selectives (12 credits)

Any Software Engineering

CS 51000 - Software Engineering

Credit Hours: 3.00. Software life cycles, requirements engineering, software design, design of distributed systems, verification and validation, software architecture, process metrics and models, and research methods in software engineering.

Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 66400 - Formal Languages, Computability, And Complexity

Credit Hours: 3.00. Topics in computability theory and formal languages include recursive function theory, the equivalence of various generic programming languages for numeric calculations and string manipulations, regular languages and finite state automata, and context-free and context-sensitive languages. In complexity theory, emphasis is on the theory of NP-completeness, including proof methods, the distinctions between strong- and weak-sense NP-completeness, NP-hardness, and performance-guaranteed approximation algorithms. Offered in alternate years. Prerequisite: ECE 60800 .

Credits: 3.00

ECE 51220 - Applied Algorithms

Credit Hours: 3.00. Solving large-scale problems typically rely on many clever data structures and algorithms. This course aims to cover many such useful algorithms for solving large-scale problems. These algorithms include greedy algorithms, dynamic programming and more advanced graph algorithms. The course also aims to demonstrate how such algorithms can be applied to solve optimization problems encountered in engineering applications. In particular, applications in the design of VLSI (very large scale integration) at circuit, layout, or system level will be used to demonstrate how an engineering problem can be formulated as a tree/graph problem and solved using established tree/graph algorithms.

Learning Outcomes: 1. Demonstrate an understanding of greedy algorithms and dynamic programming (ABET outcome 1). 2. Demonstrate an n understanding of advanced graph algorithms (ABET outcome 1). 3. Demonstrate an ability to design and implement appropriate data structures and algorithms for engineering applications (ABET outcomes 1 and 2). Credits: 3.00

Cybersecurity

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 62700 - Introduction To Cryptography And Secure Communication

Credit Hours: 3.00. Introduces the basic concepts of cryptography. Various cipher systems are presented, including transposition and substitution systems, Block ciphers, RSA, and Knapsack. Methods used to attack ciphers are discussed with emphasis on complexity. Case studies of the use of cryptographic methods in communication systems are presented with some consideration given to privacy issues. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS

and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

ECE 56401 - Computer Security

Credit Hours: 3.00. In this course the discussion will include the following topics: (not necessarily in this order) security policies, confidential policies, integrity policies, security models, security design, access control, cryptography, key management, authentication, program and software, security, malicious logic, intrusion detection, network security, security attacks and countermeasures, operation system security, smartcard tamper-resistant devices, phishing, legal and ethical issues in computer security, and selected topics.

Credits: 3.00

Embedded Software, Robotics, and Controls

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures,

especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60872 - Reliable And Secure Computer Systems

Credit Hours: 3.00. The course provides an introduction to the hardware and software methodologies for specifying, modeling and designing fault-tolerant systems supported by case studies of real systems. The material presents a broad spectrum of hardware and software error detection and recovery techniques that can be used to build reliable networked systems. The lectures discuss how the hardware and software techniques interplay, what techniques can be provided in COTS hardware, what can be embedded into operating system and network communication layers, and what can be provided via a distributed software layer and in the application itself. Prerequisite by Topic: Any one high level programming language experience; A basic background in probability.

Learning Outcomes: 1. Formulate design principles for dependable systems. 2. Analyze mathematically a system for its dependability properties. 3. Understand and apply hardware dependability techniques. 4. Understand and apply software dependability techniques. 5. Understand and apply networking dependability techniques. 6. Design, develop, and present an innovative project on dependable systems.

Credits: 3.00

Machine Learning and Data Science

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 62900 - Introduction To Neural Networks

Credit Hours: 3.00. Information processing with neural networks, biological and engineering implications, learning algorithms, current neural network models and architectures, implementational topics, applications in areas such as signal/image processing, pattern recognition, optimization, simulation, system identification, nonlinear prediction, communications, and control. Concurrent prerequisite: ECE

60000 .

Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

ECE 60146 - Deep Learning - Theory And Practice Of Deep Neural Networks

Credit Hours: 3.00. This course teaches the theory and practice of deep neural networks from basic principles through state-of-the-art methods. The class blends hands-on programming, using a variety of state-of-the-art programming frameworks, with theoretical treatment based on current literature. Implementation will emphasize the use of the Pytorch language and the use of dynamic computational graphs. Some previous experience with optimization techniques is important for success in the course.

Learning Outcomes: 1. Understand how to design a neural network architecture that is appropriate for a wide range of specific applications. 2. Create an efficient implementation of a wide range of standard neural network architectures in Pytorch. 3. Use neural networks to solve applications problems in classification, regression and data generation. 4. Understand how the fundamental theory of optimization can be used to efficiently train neural networks. 5. Understand the trade-offs between optimization techniques and how these techniques can be selected to achieve the best neural network training. 6. Understand and use current theory of neural network performance. 7. Understand the limitation of existing neural network theory and the likely directions of future research.
Credits: 3.00

Systems Software

ECE 56300 - Programming Parallel Machines

Credit Hours: 3.00. This course presents methods and techniques for programming parallel computers, such as multicore and high-end parallel architectures. Various parallel algorithms will be presented to demonstrate different techniques for identifying parallel tasks and mapping them onto parallel machines. Realistic science/engineering applications and their characteristics will be discussed. Parallel architectures to be considered are shared-memory and distributed-memory multiprocessor systems. Programming paradigms for these machines will be compared, including directive-based (OpenMP), message passing (MPI) and thread-based (Posix threads) methods. Methodologies for analyzing and improving the performance of parallel programs will be discussed. There will be a class project in which each student parallelizes and tunes the performance of a large computation application or develops/improves a tool that helps this process. Each student

will prepare one lecture for a selected topic. Offered during odd years.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 64200 - Information Theory And Source Coding

Credit Hours: 3.00. A treatment of the basic concepts of information theory. Determination of channel capacity and its relation to actual communication systems. Rate distortion theory is introduced, and the performance of various source codes is presented. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 66300 - Advanced Compilation And Automatic Programming

Credit Hours: 3.00. This course presents the concepts needed to design and implement production quality code generators for any of the more popular languages and families of computer architecture (including various pipelined, superscalar, and macro-parallel machines). Flow analysis and concurrency detection, as well as optimizations and loop and irregular code parallelizations, are covered in detail. Using C on ECN UNIX, each student will complete a project implementing a simple optimizer/parallelizer. Prerequisite: ECE 56500 , CS 50200 or ECE 46800 or ECE 57300 .

Learning Outcomes: 1. Apply automated reasoning techniques and tools to analyze and verify programs and reactive systems. 2. Explain and implement program synthesis algorithms and methodologies. 3. Apply program synthesis techniques to automate programming tasks in an application domain.

Credits: 3.00

ECE 67300 - Distributed Computing Systems

Credit Hours: 3.00. Discussions of the design issues of distributed computing systems (DCS). The general theory of distributed transaction management, reliability, and resource management is discussed. Various algorithms and specification methodologies for DCS are introduced. A general coverage of the three major areas of DCS, namely: distributed operating systems, distributed databases, and distributed AI is provided. The discussion is augmented with various case studies. Prerequisite: ECE 46900 or introductory course in operating systems.

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 50863 - Computer Network Systems

Credit Hours: 3.00. The goal of this course is to provide students with a proper grounding in the basic concepts and seminal work in computer network protocols and systems, and to introduce students to research in the field. The course will cover classical concepts such as network architecture, switching, routing, congestion control, and quality-of-service, and discuss recent developments in these areas. The course will also cover new developments in networking such as network measurements, network management, overlay networking and peer-to-peer systems, network security, and new network architectures. The course will emphasize a system-oriented and empirical view of internet architecture. Graduate standing or consent of instructor.

Learning Outcomes: 1. Understand the architectural principles underlying internet design. 2. Understand LAN interconnects, routing algorithms, and congestion control algorithms. 3. Identify, formulate, and solve problems encountered in the design of networks. 4. Implement networking systems and rigorously evaluate them using systematic empirical methods. Credits: 3.00

GPA Requirements

Speech, Language, and Hearing Sciences, MS

About the Program

Program Requirements - Clinical Thesis & Clinical Non-thesis

Clinical Seminar (4 credits)

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 54600 - Clinical Seminar In Speech-Language Pathology

Credit Hours: 1.00. This is a clinical seminar course designed to support students' ability to meet knowledge and skills standards related to the scope of practice of speech-language pathologists. This course provides supplemental learning opportunities and support for students as they complete their hands-on clinical practice each semester by taking a more in-depth look at conditions within the nine areas of practice as well as cultural and linguistically diverse families, ethical standards in clinical practice, professional issues and trends within communication sciences and disorders, and interprofessional education and practice. The course is offered each semester and objectives vary to advance the knowledge and skills required to meet the program and ASHA/CAA guidelines for completion of the program as well as certification standards as indicated by the CFCC.

Learning Outcomes: 1. Assess the interaction of cultural and linguistic variables between caregivers and the individual served. 2. Reflect on the impact of both implicit and explicit bias in clinical service delivery and actively explore individual biases and how they relate to clinical services. 3. Deconstruct the social determinants of health and environmental factors for individuals served and how these determinants relate to clinical services. 4. Distinguish the roles and importance of interdisciplinary/interprofessional assessment and intervention and connecting one's own role and those of other professions to appropriately assess and address the needs of the individuals and populations served. 5. Justify the importance of individual and collective (e.g., local, national organizations) advocacy for clients/patients/students' right to care. 6. Explore contemporary professional issues that affect Speech-Language Pathology, entry-level and advanced certifications, licensure, and other relevant professional credentials, as well as local, state, and national regulations and policies relevant to professional practice. 7. Interpret Professional code of ethics and professional fiduciary responsibility. 8. Develop leadership and mentoring skills related to the supervisory process. 9. Prioritize continuous learning in speech, language, and hearing sciences. Credits: 1.00

Clinical Practicum (xx credits)

SLHS 54900 - Clinical Practice In Speech-Language Pathology I

Credit Hours: 1.00 to 8.00. The second in a series of practicum courses designed to provide instruction and practical experience in fundamental diagnostic and therapeutic approaches to speech and language disorders. AUS 43000 is recommended. Permission of instructor required.

Learning Outcomes: 1. Develop an in-depth understanding of the process of team development, the roles, and practices of collaboration to support effective performance in a variety of settings. (Interprofessional Education) 2. Build leadership skills that support collaborative practice, team effectiveness, and understanding of how one's uniqueness contributes to effective communication, conflict

resolution, and positive Interprofessional working relationships. (Interprofessional Education) 3. Prioritize the needs, values, preferred mode of communication and cultural/linguistic background of the patient, family, caregiver, and relevant others. (Cultural Humility/Responsiveness) 4. Defend ideas of justice, equity, diversity, inclusion and intersectionality and acknowledge implicit bias in order to actively contribute to a climate supportive of diversity and inclusion. (Cultural Humility/Responsiveness) 5. Examine ASHA Code of Ethics, Scope of Practice, certification process, supervision guidelines, and professional affiliations. (Stewardship & Accountability) 6. Dissect federal, state, and institutional regulations and discuss contemporary professional issues and advocacy related to trends in practice, privacy policies, models of service delivery, reimbursement procedures/fiduciary responsibilities. (Stewardship & Accountability) 7. Improve skills in oral and written or other forms of communication sufficient for entry into professional practice. (Effective Communication) 8. Compile information related to etiologies, characteristics and interdependence of communicative and swallowing disorders as well as evidence-based practices to treat each disorder. (Continuous Learning) Credits: 1.00 to 8.00

Externships (12 credits)

SLHS 64800 - Speech-Language Pathology Education Externship

Credit Hours: 1.00 to 8.00. Full-time school-clinical experience to provide speech, language, and hearing services in elementary and secondary schools, under the supervision of a school clinician and university staff holding the ASHA Certificate of Clinical Competency.

Credits: 1.00 to 8.00

SLHS 64900 - Speech-Language Pathology Healthcare Externship

Credit Hours: 1.00 to 8.00. An advanced-level clinical practicum in speech and language disorders. Prerequisite: SLHS 54900 . Permission of instructor required.

Credits: 1.00 to 8.00

Specialty Selectives (13 credits)

SLHS 51800 - Counseling In Speech-Language Pathology And Audiology

Credit Hours: 2.00. Application of counseling models, theories, and methods to persons with communicative disorders and their families. Permission of instructor required.

Credits: 2.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 52900 - Stuttering: Nature, Diagnosis, And Treatment

Credit Hours: 2.00. Reviews applications of research findings and theoretical developments to our understanding of the onset, development, perpetuation, and amelioration of stuttering. Demonstrates and discusses methods and procedures for diagnosing and treating stuttering across the lifespan.

Learning Outcomes: 1. Students will learn the characteristics of stuttering in preschool and school-age children, adolescents, and adults. 2. Students will learn assessment and treatment procedures for preschool children, school age children, adolescents, and adults who stutter. 3. Students will become familiar with the major theoretical and clinical approaches to stuttering treatment. 4. Students will learn how to read research articles in the area of fluency and will be familiar with the major research findings in the field. 5. Students will learn about the nature and treatment of stuttering in diverse populations and will learn to use clinical methods that are sensitive to developmental

and cultural differences Credits: 2.00

SLHS 53300 - Medical Speech-Language Pathology

Credit Hours: 2.00. Introduces the graduate speech-language pathology student to issues encountered in the medical environment in preparation for a healthcare externship and a career in the healthcare setting. Topics will include collaborative models in the medical setting, clinical documentation, ethical issues, equipment and instrumentation, medications, among others.

Learning Outcomes: 1. Increase understanding of the medical speech-language pathology environment. 2. Learn about various departments, professionals, and their collaborative roles with speech-language pathologists. 3. Develop an understanding of solutions to ethical dilemmas related to the medical field. 4. Understand and explain medications and their effects on swallowing and communication disordered individuals. 5. Become familiar with equipment, instrumentation, and medical tests in the intensive care unit and other acute care settings. 6. Discuss future trends related to the medical and speech pathology healthcare arena. 7. Comprehend and explain information obtained from a medical record. Credits: 2.00

SLHS 61900 - Advanced Topics In Audiology And Speech Pathology

Credit Hours: 0.00 to 3.00. Study of advanced topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary based on topics covered. Credits: 0.00 to 3.00

SLHS 53200 - Voice Disorders

Credit Hours: 2.00. Principles of differential diagnosis and clinical management for children and adults presenting voice disorders, based on a working knowledge of normal laryngeal structure and function.

Credits: 2.00

SLHS 54300 - Assessment And Treatment Of Literacy Disorders

Credit Hours: 2.00. An introduction to the characteristics, definitions, etiologies, and assessment of literacy development in school-aged children (4-18 years of age). Emphasis is placed on the scope of practice for speech-language pathologists in the assessment and intervention process for children diagnosed with language-based literacy disorders.

Learning Outcomes: 1. Differentiate between normal and disordered literacy development. 2. Identify formal and informal assessment tools in each of the following areas: phonological processing, decoding, encoding, oral reading fluency, reading comprehension. 3. Summarize literacy strengths and weaknesses in clients with various profiles. 4. Identify appropriate strategies / techniques to remediate client weaknesses. 5. Identify various organizations, websites, programs, and supporting research for parents and educators. Credits: 2.00

SLHS 54401 - School-Clinical Methods In Communication Disorders

Credit Hours: 1.00. The focus of this course is on the implementation of speech, language, and hearing services with preschool to secondary (P-12) school-aged children. Students develop a working knowledge of special education law, disability law, and other resources for school-aged children.

Learning Outcomes: 1. Implement special education and disability laws. 2. Select the most effective instructional strategies for English Language Learners. 3. Explain the professional qualifications, roles and responsibilities related to speech-language pathology and audiology in a school setting. 4. Describe tasks required for the provision of speech, language, and hearing services in a school setting. 5. Have the knowledge and thinking skills to understand and evaluate research to incorporate evidence based strategies into clinical practice. Credits: 1.00

SLHS 54001 - Augmentative And Alternative Communication (AAC)

Credit Hours: 2.00. This course will orient students to the use of augmentative and alternative communication (AAC) across the lifespan. Assessment and evidence-based intervention for people who cannot meet their daily communication needs via natural speech and/or writing and who need AAC will be

covered. AAC is neither disorder- nor age-specific. As such, AAC strategies, techniques, and options may be used across the lifespan and with people who have severe communication disorders that interfere with expressive and/or receptive speech and/or language. In that way, AAC can have broad applicability across settings and populations.

Learning Outcomes: 1. Demonstrate knowledge of hardware, software, feature matching, and evidence related to use of AAC and SGD with individuals with complex communication needs (CCNs). 2. Demonstrate knowledge related to the assessment and intervention for various people for whom AAC might be appropriate. 3. Apply and integrate evidence-based knowledge of typical language development toward the assessment and intervention for individuals with complex communication needs (CCNs). 4. Acquire knowledge and evaluate information about a range of augmentative and alternative communication (AAC) modalities as it applies to the assessment and intervention for individuals with complex communication needs (CCN) across the lifespan. 5. Acquire familiarity with and demonstrate use of AAC app evaluation rubrics used in decision-making regarding a range of complex communication needs (CCN). 6. Acquire, evaluate, and effectively present evidence-based knowledge on a specific topic within the scope of augmentative and alternative communication modalities. Credits: 2.00

Thesis Research (3 credits)

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

SLHS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Research Project (2 credits)

SLHS 68800 - Research Integration And Dissemination For Evidence Based Practice

Credit Hours: 2.00. The focus of this course is on developing skills integrating current research and communicating about research in clinical practice. Students complete a comprehensive project involving a literature review, clinical decision and poster. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in scientific communication in a variety of modes, including developing an oral pitch, preparing a literature review and evaluation, and creating and delivering a poster and writing a research abstract. Pre-Requisite: Students must complete Evaluating Research - currently offered as SLHS 51900.

Learning Outcomes: 1. Evaluate and synthesize findings from the literature into a written and oral comprehensive review. 2. Refine scientific communication skills. 3. Understand principles of evidence-based practice guides and apply them to clinical decision making. Credits: 2.00

Program Requirements - Non-clinical Thesis & Non-clinical non-thesis

Required Courses (19 credits)

Specialty Selectives (13 credits)

Thesis Research (3 credits)

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

SLHS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Research Project (2 credits)

SLHS 68800 - Research Integration And Dissemination For Evidence Based Practice

Credit Hours: 2.00. The focus of this course is on developing skills integrating current research and communicating about research in clinical practice. Students complete a comprehensive project involving a literature review, clinical decision and poster. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in scientific communication in a variety of modes, including developing an oral pitch, preparing a literature review and evaluation, and creating and delivering a poster and writing a research abstract. Pre-Requisite: Students must complete Evaluating Research - currently offered as SLHS 51900.

Learning Outcomes: 1. Evaluate and synthesize findings from the literature into a written and oral comprehensive review. 2. Refine scientific communication skills. 3. Understand principles of evidence-based practice guides and apply them to clinical decision making. Credits: 2.00

Concentrations

GPA Requirements

Sport Management, MSSM

About the Program

Program Requirements

Required Courses (36 credits)

HK 57700 - Marketing, Branding, And Sales In Sport

Credit Hours: 3.00. This course is designed to provide students with (1) a deep understanding of theories and concepts in sport marketing, (2) an up-to-date understanding of them as they are currently being applied to solve marketing problems and issues in various sport business contexts, (3) strategies of making effective decisions concerning the marketing of sport products and brands, (4) a foundation for advanced study and work in marketing, consumer behavior, and related fields.

Learning Outcomes: 1. Articulate the factors that make sport marketing a unique enterprise. 2. Demonstrate an understanding of various research methodologies utilized in sport marketing. 3. Assess the value of segmentation in sport marketing. 4. Design, implement, and evaluate a sport marketing research plan. 5. Appreciate the elements of the sport product that contribute to its uniqueness in the marketplace. 6. Analyze the growth in importance of licensing, brand equity, and fan identification in sport marketing. 7. Differentiate among the unique factors that impact sport product pricing strategies. 8. Understand and evaluate the effectiveness of the key components of effective promotional programs and campaigns within the sport market. 9. Devise a promotional and sales plan within the sport marketplace. 10. Understand the scope and nature of sponsorship and the rationale for their use by corporations and the sport enterprise. 11. Analyze the importance of public relations and its unique role in the marketing mix within the context of sport. 12. Consider the future directions of sport marketing, giving special attention to the growth of electronic media and its parts. Credits: 3.00

HK 52900 - Venue Management

Credit Hours: 3.00. This course will examine all aspects of the management of sport facilities, including development, planning, staffing, operations, and evaluation. Students will study the relationships between the respective parties in terms of ownership, management, and the event.

Learning Outcomes: 1. Develop a basic understanding of the managerial issues (e.g., building planning, hospitality, employee and event recruitment, selection, and negotiating) that are specific to sport event and facility management. 2. Schedule, promote, market, and maintain events and facilities. 3. Develop an appreciation of the legal liability associated

with events and facilities management and emergency crowd control. 4. Understand the basic principles of facility design and construction. 5. Seek to discuss issues centered on preventive maintenance, facility planning, event administration, box office management, concessions, house and ground management, systems management, marketing, finance, and personnel administration. Credits: 3.00

HK 52600 - Communication And Media In Sport

Credit Hours: 3.00. This course is designed to provide students with a deep understanding of the unique role and importance of internal and external communications in relation to sport. Furthermore, it examines the important role the media plays in the sport universe. The intermingling of sport organization and sport media is also examined, especially within the context of the changing nature of the relationship in the 21st century.

Learning Outcomes: 1. Explain why it is essential to learn about technology today and discuss several ways technology has been integrated into our business and personal lives. 2. Discuss the organizational and societal impact of implementing technology; including some benefits and risks related to the prominence of computerized technology in our society. 3. Explain the impact of computerized communications (blogs, podcasting, viral marketing, etc.) on businesses, personal lives, and the sports Industry. 4. Describe social networking (including some computerized elements) and how it can be used to enhance and expand customer relationships for businesses and the sports Industry. 5. Define web-based multimedia and list some of the advantages and disadvantages of using multimedia and demonstrate how to utilize web-based media to create Marketing and Public Relations products; some examples include (a) newsletter, (b) press release, (c) podcast, (d) web pages, interactive training presentation, and (f) social media. Credits: 3.00

HK 52800 - Sport Event Management And Operations

Credit Hours: 3.00. Introduces students to the planning and management of national and international sport events through the strategic and systematic process of event management, exploring the phases and structural domains associated with the model.

Learning Outcomes: 1. Apply the event management process to sport events. 2. Develop sustainable sport events. 3. Create risk management solutions to minimize, transfer, avoid, or accept risks for sport events. 4. Respond appropriately to managerial challenges facing sport event managers. Credits: 3.00

HK 52100 - Sport Administration

Credit Hours: 3.00. This course is designed to provide students with a deeper understanding of variety of areas within Sport Management. Students will learn about youth, college and professional sport and the various ancillary roles and departments that are attached to each. Students will also engage in a focused book reading and current event reading to further understand the roles in sport.

Learning Outcomes: 1. Develop group leadership skills through discussions and presentations. 2. Acknowledge the historical ramification of the creation of the NCAA and of professional leagues how this impacts today's sport setting. 3. Recognize the management functions that exist in a contemporary sport organization. 4. Understand the major factors affecting today's world of professional, collegiate, and amateur sport. 5. Develop a personal philosophy regarding organizations within the sport industry. 6. Develop a greater knowledge of intercollegiate athletics administration. 7. Acknowledge the historical, socio-cultural, and ethical factors facing today's college and professional sport. Credits: 3.00

HK 52200 - Sport Law And Ethics

Credit Hours: 3.00. This course explores legal problems facing sport. Students will learn fundamental legal principles including employment law, ADA requirements, hazing, sexual

harassment, and Title IX application. Both past and current legal cases related to sport, recreation and fitness industries are examined. Concerns and problem-solving for issues of risk management are also explored.

Learning Outcomes: 1. Develop an understanding of the history and development of the American legal system and courts. 2. Analyze and apply ethical and legal literature in case law, statutes, periodicals, and texts. 3. Explain the basic understanding of terminology and procedures used in legal proceedings. 4. Discuss legal aspects most important to sport management including tort law, contract law, physical activity situations, constitutional law, Title VII and Title IX. 5. Create a comprehensive understanding of risk management and other legal theories to minimize or avoid legal liability in sport settings. 6. Gain a deeper understanding of the ethical reasoning/decision-making process and develop the knowledge, skills, and abilities to apply moral reasoning in dealing with ethical dilemmas in sport. Credits: 3.00

HK 57800 - Organizational Behavior And Leadership In Sport

Credit Hours: 3.00. This course is an introduction to the basic concepts and topics in organizational behavior (OB) and leadership. The course focuses on OB at three levels: individual, interpersonal, and collective. We will cover decision-making, relationships, motivation, personality, influence, and groups. Permission of department required.

Learning Outcomes: 1. Learn of and develop an understanding of the fundamental theories and principles of employee and organizational behavior in the context of professional, college, and amateur sports by reading the assigned textbook and related articles, listening to lectures, videos, and engaging in other course materials. 2. Identify and apply learned theories and approaches to address and resolve organizational and personnel issues encountered by management in sports organizations by analyzing and problem-solving weekly case studies based on real-life organizational behavior examples in sports settings. 3. Demonstrate knowledge of the principles and practices associated with the following areas of organizational behavior in sports including leadership, organizational culture, internal and external organizational conflict, and diversity and inclusion. 4. Apply the information learned in weekly modules and through the completion of individual personality assessments in class to understand students' individual work styles and create a personal plan to employ work traits in a practical manner as future employees. 5. Develop personal growth through assessment activities where students have the opportunity to reflect on their own style of work in light of the course material as it aligns with their career goals. Credits: 3.00

HK 57900 - Strategic Case Reviews: Lessons From The Sport Management Field

Credit Hours: 3.00. The focus of this course is to merge the application of leadership and management theory to various issues arising in Sport Management including organizational behavior, strategic planning, and human resources management. This course will utilize case studies based on true events and connect theoretical ideas with practical experience and outcomes. Permission of department required.

Learning Outcomes: 1. Learn of and develop an understanding of the fundamental theories and principles of employee and organizational behavior in the context of sports by reading the assigned textbook chapters and related articles, listening to lectures, and fully engaging in all course materials and assignments. 2. Identify and apply learned theories and approaches to address issues encountered by management in organizations by analyzing and problem-solving weekly case studies based on real-life examples in a variety of sports settings. 3. Demonstrate knowledge of the principles and practices associated with organizational behavior in sports including leadership, organizational culture, and internal and external

conflict. 4. Using information learned in weekly case studies, and through the completion of individual personality assessments, gain a better understanding of individual leadership and work styles. 5. Develop personal growth through a variety of assessment activities whereby students reflect on their own leadership style. Credits: 3.00

HK 52950 - Sport Practicum

Credit Hours: 1.00 to 3.00. This course is designed to provide students with a deeper understanding of the variety of different areas within Sport Management. Students will learn through practical experience in the field. Students will also engage in a focused book reading and current event reading to further understand the roles in sport.

Learning Outcomes: 1. Apply classroom experiences to the real world through specific projects and experiences. 2. Examine how the practice of various activities varies from the ideal taught in a classroom. 3. Lead others in moving a project from start to conclusion. 4. Present to faculty and students in the classroom how the real-world experience improved their understanding of necessary skills. Credits: 1.00 to 3.00

HK 51800 - Analytics And Technology In Sport

Credit Hours: 3.00. This course is designed to acquire the fundamentals of sports performance analytics. It provides a basic understanding of the different key performance indicators within sports performance analytics including load management, injury prevention, drafting and scouting. The course also provides an understanding of how business analytics can drive decisions in the sport world.

Learning Outcomes: 1. Apply data science principles to sports performance, referred to as sports analytics. 2. Apply measurement and statistical modeling to professional athletes in sports. 3. Examine professional athletes' performance and implication of injuries on market value. 4. Present data to different pro sports industry audiences: players, coaches, and front office management. 5. Apply the processes that take place from the inception of a research question, identification of key performance indicators, data collection, statistical analyses, and data visualization, also termed the sports science data protocol. Credits: 3.00

GPA Requirements

Statistics, MS

About the Program

Program Requirements

Required Courses (27 credits)

Core Courses (21 credits)

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51500 - Statistical Consulting Problem

Credit Hours: 0.00 to 1.00. Taken by students in the Applied Statistics Master's program who have participated in the

Statistical Consulting Service (STAT 59700). Focus is on addressing statistical consultation problems that involve either design of experiments or statistical analysis. Problems involve written reports and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Determining an appropriate design of an experiment. 2. Choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 3. Implementing various statistical methods via software and summarizing the output for the client. 4. Recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 0.00 to 1.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

STAT 58200 - Statistical Consulting And Collaboration

Credit Hours: 3.00. This course is designed to emphasize and develop the skills needed by a statistical consultant/collaborator. Topics include: problem solving, consulting session management, written and oral communication, research ethics, design of experiments, collection of data, and application of statistical methods to real problems. Class activities include actively participating in consulting sessions held by the Statistical Consulting Service, small group projects, short papers, and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Be aware of the skills necessary to be an effective statistical consultant/collaborator. These skills include consulting session management, written and oral communication with clients, interpreting facial and body language, handling personality conflicts, practicing sound research ethics, properly designing an experiment and determining an appropriate sample size, and choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 2. Know how to recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 3.00

STAT 59700 - Statistical Consulting Seminar

Credit Hours: 1.00. Active participation in weekly consulting meetings, directed reading in the statistical literature, application of statistical methods to real problems, report writing. Permission of Instructor required.

Learning Outcomes: 1. Improve on the skills needed to be an effective statistical consultant and collaborator, including problem solving, time management, and written and oral communication. 2. Develop good listener and questioner skills in order to understand the goals of a study and the data (to be) collected. 3. Apply appropriate statistical methods to address real-world problems. Credits: 1.00

STAT 52700 - Introduction To Computing For Statistics

Credit Hours: 3.00. This course provides a thorough introduction to the R programming language, and its use for statistical computing and data science. The course will first look at the fundamentals of R, including different data-structures, control-flow, and the basic vocabulary. An emphasis will be placed on learning idiomatic and efficient R, covering ideas such as recycling, vectorization and functional programming. The course will then look at principles and tools for tasks like organizing data ('tidy data'), manipulating data ('data carpentry'), querying data (through topics like regular expressions) as well as visualizing data (including interactive visualizations). The material and the homework will encourage development of modular reusable code and reproducible research through ideas such as object-oriented programming and dynamic documents in R Markdown. The last part of the course will study statistical procedures such as least-squares regression, LASSO, Monte Carlo sampling and Markov chain Monte Carlo. Besides exams and homeworks, the course will involve a final project that students can collaborate together on.

Learning Outcomes: 1. Read and write idiomatic R code. 2. Be familiar with the entire data science pipeline, from organizing, manipulating, querying and visualizing data. 3. Introduce computational tools like optimization and simulation in the context of statistical algorithms. Credits: 3.00

Foundational Selectives (6 credits)

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on

use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

Selectives (6 credits)

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 52900 - Applied Decision Theory And Bayesian Statistics

Credit Hours: 3.00. Bayesian and decision-theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; Bayesian design and sequential analysis; comparisons of statistical paradigms.

Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

STAT 54600 - Computational Statistics

Credit Hours: 3.00. The course focuses on two fundamental aspects in computational statistics: (1) what to compute and (2) how to compute. The first is covered with a brief review of advanced topics in statistical inference, including Fisher's fiducial inference, Bayesian and frequenstist methods, and the Dempster-Shafer (DS) Theory. The second is discussed in detail by examining exact, approximation, and interactive simulation methods for statistical inference with a variety of commonly used statistical models. The emphasis is on the EM-type and quasi-Newton algorithms, numerical differentiation and integration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Master commonly used numerical matrix operations, including the sweep operator, Cholesky decomposition, eigenvalue decomposition, and single value decomposition. 2. Understand statistical thinking in development of interactive numerical methods. 3. Apply optimization algorithms such as quasi-Newton and conjugate gradient methods. 4. Implement EM-type algorithms for maximum likelihood estimation when expanded complete-data models are available, including commonly used statistical models. 5. Create random number generators. 6. Implement the Gibbs sampler and Metropolis-Hastings algorithms for Bayesian data analysis. Credits: 3.00

STAT 55300 - Theory Of Linear Models And Analysis Of Experimental Designs

Credit Hours: 3.00. Least squares analysis of linear models. Gauss Markov Theorem. Estimability and testability of

parameters. Confidence regions and prediction regions. Introduction to design of experiments. Analysis of variance. Factorial and block designs. Analysis of random, fixed, and mixed models. Components of variance. Distribution of linear and quadratic forms in normal vectors. A firm background in matrix algebra and some previous exposure to linear models or analysis of variance is desirable.

Credits: 3.00

Concentrations

Additional Information

Statistics: Applied Statistics Concentration, MS (OL)

About the Program

Program Requirements

Required Courses (30 credits)

Foundation Courses (21 Credits)

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data

based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

STAT 58200 - Statistical Consulting And Collaboration

Credit Hours: 3.00. This course is designed to emphasize and develop the skills needed by a statistical consultant/collaborator. Topics include: problem solving, consulting session management, written and oral communication, research ethics, design of experiments, collection of data, and application of statistical methods to real problems. Class activities include actively participating in consulting sessions held by the Statistical Consulting Service, small group projects, short papers, and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Be aware of the skills necessary to be an effective statistical consultant/collaborator. These skills include consulting session management, written and oral communication with clients, interpreting facial and body language, handling personality conflicts, practicing sound research ethics, properly designing an experiment and determining an appropriate sample size, and choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 2. Know how to recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 3.00

STAT 52700 - Introduction To Computing For Statistics

Credit Hours: 3.00. This course provides a thorough introduction to the R programming language, and its use for statistical computing and data science. The course will first look at the fundamentals of R, including different data-structures, control-flow, and the basic vocabulary. An emphasis will be placed on learning idiomatic and efficient R, covering ideas such as recycling, vectorization and functional programming. The course will then look at principles and tools for tasks like organizing data ('tidy data'), manipulating data ('data carpentry'), querying data (through topics like regular expressions) as well as visualizing data (including interactive visualizations). The material and the homework will encourage development of modular reusable code and reproducible research through ideas

such as object-oriented programming and dynamic documents in R Markdown. The last part of the course will study statistical procedures such as least-squares regression, LASSO, Monte Carlo sampling and Markov chain Monte Carlo. Besides exams and homeworks, the course will involve a final project that students can collaborate together on.

Learning Outcomes: 1. Read and write idiomatic R code. 2. Be familiar with the entire data science pipeline, from organizing, manipulating, querying and visualizing data. 3. Introduce computational tools like optimization and simulation in the context of statistical algorithms. Credits: 3.00

Core Courses (9 credits)

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

Applied Statistics Courses (12 credits)

Core Courses (6 credits)

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

Selectives (6 credits)

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

Systems Engineering, MSE or MS

About the Program

Program Requirements

Required Courses (24 credits)

Core Courses (12 credits)

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health

and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define models of the interfaces of an engineered system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic,

environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 59000 - Projects In Systems

Credit Hours: 1.00 to 6.00. This is a Graduate Level variable title course for topics related to Systems (Systems Thinking, Systems Engineering, Systems Dynamics, etc). Graduate students and seniors can enroll in this course to do independent study or individual project with the instructor. Permission of instructor required.

Learning Outcomes: 1. Outcomes will be defined by the syllabus for each proposed instance of the course. Credits: 1.00 to 6.00

Engineering Economics and Decisions Course (3 credits)

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

Program and Project Management Course (3 credits)

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

Specialty Engineering Courses (3 credits)

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 55800 - Safety Engineering

Credit Hours: 3.00. Application of human factors and

engineering practice in accident prevention and the reduction of health hazards are presented. The objective of this course is to provide an understanding of the safety and health practices which fall within the responsibilities of the engineer in industry. Special attention is devoted to the detection and correction of hazards and to contemporary laws and enforcement on occupational safety and health.

Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

ME 55700 - Design For Manufacturability

Credit Hours: 3.00. Introduction to manufacturing concerns, such as efficient design, producibility, and quality, which must be considered early in the engineering design process. Topics include the product development cycle, manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, Taguchi's robust design methodology, life cycle engineering, and reliability. Laboratory projects in the area of tolerancing, assembly, and manufacturability are included along with a project from industry in which the students can disassemble, analyze, and redesign a product while obtaining feedback from industry concerning manufacturability.

Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

BME 56400 - Ethical Engineering Of Medical Technologies

Credit Hours: 3.00. This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice.

Learning Outcomes: 1. Recognize and analyze personal and systemic ethical issues and challenges to ethical reasoning and social responsibility. 2. Engage in empathy building activities to enhance their abilities to understand and value the perspectives of other stakeholders. 3. Use a structured, iterative, and collaborative decision-making process that considers the perspectives of multiple stakeholders in optimizing a design decision when facing an engineering problem in design and development of medical devices or assistive technologies that are ethical and socially responsible. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role

of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

Systems Analysis and Design Course (3 credits)

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques: approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 56000 - System-Of-Systems Modeling And Analysis

Credit Hours: 3.00. Introduction to features of system-of-systems problems; problem definition tools; role of complexity; network topology analysis and agent-based simulation models; architecture analysis; metrics for multi-stakeholder problems; semester team projects allow students to exercise and critique such methods for analyzing system-of-systems problems. Some background in probability and statistics (e.g. random variables, probability density and distributions, sampling methods) is expected.

Learning Outcomes: 1. Introduce to modeling and analysis techniques for system-of-systems (SoS) problems in engineering. 2. Center on students' ability for understanding, modeling, and analyzing SoS problems, which consist of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. These problems are often large-scale and interdisciplinary, involving systems and behaviors found in diverse fields such as engineering, economics, social science, policy, etc. 3. Present developments in addressing system-of-systems problems, describes criteria, lexicon, and analysis methodology for their study, and, through semester-long team projects, allows students to explore the many unknowns that persist in this emerging field. 4. Know the major subjects covered: distinguishing traits of and behaviors of SoS problems, complexity and complex adaptive systems, agent-based modeling, modern network theory and analysis tools, modeling for decision-making, and exploratory modeling. Credits: 3.00

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

IE 53300 - Industrial Applications Of Statistics

Credit Hours: 3.00. The application of statistics to the effective design and analysis of industrial studies relating to manufacturing and human factors engineering in order to optimize the utilization of equipment and resources. Emphasis on conducting these studies at the least cost.

Credits: 3.00

IE 58000 - Systems Simulation

Credit Hours: 3.00. Philosophy and elements of digital simulation language. Practical application of simulation to diverse systems. Computer simulation exercises and applications are required.

Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

ME 54100 - Engineering Design: A Decision-Based Perspective

Credit Hours: 3.00. Multi-objective decision making under risk and uncertainty; Group decision making; Sequential decision making; Model-based and data-driven decision making; Heuristics and biases in design decision making. Applications to engineering design including estimation of customer preferences, simulation-based design, and sustainable design.

Learning Outcomes: 1. Formulate design decisions under risk and uncertainty. 2. Apply multi-attribute utility theory to make decisions in engineering design. 3. Evaluate the assumptions and limitations of commonly used decision-making methods. 4. Identify heuristics and biases in design decision making. 5. Adopt an interdisciplinary approach to design across engineering economics and social sciences. Credits: 3.00

Electives (6 credits)

GPA Requirements

Technology Leadership and Innovation, MS (OL)

About the Program

Program Requirements

Required Courses (27 credits)

Human Resource Development Courses (9 credits)

OLS 58300 - Coaching And Mentoring In Organizations

Credit Hours: 3.00. This course explores issues and practices in technologically-driven organizations pertaining to the roles and functions that coaching and mentoring play in employee

development. A "best practices" approach, utilizing the case method, is emphasized. Presented from the point of view of a human resource manager/leader, the focus of the course is on identifying coaching opportunities, enhancing communication skills, developing and implementing coaching and mentoring strategies, and evaluating the outcomes of these strategies. Attention is directed to facilitating personal coaching mentoring skills. Course may be offered in traditional, distance, or blended format. Permission of department required.

Credits: 3.00

OLS 51500 - Foundations Of Human Resources

Credit Hours: 3.00. A survey course emphasizing the human resource function (and its development) in the context of the work organization. Human resource development topics include exploration of various training and development techniques, the relation of training to organizational strategies, training needs analysis, evaluation of training, and career development. The strategic approach to human resource management also is covered, including what human resource professionals can and should do to help the organization succeed. Permission of Department required.

Credits: 3.00

OLS 57400 - Managerial Training and Development

Credit Hours: 3.00. Review of current managerial education and development theories and practices; discussion of fundamental social, economic, and political changes affecting business and the work of managing; implications of these changes for individual manager development and continued growth.

Credits: 3.00

Project Management Courses (9 credits)

OLS 57200 - Integration Of Project Management For Leaders

Credit Hours: 3.00. This course emphasizes critical analysis, synthesis, and evaluation of theories and applications of project management knowledge and skills, leadership, communication, and stakeholder engagement. Students integrate theoretical and applied skills in planning, distributing, and managing communication; analyzing and interpreting project organization in context; and applying best practices in team management.

Learning Outcomes: 1. Compose and apply an appropriate communication strategy for a given situation. 2. Prepare professional documentation and presentations consistent with university and diverse workplace standards. 3. Demonstrate interpersonal skills consistent with expectations for project managers. 4. Apply critical and innovative thinking skills to improve their own, and other's decision making processes within projects. 5. Evaluate alternative strategies and implement major aspects of project management for a realistic project. 6. Model ethical sensitivity for a given situation. 7. Apply critical thinking and problem-solving skills to project knowledge areas and processes. 9. Consider and relate basic leadership principles and processes to address leadership issues and to remove obstacles in the project environment. 10. Locate, assess, and synthesize current literature on topics associated with project management competencies. 11. Facilitate the organizational change management process and encourage behavior to maximize project success. 12. Analyze power dynamics and organizational politics and suggest conflict management and negotiation techniques relevant to the project. 13. Identify, recognize, and engage both internal and external project stakeholders. 14. Demonstrate how project purpose, organizational structure, culture, roles, and knowledge management affect the ability to lead a project team. 15. Evaluate roles of team members, how they contribute to projects, and apply an understanding of self in how they relate to teams. 16. Apply knowledge of team building, operation, and behavior, considering factors that influence effectiveness for all types of teams, including those that are virtual and global. Credits: 3.00

OLS 57100 - Advanced Project Management In Technology

Credit Hours: 3.00. This course helps students learn project management through applying technology project approaches in teams. Using project tools and templates, students learn the technology project life-cycle through actual and simulated situations. The course presents terms and approaches used in industry and allows students to apply methods individually and in teams.

Credits: 3.00

OLS 58200 - Leadership and Organizational Change

Credit Hours: 3.00. Explores issues in leadership and organizational change. Included are change theories, utilizing resistance to change, contemporary approaches to change, the future workplace, and researching best practices in organizational change.

Learning Outcomes: 1. Attain an understanding of the major models of change theory. 2. Gain skills in managing change through pragmatic applications of change theories. 3. Complete a major change research project in which they investigate a change initiative, gather data, and make recommendations for successfully implementing the change. Credits: 3.00

Technical Communication Courses (9 credits)

TCM 54000 - Advanced Managing Document Quality

Credit Hours: 3.00 to 4.00. In this course, students will examine and apply principles of creating a technical or professional publication from start to finish Students will explore and practice publication quality management issues such as planning, researching audience and content, designing the publication, drafting, obtaining reviews, conducting usability testing, and negotiating within organizational cultures.

Learning Outcomes: 1. Explain the features that affect document quality. 2. Apply and explain the processes that lead to effective technical/professional publications. 3. Evaluate, use, and explain software tools that can aid technical communicators in managing the publication creation process. 4. Apply concepts relevant to effective processes that technical communicators need to understand. 5. Apply user-centered design principles and usability testing in the process of creating effective publications. 6. Synthesize ideas from secondary research concerning an emerging concept in the field that will be useful in professional practice. Credits: 3.00 to 4.00

TCM 51000 - Effective Workplace Technical Communication

Credit Hours: 3.00. Students from a variety of majors will blend theory and practice as they analyze variables in workplace communication contexts, apply iterative processes of creating effective technical communication, and produce publications within typical workplace technical communication genres.

Learning Outcomes: 1. Analyze workplace technical communication problems and recommend appropriate changes using arguments shaped by synthesis of secondary research findings. 2. Research, evaluate, select, organize, and present technical knowledge effectively to specific audiences in organizational settings. 3. Design communication that uses language and visual elements appropriately for the audience and circumstances in business and industry contexts. 4. Manage communication processes in individual and collaborative projects. 5. Evaluate relevant software to create and respond to technical communication. Credits: 3.00

TCM 55000 - Advanced Research Approaches For Technical And Professional Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of conducting applied research in technical and/or professional communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Generate effective research questions, suitable for workplace technical/professional communication research into audience, content, and communication approaches. 2. Conduct and report on results of secondary research relevant to technical/professional communication. 3. Design, conduct, and report on the results of primary research relevant to technical/professional communication. 4. Analyze reports of technical/professional communication research. 5. Explain the rationale for technical/professional research approaches, based on sound concepts and noting the capabilities and limitations of various

approaches. Credits: 3.00 or 4.00

Selectives (6 credits)

OLS 58100 - Workshop In Organizational Leadership And Supervision

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education. Course may be offered in traditional, distance, or blended format. Course format may vary, depending upon topic of course.

Credits: 0.00 to 8.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.

Credits: 3.00

OLS 57900 - Emerging World-Class Leadership Strategies

Credit Hours: 3.00. Exposes graduate students to the theoretical foundation and empirical research associated with emerging strategies and theories in the study of world-class leadership. The structure of the course is four fold: the discovery of critical leadership skills and behaviors, discovery of critical world-class leadership strategies, encouragement of self analysis, discovery of leadership strengths, and conducting research on leadership issues. Permission of instructor required.

Credits: 3.00

Concentrations

GPA Requirements

Technology Leadership and Innovation: Digital Innovation Concentration, MS

About the Program

Program Requirements

Required Courses (18 credits)

Core Courses (9 credits)

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

Concentration Core (9 credits)

TLI 52000 - Foundations Of Innovation Studies

Credit Hours: 3.00. Foundations Of Innovation Studies has been designed to provide a broad spectrum introduction to the field of innovation studies. Students will gain practical and theoretical knowledge of innovation at a variety of levels, including the individual, team, organizational, and ecosystem contexts. Students will examine innovation strategies and tensions within the innovation "Triple Helix" of industry, academia, and government through the use of case studies and individually selected research reports. Throughout the class, students will examine recent innovation efforts and present short innovation cases that align with the learning objectives of the class.

Learning Outcomes: 1. Identify innovations in multiple settings and define the key characteristics that enabled those innovations. 2. Relate multi-level innovation practices to institutional outcomes. 3. Define and contrast the conditions that foster innovative thinking and development. 4. Critically assess modern examples of innovation and suggest ways to improve outcomes. Credits: 3.00

TLI 62500 - Research In Open Innovation I

Credit Hours: 3.00. This is a research-oriented course designed

for graduate students who aim to develop and implement a scientific research project in the field of open innovation. They will critically discuss and evaluate scientific writings relevant to the new research area of open innovation from the fields and disciplines of innovation studies, information systems, and other social sciences. Through synthesis of theories and frameworks used in academic articles, the students will develop a theoretically and practically motivated research question. They will also implement a pilot study to examine their hypotheses. The Research Center for Open Digital Innovation (RCODI) in the Discovery Park at Purdue will offer opportunities to plan and implement individual questions, if students have not identified their own data source. In addition, the students will participate in an action-oriented research project in open innovation performed by the class as a group project to gain experience in experimental innovation research and practice. Prerequisites: Basic statistics (at least STAT 30100 or equivalent, STAT 50100 or higher is recommended); foundational knowledge in scientific research (TECH 64600 or SOC 58000 or equivalent). Permission of instructor required.

Learning Outcomes: 1. Evaluate and synthesize scientific literature on open innovation. 2. Develop a research question and model for an empirical study in the field of open innovation. 3. Implement a pilot study in open innovation and prepare a scientific article. Credits: 3.00

Concentration Selectives (9 credits)

Innovation, Information Systems, Information Technology Selectives (3 credits)

COM 49700 - Special Topics In Mass Communication

Credit Hours: 3.00. Offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments, a current topic or trend in Media, Technology and Society. Possible offerings include Media and Social Change, Online Communities, and Technology and International Communication.

Credits: 3.00

CNIT 55000 - Organizational Impact Of Information Technology

Credit Hours: 3.00. An enterprise view of the organizational impact of information technology as the most effective means for achieving "better, faster, cheaper operations" in today's highly competitive business environment. Examines how information technology has enabled new organizational forms and changes in business processes, products, markets, delivery systems, ways of working, and people management issues and challenges. Permission of instructor required.

Learning Outcomes: 1. Articulate methods and algorithms in network security. 2. Evaluate the strengths and weaknesses of different networking security approaches. 3. Describe how to deploy encryption techniques to secure data at rest and in transit. 4. Compare, contrast and critique existing applied research in network security. 5. Propose new ideas/technologies in network security and systematically assess your proposed work. Credits: 3.00

CNIT 55100 - Information Technology Economics

Credit Hours: 3.00. Examines the economics of information systems and information technology as it relates to business performance. Topics include strategic information technology planning, alignment with business planning, value assessment, and performance measurement. Special emphasis is placed on issues relevant to strategic information technology infrastructure management, both for the information technology unit as well as the business as a whole. Permission of instructor required.

Credits: 3.00

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

Research Methods & Statistics (6 credits)

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

Thesis Research (6 credits)

Concentrations

Technology Leadership and Innovation: STEM Education Leadership Concentration, MS

About the Program

Program Requirements

Required Courses (15 credits)

Core Courses (9 credits)

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

TLI 66200 - Philosophy Of Technology

Credit Hours: 3.00. The term technology has multiple meanings and applications so vast that one clear and all-encompassing definition of the term has become unattainable. However, to build an epistemology of technology, we must explore ways to define technology so to provide a foundation for a philosophy of technology. This course will explore multiple views and definitions of technology embedded within the scholarly work focused on technology in order to build and defend a philosophy of technology.

Learning Outcomes: 1. Develop a working definition of technology. 2. Describe the multiple views of technology and explain how these views shape the way people develop a philosophy of technology. 3. Identify ways in which technology influences society and how society influences technology. 4. Debate the lines between science vs. technology in order to identify their similarities and differences. 5. Explore the ethical implications of technology.

Credits: 3.00

Concentration Core (6 credits)

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

IT 59000 - Special Problems In Industrial Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Credits: 1.00 to 6.00

Emphasis Areas Selectives (6 credits)

Design Cognition

EDCI 67400 - Advanced Instructional Design Theory

Credit Hours: 3.00. Examines the impact of both psychological learning theories and instructional applications upon the development of various instructional design theories. Emphasis is on theory construction, influence of learning and educational principles, and the current and future possibilities of instructional design theory. Prerequisite: EDCI 53100 and 57200.

Learning Outcomes: 1. Identify and consider the key principles and underlying assumptions from several prominent Instructional Design Theories and articulate relationships across these areas. 2. Determine when, why, how, and under what conditions specific ID theoretical principles can be applied to resolve applied learning problems. 3. Assess the effectiveness of specific ID theories, explain their individual strengths and weaknesses, and propose alternative viewpoints, guidelines, and perspectives to enhance learning given specific situations. 4. Develop effective methods for analyzing and articulating sound and logical arguments regarding theoretical, instructional, and technological relationships, positions, and conceptualizations. Credits: 3.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 62000 - Design, Cognition And Learning

Credit Hours: 3.00. Design is central to engineering: it is an integral part of the engineering profession and how we educate future professionals. Design cognition and learning is an area of engineering education research that seeks to understand what designers know and how they learn, and what tools best support design activity (e.g. collaboration, innovation, etc.). This research draws from many perspectives including cognitive psychology and the learning sciences, organizational learning, engineering and product design, architecture, human-centered interaction, and creativity and innovation. Themes in the course include (1) design knowledge, (2) what theories help understand design knowing and learning, (3) what are ways to study designers and design activity, and (4) how may design research inform design education and practice? Permission of instructor required.

Learning Outcomes: 1. Explore and critique multiple perspectives on design cognition and learning, some of which are synergistic and some of which conflict, to develop a more sophisticated understanding that acknowledges and builds on different perspectives. 2. Stretch, broaden, and challenge perspectives. 3. Share and clarify ideas through writing and discussion. 4. Develop a landscape view of cognition knowing and learning that may also reveal gaps in knowledge. 5. Critique and discuss a variety of ways people study design to better understand what methods are appropriate for what kinds of research goals. 6. Examine data drawn from a variety of methods (e.g., verbal protocol analysis, sketches, surveys, debrief interviews and reports). 7. Experience different resources across disciplinary communities. 8. Identify central resources for finding information. 9. Develop an awareness of differences across diverse design communities (e.g., differences in language, values, approaches). 10. Experience and reflect on design through in class activities. 11. Examine other designers (peers as well as existing design data) to develop skills of noticing and seeing that may be used to guide personal reflections on a design philosophy, to develop a research proposal, or to develop an awareness of the kinds of challenges learners experience about design knowing. 12. Synthesize ideas through class discussion, activities, and out-of-class reflection blog posts. 13. Give and receive feedback on the final course project at multiple points in the term. 14. Develop an application of research on design knowing and learning (a philosophy statement, a research proposal, an education proposal, a synthesis to identify gaps). Credits: 3.00

ENE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (CHE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and

cycles, and personality types. Includes teaching practice and group projects. Student must be admitted into a Ph.D. program in Engineering or other technical discipline (Finished with MS or MS-bypass). Not open to students who have taken PSY 69500/EDPS 63400. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

STEM Leadership, Policy, & Administration

EDST 51600 - School-Community Relations

Credit Hours: 3.00. (EDFA 51600) This course will stress concepts and principles relevant to school-community interaction. It will focus on the new roles of the public in education and will deal with problems encountered by educators in communicating with the public.

Learning Outcomes: 1. Design their commitment to build stronger family and community relationships with schools. 2. Understand important analytical, policy-relevant, and practice-oriented perspectives on family and community involvement in education 3. Develop skills and strategies for fostering mutually beneficial family and community connections with schools. Credits: 3.00

EDST 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. (EDFA 59100) Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

EDST 60900 - Legal Aspects Of American Education

Credit Hours: 3.00. (EDFA 60900) Legal foundations of education as established by constitutional provisions, court decisions, opinions of attorney generals, administrative rulings, and executive directives. Emphasis on legal theory and principles currently in state of change. Stress of case study method of investigation into educational law. Prerequisite: 9 credit hours in Education.

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater

levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the student acquiring proficiency in human resource management; equity and access to educational programs, curricula and available supports; behavior management systems; school safety and emergency preparedness; student safety and welfare; and the rights and responsibilities of students, families, and school staff. Credits: 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

IT 59000 - Special Problems In Industrial Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Credits: 1.00 to 6.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.

Credits: 3.00

Assessment & Evaluation

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 56300 - Data-Based Decision Making For Learners With Exceptionalities

Credit Hours: 3.00. Advanced procedures for educational

assessment of exceptional individuals: norm-referenced and curriculum-based measurement, error analyses, and observational ratings. Adaptations and selections of tests for sensory impairments, behavioral styles, different intelligence levels and ages.

Learning Outcomes: 1. Apply terminology, theory, and the implications of measurement theory to select, administer, and score and interpret formal, informal, and/or curriculum-based assessment results for key stakeholders to make data-based decisions. 2. Apply principles of UDL to make decisions regarding selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 3. Apply knowledge of the referral and classification procedures and interpret, report, and communicate results to stakeholders via paper and/or digitally. 4. Evaluate eligibility (including students from culturally and/or linguistically diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and evaluating individualized learning objectives), and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with exceptionalities. 5. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth. Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDCI 64900 - Assessment In Career And Technical Education

Credit Hours: 3.00. Goals and rationale for evaluation in education and work training contexts; assessment and measurement methods, techniques, and procedures; reliability, validity, and accuracy; construction and selection of instruments; data and information collection, analysis, and interpretation; meta evaluation; adaptations and modifications for special needs populations; and using assessment data and information.

Learning Outcomes: 1. Provide an overview of assessment in career and technical education and training programs. 2. Identify goals and a rationale for evaluation. 3. Explore contemporary assessment trends and practices. 4. Develop an understanding of career assessment and measurement methods, techniques, and procedures in career and technical education and training. 5. Examine several methods for estimating instrument reliability, validity, and accuracy. 6. Develop

skills in the construction, analysis, and selection of assessment and measurement instruments and procedures in career and technical education and training programs. 7. Explore the ethical, psychological, political, social, economic, and educational issues related to assessment in career and technical education and training. 8. Gain experience in the collection and analysis of assessment data and information. 9. Develop skills in the evaluation of assessment and measurement instruments. 10. Explore a variety of appropriate procedures to interpret, disseminate, and use assessment data and information in career and technical education and training programs. Credits: 3.00

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

Integrated STEM

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 60500 - Teaching Integrated Science, Technology, Engineering And Math

Credit Hours: 3.00. Analysis of historical developments and present trends in science education; the designing, implementation, and evaluation of science programs; the role of research in present and future developments.

Learning Outcomes: 1. Identify, describe, and explain the fundamental tenets of different constructivist learning theories and their relevancy to STEM education. 2. Clarify and refine beliefs about teaching and learning in STEM education. 3. Identify and characterize students' ideas about STEM and how they influence learning. 4. Explore students' thinking and understanding of STEM through multiple strategies. 5. Describe ways to assess student learning in STEM. 6. Identify, practice, and reflect upon teaching strategies commensurate with teaching beliefs and knowledge about how students learn STEM through an integrated approach. 7. Compare and evaluate curriculum resources for integrating STEM instruction. 8. Devise a comprehensive lesson plan for integrating STEM instruction based on science and engineering practices and teaching for all learners. 9. Teach and reflect upon an integrated STEM lesson employing multiple instructional strategies. 10. Evaluate student learning in the context of an integrated STEM lesson. Credits: 3.00

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the

ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (CHE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Student must be admitted into a Ph.D. program in Engineering or other technical discipline (Finished with MS or MS-bypass). Not open to students who have taken PSY 69500/EDPS 63400. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context

of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

Research Methods

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

EDPS 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDPS 63600 - Item Response Theory

Credit Hours: 3.00. Models and model-data fit, estimation of ability and item parameters, item and test information, test construction, obtaining evidence of test reliability and validity, differential item functioning, norming, and equating.

Prerequisite: EDPS 53100 , (PSY 60100 or STAT 50200 or STAT 51200).

Learning Outcomes: 1. Explain fundamental item response theory concepts and terminology. 2. Distinguish and select from among 1-, 2-, and 3- parameter item response models for dichotomous data in practical situations. 3. Demonstrate familiarity with the graded response and partial credit item response models for polytomous data, and multidimensional item response models. 4. Use item response models for testing applications, such as item calibration during instrument/item pool development, estimation of person parameters and conditional standard errors of measurement, investigation of differential item functions, and score linking. 5. Conduct item response modeling with specialized software and interpret the results. Credits: 3.00

EDPS 68800 - Single Subject Research Design

Credit Hours: 0.00 to 3.00. Designed to introduce advanced level students to single subject research methodology in context of a science of human behavior, including design theory and application, measurement, experimental validity, applied behavior analysis, and data analysis procedures.

Learning Outcomes: 1. Demonstrate knowledge about the various single subject research designs and variations of each. 2. Demonstrate the ability to conduct reliable visual analysis, understand value of effect size for single subject design, and calculate effect size. 3. Demonstrate knowledge of the criteria for designing and evaluating high-quality, rigorous single subject design studies. 4. Demonstrate knowledge of the application of single subject research methodology in clinical and educational settings including designing, conducting, and analyzing a single subject study. Credits: 0.00 to 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students'

research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic

understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

ENE 50300 - Engineering Education Inquiry

Credit Hours: 3.00. This course is conceived as a bridge between beginning graduate students' knowledge of technical research and modes of inquiry appropriate to the new field of engineering education. It is designed as the entryway to required research method courses taken as part of the students' plan of study. By the end of this survey course, students will be able to critique research in terms of the quality of the authors' argument based on their chain of reasoning, and will recognize that the articulation of a research question, the significance of the question, the choice of methods in regards to the research goals, and the transparency of the explanation of the methodology are all the parts of the chain of reasoning. Permission of instructor required.

Learning Outcomes: 1. Provides a pathway into the discipline that characterizes the diversity of approaches to engineering education research and research topics. 2. Create opportunities to discuss the need for rigorous engineering education research. 3. Develop critical understanding of relationships between research problem, method, and design. 4. Foster community development and collaborative efforts among students and engineering education researchers. 5. Help students identify conceptual hurdles and individual pathways into research activities. 6. Support students' identity development as an engineering education researcher. Credits: 3.00

Other

EDPS 53600 - Achievement Motivation And Performance

Credit Hours: 3.00. Study of current theory and research on the nature and development of achievement motivation. Motivation for intellectual and academic performance will be emphasized. Applications of theory in educational settings will be considered.

Credits: 3.00

EDPS 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDPS 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDPS 62300 - Personality Assessment

Credit Hours: 3.00. Applied introduction to methods of administration, scoring, and interpretation of primarily objective personality assessments. Emphasis is placed on assessment of normative population with attention given to personal strengths,

developmental factors, and issues of diversity.

Learning Outcomes: 1. Select appropriate batteries of personality measures based on particular referral situations and/or questions. 2. Administer, score, and interpret results of personality assessments. 3. Incorporate clinical interview and behavioral observation data into their interpretations of personality assessment results. 4. Interpret personality assessment results from developmental and multicultural perspectives. Credits: 3.00

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 55600 - Educational Video Game Design

Credit Hours: 3.00. Designed to provide an introduction to the design of educational video games. The focus of the course is on two areas: 1) the learning, instructional design, and game design theories which can inform the design of effective and engage in educational video games, and 2) how to apply those theories within practical settings.

Learning Outcomes: 1. Become comfortable with the history, concepts, terminology, culture, and classification of educational video and computer games. 2. Explore current research on educational computer and video games. 3. Examine learning, instructional design, and game design theories for relevance to the design of educational computer and video games. 4. Apply theory be designing, developing, and implementing a prototype of an educational computer or video game as teams. Credits: 3.00

EDCI 56500 - Principles Of Adult Education

Credit Hours: 3.00. (ASEC 56500) Principles of adult education applied to helping adults learn, evaluating their performance, and determining their needs. Examines history, philosophy, and research of adult education. Explores techniques required in design and delivery of instruction for adults.

Learning Outcomes: 1. Examine principles and techniques for educating adults, including the history, philosophy, and research field. 2. Develop an individual philosophy of continuing and adult education for a wide variety of situations. 3. Apply principles, techniques, philosophy and research in development and design of adult education programs. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the

various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 62700 - Current Topics In Learning Design And Technology

Credit Hours: 3.00. A critical analysis of problems, trends, issues, and programs related to the area of learning design and technology. Prerequisite: EDCI 51300 .

Learning Outcomes: 1. Critically analyze current issues and trends in the field related to a given topic. 2. Identify and discuss advantages and limitations to implementing specific emerging tools, strategies, and /or approaches. 3. Identify strategies for examining the effectiveness of specific emerging tools and strategies. Credits: 3.00

EDCI 68200 - Contemporary Curriculum Theory

Credit Hours: 3.00. Critical examination of contemporary concepts of curriculum theory. Rational/technical curriculum, social needs/child centered curriculum. Socio-political curriculum theory; curriculum as existential, aesthetic, and phenomenological. Implications for current practice, school reform, and educational research.

Learning Outcomes: 1. Develop an understanding of the social theories and philosophies that inform contemporary curriculum theorizing. 2. Articulate the role of curriculum theorizing in defining and analyzing educational phenomena. 3. To utilize curriculum theory toward the development of educative responses to issues of ethics, equity, power, and privilege. 4. To synthesize the complexity and tensions of various curriculum theories into frameworks for educational research. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

ENE 50200 - History And Philosophy Of Engineering Education

Credit Hours: 3.00. Examines the history and philosophy of engineering education by: (1) exploring the history of engineering education through archival research and historical documents (critical moments, tensions, issues); (2) investigating philosophies of education and the philosophies that have guided engineering as a profession; and (3) critiquing the evolution of engineering education, identifying alternative scenarios, and imagining a future role in engineering education. This course introduces students to the field of engineering education while broadening their views of the roles of interrelationships between teaching and research. Open to students in Engineering Education. Permission of instructor required.

Learning Outcomes: 1. Develop a culture of critical reflection, engagement, and collaborative learning. 2. Provide opportunities

for students to identify and understand tools to inquire into the history and philosophy of engineering education and develop the skills for using these tools. 3. Provide opportunities for students to use these inquiry tools to form persuasive arguments about the nature of engineering education. Credits: 3.00

ENE 55400 - Globalization And Engineering

Credit Hours: 3.00. The focus is on the multifaceted dynamics of globalization, and its impact on engineering practice and the lives and education of engineers. The course emphasizes engineering and globalization from the perspectives of the emerging Asian economies and Europe, as well as the United States. This course is designed for practicing engineers and engineering educators. It is taught within a learner-centric, highly interactive, collaborative learning environment in which students are expected to learn from the experiences and thinking of each other, as well as from the instructor, and other course resources. The course places emphasis on reading, writing, web-based research, and discussion. Students are recommended (but not required) to have a minimum of two years work experience as a practicing engineer and strong communication skills (self-assessed). Permission of instructor is required.

Learning Outcomes: 1. Have increased global awareness. 2. Have knowledge of the dynamics of globalization as an economic and social process including contrasting theories and interpretations of events. 3. Have knowledge of how globalization is studied and characterized by economists, political scientists, and sociologists. 4. Able to interpret studies and research on globalization. 5. Understand the nature and roles of engineering education and life-long learning within the globalization dynamic. 6. Understand the innovation process within a global enterprise including contrasting theories and the ability to analyze specific cases. 7. Able to lead and innovate within a rapidly globalizing profession. 8. Know the engineering profession, engineering education, and globalization from the perspectives of countries beyond the United States, particularly perspectives from Europe and the emerging economies of Asia. Credits: 3.00

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

IT 57100 - Project Management In Industry And Technology

Credit Hours: 3.00. The factors influencing decisions during the initiation, implementation, and termination of industrial and manufacturing projects are examined. Students work as project teams, using project management tools to develop implementation strategies. Permission of instructor required.

Learning Outcomes: 1. Understand and learn latest tools and techniques used in projects. 2. Develop a system perspective for understanding projects. 3. Align projects with strategic objectives. 4. Develop and think analytically in order to successfully apply knowledge and technical expertise to the solution of real business problems. Credits: 3.00

Thesis Research (9 credits)

Concentrations

Program Learning Outcomes

Technology, MS

About the Program

Program Requirements

Required Courses (xx credits)

Concentrations

Theatre: Acting Concentration, MFA

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (xx credits)

Specialization Courses (xx credits)

Tutorial Internship (6 credits)

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

Terminal Project Course (6 credits)

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

Electives (xx credits)

GPA Requirements

Theatre: Audio Technology Concentration, MFA

About the Program

Program Requirements

Required Courses (60 credits)

Core Courses (15 credits)

THTR 56800 - Advanced Problems In Design

Credit Hours: 1.00 to 3.00. A described tutorial in theatrical design or design research. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

Specialization Courses (21 credits)

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental

principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 39000 - Directed Study Of Special Theatre Problems

Credit Hours: 1.00 to 3.00. An undergraduate level, individualized, and intensive study of any aspect of theatre required by the student's plan of study. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 55300 - Theatre Audio Technology II

Credit Hours: 3.00. The study of the technical aspects of audio as they relate to use of, and experimentation with, various techniques in the design, installation, and specification of theatre sound systems, etc. Priority for majors. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 56300 - Advanced Sound Design

Credit Hours: 3.00. Advanced study of the principles of sound design for theatre and theory application to specific problems. Offered in alternate years.

Credits: 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

Tutorial Internship (6 credits)

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

Terminal Project Course (6 credits)

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

Electives (12 credits)

GPA Requirements

Theatre: Costume Design and Technology Concentration, MFA

About the Program

Program Requirements

Required Courses (60 credits)

Core Courses (21 credits)

THTR 54500 - Directional Process In Production

Credit Hours: 3.00. A study of models the director uses when dealing with the other creative personnel involved in production. Primary emphasis will be placed on the directorial and actoral processes as they relate to the work of the designers and

technicians. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 56400 - Theatrical Rendering

Credit Hours: 3.00. Provides advanced training in rendering techniques used by theatrical designers. Students will study perspective drawing, figure drawing, painting, and explore different materials used by designers to communicate their artistic vision.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

THTR 67100 - Modern Theory And Criticism

Credit Hours: 3.00. A seminar on modern performance theory, aesthetics, and practice. Emphasis on European theatre since 1875 and American theatre after 1960, with application through performance projects. Prerequisite: THTR 60100. Permission of instructor required.

Learning Outcomes: 1. Contextualize modern and postmodern performance theory, aesthetics, and practice. 2. Develop the writing and analytical skills in terms of critical theory. 3. Employ a theoretical lens (form, content, and performance style) in a scene presentation. 4. Justify how a play fits into a particular movement. Credits: 3.00

Specialization Courses (24 credits)

THTR 36100 - Costume Design

Credit Hours: 3.00. Theory and principles of design specifically applied to stage costume design. Emphasis on the interrelationship of all aspects of production and how the costume becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 55800 - Advanced Problems In Theatre Technology

Credit Hours: 1.00 to 3.00. Advanced study and application of technical theatre problems and practice. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 56100 - Advanced Costume Design

Credit Hours: 3.00. Advanced study of the principles of costume design and their application to specific problems.

Credits: 3.00

THTR 58000 - Period Research For The Designer

Credit Hours: 3.00. A seminar focused on methods of research that effectively and responsibly relate the context of visual and cultural history to storytelling for the stage.

Learning Outcomes: 1. Recognize broad aesthetic trends in visual and written resources. 2. Communicate discoveries verbally and in writing. 3. Plan and evaluate research methods. 4. Define and apply critical theory to historical aesthetics. Credits: 3.00

THTR 59000 - Directed Study Of Special Theatre Problems

Credit Hours: 1.00 to 3.00. An individualized and intensive study of any aspect of theatre required by the student's plan of study. Permission of instructor required.

Credits: 1.00 to 3.00

Tutorial Internship (6 credits)

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

Terminal Project Course (6 credits)

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

Electives (3 credits)

GPA Requirements

Theatre: Directing Concentration, MFA

Theatre: Lighting Design and Technology Concentration, MFA

About the Program

Program Requirements

Required Courses (xx credits)

Core Courses (xx credits)

Specialization Courses (xx credits)

Tutorial Internship (6 credits)

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

Terminal Project Course (6 credits)

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

Electives (xx credits)

Theatre: Scenic Design Concentration, MFA

About the Program

Program Requirements

Required Courses (60 credits)

Core Courses (24 credits)

THTR 54500 - Directional Process In Production

Credit Hours: 3.00. A study of models the director uses when dealing with the other creative personnel involved in production. Primary emphasis will be placed on the directorial and actoral processes as they relate to the work of the designers and technicians. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 56400 - Theatrical Rendering

Credit Hours: 3.00. Provides advanced training in rendering techniques used by theatrical designers. Students will study perspective drawing, figure drawing, painting, and explore different materials used by designers to communicate their artistic vision.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

THTR 67000 - Script Interpretation

Credit Hours: 3.00. The study of scripts through several lenses, ranging from Aristotelian analysis to holistic, contemplative practice. The course includes seminar discussion, response papers, group projects, exercises, and a final script interpretation in the form of a formal paper. Prerequisite: THTR 60100. Permission of department required.

Credits: 3.00

THTR 67100 - Modern Theory And Criticism

Credit Hours: 3.00. A seminar on modern performance theory, aesthetics, and practice. Emphasis on European theatre since 1875 and American theatre after 1960, with application through performance projects. Prerequisite: THTR 60100. Permission of instructor required.

Learning Outcomes: 1. Contextualize modern and postmodern performance theory, aesthetics, and practice. 2. Develop the writing and analytical skills in terms of critical theory. 3. Employ a theoretical lens (form, content, and performance style) in a scene presentation. 4. Justify how a play fits into a particular movement. Credits: 3.00

Specialization Courses (21 credits)

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

THTR 35400 - Painting For The Stage

Credit Hours: 3.00. The principles and practice of painting for the stage. Study of tools, media, and techniques used in traditional scenic painting, costume painting, and the creation of dimensionality on various surfaces. Offered alternate years.

Credits: 3.00

THTR 56000 - Advanced Scenic Design

Credit Hours: 3.00. Advanced study of the principles of design and their application to specific staging problems.

Credits: 3.00

THTR 56700 - Model Construction

Credit Hours: 3.00. Model construction is one of many skills required of scene designers and is a preferred communication tool for many directors and designers. This course offers a variety of practical exercises for presenting both blueline and full-color models.

Credits: 3.00

THTR 58000 - Period Research For The Designer

Credit Hours: 3.00. A seminar focused on methods of research that effectively and responsibly relate the context of visual and cultural history to storytelling for the stage.

Learning Outcomes: 1. Recognize broad aesthetic trends in visual and written resources. 2. Communicate discoveries verbally and in writing. 3. Plan and evaluate research methods. 4. Define and apply critical theory to historical aesthetics. Credits: 3.00

Tutorial Internship (6 credits)

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

Terminal Project Course (6 credits)

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

Electives (3 credits)

GPA Requirements

Theatre: Sound Design Concentration, MFA

About the Program

Program Requirements

Required Courses (60 credits)

Core Courses (15 credits)

THTR 56800 - Advanced Problems In Design

Credit Hours: 1.00 to 3.00. A described tutorial in theatrical design or design research. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

Specialization Courses (21 credits)

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 39000 - Directed Study Of Special Theatre Problems

Credit Hours: 1.00 to 3.00. An undergraduate level, individualized, and intensive study of any aspect of theatre required by the student's plan of study. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 55300 - Theatre Audio Technology II

Credit Hours: 3.00. The study of the technical aspects of audio as they relate to use of, and experimentation with, various techniques in the design, installation, and specification of theatre sound systems, etc. Priority for majors. Offered in alternate years. Permission of instructor required.

Credits: 3.00

THTR 56300 - Advanced Sound Design

Credit Hours: 3.00. Advanced study of the principles of sound design for theatre and theory application to specific problems. Offered in alternate years.

Credits: 3.00

THTR 56900 - Special Problems In Audio Production

Credit Hours: 3.00. Advanced study and application of sound studio production techniques to different audio related disciplines. Permission of instructor required.

Credits: 3.00

Tutorial Internship (6 credits)

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

Terminal Project Course (6 credits)

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

Electives (12 credits)

GPA Requirements

Theatre: Technical Direction

Concentration, MFA

About the Program

Program Requirements

Required Courses (60 credits)

Core Courses (30 credits)

THTR 55000 - Advanced Scenery Technology

Credit Hours: 3.00. A theoretical and practical study of theatrical scenery planning, construction, and stage use. Topics will vary by semester and will include project management techniques, mechanical design, automation systems, show control systems, rigging, and safety issues. Permission of instructor required.

Credits: 3.00

THTR 59700 - Production And Design Seminar

Credit Hours: 3.00. Training in theatrical design based upon a variety of theatrical presentation forms. The type of presentation alternates, and specific content varies each semester.

Credits: 3.00

Specialization Courses (21 credits)

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

MET 33400 - Advanced Fluid Power

Credit Hours: 3.00. Hydraulic and pneumatic circuits and their steady state and time-variant behavior as it affects the selection and design of components and systems used in fluid power transmission and motion control are studied. Emphasis is placed on industrial and mobile applications, but the principles also apply to aerospace, marine, and other fluid power systems.

Learning Outcomes: 1. Utilize the applicable laws of fluid mechanics to compute the requirements of fluid power systems. 2. Utilize computer software to evaluate starting and stopping transient behaviors in hydraulic systems. 3. Design motion control strategies with various actuators and valves to accomplish a specified task with hydraulic and pneumatic systems. 4. Analyze the performance of various pumps and compressors and specify the appropriate pump or compressor for a hydraulic or pneumatic system. Credits: 3.00

THTR 56000 - Advanced Scenic Design

Credit Hours: 3.00. Advanced study of the principles of design and their application to specific staging problems.

Credits: 3.00

THTR 56200 - Advanced Light Design

Credit Hours: 3.00. Advanced study of the principles of light design and their application to specific lighting problems.

Credits: 3.00

MET 38200 - Controls And Instrumentation For Automation

Credit Hours: 3.00. Study of the procedures and techniques essential to industrial measurement and transmission of data is provided in the areas of microprocessor control, process control, and automated testing. Concepts of hysteresis, repeatability, weighted signals, span, suppression, range, and closed loop control are emphasized.

Learning Outcomes: 1. Evaluate and select sensors for a given application based on relevant specifications. 2. Select a data acquisition system based on the requirements of a given application. 3. Explain how process gain, dead band, and lag affect the performance of a closed loop control system. 4. Tune a closed loop PID controller. Credits: 3.00

Tutorial Internship (3 credits)

THTR 66900 - Tutorial Internship For MFA

Credit Hours: 3.00 to 6.00. Off-campus internship designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Arrangements for internship must be approved by the candidate's graduate advisory committee. Permission of instructor required.

Credits: 3.00 to 6.00

Terminal Project Course (6 credits)

THTR 69700 - MFA Terminal Project

Credit Hours: 3.00 to 6.00. MFA Terminal Project. Permission of instructor required.

Credits: 3.00 to 6.00

GPA Requirements

Theatre: Technology Concentration, MFA

Toxicology, MS

About the Program

Program Requirements - Thesis

Required Courses (20 credits)

Core Courses (17 credits)

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods

of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 56200 - Analytical Toxicology And Pathology

Credit Hours: 3.00. Historically, toxicology has been defined as the study of the adverse effects of xenobiotics. Today, toxicology encompasses much broader areas, including the study of endogenous compounds, physical agents, and even using toxicants as research tools. Basic and introductory toxicology courses cover the principles of toxicant metabolism and target organ toxicity. This course, Analytical Toxicology and Toxicologic Pathology is focused on the research and clinical applications of these principles. Two major areas will be covered: (1) principles of toxicant detection in biological matrices and (2) the assessment of pathological effects caused by toxicant exposure in biological systems. Laboratory sessions associated with each major topic allow students to have hands-on experience in these advanced analytical and pathological technologies. This course provides a unique opportunity for students to learn techniques that research and clinical toxicologists use daily in scientific or clinical laboratories. The course is suitable to both graduate and upper-class undergraduate students who are interested in toxicology, forensic science, veterinary medicine, environmental and occupational health, food toxicity, pharmaceutical drug testing, medical laboratory science, and general human and children's health.

Learning Outcomes: 1. Have a basic understanding of how to measure toxicant levels. 2. Have essential knowledge in evaluating histopathological alterations of major organs and tissues upon exposure to typical toxicants. 3. Be able to assess and interpret the adverse effects of toxicants in mammalian systems. Credits: 3.00

HSCI 67100 - Biochemical Toxicology

Credit Hours: 2.00. Toxicologists in all fields are concerned with mechanism of action or how a specific toxicant or class of toxicants produces toxicity. Introductory toxicology courses typically focus on the adverse effects exerted by a specific compound, with some examination of mechanisms. The entire focus of this upper-level graduate course is on the "how" and the "why", or a detailed examination of biochemical mechanism of toxicity. There will be some lectures, but the majority of the course will consist of student-led discussions on specific mechanisms of action. Further, students will write a review-style article on a chosen mechanism of action. Prerequisite: HSCI 56000 .

Learning Outcomes: 1. Orally describe mechanisms of action for major classes of toxicants. 2. Draft a written manuscript that critically assesses data on a specific mechanism of action. Credits: 2.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological

systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

Professional Courses (2 credits)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

Seminar Course (1 credit)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Selectives (2-4 credits)

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme

properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge

pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

ENTM 61100 - Toxicology Of Insecticides

Credit Hours: 3.00. The chemistry, mode of action, and metabolism of insecticides and related compounds in both insect and vertebrate systems. Evaluation of toxic action, principles of selective toxicity, insecticide resistance, and environmental effects are also discussed. A minimal knowledge of entomology is required. Knowledge of biochemistry and neurobiology is useful. Offered in even-numbered years.

Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

BMS 53400 - Systemic Mammalian Physiology

Credit Hours: 4.00. This course is a 4 credit hour course that provides fundamental concepts of mammalian physiology in nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems. The major physiological functions of these systems will be explained at the organ as well as the cellular level. The structure and function relationships will be studied in detail. At the end of the course, the students are expected to have a solid understanding of basic functions of the human body. In addition, the student will be exposed to the current topics and key concepts of experimental research. This course offers an excellent opportunity for those students who are looking to either learn or refresh their physiological knowledge that can benefit a variety academic and professional career goals.

Learning Outcomes: 1. Describe the fundamental concepts of nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems in mammals. 2. Examine the functional relationship among different systems. 3. Apply physiological principles as they relate to the etiology of common diseases. Credits: 4.00

BMS 52900 - Basic Bone Biology

Credit Hours: 3.00. This course is designed to present the fundamentals of bone biology. Approximately 45 hours of lecture will help the learner achieve the objectives outlined. Lectures will be given to present information and tie into information learners have acquired or will acquire in other courses (e.g. biomechanics, physiology, molecular biology, etc.) to assist them in combining all of their courses and research experiences together into one interdisciplinary learning experience. It is expected that students take additional time outside of scheduled class time to further learning. Materials for the learners will be posted on the course's website. These materials will include: Lecture notes and PowerPoints: Each lecturer will post his/her lecture notes and associated PowerPoint slides prior to the lecture. Additional information: As the course progresses, instructors may come across additional information that they may find useful for student learning of the material. These materials will be posted for students to utilize as they see fit. * *Materials found on other sites (e.g. social networking sites) will not be official course materials, so use at your own risk.* Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the morphology and organization of bone and supporting/associated tissues (e.g. bone marrow, cartilage, muscle), including cellular structure and structure of the extracellular matrix. 2. Describe the normal processes of bone development and remodeling and the cellular and molecular components of each of these processes. 3. Demonstrate knowledge of the impact of external factors (e.g. nutrition, mechanical loading, genetics) on bone health. 4. Relate bone pathology to disease

and dysfunction. 5. Describe the interplay of the skeletal system to other organ systems.
Credits: 3.00

Thesis Research (6-8 credits)

HSCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.
Credits: 1.00 to 18.00

Program Requirements - Non-Thesis

Required Courses (19 credits)

Core Courses (17 credits)

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.
Credits: 0.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.
Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.
Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies.
Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.
Credits: 3.00

HSCI 56200 - Analytical Toxicology And Pathology

Credit Hours: 3.00. Historically, toxicology has been defined as the study of the adverse effects of xenobiotics. Today, toxicology encompasses much broader areas, including the study of endogenous compounds, physical agents, and even using toxicants as research tools. Basic and introductory toxicology courses cover the principles of toxicant metabolism and target organ toxicity. This course, Analytical Toxicology and Toxicologic Pathology is focused on the research and clinical applications of these principles. Two major areas will be covered: (1) principles of toxicant detection in biological matrices and (2) the assessment of pathological effects caused by toxicant exposure in biological systems. Laboratory sessions associated with each major topic allow students to have hands-on experience in these advanced analytical and pathological technologies. This course provides a unique opportunity for

students to learn techniques that research and clinical toxicologists use daily in scientific or clinical laboratories. The course is suitable to both graduate and upper-class undergraduate students who are interested in toxicology, forensic science, veterinary medicine, environmental and occupational health, food toxicity, pharmaceutical drug testing, medical laboratory science, and general human and children's health.

Learning Outcomes: 1. Have a basic understanding of how to measure toxicant levels. 2. Have essential knowledge in evaluating histopathological alterations of major organs and tissues upon exposure to typical toxicants. 3. Be able to assess and interpret the adverse effects of toxicants in mammalian systems. Credits: 3.00

HSCI 67100 - Biochemical Toxicology

Credit Hours: 2.00. Toxicologists in all fields are concerned with mechanism of action or how a specific toxicant or class of toxicants produces toxicity. Introductory toxicology courses typically focus on the adverse effects exerted by a specific compound, with some examination of mechanisms. The entire focus of this upper-level graduate course is on the "how" and the "why", or a detailed examination of biochemical mechanism of toxicity. There will be some lectures, but the majority of the course will consist of student-led discussions on specific mechanisms of action. Further, students will write a review-style article on a chosen mechanism of action. Prerequisite: HSCI 56000 .

Learning Outcomes: 1. Orally describe mechanisms of action for major classes of toxicants. 2. Draft a written manuscript that critically assesses data on a specific mechanism of action. Credits: 2.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

Professional Course (1 credit)

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Seminar Course (1 credit)

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

Selectives (17 credits)

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting

and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

ENTM 61100 - Toxicology Of Insecticides

Credit Hours: 3.00. The chemistry, mode of action, and metabolism of insecticides and related compounds in both insect and vertebrate systems. Evaluation of toxic action, principles of selective toxicity, insecticide resistance, and environmental effects are also discussed. A minimal knowledge of entomology is required. Knowledge of biochemistry and neurobiology is useful. Offered in even-numbered years.

Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

BMS 53400 - Systemic Mammalian Physiology

Credit Hours: 4.00. This course is a 4 credit hour course that provides fundamental concepts of mammalian physiology in nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems. The major physiological functions of these systems will be explained at the organ as well as the cellular level. The structure and function relationships will be studied in detail. At the end of the course, the students are expected to have a solid understanding of basic functions of the human body. In addition, the student will be exposed to the current topics and key concepts of experimental research. This course offers an excellent opportunity for those students who are looking to either learn or refresh their physiological knowledge that can benefit a variety academic and professional career goals.

Learning Outcomes: 1. Describe the fundamental concepts of nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems in mammals. 2. Examine the functional relationship among different systems. 3. Apply physiological principles as they relate to the etiology of common diseases. Credits: 4.00

Additional Requirements

Concentrations

Additional Information

GPA Requirements

Veterinary Clinical Science, MS

About the Program

Program Requirements - Thesis & Non-thesis

Required Courses (8-12 credits)

Core Courses (4-6 credits)

VCS 60300 - Introduction To Clinical Research, Trials and Translational Research

Credit Hours: 1.00. This course is designed for students entering the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which introduce students to the elements and scope of clinical research, including the methods used in clinical research, trials and translational research. Topics covered will explain the principles of safe and ethical conduct of clinical research. Students will also be introduced to the principles of data collection, management and interpretation. Permission of instructor required.

Learning Outcomes: 1. To help students understand the elements and scope of clinical research. 2. To expose students to the methods used in clinical research, trials and translational research. 3. To understand the principles of safe and ethical conduct of clinical research. 4. To understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60400 - Animal Models In Translational Research

Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 63000 - Current Topics In Veterinary Clinical Sciences

Credit Hours: 1.00 to 6.00. One-two hour sessions organized and conducted weekly by VCS residents, with input/discussion from the attending VCS faculty. Alternating weekly topic sessions may include journal club and morbidity and mortality patient rounds or other topics appropriate to the specialty. Permission of instructor required.

Credits: 1.00 to 6.00

Biostatistics Course (2-3 credits)

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-

classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

Seminars (2-3 credits)

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

VCS 62000 - Seminar In Clinical Medicine And Surgery

Credit Hours: 1.00 to 3.00. Seminars provide a forum for discussion of current concepts and research results in clinical medicine and surgery, and other aspects of veterinary medicine. Permission of instructor required.

Credits: 1.00 to 3.00

Area of Study (3-21 credits)

Thesis Research (7-10 credits)

PSY 46400 - Research Ethics In Psychological Sciences

Credit Hours: 3.00. Research Ethics broadly refers to the application of everyday values, such as fairness, honesty, and objectivity to scientific research. This course is designed to provide broad coverage of the ethical standards that research scientists must follow and allow exploration of various real-world ethical issues in the psychological sciences.

Credits: 3.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

VCS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

Clinical Training (0-6 credits)

VCS 61000 - Clinical Training In Veterinary Clinical Sciences

Credit Hours: 2.00 to 6.00. Veterinary Clinical Sciences (VCS) residents working in specific specialty areas rotate through

relevant specialty clinical services in the Veterinary Teaching Hospital (or other specialty facilities) as determined by the resident committee and the requirements of each specialty college. Rotation lengths are 2.5 to 5 weeks. Residents are closely supervised by VCS faculty and gradually are given more individual responsibility as decision-making and clinical skills develop. Permission of instructor required.

Credits: 2.00 to 6.00

Concentrations

Program Learning Outcomes

GPA Requirements

Minor

Accounting Minor

About the Minor

Requirements for the Minor (15 credits)

Required Courses (9-12 credits)

MGMT 35100 - Intermediate Accounting II

Credit Hours: 3.00. Continuation of Intermediate Accounting I. An examination of additional problems in financial reporting, including long-term assets, liabilities, owners' equity, income taxes, earnings per share, leases, and pensions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 35000 - Intermediate Accounting I

Credit Hours: 3.00. Financial reporting for interested external parties. Emphasis on asset valuation, income measurement, and preparation of financial statements, and on appreciation of discretion available to preparers.

Learning Outcomes: 1. Understand the objectives of financial reporting. 2. Explain and apply the basic principles of accounting. 3. Describe how to prepare and analyze an income statement, balance sheet, statement of cash flows and statement of retained earnings under generally acceptable accounting principles (GAAP). 4. Understand the tradeoffs involved in standard setting, the limitations of current accounting standards, and the effects that these tradeoffs and limitations have on the quality and content of financial statements. 5. Gain an appreciation of firms' ability and incentives to choose from a wide variety of alternative measurement bases and accounting procedures and the effects that those choices have on readers of firms' financial statements. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these

objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants (i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

Additional Courses (3-6 credits)

MGMT 50900 - International Accounting

Credit Hours: 3.00. Provides insight into and an understanding of the many accounting problems and issues faced in an international business environment. The material is approached from two compatible and overlapping perspectives: the perspective of accounting or financial management in a U.S. multinational corporation and the perspective of an investor interested in understanding the international business environment.

Learning Outcomes: 1. Learn about the development of international accounting movements and implications in a globalized financial market. 2. Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS) 3. Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event. 4. Learn to cope with differences in financial measurement, recognition and reporting practices when performing international financial statement analyses. 5. Enhance the students' communication and presentation skills. 6. Contribute to the requisite background required for professional examinations such as CPA and to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

MGMT 50400 - Tax Accounting

Credit Hours: 3.00. Basic tax course designed to provide an understanding of the various federal taxes, including income, gift, estate, excise, federal insurance contribution, self-employment, and unemployment taxes.

Learning Outcomes: 1. Calculate the income tax liability for individuals, understand basic tax planning strategies, and prepare individual tax returns. 2. Understand broadly how different business entities are taxed including formation, operations, distributions, and liquidations. 3. Calculate the income tax liability for C Corporations, understand basic tax planning strategies, and prepare basic C Corporation tax returns. 4. Report the results from operations for partnerships and S Corporations. 5. Understand broadly the tax treatment of property transactions encountered by individuals and business entities. Credits: 3.00

MGMT 50300 - Advanced Accounting

Credit Hours: 3.00. Advanced course in financial accounting. A range of contemporary issues in financial reporting, such as business combinations, investments, consolidations, inflation, multinationals, and tax allocation are covered. Both technical proficiency and user applications are emphasized.

Learning Outcomes: 1. Develop a conceptual understanding of and appreciation for the significant accounting and reporting requirements pertaining to consolidated or affiliated enterprises, foreign currency transactions and translation and other topics listed in the schedule below. 2. Provide you with the technical skills and knowledge to produce financial information that can be used by management, shareholders and stakeholders. 3. Improve your ability to interpret and use such financial reports. 4. Enhance the students' communication skills. 5. Contribute to the requisite background required for professional examinations such as CPA or CMA. However, it is not the primary goal to memorize 2019 standards or regulations, but rather to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 37300 - Accounting Information Systems & Data Analytics

Credit Hours: 3.00. Learn how to manage the design, control and operation of accounting information systems. The emphasis is on identifying the information needs of decision makers and developing appropriate business process control in the design of accounting information systems. Gain an understanding and appreciation of the accounting information system and how it is used to successfully manage, audit and develop processes to support today's evolving business environment.

Learning Outcomes: 1. Understand and apply basic tools necessary for diagrammatically analyzing and documenting organizational data flows and business processes including data modeling and flowcharting. 2. Gain an understanding of the various business processes necessary for an enterprise to

successfully operate, the key controls for maintaining successful business processes, and application of the methodology for evaluating risks and controls within the given business process. 3. Explain, justify and evaluate the components of organizational governance and associated effective internal control systems. 4. Develop a basic understanding of data analytics and emerging technologies in accounting information systems. 5. Explain and justify AIS auditing, computer fraud, and security techniques. Credits: 3.00

Notes

Advanced Global Technology Minor

About the Minor

Requirements for the Minor (12-15 credits)

Short Term Mobility Option:

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

Full Semester Mobility Option:

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

Supplemental Information

Aerospace Studies Minor

Requirements for the Minor (14 credits)

Required Courses (14 credits)

AFT 48100 - National Security, Leadership Responsibilities, And Commissioning Preparation II

Credit Hours: 3.00. National Security/Commissioning Preparation is designed for college seniors and gives them the foundation to understand their role as military officers and how they are directly tied to our National Security Strategy. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

Learning Outcomes: 1. Describe the basic elements of national security policy and process. 2. Identify the basic Air Force and Space Force warfighting domains. 3. Describe the roles of the military in society. 4. Discuss current domestic and international issues affecting the military profession. 5. Describe fundamental provisions of the military justice system. 6. Describe the responsibility, authority, and functions of an Air Force commander. 7. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. 8. Plan for life as a second lieutenant. Credits: 3.00

AFT 47100 - National Security, Leadership Responsibilities, And Commissioning Preparation I

Credit Hours: 3.00. National Security/Commissioning Preparation is designed for college seniors and gives them the foundation to understand their role as military officers and how they are directly tied to our National Security Strategy. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

Learning Outcomes: 1. Describe the basic elements of national security policy and process. 2. Identify the basic Air Force and Space Force warfighting domains. 3. Describe the roles of the military in society. 4. Discuss current domestic and international issues affecting the military profession. 5. Describe fundamental provisions of the military justice system. 6. Describe the responsibility, authority, and functions of an Air Force commander. 7. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. 8. Plan for life as a second lieutenant. Credits: 3.00

AFT 36100 - Leading People And Effective Communication II

Credit Hours: 3.00. Leading People and Effective Communication uses the student's field training experience to take a more in-depth look at leadership. Special emphasis is placed on enhancing communication skills, and why that is important as a leader. Students have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

Learning Outcomes: 1. Compare and contrast individual leadership skills and approaches. 2. Analyze personal leadership strengths and weaknesses. 3. Explain the responsibility and authority of an Air Force officer. 4. Explain Air Force officer's duties and responsibilities as a subordinate leader. 5. Practice the Air Force officer's responsibilities in the counseling and feedback process. 6. Evaluate and apply concepts of ethical behavior. 7. Evaluate and analyze concepts, principles, and theories of quality in Air Force leadership and management. 8. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. Credits: 3.00

AFT 35100 - Leading People And Effective Communication I

Credit Hours: 3.00. Leading People and Effective Communication utilizes student's field training experience to take a more in-depth look at leadership. Special emphasis is placed on enhancing communication skills, and why that is important as a leader. Students have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

Learning Outcomes: 1. Compare and contrast individual leadership skills and approaches. 2. Analyze personal leadership strengths and weaknesses. 3. Explain the responsibility and authority of an Air Force officer. 4. Explain Air Force officer's duties and responsibilities as a

subordinate leader. 5. Practice the Air Force officer's responsibilities in the counseling and feedback process. 6. Evaluate and apply concepts of ethical behavior. 7. Evaluate and analyze concepts, principles, and theories of quality in Air Force leadership and management. 8. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. Credits: 3.00

AFT 24000 - Team And Leadership Fundamentals II

Credit Hours: 1.00. Provides a fundamental understanding of both leadership and team building. The lessons and course flow are designed to prepare students for field training and leadership positions in the detachment.

Learning Outcomes: 1. Explain Air Force core values. 2. Discuss examples of how Air Force core values were used throughout Air and Space Force history. 3. Describe the employment of Air and Space power from institutional, doctrinal, and historical perspectives. 4. Demonstrate basic Air Force verbal and written communication skills. Credits: 1.00

AFT 23000 - Team And Leadership Fundamentals I

Credit Hours: 1.00. Provides a fundamental understanding of both leadership and team building. The lessons and course flow are designed to prepare students for field training and leadership positions in the detachment.

Learning Outcomes: 1. Explain Air Force core values. 2. Discuss examples of how Air Force core values were used throughout Air and Space Force history. 3. Describe the employment of Air and Space power from institutional, doctrinal, and historical perspectives. 4. Demonstrate basic Air Force verbal and written communication skills. Credits: 1.00

Notes

African American Studies Minor

Requirements for the Minor (15 credits)

Required Foundation Courses (9 credits)

A. African American Studies Foundation Courses

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37100 - The African American Experience

Credit Hours: 3.00. Focus on specific topics of the personal experiences of blacks, in Africa and the diaspora, including black identity, black culture, and the relationships between blacks and society.

Credits: 3.00

AAS 27100 - Introduction To African American Studies (UCC: HUM)

Credit Hours: 3.00. Introduction to the philosophical and methodological principles underlying Afro-American studies. Dimensions of the black experience, including history, education, politics, psychology, economics, religion, social organization, and art, will be covered, and the requisite academic tools and sources will be examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

Select from B, C, D, or E (6 credits)

B. Social Science Courses Related to Africa or the African Diaspora

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers research techniques used by researchers to observe and to interpret scholarly investigation on race, class and gender from an African-American perspective.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SOC 51400 - Racial And Cultural Minorities

Credit Hours: 3.00. America's minority groups; immigration; interracial and intercultural conflicts; assimilation.

Credits: 3.00

C. History Courses Related to Africa or the African Diaspora

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 39200 - Caribbean History And Culture

Credit Hours: 3.00. This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 44100 - Africa In The Twentieth Century

Credit Hours: 3.00. A problem-oriented course in the modern history of Africa from 1880 to 1975. It analyzes origins of African nationalism, European colonialism, racial conflict, and war leading to the independence revolution of the 1960s and 1970s.

Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

HIST 39800 - African American History Since 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history from 1877 that focus on Black Americans' struggle to overcome social, economic, and political oppression and to win basic civil and human rights while making valuable contributions to American society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

D. English Courses Related to Africa or the African Diaspora

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American

males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

AAS 35900 - Black Women Writers

Credit Hours: 3.00. (ENGL 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

E. Visual and Performing Arts Courses Related to Africa or the African Diaspora

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 27700 - African American Popular Culture

Credit Hours: 3.00. This course focuses on the production of popular culture through African-based and non African-based traditions among African Americans in the United States. Pop culture forms covered include film, theatre, visual arts, literature, dance, sports, music and religious traditions.

Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

Notes

Agricultural Systems Management Minor

About the Program

Requirements for the Minor (18 credits)

Required Courses (6 credits)

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and

machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

Selective Courses (12 credits)

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ASM 20100 - Construction And Maintenance

Credit Hours: 3.00. Fundamental principles in the selection and use of tools for the construction and maintenance of agricultural and related facilities, equipment, and machines. Areas covered include small engines, concrete and masonry, wood, plumbing, electricity, and metal.

Credits: 3.00

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

ASM 24500 - Materials Handling And Processing

Credit Hours: 3.00. Principles of materials handling and processing. Physical properties and characteristics of food, fiber, and feed materials as related to harvesting, handling, processing, and storage. Processing of agricultural materials including drying, preservation, size reduction (e.g. grinding, crushing, shredding), mixing and blending, refrigeration, extrusion, and pelleting. Conveying and transport systems with consideration of their effects on damage and quality. The course elements are tied together by a treatment of scheduling and coordination of biologically based systems, which involve production, handling, quality control, and processing.

Credits: 3.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 34500 - Power Units And Power Trains

Credit Hours: 3.00. An introduction to power generation and transfer in mechanical and fluid power systems. Internal combustion engines, fuels, and cycles are introduced. Clutches, mechanical transmissions, automatic transmissions, hydrostatic transmissions, and final drives are discussed. Principles of hydraulics, fluids, cylinders, pumps, motors, valves, hoses, filters, reservoirs, and accumulators are studied.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6. Understand basics of circuits programmed using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

ASM 44100 - Methods Of Teaching Agricultural Mechanics

Credit Hours: 2.00. Emphasis on facilities, shop layout, organization, course planning, and demonstrations. Course meets during weeks 8-16. For students seeking career opportunities, certification, and instructional skill of educating others in agricultural mechanics and engineering technology utilizing a hands-on problem--solving approach. Students shall develop skills necessary to educate youth, employees, and/or consumers about complex agricultural systems. Special emphasis will be given to developing materials for kinesthetic learners.

Learning Outcomes: 1. Integrate S.T.E.M. approach in teaching and demonstrations of agricultural mechanics. 2. Develop hands-on demonstrations around agricultural technology and mechanics. 3. Analyze approaches to educational learning objectives. 4. Apply basic principles of agricultural technology and mechanics operations management. 5. Understand and apply the basic principles of

creating a safe educational environment (hazard awareness). 6. Estimate project materials, cost, and layout for hands-on learning. Credits: 2.00

ASM 49800 - Undergraduate Research In Agricultural Systems Management

Credit Hours: 1.00 to 3.00. Individual research projects for students with the approval of their advisors. Requires prior approval of, and arrangement with, a faculty research advisor. A written report and/or public oral presentation of final results are required. Permission of instructor required.

Learning Outcomes: 1. Gain basic knowledge of research methods and techniques used in the field of study. 2. Apply appropriate methods to analyze data and draw meaningful conclusions. 3. Present research findings clearly in written and/or oral formats. 4. Understand and follow ethical guidelines in conducting and reporting research. 5. Work effectively with peers and faculty members on research-related tasks and projects. 6. Evaluate existing research critically and use that knowledge to guide research efforts. Credits: 1.00 to 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ASM 51000 - Agrosecurity-Emergency Management For Agricultural Production Operations

Credit Hours: 3.00. Prepares individuals for management and loss control positions in agricultural production, agribusiness operations, and emergency management agencies. Addresses prevention, preparation, mitigation, response, and recovery from disasters such as fires, explosions, entrapments, tornadoes, floods, winter storms, earthquakes, vandalism, chemical releases, and bio-terrorism. Students complete a community service learning activity, in which they assist a farm or agribusiness manager in developing formal emergency preparedness plans.

Credits: 3.00

ASM 53000 - Power And Machinery Management

Credit Hours: 3.00. Management and selection of farm machines and power units with emphasis on cost analysis and evaluation of new machines and practices.

Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ASM 55000 - Grain Drying And Storage

Credit Hours: 3.00. Crop drying and storage principles including equilibrium moisture, psychrometrics, and drying rates. Modern drying and conditioning techniques including dryeration, in-bin counterflow drying, and combination drying. Estimating fixed and variable drying costs, aeration of stored grain, and maintenance of grain quality. Offered in even-numbered years.

Credits: 3.00

ASM 59000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of the instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 21600 - Introduction To Surveying

Credit Hours: 1.00. Introduction to plane surveying, including instruction and practice in the use of surveying instruments. Basic overview of distance/angle measurement, leveling, direction, traversing, and mapping. Each weekly topic includes practical application and field exercises as applied to landscape architecture and forestry.

Learning Outcomes: 1. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 2. Function on multidisciplinary teams. 3. Use economics principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. Credits: 1.00

ASM 42200 - Advanced Machine Technology For Agricultural Crop Production

Credit Hours: 3.00. The course examines technologies and techniques associated with modern farming practices often referred to in general as precision agriculture. It is structured to center around expert presentations from industry, academia, and farming practice, with a focus on technologies and appropriate application of such technologies in crop production systems in the Eastern Cornbelt. Consent of instructor required.

Learning Outcomes: 1. Identify and analyze technologies associated with precision agriculture. 2. Explain the appropriate use of the aforementioned technologies. 3. Compare technological alternatives in various crop production scenarios. Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 31900 - Controlled Environment Production Of Horticultural Crops

Credit Hours: 3.00. This course combines production principles with environmental concepts and advances in technology to provide a comprehensive training in sustainable production of herbaceous ornamentals and vegetables in controlled environment systems. The laboratory instruction provides hands-on experience with the practice of growing crops under controlled environments by combining the learning from lab prep with the use of technology to control environment during production.

Learning Outcomes: 1. Become familiar with best management practices for growing herbaceous ornamentals and vegetables that improve sustainability in controlled environments. 2. Learn how above and below ground environments interact with crop production. 3. Learn basics about the state-of-the-art technologies used in controlled environment agricultural production to monitor and control environments. 4. Interact with industry professionals to gain first-hand knowledge about careers and development in commercial horticulture. 5. Gain sufficient background in science, technology and regulations required to become entrepreneurs, next generation growers and researchers in the controlled environment agriculture industry. Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop a general awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5. Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

ASM 44400 - Design And Advanced Manufacturing Processes For Internal Combustion Engines

Credit Hours: 3.00. This course introduces the manufacture and assembly of machined piece parts into a functional assembly. The creation of a prototype internal combustion engine will be utilized as the base project for the course, and students will create and test the parts and final assembly. Students will be given a background on the process flow of modern manufacturing by general metal machining processes, manual machine tool operation, digital machine tool programming, numerical machine tool operation, the measurement of critical machining output variables, and the assembly of piece parts into subassemblies and final products. Course participants will work as a team to develop their production parts, final presentation, and final report.

Learning Outcomes: 1. Identify the sequence of machining operations for the construction of engine components. 2. Download specific instructions to numerically controlled machines to execute manufacturing instructions for specific parts. 3. Perform specific operations on traditional machine tools to create specific engine parts. 4. Understand how to measure critical dimensions in manufactured parts. 5. Understand the concepts of component assembly to create a functional device. 6. Know the critical functionalities of an assembled product and be able to test its performance. 7. Understand the safety concerns of machine shops and how to mitigate danger to personnel and equipment. 8. Spread workloads between colleagues, assist one another in self-learning, and collaborate to meet collective course objectives. 9. Understand the concepts of professionalism, ethical responsibility, and integrity when applied to technical projects. 10. Enhance written and oral communication skills through the production of a comprehensive final report and summary technical presentation. Credits: 3.00

ASM 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students

various home field of study. Credits: 3.00

ASM 51200 - Managing Resources and Applications for Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

ASM 44500 - Grain Elevator And Processing Course

Credit Hours: 1.00. Grain handling and processing industry coursework through the Grain Elevator and Processing Society (GEAPS). Coursework varies by topic and covers technical aspects of grain handling, including safety, grain receiving, grain quality and equipment repair. Special registration required through the ABE Department. Each course can be completed at any pace over five weeks. Permission of department required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00

Notes

American Studies Minor

Requirements for the Minor (15 credits)

A. American Studies Foundation Courses (6 credits)

AMST 30100 - Perspectives On America

Credit Hours: 3.00. Advanced interdisciplinary study of American culture, history, and society in their national and global contexts.

Credits: 3.00

AMST 20100 - Interpreting America (UCC: HUM)

Credit Hours: 3.00. Introduction to the interdisciplinary study of American culture, history, and society in its national and global contexts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major themes and issues prompted by the term American. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

B. Additional Courses (9 credits)

Art and Design

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret

statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

African American Studies

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

Anthropology

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 34100 - Culture And Personality

Credit Hours: 3.00. A cross-cultural survey stressing different basic personality types and the processes by which adult personality is acquired. Case studies of selected non-Western cultures will be used to provide comparative perspective.

Learning Outcomes: 1. Explain in words and diagrams the dialectical relations among culture, personality, and cognition. 2. Distinguish and relate childhood and adult processes of enculturation and socialization. 3. Appraise how, why, and to what extent every individual and every society is unique, comparable to some others, and similar to all others. Credits: 3.00

ANTH 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American speech communities and the culture at large.

Credits: 3.00

ANTH 37300 - Anthropology Of Religion

Credit Hours: 3.00. Anthropological theories of the origin, development, and functions of religion, ritual, and myth. Data drawn from western and non-western societies, with special emphasis on the relationship of religion to social structure, cultural patterns, and social change.

Learning Outcomes: 1. Explain anthropological approaches to the study of religious belief systems. 2. Investigate religious and cultural differences using anthropological skills. 3. Describe a diversity of faiths and worldviews. 4. Summarize the key ways that humans of the past and present have sought to make sense of the mysteries of life and the sacred. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical

research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

Asian American Studies

ASAM 24000 - Introduction To Asian American Studies (UCC: HUM)

Credit Hours: 3.00. A general introduction to Asian American history and culture, with a focus on the diverse and multifaceted experiences of peoples of Asian descent in America and their contributions to U.S. culture and society.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

Economics

ECON 45600 - Urban Economics

Credit Hours: 3.00. Examines the market forces that lead to the development, growth, and size of cities. In addition, this course covers the theory of location and land use, principles of local public finance, policy problems in the areas of urban housing, transportation, crime, and pollution.

Credits: 3.00

Education: Curriculum and Instruction & Educational Studies

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

English

ENGL 25000 - Great American Books (UCC: HUM)

Credit Hours: 3.00. What makes great American books so compelling? This course examines the dynamic history of American literature and explores how canonical and contemporary books have shaped the cultural landscape of the U.S. and the world.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions related to great American books. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American books based on appropriate use of textual evidence. Credits: 3.00

ENGL 35000 - American Literature Before 1865 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from European colonization to the U.S. Civil War. CTL:IEL 1210 American Literature I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Civil War period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35100 - American Literature After 1865 (UCC: HUM)

Credit Hours: 3.00. A survey of American literature from the Civil War to the present. CTL:IEL 1211 American Literature II

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the post-Civil War period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 38200 - The American Novel (UCC: HUM)

Credit Hours: 3.00. A survey of American novels ranging from the eighteenth century to the twenty-first-centuries.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and literary conventions related to the American novel. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American novels based on appropriate use of textual evidence. Credits: 3.00

ENGL 38600 - History Of Film To 1950

Credit Hours: 3.00. This survey crosses the divide between the silent film era and the "talkies" to explore narrative, experimental, and documentary styles of feature films from the 1890s to 1950.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to film from its origins through the mid-twentieth century. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 38700 - History Of Film Since 1950

Credit Hours: 3.00. A survey of narrative, experimental, and documentary styles of feature films from the mid-twentieth century to the present.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to films from the mid-twentieth century. 2. Identify and articulate connections among these topics and conventions as they relate to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 39600 - Studies In Literature And Language

Credit Hours: 1.00 to 3.00. A course in the study of a special topic directed by an instructor in whose particular field of specialization the content of the course falls.

Learning Outcomes: 1. Students will think critically about course content. 2. Students will read and write reflectively and critically about course content. 3. Students will engage in course discussions, either online or face-to-face, which encourage critical thought and personal engagement. Credits: 1.00 to 3.00

ENGL 41100 - Studies In Major Authors

Credit Hours: 3.00. A study of the literary, critical, or cinematic works of one or two influential authors or directors. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of the works of a particular author. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41200 - Studies In Genre

Credit Hours: 3.00. A study of literary or cinematic works that share distinctive formal features. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate detailed knowledge of a single literary genre. 2. Discuss that genre in relation to its diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41300 - Studies In Literature And History

Credit Hours: 3.00. A study of literature or film produced during a well-defined historical period from the view of its social, political, religious, and economic contexts. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of a particular period in history. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits:

3.00

ENGL 41400 - Studies In Literature And Culture

Credit Hours: 3.00. A study of literature or film from the perspective of the cultural norms and values it expresses, celebrates, and challenges. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of the relationship between literary texts and their culture. 2. Discuss those relationships in light of texts' diverse historical and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 46000 - Studies In Women's Literature

Credit Hours: 3.00. A study of literary works by women according to a specific theme, historical period, genre, or culture, e.g., Nineteenth-Century Women Novelists, Madness in Women's Writing, Caribbean Women Writers. May be repeated only with different topic.

Credits: 3.00

ENGL 55200 - Studies In Major American Authors

Credit Hours: 3.00. A study of the works of one or two influential American authors.

Credits: 3.00

ENGL 55300 - Colonial And Early American Literature

Credit Hours: 3.00. A survey of American literature to about 1820. Texts of major and minor authors, such as Bradford, Bradstreet, Rowlandson, and Cooper, are viewed within their cultural context.

Credits: 3.00

ENGL 56000 - Modern American Poetry

Credit Hours: 3.00. A survey of modern American poetry. Emphasis will be on major writers such as Eliot, Pound, Frost, Stevens, and Lowell, but attention will be paid to lesser figures.

Credits: 3.00

ENGL 59500 - Contemporary American Fiction

Credit Hours: 3.00. Intensive study of contemporary and postmodern American fiction within various formal, theoretical, and cultural contexts, including multiculturalism, poststructuralism, and gender analysis, among others.

Credits: 3.00

ENGL 59600 - Advanced Studies In Literature Or Language

Credit Hours: 3.00. Advanced study of a topic within the instructor's fields of specialization. Emphasis on scholarly analysis and research.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

Global Studies

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain an understanding

of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

GSLA 48000 - Senior Interdisciplinary Capstone Project In Global Studies I

Credit Hours: 3.00. The senior capstone course for Global Studies majors is designed to give students the chance to define and complete a research project of personal interest, and to integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001. The capstone courses are offered to students in their senior year to be completed the final two semesters of their major. Students will assemble a committee of two or more faculty members willing to direct their work. The Director of Global Studies will be an ex-officio member of the committee. Students will incorporate their prior coursework (including foreign language training), study abroad, and/or internships into their final project. The capstone may be, but is not limited to, a senior honors project, a multimedia project, service learning, or directed research. Timeline for a successful capstone project: Spring of Sophomore year: After three semesters of coursework, the student will start defining an area of interest or passion that will form the basis of their capstone research. Junior Year: The student will select courses in their interest area. They will also start speaking to faculty members in the field in order to assemble their committee. Spring of Junior Year: Students will finalize their faculty committee to direct their research. Fall of Senior Year: Research Semester, as directed by the committee. GSLA 48000. Spring of Senior Year: Complete project. GSLA 48001.

Learning Outcomes: 1. Demonstrate an awareness of Global issues through academic inquiry and extracurricular engagement. 2. Critically apply multi-perspective research frameworks to a concrete problem or case. 3. Recognize historic roots of Global inequality. 4. Develop intercultural competence and demonstrate empathy for difference. Credits: 3.00

GSLA 48001 - Senior Interdisciplinary Capstone Project In Global Studies II

Credit Hours: 3.00. The senior capstone is a year-long course for which Global Studies majors enroll in consecutive semesters. Its primary goal is for students to define and complete a research project of personal, academic, and/or professional interest, as they integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001 in order to complete the Global Studies major.

Learning Outcomes: 1. Varies per student project/ capstone. Credits: 3.00

History

HIST 30200 - Historical Topics

Credit Hours: 3.00. This variable-title course deals with broad historical topics that transcend and collapse traditional analytical, chronological, and geographic boundaries. Content will vary with faculty member teaching the class.

Learning Outcomes: 1. Students will acquire a perspective on and basic understanding of the course content. 2. Students will engage in integrative learning as they examine the course content that transcends and collapses traditional analytical, chronological, and geographic boundaries. 3. Students will develop their creative and critical thinking skills. 4. Students will strengthen their information literacy and improve their writing skills. Credits: 3.00

HIST 30400 - America In The 1960s (UCC: HUM)

Credit Hours: 3.00. Surveys the turbulent history of the 1960s America. Topics include: the Kennedy, Johnson, and Nixon presidencies; postwar liberalism and conservatism; insurgent political and social movements; the counterculture; the sexual revolution; rock 'n roll; and the Vietnam War.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 35500 - History Of American Military Affairs (UCC: HUM)

Credit Hours: 3.00. Surveys American military policy from the colonial militia to the atomic age. Covers major wars and limited wars. The course also investigates the peacetime military functions, i.e., the Navy's role in diplomacy and the Army's involvement in Indian affairs.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37100 - Society, Culture, And Rock And Roll (UCC: HUM)

Credit Hours: 3.00. Surveys American society and culture through the prism of rock and roll music. Looks at politics, gender, race, and class in the postwar era to examine and explain the social, economic, and technological forces that shaped rock and roll.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37200 - History Of The American West

Credit Hours: 3.00. This course explores the history of the trans-Mississippi and Pacific west from the early 17th century to the late 19th century. The diverse experiences of the inhabitants and the environmental transformations are the central themes of the course.

Learning Outcomes: 1. Understand the environmental and human history of the American west. 2. Be aware of the complicated and overlapping experiences of the inhabitants of the west including, but not limited to, the diverse indigenous population and the myriad groups of settlers from Asia, South and Central America, Europe, and the US. 3. Gain a new appreciation of how diverse populations interacted with multiple environments of the American west and the ongoing impact of that legacy on our modern times. 4. Build upon and improve skills as critical thinkers and readers. 5. Enhance skills in oral communication and analytical writing. Credits: 3.00

HIST 37600 - History Of Indiana

Credit Hours: 3.00. Economic, political, and social history of Indiana from the state's earliest beginnings as a part of the old Northwest Territory to the present.

Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38300 - Recent American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Intensive study of constitutional questions and Supreme Court answers from the period of the Warren Court to present. Particularly emphasized are the areas of segregation, civil rights, and civil liberties and guarantees for personal rights.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 39400 - Environmental History Of The United States (UCC: HUM)

Credit Hours: 3.00. This is a mid-level survey designed to provide students of environmental science with historical background and students of history with the unique perspective of environmental history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 46100 - The Revolutionary Era, 1763 To 1800

Credit Hours: 3.00. An analysis of the origins, nature, and consequences of the American Revolution; of the achievements and difficulties of the new nation under the Articles of Confederation; of the drafting and adoption of the Constitution; and of the initial political, economic, and social progress of the United States under the Federalists.

Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

HIST 47300 - History Of The South

Credit Hours: 3.00. Geographic, economic, cultural, social, and political aspects of the South. The significance of such figures as Jefferson, Jackson, Calhoun, Jefferson Davis, and Woodrow Wilson. The emphasis is on the evolution of the intellectual climate.

Credits: 3.00

HIST 47700 - Native American Women's History

Credit Hours: 3.00. This course studies the history of indigenous women in North America from pre-contact to the present era, examining their roles through the experience of colonization and decolonization underscoring issues of sovereignty, identity, activism, kinship, public images, and stereotypes.

Credits: 3.00

HIST 48500 - Topics In American Political History

Credit Hours: 3.00. This course deals with broad thematic and chronologically defined topics in American political history from the Revolutionary Era to the late twentieth century. Content will vary with the faculty member teaching the class.

Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 39800 - African American History Since 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history from 1877 that focus on Black Americans' struggle to overcome social, economic, and political oppression and to win basic civil and human rights while making valuable contributions to American society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 38200 - American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Survey of the fundamental principles of American constitutionalism and dominant trends in judicial interpretation, from the creation of the Constitution to the period of the New Deal.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 46700 - The Emergence Of Modern America

Credit Hours: 3.00. Examines the changes in American society between 1877 and 1932. The course covers such issues as the rise of industry, the growth of consumerism, the shift to a multi-ethnic society, imperialism, Populism, Progressivism, World War I, and the 1920s.

Credits: 3.00

HIST 46800 - Recent American History

Credit Hours: 3.00. Examines the issues that shaped American society, politics, foreign policy, and culture from 1932 to the present. Covers the Great Depression, World War II, the Cold War, and the Vietnam War as well as the social, cultural, and economic impact of those events.

Credits: 3.00

HIST 49400 - Science And Society In American Civilization

Credit Hours: 3.00. This course examines the development of science in the United States from colonial times to the present. Emphasis in the earlier periods is placed on comparison and contrast of the American scene with that of Europe. Subsequent treatment deals with industrialization, and maturation of the American scientific community, and the increasing social effects of science. Among those considered are the forces making for urbanization, for greater interdependence among science, industry and government, and for repercussions in intellectual affairs.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 46000 - American Colonial History

Credit Hours: 3.00. An investigation of the foundation of the American colonies, their place in the British imperial structure, and the eventual conflict of imperial exigencies with colonial self-interest and national feeling.

Credits: 3.00

Italian

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

Philosophy

PHIL 24200 - Philosophy, Culture, And The African American Experience (UCC: HUM)

Credit Hours: 3.00. The purpose of this course is to consider African American based or inspired conceptions of Western philosophy and new visions of what it is to do philosophy sensitive to culturally rooted diversity.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

Political Science

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 31400 - The President And Policy Process

Credit Hours: 3.00. A study of presidential leadership as the embodiment of social forces and as reflective of the personality of the incumbent; the president as national leader reflecting national myths and ideologies; the growth of the presidency; issues and forces affecting the continuity of presidential leadership; the degree of institutionalization of the presidency.

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 37300 - Campaigns And Elections

Credit Hours: 3.00. This course analyzes the role of political parties, issues, candidates, media, funding, and electoral and campaign strategies in presidential, congressional, and state campaigns. Contemporary election examples will be utilized.

Credits: 3.00

POL 41000 - Political Parties And Politics

Credit Hours: 3.00. An analysis of the nature and functioning of U.S. political parties in terms of social and economic forces that shape our political system. Interactions among political parties, pressure groups, and formal government structures are emphasized throughout. Special attention is devoted to political leadership, nominating processes, campaign management, voting behavior, and other important aspects of American politics.

Credits: 3.00

POL 41100 - Congress: Structure And Functioning

Credit Hours: 3.00. A study of how Congress actually operates. Formal and informal power structures within both chambers and roles of the individual members of Congress are analyzed. Attention is directed to latent, as well as manifest, functions of legislative, investigative, and other major activities of Congress. The problem of bringing expertise to bear on the legislative process is considered throughout.

Credits: 3.00

POL 41500 - US Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the United States.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political

communications. 5. Write correctly and clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 46000 - Judicial Politics

Credit Hours: 3.00. A survey of judicial processes as they operate in America. Both trial courts and appellate courts will be examined in light of the procedures with which they operate. The external social, economic, and political pressures surrounding courts and the impact courts have on society will be considered.

Credits: 3.00

POL 46100 - Constitutional Law I

Credit Hours: 3.00. A survey of selected areas of constitutional law, considering the political and social influences as well as the doctrinal forces that have produced these policies and interpretations.

Credits: 3.00

POL 46200 - Constitutional Law II

Credit Hours: 3.00. An examination of the development of individual rights and civil liberties through constitutional law and interpretation of the Bill of Rights and Civil War Amendments. Both doctrinal and political pressures will be discussed to illustrate the evolution of these rights.

Credits: 3.00

POL 51700 - Applied Political Economy

Credit Hours: 3.00. An examination of the core concepts of political economy, the interaction of political institutions, markets, and economic choices, including the nature of capital and labor in the political process. Understand how political institutions and policies influence the organization of economic activity, and the role of the state and policy in shaping the domestic and global political economy since World War II.

Learning Outcomes: 1. Explain the core concepts of markets, capital, labor, and how they relate to economic and political outcomes. 2. Understand and describe why policy choices of states shape the functioning of markets, the organization of capital and labor, and economic decision-making. 3. Analyze the impact of different forms of political institutions and public policies on markets, economic behavior, and economic and political outcomes. 4. Apply political economy concepts to analyzing the context of an economic problem, identify potential solutions, and assess the likely outcome of policy interventions in light of the political economy of the state. Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

Sociology

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include

multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 36700 - Religion In America

Credit Hours: 3.00. Examines the social dimensions of religion in American life; religion in American culture; social profiles of America's religious groups, trends in individual religious commitment; and religion's impact on American life.

Learning Outcomes: 1. Describe the sizes and influences of major (and some minor) religious groups in America and how these sizes and influences have changed over the past 50 years. 2. Explain and evaluate the influence of religious groups and ideas on at least one other important aspect of social life. 3. Explain ways in which trends in American society over the past 50 years (e.g., changing gender roles, political shifts, etc.) are bringing about changes in American religion. Credits: 3.00

SOC 39100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Various topics in sociology that may change from semester to semester are presented by Sociology faculty members.

Credits: 1.00 to 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

SOC 51400 - Racial And Cultural Minorities

Credit Hours: 3.00. America's minority groups; immigration; interracial and intercultural conflicts; assimilation.

Credits: 3.00

SOC 53100 - Community Organization

Credit Hours: 3.00. A history of communities and community studies from pre-contact North America to the present (including virtual communities, which students may choose to study for their course projects).

Learning Outcomes: 1. Know what communities are. 2. Know what community studies are. 3. Understand how communities are created and transformed, 4. Understand how and why communities are important. Credits: 3.00

Spanish

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

Women's Studies

IDIS 49100 - Special Topics In Interdisciplinary Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of the instructor in a particular field of specialization.

Learning Outcomes: 1. Formulate significant research questions and conduct research relevant to those questions. 2. Consider a topic from multiple perspectives. 3. Demonstrate critical thinking and problem-solving abilities. 4. Demonstrate effective communication skills. Credits: 1.00 to 4.00

WGSS 48200 - Interdisciplinary Studies In Sexuality

Credit Hours: 3.00. This course offers an interdisciplinary introduction to recent work in lesbian and gay studies in various

fields, including literature, history, film, cultural theory, medicine, law, and studies of sexuality.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

WGSS 38300 - Women, Work, And Labor

Credit Hours: 3.00. Examines race, class and gender issues as they affect working women in America. Covering women's work from domestic labor to informal economies to factories, topics include women's participation in trade unions, wage inequalities, family leave policies and sexual harassment.

Learning Outcomes: 1. Have acquired a broad comprehension of the work, including economic activity often not recognized as "work", that women typically have performed or is typically associated with women, world-wide and since the onset of industrialization. 2. Be capable of evaluating current global economic and cultural systems that impact what kinds of labor contemporary women perform, the conditions under which they work, and the nature of the gendered systems of labor that prevail in the U.S. and elsewhere. 3. Gain appreciation for the significance of women's unpaid or underpaid care-work, relational work, affective labor, and the "reproductive" labor underpinning global capitalism and industrialism. 4. Place their own personal lives and contexts within an analytical framework informed by feminist, Marxist, and intersectional perspectives on work and labor. Credits: 3.00

WGSS 38100 - Women Of Color In The United States

Credit Hours: 3.00. Explores the diversity of racial and ethnic groups in the United States with a particular emphasis on the histories, experiences, and cultural contributions of women of color. Provides a broad introduction to the intersections of gender, race and ethnicity.

Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

Notes

Animal Science Minor

Requirements for the Minor (18 credits)

A. Nutrition

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

B. Physiology

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results,

and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

C. Genetics

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed

mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

D. Products

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

E. Electives

Notes

Anthropology Minor

Requirements for the Minor (15 credits)

A. Choose One (3 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media.

Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil

record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

B. Additional Anthropology Courses 30000 level or higher (6 credits)

C. Additional Anthropology Courses (6 credits)

A. Choose One (3 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

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University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

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University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3.

Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Choose One (3 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

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Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

B. Additional Anthropology Courses 30000 level or higher (6 credits)

C. Additional Anthropology Courses (6 credits)

A. Choose One (3 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

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ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

Aquatic Sciences Minor

Requirements for the Minor (16 credits)

Required Courses (7 credits)

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

Selectives (9 credits)

A. Fisheries and Aquaculture Focus

FNR 45200 - Aquaculture

Credit Hours: 3.00. Historical perspectives and current practices in aquaculture, including production systems, feeds, water quality requirements, and diseases of commercially important species.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45300 - Fish Physiology

Credit Hours: 3.00. Presentation and discussion of physiological mechanisms exhibited by freshwater and marine invertebrates and vertebrates. Primary materials used for class presentation and discussions will be examples from primary research literature. Topics include respiration, osmoregulation, stress physiology, absorption and metabolism of compounds, and hormonal control of selected physiological mechanisms. Offered in odd-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45700 - Practical Fisheries Management

Credit Hours: 2.00. Theory and practice of fisheries management, with emphasis on strategies utilized for the management of freshwater and marine fisheries. Course content will include hands-on assessment of fish populations, as well as development of management plans and the setting of appropriate goals and objectives for effective, science-based management.

Learning Outcomes: 1. Develop understanding of the practical management of fisheries. 2. Compare and contrast a variety of fisheries management techniques with an emphasis on local fisheries. 3. Demonstrate quantitative skills in population modeling and the writing of fisheries management plans. Credits: 2.00

FNR 45600 - Fish And Marine Population Dynamics

Credit Hours: 4.00. Theory of population dynamics of animal populations in freshwater and marine environments. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, marine and freshwater

invertebrates, sport and commercial fish populations, and aquatic communities. Human resource users and non-users are considered.

Learning Outcomes: 1. Quantitatively assess the status of a fish population and develop considerations for management. 2. Practice and develop critical thinking skills through in-class discussions and a group research project. 3. Learn to interpret the scientific literature through reading of the primary literature. 4. Broaden understanding of fisheries and natural resource management. Credits: 4.00

FNR 38500 - Fish Biology And Ecology

Credit Hours: 4.00. Advanced study of the biology and ecology of fishes. In particular, the course covers aspects of the morphology, physiology, development, behavior, evolution, and diversity of fishes throughout the world. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems will be explored. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual, population, community structure, and anthropogenic effects.

Learning Outcomes: 1. Know key primitive fish groups and understand how modern fishes evolved through time. 2. Develop skills in fish taxonomy and scientific nomenclature, including identification of a wide range of fish specimens. 3. Understand fish diversity in terms of morphology, behavior, feeding, reproduction and habitats. 4. Build fish laboratory skills, including fish dissection, data collection and data analysis. 5. Understand the broad ecological roles of fishes in freshwater and marine systems. 6. Understand the principles of fish population dynamics and how populations respond to various biotic and abiotic factors. 7. Develop an understanding of the scientific method and demonstrate the ability to solve. problems, think critically and write scientific reports. Credits: 4.00

FNR 31300 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (HORT 31110) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in Western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of postharvest food storage and pest management. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 14. Be able to handle multiple tasks and deadline pressures. 15. Be able to work effectively with individuals from diverse cultures.

16. Have strong professional ethics and integrity. 17. Understand the importance of developing leadership skills. 18. Be able to work effectively in teams. 19. Have a working knowledge of SI (metric) units. Credits: 1.00

B. Marine and Freshwater Biology

EAPS 10400 - Oceanography (UCC: STS)

Credit Hours: 3.00. Origin of the oceans and marine life. Seafloor spreading and marine geology; currents, waves, and tides; marine organisms and ecology; beaches and nearshore life. Man's use and abuse of the sea, including contemporary problems and future opportunities. The role of oceans in climate and evolution of the biosphere.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand ocean and coastal processes. 2. Understand potential future impacts of ocean and other environmental changes. Credits: 3.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 45800 - Advanced Marine Biology

Credit Hours: 3.00. Focus is placed on the structure and function of major marine ecosystems, including estuarine, mangrove, coastal, coral reef, open ocean, and deep ocean environments. Course content will include rigorous treatment of the biogeochemical processes that support these ecosystems, as well as the biology and ecology of characteristic flora and fauna.

Learning Outcomes: 1. Demonstrate in-depth understanding of the structure and function of key marine ecosystems of the world. 2. Demonstrate thorough understanding of the major groups of organisms characteristic of key marine ecosystems of the world. 3. Demonstrate thorough understanding of the biogeochemical processes that sustain key marine ecosystems and their constituent taxa. 4. Understand major threats to sustainability of key marine ecosystems of the world. 5. Demonstrate improved critical thinking and scientific writing skills. Credits: 3.00

FNR 37800 - Marine Biology Practicum

Credit Hours: 3.00. This course presents students with expanded opportunities to use field techniques to sample and report on marine habitats and organisms. The course emphasizes the proper care and use of field sampling gear and identification of fish and invertebrates samples from exposed shore, lagoon, and estuary habitats. A trip to the coast of either the Atlantic Ocean or Gulf of Mexico is a central component of this course; a course fee is required to cover the expenses of the trip.

Learning Outcomes: 1. Demonstrate enhanced knowledge of the basic principles and techniques associated with sampling organisms in coastal environments. 2. Demonstrate practical knowledge and skills in sampling, handling, identifying, and reporting on marine biological communities characteristic of several costal habitat types. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills related to marine biology. Credits: 3.00

Selective

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

FNR 35100 - Aquatic Sampling Techniques

Credit Hours: 3.00. An introduction to laboratory and field sampling methods in aquaculture, limnology, and fisheries biology. Emphasis will be placed on the proper use of laboratory equipment and sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

ENTM 24200 - Data Science

Credit Hours: 3.00. Develop a data science skill set that complements coursework in mathematics, statistics, and experimental design. Data Science facilitates research by developing skills in data sourcing, formatting and using different types of data, and hypothesis generation. Mathematical communication skills are developed through data graphics, animation, and delivery of results through multiple platforms including interactive simulations on webpages.

Learning Outcomes: 1. Source different types of data and know what analyses are appropriate for each type. 2. Transform and format data for analyses. 3. Detect trends in data as part of hypothesis generation. 4. Communicate findings to different audiences through appropriate graphics and animations, including through web pages. 5. Write R scripts to accomplish all of the above. Credits: 3.00

Notes

Arabic Language and Culture Minor

About the Minor

Requirements for the Minor (15 credits)

A. Required Arabic Language Courses (6 credits)

ARAB 20100 - Standard Arabic Level III (UCC: HUM)

Credit Hours: 3.00. This course is designed to allow students to use the grammar and vocabulary acquired in the first two semesters in dealing with specific social situations. Continued improvement of conversational, reading, and writing abilities and expansion of vocabulary.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 20200 - Standard Arabic Level IV (UCC: HUM)

Credit Hours: 3.00. Increased mastery of the four language skills, with emphasis on reading and translation using materials from literary classical and modern Arabic. The course includes a study of some parts of the Koran.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

B. Arabic Literature and Culture Courses (6 credits)

ARAB 23000 - Arabic Literature In Translation

Credit Hours: 3.00. Survey of Arabic literature, from the classical to the postmodern period. Emphasis on connections between literary works and contemporary life. Conducted in English; no knowledge of Arabic required.

Credits: 3.00

ARAB 28000 - Arabic Culture (UCC: HUM)

Credit Hours: 3.00. A historical and literary survey of defining characteristics of Arabic culture from pre-Islamic times to the modern period.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ARAB 28100 - Introduction To Islamic Civilization And Culture

Credit Hours: 3.00. This course is a survey of broad currents in the cultures, thought and civilization of the Muslim world. It emphasizes religious, intellectual and cultural trends, social and political structures and contemporary issues of Muslim societies within the current global cultural world. Taught in English.

Learning Outcomes: 1. Gained understanding of the basic teachings of Islam, sources of Islamic civilization and culture, its historical development and major aspects of Islamic thought and art through today. 2. Make connections and understand the interplay among religion, politics, culture and other forms of artistic expression. 3. Provide students with tools to undertake further research about the cultures of Islam and examine the impact Islam makes in lives of communities and contemporary problems facing Muslims in a globalized cultural world. Credits: 3.00

ARAB 33000 - The Middle East On Film

Credit Hours: 3.00. This course offers an introduction to films produced in the Middle East and on Middle Eastern Cultures. In this class, we will view films from the Arab world, including North Africa, and the large Middle Eastern region. Parallel to film screening, students will read critical and analytical material that provide background as well as commentary and analysis of cultural and historical contexts on content of films and their making. The course will examine a series of topics such as identity politics, religious affiliation, gender, immigration, belonging, homeland and exile. We will also situate the films within the aesthetic traditions of production and reception and analyze how they provide critical perspectives and insights in central issues in the cultures of Middle Eastern cultures. The overarching goal of the class is to provide students with a solid understanding of the function of cinema and films in representation of the evolution and transformation of the cultures and societies of the region and the issues central to how communal and individual identities in the Middle Eastern region are shaped. The class will also equip the students with skills to analyze meaning making and the role of technical aspects such as cinematography, body language, script, setting and acting in the creation of characters. All films will be screened with English subtitles.

Learning Outcomes: 1. Assess formal and technical elements of Middle Eastern film cultures. 2. Analyze how social and cultural themes are represented in visual means and through the screen. 3. Identify and explain the important aspects of film making in the film industries of the region. 4. Construct critical responses to how cinematic work uses aesthetics to mediate culture. 5. Evaluate the role of films in articulating major shifts and movements in the cultures of the region.
Credits: 3.00

C. Arabic Elective (3 credits)

ARAB 23900 - Arab Women Writers (UCC: HUM)

Credit Hours: 3.00. Survey of Arab women writers from North Africa, the Middle East, and Arab communities in the Western world. Emphasis on issues of sexuality, marriage, work, travel and immigration. Conducted in English; no knowledge of Arabic required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ARAB 30100 - Standard Arabic Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Arabic speaking, listening, reading, and writing abilities, using materials dealing primarily with the everyday life and civilization of Arabic-speaking countries, from various sources (newspapers, poetry, chapters from the Qu'ran). Conducted primarily in Arabic.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 30200 - Standard Arabic Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading and composition skills in Standard Arabic, using materials dealing with ideas and events that have shaped the Arabic-speaking culture. Conducted primarily in Arabic.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 33400 - North African Literature And Culture

Credit Hours: 3.00. A view of the culture and society of the Maghreb (Morocco, Algeria, Tunisia, and Libya). Emphasis on issues of race, politics, religion, and gender through literature and other forms of artistic expression, including film and music. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Increase ability to think critically about other cultures and societies and appreciate cultural differences. 2. Investigate key cultural, social and political issues that have shaped cultures and societies in North Africa. 3. Develop understanding of contemporary questions such as nationalism, politics, religion and ethnicity in the region as represented through materials (literary and/or visual) from/about North Africa. 4. Develop and improve analytical skills (both oral and written) and enhance their abilities to comprehend, interpret, and analyze texts. 5. Expand familiarity and knowledge about core societal and cultural issues of this region and connect to contemporary events in the various countries and communities in North Africa. Credits: 3.00

ARAB 58700 - Modern Arab Thought

Credit Hours: 3.00. Prominent and critical issues in modern Arab thought. Identity, historical meaning, the Arab-Islamic cultural legacy, and tradition vs. modernity are engaged through Arab encounters with the West. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Become familiar with the main lines of modern Arab thought. 2. Identify critical issues in modern Arab thought, in relation to questions of identity, cultural heritage, and religious faith; situate those issues within their historical, social, and political contexts. 3. Appreciate the nuanced relationship between the Arab world and the West in terms of an often painful dialogue between tradition and modernity. Credits: 3.00

Notes

Architectural Engineering Minor

About the Minor

Requirements for the Minor (18 credits)

Required Courses (12 credits)

CE 31100 - Architectural Engineering

Credit Hours: 3.00. This course introduces energy efficiency, thermal comfort, indoor environmental quality and green building design concepts. The course covers engineering fundamentals required for the design and analysis of building systems such as thermodynamics, fluid mechanics, heat and mass transfer, light and sound transmission. The course presents engineering principles and selected applications related to hydrothermal analysis of building enclosures, air conditioning processes in heating, ventilating and air conditioning systems, building illumination, and building acoustics.

Learning Outcomes: 1. Identify and analyze the characteristics of building environmental loads, building construction, and building operations as they define the requirements for a comfortable and healthy indoor environment. 2. Demonstrate knowledge of thermodynamics , fluid mechanics, heat and mass transfer,

photometric quantities and sound transmission for use in building design. 3. Identify, formulate and solve realistic Architectural Engineering problems related to hygrothermal analysis of building enclosures, air conditioning processes in Heating Ventilating and Air Conditioning Systems, pipe and duct flow, building illumination and building acoustics. 4. Demonstrate an understanding of building systems integration to achieve efficient operation. Credits: 3.00

CE 41300 - Building Envelope Design And Thermal Loads

Credit Hours: 3.00. This course discusses the basic thermal processes in buildings and presents comprehensive methods for thermal design of envelope assemblies in commercial and residential buildings. The first part of the course includes steady-state transient conduction through envelope assemblies, convection and radiation heat transfer in buildings, solar radiation and solar gains, thermal performance of windows, internal gains, ventilation and infiltration. The second part of the course considers surface and room energy balance equations and presents analytical and computational models for calculation of hourly heating and cooling loads throughout the year. Climate-based standards, passive solar design, advanced energy guides, and innovative technologies for high performance buildings are discussed. The course also includes a design project on analytical heating/cooling load calculations for a commercial building.

Learning Outcomes: 1. Calculate heat transfer through envelope assemblies for commercial and residential buildings. 2. Solve energy balance equations for building surfaces and room air. 3. Calculate solar and internal gains and predict transient hourly heating and cooling loads for a building throughout the year using analytical and computational models. 4. Design building envelopes according to national standards. 5. Understand principles of passive solar design and the application of innovative envelope technologies. Credits: 3.00

CE 41400 - Building Mechanical And Electrical System Design

Credit Hours: 3.00. This course covers the design of building mechanical and electrical systems. In the first part of the course students learn principles of designing and integrating heating, ventilation, and air conditioning systems into building air delivery systems, mechanical cooling and heating technologies, duct design and layout, blower and pump selection, and hydronic systems. They also learn to design heating, ventilation, and air conditioning systems within the constraint of achieving satisfactory occupant thermal comfort in buildings. The second part of the course covers design concepts related to building electrical systems; including, single and three-phase power systems, motors, transformers, switching, and relays. The course includes a design project related to mechanical and electrical systems for a commercial building.

Learning Outcomes: 1. Utilize building thermal load information together with a knowledge of industry standards and numerical methods to design and integrate efficient heating, ventilation, and air conditioning systems into commercial and residential buildings. 2. Understand the benefits and drawbacks of conventional and innovative mechanical systems, and identify appropriate opportunities for the selection and integration of both. 3. Evaluate the performance and estimate energy consumption of common mechanical systems and components. 4. Understand the operating characteristics and appropriately size the components that are integrated into building electrical systems. Credits: 3.00

CE 51300 - Lighting In Buildings

Credit Hours: 3.00. This course focuses on the design of illumination systems in buildings (electric and natural lighting) in order to achieve energy efficiency and visual comfort. The first part of the course includes analytical lighting calculation techniques, visual perception, radiative transfer, lamp characteristics, electric lighting system design and control for calculation of required indoor illuminance levels. The second part of the course covers daylighting (natural lighting) systems, including state-of-the-art daylighting prediction models as well as design and control of such devices and advanced metrics. The course also has a lab section, in which the students learn how to work with lighting and daylighting tools and build their own computational transient lighting models in open programming languages, in order to design illumination systems and predict electricity consumption and potential energy savings.

Learning Outcomes: 1. Understand fundamental illumination concepts. 2. Design and assess the performance of electric and natural lighting

systems in buildings. 3. Calculate fundamental illuminance, non-point sources, radiant energy, lamp types, lighting controls, interior lighting design, daylight prediction models, optical properties of windows, advanced metrics and shading devices. 4. Build and solve lighting and daylighting models using advanced software and programming techniques to design lighting systems and calculate energy savings from the use of natural light and lighting controls. 5. Design a project, submit a project report and make an oral presentation (only individual projects are allowed). The project themes cover a wide variety of lighting/daylighting design and control such as: daylighting and lighting design of commercial buildings, measurements/monitoring of lighting levels in laboratory settings, prediction of protentional energy savings, impact of shading design and control, and advanced daylighting system modeling. Credits: 3.00

Elective Courses - Choose Two (6 credits)

CE 37100 - Structural Analysis I

Credit Hours: 3.00. Stress resultants (reactions, axial forces, shear forces, and bending moments) for beams and framed structures. Deflections of beams and frames by geometric methods (moment-area theorems and applications; conjugate beam analogy). Analysis of statically indeterminate beams and frames by classical stiffness methods; slope deflection and moment distribution. Influence functions and their applications.

Credits: 3.00

CE 47900 - Design Of Building Components And Systems

Credit Hours: 3.00. Design of simple floor and roof systems and load bearing walls; uses of building materials; fundamentals of design of metal form decking, steel joists, masonry (beams, columns and load bearing walls), and timber (beams, trusses, and mechanical connections).

Credits: 3.00

CE 51401 - Building Controls

Credit Hours: 3.00. This course is designed to provide students with the knowledge of fundamentals, design, and analysis for building control systems. It primarily consists of three parts. The first part covers basic concepts, terminology, procedures and computations of control systems including block diagrams & transfer function, open-loop & closed-loop control, control system modeling, time response, root locus techniques, design via root locus, and digital control systems. The second part focuses on issues surrounding the building controls: interfacing components such as sensors and actuators, problems encountered, and state-of-the-art solutions for building energy efficiency and thermal comfort. The third part aims to develop students' ability to convert control system concepts into real building control sytems. The course provides a hand-on opportunity for students to complete three projects associated with the three primary components during the semester: indoor environmental quality assessment, building HVAC system commissioning and its control analysis, and new control algorithm development for building energy efficiency, occupant health, and individual productivity.

Learning Outcomes: 1. Demonstrate basic HVAC processes and explain the function, layout, and operation of commercial HVAC systems. 2. Analyze the function, operating characteristics, and appropriate applications of basic control loops and control modes as found in direct digital, analog electronic, electronic and pneumatic commercial control systems. 3. Understand and program a sequence of control, lay out a control system logic diagram and program it into a DDC controller. 4. Understand the function of network devices and network protocols such as a bridge, router, gateway, hub, firewall, Ethernet, TCP/IP, BacNet, and Lon Talk. 5. Use general-purpose and specific building automation software to monitor and control a building HVAC system. 6. Numerically model a building to define the key control parameters for thermal comfort. 7. Develop and program alternative control algorithms for building HVAC systems in order to enable sustainable buildings. Credits: 3.00

CE 51501 - Building Energy Audits

Credit Hours: 3.00. This course is designed to provide students with the necessary skills to perform an energy audit on commercial and residential buildings. Energy accounting procedures for all major building subsystems are covered in

detail, along with operational cost analysis of these systems. Students learn fundamental techniques for auditing the building envelope; electrical and lighting systems; heating, ventilation, and air conditioning systems; internal thermal loads; and building maintenance and operation procedures. Students also learn to analyze electric and natural gas utility tariffs and rate structures and apply their findings to the energy auditing process.

Learning Outcomes: 1. Analyze utility tariffs and rate structures for electricity and natural gas, and use the information to help guide energy audits. 2. Perform an energy audit of all major building subsystems, including the building envelope, electrical and lighting systems, heating, ventilation, and air conditioning systems, internal thermal loads, and building maintenance and operation procedures. 3. Numerically model the energy consumption of each of the building subsystems, and run parametric studies to determine and recommend appropriate energy conservation measures. Credits: 3.00

ME 51800 - Analysis Of Thermal Systems

Credit Hours: 3.00. Modeling and optimization of thermal systems with a focus on heat-pumping equipment, such as vapor compression, absorption, and some advanced heat-pumping cycles. Students combine the use of thermodynamics, heat transfer, fluid mechanics, and numerical methods to develop and apply mathematical models for the analysis and optimization of specific equipment. Offered in alternate years.

Learning Outcomes: 1. Develop a comprehensive understanding of the fundamentals of thermal systems' modeling and analysis. 2. Develop a detailed understanding of vapor compression systems, absorption systems, and other advanced heat pumping equipment. Credits: 3.00

Notes

Art and Design Studio Minor

Requirements for the Minor (15 credits)

A. Required Courses (9 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

B. Choose One Area (6 credits)

Area 1. Ceramics

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth

experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

Area 2. Drawing & Illustration

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

Area 3. Electronic and Time-Based Art

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the

creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

Area 4. Fiber Art & Textile Design

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

Area 5. Jewelry & Metals

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 36200 - Jewelry And Metalwork

Credit Hours: 3.00. Lost wax casting and mold making, mechanisms and stone setting for jewelry and metalwork.

Learning Outcomes: 1. Students will be able to design and make wax and non-wax models for jewelry and small metal projects by reductive, addictive, and construction processes. 2. Students will learn to sprue, invest and cast their models by the lost wax centrifugal and vacuum casting methods. 3. They will learn to make waste molds and reusable rubber molds to produce their jewelry projects. 4. They will learn to make mechanisms for jewelry and settings for incorporating stones or other nonmetal materials into their jewelry. Credits: 3.00

AD 46200 - Metalsmithing

Credit Hours: 3.00. Metal forming and metalsmithing processes for small metal objects and jewelry.

Learning Outcomes: 1. Identify and utilize traditional jewelry and metalsmithing tools and materials in art metal projects. 2. Design and construct specialized tooling for metalworks. 3. Utilize newly developed tools into the fabrication of jewelry and other metal projects. Credits: 3.00

Area 6. Painting

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 36500 - Intermediate Painting

Credit Hours: 3.00. A studio course concentrating on the development of conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

Area 7. Photography

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

Area 8. Printmaking

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 33300 - Photo Silk Screen

Credit Hours: 3.00. Advanced study of the techniques of photo silkscreen and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36900 - Lithographic Printmaking

Credit Hours: 3.00. An introduction to the techniques of stone and plate lithography. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 46800 - Printmaking III

Credit Hours: 3.00. Advanced studies in selected printmaking processes including relief, silkscreen, lithography, intaglio and book arts. Emphasis on color printmaking, photomechanical methods, fine art conceptual issues, creativity, and professional practices.

Learning Outcomes: 1. Create strong contemporary personal work in printmaking with expressive and original ideas. 2. Cultivate personal style through self-directed artist research, image development and experimentation in printmaking. 3. Demonstrate advanced technical skill in one or more printmaking mediums. 4. Acquire advanced technical skills to create multi-colored prints utilizing color, layering, and registration. 5. Describe and critique the work of professional printmaking artists, self and peers. Credits: 3.00

Area 9. Interdisciplinary

Area 1. Ceramics

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

A. Required Courses (9 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required Courses (9 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

B. Choose One Area (6 credits)

Area 1. Ceramics

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

Area 2. Drawing & Illustration

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and

assess their creative work and the work of their peers. Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

Area 3. Electronic and Time-Based Art

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

Area 4. Fiber Art & Textile Design

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

Area 5. Jewelry & Metals

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to

produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 36200 - Jewelry And Metalwork

Credit Hours: 3.00. Lost wax casting and mold making, mechanisms and stone setting for jewelry and metalwork.

Learning Outcomes: 1. Students will be able to design and make wax and non-wax models for jewelry and small metal projects by reductive, addictive, and construction processes. 2. Students will learn to sprue, invest and cast their models by the lost wax centrifugal and vacuum casting methods. 3. They will learn to make waste molds and reusable rubber molds to produce their jewelry projects. 4. They will learn to make mechanisms for jewelry and settings for incorporating stones or other nonmetal materials into their jewelry. Credits: 3.00

AD 46200 - Metalsmithing

Credit Hours: 3.00. Metal forming and metalsmithing processes for small metal objects and jewelry.

Learning Outcomes: 1. Identify and utilize traditional jewelry and metalsmithing tools and materials in art metal projects. 2. Design and construct specialized tooling for metalworks. 3. Utilize newly developed tools into the fabrication of jewelry and other metal projects. Credits: 3.00

Area 6. Painting

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 36500 - Intermediate Painting

Credit Hours: 3.00. A studio course concentrating on the development of conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

Area 7. Photography

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate and analyze the history and critical theory of

analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

Area 8. Printmaking

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 33300 - Photo Silk Screen

Credit Hours: 3.00. Advanced study of the techniques of photo silkscreen and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36900 - Lithographic Printmaking

Credit Hours: 3.00. An introduction to the techniques of stone and plate lithography. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 46800 - Printmaking III

Credit Hours: 3.00. Advanced studies in selected printmaking processes including relief, silkscreen, lithography, intaglio and book arts. Emphasis on color printmaking, photomechanical methods, fine art conceptual issues, creativity, and professional practices.

Learning Outcomes: 1. Create strong contemporary personal work in printmaking with expressive and original ideas. 2. Cultivate personal style through self-directed artist research, image development and experimentation in printmaking. 3. Demonstrate advanced technical skill in one or more printmaking mediums. 4. Acquire advanced technical skills to create multi-colored prints utilizing color, layering, and registration.

5. Describe and critique the work of professional printmaking artists, self and peers. Credits: 3.00

Area 9. Interdisciplinary

Area 1. Ceramics

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

A. Required Courses (9 credits)

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

Art History Minor

Requirements for the Minor (15 credits)

A. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

B. Additional Hours (9 credits)

1. Ancient and Medieval Art

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

2. Renaissance and Baroque Art

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining

the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas. Credits: 3.00

AD 34300 - Northern Renaissance Art

Credit Hours: 3.00. The development of a mature North European art originating in the International Gothic tradition and culminating in the works of Albrecht Durer, Jerome Bosch, and Pieter Bruegel, the Elder.

Learning Outcomes: 1. Be familiar with the history of the period in general and with major artists in particular. 2. Show the ability to read and think critically about a work of art, to look carefully at a work and to discuss what he or she is seeing. 3. Be able to describe clearly a work of art and to compare it to other works and artists of the period. 4. Be able to write an explanation of how a work of art illustrates a particular theme or idea in clear and understandable prose with correct spelling and punctuation in paragraphs that lead logically from one to another. 5. Show the ability to follow instructions and pay attention to detail in the preparation and presentation of research citing sources accurately. Credits: 3.00

3. Modern and Contemporary Art

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

AD 33900 - Women Artists (UCC: BSS)

Credit Hours: 3.00. A critical overview of the lives, works, and experiences of women artists from the late 19th century to the present, examining the social and cultural challenges they faced, and reflecting on the changing roles women have played in art and society.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks and artists. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about women artists and women art by contextualizing and analyzing them and selecting artworks to illustrate your comments. 4. Apply the knowledge they will have acquired to analyze and write about artworks we would not have studied in class. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting

artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

4. World Art

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

5. Design History

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

AD 59200 - Graduate Seminar In Art Or Design History

Credit Hours: 3.00. This is a graduate seminar that focuses on a particular theme, period, or movement in the history of art or design. Permission from department required.

Learning Outcomes: 1. Analyze and discuss scholarly readings related to the history of art and design. 2. Analyze primary sources, artifacts, images, and other such materials related to the theme of the term. 3. Conduct original primary and scholarly research on a topic related to the seminar and present that research in written, visual, or oral forms. 4. Understand the social, cultural, and/or political context of art and design history. Credits: 3.00

6. Museum Studies

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

1. Ancient and Medieval Art

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context.

3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

A. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

Note

Requirements for the Minor (15 credits)

A. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

B. Additional Hours (9 credits)

1. Ancient and Medieval Art

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

2. Renaissance and Baroque Art

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas. Credits: 3.00

AD 34300 - Northern Renaissance Art

Credit Hours: 3.00. The development of a mature North European art originating in the International Gothic tradition and culminating in the works of Albrecht Durer, Jerome Bosch, and Pieter Bruegel, the Elder.

Learning Outcomes: 1. Be familiar with the history of the period in general and with major artists in particular. 2. Show the ability to read and think critically about a work of art, to look carefully at a work and to discuss what he or she is seeing. 3. Be able to describe clearly a work of art and to compare it to other works and artists of the period. 4. Be able to write an explanation of how a work of art illustrates a particular theme or idea in clear and understandable prose with correct spelling and punctuation in paragraphs that lead logically from one to another. 5. Show the ability to follow instructions and pay attention to detail in the preparation and presentation of research citing sources accurately. Credits: 3.00

3. Modern and Contemporary Art

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

AD 33900 - Women Artists (UCC: BSS)

Credit Hours: 3.00. A critical overview of the lives, works, and experiences of women artists from the late 19th century to the present, examining the social and cultural challenges they faced, and reflecting on the changing roles women have played in art and society.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks and artists. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about women artists and women art by contextualizing and analyzing them and selecting artworks to illustrate your comments. 4. Apply the knowledge they will have acquired to analyze and write about artworks we would not have studied in class. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new

technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

4. World Art

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain

historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

5. Design History

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

AD 59200 - Graduate Seminar In Art Or Design History

Credit Hours: 3.00. This is a graduate seminar that focuses on a particular theme, period, or movement in the history of art or design. Permission from department required.

Learning Outcomes: 1. Analyze and discuss scholarly readings related to the history of art and design. 2. Analyze primary sources, artifacts, images, and other such materials related to the theme of the term. 3. Conduct original primary and scholarly research on a topic related to the seminar and present that research in written, visual, or oral forms. 4. Understand the social, cultural, and/or political context of art and design history. Credits: 3.00

6. Museum Studies

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

1. Ancient and Medieval Art

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

A. General Surveys of the History of Art (6 credits)

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

Artificial Intelligence/Machine Learning Minor

About the Minor

Requirements for the Minor (15 credits)

Required Course (3 credits)

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

Core Courses - Choose Two: (6 credits)

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

ECE 36900 - Discrete Mathematics For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Credits: 3.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

Selective Courses - Choose Two: (6 credits)

ECE 43800 - Digital Signal Processing With Applications

Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; short-time spectral analysis and synthesis; linear predictive coding. Image processing: two-dimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credits: 4.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

ECE 49595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor

required.

Credits: 1.00 to 3.00

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

Notes

Asian American Studies Minor

Requirements for the Minor (15 credits)

A. Required Courses (6 credits)

ASAM 24000 - Introduction To Asian American Studies (UCC: HUM)

Credit Hours: 3.00. A general introduction to Asian American history and culture, with a focus on the diverse and multifaceted experiences of peoples of Asian descent in America and their contributions to U.S. culture and society.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

B. Diversity, Identities, and Intersectionality Courses (3-6 credits)

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the

diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

ANTH 34100 - Culture And Personality

Credit Hours: 3.00. A cross-cultural survey stressing different basic personality types and the processes by which adult personality is acquired. Case studies of selected non-Western cultures will be used to provide comparative perspective.

Learning Outcomes: 1. Explain in words and diagrams the dialectical relations among culture, personality, and cognition. 2. Distinguish and relate childhood and adult processes of enculturation and socialization. 3. Appraise how, why, and to what extent every individual and every society is unique, comparable to some others, and similar to all others. Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

WGSS 38100 - Women Of Color In The United States

Credit Hours: 3.00. Explores the diversity of racial and ethnic groups in the United States with a particular emphasis on the histories, experiences, and cultural contributions of women of color. Provides a broad introduction to the intersections of gender, race and ethnicity.

Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the diversity of

feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ASAM 49000 - Special Topics In Asian American Studies

Credit Hours: 3.00. Various topics in Asian American studies, changing from semester to semester as presented by different instructors.

Learning Outcomes: 1. Vary due to the variable nature of the course. Credits: 3.00

C. Cultural Roots: Asian History and Society Courses (3-6 credits)

AD 39100 - History Of Chinese Art

Credit Hours: 3.00. A historical survey of the visual arts and architecture of China from antiquity to the present. Emphasis will be placed on the relation of a broad range of art forms to their social and cultural contexts.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Build knowledge and understanding of Chinese art. 6. Develop analytical and writing skills through textural studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 24300 - South Asian History And Civilizations (UCC: HUM)

Credit Hours: 3.00. Survey history of India, Pakistan, and Bangladesh, from the origins of South Asian civilization to the present. Topics include ancient India, the Mughal Empire, the colonial experience, the independence movement, and conflict and popular culture.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34400 - History Of Modern Japan (UCC: HUM)

Credit Hours: 3.00. A survey of Japanese history from the nineteenth century to the present, including Japan's response to Western expansionism, the formation of the modern state, political parties, industrialization, the Pacific War, the American Occupation, the postwar "economic miracle," and Japan today.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 35900 - Gender In East Asian History (UCC: HUM)

Credit Hours: 3.00. Examination of the construction of tradition and modernity in East Asia through the lens of gender. Topics include the influence of "Confucian" ethics; gender and imperialism, nationalism and revolution; and social change in the aftermath of war and decolonization.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

A. Required Courses (6 credits)

ASAM 24000 - Introduction To Asian American Studies (UCC: HUM)

Credit Hours: 3.00. A general introduction to Asian American history and culture, with a focus on the diverse and multifaceted experiences of peoples of Asian descent in America and their contributions to U.S. culture and society.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

Note

Requirements for the Minor (15 credits)

A. Required Courses (6 credits)

ASAM 24000 - Introduction To Asian American Studies (UCC: HUM)

Credit Hours: 3.00. A general introduction to Asian American history and culture, with a focus on the diverse and multifaceted experiences of peoples of Asian descent in America and their contributions to U.S. culture and society.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

B. Diversity, Identities, and Intersectionality Courses (3-6 credits)

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

ANTH 34100 - Culture And Personality

Credit Hours: 3.00. A cross-cultural survey stressing different basic personality types and the processes by which adult personality is acquired. Case studies of selected non-Western cultures will be used to provide comparative perspective.

Learning Outcomes: 1. Explain in words and diagrams the dialectical relations among culture, personality, and cognition. 2. Distinguish and relate childhood and adult processes of enculturation and socialization. 3. Appraise how, why, and to what extent every individual and every society is unique, comparable to some others, and similar to all others. Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

WGSS 38100 - Women Of Color In The United States

Credit Hours: 3.00. Explores the diversity of racial and ethnic groups in the United States with a particular emphasis on the histories, experiences, and cultural contributions of women of color. Provides a broad introduction to the intersections of gender, race and ethnicity.

Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ASAM 49000 - Special Topics In Asian American Studies

Credit Hours: 3.00. Various topics in Asian American studies, changing from semester to semester as presented by different instructors.

Learning Outcomes: 1. Vary due to the variable nature of the course. Credits: 3.00

C. Cultural Roots: Asian History and Society Courses (3-6 credits)

AD 39100 - History Of Chinese Art

Credit Hours: 3.00. A historical survey of the visual arts and architecture of China from antiquity to the present. Emphasis will be placed on the relation of a broad range of art forms to their social and cultural contexts.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist,

or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Build knowledge and understanding of Chinese art. 6. Develop analytical and writing skills through textural studies of primary and secondary sources, as well as writing exercises.

Credits: 3.00

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 24300 - South Asian History And Civilizations (UCC: HUM)

Credit Hours: 3.00. Survey history of India, Pakistan, and Bangladesh, from the origins of South Asian civilization to the present. Topics include ancient India, the Mughal Empire, the colonial experience, the independence movement, and conflict and popular culture.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 34400 - History Of Modern Japan (UCC: HUM)

Credit Hours: 3.00. A survey of Japanese history from the nineteenth century to the present, including Japan's response to Western expansionism, the formation of the modern state, political parties, industrialization, the Pacific War, the American Occupation, the postwar "economic miracle," and Japan today.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 35900 - Gender In East Asian History (UCC: HUM)

Credit Hours: 3.00. Examination of the construction of tradition and modernity in East Asia through the lens of gender. Topics include the influence of "Confucian" ethics; gender and imperialism, nationalism and revolution; and social change in the aftermath of war and decolonization.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures

such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be

placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

A. Required Courses (6 credits)

ASAM 24000 - Introduction To Asian American Studies (UCC: HUM)

Credit Hours: 3.00. A general introduction to Asian American history and culture, with a focus on the diverse and multifaceted experiences of peoples of Asian descent in America and their contributions to U.S. culture and society.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

Asian Studies Minor

Requirements for Minor (16 credits)

A. Required Course (4 credits)

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The

course provides students with further conversational and grammatical skills. Students practice reading comprehension, grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

B. Four Additional Courses (12 credits)

1. School of Languages and Cultures - Courses in Literature and Linguistics

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in

Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59600 - Special Topics In Japanese Linguistics.

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 48000 - Special Topics In Korean Studies

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on topics related to contemporary Korean culture, arts, literature, etc. Or an internship totaling approximately 100-120 hours per semester or summer in Korea may also be credited through this course.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic

discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

2. Department of History

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24300 - South Asian History And Civilizations (UCC: HUM)

Credit Hours: 3.00. Survey history of India, Pakistan, and Bangladesh, from the origins of South Asian civilization to the present. Topics include ancient India, the Mughal Empire, the colonial experience, the independence movement, and conflict and popular culture.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well

as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34400 - History Of Modern Japan (UCC: HUM)

Credit Hours: 3.00. A survey of Japanese history from the nineteenth century to the present, including Japan's response to Western expansionism, the formation of the modern state, political parties, industrialization, the Pacific War, the American Occupation, the postwar "economic miracle," and Japan today.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 35900 - Gender In East Asian History (UCC: HUM)

Credit Hours: 3.00. Examination of the construction of tradition and modernity in East Asia through the lens of gender. Topics include the influence of "Confucian" ethics; gender and imperialism, nationalism and revolution; and social change in the aftermath of war and decolonization.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

3. Department of Philosophy

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

PHIL 31000 - Classical Chinese Philosophy

Credit Hours: 3.00. In this course, we will survey the classic works of classical Chinese philosophy (c. 600-200 BCE). We will focus on seven major philosophers (and their followers): Kongzi (Confucius), Mozi, Mengzi (Mencius), Zhuangzi, Laozi, Xunzi, and Han Feizi. We will use their work to consider topics such as: the nature and value of morality, the proper role of ritual in human life, whether human nature is good or bad, how one becomes a moral person, the proper role and function of government, and more. In addition to introducing the competing traditions of Confucianism, Mohism, Daoism, and Legalism, the course will help students to develop basic philosophical skills as they develop and defend their own views on these topics. No knowledge of Chinese is expected.

Learning Outcomes: 1. Identify the central views of classical Chinese philosophers by reading primary texts. 2. Explain these views in their own words, and relate them to alternative views, by writing summaries (as part of ""position evaluation"" assignments). 3. Apply these views and arguments to questions arising in their own lives through in-class discussion of assigned reading questions. 4. Extract arguments from prose text and analyze them, both through in-class exercises and as part of ""position evaluation"" assignments. 5. Assess the value of these arguments via in-class group discussion and final papers. 6. Formulate original arguments regarding topics discussed by Chinese philosophers via in-class group discussion and final papers.e philosophers via in-class group discussion and final papers. Credits: 3.00

4. Department of Political Science

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

POL 33500 - China And The Challenges Of Globalization (UCC: BSS)

Credit Hours: 3.00. Globalization is a very popular topic, resulting in a lot of loose and poorly thought-through talk and writing around the subject. The view taken in this course is that to understand current processes of globalization we need to examine it in less broad and amorphous ways by focusing on its specific manifestations. Thus, this course focuses on how China has managed the challenges of globalization. China is a particularly useful case study because it failed the challenges of globalization in the late 19th and early 20th centuries. For an ancient civilization such as China, this failure had tremendous impact on its national pride. The Chinese refer to this historical juncture as the "century of shame." Towards the end of the 20th century and the onset of the 21st, China faced again the challenges of globalization and has arisen to the tasks in a spectacular fashion, transforming a largely rural and agriculture economy into the world's second largest economic power. This amazing transformation is leading some to proclaim that the 21st century will belong to China!

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recall basic facts about China's geography, people, economy, and culture. 2. Identify key historical moments in China's engagement with globalization. 3. Demonstrate a clear grasp of the concept of globalization and contending definitions of it. 4. Apply knowledge to explain how China has dealt with challenges of globalization. Credits: 3.00

5. Department of Sociology

SOC 36900 - Religion And Chinese Society

Credit Hours: 3.00. This course provides an overview of various religions in contemporary China, examines religiosity at the micro, meso and macro levels, and discusses the mutual impacts between religion and social, cultural and political life in Chinese societies.

Learning Outcomes: 1. Summarize the key teachings and rituals of the major religions in Chinese society. 2. Describe the general social characteristics of religious believers in contemporary Chinese society. 3. Explain the major social and political events and their

impacts on religious change. 4. Appreciate religious diversity and cultural significance in the increasingly globalizing world. Credits: 3.00

6. Department of Anthropology

ANTH 39200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Various topics in anthropology that may change from semester to semester are presented by anthropology faculty members.

Credits: 1.00 to 3.00

1. School of Languages and Cultures - Courses in Literature and Linguistics

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing

and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59600 - Special Topics In Japanese Linguistics.

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical

mind over the political, social and cultural issues presented in cinema. Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 48000 - Special Topics In Korean Studies

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on topics related to contemporary Korean culture, arts, literature, etc. Or an internship totaling approximately 100-120 hours per semester or summer in Korea may also be credited through this course.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques,

students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

A. Required Course (4 credits)

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The course provides students with further conversational and grammatical skills. Students practice reading comprehension, grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on

personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

Notes

Requirements for Minor (16 credits)

A. Required Course (4 credits)

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The course provides students with further conversational and grammatical skills. Students practice reading comprehension, grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

B. Four Additional Courses (12 credits)

1. School of Languages and Cultures - Courses in Literature and Linguistics

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired

through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59600 - Special Topics In Japanese Linguistics.

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English. Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 48000 - Special Topics In Korean Studies

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on topics related to contemporary Korean culture, arts, literature, etc. Or an internship totaling approximately 100-120 hours per semester or summer in Korea may also be credited through this course.

Learning Outcomes: 1. Learning outcomes vary

due to nature of course. Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various

forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

2. Department of History

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24300 - South Asian History And Civilizations (UCC: HUM)

Credit Hours: 3.00. Survey history of India, Pakistan, and Bangladesh, from the origins of South Asian civilization to the present. Topics include ancient India, the Mughal Empire, the colonial experience, the independence movement, and conflict and popular culture.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 34400 - History Of Modern Japan (UCC: HUM)

Credit Hours: 3.00. A survey of Japanese history from the nineteenth century to the present, including Japan's response to Western expansionism, the formation of the modern state, political parties, industrialization, the Pacific War, the American Occupation, the postwar "economic miracle," and Japan today.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 35900 - Gender In East Asian History (UCC: HUM)

Credit Hours: 3.00. Examination of the construction of tradition

and modernity in East Asia through the lens of gender. Topics include the influence of "Confucian" ethics; gender and imperialism, nationalism and revolution; and social change in the aftermath of war and decolonization.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

3. Department of Philosophy

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

PHIL 31000 - Classical Chinese Philosophy

Credit Hours: 3.00. In this course, we will survey the classic works of classical Chinese philosophy (c. 600-200 BCE). We will focus on seven major philosophers (and their followers): Kongzi (Confucius), Mozi, Mengzi (Mencius), Zhuangzi, Laozi, Xunzi, and Han Feizi. We will use their work to consider topics such as: the nature and value of morality, the proper role of ritual in human life, whether human nature is good or bad, how one becomes a moral person, the proper role and function of government, and more. In addition to introducing the competing traditions of Confucianism, Mohism, Daoism, and Legalism, the course will help students to develop basic philosophical skills as they develop and defend their own views on these topics. No knowledge of Chinese is expected.

Learning Outcomes: 1. Identify the central views of classical Chinese philosophers by reading primary texts. 2. Explain these views in their own words, and relate them to alternative views, by writing summaries (as part of ""position evaluation"" assignments). 3. Apply these views and arguments to questions arising in their own lives through in-class discussion of assigned reading questions. 4. Extract arguments from prose text and analyze them, both through in-class exercises and as part of ""position evaluation"" assignments. 5. Assess the value

of these arguments via in-class group discussion and final papers. 6. Formulate original arguments regarding topics discussed by Chinese philosophers via in-class group discussion and final papers.e philosophers via in-class group discussion and final papers. Credits: 3.00

4. Department of Political Science

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

POL 33500 - China And The Challenges Of Globalization (UCC: BSS)

Credit Hours: 3.00. Globalization is a very popular topic, resulting in a lot of loose and poorly thought-through talk and writing around the subject. The view taken in this course is that to understand current processes of globalization we need to examine it in less broad and amorphous ways by focusing on its specific manifestations. Thus, this course focuses on how China has managed the challenges of globalization. China is a particularly useful case study because it failed the challenges of globalization in the late 19th and early 20th centuries. For an ancient civilization such as China, this failure had tremendous impact on its national pride. The Chinese refer to this historical juncture as the "century of shame." Towards the end of the 20th century and the onset of the 21st, China faced again the challenges of globalization and has arisen to the tasks in a spectacular fashion, transforming a largely rural and agriculture economy into the world's second largest economic power. This amazing transformation is leading some to proclaim that the 21st century will belong to China!

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recall basic facts about China's geography, people, economy, and culture. 2. Identify key historical moments in China's engagement with globalization. 3. Demonstrate a clear grasp of the concept of globalization and contending definitions of it. 4. Apply knowledge to explain how China has dealt with challenges of globalization. Credits: 3.00

5. Department of Sociology

SOC 36900 - Religion And Chinese Society

Credit Hours: 3.00. This course provides an overview of various religions in contemporary China, examines religiosity at the micro, meso and macro levels, and discusses the mutual impacts between religion and social, cultural and political life in Chinese societies.

Learning Outcomes: 1. Summarize the key teachings and rituals of the major religions in Chinese society. 2. Describe the general social characteristics of religious believers in contemporary Chinese society. 3. Explain the major social and political events and their impacts on religious change. 4. Appreciate religious diversity and cultural significance in the increasingly globalizing world. Credits: 3.00

6. Department of Anthropology

ANTH 39200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Various topics in anthropology that may change from semester to semester are presented by anthropology faculty members.

Credits: 1.00 to 3.00

1. School of Languages and Cultures - Courses in Literature and Linguistics

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural

and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59600 - Special Topics In Japanese Linguistics.

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 48000 - Special Topics In Korean Studies

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on topics related to contemporary Korean culture, arts, literature, etc. Or an internship totaling approximately 100-120 hours per semester or summer in Korea may also be credited through this course.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and

advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with

some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

A. Required Course (4 credits)

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The course provides students with further conversational and grammatical skills. Students practice reading comprehension, grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

ASL and Deaf Studies Minor

About the Program

Requirements for the Minor (15 credits)

ASL 28000 - American Deaf Community: Language, Culture, And Society

Credit Hours: 3.00. The linguistic, cultural, and societal context of the deaf community in America. Both historical and contemporary aspects of deaf identity will be included, with an emphasis on the central role that ASL plays in the lives of deaf individuals.

Credits: 3.00

ASL 36100 - The Structure Of American Sign Language I: Phonology And Morphology

Credit Hours: 3.00. Linguistic study of ASL, including the following: phonological features of individual signs (hand shape, orientation, location, movement) and how those features shift when placed in a stream of signs; morphological features of signs, including compounding and lexicalization of fingerspelled words; grammar, focusing on typical word orders found in ASL sentences; meaning of signs and how those meanings have shifted over time (as well as how those meanings shift for particular dialects); and typical pragmatic features of conversation in ASL. Knowledge of ASL is required.

Learning Outcomes: 1. Demonstrate increased vocabulary and grammatical structures necessary to interact with deaf people accurately in ASL. 2. Develop an understanding of the principles of ASL linguistic structure through study of ASL grammar. 3. Articulate the differences between ASL and English grammars. 4. Demonstrate appropriate structure and pragmatics when interacting with deaf and hard of hearing people. 5. Develop an intercultural awareness of the differences between deaf and hearing communities and will learn to adjust their behavior accordingly. Credits: 3.00

ASL 30100 - American Sign Language V

Credit Hours: 3.00. This course is a continuation of ASL 20200 (5th in sequence of courses in ASL). Features of Level 5 are expanded student discourse, advanced ASL structure and vocabulary, roleshift variations, formal storytelling, text analysis and formal/informal presentations.

Learning Outcomes: 1. Students will learn and demonstrate advanced grammatical uses of ASL in conversations and in storytelling. 2. Students will develop increasingly complex receptive and expressive skills in ASL discourse: how sign movements can be modified to change meaning; how and when facial expressions occur; and how body, head, and eye movements are used in phrasing and agreement. 3. Students will demonstrate fluent and appropriate communication skills with competent/native users of ASL by maintaining a high degree of grammatical accuracy. 4. Students will demonstrate increased understanding and appreciation of noted ASL artists performing handshape stories, cheers, songs, poetry, storytelling, and legends. 5. Students will be able to compare, contrast, and exchange opinions on current issues in the field of Deaf and ASL studies. Credits: 3.00

ASL 36200 - The Structure Of American Sign Language II: Syntax, Semantics And Language Use

Credit Hours: 3.00. This course introduces students who already have prior knowledge of linguistics (e.g., phonetics, phonology, and morphology) to three areas of study in linguistics: Syntax, Semantics, and language use. Linguistic study of ASL, including the following: Syntax includes units on basic sentence types, lexical categories, word order, time and aspect, verbs, and the function of the spaces. Semantics includes the meanings of individual signs and sentences. Language in Use includes Black ASL, Variation and Historical Change. Bilingualism and language acquisition will be also covered. ASL Discourse has the ways that signed conversations among deaf people differ from speaking conversation of hearing people, why these differences exist, and why they are culturally important. Knowledge of ASL is required.

Learning Outcomes: 1. Compare and differentiate the basic characteristics of signed and spoken languages by text reading. 2. Identify and describe the structure and use of American Sign Language with attention to sociolinguistic rule concerning ASL in the Deaf community by observing the film resources. 3. Apply linguistic knowledge by comparing, identifying parts and relationships of all languages, spoken and signed. 4. Develop an intercultural awareness of the differences between deaf and hearing communities and will learn to adjust their behavior accordingly. Credits: 3.00

ASL 30200 - American Sign Language Advanced-Level VI

Credit Hours: 3.00. This course is a sequential course in the advanced study of American Sign Language (ASL) with emphasis on basic concepts of language based ASL. This is an application of language usage in ASL in which students will gain

an advanced understanding and mastery of ASL grammar. Includes instruction in semantic and grammatical accuracy and appropriate discourse strategies in a variety of communication contexts. Students utilize advanced receptive and expressive skills.

Learning Outcomes: 1. Identify the appropriate use of ASL semantics and conceptual signs. 2. Apply intermediate-to-advanced ASL grammatical features to informal and formal styles. 3. Compose narratives and presentations in ASL. 4. Discuss, debate, and exchange information and perspectives of ASL and Deaf culture. Credits: 3.00

Notes

Astronomy Minor

Requirements for the Minor (15-16 credits)

Required Courses (12-13 credits)

ASTR 36300 - The Solar System

Credit Hours: 3.00. This course is intended for students in science or engineering. The components of the course consist of an overview of solar system objects and an overview of the physical processes that control the evolution of solar system objects since formation. The overview of solar system includes observations of the Sun, planets, asteroids and Kuiper-belt objects, comets, and interplanetary dust. Specific processes that are discussed include hydrostatic equilibrium, orbital dynamics, radioactive decay, and heat flow. The role of these processes in shaping planetary surfaces and atmosphere is explored.

Learning Outcomes: 1. The students will acquire extensive knowledge on the solar system, including its formation and evolution. Credits: 3.00

ASTR 36400 - Stars And Galaxies

Credit Hours: 3.00. This course is intended for students in Science or Engineering. This is the second of a two-semester introductory sequence on astronomy and astrophysics, although it is designed to be a standalone course. It is intended mainly for Science and Engineering majors who are comfortable with calculus-based contents. The course provides an overview on the formation and evolution of stars, galaxies, and clusters of galaxies. Selected topics that are covered in more detail include stellar structure and atmosphere, properties of black holes, neutron stars, and white dwarfs, galactic dynamics, and dark matter in galaxies and clusters of galaxies.

Learning Outcomes: 1. The students will acquire extensive knowledge on the properties of stars and galaxies. Credits: 3.00

ASTR 37000 - Cosmology

Credit Hours: 3.00. Intended for science and engineering majors. Basic physics and math knowledge will be assumed. The picture of how the Universe came to be and how it has evolved has recently come into sharp focus. This progress is the result of improved observational techniques that have resulted in high resolution images of very distant galaxies, a more accurate mapping of the Large Scale Structure of the Universe or the high resolution picture of the young universe provided by Cosmic Microwave Background observations. We will present a historical perspective of how ideas and data have shaped Cosmology through the centuries. In addition, we will review the theoretical models that are in agreement with the current observations. Our goal will be to provide the students with a broad overview of the current research in Cosmology with an eye toward stimulating the students curiosity about the many questions still awaiting answers in this field.

Learning Outcomes: 1. Students will acquire extensive knowledge and a broad overview of Cosmology, the study of how the Universe came to be and how it has evolved. Credits: 3.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the

Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Additional Course - (3 credits)

ASTR 56000 - Stellar Evolution

Credit Hours: 3.00. (PHYS 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

ASTR 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (PHYS 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

ASTR 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (PHYS 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

ASTR 56300 - Astroparticle Physics

Credit Hours: 3.00. (PHYS 56300) An overview of an emerging research frontier in modern physics that lies at the interface of

particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology, cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

ASTR 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (PHYS 56700) Fundamental concepts in observational astronomy, including coordinate and time systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal.

Credits: 3.00

PHYS 56000 - Stellar Evolution

Credit Hours: 3.00. (ASTR 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

PHYS 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (ASTR 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

PHYS 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (ASTR 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

PHYS 56300 - Astroparticle Physics

Credit Hours: 3.00. (ASTR 56300) An overview of an emerging research frontier in modern physics that lies at the interface of particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology, cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

PHYS 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (ASTR 56700) Fundamental concepts in observational astronomy, including coordinate and time systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal.

Credits: 3.00

Notes

Atmospheric Science Minor

About the Minor

Requirements for the Minor (15 credits)

Required Course (3 credits)

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

Additional EAPS Coursework (12 credits)

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AT 32501 - Advanced Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who are preparing for careers as professional pilots or dispatchers and require an advanced knowledge of the impact of weather on aviation operations.

Learning Outcomes: 1. Develop increased awareness of meteorology and its application to aviation operations. 2. Demonstrate knowledge of aviation meteorological concepts, with an emphasis on meteorological hazards for instrument flight operations. 3. Demonstrate the use of aviation weather data types and sources. 4. Develop expertise in obtaining and evaluating appropriate weather data, and in integrating these data into the preflight planning required for a professionally-flown instrument flight. Credits: 3.00

EAPS 23000 - Laboratory In Atmospheric Science

Credit Hours: 2.00. A laboratory course that introduces the fundamentals of atmospheric science through quantitative exercises. The theoretical exercises include the vertical structure of the atmosphere, the Earth's energy budget, atmospheric moisture, saturation and stability, clouds and precipitation and atmospheric motion. Data and map analysis exercises include mid-latitude cyclones, thunderstorms and tornadoes, hurricanes and controls of climate. Prior or current course work in introductory atmospheric science is required. This course may not be taken for credit by students in the atmospheric science option of the Department of Earth and Atmospheric Sciences.

Credits: 2.00

EAPS 32500 - Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who have an interest in topics in meteorology applied to aviation operations with emphasis on meteorological hazards for instrument flight. Topics covered include obtaining and evaluating weather data, review of synoptic meteorology, map analysis, the ICAO standard atmosphere, pressure and altimetry, atmospheric thermodynamics, moisture and stability, low-IFR operations, aircraft icing, turbulence, thunderstorms and associated hazards, and interpretation and use of radar and satellite imagery. Prior course work in introductory atmospheric science and pre-calculus is required.

Credits: 3.00

EAPS 32700 - Climate, Science And Society

Credit Hours: 3.00. This course will examine the broad problems of climate change by examining the relationship between science, politics, and society by using climate change as a lens through which to examine larger issues. Students will be encouraged to identify similar themes in their own experiences as emerging scientists, engineers and global leaders. Adequate preparation to write essays and perform basic arithmetic calculations needed. Prior knowledge of climate change science is not necessary.

Learning Outcomes: 1. Able to think logically and creatively. 2. Able to apply knowledge to practical situations. 3. Able to respond flexibly as situation changes. 4. Understand ethical issues, particularly in Science. 5. Appreciate diverse experiences, thoughts, backgrounds. 6. Understand and appreciate Science in the world environment. Credits: 3.00

EAPS 39100 - Topics In Earth And Atmospheric Sciences

Credit Hours: 1.00 to 4.00. Intermediate special topics in the earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 4.00

EAPS 42100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (AGRY 43100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in introductory atmospheric science, second semester physics or thermodynamics is required.

Credits: 3.00

EAPS 42200 - Atmospheric Dynamics I

Credit Hours: 3.00. (AGRY 43200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations, thermal wind relationships; circulation, vorticity, divergence, and vertical motion. Prior course work in atmospheric thermodynamics and differential equations is required.

Credits: 3.00

EAPS 42300 - Atmospheric Dynamics II

Credit Hours: 3.00. (AGRY 43300) An extension of EAPS 42200, with emphasis on perturbation theory and hydrodynamics stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

EAPS 43100 - Synoptic Laboratory I

Credit Hours: 1.00. (AGRY 44100) Analysis of vertical distributions of temperature and moisture with applications to adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in atmospheric thermodynamics is required.

Credits: 1.00

EAPS 43200 - Synoptic Laboratory II

Credit Hours: 1.00. Analysis of horizontal distributions of pressure, temperature, wind, vorticity, and vertical motions. Applications to synoptic-scale wave propagation. Prior course work in atmospheric thermodynamics and synoptic lab I is required.

Credits: 1.00

EAPS 43300 - Synoptic Lab III

Credit Hours: 1.00. (AGRY 44300) Diagnoses of midtropospheric wave propagation and growth. Analysis of surface pressure fields and fronts and their relationships to upper air features. Extensive use is made of teletype and facsimile weather information. Prior course work in atmospheric dynamics and synoptic lab II is required.

Credits: 1.00

EAPS 43400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (AGRY 44400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data

and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

AGRY 53500 - Boundary Layer Meteorology

Credit Hours: 3.00. (EAPS 52500) This course has required class trips. Students will pay individual lodging or meal expenses where necessary. A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

EAPS 52000 - Theory Of Climate

Credit Hours: 3.00. A general introduction to the theory of climate at an intermediate level. A brief survey of physical climatology and paleoclimates. Theoretical development of climate models. Theories of climatic stability and climatic change.

Learning Outcomes: 1. Describe in a quantitative fashion the processes that determine past and present climates, as well the qualitative patterns associated with those changes. Apply this fundamental theoretical knowledge using the tools of modeling to understand and predict climate changes and changes in modes of climatic variability. 2. Identify, calculate, and explain the various thresholds, non-linearities, and 'tipping point' mechanisms in the climate system as a complex dynamical system both from the theoretical and observational points of view. 3. Define the appropriate type of model or quantitative framework for answering a climate, paleoclimate, or future climate question and know how to utilize this model through comparison with appropriate data or theoretical predictions. Credits: 3.00

EAPS 52100 - Atmospheric Chemistry

Credit Hours: 3.00. An introduction to the chemistry of the earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

EAPS 52300 - Radar Meteorology

Credit Hours: 3.00. Origin and evolution of radar. Modern weather radar systems and their component parts. Propagation of microwave energy in the atmosphere. Rayleigh and Mie scattering theory, with application to scattering by precipitation. Utilization of radar systems in forecasting quantitative analyses and cloud physics research. Recent refinement and future potential. Prior coursework in synoptic meteorology labs and atmospheric physics is required.

Credits: 3.00

EAPS 52500 - Boundary Layer Meteorology

Credit Hours: 3.00. (AGRY 53500) A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

EAPS 53300 - Atmospheric Physics II

Credit Hours: 3.00. A continuation of EAPS 53200 , covering the following selected advanced topics in atmospheric physics: gaseous absorption, Mie scattering, the equation of transfer,

and radiative transfer in cloudy and hazy atmospheres. The application of radiative transfer in active and passive remote sensing. Advanced topics in atmospheric thermodynamics, such as heterogeneous systems, kinetic theory of gases, and planetary atmospheres. Basic ozone photochemistry applied to stratospheric and tropospheric pollution.

Credits: 3.00

EAPS 53400 - Tropical Meteorology

Credit Hours: 3.00. This course tackles the observed structure of the Earth's tropical atmosphere and the core theories that explain this structure and its variability. Topics include the 3D annual and seasonal mean state, the energy budget, the Hadley cell, monsoons, the Walker cell, equatorial waves, ENSO, convective aggregation, easterly waves, and tropical cyclones.

Learning Outcomes: 1. Visualize and identify the most important features of the tropical atmosphere and describe them in terms that can be understood by a non-expert. 2. Explain how the Sun shining on a rotating rock with an overlying water ocean provides the necessary ingredients for the many different forms of variability in the tropical atmosphere. 3. Develop testable hypotheses about any aspect of the tropical atmosphere of interest. 4. Perform experiments using simple physical computational models to test hypotheses. 5. Use real-world historical data (e.g., reanalysis) to test hypotheses. Credits: 3.00

EAPS 53600 - Introduction To General Circulation

Credit Hours: 3.00. This course provides an overview of the general circulation of the atmosphere and oceans. Topics include: global energy balance, hydrological cycle, atmospheric general circulation and climate, ocean general circulation and climate, history and evolution of Earth's climate, climate sensitivity and feedback mechanisms, global climate models, natural climate change and anthropogenic climate change.

Learning Outcomes: 1. Understand the energy balance of the Earth and the atmosphere. 2. Grasp the general circulation of the atmosphere and ocean and their energy. 3. Gain a scientific understanding of the climate's natural variability and human-induced change. 4. Learn about global climate models. Credits: 3.00

EAPS 59100 - Advanced Topics In Earth And Atmospheric Sciences

Credit Hours: 0.00 to 18.00. Specialized study offered on an individual basis or through specially arranged courses. Permission of instructor required.

Credits: 0.00 to 18.00

EAPS 53900 - Mesoscale Meteorology

Credit Hours: 3.00. Review of the theories applied in mesoscale meteorology, including semi-geostrophic systems and frontogenesis, symmetric instability, rainbands and inertia-gravity waves, sea-breeze, terrain effects, mountain waves, lee-vortices and cyclogenesis, convection, convective instability, low-level jets, drylines, and squall lines. Prior course work in synoptic labs and vector calculus is required.

Credits: 3.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source

computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 51000 - Climate Time Series Analysis

Credit Hours: 3.00. This course in time series analysis combines traditionally taught basics with topics of central importance in current weather and climate research, including long memory, extremes, nonlinear time series, chaos and complexity.

Learning Outcomes: 1. Understand concepts and methods of classical time series analysis. 2. Get hands on experience in resampling methods for time series analysis, which work for complex data sets without having to rely on strong assumptions common in classical time series analysis but rarely met in geosciences. 3. Learn how to match a time series methods to a particular geosciences data set or question. 4. Develop skills in writing programs in R to analyze geosciences data and interpret results. 5. Learn basics of advanced topics instrumental in geosciences: long memory, extremes, nonlinear time series, chaos and complexity. 6. Improve their critical thinking and oral communication skills via giving presentations on their research projects involving topics covered in the course. Credits: 3.00

EAPS 53000 - Extreme Weather And Climate: Science And Risk

Credit Hours: 3.00. This project-oriented course introduces students to the real-world analysis of weather and climate risk, including under climate change. Course will provide a risk-relevant introduction to different types of impactful weather (e.g., hurricanes, drought) and how the climate system can cause them to vary on monthly (e.g., Madden-Julian Oscillation), seasonal (e.g., El Nino and La Nina), and longer timescales (e.g., climate change). The course will further connect this intrinsic uncertainty in weather outcomes to uncertainties in real-world applications (e.g., crop yields) across a variety of economic sectors - "risk". Students will be introduced to basic methods in probability and statistics for analyzing data required to help someone make real-world decisions that depend on weather/climate. The principal course outcome is a semester-long "start-to-finish" project where students define a hypothetical real-world decision that is weather-dependent, find and analyze data to guide that decision-maker, write a concise report on their findings, and concisely present their results orally to the class.

Learning Outcomes: 1. Explain the meaning of "risk" in weather/climate and impacts. 2. Describe the basics of various types of impactful weather. 3. Describe how modes of climate variability cause weather to vary on monthly, seasonal, and longer time scales. 4. Explain how weather and climate variability translates to risk in a wide range of applications and economic sectors. 5. Analyze weather/climate data to find real-world solutions to weather risk problems. 6. Gain experience working as a hypothetical weather/climate science consultant in a team setting. 7. Summarize research in a succinct and compelling technical report. 8. Summarize research in a succinct and compelling oral presentation. 9. Use data to help someone find a solution to a real-world problem that depends on the weather/climate. Credits: 3.00

EAPS 36700 - Survey Of Planetary Atmospheres

Credit Hours: 3.00. This course is intended to serve as an introduction to the diversity of planetary atmospheres in our solar system and beyond for those without an atmospheric science background. Topics to be covered in this class include: The basic structure and properties of an atmosphere, how planetary atmospheres form / are eroded, the balance of radiation and its effect on atmospheric motions, the presence and formation of hazes, clouds, and aerosols, fundamental atmospheric compositions and chemistry, the connections between planetary interiors, surfaces, and atmospheres, and how we measure and interpret observations of exoplanet atmospheres. To achieve this, we will learn about Earth's atmosphere and us our terrestrial template to compare, contrast, and explore the atmospheres of other astronomical bodies.

Learning Outcomes: 1. Gain familiarity with the different types of planetary bodies and the atmospheres that are present on them. 2.

Recall the main properties of planetary atmospheres in our solar system. 3. Identify and apply the general properties of the atmospheres. 4. Understand the effect of radiation and distribution of energy in an atmosphere. 5. Recognize the importance of chemical reactions and pathways. 6. Identify the ways in which atmospheres are formed, lost, and evolved. 7. Make simple predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. Credits: 3.00

Notes

Behavioral Economics Minor

About the Minor

Requirements for the Minor (15 credits)

Required Courses (9 credits)

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

Additional Courses (6 credits)

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 37200 - Experimental Economics

Credit Hours: 3.00. This course will explore how experiments are used in economics to test economic theory, understand behavior, and evaluate new policies. Focusing on recent research, we read research papers on a variety of policy topics including labor market discrimination, payday lending, organ transplantation, media censorship, and voting. Applying the concepts from class, students will identify their own original research questions and design new experiments.

Learning Outcomes: 1. Understand why experiments are the gold standard for causal inference. 2. Identify the key elements of any economic experiment and evaluate design choices. 3. Generate original research questions that can be answered with an experiment. 4. Design novel experiments to test hypotheses. Credits: 3.00

Grade Requirements and Pass/No Pass Policy

Transfer Credit Policy

Additional Information

Biochemistry Minor

Requirements for the Minor (18-19 credits)

Required Courses (11-12 credits)

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2.

Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

PHSC 20500 - Organic Chemistry II

Credit Hours: 3.00. PHSC 20500 is a continuation of PHSC 20400. You will learn the principles of organic chemistry with an emphasis on reactions of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action. You will continue to apply the fundamentals learned in general chemistry to the functional classes of compounds that are most important in pharmaceutical and biological chemistry.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and

materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

Selective Courses (7 credits)

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

Notes

Bioinformatics Minor

About the Minor

Requirements for the Minor (15-16 credits)

Required Courses (12-13 credits)

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the

fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

Bioinformatics Elective - Choose One: (2-3 credits)

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design,

collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CS 47800 - Introduction To Bioinformatics

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CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure

models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

Notes

Biological Sciences Minor

Requirements for Minor (12-16 credits)

Part I (8 credits)

Cell Biology

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic

acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

Genetics and Molecular Biology

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

Ecology and Evolution

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate

scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

Part II (2-4 credits)

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole (ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the

underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the most current literature.

Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science

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BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as

genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration

or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies

from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home

source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

Part III Laboratory (2-4 credits)

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of

concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 29400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by freshman and sophomores. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

Notes

Biotechnology Minor

About the Minor

Requirements for the Minor (16 credits)

Required Courses (4 credits)

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting pertinent information from scientific journal articles. Credits: 2.00

ABE 32700 - Biotechnology Laboratory II

Credit Hours: 2.00. The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (http://www.hhmi.org/grants/sea/) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (www.phagesdb.org and the Purdue institution page can be found here: https://phagesdb.org/institutions/PURD/).

Learning Outcomes: 1. Analyze the genetic code of a unique phage in order to determine potential genes. 2. Discover the genomic organization of their unique phage. 3. Use algorithms to define potential genes, assign putative functions to them, and determine the order in which they appear in the genome. 4. Read and discuss scientific literature related to their research project. 5. Share the information gathered with others in the scientific community.
Credits: 2.00

Biochemistry Selective (3 credits)

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.
Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.
Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.
Credits: 3.00

PHSC 20800 - Biochemistry For Pharmaceutical Sciences

Credit Hours: 3.00. The overall objectives of this course are to increase students' biomedical understanding and knowledge and their ability to apply that understanding and knowledge. This requires the students in this course to learn and understand the facts, concepts, and formulaic processes, and to become skilled at applying what they have learned.
Learning Outcomes: 1. The student must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries: a. Basic principles of thermodynamics and kinetics and their role in defining chemical processes. b. The relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics.
Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.
Learning Outcomes: 1. Demonstrate the ability

to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

Biotechnology Selective (3 credits)

IMPH 56200 - Introduction To Pharmaceutical Manufacturing Processes

Credit Hours: 4.00. A course intended to provide the student with basic understanding of both the theoretical and practical aspects of pharmaceutical manufacturing by combining a thorough classroom treatment of the underlying principles of each pharmaceutical unit operation with hands-on execution of these activities in the laboratory. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to effectively communicate their field of study. 2. Demonstrate ability to conduct research in an ethical and responsible manner. 3. Demonstrate ability to think critically, creatively, and solve problems in their field of study. 4. Demonstrate ability to identify and conduct original research, scholarship, and creative endeavors. Credits: 4.00

PHSC 46100 - Drug Discovery And Development II

Credit Hours: 3.00. The course focuses on the process of drug development from pre-formulation to unit operations. The

emphasis is on the scientific principles behind every step in moving from a drug molecule to its products.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the following theoretical foundations and apply these to basic anatomy/physiology, delivery of drugs from various dosage forms, relationship between chemical structure and dosage form selection, influences of pharmacokentics on formulation and dosage form design, unit operations of drug manufacturing. 2. Demonstrate comprehension of major scientific discoveries and methods. 3. Be able to use mathematical variables to analyze physical and pharmacokentic properties of a drug compound. 4. Meld theory and abilities in a practical setting to identify and provide solutions of related problems. 5. Examine issues rationally logically, and coherently. 6. Be able to read, write, speak, listen, use data, media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 7. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances, in particular, working together in their term-projects. Credits: 3.00

ABE 58000 - Advanced Processes In Biological Engineering

Credit Hours: 3.00. Physical and chemical structure of biomass. Reaction kinetics of hydrolysis of hemicellulose and cellulose to fermentable sugars. Fundamentals of ethanol production by fermentation. Separation of fermentation products into pure components.

Learning Outcomes: 1. Analyze bioprocesses using engineering design principles, bioreactor simulations, application of basic separations methods, and applying engineering economic analysis. 2. Develop process models for batch and continuous fermentation, cell culture, and enzymatic bioreactors. 3. Analyze the impact of fundamental advances in bio-sciences on bioprocess engineering and the environment, and the potential of these advances to solve societal problems. 4. Understand the impact of biosafety and regulatory considerations on process design. Credits: 3.00

CHE 52500 - Biochemical Engineering

Credit Hours: 3.00. Enzyme kinetics, mathematical models of microbial growth, bioreactor design and operation, genetic and metabolic engineering, plant and animal cell culture, and purification of biological products.

Credits: 3.00

CHE 55100 - Principles Of Pharmaceutical Engineering

Credit Hours: 3.00. This course is designed to provide engineering, science and pharmacy students with an understanding of the structure, economic and regulatory context, product discovery and development pipeline dynamics, intellectual property considerations and common manufacturing technology of the global pharmaceutical industry.

Learning Outcomes: 1. Develop a "big picture" view of the Pharmaceutical Industry: its structure and key players; economic and regulatory context; international trends and markets; product pipeline dynamics; current manufacturing technology, strengths and limitations. 2. Develop a working vocabulary of domain concepts. 3. Develop an appreciation of technical challenges and opportunities over the life cycle of a pharmaceutical product. 4. Develop an appreciation of the important role of intellectual property law and the strategies used in maintaining and challenging product patents. 5. Enhance skills in critical review of topics involving the interplay of technology and economics and in succinctly reporting the most important conclusions in written and oral form. 6. Acquire the technical and economic context for more detailed follow-up courses in ChE, ME and IPPH. Credits: 3.00

CHE 55300 - Pharmaceutical Process, Development And Design

Credit Hours: 3.00. This course introduces the engineering methodologies involved in translating a laboratory recipe for a drug compound produced via synthetic organic chemistry methods to an industrial process. The basic features of common

unit operations used in the pharmaceutical industry will be reviewed, including batch reaction, solid-liquid separation, crystallization, drying, mixing, batch distillation and other separation systems. Both dedicated and multi-product production system design and batch and semi-continuous operating modes will be covered.

Learning Outcomes: 1. Develop knowledge and skills in the thermodynamic, reaction and transport phenomena arising in the typical batch unit operations used in the pharma and specialty chemicals industries, including batch reaction, crystallization, solid-liquid separation, mixing, distillation, drying and liquid-liquid extraction. 2. Develop knowledge and skills in the use experimental data and relevant models to design and predict the performance of these units. 3. Develop knowledge and skills in the use of engineering software to conduct studies of these operations and interpret and critically assess the results such software produces. 4. Understand different modes of operation for batch processes and their scheduling. 5. Understand aspects of the design of batch process in which the set of batch operations are integrated. 6. Develop knowledge and skills in the use of planning/scheduling software to conduct design and operational studies of integrated process. 7. Enhance skills in succinctly reporting the most important conclusions of team projects in written and oral form. Credits: 3.00

BME 56100 - Preclinical And Clinical Study Design

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly regulated environment. This course concerns the preclinical and clinical study design processes for obtaining FDA marketing approval for biomedical devices. Prior to marketing a medical device in the US, specific governmental approval is required dependent on the type of device and the risk associated. This course is part of a three-course series dealing with various aspect of regulatory science. Regulatory science considers the scientific and technical foundations that support the practical testing and regulations that ensure the safety and effectiveness of medical devices. This course covers the responsible conduct of clinical and preclinical research, including evaluation of device tissue interactions and how they may be studied with preclinical animal models to predict safety and performance in human clinical trials that are necessary to gain regulatory approval for marketing. In the section on ethics we will cover several topics related to responsible conduct of clinical and preclinical research, including informed consent, risk assessment and ethical decisions, IRB oversight and ethical study design.

Learning Outcomes: 1. Understand and apply the various considerations and perspectives in designing and implementing a preclinical and clinical study strategy that will successfully lead to the marketing approval by a regulatory authority (e.g. FDA). 2. Follow a structured, iterative decision-making process for moral reasoning to reach a supported-conclusion regarding ethical dilemmas in engineering design and testing. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

Microbiology Lab Selectives (4 credits)

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard

Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 36300 - Food Microbiology Laboratory

Credit Hours: 2.00. Classic and molecular methods for enumerating, isolating, and identifying spoilage, fermentative, and pathogenic food microorganisms in food systems.

Learning Outcomes: 1. Perform proper aseptic technique. 2. Sample foods for microbial analyses. 3. Test food products for common microorganism. 4. Interpret data obtained from microbiological analysis. 4. Understand basic molecular techniques used to identify foodborne pathogens. Credits: 2.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology

techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

Statistics Selective (3 credits)

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables,

and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval

estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

Notes

Business Economics Minor

Requirements for the Minor (15 credits)

Required Courses (9 credits)

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy

functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

Selective - Choose One (3 credits)

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial

news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

Economics Elective- Choose One (3 credits)

ECON 49900 - Economics Capstone Research

Credit Hours: 3.00. The course combines experiential learning with a hands-on research project that unfolds over the course of a semester, serving as a culminating experience at the end of their degree program. The overarching objective of the capstone project is for students to understand how business problems can be addressed with empirical methods. This course is designed to help students develop a more comprehensive and integrative understanding of the major, apply their knowledge to develop and execute a methodologically rigorous research a project, and demonstrate their mastery of critical thinking and research skills they have acquired throughout their time in the major. In addition to a paper, completion of the research project may involve the presentation of the findings in a seminar or workshop setting.

Learning Outcomes: 1. Complete a high quality research paper that applies Economic analysis to a topic of particular interest to the student. 2. Develop a deep understanding of the roles that Economic theory and/or empirical analysis (Econometrics) play in creating high-quality economic analysis. 3. Identify the economics literature (journals, books, monographs, etc.) that relates to the research topic considered. Credits: 3.00

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom

laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 46600 - International Economics

Credit Hours: 3.00. Analyzes topics in international economics, using more advantage techniques and more detailed treatment than in ECON 37000 or 37100. While coverage varies somewhat with instructor, some topics could include: economic growth, innovation and technology transfer, and the role of multinational corporations.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade and finances. 2. Understand the perspective provided by economic analysis regarding the interaction between economic growth and international trade. 3. Identify insights economics analysis provides concerning the benefits and costs of technology transfer and the role of multinational corporations. Credits: 3.00

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 39000 - Junior Level Problems In Economics

Credit Hours: 1.00 to 4.00. Investigation into a specific topic area of economics. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 38500 - Labor Economics

Credit Hours: 3.00. The purpose of this course is to introduce important topics, theories, institutions, and policy issues relating to the functioning of labor markets. Topics to be considered include labor supply decisions, investments in human capital, compensating wage differentials, labor contract theory, unions, compensation programs, signaling in labor markets, the economics of unemployment, and government employment, retirement, and workplace safety.

Learning Outcomes: 1. Distinguish the major determinants of labor market participation and hours worked. 2. Analyze how welfare programs and business cycles affect labor supply. 3. Derive the short and long term demand for labor. 4. Construct a detailed demand and supply model of the labor market. 5. Find the equilibrium labor market outcomes in the

context of the neoclassical model 6. Analyze the role played by jobs' and workers' characteristics in generating wage differentials. 7. Develop a schooling model that explains human capital investment. 8. Distinguish factors that affect earnings inequality and labor market discrimination. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

ECON 36500 - History Of Economic Thought

Credit Hours: 3.00. The course traces the development of theories of value and economic growth from the seventeenth century to Karl Marx. Among the authors studied are the mercantilists, Hume, Smith, Ricardo, and Marx. Excerpts from the original works are read and evaluated in light of modern theory.

Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including

models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

ECON 36700 - Law And Economics

Credit Hours: 3.00. It has become increasingly clear to economists, legal scholars and political scientists that it is impossible to understand economic institutions without first having an understanding of the legal framework within which they operate. Similarly, it is impossible to understand the impact of law on society without first having an understanding of economic principles. This problem is further complicated by the fact that there are often ambiguities in the written law that lead to significant differences between what the law appears to say and how the law is interpreted in the courts. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions.

Learning Outcomes: 1. Understand better the relationship of Law and Economics, two different disciplines that both directly impact the business climate. 2. Learn how the concepts taught in this class apply in a real world setting. Credits: 3.00

ECON 32500 - Economics Of Sports

Credit Hours: 3.00. This class applies economic principles to the professional sports entertainment industry and its derivative input markets. The class begins by examining the microeconomics of demand for (by fans) and supply of (by teams) sports entertainment. The labor markets for the primary input, athletic talent, receive significant attention. Coordination among economic agents, taking the forms of leagues, players' unions, and government, is considered at the end of the class, with an emphasis on how they affect the efficiency of the markets related to sports entertainment. Quantitative empirical analysis is emphasized throughout the class. This is not a sports trivia or fantasy sports strategy class.

Learning Outcomes: 1. Solve models of how fans, teams, and players behave. 2. Describe and evaluate the structures of the markets for sports outputs and inputs, e.g., players. 3. Explain information presented in quantitative forms, e.g., equations, graphs, tables. 4. Analyze the effects of leagues' or governmental polices on market efficiency. 5. Communicate conclusions about sports output and input markets in numerical, graphical, tabular, and written forms. Credits: 3.00

ECON 36200 - Health Economics

Credit Hours: 3.00. This course is designed to introduce upper level undergraduate students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues using tools from intermediate microeconomic theory. The course begins with an analysis of health care as a commodity and why health is different from other consumer goods. The course then examines the demand

for and the production of health and health care, and the behavior and organization of health care providers. The discussion then switches to information asymmetries and the functioning of health insurance markets. Afterwards, the course turns to the analysis of government involvement in the health care system. The class concludes with an examination of medical care systems around the world, paying particular attention to the U.S. health care system.

Learning Outcomes: 1. Describe the main economic theories relating to health and health care markets. 2. Apply economic theory to the analysis of health care policy and institutions. 3. Construct a detailed demand and supply model of the health insurance market. 4. Critically evaluate key policy issues in health and health care from an economic perspective. Credits: 3.00

ECON 37600 - Economics Of The European Union

Credit Hours: 3.00. Current economic structure of the European Union, and the economic challenges it is now facing.

Learning Outcomes: 1. Understand the background and current economic structure of the European Union, as well as the economic challenges it is now facing. Credits: 3.00

ECON 48500 - Economics Of Racial And Gender Discrimination

Credit Hours: 3.00. This course focuses on quantifying the extent of, and determining the underlying causes of racial and gender disparities in the labor market. Topics include the impact of prejudice on labor market outcomes, statistical discrimination, early childhood factors and differences in environment, and fertility and reproductive technology.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize the differences and importance of disparities that control and do not control for observable factors. 3. Understand the difference between prejudice and discrimination, and the extent to which prejudice can cause discrimination. 4. Assess how discrimination can occur even in the absence of prejudice. 5. Evaluate the impact of policies designed to reduce disparities, such as affirmative action. Credits: 3.00

Notes

Business French Minor

Requirements for the Minor (15 credits)

A. French Language Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

B. Business French Courses - Choose Three (9 credits)

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 22400 - Professional French I

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills will be developed toward use of French for business purposes. Course materials cover daily business dealings as well as national and international trade.

Learning Outcomes: 1. Discuss the main aspects of the French professional world (hierarchy, professional versus personal relationships, etc.). 2. Accomplish simple administrative tasks in French such as give/answer a phone call, make an appointment. 3. Behave appropriately in a French professional context. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

FR 32300 - French For Engineering

Credit Hours: 3.00. This course is an intermediate/advanced French course emphasizing vocabulary and structures necessary for communication within the context of the working world. In this course, students will further develop their speaking, listening, reading, and writing abilities through the study of specialized vocabulary from the engineering and technology sciences. Conducted in French.

Learning Outcomes: 1. Understand, explain, and apply a broad range of vocabulary related to engineering and technology. 2. Read, understand, and analyze specific engineering and technical topics in French. 3. Describe particular engineering problems in simple terms. Credits: 3.00

A. French Language Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening,

reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. French Language Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

B. Business French Courses - Choose Three (9 credits)

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 22400 - Professional French I

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills will be developed toward use of French for business purposes. Course materials cover daily business dealings as well as national and international trade.

Learning Outcomes: 1. Discuss the main aspects of the French professional world (hierarchy, professional versus personal relationships, etc.). 2. Accomplish simple administrative tasks in French such as give/answer a phone call, make an appointment. 3. Behave appropriately in a French professional context. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the

role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

FR 32300 - French For Engineering

Credit Hours: 3.00. This course is an intermediate/advanced French course emphasizing vocabulary and structures necessary for communication within the context of the working world. In this course, students will further develop their speaking, listening, reading, and writing abilities through the study of specialized vocabulary from the engineering and technology sciences. Conducted in French.

Learning Outcomes: 1. Understand, explain, and apply a broad range of vocabulary related to engineering and technology. 2. Read, understand, and analyze specific engineering and technical topics in French. 3. Describe particular engineering problems in simple terms. Credits: 3.00

A. French Language Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Chemistry Minor

Requirements for the Minor (16 credits)

Area 1 Organic Chemistry (maximum 10 credits)

Part I

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the

logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

PHSC 20400 - Organic Chemistry I

Credit Hours: 3.00. A study of the compounds of carbon on a functional group basis, with particular emphasis on those organic compounds of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

Part II

PHSC 20500 - Organic Chemistry II

Credit Hours: 3.00. PHSC 20500 is a continuation of PHSC 20400. You will learn the principles of organic chemistry with an emphasis on reactions of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action. You will continue to apply the fundamentals learned in general chemistry to the functional classes of compounds that are most important in pharmaceutical and biological chemistry.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

Part III

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

PHSC 20401 - Organic Chemistry I Laboratory

Credit Hours: 1.00. Laboratory experiments to accompany PHSC 20400 performing laboratory experiments involving the methods of purification, reactions, and synthesis of organic compounds.

Learning Outcomes: 1. Perform lab exercises that demonstrate some of the principles studied in PHSC 20400 Organic Lecture. 2. Complete "dry lab" and "wet chemistry" experiments that

directly relate to the contents that are covered in PHSC 20400 lecture. 3. Work together in groups to gather and analyze data in several lab exercises. Credits: 1.00

Part IV

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

PHSC 20501 - Organic Chemistry II Lab

Credit Hours: 1.00. This course has been designed to help you apply the concepts of organic chemistry and to enhance your understanding of the subject. This lab is an extension of the

PHSC 20401 laboratory, and you will continue to use the concepts and techniques that you learned in organic chemistry I.

Learning Outcomes: 1. Perform lab exercises demonstrating some of the principles studied in lecture. 2. Complete "wet chemistry" experiments directly related to the reactions that are covered in lecture. 3. Learn about and engage in several analytical and purification techniques like thin-layer chromatography and column chromatography. Credits: 1.00

Area 2 Additional Selectives

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 37000 - Topics In Physical Chemistry

Credit Hours: 3.00. Kinetic theory of gases; statistical thermodynamics; quantum mechanics; atomic and molecular structure and spectroscopy; properties of ionic phases. May not be used to satisfy requirements for graduation in chemistry.

Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials

chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

CHM 48100 - Environmental Chemistry

Credit Hours: 3.00. Survey of chemical aspects of environmental problems and the application of chemistry to their solution. Topics will include atmospheric pollution problems, groundwater pollution and waste disposal problems, inorganic water pollutants, and the occurrence and fate of toxic organic compounds and other substances in the environment.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to understand the connections of different courses/subdisciplines in chemistry. 4. Able to understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

CHM 51300 - Chemical Literature

Credit Hours: 1.00. Types of information in technical publications; exercises in finding, assembling, and using such data.

Credits: 1.00

CHM 56000 - Organic Spectroscopic Analysis

Credit Hours: 3.00. Identification of organic compounds and characteristic groups by the use of mass spectrometry, infrared, nuclear magnetic resonance, and ultraviolet spectroscopy.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

CHM 58100 - Atmospheric Chemistry

Credit Hours: 3.00. (EAPS 52100) An introduction to the chemistry of the earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry

traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and

present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2. Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including

spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

Notes

Chinese Minor

Requirements for the Minor (15 credits)

A. Chinese Language (6 credits)

CHNS 30100 - Chinese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 30200 - Chinese Level VI (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources with stronger emphasis on authentic texts, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

B. Chinese Literature (3 credits)

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

C. Chinese Electives (6 credits)

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary

discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 40100 - Chinese Level VII (UCC: HUM)

Credit Hours: 3.00. Continued development of Mandarin Chinese speaking, listening, reading, and writing skills. Emphasis will be upon modern, everyday language and culture (with some introduction to traditional culture) using various sources such as textbooks, newspapers, and literary works.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 40200 - Chinese Level VIII (UCC: HUM)

Credit Hours: 3.00. Further development of Mandarin Chinese speaking, listening, reading, and writing skills. Materials will include advanced textbooks and original texts such as newspapers and literary works.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

Notes

Classical Studies Minor

Requirements for the Minor (15 credits)

A. Required Foundational Course (3 credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

B. Required Additional Courses (12 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological

changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 31200 - The Archaeology Of Ancient Egypt And The Near East

Credit Hours: 3.00. Selected topics on the archaeology of ancient Near Eastern cultures in Mesopotamia, the circum-Mediterranean area, Egypt, and the Nile Valley, emphasizing an anthropological interpretation of the political, social, religious, and economic systems that contributed to their development.

Learning Outcomes: 1. Summarize the rise and development of civilization in the Near East and North Africa from 10,000 years ago to 331 BC. 2. Distinguish the emergence and strategies of governance between these neighboring regions. 3. Recognize the historical and cultural context that gave rise to the Great Pyramids, cuneiform writing, and other significant achievements in the region. 4. Interpret the Near East and North Africa within Western historical narratives and popular imaginings. Credits: 3.00

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit

into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 22000 - Topics In Classical Literature

Credit Hours: 3.00. Selected topics in Greek and Roman literature. All readings in English translation.

Learning Outcomes: 1. Gain a detailed historical understanding of the development of a specific genre or topic within ancient Greek and Roman literature. 2. Ability to appreciate and intelligently discuss major themes in ancient Greek and Roman literature through close reading of representative texts. 3. Ability to identify specific examples of the influence of the ancient Greek and Roman literature on the literature of the later western world. Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CLCS 23300 - Comparative Mythology (UCC: HUM)

Credit Hours: 3.00. Comparative study of the myths of major ancient cultures, with emphasis on shared typological features.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of principal characters, narratives, and themes in the myths of a number of representative ancient world cultures (Mesopotamian, Egyptian, Celtic, Aztec, Mayan, East Asian, African); 2. Be able to appreciate the many functions of myths within ancient societies, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify recurrent patterns and themes in the myths of historically disparate ancient and modern cultures. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23600 - Ancient World Onscreen

Credit Hours: 3.00. How film represents ancient Mediterranean civilizations and retells ancient myths; how cinematic renderings of ancient history shape views of the past and how these are affected by contemporary sensibilities. No knowledge of Greek or Latin required.

Learning Outcomes: 1. Have a detailed historical grasp of the ways in which the ancient Greek and Roman worlds have found expression in modern cinema; 2. Be able to appreciate how ancient texts fare when translated into the radically different artistic medium of film; and 3. Be able to discuss intelligently what forces influence how we choose to see and represent the ancient western world. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the

influence of ancient Greek tragedy on the drama of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 33700 - The Ancient Epic

Credit Hours: 3.00. Study of the epic in four ancient cultures, with emphasis on its structure, nature, and social functions. Readings may include Gilgamesh, Iliad, Odyssey, Aeneid, Beowulf, Tain, Mahabharata, and others.

Learning Outcomes: 1. Gain an enhanced understanding of the nature and development of the genre of epic through close reading of representative samples of the genre from different ancient cultures. 2. Ability to appreciate and intelligently discuss major themes in epic as they relate to both ancient and modern views of the heroic. 3. Ability to identify specific examples of the influence of ancient epic on the literature of the later western world. Credits: 3.00

CLCS 38000 - Alexander The Great And Hellenistic World (UCC: HUM)

Credit Hours: 3.00. Course examines the career of Alexander the Great and the rise of Macedonia in the Hellenistic Era. Topics include the emergence of Macedonia under Philip II; the achievements of Alexander the Great; and the wars of succession following his demise.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice.
Credits: 3.00

CLCS 38600 - Ancient Greek Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Greece, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the ancient Greek world from the Mycenaean to the Hellenistic period. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and

methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 48000 - Potters And Society In Antiquity

Credit Hours: 3.00. Course covers the range of eastern Mediterranean ceramics encountered in Rough Cilicia Archaeological Survey Project from the Bronze Age to the Later Roman Empire. Course also explores strategies employed by archaeologists and historians to exploit ceramics as research materials.

Credits: 3.00

CLCS 48100 - Culture And Society In The Age Of Pericles

Credit Hours: 3.00. Course explores interrelationships between the emergence of Greek democracy and the cultural, political, social, and economic rise of Athens in the fifth century BCE. More broadly, course surveys history of the Greek world from the Late Bronze Age to 362 BCE.

Credits: 3.00

CLCS 48300 - Republican Rome

Credit Hours: 3.00. Course examines the military, political, economic, and social developments that enabled the Roman people to expand from an Italian city-state to a trans-Mediterranean empire, and the consequences that initiated the decline and transition in their republican form of government.

Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

GREK 10100 - Ancient Greek Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to the grammar of Attic Greek of the Classical period, and first forays into the reading of connected prose. Emphasis on accidence, syntax, and vocabulary building.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain foundational Ancient Greek grammar and demonstrate familiarity with core vocabulary. 2. Bring together their knowledge of Ancient Greek grammar and vocabulary, creating clear English translations by analyzing basic texts adapted from Ancient Greek literature. 3. Apply this knowledge of grammar and vocabulary to writing simple sentences in Ancient Greek, and translating from English to Ancient Greek. Credits: 3.00

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn basics of reading and translating ancient Greek, completing their introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 20100 - Ancient Greek Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in New Testament Greek, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn how to apply foundational knowledge of ancient Greek grammar and syntax to readings in the New Testament. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 34400 - Greek Epic

Credit Hours: 3.00. Readings and discussion of the Greek epic, including selected passages from Homer and Hesiod.

Credits: 3.00

GREK 35300 - Greek Tragedy

Credit Hours: 3.00. Reading and discussion of selected Greek tragedies of the 5th century BCE.

Credits: 3.00

GREK 35400 - Greek Comedy

Credit Hours: 3.00. Readings and discussion of selected Greek comedies of the 4th and 5th centuries BCE.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical historians in the original Greek.

Credits: 3.00

GREK 49000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

HEBR 28400 - Ancient Near Eastern History And Culture

Credit Hours: 3.00. This course is a survey of the development of the ancient Near East, from its pre-history to Alexander the Great. It emphasizes the evolutions of various Near Eastern cultures in their many manifestations; art, government, agriculture, economics, philosophy, religion, ethics, and science. Taught in English.

Learning Outcomes: 1. Understand the difference between pre-history and history. 2. Understand various ancient and modern ideas of the purpose of writing history. 3. Understand how the invention of writing and the origins of cities were coordinate developments. 4. Understand something of the flow of empires that succeeded each other, eventually displaced by the empire of Alexander the Great, whose conquests shaped the contours of the world

much as we know it. 5. Become aware how art reflects the development of thought and idealism; how ideas of human government evolved; how religion, science, agriculture, and much else developed as empires built onto those they displaced. Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and

culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts. Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 49000 - Directed Reading In Latin

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

GREK 59000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 4.00. Directed Reading In Classical Greek. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their

disciplines. Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.

Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

LATN 10500 - Accelerated Basic Latin

Credit Hours: 4.00. Foundational Latin grammar course designed to prepare students to read classical and post-classical Latin in a single intensive semester. Focus on grammar, syntax, vocabulary, and elementary readings. The accelerated Latin course assumes *no* previous knowledge of Latin and makes it possible for the diligent student to be able to read *any* Latin prose or poetry (with a dictionary) after a single semester. (Upon completion students will be prepared to enroll in Latin 201.)

Learning Outcomes: 1. Recite Latin texts aloud (with accurate pronunciation, meaningful phrase grouping, and appropriate voice inflection) by imitating models they have heard in class. 2. Analyze Latin texts by identifying and describing the basic elements of Latin grammar, sentence structure, and style. 3. Translate intermediate level un-adapted Latin texts into English. 4. Compose complex sentences while writing a short story in Latin. Credits: 4.00

GREK 10500 - Accelerated Introductory Ancient Greek

Credit Hours: 4.00. This course is an accelerated beginning-level course designed to develop language proficiency in Ancient Greek. The course will help students progress toward competence in reading and writing, as well as toward knowledge of Ancient Greek culture. The course focuses on developing deep understanding of Greek syntax and morphology and building strategies for fluent and accurate reading of ancient texts. Primary language of instruction is English.

Learning Outcomes: 1. Differentiate the syntactic structures used in Ancient Greek sentences and longer texts based on the study of model sentences. 2. Compose sentences in Ancient Greek by focusing on a set of grammatical rules and standards in the language. 3. Recite Ancient Greek aloud with accuracy and fluency and demonstrate their ability in in-class text readings and recordings. 4. Infer the meaning of unknown vocabulary in context by reading stories. 5. Identify and analyze grammatical forms in the Greek contexts in which they are used. 6. Generate smooth-flowing and elegant English translations of the Greek, attending to inherent differences in style and structure. Credits: 4.00

A. Required Foundational Course (3 credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical"

civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required Foundational Course (3 credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

B. Required Additional Courses (12 credits)

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human

past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 31200 - The Archaeology Of Ancient Egypt And The Near East

Credit Hours: 3.00. Selected topics on the archaeology of ancient Near Eastern cultures in Mesopotamia, the circum-Mediterranean area, Egypt, and the Nile Valley, emphasizing an anthropological interpretation of the political, social, religious, and economic systems that contributed to their development.

Learning Outcomes: 1. Summarize the rise and development of civilization in the Near East and North Africa from 10,000 years ago to 331 BC. 2. Distinguish the emergence and strategies of governance between these neighboring regions. 3. Recognize the historical and cultural context that gave rise to the Great Pyramids, cuneiform writing, and other significant achievements in the region. 4. Interpret the Near East and North Africa within Western historical narratives and popular imaginings. Credits: 3.00

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art

over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 22000 - Topics In Classical Literature

Credit Hours: 3.00. Selected topics in Greek and Roman literature. All readings in English translation.

Learning Outcomes: 1. Gain a detailed historical understanding of the development of a specific genre or topic within ancient Greek and Roman literature. 2. Ability to appreciate and intelligently discuss major themes in ancient Greek and Roman literature through close reading of representative texts. 3. Ability to identify specific examples of the influence of the ancient Greek and Roman literature on the literature of the later western world. Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CLCS 23300 - Comparative Mythology (UCC: HUM)

Credit Hours: 3.00. Comparative study of the myths of major ancient cultures, with emphasis on shared typological features.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of principal characters, narratives, and themes in the myths of a number of representative ancient world cultures (Mesopotamian, Egyptian, Celtic, Aztec, Mayan, East Asian, African); 2. Be able to appreciate the many functions of myths within ancient societies, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify recurrent patterns and themes in the myths of historically disparate ancient and modern cultures. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23600 - Ancient World Onscreen

Credit Hours: 3.00. How film represents ancient Mediterranean civilizations and retells ancient myths; how cinematic renderings of ancient history shape views of the past and how these are affected by contemporary sensibilities. No knowledge of Greek or Latin required.

Learning Outcomes: 1. Have a detailed historical grasp of the ways in which the ancient Greek and Roman worlds have found expression in modern cinema; 2. Be able to appreciate how ancient texts fare when translated into the radically different artistic medium of film; and 3. Be able to discuss intelligently what forces influence how we choose to see and represent the ancient western world. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the influence of ancient Greek tragedy on the

drama of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 33700 - The Ancient Epic

Credit Hours: 3.00. Study of the epic in four ancient cultures, with emphasis on its structure, nature, and social functions. Readings may include Gilgamesh, Iliad, Odyssey, Aeneid, Beowulf, Tain, Mahabharata, and others.

Learning Outcomes: 1. Gain an enhanced understanding of the nature and development of the genre of epic through close reading of representative samples of the genre from different ancient cultures. 2. Ability to appreciate and intelligently discuss major themes in epic as they relate to both ancient and modern views of the heroic. 3. Ability to identify specific examples of the influence of ancient epic on the literature of the later western world. Credits: 3.00

CLCS 38000 - Alexander The Great And Hellenistic World (UCC: HUM)

Credit Hours: 3.00. Course examines the career of Alexander the Great and the rise of Macedonia in the Hellenistic Era. Topics include the emergence of Macedonia under Philip II; the achievements of Alexander the Great; and the wars of succession following his demise.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice.
Credits: 3.00

CLCS 38600 - Ancient Greek Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Greece, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the ancient Greek world from the Mycenaean to the Hellenistic period. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more

clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 48000 - Potters And Society In Antiquity

Credit Hours: 3.00. Course covers the range of eastern Mediterranean ceramics encountered in Rough Cilicia Archaeological Survey Project from the Bronze Age to the Later Roman Empire. Course also explores strategies employed by archaeologists and historians to exploit ceramics as research materials.

Credits: 3.00

CLCS 48100 - Culture And Society In The Age Of Pericles

Credit Hours: 3.00. Course explores interrelationships between the emergence of Greek democracy and the cultural, political, social, and economic rise of Athens in the fifth century BCE. More broadly, course surveys history of the Greek world from the Late Bronze Age to 362 BCE.

Credits: 3.00

CLCS 48300 - Republican Rome

Credit Hours: 3.00. Course examines the military, political, economic, and social developments that enabled the Roman people to expand from an Italian city-state to a trans-Mediterranean empire, and the consequences that initiated the decline and transition in their republican form of government.

Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

GREK 10100 - Ancient Greek Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to the grammar of Attic Greek of the Classical period, and first forays into the reading of connected prose. Emphasis on accidence, syntax, and vocabulary building.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain foundational Ancient Greek grammar and demonstrate familiarity with core vocabulary. 2. Bring together their knowledge of Ancient Greek grammar and vocabulary, creating clear English translations by analyzing basic texts adapted from Ancient Greek literature. 3. Apply this knowledge of grammar and vocabulary to writing simple sentences in Ancient Greek, and translating from English to Ancient Greek. Credits: 3.00

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn basics of reading

and translating ancient Greek, completing their introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 20100 - Ancient Greek Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in New Testament Greek, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn how to apply foundational knowledge of ancient Greek grammar and syntax to readings in the New Testament. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 34400 - Greek Epic

Credit Hours: 3.00. Readings and discussion of the Greek epic, including selected passages from Homer and Hesiod.

Credits: 3.00

GREK 35300 - Greek Tragedy

Credit Hours: 3.00. Reading and discussion of selected Greek tragedies of the 5th century BCE.

Credits: 3.00

GREK 35400 - Greek Comedy

Credit Hours: 3.00. Readings and discussion of selected Greek comedies of the 4th and 5th centuries BCE.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical historians in the original Greek.

Credits: 3.00

GREK 49000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

HEBR 28400 - Ancient Near Eastern History And Culture

Credit Hours: 3.00. This course is a survey of the development of the ancient Near East, from its pre-history to Alexander the Great. It emphasizes the evolutions of various Near Eastern cultures in their many manifestations; art, government, agriculture, economics, philosophy, religion, ethics, and science. Taught in English.

Learning Outcomes: 1. Understand the difference between pre-history and history. 2. Understand various ancient and modern ideas of the purpose of writing history. 3. Understand how the invention of writing and the origins of cities were coordinate developments. 4. Understand something of the flow of empires that succeeded each other, eventually displaced by the empire of Alexander the Great, whose conquests shaped the contours of the world much as we know it. 5. Become aware how art

reflects the development of thought and idealism; how ideas of human government evolved; how religion, science, agriculture, and much else developed as empires built onto those they displaced. Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary readings in classical Latin and the language of the Vulgate.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts. Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 49000 - Directed Reading In Latin

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

GREK 59000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 4.00. Directed Reading In Classical Greek. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their

disciplines. Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.

Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

LATN 10500 - Accelerated Basic Latin

Credit Hours: 4.00. Foundational Latin grammar course designed to prepare students to read classical and post-classical Latin in a single intensive semester. Focus on grammar, syntax, vocabulary, and elementary readings. The accelerated Latin course assumes *no* previous knowledge of Latin and makes it possible for the diligent student to be able to read *any* Latin prose or poetry (with a dictionary) after a single semester. (Upon completion students will be prepared to enroll in Latin 201.)

Learning Outcomes: 1. Recite Latin texts aloud (with accurate pronunciation, meaningful phrase grouping, and appropriate voice inflection) by imitating models they have heard in class. 2. Analyze Latin texts by identifying and describing the basic elements of Latin grammar, sentence structure, and style. 3. Translate intermediate level un-adapted Latin texts into English. 4. Compose complex sentences while writing a short story in Latin. Credits: 4.00

GREK 10500 - Accelerated Introductory Ancient Greek

Credit Hours: 4.00. This course is an accelerated beginning-level course designed to develop language proficiency in Ancient Greek. The course will help students progress toward competence in reading and writing, as well as toward knowledge of Ancient Greek culture. The course focuses on developing deep understanding of Greek syntax and morphology and building strategies for fluent and accurate reading of ancient texts. Primary language of instruction is English.

Learning Outcomes: 1. Differentiate the syntactic structures used in Ancient Greek sentences and longer texts based on the study of model sentences. 2. Compose sentences in Ancient Greek by focusing on a set of grammatical rules and standards in the language. 3. Recite Ancient Greek aloud with accuracy and fluency and demonstrate their ability in in-class text readings and recordings. 4. Infer the meaning of unknown vocabulary in context by reading stories. 5. Identify and analyze grammatical forms in the Greek contexts in which they are used. 6. Generate smooth-flowing and elegant English translations of the Greek, attending to inherent differences in style and structure. Credits: 4.00

A. Required Foundational Course (3 credits)

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical"

civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

Communication Minor

Requirements for the Minor (15 credits)

A. Required Course (3 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging

from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

B. Foundations in Communication (3 credits)

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

C. Communication Course - 20000 level or higher (3 credits)

D. Upper Level Communication Courses (6 credits)

A. Required Course (3 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required Course (3 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging

from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

B. Foundations in Communication (3 credits)

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

C. Communication Course - 20000 level or higher (3 credits)

D. Upper Level Communication Courses (6 credits)

A. Required Course (3 credits)

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

Computer and Information Technology Minor

Requirements for the Minor (15 credits)

Required Courses (15 credits)

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic

concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the

computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

Notes

Computer Science Minor

Requirements for the Minor (16-18 credits)

Required Courses (10 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

Elective Courses - Choose Two (6-8 credits)

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems,

generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

Notes

Construction Engineering Minor

Requirements for the Minor (15 credits)

Required Courses (6 credits)

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

CEM 29100 - Construction Internship II

Credit Hours: 0.00. Second of three internship periods and a continuation of that described. Typically, experience emphasizes the office-based activities of the sponsor.

Credits: 0.00

CEM 30100 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. This course continues an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed facilities. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Able to design a process to meet desired needs within realistic constraints. Credits: 3.00

Elective Courses (9 credits)

CEM 32400 - Human Resource Management In Construction

Credit Hours: 3.00. Introduce a broad set of fundamental topics regarding management of people in engineering and construction organizations in the U.S. Subjects include labor-management relations (laws, regulations and practices affecting construction workers and organizations); worker motivation, productivity, and training; roles and practices of managers; construction safety; management of quality.

Learning Outcomes: 1. Understand managerial aspects of the engineering and construction industry. 2. Know the background and the principal laws and practices concerning labor-management relations for the union and nonunion jobs. 3. Know current management practices involving worker supply and demand, workforce training, EEO and workforce diversity, professional ethics and construction safety. 4. Gain basic knowledge to help you become an

effective manager in engineering and construction organizations. 5. Enhance communication skills. Credits: 3.00

CEM 45500 - Temporary Structures In Construction

Credit Hours: 3.00. This course will cover the design and construction of various temporary structures and systems used in building and transportation construction. The course describes not only design issues of temporary structures such as formwork, falsework, bracing, earth retention systems, scaffolding, cofferdams, and so forth by providing lectures and design examples, but it also covers business aspects associated with the design and construction of temporary structures in the real world such as business practice, legal aspects, and design philosophy.

Learning Outcomes: 1. Develop an understanding of design and performance of various systems. 2. Develop an understanding of the importance and value of these systems and the responsibilities that will be carried into a professional career. Credits: 3.00

CEM 48500 - Legal Aspects Of Construction Engineering

Credit Hours: 3.00. This course will cover legal principles and landmark cases relevant to civil and construction engineering. Specific subjects covered include contracts, torts, agency, professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties and ethics.

Learning Outcomes: 1. Read, comprehend and interpret construction contract plans and specifications for lock and dam facilities and other inland navigation structures. Through detailed study of project plans and specs as well as construction photos, students will be taken through the process of building these facilities from planning through construction. 2. Understand how a lock and dam facility functions. 3. Identify various components of lock and dam structures. 4. Understand various types of marine equipment necessary to construct a navigation facility in the dry or wet. Credits: 3.00

CEM 49700 - Construction Engineering Projects

Credit Hours: 0.00 to 4.00. Topics vary. Permission of department required.

Credits: 0.00 to 4.00

Notes

Construction Graphics Minor

About the Minor

Requirements for the Minor (11-12 credits)

Required Courses (11-12 credits)

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-making throughout the project lifecycle. Credits: 3.00

CM 46000 - BIM IV: Model Creation & Management Utilizing Cloud

Credit Hours: 3.00. This course explores the impact of cloud-based technologies on managing construction projects with Building Information Modeling (BIM), emphasizing remote collaboration and real-time data access. Students will gain hands-on experience with industry-leading platforms like Autodesk Construction Cloud, learning to manage 3D discipline-specific models, coordinate teams, and oversee project workflows from any location. By integrating cloud-based management with BIM, the course prepares students to lead modern, digitally connected construction projects.

Learning Outcomes: 1. Manage construction projects using cloud-based BIM tools, enabling real-time collaboration, data sharing, and communication among group members as well as sponsors. 2. Coordinate multidisciplinary teams remotely, integrating project data from design to construction while ensuring seamless collaboration. 3. Master cloud-based technology to leverage data analytics that optimize construction workflows, which allow them to make informed decisions, and automate project processes for improved efficiency and reduced risk generating automated reports, and track key metrics such as timelines, budgets, and safety. 4. Apply best practices in data management within cloud-based BIM platforms, ensuring secure storage, version control, and efficient risk management through clash detection and issue resolution. Credits: 3.00

CM 46200 - Applications Of Construction Documentation II

Credit Hours: 3.00. Creating, archiving, integrating, qualifying and utilizing computer-generated, three-dimensional architectural models in a light commercial construction enterprise. Topics include components of MEP, fire protection, blueprint reading and 4D BIM scheduling. Credit cannot be obtained for both CM 36000 and CM 46200.

Learning Outcomes: 1. Learn, decipher, and apply parametric and geometric technologies to AEC problems. 2. Explain where new and emerging software technologies can be applied in the industry. 3. Program database-driven parametric objects for use in various projects. 4. Explain how parametric technologies can benefit the production homebuilder. 5. Develop leadership and life-long learning skills applicable to the construction industry. 6. Incorporate renderings and 3D models into drawing sets for effective communication. 7. Prepare effective marketing materials for residential and commercial industry. Credits: 3.00

Notes

Construction Management Minor

About the Minor

Requirements for the Minor (16 credits)

Required Courses (16 credits)

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

CM 15000 - Construction Management Fundamentals

Credit Hours: 6.00. This introductory course focuses on construction materials, methods, and contracts for basic commercial and residential projects. Students will develop essential skills in quantity estimating, construction plan reading, and project documentation. Students will participate in hands-on lab exercises that aim to connect theory with practice. The course includes OSHA 10-hour instruction, with students earning OSHA 10-hour certification cards upon completion, further emphasizing the importance of safety in construction practices.

Learning Outcomes: 1. Identify materials, means, and methods for a construction project throughout the entire project lifecycle. 2. Recognize project controls required during the pre-construction and construction phases of a construction project. 3. Explain project planning tasks relevant to a construction project. 4. Comprehend project administration on a construction project and the required documentation and technology available within the current construction industry. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

Notes

Creative Writing Minor

Requirements for the Minor (12 credits)

A. Introductory Course (3 credits)

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

B. Writing Courses (9 credits)

ENGL 31600 - Craft Of Fiction From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of fiction with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of fiction, statements of aesthetics and craft, and various fictional forms.

Learning Outcomes: 1. Analyze published fiction by applying terms of fiction craft. 2. Identify the effects of fiction forms by articulating their differences and/or similarities. 3. Analyze their own fiction by applying the terms of fiction craft. Credits: 3.00

ENGL 31700 - Craft Of Poetry From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of poetry with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of poetry, statements of aesthetics and craft, and various poetic forms.

Learning Outcomes: 1. Analyze published poetry by applying terms of poetry craft. 2. Identify the effects of poetry forms by articulating their differences and/or similarities. 3. Analyze their own poetry by applying the terms of poetic craft. Credits: 3.00

ENGL 40700 - Intermediate Poetry Writing

Credit Hours: 3.00. Study and practice of methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems by using effective imagery, line breaks, stanzas, compression, and linguistic playfulness; 2. Produce a portfolio of poems by revising according to suggestions received in workshop and in individual conferences with the instructor. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary poetry. Credits: 3.00

ENGL 40900 - Intermediate Fiction Writing

Credit Hours: 3.00. Study and practice of methods of composing fiction, with a primary emphasis on the student's own work. Workshop criticism and discussion of published fiction.

Learning Outcomes: 1. Write and revise fiction by using effective character development, plot and scene. 2. Produce a polished fiction by revising according to suggestions received in workshop. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary fiction. Credits: 3.00

ENGL 50700 - Advanced Poetry Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems, using all the skills from ENGL 40700 but at a more proficient level. 2. Produce a portfolio of poems revised according to suggestions received in workshop and in individual conferences with the instructor. 3. Acquire a broader knowledge of the context of contemporary poetry by reading and discussing several volumes by contemporary poets. Credits: 3.00

ENGL 50900 - Advanced Fiction Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing fiction, with the primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise fiction, using all the skills from English 40900 but at a more proficient level. 2. Produce polished fiction revised according to suggestions received in workshop and feedback from the instructor. 3. Acquire a broader knowledge of the context of contemporary fiction by reading and discussing work by several contemporary fiction writers. Credits: 3.00

ENGL 58900 - Directed Writing

Credit Hours: 1.00 to 3.00. Writing (creative, popularly technical, biographical, historical, philosophical) on subjects of the student's choice. Individual conferences only; no class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

Notes

Critical Disability Studies Minor

Requirements for the Minor (12 credits)

A. Required Course (3 credits)

CDIS 23900 - Introduction To Disability Studies

Credit Hours: 3.00. Introduces students to the principles of and debates within disability studies. Topics explored include ideas of normalcy; the social model of disability; history of eugenics and its current manifestations; relations between disability and other identity categories; issues of social and physical access; cultural representations of disabled people.

Learning Outcomes: 1. Identify different models of understanding disability. 2. Understand the ways normalcy is socially constructed. 3. Distinguish between impairment and disability. 4. Offer informed opinions on current eugenic practices. 5. Compare and contrast disability to other identity categories such as race, gender, and sexuality. 6. Identify exclusionary practices that marginalize disabled people. Credits: 3.00

B. Selectives (9 credits)

ASL 28000 - American Deaf Community: Language, Culture, And Society

Credit Hours: 3.00. The linguistic, cultural, and societal context of the deaf community in America. Both historical and contemporary aspects of deaf identity will be included, with an emphasis on the central role that ASL plays in the lives of deaf individuals.

Credits: 3.00

BME 49500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.

Credits: 1.00 to 6.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

ENGL 43900 - Topics In Disability Studies

Credit Hours: 3.00. Explores cultural, social, and political meanings and effects of disability in relation to literature and/or rhetoric. Specific topics will vary.

Learning Outcomes: 1. Discuss the strengths and weaknesses of different models for understanding disability. 2. Understand ways normalcy is socially constructed. 3. Identify cultural practices that exclude disabled people. 4. Compare and contrast disability with other identity categories such as race, gender, and sexuality. 5. Discuss ways in which culture defines disability as impairing one's subjectivity and even humanity. 6. Analyze literary representations of disabled characters. 7. Examine the role of disability in literary works more broadly. Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and

form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

CDIS 29000 - Special Topics In Critical Disability Studies

Credit Hours: 3.00. Various topics in critical disability studies, changing from semester to semester as presented by different instructors.

Learning Outcomes: 1. Vary due to variable nature of course. Credits: 3.00

Notes

Crop Science Minor

Requirements for the Minor (18 credits)

Required Courses (6 credits)

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific

method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

Selective Courses (12 credits)

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience

with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

AGRY 48000 - Plant Genetics

Credit Hours: 3.00. Principles and recent advances in plant genetics including: genetic segregation, linkage, DNA markers and applications, chromosomes and genomes, variation in chromosome number and structure, mutation, recombination and DNA repair, quantitatively inherited traits, introduction to principles of population genetics, gene expression, gene organization, regulation of gene activity, gene function, identifying important genes, cloning genes, reverse genetics, plant transformation, applications of genetic engineering, genome sequencing, using sequence data.

Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that

appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

AGRY 50500 - Forage Management

Credit Hours: 3.00. The study of the role of economically important crop species in the soil-plant-animal complex. Physiology, utilization, and management of forage species will be emphasized.

Credits: 3.00

AGRY 51500 - Plant Mineral Nutrition

Credit Hours: 3.00. Fundamental principles and concepts of the mineral nutrition of higher plants; processes and mechanisms controlling nutrient bioavailability and acquisition; physiological, genetic, and ecological aspects of plant nutrition including rhizosphere dynamics and interaction with disease.

Learning Outcomes: 1. Identify and describe

the essential mineral nutrients required for plant growth. 2. Recognize the symptoms of nutrient deficiencies and toxicities in plants and understand the underlying physiological and biochemical changes. 3. Understand the mechanisms of nutrient uptake from the soil by roots, the role of root hairs, mycorrhizal associations, and the transport of nutrients within the plant through xylem and phloem. 4. Comprehend the biochemical pathways and processes through which plants assimilate and utilize nutrients. 5. Explore the signaling mechanisms that regulate nutrient uptake and utilization, including sensing mechanisms, gene expression, and hormonal responses. Credits: 3.00

AGRY 52000 - Principles And Methods Of Plant Breeding

Credit Hours: 3.00. Introduction to methods and techniques of breeding field crops, with emphasis on the application of genetic principles; analysis of and present approach to the solution of specific breeding problems in selected field crops.

Credits: 3.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

AGRY 48500 - Precision Crop Management

Credit Hours: 3.00. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital georeferenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. May be used in combination with AGRY 49800 to meet the Agronomy undergraduate capstone requirement; will also meet the GIS/GPS requirement in Agronomy plans of study.

Learning Outcomes: 1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from Dupont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input levels. 2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions. 3. Utilize data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific basis. 4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management. 5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates. 6. Utilize geo-referenced field scouting data and crop models to prescribe effective pest management strategies. 7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources. 8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies. 9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors 10. Evaluate potential crop response to

varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions). 11. Describe and explain the impact of productivity influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management). 12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies. 13. Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management. Credits: 3.00

Notes

Dance Minor

Requirements for the Minor (18 credits)

A. Core Courses (4 credits)

DANC 24500 - Practicum In Dance Performance And Production

Credit Hours: 1.00 to 2.00. Open through audition. The study and practice of dance rehearsal, performance and basic concert production techniques, culminating in a main-stage dance concert. Permission of instructor required.

Learning Outcomes: 1. Demonstrate understanding of professional dance company member responsibilities and processes by learning choreography as assigned and performing at the highest standard. 2. Demonstrate personal artistry as a dancer and dependability as an ensemble member through rehearsals, technical preparations and performances. 3. Demonstrate interpersonal collaboration skills in creative process. Credits: 1.00 to 2.00

DANC 26000 - Dance Improvisation

Credit Hours: 3.00. In this course students explore a variety of techniques for creating movement. While physically researching concepts from a broad spectrum of improvisational artists, students expand their boundaries and definitions of dance, art and creativity. Important concepts include choice making, moving from internal motivations, and ensemble collaboration. All backgrounds in dance and movement are welcome, and will benefit from this course.

Learning Outcomes: 1. Demonstrate multiple approaches to create unique dance movement spontaneously. 2. Formulate and participate in improvised solo and group dance performances. 3. Generate qualities of movement and elements of dance composition through improvisation. 4. Evaluate the many critical roles of improvisation in the art of dance. Credits: 3.00

DANC 26100 - Contact Improvisation

Credit Hours: 3.00. This course is both a physical practice and philosophical exploration of the techniques and underlying premise of this contemporary partner dance form. CI training involves a practice of movement improvisation while developing the body's ability to attend to the effects of gravity, muscle tone, and anatomical structures on dancing solo and in partnership. While increasing their body awareness, respect, sensitivity and connection, students learn about collaborative community creativity, which can be applied in other settings including design, performance, and social activism. DANC 26000 is a good preparation for this course, but not required. Course may be repeated for credit.

Learning Outcomes: 1. Demonstrate basic skills of solo movement in group dance setting. 2. Demonstrate basic skills of partnering using weight sharing and touch. 3. Model nonverbal communication with a partner. 4. Improve awareness and perception of the body. Credits: 3.00

B. Dance History (3 credits)

DANC 37800 - Survey Of Concert Dance History (UCC: HUM)

Credit Hours: 3.00. This course is a broad survey of concert dance history predominately in the 20th and 21st century in

Western cultures. The direct relationship and influence of the culture, training, choreographic, and performative records of dance practices, to socio-political ideologies of gender, race, sexuality, and national identities will be the area of investigation. Students will read, watch, research and actively participate in discussion regarding important dance figures, movements, eras, and their social and cultural reverberations. Dance's relationship to other art practices throughout history will also be a subject of lecture and discussion.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate understanding of the foundational underpinnings of concert dance history. 2. Identify specific choreographers and their works of art in oral and written communication. 3. Recognize concert dance contexts in order to speak and write clearly about them. 4. Demonstrate an awareness of the relationships and interactions between dance and culture. Credits: 3.00

DANC 37900 - The Art Of Protest: An Examination Of The Role Of Arts, Artists, Activism, & Social Transformation

Credit Hours: 3.00. Throughout history, art has been used to advocate for political movements and provoke social action and transformation. This course examines the role of the arts and the artist and their relationship to activism throughout history and beyond. We will investigate how art has been used as a tool to transform cultural perspectives, alter policies, and promote social change. We will explore a range of artists whose methodologies, materials and approach challenge the cultural norms. From printmakers to musicians, to choreographers, to performance artists, students will engage and evaluate the act of art-making as a tactic of resistance and the responses to those acts. We will investigate readings that argue for and against the need for artists to make work that politically challenge their society. Once a foundation of knowledge has been laid, we will turn to the creative process through an investigation of materials and practices - performance, mixed media, and photography. Students will research, watch, discuss, create, and perform their own projects that promote social transformation.

Learning Outcomes: 1. Demonstrate effective oral and written communication in formal assignments, critical analysis, and class presentations. 2. Demonstrate through creative projects how art, culture, and activism have a direct and interactive relationship. 3. Investigate and critically engage with artists whose work transform cultural perspectives, alter policies, provide socio-political commentary, and promote social change. 4. Analyze seminal art and historical and philosophical texts that articulate the role and importance of political art. Credits: 3.00

C. Choreography (3 credits)

DANC 34500 - Choreography

Credit Hours: 3.00. This course focuses on methods and practices of choreographing contemporary dance works. It teaches the choreographic process: how to create original movement and expand and build both solo and group dance works. Basic compositional elements of exploring and manipulating movement and structuring choreographed material are utilized. The development of production elements are taught to support choreographic intent. Highly recommended before enrolling in this course: DANC 24500 and DANC 30100.

Learning Outcomes: 1. Identify and apply choreographic tools to create a coherent dance composition. 2. Analyze dance composition and understand its value and meaning as both a creator and observer. 3. Express individual artistry through dance composition. Credits: 3.00

DANC 34600 - Intermediate Choreography

Credit Hours: 1.00 or 2.00. A study of selected principles underlying the design of group performance in modern dance. Permission of instructor required.

Learning Outcomes: 1. Analyze and research methods for constructing and choreographing a group dance work. 2. Demonstrate ability to craft, edit and stage a piece of choreography for a professional-level dance performance. 3. Demonstrate growth in interpersonal and leadership skills while working with the group of dancers cast in their dance work. Credits: 1.00 or 2.00

DANC 35100 - Intermedia Dance Technology

Credit Hours: 3.00. An introduction to dance and intermedia within the choreographic process. Integration of movement and

various forms of technology which might involve digital images, film, animation, programming, sensors, sound, lighting and/or robotics.

Learning Outcomes: 1. Demonstrate new approaches to choreography by integrating intermedia technology into the dance-making process. 2. Apply basic skills for creating or implementing film, digital media, sound editing, and/or programming. 3. Analyze intermedia dance technology works. 4. Develop awareness of dance intermedia technology art and examine its value and meaning as both a creator and observer. 5. Build a sense of personal expression and artistry through the composition of intermedia dance technology works. Credits: 3.00

DANC 35000 - Dance For The Camera

Credit Hours: 3.00. An introduction to technical and aesthetic techniques to create screendance or dance film, with an emphasis on camera use, editing techniques, development and production of choreographic projects designed specifically for film format.

Learning Outcomes: 1. Demonstrate how to use a camera and capture dance footage. 2. Demonstrate basic skills in non-linear digital video editing with attention to motion and action editing in dance. 3. Analyze the art of screendance and examine its value and meaning as both a creator and observer. 4. Create a sense of personal expression and artistry through crafting dance film projects. Credits: 3.00

D. Modern Dance Technique (4 credits)

DANC 10100 - Modern Dance Technique I

Credit Hours: 2.00. An introduction to the techniques and principles of modern dance.

Learning Outcomes: 1. Demonstrate elementary level performance of skills and principles of Modern Dance technique. 2. Perform basic dance movement with personal expression. 3. Demonstrate fundamental bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 20100 - Modern Dance Technique II

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 10100.

Learning Outcomes: 1. Demonstrate confident performance of skills and principles of Modern Dance technique. 2. Perform dance movement with personal expression and artistry. 3. Demonstrate increased bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 30100 - Modern Dance Techniques III

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 20100. Emphasis placed on expressive qualities of movement.

Learning Outcomes: 1. Demonstrate strong performance of skills and principles of Modern Dance technique. 2. Perform complex movement with personal expression and artistry. 3. Evaluate the art of Modern Dance and examine its value and meaning as both a creator and observer. Credits: 2.00

E. Dance Technique courses (4 credits)

DANC 30000 - Performance Production

Credit Hours: 3.00. This course teaches many aspects of producing a performance, from backstage to onstage. Students will learn the technical aspects of creating a professional performance by both observing performance production and developing an actual performance, which this semester is the Xperimental 2024 Concert. Students may participate in the production in a variety of active roles; however, they will be exposed to all aspects through observation, participation, and discussion. Production roles include: director and assistant director, choreographer, performer, lighting design and staging, sound design and technical support, and stage crew (stage manager, house manager, ticket manager, setup and strike support). Occasional class sessions cover skills to enhance your knowledge of some areas of production such as sound design, and lighting technology. For many students who are at the university level, the art of performance is defined almost

totally by the act of being on stage performing, in studios or on stages. This course is designed to invite students to learn about all the activities that are done behind the scenes in order for live performances to be presented to an audience. We will discuss what is involved in both large institutional performance spaces, and compare this to our university performance. Then we will discuss what this scenario looks like for performance professionals after college. This course will greatly enhance students' ability to produce their own events in the future, and develop greater appreciation for the collaborative nature of live performance as art form.

Learning Outcomes: 1. Plan and create a small live performance production. 2. Identify the necessary components of a production of a professional performance and explain the key collaborative interactions among them. 3. Practice basic skills for working performers and producers including those relating to technology and business. Credits: 3.00

DANC 20200 - Ballet II

Credit Hours: 2.00. A continuation of the principles and techniques of classical ballet addressed in DANC 10200.

Learning Outcomes: 1. Demonstrate advanced ballet skills, principles and techniques used in ballet, with focus on increased strength and coordination. 2. Demonstrate correct use of ballet terminology. 3. Define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor, as well as various ballet variations. Credits: 2.00

DANC 20300 - Jazz Dance II

Credit Hours: 2.00. A continuation and refinement of the jazz dance concepts and movement vocabulary addressed in DANC 10300.

Credits: 2.00

Notes

Data Driven Agriculture Minor

About the Program

Requirements for the Minor (21 credits)

Required Course (3 credits)

AGR 33300 - Data Science For Agriculture

Credit Hours: 3.00. Students will apply data processes including identifying data needs, acquiring data, assessing data quality, data wrangling, filtering, and visualization. In each of several topic areas (forestry, animal science, agronomy, food science, entomology, engineering, economics), data-driven insights and improved decision making will be the culmination of applied data skills. Students will understand data ethics and practice data management skills including the merging of disparate but related data sets.

Learning Outcomes: 1. Construct a research question that helps address a decision. 2. Describe different types of experimental designs and discuss the differences between observational and experimental studies. 3. Identify data needed to address various research questions. 4. Identify how these data sources are used in data analysis: agronomics, machine data, maps, spreadsheets, sensor data. 5. Describe how various data sets are acquired. 6. Describe how the following impact data ethics: ownership, storage, access. 7. Assess data quality and utility. 9. Identify potential limitations of a dataset. 10. Describe the following aspects of data wrangling: data formats, data compatibility, mobility. 11. Describe the following aspects of data management: storage, curation, metadata, FAIR (findable, accessible, interoperable, reusable). 12. List reasons for filtering, cleaning, and pre-processing data. 13. Describe tools for data cleaning. 14. Integrate disparate data sets. 15. Describe uses for the following in data visualization: bar charts, line charts, maps, tables. 16. Use the following tools to analyze data: correlations, mean generation, confidence intervals, simple model building, R Python. 17.

Make decisions based on data outcomes. Credits: 3.00

Foundation in Computation - Choose One (3 credits)

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following

features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 46900 - Operating Systems Engineering

Credit Hours: 4.00. The design and construction of operating systems for both individual computers and distributed (networked) systems. Basic concepts and methods for managing processor, main memory, block-structured storage, and network resources are covered. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked versions of UNIX. These techniques are applied to design improvements of portions of a simplified, networked, UNIX-based operating system; the improvements are implemented and their performance is evaluated in laboratory experiments.

Credits: 4.00

IE 33200 - Computing In Industrial Engineering

Credit Hours: 3.00. Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Credits: 3.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 23500 - Introduction To Organizational Computing

Credit Hours: 3.00. People and organizations, decision-making, information systems, telecommunications, desktop systems, integration tools, collaboration and groupware, multimedia, authoring multimedia documents, emerging technologies. May not be taken for credit by Computer Science majors.

Credits: 3.00

MGMT 28800 - Programming For Business Applications

Credit Hours: 3.00. This course will cover the fundamentals of business rules and logic in a business application development context. Students will acquire these skills using computer programming. A modern programming language will be used to learn and reinforce logical concepts, including abstraction, process flow, variable assignment, and control structures, as well as proper programming and application development practices, including documentation.

Learning Outcomes: 1. Understand and apply basic technical knowledge to managerial problems. 2. Successfully write, test, and run computer programs designed to address managerial problems. Credits: 3.00

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

Foundation in Data Literacy, Management and Analytics - Choose One (3 credits)

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical

responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 30010 - Introduction To Machine Learning And Pattern Recognition

Credit Hours: 3.00. Intelligent information processing, search and retrieval, classification, recognition, prediction and optimization with machine learning and pattern recognition algorithms such as neural networks, support vector machines, decision trees and data mining methods, current models and architectures, implementation topics especially in software, applications in areas such as information processing, search and retrieval of internet data, forecasting (prediction), classification, signal/image processing, pattern recognition, optimization, simulation, system identification, communications, control, management and finance. Topics covered will also be illustrated with the software package MATLAB and related toolboxes. Permission of instructor required.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multi-disciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. 7. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. Credits: 3.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their

organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

ENTM 24200 - Data Science

Credit Hours: 3.00. Develop a data science skill set that complements coursework in mathematics, statistics, and experimental design. Data Science facilitates research by developing skills in data sourcing, formatting and using different types of data, and hypothesis generation. Mathematical communication skills are developed through data graphics, animation, and delivery of results through multiple platforms including interactive simulations on webpages.

Learning Outcomes: 1. Source different types of data and know what analyses are appropriate for each type. 2. Transform and format data for analyses. 3. Detect trends in data as part of hypothesis generation. 4. Communicate findings to different audiences through appropriate graphics and animations, including through web pages. 5. Write R scripts to accomplish all of the above. Credits: 3.00

SCLA 59000 - Special Topics

Credit Hours: 3.00. This course, whose specific topics might change, focuses on strategy and military studies a global scale. The course will be rooted in all the elements of strategy (political, military, economic and cultural), plus

strategic theory and technology's impact on it. The course exposes students to a set of historical and contemporary strategic dilemmas that involved difficult trade-offs, costly investments, wild risks, incredible victories, and crushing defeats. This is a multidisciplinary course that focuses on several core ideas and principles that cut across schools of thought and examples from past, present and future. Learning Outcomes: 1. Develop and analyze system-level trade-offs. 2. Plan long-term on a national scale. 3. Devolve authority and allowing for chance contingency while staying on mission. 4. Maintain individual morals and national values in strategic thinking. 5. Balance the possibilities and limits of soft power (money, prestige, culture) as strategic tools of influence. 6. Examine the learning competition aspects of strategy and security. Credits: 3.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed. Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits. University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits. Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the

most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating

insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

AGRY 42000 - Computing For The Natural Sciences

Credit Hours: 3.00. Basic programming, problem solving, data visualization and communication in the context of agriculture and natural science research using R. Topics include iteration, functions, vectors, strings, algorithms, graphics and reproducible reports in R. This course is appropriate for undergraduates with a curiosity in computing fundamentals and interest in working with research data, especially those potentially applying to graduate school. Also appropriate for graduate students, researchers or other professionals who desire an introduction to programming with R. NO programming experience is necessary. This is not a statistics course; having had introductory statistics and some background coursework in agricultural or other natural sciences is expected.

Learning Outcomes: 1. Design, code and test small R programs. 2. Use programming to solve problems. 3. Communicate results with clean, reproducible reports. Credits: 3.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

Foundation in Statistical Methods - Choose One (3 credits)

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as

used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

BIOL 39500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available

in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills

required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study.

Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills by taking advanced quantitative methods courses. Credits: 3.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals

and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

Data Acquisition - Choose One: (3 credits)

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 46000 - Sensors And Process Control

Credit Hours: 3.00. Fundamental aspects of transducers, biosensors, instrumentation, and computer control are presented, with particular emphasis on sensors and controls used in agricultural, biological, and food applications. Laboratory and pilot plant scale computer controlled equipment is used to examine response of process variables, sensor calibration, control system modeling, and controller selection and tuning. Prerequisite: differential equations and a course in either heat transfer or fluid mechanics.

Credits: 3.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6. Understand basics of circuits programmed using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ECET 35901 - Computer Based Data Acquisition Applications

Credit Hours: 3.00. This course focuses on the study and application of computer based data acquisition (DAQ) systems. Concepts of high resolution and high throughput data acquisition are introduced and applied. Students learn and use programming and scripting languages to discover the interfacing, advantages and limitations of computer based (DAQ) systems.

Learning Outcomes: 1. Define, compare and contrast common data acquisition terms. 2. Analyze the advantages and limitations of DAQ systems. 3. Demonstrate proficiency with software tools and computer based data acquisition. 4. Develop user-friendly applications for the purpose of DAQ system control. 5. Collect, analyze, and reduce data from a system for the purpose of written and oral reporting. Credits: 3.00

ABE 53100 - Instrumentation And Data Acquisition

Credit Hours: 3.00. This course educates students in the use, selection, and design of instrumentation and data acquisition for agricultural, food, environmental, and biological systems. Emphasis is on measurement of position (GPS), force, pressure, power, torque, flow, and temperature along with environmental sensors. Labs focus on building and using measurement systems and programming PC computers for data acquisition and analysis. Prior knowledge of electrical circuitry is desirable.

Learning Outcomes: 1. Understand the principles of operation and limitations of common measuring instruments. 2. Model instruments and their operating conditions to use the instruments correctly. 3. Design and use signal conditioning devices. 4. Program computers to automate the acquisition and

processing of data. 5. Design systems for the acquisition, analysis, and communication of data. 6. Gain awareness of economical and societal aspects of instrumentation systems and communication of data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

ECE 57700 - Engineering Aspects Of Remote Sensing

Credit Hours: 3.00. Introduction to the concepts of multispectral image data generation and analysis. Basic principles of optical radiation, reflection, and measurement in natural scenes. Fundamentals of multispectral sensor design and data analysis for complex scenes. Application of signal processing and signal design principles and of statistical pattern recognition to these problems. Spatial image processing methods and algorithms as appropriate to land scene data. Practice with analysis of actual aircraft and spacecraft data in a cross-disciplinary environment. Offered even years.

Learning Outcomes: 1. Knowledge of a number of important technologies based on multispectral/hyperspectral remote sensing and related image processing techniques. 2. Knowledge of machine learning techniques such as deep learning for remote sensing technologies. 3. Knowledge of developments in the areas of statistical analysis for remote sensing. 4. Knowledge of a number of other topics, such as MATLAB and Python for remote sensing algorithms. 5. Ability to utilize the theoretical analysis of topics based statistical pattern recognition and machine learning for various system designs. Credits: 3.00

Data Architecture and Usage - Choose One: (3 credits)

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology,

and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert

comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations. Credits: 3.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

Data to Decisions* - Choose One: (3 credits)

AGEC 30500 - Agricultural Prices

Credit Hours: 3.00. Analysis of prices and the movement of farm product prices; relations of farm product prices to farm input and other prices; conceptual and statistical analysis of agricultural supply and demand relationships; application of price analysis, price forecasting, agricultural outlook, agricultural policy; adjustment of farming to new price conditions.

Learning Outcomes: 1. Understand economic principles that determine prices in markets. 2. Provide knowledge of markets and the entities and factors that impact market equilibrium outcomes. 3. Apply economic principles and empirical estimation tools to inform decision-making. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic

problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGRY 44400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (EAPS 43400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ENTM 22820 - Forensic Analysis (UCC: SCI)

Credit Hours: 4.00. Forensic science evidence analysis, crime lab evidence management and data analysis techniques. Focuses on the accuracy, precision and integrity in evidence analysis for a survey of forensic disciplines. Emphasizes the place of forensic analysis as a necessary second step in a sequence that takes evidence from scene, to the lab for analysis and finally into the court of law.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Appreciate the scope of science in forensic analysis. 2. Develop an understanding of the scientific method in the context of the law. 3. Develop an understanding of the particulars for each forensic sub-discipline. 4. Experience the basic techniques employed by the sub-disciplines reviewed. Credits: 4.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

ABE 52700 - Computer Models In Environmental And Natural Resources Engineering

Credit Hours: 3.00. Offers students in environmental and natural resources engineering programs an understanding of the hydrological processes and related design skills. Principles of soil erosion by water; drainage of agricultural lands; surface runoff; flood and reservoir routing; hydrodynamic and water quality in pipe network; nonpoint source pollution; and transport phenomenon are studied. Current computer models utilized in industry for decision support are applied using case studies to further enhance the understanding of the hydrological processes. Limitations and advantages of the models are discussed. Offered in alternate years.

Credits: 3.00

AGEC 51600 - Mathematical Tools For Agricultural And Applied Economics

Credit Hours: 3.00. This course provides first year graduate students and advanced undergraduate students with the specific set of applied mathematical tools needed to support graduate coursework in microeconomics, macroeconomics, economic programming, and econometrics. The course reviews skills and concepts from a number of fields of mathematics including matrix algebra, calculus, optimization theory, and mathematical statistics. The course emphasizes specific applications to economic theory and applied problems in agricultural economics and related areas. Students should be comfortable with introductory-level calculus before entering the course. Permission of instructor required.

Learning Outcomes: 1. Knowledge and Scholarship: The ability to identify and conduct original research, scholarship or creative endeavors. 2. Communication: The ability to

effectively communicate their field of study. 3. Critical Thinking and Problem Solving: Think critically, creatively and solve problems in their field of study. 4. Ethical Conduct: Conduct research in an ethical and responsible manner. 5. Professional Development: demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

ASM 53000 - Power And Machinery Management

Credit Hours: 3.00. Management and selection of farm machines and power units with emphasis on cost analysis and evaluation of new machines and practices.

Credits: 3.00

BTNY 53500 - Plant Disease Epidemiology

Credit Hours: 3.00. Plant disease epidemics occur due to the suitable combination of various elements of the agroecosystem. Many plant pathogens and diseases have increased their geographic distribution and intensity in the U.S. and the world. A lack of epidemiological understanding can exacerbate problems and significantly challenge the management of diseases at the field level. This course is an introduction to the epidemiological basis of disease management strategies. The course includes concepts in botanical epidemiology, disease assessment and measurement, disease modeling, epidemics comparison, and a revision of the traditional plant disease control principles. *Plant Disease Epidemiology* is an upper-level course for students interested in plant pathology, agronomy, data-driven Ag, national or international agriculture, or closely related areas. Although some pathosystems are used as model systems, *Plant Disease Epidemiology* is not a "how-to" course on controlling specific plant diseases.

Learning Outcomes: 1. Standardize terminology used in epidemiology for disease management purposes. 2. Analyze the accuracy and precision of data. 3. Use models to describe plant disease epidemics. 4. Explain how epidemiology is used to evaluate disease management options. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

ASM 42200 - Advanced Machine Technology For Agricultural Crop Production

Credit Hours: 3.00. The course examines technologies and techniques associated with modern farming practices often referred to in general as precision agriculture. It is structured to center around expert presentations from industry, academia, and farming practice, with a focus on technologies and appropriate application of such technologies in crop production systems in the Eastern Cornbelt. Consent of instructor required.

Learning Outcomes: 1. Identify and analyze technologies associated with precision agriculture. 2. Explain the appropriate use of the aforementioned technologies. 3. Compare technological alternatives in various crop production scenarios. Credits: 3.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on

examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

HORT 31900 - Controlled Environment Production Of Horticultural Crops

Credit Hours: 3.00. This course combines production principles with environmental concepts and advances in technology to provide a comprehensive training in sustainable production of herbaceous ornamentals and vegetables in controlled environment systems. The laboratory instruction provides hands-on experience with the practice of growing crops under controlled environments by combining the learning from lab prep with the use of technology to control environment during production.

Learning Outcomes: 1. Become familiar with best management practices for growing herbaceous ornamentals and vegetables that improve sustainability in controlled environments. 2. Learn how above and below ground environments interact with crop production. 3. Learn basics about the state-of-the-art technologies used in controlled environment agricultural production to monitor and control environments. 4. Interact with industry professionals to gain first-hand knowledge about careers and development in commercial horticulture. 5. Gain sufficient background in science, technology and regulations required to become entrepreneurs, next generation growers and researchers in the controlled environment agriculture industry. Credits: 3.00

ASEC 58200 - Introduction To The Application Of Inferential Statistics

Credit Hours: 3.00. The goal of this course is to introduce students to the use and application of statistics with a particular focus on descriptive and inferential analysis procedures. This course will also introduce students to the use of statistical software, namely the Statistical Package for the Social Science (SPSS). Permission of instructor required.

Learning Outcomes: 1. Formulate decisions regarding selecting appropriate statistical techniques to use in analyzing data. 2. Apply data analysis techniques using SPSS and interpret relevant output and information. 3. Synthesize data from SPSS output. 4. Produce data analysis results in appropriate table and narrative form for inclusion in a dissertation, thesis, or journal article. 5. Investigate, analyze and critique the data analysis sections of peer-reviewed journal articles and determine if the analysis is appropriate for the study. 6. Apply appropriate methods and procedures in the development of survey instruments. Credits: 3.00

AGRY 48500 - Precision Crop Management

Credit Hours: 3.00. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital georeferenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. May be used in combination with AGRY 49800 to meet the Agronomy undergraduate capstone requirement; will also meet the GIS/GPS requirement in Agronomy plans of study.

Learning Outcomes: 1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from Dupont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input levels. 2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions. 3. Utilize data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific

basis. 4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management. 5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates. 6. Utilize geo-referenced field scouting data and crop models to prescribe effective pest management strategies. 7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources. 8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies. 9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors 10. Evaluate potential crop response to varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions). 11. Describe and explain the impact of productivity influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management). 12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies. 13. Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how

complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

Notes

Design and Construction Integration Minor

About the Minor

Requirements for the Minor (17 credits)

Design and Construction Minor Required Courses

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

CM 43300 - Risk Management And Legal Issues In Design And Construction Integration

Credit Hours: 2.00. An advanced course dealing with risk management and legal issues as they pertain to the interaction of designers, contractors, and owners. Students will learn to identify and mitigate potential risks that may affect the multiple stakeholders and the business organizations they represent during design and construction activity. The course will also deal with trust and teamwork issues within collaborative processes in the built environment.

Learning Outcomes: 1. Identify potential risks for designers, contractors, and owners in a collaborative construction industry environment. 2. Understand potential trust issues that inhibit collaboration within the architecture, engineering, and construction (AEC) industry. 3. Develop mitigation measures to reduce risk and increase collaboration within architecture, engineering, and construction interactions. 4. Use clear and precise questions and consider

diverse points of views when reasoning. 5. Demonstrate ability to gather, assess, record, and compare relevant information in order to support conclusions and related consequences. Credits: 2.00

CM 33200 - Architectural Design, Construction Techniques And Society

Credit Hours: 3.00. A course in which students will be exposed to the evolution of architecture and building techniques that influenced the western built environment. Emphasis will be given to the use of appropriate vocabulary and also how social and cultural factors have influenced the design of the built environment throughout the centuries. The course will survey topics from XVII century to recent times.

Learning Outcomes: 1. Recognize architectural and technical traditions of the Western culture. 2. Identify relationships between cultural patterns and social responsibilities of designers. 3. Recognize ways that history or related arts, humanities and technologies influence the built environment. 4. Use appropriate architectural and technical vocabulary. Credits: 3.00

CM 33000 - Design And Construction I

Credit Hours: 6.00. A course which introduces students to projects and the design information of the built environment as communication tools representing space and proportion. Through a blend of lectures and studio work, students obtain working knowledge of the traditions, documents and standards utilized in the planning for a built structure. Students will also experience how design decisions and programing are influenced by a multitude of outside influences.

Learning Outcomes: 1. Develop basic projects, sketches and pre-projects related to the built environment using appropriate design conventions. 2. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics and technical demands into consideration at the same time. 3. Analyze relevant precedents in order to make informed design choices. 4. Explain the feasibility analysis, supervision and coordination of integrated projects. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

Cross Cultural Experience Selective (3 credits)

ASL 20100 - American Sign Language III (UCC: HUM)

Credit Hours: 3.00. A more advanced study of American Sign Language. Further development of receptive and expressive skills using more advanced material. Continued emphasis on cultural and historical aspects in relation to the evolution of the language and language usage.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

EDPS 31600 - Collaborative Leadership: Cross-Cultural Settings (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the cultural nuances of leadership in the United States as well as around the world. This course will include impact of globalism as a context for leadership, conflict resolution in a global environment, and other important factors that impact culturally diverse or global teams.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Better understand what a culture is, broadly defined, and how it functions. 2. Better understand the importance of culturally aware, knowledgeable, and skillful leaders. 3. Increase professional and personal self-awareness in relation to leadership in diverse settings. 4. Better understand the importance of making cultural issues central for constructive conflict management. 5. Understand the complexity of leader-other interaction and impact of psycho-social variables on this interaction. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are

they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ARAB 20100 - Standard Arabic Level III (UCC: HUM)

Credit Hours: 3.00. This course is designed to allow students to use the grammar and vocabulary acquired in the first two semesters in dealing with specific social situations. Continued improvement of conversational, reading, and writing abilities and expansion of vocabulary.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

FR 20100 - French Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1903 French Level III

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 20100 - German Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate German course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts, and listening to audio recordings, and watching videos of spoken German. 2. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 3. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

HEBR 20100 - Modern Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading both in the modern language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 20100 - Italian Level III (UCC: HUM)

Credit Hours: 3.00. A continuation of ITAL 10200 .

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

PTGS 20100 - Portuguese Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Portuguese course with emphasis on communicative skills (listening and speaking),

literacy skills (reading and writing) and culture.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Discussing personal relations and academic studies. 2. Giving and receiving directions to a destination and/or in order to complete a task. 3. Preparing short oral presentations on topics related to Portuguese and Brazilian cultures. 4. Writing short essays on specified topics. Credits: 3.00

RUSS 20100 - Russian Level III (UCC: HUM)

Credit Hours: 4.00. An intermediate-level course designed to develop higher skills in speaking, listening, reading, and writing Russian, as well as in intercultural competence and communication through further work on conversational and writing ability. Students work individually and in small groups using authentic reading and audio materials.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both simple conversations on everyday topics and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain simple conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important life events, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

Design and Innovation Minor

About the Program

Requirements for the Minor (15 credits)

A. Intro Design & Innovation (3-4 credits)

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety

of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

TLI 16100 - Prototyping In Engineering/Technology Education

Credit Hours: 3.00. Design, make, and innovate! This course provides basic instruction on the proper and safe use of tools and equipment used to prototype innovative ideas. This includes 3D printers, laser cutters/engravers, fabrication tools/equipment, CNC mills/routers, and microcontrollers/microcomputers.

Learning Outcomes: 1. Demonstrate the technical competencies to properly and safely operate common prototyping equipment and tools. 2. Apply knowledge of materials properties to select the appropriate materials for a desired prototype. 3. Create operations process flow charts for planning product development. 4. Test prototypes in real situations to gather data related to their performance. Credits: 3.00

MGMT 22000 - Making The Business Case

Credit Hours: 3.00. This course develops one's ability to address situations faced by managers. This involves collecting information, analyzing that information to determine what decision or action is required and then selling the recommended decision or action to the management team. Selling this is done using one's persuasive skills in both telling a story and illustrating that story.

Learning Outcomes: 1. Differentiate whether a situation calls for making a decision or solve a problem. 2. Identify important facts in case studies. 3. Organize facts found in case studies into issues that factor in the analysis of alternatives. 4. Evaluate alternative solutions to a decision in terms of how they address issues. 5. Recommend an alternative solution. 6. Create a plan of action that will put the recommendation in place. 7. Create presentations that have a story line flowing through them. 8. Create a slide deck that supports the story line of the presentation. 9. Demonstrate effective speaking and body

language when making presentations. Credits: 3.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

B. Core Design & Innovation (6 credits)

TLI 36700 - Teaching Design And Innovation I

Credit Hours: 3.00. This course focuses on the development of appropriate engineering design knowledge and skill required to effectively teach middle and high school engineering/technology education courses by infusing engineering design into the curriculum. Students will use 3-D solid modeling software, rapid prototyping, and other design technologies as they engage in the engineering design process through an open-ended engineering design challenge.

Learning Outcomes: 1. Display the ability to teach students to develop skills for living in a knowledge-based, technological society using design-based pedagogical approaches. 2. Use the engineering design process to solve open-ended, ill-defined problems. 3. Demonstrate the ability to teach basic engineering design techniques. Credits: 3.00

TLI 46000 - Teaching Design And Innovation II

Credit Hours: 3.00. This course expands the engineering design process, incorporating rapid prototyping and other fabrication technologies to create a specified solution. The course emphasizes process flow chart planning and logistics of engineering/technology education laboratory management. Prototypes will be tested in real situations and data gathered on performance. Designs will be revised to reflect a deeper understanding of manufacturing and use, being sensitive to structure, function, and behavior from a systems-level perspective. Intellectual property, marketing, and infrastructure will be discussed.

Learning Outcomes: 1. Describe the complexity of implementing design solutions. 2. Select appropriate fabrication technologies. 3. Operationalize performance criteria into measurable variables. 4. Gather data to make rational decisions, which are transparent and justifiable. 5. Optimize design solutions and perform iteratively in the design process. Credits: 3.00

TECH 22000 - Designing Technology For People

Credit Hours: 3.00. Innovating in our complex world requires understanding people and the issues and challenges they face. This unique course brings together perspectives from technology and anthropology to address this by exploring ethnographic studies of people and technology interactions. Through this process, students will practice the problem scoping skills necessary to identify and define problems and begin to generate appropriate design solutions. In addition, students will learn how to observe and talk with people about technology and discuss a range of ways people use technology. Accordingly, the course will focus on human-centered design and how to empathize with people during the design process. This will allow students to learn how to identify opportunities for innovation that emerge when designers carefully observe and listen to humans using technology and/or experiencing problems with current technology. Note: This class engages the material in both the classroom and innovation labs.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

TECH 34000 - Prototyping Technology For People

Credit Hours: 3.00. Innovating in our complex world requires us to think strategically and make the best decisions possible for both designing and business development. Accordingly, this unique course brings together perspectives from technology and business management to iteratively prototype innovative solutions to student-selected problems. This process will include creating prototypes in a variety of media, using the appropriate methods/tools, as well as exploring the processes and biases related to how people process information and make decisions. This type of work will help to guide the innovation process by gaining insights from testing prototypes and interacting with people to deepen one's understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. At the conclusion of the course, students will pitch a viable design solution and business model for a validated problem to a variety of potential investors and/or stakeholders. Note: This class engages the material in both the classroom and innovation labs. Students of all levels of experience, will explore tools/programs related to computer aided design, 3D printing, app development, and digital prototyping.

Learning Outcomes: 1. Recognize biases in how people process information, conducting

user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to develop prototypes in a variety of media (digital and/or physical) for the level of fidelity necessary to communicate, understand, and test innovative ideas/designs. 3. Select and use appropriate methods/tools/equipment to make decisions and prototype innovative ideas. 4. Revise designs to reflect a deepening understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. 5. Pitch a viable design solution/business model for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

MGMT 39100 - Strategic Thinking And Decision-Making

Credit Hours: 3.00. This course focuses on how to think strategically and make good business decisions. By the end of the class, you will be able to do the following: (1) Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions; (2) Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas; (3) Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas; (4) Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas. 3. Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas. 4. Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

C. Global/Cultural Experience (3 credits)

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can

provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

TECH 33000 - Technology And The Global Society

Credit Hours: 3.00. The intersection of technology, globalization, and society is at the core of this course. Students examine socio-cultural issues related to the development and use of technology across intercultural contexts, explore perspectives and principles behind global technology influences, and examine the complexities and ethical nuances of technology and innovation.

Learning Outcomes: 1. Reflect on the perceptions of cultural norms, interactions, gender roles, societal ethics, and religions in order to examine their potential impact on industry and society. 2. Evaluate digital media and socio-cultural information sources to predict their influence on individual and social interactions and perspectives. 3. Conduct formal and informal reflections about oneself and others, manage one's emotions in situations of differences, and apply techniques to bridge cultural differences. 4. Assess worldwide technology needs by examining global efforts, innovations, and issues that impact contemporary society. Credits: 3.00

D. Specialization (3 credits)

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues

surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social,

cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

TECH 33000 - Technology And The Global Society

Credit Hours: 3.00. The intersection of technology, globalization, and society is at the core of this course. Students examine socio-cultural issues related to the development and use of technology across intercultural contexts, explore perspectives and principles behind global technology influences, and examine the complexities and ethical nuances of technology and innovation.

Learning Outcomes: 1. Reflect on the perceptions of cultural norms, interactions, gender roles, societal ethics, and religions in order to examine their potential impact on industry and society. 2. Evaluate digital media and socio-cultural information sources to predict their influence on individual and social interactions and perspectives. 3. Conduct formal and informal reflections about oneself and others, manage one's emotions in situations of differences, and apply techniques to bridge cultural differences. 4. Assess worldwide technology needs by examining global efforts, innovations, and issues that impact contemporary society. Credits: 3.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

MGMT 44810 - Technology Strategy

Credit Hours: 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to

develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage.

Learning Outcomes: 1. Improve ability to assess technology and innovation from a competitive perspective. 2. Learn about disruptive innovation and its effects on incumbents and new firms. 3. Consider internal processes for innovation management in existing firms. 4. Improve decision-making and skills with respect to technology and innovation. Credits: 3.00

TLI 16100 - Prototyping In Engineering/Technology Education

Credit Hours: 3.00. Design, make, and innovate! This course provides basic instruction on the proper and safe use of tools and equipment used to prototype innovative ideas. This includes 3D printers, laser cutters/engravers, fabrication tools/equipment, CNC mills/routers, and microcontrollers/microcomputers.

Learning Outcomes: 1. Demonstrate the technical competencies to properly and safely operate common prototyping equipment and tools. 2. Apply knowledge of materials properties to select the appropriate materials for a desired prototype. 3. Create operations process flow charts for planning product development. 4. Test prototypes in real situations to gather data related to their performance. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

TLI 31500 - New Product Development

Credit Hours: 3.00. This course introduces the process of technological innovation and new product development from concept to commercialization. Topics covered include ideation, R&D, prototyping (design and modeling), testing for quality, the patent process, intellectual property rights, marketing and cost evaluation.

Learning Outcomes: 1. Describe the process of innovation as it relates to new product development. 2. Identify quality standards and testing procedures for new products. 3. Describe the patent process. 4. Explain methods for protecting domestic and international intellectual property rights. 5. Describe the process for conducting market research. Credits: 3.00

Notes

Digital Natural Resources Minor

About the Minor

Requirements for the Minor (15 credits)

Data Acquisition (6 Credits)

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge

about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

AT 30901 - Introduction To UAS Sensor Technology

Credit Hours: 3.00. This course introduces students to multiple forms of UAS sensors and core fundamentals of Remote Sensing and Geospatial Technology. Students will be introduced to basic data capture and processing techniques and to effectively apply different forms of UAS sensors to real-world applications.

Learning Outcomes: 1. Identify and define core geospatial and remote sensing technology concepts. 2. Effectively associate and relate UAS sensor technology with related portions of the electromagnetic spectrum. 3. Identify and explain geographic coordinate systems and projections. 4. Process and Create UAS data products within a Geographic Information System. Credits: 3.00

AT 10901 - Introduction To Uncrewed Aircraft System Operations

Credit Hours: 3.00. This course will provide students the aeronautical knowledge required to operate a small UAS in the National Airspace. Students are introduced to various aspects of uncrewed aviation operations, which includes UAS system types and components, regulations and operational approvals, and indoctrination to the civil and commercial applications of UAS. Through the use of UAS simulation technology, students will develop basic small UAS flight skills and successfully complete various UAS operational scenarios. Upon successful completion of the course students will be prepared to obtain a Federal Aviation Administration (FAA) Remote Pilot Certificate with a Small UAS Rating. Permission of department is required.

Learning Outcomes: 1. Obtain an FAA Remote Pilot Certificate with a Small UAS Rating. 2. Understand small UAS terminology and technology. 3. Comply with regulatory framework and understand various UAS approval processes. 4. Understand basic small UAS operating procedures. 5. Appreciate and gain perspective on how to safely operate UAS in the national airspace system. 6. Using simulation technology, demonstrate basic small UAS flight maneuvers and execute basic flight operations. Credits: 3.00

Data Analysis (3 Credits)

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

Data Ethics (3 Credits)

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical

frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

Data Applications (3 Credits)

FNR 49800 - Special Assignments

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. 2. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the

important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

Notes

Earth and Planetary Sciences Minor

The department is pulling out the Atmospheric minor from the larger EAPS minor to make it easier for students to create a clear and usable minor. That means the EAPS minor needs a name change and an update to the requirements to reflect the removal of the Atmospheric Science courses. This can benefit students within our department by allowing Atmospheric Science majors to add the Earth and Planetary minor. We see this benefiting others throughout the university, creating a clear path to an Earth and Planetary minor.

Requirements for the Minor (15 credits)

Required Course (3 credits)

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and

bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

Additional EAPS Coursework (12 credits)

Earth & Planetary Science Minor Course List

EAPS 10000 - Planet Earth (UCC: STS)

Credit Hours: 3.00. An introduction to the Geosciences-Earth science, oceanography, atmospheric science and astronomy. The course emphasizes topics (earthquakes, volcanoes, ocean pollution, climate change, severe weather, etc.) that are of general interest and relevance, and the interconnections between various Earth processes. CTL:IPS 1730 Earth Science

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

EAPS 10400 - Oceanography (UCC: STS)

Credit Hours: 3.00. Origin of the oceans and marine life. Seafloor spreading and marine geology; currents, waves, and tides; marine organisms and ecology; beaches and nearshore life. Man's use and abuse of the sea, including contemporary problems and future opportunities. The role of oceans in climate and evolution of the biosphere.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand ocean and coastal processes. 2. Understand potential future impacts of ocean and other environmental changes. Credits: 3.00

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

EAPS 10600 - Geosciences In The Cinema (UCC: STS)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about natural hazards based on the depictions of such hazards in movies. Topics include earthquakes, tsunamis, volcanoes, tornadoes, hurricanes, climate change, asteroid impacts, space exploration, and wildfires. The course focuses on the accuracy of the depiction of natural hazards in the movies, the underlying processes that control their formation and the dangers they represent, how they influence society, and how students can prepare for them and keep themselves safe.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how scientists explore natural hazards, make observations, and develop theories. 2. Explain the processes that control natural hazards and where and when they are likely to occur. 3.

Know the natural hazards inherent to a student's location and be able to plan how to keep themselves safe in the event of such an occurrence. 4. Critically assess the reasonableness of depictions of natural hazards in the media. Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 11600 - Earthquakes And Volcanoes (UCC: SCI)

Credit Hours: 3.00. A survey class on earthquakes and volcanoes. Topics include earthquake hazards and forecasting, the use of seismic waves to investigate the earth's interior, volcanoes and tectonics, volcanic hazards, and the influence of volcanoes on climate. Examples of recent and historic earthquakes and volcanic eruptions are presented.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

EAPS 19100 - Introductory Topics In Earth And Atmospheric Science

Credit Hours: 1.00 to 3.00. Introductory special topics in earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 24400 - Earth Materials II

Credit Hours: 4.00. The study of common igneous, sedimentary, and metamorphic rocks. The origin and occurrence of rocks, weathering, and alteration processes. Prior course work in earth materials or mineralogy is required.

Credits: 4.00

EAPS 30900 - Computer-Aided Analysis For Geosciences

Credit Hours: 3.00. Application of computer analysis techniques including error analysis, line and surface fitting, spatial and temporal correlations, contouring, interpolation, and map projections. These methods are discussed in terms of specific geologic applications. All exercises and examples are developed using commercial mathematical software package. A three-hour-per-week computer laboratory tutorial provides hands-on experience with the techniques discussed in class. Prior course work in computer programming is required.

Learning Outcomes: 1. Carry out computational solutions to a given range of data analysis problems. 2. Select the appropriate analysis and visualization approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 31900 - Exploring Earth Through Time

Credit Hours: 3.00. The course will explore the history of the Earth from its beginning 4.5 billion years ago to the present. Our understanding and insight into the history of the Earth has greatly expanded during the last several decades. Emphasis will be placed on the relationships of tectonic processes that shaped the surface of the Earth and the evolution of the Earth's biosphere. The course will also examine how the role of evolution of life has played in the history of the atmosphere and oceans.

Credits: 3.00

EAPS 32700 - Climate, Science And Society

Credit Hours: 3.00. This course will examine the broad problems of climate change by examining the relationship between science, politics, and society by using climate change as a lens through which to examine larger issues. Students will be encouraged to identify similar themes in their own experiences as emerging scientists, engineers and global leaders. Adequate preparation to write essays and perform basic arithmetic calculations needed. Prior knowledge of climate change science is not necessary.

Learning Outcomes: 1. Able to think logically and creatively. 2. Able to apply knowledge to practical situations. 3. Able to respond flexibly as situation changes. 4. Understand ethical issues, particularly in Science. 5. Appreciate diverse experiences, thoughts, backgrounds. 6. Understand and appreciate Science in the world environment. Credits: 3.00

EAPS 35200 - Structural Geology

Credit Hours: 3.00. This course deals with the nature and evolution of structures in rock deformed naturally by flow and fracture, as deduced from experimental, theoretical and field studies. Specific topics include: structures in three dimensions using descriptive geometry and stereonets, field measurements

of rock geometry, tensors, strain and stress, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop, the structure and mechanics of mountain belts. Students will be expected to show competency with using a general set skills, techniques, and tools commonly used by professional geoscientists.

Learning Outcomes: 1. Interpret geologic structures in three dimensions using descriptive geometry, stereonets, and field measurements of rock geometry. 2. Evaluate quantitatively observations of the deformation in the crust using basic stress and strain theory, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop. 3. Recognize the structures and give a mechanical explanation for the development of mountain belts. 4. Apply these skills in the field. Credits: 3.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

EAPS 37500 - Great Issues - Fossil Fuels, Energy And Society

Credit Hours: 3.00. Prosperity of the 20th century was based on abundant and cheap energy; during the 21st century we will be faced with difficult challenges. Our society will face higher energy prices, decline of petroleum based fuels supplies, increased environmental effects of fossil fuels usage, and the challenge of solving the technological problems of developing alternative fuels. This course will review the structure, economics, and geopolitical issues faced by fossil fuel industries and the mitigation strategies that will be needed to change to low fossil fuel use society based on low polluting renewable energy sources. Counts for Great Issues course in College of Science for Juniors and Seniors.

Credits: 3.00

EAPS 39000 - Geologic Field Methods

Credit Hours: 3.00. Introduction to geologic mapping principles on quadrangle (7 1/2 min., 15 min., 1:250,000 scales) maps. Application of aerial photography, GPS, and GIS techniques. Emphasis on construction of cross sections, measurement of stratigraphic sections, and preparation of geologic reports. Several weekend field exercises will be required.

Credits: 3.00

EAPS 39100 - Topics In Earth And Atmospheric Sciences

Credit Hours: 1.00 to 4.00. Intermediate special topics in the earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 4.00

EAPS 47400 - Sedimentary Geology

Credit Hours: 4.00. Systematic study of continental and marine depositional environments. Interpretation of sedimentary facies, structures, and microfacies. Principles and applications of stratigraphy, including applications of paleontology, field relations, paleomagnetism, well logs, seismic reflections, and chemistry. Field investigations may be required. Prior course work in earth materials, mineralogy and petrology is required.

Learning Outcomes: 1. Understand core areas of sedimentary geology, and interpret a wide range of earth processes on different temporal and spatial scales. 2. Develop proficiency interpreting depositional processes and environments of ancient sedimentary strata through bedrock exposures, well logs, and drill cores. 3. Demonstrate skills of interpretive analysis and critical thinking with respect to geological problems involving temporal and spatial relationships. 4. Develop writing abilities through scientific reports that will be written individually, revised based on instructor and peer feedback, and subsequently integrated into a comprehensive basin analysis report. 5. Demonstrate competence in collecting scientific data, including field observations and field and analytical measurements. Specifically, demonstrate competency in collecting the following field datasets from outcrops: paleocurrent indicators, lithofacies associations, stratigraphic sections, and facies architectures. 6. Conduct effective independent and collaborative investigations. Specifically, develop your ability to work both independently and collaboratively during acquisition, analysis, and dissemination of scientific datasets as part of basin analysis project. Credits: 4.00

EAPS 51400 - Glacial And Quaternary Geology

Credit Hours: 3.00. Formation, dynamics, and regimen of glaciers. Erosional and depositional processes and landforms developed by alpine and continental glaciation. Glaciation of North America during the Ice Age, with emphasis on stratigraphy, soils, climates, biology, and physical changes resulting from glacial processes and environments. Application of glacial studies to agronomy, life sciences, climatology, oceanographic studies, and engineering problems. A one-day field investigation is required.

Credits: 3.00

EAPS 52600 - Introductory Geofluid Dynamics

Credit Hours: 3.00. Provides a fluid dynamics background for graduate students interested in atmospheric sciences, oceanography, mantle convection, hydrology, turbulence, or pollution. Topics covered include: basic assumptions and deviations of Navier Stokes equations, conservation laws, vorticity, divergence, waves, and applications in atmosphere, ocean, and geophysics.

Learning Outcomes: 1. Provide students a rigorous foundation in geofluid dynamics as well as the connections among math, physics, and real natural phenomena. 2. Students will become accustomed to applying the physical equations to real phenomena, and to presenting them in a concise way. 3. Understand the basic equations and physics in existing models which provides a broader and deeper understanding of the earth sciences. Credits: 3.00

EAPS 54200 - Economic Geology: Petroleum

Credit Hours: 3.00. Fundamental principles of the origin, migration, accumulation, exploration, and development of petroleum. Study of reservoir fluids, reservoir mechanics, and primary and secondary production techniques. Methods of prospect and leasehold evaluation and economic appraisal. Offered in alternate years.

Credits: 3.00

EAPS 55600 - Planetary Surface Processes

Credit Hours: 3.00. The application of petrology and structural geology to other planets. Topics include: theories of star and solar system formation, orbital dynamics and Kepler's laws, petrology and geochemistry of meteorites, age dating techniques, structure and composition of the terrestrial, giant, and icy planets, planetary surfaces, planetary atmospheres, and theories of the formation of the moon. Offered in alternate years. Prior course work in earth materials is required.

Learning Outcomes: 1. Understand the physical and chemical principles behind processes that modify planetary surfaces. 2. Identify planetary surface features in orbital imagery and use observational evidence to postulate their origin and modification histories. 3. Gain field experience with planetary surface processes and landforms at local planetary analog sites. 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic. Credits: 3.00

EAPS 55700 - Introduction To Seismology

Credit Hours: 3.00. Theory of propagation to seismic waves in elastic media. Solution of wave equations for compressional, shear, and surface waves. Analysis of travel-times, amplitudes, and attenuation of seismic waves in terms of ray and wave theory. Principles of the seismograph. Structure of the earth as determined by seismological studies. Investigation of the causes, effects, distribution, and characteristics of earthquakes. Earthquake prediction.

Credits: 3.00

EAPS 55900 - Topics In Seismology

Credit Hours: 1.00 to 3.00. This course covers current topics in seismology. Recent topics have included seismic structure of the crust and mantle, seismic anisotropy, and earthquake sources. Professor Nowack. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 57300 - Basin Analysis

Credit Hours: 3.00. Advanced study of tectonic evolution and stratigraphic history of sedimentary basins. Topics include formative mechanisms of different sedimentary basins; tectonic, eustatic, and climatic controls on basin stratigraphy; relationship of depositional systems to basin types; subsidence and thermal histories; and application of basin analysis to petroleum reservoir and ground water aquifer assessment. Required field trips. Offered in alternate years. Prior course work in sedimentology and stratigraphy is required.

Credits: 3.00

EAPS 57700 - Remote Sensing Of The Planets

Credit Hours: 3.00. Introduction to key planetary and Earth science satellite remote sensing datasets, including visible and thermal imagery, visible through mid-infrared spectroscopy, radar, gamma ray and neutron spectroscopy, and laser altimetry. Students will receive hands-on-experience with data acquisition, image processing in IDL, spectral analysis in ENVI and Davinci, crater counting, and geologic mapping in GIS programs. Includes 1-2 full-day field trips. Junior, Senior, or Graduate status required. Recommended minimum background for undergraduates: Introductory knowledge of Earth or planetary surface processes and basic programming skills.

Learning Outcomes: 1. Understand the underlying physical principles behind the interpretation of remote sensing data. 2. Gain proficiency in the acquisition, processing, and analysis of remote sensing data. 3. Gain field experience with using and ground truthing remote sensing data at planetary analog sites. 4. Propose a research topic, conduct a literature review, and design and complete an original research project. Credits: 3.00

EAPS 58000 - Geodynamics

Credit Hours: 3.00. This course will provide students with a first order understanding of geophysical processes by developing analytical solutions to a variety of geophysical and planetary thermo-mechanical problems. Topics will include stress and strain, rheology, elasticity and flexure, faulting, and conductive heat transfer, and fluid mechanics. We will develop governing analytical equations based on first order principles, such as the conservation of mass, energy, and momentum, and solve these equations for a number of boundary conditions.

Learning Outcomes: 1. Solve first-order analytical thermo-mechanical problems in geophysics and planetary science. 2. Understand the basis for more complex numerical solutions of thermo-mechanical problems in geophysics and planetary science. 3. Investigate the factors that control a variety of thermo-mechanical geophysical and planetary

processes. Credits: 3.00

EAPS 58400 - Hydrogeology

Credit Hours: 3.00. Investigates the qualitative and quantitative aspects of ground water location, occurrence, movement, evaluation, and development, and the influence of man upon this resource. Geologic and engineering aspects of ground water systems are discussed. Classroom teaching is complemented by problem sets and field trips.

Credits: 3.00

EAPS 59000 - Field Geology North America

Credit Hours: 2.00. Advanced study of tectonic evolution and stratigraphic history of specific geologic provinces. Particular emphasis on the relationship between tectonics, basin development, and sedimentation. Field component deals with application of field techniques used in basin analysis and structural studies. A 10-day field trip is required. Permission of instructor required.

Credits: 2.00

EAPS 59100 - Advanced Topics In Earth And Atmospheric Sciences

Credit Hours: 0.00 to 18.00. Specialized study offered on an individual basis or through specially arranged courses. Permission of instructor required.

Credits: 0.00 to 18.00

EAPS 36000 - Great Issues In Climate Change And Society

Credit Hours: 3.00. This course develops basic skills and knowledge critical to analyze issues of energy use, climate change, and sustainability that incorporate both societal and scientific perspectives. The goal of this course is not to arrive at particular consensus solutions to the problems associated with these issues but instead to foster an informed (through information literacy) debate that will ultimately be waged as solutions are sought. Working in teams the students work throughout the semester to complete a capstone teamwork project and a group presentation. Counts for Great Issues course in College of Science.

Learning Outcomes: 1. Understand/interpret the complex issues related to energy (production and use) policy and climate change. 2. Recognize the basic ethical, technological, political, and economic issues influencing the production of renewable and fossil energy. 3. Identify, distinguish, and use credible/factual information sources to establish a defensible viewpoint on these issues. Credits: 3.00

EAPS 52900 - Modeling Ecosystems And Biogeochemical Cycles

Credit Hours: 3.00. Process-based models are powerful tools for studying ecosystem dynamics and geochemical cycles in Earth System Sciences. In this course, we will explore how various components of ecosystems can be modeled following principles of biology, physics, and chemistry. We will also examine techniques for using modeling to study: 1) responses of the structure and functioning of ecosystems to changing climate, atmospheric composition, environmental conditions, and human activities; and 2) exchanges of major greenhouse gases (e.g., CO2, CH4, and N2O) between the atmosphere and the biosphere. During the course, we will go through the whole cycle of system modeling approach including model conceptualization, formulation, parameterization, sensitivity and uncertainty analysis, verification, and application.

Learning Outcomes: 1. Learn the whole cycle of system modeling approach including model conceptualization, formulation, parameterization, sensitivity and uncertainty analysis, verification, and application. 2. Learn how to model the key element cycles (e.g., C and N) between the atmosphere and terrestrial biosphere. Credits: 3.00

EAPS 51800 - Soil Biogeochemistry

Credit Hours: 3.00. This course will provide an introduction to the physical and microbial processes governing the cycling of photosynthetically-produced organic matter on land and in streams and rivers. Organic geochemical transformations in the soil and litter will be highlighted along with methods of characterization of the organic constituents. Biogeochemical concepts of stabilization and destabilization of soil organic matter and stress response of terrestrial ecosystems will be reinforced through manipulation of actual data sets.

Learning Outcomes: 1. Understand the basic mineral and organic chemistry of soils. 2. Understand the range of soil types and capacities to store organic matter. 3. Understand the natural and man-made stressors of soil organic matter and the range of impacts. 4. Understand the common analytical tools used to assess chemistry and health state of soils. 5. Understand how to structure and write and NSF-style proposal. 6. Understand the

need for hypothesis generation in developing a research proposal. 7. Be able to work in teams to analyze large data sets and develop and hone hypotheses. 8. Understand the mechanisms of soil stabilization and destabilization. 9. Understand the comparative role of different groups of microbes in the decay of plant-derived litter. Credits: 3.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five

scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 31500 - Biogeochemistry

Credit Hours: 3.00. The course examines the main element cycles of Earth: carbon, oxygen/hydrogen, nitrogen, sulfur, phosphorous, and trace metals, and how they are interconnected from terrestrial, aquatic/ocean, and atmospheric perspectives. General chemistry concepts such as equilibrium, free energy, electrochemistry are used to understand the energetics of the cycles. Connection between the cycles and environmental problems, such as climate change and air pollution will be emphasized.

Learning Outcomes: 1. Construct a mental model of the Earth system and the flow of elements among different parts of the system. 2. Examine modern problems caused by human perturbation of the main biogeochemical cycles. 3. Perform basic research tasks and present scientific findings. Credits: 3.00

EAPS 39500 - Astrobiology

Credit Hours: 3.00. Course explores current ideas on how life originated on Earth and may have originated elsewhere in the universe. Lectures will cover zones of habitability in stellar systems, planetary surface and atmosphere evolution and the environment of the early Earth. Topics include how life on Earth functions and its earliest evolution, SETI, planetary quarantine, panspermia, mass extinctions and the potential for life elsewhere in our own solar system.

Learning Outcomes: 1. Know the outlines of how life developed on the Earth, the principal requirements for life to originate and persist, what features makes a planet (in our system or around other stars) habitable for life. 2. Understand how extrasolar planets are found and what limitations exist in our knowledge of those planets. 3. Understand how NASA is seeking for life on Mars and elsewhere in the solar system, why we are concerned about quarantining spacecraft and returned samples. 4. Acquainted with the rationale and methods of the SETI search for intelligent life in the universe. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course

takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

EAPS 50600 - Cosmochemistry And Geochemistry

Credit Hours: 3.00. The course focuses on the chemical processes involved in the formation and evolution of our solar system and our planet. The course includes discussion of nucleosynthesis and chemical abundances, the origin and composition of various planetary objects and their constituent materials, and the distribution and cycling of elements within and between different Earth systems, including the solid Earth, atmosphere, and oceans.

Learning Outcomes: 1. Understand the cosmochemical model for solar system formation. 2. Become familiar with the inventory of planetary materials in our solar system and understand their characteristics. 3. Understand what causes the first order distribution of elements in different parts of the Earth and other planetary bodies. 4. Apply principles of thermodynamics and reaction kinetics to predict the physical and chemical characteristics of Earth and planetary materials. 5. Understand how chemical exchange between the solid earth, biosphere, and ocean-atmosphere affect the evolution of the Earth system. 6. Analyze laboratory data to gain insight geochemical and cosmochemical processes. 7. Identify outstanding questions in the primary cosmochemistry and geochemistry literature and propose what new observations, data, and/or models could be used to address these questions. Credits: 3.00

EAPS 36700 - Survey Of Planetary Atmospheres

Credit Hours: 3.00. This course is intended to serve as an introduction to the diversity of planetary atmospheres in our solar system and beyond for those without an atmospheric science background. Topics to be covered in this class include: The basic structure and properties of an atmosphere, how planetary atmospheres form / are eroded, the balance of radiation and its effect on atmospheric motions, the presence and formation of hazes, clouds, and aerosols, fundamental atmospheric compositions and chemistry, the connections between planetary interiors, surfaces, and atmospheres, and how we measure and interpret observations of exoplanet atmospheres. To achieve this, we will learn about Earth's atmosphere and us our terrestrial template to compare, contrast, and explore the atmospheres of other astronomical bodies.

Learning Outcomes: 1. Gain familiarity with the different types of planetary bodies and the atmospheres that are present on them. 2. Recall the main properties of planetary atmospheres in our solar system. 3. Identify and apply the general properties of the atmospheres. 4. Understand the effect of radiation and distribution of energy in an atmosphere. 5. Recognize the importance of chemical reactions and pathways. 6. Identify the ways in which atmospheres are formed, lost, and evolved. 7. Make simple predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. Credits: 3.00

Notes

Economics Minor

Requirements for the Minor (15 credits)

Required Courses (6 credits)

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

Intermediate Theory Course (3 credits)

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

Economics Electives - Choose Two (6 credits)

ECON 49900 - Economics Capstone Research

Credit Hours: 3.00. The course combines experiential learning with a hands-on research project that unfolds over the course of a semester, serving as a culminating experience at the end of their degree program. The overarching objective of the capstone project is for students to understand how business problems can be addressed with empirical methods. This course is designed to help students develop a more comprehensive and integrative understanding of the major, apply their knowledge to develop and execute a methodologically rigorous research a project, and demonstrate their mastery of critical thinking and research skills they have acquired throughout their time in the major. In addition to a paper, completion of the research project may involve the presentation of the findings in a seminar or workshop setting.

Learning Outcomes: 1. Complete a high quality research paper that applies Economic analysis to a topic of particular interest to the student. 2. Develop a deep understanding of the roles that Economic theory and/or empirical analysis (Econometrics) play in creating high-quality economic analysis. 3. Identify the economics literature (journals, books, monographs, etc.) that relates to the research topic considered. Credits: 3.00

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 46600 - International Economics

Credit Hours: 3.00. Analyzes topics in international economics, using more advantage techniques and more detailed treatment than in ECON 37000 or 37100. While coverage varies somewhat with instructor, some topics could include: economic growth, innovation and technology transfer, and the role of multinational corporations.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade and finances. 2. Understand the perspective provided by economic analysis regarding the interaction between economic growth and international trade. 3. Identify insights economics analysis provides concerning the benefits and costs of technology transfer and the role of multinational corporations. Credits: 3.00

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The

analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 39000 - Junior Level Problems In Economics

Credit Hours: 1.00 to 4.00. Investigation into a specific topic area of economics. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 38500 - Labor Economics

Credit Hours: 3.00. The purpose of this course is to introduce important topics, theories, institutions, and policy issues relating to the functioning of labor markets. Topics to be considered include labor supply decisions, investments in human capital, compensating wage differentials, labor contract theory, unions, compensation programs, signaling in labor markets, the economics of unemployment, and government employment, retirement, and workplace safety.

Learning Outcomes: 1. Distinguish the major determinants of labor market participation and hours worked. 2. Analyze how welfare programs and business cycles affect labor supply. 3. Derive the short and long term demand for labor. 4. Construct a detailed demand and supply model of the labor market. 5. Find the equilibrium labor market outcomes in the context of the neoclassical model 6. Analyze the role played by jobs' and workers' characteristics in generating wage differentials. 7. Develop a schooling model that explains human capital investment. 8. Distinguish factors that affect earnings inequality and labor market discrimination. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

ECON 36500 - History Of Economic Thought

Credit Hours: 3.00. The course traces the development of theories of value and economic growth from the seventeenth century to Karl Marx. Among the authors studied are the mercantilists, Hume, Smith, Ricardo, and Marx. Excerpts from the original works are read and evaluated in light of modern theory.

Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts

and theories to real world phenomena and policies. Credits: 3.00

ECON 36700 - Law And Economics

Credit Hours: 3.00. It has become increasingly clear to economists, legal scholars and political scientists that it is impossible to understand economic institutions without first having an understanding of the legal framework within which they operate. Similarly, it is impossible to understand the impact of law on society without first having an understanding of economic principles. This problem is further complicated by the fact that there are often ambiguities in the written law that lead to significant differences between what the law appears to say and how the law is interpreted in the courts. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions.

Learning Outcomes: 1. Understand better the relationship of Law and Economics, two different disciplines that both directly impact the business climate. 2. Learn how the concepts taught in this class apply in a real world setting. Credits: 3.00

ECON 32500 - Economics Of Sports

Credit Hours: 3.00. This class applies economic principles to the professional sports entertainment industry and its derivative input markets. The class begins by examining the microeconomics of demand for (by fans) and supply of (by teams) sports entertainment. The labor markets for the primary input, athletic talent, receive significant attention. Coordination among economic agents, taking the forms of leagues, players' unions, and government, is considered at the end of the class, with an emphasis on how they affect the efficiency of the markets related to sports entertainment. Quantitative empirical analysis is emphasized throughout the class. This is not a sports trivia or fantasy sports strategy class.

Learning Outcomes: 1. Solve models of how fans, teams, and players behave. 2. Describe and evaluate the structures of the markets for sports outputs and inputs, e.g., players. 3. Explain information presented in quantitative forms, e.g., equations, graphs, tables. 4. Analyze the effects of leagues' or governmental polices on market efficiency. 5. Communicate conclusions about sports output and input markets in numerical, graphical, tabular, and written forms. Credits: 3.00

ECON 36200 - Health Economics

Credit Hours: 3.00. This course is designed to introduce upper level undergraduate students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues using tools from intermediate microeconomic theory. The course begins with an analysis of health care as a commodity and why health is different from other consumer goods. The course then examines the demand for and the production of health and health care, and the behavior and organization of health care providers. The discussion then switches to information asymmetries and the functioning of health insurance markets. Afterwards, the course turns to the analysis of government involvement in the health care system. The class concludes with an examination of medical care systems around the world, paying particular attention to the U.S. health care system.

Learning Outcomes: 1. Describe the main economic theories relating to health and health care markets. 2. Apply economic theory to the analysis of health care policy and institutions. 3. Construct a detailed demand and supply model of the health insurance market. 4. Critically evaluate key policy issues in health and health care from an economic perspective. Credits: 3.00

ECON 37600 - Economics Of The European Union

Credit Hours: 3.00. Current economic structure of the European Union, and the economic challenges it is now facing.

Learning Outcomes: 1. Understand the background and current economic structure of the European Union, as well as the economic challenges it is now facing. Credits: 3.00

ECON 48500 - Economics Of Racial And Gender Discrimination

Credit Hours: 3.00. This course focuses on quantifying the extent of, and determining the underlying causes of racial and gender disparities in the labor market. Topics include the impact of prejudice on labor market outcomes, statistical discrimination, early childhood factors and differences in environment, and fertility and reproductive technology.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2.

Recognize the differences and importance of disparities that control and do not control for observable factors. 3. Understand the difference between prejudice and discrimination, and the extent to which prejudice can cause discrimination. 4. Assess how discrimination can occur even in the absence of prejudice. 5. Evaluate the impact of policies designed to reduce disparities, such as affirmative action. Credits: 3.00

ECON 32200 - Economics Of Public Policy

Credit Hours: 3.00. The examination and analysis of public finance practices and problems in the federal fiscal system. Government activities that involve spending and taxation are analyzed applying basic principles of economics. Topics include public education, social security, healthcare, environment and tax systems. State and local government issues are also addressed.

Learning Outcomes: 1. Explain how the provision of government goods and services through political institutions differs from market provision of goods and services. 2. Examine and analyze taxes and subsidies with and without market failure. 3. Examine and analyze various types of government expenditures on public education, health care, social security, income assistance, unemployment compensation, etc. 4. Explain how cost-benefit analysis can be used to help government choose among alternative investment projects. 5. Examine and analyze the impact of various types of taxes on the economy. Credits: 3.00

Notes

Electrical and Computer Engineering Minor

Requirements for the Minor (18 credits)

Applying for the Minor

Required Courses (15 credits)

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive

elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ECE 20008 - Electrical Engineering Fundamentals II Lab

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20002 Electrical Engineering Fundamentals II; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

Learning Outcomes: 1. Ability to competently select, use, and automate electronic measurement instruments. 2. Design, wire, and troubleshoot electronic circuits. 3. Ability to simulate electronic circuits. 4. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 5. Demonstrate knowledge of laboratory safety precautions. 6. Maintain laboratory notes and create professional experiment reports. Credits: 1.00

Selective Course - Choose One (3-4 credits)

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM

radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 32100 - Electromechanical Motion Devices

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Learning Outcomes: 1. Analyze/design electromagnetic circuits/devices. 2. Understand the concepts and principles of electromagnetic energy conversion. 3. Understand the concept of time-varying transformations in the analysis of time-varying systems. 4. Analyze dc machines. 5. Understand converters for dc drives. 6. Analyze brushless dc machines. 7. Analyze induction machines. Credits: 3.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system. Credits: 4.00

ECE 30411 - Electromagnetics I

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic

waves and transmission lines, which is continued in ECE 30412.

Learning Outcomes: 1. Work with electrostatic fields and find electric and potential fields from charge distributions including the presence of dielectric materials. 2. Work with magnetostatic fields and find magnetic fields from current distributions including the presence of magnetic materials. 3. Work with time varying fields including wave propagation. 4. Work with transmission lines in the time and frequency domains. Credits: 3.00

Electrical Engineering Technology Minor

About the Program

Requirements for the Minor (15 credits)

Required Courses (15 credits)

ECE 20700 - Electronic Measurement Techniques

Credit Hours: 1.00. Experimental exercises in the use of laboratory instruments. Voltage, current, impedance, frequency, and wave form measurements. Frequency and transient response. Elements of circuit modeling and design.

Credits: 1.00

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and

Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts,

devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

Pre-Requisite Information

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

Notes

Availability

Electronic and Time-Based Art Minor

Requirements for the Minor (15 credits)

A. Introduction to ETB (6 credits)

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

B. ETB Culture and Theory (3 credits)

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

C. ETB Selectives- Choose Two (6 credits)

AD 32600 - Physical Computing

Credit Hours: 3.00. Introduction to electronics and computer vision for artists. Students learn to create expressive audiovisual systems that can respond to events in the physical world (movement, light/temperature change, sound, touch, etc.) through custom interfaces.

Learning Outcomes: 1. Analyze key ideas in the field of Physical Computing by preparing a research presentation on the practice of an individual artist or collective. 2. Critique their own creative work as well as the work of their peers through group discussions. 3. Produce a variety of interactive artworks by the creative use of the Arduino microcontroller, simple electronic circuitry, and coding techniques. Credits: 3.00

AD 41700 - Variable Topics In Electronic And Time-Based Art

Credit Hours: 3.00. Examination of thematic or specialized

topics reflecting the most recent developments and contemporary artistic practices in Electronic and Time-Based Art. Permission of department required.

Learning Outcomes: 1. Use essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production. 2. Able to analyze key works and artists in the emerging field of Electronic and Time-Based Art. Credits: 3.00

Notes

Engineering and Public Policy Minor

A minor in Engineering and Public Policy is available to students in the College of Engineering.

Requirements for the Minor (21 credits)

Required Courses (15 credits)

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the

environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

IDE 49500 - Special Topics In Interdisciplinary Engineering

Credit Hours: 1.00 to 4.00. Primarily designed for interdisciplinary engineering subject areas for which there is no specific course offered, but for which there is sufficient student interest to justify teaching a specialized course on a trial basis. May be repeated for credit as long as the topic being taught is not repeated.

Credits: 1.00 to 4.00

ME 49200 - Technology And Values

Credit Hours: 3.00. The impact of science and technology on personal and societal value systems. The special responsibility of engineers. Practical methods for using human values to guide future technological developments. Societal problems considered: warfare, energy, overpopulation, resource depletion, and environmental degradation. Interdisciplinary approaches stressed. Offered in alternate years.

Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural

context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication.
Credits: 3.00

Additional Courses (6 credits)*

Public Policy (3 credits)

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.
University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.
Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.
University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.
Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.
Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.
Credits: 3.00

Technical (3 credits)

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution,

noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 36100 - Transportation Engineering

Credit Hours: 3.00. Transportation functions; transportation systems, including land, air, and marine modes; transportation system elements, including traveled way, vehicle, controls, and terminals; techniques of transportation system planning, design, and operation.

Credits: 3.00

CE 45700 - Air Pollution Control And Design

Credit Hours: 3.00. Fundamental concepts and design procedures for the removal of particulates, gases, and toxic air pollutants from waste gas streams. Problem assessment; characterization of exhaust gas streams; fan characteristics.

Credits: 3.00

CEM 48500 - Legal Aspects Of Construction Engineering

Credit Hours: 3.00. This course will cover legal principles and landmark cases relevant to civil and construction engineering. Specific subjects covered include contracts, torts, agency, professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties and ethics.

Learning Outcomes: 1. Read, comprehend and interpret construction contract plans and specifications for lock and dam facilities and other inland navigation structures. Through detailed study of project plans and specs as well as construction photos, students will be taken through the process of building these facilities from planning through construction. 2. Understand how a lock and dam facility functions. 3. Identify various components of lock and dam structures. 4. Understand various types of marine equipment necessary to construct a navigation facility in the dry or wet. Credits: 3.00

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical

responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

ABE 58000 - Advanced Processes In Biological Engineering

Credit Hours: 3.00. Physical and chemical structure of biomass. Reaction kinetics of hydrolysis of hemicellulose and cellulose to fermentable sugars. Fundamentals of ethanol production by fermentation. Separation of fermentation products into pure components.

Learning Outcomes: 1. Analyze bioprocesses using engineering design principles, bioreactor simulations, application of basic separations methods, and applying engineering economic analysis. 2. Develop process models for batch and continuous fermentation, cell culture, and enzymatic bioreactors. 3. Analyze the impact of fundamental advances in bio-sciences on bioprocess engineering and the environment, and the potential of these advances to solve societal problems. 4. Understand the impact of biosafety and regulatory considerations on process design. Credits: 3.00

ME 51400 - Fundamentals Of Wind Energy

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet, turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component machine and off-design performance. Inspection trip to industrial plan required.

Learning Outcomes: 1. Introduce students to the technology and economics of converting wind energy to electricity. 2. Inform students to the environmental concerns of wind energy. 3. Understand principles of wind turbine aerodynamics. 4. Develop the ability to design optimum blading. 5. Develop the ability to evaluate a potential site in terms of wind energy. 6. Understand wind turbine structural dynamics issues. Credits: 3.00

ME 52900 - Sustainable Energy Options And Analysis

Credit Hours: 3.00. This course develops an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. A range of different technologies and approaches are presented for meeting future energy needs. Students learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics and gain experience in assessing different energy technologies for specific case studies.

Learning Outcomes: 1. Gain an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. 2. Gain an understanding of alternative technologies for meeting future energy needs. 3. Learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics. 4. Gain experience in assessing different energy technologies. Credits: 3.00

EEE 45600 - Wastewater Treatment Processes

Credit Hours: 3.00. (CE 45600) Fundamental design principles and practice of wastewater treatment to prepare students for designing wastewater treatment systems. The major topics include design and construction process, preliminary treatment

of wastewater, primary treatment, wastewater microbiology, secondary treatment, nitrogen removal, phosphorus removal, attached microbial growth, secondary settling, disinfection and post-aeration, tertiary treatment, and wastewater plant residuals management.

Learning Outcomes: 1. Understand design principles and practice of wastewater treatment. 2. Apply the knowledge to select the best process to treat wastewater. 3. Design a wastewater treatment component or process to meet water quality goals. 4. Critically review relevant literature or contemporary issues in wastewater treatment. Credits: 3.00

CE 45600 - Wastewater Treatment Processes

Credit Hours: 3.00. (EEE 45600) Fundamental design principles and practice of wastewater treatment to prepare students for designing wastewater treatment systems. The major topics include design and construction process, preliminary treatment of wastewater, primary treatment, wastewater microbiology, secondary treatment, nitrogen removal, phosphorus removal, attached microbial growth, secondary settling, disinfection and post-aeration, tertiary treatment, and wastewater plant residuals management.

Learning Outcomes: 1. Understand design principles and practice of wastewater treatment. 2. Apply the knowledge to select the best process to treat wastewater. 3. Design a wastewater treatment component or process to meet water quality goals. 4. Critically review relevant literature or contemporary issues in wastewater treatment. Credits: 3.00

EEE 38000 - Environmental Chemodynamics

Credit Hours: 3.00. Introduction to chemical thermodynamics and general equilibrium processes in environmental and ecological engineering systems. Introduction to the first and second laws of thermodynamics; properties of pure substances; ideal and real gases; thermodynamic cycles and processes; heat transfer and combustion; and chemical equilibrium in aquatic solutions, including equilibria between phases and reaction equilibria. Emphasis is on understanding and conceptualizing important processes, and competency in thermodynamic calculations.

Learning Outcomes: 1. Apply the First and Second Laws of thermodynamics to closed and open systems. 2. Understand, identify, and quantify the environmental impacts of closed and open systems, based on mass and energy transfer. 3. Analyze full-scale systems, and compare actual and theoretical operation. 4. Understand the structure and reactivity of environmentally relevant organic compounds. 5. Calculate concentrations of different components in equilibrium and non-equilibrium environmental systems. Credits: 3.00

Notes

English Minor

Requirements for the Minor (15 credits)

A. Required English Course - Choose One (3-4 credits)

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research

and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

B. 20000 Level or Above (11-12 credits)

Notes

Environmental and Ecological Engineering Minor

Requirements for the Minor (17-18 credits)

Required Courses (11-12 credits)

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight

into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

ENTM 31100 - Insect Ecology

Credit Hours: 3.00. Insect ecology investigates the fundamental concepts of ecology as they relate to insects, including insect interactions, other insects and their environment. Topics include population and community ecology, plant-insect interactions, insect biodiversity and biogeography, and theoretical and applied ecology. Examples from current entomological and ecological studies are used. Completion of college biology or an introductory course in entomology is recommended.

Learning Outcomes: 1. Comprehend ecological principles at different scales of biological organization, from the individual to the population to the community to the ecosystem.

2. Understand the mechanisms that mediate interactions of insects with their biotic and abiotic environments. 3. Appreciate the importance of insects as stabilizing and destabilizing components of food webs. 4. Recognize the value and application of insect ecology n solving real-world problems. 5. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems.

3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population

and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

EEE 53000 - Life Cycle Assessment: Principles And Applications

Credit Hours: 3.00. This course covers the basic concept of life cycle thinking, framework and computational structure of process and economic input-output based life cycle assessment (LCA), state-of-the-art LCA software tools, industrial case studies, and recent advances in LCA methodology. Students are required to complete a group project that could potentially facilitate the adaptation of LCA tools in engineering research, education, or practice.

Learning Outcomes: 1. Conduct an LCA study using state-of-the-art software tools and databases according to ISO I4040 standards. 2. Identify the limitations and weakness of an existing LCA study. 3. Develop customized inventory dataset using information available in literature and current inventory databases. 4. Develop a simplified yet functional LCA

software tool tailored for an enterprise or organization. 5. Combine LCA results with economic and social impact analysis to support decision making. Credits: 3.00

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering design proposal. Credits: 3.00

Selective Courses (6 credits minimum)

Notes

Environmental Politics and Policy Minor

Requirements for the Minor (12 credits)

Required Course (3 credits)

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

Selective Courses - Choose Three (9 credits)

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 42900 - Contemporary Political Problems

Credit Hours: 3.00. Contemporary political problems in the United States affecting the interpretation of democracy, human rights and welfare, social pressures, and intergovernmental relations.

Credits: 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

Notes

Event and Meeting Management Minor

Requirements for the Minor (15 credits)

Required Courses (15 credits)

HTM 17300 - Tourism Systems

Credit Hours: 3.00. Tourism is a global phenomenon impacting destination communities, incorporating a range of hospitality-related businesses and organizations, and enriching the lives of tourists and residents alike. This course examines key elements of tourism systems, how these elements interact to deliver unique travel experiences, and how destination stakeholders can use tourism for sustainable development. The course will strengthen students' understanding of tourism systems while preparing them to successfully engage in it for a variety of career options in tourism and hospitality industries.

Learning Outcomes: 1. Explain the tourism system including the roles of travelers, tourism businesses and destinations, and other tourism system components. 2. Describe the impacts of tourism and the basic components of sustainable tourism practices. 3. Identify the key principles of destination marketing and management. 4. Describe key factors that influence consumer travel behavior including personal, interpersonal, and environmental factors. 5. Describe how to apply experience design principles to develop tourism products, services, and experiences. Credits: 3.00

HTM 16200 - Introduction To Event And Meeting Planning Industry

Credit Hours: 3.00. Upon completion of this course, students will have a comprehensive overview of the event and meeting industry. Topics will include the supply and demand side of event and meeting management, the basic planning process needed for any event or meeting, sustainability, business ethics, and keeping pace with current industry trends through guest lectures from event and meeting planners.

Learning Outcomes: 1. Develop a comprehensive overview of the essential supply and demand components of the event industry including corporations, associations, and the government in terms of organization, type, decision makers, attendees, and marketing efforts. 2. Compare and contrast the advantages and disadvantages of major venues of hotels, convention centers, conference centers, cruise ships, and unusual venues to those who demand and plan events. 3. Identify the key players and pioneers of the event planning industry. 4. Identify the basic needs of event planners and consumers. 5. Identify the basic principles and concepts of sustainability as applied to the event management industry. 6. Summarize the major characteristics of event planning with respect to planning, directing, organizing, controlling and assessing events. 7. Identify ethical business practices associated with the event industry. Credits: 3.00

HTM 26200 - Festivals And Special Events

Credit Hours: 3.00. This course offers a comprehensive overview of the theory and procedures associated with the coordination of festivals and special events. Essential topics will include the conceptualization, planning, coordination, sponsorship, marketing, funding, staffing, legal issues, and assessment of festivals and special events. Students will gain hands-on experience by volunteering to work a minimum of six hours to set up, help coordinate, or tear down a large-scale festival or special event.

Learning Outcomes: 1. Classify the types and purpose of festivals and special events. 2. Compare and contrast traditional events and meetings to festivals and special events. 3. Develop a basic understanding of the size and scope and the employment potential of festivals and special events. 4. Describe the key steps necessary to plan, manage, staff, organize, and assess the stated objectives of a festival or special event. 5. Knowledge of economic, financial, and accounting principles and

practices of festivals and special events. 6. Apply the principles of sustainability to festivals and special events. 7. Read relevant research and apply it to festival and special events management. 8. Differentiate between ethical and non-ethical business practices. Credits: 3.00

HTM 36200 - Event And Meeting Management

Credit Hours: 3.00. The principles and practices of event and meeting management will be covered in this course, including: strategic event planning process, project management, risk management, financial management, human resources, stakeholder management, meeting or event design, site location and management, marketing, professionalism, and ethics. Students will gain hands-on experience planning, directing, organizing and controlling a small-scale event.

Learning Outcomes: 1. Determine the purpose of a meeting and identify the relationship of a meeting to organizational strategy. 2. Develop and manage a budget for a meeting/event. 3. Develop the complete plan to meet the goals and objectives of the event (such as reserving rooms, securing meeting space, transportation, and food and beverage). 4. Review the event to determine if the goals and objectives were met. 5. Differentiate between ethical and non-ethical business practices. 6. Work with a team to plan, direct, organize and control a small scale event. Credits: 3.00

HTM 46200 - Advanced Event And Meeting Management

Credit Hours: 3.00. Advanced aspects of meeting and event management principles and practices will be covered in this course. A focus is placed on: strategic planning, project management, finance and risk management, event design, site management, and ethics.

Learning Outcomes: 1. Formulate mission, goals and objectives to ensure effective meeting management and monitor and evaluate activities to ensure they meet desired outcomes and contribute to event effectiveness and sustainability. 2. Management meeting or event to achieve mission, goals and quality standards within the meeting's scope, time and budget. 3. Prepare and determine program components and sequence; development selection criteria for, negotiate and execute contracts for speakers; determine food and beverage requirements; design environment (themes and decor) and requirements for staging and technical equipment and production; develop admittance credential systems and related crowd management control systems. 4. Develop, monitor and revise project budget; monitor revenue streams and cash flow; make ongoing effective decisions and wise resource allocations; manage registration processes. 5. Identify and analyze risks for a specific meeting. 6. Develop and implement risk management plans to reduce the probability and impact of undesirable situations. 7. Differentiate between ethical and non-ethical business practices. Credits: 3.00

Notes

Farm Management Minor

Requirements for the Minor (18 credits)

Required Courses (13 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 41100 - Farm Management

Credit Hours: 4.00. Principles of farm organization and management, farmer interviews, and the application of computerized farm decision-making methods.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Selective Courses (5 credits)

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 30500 - Agricultural Prices

Credit Hours: 3.00. Analysis of prices and the movement of farm product prices; relations of farm product prices to farm input and other prices; conceptual and statistical analysis of agricultural supply and demand relationships; application of price analysis, price forecasting, agricultural outlook, agricultural policy; adjustment of farming to new price conditions.

Learning Outcomes: 1. Understand economic principles that determine prices in markets. 2. Provide knowledge of markets and the entities and factors that impact market equilibrium outcomes. 3. Apply economic principles and empirical estimation tools to inform decision-making. Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming

solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 41200 - Farm Business Management Workshop

Credit Hours: 1.00 to 3.00. Making decisions regarding the organization and operation of farm businesses with which students will be associated after graduation. Areas of decision-making include enterprise selection, farm growth, organizing large-scale farms, communication, labor management, machinery management, operating agreements, legal organization, and tax strategies.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 1.00 to 3.00

AGEC 42100 - Advanced Commodity Marketing

Credit Hours: 3.00. Application of commodity marketing principles to grain, livestock, and other commodity sectors. Applications include hedging, speculation, risk management, and fundamental and technical price analysis. Examination and testing of pricing strategies and the development of commodity marketing plans.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply

social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42500 - Estate Planning And Property Transfer

Credit Hours: 3.00. The ownership and transfer of farm business property. Includes tax and other implications of life estates, trust arrangements, sale of property, and charitable contributions.

Credits: 3.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGEC 45600 - Federal Income Tax Law

Credit Hours: 3.00. Introduction to the federal income tax laws applicable to individuals and small business with emphasis on the farming business. The course includes management implications and the policy basis for the tax law system. Techniques and practice for the preparation of selected forms will be included. There will be limited exposure to taxation of partnerships, corporations, estates, and to federal gift and estate tax law.

Learning Outcomes: 1. Develop an understanding of the federal income tax law: for individuals and small businesses and for economic and financial decision making. 2. Gain an understanding of the management opportunities for the income tax law and how they can be applied by individuals, families, and small businesses. 3. Develop the ability to analyze facts for tax law alternatives and to communicate tax planning alternatives. Credits: 3.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

AGEC 52400 - Agricultural Finance

Credit Hours: 3.00. Designed to provide students the concepts and tools to apply financial management principles to farm businesses. Topics include financing alternatives, preparation and interpretation of financial statements, and capital investment analysis using discounted cash flows.

Learning Outcomes: 1. Prepare, interpret, and analyze financial statements used for agricultural businesses. 2. Analyze and suggest methods to improve the financial performance of agricultural businesses. 3. Evaluate capital investments using discounted cash flow methods. 4. Describe and analyze the risk and returns faced by agricultural businesses. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Notes

Fermentation Sciences Minor

About the Minor

Requirements for the Minor (18 credits)

Required Courses (3 credits)

FS 16300 - Introduction To Fermentation Sciences

Credit Hours: 3.00. This course will provide an overview of the use of microorganisms in the food, pharmaceutical and chemical industries. The course will introduce fundamental concepts associated to the microbiological transformation of various substrates to produce desirable products such as foods, beverages, pharmaceuticals or chemical compounds. As an introductory course, the scientific principles of fermentation processes will be gradually introduced through the analysis of familiar fermented food products, such as bread, cheese, beer, wine, cocoa, coffee, etc. Once the fundamental concepts are learned, examples of advanced fermentation technology for production of pharmaceutical products and fine chemicals will be presented.

Learning Outcomes: 1. Explain the role of microorganisms in the transformation of various substrates into desirable products. 2. Identify the type of microorganism (bacteria, yeast or mold) involved in the production of various fermented foods and beverages. 3. Explain the impact of environmental processing conditions (T, pH, aw, O2) on microbial growth. 4. Recognize the similarities across a wide variety of products made through fermentation. Credits: 3.00

Minor Selectives - Choose Two (6 credits)

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection

and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to

efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

Additional Courses (9 credits)

ABE 30400 - Biological Engineering Laboratory

Credit Hours: 3.00. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Learning Outcomes: 1. Understand and analyze the flow behavior in biological systems. 2. Understand and analyze enzymatic reasons in biological systems. 3. Understand and analyze fermentation processes. 4. Understand and analyze mixing and heat transfer in biological systems. 5. Collect and analyze rheological properties. 6. Design and safely execute experiments in a process laboratory. 7. Collection and statistical analysis of experimental data. 8. Present the results of analysis in the form of written report and oral presentation. Credits: 3.00

FS 47000 - Wine Appreciation

Credit Hours: 3.00. A study of wine production and marketing principles with an emphasis upon consumption responsibility. Historical perspectives form the foundations for wine classification systems and traditional serving procedures. Cardinal scale sensory evaluations are conducted in relationship to various food pairings. Must be 21 years of age or older to register for this course. Permission of department required.

Learning Outcomes: 1. Understand the nature of wine - its production, history, uses and related responsibilities. 2. Develop the ability to recognize different classes, types, and origins of wines. 3. Learn proper etiquette and tasting techniques. 4. Gain direct experience, both individually and as part of a team, in adopting these manners and methods. Credits: 3.00

FS 49100 - Special Assignments In Food Science

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who desire to study special problems in science not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 3.00

GER 28000 - German Special Topics

Credit Hours: 3.00. Selected topics on the civilization and culture of German speaking countries. Lectures and readings all in English. No knowledge of German necessary.

Learning Outcomes: 1. Students will explore in depth a particular aspect of life in German-speaking countries, leading to their increased

understanding not only of those cultures, but also, by comparison, of their own culture. Credits: 3.00

ABE 58000 - Advanced Processes In Biological Engineering

Credit Hours: 3.00. Physical and chemical structure of biomass. Reaction kinetics of hydrolysis of hemicellulose and cellulose to fermentable sugars. Fundamentals of ethanol production by fermentation. Separation of fermentation products into pure components.

Learning Outcomes: 1. Analyze bioprocesses using engineering design principles, bioreactor simulations, application of basic separations methods, and applying engineering economic analysis. 2. Develop process models for batch and continuous fermentation, cell culture, and enzymatic bioreactors. 3. Analyze the impact of fundamental advances in bio-sciences on bioprocess engineering and the environment, and the potential of these advances to solve societal problems. 4. Understand the impact of biosafety and regulatory considerations on process design. Credits: 3.00

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

FS 59100 - Special Topics

Credit Hours: 1.00 to 3.00. Specialized topics not covered in other courses will be offered as one-credit minicourses. Topics, requirements, and credits will be determined yearly. Permission of instructor required.

Credits: 1.00 to 3.00

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting pertinent information from scientific journal articles. Credits: 2.00

ANTH 25600 - Archaeology Of Beer

Credit Hours: 3.00. Alcoholic beverages are an important aspect of foodways, the cultural practices and values surrounding food and drink. This course provides an overview of the ancient origins of beer and other alcoholic beverages globally, and examines the cultural context and social role of these innovations through a combination of archaeology, material culture studies, historical texts, and ethnography. In addition to examining archaeological case studies of the production and consumption of beer and other alcoholic beverages, topics to be covered include: evolution of brewing and fermenting technology, biology and chemistry of brewing and fermentation, residue and materials analysis, origins of agriculture, emergence of social complexity, sexual division of labor, social identity (gender, class, ethnicity), and recent trends in production and consumption.

Learning Outcomes: 1. Identify the role of Anthropology in understanding the production and consumption of alcohol in cultures past and present. 2. Evaluate several different theoretical and methodological approaches within the field of Archaeology. 3. Assess and debate the role that the innovation of alcohol might have played in the origins of agriculture and social complexity in different times and places in the past. 4. Analyze and explain innovations in brewing technology over time. 5. Describe and

explain the way in which identity is shaped by the production and consumption of beer. These learning outcomes will be achieved by reading, evaluating, and summarizing course material (lectures, readings, and films) at regular intervals throughout the course and by engaging in regular group discussions. 6. Outcomes will be assessed by examining student performance on quizzes, exams, and article summaries, as well as participation in class discussion. Credits: 3.00

FS 37200 - Fermentation Microbiology

Credit Hours: 3.00. This course explores the principles underlying the design of microbes for their use in biotechnological applications. This project-based course will teach students fundamental molecular biology techniques, important parameters for strain selection and genetic engineering, and reactor design and operation in bioprocessing. Additionally, this course will cover today's diverse bioengineering goals and tools and the role of microbial biotechnology in society.

Learning Outcomes: 1. Articulate the concept of microbial cell factories and the relationship of microorganisms to food and industrial fermentations. 2. Identify genetic and environmental approaches to control the products, rate, and yield of bioconversion. 3. Understand microbial metabolic pathways and how they are engineered. 4. Design genetic strategies to engineer microbes. 5. Read primary literature relevant to fermentation biotechnology. Credits: 3.00

FS 37300 - Fermentation Microbiology Laboratory

Credit Hours: 1.00. The course provides a laboratory-based experiential learning experience with the learning of fundamental aspects of genetic, physiological and substrate manipulation to achieve product formation in industrial microbes.

Learning Outcomes: 1. Understand the genetic manipulation and physiological factors involved in successful fermentation approaches. 2. Apply various methods of monitoring growth of various bioreactor formats. 3. Manipulate and correlate growth with yield of organisms and products. 4. Identify the basic problems which cause fermentation processes to fail and understand the reasons for failure. 5. Create and troubleshoot a simple fermentation process. Credits: 1.00

FS 38100 - Industrial Fermentation Products

Credit Hours: 1.00. Industrial Fermentation Products introduces students to microbial fermentations employed in the biofuels and fine chemicals industry and their role in the larger bioeconomy. Students will be introduced to diverse final products, technical challenges in the sector, and the individuals and companies working to solve them. We end our five-week module with a field trip to a local biorefinery plant.

Learning Outcomes: 1. Identify the key products of industrial fermentations and their markets. 2. Articulate the major technical and economic challenges facing the industrial fermentations sector. 3. Research and understand fermentation production processes for a specific molecule of interest. 4. Interact with fermentation scientists in the biofuels, biochemicals, and polymers sector. Credits: 1.00

FS 38300 - Fermented Beverage Products

Credit Hours: 1.00. This course will allow students to learn and integrate concepts from microbiology, biochemistry, and processing used in the production of representative fermented beverages. Students will learn how to design and make specific fermented beverages. Must be 21 years of age or older. Permission of department required.

Learning Outcomes: 1. Explain the role of specific microorganisms (lactic acid bacteria, yeasts) in the transformation of specific substrates into fermented beverages. 2. Explain the chemical and biochemical changes whereby specific substrates are converted into fermented beverages. 3. Understand the interdisciplinary nature of fermentative processes by integrating food safety, nutrition, microbiology, economic, and regulatory considerations in process design. 4. Design a laboratory scale process to

produce a fermented beverage of their choice. Credits: 1.00

FS 40100 - Fermentation Processing

Credit Hours: 2.00. The Integration of fermentation core concepts; the application of bioprocess engineering principles to biological systems; topics covering enzyme kinetics, fermentation, downstream processing, and integrated bioprocesses important to industries.

Learning Outcomes: 1. Understand applications and solve problems relating to the use of enzymes for industrial bioprocessing. 2. Apply engineering principles to address issues in fermentation processes. 3. Analyze and identify limiting factors in a bioprocess. 4. Explain and solve problems relating to mass and energy balances in biological reactors. 5. Explain how fermentation processing is used in various fields. Credits: 2.00

FS 40200 - Fermentation Processing Laboratory

Credit Hours: 1.00. The essential concepts of industrial bioprocessing with a focus on the physiology of fermentation; a series of laboratory experiments that follow value-adding processes from conception to completion.

Learning Outcomes: 1. Learn laboratory techniques, to design and conduct experiments, and to analyze and interpret data. 2. Design appropriate bioreactor models based upon bioproducts and other process criteria. 3. Conduct fermentation experiments with process optimization and scale-up. 4. Model the growth of microorganisms in batch, fed-batch, and continuous flow processes. 5. Gain an overview of the fermentation industry. Credits: 1.00

ABE 32700 - Biotechnology Laboratory II

Credit Hours: 2.00. The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (http://www.hhmi.org/grants/sea/) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (www.phagesdb.org and the Purdue institution page can be found here: https://phagesdb.org/institutions/PURD/).

Learning Outcomes: 1. Analyze the genetic code of a unique phage in order to determine potential genes. 2. Discover the genomic organization of their unique phage. 3. Use algorithms to define potential genes, assign putative functions to them, and determine the order in which they appear in the genome. 4. Read and discuss scientific literature related to their research project. 5. Share the information gathered with others in the scientific community. Credits: 2.00

Film & Video Studies Minor

Requirements for the Minor (15 credits)

A. Required course (3 credits)

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

B. Choose Two (6 credits)

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema.

The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

GER 33000 - German Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of major German contributions to the cinema from the earliest period to the present. Emphasis on relevant aesthetic theories and on the schools of literature and painting that served as sources. Evaluation of the German film on the basis of social, artistic, and political criteria. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify and describe the major movements and trends of German film history of the 20th and 21st centuries. 2. Analyze the cinematography of representative German films. 3. Interpret the explicit and implicit meanings of representative German films. Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

LC 33300 - The Middle Ages On Film (UCC: HUM)

Credit Hours: 3.00. Introduction to the Middle Ages through films in various languages and genres from the beginning of film history to the present. Reading literary, historical, legal, and film theory texts in conjunction with the films, students critically analyze representations of the Middle Ages and the cultural context from which these emerge.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

LC 33800 - Language Through Films

Credit Hours: 3.00. The course critically explores language(s) via the medium of cinema where language plays a key role in the film. It is intended to introduce students to the fundamental place language occupies within human experience, to advance knowledge of some of the features of the system of language, develop a sharper ear for language, a better understanding of its nature, and a livelier interest in all its manifestations. The course will be taught in English and films will be shown with subtitles.

Learning Outcomes: 1. Identify the main building blocks of language. 2. Examine the universal characteristics of the many languages humans speak. 3. Appraise the relationship between language, cognition, emotion and world view. 4. Re-evaluate their thinking regarding the acquisition of a second language. 5. Access the significant position language plays within societies and cultures. Credits: 3.00

ARAB 33000 - The Middle East On Film

Credit Hours: 3.00. This course offers an introduction to films produced in the Middle East and on Middle Eastern Cultures. In this class, we will view films from the Arab world, including North Africa, and the large Middle Eastern region. Parallel to film screening, students will read critical and analytical material that provide background as well as commentary and analysis of cultural and historical contexts on content of films and their making. The course will examine a series of topics such as identity politics, religious affiliation, gender, immigration, belonging, homeland and exile. We will also situate the films within the aesthetic traditions of production and reception and analyze how they provide critical perspectives and insights in central issues in the cultures of Middle Eastern cultures. The overarching goal of the class is to provide students with a solid understanding of the function of cinema and films in representation of the evolution and transformation of the cultures and societies of the region and the issues central to how communal and individual identities in the Middle Eastern region are shaped. The class will also equip the students with skills to analyze meaning making and the role of technical aspects such as cinematography, body language, script, setting and acting in the creation of characters. All films will be screened with English subtitles.

Learning Outcomes: 1. Assess formal and technical elements of Middle Eastern film cultures. 2. Analyze how social and cultural themes are represented in visual means and through the screen. 3. Identify and explain the important aspects of film making in the film industries of the region. 4. Construct critical responses to how cinematic work uses aesthetics to mediate culture. 5. Evaluate the role of films in articulating major shifts and movements in the cultures of the region. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

FLM 29103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

C. Choose Two (6 credits)

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

ENGL 27600 - Shakespeare On Film (UCC: HUM)

Credit Hours: 3.00. Considers the relation of the written text of five or six Shakespeare plays to multiple film versions from a wide variety of times and cultures, e.g., the United States, England, France, Italy, Japan, Denmark, India, and Russia. Typically offered Fall Spring Summer.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explore a selected set of Shakespeare's plays through a comparative analytical lens. 2. Compare and contrast various film versions of Shakespeare's plays in their respective contexts. 3. Respond to the films and written texts through reflective and critical writings and discussions. Credits: 3.00

ENGL 28600 - The Movies (UCC: HUM)

Credit Hours: 3.00. Introduction to the movies from classic to contemporary films. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to classic and contemporary films. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about classic and contemporary films based on appropriate use of evidence. Credits: 3.00

ENGL 38600 - History Of Film To 1950

Credit Hours: 3.00. This survey crosses the divide between the silent film era and the "talkies" to explore narrative, experimental, and documentary styles of feature films from the 1890s to 1950.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to film from its origins through the mid-twentieth century. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 38700 - History Of Film Since 1950

Credit Hours: 3.00. A survey of narrative, experimental, and documentary styles of feature films from the mid-twentieth century to the present.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to films from the mid-twentieth century. 2. Identify and articulate connections among these topics and conventions as they relate to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-1950 films based on appropriate use of evidence. Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

EAPS 10600 - Geosciences In The Cinema (UCC: STS)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about natural hazards based on the depictions of such hazards in movies. Topics include earthquakes, tsunamis, volcanoes, tornadoes, hurricanes, climate change, asteroid impacts, space exploration, and

wildfires. The course focuses on the accuracy of the depiction of natural hazards in the movies, the underlying processes that control their formation and the dangers they represent, how they influence society, and how students can prepare for them and keep themselves safe.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how scientists explore natural hazards, make observations, and develop theories. 2. Explain the processes that control natural hazards and where and when they are likely to occur. 3. Know the natural hazards inherent to a student's location and be able to plan how to keep themselves safe in the event of such an occurrence. 4. Critically assess the reasonableness of depictions of natural hazards in the media. Credits: 3.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they invoke. 3. Apply feminist and queer theorizing of gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

FLM 29108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

A. Required course (3 credits)

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required course (3 credits)

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform

their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

B. Choose Two (6 credits)

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

GER 33000 - German Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of major German contributions to the cinema from the earliest period to the present. Emphasis on relevant aesthetic theories and on the schools of literature and painting that served as sources. Evaluation of the German film on the basis of social, artistic, and political criteria. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify and describe the major movements and trends of German film history of the 20th and 21st centuries. 2. Analyze the cinematography of representative German films. 3. Interpret the explicit and implicit meanings of representative German films. Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

LC 33300 - The Middle Ages On Film (UCC: HUM)

Credit Hours: 3.00. Introduction to the Middle Ages through films in various languages and genres from the beginning of film history to the present. Reading literary, historical, legal, and film theory texts in conjunction with the films, students critically analyze representations of the Middle Ages and the cultural context from which these emerge.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical mind over the political, social and cultural issues presented in cinema. Credits: 3.00

LC 33800 - Language Through Films

Credit Hours: 3.00. The course critically explores language(s) via the medium of cinema where language plays a key role in the film. It is intended to introduce students to the fundamental place language occupies within human experience, to advance knowledge of some of the features of the system of language, develop a sharper ear for language, a better understanding of its nature, and a livelier interest in all its manifestations. The course will be taught in English and films will be shown with subtitles.

Learning Outcomes: 1. Identify the main building blocks of language. 2. Examine the universal characteristics of the many languages humans speak. 3. Appraise the relationship between language, cognition, emotion and world view. 4. Re-evaluate their thinking regarding the acquisition of a second language. 5. Access the significant position language plays within societies and cultures. Credits: 3.00

ARAB 33000 - The Middle East On Film

Credit Hours: 3.00. This course offers an introduction to films produced in the Middle East and on Middle Eastern Cultures. In this class, we will view films from the Arab world, including North Africa, and the large Middle Eastern region. Parallel to film screening, students will read critical and analytical material that provide background as well as commentary and analysis of cultural and historical contexts on content of films and their making. The course will examine a series of topics such as identity politics, religious affiliation, gender, immigration, belonging, homeland and exile. We will also situate the films within the aesthetic traditions of production and reception and analyze how they provide critical perspectives and insights in central issues in the cultures of Middle Eastern cultures. The overarching goal of the class is to provide students with a solid understanding of the function of cinema and films in representation of the evolution and transformation of the cultures and societies of the region and the issues central to how communal and individual identities in the Middle Eastern region are shaped. The class will also equip the students with skills to analyze meaning making and the role of technical aspects such as cinematography, body language, script, setting and acting in the creation of characters. All films will be screened with English subtitles.

Learning Outcomes: 1. Assess formal and technical elements of Middle Eastern film cultures. 2. Analyze how social and cultural themes are represented in visual means and through the screen. 3. Identify and explain the important aspects of film making in the film industries of the region. 4. Construct critical responses to how cinematic work uses aesthetics to mediate culture. 5. Evaluate the role of films in articulating major shifts and movements in the cultures of the region. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

FLM 29103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

C. Choose Two (6 credits)

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

ENGL 27600 - Shakespeare On Film (UCC: HUM)

Credit Hours: 3.00. Considers the relation of the written text of five or six Shakespeare plays to multiple film versions from a wide variety of times and cultures, e.g., the United States, England, France, Italy, Japan, Denmark, India, and Russia. Typically offered Fall Spring Summer.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explore a selected set of Shakespeare's plays through a comparative analytical lens. 2. Compare and contrast various film versions of Shakespeare's plays in their respective contexts. 3. Respond to the films and written texts through reflective and critical writings and discussions. Credits: 3.00

ENGL 28600 - The Movies (UCC: HUM)

Credit Hours: 3.00. Introduction to the movies from classic to contemporary films. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to classic and contemporary films. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about classic and contemporary films based on appropriate use of evidence. Credits: 3.00

ENGL 38600 - History Of Film To 1950

Credit Hours: 3.00. This survey crosses the divide between the silent film era and the "talkies" to explore narrative, experimental, and documentary styles of feature films from the 1890s to 1950.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to film from its origins through the mid-twentieth century. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 38700 - History Of Film Since 1950

Credit Hours: 3.00. A survey of narrative, experimental, and documentary styles of feature films from the mid-twentieth century to the present.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to films from the mid-twentieth century. 2. Identify and articulate connections among these topics and conventions as they relate to their diverse

historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-1950 films based on appropriate use of evidence. Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

EAPS 10600 - Geosciences In The Cinema (UCC: STS)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about natural hazards based on the depictions of such hazards in movies. Topics include earthquakes, tsunamis, volcanoes, tornadoes, hurricanes, climate change, asteroid impacts, space exploration, and wildfires. The course focuses on the accuracy of the depiction of natural hazards in the movies, the underlying processes that control their formation and the dangers they represent, how they influence society, and how students can prepare for them and keep themselves safe.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how scientists explore natural hazards, make observations, and develop theories. 2. Explain the processes that control natural hazards and where and when they are likely to occur. 3. Know the natural hazards inherent to a student's location and be able to plan how to keep themselves safe in the event of such an occurrence. 4. Critically assess the reasonableness of depictions of natural hazards in the media. Credits: 3.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they invoke. 3. Apply feminist and queer theorizing of gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

FLM 29108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

A. Required course (3 credits)

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create

productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

Finance Minor

About the Minor

Requirements for the Minor (15 credits)

Required Courses (9 credits)

MGMT 41300 - Corporate Finance

Credit Hours: 3.00. The course provides the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending, or investment banking setting. Topics include corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition, and mergers/acquisition.

Learning Outcomes: 1. Know the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending or investment banking system through study of topics including corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition and mergers/acquisition. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

Additional Courses - Choose Two: (6 credits)

MGMT 41601 - Corporate Mergers And Acquisitions

Credit Hours: 3.00. The financial analysis of corporate acquisitions, mergers, and reorganizations including asset acquisitions, joint ventures, spin-offs, sell-offs, equity carve-outs, bankruptcy proceedings and reorganizations, and corporate governance. The course uses a combination of lectures, readings, and case analysis.

Learning Outcomes: 1. Understand the processes of valuation, negotiation, and financial outcomes of transactions involving mergers and acquisitions. Credits: 3.00

MGMT 41500 - International Financial Management

Credit Hours: 3.00. The course explores financial decision

making in an international framework from the perspective of the management of a multinational corporation. Topics covered include the international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations.

Learning Outcomes: 1. Students will learn about financial decision making in an international framework from the perspective of the management of a multinational corporation through topics such as international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations. Credits: 3.00

MGMT 41200 - Financial Institutions And Markets

Credit Hours: 3.00. Introduction to financial markets and management of financial institutions. Emphasis on determinants of interest rates, and measurement and management of financial risk. Concentration on management of depository firms such as banks and savings and loans.

Learning Outcomes: 1. Students will be introduced to financial markets and management of financial institutions through learning about determinants of interest rates, and measurement and management of financial risk, with particular attention on management of depository firms such as banks and savings and loans. Credits: 3.00

MGMT 41250 - Fixed Income Securities

Credit Hours: 3.00. This course includes examination of fixed income securities institutions that invest, roles in institution, portfolios and math associated with assessing characteristics of fixed income securities.

Learning Outcomes: 1. Examine management of fixed income securities. 2. Examine portfolios and risk management strategies. 3. Demonstrate use of simulation models for risk assessment. Credits: 3.00

MGMT 41350 - Venture Capital And Entrepreneurial Finance

Credit Hours: 3.00. This course includes descriptions of markets for start-up businesses, venture capital financial structures, valuation of start-ups, role of venture capital in economic development and business growth strategies.

Learning Outcomes: 1. Evaluate start-up ventures and understand the markets for early-stage businesses. 2. Value these companies using Discounted Cash Flow models, markets multipliers and other industry-specific valuation methods. Credits: 3.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

MGMT 41650 - Financial Engineering

Credit Hours: 3.00. The objective of this course is to develop necessary skills to value and hedge a wide variety of derivative contracts traded in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous time. Some basic knowledge of stochastic processes would be helpful, but not essential: what needed will be covered in class. The analytic valuation and hedging of derivatives using the modern martingale methods will be the main focus of the course. Applications will include forwards, futures, and options on stocks, bonds and foreign currencies. The numerical methods such as parameter estimation, Monte Carlo simulations, discretization schemes as well as the conditional volatility estimation techniques will also be addressed. In addition to the valuation and hedging derivatives, course also

covers Value-at-Risk, credit risk, modeling the term structure of interest rates and the construction of the VIX index using the S&P 500 index options obtained from the IvyDB OptionMetric database.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Outline and design new financial derivatives. 3. Develop the VIX index using options data. Credits: 3.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

Note

Food and Agribusiness Management Minor

Requirements for the Minor (18 credits)

Required Courses (9 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Selective Courses (9 credits)

AGEC 30500 - Agricultural Prices

Credit Hours: 3.00. Analysis of prices and the movement of farm product prices; relations of farm product prices to farm input and other prices; conceptual and statistical analysis of agricultural supply and demand relationships; application of price analysis, price forecasting, agricultural outlook, agricultural policy; adjustment of farming to new price conditions.

Learning Outcomes: 1. Understand economic principles that determine prices in markets. 2. Provide knowledge of markets and the entities and factors that impact market equilibrium outcomes. 3. Apply economic principles and empirical estimation tools to inform decision-making. Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test

hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 33300 - Food Distribution - A Retailing Perspective

Credit Hours: 3.00. Distribution factors that affect the food industry. Particular attention to the food wholesaling and retailing sectors. Presentation of economic tools to evaluate performance in the food industry. Discussion of the relative importance of each of the major departments in the modern supermarket. Discussion of current and future industry prototypes.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming

problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 42100 - Advanced Commodity Marketing

Credit Hours: 3.00. Application of commodity marketing principles to grain, livestock, and other commodity sectors. Applications include hedging, speculation, risk management, and fundamental and technical price analysis. Examination and testing of pricing strategies and the development of commodity marketing plans.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to

develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 43100 - Advanced Industrial Sales And Marketing

Credit Hours: 4.00. Advanced presentation techniques, sales management and analysis, improving communication skills, study of industrial marketing strategies, interaction with industry executives, and strategies for career development. Requires class trips. Students will pay individual lodging or meal expenses when necessary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

AGEC 52400 - Agricultural Finance

Credit Hours: 3.00. Designed to provide students the concepts and tools to apply financial management principles to farm businesses. Topics include financing alternatives, preparation and interpretation of financial statements, and capital investment analysis using discounted cash flows.

Learning Outcomes: 1. Prepare, interpret, and analyze financial statements used for agricultural businesses. 2. Analyze and suggest methods to improve the financial performance of agricultural businesses. 3. Evaluate capital investments using discounted cash flow methods. 4. Describe and analyze the risk and returns faced by agricultural businesses. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures,

compensation, administration, and collective bargaining. Credits: 3.00

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Notes

Food Science Minor

Requirements for the Minor (18 credits)

Required Courses (11 credits)

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.

Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3. Identify the conditions under which important pathogens are commonly inactivated, killed, or

made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 45300 - Food Chemistry

Credit Hours: 3.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Understand the importance of food chemistry and the relationship of food chemistry to other food science areas. 2. Understand the structures and functions of major food components, including water, proteins, carbohydrates, lipids, vitamins, and minerals. 3. Understand major reactions occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 4. Identify the major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 5. Be able to describe types and uses of basic sensory tests. 6. Be able to identify functions of most or all ingredients listed on the ingredient label of a food product. 7. Be able to discuss alternative ingredient choices for food products. 8. Be able to write a scientific abstract using IFT formatting. Credits: 3.00

Selective Courses (7 credits)

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain

the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

Notes

Foods and Nutrition Minor

About the Minor

Requirements for the Minor (15 credits)

A. Required Courses (6 credits)

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

B. Additional Courses (9 credits)

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional

literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 39000 - Independent Undergraduate Research

Credit Hours: 1.00 to 3.00. Individual research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 49000 - Independent Undergraduate Research

Credit Hours: 1.00 to 4.00. Independent research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 4.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

Notes

Forensic Sciences Minor

Requirements for the Minor (20 credits)

Required Courses (11 credits)

ENTM 22810 - Forensic Investigation (UCC: SCI)

Credit Hours: 4.00. Forensic science investigation, crime scene management and field data collection techniques. Includes crime scene recognition and the documentation, collection, preservation, and processing of crime scene evidence. Emphasizes the place of field data collection as the first step in a sequence that takes evidence from scene to the lab for analysis and finally into the court of law.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. Credits: 4.00

ENTM 22820 - Forensic Analysis (UCC: SCI)

Credit Hours: 4.00. Forensic science evidence analysis, crime lab evidence management and data analysis techniques. Focuses on the accuracy, precision and integrity in evidence analysis for a survey of forensic disciplines. Emphasizes the place of forensic analysis as a necessary second step in a sequence that takes evidence from scene, to the lab for analysis and finally into the court of law.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Appreciate the scope of science in forensic analysis. 2. Develop an understanding of the scientific method in the context of the law. 3. Develop an understanding of the particulars for each forensic sub-discipline. 4. Experience the basic techniques employed by the sub-disciplines reviewed. Credits: 4.00

ENTM 22830 - Forensic Testimony And Ethics

Credit Hours: 3.00. The final course in the forensic science program core, focuses on the legal ramifications that arise when forensic science is applied at the crime scene, in the crime lab and in the courtroom. Students are introduced to ethical issues that form the basis of all scientific investigations and the role of scientists as expert witnesses in maintaining the moral integrity of our justice system.

Learning Outcomes: 1. Recognize how science and the legal system interact throughout a case life history, and the role played in presenting scientific conclusions at trial. 2. Identify the ethical issues associated with scientific investigations at the scene, including the ability to avoid bias and correct for problems before a

case is compromised. 3. Identify the ethical issues associated with scientific investigations at the lab, including the ability to avoid bias and correct for problems before a case is compromised. 4. Identify the ethical issues associated with avoiding bias, correcting for errors and providing testimony as an expert scientific witness. Credits: 3.00

Selective Courses (9 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental

principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

AGRY 35500 - Soil Morphology And Geography

Credit Hours: 2.00. This course features field experience in advanced techniques in soil morphology including the study of the relationship of soils to landscaped, common parent materials of Midwest and classification of soils in the Soil Taxonomy. Course material emphasizes the development of detailed descriptions of soil properties and how these properties directly impact the interpretations and recommendations for land use options. Use and management of soils based on landscape position and morphology will be covered including on-site waste disposal, homes with basements as well as road and street construction. Collegiate soil judging is a portion of the subject matter discussed. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 2.00

AGRY 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (NRES 38500) Designed as an upper level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for

lifelong learning. Credits: 4.00

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment.

Credits: 2.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

ENTM 21000 - Introduction To Insect Behavior (UCC: SCI)

Credit Hours: 3.00. Description and introductory analysis of innate and learned insect behavior, including basic orientations and movements, behavioral periodicity, communication, chemical and structural defenses, host selection and feeding, reproduction, and insect societies. General biology and introductory entomology are desirable, but not essential.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

ENTM 33500 - Introduction To Insect Identification

Credit Hours: 4.00. This class is designed for learning more about the collection and identification of adult insects. Emphasis will be placed on collection and sampling techniques, the preparation of specimens for future study, and identification.

Learning Outcomes: 1. Use keys and other published resources to identify unknown insects to the correct family and by-sight identification. 2. Collect a diversity of insects and related arthropods and to prepare specimens to professional standards. 3. State the scientific names, critical taxonomic characters, natural history and biology, unique or interesting behaviors, ecological role, taxonomic relationships and impacts on human activities of selected families. Credits: 4.00

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana.

Credits: 3.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 34100 - Wildlife Habitat Management

Credit Hours: 3.00. Principles, practices, and justification of the habitat management approach to the manipulation of wildlife populations.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 34800 - Wildlife Investigational Techniques

Credit Hours: 3.00. An introduction to current wildlife research techniques that are used in managing populations and habitats. Laboratory and field exercises are used to gather and analyze data; basic data analysis and written dissemination of results is emphasized.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate

hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

PSY 33500 - Stereotyping And Prejudice

Credit Hours: 3.00. This course examines the topics of stereotyping, prejudice, and discrimination from a social psychological perspective. Relying on empirical findings and relevant theoretical approaches, the course moves beyond lay opinions to explore the social psychological foundations and forms of stereotyping and prejudice, and to examine various strategies for reducing intergroup biases.

Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

PSY 42800 - Drugs And Behavior

Credit Hours: 3.00. Discussion of the variety of drugs that affect the nervous system and behavior. Emphasis will be upon a discussion of the physiological and pharmacological bases for the use and misuse of drugs in our society.

Credits: 3.00

PSY 44300 - Aggression And Violence

Credit Hours: 3.00. An intensive examination of the nature of human aggression. Among the topics covered will be (1) theoretical perspectives concerning such behavior; (2) social conditions that encourage its performance; and (3) means for its prevention and control.

Credits: 3.00

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

ANTH 42800 - Field Methods In Archaeology

Credit Hours: 1.00 to 9.00. Introduces basic field and laboratory methods in contemporary archaeology: methods of site survey, mapping, and excavation through the excavation of archaeological sites; the basics of archaeological data analysis and classification, and the computer-based analysis of archaeological data. Permission of instructor required.

Learning Outcomes: 1. Describe, document, and record archaeological data and their spatial relationships in the field. 2. Apply basic archaeological field methods, including excavation, mapping, and data recording. 3. Practice database management, including sorting and labeling artifacts and samples, and maintaining a catalog of data. Credits: 1.00 to 9.00

ANTH 43600 - Human Evolution

Credit Hours: 3.00. This class examines the fossil evidence for human evolution and theories proposed to explain the development that led from the origin of primates to modern humans. This course will include lectures, exercises with fossil casts, presentation, and discussions.

Learning Outcomes: 1. Explain the analytical and research methods used in hominin paleobiology. 2. Identify important research questions within human paleobiology as well as theoretical approaches and methods used to evaluate them. 3. Describe the relevant fossil evidence to investigate the evolution of the primate lineage. 4. Demonstrate understanding of evolutionary processes, particularly those that shaped the biocultural evolution of modern humans. 5. Evaluate interpretations of the hominin fossil record and appraise the strengths and weaknesses of current debates in human evolution. Credits: 3.00

HSCI 33300 - Introduction To Immunology

Credit Hours: 3.00. Introduction to Immunology will meet twice weekly and provide an overview of this evolving field of science with an emphasis on the clinical implications and application of learned knowledge. The immunologic mechanisms associated with the normal and abnormal immune response will be discussed and students will put this knowledge into practice by directing their own case study. In addition, a number of common clinical concerns with respect to immunity will be reviewed. Furthermore, we will explore the critical role our knowledge of this branch of science plays in patient diagnosis, treatment and care both now and in the future.

Learning Outcomes: 1. Have solid understanding of the science of Immunology and the Immune Response. 2. Have an appreciation for the complexity of the immune system, its cellular components, its regulation and implications of its dysfunction. 3. Have a clearer understanding of the clinical applications and implications of the immune response. 4. Have enhanced knowledge of the course material. 5. Have the ability to transfer the written word into practical application of its principles. Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

SOC 32700 - Crime, Deviance And Mass Media

Credit Hours: 3.00. Various forms of mass media are used to explore the sociology of crime and deviance. Topics may include white collar crime, juvenile delinquency, street crime, sexuality and sexual orientation, hate crimes, deviance and community. Assignments include quizzes and short papers.

Learning Outcomes: 1. Able to identify concepts associated with specific theoretical perspectives and be able to describe these concepts. 2. Able to use these concepts to the media forms presented in the class. 3. Use the concepts to craft explanations for characters' actions in the fictional films. 4. Able to conduct analyses of the news that conform to accepted methodological standards of quantitative and qualitative research. Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are

emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand

the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical

competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role

of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CHM 22400 - Introductory Quantitative Analysis

Credit Hours: 4.00. Introduction to titrimetric, gravimetric, and instrumental methods of analysis; principles of separation processes, including chromatography; recognition and evaluation of possible sources of error. Required of students majoring in biology who do not take CHM 32100 .

Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems.

2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the

name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 33300 - Principles Of Biochemistry

Credit Hours: 3.00. Structure and function of biologically important molecules. Intended for students in life sciences.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to have a molecular understanding of chemical reactivity in biochemical systems. 3. Able to carry out calculations related to Biochemistry. 4. Able to understand energetics and kinetics of biochemical transformations. 5. Able to apply concepts of general chemistry and organic chemistry to biochemical systems. Credits: 3.00

CNIT 42000 - Basic Cyber Forensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyber forensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyber forensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss

various social issues associated with computers and information systems. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 21800 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Analyze physical circumstances according to Newton's Laws of motion properly. 2. Apply basic conservation laws and and to recognize the circumstances in which they apply. 3. Use physical terms such as energy, acceleration, momentum, impulse, velocity, etc., properly. Credits: 4.00

PHYS 21900 - General Physics II (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Learn the basic theory and application of electricity, magnetism, dc and ac circuits; geometrical and physical optics; topics in modern physics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the

important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

AGRY 58000 - Soil And Rhizosphere Microbiology

Credit Hours: 3.00. Soils are complex ecosystems that host a diverse array of organisms, which interact with and respond to their environment. This course explores the ecology, evolution, and functions of soil microbes, with a particular focus on their interactions with plants. Through this course, students will gain an understanding of the metabolic processes and life-history strategies of archaea, bacteria, fungi, and viruses in soil, root, and rhizosphere compartments. Students will also survey the microbiomes of diverse soil ecosystems, such as forests, agroecosystems, and grasslands, and learn principles of soil microbiology and biogeochemistry. In addition, students will acquire practical knowledge about the methods used for characterizing microbes in soil and plant systems.

Learning Outcomes: 1. Demonstrate understanding of the ecology and physiology of major groups of bacteria, archaea, fungi, and viruses found in soils, the rhizosphere, and roots. 2. Compare and contrast soil and rhizosphere microbiomes, and their differences between the managed versus natural ecosystems. 3. Use verbal and basic mathematical descriptions to explain theories related to microbial growth, survival, and symbioses. 4. Predict the occurrence of microbial processes and soil conditions that govern the cycling of carbon, nitrogen, phosphorus, sulfur, and metals in soils and relate this knowledge to ecosystem functions. 5. Envision potential applications for soil and root-borne microbes in natural resource management, such as agriculture, forestry, and soil conservation. 6. Apply knowledge of plant-microbe interactions to develop hypotheses, design experiments, and select appropriate study methods. 7. Recognize and select appropriate resources and tools to effectively analyze microbiome data. Credits: 3.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 59200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural

knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

CHM 53300 - Introductory Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry.

Credits: 3.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

ENTM 52500 - Medical And Veterinary Entomology

Credit Hours: 3.00. Introduction to the biology and control of arthropods of medical and veterinary importance, and coverage of the natural history and abatement of selected arthropod-related diseases, including arboviral encephalitis, filariasis, leishmaniasis, Lyme disease, malaria, plague, spotted fever, trypanosomiasis, and myasis. Offered in odd-numbered years.

Credits: 3.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

MGMT 53200 - Forensic Accounting And Fraud Examination

Credit Hours: 3.00. This course is designed to help students apply their accounting, auditing, information systems and communication skills to detect financial fraud and unauthorized reporting acts to prepare and present a fraud case for criminal proceedings or civil litigation. These skills are highly valued in the rapidly growing field of forensic accounting. Upon completing this course, students will understand the role of forensic accountants in examining financial records for fraud and detecting insurance fraud; in providing litigation support; and in capturing digital evidence. This course will also review material related to the Certified Fraud Examiner (CFE) exam. Throughout the course, students will have opportunities to improve their written and oral communication skills, particularly as they relate to communication in the legal settings associated with investigating accounting.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate their understanding of business functional areas through homework assignments, examinations and team projects that require analysis or development of fraud detection plans and litigation support. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will be able to demonstrate their understanding of how people in organizations use common technology and software to commit fraud through homework assignments, examinations and team projects. They will also be able to demonstrate their ability to use software to detect fraud and other irregular transactions. 3. Become familiar with the ethical issues that individuals face in organizations: Ethical behavior is a key factor in preventing fraud. Students will be able to demonstrate their ability to identify signs of unethical behavior and how it manifests itself in financial fraud through homework assignments, examinations and team projects. 4. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class participation and the writing and presentation of team projects. 5. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present team projects. 6. Achieve depth of understanding and applications of financial reporting. Students will demonstrate their understanding of accounting systems through homework assignments, examinations and team projects that require a deep understanding of accounting rules and procedures and the technology that individuals use to keep financial records. Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability

to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary

adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

ANTH 40500 - Ethnographic Methods

Credit Hours: 3.00. This course introduces students to the basic methods of ethnographic research: the collection, analysis, and presentation of data derived from the systematic, direct observation of human behavior and interviewing of key informants. Students are required to complete a field project.

Learning Outcomes: 1. Identify and synthesize key theoretical and methodological approaches to ethnographic field work in the following broad domains: 1) research ethics, 2) data collection (field notes, participant observation, interviewing, visual and digital methods), 3) data management, and 4) communication of research results. 2. Demonstrate scientific and scholarly literacy through critical discussion,

production of scholarly reports, and public dissemination of research efforts. 3. Develop qualitative competence and problem solving skills in an active learning environment through practical data collection and processing exercises. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

ENTM 25300 - Insect Physiology And Biochemistry

Credit Hours: 4.00. Introductory course in insect cell biology, biochemistry, and physiology including structures and functions of insect internal and external tissues and organs. A year of college biology or equivalent knowledge is expected.

Learning Outcomes: 1. Understand (i) the structure and functions of insect cells, the major internal organ systems of insects, the insect integument, and homeostatic mechanisms; (ii) insect development and reproduction, and their endocrine control; and (iii) the neural mechanisms that underlie the interactions of insects with their environment and coordinated behavior. 2. Understand the physical and chemical principles underpinning animal physiology. 3. Understand the dependence of function on structure in physiology and biochemistry. 4. Acquire familiarity with commonly used experimental procedures for research in insect physiology and biochemistry. Credits: 4.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

ENTM 32820 - Medico-Legal Entomology

Credit Hours: 3.00. This course explores the main topics covered under medico-legal entomology (MLE). Specifically, the course will focus on the role that insects play in abuse, neglect, and death investigations. Students will experience rearing and identifying the major forensically important insect groups associated with medico-legal investigations. Finally, students will gain an appreciation of the scope of MLE through the analysis of two mock cases.

Learning Outcomes: 1. Establish an understanding of how insects are in used in legal investigations. 2. Define and defend the types of insect evidence presented in abuse & neglect cases. 3. Define and defend the types of insect evidence presented in death investigations. 4. Explain how insects are used to answer various questions in legal investigations. 5. Collect, rear and identify forensically important specimens. 6. Identify forensically important specimens down to family, genus or species level. 7. Demonstrate and explain proper collection techniques from decomposing remains. 8. Demonstrate and explain proper rearing techniques for forensically important insects. 9. Experience medico-legal entomology. 10. Compare and

explain the life cycle of forensically important flies. 11. Analyze two medico-legal scenes. 12. Compose forensic entomology case reports. Credits: 3.00

ENTM 42820 - Carrion Ecology

Credit Hours: 3.00. This course explores how carrion interact with the environment and other organisms during the decomposition process. Focus will be given to an understanding of the process itself, how investigators collect information about the process, and how research is conducted into the process of decomposition. Students will carry out an experiment and write their results up in the format of a peer reviewed article.

Learning Outcomes: 1. Explain the process of decomposition. 2. Describe and distinguish the stages of vertebrate decomposition, including when those stages begin and end and what variables define a given stage. 3. Describe and explain the abiotic factors that influence decomposition. 4. Describe and explain the biotic factors that influence decomposition. 5. Explain the nutrient flow through a carrion resource, including how various living organisms take advantage of such resources. 6. Experience carrion ecology field techniques. 7. Measure the abiotic factors that influence decomposition. 8. Measure the biotic factors that influence decomposition. 9. Evaluate a decomposition scene and strategize site data collection. 10. Identify the species the animals that frequent a carrion source. 11. Develop and implement a research project. 12. Plan, propose and defend a scientific research project related to carrion ecology. 13. Build a budget for a research project. 14. Build a collection strategy SOP for a research project. 15. Conduct a proposed research project. 16. Analyze the results of a research project. 17. Write-up, print and submit a research paper on your project, using the format for INSTARS or JPUR. Credits: 3.00

Notes

Forest Ecosystems Minor

Requirements for the Minor (18 credits)

Required Courses (12 credits)

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and

fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 33800 - Introduction To Silviculture

Credit Hours: 3.00. This course introduces the common silvicultural systems used in North American forests for forestry and wildlife habitat management objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures present theoretical concepts in order to allow students to understand forest management practices, while the recitation portion of this course reviews these concepts in light of wildlife habitat management, biodiversity, and other non-timber resources. The recitation is writing-intensive requiring several reflection papers on assigned readings and a semester-ending term paper on a subject of the student's choosing. Credit cannot be earned for both FNR 33800 and FNR 43900. Permission of department required.

Learning Outcomes: 1. Be familiar with technical silvicultural terminology. 2. Describe the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices affect soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Locate, summarize and evaluate primary and selected secondary literature sources in regards to silvicultural effects on non-timber resources. Credits: 3.00

Selective Courses (6 credits)

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms.

27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

FNR 53600 - Ecology Of Disturbance

Credit Hours: 2.00. Advanced lecture- and discussion-based class examining how disturbance shapes the composition and structure of communities and landscapes across major terrestrial biomes. Students will examine and discuss the relationships between disturbance intensity, frequency, and spatial extent and how these characteristics affect ecological processes and ecologically-based management of forest and grassland ecosystems. The class will also examine the synergistic effects of multiple disturbances and the restoration of endemic disturbance regimes in contemporary ecosystems. Course is reading intensive; students will read and discuss on average 3-8 journal articles per week.

Learning Outcomes: 1. Describe how disturbance shapes community composition and structure for several major terrestrial biomes. 2. Understand how disturbance regulates biological diversity across terrestrial and aquatic ecosystems. 3. Understand the relationship between disturbance intensity, frequency, and spatial extent and how those factors affect management of forest and grassland ecosystems. 4. Describe the synergistic nature of disturbance and identify how disturbance factors interact across a landscape. 5. Describe how contemporary and restored disturbance regimes may facilitate or suppress the spread of invasive species. 6. Understand how management activities can mimic endemic disturbance regimes to promote biodiversity and sustainability. Credits: 2.00

FNR 53601 - Ecology Of Disturbance Practicum

Credit Hours: 1.00. This course is the practicum for FNR 53600 , hence enrollment is contingent upon enrollment in FNR 53600 . Course consists of a one or two-week long field trip to a remote site; prior trips have been taken to the Great Smokey National Park over spring break. Course requires an additional travel fee, depending on location visited.

Learning Outcomes: 1. How disturbance shapes community composition and the distribution of species across landscapes. 2. How alterations to endemic disturbance regimes affect the composition, structure, and function of ecosystems. 3. How interactions between natural disturbance and invasion of exotic species influence forest community development. 4. Management that uses natural disturbance to restore and maintain biotic communities and ecosystems. Credits: 1.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

Notes

French Cultural Studies Minor

About the Minor

Requirements for the Minor (15 credits)

French Language Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

Content Courses (6 credits)

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 54900 - French Literature And Film

Credit Hours: 3.00. An examination of the interrelationships of contemporary French literature and film. Discussion of the potential of each medium as an art form, problems of visual transposition of literary works, and extension of literary concepts such as Dadaism and Surrealism into cinema. Permission of department required.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

Required Capstone Course (3 credits)

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

Notes

French Minor

About the Minor

Requirements for the Minor (15 credits)

A. Required French Language Courses (6 credits)

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials

dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

B. Required French Literature Course (3 credits)

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.

Credits: 3.00

C. French Electives (6 credits)

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 39400 - Special Topics In French Literature

Credit Hours: 3.00. Studies a particular aspect in French literature (e.g., theme, device, character type, motif, place) by reading a varied selection of works of different genres, styles and/or periods. Readings, discussion, and papers in French.

Credits: 3.00

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 40100 - French Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of French speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 40200 - French Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in French. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 44300 - Introduction To Francophone Literature

Credit Hours: 3.00. The study of the most representative Francophone poets, playwrights, and novelists from various countries, such as Leopold Senghor, Aime Cesaire, Jacques Romain, Gabrielle Roy, Michel Tremblay, Mohamed Dib.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 52700 - Etudes de Style

Credit Hours: 3.00. Study of the expression of affective and artistic values in literary French. Detailed grammatical analyses and study of stylistic procedures. Comparison with English usage. Introduction to explication de texte as an approach to literature. Permission of department required.

Credits: 3.00

FR 54900 - French Literature And Film

Credit Hours: 3.00. An examination of the interrelationships of contemporary French literature and film. Discussion of the potential of each medium as an art form, problems of visual transposition of literary works, and extension of literary concepts such as Dadaism and Surrealism into cinema. Permission of department required.

Credits: 3.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

FR 59400 - Special Topics In French Literature

Credit Hours: 1.00 to 4.00. Special topics in French Literature. Permission of instructor required.

Credits: 1.00 to 4.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and

listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

Notes

Furniture Design Minor

Requirements for the Minor (18 credits)

Required Courses (12 credits)

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

FNR 41910 - Furniture Product Development And Strength Design

Credit Hours: 3.00. Qualitative and quantitative principles of furniture construction, product development methodology and strength design principles, furniture performance testing, product sustainability and end of life options (LCA, computer-based applications and solutions). Course features laboratory evaluating, furniture joints and furniture structures.

Learning Outcomes: 1. Identify and specify appropriate furniture constructions. 2. Determine whether furniture has adequate strength, stiffness, and durability. 3. Determine whether furniture will meet existing performance standards. 4. Determine product sustainability. Credits: 3.00

FNR 48410 - Sustainable Wood Products, Furniture Design And Manufacturing

Credit Hours: 3.00. This project-based course explains principles of product development, furniture construction, strength design, performance testing, and product sustainability (life cycle analysis and end-of-life options). The course familiarizes students with methods such as Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), Computer Numerical Control (CNC) router operation, rapid prototyping, and basics of secondary wood products manufacturing, to build an actual product.

Learning Outcomes: 1. Understand Computer Aided Design (CAD). 2. Understand Computer Aided Manufacturing (CAM). 3. Understand CNC router operation. 4. Understand rapid prototyping. 5. Understand the basics of secondary wood products manufacturing. 6. Understand the principles of sustainable product development. Credits: 3.00

AD 34000 - Furniture Development

Credit Hours: 3.00. This course is an introduction to furniture design. The focus of this course is information relevant to furniture design including: basic ergonomics, structural techniques and materials and processes. Additional pertinent information regarding new and ongoing design trends will be explored. A mid-semester field trip to a major furniture manufacturer and/or design studio is offered. Students will design and build two of the following objects: a small freestanding shelving unit, small table, bench, table top object or

stool. Students must pass mandatory portfolio review for this course.

Learning Outcomes: 1. Increase knowledge of materials and processes including furniture design construction methods. 2. Gain a basic understanding of ergonomics. 3. Increase aesthetic sensibility. 4. Develop an awareness of contemporary issues and trends in furniture design. 5. Design and build an original piece of furniture by the end of the class. Credits: 3.00

Selective Courses (6 Credits)

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment. Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 22800 - Visual Communication Design Computing I

Credit Hours: 3.00. An introductory course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Illustrator and Adobe InDesign. 2. Experiment with and iterate through image-making utilizing various methods and vector-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Increase ability to generate and choose intensely metaphoric imagery to enhance visual communication. 5. Understand and use design terminology and design principles. 6. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 25600 - Presentation Techniques

Credit Hours: 3.00. Studio preparing students for project presentations. Classes will cover graphic techniques, including page layout, typography, portfolio formats, perspective drawings, photography, and verbal communication.

Learning Outcomes: 1. Create original designs using iterative visualization techniques to improve and refine their design concepts. 2. Develop computer-aided design skills to present these design concepts. 3. Demonstrate 3-D computer modeling skills. 4. Demonstrate computer rendering skills. Credits: 3.00

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

AD 53500 - Furniture Design

Credit Hours: 3.00. Examination of furniture design trends and designers. Explore materials and manufacturing processes. Design and build a full-size seating unit. Shop skills required. Permission of instructor required.

Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling

and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

Note

German Minor

Requirements for the Minor (15 credits)

A. German Language Courses (6 credits)

GER 30100 - German Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of German speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Germany from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 30200 - German Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in German on the basis of materials dealing with the ideas and events that have shaped present-day Germany. Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

B. German Literature Course (3 credits)

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.

Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts. Credits: 3.00

C. German Electives (6 credits)

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

GER 34100 - German Literature I: From The Middle Ages To The 18th Century

Credit Hours: 3.00. Reading and discussion of selected texts (poetry, prose, dramatic texts, cultural documents, and artworks) in German from the Middle Ages to the Eighteenth Century.

Credits: 3.00

GER 34200 - German Literature II: From The 18th Century To The 21st Century

Credit Hours: 3.00. Reading and discussion of selected texts in German with the dual context of literary movements and historical developments between the 18th and 21st centuries.

Credits: 3.00

GER 40100 - German Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of German speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Germany. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 40200 - German Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in German. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Compose essays in German after reading authentic German articles and books. 2. Discuss current events in German based on print and media sources from German-speaking countries. 3. Formulate arguments during debate in German through group discussion. 4. State their opinions in German on recordings, television shows, and texts. 5. Describe information in German from graphs, charts, diagrams, and pictures. Credits: 3.00

GER 42400 - Business German

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Learn and practice vocabulary and cultural knowledge that is applicable to business situations in German-speaking countries. 2. Compare business practices in German-speaking countries with those in the United States, and will be able to discuss the similarities and differences in German. Credits: 3.00

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 49800 - Advanced Topics In German

Credit Hours: 3.00. Special topics on literature, linguistics and culture of contemporary German-speaking countries. Conducted in German.

Credits: 3.00

GER 52400 - German For International Trade

Credit Hours: 3.00. A broad spectrum of business and cultural materials to prepare students for work in international firms. Intensive study of technical terminology used in business transactions; stylistics in business correspondence and report writing; training for accurate oral expression in business negotiations.

Credits: 3.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

Notes

Global Engineering Studies Minor

About the Minor

Requirements for the Minor

Core Requirements

GEARE Students

ENGR 29701 - Global Engineering Orientation

Credit Hours: 1.00. Forum in preparation of study and work abroad. Understanding of cultural differences and collaborating across cultural boundaries, professionalism and ethics in foreign work and academic environments, leadership and teamwork options in foreign environments. Permission of instructor required.

Learning Outcomes: 1. Be provided with foundation in global engineering communication skills. 2. Outline teamwork and leadership opportunities available through participation in the global engineering community. 3. Be provided with globally diverse and multicultural experiences and discuss case studies to prepare them for upcoming international internships and semester study abroad. 4. Identify resources available for academic studies and industrial work experience abroad. 5. Develop a strong ethical framework and cultural sensitivity to prepare for the global professional workplace. Credits: 1.00

ENGR 39700 - Global Engineering Experience

Credit Hours: 1.00. Forum for students participating in an international internship or study abroad experience. Students will complete weekly guided writing assignments during the first 15 weeks of their international experience. Assignments will aid students with integration into the host community. Students will demonstrate increased awareness of the nature and complexities of intercultural communication by applying various theories to their lived experiences. To be taken concurrently with international internship/study abroad experience. Permission of instructor is required.

Learning Outcomes: 1. Apply cultural theories to their personal experiences. 2. Deepen understanding of cultural differences, inter-cultural communication and their cultural competency. 3. Develop strategies to bridge cultural gaps and the ability to identify, manage,

communicate and apply emotions effectively and appropriately. 4. Understand challenges of studying or working in a foreign country and develop a strong ethical framework and cultural sensitivity to succeed in a global workplace. Credits: 1.00

ENGR 49700 - Global Engineering Capstone

Credit Hours: 1.00. Forum for students returning from international internship and/or study abroad experience. Students will explore personal development resulting from the international experience as it relates to changes in world-view, understanding of culture, interpersonal skills and career aspirations. They will learn to highlight international experiences on resumes and in interviews. Students will apply and share their cultural knowledge through structured activities and summarize their entire global experience through a poster presentation. To be taken in semester following international internship/study abroad experience. Permission of instructor is required.

Learning Outcomes: 1. Identify skills gained through the international experience. 2. Able to highlight experiences on resumes and in interviews. 3. Apply skills to current and future inter-cultural situations and develop a strong ethical framework and cultural sensitivity to succeed in a global workplace. Credits: 1.00

NON-GEARE Students

ENGR 29701 - Global Engineering Orientation

Credit Hours: 1.00. Forum in preparation of study and work abroad. Understanding of cultural differences and collaborating across cultural boundaries, professionalism and ethics in foreign work and academic environments, leadership and teamwork options in foreign environments. Permission of instructor required.

Learning Outcomes: 1. Be provided with foundation in global engineering communication skills. 2. Outline teamwork and leadership opportunities available through participation in the global engineering community. 3. Be provided with globally diverse and multicultural experiences and discuss case studies to prepare them for upcoming international internships and semester study abroad. 4. Identify resources available for academic studies and industrial work experience abroad. 5. Develop a strong ethical framework and cultural sensitivity to prepare for the global professional workplace. Credits: 1.00

ENGR 49700 - Global Engineering Capstone

Credit Hours: 1.00. Forum for students returning from international internship and/or study abroad experience. Students will explore personal development resulting from the international experience as it relates to changes in world-view, understanding of culture, interpersonal skills and career aspirations. They will learn to highlight international experiences on resumes and in interviews. Students will apply and share their cultural knowledge through structured activities and summarize their entire global experience through a poster presentation. To be taken in semester following international internship/study abroad experience. Permission of instructor is required.

Learning Outcomes: 1. Identify skills gained through the international experience. 2. Able to highlight experiences on resumes and in interviews. 3. Apply skills to current and future inter-cultural situations and develop a strong ethical framework and cultural sensitivity to succeed in a global workplace. Credits: 1.00

COM 30301 - Mentored Intercultural Communication Experience

Credit Hours: 1.00 to 3.00. This class is intended as a companion to a study abroad or international internship experience. Through a series of guided assignments that integrate experiential activities embedded in the host community with reflective writing that solicits feedback from both peers and an intercultural mentor, students will be challenged to develop intercultural competencies while living in a different culture.

Learning Outcomes: 1. Demonstrate awareness of their own cultural rules and biases by explicitly articulating in reflections and discussions how their experiences have shaped their attitudes and behaviors. 2. Exhibit understanding of cultural differences in verbal and nonverbal communication by successfully completing tasks with team members from other cultural and linguistic backgrounds. 3. Interpret

experiences from more than one perspective by seeking out answers to questions about another culture, suspending judgement about another system of values and norms for behavior, and expressing empathy for another point of view. 4. Present effective arguments about their development of intercultural competencies during their study abroad by setting and assessing the achievement of intercultural learning goals and constructing a narrative that illustrates their new skills to prospective employers. Credits: 1.00 to 3.00

Global Engineering Experiences (GEE) - Choose two

Other Global Experience

Appendix A: Cultural Knowledge Courses

African

HIST 21000 - The Making Of Modern Africa (UCC: HUM)

Credit Hours: 3.00. This course provides students with a comprehensive introduction to modern African history from 1800 to the present. Using a variety of films, novels and scholarly resources, we will examine the major historical forces that have shaped African lives over the last two centuries. Emphasis will be placed on African experiences of slavery, colonialism, liberation struggles, and post-independence national building. Students will also learn to analyze contemporary African issues within a larger historical context.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand modern African history and the state of Africa today. 2. Learn how to interpret historical texts from a number of different epistemic positions (i.e. paying attention to race, class, gender, sexuality, nation and other axes of ""difference""). 3. Expect to develop stronger writing skills, as well as to improve on critical thinking and oral articulation. Credits: 3.00

HIST 44100 - Africa In The Twentieth Century

Credit Hours: 3.00. A problem-oriented course in the modern history of Africa from 1880 to 1975. It analyzes origins of African nationalism, European colonialism, racial conflict, and war leading to the independence revolution of the 1960s and 1970s.

Credits: 3.00

Arabic

ARAB 23900 - Arab Women Writers (UCC: HUM)

Credit Hours: 3.00. Survey of Arab women writers from North Africa, the Middle East, and Arab communities in the Western world. Emphasis on issues of sexuality, marriage, work, travel and immigration. Conducted in English; no knowledge of Arabic required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 28000 - Arabic Culture (UCC: HUM)

Credit Hours: 3.00. A historical and literary survey of defining characteristics of Arabic culture from pre-Islamic times to the modern period.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 24300 - South Asian History And Civilizations (UCC: HUM)

Credit Hours: 3.00. Survey history of India, Pakistan, and Bangladesh, from the origins of South Asian civilization to the present. Topics include ancient India, the Mughal Empire, the colonial experience, the independence movement, and conflict and popular culture.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 24600 - Modern Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course explores the political, social, and cultural factors that have contributed to the formation of the modern Middle East. Course includes short stories and a selection of documentary films from the region.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

Chinese

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 35900 - Gender In East Asian History (UCC: HUM)

Credit Hours: 3.00. Examination of the construction of tradition and modernity in East Asia through the lens of gender. Topics include the influence of "Confucian" ethics; gender and imperialism, nationalism and revolution; and social change in the aftermath of war and decolonization.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

Classics

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn basics of reading and translating ancient Greek, completing their introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

European

HIST 10300 - Introduction To The Medieval World (UCC: HUM)

Credit Hours: 3.00. Barbarians, kings, queens, peasants, witches, saints, teachers, students, heretics, Moslems, Jews, Christians, love, death, monks, farm life, city life, ordinary men, women, and children as Europe develops from A.D. 500 to 1500.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 32900 - History Of Women In Modern Europe (UCC: HUM)

Credit Hours: 3.00. This course examines women's

experiences and constructions of femininity in Europe from 1789 to the present, including women in revolutions, state intervention in the family, changing ideas of sexuality, women's movements, women in socialism and fascism, and women in war.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will understand the history of women in modern Europe from 1789 to the present by analyzing women's experiences and the social and cultural constructions of femininity as well as the different contexts of class, ethnicity, and nationality in the history of European women. 2. They will think historically and critically about women's participation in revolutions; state interventions in the family; working lives of women; ideals and practices of sexuality; the middle-class model of domesticity and women's responses to it; the role of women and femininity in imperialism; women in socialism, under fascism, and in the transition from communism to capitalism; women's experiences of two world wars; and the rise of feminist movements and contemporary feminisms in Europe. 3. Students will understand the difference between secondary and primary sources. They will read and interpret primary source materials, including fiction, autobiography, and other historical documents including those written by women. 4. Students will develop their critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 33700 - Europe Since 1945

Credit Hours: 3.00. This course traces the history of Europe, west and east, from 1945 to the present. Once viewed as a success story, culminating in the collapse of eastern European communism, developments after 1990 - such as the breakup of Yugoslavia, the European debt crisis, and the War in Ukraine - call this simplistic narrative into question. This course will consider Cold War division, decolonization, and political protest alongside democratization and economic recovery.

Learning Outcomes: 1. Explain broad themes in postwar European history, including the Cold War as geopolitical process and a historical framework, the role of decolonization in shaping European politics, the impact of social movements, and the distinctions and overlaps between different economic systems. 2. Read historical scholarship for arguments, evidence, and contributions to the field and assess their effectiveness in these areas. 3. Craft a persuasive argument supported by primary and secondary source evidence that makes an intervention into the historical literature on a chosen topic. 4. Interpret a diverse range of historical sources and assess their utility in understanding the past, paying attention to form, perspective, and limitations. 5. Present historical research clearly and accessibly to different audiences using a variety of media formats. Credits: 3.00

HIST 41300 - Modern European Imperialism: Repression And Resistance

Credit Hours: 3.00. This course examines the expansion, transformation and collapse of 19th and 20th-century European empires, focusing on colonial encounters and relationships. Students should come to the course familiar with major developments, events and themes in modern European and/or global history.

Learning Outcomes: 1. Contextualize and compare important events and moments in the history of European imperialism and decolonization. 2. Analyze and evaluate how historians interpret the past, and examine how this past continues to shape the present. 3. Analyze an array of historical sources and types of evidence, historical narratives, first-person accounts and commentaries, scholarly interpretations, visual imagery and fictional portrayals, as well as the setting in which these sources were produced. 4. Craft original arguments supported by historical and textual evidence in class discussions and weekly writing assignments. Credits: 3.00

HIST 40300 - Europe In The Reformation

Credit Hours: 3.00. A study of decay and renewal in European society, 1300 to 1650. Concentrates on the Protestant and Catholic Reformation and religious wars, but also covers the Northern Renaissance, the New Monarchies, and the discovery and exploration of the New World.

Credits: 3.00

French

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 40500 - The French Revolution And Napoleon

Credit Hours: 3.00. A study of revolutionary France from the fall of the ancient regime to the Congress of Vienna. Divided in emphasis between the period of the revolution and the era of Napoleon, the course stresses social, political, ideological, and institutional developments.

Credits: 3.00

German

GER 28000 - German Special Topics

Credit Hours: 3.00. Selected topics on the civilization and culture of German speaking countries. Lectures and readings all in English. No knowledge of German necessary.

Learning Outcomes: 1. Students will explore in depth a particular aspect of life in German-speaking countries, leading to their increased understanding not only of those cultures, but also, by comparison, of their own culture.
Credits: 3.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

HIST 32300 - German History (UCC: HUM)

Credit Hours: 3.00. A survey of German history from the earliest times until the present. After a brief description of the medieval empire, we will turn to the Germany of Bismarck and Hitler and its successor states. A recurring theme will be the struggle between forces of liberalism and democracy and those of authoritarianism and militarism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Italian

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

Japanese

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 34400 - History Of Modern Japan (UCC: HUM)

Credit Hours: 3.00. A survey of Japanese history from the nineteenth century to the present, including Japan's response to Western expansionism, the formation of the modern state, political parties, industrialization, the Pacific War, the American Occupation, the postwar "economic miracle," and Japan today.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

Latin American

HIST 27100 - Introduction To Colonial Latin American History (1492-1810) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the principle historical themes of Latin America during the colonial period (roughly, from 1492 to 1810). No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate a grasp of the historical forces that in many ways laid the foundation for present-day Latin America. 2. Express understanding of how these major political, social, economic, and cultural issues unfolded in different ways in Latin America, with respect to region, time, and culture. Credits: 3.00

HIST 27200 - Introduction To Modern Latin American History (1810 To The Present) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the study of the major economic, political, social, and cultural processes that shaped modern Latin American nations since independence. No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a broad understanding of the modern history of Latin America. 2. Become familiar with the major economic, political, social, and cultural processes that shaped the nations of the continent. Credits: 3.00

Russian

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Spanish

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

Notes

Global Food and Agriculture Systems Minor

About the Minor

Requirements for the Minor (18 credits)

Required Courses (6 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium

outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

Additional Courses - Choose Four (12 credits)

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 30500 - Agricultural Prices

Credit Hours: 3.00. Analysis of prices and the movement of farm product prices; relations of farm product prices to farm input and other prices; conceptual and statistical analysis of agricultural supply and demand relationships; application of price analysis, price forecasting, agricultural outlook, agricultural policy; adjustment of farming to new price conditions.

Learning Outcomes: 1. Understand economic principles that determine prices in markets. 2. Provide knowledge of markets and the entities and factors that impact market equilibrium outcomes. 3. Apply economic principles and empirical estimation tools to inform decision-making. Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33300 - Food Distribution - A Retailing Perspective

Credit Hours: 3.00. Distribution factors that affect the food industry. Particular attention to the food wholesaling and retailing sectors. Presentation of economic tools to evaluate performance in the food industry. Discussion of the relative importance of each of the major departments in the modern supermarket. Discussion of current and future industry prototypes.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates

knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 34000 - International Economic Development

Credit Hours: 3.00. This course is designed to introduce students to issues and problems related to international economic development. Topics covered include a description of the current situation in developing countries and the history of growth and development. The course is grounded in the body of theory associated with economic development, but concentrates on the many practical problems such as poverty, population growth, urbanization, education and the environment. The three areas with the greatest attention are agricultural development, international trade, and policy analysis for developing countries.

Learning Outcomes: 1. Build an appreciation for the conditions and constraints of contemporary life in developing countries. 2. Have your own notions of what it means to live in poverty, the challenges of improving welfare, and the role of economics in development. 3. Demonstrate how economic principles, models, and analysis can help evaluate and refine approaches to improving human welfare in developing countries. 4. Develop the ability to analyze and write about real-world problems and solutions. The course, particularly the assignments, will allow you to acquire technical skills that will contribute to your future professional work. Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 42100 - Advanced Commodity Marketing

Credit Hours: 3.00. Application of commodity marketing principles to grain, livestock, and other commodity sectors. Applications include hedging, speculation, risk management, and fundamental and technical price analysis. Examination and testing of pricing strategies and the development of commodity marketing plans.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate

critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

AGEC 52600 - International Food And Agribusiness Marketing Strategy

Credit Hours: 3.00. Students will develop their analytical, decision-making, and communication skills related to marketing management of food systems in the world economy. They will analyze a foreign market's potential and market entry strategies; compare consumer differences and similarities across markets; define issues related to marketing mix standardization or adaptation; and evaluate effects of economic, social, and legal environments on marketing strategy.

Credits: 3.00

AGEC 53200 - World Food Problems

Credit Hours: 3.00. This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Learning Outcomes: 1. Understand global food production and consumption, food trade and its history including: the major plants produced and consumed; where they are grown; patterns and extent of global food trade; major food animals and animal production systems; countries involved in food trade; urbanization and food transportation; and effects of post-harvest processing on food trade and availability. 2. Understand basics of world population growth and its relationship to past and future food production and consumption globally. 3. Understand what malnutrition looks like, where it occurs, how it is measured, and the interactions between malnutrition (both under nutrition and obesity) and human health. 4. Understand the basic economic principles that affect consumer food costs and consumption patterns globally. 5. Understand how culture, communication and politics influence food availability, world food problems and malnutrition. 6. Predict, based on available information, likely scenarios for the future of world food problems and malnutrition. Credits: 3.00

Notes

Global Liberal Arts Studies Minor

Requirements for the Minor (15 credits)

A. Required Courses (6 credits)

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what

processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

B. Additional Courses - Choose Two (6 credits)

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores

communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

CMPL 26700 - World Literature: From 1700 A D To The Present (UCC: HUM)

Credit Hours: 3.00. (ENGL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

CMPL 26600 - World Literature: From The Beginnings To 1700 A D (UCC: HUM)

Credit Hours: 3.00. (ENGL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 36500 - Literature And Imperialism (UCC: HUM)

Credit Hours: 3.00. A study through cultural and theoretical works of the impact of imperialism on the ruling nations.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism/colonialism. 2. Develop a foundational knowledge of the historical contexts of and theoretical approaches to literary texts: gain an introductory knowledge of postcolonial literary theory. 3. Improve close reading and textual analysis skills. 4. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.

Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex

understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

GER 28000 - German Special Topics

Credit Hours: 3.00. Selected topics on the civilization and culture of German speaking countries. Lectures and readings all in English. No knowledge of German necessary.

Learning Outcomes: 1. Students will explore in depth a particular aspect of life in German-speaking countries, leading to their increased understanding not only of those cultures, but also, by comparison, of their own culture. Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 34901 - The First World War (UCC: HUM)

Credit Hours: 3.00. This course is designed to explore the origins, course, meaning, and lasting legacy of World War I.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students are expected to understand the origins, course, and results of World War I. 2. Students are expected to understand the consequences that the war had on today's world. Credits: 3.00

HIST 35100 - The Second World War (UCC: HUM)

Credit Hours: 3.00. A study of the diplomacy, economic mobilization, and military operations of World War II, 1939-1945.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HTM 37200 - Global Tourism Geography (UCC: BSS)

Credit Hours: 3.00. Introduction and analysis of specific world travel destinations, including the exploration of geographic features, customs and tradition, population centers, visitor attractions, political, religious, language and other cultural differences as these relate to the hospitality and travel industry. The course is designed to teach students specific geographic knowledge and develop a deeper understanding and empathy for cultural values and traditions that exist outside their own culture.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain the interactions of tourism with the culture, economy, and environment of global destinations. 2. Identify international travel patterns and explain their impact on tourism management in promoting cultural understanding and global peace. 3. Locate

various countries, major cities, natural wonders, historic sites and other tourism attractions, both man-made and natural. 4. Describe how the physical environment in specific geographic regions affects the ability of humans to live there and influences inbound and outbound travel. 5. Explain how political, economic, and environmental factors affect travel both positively and negatively. 6. Explain international travel patterns and identify the major travel generating and travel receiving areas. 7. Compare and contrast different cultures throughout the world with your home culture. Identify and explain key differences and their influence on travel. 8. Identify and explain the key elements of interdependence required for the existence of modern day world travel.
Credits: 3.00

LC 37100 - Phonetics Of Foreign Languages

Credit Hours: 3.00. Introduction to articulatory phonetics for students of foreign languages. Mechanisms of production of speech sounds. Production and discrimination of sounds of other languages; contrast with English sounds; practice in pronunciation and phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be awarded for more than one of SLHS 30600 , LING 31500 , and LC 37100.
Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.
University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics
University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.
University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 23200 - Contemporary Crises In International Relations

Credit Hours: 3.00. The focus of this course will be on major world crises, such as in the Middle East and Southern Africa, and ways in which these crises may be analyzed.
Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.
University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.
University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.
Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.
Learning Outcomes: 1. Define and explain the

theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43500 - International Law

Credit Hours: 3.00. A study of international legal theories, principles, and practices, with an emphasis on the role and utility of law in contemporary international relations.

Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

SOC 33800 - Global Social Movements

Credit Hours: 3.00. Explores dynamics of social movements in the world; emphasizes movements in non-western world. Examines emergences of movements, mobilization, tactical actions and consequences, and formal and informal organizations within movements to understand how international, national and local structures affect people.

Credits: 3.00

WGSS 48300 - Feminisms In Global Perspective

Credit Hours: 3.00. Explores feminist struggles through the writings of First and Third World feminist scholars. Focuses on feminist projects within and against colonial, nationalist, religious and global contexts. Includes Third World feminist critiques of Western feminisms.

Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic

understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

AMST 10100 - America And The World (UCC: WC)

Credit Hours: 3.00. This course examines the evolution of American culture as the United States transitioned from a relatively isolated country at the end of the 19th century to an active shaper of a global community by the 21st century. We will examine ways in which American Culture shaped and was shaped by international relationships that transcend nation states. We will explore reactions to, and the results of, the spread of American culture both inside and outside the United States. By studying traditional cultural forms like art, music, design, literature, film, and technology the course will build a foundation from which to understand the configuration of American culture. Yet the course will also emphasize American culture expression, that in the forms of television, advertising, sport, cartoons, social media, video games, fashion, food, drugs, and automobiles, have transcended the geographical boundaries of the United States to engage in global interplays of material cultural exchange.

University Core Curriculum (UCC): (UCC: WC)
Learning Outcomes: 1. Identify the major themes and issues prompted by the term American Culture. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Recognize important issues that occur among peoples in an increasingly interconnected and interdependent world. 5. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 6. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

HEBR 38000 - Israel And The Modern World: Cinema, Literature, History And Politics (UCC: HUM)

Credit Hours: 3.00. Critical survey/exploration of major traits of Israeli culture through a variety of media: literature, film and music, in the larger context of Judaism, Zionism, as well as the creation of a new state and culture. Conducted in English; no knowledge of Hebrew is necessary.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand the depth of Modern Israel cultural, political and historical complexity. 2. Understand the richness of Israeli culture. 3. Understand Israeli political-social problems and its influence on world affairs. 4. Development of modern Israeli cinema and literature in reference to their historical and political groundings. 5. Mastery of major historical events, major films, major literary figures, and major social/political problems. Credits: 3.00

HIST 32105 - Spain: The First Global Empire, 1469-1713

Credit Hours: 3.00. This course examines the history of Spain's global empire from the unification of the kingdoms of Castile and Aragon to the War of the Spanish Succession. Topics include Spain's European possessions, overseas empire, ruling dynasty, society, and culture.

Learning Outcomes: 1. Assess the mechanisms that made the Spanish imperial system successful and, likewise, appraise its inherit weaknesses. 2. Distinguish the different stages in the development of the Spanish empire. 3. Judge the extent of the Spanish empire's impact on international politics and regional histories. 4. Evaluate the substantial cultural output of the period. Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

POL 33500 - China And The Challenges Of Globalization (UCC: BSS)

Credit Hours: 3.00. Globalization is a very popular topic, resulting in a lot of loose and poorly thought-through talk and writing around the subject. The view taken in this course is that to understand current processes of globalization we need to examine it in less broad and amorphous ways by focusing on its specific manifestations. Thus, this course focuses on how China has managed the challenges of globalization. China is a particularly useful case study because it failed the challenges of globalization in the late 19th and early 20th centuries. For an ancient civilization such as China, this failure had tremendous impact on its national pride. The Chinese refer to this historical juncture as the "century of shame." Towards the end of the 20th century and the onset of the 21st, China faced again the challenges of globalization and has arisen to the tasks in a spectacular fashion, transforming a largely rural and agriculture economy into the world's second largest economic power. This amazing transformation is leading some to proclaim that the 21st century will belong to China!

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recall basic facts about China's geography, people, economy, and culture. 2. Identify key historical moments in China's engagement with globalization. 3. Demonstrate a clear grasp of the concept of globalization and contending definitions of it. 4. Apply knowledge to explain how China has dealt with challenges of globalization. Credits: 3.00

ENGL 34400 - Environmental Ethics, Policy, And Sustainability

Credit Hours: 3.00. Environmental Ethics, Policy and Sustainability is an interdisciplinary course designed to open new pathways into ethical and eco-critical inquiry in the Anthropocene age. The course analyzes disciplinary differences in approaching the ethical, the human, and environmental problems such as sustainability, development, biodiversity, global security, and climate change. Students will explore what it means to be ethical in and through an interrogation of our contemporary conceptions of what it means to be human. These interrogations in turn will prompt us to reconsider human creations such as knowledge, culture, and technology, which will push us to genuinely think how humans as a species situate their creations within the realm of what they call Nature. Students will be introduced to the history of environmental studies in the discipline, to the rise of what is now known as "postcolonial ecocriticism" to theoretical inquiry into modern technology, and to other recent developments in the fields of environmental studies.

Learning Outcomes: 1. Learn, describe, and relate key developments in environmental ethics. 2. Distinguish and translate different perspectives concerning ethical challenges. 3. Comprehend the efficacies of environmental positions, and learn to push the boundaries of different disciplinary approaches to environmental dilemmas. 4. Evaluate the limitations of positions and the complex frameworks surrounding ethical problems in order to offer more imaginative and resilient

solutions. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

CMPL 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (LC 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

HIST 27800 - Money, Trade, And Power: The History Of Capitalism

Credit Hours: 3.00. This course examines the origins of capitalist institutions and their changes over time, including banks, joint-stock companies, and modern corporations -- all viewed with respect to their impact on industrialization, colonial expansion, business cycles, and the emergence of a global economy.

Learning Outcomes: 1. Explain the history of capitalism based on a combination of readings, course lectures, and course discussions. 2. Develop compelling historical arguments and demonstrate your understanding of the course material through examinations. 3. Write clear and concise analytical papers based on templates and feedback supplied by the professor. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

LC 26700 - World Literature: From 1700 A D To The Present

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge

of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

LC 26600 - World Literature: From The Beginnings to 1700 A D

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact

of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

C. Option 1 or 2 (3 credits)

1. Additional Course from Section B (3 credits)

2. International Experience (3 credits)

SCLA 49000 - Directed Reading

Credit Hours: 1.00 to 3.00. Designed for a student to work with an instructor on a topic of special interest.

Credits: 1.00 to 3.00

1. Additional Course from Section B (3 credits)

A. Required Courses (6 credits)

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required Courses (6 credits)

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

B. Additional Courses - Choose Two (6 credits)

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

CMPL 26700 - World Literature: From 1700 A D To The Present (UCC: HUM)

Credit Hours: 3.00. (ENGL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

CMPL 26600 - World Literature: From The Beginnings To 1700 A D (UCC: HUM)

Credit Hours: 3.00. (ENGL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 36500 - Literature And Imperialism (UCC: HUM)

Credit Hours: 3.00. A study through cultural and theoretical works of the impact of imperialism on the ruling nations.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism/colonialism. 2. Develop a foundational knowledge of the historical contexts of and theoretical approaches to literary texts: gain an introductory knowledge of postcolonial literary theory. 3. Improve close reading and textual analysis skills. 4. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.

Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

GER 28000 - German Special Topics

Credit Hours: 3.00. Selected topics on the civilization and culture of German speaking countries. Lectures and readings all in English. No knowledge of German necessary.

Learning Outcomes: 1. Students will explore in depth a particular aspect of life in German-speaking countries, leading to their increased understanding not only of those cultures, but also, by comparison, of their own culture. Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 34901 - The First World War (UCC: HUM)

Credit Hours: 3.00. This course is designed to explore the origins, course, meaning, and lasting legacy of World War I.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students are expected to understand the origins, course, and results of World War I. 2. Students are expected to understand the consequences that the war had on today's world. Credits: 3.00

HIST 35100 - The Second World War (UCC: HUM)

Credit Hours: 3.00. A study of the diplomacy, economic mobilization, and military operations of World War II, 1939-1945.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HTM 37200 - Global Tourism Geography (UCC: BSS)

Credit Hours: 3.00. Introduction and analysis of specific world travel destinations, including the exploration of geographic features, customs and tradition, population centers, visitor attractions, political, religious, language and other cultural differences as these relate to the hospitality and travel industry. The course is designed to teach students specific geographic knowledge and develop a deeper understanding and empathy for cultural values and traditions that exist outside their own culture.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain the interactions of tourism with the culture, economy, and environment of global destinations. 2. Identify international travel patterns and explain their impact on tourism management in promoting cultural understanding and global peace. 3. Locate various countries, major cities, natural wonders, historic sites and other tourism attractions, both man-made and natural. 4. Describe how the physical environment in specific geographic regions affects the ability of humans to live there and influences inbound and outbound travel. 5. Explain how political, economic, and environmental factors affect travel both positively and negatively. 6. Explain international travel patterns and identify the major travel generating and travel receiving areas. 7. Compare and contrast different cultures throughout the world with your home culture. Identify and explain key differences and their influence on travel. 8. Identify and explain the key elements of interdependence required

for the existence of modern day world travel.
Credits: 3.00

LC 37100 - Phonetics Of Foreign Languages

Credit Hours: 3.00. Introduction to articulatory phonetics for students of foreign languages. Mechanisms of production of speech sounds. Production and discrimination of sounds of other languages; contrast with English sounds; practice in pronunciation and phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be awarded for more than one of SLHS 30600 , LING 31500 , and LC 37100.

Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 23200 - Contemporary Crises In International Relations

Credit Hours: 3.00. The focus of this course will be on major world crises, such as in the Middle East and Southern Africa, and ways in which these crises may be analyzed.

Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an

experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43500 - International Law

Credit Hours: 3.00. A study of international legal theories, principles, and practices, with an emphasis on the role and utility of law in contemporary international relations.

Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

SOC 33800 - Global Social Movements

Credit Hours: 3.00. Explores dynamics of social movements in the world; emphasizes movements in non-western world. Examines emergences of movements, mobilization, tactical actions and consequences, and formal and informal organizations within movements to understand how international, national and local structures affect people.

Credits: 3.00

WGSS 48300 - Feminisms In Global Perspective

Credit Hours: 3.00. Explores feminist struggles through the writings of First and Third World feminist scholars. Focuses on feminist projects within and against colonial, nationalist, religious and global contexts. Includes Third World feminist critiques of Western feminisms.

Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

AMST 10100 - America And The World (UCC: WC)

Credit Hours: 3.00. This course examines the evolution of

American culture as the United States transitioned from a relatively isolated country at the end of the 19th century to an active shaper of a global community by the 21st century. We will examine ways in which American Culture shaped and was shaped by international relationships that transcend nation states. We will explore reactions to, and the results of, the spread of American culture both inside and outside the United States. By studying traditional cultural forms like art, music, design, literature, film, and technology the course will build a foundation from which to understand the configuration of American culture. Yet the course will also emphasize American culture expression, that in the forms of television, advertising, sport, cartoons, social media, video games, fashion, food, drugs, and automobiles, have transcended the geographical boundaries of the United States to engage in global interplays of material cultural exchange.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Identify the major themes and issues prompted by the term American Culture. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Recognize important issues that occur among peoples in an increasingly interconnected and interdependent world. 5. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 6. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

HEBR 38000 - Israel And The Modern World: Cinema, Literature, History And Politics (UCC: HUM)

Credit Hours: 3.00. Critical survey/exploration of major traits of Israeli culture through a variety of media: literature, film and music, in the larger context of Judaism, Zionism, as well as the creation of a new state and culture. Conducted in English; no knowledge of Hebrew is necessary.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand the depth of Modern Israel cultural, political and historical complexity. 2. Understand the richness of Israeli culture. 3. Understand Israeli political-social problems and its influence on world affairs. 4. Development of modern Israeli cinema and literature in reference to their historical and political groundings. 5. Mastery of major historical events, major films, major literary figures, and major social/political problems. Credits: 3.00

HIST 32105 - Spain: The First Global Empire, 1469-1713

Credit Hours: 3.00. This course examines the history of Spain's global empire from the unification of the kingdoms of Castile and Aragon to the War of the Spanish Succession. Topics include Spain's European possessions, overseas empire, ruling dynasty, society, and culture.

Learning Outcomes: 1. Assess the mechanisms that made the Spanish imperial system successful and, likewise, appraise its inherit weaknesses. 2. Distinguish the different stages in the development of the Spanish empire. 3. Judge the extent of the Spanish empire's impact on international politics and regional histories. 4. Evaluate the substantial cultural output of the period. Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

POL 33500 - China And The Challenges Of Globalization (UCC: BSS)

Credit Hours: 3.00. Globalization is a very popular topic, resulting in a lot of loose and poorly thought-through talk and writing around the subject. The view taken in this course is that to understand current processes of globalization we need to examine it in less broad and amorphous ways by focusing on its specific manifestations. Thus, this course focuses on how China has managed the challenges of globalization. China is a particularly useful case study because it failed the challenges of globalization in the late 19th and early 20th centuries. For an ancient civilization such as China, this failure had tremendous impact on its national pride. The Chinese refer to this historical juncture as the "century of shame." Towards the end of the 20th century and the onset of the 21st, China faced again the challenges of globalization and has arisen to the tasks in a spectacular fashion, transforming a largely rural and agriculture economy into the world's second largest economic power. This amazing transformation is leading some to proclaim that the 21st century will belong to China!

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recall basic facts about China's geography, people, economy, and culture. 2. Identify key historical moments in China's engagement with globalization. 3. Demonstrate a clear grasp of the concept of globalization and contending definitions of it. 4. Apply knowledge to explain how China has dealt with challenges of globalization. Credits: 3.00

ENGL 34400 - Environmental Ethics, Policy, And Sustainability

Credit Hours: 3.00. Environmental Ethics, Policy and Sustainability is an interdisciplinary course designed to open new pathways into ethical and eco-critical inquiry in the Anthropocene age. The course analyzes disciplinary differences in approaching the ethical, the human, and environmental problems such as sustainability, development, biodiversity, global security, and climate change. Students will explore what it means to be ethical in and through an interrogation of our contemporary conceptions of what it means to be human. These interrogations in turn will prompt us to reconsider human creations such as knowledge, culture, and technology, which will push us to genuinely think how humans as a species situate their creations within the realm of what they call Nature. Students will be introduced to the history of environmental studies in the discipline, to the rise of what is now known as "postcolonial ecocriticism" to theoretical inquiry into modern technology, and to other recent developments in the fields of environmental studies.

Learning Outcomes: 1. Learn, describe, and relate key developments in environmental ethics. 2. Distinguish and translate different perspectives concerning ethical challenges. 3. Comprehend the efficacies of environmental positions, and learn to push the boundaries of different disciplinary approaches to environmental dilemmas. 4. Evaluate the limitations of positions and the complex frameworks surrounding ethical problems in order to offer more imaginative and resilient solutions. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic

circulations by contextualizing and analyzing them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

CMPL 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (LC 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

HIST 27800 - Money, Trade, And Power: The History Of Capitalism

Credit Hours: 3.00. This course examines the origins of capitalist institutions and their changes over time, including banks, joint-stock companies, and modern corporations -- all viewed with respect to their impact on industrialization, colonial expansion, business cycles, and the emergence of a global economy.

Learning Outcomes: 1. Explain the history of capitalism based on a combination of readings, course lectures, and course discussions. 2. Develop compelling historical arguments and demonstrate your understanding of the course material through examinations. 3. Write clear and concise analytical papers based on templates and feedback supplied by the professor. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

LC 26700 - World Literature: From 1700 A D To The Present

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

LC 26600 - World Literature: From The Beginnings to 1700 A D

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge

of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

C. Option 1 or 2 (3 credits)

1. Additional Course from Section B (3 credits)

2. International Experience (3 credits)

SCLA 49000 - Directed Reading

Credit Hours: 1.00 to 3.00. Designed for a student to work with

an instructor on a topic of special interest.

Credits: 1.00 to 3.00

1. Additional Course from Section B (3 credits)

A. Required Courses (6 credits)

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

Global Studies Minor

Requirements for the Minor (11-13 credits)

A. Diversity, Equity, and Social Justice in Education (3 credits)

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local

organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

B. Multidisciplinary Course (3 credits)

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGR 20100 - Communicating Across Culture (UCC: BSS/IL)

Credit Hours: 3.00. This course will provide students with an opportunity to understand their place in a multicultural, multiethnic, multinational country, the United States. It is designed to provide an academic overview of the field of multicultural education as it evolved to this day. The course will offer an introductory overview of the many differences that exist within all human beings. Because the diversity among individuals is endless, we cannot study all differences, but will study a sampling such as race, ethnicity, gender identity, age, social class, disability, learning styles, and religion/spiritual orientation. Issues of poverty, language, and social justice may also be examined in relationship to the above major areas of emphasis.

University Core Curriculum (UCC): (UCC: BSS/IL) Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

EDCI 35002 - International Comparative Education

Credit Hours: 3.00. In this course, students will explore the education system in an international context and compare particular aspects of the system (e.g., equity, funding, language, accessibility) to their own experiences with, and knowledge of, education in the United States. Students will consider the range of schools and policies in both countries in terms of issues of social justice (e.g., redistribution, recognition, representation).

Learning Outcomes: 1. Experience, first-hand, the educational system of Tanzania and read accounts of this system from a range of perspectives which draw attention to its strengths and challenges. 2. Investigate issues of social justice (e.g., redistribution, recognition, representation) in education systems. Credits: 3.00

C. International/Globalization Emphasis (4-7 credits)

1. Study Abroad* (2-5 Weeks)

2. Additional Courses (4-7 credits)

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDCI 35001 - Tanzania Seminar

Credit Hours: 2.00. In this course, we will prepare for the Maymester in Tanzania study abroad program in a variety of ways, including investigating the history and culture of Tanzania, beginning to learn Kiswahili, conceptualizing service learning experiences, and collaborating on a plan for program logistics.

Learning Outcomes: 1. Critically explore common conceptions of Africa. 2. Investigate the history and culture of Tanzania. 3. Describe the educational system of Tanzania. 4. Read, write, and speak basic phrases and sentences in Kiswahili. 5. Conceptualize and engage in service learning experiences. Credits: 2.00

EDCI 35004 - History, Culture, And Language In Tanzania

Credit Hours: 3.00. This course is a component of the Maymester in Tanzania study abroad program. In this course, students will study the history, culture, and language of Tanzania through experiences in local schools and the community, supplemented by course readings, assignments, discussions, and service learning projects.

Learning Outcomes: 1. Explore the history of Tanzania, including its identification as the cradle of mankind, colonization, independence, and the impacts of socialism and capitalism. 2. Engage in cultural and linguistic immersion in a rural Tanzanian village and schools. 3. Experience, first-hand, the educational system of Tanzania and read accounts of this system from a range of perspectives which draw attention to its strengths and challenges. 4. Collaborate with Tanzanian residents on

developing and implementing service learning projects in the community. Credits: 3.00

EDCI 32650 - Introduction To Linguistics And Language Acquisition In Education

Credit Hours: 3.00. This course addresses foundational knowledge in language and linguistics for pre-service teachers and educational researchers. The purpose of this course is to survey linguistics, the study of the science of language. In this course, we will focus on phonetics, phonology, morphology, syntax, and semantics. These topics will be discussed in terms of theory, as well as in the context of ESL classroom instruction, materials development, and assessment.

Learning Outcomes: 1. Understand and describe core concepts and terminology of descriptive linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics. 2. Apply course concepts to analyze linguistic data and gain a fuller understanding of the systematic nature of language. 3. Apply descriptive linguistic concepts to instruction to support the four domains of speaking, listening, reading, and writing. 4. Research and describe the biological, social, and cultural dimensions of linguistics, including pragmatics, discourse, dialects, bilingualism, and language in education. 5. Discuss the role of home language and culture in ELL instruction. 6. Apply an understanding of the role of culture and family background in the student's experience of the classroom. Credits: 3.00

D. Global Studies Seminar (1 credit)

EDPS 45200 - Global Studies Seminar

Credit Hours: 1.00. (EDCI 45200) The course builds on students' international cross-cultural experiences, particularly Study Abroad. The course is required for those wishing to complete the Global Studies minor in the College of Education.

Learning Outcomes: 1. Discuss economic, social, and cultural diversity within a global context. 2. Describe the cultural, social and historical dynamics that influence individuals and groups. 3. Explain the perspective of the culture of another country through the study of world languages, arts, spiritual traditions, mythology/literature, and/or through study abroad. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. 5. Clearly communicate a central message with the supporting materials. Credits: 1.00

EDCI 45200 - Global Studies Seminar

Credit Hours: 1.00. (EDPS 45200) The course builds on students' international cross-cultural experiences, particularly Study Abroad. The course is required for those wishing to complete the Global Studies minor in the College of Education.

Learning Outcomes: 1. Discuss economic, social, and cultural diversity within a global context. 2. Describe the cultural, social and historical dynamics that influence individuals and groups. 3. Explain the perspective of the culture of another country through the study of world languages, arts, spiritual traditions, mythology/literature, and/or through study abroad. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. 5. Clearly communicate a central message with the supporting materials. Credits: 1.00

Notes

Reference

History Minor

History Courses (15 credits)

Notes

History of Science Technology and Medicine Minor

About the Minor

Minor Requirements (15 credits)

History of Science, Technology, and Medicine Courses - Choose 4: (12 credits)

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 39400 - Environmental History Of The United States (UCC: HUM)

Credit Hours: 3.00. This is a mid-level survey designed to provide students of environmental science with historical background and students of history with the unique perspective of environmental history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

HIST 31405 - Science, Technology, Engineering And Mathematics (STEM) And Gender (UCC: HUM/STS)

Credit Hours: 3.00. Scientific and technological innovation has been a cornerstone of American identity. How science and

technology matters to gender, and gender matters to science and technology, will be explored through studying amateur and professional scientists and engineers, industrialization, education, sexual division of labor, and home and work spaces in twentieth-century America. Examining technological, scientific, and engineering innovation through the lens of gender reveals changing relationships between men and women in modern America.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to gender. 2. Understand and recognize how assumptions about gender may influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

HIST 35205 - Death, Disease And Medicine In Twentieth Century American History (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of disease, dying, and medicine in the United States in the 20th century.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify and explain the relationship between science and culture and interdisciplinarity. 2. Analyze texts and cultural artifacts about medicine. 3. Identify medical practice and how it is informed by context and culture. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

HIST 33205 - The Nuclear Age (UCC: HUM/STS)

Credit Hours: 3.00. Once seen as a revolutionary and exceptional, nuclear technologies have become central to many aspects of life in the U.S. This course uses the history of nuclear technologies to trace how American society has grappled with technological change.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Write a persuasive essay evaluating nuclear energy as a source of power, using primary and secondary historical sources to support your claims. 2.

Create a compelling argument about how societies cope with technological change, using the history of nuclear technologies as a central example. 3. Summarize the importance of nuclear technologies in US history, drawing on primary and secondary historical sources introduced in the course. Credits: 3.00

HIST 30805 - History Of Life Sciences

Credit Hours: 3.00. This course will examine the development of life sciences from 1750 to the present, introducing students to critical problems related to biology and society through the study of primary and secondary sources. The "life sciences" include all the sciences that deal with life as an organic entity. A prominent theme in this historical treatment is the impact of social and political ideas on the life sciences. Topics will include theories of life, the origin of life, taxonomy and classification, theories of development, natural selection, genetics, eugenics, science and religion, the evolutionary synthesis, biodiversity, ecology and environmentalism, sociobiology, the discovery of DNA, cognition and the brain, and gender in science. Students will develop crucial skills in the interpretation of primary and secondary sources, research, analysis, and presentation.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical material. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 30905 - History Of Environmental Science

Credit Hours: 3.00. This course introduces students to various approaches to environmental science through time. It considers critical problems related to the environment and society. The "environmental sciences" include all the sciences that deal with the Earth's physical and organic environments.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical materials. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2. Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 49400 - Science And Society In American Civilization

Credit Hours: 3.00. This course examines the development of science in the United States from colonial times to the present. Emphasis in the earlier periods is placed on comparison and contrast of the American scene with that of Europe. Subsequent treatment deals with industrialization, and maturation of the American scientific community, and the increasing social effects of science. Among those considered are the forces making for urbanization, for greater interdependence among science, industry and government, and for repercussions in intellectual affairs.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and

society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 30701 - History Of Artificial Intelligence: Minds And Machines

Credit Hours: 3.00. This course examines the long history of efforts in automating human cognition. Historically, the attempts to automate human cognitive functions - from the mere reckoning of numbers to complex decision-making have been entangled with heated debates about what counts as good, proper, and desirable thinking; whose thinking machines should emulate; and whether the thinking of some humans is inferior to that of machines. In this course, we will examine how the invention of calculating machines - analogue and then digital - has developed in tandem with philosophical and scientific theories of human thinking and intelligence. In their turn, the latter developed as a response to changing social, political, and economic currents.

Learning Outcomes: 1. Critique the epistemological foundations and ethical implications of past and present approaches to the automation of human cognition. 2. Use primary sources to make arguments about the role of social, political, economic, and cultural currents that have historically provided the impulses for research and development in the automation of human cognition. 3. Assess historical scholarly arguments about social, economic, and political power asymmetries surrounding artificial intelligences. 4. Create websites to use text, imagery, and video content and effectively communicate how social factors have historically shaped the development of artificial intelligence. Credits: 3.00

HIST 36105 - History Of Science, Technology, And Environment In Pre-Modern East Asia

Credit Hours: 3.00. This course explores developments in scientific, technological, and ecological history specifically in Pre-modern East Asia. In this class, we will read basic theories and methods in the history of science and technology, as well as basic debates and questions that challenge scholars studying the history of science, technology, and the environment in a non-western pre-modern context. We will explore how society, culture, and politics affect knowledge production and people's engagement with nature, and how these interactions, in turn, shaped society, culture, and politics. All readings are in English. No prior knowledge of East Asia is necessary.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society in pre-modern East Asia. 2. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 3. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 4. Investigate the diversity of human experience in pre-modern East Asia, explain how social factors such as ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, have shaped the development or application of science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. 5. Identify and explain the major themes of the history of science, technology, and environment, write about the role of science in society, and describe ethical implications of technological and scientific developments. Credits: 3.00

HIST 30705 - History Of Data: How Data Became Big

Credit Hours: 3.00. This course offers a long history of Big Data. The first module focuses on how states collected data from the 16th to 19th centuries. Here we will focus on mortality bills, census, statistics, and accounting tables. In the second model, we will pay special attention to data collection and privacy in the 20th century. In the third module, students will explore how previous developments in data collection were applied to the new developments in analog and digital computing. The final weeks of the course will focus on present-day artificial intelligence, big data, their technical limitations, and the ways they often amplify, exploit, and contribute to a wide array of social problems.

Learning Outcomes: 1. Understand a variety of historical contexts that have shaped how we use, collect, and analyze data in the 21st century. 2. Assess historical arguments about the place of data in the growth of state bureaucracies, colonialism, eugenics, national security, warfare, and scientific research made in scholarly secondary sources. 3. Use primary sources to make arguments about the historical contingency of the ways practitioners have been using data to solve state problems. 4. Develop critical thinking about data-empowered algorithms and envision a human-centered and ethical way of creating and implementing data technologies. Credits: 3.00

HIST 30902 - History Of Biotechnology

Credit Hours: 3.00. This class examines historical intersections between engineering and biology in the Western world. The course begins by considering several possible meanings of "biotechnology." It examines how and why different biotechnologies from the life sciences, biology, and medicine have arisen in specific historical contexts, changed over time, and affected society from the late 19th century to the present. We will study vaccines and beer-making in the 19th century, cell culture, birth control pills, and DNA sequencing in the 20th century, and 21st-century genome editing and synthetic biology, for example. Overall, this course argues that biotechnologies have always forced human beings to consider whether living and non-living entities are made up of the same fundamental "stuff," the implications of manipulating living things, and the nature of life itself.

Learning Outcomes: 1. Identify and describe examples of biotechnologies. 2. Describe the role of biotechnology in history and its relevance for society today. 3. Explain major themes in the history of biotechnology, such as how biotechnologies have changed through time and impacted society by way of their interactions with (for example) ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class. 4. Investigate the history and social impacts of a biotechnology of their choosing that has not been discussed in depth in this class. 5. Explain how and why this biotechnology arose in a specific historical context, changed over time, and impacted (or impacts) society (using historical methods). Credits: 3.00

HIST 28400 - The Computer Age From Babbage To The Blockchain

Credit Hours: 3.00. In this course we will explore the history of computing-from the pre-electronic days through the computer's ascent in the twentieth century to the various electronic computing and communications technologies that surround us today. This course will investigate why there was a desire to create computing machines in the first place, the economic and political arrangements that brought computers into existence, the debates over what computers could (and should) be used for, the development of the IT profession, and the gradual shift from computers being room-sized specialty machines to everyday objects that people carry around in their pockets.

Learning Outcomes: 1. Identify social, economic, political, and historic factors that have shaped the development and application of computer technology. 2. Describe the history of computing and its relevance for the world today. 3. Locate primary source materials, critically analyze those sources by considering their context and the reasons for their creation. 4. Examine work produced by, and arguments made by, historians. 5. Discuss the role that computers play in everyday life with an expansive view of the wide breadth of computerized systems that surround us. Credits: 3.00

HIST 30801 - American Eugenics

Credit Hours: 3.00. This course explores the pre-history and history of American eugenics, as well as its afterlives. It analyzes how Americans have used scientific ideas to grapple with questions of heredity and human worth from the Early Republic to the present. We will explore the social and political uses of phrenology, physiognomy, and eugenics, and consider how those scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering.

Learning Outcomes: 1. Read and discuss primary sources. 2. Interpret how scientific knowledge has been applied in human lives and society from the 18th century to the present. 3. Analyze major themes in the history of eugenics. 4. Investigate how and why specific ideas about human value and genetic worth arise in specific historical contexts. 5. Critique the extent to which scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering. Credits: 3.00

HIST 36405 - Patient Voices In The History Of Medicine

Credit Hours: 3.00. This course examines the history of medicine in the United States from the early twentieth century to the present by starting with patient voices, which provide a glimpse into the experience of illness. Using patient reflections as the primary lens through which to examine the history of medicine, topics covered include historical changes and historical decision making related to the diagnostic process, therapeutic interventions, access to care, and medical institutions. The course also examines how assumptions about gender, race, and class have shaped differential health outcomes such as mortality rates, time to diagnosis, and determination of treatment approach and efficacy.

Learning Outcomes: 1. Identify in written and oral communication key features of the U.S. medical system by examining how patient experiences have changed over time and in different contexts. 2. Analyze how assumptions about race, gender, and class can affect the experience of illness, access to care, and health outcomes. 3. Engage with primary sources such as journal entries, memoirs, newspaper articles, artwork, and audiovisual material to identify patient perspectives and place them in historical context, and to illustrate how social, cultural, political, and economic factors have shaped the practice of medicine. 4. Reflect on the ethical issues that have arisen in medicine using patient voices as a lens to examine the impact of technology on the illness experience. 5. Examine patient experiences to make an argument about the history of medical practice, such as the diagnostic process or therapeutic approaches, using historical methods. Credits: 3.00

History Course (3 credits)

Notes

Program Learning Outcomes

Horticulture Minor

Requirements for the Minor (16 credits)

Required Courses (7 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

Selective Courses (9 credits)

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 30600 - History Of Horticulture (UCC: STS)

Credit Hours: 3.00. The origins and development of agriculture, with specific emphasis on horticulture from prehistory to the present in relation to civilization and modern culture.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 37000 - Professional Floral Design

Credit Hours: 3.00. Principles and techniques of commercial-scale floral design for weddings, funerals, hospitals, personal, and parties. Design construction for fresh, dried, and silk materials. Survey of retail florist management. Permission of department required.

Credits: 3.00

HORT 40300 - Tropical Horticulture

Credit Hours: 3.00. An introduction to the agriculture of the tropics and subtropics, emphasizing horticultural crops. Offered in even-numbered years.

Credits: 3.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals

and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

HORT 45000 - In The English Landscape: Integrating History, Horticulture, And Landscape Architecture

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Offered in even-numbered years. Permission of instructor required.

Credits: 3.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 59000 - Special Studies In Horticulture

Credit Hours: 1.00 to 3.00. Special studies in horticulture not covered in regular coursework. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 12100 - Medicine In The Garden (UCC: STS)

Credit Hours: 1.00. A survey of the uses and properties of horticultural plants for human health and well-being. Topics will focus on the close relationships between plants and human physiology, nutrition, medicines, mind-altering drugs, poisons, and beverages.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to

complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

HORT 29100 - Selected Topics In Horticulture

Credit Hours: 1.00 to 3.00. This variable-credit, lower-level selected topics course will be used for lower-division undergraduate research projects, for development of new lower-division courses and for temporary courses for lower-division students. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 52500 - The Plant Microbiome

Credit Hours: 3.00. Students will learn about the latest methods to collect and analyze root and shoot exudates, quantify the composition and activity of microbes associating with plants, and determine how these associations influence plant health and productivity. Critical reviews of the primary literature and development of a research proposal will help students acquire the skills needed to conduct research on this rapidly emerging topic.

Learning Outcomes: 1. Describe basic processes regulating plant-microbial interactions in the rhizosphere and phyllosphere, and the implications of these interactions on plant and environmental health. 2. Critically evaluate and discuss primary literature in the field. 3. Compare and contrast methods used to study processes mediating plant-microbial relationships. 4. Identify questions that remain unanswered in the field and develop a research proposal to address one of these questions. Credits: 3.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 42700 - Horticulture Capstone

Credit Hours: 1.00. Based on an approved work or internship experience, or case study, or mentored research experience, or production activity, students will collect information and develop a written analytical exploration of the commercial enterprise, internship institution, or research or production activity. The written analysis will be appropriate to the student's area of concentration. In addition, a summary oral presentation based on specific aspects of their experience will be made by each

student. Prerequisite: Completion of an approved work or internship experience or mentored research experience.

Learning Outcomes: 1. Describe the structure and operation of a horticultural enterprise, public horticultural institution or the methodology for hypothesis testing in research. 2. Give examples of strengths and weaknesses of a horticultural enterprise, public horticultural institution or the methodology used in the research project. 3. Apply principles learned in coursework to evaluation of the observed horticultural enterprise, public horticultural institution or the methodology used in the research project including the management, operational, or horticultural setting and strategies. 4. Formulate proposals for ways in which the observed horticultural enterprise, public horticultural institution or the research activity might improve. Credits: 1.00

HORT 27000 - Floral Design And Interior Plant Management

Credit Hours: 3.00. Elements and principles of floral design, as well as the identification, culture, and propagation of indoor plants. Topics in the art of floral design from both the florist's and the consumer's perspective, as well as information on growing houseplants. A variety of creative, hands-on lab projects include fresh flowers & foliage, silk, and dried materials.

Learning Outcomes: 1. Recognize and use the elements and principles of design as they apply to the art of arranging flowers. 2. Develop the skills necessary to create floral designs. 3. Correctly select and use flowers, containers, and color harmonies. 4. Properly condition cut flowers and greens for use in everyday flower arrangements. 5. Identify indoor foliage plants and flowers and problems of interior plants. 6. Better understand the factors involved in growing and maintaining plants. 7. Know the cultural requirements of 30 popular interior plants. 8. Properly manage interior plants and floral arrangements. 9. Properly evaluate floral designs used for decorating and gift giving. 10. Receive greater enjoyment from plants and flowers and increased awareness of their design qualities. Credits: 3.00

HORT 32100 - Hydroponics Systems

Credit Hours: 3.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in controlled environment agriculture (CEA). This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

Learning Outcomes: 1. Describe essential components of single-pass and recirculating hydroponic systems. 2. Compare different substrates and hydroponic system designs. 3. Interpret water quality analysis results and recommend corrections. 4. Create nutrient solutions using salts or mixed fertilizers. 5. Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponics. 6. Select hydroponic systems for production of leafy greens, herbs, and vegetable crops. 7. Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size,

substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Note

HTM International Studies Minor

Requirements for the Minor (21 credits)

I. Approved full-time Work or Study Abroad (Minimum 12 weeks)

II. Foreign Language (6 credits)

III. International Focus Coursework (15 credits)

A. Non-HTM courses (6 credits)

B. HTM courses (6 credits)

HTM 37200 - Global Tourism Geography (UCC: BSS)

Credit Hours: 3.00. Introduction and analysis of specific world travel destinations, including the exploration of geographic features, customs and tradition, population centers, visitor attractions, political, religious, language and other cultural differences as these relate to the hospitality and travel industry. The course is designed to teach students specific geographic knowledge and develop a deeper understanding and empathy for cultural values and traditions that exist outside their own culture.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain the interactions of tourism with the culture, economy, and environment of global destinations. 2. Identify international travel patterns and explain their impact on tourism management in promoting cultural understanding and global peace. 3. Locate various countries, major cities, natural wonders, historic sites and other tourism attractions, both man-made and natural. 4. Describe how the physical environment in specific geographic regions affects the ability of humans to live there and influences inbound and outbound travel. 5. Explain how political, economic, and environmental factors affect travel both positively and negatively. 6. Explain international travel patterns and identify the major travel generating and travel receiving areas. 7. Compare and contrast different cultures throughout the world with your home culture. Identify and explain key differences and their influence on travel. 8. Identify and explain the key elements of interdependence required for the existence of modern day world travel. Credits: 3.00

HTM 39000 - Undergraduate Special Problems

Credit Hours: 0.00 to 6.00. Individual or group participation in supervised reading, laboratory experiences, field experiences, or research in special areas of the field. Permission of instructor required.

Credits: 0.00 to 6.00

HTM 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an international experience that is recognized by the University.

Credits: 1.00 to 6.00

C. Additional International Focus coursework (3 credits)

1. Non-HTM Courses: Regional or Country Focus

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most

current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

2. Non-HTM Courses: Global Issues

CSR 33200 - Cross-Cultural Marketing And International Retailing

Credit Hours: 3.00. Examination of marketing/retail practices used to target domestic and global consumer market segments. Development of successful retail and marketing strategies is stressed.

Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 20600 - Introduction To Philosophy Of Religion (UCC: HUM)

Credit Hours: 3.00. The course encourages critical reflection on traditional and contemporary views about God and other religious ideas. Topics include arguments for God's existence,

the problem of evil, understanding the divine attributes, miracles, religious pluralism, and life after death. CTL:ISH 1052 Philosophy Of Religion

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate familiarity with one or more conceptions of God and with arguments for and against the coherence of such conceptions. 2. Demonstrate a familiarity with some of the arguments for and against God's existence and with some of the objections to those arguments. 3. Recognize the importance of and demonstrate familiarity with multiple religious ideas and beliefs. 4. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 5. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

Notes

Human Development and Family Science Minor

Requirements for the Minor (15 credits)

Required Courses (6 credits)

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics

at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

Additional Courses (9 credits)

Notes

Human Resource Management Minor

Requirements for the Minor (15 credits)

Required Courses (6 credits)

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

Advanced Topic Courses - (9 credits)

MGMT 49000 - Problems In Industrial Management

Credit Hours: 1.00 to 4.00. Investigation in a specific management field. Arrange with instructor before enrolling.

Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 44429 - Talent Management

Credit Hours: 3.00. This course focuses on the employer-employee relationship at work, and how managers work with employees to improve employee performance. Attention is given to the history of labor relations and performance management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing employee performance.

Learning Outcomes: 1. Identify and understand the tools and techniques of contemporary employee relations at work. 2. Identify and understand the tools and techniques of contemporary performance management at work. 3. Ability to apply these techniques. Credits: 3.00

MGMT 39000 - Junior Level Problems In Management

Credit Hours: 0.00 to 4.00. The Accounting Internship provides work experience in businesses or other institutions. Permission of instructor required.

Credits: 0.00 to 4.00

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

MGMT 44690 - Negotiation And Decision Making

Credit Hours: 3.00. The purpose of this course is to understand the theory and processes of negotiation so that you can negotiate successfully in organizational and management settings. This course covers a wide variety of negotiation problems faced by business people. In addition, models of effective and ineffective decision-making are introduced and students will have the opportunity to make decisions at both the individual and group levels.

Learning Outcomes: 1. Improve ability to effectively negotiate. 2. Recognize and analyze negotiation situations. 3. Gain confidence negotiating. 4. Improve decision-making knowledge and skills. Credits: 3.00

MGMT 44430 - Staffing: Talent Acquisition

Credit Hours: 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. It will also prepare students to evaluate methods for job analysis and selection. Students will learn how to design and ask interview questions that are behaviorally anchored and focused on organization-person fit and person-job fit, both of which are important for successful adaptation and effective performance on the job. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Describe workforce planning implementation issues and the importance of continuous refinement of the plan. 2. Define talent acquisition and differentiate between recruiting and selection processes. 3. Understand the various talent

acquisition organization models. 4. Use tangible and intangible data to build a business case for effective talent acquisition. 5. Articulate the steps in a common talent analysis and translate the analysis into selection criteria and methods. 6. Conduct a job-fit and organization-fit analysis and translate the analysis into selection criteria and methods. 7. Develop behavior-based and situation-based interview questions derived from job analysis and conduct a professional interview. 8. Design a process for final candidate evaluation. 9. Highlight various strategies to orient and onboard new acquired talent. 10. Articulate an employer's legal responsibilities in the talent acquisition process. Credits: 3.00

MGMT 44431 - Compensation: Total Rewards

Credit Hours: 3.00. This course examines the tangible and intangible aspects of compensation, through the lens of a total reward philosophy of an organization in order to attract, motivate, and retain their Human Capital. It also provides an overview of the considerations necessary to develop a compensation system that is internally and externally equitable and fiscally responsible, including the use of job evaluation and salary surveys.

Learning Outcomes: 1. Evaluate the difference Total Rewards programs can make in organizations. 2. Distinguish between total rewards and compensation and identify compensation and non-compensation elements of total rewards. 3. Recognize various reward systems, their relationship and connection to a total compensation and benefits philosophy, and how they impact the quality of work life and productivity organizations. 4. Assess the practical issues in compensation and employee benefits in light of a company's management philosophy and human resources strategies. 5. Define job evaluation and its use to develop internally equitable compensation systems. 6. Identify the implications of using salary surveys to ensure externally equitable and fiscally responsible compensation systems. 7. Explain the concepts of salary administration and application of compensation programs in the business environment. 8. Better understand effective salary and wage structures in organizations today. 9. Explain the relationship between performance evaluation methods and reward systems. 10. Discuss the legal aspects of compensation, benefits and performance appraisals. Credits: 3.00

MGMT 44433 - Leading And Working In Teams

Credit Hours: 3.00. This course will explore the forces that affect behavior in teams, and the factors that lead to team success. We will use a variety of readings, cases, activities, and class discussions to build concrete skills related to leading and working in teams. The course will explore the specific challenges associated with leading teams, some of which include: building and designing teams, managing information exchange within and across teams, structuring effective group decision processes, igniting creative thinking, enabling complex problem solving, managing team diversity and conflict, and managing systems of teams. Permission of instructor required.

Learning Outcomes: 1. Identify and define concepts related to team functioning and effectiveness. 2. Apply those concepts to understand and diagnose issues associated with team effectiveness. 3. Develop a course of action to improve team functioning. Credits: 3.00

MGMT 55500 - Leading Management Of Diversity And Inclusion In Organizations

Credit Hours: 2.00 or 3.00. This course is designed to help participants learn to effectively manage self, peers, teams, clients, and firms in diverse organizational settings and to lead organizational change to foster inclusion, equality, and productive workplaces. The class is designed to develop your skills in leading diversity and inclusion from a multi-level view in the workplace: employee, leader, team member, organizational, and institutional/societal levels. Its goal is to a) improve your ability to work in diverse teams, as well as b) develop your ability to design, and implement strategies to foster cultural and structural change to support the management of an increasingly diverse workforce toward enhanced organizational effectiveness to benefit business, employees, and society. People and leaders in organizations are constantly working with members of different backgrounds, social identities, and experiences, often

across distributed and/or digitally connected environments, fostering increased attention to diversity equity and inclusion in transforming employment settings. When understood, supported and leveraged effectively, these differences in social identities, difference and values can help attract and retain talent, strengthen societal and community economic equality, support organizational and team effectiveness; but when overlooked, or mismanaged, these differences can increase turnover, conflict, stress, talent under-utilization, and harm career and work-life wellbeing, health, and productivity. We will focus on advancing understanding of how intersecting organizational and institutional structures and cultures and their relation to strategies for creating diversity; an inclusive culture and positive climate for inclusion and talent management; and developing and retaining diverse talent to foster innovation and organizational effectiveness across multiple levels of intervention. We discuss how to conduct an organizational diagnosis of the current diversity climate and barriers and facilitators for creating a multicultural workplace and a flexible environment supportive of many identities, and how assumptions of "ideal workers" may vary across industry and cultural contexts. You as a leader will be better able to articulate your own DEI vision and develop understanding of strategies that move from description to evidence-based diagnosis to action strategies and implementation in order to move aspirations into organizational change realities. From an individual leadership perspective, we tackle the question: "Why does diversity, equity and inclusion matter in employing organizations and business, what is the state-of-the-art evidence-based knowledge, and what does it mean to me personally in my career and my leadership beliefs?" Specifically, we focus on the business and social science processes - including attitudes toward in-groups and out-groups, stereotyping, identity, privilege, and power, intersectionality, discrimination, bias, influence opportunity, bystander awareness, allyship, difficult conversations, and perspective taking - these topics relate to how members of different social groups perceive and interact with one another. Since managing social identity increasingly involves managing work-life boundaries and work and non-work public and private selves, we will also learn about authenticity choices and social and public/professional identity boundary management. Further, the opportunity to experience higher well-being and work-life balance is increasingly linked to job and life opportunities reflecting growing work-life inequality in society. From an organizational and group perspective, we address the questions: "What are best practices for successful management of diversity and inclusion? And why does it matter to me as a future leader personally and in business and in the communities and world in which I live."

Learning Outcomes: 1. Evaluate the aspects of your identity and personal experiences that shape how you interact and engage with others and how they interact and engage with you in organizations. 2. Explain how issues of power, privilege, discrimination, bias, equality, and equity influence opportunity and effectiveness in organizations operating both in local, domestic and global contexts. 3. Propose ways to make relationships across cultural and cross-cultural and gender differences in organizations more effective. 4. Describe current perspectives on the relationships among diversity, inclusion, creativity, and innovation in domestic and global organizations. 5. Analyze a company's current approach to leading diversity and use content from this course to propose ways to enhance learning and effectiveness in that company. Credits: 2.00 or 3.00

MGMT 55400 - Leading Global Organizations And People Across Cultures

Credit Hours: 2.00 or 3.00. This course focuses on the opportunities and challenges of managing a global multicultural workforce and implementing global organizational people strategies. The overall goal of this class is to help you become a more effective professional and leader in a global world on and off the job by providing information, tools and multicultural opportunities to increase conceptual and practical understanding of how national cultures shape employment settings and its implications for your own behavior as a global business professional and leader who implements human capital and organizational strategies, policies, and practices in a cross-national context. This course will also increase knowledge of and ability to implement current global human capital, international HRM, and organizational strategies for MNES and domestically. To achieve these goals, student engagement in class sessions, and willingness to share perspectives and opinions, and application of course readings and materials, are critical to the success of this course. A range of participative learning methods are used to facilitate an active classroom environment, including learning log journaling, case analysis, experiential exercises, small group projects, break out discussions, company guest speakers, and self-assessments. The role of the instructor in this course is not always to provide "the" answer, but to create an environment where you can collectively explore, examine and experiment with students' own ideas and share ideas and perspectives on working and managing global firms.

Learning Outcomes: 1. Use cross-cultural leadership and organizational abilities to understand on how cultural differences shape

workplace interactions so you can better implement organizational and people strategies to achieve business goals in a global environment. 2. Identify and avoid cultural mishaps and identify how your own national cultural values and assumptions about managing people and organizations shape your effectiveness in managing people, diversity, and systems in a global or cross-cultural firm. 3. Understand the challenges of adapting HRM policies and organizational people strategies when adapting HR and employment systems as organizations "go global" and develop a global workforce. 4. Understand the pros and cons of different multicultural strategies (cultural minimization, accommodation, cultural integration) for successfully implementing human capital strategies and HR practices in multicultural contexts. 5. Develop the core competencies needed by business leaders to work in multicultural teams contexts, including cultural intelligence, the ability to work in cross-cultural teams, develop clear and concise non country biased written communication, the ability to give effective presentations virtually and face to face, and the ability to engage in strategic cross-cultural thinking to implement global HR. 6. Understand and be able to apply core concepts in global HR/OB from 1)Global HR planning and organizational design; 2) Merger and Acquisition with a focus on linkages to successful people and organizational strategies; 3) Global talent management; 4) Development, reward, and performance management of global leaders; 5) Managing Global Teams, diversity, and cross-cultural communication; and 6) Implementing global change and improving organizational effectiveness. Credits: 2.00 or 3.00

MGMT 44434 - Human Resources Analytics

Credit Hours: 3.00. This course introduces concepts, tools, and methods used in collecting, interpreting, and presenting HR data. Students will learn how to gain new insights, solve problems, and drive performance through HR analytics. A central focus of this course is the ethics of HR analytics. This course teaches students how to ask the right questions in order to intelligently use HR analytics and metrics for business decisions. It discusses the implications of internet AI, business AI, perception AI, and autonomous AI for HR. This course will cover applications including the intelligent use of analytics related to employee engagement, healthcare expenditure, learning and development, performance management, and safety.

Learning Outcomes: 1. Gain an understanding of the different analytical approaches used by HR Professionals to solve real business problems. 2. Examine actual business cases and apply problem solving and critical thinking skills through group case studies. 3. Learn how to make impact with data by using effective storytelling techniques. 4. Build on presentation skills and demonstrate the ability to work effectively in teams. Credits: 3.00

MGMT 42930 - Labor Relations

Credit Hours: 3.00. The course focuses on employee-employer relations. Attention is given to topics in legal aspects of union organizing and collective bargaining, labor unions history and structure in the United States, labor management negotiations, dispute resolution procedures, international labor relations, and labor-management cooperation.

Learning Outcomes: 1. Summarize what unions do and why workers join labor unions. 2. Explain how management can react when its workers decide to form a union. 3. Execute the process of collective bargaining and summarize information typically contained in a collective bargaining agreement. 4. Differentiate how disputes are resolved through mediation, arbitration, and other methods. 5. Compare how labor-management relations in the USA are versus similar relationships in other countries around the world. Credits: 3.00

Notes

Human Rights Studies Minor

Department of Philosophy

Requirements for the Minor (15 credits)

A. HISTORY of Human Rights (3 credits)

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world. Credits: 3.00

B. THEORY of Human Rights (3 credits)

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 26000 - Philosophy And Law

Credit Hours: 3.00. A discussion of philosophical issues in the law: a critical examination of such basic concepts in law as property, civil liberty, punishment, right, contract, crime and responsibility; and a survey of some main philosophical theories about the nature and justification of legal systems. Readings will be drawn from both law and philosophy.

Credits: 3.00

C. STRUCTURE of Human Rights (3 credits)

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic

causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

D. APPLICATION of Human Rights - Choose Two (6 credits)

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in

non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

HIST 30000 - Eve Of Destruction: Global Crises And World Organization In The 20th Century (UCC: HUM)

Credit Hours: 3.00. Using a variety of case studies, this course considers 20th-century turning points -- often violent and disastrous ones -- in an emerging global conversation about urgent world problems and their possible solutions.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 32900 - History Of Women In Modern Europe (UCC: HUM)

Credit Hours: 3.00. This course examines women's experiences and constructions of femininity in Europe from 1789 to the present, including women in revolutions, state intervention in the family, changing ideas of sexuality, women's movements, women in socialism and fascism, and women in war.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will understand the history of women in modern Europe from 1789 to the present by analyzing women's experiences and the social and cultural constructions of femininity as well as the different contexts of class, ethnicity, and nationality in the history of European women. 2. They will think historically and critically about women's participation in revolutions; state interventions in the family; working lives of women; ideals and practices of sexuality; the middle-class model of domesticity and women's responses to it; the role of women and femininity in imperialism; women in socialism, under fascism, and in the transition from communism to capitalism; women's experiences of two world wars; and the rise of feminist movements and contemporary feminisms in Europe. 3. Students will understand the difference between secondary and primary sources. They will read and interpret primary source materials, including fiction, autobiography, and other historical documents including those written by women. 4. Students will develop their critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 33700 - Europe Since 1945

Credit Hours: 3.00. This course traces the history of Europe, west and east, from 1945 to the present. Once viewed as a success story, culminating in the collapse of eastern European communism, developments after 1990 - such as the breakup of Yugoslavia, the European debt crisis, and the War in Ukraine - call this simplistic narrative into question. This course will consider Cold War division, decolonization, and political protest alongside democratization and economic recovery.

Learning Outcomes: 1. Explain broad themes in postwar European history, including the Cold War as geopolitical process and a historical framework, the role of decolonization in shaping European politics, the impact of social movements, and the distinctions and overlaps between different economic systems. 2. Read historical scholarship for arguments, evidence, and contributions to the field and assess their effectiveness in these areas. 3. Craft a persuasive argument supported by primary and secondary source evidence that makes an intervention into the historical literature on a chosen topic. 4. Interpret a diverse range of historical sources and assess their utility in understanding the past, paying attention to form, perspective, and limitations. 5. Present historical research clearly and accessibly to different audiences using a variety of media formats. Credits: 3.00

HIST 38300 - Recent American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Intensive study of constitutional questions and Supreme Court answers from the period of the Warren Court to present. Particularly emphasized are the areas of segregation, civil rights, and civil liberties and guarantees for personal rights.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 40800 - Dictatorship And Democracy: Europe 1919-1945

Credit Hours: 3.00. This course examines the fleeting triumph of democracy across Europe. Followed by the rise of fascism, communism, and Nazism. Emphasis will be placed on broad economic, social, and cultural transformations as well as individual choices to resist or conform.

Credits: 3.00

HIST 41300 - Modern European Imperialism: Repression And Resistance

Credit Hours: 3.00. This course examines the expansion, transformation and collapse of 19th and 20th-century European empires, focusing on colonial encounters and relationships. Students should come to the course familiar with major developments, events and themes in modern European and/or global history.

Learning Outcomes: 1. Contextualize and compare important events and moments in the history of European imperialism and decolonization. 2. Analyze and evaluate how historians interpret the past, and examine how this past continues to shape the present. 3. Analyze an array of historical sources and types of evidence, historical narratives, first-person accounts and commentaries, scholarly interpretations, visual imagery and fictional portrayals, as well as the setting in which these sources were produced. 4. Craft original arguments supported by historical and textual evidence in class discussions and weekly writing assignments. Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

PHIL 11400 - Global Moral Issues (UCC: HUM)

Credit Hours: 3.00. A systematic and representative examination of significant contemporary moral problems with a focus on global issues such as international justice, poverty and foreign aid, nationalism and patriotism, just war, population and the environment, human rights, gender equality, and national self-determination.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of a comprehensive selection of global moral issues, including the concepts and theories that are essential to understanding and discussing these issues. 2. Acquire skills in the analysis and evaluation, as well the construction, of the kind of arguments needed for justifying personal opinion on ethical issues. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of

international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal

thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

CDIS 23900 - Introduction To Disability Studies

Credit Hours: 3.00. Introduces students to the principles of and debates within disability studies. Topics explored include ideas of normalcy; the social model of disability; history of eugenics and its current manifestations; relations between disability and other identity categories; issues of social and physical access; cultural representations of disabled people.

Learning Outcomes: 1. Identify different models of understanding disability. 2. Understand the ways normalcy is socially constructed. 3. Distinguish between impairment and disability. 4. Offer informed opinions on current eugenic practices. 5. Compare and contrast disability to other identity categories such as race, gender, and sexuality. 6. Identify exclusionary practices that marginalize disabled people. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

ANTH 21500 - Introduction To Forensic Anthropology

Credit Hours: 3.00. Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. This course introduces students to methods used to recover and positively identify human remains, and to evaluate trauma and taphonomy in medico-legal situations. Topics include an overview of historical and current developments in the field. Students will develop a comprehensive understanding of the sequential order of applied work from the search for forensic scenes through the recovery of remains, and skeletal analysis in the laboratory.

Learning Outcomes: 1. Understand the legal context in which anthropologists work in both state and federal courts by the standards of the US medico-legal system. 2. Explain the statistical approaches to forensic anthropological problems by analysis of problem sets. 3. Gain general knowledge about the methods of the biological profile (age, sex, ancestry, stature and pathology) to improve competency and understand the errors associated with each method by review and evaluation of relevant literature. 4. Explain the biological basis of the components of the biological profile by advancing reasonable conclusions. 5. Critically examine the use of the terms race and ancestry in forensic contexts by group discussion. Credits: 3.00

HIST 38200 - American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Survey of the fundamental principles of American constitutionalism and dominant trends in judicial interpretation, from the creation of the Constitution to the period of the New Deal.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 40500 - The French Revolution And Napoleon

Credit Hours: 3.00. A study of revolutionary France from the fall of the ancient regime to the Congress of Vienna. Divided in emphasis between the period of the revolution and the era of Napoleon, the course stresses social, political, ideological, and institutional developments.

Credits: 3.00

HIST 40600 - Rebels And Romantics: Europe 1815-1870

Credit Hours: 3.00. Examines the dramatic social, cultural, and political developments in Europe following the defeat of Napoleon through various rebellious and romantic personalities, as well as figures who supported conservative or reformist solutions to the upheavals of industrialization, revolution, and nationalism.

Credits: 3.00

A. HISTORY of Human Rights (3 credits)

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world.
Credits: 3.00

Requirements for the Minor (15 credits)

A. HISTORY of Human Rights (3 credits)

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world.
Credits: 3.00

B. THEORY of Human Rights (3 credits)

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 26000 - Philosophy And Law

Credit Hours: 3.00. A discussion of philosophical issues in the law: a critical examination of such basic concepts in law as property, civil liberty, punishment, right, contract, crime and responsibility; and a survey of some main philosophical theories

about the nature and justification of legal systems. Readings will be drawn from both law and philosophy.

Credits: 3.00

C. STRUCTURE of Human Rights (3 credits)

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

D. APPLICATION of Human Rights - Choose Two (6 credits)

ANTH 20300 - Biological Bases Of Human Social Behavior (UCC: BSS)

Credit Hours: 3.00. This course is an introduction to human social behavior from the perspective of biological anthropology, with special emphasis on human evolution and non-human primates. Topics include aggression, communication, learning, maturation, sexuality, and the evolution of social systems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Demonstrate understanding of core concepts and theories of human evolutionary biology and ecology. 2. Describe key components of human life course evolution and hunter-gatherer lifestyles. 3. Analyze the evolutionary mechanisms underlying behavioral variation across primates. 4. Assess cross-cultural variation in food acquisition, mating, parenting, and social systems. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and

contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

HIST 33700 - Europe Since 1945

Credit Hours: 3.00. This course traces the history of Europe, west and east, from 1945 to the present. Once viewed as a success story, culminating in the collapse of eastern European communism, developments after 1990 - such as the breakup of Yugoslavia, the European debt crisis, and the War in Ukraine - call this simplistic narrative into question. This course will consider Cold War division, decolonization, and political protest alongside democratization and economic recovery.

Learning Outcomes: 1. Explain broad themes in postwar European history, including the Cold War as geopolitical process and a historical framework, the role of decolonization in shaping European politics, the impact of social movements, and the distinctions and overlaps between different economic systems. 2. Read historical scholarship for arguments, evidence, and contributions to the field and assess their effectiveness in these areas. 3. Craft a persuasive argument supported by primary and secondary source evidence that makes an intervention into the historical literature on a chosen topic. 4. Interpret a diverse range of

historical sources and assess their utility in understanding the past, paying attention to form, perspective, and limitations. 5. Present historical research clearly and accessibly to different audiences using a variety of media formats. Credits: 3.00

HIST 38300 - Recent American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Intensive study of constitutional questions and Supreme Court answers from the period of the Warren Court to present. Particularly emphasized are the areas of segregation, civil rights, and civil liberties and guarantees for personal rights.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 40800 - Dictatorship And Democracy: Europe 1919-1945

Credit Hours: 3.00. This course examines the fleeting triumph of democracy across Europe. Followed by the rise of fascism, communism, and Nazism. Emphasis will be placed on broad economic, social, and cultural transformations as well as individual choices to resist or conform.

Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

PHIL 11400 - Global Moral Issues (UCC: HUM)

Credit Hours: 3.00. A systematic and representative examination of significant contemporary moral problems with a focus on global issues such as international justice, poverty and foreign aid, nationalism and patriotism, just war, population and the environment, human rights, gender equality, and national self-determination.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Acquire a thorough understanding of a comprehensive selection of global moral issues, including the concepts and theories that are essential to understanding and discussing these issues. 2. Acquire skills in the analysis and evaluation, as well the construction, of the kind of arguments needed for justifying personal opinion on ethical issues. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents

the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 33900 - Sociology Of Global Development

Credit Hours: 3.00. Analysis of the causes and consequences of global development. Topics include: globalization; colonialism and decolonization; food insecurity and dependency; industrialization, poverty and inequality; migration; debt and trade; women's empowerment; global health; rights and social change; and sustainable development. This course will introduce you to the study of global development and globalization. The primary questions we will address are: What is development? What is globalization and what is its relationship with development? How have the processes of global development produced inequalities among nations,

regions, races, genders, and classes? Is there a "developing" world and a "developed" world? If so, what are their differences and how do they relate with each other? How have some developing countries become more developed than others? What roles do corporations, the state, and civil society organizations play in the processes of global development? How is global development interrelated with the physical environment, inequalities of consumption, and the environmental crisis? How do people resist the inequalities and perceived injustices of global development through global social movements? How are we interconnected economically, politically, culturally, socially, and ecologically with people all over the world? What are the possible futures of development? To address these issues, our focus will be on the developing world, our scope will be global and long-term, our methodology will be historical-comparative, and our perspective will be social-scientific and critical.

Learning Outcomes: 1. Demonstrate knowledge of the causes and consequences of global development. 2. Outline the strengths and weaknesses of the basic theoretical perspectives on global development. 3. Identify the key historical events that have led to the project of global development. 4. Apply sociological analysis to different complex and power dynamics. 5. Describe how small- and large-scale projects might contribute to or hinder sustainable development. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

CDIS 23900 - Introduction To Disability Studies

Credit Hours: 3.00. Introduces students to the principles of and debates within disability studies. Topics explored include ideas of normalcy; the social model of disability; history of eugenics and its current manifestations; relations between disability and other identity categories; issues of social and physical access; cultural representations of disabled people.

Learning Outcomes: 1. Identify different models of understanding disability. 2. Understand the ways normalcy is socially constructed. 3. Distinguish between impairment and disability. 4. Offer informed opinions on current eugenic practices. 5. Compare and contrast disability to other identity categories such as race, gender, and sexuality. 6. Identify exclusionary practices that marginalize disabled people. Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through

the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

PHIL 40300 - Moral Psychology And Climate Change

Credit Hours: 3.00. This course investigates the ethical challenges posed by climate change in conjunction with the deep cognitive and motivational factors that shape our individual and collective responses to it. Current research on human moral psychology is examined, drawing on work from a range of disciplines. Ethical theories concerning the unique moral challenges posed by a threat that spans national borders and human generations are considered. Strategies for addressing climate change that try to avoid our common cognitive foibles, and to leverage what we know about human moral capacities for collective action, are examined.

Learning Outcomes: 1. Identify the structure, thesis statement, and main lines of argumentation in written work of philosophers and psychologists, and also to analyze the arguments by breaking them down into their component parts, and formulating their own objections. 2. Discuss a wide variety of issues and sources surrounding moral psychology, from philosophers, psychologists, biologists, economists and anthropologists; they will develop this ability by summarizing and commenting on the assigned readings in weekly blog posts. 3. Compare the threat raised by climate change to other existential threats by reporting on the way different kinds of threats are processed cognitively. 4. Appraise the strengths and weaknesses of different strategies for addressing climate change, as assessed from the point of view of the state of the art understanding of human cognition and moral motivation; they will write a research paper that assesses the pros and cons of such strategies. 5. Identify common cognitive blind spots, predictable irrationalities, and motivational hurdles, and will be able to use this to appreciate the scope of the collective action problems associated with climate change; they will develop these skills by reading academic texts devoted to these issues. Credits: 3.00

ANTH 21500 - Introduction To Forensic Anthropology

Credit Hours: 3.00. Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. This course introduces students to methods used to recover and positively identify human remains, and to evaluate trauma and taphonomy in medico-legal situations. Topics include an overview of historical and current developments in the field. Students will develop a comprehensive understanding of the sequential order of applied work from the search for forensic scenes through the recovery of remains, and skeletal analysis in the laboratory.

Learning Outcomes: 1. Understand the legal context in which anthropologists work in both state and federal courts by the standards of the US medico-legal system. 2. Explain the statistical approaches to forensic anthropological problems by analysis of problem sets. 3. Gain general knowledge about the methods of the biological profile (age, sex, ancestry, stature and pathology) to improve competency and understand the errors associated with each method by review and evaluation of relevant literature. 4. Explain the biological basis of the components of the biological profile by advancing reasonable conclusions. 5. Critically examine the use of the terms race and ancestry in forensic contexts by group discussion. Credits: 3.00

HIST 38200 - American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Survey of the fundamental principles of American constitutionalism and dominant trends in judicial interpretation, from the creation of the Constitution to the period of the New Deal.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Notes

Program Learning Outcomes

Requirements for the Minor (15 credits)

A. HISTORY of Human Rights (3 credits)

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world.
Credits: 3.00

B. THEORY of Human Rights (3 credits)

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized" future will be considered.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 26000 - Philosophy And Law

Credit Hours: 3.00. A discussion of philosophical issues in the law: a critical examination of such basic concepts in law as property, civil liberty, punishment, right, contract, crime and responsibility; and a survey of some main philosophical theories about the nature and justification of legal systems. Readings will be drawn from both law and philosophy.

Credits: 3.00

C. STRUCTURE of Human Rights (3 credits)

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials

and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

D. APPLICATION of Human Rights - Choose Two (6 credits)

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated,

how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

HIST 30000 - Eve Of Destruction: Global Crises And World Organization In The 20th Century (UCC: HUM)

Credit Hours: 3.00. Using a variety of case studies, this course considers 20th-century turning points -- often violent and disastrous ones -- in an emerging global conversation about urgent world problems and their possible solutions.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 32900 - History Of Women In Modern Europe (UCC: HUM)

Credit Hours: 3.00. This course examines women's experiences and constructions of femininity in Europe from 1789 to the present, including women in revolutions, state intervention in the family, changing ideas of sexuality, women's movements, women in socialism and fascism, and women in war.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will understand the history of women in modern Europe from 1789 to the present by analyzing women's experiences and the social and cultural constructions of femininity as well as the different contexts of class, ethnicity, and nationality in the history of European women. 2. They will think historically and critically about women's participation in revolutions; state interventions in the family; working lives of women; ideals and practices of sexuality; the middle-class model of domesticity and women's responses to it; the role of women and femininity in imperialism; women in socialism, under fascism, and in the transition from communism to capitalism; women's experiences of two world wars; and the rise of feminist movements and contemporary feminisms in Europe. 3. Students will understand the difference between secondary and primary sources. They will read and interpret primary source materials, including fiction, autobiography, and other historical documents including those written by women. 4. Students will develop their critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 33700 - Europe Since 1945

Credit Hours: 3.00. This course traces the history of Europe, west and east, from 1945 to the present. Once viewed as a success story, culminating in the collapse of eastern European communism, developments after 1990 - such as the breakup of Yugoslavia, the European debt crisis, and the War in Ukraine - call this simplistic narrative into question. This course will consider Cold War division, decolonization, and political protest alongside democratization and economic recovery.

Learning Outcomes: 1. Explain broad themes in postwar European history, including the Cold War as geopolitical process and a historical framework, the role of decolonization in shaping European politics, the impact of social movements, and the distinctions and overlaps between different economic systems. 2. Read historical scholarship for arguments, evidence, and contributions to the field and assess their effectiveness in these areas. 3. Craft a persuasive argument supported by primary and secondary source evidence that makes an intervention into the historical literature on a chosen topic. 4. Interpret a diverse range of historical sources and assess their utility in understanding the past, paying attention to form, perspective, and limitations. 5. Present historical research clearly and accessibly to different audiences using a variety of media

formats. Credits: 3.00

HIST 38300 - Recent American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Intensive study of constitutional questions and Supreme Court answers from the period of the Warren Court to present. Particularly emphasized are the areas of segregation, civil rights, and civil liberties and guarantees for personal rights.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 40800 - Dictatorship And Democracy: Europe 1919-1945

Credit Hours: 3.00. This course examines the fleeting triumph of democracy across Europe. Followed by the rise of fascism, communism, and Nazism. Emphasis will be placed on broad economic, social, and cultural transformations as well as individual choices to resist or conform.

Credits: 3.00

HIST 41300 - Modern European Imperialism: Repression And Resistance

Credit Hours: 3.00. This course examines the expansion, transformation and collapse of 19th and 20th-century European empires, focusing on colonial encounters and relationships. Students should come to the course familiar with major developments, events and themes in modern European and/or global history.

Learning Outcomes: 1. Contextualize and compare important events and moments in the history of European imperialism and decolonization. 2. Analyze and evaluate how historians interpret the past, and examine how this past continues to shape the present. 3. Analyze an array of historical sources and types of evidence, historical narratives, first-person accounts and commentaries, scholarly interpretations, visual imagery and fictional portrayals, as well as the setting in which these sources were produced. 4. Craft original arguments supported by historical and textual evidence in class discussions and weekly writing assignments. Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

PHIL 11400 - Global Moral Issues (UCC: HUM)

Credit Hours: 3.00. A systematic and representative examination of significant contemporary moral problems with a focus on global issues such as international justice, poverty and foreign aid, nationalism and patriotism, just war, population and the environment, human rights, gender equality, and national self-determination.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of a comprehensive selection of global moral issues, including the concepts and theories that are essential to understanding and discussing these issues. 2. Acquire skills in the analysis and evaluation, as well the construction, of the kind of arguments needed for justifying personal opinion on ethical issues. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from

first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

CDIS 23900 - Introduction To Disability Studies

Credit Hours: 3.00. Introduces students to the principles of and debates within disability studies. Topics explored include ideas of normalcy; the social model of disability; history of eugenics and its current manifestations; relations between disability and other identity categories; issues of social and physical access; cultural representations of disabled people.

Learning Outcomes: 1. Identify different models of understanding disability. 2. Understand the ways normalcy is socially constructed. 3. Distinguish between impairment and disability. 4. Offer informed opinions on current eugenic practices. 5. Compare and contrast disability to other identity categories such as race, gender, and sexuality. 6. Identify exclusionary practices that marginalize disabled people. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

ANTH 21500 - Introduction To Forensic Anthropology

Credit Hours: 3.00. Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. This course introduces students to methods used to recover and positively identify human remains, and to evaluate trauma and taphonomy in medico-legal situations. Topics include an overview of historical and current developments in the field. Students will develop a comprehensive understanding of the sequential order of applied work from the search for forensic scenes through the recovery of remains, and skeletal analysis in the laboratory.

Learning Outcomes: 1. Understand the legal context in which anthropologists work in both state and federal courts by the standards of the US medico-legal system. 2. Explain the statistical approaches to forensic anthropological problems by analysis of problem sets. 3. Gain general knowledge about the methods of the biological profile (age, sex, ancestry, stature and pathology) to improve competency and understand the errors

associated with each method by review and evaluation of relevant literature. 4. Explain the biological basis of the components of the biological profile by advancing reasonable conclusions. 5. Critically examine the use of the terms race and ancestry in forensic contexts by group discussion. Credits: 3.00

HIST 38200 - American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Survey of the fundamental principles of American constitutionalism and dominant trends in judicial interpretation, from the creation of the Constitution to the period of the New Deal.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 40500 - The French Revolution And Napoleon

Credit Hours: 3.00. A study of revolutionary France from the fall of the ancient regime to the Congress of Vienna. Divided in emphasis between the period of the revolution and the era of Napoleon, the course stresses social, political, ideological, and institutional developments.

Credits: 3.00

HIST 40600 - Rebels And Romantics: Europe 1815-1870

Credit Hours: 3.00. Examines the dramatic social, cultural, and political developments in Europe following the defeat of Napoleon through various rebellious and romantic personalities, as well as figures who supported conservative or reformist solutions to the upheavals of industrialization, revolution, and nationalism.

Credits: 3.00

A. HISTORY of Human Rights (3 credits)

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world.
Credits: 3.00

Information Studies Minor

About the Minor

Requirements for the Minor (15 credits)

Core Courses (6 credits)

Required Foundation Course (3 credits)

ILS 10000 - Introduction To Information Studies

Credit Hours: 3.00. This course will provide a foundation for navigating and engaging with the information-rich world. Students will define and assess information in order to address real-world situations; map their information landscape and effectively engage with information systems as well as human sources of information; develop a practice of critical and ethical information use; and conceptualize, apply, and examine the strategies for information and knowledge management, production, and dissemination. Students will examine the societal impact and implications of information and information privilege to explore the applications and consequences of information, in addition to examining data practices and methods. This will provide students with an opportunity to strengthen their research and information literacy skills, reflect in an informed and critical manner, and give them the tools to successfully make ethical, evidence-based decisions in the academic and professional context.

Learning Outcomes: 1. Identify different types of primary and secondary information formats and how they are created. 2. Analyze the societal, historical, and political significance of

information. 3. Identify and explain different types of information-seeking behaviors. 4. Demonstrate ethical attribution of sources in their own information production. 5. Critically evaluate information. 6. Synthesize information in order to make ethical and evidence-based decisions. 7. Identify interested parties, such as scholars, experts, archives, organizations, governments, and industries, who might produce or house information about a topic and then determine how to access that information. 8. Match information needs and search strategies to appropriate search tools. 9. Design and refine needs and search strategies. 10. Understand how information systems (i.e., collections of recorded information) are organized in order to access relevant information. 11. Understand how and why information is selected for long-term preservation and access. 12. Organize information in situationally relevant ways. 13. Explain different forms of information dissemination. 14. Explore different professional pathways and career options in relation to information. 15. Analyze and criticize forms of preservation. Credits: 3.00

Additional Foundation Courses - choose one of the following (3 credits)

ILS 30000 - Information, Culture, And Society

Credit Hours: 3.00. Information and information systems shape our beliefs, influence decision-making, define our collective knowledge, and are integral to being an informed, responsible, and engaged citizen in our modern world. This course will examine the intricate relationship between information and society to better understand how information ecosystems, constituted by various technologies and practices, shape and are shaped by individual identities, structures of power, and ethical considerations/human values. Using an interdisciplinary and team-based approach, students will gain essential skills to navigate their information-rich world.

Learning Outcomes: 1. Identify and apply frameworks to critically evaluate the impact of information and technology on cultural norms, values, and societal structures. 2. Explore the concept of information identity, including how individuals and communities construct their identities through information consumption and production, and critically analyze the impact of information identity on culture and society. 3. Explain the components of information ecosystems, including producers, consumers, intermediaries, and technologies, and how they interact within different cultural and societal contexts. 4. Analyze the power structures in information ecosystems, including the privileged access and control of certain individuals or groups, and explain how these power dynamics intersect with social constructs like race, gender, class, and ethnicity to shape cultural and societal dynamics. 5. Articulate ethical principles related to information ownership, privacy, censorship, transparency, and research in various contexts. Credits: 3.00

ILS 30100 - Data Foundations, Tools, And Applications

Credit Hours: 3.00. Data are everywhere. Data permeates every aspect of our lives, from journalistic reporting to workplace projects to artificial intelligence applications. This course covers the basics of the data research lifecycle, including locating and managing datasets, along with applying different methods and tools a to craft compelling stories about data. Students will learn the difference between data and information and how to transform raw data into information to be communicated to a wider audience. This course offers unique skills for students from any discipline who want to discover the world of data.

Learning Outcomes: 1. Understand the differences between data and information. 2. Navigate the basics of data management, ethics, and analysis. 3. Explore different datasets and their lifecycles. 4. Apply fundamental methods--and tools--of data location, analysis, cleaning, and visualization. 5. Create an original data story with and about data. Credits: 3.00

Selective Courses (9 credits)

Group 1 - choose any of the following (6 credits)

MGMT 17500 - Information Strategies For Management (UCC: IL)

Credit Hours: 1.00. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Organization and use of electronic and print tools will be explained through discussion, hands-on exercises, and homework assignments. Permission of instructor required.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Ability to access information and determine what different sources are needed for problem solving. 2. Develop a foundation in problem-solving to use discovered information effectively and efficiently. 3. Develop a knowledge base into the full array of information available (scholarly articles, market reports, quality websites, and other types of information). 4. Prioritize sources based on credibility and relevance. 5. Accurately cite the information you find. 6. Use retrieved information to accomplish a specific purpose and present information clearly and persuasively using a range of technology tools and media. Credits: 1.00

MGMT 11000 - Introduction To Management And Information Strategies

Credit Hours: 2.00. An introduction to and survey of the field of business. Exposure to the different functional areas of management will be stressed. Focus will be on the individual development of the student in regard not only to future professional employment but also to his or her educational planning. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Students apply their knowledge of business in a Case Competition. Required for freshman Krannert Leaders Academy students.

Learning Outcomes: 1. Learn how to manage themselves. 2. Identify various professional development options available to them. 3. Reflect upon what type of Krannert student they would like to be. 4. Learn strategies and tactics to help them transition to college life 5. Analyze and rank different main areas of business in accordance with individual interests. 6. Learn how to manage teams. 7. Reflect upon their behavior within a group. 8. Learn how to manage a small team to be efficient 9. Compete in a freshmen case competition to explore further how to practice teamwork in a case environment. 10. Use information and fundamentals of business to make decisions 11. Understand the fundamental vocabulary of business. 12. Become aware of various resources that are available to them through the library. 13. Break down problems into segments. 14. Use information to make decisions in groups. 15. Become acquainted with numerous people associated with Krannert's past, current, and future endeavors. Credits: 2.00

IDIS 20100 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods

through critical inquiry. 4. Create a process for developing and completing a digital project. Credits: 3.00

Group 2 - choose any of the following (3 credits)

AMST 30100 - Perspectives On America

Credit Hours: 3.00. Advanced interdisciplinary study of American culture, history, and society in their national and global contexts.

Credits: 3.00

CHM 51300 - Chemical Literature

Credit Hours: 1.00. Types of information in technical publications; exercises in finding, assembling, and using such data.

Credits: 1.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

Program-Level Learning Outcomes

Innovation and Transformational

Change Minor

About the Minor

Requirements for the Minor (18 credits)

Required Courses (6 credits)

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ENGR 30500 - Fundamentals Of Innovation Theory And Practice

Credit Hours: 3.00. This course is designed to provide students with initial exposure to the fundamental patterns, mindsets, behaviors, attributes, tools, and methods employed in the innovative activity of individuals and organizations. Emphasis is placed on understanding and effectively utilizing techniques to systematically drive innovation that are drawn from the fields of business, design, problem-solving, engineering, and the social sciences. Lecture, in-class small group activities, and individual and team assignments are employed across an array of contemporary socio-technical challenges to provide students with the opportunity to apply conveyed theory and methods to rigorously structure problems, understand involved stakeholders, utilize innovation motifs and analogical reasoning to develop robust views of potential solutions spaces, tailor solution design to stakeholder context, consider the full suite of functional, social, and emotional dimensions that could influence solution prioritization, and document and systematically assess underlying solution assumptions to iterate toward a viable and sustainable forward-looking plan that could achieve target outcomes. This course counts toward, serves as a required entry course for, the College of Engineering Minor in Innovation and Transformational Change.

Learning Outcomes: 1. Develop working knowledge of established innovation forms and motifs. 2. Demonstrate ability to link innovation motifs to specific classes of problems. 3. Understand, and be able to pursue, the core aspects of an end-to-end innovation process. 4. Recognize the mental models, mindsets and behaviors of innovators. 5. Gain awareness of the approaches various forms of organizations take to systematically innovate. 6. Acquire leadership and communication skills through teamwork, oral presentations, and written deliverables. Credits: 3.00

ENGR 49001 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multi-disciplinary student teams directly apply cumulative learning to address selected parts of a real-world complex societal challenge in close collaboration with a partner organization, in an experiential learning format. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation. Permission of instructor required.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually-exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services, and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversion methodologies and the role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Understand combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion, and retention of new solutions. Credits: 3.00

CE 59601 - Entrepreneurship And Business Strategy In Engineering

Credit Hours: 3.00. This course offers students the opportunity to learn and apply the core skills required to build and grow engineering- and technology-based businesses through lecture,

case discussions, and weekly activities tied to a semester-long team project. Course content includes market analysis techniques to link technology attributes to opportunity and vice versa, combinatorial business design and planning methods, strategic innovation theories, competitive analysis, methods of emergent strategy and risk mitigation, as well as examination of team building, firm influence and navigation, and organizational design principles. Emphasis throughout is placed on the implications of research and development uncertainty, long-lifecycle economics, and the management of subcontracts and multi-disciplinary teams often encountered when developing and delivering complex engineering outputs. Case studies are used to contrast the challenges faced when creating new businesses (entrepreneurial) with those encountered in attempts to grow an existing enterprise (intrapreneurial). Coursework and project activities also facilitate development of business acumen, and skill building in conceptual thinking, synthesis, and persuasive communication. This course is particularly relevant for engineering students intending to progress into managerial roles in technology or R&D driven organizations. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Articulate the similarities and differences between entrepreneurship and intrapreneurship. 2. Employ open-ended problem solving techniques to identify opportunities to grow or transform new or existing organizations and/or commercialize new technologies. 3. Utilize and interpret qualitative and quantitative issue and market analysis methods to understand and/or quantify the level of market interest in an idea. 4. Understand and apply theories of innovation to define competitive market entry strategies. 5. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 6. Employ principles of risk mitigation and emergent strategy to define the assumptions underlying new ideas and explore paths to capture market value. 7. Perform and interpret financial evaluations of new ideas and businesses. 8. Interpret the tradeoffs of varying legal and management structures for a new enterprise. 9. Recognize influence paths in an organization and/or market ecosystem and tailor oral and written communications accordingly.

Credits: 3.00

CE 59801 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multidisciplinary student teams directly apply cumulative learning to address a real-world complex societal challenge in close collaboration with a partner organization in an experiential learning format. The course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversation methodologies and role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means

to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion and retention of new solutions. Credits: 3.00

Selective Courses (9 credits)

Design Holistic Solutions (3 credits)

CE 39800 - Introduction To Civil Engineering Systems Design

Credit Hours: 3.00. An introduction to engineering economy and systems analysis. A systematic approach to the engineering method of design and problem solving.

Credits: 3.00

EEE 25000 - Environmental, Ecological, And Engineering Systems

Credit Hours: 3.00. An overview of systems thinking and examples, and applications to environmental, ecological, and engineering systems. Students will develop an understanding of complex and global systems, along with the tools and analysis methods required to deal with them. Basic environmental and ecological science concepts are also included.

Learning Outcomes: 1. Understand the types of relationships and dynamics common in complex systems, including environmental systems, ecological systems, and engineering systems. 2. Able to apply fundamental systems tools and modeling approaches to a wide variety of engineering, environmental, and ecological problems. 3. Understand the foundational concepts and vocabulary of global environment and ecological systems. 4. Appreciate the complexity of contemporary issues related to society and EEE, including and understanding of the roles and responsibilities of stakeholders. Credits: 3.00

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 56000 - System-Of-Systems Modeling And Analysis

Credit Hours: 3.00. Introduction to features of system-of-systems problems; problem definition tools; role of complexity; network topology analysis and agent-based simulation models; architecture analysis; metrics for multi-stakeholder problems; semester team projects allow students to exercise and critique such methods for analyzing system-of-systems problems. Some background in probability and statistics (e.g. random variables, probability density and distributions, sampling methods) is expected.

Learning Outcomes: 1. Introduce to modeling and analysis techniques for system-of-systems (SoS) problems in engineering. 2. Center on students' ability for understanding, modeling, and analyzing SoS problems, which consist of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. These problems are often large-scale and interdisciplinary, involving systems and behaviors found in diverse fields such as engineering, economics, social science, policy, etc. 3. Present developments in addressing system-of-systems problems, describes criteria, lexicon, and analysis methodology for their study, and, through semester-long team projects, allows students to explore the many unknowns that persist in this emerging field. 4. Know the major subjects covered: distinguishing traits of and behaviors of SoS problems, complexity and complex adaptive systems, agent-based modeling, modern network theory and analysis tools, modeling for decision-making, and exploratory modeling. Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the

entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

TECH 53300 - Design Theory And Technology

Credit Hours: 3.00. This course provides an overview of theories and approaches to the transdisciplinary concept of design, spanning multiple disciplines and types of design outputs with a focus on technology. Students will read the work of leading design scholars, and situate their personal approach to design practice and research based on historical and current trends in the literature. Student work will be focused on theoretical and practical outcomes, with two main learning goals: 1) building upon and critiquing theories, methods, and processes of design in their original research; and 2) generating an awareness and representation of their personal design philosophy.

Learning Outcomes: 1. Situate design as a unique epistemology and ontology. 2. Explain key aspects of design activity. 3. Identify scholars, seminal works, and theories relating to design. 4. Distinguish between every day and professional design, craft, and art. 5. Critique theoretical foundations of their own discipline using the language and constructs of design theory. 6. Identify and articulate vital components of their design activity. 7. Synthesize and prioritize their design commitments. 8. Communicate their philosophy of design in multiple discipline-appropriate ways. Credits: 3.00

TLI 52000 - Foundations Of Innovation Studies

Credit Hours: 3.00. Foundations Of Innovation Studies has been designed to provide a broad spectrum introduction to the field of innovation studies. Students will gain practical and theoretical knowledge of innovation at a variety of levels, including the individual, team, organizational, and ecosystem contexts. Students will examine innovation strategies and tensions within the innovation "Triple Helix" of industry, academia, and government through the use of case studies and individually selected research reports. Throughout the class, students will examine recent innovation efforts and present short innovation cases that align with the learning objectives of the class.

Learning Outcomes: 1. Identify innovations in multiple settings and define the key characteristics that enabled those innovations. 2. Relate multi-level innovation practices to institutional outcomes. 3. Define and contrast the conditions that foster innovative thinking and development. 4. Critically assess modern examples of innovation and suggest ways to improve outcomes. Credits: 3.00

IE 47200 - Imagine, Model, Make

Credit Hours: 3.00. This course develops a holistic view of an initial competency in engineering design by conceiving, designing, manufacturing, and optimizing a system component such as a complex structural part. Activities include hand sketching, CAD modeling, and operation of CNC machining equipment for rapid prototyping. Tolerance requirements will be verified and optimized prior to the fabrication of the part in the laboratory using rapid prototyping techniques. The focus is on the design process itself as well as the complementary roles of human creativity and computational methods and tools.

Learning Outcomes: 1. Create any object using 3D CAD design software (modeling, texturing, and animation). 2. Evaluate and optimize 3D designs for different manufacturing processes and materials. 3. Apply the principles of engineering tolerance to 3D CAD design. 4. Use rapid prototyping techniques (laser cutting, laser engraving, injection molding, and 3D printing) to manufacture 3D CAD designs. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design

problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

Motivate Change (3 credits)

CSR 33100 - Consumer Behavior

Credit Hours: 3.00. An interdisciplinary survey of consumer behavior theory focused on psychological, sociological, and cultural influences on consumer choice and use of products and services. Credit will not be given for both CSR 33100.

Credits: 3.00

CSR 34400 - Fundamentals Of Negotiations

Credit Hours: 3.00. This course is designed to be relevant to the broad spectrum of bargaining "problems" that are traditionally faced by the manager, sales personnel and financial advisors. The course explores the processes of bargaining and negotiation as social and managerial activities. Special emphasis will be given to the areas of interpersonal and interpersonal and intergroup conflict, in addition to the interpersonal influence techniques and the tactics and strategies involved with improved bargaining and negotiation. The major purpose of the course is for each student to gain insight into his or her own negotiating style and to become a more effective negotiator, as well as a more astute observer of social process. The course will involve extensive use of cases, role-plays, and related participative activities, enhanced by rigorous self-review and introspection.

Learning Outcomes: 1. Explore the major concepts and theories of the psychology of bargaining and negotiation. 2. Understand the dynamics of interpersonal and intergroup conflict and its resolution. 3. Help develop the sophistication to analyze bargaining and conflict relationships. 4. Learn about your own individual "bargaining" style. 5. Development appropriate negotiation strategies and tactics for specific situations. Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and

practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

COM 44400 - Introduction To Communication And Social Entrepreneurship

Credit Hours: 3.00. This class introduces students to the roles that communication and innovation play in social entrepreneurship. It explores activities of entrepreneurs, ethics and skill development at the individual and organizational levels, and communication functions in not-for-profit and social venture space.

Learning Outcomes: 1. Identify the major components of communication and social change. 2. Describe the social economy. 3. Articulate how both social entrepreneurship and social innovation benefit society. 4. Describe the difference between nonprofit organizations (NPs), social action efforts, NGOs and social enterprises, as well as traditional entrepreneurship, social entrepreneurship, social intrapreneurship and social innovation. 5. Explain how social enterprises function in different sectors and regions, of various sizes, with vastly different missions. 6. Articulate the challenges social entrepreneurs face as they startup, develop, and communicate with various publics. 7. Identify the best approaches and communication tools that can be deployed to assist in ""getting out the message"" about NP goals and objectives. Credits: 3.00

Develop Strategies for Financial Sustainability (3 credits)

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 33900 - Sociology Of Global Development

Credit Hours: 3.00. Analysis of the causes and consequences of global development. Topics include: globalization; colonialism and decolonization; food insecurity and dependency; industrialization, poverty and inequality; migration; debt and trade; women's empowerment; global health; rights and social change; and sustainable development. This course will introduce you to the study of global development and globalization. The primary questions we will address are: What

is development? What is globalization and what is its relationship with development? How have the processes of global development produced inequalities among nations, regions, races, genders, and classes? Is there a "developing" world and a "developed" world? If so, what are their differences and how do they relate with each other? How have some developing countries become more developed than others? What roles do corporations, the state, and civil society organizations play in the processes of global development? How is global development interrelated with the physical environment, inequalities of consumption, and the environmental crisis? How do people resist the inequalities and perceived injustices of global development through global social movements? How are we interconnected economically, politically, culturally, socially, and ecologically with people all over the world? What are the possible futures of development? To address these issues, our focus will be on the developing world, our scope will be global and long-term, our methodology will be historical-comparative, and our perspective will be social-scientific and critical.

Learning Outcomes: 1. Demonstrate knowledge of the causes and consequences of global development. 2. Outline the strengths and weaknesses of the basic theoretical perspectives on global development. 3. Identify the key historical events that have led to the project of global development. 4. Apply sociological analysis to different complex and power dynamics. 5. Describe how small- and large-scale projects might contribute to or hinder sustainable development. Credits: 3.00

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

MGMT 48400 - Management Of Entrepreneurial Ventures

Credit Hours: 3.00. This course teaches skills required to become an entrepreneur, succeed in a start-up venture, work in venture capital, join a family business, or develop a franchise operation. Students will learn about how to identify and shape emerging market opportunities, innovate new business models, prepare and evaluate business plans, raise capital, build a skilled founding team, network for resources, and grow an initial market.

Learning Outcomes: 1. Identify and shape emerging market opportunities. 2. Innovate new business models. 3. Prepare and evaluate

business plans. 4. Raise capital. 5. Build a skilled founding team, network for resources, and grow an initial market. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

CE 59601 - Entrepreneurship And Business Strategy In Engineering

Credit Hours: 3.00. This course offers students the opportunity to learn and apply the core skills required to build and grow engineering- and technology-based businesses through lecture, case discussions, and weekly activities tied to a semester-long team project. Course content includes market analysis techniques to link technology attributes to opportunity and vice versa, combinatorial business design and planning methods, strategic innovation theories, competitive analysis, methods of emergent strategy and risk mitigation, as well as examination of team building, firm influence and navigation, and organizational design principles. Emphasis throughout is placed on the implications of research and development uncertainty, long-lifecycle economics, and the management of subcontracts and multi-disciplinary teams often encountered when developing and delivering complex engineering outputs. Case studies are used to contrast the challenges faced when creating new businesses (entrepreneurial) with those encountered in attempts to grow an existing enterprise (intrapreneurial). Coursework and project activities also facilitate development of business acumen, and skill building in conceptual thinking, synthesis, and persuasive communication. This course is particularly relevant for engineering students intending to progress into managerial roles in technology or R&D driven organizations. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Articulate the similarities and differences between entrepreneurship and intrapreneurship. 2. Employ open-ended problem solving techniques to identify opportunities to grow or transform new or existing organizations and/or commercialize new technologies. 3. Utilize and interpret qualitative and quantitative issue and market analysis methods to understand and/or quantify the level of market interest in an idea. 4. Understand and apply theories of innovation to define competitive market entry strategies. 5. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 6. Employ principles of risk mitigation and emergent strategy to define the assumptions underlying new ideas and explore paths to capture market value. 7. Perform and interpret financial evaluations of new ideas and businesses. 8. Interpret the tradeoffs of varying legal and management structures for a new enterprise. 9. Recognize influence paths in an organization and/or market ecosystem and tailor oral and written communications accordingly. Credits: 3.00

Electives (3 credits)

Research Methods

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

ANTH 38500 - Community Engagement In Anthropology

Credit Hours: 3.00. This course offers hands-on service learning experience with local community organizations involved with minority and immigrant populations. Part of the semester will include class meetings to explore issues and experiences of immigrant and ethnic groups in the U.S.

Learning Outcomes: 1. Explain the ethical, historical, and theoretical approaches and challenges of conducting community-engaged anthropological research. 2. Design community-engaged research projects involving ethical approaches to partnerships, methods, and data analysis. 3. Apply course concepts to real-life situations by conducting community-engaged research with a community partner. 4. Summarize final research findings to a community partner. Credits: 3.00

ANTH 41800 - Field Methods In Cultural Anthropology

Credit Hours: 1.00 to 9.00. Introduces basic field methods in Cultural Anthropology. Topics may include ethnographic or other interviewing techniques and methods of inquiry into any of the broad topics covered by Cultural Anthropology. Permission of department required.

Learning Outcomes: 1. Understanding the use of anthropological methods such as participant observation, ethnographic analysis and general interviewing techniques. Credits: 1.00 to 9.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

ANTH 59200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

Grand Challenges

General

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 34000 - International Economic Development

Credit Hours: 3.00. This course is designed to introduce students to issues and problems related to international economic development. Topics covered include a description of the current situation in developing countries and the history of growth and development. The course is grounded in the body of theory associated with economic development, but concentrates on the many practical problems such as poverty, population growth, urbanization, education and the environment. The three areas with the greatest attention are agricultural development, international trade, and policy analysis for developing countries.

Learning Outcomes: 1. Build an appreciation for the conditions and constraints of contemporary life in developing countries. 2. Have your own notions of what it means to live in poverty, the challenges of improving welfare, and the role of economics in development. 3. Demonstrate how economic principles, models, and analysis can help evaluate and refine approaches to improving human welfare in developing countries. 4. Develop the ability to analyze and write about real-world problems and solutions. The course, particularly the assignments, will allow you to acquire technical skills that will

contribute to your future professional work. Credits: 3.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

ME 49200 - Technology And Values

Credit Hours: 3.00. The impact of science and technology on personal and societal value systems. The special responsibility of engineers. Practical methods for using human values to guide future technological developments. Societal problems considered: warfare, energy, overpopulation, resource depletion, and environmental degradation. Interdisciplinary approaches stressed. Offered in alternate years.

Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

ANTH 32700 - Environment And Culture

Credit Hours: 3.00. This course provides a general overview to the field of environmental anthropology, and surveys key methods, and theories that anthropologists use to interpret human-environment interactions. Topics include culture ecology, agroecology, ethnobiology, political ecology, and environmental justice.

Learning Outcomes: 1. Identify and explain the key theories in environmental anthropology. 2. Identify several cross-cultural examples of human-environment interactions. 3. Distinguish between anthropological approaches and other disciplines that study the environment. 4. Apply the theories and methods learned in this course to real world environmental issues. 5. Demonstrate professional skills in research, analysis, presentation and peer review. Credits: 3.00

HSOP 55600 - Healthcare Economics And Public Policy

Credit Hours: 3.00. Principles and theories of healthcare economics applied in analysis of the U.S. healthcare system. Perspectives are presented on the differential roles of economic analysis and policy analysis. Topics include medical care as an input to health, pharmaceutical service market, adequacy of health manpower supply, health associations and demand for legislation. Healthcare reform, the pharmaceutical industry, and social values that guide policy are explored.

Credits: 3.00

SOC 57200 - Comparative Healthcare Systems

Credit Hours: 3.00. Using cost, quality, and access to care as core concepts, this course explores healthcare in comparative context. Special topics are health and gender, the environment, epidemics, long-term care, technology, and rationing, among others.

Credits: 3.00

AMST 31000 - Invention, Innovation, And Design (UCC: HUM/STS)

Credit Hours: 3.00. This course focuses on the various ways that invention, innovation, and design shape the modern world. We will investigate the forms, uses, and meanings of a diverse set of objects, networks, and systems that influence the ways we live. We will explore these ideas through the concepts of consumption, waste, and "smart" to gain a deeper understanding of how material infrastructures influence human existence. This project-based course will use readings, discussions, and critical reflections to inform a series of hands-on projects to understand our roles as designers, creators, and users of science, technology, and material culture. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms invention, innovation, and design. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through designed objects. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze invention, innovation and design through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 32500 - Sports, Technology, And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines how science, technology, engineering, and data analysis reshape sports. Traditionally, sports have been understood as competitions between humans. However, recent technoscientific developments have altered this arrangement and have changed the ways sports are played. We have reached a place where heated competitions not only take place on the fields of play, but also within scientific and engineering laboratories. The fundamental question this project-based course will address is: how will new and emerging scientific knowledge and technological innovations transform sports? We will explore topics ranging from football, baseball, basketball, and soccer, to e-sports, fantasy sports, and sports analytics.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms sports, technology, and innovation. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through the play and consumption of

sports. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze sporting invention, innovation, design, and culture through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

ENGR 31000 - Engineering In Global Context (UCC: STS)

Credit Hours: 3.00. This course provides students with opportunities to study how engineering is intertwined with larger economic, social, cultural, and technological dynamics in an era of intensified globalization. Its major goals are to help students understand and appreciate what engineering is, how engineers are trained, what engineers do, and how engineering and society interact. The course approaches these themes through discussion of: the relation and interaction of engineering, science, technology, and society; the historical origins and development of engineering as a profession; diversity issues in engineering and other STEM fields; engineering in cross-national/cultural contexts; and contemporary challenges related to globalization, ethics, and sustainability. In summary, the course is designed to help students understand what it means to identify as, and/or work with, engineers. Recitation sections and/or independent projects (at the instructor's discretion) provide further opportunities for students to expand their knowledge and improve their skills in relation to course themes.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe and evaluate the specific kinds of knowledge and methods typically employed by engineers, including in comparison with other professional fields. 2. Understand the historical development of engineering education and the engineering profession in the United States. 3. Recognize how national differences are important in engineering work, including by comparing and contrasting different national cultures and styles of engineering. 4. Explain the significance of diversity in engineering education and professional practice, including by evaluating competing perspectives on diversity in different historical and sociocultural contexts. 5. Understand contemporary trends and issues related to globalization, ethics, social responsibility, and sustainability, and interpret their significance in relation to engineering education and practice. 6. Demonstrate written communication capabilities at the level of emerging or higher (as defined by the Purdue Core Curriculum guidelines). Credits: 3.00

Education

EDPS 30102 - Social-Emotional Aspects Of Learning In Diverse Environments

Credit Hours: 3.00. The course examines the role of social emotional competence in learning and builds understandings of the inter-relationships between theory, empirical evidence, and instructional practice. It takes the perspective that experiences across different learning contexts are interrelated and may influence each other in reciprocal ways. The course views social-emotional dimensions of learning as: embedded in person-environment transactions; tied to specific instructional (formal and/or informal) contexts over time; co-evolving with cognition and language; critical to psychological, behavioral, and learning outcomes. The focus is on intersection of social-emotional competence, learning, and instruction. The course is intended to provide the foundations (theoretical and empirical) that can help those interested in formal and informal instructional environments make informed educational decisions by considering the social-emotional dimensions of learning.

Learning Outcomes: 1. Students will develop familiarity with major theoretical perspectives that inform social and emotional development in learning contexts. 2. Students will be able to define and distinguish core theoretical principles and connect them to empirical evidence and instructional practices in formal and informal learning contexts. 3. Students will be able to think critically about and evaluate the characteristics of different learning environments (and the instructional practices within these environments) and their relationship to learner development. 4. Students will develop familiarity with research methods

for studying and assessing social development in different contexts. 5. Students will be familiar with key dimensions of social-emotional competence. 6. Students will develop the ability to think critically about the dimensions of social-emotional competence and their links to learner development in different contexts. 7. Students will be familiar with the social processes that operate in key contexts. Credits: 3.00

EDST 51200 - Foundations Of Educational Policy

Credit Hours: 3.00. (EDFA 51200) An examination of the relationship between policy, values, and social change in education, including the roles of local, state, and federal government in educational policymaking and the effects of educational policies on societal issues such as equity, cultural diversity, and opportunity.

Learning Outcomes: 1. Understand the policy-making process at different levels of government. 2. Understand underlying values and theories of education behind different policy initiatives. 3. Understand the relationship between educational policy and social issues. Credits: 3.00

EDST 51400 - Economics Of Education

Credit Hours: 3.00. A general course in financing education, including current economic theories, sources of revenues, and trends in fiscal structure and operations in education.

Learning Outcomes: 1. Develop and understand the goals of public education, why states invest in education, and the legal basis for financing public education. 2. Develop and understand the sources of revenues for public education and the approaches used to raise and distribute funds for school district operations. 3. Develop and understand the concepts of equity and adequacy and how these ideas are reflected in current state education policy and educational leadership practices. 4. Develop and understand budgeting strategies and procedures used by educational leaders to influence student achievement outcomes and realize other school-based goals. Credits: 3.00

EDCI 56500 - Principles Of Adult Education

Credit Hours: 3.00. (ASEC 56500) Principles of adult education applied to helping adults learn, evaluating their performance, and determining their needs. Examines history, philosophy, and research of adult education. Explores techniques required in design and delivery of instruction for adults.

Learning Outcomes: 1. Examine principles and techniques for educating adults, including the history, philosophy, and research field. 2. Develop an individual philosophy of continuing and adult education for a wide variety of situations. 3. Apply principles, techniques, philosophy and research in development and design of adult education programs. Credits: 3.00

Environment

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in

forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

HIST 39400 - Environmental History Of The United States (UCC: HUM)

Credit Hours: 3.00. This is a mid-level survey designed to provide students of environmental science with historical background and students of history with the unique perspective of environmental history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn

fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

EAPS 32700 - Climate, Science And Society

Credit Hours: 3.00. This course will examine the broad problems of climate change by examining the relationship between science, politics, and society by using climate change as a lens through which to examine larger issues. Students will be encouraged to identify similar themes in their own experiences as emerging scientists, engineers and global leaders. Adequate preparation to write essays and perform basic arithmetic calculations needed. Prior knowledge of climate change science is not necessary.

Learning Outcomes: 1. Able to think logically and creatively. 2. Able to apply knowledge to practical situations. 3. Able to respond flexibly as situation changes. 4. Understand ethical issues, particularly in Science. 5. Appreciate diverse experiences, thoughts, backgrounds. 6. Understand and appreciate Science in the world environment. Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

EAPS 36000 - Great Issues In Climate Change And Society

Credit Hours: 3.00. This course develops basic skills and knowledge critical to analyze issues of energy use, climate change, and sustainability that incorporate both societal and scientific perspectives. The goal of this course is not to arrive at particular consensus solutions to the problems associated with these issues but instead to foster an informed (through information literacy) debate that will ultimately be waged as solutions are sought. Working in teams the students work throughout the semester to complete a capstone teamwork project and a group presentation. Counts for Great Issues course in College of Science.

Learning Outcomes: 1. Understand/interpret the complex issues related to energy (production and use) policy and climate change. 2. Recognize the basic ethical, technological, political, and economic issues influencing the production of renewable and fossil energy. 3.

Identify, distinguish, and use credible/factual information sources to establish a defensible viewpoint on these issues. Credits: 3.00

FNR 30200 - Global Sustainability Issues

Credit Hours: 2.00. This course explores global sustainability issues in natural resources with emphasis on forestry, wood products manufacturing, conservation, water management, energy and their impact on the targeted geographic location (such as Central America, Eastern Europe) and the rest of the world. The purpose of this course is to present students, regardless of their disciplinary background, with an overview of the interdisciplinary aspects of sustainable natural resource management. This colloquium course will examine global sustainable natural resources and related issues (including population, poverty, pollution, climate change, deforestation, invasive species, urbanization, habitat loss, cultural traditions, water management, energy, education, technology, and international collaboration).

Learning Outcomes: 1. Appraise the impact of natural resources in developing and developed economies. 2. Understand the most important factors that threaten natural resources in developing and developed economies. 3. Understand how developments in natural resources in foreign countries relate to similar developments in Indiana and the United States. 4. Comprehend the complexity of global natural resource issues and the role of sustainable natural resource management in sustainable development. Credits: 2.00

HTM 37000 - Sustainable Tourism And Responsible Travel

Credit Hours: 3.00. This course will examine issues associated with sustainability in the hospitality and tourism industry. It will examine how principles of sustainable development and the triple bottom line (economic, social and environmental) are applied to hospitality and tourism. The course will address sustainability across a variety of tourism sectors including destination management, lodging, restaurants and meetings. The course will also examine consumer issues associated with sustainability.

Learning Outcomes: 1. Define sustainability and describe its applications in the tourism and hospitality system. 2. Explain the relationship between tourism and the UN Sustainable Development Goals/Grand Challenges. 3. Describe the components of sustainability programs in tourism and hospitality organizations. 4. Analyze sustainability programs in various tourism sectors to determine their effectiveness in achieving social and environmental goals. 5. Apply and evaluate environmental performance programs in the hospitality industry. 6. Explain the major consumer issues associated with sustainability in the tourism and hospitality industry. 7. Identify and explain principles of ethics as applied to the tourism industry. 8. Identify career opportunities associated with sustainability in tourism and hospitality. Credits: 3.00

Energy

ME 44000 - Automotive Prime Movers: Green Engines And Clean Fuel

Credit Hours: 3.00. Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics- engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics- different components of hybrid engines and the powertrain design. FCE topics- fundamentals of fuel cells and automotive applications. Clean fuel topics- biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels.

Learning Outcomes: 1. Relate processes in automotive prime movers to engineering fundamentals. 2. Study low-carbon emitting, and LEV, ULEV, SULEV, PZEV, and ZEV prime mover designs. 3. Study prime mover designs that are alternative to conventional combustion engines. 4. Study cleaner alternatives to conventional fossil fuels. 5. Carry out analysis of prime mover designs and fuel alternatives to identify cost and energy tradeoffs. Credits: 3.00

EAPS 30100 - Oil!

Credit Hours: 3.00. Petroleum is a common thread that interweaves Geoscience with the Political-Economic history of the 20th century. Its dominance in current society has major

repercussions on our current and future society and environment. The unequal distribution of petroleum and natural gas, coupled with innovative geologists and engineers, has set the stage for the modern geo-political world. This course is a unique survey into the multitude of aspects of petroleum -- from its formation to "resource wars".

Learning Outcomes: 1. Enlighten and enable self-discovery of this major past, present and future issue in human civilization. 2. Understand the selected major oil-gas basins. 3. Learn Technical writing. 4. Examine case examples of past unethical corporate or private behaviors and how these were eventually resolved or remain a concern (e.g., monopoly building and later bread-up of Standard Oil; Ecuador pollution cases;; CIA involvement with Iranian government overthrow in 1950s to restore oil company monopoly; corruption in African and other ""oil-cursed"" nations; atmospheric pollution of cities; major oil spills; etc.). 5. Learn exactly how a hydrogen-fuel car would function, including engineering costs; or exactly how ozone is produced in car-dominated cities in the summer. This multidisciplinary course also includes aspect of social change, role of oil-gas in national politics, climate effects, and the petrochemical industry products. 6. Understand petroleum basins and the importance of hydrocarbons in history/society/climate is essential. This OIL! Course is unique in placing the geological aspects into the broader context of social, international and environmental concerns. Credits: 3.00

EAPS 37500 - Great Issues - Fossil Fuels, Energy And Society

Credit Hours: 3.00. Prosperity of the 20th century was based on abundant and cheap energy; during the 21st century we will be faced with difficult challenges. Our society will face higher energy prices, decline of petroleum based fuels supplies, increased environmental effects of fossil fuels usage, and the challenge of solving the technological problems of developing alternative fuels. This course will review the structure, economics, and geopolitical issues faced by fossil fuel industries and the mitigation strategies that will be needed to change to low fossil fuel use society based on low polluting renewable energy sources. Counts for Great Issues course in College of Science for Juniors and Seniors.

Credits: 3.00

Food

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4. Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 52800 - Global Change And The Challenge Of Sustainably Feeding A Growing Planet

Credit Hours: 3.00. This course investigates the major drivers of global agricultural and environmental change associated with the global farm and food system. This includes demography, income growth, biofuels, climate change, environmental and ecosystem services, livestock consumption, food waste and land use change. Weekly modules include a guest lecture, student led discussion of readings and discussion of lab assignments undertaken using the SIMPLE model of global agriculture, environment and food security. The class culminates with a course project which is presented to the class and written up in a term paper.

Learning Outcomes: 1. Gain exposure to different disciplines and their approaches to analyzing global change. 2. Master the basic

economic concepts of demand and supply in the context of the global food economy. 3. Become proficient in undertaking economic analysis using the SIMPLE model. 4. Gain a knowledge of the role which economic analysis plays in analyzing long run sustainability of the global food system. Credits: 3.00

Health

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

BIOL 31200 - Great Issues Genomics And Society

Credit Hours: 3.00. The course will revolve around genomics, the science and technology involved in determining the sequence of the entire DNA complement in an organism. Almost everyone has heard of the human genome project, but fewer are aware of the spectacular technical progress in this field and the fact that many thousands of genomes have been sequenced. Until recently, most of these have been microorganisms, but technological and computational progress has made it progressively easier and cheaper to sequence the genomes of higher organisms. This field may have more of an impact on your future lives than almost any other field of the life sciences - mostly because it touches on all areas of study. The course will focus on the impact that genomes will have in selected areas. It will begin with a basic understanding of the science and technology that gave rise to our current capabilities in sequencing and the fact that technology continues to provide greater capacity and cheaper prices. You will soon see that every field in the College of Science is well represented in the science and technology. We will then go on to see how genomics influences many topics that affect our daily lives and can possibly provide answers to some critical questions (or at least pose better questions): What is the basis of personalized medicine? What does genomics tell us about the genealogy of mankind? What impact will genomics have on our future food supply and our ability to feed a population of 9 billion people? What is the human microbiome and what does that mean to me? Similarly, what is the gut microbiome, the mouth microbiome, etc? What impact will genomics have on the development of alternative energy sources, especially biofuels? In every area, we will discuss the scientific challenges, but also the ethical and societal implications. In most cases, there is no one right answer, but a series of choices that can be guided by ethical considerations.

Learning Outcomes: 1. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. Credits: 3.00

PUBH 51100 - Foundations Of Global Health

Credit Hours: 3.00. Global disparities in the health and well-being of diverse populations, across and within borders, has never been greater. Profound and rapid changes in demographics, from population growth to urbanization, along with unprecedented shifts in patterns of disease and risks, are coupled with game-changing advances in knowledge, technology, and innovation. This course will introduce students to current challenges and efforts at solutions in global health, with a focus on low- and middle-income countries. It will provide an interdisciplinary overview of topics that include measures of health and disease, communicable diseases such as HIV/AIDS and malaria, non-communicable diseases such as diabetes and cardiovascular disease, women's health, maternal and child health, food systems and nutrition, health systems, and health care delivery. In addition to lectures, the course will include interactive discussions of case studies and specific country examples, aimed at immersing students in the debates and challenges facing global health leaders and decision makers.

Learning Outcomes: 1. Identify major shifts and trends in health patterns, burden of disease, population dynamics, and globalization. 2. Understand the historical context of global health and current evolving agendas. 3. Analyze diverse global health challenges, incorporating ethical, environmental, political, historical, and societal perspectives, with a focus on low- and middle-income countries. 4. Evaluate global health research to assess how conclusions arise from evidence and analysis. 5. Formulate evidence-based arguments for/against diverse global health policies or interventions. Credits:

3.00

Notes:

Insect Biology Minor

Requirements for the Minor (15 credits)

Required Courses (3 credits)

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

Selective Courses (12 credits)

ENTM 10500 - Insects: Friend And Foe (UCC: SCI/STS)

Credit Hours: 3.00. A one-semester course for nonscience students who want to know more about insects - the most numerous organisms on earth. An introduction to insects and their relationship with humankind, including interesting aspects of insect biology; insects in music, decoration, history; use of insects in teaching at the elementary school level; their use in art, photography, and drawing; insects as human food.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 3.00

ENTM 21000 - Introduction To Insect Behavior (UCC: SCI)

Credit Hours: 3.00. Description and introductory analysis of innate and learned insect behavior, including basic orientations and movements, behavioral periodicity, communication, chemical and structural defenses, host selection and feeding, reproduction, and insect societies. General biology and introductory entomology are desirable, but not essential.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

ENTM 31100 - Insect Ecology

Credit Hours: 3.00. Insect ecology investigates the fundamental concepts of ecology as they relate to insects, including insect interactions, other insects and their environment. Topics include population and community ecology, plant-insect interactions, insect biodiversity and biogeography, and theoretical and applied ecology. Examples from current entomological and ecological studies are used. Completion of college biology or an introductory course in entomology is recommended.

Learning Outcomes: 1. Comprehend ecological principles at different scales of biological organization, from the individual to the population to the community to the ecosystem. 2. Understand the mechanisms that mediate interactions of insects with their biotic and abiotic environments. 3. Appreciate the importance of insects as stabilizing and destabilizing components of food webs. 4. Recognize the value and application of insect ecology n solving real-world problems. 5. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 3.00

ENTM 33500 - Introduction To Insect Identification

Credit Hours: 4.00. This class is designed for learning more about the collection and identification of adult insects. Emphasis will be placed on collection and sampling techniques, the preparation of specimens for future study, and identification.

Learning Outcomes: 1. Use keys and other published resources to identify unknown insects to the correct family and by-sight identification. 2. Collect a diversity of insects and related arthropods and to prepare specimens to professional standards. 3. State the scientific names, critical taxonomic characters, natural history and biology, unique or interesting behaviors, ecological role, taxonomic relationships and impacts on human activities of selected families. Credits: 4.00

ENTM 52500 - Medical And Veterinary Entomology

Credit Hours: 3.00. Introduction to the biology and control of arthropods of medical and veterinary importance, and coverage of the natural history and abatement of selected arthropod-related diseases, including arboviral encephalitis, filariasis, leishmaniasis, Lyme disease, malaria, plague, spotted fever, trypanosomiasis, and myasis. Offered in odd-numbered years.

Credits: 3.00

ENTM 25300 - Insect Physiology And Biochemistry

Credit Hours: 4.00. Introductory course in insect cell biology, biochemistry, and physiology including structures and functions of insect internal and external tissues and organs. A year of college biology or equivalent knowledge is expected.

Learning Outcomes: 1. Understand (i) the structure and functions of insect cells, the major internal organ systems of insects, the insect integument, and homeostatic mechanisms; (ii) insect development and reproduction, and their endocrine control; and (iii) the neural mechanisms that underlie the interactions of insects with their environment and coordinated behavior. 2. Understand the physical and chemical principles underpinning animal physiology. 3. Understand the dependence of function on structure in physiology and biochemistry. 4. Acquire familiarity with commonly used experimental procedures for research in insect physiology and biochemistry. Credits: 4.00

ENTM 31200 - Plant-Insect Chemical Ecology

Credit Hours: 3.00. An overview of the structure and function of natural and synthetic chemical products in insect ecology. One year of college biology. One year of college chemistry strongly recommended.

Learning Outcomes: 1. Appreciate the history and scope of chemical ecology as a discipline. 2. Understand the role of chemistry in the biology/ecology of plants and animals. 3. Appreciate how chemical products influence processes at various levels of biological integration - from genes to ecosystems. 4. Evaluate and critique primary literature on chemical ecology. 5. Recognize the application of insect chemical ecology in solving grand challenges in entomology. Credits: 3.00

ENTM 35300 - Insecticides And Environment

Credit Hours: 3.00. Insecticides, their interactions with biological organisms and the environment, regulatory policies, environmental and human health outcomes, and current controversies. A year of college biology and college chemistry or equivalent knowledge is expected.

Learning Outcomes: 1. Communicate to the public about insecticide issues including risk, best practices for management and use. 2. Apply principles of toxicology including dose response, target sites, differential toxicity, and resistance. 3. Evaluate environmental hazards, their management and mitigation. 4. Interpret and implement insecticide label instructions. 5. Explain how Risk Assessment and Management is implemented in the U.S. to protect human health and safety balance economic and environmental risks. Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and

ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 32820 - Medico-Legal Entomology

Credit Hours: 3.00. This course explores the main topics covered under medico-legal entomology (MLE). Specifically, the course will focus on the role that insects play in abuse, neglect, and death investigations. Students will experience rearing and identifying the major forensically important insect groups associated with medico-legal investigations. Finally, students will gain an appreciation of the scope of MLE through the analysis of two mock cases.

Learning Outcomes: 1. Establish an understanding of how insects are in used in legal investigations. 2. Define and defend the types of insect evidence presented in abuse & neglect cases. 3. Define and defend the types of insect evidence presented in death investigations. 4. Explain how insects are used to answer various questions in legal investigations. 5. Collect, rear and identify forensically important specimens. 6. Identify forensically important specimens down to family, genus or species level. 7. Demonstrate and explain proper collection techniques from decomposing remains. 8. Demonstrate and explain proper rearing techniques for forensically important insects. 9. Experience medico-legal entomology. 10. Compare and explain the life cycle of forensically important flies. 11. Analyze two medico-legal scenes. 12. Compose forensic entomology case reports. Credits: 3.00

Intellectual Property Law for Engineers Minor

A minor in Intellectual Property Law is available to students in the College of Engineering.

Requirements for the Minor (19 credits)

Required Courses (13 credits)

IDE 49500 - Special Topics In Interdisciplinary Engineering

Credit Hours: 1.00 to 4.00. Primarily designed for interdisciplinary engineering subject areas for which there is no specific course offered, but for which there is sufficient student interest to justify teaching a specialized course on a trial basis. May be repeated for credit as long as the topic being taught is not repeated.

Credits: 1.00 to 4.00

ME 49200 - Technology And Values

Credit Hours: 3.00. The impact of science and technology on personal and societal value systems. The special responsibility of engineers. Practical methods for using human values to guide future technological developments. Societal problems considered: warfare, energy, overpopulation, resource depletion, and environmental degradation. Interdisciplinary approaches stressed. Offered in alternate years.

Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and

industries. Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

ME 55400 - Intellectual Property For Engineers

Credit Hours: 1.00. Survey of the law of patents, trade secrets, trademarks, and copyrights, with special emphasis on the process of defining inventions broadly and diversely. Obtaining, registering, licensing, and litigation of intellectual property.

Credits: 1.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

Elective Courses (6 credits)

Law (3 credits)

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 46100 - Constitutional Law I

Credit Hours: 3.00. A survey of selected areas of constitutional law, considering the political and social influences as well as the doctrinal forces that have produced these policies and interpretations.

Credits: 3.00

POL 46200 - Constitutional Law II

Credit Hours: 3.00. An examination of the development of individual rights and civil liberties through constitutional law and interpretation of the Bill of Rights and Civil War Amendments. Both doctrinal and political pressures will be discussed to illustrate the evolution of these rights.

Credits: 3.00

Technical (3 credits)

CEM 48500 - Legal Aspects Of Construction Engineering

Credit Hours: 3.00. This course will cover legal principles and landmark cases relevant to civil and construction engineering. Specific subjects covered include contracts, torts, agency, professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties and ethics.

Learning Outcomes: 1. Read, comprehend and interpret construction contract plans and specifications for lock and dam facilities and other inland navigation structures. Through detailed study of project plans and specs as well as construction photos, students will be taken through the process of building these facilities from planning through construction. 2. Understand how a lock and dam facility functions. 3. Identify various components of lock and dam structures. 4. Understand various types of marine equipment necessary to construct a navigation facility in the dry or wet. Credits: 3.00

ECE 38200 - Feedback System Analysis And Design

Credit Hours: 3.00. In this course, classical concepts of feedback system analysis and associated compensation techniques are presented. In particular, the root locus, Bode diagram, and Nyquist criterion are used as determinants of stability.

Credits: 3.00

ECE 48300 - Digital Control Systems Analysis And Design

Credit Hours: 3.00. The course introduces feedback computer controlled systems, the components of digital control systems, and system models on the z-domain (z-transfer functions) and on the time domain (state variable representations.) The objectives for system design and evaluation of system performance are considered. Various discrete-time controllers are designed including PID-controllers, state and output feedback controllers, and reconstruction of states using observers. The systems with the designated controllers are tested by simulations.

Learning Outcomes: 1. Understand digital feedback control systems. 2. Know constructing discrete-time mathematical model system. 3, Know the analyzing system behavior using discrete-time model and evaluating the system performance. 4. Know to use controller design techniques to make the system behavior satisfy specified design objectives. 5. Evaluate and test the system performance using digital simulations. Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-

aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

ME 36300 - Principles And Practices Of Manufacturing Processes

Credit Hours: 3.00. Manufacturing processes for engineering materials, both metallic and non-metallic. Fundamentals of manufacturing processes with a "hands-on" laboratory sequence. Analysis and design of processes for various engineering materials and their link to engineering design. Hands-on experiences through laboratory experiments and demonstrations. Not open to students with credit in IE 37000.

Credits: 3.00

ME 44400 - Computer-Aided Design And Prototyping

Credit Hours: 3.00. Introduction to advanced computer-aided design (CAD) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional and marketable product. Projects include use of the advanced design tools to produce a working prototype that is manufacturable. Application to design, manufacturing, and analysis.

Credits: 3.00

ME 47500 - Automatic Control Systems

Credit Hours: 3.00. Controller design in frequency domain with introduction to digital systems and control.

Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 55700 - Design For Manufacturability

Credit Hours: 3.00. Introduction to manufacturing concerns, such as efficient design, producibility, and quality, which must be considered early in the engineering design process. Topics include the product development cycle, manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, Taguchi's robust design methodology, life cycle engineering, and reliability. Laboratory projects in the area of tolerancing, assembly, and manufacturability are included along with a project from industry in which the students can disassemble, analyze, and redesign a product while obtaining feedback from industry concerning manufacturability.

Credits: 3.00

ME 57000 - Machine Design

Credit Hours: 3.00. Analysis of stresses and deflections due to complicated loading. Investigation of specific design problems through application of theory of elasticity, failure criteria, energy approach, and numerical methods. Individual design project.

Learning Outcomes: 1. Understand complicated 3-D state of stress for both determinate and indeterminate problems. 2. Learn advance theory of elasticity. 3. Gain fundamental knowledge of bodies in contact. 4. Solution methods for torsion of prismatic section and bending of asymmetric cross section. 5. Apply energy method to solve problems for linear and nonlinear materials. Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles

of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 57200 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. Introduction to the analysis and design of robotic manipulators. Topics include: kinematic configurations, forward and inverse position solution, velocity and acceleration, path planning, workspace analysis, force and torque solutions, rigid body dynamics, motors and actuators, robot design, sensors and controls, computer simulation, and graphical animation.

Learning Outcomes: 1. Analysis of manipulator motion and forces. 2. Manipulator design including actuator, drive, and sensor issues. 3. Computer simulation to predict motion and forces. Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57600 - Computer Control Of Manufacturing Processes

Credit Hours: 3.00. Fundamental elements for manufacturing process control are presented with advanced control theories, modeling and analysis of actuators, controller architecture, interfacing and programming. Emphasis is on computer integrated manufacturing with computer numerical control of machine tools, automation via programmable logic controllers, motion control, process control examples, and manufacturing process monitoring. Hands-on experience is attained through laboratory experiments with state-of-the-art equipment.

Credits: 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 35400 - Machine Design

Credit Hours: 3.00. Design, analysis, and selection of machine components for fluctuating loading. Application of design fundamentals to mechanical components and integration of components to form systems. Open-ended design projects reinforce the design process.

Learning Outcomes: 1. Apply Statics, Dynamics, and Strength of Materials to the realization of machine components. 2. Understand fatigue failure mechanisms 3. Apply fatigue failure theories to create reliable mechanical components. 4. Select standard machine components and materials. 5. Enhance problem-solving and communication skills through design projects. Credits: 3.00

Notes

International Studies in Agriculture Minor

About the Program

Requirements for the Minor (15-27 credits)

Requirements - Complete Five (5) Learning Outcomes:

Learning Outcome 1 - Projects

Option 1: Research Project

Option 2: Capstone Project

Option 3: International Agriculture Project

Learning Outcome 2 - World Language

Option 1 - World Language Aptitude

Option 1a - World Language Advanced Coursework (12 credits)

Option 1b - Study Abroad Course taught in Foreign Language

Option 1c - World Language Proficiency Exam

Option 2 - Intercultural Development Inventory (IDI)

Learning Outcome 3 - International Engagement

Option 1 - Study Abroad Experience

Option 2 - Campus Engagement with International Group

Learning Outcome 4 - International Agriculture Courses (15 credits)

Learning Outcome 5 - Reflective Paper/Video

Course Examples:

Examples of College of Agriculture International-related Courses

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 34000 - International Economic Development

Credit Hours: 3.00. This course is designed to introduce students to issues and problems related to international economic development. Topics covered include a description of the current situation in developing countries and the history of growth and development. The course is grounded in the body of theory associated with economic development, but concentrates on the many practical problems such as poverty, population growth, urbanization, education and the environment. The three areas with the greatest attention are agricultural development, international trade, and policy analysis for developing countries.

Learning Outcomes: 1. Build an appreciation for the conditions and constraints of contemporary life in developing countries. 2. Have your own notions of what it means to live in poverty, the challenges of improving welfare, and the role of economics in development. 3. Demonstrate how economic principles, models, and analysis can help evaluate and refine approaches to improving human welfare in developing countries. 4. Develop the ability to analyze and write about real-world problems and solutions. The course, particularly the assignments, will allow you to acquire technical skills that will contribute to your future professional work.

Credits: 3.00

AGEC 40000 - Agricultural Economics Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with

cooperating foreign universities.

Credits: 0.00 to 8.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

AGEC 49800 - Special Problems

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who want to study special problems in agricultural economics not covered in regular work. Permission of instructor required.

Credits: 1.00 to 3.00

ASM 40000 - Agricultural Systems Management Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

AGR 40000 - Agriculture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

AGR 49300 - Special Topics In International Agriculture

Credit Hours: 0.00 to 3.00. A course that provides students interested in international agriculture opportunity for in-depth study and analysis of major issues associated with the relationship of U.S. agriculture to world agriculture and agricultural development abroad. Current and significant topics will be selected. Permission of instructor required.

Credits: 0.00 to 3.00

AGR 49500 - International Professional Experience In Agriculture, Food, Or Natural Resources

Credit Hours: 0.00. Supervised international professional experiences in agricultural, food, or natural resource disciplines. The professional experience period must be preplanned and conducted under the supervision of a College of Agriculture faculty member. Students must submit a summary report. Consent of the College of Agriculture international professional experience program coordinator required. Permission of instructor required.

Credits: 0.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

AGRY 35000 - Global Awareness

Credit Hours: 1.00 to 3.00. A seminar-type course about world geography, cultures, and agriculture. Speakers are selected from the many Purdue graduate students and visiting scholars from around the world. Extra credit may be earned through independent study of a global issue.

Credits: 1.00 to 3.00

AGRY 39900 - Individual Study

Credit Hours: 1.00 to 3.00. Supervised individual study or research over topics not covered in other courses. Arrange with agronomy faculty before registering. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 29500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in formal courses of the department. The specific topic that is offered will be indicated on the student's record. May be repeated for credit with variable title. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 40000 - Animal Sciences Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

BCHM 40000 - Biochemistry Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

BTNY 39000 - Selected Topics In Plant Science

Credit Hours: 1.00 to 3.00. This course deals with special topics in botany not covered in regular undergraduate coursework. Credit depends upon work done. May be repeated once for credit. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 40000 - Botany And Plant Pathology Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ENTM 40000 - Entomology Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

FS 40000 - Food Science Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

FS 47000 - Wine Appreciation

Credit Hours: 3.00. A study of wine production and marketing principles with an emphasis upon consumption responsibility. Historical perspectives form the foundations for wine classification systems and traditional serving procedures. Cardinal scale sensory evaluations are conducted in relationship to various food pairings. Must be 21 years of age or older to register for this course. Permission of department required.

Learning Outcomes: 1. Understand the nature of wine - its production, history, uses and related responsibilities. 2. Develop the ability to recognize different classes, types, and origins of wines. 3. Learn proper etiquette and tasting techniques. 4. Gain direct experience, both individually and as part of a team, in adopting these manners and methods. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 40000 - Forestry And Natural Resources Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 8.00

FNR 46000 - International Natural Resources Summer Program

Credit Hours: 3.00. A four-week, intensive program examining the management and conservation of natural resources in Europe and the United States. Jointly taught with faculty and students from the Swedish University of Agricultural Sciences. The program topic and venue change each year, but emphasis is placed on student interaction and internationalization as well

as on cross-cultural communication skills within a natural resources framework. Offered in even-numbered years at Purdue University and in odd-numbered years at the Swedish University of Agricultural Sciences in Sweden.

Learning Outcomes: 1. Explain cultural differences in managing natural resources sustainably. 2. Evaluate natural resource use alternatives and policies. 3. Evaluate the sustainability of various landscapes and uses of natural resources. Credits: 3.00

HORT 40000 - Horticulture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

HORT 40300 - Tropical Horticulture

Credit Hours: 3.00. An introduction to the agriculture of the tropics and subtropics, emphasizing horticultural crops. Offered in even-numbered years.

Credits: 3.00

HORT 45000 - In The English Landscape: Integrating History, Horticulture, And Landscape Architecture

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Offered in even-numbered years. Permission of instructor required.

Credits: 3.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

LA 40000 - Landscape Architecture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

LA 45000 - In The English Landscape:Integrating History, Horticulture, and Landscape Architecture

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Offered in even-numbered years. Permission of instructor required.

Credits: 3.00

NRES 40000 - Natural Resources And Environmental Science Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

AGEC 52600 - International Food And Agribusiness Marketing Strategy

Credit Hours: 3.00. Students will develop their analytical, decision-making, and communication skills related to marketing management of food systems in the world economy. They will analyze a foreign market's potential and market entry strategies; compare consumer differences and similarities across markets; define issues related to marketing mix standardization or adaptation; and evaluate effects of economic, social, and legal environments on marketing strategy.

Credits: 3.00

AGEC 59600 - Seminars In Current Issues In Agricultural Economics

Credit Hours: 1.00 to 3.00. Study of selected current developments in agricultural economics. Topics will be announced in advance. Permission of instructor required.

Credits: 1.00 to 3.00

AGRY 59800 - Special Problems

Credit Hours: 1.00 to 6.00. Research on agronomic problems conducted in laboratory, field, or library; report required; arrange with an agronomy staff member before registering. Permission of instructor required.

Credits: 1.00 to 6.00

FNR 30200 - Global Sustainability Issues

Credit Hours: 2.00. This course explores global sustainability issues in natural resources with emphasis on forestry, wood products manufacturing, conservation, water management, energy and their impact on the targeted geographic location (such as Central America, Eastern Europe) and the rest of the world. The purpose of this course is to present students,

regardless of their disciplinary background, with an overview of the interdisciplinary aspects of sustainable natural resource management. This colloquium course will examine global sustainable natural resources and related issues (including population, poverty, pollution, climate change, deforestation, invasive species, urbanization, habitat loss, cultural traditions, water management, energy, education, technology, and international collaboration).

Learning Outcomes: 1. Appraise the impact of natural resources in developing and developed economies. 2. Understand the most important factors that threaten natural resources in developing and developed economies. 3. Understand how developments in natural resources in foreign countries relate to similar developments in Indiana and the United States. 4. Comprehend the complexity of global natural resource issues and the role of sustainable natural resource management in sustainable development. Credits: 2.00

ASEC 43100 - Planning For International Engagement Methods

Credit Hours: 1.00. A team-based laboratory course for students who seek experience working with international partners to plan and conduct quality service-learning projects. Using established partner relationships, students will work with international partners to address hands-on, real-world, identified challenges to learn the principles of extension methodology and sustainable community development by integrating their discipline knowledge and technical skills from previous courses. Students will also learn the intercultural communication, market analysis, project design and planning, entrepreneurial business planning for micro-credit loans and business ventures, and cultural factors affecting community food security while they work in bi-national teams to determine how best to apply their classroom knowledge and experience to respond to partners' needs and local resource constraints.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their economic and social challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and emotional intelligence in evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate the ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

ASEC 43120 - Evaluating International Engagement Methods

Credit Hours: 1.00. Designed for students who have just returned from the Engagement Methods for Int'l Food Security course or have previous experience working with our partners. In order to 1) fully comprehend the impact of the experience and 2) foster true long-term relationships with and service to our partners, it is required to work on our projects when we return. Matt McGregor, Former Exec. Dir. of Timmy Global Health, told us that "it's not really about the trip". It is essential that we accomplish: 1) Closure of trip experiences with partners and contacts - thank you's and complete follow-up; 2) Reflection of Purdue student experiences and personal goals/follow-up actions; 3) Promotion of food insecurity realities and opportunities for support; and 4) Planning, recommendations, and promotion of future service learning courses.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different

cultural setting. 5. Assess partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

BTNY 28500 - Plants And Civilization (UCC: STS)

Credit Hours: 3.00. This course, intended primarily for non-majors, covers the history of agriculture, with focus on the centers of origin of our major food, fiber, and medicinal plants, and their historical, cultural, and economic relevance. The course also surveys the biology of crop plants, with respect to taxonomy, anatomy, cell structure, physiology, development, and genetics. Discussions also center on the roles plant biotechnology may play in sustainable agriculture and in helping to alleviate problems caused by overpopulation and ecological stress.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Professional preparation, scientific principles, critical thinking, cultural understanding, social science principles and lifelong learning. Credits: 3.00

ASEC 55100 - International Engagement And Development Strategies

Credit Hours: 3.00. Sem. S and SS, cr. 3; an overview of cross-disciplinary, cultural, theoretical frameworks, communication tools, and assessment methods applied to international agricultural development and engagement. Lectures, panel discussions, and case studies on appropriate methods of development and engagement, international project planning, intercultural effectiveness, principles of sustainable agricultural, food, community development, and program/project monitoring and evaluation will be the basis of assignments and team work. This eight-week course will provide the theoretical and social frameworks and principles needed to successfully work in multi-agency partnerships on international development projects.

Learning Outcomes: 1. Select the most culturally-appropriate application of disciplinary knowledge and technologies for agriculture, food, natural resources and related sciences in development programs. 2. Deconstruct self biases and intercultural effectiveness and their critical and creative thinking skills for different contexts in appropriate applications of scientific research as creative interventions and evaluation. 3. Differentiate high and low oral and written communication skills, tolerance of cultural ambiguity, and adaptability. 4. Judge the efficacy of applying appropriate theoretical frameworks for engaging stakeholders in projects to create sustainable impact. 5. Determine the relevance of the result of applying principals and applications of ethical decision making and professional development. 6. Reflect on one's progress and abilities to work in multi-disciplinary teams to carryout developing country assessments and conceptualize a viable project proposal under a tight deadline. Credits: 3.00

ANSC 33100 - The Role Of Horses In Human History, Culture, And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

Examples of courses from outside of the College of Agriculture

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

Notes

Islamic Studies Minor

Requirements for the Minor (15 credits)

A. Required Course - Choose One (3 credits)

ARAB 28100 - Introduction To Islamic Civilization And Culture

Credit Hours: 3.00. This course is a survey of broad currents in the cultures, thought and civilization of the Muslim world. It emphasizes religious, intellectual and cultural trends, social and political structures and contemporary issues of Muslim societies within the current global cultural world. Taught in English.

Learning Outcomes: 1. Gained understanding of the basic teachings of Islam, sources of Islamic civilization and culture, its historical development and major aspects of Islamic thought and art through today. 2. Make connections and understand the interplay among religion, politics, culture and other forms of artistic expression. 3. Provide students with tools to undertake further research about the cultures of Islam and examine the impact Islam makes in lives of communities and contemporary problems facing Muslims in a globalized cultural world. Credits: 3.00

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

B. Category I and Category II (12 credits)

Category I: Islamic Culture, Gender and Diversity (at least 3 credits)

ARAB 10200 - Standard Arabic Level II (UCC: HUM)

Credit Hours: 3.00. Further study of Modern Standard Arabic. Continued presentation of the basic structures of Arabic grammar and expansion of vocabulary. Reading and writing will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify language comprehension by reading, reporting on, and or writing about long segments of Arabic text and speech. 2. Use simple grammatical and syntactic structures in daily communication. 3. Compose simple sentences and short paragraphs. 4. Demonstrate language

comprehension by discussing familiar topics with peers. Credits: 3.00

ARAB 23000 - Arabic Literature In Translation

Credit Hours: 3.00. Survey of Arabic literature, from the classical to the postmodern period. Emphasis on connections between literary works and contemporary life. Conducted in English; no knowledge of Arabic required.

Credits: 3.00

ARAB 23900 - Arab Women Writers (UCC: HUM)

Credit Hours: 3.00. Survey of Arab women writers from North Africa, the Middle East, and Arab communities in the Western world. Emphasis on issues of sexuality, marriage, work, travel and immigration. Conducted in English; no knowledge of Arabic required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 28000 - Arabic Culture (UCC: HUM)

Credit Hours: 3.00. A historical and literary survey of defining characteristics of Arabic culture from pre-Islamic times to the modern period.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 28100 - Introduction To Islamic Civilization And Culture

Credit Hours: 3.00. This course is a survey of broad currents in the cultures, thought and civilization of the Muslim world. It emphasizes religious, intellectual and cultural trends, social and political structures and contemporary issues of Muslim societies within the current global cultural world. Taught in English.

Learning Outcomes: 1. Gained understanding of the basic teachings of Islam, sources of Islamic civilization and culture, its historical development and major aspects of Islamic thought and art through today. 2. Make connections and understand the interplay among religion, politics, culture and other forms of artistic expression. 3. Provide students with tools to undertake further research about the cultures of Islam and examine the impact Islam makes in lives of communities and contemporary problems facing Muslims in a globalized cultural world. Credits: 3.00

ARAB 33400 - North African Literature And Culture

Credit Hours: 3.00. A view of the culture and society of the Maghreb (Morocco, Algeria, Tunisia, and Libya). Emphasis on issues of race, politics, religion, and gender through literature and other forms of artistic expression, including film and music. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Increase ability to think critically about other cultures and societies and appreciate cultural differences. 2. Investigate key cultural, social and political issues that have shaped cultures and societies in North Africa. 3. Develop understanding of contemporary questions such as nationalism, politics, religion and ethnicity in the region as represented through materials (literary and/or visual) from/about North Africa. 4. Develop and improve analytical skills (both oral and written) and enhance their abilities to comprehend, interpret, and analyze texts. 5. Expand familiarity and knowledge about core societal and cultural issues of this region and connect to contemporary events in the various countries and communities in North Africa. Credits: 3.00

Category II: Islam and the World: History, Politics, and Philosophy (at least 3 credits)

ANTH 31200 - The Archaeology Of Ancient Egypt And The Near East

Credit Hours: 3.00. Selected topics on the archaeology of ancient Near Eastern cultures in Mesopotamia, the circum-Mediterranean area, Egypt, and the Nile Valley, emphasizing an anthropological interpretation of the political, social, religious, and economic systems that contributed to their development.

Learning Outcomes: 1. Summarize the rise and development of civilization in the Near East and North Africa from 10,000 years ago to 331 BC. 2. Distinguish the emergence and strategies of governance between these neighboring regions. 3. Recognize the historical and cultural context that gave rise to the Great Pyramids, cuneiform writing, and other significant achievements in the region. 4. Interpret the Near East and North

Africa within Western historical narratives and popular imaginings. Credits: 3.00

HIST 24600 - Modern Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course explores the political, social, and cultural factors that have contributed to the formation of the modern Middle East. Course includes short stories and a selection of documentary films from the region.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 25000 - United States Relations With The Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course examines US relations with the Middle East and North Africa since World War II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gained a deeper understanding of the patterns and processes shaping US relations with the Middle East and North Africa. 2. Thought historically and critically about approaches to the study of US relations with the Middle East and North Africa. 3. Used primary source evidence to analyze fundamental issues in US relations with the Middle East and North Africa. 4. Sharpened critical reading, thinking, writing, and discussion skills in order to defend an independent argument. Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the human good, the nature of God, and divine language.

Credits: 3.00

ARAB 58700 - Modern Arab Thought

Credit Hours: 3.00. Prominent and critical issues in modern Arab thought. Identity, historical meaning, the Arab-Islamic cultural legacy, and tradition vs. modernity are engaged through Arab encounters with the West. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Become familiar with the main lines of modern Arab thought. 2. Identify critical issues in modern Arab thought, in relation to questions of identity, cultural heritage, and religious faith; situate those issues within their historical, social, and political contexts. 3. Appreciate the nuanced relationship between the Arab world and the West in terms of an often painful dialogue between tradition and modernity. Credits: 3.00

Notes

Italian Minor

Requirements for the Minor (15 credits)

A. Italian Language/Literature Courses (12 credits)

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through

integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

B. Additional Italian Course 20000 or higher (3 credits)

ITAL 23100 - Dante's Divine Comedy

Credit Hours: 3.00. Reading and discussion of Dante's Divine Comedy. The major critical approaches to Dante's masterpiece will be reviewed. All readings, papers, and examinations will be in English.

Credits: 3.00

ITAL 28000 - Italian Culture And Civilization (UCC: HUM)

Credit Hours: 3.00. Course focuses on salient aspects of Italian culture and civilization from the Middle Ages to the present. In English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of Italian culture and its legacy in the world. 2. Identify crucial developments of Italian society and culture of the time studied. 3. Situate the arts, literature, and music of Italy in their historical context. 4. Become aware of the political and national struggles that Italy faced throughout the centuries. 5. Be introduced to key figures from different fields of studies whose work, inventions, and discoveries changed and are still changing our world perspectives. Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

ITAL 39300 - Special Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will focus on particular aspects of Italian literature, cinema or culture. No knowledge of Italian required.

Credits: 3.00

ITAL 39400 - Special Topics In Italian Literature

Credit Hours: 3.00. This course studies a particular aspect in Italian literature (e.g., a theme, device, character type, motif, place) by reading a varied selection of works of different genres, styles, and/or periods. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 49300 - Advanced Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will analyze in depth particular aspects of Italian literature, cinema or culture. No knowledge of Italian necessary.

Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

ITAL 28500 - Intercultural Migration To Italy In Film, Literature, And Art (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the complexities of recent migrations to Italy through the perspectives of film, literature, and art. The course covers a wide range of topics, from a historical and geographical overview of migrations to Italy, to the hotly debated issues of immigration policies, Italian citizenship law, human rights and social justice, and the process of reimagining the Italian identity in more diverse and inclusive terms. Course taught in English. No Italian knowledge required.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Define the historical context, geographical routes, and reasons of migration to Italy. 2. Explain the impact of migration on Italian demographics, economy, and Italian identity ("Italianità"). 3. Compare diverse cultural representations of migration to Italy with diverse representations of migration in their own cultural contexts. 4. Outline the intersections between migration and the issues of citizenship, human rights, and social justice in Italian and their own cultural context. 5. Reflect on their intercultural learning in the domain of curiosity, openness, empathy, and global awareness. Credits: 3.00

A. Italian Language/Literature Courses (12 credits)

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Italian Language/Literature Courses (12 credits)

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

B. Additional Italian Course 20000 or higher (3 credits)

ITAL 23100 - Dante's Divine Comedy

Credit Hours: 3.00. Reading and discussion of Dante's Divine Comedy. The major critical approaches to Dante's masterpiece will be reviewed. All readings, papers, and examinations will be in English.

Credits: 3.00

ITAL 28000 - Italian Culture And Civilization (UCC: HUM)

Credit Hours: 3.00. Course focuses on salient aspects of Italian culture and civilization from the Middle Ages to the present. In English.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate knowledge of Italian culture and its legacy in the world. 2. Identify crucial developments of Italian society and culture of the time studied. 3. Situate the arts, literature, and music of Italy in their historical context. 4. Become aware of the political and national struggles that Italy faced throughout the centuries. 5. Be introduced to key figures from different fields of studies whose work, inventions, and discoveries changed and are still changing our world perspectives.
Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

ITAL 39300 - Special Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will focus on particular aspects of Italian literature, cinema or culture. No knowledge of Italian required.

Credits: 3.00

ITAL 39400 - Special Topics In Italian Literature

Credit Hours: 3.00. This course studies a particular aspect in Italian literature (e.g., a theme, device, character type, motif, place) by reading a varied selection of works of different genres, styles, and/or periods. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 49300 - Advanced Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will analyze in depth particular aspects of Italian literature, cinema or culture. No knowledge of Italian necessary.

Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

ITAL 28500 - Intercultural Migration To Italy In Film, Literature, And Art (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the complexities of recent migrations to Italy through the perspectives of film, literature, and art. The course covers a wide range of topics, from a historical and geographical overview of migrations to Italy, to the hotly debated issues of immigration policies, Italian citizenship law, human rights and social justice, and the process of reimagining the Italian identity in more diverse and inclusive terms. Course taught in English. No Italian knowledge required.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Define the historical context, geographical routes, and reasons of migration to Italy. 2. Explain the impact of migration on Italian demographics, economy, and Italian identity ("Italianità"). 3. Compare diverse cultural representations of migration to Italy with diverse representations of migration in their own cultural contexts. 4. Outline the intersections between migration and the issues of citizenship, human rights, and social justice in Italian and their own cultural context. 5. Reflect on their intercultural learning in the domain of curiosity, openness, empathy, and global awareness. Credits: 3.00

A. Italian Language/Literature Courses (12 credits)

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature,

etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

Japanese Minor

Requirements for the Minor (15 credits)

A. Japanese Language (6 credits)

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

B. Japanese Literature/Culture (3 credits)

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

C. Japanese Electives (6 credits)

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 40200 - Japanese Level VIII (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of Fourth Year Japanese I. It continues work on the acquisition of advanced-level proficiency in speaking, listening, reading and writing. Students are given opportunities to understand the main ideas of extended discourse, to read texts which are linguistically complex, and to write about a variety of topics.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

A. Japanese Language (6 credits)

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Japanese Language (6 credits)

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

B. Japanese Literature/Culture (3 credits)

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

C. Japanese Electives (6 credits)

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 40200 - Japanese Level VIII (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of Fourth Year Japanese I. It continues work on the acquisition of advanced-level proficiency in speaking, listening, reading and writing. Students are given opportunities to understand the main ideas of extended discourse, to read texts which are linguistically complex, and to write about a variety of topics.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

A. Japanese Language (6 credits)

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

Jewish Studies Minor

Requirements for the Minor (15 credits)

A. Required Course - Choose One (3 credits)

HIST 30200 - Historical Topics

Credit Hours: 3.00. This variable-title course deals with broad historical topics that transcend and collapse traditional analytical, chronological, and geographic boundaries. Content will vary with faculty member teaching the class.

Learning Outcomes: 1. Students will acquire a perspective on and basic understanding of the course content. 2. Students will engage in integrative learning as they examine the course content that transcends and collapses traditional analytical, chronological, and geographic boundaries. 3. Students will develop their creative and critical thinking skills. 4. Students will strengthen their information literacy and improve their writing skills. Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

POL 49300 - Interdisciplinary Undergraduate Seminar

Credit Hours: 1.00 to 3.00. An undergraduate seminar devoted to an interdisciplinary examination of social, economic, political, and intellectual movements, using the faculty resources of the participating departments. Subject matter will vary. Each offering of the seminar will be approved by a committee of department heads from the sponsoring departments. Permission of instructor required.

Credits: 1.00 to 3.00

B. Additional Courses - Choose from at least Two Areas (12 credits)

1. English

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 46200 - The Bible As Literature: The Old Testament

Credit Hours: 3.00. A study of the Old Testament - Pentateuch, Prophets, and other books such as Psalms, Proverbs, Job, and Ecclesiastes - with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 46300 - The Bible As Literature: The New Testament

Credit Hours: 3.00. A study of the New Testament, with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 59000 - Directed Reading

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

2. Languages and Cultures

HEBR 10100 - Modern Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to Modern Hebrew: the writing and sound systems, and systematic presentation of basic structures. All language skills - reading, writing, speaking, and comprehension - are emphasized. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 10200 - Modern Hebrew II (UCC: HUM)

Credit Hours: 3.00. Continuation and extension of the first semester. The course aims to develop fluency in reading, comprehension, and spoken language. Knowledge of grammar and vocabulary is expanded.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 12100 - Biblical Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. The first semester of biblical Hebrew will present the basic elements of the language, including alphabet, vocabulary, and grammar. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 12200 - Biblical Hebrew Level II (UCC: HUM)

Credit Hours: 3.00. The second semester of biblical Hebrew will continue the study of reading, vocabulary and grammar, based on selections from the Hebrew Bible.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 20100 - Modern Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading both in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 20200 - Modern Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22100 - Biblical Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. The third semester of biblical Hebrew focuses on reading and translation of extended passages form the Pentateuch and the use of textual criticism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22200 - Biblical Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. The fourth semester of biblical Hebrew exposes the student to both narrative and poetic sections of the Bible.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 38500 - The Holocaust In Modern Hebrew Literature

Credit Hours: 3.00. This course critically examines the Holocaust and the ways in which it has influenced modern Hebrew literature, the role it plays, and how it is represented in modern Hebrew literature. Conducted in English; no knowledge of Hebrew is necessary.

Credits: 3.00

JWST 59000 - Directed Readings In Jewish Studies

Credit Hours: 3.00. A reading course in aspects of Judaica directed by the instructor in whose particular field of specialization the content of the reading falls. Permission of Instructor required.

Learning Outcomes: 1. Deepen the knowledge of select topics in Judaica. Credits: 3.00

LC 59300 - Special Topics In Literature

Credit Hours: 1.00 to 4.00. Special topics in Literature. Permission of instructor required.

Credits: 1.00 to 4.00

HEBR 38000 - Israel And The Modern World: Cinema, Literature, History And Politics (UCC: HUM)

Credit Hours: 3.00. Critical survey/exploration of major traits of Israeli culture through a variety of media: literature, film and music, in the larger context of Judaism, Zionism, as well as the creation of a new state and culture. Conducted in English; no knowledge of Hebrew is necessary.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand the depth of Modern Israel cultural, political and historical complexity. 2. Understand the richness of Israeli culture. 3. Understand Israeli political-social problems and its influence on world affairs. 4. Development of modern Israeli cinema and literature in reference to their historical and political groundings. 5. Mastery of major historical events, major films, major literary figures, and major social/political problems.
Credits: 3.00

3. History

HIST 10300 - Introduction To The Medieval World (UCC: HUM)

Credit Hours: 3.00. Barbarians, kings, queens, peasants, witches, saints, teachers, students, heretics, Moslems, Jews, Christians, love, death, monks, farm life, city life, ordinary men, women, and children as Europe develops from A.D. 500 to 1500.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 40800 - Dictatorship And Democracy: Europe 1919-1945

Credit Hours: 3.00. This course examines the fleeting triumph of democracy across Europe. Followed by the rise of fascism, communism, and Nazism. Emphasis will be placed on broad economic, social, and cultural transformations as well as individual choices to resist or conform.

Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

4. Philosophy

PHIL 20600 - Introduction To Philosophy Of Religion (UCC: HUM)

Credit Hours: 3.00. The course encourages critical reflection on traditional and contemporary views about God and other religious ideas. Topics include arguments for God's existence, the problem of evil, understanding the divine attributes, miracles, religious pluralism, and life after death. CTL:ISH 1052 Philosophy Of Religion

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate familiarity with one or more conceptions of God and with arguments for and against the coherence of such conceptions. 2. Demonstrate a familiarity with some of the arguments for and against God's existence and with some of the objections to those arguments. 3. Recognize the importance of and demonstrate familiarity with multiple religious ideas and beliefs. 4. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 5. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. Credits: 3.00

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the human good, the nature of God, and divine language.

Credits: 3.00

5. Political Science

POL 59000 - Directed Reading In Political Science

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

6. Religious Studies

REL 20200 - Interpretation Of The Old Testament

Credit Hours: 3.00. An investigation of the religious content of documents Christians call the "Old Testament" in light of the historical, social, and intellectual contexts out of which they arose. The student will be introduced to problems and methods in their interpretation.

Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

REL 31700 - Ancient Judaism And Early Christianity

Credit Hours: 3.00. This course is a study of the emergence of Judaism and the rise of Christianity out of roots in the history of ancient Israel. This will include noticing the effects of Greek culture, evidence of anti-Semitism and admiration of the Jews, conversion in a setting of religious pluralism, and the development of Jewish and Christian self-definition in this climate.

Credits: 3.00

REL 31800 - The Bible And Its Early Interpreters

Credit Hours: 3.00. This course will start with observation of the development of early themes in later parts of the Hebrew Bible and proceed to the on-going influence of these themes in Jewish literature outside the Hebrew canon (apocrypha, pseudepigrapha, targums, midrash, Josephus, Philo, and other Hellenistic Jewish authors), as well as in pagan literature of this era and in early Christian literature, particularly the New Testament.

Credits: 3.00

7. Sociology

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations.
Credits: 3.00

SOC 36700 - Religion In America

Credit Hours: 3.00. Examines the social dimensions of religion in American life; religion in American culture; social profiles of America's religious groups, trends in individual religious commitment; and religion's impact on American life.

Learning Outcomes: 1. Describe the sizes and influences of major (and some minor) religious groups in America and how these sizes and influences have changed over the past 50 years. 2. Explain and evaluate the influence of religious groups and ideas on at least one other important aspect of social life. 3. Explain ways in which trends in American society over the past 50 years (e.g., changing gender roles, political shifts, etc.) are bringing about changes

in American religion. Credits: 3.00

SOC 51400 - Racial And Cultural Minorities

Credit Hours: 3.00. America's minority groups; immigration; interracial and intercultural conflicts; assimilation.

Credits: 3.00

SOC 59000 - Individual Research Problems

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of sociology under a Sociology department staff member. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 3.00

Notes

Korean Studies Minor

About the Minor

Requirements for the Minor (15 credits)

A. Korean Language Courses (6 credits)

KOR 30100 - Korean Level V

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas-speaking, listening, reading, and writing-in Korean at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. Emphasis will be on the appropriate use of Korean in a variety of situations including schools, companies, and formal/informal meetings. This course also enables students to understand Korean culture and history and to develop cross-cultural insights by comparing Korean society with US society. Korean history, image of Korea, and current social trends in Korea will be discussed for a solid understanding of Korean culture in which Korean language is embedded.

Learning Outcomes: 1. Obtain knowledge about linguistic structures and language-related cultures through linguistic and cultural analysis and synthesis of various types of data. 2. Apply their linguistic and cultural knowledge to comprehend (reading and listening) and produce (writing and speaking) language. 3. Assess paragraph-length texts and oral discourse to comprehend provided texts and dialogue in the classroom. 4. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 5. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 6. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 7. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams.

Credits: 3.00

KOR 30200 - Korean Level VI

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas-speaking, listening, reading, and writing-in Korean at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. Emphasis will be on the appropriate use of Korean in a variety of situations including schools, companies, and formal/informal meetings. This course also enables students to understand Korean culture and history and to develop cross-cultural insights by comparing Korean society with US society. Korean history, image of Korea, and current social trends in Korea will be discussed for a solid understanding of Korean culture in which Korean language is embedded.

Learning Outcomes: 1. Obtain knowledge about linguistic structures and language-related cultures through linguistic and cultural analysis and synthesis of various types of data. 2. Apply their linguistic and cultural knowledge to comprehend (reading and listening) and produce (writing and speaking) language. 3. Assess paragraph-length texts and oral discourse to comprehend provided texts and dialogue in the classroom. 4. Explain orally in Korean topics that are based on personal experiences in order to successfully interact

with native speakers on a prepared topic. 4. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 5. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 6. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 3.00

B. Literature and Culture (3 credits)

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

C. Selectives - Choose Two: (6 credits)

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 48000 - Special Topics In Korean Studies

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on topics related to contemporary Korean culture, arts, literature, etc. Or an internship totaling approximately 100-120 hours per semester or summer in Korea may also be credited through this course.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 40100 - Korean Level VII

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas (speaking, listening, reading, and writing) at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. By dealing with various topics on authentic materials including news, articles on websites, and short stories, this course enables students to enhance linguistics knowledge and skills and also helps them to

understand Korean culture, history, and current issues in Korea. It is expected that students will be able to discuss various topics and express opinions fluently in both spoken and written language.

Learning Outcomes: 1. Assess discourse-length texts to comprehend provided texts and dialogue in the classroom. 2. Explain the main ideas and most supporting details in connected discourse of paragraphs on a variety of general interest topics in written and spoken Korean. 3. Analyze, learn, and produce forms in informal and formal settings, provide lengthy and coherent narrations, present opinions on a number of issues, and provide structured arguments to support them. 4. Compose written language in Korean to demonstrate the ability to write about various topics with good control of frequently used structures and vocabulary, by using paraphrasing and elaboration to provide clarity. 5. Describe facts and evidence related to Korean history, culture, and society through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional games. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be

placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

Landscape and Turf Minor

Requirements for the Minor (13 Credits)

Required Courses (10 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural

understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

Selective Course (3 credits)

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

Notes

Landscape Management Minor

Requirements for the Minor (12-13 credits)

Required Courses (9-10 credits)

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the

installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

Selective Course (3 credits)

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic

herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

Notes

Latin American and Latino Studies Minor

School of Interdisciplinary Studies

Requirements for the Minor (15 credits)

A. Required Course (3 Credits)

LALS 25000 - Introduction To Latin American And Latino Studies

Credit Hours: 3.00. Interdisciplinary and integrative presentation and examination of the historical, political, economic, and cultural processes of Latin America, from independence to the present followed by an analysis of scholarly works that include theoretical models, methodological strategies, and analytical approaches to learning about US Latinos. Special emphasis is placed on the immigrant experience and its role in the incorporation of Latinos into the US society.

Credits: 3.00

B. Literary and Cultural Studies (3-6 Credits)

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

LALS 26000 - U S Latino Culture

Credit Hours: 3.00. This course uses an interdisciplinary approach to study Latino culture in the United States through art, film, literature, music and theater.

Credits: 3.00

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

SPAN 23500 - Spanish American Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Spanish American literature. The course context will change from semester to semester. Knowledge of Spanish not required.

Credits: 3.00

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

PTGS 55100 - Brazilian Poetry

Credit Hours: 3.00. A survey of the major currents and most important writers of Brazilian poetry. Readings include Gregorio de Matos, Goncalves Dias, Castro Alves, Mario de Andrade, Manuel Bandeira, and Cecilia Meireles. Permission of instructor required.

Credits: 3.00

PTGS 55500 - Brazilian Drama

Credit Hours: 3.00. A survey of the primary movements and most important works of Brazilian theatre. Readings include plays by Nelson Rodrigues, Dias Gomes, Ariano Suassuna, and Jorge Andrade. Permission of instructor required.

Credits: 3.00

PTGS 55700 - Brazilian Fiction

Credit Hours: 3.00. A survey of the development and major texts of Brazilian fiction. Readings include novels or short stories by Jose de Alencar, Machado de Assis, Graciliano Ramos, and Clarice Lispector, among others. Permission of instructor required.

Credits: 3.00

SPAN 54900 - Hispanic Women Writers

Credit Hours: 3.00. A survey of the literature of Hispanic women writers from Latin America, the Caribbean, and Spain in light of their traditions and of feminist literary theory and criticism. Permission of instructor required.

Learning Outcomes: 1. Discuss female characters from an informed perspective, whether applying feminist theories or not . 2. Compare and contrast literary innovations of male and female writers in literary movement since Modernity Credits: 3.00

SPAN 55000 - Spanish American Literature Of The Colonial Period

Credit Hours: 3.00. A survey of Spanish American literature of the colonial period. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55100 - Spanish American Literature Of The 19th Century

Credit Hours: 3.00. A survey of Spanish American literature of the 19th century. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55200 - Spanish American Literature From 1900 To 1970

Credit Hours: 3.00. A survey of Spanish American literature from 1900 to 1970. Readings and discussion of a number of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55300 - Spanish American Literature From 1970 - Present

Credit Hours: 3.00. A survey of Spanish American literature from 1970 to the present. Readings and discussion of a number of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55400 - Hispanic Caribbean Literature

Credit Hours: 3.00. This course focuses on various topics pertaining to Hispanic Caribbean literature. The particular works included will change each time the course is offered. All coursework and discussion is in Spanish.

Credits: 3.00

SPAN 55500 - Latino/a Literature

Credit Hours: 3.00. This class offers an overview of U.S. Latino/a literature, written in Spanish and English and produced in the United States. It will introduce students to the many and diverse experiences of different Latino/a groups through their literary production. Permission of instructor required.

Learning Outcomes: 1. Gain a sense of the diversity of the Latino/a experience in the U.S. as well as the longevity and richness of the Latino/a literary tradition in the U.S. 2. Become familiar with some of the major themes and trends in Latino/a literature. 3. Consider the ways in which identities like - class, race, and gender - intersect with one another and are constructed in relation to one another. 4. Learn how to close-read a literary or cultural object, such as a novel, a film, or a poem. 5. Work on improving their writing and research skills through the development of an original research project dealing with Latino/a literature. Credits: 3.00

SPAN 55600 - Mexican Literature

Credit Hours: 3.00. A survey of Mexican literature. Reading and discussion of a number of representative works as well as excerpts from several others. Permission of instructor required.

Learning Outcomes: 1. Discuss the impact the history of Mexico has on literary production. 2. Examine the nature of the development of Mexican literary movements. 3. Analyze Mexican literature with consideration of its individual literary innovations. Credits: 3.00

SPAN 55700 - Argentine Literature

Credit Hours: 3.00. A survey of Argentine literature. Reading and discussion of a number of representative works as well as excerpts from several others and from standard anthologies.

Credits: 3.00

LALS 40100 - Special Topics In Latin American/Latino Studies

Credit Hours: 3.00. Investigation of a special topic in Latin American or US Latina/o studies. The topic will vary from semester to semester.

Credits: 3.00

LALS 40200 - Directed Reading In Latin American/Latino Studies

Credit Hours: 1.00 to 6.00. Directs the reading of students with special interests in Latin American or U.S. Latina/o studies. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 6.00

LALS 30100 - Latin American Literary And Cultural Studies

Credit Hours: 3.00. Focuses on Latin American literatures and cultural products, such as film, music, and/or art. As a variable-topics course, individual sections may variously focus on South and/or Central America, Mexico, the Caribbean, U.S. Latina/o

populations, or any combination of the above. Individual sections may also examine major cultural and historical movements, and/or canonical and emerging authors and artists. May be repeated for credit.

Credits: 3.00

C. History, Philosophy and Social Sciences (3-6 Credits)

HIST 27100 - Introduction To Colonial Latin American History (1492-1810) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the principle historical themes of Latin America during the colonial period (roughly, from 1492 to 1810). No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate a grasp of the historical forces that in many ways laid the foundation for present-day Latin America. 2. Express understanding of how these major political, social, economic, and cultural issues unfolded in different ways in Latin America, with respect to region, time, and culture. Credits: 3.00

HIST 27200 - Introduction To Modern Latin American History (1810 To The Present) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the study of the major economic, political, social, and cultural processes that shaped modern Latin American nations since independence. No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a broad understanding of the modern history of Latin America. 2. Become familiar with the major economic, political, social, and cultural processes that shaped the nations of the continent. Credits: 3.00

LALS 35500 - Political Economy Of Latin America

Credit Hours: 3.00. Examines the salient issues of the 21st century in the political economy of Latin America. The first part introduces students to the historical evolution of the region's economy and its socio-economic and political determinants. Then it focuses on topical inquiry, analyzing key policy areas, frameworks and choices at the core of the current political economy of the region's countries: fiscal and industrial policies, monetary and financial policies and policies on trade, migration and inequality, energy and the environment.

Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 34700 - Introduction To Latin American Politics

Credit Hours: 3.00. Major aspects of Latin American politics and development. Questions such as the impact of the military on political development, the dynamics of Latin American industrialization, and Latin America's changing international role will be explored.

Credits: 3.00

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 57700 - Contemporary Latin America

Credit Hours: 3.00. A topical and regional approach to recent political, social, and economic movements in Latin America.

Credits: 3.00

LALS 40100 - Special Topics In Latin American/Latino Studies

Credit Hours: 3.00. Investigation of a special topic in Latin American or US Latina/o studies. The topic will vary from semester to semester.

Credits: 3.00

LALS 40200 - Directed Reading In Latin American/Latino Studies

Credit Hours: 1.00 to 6.00. Directs the reading of students with special interests in Latin American or U.S. Latina/o studies. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 6.00

LALS 34700 - Latin American Politics

Credit Hours: 3.00. Focuses on major aspects of Latin American and/or U.S. Latina/o politics and development. As a variable-topics course, individual sections may variously focus on U.S. foreign policy toward countries in Latin America, the U.S.'s historical role in the politics of the Western hemisphere, the impact of the military on political development, the dynamics of Latin American industrialization, Latin America's changing international role, Latinas/os's political participation in the United States, or any combination of the above. Individual sections may also Latin American political thought from the colonial period through the present day.

Credits: 3.00

D. Languages and Linguistics (3-6 Credits)

PTGS 20100 - Portuguese Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Portuguese course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Discussing personal relations and academic studies. 2. Giving and receiving directions to a destination and/or in order to complete a task. 3. Preparing short oral presentations on topics related to Portuguese and Brazilian cultures. 4. Writing short essays on specified topics. Credits: 3.00

PTGS 20200 - Portuguese Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of PTGS 20100 .

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

SPAN 20200 - Spanish Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 20100. CTL:IWL 1913 Spanish Level IV

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate control of most structures, considerable breadth of vocabulary, and appropriate communicative competence. 2. Develop the linguistic and analytic skills needed for advanced study in Spanish. 3. Be able to communicate in an academic setting, critically assess ideas and texts, and be able to present them in writing to an academic audience. 4. Show the knowledge of the rich cultural, geographical, and linguistic variety of the Spanish-speaking world. Credits: 3.00

LALS 40100 - Special Topics In Latin American/Latino Studies

Credit Hours: 3.00. Investigation of a special topic in Latin American or US Latina/o studies. The topic will vary from semester to semester.

Credits: 3.00

LALS 40200 - Directed Reading In Latin American/Latino Studies

Credit Hours: 1.00 to 6.00. Directs the reading of students with special interests in Latin American or U.S. Latina/o studies. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 6.00

LALS 30300 - Latin American Languages And Linguistics

Credit Hours: 3.00. Focuses on the languages and linguistic

practices of Latin American and/or U.S. Latina/o populations, also including the Caribbean. As a variable-topics course, individual sections may variously focus on the nature and structure of specific languages, as well as the study of their dialects, semantics, and histories; the history, structure, uses, and educational concerns of Latin American indigenous, Caribbean Creole and/or U.S. Latina/o speech communities; or any combination of the above. May be repeated for credit.

Credits: 3.00

Notes

Law and Society Minor

Requirements for the Minor (15 credits)

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

B. Required Law and Process Courses (9 credits)

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

C. Selective Course (3 credits)

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social

organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 32600 - Social Conflict And Criminal Justice (UCC: BSS)

Credit Hours: 3.00. This course examines the dynamics of social conflict, with a special focus on legal institutions and criminological processes. Students will learn to think more analytically about the causes of social conflict, its dynamics, and strategies for resolution.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Become familiar with classic theories of social conflict and social order. 2. Understand why society needs dissent. 3. Understand strategies for conflict resolution. Credits: 3.00

SOC 32700 - Crime, Deviance And Mass Media

Credit Hours: 3.00. Various forms of mass media are used to explore the sociology of crime and deviance. Topics may include white collar crime, juvenile delinquency, street crime, sexuality and sexual orientation, hate crimes, deviance and community. Assignments include quizzes and short papers.

Learning Outcomes: 1. Able to identify concepts associated with specific theoretical perspectives and be able to describe these concepts. 2. Able to use these concepts to the media forms presented in the class. 3. Use the concepts to craft explanations for characters' actions in the fictional films. 4. Able to conduct analyses of the news that conform to accepted methodological standards of quantitative and qualitative research. Credits: 3.00

SOC 33400 - Urban Sociology

Credit Hours: 3.00. Development of the city and its functions; types of social behavior in cities; influences of city life on personality; city planning.

Credits: 3.00

SOC 34000 - General Social Psychology

Credit Hours: 3.00. Social influences on the individual and processes of social interaction. Individual attitudes and behavior as related to socialization, social norms, social roles, communication and propaganda, and other social influences. Among the interaction processes considered are interpersonal attraction, influence, leadership, cooperation, and conflict. Not open to students with credit in PSY 24000.

Learning Outcomes: 1. Develop an understanding of how politics has been approached and analyzed by sociologists over time, and an appreciation for the important thinkers and historical events that have shaped these approaches. 2. Identify specific areas of political polarization and political consensus in contemporary American politics, including

where we find evidence of partisan asymmetry. 3. Demonstrate ability to develop and communicate sociological insights as they relate to political history and contemporary political dynamics, both in class and in written assignments. Credits: 3.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 39100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Various topics in sociology that may change from semester to semester are presented by Sociology faculty members.

Credits: 1.00 to 3.00

SOC 40200 - Sociological Theory

Credit Hours: 3.00. An advanced critical treatment of the theories, concepts, and methods of sociology. A basic course required of undergraduate majors in sociology.

Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

SOC 42100 - Juvenile Delinquency

Credit Hours: 3.00. A study of social and psychological factors influencing individual delinquent behavior patterns. Emphasis on preventive and rehabilitative programs and the role of community agencies such as social service agencies, juvenile

courts, and youth authorities. Visits to selected organizations and institutions.

Learning Outcomes: 1. Understand the causes and consequences of juvenile crime on individuals, families, and society. 2. Understand the prevalence and types of juvenile delinquency in the United States. 3. Learn the basic theories of juvenile crime. 4. Assess the theories onset of, recidivism, and desistance from crime. 5. Assess effects of social factors in delinquency, such as parents, siblings, family structure, and peers. 6. Know the history of and reasons for the juvenile justice system. 7. Critically evaluate the juvenile justice system and social response to juvenile crime. 8. Identify and evaluate multiple local organizations and institutions that intervene or act in juvenile delinquency prevention, rehabilitation, or response. Credits: 3.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

SOC 33500 - Political Sociology (UCC: STS)

Credit Hours: 3.00. Analysis of the social and social psychological sources of routine political participation such as voting and interest group activity, and nonroutine political action such as protest movements and revolution; the organization of power at the community, national, and international level; and political ideology.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Have a basic understanding of sociological theories of the state 2. Acquire an understanding of recent social and political science explanations of political processes and events 3. Apply sociological principles to make sense of current world events and to contribute to social debates 4. Comprehend different opportunities to influence political decisions by average citizens. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize

what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

B. Required Law and Process Courses (9 credits)

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in

the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

C. Selective Course (3 credits)

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 32600 - Social Conflict And Criminal Justice (UCC: BSS)

Credit Hours: 3.00. This course examines the dynamics of social conflict, with a special focus on legal institutions and criminological processes. Students will learn to think more analytically about the causes of social conflict, its dynamics, and strategies for resolution.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Become familiar with classic theories of social conflict and social order. 2. Understand why society needs dissent. 3. Understand strategies for conflict resolution. Credits: 3.00

SOC 32700 - Crime, Deviance And Mass Media

Credit Hours: 3.00. Various forms of mass media are used to explore the sociology of crime and deviance. Topics may include white collar crime, juvenile delinquency, street crime, sexuality and sexual orientation, hate crimes, deviance and community. Assignments include quizzes and short papers.

Learning Outcomes: 1. Able to identify concepts associated with specific theoretical perspectives and be able to describe these concepts. 2. Able to use these concepts to the media forms presented in the class. 3. Use the concepts to craft explanations for characters' actions in the fictional films. 4. Able to conduct analyses of the news that conform to accepted methodological standards of quantitative and qualitative research. Credits: 3.00

SOC 33400 - Urban Sociology

Credit Hours: 3.00. Development of the city and its functions; types of social behavior in cities; influences of city life on personality; city planning.

Credits: 3.00

SOC 34000 - General Social Psychology

Credit Hours: 3.00. Social influences on the individual and processes of social interaction. Individual attitudes and behavior as related to socialization, social norms, social roles, communication and propaganda, and other social influences. Among the interaction processes considered are interpersonal attraction, influence, leadership, cooperation, and conflict. Not open to students with credit in PSY 24000.

Learning Outcomes: 1. Develop an understanding of how politics has been approached and analyzed by sociologists over time, and an appreciation for the important thinkers and historical events that have shaped these approaches. 2. Identify specific areas of political polarization and political consensus in contemporary American politics, including where we find evidence of partisan asymmetry. 3. Demonstrate ability to develop and communicate sociological insights as they relate to political history and contemporary political dynamics, both in class and in written assignments. Credits: 3.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social

research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 39100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Various topics in sociology that may change from semester to semester are presented by Sociology faculty members.

Credits: 1.00 to 3.00

SOC 40200 - Sociological Theory

Credit Hours: 3.00. An advanced critical treatment of the theories, concepts, and methods of sociology. A basic course required of undergraduate majors in sociology.

Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

SOC 42100 - Juvenile Delinquency

Credit Hours: 3.00. A study of social and psychological factors influencing individual delinquent behavior patterns. Emphasis on preventive and rehabilitative programs and the role of community agencies such as social service agencies, juvenile courts, and youth authorities. Visits to selected organizations and institutions.

Learning Outcomes: 1. Understand the causes and consequences of juvenile crime on individuals, families, and society. 2. Understand the prevalence and types of juvenile delinquency in the United States. 3. Learn the basic theories of juvenile crime. 4. Assess the theories onset of, recidivism, and desistance from crime. 5. Assess effects of social factors in delinquency, such as parents, siblings, family structure, and peers. 6. Know the history of and reasons for the juvenile justice system. 7. Critically evaluate the juvenile justice system and social response to juvenile crime. 8. Identify and evaluate multiple local organizations and institutions that intervene or act in juvenile delinquency prevention, rehabilitation, or response. Credits: 3.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

SOC 33500 - Political Sociology (UCC: STS)

Credit Hours: 3.00. Analysis of the social and social psychological sources of routine political participation such as voting and interest group activity, and nonroutine political action such as protest movements and revolution; the organization of power at the community, national, and international level; and

political ideology.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Have a basic understanding of sociological theories of the state 2. Acquire an understanding of recent social and political science explanations of political processes and events 3. Apply sociological principles to make sense of current world events and to contribute to social debates 4. Comprehend different opportunities to influence political decisions by average citizens. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

Learning Sciences in Educational Studies Minor

Requirements for the Minor (15 credits)

Required Courses (5-6 credits)

EDPS 10101 - Learning In Context-An Introduction To The Learning Sciences

Credit Hours: 3.00. This introductory course is designed to acquaint first year Learning Science students with the core concepts, principles, and research findings of the learning sciences as they apply to a wide range of formal and informal educational contexts. The course provides students with opportunities to interact with and learn about the scholarship of

College of Education faculty who conduct research within the framework of the learning sciences. Students will learn about faculty projects that exemplify key features of the Learning Sciences such as attention to the complexity of learning environments, the study of social and cultural as well as individual dimensions of learning, and the cross-disciplinary nature of the field.

Learning Outcomes: 1. Identify the features of education as a design discipline. 2. Identify core principles, questions, and challenges, that define educational research and practice from a Learning Sciences perspective. 3. Identify the varied sources of cross-disciplinary knowledge that contribute to the design and study of effective learning environments. Credits: 3.00

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

Selectives (9-10 credits)

EDPS 30101 - Motivation To Learn

Credit Hours: 3.00. This course introduces students to current social-cognitive and sociocultural theories of motivation for learning and academic achievement, and research framed by those theories. Both individual-level and contextual factors associated with motivation will be considered. The course will also address applications of theory in educational settings, including motivational interventions.

Learning Outcomes: 1. Be familiar with predominant social-cognitive theories of motivation and their related constructs. 2. Understand how social-cognitive and socio-cultural approaches to studying motivation differ conceptually, methodologically, and empirically. 3. Be familiar with a range of methodologies that are used to measure student motivation, and strengths and weaknesses of each. 4. Understand and think critically about research design issues in motivation research, including descriptive correlational, quasi-experimental, and design research. 5. Understand the implications of motivation for student learning and achievement, and how this association is affected by affective, behavioral, and cognitive engagement. 6. Be familiar with proximal and distal contextual factors that are associated with motivation, and reasons for those associations. 7. Be familiar with ways that teaching and learning practices can facilitate or impede optimal student motivation. Credits: 3.00

EDPS 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDPS 49100 - Topics And Issues In Education

Credit Hours: 1.00 to 3.00. Provides student with opportunity to strengthen preparation through study of selected educational topics and issues based upon individual needs and interests. One topic is considered in each enrollment.

Credits: 1.00 to 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal

articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area

performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities. Credits: 2.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for

implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

EDPS 34501 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students and provides you with knowledge and skills needed to effectively support healthy psychosocial development through your work with gifted students. As well as providing an overview of the

characteristics and needs of gifted students, we will also discuss special populations of gifted learners, diversity issues, family and peer relationships, and current educational approaches and counseling interventions, including considerations for career development for gifted students. Permission of instructor required.

Learning Outcomes: 1. Recognize the social and affective characteristics and needs of high-ability students; describe and apply research-based practices to support their affective developments across home, school, and community. [NAGC-CEC Standards: 1.1, 1.2, 2.1] 2. Practice designing products that incorporate meaningful and engaging social and affective components that promote social-emotional well-being, including coping skills, proactive, adaptive behaviors, performance skills, and social skills. [NAGC-CEC Standards: 2.1-2.3, 3.1, 3.4, 4.5, 5.1] 3. Discuss characteristics and needs of subpopulations of high-ability learners and the implications for academic instruction, ethical leadership development, and/or counseling interventions. [NAGC-CEC Standards: 2.1-2.3, 4.1-4.5, 6.1, 6.3] 4. Increase knowledge and experience through regular participation in class discussion boards, interaction with gifted students and their parents, and completion of an in-depth, original affective case study of a high-ability students K-12. [NAGC-CEC Standards: 3.1, 4.3, 4.5, 7.1-7.2] Credits: 3.00

Notes

LGBTQ Studies Minor

Requirements for the Minor (12 credits)

A. LGBTQ Foundational Course (3 credits)

ANTH 28200 - Introduction To LGBTQ Studies

Credit Hours: 3.00. (WGSS 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding if the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

B. LGBTQ 40000-level Course (3 credits)

ANTH 48200 - Sexual Diversity In Global Perspectives

Credit Hours: 3.00. This course focuses on anthropological and interdisciplinary research in the study of sexuality with particular attention to lesbian, gay, bisexual and transgender identities. It explores historical, theoretical and ethnographic work on sexualities and genders in the US and globally.

Learning Outcomes: 1. Develop an in-depth

understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

HIST 48800 - History Of Sexual Regulation In The United States

Credit Hours: 3.00. This course will illuminate broad themes in the historical regulation of sexual violence, consensual sex, and homosexuality. Student will understand and analyze how cultural, social, religious, and moral ideologies have influenced conceptions of deviant and normative sexuality in the United States.

Learning Outcomes: 1. Students will be able to articulate verbally and in writing what they have learned about the nineteenth and twentieth century history of sexual regulation. 2. Students will be able to identify and analyze the cultural and religious values which informed sexual regulation. 3. Students will develop a deeper understanding of how regulations and reform worked by conducting primary source research and synthesizing it into written arguments. Credits: 3.00

WGSS 48200 - Interdisciplinary Studies In Sexuality

Credit Hours: 3.00. This course offers an interdisciplinary introduction to recent work in lesbian and gay studies in various fields, including literature, history, film, cultural theory, medicine, law, and studies of sexuality.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

C. LGBTQ Studies Electives (6 credits)

1. Category 1 - Choose One (3 credits)

PSY 24400 - Introduction To Human Sexuality

Credit Hours: 3.00. This course will provide a broad survey of research on human sexuality from a psychosocial perspective. Topics covered include research methods, gender identity, sexual orientation, reproductive anatomy, typical and atypical sexual behavior, and sexual difficulties and their treatments. CTL:ISH 1022 Human Sexuality

Credits: 3.00

ANTH 48200 - Sexual Diversity In Global Perspectives

Credit Hours: 3.00. This course focuses on anthropological and interdisciplinary research in the study of sexuality with particular attention to lesbian, gay, bisexual and transgender identities. It explores historical, theoretical and ethnographic work on sexualities and genders in the US and globally.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various

communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

HIST 48800 - History Of Sexual Regulation In The United States

Credit Hours: 3.00. This course will illuminate broad themes in the historical regulation of sexual violence, consensual sex, and homosexuality. Student will understand and analyze how cultural, social, religious, and moral ideologies have influenced conceptions of deviant and normative sexuality in the United States.

Learning Outcomes: 1. Students will be able to articulate verbally and in writing what they have learned about the nineteenth and twentieth century history of sexual regulation. 2. Students will be able to identify and analyze the cultural and religious values which informed sexual regulation. 3. Students will develop a deeper understanding of how regulations and reform worked by conducting primary source research and synthesizing it into written arguments. Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

WGSS 49200 - Practicum In Women's, Gender, and Sexuality Studies

Credit Hours: 2.00 to 4.00. This course is designed to integrate knowledge derived from women's studies scholarship with practical experience. Students will define their own projects in consultation with women's studies faculty. Periodic conferences and written reports required. Permission of instructor required.

Credits: 2.00 to 4.00

WGSS 48200 - Interdisciplinary Studies In Sexuality

Credit Hours: 3.00. This course offers an interdisciplinary introduction to recent work in lesbian and gay studies in various fields, including literature, history, film, cultural theory, medicine, law, and studies of sexuality.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 38200 - Love, Sex And Sexuality

Credit Hours: 3.00. Explores intimate relationships and marriage practices in Western and non-Western societies from a historical and comparative perspective. Examines the changes in love and marriage in Greco-Roman societies, medieval and modern Europe, China, India and the Muslim world, among others.

Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural

diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

2. Category 2 - Choose One (3 credits)

ENGL 36000 - Gender And Literature (UCC: HUM)

Credit Hours: 3.00. An introduction to feminist approaches to the study of literature, including poetry, drama, fiction, and/or autobiography. Examines how gender intersects with race, ethnicity, sexual orientation, and class in shaping authorship, reading, and representation.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37500 - Women In America Since 1870 (UCC: HUM)

Credit Hours: 3.00. A survey of the history of women in the United States from 1870 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LC 23900 - Women Writers In Translation (UCC: HUM)

Credit Hours: 3.00. An examination of international female writers' literary creativity in the context of women's studies and feminist theory, as articulated in their specific cultural and geographical milieu. Course content will vary in terms of cultural focus. In English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop skills in writing, reading, critical thinking, and oral expression. 2. Gain knowledge of female literary traditions in different geographical milieu and time periods. 3. Increase awareness of the ways in which women writers reflect upon and resist stereotypes of women in literature, and how this process may differ across cultures. 4. Understand fundamental concepts in women's gender and sexuality studies. Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of

role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

WGSS 48300 - Feminisms In Global Perspective

Credit Hours: 3.00. Explores feminist struggles through the writings of First and Third World feminist scholars. Focuses on feminist projects within and against colonial, nationalist, religious and global contexts. Includes Third World feminist critiques of Western feminisms.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

Notes

Disclaimer

Linguistics Minor

Requirements for the Minor (15 credits)

A. Introduction to Linguistics - Choose One (3 credits)

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

LING 20100 - Introduction To Linguistics (UCC: BSS)

Credit Hours: 3.00. Basic concepts of linguistics and methods of analysis of language; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax, and semantics, and to problem-solving techniques, with material drawn from a variety of languages.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

LC 26100 - Introduction To The Linguistic Study Of Foreign Languages (UCC: BSS)

Credit Hours: 3.00. Overview of linguistics and the role of language in society; fundamental concepts of linguistic analysis. The course focuses on linguistic phenomena found in French, German, Russian, and Spanish, with material, examples, and assignments drawn primarily from those languages whenever appropriate.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

B. General Linguistics (6 credits)

1. Category #1

ENGL 32900 - English Language III: Sound And Form

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on phonology and morphology. Implications of recent theory to the teaching of English.

Credits: 3.00

LING 31100 - Fundamentals Of Phonology And Morphology

Credit Hours: 3.00. Basic concepts and tools of phonological and morphological analysis viewed through the material of American English. Current theoretical approaches to phonology and morphology, including word-formation processes and applications.

Credits: 3.00

2. Category #2

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

LC 37100 - Phonetics Of Foreign Languages

Credit Hours: 3.00. Introduction to articulatory phonetics for students of foreign languages. Mechanisms of production of speech sounds. Production and discrimination of sounds of other languages; contrast with English sounds; practice in pronunciation and phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be awarded for more than one of SLHS 30600 , LING 31500 , and LC 37100.

Credits: 3.00

LING 31500 - Elements Of Phonetics

Credit Hours: 3.00. Introduction to articulatory phonetics. Mechanisms of production of speech sounds. Sounds of languages of the world, ear training for discriminating speech sounds, and practice in broad and narrow phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be given for both LING 31500 and SLHS 30600.

Credits: 3.00

3. Category #3

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 .

Credits: 3.00

LING 32100 - Foundations Of Syntax And Semantics

Credit Hours: 3.00. Introduction to syntactic and semantic analysis based on American English and its dialects. Underlying structure and its relation to meaning. Analysis of parts of speech, constituent phrases, sentence structure, representations, ambiguity, and applications of current theory. Credit will not be given for both LING 32100 and ENGL 32800 .

Credits: 3.00

C. Additional Courses in Linguistics - Choose Two (6 credits)

PSY 40300 - Psycholinguistics

Credit Hours: 3.00. (PSY 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

PSY 42600 - Language Development

Credit Hours: 3.00. (SLHS 30900) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

Credits: 3.00

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how

waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception. Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

SLHS 40100 - Language And The Brain

Credit Hours: 3.00. (PSY 40100) This course is an overview of the neutral systems that underlie the core components of language, including speech perception and production, reading and writing, morphology, syntax, semantics, and discourse. During the past few decades, there has been an unprecedented increase in studies on these topics, due in large part to the widespread use of highly sensitive brain mapping techniques that enable researchers to identify relationships between particular brain areas and particular language functions. The findings that have been emerged from this recent explosion of research are exciting and important for several reasons. They provide fresh insights into the nature of the uniquely human capacity for language, and they have significant implications for understanding and treating language disorders that result from brain injury.

Learning Outcomes: 1. Understand the main methods for investigating the neural substrates of language. 2. Understand the classic and progressive aphasia syndromes. 3. Basic neural underpinnings of the core aspects of language. 4. Critically evaluate research on language. 5. Critically evaluate research on language and the brain. Credits: 3.00

SLHS 40300 - Psycholinguistics

Credit Hours: 3.00. (SLHS 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

ANTH 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American speech communities and the culture at large.

Credits: 3.00

ANTH 39200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Various topics in anthropology that may change from semester to semester are presented by anthropology faculty members.

Credits: 1.00 to 3.00

ENGL 32700 - English Language I: History And Development

Credit Hours: 3.00. Introduction to the history of the English language, its sounds, inflections, words, and sentence structures. Cultural and historical events affecting this history, and the interplay between language and literature.

Credits: 3.00

ENGL 39600 - Studies In Literature And Language

Credit Hours: 1.00 to 3.00. A course in the study of a special topic directed by an instructor in whose particular field of specialization the content of the course falls.

Learning Outcomes: 1. Students will think

critically about course content. 2. Students will read and write reflectively and critically about course content. 3. Students will engage in course discussions, either online or face-to-face, which encourage critical thought and personal engagement. Credits: 1.00 to 3.00

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

LC 49000 - Special Topics In Foreign Languages And Literatures

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

LING 49800 - Special Topics In Linguistics II

Credit Hours: 3.00. Investigation of a special topic in linguistics. The topic will vary from semester to semester. Permission of instructor required.

Credits: 3.00

LING 49000 - Directed Reading In Linguistics

Credit Hours: 1.00 to 4.00. Independent study and reading on a topic in linguistics directed by a faculty member. Permission of instructor required.

Credits: 1.00 to 4.00

LING 39800 - Special Topics In Linguistics I

Credit Hours: 3.00. Investigation of a special topic in linguistics. The topic will vary from semester to semester. Permission of instructor required.

Credits: 3.00

LING 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American English in African American speech communities and the United States culture at large.

Credits: 3.00

PHIL 46500 - Philosophy Of Language

Credit Hours: 3.00. An examination of some of the central issues in the philosophy of language, such as meaning, reference, truth, propositions, and speech acts.

Credits: 3.00

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning

process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

COM 50700 - Introduction To Semiotics

Credit Hours: 3.00. (ANTH 51900, AUSL 58900, ENGL 57000, LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena, which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Learning Outcomes: 1. Describe and apply semiotic theories. 2. Apply semiotic theory and practice to everyday life. 3. Apply semiotic theory to different socio-cultural contexts. 4. Describe the semiotic theory behind the social construction of reality. 5. Analyze sign systems within their socio-cultural milieus. Credits: 3.00

COM 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, AUSL 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ANTH 51900 - Introduction To Semiotics

Credit Hours: 3.00. (COM 50700 , ENGL 57000 , LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ANTH 56500 - Sociolinguistics

Credit Hours: 3.00. (SLHS 56500, COM 56500 , ENGL 56500 , LC 56500 , LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ANTH 59200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

ENGL 51100 - Semantics

Credit Hours: 3.00. An introduction to and survey of current semantic theories and methods with an emphasis on English. Basic concepts of linguistic semantics and its relation to the other semantics. Compositional (transformational), model-theoretical (truth-conditional), pragmatic, and contextual semantics.

Credits: 3.00

ENGL 51200 - English Syntax And Syntactic Theory

Credit Hours: 3.00. Introduction to English syntactic structure, syntactic argumentation, and syntactic theory. Emphasis on one current theory as the primary theoretical framework, with other theories considered.

Credits: 3.00

ENGL 51300 - English Phonology

Credit Hours: 3.00. Introduction to current phonological theory, with applications to descriptions of American and British English. Articulatory description of English phonological structure and contrastive analysis of phonetic variation across dialects. Evolution of the stress system of English and its utilization by poets writing metrical verse.

Credits: 3.00

ENGL 51600 - Teaching English As A Second Language: Theoretical Foundations

Credit Hours: 3.00. Survey of theories of learning and teaching English as a second/foreign/international language. Focus is on current theories and their implications for practice.

Learning Outcomes: 1. Demonstrate an understanding of current theories of second-

language learning and teaching and their implications. Credits: 3.00

ENGL 51800 - Teaching English As A Second Language: Principles And Practices

Credit Hours: 3.00. Studies of issues and principles in ESL/EFL program development. Emphasis is on practical application of theory in a variety of English learning and teaching contexts in the U.S. and abroad.

Credits: 3.00

ENGL 56300 - Historical Linguistics

Credit Hours: 3.00. (ANTH 56300, LC 56300) A survey of mechanisms and motivations of linguistic change. Topics include: phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

ENGL 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, LC 56500, LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ENGL 57000 - Introduction To Semiotics

Credit Hours: 3.00. The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ENGL 59600 - Advanced Studies In Literature Or Language

Credit Hours: 3.00. Advanced study of a topic within the instructor's fields of specialization. Emphasis on scholarly analysis and research.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

SLHS 50200 - Fundamentals Of Speech Production And Perception

Credit Hours: 3.00. The physical, biological, and behavioral correlates of normal speech production and perception. Includes an exposure to the measures and methods of speech science.

Learning Outcomes: 1. The student will be able to describe how the muscles and nerves (cranial and spinal) of the respiratory, laryngeal, and supralaryngeal systems are involved in normal speech production. 2. The student will be able to describe how the acoustic speech signal is formed by the speech production system and understand the resulting acoustic signal for consonants and vowels. 3. The student will understand the underlying principles of speech perception. 4. The student will demonstrate acceptable writing skills. 5. The student will demonstrate how research principles can be integrated into evidence-based practice. Credits: 3.00

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 59600 - Special Topics In French Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 59600 - Special Topics In German Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59600 - Special Topics In Japanese Linguistics.

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

LC 56300 - Historical Linguistics

Credit Hours: 3.00. (ANTH 56300, ENGL 56300) A survey of mechanisms and motivations of linguistic change. Topics include phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

LC 57000 - Introduction To Semiotics

Credit Hours: 3.00. (ANTH 51900, SLHS 58900, COM 50700, ENGL 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena that can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

LC 57500 - Theories Of Foreign Language Acquisition

Credit Hours: 3.00. An advanced course designed to provide an overview of major theoretical issues in foreign language acquisition research. Provides a broad historical introduction to theories of acquisition that underlie these different perspectives. This course also provides an understanding of skills assessment and selection of instructional materials. Permission of instructor required.

Credits: 3.00

LC 59000 - Directed Reading In Foreign Languages

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

LC 59600 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Special topics in Linguistics. Permission of instructor required.

Credits: 1.00 to 4.00

LING 59800 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Investigation of an advanced topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 1.00 to 4.00

LING 59400 - Special Topics In Historical Linguistics

Credit Hours: 3.00. Investigation of an advanced topic in historical linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59300 - Special Topics In Semantics

Credit Hours: 3.00. Investigation of an advanced topic in semantics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59100 - Special Topics In Phonology

Credit Hours: 3.00. Investigation of an advanced topic in phonology. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59000 - Directed Reading In Linguistics

Credit Hours: 1.00 to 4.00. Independent study and reading on a topic in linguistics directed by a faculty member. Permission of instructor required.

Credits: 1.00 to 4.00

LING 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Learning Outcomes: 1. Able to discuss the relationship between language and society and identify the roles of language in its social and cultural context. 2. Able to critique current theories in sociolinguistics using data sets provided in course texts. 3. Able to identify the major models for sociolinguistic analysis and suggest reformulations and refinements necessary for various societies and cultures. 4. Able to recognize the sociolinguist's responsibility in the ethical treatment of human subjects and collected data. Credits: 3.00

LING 54100 - Historical Linguistics And Language Change

Credit Hours: 3.00. A general examination of the ways in which languages and their subsystems change over time and of the forces that produce change. The comparative method; internal reconstruction; geographical variation; and social variation. Overview of world language families and genetic relationships. Offered in conjunction with ENGL 56300 or LC 56300 .

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 52200 - Syntax II: Issues In Syntax

Credit Hours: 3.00. Deeper examination of a wider range of syntactic phenomena and evaluation of competing theoretical analyses proposed to account for them. Constructing theoretical analyses and evaluating their explanatory adequacy for Universal Grammar. Topics include LF phenomena, functional projections, and structural representations.

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

LING 51200 - Phonology II: Theoretical Approaches

Credit Hours: 3.00. Examination, comparison, and evaluation of contemporary phonological theories, with focus on the contribution of each theory to our understanding of representations and operations in phonological analysis. Primary emphasis is on autosegmental phonology, metrical phonology, lexical phonology, and optimality theory.

Credits: 3.00

LING 51100 - Phonology I: Descriptive Analysis

Credit Hours: 3.00. Foundations of phonological analysis. Development of concepts and methods for the analysis of phonological data and the phonological structures of natural languages within the framework of generative phonology. Focuses on problem solving and linguistic argumentation. Offered in conjunction with ENGL 51300 .

Credits: 3.00

RUSS 56100 - The Structure Of Russian I: Phonology And Syntax

Credit Hours: 3.00. This course treats the sound system and sentence structure of Russian, dealing with the structural pattern on various levels (phonetic, phonemic, syntactic) from various points of view. One weekly class is devoted to theoretical issues affecting Russian phonology and syntax.

Credits: 3.00

RUSS 56200 - The Structure Of Russian II: Morphology

Credit Hours: 3.00. This course will present a systematic study of Russian morphology in the light of current linguistic research, dealing both with the various categories of inflected words (nouns, pronouns, adjectives, verbs) and with word formation.

Credits: 3.00

RUSS 59600 - Special Topics In Russian Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 56100 - The Structure Of Spanish I: Phonetics, Phonology, And Dialectology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a theoretical and contrastive Spanish/English perspective.

Learning Outcomes: 1. Understand, recall, and discuss the main concepts in the fields of phonetics and phonology. 2. Apply and adapt the fundamental concepts of phonetics and phonology to multiple varieties of Spanish. 3. Examine and critically assess current research in the field. 4. Design and conduct original research in the field of Spanish phonetics and phonology. Credits: 3.00

SPAN 56200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Have knowledge and understanding of basic notions of Spanish syntax including syntagmatic structure, X-bar theory, thematic roles, argument structure, constituents and hierarchical representation, and syntactic operations (e.g., wh-movement). 2. Be able to observe, describe, and formulate abstract theoretical concepts in relation to the syntactic structure of Spanish. 3. Be able to relate theoretical analysis to experimental syntax, specifically in relation to the acquisition of Spanish syntax and semantics among second language learners and heritage speakers. Credits: 3.00

SPAN 56300 - History Of The Spanish Language

Credit Hours: 3.00. Development of Spanish since the Ancient Latin period, taking into account influences of other cultures and languages; Spanish in relation to Latin and other Romance languages; basic principles of language change; language change underlying differences between American and Peninsular Spanish.

Learning Outcomes: 1. Have a perspective of the evolution of Spanish and being able to identify the basic features of Spanish through its history, as well as understanding the influence of external influences in the evolution of the language. 2. Understand the configuration of

the different varieties of Spanish in the different areas (peninsular Spanish and Spanish in America). 3. Read publications on general aspects of History of Spanish Language with critical sense and understanding basic problems of diachronic studies and basic principles of language change. 4. Able to read, understand and linguistically analyze texts from all the stages of Spanish. Credits: 3.00

SPAN 59600 - Special Topics In Spanish Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

ENGL 21500 - Inventing Languages

Credit Hours: 3.00. "Invented languages" include linguistic systems created for fictional worlds, such as Dothraki (Game of Thrones), Na'vi (Avatar), Elvish (Lord of the Rings) and Klingon (Star Trek), as well as languages invented for international communication by real speakers, such as Esperanto. In this course, you will study these systems, learn the major properties of natural human languages, and construct your own rudimentary languages.

Learning Outcomes: 1. Understand the characteristics and goals of various invented languages from linguistic, cultural, and historical perspectives. 2. Show mastery of basic concepts of language structure and language typology. 3. Elucidate mastery of basic concepts of sociolinguistics, historical linguistics, and linguistic anthropology. 4. Explain how natural languages has influenced the development of invented languages. 5. Construct a rudimentary language system and create a back story, dictionary, grammar, and sample text. Credits: 3.00

LING 50100 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual development.

Learning Outcomes: 1. Learn how languages are acquired and developmental stages of main linguistic components. 2. Know major concepts and issues relative to child language development. 3. Know major concepts and issues relative to bilingual first language acquisition. 4. Know main sociocultural constructs related to language development. 5. Become familiar with main issues relative to methodological issues in language acquisition. 6. Know main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

LING 56300 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual develpment.

Learning Outcomes: 1. Understand how languages are acquired and developmental stages of main linguistic components. 2. Understand major concepts and issues relative to child language development. 3. Understand major concepts and issues relative to bilingual first-language acquisition. 4. Understand knowledge of main sociocultural constructs related to language development. 5. Understand main issues relative to methodological issues in language acquisition. 6. Understand main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

LC 57700 - Acoustic Analysis Of Speech

Credit Hours: 3.00. This course is an introduction to those aspects of acoustics most pertinent to understanding speech production and perception. It covers sound waves and their properties, digital signal processing, hearing and loudness, sound recording, and details of the acoustics of specific speech sounds such as vowels, plosives, fricatives, and nasals. The course includes a prominent practicum component aimed at learning to use software tools, specifically Praat, for analyzing acoustic properties of speech sounds.

Learning Outcomes: 1. Define the physical parameters of sound waves; explain how sound waves are created and how they propagate through a medium. 2. Explain the concepts of resonance and filtering as applied to speech production. 3. Explain digital signal processing as applied to the analysis of speech. 4. Use their understanding of acoustics to explain aspects of hearing and perception of speech, including the perception of loudness; explain and apply standard methods of measuring loudness. 5. Use the tools of acoustic analysis to measure acoustic properties of speech sounds, such as duration, loudness, fundamental frequency, and other spectral properties; communicate the results effectively orally and in writing. Credits: 3.00

LC 57300 - Methods Of Experimental Research In Linguistics

Credit Hours: 3.00. The course is an overview of experimental methods used in linguistic research. The goal of the course is to introduce basic concepts, terminology, and procedures associated with experimental research in general, and to survey the types of experiments typically conducted in several major subfields of linguistics, including the associated experiment designs and approaches to data analysis. The course will focus mainly on designing and conducting the experiment, rather than on data analysis, although the data analysis techniques appropriate to the types of data will be briefly discussed whenever possible. The course will also cover additional topics such as ethics of experimental research (preparing an IRB protocol), doing background research, getting funding, choosing the right conference for presenting the results, writing a conference abstract, creating and delivering a conference presentation/poster, and writing up the results for publication.

Learning Outcomes: 1. Define experimental research and explain its differences from other types of research. 2. Explain best practices in developing research questions, hypotheses, and designing experiments. 3. Distinguish different types of data and measurement levels and select the appropriate type of data analysis for a given type of data. 4. Design and implement experimental studies independently to test hypotheses in linguistics, including determining the necessary equipment, software, facilities, and subject pool, preparing IRB protocols, and obtaining funding. 5. Summarize and present experimental results effectively both orally and in writing and in appropriate presenting and publishing outlets. Credits: 3.00

Notes

Management Minor

Requirements for the Minor (18 credits)

Required Courses (9 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal

use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Electives (9 credits)

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are

conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial decision making are emphasized.

Learning Outcomes: 1. Develop an

understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 36100 - Operations Management

Credit Hours: 3.00. Operations Management (OM) is an area of business concerned with the production of goods and services. It involves the responsibility of ensuring that business operations are efficient in terms of using as little resource as needed, and effective in terms of meeting customer requirements. The course covers five major OM topics: process analysis, process variability, quality management, inventory management, and supply chain management. The course aims to provide a working knowledge of the vocabulary of OM, to help students develop an ability to design, improve, and manage processes by answering the questions: What are the components of a process? How should various process parameters such as capacities, output, and work-in-process inventories be calculated? What are the major opportunities for improving a process? The students get familiar with key issues (cost, quality, delivery, and flexibility) and problems (e.g., variability) facing an operations manager. At the end of the course, the students analyze operational strengths and weaknesses of a local firm, suggest some improvements of its operations and present the results.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to

managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants (i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.

5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

Notes

Manufacturing Minor

A minor in Manufacturing is available to students in the College of Engineering and Polytechnic Institute.

Requirements for the Minor (18 credits)

Core Courses (9 credits)

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

ME 36300 - Principles And Practices Of Manufacturing Processes

Credit Hours: 3.00. Manufacturing processes for engineering materials, both metallic and non-metallic. Fundamentals of manufacturing processes with a "hands-on" laboratory sequence. Analysis and design of processes for various engineering materials and their link to engineering design. Hands-on experiences through laboratory experiments and demonstrations. Not open to students with credit in IE 37000.

Credits: 3.00

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

Elective Courses (9 credits)

Manufacturing Processes, Systems and Planning

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

ABE 50100 - Welding Engineering

Credit Hours: 3.00. Design of weldments and modeling of heat transfer and residual stresses of the welding processes. Finite element theory of nonlinear properties for the many processes including laser, submerged arc, manual, Gas Tungsten Arc Welding (GTAW), plasma, and electron beam. Metallurgy topics include continuous cooling transformation curves in optimizing engineered joint strength, including cutting and welding. Offered in alternate years.

Learning Outcomes: 1. Analyze and effectively discuss positive and negative sides of major

welding processes and make a sound choice of the most appropriate welding process for the given requirements. 2. Analyze and critique currently accepted theories of heat transfer and rapid solidification applied to welding processes. 3. Predict development of microstructure in the weld and residual stresses in the welded structure. Analyze the evolution of microstructure and segregation in the three main zones of welded joints. 4. Design the geometry of welded joints and determine proper welding parameters. 5. Recognize and analyze major welding defects, know inspection methods used to detect them, the major causes for their occurrence, and measures for their prevention or correction. Credits: 3.00

ME 55700 - Design For Manufacturability

Credit Hours: 3.00. Introduction to manufacturing concerns, such as efficient design, producibility, and quality, which must be considered early in the engineering design process. Topics include the product development cycle, manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, Taguchi's robust design methodology, life cycle engineering, and reliability. Laboratory projects in the area of tolerancing, assembly, and manufacturability are included along with a project from industry in which the students can disassemble, analyze, and redesign a product while obtaining feedback from industry concerning manufacturability.

Credits: 3.00

Automated Manufacturing and Integration

MFET 37400 - Manufacturing Integration I

Credit Hours: 3.00. The fundamentals of data communications and local area networks are taught in order to show students how to integrate modern manufacturing systems. Emphasis is on the various levels of communications between shop floor computers, PLCs, robots, and automatic identification equipment. Database technology is used as an integration tool. This course prepares students for the MFET capstone course.

Learning Outcomes: 1. Achieve communications between various types of controls and devices. 2. Interface various peripheral manufacturing devices using networking and serial communications. Credits: 3.00

MFET 34800 - Introduction To Robot Kinematics

Credit Hours: 3.00. This course introduces the fundamentals of robotics with an emphasis on solutions to the kinematics problems of serial robotic manipulators. It covers robot modeling and simulation, forward kinematics, inverse kinematics, analysis of robot motion and static forces, and trajectory planning.

Learning Outcomes: 1. Create the kinematics model of a robotic manipulator. 2. Solve forward and inverse kinematics problems of a robotic manipulator. 3. Analyze the motion and static forces of a robotic manipulator. 4. Plan trajectories of a robotic manipulator. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

ME 57600 - Computer Control Of Manufacturing Processes

Credit Hours: 3.00. Fundamental elements for manufacturing process control are presented with advanced control theories, modeling and analysis of actuators, controller architecture, interfacing and programming. Emphasis is on computer integrated manufacturing with computer numerical control of machine tools, automation via programmable logic controllers, motion control, process control examples, and manufacturing process monitoring. Hands-on experience is attained through laboratory experiments with state-of-the-art equipment.

Credits: 3.00

Advanced Manufacturing

MET 49000 - Special Topics In MET

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of mechanical engineering technology is provided by MET faculty, subject to MET curriculum subcommittee approval. Hours, subject matter, and credit to be arranged by faculty.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00 to 3.00

ME 50700 - Laser Processing

Credit Hours: 3.00. Introduces background knowledge in laser science and laser technology and fundamentals involved in laser processing and manufacturing. The following topics are discussed: laser fundamentals, industrial laser systems and processes, and the laser-induced thermal, thermo-mechanical, and thermo-acoustic effects. The course also discusses emerging areas of laser applications, such as microscale laser processing, ultrafast laser processing, and the related energy transport analyses. Laboratory and video demonstration sessions are used to enhance the overall understanding of the course materials. Offered in alternate years.

Credits: 3.00

Computer-Aided Design in Manufacturing

ME 44400 - Computer-Aided Design And Prototyping

Credit Hours: 3.00. Introduction to advanced computer-aided design (CAD) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional and marketable product. Projects include use of the advanced design tools to produce a working prototype that is manufacturable. Application to design, manufacturing, and analysis.

Credits: 3.00

IE 47200 - Imagine, Model, Make

Credit Hours: 3.00. This course develops a holistic view of an initial competency in engineering design by conceiving, designing, manufacturing, and optimizing a system component such as a complex structural part. Activities include hand sketching, CAD modeling, and operation of CNC machining equipment for rapid prototyping. Tolerance requirements will be verified and optimized prior to the fabrication of the part in the laboratory using rapid prototyping techniques. The focus is on the design process itself as well as the complementary roles of human creativity and computational methods and tools.

Learning Outcomes: 1. Create any object using 3D CAD design software (modeling, texturing, and animation). 2. Evaluate and optimize 3D designs for different manufacturing processes and materials. 3. Apply the principles of engineering tolerance to 3D CAD design. 4. Use rapid prototyping techniques (laser cutting, laser engraving, injection molding, and 3D printing) to manufacture 3D CAD designs. Credits: 3.00

Quality Control

MET 45100 - Manufacturing Quality Control

Credit Hours: 3.00. (MFET 45100) Quality control practices used in manufacturing industries; management, statistical control charts, reliability, sampling plans, economics, computer methods, and test equipment are presented and applied. Credit will not be granted for both MET 45100 and MFET 45100.

Learning Outcomes: 1. Apply the theory, principles, and applications of various quality management philosophes. 2. Measure and collect data in a variety of manners using technical standards related to sampling plans and quality process documentation. 3. Work in teams to conduct measurement system analysis and statistical process control (SPC). 4. Develop a solid understanding of how to utilize common quality management tools. 5. Conduct quality control experiments commonly used in industry for different manufacturing processes. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

Notes

Materials Science and Engineering Minor

Requirements for the Minor (15 credits)

Core Requirements (3 credits)

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

NUCL 32000 - Introduction To Materials For Nuclear Applications

Credit Hours: 3.00. Nuclear environments and materials selection for nuclear applications, bonding, crystal structure and symmetry, defects and irradiation, chemical thermodynamics, phase equilibria, phase transformations, and corrosion in nuclear systems and design.

Credits: 3.00

Selective - Choose Two (6 credits)

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific

literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

MSE 33000 - Processing And Properties Of Materials

Credit Hours: 3.00. An introduction to the relationships between the processing of materials and their properties. Heat treating, forming, casting, consolidation, and other more material-specific manufacturing processes. Elucidation of the role of phenomena such as heat flow, mass diffusion, nucleation, interfacial tension, elastic and plastic deformation, precipitation, grain growth.

Credits: 3.00

MSE 37000 - Electrical, Optical, And Magnetic Properties Of Materials

Credit Hours: 3.00. An introductory course to provide basic background on the behavior of materials; electronic band structure, electronic and ionic conduction, electronic processes in semiconductors, dielectric, optical, and magnetic properties, and superconductivity; emphasis is on the relation between the properties and the structural aspects of materials.

Credits: 3.00

Additional Selective - Choose Two (6 credits)

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

MSE 38200 - Mechanical Response Of Materials

Credit Hours: 3.00. This course encompasses deformation-based microscopic mechanisms, including dislocation motion, diffusion, and viscoplasticity. Macroscopic mechanical response of metals, ceramics, polymers, and composites will be related to elasticity and plasticity concepts for single crystal, polycrystalline, and amorphous materials. Practical design considerations for deformation will be included as well as an introduction to fracture mechanisms.

Learning Outcomes: 1. Conversant with conventional nomenclature, units and notation of mechanical behavior. Examples: Stress,

strain, yield strength, fracture strength; yield criteria, flow rules, creep, fracture. 2. Estimate relative ranges and values for important properties of common engineering materials. Examples: Young's modulus at room temperature for steels versus most polymers; yield strength ranges for ductile metals. 3. Recognize mechanisms for important mechanical behaviors. Examples: Plastic deformation by dislocation glide; plastic deformation by molecular rearrangement; dilatant deformation processes; strengthening mechanisms in crystalline solids. 4. Predict mechanical responses based on given information. Examples: Will yielding occur given a stress state and properties? Will fracture occur given a stress state and properties? How will the material change shape for the applied deformation? Which slip system(s) will be operative? 5. Explain the fundamental basis for important deformation mechanisms or processes. Examples: Dislocation glide, cross-slip, dislocation climb, precipitation strengthening; molecular orientation; Nabarro-Herring creep; plane strain fracture. 6. Apply the mechanisms of deformation to component design or alloy design. Credits: 3.00

MSE 44500 - Materials Engineering Systems Analysis And Design

Credit Hours: 3.00. Integration of materials engineering core coursework with statistical, economic and environmental considerations for analysis and design of systems. Analysis of primary materials processing operations using mathematical and statistical models for predicting interactive effects and process optimization. Specification of materials and processes for mechanical designs, incorporating properties assessment and tradeoffs, cost analysis, and performance optimization with multiple constraints.

Learning Outcomes: 1. Translate performance attributes in a given design to the corresponding nominal material properties. 2. Derive and apply material indices to materials selection for single- and multi-objective designs using the CES materials database and software tools. 3. Specify manufacturing processes for a given component design (material, shape, production rate) using basic cost modeling. 4. Apply a computational model for simulating a materials production and/or processing operation. 5. Quantify material properties, processing and performance variability using statistical methods. Examples: error analysis, probability distributions, sampling theory, statistic intervals and statistical process control charts. 6. Perform basic calculations for engineering cost analysis and use those results to make choices among trade-offs in product design or process operation. 7. Locate and evaluate design information for specific materials and processes. Examples: testing standards, processing specifications, commercial data and patents. 8. Apply quantitative trade-off strategies in selection of materials for designs with conflicting objectives. 9. Apply computational models for materials production and/or processing operations to predict interactive effects of inputs on material quality, production rates, cost minimization, and environmental impact. 10. Optimize material and process selection simultaneously, based on refined functional relationships between processing, properties and costs. Credits: 3.00

MSE 49900 - Research In Materials Engineering

Credit Hours: 0.00 to 18.00. Available upon prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 42000 - Structure And Properties Of Organic Materials

Credit Hours: 3.00. This course presents information on the chemical and physical structure and basic material properties of organic materials, including synthetic plastics and specialty polymers and surfactants as well as select natural materials (e.g., proteins, carbohydrates, lipids). Fundamental concepts from organic chemistry will be presented along with descriptions of how the chemical and physical structures of organic

molecules directly impact the properties of bulk materials over multiple length scales, from the molecular-level to the macroscale. This course will prepare students to be successful in higher-level polymer and soft material elective courses in materials engineering.

Learning Outcomes: 1. Describe atomic-scale bonding and identify common hydrocarbon units in organic molecules and describe common organic reactions involving those units. 2. Select the appropriate characterization techniques for chemical structures, physical structures, and bulk material properties and interpret basic data from selected techniques. 3. Explain how macromolecules are synthesized and outline the most common synthesis reactions. 4. Distinguish between chemical and physical structures or organic materials and classify different structures into appropriate material length scales. 5. Explain important structure-property relationships over multiple length scales. Credits: 3.00

The pre- and co-requisites for MSE courses relevant to the minor are:

Notes

Mathematical Economics Minor

About the Program

Requirements for the Minor (16 credits)

Required Courses (13 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical

models. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

Additional Course - Choose One (3 credits)

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This

course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

Notes

Mathematics Minor

The Mathematics Minor provides a strong background in mathematics for students majoring in some other discipline.

Requirements for the Minor (12-13 credits)

Area 1 - Choose One (3 credits)

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4.

Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

Area 2 - Choose One (3 credits)

Algebra

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

Analysis

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

Area 3 - Choose Two (6-7 credits)

Algebra

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

Analysis

MA 30100 - An Introduction To Proof Through Real Analysis

Credit Hours: 3.00. An introduction to abstract reasoning in the context of real analysis. Topics may include axioms for the real numbers, mathematical induction, formal definition of limits, density, decimal representations, convergence of sequences and series, continuity, differentiability, the extreme value, mean value and intermediate value theorems, and cardinality. The emphasis, however, is more on the concept of proof than on any one given topic.

Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform

convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

Computer Science

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching

algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently

handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

Differential Equations

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

Discrete Mathematics, Foundation

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph

problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms.

Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

Linear Algebra

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation. 3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics.

Credits: 3.00

Numerical Analysis

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) AIternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

Statistics, Probability

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

Notes

Microelectronics and Semiconductors Minor

About the Minor

Requirements for the Minor (18 credits)

Required Courses - Choose One: (10 credits)

Option 1: Microelectronics Track (10 credits)

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 33700 - ASIC Design Laboratory

Credit Hours: 2.00. Introduction to standard cell design of Application Specific Integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and verification.

Learning Outcomes: 1. Design combinational

and sequential logic in a variety of styles and awareness of resource usage. 2. Use, modify, create scripts to control logic synthesis. 3. Create a test bench and use it to verify a design that incorporates multiple sequential blocks. 4. Place, route, and verify timing of an ASIC design. 5. Determine the RTL architecture implied by HDL code of moderate complexity. 6. Explain the difference between various ASIC and digital system design approaches - standard cell, full custom, and programmable device. Credits: 2.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

Option 2: Semiconductors Track (10 credits)

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses

mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

Electives (8 credits)

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 33700 - ASIC Design Laboratory

Credit Hours: 2.00. Introduction to standard cell design of Application Specific Integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and verification.

Learning Outcomes: 1. Design combinational and sequential logic in a variety of styles and awareness of resource usage. 2. Use, modify, create scripts to control logic synthesis. 3. Create a test bench and use it to verify a design that incorporates multiple sequential blocks. 4. Place, route, and verify timing of an ASIC design. 5. Determine the RTL architecture implied by HDL code of moderate complexity. 6. Explain the difference between various ASIC

and digital system design approaches - standard cell, full custom, and programmable device. Credits: 2.00

ECE 43700 - Computer Design And Prototyping

Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, datapath design, control strategies, pipelining, memory hierarchy, and I/O interface design.

Credits: 4.00

ECE 45500 - Integrated Circuit Engineering

Credit Hours: 3.00. Analysis, design, and fabrication of silicon bipolar and MOSFET monolithic integrated circuits. Consideration of amplifier circuit design and fabrication techniques with circuit simulation using Spice-2. Integrated operational amplifiers with difference amplifiers, current sources, active loads, and voltage references. Design of IC analog circuit building blocks.

Credits: 3.00

ECE 45600 - Digital Integrated Circuit Analysis And Design

Credit Hours: 3.00. As applied t digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential, and dynamic logic circuits are considered. While the focus of the course is on CMOS technology, bipolar, nMOS, and BiCMOS circuits are introduced as well. SPICE is used as both an analysis and design tool. Semiconductor memory circuits are also discussed.

Credits: 3.00

ECE 55700 - Integrated Circuit Fabrication Laboratory

Credit Hours: 3.00. Laboratory exercises in the fabrication and testing of silicon integrated circuits. Both bipolar and MOS integrated circuit test chips are fabricated and tested. Laboratory technique, the technology of integrated circuit fabrication, and electrical characterization are emphasized. Permission of department required.

Credits: 3.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system.

Credits: 4.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in

circuit analysis and design. Credits: 3.00

Military Science and Leadership Minor

Requirements for the Minor (15 credits)

Required Courses (12 credits)

MSL 40200 - Company Grade Leadership

Credit Hours: 3.00 to 4.00. This course explores the roles and responsibilities of company-grade Army officers with respect to unified land operations. Emphasizes the knowledge, skills and abilities required of junior officers in preparation for commissioning.

Learning Outcomes: 1. Describe company grade officer roles and responsibilities pertaining to unified land operations. 2. Demonstrate officership as it pertains to a U.S. Army Second Lieutenant. Credits: 3.00 to 4.00

MSL 40100 - The Army Officer

Credit Hours: 3.00 to 4.00. An examination of Army officer development to include planning, resourcing, and assessing training at the small-unit level. Topics include counseling subordinates, evaluating performance, values and ethics, career planning, legal responsibilities, and programs that support Army officers in these endeavors.

Learning Outcomes: 1. Describe Army programs that support counseling subordinates and evaluating performance, values and ethics, career planning, and legal responsibilities. 2. Explain how to plan, prepare, execute, and continuously assess training at the company level. Credits: 3.00 to 4.00

MSL 30200 - Applied Leadership In Small Unit Operations

Credit Hours: 3.00 to 4.00. An examination of the fundamentals of direct-level leadership and small-unit tactics at the platoon level in preparation for Cadet Summer Training Advance Camp. Emphasizes the planning, coordinating, navigating, motivating, and leading a platoon to execute a mission.

Learning Outcomes: 1. Describe the fundamentals of direct-level leadership and small unit tactics at the platoon level. 2. Explain how the Army operates through the warfighting functions. 3. Plan, coordinate, and lead a platoon to execute a mission. Credits: 3.00 to 4.00

MSL 30100 - Training Management And The Warfighting Function

Credit Hours: 3.00 to 4.00. Examines how the Army operates through warfighting functions. Emphasizes planning, preparing, and executing training for small-unit tactics.

Learning Outcomes: 1. Describe the fundamentals of training management. 2. Explain how the Army operates through the warfighting functions. 3. Plan, prepare, and execute training for a squad conducting small-unit tactics. Credits: 3.00 to 4.00

Military History/Policy Selective (3 credits)

HIST 30000 - Eve Of Destruction: Global Crises And World Organization In The 20th Century (UCC: HUM)

Credit Hours: 3.00. Using a variety of case studies, this course considers 20th-century turning points -- often violent and disastrous ones -- in an emerging global conversation about urgent world problems and their possible solutions.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 35100 - The Second World War (UCC: HUM)

Credit Hours: 3.00. A study of the diplomacy, economic mobilization, and military operations of World War II, 1939-1945.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 35500 - History Of American Military Affairs (UCC: HUM)

Credit Hours: 3.00. Surveys American military policy from the colonial militia to the atomic age. Covers major wars and limited wars. The course also investigates the peacetime military functions, i.e., the Navy's role in diplomacy and the Army's involvement in Indian affairs.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

Notes

Music History and Theory Minor

Requirements for the Minor (15 credits)

A. Required Theory Courses (6 credits)

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

B. Required History Course (3 credits)

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

C. Music Selectives (6 credits)

MUS 37500 - Selected Topics In Music

Credit Hours: 3.00. A study of a specific genre in music (symphony, opera, chamber music, etc.) or the works of a single composer.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 3.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 49000 - Guided Reading In Music

Credit Hours: 1.00 to 6.00. For students with specialized needs and interests in the field. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 6.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

MUS 38400 - Digital Record And Production II

Credit Hours: 3.00. This course is a continuation of MUS

38300, Digital Audio Recording and Production I. Topics covered will include advanced musical sequencing, multitrack audio recording, audio signal processing, mixing, mastering and advanced audio and digital production. Students will be required to develop music recording and production projects.

Learning Outcomes: 1. Explain and demonstrate multitrack recording, mixing, analog and digital effects processing, sampling, use of specialized filters and audio tools such as vocoders and other electronic instruments to shape and edit sound. 2. Explain and demonstrate advanced musical sequencing and digital audio editing. 3. Explain and demonstrate issues and techniques used when combining digital sound with acoustic instruments and voices. 4. Create professional mixes that use reverb, compression, and special effects, etc. 5. Explain and demonstrate techniques used in combining sound and music to video and film productions. Credits: 3.00

MUS 17100 - Jazz Improvisation I

Credit Hours: 2.00. This course is an introduction to the development of beginning jazz improvisational and theoretical skills for all instrumentalists and vocalists. Fundamentals theoretical and musicianship skills are addressed through practical application, guided listening, dictation, transcription, harmonic and rhythmic analysis, and performance of standard jazz repertoire.

Learning Outcomes: 1. Explain the fundamentals of jazz theory and musicianship. 2. Write or transcribe a jazz solo from a recording. 3. Explain and notate jazz harmonies and voicings using established forms of analysis. 4. Describe various jazz styles in performance. 5. Perform selected jazz repertoire. 6. Perform an improvised jazz solo. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

A. Required Theory Courses (6 credits)

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies.

Credits: 3.00

Note

Requirements for the Minor (15 credits)

A. Required Theory Courses (6 credits)

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters.
Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies.
Credits: 3.00

B. Required History Course (3 credits)

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

C. Music Selectives (6 credits)

MUS 37500 - Selected Topics In Music

Credit Hours: 3.00. A study of a specific genre in music (symphony, opera, chamber music, etc.) or the works of a single composer.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 3.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 49000 - Guided Reading In Music

Credit Hours: 1.00 to 6.00. For students with specialized needs and interests in the field. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 6.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will

also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

MUS 38400 - Digital Record And Production II

Credit Hours: 3.00. This course is a continuation of MUS 38300, Digital Audio Recording and Production I. Topics covered will include advanced musical sequencing, multitrack audio recording, audio signal processing, mixing, mastering and advanced audio and digital production. Students will be required to develop music recording and production projects.

Learning Outcomes: 1. Explain and demonstrate multitrack recording, mixing, analog and digital effects processing, sampling, use of specialized filters and audio tools such as vocoders and other electronic instruments to shape and edit sound. 2. Explain and demonstrate advanced musical sequencing and digital audio editing. 3. Explain and demonstrate issues and techniques used when combining digital sound with acoustic instruments and voices. 4. Create professional mixes that use reverb, compression, and special effects, etc. 5. Explain and demonstrate techniques used in combining sound and music to video and film productions. Credits: 3.00

MUS 17100 - Jazz Improvisation I

Credit Hours: 2.00. This course is an introduction to the development of beginning jazz improvisational and theoretical skills for all instrumentalists and vocalists. Fundamentals theoretical and musicianship skills are addressed through practical application, guided listening, dictation, transcription, harmonic and rhythmic analysis, and performance of standard jazz repertoire.

Learning Outcomes: 1. Explain the fundamentals of jazz theory and musicianship. 2. Write or transcribe a jazz solo from a recording. 3. Explain and notate jazz harmonies and voicings using established forms of analysis. 4. Describe various jazz styles in performance. 5. Perform selected jazz

repertoire. 6. Perform an improvised jazz solo.
Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility.
Credits: 2.00

A. Required Theory Courses (6 credits)

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters.
Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies.
Credits: 3.00

Native American and Indigenous Studies Minor

About the Minor

Requirements for the Minor (15 credits)

A. Foundational Course - Choose One (3 credits)

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

B. Electives - Choose Four (12 credits)

ANTH 31300 - Archaeology Of North America

Credit Hours: 3.00. Archaeological overview of North America emphasizing Indigenous cultures prior to the arrival of Europeans, but including Contact and Post-Contact communities of the Historic Period. Topics will include the peopling of the Americas, culture and environment, social complexity, and Cultural Resource Management.

Learning Outcomes: 1. Describe the general historical outline for North America's past. 2. Summarize the diversity of peoples and cultures that existed in North America. 3. Explain how North American archaeologists gather information and interpret the past. 4. Recognize how contemporary archaeologists engage with other stakeholders in North America's past. Credits: 3.00

ANTH 37700 - Anthropology Of Hunter-Gatherer Societies

Credit Hours: 3.00. Selective global survey of societies whose mode of subsistence is/was based on the collection of wild food resources. Topics to be covered include: the development and current state of theory, ecology, social organization, land use, demography, subsistence rights, and worldview.

Learning Outcomes: 1. Explain the forager lifestyle and the range of variation that researchers continue to discover. 2. Summarize the role that hunter-gatherer studies have played in the development of anthropological and biological inquiry and theory. 3. Recognize why the hunter-gatherer lifestyle has persisted as a human adaptation for as long as it has and how knowledge derived from its study can help scientists understand humanity. 4. Describe major issues faced by foragers and their descendants today. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ANTH 41800 - Field Methods In Cultural Anthropology

Credit Hours: 1.00 to 9.00. Introduces basic field methods in Cultural Anthropology. Topics may include ethnographic or other interviewing techniques and methods of inquiry into any of the broad topics covered by Cultural Anthropology. Permission of department required.

Learning Outcomes: 1. Understanding the use of anthropological methods such as participant observation, ethnographic analysis and general interviewing techniques. Credits: 1.00 to 9.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance their creative thinking. 6. Strengthen skills in

critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

HIST 47700 - Native American Women's History

Credit Hours: 3.00. This course studies the history of indigenous women in North America from pre-contact to the present era, examining their roles through the experience of colonization and decolonization underscoring issues of sovereignty, identity, activism, kinship, public images, and stereotypes.

Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

LING 59800 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Investigation of an advanced topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 1.00 to 4.00

LING 57600 - Latin American Indigenous Languages And Cultures

Credit Hours: 3.00. This course will help students to learn the importance of understanding the diversity of Latin American indigenous languages and cultures as well as the intercultural understandings gained when these indigenous languages are valued within the global context. Moreover, this course will provide a general cultural and linguistic framework to understand the sociolinguistic status of the language within the context where it exists. In this course, students will deepen their knowledge of Latin American indigenous cultures and their historics, as a means to achieving a greater understanding of both a shared humanity and the variety of human experiences.

Learning Outcomes: 1. Acquire in-depth knowledge in a chosen, specific indigenous people while demonstrating panoramic understanding of Latin American indigenous groups. 2. Explain the brief history of US interaction with a particular Latin American country of this course topic. 3. Show basic oral and auditory competency in the language; will demonstrate how to express and understand basic statements, greetings, requests for directions, for food, and general courtesy interactions in the particular language. 4. Identify the particular complex interactions of the indigenous language within the context of the dominant colonial language. 5. Identify the linguistic position of the language within the context of indigenous languages of the Americas. 6. Identify basic cultural characteristics associated with the language speaking community. Credits: 3.00

LING 56000 - Service Learning In Languages And Linguistics

Credit Hours: 1.00 to 4.00. This course aims to introduce the student to critical reflective thinking and experiential learning that address local and global needs and foster civic responsibility. This service learning course is a multifaceted method of teaching and learning that enriches a students' academic life and real life learning by engaging her/him in meaningful hands-on service to the community while gaining valuable knowledge and skills that integrate with course objectives.

Learning Outcomes: 1. Participated in socially responsible activities that would have a positive impact not only on her/his local and global community. 2. Acquired skills that are transferable to her/his future work environments. 3. Reflected on how to maximize her/his personal and academic development to help her/him achieve her/his goals in life. 4. Gained knowledge and insights that will prepare

her/him for active civic engagement. Credits: 1.00 to 4.00

Notes

Natural Resources and Environmental Science Minor

Requirements for the Minor (15 credits)

Required Course (3 credits)

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.
University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation

biology, and environmental geology. Credits: 3.00

Selective Course (3 credits)

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

Emphasis Areas Selectives (9 credits)

Climate and Energy Emphasis

NRES 23000 - Survey Of Meteorology (UCC: SCI)

Credit Hours: 3.00. (EAPS 22100) An introductory course for both science and non-science students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate, ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the

greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

Environmental Policy and Analysis Emphasis

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

Environmental Quality and Restoration Emphasis

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

Sustainability Science Emphasis

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about

sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical

inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering design proposal. Credits: 3.00

Watershed Management Emphasis

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

NRES 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (AGRY 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Credits: 3.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

NRES 33700 - Environmental Hydrology

Credit Hours: 3.00. (AGRY 33700) This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Learning Outcomes: 1. Become familiar with hydrological processes, interactions and their representations over scales from point to ""continental"" and times from seconds to years. The major emphasis is on surface and near surface phenomenon. 2. Gain qualitative and quantitative understanding of land surface water budgets and how they respond to environmental

change. 3. Develop problem solving abilities on topics related to surface water hydrology. Credits: 3.00

NRES 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Discuss the complexity of involving stakeholders in decisions about landscape management. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

HORT 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Demonstrate knowledge of a variety of participatory and facilitation techniques. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

Note

Naval Science Minor

Requirements for the Minor (15 credits)

Required Courses (12 credits)

NS 41300 - Naval Leadership And Ethics

Credit Hours: 3.00. This course completes the final preparations of ensigns and second lieutenants for service in the Navy and Marine Corps. The course integrates an intellectual exploration of Western moral traditions and ethical philosophy with a variety of topics, such as military leadership, core values, professional ethics, the UCMJ and Navy regulations, and discussions relating to the roles of enlisted members, junior and senior officers, command relationships, and the conduct of warfare. The course provides midshipmen with a foundation of moral traditions, combined with a discussion of actual current and historical events in the Navy and Marine Corps, to prepare them for the roles and responsibilities of leadership in the Naval Service of the 21st century. Permission of instructor required.

Learning Outcomes: 1. Explain the role of commissioned officers as members of the U.S. Armed Forces and the obligations and responsibilities assumed by taking the oath of office, including the constitutional requirement for civilian control. 2. Explain the naval officer's roles and responsibilities as a member of the profession of arms. 3. Explain the significance of special trust and confidence vested in commissioned officers. 4. Explain the Uniform Code of Military Justice (UCMJ), the practice of military law, and the applications of regulations as they may involve a junior officer in the performance of duties. 5. Explain the purpose, scope, and constitutional basis of Navy regulations and the UCMJ, relating them to personal conduct in the military service. 6. Explain the professional, moral, and ethical responsibilities of the naval officer. 7. Explain the relationship of integrity, moral courage, and ethical behavior to authority, responsibility, and accountability. 8. Demonstrate, by personal example, the professional attributes and behaviors of a naval officer. 9. Describe how leadership by example influences an officer's ability to effectively lead

in an organization. Credits: 3.00

NS 21400 - Naval Leadership And Management

Credit Hours: 3.00. Introduces the student to many of the fundamental concepts of leading Sailors and Marines, which shall be expanded upon during the continuum of leadership development throughout NROTC. It develops the elements of leadership vital to the effectiveness of Navy/Marine Corps officers by reviewing the theories and parameters of leadership and management within and outside of the Naval Service and progressing through values development, interpersonal skills, management skills, and application theory. Practical applications are explored through the use of experiential exercises, readings, case studies, and laboratory discussions.

Learning Outcomes: 1. Explain the differences between management and leadership. 2. Describe sources of leader power and related influence tactics. 3. Describe the interaction between the leader, the followers, and the situation. 4. Describe the building blocks of leadership skills and how they impact a leader's effectiveness. 5. Perform a leadership personality analysis and interpret its results. 6. Describe rational and emotional approaches to organizational changes. 7. Apply leadership concepts to a written analysis of a real-world leader. Credits: 3.00

NS 21300 - Sea Power And Maritime Affairs

Credit Hours: 3.00. This course is a study of the U.S. Navy and sea power's influence on history and the political process. Students will explore the major events, attitudes, personalities, and circumstances that have imbued the U.S. Navy with its proud history and rich tradition. It deals with issues of national imperatives in peacetime, as well as war, varying maritime philosophies that were interpreted into naval strategies/doctrines, budgetary concerns that shaped force realities, and the pursuit of American diplomatic objectives. It concludes with a discussion of the Navy's strategic and structural changes at the end of the Cold War and its new focus, mission, and strategy in the post-September 11, 2001 world.

Learning Outcomes: 1. Describe the impact and significance of geography and Sea Lines of Communication on maritime strategy and naval operations. 2. State the mission and basic organization of the Navy and Marine Corps. 3. Describe the current organization of the Department of the Navy. 4. Describe significant events in U.S. naval history. 5. Describe the evolution of the Navy and Marine Corps including the origins. 6. Describe the importance of power projection by seaborne forces and cite historical examples. 7. Describe the significant historical developments of naval weapons systems, platforms, tactics, techniques, and procedures. Credits: 3.00

NS 11000 - Introduction To Naval Science

Credit Hours: 3.00. This course is a general introduction to the USN and USMC that emphasizes organizational structure, warfare components and assigned roles/missions of USN/USMC. It covers all aspects of naval service from its relative position within the DoD to the specific warfare community/career paths and includes basic elements of leadership and USN and USMC core values. The course provides students with initial exposure to many elements of naval culture and provides the conceptual framework/working vocabulary for students to use on summer cruise.

Learning Outcomes: 1. Demonstrate proficiency in USN and USMC customs, such as the hand salute, uniform preparation, and flag etiquette. 2. Describe the departmental organizations of the USN and USMC. 3. Define the various watch-standing roles of shipboard personnel. 4. Describe the general career path of the various unrestricted line communities in the Navy and Marine Corps. 5. Describe all rank insignia of the armed forces. 6. Explain institutional values and ethics of the Department of the Navy. Credits: 3.00

Naval Science Selectives (3 credits)

NS 44000 - Fundamentals Of Maneuver Warfare

Credit Hours: 3.00. The purpose of this course is to introduce the student to the foundational concepts and history of the USMC as the premier maneuver warfighting organization. It is a theoretical class that utilizes both historical examples from previous military operations as well as current doctrine, developing an individual who is both a critical thinker and scholar in the profession of arms. The goal is to educate the student to read military history analytically.

Learning Outcomes: 1. Describe the role of the United States Marine Corps as a premier amphibious warfare fighting institution. 2. Describe specific successful amphibious-based maneuver warfare operations throughout Marine Corps history. 3. Describe how amphibious warfare ties into general warfare, serving as a subset of total warfare. 4. Perform an analysis of historical influences upon current tactical, operational and strategic implications of maneuver warfare practices used in current and future operations. 5. Recite a basic understanding of Marine Corps doctrine that facilitates successful sea-based operations, requiring ship-to-shore movements. Credits: 3.00

NS 35000 - Naval Ship Systems-Engineering

Credit Hours: 3.00. In this course, students learn detailed ship design, hydrodynamic forces, stability, propulsion, electrical theory and distribution, hydraulic theory and ship control, and damage control. The course includes basic concepts of theory/design of steam, gas turbine, diesel, and nuclear propulsion.

Learning Outcomes: 1. Explain the first and second laws of thermodynamics and how they apply to naval ship systems. 2. Understand the difference between thermal and mechanical energy and how to transfer between the two to produce propulsion. 3. Explain how energy is stored onboard US naval vessels and the ways that stored energy is converted into propulsion. 4. Describe each step of a thermodynamic cycle and be able to apply them to various heat engines. 5. Draw the steam cycle on a temperature/entropy graph and describe each process. 6. Describe the role of various auxiliary equipment in a propulsion plant. 7. Describe the basic damage control process and the initial ship-wide response to fire and flooding. Credits: 3.00

NS 33000 - Evolution Of Warfare

Credit Hours: 3.00. The purpose of Evolution of Warfare is to imbue students with an understanding of the origins of modern warfighting theory through an analysis of historical philosophies, domains, tactics and technology. Through a study of military history, students explore the timeless fundamentals of armed conflict as well as the central role of innovation. They will apply these fundamental warfighting concepts to historic amphibious and expeditionary operations through guided analysis and decision games.

Learning Outcomes: 1. State the major cultural, technological, organizational, and doctrinal transformations in warfare. 2. State the operational history of amphibious and expeditionary warfare. 3. Recite the warrior ethos. 4. Describe the relationship between the tactical, operational, and strategic level of warfare. 5. Describe the origins of current USMC and Joint doctrine, especially MCDP 1 and MCDP 1-0. 6. Apply symmetric and asymmetric principles across all warfighting domains. 7. Apply knowledge from historical conflicts to modern and future challenges. 8. Demonstrate fundamental writing and speaking skills required of a marine officer. 9. Demonstrate a tactical mindset and effective decision-making. Credits: 3.00

NS 31100 - Naval Operations And Seamanship

Credit Hours: 3.00. This course is a continued study of relative motion, formation tactics, and ship employment. It includes introductions to naval operations and operations analysis, ship behavior and characteristics in maneuvering, applied aspects of ship handling, afloat communications, naval command and control, naval warfare areas, and joint warfare.

Learning Outcomes: 1. Explain the theory of relative motion as it applies to vessels at sea. 2. Describe the fundamentals of the U.S. Navy's systems of communications used on sea-going vessels. 3. Demonstrate proper use of the Rules of the Road preventing collisions at sea. 4. Discuss the many issues relating to ship handling and Naval Officers' responsibility. 5. Demonstrate relative motion and the capability to solve problems associated with relative motion using maneuvering boards. 6. Perform

the proper use of Standard Commands during Conning Officer Virtual Environment (COVE) lab. 7. Explain the doctrines of Naval Warfare, Command and Control, and Joint Operations. Credits: 3.00

NS 31000 - Naval Navigation

Credit Hours: 3.00. This course is an in-depth study of the theory, principles, procedures, and application of plotting, piloting, and electronic navigation, as well as an introduction to maneuvering boards. Students learn piloting techniques, the use of charts, the use of visual and electronic aids, and the theory of operation of both magnetic and gyrocompasses. Students develop practical skills in plotting and electronic navigation. Other topics include tides, currents, effects of wind/weather, voyage planning, and an application and introduction to the international/inland rules of navigation.

Learning Outcomes: 1. Explain the theory and practice of navigation at sea. 2. Describe the environmental weather factors affecting naval operations. 3. Describe the sources of environmental products/predictions, forecasts available to naval units underway. 4. Demonstrate relative motion and the capability to solve problems associated with relative motion using maneuvering boards. 5. Demonstrate proper use of the Rules of the Road preventing collisions at sea. Credits: 3.00

NS 21200 - Naval Ships Systems II (Weapons)

Credit Hours: 3.00. This course outlines the theory and employment of weapons systems. Students explore the processes of detection, evaluation, threat analysis, weapon selection, delivery, guidance, and explosives. Fire control systems and major weapons types are discussed, including capabilities and limitations. The physical aspects of radar and underwater sound are described. Facets of command, control, communications, computers, and intelligence are explored as a means of weapons system integration. The tactical and strategic significance of command and control warfare and information warfare is discussed.

Learning Outcomes: 1. Explain the choice of weapon, given the defined threat's capabilities. 2. Define the capabilities and limitations of Naval Ship weaponry. 3. Identify, visually, a ship's array of antennae and communication components. 4. Describe the importance of command and control warfare. 5. Analyze the moral and ethical responsibilities of leaders and their use of firepower. Credits: 3.00

Note

Nuclear Engineering Minor

About the Minor

Requirements for the Minor (12 credits)

Required Courses (6 credits)

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

NUCL 30000 - Nuclear Structure And Radiation Interactions

Credit Hours: 3.00. Review of atomic properties and introduction to nuclear models. Discussion of radioactive decay and the interaction of nuclear radiation and reaction products with matter. Energetics and cross-sections of nuclear reactions with applications to problems typical of nuclear engineering.

Credits: 3.00

Additional Requirements (6 credits)

NUCL 20500 - Nuclear Engineering Undergraduate Laboratory I

Credit Hours: 2.00. A laboratory course designed for the study of the properties of radiation, radioactive material, and radiation detectors. The hazards of radiation and safe handling techniques are emphasized.

Credits: 2.00

NUCL 49700 - Selected Topics In Nuclear Engineering

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Learning Outcomes: 1. Learning objectives will vary with coursework. Credits: 1.00 to 3.00

NUCL 59700 - Selected Topics In Nuclear Engineering I

Credit Hours: 1.00 to 3.00. Development of individual research and study projects. Permission of instructor required.

Learning Outcomes: 1. Vary with coursework. Credits: 1.00 to 3.00

Notes

Nutrition Minor

About the Minor

Requirements for the Minor (15 credits)

A. Required Courses (9 credits)

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

B. Additional Courses (6 credits)

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 39000 - Independent Undergraduate Research

Credit Hours: 1.00 to 3.00. Individual research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 49000 - Independent Undergraduate Research

Credit Hours: 1.00 to 4.00. Independent research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 4.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

Notes

Occupational and Environmental Health and Safety Minor

Required Courses (15 credits)

Fundamental Required Courses (3 credits)

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

Selective Courses - Choose 12 credits

HSCI 34600 - Industrial Hygiene Engineering Control

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Describe/understand different approaches for controlling exposures in the occupational environment, and give hypothetical and real situations in terms of the best control methods. 2. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a complete ventilation system. 3. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 4. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to prevent it in the workplace. 5. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 6. Synthesize and apply knowledge of the IH paradigm (AREC) in analyzing practical industrial hygiene/occupational health problems. Credits: 4.00

HSCI 34800 - Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. Sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Explain the rationale of the sampling strategy. 2. Perform basic sampling procedures for certain gases, vapors, particulates, noise, and heat, including proper selection, set-up, and operation of equipment. 3. Summarize the basic principles of the sampling procedures and explain why they function as they do. 4. Describe the limitations of sampling and analysis in real-world situations and how to deal with them. 5. Collect, analyze, interpret, and summarize laboratory data into a well-written report. 6. Describe the advantages as well as the difficulties of working together on

a team. Credits: 3.00

IET 33100 - Advanced Industrial Safety And Health Management

Credit Hours: 3.00. An introduction to OSHA and standards development for occupational health in general industry. Special emphasis is on fire protection and egress, flammable and combustible liquids, electrical, personal protective equipment, machine guarding, industrial hygiene/blood-borne pathogens, ergonomics, and ISO 9000/14000 integration.

Learning Outcomes: 1. Explain the purpose of the Occupational Safety and Health Administration (OSHA). 2. Describe the fundamental requirements of each of the General Industry Regulations in 29 CFR 1910. 3. Apply the General Industry Regulations in real-life scenarios within the workplace. 4. Explain how to prepare for the OHSA workplace inspection. 5. Create an adequate training plan for workplace employees. 6. Identify readily available resources for creating a workplace free from recognized hazards. Credits: 3.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 4.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 58000 - Occupational Biomechanics And Ergonomics

Credit Hours: 2.00. Occupational safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. Occupational ergonomics is a branch of science that focuses on optimizing the relationships between workers and their work environment. This course focuses on the principles and applications of safety and ergonomics as it applies to workers. The first part of the course will consist of lectures on the fundamentals of safety standards and liability and the development of work-related musculoskeletal disorders, ergonomic risk factors including work practices, tools and workstation design. The last part will consist of identification and use of safety and ergonomic controls to reduce and prevent work-related fatalities, injuries, and musculoskeletal disorders.

Learning Outcomes: 1. Describe ergonomic risk factors in the workplace. 2. Analyze work stations and identify ergonomic risk factors. 3. Develop solutions to minimize identified ergonomic risk factors. 4. Describe cumulative trauma disorders which may occur due to exposure to poor ergonomic conditions. 5. Explain how people perceive & understand information, and use this knowledge to improve work flow. Credits: 2.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

HSCI 35300 - Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and frontline employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the frontline employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the frontline employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the frontline employees and upper management together in their vision of a safe and healthy workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. 6. Demonstrate group and team building strategies as it relates to health and safety. Credits: 3.00

HSCI 55300 - Advanced Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization, protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front line

employees. As such, the successful health and safety manager needs to skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the front line employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the front line employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the front line employees and upper management together in their vision of a safe and health workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. Credits: 3.00

HSCI 44400 - Exposure Assessment In OEHS

Credit Hours: 3.00. Exposure assessment is an essential component of Environmental Health Science and industrial hygiene. This course provides students basic scientific knowledge of exposure assessment, with emphasis on practical aspects of exposure science, including study design, data and measurement collection, data analysis, and results interpretation and presentation. Course topics include major exposure media and pathways (air, water, food, soil, etc.) and important exposure routes (inhalation, ingestion, dermal absorption); exposure measurement and assessment; strengths and weaknesses of various exposure assessment techniques, how to link exposure assessment with environmental health, and human subject research in exposure studies. The course includes case studies and group projects. Students are expected to develop entry-level skills for designing exposure studies applicable to human exposure monitoring, epidemiologic investigations and health risk assessment.

Learning Outcomes: 1. Describe basic components of exposure assessment studies. 2. Design a study to conduct basic assessments of exposure to chemical hazards at workplace or in a community setting. 3. Obtain and analyze existing data, collect and analyze measurement data, prepare technical reports, and present results. 4. Discuss ethical and professional responsibilities in exposure studies. 5. Function effectively on a team that identify, evaluate and solve problems related to exposures in occupational and environmental settings. Credits: 3.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 3.00

HSCI 58001 - Occupational Biomechanics And Ergonomics Laboratory

Credit Hours: 1.00. This course will be the laboratory component for HSCI 58000. Occupational Biomechanics and Ergonomics. Laboratory exercises will accompany and illustrate each topic discussed during the lecture course. An ergonomic project will allow the students to evaluate an individual performing a job and provide ergonomic recommendations to improve the work situation. The course will also emphasize report writing, teamwork, and communication skills.

Learning Outcomes: 1. Evaluate scientific literature to identify the strengths & weaknesses of study designs, interpretation of results, and implications for the future. 2. Display techniques for performing ergonomic measurements. 3. Evaluate ergonomic hazards of the workplace and make recommendations to correct the identified hazards. 4. Write professional quality reports summarizing laboratory procedures, clearly display experiment results, and interpret those results in the context of the principles learned in the HSCI 58000 lectures. Credits: 1.00

HSCI 44700 - Global Workplace Health

Credit Hours: 2.00. This course will examine health and safety issues, particularly those which occur in the work setting, in various countries around the world. A particular focus will be toward developing countries in which the regulatory environment and resources to control hazards are less than those of more developed countries. Students will participate through an established professional organization. They will virtually work on specific projects in various countries, with the goal of improving the health and safety environment.

Learning Outcomes: 1. Identify exposures to harmful environmental agents which may adversely affect human health. 2. Apply their knowledge and skills of occupational health to recommend methods to reduce exposure to harmful environmental agents. 3. Be able to function as part of team to address issues involving human health. 4. Be able to describe the differences in exposure to hazardous agents for different parts of the world. 5. Obtain a knowledge of current events and identify how

the events relate to disparities in human health across different cultures and countries. 6. Obtain an understanding of professional ethics in relation to differing health and safety policies. Credits: 2.00

Notes

Organizational Leadership Minor

Requirements for the Minor (12 credits)

Required Courses (6 credits)

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

Electives (6 credits)

OLS 48400 - Leadership Strategies For Quality And Productivity

Credit Hours: 3.00. A study of how organizational leaders create an environment conducive to high levels of employee self-motivation, quality, and productivity (TQM). Actual case situations are used to illustrate the application of course content.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

OLS 47700 - Conflict Management

Credit Hours: 3.00. A study of the methods for dealing with innerpersonal, interpersonal, and political disputes by means generally outside the traditional court system. Students will investigate the theoretical and practical aspects of conflict assessment, negotiation, problem solving, mediation, and arbitration.

Learning Outcomes: 1. Interpret and summarize major conflict management concepts. 2. Apply course conflict management concepts to new situations and real-world applications. 3. Assess conflict situations and apply appropriate methods to mitigate conflict. 4. Demonstrate ability to handle difficult people and situations. Credits: 3.00

OLS 45400 - Gender And Diversity In Management

Credit Hours: 3.00. Today's workforce is composed of employees with a variety of individual differences, including race, gender, LGBTQ+, culture, national origin, mental and physical disabilities and age. This course will use the knowledge of diversity, equity, inclusion and ethical responsibilities to develop effective leadership.

Learning Outcomes: 1. Define managing diversity, valuing diversity and affirmative action. 2. Compare American cultural values with non-American cultural values. 3. Describe the major diversity issues, including inclusion, equity and ethical responsibilities, encountered in the workplace. 4. Explain how federal anti-discrimination laws affect the management of diversity and ethical responsibilities. 5. Describe how leaders can effectively manage diversity, inclusion, equity and ethical responsibilities. 6. List the major components of a diversity/inclusion program. Credits: 3.00

OLS 38600 - Leadership For Organizational Change

Credit Hours: 3.00. Introduction to and overview of fundamental concepts of leading organizational change. Topics include setting the stage for organizational change, implementing organizational change, sustaining organizational change, and the role of the change manager. Concepts and frameworks taught in this course are applicable to change at multiple scales from small enterprises and large corporations to communities and ecosystems.

Learning Outcomes: 1. Identify organizational culture and transformation readiness. 2. Apply various change management frameworks to leading organizational change. 3. Understand the role organizational culture plays in change and transformation. 4. Identify the effect of technological change on organizations, communities, and society. 5. Develop and apply a change management framework. Credits: 3.00

OLS 37800 - Labor And Management Relations

Credit Hours: 3.00. An introduction to, and overview of, the fundamental concepts of labor relations, collective bargaining, and dispute resolution procedures. An international comparative analysis is used to assess some of the legal, economic, and political structures of labor relations.

Credits: 3.00

OLS 37500 - Training Methods

Credit Hours: 3.00. Principles, practices, and methods of employee training. Introduction to systematic training program design, development, and evaluation. Emphasis is on the supervisor as a trainer.

Learning Outcomes: 1. Define the role training and development plays in sustaining a competitive advantage across the full array of modern organizations. 2. Explain how training is a systemic process and how it relates to the overall leadership, supervision, and human resource management system of an organization. 3. Describe the purpose and scope of a training needs assessment and plan, including its key components in designing training systems in leadership, supervision, and human resource management system of an organization. 4. Compare and contrast various training delivery methods, citing advantages and disadvantages of each. 5. Describe the essential principles of adult learning and intervention evaluation in developing and designing a training program in leadership, supervision, and human resource management system of an organization. Credits: 3.00

OLS 34600 - Critical Thinking And Ethics

Credit Hours: 3.00. A course in complex problem solving and creative thinking with an emphasis on the ethical impacts of these solutions.

Learning Outcomes: 1. Define various approaches to the study of ethics in leadership. 2. Recognize and apply laws and regulations that affect ethical behavior in business and industry. 3. Work through processes to better identify what are real problems and perceived problems. 4. Use various techniques to ensure the real problem is identified and generate solutions. 5. Relate methods and concepts learned to new situations in order to solve

problems. 6. Identify necessary steps to evaluate and implement solutions. 7. Develop individual problem solving and analytical skills. 8. Identify ethical, legal, and global challenges facing organizational leaders. Credits: 3.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

OLS 48900 - Digital Transformation

Credit Hours: 3.00. This course covers the role of digital transformation and what it means for companies. This course includes practicums in digital transformation, including business transformation strategies, and AI driven insight.

Learning Outcomes: 1. Describe the foundations of Industry 4.0. 2. Explain the history of digital transformation. 3. Evaluate business collaboration in the modern workplace. 4. Synthesize performance management goals and objectives. Credits: 3.00

Notes

Pet Food Processing Minor

Requirements for the Minor (21 credits)

Required Courses (21 credits)

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 32400 - Applied Animal Nutrition

Credit Hours: 3.00. Application of the principles of animal nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Understand and apply basic nutritional principles in the use of available ingredients to provide optimum nutrition for growth, development and reproduction. 2. Become familiar and competent with a least cost computer program on feed formulation as used by the commercial feed industry. 3. Enhance student understanding and appreciation of animal research with hands-on experience in conducting and summarizing nutrition research. Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.

Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3. Identify the conditions under which important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 34200 - Food Processing I Laboratory

Credit Hours: 1.00. This laboratory course applies food engineering principles and thermal processing methods for production of safe and high-quality foods. The course will include applications of mathematics and physics principles in food processing operations, engineering problem-solving exercises and laboratory demonstrations. Engineering concepts such as heat transfer, fluid flow, mass and energy balances applied to various food systems will be a major portion of this laboratory.

Learning Outcomes: 1. Apply mathematical principles to food processing application. 2. Demonstrate an understanding of energy, heat transfer and fluid flow principles. 3. Apply engineering principles to thermal processing of foods. 4. Identify conditions under which microorganisms are commonly inactivated, killed, or made harmless in foods including pasteurization, sterilization, and aseptic processing. 5. Demonstrate use mass and energy balances for a food process. Credits: 1.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 44200 - Food Processing II

Credit Hours: 2.00. Study of food processing and preservation methods based on the integrated knowledge of microbiology, chemistry, and food engineering; emphasis will be on temperature reduction, water activity, concentration, dehydration, irradiation, and extrusion.

Learning Outcomes: 1. Have sufficient knowledge of food chemistry to control reactions in foods. 2. Understand the major chemical reactions that limit shelf-life of foods. 3. Identify the conditions under which the important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Understand the principles involving food preservation via fermentation processes. 5. Be able to identify the conditions, including

sanitation practices under which the important pathogens and spoilage microorganisms are commonly inactivated, killed, or made harmless in foods. 6. Explain the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage. 7. Understand the principles that make a food product safe for consumption. 8. Be able to use mass and energy balances for a given food process. 9. Explain the unit operation required to produce a given food product. 10.Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality. 11.Be able to apply and incorporate the principles of food science in practical, real-world situations. 12.Define a problem, identify causes and possible solutions, and make thoughtful recommendations. 13.Work effectively on a team project. Credits: 2.00

FS 44700 - Food Processing II Laboratory

Credit Hours: 1.00. This lab is designed to build upon fundamental concepts associated with the preservation and processing of various food products. Concepts to be covered include water activity, dehydration (drum, spray and freeze drying), frying, high pressure, microwave and ohmic heating. The focus of this lab will be hands-on production of various food products and the demonstration of fundamental food processing unit operations and calculations related to each preservation method.

Learning Outcomes: 1. Perform experiments using appropriate food processing unit operations to create various food products. 2. Write a lab report that includes analysis and interpretation of the results. 3. Work on a project team to duplicate a commercial food product and present the finding of the project in an oral and written report. Credits: 1.00

Notes

Philosophy Minor

Requirements for the Minor (15 credits)

A. Philosophy Course - Choose One (3 credits)

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

B. Philosophy course 30000-level or above (3 credits)

C. Additional Philosophy courses - Choose Three (9 credits)

Notes

Physics Minor

Requirements for the Minor (18-20 credits)

Required Courses (12-14 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know techniques of

vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

Physics and Astronomy courses 30000-level or above (6 credits)

Notes

Plant Biology Minor

Requirements for the Minor (15 credits)

Required Courses (4-8 credits)

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates

knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8. Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

Selective Courses (7-11 credits)

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak

with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

BTNY 55000 - Biology Of Fungi

Credit Hours: 3.00. Lectures cover general features of fungi, unique characteristics of major fungal groups, fungal interactions with other organisms, and principles of fungal genetics. Lab exercises include examination of representative species from major groups of fungi and classical and molecular manipulations of fungi.

Learning Outcomes: 1. Demonstrate the understanding of fungal structures and development. 2. Identify different fungal groups. 3. Understand unique features of fungal genetics. 4. Demonstrate the ability to culture and observe different fungi. Credits: 3.00

BTNY 28500 - Plants And Civilization (UCC: STS)

Credit Hours: 3.00. This course, intended primarily for non-majors, covers the history of agriculture, with focus on the centers of origin of our major food, fiber, and medicinal plants, and their historical, cultural, and economic relevance. The course also surveys the biology of crop plants, with respect to taxonomy, anatomy, cell structure, physiology, development, and genetics. Discussions also center on the roles plant biotechnology may play in sustainable agriculture and in helping to alleviate problems caused by overpopulation and ecological stress.

University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Professional preparation, scientific principles, critical thinking, cultural understanding, social science principles and lifelong learning. Credits: 3.00

Notes

Plant Pathology Minor

Requirements for the Minor (15 credits)

Required Courses (9 credits)

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology,

including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 52500 - Intermediate Plant Pathology

Credit Hours: 3.00. Examines the biological and pathological characteristics of major causal agents; concepts of epidemiology and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions; disease management practices; and methods of disease diagnosis.

Learning Outcomes: 1. Understand concepts of disease and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions. 2. Understand the current state of knowledge in plant pathology from applied to molecular plant pathogen interactions. 3. Understand importance of plant disease in food security. 4. Understand plant pathogens and how they cause diseases; the biological and pathological characteristics of major pathogens; Understand pathogenesis of bacterial, fungal, nematode and viral diseases. 5. Understand plant disease resistance pathways, genetic resistance mechanisms starting form gene for gene interactions. 6. Understand resistance to necrotrophic plant pathogens. 7. Understand biotechnological approaches to plant diseases resistance. 8. Identify and describe an economically important plant disease. Credits: 3.00

BTNY 53500 - Plant Disease Epidemiology

Credit Hours: 3.00. Plant disease epidemics occur due to the suitable combination of various elements of the agroecosystem. Many plant pathogens and diseases have increased their geographic distribution and intensity in the U.S. and the world. A lack of epidemiological understanding can exacerbate problems and significantly challenge the management of diseases at the field level. This course is an introduction to the epidemiological basis of disease management strategies. The course includes concepts in botanical epidemiology, disease assessment and measurement, disease modeling, epidemics comparison, and a revision of the traditional plant disease control principles. *Plant Disease Epidemiology* is an upper-level course for students interested in plant pathology, agronomy, data-driven Ag, national or international agriculture, or closely related areas. Although some pathosystems are used as model systems, *Plant Disease Epidemiology* is not a "how-to" course on controlling specific plant diseases.

Learning Outcomes: 1. Standardize terminology used in epidemiology for disease management purposes. 2. Analyze the accuracy and precision of data. 3. Use models to describe plant disease epidemics. 4. Explain how epidemiology is used to evaluate disease management options. Credits: 3.00

Selective Courses (6 credits)

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates

knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

BTNY 55000 - Biology Of Fungi

Credit Hours: 3.00. Lectures cover general features of fungi, unique characteristics of major fungal groups, fungal interactions with other organisms, and principles of fungal genetics. Lab exercises include examination of representative species from major groups of fungi and classical and molecular manipulations of fungi.

Learning Outcomes: 1. Demonstrate the understanding of fungal structures and development. 2. Identify different fungal groups. 3. Understand unique features of fungal genetics. 4. Demonstrate the ability to culture and observe different fungi. Credits: 3.00

Notes

Political Science Minor

About the Minor

Requirements for Minor (15 credits)

Political Science courses

Notes

Program Learning Outcomes

Portuguese Minor

Requirements for the Minor (15 credits)

A. Required Courses (12 credits)

PTGS 20100 - Portuguese Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Portuguese course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Discussing personal relations and academic studies. 2. Giving and receiving directions to a destination and/or in order to complete a task. 3. Preparing short oral presentations on topics related to Portuguese and Brazilian cultures. 4. Writing short essays on specified topics. Credits: 3.00

PTGS 20200 - Portuguese Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of PTGS 20100 .

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PTGS 30100 - Portuguese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Portuguese speaking, listening, reading and writing abilities, using materials dealing primarily with everyday life and civilization in the

Portuguese-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Portuguese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PTGS 30200 - Portuguese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Portuguese on the basis of materials dealing primarily with the ideas and events that have shaped present-day Portuguese-speaking countries. Conducted primarily in Portuguese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

B. Portuguese Electives (3 credits)

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

PTGS 39800 - Topics In Portuguese

Credit Hours: 3.00. Advanced studies of particular aspects of Portuguese (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussion, and papers in Portuguese.

Credits: 3.00

PTGS 49800 - Advanced Topics In Portuguese

Credit Hours: 3.00. Advanced studies of particular aspects of Portuguese (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussion, and papers in Portuguese.

Credits: 3.00

PTGS 55100 - Brazilian Poetry

Credit Hours: 3.00. A survey of the major currents and most important writers of Brazilian poetry. Readings include Gregorio de Matos, Goncalves Dias, Castro Alves, Mario de Andrade, Manuel Bandeira, and Cecilia Meireles. Permission of instructor required.

Credits: 3.00

PTGS 55500 - Brazilian Drama

Credit Hours: 3.00. A survey of the primary movements and most important works of Brazilian theatre. Readings include plays by Nelson Rodrigues, Dias Gomes, Ariano Suassuna, and Jorge Andrade. Permission of instructor required.

Credits: 3.00

PTGS 55700 - Brazilian Fiction

Credit Hours: 3.00. A survey of the development and major texts of Brazilian fiction. Readings include novels or short stories by Jose de Alencar, Machado de Assis, Graciliano Ramos, and Clarice Lispector, among others. Permission of instructor required.

Credits: 3.00

Notes

Product Lifecycle Management Minor

About the Minor

Requirements for the Minor (15-16 credits)

Prerequisite Courses for Non-Engineering Students

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role

of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

Prerequisite Courses for Engineering Students

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

Required Courses

MFET 20301 - Model-Based Definition

Credit Hours: 3.00. This course provides experience in the development of model-based product definition through the use of contemporary modeling tools and the application of ASME dimensional standards. This course also covers product data exchange and interoperability standards from the perspective of

neutral and proprietary data formats and models. Long-term archival concepts are also covered.

Learning Outcomes: 1. Explain the significance of 2D and 3D CAD model standards relative to industrial practice. 2. Describe the elements and process of 3D model-based definition. 3. Incorporate model-based definition techniques into the CAD model database and technical documentation when creating geometry. 4. Implement modeling techniques that support long-term archival of product data. 5. Develop standard parts libraries which incorporate industrial standard parts specifications. 6. Select appropriate file format(s) for the communication of CAD data through different toolsets and data exchange media. 7. Develop basic literacy in interpreting technical documentation. Credits: 3.00

MFET 21301 - Simulation And Visualization Applications

Credit Hours: 3.00. This course provides an investigation of predictive and documentary capabilities of engineering simulation and visualization tools. The course is based on concepts derived from theoretical computer graphics and related industrial standards, as well as the use of the geometric model-based product definition.

Learning Outcomes: 1. Describe the processes of simulation and visualization methods and tools. 2. Select and use appropriate simulation and visualization tools for specific PLM tasks. 3. Describe the role of product data models to enhance the processes of engineering design optimization and verification. 4. Develop skills of communication and project management through written assignments, individual, and group projects. 5. Define and apply the fundamentals of technical simulation and visualization with CAx tools in a PLM environment. Credits: 3.00

MFET 30301 - Digital Manufacturing

Credit Hours: 3.00. This course investigates digital manufacturing methods, tools, and processes. Topics include additive and subtractive production techniques, CNC tools, geometric dimensioning and tolerance, model-based definition, measurement instruments and metrology, and scanning techniques for geometry validation.

Learning Outcomes: 1. Describe the differences between additive and subtractive manufacturing. 2. Create a simple CNC program to drive a desktop mill, lathe, and cutter. 3. Understand the basic steps to moving CAD data through a CAM system to drive a machine. 4. Use measurement techniques and model-based data to inspect a manufactured part. 5. Use 3D scanning technology to validate a manufactured part. Credits: 3.00

MFET 31301 - The Business Of Managing Digital Product Data

Credit Hours: 3.00. This course provides experience in the business-related aspects of PLM tools and methods. Topics include identifying specifications and roles for system users within an organization, creating database models for digital product information, workflows, virtual machine installation and configuration of PLM systems, budgeting, and benchmarking.

Learning Outcomes: 1. Identify specifications and requirements for users of PLM systems. 2. Identify user roles and create them with appropriate permissions in a PLM system. 3. Install and configure a PLM system to be used by student teams. 4. Develop the product data model consistent with user requirements. 5. Conduct basic benchmarking and budgeting activities for a PLM deployment. Credits: 3.00

Notes

Professional Writing Minor

Requirements for the Minor (15 credits)

A. Research, Introduction, Digital Publishing - Choose One (3 credits)

ENGL 20300 - Introduction To Research For Professional Writers

Credit Hours: 3.00. Introduction to research sources and

methods useful for professional writers, including electronic resources. Focus on collecting print and online information, interviewing, surveying, and conducting observations; and on evaluating, summarizing, analyzing, and reporting research.

Credits: 3.00

ENGL 30600 - Introduction To Professional Writing

Credit Hours: 3.00. Development of skill in analyzing rhetorical situations in the workplace. Practice in planning, writing, evaluating, and revising a variety of documents typical of those used in the arts and industry.

Learning Outcomes: 1. Understand the basic rhetorical theories that underlie professional and technical writing. 2. Explore issues and challenges in professional writing in a variety of professional and technical contexts. 3. Produce critical writing on rhetorical issues in the field. 4. Solve workplace or organizational problems using writing. Credits: 3.00

ENGL 30900 - Digital Design And Production

Credit Hours: 3.00. The development of the ability to write and design documents using electronic publishing technologies. Students will receive instruction in writing, graphics, and publishing software and will write, design, produce, and critique a number of publications.

Learning Outcomes: 1. Understand the foundational principles of document design and gain practical experience with contemporary design tools. 2. Build portfolio pieces that employ a design thinking approach, both in content and execution 3. Apply theories of document design to a variety of different genres directed to different audiences and rhetorical purposes. Credits: 3.00

ENGL 28000 - Games, Narrative, Culture

Credit Hours: 3.00. This is an introduction to the field of game studies, and to games as narrative and cultural media. We will look at the stories games tell; the way their narrative elements or plot devices intersect with the culture around the games and gaming itself; and how all these things come together to affect game design, meaning, and play.

Learning Outcomes: 1. Demonstrate knowledge of key concepts in both game studies and narrative theory in order to critique a game's systems and narrative elements. 2. Articulate how a game's narrative and the industry's workplace practices are situated in specific historical and cultural contexts. 3. Demonstrate critical thinking skills suited to cultural and historical complexities. 4. Articulate concise, coherent arguments about the effects of writing, narrative, and workplace practices and policies on the video game industry and a game's audience. Credits: 3.00

B. General Education Professional Writing - Choose One (3 credits)

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse

audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

C. Advanced Professional Writing Classes - Choose Two (6 credits)

ENGL 40600 - Review Writing

Credit Hours: 3.00. Intensive practice in the writing of book, film, and theatre criticism, as well as reviews of musical programs and art exhibits. Readings in critics to serve as possible models. Audience analysis of newspapers and periodicals that would be potential markets.

Credits: 3.00

ENGL 47000 - Advanced Topics In Rhetorical Studies

Credit Hours: 3.00. Study of rhetorical theories and practices past and present. Includes readings in primary texts in the history and theory of rhetoric. May be repeated for credit with a different topic.

Learning Outcomes: 1. Demonstrate advanced

understanding of rhetorical concepts, theories, and practices. 2. Analyze and assess rhetorical situations from which arguments are generated; evaluate arguments and their public, institutional, or organizational success; produce arguments in a variety of genres and forms. 3. Demonstrate understanding of how and why rhetoric accomplishes its work from a variety of perspectives across the humanities and sciences. Credits: 3.00

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

ENGL 49000 - Worksite Internship Practicum

Credit Hours: 1.00 to 3.00. Course facilitates the transition between an English undergraduate degree and the workplace or professional life. The course has two components: a professor-guided component and a practicum component in a chosen area. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

ENGL 43300 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants is a professional writing workshop that teaches students to write workplace proposals and grants in for-profit and not-for-profit companies and organizations. Students will also learn how to write business plans, a specialized form of proposal.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Generate new ideas for businesses, products, and services. 3. Organize proposals and grants using various proposal genres. 4. Write in a plain and persuasive style that is appropriate to readers. 5. Design documents in ways that make information accessible. 6. Edit and revise proposals and grants. 7. Work with authors, customers, and funding agencies to sharpen the message of a proposal or grant. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

ENGL 33000 - Games And Diversity

Credit Hours: 3.00. This course looks critically at diversity in games, game development, and in the larger mainstream games community. Students will analyze and play games that related to women, minorities, members of the LGBTQ community, and/or those who lack access because of disability.

Learning Outcomes: 1. Analyze a game's narrative based on a specific frame of diversity (i.e. gender, ethnicity, sexuality, and/or disability). 2. Explain how video games relate to contemporary cultural issues. 3. Use evidence-based arguments to defend a position related to video games and diversity. Credits: 3.00

ENGL 33200 - Games And User Experience (UX)

Credit Hours: 3.00. This course connects gamers and their

experiences with games by developing ways to harvest gaming experiences for the improvement of games. We aim to prepare you to better understand gaming experiences, use those understandings to improve games in development, and be able to think and write critically about those experiences.

Learning Outcomes: 1. Identify and address the variables affecting usability investigation. 2. Articulate and employ methods for collecting and processing usability/user experience information about games. 3. Practice evidence-based arguments on game development and improvements. Credits: 3.00

ENGL 43201 - Editing And Publishing

Credit Hours: 3.00. Editing and Publishing is a professional writing workshop that teaches students how to proofread, copyedit, substantive edit, and global edit documents. Students will learn how to navigate the publishing industry and work with authors on print, electronic, online, and multimedia documents.

Learning Outcomes: 1. Understand how the publishing industry operates, especially from an editor's perspective. 2. Apply the four levels of edit (global editing, substantive editing, copyediting, and proofreading) in an editorial project. 3. Work collaboratively with authors to produce clearly written and persuasive documents. 4. Edit document design and graphics in a document. 5. Interact with publishers to bring a text from manuscript form into a published manuscript. Credits: 3.00

D. Additional Professional Writing Course (3 credits)

Notes

Psychology Minor

Requirements for the Minor (15 credits)

A. Required Course (3 credits)

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

B. Selective (3 credits)

PSY 20000 - Introduction To Cognitive Psychology

Credit Hours: 3.00. A survey of psychology as the science of mental life, covering theories and research in perception, reading, attention, consciousness, imagery, memory and its improvement, problem solving, creativity, decision-making, and artificial intelligence.

Learning Outcomes: 1. Describe basic aspects of visual perception and visual imagery. 2. Explain the role of attention in cognition. 3. Describe basic representations and processes of memory. 4. Understand high-level cognitive functions such as reasoning, problem solving, and language. 5. Understand how cognitive neuroscience can inform cognitive psychology. Credits: 3.00

PSY 22200 - Introduction To Behavioral Neuroscience

Credit Hours: 3.00. An introduction to how the nervous system controls behavior. Topics include evolution and comparative psychobiology, the neuroscience of sensation and perception, the neuroscience of motivation, neuropsychology, and cognitive neuroscience.

Learning Outcomes: 1. Describe the basic structure and function of the brain including neuroanatomy and neural communication. 2. Explain how the central nervous system processes internal and external stimuli. 3. Explain how experience influences current and future behavior. 4. Discern normal from abnormal brain function and describe its influence on behavior. Credits: 3.00

C. Selective (3 credits)

PSY 23500 - Child Psychology

Credit Hours: 3.00. Not open to students with credit in PSY 36000. General principles of children's behavior and development, from conception to adolescence, including sensory and motor development, and basic psychological processes such as learning, motivation, and socialization.

Credits: 3.00

PSY 24000 - Introduction To Social Psychology

Credit Hours: 3.00. Not open to students with credit in SOC 34000 . A broad survey in current knowledge about human social behavior. Topics covered include aggression, attraction and love, social influence, attitudes and attitude change, nonverbal communication, leadership, prejudice and discrimination, and application of social psychology to law, medicine, and other fields. CTL:ISH 1024 Social Psychology

Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training, motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

D. Additional Psychology Courses (6 credits)

Notes

Quantum Science Minor

About the Minor

Requirements for the Quantum Science Minor (19 credits)

Required Courses (11 credits)

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has

enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

QSCI 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

QSCI 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

QSCI 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum,

entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

QSCI 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34900 - Introduction To Quantum Computing

Credit Hours: 3.00. This is a first course in quantum information and quantum computing, for students who have already had an introduction to quantum science. Linear algebra and some probability theory will be presented and used throughout this course. The basic postulates of quantum mechanics will motivate the applications to qubits, cryptography, quantum computation, algorithms, error correction, and other current topics.

Learning Outcomes: 1. Explain the difference between classical and quantum computation. 2. Understand the essential role of quantum entanglement. 3. Appreciate the role of eigenstates in quantum cryptography. 4. Explain the historical significance of Shor's algorithm in establishing the field of quantum computing. 5. Demonstrate the ability to write a quantum computing program. Credits: 3.00

QSCI 34900 - Introduction To Quantum Computing

Credit Hours: 3.00. This is a first course in quantum information and quantum computing, for students who have already had an introduction to quantum science. Linear algebra and some probability theory will be presented and used throughout this course. The basic postulates of quantum mechanics will motivate the applications to qubits, cryptography, quantum computation, algorithms, error correction, and other current topics.

Learning Outcomes: 1. Explain the difference between classical and quantum computation. 2. Understand the essential role of quantum entanglement. 3. Appreciate the role of eigenstates in quantum cryptography. 4. Explain the historical significance of Shor's algorithm in establishing the field of quantum computing. 5. Demonstrate the ability to write a quantum computing program. Credits: 3.00

Additional Courses (8 credits)

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient,

how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

Notes

Radiological Health Sciences Minor

Requirements for the Minor (15-16 credits)

Fundamental Required Courses (5 credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5.

Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

Advanced Required Courses (8 credits)

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

Selective: (2-3 credits)

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3.

Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

Notes

Real Estate Finance Minor

About the Minor

Requirements for the Minor (18 credits)

Required Real Estate Courses (9 credits)

MGMT 37000 - Real Estate Fundamentals

Credit Hours: 3.00. This course introduces the basic concepts, principles, and analytic methods applied in the field of real estate. The course covers topics including legal, financial, economic and marketing concepts related to real estate. The goal of the course is to expose students to the field of real estate and prepare them for more advanced real estate courses.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Describe titles to the conveyance of real estate. 3. Review land economic principles as they relate to real estate values. 4. Identify all quantitative issues required to complete effective real estate transactions. 5. Discuss the aspects of city planning and zoning on real estate values. 6. Understand basic methods for real estate valuation. 7. Understand basic issues in real estate development. Credits: 3.00

MGMT 43901 - Real Estate Investment & Development

Credit Hours: 3.00. The course will cover two main topics: real estate development and real state investment. For real estate development, we will discuss the process of the real estate development process, including the basics of the idea conception, feasibility, planning, financing, market analysis, contract negotiation, risk management, marketing, and asset management. For real estate investment, we will discuss the process and techniques of analyzing real property investment, and the effects of market conditions, government policies, and other factors on real estate investment.

Learning Outcomes: 1. Understand the nature of real estate markets and how value is determined. 2. Understand the process of developing real estate properties. 3. Understand the basic methods for evaluating financial and other risks associated with a real estate development project. 4. Understand and utilize the underlying theory in the analysis of income-producing real estate as an investment medium. 5. Use the net present value and internal rate of return and traditional measures of investment analysis of a real estate investment. 6. Understand the basic principles in structuring real estate investments. Credits: 3.00

MGMT 43905 - Real Estate Industry Project

Credit Hours: 3.00. This course gives students opportunities of working on real-world projects provided by commercial

corporations or organizations. Through the experiential learning experience, students have the opportunities to develop knowledge and skills in managing real estate projects. Depending on the available projects, students will work on topics related to real estate investment and development, facility design and renovation, asset management and other issues. The focus is on developing students' ability in applying what they've learned to solve real-world challenges and receiving coaching and feedback from industry experts.

Learning Outcomes: 1. Learn how to organize your investment or development project by analyzing key characteristics and external constraints that affect schedule, budget, and outcomes. 2. Plan and manage financial and physical resources by a well-planned schedule with appropriate tasks. 3. Monitor project progress and make necessary adjustments to the project schedule manpower and costs. 4. Develop team leadership and communication skills. Credits: 3.00

Additional Course Requirements (9 credits)

Additional Required Courses (3-6 credits)

MGMT 43902 - Real Estate Capital Markets

Credit Hours: 3.00. In this course, students explore the world of real estate finance and capital markets from the perspectives of investors, lenders, fund managers, and other capital allocators. Diving into essential topics like deal structuring, waterfall analysis, debt management, real estate private equity, taxation and regulation, public incentives, mortgage-backed securities (MBS), and Real Estate Investment Trusts (REITs). Through hands-on experience, they will learn to model before-tax and after-tax cash flows, price various securities and deal structures, and develop strategies for managing risk and distress at both project and fund levels. With a strong focus on case study analysis, this course will equip students with practical insights and skills to succeed in real estate finance.

Learning Outcomes: 1. Demonstrate a deep understanding of the history and composition of both debt and equity components of real estate capital markets. 2. Understand the main drivers of real estate capital flows and capital pricing. 3. Describe the structure of residential and commercial mortgage-backed securities. 4. Perform a comprehensive valuation of a REIT. 5. Structure the capitalization for a given project type. Credits: 3.00

MGMT 37500 - Real Estate Law

Credit Hours: 3.00. The course provides an overview of real estate law and its influence on various aspects of the real estate industry. The course examines the legal issues surrounding the nature of real property, types of ownership and possession, real estate contracts, escrow and title and insurance, zoning, financing, landlord and tenant, land use regulations, environments law and regulations, and agency ethics.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Understand how the right to use land is conveyed. 3. Understand the limitations and requirements of land ownership. 4. Understand how the state controls and influences the use of property. 5. Describe the various ways of acquiring the title of real property. 6. Interpret the regulations on real estate contracts. 7. Evaluate various types of real estate ownership and financing techniques. 8. Understand the limitations which can be imposed on real property based on environmental concerns. Credits: 3.00

Real Estate Selective Courses (3-6 credits)

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and

critically evaluate ideas, arguments, and points of view. Credits: 3.00

ECON 45600 - Urban Economics

Credit Hours: 3.00. Examines the market forces that lead to the development, growth, and size of cities. In addition, this course covers the theory of location and land use, principles of local public finance, policy problems in the areas of urban housing, transportation, crime, and pollution.

Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 41601 - Corporate Mergers And Acquisitions

Credit Hours: 3.00. The financial analysis of corporate acquisitions, mergers, and reorganizations including asset acquisitions, joint ventures, spin-offs, sell-offs, equity carve-outs, bankruptcy proceedings and reorganizations, and

corporate governance. The course uses a combination of lectures, readings, and case analysis.

Learning Outcomes: 1. Understand the processes of valuation, negotiation, and financial outcomes of transactions involving mergers and acquisitions. Credits: 3.00

MGMT 41300 - Corporate Finance

Credit Hours: 3.00. The course provides the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending, or investment banking setting. Topics include corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition, and mergers/acquisition.

Learning Outcomes: 1. Know the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending or investment banking system through study of topics including corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition and mergers/acquisition. Credits: 3.00

MGMT 41200 - Financial Institutions And Markets

Credit Hours: 3.00. Introduction to financial markets and management of financial institutions. Emphasis on determinants of interest rates, and measurement and management of financial risk. Concentration on management of depository firms such as banks and savings and loans.

Learning Outcomes: 1. Students will be introduced to financial markets and management of financial institutions through learning about determinants of interest rates, and measurement and management of financial risk, with particular attention on management of depository firms such as banks and savings and loans. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 44690 - Negotiation And Decision Making

Credit Hours: 3.00. The purpose of this course is to understand the theory and processes of negotiation so that you can negotiate successfully in organizational and management settings. This course covers a wide variety of negotiation problems faced by business people. In addition, models of effective and ineffective decision-making are introduced and students will have the opportunity to make decisions at both the individual and group levels.

Learning Outcomes: 1. Improve ability to effectively negotiate. 2. Recognize and analyze negotiation situations. 3. Gain confidence negotiating. 4. Improve decision-making knowledge and skills. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 43907 - Advanced Topics In Real Estate

Credit Hours: 3.00. This course covers selected and timely topics in real estate that are not covered in other regular courses. The topics are determined by the instructor offering the course. The instructor may also include advanced analytical techniques for real estate investment decisions, real estate valuation, and other analyses. Cases and research reports may be used in this course.

Learning Outcomes: 1. Recognize and understand issues and their impacts on the real estate industry. 2. Assess the impacts of certain issues on a company. 3. Understand and apply advanced analytical methods in real estate decisions. 4. Develop a life-long learning ability for future issues in real estate. Credits: 3.00

Notes

Real Estate Minor

About the Minor

Requirements for the Minor (18 credits)

Required Business & Economics Courses (9 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

Required Real Estate Courses (9 credits)

MGMT 37000 - Real Estate Fundamentals

Credit Hours: 3.00. This course introduces the basic concepts, principles, and analytic methods applied in the field of real estate. The course covers topics including legal, financial, economic and marketing concepts related to real estate. The goal of the course is to expose students to the field of real estate and prepare them for more advanced real estate courses.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Describe titles to the conveyance of real estate. 3. Review land economic principles as they relate to real estate values. 4. Identify all quantitative issues required to complete effective real estate transactions. 5. Discuss the aspects of city planning and zoning on real estate values. 6.

Understand basic methods for real estate valuation. 7. Understand basic issues in real estate development. Credits: 3.00

MGMT 43901 - Real Estate Investment & Development

Credit Hours: 3.00. The course will cover two main topics: real estate development and real state investment. For real estate development, we will discuss the process of the real estate development process, including the basics of the idea conception, feasibility, planning, financing, market analysis, contract negotiation, risk management, marketing, and asset management. For real estate investment, we will discuss the process and techniques of analyzing real property investment, and the effects of market conditions, government policies, and other factors on real estate investment.

Learning Outcomes: 1. Understand the nature of real estate markets and how value is determined. 2. Understand the process of developing real estate properties. 3. Understand the basic methods for evaluating financial and other risks associated with a real estate development project. 4. Understand and utilize the underlying theory in the analysis of income-producing real estate as an investment medium. 5. Use the net present value and internal rate of return and traditional measures of investment analysis of a real estate investment. 6. Understand the basic principles in structuring real estate investments. Credits: 3.00

MGMT 37500 - Real Estate Law

Credit Hours: 3.00. The course provides an overview of real estate law and its influence on various aspects of the real estate industry. The course examines the legal issues surrounding the nature of real property, types of ownership and possession, real estate contracts, escrow and title and insurance, zoning, financing, landlord and tenant, land use regulations, environments law and regulations, and agency ethics.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Understand how the right to use land is conveyed. 3. Understand the limitations and requirements of land ownership. 4. Understand how the state controls and influences the use of property. 5. Describe the various ways of acquiring the title of real property. 6. Interpret the regulations on real estate contracts. 7. Evaluate various types of real estate ownership and financing techniques. 8. Understand the limitations which can be imposed on real property based on environmental concerns. Credits: 3.00

Notes

Religious Studies Minor

Requirements for the Minor (15 credits)

A. Required Courses (9 credits)

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

REL 20000 - Introduction To The Study Of Religion (UCC: HUM)

Credit Hours: 3.00. This course will introduce students to the academic study of religion through an exploration of various methodologies available for a critical, reflective investigation of the study of religion.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

B. Elective - Choose One (3 credits)

Category I: Religious Traditions and Diversity

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 46200 - The Bible As Literature: The Old Testament

Credit Hours: 3.00. A study of the Old Testament - Pentateuch, Prophets, and other books such as Psalms, Proverbs, Job, and Ecclesiastes - with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 46300 - The Bible As Literature: The New Testament

Credit Hours: 3.00. A study of the New Testament, with emphasis on its unique literary characteristics.

Credits: 3.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

REL 20100 - Interpretation Of The New Testament

Credit Hours: 3.00. An investigation of the religious content of the Christian Scriptures in light of the historical, social, and intellectual contexts out of which they emerged. Other canons and extra-canonical interpretations of the New Testament will also be investigated.

Credits: 3.00

REL 20200 - Interpretation Of The Old Testament

Credit Hours: 3.00. An investigation of the religious content of documents Christians call the "Old Testament" in light of the historical, social, and intellectual contexts out of which they arose. The student will be introduced to problems and methods in their interpretation.

Credits: 3.00

REL 20300 - Theology Of Paul

Credit Hours: 3.00. A critical examination of the Pauline and Deutero-Pauline epistles, the book of Acts, and other first century texts associated with Paul of Tarsus. Students will be introduced to problems and methods in the interpretation of ancient texts.

Credits: 3.00

REL 31700 - Ancient Judaism And Early Christianity

Credit Hours: 3.00. This course is a study of the emergence of Judaism and the rise of Christianity out of roots in the history of

ancient Israel. This will include noticing the effects of Greek culture, evidence of anti-Semitism and admiration of the Jews, conversion in a setting of religious pluralism, and the development of Jewish and Christian self-definition in this climate.

Credits: 3.00

REL 31800 - The Bible And Its Early Interpreters

Credit Hours: 3.00. This course will start with observation of the development of early themes in later parts of the Hebrew Bible and proceed to the on-going influence of these themes in Jewish literature outside the Hebrew canon (apocrypha, pseudepigrapha, targums, midrash, Josephus, Philo, and other Hellenistic Jewish authors), as well as in pagan literature of this era and in early Christian literature, particularly the New Testament.

Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

REL 24000 - Engaging Religious Diversity (UCC: HUM)

Credit Hours: 3.00. The course offers students case-based explorations of local and global religious diversity in various cultural contexts. Religious diversity in secular spaces and the significance of religion for shaping community identities will be examined from multiple disciplinary perspectives. Students will analyze religious representations and influences in the public sphere by studying examples from different genres and media. Additionally, this course offers students opportunities to improve their religious literacy and gain real-world experience through experiential learning projects.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Identify religious values and practices from multiple traditions. 2. Explain the importance of engaging religious diversity in various contexts. 3. Analyze interactions between religion and civic participation. 4. Evaluate the role of religion in shaping identities. 5. Assess public representations of religion. Credits: 3.00

Category II: Religion, Society and the Public Square

ANTH 37300 - Anthropology Of Religion

Credit Hours: 3.00. Anthropological theories of the origin, development, and functions of religion, ritual, and myth. Data drawn from western and non-western societies, with special emphasis on the relationship of religion to social structure, cultural patterns, and social change.

Learning Outcomes: 1. Explain anthropological approaches to the study of religious belief systems. 2. Investigate religious and cultural differences using anthropological skills. 3. Describe a diversity of faiths and worldviews. 4. Summarize the key ways that humans of the past and present have sought to make sense of the mysteries of life and the sacred. Credits: 3.00

HIST 24600 - Modern Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course explores the political, social, and cultural factors that have contributed to the formation of the modern Middle East. Course includes short stories and a selection of documentary films from the region.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 31700 - A History Of The Christian Church And The Expansion Of Christianity I

Credit Hours: 3.00. A history of the emergence of Christianity, the development of the Christian church, and the impact of Christian thought and institutions upon western Europe prior to the Reformation.

Credits: 3.00

SOC 36700 - Religion In America

Credit Hours: 3.00. Examines the social dimensions of religion in American life; religion in American culture; social profiles of America's religious groups, trends in individual religious commitment; and religion's impact on American life.

Learning Outcomes: 1. Describe the sizes and influences of major (and some minor) religious groups in America and how these sizes and influences have changed over the past 50 years. 2. Explain and evaluate the influence of religious groups and ideas on at least one other important aspect of social life. 3. Explain ways

in which trends in American society over the past 50 years (e.g., changing gender roles, political shifts, etc.) are bringing about changes in American religion. Credits: 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

HIST 31905 - Christianity In The Global Age

Credit Hours: 3.00. This course examines the social, cultural, economic, legal, and religious dynamics of global Christianity in its emerging centers of Latin America, Asia, and Africa during the 20th and 21st centuries.

Learning Outcomes: 1. Understand key issues in the global Christianity in 20th and 21st centuries. 2. Distinguish between secondary and primary sources, and be able to critically read both types of sources. 3. Synthesize information and arguments from both types of sources. 4. Engage in independent historical analysis with the use of primary and secondary sources. 5. Write analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. 6. Research a contemporary topic using a variety of international sources and write a report analyzing the issue in the context of longer historical developments. Credits: 3.00

HIST 40300 - Europe In The Reformation

Credit Hours: 3.00. A study of decay and renewal in European society, 1300 to 1650. Concentrates on the Protestant and Catholic Reformation and religious wars, but also covers the Northern Renaissance, the New Monarchies, and the discovery and exploration of the New World.

Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

C. Elective - Choose One (3 credits)

Category III: Religion, Culture, and Intellectual History

PHIL 20600 - Introduction To Philosophy Of Religion (UCC: HUM)

Credit Hours: 3.00. The course encourages critical reflection on traditional and contemporary views about God and other religious ideas. Topics include arguments for God's existence, the problem of evil, understanding the divine attributes, miracles, religious pluralism, and life after death. CTL:ISH 1052 Philosophy Of Religion

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate familiarity with one or more conceptions of God and with arguments for and against the coherence of such conceptions. 2. Demonstrate a familiarity with some of the arguments for and against God's existence and with some of the objections to those arguments. 3. Recognize the importance of and demonstrate familiarity with multiple religious ideas and beliefs. 4. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 5. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 40200 - Studies In Medieval Christian Thought

Credit Hours: 3.00. A survey of medieval (and patristic) philosophical theology. Issues include the nature and existence of God, religious language, and doctrines such as the Trinity, Incarnation, and Atonement. Readings (in English translation) will include, among others, Augustine, Boethius, Anselm, and Aquinas.

Credits: 3.00

PHIL 40600 - Intermediate Philosophy Of Religion

Credit Hours: 3.00. An intensive study of some important problems such as the existence of God, the problem of evil, immortality, or the nature of religion. Or the religious philosophy of some significant thinkers such as Buber, Berdyaev, Tillich, Barth, Maritain, or Chardin may form the content of the course. Subject matter may vary.

Credits: 3.00

REL 20400 - Introduction To Christian Theology

Credit Hours: 3.00. This course is an introductory survey of the goals and aims of theology in the Christian tradition. Focus is on the content of Christian theology, its methodological presuppositions and principles of development.

Credits: 3.00

REL 25000 - A History Of The Christian Afterlife

Credit Hours: 3.00. An exploration of the ways Christians have envisioned the afterlife, including New Testament descriptions. Apocryphal notions, Patristic conceptions, mystical and 19th century descriptions of heaven as sexual union, and 20th century understandings of the afterlife as a "process of education".

Credits: 3.00

REL 35100 - Christian Mysticism

Credit Hours: 3.00. A critical, historical examination of the development of Christian mystical thought, beginning with its earliest intimations in the Hebrew Scriptures, the thought of Plato and Aristotle and continuing through Patristic, Medieval, Renaissance, Reformation, Counter-Reformation and Modern periods to the present.

Credits: 3.00

REL 45000 - Christian Ethics

Credit Hours: 3.00. The course explores the historical development of Christian moral theology, from pre-Christian times to the present. It includes a study of Biblical moral conceptions, patristic, medieval, Enlightenment, modern, and contemporary understandings of Christian ethics.

Credits: 3.00

REL 45100 - Christology

Credit Hours: 3.00. The course examines the historical development of Christological doctrine in the Christian faith from the age of the New Testament to the late 20th/early 21st century, paying special attention to the New Testament and conciliar formulations.

Credits: 3.00

REL 45200 - Systematic Theology

Credit Hours: 3.00. An introduction to the nature, tasks, and methods of what Christians have called "systematic theology", historically conceived through an exploration of the writings of figures such as Augustine, Aquinas, Melancthon, John Calvin, Barth, and Paul Tillich.

Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the human good, the nature of God, and divine language.

Credits: 3.00

PHIL 50600 - Advanced Philosophy Of Religion

Credit Hours: 3.00. A detailed critical investigation of some central problems in a philosophical approach to religion. Readings will be selected from leading representatives of traditional theism and various contemporary schools. The thought of the representative thinkers will be analyzed, discussed, and critically evaluated. The problems discussed will be selected from the existence of God, the problem of evil, freedom and determinism, the problem of immortality, and the nature of religious language. Variable content.

Credits: 3.00

PHIL 52000 - Existentialism

Credit Hours: 3.00. A detailed exploration and examination of the existentialist movement in modern thought, including its historical roots, its philosophical formulations, and its influence and expression in and relation to art, literature, psychology, social criticism, and religion. Readings will be from at least some of the major existentialists: Kierkegaard, Nietzsche, Jaspers, Heidegger, and Sartre. In addition, texts from existentialist thinkers in other areas will be used.

Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

Notes

Russian Minor

Requirements for the Minor (15 credits)

A. Russian Language (9 credits)

RUSS 30100 - Russian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Russian speaking, listening, reading, and writing abilities, using material dealing primarily with everyday life and civilization in the Soviet Union from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

RUSS 30200 - Russian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Russian, on the basis of materials dealing with the ideas and events that have shaped present-day Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

RUSS 40100 - Russian Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Russian speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

B. Russian Literature (3 credits)

RUSS 34100 - Russian Literature In The Nineteenth Century

Credit Hours: 3.00. Selected Russian poetry, prose, and drama from the Kievan period to 1900 in historical and cultural context. Students will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role of literature in 19th century Russian culture and society. 2. Situate the works they read in their historical and political content. 3. Improve understanding of the way literary works function through various artistic devices. 4. Improve ability to perform close readings of literary texts. 5. Increase ability to write analytical papers supporting a thesis. 6. Increase ability to conduct and present independent research. 7. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 34200 - Revolution, Repression, Renewal: Soviet Literature And Beyond

Credit Hours: 3.00. Selected Russian poetry, prose, and drama of the 20th century in historical and cultural context. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role and position of literature in the Soviet Union. 2. Situate the works they read in their historical and political context. 3. Understand the relationship between writers, the Soviet state, and the means of disseminating texts. 4. Improve understanding of the way literary works function through various artistic devices. 5. Improve ability to perform close readings of literary texts. 6. Increase ability to write analytical papers supporting a thesis. 7. Increase ability to conduct and present independent research. 8. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

C. Russian Electives (3 credits)

RUSS 34100 - Russian Literature In The Nineteenth Century

Credit Hours: 3.00. Selected Russian poetry, prose, and drama from the Kievan period to 1900 in historical and cultural context. Students will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role of literature in 19th century Russian culture and society. 2. Situate the works they read in their historical and political content. 3. Improve understanding of the way literary works function through various artistic devices. 4. Improve ability to perform close readings of literary texts. 5. Increase ability to write analytical papers supporting a thesis. 6. Increase ability to conduct and present independent research. 7. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 34200 - Revolution, Repression, Renewal: Soviet Literature And Beyond

Credit Hours: 3.00. Selected Russian poetry, prose, and drama of the 20th century in historical and cultural context. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role and position of literature in the Soviet Union. 2. Situate the works they read in their historical and political context. 3. Understand the relationship between writers, the Soviet state, and the means of disseminating texts. 4. Improve understanding of the way literary works function through various artistic devices. 5. Improve ability to perform close readings of literary texts. 6. Increase ability to write analytical papers supporting a thesis. 7. Increase ability to conduct and present independent research. 8. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 40200 - Russian Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in Russian. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Improve proficiency in the four language skills: speaking, listening, writing, and reading. 2. Achieve a proficiency of Intermediate High to Advanced Low (ACTFL scale), Level 3 (State Department Scale). 3. Gain greater familiarity with various elements of Russian society and both high and popular culture. Credits: 3.00

RUSS 42400 - Business Russian

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

RUSS 56100 - The Structure Of Russian I: Phonology And Syntax

Credit Hours: 3.00. This course treats the sound system and sentence structure of Russian, dealing with the structural pattern on various levels (phonetic, phonemic, syntactic) from various points of view. One weekly class is devoted to theoretical issues affecting Russian phonology and syntax.

Credits: 3.00

RUSS 56200 - The Structure Of Russian II: Morphology

Credit Hours: 3.00. This course will present a systematic study of Russian morphology in the light of current linguistic research, dealing both with the various categories of inflected words (nouns, pronouns, adjectives, verbs) and with word formation.

Credits: 3.00

RUSS 59600 - Special Topics In Russian Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

RUSS 38000 - Russian Culture And Civilization I

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia, starting with the founding of the Kievan state and continuing to the last days of the Russian Empire. No knowledge of Russian is required.

Learning Outcomes: 1. Understand the forces

and circumstances (geographical, historical, political) that shaped the Russian state and gave rise to its distinctive forms of culture. 2. Understand the distinction between rossiskoe (Russian as pertains to the polity) and russkoe (ethnically and linguistically Russian), and improve understanding of Russia as a multi-ethnic state. 3. Discover the contributions of non-ethnic Russians to Russian culture. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. 5. Increase ability to read critically and write persuasively. Credits: 3.00

RUSS 38100 - Russian Culture And Civilization II

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia from the revolutionary period to the present. No knowledge of Russian is required.

Learning Outcomes: 1. Increase understanding of the interactions between revolutionary politics and revolutionary art, and explore the role of art in a political society while encountering various strategies authors, composers, etc. used to navigate between creative impulses and political requirements. 2. Move beyond the simplistic dichotomy of propaganda vs. dissidence and explore the complex gradations between the extremes of official anti-Soviet culture. 3. Increase knowledge of the relationship between cultural production, distribution, and consumption and the forms that culture takes. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. Credits: 3.00

RUSS 49700 - Topics In Russian Literature

Credit Hours: 3.00 to 6.00. This course provides in-depth study of a particular author or facet of the Russian literary tradition. Possible topics include Dostoevsky and His Age; The Art and Thought of Leo Tolstoy; Russian Romanticism: Pushki, Gogol, Lermontov; The Russian Stage: Theater in Russia and the Soviet Union.

Learning Outcomes: 1. Increase familiarity with various writers, movements, and other aspects of the Russian literary tradition. 2. Improve understanding of the ways in which Russian writers confronted moral and artistic problems in their works. 3. Able to contextualize Russian literary works in the historical and cultural context in which they appeared. 4. Increase ability to read critically and write persuasively. 5. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

RUSS 49800 - Topics In Russian Culture

Credit Hours: 3.00 to 6.00. This course provides a sustained examination of some aspect of Russian culture or a topic relevant to Russian cultural studies. Topics may include Russia Confronts the East; The Caucasus: An Introduction; Popular Culture in Russia.

Learning Outcomes: 1. Attain an in-depth understanding of a particular movement, feature, or aspect of Russian culture. 2. Improve knowledge of Russian history and society as it pertains to cultural development. 3. Increase ability to read critically and write persuasively. 4. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

Notes

Smart Manufacturing Enterprise Minor

About the Minor

Requirements for the Minor (15 credits)

Required Courses (15 credits)

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

MFET 35000 - Smart Manufacturing Systems Modeling & Simulation

Credit Hours: 3.00. This course addresses application of industrial internet of things (IIoT) for modeling and simulation of smart manufacturing assets, processes, and operations. Emphasis is on synchronizing modeling/simulation with real-time data to develop innovative services, create efficiencies, and enable productivity improvement in smart factories.

Learning Outcomes: 1. Describe the convergence of the physical and digital worlds, technology, and standards of IIoT-aided modeling and simulation. 2. Implement process data modeling and application to various types of plant data (drives, pumps, production lines) using real-time, historical, and event-based data. 3. Develop digital/virtual-cloud representation models to be mirrored onto physical manufacturing systems. 4. Create digital twin (DT) models using data from IIoT devices for monitoring and automating control of smart connected assets. 5. Construct DT-oriented simulation model for IoT-aided manufacturing system for applications in productivity, reliability, efficiency, and predictive maintenance operations. 6. Develop application of augmented reality and manufacturing model proxies in diagnostic and troubleshooting operations. Credits: 3.00

MFET 23000 - Industrial Internet Of Things, Networks, And Systems I

Credit Hours: 3.00. This course provides an introduction to Industrial Internet of Things (IIoT) devices, networks, and standards in the context of converged information technology (IT) and operations technology (OT) industrial automation systems. Course topics include an examination of IT and OT networks, hardware, architecture, protocols, standards, and security practices in the context of industrial applications.

Learning Outcomes: 1. Explain the concept of Industrial Internet of Things (IIoT) and the enabling technologies. 2. Describe IT and OT development and detail differences in priorities and capabilities. 3. Design, implement, and analyze an integrated industrial network. 4. Configure host-level and network-level technical security controls in IT and OT systems. 5. Apply industry standards and reference architectures to ensure best practices in the selection,

deployment, and operation of IIoT devices. Credits: 3.00

MFET 25000 - Smart Manufacturing Cloud Computing Applications

Credit Hours: 3.00. This course introduces concepts and principles of cloud computing and the virtualization of computing resources and services for smart manufacturing applications. The fundamental topics of cloud computing will be addressed, including virtually processing, storing, modeling and analyzing of data in the cloud environment. Fundamental concepts about cloud tools, applications, and services from a production and manufacturing perspective will be presented.

Learning Outcomes: 1. State the challenges and advantages of cloud computing in smart manufacturing. 2. Explain the concepts and principles of cloud computing such as a scalability, elasticity, agility, fault tolerance, disaster recovery and networking. 3. Recognize the models, tools, and service types offered by the different cloud platforms for smart manufacturing applications. 4. Select strategies for managing and optimizing cloud computing resources for different manufacturing applications. 5. Apply techniques in clouding computing to model and manage manufacturing data. 6. Build manufacturing apps using cloud based platform tools and services. Credits: 3.00

Notes

Sociology Minor

Requirements for the Minor (15 credits)

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

B. Sociology Electives (12 credits)

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060

Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

B. Sociology Electives (12 credits)

A. Required Foundation Course (3 credits)

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

Soil Science Minor

Requirements for the Minor (18 credits)

Required Courses (6 credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6.

Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

Selective Courses (12 credits)

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

AGRY 35500 - Soil Morphology And Geography

Credit Hours: 2.00. This course features field experience in advanced techniques in soil morphology including the study of the relationship of soils to landscaped, common parent materials of Midwest and classification of soils in the Soil Taxonomy. Course material emphasizes the development of detailed descriptions of soil properties and how these properties directly impact the interpretations and recommendations for land use options. Use and management of soils based on landscape position and morphology will be covered including on-site waste disposal, homes with basements as well as road and street construction. Collegiate soil judging is a portion of the subject matter discussed. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society

at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 2.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 54000 - Soil Chemistry

Credit Hours: 3.00. Emphasis on processes controlling the gaseous, solution, and solid phases in soils including precipitation, acid-base, oxidation-reduction, complexation, absorption, and ion exchange.

Credits: 3.00

AGRY 54400 - Environmental Organic Chemistry

Credit Hours: 3.00. The fundamental properties and processes responsible for the fate of organic chemicals in the environment, with emphasis on soil and water chemistry. Areas to be addressed will include both conceptual and theoretical aspects of processes relevant to environmental fate of contaminants; measurement, estimation, correlation, and application of the parameters most commonly used to assess various chemodynamic properties in soil-water systems.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in surface and subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-base speciation and reactivity. 3. Quantify chemical distribution between soil-water, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and

supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

AGRY 58000 - Soil And Rhizosphere Microbiology

Credit Hours: 3.00. Soils are complex ecosystems that host a diverse array of organisms, which interact with and respond to their environment. This course explores the ecology, evolution, and functions of soil microbes, with a particular focus on their interactions with plants. Through this course, students will gain an understanding of the metabolic processes and life-history strategies of archaea, bacteria, fungi, and viruses in soil, root, and rhizosphere compartments. Students will also survey the microbiomes of diverse soil ecosystems, such as forests, agroecosystems, and grasslands, and learn principles of soil microbiology and biogeochemistry. In addition, students will acquire practical knowledge about the methods used for characterizing microbes in soil and plant systems.

Learning Outcomes: 1. Demonstrate understanding of the ecology and physiology of major groups of bacteria, archaea, fungi, and viruses found in soils, the rhizosphere, and roots. 2. Compare and contrast soil and rhizosphere microbiomes, and their differences between the managed versus natural ecosystems. 3. Use verbal and basic mathematical descriptions to explain theories related to microbial growth, survival, and symbioses. 4. Predict the occurrence of microbial processes and soil conditions that govern the cycling of carbon, nitrogen, phosphorus, sulfur, and metals in soils and relate this knowledge to ecosystem functions. 5. Envision potential applications for soil and root-borne microbes in natural resource management, such as agriculture, forestry, and soil conservation. 6. Apply knowledge of plant-microbe interactions to develop hypotheses, design experiments, and select appropriate study methods. 7. Recognize and select appropriate resources and tools to effectively analyze microbiome data. Credits: 3.00

AGRY 58500 - Soils And Land Use

Credit Hours: 3.00. Soils as a resource in development planning; soil properties affecting land use; use of soil survey, aerial photos, topographic maps, and other resource data in land-use allocation; nonengineering aspects of site selection for various land uses, water conservation, waste disposal, and erosion control.

Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

Notes

Spanish for the Professions Minor

Requirements for the Minor (15 credits)

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

B. Spanish for the Professions Required Course (3 credits)

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2. Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

C. Spanish for the Professions Elective (3-6 credits)

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over the phone, conference, etc.). 5. Understand the basic principles of cross-cultural communication. Credits: 3.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

SPAN 32500 - Spanish For Engineering And Technology

Credit Hours: 3.00. This is an intermediate-level course directed towards the use of Spanish in Engineering and Technology professions. It covers specialized vocabulary from the different technical areas, as well as grammar and syntax, with the goal of developing speaking, listening, reading, and writing abilities. Students will have the opportunity to apply their skills in practical contexts, including job interviews, internships, formal presentations and communication in the workplace.

Learning Outcomes: 1. Recognize and apply a broad range of engineering and technical-related vocabulary. 2. Read, understand, and

discuss specific engineering and technical topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific engineering problems in Spanish. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

D. Additional Course (0-3 credits)

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and

movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48100 - Spanish Culture

Credit Hours: 3.00. The development of the cultural life of the Spanish people as reflected in the geography, history, music, art, and architecture of Spain. Lectures in Spanish.

Learning Outcomes: 1. Catalogue and describe in Spanish the major historical epochs of Spain. 2. Correctly identify major works of painting and music, and locate them temporally, geographically, and by cultural movement or period. 3. Debate accurately Spain's current regional conflicts through knowledgeable

assessment of the historical evolution of the language, literature, commerce, and agriculture. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 38000 - Spanish Language And Culture Abroad

Credit Hours: 1.00 to 6.00. This course must be taken concurrently with participation in an experiential learning opportunity abroad (e.g., study abroad, internship) that requires a period abroad in a Spanish-speaking location. The course will guide students to improve their Spanish language abilities and gain cultural knowledge about their experiential learning location. This course, coupled with the immersion experience, will enhance student learning through Spanish language activities and also cultural research projects. Permission of instructor is required.

Learning Outcomes: 1. Identify important moments of daily learning and reflect on them in written form in Spanish. 2. Explain experiences in the Spanish-speaking location through conversations in Spanish with a peer. 3. Compare experiences and problems encountered through conversations in Spanish with a peer; formulate possible solutions to problems if encountered in the future. 4. Research cultural surroundings and present findings in various modes of communication (e.g., presentational, written). 5. Assess learning during the immersion period in a summative way, reflecting on language and cultural learning through the creation of a final presentation project. Credits: 1.00 to 6.00

SPAN 36600 - Spanish In The United States

Credit Hours: 3.00. The course explores the linguistic profile of established and emerging Spanish-speaking communities in the United States. Topics addressed are the current demographic profiles of Spanish speakers, the historical presence of Spanish, language identity, the meaning of linguistic landscapes, American Spanish and its speakers in the media and social institutions, as well as the varieties of Spanish in the U.S. The course is conducted in Spanish.

Learning Outcomes: 1. Describe Spanish-speaking populations in the U.S. considering their diverse histories. 2. Use course-related concepts and terms accurately in class discussions and written texts. 3. Examine the experience of Spanish-speakers in the U.S. through course activities. 4. Investigate the

sociopolitical position of language through course readings and data analysis. 5. Identify a topic of research and conduct research to contribute to our knowledge of Spanish or Spanish speakers in the U.S. Credits: 3.00

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

B. Spanish for the Professions Required Course (3 credits)

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2.

Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

C. Spanish for the Professions Elective (3-6 credits)

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over the phone, conference, etc.). 5. Understand the basic principles of cross-cultural communication. Credits: 3.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

SPAN 32500 - Spanish For Engineering And Technology

Credit Hours: 3.00. This is an intermediate-level course directed towards the use of Spanish in Engineering and Technology professions. It covers specialized vocabulary from the different technical areas, as well as grammar and syntax, with the goal of developing speaking, listening, reading, and writing abilities. Students will have the opportunity to apply their skills in practical contexts, including job interviews, internships, formal presentations and communication in the workplace.

Learning Outcomes: 1. Recognize and apply a broad range of engineering and technical-related vocabulary. 2. Read, understand, and discuss specific engineering and technical topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific engineering problems in Spanish. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the

Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

D. Additional Course (0-3 credits)

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a

broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48100 - Spanish Culture

Credit Hours: 3.00. The development of the cultural life of the Spanish people as reflected in the geography, history, music, art, and architecture of Spain. Lectures in Spanish.

Learning Outcomes: 1. Catalogue and describe in Spanish the major historical epochs of Spain. 2. Correctly identify major works of painting and music, and locate them temporally, geographically, and by cultural movement or period. 3. Debate accurately Spain's current regional conflicts through knowledgeable assessment of the historical evolution of the language, literature, commerce, and agriculture. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 38000 - Spanish Language And Culture Abroad

Credit Hours: 1.00 to 6.00. This course must be taken concurrently with participation in an experiential learning opportunity abroad (e.g., study abroad, internship) that requires a period abroad in a Spanish-speaking location. The course will guide students to improve their Spanish language abilities and gain cultural knowledge about their experiential learning location. This course, coupled with the immersion experience, will enhance student learning through Spanish language activities and also cultural research projects. Permission of instructor is required.

Learning Outcomes: 1. Identify important moments of daily learning and reflect on them in written form in Spanish. 2. Explain experiences in the Spanish-speaking location through conversations in Spanish with a peer. 3. Compare experiences and problems encountered through conversations in Spanish with a peer; formulate possible solutions to problems if encountered in the future. 4. Research cultural surroundings and present findings in various modes of communication (e.g., presentational, written). 5. Assess learning during the immersion period in a summative way, reflecting on language and cultural learning through the creation of a final presentation project. Credits: 1.00 to 6.00

SPAN 36600 - Spanish In The United States

Credit Hours: 3.00. The course explores the linguistic profile of established and emerging Spanish-speaking communities in the United States. Topics addressed are the current demographic profiles of Spanish speakers, the historical presence of Spanish, language identity, the meaning of linguistic landscapes, American Spanish and its speakers in the media and social institutions, as well as the varieties of Spanish in the U.S. The course is conducted in Spanish.

Learning Outcomes: 1. Describe Spanish-speaking populations in the U.S. considering their diverse histories. 2. Use course-related concepts and terms accurately in class discussions and written texts. 3. Examine the experience of Spanish-speakers in the U.S. through course activities. 4. Investigate the sociopolitical position of language through course readings and data analysis. 5. Identify a topic of research and conduct research to contribute to our knowledge of Spanish or Spanish speakers in the U.S. Credits: 3.00

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

Spanish Minor

Requirements for the Minor (15 credits)

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

B. Spanish Literature Course (3 credits)

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

C. Spanish Electives (6 credits)

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers

specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a

broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over the phone, conference, etc.). 5. Understand the basic principles of cross-cultural communication. Credits: 3.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken

there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48100 - Spanish Culture

Credit Hours: 3.00. The development of the cultural life of the Spanish people as reflected in the geography, history, music, art, and architecture of Spain. Lectures in Spanish.

Learning Outcomes: 1. Catalogue and describe in Spanish the major historical epochs of Spain. 2. Correctly identify major works of painting and music, and locate them temporally, geographically, and by cultural movement or period. 3. Debate accurately Spain's current regional conflicts through knowledgeable assessment of the historical evolution of the language, literature, commerce, and agriculture. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 49800 - Advanced Topics In Spanish

Credit Hours: 1.00 to 3.00. Advanced studies of particular aspects of Spanish (e.g. culture, civilization, literature, linguistics, film, etc) by examining a varied selection of works. Readings, discussion, and papers in Spanish.

Credits: 1.00 to 3.00

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2. Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and

meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

SPAN 32500 - Spanish For Engineering And Technology

Credit Hours: 3.00. This is an intermediate-level course directed towards the use of Spanish in Engineering and Technology professions. It covers specialized vocabulary from the different technical areas, as well as grammar and syntax, with the goal of developing speaking, listening, reading, and writing abilities. Students will have the opportunity to apply their skills in practical contexts, including job interviews, internships, formal presentations and communication in the workplace.

Learning Outcomes: 1. Recognize and apply a broad range of engineering and technical-related vocabulary. 2. Read, understand, and discuss specific engineering and technical topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific engineering problems in Spanish. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 38000 - Spanish Language And Culture Abroad

Credit Hours: 1.00 to 6.00. This course must be taken concurrently with participation in an experiential learning opportunity abroad (e.g., study abroad, internship) that requires a period abroad in a Spanish-speaking location. The course will guide students to improve their Spanish language abilities and gain cultural knowledge about their experiential learning location. This course, coupled with the immersion experience, will enhance student learning through Spanish language activities and also cultural research projects. Permission of instructor is required.

Learning Outcomes: 1. Identify important moments of daily learning and reflect on them in written form in Spanish. 2. Explain experiences in the Spanish-speaking location through conversations in Spanish with a peer. 3. Compare experiences and problems encountered through conversations in Spanish with a peer; formulate possible solutions to problems if encountered in the future. 4. Research cultural surroundings and present findings in various modes of communication (e.g., presentational, written). 5. Assess learning during the immersion period in a summative way, reflecting on language and cultural learning through the creation of a final presentation project. Credits: 1.00 to 6.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class

meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

SPAN 36600 - Spanish In The United States

Credit Hours: 3.00. The course explores the linguistic profile of established and emerging Spanish-speaking communities in the United States. Topics addressed are the current demographic profiles of Spanish speakers, the historical presence of Spanish, language identity, the meaning of linguistic landscapes, American Spanish and its speakers in the media and social institutions, as well as the varieties of Spanish in the U.S. The course is conducted in Spanish.

Learning Outcomes: 1. Describe Spanish-speaking populations in the U.S. considering their diverse histories. 2. Use course-related concepts and terms accurately in class discussions and written texts. 3. Examine the experience of Spanish-speakers in the U.S. through course activities. 4. Investigate the sociopolitical position of language through course readings and data analysis. 5. Identify a topic of research and conduct research to contribute to our knowledge of Spanish or Spanish speakers in the U.S. Credits: 3.00

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence

but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

B. Spanish Literature Course (3 credits)

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

C. Spanish Electives (6 credits)

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over the phone, conference, etc.). 5. Understand the basic principles of cross-cultural communication. Credits: 3.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48100 - Spanish Culture

Credit Hours: 3.00. The development of the cultural life of the Spanish people as reflected in the geography, history, music, art, and architecture of Spain. Lectures in Spanish.

Learning Outcomes: 1. Catalogue and describe in Spanish the major historical epochs of Spain. 2. Correctly identify major works of painting and music, and locate them temporally, geographically, and by cultural movement or period. 3. Debate accurately Spain's current regional conflicts through knowledgeable assessment of the historical evolution of the language, literature, commerce, and agriculture. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral

presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 49800 - Advanced Topics In Spanish

Credit Hours: 1.00 to 3.00. Advanced studies of particular aspects of Spanish (e.g. culture, civilization, literature, linguistics, film, etc) by examining a varied selection of works. Readings, discussion, and papers in Spanish.

Credits: 1.00 to 3.00

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2. Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

SPAN 32500 - Spanish For Engineering And Technology

Credit Hours: 3.00. This is an intermediate-level course directed towards the use of Spanish in Engineering and Technology professions. It covers specialized vocabulary from the different technical areas, as well as grammar and syntax, with the goal of developing speaking, listening, reading, and writing abilities. Students will have the opportunity to apply their skills in practical contexts, including job interviews, internships, formal presentations and communication in the workplace.

Learning Outcomes: 1. Recognize and apply a broad range of engineering and technical-related vocabulary. 2. Read, understand, and discuss specific engineering and technical topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific engineering problems in Spanish. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 38000 - Spanish Language And Culture Abroad

Credit Hours: 1.00 to 6.00. This course must be taken concurrently with participation in an experiential learning opportunity abroad (e.g., study abroad, internship) that requires a period abroad in a Spanish-speaking location. The course will guide students to improve their Spanish language abilities and gain cultural knowledge about their experiential learning location. This course, coupled with the immersion experience, will enhance student learning through Spanish language activities and also cultural research projects. Permission of

instructor is required.

Learning Outcomes: 1. Identify important moments of daily learning and reflect on them in written form in Spanish. 2. Explain experiences in the Spanish-speaking location through conversations in Spanish with a peer. 3. Compare experiences and problems encountered through conversations in Spanish with a peer; formulate possible solutions to problems if encountered in the future. 4. Research cultural surroundings and present findings in various modes of communication (e.g., presentational, written). 5. Assess learning during the immersion period in a summative way, reflecting on language and cultural learning through the creation of a final presentation project. Credits: 1.00 to 6.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

SPAN 36600 - Spanish In The United States

Credit Hours: 3.00. The course explores the linguistic profile of established and emerging Spanish-speaking communities in the United States. Topics addressed are the current demographic profiles of Spanish speakers, the historical presence of Spanish, language identity, the meaning of linguistic landscapes, American Spanish and its speakers in the media and social institutions, as well as the varieties of Spanish in the U.S. The course is conducted in Spanish.

Learning Outcomes: 1. Describe Spanish-speaking populations in the U.S. considering their diverse histories. 2. Use course-related concepts and terms accurately in class discussions and written texts. 3. Examine the experience of Spanish-speakers in the U.S. through course activities. 4. Investigate the sociopolitical position of language through course readings and data analysis. 5. Identify a topic of research and conduct research to contribute to our knowledge of Spanish or Spanish speakers in the U.S. Credits: 3.00

A. Spanish Language (6 credits)

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific

texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

Statistics Minor

Requirements for the Minor (15 credits)

Area 1 - Choose One (3 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with

emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits:

3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

Area 2 - Choose One (3 credits)

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and

moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

Area 3 (3 credits)

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

Area 4 - Choose Two (6 credits)

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

Due to Minor Requirements and Pre-requisites, Below are the Suggested Pathways for Specific Majors

Krannert School of Management Majors

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

Industrial Engineering Majors

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective

conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

Pharmacy, Nursing, Biology, Agriculture Majors (Majors that utilize STAT 50300)

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to

identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Majors that require MA 26100 (Calculus III)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics:

variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Majors that do not require MA 26100 (Calculus III)

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing.

Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually

understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

Notes

Supply Chain Engineering Technology Minor

About the Minor

Requirements for the Minor (15 credits)

Required Courses (15 credits)

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 34200 - Warehouse And Inventory Management

Credit Hours: 3.00. A course designed to develop understanding of types of warehouses, methods of organizing the warehouse environment, and determining efficient inventory control procedures. Technology applications related to the management of warehouse and inventory stock-keeping units (SKU) are investigated. Storage of inventory, placement of inventory, picking, packing, shipping, and other internal logistics management topics will be explored.

Learning Outcomes: 1. Identify activities associated with inventory and warehouse management. 2. Explain the relationship of inventory and warehouse management to supply chain management with other various functional areas, including corporate strategy. 3. Design various warehouse activities under given circumstances. 4. Describe material/distribution requirements planning (MRP/DRP) systems. Credits: 3.00

IET 34300 - Technical And Service Selling

Credit Hours: 3.00. A study of sales models and techniques for technical and service sales in business-to-business environments, including development of channel relationships, long-term sales agreements, customer relationship management efforts, total cost of ownership tools and complex sales presentations. Covers critical sales skills such as e-economy sales and marketing, lead management, building credibility, consultative selling, ethical negotiations, and sustainable product management.

Learning Outcomes: 1. Explain the roles of technical and service sales in business to business channels. 2. Describe the relationship between personal selling and marketing. 3. Describe critical influencing factors on organizational buyer behavior. 4. Describe various types of buying situations and typical sales agreements. 5. Demonstrate a personal selling communication model. 6. Describe customer relationship management. Credits: 3.00

Note

Sustainable Engineering Minor

Requirements for the Minor (18 credits)

Required Courses (12 credits)

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative

thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

FNR 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (AGEC 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities

and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

EEE 53000 - Life Cycle Assessment: Principles And Applications

Credit Hours: 3.00. This course covers the basic concept of life cycle thinking, framework and computational structure of process and economic input-output based life cycle assessment (LCA), state-of-the-art LCA software tools, industrial case studies, and recent advances in LCA methodology. Students are required to complete a group project that could potentially facilitate the adaptation of LCA tools in engineering research, education, or practice.

Learning Outcomes: 1. Conduct an LCA study using state-of-the-art software tools and databases according to ISO I4040 standards. 2. Identify the limitations and weakness of an existing LCA study. 3. Develop customized inventory dataset using information available in literature and current inventory databases. 4. Develop a simplified yet functional LCA software tool tailored for an enterprise or organization. 5. Combine LCA results with economic and social impact analysis to support decision making. Credits: 3.00

Public Policy (3 credits)

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

Technical Courses - Choose One (3 credits)

Agriculture/Environmental Sustainability

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

EAPS 37500 - Great Issues - Fossil Fuels, Energy And Society

Credit Hours: 3.00. Prosperity of the 20th century was based on abundant and cheap energy; during the 21st century we will be faced with difficult challenges. Our society will face higher energy prices, decline of petroleum based fuels supplies, increased environmental effects of fossil fuels usage, and the challenge of solving the technological problems of developing alternative fuels. This course will review the structure, economics, and geopolitical issues faced by fossil fuel industries and the mitigation strategies that will be needed to change to low fossil fuel use society based on low polluting renewable energy sources. Counts for Great Issues course in College of Science for Juniors and Seniors.

Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

CE 55700 - Air Quality Management

Credit Hours: 3.00. Discussion of fugitive, mobile, and point sources of air pollution with attendant effects on materials, plants, and humans. Development and status of state and federal regulations with emphasis on the development and use of mathematical dispersion models including meteorological fundamentals and atmospheric transport. Discussion of concepts for ambient air quality control strategies including urban planning and transportation considerations.

Credits: 3.00

AGEC 52800 - Global Change And The Challenge Of Sustainably Feeding A Growing Planet

Credit Hours: 3.00. This course investigates the major drivers of global agricultural and environmental change associated with the global farm and food system. This includes demography, income growth, biofuels, climate change, environmental and ecosystem services, livestock consumption, food waste and land use change. Weekly modules include a guest lecture, student led discussion of readings and discussion of lab assignments undertaken using the SIMPLE model of global agriculture, environment and food security. The class culminates with a course project which is presented to the class and written up in a term paper.

Learning Outcomes: 1. Gain exposure to different disciplines and their approaches to analyzing global change. 2. Master the basic economic concepts of demand and supply in the context of the global food economy. 3. Become proficient in undertaking economic analysis using the SIMPLE model. 4. Gain a knowledge of the role which economic analysis plays in analyzing long run sustainability of the global food system. Credits: 3.00

EEE 38000 - Environmental Chemodynamics

Credit Hours: 3.00. Introduction to chemical thermodynamics and general equilibrium processes in environmental and ecological engineering systems. Introduction to the first and second laws of thermodynamics; properties of pure substances; ideal and real gases; thermodynamic cycles and processes; heat transfer and combustion; and chemical equilibrium in aquatic solutions, including equilibria between phases and reaction equilibria. Emphasis is on understanding and conceptualizing important processes, and competency in thermodynamic calculations.

Learning Outcomes: 1. Apply the First and Second Laws of thermodynamics to closed and open systems. 2. Understand, identify, and quantify the environmental impacts of closed and open systems, based on mass and energy transfer. 3. Analyze full-scale systems, and compare actual and theoretical operation. 4. Understand the structure and reactivity of environmentally relevant organic compounds. 5. Calculate concentrations of different components in equilibrium and non-equilibrium environmental systems. Credits: 3.00

Energy Conversion and Storage

NUCL 47000 - Fuel Cell Engineering

Credit Hours: 3.00. The principles of electromechanical energy conversion for a single fuel cell, fuel cell stack, process engineering in the fuel and oxidizer supply systems. Principles, components, operation and performance for alkaline, phosphoric acid, solid polymer, molten carbonate and solid oxide fuel cells. Provides broad insight into science, technology, system design, and safety concerns in design and operation of fuel cells.

Credits: 3.00

NUCL 56300 - Direct Energy Conversion

Credit Hours: 3.00. Review of energy sources and study of the basic processes of direct energy conversion and their applications to energy utilization, based on both conventional and nuclear energy conversion schemes. Conventional schemes include thermoelectric, photovoltaic, thermionic, magnetohydrodynamic generators, fuel cell systems, etc.; and nuclear energy conversion schemes correspond to nuclear radiation and fusion energy conversion. Permission of instructor required.

Credits: 3.00

Energy Utilization and Equipment

ME 44000 - Automotive Prime Movers: Green Engines And Clean Fuel

Credit Hours: 3.00. Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics- engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics- different components of hybrid engines and the powertrain design. FCE topics- fundamentals of fuel cells and automotive applications. Clean fuel topics- biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels.

Learning Outcomes: 1. Relate processes in automotive prime movers to engineering fundamentals. 2. Study low-carbon emitting, and LEV, ULEV, SULEV, PZEV, and ZEV prime mover designs. 3. Study prime mover designs that are alternative to conventional combustion engines. 4. Study cleaner alternatives to conventional fossil fuels. 5. Carry out analysis of prime mover designs and fuel alternatives to identify cost and energy tradeoffs. Credits: 3.00

Sustainable Design and Construction

AD 39700 - Sustainability In The Built Environment

Credit Hours: 3.00. The study of philosophical concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants. To provide a foundation for evaluation of materials, processes, and applications of design components for environmentally responsible. Field trips will be required.

Learning Outcomes: 1. Define sustainability and assess the ways that sustainable design strategies, processes, and products may be integrated effectively into the built environment. 2. Identify complex social, ecological, and economic dimensions that affect the well-being of humans, neighborhoods, communities, and

ecological systems. 3. Apply critical thinking skills to explain how green building methods affect the way built environments are designed, constructed, and operated. 4. Utilize appropriate methodological tools to analyze sustainable problems and provide environmentally responsible solutions for a green-building scenario. 5. Articulate a comprehensive, progressive world view that integrates diverse approaches to sustainability. 6. Utilize USGBC materials and other educational sources to explain the LEED rating system, LEED professional credentials, and Green Building principles and techniques preparatory to obtaining the LEED Green Associate credential. Credits: 3.00

CM 51000 - Topics In Environmentally Sustainable Construction, Design And Development

Credit Hours: 3.00. This course explores environmental sustainability in all its forms, starting with the historical and theoretical basis and continuing through an understanding of sustainable building construction, design, development, and renewable energy strategies/management tools and how these can be applied in practice.

Learning Outcomes: 1. Recognize human population trends and their effects on associated resource demands. 2. Identify and evaluate energy use trends, including status quo, business-as-usual (BAU) and alternative production and delivery approaches. 3. Interpret and analyze regional and global climate trends and implications, including policy alternatives. 4. Illustrate economic and social drivers, including triple bottom line business practices. 5. Discuss trends and management alternatives in land and ocean ecosystems. 6. Examine food and water security issues including production, management, and distribution alternatives. 7. Distinguish behavior psychology including examination of constraints and opportunities for sustainable practices. 8. Compare market and other incentives designed to stimulate best practices for building design and community planning. 9. Demonstrate knowledge of the conceptual history and controversies involving sustainability. 10. Apply current sustainability principles. 11. Debate common sustainability issues from multiple perspectives. 12. Recognize uncertainty envelopes and constraints on predictive knowledge. 13. Apply best practices in sustainability to their specific field of interest. 14. Employ interdisciplinary approaches to sustainability outside of their own field. 15. Recognize the challenges and opportunities of applying science and technology to governance. 16. Formulate messaging skills needed to deliver scientific information to popular audiences. 17. Practice abstract theoretical evaluation of sustainability challenges and solutions. 18. Employ critical reading and writing skills within scientific, policy and popular media. 19. Prepare action research projects to transform sector-specific practices for sustainability. 20. Construct a broad range of delivery and assessment strategies to support change for sustainability. Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of

instructor required.

Credits: 3.00

Sustainable Energy Options

ABE 58000 - Advanced Processes In Biological Engineering

Credit Hours: 3.00. Physical and chemical structure of biomass. Reaction kinetics of hydrolysis of hemicellulose and cellulose to fermentable sugars. Fundamentals of ethanol production by fermentation. Separation of fermentation products into pure components.

Learning Outcomes: 1. Analyze bioprocesses using engineering design principles, bioreactor simulations, application of basic separations methods, and applying engineering economic analysis. 2. Develop process models for batch and continuous fermentation, cell culture, and enzymatic bioreactors. 3. Analyze the impact of fundamental advances in bio-sciences on bioprocess engineering and the environment, and the potential of these advances to solve societal problems. 4. Understand the impact of biosafety and regulatory considerations on process design. Credits: 3.00

CHE 55800 - Rate-Controlled Separation Processes

Credit Hours: 3.00. Rate-controlled separation processes based on solute movement (adsorption, chromatography and ion exchange), membranes (reverse osmosis, ultrafiltration, and gas permeation), and crystallization.

Credits: 3.00

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 51400 - Fundamentals Of Wind Energy

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet, turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component machine and off-design performance. Inspection trip to industrial plan required.

Learning Outcomes: 1. Introduce students to the technology and economics of converting wind energy to electricity. 2. Inform students to the environmental concerns of wind energy. 3. Understand principles of wind turbine aerodynamics. 4. Develop the ability to design optimum blading. 5. Develop the ability to evaluate a potential site in terms of wind energy. 6. Understand wind turbine structural dynamics issues. Credits: 3.00

ME 49601 - Experimental Courses

Credit Hours: 1.00 to 6.00. Experimental classes offered at the junior or senior level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 1.00 to 6.00

ECE 50616 - Physics And Manufacturing Of Solar Cells

Credit Hours: 3.00. This course introduces the electronic, optical and material properties and the manufacturing of photovoltaic devices. Topics include electronic charge separation, transportation and recombination; optical concentration, trapping and confinement; material preparations in photovoltaic systems; bulk crystal, thin-film and organic photovoltaic device configurations; energy storage; as well as emerging concepts in photovoltaics. Discussions also involve the process and equipment for the manufacturing of various photovoltaic modules, with special emphasis on driving down the cost of photovoltaic systems.

Learning Outcomes: 1. Understand different market segments for photovoltaics and their key requirements. 2. Understanding of p-n junctions, drift and diffusion of charges, LUMO and HOMO. 3. Extract efficiency from i-v characteristics of photovoltaic cells. Credits: 3.00

ME 52900 - Sustainable Energy Options And Analysis

Credit Hours: 3.00. This course develops an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. A range of different technologies and approaches are presented for meeting future energy needs. Students learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics and gain experience in assessing different energy technologies for specific case studies.

Learning Outcomes: 1. Gain an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. 2. Gain an understanding of alternative technologies for meeting future energy needs. 3. Learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics. 4. Gain experience in assessing different energy technologies. Credits: 3.00

Notes

Sustainable Food and Farming Systems Minor

About the Minor

Requirements for the Minor (18 credits)

Required Courses (9 Credits)

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working

on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

Systems Modules (3 credits)

SFS 31100 - Aquaponics

Credit Hours: 1.00. (FNR 31300) (HORT 31100) There has been significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia, and our impending food crisis has kindled an interest in developing aquaponic systems in western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. High input costs can, however, be a limitation. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of post harvest food storage and pest management. Credits: 1.00

SFS 31200 - Urban Agriculture

Credit Hours: 1.00. Urban agriculture has the potential to address a range of social, economic and environmental issues including food insecurity, energy conservation, and human health and well-being. During this 5-week course, students will learn about the forces driving urban agriculture as well as the political and biophysical factors constraining it by reading articles, reviewing case studies, and visiting urban farms, vertical farm factories, food pantries, and local food advocacy groups. At the end of this course, students will apply the knowledge they've gained by developing a plan to increase urban agriculture in the greater Lafayette metropolitan area.

Learning Outcomes: 1. Understand the complexity of our global food system and learn how urban agriculture can address social, economic and ecological issues in cities around the world. 2. Develop critical thinking and communication skills through in-class discussions and writing assignments that integrate agroecology, urban planning, and civic engagement as they relate to urban agriculture. 3. Apply relevant theories and examples by developing a plan to facilitate the growth of urban agriculture. Credits: 1.00

SFS 31300 - Farm To Fork

Credit Hours: 1.00. This course will investigate the culinary opportunities of local and seasonal foods and the horticultural demands of producing and marketing them. Dr. Hallett will represent the "farm", giving students a brief overview of the production of local and seasonal foods in Indiana. The "farm" will harvest produce at the student farm and deliver it to the "fork" -- Chef Ambarish Lulay - who will work his culinary magic in the teaching kitchens in the HTM department. The focus, from both "sides" of the course will be the importance of niche marketing for farmers and chefs. This course is going to be tasty and fun!

Learning Outcomes: 1. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 2. Have a broad awareness of the role of agriculture in global society. 3. Understand the advantages and disadvantages of different approaches to

food production. 4. Understand the principles of food marketing and sales. 5. Understand the principles of postharvest food storage and pest management. 6. Be able to handle multiple tasks and deadline pressures. 7. Be able to work effectively with individuals from diverse cultures. 8. Have strong professional ethics and integrity. 9. Understand the importance of developing leadership skills. 10. Be able to work effectively in teams. Credits: 1.00

SFS 31400 - Comparative Livestock Production Systems

Credit Hours: 1.00. This course will compare and contrast the various livestock and poultry systems in the United States. The course will begin with in depth analysis of the history and structure of prevalent or conventional livestock and poultry production systems followed by a similar analysis of the various alternative production systems currently in use in the US, including organic, grass-fed, and pasture-raised among others. A heavy focus will be placed on critically evaluating the pros and cons of each system, regulations of both conventional and process-verified systems and potential differences in products resulting from different management and processing systems.

Learning Outcomes: 1. Understand the structure of conventional livestock and poultry production systems in the US. 2. Understand the alternative livestock and poultry production systems prevalent in the US. 3. Know how each system is regulated including the various process verified systems. 4. Know how different management and processing systems do or do not impact final product qualities. 5. Be able to critically evaluate and compare the benefits and challenges inherent in different production systems. Credits: 1.00

SFS 31500 - Principles Of Permaculture

Credit Hours: 1.00. The goal of this class is to encourage students to think of farming systems, including their energy and resource flows, economics and social characteristics, in the ways that ecologists think of ecological systems. How does energy flow through farming systems, and how do resources recycle (or not)? What are the weaknesses of farming systems that could be mitigated by mimicking natural systems? Issues of efficiency, sustainability and resilience will be investigated in the context of permaculture, a theory of food production and landscape design that has an emphasis on perennial crops, low input production, and ecological diversity. The centerpiece of the course will be to further develop the Purdue Student Farm using permaculture principles.

Learning Outcomes: 1. Analyze energy and natural resource issues of modern society in the context of ecological systems thinking. Credits: 1.00

Selectives (6 credits)

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of

accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 20100 - Construction And Maintenance

Credit Hours: 3.00. Fundamental principles in the selection and use of tools for the construction and maintenance of agricultural and related facilities, equipment, and machines. Areas covered include small engines, concrete and masonry, wood, plumbing, electricity, and metal.

Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team.

Credits: 4.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

ENTM 31100 - Insect Ecology

Credit Hours: 3.00. Insect ecology investigates the fundamental concepts of ecology as they relate to insects, including insect

interactions, other insects and their environment. Topics include population and community ecology, plant-insect interactions, insect biodiversity and biogeography, and theoretical and applied ecology. Examples from current entomological and ecological studies are used. Completion of college biology or an introductory course in entomology is recommended.

Learning Outcomes: 1. Comprehend ecological principles at different scales of biological organization, from the individual to the population to the community to the ecosystem. 2. Understand the mechanisms that mediate interactions of insects with their biotic and abiotic environments. 3. Appreciate the importance of insects as stabilizing and destabilizing components of food webs. 4. Recognize the value and application of insect ecology n solving real-world problems. 5. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 3.00

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

SFS 30100 - Agroecology

Credit Hours: 3.00. This course introduces students to the application of ecological concepts to food production systems and farm management. We will consider species interactions, nutrient and water cycles, regenerative practices, alternative approaches to agriculture, and ecosystem services provided to and by agro-ecosystems.

Learning Outcomes: 1. Understand key connections between ecology and agriculture. 2. Apply the agro-ecosystem concept to farming systems. 3. Discuss the relative strengths and weaknesses of conventional and alternative forms of agriculture. 4. Understand the effect of farm management practices on primary productivity, nutrient cycling, and species interaction. 5. Evaluate ecosystem services provided to and by agro-ecosystems. 6. Consider the role of social factors on farming systems. 7. Discuss the potential for ecologically based agriculture to address farming issues at local, regional, and global levels. Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial

advisors when entering the workforce. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

SFS 41100 - Structural Racism In US Agriculture

Credit Hours: 1.00. A discussion-based exploration of the history and legacies of structural racism in American agriculture. We will analyze the barriers to success faced by non-white farmers in the US, the structures that have oppressed minority groups in agriculture, and ways in which these forces might be reversed or resisted.

Learning Outcomes: 1. Deepen an understanding of racism, bias, and white privilege. 2. Develop an understanding of the governmental, institutional, and social structures that have led to racial and ethnic inequities in American agriculture. 3. Understand the relationship of all peoples with American agriculture, whether indigenous or arriving as enslaved person or immigrant, and the legacies of those relationships. 4. Analyze the ways in which immigration and foreign policy impact the US food system. 5. Learn to communicate issues of structural racism in American agriculture effectively. 6. Construct ideas that might promote a more equitable food system. Credits: 1.00

SFS 41200 - Colonialism, Globalization, And Food Justice

Credit Hours: 1.00. This course will uncover the foundations of inequities in access to healthy, nutritious food from the first era of colonization to the modern era of globalization. The course will make students aware of the racial and ethnic inequities in farming and food systems and consider mechanisms of decolonization: resistance against the status quo and the development of new food systems.

Learning Outcomes: 1. Understand the emergence of modern food systems through the eras of colonization and globalization. 2. Analyze the factors that contribute to inequities in access to healthy, nutritious food. 3. Investigate global and local food justice movements. 4. Evaluate the legacies of colonialism in today's food deserts. 5. Investigate local food movements, such as urban agriculture, represent attempts at decolonization. 6. Investigate the activism of indigenous groups around the world seeking decolonization and food justice. 7. Consider policies to reduce inequities in food systems. Credits: 1.00

SFS 41300 - The Cultures And Agricultures Of The United States

Credit Hours: 1.00. The United States is a vast country encompassing many climates, geographies, and human

histories. This course will investigate the diversity of the United States by examining a dozen locations with respect to people-and-place. How have people shaped these places, and how have these places shaped the people who have lived in them?

Learning Outcomes: 1. Understand the different types of land use, especially agriculture, in different regions of the United States, and consider their sustainability. 2. Investigate the cultures and agricultures of American Indian tribes prior to first contact with Europeans. 3. Analyze the displacement and relocation of American Indian tribes in specific regions. 4. Analyze the nature and legacies of slavery, and the means by which African Americans have been excluded from land ownership since reconstruction. 5. Consider the contributions of Asian Americans to the cultures and agricultures of the United States. 6. Investigate changes to the natural, built, and cultural landscapes of the United States through time. 7. Consider how the sustainability of cultures, economies, environmental health, and agriculture can (or cannot) be sustained in different regions of the United States. Credits: 1.00

HORT 32100 - Hydroponics Systems

Credit Hours: 3.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in controlled environment agriculture (CEA). This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

Learning Outcomes: 1. Describe essential components of single-pass and recirculating hydroponic systems. 2. Compare different substrates and hydroponic system designs. 3. Interpret water quality analysis results and recommend corrections. 4. Create nutrient solutions using salts or mixed fertilizers. 5. Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponics. 6. Select hydroponic systems for production of leafy greens, herbs, and vegetable crops. 7. Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

Theatre Design and Production Minor

Requirements for the Minor (15 credits)

A. Required Theatre Courses (5 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more

comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

B. Theatre Selective - Choose One (2 credits)

THTR 16000 - Introduction To Scene Design And Technology

Credit Hours: 2.00. This course is designed to introduce the students to the process and tools of scene design and technology.

Credits: 2.00

THTR 16100 - Introduction To Costume Design And Technology

Credit Hours: 2.00. Introduction to analytical, artistic, and practical skills required when creating costumes for theatre. Beginning training in elements and principles of design, rendering and presentation skills. Elementary instruction in costume construction, including hand and machine sewing, costume crafts, and basic patterning.

Credits: 2.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

C. Theatre Design and Production Selectives (8 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

A. Required Theatre Courses (5 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more

comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

Note

Requirements for the Minor (15 credits)

A. Required Theatre Courses (5 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

B. Theatre Selective - Choose One (2 credits)

THTR 16000 - Introduction To Scene Design And Technology

Credit Hours: 2.00. This course is designed to introduce the students to the process and tools of scene design and technology.

Credits: 2.00

THTR 16100 - Introduction To Costume Design And Technology

Credit Hours: 2.00. Introduction to analytical, artistic, and practical skills required when creating costumes for theatre. Beginning training in elements and principles of design, rendering and presentation skills. Elementary instruction in costume construction, including hand and machine sewing, costume crafts, and basic patterning.

Credits: 2.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate

resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

C. Theatre Design and Production Selectives (8 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

A. Required Theatre Courses (5 credits)

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

Theatre Minor

Requirements for the Minor (15 credits)

A. Required Theatre Courses (6 credits)

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea

through the medium of character in a scene from a published play. Credits: 3.00

B. Theatre Design and Production Selectives - Choose Two (4 credits)

THTR 16000 - Introduction To Scene Design And Technology

Credit Hours: 2.00. This course is designed to introduce the students to the process and tools of scene design and technology.

Credits: 2.00

THTR 16100 - Introduction To Costume Design And Technology

Credit Hours: 2.00. Introduction to analytical, artistic, and practical skills required when creating costumes for theatre. Beginning training in elements and principles of design, rendering and presentation skills. Elementary instruction in costume construction, including hand and machine sewing, costume crafts, and basic patterning.

Credits: 2.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

C. Additional Theatre Selectives (5 credits)

THTR 23300 - Acting II

Credit Hours: 3.00. Continued development of the basic acting tools of objectives, actions, justification, and personalization; continued vocal and physical work; introduction of script and character analysis; and the introduction of audition techniques. The course will use material from contemporary dramatic literature in the rehearsal process. Prerequisite: THTR 133. Instructor permission required for non-majors.

Learning Outcomes: 1. Practice and incorporate relaxation, physical, vocal, and sense memory exercises into a daily warm-up. 2. See, connect, and respond to a partner within improvised scenarios. 3. Read plays with insight and imagine the experience of the characters in the given circumstance of a play. 4. Analyze and break scenes down into beats, with each beat having a clear action and objective. 5. Analyze, rehearse and publicly perform an open scene, and a contemporary monologue and scene. Credits: 3.00

THTR 25600 - Stage Make-Up

Credit Hours: 2.00. Study of facial anatomy, the aging process, the principles of light and shadow, and character analysis. Theory and practice in the basic techniques of applying stage makeup.

Credits: 2.00

THTR 33300 - Acting III

Credit Hours: 3.00. Application of foundational acting techniques to specific disciplines. May be repeated for credit. Instructor permission required for non-majors.

Learning Outcomes: 1. Identify, define, describe and demonstrate the basic principles of the craft of acting. 2. Identify, define, describe and demonstrate the basic terminology of stage technique. 3. Identify, define and describe the basic principles of script & character analysis. 4. Read, investigate, interpret and articulate your analysis of specific plays from the canon of 20th and 21st Century realistic dramatic literature. 5.

Develop critical thinking as it applies to your own work, your peers' work and in production work. Credits: 3.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 35400 - Painting For The Stage

Credit Hours: 3.00. The principles and practice of painting for the stage. Study of tools, media, and techniques used in traditional scenic painting, costume painting, and the creation of dimensionality on various surfaces. Offered alternate years.

Credits: 3.00

THTR 36000 - Scenic Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into an environment for dramatic action. Emphasis on the interrelationship among all aspects of production and how the scenic element becomes a building block toward total picturization. Offered alternate years.

Credits: 3.00

THTR 36100 - Costume Design

Credit Hours: 3.00. Theory and principles of design specifically applied to stage costume design. Emphasis on the interrelationship of all aspects of production and how the costume becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 38000 - Histories Of Theatre

Credit Hours: 3.00. Variable topics in theatre and performance history. Emphasis on the study of the works, aesthetics, and innovations of a theatrical form/genre alongside social, cultural, economic, and political contexts.

Credits: 3.00

THTR 38100 - Theatre And Performance Historiography

Credit Hours: 3.00. Historiographic analysis of theatre, drama, and performance of the 20th and 21st centuries. Emphasis on the relationship between modern and contemporary performance to world history from social, political, and cultural perspectives. Course includes both written and practical components. Prerequisites: THTR 201, THTR 271.

Learning Outcomes: 1. Interpret plays, performances, and performance theory from the 20th and 21st century. 2. Analyze theatre and performance histories through a combination of historical research, critical questioning, and practical application. 3. Demonstrate how political, economic, and cultural structures impact theatre and performance histories of the 20th and 21st Century. 4. Demonstrate skills in research, collaboration, and oral presentation.
Credits: 3.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.).
Credits: 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship

among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

DANC 37900 - The Art Of Protest: An Examination Of The Role Of Arts, Artists, Activism, & Social Transformation

Credit Hours: 3.00. Throughout history, art has been used to advocate for political movements and provoke social action and transformation. This course examines the role of the arts and the artist and their relationship to activism throughout history and beyond. We will investigate how art has been used as a tool to transform cultural perspectives, alter policies, and promote social change. We will explore a range of artists whose methodologies, materials and approach challenge the cultural norms. From printmakers to musicians, to choreographers, to performance artists, students will engage and evaluate the act of art-making as a tactic of resistance and the responses to those acts. We will investigate readings that argue for and against the need for artists to make work that politically challenge their society. Once a foundation of knowledge has been laid, we will turn to the creative process through an investigation of materials and practices - performance, mixed media, and photography. Students will research, watch, discuss, create, and perform their own projects that promote social transformation.

Learning Outcomes: 1. Demonstrate effective oral and written communication in formal assignments, critical analysis, and class presentations. 2. Demonstrate through creative projects how art, culture, and activism have a direct and interactive relationship. 3. Investigate and critically engage with artists whose work transform cultural perspectives, alter policies, provide socio-political commentary, and promote social change. 4. Analyze seminal art and historical and philosophical texts that articulate the role and importance of political art. Credits: 3.00

THTR 48400 - Performance, Media, And Technology

Credit Hours: 3.00. This course explores the intersection of performance, media, and technology from the early 20th century through present day, examining how technological innovations have transformed performance practices and audience experiences.

Learning Outcomes: 1. Describe the historical development of media and technology in 20th and 21st-century performance. 2. Apply theories of liveness, remediation, intermediality, and mediatization toward analysis of contemporary performance practices. 3. Assess the impacts of new media on concepts such as narrative, space, text, and embodiment. 4. Generate strategies for conceptualizing projects that integrate media into performance. Credits: 3.00

A. Required Theatre Courses (6 credits)

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

Notes

Requirements for the Minor (15 credits)

A. Required Theatre Courses (6 credits)

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

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Credits: 2.00

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Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

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Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

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Credits: 2.00

C. Additional Theatre Selectives (5 credits)

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Credits: 3.00

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Credits: 3.00

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Credits: 3.00

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A. Required Theatre Courses (6 credits)

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Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation. 2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

Themed Entertainment Design Minor

About the Minor

Requirements for the Minor (15 credits)

Required Courses (15 credits)

CGT 40700 - Current And Future Trends In Themed Attraction Design

Credit Hours: 3.00. Students will learn about current trends in immersive attractions. Current technologies will be explored that can be used to enhance the narrative in a themed immersive space. Students will explore technologies, narrative techniques and integration of engineering.

Credits: 3.00

CGT 20400 - Introduction To Themed Attraction Design

Credit Hours: 3.00. An introduction to immersive attraction; including the consideration of operations, graphics, engineering, technology and design. Students will apply their knowledge in narration and graphic principles to concept projects in immersive spaces.

Credits: 3.00

CGT 32800 - Business Of Themed Entertainment

Credit Hours: 3.00. This course provides an insider's look at the skills needed to succeed in themed entertainment industry as well as provide an overview of the experience economy. Students will get an insider understanding of the project process, working with outside vendors, team communication, common constraints and budgeting.

Credits: 3.00

CGT 31700 - Planning And Communicating Themed Attraction Design

Credit Hours: 3.00. Building on students knowledge of narrative creation and design, students will learn about the fundamentals of operations, graphics, engineering, technology and design to create theme-based immersive attractions. This course will focus on design concepts, technical design, management and creation of immersive experiences.

Credits: 3.00

CGT 36700 - Previsualization In Themed Entertainment

Credit Hours: 3.00. This course provides an overview of themed entertainment development from concept to previsualization and communication. Students will have the opportunity to take initial concepts for themed experiences and visualize them to communicate to multiple external audiences.

Credits: 3.00

Learning Outcomes

Turf Management Minor

Requirements for the Minor (13 credits)

Required Courses (10 Credits)

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

Selective Course - Choose One (3 Credits)

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn care companies, and sod production facilities in an efficient and environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are

expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

Notes

Unmanned Aerial Systems Minor

Requirements for the Minor (15 credits)

Required Courses (15 credits)

AT 20900 - Autonomous Aircraft Technology And Maintenance I

Credit Hours: 3.00. This course introduces fundamental concepts of autonomous aircraft technology and maintenance. Topics include history, airframe and powerplant selection, regulations governing uncrewed systems, airspace descriptions, safety, autonomous system programming and calibration, data package options, weather, system maintenance and repair, manual flight training, and aerodynamics and flight controls for autonomous aircraft.

Learning Outcomes: 1. Reflect on the history of UAS and project the future growth of UAS. 2. Analyze data sources to determine flight feasibility and mitigate hazards. 3. Collaborate effectively as a crew member both in the lab and in the field. 4. Design and print flight ready 3D model. 5. Assess airspace and flight feasibility by submission of FAA waiver application. 6. Demonstrate effective design choices. Credits: 3.00

AT 21900 - Autonomous Aircraft Technology And Maintenance II

Credit Hours: 3.00. This course will further develop skills and understanding of autonomous aircraft technology and maintenance. Emphasis will be on design, selection, construction, flight test, evaluation, and repair, of stabilized uncrewed aircraft. Students will work hands-on with open-source flight controllers to perform autonomous missions. Additionally, students will design and deploy scenario-specific sensors using student-constructed rotorcraft. Students will be expected to demonstrate their sensor payload through lab and field demonstration and professional documentation.

Learning Outcomes: 1. Apply flight principles to building a UAS capable of performing a specific operation. 2. Analyze and compare flight characteristics of UAS under different environmental and physical conditions. 3. Predict and compare flight characteristics of UAS using different components and configurations. 4. Integrate custom sensor payload into UAS design. 5. Safely and efficiently coordinate automated flights with team members. 6. Develop an enterprise-ready online user manual for UAS and sensor payload. Credits: 3.00

AT 30901 - Introduction To UAS Sensor Technology

Credit Hours: 3.00. This course introduces students to multiple forms of UAS sensors and core fundamentals of Remote Sensing and Geospatial Technology. Students will be introduced to basic data capture and processing techniques and to effectively apply different forms of UAS sensors to real-world applications.

Learning Outcomes: 1. Identify and define core geospatial and remote sensing technology

concepts. 2. Effectively associate and relate UAS sensor technology with related portions of the electromagnetic spectrum. 3. Identify and explain geographic coordinate systems and projections. 4. Process and Create UAS data products within a Geographic Information System. Credits: 3.00

AT 10901 - Introduction To Uncrewed Aircraft System Operations

Credit Hours: 3.00. This course will provide students the aeronautical knowledge required to operate a small UAS in the National Airspace. Students are introduced to various aspects of uncrewed aviation operations, which includes UAS system types and components, regulations and operational approvals, and indoctrination to the civil and commercial applications of UAS. Through the use of UAS simulation technology, students will develop basic small UAS flight skills and successfully complete various UAS operational scenarios. Upon successful completion of the course students will be prepared to obtain a Federal Aviation Administration (FAA) Remote Pilot Certificate with a Small UAS Rating. Permission of department is required.

Learning Outcomes: 1. Obtain an FAA Remote Pilot Certificate with a Small UAS Rating. 2. Understand small UAS terminology and technology. 3. Comply with regulatory framework and understand various UAS approval processes. 4. Understand basic small UAS operating procedures. 5. Appreciate and gain perspective on how to safely operate UAS in the national airspace system. 6. Using simulation technology, demonstrate basic small UAS flight maneuvers and execute basic flight operations. Credits: 3.00

AT 11901 - Uncrewed Aerial Systems: Safety And Risk Management

Credit Hours: 3.00. This course discusses the fundamental concepts of Safety and Risk Management and their application to UAS operations. The course will provide insight into strategies for developing and implementing a formal safety management system (SMS) that effectively supports an organization's UAS operations. In addition, students will gain an understanding of ethical decision-making and its relationship to safety. Laboratory exercises provide students practical application of this knowledge to various UAS operational scenarios, which includes utilizing SMS principles in assessing risks and developing appropriate mitigations. Must possess a valid FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Understand and demonstrate the application of safety and risk management principles to UAS operations. 2. Exemplify the UAS regulatory environment, which includes related regulatory approval and waiver processes. 3. Understand and apply technical data sources to evaluate UAS airworthiness and system health, to include ground and flight testing, troubleshooting, maintenance and repair. 4. Demonstrate the ability to plan and safely complete basic UAS missions that are regulatory compliant. 5. Understand and demonstrate ethical decision-making. Credits: 3.00

Urban Forestry Minor

Requirements for the Minor (16 credits)

A. Required Courses (10 credits)

FNR 44400 - Arboricultural Practices

Credit Hours: 4.00. Course covers a broad spectrum of arboriculture principles and techniques, including pruning, transplanting, fertilization, climbing, rigging, removal, cabling, bracing, lightning protection, hazard tree evaluation, tree appraisal, and street tree inventory.

Learning Outcomes: 1. Recognize and explain the various arboricultural practices that enhance the sustainability of trees in the built environment. 2. Apply essential plant health care practices and arboricultural practices used in the cultivation and management of trees and other woody plants in the built environment including planting, pruning and pest management. Credits: 4.00

FNR 44500 - Urban Forest Issues

Credit Hours: 3.00. This course presents an array of topics germane to the management of trees in the urban environment. This includes the benefits of trees and general tree care, tree

appraisal, tree ordinances, tree inventory and management plans, and tree preservation and construction.

Learning Outcomes: 1. Understand sustainable urban & community forestry and why it is important. 2. Recognize the numerous benefits of urban/community forests to society, and the ecosystem services provided. 3. Identify common issues, challenges and pressures which threaten the urban forest. 4. Recognize the unique features of urban forest systems and how to apply the principles of urban forest management to real-world cases. 5. Acquire an understanding of sustainability as it pertains to urban forests and urban forestry programs in metropolitan regions, cities, towns, communities and neighborhoods. Credits: 3.00

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

B. Selective Courses (6 credits)

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional

salesperson. Credits: 3.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying

macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique

of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

FNR 33800 - Introduction To Silviculture

Credit Hours: 3.00. This course introduces the common silvicultural systems used in North American forests for forestry and wildlife habitat management objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures present theoretical concepts in order to allow students to understand forest management practices, while the recitation portion of this course reviews these concepts in light of wildlife habitat management, biodiversity, and other non-timber resources. The recitation is writing-intensive requiring several reflection papers on assigned readings and a semester-ending term paper on a subject of the student's choosing. Credit cannot be earned for both FNR 33800 and FNR 43900. Permission of department required.

Learning Outcomes: 1. Be familiar with technical silvicultural terminology. 2. Describe the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices affect soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Locate, summarize and evaluate primary and selected secondary literature sources in regards to silvicultural effects on non-timber resources. Credits: 3.00

Notes

Weed Science Minor

Requirements for the Minor (15 credits)

A. Required Courses (6 credits)

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

BTNY 50400 - Advanced Weed Science

Credit Hours: 3.00. Emphasizes the mode and mechanism of herbicide action and herbicide interaction with plants, and the biology and ecology of weedy plants. Offered in odd-numbered years.

Learning Outcomes: 1. Understand the physical, biological, biochemical, and physiological parameters that influence herbicide efficacy from the start to the end of the herbicide mode of action process in plants. 2. Demonstrate the unique differences in the practical use and plant activity of the major herbicide mode of action groups used in the United States. 3. Explain the development of herbicide-resistant crops, the evolution of herbicide-resistant weeds, and apply this knowledge to describe how these factors influence modern weed management practices. 4. Provide a technical analysis comparing the mode of action for herbicides, insecticides, and fungicides and the factors involved with management of pest resistance for these different pesticide groups. Credits: 3.00

BTNY 50500 - Advanced Biology Of Weeds

Credit Hours: 3.00. Principles of weed biology and ecology, with focus on reproduction and ecophysiology, population dynamics, community ecology, and ecosystem level phenomena. Instruction will emphasize the development and refinement of critical thinking skills.

Learning Outcomes: 1. Develop as a scholar by creating a scholarly review paper on a topic or issue related to weed biology. 2. Be able to understand and analyze peer-reviewed scientific literature so that you can engage in informed discussions about weed science. 3. Gain knowledge about key topics in weed biology, including seed and seed bank ecology, effects of biotic and abiotic factors on weed growth, and key theories related to plant invasions. Credits: 3.00

B. Selectives (9 credits)

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

Notes

Wildlife Science Minor

Requirements for the Minor (17 credits)

Required Courses (11 credits)

FNR 24000 - Wildlife In America (UCC: STS)

Credit Hours: 3.00. History of the occurrence, exploitation, and management of North America's wildlife resources. Life histories, habitat relationships, and human impacts on selected species. Current conservation practices and future prospects.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify and describe the diversity of North American wildlife and their habitats in order to improve their ecological study and aid in their management and conservation. 2. Describe and explain fundamental concepts and theories in the field of ecology in order to inform different wildlife conservation and management strategies. 3.

Compare and contrast the various anthropogenic threats to wildlife in order to synthesize and evaluate their impacts on wildlife. 4. Explain and apply approaches and tools used in wildlife conservation and management in order to address anthropogenic threats to wildlife. 5. Evaluate primary literature in order to analyze the merits and weaknesses of current research in the fields of ecology, conservation, and management as they relate to major wildlife groups. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

Selective Courses (6 credits)

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 46000 - International Natural Resources Summer Program

Credit Hours: 3.00. A four-week, intensive program examining the management and conservation of natural resources in Europe and the United States. Jointly taught with faculty and students from the Swedish University of Agricultural Sciences. The program topic and venue change each year, but emphasis is placed on student interaction and internationalization as well as on cross-cultural communication skills within a natural resources framework. Offered in even-numbered years at Purdue University and in odd-numbered years at the Swedish University of Agricultural Sciences in Sweden.

Learning Outcomes: 1. Explain cultural differences in managing natural resources sustainably. 2. Evaluate natural resource use alternatives and policies. 3. Evaluate the sustainability of various landscapes and uses of natural resources. Credits: 3.00

ANTH 23500 - The Great Apes

Credit Hours: 3.00. Students will learn the behavior and conservation of our closest relatives and how early ape studies changed our understanding of what it meant to be human. Topics include gender in science, ethics of research and cross-cultural understandings.

Learning Outcomes: 1. Identify the geographic distribution as well as the anatomical and behavioral traits that characterize great ape species. 2. Explain the major achievements of and challenges to great ape research in the wild and captivity. 3. Demonstrate an understanding of why and how anthropologists use great apes to model human evolution. 4. Describe the ethical issues of conducting research on our closest living relatives and conserving them in the wild. Credits: 3.00

ANTH 33500 - Primate Behavior

Credit Hours: 3.00. This course is an introduction to the primate order and primate studies. The emphasis is on field studies. Ecological influences on social organization and behavior, learning, play, and communication will be considered as adaptations within an evolutionary framework.

Learning Outcomes: 1. Understand the diversity of anatomical and behavioral traits in primates, and how that diversity is taxonomically organized. 2. Describe the science of primatology, critically evaluate scientific research on primates, and contextualize primatology within Anthropology and closely related fields. 3. Communicate an understanding of the relationships among primates and their ecosystems as well as the ecological, evolutionary, and social forces that shape their lives. 4. Appreciate the complexities of the work of preserving and managing primate populations. Credits: 3.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing

biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses

and predictions, develop an experimental design. Credits: 2.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 53600 - Ecology Of Disturbance

Credit Hours: 2.00. Advanced lecture- and discussion-based class examining how disturbance shapes the composition and structure of communities and landscapes across major terrestrial biomes. Students will examine and discuss the relationships between disturbance intensity, frequency, and spatial extent and how these characteristics affect ecological processes and ecologically-based management of forest and grassland ecosystems. The class will also examine the synergistic effects of multiple disturbances and the restoration of endemic disturbance regimes in contemporary ecosystems. Course is reading intensive; students will read and discuss on average 3-8 journal articles per week.

Learning Outcomes: 1. Describe how disturbance shapes community composition and structure for several major terrestrial biomes. 2. Understand how disturbance regulates biological diversity across terrestrial and aquatic ecosystems. 3. Understand the relationship between disturbance intensity, frequency, and spatial extent and how those factors affect management of forest and grassland ecosystems. 4. Describe the synergistic nature of disturbance and identify how disturbance factors interact across a landscape. 5. Describe how contemporary and restored disturbance regimes may facilitate or suppress the spread of invasive species. 6. Understand how management activities can mimic endemic disturbance regimes to promote biodiversity and sustainability. Credits: 2.00

FNR 53601 - Ecology Of Disturbance Practicum

Credit Hours: 1.00. This course is the practicum for FNR 53600 , hence enrollment is contingent upon enrollment in FNR 53600 . Course consists of a one or two-week long field trip to a remote site; prior trips have been taken to the Great Smokey National Park over spring break. Course requires an additional travel fee, depending on location visited.

Learning Outcomes: 1. How disturbance shapes community composition and the distribution of species across landscapes. 2. How alterations to endemic disturbance regimes affect the composition, structure, and function of ecosystems. 3. How interactions between natural disturbance and invasion of exotic species influence forest community development. 4. Management that uses natural disturbance to restore and maintain biotic communities and ecosystems. Credits: 1.00

FNR 54300 - Conservation Biology I

Credit Hours: 3.00. Introduction to conservation biology, including population dynamics and genetic structure of rare organisms. Recovery planning, restoration ecology, environmental policy making, and sustainable developments are considered, as is ethics in conservation of biological diversity. Offered in odd-numbered years. Permission of instructor required.

Learning Outcomes: 1. Read and interpret the scientific literature on conservation of natural resources with an awareness of the current status of what is known about biodiversity, endangered species and ecosystems, biological invasions, and the effects of climate change on natural communities. 2. Explain how conservation research is carried out, and appreciate common pitfalls in designing research for goals of conservation interest. 3. Consider and evaluate the balance between conservation goals and other priorities in land management, societal and economic goals, and socio-political systems. Credits: 3.00

FNR 56700 - Advanced Mammalogy

Credit Hours: 3.00. The class explores approaches to mammalian research and wildlife management through readings, discussions, field, and laboratory exercises. Topics such as mammalian behavior, ecology, phylogeny, taxonomy, and conservation are emphasized. The intention of this class is to help students who have a sincere interest in mammalian research and management to progress beyond identification in their understanding of mammals.

Learning Outcomes: 1. Understand the diversity of topics currently being examined using wild mammal populations and communities. 2. Integrate the results of published research into the design and exploration of research topics in which the students are interested. 3. Exhibit improved abilities in critical thinking, writing, and oral communication in discussing mammalian research and management topics. Credits: 3.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 57100 - Advanced Ornithology

Credit Hours: 3.00. Study of current avian research topics and techniques. Class discussion of recent scientific literature; field and laboratory exercises to illustrate approaches to ornithological research. One weekend field trip is offered. (Offered in even-numbered years.)

Learning Outcomes: 1. Read the scientific literature on birds with a greater awareness of the current status of what is known about birds. 2. Describe how avian research is done and appreciate common pitfalls in designing research on birds. 3. Understand the conservation and management implications of current avian knowledge. Credits: 3.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 43200 - Human-Wildlife Conflicts

Credit Hours: 3.00. Exploration of conflicts between human interests and wildlife and the regulations policies and legislation used to minimize conflicts. Negative interactions may be real or perceived, economic or aesthetic, social or political, and may pose risks to human health and safety. Emphasis on the causes of conflict and resolutions that seek to balance protection or conservation of wildlife with protection of other public resources and individual property owners. Prior knowledge of college-level general biology and ecology is expected.

Learning Outcomes: 1. Identify common causes of human-wildlife conflicts. 2. Evaluate the impacts of the conflict damage/threat. 3. Prescribe options for resolving the conflict. 4. Measure effectiveness of applied mitigation strategies. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes (natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

FNR 33350 - Applied Fire Ecology

Credit Hours: 3.00. Fire, either as a natural disturbance or anthropogenically mediated disturbance, has been a feature of almost every major terrestrial ecosystem in North America. In this era of climate change, land management agencies are increasingly using fire both to manage terrestrial ecosystems and to actively contain wildfire. This class will provide basic understanding to both fire behavior and its ecological impacts on terrestrial ecosystems, focusing on systems common to the Central Hardwood Region. Students will get experience conducting prescribed fire and take Firefighter Type II (FFT2) online training modules, in partial fulfillment of requirements of an Incident Qualification Card (i.e., "red card"). Students will learn how to develop a burn plan for a given property, including assessment of risks, prediction of fire behavior (i.e., BEHAVE model), and estimation of burn effects.

Learning Outcomes: 1. Explain the role of fire in the development of North American ecosystems. 2. Describe fire as a physical and ecological process. 3. Demonstrate the ability to utilize prescribed fire safely. 4. Develop a burn plan to complete a prescribed fire safely and effectively. 5. Evaluate the role of fire as a contemporary management tool. Credits: 3.00

BIOL 58602 - Laboratory In Ecology

Credit Hours: 1.00. This course is intended to complement many of the concepts discussed in BIOL 58601 Ecology Lecture. By studying selected topics in depth, both experimentally and through primary literature, you should gain a greater understanding of ecological principles and the process of science as it is applied to a variety of ecological topics. Permission of department required.

Learning Outcomes: 1. Read and discuss papers from the primary literature. 2. Develop hypotheses and conduct hypotheses testing through discussion of literature and predictions for experiments conducted in class. 3. Write and present on a scientific paper based on experiments conducted in class and lab-related topics. 4. Discuss parametric and non-parametric statistical tests and discuss the proper application of statistical tools. 5. Use multiple field techniques for sampling terrestrial plants, aquatic insects, and avian behavior. Credits: 1.00

Notes

Women's, Gender, & Sexuality Studies Minor

Requirements for the Minor (12 credits)

A. Introductory Course (3 credits)

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

B. Women's Studies (3 credits)

ANTH 28200 - Introduction To LGBTQ Studies

Credit Hours: 3.00. (WGSS 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding if the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 49900 - Independent Study In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of the instructor in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 49200 - Practicum In Women's, Gender, and Sexuality Studies

Credit Hours: 2.00 to 4.00. This course is designed to integrate knowledge derived from women's studies scholarship with practical experience. Students will define their own projects in consultation with women's studies faculty. Periodic conferences and written reports required. Permission of instructor required.

Credits: 2.00 to 4.00

WGSS 48300 - Feminisms In Global Perspective

Credit Hours: 3.00. Explores feminist struggles through the writings of First and Third World feminist scholars. Focuses on feminist projects within and against colonial, nationalist, religious and global contexts. Includes Third World feminist critiques of Western feminisms.

Credits: 3.00

WGSS 48200 - Interdisciplinary Studies In Sexuality

Credit Hours: 3.00. This course offers an interdisciplinary introduction to recent work in lesbian and gay studies in various fields, including literature, history, film, cultural theory, medicine, law, and studies of sexuality.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally.

4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 38300 - Women, Work, And Labor

Credit Hours: 3.00. Examines race, class and gender issues as they affect working women in America. Covering women's work from domestic labor to informal economies to factories, topics include women's participation in trade unions, wage inequalities, family leave policies and sexual harassment.

Learning Outcomes: 1. Have acquired a broad comprehension of the work, including economic activity often not recognized as "work", that women typically have performed or is typically associated with women, world-wide and since the onset of industrialization. 2. Be capable of evaluating current global economic and cultural systems that impact what kinds of labor contemporary women perform, the conditions under which they work, and the nature of the gendered systems of labor that prevail in the U.S. and elsewhere. 3. Gain appreciation for the significance of women's unpaid or underpaid care-work, relational work, affective labor, and the "reproductive" labor underpinning global capitalism and industrialism. 4. Place their own personal lives and contexts within an analytical framework informed by feminist, Marxist, and intersectional perspectives on work and labor. Credits: 3.00

WGSS 38200 - Love, Sex And Sexuality

Credit Hours: 3.00. Explores intimate relationships and marriage practices in Western and non-Western societies from a historical and comparative perspective. Examines the changes in love and marriage in Greco-Roman societies, medieval and modern Europe, China, India and the Muslim world, among others.

Credits: 3.00

WGSS 38100 - Women Of Color In The United States

Credit Hours: 3.00. Explores the diversity of racial and ethnic groups in the United States with a particular emphasis on the histories, experiences, and cultural contributions of women of color. Provides a broad introduction to the intersections of gender, race and ethnicity.

Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 28100 - Variable Topics In Women's, Gender, And Sexuality Studies

Credit Hours: 1.00 to 4.00. This course examines in-depth particular topics from the introductory course in Women's Studies. It addresses gender issues for both men and women. Possible topics include gender and popular culture, women's bodies, body image, and health, masculinities, queering gender and gender transgression.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and

social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 59900 - Selected Topics In Women's Gender And Sexuality Studies

Credit Hours: 3.00. A study of selected topics taught by an instructor in whose particular field of specialization the content of the course falls. Permission of instructor required.

Learning Outcomes: 1. Understand the influence of men's views and control of women's participation in sport across age, race/ethnicity and sexual orientation. 2. Understand feminist perspectives on sport. 3. Clarify the meaning of one's own sport experience. 4. Appreciate the contributions of pioneering women in creating opportunities for women today. 5. Identify obligations to those in future generations regarding access to future sport participation. 6. Understand and appreciate the differences in experiences and perceptions of others through group work and class discussions. 7. Lean how gender ideologies impact women and men's access to sport. 8. Interrogate masculinity and femininity in order to understanding how gender is constructed in and through sport. 9. Enhance students critical thinking and analytical skills Credits: 3.00

WGSS 39000 - Variable Topics In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Variable topics under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they invoke. 3. Apply feminist and queer theorizing of

gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

C. Selectives - Choose Two (6 credits)

PUBH 22500 - Contemporary Women's Health

Credit Hours: 3.00. Examines behavioral, psychological, and sociocultural aspects of women's experience in healthcare systems. Includes the influence of factors such as age, social class, and ethnicity on women's roles as recipients and providers of health care.

Credits: 3.00

PSY 23900 - The Psychology Of Women

Credit Hours: 3.00. The purpose of the course is to provide an overview of the psychology of women. Topics include stereotyping, women and achievement, aggression and power, the psychological concept of androgyny, and attitudes toward feminism.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

AAS 35900 - Black Women Writers

Credit Hours: 3.00. (ENGL 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various

communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

COM 38100 - Gender And Feminist Studies In Communication

Credit Hours: 3.00. This course examines the ways in which communication constructs and maintains our conceptions of gender. It explores different approaches to the study of gender and feminist issues in public, organizational, and mass communication.

Credits: 3.00

ENGL 36000 - Gender And Literature (UCC: HUM)

Credit Hours: 3.00. An introduction to feminist approaches to the study of literature, including poetry, drama, fiction, and/or autobiography. Examines how gender intersects with race, ethnicity, sexual orientation, and class in shaping authorship, reading, and representation.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ENGL 46000 - Studies In Women's Literature

Credit Hours: 3.00. A study of literary works by women according to a specific theme, historical period, genre, or culture, e.g., Nineteenth-Century Women Novelists, Madness in Women's Writing, Caribbean Women Writers. May be repeated only with different topic.

Credits: 3.00

HIST 32900 - History Of Women In Modern Europe (UCC: HUM)

Credit Hours: 3.00. This course examines women's experiences and constructions of femininity in Europe from 1789 to the present, including women in revolutions, state intervention in the family, changing ideas of sexuality, women's movements, women in socialism and fascism, and women in war.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Students will understand the history of women in modern Europe from 1789 to the present by analyzing women's experiences and the social and cultural constructions of femininity as well as the different contexts of class, ethnicity, and nationality in the history of European women. 2. They will think historically and critically about women's participation in revolutions; state interventions in the family; working lives of women; ideals and practices of sexuality; the middle-class model of domesticity and women's responses to it; the role of women and femininity in imperialism; women in socialism, under fascism, and in the transition from communism to capitalism; women's experiences of two world wars; and the rise of feminist movements and contemporary feminisms in Europe. 3. Students will understand the difference between secondary and primary sources. They will read and interpret primary source materials, including fiction, autobiography, and other historical documents including those written by women. 4. Students will develop their critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 37500 - Women In America Since 1870 (UCC: HUM)

Credit Hours: 3.00. A survey of the history of women in the United States from 1870 to the present.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HIST 47700 - Native American Women's History

Credit Hours: 3.00. This course studies the history of indigenous women in North America from pre-contact to the present era, examining their roles through the experience of colonization and decolonization underscoring issues of sovereignty, identity, activism, kinship, public images, and stereotypes.

Credits: 3.00

HIST 48800 - History Of Sexual Regulation In The United States

Credit Hours: 3.00. This course will illuminate broad themes in the historical regulation of sexual violence, consensual sex, and homosexuality. Student will understand and analyze how cultural, social, religious, and moral ideologies have influenced conceptions of deviant and normative sexuality in the United States.

Learning Outcomes: 1. Students will be able to

articulate verbally and in writing what they have learned about the nineteenth and twentieth century history of sexual regulation. 2. Students will be able to identify and analyze the cultural and religious values which informed sexual regulation. 3. Students will develop a deeper understanding of how regulations and reform worked by conducting primary source research and synthesizing it into written arguments. Credits: 3.00

LC 23900 - Women Writers In Translation (UCC: HUM)

Credit Hours: 3.00. An examination of international female writers' literary creativity in the context of women's studies and feminist theory, as articulated in their specific cultural and geographical milieu. Course content will vary in terms of cultural focus. In English.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Develop skills in writing, reading, critical thinking, and oral expression. 2. Gain knowledge of female literary traditions in different geographical milieu and time periods. 3. Increase awareness of the ways in which women writers reflect upon and resist stereotypes of women in literature, and how this process may differ across cultures. 4. Understand fundamental concepts in women's gender and sexuality studies. Credits: 3.00

PHIL 22500 - Philosophy And Gender (UCC: HUM)

Credit Hours: 3.00. An examination of the beliefs, assumptions, and values found in traditional and contemporary philosophical analyses of women. A range of feminist approaches to knowledge, values, and social issues will be introduced.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Improved knowledge of human cultures, creative thinking, critical thinking, integrative learning. Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

SOC 35000 - Sociology Of Family

Credit Hours: 3.00. Designed to provide an understanding of contemporary courtship, marriage, and family interaction as cultural, social, and social-psychological phenomena. Consideration of the major sources of marital strain and conflict within a heterogeneous, rapidly changing society.

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Understand the experiences of people suffering from chronic illness. Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

WGSS 38300 - Women, Work, And Labor

Credit Hours: 3.00. Examines race, class and gender issues as they affect working women in America. Covering women's work from domestic labor to informal economies to factories, topics include women's participation in trade unions, wage inequalities, family leave policies and sexual harassment.

Learning Outcomes: 1. Have acquired a broad comprehension of the work, including economic activity often not recognized as "work", that women typically have performed or is typically associated with women, world-wide and since the onset of industrialization. 2. Be capable of

evaluating current global economic and cultural systems that impact what kinds of labor contemporary women perform, the conditions under which they work, and the nature of the gendered systems of labor that prevail in the U.S. and elsewhere. 3. Gain appreciation for the significance of women's unpaid or underpaid care-work, relational work, affective labor, and the "reproductive" labor underpinning global capitalism and industrialism. 4. Place their own personal lives and contexts within an analytical framework informed by feminist, Marxist, and intersectional perspectives on work and labor. Credits: 3.00

WGSS 38200 - Love, Sex And Sexuality

Credit Hours: 3.00. Explores intimate relationships and marriage practices in Western and non-Western societies from a historical and comparative perspective. Examines the changes in love and marriage in Greco-Roman societies, medieval and modern Europe, China, India and the Muslim world, among others.

Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

ENGL 59700 - Contemporary Black Feminist Literature

Credit Hours: 3.00. An intense examination of recent literary works by black women along with various critical theories constructed about black women's literature, beginning with the premise that black feminism is a "sign to be interrogated, a locus of contradictions."

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

SPAN 54900 - Hispanic Women Writers

Credit Hours: 3.00. A survey of the literature of Hispanic women writers from Latin America, the Caribbean, and Spain in light of their traditions and of feminist literary theory and criticism. Permission of instructor required.

Learning Outcomes: 1. Discuss female characters from an informed perspective, whether applying feminist theories or not . 2. Compare and contrast literary innovations of male and female writers in literary movement since Modernity Credits: 3.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they invoke. 3. Apply feminist and queer theorizing of gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

Notes

Wood Products Manufacturing Technology Minor

Requirements for the Minor (15 credits)

Required Courses (9 credits)

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips.

2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

FNR 48410 - Sustainable Wood Products, Furniture Design And Manufacturing

Credit Hours: 3.00. This project-based course explains principles of product development, furniture construction, strength design, performance testing, and product sustainability (life cycle analysis and end-of-life options). The course familiarizes students with methods such as Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), Computer Numerical Control (CNC) router operation, rapid prototyping, and basics of secondary wood products manufacturing, to build an actual product.

Learning Outcomes: 1. Understand Computer Aided Design (CAD). 2. Understand Computer Aided Manufacturing (CAM). 3. Understand CNC router operation. 4. Understand rapid prototyping. 5. Understand the basics of secondary wood products manufacturing. 6. Understand the principles of sustainable product development. Credits: 3.00

Selective Courses (6 credits)

FNR 41910 - Furniture Product Development And Strength Design

Credit Hours: 3.00. Qualitative and quantitative principles of furniture construction, product development methodology and strength design principles, furniture performance testing, product sustainability and end of life options (LCA, computer-based applications and solutions). Course features laboratory evaluating, furniture joints and furniture structures.

Learning Outcomes: 1. Identify and specify appropriate furniture constructions. 2. Determine whether furniture has adequate strength, stiffness, and durability. 3. Determine whether furniture will meet existing performance standards. 4. Determine product sustainability. Credits: 3.00

AD 49000 - Special Problems In Art And Design

Credit Hours: 1.00 to 6.00. Individual problems in art and design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 43540 - Facilities Planning And Material Handling

Credit Hours: 3.00. This course takes a systematic approach to design of facilities and material handling systems for effective and lean production of goods and services. An array of qualitative and quantitative tools and techniques are introduced and utilized, emphasizing lean principles, waste reduction, and overall efficiency of operations. Flow analysis and optimization tools, including computer simulation, are introduced. Strong emphasis is placed on a comprehensive semester-long team project as an integral component of this course.

Learning Outcomes: 1. Calculate various elements of time study and Takt time. 2. Apply various flow analysis tools. 3. Apply the principles of line balancing. 4. Calculate the efficiency of an assembly line. 5. Calculate facility space requirements. 6. Develop a systematic approach to layout and resource planning, incorporating basic material handling systems. Credits: 3.00

AD 53500 - Furniture Design

Credit Hours: 3.00. Examination of furniture design trends and designers. Explore materials and manufacturing processes. Design and build a full-size seating unit. Shop skills required. Permission of instructor required.

Credits: 3.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

Note

Post-Baccalaureate Certificate

Advanced Methodologies in the Behavioral, Social, and Health Sciences, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

Quantitative Courses

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM).

The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal

articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

ILS 65000 - Introduction To Computational Text Analysis

Credit Hours: 3.00. This course provides an introduction to the methods, debates, and tools of computational text analysis, specifically crafted for the humanities and social science graduate students.

Learning Outcomes: 1. Recognize and assess the possibilities for computational text analysis for research. 2. Find and implement code for text analysis projects. 3. Experiment with both existing and original code. 4. Appraise and critique the limits of computational text analysis for research. 5. Design original projects using course lessons. Credits: 3.00

Qualitative Courses

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview

methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

POL 60800 - Qualitative Methods In Political Science

Credit Hours: 3.00. This course is an introduction to the use of qualitative methods in political science. In addition to a detailed consideration of several leading qualitative approaches to political research, the course will also consider the distinctive issues of research design for qualitative research as well as the

relationship of qualitative and quantitative methods. Prerequisite: POL 50100 Political Science Methodology or equivalent or consent of instructor.

Learning Outcomes: 1. Know and understand the different perspectives and epistemologies related to qualitative research. 2. Know and understand the primary components of qualitative research design. 3. Recognize and apply the common tools for the collection and analysis of qualitative data. 4. Understand the distinctive ethical issues that can arise in qualitative research. 5. Create and compose a research proposal with a substantial qualitative methods component. Credits: 3.00

ANTH 64000 - Foundations And Frameworks: Applying Anthropology

Credit Hours: 3.00. This course focuses on using anthropology to address social issues. The course examines topics including: the history of anthropologists working in applied settings, the relationship between theory and practice, professional ethics, job opportunities, and skills needed as anthropological practitioners. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Identify key questions and concerns in applied anthropology. 2. Speak about the relationship of anthropological theory and practice and how that relationship has been discussed in the discipline. 3. Know about a series of anthropological practice areas and their progression over time. 4. Analyze your own development as an anthropologist by doing career related research and self-reflexive writing in the course. Credits: 3.00

ANTH 64200 - Public Engagement: Using Anthropological Knowledge

Credit Hours: 3.00. This course is about using and communicating anthropological knowledge. We will discuss what it means to work as an anthropologist and public intellectual. Effectively working with stakeholders, presenting information, offering solutions for addressing problems and implementing change are addressed. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Know how to convey your anthropological ideas and findings for multiple purposes and audiences. 2. Be familiar with how some well-known anthropologists have had broad influence inside and outside our discipline. 3. Prepare your anthropological data and information for disseminating to different audiences and outlets. 4. Develop your anthropological critical thinking, writing and presentation skills to become a more effective anthropological communicator. 5. Consider the most successful ways for being an engaged anthropologist in your own areas of interests. Credits: 3.00

ANTH 64100 - Discovery And Design: Making Projects Work

Credit Hours: 3.00. This course is about using anthropology to make projects work. Students will learn anthropological approaches and methods to discover salient aspects of a design problem and use this understanding to devise responses. Anthropological discovery, design and delivery processes are demonstrated. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Be able to use Rapid Assessment Procedures (RAP), the Delphi Technique, Domain Analysis and Cross-Cultural Survey Design. 2. Understand how community projects are put together from goals and objectives, strategies implementation plans and monitoring and evaluation and be able to use that knowledge in effectively designing projects. 3. Write a funding proposal that clearly explains the purpose, impact, and essential features of the project in order to secure funding or other essential support. 4. Apply the skills of anthropological discovery and design in your own practice area of interest. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data

visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

Quantitative Courses

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an

understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data

management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly

digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

ILS 65000 - Introduction To Computational Text Analysis

Credit Hours: 3.00. This course provides an introduction to the methods, debates, and tools of computational text analysis, specifically crafted for the humanities and social science graduate students.

Learning Outcomes: 1. Recognize and assess the possibilities for computational text analysis for research. 2. Find and implement code for text analysis projects. 3. Experiment with both existing and original code. 4. Appraise and critique the limits of computational text analysis for research. 5. Design original projects using course lessons. Credits: 3.00

Additional Program Requirements

Workshops

Work-In-Progress Talks

Capstone Experience

Workshops

Required Courses (12 credits)

Quantitative Courses

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical

questions in the context of strategic communication. Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run

various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

ILS 65000 - Introduction To Computational Text Analysis

Credit Hours: 3.00. This course provides an introduction to the methods, debates, and tools of computational text analysis, specifically crafted for the humanities and social science graduate students.

Learning Outcomes: 1. Recognize and assess the possibilities for computational text analysis for research. 2. Find and implement code for text analysis projects. 3. Experiment with both existing and original code. 4. Appraise and critique the limits of computational text analysis for research. 5. Design original projects using course lessons. Credits: 3.00

Qualitative Courses

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

POL 60800 - Qualitative Methods In Political Science

Credit Hours: 3.00. This course is an introduction to the use of qualitative methods in political science. In addition to a detailed consideration of several leading qualitative approaches to political research, the course will also consider the distinctive issues of research design for qualitative research as well as the relationship of qualitative and quantitative methods. Prerequisite: POL 50100 Political Science Methodology or equivalent or consent of instructor.

Learning Outcomes: 1. Know and understand the different perspectives and epistemologies related to qualitative research. 2. Know and understand the primary components of qualitative research design. 3. Recognize and apply the common tools for the collection and analysis of qualitative data. 4. Understand the distinctive ethical issues that can arise in qualitative research. 5. Create and compose a research proposal with a substantial qualitative methods component. Credits: 3.00

ANTH 64000 - Foundations And Frameworks: Applying Anthropology

Credit Hours: 3.00. This course focuses on using anthropology to address social issues. The course examines topics including: the history of anthropologists working in applied settings, the relationship between theory and practice, professional ethics, job opportunities, and skills needed as anthropological practitioners. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Identify key questions and concerns in applied anthropology. 2. Speak about the relationship of anthropological theory and practice and how that relationship has been discussed in the discipline. 3. Know about a series of anthropological practice areas and their progression over time. 4. Analyze your own development as an anthropologist by doing career related research and self-reflexive writing in the course. Credits: 3.00

ANTH 64200 - Public Engagement: Using Anthropological Knowledge

Credit Hours: 3.00. This course is about using and communicating anthropological knowledge. We will discuss what it means to work as an anthropologist and public intellectual. Effectively working with stakeholders, presenting information, offering solutions for addressing problems and implementing change are addressed. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Know how to convey your anthropological ideas and findings for multiple purposes and audiences. 2. Be familiar with how some well-known anthropologists have had broad influence inside and outside our discipline. 3. Prepare your anthropological data and information for disseminating to different audiences and outlets. 4. Develop your anthropological critical thinking, writing and presentation skills to become a more effective anthropological communicator. 5. Consider the most successful ways for being an engaged anthropologist in your own areas of interests. Credits: 3.00

ANTH 64100 - Discovery And Design: Making Projects Work

Credit Hours: 3.00. This course is about using anthropology to make projects work. Students will learn anthropological approaches and methods to discover salient aspects of a design problem and use this understanding to devise responses. Anthropological discovery, design and delivery processes are demonstrated. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Be able to use Rapid Assessment Procedures (RAP), the Delphi Technique, Domain Analysis and Cross-Cultural Survey Design. 2. Understand how community projects are put together from goals and objectives, strategies implementation plans and monitoring and evaluation and be able to use that knowledge in effectively designing projects. 3. Write a funding proposal that clearly explains the purpose, impact, and essential features of the project in order to secure funding or other essential support. 4. Apply the skills of anthropological discovery and design in your own practice area of interest. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

Quantitative Courses

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad

theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions

of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

ILS 65000 - Introduction To Computational Text Analysis

Credit Hours: 3.00. This course provides an introduction to the methods, debates, and tools of computational text analysis, specifically crafted for the humanities and social science graduate students.

Learning Outcomes: 1. Recognize and assess the possibilities for computational text analysis for research. 2. Find and implement code for text analysis projects. 3. Experiment with both existing and original code. 4. Appraise and

critique the limits of computational text analysis for research. 5. Design original projects using course lessons. Credits: 3.00

GPA Requirements

Transfer Credit Policy

Additional Information

About the Program

African American Studies, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

AAS 57500 - Theories Of African American Studies

Credit Hours: 3.00. This course addresses the development of an African American intellectual tradition. The course will span disciplines and swathes of time in order to understand how scholars not only created new ideas but developed theories that shaped and changed academic inquiry.

Learning Outcomes: 1. Critically analyze & synthesize Theoretical Paradigms of the African American experience. 2. Present material clearly and facilitate discussion. 3. Enhance interpretive skills. 4. Conduct ethical research. Credits: 3.00

AAS 57400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers techniques used by researchers and to interpret scholarly investigation on race, class and gender from an African American perspective.

Learning Outcomes: 1. Critically analyze & synthesize theoretical paradigms of the African American Experience. 2. Apply research methods associated with African American Studies . 3. Enhance interpretive skills. 4. Conduct ethical research. 5. Enhance critical thinking. Credits: 3.00

Selectives (6 credits)

ENGL 59700 - Contemporary Black Feminist Literature

Credit Hours: 3.00. An intense examination of recent literary works by black women along with various critical theories constructed about black women's literature, beginning with the premise that black feminism is a "sign to be interrogated, a locus of contradictions."

Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 61100 - Research Seminar In American Government And Politics

Credit Hours: 3.00. Topics vary. Permission of department required.

Credits: 3.00

SOC 61100 - Social Inequality: Class, Race, And Gender

Credit Hours: 3.00. Survey of major approaches (functional, status attainment, labor market, class, culture) to the sociological study of inequality, including qualitative and quantitative, historical and comparative studies. Students will be asked to complete a project analyzing inequality, which might provide the basis for a publishable paper. Prerequisite: Master's student standing and Sociology majors only.

Credits: 3.00

AAS 59000 - Directed Readings In African American Studies

Credit Hours: 1.00 to 4.00. This directed readings course allows students to work with African American Studies faculty on work that cannot be achieved through one of the regular course offerings. This is a variable topics course that can be satisfied through individual course work with an instructor. A student wishing to earn such credit is required to obtain permission of the instructor in order to enroll for the course. This does not include work for thesis or dissertation projects. Permission of instructor required.

Learning Outcomes: 1. Analyze and synthesize theoretical paradigms involving the African American experience. 2. Enhance interpretive and critical thinking skills. 3. Develop and understand the methodological approaches employed in gathering data, and in presenting material clearly to facilitate discussion. Credits: 1.00 to 4.00

Required Courses (6 credits)

AAS 57500 - Theories Of African American Studies

Credit Hours: 3.00. This course addresses the development of an African American intellectual tradition. The course will span disciplines and swathes of time in order to understand how scholars not only created new ideas but developed theories that shaped and changed academic inquiry.

Learning Outcomes: 1. Critically analyze & synthesize Theoretical Paradigms of the African American experience. 2. Present material clearly and facilitate discussion. 3. Enhance interpretive skills. 4. Conduct ethical research. Credits: 3.00

AAS 57400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers techniques used by researchers and to interpret scholarly investigation on race, class and gender from an African American perspective.

Learning Outcomes: 1. Critically analyze & synthesize theoretical paradigms of the African American Experience. 2. Apply research methods associated with African American Studies . 3. Enhance interpretive skills. 4. Conduct ethical research. 5. Enhance critical thinking. Credits: 3.00

About the Program

Agricultural Sciences Education, Extension, and Communication, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (3 credits)

ASEC 52000 - Foundations Of Agricultural Education, Extension, And Communication

Credit Hours: 3.00. Critical analysis of the historical and philosophical assumptions, current strategic intents and relevant policies underpinning the discipline of agricultural education - inclusive of Extension education and agricultural communication - and project the impact existing economic, social and political issues may have in this field in the next 15 to 25 years. Instructor permission required.

Learning Outcomes: 1. Explain how social and economic conditions in the 19th century helped shape AEEC. 2. Identify and discuss how key events, leaders, driving forces, and policies (i.e., legislation) that shaped AEEC. 3. Compare and contrast similarities and differences among school-based agricultural education, non-formal (Extension) education, and agricultural communication regarding their purpose, development as a field, structure and stakeholders. 4. Discuss the philosophies of pragmatism, behaviorism, and constructivism, and how these philosophical assumptions influenced the policies and practices of AEEC. 5. Identify leaders and what role they played in helping shape AEEC. 6. Discuss how principles of community-based education support the

development of human, cultural and social capital in AEEC. 7. Examine current trends regarding existing organizational structures, enrollment, funding, and collaborative partners of AEEC, and project how current social and economic conditions in the 21st century may impact AEEC. 8. Discuss contemporary leadership and program models for the next 25 years, and analyze visions in AEEC are positioned to address grand challenges visions in AEEC. Credits: 3.00

Selectives (6 credits)

ASEC 55100 - International Engagement And Development Strategies

Credit Hours: 3.00. Sem. S and SS, cr. 3; an overview of cross-disciplinary, cultural, theoretical frameworks, communication tools, and assessment methods applied to international agricultural development and engagement. Lectures, panel discussions, and case studies on appropriate methods of development and engagement, international project planning, intercultural effectiveness, principles of sustainable agricultural, food, community development, and program/project monitoring and evaluation will be the basis of assignments and team work. This eight-week course will provide the theoretical and social frameworks and principles needed to successfully work in multi-agency partnerships on international development projects.

Learning Outcomes: 1. Select the most culturally-appropriate application of disciplinary knowledge and technologies for agriculture, food, natural resources and related sciences in development programs. 2. Deconstruct self biases and intercultural effectiveness and their critical and creative thinking skills for different contexts in appropriate applications of scientific research as creative interventions and evaluation. 3. Differentiate high and low oral and written communication skills, tolerance of cultural ambiguity, and adaptability. 4. Judge the efficacy of applying appropriate theoretical frameworks for engaging stakeholders in projects to create sustainable impact. 5. Determine the relevance of the result of applying principals and applications of ethical decision making and professional development. 6. Reflect on one's progress and abilities to work in multi-disciplinary teams to carryout developing country assessments and conceptualize a viable project proposal under a tight deadline. Credits: 3.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

ASEC 54600 - Communication And Issues Engagement For Agricultural Professionals

Credit Hours: 3.00. In this eight-week online course, students will be exposed to science communication and issues engagement principles. The course is designed primarily for those with little or no formal communication training. Topics

include evidence-based best practices for communicating science; news media and social media influences on controversial science; how to monitor controversial issues; and major theoretical perspectives and strategies for engaging the public on food and agricultural science.

Learning Outcomes: 1. Integrate best communication practices from the literature for engaging audiences about agriculture and science. 2. Analyze audiences and design appropriate messaging based on audience characteristics and needs. 3. Develop and adapt communication strategies for science-based controversial issues. 4. Formulate evidence-based strategies to anticipate controversial issues in agriculture and science. Credits: 3.00

ASEC 53100 - Global Learning For Agriculture, Food And Natural Resources

Credit Hours: 3.00. This is a graduate-level course in which students research, design, and evaluate communication and education methods and theoretical frameworks to apply appropriate cultural, community engagement, targeted outcomes of a population defined by the student. The central experience is an international/intercultural professional development experience immersed in rural and urban communities and cultures. Students will learn and develop global perspectives and effective engagement strategies to address agronomic, cultural, and community engagement realities affecting agriculture, life sciences and natural resources.

Learning Outcomes: 1. Have the skills to distinguish between educational designs needed for different goals and outcomes of global/intercultural learning programs. 2. Understand and apply one's own culture to interact among people with differing cultures, beliefs and values while designing engagement programs. 3. Design an educational intervention/module which is culturally appropriate and meets the needs of the community/learners. 4. Construct meaning from instructional messages, including oral, written and graphic communication applying the intersectionality of Social Identity, Intercultural Sensitivity, and Critical Race theories to engagement situations. 5. Evaluate one's self-awareness and recognition of others such that they can emotionally adapt their thinking and being in global/intercultural engagement efforts. 6. Identify best practices for educational global immersion experience related to food, fiber, and natural resources. Credits: 3.00

Required Courses (3 credits)

ASEC 52000 - Foundations Of Agricultural Education, Extension, And Communication

Credit Hours: 3.00. Critical analysis of the historical and philosophical assumptions, current strategic intents and relevant policies underpinning the discipline of agricultural education - inclusive of Extension education and agricultural communication - and project the impact existing economic, social and political issues may have in this field in the next 15 to 25 years. Instructor permission required.

Learning Outcomes: 1. Explain how social and economic conditions in the 19th century helped shape AEEC. 2. Identify and discuss how key events, leaders, driving forces, and policies (i.e., legislation) that shaped AEEC. 3. Compare and contrast similarities and differences among school-based agricultural education, non-formal (Extension) education, and agricultural communication regarding their purpose, development as a field, structure and stakeholders. 4. Discuss the philosophies of pragmatism, behaviorism, and constructivism, and how these philosophical assumptions influenced the policies and practices of AEEC. 5. Identify leaders and what role they played in helping shape AEEC. 6. Discuss how principles of community-based education support the development of human, cultural and social capital in AEEC. 7. Examine current trends regarding existing organizational structures, enrollment, funding, and collaborative partners of AEEC, and project how current social and economic conditions in the 21st century may impact AEEC. 8. Discuss contemporary

leadership and program models for the next 25 years, and analyze visions in AEEC are positioned to address grand challenges visions in AEEC. Credits: 3.00

About the Program

Applied Data Analytics in Technology, Post-Baccalaureate Certificate

About the Program

Program Requirements

Program Learning Outcomes

About the Program

Applied Heat Transfer, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 51100 - Heat Transfer In Electronic Systems

Credit Hours: 3.00. This course covers both traditional and more innovative methods for heat extraction in electronic systems and the effectiveness and applicability of these methods over a wide range of scales. Special emphasis is given to industry-related applications with experts often attending and presenting material as part of class instruction.

Learning Outcomes: 1. Introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practicing engineers. 2. Provide an appreciation for the applications of first principles to electronics cooling and packaging problems in industry. 3. Provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge. Credits: 3.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

Selectives (6 credits)

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations.
Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory.
Credits: 3.00

ME 51000 - Gas Dynamics

Credit Hours: 3.00. Flow of compressible fluids. One-dimensional flows including basic concepts, isentropic flow, normal and oblique shock waves, Rayleigh line, Fanno line, and simple waves. Multidimensional flows including general concepts, small perturbation theory for linearized flows and method of characteristics for nonlinear flows. Prerequisite: first course in fluid or aerodynamics.

Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

ME 61400 - Computational Fluid Dynamics

Credit Hours: 3.00. Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solution of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Prerequisite: ME 50900 or ME 58100 .

Credits: 3.00

Required Courses (6 credits)

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-

dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 51100 - Heat Transfer In Electronic Systems

Credit Hours: 3.00. This course covers both traditional and more innovative methods for heat extraction in electronic systems and the effectiveness and applicability of these methods over a wide range of scales. Special emphasis is given to industry-related applications with experts often attending and presenting material as part of class instruction.

Learning Outcomes: 1. Introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practicing engineers. 2. Provide an appreciation for the applications of first principles to electronics cooling and packaging problems in industry. 3. Provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge. Credits: 3.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

Additional Information

GPA Requirements

About the Program

Applied Helping Skills, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDPS 50700 - Counseling Multicultural And Diverse Populations

Credit Hours: 3.00. Counseling strategies for multicultural and diverse populations encountered by helping professionals. Among the populations considered are ethnic and cultural minorities, older persons, the gifted, and the disabled.

Learning Outcomes: 1. Examine how social and cultural factors influence the counseling relationship and are reflected in counseling theory and practice. 2. Develop strategies for working with diverse individuals, couples, families, groups, and communities. 3. Develop an awareness of multicultural and pluralistic trends, including characteristics and concerns of specific socially and culturally diverse groups. 4. Examine ethical and legal issues related to counseling diverse populations. Credits: 3.00

EDPS 60000 - Counseling Theories And Techniques

Credit Hours: 3.00. Examination of major counseling theories and counseling techniques, professional and ethical issues. Permission of instructor required.

Learning Outcomes: 1. Utilize theoretical approaches to individual personality, behavior, decision, and life difficulties in clinical settings with clients. 2. Develop and write case conceptualization through active application. 3. Ascertain how counseling theory informs counseling techniques. 4. Theoretically conceptualize client presentations based on the context of diversity-related strengths and limitations of counseling theory (i.e. age, ethnicity, disabilities, language, national origin, race, religion, sexual orientation, and SES). Credits: 3.00

EDPS 60100 - Counseling Theories And Techniques Laboratory

Credit Hours: 3.00. Use of counseling techniques in a supervised laboratory; application of theories and techniques within varying employment settings. Concurrent Prerequisite: EDPS 60000 .

Learning Outcomes: 1. Identify counselor behaviors and characteristics that influence the helping process, including age, gender, ethnic differences, verbal and nonverbal behaviors, and personal characteristics, orientations, and skills. 2. Demonstrate essential interviewing and counseling skills, establishing appropriate counseling goals, designing intervention strategies, evaluating client outcomes, and successfully terminating the counselor-client relationship. Credits: 3.00

Selectives (3 credits)

EDPS 50000 - Group Counseling Theories And Techniques

Credit Hours: 3.00. Theoretical and experiential overview of fundamental elements of group work and group counseling processes. Broad topics include purposes and types of groups, therapeutic factors and stages of leadership skills, and multicultural, ethical, and legal aspects of group counseling.

Learning Outcomes: 1. Differentiate among various types and purposes groups and specializations in group work. 2. Identify the essential group dynamics involved in understanding group interactions. 3. Develop an understanding of the principles and challenges associated with planning a group intervention. 4. Develop an understanding of the principles and challenges associated with implementing a group intervention such as recruitment, therapeutic factors, and developmental stages of group. 5. Compare and contrast different perspectives on group leadership. 6. Examine and discuss the ethical considerations unique to group work. 7. Acquire knowledge regarding diversity-competent group practice. 8. Evaluate empirical findings associated with group work. 9. Consider various approaches to evaluating group processes (e.g., program evaluation) and the outcome of group work. Credits: 3.00

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 62500 - Human Growth And Development

Credit Hours: 3.00. An overview of lifespan development. Study of major development theories of childhood, adolescence, and adulthood. Prerequisite: EDPS 60000 .

Learning Outcomes: 1. Demonstrate knowledge of the nature and needs of individuals at all developmental levels across the life span, including theories of individual and family development and transition. 2. Demonstrate knowledge of major theories of learning and personality development. 3. Demonstrate knowledge of cognitive and emotional aspects of growth, including learning, intellectual, and moral development. Credits: 3.00

Required Courses (9 credits)

EDPS 50700 - Counseling Multicultural And Diverse Populations

Credit Hours: 3.00. Counseling strategies for multicultural and diverse populations encountered by helping professionals. Among the populations considered are ethnic and cultural minorities, older persons, the gifted, and the disabled.

Learning Outcomes: 1. Examine how social and cultural factors influence the counseling relationship and are reflected in counseling theory and practice. 2. Develop strategies for working with diverse individuals, couples, families, groups, and communities. 3. Develop an awareness of multicultural and pluralistic trends, including characteristics and concerns of specific socially and culturally diverse groups. 4. Examine ethical and legal issues related to counseling diverse populations. Credits: 3.00

EDPS 60000 - Counseling Theories And Techniques

Credit Hours: 3.00. Examination of major counseling theories and counseling techniques, professional and ethical issues. Permission of instructor required.

Learning Outcomes: 1. Utilize theoretical approaches to individual personality, behavior, decision, and life difficulties in clinical settings with clients. 2. Develop and write case conceptualization through active application. 3. Ascertain how counseling theory informs counseling techniques. 4. Theoretically conceptualize client presentations based on the context of diversity-related strengths and limitations of counseling theory (i.e. age, ethnicity, disabilities, language, national origin, race, religion, sexual orientation, and SES). Credits: 3.00

EDPS 60100 - Counseling Theories And Techniques Laboratory

Credit Hours: 3.00. Use of counseling techniques in a supervised laboratory; application of theories and techniques within varying employment settings. Concurrent Prerequisite: EDPS 60000 .

Learning Outcomes: 1. Identify counselor behaviors and characteristics that influence the helping process, including age, gender, ethnic differences, verbal and nonverbal behaviors, and personal characteristics, orientations, and skills. 2. Demonstrate essential interviewing and counseling skills, establishing appropriate counseling goals, designing intervention strategies, evaluating client outcomes, and successfully terminating the counselor-client relationship. Credits: 3.00

Additional Information

About the Program

Applied Statistics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

Selectives (6 credits)

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper

statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

Required Courses (6 credits)

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive

theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

Additional Information

About the Program

Aviation Financial Management, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

AT 54600 - Aviation Financial Instruments And Operations

Credit Hours: 3.00. The course concentrates on increasing the understanding of financial expertise in analyzing trading and hedging programs for application in reducing aviation operational risk exposure. The studies include research into the development and use of operational indexes and their possible relation to hedging with commodity and security instruments. Emphasis will be placed on the understanding of current operational measurements and correlations to trading and hedging financial instruments in providing improved risk management in operational environments.

Learning Outcomes: 1. Propose and defend an analysis using operational data, trading, and hedging programs to reduce financial and operational risk in a specific business area in airline operations. 2. Collect, assess, organize, and present the relationships between operational data, financial data, and commodity volatility. 3. Develop and present the impact of complexity on airline business operations. Credits: 3.00

AT 54700 - Airline Revenue Management

Credit Hours: 3.00. This course aims to provide students with experience in airline revenue management applications. Primarily focusing on the commercial operation of airlines, this course covers various contemporary topics such as the segmentation, inventory control, forecasting, budgeting and pricing. This course will use simulations to enhance the overall learning-teaching experience.

Learning Outcomes: 1. Summarize the development of revenue management in the airline industry, and explain the importance of revenue management to business operation of airlines. 2. Interpret concepts such as segmentation, forecasting, budgeting, pricing, revenue management, and yield in the domain of the airlines industry and the broader hospitality sector. 3. Evaluate pricing schemes used by airlines on different markets (for instance, long-haul & short-haul, domestic & international, competitive & dominant, peak season & low season) in real world. 4. Implement inventory control in a simulated environment to respond to the dynamic and complex market conditions. 5. Develop appropriate strategies to optimize revenue for a specific airline (either full-service carrier or low-cost carrier) in a certain market (simulated environment). Credits: 3.00

AT 54800 - Aircraft Asset Management

Credit Hours: 3.00. This course provides the student with a detailed exploration of aircraft asset management programs in both airlines and business aviation organizations. Students analyze and study the critical components of an asset management program, the financial methods in aircraft asset management, acquisition proposals, and development plans of aircraft acquisitions in this course. An airline industry-relevant project is used to improve student reasoning and application of industry standard aircraft asset management analysis procedures to include forecasting techniques, present value calculations, and benefit-cost analyses. This course serves as the foundational knowledge required for AT 54900.

Learning Outcomes: 1. Review critically, synthesize, document and summarize relevant research literature in the field of aircraft asset management, expressing themselves clearly and concisely in writing and oral presentation. 2.

Recognize the critical components of an aircraft asset management program, thoroughly develop a business case for aircraft acquisition, and manage an in-service fleet of aircraft. 3. Develop a simulated asset management team and work effectively and collaboratively as part of the team. 4. Produce a high-quality airline industry aircraft asset management project, conduct financial analyses of aircraft assets, document findings in a paper, and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 54900 - Aircraft Leasing

Credit Hours: 3.00. This course provides students with training and experience managing aircraft leases using financial and risk management methodologies specific to the airline and business aviation industries. Students conduct financial evaluations of leasing versus ownership programs of airlines, as well as analyze debt, equity and capital markets for aircraft financing. The course includes an examination of taxation issues related to aircraft leasing, maintenance reserves, and auditing of aircraft financial performance. The prerequisite for this course is AT 54800.

Learning Outcomes: 1. Review critically, synthesize, document and present relevant research literature in the field of aircraft leasing and financing, expressing themselves clearly and concisely in writing and oral presentation. 2. Explain the necessary components of an aircraft lease, audit in-service aircraft financial performance, thoroughly analyze aircraft maintenance reserves, and summarize taxation issues with aircraft assets. 3. Develop a simulated aircraft leasing management team and work effectively and collaboratively as part of the team. 4. Generate a high-quality aircraft asset leasing project, conduct financial evaluations of leasing and owning options, document findings in a paper and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

Required Courses (12 credits)

AT 54600 - Aviation Financial Instruments And Operations

Credit Hours: 3.00. The course concentrates on increasing the understanding of financial expertise in analyzing trading and hedging programs for application in reducing aviation operational risk exposure. The studies include research into the development and use of operational indexes and their possible relation to hedging with commodity and security instruments. Emphasis will be placed on the understanding of current operational measurements and correlations to trading and hedging financial instruments in providing improved risk management in operational environments.

Learning Outcomes: 1. Propose and defend an analysis using operational data, trading, and hedging programs to reduce financial and operational risk in a specific business area in airline operations. 2. Collect, assess, organize, and present the relationships between operational data, financial data, and commodity volatility. 3. Develop and present the impact of complexity on airline business operations. Credits: 3.00

AT 54700 - Airline Revenue Management

Credit Hours: 3.00. This course aims to provide students with experience in airline revenue management applications. Primarily focusing on the commercial operation of airlines, this course covers various contemporary topics such as the segmentation, inventory control, forecasting, budgeting and pricing. This course will use simulations to enhance the overall learning-teaching experience.

Learning Outcomes: 1. Summarize the development of revenue management in the airline industry, and explain the importance of revenue management to business operation of airlines. 2. Interpret concepts such as segmentation, forecasting, budgeting, pricing, revenue management, and yield in the domain of the airlines industry and the broader hospitality sector. 3. Evaluate pricing schemes used by airlines on different markets (for instance, long-haul & short-haul, domestic & international, competitive & dominant, peak

season & low season) in real world. 4. Implement inventory control in a simulated environment to respond to the dynamic and complex market conditions. 5. Develop appropriate strategies to optimize revenue for a specific airline (either full-service carrier or low-cost carrier) in a certain market (simulated environment). Credits: 3.00

AT 54800 - Aircraft Asset Management

Credit Hours: 3.00. This course provides the student with a detailed exploration of aircraft asset management programs in both airlines and business aviation organizations. Students analyze and study the critical components of an asset management program, the financial methods in aircraft asset management, acquisition proposals, and development plans of aircraft acquisitions in this course. An airline industry-relevant project is used to improve student reasoning and application of industry standard aircraft asset management analysis procedures to include forecasting techniques, present value calculations, and benefit-cost analyses. This course serves as the foundational knowledge required for AT 54900.

Learning Outcomes: 1. Review critically, synthesize, document and summarize relevant research literature in the field of aircraft asset management, expressing themselves clearly and concisely in writing and oral presentation. 2. Recognize the critical components of an aircraft asset management program, thoroughly develop a business case for aircraft acquisition, and manage an in-service fleet of aircraft. 3. Develop a simulated asset management team and work effectively and collaboratively as part of the team. 4. Produce a high-quality airline industry aircraft asset management project, conduct financial analyses of aircraft assets, document findings in a paper, and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 54900 - Aircraft Leasing

Credit Hours: 3.00. This course provides students with training and experience managing aircraft leases using financial and risk management methodologies specific to the airline and business aviation industries. Students conduct financial evaluations of leasing versus ownership programs of airlines, as well as analyze debt, equity and capital markets for aircraft financing. The course includes an examination of taxation issues related to aircraft leasing, maintenance reserves, and auditing of aircraft financial performance. The prerequisite for this course is AT 54800.

Learning Outcomes: 1. Review critically, synthesize, document and present relevant research literature in the field of aircraft leasing and financing, expressing themselves clearly and concisely in writing and oral presentation. 2. Explain the necessary components of an aircraft lease, audit in-service aircraft financial performance, thoroughly analyze aircraft maintenance reserves, and summarize taxation issues with aircraft assets. 3. Develop a simulated aircraft leasing management team and work effectively and collaboratively as part of the team. 4. Generate a high-quality aircraft asset leasing project, conduct financial evaluations of leasing and owning options, document findings in a paper and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

Program Learning Outcomes

GPA Requirements

About the Program

Aviation Safety Management, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

AT 57200 - Human Error And Safety

Credit Hours: 3.00. Explores the definition and nature of human error, error chains, and causal factors in error generation. Error taxonomies are reviewed in order to provide a classification scheme for grouping errors and assessing error criticality. Methods for assessing risk and predicting error generation potentials are learned, as well as strategies for controlling or eliminating errors. Case studies are utilized throughout the course to illustrate course concepts. Permission of instructor required.

Learning Outcomes: 1. Classify and evaluate types of human error using established taxonomies and assess their criticality in complex systems. 2. Analyze the antecedents and causal factors of human error, including those related to equipment, operators, organizational practices, regulatory frameworks, and cultural influences. 3. Apply error investigation methods, including data collection and analysis, to identify patterns and inform risk reduction strategies. 4. Examine case studies critically to propose evidence-based strategies for mitigating error incidents and improving safety outcomes. 5. Develop and present a scholarly research project on a contemporary human factors issue, demonstrating effective written and oral communication skills for professional contexts. Credits: 3.00

AT 57300 - Managing The Risk Of Organizational Accidents

Credit Hours: 3.00. Examines strategies various industries use to assess the risk of organizational accidents and to develop safety management programs to prevent, capture, and recover from conditions that lead to disastrous outcomes. Strategies such as High Reliability Organizations, Operational Risk Management, Behavioral Based Safety, Tripod Delta, and Safety Cultures are explored as successful methods for improving organizational safety in high-risk environments and endeavors. Permission of instructor required.

Learning Outcomes: 1. Explain Reason's model of Organizational Accidents (OA) and its application in understanding accident causation and prevention. 2. Analyze everyday operational events through the lens of the OA model to identify latent risks and contributory factors. 3. Evaluate best practices from safety frameworks such as High Reliability Organizations, Operational Risk Management, and Safety Cultures to mitigate the risk of organizational accidents. 4. Develop a detailed, evidence-based analysis of selected aviation accidents or incidents, incorporating the principles of the OA model. 5. Propose strategies to enhance organizational safety by integrating behavioral-based safety and proactive risk management techniques into safety management systems. Credits: 3.00

AT 67500 - Aviation Safety Program Development

Credit Hours: 3.00. This course is designed to provide graduate students with essential information and practical activities necessary to develop and manage effective and comprehensive safety programs for a wide variety of aviation operations. Students will conduct safety research, analyze data, and make presentations based on developed safety systems. Instructor permission required.

Learning Outcomes: 1. Describe the regulatory

and risk environment in which airline safety offices exist. 2. Describe safety theories and models. 3. Describe human factors and accident causation. 4. Collect and analyze safety related data. 5. Process and disseminate information related to accident prevention and risk minimization. 6. Manage an airline safety office and implement procedures. 7. Design a safety management program for an air career or FBO. Credits: 3.00

Required Courses (12 credits)

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

AT 57200 - Human Error And Safety

Credit Hours: 3.00. Explores the definition and nature of human error, error chains, and causal factors in error generation. Error taxonomies are reviewed in order to provide a classification scheme for grouping errors and assessing error criticality. Methods for assessing risk and predicting error generation potentials are learned, as well as strategies for controlling or eliminating errors. Case studies are utilized throughout the course to illustrate course concepts. Permission of instructor required.

Learning Outcomes: 1. Classify and evaluate types of human error using established taxonomies and assess their criticality in complex systems. 2. Analyze the antecedents and causal factors of human error, including those related to equipment, operators, organizational practices, regulatory frameworks, and cultural influences. 3. Apply error investigation methods, including data collection and analysis, to identify patterns and inform risk reduction strategies. 4. Examine case studies critically to propose evidence-based strategies for mitigating error incidents and improving safety outcomes. 5. Develop and present a scholarly research project on a contemporary human factors issue, demonstrating effective written and oral communication skills for professional contexts. Credits: 3.00

AT 57300 - Managing The Risk Of Organizational Accidents

Credit Hours: 3.00. Examines strategies various industries use to assess the risk of organizational accidents and to develop safety management programs to prevent, capture, and recover from conditions that lead to disastrous outcomes. Strategies such as High Reliability Organizations, Operational Risk Management, Behavioral Based Safety, Tripod Delta, and Safety Cultures are explored as successful methods for improving organizational safety in high-risk environments and endeavors. Permission of instructor required.

Learning Outcomes: 1. Explain Reason's model of Organizational Accidents (OA) and its application in understanding accident causation and prevention. 2. Analyze everyday operational events through the lens of the OA model to identify latent risks and contributory factors. 3. Evaluate best practices from safety frameworks such as High Reliability Organizations, Operational Risk Management, and Safety Cultures to mitigate the risk of organizational accidents. 4. Develop a detailed, evidence-based analysis of selected aviation accidents or incidents, incorporating the principles of the OA model. 5. Propose

strategies to enhance organizational safety by integrating behavioral-based safety and proactive risk management techniques into safety management systems. Credits: 3.00

AT 67500 - Aviation Safety Program Development

Credit Hours: 3.00. This course is designed to provide graduate students with essential information and practical activities necessary to develop and manage effective and comprehensive safety programs for a wide variety of aviation operations. Students will conduct safety research, analyze data, and make presentations based on developed safety systems. Instructor permission required.

Learning Outcomes: 1. Describe the regulatory and risk environment in which airline safety offices exist. 2. Describe safety theories and models. 3. Describe human factors and accident causation. 4. Collect and analyze safety related data. 5. Process and disseminate information related to accident prevention and risk minimization. 6. Manage an airline safety office and implement procedures. 7. Design a safety management program for an air career or FBO. Credits: 3.00

Program Learning Outcomes

GPA Requirements

About the Program

Aviation Sustainability, Post-Baccalaureate Certificate Biochemistry and Molecular Biology, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (8 credits)

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological

macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

Electives (2 credits)

Required Courses (8 credits)

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

Additional Information

About the Program

Biotechnology Quality and Regulation Compliance, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

ABE 51100 - Drug Development

Credit Hours: 3.00. A review of drug discovery and drug development, with emphasis on the regulatory aspects of these activities. Animal preclinical research and human clinical research are discussed in detail. In addition, the process for the assembly of an IND and NDA is discussed along with the Phases (I,II,III) of human clinical trials. The CMC (chemistry manufacturing and control) aspects of drug development are presented along with ICH documents and manufacturing process analytical technologies. The course concludes with a brief review of international regulatory issues and patents.

Learning Outcomes: 1. Comprehend strategies used for biotechnology innovation: regulatory and quality documents and materials in the areas of drug development and discovery. 2. Ability to meld theory and practice. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use data, media and computers to send and respond effectively to communication for varied audiences and purposes. 5. Demonstrate sensitivity to and facility with personal values and ethical principles in professional and social contexts. Credits: 3.00

ABE 51200 - Good Regulatory Practices

Credit Hours: 3.00. Includes a review of the FDA and ICH regulations on good manufacturing, good laboratory, good clinical practices. The meaning of these regulations, the globalization of practices and the roles and responsibilities of various professionals implementing these regulations will be addressed. Special emphasis will be detailed coverage of the process for the assembly and submission of an IND or NDA, and the function of the regulatory affairs department in a pharmaceutical company.

Learning Outcomes: 1. Identify cGMP regulations, and relationship to maintaining control of the chemical and ultimately the drug product with a focus on Phase 3, product introduction, and post marketing. 2. Examine about the regulatory history of the FDA and the GxP framework. 3. Identify NDA and BLA applications, product control including specifications, quality outcomes, critical quality attributes, and ICH framework. 4. Evaluate the

regulations governing the manufacture of drug products, including the methods used to prove this, validation of those methods, validation of the manufacture, quality by design, comparability protocols, and continuous improvement. 5. Identify and evaluate compliance to GMP and warning letters. 6. Evaluate Good Distribution Practices (GDP) and the integration of supply chain controls into the Quality Management System. 7. Learn GCP, clinical regulations, and relationship to ensuring the drug or device is safe and efficacious. 8. Evaluate and describe basic clinical trial design and how to write the investigator's brochure that informs patients (through the informed consent document that they sign) of clinical information. 9. Examine the rigid control that governs the clinical protocols and processes such as compliance oversight procedures, the role of clinical auditors and the process of auditing a clinical trial to ensure that it is done right. 10. Identify about the impact of technology and patient involvement in clinical trials through online resources, such as clinicaltrials.gov, YouTube instruction videos including videos describing GCP for devices. 11. Summarize the impact of recent adverse clinical trial events with innovative applications such as in biologics (Tegerno) and gene therapy (Gelsinger). Students will also identify and describe the role of approved Risk Evaluation and Mitigation Strategies (REMS), pharmacovigilance programs and adverse drug event reporting. 12. Identify and evaluate GLP and regulations that ensure a drug product is safe. 13. Examine GLP protocols, toxicology testing, including animal and human safety, and indicators for safety (irregular heartbeats in animals, etc.). 14. Evaluate the ethical considerations of testing, including impact of falsifying safety testing. 15. Analyze how GLP regulations are implemented during development and testing of devices. 16. Discover how technology and innovation impact the regulatory process. 17. Review data integrity and compliance with cGMP. 18. Evaluate the role of computer systems and computer systems validation. 19. Assess the emerging area of predictive toxicology and the potential for testing without animals. 20. Evaluate and explain innovation in safety and adaptive clinical trials. 21. Examine innovation in CMC including quality by design and predicting the quality of manufacturing on the large scale with small scale experiments, including analytics modeling. 22. Discover how the global environment impacts the regulatory process. 23. Evaluate special considerations of implementing a generic system in the developing and third world country . 24. Analyze global regulatory authorities and WHO PQ process. 25. Examine special considerations of the regulatory process as applied to devices, diagnostics and generics. 26. Identify the importance of design to a device, attributes that lead to the specifications and raw materials for diagnostics and the importance of product equivalence for generics and special considerations for biologics. Credits: 3.00

ABE 51300 - Quality Management, Audits, Inspections

Credit Hours: 3.00. This course provides advanced topics in quality management and business improvement methods that apply to the pharmaceutical industry. Emphasis will be placed on specific issues of industry, audits, and inspections, as well as the successful selection and presentation of business and quality improvement projects to produce compliance and competitive advantage.

Learning Outcomes: 1. Understand quality management definitions, concepts, and guidelines. 2. Define quality and how to establish a quality management system. 3. Define quality plan, describe its purpose for the organization as a whole and identify various functional areas and people that have

responsibility for contributing to its development. 4. Understand the audit process and quality control, including the various approaches to audits, inspections and reviews. 5. Understand basic skills required to manage audits, inspections and reviews. 6. Learn how to set up effective self audit systems. 7. Understand the impact of changing technologies, such as electronic systems, on supporting a quality management system. 8. Understand how quality management functions support global business decisions for asset acquisitions and growth of a company. 9. Understand the key elements of supply chain management, assessing risk, and managing outcomes from supplier and vendor audits. 10. Understand regulatory compliance aspects and implementation of ICH and global quality principles in supply chain management, including good distribution practices. 11. Define a continuous quality improvement or business improvement project within an organization. 12. Select and define continuous quality improvement tools and techniques in order to achieve operational excellence. 13. Develop in-depth knowledge of how to implement and obtain operational excellence and present the findings in a coherent and informative manner. Credits: 3.00

ABE 51500 - Molecular Basis Of Manufacturing

Credit Hours: 3.00. This advanced course addresses important Chemistry Manufacturing and Control (CMC) issues related to manufacturing and quality by design. The course provides important information on strategies for quality by design, manufacturing strategies for early development, the best approaches to analyzing data, and strategies for reporting the information to the FDA. This course will also focus on product design and processing. Using product and process design helps achieve quality by design (QbD), strong development reports, excellent regulatory submissions and allows continuous improvement. The course includes laboratory exercises, laboratory tours, and/or workshops outlining how to interpret the data. Learning Outcomes: 1. Identify GMP manufacturing procedures operations including blending, granulation, drying, compression, coating, etc.; Specifications in manufacturing; Statistical principles important in manufacturing. 2. Characterize GMP manufacturing procedures. 3. Evaluate how drug products (solids, liquids, injectables) are characterized especially related to: Dissolution; Weight variation; Content uniformity; Instrumental methods including X-ray diffraction; Approaches to determining critical quality attributes; Factors that influence the quality of the final product; DOE approaches to product optimization. 4. Construct QOS and Critical quality attributes diagram. 5. Outline how technology and innovation impact the manufacturing process: Strategies for continuous manufacturing; Process analytical technology methods; Innovations in manufacturing methods; How the global manufacturing environment impacts pharmaceutical manufacturing. Credits: 3.00

Required Courses (9 credits)

ABE 51100 - Drug Development

Credit Hours: 3.00. A review of drug discovery and drug development, with emphasis on the regulatory aspects of these activities. Animal preclinical research and human clinical research are discussed in detail. In addition, the process for the assembly of an IND and NDA is discussed along with the Phases (I,II,III) of human clinical trials. The CMC (chemistry manufacturing and control) aspects of drug development are presented along with ICH documents and manufacturing process analytical technologies. The course concludes with a brief review of international regulatory issues and patents. Learning Outcomes: 1. Comprehend strategies used for biotechnology innovation: regulatory and quality documents and materials in the areas of drug development and discovery. 2. Ability to meld theory and practice. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information

and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use data, media and computers to send and respond effectively to communication for varied audiences and purposes. 5. Demonstrate sensitivity to and facility with personal values and ethical principles in professional and social contexts. Credits: 3.00

ABE 51200 - Good Regulatory Practices

Credit Hours: 3.00. Includes a review of the FDA and ICH regulations on good manufacturing, good laboratory, good clinical practices. The meaning of these regulations, the globalization of practices and the roles and responsibilities of various professionals implementing these regulations will be addressed. Special emphasis will be detailed coverage of the process for the assembly and submission of an IND or NDA, and the function of the regulatory affairs department in a pharmaceutical company.

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large scale with small scale experiments, including analytics modeling. 22. Discover how the global environment impacts the regulatory process. 23. Evaluate special considerations of implementing a generic system in the developing and third world country . 24. Analyze global regulatory authorities and WHO PQ process. 25. Examine special considerations of the regulatory process as applied to devices, diagnostics and generics. 26. Identify the importance of design to a device, attributes that lead to the specifications and raw materials for diagnostics and the importance of product equivalence for generics and special considerations for biologics. Credits: 3.00

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Learning Outcomes: 1. Understand quality management definitions, concepts, and guidelines. 2. Define quality and how to establish a quality management system. 3. Define quality plan, describe its purpose for the organization as a whole and identify various functional areas and people that have responsibility for contributing to its development. 4. Understand the audit process and quality control, including the various approaches to audits, inspections and reviews. 5. Understand basic skills required to manage audits, inspections and reviews. 6. Learn how to set up effective self audit systems. 7. Understand the impact of changing technologies, such as electronic systems, on supporting a quality management system. 8. Understand how quality management functions support global business decisions for asset acquisitions and growth of a company. 9. Understand the key elements of supply chain management, assessing risk, and managing outcomes from supplier and vendor audits. 10. Understand regulatory compliance aspects and implementation of ICH and global quality principles in supply chain management, including good distribution practices. 11. Define a continuous quality improvement or business improvement project within an organization. 12. Select and define continuous quality improvement tools and techniques in order to achieve operational excellence. 13. Develop in-depth knowledge of how to implement and obtain operational excellence and present the findings in a coherent and informative manner. Credits: 3.00

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Credit Hours: 3.00. This advanced course addresses important Chemistry Manufacturing and Control (CMC) issues related to manufacturing and quality by design. The course provides important information on strategies for quality by design, manufacturing strategies for early development, the best approaches to analyzing data, and strategies for reporting the information to the FDA. This course will also focus on product design and processing. Using product and process design helps achieve quality by design (QbD), strong development reports, excellent regulatory submissions and allows continuous improvement. The course includes laboratory exercises, laboratory tours, and/or workshops outlining how to interpret the data.

Learning Outcomes: 1. Identify GMP manufacturing procedures operations including blending, granulation, drying, compression, coating, etc.; Specifications in manufacturing; Statistical principles important in manufacturing. 2. Characterize GMP manufacturing procedures. 3. Evaluate how drug products (solids, liquids, injectables) are characterized especially related to: Dissolution; Weight variation; Content uniformity; Instrumental methods including X-ray diffraction; Approaches to determining critical quality attributes; Factors

that influence the quality of the final product; DOE approaches to product optimization. 4. Construct QOS and Critical quality attributes diagram. 5. Outline how technology and innovation impact the manufacturing process: Strategies for continuous manufacturing; Process analytical technology methods; Innovations in manufacturing methods; How the global manufacturing environment impacts pharmaceutical manufacturing. Credits: 3.00

Program Learning Outcomes

About the Program

Branding and Marketing, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Course (3 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

Selectives (6 credits)

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

COM 64600 - Strategic Corporate Branding

Credit Hours: 3.00. This graduate course will survey the theories and processes of business brand design, development, and implementation. The course will examine best practices, trends, and creative strategies used in contemporary business branding. An emphasis will be placed on experiential learning, case study analysis, and the application of relevant theory to provide an in-depth understanding of the development, planning, execution, and evaluation of business brands.

Learning Outcomes: 1. Develop a strong conceptual foundation for formulating creative, meaningful, and effective business brands. 2.

Apply strategic branding concepts to a variety of business needs and applications. 3. Demonstrate an understanding of various branding principles, theories, tools, techniques, and models. 4. Critique real-world brands for their efficacy, impact, and creativity. 5. Develop and present a business branding campaign. Credits: 3.00

COM 64400 - Strategic Personal Branding

Credit Hours: 3.00. This graduate course will examine the theories and processes of personal brand development and self-marketing. The course will examine best practices, trends, and creative strategies used in contemporary personal branding. An emphasis will be placed on experiential learning, self-awareness, image and perceptual management, career development, self-promotion, brainstorming, and effective communication.

Learning Outcomes: 1. Convey deep understanding of personal mission, vision, values, personality, skills, and other key attributes and differentiators. 2. Develop a strong conceptual foundation for formulating distinctive, professional, and effective personal brands. 3. Demonstrate an understanding of various personal branding principles, theories, tools, techniques, and models. 4. Critique real-world personal brands for their authenticity, impact, and effectiveness. 5. Develop and present a personal branding and self-marketing campaign. Credits: 3.00

Program Learning Outcomes

Business Analytics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6-9 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

Selectives (2-5 credits)

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic

optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work. Credits: 2.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive

web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Required Courses (6-9 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached

from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

GPA Requirements

About the Program

Business and Economics Data Analytics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (4 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

Selectives (4-6 credits)

Selectives List #1

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An

integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 58700 - Advanced Quantitative Economics With Python

Credit Hours: 3.00. The main goal of this course is to extend the computational and programming toolkit developed in Quantitative Economics with Python course. In particular, we will cover advanced methods for working with, visualizing and analyzing data in Python. In addition, we will consider more advanced programming techniques including stochastic optimization and dynamic programming. Throughout the course, we will consider a number of applications related to microeconomics, macroeconomics, and econometrics covered in the MS Econ program curriculum.

Learning Outcomes: 1. Gain working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Understand numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 55500 - Economic Forecasting

Credit Hours: 2.00. This course provides an introduction to forecasting methods of current interest in economics. The goal is to equip students with a working knowledge of state-of-the-art techniques that are useful for forecasting macroeconomic variables. The strengths and weaknesses of the techniques will be analyzed and their empirical relevance will be demonstrated through a variety of applications to real data sets. The topics will include univariate prediction models, vector autoregressions, forecasting with large data sets, forecast combinations and forecast evaluation. Particular emphasis will be placed on applications and the issues involved with implementation of the various methods in practice.

Learning Outcomes: 1. Identify the statistical issues involved in forecasting economic data. 2. Analyze the strengths and weaknesses of a variety of forecasting techniques commonly used in economics. 3. Demonstrate the empirical relevance of each forecasting approach through applications to real-world data sets. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the

logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

Selectives List #2

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 55000 - Personnel Economics

Credit Hours: 2.00. Personnel Economics applies micro- and macroeconomic theory to the workings of the labor market while maintaining a focus on incentives in the workplace. The course will investigate the determination of wages and compensation (based on a study of labor demand and supply) and the differences in these forms of payment for labor services across workers within an occupation, across occupations, and across cultures. Other topics to be considered include the connection between investments in education and training and labor market outcomes and estimates of the costs and benefits of immigration and employee turnover and discuss the impact of unions, as well as discrimination in the labor market issues. Permission of department required.

Learning Outcomes: 1. Students will have the tools of economic logic that allow them to evaluate proposals for labor policies on a firm-specific level and on a national level. Credits: 2.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 59100 - Financial Valuation And Decision Making

Credit Hours: 2.00 or 3.00. A comprehensive introduction to finance. The object of this course is to provide the computational framework necessary to appreciate and understand how to make decisions based on sound financial reasoning.

Learning Outcomes: 1. Develop skills in investment decisions and financing decisions. Credits: 2.00 or 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities. 3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care

reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

ECON 58400 - Experimental Economics

Credit Hours: 2.00 or 3.00. This course introduces you to the experimental methods used by economists to study human behavior. These methods analyze data collected in controlled laboratory experiments. Throughout the course, we will discuss different types of experiments that have been extensively researched by experimental economists. To help introduce and motivate each topic, you will participate in weekly synchronous experiments with your classmates over the internet. You will then complete an assignment analyzing the data generated by your class in the online experiment. The following lecture will provide an overview of the theoretical framework and experimental predictions. We will also discuss commonly observed behavior and any relevant explanations for such behavior.

Learning Outcomes: 1. Demonstrate an understanding of the experimental methodology used by economists to study human behavior. 2. Evaluate economic behavior by analyzing and interpreting experimental data and its relationship to common economic models. 3. Identify and explain common insights that experiments provide regarding people's behavior in strategic situations. Credits: 2.00 or 3.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

Selectives List #1

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00

or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 58700 - Advanced Quantitative Economics With Python

Credit Hours: 3.00. The main goal of this course is to extend the computational and programming toolkit developed in Quantitative Economics with Python course. In particular, we will cover advanced methods for working with, visualizing and analyzing data in Python. In addition, we will consider more advanced programming techniques including stochastic optimization and dynamic programming. Throughout the course, we will consider a number of applications related to microeconomics, macroeconomics, and econometrics covered in the MS Econ program curriculum.

Learning Outcomes: 1. Gain working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Understand numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 55500 - Economic Forecasting

Credit Hours: 2.00. This course provides an introduction to forecasting methods of current interest in economics. The goal is to equip students with a working knowledge of state-of-the-art techniques that are useful for forecasting macroeconomic variables. The strengths and weaknesses of the techniques will be analyzed and their empirical relevance will be demonstrated through a variety of applications to real data sets. The topics will include univariate prediction models, vector autoregressions, forecasting with large data sets, forecast combinations and forecast evaluation. Particular emphasis will be placed on applications and the issues involved with implementation of the various methods in practice.

Learning Outcomes: 1. Identify the statistical issues involved in forecasting economic data. 2. Analyze the strengths and weaknesses of a variety of forecasting techniques commonly used in economics. 3. Demonstrate the empirical relevance of each forecasting approach through applications to real-world data sets. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

Required Courses (4 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics

covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

GPA Requirements

About the Program

Business Essentials, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 51400 - Microeconomics (UCC: BSS)

Credit Hours: 2.00. An introduction to microeconomic theory. Analysis of consumer demand, output and input decisions of firms, price determination, economic efficiency, market structures, and market failure.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate the efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 2.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling

these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business

cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Required Courses (9 credits)

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 51400 - Microeconomics (UCC: BSS)

Credit Hours: 2.00. An introduction to microeconomic theory. Analysis of consumer demand, output and input decisions of firms, price determination, economic efficiency, market structures, and market failure.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate the efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 2.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures.

Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

GPA Requirements

About the Program

Communication and Leadership, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

Selectives (6 credits)

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2.

Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

COM 65200 - Communication Education And Training

Credit Hours: 3.00. This course is designed to introduce fundamental concepts related to learning theory and learning design as applied to training and educational settings. The course will examine best practices and strategies with a focus on assessing and enhancing communication-related skills.

Learning Outcomes: 1. Define key communication skills and vocabulary. 2. Understand and apply the basic tenets of learning theory. 3. Design, develop, and evaluate an effective educational workshop or course. Credits: 3.00

COM 64400 - Strategic Personal Branding

Credit Hours: 3.00. This graduate course will examine the theories and processes of personal brand development and self-marketing. The course will examine best practices, trends, and creative strategies used in contemporary personal branding. An emphasis will be placed on experiential learning, self-awareness, image and perceptual management, career development, self-promotion, brainstorming, and effective communication.

Learning Outcomes: 1. Convey deep understanding of personal mission, vision, values, personality, skills, and other key attributes and differentiators. 2. Develop a strong conceptual foundation for formulating distinctive, professional, and effective personal brands. 3. Demonstrate an understanding of various personal branding principles, theories, tools, techniques, and models. 4. Critique real-world personal brands for their authenticity, impact, and effectiveness. 5. Develop and present a personal branding and self-marketing campaign. Credits: 3.00

Required Courses (6 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic

communication through course assignments. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

Additional Information

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for

radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

PUBH 60400 - Public Health Administration

Credit Hours: 3.00. An introduction to the principals of management as applied to public health organizations, particularly local health departments. Topics include the organization of the U.S. public health system, legal and ethical obligations of public health administrators, the public health workforce and human resource issues, public health budgeting and finance, and leadership in the public health agency. The course is designed to introduce master's level students in public health to the management skills necessary to successfully implement a public health program.

Learning Outcomes: 1. Understand the transforming integrated health delivery system in the United States to build collaborative network of care providers. 2. Formulate action plans for process improvement that addresses gaps of public health service areas. 3. Appraise effectiveness of initiatives and programs to determine best practices and benchmarks for delivering public health services. Credits: 3.00

About the Program

Data Science in Finance, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

STAT 54000 - Computational Finance I

Credit Hours: 3.00. An introduction to the mathematical tools and techniques of modern finance theory, in the context of Black-Scholes option pricing. Brownian motion and its stochastic calculus, Ito's formula, and Feynman-Kac formula. Pricing and hedging of claims on Black-Scholes assets. Incomplete markets. Path-dependent options. Stochastic portfolio optimization.

Learning Outcomes: 1. Obtain necessary mathematical background necessary to study quantitative methods in finance. 2. Understand mathematical models of modern financial markets. Credits: 3.00

STAT 57900 - Foundations Of Statistical Machine Learning

Credit Hours: 3.00. This course provides a comprehensive treatment of modern statistical machine learning topics. These include linear regression, kernel method, trees, boosting, and deep neural networks. We understand these subjects from a statistical perspective with some mathematical rigorousness.

Learning Outcomes: 1. Understand classical supervised learning methods such as linear regression, nonlinear regression, random forest, and boosting. 2. Understand classical unsupervised learning methods such as K-means clustering and PCA. 3. Understand modern AI techniques using deep neural networks, such as manifold learning and deep generative models. 4. Practice complex and high dimensional data analysis using the methodology and software packages. Credits: 3.00

STAT 58700 - Machine Learning In Finance

Credit Hours: 3.00. This graduate course on Machine Learning in Finance explores contemporary topics in quantitative finance, including optimal execution, dynamics of limit order books, optimal portfolio selection, and more. The course focuses on illustrating how machine learning methods are applied in these specific areas.

Learning Outcomes: 1. Gain a comprehensive understanding of the latest advancements in machine learning methodologies. 2. Apply these methodologies using practical applications within the context of financial markets. Credits: 3.00

Digital Humanities, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

Selectives (6 credits)

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass

communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

ENGL 60500 - Computers In Language And Rhetoric

Credit Hours: 3.00. Seminar that investigates how computers figure in contemporary theories of text and text making. Typical topics: critiques of technology, hypertext, cyberspace, computer-mediated communication, Internet, electronic writing, online research, pedagogy, and publishing.

Credits: 3.00

ENGL 62800 - Natural Language Processing

Credit Hours: 3.00. (ECE 66900) This course focuses on keyword-driven question answering systems; transition networks; parsing procedures for context-free grammars; theory of transformational grammars; implementation of recursive transition networks; implementation of augmented transition networks; representation of conceptual dependencies; surface semantic conceptual analysis; conceptual dependency parsing; generating natural language from a conceptual base; scripts, plans, and goals; building conversationalist programs. Prerequisite: ENGL 50600 or ECE 57000 .

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

AD 61600 - Electronic And Time-Based Art

Credit Hours: 3.00 to 6.00. This seminar explores contemporary artistic practices in Electronic and Time-Based Art, including emerging fields such as: generative and interactive art, audio-visual installation, and new media performance. The format of the course is a mixture of critique, workshops, research, presentations, and discussion. Permission of department required.

Learning Outcomes: 1. Make use of essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production, collaborative and interdisciplinary team work. 2. Use shared knowledge from online communities that is relevant to their projects. 3. Consider contributing their own findings and knowledge gained in this class to relevant online communities (e.g. arduino.cc, processing.org, instructables.com, makezine.com, etc). 4. Know how to research and find relevant exhibition venues, festivals and competitions. 5. Find the most effective medium for their ideas and concepts. 6. Know how to adjust to a field of artistic expression in which the tools (i.e. digital software and hardware technologies) are changing rapidly. 7. Have developed effective research strategies pertinent to the history of Electronic and Time-Based Art. 8. Able to analyze key works and artists in the merging field of Electronic and Time-Based Art. Be able to place their artistic practice in a rich historical

context of related earlier art forms such as: Kinetic Art, Film, Dada, Fluxus and Performance Art. 9. Understand that "A technology is not merely a system of machines with certain functions; rather, it is an expression of a social world. Electricity, the telephone, radio, television, the computer, and the Internet are not implacable forces moving through history, but social processes that vary from one time period to another and from one culture to another. " (Nye 2006, 47). 10. Improve their writing skills toward successful project and exhibition proposals, artist statements and research papers according to CAA's latest Guidelines for Faculty Teaching in New-Media Arts (2007): "In this emergent field, contributions to theory should be seen as having equal significance as aesthetic productions. " (see: http://www.collegeart.org/guidelines/newmedia07.html). Credits: 3.00 to 6.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 69500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

ILS 63100 - Digital And Analog Archives

Credit Hours: 3.00. Digital and Analog Archives provides an overview of archival theory and practice, including archival arrangement and description, preservation, and digitization best practices. Lab components incorporate archival research, digital reformatting, metadata creation, the creation of digital archives, and presentation of archives to users.

Learning Outcomes: 1. Analyze and think critically about archives. 2. Arrange, describe, preserve archival materials. 3. Conduct archival research; Communicate and defend a research argument. 4. Utilize digital humanities tools to create a digital archives project. Credits: 3.00

ENGL 66900 - Introduction To Visual Theory And Visual Culture

Credit Hours: 3.00. Visual studies is the multidisciplinary study of images, viewers, and vision. Students will be provided with an overview of the theories, practices, and histories of the visual

from a variety of disciplinary perspectives and historical periods. The seminar will be organized around a series of basic questions (such as "What is an image?" "How do images produce meaning?" "What do images do?" "What is vision?") whose responses have come to constitute the field as well as its transdisciplinarity. Readings will be drawn from seminal works in visual theory, cultural semiotics, cultural theory, intermediality, art history, media studies as well as the psychology, philosophy, and science of vision.

Learning Outcomes: 1. Demonstrate knowledge of the theories, practices, and histories of the visual from a variety of disciplinary perspectives and historical periods (including what is an images are and how they produce meaning). 2. Produce a finished conference paper and abstract. 3. Produce a finished undergraduate syllabus on a topic related to the course and student expertise. Credits: 3.00

Required Courses (6 credits)

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

About the Program

Digital Marketing and Analytics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (5-10 credits)

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical

methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

Selectives (1-4 credits)

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely

description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work. Credits: 2.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

Required Courses (5-10 credits)

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

GPA Requirements

About the Program

Digital Media and Communications Technology, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure

to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 62300 - Artificial Intelligence & Social Media

Credit Hours: 3.00. This course provides an overview of the use of artificial intelligence and machine learning technologies in contemporary social media campaign development and management. Students will learn about the technologies, AI tools, theories, issues, challenges, ethical considerations, and best practices that inform the planning and implementation of successful social media communication and audience engagement. Throughout the course, students may engage in experiential learning, case studies, and group projects to apply their knowledge and gain hands-on experience in using AI for social media management.

Learning Outcomes: 1. Analyze the Role of AI in Social Media Communication: Critically evaluate how AI technologies are transforming social media marketing, content personalization, and user-engagement strategies. 2. Apply AI Tools for Social Media Campaigns: Integrate AI tools such as chatbots, sentiment analysis, and predictive analytics into the design and execution of effective social media campaigns. 3. Navigate AI in Social Media Practices: Assess the ethical implications of AI usage in social media, including issues related to privacy, bias, PII, data collection, and transparency, and propose solutions to mitigate these challenges. 4. Measure AI-Driven Social Media Outcomes: Use analytics to measure the effect of AI-enhanced social media strategies on brand awareness, audience engagement, and conversion rates. 5. Understand how artificial intelligence (AI) and machine learning (ML) technologies are used in social media management. 6. Investigate, understand and analyze how AI is leveraged to create personalized content and automate content generation, and the ethical/legal issues involved. 7. Explore and understand how AI is used to collect and analyze social media data for insights and decision-making. Credits: 3.00

Digital Signal Processing - IDE, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

ECE 53800 - Digital Signal Processing I

Credit Hours: 3.00. Theory and algorithms for processing of deterministic and stochastic signals. Topics include discrete signals, systems, and transforms, linear filtering, fast Fourier transform, nonlinear filtering, spectrum estimation, linear prediction, adaptive filtering, and array signal processing.

Learning Outcomes: 1. Understand the autocorrelation and covariance methods of estimating the correlation matrix. 2. Know the Discrete Time Fourier Transform (DTFT) and its relationship to the Discrete Fourier Transform (DFT). 3. Comprehend of parametric methods of spectrum estimation, including autoregressive modeling, minimum variance, linear prediction, and eigendecomposition-based methods. 4. Understand nonparametric

methods of spectrum estimation, including the periodogram and the correlogram. 5. Understand of linear filters, including the Wiener filter, as applied stochastic to signals. 6. Introduce to adaptive filters, including the method of steepest descent and the least-mean-square (LMS) algorithms. Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

Selectives (9 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration,

reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 64100 - Model Based Image And Signal Processing

Credit Hours: 3.00. An advanced treatment of the methods in model-based signal and image processing including stochastic modeling of multidimensional signals, Bayesian estimation, inverse methods, doubly stochastic models, regularized inversion, the EM algorithm, Bayesian networks, Markov chains, optimization, convexity, majorization techniques, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation. Prerequisite: ECE 60000, 63700.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

Required Courses (6 credits)

ECE 53800 - Digital Signal Processing I

Credit Hours: 3.00. Theory and algorithms for processing of deterministic and stochastic signals. Topics include discrete signals, systems, and transforms, linear filtering, fast Fourier transform, nonlinear filtering, spectrum estimation, linear prediction, adaptive filtering, and array signal processing.

Learning Outcomes: 1. Understand the autocorrelation and covariance methods of estimating the correlation matrix. 2. Know the Discrete Time Fourier Transform (DTFT) and its relationship to the Discrete Fourier Transform (DFT). 3. Comprehend of parametric methods of spectrum estimation, including autoregressive modeling, minimum variance, linear prediction, and eigendecomposition-based methods. 4. Understand nonparametric methods of spectrum estimation, including the periodogram and the correlogram. 5. Understand of linear filters, including the Wiener filter, as applied stochastic to signals. 6. Introduce to adaptive filters, including the method of steepest descent and the least-mean-square (LMS) algorithms. Credits: 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

GPA Requirements

About the Program

Distance Education, Post-Baccalaureate Certificate
Dual Language Bilingual Education, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 52301 - Foundations Of Bilingual Education

Credit Hours: 3.00. This course builds foundational and practical knowledge of children's bilingual development and the sociocultural, cognitive, philosophical, and educational basis for high-quality dual language and other bilingual education programs. It focuses on research and current issues related to the bilingual development of emergent bilinguals in K-12 contexts. It is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify the various dimensions of bilingualism, bilingual language use, and bilingual language ability. 2. Outline the dimensions of language proficiency and the challenges of measuring bilingualism. 3. Describe development processes and types of early and late development of bilingualism. 4. Describe the role of translanguaging in bilingual language development and use, and the connections between identity and bilingualism. 5. Describe the role of languages in society, including factors that contribute to language maintenance and loss. 6. Describe the cognitive aspects bilingualism. 7. Identify the features of various models of bilingual education and the theories that guide their implementation. 8. Describe historical and current policies, court decisions, and legislation that have shaped bilingual education. 9. Identify the essential features of strong bilingual programs that lead to high levels of bilingualism and biliteracy. 10. Explore the findings of specific research studies that provide evidence of the effectiveness of well-designed bilingual education programs. 11. Describe the ways bilingual education programs can address the needs of a all bilingual students, including students with exceptionalities and special needs. Credits: 3.00

EDCI 52401 - Teaching Methods In Bilingual Education

Credit Hours: 3.00. Application of theory, research, and guiding principles to providing high-quality instruction in dual language and other bilingual education programs in K-12 education. This course includes a specific focus on both program-level design of effective dual language programs, and effective language and literacy instruction for emergent bilingual students leading to high levels of bilingualism, biliteracy, and academic achievement. This course is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify and describe the principles and key aspects of the structure and curriculum of dual language bilingual education programs. 2. Define biliteracy and the key components of the Literacy Squared model. 3. Identify and describe the principles and key aspects of effective oral language instruction and the development of metalinguistic skills. 4. Identify and describe the principles and key aspects of effective reading instruction across two languages. 5. Identify and describe the principles and key aspects of effective writing instruction across two languages. 6. Identify and describe the principles and key aspects of effective assessment practices across two languages. 7. Develop effective lesson plans for bilingual and biliteracy development. 8. Identify and describe the principles and key aspects of whole school considerations in supporting effective dual language bilingual education programs. Credits: 3.00

Selectives (3 credits)

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

Required Courses (9 credits)

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are

learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 52301 - Foundations Of Bilingual Education

Credit Hours: 3.00. This course builds foundational and practical knowledge of children's bilingual development and the sociocultural, cognitive, philosophical, and educational basis for high-quality dual language and other bilingual education programs. It focuses on research and current issues related to the bilingual development of emergent bilinguals in K-12 contexts. It is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify the various dimensions of bilingualism, bilingual language use, and bilingual language ability. 2. Outline the dimensions of language proficiency and the challenges of measuring bilingualism. 3. Describe development processes and types of early and late development of bilingualism. 4. Describe the role of translanguaging in bilingual language development and use, and the connections between identity and bilingualism. 5. Describe the role of languages in society, including factors that contribute to language maintenance and loss. 6. Describe the cognitive aspects bilingualism. 7. Identify the features of various models of bilingual education and the theories that guide their implementation. 8. Describe historical and current policies, court decisions, and legislation that have shaped bilingual education. 9. Identify the essential features of strong bilingual programs that lead to high levels of bilingualism and biliteracy. 10. Explore the findings of specific research studies that provide evidence of the effectiveness of well-designed bilingual education programs. 11. Describe the ways bilingual education programs can address the needs of a all bilingual students, including students with exceptionalities and special needs. Credits: 3.00

EDCI 52401 - Teaching Methods In Bilingual Education

Credit Hours: 3.00. Application of theory, research, and guiding principles to providing high-quality instruction in dual language and other bilingual education programs in K-12 education. This course includes a specific focus on both program-level design of effective dual language programs, and effective language and literacy instruction for emergent bilingual students leading to high levels of bilingualism, biliteracy, and academic achievement. This course is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify and describe the

principles and key aspects of the structure and curriculum of dual language bilingual education programs. 2. Define biliteracy and the key components of the Literacy Squared model. 3. Identify and describe the principles and key aspects of effective oral language instruction and the development of metalinguistic skills. 4. Identify and describe the principles and key aspects of effective reading instruction across two languages. 5. Identify and describe the principles and key aspects of effective writing instruction across two languages. 6. Identify and describe the principles and key aspects of effective assessment practices across two languages. 7. Develop effective lesson plans for bilingual and biliteracy development. 8. Identify and describe the principles and key aspects of whole school considerations in supporting effective dual language bilingual education programs. Credits: 3.00

About the Program

Environmental Policy, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

Policy Process Course (3 credits)

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

Policy Analysis Tools Courses (3 credits)

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

POL 60600 - Advanced Quantitative Techniques In Political Science

Credit Hours: 3.00. This course deals with advanced quantitative techniques useful in political science research. These include multiple correlation and regression, causal modeling, dynamic (time series) analysis, dimensional analysis (Coombsean scaling, Shepard-Kruskal scaling, and factor analysis), and cross-level inference techniques. Prerequisite: POL 50100 , POL 60500 .

Learning Outcomes: 1. Understand the logic and interpretation of various models. 2. Understand the assumptions underlying various advanced quantitative techniques. 3. Analyze data using advanced quantitative techniques. 4. Learn the appropriate software to apply advanced quantitative techniques. Credits: 3.00

POL 69300 - Interdisciplinary Seminar

Credit Hours: 3.00. Topics vary - Interdisciplinary Seminar. Permission of instructor required.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and

logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

Substantive Courses (6 credits)

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

POL 62300 - Research Seminar In Environmental Policy

Credit Hours: 3.00. Investigation in depth of a substantive aspect of environmental policy or a theoretical approach to environmental policy, with emphasis on student research. Permission of instructor required.

Credits: 3.00

Policy Process Course (3 credits)

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

Required Courses (12 credits)

Policy Process Course (3 credits)

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

Policy Analysis Tools Courses (3 credits)

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

POL 60600 - Advanced Quantitative Techniques In Political Science

Credit Hours: 3.00. This course deals with advanced quantitative techniques useful in political science research. These include multiple correlation and regression, causal modeling, dynamic (time series) analysis, dimensional analysis (Coombsean scaling, Shepard-Kruskal scaling, and factor analysis), and cross-level inference techniques. Prerequisite: POL 50100 , POL 60500 .

Learning Outcomes: 1. Understand the logic and interpretation of various models. 2. Understand the assumptions underlying various advanced quantitative techniques. 3. Analyze data using advanced quantitative techniques. 4. Learn the appropriate software to apply advanced quantitative techniques. Credits: 3.00

POL 69300 - Interdisciplinary Seminar

Credit Hours: 3.00. Topics vary - Interdisciplinary Seminar. Permission of instructor required.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and

interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

Substantive Courses (6 credits)

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

POL 62300 - Research Seminar In Environmental Policy

Credit Hours: 3.00. Investigation in depth of a substantive aspect of environmental policy or a theoretical approach to environmental policy, with emphasis on student research. Permission of instructor required.

Credits: 3.00

Policy Process Course (3 credits)

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

GPA Requirements

About the Program

Executive Construction Management, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

CM 52000 - Preconstruction Project Management

Credit Hours: 3.00. Management and control of projects from authorization to start of construction. Project success factors, conceptual and parametric estimating, design planning and management constructability review techniques and value engineering methods. Real estate transactions. Land zoning, platting, development and pro forma calculations.

Learning Outcomes: 1. Appreciate the real estate site selection process. 2. Understand the zoning and platting process. 3. Develop an understanding of the real estate transaction process. 4. Compare and contrast project delivery systems. 5. Understand the design process. 6. Identify project success factors. 7. Utilize value engineering and constructability

concepts. 8. Understand the role of preconstruction in the project life cycle. 9. Employ early estimating techniques. 10. Analyze projects from a time-value of money perspective. 11. Evaluate the viability of a construction project before authorization. 12. Appreciate roles played by the various participants in the preconstruction process. 13. Ensure adequate risk management measures have been employed. 14. Apply real estate development rules and consider regulatory issues. Credits: 3.00

CM 52500 - Managing Construction Quality And Production

Credit Hours: 3.00. Advanced techniques for assessing the success of construction project management including schedule cost, safety and quality measurements. Impacts of pre planning, human factors, and communication systems on quality and productivity. Statistical methods for analysis of construction operations.

Learning Outcomes: 1. Define construction productivity and quality. 2. Understand the project owner's role, the designer's role, and the construction firm's role in construction, productivity and quality. 3. Demonstrate the ability to manage productivity at the following enterprise levels - company, project, and construction site. 4. Demonstrate the ability to manage construction labor productivity, equipment productivity, and subcontractor productivity. 5. Measure construction labor productivity. 6. Understand the impact that changes have on productivity. 7. Quantify lost productivity. 8. Implement a Total Quality Management (TQM) system. Credits: 3.00

CM 53000 - Construction Operations And Strategic Management

Credit Hours: 3.00. Principles of construction company business management for U.S. companies. Executive-level construction functions including strategic planning, organizational structure, and ownership structure including succession planning.

Learning Outcomes: 1. Undertake company strategic planning. 2. Prepare a company business plan. 3. Create organizational structure. 4. Develop policies and procedures. 5. Manage change. 6. Manage equipment utilization. 7. Ensure contract profitability. 8. Identify and manage other operational concerns. 9. Develop succession plans. 10. Implement succession plans. Credits: 3.00

CM 53500 - Construction Accounting And Financial Management

Credit Hours: 3.00. Accounting techniques, financial methods, and financial management for construction firm management. Analysis techniques for contemporary construction company accounting and finance practice with an emphasis on cash flow analysis and cash management.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction company. 2. Explain the progress billing terms retainage and front loading and discuss the reasons for and against such practice. 3. Identify the accounts applied and their use when the percentage of completion method of accounting is applied. 4. Explain the difference between underbilling and overbilling, discuss why they occur and their impact on cash flow. 5. Apply the following financial analysis techniques to financial statements: line-item analysis, horizontal analysis, vertical analysis, use-source analysis, ratio analysis, cost-volume-profit analysis, and profit center analysis. 6. Prepare the budgeted income statement and develop rates for overhead and profit mark-up, exercise control over company cost, and prepare a cash plan. 7. Apply time value of money principles to various decision making tools when seeking company and project financing and the acquisition of capital assets. Credits: 3.00

CM 54000 - Law For Construction Managers

Credit Hours: 3.00. A study of the legal system and its impact on the construction process. The focus is on the legal obligations, rights and remedies pertaining to the construction

company. Topics include bidding, contracts, and construction changes.

Learning Outcomes: 1. Describe agency relationships, contracts, torts, professional liability, risk management, indemnification, risk sharing and surety bonds. 2. Explain the concept of the design professional as judge. 3. Recognize the procedures for legally terminating a construction contract. 4. Plan the project with a contract law viewpoint. 5. Comply with the legal requirements for competitive bidding. 6. Create as well as to comply with the rights & duties of the construction contract. 7. Demonstrate the ability to apply construction law concepts to subcontracting, changes, payments, performance problems, defects, subsurface problems, time and claims. Credits: 3.00

CM 54500 - Construction Management Training And Development

Credit Hours: 3.00. Identification, training and development of future company leaders. Mentorship as a required, managerial activity, effective delegation of responsibility, and empowerment of subordinates to take initiative.

Learning Outcomes: 1. Interpret the role of the training department in meeting an organization's strategic goals. 2. Analyze the broader organizational context and business environment in order to ensure that training meets business needs and achieves stakeholder support. 3. Use effective investigative and analytical methods to advise and assist clients in identifying needs, at organizational levels, to which training is the most appropriate response. 4. Work with stakeholders to design training events (including formal programs) that are grounded in the principles of learning, are accessible, effective and make timely use of available resources. 5. Incorporate new technology as appropriate into both training and learning processes, and the effective management of the training and development function. 6. Carry out appropriate monitoring and evaluation of training programs, and coordinate with stakeholders on any necessary changes to training provision and practice. 7. Explore models and research relating to the core competencies and behavioral characteristics of effective trainers. Credits: 3.00

CM 55000 - Risk Management In Construction

Credit Hours: 3.00. Analysis of the depth and breadth of risk in construction. Defining key terms and concepts used in various risk management arenas - legal statutes, precedent and case studies relevant to construction risk management, insurance, and surety bonding. Subjects include: contracts, torts, insurance, surety, safety laws, quality, and risk management models. Analysis of case studies to utilize risk management tools and identify issues and possible approaches. Project risk control including management of foreseeable hazards as well as unforeseen conditions.

Learning Outcomes: 1. Overview of risk fundamentals - and how liability drives outcomes. 2. Understand the relationships between insurance, sureties, contractual risk transfer and risk financing. 3. Understand how safety covers direct employees, other parties, and member of the public. 4. Understand the role of incident investigation, and management of claims of various types. 5. Understand quality and how to deliver acceptable project results. 6. Understand the value of Business Continuity Planning and other Crisis Management methods and tools. 7. Understand the value of corporate compliance programs for satisfaction of regulatory and other legal requirements. 8. Understand standards of care, and their evolutionary nature, compelling "compliance as you go." 9. Ability to critically evaluate existing risk management approaches, and apply risk management models to promote successful project outcomes. Credits: 3.00

CM 55500 - Construction Leadership And Marketing

Credit Hours: 3.00. Analysis of organizational leadership at the

executive level. The goals of this course are to introduce and stimulate thought and discussion of leadership theories, characteristics and behaviors of successful leaders, contextual factors affecting leader effectiveness, dynamics of leader-follower relationships, communication, decision-making and contemporary challenges confronting organizational leaders as well as marketing theory, marketing vs. business development, the marketing process, and an introduction to a construction marketing dashboard.

Learning Outcomes: 1. Understand the essential principles of leadership theories and apply the theories in construction management. 2. Comprehend the characteristics and behaviors of successful leaders in the field of construction. 3. Grasp the main contextual factors affecting leader effectiveness. 4. Apply the dynamics of leader-follower relationships in daily operations. 5. Acquire communication, decision-making and other key leadership skills. 6. Recognize the contemporary challenges confronting organizational leaders. 7. Understand the marketing theory, the market process, and marketing vs. business development. 8. Understand and utilize construction marketing dashboard. Credits: 3.00

CM 58100 - Workshop In Building Construction Management Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 8.00

Required Courses (12 credits)

CM 52000 - Preconstruction Project Management

Credit Hours: 3.00. Management and control of projects from authorization to start of construction. Project success factors, conceptual and parametric estimating, design planning and management constructability review techniques and value engineering methods. Real estate transactions. Land zoning, platting, development and pro forma calculations.

Learning Outcomes: 1. Appreciate the real estate site selection process. 2. Understand the zoning and platting process. 3. Develop an understanding of the real estate transaction process. 4. Compare and contrast project delivery systems. 5. Understand the design process. 6. Identify project success factors. 7. Utilize value engineering and constructability concepts. 8. Understand the role of preconstruction in the project life cycle. 9. Employ early estimating techniques. 10. Analyze projects from a time-value of money perspective. 11. Evaluate the viability of a construction project before authorization. 12. Appreciate roles played by the various participants in the preconstruction process. 13. Ensure adequate risk management measures have been employed. 14. Apply real estate development rules and consider regulatory issues. Credits: 3.00

CM 52500 - Managing Construction Quality And Production

Credit Hours: 3.00. Advanced techniques for assessing the success of construction project management including schedule cost, safety and quality measurements. Impacts of pre planning, human factors, and communication systems on quality and productivity. Statistical methods for analysis of construction operations.

Learning Outcomes: 1. Define construction productivity and quality. 2. Understand the project owner's role, the designer's role, and the construction firm's role in construction, productivity and quality. 3. Demonstrate the ability to manage productivity at the following enterprise levels - company, project, and construction site. 4. Demonstrate the ability to manage construction labor productivity, equipment productivity, and subcontractor productivity. 5. Measure construction labor productivity. 6. Understand the impact that changes have on productivity. 7. Quantify lost productivity. 8. Implement a Total Quality Management (TQM) system. Credits: 3.00

CM 53000 - Construction Operations And Strategic Management

Credit Hours: 3.00. Principles of construction company business management for U.S. companies. Executive-level construction functions including strategic planning, organizational structure, and ownership structure including succession planning.

Learning Outcomes: 1. Undertake company strategic planning. 2. Prepare a company business plan. 3. Create organizational structure. 4. Develop policies and procedures. 5. Manage change. 6. Manage equipment utilization. 7. Ensure contract profitability. 8. Identify and manage other operational concerns. 9. Develop succession plans. 10. Implement succession plans. Credits: 3.00

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Credit Hours: 3.00. Accounting techniques, financial methods, and financial management for construction firm management. Analysis techniques for contemporary construction company accounting and finance practice with an emphasis on cash flow analysis and cash management.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction company. 2. Explain the progress billing terms retainage and front loading and discuss the reasons for and against such practice. 3. Identify the accounts applied and their use when the percentage of completion method of accounting is applied. 4. Explain the difference between underbilling and overbilling, discuss why they occur and their impact on cash flow. 5. Apply the following financial analysis techniques to financial statements: line-item analysis, horizontal analysis, vertical analysis, use-source analysis, ratio analysis, cost-volume-profit analysis, and profit center analysis. 6. Prepare the budgeted income statement and develop rates for overhead and profit mark-up, exercise control over company cost, and prepare a cash plan. 7. Apply time value of money principles to various decision making tools when seeking company and project financing and the acquisition of capital assets. Credits: 3.00

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CM 54500 - Construction Management Training And Development

Credit Hours: 3.00. Identification, training and development of future company leaders. Mentorship as a required, managerial activity, effective delegation of responsibility, and empowerment of subordinates to take initiative.

Learning Outcomes: 1. Interpret the role of the training department in meeting an organization's strategic goals. 2. Analyze the broader organizational context and business environment in order to ensure that training meets business needs and achieves stakeholder support. 3. Use effective investigative and analytical methods to advise and assist clients in identifying needs, at organizational levels, to which training is the most appropriate response. 4. Work with

stakeholders to design training events (including formal programs) that are grounded in the principles of learning, are accessible, effective and make timely use of available resources. 5. Incorporate new technology as appropriate into both training and learning processes, and the effective management of the training and development function. 6. Carry out appropriate monitoring and evaluation of training programs, and coordinate with stakeholders on any necessary changes to training provision and practice. 7. Explore models and research relating to the core competencies and behavioral characteristics of effective trainers. Credits: 3.00

CM 55000 - Risk Management In Construction

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Learning Outcomes: 1. Overview of risk fundamentals - and how liability drives outcomes. 2. Understand the relationships between insurance, sureties, contractual risk transfer and risk financing. 3. Understand how safety covers direct employees, other parties, and member of the public. 4. Understand the role of incident investigation, and management of claims of various types. 5. Understand quality and how to deliver acceptable project results. 6. Understand the value of Business Continuity Planning and other Crisis Management methods and tools. 7. Understand the value of corporate compliance programs for satisfaction of regulatory and other legal requirements. 8. Understand standards of care, and their evolutionary nature, compelling "compliance as you go." 9. Ability to critically evaluate existing risk management approaches, and apply risk management models to promote successful project outcomes. Credits: 3.00

CM 55500 - Construction Leadership And Marketing

Credit Hours: 3.00. Analysis of organizational leadership at the executive level. The goals of this course are to introduce and stimulate thought and discussion of leadership theories, characteristics and behaviors of successful leaders, contextual factors affecting leader effectiveness, dynamics of leader-follower relationships, communication, decision-making and contemporary challenges confronting organizational leaders as well as marketing theory, marketing vs. business development, the marketing process, and an introduction to a construction marketing dashboard.

Learning Outcomes: 1. Understand the essential principles of leadership theories and apply the theories in construction management. 2. Comprehend the characteristics and behaviors of successful leaders in the field of construction. 3. Grasp the main contextual factors affecting leader effectiveness. 4. Apply the dynamics of leader-follower relationships in daily operations. 5. Acquire communication, decision-making and other key leadership skills. 6. Recognize the contemporary challenges confronting organizational leaders. 7. Understand the marketing theory, the market process, and marketing vs. business development. 8. Understand and utilize construction marketing dashboard. Credits: 3.00

CM 58100 - Workshop In Building Construction Management Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 8.00

Program Learning Outcomes

About the Program

Financial Economics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (4-5 credits)

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

Selectives List #1 (2-3 credits)

ECON 58500 - Behavioral Economics

Credit Hours: 2.00 or 3.00. This course explores human economic behavior, with a strong emphasis on laboratory and field experiment methodology used in behavioral economics research. Topics considered include behavior in markets for financial assets and auction markets, and behavior in social dilemmas that arise when people try to provide public goods voluntarily or increase economic surplus through trust. Students will also study how people bargain with and exhibit social preferences towards others. Decision-making and anomalies for risky uncertain choices will also be covered.

Credits: 2.00 or 3.00

ECON 53800 - International Economics

Credit Hours: 2.00 or 3.00. The course covers selected topics in international trade with a focus on real world applications.

Learning Outcomes: 1. Identify the effects of international trade on wages, prices or products and welfare of nations. 2. Develop models as well as a diverse set of academic papers to discuss current policy debates. Credits: 2.00 or 3.00

ECON 59100 - Financial Valuation And Decision Making

Credit Hours: 2.00 or 3.00. A comprehensive introduction to finance. The object of this course is to provide the computational framework necessary to appreciate and understand how to make decisions based on sound financial reasoning.

Learning Outcomes: 1. Develop skills in investment decisions and financing decisions. Credits: 2.00 or 3.00

ECON 58400 - Experimental Economics

Credit Hours: 2.00 or 3.00. This course introduces you to the experimental methods used by economists to study human behavior. These methods analyze data collected in controlled laboratory experiments. Throughout the course, we will discuss different types of experiments that have been extensively researched by experimental economists. To help introduce and motivate each topic, you will participate in weekly synchronous experiments with your classmates over the internet. You will then complete an assignment analyzing the data generated by your class in the online experiment. The following lecture will

provide an overview of the theoretical framework and experimental predictions. We will also discuss commonly observed behavior and any relevant explanations for such behavior.

Learning Outcomes: 1. Demonstrate an understanding of the experimental methodology used by economists to study human behavior. 2. Evaluate economic behavior by analyzing and interpreting experimental data and its relationship to common economic models. 3. Identify and explain common insights that experiments provide regarding people's behavior in strategic situations. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

Selectives List #2 (4-5 credits)

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 55000 - Personnel Economics

Credit Hours: 2.00. Personnel Economics applies micro- and macroeconomic theory to the workings of the labor market while maintaining a focus on incentives in the workplace. The course will investigate the determination of wages and compensation (based on a study of labor demand and supply) and the differences in these forms of payment for labor services across workers within an occupation, across occupations, and across cultures. Other topics to be considered include the connection between investments in education and training and labor market outcomes and estimates of the costs and benefits of immigration and employee turnover and discuss the impact of unions, as well as discrimination in the labor market issues. Permission of department required.

Learning Outcomes: 1. Students will have the tools of economic logic that allow them to evaluate proposals for labor policies on a firm-specific level and on a national level. Credits: 2.00

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and

interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.
Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities.

3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

Required Courses (4-5 credits)

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained

optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

About the Program

Foundations of Artificial Intelligence, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (7 credits)

SCLA 52200 - Artificial Intelligence Policy, Governance, And Ethics

Credit Hours: 3.00. This course provides students with a strong grounding in the policy, ethical, and legal regulatory dimensions and environment that shape the governance of AI. Students will analyze current and emerging laws, regulations, and governance strategies shaping the AI landscape across multiple jurisdictions and sectors. The course will help students gain an interdisciplinary understanding of the core ethical principles and values that guide AI.

Learning Outcomes: 1. Describe key stakeholders, institutions, and strategies involved in AI policymaking across multiple levels of government (local to global) in multiple fields and explain their roles in governing AI systems. 2. Evaluate the legal, regulatory, and other governance strategies that have been proposed or adopted by governments, firms, and civil society organizations, such as model cards, liability frameworks, standards, and impact assessments. 3. Analyze ethical and social issues related to the development and application of AI systems within multiple fields, including power, model bias, transparency, accountability, worker well-being, and privacy, as well as the translation of ethical values into technical aspects of AI governance practices within public and private, and non-profit sector organizations. 4. Synthesize, analyze, and communicate information about emerging policy issues in AI and the associated ethical and social dimensions, identify stakeholder perspectives, and summarize proposed solutions. 5. Assess current and evolving trends, debates, and solutions in AI governance and ethics through case studies, contemporary issues, and comparative analysis. Credits: 3.00

SCLA 52100 - Societal Impacts Of Artificial Intelligence

Credit Hours: 3.00. Students in this course will draw upon knowledge from multiple fields to understand how AI is transforming social, political, and economic practices in institutions and in society. They will utilize interdisciplinary theories and methodological tools to measure and evaluate the societal impacts of AI. The utilizes a mix of case and source data and recent research in the field of AI to create opportunities for shared communication and learning among those in technical and non-technical fields that utilize artificial intelligence. Students will engage in systematic analysis of societal impact.

Learning Outcomes: 1. Describe how AI is transforming social, political, and economic

institutions, practices and employment in multiple sectors, including healthcare, education, finance, communications, criminal justice and others. 2. Explain the nature of risks of AI in society and outline common strategies to manage risks. 3. Evaluate core theories used to understand AI's potential societal impact on connectedness, trust, creativity, and conflict. 4. Assess and communicate AI impacts by applying interdisciplinary tools drawing from social sciences, humanities, and STEM fields. 5. Identify the human rights implications of AI and understand potential mitigation practices. Credits: 3.00

GRAD 50200 - Interdisciplinary AI Fundamentals: Bridging Knowledge

Credit Hours: 1.00. This course provides foundational concepts for AI for those in both MSAI majors. This course covers the history of AI, the foundations of artificial reasoning and knowledge, and practical skills for communicating about AI technology, projects, and workflow. This graduate course, designed to be accessible to learners with diverse backgrounds, serves as a foundational introduction to the field of AI. Whether you come from a technical or non-technical background, this course will provide you with a solid grasp of AI concepts, principles, and their real-world applications. To be successful in this course, we encourage students to know math (e.g., algebra and calculus) and a basic understanding of programming (e.g., R, Python, or Java).

Learning Outcomes: 1. Describe the foundations of artificial reasoning, knowledge, and trace the historical development of AI. 2. Explain the basic concepts, terminologies, and applications of different AI algorithms, developing a problem-solving mindset applicable to various domains. 3. Examine the diverse range of AI applications across varied industries. 4. Explain the role human factors and social context play in the development of artificial intelligence. Credits: 1.00

Selective (2 credits)

GRAD 50400 - Advanced AI Fundamentals For Technical Professional

Credit Hours: 2.00. Artificial Intelligence (AI) is the driving force behind the transformation of industries, research, and technology. For students with a highly technical background, this 2-credit hour graduate course offers a deep dive into the fundamental principles, theories, and applications of AI. Specifically, this course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focus on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation. To be successful in this course students should have experience with programming such as Python and R and have a background that includes calculus, linear algebra, algorithms, and probability theory.

Learning Outcomes: 1. Identify key elements of Artificial Intelligence (AI) and Machine Learning (ML) algorithms. 2. Understand how to choose AI/ML algorithms for different analysis tasks. 3. Analyze data in both an exploratory and targeted manner using AI and ML approaches. 4. Implement and apply basic AI/ML algorithms for supervised and unsupervised learning. 5. Accurately evaluate the performance of AI/ML algorithms, as well as formulate and test hypotheses. Credits: 2.00

GRAD 50300 - AI Essentials: A Non-Technical Introduction

Credit Hours: 2.00. This course provides students on the translator track a foundation in the principles and methodologies of Artificial Intelligence (AI) to empower them to actively engage in interdisciplinary collaborations. With a focus on the essentials of AI, machine learning, and natural language processing, students will gain the knowledge and skills needed to bridge the gap between language and technology. Students will leverage AI tools and techniques to enhance translation efficiency, accuracy, and engagement in the ever-evolving digital landscape. Students will have a foundation in the methodology so they can effectively participate in interdisciplinary collaborations, serving as a valuable resource for industries where language and technology converge.

Learning Outcomes: 1. Explain the basic concepts and applications of different AI algorithms and how they apply for specific fields

for application or research purposes. 2. Describe the types of data inputs and outputs used in different AI applications. 3. Define a project and apply basic AI approaches in a programming environment. 4. Communicate methods and results of an AI project to specialists and non-specialists. Credits: 2.00

Program Learning Outcomes

Foundations of Data Science, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (3 credits)

GRAD 50500 - Foundations In Data Science

Credit Hours: 3.00. This course is the inaugural course in the Master of Science in Data Science program. Tailored for students with a technical background, this course provides a comprehensive introduction to key concepts, statistical techniques, and tools foundational to the field of data science. The syllabus integrates hands-on experience, ethical considerations, programming refresher, and agile project management principles to equip students with a robust foundation for their data science journey.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of core data science concepts and articulate the significance of data in various domains. 2. Acquire skills to perform exploratory data analysis, identify patterns, and make informed decisions based on statistical inference. 3. Analyze ethical dilemmas arising in data-driven contexts, apply ethical decision-making models, and navigate the legal implications of data handling and analysis. 4. Demonstrate a comprehensive understanding of programming fundamentals and the application of agile methodologies to manage and execute data science projects. 5. Access, navigate, and employ Purdue's computing resources available through Purdue's Rosen Center for Advanced Computing (RCAC). Credits: 3.00

Foundational Selective (3 credits)

GRAD 50600 - Big Data Tools And Technologies

Credit Hours: 3.00. This course is designed to equip students with the essential skills to handle big data effectively. It covers proficiency in big data technologies, scalable data processing techniques, and the integration of big data tools into data science workflows.

Learning Outcomes: 1. Demonstrate proficiency in big data technologies. 2. Apply scalable data processing techniques to handle large datasets. 3. Integrate big data tools into comprehensive data science workflows. 4. Demonstrate proficiency with cloud computing. Credits: 3.00

GRAD 50700 - Cross Domain Data Communication And Visualization

Credit Hours: 3.00. This course focuses on the proficient use of data communication strategies and competencies. The course will focus on identifying data narratives, generating stories from data, illustrating with powerful and self-explanatory visualization, and basic principles of ethical use of non-data narrative frames for data communication. Designed for students with a technical background pursuing a Master of Science in Data Science, this course aims to enhance students' ability to extract and communicate meaning and narratives from raw data and visually represent it.

Learning Outcomes: 1. Create effective and aesthetically pleasing data visualizations. 2. Communicate complex data findings clearly to diverse audiences. 3. Utilize interactive visualization techniques for dynamic exploration of datasets. 4. Develop the ability to integrate ethics and data privacy considerations effectively when communicating with data. Credits: 3.00

GRAD 50800 - Data Analytics

Credit Hours: 3.00. This course provides an in-depth exploration of advanced data analysis techniques, predictive modeling, ensemble methods, and proficiency in data manipulation and transformation. It is designed for students with a technical background pursuing a Master of Science in Data Science.

Learning Outcomes: 1. Apply advanced data analysis techniques to extract meaningful insights from complex datasets. 2. Implement predictive modeling and ensemble methods for accurate data-driven predictions. 3. Demonstrate proficiency in data manipulation and transformation techniques. Credits: 3.00

GRAD 50900 - Applied Machine Learning: From Foundations To Latest Advances

Credit Hours: 3.00. This course provides an in-depth exploration of machine learning algorithms and data mining techniques, building on the foundational concepts introduced in the Foundations of Data Science course. Students will develop a comprehensive understanding of various machine learning algorithms, focusing on practical applications and hands-on experience. Additionally, the course will cover data mining techniques for dimension reduction and pattern discovery.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of popular machine learning algorithms, including supervised and unsupervised learning techniques. 2. Demonstrate the ability to analyze mathematical foundations and principles behind machine learning models. 3. Understand the nuances of applying various machine learning models, emphasizing the trade-offs between performance, computational complexity, and interpretability. 4. Students will actively explore unsupervised learning techniques, emphasizing clustering algorithms, and recognizing their vital role in solving real-world challenges. 5. Demonstrate proficiency into the fundamental principles of deep learning and investigate recent advancements, such as optimization using diffusion models, learning from unlabeled data using consistency models, and decentralized data processing through federated learning. Credits: 3.00

General Selective (3 credits)

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4.

Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

AGEC 68700 - Problem Solving And Project Management For Decision Makers

Credit Hours: 3.00. Develops a structured approach to problem solving, including problem definition, development of alternatives, identifying consequences, assessing trade-offs, and making informed choices. Research methods and project management concepts will be addressed. A major business analysis project will be framed during the course, to be completed as part of the capstone course in business analysis. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to

constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course

introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

STAT 58200 - Statistical Consulting And Collaboration

Credit Hours: 3.00. This course is designed to emphasize and develop the skills needed by a statistical consultant/collaborator. Topics include: problem solving, consulting session management, written and oral communication, research ethics, design of experiments, collection of data, and application of statistical methods to real problems. Class activities include actively participating in consulting sessions held by the Statistical Consulting Service, small group projects, short papers, and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Be aware of the skills necessary to be an effective statistical consultant/collaborator. These skills include consulting session management, written and oral communication with clients, interpreting facial and body language, handling personality conflicts, practicing sound research ethics, properly designing an experiment and determining an appropriate sample size, and choosing an appropriate statistical method

whose analysis addresses the client's questions given the available data. 2. Know how to recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

ILS 69500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as

R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

FNR 58700 - Advanced Spatial Ecology And GIS

Credit Hours: 3.00. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales. The lab will focus on the use and application of these databases that are common in natural resource management settings.

Learning Outcomes: 1. Apply the principles of landscape ecology to the analysis of spatial change in urban, agricultural and forested landscapes for the purposes of natural resource management. 2. Calculate change in landscape patterns using a variety of geospatial tools such as geographic information systems, spatial models, and geostatistics. 3. Prepare reports using the traditional scientific journal article format, on the analysis of landscape-scale change, focusing on problems common to watershed management. 4. Compare and contrast the ways that biodiversity can be calculated using standard indices of organismal diversity. 5. Calculate ecological footprints and evaluate why these vary across geopolitical and/or ecological units. Credits: 3.00

CS 50023 - Data Engineering I

Credit Hours: 1.00. The course introduces students to the fundamentals of Data Engineering with a focus on tools and computational techniques to gather, construct, manipulate, summarize, and visualize data sets as a means to extract knowledge from the underlying data. Python and Python libraries are used. Completion of the course will allow learners to perform basic data analysis on data sets. Experience in Python Programming and Linear Algebra is required. The course also prepares learners for additional instruction in the courses Data Engineering II and Foundations of Decision Making.

Learning Outcomes: 1. Identify key file types (TXT, CSV, HTML) and their characteristics. Using Python, read data in these formats. 2. Create and execute Python scripts to parse,

select, transform, summarize, and visualize data. 3. Explain how to identify and fill in missing values in data values. 4. Create informative visualizations from given data and recognize the key qualities of good visualizations. 5. Apply Pandas functions to slice, dice, and summarize datasets. 6. Apply the process of sampling data and sample probabilistically. 7. Demonstrate how to transform and construct features (e.g., standardization, distances). 8. Compute summary statistics from data (e.g., covariance, correlation). 9. Explain how to solve simple data analysis problems. Credits: 1.00

CS 50025 - Foundations Of Decision Making

Credit Hours: 1.00. This course provides an overview of data science methods used for data-driven discovery, extraction of knowledge, and informed decision making. The course covers fundamental computational methods and statistical techniques used to correctly reason about uncertainty, conduct hypothesis tests, infer causal relationships, and apply and evaluate predictive models. The course highlights how sampling biases can impact fairness in decision making. Throughout, students get hands-on experience on how to make correct and explainable inferences from data. Experience in Python Progamming, Probability, Statistics and Linear Algebra is required.

Learning Outcomes: 1. Support and justify claims with evidence from data and discuss how human biases can impact interpretations. 2. Recognize the basic approach to formulating statistical hypothesis tests and apply parametric hypothesis tests for both discrete and continuous data. 3. Interpret p-values and apply them effectively to support claims about data. 4. Formulate and test conjectures with controlled experiments, including A/B testing. 5. Recognize the types of errors encountered when conducting multiple hypothesis tests. 6. Use computational approaches based on randomization for hypothesis testing and uncertainty quantification. 7. Discuss ethical issues such as privacy and fairness that can be associated with automating decisions based on machine learning methods. 8. Apply the basic components of classification methods using Python libraries. 9. Evaluate the performance of learned models with learning curves and k-fold cross validation and assess significance with hypothesis tests. Credits: 1.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

STAT 52700 - Introduction To Computing For Statistics

Credit Hours: 3.00. This course provides a thorough introduction to the R programming language, and its use for statistical computing and data science. The course will first look at the fundamentals of R, including different data-structures, control-flow, and the basic vocabulary. An emphasis will be placed on learning idiomatic and efficient R, covering ideas such as recycling, vectorization and functional programming. The course will then look at principles and tools for tasks like organizing data ('tidy data'), manipulating data ('data carpentry'), querying data (through topics like regular expressions) as well as visualizing data (including interactive visualizations). The material and the homework will encourage development of modular reusable code and reproducible research through ideas such as object-oriented programming and dynamic documents in R Markdown. The last part of the course will study statistical procedures such as least-squares regression, LASSO, Monte Carlo sampling and Markov chain Monte Carlo. Besides exams and homeworks, the course will involve a final project that students can collaborate together on.

Learning Outcomes: 1. Read and write idiomatic R code. 2. Be familiar with the entire data science pipeline, from organizing, manipulating, querying and visualizing data. 3. Introduce computational tools like optimization and simulation in the context of statistical algorithms. Credits: 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

Fundamentals of Human Resources, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (10 credits)

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65460 - Talent Acquisition

Credit Hours: 2.00 to 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions, and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Design a talent acquisition program in order for an organization's talent to be its competitive advantage. 2. Design a workforce implementation plan and a process to identify issues and continuous refinement of the plan. 3. Create a Recruiting plan that is focused on both external and internal candidates. 4. Design a process for final candidate evaluation. 5. Develop strategies to orient and onboard newly acquired talent. Credits: 2.00 to 3.00

MGMT 65330 - HR Strategy

Credit Hours: 2.00 to 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Learning Outcomes: 1. Understand the history of human resource management and how it has evolved to the strategic level. 2. Understand what strategic Human Resource Management means and entails. 3. Understand and complete a Human Resource Management Strategic plan. 4. Make yourself an invaluable resource to upper level management and the CEO by demonstrating the extreme importance and value of Strategic Human Resource management. Credits: 2.00 to 3.00

MGMT 65470 - Talent Management

Credit Hours: 2.00 to 3.00. This course focuses on the employer-employee relationship and how managers work with employees to improve their performance. Attention is given to Talent, Talent Management, and Performance Management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing talent. Various definitions of Employee Engagement will be explored, along with how it is, measured, and why it is so important to your organization. Finally, various methods to engage employees in the organization will be studied.

Learning Outcomes: 1. Define talent and talent management. 2. Determine talent management strategies to support an organization's objectives and goals. 3. Evaluate talent management models to address organizational needs. 4. Develop and integrate a talent management system into organizations. 5. Define critical elements of a successful performance management system. 6. Identify methods to promote and maintain an engaged workforce. Credits: 2.00 to 3.00

MGMT 65480 - Total Rewards

Credit Hours: 2.00. This course examines how organizations can optimize financial and relational returns to gain and sustain a competitive advantage in a global environment. We will use theory and cases to develop a sound understanding of the compensation system.

Learning Outcomes: 1. Understand compensation systems and how they can be a catalyst for change and to help organizations execute their business strategies. 2. Know how to attract, engage, and retain top talent effectively. 3. Apply practical management tools for sustaining competitive advantage. 4. Develop technical compensation skills to design pay structures and market pricing systems. 5. Comprehend the importance of rational returns for employees and the role it plays in employee development. Credits: 2.00

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GPA Requirements

About the Program

Geospatial Information Sciences, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

Introductory Courses (3 credits)

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to

environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

Advanced Topics Courses (3 credits)

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information.
Credits: 3.00

CS 53100 - Computational Geometry

Credit Hours: 3.00. Computational geometry studies how to compute with and reason about geometric objects. The subject is playing an increasingly important role in computer graphics, game software, geometric modeling, geographic information systems, and many other applications. Course topics include convex hull, segment manipulations, triangulations, range searching, Voronoi diagrams, window queries, Delaunay triangulation, and duality. Some key algorithms are implemented. Questions of floating-point accuracy and robust algorithm design are considered throughout the course.
Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.
Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.
Credits: 0.00 to 18.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.
Credits: 0.00 to 6.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.
Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application.
Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.
Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply

them to their disciplinary research. Credits: 1.00 to 4.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

CGT 67000 - Applications In Visual Analytics

Credit Hours: 3.00. Visual Analytics (VA) provides a fast way for people to make sense of large number of data, and has applications in many sectors. This course will introduce Visual Analytics through foundational theories and a broad range of techniques and tools, focusing on using visualization methods to reason and solve complex problems in a wide variety of applications. Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces that synthesize human and computational ability to attack large complex problems. It is concerned with analytical reasoning, interaction, data transformations, data visualization, analytic reporting, and technology transition. While the different visual analytics applications share common theories and strategies, each of them has its unique data composition, visual representations, and analytical needs and strategies. Through survey and study a broad range of visual analytics applications, students will be able to apply visual analytics on their own applications, analyze and break down a complex analytical problem into proper components and steps, evaluate different visual analytic techniques and strategies, and finally design and develop an effective visual analytics solution toward the problem.

Learning Outcomes: 1. Describe the purposes, foundational theories, research components, and process of visual analytics. 2. Select proper visualization forms from visual analytics tools to answer specific reasoning questions. 3. Apply information visualization and visual analytics approaches to analyze complex problems from data processing, transformation, to visualization, and analysis. 4. Compare, analyze and assess different visual analytics approaches from various aspects such as effectiveness, efficiency, scalability, learnability, and user experience. 5. Develop a visual analytics solution and evaluate its efficacy in solving a complex domain problem. Credits: 3.00

CE 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

Geospatial Information Application Courses (3 credits)

ABE 52700 - Computer Models In Environmental And Natural Resources Engineering

Credit Hours: 3.00. Offers students in environmental and natural resources engineering programs an understanding of the hydrological processes and related design skills. Principles of soil erosion by water; drainage of agricultural lands; surface runoff; flood and reservoir routing; hydrodynamic and water quality in pipe network; nonpoint source pollution; and transport phenomenon are studied. Current computer models utilized in industry for decision support are applied using case studies to further enhance the understanding of the hydrological processes. Limitations and advantages of the models are discussed. Offered in alternate years.

Credits: 3.00

ABE 52900 - Nonpoint Source Pollution Engineering

Credit Hours: 3.00. Engineering principles involved in assessment and management of nonpoint source (NPS) pollution. Effect of NPS pollution on ecosystem integrity. Use of GIS/mathematical models to quantify extent of pollution. Design/implementation of best management practices to reduce nonpoint source pollution and improve water quality. Discussion of total maximum daily load (TMDL) principles and processes.

Learning Outcomes: 1. Understand sources and nature of NPS pollution originating from agricultural and urban land use. 2. Link nature of diffuse pollution with physical, chemical and biological integrity of ecosystems and water usage. 3. Quantify amount of diffuse pollution from a watershed using state-of-the-art methods and models. 4. Design best management practices to minimize nonpoint source pollution from agricultural and urban land use. 5. Understand TMDL issues, and processes involved in developing TMDL plans. 6. Understand basic monitoring and modeling principles. 7. Apply engineering principles in developing pollution prevention plan. Credits: 3.00

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to

appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

EAPS 57700 - Remote Sensing Of The Planets

Credit Hours: 3.00. Introduction to key planetary and Earth science satellite remote sensing datasets, including visible and thermal imagery, visible through mid-infrared spectroscopy, radar, gamma ray and neutron spectroscopy, and laser altimetry. Students will receive hands-on-experience with data acquisition, image processing in IDL, spectral analysis in ENVI and Davinci, crater counting, and geologic mapping in GIS programs. Includes 1-2 full-day field trips. Junior, Senior, or Graduate status required. Recommended minimum background for undergraduates: Introductory knowledge of Earth or planetary surface processes and basic programming skills.

Learning Outcomes: 1. Understand the underlying physical principles behind the interpretation of remote sensing data. 2. Gain proficiency in the acquisition, processing, and analysis of remote sensing data. 3. Gain field experience with using and ground truthing remote sensing data at planetary analog sites. 4. Propose a research topic, conduct a literature review, and design and complete an original research project. Credits: 3.00

FNR 59800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

CE 54900 - Computational Watershed Hydrology

Credit Hours: 3.00. Use of professional computer programs for the calculation of the runoff from complex basins. Generation of unit hydrographs. Calculation of losses, channel and reservoir routing, parameter optimization, and application of Kinematic wave technique to urban catchments. Offered in alternate years.

Credits: 3.00

EAPS 52700 - Principles Of Terrestrial Ecosystem Ecology

Credit Hours: 3.00. The objective of this course is to build a conceptual model of terrestrial ecosystems and to provide students with the state-of-the-art mechanisms by which terrestrial ecosystems work. Topics include ecosystem concept, Earth's climate system, geology and soils, terrestrial water and energy balance, terrestrial production processes, terrestrial decomposition, terrestrial plant nutrient use and cycling, biogeochemical pathways, and ecosystem temporal and spatial dynamics. Permission of instructor required.

Learning Outcomes: 1. Learn what key variables to be observed for ecosystem studies. 2. Understand the feedbacks between the atmosphere and terrestrial biosphere. Credits: 3.00

ANTH 64100 - Discovery And Design: Making Projects Work

Credit Hours: 3.00. This course is about using anthropology to make projects work. Students will learn anthropological approaches and methods to discover salient aspects of a design problem and use this understanding to devise responses. Anthropological discovery, design and delivery processes are demonstrated. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Be able to use Rapid Assessment Procedures (RAP), the Delphi Technique, Domain Analysis and Cross-Cultural Survey Design. 2. Understand how community

projects are put together from goals and objectives, strategies implementation plans and monitoring and evaluation and be able to use that knowledge in effectively designing projects. 3. Write a funding proposal that clearly explains the purpose, impact, and essential features of the project in order to secure funding or other essential support. 4. Apply the skills of anthropological discovery and design in your own practice area of interest. Credits: 3.00

EAPS 54100 - Geodetic Data And Applications

Credit Hours: 3.00. This course will provide students with hands-on experience in the selection, processing, and analysis of geodetic data sets, particularly InSAR and GPS. Students will learn how to select data, evaluate its strengths and weaknesses, process and analyze the data, and apply it to the investigation of geological problems.

Learning Outcomes: 1. Explain essential theory behind processing geodetic data. 2. Describe various processing parameters and how they influence data analysis. 3. Evaluate quality of various datasets and determine most appropriate analysis strategies for desired application. 4. Interpret analyzed datasets in the context of geological problems. 5. Judge whether models fit data and if model parameters are compatible with available non-geodetic data sources. 6. Devise an original research project topic and develop hypothesis and a methodology for its evaluation. 7. Summarize main research results in a clear, concise manner in both written and oral form. Credits: 3.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

CE 50301 - Digital Photogrammetric Systems

Credit Hours: 3.00. This course deals with various aspects related to 3D reconstruction from 2D imagery. The course starts with comprehensive coverage of data acquisition systems while focusing on different factors that affect the quality of image measurements. Then, the course focuses on the mathematical details for deriving 3D information from imagery including 2D/3D rotation, collinearity equations, projective transformation, direct linear transformation, theory of orientation, bundle adjustment, image resampling according to epipolar geometry, image matching, and orthophoto generation. The course also covers the similarities/differences between photogrammetric and computer vision approaches toward 3D reconstruction.

Learning Outcomes: 1. Define photogrammetric mapping and its possible applications. 2. Explain basic definitions related to electromagnetic radiation. 3. Define basic optical principles, film development steps, and operational principles of digital cameras. 4. Derive photogrammetric formulas for vertical photography. 5. Explain image coordinate measurements and reduction/refinement. 6. Explain/derive mathematical and geometric principles. 7. Explain the theory and procedures of photogrammetric orientation. 8. Describe the different options for photogrammetric georeferencing. 9. Describe the principles of digital image matching. 10. Explain the steps for digital orthophoto generation. Credits: 3.00

CE 52501 - Built Environment Modeling

Credit Hours: 3.00. A study of computational tools to model, analyze, and manage the built environment, specifically, the civil infrastructure from a life cycle and system's perspective. Such

computational tools include geospatial technologies, engineering sensing technologies, engineering database, building information modeling, object-oriented modeling, and spatial analytics.

Learning Outcomes: 1. Integrate geographic information system (GIS) and building information modeling (BIM) into a digital twin. 2. Explain the fundamental concepts and theories in BIM to more effectively use it as a tool in infrastructure life cycle management. 3. Apply BIM tools to design infrastructure, estimate cost, and plan its construction process. 4. Reason the necessity to incorporate GIS in supplementing BIM in infrastructure engineering. 5. Explain the fundamental concepts and theories in GIS in order to identify the right tools for given tasks. 6. Apply GIS tools to model infrastructure and its surroundings. 7. Apply object-oriented modeling approach in both GIS and BIM to identify the common ground for integration. 8. Design an object-oriented model to integrate GIS and BIM. 9. Use modeling tools to model the civil infrastructure and its spatial context from a life cycle perspective. 10. Identify the data needs and functionality requirements in life cycle infrastructure engineering. 11. Select and apply sensing technologies to collect data. 12. Design geospatial database to store and manage infrastructure data 13. Design a system to use geospatial database for varying tasks throughout the infrastructure life cycle. 14. Develop a digital twin to solve a selected infrastructure engineering problem. 15. Identify and articulate an infrastructure engineering problem. Propose a methodology to address the problem. Work as a team to implement the proposed method. Communicate and present the findings. Credits: 3.00

CE 50601 - Adjustment Of Geospatial Observations

Credit Hours: 3.00. This course presents a thorough and comprehensive look at the topic of fitting data to a mathematical model. The techniques presented will free the scientist or engineer from dependence on restrictive software applications, and allow customization of solutions using weighting, constraints, parameter dependencies, and robust techniques which minimize the influence of blunders. Example applications include 2D/3D ranging, 2D/3D triangulation, curve and surface fitting, coordinate transformations, leveling, and image triangulation. Pre-analysis and design techniques permit the precision of unknown parameters to be determined in advance, prior to expending time and effort in field measurements.

Learning Outcomes: 1. Perform error/covariance propagation to make quantitative statements about uncertainties of the results, and to evaluate statistical hypothesis tests. 2. Become conversant with both linear and nonlinear models as well as sequential estimation. Credits: 3.00

AT 51900 - Aviation Geographic Information Science Applications

Credit Hours: 3.00. This course provides a core set of skills essential for understanding geospatial science and using Geographic Information Systems as a tool to conduct research with a spatial component. The student will learn how to acquire, process, analyze, and interpret geospatial data using real-world data sets in applied situations.

Learning Outcomes: 1. Acquire core geospatial and remote sensing technology concepts. 2. Demonstrate an ability to apply GIS data to real-world applied situations. 3. Demonstrate a fundamental understanding of cartography through the creation of map layouts in a GIS. Credits: 3.00

Project-Based Course (3 credits)

ILS 59000 - Independent Study In Information Sciences

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue University. Plan of study and assessment is agreed upon by faculty and student before registration. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

Introductory Courses (3 credits)

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

Required Courses (12 credits)

Introductory Courses (3 credits)

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

Advanced Topics Courses (3 credits)

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

CS 53100 - Computational Geometry

Credit Hours: 3.00. Computational geometry studies how to compute with and reason about geometric objects. The subject is playing an increasingly important role in computer graphics, game software, geometric modeling, geographic information systems, and many other applications. Course topics include convex hull, segment manipulations, triangulations, range searching, Voronoi diagrams, window queries, Delaunay triangulation, and duality. Some key algorithms are implemented. Questions of floating-point accuracy and robust algorithm design are considered throughout the course.

Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.

Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data

management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

CGT 67000 - Applications In Visual Analytics

Credit Hours: 3.00. Visual Analytics (VA) provides a fast way for people to make sense of large number of data, and has applications in many sectors. This course will introduce Visual Analytics through foundational theories and a broad range of techniques and tools, focusing on using visualization methods to reason and solve complex problems in a wide variety of applications. Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces that synthesize human and computational ability to attack large complex problems. It is concerned with analytical reasoning, interaction, data transformations, data visualization, analytic reporting, and technology transition. While the different visual analytics applications share common theories and strategies, each of them has its unique data composition, visual representations, and analytical needs and strategies. Through survey and study a broad range of visual analytics applications, students will be able to apply visual analytics on their own applications, analyze and break down a complex analytical problem into proper components and steps, evaluate different visual analytic techniques and strategies, and finally design and develop an effective visual analytics solution toward the problem.

Learning Outcomes: 1. Describe the purposes, foundational theories, research components, and process of visual analytics. 2. Select proper visualization forms from visual analytics tools to answer specific reasoning questions. 3. Apply information visualization and visual analytics approaches to analyze complex problems from data processing, transformation, to visualization, and analysis. 4. Compare, analyze and assess different visual analytics approaches from various aspects such as effectiveness, efficiency, scalability, learnability, and user experience. 5. Develop a visual analytics solution and evaluate its efficacy in solving a complex domain problem. Credits: 3.00

CE 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

Geospatial Information Application Courses (3 credits)

ABE 52700 - Computer Models In Environmental And Natural Resources Engineering

Credit Hours: 3.00. Offers students in environmental and natural resources engineering programs an understanding of the hydrological processes and related design skills. Principles

of soil erosion by water; drainage of agricultural lands; surface runoff; flood and reservoir routing; hydrodynamic and water quality in pipe network; nonpoint source pollution; and transport phenomenon are studied. Current computer models utilized in industry for decision support are applied using case studies to further enhance the understanding of the hydrological processes. Limitations and advantages of the models are discussed. Offered in alternate years.

Credits: 3.00

ABE 52900 - Nonpoint Source Pollution Engineering

Credit Hours: 3.00. Engineering principles involved in assessment and management of nonpoint source (NPS) pollution. Effect of NPS pollution on ecosystem integrity. Use of GIS/mathematical models to quantify extent of pollution. Design/implementation of best management practices to reduce nonpoint source pollution and improve water quality. Discussion of total maximum daily load (TMDL) principles and processes.

Learning Outcomes: 1. Understand sources and nature of NPS pollution originating from agricultural and urban land use. 2. Link nature of diffuse pollution with physical, chemical and biological integrity of ecosystems and water usage. 3. Quantify amount of diffuse pollution from a watershed using state-of-the-art methods and models. 4. Design best management practices to minimize nonpoint source pollution from agricultural and urban land use. 5. Understand TMDL issues, and processes involved in developing TMDL plans. 6. Understand basic monitoring and modeling principles. 7. Apply engineering principles in developing pollution prevention plan. Credits: 3.00

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of

ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

EAPS 57700 - Remote Sensing Of The Planets

Credit Hours: 3.00. Introduction to key planetary and Earth science satellite remote sensing datasets, including visible and thermal imagery, visible through mid-infrared spectroscopy, radar, gamma ray and neutron spectroscopy, and laser altimetry. Students will receive hands-on-experience with data acquisition, image processing in IDL, spectral analysis in ENVI and Davinci, crater counting, and geologic mapping in GIS programs. Includes 1-2 full-day field trips. Junior, Senior, or Graduate status required. Recommended minimum background for undergraduates: Introductory knowledge of Earth or planetary surface processes and basic programming skills.

Learning Outcomes: 1. Understand the underlying physical principles behind the interpretation of remote sensing data. 2. Gain proficiency in the acquisition, processing, and analysis of remote sensing data. 3. Gain field experience with using and ground truthing remote sensing data at planetary analog sites. 4. Propose a research topic, conduct a literature review, and design and complete an original research project. Credits: 3.00

FNR 59800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

CE 54900 - Computational Watershed Hydrology

Credit Hours: 3.00. Use of professional computer programs for the calculation of the runoff from complex basins. Generation of unit hydrographs. Calculation of losses, channel and reservoir routing, parameter optimization, and application of Kinematic wave technique to urban catchments. Offered in alternate years.

Credits: 3.00

EAPS 52700 - Principles Of Terrestrial Ecosystem Ecology

Credit Hours: 3.00. The objective of this course is to build a conceptual model of terrestrial ecosystems and to provide students with the state-of-the-art mechanisms by which terrestrial ecosystems work. Topics include ecosystem concept, Earth's climate system, geology and soils, terrestrial water and energy balance, terrestrial production processes, terrestrial decomposition, terrestrial plant nutrient use and cycling, biogeochemical pathways, and ecosystem temporal and spatial dynamics. Permission of instructor required.

Learning Outcomes: 1. Learn what key variables to be observed for ecosystem studies. 2. Understand the feedbacks between the atmosphere and terrestrial biosphere. Credits: 3.00

ANTH 64100 - Discovery And Design: Making Projects Work

Credit Hours: 3.00. This course is about using anthropology to make projects work. Students will learn anthropological approaches and methods to discover salient aspects of a design problem and use this understanding to devise responses. Anthropological discovery, design and delivery processes are demonstrated. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Be able to use Rapid Assessment Procedures (RAP), the Delphi Technique, Domain Analysis and Cross-Cultural Survey Design. 2. Understand how community projects are put together from goals and objectives, strategies implementation plans and monitoring and evaluation and be able to use that knowledge in effectively designing projects. 3. Write a funding proposal that clearly explains the purpose, impact, and essential features of the project in order to secure funding or other essential support. 4. Apply the skills of anthropological discovery and design in your own practice area of interest. Credits: 3.00

EAPS 54100 - Geodetic Data And Applications

Credit Hours: 3.00. This course will provide students with hands-on experience in the selection, processing, and analysis of geodetic data sets, particularly InSAR and GPS. Students will learn how to select data, evaluate its strengths and weaknesses, process and analyze the data, and apply it to the investigation of geological problems.

Learning Outcomes: 1. Explain essential theory behind processing geodetic data. 2. Describe various processing parameters and how they influence data analysis. 3. Evaluate quality of various datasets and determine most appropriate analysis strategies for desired application. 4. Interpret analyzed datasets in the context of geological problems. 5. Judge whether models fit data and if model parameters are compatible with available non-geodetic data sources. 6. Devise an original research project topic and develop hypothesis and a methodology for its evaluation. 7. Summarize main research results in a clear, concise manner in both written and oral form. Credits: 3.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

CE 50301 - Digital Photogrammetric Systems

Credit Hours: 3.00. This course deals with various aspects related to 3D reconstruction from 2D imagery. The course starts with comprehensive coverage of data acquisition systems while focusing on different factors that affect the quality of image measurements. Then, the course focuses on the mathematical details for deriving 3D information from imagery including 2D/3D rotation, collinearity equations, projective transformation, direct linear transformation, theory of orientation, bundle adjustment, image resampling according to epipolar geometry, image matching, and orthophoto generation. The course also covers the similarities/differences between photogrammetric and computer vision approaches toward 3D reconstruction.

Learning Outcomes: 1. Define photogrammetric mapping and its possible applications. 2. Explain basic definitions related to electromagnetic radiation. 3. Define basic optical principles, film development steps, and operational principles of digital cameras. 4. Derive photogrammetric formulas for vertical photography. 5. Explain image coordinate measurements and reduction/refinement. 6. Explain/derive mathematical and geometric principles. 7. Explain the theory and procedures of photogrammetric orientation. 8. Describe the different options for photogrammetric georeferencing. 9. Describe the principles of digital image matching. 10. Explain the steps for digital orthophoto generation. Credits: 3.00

CE 52501 - Built Environment Modeling

Credit Hours: 3.00. A study of computational tools to model, analyze, and manage the built environment, specifically, the civil infrastructure from a life cycle and system's perspective. Such computational tools include geospatial technologies, engineering sensing technologies, engineering database, building information modeling, object-oriented modeling, and spatial analytics.

Learning Outcomes: 1. Integrate geographic information system (GIS) and building information modeling (BIM) into a digital twin. 2. Explain the fundamental concepts and theories in BIM to more effectively use it as a tool in infrastructure life cycle management. 3. Apply BIM tools to design infrastructure, estimate cost, and plan its construction process. 4. Reason the necessity to incorporate GIS in supplementing BIM in infrastructure engineering. 5. Explain the fundamental concepts and theories in GIS in order to identify the right tools for given tasks. 6. Apply GIS tools to model infrastructure and its surroundings. 7. Apply object-oriented modeling approach in both GIS and BIM to identify the common ground for integration. 8. Design an object-oriented model to integrate GIS and BIM. 9. Use modeling tools to model the civil infrastructure and its spatial context from a life cycle perspective. 10. Identify the data needs and functionality requirements in life cycle infrastructure engineering. 11. Select and apply sensing technologies to collect data. 12. Design geospatial database to store and manage infrastructure data 13. Design a system to use geospatial database for varying tasks throughout the infrastructure life cycle. 14. Develop a digital twin to solve a selected infrastructure engineering problem. 15. Identify and articulate an infrastructure engineering problem. Propose a methodology to address the problem. Work as a team to implement the proposed method. Communicate and present the findings. Credits: 3.00

CE 50601 - Adjustment Of Geospatial Observations

Credit Hours: 3.00. This course presents a thorough and comprehensive look at the topic of fitting data to a mathematical model. The techniques presented will free the scientist or engineer from dependence on restrictive software applications, and allow customization of solutions using weighting, constraints, parameter dependencies, and robust techniques which minimize the influence of blunders. Example applications include 2D/3D ranging, 2D/3D triangulation, curve and surface fitting, coordinate transformations, leveling, and image triangulation. Pre-analysis and design techniques permit the precision of unknown parameters to be determined in advance, prior to expending time and effort in field measurements.

Learning Outcomes: 1. Perform error/covariance propagation to make quantitative statements about uncertainties of the results, and to evaluate statistical hypothesis tests. 2. Become conversant with both linear and nonlinear models as well as sequential estimation. Credits: 3.00

AT 51900 - Aviation Geographic Information Science Applications

Credit Hours: 3.00. This course provides a core set of skills essential for understanding geospatial science and using Geographic Information Systems as a tool to conduct research with a spatial component. The student will learn how to acquire, process, analyze, and interpret geospatial data using real-world data sets in applied situations.

Learning Outcomes: 1. Acquire core geospatial and remote sensing technology concepts. 2. Demonstrate an ability to apply GIS data to real-world applied situations. 3. Demonstrate a fundamental understanding of cartography through the creation of map layouts in a GIS. Credits: 3.00

Project-Based Course (3 credits)

ILS 59000 - Independent Study In Information Sciences

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue University. Plan of study and assessment is agreed upon by faculty and student before registration. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

Introductory Courses (3 credits)

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

About the Program

Gerontology, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

HDFS 64900 - Multidisciplinary Gerontology

Credit Hours: 3.00. A multidisciplinary overview of aging that provides a background for graduate studies on aging. An examination of sociological, psychological, and biological theory and research in the field of aging. The aging process from cells to social security will be covered. Projects will assist students in developing appropriate professional skills in their field of study. Students are expected to have basic research and writing skills in their field of study. The course serves as a graduate-level introduction to the field of gerontology. There are several options for course projects.

Learning Outcomes: 1. Describe and critique major theoretical and empirical foundations and advances in gerontological research. 2. Examine and discuss the ways influences at different levels of function (e.g., biological, social) and from different academic disciplines (e.g., psychology, sociology) interact to shape the aging process and related outcomes. 3. Use existing literature to construct and support novel research ideas. 4. Practice and produce cogent, compelling writing. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

Selectives (0-6 credits)

HK 44400 - Balance Rehab In Older Adults

Credit Hours: 3.00. In this course, students learn about the decline in motor function that occurs in older adults and techniques to improve motor function in an older population. Topics include decreased balance control, loss of muscle strength, and declines in adaptive locomotion as a function of age. Students enrolled in this class also participate in an off-campus lab. In the lab, students are paired with an older adult and use the knowledge gained in lecture to improve the motor function of the older adult. This class provides students with a unique opportunity to gain hands-on experience working with an older population. Permission of instructor required.

Learning Outcomes: 1. Describe the declines in motor function that occur in older adults. 2. Critically assess intervention research with aims to improve motor function in older adults. 3. Describe and evaluate types of interventions and their effectiveness. 4. Use quantitative equipment to assess balance and mobility of younger and older adults. Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

HDFS 60000 - Families And Health Across The Life Course

Credit Hours: 3.00. Interpersonal processes of family members and close others in the promotion of individual health choices

and management of disease across the life course are covered. Course topics include involvement of family and close others in: health promotion and disease prevention; disease management; interactions with healthcare providers; and informal caregiving in the family context.

Learning Outcomes: 1. Evaluate research linking family ties with individual health and well-being across the life course. 2. Examine how interpersonal processes contribute to promoting health and managing illness of individuals across the life course. 3. Understand the role of family members in interactions with the healthcare system. 4. Differentiate diverse disciplinary approaches to families and health research across the life course. Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 64900 - Multidisciplinary Gerontology

Credit Hours: 3.00. A multidisciplinary overview of aging that provides a background for graduate studies on aging. An examination of sociological, psychological, and biological theory and research in the field of aging. The aging process from cells to social security will be covered. Projects will assist students in developing appropriate professional skills in their field of study. Students are expected to have basic research and writing skills in their field of study. The course serves as a graduate-level introduction to the field of gerontology. There are several options for course projects.

Learning Outcomes: 1. Describe and critique major theoretical and empirical foundations and advances in gerontological research. 2. Examine and discuss the ways influences at different levels of function (e.g., biological, social) and from different academic disciplines (e.g., psychology, sociology) interact to shape the aging process and related outcomes. 3. Use existing literature to construct and support novel research ideas. 4. Practice and produce cogent, compelling writing. Credits: 3.00

NUTR 63400 - Nutrition And Cancer Prevention

Credit Hours: 2.00. An in-depth examination of the role of nutrition in cancer prevention. Typically offered in alternate years.

Credits: 2.00

SOC 57600 - Health And Aging In Social Context

Credit Hours: 3.00. Analysis of the social and cultural influences on health in adulthood and later life. Considers distribution of illness among older adults, health behavior, and health services use, including long-term care.

Credits: 3.00

SOC 67700 - Research Seminar On Aging And The Life Course

Credit Hours: 1.00. An interdisciplinary seminar examining recent research on aging and the responsible conduct of research. Emphasis is given to professional development in gerontology and related fields.

Credits: 1.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 53100 - Language Disorders In Adults

Credit Hours: 3.00. Study of the causes, assessment, and treatment of acquired language disorders in adults, including aphasia, right hemisphere syndromes, and dementia.

Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

SLHS 53800 - Motor Disorders Of Speech

Credit Hours: 2.00. A study of the neuropathologies that affect the speech production system. Emphasizes the differential diagnosis and management of acquired motor speech disorders.

Learning Outcomes: 1. The student will be able to describe how the types of dysarthria relate to damage in the brain and how the cranial nerves are involved in dysarthria. 2. The student will be able to describe and different views of disability and the levels at which individuals are affected by their difficulties and be able to implement these issues when assessing individuals with dysarthria and when setting goals for treatment. 3. The student will be able to correctly identify dysarthrias, based on case information and symptoms. 4. The student will be able to explain and describe appropriate intervention procedures given specific dysarthrias or speech, voice, resonance, and respiratory symptoms. 5. The student will demonstrate acceptable writing skills. Credits: 2.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to diversity in developmental influences and trajectories, including atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

Alternative Selectives (0-6 credits)

HSCI 49000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for senior students. Permission of instructor required.

Credits: 1.00 to 8.00

ANTH 60900 - Seminar In Anthropology

Credit Hours: 2.00 or 3.00. Topics vary. Permission of instructor required.

Credits: 2.00 or 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

HK 59000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for graduate students. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes vary due to special topics nature of course. Credits: 1.00 to 3.00

HK 66800 - Seminar In Exercise Physiology

Credit Hours: 3.00. Review of literature; design and conduct of research in an area of current interest in exercise physiology. Permission of instructor required.

Credits: 3.00

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

PSY 51200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, BIOL 56200) Background in cell biology, psychobiology, physiology, or anatomy is recommended. Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Permission of instructor required.

Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 67400 - Seminar In Medical Sociology

Credit Hours: 2.00 or 3.00. Seminar in Medical Sociology. Prerequisite: SOC 57400 .

Credits: 2.00 or 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

SLHS 53900 - Dysphagia

Credit Hours: 3.00. A study of the normal and disordered anatomy and physiology of the swallowing process. Principles of evaluation and treatment of dysphagia are discussed.

Learning Outcomes: 1. Knowledge of the anatomy of the respiratory, laryngeal, and articulatory subsystems. 2. Understanding of the normal physiology of the repertory, laryngeal, and articulatory subsystems. 3. Basic

knowledge of the cranial nerve system. Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 6.00

NUR 59900 - Special Topics/Independent Study In Nursing

Credit Hours: 0.00 to 6.00 (West Lafayette, Calumet) 1.00 to 6.00 (Fort Wayne). Special topics in nursing are critically examined. Hours, credit, and subject matter are determined by the staff. Permission of instructor required.

Credits: 0.00 to 6.00

PUBH 54300 - Physical Activity And Public Health

Credit Hours: 3.00. In this course students will be exposed to epidemiological, behavioral, and public health issues relevant to effective promotion of physical activity. The course is appropriate for students training to be practitioners or researchers from a range of disciplines including exercise science, nutrition, psychology, and public health. Major topic areas will include physical activity epidemiology, determinants of physical activity in youth and adults, and current evidence for physical activity interventions ranging from individual, behavioral strategies, to environmental or policy approaches.

Learning Outcomes: 1. Differentiate between various definitions of physical activity, exercise, and physical fitness. 2. Describe and identify strengths and weaknesses of different approaches used to measure physical activity, including surveys, and objective methods using pedometers and accelerometers. 3. Discuss epidemiological evidence on relationships between physical activity and all-cause mortality, cardiovascular disease, cancers, diabetes, obesity, and overweight. 4. Describe and critically evaluate the physical activity determinants literature in children, youth, and adults, and the current determinants research focus in these populations. 5. Describe and critically evaluate physical activity intervention literature, including currently recommended approaches for children, youth, and adults (e.g., based on the Community Guide to P{Preventive Services). Credits: 3.00

HK 53200 - Musculoskeletal Adaptations

Credit Hours: 3.00. This course will utilize traditional lecture combined with small group, student-lead learning to study the impact of acute and chronic exercise on skeletal muscle and tendon. Topics covered will include muscle growth, muscle metabolism, structural and functional changes in skeletal muscle and tendon, the impact of age and sex on exercise adaptations, and the impact of exogenous agents on skeletal muscle and tendon adaptations to exercise. Other topics may include the impact of unloading (e.g., bedrest) and spinal injury on skeletal muscle and tendon. This course will be relevant to those interested in exercise physiology, athletic training, physical therapy, occupational therapy, medical school, nutrition science, engineering, and similar programs of study. Permission of department required.

Learning Outcomes: 1. Analyze and synthesize research in the area of musculoskeletal adaptations to exercise - including the effects of exercise on skeletal muscle, tendon, and bone - and how aging, sex, and lack of activity influence exercise adaptations. 2. Critically evaluate research data in the context of exercise, human health, and rehabilitation. 3. Develop a strong base knowledge of the current state of the literature regarding musculoskeletal adaptations to exercise. 4. Gain experience presenting research findings in oral and written format. Credits: 3.00

Selectives (0-6 credits)

HK 44400 - Balance Rehab In Older Adults

Credit Hours: 3.00. In this course, students learn about the decline in motor function that occurs in older adults and techniques to improve motor function in an older population. Topics include decreased balance control, loss of muscle strength, and declines in adaptive locomotion as a function of age. Students enrolled in this class also participate in an off-campus lab. In the lab, students are paired with an older adult and use the knowledge gained in lecture to improve the motor function of the older adult. This class provides students with a unique opportunity to gain hands-on experience working with an older population. Permission of instructor required.

Learning Outcomes: 1. Describe the declines in

motor function that occur in older adults. 2. Critically assess intervention research with aims to improve motor function in older adults. 3. Describe and evaluate types of interventions and their effectiveness. 4. Use quantitative equipment to assess balance and mobility of younger and older adults. Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

HDFS 60000 - Families And Health Across The Life Course

Credit Hours: 3.00. Interpersonal processes of family members and close others in the promotion of individual health choices and management of disease across the life course are covered. Course topics include involvement of family and close others in: health promotion and disease prevention; disease management; interactions with healthcare providers; and informal caregiving in the family context.

Learning Outcomes: 1. Evaluate research linking family ties with individual health and well-being across the life course. 2. Examine how interpersonal processes contribute to promoting health and managing illness of individuals across the life course. 3. Understand the role of family members in interactions with the healthcare system. 4. Differentiate diverse disciplinary approaches to families and health research across the life course. Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 64900 - Multidisciplinary Gerontology

Credit Hours: 3.00. A multidisciplinary overview of aging that provides a background for graduate studies on aging. An examination of sociological, psychological, and biological theory and research in the field of aging. The aging process from cells to social security will be covered. Projects will assist students in developing appropriate professional skills in their field of study. Students are expected to have basic research and writing skills in their field of study. The course serves as a graduate-level introduction to the field of gerontology. There are several options for course projects.

Learning Outcomes: 1. Describe and critique major theoretical and empirical foundations and

advances in gerontological research. 2. Examine and discuss the ways influences at different levels of function (e.g., biological, social) and from different academic disciplines (e.g., psychology, sociology) interact to shape the aging process and related outcomes. 3. Use existing literature to construct and support novel research ideas. 4. Practice and produce cogent, compelling writing. Credits: 3.00

NUTR 63400 - Nutrition And Cancer Prevention

Credit Hours: 2.00. An in-depth examination of the role of nutrition in cancer prevention. Typically offered in alternate years.

Credits: 2.00

SOC 57600 - Health And Aging In Social Context

Credit Hours: 3.00. Analysis of the social and cultural influences on health in adulthood and later life. Considers distribution of illness among older adults, health behavior, and health services use, including long-term care.

Credits: 3.00

SOC 67700 - Research Seminar On Aging And The Life Course

Credit Hours: 1.00. An interdisciplinary seminar examining recent research on aging and the responsible conduct of research. Emphasis is given to professional development in gerontology and related fields.

Credits: 1.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 53100 - Language Disorders In Adults

Credit Hours: 3.00. Study of the causes, assessment, and treatment of acquired language disorders in adults, including aphasia, right hemisphere syndromes, and dementia.

Credits: 3.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

SLHS 53800 - Motor Disorders Of Speech

Credit Hours: 2.00. A study of the neuropathologies that affect the speech production system. Emphasizes the differential diagnosis and management of acquired motor speech disorders.

Learning Outcomes: 1. The student will be able to describe how the types of dysarthria relate to damage in the brain and how the cranial nerves are involved in dysarthria. 2. The student will be able to describe and different views of disability and the levels at which individuals are affected by their difficulties and be able to implement these issues when assessing individuals with dysarthria and when setting goals for treatment. 3. The student will be able to correctly identify dysarthrias, based on case information and symptoms. 4. The student will be able to explain and describe appropriate intervention procedures given specific dysarthrias or speech, voice, resonance, and respiratory symptoms. 5. The student will demonstrate acceptable writing skills. Credits: 2.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to

diversity in developmental influences and trajectories, including atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

About the Program

Gifted, Creative, and Talented Studies, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54200 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to the curriculum development and program design for meeting the needs of gifted, creative, and talented students. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students.

Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns

along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Learning Outcomes: 1. Measure and evaluate one's professional growth and case conceptualization skills through use of audio tapes and case notes. 2. Demonstrate respect, understanding, and tolerance of multicultural and diversity issues as they relate to clients' need and concerns. 3. Demonstrate ethical and professional behavior in accord with the ACA Code of Ethics. Credits: 1.00 to 10.00

Required Courses (12 credits)

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

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Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

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Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns

along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Learning Outcomes: 1. Measure and evaluate one's professional growth and case conceptualization skills through use of audio tapes and case notes. 2. Demonstrate respect, understanding, and tolerance of multicultural and diversity issues as they relate to clients' need and concerns. 3. Demonstrate ethical and professional behavior in accord with the ACA Code of Ethics. Credits: 1.00 to 10.00

About the Program

Global Supply Chain Management, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (10 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

Selective (2 credits)

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

Required Courses (10 credits)

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision

procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

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Learning Outcomes: 1. Train the students to understand the issues in managing a global supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

GPA Requirements

About the Program

Governance and Policy for AI and Data Technology, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

POL 52101 - Applied Public Policy: Institutions, Processes, Practices

Credit Hours: 3.00. Applied introduction to the institutions, processes, and practices in the field of public policy. Students will examine the role of government institutions, standards organizations, corporate actors, and non-governmental organizations, policymakers, regulators, and the public in the policy process. The course will draw examples from one or more applied policy areas such as economic development, emerging technology policy, sustainability policy, energy, foreign policy, or social policy.

Learning Outcomes: 1. Summarize and describe the institutions, actors, and policy

process for different political systems. 2. Compare and contrast the role of political analysis and policy analysis for analyzing the viability and success of policy. 3. Evaluate a policy area and write a policy brief describing the history of the policy, current stakeholders in the area, the current state of policy, and emerging policy challenges or prospective changes. 4. Design translational communication materials to convey policy information to different audiences including specialists and non-specialists. Credits: 3.00

POL 52601 - Technology, AI, And Ethics In Public Policy And Public Administration

Credit Hours: 3.00. Examines how emerging technologies like artificial intelligence (AI), automated decision systems, and digital platforms are being adopted in the public sector. It explores the benefits as well as ethical risks and challenges associated with implementing these technologies in areas like healthcare, education, child welfare, and criminal justice. Students will analyze governance strategies, policies, and administrative procedures to promote responsible technology use in government.

Learning Outcomes: 1. Summarize the main forms of digital technology and algorithmic practices (AI) that are being adopted in government operations and decision-making, including automated decision systems, digital public interfaces, and data integration platforms. 2. Analyze emerging trends and developments in the use of AI, automated decision systems, and data analytics in public agencies and governments, in the U.S., internationally, and at the local level. 3. Assess the benefits as well as risks and challenges associated with implementing these technologies in the public sector, including how the use of new technology is transforming interactions between government and citizens, impacting social welfare, and implicating issues of transparency, accountability, discretion, discrimination, and public trust. 4. Evaluate ethical concerns, biases, and risks to social welfare that may arise from the use of AI and automated decision systems in administering public programs and services and demonstrate the ability to examine issues from multiple stakeholder perspectives. 5. Propose governance strategies, policy solutions, and administrative procedures to ensure responsible and ethical use of AI and other emerging technologies in the public sector, such as best practices for procurement, implementation, auditing, and public engagement. Credits: 3.00

POL 52701 - Local To Global Governance Of Data, AI, And Emerging Technology

Credit Hours: 3.00. This course introduces students to the institutions and governing systems at the subnational, national, supranational, and international levels that regulate emerging technology, AI, and data. Focusing on laws, standards, and best practices, students will examine comparative case studies of regulation of big tech in differing governing environments. Students will explore how social, economic, and political factors shape differences in technology regulation across the globe.

Learning Outcomes: 1. Summarize the main policy institutions, stakeholders, and regulatory actors in subnational, national, supranational, and international settings as applied to area of emerging technology, AI, and data. 2. Analyze the current state of policy and its implementation in one or more regions or states as applied to areas of emerging technology, AI, and data. 3. Develop a proposal for best practices for managing the use of AI, data resources, or other emerging technology in a private, public, or non-profit setting. 4. Compare and contrast differences in technology regulation across the globe and explain common sources for these differences. Credits: 3.00

Selective (3 credits)

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to political science data.

Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

SCLA 51000 - Data And AI Storytelling

Credit Hours: 3.00. The primary assumption of our course is that the goal of communicating with data is ultimately to identify causal mechanisms and change the status quo due to the obtained insights. All audiences have previous understandings of the world, and meaningful data stories should challenge their assumptions about that world. The communication of this data-based new knowledge violates prior assumptions, shares memorable new information and moves the audience to act based on the new knowledge. This is best accomplished through a story. In other words, this communication assumes the form of a story, which is defined as the narrative of how an unexpected cause creates an effect.

Learning Outcomes: 1. Provide high-quality data story examples and justify why they meet the good story criteria. 2. Identify and extrapolate core relationships between research design and story-building. 3. Generate hypotheses based on data. 4. Create specific data visualizations which maintain casual narratives. 5. Identify story elements that map onto the five tenets of What is a Data Story? 6. Identify in examples the adherence or violation of data transparency, validity and ethics. Credits: 3.00

SCLA 52200 - Artificial Intelligence Policy, Governance, And Ethics

Credit Hours: 3.00. This course provides students with a strong grounding in the policy, ethical, and legal regulatory dimensions and environment that shape the governance of AI. Students will analyze current and emerging laws, regulations, and governance strategies shaping the AI landscape across multiple jurisdictions and sectors. The course will help students gain an interdisciplinary understanding of the core ethical principles and values that guide AI.

Learning Outcomes: 1. Describe key stakeholders, institutions, and strategies involved in AI policymaking across multiple levels of government (local to global) in multiple fields and explain their roles in governing AI systems. 2. Evaluate the legal, regulatory, and other governance strategies that have been proposed or adopted by governments, firms, and civil society organizations, such as model cards, liability frameworks, standards, and impact assessments. 3. Analyze ethical and social issues related to the development and application of AI systems within multiple fields, including power, model bias, transparency, accountability, worker well-being, and privacy, as well as the translation of ethical values into technical aspects of AI governance practices within public and private, and non-profit sector organizations. 4. Synthesize, analyze, and communicate information about emerging policy issues in AI and the associated ethical and social dimensions, identify stakeholder perspectives, and summarize proposed solutions. 5. Assess current and evolving trends, debates, and solutions in AI governance and ethics through case studies, contemporary issues, and comparative analysis. Credits: 3.00

SCLA 52100 - Societal Impacts Of Artificial Intelligence

Credit Hours: 3.00. Students in this course will draw upon knowledge from multiple fields to understand how AI is transforming social, political, and economic practices in institutions and in society. They will utilize interdisciplinary theories and methodological tools to measure and evaluate the societal impacts of AI. The utilizes a mix of case and source data and recent research in the field of AI to create opportunities for shared communication and learning among those in technical and non-technical fields that utilize artificial intelligence. Students will engage in systematic analysis of societal impact.

Learning Outcomes: 1. Describe how AI is transforming social, political, and economic

institutions, practices and employment in multiple sectors, including healthcare, education, finance, communications, criminal justice and others. 2. Explain the nature of risks of AI in society and outline common strategies to manage risks. 3. Evaluate core theories used to understand AI's potential societal impact on connectedness, trust, creativity, and conflict. 4. Assess and communicate AI impacts by applying interdisciplinary tools drawing from social sciences, humanities, and STEM fields. 5. Identify the human rights implications of AI and understand potential mitigation practices. Credits: 3.00

POL 52901 - Applied Policy And Program Evaluation

Credit Hours: 3.00. This course introduces students to the logic of designing and implementing program evaluations to assess implemented policies and programs. The course examines research designs for different evaluation goals, the application of evaluation strategies, and strategies for reporting results to specialist and non-specialist audiences.

Learning Outcomes: 1. Describe the role and principles of evidence-based policymaking and program evaluation, including ethical considerations. 2. Explain the different aspects of evaluation, including inputs, outputs, outcomes, impacts, and processes, and identify complementary evaluation strategies. 3. Compare and contrast different methods for program impact evaluation, including ethical considerations. 4. Synthesize knowledge of program evaluation strategies to solve applied problems. 5. Communicate program evaluation results to specialists and non-specialists effectively. Credits: 3.00

POL 50601 - Data, Machine Learning, And Artificial Intelligence For The Public Sector

Credit Hours: 3.00. This course examines how machine learning algorithms and tools related to artificial intelligence can be used to advance our understanding in public sector domains. Students will develop a comprehensive understanding of how to apply AI and various machine learning algorithms, focusing on practical applications and hands-on experience. It provides an overview public sector data sources and addresses ethical and privacy issues associated with this type of data.

Learning Outcomes: 1. Identify, construct, and manipulate public data ethically and appropriately for use in AI and machine learning applications. 2. Explain privacy and ethical considerations associated with the use of public sector data, including issues that arise when combining public and private sector data. 3. Demonstrate a comprehensive understanding of popular AI and machine learning algorithms, including supervised and unsupervised learning techniques. 4. Apply AI and machine learning techniques to real-world data sets, emphasizing those techniques commonly used in government, policy, and political settings. 5. Assess, interpret, and report AI and machine learning output to audiences commonly found in government, policy, and political settings. Credits: 3.00

GRAD 50600 - Big Data Tools And Technologies

Credit Hours: 3.00. This course is designed to equip students with the essential skills to handle big data effectively. It covers proficiency in big data technologies, scalable data processing techniques, and the integration of big data tools into data science workflows.

Learning Outcomes: 1. Demonstrate proficiency in big data technologies. 2. Apply scalable data processing techniques to handle large datasets. 3. Integrate big data tools into comprehensive data science workflows. 4. Demonstrate proficiency with cloud computing. Credits: 3.00

GRAD 50700 - Cross Domain Data Communication And Visualization

Credit Hours: 3.00. This course focuses on the proficient use of data communication strategies and competencies. The course will focus on identifying data narratives, generating stories from data, illustrating with powerful and self-explanatory visualization, and basic principles of ethical use of non-data narrative frames for data communication. Designed for students with a technical background pursuing a Master of Science in Data Science, this course aims to enhance students' ability to extract and communicate meaning and narratives from raw data and visually represent it.

Learning Outcomes: 1. Create effective and aesthetically pleasing data visualizations. 2. Communicate complex data findings clearly to diverse audiences. 3. Utilize interactive visualization techniques for dynamic exploration of datasets. 4. Develop the ability to integrate ethics and data privacy considerations effectively when communicating with data. Credits: 3.00

Program Learning Outcomes

Health Communication Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Course (3 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

Selectives (6 credits)

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing,

and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

Required Course (3 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

Program Learning Outcomes

About the Program

Healthcare Leadership, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

PUBH 57100 - The Business Of Healthcare

Credit Hours: 3.00. This course is designed to help you keep pace with the rapidly changing world health and healthcare. We will (1) explore the drivers of value creation, valuation approaches, and the differences in capital structures between nonprofit and for-profit healthcare providers; (2) examine horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures, and vertical consolidation and integration between providers and payers; and (3) discuss the ethos of healthcare, disruptive innovation, and emotional intelligence.

Learning Outcomes: 1. Understand the drivers of value creation, valuation approaches, and differences in capital structures between nonprofit and for-profit healthcare providers. 2. Evaluate horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures and vertical consolidation and integrations between providers and payers. 3. Understand the ethos of healthcare and role of disruptive innovation and emotional intelligence in the advancement of healthcare delivery. 4. Analyze the role of healthcare value creation and its connection with hospital ownership and the disruptive innovation in healthcare. 5. Evaluate the intersection of public health,

population health, and the business of healthcare delivery. Credits: 3.00

PUBH 57600 - Workforce Management And Organizational Behavior In Healthcare

Credit Hours: 3.00. The course focuses on the relationships between healthcare administration and human resource management across various health care organizations, including hospitals, long-term care facilities, and community health organizations. Topics include personnel recruitment and training; compensation and benefits; performance evaluations; staffing plans; employee discipline; and credentialing health care professionals. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Identify strategies for the recruitment, selection, development, and retention of quality health care professionals while applying accreditation criteria to human resources practices. 2. Apply human resources management for problem solving and decision-making. 3. Identify various legal issues, which require managerial attention and strategy. 4. Understand the changing workforce dynamics and the issues associated with labor shortages of skilled professionals in the healthcare industry. 5. Prepare for future challenges and examining future trends in the human resource field within the industry of healthcare. 6. Understand regulatory compliance issues uniquely associated to the field of health care (such as Joint Commission) standards pertaining to safety, emergency preparedness, job analysis, performance appraisals, and employee retention. 7. Analyze employee productivity in patient-centered environments. 8. Put human resource principles, concepts, generalizations, theories and models into practice 9. Analyze the impact human resources management has on strategy formulation and strategy implementation. Credits: 3.00

PUBH 57700 - Strategic Planning And Marketing For Healthcare

Credit Hours: 3.00. This course provides an introduction to the conceptualization, development and implementation of strategic planning and marketing for healthcare organizations across several practice settings. Topics covered in the course include theories of decision-making, strategic planning and resource allocation, consumer behavior and provider comparisons. This course is a core class for the "Healthcare Quality Improvement" certificate program.

Learning Outcomes: 1. Apply the strategic planning process to a health care organization. 2. Understand strategic planning and marketing theories, principles, concepts, terms, methods, tactics, and tools. 3. Integrate strategic planning with marketing. 4. Analyze applications of planning and marketing in health care. 5. Know how strategic planning guides an organization in positioning itself in its defined market. 6. Discuss and define the position of the marketing function within the overall organizational structure of a health care system. 7. Formulate a health services marketing plan. 8. Compare alternative market research methods. 9. Identify the role and responsibility of health system governance in health care marketing. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Required Courses (9 credits)

PUBH 57100 - The Business Of Healthcare

Credit Hours: 3.00. This course is designed to help you keep pace with the rapidly changing world health and healthcare. We will (1) explore the drivers of value creation, valuation approaches, and the differences in capital structures between nonprofit and for-profit healthcare providers; (2) examine horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures, and vertical consolidation and integration between providers and payers; and (3) discuss the ethos of healthcare, disruptive

innovation, and emotional intelligence.

Learning Outcomes: 1. Understand the drivers of value creation, valuation approaches, and differences in capital structures between nonprofit and for-profit healthcare providers. 2. Evaluate horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures and vertical consolidation and integrations between providers and payers. 3. Understand the ethos of healthcare and role of disruptive innovation and emotional intelligence in the advancement of healthcare delivery. 4. Analyze the role of healthcare value creation and its connection with hospital ownership and the disruptive innovation in healthcare. 5. Evaluate the intersection of public health, population health, and the business of healthcare delivery. Credits: 3.00

PUBH 57600 - Workforce Management And Organizational Behavior In Healthcare

Credit Hours: 3.00. The course focuses on the relationships between healthcare administration and human resource management across various health care organizations, including hospitals, long-term care facilities, and community health organizations. Topics include personnel recruitment and training; compensation and benefits; performance evaluations; staffing plans; employee discipline; and credentialing health care professionals. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Identify strategies for the recruitment, selection, development, and retention of quality health care professionals while applying accreditation criteria to human resources practices. 2. Apply human resources management for problem solving and decision-making. 3. Identify various legal issues, which require managerial attention and strategy. 4. Understand the changing workforce dynamics and the issues associated with labor shortages of skilled professionals in the healthcare industry. 5. Prepare for future challenges and examining future trends in the human resource field within the industry of healthcare. 6. Understand regulatory compliance issues uniquely associated to the field of health care (such as Joint Commission) standards pertaining to safety, emergency preparedness, job analysis, performance appraisals, and employee retention. 7. Analyze employee productivity in patient-centered environments. 8. Put human resource principles, concepts, generalizations, theories and models into practice 9. Analyze the impact human resources management has on strategy formulation and strategy implementation. Credits: 3.00

PUBH 57700 - Strategic Planning And Marketing For Healthcare

Credit Hours: 3.00. This course provides an introduction to the conceptualization, development and implementation of strategic planning and marketing for healthcare organizations across several practice settings. Topics covered in the course include theories of decision-making, strategic planning and resource allocation, consumer behavior and provider comparisons. This course is a core class for the "Healthcare Quality Improvement" certificate program.

Learning Outcomes: 1. Apply the strategic planning process to a health care organization. 2. Understand strategic planning and marketing theories, principles, concepts, terms, methods, tactics, and tools. 3. Integrate strategic planning with marketing. 4. Analyze applications of planning and marketing in health care. 5. Know how strategic planning guides an organization in positioning itself in its defined market. 6. Discuss and define the position of the marketing function within the overall organizational structure of a health care system. 7. Formulate a health services marketing plan. 8. Compare alternative market research methods. 9. Identify the role and responsibility of health system governance in health care marketing. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that

may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Program Learning Outcomes

About the Program

Healthcare Operations, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

PUBH 58100 - Managing Complex Healthcare Operations

Credit Hours: 3.00. This course focuses on the familiarization of production processes and service systems, and quantitative analysis of problems arising in the management of operations. We consider key performance measures of operations (productivity, flexibility, quality, and response time) as well as important concepts in the planning, design, control, and improvement of processes in healthcare contexts along these dimensions. For this course, students will also acquire the ability to learn ways to conduct operations management through data analysis. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Understand the crucial importance of operations management in the healthcare environment. 2. Enhance analytical skills and the ability to uncover problems and opportunities for improvement in healthcare as well as other production and service processes. Credits: 3.00

PUBH 57500 - Healthcare Accounting & Reimbursement

Credit Hours: 3.00. This course teaches core financial skills of accounting and financial management as they apply to healthcare management systems. Topics include analysis of financial reporting, cost management; reimburse mechanisms, CFO Responsibilities, managed care contracting and fundraising and capital investment. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Apply financial concepts to health care related issues. 2. Assess the performance of healthcare organizations. 3. Use financial data to strategically align planning methodologies to reimbursement issues. 4. Discuss the impact of healthcare reimbursement on the financial solvency of the healthcare system. 5. Explore varying healthcare setting and the differing financial aspects of each. 6. Calculate profit in capitated markets. 7. Accounts receivable and revenue cycles in patient care environments. 8. Estimate cash flows in patient care settings. 9. Identify charge master and medical record and coding. Credits: 3.00

PUBH 58000 - Health Economics

Credit Hours: 3.00. This course will provide an introduction to the application of health economic principles as it relates to various health care systems, healthcare stakeholders and health policy issues in the United States. Topics include access to care; healthcare parity; relationships between economic characteristics and health status; impact of economy on health services industry; demand and resources for health services; utilization, prices, costs, and health insurance. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Understand the fundamental principles, generalizations and theories of health care economics and health care policy. 2. Apply economics and policy to improve rational thinking, problem solving and decision making for health care issues. 3. Develop skills, competencies and viewpoints needed by health services administrators. 4. Know how and why health care policy is formulated, implemented, and modified (based on outcomes). 5. Relate the relevance of economics to public policy. 6. Understand the

methodology and evaluation of various health programs and policies through the use of cost effectiveness and cost benefit analysis. 7. Identify how to participate in the policy-making process. 8. Communicate effectively orally and in writing with a wide range of people in varying settings. 9. Apply complex concepts, develop creative solutions, or adapt previous solutions in new ways. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Required Courses (9 credits)

PUBH 58100 - Managing Complex Healthcare Operations

Credit Hours: 3.00. This course focuses on the familiarization of production processes and service systems, and quantitative analysis of problems arising in the management of operations. We consider key performance measures of operations (productivity, flexibility, quality, and response time) as well as important concepts in the planning, design, control, and improvement of processes in healthcare contexts along these dimensions. For this course, students will also acquire the ability to learn ways to conduct operations management through data analysis. This course is a core class for the Healthcare Operations certificate program.

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effectiveness and cost benefit analysis. 7. Identify how to participate in the policy-making process. 8. Communicate effectively orally and in writing with a wide range of people in varying settings. 9. Apply complex concepts, develop creative solutions, or adapt previous solutions in new ways. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Program Learning Outcomes

About the Program

Healthcare Quality Improvement, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

PUBH 57800 - Healthcare Quality And Risk Management

Credit Hours: 3.00. The course explores how to identify quality and complexity issues affecting healthcare organization; how to develop, implement and assess quality improvement programs and strategies in various healthcare settings. Topics include continuous quality improvement; lean management; Six Sigma; IHI Quality Improvement Program; Baldrige criteria; patient safety; and quality tools. This course is a core class for the Healthcare Quality Improvement certificate programs.

Learning Outcomes: 1. Understand the interdependence, drivers and challenges of Quality and Information Management. 2. Learn and practice key aspects of multiple change management models, quality improvement methodologies and tools. Complete a quality improvement project using a basic improvement methodology. 3. Apply health care operations and quality management skills for problem solving and decision making. 4. Integrate the professions of health care operations, quality management and health administration. 5. Understand how health care operations and quality management affect allied health professionals and others. 6. Develop and use new ways of thinking about health care operations and quality management jobs and professions. 7. Analyze the impact health care operations has on quality management strategy formulation and strategy implementation. 8. Be able to integrate health care operations and quality management with organization and performance outcomes. 9. Understand the challenges in creating a culture of safety. 10. Understand the structures and drivers in incentive programs to improve care. Credits: 3.00

PUBH 57900 - Information Powered Patient Care In The 21st Century

Credit Hours: 3.00. This course focuses on the use of computer technology and information science to identify, gather, process, and manage information to help healthcare organizations succeed. Emphasis is placed on technology-based health applications, which support clinical, administrative, research, and educational decision-making that enhance the efficacy of health care administration.

Learning Outcomes: 1. Evaluate computer applications to aggregate and analyze data for evidence- based practice and quality improvement. 2. Describe systems theory and design as applied to health informatics. 3. Identify key trends and regulatory requirements for healthcare information systems. 4. Evaluate the strengths and weaknesses of health

information systems in practice. 5. Explain the relationship among information technology, information literacy, and evidence-based practice. 6. Describe and critique taxonomic and terminology systems used in national efforts to enhance interoperability of information systems and knowledge management. 7. Articulate ethical/legal issues that arise in using, designing, and managing healthcare information systems. 8. Analyze the methods used to align a health care information management plan with the corporate and strategic goals of a health care organization. 9. Practice the principles of project management. 10. Understand security and confidentiality issues, as well as health care information management trends and risks. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Required Courses (9 credits)

PUBH 57800 - Healthcare Quality And Risk Management

Credit Hours: 3.00. The course explores how to identify quality and complexity issues affecting healthcare organization; how to develop, implement and assess quality improvement programs and strategies in various healthcare settings. Topics include continuous quality improvement; lean management; Six Sigma; IHI Quality Improvement Program; Baldrige criteria; patient safety; and quality tools. This course is a core class for the Healthcare Quality Improvement certificate programs.

Learning Outcomes: 1. Understand the interdependence, drivers and challenges of Quality and Information Management. 2. Learn and practice key aspects of multiple change management models, quality improvement methodologies and tools. Complete a quality improvement project using a basic improvement methodology. 3. Apply health care operations and quality management skills for problem solving and decision making. 4. Integrate the professions of health care operations, quality management and health administration. 5. Understand how health care operations and quality management affect allied health professionals and others. 6. Develop and use new ways of thinking about health care operations and quality management jobs and professions. 7. Analyze the impact health care operations has on quality management strategy formulation and strategy implementation. 8. Be able to integrate health care operations and quality management with organization and performance outcomes. 9. Understand the challenges in creating a culture of safety. 10. Understand the structures and drivers in incentive programs to improve care. Credits: 3.00

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PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

Program Learning Outcomes

About the Program

Healthcare Service Excellence, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

HTM 55300 - Cultivating A Service Excellence Mindset For Healthcare Professionals

Credit Hours: 3.00. Notwithstanding the importance for healthcare services to prioritize clinical outcomes for patients, there is a growing need to think about the patient experience beyond science-driven, evidence-based practices. The healthcare sector is being transformed by consumerism and transparency that demands a more holistic approach to managing the patient experience. In order to promote patient engagement and to enhance their experience, an intentional strategic intent, as reflected in a service excellence mindset, is required. This course seeks to establish the foundation of this mindset for healthcare professionals that are driven to make a difference in their patients' lives. The aim of the course is for students to develop a greater appreciation for the complexity of providing excellent service in the healthcare industry. The course will stimulate students to think differently and more deeply about the patient experience through a service management lens. In doing so they will develop the necessary skills to make effective decisions in the constantly changing patient experience landscape. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the patient experience (patient expectations, drivers of satisfaction, service quality measurement, creating a service culture). 2. Examine the critical role of managing the employee-patient interface in delivering patient-centric services. 3. Recognize and evaluate various service management practices to enhance the patient experience. 4. Recommend key service management systems and practices to improve or solve problems in the complex healthcare environment. Credits: 3.00

HTM 55400 - Designing The Patient Experience For Contemporary Healthcare Systems

Credit Hours: 3.00. In the rapidly evolving healthcare industry, optimizing the patient experience remains a fundamental focus of practice. Addressing the practical challenge and complexity of providing excellent healthcare services, this class aims to inspire a design-thinking approach to reimagine and reinvent the patient experience in the contemporary healthcare systems. Learning by practice, students will apply the design tools to envisage, blueprint, and devise a patient experience solution. Gaining insights on experience-centric innovations in the healthcare domain, students will develop capabilities to better manage the service interactions, facility, and processes to enhance the quality of the patient experience and ease the stress of a hospital stay. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the role of experience design for healthcare organizations' strategic success in the contemporary market environment. 2. Conduct critical quantitative and qualitative analysis of the healthcare service experience. 3. Apply various experience design tools to innovatively design healthcare service experiences for the relevant stakeholders (e.g., patients, service providers). 4. Communicate effectively the design product in both written and verbal manners to healthcare professionals. Credits: 3.00

HTM 55500 - Investing In Healthcare Human Capital

Credit Hours: 3.00. The modern work environment is increasingly focused on working with people in teams - working with people and for people. In seeking to motivate and lead people, it is imperative to acknowledge individuals have different backgrounds, perspectives, and viewpoints. In successfully balancing the challenges of working with people in the labor intensive, diverse and high-stakes nature of the healthcare industry, this class seeks to provide knowledge on organizational behavior concepts (e.g., employee performance, satisfaction, engagement, and motivation; group behavior, teamwork; emotional labor, stress, work-life balance) and the skills to practice this knowledge as a healthcare professional. This course will provide students with the foundational building blocks to adapt to the changing landscape of the work environment, applying theories and exercising critical thinking skills to realize a transformative healthcare workforce experience. Permission of the department required.

Learning Outcomes: 1. Demonstrate an understanding of knowledge, skills, and abilities (KSA's) needed by successful leaders in the healthcare industry. 2. Apply organizational behavior theories and the role of managers in the context of the healthcare work environment. 3. Evaluate the role of leadership and management of personnel - individuals, groups, and teams - within the healthcare industry. 4. Recommend various leadership and management practices to improve and provide solutions for issues in today's healthcare workforce. Credits: 3.00

Program Learning Outcomes

History of the English Language, Post-Baccalaureate Certificate Human Resource Development, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

OLS 58300 - Coaching And Mentoring In Organizations

Credit Hours: 3.00. This course explores issues and practices in technologically-driven organizations pertaining to the roles and functions that coaching and mentoring play in employee development. A "best practices" approach, utilizing the case method, is emphasized. Presented from the point of view of a human resource manager/leader, the focus of the course is on identifying coaching opportunities, enhancing communication skills, developing and implementing coaching and mentoring strategies, and evaluating the outcomes of these strategies. Attention is directed to facilitating personal coaching mentoring skills. Course may be offered in traditional, distance, or blended format. Permission of department required.

Credits: 3.00

OLS 51500 - Foundations Of Human Resources

Credit Hours: 3.00. A survey course emphasizing the human resource function (and its development) in the context of the work organization. Human resource development topics include exploration of various training and development techniques, the relation of training to organizational strategies, training needs analysis, evaluation of training, and career development. The strategic approach to human resource management also is covered, including what human resource professionals can and should do to help the organization succeed. Permission of Department required.

Credits: 3.00

OLS 57400 - Managerial Training and Development

Credit Hours: 3.00. Review of current managerial education

and development theories and practices; discussion of fundamental social, economic, and political changes affecting business and the work of managing; implications of these changes for individual manager development and continued growth.

Credits: 3.00

Program Learning Outcomes

Hybrid Vehicle Systems ABE, Post-Baccalaureate Certificate Hybrid Vehicle Systems CHE, Post-Baccalaureate Certificate Hybrid Vehicle Systems ECE, Post-Baccalaureate Certificate Hybrid Vehicle Systems ME, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

Architecture Course (3 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ECE 51018 - Hybrid Electric Vehicles

Credit Hours: 3.00. Introduction to architectures and technologies associated with electric and hybrid electric vehicles including their constituent components. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization. Prerequisite by Topic: Energy conversion and power electronics.

Learning Outcomes: 1. Understand the principal architectures of electric and hybrid electric vehicles. 2. Analyze performance characteristics and understand limitations of each architecture. 3. Understand the principal components of an HEV including the energy storage, conversion, transmission, and control subsystems. 4. Integrate disparate subsystem models to form end-to-end vehicle model.

Credits: 3.00

ME 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and recognize the technologies available for each component. 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly

available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

Energy Storage or Controls Course (3 credits)

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

Prime Mover Course (3 credits)

ABE 69100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for advanced specialized topic areas in agricultural and biological engineering for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

ME 52500 - Combustion

Credit Hours: 3.00. Physical and chemical aspects of basic combustion phenomena. Chemical energetics and equilibrium. Basic chemical kinetics, chain reactions, and explosions. Chain and thermal ignition. Homogeneous combustion models. Detonations and deflagrations. Laminar flame speed and flame extinction. The Shvab-Zeldovich formulation of the multicomponent conservation equations. Diffusion flames and droplet combustion. Introduction to turbulent combustion.

Credits: 3.00

ME 54000 - Internal Combustion Engines

Credit Hours: 3.00. Spark-ignition and compression-ignition engine processes. Study of the fundamentals of turbulence, boundary, layers, liquid atomization, sprays, combustion, and pollutant formation as applied to engines. Engine after treatment. Modeling of engine flows, sprays, combustion, and pollutants. Offered in alternate years.

Learning Outcomes: 1. Study the fundamentals of turbulence, boundary layers, liquid atomization, sprays, combustion, and pollutant formation as applied to internal combustion engines. 2. Study the modeling of engine flows, sprays, combustion, and pollutant formation in internal combustion engines. Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

Additional Requirements

Architecture Course (3 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ECE 51018 - Hybrid Electric Vehicles

Credit Hours: 3.00. Introduction to architectures and technologies associated with electric and hybrid electric vehicles including their constituent components. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization. Prerequisite by Topic: Energy conversion and power electronics.

Learning Outcomes: 1. Understand the principal architectures of electric and hybrid electric vehicles. 2. Analyze performance characteristics and understand limitations of each architecture. 3. Understand the principal components of an HEV including the energy storage, conversion, transmission, and control subsystems. 4. Integrate disparate subsystem models to form end-to-end vehicle model.

Credits: 3.00

ME 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and recognize the technologies available for each component. 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

GPA Requirements

Required Courses (9 credits)

Architecture Course (3 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ECE 51018 - Hybrid Electric Vehicles

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Energy Storage or Controls Course (3 credits)

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

Prime Mover Course (3 credits)

ABE 69100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for advanced specialized topic areas in agricultural and biological engineering for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor

required.

Credits: 1.00 to 4.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

ME 52500 - Combustion

Credit Hours: 3.00. Physical and chemical aspects of basic combustion phenomena. Chemical energetics and equilibrium. Basic chemical kinetics, chain reactions, and explosions. Chain and thermal ignition. Homogeneous combustion models. Detonations and deflagrations. Laminar flame speed and flame extinction. The Shvab-Zeldovich formulation of the multicomponent conservation equations. Diffusion flames and droplet combustion. Introduction to turbulent combustion.

Credits: 3.00

ME 54000 - Internal Combustion Engines

Credit Hours: 3.00. Spark-ignition and compression-ignition engine processes. Study of the fundamentals of turbulence, boundary, layers, liquid atomization, sprays, combustion, and pollutant formation as applied to engines. Engine after treatment. Modeling of engine flows, sprays, combustion, and pollutants. Offered in alternate years.

Learning Outcomes: 1. Study the fundamentals of turbulence, boundary layers, liquid atomization, sprays, combustion, and pollutant formation as applied to internal combustion engines. 2. Study the modeling of engine flows, sprays, combustion, and pollutant formation in internal combustion engines. Credits: 3.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

Additional Requirements

Architecture Course (3 credits)

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ECE 51018 - Hybrid Electric Vehicles

Credit Hours: 3.00. Introduction to architectures and technologies associated with electric and hybrid electric vehicles including their constituent components. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization. Prerequisite by Topic: Energy conversion and power electronics.

Learning Outcomes: 1. Understand the principal architectures of electric and hybrid electric vehicles. 2. Analyze performance characteristics and understand limitations of each architecture. 3. Understand the principal components of an HEV including the energy storage, conversion, transmission, and control

subsystems. 4. Integrate disparate subsystem models to form end-to-end vehicle model. Credits: 3.00

ME 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and recognize the technologies available for each component. 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

About the Program

Hybrid Vehicle Systems MSE, Post-Baccalaureate Certificate Hypersonics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (3 credits)

AAE 51100 - Introduction To Fluid Mechanics

Credit Hours: 3.00. The basic conservation equations are derived for a compressible viscous fluid, and then are specialized for applications in potential flow, viscous flow, and gas dynamics.

Learning Outcomes: 1. Use index notation to derive vector and tensor relations. 2. Manipulate and derive governing equations in various forms. 3. Determine streamlines, pathlines, streaklines and timelines for unsteady flow. 4. Determine how vorticity is produced by various mechanisms. 5. Determine the motion of two-dimensional point vortices. 6. Use conformal mapping to find the lift coefficient on an airfoil shape. 7. Use a Schwarz-Christoffel transformation to solve for potential flow with corners. 8. Use three-dimensional potential flow to solve for flow over axisymmetric bodies. 9. Solve for steady and unsteady exact solutions of the Navier-Stokes equations. 10. Derive and use the Stokes drag law for a sphere. 11. Derive boundary layer equations, find self-similar solutions and determine scaling laws. 12. Compute skin friction on an airfoil using an approximate boundary layer method. 13. Determine the qualitative effects of turbulence on a flow. Credits: 3.00

AAE 51400 - Intermediate Aerodynamics

Credit Hours: 3.00. Thin airfoil theory and panel methods. Three-dimensional elementary solutions, lifting-line and lifting-surface models. Slender wing and slender body theory. Normal/oblique shock waves. One- and multi-dimensional flows and conical flows. Method of characteristics. Introduction to transonic flow, hypersonic flow, and airfoil design.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

ME 50900 - Intermediate Fluid Mechanics

Credit Hours: 3.00. Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

Learning Outcomes: 1. State basic laws for a control volume in different coordinate systems. 2. Derive the kinematics of fluid flow in problem solving. 3. Derive the equations for frictionless and incompressible flows. 4. Derive the basic equations of motion of viscous flows. 5. Find standard exact solutions of viscous-flow equations and apply them. 6. Derive and solve basic equations of boundary-layer theory. 7. Find lift and drag forces on immersed bodies with simple shapes. 8. Understand concepts of incompressible turbulent flows and wall turbulence. Credits: 3.00

ME 51000 - Gas Dynamics

Credit Hours: 3.00. Flow of compressible fluids. One-dimensional flows including basic concepts, isentropic flow, normal and oblique shock waves, Rayleigh line, Fanno line, and simple waves. Multidimensional flows including general concepts, small perturbation theory for linearized flows and method of characteristics for nonlinear flows. Prerequisite: first course in fluid or aerodynamics.

Credits: 3.00

AAE 54800 - Mechanical Behavior Of Aerospace Materials

Credit Hours: 3.00. This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smartphones. In fact, breakthroughs with material research are often accompanied by rapid advancements in technology. Thus, it is paramount for all engineers to have an understanding of the structure and behavior of materials. In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and, ultimately, failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms. Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal-material levels and their use in explaining the deformation and failure characteristics in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of aerospace materials: metal alloys, ceramic-matrix composites, and fiber-reinforced polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, creep, and failure mechanisms; design criteria; special topics. We will attempt to have minimal overlap with AAE 55400, Fatigue of Structures and Materials. Therefore we will not cover fracture, fatigue, or stress concentrators.

Learning Outcomes: 1. Express vector and tensor equations using indicial notation. 2. Express crystallography according to Miller indices and define slip systems in basic crystal structures. 3. Calculate and understand the physical basis of elastic anisotropy. 4. Understand, calculate, and use basic states of stress and yield criteria. 5. Define and understand the physical basis of point, line, and area defects in crystalline materials. 6. Calculate the strain fields, stress fields, and energy of dislocations, in addition forces between dislocations. 7. Understand dislocation motion as well as interactions between dislocations. 8. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 9. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 10. Understand origins of twinning, stacking faults, and the shape memory effects. 11. Understand physics and calculate strengthening influence of solutes, precipitates, grain boundaries, and strain hardening. 12. Understand physical origins of creep, calculate creep using Larson-Miller expressions, and use creep deformation mechanism map. 13. Understand origins of residual stress and apply to constrain problems. 14. Understand and apply statistical approaches to identify probability of failure and property variations. 15. Define and classify polymer

structures. 16. Understand viscoelasticity and calculate behavior using classical models. 17. Distinguish physical mechanisms of polymer deformation, crazing, and fracture. 18. Express stiffness and strength of fiber reinforced composite structures. Credits: 3.00

Hypersonic Courses (6 credits)

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 51900 - Hypersonic Aerothermodynamics

Credit Hours: 3.00. Aerodynamics of satellites and planetary re-entry. Continuum hypersonic flow. Inviscid and viscous effects, boundary layers, and heat transfer. Shock and boundary-layer interactions. Equilibrium flow of high-temperature reacting gases. Nonequilibrium effects. Kinetic theory and rarefied flows. Direct simulation Monte Carlo techniques.

Credits: 3.00

AAE 53700 - Hypersonic Propulsion

Credit Hours: 3.00. Analysis of advanced high speed air breathing propulsion concepts for hypersonic flight. Missions and trajectories. Engine/airframe integration. Aerothermodynamic analysis of ramjets, scramjets, and oblique detonation wave engines. On- and off-design of compression inlets and minimum length nozzles. Cryogenic fuels and skin cooling. Ram accelerator ballistic launch concepts.

Learning Outcomes: 1. Develop understanding of high-speed inlet systems. 2. Develop understanding of mixing systems employed in airbreathing engines. 3. Develop understanding of turbine-based combined cycle systems. 4. Develop understanding of detonative-based propulsion systems. 5. Develop understanding of ducted rockets. 6. Develop understanding of ramjet and scramjet propulsion systems.
Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 62400 - Laminar-Turbulent Transition

Credit Hours: 3.00. Instability mechanisms, such as Kelvin-Helmholtz, Tollmien-Schlichting, Gortler, and crossflow. Secondary instabilities. Nonlinear and nonparallel effects; the Parabolized Stability Equations; receptivity; transition prediction. Effects of compressibility, heating, roughness, turbulence, noise, curvature, etc. Turbulent spots and the extent of transitional flow. Prerequisite: AAE 51100.

Credits: 3.00

MSE 51700 - Materials For Hypersonics

Credit Hours: 3.00. This course will include a brief history of hypersonic flight and design, along with a description of the aerothermal environment, to provide motivation for the use of ceramic materials as thermal protection systems and window materials. The classroom approach is to develop a fundamental understanding of materials structure, forming and sintering, and properties (mechanical and thermal) of ceramics, and then apply that knowledge for hypersonic applications such as ultra-

high temperature ceramics (UHTCs including ZrB2), ceramic matrix composites (including Cf/SiC, SiCf/SiC, and Carbon/Carbon), and materials requirements for RF and IR radomes and windows. Permission of instructor required.

Learning Outcomes: 1. Become familiar with the aerothermal environment expected during hypersonic flight. 2. Learn how to process high-temperature ceramic materials, from colloidal design to forming methods such as additive manufacturing. 3. Understand flexure testing and Weibull statistics interpretation of ceramic materials. 4. Know how bonding and microstructure affect thermal properties. 5. Understand the basic material requirements for radar frequency and infrared frequency windows for hypersonic flight. 6. Articulate the assumptions of various thermodynamic models used to estimate heat flux and surface temperatures during hypersonic flight. 7. Differentiate the advantages and disadvantages of different additive manufacturing techniques used for ceramics. 8. Calculate sample strengths for different-sized flexure specimens. 9. Make assessments of the thermal shock resistance of materials based on mechanical and thermal properties. 10. Calculate the thicknesses of random materials based on the frequency of interest for different RF window concepts. Credits: 3.00

Mathematics Courses (3 credits)

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations. Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory. Credits: 3.00

Required Courses (3 credits)

AAE 51100 - Introduction To Fluid Mechanics

Credit Hours: 3.00. The basic conservation equations are derived for a compressible viscous fluid, and then are specialized for applications in potential flow, viscous flow, and gas dynamics.

Learning Outcomes: 1. Use index notation to derive vector and tensor relations. 2. Manipulate and derive governing equations in various forms. 3. Determine streamlines, pathlines, streaklines and timelines for unsteady flow. 4.

Determine how vorticity is produced by various mechanisms. 5. Determine the motion of two-dimensional point vortices. 6. Use conformal mapping to find the lift coefficient on an airfoil shape. 7. Use a Schwarz-Christoffel transformation to solve for potential flow with corners. 8. Use three-dimensional potential flow to solve for flow over axisymmetric bodies. 9. Solve for steady and unsteady exact solutions of the Navier-Stokes equations. 10. Derive and use the Stokes drag law for a sphere. 11. Derive boundary layer equations, find self-similar solutions and determine scaling laws. 12. Compute skin friction on an airfoil using an approximate boundary layer method. 13. Determine the qualitative effects of turbulence on a flow. Credits: 3.00

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Credit Hours: 3.00. Thin airfoil theory and panel methods. Three-dimensional elementary solutions, lifting-line and lifting-surface models. Slender wing and slender body theory. Normal/oblique shock waves. One- and multi-dimensional flows and conical flows. Method of characteristics. Introduction to transonic flow, hypersonic flow, and airfoil design.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

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Credit Hours: 3.00. Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

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Credits: 3.00

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Credit Hours: 3.00. This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smartphones. In fact, breakthroughs with material research are often accompanied by rapid advancements in technology. Thus, it is paramount for all engineers to have an understanding of the structure and behavior of materials. In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and, ultimately, failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms. Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal-material levels and their use in explaining the deformation and failure characteristics in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of aerospace materials: metal alloys, ceramic-matrix composites, and fiber-reinforced polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, creep, and failure mechanisms; design criteria; special topics. We will attempt to have minimal overlap with AAE 55400, Fatigue of Structures and Materials. Therefore we will not cover fracture, fatigue, or stress concentrators.

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Express crystallography according to Miller indices and define slip systems in basic crystal structures. 3. Calculate and understand the physical basis of elastic anisotropy. 4. Understand, calculate, and use basic states of stress and yield criteria. 5. Define and understand the physical basis of point, line, and area defects in crystalline materials. 6. Calculate the strain fields, stress fields, and energy of dislocations, in addition forces between dislocations. 7. Understand dislocation motion as well as interactions between dislocations. 8. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 9. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 10. Understand origins of twinning, stacking faults, and the shape memory effects. 11. Understand physics and calculate strengthening influence of solutes, precipitates, grain boundaries, and strain hardening. 12. Understand physical origins of creep, calculate creep using Larson-Miller expressions, and use creep deformation mechanism map. 13. Understand origins of residual stress and apply to constrain problems. 14. Understand and apply statistical approaches to identify probability of failure and property variations. 15. Define and classify polymer structures. 16. Understand viscoelasticity and calculate behavior using classical models. 17. Distinguish physical mechanisms of polymer deformation, crazing, and fracture. 18. Express stiffness and strength of fiber reinforced composite structures. Credits: 3.00

GPA Requirements

About the Program

Inclusive Excellence, Post-

Baccalaureate Certificate

About the Program

Program Requirements

Required Course (3 credits)

AMST 65000 - Reading Seminar In American Studies

Credit Hours: 3.00. A reading seminar on a selected topic in American Studies, taught by two faculty members from different disciplines, usually one from the humanities and one from the social sciences. Prerequisite: AMST 60100.

Credits: 3.00

Experiential Learning Course (3 credits)

AMST 69500 - American Studies Service Learning/Internship

Credit Hours: 3.00. This course is to be used by students to complete a service learning or internship project that provides professional development towards completion of the degree. The project must be conducted under the supervision of a faculty member and community partner. The faculty supervisor will be responsible for determining the academic content of the course and requirements of service. In addition to academic requirements for the course, a final written report on the project must be filed with the American Studies program. The final report must describe the relationship between work completed for the course and the student's plan of study. Prerequisite: AMST 60100, AMST60200.

Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

Selectives (3 credits)

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

PUBH 51100 - Foundations Of Global Health

Credit Hours: 3.00. Global disparities in the health and well-being of diverse populations, across and within borders, has never been greater. Profound and rapid changes in demographics, from population growth to urbanization, along with unprecedented shifts in patterns of disease and risks, are coupled with game-changing advances in knowledge, technology, and innovation. This course will introduce students to current challenges and efforts at solutions in global health, with a focus on low- and middle-income countries. It will provide an interdisciplinary overview of topics that include measures of health and disease, communicable diseases such as HIV/AIDS and malaria, non-communicable diseases such as diabetes and cardiovascular disease, women's health, maternal and child health, food systems and nutrition, health systems, and health care delivery. In addition to lectures, the course will include interactive discussions of case studies and specific country examples, aimed at immersing students in the debates and challenges facing global health leaders and decision makers.

Learning Outcomes: 1. Identify major shifts and trends in health patterns, burden of disease, population dynamics, and globalization. 2. Understand the historical context of global health and current evolving agendas. 3. Analyze diverse global health challenges, incorporating ethical, environmental, political, historical, and societal perspectives, with a focus on low- and middle-income countries. 4. Evaluate global health research to assess how conclusions arise from evidence and analysis. 5. Formulate evidence-based arguments for/against diverse global health policies or interventions. Credits: 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

PSY 68200 - Advanced Seminar In Industrial Organizational Psychology

Credit Hours: 3.00. Special topics in industrial and organizational psychology are offered on a two-year rotating basis. The special topics are: work motivation, leadership, advanced selection and placement, and performance appraisal. One topic will be treated each semester.

Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 61100 - Social Inequality: Class, Race, And Gender

Credit Hours: 3.00. Survey of major approaches (functional, status attainment, labor market, class, culture) to the sociological study of inequality, including qualitative and quantitative, historical and comparative studies. Students will be asked to complete a project analyzing inequality, which might provide the basis for a publishable paper. Prerequisite: Master's student standing and Sociology majors only.

Credits: 3.00

AAS 57500 - Theories Of African American Studies

Credit Hours: 3.00. This course addresses the development of an African American intellectual tradition. The course will span disciplines and swathes of time in order to understand how scholars not only created new ideas but developed theories that shaped and changed academic inquiry.

Learning Outcomes: 1. Critically analyze & synthesize Theoretical Paradigms of the African American experience. 2. Present material clearly and facilitate discussion. 3. Enhance interpretive skills. 4. Conduct ethical research. Credits: 3.00

AMST 65000 - Reading Seminar In American Studies

Credit Hours: 3.00. A reading seminar on a selected topic in American Studies, taught by two faculty members from different disciplines, usually one from the humanities and one from the social sciences. Prerequisite: AMST 60100.

Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

WGSS 68200 - Issues In Feminist Research And Methodology

Credit Hours: 3.00. This course provides a methodological framework for theorizing, constructing and executing research from a feminist perspective. Students acquire knowledge of the diversity of feminist research projects and methods; they learn to pose research questions; and they will be able to prepare a research or grant proposal drawing on interdisciplinary methods. The course is designed to meet the needs of graduate students in Women's Studies and is open to students in other programs who are interested in feminist research. The course deals with both theoretical and practical issues in methodology. Prerequisites: WGSS 68000 .

Learning Outcomes: 1. To understand and describe the distinguishing features of feminist research from a variety of disciplines. 2. About the range of qualitative and quantitative research methods used by feminist scholars. 3. To examine how interdisciplinary feminist perspectives shape research methods. 4. About discussions of feminist epistemology, including feminist critiques of science and the development of feminist empiricist, standpoint and postmodernist epistemologies. 5. To develop the skills to interpret and critically evaluate research in women's studies, in both interdisciplinary journals and discipline-specific journals. 6. To develop their own feminist methods and approaches by producing a research project. Credits: 3.00

WGSS 68000 - Feminist Theory

Credit Hours: 3.00. This course focuses on feminist theories at an advanced level and in a global perspective. Graduate students engage with key theoretical issues in contemporary feminist studies, and examine how feminist scholars have theorized women and gender issues across disciplines.

Credits: 3.00

AGEC 53200 - World Food Problems

Credit Hours: 3.00. This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Learning Outcomes: 1. Understand global food production and consumption, food trade and its history including: the major plants produced and consumed; where they are grown; patterns and extent of global food trade; major food animals and animal production systems; countries involved in food trade; urbanization and food

transportation; and effects of post-harvest processing on food trade and availability. 2. Understand basics of world population growth and its relationship to past and future food production and consumption globally. 3. Understand what malnutrition looks like, where it occurs, how it is measured, and the interactions between malnutrition (both under nutrition and obesity) and human health. 4. Understand the basic economic principles that affect consumer food costs and consumption patterns globally. 5. Understand how culture, communication and politics influence food availability, world food problems and malnutrition. 6. Predict, based on available information, likely scenarios for the future of world food problems and malnutrition. Credits: 3.00

Required Course (3 credits)

AMST 65000 - Reading Seminar In American Studies

Credit Hours: 3.00. A reading seminar on a selected topic in American Studies, taught by two faculty members from different disciplines, usually one from the humanities and one from the social sciences. Prerequisite: AMST 60100.
Credits: 3.00

Program Learning Outcomes

Additional Information

About the Program

Information Assurance Education, Post-Baccalaureate Certificate
Information Technology Business Analysis, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Course (3 credits)

CNIT 53000 - Information Technology Business Analysis

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that business analysts use to solve business problems related to information technology projects. Special emphasis is placed on learning and applying the concepts of enterprise analysis, business analysis planning, stakeholder management, requirements management, and solution evaluation. Permission of department required.
Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for IT business analyst skillsets in information technology projects. 2. Research and assess the various means to construct a business case and business analysis plan to justify the execution of a project and then plan the business analyst's activities on the project. 3. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 4. Select, defend and utilize business analysis tools and techniques in the context of information technology projects. 5. Research and contribute to the business analysis body of knowledge as it can be applied to information technology projects. Credits: 3.00

Selectives (9 credits)

CNIT 53100 - Information Technology Requirements Analysis And Modeling

Credit Hours: 3.00. This course introduces and develops the skills that business analysts will need to solve business

problems and effectively model and analyze stakeholder requirements in order to define workable solutions and effective communicate customer needs. Permission of department required.

Learning Outcomes: 1. Apply business and requirements modeling techniques to solicit and support business analysis and problem solving. 2. Categorize, select and use specific visual modeling techniques to elicit, understand and communicate business requirements. 3. Research and analyze, then discuss in intelligent conversation, the techniques and tools used for modeling to support business requirements. 4. Perform general modeling techniques in combination with Visual Modeling learned from the resources provided for analyzing requirements and creating a requirements toolbox for a proposed solution. Credits: 3.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

CNIT 58500 - Organizational Change Management For IT Projects

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to manage the "people" side of organizational change that results from IT projects that implement new technologies, systems, services, and products into the workplace. This is sometimes called stakeholder management. The course reviews research of best practices in change management and their impact on project metrics such as schedule, budget, scope, stakeholder satisfaction. Students also learn how to identify and document the organizational and people impacts of new information technology solutions, and then develop a formal project plan to manage the organizational change. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for organizational change management into information technology projects. 2. Pro-actively apply an organizational change management framework and principles to a business situation, ideally an information technology project. 3. Discuss, in intelligent discourse, the types of disruptive organizational change and how they can be caused by information technology projects. 4. Accurately document, and communicate IT-enabled changes to existing business processes. 5. Select, defend and utilize organizational change management tools and techniques in the context of information technology projects and management. 6. For residential, thesis students, research and contribute to the organizational change management body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 53200 - IT Enterprise Analysis

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that enterprise level business analyst use to create accurate requirements statements, organization level needs analysis and accurate business cases which assist the project team in developing schedules and budgets as well as strategic management teams in selecting the right projects to execute. Special emphasis is placed on learning and applying the concepts of innovation driven management. Permission of Department required.

Learning Outcomes: 1. Research in order to

identify and define enterprise level business needs mostly represented in a strategic plan and discover opportunities for improvement. 2. Develop the ability to assess and build an accurate informative assessable business case for proposed projects. 3. Apply the process to consistently and accurately capture project metrics to assess its success or failure at meeting customer stated goals. 4. Research, analyze, and demonstrate how to build a mature, Innovation-Driven business analysis practice or center of excellence within an enterprise. Credits: 3.00

CNIT 53500 - Advanced Topics In IT Business Analysis

Credit Hours: 3.00. The course explores the topics and tools used by today's information system professionals to lead the requirements gathering, estimating, developing, and delivery efforts of custom software applications. Course emphasis focuses on agile methodologies. Emphasis is also placed on requirements gathering and estimating technics commonly used with agile teams. Permission of Department required.

Learning Outcomes: 1. Research and analyze, then discuss then in intelligent discourse, the applications of an agile mindset to your life. 2. Research and demonstrate an understanding of an Agile methodology. 3. Research and analyze, then discuss in intelligent discourse, commonalities and detail differences between common Agile frameworks. 4. Research and analyze requirements elicitation and management practices using an agile methodology. 5. Research and apply user experience and user interface techniques, and agile estimating techniques. 6. Research and analyze, then discuss then in intelligent discourse, enterprise agile frameworks. 7. Research and analyze, then discuss then in intelligent discourse, tools that can aide in the organization of teams and project information. 8. Research and analyze, then discuss then in intelligent discourse, Business Analysis certifications, their value and purpose. Credits: 3.00

CNIT 58600 - IT Requirements Management

Credit Hours: 3.00. The course explores the approaches used by today's information system professionals to conduct and manage the requirements development process. Course emphasis focuses on contemporary techniques for requirements elicitation, requirements analysis, requirements specification, requirements validation and verification. Emphasis is also placed on identifying stakeholders through the use of formal stakeholder analysis techniques, the use of formal change control, requirements traceability and the use of requirements management tools. The course is designed based on the principles and competencies prescribed by the Project Management institute's PM BOK (Project Management Body of Knowledge) and Business Analyst Guide as well as the International Institute of Business Analysis's BABOK (Business Analysis Body of Knowledge). Permission of Department required.

Learning Outcomes: 1. Research and analyze in order to discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for requirements management into information technology projects. 2. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 3. Accurately document, and communicate business requirements for an IT project. 4. Select, defend and utilize requirements management tools and techniques in the context of information technology projects and management. 5. For residential, thesis students, research and contribute to the requirements management body of knowledge as it can be applied to information technology projects. Credits: 3.00

Required Course (3 credits)

CNIT 53000 - Information Technology Business Analysis

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that business analysts use to solve business problems related to information technology projects. Special emphasis is placed on learning and applying the concepts of enterprise analysis, business analysis

planning, stakeholder management, requirements management, and solution evaluation. Permission of department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for IT business analyst skillsets in information technology projects. 2. Research and assess the various means to construct a business case and business analysis plan to justify the execution of a project and then plan the business analyst's activities on the project. 3. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 4. Select, defend and utilize business analysis tools and techniques in the context of information technology projects. 5. Research and contribute to the business analysis body of knowledge as it can be applied to information technology projects. Credits: 3.00

About the Program

Innovation and Technology Commercialization, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (4 credits)

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65730 - Technology Strategy

Credit Hours: 2.00 or 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage. We take an in-depth look at how technological innovation affects the competitive dynamics of markets, how firms can strategically manage these dynamics, and how firms can create and implement strategies to maximize their likelihood of success. The course introduces tools, concepts, and analytical frameworks that will enhance your ability to define and analyze strategic problems that stem from innovation and technological change, and to identify sources of competitive advantage from both an industry and firm-level perspective. Permission of department required.

Learning Outcomes: 1. Assess the degree to which a firm or industry is subject to technological factors. 2. Evaluate the temporal dynamics of an industry, lifecycles and s-curves from both a technological maturity and adoption (installed customer base) perspective. 3. Design firm strategies to capitalize on internal technological capabilities and external opportunities. 4. Formulate collaboration strategies and strategies for protecting innovation. Credits: 2.00 or 3.00

Selectives (5 credits)

MGMT 64500 - Mergers, Acquisitions, And Corporate Control

Credit Hours: 2.00 to 4.00. Focuses on firms' internal governance structures and on pressure from the external market for corporate control, including executive compensation, board of directors' composition, shareholder activism, mergers, and takeovers. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00

to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65330 - HR Strategy

Credit Hours: 2.00 to 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Learning Outcomes: 1. Understand the history of human resource management and how it has evolved to the strategic level. 2. Understand what strategic Human Resource Management means and entails. 3. Understand and complete a Human Resource Management Strategic plan. 4. Make yourself an invaluable resource to upper level management and the CEO by demonstrating the extreme importance and value of Strategic Human Resource management. Credits: 2.00 to 3.00

MGMT 57400 - Frontiers In Manufacturing Technology

Credit Hours: 1.00. This course will explore various types of technologies used in manufacturing today and the implication for future uses and applications. These modules will provide background, applications, and current use cases of the various tools. Students will also conduct weekly research on various technology applications.

Learning Outcomes: 1. Gain an understanding of the various technologies (17 types will be discussed). 2. Gain an understanding and be able to apply these tools to within the manufacturing sector. 3. Work independently and improve their ability to stay on task. 4. Be exposed to the history and how these technologies have evolved. 5. Gain an understanding of the future technological trends. Credits: 1.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence

others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Required Courses (4 credits)

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65730 - Technology Strategy

Credit Hours: 2.00 or 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage. We take an in-depth look at how technological innovation affects the competitive dynamics of markets, how firms can strategically manage these dynamics, and how firms can create and implement strategies to maximize their likelihood of success. The course introduces tools, concepts, and analytical frameworks that will enhance your ability to define and analyze strategic problems that stem from innovation and technological change, and to identify sources of competitive advantage from both an industry and firm-level perspective. Permission of department required.

Learning Outcomes: 1. Assess the degree to which a firm or industry is subject to technological factors. 2. Evaluate the temporal dynamics of an industry, lifecycles and s-curves from both a technological maturity and adoption (installed customer base) perspective. 3. Design firm strategies to capitalize on internal technological capabilities and external opportunities. 4. Formulate collaboration strategies and strategies for protecting innovation. Credits: 2.00 or 3.00

GPA Requirements

About the Program

Instructional Design, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself.

Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

Selective Course (3 credits)

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 55600 - Educational Video Game Design

Credit Hours: 3.00. Designed to provide an introduction to the design of educational video games. The focus of the course is on two areas: 1) the learning, instructional design, and game design theories which can inform the design of effective and engage in educational video games, and 2) how to apply those theories within practical settings.

Learning Outcomes: 1. Become comfortable with the history, concepts, terminology, culture, and classification of educational video and computer games. 2. Explore current research on educational computer and video games. 3. Examine learning, instructional design, and game design theories for relevance to the design of educational computer and video games. 4. Apply theory be designing, developing, and implementing a prototype of an educational computer or video game as teams. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of

educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of learning systems design to real-world educational situations through the in-depth consideration of key instructional design processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose

and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

EDCI 63300 - Instructional Design Project Management

Credit Hours: 3.00. This course focuses on the application of project management ideas, concepts, and strategies in instructional design settings. Students will be asked to consider the relationship between instructional design and project management, tools that can assist with managing instructional design projects, and factors influencing the instructional design project management process. Students will explore these topics by creating deliverables for instructional design cases and other interactive assignments.

Learning Outcomes: 1. Explain and reflect upon common project management terminology's role in instructional design projects. 2. Analyze and articulate the relationship between project management and instructional design. 3. Propose and/or develop relevant intervention strategies (instructional design and project management) to real-world instructional design issues that are consistent with arguments and evidence presented. 4. Integrate project management technologies and tools in the development of instructional design project management. 5. Interpret the role of interpersonal skills in and factors impacting project management instructional design initiatives. Credits: 3.00

Intercultural Competence Mentorship, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Course (3 credits)

GRAD 60000 - Mentoring Intercultural Growth: Theory And Application

Credit Hours: 3.00. The ability to mentor intercultural competence, the capacity to interact effectively across differences of many kinds is a key expectation of today's leaders. This course supports your ability to mentor others' intercultural development by building your own and by engaging in experiential learning, reflective practices, and knowledge acquisition. Topics explored include mentorship, learning theories, facilitation, assessment, and frameworks for intercultural competence and diversity, equity, and inclusion.

Learning Outcomes: 1. Articulate new self-awareness (e.g., of your own cultural identity and habitual behaviors) as an intercultural mentor, noting areas for potential growth. 2. Demonstrate foundational knowledge of models, frameworks, and practical approaches to bridging differences from the intercultural/global and diversity/inclusion realms. 3. Design and implement learning interventions for the development of intercultural competence. 4. Utilize appropriate formative and summative methods of assessing learners' intercultural development. Credits: 3.00

Electives (6 credits)

Additional Requirements (0-3 credits)

Required Course (3 credits)

GRAD 60000 - Mentoring Intercultural Growth: Theory And Application

Credit Hours: 3.00. The ability to mentor intercultural

competence, the capacity to interact effectively across differences of many kinds is a key expectation of today's leaders. This course supports your ability to mentor others' intercultural development by building your own and by engaging in experiential learning, reflective practices, and knowledge acquisition. Topics explored include mentorship, learning theories, facilitation, assessment, and frameworks for intercultural competence and diversity, equity, and inclusion.

Learning Outcomes: 1. Articulate new self-awareness (e.g., of your own cultural identity and habitual behaviors) as an intercultural mentor, noting areas for potential growth. 2. Demonstrate foundational knowledge of models, frameworks, and practical approaches to bridging differences from the intercultural/global and diversity/inclusion realms. 3. Design and implement learning interventions for the development of intercultural competence. 4. Utilize appropriate formative and summative methods of assessing learners' intercultural development. Credits: 3.00

Additional Information

Program Learning Outcomes

About the Program

International Development, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ENE 55400 - Globalization And Engineering

Credit Hours: 3.00. The focus is on the multifaceted dynamics of globalization, and its impact on engineering practice and the lives and education of engineers. The course emphasizes engineering and globalization from the perspectives of the emerging Asian economies and Europe, as well as the United States. This course is designed for practicing engineers and engineering educators. It is taught within a learner-centric, highly interactive, collaborative learning environment in which students are expected to learn from the experiences and thinking of each other, as well as from the instructor, and other course resources. The course places emphasis on reading, writing, web-based research, and discussion. Students are recommended (but not required) to have a minimum of two years work experience as a practicing engineer and strong communication skills (self-assessed). Permission of instructor is required.

Learning Outcomes: 1. Have increased global awareness. 2. Have knowledge of the dynamics of globalization as an economic and social process including contrasting theories and interpretations of events. 3. Have knowledge of how globalization is studied and characterized by economists, political scientists, and sociologists. 4. Able to interpret studies and research on globalization. 5. Understand the nature and roles of engineering education and life-long learning within the globalization dynamic. 6. Understand the innovation process within a global enterprise including contrasting theories and the ability to analyze specific cases. 7. Able to lead and innovate within a rapidly globalizing profession. 8. Know the engineering profession, engineering education, and globalization from the perspectives of countries beyond the United States, particularly perspectives from Europe and the emerging economies of Asia. Credits: 3.00

ASEC 55100 - International Engagement And Development Strategies

Credit Hours: 3.00. Sem. S and SS, cr. 3; an overview of cross-disciplinary, cultural, theoretical frameworks, communication tools, and assessment methods applied to international agricultural development and engagement. Lectures, panel

discussions, and case studies on appropriate methods of development and engagement, international project planning, intercultural effectiveness, principles of sustainable agricultural, food, community development, and program/project monitoring and evaluation will be the basis of assignments and team work. This eight-week course will provide the theoretical and social frameworks and principles needed to successfully work in multi-agency partnerships on international development projects.

Learning Outcomes: 1. Select the most culturally-appropriate application of disciplinary knowledge and technologies for agriculture, food, natural resources and related sciences in development programs. 2. Deconstruct self biases and intercultural effectiveness and their critical and creative thinking skills for different contexts in appropriate applications of scientific research as creative interventions and evaluation. 3. Differentiate high and low oral and written communication skills, tolerance of cultural ambiguity, and adaptability. 4. Judge the efficacy of applying appropriate theoretical frameworks for engaging stakeholders in projects to create sustainable impact. 5. Determine the relevance of the result of applying principals and applications of ethical decision making and professional development. 6. Reflect on one's progress and abilities to work in multi-disciplinary teams to carryout developing country assessments and conceptualize a viable project proposal under a tight deadline. Credits: 3.00

POL 54101 - Applied Foundations Of Global Development

Credit Hours: 3.00. Describes the foundational concepts of economic development and the historical emergence of global inequality, provides explanations of global inequality, and explores Western efforts to mitigate it through foreign aid. Applies concepts to analyze current trends in development and emerging practices in foreign aid.

Learning Outcomes: 1. Explain the global history of economic and human development. 2. Contrast notions of development beyond the narrow concept of economic growth. 3. Identify and critique a wide array of explanations for why some countries are developed and others are not. 4. Analyze international, domestic, and geographical constraints on economic development. 5. Describe the workings of the international aid regime. 6. Demonstrate practical skills for working in the field of development such as communication, organization, and analysis. Credits: 3.00

Selective (3 credits)

AGEC 64000 - Agricultural Policy

Credit Hours: 3.00. Policy analysis for agriculture in the world economy. Emphasis on application of economic theory to analyze commodity programs, international trade, environmental concerns, and investment in human capital and agricultural research. Prerequisite: AGEC 41000, AGEC 60400.

Credits: 3.00

AGEC 68400 - Applied Quantitative Methods For Decision Making

Credit Hours: 3.00. Explores the application of contemporary concepts and quantitative techniques for decision making in the face of uncertainty. Focus is on application of statistical tools to decisions facing the food and agricultural business manager. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68700 - Problem Solving And Project Management For Decision Makers

Credit Hours: 3.00. Develops a structured approach to problem solving, including problem definition, development of alternatives, identifying consequences, assessing trade-offs, and making informed choices. Research methods and project management concepts will be addressed. A major business analysis project will be framed during the course, to be completed as part of the capstone course in business analysis. Permission of department required.

Learning Outcomes: 1. Identify and conduct

original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

CE 54300 - Coastal Engineering

Credit Hours: 3.00. An introduction to coastal engineering with emphasis on the interaction between oceanic dynamic processes (waves, currents, and tides) and coastal regions (beaches, harbors, structures, and estuaries) and on the engineering approaches necessary to prevent adverse effects caused by this interaction.

Credits: 3.00

CE 54900 - Computational Watershed Hydrology

Credit Hours: 3.00. Use of professional computer programs for the calculation of the runoff from complex basins. Generation of unit hydrographs. Calculation of losses, channel and reservoir routing, parameter optimization, and application of Kinematic wave technique to urban catchments. Offered in alternate years.

Credits: 3.00

CE 55000 - Physico-Chemical Processes In Environmental Engineering I

Credit Hours: 3.00. This is the first of a two-course sequence and covers physico-chemical processes as applied in water and wastewater treatment. Topics include: reactor theory, mixing, gravity separation, centrifugation, adsorption, ion exchange, disinfection kinetics, acid/base chemistry, neutralization, precipitation, and corrosion.

Learning Outcomes: 1. Learn fundamental principles of physico/chemical processes that are commonly used by Environmental Engineers with an emphasis on water treatment. 2. Understand principles that have a broad application in Environmental Engineering and other disciplines. 3. Focus on fundamental concepts so as to prompt application in a wide range of settings and to promote creativity. Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

ENE 55400 - Globalization And Engineering

Credit Hours: 3.00. The focus is on the multifaceted dynamics of globalization, and its impact on engineering practice and the lives and education of engineers. The course emphasizes engineering and globalization from the perspectives of the emerging Asian economies and Europe, as well as the United States. This course is designed for practicing engineers and engineering educators. It is taught within a learner-centric, highly interactive, collaborative learning environment in which students are expected to learn from the experiences and thinking of each other, as well as from the instructor, and other course resources. The course places emphasis on reading, writing, web-based research, and discussion. Students are recommended (but not required) to have a minimum of two years work experience as a practicing engineer and strong communication skills (self-assessed). Permission of instructor is required.

Learning Outcomes: 1. Have increased global awareness. 2. Have knowledge of the dynamics of globalization as an economic and social process including contrasting theories and interpretations of events. 3. Have knowledge of how globalization is studied and characterized by economists, political scientists, and sociologists. 4. Able to interpret studies and research on globalization. 5. Understand the nature and roles of engineering education and life-long learning within the globalization dynamic. 6. Understand the innovation process within a global enterprise including contrasting theories and the ability to analyze specific cases. 7. Able to lead and innovate within a rapidly globalizing profession. 8. Know the engineering profession, engineering education, and globalization from the perspectives of countries beyond the United States, particularly perspectives from Europe and the emerging economies of Asia. Credits: 3.00

AGEC 68100 - Economics For Food And Agribusiness Managers

Credit Hours: 3.00. Addresses the institutional setting, business climate, and structure of the food and agricultural markets. Encompasses both the domestic and international dimensions of the food chain, including consumer demand, global sourcing, and worldwide production potential. Focuses on managerial economics, as applied to such topics as food system market structure, the nature and dimensions of domestic and global competition, the components of cost and revenue, and the food system value chain. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68500 - Advanced Quantitative Methods For Decision Making Under Uncertainty

Credit Hours: 3.00. Explores key areas of risk management of the food and agricultural firm, including price, production, strategic, regulatory, technology, market/competitor, political, financial, and exchange rate risk. Contemporary tools, such as score carding, decision trees, and real options are introduced for quantifying and managing uncertain decisions. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68600 - Strategic Food And Agribusiness Management

Credit Hours: 3.00. This course explores integration of the functional areas of business at the corporate level. Heavy emphasis is on analysis of the business environment, setting strategic direction, assessing core competencies, choosing a market position and developing competitive advantage, and organizational implementation and control in the context of the food and agricultural markets. The course makes heavy use of case studies of firms in the food and agricultural marketplace. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68200 - The Macroeconomics And Trade Environment Of The Food System

Credit Hours: 3.00. Exposes students to the nature of linkages among agriculture, international markets, and the macro-economy, which are key to the fortunes of U.S. farmers and agribusiness. Exam theories and methods that allow students to establish or quantify these linkages and evaluate the consequences of alternative policies, demonstrating the usefulness of economic analysis as a tool. Also explores current policy issues facing the food and agribusiness industries, which might include farm legislation; environmental regulations; and food safety and nutrition labeling rules, among other policy topics. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 53200 - World Food Problems

Credit Hours: 3.00. This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Learning Outcomes: 1. Understand global food

production and consumption, food trade and its history including: the major plants produced and consumed; where they are grown; patterns and extent of global food trade; major food animals and animal production systems; countries involved in food trade; urbanization and food transportation; and effects of post-harvest processing on food trade and availability. 2. Understand basics of world population growth and its relationship to past and future food production and consumption globally. 3. Understand what malnutrition looks like, where it occurs, how it is measured, and the interactions between malnutrition (both under nutrition and obesity) and human health. 4. Understand the basic economic principles that affect consumer food costs and consumption patterns globally. 5. Understand how culture, communication and politics influence food availability, world food problems and malnutrition. 6. Predict, based on available information, likely scenarios for the future of world food problems and malnutrition. Credits: 3.00

ASEC 54600 - Communication And Issues Engagement For Agricultural Professionals

Credit Hours: 3.00. In this eight-week online course, students will be exposed to science communication and issues engagement principles. The course is designed primarily for those with little or no formal communication training. Topics include evidence-based best practices for communicating science; news media and social media influences on controversial science; how to monitor controversial issues; and major theoretical perspectives and strategies for engaging the public on food and agricultural science.

Learning Outcomes: 1. Integrate best communication practices from the literature for engaging audiences about agriculture and science. 2. Analyze audiences and design appropriate messaging based on audience characteristics and needs. 3. Develop and adapt communication strategies for science-based controversial issues. 4. Formulate evidence-based strategies to anticipate controversial issues in agriculture and science. Credits: 3.00

ASEC 54800 - Communicating Science To The Public

Credit Hours: 1.00. This course will help graduate students in science disciplines learn to communicate science to non-expert audiences. Through readings, assignments and guided discussions, students will learn relevant communication theories and recommended strategies for engaging with the public on science and technology topics.

Learning Outcomes: 1. Apply findings from the literature to anticipate how values and culture influence public perceptions of science. 2. Integrate key communication concepts and theories in the development of effective communication strategies for science and technology. 3. Analyze audiences and design messaging for specific audience segments. Credits: 1.00

CE 53600 - Non-destructive Testing And Sensing For Civil Infrastructures

Credit Hours: 3.00. This course will equip students with necessary fundamental knowledge related to the Non-Destructive Testing methods. The topics will be discussed including fundamental materials mechanical properties and linear fracture mechanics of materials, testing procedures of commonly used civil materials and structures. The content such as, elasticity, fracture mechanics, and wave propagation, will be covered. Various case studies will be discussed to help students understand and apply the knowledge to field inspection or monitoring of civil materials and structures.

Learning Outcomes: 1. Be familiar with terminology and basic concepts of materials and structure failure mode, and failure mechanisms. 2. Understand basic principles of various NDT techniques including stress wave, magnetic, electrical, radar and fiber optics-based methods. 3. Be familiar with typical data acquisition and signal processing involved in NDT methods. 4. Be familiar with equipment and testing procedures of common NDT methods used for civil infrastructure materials and structures. 5. Understand working mechanisms of various infrastructure sensing

and monitoring technologies, their applications and limitations. 6. Identify and apply appropriate NDT methods for materials and structural health monitoring and sensing. 7. Perform hands on testing and make decisions after data processing. 8. Report the NDT testing results professionally in both oral and written format. Credits: 3.00

POL 52101 - Applied Public Policy: Institutions, Processes, Practices

Credit Hours: 3.00. Applied introduction to the institutions, processes, and practices in the field of public policy. Students will examine the role of government institutions, standards organizations, corporate actors, and non-governmental organizations, policymakers, regulators, and the public in the policy process. The course will draw examples from one or more applied policy areas such as economic development, emerging technology policy, sustainability policy, energy, foreign policy, or social policy.

Learning Outcomes: 1. Summarize and describe the institutions, actors, and policy process for different political systems. 2. Compare and contrast the role of political analysis and policy analysis for analyzing the viability and success of policy. 3. Evaluate a policy area and write a policy brief describing the history of the policy, current stakeholders in the area, the current state of policy, and emerging policy challenges or prospective changes. 4. Design translational communication materials to convey policy information to different audiences including specialists and non-specialists. Credits: 3.00

POL 52901 - Applied Policy And Program Evaluation

Credit Hours: 3.00. This course introduces students to the logic of designing and implementing program evaluations to assess implemented policies and programs. The course examines research designs for different evaluation goals, the application of evaluation strategies, and strategies for reporting results to specialist and non-specialist audiences.

Learning Outcomes: 1. Describe the role and principles of evidence-based policymaking and program evaluation, including ethical considerations. 2. Explain the different aspects of evaluation, including inputs, outputs, outcomes, impacts, and processes, and identify complementary evaluation strategies. 3. Compare and contrast different methods for program impact evaluation, including ethical considerations. 4. Synthesize knowledge of program evaluation strategies to solve applied problems. 5. Communicate program evaluation results to specialists and non-specialists effectively. Credits: 3.00

Program Learning Outcomes

GPA Requirements

K-12 Integrated STEM Education, Post-Baccalaureate Certificate

About the Program

Program Requirements

Residential Option

Required Courses (12 credits)

EDCI 53900 - Introduction To K-12 Integrated Science, Technology, Engineering And Mathematics (STEM) Education

Credit Hours: 3.00. This course will provide students with a conceptual understanding of integrated K-12 Science, Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3.

Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDCI 55850 - Introduction To Teaching Engineering And Technology Design In The Context Of K-12 Integrated STEM

Credit Hours: 3.00. Engineering and technology design has gained considerable traction in many K-12 schools. In this course, we will examine principals of engineering design and technology as well as where and how engineering and technology design best fits in a K-12 integrated STEM curriculum. Course participants will engage in authentic engineering and technology design experiences. Course participants will also design, develop, deliver integrated lessons that help K-12 students develop the knowledge, skills, and practices of engineering and technology design.

Learning Outcomes: 1. Demonstrate a broad understanding of engineering and technology education disciplines and concepts. 2. Scaffold engineering practices that support diverse learners and describe conceptual understanding and content knowledge of engineering and technology design skills through problem-based learning in i-STEM environments. 3. Comprehend and elaborate data-driven decision-making skills as practiced by engineering and technology professionals to develop solutions to design briefs that support K-12 learning in diverse learning environments. 4. Examine and evaluate the engineering design process in the context of integrated STEM education at the K-12 learning. 5. Collaborate and prepare pedagogical practices in integrated engineering and technology design through integrated STEM that support K-12 learning for a diverse group of learners. Credits: 3.00

EDCI 55950 - Engineering And Technology Design Practicum

Credit Hours: 3.00. EPICS is a service-learning design course in which teams of students from across campus work together on long- term projects that benefit the community. Project work centers around the engineering, technology, and computing needs of a community partner, but interdisciplinary team interaction is an integral element for project success. Students may participate in EPICS multiple semesters and participation for multiple consecutive semesters on a project team is encouraged. Teams are composed of first year students through seniors.

Most EPICS projects last at least one-year, though partnership with the community organization continues for several years. Projects are intended to solve real problems, are defined in partnership with their community partners, and span the complete design process cycle [problem identification - specification development - conceptual design - detailed design - delivery - service/maintenance - retirement].

You receive academic credit for participating in EPICS. How academic credits are applied to your major depends on your degree program and is determined by your department and/or advisor. See https://engineering.purdue.edu/EPICS/purdue/epics-purdue/credit.

Learning Outcomes: 1. Apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Be aware of the customer. 5. Function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Communicate effectively both orally and written with widely-varying backgrounds. 7. Be aware of professional ethics and responsibility. 8. Have an appreciation of the role that their discipline can play in social contexts. Credits: 3.00

Selective (3 credits)

EDCI 60500 - Teaching Integrated Science, Technology, Engineering And Math

Credit Hours: 3.00. Analysis of historical developments and present trends in science education; the designing, implementation, and evaluation of science programs; the role of research in present and future developments.

Learning Outcomes: 1. Identify, describe, and explain the fundamental tenets of different constructivist learning theories and their relevancy to STEM education. 2. Clarify and refine beliefs about teaching and learning in STEM education. 3. Identify and characterize students' ideas about STEM and how they influence learning. 4. Explore students' thinking and understanding of STEM through multiple strategies. 5. Describe ways to assess student learning in STEM. 6. Identify, practice, and reflect upon teaching strategies commensurate with teaching beliefs and knowledge about how students learn STEM through an integrated approach. 7. Compare and evaluate curriculum resources for integrating STEM instruction. 8. Devise a comprehensive lesson plan for integrating STEM instruction based on science and engineering practices and teaching for all learners. 9. Teach and reflect upon an integrated STEM lesson employing multiple instructional strategies. 10. Evaluate student learning in the context of an integrated STEM lesson. Credits: 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

EDCI 55850 - Introduction To Teaching Engineering And Technology Design In The Context Of K-12 Integrated STEM

Credit Hours: 3.00. Engineering and technology design has gained considerable traction in many K-12 schools. In this course, we will examine principals of engineering design and technology as well as where and how engineering and technology design best fits in a K-12 integrated STEM curriculum. Course participants will engage in authentic engineering and technology design experiences. Course participants will also design, develop, deliver integrated lessons that help K-12 students develop the knowledge, skills, and practices of engineering and technology design.

Learning Outcomes: 1. Demonstrate a broad understanding of engineering and technology education disciplines and concepts. 2. Scaffold engineering practices that support diverse learners and describe conceptual understanding and content knowledge of engineering and technology design skills through problem-based learning in i-STEM environments. 3. Comprehend and elaborate data-driven decision-making skills as practiced by engineering and technology professionals to develop solutions to design briefs that support K-12 learning in diverse learning environments. 4. Examine and evaluate the engineering

design process in the context of integrated STEM education at the K-12 learning. 5. Collaborate and prepare pedagogical practices in integrated engineering and technology design through integrated STEM that support K-12 learning for a diverse group of learners. Credits: 3.00

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Most EPICS projects last at least one-year, though partnership with the community organization continues for several years. Projects are intended to solve real problems, are defined in partnership with their community partners, and span the complete design process cycle [problem identification - specification development - conceptual design - detailed design - delivery - service/maintenance - retirement].
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https://engineering.purdue.edu/EPICS/purdue/epics-purdue/credit.

Learning Outcomes: 1. Apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Be aware of the customer. 5. Function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Communicate effectively both orally and written with widely-varying backgrounds. 7. Be aware of professional ethics and responsibility. 8. Have an appreciation of the role that their discipline can play in social contexts. Credits: 3.00

Required Courses (12 credits)

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Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types

of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

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Credit Hours: 3.00. Engineering and technology design has gained considerable traction in many K-12 schools. In this course, we will examine principals of engineering design and technology as well as where and how engineering and technology design best fits in a K-12 integrated STEM curriculum. Course participants will engage in authentic engineering and technology design experiences. Course participants will also design, develop, deliver integrated lessons that help K-12 students develop the knowledge, skills, and practices of engineering and technology design.

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Online Option

Required Courses (15 credits)

EDCI 54900 - Assessment In STEM Education

Credit Hours: 3.00. This course is designed to help teachers of STEM recognize the link between productive assessment and productive instruction, using the STEM education standards for teacher competence in educational assessment. This course is designed to help teachers meet those professional standards and understand the public pressure as well as instructional need for effective formative and summative assessment.

Learning Outcomes: 1. Choose appropriate assessment methods. 2. Develop appropriate assessment methods. 3. Administer scoring and interpreting assessment results. 4. Use assessment results to make decisions about individual students, plan teaching and develop curriculum. 5. Communicate assessment results to students, parents, and other educators. 6. Recognize inappropriate assessment methods and uses of assessment information. Credits: 3.00

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Learning Outcomes: 1. Apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Be aware of the customer. 5. Function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Communicate effectively both orally and written with widely-varying backgrounds. 7. Be aware of professional ethics and responsibility. 8. Have an appreciation of the role that their discipline can play in social contexts. Credits: 3.00

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Credit Hours: 3.00. This course will provide students with a conceptual understanding of integrated K-12 Science, Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to

nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDCI 55850 - Introduction To Teaching Engineering And Technology Design In The Context Of K-12 Integrated STEM

Credit Hours: 3.00. Engineering and technology design has gained considerable traction in many K-12 schools. In this course, we will examine principals of engineering design and technology as well as where and how engineering and technology design best fits in a K-12 integrated STEM curriculum. Course participants will engage in authentic engineering and technology design experiences. Course participants will also design, develop, deliver integrated lessons that help K-12 students develop the knowledge, skills, and practices of engineering and technology design.

Learning Outcomes: 1. Demonstrate a broad understanding of engineering and technology education disciplines and concepts. 2. Scaffold engineering practices that support diverse learners and describe conceptual understanding and content knowledge of engineering and technology design skills through problem-based learning in i-STEM environments. 3. Comprehend and elaborate data-driven decision-making skills as practiced by engineering and technology professionals to develop solutions to design briefs that support K-12 learning in diverse learning environments. 4. Examine and evaluate the engineering design process in the context of integrated STEM education at the K-12 learning. 5. Collaborate and prepare pedagogical practices in integrated engineering and technology design through integrated STEM that support K-12 learning for a diverse group of learners. Credits: 3.00

EDCI 55950 - Engineering And Technology Design Practicum

Credit Hours: 3.00. EPICS is a service-learning design course in which teams of students from across campus work together on long- term projects that benefit the community. Project work centers around the engineering, technology, and computing needs of a community partner, but interdisciplinary team interaction is an integral element for project success. Students may participate in EPICS multiple semesters and participation for multiple consecutive semesters on a project team is encouraged. Teams are composed of first year students through seniors.

Most EPICS projects last at least one-year, though partnership with the community organization continues for several years. Projects are intended to solve real problems, are defined in partnership with their community partners, and span the complete design process cycle [problem identification - specification development - conceptual design - detailed design - delivery - service/maintenance - retirement].

You receive academic credit for participating in EPICS. How academic credits are applied to your major depends on your degree program and is determined by your department and/or advisor. See

https://engineering.purdue.edu/EPICS/purdue/epics-purdue/credit.

Learning Outcomes: 1. Apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Be aware of the customer. 5. Function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Communicate effectively both orally and written with widely-varying backgrounds. 7. Be aware of professional ethics and responsibility. 8. Have an appreciation of the role that their discipline can play in social contexts. Credits: 3.00

About the Program

K-12 Technology Integration, Post-Baccalaureate Certificate Leadership Development Program: Advanced Manufacturing Education, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDCI 55300 - Leadership Development In Career And Technical Education

Credit Hours: 3.00. Design, development, implementation, and evaluation of systems and strategies for enhancing the skills and knowledge of personnel seeking to become leaders in the field of Career and Technical Education (CTE); research related to critical and emerging leadership issues, strategies, policies, and resources are examined and applied to program improvement initiatives in schools, the workplace, agencies, and other organizations that serve a wide variety of youth, adolescents, young adults, and adults.

Learning Outcomes: 1. Identify and adapt models of staff development, in-service education, and program improvement. 2. Use organizational, adult learning, motivational, leadership, and social systems therapy in staff development and school-or agency-based program improvement activities. 3. Develop and implement organizational communications and group-related interactions effectively. 4. Evaluate the principles related to leadership style; organizational development, initiation and management of change, needs analysis, and consultation strategies; and program improvement activities. 5. Locate current and emerging funding sources, as well as effective procedures for developing grant seeking and project management strategies. 6. Implement comprehensive strategies for developing assessing and improving programs, policies, practices, and services related to career and technical education programs. 7. Design and implement effective interagency collaboration initiatives. Credits: 3.00

EDCI 65300 - Seminar In Career And Technical Education

Credit Hours: 1.00 to 9.00. Current trends, theory, and practices related to educational contexts and careers.

Learning Outcomes: 1. Review, synthesize, analyze, and critique current research in education, career and technical education, and related fields and disciplines. 2. Identify significant research problem areas and researchable problems in education. 3. Examine and evaluate research methods used and applicable in education fields and related disciplines. 4. Explore various research dissemination strategies. 5. Network with researchers in education and related fields. Credits: 1.00 to 9.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Leadership Development Program: Career Education, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDCI 55000 - Career Education

Credit Hours: 3.00. An overview of contemporary legislation, educational reform, trends, and issues; career education program models; vocational and technical education, technology prep, and school-to-work systems; partnerships; foundations of career education; career development; curriculum; career guidance and counseling; career assessment; career planning practices; learning styles and instructional strategies; career information sources and resources; exemplary programs; and special needs populations and practices.

Learning Outcomes: 1. Describe the major legislative provisions and educational reforms affecting the delivery of career education. 2. Evaluate significant trends in career education, and professional and social issues. 3. Identify and adapt (a) career education model(s). 4. Describe the Career and Technical Education, Tech Prep, Career Pathways, and School-to-Career delivery systems. 5. Discuss effective partnerships between and among the school, the community, and business and industry. 6. Describe the foundations of career education. 7. Explain the career development process. 8. Identify the roles of elementary, middle, high school, postsecondary, and adult education; and business and industry in career education. 9. Develop career education curriculum; career clusters and pathways; and occupational, job, and task analysis. 10. Apply career guidance and counseling practices and procedures. 11. Utilize career assessment strategies. 12. Implement career planning practices and procedures. 13. Adapt appropriate learning styles and instructional strategies for individual learners. 14. Locate and use career information sources. 15. Identify, select, and utilize appropriate career information resources related to the school, community, governmental agency, occupational, and professional resources. 16. Identify, compare, contrast, and adapt exemplary career education programs. 17. Identify special needs populations and effective practices. Credits: 3.00

EDCI 55300 - Leadership Development In Career And Technical Education

Credit Hours: 3.00. Design, development, implementation, and evaluation of systems and strategies for enhancing the skills and knowledge of personnel seeking to become leaders in the field of Career and Technical Education (CTE); research related to critical and emerging leadership issues, strategies, policies, and resources are examined and applied to program improvement initiatives in schools, the workplace, agencies, and other organizations that serve a wide variety of youth, adolescents, young adults, and adults.

Learning Outcomes: 1. Identify and adapt models of staff development, in-service education, and program improvement. 2. Use organizational, adult learning, motivational, leadership, and social systems therapy in staff development and school-or agency-based program improvement activities. 3. Develop and implement organizational communications and group-related interactions effectively. 4. Evaluate the principles related to leadership style; organizational development, initiation and management of change, needs analysis, and

consultation strategies; and program improvement activities. 5. Locate current and emerging funding sources, as well as effective procedures for developing grant seeking and project management strategies. 6. Implement comprehensive strategies for developing assessing and improving programs, policies, practices, and services related to career and technical education programs. 7. Design and implement effective interagency collaboration initiatives. Credits: 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Leadership Development Program: Generalizable Skills Instruction, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDCI 55200 - Generalizable Skills Instruction In Career And Technical Education

Credit Hours: 3.00. Curriculum, assessment, planning, implementation, and evaluation relating to generalizable skills (also known as generic, transferable, or workplace skills) in career and technical education, other content areas, and special education programs; philosophical, historical, social, economic, political, and educational influencing factors; analysis and synthesis of current research and conceptual models; practical applications for programs; instructional strategies; resources and support services, interdisciplinary collaboration approaches; applications for special needs learners; learning styles and characteristics.

Learning Outcomes: 1. Identify and analyze the philosophical, historical, social, economic, political, and educational factors influencing generalizable skills instruction in career and technical education programs. 2. Locate, analyze, and synthesize contemporary generalizable skills literature and research and its application in career and technical programs. 3. Identify, analyze, and apply a conceptual model for generalizable skills instruction regarding curriculum, assessment, planning, implementation, and evaluation. 4. Identify generalizable skills curriculum. 5. Examine and apply methods of generalizable skills curriculum development and revision. 6. Review and analyze functional, curriculum-based assessment, instruments, strategies, and procedures. 7. Describe and use procedures for using generalizable skills assessment data/information in individualized educational planning. 8. Identify the individual learning styles and characteristics of, and apply appropriate instructional approaches for, individual students in career and technical programs. 9. Identify, locate, select, and evaluate instructional resource materials and support services useful in generalizable skills instruction. 10. Identify, adapt, and develop methods for teaching generalizable skills in career and technical programs. 11. Develop and implement interagency collaboration strategies among career and technical education, special education, support/remedial services, and content related (e.g., mathematics, reading) school personnel. 12. Identify and select appropriate evaluation methods and procedures for determining the adequacy, quality, and effectiveness of generalizable skills instruction and support services in career and technical education programs. Credits: 3.00

EDCI 55300 - Leadership Development In Career And Technical Education

Credit Hours: 3.00. Design, development, implementation, and evaluation of systems and strategies for enhancing the skills and knowledge of personnel seeking to become leaders in the field of Career and Technical Education (CTE); research related to critical and emerging leadership issues, strategies, policies, and resources are examined and applied to program improvement initiatives in schools, the workplace, agencies, and other organizations that serve a wide variety of youth, adolescents, young adults, and adults.

Learning Outcomes: 1. Identify and adapt models of staff development, in-service education, and program improvement. 2. Use organizational, adult learning, motivational, leadership, and social systems therapy in staff development and school-or agency-based program improvement activities. 3. Develop and implement organizational communications and group-related interactions effectively. 4. Evaluate the principles related to leadership style; organizational development, initiation and management of change, needs analysis, and consultation strategies; and program improvement activities. 5. Locate current and emerging funding sources, as well as effective procedures for developing grant seeking and project management strategies. 6. Implement comprehensive strategies for developing assessing and improving programs, policies, practices, and services related to career and technical education programs. 7. Design and implement effective interagency collaboration initiatives. Credits: 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Leadership Development

Program: Special Needs, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDCI 54400 - Career And Technical Education For Special Needs Learners

Credit Hours: 3.00. Legislative initiatives; identification of special needs learners at the elementary, secondary, postsecondary, and adult levels; learning characteristics; assessment; individualized planning; instructional adaptations; school and community resources; exemplary program models; research, trends, and issues; and evaluation.

Learning Outcomes: 1. Describe the major historical and contemporary legislative provisions affecting the delivery of career and technical education to special needs learners. 2. Identify and describe the educational characteristics of special needs learners, including students with disabilities, disadvantaged students, gifted and talented learners, non-traditional learners, and limited-English proficient speakers. 3. Describe and use appropriate strategies for assessment of the career needs, learning styles, and progress of special needs learners. 4. Develop and evaluate individualized education, career, and transition plans for a special needs learner. 5. Select and use appropriate instructional strategies, procedures, and materials. 6. Identify and select appropriate community, business, industry, school, governmental agency, occupational, and professional resources. 7. Compare and contrast various exemplary program models for special needs learners. 8. Evaluate the major professional trends, issues, and implications for career and technical

education programs for special needs learners. Credits: 3.00

EDCI 65300 - Seminar In Career And Technical Education

Credit Hours: 1.00 to 9.00. Current trends, theory, and practices related to educational contexts and careers.

Learning Outcomes: 1. Review, synthesize, analyze, and critique current research in education, career and technical education, and related fields and disciplines. 2. Identify significant research problem areas and researchable problems in education. 3. Examine and evaluate research methods used and applicable in education fields and related disciplines. 4. Explore various research dissemination strategies. 5. Network with researchers in education and related fields. Credits: 1.00 to 9.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Leadership Development Program: Work-based Learning, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDCI 55300 - Leadership Development In Career And Technical Education

Credit Hours: 3.00. Design, development, implementation, and evaluation of systems and strategies for enhancing the skills and knowledge of personnel seeking to become leaders in the field of Career and Technical Education (CTE); research related to critical and emerging leadership issues, strategies, policies, and resources are examined and applied to program improvement initiatives in schools, the workplace, agencies, and other organizations that serve a wide variety of youth, adolescents, young adults, and adults.

Learning Outcomes: 1. Identify and adapt models of staff development, in-service education, and program improvement. 2. Use organizational, adult learning, motivational, leadership, and social systems therapy in staff development and school-or agency-based program improvement activities. 3. Develop and implement organizational communications and group-related interactions effectively. 4. Evaluate the principles related to leadership style; organizational development, initiation and management of change, needs analysis, and consultation strategies; and program improvement activities. 5. Locate current and emerging funding sources, as well as effective procedures for developing grant seeking and project management strategies. 6. Implement comprehensive strategies for developing assessing and improving programs, policies, practices, and services related to career and technical education programs. 7. Design and implement effective interagency collaboration initiatives. Credits: 3.00

EDCI 65300 - Seminar In Career And Technical Education

Credit Hours: 1.00 to 9.00. Current trends, theory, and practices related to educational contexts and careers.

Learning Outcomes: 1. Review, synthesize, analyze, and critique current research in education, career and technical education, and related fields and disciplines. 2. Identify significant research problem areas and researchable problems in education. 3. Examine and evaluate research methods used and applicable in education fields and related disciplines. 4. Explore various research

dissemination strategies. 5. Network with researchers in education and related fields.
Credits: 1.00 to 9.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

Leadership, Change Management, and Negotiations, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

OBHR 69000 - Advanced Problems In Organizational Behavior And Human Resource Management

Credit Hours: 2.00 to 4.00. Advanced investigation in a specific organizational behavior or human resource field at the graduate level.

Credits: 2.00 to 4.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class.
Credits: 1.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth).
Credits: 1.00 to 3.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

Required Courses (9 credits)

OBHR 69000 - Advanced Problems In Organizational Behavior And Human Resource Management

Credit Hours: 2.00 to 4.00. Advanced investigation in a specific organizational behavior or human resource field at the graduate level.

Credits: 2.00 to 4.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class.

Credits: 1.00 to 3.00

MGMT 65420 - Leadership

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Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth).

Credits: 1.00 to 3.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

GPA Requirements

About the Program

Managing Information Technology Projects, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Course (3 credits)

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

Selectives (9 credits)

CNIT 55100 - Information Technology Economics

Credit Hours: 3.00. Examines the economics of information systems and information technology as it relates to business performance. Topics include strategic information technology planning, alignment with business planning, value assessment, and performance measurement. Special emphasis is placed on issues relevant to strategic information technology infrastructure management, both for the information technology unit as well as the business as a whole. Permission of instructor required.

Credits: 3.00

CNIT 58200 - IT Project Estimating, Control And Scheduling

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to create and manage time and cost estimates, as well as the creation of accurate schedules with dependencies. The course reviews research of best practices in schedule management and budget management. Students will apply these skills and techniques to business problems. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for creation of IT project estimates and budgets into IT projects. 2. Understand and be able to apply current techniques and methodologies used to build cost and time estimates for IT projects including Function Points, COCOMO, and others. 3. Discuss, in intelligent discourse, the types of schedules (Work Breakdown Structures) needed to run IT projects today including traditional lifecycles and Agile approaches. 4. Accurately conduct analysis of network schedule dependencies including calculation of slack, Critical Path Analysis and Critical Chain Scheduling. 5. Discuss, in intelligent discourse, the role corporate politics and negotiation skills play in building project budgets and successfully executing the project. 6. Understand and be able to apply time and cost monitoring and control techniques including Earned Value Management (EVM). Credits: 3.00

CNIT 58500 - Organizational Change Management For IT Projects

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to manage the "people" side of organizational change that results from IT projects that implement new technologies, systems, services, and products into the workplace. This is sometimes called stakeholder management. The course reviews research of best practices in change management and their impact on project metrics such as schedule, budget, scope, stakeholder satisfaction. Students also learn how to identify and document the organizational and people impacts of new information technology solutions, and then develop a formal project plan to manage the organizational change. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for organizational change management into information technology projects. 2. Pro-actively apply an organizational change management framework and principles to a business situation, ideally an information technology project. 3. Discuss, in intelligent discourse, the types of disruptive organizational change and how they can be caused by information technology projects. 4. Accurately document, and communicate IT-

enabled changes to existing business processes. 5. Select, defend and utilize organizational change management tools and techniques in the context of information technology projects and management. 6. For residential, thesis students, research and contribute to the organizational change management body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 58000 - Advanced Topics In Information Technology Project Management

Credit Hours: 3.00. The course explores and applies the advanced concepts, skills, knowledge, techniques, and tools required to successfully initiate, plan, manage, execute, control, and report on information technology projects. Special emphasis is placed on applying the PM BOK in a real life business case study as well as researching and learning concepts, techniques, and processes experienced project and program managers employ to successfully plan and manage projects. This course enables the student to learn project management through the application of project approaches in a team based setting. Through the application of project methodologies, tools and templates, the student learns the project life-cycle approach as demonstrated through actual and simulated project situations. Permission of Department required.

Learning Outcomes: 1. Explain and apply the processes and Weekly Assignments, Live, and artifacts prescribed by the PMBOK. 2. Assess the objectives of a project management office and how organizations implement them based on their organizational structure and culture. 3. Research and analyze methodologies, tools, and techniques used by today's experienced IT project managers. 4. Research and analyze current business and technology conditions that affect project managers of today. 5. Describe and evaluate the competencies that are required to be an effective project manager. 6. Research innovative methods and techniques for performing IT project management. Credits: 3.00

CNIT 58300 - IT Program And Portfolio Management

Credit Hours: 3.00. Program and Portfolio Management deliver benefits to organizations by enhancing current abilities or developing new capabilities for the organization to use. This CNIT Graduate course will provide a detailed understanding of Program and Portfolio Management and its relationship to Project management and will present concepts that promote efficient and effective management and communications among various groups. This course curriculum is consistent with the Project Management Body of Knowledge (PM BOK) and related Standards for Program and Portfolio Management published by the Project Management Institute. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the differences between portfolio, program and project management. 2. Understand and articulate the importance of project governance within the company and associated portfolio, program, and project processes. 3. Understand the possible compositions and value of the Project Management Office (PMO) and strategies for implementation. 4. Understand and discuss in intelligent discourse the importance of project planning, change management and communication within the company to foster Project, Program and Portfolio management success. 5. Discuss, in intelligent discourse, the role corporate politics and negotiation skills play in building project budgets and successfully executing the project. 6. Understand and be able to apply time and cost monitoring and control techniques including Earned Value Management (EVM). Credits: 3.00

CNIT 58600 - IT Requirements Management

Credit Hours: 3.00. The course explores the approaches used by today's information system professionals to conduct and manage the requirements development process. Course emphasis focuses on contemporary techniques for requirements elicitation, requirements analysis, requirements specification, requirements validation and verification. Emphasis is also placed on identifying stakeholders through the use of formal stakeholder analysis techniques, the use of formal change control, requirements traceability and the use of requirements management tools. The course is designed based on the principles and competencies prescribed by the Project Management institute's PM BOK (Project Management Body of

Knowledge) and Business Analyst Guide as well as the International Institute of Business Analysis's BABOK (Business Analysis Body of Knowledge). Permission of Department required.

Learning Outcomes: 1. Research and analyze in order to discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for requirements management into information technology projects. 2. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 3. Accurately document, and communicate business requirements for an IT project. 4. Select, defend and utilize requirements management tools and techniques in the context of information technology projects and management. 5. For residential, thesis students, research and contribute to the requirements management body of knowledge as it can be applied to information technology projects. Credits: 3.00

Required Course (3 credits)

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

About the Program

Manufacturing Engineering, Post-Baccalaureate Certificate

Marketing Analytics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

MGMT 52300 - Digital Marketing Strategy

Credit Hours: 2.00. This course enables students to rethink marketing in the evolving digital age and develop capabilities in developing, implementing, and evaluating digital marketing strategies. Topics include: digital marketing strategy framework, search engine marketing, social media marketing, and location based marketing (mobile).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital and social media age. 2. Understand how digital and social media marketing strategies fit with

companies' overall marketing strategy. 3. Learn to develop, implement, and evaluate digital and social media marketing plan. 4. Understand the major tools of digital and social media marketing: online ads, search engine optimization, paid search ads, organic social media, social media ads, web analytics, and social media analytics, and others. 5. Explore the future development of digital marketing. Credits: 2.00

MGMT 52610 - Data And AI-Driven Marketing

Credit Hours: 2.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course introduces modern statistical methods and AI algorithms for marketing using big data. It discusses marketing applications for which we may use statistical and machine learning methods to improve and optimize decisions. Students will use Python to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis.

Learning Outcomes: 1. Apply appropriate modern statistical and machine learning methods required for marketing using big data. 2. Implement the methods in Python using real-world data. Credits: 2.00

Selectives (4-5 credits)

MGMT 63800 - Pricing Strategies And Algorithms

Credit Hours: 2.00. The course enables participants to formulate a systematic framework for approaching the problem of pricing a product, and more generally, a product line. The concepts and analytical methods necessary to develop such a framework are explored and incorporate marketing, competitive, and legal aspects. The course will use a combination of lectures, case discussions and exercises. Prerequisite: MGMT 62000.

Learning Outcomes: 1. Adopt a systematic framework to approach the problem of pricing a product or service. 2. Understand various approaches to estimate value of a product or service to users. 3. Understand the tradeoff between price and sales volume and its relation to price elasticity. 4. Understand segmented pricing and psychological aspects of pricing. 5. Understand the implications of pricing in a competitive environment and the importance of price policy. 6. Appreciate pricing issues when selling through an intermediary. 7. Be introduced to legal aspects of pricing. Credits: 2.00

MGMT 52900 - Marketing Consulting Projects

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet once a week to review project progress and discuss the next steps generally in the presence of the faculty supervisor. Projects are done in teams, although evaluation is individual.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the findings from a project analysis into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Exposed to the challenges of working in teams to achieve project goals. Credits: 3.00

MGMT 52020 - Analytics For Marketing Managers

Credit Hours: 2.00 or 3.00. The purpose of this course is to learn tools, technologies, applications and practices used to collect, integrate, analyze, and present raw data in order to create insightful visualization and actionable marketing information. It will cover conceptual understanding of marketing performance based on data and statistical methods. Once conceptual understanding is familiarized, students will learn common tools and techniques for marketing managers in

today's industry.

Learning Outcomes: 1. Learn how to collect and analyze basic analytical concepts and tools. 2. Gain experience in understanding the importance of visualizations. 3. Learn to become a marketing manager who can provide marketing insights based on analytics. 4. Be exposed to the challenges of resent online platforms of visualization for user interactivities. Credits: 2.00 or 3.00

MGMT 53900 - Analytics For Social Media Marketing

Credit Hours: 2.00 or 3.00. The objective of this course is to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Be exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 2.00 or 3.00

Program Learning Outcomes

About the Program

Medical and Healthcare Writing, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

ENGL 60411 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants teaches students how to analyze requests for proposals, analyze problems, devise project plans, and write proposals for for-profit corporations and non-profit organizations. Permission of department required.

Learning Outcomes: 1. Interpret and analyze a request for proposals (RFP). 2. Identify the ""problem"" that initiated the RFP by determining its causes and effects. 3. Develop clear objectives, outcomes, and deliverables that will make a project attractive to a client. 4. Propose a project plan that meets the client's needs and expectations. 5. Demonstrate why your company or organization is uniquely qualified to take on the project. 6. Compare the costs and benefits for readers of accepting a project proposal or grant proposal. 7. Present a proposal orally or in video form to decision-makers. Credits: 3.00

ENGL 60311 - Medical And Healthcare Writing

Credit Hours: 3.00. This course helps students master various genres, writing styles, and rhetorical strategies common in medical and healthcare contexts. More specifically, you will learn how to analyze, prepare, and edit documents that are used to communicate within and about the healthcare industry (i.e., protocols, patient educational materials, and proposals). Permission of department required.

Learning Outcomes: 1. Identify and understand the written genres that are common in healthcare and medical fields. 2. Analyze audiences for medical and healthcare documents and understand their needs. 3. Generate and translate health complex medical information to both healthcare professionals and the public. 4. Organize information in a way that is accessible and useful in healthcare

workplaces. 5. Develop and design professional quality medical documents such as protocols, patient educational materials, and proposals. Credits: 3.00

ENGL 60511 - Editing And Publishing

Credit Hours: 3.00. The purpose of this course is to show you how to use professional editing techniques to produce high-quality and publishable documents. Students learn how to work as a professional editor at four "levels of edit," which include proofreading, copyediting, substantive editing, and development editing. Permission of department required.

Learning Outcomes: 1. Apply editing techniques at the four levels of edit (proofreading, copyediting, substantive editing, and development editing). 2. Demonstrate effective decisions about the kinds of editing needed and expected for a task or a piece of writing. 3. Employ editing and publishing terminology and knowledge to a variety of documents in a variety of situations. 4. Demonstrate the use of proofreading and copyediting marks as used in print-based and electronic documents. 5. Employ strategies for doing substantive editing on larger documents in scientific, technical, medical, and healthcare professional settings. Credits: 3.00

Program Learning Outcomes

Microelectronics and Semiconductors, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (3 credits)

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance

and the two Landauer formulas. Credits: 1.00

Selectives (6 credits)

ECE 52600 - Fundamentals Of MEMS And Micro-Integrated Systems

Credit Hours: 3.00. (BME 58100) Key topics in micro-electro-mechanical systems (MEMS) and biological micro-integrated systems; properties of materials for MEMS; microelectronic process modules for design and fabrication. Students will prepare a project report on the design of a biomedical MEMS-based micro-integrated system. Offered in alternate years. Permission of department required.

Credits: 3.00

ECE 55200 - Introduction To Lasers

Credit Hours: 3.00. An introduction to lasers and laser applications which does not require a knowledge of quantum mechanics as a prerequisite. Topics include: the theory of laser operation; some specific laser systems; nonlinear optics; optical detection; and applications to optical communications, holography, laser-driven fusion, and integrated optics.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 61200 - Advanced VLSI Devices

Credit Hours: 3.00. Device physics of advanced transistors. Process, device, circuit, and systems considerations affecting development of new integrated circuit technologies. Review of metal oxide semiconductor (MOS) fundamentals along with key process and circuit concepts. Short channel effects in sub-micron channel length metal oxide semiconductor field-effect transistors (MOSFETs) including device scaling considerations. Device physics and technology issues for sub-100 nm (nanoscale) MOSFETs. Limits of silicon device technology and key issues in the continuing miniaturization of devices. Alternative device structures to replace bulk MOSFET. Computer simulation employed throughout the course to examine device issues and prototype new device technologies. Offered in alternate years. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 68800 - VLSI Testing And Verification

Credit Hours: 3.00. Discusses different aspects of VLSI testing and formal verification of designs. Design and manufacturing defect models are introduced along with test generation and fault simulation algorithms targeting the different fault models. Both combinational and sequential logic testing are covered, and different synthesis for testability schemes such as BIST (Built-In-Self-Test), scan path design, etc., are introduced. Other new and emerging test and verification techniques also are discussed. Offered every third semester. Prerequisite: ECE 55900 .

Credits: 3.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60420 - Radio Frequency Integrated Circuits

Credit Hours: 3.00. This course aims at analysis and design of CMOS integrated radio frequency (RF), microwave and mm-wave circuits. Various modules of an RF transceiver are discussed including low noise amplifiers, mixers, oscillators, frequency synthesizers and power amplifiers. A term project on design of an RF to mm-wave module is also required.

Learning Outcomes: 1. Know various wireless standards, modulation techniques and CMOS technology. 2. Know matching network, transmission line effects, scattering parameters. 3. Know analysis and design of CMOS low noise amplifiers from RF to mm-wave frequencies. Credits: 3.00

ECE 50632 - Introduction To Quantum Transport

Credit Hours: 1.00. This course introduces the Schrödinger equation, uses the tight-binding method to discuss the concept of bandstructure and E(k) relations, along with simple quantum transport problems. No prior background in quantum mechanics or statistical mechanics is assumed.

Learning Outcomes: 1. Explain tight-binding model, reciprocal lattice and evaluate dispersion relation. 2. Explain NEGF equations, dephasing, quantum point contact and evaluate quantities like the transmission, the self-energy and spectral functions. 3. Use Pauli spin matrices and evaluate quantities like spin density. Credits: 1.00

ECE 50633 - Boltzmann Law: Physics To Computing

Credit Hours: 1.00. This course introduces the key concepts of equilibrium statistical mechanics leading to the celebrated Boltzmann law and how it leads to Boltzmann machines and related concepts in modern machine learning. No prior background in statistical mechanics is assumed.

Learning Outcomes: 1. Explain the law of equilibrium and entropy. 2. Understand the operation of Boltzmann machines. 3. Understand the operation of quantum circuits. Credits: 1.00

ECE 60422 - Primer On RF Design

Credit Hours: 1.00. This course covers the fundamentals of RF design. It is designed as a first course for students or engineers with limited background in high-frequency electronics. Engineers that need to understand the 'RF language' and gain working knowledge of critical RF concepts will benefit from taking this course. Students in this class will learn the basic RF tools and design principles. By the end of this class students will be able to understand important RF concepts and how these are related to the design of practical RF blocks.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF systems and modules. 2. Use common tools and techniques in the RF design space. Credits: 1.00

ECE 51220 - Applied Algorithms

Credit Hours: 3.00. Solving large-scale problems typically rely on many clever data structures and algorithms. This course aims to cover many such useful algorithms for solving large-scale problems. These algorithms include greedy algorithms, dynamic programming and more advanced graph algorithms. The course also aims to demonstrate how such algorithms can be applied to solve optimization problems encountered in engineering applications. In particular, applications in the design of VLSI (very large scale integration) at circuit, layout, or system level will be used to demonstrate how an engineering problem can be formulated as a tree/graph problem and solved using established tree/graph algorithms.

Learning Outcomes: 1. Demonstrate an understanding of greedy algorithms and dynamic programming (ABET outcome 1). 2. Demonstrate an n understanding of advanced graph algorithms (ABET outcome 1). 3. Demonstrate an ability to design and implement appropriate data structures and algorithms for engineering applications (ABET outcomes 1 and 2). Credits: 3.00

ECE 60423 - RF System Design

Credit Hours: 1.00. Following the 'Primer on RF Design' course, this class focuses on system-level issues. We discuss several important design considerations including noise, non-linearity, distortion, sensitivity and dynamic range and their impact in selecting the appropriate system architecture. The course also covers common receiver architectures including superheterodyne and direct-conversion receivers.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF modules and transceivers. 2. Describe and articulate common transceiver architectures. 3. Use tools

and analysis techniques to estimate the impact of non-linear effects, noise and interferences on transceivers. Credits: 1.00

ECE 60424 - RF Design: Passive And Active Components

Credit Hours: 1.00. Following the 'Primer on RF Design' course, this class focuses on passive and active components. We use the techniques learnt in the previous course, to design advanced RF devices including couplers, filters and amplifiers. Current research topics are discussed as appropriate.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF passive and active components. 2. Design RF couplers, filters and amplifiers. 3. Use tools and analysis techniques to support the design of RF filters and amplifiers. Credits: 1.00

ECE 51216 - Digital Systems Design Automation

Credit Hours: 3.00. This course will provide an introduction to the tools used to design and analyze circuits at the logic level of abstraction (where circuits are composed of gates and flip-flops). Most digital chips used in computing and electronic systems (including microprocessors, graphics processors, chips used in network routers, cell phones, digital audio/video appliances, automotive electronics) are entirely or largely designed using EDA tools. This course will focus on the foundations of logic-level EDA tools, including the design of exact and heuristic algorithms that form the basis for VLSI Computer-Aided Design. Topics covered include an overview of the IC design flow and levels of abstraction, synthesis of two-level (AND-OR / PLA) circuits, multi-level logic synthesis and technology mapping, sequential circuit synthesis, Logic-level verification using Boolean Satisfiability and BDDs, Timing Analysis, Power analysis and Reduction, and design techniques for emerging nanoscale technologies.

Learning Outcomes: 1. Design minimal combinational logic circuits. 2. Design minimal finite-state machines. Credits: 3.00

ECE 51214 - CMOS Analog IC Design

Credit Hours: 3.00. The course covers general topics in CMOS analog IC design; biasing, noise, single stage amplifiers, differential amplifiers, OP-Amp, OTA, frequency domain analysis, and active filters. While the focus of the course is on CMOS IC design, design in bipolar andBi CMOS technologies are introduced as well. A design project is a key component of the course. The students conduct group or individual design projects. Process Design *Kit* and EDA tools are provided for the design projects.

Learning Outcomes: 1. Have basic knowledge of bias circuits. 2. Have basic knowledge of noise analysis. 3. Understand single-stage amplifiers and their applications. 4. Understand differential Op-amp, OTA, and practical design skills. 5. Understand feedback circuits. 6. Understand basic active filters, practical design skills, and applications. Credits: 3.00

Required Courses (3 credits)

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel

ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance and the two Landauer formulas. Credits: 1.00

About the Program

Natural Language Process, Post-Baccalaureate Certificate
Noise Control Engineering, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

Selectives (6 credits)

ME 50000 - Advanced Thermodynamics

Credit Hours: 3.00. The empirical, physical basis of the laws of thermodynamics. Availability/exergy concepts and applications. Properties and relations between properties in homogeneous and heterogeneous systems. The criteria of equilibrium. Application to a variety of systems and problems, including phase and reaction equilibrium. Offered in alternate years.

Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 52500 - Introduction To Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; applications. Not open to students with credit in MA 42500.

Credits: 3.00

ME 50900 - Intermediate Fluid Mechanics

Credit Hours: 3.00. Fluid properties. Basic laws for a control volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

Learning Outcomes: 1. State basic laws for a control volume in different coordinate systems. 2. Derive the kinematics of fluid flow in problem solving. 3. Derive the equations for frictionless and incompressible flows. 4. Derive the basic

equations of motion of viscous flows. 5. Find standard exact solutions of viscous-flow equations and apply them. 6. Derive and solve basic equations of boundary-layer theory. 7. Find lift and drag forces on immersed bodies with simple shapes. 8. Understand concepts of incompressible turbulent flows and wall turbulence. Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57900 - Fourier Methods In Digital Signal Processing

Credit Hours: 3.00. Fundamentals of signal processing associated with Fourier analyzer systems are presented. Emphasis is on amplitude accuracy and frequency resolution properties necessary for reliable experimental methodologies in system identification, spectrum estimation, and correlation analysis. Deterministic, as well as random, data analyses are presented. Students are required to develop algorithms that significantly expand the utility of Fourier analyzer systems.

Credits: 3.00

Required Courses (6 credits)

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

GPA Requirements

About the Program

Project Management, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

OLS 57200 - Integration Of Project Management For Leaders

Credit Hours: 3.00. This course emphasizes critical analysis, synthesis, and evaluation of theories and applications of project management knowledge and skills, leadership, communication, and stakeholder engagement. Students integrate theoretical and applied skills in planning, distributing, and managing communication; analyzing and interpreting project organization in context; and applying best practices in team management.

Learning Outcomes: 1. Compose and apply an appropriate communication strategy for a given situation. 2. Prepare professional documentation and presentations consistent with university and diverse workplace standards. 3. Demonstrate interpersonal skills consistent with expectations for project managers. 4. Apply critical and innovative thinking skills to improve their own, and other's

decision making processes within projects. 5. Evaluate alternative strategies and implement major aspects of project management for a realistic project. 6. Model ethical sensitivity for a given situation. 7. Apply critical thinking and problem-solving skills to project knowledge areas and processes. 9. Consider and relate basic leadership principles and processes to address leadership issues and to remove obstacles in the project environment. 10. Locate, assess, and synthesize current literature on topics associated with project management competencies. 11. Facilitate the organizational change management process and encourage behavior to maximize project success. 12. Analyze power dynamics and organizational politics and suggest conflict management and negotiation techniques relevant to the project. 13. Identify, recognize, and engage both internal and external project stakeholders. 14. Demonstrate how project purpose, organizational structure, culture, roles, and knowledge management affect the ability to lead a project team. 15. Evaluate roles of team members, how they contribute to projects, and apply an understanding of self in how they relate to teams. 16. Apply knowledge of team building, operation, and behavior, considering factors that influence effectiveness for all types of teams, including those that are virtual and global. Credits: 3.00

OLS 57100 - Advanced Project Management In Technology

Credit Hours: 3.00. This course helps students learn project management through applying technology project approaches in teams. Using project tools and templates, students learn the technology project life-cycle through actual and simulated situations. The course presents terms and approaches used in industry and allows students to apply methods individually and in teams.

Credits: 3.00

OLS 58200 - Leadership and Organizational Change

Credit Hours: 3.00. Explores issues in leadership and organizational change. Included are change theories, utilizing resistance to change, contemporary approaches to change, the future workplace, and researching best practices in organizational change.

Learning Outcomes: 1. Attain an understanding of the major models of change theory. 2. Gain skills in managing change through pragmatic applications of change theories. 3. Complete a major change research project in which they investigate a change initiative, gather data, and make recommendations for successfully implementing the change. Credits: 3.00

Program Learning Outcomes

Psychological Statistics, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-

level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60500 - Applied Multivariate Analysis

Credit Hours: 3.00. A survey of the most frequently employed multivariate research techniques, such as multivariate generalizations of univariate tests and analysis of variance, principal components, canonical analysis, and discriminant analysis. A central theme of the course is the general linear model, both univariate and multivariate. A multipurpose program for this model provides the student with practical experience in conducting multivariate research. Some prior exposure to elementary matrix algebra is recommended. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students

with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

Required Courses (9 credits)

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background

training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

PSY 60500 - Applied Multivariate Analysis

Credit Hours: 3.00. A survey of the most frequently employed multivariate research techniques, such as multivariate generalizations of univariate tests and analysis of variance, principal components, canonical analysis, and discriminant analysis. A central theme of the course is the general linear model, both univariate and multivariate. A multipurpose program for this model provides the student with practical experience in conducting multivariate research. Some prior exposure to elementary matrix algebra is recommended. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used.

Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

About the Program

Public Economics and Policy, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (5 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

Selectives (5 credits)

List #1 (2-3 credits)

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 55000 - Personnel Economics

Credit Hours: 2.00. Personnel Economics applies micro- and macroeconomic theory to the workings of the labor market while maintaining a focus on incentives in the workplace. The course will investigate the determination of wages and compensation (based on a study of labor demand and supply) and the differences in these forms of payment for labor services across workers within an occupation, across occupations, and across cultures. Other topics to be considered include the connection between investments in education and training and labor market outcomes and estimates of the costs and benefits of immigration and employee turnover and discuss the impact of unions, as well as discrimination in the labor market issues. Permission of department required.

Learning Outcomes: 1. Students will have the tools of economic logic that allow them to evaluate proposals for labor policies on a firm-specific level and on a national level. Credits: 2.00

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities. 3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

List #2 (2-3 credits)

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business

decisions. Credits: 2.00 to 3.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural

knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 54100 - Managerial Economics & Business Strategy

Credit Hours: 1.00. The course covers topics such as monopolies (price discrimination, optimal pricing strategies), advanced strategic decision-making and imperfect competition (optimal pricing and production), new product introductions, product variety offered on the market, and entry deterrence strategies. The main goal of this course is to provide a basis for a good understanding of the logical mechanics, and to provide a good intuition in managerial economics and business decision-making processes that facilitate the understanding of daily business problems.

Learning Outcomes: 1. Identify and explain logical mechanics that determine individuals' choices and decisions. 2. Evaluate managerial economic problems to better identify daily business problems. 3. Apply key aspects such as marginal concepts and countervailing effects when proposing solutions. 4. Illustrate main mechanisms using graphs and apply basic knowledge of algebra and calculus to business problems. Credits: 1.00

ECON 55500 - Economic Forecasting

Credit Hours: 2.00. This course provides an introduction to forecasting methods of current interest in economics. The goal is to equip students with a working knowledge of state-of-the-art techniques that are useful for forecasting macroeconomic variables. The strengths and weaknesses of the techniques will be analyzed and their empirical relevance will be demonstrated through a variety of applications to real data sets. The topics will include univariate prediction models, vector autoregressions, forecasting with large data sets, forecast combinations and forecast evaluation. Particular emphasis will be placed on applications and the issues involved with implementation of the various methods in practice.

Learning Outcomes: 1. Identify the statistical issues involved in forecasting economic data. 2. Analyze the strengths and weaknesses of a variety of forecasting techniques commonly used in economics. 3. Demonstrate the empirical relevance of each forecasting approach through applications to real-world data sets. Credits: 2.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

List #1 (2-3 credits)

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 55000 - Personnel Economics

Credit Hours: 2.00. Personnel Economics applies micro- and macroeconomic theory to the workings of the labor market while maintaining a focus on incentives in the workplace. The course will investigate the determination of wages and compensation (based on a study of labor demand and supply) and the differences in these forms of payment for labor services across workers within an occupation, across occupations, and across cultures. Other topics to be considered include the connection between investments in education and training and labor market outcomes and estimates of the costs and benefits of immigration and employee turnover and discuss the impact of unions, as well as discrimination in the labor market issues. Permission of department required.

Learning Outcomes: 1. Students will have the tools of economic logic that allow them to evaluate proposals for labor policies on a firm-specific level and on a national level. Credits: 2.00

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system

and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities. 3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

Required Courses (5 credits)

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function)

and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

GPA Requirements

About the Program

Qualitative Research, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (6 credits)

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

Selectives (6 credits)

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

EDCI 56700 - Action Research In Science Education

Credit Hours: 3.00. An introduction to various models and conceptions of teacher action research in science education. Students review literature on action research, participate in small research cohorts, and plan and conduct action research within their respective educational situations.

Learning Outcomes: 1. Develop an understanding of what action research is, how it is conducted, and what role it plays in the construction of teacher knowledge in science education. 2. Plan and conduct action research within your respective educational situation. 3. Examine various models for action research in pre-service, in-service, and independent projects in science education. 4. Gain insight into the role action research plays in science education and science teacher education. Credits: 3.00

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 61200 - Seminar In Literacy

Credit Hours: 3.00. Recent trends and research in literacy. Topics provide in-depth study of literacy acquisition in educational settings.

Learning Outcomes: 1. Investigate a specific topic of interest through readings, written work, and discussion. 2. Develop understandings of a new topic area relevant to the study of literacy and language. Credits: 3.00

HDFS 67900 - Qualitative Research On Families

Credit Hours: 3.00. Provides an introduction to qualitative research theory and methods and prepares graduate students to conduct and evaluate qualitative family research. Students conduct observations, interviews, and basic data analysis. Prerequisite: a course in research methods.

Credits: 3.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research

methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

WGSS 68200 - Issues In Feminist Research And Methodology

Credit Hours: 3.00. This course provides a methodological framework for theorizing, constructing and executing research from a feminist perspective. Students acquire knowledge of the diversity of feminist research projects and methods; they learn to pose research questions; and they will be able to prepare a research or grant proposal drawing on interdisciplinary methods. The course is designed to meet the needs of graduate students in Women's Studies and is open to students in other programs who are interested in feminist research. The course deals with both theoretical and practical issues in methodology. Prerequisites: WGSS 68000 .

Learning Outcomes: 1. To understand and describe the distinguishing features of feminist research from a variety of disciplines. 2. About the range of qualitative and quantitative research methods used by feminist scholars. 3. To examine how interdisciplinary feminist perspectives shape research methods. 4. About discussions of feminist epistemology, including feminist critiques of science and the development of feminist empiricist, standpoint and postmodernist epistemologies. 5. To develop the skills to interpret and critically evaluate research in women's studies, in both interdisciplinary journals and discipline-specific journals. 6. To develop their own feminist methods and approaches by producing a research project. Credits: 3.00

WGSS 68000 - Feminist Theory

Credit Hours: 3.00. This course focuses on feminist theories at an advanced level and in a global perspective. Graduate students engage with key theoretical issues in contemporary feminist studies, and examine how feminist scholars have theorized women and gender issues across disciplines.

Credits: 3.00

EDCI 62100 - Technology For Qualitative Research

Credit Hours: 3.00. Exploration of the effective use of technology to facilitate data collection, organization, and analysis. Emphasis on application of theoretically-based methodologies for handling and analyzing qualitative data through the use of qualitative research software. Course also includes attention to other hardware or software relevant to the collection, organization and analysis of qualitative data. Prerequisites: EDCI 61500.

Learning Outcomes: 1. Explore and practice the application of theoretically-based methodologies for handling and analyzing qualitative data through the use of qualitative research software (NVivo). 2. Explore and practice the following mobile applications that may be used for data collection and other research purposes: digital photo, audio, and video recording and editing apps; document scanning apps (Scanner Pro); notetaking apps (e.g., Evernote, Notability); Adobe Acrobat .pdf file management and mark-up apps (Notability); and the integration of these apps with NVivo. Credits: 3.00

Required Courses (6 credits)

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple

paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

GPA Requirements

About the Program

Quantitative Research, Assessment, and Evaluation, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 63200 - Seminar In Research Procedures In Education

Credit Hours: 1.00 to 3.00. Experimental, field study, scientific survey, and prediction study methods in education. Internal and external validity, identification and development of research problems, criteria development, common methodological errors, strategies of analysis, and sources of acceptable educational research literature will be reviewed. Critical analyses of the research methodology of educational research reports in the student's field. Prerequisite: EDPS 63000 or 53300 and course work in Statistics.

Learning Outcomes: 1. Develop specific advanced methodological skills and knowledge that are applicable to education research and practice. Credits: 1.00 to 3.00

EDPS 63500 - Psychometric Theory And Application

Credit Hours: 3.00. Advanced classical test theory and application of psychometric methods to study technical properties of tests. Prerequisite: (EDPS 53100 and STAT 50200), or (PSY 60100 or PSY 51200) or consent of Instructor.

Learning Outcomes: 1. Demonstrate an understanding of mathematical and statistical concepts in various measurements principles. 2. Apply understanding of reliability and validity in both classical and modern measurement theory frameworks to solve practical measurement problems. 3. Demonstrate knowledge of psychometric theories in scale development. 4. Read the literature related to psychometrics in their own substantive areas more critically. 5. Use measurement or scales more intelligently in research. 6. Explain different models of modern test theory. Credits: 3.00

EDPS 63600 - Item Response Theory

Credit Hours: 3.00. Models and model-data fit, estimation of ability and item parameters, item and test information, test construction, obtaining evidence of test reliability and validity, differential item functioning, norming, and equating. Prerequisite: EDPS 53100 , (PSY 60100 or STAT 50200 or STAT 51200).

Learning Outcomes: 1. Explain fundamental

item response theory concepts and terminology. 2. Distinguish and select from among 1-, 2-, and 3- parameter item response models for dichotomous data in practical situations. 3. Demonstrate familiarity with the graded response and partial credit item response models for polytomous data, and multidimensional item response models. 4. Use item response models for testing applications, such as item calibration during instrument/item pool development, estimation of person parameters and conditional standard errors of measurement, investigation of differential item functions, and score linking. 5. Conduct item response modeling with specialized software and interpret the results. Credits: 3.00

EDPS 63800 - Factor Analytic Procedures

Credit Hours: 3.00. Introduction to exploratory and confirmatory factor analysis techniques and examination of the use of factor analysis in social sciences. Emphasis on application of methods. Students will develop skills to conduct factor analytic research and critically review use of factor analysis in research. Prerequisite: STAT 51200 , STAT 52400 .

Credits: 3.00

Required Courses (12 credits)

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 63200 - Seminar In Research Procedures In Education

Credit Hours: 1.00 to 3.00. Experimental, field study, scientific survey, and prediction study methods in education. Internal and external validity, identification and development of research problems, criteria development, common methodological errors, strategies of analysis, and sources of acceptable educational research literature will be reviewed. Critical analyses of the research methodology of educational research reports in the student's field. Prerequisite: EDPS 63000 or 53300 and course work in Statistics.

Learning Outcomes: 1. Develop specific advanced methodological skills and knowledge that are applicable to education research and practice. Credits: 1.00 to 3.00

EDPS 63500 - Psychometric Theory And Application

Credit Hours: 3.00. Advanced classical test theory and application of psychometric methods to study technical properties of tests. Prerequisite: (EDPS 53100 and STAT 50200), or (PSY 60100 or PSY 51200) or consent of Instructor.

Learning Outcomes: 1. Demonstrate an understanding of mathematical and statistical concepts in various measurements principles. 2. Apply understanding of reliability and validity in both classical and modern measurement theory frameworks to solve practical measurement problems. 3. Demonstrate knowledge of psychometric theories in scale development. 4. Read the literature related to psychometrics in their own substantive areas more critically. 5. Use measurement or scales more intelligently in research. 6. Explain different models of modern test theory. Credits: 3.00

EDPS 63600 - Item Response Theory

Credit Hours: 3.00. Models and model-data fit, estimation of ability and item parameters, item and test information, test construction, obtaining evidence of test reliability and validity, differential item functioning, norming, and equating. Prerequisite: EDPS 53100 , (PSY 60100 or STAT 50200 or STAT 51200).

Learning Outcomes: 1. Explain fundamental item response theory concepts and terminology. 2. Distinguish and select from among 1-, 2-, and

3- parameter item response models for dichotomous data in practical situations. 3. Demonstrate familiarity with the graded response and partial credit item response models for polytomous data, and multidimensional item response models. 4. Use item response models for testing applications, such as item calibration during instrument/item pool development, estimation of person parameters and conditional standard errors of measurement, investigation of differential item functions, and score linking. 5. Conduct item response modeling with specialized software and interpret the results. Credits: 3.00

EDPS 63800 - Factor Analytic Procedures

Credit Hours: 3.00. Introduction to exploratory and confirmatory factor analysis techniques and examination of the use of factor analysis in social sciences. Emphasis on application of methods. Students will develop skills to conduct factor analytic research and critically review use of factor analysis in research. Prerequisite: STAT 51200 , STAT 52400 .

Credits: 3.00

GPA Requirements

About the Program

Regulatory Affairs and Regulatory Science for Medical Devices, Post-Baccalaureate Certificate

About the Program

Certificate Requirements (9 credits)

Required Courses (6-9 credits)

BME 56100 - Preclinical And Clinical Study Design

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly regulated environment. This course concerns the preclinical and clinical study design processes for obtaining FDA marketing approval for biomedical devices. Prior to marketing a medical device in the US, specific governmental approval is required dependent on the type of device and the risk associated. This course is part of a three-course series dealing with various aspect of regulatory science. Regulatory science considers the scientific and technical foundations that support the practical testing and regulations that ensure the safety and effectiveness of medical devices. This course covers the responsible conduct of clinical and preclinical research, including evaluation of device tissue interactions and how they may be studied with preclinical animal models to predict safety and performance in human clinical trials that are necessary to gain regulatory approval for marketing. In the section on ethics we will cover several topics related to responsible conduct of clinical and preclinical research, including informed consent, risk assessment and ethical decisions, IRB oversight and ethical study design.

Learning Outcomes: 1. Understand and apply the various considerations and perspectives in designing and implementing a preclinical and clinical study strategy that will successfully lead to the marketing approval by a regulatory authority (e.g. FDA). 2. Follow a structured, iterative decision-making process for moral reasoning to reach a supported-conclusion regarding ethical dilemmas in engineering design and testing. Credits: 3.00

BME 56200 - Regulatory Issues Surrounding Approval Of Biomedical Devices

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly-regulated environment. This course primarily concerns the processes for obtaining FDA marketing approval or clearance for biomedical devices. Prior to marketing a medical device in the US, a specific governmental approval or clearance is required depending on the type of device and the risk associated with the device. This course is part of a three-course series dealing with various aspects of regulatory science. Regulatory processes for class I, II, and III devices, including combination devices, are covered with specific focus on 510(k) and PMA requirements. Approval requirements in the EU, Japan and other countries will also be briefly considered. Throughout the course, emphasis will be placed on regulatory science, regulatory strategy and principles of interacting with regulatory agencies.

Learning Outcomes: 1. Use the appropriate regulatory classification and pathway for any medical device in the U.S. 2. Describe the significance of each major component of a 510(k) submission. 3. Describe the significance of each major component of a PMA submission. 4. Develop awareness for the need to seek country-specific expertise to prepare submissions for countries outside the U.S. 5. Select the appropriate messages and clearly present, in both oral and written communication, in a mock FDA meeting. 6. Identify contents of a CER and know the strategy for writing a CER. Credits: 3.00

BME 56300 - Quality Systems For Regulatory Compliance

Credit Hours: 3.00. Medical devices are developed and manufactured in a highly regulated environment. This course will provide an introduction, overview, and systematic study of the intent and impact of the major federal laws and regulations governing the development, manufacturing, distribution, and marketing of medical devices. Focus is on understanding the critical elements of regulatory science and quality compliance from a design control perspective. Instruction and mentoring in regulatory science skills is provided by academics and industry representatives with expertise in their fields. This course is part of a three-course series.

Learning Outcomes: 1. Demonstrate a functional understanding of regulatory compliance for biomedical devices. 2. Use the main tools within the quality craft (Ex: confidence interval, control chart, difference between a T-test and F-test). 3. Demonstrate understanding of how the FDA approaches control. Credits: 3.00

Selective Courses (0-3 credits)

BME 50100 - Multivariate Analyses In Biostatistics

Credit Hours: 3.00. This course focuses on fundamental principles of multivariate statistical analyses in biostatistics, including multiple linear regression, multiple logistic regression, analysis of variance, and basic epidemiology. The fundamental theories are applied to analyze various biomedical applications ranging from laboratory data to large-scale epidemiological data.

Learning Outcomes: 1. Understand fundamental concepts in multivariate regression analyses. 2. Translate research questions into suitable multivariate frameworks. 3. Design studies with appropriate statistical power. 4. Compute and interpret appropriate statistical estimates from multivariate analyses. 5. Use a major statistical software package (e.g. STATA, SAS, SPSS, and R) to perform large-size data analyses. Credits: 3.00

BME 56400 - Ethical Engineering Of Medical Technologies

Credit Hours: 3.00. This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice.

Learning Outcomes: 1. Recognize and analyze personal and systemic ethical issues and challenges to ethical reasoning and social responsibility. 2. Engage in empathy building activities to enhance their abilities to understand and value the perspectives of other stakeholders. 3. Use a structured, iterative, and collaborative decision-making process that considers the perspectives of multiple stakeholders in optimizing a design decision when facing an engineering problem in design and development of medical devices or assistive technologies that are ethical and socially responsible. Credits: 3.00

Program Learning Outcomes

Second Language Studies/ESL, Post-Baccalaureate Certificate

Smart Manufacturing Enterprise, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (14 credits)

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

Smart Manufacturing, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

ENGT 55000 - Manufacturing System Design For Sustainability

Credit Hours: 3.00. This course prepares manufacturing and information technology leaders to design and analyze manufacturing processes to achieve manufacturing system objectives that meet internal and external customers quality, cost and delivery requirements within a safe environment. The course project covers major aspects of manufacturing system design and Industry 4.0 in the context of meeting customer needs. Technology leaders and entrepreneurs learn how to work with others to develop the design of manufacturing systems that are sustainable (business, ecological, social, technological) for the long term. When to use lean and six-sigma techniques in the context of the manufacturing enterprise system design to meet customer needs will be assessed from a system design perspective, through analytical and computer simulation techniques, and through the use of physical modeling tools.

Learning Outcomes: 1. Relate why and how the design of manufacturing processes/equipment that support manufacturing system requirements enables lower cost, high quality, on-time delivery, volume and mix flexibility, sustainability, and continuous improvement. 2. Determine why our tone affects the ability to make systems improvements; realize that the origin of at least 90 percent of all issues is due to the system design and implementation and not the people. 3. Apply a structured approach and language to identify, describe, and relate system design thinking to implementation structure and work - i.e. Lean is an outcome of effective system design. 4. Align performance measures to reinforce manufacturing system design requirements with the knowledge that total cost results from the system design. 5. Design a manufacturing system and the included manufacturing processes to establish product flow, part families and takt time -- time per unit (average pace of customer demand). 6. Create a controllable, robust system design, i.e., a manufacturing system that meets customer quality and delivery expectations in spite of disruptions. 7. Reduce the 5 Delays that increase manufacturing lead time by using manufacturing system design. 8. Apply methods to evaluate and develop Manufacturing Systems, including the Manufacturing System Design Decomposition (MSDD), Capability Maturity Model Integration (CMMI), Six Sigma (DMAIC) Process. 9. Describe why Tone, Plan Do Check Act (PDCA), Standard Work, Takt Time and a Robust / Controllable System Design are necessary for continuous improvement and sustainability. 10. Develop an organizational structure to sustain and improve the manufacturing system. Credits: 3.00

MFET 55800 - Smart Manufacturing & Global Supply Chain

Credit Hours: 3.00. Progressive manufacturing uses innovative technology to improve products or processes through the Internet of Things. Smart manufacturing is not limited to emerging technologies; rather, it is composed of efficient,

productive, highly integrated, tightly controlled processes across a spectrum of globally competitive U.S. manufacturers and suppliers, including the facilities themselves. The course will examine the selection, characteristics, and optimization of materials, processes, big data, cloud analysis of design data, control and adaptive theories, and personnel in a production environment. Examining global manufacturing issues through a variety of business examples, you will study the framework that explains the characteristics and challenges surrounding global supply chain management and investigate the impact on suppliers, manufacturers, and customers.

Learning Outcomes: 1. Evaluate and design automation and control strategies in manufacturing operations. 2. Assess data collection, analysis, and sharing attributes of manufacturing systems and subsystems. 3. Plan and apply strategies for managing data from multiple sources. 4. Analyze and appraise variables significant for global supply chain management. Credits: 3.00

ENGT 51000 - Internet Of Things And Cybersecurity For Engineering And Technology

Credit Hours: 3.00. The internet has brought about the ability to embed computing into everyday devices to allow them to send and receive information. These devices, known as the Internet of Things (IoT), will require management at all levels to understand the inherent security risks due to the interconnection via the internet. Illegally accessing (hacking) IoT is increasingly becoming the most pervasive form of industrial espionage in use today. Understanding the threats aimed at IoT and how to protect IoT will be the key to keeping sensitive corporate information and secrets secure and private, and will require everyone's participation, not just the IT department. For this course students will learn the basics of research of and into cybersecurity, and the techniques used to commit industrial related crimes; how to detect these potentially catastrophic crimes; and the means to protect one of the company's most important assets...its systems and data.

Learning Outcomes: 1. Analyze security regulations relevant to their industry. 2. Apply a cybersecurity framework based upon industry regulations. 3. Analyze privacy issues with Internet of Things. 4. Analyze the difference between threats, vulnerabilities and risks as it relates to Internet of Things. 5. Apply techniques to mitigate risk to Internet of Things. 6. Evaluate the inherent benefits of using IoT, potential risks to IoT, and how to use a cybersecurity framework to help mitigate risk to IoT. Credits: 3.00

Program Learning Outcomes

Smart Transportation, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

CE 56401 - Data Science For Smart Cities

Credit Hours: 3.00. The availability of low-cost and ubiquitous sensors in city infrastructure provides high granular data at unprecedented spatiotemporal scales. "Smart Cities" is a concept to utilize this data to provide a healthy, happy and sustainable urban ecosystem by integrating the information and communication technology, Internet of things, and citizen participation to effectively manage and utilize city's infrastructure and services. 'Data science' is an interdisciplinary field of scientific methods, processes, algorithms, and systems to extract knowledge from data in various forms. This course will introduce techniques that will allow the analysis, inference, and prediction of large-scale data (e.g., GPS trajectories, individual social networks, etc.) that are present in urban networks. The course will focus both on the methods and their application to smart city problems. Python will be used to demonstrate the application of each method on datasets available to the instructor. Examples of applications that will be discussed as an example of applications of data science for smart city applications include: ridesharing platforms, energy modeling, smart and energy-efficient buildings, evacuation modeling, decision-making during extreme events, and urban resilience.

Learning Outcomes: 1. Understand the different types of data generated by smart cities. 2. Understand the basics of various data mining techniques. 3. Understand what type of data mining analysis is appropriate for various smart city applications. 4. Gain basic knowledge of using Python for data analytics and results

visualization. 5. Apply the methods and techniques learned in this course to an applied smart city project. Credits: 3.00

CE 56901 - Smart Logistics

Credit Hours: 3.00. This course provides a foundation of analytical tools, methods and applications of logistics systems in the context of planning and operations of integrated supply chain systems. The material is useful for students interested in managing supply chain systems providing a background on where and how specific methods can be used for improving overall performance of the supply chain. The course is broadly divided into two parts: (1) Science of Logistics which provides an introduction to unique characteristics of supply chain management; demand forecasting, planning and management; inventory control and planning; operational transportation issues such as vehicle routing and supply chain contracts and network design. (2) Business of Logistics which discusses the applications of the science to real-world logistics systems. Real-world case studies from past problems will be the basis for discussion and will include the nature of costs in supply chain networks, operational issues, vehicle routing problems, interactions of carriers and shippers using auctions and yield management. The course will use intuitive arguments and mathematical optimization tools will be used to illustrate many situations in a rigorous fashion.

Learning Outcomes: 1. Reinforce the integrated nature of logistics systems from tactical, operational and strategic perspectives, different actors in this system and the role of logistics systems as an economic driver. 2. Understand the basics concepts and models of demand prediction, inventory management, operational and tactical planning in supply chain management. 3. Demonstrate the ability to develop appropriate quantitative tools for planning and logistics problems using optimization techniques and solve them using appropriate solution algorithms, techniques and software. 4. Apply the science of logistics systems to improve the cost and overall efficiency of real-world logistics problems. Credits: 3.00

CE 56601 - Network Models For Connected And Autonomous Vehicles

Credit Hours: 3.00. This course provides an introduction to mathematical foundations of the analysis of transportation networks. The course will be divided into two main sections. Section 1 will introduce the basic foundations of network routing problems including user equilibrium (selfish routing) and system optimal games on networks. Various optimization-based formulations, algorithms and extensions will be discussed. A particular emphasis will be on devising efficient algorithms and computation on city networks. Students will be expected to know how to design efficient algorithms for network analysis and implement them on various datasets. The second half of the course will tailor the network models learned in the first half to understanding the impacts of connected and autonomous vehicles (CAVs). This will be done by taking specific example problems such as autonomous intersection control, parking design, network design for CAVs, etc. Recent research papers will form the basis for developing these models. Extensive use of intuitive arguments, counterintuitive phenomenon (paradoxes) and network structures will be utilized to illustrate many situations graphically. In addition, computing the solutions efficiently using various network algorithms will be discussed. The course is research based and students in addition to learning the concepts will extend the concepts to a research project to be finished within the semester.

Learning Outcomes: 1. Analyze transportation systems using game theory and optimization by drawing on analogies between the interactions of supply and demand in economic markets. Define selfish routing (user equilibrium) and system optimal problems; Develop solution algorithms for large scale networks. 2. Apply specialized network structures to solve selfish routing games efficiently. 3. Formulate and apply various extensions of the selfish routing game rigorously - traffic assignment with elasticity, stochastic user equilibrium, network design and OD estimation. 4. Understand the basic concepts of Connected and Autonomous vehicles (CAVs). 5. Apply the static network models to CAV planning and operations problems. 6. Use software to analyze various large-scale transportation networks and understand issues from real-world practitioners. Credits: 3.00

Required Courses (9 credits)

CE 56401 - Data Science For Smart Cities

Credit Hours: 3.00. The availability of low-cost and ubiquitous sensors in city infrastructure provides high granular data at unprecedented spatiotemporal scales. "Smart Cities" is a concept to utilize this data to provide a healthy, happy and sustainable urban ecosystem by integrating the information and communication technology, Internet of things, and citizen participation to effectively manage and utilize city's infrastructure and services. 'Data science' is an interdisciplinary field of scientific methods, processes, algorithms, and systems to extract knowledge from data in various forms. This course will introduce techniques that will allow the analysis, inference, and prediction of large-scale data (e.g., GPS trajectories, individual social networks, etc.) that are present in urban networks. The course will focus both on the methods and their application to smart city problems. Python will be used to demonstrate the application of each method on datasets available to the instructor. Examples of applications that will be discussed as an example of applications of data science for smart city applications include: ridesharing platforms, energy modeling, smart and energy-efficient buildings, evacuation modeling, decision-making during extreme events, and urban resilience.

Learning Outcomes: 1. Understand the different types of data generated by smart cities. 2. Understand the basics of various data mining techniques. 3. Understand what type of data mining analysis is appropriate for various smart city applications. 4. Gain basic knowledge of using Python for data analytics and results visualization. 5. Apply the methods and techniques learned in this course to an applied smart city project. Credits: 3.00

CE 56901 - Smart Logistics

Credit Hours: 3.00. This course provides a foundation of analytical tools, methods and applications of logistics systems in the context of planning and operations of integrated supply chain systems. The material is useful for students interested in managing supply chain systems providing a background on where and how specific methods can be used for improving overall performance of the supply chain. The course is broadly divided into two parts: (1) Science of Logistics which provides an introduction to unique characteristics of supply chain management; demand forecasting, planning and management; inventory control and planning; operational transportation issues such as vehicle routing and supply chain contracts and network design. (2) Business of Logistics which discusses the applications of the science to real-world logistics systems. Real-world case studies from past problems will be the basis for discussion and will include the nature of costs in supply chain networks, operational issues, vehicle routing problems, interactions of carriers and shippers using auctions and yield management. The course will use intuitive arguments and mathematical optimization tools will be used to illustrate many situations in a rigorous fashion.

Learning Outcomes: 1. Reinforce the integrated nature of logistics systems from tactical, operational and strategic perspectives, different actors in this system and the role of logistics systems as an economic driver. 2. Understand the basics concepts and models of demand prediction, inventory management, operational and tactical planning in supply chain management. 3. Demonstrate the ability to develop appropriate quantitative tools for planning and logistics problems using optimization techniques and solve them using appropriate solution algorithms, techniques and software. 4. Apply the science of logistics systems to improve the cost and overall efficiency of real-world logistics problems. Credits: 3.00

CE 56601 - Network Models For Connected And Autonomous Vehicles

Credit Hours: 3.00. This course provides an introduction to mathematical foundations of the analysis of transportation networks. The course will be divided into two main sections. Section 1 will introduce the basic foundations of network routing problems including user equilibrium (selfish routing) and system optimal games on networks. Various optimization-based formulations, algorithms and extensions will be discussed. A particular emphasis will be on devising efficient algorithms and computation on city networks. Students will be expected to know how to design efficient algorithms for network analysis and implement them on various datasets. The second half of the course will tailor the network models learned in the first half to understanding the impacts of connected and autonomous vehicles (CAVs). This will be done by taking specific example problems such as autonomous intersection control, parking design, network design for CAVs, etc. Recent research papers will form the basis for developing these models. Extensive use of intuitive arguments, counterintuitive phenomenon (paradoxes) and network structures will be utilized to illustrate many situations graphically. In addition, computing the solutions efficiently using various network algorithms will be discussed. The course is research based and students in addition to learning the concepts will extend the concepts to a research

project to be finished within the semester.

Learning Outcomes: 1. Analyze transportation systems using game theory and optimization by drawing on analogies between the interactions of supply and demand in economic markets. Define selfish routing (user equilibrium) and system optimal problems; Develop solution algorithms for large scale networks. 2. Apply specialized network structures to solve selfish routing games efficiently. 3. Formulate and apply various extensions of the selfish routing game rigorously - traffic assignment with elasticity, stochastic user equilibrium, network design and OD estimation. 4. Understand the basic concepts of Connected and Autonomous vehicles (CAVs). 5. Apply the static network models to CAV planning and operations problems. 6. Use software to analyze various large-scale transportation networks and understand issues from real-world practitioners. Credits: 3.00

Program Learning Outcomes

About the Program

Social Policy, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

Policy Process Course (3 credits)

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

Policy Analysis Tools Courses (3 credits)

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

POL 60600 - Advanced Quantitative Techniques In Political Science

Credit Hours: 3.00. This course deals with advanced quantitative techniques useful in political science research. These include multiple correlation and regression, causal modeling, dynamic (time series) analysis, dimensional analysis (Coombsean scaling, Shepard-Kruskal scaling, and factor analysis), and cross-level inference techniques. Prerequisite: POL 50100 , POL 60500 .

Learning Outcomes: 1. Understand the logic and interpretation of various models. 2. Understand the assumptions underlying various advanced quantitative techniques. 3. Analyze data using advanced quantitative techniques. 4. Learn the appropriate software to apply advanced quantitative techniques. Credits: 3.00

POL 69300 - Interdisciplinary Seminar

Credit Hours: 3.00. Topics vary - Interdisciplinary Seminar. Permission of instructor required.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

Substantive Courses (6 credits)

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

POL 62200 - Research Seminar In Public Policy And Public Administration

Credit Hours: 3.00. Investigation in depth of a substantive aspect of public policy such as energy policy or social policy, or of a theoretical topic, for example, policy formulation, enactment, implementation, impact, or evaluation. Permission of instructor required.

Credits: 3.00

SOC 57200 - Comparative Healthcare Systems

Credit Hours: 3.00. Using cost, quality, and access to care as core concepts, this course explores healthcare in comparative context. Special topics are health and gender, the environment, epidemics, long-term care, technology, and rationing, among

others.

Credits: 3.00

SOC 57300 - The Human Side Of Medicine

Credit Hours: 3.00. Focuses on sociological theory and research related to social conflicts over the delivery of healthcare in the U.S. Considers social issues pertaining to abortion, AIDS, human experimentation, reproductive technologies, euthanasia, and others.

Credits: 3.00

SOC 57400 - The Social Organization Of Healthcare

Credit Hours: 3.00. Analysis of the determinants and consequences of the social organization of medical care. Considers morbidity and mortality, costs and utilization of medical services, healthcare occupations and institutions, and change in programs and policies.

Credits: 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

Policy Process Course (3 credits)

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

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Credits: 3.00

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Credits: 3.00

Policy Process Course (3 credits)

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

GPA Requirements

About the Program

Spatial Data Science, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (12 credits)

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to

communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

FNR 58700 - Advanced Spatial Ecology And GIS

Credit Hours: 3.00. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales. The lab will focus on the use and application of these databases that are common in natural resource management settings.

Learning Outcomes: 1. Apply the principles of landscape ecology to the analysis of spatial change in urban, agricultural and forested landscapes for the purposes of natural resource management. 2. Calculate change in landscape patterns using a variety of geospatial tools such as geographic information systems, spatial models, and geostatistics. 3. Prepare reports using the traditional scientific journal article format, on the analysis of landscape-scale change, focusing on problems common to watershed management. 4. Compare and contrast the ways that biodiversity can be calculated using standard indices of organismal diversity. 5. Calculate ecological footprints and evaluate why these vary across geopolitical and/or ecological units. Credits: 3.00

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About the Program

Sports Communication, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 66111 - Sports Communications

Credit Hours: 3.00. This course provides students a strategic and holistic sports communication approach and framework to solve for communications challenges. The course focuses on understanding the ever-increasingly competitive athletic landscape - collegiate and professional (though the lines are blurring) -- to aid the sports communicator in crafting a strategic communication plan based on quantifiable objectives and desired outcomes. Special topics include crisis and reputation management, leveraging social media, the emergence of AI, and athletes and culture.

Learning Outcomes: 1. Develop a strategic sports communication plan. 2. Integrate social media and AI into strategic communication planning. 3. Apply effective strategies to engage productively with collegiate and professional sports media. 4. Analyze a crisis event to develop strategies for advancing organizational reputation. 5. Articulate the role of sports in culture. Credits: 3.00

COM 66211 - Strategic Sports Media Relations

Credit Hours: 3.00. This course explores how to navigate a

media landscape that is evolving at light-speed both in collegiate and professional sports. The course offers students the tools to engage productively with media members and places particular emphasis on the communicator/media relationship, how media prefer to receive content and the role of the communications leader. Strategic Sports Media Relations also delves into media interaction during crisis events and the rise of AI.

Learning Outcomes: 1. Articulate how sports media relations have evolved across print, radio, TV, online and social media. 2. Explain the roles of collegiate and professional athletics communicators. 3. Demonstrate the ability to facilitate interviews and pitch/write in the sports media relations setting. 4. Respond to crisis and reputation management events. 5. Discuss sports media relations ethics/law and AI's impacts. Credits: 3.00

Required Courses (9 credits)

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Program Learning Outcomes

About the Program

Strategic Communication

Management, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Course (3 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

Selectives (6 credits)

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3.

Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

Required Course (3 credits)

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

About the Program

Strategic Defense Technologies, Post-Baccalaureate Certificate

About the Program

Program Requirements (9 credits)

Required Course (3 credits)

SCLA 50500 - Technology, War, And Strategy

Credit Hours: 3.00. This course introduces students to the interaction between strategy and technology internationally and across historical eras. The course is rooted in historical political, military, economic, technological, and cultural strategy, and it engages core ideas that cut across disparate schools of thought and historical contexts. The course prepares students to appreciate and understand the foundational principles of designing and executing broad strategic initiatives with world-changing consequences that engage profound national economic and technological commitments.

Learning Outcomes: 1. Classify and compare the core strategic competencies needed in designing and implementing strategic defense technologies. 2. Sequence and apply in strategic planning historical constants of strategic technology development. 3. Assess

the concept of strategic technological offset in context. 4. Devise effective communication and presentation skills. Credits: 3.00

Selectives (6 credits)

SCLA 52000 - Social And Digital Media Analytics For Strategic Communication

Credit Hours: 3.00. This course provides an overview of how to transform social media and digital media information into business intelligence and actionable insight. Although students are not expected to know a programming language prior to taking the course, students are expected to understand basic statistics and to have a desire to learn the processes, procedures and vocabulary used by data analysts in modern organizations. The goal is not to train them as practicing data scientists, but as knowledgeable data analytics consumers and as informed teammates and leaders of cross-functional teams tasked to make decisions using data.

Learning Outcomes: 1. Differentiate between the opportunities and limitations with social media data. 2. Identify methods for using ready and custom-made tools to transform information into insight, from data collection to analysis, interpretation, and recommendation. 3. Sharpen their quantitative and business analytical skills using spreadsheets and online tools. 4. Write effective reports and draft scorecards. 5. Be prepared to interact with data scientists by speaking their language and understanding their processes for data mining and business intelligence. Credits: 3.00

SCLA 51000 - Data And AI Storytelling

Credit Hours: 3.00. The primary assumption of our course is that the goal of communicating with data is ultimately to identify causal mechanisms and change the status quo due to the obtained insights. All audiences have previous understandings of the world, and meaningful data stories should challenge their assumptions about that world. The communication of this data-based new knowledge violates prior assumptions, shares memorable new information and moves the audience to act based on the new knowledge. This is best accomplished through a story. In other words, this communication assumes the form of a story, which is defined as the narrative of how an unexpected cause creates an effect.

Learning Outcomes: 1. Provide high-quality data story examples and justify why they meet the good story criteria. 2. Identify and extrapolate core relationships between research design and story-building. 3. Generate hypotheses based on data. 4. Create specific data visualizations which maintain casual narratives. 5. Identify story elements that map onto the five tenets of What is a Data Story? 6. Identify in examples the adherence or violation of data transparency, validity and ethics. Credits: 3.00

SCLA 50600 - Space Strategy

Credit Hours: 3.00. Space is the most recent domain in which nations and great powers dispute strategic political, military, economic, and legal interests. The course analyzes the origins, tensions, and promises embedded in the space-focused strategies of major international players. The course will discuss these issues from the US national and strategic interests perspective, focusing on how strategic competition and conflict in space could and should be handled. The course combines technological with grand strategy concerns.

Learning Outcomes: 1. Distinguish the key characteristics of grand strategy with examples for each great power involved in space strategy. 2. Distinguish the main phases in the history of space exploration and appraise their role in revealing various strategic priorities for space policy. 3. Differentiate essential provisions of the key space legal documents and principles by their domain and effect. 4. Assess the main space-paced conflictual relationships and prioritize them by importance and immediacy. 5. Differentiate the role of governments and private organizations in space strategic control and determine their main common interests by great power. Credits: 3.00

SCLA 53000 - Strategic Foresight And Leadership

Credit Hours: 3.00. This course provides emerging leaders with strategic foresight tools and skills to understand and make decisions regarding long-term future operational defense-related environments. Strategic foresight is the ability to create and sustain a variety of high-quality long-term views and apply emerging insights in organizationally adaptive ways. Strategic

foresight produces scenarios that are the basis for strategies and plans to help defense or industry organizations remain competitive into the foreseeable future.

Learning Outcomes: 1. Define and explain strategic foresight. 2. Distinguish the difference between a growth, fixed, and futures mindset in strategic foresight. 3. Make use of specific strategic foresight methodologies: horizon scanning, signals and drivers of change, the 2 x 2 matrix and archetype methods. 4. Make use of vision and alignment in executing a strategic foresight model. 5. Argue the importance of vision for strategic leadership. Credits: 3.00

SCLA 52200 - Artificial Intelligence Policy, Governance, And Ethics

Credit Hours: 3.00. This course provides students with a strong grounding in the policy, ethical, and legal regulatory dimensions and environment that shape the governance of AI. Students will analyze current and emerging laws, regulations, and governance strategies shaping the AI landscape across multiple jurisdictions and sectors. The course will help students gain an interdisciplinary understanding of the core ethical principles and values that guide AI.

Learning Outcomes: 1. Describe key stakeholders, institutions, and strategies involved in AI policymaking across multiple levels of government (local to global) in multiple fields and explain their roles in governing AI systems. 2. Evaluate the legal, regulatory, and other governance strategies that have been proposed or adopted by governments, firms, and civil society organizations, such as model cards, liability frameworks, standards, and impact assessments. 3. Analyze ethical and social issues related to the development and application of AI systems within multiple fields, including power, model bias, transparency, accountability, worker well-being, and privacy, as well as the translation of ethical values into technical aspects of AI governance practices within public and private, and non-profit sector organizations. 4. Synthesize, analyze, and communicate information about emerging policy issues in AI and the associated ethical and social dimensions, identify stakeholder perspectives, and summarize proposed solutions. 5. Assess current and evolving trends, debates, and solutions in AI governance and ethics through case studies, contemporary issues, and comparative analysis. Credits: 3.00

SCLA 50700 - Grand Challenges In Defense Engineering

Credit Hours: 3.00. This course examines past, present, and future engineering challenges to develop new conceptual insight, research priorities, system integration, and timely methods to meet emerging national defense engineering needs. The course matter involves challenges in Energy, Logistics and Information, and Rapid Offense and Defensive Systems and subsets of each designed to develop understanding depth and transfer analytic and planning skills needed to meet future defense needs. The selected three topics begin with a past engineering challenge to gain perspective on how prior needs were met in their time, a present challenge under current focus, and a possible future challenge and solutions that will require combining prior best practices with the accelerated development needed in the changing world.

Learning Outcomes: 1. Develop professional methods to identify, research, collaborate, and develop solutions to engineering challenges while maintaining appropriate systematic thinking. 2. Formulate and solve structured problems using standardized professional methods including case study research, system engineering design, and policy analysis. 3. Appraise historic, present, and anticipated future engineering challenges by identifying the necessary parameters required for solving them, such as specifying challenge dimensions, generating appropriate assumptions for missing information, formulating solutions, and projecting possible results. 4. Identify, locate, and integrate data, parameters, or information about past, present and future practices needed to develop solutions to course problems. 5. Assemble and compose written and oral communications involving solutions and arguments valuable for both senior and technical leadership while maintaining ethical

and professional conduct. Credits: 3.00

Required Course (3 credits)

SCLA 50500 - Technology, War, And Strategy

Credit Hours: 3.00. This course introduces students to the interaction between strategy and technology internationally and across historical eras. The course is rooted in historical political, military, economic, technological, and cultural strategy, and it engages core ideas that cut across disparate schools of thought and historical contexts. The course prepares students to appreciate and understand the foundational principles of designing and executing broad strategic initiatives with world-changing consequences that engage profound national economic and technological commitments.

Learning Outcomes: 1. Classify and compare the core strategic competencies needed in designing and implementing strategic defense technologies. 2. Sequence and apply in strategic planning historical constants of strategic technology development. 3. Assess the concept of strategic technological offset in context. 4. Devise effective communication and presentation skills. Credits: 3.00

About the Program

Systems, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define

an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define models of the interfaces of an engineered system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

Required Courses (9 credits)

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic,

environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define models of the interfaces of an engineered system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

About the Program

Teaching and Learning in Engineering, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (7 credits)

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (CHE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Student must be admitted into a Ph.D. program in Engineering or other technical discipline (Finished with MS or MS-bypass). Not open to students who have taken PSY 69500/EDPS 63400. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

ENE 68700 - Mentored Teaching In Engineering

Credit Hours: 1.00 or 3.00. Mentored experience in the teaching of engineering, with structured opportunities for individual reflection. All students create a scholarly teaching portfolio. Students who register for three credits conduct a scholarship of teaching and learning project. Prerequisites: Significant concurrent responsibility for teaching an engineering course. Registration in or completion of ENE 50600 (Content, Assessment And Pedagogy) or ENE 68500 (Educational Methods In Engineering); or instructor permission required.

Learning Outcomes: 1. Think critically about the relationships between your teaching experiences and the readings in this course and the prerequisite courses. 2. Use reflection, mentoring, and student feedback to learn from teaching experiences. 3. Explain the reasons for choices of teaching methods. 4. Analyze evidence of student learning. 5. Identify and address ethical issues in teaching situations. 6. Plan and carry out a scholarly investigation of teaching and learning through the SoTL project. Credits: 1.00 or 3.00

Selective (3 credits)

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

ENE 58600 - Exploring Alternative Career Paths As An Engineering Educator

Credit Hours: 3.00. This course is designed for graduate students in engineering or closely related fields who want to be involved in educating current or future engineering students or practicing engineers or in communicating technical material to others, including teachers, the public, or policymakers - but are not currently interested in a tenure-track faculty position. It explores a wide range of positions in formal education, informal education (e.g., museums, foundations), industry, and government and offers an opportunity to learn and practice some skills typically required for success in those positions.

Learning Outcomes: 1. Describe non-tenure-track positions of interest to them and where to look for those types of positions. 2. Build and maintain networks with people who have similar interests. 3. Prepare a professional development plan to develop and polish the skills they need in their current or future position. 4. Write an effective proposal seeking funding for a project of interest. Credits: 3.00

Required Courses (7 credits)

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection

and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (CHE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Student must be admitted into a Ph.D. program in Engineering or other technical discipline (Finished with MS or MS-bypass). Not open to students who have taken PSY 69500/EDPS 63400. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

ENE 68700 - Mentored Teaching In Engineering

Credit Hours: 1.00 or 3.00. Mentored experience in the teaching of engineering, with structured opportunities for individual reflection. All students create a scholarly teaching portfolio. Students who register for three credits conduct a scholarship of teaching and learning project. Prerequisites: Significant concurrent responsibility for teaching an engineering course. Registration in or completion of ENE 50600 (Content, Assessment And Pedagogy) or ENE 68500 (Educational Methods In Engineering); or instructor permission required.

Learning Outcomes: 1. Think critically about the relationships between your teaching experiences and the readings in this course and the prerequisite courses. 2. Use reflection, mentoring, and student feedback to learn from teaching experiences. 3. Explain the reasons for choices of teaching methods. 4. Analyze evidence of student learning. 5. Identify and address ethical issues in teaching situations. 6. Plan and carry out a scholarly investigation of teaching and learning through the SoTL project. Credits: 1.00 or 3.00

Program Learning Outcomes

About the Program

Teaching English Language Learners in K-12, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (15 credits)

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

Required Courses (15 credits)

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

Additional Information

About the Program

Technical Communication, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

TCM 54000 - Advanced Managing Document Quality

Credit Hours: 3.00 to 4.00. In this course, students will examine and apply principles of creating a technical or professional publication from start to finish Students will explore and practice publication quality management issues such as planning, researching audience and content, designing the publication, drafting, obtaining reviews, conducting usability testing, and negotiating within organizational cultures.

Learning Outcomes: 1. Explain the features that affect document quality. 2. Apply and explain the processes that lead to effective technical/professional publications. 3. Evaluate, use, and explain software tools that can aid

technical communicators in managing the publication creation process. 4. Apply concepts relevant to effective processes that technical communicators need to understand. 5. Apply user-centered design principles and usability testing in the process of creating effective publications. 6. Synthesize ideas from secondary research concerning an emerging concept in the field that will be useful in professional practice. Credits: 3.00 to 4.00

TCM 55000 - Advanced Research Approaches For Technical And Professional Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of conducting applied research in technical and/or professional communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Generate effective research questions, suitable for workplace technical/professional communication research into audience, content, and communication approaches. 2. Conduct and report on results of secondary research relevant to technical/professional communication. 3. Design, conduct, and report on the results of primary research relevant to technical/professional communication. 4. Analyze reports of technical/professional communication research. 5. Explain the rationale for technical/professional research approaches, based on sound concepts and noting the capabilities and limitations of various approaches. Credits: 3.00 or 4.00

Program Learning Outcomes

Wireless Systems Engineering, Post-Baccalaureate Certificate Workplace Learning, Post-Baccalaureate Certificate

About the Program

Program Requirements

Required Courses (9 credits)

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology

principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting. Credits: 3.00

Post-Master's Certificate

Adult Gerontology Primary Care Nurse Practitioner, Post-Master's Certificate

About the Program

Program Requirements

About the Program

Medical Physics, Post-Masters Certificate

About the Program

Program Requirements

Required Courses (16 credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their

functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes

such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special

techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 54100 - Human Sectional Anatomy

Credit Hours: 2.00. This course connects anatomy and physiology with medical imaging. The primary focus is on anatomic imaging methods such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) but includes Positron Emission Tomography (PET) and Ultrasound (US) images when applicable or are in common use as part of clinical care.

Learning Outcomes: 1. Identify and label the anatomy associated with the topical outline in diagnostic CT/MRI images. 2. Critique CT/MRI images for the presence or absence of anatomy and pathology to decide whether the image is appropriately positioned and diagnostic for radiological assessment. 3. Locate anatomical systems and possible pathology based on background knowledge of typical anatomical locations and identify normal course of system function for appropriate positioning, patient instructions, and CT/MRI imaging. Credits: 2.00

Required Courses (16 credits)

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism.

Integrated into the study of the human organism are laboratory exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes

such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing. The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special

techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 54100 - Human Sectional Anatomy

Credit Hours: 2.00. This course connects anatomy and physiology with medical imaging. The primary focus is on anatomic imaging methods such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) but includes Positron Emission Tomography (PET) and Ultrasound (US) images when applicable or are in common use as part of clinical care.

Learning Outcomes: 1. Identify and label the anatomy associated with the topical outline in diagnostic CT/MRI images. 2. Critique CT/MRI images for the presence or absence of anatomy and pathology to decide whether the image is appropriately positioned and diagnostic for radiological assessment. 3. Locate anatomical systems and possible pathology based on background knowledge of typical anatomical locations and identify normal course of system function for appropriate positioning, patient instructions, and CT/MRI imaging. Credits: 2.00

About the Program

Primary Care Family Nurse Practitioner, Post-Master's Certificate

About the Program

Program Requirements

About the Program

Primary Care Pediatric Nurse Practitioner, Post-Master's Certificate

About the Program

Program Requirements

About the Program

Psychiatric Mental Health Nurse Practitioner, Post-Master's Certificate

About the Program

Program Requirements

About the Program

Pre-Program

Data Science First Year (CS)

Data Science First Year

Program Requirements (25-28 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CS 19300 - Tools

Credit Hours: 1.00. This course is designed to introduce new Computer Science students to various programming tools which will aid them in their Computer Science classes, personal projects, and software development job experiences.

Learning Outcomes: 1. Understand Unix/Linux commands for navigating directories and files and manipulating files and folders. 2. Understand terminal commands for searching and input/output redirection. 3. Understand shells such as sh, csh, ksh, tcsh, bash, zsh. 4. Understand debugging via print statements and general debugger concepts. 5. Understand version control via Git and Github, source control, workflow, commit, collaboration, pull, push, create and pushing a new repository, cloning, branches, merging, and conflicts. 6. Understand vim including mouseless navigation, normal/insert mode, copy/paste, search/replace, and saving/quitting. Credits: 1.00

16-18 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the

interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

15-17 Credits

Notes

Data Science First Year (Math)

Data Science First Year

Program Requirements (25-28 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CS 19300 - Tools

Credit Hours: 1.00. This course is designed to introduce new Computer Science students to various programming tools which will aid them in their Computer Science classes, personal projects, and software development job experiences.

Learning Outcomes: 1. Understand Unix/Linux commands for navigating directories and files and manipulating files and folders. 2. Understand terminal commands for searching

and input/output redirection. 3. Understand shells such as sh, csh, ksh, tcsh, bash, zsh. 4. Understand debugging via print statements and general debugger concepts. 5. Understand version control via Git and Github, source control, workflow, commit, collaboration, pull, push, create and pushing a new repository, cloning, branches, merging, and conflicts. 6. Understand vim including mouseless navigation, normal/insert mode, copy/paste, search/replace, and saving/quitting. Credits: 1.00

16-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write

applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

14-17 Credits

Notes

Data Science First Year (Statistics)

Data Science First Year

Program Requirements (25-28 credits)

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves.

5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

Fall 1st Year

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a

one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

CS 19300 - Tools

Credit Hours: 1.00. This course is designed to introduce new Computer Science students to various programming tools which will aid them in their Computer Science classes, personal projects, and software development job experiences.

Learning Outcomes: 1. Understand Unix/Linux commands for navigating directories and files and manipulating files and folders. 2. Understand terminal commands for searching and input/output redirection. 3. Understand shells such as sh, csh, ksh, tcsh, bash, zsh. 4. Understand debugging via print statements and general debugger concepts. 5. Understand version control via Git and Github, source control, workflow, commit, collaboration, pull, push, create and pushing a new repository, cloning, branches, merging, and conflicts. 6. Understand vim including mouseless navigation, normal/insert mode, copy/paste, search/replace, and saving/quitting. Credits: 1.00

16-17 Credits

Spring 1st Year

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of

revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

15-17 Credits

Notes

Explorers, DS

About the Program

Degree Requirements

Required Courses: (10-12 credits)

EDPS 10500 - Academic And Career Planning (UCC: IL)

Credit Hours: 3.00. Builds understanding of career interests and personality characteristics related to academic and career decisions. Expands knowledge of Purdue academic programs and of the world of work. Introduces decision-making strategies.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Describe and explain multiple facets of your identity. 2. Identify and analyze potential academic majors. 3. Identify and analyze potential careers. 4. Evaluate potential majors and careers in relation to yourself. Credits: 3.00

Other Departmental/Program Course Requirements

Program Requirements

Fall 1st Year

EDPS 10500 - Academic And Career Planning (UCC: IL)

Credit Hours: 3.00. Builds understanding of career interests and personality characteristics related to academic and career decisions. Expands knowledge of Purdue academic programs and of the world of work. Introduces decision-making strategies.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe and explain multiple facets of your identity. 2. Identify and analyze potential academic majors. 3. Identify and analyze potential careers. 4. Evaluate potential majors and careers in relation to yourself. Credits: 3.00

13-19 Credits

Spring 1st Year

15-17 Credits

First Year Engineering Program Requirements - Other Options

First-Year Engineering Program Requirements - EPICS Option

Fall 1st Year

EPCS 11100 - First Year Participation In EPICS I (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one-year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to

compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

ENGR 13300 - Transforming Ideas To Innovation, EPICS/VIP (UCC: IL)

Credit Hours: 2.00. Introduces students to the engineering professions using multidisciplinary, societally relevant content. Students will develop engineering approaches to systems, generate and explore creative ideas, and use quantitative methods to support design decisions. Students will experience the process of design and analysis in engineering including how to work effectively in teams, and will develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB). An emphasis will be placed on computing logic development and builds upon the co-requisite experience of the students in the EPICS class.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Examine and analyze career information from various resources to make informed decisions about which engineering discipline to pursue. 2. Develop metacognitive skills in evaluating own teamwork and leadership abilities, recognizing how own behavior impact the whole team, and make team process adjustments when necessary. 3. Explain critical and diverse use of modeling in engineering to understand problems, represent solutions, compare alternatives, make predications, etc. 4. Use multiple models, estimation, and logic to triangulate and evaluate information coming from various data sources. 5. Collect, analyze, and represent data to make informative explanations and persuasive arguments. 6. Develop a logical problem solving process which includes sequential structures, conditional structures, and repetition structures for fundamental engineering problems. 7. Solve fundamental engineering problems using computer tools. 8. Perform basic file management tasks using an appropriate computer tool. 9. Work effectively and ethically as a member of a technical team. 10. Develop a work ethic appropriate for the engineering profession. 11. Reflect on personal and team performance to achieve continuous improvement. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-16 Credits

Spring 1st Year

EPCS 12100 - First Year Participation In EPICS II (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and educational organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project for two or more semesters. First-year students participating in EPICS gain insight into the specific project, and more generally, into the design and development process. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Ability to apply material from their discipline to the design of community-based projects. 2. Understanding of design as a start-to-finish process. 3. Ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Awareness of the customer. 5. Ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Ability to communicate effectively with audiences with widely-varying backgrounds. 7. Awareness of professional ethics and responsibility. 8. Appreciation of the role that their discipline can play in social contexts. Credits: 1.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all

this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

15-18 Credits

First-Year Engineering Program Requirements - GOSS Scholars Option

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

ENGR 16100 - Honors Introduction To Innovation And The Physical Science Of Engineering Design I (UCC: IL/SCI)

Credit Hours: 4.00. This course introduces students to the engineering profession using physics-based, multidisciplinary, societally relevant content. Students develop engineering approaches to systems, generate and explore creative and innovative ideas, and use of computational methods to support design decisions. In particular, the students will develop the ability to model and investigate physical systems at the microscopic and macroscopic levels with a focus on vectors analysis, linear momentum, angular momentum, work-energy, and solid material interactions. Design challenges and projects will explore a wide range of natural phenomena experimentally and computationally (utilizing MATLAB and Python) and engage students in innovative thinking across the engineering disciplines at Purdue. They will learn the basics of descriptive statistics, data analysis, sensitivity analysis, and decision-making. Students experience the process of design and analysis in engineering including how to work effectively in teams. Students also develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Discuss the engineering education process, courses, and options, explain and compare engineering job functions and roles, and use this information to prepare a moderately well-informed course of study for academic and career success (3). 2. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and demonstrating a personal growth mindset to thoughtfully pursue course

activities and the course as a whole (2). 3. Plan and implement systematic design processes using formal engineering management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (6). 4. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 5. Describe a wide range of physical phenomena using a few fundamental physical laws (12). 6. Learn how to implement a unified approach that relates microscopic behavior to macroscopic behavior. These include mechanical theories based on particle, spring, and material models (10). 7. Model natural phenomena using computer simulations (5). 8. Demonstrate professional communication skills in the areas of technical writing to produce engineering reports, in presentations to convey engineering evidence and findings verbally and graphically to audiences, and in interpersonal communication to work with other members of the class (2). 9. Work alongside individuals with diverse backgrounds, utilizing the team environment to learn interdependently, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 10. Evaluate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (5). 11. Incorporate the consideration of engineering ethics, including social, safety, and sustainability issues into instances of engineering thinking and engineering problem solving so that the broader impacts of engineering work are evaluated and accounted for (3). 12. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, visualization, significant digits, and the problem presentation method to engineering applications (2). 13. Display proficiency in the applications of engineering content knowledge including basic statistics (5). Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis

techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15-17 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

ENGR 16200 - Honors Introduction To Innovation And The Physical Science Of Engineering Design II (UCC: IL/SCI)

Credit Hours: 4.00. Students will take an in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. The students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g. MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control in an effort to identify and characterize physical material systems.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Utilize knowledge of the engineering education process, courses, and options, and engineering job functions and roles to prepare a final course of study for academic and career success (3). 2. Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories (10). 3. Apply the unified approach to material interactions to a broad array of applications including asteroids, black holes, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity (7). 4. Model natural phenomena using computer simulations (7). 5. Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem solving to ensure that the broader impacts of engineering work are consistently evaluated and accounted for (3). 6. Display proficiency in the applications of engineering content knowledge including statistics, statics, mechanics of materials, the universal accounting equation, electrical theory, and design of experiments (8). 7. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole (2). 8. Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (2). 9. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 10. Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms (5). 11. Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce

engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class (3). 12. Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 13. Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (3). 14. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering challenges (2). Credits: 4.00

14-17 Credits

First-Year Engineering Program Requirements - VIP Option

Fall 1st Year

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

VIP 17911 - First Year Participation In Vertically Integrated Projects (VIP) I (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a

broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

ENGR 13300 - Transforming Ideas To Innovation, EPICS/VIP (UCC: IL)

Credit Hours: 2.00. Introduces students to the engineering professions using multidisciplinary, societally relevant content. Students will develop engineering approaches to systems, generate and explore creative ideas, and use quantitative methods to support design decisions. Students will experience the process of design and analysis in engineering including how to work effectively in teams, and will develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB). An emphasis will be placed on computing logic development and builds upon the co-requisite experience of the students in the EPICS class.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Examine and analyze career information from various resources to make informed decisions about which engineering discipline to pursue. 2. Develop metacognitive skills in evaluating own teamwork and leadership abilities, recognizing how own behavior impact the whole team, and make team process adjustments when necessary. 3. Explain critical and diverse use of modeling in engineering to understand problems, represent solutions, compare alternatives, make predications, etc. 4. Use multiple models, estimation, and logic to triangulate and evaluate information coming from various data sources. 5. Collect, analyze, and represent data to make informative explanations and persuasive arguments. 6. Develop a logical problem solving process which includes sequential structures, conditional structures, and repetition structures for fundamental engineering problems. 7. Solve fundamental engineering problems using computer tools. 8. Perform basic file management tasks using an appropriate computer tool. 9. Work effectively and ethically as a member of a technical team. 10. Develop a work ethic appropriate for the engineering profession. 11. Reflect on personal and team performance to achieve continuous improvement. Credits: 2.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum

theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-16 Credits

Spring 1st Year

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

VIP 17912 - First Year Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering

design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

15-18 Credits

First-Year Engineering

About the Program

Other Options for First Year Engineering

SCLA 11000 - Language And Cultural Exchange I: Self In Context (UCC: HUM)

Credit Hours: 3.00. The course takes a social science-based approach to investigating the American university by examining contemporary college life, the history of the American academy, social and environmental issues on campus, and opportunities for engagement with the wider community. Students will improve their speaking, listening, reading, writing skills in English so that they can actively participate in social and academic communication.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Speak English more fluently. 2. Read English more fluently. 3. Communicate in English with increased clarity (writing effective academic sentences and paragraphs; speaking on familiar topics). 4. Develop and apply a process for cross-cultural comparison and reflection. Credits: 3.00

SCLA 11100 - Language And Cultural Exchange II: Texts And Contexts

Credit Hours: 3.00. Students will continue to develop the foundational language skills and knowledge that they need to succeed in their other classes at Purdue and to prepare for further academic and professional opportunities. Students will also deepen their understanding of American culture and improve their ability to think about cultural differences in positive ways. In a sense, this class will be a bridge to help you transition to other language-intensive courses at Purdue where you need to read, write, and speak frequently and/or work in groups (such as business, engineering, literature, public speaking, and social sciences).

Learning Outcomes: 1. Speak and read English more fluently. 2. Present academic topics to an audience with increased clarity and within time constraints (write effective, short academic essays; present information orally to an academic audience). 3. Understand reasons and practices for using outside sources in an American academic context. Credits: 3.00

Grade Average Requirement

Grade Requirements

Pass/No Pass Policy

Transfer Credit Policy

Notes

Non-course / Non-credit Requirements

Transitioning to a degree program

Plant Studies: Exploratory (Pre)

About the Program

This pre-major is intended to serve as an optional entry point/portal for students interested in life sciences and enrolling in the Purdue College of Agriculture with an interest in plants but who are uncertain about the differences between all the majors and career options. As a Plant Studies - Exploratory major, students will make progress toward their Bachelor of Science degree and engage the numerous experiential learning opportunities (e.g. learning communities, clubs, leadership opportunities, Study Abroad, etc.) offered in the College. Students will have up to 4-semesters or 60 total credits to explore the various majors before selecting one that best meets their educational and career interests. It is anticipated that most students will likely select a major by the end of their first two semesters.
Plant Studies: Exploratory Major Change (CODO) Requirements

Degree Requirements

Departmental/Program Major Courses (2.5 credits)

Required Major Courses (2.5 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 29000 - Special Topics In Agriculture

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. The specific topic that is offered will be indicated on the student's academic record.

Learning Outcomes: 1. Learning outcomes addressed include communication, critical thinking, and professional development. Credits: 0.00 to 3.00

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

Other Departmental/Program Course Requirements (26-31 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team.
Credits: 4.00

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

SFS 31200 - Urban Agriculture

Credit Hours: 1.00. Urban agriculture has the potential to address a range of social, economic and environmental issues including food insecurity, energy conservation, and human health and well-being. During this 5-week course, students will learn about the forces driving urban agriculture as well as the political and biophysical factors constraining it by reading articles, reviewing case studies, and visiting urban farms, vertical farm factories, food pantries, and local food advocacy groups. At the end of this course, students will apply the knowledge they've gained by developing a plan to increase urban agriculture in the greater Lafayette metropolitan area.

Learning Outcomes: 1. Understand the complexity of our global food system and learn how urban agriculture can address social, economic and ecological issues in cities around the world. 2. Develop critical thinking and communication skills through in-class discussions and writing assignments that integrate agroecology, urban planning, and civic engagement as they relate to urban agriculture. 3. Apply relevant theories and examples by developing a plan to facilitate the growth of urban agriculture. Credits: 1.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including

experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific

method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences,

management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

HORT 12100 - Medicine In The Garden (UCC: STS)

Credit Hours: 1.00. A survey of the uses and properties of horticultural plants for human health and well-being. Topics will focus on the close relationships between plants and human physiology, nutrition, medicines, mind-altering drugs, poisons, and beverages.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

AGRY 12300 - Genetics And Society

Credit Hours: 3.00. Introduction to the broad impacts that genetics and genomics have on society, from medicine, genetic testing and DNA evidence to agriculture, genetically modified crops and synthetic life. Background information is provided on a weekly topic followed by extensive in-class discussion.

Learning Outcomes: 1. Describe the issues, facts, and concepts central to a broad range of

genetics and genomics topics. 2. Form own opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe work done in three scientific disciplines, biology, genetics and genomics, as well as some intersecting disciplines such as medicine and engineering. Credits: 3.00

BTNY 28500 - Plants And Civilization (UCC: STS)

Credit Hours: 3.00. This course, intended primarily for non-majors, covers the history of agriculture, with focus on the centers of origin of our major food, fiber, and medicinal plants, and their historical, cultural, and economic relevance. The course also surveys the biology of crop plants, with respect to taxonomy, anatomy, cell structure, physiology, development, and genetics. Discussions also center on the roles plant biotechnology may play in sustainable agriculture and in helping to alleviate problems caused by overpopulation and ecological stress.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Professional preparation, scientific principles, critical thinking, cultural understanding, social science principles and lifelong learning. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how

scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital

instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

Electives (1-3 credits)

Program Requirements

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 29000 - Special Topics In Agriculture

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. The specific topic that is offered will be indicated on the student's academic record.

Learning Outcomes: 1. Learning outcomes addressed include communication, critical thinking, and professional development. Credits: 0.00 to 3.00

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of

disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

15.5-17.5 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.
Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.
Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to

collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

14-19 Credits

Pre-Accounting

About the Pre-Program

Pre-Program Requirements (26-37 credits)

Required Major Courses (9 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 19700 - Careers In Accounting & Finance

Credit Hours: 1.00. This course explores the various career opportunities available to accounting majors, as well as opportunities available to non-accounting majors who have a strong background in accounting. While most students believe public/private accounting are the only career options for accounting majors, we examine other avenues such as hedge funds, private equity and consulting, among others.

Learning Outcomes: 1. Identify potential career paths for both accounting and non-accounting majors with a strong accounting background. 2. Demonstrate an understanding of the various tasks employees perform in several distinct careers. 3. Develop the attributes necessary to succeed in various careers designed for individuals with an accounting major or a strong understanding of accounting (for non-accounting majors). Credits: 1.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts.

Credits: 1.00

Other Departmental/Program Course Requirements (17-28 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work.

Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral

calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Sample Pre-Program (1 year)

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of

junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to

express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 19700 - Careers In Accounting & Finance

Credit Hours: 1.00. This course explores the various career opportunities available to accounting majors, as well as opportunities available to non-accounting majors who have a strong background in accounting. While most students believe public/private accounting are the only career options for accounting majors, we examine other avenues such as hedge funds, private equity and consulting, among others.

Learning Outcomes: 1. Identify potential career paths for both accounting and non-accounting majors with a strong accounting background. 2. Demonstrate an understanding of the various tasks employees perform in several distinct careers. 3. Develop the attributes necessary to succeed in various careers designed for individuals with an accounting major or a strong understanding of accounting (for non-accounting majors). Credits: 1.00

13-21 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills

interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources

and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

16-20 Credits

Pre-Agricultural and Biological Engineering

About the Program

Grade Average Requirement

Grade Requirements

Pass/No Pass Policy

Transfer Credit Policy

Notes

Pre-Business Analytics & Information Management

About the Program

Pre-Program Requirements (29-40 credits)

Required Major Courses (10 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Other Departmental/Program Course Requirements (19-30 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.
Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts;

critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of

functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Sample Pre-Program (1 year)

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide

constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions.

Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-23 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some

exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a

variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

16-21 Credits

Pre-Communication

Pre-Communication Courses

Pre-Com Required Courses

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and

modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

Introductory Courses

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

Notes

Fall 1st Year

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

16 Credits

Spring 1st Year

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

15-16 Credits

Fall 2nd Year

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)
Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

15 Credits

Spring 2nd Year

15 Credits

Pre-Economics

About the Program

Pre-Program Requirements (37-43 credits)

Required Major Courses (14 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret

statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career

readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies

essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Other Departmental Requirements (11-17 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts,

drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (6 credits)

Sample Pre-Program (1 year)

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6.

Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand

why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide

students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential

elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative

literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15 Credits

Pre-Economics (Liberal Arts)

Pre-Economics Coursework

Economics Admission Index (EAI) Courses

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least

7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide

students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Other Pre-Economics Coursework

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

Sample Pre-Economics 1-Year Plan

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional

models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing

hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences

and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

15-18 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)
Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: Will update at a later date.

Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes

of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15-17 Credits

Notes

Pre-Finance

About the Program

Pre-Program Requirements (33-42 credits)

Major Courses (14 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling,

and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 25300 - Finance Industry Exploration

Credit Hours: 2.00. Finance Industry Exploration will introduce students to various sectors of the financial services industry through lectures, guest lectures by financial market participants and regular reading of financial publications (Wall Street Journal, Financial Times, etc.). Students will understand potential career paths, how specific financial markets operate, career success factors, employment differentiation, industry vernacular and suggested future coursework. Topics covered may include (subject to speaker availability) - Investment Banking, Mergers and Acquisitions, Corporate Finance, Corporate Development, Public Finance, Commercial Banking, Sales and Trading, Wealth Management, Asset Management, Private Equity and Private Credit, Venture Capital, Investor Relations and FinTech.

Learning Outcomes: 1. Analyze and explain the commercial landscape of the finance industry, including key firms, influential personalities, and the challenges and opportunities each face. 2. Develop and evaluate a tailored career strategy by identifying one or two industry sectors, multiple companies, and specific roles of interest, and designing a curricular and extracurricular pathway to enhance competitiveness in the job market. 3. Identify and interpret the success factors of various industry sectors and evaluate how specific roles generate value for their company and clients. 4. Demonstrate the ability to discuss industry topics with professionals by using appropriate

terminology and providing relevant historical and company-specific examples. Credits: 2.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Other Departmental Requirements (16-25 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or

15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding

of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Elective (3 credits)

Sample Pre-Program (1 year)

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC:

IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of

different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other

data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation,

including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 25300 - Finance Industry Exploration

Credit Hours: 2.00. Finance Industry Exploration will introduce students to various sectors of the financial services industry through lectures, guest lectures by financial market participants and regular reading of financial publications (Wall Street Journal, Financial Times, etc.). Students will understand potential career paths, how specific financial markets operate, career success factors, employment differentiation, industry vernacular and suggested future coursework. Topics covered may include (subject to speaker availability) - Investment Banking, Mergers and Acquisitions, Corporate Finance, Corporate Development, Public Finance, Commercial Banking, Sales and Trading, Wealth Management, Asset Management, Private Equity and Private Credit, Venture Capital, Investor Relations and FinTech.

Learning Outcomes: 1. Analyze and explain the commercial landscape of the finance industry, including key firms, influential personalities, and the challenges and opportunities each face. 2. Develop and evaluate a tailored career strategy by identifying one or two industry sectors, multiple companies, and specific roles of interest, and designing a curricular and extracurricular pathway to enhance competitiveness in the job market. 3. Identify and interpret the success factors of various industry sectors and evaluate how specific roles generate value for their company and clients. 4. Demonstrate the ability to discuss industry topics with professionals by using appropriate terminology and providing relevant historical and company-specific examples. Credits: 2.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-19 credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills

interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a

result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

15-18 Credits

Pre-General Management

About the Program

Pre-Program Requirements (33-42 credits)

Required Major Courses (11 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions

and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students

will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Other Departmental/Program Course Requirements (19-28 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The

skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Elective (3 credits)

Sample Pre-Program (1 year)

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent).

Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding

of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

14-20 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to

summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing

complex business problems. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

14-17 Credits

Pre-Landscape Architecture

See the program Landscape Architecture, BSLA for information.

Pre-Landscape Architecture Major Change (CODO) Requirements

Pre-Program Requirement

Required Major Courses (9 credits)

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member.

Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

Other Departmental/Program Course Requirements (21-22 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or

15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal,

and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Fall 1st Semester

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate

subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and

non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

16 Credits

Spring 2nd Semester

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 .

Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

14-15 Credits

Notes

Pre-Marketing

About the Program

Pre-Program Requirements (27-35 credits)

Required Major Courses (9 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

Other Departmental/Program Course Requirements (15-23 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of

polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections.

Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting

appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (3 credits)

Sample Pre-Program (1 year)

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of

junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to

express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-20 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other

data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation,

including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

13-15 Credits

Pre-Quantitative Business Economics

About the Program

Pre-Program Requirement (31-37 credits)

Required Major Courses (17 credits)

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation

and relationships. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.

2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific

business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

Other Departmental/Program Course Requirements (11-17 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write

with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions.

Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Electives (3 credits)

Sample Pre-Program (1 year)

Fall 1st Year

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or

departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5.

Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.

2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

16-22 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal

intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related careers. Credits: 1.00

15 Credits

Pre-Supply Chain & Operations Management

About the Program

Pre-Program Requirements (32-42 credits)

Required Major Courses (8 credits)

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in

influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

Other Departmental/Program Course Requirements (24-34 credits)

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform

research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a

one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits:

4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

Sample Pre-Program (1 year)

Fall 1st Year

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

14-21 Credits

Spring 1st Year

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR)
Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the

statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase

your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

16-21 Credits

Pre-Veterinary Medicine

About the Program

Degree Requirements

Departmental/Program Major Courses (18 credits)

Required Major Courses (9 credits)

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12400 - Introduction To College Of Agriculture Pre-Veterinary Medicine Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Veterinary Medicine. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental

principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

Agricultural Selectives (9 credits)

Other Departmental/Program Course Requirements (68-69 credits)

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.
Credits: 3.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication,

transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy. Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback

and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community

ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11.

Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level

required to perform standard applications related to life sciences, management and technology. Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic

costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior

knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using

calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

Electives (5-6 credits)

Sample Plan of Study

Fall 1st Year

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12400 - Introduction To College Of Agriculture Pre-Veterinary Medicine Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Veterinary Medicine. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work.

Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their

environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory

experiment. Credits: 1.00

15-16 Credits

Spring 1st Year

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life. Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC) Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: Will update at a later date. Credits: 3.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative

analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics.

Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

15 Credits

Fall 2nd Year

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students

will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

15 Credits

Spring 2nd Year

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given information about a trait. 3. Distinguish single gene traits from polygenic traits and the

influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

17 Credits

Fall 3rd Year

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Credits: 3.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media.

Credits: 4.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation.

Credits: 3.00

15-16 Credits

Spring 3rd Year

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the

macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

14 Credits

College of Agriculture

Overview

Purdue Agriculture is one of the world's leading colleges that offers food, agricultural, and natural resources programs. We train the next generation, who will drive innovation and discovery to reshape life sciences, biosecurity, the environment, agriculture, and the food system. Purdue Agriculture graduates are in great demand. During the past two decades, more than 90 percent of our graduates were employed or were enrolled in graduate or professional schools within three months of graduation.

Undergraduate Degree

Your undergraduate program will blend courses and experiences in your major with preparation in the life and physical sciences, written and oral communication, social sciences and humanities, multicultural awareness, and international understanding. Professional work experiences, leadership development, participation in student organizations, study abroad, and directed research can add to your professional development.

Admissions

Successful completion of all Teacher Education Program (TEP) Requirements, including a minimum 2.5 Teacher Education Overall GPA are required to progress beyond each TEP Milestone. All Professional Education courses, including Learner Specialty

Concentration/Pathway courses, must be completed with no grade lower than a "C" and no "I" (Incompletes). Degree requirements must be fulfilled to qualify for TEP completion. A minimum passing score on all required licensure examinations and completion of licensure requirements are necessary to be eligible for an Indiana Instructional Educator License.
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- Summary of Teacher Education Milestones
- Licensure Information
- Technology Integration- Blended and Online Teaching (Ti-BOT)

Summary of Teacher Education Milestones

Admission to Teacher Education Program

Admission to the Teacher Education Program (TEP) is directly granted upon acceptance and enrollment at Purdue University, West Lafayette. The Teacher Education Program is aligned with national and state accreditation and licensure standards, regulations, and rules; university guidelines; and prescribed Plan(s) of Study (POS) as defined by Admission Year or as otherwise authorized by the Office of Teacher Education and Licensure (OTEL).

TEP Program Progression by Milestone (Milestones A-F)

Successful TEP progression and completion are achieved by attaining each TEP Milestone at or above Standard as outlined within the 2025-2026 Program Requirements and Milestones for each individual content area/major and as referenced and assigned within the 2025-2026 University Catalog, 2025-2026 Teacher Education Program Directory, the Brightspace course 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements, Plan(s) of Study (POS), and course syllabi.

Required Brightspace Course

Every incoming 2025-2026 Teacher Education (TE) student will be enrolled in the REQUIRED 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements Brightspace course. This course serves as the official/primary manner for which the Office of Teacher Education and Licensure (OTEL) will communicate and monitor cohort-specific requirements, milestones, timelines, notifications, tutorials, actions, student engagement, etc. for each TE student. Course commitment is continuous beginning upon arrival to the university and concludes when Milestones A-F are attained.

Course Substitutions

Course substitutions must fulfill degree requirements, associated Teacher Education Program (TEP) key and/or common assessments, and licensure standards/requirements. Prior approval by the Office of Teacher Education and Licensure is required for all course substitutions.

Milestone A: Methods Qualified

Milestone A - Teacher Education Program Progression Status

- Exceeds Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone A Criteria as defined by Content Area/Admission Year. NOTE: A Professional

Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.

- Milestone A Decision Deferred to Milestone B: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone A - Review Schedule

- Conducted - Close of Spring Semester 2026
- Decision/Notification - Early Fall Semester 2026

1. 2.50/4.00 Overall GPA (at time of Milestone A review)
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone A review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete three (3) Ti-BOT badges (at the time of Milestone A review).
7. No unresolved Professional Dispositions issues/concerns.
8. Adhere to the Criminal Background Check Policy.
9. Complete TEP Brightspace Assignments, including but not limited to attendance at the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
10. Attend the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
11. Submit the Teacher Education Program Agreement (TEPA).
12. Identify via the Teacher Education Program Agreement (TEPA) one of four chosen Learner Specialty Pathways. Learner Specialty Concentration/Pathway requirements are specific to individual content area/major.

Milestone B: Student Teaching/ Placement

Milestone B - Student Teaching Placement

- Exceeds Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone B Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone B Decision Deferred to Milestone C: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone B - Review Schedule

- Conducted - Close of Fall Semester 2027
- Decision/Notification - Early Spring Semester 2028

1. 2.50/4.00 Overall GPA (at time of Milestone B review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone B review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete five (5) total Ti-BOT badges (at the time of Milestone B review).
7. No unresolved Professional Dispositions issues/concerns.
8. Complete TEP Brightspace Assignments.
9. Attend the mandatory Student Teaching Clinical Acceptance Process (CAP) Workshop provided by the Office of Clinical Practice (OCP) AND submit your CAP Application as directed by OCP.

- Expanded Student Teaching practicums and full-time Student Teaching occur over two consecutive semesters.
- Verify from the CAP Application projected Student Teaching semester/year.

Milestone C: Student Teaching Authorization

Milestone C - Student Teaching Authorization

- Exceeds Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone C Criteria as defined by Content Area/Admission Year.

Milestone C Criteria must be attained At Standard before the Office of Teacher Education and Licensure (OTEL) will authorize enrollment reinstatement for Student Teaching.

Milestone C - Review Schedule

- Conducted - Close of Fall Semester 2028
- Decision/Notification - Early Spring Semester 2029

1. 2.50/4.00 Overall GPA (at time of Milestone C review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University

Catalog).

4. *Be in Good Standing with the University (at time of Milestone C review).
5. **Successful completion and target met on Foundations Portfolio (submission and target met on Common Lesson Plan in Semester 7).
6. ***Successfully complete ten (10) total Ti-BOT badges (at the time of Milestone C review).
7. Successfully complete all Professional Education (including Foundation and Methods), Learner Specialty Pathway, and degree courses prior to student teaching (Semester Eight).
8. Attempt all required content test(s) before the Student Teaching semester per the timeline below; Test Requirements (ets.org)

Content Test Attempts for Major

For Fall Student Teaching: Official Score Reports due to OTEL no later than July 1.

For Spring Student Teaching: Official Score Reports due to OTEL no later than December 1.

Content Test Attempts for Pathways/Concentrations (High Ability and English Language Learning)

For Fall Student Teaching: Test Registrations received in OTEL by May 15th confirming a test date scheduled no later than June 30th.

For Spring Student Teaching: Test Registrations received in OTEL by October 15th confirming a test date scheduled no later January 31st.

Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts; If completing a Learner Specialty Pathway that leads to licensure (High Ability or English Language Learners), the associated content exam must be attempted prior to the Student Teaching (Semester 8).

9. No unresolved Professional Dispositions issues/concerns.
10. Adhere to the Criminal Background Check Policy.

Milestone D: Teacher Education Program Completion

Milestone D - Teacher Education Program Completion

- Exceeds Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone D Criteria as defined by Content Area/Admission Year.*

Milestone D - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-C met.
2. 2.50/4.00 Overall GPA (at time of Milestone D review).
3. Professional Education (including Professional Education electives) and

Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".

4. Verify degree is conferred on Transcript/Academic Record.
5. *Be in Good Standing with the University (at time of Milestone D review).
6. No unresolved Professional Dispositions issues/concerns.
7. ****Successful completion and target met on all Common Assessments (submission and target met on CPAST and edTPA in Semester 8).

Milestone E: Licensure Eligible

Successful completion of the Purdue University Agricultural Education Program, Agricultural Education, BS, and the State of Indiana licensure requirements for an Indiana REPA 3 Initial Instructional License in Career and Technical Education (CTE): Agriculture (5-12) and *Blended and Online Teaching (5-12).

Milestone E - Licensure Eligible

- Exceeds Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone E Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone E - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-D met.
2. Resolve any holds on academic records (if applicable).
3. Successfully complete the required pedagogy test; Test Requirements (ets.org). Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
4. Successfully complete all required content test(s) Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
5. For all Career and Technical Education (CTE) majors ONLY- Verify that the required number of clock hours has been completed and received by your advisor. Students must complete 4,000 clock hours of successful employment in the appropriate CTE area, or 1,500 clock hours of supervised work in the appropriate CTE area under an approved Teacher Education Program or an equivalent combination.

Milestone F: Licensure Action(s)

Milestone F - Licensure Actions

- Exceeds Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone F Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone F - Review Schedule

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Conducted - Upon Licensure Application - Summer 2029

- Decision/Notification - Upon Formal Action

1. Milestones A-E met.
2. Complete and upload with your Indiana License Application CPR/Heimlich Maneuver/AED certification or card (must include a hands-on, face-to-face skills demonstration).
3. Complete and upload with your Indiana License Application documentation of Suicide Prevention certification (training must be at least one hour).
4. Submit Indiana License Application online via Licensing Verification and Information System (LVIS) at https://license.doe.in.gov/.
5. Allow three weeks (given all licensure criteria are met) for Purdue University to certify and the Indiana Department of Education (IDOE) to grant the Indiana License.
6. After receipt of an Indiana License, apply for out-of-state licensure (if desired).

*For purposes of reports and communications to other institutions or agencies, and in the absence of any further qualifications of the term, a student shall be considered in Good Standing unless the student has been dismissed, suspended, or dropped from the University and not readmitted. A student is considered in Good Academic Standing if both a student's semester and cumulative GPA are above a 2.00/4.00.

**Foundation Courses linked with the Foundations Portfolio Common Assessments include EDCI 20002, EDCI 28500, EDCI 35000, EDPS 20001, EDPS 23500, EDPS 24800, EDPS 32700, EDPS 36201, EDPS 43010, and EDST 20010. These may be subject to change.

***The Blended and Online Teaching (5-12) License is required for students on Admission Year Fall 2024-Spring 2025. The Blended and Online Teaching (Ti-BOT) License requirements are embedded into coursework for all Teacher Education Undergraduate majors. Some exceptions apply.

****Common Assessments include Foundations Portfolio, Field Experience Dispositions, CPAST, edTPA, Common Lesson Plan, and Licensure. Common Assessments for Early Childhood Education and Special Needs align with the National Association for the Education of Young Children (NAEYC).

Beginning July 1, 2025 - According to the Indiana State Board of Education, students seeking an Initial Indiana License in a content area involving literacy instruction, including special education, must obtain a licensure addition in Early Literacy (P-5), as required under IC 20-28-5-19.7.

Licensure Information

The Office of Teacher Education and Licensure (OTEL) is the formal liaison with the Indiana Department of Education and serves as the official repository for Purdue West Lafayette Teacher Education Program Progression and Licensure actions. OTEL maintains and permanently retains a *Teacher Education Program and Licensure Credential Portfolio* for each current and former Purdue University Teacher Education Candidate/Student. OTEL provides reliable, career-long guidance on Indiana Teacher Education and Licensure Standards, Rules, and Procedures. Indiana Licensing Rules and

Regulations are subject to change by the Indiana State Board of Education, Indiana Department of Education (IDOE), and/or the Indiana General Assembly.

Advising

Department	Contact	Phone Number	Email
Agricultual and Biological Engineering	Brenda Schroeder	765-494-3060	brendaschroeder@purdue.edu
Agricultural Economics	LeeAnn Williams	765-494-4201	leewill@purdue.edu
Agricultural Sciences Education and Communication	Agricultural Communication - Mark Tucker	765-494-8429	matucker@purdue.edu
Agricultural Sciences Education and Communication	Agricultural Education - B. Allen Talbert	765-494-8433	btalbert@purdue.edu
Agronomy	Jane Wiercioch	765-494-4788	jwiercioch@purdue.edu
Animal Sciences	Ashley York	765-494-4843	ashleyyork@purdue.edu
Biochemistry	Heidi Fornes	765-494-1612	hfornes@purdue.edu
Botany and Plant Pathology	Lisa Klein	765-494-0352	klein85@purdue.edu
Entomology	Amanda L. Wilson	765-494-9061	apendle@purdue.edu
Food Science	Patrick Tiffany	765-494-7700	ptiffan@purdue.edu
Forestry and Natural Resources	Liz Flaherty	765-494-3567	eflaher@purdue.edu
Horticulture and Landscape Architecture	Kathryn Orvis	765-496-6433	hlacareers@purdue.edu
Natural Resources and Environmental Science	Mandy Chalk Marquardt	765-496-9024	chalkm@purdue.edu
Pre-Veterinary Medicine	Tim Kerr	765-494-8481	prevetinag@purdue.edu

Contact Information

College of Agriculture
615 Mitch Daniels Blvd.
West Lafayette, IN 47907-2053
Email: exp@purdue.edu
Phone: 765-494-8470

College of Agriculture Administration

About Agricultural Administration

Purdue University's College of Agriculture is one of the world's leading colleges of agricultural, food, life, and natural resource sciences. As a land-grant institution, we are committed to preparing our students to make a difference, wherever their careers take them; stretching the frontiers of science to find

solutions to some of our most pressing global challenges; and, through Purdue Extension and engagement programs, helping the people of Indiana, the nation and the world improve their lives and livelihoods.
Also housed within the College of Agriculture Office of Academic Programs are interdisciplinary degrees, minors, certificates, and pre-programs. See below for more detailed information.

College of Agriculture Academic Programs (website)

Interdisciplinary Agriculture, BS Students are not admitted directly into this major. See your advisor for more information.

Contact Information

College of Agriculture
615 Mitch Daniels Blvd.
West Lafayette, IN 47907-2053
Email: exp@purdue.edu
Phone: 765-494-8470

NRES Water Sampling

Natural Resources and Environmental Science

NRES is a unique and exciting major for students who want to contribute to environmental change in the world. It is an interdisciplinary applied science-based program that focuses on environmental restoration, management, policy, and science. With guidance from your advisor, you will design a plan of study in one of six concentrations.

Contact Information

Natural Resources & Environmental Science (website)
175 Marsteller Street
West Lafayette, IN 47907-2083
Phone: (765) 496-0376
Email: nres@purdue.edu

International Studies in Agriculture Minor

Natural Resources and Environmental Science: Climate and Energy Solutions Concentration, BS

Natural Resources and Environmental Science: Emerging Environmental Challenges Concentration, BS

Natural Resources and Environmental Science: Environmental Policy and Analysis Concentration, BS

Natural Resources and Environmental Science: Watershed Management Concentration, BS

Natural Resources and Environmental Science: Environmental Quality And Restoration Concentration, BS

Deans Scholar Certificate

Pre-Veterinary Medicine

Plant Studies: Exploratory (Pre)

About the Program

This pre-major is intended to serve as an optional entry point/portal for students interested in life sciences and enrolling

in the Purdue College of Agriculture with an interest in plants but who are uncertain about the differences between all the majors and career options. As a Plant Studies - Exploratory major, students will make progress toward their Bachelor of Science degree and engage the numerous experiential learning opportunities (e.g. learning communities, clubs, leadership opportunities, Study Abroad, etc.) offered in the College. Students will have up to 4-semesters or 60 total credits to explore the various majors before selecting one that best meets their educational and career interests. It is anticipated that most students will likely select a major by the end of their first two semesters.
Plant Studies: Exploratory Major Change (CODO) Requirements

Data Driven Agriculture Minor

Natural Resources and Environmental Science: Sustainability Science Concentration, BS

Natural Resources and Environmental Science Minor

Agriculture Leadership and Professional Development Program Certificate

AGR 10100 - Introduction To The College Of Agriculture And Purdue University

Credit Hours: 0.50. Students are introduced to the College of Agriculture and Purdue University. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the impact of undergraduate coursework, including the core curriculum, on scholarship and career preparation, and the challenges facing the food, agricultural, and natural resource system. The use of guest lecturers provides a networking opportunity for students. Enrollment in this course is restricted to beginning freshmen students. Course meets weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 10700 - Pathway To Purdue

Credit Hours: 1.00. This course is a required one credit introductory course for students participating in the Pathway to Purdue program. Students will learn about the Pathway to Purdue programs, study skills and techniques, transfer policies and requirements, as well as hear from a variety of guest speakers who will discuss relevant topics. Permission of department required.

Learning Outcomes: 1. Know about the Pathway to Purdue program. 2. Know about the transfer policies between Ivy Tech Community College and Purdue University. 3. Know study skills and techniques to be successful in college. 4. Identify areas of interest in the field of Agriculture. Credits: 1.00

AGR 10800 - Agriculture Technology And Innovation

Credit Hours: 1.00. The course will cover a broad range of innovations and technologies involved in the agricultural industry. The broad topics covered in this class will discuss development of latest technologies assisting in increase in yield, production and efficiency of agricultural systems. This may include, but is not limited to topics regarding environmental protection, plant production, livestock systems, and agricultural machinery.

Learning Outcomes: Learning Objectives: 1. Demonstrate an understanding of technological advancements in areas of: a). Environmental protection; b). Plant production; c). Livestock systems; d). Agricultural machinery. 2. Demonstrate an understanding of innovation processes and commercial development. 3. Communicate an understanding of several agricultural systems. 4. Explain some history of agricultural developments. 5. Appreciate the land grant system and recall specific examples of Purdue impact on global agriculture. 6. Improve ability to critically evaluate sources of information. 7. Connect to your academic program. Credits: 1.00

AGR 11100 - Introduction To Agricultural And Biological Engineering Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural and Biological Engineering which include Agricultural Systems Management, Agricultural and Natural Resources Engineering, and Biological and Food Process Engineering. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11200 - Introduction To Agricultural Economics Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Economics. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11300 - Introduction To Agronomy Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agronomy, which includes Applied Meteorology, Agronomic Business and Marketing, Environmental Soil Science, International Agronomy, Plant Genetics and Plant Breeding, Soil and Crop Management, Soil and Crop Science, Turf Science, and associate degrees. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11400 - Introduction To Animal Sciences Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Animal Sciences. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11500 - Introduction To Biochemistry Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Biochemistry. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11700 - Introduction To Entomology Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Entomology. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11800 - Introduction To Food Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Food Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 11900 - Introduction To Forestry And Natural Resources Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Forestry and Natural Resources. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12000 - Introduction To Horticulture And Landscape Architecture Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Horticulture and Landscape Architecture. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12100 - Introduction To Agricultural Sciences Education And Communication Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in the Department of Agricultural Sciences Education and Communication which includes Agricultural Communication and Agricultural Education. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12200 - Introduction To Natural Resources And Environmental Science Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Environmental Studies and Natural Resources and Environmental Science. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12400 - Introduction To College Of Agriculture Pre-Veterinary Medicine Academic Programs

Credit Hours: 0.50. An introduction to the academic programs offered in Pre-Veterinary Medicine. Topics include, but are not limited to undergraduate plans of study, courses, experiential programs, internships, student organizations, career opportunities, academic policies, scholarships, and student services. Course meets during weeks 1-8.

Learning Outcomes: 1. Students will understand academic program options, academic rules and regulations, academic student services, scholarship offerings, career opportunities and services. Credits: 0.50

AGR 12500 - Introduction To Plant Science

Credit Hours: 1.00. An introduction to the academic programs offered in plant science. Topics include, but are not limited to, undergraduate plans of study, courses, and experiential programs including undergraduate research opportunities, internships, student organizations, career opportunities, academic policies, scholarships, and student services.

Learning Outcomes: 1. Understand academic program options, department research opportunities, and career opportunities. Credits: 1.00

AGR 15000 - Woman In Agriculture I

Credit Hours: 1.00. Intended to expose first-year students to resources and the development of a network of students across campus. The course will support their transition to Purdue through a sense of community and increased engagement, and provide students access to faculty across the College of Agriculture in a small group setting. Activities include seminars to expose students to college and university resources, hands-on learning activity for team building, study halls, and group meals.

Learning Outcomes: 1. Learn about resources and tools that are available to you as a Purdue Student. 2. Build a rapport with female professors and staff in the College of Agriculture. 3. Introduce you to other students in the College to build a support network. 4. Learn a method to strengthen your confidence in engaging faculty and staff around campus. 5. Connect you with a network of professionals in the agriculture industry. Credits: 1.00

AGR 15100 - Women In Agriculture II

Credit Hours: 1.00. Intended to expose first-year students to academic, industry, government and professionals across the field of agriculture. The course will support networking and internship preparation through increased engagement with professionals across the field of agriculture, site visits and seminars. Activities include student seminars and presentation, field trips, case-studies and mock scenarios for problem solving and team building. Section one will focus on career exposure, development and communication skills.

Learning Outcomes: 1. Build presentation skills through active presentations and review of peer presentations. 2. Build a rapport with industry professionals through a mentorship project. 3. Strengthen skills in working with diverse and varied cultures. 4. Work on group case studies to solve an industry challenge. 5. Connect you with a network of professionals and explore career opportunities. Credits: 1.00

AGR 20100 - Communicating Across Culture (UCC: BSS/IL)

Credit Hours: 3.00. This course will provide students with an opportunity to understand their place in a multicultural, multiethnic, multinational country, the United States. It is designed to provide an academic overview of the field of multicultural education as it evolved to this day. The course will offer an introductory overview of the many differences that exist within all human beings. Because the diversity among individuals is endless, we cannot study all differences, but will study a sampling such as race, ethnicity, gender identity, age, social class, disability, learning styles, and religion/spiritual orientation. Issues of poverty, language, and social justice may also be examined in relationship to the above major areas of emphasis.

University Core Curriculum (UCC): (UCC: BSS/IL) Credits: 3.00

AGR 20500 - Dean's Scholars Seminar

Credit Hours: 1.00. Students are introduced to the breadth and mission of the College of Agriculture. Specific areas discussed include the diversity of career opportunities within agriculture, the relationships between different areas of agriculture, ethics, the opportunities within undergraduate research, and the challenges facing the food, agricultural, and natural resource system. Students will be exposed to a series of guest lecturers to gain an overview of the various fields within the college and undergraduate research or scholarly work opportunities.

Learning Outcomes: 1. Have an increased appreciation for the diversity of disciplines in agriculture and the contributions that a specific discipline can make to addressing human issues. 2. Gain an interdisciplinary understanding of Purdue Agriculture through research, scholarly article reviews, common reading experiences, group discussions and project work. 3. Work collaboratively with fellow students and peer mentors. 4. Develop a relationship with a small group of Dean's

Scholars thus enhancing own college experience and learning skills. 5. Understand the requirements for the Dean's Scholars program including honors coursework, undergraduate honors research or scholarly project. Credits: 1.00

AGR 29000 - Special Topics In Agriculture

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. The specific topic that is offered will be indicated on the student's academic record.

Learning Outcomes: 1. Learning outcomes addressed include communication, critical thinking, and professional development. Credits: 0.00 to 3.00

AGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 29400 - Directed Readings In Agriculture, Environment, And Society

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. Directed reading and discussion of books and other documents of significant importance and current interest in agriculture, food systems, renewable natural resources, and the environment. The specific topic that is covered will be indicated on the student's academic record. Permission of instructor required.

Learning Outcomes: 1. Develop an appreciation and understanding of the importance for the practice of critical reading. 2. Develop the ability to come up with questions that address the bigger/broader picture as shared through the readings. 3. Clearly articulate position and/or justify and defend stand amongst one's peers. 4. Carefully review and consider the facts, consider and propose future directions, next steps that could be taken as a result of the readings. 5. Develop initial strategies to discover pertinent and reliable information to improve your understanding. Credits: 0.00 to 3.00

AGR 33300 - Data Science For Agriculture

Credit Hours: 3.00. Students will apply data processes including identifying data needs, acquiring data, assessing data quality, data wrangling, filtering, and visualization. In each of several topic areas (forestry, animal science, agronomy, food science, entomology, engineering, economics), data-driven insights and improved decision making will be the culmination of applied data skills. Students will understand data ethics and practice data management skills including the merging of disparate but related data sets.

Learning Outcomes: 1. Construct a research question that helps address a decision. 2. Describe different types of experimental designs and discuss the differences between observational and experimental studies. 3. Identify data needed to address various

research questions. 4. Identify how these data sources are used in data analysis: agronomics, machine data, maps, spreadsheets, sensor data. 5. Describe how various data sets are acquired. 6. Describe how the following impact data ethics: ownership, storage, access. 7. Assess data quality and utility. 9. Identify potential limitations of a dataset. 10. Describe the following aspects of data wrangling: data formats, data compatibility, mobility. 11. Describe the following aspects of data management: storage, curation, metadata, FAIR (findable, accessible, interoperable, reusable). 12. List reasons for filtering, cleaning, and pre-processing data. 13. Describe tools for data cleaning. 14. Integrate disparate data sets. 15. Describe uses for the following in data visualization: bar charts, line charts, maps, tables. 16. Use the following tools to analyze data: correlations, mean generation, confidence intervals, simple model building, R Python. 17. Make decisions based on data outcomes. Credits: 3.00

AGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 39500 - International Internship

Credit Hours: 3.00. Supervised international internship in agricultural, food, or natural resource disciplines. The international internship must be approved as part of a Purdue University study abroad program and conducted under the supervision of a College of Agriculture faculty member. Students must submit a summary report and fulfill all requirements established by faculty supervisor. Consent of the College of Agriculture International Programs in Agriculture and Office of Academic Programs staff required.

Learning Outcomes: 1. Discuss the agri-business climate/economy of the internship country. 2. Demonstrate knowledge of culture in country of internship. 3. Compare and contrast agriculture practices between country of internship and the US. 4. Demonstrate emerging intercultural knowledge and effectiveness in the following areas: a) Cultural Self-Awareness: Recognizes new perspectives about own cultural rules and biases; b) Worldview frameworks: Demonstrates adequate understanding of the complexity of elements important to members of another culture in relation to its history, values, politics, communications styles, economy, or beliefs and practices: c) Curiosity: Asks deeper questions about other cultures and seeks out answers to these questions. Credits: 3.00

AGR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agriculture, food, or natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGR 40000 - Agriculture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

AGR 49000 - Special Problems

Credit Hours: 0.00 to 3.00. Topics and credit hours to be arranged.

Credits: 0.00 to 3.00

AGR 49300 - Special Topics In International Agriculture

Credit Hours: 0.00 to 3.00. A course that provides students interested in international agriculture opportunity for in-depth study and analysis of major issues associated with the relationship of U.S. agriculture to world agriculture and agricultural development abroad. Current and significant topics will be selected. Permission of instructor required.

Credits: 0.00 to 3.00

AGR 49400 - Advanced Readings In Agriculture, Environment, And Society

Credit Hours: 0.00 to 3.00. Presentation of subject matter not available in other courses offered by the college. Directed reading and discussion of books and other documents of significant importance and current interest in agriculture, food systems, renewable resources and the environment. The specific topic that is offered will be indicated on the student's academic record. Permission of instructor required.

Learning Outcomes: 1. Develop an appreciation and understanding of the importance for the practice of critical reading. 2. Develop the ability to come up with questions that address the bigger/broader picture as shared through the readings. 3. Clearly articulate and/or justify and defend stand amongst one's peers. 4. Carefully review and consider the facts, consider and propose future directions, next steps that could be taken as a result of the readings. 5. Develop initial strategies to discover pertinent and reliable information to improve your understanding. Credits: 0.00 to 3.00

AGR 49500 - International Professional Experience In Agriculture, Food, Or Natural Resources

Credit Hours: 0.00. Supervised international professional experiences in agricultural, food, or natural resource disciplines. The professional experience period must be preplanned and conducted under the supervision of a College of Agriculture faculty member. Students must submit a summary report. Consent of the College of Agriculture international professional experience program coordinator required. Permission of instructor required.

Credits: 0.00

AGR 49600 - Multicultural Professional Experience

Credit Hours: 0.00. The multicultural professional experience must be pre-planned and conducted under the supervision of a College of Agriculture faculty member. The experience must be a minimum of four weeks in length. Students must submit a summary report.

Credits: 0.00

NRES 12100 - Stepping Stones To Environmental Science

Credit Hours: 1.00. Intended to expose first-year students to emerging environmental problems and innovative solutions, to support their transition to Purdue through a sense of community and increased engagement, and to provide students access to faculty in the environmental sciences in a small group setting. Activities include field trips, hands-on learning, study halls, and meals together. Enrollment is restricted to members of the environmental science learning community. Department

permission required.

Learning Outcomes: 1. Recognize environmental service and awareness groups on campus and in the local community. 2. Identify local environmental challenges. 3. Increase knowledge of potential solutions for increasing food-water-energy sustainability. Credits: 1.00

NRES 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, FNR 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

NRES 20000 - Introduction To Environmental Careers

Credit Hours: 1.00. This course offers an introduction to general developments and practices in the environmental arena. A presentation of environmental careers and aspects of those careers that may affect job satisfaction and commitment is the main focus of the course. Included is an overview of coursework that benefits particular careers. The course is designed to introduce students to the specialized environmental areas in which they may choose to work.

Credits: 1.00

NRES 23000 - Survey Of Meteorology (UCC: SCI)

Credit Hours: 3.00. (EAPS 22100) An introductory course for both science and non-science students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate, ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

NRES 25500 - Soil Science

Credit Hours: 3.00. (AGRY 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Credits: 3.00

NRES 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

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Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00 Credits: 1.00

NRES 33700 - Environmental Hydrology

Credit Hours: 3.00. (AGRY 33700) This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Learning Outcomes: 1. Become familiar with hydrological processes, interactions and their

representations over scales from point to ""continental"" and times from seconds to years. The major emphasis is on surface and near surface phenomenon. 2. Gain qualitative and quantitative understanding of land surface water budgets and how they respond to environmental change. 3. Develop problem solving abilities on topics related to surface water hydrology. Credits: 3.00

NRES 33800 - Environmental Field Skills

Credit Hours: 1.00. (AGRY 33800) This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhance understanding of physical, chemical, and biological hydrological process. 2. Develop critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Develop technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encourage lifetime learning habits through practical problem solving. Credits: 1.00

NRES 38010 - Hazardous Waste Handling

Credit Hours: 3.00. This course trains individuals to stop the release or potential releases of hazardous substances. They have a more aggressive role than first responders at the operations level by approaching the point of the release to plug, patch, or otherwise stop it or manage offensive operations. This course satisfies the OSHA standards for completion of the 40-hour Hazardous Waste Operator/Emergency Response Technician certification, 29CFR1910.120. Topics covered include implementing an employer's emergency response plan; classification and identification of unknown materials using field survey instruments; functioning within the Incident Command System; specialized chemical protective equipment; hazard and risk assessment techniques; advanced product control operations; decontamination procedures; proper termination procedures; and basic chemical and toxicological terminology.

Learning Outcomes: 1. Analyze a response scene to stop the release or potential releases of hazardous substances. 2. Connect knowledge and awareness to meet OSHA requirements. (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. 3. Receive their 40-hour HAZWOPER Certification after successfully completing all requirements. Credits: 3.00

NRES 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (AGRY 38500) Designed as an upper level introductory course covering environmental soil chemistry concepts in the framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or mathematics background.

Credits: 4.00

NRES 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Credits: 3.00

NRES 40000 - Natural Resources And Environmental Science Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

NRES 41000 - Research In Natural Resources And Environmental Science

Credit Hours: 1.00 to 3.00. Supervised individual research. NRES 41000 provides the opportunity to participate in independent undergraduate research with the goal of learning how to design, execute, and report research. Students will properly and permanently record their information in a timely fashion and learn how to examine, analyze, and interpret their results. One credit hour corresponds to one how of laboratory preparation and three hours of laboratory research. Total credits in NRES 41000 and NRES 41100 may not exceed six credits. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00 to 3.00

NRES 42000 - Environmental Internship Reporting

Credit Hours: 1.00. Reporting on participation in government, industrial, or other internship program. Permission of department required.

Learning Outcomes: 1. Develop a basic understanding of plant, soil, environment, and climate principles. 2. Become capable in the implementation of strategies, which optimize the profitability, productivity, sustainability, and environmental stewardship as concurrently achievable goals. 3. Communicate effectively using electronic media. 4. Work effectively in a team situation either as leader or participant. 5. Possess and demonstrate high standards of achievement. 6. Able to define a problem (given a situation) identify the resources needed to solve it and their repositories and propose and evaluate different solutions based on the resources of the client. 7. Analyze and interpret simple research data with an understanding of basic statistical principles such as the mean, SE, F ration, LSD, and significance levels. Calculate and interpret a simple ANOVA, linear regression, and correlation. 8. Perform mathematical calculations appropriate to the profession, and interpret graphical and tabular information. Credits: 1.00

NRES 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (AGRY 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Credits: 3.00

NRES 48000 - Hazardous Waste Certification Renewal

Credit Hours: 0.00. Upon completion of this course, students will be able to 1) analyze a response scene to stop the release or potential releases of hazardous substances, and 2) connect knowledge and awareness to meet OSHA requirements (29 CFR 1910.120) for working on projects that involve the handling of hazardous materials. Students successfully completing all requirements will receive their 40-hour HAZWOPER Certification.

Learning Outcomes: 1. Receive 40-hour HAZWOPER Certification Renewal upon completion of this course. Credits: 0.00

NRES 48500 - Environmental Communications

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

NRES 49700 - Current Topics In Environmental Sciences

Credit Hours: 2.00. This course is part of the NRES capstone experience and helps students examine contemporary environmental issues through the diverse disciplinary lenses they have been exposed to through their NRES coursework.

Learning Outcomes: 1. Explain the issues, facts, and concepts central to contemporary environmental issues. 2. Apply scientific evidence to form ethically-grounded opinions on controversial environmental topics. 3. Assess proposed solutions to environmental problems. Credits: 2.00

NRES 49800 - Individual Studies In Environmental Science

Credit Hours: 1.00 to 3.00. An opportunity for upper-level undergraduates to focus their interests and knowledge on an environmentally related problem. Arrangements must be made with a Natural Resources and Environmental Science Program faculty member before registration. Permission of instructor required.

Credits: 1.00 to 3.00

Department of Agricultural and Biological Engineering

ABE dept 2021Overview

Welcome to the Department of Agricultural & Biological Engineering at Purdue University. Our mission is to prepare students, citizens, and industry for the future through innovative education and extension/outreach programs and the discovery of knowledge.
Our cross-disciplinary strengths include academic and research programs in agriculture, biology, and engineering, as well as dual degree programs. Agricultural and Biological Engineering offers three degree programs, including two engineering programs: Bachelor of Science in Engineering in Agricultural Engineering (BSAGE) and Bachelor of Science in Engineering in Biological Engineering (BSBE), and one agriculture program: Agricultural Systems Management, BS. ABE's degree programs also offer multiple majors and concentrations. The job market remains strong for our graduates who have excellent career opportunities, and demand for our graduates is very high.
Our faculty, students and staff are pursuing cutting-edge research that improves quality of life as well as advances scientific and engineering frontiers. Our extension programs are helping citizens of Indiana and beyond improve their lives.

Agricultural Systems Management

The Agricultural Systems Management program prepares graduates to develop and manage technology-intensive agricultural production and processing systems. ASM graduates are problem solvers. They benefit from a diverse applied agricultural curriculum that includes opportunities for extensive career-related experience at home and abroad.

Biological Engineering

This program deals with the applications of basic scientific and engineering principles to the design, development and operation of large scale manufacture of food and biologically-based products. Such products are environmentally friendly, renewable and represent a future wave of consumer demand for better health and environment. In addition to learning the engineering aspects of food and biological processing, you will also learn the basic principles in biochemistry and food sciences.
Dual Degree programs with Biological Engineering and Biochemistry or Pharmaceutical Sciences are also offered -

these programs require an additional year of courses leading to two degrees.

Agricultural Engineering - major in Environmental & Natural Resources Engineering

This major prepares engineers with specialized expertise to design and analyze new and environmentally sound ways to produce food and fiber while conserving our natural resources. Students gain expertise in areas such as watershed management, geographic information systems, computer-based watershed modeling, and contaminant transport models, and soil and water conservation engineering practices.

Agricultural Engineering - major in Machine Systems Engineering

This major prepares students with a background in mechanical design, hydraulics, instrumentation and control, finite element analysis, electronics and sensors to design, develop, analyze and operate machines and systems for agricultural and biological products and processes, materials handling, construction and mining, forestry, lawn- and ground-care, and food and fiber production and processing.

Faculty (website)

Department of Agricultural and Biological Engineering (website)

Contact Information

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Agricultural and Biological Engineering
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West Lafayette, IN 47907-2093
Phone: (765) 494-1162
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Current Students - Click here for advising and degree requirement resources.

Prospective Students - Click here to learn more and schedule a visit.

Graduate Information

For Graduate information please see Department of Agricultural and Biological Engineering (Graduate)

Agricultural Systems Management Minor

Agricultural Systems Management, BS

Agricultural Engineering, BSAGE

Environmental and Natural Resources Engineering, BSAGE

Biotechnology Minor

Pre-Agricultural and Biological Engineering

Agricultural Systems Management: Data and Information Systems, BS

Agricultural Systems Management: Leadership and Management, BS

Agricultural Systems Management: AgroSecurity, BS

Biological Engineering, BSBE

ABE 20100 - Material And Energy Balances In Biological Engineering

Credit Hours: 4.00. Thermodynamic principles associated with biological systems and processing of biological materials. Emphasis on the first law of thermodynamics. Fundamentals of steady-state mass and energy balances for reacting and non-reacting processes including multiple unit operations emphasizing living systems and bioprocessing. Applications of the first law conservation of energy to biological systems, energy conversion systems, and the environmental impacts of energy production. Development of engineering problem solving skills via MathCad and MatLab software. Laboratory emphasizes combining technical engineering skills with professional skill development through computer and laboratory exercises including two extensive projects that result in a biological product design.

Learning Outcomes: 1. Analyze problems and use a systematic approach to problem solving in the engineering of biological systems. 2. Develop mass balances for systems with and without biochemical reactions for in vivo and in vitro biological systems. 3. Characterize the properties of solids, liquids, and gases common to biological systems. 4. Estimate gas/vapor properties using gas laws. 5. Understand the relationships between pressure, partial pressure, and humidity. 6. Apply the basic thermodynamic concepts to quantify phase and chemical equilibrium parameters for food and biological systems. 7. Use models to predict the physical behavior of materials at equilibrium in multi-component, multi-phase systems. 8. Use computational software to solve problems in biological systems. 9. Able to apply science and math skills to develop a new product and the processes required to transform the input materials into the final product. 10. Able to apply engineering fundamentals and analytical skills, specifically mass and energy balances and thermodynamics, to product and process development projects. 11. Able to communicate technical information, oral and written. 12. Develop leadership and teamwork skills through personal awareness and reflection, and team experiences. 13. Develop an innovative and a strong work ethic through new product development. 14. Have increased awareness of ethical responsibility through evaluating case studies and classroom discussion. 15. Be more curious and persistent learners through self-directed team projects. Credits: 4.00

ABE 20200 - Thermodynamics In Biological Engineering

Credit Hours: 3.00. Thermodynamic principles and their applications to biochemical and biological systems with emphasis on the second law of thermodynamics and use of molecular interpretations of energies and entropies. Concept of entropy balances and process efficiency. Free energy and chemical equilibrium. Equilibrium between phases, colligative properties, binding of ligands and formation of biological membranes. Molecular motion and transport properties and their application in biochemical analytical methods. Development of physical chemical problem solving skills using MathCad and MatLab software.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations to macro scale thermodynamic processes. 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering disciplines (First & Second Law of Thermodynamics; Open vs closed systems o Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility; Path dependence/independence). 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with bioprocesses. 4. Solve multiphysics and multi-scale problems for thermodynamic processes using the computer.

5. Develop the attitudinal dimensions of computational thinking. 6. Gain experience in working with non-linear systems and systems away from equilibrium. Credits: 3.00

ABE 20500 - Computations For Engineering Systems

Credit Hours: 3.00. Development of engineering problem solving and design skills. Use of Excel, MATLAB, and Mathcad for problem solving, data analysis, numerical modeling, and statistics. Introduction to elementary statics, dynamics, materials, thermodynamics, fluid mechanics, and energy topics.

Learning Outcomes: 1. Apply and interpret descriptive statistical tests to describe variability in data. 2. Identify structure and specific elements of good experimental design. 3. Select and apply appropriate statistical tests to quantify relationships and differences in data. 4. Interpret results of statistical analyses and communicate findings to technical and non-technical audiences. Credits: 3.00

ABE 21000 - Thermodynamics Principles Of Engineering And Biological Systems

Credit Hours: 3.00. Application of thermodynamic principles to the design and operation of biological and engineering systems. The focus is on mass and energy balances for non-reacting processes and on the second law of thermodynamics. These principles are applied to biological and agricultural engineering systems. Specific topics include refrigeration systems, power cycles, energy conversion systems, and environmental impacts of energy production.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to function on multidisciplinary teams. 4. An ability to identify, formulate, and solve engineering problems. 5. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 6. A knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 22600 - Biotechnology Laboratory I (UCC: STS)

Credit Hours: 2.00. Focuses on nucleic acid manipulation. Modules include, making a eukaryotic library, identifying clones, sub-cloning into a bacterial expression vector and verification of the clone's identity by restriction analysis and DNA sequencing. Basic laboratory techniques (solution making, buffer preparation, good safety techniques), sterile technique and compliance procedures.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Perform techniques currently used in cell, molecular, and microbiology, while understanding the rationale behind the specific approaches. 2. Explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions. 3. Given a specific biological question, the student will be able to determine appropriate applications of specific cell, molecular, and microbiological techniques. 4. Gain experience in dissecting and extracting pertinent information from scientific journal articles. Credits: 2.00

ABE 28100 - Professional Internship

Credit Hours: 0.00. Supervised professional experience in agricultural and biological engineering. Program conducted under the direction of an engineering faculty member and with the cooperation of an employer. Student submits a summary report. Permission of department required.

Credits: 0.00

ABE 29000 - Sophomore Seminar (UCC: STS)

Credit Hours: 1.00. Current agricultural and biological engineering issues will be discussed by students, staff, and guest speakers. Career planning, employment opportunities, professionalism, ethics, and improvement of communication skills will be emphasized.

University Core Curriculum (UCC): (UCC: STS)

Credits: 1.00

ABE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 30100 - Modeling And Computational Tools In Biological Engineering

Credit Hours: 3.00. Introduction to principles of analysis, setup, and modeling of biological systems using fundamental principles of engineering. Development of mathematical and numerical models to solve steady state and transient processes involving material and energy balances and utilizing thermodynamic, transport, and kinetic reaction principles, and economics in biological engineering systems.

Learning Outcomes: 1. Understand the purpose and structure of critical arguments. 2. Develop skills to analyze written, visual critical arguments on contemporary issues. 3. Develop skills to create critical arguments. 4. Understand the structural similarities between critical arguments and quantitative modeling. 5. Understand ethical behavior in academic setting. 6. Understand process of how to develop mathematical models involved with food and biological phenomena. 7. Understand the types of models and their purpose/utility from an engineering context. 8. Understand the application of the numerical modeling principles and techniques of modeling and solutions. 9. Understand the limitations related to computational accuracy/error and statistical precision of numerical modeling. 10. Develop skills to create numerical models involving biological engineering systems using mechanistic concepts, such as reaction kinetics, transport phenomena, and thermodynamics. 11. Develop skills for creating computational tools to quantify/evaluate numerical models. Credits: 3.00

ABE 30200 - Biochemical Laboratory Techniques For Biological Engineers

Credit Hours: 1.00. Experiments that introduce methods for analysis and recovery of biological molecules and that utilize the mathematical concepts to manipulate collected data. Introduction to engineering experimental design.

Learning Outcomes: 1. Perform statistical analysis on collected data to produce results to be interpreted and disseminated both written and orally. 2. Demonstrate proficiency in the following lab skills: Read and understand both digital and analog outputs; Liquid handling and dilutions; Protein purification and determination assays; Column chromatography; Spectrophotometric assays; Enzyme activity assays. 3. Understand and apply scientific methods of experimental design and analysis. Credits: 1.00

ABE 30300 - Physical Chemistry In Biological Engineering

Credit Hours: 3.00. Physical chemical principles associated with transport of mass, momentum and energy in bioprocesses. Principles for measuring physical chemical properties, a description of predictive equations for their evaluation and the role of these principles in the design and optimization of bioprocesses.

Learning Outcomes: 1. Design complex engineering problems by applying physical chemistry. 2. Explain the principles of characterizing biological materials using physical and optical techniques. 3. Determine the appropriate methods to characterize or purify biological materials based on their physical properties. 4. Predict the results of a spectroscopic technique based on the optical properties of materials and vice versa. Credits: 3.00

ABE 30400 - Biological Engineering Laboratory

Credit Hours: 3.00. Laboratory course focused on bioprocessing topics such as fluid flow, mixing, rheology, hydrolysis, and fermentation of biomaterials. Students will participate in design of experiments, system set up, data collection, statistical data analysis, and presentation of results.

Learning Outcomes: 1. Understand and analyze the flow behavior in biological systems. 2. Understand and analyze enzymatic reasons in biological systems. 3. Understand and analyze fermentation processes. 4. Understand and analyze mixing and heat transfer in biological systems. 5. Collect and analyze rheological properties. 6. Design and safely execute experiments in a process laboratory. 7. Collection and statistical analysis of experimental data. 8. Present the results of analysis in the form of written report and oral presentation. Credits: 3.00

ABE 30500 - Physical Properties Of Biological Materials

Credit Hours: 3.00. Physical properties of agricultural crops and food products and their relationship to harvesting, storage, and processing. Physical properties covered include: density, shape, moisture content, water potential, water activity, friction and flow or particulate solids, terminal velocity, thermal properties, interaction with electromagnetic radiation, and viscoelastic behavior of solids.

Credits: 3.00

ABE 30700 - Momentum Transfer In Biological Engineering

Credit Hours: 3.00. Fluid statics, Newton's law of viscosity, shell momentum balances, equations of continuity and motion, one dimensional flow problems, flow through porous media, velocity distributions with more than one independent variable, two dimensional flow through a channel, stream function, velocity potential, dimensional analysis, boundary layer, turbulent flow, Reynolds stress, form and skin friction, application of macroscopic momentum and mechanical energy balances to engineering problems.

Learning Outcomes: 1. Know the principles of fluid statics. 2. Know the principles of dimensional analysis for analysis of flow problems. 3. Know the characteristics and analysis of the flow of food and biological fluids. 4. Gain an understanding of the principles of turbulent flow. 5. Know how to apply macroscopic mass and momentum balances to flow problems in food and biological systems. Credits: 3.00

ABE 30800 - Heat And Mass Transfer In Biological Engineering

Credit Hours: 3.00. Principles of transport of energy and mass. Mechanisms of heat transfer, heat conduction, heat convection and heat radiation. Development of applications using macroscopic and microscopic balances of energy. Application of thermal energy balances and Fourier's Law to describe steady state and transient conduction applications including heat generation. Effect of the geometry on these processes. Basic principles of design of heat transfer equipment and its operation. Application of species mass balances and Fick's Law to steady state and transient diffusion problems. Effect of geometry on these processes. Analogies between transport of momentum, heat and mass applications to the solution of practical problems in the Food Process and Biological Engineering fields.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct

experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multidisciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. Have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. A recognition of the need for, and an ability to engage in life-long learning. 8. A knowledge of contemporary issues. 9. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 31400 - Design Of Electronic Systems

Credit Hours: 3.00. Fundamental aspects of circuits, microprocessors, transducers, sensors, instrumentation, and data acquisition are presented, with particular emphasis on electronic systems used in agricultural, biological, and food applications. Laboratory exercises used to apply the course material to constructing and testing circuits, microprocessor controlled systems, and the data collection and monitoring of systems.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to identify, formulate, and solve engineering problems. 5. A recognition of the need for, and an ability to engage in life-long learning. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 32000 - Solid Modeling, Simulation, And Analysis

Credit Hours: 3.00. Introduction to parametric, feature-based solid modeling; dimensioned 2D and 3D engineering drawings; tolerancing; mechanical dynamic simulation; kinematic models, analysis and simulation of simple linkages and complex systems; mechanism design and evaluation; visualization and animation of results; interfacing of computer aided engineering software. Projects involving industrial parts and assemblies will be discussed and assigned.

Credits: 3.00

ABE 32500 - Soil And Water Resource Engineering

Credit Hours: 4.00. Interrelationships of the plant-water-air-soil system; hydrologic processes; protection of surface and ground water quality; GIS targeting of soil and water protection measures; and design of subsurface and overland drainage systems, irrigation systems, and soil erosion control practices.

Learning Outcomes: 1. Understand the agricultural and biological engineering profession and practice. 2. Able to understand and apply knowledge of mathematics, science, and engineering. 3. Understand and able to, identify, formulate, model and solve problems for engineering systems. 4. Able to design a system, component or process to meet desired goal subject to constraints. Credits: 4.00

ABE 32700 - Biotechnology Laboratory II

Credit Hours: 2.00. The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (http://www.hhmi.org/grants/sea/) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (www.phagesdb.org and the Purdue institution page can be found here: https://phagesdb.org/institutions/PURD/).

Learning Outcomes: 1. Analyze the genetic code of a unique phage in order to determine potential genes. 2. Discover the genomic organization of their unique phage. 3. Use algorithms to define potential genes, assign putative functions to them, and determine the

order in which they appear in the genome. 4. Read and discuss scientific literature related to their research project. 5. Share the information gathered with others in the scientific community. Credits: 2.00

ABE 33000 - Design Of Machine Components

Credit Hours: 3.00. Introduction to design; stress analysis; deformation and stiffness considerations; static and fatigue strength design; design of components of the food processing, farm and off-highway machines, and mechanical systems.

Credits: 3.00

ABE 35100 - Microbes In Germany

Credit Hours: 3.00. Since before pre-history, microorganisms have been responsible for what we now recognize as biotechnology applications-initially used for beverage applications including beer and wine-making and expanding to food applications like leavening dough for bread, or preserving food through pickling. Today, modern fermentation is a multibillion-dollar industry that includes a variety of sectors from foods to pharmaceuticals. This course will explore a range of industrial facilities to produce enzymes, pharmaceuticals, foods, and commodity chemicals. We will travel to various parts of Germany to explore these sectors.

Learning Outcomes: 1. Understand, describe, and calculate quantitative features of microbial biotechnology. 2. Appreciate German cultural heritage through cultural experiences and discussions. 3. Reflect thoughtfully on the cultural differences and similarities of America and Germany through writing blogs posts and commenting on the posts of peers. Credits: 3.00

ABE 37000 - Reaction Kinetics In Biological Engineering

Credit Hours: 3.00. This course will introduce students to the tenets of kinetics/rates of chemical/biochemical reactions. Reaction rate models will be developed and used to design basic ideal reactors and non-ideal flow reactors. Models for homogeneous, heterogeneous, and catalytic reactions will be developed and used to develop reactor designs. A variety of computational numerical modeling skills will be used in the solution of these models, including numerical interpolation, and numerical solution of set of differential equations. MatLAB software programming tools will be used by students for computational analysis.

Learning Outcomes: 1. Gain an understanding of the basic concepts of reaction kinetics for chemical and biochemical systems. 2. Gain an understanding of basic engineering reactor design models. 3. Gain an understanding of the application of kinetic models to reaction processes involving diffusive and convective mass transport. 4. Understand how kinetic reaction and reactor design models are applied to food and biological engineering processes. 5. Apply mathematical skills to developing analytical and numerical solutions. Credits: 3.00

ABE 38199 - Professional Practice Coop I

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of department required. Professional Practice students only.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession

and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural and biological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ABE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking and problem solving, communication, and teamwork. 2. Contribute to program outcomes related to understanding of the engineering profession and practice, basic engineering principles, knowledge of contemporary issues, and ability to understand and practice ethical responsibility in personal and professional life. Credits: 0.00

ABE 40600 - Ag/Biol Engineering Ambassador Leadership Seminar

Credit Hours: 1.00. Students engage in a weekly seminar/lab that includes topics such as leadership, professional skills, teamwork, engaging audiences and Purdue culture. Students utilize these skills while representing the Department of Agricultural and Biological Engineering to current and prospective students, alumni, donors, legislators, and other supporters of Purdue' Agricultural and Biological Engineering department. Students must be selected as an ABE Ambassador. Permission of department required.

Learning Outcomes: 1. Provide students with theoretical and experiential basis from which they may acquire and enhance their knowledge and skills in the areas of leadership principles and models; instructional techniques; curriculum/program design; Purdue structure, culture, and engineering education opportunities; and, personal/professional effectiveness, including teamwork and public speaking. 2. Provide students with the opportunity to develop effective engagement skills that will enable to effectively communicate, through hands-on learning experience, engineering/technology skills and concepts to youth and adults. 3. Provide students with the skills to successfully develop, implement and evaluate educational programs designed for specific audiences. Credits: 1.00

ABE 42500 - Water Quality Engineering

Credit Hours: 3.00. This course provides in-depth perspectives on water quality in source and environmental water systems (lakes, rivers, groundwaters, and coastal waters) including sources and causes of water quality impairments and design of workable and cost-effective management solutions. The course integrates hydrology, chemistry, biology, and ecology as foundations of water quality management and incorporates operation mechanisms of management practices in designing solutions for pollution control. Students will have opportunities to engage with lectures, water quality measurements and data analysis, computer modeling, case studies, design, and discussion sessions.

Learning Outcomes: 1. Identify causes and sources of water quality impairments. 2. Explain the health, ecological, and societal consequences of impaired waters. 3. Collect in-field water quality measurements. 4. Analyze water samples and associated data. 5. Design watershed-based solutions for pollutant control and water quality protection. Credits: 3.00

ABE 42600 - Ecological Restoration Engineering

Credit Hours: 3.00. This course focuses on ecologically-based design principles to restore degraded ecosystems, specifically wetlands, stream/floodplains, and prairies. Students will identify and synthesize design elements, natural and anthropogenic stresses, and management considerations to develop resilient restoration designs. Laboratory experience provides open-ended projects, data collection, and field trips to reinforce the design process.

Learning Outcomes: 1. Identify and synthesize design elements, natural and anthropogenic stresses, and management considerations for restored streams, floodplains & riparian zones, wetlands, and prairies. 2. Apply governing principles of ecological engineering, including biological, chemical, and physical conditions to develop resilient restoration designs. 3. Characterize and give examples of ecological concepts, such as water and elemental cycling, vegetation succession, food web dynamics, and ecological disturbance and how they apply to monitoring restoration success. 4. Read and extract key findings from readings. 5. Communicate effectively in written and oral format to a wide audience. Credits: 3.00

ABE 43500 - Hydraulic Control Systems For Mobile Equipment

Credit Hours: 3.00. Design of basic fluid power components and systems. Includes power steering, hydrostatic and hydromechanical transmission, electrohydraulic servo valves, servomechanism, and manually controlled systems.

Credits: 3.00

ABE 44000 - Cell And Molecular Modeling In Biological Engineering

Credit Hours: 3.00. This course examines the design principles underlying the organizations and dynamics of biological

networks with an emphasis on genetic/molecular circuits. Topics include the structure and tuning of network motifs and relationship to performance parameters such as robustness to internal noise, temporal response, noise filtering, bi-stability, pattern generation and temporal programs. Examples are presented from the study of natural systems and the design of new synthetic systems.

Learning Outcomes: 1. Understand, describe, and calculate quantitative features of biological networks. 2. Create simple, mechanistic models of gene expression. 3. Identify different types of networks motifs in biological networks. 4. Describe when particular motifs would be useful for specific types of biological functions. 5. Ananlyze the dynamics and steady state behavior of simple transcriptional motifs or gene circuits. 6. Tune the parameters of a genetic circuit to design a particular behavior such as a temporal program, an asymmetric, or a bistable switch. 7. Design and characterize a transcriptional motif or genetic to result in a particular function, behavior of feature such as robustness, noise filtering, or patterning. 8. Understand the importance of and describe the basic requirements for generating oscillations in cells. Credits: 3.00

ABE 44400 - Design And Advanced Manufacturing Processes For Internal Combustion Engines

Credit Hours: 3.00. This course introduces the manufacture and assembly of machined piece parts into a functional assembly. The creation of a prototype internal combustion engine will be utilized as the base project for the course, and students will design and create the parts and final assemblies. Students will be given a background on the process flow of modern manufacturing by general metal machining processes, manual machine tool operation, digital machine tool programming, numerical machine tool operation, the measurement of critical machining output variables, and the assembly of piece parts into subassemblies and final products. Course participants will work as a team to develop their production parts, final presentation, and final report.

Learning Outcomes: 1. Identify and understand the forces present on various components of internal combustion engines (ABET 1). 2. Design specific components for internal combustion engines and plan for their manufacture (ABET 1). 3. Identify the sequence of machining operations for the construction of engine components (ABET 1). 4. Download specific instructions to numerically controlled machines to execute manufacturing instructions for specific parts (ABET 1). 5. Perform specific operations on traditional machine tools to create specific engine parts (ABET 1). 6. Understand how to measure critical dimensions in manufactured parts (ABET 1). 7. Understand the concepts of component assembly to create a functional device (ABET 2). 8. Understand the safety concerns of machine shops and how to mitigate danger to personnel and equipment (ABET 4). 9. Spread workloads between colleagues, assist one another in self-learning, and collaborate to meet collective course objectives (ABET 5). 10. Understand the concepts of professionalism, ethical responsibility, and integrity when applied to technical projects (ABET 4). 11. Enhance written and oral communication skills through the production of a comprehensive final report and summary technical presentation (ABET 3). Credits: 3.00

ABE 45000 - Computational Modeling And Data Analysis In Agricultural Engineering

Credit Hours: 3.00. The course is divided into three sections. Students will (1) learn about first and second-order dynamic systems, block diagrams, modeling of mechanical and electrical systems, and control theory while using Matlab and Simulink for modeling; (2) Learn about numerical methods for modeling of continuum mechanics and transport phenomena including finite element method and finite difference method. Applications in heat transfer, fluid flow, and solid mechanics will be studied in the computer lab; (3) Learn about data analysis topics including statistical models, probability theory, regression analysis, classification techniques, and machine learning.

Learning Outcomes: 1. Understand the fundamentals of dynamic systems modeling. 2. Create block diagram models for mechanical and electrical systems. 3. Understand control

theory concepts and use it to design controllers. 4. Understand the fundamentals of finite element method and finite difference method including 1-D and 2-D formulations, boundary conditions, and postprocessing. 5. Use a major FEA software tool. 6. Evaluate the accuracy of the results. 7. Understand probability theory and regression analysis. 8. Explore classification techniques and machine learning concepts. 9. Apply data analysis skills to real-world datasets. Credits: 3.00

ABE 45300 - Leadership In Biotechnology

Credit Hours: 1.00 to 3.00. This course provides students who have completed the research experience in ABE biotechnology laboratory courses an opportunity to continue their professional development by serving as peer leaders in the classroom. The ABE biotechnology laboratory courses are part of the Howard Hughes Medical Institute's (HHMI) Science Education Alliance and provide an authentic laboratory research experience with the students engaged in hands-on discovery as a scientist with the ultimate objective of contributing new viral genomes to the scientific literature and public databases. As part of the model for implementing the course-based undergraduate research experience in the biotechnology laboratory courses, senior-level students that successfully completed those courses serve as peer leaders in the classroom. Peer leaders attend the course section along with the currently enrolled students and build competencies in leadership by guiding their team on their research project throughout the semester. Permission of instructor required.

Learning Outcomes: 1. Mentor peers in the use of scientific practices. 2. Guide peers through the process of discovery including iteration as their team isolates and characterizes a unique mycobacteriophage and designs a phage synthetic biology research project. 3. Mentor peers in collaboration by guiding their efforts to work productively together on a team and communicate the results of their project. Credits: 1.00 to 3.00

ABE 45700 - Unit Operations In Biological Engineering

Credit Hours: 3.00. Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipe flow, pumps, mixing, emulsification, extrusion, sheeting, heat exchanges, aseptic processing, sterilization, freezing, and evaporation.

Learning Outcomes: 1. Gain and understand the principles, design and analysis of biological and food process engineering operations. 2. Know the characteristics and analysis of the flow of biological fluids. 3. Gain an understanding of the principles, design and analysis of thermal processing operations. 4. Gain an understanding of the principles and analysis of freezing. Credits: 3.00

ABE 46000 - Sensors And Process Control

Credit Hours: 3.00. Fundamental aspects of transducers, biosensors, instrumentation, and computer control are presented, with particular emphasis on sensors and controls used in agricultural, biological, and food applications. Laboratory and pilot plant scale computer controlled equipment is used to examine response of process variables, sensor calibration, control system modeling, and controller selection and tuning. Prerequisite: differential equations and a course in either heat transfer or fluid mechanics.

Credits: 3.00

ABE 48400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Credits: 1.00

ABE 48500 - Agricultural Engineering Project Management And Design

Credit Hours: 4.00. Team based projects are completed during the semester and documented with a written report and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive

design report and/or project report for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams which include government, and industry engineers and marketing personnel supporting the specific projects. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering practice with professionalism and ethical responsibility.
Credits: 4.00

ABE 48600 - Agricultural Engineering Design

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ABE 48400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural engineering such as the design of environmental systems, machinery, precision agriculture and robotics, and student design competitions.

Learning Outcomes: 1. Design an environmental and natural resources system or a machine system. 2. Write a comprehensive design report and/or project reports for various target audiences. 3. Model/prototype and test projects in multidisciplinary teams with consultation available to students from government and industry engineers and marketing personnel. 4. Enhance communication skills by presenting project progress and final reports (written and oral) in a formal setting. 5. Experience engineering or project management practice with professionalism and ethical responsibility.
Credits: 3.00

ABE 49000 - Professional Practice In Agricultural And Biological Engineering

Credit Hours: 1.00. Career areas in agricultural engineering; job opportunities and graduate study; professional attitudes and ethics; contracts and specifications; patents.

Credits: 1.00

ABE 49500 - Select Topics In Agricultural And Biological Engineering

Credit Hours: 1.00 to 3.00. Credit and hours to be arranged. Special topics and projects of contemporary importance or of special interest that are outside the scope of the standard agricultural and biological engineering curriculum. The specific topic that is offered will be indicated on the student's record. A written report and oral presentation of final results are required. Permission of instructor required.

Credits: 1.00 to 3.00

ABE 49800 - Undergraduate Research In Agricultural And Biological Engineering

Credit Hours: 1.00 to 3.00. Credit and hours to be arranged. Individual research projects for students with the approval of their advisors. Requires prior approval of, and arrangement with, a faculty research advisor. A written report and public oral presentation of final results are required. Permission of instructor required.

Credits: 1.00 to 3.00

ASM 10400 - Introduction To Agricultural Systems

Credit Hours: 3.00. Basic principles of selection and operation of agricultural production equipment, including farm tractors and machines and crop-processing equipment. Planning considerations for crop storage and animal production systems and devices for water conservation and erosion control.

Credits: 3.00

ASM 10500 - Computing Technology With Applications

Credit Hours: 3.00. Computers will be used to solve problems (logistics, economic, agri-science) related to agricultural technology and businesses. Spreadsheets for problem solving and data analysis is the focus, with advanced features employed to improve functionality and capability of decision aids. Use of office software for written communication and visual aids will also be covered. Some applications of cloud platforms and specialty applications for communication and computations in team/group environments will be used. Interoperability and compatibility of files and platforms will be part of the experience.

Learning Outcomes: 1. Demonstrate ability to use email software effectively including contact and distribution lists, attachments, folders, and archives. 2. Demonstrate ability to set up spreadsheet solutions to complex problems in a

logical format allowing others to fully understand your solution. 3. Be a power user of spreadsheet software and demonstrate ability to use the following features: named cells, goal seek, solver, data tables, charting, look-up tables, conditional formatting, forms, statistical analysis, data filtering, saving as web page, import data, macros, and many intrinsic functions. 4. Demonstrate ability to write a technical report with proper use of headings, logical flow of content, good grammar, and clear presentation of data in tables and charts. 5. Be a wise user of word processing software and demonstrate ability to use the following features: ruler, tabs, named fields, page setup, hyperlinks, equation editor, track changes, objects insertion, and saving as web page. 6. Demonstrate ability to deliver a clear and logically organized brief presentation or instructional software demonstration. 7. Be a well-informed and skilled user of presentation software and demonstrate ability to use the following features: animation, hyperlinks, embedding images and video, shapes, notes, and drawing. 8. Have experience running other software to build your confidence with new applications. Examples: virtual meeting software, downloaded simulation software, machinery management software. 9. Have experience with mobile computing technologies to stretch your vision of potential uses. Credits: 3.00

ASM 20100 - Construction And Maintenance

Credit Hours: 3.00. Fundamental principles in the selection and use of tools for the construction and maintenance of agricultural and related facilities, equipment, and machines. Areas covered include small engines, concrete and masonry, wood, plumbing, electricity, and metal.

Credits: 3.00

ASM 21100 - Technical Graphic Communications

Credit Hours: 3.00. Introduction to graphic communication methods using traditional techniques and emphasizing modern computer-based techniques. Topics covered include: free-hand sketching, lettering, and dimensioning; selection of data presentation methods; and plan interpretation and cost calculations. A majority of assignments will include use of commercially available computer-aided drawing packages.

Credits: 3.00

ASM 21600 - Introduction To Surveying

Credit Hours: 1.00. Introduction to plane surveying, including instruction and practice in the use of surveying instruments. Basic overview of distance/angle measurement, leveling, direction, traversing, and mapping. Each weekly topic includes practical application and field exercises as applied to landscape architecture and forestry.

Learning Outcomes: 1. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 2. Function on multidisciplinary teams. 3. Use economics principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. Credits: 1.00

ASM 22100 - Career Opportunities Seminar

Credit Hours: 1.00. An introductory course to acquaint students with career and employment opportunities in the field of agricultural systems management. Guest speakers are invited to share their experiences and philosophies with the students. Special emphasis is given to improving communication skills.

Credits: 1.00

ASM 22200 - Crop Production Equipment

Credit Hours: 3.00. Principles of machine performance, capacity, machinery components, and operation. Study of tractors, trucks, utility vehicles, and combines. Equipment topics include chemical application, tillage tools, planters and seeders, hay and forage harvesters, electronic monitors and controllers. Computer-based analysis of equipment sizing and systems selection.

Credits: 3.00

ASM 23600 - Environmental Systems Management (UCC: STS)

Credit Hours: 3.00. Analysis of environmental systems with special emphasis on non-urban and agribusiness needs. Technological and sociological solutions to environmental problems. Computer-based tools are used to analyze global environmental issues, chemical use and management, waste disposal and management, water and air quality, soil and water conservation, sustainable agriculture, regulatory and policy issues.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Develop a general awareness of the interactions between agricultural systems and the environment. 2. Increase familiarity with major environmental issues related to agriculture. 3. Increase awareness of contemporary and future trends and the potential effects on the environment, agriculture, and society. 4. Understand the need to use a systems approach rather than focusing on one component to use technologies in an environmentally responsible manner. 5. Broaden/enhance problem solving skills, written skills, and oral communication skills. Credits: 3.00

ASM 24500 - Materials Handling And Processing

Credit Hours: 3.00. Principles of materials handling and processing. Physical properties and characteristics of food, fiber, and feed materials as related to harvesting, handling, processing, and storage. Processing of agricultural materials including drying, preservation, size reduction (e.g. grinding, crushing, shredding), mixing and blending, refrigeration, extrusion, and pelleting. Conveying and transport systems with consideration of their effects on damage and quality. The course elements are tied together by a treatment of scheduling and coordination of biologically based systems, which involve production, handling, quality control, and processing.

Credits: 3.00

ASM 29100 - Special Topics

Credit Hours: 1.00 to 4.00. Designed for specialized topic areas for which there is no specific course, but have enough student interest to justify formalized teaching of an undergraduate-level course. The course may be repeated by a student as long as the topic being taught is not repeated. The special topic that is offered will be indicated on the student's record. Permission of instructor is required.

Credits: 1.00 to 4.00

ASM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 33300 - Facilities Planning And Management

Credit Hours: 3.00. Principles of facility (system) planning and management involving buildings, equipment, and materials handling and flow. Student teams select a case firm (problem) with instructor approval. Principles learned week by week are applied to the development of an overall plan for the complex, over the course of the semester. Case examples can include firms handling supplies, seeds, grains, feeds, chemicals, wastes, and farm produce, as well as farming operations

producing grain, forage, and/or livestock products. Students will learn to use AutoCAD to develop drawings, without prior computer drafting experience.

Credits: 3.00

ASM 34500 - Power Units And Power Trains

Credit Hours: 3.00. An introduction to power generation and transfer in mechanical and fluid power systems. Internal combustion engines, fuels, and cycles are introduced. Clutches, mechanical transmissions, automatic transmissions, hydrostatic transmissions, and final drives are discussed. Principles of hydraulics, fluids, cylinders, pumps, motors, valves, hoses, filters, reservoirs, and accumulators are studied.

Credits: 3.00

ASM 35000 - Safety In Agriculture

Credit Hours: 1.00. An overview of the agricultural safety movement in the United States with consideration given to the specific human environmental and technological factors influencing farm-related accidents. Special emphasis is given to reduction of unnecessary risks in agricultural production. Course meets during weeks 1-8.

Credits: 1.00

ASM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural systems management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ASM 40000 - Agricultural Systems Management Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ASM 42000 - Electric Power And Controls

Credit Hours: 3.00. Fundamentals and application of electric power for agricultural facilities; safe wiring principles; operation and performance characteristics of electric motors; applications of control systems that include monitors, sensors, relays, and programmable logic controllers.

Learning Outcomes: 1. Know Ohm's Law and electrical energy and power relationships. 2. Operate a multimeter to evaluate and troubleshoot circuit. 3. Select motors for given

applications. 4. Plan efficient electrical distribution systems. 5. Evaluate alternative energy sources and electrical devices. 6. Understand basics of circuits programmed using PLC ladder logic. 7. Determine lamp fixtures to meet various lighting needs. Credits: 3.00

ASM 42100 - Senior Seminar

Credit Hours: 1.00. Professional attitudes and ethics, resume preparation and interview procedures, business correspondence, meetings, and career planning.

Learning Outcomes: 1. Have shown you can provide and receive constructive criticism. 2. Have a respectable resume and cover letter. 3. Apply differing theories and views regarding ethics and be able to identify applications of them. 4. Distinguish between good and poor meeting structure and involvement. 5. Understand principles of developing a long term career plan. 6. Have demonstrated good oral communication skills. 7. Have demonstrated high quality written communication ability. 8. Understand the importance of remaining current and have practice at doing so. 9. Be ready to graduate as a professional (of course you must meet other curricular requirements). Credits: 1.00

ASM 42200 - Advanced Machine Technology For Agricultural Crop Production

Credit Hours: 3.00. The course examines technologies and techniques associated with modern farming practices often referred to in general as precision agriculture. It is structured to center around expert presentations from industry, academia, and farming practice, with a focus on technologies and appropriate application of such technologies in crop production systems in the Eastern Cornbelt. Consent of instructor required.

Learning Outcomes: 1. Identify and analyze technologies associated with precision agriculture. 2. Explain the appropriate use of the aforementioned technologies. 3. Compare technological alternatives in various crop production scenarios. Credits: 3.00

ASM 44100 - Methods Of Teaching Agricultural Mechanics

Credit Hours: 2.00. Emphasis on facilities, shop layout, organization, course planning, and demonstrations. Course meets during weeks 8-16. For students seeking career opportunities, certification, and instructional skill of educating others in agricultural mechanics and engineering technology utilizing a hands-on problem--solving approach. Students shall develop skills necessary to educate youth, employees, and/or consumers about complex agricultural systems. Special emphasis will be given to developing materials for kinesthetic learners.

Learning Outcomes: 1. Integrate S.T.E.M. approach in teaching and demonstrations of agricultural mechanics. 2. Develop hands-on demonstrations around agricultural technology and mechanics. 3. Analyze approaches to educational learning objectives. 4. Apply basic principles of agricultural technology and mechanics operations management. 5. Understand and apply the basic principles of creating a safe educational environment (hazard awareness). 6. Estimate project materials, cost, and layout for hands-on learning. Credits: 2.00

ASM 44400 - Design And Advanced Manufacturing Processes For Internal Combustion Engines

Credit Hours: 3.00. This course introduces the manufacture and assembly of machined piece parts into a functional assembly. The creation of a prototype internal combustion engine will be utilized as the base project for the course, and students will create and test the parts and final assembly. Students will be given a background on the process flow of modern manufacturing by general metal machining processes, manual machine tool operation, digital machine tool programming, numerical machine tool operation, the measurement of critical machining output variables, and the assembly of piece parts into subassemblies and final products. Course participants will work as a team to develop their production parts, final presentation, and final report.

Learning Outcomes: 1. Identify the sequence of machining operations for the construction of engine components. 2. Download specific instructions to numerically controlled machines to execute manufacturing instructions for

specific parts. 3. Perform specific operations on traditional machine tools to create specific engine parts. 4. Understand how to measure critical dimensions in manufactured parts. 5. Understand the concepts of component assembly to create a functional device. 6. Know the critical functionalities of an assembled product and be able to test its performance. 7. Understand the safety concerns of machine shops and how to mitigate danger to personnel and equipment. 8. Spread workloads between colleagues, assist one another in self-learning, and collaborate to meet collective course objectives. 9. Understand the concepts of professionalism, ethical responsibility, and integrity when applied to technical projects. 10. Enhance written and oral communication skills through the production of a comprehensive final report and summary technical presentation.
Credits: 3.00

ASM 44500 - Grain Elevator And Processing Course

Credit Hours: 1.00. Grain handling and processing industry coursework through the Grain Elevator and Processing Society (GEAPS). Coursework varies by topic and covers technical aspects of grain handling, including safety, grain receiving, grain quality and equipment repair. Special registration required through the ABE Department. Each course can be completed at any pace over five weeks. Permission of department required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00

ASM 49000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. A written report and oral presentation of final results is required. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 49100 - Special Topics

Credit Hours: 1.00 to 4.00. Designed for specialized topic areas for which there is no specific course, but have enough student interest to justify formalized teaching of an undergraduate-level course. The course may be repeated by a student as long as the topic being taught is not repeated. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

ASM 49400 - Project Planning And Management

Credit Hours: 1.00. Review of topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property rights, contracts and timelines. Students will select a Capstone project and assemble a project proposal within a team environment.

Learning Outcomes: 1. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 2. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 3. Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 4. Function with, and contribute effectively to, multi-disciplinary teams. 5. Understand professional and ethical responsibilities and put them into practice.
Credits: 1.00

ASM 49500 - Agricultural Systems Management Capstone Project

Credit Hours: 3.00. Students implement, test, refine, present, and deliver the capstone project solution proposed in ASM 49400. Team based projects are completed during the semester and documented with a written report, poster presentation, and oral presentations. Projects encompass a broad range of topics within agricultural systems management.

Learning Outcomes: 1. Understand and apply the basic principles of mathematics, science, technology, management, and economics to agricultural systems. 2. Identify agricultural systems problems, locate relevant information, develop and analyze possible alternatives, and formulate and implement solutions. 3. Use

economic principles, scientific technologies, techniques, and skills necessary to manage agricultural systems. 4. Recognize and define agricultural systems problems and the impact of their proposed technological solutions in an international and societal context. 5. Understand and participate in performance evaluations, collect, analyze and interpret data, and communicate the results. 6 Demonstrate appropriate listening, speaking, writing, presentation, and interpersonal skills needed to interact and communicate effectively. 7. Function with, and contribute effectively to, multi-disciplinary teams. 8. Understand professional and ethical responsibilities and put them into practice. Credits: 3.00

ASM 49600 - Project Planning And Capstone Project

Credit Hours: 1.00 to 4.00. Topics relevant to project planning and execution in industry, including technical communication, budgeting, team management, intellectual property, and timelines. Students will develop a project proposal to address contemporary issues in agricultural systems management and complete that plan related to contemporary issues in agricultural systems management. Permission of instructor required.

Learning Outcomes: 1. Identify strategic project objectives and key tasks associated with specific objective completion. 2. Design an environmental and natural resources system or a machine system to solve a specific need. 3. Plan the timeline and details of an intermediate term project. 4. Provide informal progress updates to mentors and instructors regarding project progress. 5. Interface with and seek guidance from project sponsors. 6. Model, prototype, and test project designs within a team environment. 7. Learn how to accomplish specific tactical goals for a project within a larger operational environment (i.e. University Machine Shop & Business Office; Corporate Sponsor's Organization). 8. Understand the compromises and load sharing necessary for effective team harmony. 9. Understand the concepts of professionalism, ethical responsibility, and integrity when applied to technical projects. 10. Enhance written communication skills through the production of a comprehensive final report. 11. Enhance oral communication skills through the production of a summary technical presentation. 12. Learn how to respond to questions and criticism. 13. Understand the concepts of deadline, closure, and delivery. Credits: 1.00 to 4.00

ASM 49800 - Undergraduate Research In Agricultural Systems Management

Credit Hours: 1.00 to 3.00. Individual research projects for students with the approval of their advisors. Requires prior approval of, and arrangement with, a faculty research advisor. A written report and/or public oral presentation of final results are required. Permission of instructor required.

Learning Outcomes: 1. Gain basic knowledge of research methods and techniques used in the field of study. 2. Apply appropriate methods to analyze data and draw meaningful conclusions. 3. Present research findings clearly in written and/or oral formats. 4. Understand and follow ethical guidelines in conducting and reporting research. 5. Work effectively with peers and faculty members on research-related tasks and projects. 6. Evaluate existing research critically and use that knowledge to guide research efforts. Credits: 1.00 to 3.00

Department of Agricultural Economics

AgEcon1	AgEcon2
AgEcon3	AgEcon4

Overview

The Department of Agricultural Economics has a long history of preparing students for careers in the food and agricultural

industry as well as preparation for graduate and law school. The variation of majors offers students the opportunity to focus in agribusiness, economics, sales and marketing, or farm management.

Students have the opportunity to learn from faculty who lead the department's Center for Food and Agricultural Business and the Center for Commercial Agriculture. The Center for Food and Agricultural Business combines research with real-world applications to offer seminars, workshops, and custom programs to the same companies that are hiring our undergraduate students for internships and full-time positions. The Center for Commercial Agriculture has a vision to "be the leading source of management education and knowledge generation for farmers" bringing a wealth of experienced faculty to guide students interested in a career path in production agriculture.

Students are advised by a passionate group of academic advisors who encourage students to enhance their Purdue experience by participating in transformational experiences. These experiences range from attending a national or campus leadership conference, studying abroad, competing in an academic competition, completing an undergraduate research project, serving as an officer in one of the numerous campus organizations, etc.

Faculty (website)

Department of Agricultural Economics (website)

Contact Information

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Prospective Undergraduate Students (website)

Current Undergraduate Students (website)

Graduate Information

For Graduate Information please see Agricultural Economics Graduate Program Information .

Farm Management Minor

Agribusiness: Agribusiness Management Concentration, BS

Agribusiness: Agricultural Marketing Concentration, BS

Agribusiness: Agricultural Finance Concentration, BS

Agribusiness: Food Marketing Concentration, BS

Agricultural Economics: Applied Agricultural Economics Concentration, BS

Farm Management, BS

Sales and Marketing, BS

Food and Agribusiness Management Minor

Industrial Selling Certificate

The Certificate in Industrial Selling is open to students in any major who are interested in Industrial Selling.
It has three required courses and a capstone course, totaling thirteen credit hours. Each certificate earner must also complete a day long industry sales experience with a B2B sales practitioner in their area of professional interest, and must participate in a sales or marketing oriented experience on campus. It is expected that additional courses (sales management, negotiations, etc.) will be developed over time as alternatives and complements to this set of initial courses.

Global Food and Agriculture Systems Minor

Agricultural Economics: Policy and Pre-Law Concentration, BS

Agricultural Economics: Quantitative Data Analytics Concentration, BS

AGEC 20201 - Introduction To Data Analytics For Agricultural Business

Credit Hours: 3.00. Overview of data analytics in agricultural business. Students are exposed to an overview of software tools with a primary focus on Excel, introduction to relational databases, and data visualization. Focus is in using financial, accounting, and economic data to make management decisions. Laptop required.

Learning Outcomes: 1. Create and format a basic Excel worksheet. 2. Apply formulas and functions to calculate and analyze data. 3. Create charts and insert sparklines to represent data visually. 4. Manage and analyze large sets of data. 5. Analyze data by creating subtotals, PivotTables, and PivotCharts. 6. Use decision-making tools such as Range Names, Data Tables, and Goal Seek. 7. Manipulate data using date, logical, statistical, and financial functions. 8. Employ statistical functions to analyze data for decision making. 9. Demonstrate data management and error control within workbooks containing links and 3-D formulas. 10. Import, format, and manipulate data from external sources. 11. Manipulate data using text, database, and lookup functions. 12. Demonstrate how to design templates, insert comments, create macros, and use VBA. 13. Read an ERD Diagram. 14. Learn elements of Structured Query Language including the ability to create tables, retrieve, update, and delete data. 15. Understand usage of primary and foreign keys. 16. Create a relational database. 17. Understand different data types. 18. Create and format visualizations. 19. Create visualizations for nominal, ordinal, interval, and ratio scale data. 20. Create map visualizations.
Credits: 3.00

AGEC 20300 - Introductory Microeconomics For Food And Agribusiness (UCC: BSS)

Credit Hours: 3.00. This course introduces the application of microeconomics as used by farms and agribusiness firms. The behavior of individual firms is evaluated as price and output are determined in various market structures (pure competition, pure monopoly, monopolistic competition, and oligopoly). Other topics include pricing and employment of resources, market failure and the social control of industry (government, economics policy, and regulation), cost and production theory.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

AGEC 20400 - Introduction To Resource Economics And Environmental Policy (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of microeconomic theory and its application to issues related to evaluating resource economic issues and environmental policy. Topics discussed include efficiency, sustainability, valuation, externalities, governmental policies, and benefit cost analysis.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 21700 - Economics (UCC: BSS)

Credit Hours: 3.00. National economic problems such as unemployment, recessions, inflation, taxation, bank interest rates, the growth of government, monetary systems, and a rising national debt are discussed along with the principles, policies, and institutions for solving these macroeconomic problems.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply knowledge of economic measurement, the economic model and the history of U.S. economic policy to analyze economic events, both personal and global, which occur during the rest of your life.

Credits: 3.00

AGEC 22000 - Economics Of Agricultural Markets

Credit Hours: 3.00. This class provides an overview of U.S. and international agricultural markets, and develops a framework for analyzing those markets. Concepts include determination of agricultural prices, spatial dimensions of agricultural markets, and trade; temporal dimensions of agricultural markets, and futures and options markets; and public policy in agricultural markets.

Credits: 3.00

AGEC 25000 - Economic Geography Of World Food And Resources (UCC: BSS)

Credit Hours: 3.00. A study of the important issues and economic decisions about worldwide resource use for food and fiber production as influenced by geography, climate, history, social institutions, national self-interest, and the environment.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

AGEC 26000 - Mentoring Leadership

Credit Hours: 1.00. This course is designed to teach upperclassmen how to mentor freshman to thrive and survive as entering freshmen in Agricultural Economics. The main focus is on the transition to college life, as well as practical information on time management, taking and rewriting classroom notes, preparing for examinations and quizzes, dealing with stress and interpersonal relationships, and health. Additional topics include opportunities for student involvement in campus life and organizations, career paths for the various programs of study in Agricultural Economics, and how to successfully work in groups. Mentors are restricted to AGBS, AGEC, AGFN, AGMG, FARM, FIMM, QAEC, and SLMK students. Permission of department required.

Learning Outcomes: 1. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 2. Demonstrate the ability to work effectively as part of a problem-solving team. 3. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 4. Demonstrate awareness of civic responsibility to community and society at large. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

AGEC 28900 - Foundational Internship

Credit Hours: 1.00. Foundational internship that is preplanned and conducted under the direction of a faculty or staff member working in cooperation with an employer representative. A learning plan must be developed and approved by the student, faculty or staff coordinator, and employer representative prior to beginning the internship. A comprehensive report describing the management strategies used by the company or organization when he/she spent their internship is required. Permission of department required.

Credits: 1.00

AGEC 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 29600 - Selected Topics In Agricultural Economics

Credit Hours: 1.00 to 3.00. Special topics in agricultural economics aimed at sophomore-level students. May be repeated for credit under a different topic title.

Credits: 1.00 to 3.00

AGEC 29800 - Careers In Agribusiness

Credit Hours: 1.00. This course is designed to give an overview of the career possibilities available to students with a degree from the Department of Agricultural Economics at Purdue University. The goal of the course is to help students think about their future, engender excitement about the diversity of career prospects that will be available to them, and help provide real-world context for the material that will be learned in other Agribusiness and Agricultural Economics courses. Students will learn from individuals working all along the farm and food value chain from agricultural input supply to farming to transportation and storage to food processing to food retailing, in firms ranging from start-ups to multinational corporations. Additionally, students will learn from individuals working in affiliated careers from government, law, education and non-governmental organizations, etc. as well as from some who are no longer working in food and agriculture.

Learning Outcomes: 1. Identify different career paths available to individuals with a degree from the Department of Agricultural Economics. 2. Understand which career paths are interesting to you and potentially a good fit for you. 3. Determine the steps needed to get an internship/job and launch a successful career. Credits: 1.00

AGEC 30300 - Intermediate Applied Microeconomics

Credit Hours: 3.00. This course develops advanced microeconomic models of consumer and producer choice. All theory will be derived from mathematical first principles and will rely heavily on applications of calculus, with motivating examples and case studies drawn from topics in agricultural and resource economics. The course will also cover basic numerical simulation methods in tandem with the theory; the aim is for students to be able to simulate and quantify economic phenomena using real-world examples related to the theory.

Learning Outcomes: 1. Analyze and explain consumer, firm, and market behavior using mathematics and graphs. 2. Evaluate critically the impact of policies or other shocks on economic welfare from the perspective of economic theory. 3. Calibrate numerical models and use them to simulate economic phenomena. 4. Communicate the intuition behind key economic results. Credits: 3.00

AGEC 30500 - Agricultural Prices

Credit Hours: 3.00. Analysis of prices and the movement of farm product prices; relations of farm product prices to farm input and other prices; conceptual and statistical analysis of agricultural supply and demand relationships; application of price analysis, price forecasting, agricultural outlook, agricultural policy; adjustment of farming to new price conditions.

Learning Outcomes: 1. Understand economic principles that determine prices in markets. 2. Provide knowledge of markets and the entities and factors that impact market equilibrium outcomes. 3. Apply economic principles and empirical estimation tools to inform decision-making. Credits: 3.00

AGEC 31000 - Farm Organization

Credit Hours: 3.00. Economic factors controlling success in farming; types of farming; business records and analysis; adjustment in organization to meet changing economic conditions; organization and management of successful farms.

Credits: 3.00

AGEC 32100 - Principles Of Commodity Marketing

Credit Hours: 3.00. An in-depth background on the origin, operation, and application of futures and options in risk management for agriculture. Covers grain, livestock, and yield futures and options. Applications of futures and options to price and yield risk management is provided. Comparison of expected results from various risk management alternatives and decision-making processes to use in selecting a risk management strategy.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 32700 - Principles Of Food And Agribusiness Marketing

Credit Hours: 3.00. This course is a study of the major components of marketing decisions made by food and agribusiness firms. The course examines the marketing process, market research, marketing opportunities, and marketing strategies. Students will work on developing skills for evaluating and making marketing decisions.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 33000 - Management Methods For Agricultural Business

Credit Hours: 3.00. Management of nonfarm, agriculturally related businesses. Topics include tools for management decision making, legal forms of business organization, basics of accounting, and important financial management techniques. Case studies and computer simulation game.

Credits: 3.00

AGEC 33100 - Principles Of Industrial Selling

Credit Hours: 3.00. The principles of selling and their application to the industrial businesses. Topics include attitudes and value systems, basic behavioral patterns, the purchase decision process, relationship of sales to marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Emphasis is placed on application of principles to real-world situations and on building selling skills through class projects. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Learn about different aspects of buyer behavior, organized business communication, and psychology as it affects the sales of technical goods in industrial settings. 2. Interact with several salespeople to learn first-hand some of the opportunities and frustrations of a career in selling. 3. Prepare and apply sales concepts through an interactive sales presentation that is evaluated by a professional salesperson. Credits: 3.00

AGEC 33300 - Food Distribution - A Retailing Perspective

Credit Hours: 3.00. Distribution factors that affect the food industry. Particular attention to the food wholesaling and retailing sectors. Presentation of economic tools to evaluate performance in the food industry. Discussion of the relative importance of each of the major departments in the modern supermarket. Discussion of current and future industry prototypes.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 34000 - International Economic Development

Credit Hours: 3.00. This course is designed to introduce students to issues and problems related to international economic development. Topics covered include a description of the current situation in developing countries and the history of growth and development. The course is grounded in the body of theory associated with economic development, but concentrates on the many practical problems such as poverty, population growth, urbanization, education and the environment. The three areas with the greatest attention are agricultural development, international trade, and policy analysis for developing countries.

Learning Outcomes: 1. Build an appreciation for the conditions and constraints of contemporary life in developing countries. 2. Have your own notions of what it means to live in poverty, the challenges of improving welfare, and the role of economics in development. 3. Demonstrate how economic principles, models, and analysis can help evaluate and refine approaches to improving human welfare in developing countries. 4. Develop the ability to analyze and write about real-world problems and solutions. The course, particularly the assignments, will allow you to acquire technical skills that will contribute to your future professional work. Credits: 3.00

AGEC 35200 - Quantitative Techniques For Firm Decision Making

Credit Hours: 3.00. Introduction to mathematical programming and computing as an aid to agricultural decision making by firms, linear programming, game theory and strategy, simulation, the waiting-line problem, the equipment replacement decision, and multiproduct scheduling methods.

Learning Outcomes: 1. Manipulate and use spreadsheets. 2. Formulate linear programming problems. 3. Solve linear programming problems in Excel. 4. Interpret results obtained from linear programming models. 5. Present and explain linear programming results. 6. Understand graphically the concept of optimality in a linear program. 7. Understand the properties of optimal linear programming solutions. 8. Recognize and demonstrate instances where linear programming and simulation modeling might be valuable. Credits: 3.00

AGEC 37500 - The Process Of Economic Research

Credit Hours: 1.00. This course is a study of the process of conducting economic research. The course examines the research problem and objectives, literature review, conceptual framework, methods and procedures, and reporting research. Students will identify a research topic and project advisor. For Honors program students only in Agricultural Economics. Permission of instructor required.

Learning Outcomes: 1. Understand and appreciate the process of conducting economic research. 2. Develop a research plan of work for an honors thesis. 3. Discuss your research and the research of others. Credits: 1.00

AGEC 39001 - Professional Internship Programs In Agricultural Economics

Credit Hours: 0.00. Supervised professional experiences in agricultural economics. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of instructor required.

Credits: 0.00

AGEC 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agricultural economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGEC 40000 - Agricultural Economics Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

AGEC 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (FNR 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

AGEC 41000 - Agricultural Policy

Credit Hours: 3.00. Economic analysis of U.S. food and agricultural policy; current and past farm legislation; international trade; agricultural policies in selected countries; domestic and foreign food assistance; structural change; agricultural research policy; macroeconomic linkages with the agricultural sector; and emerging environmental policy issues, land and water use.

Learning Outcomes: 1. Understand the role of government interventions in the farm and food system. 2. Apply economic principles to the analysis of government interventions. 3. Delineate between economic and values-based arguments in assessment of policies. 4.

Understand the breadth, complexity and importance of 'Agricultural Policy'. Credits: 3.00

AGEC 41100 - Farm Management

Credit Hours: 4.00. Principles of farm organization and management, farmer interviews, and the application of computerized farm decision-making methods.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 41200 - Farm Business Management Workshop

Credit Hours: 1.00 to 3.00. Making decisions regarding the organization and operation of farm businesses with which students will be associated after graduation. Areas of decision-making include enterprise selection, farm growth, organizing large-scale farms, communication, labor management, machinery management, operating agreements, legal organization, and tax strategies.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 1.00 to 3.00

AGEC 42100 - Advanced Commodity Marketing

Credit Hours: 3.00. Application of commodity marketing principles to grain, livestock, and other commodity sectors. Applications include hedging, speculation, risk management, and fundamental and technical price analysis. Examination and testing of pricing strategies and the development of commodity marketing plans.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42400 - Financial Management Of Agricultural Business

Credit Hours: 3.00. A study of the major types of financial decisions made by agriculturally related firms, including investment in inventory, receivables and cash, property, plant, and equipment; sources and types of short-term, intermediate, and long-term capital; legal patterns of the business organization, emphasis on implementation involving agribusiness case problems.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to

develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42500 - Estate Planning And Property Transfer

Credit Hours: 3.00. The ownership and transfer of farm business property. Includes tax and other implications of life estates, trust arrangements, sale of property, and charitable contributions.

Credits: 3.00

AGEC 42700 - Advanced Agribusiness Marketing

Credit Hours: 3.00. Application of marketing principles to market planning, research, and analysis. Development of strategic marketing plans for agribusiness.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze date, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 42900 - Agri-Marketing Analytics

Credit Hours: 3.00. This course focuses on the use of modern, data-drive analytics marketing techniques. Focuses on the analysis of marketing data and metrics to help make business decisions. A hands-on course that requires extensive use of the computer. Laptops required.

Learning Outcomes: 1. Learn how to use Excel to summarize and present business data. 2. Learn how to integrate data with microeconomic and statistical concepts to rigorously tackle business questions. 3. Learn modern big-data marketing analytics tools to examine pricing, market segmentation, customer valuation, retailing, advertising, market research, and internet and social marketing. Credits: 3.00

AGEC 43000 - Agricultural And Food Business Strategy

Credit Hours: 3.00. An advanced course in business planning and strategy for potential agribusiness and food firm managers. Focuses on development of viable business strategy in the context of the firm's market and its internal condition. Makes extensive use of case studies that document management dilemmas of agribusiness firms, ranging from those providing inputs to agricultural producers to firms involved in the retail distribution of food.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 3.00

AGEC 43100 - Advanced Industrial Sales And Marketing

Credit Hours: 4.00. Advanced presentation techniques, sales management and analysis, improving communication skills, study of industrial marketing strategies, interaction with industry executives, and strategies for career development. Requires class trips. Students will pay individual lodging or meal expenses when necessary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates

knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. Credits: 4.00

AGEC 45000 - International Agricultural Trade

Credit Hours: 3.00. Study of U.S. agricultural trade with emphasis on international trade theory, exchange rates and their determination, relationships between domestic agricultural policies and trade policies, and analysis of institutional arrangements for world trade in agricultural products.

Learning Outcomes: 1. Explain the rationale for international trade in a variety of economic models. 2. Assess the models in terms of their assumptions and implications. 3. Discuss supplementary research that qualifies and extends the basic models. 4. Discuss the implications of international trade policies, institutions and agreements for international trade, especially trade in food and agricultural products. Credits: 3.00

AGEC 45100 - Applied Econometrics

Credit Hours: 3.00. Application of strategies to economic problems. Simple and multiple regression, dummy variables, logit analysis, time series, and forecasting.

Learning Outcomes: 1. Learn how to estimate and interpret linear regression models. 2. Learn how to test hypotheses based on regression coefficients. 3. Learn how to develop forecasts abased on regression models. Credits: 3.00

AGEC 45500 - Agricultural Law

Credit Hours: 3.00. Selected general legal topics (courts, contracts, torts, property and commercial law) with emphasis on farming problems (e.g., landowner-tenant, grain contracts, fences, and animal liability) and cases.

Credits: 3.00

AGEC 45600 - Federal Income Tax Law

Credit Hours: 3.00. Introduction to the federal income tax laws applicable to individuals and small business with emphasis on the farming business. The course includes management implications and the policy basis for the tax law system. Techniques and practice for the preparation of selected forms will be included. There will be limited exposure to taxation of partnerships, corporations, estates, and to federal gift and estate tax law.

Learning Outcomes: 1. Develop an understanding of the federal income tax law: for individuals and small businesses and for economic and financial decision making. 2. Gain an understanding of the management opportunities for the income tax law and how they can be applied by individuals, families, and small businesses. 3. Develop the ability to analyze facts for tax law alternatives and to communicate tax planning alternatives. Credits: 3.00

AGEC 49800 - Special Problems

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who want to study special problems in agricultural economics not covered in regular work. Permission of instructor required.

Credits: 1.00 to 3.00

AGEC 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Credits: 1.00 to 6.00

Department of Agricultural Sciences Education and Communication

Ag Sciences Education & Communication Pic 1 Ag

Sciences Education & Communication Pic 2

Overview

The Department of Agricultural Sciences Education and Communication prepares professionals for rewarding careers supporting the food and agricultural industry.
Our Agricultural Communication Program prepares students as professional communicators for agricultural and natural resource organizations, agribusiness, government agencies, and advertising and public relations agencies.
Our Agricultural Education Program prepares teachers who help people learn about food and natural resources in schools and other settings. Agricultural Education graduates are highly sought after in business, government and other fields where professionals are needed to train and work with people.
All of our students receive personalized advising from caring staff and faculty with professional experience in their fields. We connect students with exciting and transformational experiences through study abroad, internships, student teaching, undergraduate research and more. The Department of Agricultural Sciences Education and Communication is also home to a nationally recognized graduate program focused on learning and communication in the context of agriculture, food, natural resources and science.

Department of Agricultural Sciences Education and Communication (website)

Faculty (website)

Contact Information

Agricultural Sciences Education and Communication
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Graduate Information

For Graduate Information please see Agricultural Sciences Education and Communication Graduate Program Information .

Agricultural Education, BS

Agricultural Communication, BS

ASEC 10100 - Agriculture, Science And Social Issues

Credit Hours: 1.00. This course introduces Purdue Agriculture students to social issues that influence the future of science innovation and the agriculture industry. It will particularly focus on areas of apparent disconnect with regard to agriculture, scientific evidence and the general public. In order to learn how to communicate with others on controversial issues, concepts of engagement will be discussed as ways to better understand audiences and find areas of common interest. Featuring guest speakers on current social issues, students will learn how issues impact the agriculture industry and science innovation and consider how to engage stakeholders regarding these concerns.
Learning Outcomes: 1. Identify current social issues that affect agriculture and science. 2. Understand various perspectives on issues and how those perceptions are influenced and shaped. 3. Articulate how engagement on social issues can build relationships and establish common ground. 4. Analyze how an engagement strategy could be used by those in agriculture and science to communicate with concerned stakeholders on specific issues.
Credits: 1.00

ASEC 15200 - Agricultural Communication Seminar

Credit Hours: 3.00. This course provides an introduction to agricultural communication as a professional field, including its current status and role within the larger U.S. mass media system. The course will also provide an overview of career options and professional skills and competencies required of agricultural communicators.

Credits: 3.00

ASEC 24000 - Seminar In Agricultural Education

Credit Hours: 1.00. Development of an understanding of the origin, scope, and objectives of agricultural education; role of the agricultural science and business teacher as a professional educator; basic responsibilities of a teacher of agricultural science and business; and significance of legislation affecting agricultural education.

Learning Outcomes: 1. Summarize the history, philosophy and aims of agricultural education. 2. Demonstrate small group communication through committee activities. 3. Practice the roles of an advisor to a student organization. 4. Evaluate self-awareness and understanding of own style of working with and relating to others and begin to make appropriate modifications. 5. Explain the importance of professional networks and the techniques to develop them. Credits: 1.00

ASEC 25000 - Storytelling For Professional Communication

Credit Hours: 3.00. In this course students will develop skills to help them develop and produce professional-quality narratives for a variety of professional communication applications, including content creation, marketing, and advocacy. Students will understand how to identify, focus, and structure stories and messages that resonate with audiences and help them achieve practical communication goals. The work students produce will include both written and visual components.

Learning Outcomes: 1. Focus stories for effective results. 2. Structure ideas to create consistently compelling stories. 3. Apply storytelling principles to written media and understand how they apply to other media, such as photography, video, and audio. 4. Know when and how to use storytelling techniques to inform, market, and advocate to various audiences. 5. Demonstrate professionalism and professional "improvisation." Credits: 3.00

ASEC 28000 - Digital Storytelling

Credit Hours: 3.00. Students will plan, shoot, and edit videos; collaborate in teams; plan and generate social media; and write feature pieces for digital platforms. Students will gain meaningful digital storytelling experiences that will enhance their understanding of various platforms and build their professional portfolios.

Learning Outcomes: 1. Develop compelling, audience-appropriate written and video feature stories for online platforms. This requires critical thinking (for planning, audience analysis, etc.), knowledge (effective storytelling techniques), and communication (must collaborate with classmates to coordinate topics and schedules). 2. Plan and integrate social media strategies into your work. This requires critical thinking (must plan ahead to include these pieces from the beginning of the project, must analyze audience), communication (must create and schedule effective, audience-relevant posts), and communication (must collaborate with classmates to coordinate posts and schedules). 3. Develop projects that meet a client's expectations and communication goals. This requires communication (with the client and source), knowledge (of effective interviewing and shooting principles), and critical thinking (to determine what audiences want to know and assess what they may already know). 4. Communicate science topics to lay audiences. This requires communication (to translate sometimes difficult subjects in ways that even elementary age audiences will understand), critical thinking (to determine what should and should not be covered), and knowledge (of effective video storytelling techniques). 5. Collaborate effectively with others. This requires

communication (with colleagues all topics and schedules) and ethics (to be reliable team members who are just as responsible to each other as to themselves). 6. Reflect the diversity of the community you report on. This requires ethics (students must ensure that their work is diverse and inclusive) and critical thinking (students must be aware of when their work does not reflect the diversity of the population they serve). Credits: 3.00

ASEC 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

ASEC 29000 - Special Problems In Agricultural Science And Education Communication

Credit Hours: 1.00 to 6.00. Open primarily to freshmen and sophomores who desire to study special problems in agricultural communication, agricultural education, life science education, extension education, leadership education or youth development not covered in regular coursework. To be arranged with instructor or departmental representative prior to registering. Permission of instructor required.

Learning Outcomes: 1. Course will address the college Communications and Critical Thinking outcomes. 2. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 6.00

ASEC 30100 - Building Intercultural Partnerships (UCC: HUM)

Credit Hours: 3.00. This course uses a combination of readings, videos, experiential activities, presentations, and face-to-face & virtual excursions/engagement with "other/different" international cultural groups to deepen students' ownership of their own learning and to identify and understand both similarities and differences in values and social norms across countries and cultures. Students will enhance their intercultural communication skills, their emotional resilience, and their ability to engage effectively and equitably in conversations and partnerships with people from other countries and cultures.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate that you recognize the relevance of the learning process and the roles you and other play in that process. 2. Recognize and participate in cultural differences in verbal and nonverbal communication and begin to appropriately engage with people from other countries and cultures to negotiate a shared understanding based on those differences. 3. Recognize your own strengths and understand both the values and social norms across countries and cultures and challenges in adapting and adjusting under stress, and identify practices and techniques for managing your emotions. 4. Analyze substantial connections between the worldviews, experiences, and power structures of multiple cultural groups while incorporating respectful interactions with them. Credits: 3.00

ASEC 31800 - Coordination Of Supervised Agricultural Experience Programs

Credit Hours: 2.00. Record keeping and supervisory skills needed to advise and coordinate supervised agricultural experience programs for secondary agricultural science and business students. Integration of supervised agricultural experiences with programming in youth organizations and classroom instruction for secondary agricultural science and business classrooms.

Learning Outcomes: 1. Model a comprehensive design for school-based agricultural education. 2. Analyze Supervised Agricultural Experiences for learner career readiness. 3. Utilize a comprehensive record-keeping system. 4. Utilize student recognition tools such as FFA degree and proficiency applications. Credits: 2.00

ASEC 31900 - Planning Agricultural Science And Business Programs

Credit Hours: 2.00. Development of course content plans that coordinate and utilize agricultural science and business, community resources, FFA, and supervised agricultural experience programs.

Learning Outcomes: 1. Explain the functions of an advisory committee. 2. Develop a philosophy/mission statement, vision, and goals. 3. Conduct a needs assessment. 4. Plan and implement strategies to build school and community support, including recruitment of students. 5. Describe the purpose of developing an effective FFA Program of Activities. 6. Describe the purpose and process of evaluating an agricultural education program. Credits: 2.00

ASEC 33100 - The Role Of Horses In Human History, Culture And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ASEC 34000 - Laboratory Practices In Agricultural Education

Credit Hours: 2.00. This course is designed to introduce pre-service agricultural education teachers to laboratory integration into the agricultural education curriculum at the middle school and secondary school level. Emphasis is placed on laboratory safety, skill acquisition, developing knowledge of laboratory components in Agriscience, laboratory utilization, facilitating student learning in the laboratory setting, appropriate teaching methods and techniques, curriculum applications, and classroom resources. Travel to on and off-campus sites will be required.

Learning Outcomes: 1. Facilitate learning in agricultural teaching laboratory settings. 2. Utilize resources in agricultural teaching laboratory settings. 3. Practice safe procedures with agricultural teaching laboratory equipment, supplies, and materials. Credits: 2.00

ASEC 34100 - Curriculum Development In Agricultural Education

Credit Hours: 2.00. This course is designed to expose students to appropriate teaching techniques, curricula and resources within agricultural education. Procedures for designing, implementing, and evaluating curriculum will be examined. Emphasis will be placed on new and emerging areas in agriculture, food, and natural resources.

Learning Outcomes: 1. Design curriculum for instruction in agriculture, food, and natural resources. 2. Implement curriculum for instruction in agriculture, food, and natural resources. 3. Evaluate curriculum for instruction in agriculture, food, and natural resources. Credits: 2.00

ASEC 35500 - Controversial Science And Media In The Public Sphere (UCC: HUM/STS)

Credit Hours: 3.00. This course will utilize case studies of controversial science news to explore the multiple factors that converge to influence how science and technology become controversial issues across a variety of social/ political domains. In addition to foundational understanding of communication theory, students will develop two primary skills: 1) a structure for the critical analysis of science news, 2) the skills to meaningfully communicate across stakeholders. The science content (GMOs, climate change, pesticide use, etc.) will provide the background information for analysis of the main focus of the course, which is in learning the communication process for effectively communicating science to non-science audiences. Case studies and applied critical media theory will be utilized to explore such controversies as climate change, genetically modified foods, and other emergent science controversies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Evaluate forces shaping public understanding of/and engagement with/science, including the role of technology in misinformation (fake news, bots, algorithms, misinformation campaigns, and propaganda) and the role of commercial funding of media. 2. Able to critically analyze media reports of science issues including: Types of Journalism, Levels of Completeness, and Evidence within the story. 3. Apply reliable evidence from your critical news analysis to your projects. 4. Identify and analyze prominent and recurrent patterns in the communication of controversial issues. 5. Apply the skills learned to communicate controversial science to a non-science audience. 6. Critically evaluate the evolving role of media in shaping understanding of science across democratic societies. 7. Know content (quizzes and reflection papers). 8. Process Knowledge (Discussion and applied projects). 9. Use integrated knowledge to meaningfully critique others work. 10. Demonstrate process comprehension through construction of a critical news analysis of a current controversial issue. Credits: 3.00

ASEC 38000 - Feature Writing And Production

Credit Hours: 3.00. Students gain hands-on studio experiences in all phases of features writing, storytelling, and production. Students will analyze audiences, generate story ideas, research, interview, write, edit, shoot photos, plan social media, design pages, and can shoot short-form video.

Learning Outcomes: 1. Develop audience-appropriate story ideas consistent with Destination Purdue's mission. This requires critical thinking (will a topic actually interest readers and our client) and communication skills (students must articulate to the instructor and others why their stories will work). 2. Distinguish the differences between feature and news stories. This requires knowledge (what are the technical differences between these two seminal communication styles). 3. Write compelling, newsworthy feature stories. This requires critical thinking (what parts of conversations with sources will appeal to our readers). 4. Produce and prepare publication-quality photos. This requires knowledge (how to shoot and prepare an effective photo). 5. Demonstrate basic skills in desktop publishing software, design, and layout. This requires knowledge (of basic design principles and publishing software). 6. Develop and demonstrate reporting skills that accurately reflect the diversity of the Purdue Agriculture community. This requires ethics (students must ensure that their work is diverse and inclusive) and critical thinking (students must be aware of when their work does not reflect the diversity of the population they serve). 7. Demonstrate professionalism and professional "improvisation". This requires ethics (students must learn how to operate as professionals) and critical thinking (students must be able to solve unexpected problems that arise during the process). Credits: 3.00

ASEC 38500 - Communication Strategies For Controversial Issues In ANR

Credit Hours: 3.00. This course trains students to communicate about controversial science and emerging technology in contested environments. Additionally, the course covers public engagement principles for science topics and how to communicate risks in the context of agriculture, and natural resources science and technology.

Learning Outcomes: 1. Define and apply evidence-based science communication and public engagement models in communication of controversial science. 2. Identify a range of factors (individual, socio-cultural, economic, political) that contribute to social conflict and controversy over science or technology issues. 3. Explain impacts of different media platform on the effectiveness of science communication. 4. Define and apply conflict resolution skills in the context of a science or technology controversy. 5. Apply communication best practices when engaging on controversial science and emerging technology across diverse audiences. Credits: 3.00

ASEC 40000 - Agricultural Education Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ASEC 43100 - Planning For International Engagement Methods

Credit Hours: 1.00. A team-based laboratory course for students who seek experience working with international partners to plan and conduct quality service-learning projects. Using established partner relationships, students will work with international partners to address hands-on, real-world, identified challenges to learn the principles of extension methodology and sustainable community development by integrating their discipline knowledge and technical skills from previous courses. Students will also learn the intercultural communication, market analysis, project design and planning, entrepreneurial business planning for micro-credit loans and business ventures, and cultural factors affecting community food security while they work in bi-national teams to determine how best to apply their classroom knowledge and experience to respond to partners' needs and local resource constraints.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their economic and social challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and emotional intelligence in evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate the ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

ASEC 43110 - International Engagement Methods

Credit Hours: 1.00 to 3.00. Using established partner relationships, students will travel to and live in Cap Haitien for 8-10 days and work with Haitian partners and students to learn the principles of extension methodology, sustainable community development, and how to most effectively work with local leaders. Students will also learn the intercultural communication, entrepreneurial business planning, and cultural factors affecting community food security status while they work bi-national teams to determine how best to apply their classroom knowledge and experience.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing

assumptions that exist because of ethnic and cultural differences. 3. Demonstrate personal growth in cultural worldview and self-awareness to confidently address specific food security-related challenges and belief in their personal ability to succeed in a particular situation. 4. Demonstrate critical thinking, intercultural curiosity, and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 5. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 6. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 7. Demonstrate intercultural openness, empathy, flexibility, and open-mindedness to work constructively as part of a bi-national problem-solving team. Credits: 1.00 to 3.00

ASEC 43120 - Evaluating International Engagement Methods

Credit Hours: 1.00. Designed for students who have just returned from the Engagement Methods for Int'l Food Security course or have previous experience working with our partners. In order to 1) fully comprehend the impact of the experience and 2) foster true long-term relationships with and service to our partners, it is required to work on our projects when we return. Matt McGregor, Former Exec. Dir. of Timmy Global Health, told us that "it's not really about the trip". It is essential that we accomplish: 1) Closure of trip experiences with partners and contacts - thank you's and complete follow-up; 2) Reflection of Purdue student experiences and personal goals/follow-up actions; 3) Promotion of food insecurity realities and opportunities for support; and 4) Planning, recommendations, and promotion of future service learning courses.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

ASEC 44000 - Methods Of Teaching Agricultural Education

Credit Hours: 3.00. Principles and procedures for teaching agricultural science and business in public schools. Must be admitted to teacher education program.

Learning Outcomes: 1. Describe the role of the instructor in the learning process, including characteristics of effective instructors and teaching. 2. Identify factors affecting individual learner differences. 3. Prepare lesson plans which address diversity in student populations. 4. Correctly demonstrate the use of the teacher-centered, social interaction, and student-centered learning activities within the agricultural education setting. 5. Develop and teach lessons using appropriate learning activities which build learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 6. Select appropriate educational technology to enhance learners' agricultural-related conceptual understandings, relevant skills, and problem-solving strategies. 7. Design lessons which incorporate the use of agricultural teaching laboratories and/or equipment. Credits: 3.00

ASEC 44100 - Field Experience In Agricultural Education Programs

Credit Hours: 1.00 to 3.00. Field experience in agricultural science and business programs to include observation and participation in the teaching process and program development activities.

Learning Outcomes: 1. Document scope and sequence of secondary agricultural education curriculum. 2. Conduct an on-site review of facilities, equipment, supplies and procedures for an agricultural education program. 3. Reflect on the Agricultural Education Model and its impact on teaching and learning. Credits: 1.00 to 3.00

ASEC 44200 - Curriculum Implementation In Agricultural Education

Credit Hours: 2.00. Students develop skills necessary to implement standards-based curriculum in Agricultural Education through hands-on application. Course is designed for students who have an understanding of curriculum development and teaching methodology.

Learning Outcomes: 1. Assess curriculum justifying its use in a given situation. 2. Design instruction based on given standards and curricular materials. 3. Practice safe procedures with laboratory equipment, supplies, and materials. Credits: 2.00

ASEC 48000 - Agricultural Communication Capstone Seminar

Credit Hours: 3.00. Prepares graduating students for entry to the workplace, assesses and enhances their communication knowledge and skills, and provides project experiences that will demonstrate their ability to communicate scientific and technical information through a variety of media. Projects will include student presentations and magazine style articles on issues of concern to agricultural and general audiences; and a final project that requires students to conceive and create a web site that uses converging media to communicate effectively a topical issue.

Learning Outcomes: 1. Display mastery in the art of communicating science (agriculture, health, or environmental science) in explanatory writing form for non-technical audiences. 2. Conduct interviews, organize and produce professional-quality writing products. 3. Quickly assemble content, seek approvals and make revisions under tight deadlines. 4. Gather data and analyze audiences. 5. Work with a team to identify effective communication goals; determine communications resources and coordinate those for strategic outcomes. 6. Develop creative products for professional portfolios to showcase communication expertise and assist in the job search. Credits: 3.00

ASEC 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

ASEC 49000 - Special Problems

Credit Hours: 1.00 to 6.00. Open to undergraduates who desire

to study special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

ASEC 49100 - Special Topics In Agricultural Science And Education Communication

Credit Hours: 1.00 to 3.00. Designed for specialized topic areas for which there is no specific course, but have enough student interest to justify formalized teaching of an undergraduate-level course. The course may be repeated by a student as long as the topic being taught is not repeated. The specific topic that is offered will be indicated on the student's record. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 3.00

ASEC 49700 - Thesis Research

Credit Hours: 1.00 to 6.00. For Honors students only doing specialized youth development and agricultural education research. Arrange with academic advisor and honors research coordinator before registering.

Credits: 1.00 to 6.00

ASEC 49900 - Special Problems In Agricultural Communication

Credit Hours: 1.00 to 3.00. Application of principles of mass communication in the production of agriculturally related news, feature, and magazine articles, radio and television reports, photographs, and publications in the Department of Agricultural Communication Service. Permission of instructor required.

Credits: 1.00 to 3.00

Department of Agronomy

Overview

The Department of Agronomy at Purdue University provides global leadership in data management, plant genetics, plant physiology, and soil and water sciences to enhance the quality of life through agronomic education that results from discovery, education, and engagement.
Agronomy is the core of all agricultural sciences. The management of soil and water, with a view to achieving production of high yielding varieties is exclusively an agronomic domain. Among all the variances in agriculture, agronomy occupies a pivotal position. Similar to agriculture, agronomy is an integrated and applied aspect of different disciplines of pure sciences.

Our Mission & Vision

Faculty (website)

Department of Agronomy (website)

Contact Information

Department of Agronomy
Purdue University
Lilly Hall of Life Sciences
915 Mitch Daniels Blvd
West Lafayette, IN 47907-2054
Phone: 765-494-4773

Email: agronomy@purdue.edu

The Undergraduate Advising office is located in LILY 3440.

Graduate Studies

Department of Agronomy - Graduate Program Information

Crop Science Minor

Soil Science Minor

Agronomy: Agronomic Business and Marketing Concentration, BS

Agronomy: Crop and Soil Management Concentration, BS

Agronomy: International Agronomy Concentration, BS

Applied Meteorology and Climatology, BS

Crop Science, BS

Plant Genetics, Breeding, and Biotechnology, BS

Soil and Water Sciences, BS

Digital Agronomy, BS

AGRY 10500 - Crop Production

Credit Hours: 3.00. Fundamental principles of crop production and distribution. Emphasis is placed on applying technological advances in agronomy to active crop-production situations, including basic soils, agricultural meteorology, and crop physiology and breeding.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 12000 - Water And Food Security

Credit Hours: 3.00. General science introduction to global and regional water resources issues, especially with respect to food security. It will address the role of water in agriculture throughout the world and agriculture's impact on water resources. Students will focus first on developing the scientific underpinnings of water supply and crop water use. With this background, they will explore key issues relating to water scarcity and balancing agricultural and urban demands for water, water quality and soil salinization, water footprints of food and the use of virtual water embedded in food to offset national water deficits, regulation and roles science and policy in solving water problems.

Learning Outcomes: 1. Be familiar with water resources concepts, including water supply, water demand, irrigation needs, crop water use and water contamination. 2. Gain qualitative and quantitative understanding of water scarcity, water use efficiency and water footprints. 3. Develop oral and written communication skills and problem solving abilities on topics related to agricultural water resources. Credits: 3.00

AGRY 12300 - Genetics And Society

Credit Hours: 3.00. Introduction to the broad impacts that genetics and genomics have on society, from medicine, genetic testing and DNA evidence to agriculture, genetically modified crops and synthetic life. Background information is provided on a weekly topic followed by extensive in-class discussion.

Learning Outcomes: 1. Describe the issues, facts, and concepts central to a broad range of genetics and genomics topics. 2. Form own

opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe work done in three scientific disciplines, biology, genetics and genomics, as well as some intersecting disciplines such as medicine and engineering. Credits: 3.00

AGRY 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (EAPS 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

AGRY 15500 - Introduction To Soil Morphology

Credit Hours: 2.00. This course features an introductory field experience in evaluating soil morphology. Students will develop skills determining horizon nomenclature, texture, soil color, structure, consistence and drainage. Basic concepts regarding the impact of soil morphology on use of soils for various purposes will be presented. Collegiate soil judging is a portion of the subject matter discussed.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 2.00

AGRY 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (HORT 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high quality, low maintenance lawn will be discussed.

Credits: 3.00

AGRY 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (HORT 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 510. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

AGRY 25500 - Soil Science

Credit Hours: 3.00. (NRES 25500) Differences in soils; soils genesis; physical, chemical, and biological properties of soils; relation of soils to problems of land use and pollution; soil management relative to tillage, erosion, drainage, moisture supply, temperature, aeration, fertility, and plant nutrition. Introduction to fertilizer chemistry and use. Not available to students who have taken AGRY 27000.

Learning Outcomes: 1. Demonstrate proficiency

in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 27000 - Forest Soils

Credit Hours: 3.00. Development, distribution, and classification of soil profile; soil characteristics related to forest practices; nature and cause of soil differences; fertility and plant nutrition. Not available to students who have taken AGRY 25500 or NRES 25500.

Credits: 3.00

AGRY 28500 - World Crop Adaptation And Distribution (UCC: STS)

Credit Hours: 3.00. Examination of how environmental factors, including climate and soils, impact the global distribution of major food crops. Identification of the types of naturally occurring plant communities and comparison of these communities with those of environmentally and economically sound field cropping systems. Exploration of how man's intervention has maintained or modified the productivity of food crops in agricultural communities and how his intervention has affected the environment.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

AGRY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 32000 - Genetics

Credit Hours: 3.00. The transmission of heritable traits; probability; genotypic-environmental interactions; chromosomal aberrations; polyploidy; gene mutations; genes in populations; the structure and function of nucleic acids; biochemical genetics; molecular genetics; coding.

Learning Outcomes: 1. Deduce and explain which sources of variation in heredity may apply in examples of biological phenomena. 2. Describe units of inheritance at the population, organismal and molecular levels when given

information about a trait. 3. Distinguish single gene traits from polygenic traits and the influence of environment when given information about a trait. 4. Describe how selection influences genetic variation at the population level within applied genetic scenarios. 5. Correctly apply basic genetic calculations to solve classical genetic problems and explain the results. Credits: 3.00

AGRY 32100 - Genetics Laboratory

Credit Hours: 1.00. This course is a hands-on laboratory course that uses plants and microorganisms to demonstrate basic concepts of classical, molecular, and modern genetics. This course is designed to provide students with fundamental knowledge and skills for conducting genetics and molecular biology laboratory experiments. Students will gain experience with methods including but not limited to gel electrophoresis, DNA extraction, PCR, cloning, restriction digest analysis, phenotypic analysis, DNA sequencing, bioinformatics, SNP genotyping, qualitative gene expression analysis, and quantitative gene expression analysis. Students will learn how to plan and validate their laboratory experiments. The goal of this course is to prepare students to confidently perform and interpret experimental results in future laboratory courses or careers.

Learning Outcomes: 1. Apply fundamental principles of genetics to modern methods of genetic analyses. 2. Plan, perform, and interpret classical genetics laboratory experiments and methods. 3. Identify and utilize bioinformatic genetics resources to plan and perform an experiment. Credits: 1.00

AGRY 33500 - Weather And Climate

Credit Hours: 3.00. An introductory course in meteorology and climatology with applications to daily life. The study of the fundamental physical principles behind weather and climate and how they apply to the homeowner and the world citizen. Emphasis is on how to interpret weather conditions and forecasts, what controls the wide range of climates in the world, and what the future may hold.

Credits: 3.00

AGRY 33700 - Environmental Hydrology

Credit Hours: 3.00. This course is designed to provide undergraduate students with both the basics of how water moves through the environment and current theories as to how hydrologic response is modified by environmental change at a variety of temporal and spatial scales.

Credits: 3.00

AGRY 33800 - Environmental Field Skills

Credit Hours: 1.00. This practical, field-based laboratory course is designed to provide hands-on experience with environmental monitoring field techniques, including stream discharge measurements, slug tests, aquatic sampling, surveying and wetland delineations utilizing local sites and watersheds as the classroom.

Learning Outcomes: 1. Enhanced understanding of physical, chemical, and biological hydrological processes. 2. Development of critical thinking skills and the application of field methods and instrumentation used in evaluating hydrologic processes. 3. Development of technical communication skills and problem solving abilities on topics related to surface water hydrology. 4. Encouragement of lifetime learning habits through practical problem solving. Credits: 1.00

AGRY 34900 - Soil Ecology

Credit Hours: 3.00. An introductory course that will cover the basic concepts of soil ecology. Biological diversity and the interactions between and within biotic and abiotic components of the soil ecosystem, nutrient cycling, and genetic engineering are introduced.

Credits: 3.00

AGRY 35000 - Global Awareness

Credit Hours: 1.00 to 3.00. A seminar-type course about world geography, cultures, and agriculture. Speakers are selected from the many Purdue graduate students and visiting scholars from around the world. Extra credit may be earned through independent study of a global issue.

Credits: 1.00 to 3.00

AGRY 35500 - Soil Morphology And Geography

Credit Hours: 2.00. This course features field experience in advanced techniques in soil morphology including the study of the relationship of soils to landscaped, common parent materials of Midwest and classification of soils in the Soil

Taxonomy. Course material emphasizes the development of detailed descriptions of soil properties and how these properties directly impact the interpretations and recommendations for land use options. Use and management of soils based on landscape position and morphology will be covered including on-site waste disposal, homes with basements as well as road and street construction. Collegiate soil judging is a portion of the subject matter discussed. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 2.00

AGRY 36500 - Soil Fertility

Credit Hours: 3.00. Principles of soil chemistry and physics influencing plant nutrition; emphasis on diagnosis and solution of problems on soil reaction and nutrient status; fertilizer chemistry and use; reaction of pesticides and growth regulators with soils.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 37500 - Crop Production Systems

Credit Hours: 3.00. Factors affecting management decisions in crop production systems. Development of small grain and row cropping systems. Interaction of factors affecting efficient production systems, including seed selection, tillage, planting management, pest management, and harvesting and storage considerations.

Credits: 3.00

AGRY 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (NRES 38500) Designed as an upper level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience

and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 4.00

AGRY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in agronomy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AGRY 39800 - Agronomy Seminar

Credit Hours: 1.00. Weekly discussions of agronomic topics and other subjects relative to agronomic interest. Students are expected to participate in the discussions.

Learning Outcomes: 1. Critical Thinking: Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 2. Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 1.00

AGRY 39900 - Individual Study

Credit Hours: 1.00 to 3.00. Supervised individual study or research over topics not covered in other courses. Arrange with agronomy faculty before registering. Permission of instructor required.

Credits: 1.00 to 3.00

AGRY 42000 - Computing For The Natural Sciences

Credit Hours: 3.00. Basic programming, problem solving, data visualization and communication in the context of agriculture and natural science research using R. Topics include iteration, functions, vectors, strings, algorithms, graphics and reproducible reports in R. This course is appropriate for undergraduates with a curiosity in computing fundamentals and

interest in working with research data, especially those potentially applying to graduate school. Also appropriate for graduate students, researchers or other professionals who desire an introduction to programming with R. NO programming experience is necessary. This is not a statistics course; having had introductory statistics and some background coursework in agricultural or other natural sciences is expected.

Learning Outcomes: 1. Design, code and test small R programs. 2. Use programming to solve problems. 3. Communicate results with clean, reproducible reports. Credits: 3.00

AGRY 43100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (EAPS 42100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 3.00

AGRY 43200 - Atmospheric Dynamics I

Credit Hours: 3.00. (EAPS 42200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations; thermal wind relationships; circulation, vorticity, divergence, and vertical motion.

Credits: 3.00

AGRY 43300 - Atmospheric Dynamics II

Credit Hours: 3.00. (EAPS 42300) An extension of AGRY 43200 with the emphasis on perturbation theory and hydrodynamic stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

AGRY 44100 - Synoptic Laboratory I

Credit Hours: 1.00. (EAPS 43100) Analysis of vertical distributions of temperature and moisture with applications to adiabatic and pseudoadiabatic processes, hydrostatic stability, and air mass determination.

Credits: 1.00

AGRY 44200 - Synoptic Laboratory II

Credit Hours: 1.00. (EAPS 43200) Analysis of horizontal distributions of pressure, temperature, wind, vorticity, and vertical motions. Applications to synoptic scale wave propagation.

Credits: 1.00

AGRY 44300 - Synoptic Laboratory III

Credit Hours: 1.00. (EAPS 43300) Diagnosis of midtropospheric wave propagation and growth. Analysis of surface pressure fields and fronts and their relationships to upper air features. Extensive use is made of teletype and facsimile weather information.

Credits: 1.00

AGRY 44400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (EAPS 43400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

AGRY 45000 - Soil Conservation And Water Management

Credit Hours: 3.00. (NRES 45000) Principles of soil conservation with emphasis on control of soil erosion by wind and water; impact of soil management decisions on environment; soil-water-plant relations, includes agronomic aspects of water management for both irrigation and drainage.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 8. Demonstrate awareness

of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 3.00

AGRY 48000 - Plant Genetics

Credit Hours: 3.00. Principles and recent advances in plant genetics including: genetic segregation, linkage, DNA markers and applications, chromosomes and genomes, variation in chromosome number and structure, mutation, recombination and DNA repair, quantitatively inherited traits, introduction to principles of population genetics, gene expression, gene organization, regulation of gene activity, gene function, identifying important genes, cloning genes, reverse genetics, plant transformation, applications of genetic engineering, genome sequencing, using sequence data.

Credits: 3.00

AGRY 48500 - Precision Crop Management

Credit Hours: 3.00. An experiential lecture, discussion and field laboratory course for graduating seniors majoring in Agronomy. Analysis of multi-layer digital georeferenced crop data is used to inform the development and evaluation of zone-specific agronomic input prescriptions. Variables include factors affecting soil productivity, soil fertility and N management (including emerging sensor and crop modeling technologies). Prescriptions for variable crop genetics and seeding rates are also discussed. Sound agronomic use of emerging technologies such as real time soil moisture, organic matter, temperature and moisture sensing to affect variable seeding depth, rate and precision are included. May be used in combination with AGRY 49800 to meet the Agronomy undergraduate capstone requirement; will also meet the GIS/GPS requirement in Agronomy plans of study.

Learning Outcomes: 1. Understand the capabilities and use of integrated crop management digital data software packages (e.g. ENCIRCA from Dupont Pioneer or FieldView from Climate Corporation) to organize, analyze and interpret multiple layers and sources of geo-referenced data to correctly prescribe agronomic crop inputs and input levels. 2. Identify primary limitations within field zones and uniquely manage corn and soybean crops by zone-specific prescriptions. 3. Utilize data-based soil sampling strategies to manage soil fertility (primarily P, K, pH) on a site-specific basis. 4. Make cost-effective, environmentally-sound N fertility management recommendations for corn utilizing soil, genetic, agronomic and economic data, software crop models, temperature and precipitation data and sensors as tools for N management. 5. Write site-specific prescriptions for genetic (i.e. corn hybrid and soybean cultivar) placement and seeding rates. 6. Utilize geo-referenced field scouting data and crop models to prescribe effective pest management strategies. 7. Acquire, analyze and utilize, geo-referenced crop data from multiple sources including spectral reflectance, grain harvest yield maps (calibrated and cleaned), real-time sensor readings of soil organic matter, moisture and temperature at planting (e.g. SmartFirmer), soil conductivity, SSURGO and other geo-referenced soils map resources. 8. Explain the capabilities and utility of auto-steer, section control, and variable rate control crop production technologies. 9. Use yield maps plus as-applied site-specific crop input (e.g. N, P, K, ag lime, herbicide, hybrid, variety, seeding rate, fungicide and yield map layers as analytical tools to assess possible yield and profit-limiting factors 10. Evaluate potential crop response to varying input level main effects and input interactions with other yield-influencing factors (e.g. soil type X corn hybrid or soil type X corn hybrid X N rate interactions). 11. Describe and explain the impact of productivity influencing soils factors (e.g. soil drainage system design and installation, cover crops and crop residue management). 12. Describe the use of precision technologies in the management of irrigation (e.g. capacitance probe soil moisture sensing and crop modeling software) strategies. 13. Prepare and deliver a professional extension or industry education agronomic presentation covering an aspect of Precision Crop Management. Credits: 3.00

AGRY 49700 - Agronomy Internship Or Research Reporting

Credit Hours: 1.00. Reflection and reporting on participation in government, industrial, or other internship program or research assistantship. This course is intended to provide an opportunity for students to reflect on their internship experience, interact with students with similar experience, and report on the experience, as part of preparation for a career in the environmental sciences. Permission of department required.

Learning Outcomes: 1. Compare and contrast different professional settings and work environments through the internship experience. 2. Reflect on the internship experience and how it informs career goals. 3. Analyze and interpret simple data, appropriate to the professional setting. 4. Communicate effectively using written and oral media. Credits: 1.00

AGRY 49800 - Agronomy Senior Seminar

Credit Hours: 1.00. Weekly discussions and presentations on assigned topics in Agronomy, interpersonal interactions, professional ethics, and leadership skills. Student teams will evaluate case studies and present their analysis orally and in writing.

Credits: 1.00

Department of Animal Sciences

OverviewAnimal Science Picture Devon

The Purdue University Department of Animal Sciences promotes leadership and inspiration to educate students, enabling them to anticipate and effectively respond to challenges facing the global animal industries. The Animal Sciences faculty conducts relevant scientific research and facilitates technology transfer for efficient and sustainable production of high quality animal products, optimizing animal well-being, enhancing the human diet, and advancing sound environmental practices.

The vision of the Department of Animal Sciences is simple. We desire to be the "place to go" for the citizens of Indiana and beyond for knowledge in animal sciences. This includes students, commodity groups, industry partners, government agencies, consumers, and many others. Our shared goals are to:

- provide students with a rigorous and relevant education, preparing them for a lifetime of learning;
- achieve scientific preeminence in selected areas, and develop teams to identify and solve real world problems; and
- meet the needs of our diverse clientele making the best use of emerging technologies.

The Animal Sciences faculty has expertise in the disciplines of growth and development, nutrition, breeding and genetics, physiology, management, and animal well-being and behavior. In addition, scientists in the USDA Livestock Behavior Unit associated with Purdue are adjunct faculty members.

Concentrations include:

- Animal Agribusiness
- Behavior/Well-Being
- Biosciences
- Pre-Veterinary Medicine
- Production & Industry

Prospective Students (website)Animal Science 2nd image

Current Students (website)

Faculty (website)

Animal Sciences (website)

Contact Information

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Animal Science Minor

Animal Sciences: Animal Agribusiness Concentration, BS

Animal Sciences: Behavior/Well-Being Concentration, BS

Animal Sciences: Biosciences Concentration, BS

Animal Sciences: Pre-Veterinary Medicine Concentration, BS

Animal Sciences: Animal Production and Industry Concentration, BS

ANSC 10200 - Introduction To Animal Agriculture (UCC: STS)

Credit Hours: 3.00. A study of animal agriculture emphasizing the efficient production of animal food products from poultry, dairy and meat animals. Credit cannot be obtained for both ANSC 10100 and 10200. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by Department of Animal Sciences. This course is required for ANSC majors classified as Freshman and Sophomores.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

ANSC 10600 - Biology Companion Animal

Credit Hours: 3.00. Introduction to the various aspects of companion animal biology. Topics include anatomy, physiology, health, immunity, nutrition, growth, digestion, metabolism, behavior, genetics, reproduction and lactation.

Credits: 3.00

ANSC 12100 - Ethics Of Animal Use

Credit Hours: 2.00. The Ethics of Animal Use explores ethical issues relating to animal use in contemporary society. It integrates philosophical theories with scientific evidence relating to the use of animals in agriculture, biomedical research, companion animals, and issues relating to wildlife and the environment.

Learning Outcomes: 1. Describe ethical views related to animal use. 2. Evaluate the diversity of factors (personal values, knowledge/experience, regulation, and economics) which influence societal decisions about animal use. 3. Construct arguments using philosophical theories to support or refute ethical positions related to topics of animal use.
Credits: 2.00

ANSC 18100 - Professional Development And Exploration In Animal Sciences

Credit Hours: 1.00. Introduction to the faculty, programs, opportunities, career preparation, and personal development requirements needed to succeed in a career in the animal industries. Course meets during weeks 1-8.

Learning Outcomes: 1. Create and maintain professional documents such as a resume, cover letter, professional development plan, and LinkedIn profile. 2. Identify and analyze potential animal science careers. 3. Develop multiple parallel career plans and be able articulate those plans. 4. Enhance career success in animal sciences by participating in lectures focusing on leadership, professional development, and career exploration. Credits: 1.00

ANSC 22100 - Principles Of Animal Nutrition

Credit Hours: 3.00. Classification and function of nutrients, deficiency symptoms, digestive processes, characterization of feedstuffs, and formulation of diets for domestic animals.

Credits: 3.00

ANSC 23000 - Physiology Of Domestic Animals

Credit Hours: 4.00. A lecture and laboratory course designed to present physiology of domestic farm animals. Function of tissues and organs, maintenance of internal steady-state conditions, and body responses to external environmental conditions will be presented. Physiological mechanisms involved in lactation, growth, and reproduction will be included.

Learning Outcomes: 1. Understand the different physiological systems and their specific functions, including the detailed anatomy of each organ/organ system and their function on the cellular level. 2. Develop a thorough understanding of the principle of homeostasis, interactions between physiological systems, and regulation of mammalian/avian physiology. 3. Explain how physiological processes integrate across the whole animal. 4. Understand the similarities and differences in the anatomy and physiology among animal species, including humans, food animals, and companion animals. 5. Critically apply course learning to interpret basic laboratory findings of others. Credits: 4.00

ANSC 24000 - Principles Of Animal Production

Credit Hours: 3.00. A comprehensive overview of production systems including life cycles and animal requirements for non-ruminant and ruminant farm animals species. How animal production is affected by the environment, availability of resources, and market access will emphasized. Data requirements and interpretation for decision making will be highlighted.

Learning Outcomes: 1. Recall basic production terminology. 2. Explain production methodology from a scientific basis. 3. Identify and summarize scientific publications. 4. Identify what information is needed to make a decision. 5. Describe data needed to answer question/solve problem. 6. Evaluate validity of sources. 7. Demonstrate ability to manipulate data and make graphs/figures. 8. Describe aspects of a management system(s). 9. Propose animal production systems within given environments(s). Credits: 3.00

ANSC 24500 - Applied Animal Management

Credit Hours: 2.00. Skills and practices related to handling and care of beef and dairy cattle, horses, poultry, sheep, and swine.

Credits: 2.00

ANSC 25500 - Principles Of Animal Products

Credit Hours: 3.00. Survey of the animal product industries; meat, dairy, eggs, and wool. Meat as a food, conversion of muscle to meat, conversion of dairy to dairy products, food safety, food quality, inspection, and basic processing, in addition to basic wool production.

Learning Outcomes: 1. Explain the relationships between animal agriculture and food production; i.e. conversion of muscle to meat, lactation, egg production, fiber. 2. Identify and describe intrinsic and extrinsic factors affecting animal production and animal products. 3. Define and explain animal product safety, quality, and wholesomeness, and factors that impact each. 4. Evaluate current issues and technologies related to animal product quantity and quality. Credits: 3.00

ANSC 28100 - Career Planning In Animal Sciences

Credit Hours: 1.00. A seminar course designed to inform students of the career opportunities in animal industries, develop their interviewing and other interpersonal skills, and begin to plan the course of study, work experiences, and marketing methods needed to obtain a successful internship and employment.

Credits: 1.00

ANSC 29200 - Special Assignments

Credit Hours: 0.00. To be arranged with individual staff members prior to registration. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Permission of department required.

Credits: 0.00

ANSC 29300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and AGR 49300 cannot exceed six credits. Permission of instructor required.

Credits: 1.00 to 3.00

ANSC 29500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in formal courses of the department. The specific topic that is offered will be indicated on the student's record. May be repeated for credit with variable title. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 30100 - Animal Growth, Development, And Evaluation

Credit Hours: 2.00. Provides an overview of how nutrition, genetics, and environment affect beef cattle, swine, and sheep growth, development, and end-product quality and value. Students receive hands-on experience evaluating and determining the economic value of live animals and carcasses in various market grids.

Learning Outcomes: 1. Summarize animal growth and development and its relation to carcass and live animal traits. 2. Evaluate meat animals and their carcasses. Students will be expected to learn the techniques discussed and be able to apply them to slaughter animals and carcasses. Students will be expected to demonstrate knowledge of the accuracy and objectivity of these evaluation techniques. 3. Explain carcass composition. Students will be expected to know the yields of carcasses obtained from meat animals and the yields of edible product and waste materials obtained from meat animal carcasses. 4. Compare economically important traits of carcasses to traits of meat animals. Students will be expected to learn how carcass value is established and its relation to value of slaughter animals. Credits: 2.00

ANSC 30300 - Animal Behavior

Credit Hours: 3.00. Discussion of animal behavior with emphasis on developing an understanding of the reasons domesticated animals react the way they do toward their kind and to humans. The laboratory will be used for observation of behavior patterns in animals. Solutions for unusual behavior include behavior modification techniques.

Credits: 3.00

ANSC 31100 - Animal Breeding And Genetics

Credit Hours: 4.00. Genetic principles and their applications in improvement of production efficiency in livestock.

Learning Outcomes: 1. Explain how decisions relative to selection and mating systems to result in animal improvement. 2. Discuss mating systems and impact of systems on inbreeding and heterosis. 3. Understand the impact of heritability, accuracy of selection, and intensity of selection. Credits: 4.00

ANSC 32400 - Applied Animal Nutrition

Credit Hours: 3.00. Application of the principles of animal nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Understand and apply basic nutritional principles in the use of available ingredients to provide optimum nutrition for growth, development and reproduction. 2. Become familiar and competent with a least cost computer program on feed formulation as used by the commercial feed industry. 3. Enhance student understanding and appreciation of animal research with hands-on experience in conducting and summarizing nutrition research. Credits: 3.00

ANSC 32500 - Applied Ruminant Nutrition

Credit Hours: 2.00. Application of the principles of ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution

values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic ruminant nutrition principles are applied to solve ""real world"" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 32600 - Applied Non-ruminant Nutrition

Credit Hours: 2.00. Application of the principles of non-ruminant nutrition to the formulation and feeding of supplements and complete rations for animals; ration ingredients and substitution values; computer applications; legal aspects of feed formulation; and industry practices.

Learning Outcomes: 1. Become proficient in basic diet formulation. 2. Develop a better understanding of how basic non-ruminant nutrition principles are applied to solve "real world" nutritional challenges. 3. Develop independent problem-solving skills. 4. Improve written and oral communication. 5. Increase computer proficiency. Credits: 2.00

ANSC 33100 - The Role Of Horses In Human History, Culture, And Society (UCC: HUM)

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the history of the human-horse relationship in a global context. Because the history of horse and human interaction is so broad and so important to the development of civilization, the course will include a broad view of horses in the context of agriculture, transportation, sport, culture and art.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Interpret and explain the integral role horses have played in human civilization. 2. Compare the roles of horses in Asia, Europe and the Americas through history. 3. Analyze the impact of horses on the political, social and cultural environments in different parts of the world. 4. Develop a logical argument as to why horses still have a role in international society in the contemporary historical period. Credits: 3.00

ANSC 33200 - Environmental Physiology Of Domestic Animals

Credit Hours: 2.00. Interactions of environmental factors with physiological processes in domestic animals.

Credits: 2.00

ANSC 33300 - Physiology Of Reproduction

Credit Hours: 3.00. This course is designed to introduce students to the essential principles of mammalian reproduction and apply this knowledge in a hands-on laboratory setting. Upon completion of this course, students are expected to understand the processes of sexual determination, sexual differentiation, steroid hormone signaling, spermatogenesis, oogenesis, fertilization, gestation, parturition and lactation.

Learning Outcomes: 1. Identify and describe functions of the macroscopic and microscopic parts of the reproductive and mammary systems of the male and female of several livestock species. 2. Discuss relationships among cells, tissues, glands, hormones and organs involved in reproduction and lactation and explain the main biological mechanisms involved in each of these processes. 3. Explain how reproduction and lactation are influenced by environmental and genetic factors. 4. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 34500 - Animal Health Management

Credit Hours: 3.00. The objectives of this course are to familiarize the student with disease processes and mechanisms. Management techniques in food, companion, and research animal species that minimize or prevent disease will be emphasized, as well as the consequences on animal production, reproduction, and human health.

Credits: 3.00

ANSC 35100 - Meat Science

Credit Hours: 3.00. Study of muscle and meat, principles involved in the conversion of living animals to meat and by-products; efficient utilization of all types of meat as food.

Credits: 3.00

ANSC 35101 - Meat Science Laboratory

Credit Hours: 1.00. Application of scientific principles to the meat industry, with emphasis on all aspects of processing including: harvest; carcass grading and evaluation; fabrication; cured, smoked, and comminuted meat products; quality control; product development; and retail and food service merchandising.

Credits: 1.00

ANSC 36000 - Muscle Food Production And Safety

Credit Hours: 3.00. Study the science, art, and economics of processed meats. Investigate methods to add value to meat and meat products, including hands-on processing, new product development, and industry tours. Study of meat-borne pathogens and methods of control. Science and practical aspects of food safety in meat production. Seven principles of HACCP will be investigated and each student will receive HACCP Certification from the International HACCP Alliance.

Learning Outcomes: 1. Explain the science, art, and economics of processed meat production. 2. Analyze the physical, chemical, and biochemical reactions involved in the manufacture of further processed meat products. 3. Understand the intrinsic factors of muscle composition (protein and lipid chemistry) and the relationship to the functionality of processed meat products. 4. Categorize the hazards associated with meat products and the procedures used to mitigate these hazards to develop a HACCP plan. 5. Apply meat science knowledge and problem solving to the process of new product development; concept development, formulation, evaluation, economic feasibility, and regulations. Credits: 3.00

ANSC 37000 - Livestock Evaluation

Credit Hours: 2.00. This course is designed to develop logical thinking and speaking skills, while developing the ability to critically evaluate livestock in their production environments. Prior experience in public speaking or judging is not required. The combination of ANSC 37000, ANSC 37100, ANSC 37200, ANSC 47000, ANSC 47100, and ANSC 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 37100 - Dairy Evaluation

Credit Hours: 2.00. This course will enable the student to become familiar with breeds of dairy, parts of dairy cattle and their relationship to function. Opportunities will exist to associate with people from various breed organizations within the dairy industry. The combination of ANSC 37000, 37100, 37200, 47000, 47100, and 47200 cannot exceed three credits toward ANSC electives. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 2.00

ANSC 38100 - Leadership For A Diverse Workplace

Credit Hours: 3.00. An interactive, small group discussion class covering effective interpersonal and group skills needed to enhance career satisfaction in a diverse workplace including building networks within industry, cross-cultural communication and gaining experiences in group problem-solving and decision-making. This course may be used as an additional written communication elective as required in all plans of study in Animal Sciences.

Learning Outcomes: 1. Learn opportunities and mechanisms used to pursue job placement, graduate school or professional schools. 2. Interact with alumni to build networks and appreciate the real-life challenges faced in careers in animal industries. 3. Use numerous team experiences to develop comfort and effectiveness in functioning in teams and committees. Credits: 3.00

ANSC 39000 - Animal Sciences Internship

Credit Hours: 0.00. Internships with producers, businesses, or agencies arranged in cooperation with faculty coordinator. Permission of department required.

Credits: 0.00

ANSC 40000 - Animal Sciences Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ANSC 40400 - Animal Welfare

Credit Hours: 3.00. A multi-disciplinary course that introduces students to the fields of animal welfare and the ethics of animal use. The course will emphasize farm animal welfare and production issues. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 41500 - Advanced Animal Physiology

Credit Hours: 3.00. This course is an advanced physiology course building on concepts and knowledge introduced in ANSC 23000 about whole body physiology. Additionally, this course will introduce interpretation of scientific literature to understand physiological processes.

Learning Outcomes: 1. Interpret and analyze scientific literature in Animal Physiology. 2. Evaluate the background and methodology used in the literature, compare different and opposing lines of thought, including their own conclusions derived from the work. 3. Acknowledge the critical thinking process in scientific work and how it could lead to the right or wrong conclusions if not carefully assessed. 4. Identify and name the components of the body systems. 5. Describe the physiological process that govern the body systems. 6. Describe the interactions between body systems. Credits: 3.00

ANSC 42500 - Ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with the reproductive management of beef cattle, dairy cattle, goats, and sheep will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of ruminant livestock. Credits: 2.00

ANSC 42600 - Non-ruminant Reproductive Farm Management

Credit Hours: 2.00. This course will teach how to apply the animal science disciplines such as nutrition, genetics, physiology, and animal behavior in a systems approach that will result in the desired level of reproductive performance. Animal handling skills associated with reproductive management of swine and horses will be discussed. Laboratories require use of both live animals and animal specimens.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in non-ruminant farm animals. 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of non-ruminant livestock. Credits: 2.00

ANSC 43500 - Reproductive Management Of Farm Animals

Credit Hours: 3.00. Management practices associated with improved reproductive efficiency. Procedures for diagnosis of reproductive failure and practical methods of controlling reproduction will be identified.

Learning Outcomes: 1. Understand practical skills required for assisted reproductive technologies in farm animals 2. Utilize principles, facts and concepts gained from course material to provide solutions to problems related to reproduction and lactation of livestock. Credits: 3.00

ANSC 44000 - Horse Management

Credit Hours: 3.00. Current breeding, feeding, housing, selection, disease control, and other management practices essential for sound economic planning of horse operations in today's horse industry. Laboratory farm visits provide students with real application examples and industry contacts.

Credits: 3.00

ANSC 44100 - Beef Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical beef production, including

performance testing.

Credits: 3.00

ANSC 44200 - Sheep Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for economical sheep production and commercial lamb feeding, including performance testing.

Credits: 3.00

ANSC 44300 - Swine Management

Credit Hours: 3.00. Breeding, feeding, and management practices essential for commercial swine production, including performance testing.

Credits: 3.00

ANSC 44400 - Dairy Management

Credit Hours: 3.00. Current breeding, feeding, physiology, disease prevention, and management practices essential for economical milk production. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44500 - Commercial Poultry Management

Credit Hours: 3.00. Current developments and practices in the commercial production of eggs, broilers, and turkeys; principles of breeding, physiology, nutrition, management, and disease prevention. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

ANSC 44600 - Companion Animal Management

Credit Hours: 3.00. This course details understanding of the economic scope of the pet industry as well as the role of pets in American society. The students will acquire the information to be responsible pet owners by experiencing their knowledge of housing practices, nutritional care, health care, behavior and breeding of companion animals.

Credits: 3.00

ANSC 47000 - Livestock Judging

Credit Hours: 1.00. This course is designed to teach livestock evaluation, relationship of production data to live animal evaluation characteristics, expand logical thinking and reasoning skills, and enhance oral communication skills. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 47100 - Dairy Judging

Credit Hours: 1.00. Opportunities will exist to allow the student to practice analysis and enhance decision-making processes in placing animals in collegiate dairy contests. Communication skills will be developed to properly present and defend those decisions with confidence. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 1.00

ANSC 48100 - Contemporary Issues In Animal Sciences

Credit Hours: 1.00. Industry-led and student-led discussions and debate of current issues facing animal industries. Experiences from internships, research problems, study abroad, or job shadowing will be shared among the students.

Learning Outcomes: 1. Become aware of contemporary issues and science-based solutions in the animal science industries. 2. Enhance teamwork and problem-solving skills for resolving current issues in the animal industries. 3. Actively listen and communicate a science-based response as a team to a contemporary issue presented by industry leaders, agencies and policymakers. 4. Establish professional contacts for solving industry-related problems and to enhance employer networking with industry, alumni, faculty and peers. 5. Enhance career planning and employment seeking skills to empower animal science students to obtain the best career path based on their strengths and interest. Credits: 1.00

ANSC 48500 - Dairy Farm Evaluation

Credit Hours: 2.00. This course will provide students with an opportunity to integrate and apply knowledge of dairy cattle management systems, nutrition, reproduction, genetics, milk quality, animal handling, physical farm facilities, manure handling and management, personnel and their financial implications. Students will develop critical analysis skills and apply troubleshooting principles in the identification and resolution of dairy farm management issues in a learning environment that is structured around farm evaluation field trips and case studies.

Learning Outcomes: 1. Increase understanding of dairy farm management systems. 2. Integrate knowledge of animal sciences with dairy-specific experiences. 3. Highlight opportunities for lifelong learning. 4. Foster critical thinking and evaluation skills. 5. Promote communication skills. 6. Encourage professionalism through tactful delivery of critical analyses. 7. Provide critical evaluations of dairy farms as a service to the owners.
Credits: 2.00

ANSC 49100 - Special Problems

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or library assignments. Written reports required. Permission of instructor required.
Credits: 1.00 to 3.00

ANSC 49300 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, discussions, written reports, seminar presentations, teaching, field or laboratory experiences provided for enrichment in special areas of animal science. Combination of ANSC 29300 and 49300 cannot exceed six credits. Permission of instructor required.
Credits: 1.00 to 3.00

ANSC 49500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic that is offered will be indicated on the student's record. Permission of instructor required.
Credits: 0.00 to 3.00

ANSC 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For students doing specialized animal sciences research; report required. Arrange with academic advisor and honors research coordinator before registering. Permission of instructor required.
Credits: 1.00 to 6.00

Department of Biochemistry

Biochemistry PhotoOverview

The Department of Biochemistry is a vibrant research community with widespread, multidisciplinary collaborations. We offer both undergraduate and graduate programs with emphasis on research excellence in broad areas of science. The field of biochemistry has historically focused on molecular dissection of biological molecules and cellular pathways. Our current faculty build upon this classical approach, using cutting-edge approaches ranging from genome-wide transcriptional analyses, state-of-the-art mass spectroscopy, and x-ray crystallography in a variety of model systems including bacteria, fungi, plants and fruit flies. These approaches allow our researchers to link real world problems such as energy production and human disease prevention to defects in basic molecular processes, tackling the most pressing issues in society.

Faculty (website)

Department of Biochemistry (website)

Contact Information

Department of Biochemistry
Purdue University
Biochemistry Building
175 South University Street
West Lafayette, IN 47907-2063
Phone: 765-494-1600
Email: biochem-boilers@purdue.edu

The main office for the department is located in Room 120 of the BCHM Building.

Graduate Information

For Graduate Information please see Biochemistry Graduate Program Information .

Biochemistry Minor

Biochemistry: Pre-Med Concentration, BS

Biochemistry: Pre-Vet Concentration, BS

Biochemistry, BS

Bioinformatics Minor

BCHM 10000 - Introduction To Biochemistry (UCC: STS)

Credit Hours: 2.00. A survey of modern biochemistry using case studies that highlight general theories and unifying concepts. This course is open to all majors and does not require any college science courses as background or prerequisite.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. Be able to develop hypotheses, design experiments and critically analyze results to create new knowledge. 3. Appreciate the ethical issues facing professionals in the life sciences. 4. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 10100 - Introduction To Biochemistry Laboratory

Credit Hours: 1.00. An entry-level laboratory course to help freshmen students become interested and excited about scientific research, and at the same time, gain the skills necessary to become better prepared for undergraduate research opportunities. Students perform real-world experiments to identify single base-pair changes in a DNA sequence that can change a protein-protein interaction. Students learn common laboratory skills such as pipetting, centrifugation, and sterile technique. Students also learn how to display and interpret scientific results in written form.

Learning Outcomes: 1. Demonstrate common laboratory skills such as sterile technique, micropipetting, centrifugation, plasmid DNA isolation, and culturing bacteria and yeast. 2. Define commonly used laboratory terminology and understand and execute protocols that contain these terms. 3. Display and interpret scientific methods and results in written form. 4. Identify positive and negative controls for an experiment. 5. Write an appropriate aim for an experiment. 6. Analyze DNA and protein sequence information. Credits: 1.00

BCHM 22100 - Analytical Biochemistry

Credit Hours: 3.00. Discussion of qualitative and quantitative analysis of biological compounds including pH measurement and control, spectrophotometry, measurement of radioactivity; theoretical basis of various separation techniques, including chromatography and electrophoresis; application of these methods to separation and analysis of biological compounds. Laboratory sessions will provide practical experience in the use of these methods. This course is designed for biochemistry majors.

Credits: 3.00

BCHM 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by departmental faculty and College of Agriculture Honors Committee. Restriction: Enrollment in an honors program. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

BCHM 29000 - Experimental Design Seminar

Credit Hours: 2.00. Introduction to fundamentals of scientific principles and practice in biochemistry. Students will learn how to develop hypotheses, design experiments, and critically analyze results to create new knowledge. Intended for sophomores.

Learning Outcomes: 1. Have an understanding of the scientific method. 2. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Have an appreciation of ethical issues facing professionals in the life sciences. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. Credits: 2.00

BCHM 29800 - Introduction To Biochemistry Research

Credit Hours: 1.00 or 2.00. Supervised individual research. This course is intended to provide an introduction to independent undergraduate research. The primary goal of this experience is to learn the mechanics of laboratory science. Students will learn to work in a real laboratory situation where experiments are not preassembled for them. Students will record their data in laboratory notebooks, and gain experience in trouble-shooting and critically analyzing the results of their experiments. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 3. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 4. Demonstrate knowledge of accepted safe laboratory practices. 5. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 6. Demonstrate the ability to organize and document laboratory procedures and results. 7. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 or 2.00

BCHM 29801 - Head Start To Introductory Biochemistry Research

Credit Hours: 0.50 or 1.00. Supervised individual research. Weeks 9-16. This course is intended to provide a brief introduction to independent undergraduate research. Students should plan on continuing their research in the same laboratory in the following semester. The primary goal of this course is to gain experience working side-by-side with researchers in a real laboratory setting. Students will begin to learn how to best record their data in laboratory notebooks, and gain experience in trouble-shooting and critically analyzing the results of their experiments. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 3. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 4. Demonstrate knowledge of accepted safe laboratory practices. 5. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 6. Demonstrate the ability to organize and document laboratory procedures and results. 7. Appreciate the ethical issues facing professionals in the life sciences. Credits: 0.50 or 1.00

BCHM 30700 - Biochemistry

Credit Hours: 3.00. Students will have an understanding of the following content areas: structure/function of amino acids, carbohydrates, lipids and nucleic acids; protein structure, function and purification; basic enzymology; replication, transcription and translation; intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. Students will also develop an appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.

Learning Outcomes: 1. Understanding of the structure/function of amino acids, carbohydrates, lipids and nucleic acids. 2. Understanding of protein structure, function and

purification. 3. Understanding of basic enzymology. 4. Understanding of replication, transcription and translation. 5. Understanding of intermediary metabolism including glycolysis, the citric acid cycle, oxidative phosphorylation, photosynthesis. 6. Appreciation for some of the contributions that have been made by biochemistry to society, including improvements to medicine, agriculture, and the economy.
Credits: 3.00

BCHM 30900 - Biochemistry Laboratory

Credit Hours: 1.00. Experiments that introduce methods for analysis and separation of biological molecules and that illustrate the biochemical and metabolic concepts covered in BCHM 30700.

Credits: 1.00

BCHM 32200 - Analytical Biochemistry II

Credit Hours: 2.00. Modern biochemical techniques for the purification and characterization of biological proteins. This is a project-oriented course where students begin by purifying a recombinant enzyme by affinity chromatography and then characterize various biochemical properties of the enzyme throughout the semester. Emphasis will be placed on quantitative analyses, including measurements of enzyme activity and inhibition, molecular interactions, and oligomeric state. Students will learn basic principles of designing assays to measure biochemical phenomena. Use of bioinformatics and computational modeling tools for protein structure analysis will be integrated. The course will culminate with preparation of a manuscript-style report describing the enzyme characterization.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Skilled laboratory scientists performing a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. Understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge. 4. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. 5. Communicate scientific knowledge, experiments and conclusions effectively as writers. 6. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment.
Credits: 2.00

BCHM 36100 - Molecules

Credit Hours: 3.00. A lecture course that relates biochemistry to organic chemistry. Chemical principles relevant to the assembly and function of macromolecules, the logic of biological free energy conversion, and enzyme catalysis are emphasized, all of which provide a foundation for the study of metabolism.

Learning Outcomes: 1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids. 2. Demonstrate knowledge of the higher order structures of proteins, nucleic acids and polysaccharides. 3. Understand the principles of enzyme catalysis and regulation. 4. Demonstrate knowledge of lipid membrane structure and function. 5. Understand how energy is harvested and utilized by biological systems. 6. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 7. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy and the environment.
Credits: 3.00

BCHM 39000 - Professional Development Seminar

Credit Hours: 1.00. The objective of this course is to help biochemistry students with professional development and career planning. Students will learn about career possibilities, interview skills, job search strategies, graduate and professional school applications, resume construction and industrial practices. Intended for juniors.

Learning Outcomes: 1. Understand the contributions of our discipline to society, including improvements to medicine,

agriculture, the economy and the environment. 2. Acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication. Credits: 1.00

BCHM 39100 - Internship In Biochemistry

Credit Hours: 0.00. Professional internship with biochemistry related employers in industry, government or small business. Permission of department required.

Learning Outcomes: 1. Contribute toward the student's development in the College of Agriculture outcomes related to professional preparation, critical thinking, and problem solving, communication and teamwork. 2. Contribute to program outcomes related to understanding the contributions of our discipline to society, appreciating the ethical issues facing professionals in the life sciences, communicating scientific knowledge, performing a wide variety of biochemical and olecular techniques and understanding the scientific method. Credits: 0.00

BCHM 40000 - Biochemistry Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

BCHM 42100 - R For Molecular Biosciences

Credit Hours: 3.00. Students will acquire, assess, clean, visualize and analyze biological data sets with R. Students will be able to describe the link between complex biological phenomena and the data captured through human observation or scientific instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R will be taught starting with small-scale data such as drug sensitivity assays moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of increasing data literacy and enabling reproducible research through clear documentation of data and communication of analyses. Relevant concepts from biology and statistics will be reviewed.

Learning Outcomes: 1. Understand how complex biological phenomena are captured as data. 2. Learn how to manage data science projects using tools such as R, Linux and remote computing. 3. Use R to acquire, assess, clean, organize, visualize and analyze biological data. 4. Use R to document and communicate analysis of biological data. Credits: 3.00

BCHM 42200 - Computational Genomics

Credit Hours: 3.00. This course introduces students to modern genomics and computational tools that will be used for screening. Students will review the notion of gene, genomic, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these with cell.

Learning Outcomes: 1. Evaluate features of a genome (e.g. conservation, GC content, gene coding potential). 2. Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed. 3. Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments. 4. Integrate various genomics data to answer specific biological question related to genomics and gene regulation. Credits: 3.00

BCHM 43400 - Medical Topics In Biochemistry

Credit Hours: 3.00. This course applies the principles of biochemistry and metabolic regulation to understand the diagnosis and treatment of human disease. The course emphasizes the biochemistry relevant to diabetes, blood disorders and the medical consequences of liver disease and aging. Roughly half of the class time is focused on small group activities including team-based learning and problem-based learning using patient cases. Students will search authoritative sources to discover links between biochemistry and clinical symptoms and communicate that information to their peers.

Learning Outcomes: 1. Understand mechanisms that regulate metabolic pathways within individual cells, tissues and organ systems in healthy and disease patients. 2. Predict biochemical and clinical effects given specific defects in a pathway. 3. Appreciate ethical issues facing life science professionals

who perform research involving humans or human tissues. 4. Communicate scientific knowledge effectively to non-scientists. Credits: 3.00

BCHM 46200 - Metabolism

Credit Hours: 3.00. A lecture course to provide students with a broad and thorough understanding of core metabolic pathways and how they are resulted. Anabolic and catabolic processes of metabolic pathways will be studied at the biochemical, structural, genetic and molecular levels. Students will learn to appreciate how the various metabolic pathways are integrated and how the fundamental metabolic pathways relate to medicine, agriculture and human disease.

Learning Outcomes: 1. Students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 46500 - Biochemistry Of Life Processes

Credit Hours: 2.00. Major questions in biochemistry and contemporary approaches to these problems. Material covered in class will primarily be derived from primary literature. Students will continue to develop the skills needed to critically read, evaluate, and assimilate the primary scientific literature.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. 3. Develop hypotheses, design experiments and critically analyze results to create new knowledge. 4. Acquire information literacy: the ability to locate, evaluate and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis and communication. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contribution of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 2.00

BCHM 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 2. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 3. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 4. Demonstrate awareness of civic responsibility to community and society at large. 5. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. Demonstrate use of the scientific method to identify problems, formulate and text hypotheses, conduct experiments and analyze data, and derive conclusions. 6. Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community. 7. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 1.00 to 4.00

BCHM 49000 - Undergraduate Seminar

Credit Hours: 1.00. Discussion of individual student's research projects. Preparation of posters and public seminars based upon research results. Permission of instructor required.

Learning Outcomes: 1. Become skilled laboratory scientists. 2. Perform a wide variety of biochemical and molecular techniques. 3. Understand the scientific method. They will be able to develop hypotheses, design experiments, and analyze results to create new

knowledge. 4. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 5. Appreciate the ethical issues facing professionals in the life sciences. 6. Understand the contributions of the discipline to society, including improvements to medicine, agriculture, the economy, and the environment. Credits: 1.00

BCHM 49500 - Special Assignments

Credit Hours: 1.00 to 3.00. Special work in biochemistry not included in other courses. Permission of instructor required.

Credits: 1.00 to 3.00

BCHM 49800 - Research In Biochemistry

Credit Hours: 1.00 to 6.00. Supervised individual research. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method; able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 1.00 to 6.00

BCHM 49801 - Head Start To Biochemistry Research

Credit Hours: 0.50 to 2.00. Supervised individual research. Weeks 9-16. This course is intended to provide a brief research experience in preparation for in-depth, independent undergraduate research the following semester. The students enrolled in this course will begin to learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in written form. Permission of instructor required.

Learning Outcomes: 1. Understand the scientific method. They will be able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 0.50 to 2.00

BCHM 49900 - Honors Thesis In Biochemistry

Credit Hours: 3.00. This course is intended to provide the opportunity for in-depth, independent undergraduate research. The students enrolled in this course will learn how to devise hypotheses, design experiments that test their hypotheses, record their data in laboratory notebooks, critically analyze the results of their analyses, and present their findings to others in

the form of a written thesis. Permission of instructor required.

Credits: 3.00

BCHM 56600 - General Biochemistry

Credit Hours: 4.00. This course provides an overview of the fundamental biochemical and structural properties of amino acids, nucleic acids, lipids and carbohydrates, the major chemical building blocks of biological systems. The course will connect those properties to the structure and function of macromolecules and cellular structures (e.g. proteins, DNA, membranes). The catalytic mechanisms, kinetic properties and regulation of enzymes will be covered, including the interpretation of data from enzyme assays. Finally, the course provides an overview of how multiple enzymatic activities and their regulation define key metabolic pathways that generate energy, synthesize and degrade biomolecules, and maintain cellular homeostasis.

Learning Outcomes: 1. Identify and interpret the role of weak chemical forces in macromolecular structure and function. 2. Apply the principles of chemistry and thermodynamics to explain the higher order structure of proteins, nucleic acids, and membranes. 3. Interpret chemical and kinetic data to evaluate the specificity, catalytic mechanism and regulation of enzymes. 4. Compare and contrast the roles of lipids and proteins in membrane structure and function. 5. Identify and interpret the function and regulation of the major metabolic pathways that sustain life. 6. Decipher the logic of the enzyme-facilitated chemical transformations of the core metabolic pathways that generate energy and synthesize/degrade the major biochemical building blocks. 7. Interpret the structure of selected enzymes, their regulation, and the biochemical mechanisms by which they catalyze metabolic reactions. Credits: 4.00

Department of Botany and Plant Pathology

Botany main page

Overview

Welcome to the Department of Botany and Plant Pathology at Purdue University.
Plants are key to all life on earth and are critical for global carbon cycles and ecosystem function. Plants also provide us with food, medicines, and many other products. The Purdue Department of Botany and Plant Pathology has been at the forefront of plant science research, teaching, and community engagement since 1887. Our department includes 35 faculty who are advancing and teaching the disciplines of plant biology, plant pathology, and weed science.
With a degree in Plant Science from Purdue's Botany and Plant Pathology department, you will gain fundamental knowledge about plant evolution and diversity, structure, function, ecology, and development. Career opportunities include environmental and conservation biology, teaching in schools and colleges, research and teaching in academia, industry research and development, managing botanic gardens, and stewardship of our natural world through private and governmental programs.

Faculty (website)

Department of Botany and Plant Pathology (website)

Contact Information

Department of Botany and Plant Pathology
Purdue University
Lilly Hall of Life Sciences
915 West State Street
West Lafayette, IN 47907-2054
Phone: 765.494.0352
E-mail: botany@purdue.edu
The main office for the department is located in Room 1-446 of LILY Hall.

Graduate Information

For Graduate Information please see Botany and Plant Pathology Graduate Program Information .

Plant Biology Minor

Plant Pathology Minor

Weed Science Minor

Plant Science, BS

BTNY 11000 - Introduction To Plant Science (UCC: SCI)

Credit Hours: 4.00. An introduction to the major groups in the plant kingdom, their origin, classification, and economic importance. The areas of anatomy, morphology, cytology, physiology, biochemistry, molecular biology, genetics, and ecology will be explored as they relate to plant sciences and agriculture. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Botany and Plant Pathology.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 4.00

BTNY 12000 - Principles Of Plant Biology I

Credit Hours: 4.00. This course is the first of a two-semester series that introduces fundamental biological concepts and prepares students for more specialized plant biology studies. Lectures and laboratory exercises will cover the topics of plant diversity, morphology, physiology, and ecology. Throughout the course, emphasis will be placed on how scientific data is collected and interpreted, and the lab component will perfect key observational skills in botany. Our goal is to provide essential foundational knowledge in plant biology for progression to upper-level courses.

Learning Outcomes: 1. Know the major groups of land plants and describe the life cycles of each of these groups. 2. Describe and identify the key features of a plant. 3. Identify and describe the properties of life and levels of organization among living organisms. 4. Explain how plants obtain and use resources, highlighting relationships between structure and function. 5. Recognize the factors that influence the abundance and distribution of plants. 6. Examine how environmental change impacts the physiology and ecology of plants. 7. Practice qualitative and quantitative analytical and communications skills. Credits: 4.00

BTNY 12100 - Principles Of Plant Biology II

Credit Hours: 4.00. This course is an introduction to fundamental biological concepts designed to prepare students for more specialized study. Lectures and laboratory exercises will cover mechanisms and processes of genetics, molecular biology and cell biology. Our goal is to convey how these levels of organization are integrated. Throughout the course, emphasis will be made on the means by which scientific data is collected and interpreted, and key experiments performed in the lab component will be used to illustrate this process.

Learning Outcomes: 1. Understand the structure and function of nucleic acids in plants. 2. Understand the means by which genetic information is passed on from cell to cell and generation to generation. 3. Understand the ways that the genetic composition of plants can be altered and manipulated. 4. Identify and describe the properties of life and levels of organization among living organisms. 5. Outline the structure of biomolecules and relate their structure to function. 6. Identify basic cell components and discuss their cellular functions and relationships. 7. Explain how plants develop from a single cell into a complex organism. 8.

Practice qualitative and quantitative analytic and communications skills. Credits: 4.00

BTNY 20700 - The Microbial World

Credit Hours: 3.00. This course delivers a broad synthesis of microbiology, discussing all taxa of the microbial world. The course also discusses a wide range of subjects related to microbiology, including medical microbiology, but it has a strong emphasis on the botanical and environmental sciences. One particular characteristic that separates it from other microbiology courses is the reduced emphasis upon bacteriology, with discussions of the protists and viruses and, especially of the fungi, occurring in greater detail than the other general microbiology courses available.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 3.00

BTNY 20800 - Introduction To Plant Science Research

Credit Hours: 1.00. The course is designed to expose students to the diversity of Plant Science research at Purdue and help students to get started in research and in the fantastic world of scientific discovery. Students will learn the importance of Plant Science research in society and how to become active participants of Purdue research discoveries. Students will learn about the scientific method and how discoveries are made to find answers to world problems. The students will explore department and campus resources to identify areas of research interest, learn how to search and apply for research/internship opportunities and find faculty that can serve as professional models and mentors. We will provide opportunities for students to interact and network with faculty members, professionals from industry and students involved in diverse research areas.

Learning Outcomes: 1. Recognize the importance of plant science research and its contribution to society. 2. Define ""scientific method"" and outline the process of scientific discovery. 3. Recognize the value of publishing/communicating scientific knowledge. 4. Critically evaluate claims in both scientific and popular media publications. 5. Identify possible research and internships experiences. 6. Identify necessary skills for specific careers in Plant Sciences. Credits: 1.00

BTNY 26200 - Plant Structure And Tissue Biology

Credit Hours: 3.00. This course focuses on fundamental knowledge of the internal structure of plants, including distinct cell types, tissues, tissue systems, and organs that make up a plant. Lectures and laboratories will cover the structural parts that comprise the plant body including three major vegetative organs (roots, stems, and leaves) and a set of reproductive organs (flowers, fruits, and seeds). The goal of this course is to understand the internal organization of plants, to learn multiple lab techniques critical for plant science research, and to develop critical thinking and problem solving skills.

Learning Outcomes: 1. Describe the internal structure of plants. 2. Perform lab techniques, such as fresh sectioning and microscopy, for plant science research. 3. Critically evaluate plant cell, tissue, and organ structures. Credits: 3.00

BTNY 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first-and second-year students. Courses offered must be approved by department or program faculty, and College of Agriculture Honors Committee. Permission of department required.

Learning Outcomes: 1. Learning Outcomes will be determined by the instructor to meet a level of academic rigor consistent with the honors level given the specific course content and may also include: Critical Thinking, Communication, Cultural Understanding, Civic Responsibilities, Professional Preparation, Scientific Principles, Social Science Principles, and/or Teamwork.

Credits: 1.00 to 4.00

BTNY 28500 - Plants And Civilization (UCC: STS)

Credit Hours: 3.00. This course, intended primarily for non-majors, covers the history of agriculture, with focus on the centers of origin of our major food, fiber, and medicinal plants, and their historical, cultural, and economic relevance. The course also surveys the biology of crop plants, with respect to taxonomy, anatomy, cell structure, physiology, development, and genetics. Discussions also center on the roles plant biotechnology may play in sustainable agriculture and in helping to alleviate problems caused by overpopulation and ecological stress.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Professional preparation, scientific principles, critical thinking, cultural understanding, social science principles and lifelong learning. Credits: 3.00

BTNY 29800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research for freshmen and sophomore undergraduate students. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

BTNY 30100 - Introductory Plant Pathology

Credit Hours: 3.00. Basic principles of plant pathology, including etiology, symptomatology, control, and epidemiology of representative diseases of plants.

Learning Outcomes: 1. Recognize the signs and symptoms of plant disease so that you can distinguish between diseases caused by pathogenic entities and those caused by environmental factors. This is important for the formulation of methods to manage the disease. 2. Compare and contrast the survival and spread of the major plant pathogen groups: fungal and fungal-like pathogens, bacteria, viruses, nematodes, and parasitic plants so that appropriate control methods can be used to mitigate diseases caused by these pathogens. Control measures are based on the biology of the pathogen 3. Explain how pathogens, hosts, and environments interact in plant disease epidemics to predict the severity of a disease at a given time. Such information is important in deciding whether to use management strategies. Credits: 3.00

BTNY 30200 - Plant Ecology

Credit Hours: 3.00. This course will provide an introduction to the broad field of plant ecology. Through lectures and lab assignments, students will gain an in-depth understanding of ecological concepts regarding the distribution and abundance of plant species and populations. Students will also gain insights into the application of these concepts to the conservation and management of plant species and populations.

Learning Outcomes: 1. Understand ecological concepts regarding the distribution and abundance of plant species. 2. Develop insight into the application of basic ecological concepts to the conservation and management of plant species and populations. 3. Gain experience in the design and analysis (using the R programming language) of ecological experiments. 4. Gain experience collecting and analyzing plant community data. 5. Increase your communication skills by creating and presenting a poster. Credits: 3.00

BTNY 30400 - Introductory Weed Science

Credit Hours: 3.00. A survey of the scientific principles underlying weed control practices; emphasis is on the ecology of weeds and control in crop associations. It is recommended that this course be followed by BTNY 50400.

Learning Outcomes: 1. Demonstrate your knowledge on the characteristics of weed species to properly identify and assess the negative impact the plants have on a site. 2. Describe how the characteristics of weed species and the specific site area influence the

effectiveness of cultural, mechanical, chemical, and biological weed control methods. 3. Apply the aspects of herbicide use to develop sound approaches for weed management that promote sustainability, especially when integrated with other weed control methods. Credits: 3.00

BTNY 30500 - Plant Evolution And Taxonomy

Credit Hours: 3.00. This course focuses on the systematics and evolution of land plants, with an emphasis on plant identification in both laboratory and field. Topics covered include the diversity and evolution of land plants, plant systematics and biogeography. This is a lab and field intensive course consisting of multiple field trips and hands-on laboratories. Students will master the skills required for plant identification anywhere in the world.

Learning Outcomes: 1. Become familiar with locally important plant orders and families. 2. Learn the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Become proficient with the use of keys so that you can quickly determine the scientific name of any plant. 4. Learn how DNA sequences are used to decipher phylogenetic relationships among plants. Credits: 3.00

BTNY 35000 - Biotechnology In Agriculture

Credit Hours: 3.00. A study of the methods used to produce genetically modified organisms, primarily using gene transfer technology, and the application of these organisms in agriculture. The uses of microbes, plants, and animals in agricultural biotechnology are examined. Social, economic, and ethical issues related to biotechnology are discussed.

Learning Outcomes: 1. Understand the broad scientific principles that underlie biotechnology. 2. Understand how principles underlying biotechnology are applied in agriculture. 3. Describe how transgenic plants are produced. 4. Explain how transgenic organisms and other biotechnology tools are applied in agriculture. 5. Evaluate the impact of these technologies in agriculture. 6. Analyze the controversies that surround the use of these technologies. Credits: 3.00

BTNY 35700 - The Intoxicated Botanist - Flora Of Indiana

Credit Hours: 1.00. Over millions of years, plants have evolved the ability to biosynthesize thousands of compounds. In only the last few thousand years, humans have cultivated plants for their ability to feed, heal, intoxicate and even poison-depending upon the plant and the compounds they produce. The objective of this course is to learn and apply plant taxonomy to identify and study the regional flora of Indiana with a focus on flora used in the production 'intoxicants'. Individuals must be 21 years of age no later than the first day of class. Permission of instructor required.

Learning Outcomes: 1. Identify important plant orders and families used in the making of spirits, wine and beer. 2. Recall the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Use plant identification keys to quickly determine the scientific name of any plant. 4. Describe the properties of plants and fungi and relate them to their abilities and their contributions to human society, namely intoxication. 5. Develop an appreciation (connoisseurship) that plants provide in the form of wine, beer, and spirits and learn about their role in human civilization, past and present. Credits: 1.00

BTNY 35710 - The Intoxicated Botanist - Study Abroad

Credit Hours: 3.00. Over millions of years, plants have evolved the ability to biosynthesize thousands of compounds. In only the last few thousand years, humans have cultivated plants for their ability to feed, heal, intoxicate and even poison-depending upon the plant and the compounds they produce. The objective of this course is to learn and apply plant taxonomy to identify and study the flora of Slovenia with a focus on flora used in the production 'intoxicants'. Permission of instructor required.

Learning Outcomes: 1. Identify important plant orders and families used in the making of spirits, wine and beer. 2. Recall the vegetative and floral characters (and the associated terminology) that are essential for the identification of flowering plants. 3. Use plant

identification keys to quickly determine the scientific name of any plant. 4. Describe the properties of plants and fungi and relate them to their abilities and their contributions to human society, namely intoxication. 5. Develop an appreciation (connoisseurship) that plants provide in the form of wine, beer, and spirits and learn about their role in human civilization, past and present. Credits: 3.00

BTNY 39000 - Selected Topics In Plant Science

Credit Hours: 1.00 to 3.00. This course deals with special topics in botany not covered in regular undergraduate coursework. Credit depends upon work done. May be repeated once for credit. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 40000 - Botany And Plant Pathology Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

BTNY 42000 - Plant Cellular And Developmental Biology

Credit Hours: 3.00. This course will focus on the fundamentals of plant cellular and developmental biology. Topics to be covered include: the structure and function of plant organelles and membranes; the cell cycle; DNA, RNA and protein synthesis; the secretory pathway, and the cellular basis of development and whole plant morphogenesis.

Learning Outcomes: 1. Understand the organization of plant genomes and cells. 2. Know how plant organs, tissues and cells are organized. 3. Know how a plant cell secretes proteins. 4. Know the mechanism of protein degradation and why it is a key aspect of developmental pathways. 5. Know the function of each plant hormone, understand where and how it is made, and most importantly, how that hormone exerts its influence. 6. Feel confident entering a graduate-level course in plant molecular, cellular or developmental biology. Credits: 3.00

BTNY 43100 - Planning For International Engagement Methods

Credit Hours: 1.00. A team-based laboratory course for students who seek experience working with international partners to plan and conduct quality service-learning projects. Using established partner relationships, students will work with international partners to address hands-on, real-world, identified challenges to learn the principles of extension methodology and sustainable community development by integrating their discipline knowledge and technical skills from previous courses. Students will also learn the intercultural communication, market analysis, project design and planning, entrepreneurial business planning for micro-credit loans and business ventures, and cultural factors affecting community food security while they work in bi-national teams to determine how best to apply their classroom knowledge and experience to respond to partners' needs and local resource constraints.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their economic and social challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and emotional intelligence in evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate the ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

BTNY 43110 - International Engagement Methods

Credit Hours: 1.00 to 3.00. Using established partner relationships, students will travel to and live in Cap Haitien for 8-10 days and work with Haitian partners and students to learn the principles of extension methodology, sustainable community development, and how to most effectively work with local leaders. Students will also learn the intercultural communication, entrepreneurial business planning, and cultural factors affecting community food security status while they work bi-national teams to determine how best to apply their classroom knowledge and experience.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate personal growth in cultural worldview and self-awareness to confidently address specific food security-related challenges and belief in their personal ability to succeed in a particular situation. 4. Demonstrate critical thinking, intercultural curiosity, and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 5. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 6. Assess the partners' needs, plan, present, and assess educational programs in Haiti. 7. Demonstrate intercultural openness, empathy, flexibility, and open-mindedness to work constructively as part of a bi-national problem-solving team. Credits: 1.00 to 3.00

BTNY 43120 - Evaluating International Engagement Methods

Credit Hours: 1.00. Designed for students who have just returned from the Engagement Methods for Int'l Food Security course or have previous experience working with our partners. In order to 1) fully comprehend the impact of the experience and 2) foster true long-term relationships with and service to our partners, it is required to work on our projects when we return. Matt McGregor, Former Exec. Dir. of Timmy Global Health, told us that "it's not really about the trip". It is essential that we accomplish: 1) Closure of trip experiences with partners and contacts - thank you's and complete follow-up; 2) Reflection of Purdue student experiences and personal goals/follow-up actions; 3) Promotion of food insecurity realities and opportunities for support; and 4) Planning, recommendations, and promotion of future service learning courses.

Learning Outcomes: 1. Apply classroom knowledge and science technologies through extension methodologies to assist partners in addressing their challenges. 2. Demonstrate intercultural knowledge and effectiveness to successfully communicate, understand, and interact among people with differing assumptions that exist because of ethnic and cultural differences. 3. Demonstrate critical thinking and evaluation of what is read and heard by using data and reasoning to identify and assess opportunities and develop sound responses to complex problems in a rural international village setting. 4. Demonstrate the ability to communicate persuasively and while considering audience and purpose in a different cultural setting. 5. Assess partners' needs, plan, present, and assess educational programs in Haiti. 6. Demonstrate ability to work constructively as part of a bi-national problem-solving team. Credits: 1.00

BTNY 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third-and fourth-year students. Courses offered must be approved by department or program faculty, and College of Agriculture Honors Committee. Permission of department required.

Learning Outcomes: 1. Learning Outcomes will

be determined by the instructor to meet a level of academic rigor consistent with the honors level given the specific course content and may also include: Critical Thinking, Communication, Cultural Understanding, Civic Responsibilities, Professional Preparation, Scientific Principles, Social Science Principles, and/or Teamwork. Credits: 1.00 to 4.00

BTNY 49700 - Undergraduate Research Capstone

Credit Hours: 1.00. Professional preparation of a presentation related to the student's undergraduate research experience (BTNY 49800). Students will prepare a presentation to summarize their work and present at an academic research event. Other subjects covered: graduate school and/or career preparation, resume production/refinement, interpreting scientific data, public presenting. Students must have completed BTNY 49800 prior to registering for BTNY 49700.

Learning Outcomes: 1. Define and explain the scientific method as it applies to the student's individual research project. 2. Synthesize their undergraduate research project in the form of a scientific poster. 3. Master communication skills for engaging a broad audience on scientific principles related to the student's unique research. Credits: 1.00

BTNY 49800 - Research In Plant Science

Credit Hours: 1.00 to 3.00. Supervised individual laboratory or field research. Permission of department required.

Learning Outcomes: 1. Define and explain the scientific method as it applies to plant science research. 2. Identify and practice research ethics and responsible conduct in research. 3. Reflect on their own research, identifying lessons learned, strengths, and ways to improve. Credits: 1.00 to 3.00

BTNY 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. Thesis research. Admission to the honors program. Permission of instructor required.

Credits: 1.00 to 6.00

Department of Entomology

Overview

Vision

To be a leader recognized worldwide for the solutions and discoveries generated through the application of science focused on insect biology.

Mission

Our mission is to prepare students to addresses Societal Grand Challenges through the development and application of arthropod/ nematode science.

Core Values

- Encourage the highest standards of ethics and citizenship
- Operate in an open, objective, and inclusive environment
- A community of scholars committed to excellence and teamwork
- Promote the synergism that comes from interdisciplinary interactions
- Value our human capital
- Embrace and promote increased diversity
- Adopt emerging information and other technologies as tools - not final solutions
- Resolve to actively disseminate our knowledge to people of all ages

Faculty (website)

Department of Entomology (website)

Contact Information

Department of Entomology
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Email: insectbiology@purdue.edu
The main office for the department is located in Room 100 of SMTH Hall.

Graduate Information

For Graduate Information please see Entomology Graduate Program Information .

Insect Biology, BS

Forensic Sciences Minor

Insect Biology Minor

ENTM 10100 - Insect Biology And Societal Grand Challenges

Credit Hours: 1.00. An introduction to the roles of insect biologists in addressing societal grand challenges.

Learning Outcomes: 1. Appreciate the scope of societal grand challenges. 2. Understand and demonstrate where Insect Biology and grand challenges intersect. 3. Evaluate and critique popular literature and media surrounding these issues. 4. Identify gaps in our current knowledge and understand future needs. Credits: 1.00

ENTM 10200 - The Practice Of Science

Credit Hours: 2.00. A critical examination of science, best practices for conducting science, the contribution of research to knowledge accumulation, and the ethical obligations of scientists.

Learning Outcomes: 1. Understand and practice the fundamental components of conducting scientific investigations (observation, explanation, and investigation). 2. Understand the concept of falsifiable hypotheses and their role in the practice of science. 3. Understand concepts underlying approaches to the quantitative analysis of data. 4. Appreciate the importance of accuracy, precision, and the identification and mitigation of sources of error in data collection and analysis. 5. Understand the ethical expectations of peers, sponsors, and the general public in the practice of science. 6. Understand the distinction between science and pseudoscience, and be able to recognize each. Credits: 2.00

ENTM 10500 - Insects: Friend And Foe (UCC: SCI/STS)

Credit Hours: 3.00. A one-semester course for nonscience students who want to know more about insects - the most numerous organisms on earth. An introduction to insects and their relationship with humankind, including interesting aspects of insect biology; insects in music, decoration, history; use of insects in teaching at the elementary school level; their use in art, photography, and drawing; insects as human food.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 3.00

ENTM 12800 - Investigating Forensic Science (UCC: STS)

Credit Hours: 3.00. Designed for both forensic science majors and non-majors, this course will provide an overview of the issues affecting the study and practice of forensic science as defined by the National Academy of Science 2009 report: "Strengthening Forensic Science". Using a mixture of popular media (film, television, news articles) as well as more conventional academic peer-reviewed articles, students will learn how the scientific method is applied to forensic investigations including; identifying pseudoscience, crime lab procedures, DNA evidence, errors in thinking and problem-solving, types of fraud, and the influence of the "CSI Effect".

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Recognize basic phases of science and the procedural steps of the scientific method and explain the difference between the two. 2. Recognize the difference

between science and pseudoscience and how poor forensic science impacts the application of law. 3. Understand how basic procedural issues affect crime labs. 4. Recognize how a need for confidence in measurement impacts the scientific method and how this need shapes the current paradigm in forensic science. 5. Recall basic tenants of DNA evidence. 6. Understand the primacy of DNA evidence under the current paradigm of forensic science compared to other forensic science disciplines. Credits: 3.00

ENTM 20100 - Scientific And Technical Communication

Credit Hours: 3.00. Students gain a foundation for communicating science and insect biology at multiple levels through study and practice. Prior completion of a college-level composition course is strongly recommended.

Learning Outcomes: 1. Develop and practice skills to describe research and present results and conclusions from research to peers to non-scientist audiences both in written and oral formats. 2. Understand the difference between scientific and science writing and effectively communicate science to various general public audiences both orally and through writing. Credits: 3.00

ENTM 20600 - General Entomology (UCC: SCI)

Credit Hours: 2.00. A general course on insect structure, function, biology, ecology and population management. Coordinated with the ENTM 20700 laboratory as an introductory course in entomology.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 2.00

ENTM 20700 - General Entomology Laboratory

Credit Hours: 1.00. Laboratory exercises parallel topics presented in ENTM 20600 . Insect structures and function are studied as a basis for learning to identify insects and other arthropods.

Credits: 1.00

ENTM 21000 - Introduction To Insect Behavior (UCC: SCI)

Credit Hours: 3.00. Description and introductory analysis of innate and learned insect behavior, including basic orientations and movements, behavioral periodicity, communication, chemical and structural defenses, host selection and feeding, reproduction, and insect societies. General biology and introductory entomology are desirable, but not essential.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

ENTM 22810 - Forensic Investigation (UCC: SCI)

Credit Hours: 4.00. Forensic science investigation, crime scene management and field data collection techniques. Includes crime scene recognition and the documentation, collection, preservation, and processing of crime scene evidence. Emphasizes the place of field data collection as the first step in a sequence that takes evidence from scene to the lab for analysis and finally into the court of law.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. Credits: 4.00

ENTM 22820 - Forensic Analysis (UCC: SCI)

Credit Hours: 4.00. Forensic science evidence analysis, crime lab evidence management and data analysis techniques. Focuses on the accuracy, precision and integrity in evidence analysis for a survey of forensic disciplines. Emphasizes the place of forensic analysis as a necessary second step in a sequence that takes evidence from scene, to the lab for analysis and finally into the court of law.

University Core Curriculum (UCC): (UCC: SCI)
Learning Outcomes: 1. Appreciate the scope of science in forensic analysis. 2. Develop an understanding of the scientific method in the context of the law. 3. Develop an understanding

of the particulars for each forensic sub-discipline. 4. Experience the basic techniques employed by the sub-disciplines reviewed. Credits: 4.00

ENTM 22830 - Forensic Testimony And Ethics

Credit Hours: 3.00. The final course in the forensic science program core, focuses on the legal ramifications that arise when forensic science is applied at the crime scene, in the crime lab and in the courtroom. Students are introduced to ethical issues that form the basis of all scientific investigations and the role of scientists as expert witnesses in maintaining the moral integrity of our justice system.

Learning Outcomes: 1. Recognize how science and the legal system interact throughout a case life history, and the role played in presenting scientific conclusions at trial. 2. Identify the ethical issues associated with scientific investigations at the scene, including the ability to avoid bias and correct for problems before a case is compromised. 3. Identify the ethical issues associated with scientific investigations at the lab, including the ability to avoid bias and correct for problems before a case is compromised. 4. Identify the ethical issues associated with avoiding bias, correcting for errors and providing testimony as an expert scientific witness. Credits: 3.00

ENTM 22840 - Forensic Entomology Principles

Credit Hours: 2.00. An overview to the four disciplines of forensic entomology. An introduction to stored products, urban, medical/veterinary, and medico-legal entomology.

Learning Outcomes: 1. Understand the broad field of forensic entomology coverage. 2. Define each discipline within forensic entomology. 3. Explain the depth of human and insect interactions. 4. Discuss the role an entomologist can play in a forensic context. 5. Develop an understanding of and explain what each discipline of forensic entomology handles. 6. Categorize the insects that are important to and used in each discipline. 7. Compare and contrast the context that each discipline deals with. 8. Describe the historical impact insects have played within each discipline. Credits: 2.00

ENTM 22841 - Forensic Entomology Principles Lab

Credit Hours: 1.00. An optional laboratory component to Principles of Forensic Entomology. Insects of importance in the fields of stored products, urban, medical/veterinary, and medico-legal will be covered, including morphological identifications and an assessment of their biology and damage.

Learning Outcomes: 1. Experience the basic techniques and skills employed by each of the four main disciplines reviewed. 2. Classify and identify insects within each discipline using morphological characteristics. 3. Develop appropriate collecting and rearing techniques for each type of insect. 4. Evaluate an entomological scenario and create guidelines on how to best handle the situation. Credits: 1.00

ENTM 24200 - Data Science

Credit Hours: 3.00. Develop a data science skill set that complements coursework in mathematics, statistics, and experimental design. Data Science facilitates research by developing skills in data sourcing, formatting and using different types of data, and hypothesis generation. Mathematical communication skills are developed through data graphics, animation, and delivery of results through multiple platforms including interactive simulations on webpages.

Learning Outcomes: 1. Source different types of data and know what analyses are appropriate for each type. 2. Transform and format data for analyses. 3. Detect trends in data as part of hypothesis generation. 4. Communicate findings to different audiences through appropriate graphics and animations, including through web pages. 5. Write R scripts to accomplish all of the above. Credits: 3.00

ENTM 25300 - Insect Physiology And Biochemistry

Credit Hours: 4.00. Introductory course in insect cell biology, biochemistry, and physiology including structures and functions

of insect internal and external tissues and organs. A year of college biology or equivalent knowledge is expected.

Learning Outcomes: 1. Understand (i) the structure and functions of insect cells, the major internal organ systems of insects, the insect integument, and homeostatic mechanisms; (ii) insect development and reproduction, and their endocrine control; and (iii) the neural mechanisms that underlie the interactions of insects with their environment and coordinated behavior. 2. Understand the physical and chemical principles underpinning animal physiology. 3. Understand the dependence of function on structure in physiology and biochemistry. 4. Acquire familiarity with commonly used experimental procedures for research in insect physiology and biochemistry. Credits: 4.00

ENTM 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first and second-year students. Courses offered must be approved by departmental or program faculty, and the College of Agriculture Honors Committee. Must be enrolled in an Honors program. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and a professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 29400 - Topics In Forensic Sciences

Credit Hours: 1.00 to 4.00. This course will address the needs for our students to have current information about important emerging areas of Forensic Science and will provide a mechanism for recording such studies on their transcript.

Learning Outcomes: 1. The series is intended to develop content knowledge and critical thinking skills and allow students to demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 29410 - Laboratory Topics In Forensic Science

Credit Hours: 1.00 to 4.00. This course provides students with combined lecture and laboratory experience in important emerging areas of Forensic Science.

Credits: 1.00 to 4.00

ENTM 29500 - Topics In Entomology

Credit Hours: 1.00 to 4.00. Special topics in entomology not available in other entomology courses.

Credits: 1.00 to 4.00

ENTM 29510 - Laboratory Topics In Entomology

Credit Hours: 1.00 to 4.00. Special topics in entomology not available in other entomology courses that include laboratory.

Credits: 1.00 to 4.00

ENTM 30100 - Experimentation And Analysis

Credit Hours: 3.00. Introduction to experimentation and quantitative data analysis in the life sciences with a focus on examples from insect biology.

Learning Outcomes: 1. Start with an observation and design appropriate experiment that recognizes and avoids common pitfalls. 2. Apply the general linear model and its variants in data analysis. 3. Appropriately use common basic statistical packages. Credits: 3.00

ENTM 31100 - Insect Ecology

Credit Hours: 3.00. Insect ecology investigates the fundamental concepts of ecology as they relate to insects, including insect interactions, other insects and their environment. Topics include population and community ecology, plant-insect interactions, insect biodiversity and biogeography, and theoretical and applied ecology. Examples from current entomological and ecological studies are used. Completion of college biology or an introductory course in entomology is recommended.

Learning Outcomes: 1. Comprehend ecological principles at different scales of biological organization, from the individual to the population to the community to the ecosystem. 2. Understand the mechanisms that mediate interactions of insects with their biotic and abiotic environments. 3. Appreciate the importance of insects as stabilizing and destabilizing components of food webs. 4. Recognize the value and application of insect ecology n solving real-world problems. 5. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 3.00

ENTM 31200 - Plant-Insect Chemical Ecology

Credit Hours: 3.00. An overview of the structure and function of natural and synthetic chemical products in insect ecology. One year of college biology. One year of college chemistry strongly recommended.

Learning Outcomes: 1. Appreciate the history and scope of chemical ecology as a discipline. 2. Understand the role of chemistry in the biology/ecology of plants and animals. 3. Appreciate how chemical products influence processes at various levels of biological integration - from genes to ecosystems. 4. Evaluate and critique primary literature on chemical ecology. 5. Recognize the application of insect chemical ecology in solving grand challenges in entomology. Credits: 3.00

ENTM 32810 - Practical Molecular Biology

Credit Hours: 3.00. Students explore molecular technology commonly used in population genetics and diagnostics and apply them to questions in Insect Biology and Forensics.

Learning Outcomes: 1. Appreciate the scope and application of modern Forensic Biology and Insect Biology. 2. Appreciate the scope, diversity and utility of a variety of modern molecular typing techniques as they are used to address Grad Challenges. 3. Perform the primary techniques used in current entomological and forensic molecular data generation: DNA extraction and quantification, PCR, gel electrophoresis and sample purification. 4. Perform molecular data generation analysis. Credits: 3.00

ENTM 32820 - Medico-Legal Entomology

Credit Hours: 3.00. This course explores the main topics covered under medico-legal entomology (MLE). Specifically, the course will focus on the role that insects play in abuse, neglect, and death investigations. Students will experience rearing and identifying the major forensically important insect groups associated with medico-legal investigations. Finally, students will gain an appreciation of the scope of MLE through the

analysis of two mock cases.

Learning Outcomes: 1. Establish an understanding of how insects are in used in legal investigations. 2. Define and defend the types of insect evidence presented in abuse & neglect cases. 3. Define and defend the types of insect evidence presented in death investigations. 4. Explain how insects are used to answer various questions in legal investigations. 5. Collect, rear and identify forensically important specimens. 6. Identify forensically important specimens down to family, genus or species level. 7. Demonstrate and explain proper collection techniques from decomposing remains. 8. Demonstrate and explain proper rearing techniques for forensically important insects. 9. Experience medico-legal entomology. 10. Compare and explain the life cycle of forensically important flies. 11. Analyze two medico-legal scenes. 12. Compose forensic entomology case reports. Credits: 3.00

ENTM 33500 - Introduction To Insect Identification

Credit Hours: 4.00. This class is designed for learning more about the collection and identification of adult insects. Emphasis will be placed on collection and sampling techniques, the preparation of specimens for future study, and identification.

Learning Outcomes: 1. Use keys and other published resources to identify unknown insects to the correct family and by-sight identification. 2. Collect a diversity of insects and related arthropods and to prepare specimens to professional standards. 3. State the scientific names, critical taxonomic characters, natural history and biology, unique or interesting behaviors, ecological role, taxonomic relationships and impacts on human activities of selected families. Credits: 4.00

ENTM 35300 - Insecticides And Environment

Credit Hours: 3.00. Insecticides, their interactions with biological organisms and the environment, regulatory policies, environmental and human health outcomes, and current controversies. A year of college biology and college chemistry or equivalent knowledge is expected.

Learning Outcomes: 1. Communicate to the public about insecticide issues including risk, best practices for management and use. 2. Apply principles of toxicology including dose response, target sites, differential toxicity, and resistance. 3. Evaluate environmental hazards, their management and mitigation. 4. Interpret and implement insecticide label instructions. 5. Explain how Risk Assessment and Management is implemented in the U.S. to protect human health and safety balance economic and environmental risks. Credits: 3.00

ENTM 39000 - Professional Experience Programs In Entomology

Credit Hours: 0.00. Supervised professional experiences in entomology, integrated pest management, or urban/industrial pest control. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of instructor required.

Credits: 0.00

ENTM 39100 - Professional Experience Programs In Forensic Sciences

Credit Hours: 0.00 to 8.00. The course provides a mechanism for students to record unpaid internships and appropriate professional experiences in Forensic Science on their transcript. Permission of department required.

Learning Outcomes: 1. Experiential learning through interactions with professionals. Credits: 0.00 to 8.00

ENTM 39300 - Insect Biology Practicum

Credit Hours: 1.00. Imbedded programmatic experiences for undergraduate students in Insect Biology including focused reflection on the knowledge, skills, and values necessary for contributions in the discipline. Permission of instructor required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of Insect Biology. 2. Be able to make relevant connections to their own academic, professional and personal

motivations and goals in Insect Biology. 3. Understand procedures and approaches useful for research, teaching and extension in Insect Biology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

ENTM 39310 - Insect Biology Practicum II

Credit Hours: 1.00. This course provides imbedded programmatic experiences for undergraduate students. It introduces students to the breadth of the discipline of entomology by engaging them at a programmatic level. This is accomplished by incorporating students into laboratory meetings, research, extension or teaching activities and through discussions with the faculty instructor about the goals and motivations driving their weekly research, extension or teaching activities and how these activities address societal grand challenges. All students enrolled in ENTM 39310 will be required at the end of each of the 8-week sessions and provide a recorded presentation overviewing some aspect of the mentor's program and its linkage to societal grand challenges. Permission of department required.

Learning Outcomes: 1. Survey and experience the scope of the discipline of entomology. 2. Provide students with an opportunity to make relevant connections to their own academic, professional and personal motivations and goals in entomology. 3. Understand procedures and approaches useful for research, teaching and extension in entomology. 4. Communicate to others how societal grand challenges are being addressed through the lens of the mentor's program. Credits: 1.00

ENTM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in entomology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENTM 40000 - Entomology Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

ENTM 40100 - Addressing Grand Challenges Through Insect Biology

Credit Hours: 1.00. This course engages students in an examination of societal grand challenges by identifying the problems, understanding the current state of knowledge, identifying knowledge gaps, and implementing possible solutions. Permission of department required.

Learning Outcomes: 1. Explain how the accumulated knowledge and experiences of Insect Biology majors can be applied to address Grand Challenges. 2. Demonstrate where capstone projects and grand challenges intersect. 3. Explain roles insect biologists play in addressing grand challenges, and the relationship to future career options. 4. Demonstrate skills in communication, critical thinking and teamwork. Credits: 1.00

ENTM 41000 - Applied Insect Biology

Credit Hours: 2.00. Identification, biology and management of insects associated with global food and energy security and human and animal health and well-being. Students are expected to have a knowledge of college biology.

Learning Outcomes: 1. Identify insects impacting global food and energy security, human and animal health and well-being, and environmental integrity. 2. Demonstrate familiarity with the biology of insect pests. 3. Understand and demonstrate the principles and practice of insect management and conservation. Credits: 2.00

ENTM 41001 - Insects Of Urban Landscapes

Credit Hours: 1.00. Students focus on identification and biology of insects associated with turfgrass and ornamental plants. The role of experimentation in applied insect biology is examined.

Learning Outcomes: 1. Identify pest and beneficial insects associated with turfgrass and ornamental plants. 2. Understand and describe the biology of pest and beneficial insects associated with turfgrass and ornamental plants. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 41002 - Insects Of Agricultural Crops

Credit Hours: 1.00. Students focus on identification, biology, and management of pests of agricultural crops, identification of natural enemies, and application of scientific method to applied insect biology.

Learning Outcomes: 1. Identify pest insects associated with agricultural crops and understand their biology and management. 2. Identify natural enemies of pest species associated with agricultural corps and explain how they can be used in pest management. 3. Participate in the design, implementation, analysis, summary and critique of a semester-long group research project or experiment in applied insect biology. Credits: 1.00

ENTM 42820 - Carrion Ecology

Credit Hours: 3.00. This course explores how carrion interact with the environment and other organisms during the decomposition process. Focus will be given to an understanding of the process itself, how investigators collect information about the process, and how research is conducted into the process of decomposition. Students will carry out an experiment and write their results up in the format of a peer reviewed article.

Learning Outcomes: 1. Explain the process of decomposition. 2. Describe and distinguish the stages of vertebrate decomposition, including when those stages begin and end and what variables define a given stage. 3. Describe and explain the abiotic factors that influence decomposition. 4. Describe and explain the biotic factors that influence decomposition. 5. Explain the nutrient flow through a carrion resource, including how various living organisms take advantage of such resources. 6. Experience carrion ecology field techniques. 7. Measure the abiotic factors that influence decomposition. 8. Measure the biotic factors that influence decomposition. 9. Evaluate a

decomposition scene and strategize site data collection. 10. Identify the species the animals that frequent a carrion source. 11. Develop and implement a research project. 12. Plan, propose and defend a scientific research project related to carrion ecology. 13. Build a budget for a research project. 14. Build a collection strategy SOP for a research project. 15. Conduct a proposed research project. 16. Analyze the results of a research project. 17. Write-up, print and submit a research paper on your project, using the format for INSTARS or JPUR. Credits: 3.00

ENTM 42890 - Forensic Science Teaching

Credit Hours: 3.00. This course provides an opportunity for students who have completed forensic science courses to assist in that course previously taken, reinforcing the skills, expanding their mastery of the scientific method and how it pertains to forensic science as well as introducing basic pedagogical tools for instruction to the student. Permission of Instructor required.

Learning Outcomes: 1. Display mastery in the scientific method in the context of the law. 2. Demonstrate appropriate presentation skills. 3. Demonstrate appropriate assessment and pedagogical skills. Credits: 3.00

ENTM 43100 - Human-Wildlife Conflicts

Credit Hours: 3.00. Exploration of conflicts between human interests and wildlife and the regulations policies and legislation used to minimize conflicts. Negative interactions may be real or perceived, economic or aesthetic, social or political, and may pose risks to human health and safety. Emphasis on the causes of conflict and resolutions that seek to balance protection or conservation of wildlife with protection of other public resources and individual property owners. Prior knowledge of college-level general biology and ecology is expected.

Learning Outcomes: 1. Identify common causes of human-wildlife conflicts. 2. Evaluate the impacts of the conflict damage/threat. 3. Prescribe options for resolving the conflict. 4. Measure effectiveness of applied mitigation strategies. Credits: 3.00

ENTM 47500 - Honors Course-Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third and fourth-year students. Courses offered must be approved by departmental or program faculty, and the College of Agriculture Honors Committee. Must be enrolled in an Honors program. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and a professional conduct. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49310 - Insect Biology Capstone Experience

Credit Hours: 2.00 or 4.00. Insect Biology majors complete a capstone project under the guidance of a faculty mentor. Permission of instructor required.

Learning Outcomes: 1. Conduct a capstone project and analyze and interpret the information generated. Credits: 2.00 or 4.00

ENTM 49320 - Insect Biology Capstone Experience II

Credit Hours: 2.00 to 4.00. This course is an experiential meant to familiarize students with the options and procedures associated with the Entomology capstone experience and provide students with an avenue for fulfilling their capstone requirement by conducting a capstone project. Students may use a research, extension or teaching project to meet this requirement. Although the capstone project may build on or extend a previously conducted undergraduate research project, independent study, or study abroad, students enrolled in ENTM 49320 must conduct their capstone project in a manner that is independent from any other project for which credit will be awarded or for which they will be paid as an employee. Students may enroll in ENTM 49320 and conduct the capstone project at any time during the last 2 years of study. Permission of department required.

Learning Outcomes: 1. Demonstrate their ability to integrate their accumulated knowledge and technical and social skills in order to identify and solve a problem relevant to Entomology. 2.

Conduct a capstone project and analyze or interpret the information generated. Credits: 2.00 to 4.00

ENTM 49390 - Insect Biology Capstone Forum

Credit Hours: 1.00. Students apply their accumulated knowledge to grand challenges and careers in insect biology. Permission of department required.

Learning Outcomes: 1. Demonstrate ability to integrate accumulated knowledge, technical and social skills to identify and solve a problem relevant to Insect Biology. 2. Communicate the results the Capstone mentored research project through oral and written presentations. Credits: 1.00

ENTM 49400 - Advanced Topics In Forensic Sciences

Credit Hours: 1.00 to 4.00. This course will provide an avenue for students to pursue knowledge in emerging advanced areas of Forensic Science. Permission of department required.

Learning Outcomes: 1. The series is intended to develop content knowledge and critical thinking skills and allow students to demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49410 - Advanced Laboratory Topics In Forensic Science

Credit Hours: 1.00 to 4.00. This course will provide an avenue for students to pursue laboratory techniques in emerging advanced areas of Forensic Science. Permission of Department required.

Credits: 1.00 to 4.00

ENTM 49500 - Advanced Topics In Entomology

Credit Hours: 1.00 to 4.00. Special topics in entomology at upper division level not available in other entomology courses. Permission of department required.

Learning Outcomes: 1. Learn information about important emerging areas of entomology including but not limited to new invasive species, advance in biotechnology, advances in insect science and topics that prepare students to address emerging problems at the state, national and global levels. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49510 - Advanced Laboratories In Entomology

Credit Hours: 1.00 to 4.00. Special laboratories in entomology at upper division level not available in other entomology courses. Permission of department required.

Credits: 1.00 to 4.00

ENTM 49700 - Special Problems In Forensic Science

Credit Hours: 1.00 to 4.00. This course will provide an opportunity for qualified sophomores, juniors and seniors to engage in the study of special Forensic Science problems not covered in regular coursework. It will also provide a mechanism for recording these independent studies on their transcript. Permission of department required.

Learning Outcomes: 1. To develop content knowledge and critical thinking skills and allow students an opportunity to demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. Credits: 1.00 to 4.00

ENTM 49800 - Special Problems In Entomology

Credit Hours: 1.00 to 4.00. Open to qualified sophomores, juniors, and seniors who want to study special problems in entomology not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 4.00

Department of Food Science

Food Science Photo

Overview

The Department of Food Science at Purdue University is committed to impacting the world food system and quality of life

by educating and training undergraduate and graduate students for careers in industry, government, and academia. Our mission is to expand and transfer knowledge for continuous improvement of the safety, quality, value, and security of the world's food supply through basic research and outreach programs.
Our faculty, staff, and students are located on Purdue University's main campus in the **Philip E. Nelson Hall of Food Science, 745 Agriculture Mall Drive, West Lafayette, Indiana 47907**. This building provides excellent research laboratories, as well as specialized facilities such as the sensory evaluation laboratory, pilot scale-manufacturing plant, student product development and innovation laboratory, and enology library for us to engage with the food and beverage industry and government partners.

Faculty (website)

Department of Food Science (website)

Contact Information

Department of Food Science
Purdue University
Nelson Hall of Food Science
745 Agriculture Mall Drive
West Lafayette, IN 47907
Phone: (765) 494-8256
Email: foodsci@purdue.edu

The main office for the department is located in Room 2203 of the NLSN Building.

Current and Prospective Undergraduate Students (website)

Graduate Information

For Graduate Information please see Food Sciences Graduate Program Information .

Food Science Minor

Pet Food Processing Minor

Food Science, BS

Fermentation Sciences Minor

Fermentation Science, BS

The field of Fermentation Science integrates scientific disciplines, such as microbiology and biochemistry, with process engineering to discover ways to use microbes as biotechnological factories to produce goods of societal value, from foods to biofuels to pharmaceuticals. A fermentation scientist possesses the skills necessary to engineer microbes to convert diverse feedstocks into value-added products, design and operate fermentation processes, and recover and refine the synthesized products. Graduates apply scientific knowledge and economic principles to biotechnology and fermentation operation, research, development, and marketing or pursue graduate studies in biotechnology, applied microbiology, or biological engineering.

FS 16100 - Science Of Food (UCC: STS)

Credit Hours: 3.00. Chemical and physical properties of foods; issues pertaining to safety, food-diet-health relationship; government regulations pertaining to food safety, quality and additives; preservation techniques and transformation of agricultural commodities to food products; Food facts, myths, and practices that are important for making intelligent food decisions. Course may also be offered for dual credit with cooperating Indiana high schools upon documented approval by the Department of Food Science.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

FS 16200 - Introduction To Food Processing

Credit Hours: 1.00. Application of introductory food science principles (e.g., food chemistry, food microbiology, and unit operations) to food processing; emphasis will be placed on food formulation, pilot-scale process design, and resulting food quality. May require class trips.

Credits: 1.00

FS 16300 - Introduction To Fermentation Sciences

Credit Hours: 3.00. This course will provide an overview of the use of microorganisms in the food, pharmaceutical and chemical industries. The course will introduce fundamental concepts associated to the microbiological transformation of various substrates to produce desirable products such as foods, beverages, pharmaceuticals or chemical compounds. As an introductory course, the scientific principles of fermentation processes will be gradually introduced through the analysis of familiar fermented food products, such as bread, cheese, beer, wine, cocoa, coffee, etc. Once the fundamental concepts are learned, examples of advanced fermentation technology for production of pharmaceutical products and fine chemicals will be presented.

Learning Outcomes: 1. Explain the role of microorganisms in the transformation of various substrates into desirable products. 2. Identify the type of microorganism (bacteria, yeast or mold) involved in the production of various fermented foods and beverages. 3. Explain the impact of environmental processing conditions (T, pH, aw, O2) on microbial growth. 4. Recognize the similarities across a wide variety of products made through fermentation. Credits: 3.00

FS 24500 - Food Packaging

Credit Hours: 1.00. Elements of packaging science and technology applied to preservation, distribution, and marketing of food products; packaging materials; principles of diffusion and permeability; procedures for developing, evaluating, and testing food packages; packaging requirements for specific types of foods; other special topics of current interest.

Learning Outcomes: 1. Appreciate the important role that packaging plays in today's sophisticated food processing operations, its effect on final product quality and self-life, and its influence on distribution methods and marketing related decisions. 2. Understand the basic packaging materials and the technology to produce food packages. 3. Understand basic concepts of diffusion, permeation, and migration, especially as they relate to package properties, food quality, and product shelf-life. 4. Develop general guidelines for selecting appropriate packaging materials to fit the needs of specific food products. 5. Have a general appreciation of the methods used to test and evaluate packaging materials for specific properties and whole containers for integrity, suitability, and overall performance. 6. Intelligently discuss current food packaging related topics (i.e. package degradability/recyclability, tamper evident/proof packaging, modified atmosphere packaging, aseptic packaging, microwaveable packaging, etc.) Credits: 1.00

FS 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by instructor and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

FS 29100 - Special Assignments

Credit Hours: 1.00 to 3.00. Open to primarily freshmen and sophomores who desire to study special problems in science not covered in regular coursework. May be repeated for credit with instructor permission. Permission of instructor required.

Credits: 1.00 to 3.00

FS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 29800 - Sophomore Seminar

Credit Hours: 1.00. Current food science issues will be discussed by students, staff, and guest speakers. Career planning and improvement of communication skills will be emphasized.

Learning Outcomes: 1. Construct a professional resume that includes educational background and experience. 2. Construct a professional cover letter in reference to a job posting. 3. Demonstrate the ability to professionally answer interview questions in an interview setting. 4. Demonstrate the ability to present information with PowerPoint software. 5. Identify your Myers Briggs personality profile. 6. Explore some current issues in the food industry. 7. Plan your coursework for each semester through graduation. Credits: 1.00

FS 34000 - Introduction To Food Law And Regulations

Credit Hours: 1.00. This course will cover basic knowledge and familiarity of the principal law and regulations governing raw and processed foods. Class meets during weeks 1-5.

Learning Outcomes: 1. To gain a basic knowledge and familiarity of the principal laws and regulations governing raw and processed foods. 2. To develop an understanding of the law's core - adulteration and misbranding. 3. To learn basic food labeling and health claim regulations. 4. To obtain a working knowledge of US food law and promulgated regulations, current issues concerning food regulations, and how to obtain further information for specific regulatory problems. Credits: 1.00

FS 34100 - Food Processing I

Credit Hours: 2.00. Applications of the fundamentals of food engineering, microbiology, and chemistry to methods of food processing and preservation; emphasis will be on processing concepts, preparation for food processing, food formulation, and thermal processing.

Learning Outcomes: 1. Explain the sources of variability of raw food materials and their impact on food processing operations. 2. List and describe the major methods covered in class to control deterioration and spoilage in foods. 3. Identify the conditions under which important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Identify conditions including sanitation practices under which microorganisms are commonly inactivated, killed, or made harmless in foods. 5. Demonstrate use mass and energy balances for

a food process. 6. Explain the transport processes and unit operations involved in processing a particular food. 7. Identify the principles and current practices of processing techniques and the effects of processing parameters in product quality. 8. Predict changes in food quality during storage or processing. 9. Understand the requirements for water utilization and waste management in food and food processing. Credits: 2.00

FS 34200 - Food Processing I Laboratory

Credit Hours: 1.00. This laboratory course applies food engineering principles and thermal processing methods for production of safe and high-quality foods. The course will include applications of mathematics and physics principles in food processing operations, engineering problem-solving exercises and laboratory demonstrations. Engineering concepts such as heat transfer, fluid flow, mass and energy balances applied to various food systems will be a major portion of this laboratory.

Learning Outcomes: 1. Apply mathematical principles to food processing application. 2. Demonstrate an understanding of energy, heat transfer and fluid flow principles. 3. Apply engineering principles to thermal processing of foods. 4. Identify conditions under which microorganisms are commonly inactivated, killed, or made harmless in foods including pasteurization, sterilization, and aseptic processing. 5. Demonstrate use mass and energy balances for a food process. Credits: 1.00

FS 36100 - Food Plant Sanitation

Credit Hours: 1.00. Relation of food-plant sanitation to good manufacturing practices and regulations affecting sanitation; organization of a food-plant sanitation program; sanitary building and equipment construction; selection of cleaning, sanitizing, and pesticidal compounds; water, air, and waste treatment; food storage and transportation.

Credits: 1.00

FS 36200 - Food Microbiology

Credit Hours: 3.00. Microbiology of foods, with emphasis on the conditions for growth of microorganisms and degradation of food components, preservation methods, use of Hazard Analysis and Critical Control Point (HACCP) concepts, and microorganisms associated with foodborne illness, and modern detection methods.

Learning Outcomes: 1. Students should be able to identify the major components of food that affect microbial growth, to identify degradation in foods when microorganisms grow. 2. Students will be able to explain how preservations methods affect microbes in food, to explain major foodborne pathogens and under what conditions they thrive, to use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 3.00

FS 36300 - Food Microbiology Laboratory

Credit Hours: 2.00. Classic and molecular methods for enumerating, isolating, and identifying spoilage, fermentative, and pathogenic food microorganisms in food systems.

Learning Outcomes: 1. Perform proper aseptic technique. 2. Sample foods for microbial analyses. 3. Test food products for common microorganism. 4. Interpret data obtained from microbiological analysis. 4. Understand basic molecular techniques used to identify foodborne pathogens. Credits: 2.00

FS 37200 - Fermentation Microbiology

Credit Hours: 3.00. This course explores the principles underlying the design of microbes for their use in biotechnological applications. This project-based course will teach students fundamental molecular biology techniques, important parameters for strain selection and genetic engineering, and reactor design and operation in bioprocessing. Additionally, this course will cover today's diverse bioengineering goals and tools and the role of microbial biotechnology in society.

Learning Outcomes: 1. Articulate the concept of microbial cell factories and the relationship of microorganisms to food and industrial fermentations. 2. Identify genetic and environmental approaches to control the

products, rate, and yield of bioconversion. 3. Understand microbial metabolic pathways and how they are engineered. 4. Design genetic strategies to engineer microbes. 5. Read primary literature relevant to fermentation biotechnology. Credits: 3.00

FS 37300 - Fermentation Microbiology Laboratory

Credit Hours: 1.00. The course provides a laboratory-based experiential learning experience with the learning of fundamental aspects of genetic, physiological and substrate manipulation to achieve product formation in industrial microbes.

Learning Outcomes: 1. Understand the genetic manipulation and physiological factors involved in successful fermentation approaches. 2. Apply various methods of monitoring growth of various bioreactor formats. 3. Manipulate and correlate growth with yield of organisms and products. 4. Identify the basic problems which cause fermentation processes to fail and understand the reasons for failure. 5. Create and troubleshoot a simple fermentation process. Credits: 1.00

FS 38000 - Fermented Food Products

Credit Hours: 1.00. This course will allow students to learn and integrate concepts from microbiology, biochemistry, and processing used in the production of representative fermented food products. Students will learn how to design and make specific fermented foods.

Learning Outcomes: 1. Explain the role of specific microorganisms (lactic acid bacteria, yeasts) in the transformation of specific substrates into fermented food products. 2. Explain the chemical and biochemical changes whereby specific substrates are converted into fermented foods. 3. Understand the interdisciplinary nature of fermentative processes by integrating food safety, nutrition, microbiology, economic, and regulatory considerations in process design. 4. Design a laboratory scale process to produce a fermented food product of their choice. Credits: 1.00

FS 38100 - Industrial Fermentation Products

Credit Hours: 1.00. Industrial Fermentation Products introduces students to microbial fermentations employed in the biofuels and fine chemicals industry and their role in the larger bioeconomy. Students will be introduced to diverse final products, technical challenges in the sector, and the individuals and companies working to solve them. We end our five-week module with a field trip to a local biorefinery plant.

Learning Outcomes: 1. Identify the key products of industrial fermentations and their markets. 2. Articulate the major technical and economic challenges facing the industrial fermentations sector. 3. Research and understand fermentation production processes for a specific molecule of interest. 4. Interact with fermentation scientists in the biofuels, biochemicals, and polymers sector. Credits: 1.00

FS 38300 - Fermented Beverage Products

Credit Hours: 1.00. This course will allow students to learn and integrate concepts from microbiology, biochemistry, and processing used in the production of representative fermented beverages. Students will learn how to design and make specific fermented beverages. Must be 21 years of age or older. Permission of department required.

Learning Outcomes: 1. Explain the role of specific microorganisms (lactic acid bacteria, yeasts) in the transformation of specific substrates into fermented beverages. 2. Explain the chemical and biochemical changes whereby specific substrates are converted into fermented beverages. 3. Understand the interdisciplinary nature of fermentative processes by integrating food safety, nutrition, microbiology, economic, and regulatory considerations in process design. 4. Design a laboratory scale process to produce a fermented beverage of their choice. Credits: 1.00

FS 39000 - Food Science Cooperative Work Experience

Credit Hours: 0.00. Supervised professional experiences in the food science industry. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of department required.

Credits: 0.00

FS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in food science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FS 40000 - Food Science Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

FS 40100 - Fermentation Processing

Credit Hours: 2.00. The Integration of fermentation core concepts; the application of bioprocess engineering principles to biological systems; topics covering enzyme kinetics, fermentation, downstream processing, and integrated bioprocesses important to industries.

Learning Outcomes: 1. Understand applications and solve problems relating to the use of enzymes for industrial bioprocessing. 2. Apply engineering principles to address issues in fermentation processes. 3. Analyze and identify limiting factors in a bioprocess. 4. Explain and solve problems relating to mass and energy balances in biological reactors. 5. Explain how fermentation processing is used in various fields. Credits: 2.00

FS 40200 - Fermentation Processing Laboratory

Credit Hours: 1.00. The essential concepts of industrial bioprocessing with a focus on the physiology of fermentation; a series of laboratory experiments that follow value-adding processes from conception to completion.

Learning Outcomes: 1. Learn laboratory techniques, to design and conduct experiments, and to analyze and interpret data. 2. Design

appropriate bioreactor models based upon bioproducts and other process criteria. 3. Conduct fermentation experiments with process optimization and scale-up. 4. Model the growth of microorganisms in batch, fed-batch, and continuous flow processes. 5. Gain an overview of the fermentation industry. Credits: 1.00

FS 43500 - Sensory Science

Credit Hours: 1.00. Introduction to the fundamental concepts and practices of sensory analysis of food products. Technical aspects of planning and conducting human sensory panels on food products including analysis and interpretation of collected data. Course meets weeks 1-8.

Learning Outcomes: 1. Solve typical sensory problems occurring in the food industry. 2. Conduct sensory testes, analyze and interpret the results. 3. Write a report and executive summary of the findings. Credits: 1.00

FS 44200 - Food Processing II

Credit Hours: 2.00. Study of food processing and preservation methods based on the integrated knowledge of microbiology, chemistry, and food engineering; emphasis will be on temperature reduction, water activity, concentration, dehydration, irradiation, and extrusion.

Learning Outcomes: 1. Have sufficient knowledge of food chemistry to control reactions in foods. 2. Understand the major chemical reactions that limit shelf-life of foods. 3. Identify the conditions under which the important pathogens are commonly inactivated, killed, or made harmless in foods. 4. Understand the principles involving food preservation via fermentation processes. 5. Be able to identify the conditions, including sanitation practices under which the important pathogens and spoilage microorganisms are commonly inactivated, killed, or made harmless in foods. 6. Explain the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage. 7. Understand the principles that make a food product safe for consumption. 8. Be able to use mass and energy balances for a given food process. 9. Explain the unit operation required to produce a given food product. 10.Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality. 11.Be able to apply and incorporate the principles of food science in practical, real-world situations. 12.Define a problem, identify causes and possible solutions, and make thoughtful recommendations. 13.Work effectively on a team project. Credits: 2.00

FS 44300 - Food Product Design (Capstone)

Credit Hours: 3.00. Teams develop a new product from concept through marketing. Final case study defense is presented to faculty and peers. Classes include guest lectures from the food industry.

Learning Outcomes: 1. Apply fundamental aspects of food chemistry, microbiology, food safety, nutrition, processing and packaging in the design and develop a new product from market concepts to practical prototype. 2. Apply knowledge food ingredient sourcing and functionality to the product development process. 3. Understand the basics of project management in the context of group projects. 4. Develop insight into bench top to pilot scale prototyping of food products. 5. Apply statistical principles through process control, experimental design and assessment of experimental data. 6. Have an appreciation for factors impacting product shelf-life and methods to control spoilage. 7. Intelligently discuss current topics in food science and trends that impact the food industry. Credits: 3.00

FS 44400 - Statistical Process Control

Credit Hours: 1.00. Basic concepts and techniques of solving quality problems and assuring the quality of production processes; emphasis is on quality improvement programs, problem-solving tools, control charts for variables and attributes,

process capability analysis, and sampling methods. Course meets during weeks 6-10.

Credits: 1.00

FS 44700 - Food Processing II Laboratory

Credit Hours: 1.00. This lab is designed to build upon fundamental concepts associated with the preservation and processing of various food products. Concepts to be covered include water activity, dehydration (drum, spray and freeze drying), frying, high pressure, microwave and ohmic heating. The focus of this lab will be hands-on production of various food products and the demonstration of fundamental food processing unit operations and calculations related to each preservation method.

Learning Outcomes: 1. Perform experiments using appropriate food processing unit operations to create various food products. 2. Write a lab report that includes analysis and interpretation of the results. 3. Work on a project team to duplicate a commercial food product and present the finding of the project in an oral and written report. Credits: 1.00

FS 45300 - Food Chemistry

Credit Hours: 3.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Understand the importance of food chemistry and the relationship of food chemistry to other food science areas. 2. Understand the structures and functions of major food components, including water, proteins, carbohydrates, lipids, vitamins, and minerals. 3. Understand major reactions occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 4. Identify the major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 5. Be able to describe types and uses of basic sensory tests. 6. Be able to identify functions of most or all ingredients listed on the ingredient label of a food product. 7. Be able to discuss alternative ingredient choices for food products. 8. Be able to write a scientific abstract using IFT formatting. Credits: 3.00

FS 45400 - Food Chemistry Laboratory

Credit Hours: 1.00. Laboratory to demonstrate application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Performance of the students' progress will be evaluated by 7 lab reports and 3 in-class problem solving activities. Credits: 1.00

FS 45500 - Cereal Chemistry And Processing

Credit Hours: 1.00. Cereal grain structure, chemical and functional properties, and nutritional aspects related to grain milling and processing. Cereal processing covers dry and wet milling, brewing, baked products, pasta, breakfast cereals, snack foods, and traditional cereal foods from other countries. (Offered in even-numbered years.)

Learning Outcomes: 1. To gain a fundamental knowledge and familiarity of the chemistry of cereal grain components and the major cereals processed to consumer products. 2. Have a working knowledge of the relationship between chemical structures, interactions and processing. Credits: 1.00

FS 46700 - Food Analysis

Credit Hours: 3.00. Application of quantitative and qualitative physical, chemical, and instrumental methods of analysis to the examination of food products; evaluation of methods for specific applications.

Learning Outcomes: 1. Describe the principles of the official and rapid methods of analysis for the following food components: moisture, ash, fat, and protein. 2. Select and justify the use of: (for any given food product) a) an official method, and b) a rapid method of analysis for the following food components: moisture, ash, fat, and protein. 3. Describe the principles of the method(s) of analysis for the following food components or properties: individual sugars, starch, total dietary fiber, individual minerals,

oxygen demand, texture, color, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional quality, protein functional properties. 4. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy, spectrometry, immune-based assays, enzymatic assays, animal assays. 5. Identify government regulations that dictate industrial standard practices of food analysis. Credits: 3.00

FS 46900 - Food Analysis Laboratory

Credit Hours: 2.00. Practical laboratory applications of food analysis, including relevant calculations using data gathered and interpretation of data. (Intended for upper-division students.)

Learning Outcomes: 1. Demonstrate practical proficiency in a food analysis laboratory, including relevant calculations using data gathered. Credits: 2.00

FS 47000 - Wine Appreciation

Credit Hours: 3.00. A study of wine production and marketing principles with an emphasis upon consumption responsibility. Historical perspectives form the foundations for wine classification systems and traditional serving procedures. Cardinal scale sensory evaluations are conducted in relationship to various food pairings. Must be 21 years of age or older to register for this course. Permission of department required.

Learning Outcomes: 1. Understand the nature of wine - its production, history, uses and related responsibilities. 2. Develop the ability to recognize different classes, types, and origins of wines. 3. Learn proper etiquette and tasting techniques. 4. Gain direct experience, both individually and as part of a team, in adopting these manners and methods. Credits: 3.00

FS 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by instructor and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

FS 48200 - Food Science Senior Seminar

Credit Hours: 1.00. Oral and written reports on selected food science topics.

Credits: 1.00

FS 48300 - Fermentation Capstone

Credit Hours: 3.00. The development of value-added fermentation processes requires a complex blend of technoeconomic and market awareness, resource gathering, strain selection and engineering, reactor optimization and operation, product recovery, and project management skills. Keeping these diverse aspects in balance while managing project timelines is essential to a successful fermentation process - that is, one that is both technically and economically successful. This course is organized to develop your knowledge of the diverse inputs into design of microbial fermentation and your ability to apply concepts learned in prior fermentation classes to the design of a fermentation process, integrating microbiology, chemistry, and processing with basic marketing and business concepts. Students will be organized into project teams for the semester and challenged to design, market, develop, prototype, and scale up a new fermentation. Classes will include guest lectures from experts in the fermentation industry and academia. Project teams will be organized and project leaders selected to manage communication between individual groups and the instructors. Final product concepts will be presented to faculty and peers for evaluation.

Learning Outcomes: 1. Apply and practically integrate fundamental aspect of fermentation microbiology, chemistry, and processing in the design and development of a new value-added process. 2. Understand and navigate the challenges associated with scaling up a benchtop fermentation process. 3. Apply knowledge of factors impacting fermentation

design, productivity, yield, and stability to optimize economic value of a process. 4. Generate an ""elevator speech"" to spur project investment. 5. Manage projects in group contexts. 6. Apply statistical principles in experimental design and assessment of experimental data as it relates to process control and product assessment. 7. Discuss current topics in fermentation science competently. Credits: 3.00

FS 49100 - Special Assignments In Food Science

Credit Hours: 1.00 to 3.00. Open primarily to qualified seniors who desire to study special problems in science not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 3.00

FS 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For honors students doing independent research. Permission of instructor required.

Credits: 1.00 to 6.00

Department of Forestry and Natural Resources

Overview

Welcome to the Department of Forestry and Natural Resources (FNR)! As one of the nation's elite programs in ecology and evolutionary biology, it is our mission to develop and disseminate knowledge associated with the protection, management, and sustainable use of terrestrial and aquatic ecosystems. FNR is training the next generation of professionals in the natural resource sciences, which includes aquatic science, forestry and wildlife.

Faculty (website)

Department of Forestry and Natural Resources (FNR) (website)

Contact Information

The Department of Forestry and Natural Resources
Purdue University
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Email: joinfnr@purdue.edu
The main office for the department is located in Room 125 in PFEN Hall.

Current Undergraduate Students (website)

Future Undergraduate Students (website)

Graduate Information

For Graduate Information please see Forestry and Natural Resources Graduate Program Information .

Furniture Design Minor

Urban Forestry Minor

Wildlife Science Minor

Wood Products Manufacturing Technology Minor

Wildlife, BS

Forest Ecosystems Minor

Aquatic Sciences: Fisheries Concentration, BS

Aquatic Sciences: Marine and Freshwater Biology Concentration, BS

Forestry: Forest Science Concentration, BSFOR

Forestry: Sustainable Biomaterials Concentration, BSFOR

Forestry: Forest Management Concentration, BSFOR

Forestry: Urban Forestry, BSFOR

Aquatic Sciences Minor

Digital Natural Resources Minor

FNR 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, EAPS 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

FNR 15000 - The Nature Of Wild Things

Credit Hours: 1.00. This is the core course for "The Nature of Wild Things" learning community. The course focuses on the majors offered in the Department of Forestry and Natural Resources (FNR), and new student integration into the University and department. This course expands knowledge of academic programs and career options in FNR, and resources available on campus to facilitate student success in the first year. Permission of department required.

Learning Outcomes: 1. Understand the importance of being engaged in FNR as a new student. 2. Be familiar with many of the faculty and some of the staff in FNR. 3. Be familiar with many of the available resources offered by Purdue University, the College of Agriculture, and FNR that facilitate student success in the first year on campus. 4. Understand proper classroom etiquette, and how to conduct oneself appropriately when interacting with faculty, academic advisors, graduate students, upperclassmen, and other members of the campus community. 5. Feel a sense of community with others in his/her cohort. Credits: 1.00

FNR 19800 - Introductory Topics In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 3.00

FNR 20100 - Marine Biology

Credit Hours: 3.00. An introduction to the major groups of marine organisms and their habitats. Emphasis on application of ecological principles to the conservation of important marine species. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 21000 - Natural Resource Information Management

Credit Hours: 3.00. Introduction to natural resource and land information systems and data management technologies. Principles of data storage, organization, and retrieval for both textual and spatial data (geographic information systems), data acquisition, accuracy assessment, mapping, and use of this data in natural resource management are presented.

Learning Outcomes: 1. Define basic spatial data concepts (GIS). 2. Create and use spatial and textual databases. 3. Develop spatial analysis abilities using ArcGIS Pro. 4. Contribute to the following: critical thinking, problem solving, quantitative reasoning, information literacy and written communication. Credits: 3.00

FNR 22310 - Introduction To Environmental Policy (UCC: STS)

Credit Hours: 3.00. (POL 22300) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

FNR 22500 - Dendrology

Credit Hours: 3.00. Field identification, taxonomy, and ecological characteristics of trees, shrubs, and herbs found in forests, prairies, old fields, and wetlands.

Learning Outcomes: 1. Understand factors that control the distribution of major tree species that are native to forest regions of North America. 2. Gain exposure to silviculture, ecology, commercial, and wildlife uses of the tree species in various forest types. 3. Learn identifying characteristics of woody vegetation in North America, with emphasis on Indiana. Credits: 3.00

FNR 23000 - The World's Forests And Society (UCC: STS)

Credit Hours: 3.00. Examination of structure, function, and environmental and cultural significance of forest ecosystems throughout the world.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Comprehend the complexity of the forests worldwide and understand their variety, distribution, ecological functioning, and role in developing societies and communities. 2. Provide a global perspective of forests' social and economic values, their multiple uses, and the variety of products derived from them. 3. Understand the most critical factors threatening forests and related natural resources in developing and developed countries. 4. Understand the strong connection between forests and related natural resource fields (ecology, wildlife, forest products, sustainability, etc.). Credits: 3.00

FNR 24000 - Wildlife In America (UCC: STS)

Credit Hours: 3.00. History of the occurrence, exploitation, and management of North America's wildlife resources. Life histories, habitat relationships, and human impacts on selected species. Current conservation practices and future prospects.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify and describe the diversity of North American wildlife and their habitats in order to improve their ecological study and aid in their management and conservation. 2. Describe and explain fundamental concepts and theories in the field of ecology in order to inform different wildlife conservation and management strategies. 3. Compare and contrast the various anthropogenic threats to wildlife in order to synthesize and evaluate their impacts on wildlife. 4. Explain and apply approaches and tools used in wildlife conservation and management in order to address anthropogenic threats to wildlife. 5. Evaluate primary literature in order to analyze the merits and weaknesses of current research in the fields of ecology, conservation, and management as they relate to major wildlife groups. Credits: 3.00

FNR 24150 - Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 3.00. Introduction to the ecology and systematics of Fish, Amphibians and Reptiles. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of fish, amphibians and reptiles.

Learning Outcomes: 1. Know about the evolutionary history of fishes, amphibians and reptiles. 2. Know the major taxa of fishes, amphibians and reptiles and the special anatomical, morphological, behavioral, and ecological features that characterize each group. 3. Be familiar with many of the techniques used to study the behavior and ecology of fishes, amphibians and reptiles. 4. Be familiar with major threats facing these groups. Credits: 3.00

FNR 24250 - Laboratory In Ecology And Systematics Of Fishes, Amphibians And Reptiles

Credit Hours: 1.00. Basic anatomy, classification, and identification of fishes, amphibians and reptiles. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Learn to identify important North American fish, amphibians, and reptile species, with an emphasis on species of the Midwestern U.S. 2. Be familar with the ecology, natural history, and systematics of the fish, amphibians, and reptiles. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxomonic keys. Credits: 1.00

FNR 25150 - Ecology And Systematics Of Mammals And Birds

Credit Hours: 3.00. Introduction to the ecology and systematics of mammals and birds. Discuss the evolutionary adaptations and ecological processes of these vertebrate groups at the individual, population, and community levels. Examine the roles of phylogeny, physiology, morphology, and behavior in influencing organismal responses to the environment. Assess issues related to the conservation of mammals and birds.

Learning Outcomes: 1. Be familiar with the evolutionary origins of mammals and birds. 2. Know the major taxa of mammals and birds. 3. Be familiar with the behavioral and ecological characteristics of wild mammals and birds. 4. Be familiar with major threats facing wild mammal and bird populations. 5. Gain experience reading and summarizing primary literature on wild mammals and birds. Credits: 3.00

FNR 25250 - Laboratory In Ecology And Systematics Of Mammals And Birds

Credit Hours: 1.00. Basic anatomy, classification, and identification of mammals and birds. Identification deals with representative species from selected phylogenetic and geographic groupings in North America.

Learning Outcomes: 1. Identify important North American mammal and bird species, with an emphasis on species of the Midwestern U.S. 2. Be familiar with the ecology, natural history, and systematics of the mammals and birds. 3. Describe the characteristic features of some of the important North American vertebrates, using a combination of preserved specimens, photographic images, field guides, and taxonomic keys. Credits: 1.00

FNR 27000 - Landscape-Level Planning

Credit Hours: 1.00. The main objective of this course is to teach students about natural resources planning with an emphasis on critical skills for developing landscape-level management plans. This one credit course uses guest speakers, lectures, in-class activities, group presentations and take-home assignments to facilitate student learning.

Learning Outcomes: 1. Understand the role of planning in natural resource management. 2. Communicate the importance of landscape level planning. 3. Write the key elements in a natural resource management plan. 4. Understand planning tools such as zoning, conservation easements, and grant funding. 5. Think through how to evaluate a plan. Credits: 1.00

FNR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 29800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 0.00 to 4.00. The class will be used primarily for lower-level undergraduate research projects and for the development of new and/or temporary courses for lower-division students. The course also offered for 0 credit for training opportunities (e.g., first aid for undergraduates attending summer practicum).

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 4.00

FNR 30110 - Sustainable Wood Products Manufacturing

Credit Hours: 3.00. Sustainable wood processing methods for hardwood and softwood sawmilling; veneering; plywood; pallets; lumber drying; reconstituted products including particleboard, medium density fiberboard, and oriented strand board; wood preservation including lumber, crossties, poles, and piling; secondary products including furniture, cabinets, millwork; and others; wood residues, woody biomass and others as appropriate will be covered. In addition to processing methods, the grading of material, including logs, hardwood and softwood lumber and consideration of applicable standards, and sustainability initiatives will be covered.

Learning Outcomes: 1. Provide insight into the

many products and processes which are used to sustainably convert round timber into consumer and industrial products, emphasis on the hardwood industry. 2. Provide adequate background in order to be employable by the wood manufacturing industry. Credits: 3.00

FNR 30200 - Global Sustainability Issues

Credit Hours: 2.00. This course explores global sustainability issues in natural resources with emphasis on forestry, wood products manufacturing, conservation, water management, energy and their impact on the targeted geographic location (such as Central America, Eastern Europe) and the rest of the world. The purpose of this course is to present students, regardless of their disciplinary background, with an overview of the interdisciplinary aspects of sustainable natural resource management. This colloquium course will examine global sustainable natural resources and related issues (including population, poverty, pollution, climate change, deforestation, invasive species, urbanization, habitat loss, cultural traditions, water management, energy, education, technology, and international collaboration).

Learning Outcomes: 1. Appraise the impact of natural resources in developing and developed economies. 2. Understand the most important factors that threaten natural resources in developing and developed economies. 3. Understand how developments in natural resources in foreign countries relate to similar developments in Indiana and the United States. 4. Comprehend the complexity of global natural resource issues and the role of sustainable natural resource management in sustainable development. Credits: 2.00

FNR 30500 - Conservation Genetics

Credit Hours: 3.00. Fundamentals and principles of genetics, including Mendelian inheritance, genetic mapping & linkage, DNA fingerprinting, phylogeography, and speciation. Topics cover the theoretical and empirical evidence illustrating how mutation, migration, drift, and natural selection influence the evolution of genes in natural populations. Designed for ecologists and natural resource professionals.

Learning Outcomes: 1. Develop conceptual understanding of modern genetics and the use of molecular markers in studies of wildlife/fisheries/forest management, ecology, and evolutionary biology. 2. Explore how genetic information is used in sportfish stockings, wildlife reintroductions, and selective harvest of native trees. 3. Recognize and predict the genetic ramifications of these artificial activities. 4. Compare these effects to the consequences of natural disturbances. (e.g., glaciations). Credits: 3.00

FNR 31110 - Identification And Basic Properties Of Wood

Credit Hours: 3.00. The identification of macro characteristics of North American wood species and discussion of their availability, distribution, and unique characteristics. Basic physical, mechanical and working properties of wood, including orthotropic nature of wood, grain, texture, moisture content, shrinking, specific gravity, machining, thermal properties, electrical properties, strength prosperities, natural characteristics affecting mechanical properties, also the effect of manufacturing and service environment on mechanical properties through laboratory exercises and field trips. Students will study the cellular structure and arrangement of woody biomaterials, their manufacturing characteristics and uses.

Learning Outcomes: 1. Learn the identifying macro characteristics of commercially important woody biomaterials (color, odor, cellular arrangement, grain patterns, character marks, etc.) through laboratory exercises and field trips. 2. Learn the cellular structure and arrangement of woody biomaterials. 3. Know the manufacturing characteristics and uses of woody biomaterials. 4. Identify upon sight the major commercial hardwood and softwood species produced in North America. Credits: 3.00

FNR 31300 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (HORT 31110) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in Western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem

of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of postharvest food storage and pest management. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 14. Be able to handle multiple tasks and deadline pressures. 15. Be able to work effectively with individuals from diverse cultures. 16. Have strong professional ethics and integrity. 17. Understand the importance of developing leadership skills. 18. Be able to work effectively in teams. 19. Have a working knowledge of SI (metric) units. Credits: 1.00

FNR 33100 - Forest Ecosystems

Credit Hours: 3.00. Introduction to ecosystem processes, with emphasis on structural dynamics, energy flows, nutrient cycling, spatial patterns, classification and interaction of plant and animal populations. Processes will be related to human activities.

Learning Outcomes: 1. Understand the basic principles of ecology. 2. Understand the response to forest vegetation to environmental factors. 3. Understand the role of disturbance in driving community dynamics, stand development, and ecosystem function. 4. Understand primary productivity and nutrient cycling. 5. Understand plant-animal interactions. 6. Understand the influence of human activities on ecosystem processes. Credits: 3.00

FNR 33350 - Applied Fire Ecology

Credit Hours: 3.00. Fire, either as a natural disturbance or anthropogenically mediated disturbance, has been a feature of almost every major terrestrial ecosystem in North America. In this era of climate change, land management agencies are increasingly using fire both to manage terrestrial ecosystems and to actively contain wildfire. This class will provide basic understanding to both fire behavior and its ecological impacts on terrestrial ecosystems, focusing on systems common to the Central Hardwood Region. Students will get experience conducting prescribed fire and take Firefighter Type II (FFT2) online training modules, in partial fulfillment of requirements of an Incident Qualification Card (i.e., "red card"). Students will learn how to develop a burn plan for a given property, including assessment of risks, prediction of fire behavior (i.e., BEHAVE model), and estimation of burn effects.

Learning Outcomes: 1. Explain the role of fire in the development of North American ecosystems. 2. Describe fire as a physical and ecological process. 3. Demonstrate the ability to utilize prescribed fire safely. 4. Develop a burn plan to complete a prescribed fire safely and effectively. 5. Evaluate the role of fire as a contemporary management tool. Credits: 3.00

FNR 33800 - Introduction To Silviculture

Credit Hours: 3.00. This course introduces the common silvicultural systems used in North American forests for forestry

and wildlife habitat management objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures present theoretical concepts in order to allow students to understand forest management practices, while the recitation portion of this course reviews these concepts in light of wildlife habitat management, biodiversity, and other non-timber resources. The recitation is writing-intensive requiring several reflection papers on assigned readings and a semester-ending term paper on a subject of the student's choosing. Credit cannot be earned for both FNR 33800 and FNR 43900. Permission of department required.

Learning Outcomes: 1. Be familiar with technical silvicultural terminology. 2. Describe the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices affect soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Locate, summarize and evaluate primary and selected secondary literature sources in regards to silvicultural effects on non-timber resources. Credits: 3.00

FNR 34100 - Wildlife Habitat Management

Credit Hours: 3.00. Principles, practices, and justification of the habitat management approach to the manipulation of wildlife populations.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 34800 - Wildlife Investigational Techniques

Credit Hours: 3.00. An introduction to current wildlife research techniques that are used in managing populations and habitats. Laboratory and field exercises are used to gather and analyze data; basic data analysis and written dissemination of results is emphasized.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35100 - Aquatic Sampling Techniques

Credit Hours: 3.00. An introduction to laboratory and field sampling methods in aquaculture, limnology, and fisheries biology. Emphasis will be placed on the proper use of laboratory equipment and sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35110 - Aquatic Sampling Techniques I

Credit Hours: 2.00. This course presents an introduction to field sampling methods used in aquaculture, aquatic ecology, and fisheries biology. The course emphasizes the proper care and use of field sampling gears, as well as the development of sampling protocols for collecting representative, non-biased fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with assessing physical habitat, lower trophic levels, and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including basic data analysis and decision-making as it pertains to the sampling and management of aquatic ecosystems. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills relative to fisheries and

aquatic science sampling considerations and issues. Credits: 2.00

FNR 35150 - Aquatic Sampling Techniques II

Credit Hours: 2.00. This course presents an introduction to laboratory and field sampling methods used in aquaculture, limnology, and fisheries biology. The course emphasizes the proper care and use of laboratory equipment and field sampling gears, as well as the analyses and reporting of fisheries and aquatic sciences data.

Learning Outcomes: 1. Apply principles and techniques associated with hatchery and freshwater and marine fish culture systems and assessment of fish health, fish diet and age, physical habitat, water quality and fish populations in lentic and lotic environments. 2. Assess aquatic resources, including data analysis, reporting, and decision-making as it pertains to the sampling and management of fish culture systems and aquatic ecosystems. 3. Advance critical thinking and written and oral communication, and professional skills relative to fisheries and aquatic science sampling considerations and issues. Credits: 2.00

FNR 35300 - Natural Resources Measurement

Credit Hours: 3.00. An introduction to sampling techniques and fundamental principles for measuring natural resources.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3 . Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 35500 - Quantitative Methods For Resource Management

Credit Hours: 3.00. Application of analytical and computational techniques for the purpose of making decisions regarding the management of forests.

Learning Outcomes: 1. Evaluate natural resources critically, discern the strength of evidence and arguments, determine credibility, and identify potential bias and overall quality. 2. Use simulation and optimization tools to address various natural resources management problems and challenges. 3. Appreciate the basics of computer simulation, visualization, and data management. Credits: 3.00

FNR 35700 - Fundamental Remote Sensing

Credit Hours: 3.00. Introduction to the principles of remote sensing, aerial photo interpretation, photogrammetry, geographic information systems, and global positioning systems. Primary applications of geospatial science and technology in forestry and natural resources.

Learning Outcomes: 1. Understand remote sensing fundamentals and gain knowledge about the applications of remotely sensed data in vegetation and land use. 2. Exercise relevant computer software (Erdas Imagine) for handling and aerial photographs and satellite imagery. 3. Use remote sensing skills to solve problems associated with agriculture, forestry, natural resources, and urban areas. Credits: 3.00

FNR 35910 - Spatial Ecology

Credit Hours: 2.00. Introduction to the principles of landscape ecology and biogeography. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance.

Learning Outcomes: 1. Able to understand the theory, applications (how theory is applied) can be used to study landscape and larger scale problems related to natural resources. 2. Know what a landscape is. 3. Know the methods to quantify landscape pattern. 4. Understand important terms in landscape ecology and biogeography. 5. Understand the causes

(natural and human) of landscape pattern. 6. Understand the threats to biodiversity locally and globally. 7. Able to explain the theory of island biogeography. 8. Define sustainability and know how to calculate an ecological footprint. Credits: 2.00

FNR 35950 - Spatial Ecology Laboratory

Credit Hours: 1.00. The lab will focus on the use and application of spatial databases that are common in natural resource management settings. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales.

Learning Outcomes: 1. Know methods to quantify landscape pattern. 2. Use GIS to conduct simple and moderately complex analyses using common public domain databases. 3. Know where to get important geospatial data from the internet. 4. Work with US government data and understand the various levels of aggregation of spatial data. Credits: 1.00

FNR 37010 - Natural Resources Practicum

Credit Hours: 1.00. Specific field instruction in forestry, fisheries and aquatic sciences and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Identify common local trees and shrubs. 2. Use aerial photos, topographic maps, magnetic compass and pacing to navigate on the landscape. 3. Use aerial photos and topgraphic maps to determine distance, area, landforms and cover types on the landscape. 4. Identify habitat types with aerial photos and define habitat boundaries on ground with hand-held GPS. 5. Delineate watershed boundaries with stereo aerial photos. 6. Locating land marks with Lat-Lon and UTM coordinates under different datum systems. Credits: 1.00

FNR 37050 - Forest Habitats And Communities Practicum

Credit Hours: 1.00. Specific field instruction in forestry and wildlife. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Use field classification keys to perform habitat typing of forest communities. 2. Collect and analyze field vegetation data to describe forest composition and structure. 3. Identify soil, site, and disturbance characteristics that determine the distribution and abundance of plant and animal species. 4. Describe the responsibilities, duties, and challenges of working as a professional forester or wildlife biologist. 5. Evaluate wildlife abundance using a variety of field methods and understand the differences between population estimates and indices. Credits: 1.00

FNR 37100 - Fisheries And Aquatic Sciences Practicum

Credit Hours: 5.00. Specific field instruction in fisheries and aquatic sciences. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Develop knowledge in the principles and techniques associated with sampling and assessing fish populations, aquatic habitats, and lower trophic levels (e.g.. zooplankton. benthic invertebrates, etc.) in stream/river (i.e.. lotic) and pond/lake (i.e.. lentic) ecosystems. 2. Develop practical, hands-on experience in aquatic resource assessment, data analysis, reporting, and decision-making as it pertains to sampling and management of aquatic ecosystems. 3. Sharpen critical thinking, written and oral communication, and

professional skills relative to fisheries and aquatic sciences as they apply to both basic and applied science. Credits: 5.00

FNR 37200 - Forestry Practicum

Credit Hours: 4.00. Specific field instruction in forestry. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Perform basic surveying skills. 2. Perform basic GIS/GPS operations. 3. Perform forest inventory and measurement techniques. 4. Utilize computer applications and analysis of inventory data. 5. Define silvicultural terminology. 6. Explain ecological concepts related to forest-stand development. 7. Explain how forest management affects various resources including: soil, water, timber, wildlife, biodiversity, aesthetics, and forest health. 8. Describe tree improvement, seedling production, and reforestation practices. 9. Plant a seedling properly and understand how to check planting quality of a planting crew. 10. Explain what management practices can be used to promote forest health. 11. Explain the differences in primary production processes for paper, dimensional lumber and engineered wood. 12. Explain the differences in primary production processes for OSB and paper. 13. Estimate the stumpage value of a stand. 14. Assess plant biodiversity of a stand. 15. Estimate recreational values of a national forest. 16. Describe flows of matter and energy in coupled human and natural systems. 17. Discuss how drivers of ecological processes change across an urban-rural gradient. 18. Compare and contrast forest ecosystem structure and function in urban and rural settings, including diversity and distribution of organisms, landcover types, and ecosystem services. 19. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 20. Recognize the various types of nursery stock available for planting and their purpose. 21. Describe the best management practices for installing a landscape-scale tree in the urban environment. 22. Demonstrate proper technique for planting and transplanting trees by installing a tree using best management practices. 23. Explain why arborists climb trees. 24. Describe situational awareness of tree work aloft including H.O.P.E. 25. Recognize the basic equipment for ascending a tree and how they are applied in climbing operations. 26. Demonstrate basic ascending and descending techniques for access to the tree. 27. Explain the benefits of trees. 28. Describe tree value and how they contribute to ecosystem services. 29. Explain why trees should be assessed for risk. 30. Identify basic and advanced tools used in a risk assessment. 31. Recognize typical defects found in trees and their relative risk factor. 32. Demonstrate the principles of a basic risk assessment for trees. Credits: 4.00

FNR 37300 - Wildlife Practicum

Credit Hours: 4.00. Specific field instruction in wildlife science and management. Students pay university tuition plus a fee for living facilities and subsistence.

Learning Outcomes: 1. Able to identify the common birds seen and heard on the campus of Covenant Point and surrounding areas. 2. Able to set up mist nets, remove birds safely from the nets and take down and store the equipment properly. 3. Able to safely handle and measure birds, mark them with leg bands and record appropriate data. 4. Create and maintain a field notebook of their observations and activities during the week. 5. Able to lay out a small mammal trapping grid and properly place traps. 6. Able to remove small mammals

from live traps, mark those animals, measure them for identification and release them. 7. Able to operate a telemetry to receiver to estimate the location of a radio collar via triangulation and use homing technique to find that transmitter. 8. Able to identify bat roosting habitat, use acoustic recorders to detect bats and use software to identify bat species from recorded calls. 9. Able to track small mammals using both spool and line and fluorescent powder techniques. 10. Able to develop a null hypothesis about habitat selection and use a chi square test for independence to accept or reject that null hypothesis. 11. Perform current techniques for sampling herpetofanua and macroinvertebrates. 12. Describe and perform herpetofanual marking techniques. 13. Identify anuran species by call. 14. Identify and dissect larval amphibians. 15. Identify macroinvertebrate species in lentic and lotic habitats. 16. Describe common diseases of amphibians. Credits: 4.00

FNR 37500 - Human Dimensions Of Natural Resource Management

Credit Hours: 3.00. An introduction to the human dimensions of forestry, wildlife, and recreation; students will learn how values, attitudes, community, and behavior relate to natural resource management and decision-making; various natural resource management stakeholders such as private landowners, natural resource agencies, the judiciary, and environmental and natural resource interest groups will be discussed; course will utilize case studies specific to Indiana and the Midwest; course includes weekly discussions during recitations.

Learning Outcomes: 1. Become familiar with key concepts and theories related to the human dimensions of natural resource management. 2. Become familiar with key methods that can be used to collect and analyze human dimensions data to inform natural resource management and environmental conservation decisions. 3. Identify various social, economic, political, and cultural factors that influence how people (particularly individuals) think about and act towards natural resources and the environment. 4. Identify potential strategies for informing and influencing human behaviors towards a more sustainable future. 5. Examine current natural resource management and conservation approaches/programs from a human-dimensions perspective critically and suggest well-informed alternatives/changes/additions to enhance management and conservation outcomes. Credits: 3.00

FNR 37700 - Optimize Student Conference Attendance

Credit Hours: 1.00. Participation in this course will formalize the experience of attending a professional conference by training students to optimize their experience. Students will then attend a professional conference with mentoring from the course instructors. Permission of instructor required.

Learning Outcomes: 1. Attend a profession conference. 2. Gained an understanding of how to plan a personal conference schedule and maximize networking opportunities to gain the most out of the experience. 3. Develop critical evaluation skills that allow for assessment of the quality of research and what to expect from a conference presentation based on an abstract. 4. Broaden their understanding of career options available in their chose field and the training and experience necessary to be qualified for those careers. Credits: 1.00

FNR 37800 - Marine Biology Practicum

Credit Hours: 3.00. This course presents students with expanded opportunities to use field techniques to sample and report on marine habitats and organisms. The course emphasizes the proper care and use of field sampling gear and identification of fish and invertebrates samples from exposed shore, lagoon, and estuary habitats. A trip to the coast of either the Atlantic Ocean or Gulf of Mexico is a central component of this course; a course fee is required to cover the expenses of the trip.

Learning Outcomes: 1. Demonstrate enhanced knowledge of the basic principles and techniques associated with sampling organisms

in coastal environments. 2. Demonstrate practical knowledge and skills in sampling, handling, identifying, and reporting on marine biological communities characteristic of several costal habitat types. 3. Demonstrate improved critical thinking, written and oral communication, and professional skills related to marine biology. Credits: 3.00

FNR 38400 - Statistics For Natural Resources

Credit Hours: 3.00. Methods of statistical analysis and modeling for data and problems encountered in natural resources conservation, science and management. Emphasis is on application of methods and interpretation of results in the context of natural resource problems. Topics include introductory sampling design, exploratory analyses, general linear models, generalized linear models, introduction to resampling methods, likelihood-based model selection, and model goodness-of-fit.

Learning Outcomes: 1. Describe the importance of proper design and analysis when seeking answers/solutions to a broad array of natural resources issues. 2. Independently assess the relative merits of multiple analysis approaches when presented with data collected to improve our understanding of a particular process or pattern in natural resources. 3. Fit and evaluate regression models for quantitative and categorical response variables with an appropriate underlying probabilistic structure. Credits: 3.00

FNR 38500 - Fish Biology And Ecology

Credit Hours: 4.00. Advanced study of the biology and ecology of fishes. In particular, the course covers aspects of the morphology, physiology, development, behavior, evolution, and diversity of fishes throughout the world. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems will be explored. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual, population, community structure, and anthropogenic effects.

Learning Outcomes: 1. Know key primitive fish groups and understand how modern fishes evolved through time. 2. Develop skills in fish taxonomy and scientific nomenclature, including identification of a wide range of fish specimens. 3. Understand fish diversity in terms of morphology, behavior, feeding, reproduction and habitats. 4. Build fish laboratory skills, including fish dissection, data collection and data analysis. 5. Understand the broad ecological roles of fishes in freshwater and marine systems. 6. Understand the principles of fish population dynamics and how populations respond to various biotic and abiotic factors. 7. Develop an understanding of the scientific method and demonstrate the ability to solve. problems, think critically and write scientific reports. Credits: 4.00

FNR 39000 - Cooperative Professional Program

Credit Hours: 0.00. Supervised professional experience in forestry. Programs must be preplanned and conducted under the direction of a forestry faculty coordinator with the cooperation of an employer. Students must submit a summary report. Admission to forestry Co-op program.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00

FNR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in forestry & natural resources. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

FNR 40000 - Forestry And Natural Resources Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 8.00

FNR 40100 - Limnology

Credit Hours: 3.00. Limnology is the study of the chemical, physical, geological, biological, and ecological processes that influence the structure and function of freshwater ecosystems. The course will focus on developing the understanding of key terms and mechanisms related to the basic understanding of limnological processes. Moreover, various applications and management considerations related to freshwater ecosystems will be presented.

Learning Outcomes: 1. Practice and develop critical thinking skills through in-class discussions and presentations. 2. Learn how to read and interpret the scientific literature. 3. Broaden their understanding of freshwater ecosystems, through lectures. Credits: 3.00

FNR 40600 - Natural Resource And Environmental Economics

Credit Hours: 3.00. (AGEC 40600) Introduction to economic models of renewable and nonrenewable natural resources and the use of these models in the analysis of current resource use and environmental issues.

Learning Outcomes: 1. Define "social efficiency" and "cost-effectiveness" and discuss each concept's caveats in allocating environmental goods. 2. Identify externalities and understand the government's role in addressing them. 3. Apply basic cost-benefit analysis for environmental decision-making. 4. Understand the process of and justification for valuing environmental amenities. 5. Discuss the economic perspective on environmental sustainability. Credits: 3.00

FNR 40700 - Forest Economics

Credit Hours: 3.00. Implications of unique economic characteristics of forest resources, including a tree as both capital and output, high capital-to-output ratio, location utility of in-forest uses, long investment periods, and non-market outputs.

Learning Outcomes: 1. Describe the different approaches to forest management including the planning concepts. 2. Identify the ecological, social and economic objectives associated with management strategies. 3. Understand concepts related to forest sustainability and conservation. 4. Understand the management

implications of contemporary issues. 5. Apply analytical tools of forest decision making. Credits: 3.00

FNR 40910 - Forest Resources Management

Credit Hours: 3.00. This course focuses on the long-term sustainable management of forests for the production of wood fiber, ecological services, and other market and non-market goods and services.

Learning Outcomes: 1. Describe the different approaches to forest management including: planning concepts; ecological, social and economic objectives; forest sustainability and regulation; certification programs; adaptive management; and forest decision analysis and tools (discounted cash flow, financial maturity, growth and yield estimates and projections, mathematical programming). 2. Confidently develop a management plan for a property including: defining and creating useful stand delineations; assessing the condition of the land and timber; establishing objectives including the goal of long-term sustainability; defining the future forest conditions needed to achieve these objectives; creating alternative prescriptions to achieve the future conditions; and recommending a plan of action, while maintaining a record of alternatives considered, but not recommended. Credits: 3.00

FNR 41800 - Properties Of Wood Related To Manufacturing

Credit Hours: 3.00. Orthotopic nature of wood, grain, texture, moisture content, shrinking, swelling, specific gravity, machining, thermal properties, electrical properties, elastic properties, strength properties, vibration properties, bending, natural characteristics affecting mechanical properties, effect of manufacturing and service environment on mechanical properties, changing quality of available resources and implications of wood quality changes for manufacturing.

Learning Outcomes: 1. Familiarize the student with the basic physical, mechanical, and working properties of wood and wood composites. 2. Understand the effect of manufacturing and service environment on mechanical properties, changing quality of available resources, and implications of wood quality changes for manufacturing. Credits: 3.00

FNR 41910 - Furniture Product Development And Strength Design

Credit Hours: 3.00. Qualitative and quantitative principles of furniture construction, product development methodology and strength design principles, furniture performance testing, product sustainability and end of life options (LCA, computer-based applications and solutions). Course features laboratory evaluating, furniture joints and furniture structures.

Learning Outcomes: 1. Identify and specify appropriate furniture constructions. 2. Determine whether furniture has adequate strength, stiffness, and durability. 3. Determine whether furniture will meet existing performance standards. 4. Determine product sustainability. Credits: 3.00

FNR 42500 - Secondary Wood Products Manufacturing

Credit Hours: 3.00. Secondary wood products manufacturing; structure of the industry, organization of a furniture factory, raw materials, rough mill, finish mill, assembly, finishing, machinery, wood machining, plant layout, production methods, modern industrial engineering concepts; includes visits to manufacturing operations. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Familiarize the student with the basics of secondary hardwood products manufacturing: organization, raw materials, machinery, plant layout, production methods, machining, finishing, and CNC router operation. Credits: 3.00

FNR 43200 - Human-Wildlife Conflicts

Credit Hours: 3.00. Exploration of conflicts between human interests and wildlife and the regulations policies and legislation used to minimize conflicts. Negative interactions may be real or perceived, economic or aesthetic, social or political, and may pose risks to human health and safety. Emphasis on the causes of conflict and resolutions that seek to balance protection or conservation of wildlife with protection of other public resources and individual property owners. Prior knowledge of college-level general biology and ecology is expected.

Learning Outcomes: 1. Identify common causes of human-wildlife conflicts. 2. Evaluate the impacts of the conflict damage/threat. 3. Prescribe options for resolving the conflict. 4. Measure effectiveness of applied mitigation strategies. Credits: 3.00

FNR 43300 - Grand Challenges In Forest Management

Credit Hours: 3.00. This course will guide students through readings, discussions, and presentations of the grand challenges that face the field of forest management. These topics will vary with each iteration of the class but may include topics such as climate change, invasive species, pressure on forest lands from a growing population, altered disturbance regimes, development of new silvicultural techniques, economic pressure at multiple scales, and shifting public perceptions on the management of forests. Students will examine and discuss these challenges from the vantage points of multiple stakeholders to gain insight into their complexity and importance. Students will read and discuss on average 2-4 research or review articles, book chapters, or other sources per week.

Learning Outcomes: 1. Identify and discuss major challenges facing the field of forest management. 2. Describe how these challenges interact and develop an understanding of how these interactions may result in amplified effects on forests. 3. Understand how these challenges may be viewed from a variety of perspectives by different stakeholders. 4. Identify how forest management may be used to mitigate some of the effects of these challenges. 5. Organize and present an oral and written case study of a forest management scenario that is linked to multiple challenges discussed in class. Credits: 3.00

FNR 43400 - Tree Physiology

Credit Hours: 3.00. Study of physiology of growth and development of woody plants. Emphasis on the structure and function of trees and their physiological response to environmental factors.

Learning Outcomes: 1. Explain the importance of the various physiological processes through which heredity and environment interact to influence tree growth. 2. Provide an overview of both the form and structure of trees. 3. Define patterns of vegetative growth for temperate-zone and tropical woody plants. 4. Describe the prominent features of the important physiological processes that affect plant growth and development, such as: photosynthesis; respiration; carbohydrate, nitrogen, and mineral nutrient relations; water absorption; transpiration; and plant hormones and other signaling molecules. Credits: 3.00

FNR 43900 - Silviculture

Credit Hours: 3.00. This course details common silvicultural systems used in North America for establishment and tending of forest stands for a variety of objectives. Topics range from stand dynamics to thinning practices and regenerative harvest systems in naturally-regenerated forests. Lectures focus is on theoretical concepts in order to allow students to apply their knowledge to North American forest ecosystems, while the laboratory portion of this course includes practical experience in marking silvicultural prescriptions and conducting silvicultural treatments. Lab projects emphasize critical thinking, data-driven decision-making (using growth and yield models), technical writing and oral communication. Permission of department required. Credit cannot be earned for both FNR 33800 and FNR 43900.

Learning Outcomes: 1. Be fluent in technical silvicultural terminology. 2. Develop and critically evaluate the effectiveness of alternative site preparation, regeneration, stand tending, and harvesting methods for natural stands. 3. Describe the impacts of silvicultural practices on soil resources, forest health, timber production, wildlife habitat, biodiversity, aesthetics and other aspects in natural stands. 4. Appraise the ecological and economic costs/benefits for various silvicultural treatments. 5. Use growth-and-yield models (i.e., FVS) to help predict future stand development and evaluate silvicultural alternatives (i.e., data-driven decision making). 6. Design silvicultural prescriptions that are applicable to Central Hardwood forests. Credits:

3.00

FNR 44400 - Arboricultural Practices

Credit Hours: 4.00. Course covers a broad spectrum of arboriculture principles and techniques, including pruning, transplanting, fertilization, climbing, rigging, removal, cabling, bracing, lightning protection, hazard tree evaluation, tree appraisal, and street tree inventory.

Learning Outcomes: 1. Recognize and explain the various arboricultural practices that enhance the sustainability of trees in the built environment. 2. Apply essential plant health care practices and arboricultural practices used in the cultivation and management of trees and other woody plants in the built environment including planting, pruning and pest management. Credits: 4.00

FNR 44500 - Urban Forest Issues

Credit Hours: 3.00. This course presents an array of topics germane to the management of trees in the urban environment. This includes the benefits of trees and general tree care, tree appraisal, tree ordinances, tree inventory and management plans, and tree preservation and construction.

Learning Outcomes: 1. Understand sustainable urban & community forestry and why it is important. 2. Recognize the numerous benefits of urban/community forests to society, and the ecosystem services provided. 3. Identify common issues, challenges and pressures which threaten the urban forest. 4. Recognize the unique features of urban forest systems and how to apply the principles of urban forest management to real-world cases. 5. Acquire an understanding of sustainability as it pertains to urban forests and urban forestry programs in metropolitan regions, cities, towns, communities and neighborhoods. Credits: 3.00

FNR 44700 - Vertebrate Population Dynamics

Credit Hours: 4.00. Estimation and analysis of populations; computer modeling of sampling methods, population dynamics, population and habitat management. Knowledge of computer programming not required.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 4.00

FNR 45200 - Aquaculture

Credit Hours: 3.00. Historical perspectives and current practices in aquaculture, including production systems, feeds, water quality requirements, and diseases of commercially important species.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45300 - Fish Physiology

Credit Hours: 3.00. Presentation and discussion of physiological mechanisms exhibited by freshwater and marine invertebrates and vertebrates. Primary materials used for class presentation and discussions will be examples from primary research literature. Topics include respiration, osmoregulation, stress physiology, absorption and metabolism of compounds, and hormonal control of selected physiological mechanisms. Offered in odd-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45500 - Fish Ecology

Credit Hours: 3.00. The relationship of fishes to the physical, chemical, and biological features of the environment in both natural and perturbed aquatic ecosystems. An emphasis will be placed on diversity in morphology, behavior, feeding, and reproductive strategies as they relate to individual and population adaptation, community structure, and anthropogenic effects. Offered in even-numbered years.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate hypothesis tests, conduct and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using evidence-based information to develop sound responses to complex problems. 3. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and ethics. Credits: 3.00

FNR 45600 - Fish And Marine Population Dynamics

Credit Hours: 4.00. Theory of population dynamics of animal populations in freshwater and marine environments. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, marine and freshwater invertebrates, sport and commercial fish populations, and aquatic communities. Human resource users and non-users are considered.

Learning Outcomes: 1. Quantitatively assess the status of a fish population and develop considerations for management. 2. Practice and develop critical thinking skills through in-class discussions and a group research project. 3. Learn to interpret the scientific literature through reading of the primary literature. 4. Broaden understanding of fisheries and natural resource management. Credits: 4.00

FNR 45700 - Practical Fisheries Management

Credit Hours: 2.00. Theory and practice of fisheries management, with emphasis on strategies utilized for the management of freshwater and marine fisheries. Course content will include hands-on assessment of fish populations, as well as development of management plans and the setting of appropriate goals and objectives for effective, science-based management.

Learning Outcomes: 1. Develop understanding of the practical management of fisheries. 2. Compare and contrast a variety of fisheries management techniques with an emphasis on local fisheries. 3. Demonstrate quantitative skills in population modeling and the writing of fisheries management plans. Credits: 2.00

FNR 45800 - Advanced Marine Biology

Credit Hours: 3.00. Focus is placed on the structure and function of major marine ecosystems, including estuarine, mangrove, coastal, coral reef, open ocean, and deep ocean environments. Course content will include rigorous treatment of the biogeochemical processes that support these ecosystems, as well as the biology and ecology of characteristic flora and fauna.

Learning Outcomes: 1. Demonstrate in-depth understanding of the structure and function of key marine ecosystems of the world. 2. Demonstrate thorough understanding of the major groups of organisms characteristic of key marine ecosystems of the world. 3. Demonstrate thorough understanding of the biogeochemical processes that sustain key marine ecosystems and their constituent taxa. 4. Understand major threats to sustainability of key marine ecosystems of the world. 5. Demonstrate improved critical thinking and scientific writing skills. Credits: 3.00

FNR 46000 - International Natural Resources Summer Program

Credit Hours: 3.00. A four-week, intensive program examining the management and conservation of natural resources in Europe and the United States. Jointly taught with faculty and students from the Swedish University of Agricultural Sciences. The program topic and venue change each year, but emphasis is placed on student interaction and internationalization as well as on cross-cultural communication skills within a natural resources framework. Offered in even-numbered years at Purdue University and in odd-numbered years at the Swedish University of Agricultural Sciences in Sweden.

Learning Outcomes: 1. Explain cultural differences in managing natural resources sustainably. 2. Evaluate natural resource use

alternatives and policies. 3. Evaluate the sustainability of various landscapes and uses of natural resources. Credits: 3.00

FNR 46500 - History And Role Of Hunting In North American Wildlife Conservation

Credit Hours: 1.00. Introduction to the social, economic and wildlife management importance of hunting and how it relates to North American wildlife conservation. History of hunting and the North American Model of wildlife conservation, contrasted with those of European nations. Students will be required to participate in or observe hunting-related activities outside of class. This exercise is conducted off-campus on local Purdue-maintained properties.

Learning Outcomes: 1. Understand the history and role of hunting in North America. 2. Understand the economic impacts of hunting to wildlife conservation. 3. Examine how hunting influences wildlife management. 4. Examine the relationship of hunter demographics, ethics, public perception, and animal rights issues to hunting. 5. Apply the tenets of the North American Model of Wildlife Conservation to management and conservation challenges. 6. Experience hunting through first-hand activities. 7. Articulate the impacts of hunting to peers and constituents. Credits: 1.00

FNR 46600 - Costa Rica Natural History Study

Credit Hours: 2.00. This course is intended to introduce students to the natural history, ecology, and people of Costa Rica. Our purpose is to explore the region's diversity and contrast it with that of the United States. The course consists of excursions, field lectures, and discussions in a variety of ecosystems throughout the country. We will stay in facilities that allow close observation of a wide variety of Costa Rican fauna and flora.

Learning Outcomes: 1. Identify a wide variety of Costa Rican plants and animals with an appreciation of the biological diversity of the tropics. 2. Describe how conservation research and field implementation are done and appreciate common pitfalls in designing research on targets of conservation interest. 3. Appreciate Costa Rican attitudes and priorities regarding natural resources within a socio-economic framework specific to this society. 4. Weigh the balance between conservation and other priorities in land management, societal goals, and socio-political systems. Credits: 2.00

FNR 47100 - Environmental Sensors And Data

Credit Hours: 1.00. Environmental sensors and the data these devices generate are becoming increasingly central to routine ecological and environmental science research and monitoring. This course introduces students to the function of a range of environmental sensors, operation of microcontrollers that control these sensors, and application of data produced by these sensors. This class emphasizes a practical approach with hands-on work with programming sensors and analyzing data.

Learning Outcomes: 1. Learn how to apply environmental sensors to research and monitoring efforts. 2. Visualize and model environmental data from sensors available on live streaming data portals. 3. Use embedded microcontrollers to collect data and stream those data to the web. 4. Learn how to problem solve using online resources and discussion forums (including Slack and Stackoverflow). Credits: 1.00

FNR 48410 - Sustainable Wood Products, Furniture Design And Manufacturing

Credit Hours: 3.00. This project-based course explains principles of product development, furniture construction, strength design, performance testing, and product sustainability (life cycle analysis and end-of-life options). The course familiarizes students with methods such as Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), Computer Numerical Control (CNC) router operation, rapid prototyping, and basics of secondary wood products manufacturing, to build an actual product.

Learning Outcomes: 1. Understand Computer Aided Design (CAD). 2. Understand Computer Aided Manufacturing (CAM). 3. Understand CNC router operation. 4. Understand rapid prototyping. 5. Understand the basics of secondary wood products manufacturing. 6. Understand the principles of sustainable product development. Credits: 3.00

FNR 49800 - Special Assignments

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. 2. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

FNR 49900 - Thesis

Credit Hours: 1.00 to 6.00. Thesis. Permission of instructor required.

Learning Outcomes: 1. Write a research proposal describing a research initiative and explaining the scientific value in conducting the research. 2. Conduct research including forming the project scope, initiating and conducting the research, analyzing data and summarizing the results. 3. Present a summary of the research's findings in either oral or written format. Credits: 1.00 to 6.00

Department of Horticulture and Landscape Architecture

Horticulture Landscape Architecture PhotoOverview

Welcome to the Department of Horticulture and Landscape Architecture at Purdue University. The mission of the Department of Horticulture and Landscape Architecture is both education and discovery. Our faculty is committed to teaching, counseling students, and enjoys a worldwide reputation for excellence in research related to horticultural crops.
Our goal is to provide the student with the necessary technical information to be immediately successful in today's job market. Beyond that, we strive to provide students with the analytical skills necessary to interpret new information as the world of horticulture, landscape architecture, turf management and sustainable farming continues to change. In addition, our curricula are designed to provide you with communication skills, analytical skills and sensitivity to cultural diversity necessary for success in an increasingly global economy.
Upon graduation, you will leave Purdue with a wealth of knowledge and the skills for continued life-long learning. This commitment to quality education by our faculty makes the Department of Horticulture and Landscape Architecture at Purdue University one of the first places potential employers turn for employees.

Faculty (website)

Department of Horticulture & Landscape Architecture (website)

Contact Information

Department of Horticulture & Landscape Architecture
Purdue University
Horticulture Building
625 Agriculture Mall Dr.
West Lafayette, IN 47907
Phone: (765) 494-1300
Email:hlacareers@purdue.edu

The main office for the department is located in room 207 of the HORT Building.

Future Undergraduate Students (website)

Graduate Information

For Graduate Information please see Horticulture and Landscape Architecture Graduate Program Information .

Turf Management and Science, BS

Horticulture Minor

Horticulture: Horticultural Production and Marketing Concentration, BS

Horticulture: Landscape Enterprise Management Concentration, BS

Horticulture: Plant Science Concentration, BS

Horticulture: Public Horticulture Concentration, BS

Landscape Architecture, BSLA

Sustainable Food and Farming Systems, BS

Landscape and Turf Minor

Turf Management Minor

Pre-Landscape Architecture

See the program Landscape Architecture, BSLA for information.

Pre-Landscape Architecture Major Change (CODO) Requirements

Landscape Management and Turf Management Certificate

Horticulture: Landscape Design Concentration, BS

Horticulture: Landscape Contracting and Management Concentration, BS

Sustainable Food and Farming Systems Minor

Landscape Management Minor

Horticulture: Controlled Environment Agriculture Concentration, BS

HORT 10100 - Fundamentals Of Horticulture (UCC: SCI)

Credit Hours: 3.00. Biology and technology involved in the production, storage, processing, and marketing of horticultural plants and products. Laboratories include experiments demonstrating both the theoretical and practical aspects of horticultural plant growth and development.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

HORT 11000 - Opportunities In Horticulture

Credit Hours: 1.00. A survey of the field of horticulture, with emphasis on horticultural information and career opportunities. This course will utilize a lecture format with a combination of presentations by the instructor and guest speakers with expertise and experience in specialized areas of horticulture.

Learning Outcomes: 1. Identify important issues and opportunities in the horticulture industry. 2. Identify different career paths in the field of horticulture. 3. Utilize the department, college and university job placement facilities to find summer jobs, internships, and permanent job opportunities. 4. Identify individuals who can

assist you in career counseling and job placement. 5. Experience some the many great activities and opportunities that Purdue has to offer. Credits: 1.00

HORT 12100 - Medicine In The Garden (UCC: STS)

Credit Hours: 1.00. A survey of the uses and properties of horticultural plants for human health and well-being. Topics will focus on the close relationships between plants and human physiology, nutrition, medicines, mind-altering drugs, poisons, and beverages.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. Credits: 1.00

HORT 12200 - Living Landscapes: Grow, Design, Sustain

Credit Hours: 1.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in HLA majors. Students will learn about concepts such as plant science, land use, landscape design, sustainability, food systems, and more. Activities include learning from faculty in various fields, taking field trips, and participating in engaging academic and social activities. The course will cover broad topics related to plants, what you can study and courses you can take, and how you can put plants to work in a variety of careers.

Learning Outcomes: 1. Demonstrate an understanding of Horticulture and Landscape Architecture. 2. Explain several examples of how HLA is involved in your education. 3. Have improved ability to critically evaluate sources of information. 4. Be increasingly connected to an academic program. Credits: 1.00

HORT 20100 - Plant Propagation

Credit Hours: 3.00. Theoretical and applied aspects of controlled plant reproduction by sexual and asexual techniques, including seeds, grafting and budding, layering, cuttings, micropropagation (in vitro culture), and specialized structures. Lectures emphasize morphological changes and physiological processes involved in plant propagation. Laboratory exercises illustrate the practical applications of propagation techniques.

Learning Outcomes: 1. Demonstrate the various common propagation techniques. 2. Determine which technique would be most applicable for a particular situation. 3. Discuss the biological principles underlying the techniques. Credits: 3.00

HORT 21000 - Fundamentals Of Turfgrass Culture

Credit Hours: 3.00. (AGRY 21000) An introductory course in turfgrass management emphasizing turfgrass growth and development, species characteristics, their adaptation and basic cultural requirements for ornamental and functional turfgrass areas. The requirements and cultural inputs needed for proper establishment and maintenance of a high-quality, low-maintenance lawn will be discussed.

Credits: 3.00

HORT 21100 - Fundamentals Of Turfgrass Culture Laboratory

Credit Hours: 1.00. (AGRY 21100) Companion lab to AGRY 21000. Laboratory exercises will focus on turfgrass and seed anatomy, morphology, identification as well as the hands-on basic principles of turfgrass culture. Designed for the student who intends to pursue a career in turfgrass management and plans to enroll in AGRY 51000. Enrollment preference will be given to Turfgrass Science Majors.

Credits: 1.00

HORT 21200 - Greenhouse And Landscape Fundamentals For Educators

Credit Hours: 3.00. (ASEC 21200) This course will prepare future educators in using a greenhouse and landscape as teaching tools. The key focus will be preparing students to apply greenhouse and landscape management fundamentals in order to teach these concepts in the classroom. Laboratories will explore how to identify and produce both woody and herbaceous plants while safely maintaining and operating

greenhouse technologies. Students will also explore how to implement landscape design technologies and identify tools, equipment, and landscape plants. Permission of instructor required.

Learning Outcomes: 1. Identify and apply basic propagation techniques. 2. Identify and describe plant species specific to greenhouse and landscape plantings. 3. Interpret funding for greenhouses, greenhouse technologies, and landscape design equipment. 4. Apply IPM, irrigation, and propagation techniques while safely maintaining and operating a greenhouse. 5. Analyze and utilize landscape design software and tools to design a landscape. Credits: 3.00

HORT 21700 - Woody Landscape Plants

Credit Hours: 4.00. Recognition and identification of woody landscape plants; plant characteristics in terms of landscape function.

Credits: 4.00

HORT 21810 - Flowers For Color

Credit Hours: 1.00. Survey of annual and tender/tropical perennial ornamentals commonly used for seasonal color programs and curb appeal; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 1.00

HORT 21820 - Hardy Herbaceous Landscape Plants

Credit Hours: 2.00. Survey of hardy perennial herbaceous ornamentals including native and non-native species, bulbs, groundcovers, grasses, ferns, aquatics; recognition; cultural requirements; and use in landscape plantings.

Learning Outcomes: 1. Identify basic herbaceous ornamental plants on sight. 2. Use proper nomenclature with these taxa. 3. Be familiar with the cultural requirements for these taxa. 4. Design planting layouts that reflect appropriate design criteria. Credits: 2.00

HORT 27000 - Floral Design And Interior Plant Management

Credit Hours: 3.00. Elements and principles of floral design, as well as the identification, culture, and propagation of indoor plants. Topics in the art of floral design from both the florist's and the consumer's perspective, as well as information on growing houseplants. A variety of creative, hands-on lab projects include fresh flowers & foliage, silk, and dried materials.

Learning Outcomes: 1. Recognize and use the elements and principles of design as they apply to the art of arranging flowers. 2. Develop the skills necessary to create floral designs. 3. Correctly select and use flowers, containers, and color harmonies. 4. Properly condition cut flowers and greens for use in everyday flower arrangements. 5. Identify indoor foliage plants and flowers and problems of interior plants. 6. Better understand the factors involved in growing and maintaining plants. 7. Know the cultural requirements of 30 popular interior plants. 8. Properly manage interior plants and floral arrangements. 9. Properly evaluate floral designs used for decorating and gift giving. 10. Receive greater enjoyment from plants and flowers and increased awareness of their design qualities. Credits: 3.00

HORT 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to

4.00

HORT 29100 - Selected Topics In Horticulture

Credit Hours: 1.00 to 3.00. This variable-credit, lower-level selected topics course will be used for lower-division undergraduate research projects, for development of new lower-division courses and for temporary courses for lower-division students. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 30100 - Plant Physiology

Credit Hours: 4.00. Basic physiological processes of higher plants, particularly as related to the influence of environmental factors on growth, metabolism, and reproduction. Laboratory experiments involve hands-on experience with numerous aspects of plant physiology, including water relations, photosynthesis, growth, dormancy, hormones, and flowering.

Learning Outcomes: 1. Learn plant physiology. 2. Attain understanding of mechanisms and processes critical for plant life essential functions, metabolism, growth and development, and environmental adaptation and acclimation. Credits: 4.00

HORT 30600 - History Of Horticulture (UCC: STS)

Credit Hours: 3.00. The origins and development of agriculture, with specific emphasis on horticulture from prehistory to the present in relation to civilization and modern culture.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

HORT 31110 - Aquaponics

Credit Hours: 1.00. (SFS 31100) (FNR 31300) There has been a significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia; and our impending food crisis has kindled an interest in developing aquaponics systems in western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources

in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of post harvest food storage and pest management. Credits: 1.00

HORT 31700 - Landscape Contracting And Management

Credit Hours: 3.00. Principles and practices applicable to the installation and management of landscape plants. Topics include site and project assessment, site modification and plant installation, the business practices of estimating and bidding, and plant management. Requires class trips. Students will pay individual lodging or meal expenses when necessary.

Credits: 3.00

HORT 31800 - Field Production Of Horticultural Crops

Credit Hours: 3.00. A survey of the principles and practices of field production of horticultural crops: fruits, vegetables, herbs, and nursery crops. Production principles will be discussed in lab prep while laboratory exercises will emphasize practical hands-on experience in modern technology of specialty crop production including management inputs, cultivar selection, crop manipulation, harvesting and handling.

Learning Outcomes: 1. Learn how horticultural crops are produced at various farm sizes for direct-to-consumer production and marketing, and commercial production for wholesale markets and processing. 2. Interact with industry leaders in the commercial horticulture industry. 3. Become familiar with the requirements for certified organic production. 4. Compare and contrast various approaches to maximize production, including breeding and biotechnology. Credits: 3.00

HORT 31900 - Controlled Environment Production Of Horticultural Crops

Credit Hours: 3.00. This course combines production principles with environmental concepts and advances in technology to provide a comprehensive training in sustainable production of herbaceous ornamentals and vegetables in controlled environment systems. The laboratory instruction provides hands-on experience with the practice of growing crops under controlled environments by combining the learning from lab prep with the use of technology to control environment during production.

Learning Outcomes: 1. Become familiar with best management practices for growing herbaceous ornamentals and vegetables that improve sustainability in controlled environments. 2. Learn how above and below ground environments interact with crop production. 3. Learn basics about the state-of-the-art technologies used in controlled environment agricultural production to monitor and control environments. 4. Interact with industry professionals to gain first-hand knowledge about careers and development in commercial horticulture. 5. Gain sufficient background in science, technology and regulations required to become entrepreneurs, next generation growers and researchers in the controlled environment agriculture industry. Credits: 3.00

HORT 32100 - Hydroponics Systems

Credit Hours: 3.00. This course is designed for students in the department of Horticulture and Landscape Architecture or those interested in controlled environment agriculture (CEA). This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

Learning Outcomes: 1. Describe essential components of single-pass and recirculating hydroponic systems. 2. Compare different substrates and hydroponic system designs. 3. Interpret water quality analysis results and recommend corrections. 4. Create nutrient solutions using salts or mixed fertilizers. 5. Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponics. 6. Select hydroponic systems

for production of leafy greens, herbs, and vegetable crops. 7. Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems. Credits: 3.00

HORT 32200 - Greenhouse Crop Production

Credit Hours: 3.00. This course will offer students foundational information on the principles of planning, organizing, and managing greenhouse operations for bedding plant production. Students will learn about current cultural practices and challenges faced by the industry, as well as how environmental factors are monitored and controlled in production facilities. Hands-on activities will focus on integrated crop management practices for commercial greenhouse production. Case studies and discussions of relevant literature will help prepare students for positions in the green industry.

Learning Outcomes: 1. Demonstrate basic technical knowledge of the operations performed in a commercial greenhouse facility. 2. Explain methods of monitoring and manipulating environment factors (e.g., light temperature) and cultural practices (e.g., fertilizer composition and rate, container size, substrate type) to help maximize plant quality and minimize production costs. 3. Demonstrate skills required for bedding plant management in production. 4. Describe the various production technologies used by the greenhouse industry. Credits: 3.00

HORT 37000 - Professional Floral Design

Credit Hours: 3.00. Principles and techniques of commercial-scale floral design for weddings, funerals, hospitals, personal, and parties. Design construction for fresh, dried, and silk materials. Survey of retail florist management. Permission of department required.

Credits: 3.00

HORT 39000 - Cooperative Program In Horticulture

Credit Hours: 0.00. Supervised work experience in horticultural industry. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of department required.

Credits: 0.00

HORT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in horticulture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking,

problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

HORT 40000 - Horticulture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

HORT 40300 - Tropical Horticulture

Credit Hours: 3.00. An introduction to the agriculture of the tropics and subtropics, emphasizing horticultural crops. Offered in even-numbered years.

Credits: 3.00

HORT 42700 - Horticulture Capstone

Credit Hours: 1.00. Based on an approved work or internship experience, or case study, or mentored research experience, or production activity, students will collect information and develop a written analytical exploration of the commercial enterprise, internship institution, or research or production activity. The written analysis will be appropriate to the student's area of concentration. In addition, a summary oral presentation based on specific aspects of their experience will be made by each student. Prerequisite: Completion of an approved work or internship experience or mentored research experience.

Learning Outcomes: 1. Describe the structure and operation of a horticultural enterprise, public horticultural institution or the methodology for hypothesis testing in research. 2. Give examples of strengths and weaknesses of a horticultural enterprise, public horticultural institution or the methodology used in the research project. 3. Apply principles learned in coursework to evaluation of the observed horticultural enterprise, public horticultural institution or the methodology used in the research project including the management, operational, or horticultural setting and strategies. 4. Formulate proposals for ways in which the observed horticultural enterprise, public horticultural institution or the research activity might improve. Credits: 1.00

HORT 43500 - Developing An Agricultural Startup

Credit Hours: 4.00. Principles of marketing and business management in the horticultural industries; market organization, performance, and planning; financial planning, pricing, promotion, cost control, and legal aspects of retailing. Case studies in direct farm, floral, and garden center management.

Learning Outcomes: 1. Become critical thinkers. 2. Gain an understanding of marketing principles and theory. 3. Develop an understanding of marketing information available to horticulture industry professionals and how this information can be used. 4. Identify the four kinds of resources managers use. 5. Develop an understanding of financial terminology sufficiently to communicate with financial professionals and make informed decisions. 6. Construct and use an income statement, balance sheet, strategic profitability model, and cash flow budget. 7. Establish a level of confidence in creating a business plan as a tool to assess, create, and communicate a business concept. 8. Understand how to manage people in the workplace. Credits: 4.00

HORT 45000 - In The English Landscape: Integrating History, Horticulture, And Landscape Architecture

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Offered in even-numbered years. Permission of instructor required.

Credits: 3.00

HORT 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

HORT 49100 - Special Assignments In Horticulture

Credit Hours: 1.00 to 3.00. Training in research techniques, statistical methods, and record procedures. Assigned research problems. A written report of work accomplished is required. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For students doing individualized research on horticultural problems; report required. Arrange with academic advisor and honors research advisor before registering. Admission to the honors program. Permission of instructor required.

Credits: 1.00 to 6.00

LA 10110 - Survey Of Landscape Architecture

Credit Hours: 2.00. An overview of landscape architecture, this course provides students with their first introduction to the knowledge areas, skills, and abilities that form the foundation of the landscape architecture profession. The course offers a preview of the discipline for pre-landscape architecture and horticulture students while also providing general information for students across campus who have an interest in becoming familiar with landscape architecture.

Learning Outcomes: 1. Define landscape architecture and the scope of projects and design services offered by LAs. 2. Apply an understanding of natural, social and behavior sciences in making judgments about landscape spaces. 3. Describe different types of landscape architectural practices, and a representative range of professional landscape architectural projects. 4. Communicate using the vocabulary of landscape architectural design processes, materials and construction practices, and professional practice. Credits: 2.00

LA 10600 - Accelerated Foundations Studio

Credit Hours: 6.00. Conceptualizing, recording, and presenting site design ideas through problem-solving projects. Introduction to design and to presentation techniques fundamental to landscape architecture. Short projects give students exposure to a variety of design topics and presentation materials (pencil, ink, pastel, paper and board) and freehand lettering through two- and three-dimensional creative projects. Materials used are purchased by the student.

Learning Outcomes: 1. Demonstrate/understand fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate/understand basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate/understand investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Demonstrate/understand effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5. Demonstrate/understand roles, contributions and responsibilities of Landscape Architecture to society and to environmental health. 6. Demonstrate/understand how to be a design student: time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 6.00

LA 11600 - Graphic Communication In Design I

Credit Hours: 3.00. A foundational course that covers a broad spectrum of hand-graphic communication techniques fundamental to landscape design including hand-drafting, sketching, architectural lettering, conceptual graphics, illustrative rendering, technical drawing, and drawing to scale. A series of short studio exercises will foster three-dimensional thinking and associated drawing methods. Materials used are purchased by the student.

Learning Outcomes: 1. Develop graphic ability to clearly describe design ideas, concepts and proposals. 2. Develop an awareness of the

range of graphic representations, techniques and methods available to the designer. 3. Develop a working vocabulary for graphic communication in landscape design. 4. Foster the value of CRAFTSMANSHIP and PROFESSIONALISM in the preparation of graphics. Credits: 3.00

LA 11700 - Graphic Communication In Design II

Credit Hours: 3.00. A course in graphic communication theory focusing on digital skills and processes. Project-based instruction will be used to simulate design office procedures through 2D and 3D exercises using raster and vector software.

Learning Outcomes: 1. Prepare students for internship and professional practice through office-ready digital workflows. 2. Develop and refine a personal graphic style along with a critical ""designer's eye"" through formal presentation and discussion. 3. Analyze a problem and determine the best tool(s) for the task while pursuing graphic innovation by knowing the ""why"" and ""how"" of digital tools. Credits: 3.00

LA 16100 - Land And Society (UCC: STS)

Credit Hours: 1.00. An introduction to human interaction with the landscape with emphasis on the science of ecology and the technological advancements that form the response to contemporary social and environmental issues. Specific topics include: shifting cultural views of nature, climate change, land development patterns, green infrastructure and building technologies, and the role of design in shaping responses.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe social and cultural views of nature and land leading to the shape of American settlement patterns, cities, rural areas, and suburbs. 2. Define the four ecological systems and describe the interrelationship of their components. 3. Describe the human response to these four ecological systems in settlement patterns. 4. Apply an understanding of ecological sciences in making judgments about landscapes and their relationship to the cultures who created them. 5. Evaluate the impact of climate change on U.S. landscapes and describe the design response to these present and future changes. 6. Describe the impact of technological changes in measuring and recording land on the cultural understanding of natural and built systems. 7. Apply the understanding of complex interrelationships of ecological sciences to make judgements on the potential of green infrastructure technologies to make beneficial changes. Credits: 1.00

LA 16600 - History And Theory Of Landscape Architecture

Credit Hours: 3.00. A study of the historic evolution of landscape architecture to the status of a recognized profession. The course covers the social, economic, political, climatic, and other factors that have influenced the development of design styles and theories.

Credits: 3.00

LA 21600 - Studio I: Foundational Design

Credit Hours: 3.00. Landscape architectural site design, an introduction into processes and products. Building on the introduction to graphics in LA 11600 this is an introduction to the processes and production of site design and development drawings. Recording, conceptualizing and presenting site design ideas through problem solving projects. Emphasis on hand and computer drafting and drawing skills to communicate design ideas. Permission of department required.

Learning Outcomes: 1. Apply the fundamental tools and processes of design: spatial organizations and relationships, analytical tools and ordering principles. 2. Demonstrate basic critical thinking, and a foundation of literacy in design and environmental ideas. 3. Demonstrate the investigations and processes that lead to the formation of design concepts, and their realization as objects, plans and places. 4. Make effective use of basic communication methods and the tools used in their making: diagrams, drawing, lettering, model making, speaking and writing. 5.

Articulate the roles, contributions and responsibilities of landscape architecture to society and to environmental health. 6. Demonstrate time/task management, learning and functioning in a studio environment, working independently and as a team member. Credits: 3.00

LA 22600 - Studio II: Site Analysis And Design

Credit Hours: 4.00. Methods, principles and the process of designing in the built environment. Basic principles of site organization and composition are presented and applied in a series of exercises and studio projects. Role of the design process is reinforced both as a problem-solving tool and as a means of creativity and ideation.

Learning Outcomes: 1. Recognize and discuss theoretical design principles, identify those principles in well-designed sites, and apply those principles to their own design work. 2. Apply a robust design process to solve increasingly complex site design problems. 3. Ideate and assess appropriate program elements based on client and site needs and investigate the impact of alternate program elements on successful site design. 4. Analyze natural systems and apply that understanding to determine the appropriate design of sites. 5. Apply knowledge of the functional requirements of landscape elements to locate, size, and use these elements in the landscape. Credits: 4.00

LA 22700 - Planting I: Creating Ecologically Connected Landscapes

Credit Hours: 3.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants in fall.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 3.00

LA 22704 - Studio III: Planting Design

Credit Hours: 4.00. Review of design principles as related to plant design characteristics; design implications of plant responses to environment; review of landscape plants.

Learning Outcomes: 1. Apply knowledge of plant requirements and characteristics to the design of landscape spaces using plants and plant communities as the primary design material. 2. Construct appropriate plant palettes using both native and horticultural plants to build a cohesive sense of place, including a palette that is regionally appropriate to the Midwest. 3. Explore alternative solutions and use personal judgments to select plant combinations for technical, functional, and aesthetic uses in the landscape. 4. Distinguish the differences in garden styles and know the characteristics of each style. 5. Create a planting plan and schedule, incorporating appropriate nursery standards, and understand how these elements are part of the necessary construction documents for site construction. 6. Apply design process (site, inventory, analysis, concept, schematic, and master plan) to planting design. Credits: 4.00

LA 24600 - Site Engineering: Earthwork And Stormwater

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation, and nomenclature. Methods for calculating volumes of cut and fill.

Learning Outcomes: 1. Understand three-dimensional forms in the built environment and how these forms are represented using standard graphic conventions. 2. Visualize and manipulate geomorphic and manmade terrains. 3. Articulate, utilize, and specify methods for landscape architecture earthwork manipulation and stormwater management. 4. Demonstrate an understanding of circulation systems design, including rationale, safety, and proper documentation for construction through the design of circulation systems. 5. Apply knowledge of hydrology and traditional and sustainable stormwater management techniques to the design of site-specific stormwater systems. Credits: 4.00

LA 27500 - Honors Course - Lower Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to first- and second-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

LA 29000 - Special Topics In Landscape Architecture

Credit Hours: 1.00 to 4.00. Special topics in landscape architecture are explored. Topic selection is based on student interest. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge of the presented topic to the larger framework of landscape architecture projects, products, and practices. 2. Communicate effectively, using written, graphic, or oral communication, including delivering effective presentations where required. 3. Apply methods of investigation and inquiry that are appropriate to the subject and desired product, including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. Credits: 1.00 to 4.00

LA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 30900 - Co-Op Preparation

Credit Hours: 1.00. The material presented in this course consists of a broad overview of the employment opportunities in the professional practice of landscape architecture and the ways to secure an internship. It provides the student with information about career choices in landscape architecture and an appropriate knowledge base with which to make informed internship choices. Students prepare written and graphic documents for seeking employment. Students prepare for interviews and communications leading to employment as an intern in landscape architecture. Course meets during weeks 1-8.

Learning Outcomes: 1. Prepare and critique application materials in pursuit of gaining a co-op internship. 2. Practice interview skills and research firms available for co-op internships. Credits: 1.00

LA 31600 - Studio IV: Park And Open Space Design

Credit Hours: 4.00. Design theory and meaning in landscape architecture. Past, current and emerging design theories are investigated via lectures, research assignments and studio projects. Projects gain in size, complexity and depth of meaning. Emphasis on the role theory plays both as a stabilizing force and as a catalyst for change.

Learning Outcomes: 1. Access available landscape data to summarize critical natural resource needs at the site scale and translate this into fundamental ecological design principles for parks and open spaces. 2. Analyze the activities people participate in using available community parks and open space, categorize the landscape elements necessary to support current and projected future activities, and develop a parks program recommendation based on these social conditions. 3. Design public spaces that support multi-functional landscapes that fulfill recreation, education, and conservation program goals. Credits: 4.00

LA 32500 - Ecological Landscape Performance And Planting

Credit Hours: 3.00. Study of plants and their integration with other site features (e.g., water, landform) to increase sustainability. Plants will not only be studied for their aesthetic and spatial uses in the landscape, but also their ecological functions and temporal dynamics. The relationship of plants to site planning, ecosystems, and human use will be explored. Various scales, sustainable practices, and landscape performance will be considered. Class trip may be required. Students will pay individual lodging or meal expenses when necessary.

Learning Outcomes: 1. Be familiar with and able to use design principles and elements in the development of planting designs and understand the implications of plants as living things. 2. Understand the relationship of planting design, ecological functions, social factors, and sustainability. 3. Have a clear understanding of the concept and measurement methods of landscape performance. 4. Set smart and measurable sustainable goals and be able to select suitable plant material and create effective compositions appropriate for a variety of site conditions. 5. Know how to observe plants from multiple perspectives (plant needs & site/environmental conditions; human spatial needs; aesthetic responses; ecological implications) and be able to integrate these perspectives into functional designs. Credits: 3.00

LA 32600 - Studio V: Community Design And Planning

Credit Hours: 4.00. Community planning and design. Past, current and emerging planning theories are investigated via lectures, research assignments and studio projects. The interrelationship of land use, circulation, and open space are explored using environmental and sustainable principles within a framework of traditional neighborhood design.

Learning Outcomes: 1. Understand the fundamental terminologies, design strategies, and workflow of master plan community planning. 2. Distinguish the attributes and

characteristics of different residential types. 3. Articulate, utilize and specify methods for spatial layout and resource Integration (open space, transportation, parking and facilities, and building blocks) in different community planning projects. 4. Develop well-reasoned design concept and defensible design decisions that best respond to site constraints and planning regulations. 5. Apply knowledge of stormwater management and sustainable practices to community design. 6. Improve the abilities to research, critical thinking, collaboration, model making (hand and digital), verbal representation, and digital rendering techniques. Credits: 4.00

LA 34600 - Site Systems II

Credit Hours: 3.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Credits: 3.00

LA 34604 - Site Engineering: Materials And Construction

Credit Hours: 4.00. Earthwork, grading, surface drainage and storm water management. Properties of contour lines and topographic representation. Standards for grading practices, notation and nomenclature. Methods for calculating volumes of cut and fill. Methodology for horizontal and vertical alignment of roads and trails.

Learning Outcomes: 1. Demonstrate an understanding of common landscape construction materials and their application in the built environment. 2. Demonstrate an understanding of structural qualities and limitations of construction materials and systems. 3. Demonstrate an understanding of basic construction documentation. 4. Demonstrate the ability to access, evaluate, and document a variety of materials and construction systems commonly found in landscape construction. Credits: 4.00

LA 35600 - Site Engineering: Construction Documents And Advanced Systems

Credit Hours: 4.00. Methods and standards of construction documentation using current technology. Preparation and packaging of site-related technical drawings and bid packages. Methods for site layout and dimensioning. Organization and composition of planting plans, plant lists, grading plans, lighting plans, and associated detail sheets. Standards and sequence of site-related specification documents.

Learning Outcomes: 1. Develop office-ready documentation techniques toward the efficient and complete generation of legally binding CD drawings. 2. Understand and demonstrate CAD drawing standards. 3. Understand and capable of developing construction details and technical specifications to describe all project components. 4. Demonstrate a preliminary understanding of on-site construction observation work. Credits: 4.00

LA 39000 - Professional Cooperative Programs In Landscape Architecture

Credit Hours: 0.00. Supervised work experiences in landscape architectural offices and in the landscape construction or maintenance industry. Programs must be preplanned and conducted under the direction of the cooperative educational coordinator in cooperation with an employer. Students must submit a summary report of the work experience. Consent of cooperative program coordinator required. Department permission required. Additionally, student must have a C- or better average in all LA courses taken to date.

Credits: 0.00

LA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in landscape architecture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LA 40000 - Landscape Architecture Study Abroad

Credit Hours: 0.00 to 8.00. Utilized to record credits earned through participation in Purdue study abroad programs with cooperating foreign universities.

Credits: 0.00 to 8.00

LA 41600 - Studio VI: Urban Design

Credit Hours: 4.00. An intensive design studio focusing on urban issues, including environmental, social, and economic approaches to the built environment. Exploration of development history, regulatory structures, local and regional demographics, economies, and environmental systems will be expressed through detailed design proposals, case study, and presentation critiques.

Learning Outcomes: 1. Explore spatial, social, and economic issues of design in an urban context. 2. Create design proposals dealing with urban populations and systems including urban ecology and demographics. 3. Analyze existing built works and design theories for lessons learned to inform innovative design solutions. Credits: 4.00

LA 42600 - Studio VII: Landscape Architecture Capstone

Credit Hours: 4.00. This course will focus on the integration and application of accumulated knowledge of landscape architecture from the student's previous coursework and internship experience. Students will be challenged to identify and solve problems in community-based projects. The students will also communicate, through reports and presentations, their results and plan to community audiences, faculty, and other students. Students will also do directed readings and then discuss topics related to the current and future practices of landscape architecture and environmental design.

Learning Outcomes: 1. Apply a meaningful and exhaustive process of investigation along with analysis that codifies modeling and testing of design hypotheses and expression. 2. Address all critical issues in the development of the project including challenges and limitations. 3. Develop clear and precise concepts defining theoretical and practical solutions to project issues, including aesthetics; site/environmental factors; and behavioral, historic, contextual and technological elements during the process of design. Credits: 4.00

LA 45000 - In The English Landscape:Integrating History, Horticulture, and Landscape Architecture

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Offered in even-numbered years. Permission of instructor required.

Credits: 3.00

LA 47500 - Honors Course - Upper Division

Credit Hours: 1.00 to 4.00. Utilized to offer a new honors course for a maximum of three years. Variable title, credit, and instructional type. Course may be repeated for credit if content and titles are different. Offered primarily to third- and fourth-year students. Courses offered must be approved by departmental or program faculty and College of Agriculture Honors Committee. Permission of instructor required.

Learning Outcomes: 1. Have critical thinking. 2. Have communication. 3. Have cultural understanding. 4. Know civic responsibilities. 5. Have professional preparation. 6. Know scientific principles. 7. Know social science principles. 8. Able to teamwork. Credits: 1.00 to 4.00

LA 47600 - Professional Practice Of Landscape Architecture

Credit Hours: 2.00. A study of the principles and practice of landscape architecture in private and public offices. The course covers project acquisition, office management, and project implementation procedures. Preparation of a professional compendium is required.

Credits: 2.00

LA 48100 - Special Topics In Landscape Architecture

Credit Hours: 1.00 to 3.00. This variable-credit, special topics course will be used for rotating topics dealing with skills, knowledge, and experiences related to landscape architectural theory, expression, and practice. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand and relate information about significant examples of landscape architecture in North America which illustrate key principles and concepts of physical design and the organization of space for functional and aesthetic purposes. 2. Demonstrate that important historical landscape design is the product of both the broad cultural context (social, political, economic, and philosophical trends) and, of environmental factors such as climate and topography. Credits: 1.00 to 3.00

LA 48200 - Contemporary Issues In Landscape Architecture

Credit Hours: 2.00. Rotating topics that explore focused issues in landscape architecture theory and practice. Analysis and experience of contemporary issues, designs, and designers explored through presentation, discussion, critique, and practice of thematic content. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Analyze and evaluate focused topics in landscape architecture. 2. Understand and apply contemporary issues and theories in landscape architecture towards design studio, theory, and technology projects. Credits: 2.00

LA 49000 - Special Problems In Landscape Architecture

Credit Hours: 1.00 to 6.00. Independent in-depth study and presentation of specific research or design problems selected by the student in consultation with the instructor. Open only to advanced students. Permission of instructor required.

Credits: 1.00 to 6.00

LA 49900 - Thesis Research

Credit Hours: 1.00 to 6.00. For students doing individualized research on landscape architecture; report required. Arrange with academic advisor and honors research advisor before registering. Admission to the honors program required. Permission of instructor required.

Credits: 1.00 to 6.00

SFS 21000 - Small Farm Experience I

Credit Hours: 3.00. This is the first course of two designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader

appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 21100 - Small Farm Experience II

Credit Hours: 3.00. This course is a continuation of SFS 21000 and is designed to help students gain an understanding of what is needed to establish a productive small farm enterprise. There will be short field trips to local small farming enterprises. Classes will also be taught by guest lecturers and local farmers who have been successful at establishing small farming enterprises. Students in the class will be responsible for working on the Purdue Student Farm to gain practical experience on the topics and concepts being taught in the class.

Learning Outcomes: 1. Develop a broader appreciation of the range of agricultural enterprises that are feasible in the Midwest. 2. Lean and experience a range of skills pertaining to small farm management. 3. Improve ability to design, market, and operate a small farming business. Credits: 3.00

SFS 30100 - Agroecology

Credit Hours: 3.00. This course introduces students to the application of ecological concepts to food production systems and farm management. We will consider species interactions, nutrient and water cycles, regenerative practices, alternative approaches to agriculture, and ecosystem services provided to and by agro-ecosystems.

Learning Outcomes: 1. Understand key connections between ecology and agriculture. 2. Apply the agro-ecosystem concept to farming systems. 3. Discuss the relative strengths and weaknesses of conventional and alternative forms of agriculture. 4. Understand the effect of farm management practices on primary productivity, nutrient cycling, and species interaction. 5. Evaluate ecosystem services provided to and by agro-ecosystems. 6. Consider the role of social factors on farming systems. 7. Discuss the potential for ecologically based agriculture to address farming issues at local, regional, and global levels. Credits: 3.00

SFS 30200 - Principles Of Sustainability

Credit Hours: 3.00. Principles of sustainability is an experiential (discussion/debate) course that delivers an expansive overview of the principles of sustainability as they relate to energy and resources, communities, and agriculture. Students will learn to understand and analyze different food and farming systems and how they relate to environmental, economic and social sustainability.

Learning Outcomes: 1. Know the global carbon cycle and understand the greenhouse effect. 2. Understand the concepts of the individual, populations, communities, ecosystems and biomes. 3. Understand the ecological processes of vegetation succession. 4. Understand the role of crop rotations, cover crops and other land management methods. 5. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 6. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 7. Understand the importance of energy in society and in agricultural production systems. 8. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 9. Have a broad awareness of the role of agriculture in global society. 10. Understand the advantages and disadvantages of different approaches to food production. 11. Understand the principles of food marketing and sales. 12. Be able to communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 13. Be able to perform, analyze and discuss supervised experiments. 14. Be able to conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by

accessing material that is not specifically taught in class. 15. Be able to handle multiple tasks and deadline pressures. 16. Be able to work effectively with individuals from diverse cultures. 17. Have strong professional ethics and integrity. 18. Understand the importance of developing leadership skills. 19. Be able to work effectively in teams. Credits: 3.00

SFS 31100 - Aquaponics

Credit Hours: 1.00. (FNR 31300) (HORT 31100) There has been significant renewed interest in the investigation of integrated fish-food plant systems. Such systems have a long and rich history, particularly in Asia, and our impending food crisis has kindled an interest in developing aquaponic systems in western countries. Many growers are turning to controlled environment and hydroponic production methods to produce high-value crops in tight quarters. High input costs can, however, be a limitation. The waste disposal problem of the fish can become the nutrient supply to the plants.

Learning Outcomes: 1. Understand the nature of interactions among organisms, in particular those involving plants: mutualism, commensalism, parasitism, herbivory. 2. Understand the relationships among host, environment and pathogen for development of plant disease. 3. Know principal pathogens of Midwestern crops. 4. Understand the pathways of nutrient cycling in the soil and the biosphere; e.g. N, P, C cycles. 5. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 6. Understand the importance of energy in society and in agricultural production systems. 7. Understand the importance of natural resources in society and in agricultural production, and the principles of their conservation. 8. Have a broad awareness of the role of agriculture in global society. 9. Understand the advantages and disadvantages of different approaches to food production. 10. Understand the principles of food marketing and sales. 11. Understand the principles of post harvest food storage and pest management. Credits: 1.00

SFS 31200 - Urban Agriculture

Credit Hours: 1.00. Urban agriculture has the potential to address a range of social, economic and environmental issues including food insecurity, energy conservation, and human health and well-being. During this 5-week course, students will learn about the forces driving urban agriculture as well as the political and biophysical factors constraining it by reading articles, reviewing case studies, and visiting urban farms, vertical farm factories, food pantries, and local food advocacy groups. At the end of this course, students will apply the knowledge they've gained by developing a plan to increase urban agriculture in the greater Lafayette metropolitan area.

Learning Outcomes: 1. Understand the complexity of our global food system and learn how urban agriculture can address social, economic and ecological issues in cities around the world. 2. Develop critical thinking and communication skills through in-class discussions and writing assignments that integrate agroecology, urban planning, and civic engagement as they relate to urban agriculture. 3. Apply relevant theories and examples by developing a plan to facilitate the growth of urban agriculture. Credits: 1.00

SFS 31300 - Farm To Fork

Credit Hours: 1.00. This course will investigate the culinary opportunities of local and seasonal foods and the horticultural demands of producing and marketing them. Dr. Hallett will represent the "farm", giving students a brief overview of the production of local and seasonal foods in Indiana. The "farm" will harvest produce at the student farm and deliver it to the "fork" -- Chef Ambarish Lulay - who will work his culinary magic in the teaching kitchens in the HTM department. The focus, from both "sides" of the course will be the importance of niche marketing for farmers and chefs. This course is going to be tasty and fun!

Learning Outcomes: 1. Have a broad understanding of the principles of sustainability, including agricultural sustainability. 2. Have a broad awareness of the role of agriculture in global society. 3. Understand the advantages and disadvantages of different approaches to food production. 4. Understand the principles of

food marketing and sales. 5. Understand the principles of postharvest food storage and pest management. 6. Be able to handle multiple tasks and deadline pressures. 7. Be able to work effectively with individuals from diverse cultures. 8. Have strong professional ethics and integrity. 9. Understand the importance of developing leadership skills. 10. Be able to work effectively in teams. Credits: 1.00

SFS 31400 - Comparative Livestock Production Systems

Credit Hours: 1.00. This course will compare and contrast the various livestock and poultry systems in the United States. The course will begin with in depth analysis of the history and structure of prevalent or conventional livestock and poultry production systems followed by a similar analysis of the various alternative production systems currently in use in the US, including organic, grass-fed, and pasture-raised among others. A heavy focus will be placed on critically evaluating the pros and cons of each system, regulations of both conventional and process-verified systems and potential differences in products resulting from different management and processing systems.

Learning Outcomes: 1. Understand the structure of conventional livestock and poultry production systems in the US. 2. Understand the alternative livestock and poultry production systems prevalent in the US. 3. Know how each system is regulated including the various process verified systems. 4. Know how different management and processing systems do or do not impact final product qualities. 5. Be able to critically evaluate and compare the benefits and challenges inherent in different production systems. Credits: 1.00

SFS 31500 - Principles Of Permaculture

Credit Hours: 1.00. The goal of this class is to encourage students to think of farming systems, including their energy and resource flows, economics and social characteristics, in the ways that ecologists think of ecological systems. How does energy flow through farming systems, and how do resources recycle (or not)? What are the weaknesses of farming systems that could be mitigated by mimicking natural systems? Issues of efficiency, sustainability and resilience will be investigated in the context of permaculture, a theory of food production and landscape design that has an emphasis on perennial crops, low input production, and ecological diversity. The centerpiece of the course will be to further develop the Purdue Student Farm using permaculture principles.

Learning Outcomes: 1. Analyze energy and natural resource issues of modern society in the context of ecological systems thinking. Credits: 1.00

SFS 35100 - SFS Capstone Project

Credit Hours: 1.00. The SFS Capstone Project is a directed-learning course that will require students to prepare and present a sustainability analysis of a farm enterprise, most likely the enterprise at which they conduct their required summer internship, and this may be an internship approved at an operation other than a farm. Students will be required to analyze and enterprise taking into account its economic, environmental and social sustainability, and its broader role in sustaining the local and regional economy, environment and community. The analysis will be prepared as a paper and a presentation that will be given to the undergraduates of the SFS program at an SFS program meeting. The paper and the presentation will be prepared in consultation with a faculty mentor from the SFS program committee and will be graded by the faculty mentor. Completion of an approved work or internship experience.

Learning Outcomes: 1. Analyze complex concepts. 2. Think critically about systems and business operations from a range of different economic and social contexts. 3. Develop written and oral communication skills. Credits: 1.00

SFS 39100 - Special Problems In Sustainable Food And Farming Systems

Credit Hours: 1.00 to 3.00. Contemporary topics in sustainable food and farming systems are explored. Topic selection is based on student interest. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively verbally, including being able to prepare and deliver effective scientific papers and presentations. 2. Conduct a competent literature search, including a search for primary literature, and also including the ability to find and assimilate information that will broaden understanding of subject areas by accessing material that is not specifically taught in class. 3. Develop an understanding of and be able to

practice the scientific method of investigation. 4. Handle multiple tasks and deadlines. 5. Have a strong professional ethics and integrity. 6. Have a working knowledge of SI (metric) units. Credits: 1.00 to 3.00

SFS 41100 - Structural Racism In US Agriculture

Credit Hours: 1.00. A discussion-based exploration of the history and legacies of structural racism in American agriculture. We will analyze the barriers to success faced by non-white farmers in the US, the structures that have oppressed minority groups in agriculture, and ways in which these forces might be reversed or resisted.

Learning Outcomes: 1. Deepen an understanding of racism, bias, and white privilege. 2. Develop an understanding of the governmental, institutional, and social structures that have led to racial and ethnic inequities in American agriculture. 3. Understand the relationship of all peoples with American agriculture, whether indigenous or arriving as enslaved person or immigrant, and the legacies of those relationships. 4. Analyze the ways in which immigration and foreign policy impact the US food system. 5. Learn to communicate issues of structural racism in American agriculture effectively. 6. Construct ideas that might promote a more equitable food system. Credits: 1.00

SFS 41200 - Colonialism, Globalization, And Food Justice

Credit Hours: 1.00. This course will uncover the foundations of inequities in access to healthy, nutritious food from the first era of colonization to the modern era of globalization. The course will make students aware of the racial and ethnic inequities in farming and food systems and consider mechanisms of decolonization: resistance against the status quo and the development of new food systems.

Learning Outcomes: 1. Understand the emergence of modern food systems through the eras of colonization and globalization. 2. Analyze the factors that contribute to inequities in access to healthy, nutritious food. 3. Investigate global and local food justice movements. 4. Evaluate the legacies of colonialism in today's food deserts. 5. Investigate local food movements, such as urban agriculture, represent attempts at decolonization. 6. Investigate the activism of indigenous groups around the world seeking decolonization and food justice. 7. Consider policies to reduce inequities in food systems. Credits: 1.00

SFS 41300 - The Cultures And Agricultures Of The United States

Credit Hours: 1.00. The United States is a vast country encompassing many climates, geographies, and human histories. This course will investigate the diversity of the United States by examining a dozen locations with respect to people-and-place. How have people shaped these places, and how have these places shaped the people who have lived in them?

Learning Outcomes: 1. Understand the different types of land use, especially agriculture, in different regions of the United States, and consider their sustainability. 2. Investigate the cultures and agricultures of American Indian tribes prior to first contact with Europeans. 3. Analyze the displacement and relocation of American Indian tribes in specific regions. 4. Analyze the nature and legacies of slavery, and the means by which African Americans have been excluded from land ownership since reconstruction. 5. Consider the contributions of Asian Americans to the cultures and agricultures of the United States. 6. Investigate changes to the natural, built, and cultural landscapes of the United States through time. 7. Consider how the sustainability of cultures, economies, environmental health, and agriculture can (or cannot) be sustained in different regions of the United States. Credits: 1.00

SFS 48500 - Environmental Communication

Credit Hours: 3.00. This is an interactive learning course in

science and environmental communication with a strong emphasis on development of practical writing and communication skills for students who will become professionals in environment or natural resources. The public primarily obtains environmental information through the media, as such, scientists need to develop the understanding and skills necessary to engage with a range of audiences through the design of effective communication products. This course provides a unique balance of communication theory and skills training in which students develop the confidence to meaningfully communicate environmental issues. Permission of instructor required if not Junior or Senior standing.

Learning Outcomes: 1. Develop a working understanding of the practical fundamentals of communicating complex environmental science to non-technical and technical audiences. 2. Apply foundational communication theory across a range of writing forms including academic writing form, explanatory short-form, poetry, white papers, and TED talks. 3. Analyze book-length environmental nonfiction to identify effective writing techniques and strategies. 4. Investigate strategies used in environmental and nature writing in poetry and fiction to engage audiences and write compelling science stories. 5. Understand key elements of human nature (information processing, risk perceptions, social norms, etc.) that are contributing to environmental controversy and apply that knowledge in strategic design of communication products. Credits: 3.00

Mitch Daniels School of Business

Take Your Next Giant Leap

Take your next giant leap at Purdue University's Mitch Daniels School of Business. We are developing future leaders ready to manage, or found, great companies and transform society. By integrating business with technology, engineering, and science and offering transformative, hands-on learning, our top faculty and programs will prepare you to harness the power of data and analytical thinking. Master technological excellence and communication skills to turn discoveries into world-changing solutions.

Launch Your Career with Confidence

From your first day on campus, you'll find support to help you prepare for your future career. At the Daniels School of Business, career development is built into your student experience-through classes, clubs, internships, alumni connections, and real-world projects.
Our Business Career Services team will work with you early and often, offering one-on-one advising, career treks, events, and training to help you build the confidence and skills to take your next giant leap. Whether you're searching for your first internship or planning long-term goals, we'll help you create a path that aligns with your strengths and ambitions.

Jump on the Fast Track

Most business school students start their journey at a point of entry where they complete a common core of foundational courses for management and economics, along with

general core curriculum courses. After earning the GPA required for admission into upper division, students will follow a plan of study associated with a specific major. Many students bring in ample AP and dual credits such that they move fast through this entry-level stage to pursue multiple majors, minors, concentrations certificates, and internships. And most of our majors may be completed in three years. The school's mission is to facilitate students' success in designing and completing the plan of study that optimizes every student's educational and professional objectives.

Admissions (website)

Contact Information

Krannert Building
403 Mitch Daniels Blvd.
West Lafayette, IN 47907-2056
Rawls Hall
100 S. Grant Street
West Lafayette, IN 47907-2076

Build the Future of Business

Business school students may aspire to the C-suite to become Chief Executive Officers, Chief Financial Officers, Chief Information Officers or Chief People Officers for multi-national organizations. Many pursue careers in accounting, management consulting, investment banking or data analysis. Others thrive as entrepreneurs and launch successful startups. You will find Daniels School graduates working all around the world, using their skills and talents to make the world a better place.

Advising Information

Talk with an Advisor or Mentor
Business school advisors and student Ambassadors are here to answer your questions and tell you more about the Daniels School.
Krannert Building, Third Floor
403 Mitch Daniels Blvd
West Lafayette, IN 47907
Phone: (765) 494-4343
Fax: (765) 496-1479

More Information:

- Daniels School of Business Pass/No Pass Policy
- Information on summer courses is available at www.purdue.edu/thinksummer.

Department of Business Administration

Overview

All organizations, large and small, need leaders with business acumen. They effectively design, coordinate, and communicate innovative solutions in all aspects of an organization from operations to human resources. Daniels business graduates are adaptable leaders with strong roots in analytics, complemented by communication skills and technological expertise that help their organizations compete in the business world.
A multi-functional approach to coursework allows you to discover different business areas at the same time, including finance, strategy, law and organizational behavior. You'll refine your critical thinking, communication and analytical skills as you explore the ways profitable businesses contribute value to society. Once you complete these foundational courses, dive deeper into the major of your choice. Additional minors and concentrations allow you to focus on specific interests.
Daniels graduates pursue many different careers. Some begin in corporate management rotational programs as account executives or project managers. Others apply their business education as entrepreneurs who start their own businesses. You will find Daniels graduates in companies all over the word, including Boeing, Tesla, Accenture, IBM, PwC, KPMG, Amazon, Google, Procter & Gamble, United Technologies, and JPMorgan Chase.

For more information on undergraduate programs, please follow the links under Programs below.

Contact Information

The Daniels School of Business
403 Mitch Daniels Blvd.
West Lafayette, IN 49707
(765) 494-4343
businessadvising@purdue.edu

Current Undergraduate Students (website)

Prospective Students (website)

Graduate Information

For Graduate Information please see Department of Management (Graduate)

Marketing, BS

Finance, BS

Accounting, BS

Economics, BS

Management Minor

Economics Minor

Quantitative Business Economics, BS

General Management, BS

Business Economics Minor

Business Analytics & Information Management, BS

Mathematical Economics Minor

Accounting Minor

Supply Chain & Operations Management, BS

Integrated Business & Engineering, BS

Real Estate Finance Minor

Real Estate Minor

Finance Minor

Behavioral Economics Minor

Pre-Quantitative Business Economics

Human Resource Management Minor

Pre-Accounting

Pre-Business Analytics & Information Management

Pre-Economics

Pre-Finance

Pre-General Management

Pre-Marketing

Pre-Supply Chain & Operations Management

Economics: Economic Policy Concentration, BS

Economics: Business Economics Concentration, BS

Economics: Quantitative Economics and Data Analytics Concentration, BS

Economics: Mathematical Economics Concentration, BS

Economics: Behavioral Economics Concentration, BS

Marketing: Digital Marketing and Product Innovation, BS

Marketing: Marketing Analytics Concentration, BS

Marketing: Sales Management Concentration, BS

ECON 10500 - Exploring Careers In Business Economics And Consulting

Credit Hours: 1.00. Careers in economics are far more diverse than you might expect. This course introduces students to a wide range of career opportunities within the field of economics, while also emphasizing its value for those pursuing other majors. Through interactive sessions featuring guest speakers and alumni networking opportunities, students will explore various career paths and identify the skills and experiences necessary for a successful career in economics. Each session delves into essential themes, including critical skills for business economics and consulting, insights into economics-related career opportunities, and real-world advice from industry professionals.

Learning Outcomes: 1. Distinguish the wide range of career opportunities within economics and related fields, recognizing the profession's versatility and applicability to various industries. 2. Identify the key skills and competencies essential for success in business economics, consulting, and other economics-related career paths. 3. Recognize how economics principles apply to different roles and industries, including consulting, business strategy, and policy-making. 4. Engage effectively with alumni and professionals, leveraging networking opportunities to gain insights into real-world applications of economics and potential career trajectories. 5. Formulate a personalized strategy to build their academic and professional experiences, preparing for a successful transition into economics-related

careers. Credits: 1.00

ECON 21000 - Principles Of Economics (UCC: BSS)

Credit Hours: 3.00. This course presents the principles upon which the social science of economics is based. Specifically, it examines how individuals, firms, and the government interact through markets. It also examines several important macroeconomic issues including unemployment, inflation, international trade, and economic growth. Students are expected to be able to apply these economic principles to analyze current events, work decisions, and personal choices. CTL:ISH 1040 Introduction To Economics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify costs and benefits involved in economic decision making. 2. Predict market equilibrium and changes in equilibrium. 3. Evaluate the efficiency of market equilibrium. 4. Express and interpret economic theories and data using various visual representations (e.g., graphs, tables, charts). 5. Calculate basic measures of macroeconomic performance and the forces that influence those measures. Credits: 3.00

ECON 21900 - Economics For Future Elementary Teachers

Credit Hours: 3.00. A principles of economics course designed for future elementary and social studies teachers. The purpose of this course is to: 1) introduce the future teacher to basic economic concepts required by the Indiana Academic Standards for Social Studies, K-6, 2) learn methods for teaching these concepts in the K-6 curriculum, and 3) develop a catalog of curriculum materials appropriate for teaching economics in grades K-6. No credit for management students.

Learning Outcomes: 1. Identify and understand the basic concepts and principles of economics in order to teach at the elementary school level. 2. Develop an `Economic Way of Thinking? that can be utilized to make more efficient choices as consumers, and as voters. 3. Identify supplementary materials (DVDs, online and app-based resources, simulations, curriculum materials, etc.) that can be used in K-6 teaching or as a supplement in K-6 classrooms. 4. Apply this 'Economic Way of Thinking' in the analysis existing curriculum in K-6 economics, and of everyday current events. 5. Utilize the basic concepts and principles of economics to design and develop new K-6 curriculum. Credits: 3.00

ECON 21910 - Economics For Future Secondary Teachers

Credit Hours: 3.00. Upon completion of this course students will be able to analyze economic events in order to make more intelligent choices as consumers, workers, and voting citizens; identify and understand the basic concepts and principles of economics in order to meet standards at the secondary school level; identify supplemental materials and programs from variety of sources used in your teaching major, minor or as supplements in your classrooms; and review and organize lessons that teach economic concepts. No credit for management students. The course content is principles-level economics and is designed for social studies education students who are beginning their sequence of required economics courses. The course is designed to be taken before upper-division economic content courses.

Learning Outcomes: 1. Analyze economic events so that you will be able to make more intelligent choices as a consumer, worker, and voting citizen 2. Identify and understand the basic concepts and principles of economics in order to teach at the secondary school level. 3. Identify supplementary materials and programs (CD's, video tapes, simulations, curriculum materials, etc.) from a variety of sources that can be used in your teaching major, minor or as supplements in your classroom. 4. Review and organize lessons that teach economic concepts in your chosen Social Studies area. 5. Assist course instructor in improving the course to better fit your needs. Credits: 3.00

ECON 25100 - Microeconomics (UCC: BSS)

Credit Hours: 3.00. Microeconomics studies the choices individuals make and the incentives that influence those choices. Emphasis is on the incentives that determine market prices and resource allocation. The role of public policy in influencing incentives and efficiency is also addressed. CTL:ISH 1042 Microeconomics

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic

costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 3.00

ECON 25200 - Macroeconomics (UCC: BSS)

Credit Hours: 3.00. This course examines how the US economy functions and provides an overview of important macroeconomic issues including: unemployment, inflation, social security, national debt, international trade, the sub-prime crisis, and business cycles. Emphasis is placed upon the role and limits of government fiscal and monetary policy in promoting economic growth and stable prices. CTL: ISH 1041 Macroeconomics

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Understand the causes of economic prosperity. 2. Recognize the causes and effects of unemployment, inflation, and business cycles. 3. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 4. Critically assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 3.00

ECON 26000 - Data Visualization And Inference

1. Describe and analyze statistical data in an economics context.
2. Build probability models of continuous and discrete random variables to analyze economic and business situations.
3. Estimate the value of an unknown population parameter and assess the reliability of the estimate using confidence intervals as well as hypothesis testing.
4. Identify the advantages as well as the limitations of statistics in the process of making real-world business and economic decisions.
5. Use STATA to compute probability models and interpret the results of the statistical analysis to draw conclusions from economic and business data.

Learning Outcomes: 1. Develop a working knowledge of data production and interpretation in an economics context. 2. Illustrate the fundamental interconnectedness of economics and data. 3. Introduce the basic concepts in statistics needed for further study of econometrics. Credits: 3.00

ECON 28600 - Economics Scholars

Credit Hours: 1.00. This course explores the concept of human capital investment in higher education. For each course meeting you will be assigned readings. You must complete the assigned readings before the scheduled discussion and come prepared to discuss them. Class will consist of a discussion of the ideas in the readings, not a lecture, with grades based on your participation in addition to one writing assignment at the end of the semester. The instructor will suggest questions to get the discussion started and will maintain the queue that determines speaking order. Permission of instructor required.

Learning Outcomes: 1. Read essays on higher education investment and be able to explain and evaluate their arguments. 2. Discuss and write about how the concept human capital investment theory applies to higher education policy today. Credits: 1.00

ECON 29000 - Sophomore Level Problems In Economics

Credit Hours: 1.00 to 4.00. Arrange with instructor before enrolling. Investigation in a specific economics field. Permission of instructor required.

Learning Outcomes: 1. Vary by course topic. Credits: 1.00 to 4.00

ECON 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 30100 - Managerial Economics

Credit Hours: 3.00. This course provides students with essential tools from intermediate microeconomic theory to support effective decision-making in business and institutional settings. By exploring fundamental economic concepts such as marginal analysis, profit maximization, cost minimization, and pricing strategies, students will enhance their strategic thinking and managerial capabilities. The course addresses key topics including consumer behavior, demand, production and costs, factor demand, market structure, and strategic behavior, equipping students to tackle complex business challenges and make sound economic decisions. By the end of the course, students will have developed the skills to determine optimal strategies in various market conditions, preparing them to succeed as informed business managers.

Learning Outcomes: 1. Learn how to identify goals and constraints, and use inductive and deductive reasoning to draw logical conclusions. 2. Recognize the nature and importance of profits in directing resources to their highest value in use. 3. Understand how incentives shape individual and institutional decisions. 4. Understand the functioning of markets in managing individual and social allocation of scarce resources. 5. Recognize the importance of time value of money in making sound managerial decisions. 6. Learn the value of "thinking at the margin" when we seek to reach optimal outcomes. Credits: 3.00

ECON 32200 - Economics Of Public Policy

Credit Hours: 3.00. The examination and analysis of public finance practices and problems in the federal fiscal system. Government activities that involve spending and taxation are analyzed applying basic principles of economics. Topics include public education, social security, healthcare, environment and tax systems. State and local government issues are also addressed.

Learning Outcomes: 1. Explain how the provision of government goods and services through political institutions differs from market provision of goods and services. 2. Examine and analyze taxes and subsidies with and without market failure. 3. Examine and analyze various types of government expenditures on public education, health care, social security, income assistance, unemployment compensation, etc. 4. Explain how cost-benefit analysis can be used to help government choose among alternative investment projects. 5. Examine and analyze the impact of various types of taxes on the economy. Credits: 3.00

ECON 32500 - Economics Of Sports

Credit Hours: 3.00. This class applies economic principles to the professional sports entertainment industry and its derivative input markets. The class begins by examining the microeconomics of demand for (by fans) and supply of (by teams) sports entertainment. The labor markets for the primary input, athletic talent, receive significant attention. Coordination among economic agents, taking the forms of leagues, players' unions, and government, is considered at the end of the class, with an emphasis on how they affect the efficiency of the markets related to sports entertainment. Quantitative empirical analysis is emphasized throughout the class. This is not a sports trivia or fantasy sports strategy class.

Learning Outcomes: 1. Solve models of how fans, teams, and players behave. 2. Describe and evaluate the structures of the markets for sports outputs and inputs, e.g., players. 3. Explain information presented in quantitative forms, e.g., equations, graphs, tables. 4. Analyze the effects of leagues' or governmental

polices on market efficiency. 5. Communicate conclusions about sports output and input markets in numerical, graphical, tabular, and written forms. Credits: 3.00

ECON 34000 - Intermediate Microeconomic Theory

Credit Hours: 3.00. This course provides students with the techniques needed to model and analyze the behavior of individual economic agents. It introduces a variety of techniques that will allow students to solve business problems and make informed personal economic decisions. The course covers topics from consumer behavior and demand, decisions under uncertainty, production and cost, factor demand, market structure, pricing strategies, and strategic behavior. This is an upper-division economics course required for all economics majors and it serves as a foundation for higher level elective courses in economics.

Learning Outcomes: 1. Analyze the means by which individuals and firms make rational choices when demanding and supplying goods and services. 2. Describe the equilibrium outcomes of individuals and firms interacting in markets. 3. Evaluate market outcomes in terms of economic efficiency. 4. Practice analytical and quantitative reasoning skills. 5. Identify and describe the management and pricing strategies of competitive, monopolistic, monopsonistic, and oligopolistic firms. Credits: 3.00

ECON 35200 - Intermediate Macroeconomics

Credit Hours: 3.00. This course offers a rigorous introduction to macroeconomic theory and empirics with real-world applications. We examine longstanding stylized facts about long-run economic growth, short-run economic fluctuations (booms and recessions), and the aggregate effects of government policy. We study determinants of equilibrium in labor, consumption, investment, and money markets as well as the role of fiscal and monetary policies in closed and open economies.

Learning Outcomes: 1. Provide students with a framework for analyzing different macroeconomic questions related to the determination of income, consumption, employment, inflation, interest rates, and exchange rates. 2. Develop analytical skills to understand and apply macroeconomic concepts and theories to real world phenomena and policies. Credits: 3.00

ECON 36000 - Econometrics

Credit Hours: 3.00. This course examines the statistical techniques economists use to analyze data, estimate causal effects, make predictions, and test economic theory. It emphasizes estimating multiple regression models including models of firm output, product prices, and wages. Students learn to make statistical and practical inferences about the true causal relationships. The course covers the data analysis skills required for careers as a consultant, financial analyst, researcher, or economist in the private and public sectors. The skills practiced in the course include using statistical software to analyze data.

Learning Outcomes: 1. Model economic relationships in a regression framework. 2. Estimate economic models using the assigned statistical software. 3. Perform statistical and practical inference based on the results of empirical analysis. 4. Communicate empirical results clearly and concisely, in graphs, tables and writing. 5. Derive properties of estimators (unbiasedness, consistency, efficiency) and evaluate the characteristics of specific empirical models. Credits: 3.00

ECON 36100 - Antitrust And Regulation

Credit Hours: 3.00. This course studies the influence of laws and regulations on market performance and on the functioning of a free-enterprise system. The focus is on two types of government policies: antitrust law and economic regulation. Antitrust laws define the rules by which firms are supposed to compete. Regulations may require that firms obtain approval to set prices, change prices, or enter new markets. They may require firms to adhere to environmental or safety standards. The focus is on current topics in both areas, including comparison of U.S. practice with that of European Union and elsewhere.

Learning Outcomes: 1. Demonstrate a basic understanding of economics as applied to antitrust and government regulation of firms, including comparisons of U.S. practice with that of the European Union and elsewhere. 2. Understand the perspective provided by

economic analysis regarding the interplay between government regulation and firms' decisions regarding such factors as pricing, market entry, and the extent/form of competition. 3. Identify insights economic analysis provides concerning the creation and implementation of optimal regulation of business. Credits: 3.00

ECON 36200 - Health Economics

Credit Hours: 3.00. This course is designed to introduce upper level undergraduate students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues using tools from intermediate microeconomic theory. The course begins with an analysis of health care as a commodity and why health is different from other consumer goods. The course then examines the demand for and the production of health and health care, and the behavior and organization of health care providers. The discussion then switches to information asymmetries and the functioning of health insurance markets. Afterwards, the course turns to the analysis of government involvement in the health care system. The class concludes with an examination of medical care systems around the world, paying particular attention to the U.S. health care system.

Learning Outcomes: 1. Describe the main economic theories relating to health and health care markets. 2. Apply economic theory to the analysis of health care policy and institutions. 3. Construct a detailed demand and supply model of the health insurance market. 4. Critically evaluate key policy issues in health and health care from an economic perspective. Credits: 3.00

ECON 36500 - History Of Economic Thought

Credit Hours: 3.00. The course traces the development of theories of value and economic growth from the seventeenth century to Karl Marx. Among the authors studied are the mercantilists, Hume, Smith, Ricardo, and Marx. Excerpts from the original works are read and evaluated in light of modern theory.

Credits: 3.00

ECON 36700 - Law And Economics

Credit Hours: 3.00. It has become increasingly clear to economists, legal scholars and political scientists that it is impossible to understand economic institutions without first having an understanding of the legal framework within which they operate. Similarly, it is impossible to understand the impact of law on society without first having an understanding of economic principles. This problem is further complicated by the fact that there are often ambiguities in the written law that lead to significant differences between what the law appears to say and how the law is interpreted in the courts. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions.

Learning Outcomes: 1. Understand better the relationship of Law and Economics, two different disciplines that both directly impact the business climate. 2. Learn how the concepts taught in this class apply in a real world setting. Credits: 3.00

ECON 37000 - International Trade

Credit Hours: 3.00. Develops an understanding of the economics of globalization, including the movement of goods, people, capital, and ideas across countries. Using the tools of intermediate economic theory, we discuss the benefits and costs of globalization, the implications of globalization for wages, earnings, and national welfare, and their intersection with government policies.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade, including the movement of goods, people, capital, and ideas across countries. 2. Understand the perspective provided by economic analysis regarding globalization of economies, including the implications for wages, earnings and national welfare. 3. Identify insights economics analysis provides concerning the benefits and costs of globalization and the implications for government policies. Credits: 3.00

ECON 37200 - Experimental Economics

Credit Hours: 3.00. This course will explore how experiments are used in economics to test economic theory, understand behavior, and evaluate new policies. Focusing on recent research, we read research papers on a variety of policy topics

including labor market discrimination, payday lending, organ transplantation, media censorship, and voting. Applying the concepts from class, students will identify their own original research questions and design new experiments.

Learning Outcomes: 1. Understand why experiments are the gold standard for causal inference. 2. Identify the key elements of any economic experiment and evaluate design choices. 3. Generate original research questions that can be answered with an experiment. 4. Design novel experiments to test hypotheses. Credits: 3.00

ECON 37300 - Computational Economics

Credit Hours: 3.00. The main goal of this course is to introduce economics students to the computation, programming, and data analysis in Python. In the first part of the course, we will cover basic programming techniques and the use of popular Python packages for data analysis. In the second part of the course, we will consider more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Throughout the course we will consider a number applications related to microeconomics, macroeconomics, and econometrics covered in the Economics program curriculum.

Learning Outcomes: 1. Have a working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Possess an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 37600 - Economics Of The European Union

Credit Hours: 3.00. Current economic structure of the European Union, and the economic challenges it is now facing.

Learning Outcomes: 1. Understand the background and current economic structure of the European Union, as well as the economic challenges it is now facing. Credits: 3.00

ECON 38000 - Money And Banking

Credit Hours: 3.00. The course analyzes the economics of money, monetary systems, investments, and financial intermediaries in modern industrial economies. Topics considered include the origin of money and the banking industry, financial asset markets, the role of central banks, and the effects of various monetary policies. The theory will be presented side by side with current economic and financial news, and the students will learn how to track financial and economic data via The Wall Street Journal.

Learning Outcomes: 1. Understand economic analysis, through developing the economic intuition necessary to organize concepts and facts, and draw conclusions through use of inductive and deductive logic. 2. Evaluate current developments and financial news, using economic analysis to think critically about how to interpret current events. 3. Use economic analysis to predict likely changes in the economy and financial system. Credits: 3.00

ECON 38500 - Labor Economics

Credit Hours: 3.00. The purpose of this course is to introduce important topics, theories, institutions, and policy issues relating to the functioning of labor markets. Topics to be considered include labor supply decisions, investments in human capital, compensating wage differentials, labor contract theory, unions, compensation programs, signaling in labor markets, the economics of unemployment, and government employment, retirement, and workplace safety.

Learning Outcomes: 1. Distinguish the major determinants of labor market participation and hours worked. 2. Analyze how welfare programs and business cycles affect labor supply. 3. Derive the short and long term demand for labor. 4. Construct a detailed demand and supply model of the labor market. 5. Find the equilibrium labor market outcomes in the context of the neoclassical model 6. Analyze the role played by jobs' and workers' characteristics in generating wage differentials. 7. Develop a schooling model that explains human capital investment. 8. Distinguish factors that affect earnings inequality and labor market discrimination. Credits: 3.00

ECON 39000 - Junior Level Problems In Economics

Credit Hours: 1.00 to 4.00. Investigation into a specific topic area of economics. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 39040 - Economics Internship

Credit Hours: 1.00. An Economics-related work experience. This internship experience is intended to complement the student's academic plan-of-study and help prepare him/her for his/her future role in Economics. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job description may be requested before registration will be permitted. Permission of instructor required.

Learning Outcomes: 1. Internship experience. Credits: 1.00

ECON 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in economics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECON 43200 - Economics Of Growth & Innovation

Credit Hours: 3.00. Part one: we focus on this fact: the richest countries in the world have incomes nearly 200 times greater than the poorest, with profound consequences for the lives (and deaths) of their citizens. Why nations are poor and how they can become rich is one of the most important questions in Economics. We will look at the role of investment, schooling, population growth and technology. Part two: we explore how globalization affects productivity and innovation. This includes how international trade and domestic policies affect allocative efficiency, accelerate structural change, and discipline competitive behaviors by domestic firms. We explore how firms grow on global markets, how technology is embodied in traded inputs, and how international markets for ideas and the possibility of imitation can lead to explosive growth. Part three: we explore a rapidly growing literature on the economics of innovation. We'll wrestle with the questions of: where new ideas come from, and whether it is becoming more difficult to innovate; how cities become hotbeds of innovation and how this will be affected by remote work; and how innovation can be shaped by choices of firms and by government policies.

Learning Outcomes: 1. Analyze income levels and growth rates across countries using economic models to understand and assess the

underlying factors driving disparities in economic development, including investment, population growth, schooling, and technology; quantitatively assess these factors and make cross-country comparisons to build capabilities for engaging in economic reasoning through data; use economic models and research evidence to evaluate the causal drivers of, and impact of policy decisions on, innovation at the level of individuals, institutions, and places. Credits: 3.00

ECON 45100 - Game Theory

Credit Hours: 3.00. In the course, economic, political, and social interactions are represented as games, in which strategies and resulting outcomes can be analyzed. The analysis of these interactions is then used to demonstrate how one can make optimal decisions under uncertainty. This course uses Calculus.

Learning Outcomes: 1. Model strategic interactions as a game. 2. Describe behavior in games using strategies. 3. Calculate the Nash equilibrium of a game. 4. Predict behavior in different games. 5. Explain the role of uncertainty in strategic interactions. Credits: 3.00

ECON 45600 - Urban Economics

Credit Hours: 3.00. Examines the market forces that lead to the development, growth, and size of cities. In addition, this course covers the theory of location and land use, principles of local public finance, policy problems in the areas of urban housing, transportation, crime, and pollution.

Credits: 3.00

ECON 46100 - Industrial Organization

Credit Hours: 3.00. This course examines the determinants of firm and market structure and the resulting market performance in imperfectly-competitive markets. Advanced topics include advertising, research and development, imperfectly competitive international markets, and market integration. Emphasis is placed on using theoretical models of firm and industry behavior to explain and analyze real-world examples of firm behavior.

Learning Outcomes: 1. Use basic versions of the models economists use to analyze imperfectly competitive markets. 2. Recognize the results of empirical tests of those models, in the laboratory and using real-world data. 3. Recognize the implications of these models for public policy toward business competition. Credits: 3.00

ECON 46300 - Advanced Data Analysis And Machine Learning

Credit Hours: 3.00. This is an advanced applied econometrics course that introduces students to a variety of techniques and methods for the empirical study of economic data. This course focuses on the practical aspects of economic data analysis, including data organization (such as merging and appending datasets) and the implementation of econometric models. This course will cover multivaraite linear regression, non-linear least squares, models for binary and categorical outcomes, model selection using machine learning, and panel data models. As part of the course, students will learn to conduct empirical analysis of economic data using Stata, a statistical software package.

Learning Outcomes: 1. Explore and organize economic data. 2. Apply a variety of econometric techniques including: multivariate linear regression, non-linear least squares, models for binary outcomes (including logit and probit models), and models for panel data (including linear random effects and fixed effects models). 3. Understand the fundamentals of machine learning and use machine learning for model selection. 4. Interpret and critique the results from econometric estimations. Credits: 3.00

ECON 46600 - International Economics

Credit Hours: 3.00. Analyzes topics in international economics, using more advantage techniques and more detailed treatment than in ECON 37000 or 37100. While coverage varies somewhat with instructor, some topics could include: economic growth, innovation and technology transfer, and the role of multinational corporations.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to international trade and finances. 2. Understand the perspective provided by economic analysis regarding the interaction between economic

growth and international trade. 3. Identify insights economics analysis provides concerning the benefits and costs of technology transfer and the role of multinational corporations. Credits: 3.00

ECON 47100 - Behavioral Economics

Credit Hours: 3.00. Students learn about human behavior in economic environments, with a strong emphasis on classroom laboratory exercises. Topics considered include behavior in a variety of markets - for example, markets with price controls, markets for financial assets and auction markets -- and behavior in social dilemmas that arise when people try to provide public goods voluntarily or when sellers try to conspire to fix prices. Students will also learn how people bargain with, trust each other, and show social preferences towards others. Decision-making and anomalies for risky and uncertain choices will also be covered.

Learning Outcomes: 1. Demonstrate a basic understanding of Economics as applied to human behavior in various economic environments based on classroom laboratory exercises. 2. Understand the perspective provided by economic analysis in social exchanges that involve bargaining, trust, and uncertainty. 3. Identify insights experimental economics provides concerning individuals' behavior in markets. Credits: 3.00

ECON 48500 - Economics Of Racial And Gender Discrimination

Credit Hours: 3.00. This course focuses on quantifying the extent of, and determining the underlying causes of racial and gender disparities in the labor market. Topics include the impact of prejudice on labor market outcomes, statistical discrimination, early childhood factors and differences in environment, and fertility and reproductive technology.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize the differences and importance of disparities that control and do not control for observable factors. 3. Understand the difference between prejudice and discrimination, and the extent to which prejudice can cause discrimination. 4. Assess how discrimination can occur even in the absence of prejudice. 5. Evaluate the impact of policies designed to reduce disparities, such as affirmative action. Credits: 3.00

ECON 49000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Open only to a limited number of seniors with superior records in previous courses. Permission of instructor required.

Learning Outcomes: 1. Vary by course topic. Credits: 1.00 to 4.00

ECON 49900 - Economics Capstone Research

Credit Hours: 3.00. The course combines experiential learning with a hands-on research project that unfolds over the course of a semester, serving as a culminating experience at the end of their degree program. The overarching objective of the capstone project is for students to understand how business problems can be addressed with empirical methods. This course is designed to help students develop a more comprehensive and integrative understanding of the major, apply their knowledge to develop and execute a methodologically rigorous research a project, and demonstrate their mastery of critical thinking and research skills they have acquired throughout their time in the major. In addition to a paper, completion of the research project may involve the presentation of the findings in a seminar or workshop setting.

Learning Outcomes: 1. Complete a high quality research paper that applies Economic analysis to a topic of particular interest to the student. 2. Develop a deep understanding of the roles that Economic theory and/or empirical analysis (Econometrics) play in creating high-quality economic analysis. 3. Identify the economics literature (journals, books, monographs, etc.) that relates to the research topic considered. Credits: 3.00

MGMT 10000 - Introduction To Management

Credit Hours: 1.00. An introduction to and survey of the field of management. Exposure to the different functional areas of management will be stressed. Focus will be on the individual development of the student in regard not only to future professional employment but also to his or her educational planning. Required for freshman management students.

Learning Outcomes: 1. Understand the fundamental vocabulary of Business. 2. Analyze and rank different main areas of business in accordance with individual interests. 3. Apply appropriate strategies to maximize the possibility of getting the desired grade. 4. Develop a working knowledge of the many offerings that Krannert provides. 5. Become acquainted with numerous people associated with Krannert's past, current, and future endeavors. Credits: 1.00

MGMT 11000 - Introduction To Management And Information Strategies

Credit Hours: 2.00. An introduction to and survey of the field of business. Exposure to the different functional areas of management will be stressed. Focus will be on the individual development of the student in regard not only to future professional employment but also to his or her educational planning. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Students apply their knowledge of business in a Case Competition. Required for freshman Krannert Leaders Academy students.

Learning Outcomes: 1. Learn how to manage themselves. 2. Identify various professional development options available to them. 3. Reflect upon what type of Krannert student they would like to be. 4. Learn strategies and tactics to help them transition to college life 5. Analyze and rank different main areas of business in accordance with individual interests. 6. Learn how to manage teams. 7. Reflect upon their behavior within a group. 8. Learn how to manage a small team to be efficient 9. Compete in a freshmen case competition to explore further how to practice teamwork in a case environment. 10. Use information and fundamentals of business to make decisions 11. Understand the fundamental vocabulary of business. 12. Become aware of various resources that are available to them through the library. 13. Break down problems into segments. 14. Use information to make decisions in groups. 15. Become acquainted with numerous people associated with Krannert's past, current, and future endeavors. Credits: 2.00

MGMT 17300 - Data Mining Lab

Credit Hours: 1.00. The Data Mining Lab provides a guided Experiential Learning environment for School of Business', especially BS BAIM's, freshman and sophomore students to learn the basics of business data variety, how they are organized, and what insights may be mined for. Students will have hands-on experience to get familiar with a specific data mining tool, R, for carrying out some data mining experiments. Completion of this course will not only enable students to see how the prerequisite or accompanying foundational courses are relate to their major studies but also help them better preparing for successes in their multiple upper division course studies.

Learning Outcomes: 1. Recall examples of business data and data driven decisions. 2. Exemplify the concepts of structured business data and enterprise data management infrastructure. 3. Differentiate business applications of supervised and unsupervised data mining methods. 4. Explain data mining framework that consists of data understanding, insights derivation, and analytical result communication. 5. Use a data mining tool, R, for simple data mining related tasks. Credits: 1.00

MGMT 17500 - Information Strategies For Management (UCC: IL)

Credit Hours: 1.00. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Organization and use of electronic and print tools will be explained through discussion, hands-on exercises, and homework assignments. Permission of instructor required.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Ability to access information and determine what different sources are needed for problem solving. 2. Develop a foundation in problem-solving to use discovered information effectively and

efficiently. 3. Develop a knowledge base into the full array of information available (scholarly articles, market reports, quality websites, and other types of information). 4. Prioritize sources based on credibility and relevance. 5. Accurately cite the information you find. 6. Use retrieved information to accomplish a specific purpose and present information clearly and persuasively using a range of technology tools and media. Credits: 1.00

MGMT 18700 - Intro To AI For Business

Credit Hours: 2.00. This course provides an introduction to artificial intelligence (AI) and its application within business contexts. Students will explore AI fundamentals, including conceptual, architectural, and data pipeline essentials for successful deployment. It will introduce various machine learning models including predictive models, language models, and generative AI. The examination of AI's role in transforming business operations, decision-making, and customer relations will be a key focus.

Learning Outcomes: 1. Explain the fundamental concepts of AI, including its conceptual, architectural, and data foundations. 2. Differentiate between various AI models, assess their characteristics, and apply practical skills to determine their suitability for solving specific business problems. 3. Evaluate the potential applications of AI across business domains such as finance, marketing, and operations, while considering legal and social implications. 4. Develop and defend critical decisions based on AI-driven insights, fostering innovative problem-solving approaches. Credits: 2.00

MGMT 19000 - Freshman Level Problems In Management

Credit Hours: 1.00 to 4.00. Investigation into a specific topic area of Management. Arrange with instructor before enrolling.

Credits: 1.00 to 4.00

MGMT 19700 - Careers In Accounting & Finance

Credit Hours: 1.00. This course explores the various career opportunities available to accounting majors, as well as opportunities available to non-accounting majors who have a strong background in accounting. While most students believe public/private accounting are the only career options for accounting majors, we examine other avenues such as hedge funds, private equity and consulting, among others.

Learning Outcomes: 1. Identify potential career paths for both accounting and non-accounting majors with a strong accounting background. 2. Demonstrate an understanding of the various tasks employees perform in several distinct careers. 3. Develop the attributes necessary to succeed in various careers designed for individuals with an accounting major or a strong understanding of accounting (for non-accounting majors). Credits: 1.00

MGMT 20000 - Introductory Accounting

Credit Hours: 3.00. The objectives of the course are to help students: (1) understand what is in financial statements and what the statements say about a business, (2) identify the business activities that caused the amounts that appear in the statements, and (3) understand how, when, and at what amount the effects of manager and employee actions will appear in the statements. CTL:IPO 1801 Accounting I

Learning Outcomes: 1. Gain an understanding of accounting terminology, principles and concepts. 2. Learn how business events and transactions are reported in financial statements. 3. Prepare basic financial statements for a business. 4. Analyze financial statements to assess the performance and risk of a business. 5. Learn how financial information is utilized in the decision-making process. Credits: 3.00

MGMT 20100 - Management Accounting I

Credit Hours: 3.00. An introduction to management's internal use of accounting information--for decision making, production management, product costing, motivating and evaluating performance, and budgeting. CTL:IPO 1802 Accounting II

Learning Outcomes: 1. Understand how managerial accounting and financial accounting differ and the role of managerial accounting in costing a company's products or services. 2. Understand how accounting information is used

to make decisions for the firm, improving its operational efficiency and increasing its profits. 3. Understand how accounting information can be used to evaluate the performance of managers at all levels of an organization. 4. Understand concepts, and not rely on memorization, so that one can use the topics/information in new situations, in other courses and in one's professional career. Credits: 3.00

MGMT 21200 - Business Accounting

Credit Hours: 3.00. The two primary objectives are to teach the skills to produce financial information-to send the relevant signals to decision makers; and to teach the skills to interpret the financial report-to receive the signals. To meet these objectives the students will gain an understanding of the reasoning behind the processes used to record financial information and the manner in which it is reported to external decision makers; gain an understanding of the four basic statements; and an understanding of the importance of financial statement information in interpreting the performance of organizations.

Learning Outcomes: 1. Teach basics of accounting to students as future business owners and employees. 2. Establish communications with accountants and financial advisors when entering the workforce. Credits: 3.00

MGMT 22000 - Making The Business Case

Credit Hours: 3.00. This course develops one's ability to address situations faced by managers. This involves collecting information, analyzing that information to determine what decision or action is required and then selling the recommended decision or action to the management team. Selling this is done using one's persuasive skills in both telling a story and illustrating that story.

Learning Outcomes: 1. Differentiate whether a situation calls for making a decision or solve a problem. 2. Identify important facts in case studies. 3. Organize facts found in case studies into issues that factor in the analysis of alternatives. 4. Evaluate alternative solutions to a decision in terms of how they address issues. 5. Recommend an alternative solution. 6. Create a plan of action that will put the recommendation in place. 7. Create presentations that have a story line flowing through them. 8. Create a slide deck that supports the story line of the presentation. 9. Demonstrate effective speaking and body language when making presentations. Credits: 3.00

MGMT 22300 - Marketing Excel Fundamentals And Data Analytics

Credit Hours: 3.00. This course provides marketing students with essential skills in data management, visualization, and analysis using Microsoft Excel. Students will explore how to leverage data analytics to inform marketing strategies, optimize campaign performance, and drive decision-making. Hands-on training includes using Excel functions, tables, charts, and PivotTables, with a focus on practical, real-world marketing applications such as segmentation analysis, customer profiling, and campaign ROI assessment.

Learning Outcomes: 1. Apply Excel functions to process and analyze marketing data effectively. 2. Create data visualizations that effectively communicate insights to marketing teams and stakeholders. 3. Analyze marketing data using advanced analytical techniques to optimize campaign performance. 4. Develop proficiency in cleaning, validating, and consolidating marketing data for enhanced decision-making. Credits: 3.00

MGMT 23500 - Data Tools For Business

Credit Hours: 3.00. This course covers the fundamentals of data use and analysis. Students will acquire these skills using a common business suite application for data handling. Students will also be introduced to application software or modern programming language that interacts with the business suite application and its data to allow for data analysis, management, and presentation for solving business problems.

Learning Outcomes: 1. Identify and explain the main terminology, concepts, and design of a data-oriented business-suite application and the data it manages. 2. Develop and implement data management solutions by creating

application models, commands, and functions using a data-oriented business-suite application. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and analysis functions. 4. Execute and evaluate advanced data management activities such as text manipulation, database functions, and macros to improve data workflows. 5. Integrate and implement third-party data management applications with a data-oriented business-suite application to perform data analysis, management, and presentation, addressing complex business problems. Credits: 3.00

MGMT 24200 - Contemporary Problems In Personal Finance For Minorities

Credit Hours: 3.00. This course is designed to allow students to make informed decisions regarding their current and future financial position. Utilizing basic tools such as financial statements and budgets, the students can learn how to plan effectively for continuous financial stability. Students also are able to acquire a basic understanding of different saving instruments, investments, and retirement planning methods, as well as the benefits of purchasing real assets and accumulating wealth to allow stability. Students also have the opportunity to explore other interesting topics of personal finance through presentations and voluntary participation in class discussion. Permission of instructor required.

Learning Outcomes: 1. Create a personal spending, saving, and investment plan for immediately after college. 2. Invest in desired stocks based on popular statistical measures. 3. Obtain a general understanding of careers in financial services. 4. Understand the financial impact of taxes, debt, and health. Credits: 3.00

MGMT 24300 - Contemporary Thought Of Minorities In Management

Credit Hours: 3.00. The basic goal of this course is to introduce the minority student to the vast opportunities that are available in the field of management. The logic of a business education for the minority student is a reflection of the phenomenon that many corporations today are actively seeking minorities for managerial positions. Each semester, approximately 15 Fortune 500 companies are invited to the class to give presentations about entry-level opportunities with their firms. Other topics include the interview, resume writing, dual-career couples, the work force, affirmative action, minorities in the corporate world, etc. Each student is required to give a class presentation covering a business area of interest followed by class discussion over the topic.

Learning Outcomes: 1. Develop job search strategies tailored to your career of choice. 2. Understand the largest challenges facing minority employees within corporate America. 3. Demonstrate an ability to work on a team to analyze data and provide a recommendation to a business case. Credits: 3.00

MGMT 24500 - Introduction To Finance With Excel

Credit Hours: 3.00. This course introduces essential Excel skills for finance, including data organization, basic calculations, and summary analysis. Through hands-on projects, students develop practical spreadsheets and formatting skills for real-world applications. No prior Excel experience is required.

Learning Outcomes: 1. Identify and explain the main functionality of Microsoft Excel and other spreadsheet programs. 2. Design effective and professional data presentation using table operations, formatting, and visuals. 3. Demonstrate proficiency in various types of data analysis and manipulation, including date/time functions, logical functions, conditional functions, statistical functions, financial functions, and text functions. Credits: 3.00

MGMT 25300 - Finance Industry Exploration

Credit Hours: 2.00. Finance Industry Exploration will introduce students to various sectors of the financial services industry through lectures, guest lectures by financial market participants and regular reading of financial publications (Wall Street Journal, Financial Times, etc.). Students will understand potential career paths, how specific financial markets operate, career success factors, employment differentiation, industry vernacular and suggested future coursework. Topics covered may include (subject to speaker availability) - Investment Banking, Mergers and Acquisitions, Corporate Finance, Corporate Development, Public Finance, Commercial Banking, Sales and Trading, Wealth Management, Asset Management, Private Equity and Private Credit, Venture Capital, Investor

Relations and FinTech.

Learning Outcomes: 1. Analyze and explain the commercial landscape of the finance industry, including key firms, influential personalities, and the challenges and opportunities each face. 2. Develop and evaluate a tailored career strategy by identifying one or two industry sectors, multiple companies, and specific roles of interest, and designing a curricular and extracurricular pathway to enhance competitiveness in the job market. 3. Identify and interpret the success factors of various industry sectors and evaluate how specific roles generate value for their company and clients. 4. Demonstrate the ability to discuss industry topics with professionals by using appropriate terminology and providing relevant historical and company-specific examples. Credits: 2.00

MGMT 25400 - Legal Foundations Of Business I

Credit Hours: 3.00. An examination and study, for management students, of the nature and place of law in our society, both national and international, the social and moral bases of law enactment, regulation of business, legal liability, enforcement procedures, and the legal environment for managers.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MGMT 25500 - Foundations Of Business Ethics

Credit Hours: 1.00. Business ethics can be defined as the principles and standards that determine acceptable conduct in business organizations. During the course, we will examine ethical concepts, then dig into frameworks like Stakeholder Analysis, right v. right, and many more. This is your opportunity to evaluate past cases of ethical violations while also pre-thinking how you want to lead in the organization you work for across your career. Pre-thinking and planning who you want to be and how you want to lead is a critical piece of ethical leadership, and this course is designed to build you in that process.

Learning Outcomes: 1. Describe four theoretical frameworks about business ethics in your own words. 2. Apply business ethics in real-world cases both in class and through discussion board posts. 3. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 4. Articulate the importance of adhering to and maintaining ethical principles and conduct in personal and business contexts. Credits: 1.00

MGMT 25600 - Technology Landscape

Credit Hours: 1.00. Success in business requires an understanding of today's rapidly evolving technological landscape. This course provides students with an overview of emerging technologies that are shaping the future of business. Weekly meetings feature forums with technology experts and business practitioners, giving students insights into the latest technological advancements and their practical applications in diverse business contexts.

Learning Outcomes: 1. Identify and evaluate new and emerging technologies, including those associated with Computing, Digital Transformation, Automation, Biotechnology, Nanotechnology & Advanced Materials, Technology Management. 2. Integrate new and emerging technologies to promote business growth, competitiveness, and sustainability. 3. Conceive and describe applications of new and emerging technologies to tackle the challenges facing businesses over the next decade. 4. Conceive and describe applications of new and emerging technologies for a sustainable local, national, and global society. 5. Describe the political, legal, and ethical challenges resulting from the development and application of new and emerging technologies. 6. Create and deliver clear, effective, and engaging written assignments appropriate for both technical and non-technical audiences. Credits: 1.00

MGMT 26100 - Introduction To Supply Chain Management

Credit Hours: 3.00. This course seeks to introduce general concepts in supply chain management, including procurement,

supply planning, demand planning, and logistics. This course is designed around a corporate partnership to provide students with the opportunity to collaborate on solving a large-scale supply chain challenge. In the first five weeks of the semester, students will be introduced to basics of SCM through lectures, cases, and assignments. Beginning in the sixth week, students will form teams to work on a real-world case presented by the corporate partner, a complex problem broken down into six learning areas, each with a corresponding deliverable.

Learning Outcomes: 1. Define, measure, and recommend improvements to an organization's supply chain. 2. Gain experience in applying these skills to a real-world business problem. 3. Learn about the different aspects of supply chain management. Credits: 3.00

MGMT 28800 - Programming For Business Applications

Credit Hours: 3.00. This course will cover the fundamentals of business rules and logic in a business application development context. Students will acquire these skills using computer programming. A modern programming language will be used to learn and reinforce logical concepts, including abstraction, process flow, variable assignment, and control structures, as well as proper programming and application development practices, including documentation.

Learning Outcomes: 1. Understand and apply basic technical knowledge to managerial problems. 2. Successfully write, test, and run computer programs designed to address managerial problems. Credits: 3.00

MGMT 28900 - Doster Leadership Conference Board Experiential Course

Credit Hours: 1.00. This experiential course focuses on developing leadership and managerial skills through the planning and execution of the Doster Leadership Conference. The course is designed for students currently in a leadership role related to the Doster Leadership Conference. The material is developed to offer evidence-based approaches to tasks and issues you will face in your role as a board member for the Doster Leadership Conference. In this course, you'll learn to tackle real-world challenges, improve communication, and foster effective teamwork. You'll also gain insights into event logistics, budgeting, and stakeholder engagement while honing your problem-solving abilities. By actively participating in the conference's development, you'll grow as a leader, event organizer, and team member and be better prepared for leadership and project management roles in the future. Ultimately, you will become a stronger, more thoughtful, more organized, and more creative board member and board committee as a whole. Permission of instructor required.

Learning Outcomes: 1. Make evidence-based decisions to address managerial issues. 2. Develop a systematic approach to fulfilling board member responsibilities and obligations. 3. Embrace a growth mindset as individuals and as a collective board. 4. Identify and address opportunities for improvement to deliver a high-quality conference. Credits: 1.00

MGMT 29000 - Problems In Management

Credit Hours: 0.00 to 4.00. Arrange with instructor before enrolling. Investigation in a specific management field. Permission of instructor required.

Credits: 0.00 to 4.00

MGMT 29050 - Professional Internship

Credit Hours: 0.00. Students should be pursuing an internship complementing their academic plans-of-study (majors, minors, and concentrations within the Krannert School of Management). The intended purpose of the internship experience is to help students clarify career interests and prepare for future roles in Accounting; Analytical Consulting; Economics; Finance; Human Resources (OBHR); Industrial Management; International Business; Management; Management Information Systems; Marketing; Supply Chain, Manufacturing, and Operations Management; Quantitative Methods; or Strategic Management. Students must be seeking a Bachelor of Science degree in the School of Management. Employment must be related to the students major, minor, or area of academic concentration. May not be taken for more than five (5) semesters. Permission of instructor required.

Learning Outcomes: 1. Identify skills, values and interests that ultimately help determine career fit and gain career preparedness. Credits: 0.00

MGMT 29110 - Integrated Business & Engineering Seminar I

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on

professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation.
Credits: 1.00

MGMT 29120 - Integrated Business & Engineering Seminar II

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation.
Credits: 1.00

MGMT 29130 - Integrated Business & Engineering Seminar III

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation.
Credits: 1.00

MGMT 29140 - Integrated Business & Engineering Seminar IV

Credit Hours: 1.00. The seminar courses to expose students to contemporary topics related to the design and management of modern organizations and enterprises. These seminars will leverage the expertise of faculty across Purdue, prominent alumni, and thought leaders in each (flexible, rotating) topic area. Seminar topics might include contemporary topics, for example, artificial intelligence, cybersecurity, climate resilience, and sustainable economic growth. Seminars will also focus on professional development of students along with discovery, development, and practice of skills required to enable a diverse team to address complex problems affecting a wide range of stakeholder through collaboration, communication, and application of a wide range of influencing strategies and techniques. Simulation, guest speakers, projects, field visits will be used as appropriate.

Learning Outcomes: 1. Demonstrate mastery of seminar topics. 2. Synthesize and critically evaluate. 3. Apply the topics to a situation.
Credits: 1.00

MGMT 29150 - IBE Professional Development

Credit Hours: 0.00. This course is meant to promote meaningful reflection on multiple experiential learning opportunities offered to IBE cohort members as 2nd Year/Sophomores & 3rd Year/Juniors. The course will be required each semester during the 2nd and 3rd Years of the IBE program cohort experience. Assignments will include a reflection quiz or paper based on each event experience. Students will be required to complete at a minimum, 3 experiential learning experiences and corresponding reflections. All questions for surveys will be available on the Brightspace page.

Learning Outcomes: 1. Reflect upon learning experiences that allow you to connect these opportunities in an academic, professional, and social context. 2. Determine how curricular, co-curricular, and industry-based experiences affect your goals and professional development.
Credits: 0.00

MGMT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 29300 - Diversity In The Workplace

Credit Hours: 3.00. Diversity can be defined as real or perceived differences among people with regards to race, ethnicity, sexual orientation, religion, age, physical and mental ability, and family status that affect an individual's treatment, opportunities and outcomes. As demonstrated in the workplace, diversity is the numerous ways that employees are viewed as being similar or different. Through this course, students will examine the historical context and the emergence of diversity in the workplace including bias, meritocracy, privilege, social identity frameworks, organizational culture, allyship and advocacy.

Learning Outcomes: 1. Demonstrate knowledge of historical policy and employment regulations that drive current workplace decisions. 2. Demonstrate awareness of social identities, values, and biases of self and of others. 3. Demonstrate perspective and skills to effectively navigate workplace groups and relationships. Credits: 3.00

MGMT 29400 - Navigating Gender In The Workplace

Credit Hours: 3.00. This course has four objectives: (1) To Increase self-awareness and understand its value in managing careers; (2) To learn how gender culture and implicit bias may affect workplace experiences; (3) To develop strategies to deal with gender related challenges; and (4) To develop competencies in leading effective, gender-aware teams. By exploring these areas, students will develop new insights for managing their careers, and they will learn new leadership strategies to help their teams achieve higher levels of performance.

Learning Outcomes: 1. Through self-assessment, increase understanding of your strengths, core values and work styles. 2. Practice behaviors that demonstrate your confidence and leadership skills. 3. Learn how men and women might behave differently in certain work situations, based on research. 4. Understand implicit bias and its potential impact on talent assessment and advancement. 5. Learn effective strategies and skills to handle common gender-related work challenges - as an individual, as a team member and as a leader. Credits: 3.00

MGMT 29450 - Women In Leadership

Credit Hours: 1.00. Ready to grow your confidence in leadership? In this one-credit course, we will explore how to develop and grow your talents, strengths and leadership while also making an impact at the school of business. We'll also explore what leadership looks like in different contexts, tools you need, and how to be a more inclusive leader.

Learning Outcomes: 1. Explore leadership theories and apply them to your experiences. 2. Develop a leadership plan for your personal leadership development and growth. 4. Assess how your MyStrengths talents make you uniquely qualified to lead. 5. Reflect on past

success as you build a plan for personal leadership growth. Credits: 1.00

MGMT 29500 - Business Professional Development & Career Strategies

Credit Hours: 1.00. This is a required one-credit-hour career readiness and development course geared toward preparing you to meet your short and long-term career goals. Come prepared to develop your career goals, create and modify your career necessities (resume, LinkedIn profile, elevator pitch, etc.), while growing in the competencies employers are looking for when hiring recent graduates. Following career necessities, you'll get an idea of what you might encounter in the workforce, and what steps you can take to be successful in the workplace.

Learning Outcomes: 1. Identify and communicate professional strengths using Clifton Strengths assessment. 2. Communicate professionally using STAR and SOAR methods in professional documents in order to articulate their skills and experiences. 3. Develop oral and written communication skills via email, over Zoom, and in person with School of Business alumni, faculty, fellow students, and staff. As a result, students will be able to effectively communicate their skills and experiences in a variety of professional contexts, including networking events, career fairs, and interviews. 4. Identify methods for internship and full-time job search. 5. Identify key financial resources and best practices in regard to benefits packages and money management. Credits: 1.00

MGMT 30400 - Introduction To Financial Management

Credit Hours: 3.00. Introductory course providing a foundation in corporate finance and covering topics such as: discounted cash flow valuation, bond valuation, equity valuation, option valuation, factors influencing a firm's cost of capital, and international finance issues.

Learning Outcomes: 1. Provide non-School of Management majors with a foundation in corporate finance. Credits: 3.00

MGMT 30500 - Business Statistics

Credit Hours: 3.00. Introduction to business statistics as related to facilitating managerial decision making. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to do their own analyses.

Learning Outcomes: 1. Learn about business statistics as they relate to facilitating managerial decision making, through topics such as descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Credits: 3.00

MGMT 30600 - Management Science

Credit Hours: 3.00. Use of optimization, simulation, and decision theory models to support management decision making. Emphasis on modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Computer applications are stressed.

Learning Outcomes: 1. Learn management decision making through optimization, simulation, and decision theory models, by modeling and interpreting results for managerial applications of linear and integer programming models, network problems, simulation models, and decision analysis. Credits: 3.00

MGMT 31000 - Financial Management

Credit Hours: 3.00. Management of the financial affairs of the industrial enterprise. Working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions.

Learning Outcomes: 1. Know management of financial affairs of the industrial enterprise, including working capital management, current asset management, capital budgeting, stock and bond valuation, and capital structure decisions. Credits: 3.00

MGMT 31200 - Challenge X: Discovering Meaningful Problems Worth Solving

Credit Hours: 3.00. Venture creation drives progress by solving complex challenges, addressing pressing problems, and unlocking new opportunities. It begins with a deep understanding of stakeholder needs, customer pain points, and systemic challenges through rigorous observation and direct

engagement. This course helps students lay that foundation by identifying a problem space they care about and embarking on a discovery journey. By the end, they will define their Challenge X?a clear, high-impact problem or opportunity that could inspire a new venture. Permission from Instructor is required.

Learning Outcomes: 1. Generate innovative venture ideas and critically evaluate their attractiveness and alignment with emerging market opportunities. [Idea Generation and Evaluation] 2. Conduct effective customer discovery processes - including secondary research, interviews and surveys - to validate problem hypotheses and refine business concepts. [Customer Discovery Skills] 3. Develop a strong understanding of problem-framing dynamics by synthesizing customer feedback into actionable insights that guide iteration and improvement of venture ideas. [Problem Framing] 4. Analyze target customers and markets using tools and frameworks to estimate market size, identify key segments, and assess competitive landscapes. [Market Analysis Competence] 5. Create and deliver persuasive presentations that effectively communicate validated business opportunities and demonstrate readiness for further entrepreneurial development. [Entrepreneurial Communication] Credits: 3.00

MGMT 31300 - Solution X - Designing And Building The Product To Address Challenge X

Credit Hours: 3.00. Once a validated problem is identified, how do we transform deep insights into impactful solutions? Building on Venture X1, this course focuses on designing, testing, and refining the right solution through rapid prototyping, business model innovation, and stakeholder engagement. Students will explore multiple solutions, iterate based on real-world feedback, and prioritize those that leverage existing technologies for maximum impact. By the end, they will have their Solution X-a validated prototype and model ready for further development and eventual venture creation. Permission of instructor required.

Learning Outcomes: 1. Design and build a Minimum Viable Product (MVP) that addresses a validated problem, and test it iteratively with customers to gather actionable feedback. [MVP Development and Testing] 2. Identify, prioritize, and validate critical assumptions about the desirability, feasibility, and viability of a business idea through structured experimentation. [Critical Assumption Testing] 3. Develop a comprehensive business model that integrates key components such as value proposition, customer segments, revenue streams, and cost structures. [Business Model Design] 4. Formulate and evaluate a go-to-market strategy that aligns with the product offering, target customers, and competitive landscape. [Go-to-Market Strategy] 5. Deliver a compelling presentation that effectively communicates the MVP, business model, and validated assumptions to potential investors or stakeholders. [Pitching and Stakeholder Communication] Credits: 3.00

MGMT 31400 - MODEL X - Assembling And Attracting Resources For Launch

Credit Hours: 3.00. This course helps students transition from a validated solution to a scalable venture by focusing on assembling the critical resources needed for launch and long-term success. Building on X1 and X2, it shifts from solution development to securing the right team, customer traction, strategic partnerships, and sustainable funding. Through hands-on engagement with potential customers, investors, and partners, students refine their model and identify the best pathway-whether as a startup, business unit, or product extension. Over the summer, they will receive financial support, collaborate in a shared environment, and ultimately pitch their venture to attract the necessary resources for launch. Permission of instructor required.

Learning Outcomes: 1. Develop and refine a customer-validated business model with a clear value proposition that resonates with a specific cohort of paying customers. [Customer-Validated Business Model] 2. Form and manage a purpose-built co-founding team, leveraging partnerships with mentors, advisors, and subject matter experts to strengthen the venture. [Team Building and Leadership] 3. Identify and establish key partnerships with organizations and stakeholders to enhance

business growth and scalability. [Strategic Partnerships] 4. Create and deliver an investor pitch that clearly communicates the value proposition, business model, and traction, while targeting the right investors for the venture. [Pitching and Fundraising] 5. Work effectively in a co-located team environment, learning from peers and leveraging the local network in downtown Indianapolis to solve real-world entrepreneurial challenges. [Collaborative Problem Solving] Credits: 3.00

MGMT 32300 - Principles Of Marketing

Credit Hours: 3.00. This course aims to provide students with a broad understanding of marketing concepts that are useful to managers in a variety of applications including the marketing of consumer products, marketing of services, business-to-business marketing, and the marketing challenges that arise in not-for-profit organizations. Marketing involves identifying customer needs, then satisfying those needs by offering the right product and/or service at an acceptable price, making it available to customers through appropriate distribution channels, and promoting it in ways that motivate purchase as much as possible. The course serves as a foundation for marketing knowledge in general. No credit for students in the School of Management, except economics majors. Offered Fall Spring Summer.

Learning Outcomes: 1. Students will learn about the functional area of marketing through the managerial perspective. 2. Students will learn about the marketing-decision making process. Credits: 3.00

MGMT 32400 - Marketing Management

Credit Hours: 3.00. The objective of this course is to introduce students to the concepts, analyses, and activities that comprise marketing management, and to provide practice in analyzing and solving marketing problems. The course is also a foundation for advanced elective courses in marketing. Topics covered in the course include customer behavior, market segmentation, product positioning, market research, product management, pricing, promotion, sales force management and competitive analysis.

Learning Outcomes: 1. Develop understanding of marketing activities and the marketing concept. 2. Provide an understanding of how marketing ties in with other corporate functions. 3. Develop your intuition in analyzing a business environment and making subsequent decisions. Credits: 3.00

MGMT 33100 - Development And Impact of Equal Employment Law

Credit Hours: 3.00. This class will delve into the legal issues that affect women and men with regard to gender discrimination, equality under the law, sexual harassment, the wage gap, the glass ceiling, affirmative action, family law, and more. The class will be lead through a variety of teaching formats including lectures, activities, presentations, and more. Through this course students will learn about these important areas and, in the process, develop strategies that will assist them as they pursue careers in business and management. Students will have the opportunity to delve deeply into areas that interest them and will impact their future careers. They will do this through a research topic and presentation. Sophomores and juniors are encouraged to enroll. The content may be of particular interest to women, but the course is open to all students.

Learning Outcomes: 1. Learn about the law as it relates to women in business and other areas. 2. Learn the theory related to law and women in business. 3. Practice through experiential exercises approaches to legal situations women confront in the business context. 4. Conduct research and make presentations related to class topics. Credits: 3.00

MGMT 33200 - Business World Problem Solving

Credit Hours: 3.00. The class engages students to work in cross-functional teams to analyze business problems,develop recommendations, and persuade decision makers through the presentation of compelling solutions. In the classroom students will work together in teams to solve problems that are difficult for firms to outsource and are usually solved in-house without the opportunity to engage a consultant.

Learning Outcomes: 1. Identify the critical elements of a business decision. 2. Develop a solution as a team. 3. Prepare and present a professional presentation of a business solution. Credits: 3.00

MGMT 33500 - Strategic Business Writing (UCC: WC)

Credit Hours: 3.00. This course is designed to help Daniels School of Business undergraduate students become more effective, strategic writers in a business setting. However, there will be opportunities in this class to develop and practice speaking and interaction skills as well. The course format involves class lectures/discussions and extensive written work.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Recognize key communication principles of Audience Analysis, Emotional Intelligence, Critical Thinking and Problem Solving, Building Connection and Trust, and Communication Ethics: Identify an audience and what matters to them; Identify your own emotions when communicating and empathize with others; Recognize when you need to think critically, and problem solve based on the larger situation and context; Apply strategies for how to build connection and trust with an audience; Identify best practices for ethical communication. 2. Employ AI tools ethically and effectively to enhance the quality and impact of written content, while respecting privacy and intellectual property rights: Identify best practices for using AI in business writing; Recognize drawbacks and problems with using AI in business writing. 3. Attain proficiency in producing a range of standard business writing formats, demonstrating versatility and competence in professional communication through exercises and assessments: Identify different types of business writing and when to use them; Recall the key components and formatting requirements to demonstrate a foundational understanding of diverse business writing formats; Find common errors and best practices in business writing through self-assessment and peer feedback, fostering an awareness of areas for improvement and enhancing overall proficiency in professional communication. Credits: 3.00

MGMT 33900 - Krannert Mentoring & Leadership Program

Credit Hours: 2.00. This course will help students learn mentoring best practices and qualities of an effective mentor while practicing and developing these qualities in themselves as they mentor incoming Krannert first-year students. Additional topics include: 1) how to implement and assess mentoring programs in companies, 2) how mentoring builds ethics and leadership skills, and 3) how to be a better cross-cultural mentor.

Learning Outcomes: 1. Learn best business mentoring practices and how to implement them. 2. Grow your awareness of your mentoring and leadership skills and challenges. 3. Develop formal mentoring relationships with assigned mentees and informal mentoring relationships with other mentors and mentees. 4. Acclimate mentees to Krannert, college life, and business opportunities. 5. Facilitate your professional and personal growth (to mentor you) as you develop your mentees. Credits: 2.00

MGMT 34900 - Accounting Analysis & Modeling

Credit Hours: 3.00. Accounting information is found everywhere in business organizations. This introductory course is designed to equip students with the skills to analyze and model accounting information. Although much of the course's focus will be on external users of financial statement information, the course also covers the use of internal information for managerial decision making. The course heavily emphasizes the use of Excel as a tool to prepare and analyze data, as well as to summarize and communicate the results. Students will also gain a basic understanding of Tableau.

Learning Outcomes: 1. Use accounting data to make business decisions. 2. Evaluate firm and managerial financial performance. 3. Develop pro forma financial statements. 4. Model specific accounting line items using excel. 5. Present summarized information in Tableau. Credits: 3.00

MGMT 35000 - Intermediate Accounting I

Credit Hours: 3.00. Financial reporting for interested external parties. Emphasis on asset valuation, income measurement, and preparation of financial statements, and on appreciation of discretion available to preparers.

Learning Outcomes: 1. Understand the

objectives of financial reporting. 2. Explain and apply the basic principles of accounting. 3. Describe how to prepare and analyze an income statement, balance sheet, statement of cash flows and statement of retained earnings under generally acceptable accounting principles (GAAP). 4. Understand the tradeoffs involved in standard setting, the limitations of current accounting standards, and the effects that these tradeoffs and limitations have on the quality and content of financial statements. 5. Gain an appreciation of firms' ability and incentives to choose from a wide variety of alternative measurement bases and accounting procedures and the effects that those choices have on readers of firms' financial statements. Credits: 3.00

MGMT 35100 - Intermediate Accounting II

Credit Hours: 3.00. Continuation of Intermediate Accounting I. An examination of additional problems in financial reporting, including long-term assets, liabilities, owners' equity, income taxes, earnings per share, leases, and pensions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas. Credits: 3.00

MGMT 35200 - Strategic Management

Credit Hours: 3.00. The course focuses on understanding competitive forces and how organizations strive to build sustainable competitive advantages through business- and corporate-level strategies. It integrates and builds upon previous training in functional areas and presents new analytical tools for developing an understanding of the strategic decisions that determine future directions and effectiveness of the organization.

Learning Outcomes: 1. Develop and practice diagnostic reasoning skills relevant to problems of strategic management. 2. Learn and practice communicating your reasoning and judgments related to problems of strategic management - both through face-to-face listening and persuading, and through writing formal strategic analysis reports. 3. Understand the conceptual frameworks that will guide you in framing the relevant issues in a strategic situation. Credits: 3.00

MGMT 35300 - Intermediate Accounting For Non-Accounting Majors

Credit Hours: 3.00. The course is designed to meet the needs of students of predominantly finance students, as a firm grasp of key accounting concepts is critical to success in most finance professions. Throughout the course we will study measurement and reporting issues related to selected important financial statement items. The goal of this course is to educate students on major accounting topics that are likely to influence key financial decisions such as different inventory methods, different depreciation methods, lease recognition, pension accounting, among other topics.

Learning Outcomes: 1. Identify, analyze, and interpret intermediate financial accounting concepts that are relevant to market participants (i.e., shareholders, debtholders, regulators, among others). 2. Demonstrate a thorough understanding of complex financial accounting concepts that are vital to understanding firms' financial statements. 3. Outline how firms use accounting to communicate business results to stakeholders and other interested parties. Credits: 3.00

MGMT 35500 - Consulting Tools And Skills

Credit Hours: 3.00. This novel course will provide an opportunity for motivated students to gain exposure to the skills and tools necessary to succeed in the consulting industry. There will be a chance to work in small teams to define client problems, collect and analyze data, develop solution proposals, and implement recommendations. Students will also be given an insider's look into the history of consulting, common types of consulting, and professional standards in this specialized area of management. Honing skills in project management, presentation delivery, storytelling, and stakeholder engagement will form the foundation of the tools used to solve client challenges.

Learning Outcomes: 1. Effectively and confidently use specific consulting business language. 2. Critically analyze resumes and case interviews. 3. Effectively research businesses and unfamiliar industries. 4. Use a

consulting approach to problem solving. 5. Present a professional, engaging, and authentic persona. Credits: 3.00

MGMT 37000 - Real Estate Fundamentals

Credit Hours: 3.00. This course introduces the basic concepts, principles, and analytic methods applied in the field of real estate. The course covers topics including legal, financial, economic and marketing concepts related to real estate. The goal of the course is to expose students to the field of real estate and prepare them for more advanced real estate courses.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Describe titles to the conveyance of real estate. 3. Review land economic principles as they relate to real estate values. 4. Identify all quantitative issues required to complete effective real estate transactions. 5. Discuss the aspects of city planning and zoning on real estate values. 6. Understand basic methods for real estate valuation. 7. Understand basic issues in real estate development. Credits: 3.00

MGMT 37300 - Accounting Information Systems & Data Analytics

Credit Hours: 3.00. Learn how to manage the design, control and operation of accounting information systems. The emphasis is on identifying the information needs of decision makers and developing appropriate business process control in the design of accounting information systems. Gain an understanding and appreciation of the accounting information system and how it is used to successfully manage, audit and develop processes to support today's evolving business environment.

Learning Outcomes: 1. Understand and apply basic tools necessary for diagrammatically analyzing and documenting organizational data flows and business processes including data modeling and flowcharting. 2. Gain an understanding of the various business processes necessary for an enterprise to successfully operate, the key controls for maintaining successful business processes, and application of the methodology for evaluating risks and controls within the given business process. 3. Explain, justify and evaluate the components of organizational governance and associated effective internal control systems. 4. Develop a basic understanding of data analytics and emerging technologies in accounting information systems. 5. Explain and justify AIS auditing, computer fraud, and security techniques. Credits: 3.00

MGMT 37500 - Real Estate Law

Credit Hours: 3.00. The course provides an overview of real estate law and its influence on various aspects of the real estate industry. The course examines the legal issues surrounding the nature of real property, types of ownership and possession, real estate contracts, escrow and title and insurance, zoning, financing, landlord and tenant, land use regulations, environments law and regulations, and agency ethics.

Learning Outcomes: 1. Recognize and understand what real property is. 2. Understand how the right to use land is conveyed. 3. Understand the limitations and requirements of land ownership. 4. Understand how the state controls and influences the use of property. 5. Describe the various ways of acquiring the title of real property. 6. Interpret the regulations on real estate contracts. 7. Evaluate various types of real estate ownership and financing techniques. 8. Understand the limitations which can be imposed on real property based on environmental concerns. Credits: 3.00

MGMT 38200 - Management Information Systems

Credit Hours: 3.00. This case-oriented course is designed to familiarize students with existing and emerging technologies and their business applications. It also covers issues, problems, and opportunities that information systems (IS) executives and general managers face when managing IS resources in their organizations. Includes lectures, presentations, case analyses and discussions, and a World Wide Web project. Case discussions cover real situations and deal with the operational and strategic decisions that every IS manager has to make in managing and exploiting the available information technology.

Learning Outcomes: 1. Students will learn about existing and emerging technologies and their

business applications. 2. Students will learn about issues, problems, and opportunities that information systems executives and general managers face through a variety of learning objectives, including lectures, case discussions, presentations, and projects. Credits: 3.00

MGMT 38800 - Python For Business

Credit Hours: 3.00. This course will cover the business rules and logic in a business application development context. These skills will be acquired using computer programming; specifically employing Python. Solution development will reinforce logical concepts process flow, variable assignment, and control structures, as well as proper programming and application development practices.

Learning Outcomes: 1. Program Python, a strong and popular open source programming language. 2. Develop algorithmic thinking. 3. Program using Basic Data types, conditional branching, looping, functions. 4. Utilize Python libraries that can be used for business analytics. 5. Produce a Python solution for a business application. Credits: 3.00

MGMT 38900 - Using R For Business Analytics

Credit Hours: 3.00. The main purpose of this course is to introduce and familiarize undergraduate students to RStudio and the R programming language as tools for business data analytics. Students will develop a small portfolio of projects that demonstrate fundamental knowledge of programming, exploratory data analysis, data visualization, and basic predictive modeling techniques using R. The emphasis of the course will be on hands-on applied projects in R in which students will be able to appreciate and visualize statistical and machine learning concepts tailored to real world business applications.

Learning Outcomes: 1. Process data using R and RStudio. 2. Apply statistical and machine learning principles using R and RStudio. 3. Produce meaningful data visualization outputs using R and RStudio. 4. Examine the interaction between business principles and data analytics. Credits: 3.00

MGMT 39000 - Junior Level Problems In Management

Credit Hours: 0.00 to 4.00. The Accounting Internship provides work experience in businesses or other institutions. Permission of instructor required.

Credits: 0.00 to 4.00

MGMT 39100 - Strategic Thinking And Decision-Making

Credit Hours: 3.00. This course focuses on how to think strategically and make good business decisions. By the end of the class, you will be able to do the following: (1) Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions; (2) Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas; (3) Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas; (4) Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to design/develop prototypes in a variety of media (digital and/or physical) for the appropriate level of fidelity necessary to communicate, understand, and test innovative ideas. 3. Select and use appropriate methods/tools/equipment to make decisions and design/prototype innovative ideas. 4. Pitch a viable solution for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

MGMT 39200 - Optimizing Personal Brand And Image

Credit Hours: 3.00. This course will focus on four areas: personal branding, social and digital media strategies, financial literacy and philanthropy. You'll gain an understanding of how to convey your image to an external audience, evaluate the proper channels to maximize and monetize that image responsibly, select advisors to help negotiate contracts and invest your

money, and establish charities and events that support your personal causes. You'll learn which media and financial landmines to avoid while staying true to your personal principles and philosophies, and you'll gain leading-edge information about the technologies to keep you ahead in the game of life.

Learning Outcomes: 1. Outline the basics of developing your brand and convey your image to an external audience. 2. Evaluate the proper channels to maximize and monetize that image responsibly. 3. Explain basic financial concepts and compare advisors to negotiate contracts and invest your money responsibly. 4. Demonstrate how to establish philanthropies and events that align with your personal causes and brand. Credits: 3.00

MGMT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MGMT 39699 - Professional Practice Internship

Credit Hours: 0.00 to 1.00. Professional experience in Management. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit reflective summaries and receive company evaluation. Permission of Instructor required.

Learning Outcomes: 1. Identify the practices, protocols, and key skills used for various positions of a particular organization and/or industry in which they are working. 2. Reflect on their professional growth, personal development, and the practical application of theoretical knowledge within their chosen field. 3. Refine and reassess their own career goals as a result of the experience. Credits: 0.00 to 1.00

MGMT 39799 - Professional Internship

Credit Hours: 1.00 to 3.00. Professional experience in Management. The internship must be for a minimum of 11 weeks and credit hours are determined based on worked hours per week and total hours worked. Program coordinated by the Office of Professional Practice in collaboration with Business Careers Services in the Mitch Daniels School of Business.

Surveys are required to gather information on each student's experience, including details about compensation, location, and position. Along with completing work experience surveys, students are also evaluated by their supervisors. At the completion of the internship course, students are required to submit their updated resume which reflects their internship experiences. Other assignments may be required depending on the number of credits assigned to the course. Permission of instructor required.

Learning Outcomes: 1. Identify the practices, protocols, and key skills used for various positions of a particular organization and/or industry in which they are working. 2. Reflect on their professional growth, personal development, and the practical application of theoretical knowledge within their chosen field. 3. Refine and reassess their own career goals as a result of the experience. Credits: 1.00 to 3.00

MGMT 39800 - Using R For Business Analytics

Credit Hours: 3.00. The main purpose of this course is to introduce and familiarize undergraduate students to RStudio and the R programming language as tools for business data analytics. Students will develop a small portfolio of projects that demonstrate fundamental knowledge of programming, exploratory data analysis, data visualization, and basic predictive modeling techniques using R. The emphasis of the course will be on hands-on applied projects in R in which students will be able to appreciate and visualize statistical and machine learning concepts tailored to real world business applications.

Learning Outcomes: 1. Process data using R and RStudio. 2. Apply statistical and machine learning principles using R and RStudio. 3. Produce meaningful data visualization outputs using R and RStudio. 4. Examine the interaction between business principles and data analytics. Credits: 3.00

MGMT 40100 - Executive Forum

Credit Hours: 1.00. A lecture-discussion course featuring executives from business firms and other organizations. Emphasis is placed on the actual practice of management in corporate America, on career selection and mobility, on styles of management, and on other topics not normally covered in undergraduate courses.

Learning Outcomes: 1. Learn from a diverse set of speakers from a variety of institutions. 2. Understand problems and solutions and opportunities. 3. Gain the need for educational preparation of future business leaders. 4. Understand themselves, their responsibilities and their relationships with each other. 5. Understand the executive suite. Credits: 1.00

MGMT 40500 - Six Sigma And Quality Analytics

Credit Hours: 3.00. The course is an undergraduate elective offered as part of the Center for Manufacturing Management Enterprises (CMME) quality initiatives. Provides an overview of various tools and methods for total quality management.

Learning Outcomes: 1. Make data driven conclusions and decisions for quality management operations through working on various business cases. 2. Apply previously gained statistical knowledge to understand and to analyze data. 3. Gain some advanced analytical technics such as Analysis of Variances (ANOVA) and Design of Experiment (DOE) to optimize obtaining data and learnings. 4. Master a simple yet powerful MINITAB software to carry out complex tasks. Credits: 3.00

MGMT 41100 - Investment Management

Credit Hours: 3.00. Examination of investment alternatives relevant to the individual and/or family-unit investor. Operations of the markets in which securities are traded. Theory and application of security valuation, portfolio construction, capital markets, and performance evaluation. Particular attention given to fixed income securities, common stocks, options, investment companies, and other popular investment alternatives.

Learning Outcomes: 1. Learn about the investment alternatives relevant to the individual and/or family-unit investor by studying operations of the markets in which securities are traded, examining theory and application of security valuation, portfolio construction, capital markets, and performance evaluations. 2. Learn more in-depth information regarding fixed

income securities, common stocks, options, investments companies, and other popular investment alternatives. Credits: 3.00

MGMT 41150 - Futures And Options

Credit Hours: 3.00. The course covers basic features and pricing of derivative securities such as forwards, futures, and options.

Learning Outcomes: 1. Understand the basic features and pricing of commonly used derivative products. 2. Develop necessary analytical tools needed to make good managerial decisions using derivatives. Credits: 3.00

MGMT 41200 - Financial Institutions And Markets

Credit Hours: 3.00. Introduction to financial markets and management of financial institutions. Emphasis on determinants of interest rates, and measurement and management of financial risk. Concentration on management of depository firms such as banks and savings and loans.

Learning Outcomes: 1. Students will be introduced to financial markets and management of financial institutions through learning about determinants of interest rates, and measurement and management of financial risk, with particular attention on management of depository firms such as banks and savings and loans. Credits: 3.00

MGMT 41220 - FinTech

Credit Hours: 3.00. Dramatic development in technology is fundamentally transforming all aspects of financial intermediation including lending, payment services, investments and trading. The goal of the course is to introduce these new developments to students with the emphasis on underlying economic mechanisms. We will start with talking about fiat money but quickly delve into cryptocurrencies and their applications. We will talk about tokens, smart contracts, automated market making and how applications of these concepts are transforming financial services and financial inclusion. We will cover these topics by analyzing real companies and contrast them with traditional players in the financial system.

Learning Outcomes: 1. Understand fundamentals of blockchain and cryptocurrencies. 2. Understand tokenization, smart contracts, and automated market makers. 3. Evaluate implications of decentralized finance on banking, fund raising, financial markets and financial inclusion. 4. Develop skills to analyze various business models in the Fintech space. 5. Create a case study on a real Fintech company. Credits: 3.00

MGMT 41250 - Fixed Income Securities

Credit Hours: 3.00. This course includes examination of fixed income securities institutions that invest, roles in institution, portfolios and math associated with assessing characteristics of fixed income securities.

Learning Outcomes: 1. Examine management of fixed income securities. 2. Examine portfolios and risk management strategies. 3. Demonstrate use of simulation models for risk assessment. Credits: 3.00

MGMT 41300 - Corporate Finance

Credit Hours: 3.00. The course provides the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending, or investment banking setting. Topics include corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition, and mergers/acquisition.

Learning Outcomes: 1. Know the theoretical and problem-solving tools needed in entry-level financial analysis positions in a corporate, commercial lending or investment banking system through study of topics including corporate valuation, cash flow forecasting, project evaluation, capital structure, dividend policy, capital acquisition and mergers/acquisition. Credits: 3.00

MGMT 41310 - Financial Data Analysis And Modeling

Credit Hours: 3.00. In the business world today, finance professionals are going to be given opportunities to analyze and model data. The objective of MGMT 41310 is to give students opportunities to work with financial data sets to ask and answer

real questions that businesses have. In this course, students will use several data analysis software packages including R. Additionally, the course will include extensive application of Excel tools for Financial Modeling.

Learning Outcomes: 1. Understand how to set up, perform financial analysis, as well as work in teams on complex assignments. Credits: 3.00

MGMT 41350 - Venture Capital And Entrepreneurial Finance

Credit Hours: 3.00. This course includes descriptions of markets for start-up businesses, venture capital financial structures, valuation of start-ups, role of venture capital in economic development and business growth strategies.

Learning Outcomes: 1. Evaluate start-up ventures and understand the markets for early-stage businesses. 2. Value these companies using Discounted Cash Flow models, markets multipliers and other industry-specific valuation methods. Credits: 3.00

MGMT 41500 - International Financial Management

Credit Hours: 3.00. The course explores financial decision making in an international framework from the perspective of the management of a multinational corporation. Topics covered include the international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations.

Learning Outcomes: 1. Students will learn about financial decision making in an international framework from the perspective of the management of a multinational corporation through topics such as international financial markets, the measurement and management of exchange risk and political risk, and the financial aspects of the decision to set up cross-border operations. Credits: 3.00

MGMT 41601 - Corporate Mergers And Acquisitions

Credit Hours: 3.00. The financial analysis of corporate acquisitions, mergers, and reorganizations including asset acquisitions, joint ventures, spin-offs, sell-offs, equity carve-outs, bankruptcy proceedings and reorganizations, and corporate governance. The course uses a combination of lectures, readings, and case analysis.

Learning Outcomes: 1. Understand the processes of valuation, negotiation, and financial outcomes of transactions involving mergers and acquisitions. Credits: 3.00

MGMT 41650 - Financial Engineering

Credit Hours: 3.00. The objective of this course is to develop necessary skills to value and hedge a wide variety of derivative contracts traded in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous time. Some basic knowledge of stochastic processes would be helpful, but not essential: what needed will be covered in class. The analytic valuation and hedging of derivatives using the modern martingale methods will be the main focus of the course. Applications will include forwards, futures, and options on stocks, bonds and foreign currencies. The numerical methods such as parameter estimation, Monte Carlo simulations, discretization schemes as well as the conditional volatility estimation techniques will also be addressed. In addition to the valuation and hedging derivatives, course also covers Value-at-Risk, credit risk, modeling the term structure of interest rates and the construction of the VIX index using the S&P 500 index options obtained from the IvyDB OptionMetric database.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Outline and design new financial derivatives. 3. Develop the VIX index using options data. Credits: 3.00

MGMT 42000 - Consumer Analytics

Credit Hours: 3.00. Many firms possess extensive information about customers, their transactions, and their relationships with the firms, necessitating expertise for intelligent utilization. The objective of this course is to equip you with a scientific approach to customer marketing, featuring hands-on use of databases, analytics, and computing to collect, analyze, and act on customer information for various industries. This course specifically focuses on customer relationship analytics, including identifying promising prospects and customer acquisition, customer development through up-selling, cross-selling, and personalization, as well as managing customer attrition, retention, and evaluating customer lifetime value. It also explores advanced analytics models such as conjoint analysis, purchase forecasting, and perception analysis.

Learning Outcomes: 1. Use data analytics to improve customer engagement and elevate the

overall customer experience. 2. Clarify the role of analytical customer relationship management in achieving strategic marketing goals across various industries. 3. Carry out analytical skills through practical experience with customer datasets. 4. Recognize advanced modeling techniques commonly employed in the field. 5. Summarize the financial advantages of adopting marketing strategies based on the concept of 'Customer Lifetime Value'. Credits: 3.00

MGMT 42110 - Marketing Analytics

Credit Hours: 3.00. This course covers essential decision models and strategic metrics that form the cornerstone of marketing analytics. Using the insight gained in the course, students can predict the outcome of marketing plans to boost return on marketing investment (ROMI). The course emphasizes hands-on learning so students can immediately apply the econometric tools and techniques on a variety of marketing applications. A number of relevant topics are discussed, such as market sizing, forecasting and positioning, promotion budget allocation, and profit maximization. The final piece of this course is guiding the students on how best to craft data-driven presentations to key stakeholders through the use of an experiential learning project provided by an external client.

Learning Outcomes: 1. Enhance the student's knowledge on Advanced Modeling Techniques, such as how and when to apply Logistic Regression, Logit, Multinomial Logit, Ordinal Logit, and Tobit. 2. Showcase situations across a variety of marketing topics (pricing, sales, advertising, new product development, etc.) where analytical methods can bring greater insight to the marketing practitioner. 3. Apply the above information to a real-world consulting project and deliver not only managerial insights, but also a data-driven presentation. Credits: 3.00

MGMT 42120 - Data & AI-Driven Marketing

Credit Hours: 3.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course offers an immersive exploration into the intersection of data science, artificial intelligence, and marketing strategies, providing students with the knowledge and skills to thrive in the digital era. It will discuss uses of data science tools and AI algorithms in marketing applications, such as personalized marketing, sentiment analysis, and ad campaign optimization. Students will also gain hands-on experience on applying the methods to real-world data.

Learning Outcomes: 1. Identify modern statistical & machine learning methods required for marketing using big data. 2. Carry out applying statistical and machine learning methods to improve major marketing decisions. 3. Implement statistical and machine learning methods in Python using real-world data. Credits: 3.00

MGMT 42130 - Consumer Behavior

Credit Hours: 3.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, economics and sociology to learn why consumers behave in the ways that they do. The course focuses on three general topics. 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision-making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior.

Learning Outcomes: 1. Organize, explain and predict consumers judgements and choices using social science multiple concepts, frameworks and theories. 2. Identify & analyze consumer behavior issues and apply relevant theories to aid in managerial decision-making. 3. Generate basic applied experiments in consumer behavior to test relevant theories with real consumers. Credits: 3.00

MGMT 42210 - International Marketing

Credit Hours: 3.00. Most U.S. businesses, large and small, are becoming deeply involved in international business. The trend is going to grow even stronger because of the influence of World

Trade Organization and regional trade blocks. Under these circumstances, it is imperative that business managers possess the skill sets to adapt their marketing strategies to the needs of international markets. This course will cover the concepts and theories pertaining to international marketing. It is aimed to provide students with skills in formulating a marketing plan for foreign market entry and conducting business in a foreign country.

Learning Outcomes: 1. Understand the issues involved in formulating and evaluating international marketing strategies. 2. Learn about global market entry, expansion, and sustainment. 3. Be exposed to the appropriate theories, models, and other tools to make better marketing decisions in cross-cultural business settings. 4. Obtain insights into how profitable global marketing strategies can be created. Credits: 3.00

MGMT 42300 - New Product Development

Credit Hours: 3.00. Provides an overview of the new product development process. Detailed insights are provided in the "fuzzy front end" of this process. Targeting positioning, and product decisions are also covered. The second half of the course completes the marketing mix and covers various market testing and product launch issues.

Learning Outcomes: 1. Understand new product development process. 2. Analyze new product development cases. 3. Develop and test a new product idea. Credits: 3.00

MGMT 42410 - Retail Management

Credit Hours: 3.00. Understanding and executing effective sales and retail strategies are essential for achieving overall business success, impacting growth, customer relationships, and competitiveness in the market. This course combines theoretical foundations with practical applications, guiding students in integrating sales and retail management principles into comprehensive business decision-making processes.

Learning Outcomes: 1. Apply market analysis techniques to identifying customer segments, analyze sales techniques and create a strategic sales plan. 2. Demonstrate an understanding of the principles of inventory management, merchandising strategies and their impact on customer experience and profitability. 3. Analyze the alignment of sales and retail strategies with broader business objectives. 4. Apply sales and retail management concepts to diverse business scenarios. Credits: 3.00

MGMT 42420 - Sales Management

Credit Hours: 3.00. An introduction to sales force management, this course offers a comprehensive examination of the salesforce management process. Key topics include the principles and best practices of recruiting, selecting, training, compensating, and motivating sales personnel. Additionally, the course will cover strategies for effective supervision and evaluation of a sales team to ensure optimal performance.

Learning Outcomes: 1. Explain the different components/skills of relationship sales management and apply them through course assignments. 2. Compare and contrast different sales management strategies through cases and simulations. 3. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues, and activities. Credits: 3.00

MGMT 42500 - Marketing Research

Credit Hours: 3.00. The purpose of this course is to develop skills in the planning and execution of market research studies designed to acquire useful information for marketing decisions. It aims to familiarize students with techniques of research design, data collection, and analysis. Emphasis is placed on evaluating the results obtained from such investigations.

Learning Outcomes: 1. Identify and prioritize marketing research needs by analyzing a firm's marketing plan. 2. Demonstrate competency using a variety of research methods, such as regression, conjoint analysis, multi-dimensional scaling, and cross-tabulation. 3. Develop a marketing research proposal that includes a problem description, associated research theory and models, a research instrument, a description of data collection procedures and protocols, and data analysis. 4. Critique different marketing research projects, identifying

strengths, weaknesses and potential improvements in theory, measurement and analysis. 5. Demonstrate the ability to work in teams to design, conduct and report marketing research. Credits: 3.00

MGMT 42610 - Brand Management

Credit Hours: 3.00. This course is designed to provide an understanding of how to manage a brand, product, or product category. The course concerns issues related to customer behavior and customer decision making, with an emphasis on how to utilize such customer-oriented knowledge for building and maintaining brand equity. This course builds on concepts and topics covered in the core marketing course.

Learning Outcomes: 1. Increase understanding of the important issues in planning and evaluating brand strategies. 2. Provide appropriate theories, models, and other tools to make better brand management decisions. 3. Provide students with insights into how profitable brand strategies can be created. Credits: 3.00

MGMT 42710 - Digital Marketing Strategy

Credit Hours: 3.00. Digital marketing is where marketing meets the internet, wireless devices, and other digital media. The course covers a variety of topics including online advertising, search engine optimization, participation in social media, online listening and monitoring, and web & social media analytics. Through a combination of lecture, case studies, hands-on exercises, and course projects, students develop capabilities in designing, implementing, and evaluating digital marketing strategies. Students can also gain hand-on learning experience in the course by participating in an online marketing project. In the online marketing project, each student team is given $50 to promote a chosen business or organization via online or social media platform (including search engine advertising and online display advertising).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital age. 2. Develop capabilities in designing, implementing, and evaluating digital marketing strategies. 3. Understand major tools of digital marketing by gaining hands-on learning experience of search engine advertising tools by participating in a Google sponsored online marketing challenge competition. Credits: 3.00

MGMT 42910 - Experiential Marketing

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet regularly with the faculty supervisor and also the project sponsor to review project progress and discuss the next steps towards meeting project requirements. Projects are done in teams, although evaluation is individual. Permission of instructor required.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the project analysis and information gathered into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Experience challenges of working in teams to achieve projects goals. Credits: 3.00

MGMT 42930 - Labor Relations

Credit Hours: 3.00. The course focuses on employee-employer relations. Attention is given to topics in legal aspects of union organizing and collective bargaining, labor unions history and structure in the United States, labor management negotiations, dispute resolution procedures, international labor relations, and labor-management cooperation.

Learning Outcomes: 1. Summarize what unions do and why workers join labor unions. 2. Explain how management can react when its workers decide to form a union. 3. Execute the process of collective bargaining and summarize

information typically contained in a collective bargaining agreement. 4. Differentiate how disputes are resolved through mediation, arbitration, and other methods. 5. Compare how labor-management relations in the USA are versus similar relationships in other countries around the world. Credits: 3.00

MGMT 43000 - Professional Selling

Credit Hours: 3.00. The course covers all aspects of professional selling to help students develop an understanding of sales managers' goals, decisions, and challenges and learn about the tools, frameworks, and insights to diagnose and resolve strategic and tactical issues of selling. These concepts can help all employees promote their own ideas internally and more effectively work with the sales organization to achieve organizational success.

Learning Outcomes: 1. Introduce students to the concepts, analyses, and activities that comprise professional selling. 2. Provide practice in assessing and solving problems sales professionals encounter. 3. Demonstrate how the sales function supports other marketing and strategic priorities within companies. Credits: 3.00

MGMT 43700 - Social Media Marketing

Credit Hours: 3.00. This course is deigned to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class. The deliverables for this project will be a slide presentation (no more than 10 pages, excluding appendices) to showcase what you have learned. This may be included as a part of your resume to show your potential employers. These are some of the basic knowledge of useful skills in web crawling, data mining, and statistical analyses, so you may leverage your portfolio when seeking entry/junior level marketing analyst positions.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 3.00

MGMT 43800 - Pricing Strategies

Credit Hours: 3.00. In the era of Big Data, where extensive information is available at the customer level, managers benefit from an increased ability to learn from their customers' behavior. In this scenario pricing becomes a crucial lever for increasing the relationship with the customer and maximizing profits and shareholder value. In this course, students will learn how to systematically approach pricing decisions, taking the perspective of the marketing manager. The course will use a combination of lectures, case discussions and in-class exercises to leverage micro-level transaction data for pricing decisions.

Learning Outcomes: 1. Become familiar with the concepts, theory, and latest thinking bearing on the key issues in pricing, taking the perspective of the marketing manager. 2. Apply concepts and theory to the solution of real pricing problems in marketing settings. 3. Develop your business communication skills and receive feedback from your peers and the instructor. Credits: 3.00

MGMT 43901 - Real Estate Investment & Development

Credit Hours: 3.00. The course will cover two main topics: real estate development and real state investment. For real estate development, we will discuss the process of the real estate development process, including the basics of the idea conception, feasibility, planning, financing, market analysis, contract negotiation, risk management, marketing, and asset management. For real estate investment, we will discuss the process and techniques of analyzing real property investment, and the effects of market conditions, government policies, and other factors on real estate investment.

Learning Outcomes: 1. Understand the nature

of real estate markets and how value is determined. 2. Understand the process of developing real estate properties. 3. Understand the basic methods for evaluating financial and other risks associated with a real estate development project. 4. Understand and utilize the underlying theory in the analysis of income-producing real estate as an investment medium. 5. Use the net present value and internal rate of return and traditional measures of investment analysis of a real estate investment. 6. Understand the basic principles in structuring real estate investments. Credits: 3.00

MGMT 43902 - Real Estate Capital Markets

Credit Hours: 3.00. In this course, students explore the world of real estate finance and capital markets from the perspectives of investors, lenders, fund managers, and other capital allocators. Diving into essential topics like deal structuring, waterfall analysis, debt management, real estate private equity, taxation and regulation, public incentives, mortgage-backed securities (MBS), and Real Estate Investment Trusts (REITs). Through hands-on experience, they will learn to model before-tax and after-tax cash flows, price various securities and deal structures, and develop strategies for managing risk and distress at both project and fund levels. With a strong focus on case study analysis, this course will equip students with practical insights and skills to succeed in real estate finance.

Learning Outcomes: 1. Demonstrate a deep understanding of the history and composition of both debt and equity components of real estate capital markets. 2. Understand the main drivers of real estate capital flows and capital pricing. 3. Describe the structure of residential and commercial mortgage-backed securities. 4. Perform a comprehensive valuation of a REIT. 5. Structure the capitalization for a given project type. Credits: 3.00

MGMT 43905 - Real Estate Industry Project

Credit Hours: 3.00. This course gives students opportunities of working on real-world projects provided by commercial corporations or organizations. Through the experiential learning experience, students have the opportunities to develop knowledge and skills in managing real estate projects. Depending on the available projects, students will work on topics related to real estate investment and development, facility design and renovation, asset management and other issues. The focus is on developing students' ability in applying what they've learned to solve real-world challenges and receiving coaching and feedback from industry experts.

Learning Outcomes: 1. Learn how to organize your investment or development project by analyzing key characteristics and external constraints that affect schedule, budget, and outcomes. 2. Plan and manage financial and physical resources by a well-planned schedule with appropriate tasks. 3. Monitor project progress and make necessary adjustments to the project schedule manpower and costs. 4. Develop team leadership and communication skills. Credits: 3.00

MGMT 43907 - Advanced Topics In Real Estate

Credit Hours: 3.00. This course covers selected and timely topics in real estate that are not covered in other regular courses. The topics are determined by the instructor offering the course. The instructor may also include advanced analytical techniques for real estate investment decisions, real estate valuation, and other analyses. Cases and research reports may be used in this course.

Learning Outcomes: 1. Recognize and understand issues and their impacts on the real estate industry. 2. Assess the impacts of certain issues on a company. 3. Understand and apply advanced analytical methods in real estate decisions. 4. Develop a life-long learning ability for future issues in real estate. Credits: 3.00

MGMT 44301 - Management Of Human Resources

Credit Hours: 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on legal concerns, human resource staffing and development, reward systems, and the role of unions in American society. Techniques studied include job analysis, the use of various recruitment and selection procedures, compensation, administration, and collective bargaining. No credit for students in the School of Management.

Learning Outcomes: 1. Students will learn about human resource management including legal

concerns, human resource staffing, development, rewards systems, and the role of unions through study of job analysis, recruitment and selection procedures, compensation, administration, and collective bargaining. Credits: 3.00

MGMT 44310 - China, America And Artificial Intelligence

Credit Hours: 3.00. The key to business success is to read broadly and to understand how culture, economics, history, and politics converge. Through frequent writing assignments, close readings of personal accounts, and daily class discussions, students will gain insights into how culture, economics, history, and politics intersect to influence human behavior and worldviews. Case studies and examples will be drawn from the United States, China, and Taiwan. Finally, we will apply what we have learned to the practice of global cultural dexterity. Students will identify cultural nuances and subtleties in order to share examples of how each student has adapted or failed to adapt to different cultural dynamics.

Learning Outcomes: 1. Identify and to analyze cultural, economic, historical, political, and social variables. 2. Understand how culture, economics, history, politics and society converge to influence human behavior and worldviews. 3. Gain knowledge of cultural worldview frameworks. 4. Acquire an attitude of openness. Credits: 3.00

MGMT 44362 - Leadership In A Changing World

Credit Hours: 3.00. This course is designed to help you become a more effective leader in a complex and rapidly changing world. Effective leadership-developed over time through practice, feedback, and self-reflection-is crucial for organizational success. While engaging in effective leadership practices can be rewarding, it is also a significant challenge for most people. This course aims to equip you with the knowledge and tools necessary to improve your leadership capabilities and confidence based on evidence-based practices and leadership theories. Through interactive sessions, we will explore various aspects of effective leadership, assess where you stand in your leadership development journey, and hone your leadership skills. By the end of the course, you should be able to recognize the importance of interpersonal relationship skills and abilities in effective leadership, discuss key leadership principles and practices in organizational settings with peers, colleagues, supervisors, and mentors, identify your own leadership strengths and areas for development, propose evidence-based solutions to real-world leadership problems, and develop a leadership philosophy based on your personal values and evidence-based strategies.

Learning Outcomes: 1. Discuss effective leadership practices occurring in organizational settings with peers, colleagues, supervisors, and mentors. 2. Recognize your own leadership-relevant strengths and opportunities for development. 3. Develop your leadership skills and perspectives based on evidence-based strategies and personal values. 4. Propose actionable and evidence-based solutions to real-world leadership problems. Credits: 3.00

MGMT 44363 - Confident Transitions And Leadership

Credit Hours: 1.00. In this course offered by the Brock Wilson Center for Women in Management, graduating senior women will prepare for a confident transition from student to professional. Students will focus on common issues for new employees as well as be paired with an alumni mentor. They will develop a personal plan for their transition from college student to successful professional through reading and discussing key business leadership books. Through this course, each student will build a plan for the first six months of their job and decide what a successful transition looks like for them. Permission of instructor required.

Learning Outcomes: 1. Understand the core principles of successful professionals and how they apply to a first job. 2. Explain and reflect on best practices for launching a successful career. 3. Formulate a plan for the first six months of your new position and what success will look like. 4. Utilize your unique MyStrengths as part of your plan for a Confident Transition. Credits: 1.00

MGMT 44428 - Human Resources Management

Credit Hours: 3.00. Survey of the techniques and practices used in human resource management. Emphasis is on legal requirements, cost/benefit considerations, and strategic needs in managing human resources. Topics include recruitment, selection and placement, compensation, work design, and reactions to work. Specific techniques reviewed include assessment centers, incentive plans, structured interviewing, and autonomous work groups. Current issues and managerial

decision making are emphasized.

Learning Outcomes: 1. Develop an understanding of the major HR management needs of most organizations. 2. Develop a familiarity with alternative HR systems designed to address those needs, and the advantages and disadvantages of each. 3. Gain an awareness of the technology underlying the HR systems, so that the range of quality can be understood. 4. Develop an appreciation for basic HR decisions. Credits: 3.00

MGMT 44429 - Talent Management

Credit Hours: 3.00. This course focuses on the employer-employee relationship at work, and how managers work with employees to improve employee performance. Attention is given to the history of labor relations and performance management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing employee performance.

Learning Outcomes: 1. Identify and understand the tools and techniques of contemporary employee relations at work. 2. Identify and understand the tools and techniques of contemporary performance management at work. 3. Ability to apply these techniques. Credits: 3.00

MGMT 44430 - Staffing: Talent Acquisition

Credit Hours: 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. It will also prepare students to evaluate methods for job analysis and selection. Students will learn how to design and ask interview questions that are behaviorally anchored and focused on organization-person fit and person-job fit, both of which are important for successful adaptation and effective performance on the job. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Describe workforce planning implementation issues and the importance of continuous refinement of the plan. 2. Define talent acquisition and differentiate between recruiting and selection processes. 3. Understand the various talent acquisition organization models. 4. Use tangible and intangible data to build a business case for effective talent acquisition. 5. Articulate the steps in a common talent analysis and translate the analysis into selection criteria and methods. 6. Conduct a job-fit and organization-fit analysis and translate the analysis into selection criteria and methods. 7. Develop behavior-based and situation-based interview questions derived from job analysis and conduct a professional interview. 8. Design a process for final candidate evaluation. 9. Highlight various strategies to orient and onboard new acquired talent. 10. Articulate an employer's legal responsibilities in the talent acquisition process. Credits: 3.00

MGMT 44431 - Compensation: Total Rewards

Credit Hours: 3.00. This course examines the tangible and intangible aspects of compensation, through the lens of a total reward philosophy of an organization in order to attract, motivate, and retain their Human Capital. It also provides an overview of the considerations necessary to develop a compensation system that is internally and externally equitable and fiscally responsible, including the use of job evaluation and salary surveys.

Learning Outcomes: 1. Evaluate the difference Total Rewards programs can make in organizations. 2. Distinguish between total rewards and compensation and identify compensation and non-compensation elements of total rewards. 3. Recognize various reward systems, their relationship and connection to a total compensation and benefits philosophy, and how they impact the quality of work life and productivity organizations. 4. Assess the practical issues in compensation and employee benefits in light of a company's management philosophy and human resources strategies. 5.

Define job evaluation and its use to develop internally equitable compensation systems. 6. Identify the implications of using salary surveys to ensure externally equitable and fiscally responsible compensation systems. 7. Explain the concepts of salary administration and application of compensation programs in the business environment. 8. Better understand effective salary and wage structures in organizations today. 9. Explain the relationship between performance evaluation methods and reward systems. 10. Discuss the legal aspects of compensation, benefits and performance appraisals. Credits: 3.00

MGMT 44433 - Leading And Working In Teams

Credit Hours: 3.00. This course will explore the forces that affect behavior in teams, and the factors that lead to team success. We will use a variety of readings, cases, activities, and class discussions to build concrete skills related to leading and working in teams. The course will explore the specific challenges associated with leading teams, some of which include: building and designing teams, managing information exchange within and across teams, structuring effective group decision processes, igniting creative thinking, enabling complex problem solving, managing team diversity and conflict, and managing systems of teams. Permission of instructor required.

Learning Outcomes: 1. Identify and define concepts related to team functioning and effectiveness. 2. Apply those concepts to understand and diagnose issues associated with team effectiveness. 3. Develop a course of action to improve team functioning. Credits: 3.00

MGMT 44434 - Human Resources Analytics

Credit Hours: 3.00. This course introduces concepts, tools, and methods used in collecting, interpreting, and presenting HR data. Students will learn how to gain new insights, solve problems, and drive performance through HR analytics. A central focus of this course is the ethics of HR analytics. This course teaches students how to ask the right questions in order to intelligently use HR analytics and metrics for business decisions. It discusses the implications of internet AI, business AI, perception AI, and autonomous AI for HR. This course will cover applications including the intelligent use of analytics related to employee engagement, healthcare expenditure, learning and development, performance management, and safety.

Learning Outcomes: 1. Gain an understanding of the different analytical approaches used by HR Professionals to solve real business problems. 2. Examine actual business cases and apply problem solving and critical thinking skills through group case studies. 3. Learn how to make impact with data by using effective storytelling techniques. 4. Build on presentation skills and demonstrate the ability to work effectively in teams. Credits: 3.00

MGMT 44630 - Innovation Management

Credit Hours: 3.00. In this course you learn why organizations struggle to innovate, how to successfully analyze and implement an innovation strategy, and you learn to manage the innovation process. The course consists of two pillars (or 'walls') that enable a company to become innovative (Innovation Strategy and Organization Design) and the innovation process itself. The innovation process contains how to generate, select, implement, protect, experiment, scale, and diffuse ideas. Consequently, this course will provide you the skills and knowledge to manage innovations. Permission of department required.

Learning Outcomes: 1. Analyze the potential and implication of ideas and innovations for an organization and environment. 2. Formulate an innovation strategy. 3. Develop an innovation process. 4. Distinguish the different approaches to designing an innovative organization. Credits: 3.00

MGMT 44670 - The Great Leaders Book Club

Credit Hours: 3.00. One way to learn about leadership and being an effective leader is to learn from other leaders past and present. Numerous articles and books have been written about leadership and/or profile one or more leaders. We will study leaders through historical and contemporary review and analysis of selected books that illustrate important leadership principles and situations. Course readings will typically include books that one would find on bookshelves of top-level leaders in organizations and institutions. Each week students and instructor meet to discuss the assigned readings and identify key leadership lessons and takeaways. These discussions are reinforced through role play and in-class exercises. Students are expected to be active co-participants and will be challenged

to ask curious questions and develop critical thinking skills. This class is designed for high potential leaders who take leadership seriously and wish to develop their leadership capability to its fullest. Permission of instructor required.

Learning Outcomes: 1. Identify what leadership is and what it is not. 2. Summarize key differences between effective and ineffective leaders. 3. Deconstruct and differentiate leader attributes and behaviors that contribute to leader outcomes. 4. Identify and use influence techniques to influence others. 5. Recognize differences in situations that may call for different leadership approaches. Credits: 3.00

MGMT 44671 - Corporate Conscience

Credit Hours: 3.00. Is there a moral component to leadership? Does a moral person translate to a moral manager? What does leading ethically entail? Where have organizations and their leaders failed to act in a way that advances the interests of their employees and society at large? This course takes a case study approach to understanding ethical leadership. We look inside organizations, through case study, to evaluate an organization's corporate conscience, defined here as the extent to which a company or organization prioritizes ethics and demonstrates ethical behavior or unethical behavior. We examine the drivers of ethical decision making and the qualities of what it means to be a servant leader. Permission of instructor required.

Learning Outcomes: 1. Identify the components of ethical behavior. 2. Summarize ways of thinking about ethics. 3. Differentiate ""means"" based ethics and ""ends"" based ethics. 4. Create a personal code of ethics. 5. Identify behaviors that define what it means to be a servant leader. 6. Integrate ethical concepts in analysis of real world, organization-based case studies. Credits: 3.00

MGMT 44672 - Transformational Leadership Development Immersion Experience

Credit Hours: 1.00 to 4.00. Courses involve leadership immersion trips to develop one's leadership acumen and enable one to reflect on one's guiding principles. Immersion learning takes place in novel, inspiring settings where real leadership is/was required. Permission of instructor required.

Learning Outcomes: 1. Generate a list of strategic leadership advantages; finding the "high ground" and positioning for success. 2. Carry out communication with others and influence them for strategic advantage. 3. Differentiate both the rational and emotional components of being a transformational leader. 4. Reflect on how transformational leadership can be utilized for strategic advantage. 5. Identify the traits and characteristics of some of history's greatest leaders during the Civil War and Battle of Gettysburg and apply their leadership principles to today's challenges, whether they be in your family, community, school, or organization. 6. Deconstruct how leadership, discipline, trust and teamwork drove many of the successes in the early history of NASA. 7. Summarize factors in an organization or team that can derail the team and lead to sub-optimal outcomes including issues of structure, process, conflict, power, politics and differing perceptions of risk. 8. Identify the root causes of failure and develop successful interventions for leading in VUCA (volatile, uncertain, complex, ambiguous) environments. 9. Differentiate the relationship between vulnerability, humility, trust, control, and credibility. 10. Use skills that will create the confidence to lead a team in novel, stressful, difficult situations. 11. Reflect on the inspirational power and natural beauty of Yosemite and appreciate how the magnificence of nature contributes to developing one's personal humility. 12. Identify team roles and use one's understanding of roles to lead by example. 13. Carry out teaming skills that develop willingness to be vulnerable to others in uncertain, challenging situations. 14. Differentiate transformational and pseudo-transformational leadership. 15. Generate a set of ethical leadership principles and compare to the actions of historical and contemporary leaders. 16. Reflect on their own leadership

guiding principles and the impact a good or bad leader can have, not just on a team or organization, but civilization. 17. Summarize the principles of power and influence; Recognize the conditions under which a population (e.g., nation) could be vulnerable to and be transformed by the false promises of a highly charismatic leader. 18. Reflect upon and attempt to find inspiration in the stories of courage and sacrifice that won WWII for the Allies in Europe. Credits: 1.00 to 4.00

MGMT 44673 - Intensive Leadership Sprint

Credit Hours: 1.00. Intensives are rapid leadership development experiences condensed over a weekend, with topics focused on self-leadership, teambuilding, conflict resolution, decision-making, communication, influence, and visioning. Permission of instructor required.

Learning Outcomes: 1. Identify the connection between personality and leadership. 2. Identify the qualities of effective teaming and what it means to be a team-player. 3. Carry out effective teaming behaviors and recognize how individual personality and communication style differences affect team success. 4. Design/develop strategies that will motivate self and others. 5. Summarize the ways people resolve conflict. 6. Determine one's own conflict resolution style and its implications for leadership. 7. Differentiate the ways we get people to go along and their implications on organizational outcomes. 8. Create new ways demonstrate influence tactics and apply them to influence other team members. 9. Contribute more effectively to a team. 10. Recognize and avoid costly team mistakes that plague many teams. 11. Create a crisis management plan for an organization. 12. Use their problem solving and decision-making skills to solve team challenges and problems. 13. Deconstruct the leader's role in leading a team to effective decision-making. 14. Identify their own personal ""why"" or leader purpose. 15. Reflect upon and summarize one's own limitations and strengths as a leader. 16. Deconstruct the role of vision and strategic decision-making at various levels of leadership in an organization. 17. Create a vision for themselves and other organizations. Credits: 1.00

MGMT 44680 - Experiential Learning And Team Consulting Projects

Credit Hours: 1.00 to 4.00. This course is for independent team experiential consulting projects. Students work on solving a real-world problem. Projects will typically involve an external corporate or alumni partner that sponsors a project and provides a problem to be solved. Student teams will work with the client to define the scope of engagement, develop a project plan, conduct a needs assessment, provide benchmark data and market analysis, solve problems, make decisions and present recommendations. In addition, students will develop professionalism skills in communicating and interacting with corporate clients through written and oral communication, including a final presentation to corporate stakeholders. Permission of instructor required.

Learning Outcomes: 1. Develop professionalism through written and verbal communication. 2. Develop teamwork skills by working in a cross-functional team. 3. Use and apply consulting methodologies and frameworks. 4. Analyze and assess current client situation. 5. Apply management tools such as SWOT analysis. 6. Conduct internal and external research and benchmarking. 7. Provide recommendations to solve real-world business problems. Credits: 1.00 to 4.00

MGMT 44690 - Negotiation And Decision Making

Credit Hours: 3.00. The purpose of this course is to understand the theory and processes of negotiation so that you can negotiate successfully in organizational and management settings. This course covers a wide variety of negotiation problems faced by business people. In addition, models of effective and ineffective decision-making are introduced and students will have the opportunity to make decisions at both the individual and group levels.

Learning Outcomes: 1. Improve ability to effectively negotiate. 2. Recognize and analyze

negotiation situations. 3. Gain confidence negotiating. 4. Improve decision-making knowledge and skills. Credits: 3.00

MGMT 44710 - Competitive Strategy

Credit Hours: 3.00. This course focuses on the dynamics between a firm and the marketplace including interaction with competition. Strategy implementation occurs over multiple periods and is highly dependent on choices and behavior of competition. The course material covers how these dynamics and expectations of competitor response will shape the decisions of managers. This is inclusive of signaling intent to competitors and mutual forbearance to avoid negative sum gain competition.

Learning Outcomes: 1. Improve ability at market and competitive analysis. 2. Recognize opportunities and problems for market entry that may follow from market and competitive analysis. 3. Improve decision making knowledge and skills. Credits: 3.00

MGMT 44810 - Technology Strategy

Credit Hours: 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage.

Learning Outcomes: 1. Improve ability to assess technology and innovation from a competitive perspective. 2. Learn about disruptive innovation and its effects on incumbents and new firms. 3. Consider internal processes for innovation management in existing firms. 4. Improve decision-making and skills with respect to technology and innovation. Credits: 3.00

MGMT 45200 - Manufacturing Strategy And Process Innovation

Credit Hours: 3.00. This course examines the management challenges posed by the growth in worldwide manufacturing capabilities, markets, and competition and by rapid advances in technology and the concomitant decline in product life cycles. The manufacturing function is considered within a broader context encompassing design, engineering, purchasing, marketing, and customer service in an effort to assess the degree to which existing management structures successfully meet the challenges arising from the changing manufacturing environment.

Learning Outcomes: 1. Identify the tradeoffs made between operations flexibility and cost. 2. Identify proper alignment between manufacturing strategy and business strategy. 3. Identify the pros and cons of different types of plant network strategies. 4. Identify the behavioral issues associated with implementation of rigid project management tools. 5. Identify the potential long term implications of outsourcing on the development of competition. Credits: 3.00

MGMT 45500 - Legal Background For Business I

Credit Hours: 3.00. The nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. Special emphasis on torts, contracts, and agency. No credit to students in the School of Management.

Learning Outcomes: 1. Learn about the nature and place of law in our society, national and international, social and moral bases of law enactment, regulation of business, legal liability, and enforcement procedures. 2. Learn about torts, contracts and agency. Credits: 3.00

MGMT 45600 - Legal Foundations For Business II

Credit Hours: 3.00. A study of commercial law as prescribed by the Uniform Commercial Code, including the law of sales, documents of title, negotiable instruments, and the law relating to security interests. Additional material is presented covering the legal aspects of real estate transactions and personal property transfer.

Learning Outcomes: 1. Have a good basic understanding of the structure of the U.S. legal system. 2. Be able to understand and apply basic legal terms and concepts in almost every

area of the law. 3. Be able to recognize common legal and ethical issues which will arise in the course of doing business. 4. Demonstrate your knowledge in classroom discussion and through the four (4) exams given during the semester. 5. Have the ability to more effectively communicate with and assist counsel on legal matters in your future business career. Credits: 3.00

MGMT 45900 - International Management

Credit Hours: 3.00. This course focuses on the challenges top managers face in developing strategies and management policies in multinational corporations (MNCs). Major topics usually covered include foreign market entry strategies, motivations and organizational challenges of internationalization, analyzing global industries, managing MNC/host government relations, building competitive advantage in global industries, international alliances and acquisitions, structuring and controlling MNCs, risk management, and the country manager role.

Learning Outcomes: 1. Understand the range of competitive opportunities and challenges companies and managers face in creating value worldwide. 2. Appreciate the complexities of national institutions and the dynamics of industry competition. 3. Deal with a company's multiple stakeholders including its internal constituents. 4. Integrate the concepts, principles, skills, and knowledge acquired in functional courses. Credits: 3.00

MGMT 46200 - Advanced Manufacturing Planning And Control Systems

Credit Hours: 3.00. The course examines key concepts in the planning, control, and improvement of processes in manufacturing and service operations. Specific topics covered in the course include: (i) Product/service characteristics that provide value to customers and competitive priorities, (ii) Role of processes and key operations choices to support the competitive priorities, (iii) Process analysis and scheduling, (iv) Throughput principles to deal with adverse impacts of process uncertainties and bottlenecks, (v) Managing capacity and lead times, (vi) Throughput principles to deal with wastes and errors, including the Toyota Production System and Lean Operations, and (vii) Coordinating material/order flows in supply chain - MRP, and Resources and Production Planning - Aggregate Production Planning. The class uses a combination of lectures, cases, simulations, outside speakers, experiential exercises, and student presentations. An important component of the course is a hands-on exercise where students in teams of seven or eight design and run a production process to meet demand for a quality-conscious customer. The teams then present the lessons learned to the class.

Learning Outcomes: 1. Learn the details of production planning, master scheduling, materials planning, short range capacity planning, production floor execution, and quality control. Credits: 3.00

MGMT 46300 - Supply Chain Analytics

Credit Hours: 3.00. This course focuses on rigorous quantitative decision-making in supply chain management. It covers optimization (linear, nonlinear, and integer), stochastics/probability, and simulation. The coursework is conducted through experiential learning activities based on real-world data, proficiency with analytics software, and operation research case studies. MGMT 30600 is highly recommended but not required. Basic Calculus, Statistics, and Excel literacy are required.

Learning Outcomes: 1. Gain analytical insights on major supply chain tradeoffs. 2. Know supply chain functions: demand forecasting, procurement, inventory, transportation, pricing, contract, revenue management, reverse supply chain and integration of multiple functions. 3. Know a systematic set of analytical methodologies to use effectively in their future careers. Credits: 3.00

MGMT 46400 - Logistics: Concepts And Models

Credit Hours: 3.00. The course familiarizes students with main concepts and models of business logistics management. Through the course, students develop an ability to design, improve, and manage logistics operations such as Inventory, Transportation, Warehousing, and Logistics Network Design. Since logistics decisions often require certain trade-offs to be made, students develop necessary quantitative and qualitative analytical skills to improve their decision-making. At the end of the course, students should be able to analyze logistics strategy of a firm, identify problems and tradeoffs in different logistics functions, formulate the corresponding models, identify quantitative methods to solve it, obtain results and interpret them for small-size problems using standard spreadsheet software, communicate the results to a broader audience using

business language, discuss issues and challenges in same-day delivery, humanitarian logistics, physical internet.

Learning Outcomes: 1. Know vocabulary of Logistics, and Supply Chain. 2. Design, improve and manage processes by learning decision making tools. 3. Become familiar with the key issues and problems facing an operations manager. Credits: 3.00

MGMT 46501 - Strategic Sourcing And Procurement Operations Analytics

Credit Hours: 3.00. This elective course will serve as an important complement to the existing OM modules (e.g., MGMT 36100 Operations Management) to introduce more in-depth knowledge about supply chain management to undergraduate students, especially those major in SC&OM, focusing on strategic sourcing and procurement operations which are the building blocks for supply chain operations. More specifically, this course will introduce procure-to-pay process, category management, supplier selection and evaluation, supplier relationship management, vertical integration, global sourcing, outsourcing, auctioning, supply contract design and negotiation, business ethics, legal and compliance issues, etc. Sourcing and procurement is the major job title for supply chain operations jobs in the industry and our course can also help students to get the professional certificate of sourcing and procurement. Hence, it may also help senior students prepare for the job placements.

Learning Outcomes: 1. Master the working knowledge and vocabulary of strategic sourcing and procurement. 2. Know how to design and manage the business process in sourcing operations. 3. Know how to align sourcing strategies with corporate strategies. 4. Know how to model the key decision-making process of sourcing operations. 5. Apply data analytics techniques to develop sourcing strategies. Credits: 3.00

MGMT 46600 - Project Management

Credit Hours: 3.00. This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, quality management and procurement management will be covered. Students will also gain a working knowledge of MSProject software.

Learning Outcomes: 1. Provide in-depth exposure to the use of project management tools and philosophies. 2. Demonstrate a realistic experience using these tools to plan and control a project. 3. Know basic steps in project planning: work breakdown, scheduling, resource allocation, information systems, and control. Credits: 3.00

MGMT 46700 - Big Data & Cloud Computing

Credit Hours: 3.00. Cloud computing and big data technologies are rapidly enhancing an organization's business intelligence ecosystem. Two modules of the course are specially designed for students to gain valuable hands-on experience in collecting, cleaning, formatting, integrating, and storing massive amounts of data that may be structured or unstructured, archived, or streaming in a cloud platform. The first module will introduce cloud computing fundamentals, its enabling technologies, main building blocks, and hands-on experience through projects utilizing Google Cloud Platform (GCP). The second module will cover processes for creating data pipelines in GCP so that the student will be able to curate big data for training, analysis, and prediction using AI/ML and other data science techniques.

Learning Outcomes: 1. Configure rapidly GCP to meet any analytics related challenge. 2. Build Data Lakes and Data Warehouses for big data analytics. 3. Use BigQuery and related services for advanced, real-time analytics. 4. Use BigQuery ML for classification and regression. 5. Build complex data pipelines using GCP's Dataflow, Cloud pub/sub, and Cloud Function to prepare data for machine learning algorithms. Credits: 3.00

MGMT 46800 - Supply Chain Technology

Credit Hours: 3.00. The course will introduce the major SCM information systems and technologies utilized by industry leaders to integrate SCM operations and achieve coordination within and across various business functions. The students will learn how to manage SCM operations, including: sales & distribution, materials management, production planning and control, warehouse management, retail operations. The course will provide students the opportunity to study, analyze, and observe the information systems and technology tools. Topics include Enterprise Resource Planning Systems (ERP), Blockchain, Warehouse Management System (WMS), Transportation Management Systems (TMS), Internet of Things (IOT) in retail. The students will learn how to use the SAP

software to execute SCM operations. The course will review the technology implementation process and how such projects should be organized and managed.

Learning Outcomes: 1. Learn how to manage SCM operations, including: sales & distribution, materials management, production planning and control, warehouse management, retail operations. Methods of Evaluation: HWs, Quizzes. 2. Study, analyze, and observe the information systems and technology tools. Methods of Evaluation: Case studies, lab sessions, online discussions. 3. Learn how to use the SAP software to execute SCM operations. Methods of Evaluation: Lab exercises, team workshop, games. Credits: 3.00

MGMT 46900 - Supply Chain & Operations Analytics Consulting

Credit Hours: 3.00. This supply chain experiential learning course aims to provide students opportunities to apply theories and methods learned from supply chain and operations management courses to tackle real-world supply chain problems. A salient feature of this course is that it consists of two pillars. The first pillar is the partnerships with leading companies (e.g., Wabash, Corteva and Rolls Royce) to offer project opportunities and assign internal experts to advise student teams. Students will have opportunities to visit company sites, interact with domain experts, and present their findings to leadership teams. The second pillar is the partnership with a group of Purdue alumni to leverage their extensive supply chain consulting and corporate leadership experiences to advise students the consultation approach to problem-solving: how to approach problems, engage stakeholders, and professionally manage project delivery processes as internal or external consultants for business organizations.

Learning Outcomes: 1. Apply knowledge and skills learned in classes to real-world supply chain and operations problems. 2. Identify and approach real-world supply chain problems. 3. Collect, process and analyze real-world data. 4. Communicate and interact with supply chain executives. 5. Manage supply chain projects as a consultant. Credits: 3.00

MGMT 47200 - Advanced Spreadsheet Modeling And Simulation

Credit Hours: 3.00. This course covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations. The topical coverage consists of the following five modules: (1) Excel functions, skills and financial models; (2) deterministic and stochastic optimization techniques to determine the best managerial actions under internally-and/or externally-imposed constraints; (3) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (4) simulation modeling techniques to discover and analyze the risk and uncertainties in business environment and processes; (5) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics(stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer application using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Learning Outcomes: 1. Acquire advanced Excel skills to quickly build business spreadsheets that easily convey information and significance to the reader. 2. Construct complex deterministic and stochastic computer models to aid in the decision making process. 3. Use simulation modeling to identify and assess the risks in decisions and processes. 4. Conduct financial analysis including asset and options pricing. 5. Become skilled in the use of @RISK, RiskOptimizer, SolverTable, SimQuick and other software packages in making and analyzing business decisions. Credits: 3.00

MGMT 47300 - Data Mining

Credit Hours: 3.00. Students follow a structured analytical process using popular industry tools (e.g., RStudio, Tableau, SQL) to identify, visualize, and summarize relationships within large data sets to support business problems. More focus is on descriptive analytics which includes business segmentation and clustering methods, but also introduces two predictive analytic methods, decision trees, and neural networks.

Learning Outcomes: 1. Demonstrate working knowledge of relationship databases, SQL queries, and efficient sampling. 2. Demonstrate working knowledge of RStudio to perform EDA, visualization, and data mining techniques. 3. Demonstrate working knowledge of data visualization and exploration using Tableau. 4. Demonstrate practical understanding of popular unsupervised and supervised learning methods.

Credits: 3.00

MGMT 47400 - Predictive Analytics

Credit Hours: 3.00. Students build and evaluate predictive models to support regression-type and classification-type business problems using popular industry tools (e.g., RStudio, SAS Enterprise Miner). Methods covered include multiple linear regression, ridge regression, lasso, CART, logistic regression, LDA/QDA, SVM, and ensemble methods such as random forests.

Learning Outcomes: 1. Generate a valid predictive analytics solution by following a structured process. 2. Demonstrate practical understanding of frequently used predictive analytics techniques. 3. Demonstrate a working knowledge of RStudio and SAS Enterprise Miner to build an access predictive models. 4. Demonstrate project poster and presentation of a predictive analytics solution to a business problem. Credits: 3.00

MGMT 47500 - Machine Learning For Business

Credit Hours: 3.00. This course concerns the latest techniques in machine learning, focusing on deep learning and reinforcement learning, with applications to computer vision, natural language understanding, speech recognition, news recommendation, and others. The course plans to cover Neural Nets, Backpropagation, Convolutional neural network, Recurrent Networks, Autoencoders and other architectures in Deep Learning in the rst half. Next, the course plans to cover multi-armed bandits, Contextual bandits, Markov decision process, and Policy gradient methods in Reinforcement Learning.

Learning Outcomes: 1. Perceive the scope and importance of machine learning. 2. Understand and evaluate modern machine learning algorithms. 3. Apply appropriate programming skills to administer a machine learning algorithm in a real-world problem. 4. Communicate the machine learning results in an appropriate level of detail for an intended audience. Credits: 3.00

MGMT 47600 - Employment Law For Business

Credit Hours: 3.00. Employment Law for Business is designed to help students navigate the complex legal challenges businesses face in employment. Students will explore key topics like defining the employment relationship, addressing discrimination and harassment, and managing technology and privacy issues in the workplace. Through real-world examples, students will learn about critical regulations, including the Fair Labor Standards Act, FMLA, OSHA, and laws governing employee benefits. By the end of the course, students will develop the skills to approach employment law issues with confidence, applying legal, managerial, and ethical perspectives to solve problems effectively.

Learning Outcomes: 1. Analyze and apply legal principles and legislation to evaluate employment decisions in business scenarios. 2. Explain and evaluate the legal protections and responsibilities of managers in various business contexts. 3. Identify and assess the fundamental components of litigation and analyze the financial and reputational costs of HR law violations. 4. Apply best practices in management, ethical frameworks, and legal mandates to resolve employment law issues effectively. 5. Develop and apply communication, analytical, and logical reasoning skills through case studies and writing exercises, demonstrating proficiency in at least three key areas. 6. Analyze the impact of public policy changes on legal frameworks, with examples of recent legislative shifts. Credits: 3.00

MGMT 47700 - Accenture Innovating Industry

Credit Hours: 3.00. Delve into the transformative role of innovation in driving industry growth and competitiveness. Students will explore how businesses can harness emerging technologies, evolving market dynamics, and disruptive business models to reshape industries. Through a combination of case studies, business world examples, and hands-on projects, the course emphasizes the importance of strategic thinking, design thinking, and creative problem-solving in identifying opportunities for innovation across sectors.

Learning Outcomes: 1. Analyze key drivers of innovation within different industries. 2. Apply innovation frameworks to solve business world challenges. 3. Design and prototype new business models that address tech-driven industries. 4. Lead initiatives that use

technology to help businesses grow by creating relevance with their customers. 5. Evaluate the impact of technological and social trends on industry evolution. 6. Deliver a solution to a corporate partner that satisfies their needs in an agile fashion. Credits: 3.00

MGMT 47800 - Experiential Project In Analytics

Credit Hours: 3.00. Most degree programs offer students an opportunity to apply the knowledge learned from their studies in an applicable area via a thesis, a research project, or capstone. This course provides such an opportunity and is designed specifically for Business Analytics & Information Management undergraduate students that will pursue analytical-type careers (e.g., Data/OR Analyst, Data Scientist, Decision Scientist, Consultant, Developer, etc.). This course is designed to polish and integrate the knowledge, skills, and abilities you have developed from your coursework by successfully developing an analytics solution with an industry partner in a structured fashion. Thus, most of your time will be devoted to working with your project teammates to provide the answers and deliverables specified by the partner over the course of many sprints. Every project team will be provided with a project description, data dictionary, and access to the dataset (or directions in where to find the necessary data), as well as an NDA to read, understand, sign, and return to your professor before you can gain access to the data. These are tasks that might be required of you to perform when you work on a new project or have a new client. Students are expected to be familiar with at least one programming language (e.g., Python, R). Permission of instructor required.

Learning Outcomes: 1. Formulate a business problem into an analytical problem. 2. Deliver an analytical solution to stakeholders in an agile fashion in programming languages. 3. Communicate effectively with stakeholders. 4. Work effectively in a team. Credits: 3.00

MGMT 47900 - Data Visualization

Credit Hours: 2.00 or 3.00. This course is an introduction to the techniques and algorithms for creating effective data visualization. Visualizations are graphical depictions of data that can improve comprehension, communication, and decision making. This course emphasizes application in business settings where visual representation methods that are covered in this course will improve our understanding of complex data and models. We focus in particular on pattern identification, difference and trends in data sets across categories, space, and time. In addition to participating in in-class discussions, students will have sufficient hands-on experience with the tools and techniques covered in this course. Students will be expected to complete several short programming and data analysis assignments. Students will also have an opportunity to work as groups on a final project. Permission of department required.

Learning Outcomes: 1. Understand the key techniques and theory used in visualization, including data models and graphical perception. 2. Apply perception and cognition principles in visualization. 3. Become familiar with a large number of data visualization tools. 4. Transform large database for visual displays using various representation techniques. 5. Critique various visualization representation and interaction techniques. 6. Read and discuss research papers from the visualization literatures. Credits: 2.00 or 3.00

MGMT 48400 - Management Of Entrepreneurial Ventures

Credit Hours: 3.00. This course teaches skills required to become an entrepreneur, succeed in a start-up venture, work in venture capital, join a family business, or develop a franchise operation. Students will learn about how to identify and shape emerging market opportunities, innovate new business models, prepare and evaluate business plans, raise capital, build a skilled founding team, network for resources, and grow an initial market.

Learning Outcomes: 1. Identify and shape emerging market opportunities. 2. Innovate new business models. 3. Prepare and evaluate business plans. 4. Raise capital. 5. Build a skilled founding team, network for resources, and grow an initial market. Credits: 3.00

MGMT 48800 - Data-Driven Decisions In Digital Markets

Credit Hours: 3.00. This course analyzes the changes in business models that have been enabled by Internet technologies, and exposes students to hands-on data analyses to quantify the impact these technologies and business models have on firms, economies, and people. A programming course such as MGMT 28800 Programming for Business Applications or MGMT 38800 Python for Business or CS 17600 Data Engineering in Python or CS 17700 Programming with Multimedia Objects or CNIT 17500 Visual Programming or CS 18000 Problem Solving & Object Oriented Programming and a

statistics course such as STAT 30301 Probability & Statistics for Business or MGMT 30500 Business Statistics is highly recommended.

Learning Outcomes: 1. Recognize the role of business models and data-driven decisions in digital markets. 2. Measure, evaluate, and improve online technology usage, advertisement campaigns, and product pricing to meet specific business objective like better serving customers, customer acquisition, quantifying network effects, etc. 3. Analyze the sheer amount of data ("traces") collected by businesses from different touch points - Google Glass, Apple Watch, smart phones, or simple computing devices - and make critical business decisions. Credits: 3.00

MGMT 49000 - Problems In Industrial Management

Credit Hours: 1.00 to 4.00. Investigation in a specific management field. Arrange with instructor before enrolling. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 49200 - Intellectual Property Management

Credit Hours: 2.00. Intellectual property (IP) has become a strategic opportunity for creating value for the firm. Firms are tasked with understanding how to utilize intellectual property as a competitive advantage in multiple market contexts. In the current economic environment, intellectual assets can be the largest portion of a firm's total wealth. Strategic management of these assets is very critical. Managing intellectual property is about transforming a firm's ideas, know-how, etc., into learning, products, and ultimately cash flow. In Managing Intellectual Property, we examine this topic by viewing intellectual property as both a legal asset (property ownership) and business asset (value-adding). The focus of Managing Intellectual Property is on the integration of IP generation, IP protection, and strategizing functions of the firm in creating value with an IP portfolio. Concepts and frameworks discussed/developed in lecture are exercised in case studies from multiple contexts.

Learning Outcomes: 1. Understand key elements in intellectual property management. 2. Aware of the different types/forms of intellectual property. 3. Understand how the difference in the types of intellectual property provides strategic opportunities. 4. Confidence in your own abilities to manage intellectual property. 5. Aware of the role of multiple functions in creating an intellectual property portfolio (e.g. R&D, Marketing, Legal, Merger & Acquisition, Business Development, Human Resources, Finance). Credits: 2.00

MGMT 49300 - Storytelling With Data

Credit Hours: 2.00. Business students are trained to be experts in turning data into information. With a strong focus on data visualization, the purpose of this course (Storytelling with Data) is to help students take the next step: Turning that information into action. This course will provide you with helpful frameworks for understanding your audience, insights about how people perceive information best, and effective skills to express your ideas in ways that connect.

Learning Outcomes: 1. Understand the importance of communication context, elements of good storytelling, and basic principles of human information processing as related to data visualization. 2. Apply this understanding to the communication of complex (i.e., data-driven) information. 3. Analyze data visualization design choices. 4. Evaluate the effectiveness of data communication. 5. Create a compelling story using data with the tools and skills taught in this course. Credits: 2.00

MGMT 49400 - IBE Capstone

Credit Hours: 3.00. The objective of the IBE Capstone course is to provide students with the opportunity to apply and integrate what they have learned from prior courses in "Real World" settings. There are no traditional classes. Rather, students will work in self-managed teams of 5-6 on projects that have both business and engineering elements with the support of a mentor; in many cases the mentor will be from a sponsoring company. The role of the company mentor is to provide advice and guidance to the student team as well as to expose the students to the approaches and processes used in industrial and commercial organizations. The course instructors will also meet with the student teams on a weekly basis to assess progress and provide guidance. Possible options for the projects include: 'Product Design' and 'Business Solution'. The Product Design projects would be focused on the marketing, technical, and economic feasibility of a new product concept. The Business Solution projects would be focused on technical

issues in a business context and developing solutions to a "real world" problem presented by a sponsoring company. Examples of these projects might include use of 3-D printing for spare and replacement parts or incorporation of autonomous transportation into a company's operations and supply chain.

Learning Outcomes: 1. Exhibit integrity, accept responsibility, take initiative, and provide leadership necessary to ensure project success. 2. Produce product designs or business solutions that meet important performance requirements while satisfying relevant societal, legal/regulatory, and professional constraints. 3. Establish relationships and implement practices with team members, advisors, and other stakeholders that support high performance and continuous improvement. 4. Plan, monitor, and manage project schedule, resources, and work assignments to ensure successful project completion. 5. Utilize and synthesize prior knowledge, independent research, published information, and original ideas in addressing problems and generating solutions. 6. Make decisions based on customer and user needs, product design or business solution requirements, resource availability, and associated risks. 7. Demonstrate effective use of contemporary tools for engineering and business analysis. 8. Test and defend performance of a product design or business solution with respect to key requirements. 9. Use formal and informal communications with team, advisor, and other stakeholders to document and facilitate progress and to enhance impact of design products. Credits: 3.00

MGMT 49600 - Management Consulting Practicum

Credit Hours: 3.00. Management Consulting Practicum is an elective course consisting of consulting engagements with clients and projects from the Purdue Foundry and other sources. This course uses class time for students working in teams to receive timely guidance on applying a wide range of consulting skills and tools to supplement the client engagements.

Learning Outcomes: 1. Apply core consulting skills in solving real-life problems. 2. Collaborate and build relationships with business clients. 3. Analyze and identify various sources of data, prepare deliverables, and report results. Credits: 3.00

MGMT 49700 - The Science Of Working Well

Credit Hours: 3.00. What does it truly mean to "work well"? From burnout and physical exhaustion to lack of motivation and meaning in their work, to not feeling socially connected to others-there are many factors that can influence the extent to which employees feel like they are able to thrive at work and at home. In this course, we will explore individual; relational/dyadic; organizational; and community influences on working well by diving into the common challenges employees' face in their daily work, both in managing their well-being and the well-being of others as leaders, coworkers, and community members. Together we will work towards identifying solutions to challenges that influence our ability to work well based on the scientific evidence.

Learning Outcomes: 1. Identify key definitions and theories of well-being at work and at home. 2. Distinguish antecedents of well-being at work and home stemming from individual, relational, organizational, and community-level factors. 3. Analyze data for "intervention points" to help offer improved support and programs for employees' well-being. 4. Plan habits or routines that promote your well-being at work and at home. Credits: 3.00

OBHR 33000 - Introduction To Organizational Behavior

Credit Hours: 3.00. This course investigates the impact that individuals, groups, and organizational structure have on behavior within organizations for the purpose of applying such knowledge toward improving an organization's effectiveness. Attention is given to such topics as motivation, leadership, group processes, organizational structure, technological innovation, and conflict management. Emphasis is placed on developing management skills and application of organizational behavior theories.

Learning Outcomes: 1. Learn basic principles and concepts of organizational behavior. 2. Examine issues relating to the interaction

between human beings and the organizational context within which they work. 3. Gain a better understanding of their own organizational behavior, both as an employee, team member and leader. Credits: 3.00

OBHR 49000 - Problems In Organizational Behavior

Credit Hours: 1.00 to 4.00. Supervised readings and reports in various subjects. Arrange with instructor before enrolling. Permission of instructor required.

Credits: 1.00 to 4.00

College of Education

opt_EDU_2016

Mission Statement

The College of Education provides leadership through exemplary teaching, research and engagement while embracing collaboration, creativity, respect and diversity. The college's mission is to advance scientific discovery in both applied and scholarly learning; prepare students to become exceptional teachers and education professionals; and maximize educational outcomes through inspired teaching, research and public service.

To further its mission, the College of Education creates knowledge through innovative inquiry and superior scholarship; delivers a contemporary and innovative professional curriculum; empowers faculty, staff and students to effect professional, social and technological change in a global, multi-cultural and diverse society; engages in cross-disciplinary collaboration to seek solutions to critical educational challenges both locally and globally; informs educational programs and policy; and attracts and retains talented and diverse faculty, staff and students.

Organization and Purpose

The College of Education consists of the Department of Curriculum and Instruction and the Department of Educational Studies.

The Department of Curriculum and Instruction offers undergraduate instruction in elementary education and social studies education as well as courses in teaching methods for all programs leading to initial teacher licensure offered at Purdue. At the graduate level, the department offers degree programs in curriculum studies, education for work and community, educational technology, literacy and language education, mathematics education, science education and social studies education. At the graduate degree level, the department prepares master teachers, curriculum specialists, teacher educators, educational researchers, instructional designers, educational technology specialists and university faculty members.

The Department of Educational Studies offers undergraduate-level and graduate-level instruction in counseling and development, cultural foundations, educational leadership, educational psychology, gifted education, measurement and research methods and special education. At the graduate degree level, the department prepares educational researchers; educational policy analysts; school principals and superintendents; counseling psychologists; teacher educators; and specialists in gifted education, measurement and the social and philosophical foundations of education. There is a counseling psychology doctoral program accredited by the American Psychological Association.

College of Education
100 N. University Street
West Lafayette, IN 47907
Phone: (765) 494-2341
Fax: (765) 494-5832

Admissions Information

Successful completion of all Teacher Education Program (TEP) Requirements, including a minimum 2.5 Teacher Education Overall GPA are required to progress beyond each TEP Milestone. All Professional Education courses, including Learner Specialty Concentration/Pathway courses, must be completed with no grade lower than a "C" and no "I" (Incompletes). Degree requirements must be fulfilled to qualify for TEP completion. A minimum passing score on all required licensure examinations and completion of licensure requirements are necessary to be eligible for an Indiana Instructional Educator License.

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- Summary of Teacher Education Milestones

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Licensure Information

- Technology Integration- Blended and Online Teaching (Ti-BOT)

Summary of Teacher Education Milestones

Admission to Teacher Education Program

Admission to the Teacher Education Program (TEP) is directly granted upon acceptance and enrollment at Purdue University, West Lafayette. The Teacher Education Program is aligned with national and state accreditation and licensure standards, regulations, and rules; university guidelines; and prescribed Plan(s) of Study (POS) as defined by Admission Year or as otherwise authorized by the Office of Teacher Education and Licensure (OTEL).

TEP Program Progression by Milestone (Milestones A-F)

Successful TEP progression and completion are achieved by attaining each TEP Milestone at or above Standard as outlined within the 2025-2026 Program Requirements and Milestones for each individual content area/major and as referenced and assigned within the 2025-2026 University Catalog, 2025-2026 Teacher Education Program Directory, the Brightspace course 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements, Plan(s) of Study (POS), and course syllabi.

Required Brightspace Course

Every incoming 2025-2026 Teacher Education (TE) student will be enrolled in the REQUIRED 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements Brightspace course. This course serves as the official/primary manner for which the Office of Teacher Education and Licensure (OTEL) will communicate and monitor cohort-specific requirements, milestones, timelines, notifications, tutorials, actions, student engagement, etc. for each TE student. Course commitment is continuous beginning upon arrival to the university and concludes when Milestones A-F are attained.

Course Substitutions

Course substitutions must fulfill degree requirements, associated Teacher Education Program (TEP) key and/or common assessments, and licensure standards/requirements. Prior approval by the Office of Teacher Education and Licensure is required for all course substitutions.

Milestone A: Methods Qualified

Milestone A - Teacher Education Program Progression Status

- Exceeds Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone A Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone A Decision Deferred to Milestone B: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone A - Review Schedule

- Conducted - Close of Spring Semester 2026
- Decision/Notification - Early Fall Semester 2026

1. 2.50/4.00 Overall GPA (at time of Milestone A review)
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone A review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete three (3) Ti-BOT badges (at the time of Milestone A review).
7. No unresolved Professional Dispositions issues/concerns.
8. Adhere to the Criminal Background Check Policy.
9. Complete TEP Brightspace Assignments, including but not limited to attendance at the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
10. Attend the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
11. Submit the Teacher Education Program Agreement (TEPA).
12. Identify via the Teacher Education Program Agreement (TEPA) one of four chosen Learner Specialty Pathways. Learner Specialty Concentration/Pathway requirements are specific to individual content area/major.

Milestone B: Student Teaching/ Placement

Milestone B - Student Teaching Placement

- Exceeds Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone B Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone B Decision Deferred to Milestone C: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone B - Review Schedule

- Conducted - Close of Fall Semester 2027
- Decision/Notification - Early Spring Semester 2028

1. 2.50/4.00 Overall GPA (at time of Milestone B review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C"

or higher, no "I" (Incomplete), no "Pass/Fail".

3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone B review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete five (5) total Ti-BOT badges (at the time of Milestone B review).
7. No unresolved Professional Dispositions issues/concerns.
8. Complete TEP Brightspace Assignments.
9. Attend the mandatory Student Teaching Clinical Acceptance Process (CAP) Workshop provided by the Office of Clinical Practice (OCP) AND submit your CAP Application as directed by OCP.

- Expanded Student Teaching practicums and full-time Student Teaching occur over two consecutive semesters.
- Verify from the CAP Application projected Student Teaching semester/year.

Milestone C: Student Teaching Authorization

Milestone C - Student Teaching Authorization

- Exceeds Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone C Criteria as defined by Content Area/Admission Year.

Milestone C Criteria must be attained At Standard before the Office of Teacher Education and Licensure (OTEL) will authorize enrollment reinstatement for Student Teaching.

Milestone C - Review Schedule

- Conducted - Close of Fall Semester 2028
- Decision/Notification - Early Spring Semester 2029

1. 2.50/4.00 Overall GPA (at time of Milestone C review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone C review).
5. **Successful completion and target met on Foundations Portfolio (submission and target met on Common Lesson Plan in Semester 7).
6. ***Successfully complete ten (10) total Ti-BOT badges (at the time of Milestone C review).
7.

Successfully complete all Professional Education (including Foundation and Methods), Learner Specialty Pathway, and degree courses prior to student teaching (Semester Eight).

8. Attempt all required content test(s) before the Student Teaching semester per the timeline below; Test Requirements (ets.org)

Content Test Attempts for Major

For Fall Student Teaching: Official Score Reports due to OTEL no later than July 1.

For Spring Student Teaching: Official Score Reports due to OTEL no later than December 1.

Content Test Attempts for Pathways/Concentrations (High Ability and English Language Learning)

For Fall Student Teaching: Test Registrations received in OTEL by May 15th confirming a test date scheduled no later than June 30th.

For Spring Student Teaching: Test Registrations received in OTEL by October 15th confirming a test date scheduled no later January 31st.
Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts; If completing a Learner Specialty Pathway that leads to licensure (High Ability or English Language Learners), the associated content exam must be attempted prior to the Student Teaching (Semester 8).

9. No unresolved Professional Dispositions issues/concerns.

10. Adhere to the Criminal Background Check Policy.

Milestone D: Teacher Education Program Completion

Milestone D - Teacher Education Program Completion

- Exceeds Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone D Criteria as defined by Content Area/Admission Year.*

Milestone D - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-C met.
2. 2.50/4.00 Overall GPA (at time of Milestone D review).
3. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
4. Verify degree is conferred on Transcript/Academic Record.
5. *Be in Good Standing with the University (at time of Milestone D review).
6. No unresolved Professional Dispositions issues/concerns.
7. ****Successful completion and target met on

all Common Assessments (submission and target met on CPAST and edTPA in Semester 8).

Milestone E: Licensure Eligible

Successful completion of the Purdue University Agricultural Education Program, Agricultural Education, BS, and the State of Indiana licensure requirements for an Indiana REPA 3 Initial Instructional License in Career and Technical Education (CTE): Agriculture (5-12) and *Blended and Online Teaching (5-12).

Milestone E - Licensure Eligible

- Exceeds Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone E Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone E - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-D met.
2. Resolve any holds on academic records (if applicable).
3. Successfully complete the required pedagogy test; Test Requirements (ets.org). Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
4. Successfully complete all required content test(s) Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
5. For all Career and Technical Education (CTE) majors ONLY- Verify that the required number of clock hours has been completed and received by your advisor. Students must complete 4,000 clock hours of successful employment in the appropriate CTE area, or 1,500 clock hours of supervised work in the appropriate CTE area under an approved Teacher Education Program or an equivalent combination.

Milestone F: Licensure Action(s)

Milestone F - Licensure Actions

- Exceeds Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone F Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone F - Review Schedule

- Conducted - Upon Licensure Application - Summer 2029
- Decision/Notification - Upon Formal Action

1. Milestones A-E met.
2. Complete and upload with your Indiana License Application CPR/Heimlich Maneuver/AED certification or card (must include a hands-on, face-to-face skills demonstration).
3.

Complete and upload with your Indiana License Application documentation of Suicide Prevention certification (training must be at least one hour).

4. Submit Indiana License Application online via Licensing Verification and Information System (LVIS) at https://license.doe.in.gov/.
5. Allow three weeks (given all licensure criteria are met) for Purdue University to certify and the Indiana Department of Education (IDOE) to grant the Indiana License.
6. After receipt of an Indiana License, apply for out-of-state licensure (if desired).

*For purposes of reports and communications to other institutions or agencies, and in the absence of any further qualifications of the term, a student shall be considered in Good Standing unless the student has been dismissed, suspended, or dropped from the University and not readmitted. A student is considered in Good Academic Standing if both a student's semester and cumulative GPA are above a 2.00/4.00.

**Foundation Courses linked with the Foundations Portfolio Common Assessments include EDCI 20002, EDCI 28500, EDCI 35000, EDPS 20001, EDPS 23500, EDPS 24800, EDPS 32700, EDPS 36201, EDPS 43010, and EDST 20010. These may be subject to change.

***The Blended and Online Teaching (5-12) License is required for students on Admission Year Fall 2024-Spring 2025. The Blended and Online Teaching (Ti-BOT) License requirements are embedded into coursework for all Teacher Education Undergraduate majors. Some exceptions apply.

****Common Assessments include Foundations Portfolio, Field Experience Dispositions, CPAST, edTPA, Common Lesson Plan, and Licensure. Common Assessments for Early Childhood Education and Special Needs align with the National Association for the Education of Young Children (NAEYC).

Beginning July 1, 2025 - According to the Indiana State Board of Education, students seeking an Initial Indiana License in a content area involving literacy instruction, including special education, must obtain a licensure addition in Early Literacy (P-5), as required under IC 20-28-5-19.7.

Licensure Information

The Office of Teacher Education and Licensure (OTEL) is the formal liaison with the Indiana Department of Education and serves as the official repository for Purdue West Lafayette Teacher Education Program Progression and Licensure actions. OTEL maintains and permanently retains a *Teacher Education Program and Licensure Credential Portfolio* for each current and former Purdue University Teacher Education Candidate/Student. OTEL provides reliable, career-long guidance on Indiana Teacher Education and Licensure Standards, Rules, and Procedures. Indiana Licensing Rules and Regulations are subject to change by the Indiana State Board of Education, Indiana Department of Education (IDOE), and/or the Indiana General Assembly.

Welcome to the Office of Advising and Recruiting

The Office of Advising and Recruiting welcomes you to take advantage of our services so we can assist you with your academic career. We assist current and prospective College of

Education students by providing quality advising about College of Education programs and referrals to additional academic, personal, and career counseling, as needed. Our primary purpose is to assist students in accomplishing their academic and lifelong learning goals.
A team of professional academic advisors work with students, faculty, staff, departments, and administration to maintain and improve the quality of education in the College of Education and Purdue University, as a whole. As advisors, we are committed to supporting each student in developing and implementing an individualized plan for academic success and career development.

Contact Us:

Office of Advising and Recruiting
Beering Hall, Room 3229
Purdue University
100 N. University Street
West Lafayette, IN 47907-2098
Voice: (765) 494-2345
Fax: (765) 494-0587
Email: education-advising@purdue.edu

College of Education Graduate Studies Office
For information about graduate study in the Purdue University College of Education, or to check on the status of your application:
The Office of Graduate Studies
Purdue University College of Education
Beering Hall of Liberal Arts and Education, Room 3229
100 N. University St.
West Lafayette, Indiana, 47907 USA
Voice: (765) 494-2345
Fax: (765) 494-5832
E-mail: education-gradoffice@purdue.edu

Contact Program Area, Faculty or Staff
Graduate Program Areas
Undergraduate Studies

-

Department of Curriculum and Instruction

Overview

Welcome to the Department of Curriculum & Instruction (C&I)

We offer high quality learning programs to prepare education professionals for positions in schools, higher education, and the workplace. Undergraduates in C&I may enroll in programs leading to teacher licensure in elementary education or social studies education. In addition, C&I offers courses in teaching methods for all programs leading to initial teacher licensure at Purdue. At the graduate level, students may pursue advanced degrees in education disciplines including curriculum studies, education for work and community, educational technology, literacy and language education, mathematics education, science education, and social studies education.
Our faculty conducts research that links theory to practice leading to new discoveries in many aspects of the teaching and learning process across a wide variety of educational contexts. C&I serves the needs of society through engagement with our local, state, national, and international communities. We value collaboration, community, diversity, global perspectives, inquiry, and reflection, and we aspire to provide educational leadership in an increasingly diverse, interconnected, and technology-rich world.
Sincerely,
Janet M. Alsup
Head of the Department of Curriculum & Instruction

Mission Statement

We aspire to collaborate on issues associated with the teaching and learning process by linking theory and practice in a wide variety of educational contexts. We value community, collaboration, diversity, inquiry, and reflection.
We fulfill our mission by:

- Preparing education professionals for school, community, business, and government
- Providing educational experiences, built upon a common core of research and foundational knowledge, through innovative, coherent programs that include: diverse and field-based experiences, the infusion of technology, the integration of content and pedagogy, and ongoing assessment

- Fostering university-wide collaboration
- Reflecting diverse and international perspectives
- Engaging in teaching, inquiry, scholarship, service, and outreach activities

Departmental Website

Faculty

Contact Information

Contact the Department

Department of Curriculum and Instruction
Purdue University College of Education
Beering Hall of Liberal Arts and Education, Room 4108
100 N. University St.
West Lafayette, Indiana 47907-2098 USA
Voice: (765) 494-9172
Fax: (765) 496-1622
Email: edci@purdue.edu

Contact the College of Education Graduate Studies Office

For information about graduate study in the Purdue University College of Education, or to check on the status of your application:

The Office of Graduate Studies

Purdue University College of Education

Beering Hall of Liberal Arts and Education, Room 3229

100 N. University St.

West Lafayette, Indiana, 47907 USA

Voice: (765) 494-2345

Fax: (765) 494-5832

E-mail: education-gradoffice@purdue.edu

Contact Program Area, Faculty or Staff

Find Graduate Program Areas Information
Find Undergraduate Studies Information

Name	Title	E-Mail	Phone
Janet M. Alsup	Department Head	alsupj@purdue.edu	(765) 494-2367
Gina Haines	Administrative Assistant	hainesg@purdue.edu	(765) 494-2368
Kristy Bennett	Departmental Secretary	kristybennett@purdue.edu	(765) 494-7935

Our office staff is here to assist you. Drop by BRNG 4108 if you have questions or concerns.

Graduate Information

For Graduate Information please see Curriculum and Instruction Graduate Program Information .

Social Studies Education, BA

General Education: Curriculum and Instruction, BA (non-licensure)

English Education, BA

Elementary Education, BA

Global Studies Minor

EDCI 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDPS 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common

inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various education field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 40 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. (EDCI 20002) This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works well with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDCI 20500 - Exploring Teaching As A Career (UCC: WC)

Credit Hours: 0.00 to 3.00. Students will become familiar with the work of teachers and begin to develop their educational philosophies through examining what it means to teach and to learn and the nature and purpose of schools. Students will critically evaluate teaching as their chosen profession. This course includes a required weekly field-based experience in an elementary, middle, or high school classroom.

University Core Curriculum (UCC): (UCC: WC)

Learning Outcomes: 1. Learn what it means to teach as they reflect on why, whom, and how they will teach. 2. Learn to shift from a student perspective to a teacher perspective through the examination of teaching, learning, and schools. 3. Learn that teaching is affected by socio-political, community and school contexts. Credits: 0.00 to 3.00

EDCI 20700 - Construction And Textile Lab Management

Credit Hours: 3.00. A lecture/lab course which provides clothing construction and textile science content to be applied in the secondary family and consumer sciences classroom.

Learning Outcomes: 1. Demonstrate clothing construction concepts. 2. Apply basic textile science to fabric and clothing selection. 3. Manage a clothing and/or textile lab within a secondary family and consumer sciences classroom. Credits: 3.00

EDCI 21000 - Education Scholars Program I

Credit Hours: 1.00 to 3.00. EDCI 21000 is the first course in a two course, introductory sequence for College of Education students enrolled in the Honors College and/or DeVito Program scholarship recipients. In this course, we will examine key concepts and ideas in educational thought and research, understand what research is, and begin to explore individual students' research interests.

Learning Outcomes: 1. Introduced to key concepts and ideas in educational thought, e.g. democracy; diversity; equity; teaching, learning, and testing; creativity; and technology. 2. Examine how educational researchers conceptualize and conduct research. 3. Explore research interests in education, and how to access resources to further develop those interests. 4. Introduced to campus-based academic resources. 5. Complete multiple writing assignments to develop scholarly writing skills. Credits: 1.00 to 3.00

EDCI 21100 - Education Scholars II

Credit Hours: 1.00 to 3.00. This is the second course in a two course, introductory sequence for College of Education students enrolled in the Honors College and/or DeVito Program scholarship recipients. In this course, students will work on a research project with a faculty mentor, will participate in reflection and discussion of that research experience, will participate in seminars with faculty to read and discuss research, and continue to explore their own research interests and campus resources.

Learning Outcomes: 1. Participate in a semester-long research project with a faculty mentor for 3-4 hours per week. 2. Participate in structured written and oral reflection on their semester-long research experiences. 3. Interact with faculty in the College of Education through 3-4 seminars focused on discussion of their research and scholarship. 4. Explore their research interests, and campus resources. 5. Present their research projects during a public presentation session at the end of the semester. Credits: 1.00 to 3.00

EDCI 21510 - Language & Literacy Foundations For Teachers

Credit Hours: 1.00. The goal of the course is to provide background information in language and literacy necessary for success in literacy methods courses. The course will address basic linguistics and phonetic patterns of English, as well as the structures of literature and literary terms.

Learning Outcomes: 1. Compare and contrast levels of language structure: phoneme, morpheme, root, affix, phrase, sentence. 2. Differentiate graphic from phonological elements of language (e.g., grapheme vs phoneme). 3. Compare and contrast vocabulary terms (e.g. synonym, homonym, homograph). 4. Define and articulate written elements (e.g. digraphs, consonant clusters, long/short vowels). 5. Identify morpho-syntactic structures and phonological patters in written and spoken language. 6. Compare and contrast literary genres (e.g. narrative, non-narrative, fiction, nonfiction). 7. Distinguish the organizational structures of fictional genres from those of nonfictional genres. 8. Identify literary terms in context (e.g. alliteration, character traits, plot, stanza). Credits: 1.00

EDCI 21610 - Teaching History: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching history in powerful, exciting and innovative ways through a topical study (e.g., American Civil Rights Movement) approach. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national history standards. 2. Use research and theory about how grades 5-12 students learn history. 3. Merge historical content and processes with pedagogy to forge pedagogical content knowledge. 4. Employ appropriate history-specific academic language in history lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful and purposeful history teaching and learning

grades 5-12. Credits: 1.00

EDCI 21710 - Teaching Geography: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching geography in powerful, exciting and innovative ways through a study of geographic concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum. Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national geography standards. 2. Use research and theory about how secondary students learn geography. 3. Merge geographical content and process with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful geography lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary geography teaching and learning. Credits: 1.00

EDCI 21810 - Teaching Civics And Government: Standards And Strategies

Credit Hours: 1.00. Course prepares students for teaching civics and government in powerful, exciting and innovative ways through a study of civics and political science concepts within the framework of inquiry design model (IDM) and an inquiry-based curriculum Required for all Social Studies Education majors.

Learning Outcomes: 1. Develop knowledge of appropriate state and national civics and government standards. 2. Use research and theory about how secondary students learn civics and government. 3. Merge political science content and processes with pedagogy to forge pedagogical content knowledge. 4. Plan standards-based powerful civics and government-oriented lessons. 5. Utilize new understandings to draw conclusions about what constitutes powerful secondary civics and government teaching and learning. Credits: 1.00

EDCI 21910 - Teaching For Economic Literacy: Developing An Economic Way Of Thinking

Credit Hours: 1.00. Course focuses on preparing students in the social studies education licensure program to teach high school economics and to integrate economics into other middle and/or high school social studies courses. Course addresses issues of economic pedagogy. It will address economic content/concepts specifically and only in a way to illustrate/expand on the teaching ideas, resources, methods, and assessment.

Learning Outcomes: 1. Develop a rationale for teaching high school economics. 2. Identify state and national standards addressing economic content. 3. Explore methods for active teaching/learning in economics. 4. Identify resources appropriate for the active teaching/learning of economics. Credits: 1.00

EDCI 22200 - Knowing The World Through Mathematics (UCC: QR)

Credit Hours: 3.00. In this course, *Knowing the World Through Mathematics*, students will connect their situated experiences to larger trends in equity and social justice around the globe through mathematical investigations embedded in the context of the United Nations 2030 Agenda (United Nations, 2015). Students in this course will make use of mathematics and global policy documents to critically interpret, model, and represent world phenomena. Students will collaboratively analyze quantitative information gathered through trustworthy, globally representative data sets and individual survey and questionnaire items to investigate local experiences in relation to students' area(s) of interest. Students will learn about and utilize the GAISE Framework for Statistical Problem Solving (Franklin, et al., 2005) and the Four Dimensions of Equity in Mathematics Education (Gutiérrez, 2012) to ground their discussions and deliverables for *Knowing the World Through Mathematics*.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use a critical mathematics perspective to interpret world patterns, situations, and events. 2. Create mathematical models of world phenomena. 3. Use multiple mathematical representations to present global issues. 4. Identify and implement appropriate mathematical strategies to investigate world phenomena. 5. Express mathematical arguments related to world phenomena. 6. Use mathematics to explore global policy documents. 7. Explore world phenomena through quantitative (and

qualitative) methods. Credits: 3.00

EDCI 22222 - Integrated Health And Physical Education For Elementary Teachers

Credit Hours: 3.00. This course provides elementary education majors with a comprehensive understanding of the critical role health and physical education play in the overall development of young learners. Students will explore how physical activity and health education contribute to cognitive, social, emotional, and physical growth. The course emphasizes the importance of integrating movement and health topics such as personal safety, nutrition, and emotional health into the elementary classroom to enhance academic performance, promote wellness, and develop lifelong healthy habits. Through a blend of theory, practical strategies, and hands-on activities, students will learn to design inclusive, developmentally appropriate physical education lessons and comprehensive school health education (CSHE) plans that cater to diverse learners. By the end of the course, students will be equipped to create engaging, safe, and supportive environments that foster both physical well-being and academic success.

Learning Outcomes: 1. Understand health-related fitness concepts and principles related to physical activity and wellness. 2. Promote physical, emotional, and social well-being in elementary students. 3. Understand and teach proper nutrition, including the relationship between healthy eating, physical activity, and overall wellness. 4. Promote mental and emotional health by teaching coping strategies, stress management, and emotional regulation. 5. Teach personal safety and injury prevention, including strategies for safe play, accident prevention, and emergency response. 6. Integrate physical activity into daily classroom activities, promoting active learning and encouraging students to develop positive attitudes toward physical activity. 7. Develop inclusive and developmentally appropriate physical education lessons, ensuring students of all abilities can participate in and benefit from physical education. Credits: 3.00

EDCI 22550 - Mathematics Education Seminar

Credit Hours: 1.00. In this course, students will be introduced to many aspects of mathematics education, including pedagogies, professional organizations, standards, research, lesson planning, technology, etc. In addition, they will have opportunities to get to know others in their major earlier in their program.

Learning Outcomes: 1. Examine critically current pedagogical practices used in secondary mathematics classrooms. 2. Explore alternative pedagogies to enhance student engagement and conceptions of the relevance of mathematics. 3. Become familiar with technologies available for use in mathematics teaching and learning, mathematics education research, and professional organizations and standards. Credits: 1.00

EDCI 25000 - Professional Development In Family And Consumer Sciences Education

Credit Hours: 0.00 to 2.00. This course focuses on students' professional development as family and consumer sciences educators. Characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; the Purdue Family and Consumer Sciences Education program; and expectations for Indiana FCS teacher-licensure are emphasized. Includes participation in professional organizations and meetings.

Learning Outcomes: 1. Formulate and implement plans for building and documenting one's professional identity, competence, and career development as a family and consumer sciences educator. 2. Examine characteristics and relationships among middle and high school family and consumer sciences standards, resources, and learning experiences; coursework and field-based experiences in the Purdue Family and Consumer Sciences Education (FCSE) program; and licensure requirements and standards for teachers of family and consumer sciences. Credits: 0.00 to 2.00

EDCI 27000 - Introduction To Educational Technology And Computing (UCC: IL)

Credit Hours: 1.00 to 3.00. Addresses fundamentals of educational technology, including the integration of instructional design, media, computers and related technologies within the

classroom setting.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Demonstrate the ability to use various forms of technology to access, generate, and manipulate information; as well as to present and communicate results. 2. Given the background information and resources for a potential lesson, identify the instructional activities, methods, and media that should optimally be selected, implemented and evaluated within the lesson. 3. Apply educational technology to plan and deliver instructional lessons that integrate a variety of software, applications, and learning tools. 4. Identify issues (e.g. equity, privacy, security, plagiarism, isolationism) that have been produced or enhanced because of the integration of technology and describe how these issues can be effectively addressed. Credits: 1.00 to 3.00

EDCI 28500 - Multiculturalism And Education (UCC: BSS)

Credit Hours: 2.00 to 3.00. This course integrates an understanding of multiculturalism with principles of democratic education. Historical, sociological, cultural, political, philosophical, and pedagogical foundations of multiculturalism are explored and related to issues of pedagogy in a pluralistic society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Develop awareness of issues and concerns related to multicultural education. 2. Develop knowledge of how multiculturalism impacts teachers, schools, classrooms, and society. 3. Develop skills of critical thinking and reflection that will enable educators to contribute to meeting the needs of students in a multicultural and global world. Credits: 2.00 to 3.00

EDCI 28550 - Foundations Of Multicultural Education And Community (UCC: BSS)

Credit Hours: 3.00. The purpose of this course is to give students an opportunity to explore various facets of multiculturalism within their communities. We will examine the influence of social group identities on teaching, learning, and communities as they relate to contexts both in and out of schools. While this course is broad in scope, the primary aim is to assist you in exploring what it means to be an educator and/or concerned citizen in a society that is multicultural.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand and describe the impact of diversity on American schools and classrooms. 2. Understand and describe how their own views and perspectives have been shaped by their backgrounds and identities. 3. Understand and describe the challenges of teaching and communicating in diverse and multicultural schools and communities. 4. Demonstrate the awareness, knowledge, skills, and actions needed for teaching in diverse and multicultural schools and communities. 5. Identify strengths as a community volunteer and collaborate with local organizations to identify community needs. 6. Recognize the needs of community stakeholders through formal and informal conversations. Credits: 3.00

EDCI 30101 - Inquiry Into Teaching And Learning In K-2

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the K-2 classroom. Admission to Teacher Education required. Cannot be taken concurrently with EDCI 30002.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach, assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6.

Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 30102 - Inquiry Into Teaching And Learning In 3-6

Credit Hours: 1.00. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently through cycles of inquiry. In particular, this seminar is intended to be an inquiry space for questions and topics related to teaching using pedagogies of care in the 3-6 classroom. Admission to Teacher Education is required. Cannot be taken concurrently with EDCI 30101.

Learning Outcomes: 1. Engage with teachers and students in connected, educative, and personally rewarding field experiences. 2. Engage in practical experiences with opportunities to observe, plan, teach assess, and receive feedback. 3. Gain understanding of the professional responsibilities of a teacher. 4. Explore the role of collaboration among colleagues in a school. 5. Draw connections and distinctions among disciplinary practices. 6. Be active participants in an ongoing, supportive lesson inquiry group. 7. Evaluate the outcomes of their teaching practice and constructively respond to feedback. 8. Receive mentoring and engage in peer mentoring. 9. Examine collaboratively and critically, educational needs within the field placement. Credits: 1.00

EDCI 30900 - Reading In Middle And Secondary Schools: Methods And Problems

Credit Hours: 1.00 to 3.00. For prospective teachers at junior and senior high schools. An overview of reading processes, fundamentals of reading instruction, factors that influence the ability to read text materials, strategies and materials for identifying and reducing reading problems, school resources, and programs for normal and deficient readers. Concurrent enrollment with program-specified methods course.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 2. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary literacy. Credits: 1.00 to 3.00

EDCI 31100 - Media For Children

Credit Hours: 3.00. Books and other resources designed for children and adolescents are studied and evaluated in terms of literary theory and aesthetic appreciation. Emphasis is placed on literature and its place in the child's world.

Credits: 3.00

EDCI 31101 - Integrating Media In The K-2 Classroom

Credit Hours: 2.00. The goal of the course is for teacher candidates to understand how to choose and evaluate children's literature and media to use in K-2 classroom, develop ways to integrate literature and understanding of literature and media using a variety of methods, select appropriate materials for individual student's needs, and assess student's learning. Admission to Teacher Education is required.

Learning Outcomes: 1. Evaluate both fiction and nonfiction resources for the use in classroom including identifying media which is broadly representative of the world in which we live using a variety of rubrics and evaluation forms. 2. Determine cross-curricular connections, teaching ideas, and assessment methods of individual titles for use in the K-2 classroom. 3. Develop materials (i.e., graphic organizers, vocabulary activities, comprehension supports) to use with literature which may be differentiated for individual learner's needs. Credits: 2.00

EDCI 31102 - Integrating Media In The 3-6 Classroom

Credit Hours: 1.00. The goal of the course is for teacher candidates to understand how to choose and evaluate children's literature and media to use in the 3-6 classroom, develop ways to integrate literature and media throughout the curriculum,

support students' understanding of literature and media using a variety of methods, select appropriate materials for individual student's needs, and assess students' learning.

Learning Outcomes: 1. Evaluate both fiction and nonfiction resources for use in the classroom including identifying media which is broadly representative of the world in which we live. 2. Determine cross-curricular connections, teaching ideas, and assessment methods of individual titles for use in the 3-6 classroom. 3. Develop materials (i.e., graphic organizers, vocabulary activities, comprehension supports) to use with literature which may be differentiated for individual learner's needs. 4. Research and develop a rationale for including social justice topics at part of the 3-6 curriculum. Credits: 1.00

EDCI 31103 - Integrating Media In The K-6 Classroom

Credit Hours: 3.00. This course prepares teacher candidates to select, evaluate, and integrate children's literature and media in K-6 classrooms. Focusing on high-quality, diverse texts and media, candidates will learn to choose materials that are developmentally appropriate and reflect the diversity of the world in which we live. Emphasis will be placed on the critical role literature and media play in fostering vocabulary development, enhancing critical thinking skills, and supporting literacy development across subjects. The course will focus on how K-6 students learn to use comprehension strategies independently and efficiently as they progress through elementary school fostering both their academic growth and their ability to engage with diverse texts.

Learning Outcomes: 1. Integrate literature and media into content area lessons to enhance vocabulary (including academic language skills), critical thinking, and comprehension. 2. Select and evaluate three trade books to read aloud during a math, a social studies, and a science lesson. 3. Identify instructional strategies supported by the Science of Reading that teach k-6 students' academic language skills, vocabulary knowledge, and reading and listening comprehension. Credits: 3.00

EDCI 31950 - Approaches To English Learner Education

Credit Hours: 3.00. This course addresses English language instruction and content instruction for English Learning students in mainstream classrooms. The purpose of this course is to provide information necessary to the design of materials and instructional strategies for English Language Learners in K-12 context. In this course, we will focus on current issues and techniques in instruction for ELL students who are at different stages of English language acquisition in the K-12 school context. The course will also consider the nature of immigrants' experiences of a new country and school context. Practical field experiences integrated into the course will provide students with the opportunity to apply and demonstrate principles and strategies presented in the course.

Learning Outcomes: 1. Use essential techniques for instruction of ELLs across various grade levels. 2. Evaluate the language used in resources for ELL content instruction. 3. Examine the role of visual and verbal language in ELL instruction. 4. Analyze the ways in which students use literacy as writing, drawing, and talk. 5. Describe the language characteristics of important school genres. 6. Apply the teaching and learning cycle in the genre approach to lesson planning. 7. Implement and reflect on a multimodal, content area ELL lesson. 8. Discuss the role of home language and culture in ELL instruction. 9. Apply an understanding of the role of culture and family background in the student's experience of the classroom. Credits: 3.00

EDCI 32250 - Physical Education In The Elementary School

Credit Hours: 2.00. Current conceptions of elementary school physical education, with a particular emphasis on curriculum implementation.

Learning Outcomes: 1. Competence in instructional and organizational strategies appropriate for effective elementary gymnasium practice. 2. Ability to develop and implement warm-up, concept-based fitness, skill-based, and culminating activity instructional episodes.

3. Ability to provide developmentally appropriate assessment for skill-based physical education lessons. Credits: 2.00

EDCI 32500 - Literacy In The Early Childhood Classroom

Credit Hours: 3.00. Students will study how children's oral language develops, how children learn to read and write in early childhood/K3 settings, and the teacher's role in this process. Students will learn how phonemic awareness, phonics, fluency, vocabulary and comprehension influence children's literacy development. Students will learn how to select appropriate instructional materials; employ teaching strategies to meet the cognitive and affective literacy needs of all children; and collect, interpret, and use data from various types of assessments to inform literacy teaching and learning processes.

Learning Outcomes: 1. Develop a sound background in theory and research about children's language and literacy development and learning in grades K-3. 2. Learn how literacy learning, teaching, and assessment in phonemic awareness, phonics, fluency, vocabulary, comprehension and writing can be effectively and systematically integrated and diversified to meet individual or group needs in grades K-3. 3. Design and implement developmentally appropriate instruction for K-3 grade students. Credits: 3.00

EDCI 32501 - Teaching Literacy In K-2

Credit Hours: 2.00. Students will study how children's oral language develops, how children learn to read and write in primary grade settings, and the teacher's role in this process. Students will learn how phonemic awareness, phonics, fluency, vocabulary and comprehension influence children's literacy development. Students will learn how to select appropriate instructional materials; employ teaching strategies to meet the cognitive and affective literacy needs of all children, and collect, interpret, and use data from various types of assessments to inform literacy teaching and learning processes.

Learning Outcomes: 1. Develop a sound background in theory and research about children's language and literacy development and learning. 2. Learn how literacy learning, teaching, and assessment in phonemic awareness, phonics, fluency, vocabulary, comprehension and writing can be effectively and systematically integrated and diversified to meet individual or group needs. 3. Design and implement developmentally appropriate instruction for primary grade students. Credits: 2.00

EDCI 32600 - Literacy In The Intermediate Classroom

Credit Hours: 3.00. This course includes a field-based component. Students will build on material learned in EDCI 32500 . They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children; and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Develop a sound understanding of student literacy needs in the intermediate grades with a focus on comprehension strategies, strategic reading, vocabulary development, literary analysis, content area reading, and the writing process. 2. Assess student's learning and use this information to design and implement developmentally and culturally appropriate instruction in literacy and social studies. 3. Learn how literacy learning, teaching, and assessment can be effectively and systematically integrated and diversified to meet individual or group needs. Credits: 3.00

EDCI 32602 - Teaching Literacy In 3-6

Credit Hours: 2.00. Students will build on material learned in EDCI 32501. They will concentrate on increasing student's literacy skills with a focus on fluency, phonics, strategic reading, vocabulary, literary analysis, content area reading, the writing process, and building comprehension skills. They will learn to select appropriate materials, employ strategies to meet the cognitive and affective literacy needs of all children, and create integrate, and use data from various forms of assessment to inform the teaching and learning process.

Learning Outcomes: 1. Demonstrate an understanding of theoretical and evidence-

based foundations that guide reading, writing processes, and instruction. 2. Design developmentally appropriate instruction that addresses the needs of all learners. 3. Teach developmentally appropriate lessons/units in the school setting. 4. Assess student learning by designing/using/adjusting formative and summative assessments for your group of students, and pre-assessments. 5. Reflect and analyze your own teaching. Credits: 2.00

EDCI 32650 - Introduction To Linguistics And Language Acquisition In Education

Credit Hours: 3.00. This course addresses foundational knowledge in language and linguistics for pre-service teachers and educational researchers. The purpose of this course is to survey linguistics, the study of the science of language. In this course, we will focus on phonetics, phonology, morphology, syntax, and semantics. These topics will be discussed in terms of theory, as well as in the context of ESL classroom instruction, materials development, and assessment.

Learning Outcomes: 1. Understand and describe core concepts and terminology of descriptive linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics. 2. Apply course concepts to analyze linguistic data and gain a fuller understanding of the systematic nature of language. 3. Apply descriptive linguistic concepts to instruction to support the four domains of speaking, listening, reading, and writing. 4. Research and describe the biological, social, and cultural dimensions of linguistics, including pragmatics, discourse, dialects, bilingualism, and language in education. 5. Discuss the role of home language and culture in ELL instruction. 6. Apply an understanding of the role of culture and family background in the student's experience of the classroom. Credits: 3.00

EDCI 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00. Given the needs of struggling/striving readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine a number of reading models and instructional approaches designed to ensure all students have access to effective, research-based literacy instruction. The goal is to ensure students complete the semester with a range of essential tools for working with this population.

Learning Outcomes: 1. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 2. Implement Tier 1 and Tier 2 reading practices in a classroom. 3. Establish an understanding of reading difficulties/disabilities. 4. Extend knowledge of unique needs of struggling readers. Credits: 2.00

EDCI 35000 - Community Issues & Applications For Educators

Credit Hours: 1.00 to 3.00. This course is an examination of diverse individual, family, and community characteristics and issues, and potential impacts on teaching and learning processes. Includes service learning with human service agencies and personnel in the school and community. As part of this course, students complete certification to meet the Indiana Department of Education suicide prevention training requirement for teacher licensure.

Learning Outcomes: 1. Become a more effective teacher by developing greater awareness about, caring and respect for, and ability to relate with people (particularly students and their families) whose backgrounds, life experiences, perspectives, and values are different from one's own. 2. Demonstrate responsiveness to students' diverse backgrounds, life experiences, perspectives, and values through WHAT you teach (curriculum topics, content, and processes), HOW you teach (formal and informal interactions with students, inside and outside of classroom), and WHO you are (personally/professional values and commitments). 3. Examine community human service agencies in terms of (a) ways to

contribute as a community volunteer, either individually or with students; (b) ways to interact with agencies on behalf of students; and (c) future career opportunities. Credits: 1.00 to 3.00

EDCI 35001 - Tanzania Seminar

Credit Hours: 2.00. In this course, we will prepare for the Maymester in Tanzania study abroad program in a variety of ways, including investigating the history and culture of Tanzania, beginning to learn Kiswahili, conceptualizing service learning experiences, and collaborating on a plan for program logistics.

Learning Outcomes: 1. Critically explore common conceptions of Africa. 2. Investigate the history and culture of Tanzania. 3. Describe the educational system of Tanzania. 4. Read, write, and speak basic phrases and sentences in Kiswahili. 5. Conceptualize and engage in service learning experiences. Credits: 2.00

EDCI 35002 - International Comparative Education

Credit Hours: 3.00. In this course, students will explore the education system in an international context and compare particular aspects of the system (e.g., equity, funding, language, accessibility) to their own experiences with, and knowledge of, education in the United States. Students will consider the range of schools and policies in both countries in terms of issues of social justice (e.g., redistribution, recognition, representation).

Learning Outcomes: 1. Experience, first-hand, the educational system of Tanzania and read accounts of this system from a range of perspectives which draw attention to its strengths and challenges. 2. Investigate issues of social justice (e.g., redistribution, recognition, representation) in education systems. Credits: 3.00

EDCI 35003 - Knowing Africa Through Literature

Credit Hours: 3.00. Through a set of texts, this course will offer opportunities to understand, broaden and question a new (to you) and significantly different culture and your experiences in that culture. You will read a variety of African literature, including short stories, novels, and poetry, in order to investigate perspectives on African history, culture, language and education. You will then draw upon your personal encounters and activities while in Tanzania to extend your learning.

Learning Outcomes: 1. Investigate "growing up" cultural, and traveling experiences in Africa from a range of perspectives. 2. Extend understanding of Africa through the study of literature, including short stories, novels, and poetry. Credits: 3.00

EDCI 35004 - History, Culture, And Language In Tanzania

Credit Hours: 3.00. This course is a component of the Maymester in Tanzania study abroad program. In this course, students will study the history, culture, and language of Tanzania through experiences in local schools and the community, supplemented by course readings, assignments, discussions, and service learning projects.

Learning Outcomes: 1. Explore the history of Tanzania, including its identification as the cradle of mankind, colonization, independence, and the impacts of socialism and capitalism. 2. Engage in cultural and linguistic immersion in a rural Tanzanian village and schools. 3. Experience, first-hand, the educational system of Tanzania and read accounts of this system from a range of perspectives which draw attention to its strengths and challenges. 4. Collaborate with Tanzanian residents on developing and implementing service learning projects in the community. Credits: 3.00

EDCI 35600 - Career Education In Family And Consumer Sciences

Credit Hours: 3.00. Examination of middle and high school career education accomplished through family and consumer sciences, including (1) life and career exploration and planning; (2) analysis of career paths and opportunities in family and consumer sciences; and (3) career preparation through laboratory and cooperative education programs. Historical and contemporary foundations for career education in family and consumer sciences is also are addressed. Includes observations and interactions with students and teachers in career-education programs and participation in professional meetings.

Learning Outcomes: 1. Examine purposes, curriculum, and implementation strategies for career education accomplished through family

and consumer sciences, including FCS careers, FCS supporting content, and FCS life and career foundations. 2. Examine the structure and delivery of career and technical education in the United States and Indiana, state and federal laws and regulations pertaining to career and technical education, and important events and developments in the history of career and technical education and family and consumer sciences education. 3. Engage in ethical professional practice professional development, and outreach in family and consumer sciences education, including advocacy and working with local advisory committees. 4. Analyze instructional strategies and procedures for career education in family and consumer sciences, including integration of career and technical student organizations, particularly the Family, Career and Community Leaders of America (FCCLA) and coordination of students' work-based learning experiences through in-school laboratories and community-based placements. Credits: 3.00

EDCI 35950 - Content Area Instruction For English Learners

Credit Hours: 3.00. This course identifies the linguistic challenges faced by English language learners (ELLs) in the content areas of English language arts, mathematics, science, and the social studies. Participants will learn to describe how language varies in the way it presents knowledge in different content areas. The course links these challenges to English language instruction and subject-matter instruction in English for ELLs who are in general education classrooms. The course emphasizes assessment tools designed to assess content knowledge and links these students' English language development. Participants will describe academic tasks that require advanced levels of reading and writing and the expectations for the development of academic literacy as ELLs move from elementary to secondary "literacy" contexts, or the kinds of meaning-making typical of secondary and postsecondary education.

Learning Outcomes: 1. Evaluate the linguistic challenges of academic language in the English language arts, mathematics, science, and the social studies for ELLs. 2. Assess the development of academic literacy as ELLs move from elementary into secondary and postsecondary education. 3. Evaluate how standardized tests pose challenges for ELLs. 4. Analyze how various issues of assessment affect ELL student learning. 5. Create standards-based ESL and content instruction in a supportive learning environment for ELLs with different Limited English Proficiency (LEP) levels. 6. Implement a variety of standards-based teaching strategies, tools, and techniques for developing and integrating the four skills and for assessing the grade-level curriculum. 7. Apply academic tasks that require advanced levels of reading and writing. Credits: 3.00

EDCI 36000 - Curriculum And Instruction In Family And Consumer Sciences: Middle School

Credit Hours: 3.00. Instructional program development for family and consumer sciences. Developmental needs and issues of early adolescents; study of adolescent literacy; and curriculum integration of language arts, math, and other content areas are emphasized. Development of a comprehensive unit of instruction that incorporates standard-based curriculum, assessment, and instruction for family and consumer sciences is a major component of the course. Includes observations and interactions with family and consumer sciences teachers and students and participation in professional meetings.

Learning Outcomes: 1. Utilize middle school philosophy/perspectives, state-level resources, and community assets to guide curriculum development in Family & Consumer Sciences that is challenging, exploratory, integrative, and diverse, and which fosters learning that is active, purposeful, and democratic. (FCS TEd 7) 2. Integrate professional knowledge/behaviors supportive of middle-level education learner development (physical, cognitive, socio-emotional, psychological) into FCS curricula/practices, attentive to the health, wellness, and social-emotional competence of learners. (FCS TEd 8) 3. Employ professional

and other resources to develop a "literary" classroom environment that reflects all students. (FCS TEd 11) 4. Identify and collect resources, references, and other materials that support the identity, intellect, skill, and criticality development of students across FCS content. (FCS-Ted) 5. Create student-centered learning experiences in blended and online settings using UDL principles that are culturally responsive (TIBOT competency 3; FCS-Ted 7, 8, 11) 6. Review and critique FCS curriculum materials and practices for alignment with best practices for inclusion, access, equity, and diversity. (FCS-TEd 7, 8) 7. Relate family and consumer sciences programs to broader educational program goals and to community assets and needs. 8. Integrate foundational FCS perspectives (historical lens, Body of Knowledge, Critical Science approach) into professional schema. (FCS-TEd 12) 9. Develop and reflect on personal/professional characteristics that shape optimal middle school/FCS educator practice. (FCS-TEd 12) Credits: 3.00

EDCI 36100 - Social Studies In The Elementary School

Credit Hours: 3.00. Provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to elementary school children. Encourages participants to reflect on social studies knowledge, skills and dispositions, how students learn these most effectively, and how best to teach social studies. Includes a field-based experiential component. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Students will work to identify the most important social studies knowledge, skills and dispositions. 2. Investigate how students learn most effectively. 3. Utilize their new understandings to draw conclusions about what constitutes powerful teaching in the social studies. Credits: 3.00

EDCI 36101 - Teaching Social Studies In K-2

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practice strategies for teaching social studies to children in the K-2 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how K-2 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the K-2 grades. Admission to Teacher Education is required.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the K-2 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the K-2 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the K-2 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36102 - Teaching Social Studies In 3-6

Credit Hours: 2.00. This course provides students with an overview of the field of social studies, of selected issues in the field, and of best practices strategies for teaching social studies to children in the 3-6 classroom. Students will work to identify the most important social studies knowledge, skills and dispositions; investigate how 3-6 children learn social studies most effectively. Students will then use their new understandings to implement lessons, analyzing the effectiveness of their instruction for children in the 3-6 grades.

Learning Outcomes: 1. Develop compelling questions in order to guide inquiry in the 3-6 social studies classroom. 2. Apply social studies disciplinary concepts and tools in developing curriculum and implementing effective teaching strategies for the 3-6 children. 3. Use evidence to guide instruction and to evaluate the effectiveness of their instructional practice. 4. Identify critical issues in teaching social studies to the 3-6 learner and pose evidence-based solutions. Credits: 2.00

EDCI 36300 - Literacy In The Elementary School II

Credit Hours: 3.00. Focuses on teaching children who experience difficulty acquiring literacy. Assessments of children's strengths and needs are used to plan and evaluate instruction. Strategies for helping children develop more mature literacy understandings are applied in weekly small-group instructional sessions. Includes a field-based experiential component. Taken concurrently with EDPS 43000.

Learning Outcomes: 1. Know the literacy processes so that they are able to make decisions about the use of appropriate assessment measures and instructional strategies for children who are experiencing difficulty learning to read and write. Credits: 3.00

EDCI 36303 - Literacy Teaching And Assessment In K-6

Credit Hours: 2.00 to 3.00. This course is an undergraduate, elementary education course designed to provide preservice teachers with classroom and practicum experiences focused on literacy instruction for children experiencing difficulty learning to read and write. Students learn to administer and analyze individual assessments to determine the strengths and needs of a struggling reader/writer and set intervention goals based on these results. Application of appropriate research-based reading instructional strategies for developing (structured literacy instruction) phonological awareness, phonics, comprehension, vocabulary, and fluency is the focus of weekly literacy teaching in local elementary schools.

Learning Outcomes: 1. Demonstrate the importance of providing instruction to meet the needs of all children through their teaching. 2. Implement a framework for assessment and instruction that allows the teacher to evaluate and adjust for an optimal match between the reader/writer, the text and the literacy context. 3. Translate assessment findings into a plan for instructional support that is realistic in view of the child's needs and the available resources. 4. Use assessment as an ongoing guide to instructional decisions. 5. Become skillful in observing, planning, implementing, and evaluating literacy lessons. 6. Demonstrate knowledge of materials, procedures, and strategies for individual and group literacy instruction. 7. Examine a range of assessment and evaluation tools and strategies. 8. Report to others their assessments of students' literacy learning. 9. Work as a team with peers and school personnel. Credits: 2.00 to 3.00

EDCI 36401 - Teaching Mathematics In K-2

Credit Hours: 2.00. This course focuses on teaching mathematics in the elementary school, grades K-2, and encouraging children as mathematical problem posers. Students learn what it means to teach math interactionally using children's ideas, beliefs, and experiences as primary resources. Eliciting and interpreting children's mathematical thinking as well as mathematical reasoning, problem solving, communication, and connections are foci. Admission to Teacher Education required.

Learning Outcomes: 1. Gain skill in assessing, evaluating, and responding to the diverse needs of K-2 learners in mathematics. 2. Identify, practice, and reflect on strategies of teaching mathematics to support K-2 students conceptual and procedural knowledge. 3. Analyze mathematics books and tasks for language demands, conceptual and procedural knowledge, and cross-curricular connections. 4. Reflect on the role of K-2 teachers and children's funds of knowledge in relation to their learning of mathematics. Credits: 2.00

EDCI 36402 - Teaching Mathematics In Grades 3-6

Credit Hours: 2.00. Focuses on teaching mathematics in the elementary school grades 3-6. Students learn what it means to teach mathematics interactionally using children's ideas, beliefs, and experiences as primary resources. Mathematical reasoning, problem solving, communication, and connections are foci.

Learning Outcomes: 1. Develop, apply, analyze, and evaluate strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Know and analyze methods of assessing and responding to the needs of mathematics learners labeled in schools. 3.

Analyze and apply student's mathematical conceptual understanding and procedural knowledge to the development of problem-solving based mathematics lessons. 4. Create and analyze instructional activities drawing from student's conceptual understanding and procedural knowledge as primary resources. Credits: 2.00

EDCI 36404 - Mathematics In The Elementary School

Credit Hours: 4.00. Focuses on teaching mathematics in the elementary school. Students learn what it means to teach mathematics when reasoning, problem solving, communication, and connections are the foci. Includes a field-based experiential component.

Learning Outcomes: 1. Learn, practice, and reflect on strategies of teaching mathematics and their relationships to your beliefs and knowledge about how children learn mathematics. 2. Gain skill in assessing, evaluating, and responding to the needs of diverse learners in mathematics. 3. Understand ways to assess students mathematical understanding and learning. 4. Plan and carry out problem-solving mathematics instruction with a focus on students conceptual and procedural understanding. Credits: 4.00

EDCI 36500 - Science In The Elementary School

Credit Hours: 3.00. Investigates ways children learn science as a basis for planning, enacting, and assessing science curriculum and instruction. State and national standards, teaching cases, and science lab experiences are used as tools for reflecting on practice. Includes a field-based experiential component. Taken concurrently with EDCI 36400 and EDCI 37000.

Learning Outcomes: 1. Explore the instruction of elementary science through pedagogically appropriate methods. Lesson design will follow the learning cycle (5 E format) and lessons will be designed in a discovery/inquiry fashion using hands-on instruction. 2. Study in-depth teacher/student and student/student interactions in the classroom and to better understand how knowledge of children can inform the teaching-learning process, especially in science instruction. 3. Explore planning processes in several subject areas to learn to integrate science into other curricular areas, as well as developing both weekly and daily lesson plans. 4. Examine the nature of teaching and teacher growth through reflection. 5. Demonstrate through the planning and teaching of lessons, that you possess the subject matter knowledge necessary to provide quality educational experiences for children in grades K-6. 6. Examine management routines, teacher rationale for those routines, procedures, and management in the classroom. 7. Examine methods of evaluation, including anecdotal records, alternative assessments, performance assessments, general record keeping, and grading. 8. Examine the school as a community of diverse learners. 9. Examine your philosophy of education throughout this field experience. Credits: 3.00

EDCI 36501 - Teaching Science Through Design In Grades K-2

Credit Hours: 2.00. The aim of this lab-based course is to prepare students to teach science, engineering, and computational thinking with grade K-2 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade K through 2 learners. At least 9 credits of science content required.

Learning Outcomes: 1. List and contrast current models of science teaching and learning. 2. Demonstrate competence in the use of various learner-centered pedagogical strategies for culturally and linguistically diverse students. 3. Develop collaborative, inquiry based, cross-

cultural, learner centered unit plans. 4. Demonstrate competence in assessing student learning and in developing plans of action to meet students' needs. 5. Implement pro-active strategies to establish a safe classroom environment in which all students are encouraged to participate and express their views. 6. Demonstrate competence in the use of instructional technologies to enhance student learning. 7. Demonstrate competence in integrating science, technology, engineering practices and mathematics (STEM) across the curriculum to address culturally and socially relevant issues. 8. Demonstrate competence in developing unit plans that engage children in the use of the engineering design process to address culturally and socially relevant issues. 9. Demonstrate competence in developing activities that promote children's computational thinking. 10. Explain how his/her personal philosophy of teaching and learning contrasts with the College of Education mission: "We are committed to social justice and education of all the children of all the people - especially in the area of P=12 STEM education." 11. Participate actively in discussing regarding curriculum development and implementation designed to address the needs of culturally diverse learners. Credits: 2.00

EDCI 36502 - Teaching Science Through Design In Grades 3-6

Credit Hours: 2.00. The aim of this course is to prepare students to teach science, engineering, and computational thinking with grade 3-6 learners by building on existing pedagogical and subject matter knowledge in science. Students will engage in science and engineering learning experiences; identify and analyze children's ideas and background experiences; and examine instructional strategies for leveraging students' sense making. Using this knowledge, students will plan for and implement standards-based lessons, reflecting on the strengths and areas of improvement of their instruction for grade 3 through 6 learners. At least 9 credits of science content courses are required.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 2.00

EDCI 37001 - Teaching And Learning English As A New Language

Credit Hours: 0.00 to 3.00. This course builds foundational knowledge on the theories and practices related to the English language development of English language learners in the P-12 contexts. Particular attention is given to the current issues as well as on techniques for instructing and assessing students at different stages of English language development in the school context. Students will learn to identify students' strengths and current needs in English, to design classroom experiences across the curriculum, and to assess student performance using current WIDA standards.

Learning Outcomes: 1. Develop understanding of the English language and literacy development process of English language learners. 2. Instruct and assess students who are at different stages of English language development. 3. Identify English Learners' strengths and needs in English. 4. Practice in designing classroom experiences across the curriculum on the basis of these strengths and needs. 5. Learn background in WIDA and practice in designing Model Performance Indicators in connection with teaching experiences in the field for English Learners. 6. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of their ELLs. Credits: 0.00 to 3.00

EDCI 38100 - Teaching For Social Justice: Culturally And Linguistically Diverse Learners

Credit Hours: 3.00. This course builds on the content of EDCI 28500 (Multicultural Education) with specific attention to issues of social justice related to literacy and linguistic diversity. Within this framework, students will learn strategies for teaching English language learners, deconstruct deficit perspectives of dialectical differences, and consider approaches to classroom management. Additionally, a field experience component with an ELL teacher will be included in the course.

Learning Outcomes: 1. Engage with the following concepts via reading, analysis/critique,

and consideration of how they might apply in future classrooms: culturally relevant pedagogy and culturally sustaining pedagogy, code switching and code meshing, restorative justice. 2. Learn pedagogical strategies for working with ELLs in secondary English classrooms. 3. Understand the school-to-prison pipeline phenomenon and develop classroom management principles accordingly. 4. Participate in a field experience that requires interaction with culturally and linguistically diverse students in a local ELL classroom. Credits: 3.00

EDCI 42100 - The Teaching Of Biology In Secondary Schools

Credit Hours: 3.00. The rationale, objectives, methods, and materials of teaching biology and life science in junior and senior high schools. Extensive use of multimedia resources in planning specifically for the student teaching experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Have a conceptual understanding of science, how to develop a learning community within a classroom, and an understanding of and strategies to implement educational equity in a classroom. 2. Learn how to carry out the practical activities of science teaching, develop worksheets, hold class discussions, develop and grade tests, and use textbooks. 3. Learn about the nature of scientific understanding and classroom communities, and how to use theoretical knowledge of learners & communities to guide their teaching. Credits: 3.00

EDCI 42200 - The Teaching Of English In Secondary Schools

Credit Hours: 3.00. Explores a wide variety of instructional practices suitable for teaching middle and high school English including language, literature, and writing - addressing specific pedagogical issues such as teaching diverse learners and developing cohesive units of instruction.

Learning Outcomes: 1. Explore different philosophical and instructional applications for secondary English teaching. 2. Examine diverse issues affecting teaching and learning in the secondary English classrooms. 3. Develop the reflective and critical thinking skills necessary for secondary English teachers. 4. Increase pedagogical competency in diverse aspects of teaching and learning, including classroom instruction, student interaction, and teacher development. Credits: 3.00

EDCI 42300 - The Teaching Of Social Studies In Secondary Schools

Credit Hours: 3.00. The purpose of this course is the development of a theoretical framework and pedagogical skills necessary to teach social studies to middle and high school students. Students are introduced to the general issues involved in planning and organizing a social studies curriculum.

Learning Outcomes: 1. Develop theoretical understanding and pedagogical skills necessary to teach social studies to middle and high school students. 2. Develop understanding of cross collaboration, communication, and the characteristics of the community, school, and classroom. 3. Develop specific and relevant understanding of student characteristics, approaches to learning, or skills and prior learning. 4. Learn general issues involved in planning and organizing a social studies curriculum. 5. Obtain the knowledge, skills, and attitudes necessary to become a reflective and skilled social studies teacher. Credits: 3.00

EDCI 42400 - The Teaching Of Earth And Physical Science In The Secondary Schools

Credit Hours: 3.00. The methods and materials needed for the teaching of chemistry, earth-space, physics, and general science in the secondary schools, including field experience. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. May be taken for two credits (no field experience) by students who are enrolled in another methods course with field experience.

Learning Outcomes: 1. State your goals for

secondary science teaching based on an informal position. 2. Use questions, demonstrations, and activities to probe students' concepts. 3. Describe teaching strategies which motivate students and which foster learning. 4. Describe teaching strategies to encourage meaningful problem solving. 5. Plan a science unit using a model of science teaching which takes student conceptual change into account. 6. Teach a lesson, lab, or demonstration employing appropriate strategies. 7. Choose appropriate assessment techniques to evaluate various learning outcomes. 8. Compare and evaluate secondary science curriculum materials, including audio-visual and computer materials. 9. Be able to store and/or dispose of materials properly and select experiments based on appropriate safety guidelines. 10. Describe strategies to provide appropriate learning for a diverse student population. Credits: 3.00

EDCI 42500 - Teaching Of Secondary Mathematics - Methods I

Credit Hours: 3.00. This is the first of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, curriculum, teaching, learning, assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's principles and standards, as well as the content and process standards included in Indiana Academic Standards for Mathematics, and pedagogical strategies for teaching these in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 42600 - Teaching Of Secondary Mathematics - Methods II

Credit Hours: 3.00. This is the second of two methods courses designed for students who are planning to be secondary mathematics teachers. The course content is organized around principles of equity, mathematical task design, classroom discourse, classroom environment assessment and technology. It also focuses on the cycle of effective teaching, which includes justifying planning decisions, analyzing teaching, and using data to inform instruction. The courses addresses NCTM's Professional Standards as well as the content and process standards included in Indiana Academic Standards for Mathematics and pedagogical strategies for teaching in ways that serve the diverse population of mathematics learners.

Learning Outcomes: 1. Develop an understanding of students' thinking and the processes by which they come to learn mathematics and think mathematically. 2. Develop an understanding of teaching and learning environments through analyzing classroom interactions and the interplay among mathematics, classroom tasks, teacher moves, and students' ways of thinking and being. 3. Develop an understanding of the scope and significance of school mathematics through an examination of state and national standards and mathematics education research. 4. Develop professional attitudes and work habits and identify professional organizations and resources locally and nationally. 5. Continue learning mathematics, especially in ways that promote inquiry and investigation. Credits: 3.00

EDCI 42700 - Teaching Of World Languages

Credit Hours: 3.00. This is one of the two methods courses required for World Language Teaching major. While LC 47500 is a theoretical course, this course is a practical course on world language teaching in secondary school.

Learning Outcomes: 1. Design lesson plans that draw on knowledge of content areas. 2. Write language learning assessment documents (diagnostic formative, and summative). 3. Design language assessment rubrics. 4. Evaluate their own and others' teaching effectiveness. 5. Plan lessons that incorporate strategies to monitor student learning. 6. Build collaborative relationships with other language teaching professionals. 7. Identify resources for the developing foreign language teaching, including textbooks, scholarly journals, pedagogy associations and conferences. Credits: 3.00

EDCI 42800 - Teaching Science In The Middle And Junior High School

Credit Hours: 2.00. Designed to prepare preservice teachers to teach science in the middle and junior high school (grades 5-9). No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Gain knowledge about Indiana's middle school science standards. 2. Gain knowledge about curriculum of the courses that they will be student teaching. 3. Gain knowledge about relevant professional organizations and communities. 4. Gain skills to write a high school science lesson plan and teach. 5. Gain skills to write a lab lesson plan. 6. Gain skills to identify and use resources from professional communities. 7. Gain skills to develop project-based learning unit. 8. Gain skills to write a lesson plan to teach NOS. 9. Gain skills to collaborate in a team of teachers. Credits: 2.00

EDCI 43300 - Advanced Social Studies Methods

Credit Hours: 2.00. Foundations of social studies; methods, techniques, strategies of teaching, and activities - with special attention to skills of planning, questioning, and testing. Includes observation, participation, and microteaching in social studies classrooms. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education.

Learning Outcomes: 1. Develop knowledge of social studies content, appropriate state and national standards, and social studies specific pedagogy. 2. Develop and apply knowledge of middle level learners' academic needs and interests. 3. Utilize their new understandings to draw conclusions about what constitutes powerful social studies teaching and learning in middle school. Credits: 2.00

EDCI 43400 - Literacy Teaching And Learning In Secondary Schools

Credit Hours: 2.00. Exploration and development of various instructional methods and materials appropriate for supporting adolescent literacy in secondary English (i.e., middle and high school English Language Arts), including the teaching of reading. Content-area literacy methods and materials are also addressed. Includes a field experience of up to 20 hours in a secondary English school setting.

Learning Outcomes: 1. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of secondary English literacy. 2. Explore multiple, diverse, research-based instructional strategies and materials to support the teaching of content-area literacy. 3. Support the development of pedagogical competency through continued work with issues of teaching and learning in secondary English. Credits: 2.00

EDCI 44400 - Methods For Teaching Family And Consumer Sciences

Credit Hours: 4.00. The culminating on-campus teacher-education course for the Purdue University Family and Consumer Sciences program. The course builds and consolidates teacher-candidates' knowledge and skills for teaching family and consumer sciences. Emphasis placed on

standards-based instructional planning and materials; instructional strategies, including laboratories, assessment of student learning, and classroom management. Course includes field experiences. Program content requirements should be completed previous to or concurrent with this course.

Learning Outcomes: 1. Establish a comprehensive knowledge base of standards in a range of family and consumer sciences content areas, with a corresponding knowledge base for integrating standards in other areas such as financial literacy, technology, English Language Arts, and mathematics. 2. Design and implement standards-based curriculum, teaching/learning strategies, and assessment of student learning to meet the needs of diverse learners. 3. Apply knowledge of student behavior, organizational skills, and classroom and laboratory management skills to create a safe, supportive, and productive learning environment. 4. Enable student learning of family and consumer sciences concepts and skills through instructional strategies and laboratory experiences that build student capacities for self-directed learning, critical-thinking, problem-solving, decision-making, leadership, and managent. Credits: 4.00

EDCI 44600 - Directed Observation For Family And Consumer Sciences

Credit Hours: 1.00 to 4.00. Field-based experience in a middle or high school, a Cooperative Extension setting, or other applicable career setting for family and consumer sciences educators. Build professional capacity through focused, participatory experiences that include interactions with family and consumer sciences educators, other school/agency personnel, and students/clients. Thirty-five hours of documented experience in approved setting needed for one credit.

Learning Outcomes: 1. Develop knowledge and awareness of family and consumer sciences education professional setting, including purposes, structures, day-to-day activities, and interactions among participants. 2. Examine professional responsibilities of family and consumer sciences educators, and corresponding knowledge, skills, and capacities for professional effectiveness. 3. Build professional experiences and capacity as a family and consumer sciences educator. 4. Assess personal competence, goals, and areas for continued professional growth as a family and consumer sciences educator. Credits: 1.00 to 4.00

EDCI 45200 - Global Studies Seminar

Credit Hours: 1.00. (EDPS 45200) The course builds on students' international cross-cultural experiences, particularly Study Abroad. The course is required for those wishing to complete the Global Studies minor in the College of Education.

Learning Outcomes: 1. Discuss economic, social, and cultural diversity within a global context. 2. Describe the cultural, social and historical dynamics that influence individuals and groups. 3. Explain the perspective of the culture of another country through the study of world languages, arts, spiritual traditions, mythology/literature, and/or through study abroad. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. 5. Clearly communicate a central message with the supporting materials. Credits: 1.00

EDCI 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDCI 49200 - Honors Scholarly Project Capstone

Credit Hours: 1.00 to 6.00. This course is designed to provide students with an introduction to designing and writing a proposal for the Honors Scholarly Project.

Learning Outcomes: 1. Identify a research question for the Honors Scholarly Project. 2. Learn how to review relevant literature, identify a methodology/approach forthe research,

design the research study (or equivalent scholarly project) and identify an appropriate mentor. 3. Write, present, and submit a proposal for approval for the Honors Scholarly Project. Credits: 1.00 to 6.00

EDCI 49600 - Student Teaching In The Elementary School (UCC: OC)

Credit Hours: 6.00 to 16.00. Full-time elementary classroom teaching experiences and a student teaching seminar under the mentorship of the classroom teacher and a University supervisor.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each child's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each child's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

EDCI 49601 - Elementary Education Expanded Student Teaching

Credit Hours: 1.00 to 8.00. This course is the initial residency experience that precedes a full semester of student teaching. The seminar and field experience focus on induction into the broader elementary school context and building mentoring relationships as both a mentee and mentor. Students will develop their identity as a professional educator who advocates for the profession, themselves, and their students. Includes a field experience. Admission to Teacher Education required.

Learning Outcomes: 1. Integrate their learning from Foundations and Methods courses into their teaching experiences in the classroom. 2. Design and deliver instruction that meets learner needs, continually assess student learning, and use assessment to drive instruction. 3. Develop their skills and professional identity as an educator through self-reflection, analysis of student learning, and analysis of feedback. 4. Use observation, academic and personal engagement, and assessment data to develop an understanding of their students as learners at the individual and group level. Credits: 1.00 to 8.00

EDCI 49800 - Supervised Teaching (UCC: OC)

Credit Hours: 6.00 to 16.00. Teaching full-time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. Completion of education methods courses and other Gate requirements for the major area and admittance to teacher education required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Understand and address each student's development and learning needs. 2. Understand and apply content and curricular knowledge for teaching. 3. Assess, plan, and design contexts for learning. 4. Support each student's learning using effective instruction. 5. Develop as a professional. Credits: 6.00 to 16.00

Department of Educational Studies

Overview

Welcome to the Department of Educational Studies (EDST)
Cast against a vibrant history of innovation, research, teaching, and learning that continues to contribute to the enhancement of human potential in a wide variety of learning environments, our internationally recognized faculty offer world-class opportunities for study that emphasizes discovery of new knowledge. Amidst a collaborative, nurturing atmosphere in which professors know students by name, educational experiences are targeted at cutting-edge advances from the very people who have discovered them.
The EDST faculty is comprised of distinguished teachers and scholars who investigate, apply, practice, and disseminate information related to: the education of diverse learners; science, technology, engineering, and mathematics as well as the liberal arts; and effective instruction. In addition, EDST offers undergraduate majors that encourage students to work alongside faculty, who emphasize hands-on and exploratory experiences in Learning Sciences and Special Education.
Our graduates historically are successful in a diversity of positions in both the private and public sector. Depending on the program completed, graduates are employed as college and university faculty, researchers, consultants, educational research analysts, program evaluators, assessment specialists,

clinicians, or therapists.
Whether you are a hard-working undergraduate, an ambitious graduate student, or a distinguished alumnus, we value your interest in EDST!
Warmly,
Ala Samarapungavan
Interim Department Head

Mission Statement

The Department of Educational Studies (EDST) seeks to contribute to the discovery and development of human potential in diverse learning environments. This mission is accomplished through the discovery, application, and dissemination of new knowledge centered on three key themes: We aim to develop future generations of innovative, engaged, and skilled education professionals through our high quality undergraduate and graduate programs. The department supports the mission of the College of Education and the goals and objectives of the college. We are committed to fostering a collaborative culture that values inquiry, diversity, and engagement among students, faculty, staff, and community as we move forward with our educational mission.

Faculty (website)

Contact Information

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Undergraduate Studies
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Graduate Information

For Graduate Information please see Educational Studies Graduate Program Information .

General Education: Educational Studies, BA (non-licensure)

Special Education/Elementary Education, BA

Collaborative Leadership Certificate

Learning Sciences in Educational Studies Minor

Special Education Mild and Intense Intervention P to 12, BA

EDPS 10101 - Learning In Context-An Introduction To The Learning Sciences

Credit Hours: 3.00. This introductory course is designed to acquaint first year Learning Science students with the core concepts, principles, and research findings of the learning sciences as they apply to a wide range of formal and informal educational contexts. The course provides students with opportunities to interact with and learn about the scholarship of College of Education faculty who conduct research within the framework of the learning sciences. Students will learn about faculty projects that exemplify key features of the Learning Sciences such as attention to the complexity of learning environments, the study of social and cultural as well as individual dimensions of learning, and the cross-disciplinary nature of the field.

Learning Outcomes: 1. Identify the features of education as a design discipline. 2. Identify core principles, questions, and challenges, that define educational research and practice from a Learning Sciences perspective. 3. Identify the varied sources of cross-disciplinary knowledge that contribute to the design and study of effective learning environments. Credits: 3.00

EDPS 10500 - Academic And Career Planning (UCC: IL)

Credit Hours: 3.00. Builds understanding of career interests and personality characteristics related to academic and career decisions. Expands knowledge of Purdue academic programs and of the world of work. Introduces decision-making strategies.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe and explain multiple facets of your identity. 2. Identify and analyze potential academic majors. 3. Identify and analyze potential careers. 4. Evaluate potential majors and careers in relation to yourself. Credits: 3.00

EDPS 10600 - Mapping Your Career

Credit Hours: 1.00. A course designed to help students explore professional development and create an individualized career plan toward their career goals. Students can use this career plan while meeting educational goals at Purdue.

Learning Outcomes: 1. Describe your interests, skills, values, and motivations. 2. Identify and research potential career opportunities that match your career goals. 3. Develop verbal, written, and physical ("body language") communication skills. 4. Expand your knowledge of what a career is and plan for life beyond college. 5. Create a portfolio of professional tools you can use in the real world. Credits: 1.00

EDPS 17700 - Learning And Regulation Strategies For College Success

Credit Hours: 3.00. This course is designed to help students improve their college academic success by studying more efficiently and effectively, through strategic engagement, learning, and performance. We examine and apply evidence-based learning, motivation, and regulation strategies beneficial for college and lifelong learning. Educational psychology provides the theoretical framework for practical application of intentional and informed learning, cognition, motivation and behavior regulation.

Learning Outcomes: 1. Integrate evidence-based strategies to strengthen learning across environment and disciplines. 2. Apply self-regulation techniques to strengthen learning. 3. Develop confidence in implementing learning strategies for college success, including working in groups. Credits: 3.00

EDPS 20001 - Special Populations Seminar: Focus On Students With Disabilities And Differentiation Approaches

Credit Hours: 1.00. (EDCI 20001) This seminar is focused on special populations of learners for teacher education majors with an emphasis on exceptional students and approaches to curricular differentiation. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms including exceptional students. This seminar is intended to be taken concurrently with EDPS 24800 and EDPS 26501.

Learning Outcomes: 1. Identify key educational theories and describe practices for implementation across various educational field placements. 2. Discuss and use culturally responsive teaching and communication practices. 3. Reflect on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 4. Complete a minimum of 30 hours in the required field experience setting. 5. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 20002 - Special Populations Seminar: English Language Learners And Students With Gifts And Talents

Credit Hours: 1.00. This seminar is focused on special populations of learners for teacher education majors with an emphasis on students who are English learners and students with gifts, talents, and creativity. Students will engage in mentoring activities and ongoing support in their development as a professional. The goal of the seminar is to connect theory to practice by engaging in an immersive field experience that

connects to content and courses taken concurrently. The seminar provides an environment conducive to fostering rich relationships with schools and communities, pursuing common inquiry, thinking critically about theory, content and practice and advocating for equitable schooling. This seminar includes a field experience targeting schools and classrooms with ELLs and students with gifts, creativity, and talents. This seminar is intended to be taken concurrently with EDPS 24000 and EDCI 37001.

Learning Outcomes: 1. Identify connections between educational theory to educational practice as related to ELLs and students with GCT. 2. Demonstrate active listening and constructive peer feedback during seminar sessions and in the field. 3. Engage in mentoring activities related to teaching and learning in a community of peers and professionals. 4. Reflect on their own learning, gaining insight into themselves and their interactions with the classroom as teachers of ELLs and students with GCTs. 5. Complete a minimum of 30 hours in a school-based clinical experience including classroom observations, tutoring, assisting teachers, small and large group instruction and practicing the duties of a teacher who works with ELLs and students with GCTs. 6. Demonstrate the professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 21100 - Special Education Law, Policy, And Ethical Guidelines

Credit Hours: 3.00. This course provides opportunities for analysis and practical application of special education law and policy through discourse and advocacy. It is designed to provide students with a foundational understanding of special education, including the historical context for special education and the laws, policies, and ethical guidelines that have driven current special education legislation. Special education professionals hold multiple roles...teacher, case manager, general education consultant, instructional aid supervisor, researcher, and administrator to name a few. Moreover, there are numerous responsibilities required to successfully work in each of these roles and in this course we focus on law, policy, and ethical guidelines where they are relevant to special education pre-service teachers and support personnel.

Learning Outcomes: 1. Use observation, academic and personal engagement, and assessment data to develop and understanding of their students as learners at the individual and group level. 2. Demonstrate a strong knowledge of applicable federal, state, local laws, regulations, and policies pertaining to individuals with exceptionalities and how these laws affect the delivery of services and supports. 3. Demonstrate the ability to advocate for resources and professional learning conditions to help individuals with exceptionalities meet instructional, behavioral, social, and transition goals and outcomes. 4. Demonstrate the knowledge to draft sound and ambitiously appropriate individualized education programs. 5. Demonstrate the ability to engage in professional activities and participate actively in peer and professional learning communities that benefit individuals with exceptionalities and families, colleagues and their own professional growth. 6. Demonstrate the ability to keep current with research and contemporary practices in multiple way. Credits: 3.00

EDPS 21200 - Collaboration And Family Engagement To Support Students With Disabilities

Credit Hours: 3.00. Students will learn strategies for communicating and collaborating with a variety of team members. Finally culture will be explored. Strategies for collaborating with family members, administrators, paraprofessionals and related service personnel will be explored. This course includes a field experience.

Learning Outcomes: 1. Differentiate between professional and personal perspectives that impact teamwork and collaboration. 2. Describe how cultural values, context (e.g., social expectations, home language, resources, etc.), and experiences impact families' educational involvement and student learning. 3. Describe the additional roles and potential stressors families of children with disabilities may

experience. 4. Identify strategies and steps for developing home-school partnerships and facilitating communication with families and school personnel. 5. Identify roles and responsibilities of key members (e.g., speech, school counselor, general education, paraeducator, etc.) of the educational team. 6. Outline and describe strategies (e.g., collaborative goal setting, coteaching, planning, etc.) for training and problem solving. Credits: 3.00

EDPS 23500 - Learning And Motivation (UCC: BSS)

Credit Hours: 0.00 to 3.00. Introduction to concepts of learning and motivation in educational contexts (i.e., Educational Psychology). Influence of development, culture, and individual differences on learning and motivation. Uses of assessment and technology in promoting learning and motivation. A field-based experiential component is included.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understanding of the learning processes including the role of previous experiences and the constructive nature of learning, cognitive constraints, and the role of the social environment. 2. Understanding of the principles of cognitive, personal, social, and moral development. 3. Understanding of principles of motivation including how to initiate and maintain student engagement. 4. Understand the fundamental assessment concepts including the purpose of assessment, the importance of alignment to instructional goals, and the interpretation and use of data. 5. Understanding of the creation of environments conducive for learning. Credits: 0.00 to 3.00

EDPS 24000 - Children With Gifts, Creativity, And Talents

Credit Hours: 1.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted children youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). Cannot be taken concurrently with EDPS 24800.

Learning Outcomes: 1. Understand who gifted, creative and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 1.00

EDPS 24001 - Foundations Of Gifted Education And Differentiated Instruction

Credit Hours: 2.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership). This course will also help you learn and apply various research-based strategies and curriculum models aligned with gifted education pedagogy. Through readings, in-person small group discussions, and direct application, you will establish the groundwork for differentiated instruction for all students.

Learning Outcomes: 1. Describe the history, philosophical traditions, paradigms, and policies of gifted education. [NAGC-CEC Standards (2013): 6.2] 2. Describe giftedness, creativity, and talented development related to students in school settings. [NAGC-CEC Standards (2013): 1.2, 1.2, 2.1, 5.4, 6.1] 3. Develop awareness of the diversity that exists within the gifted, creative, and talented population. [NAGCCEC Standards (2013): 1.1; 6.3] 4. Apply specific differentiation models and strategies as a response to the needs, interests, and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. [NAGCCEC

Standards (2013): 3.3; 5.1] 5. Create and justify differentiated lessons that utilize instructional strategies and technologies to engage high-potential, gifted, and multi-exceptional students. [NAGC-CEC Standards (2013): 3.1-3.4, 4.2, 4.4, 5.1] 6. Evaluate curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] Credits: 2.00

EDPS 24800 - Differentiating Curriculum And Instruction

Credit Hours: 1.00. This course provides a solid foundation and set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online classroom meetings and discussions, case studies, differentiated instruction examples, direct application and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative and summative assessments to inform instructional decision-making; and c) flexible grouping addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn. Understanding that process of differentiation involves modifying content, process, product, learning environment, and/or affect incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (Rtl), and Multi-Tiered System of Support(MTSS). Effective teachers do more than teach content; they teach unique individuals who enter classrooms with various levels of expertise, skills, abilities, social-emotional needs, and learning expectations. Effective teachers differentiate curriculum by personalizing content based on the particular needs and interests of their students. Effective teachers differentiate instruction by applying various grouping strategies, technology applications and thinking skills. The goal of every effective teacher is that every child learns something new every day. Cannot be taken concurrently with EDPS 24000. Learning Outcomes: 1. Describe and implement the concept of differentiation as a response to the needs, interests and abilities of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Demonstrate proficiency in assessing students readiness, interests, and learning profiles and in creating differentiated lessons that utilize instructional strategies and technologies to engage special populations of students in learning. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and plan for your future use of knowledge and skills gained in this course. Credits: 1.00

EDPS 26500 - The Inclusive Classroom

Credit Hours: 3.00. Characteristics of students with special needs/talents; strategies for helping students learn and develop in general educational settings. Emphasis placed upon research evidence, case studies, problem-based learning, and development of a plan for an inclusive classroom. A field-based component is included.

Credits: 3.00

EDPS 26501 - The Inclusive Classroom

Credit Hours: 2.00. This course is designed to provide an overview of the characteristics of children (birth through age 21) with disabilities, causes of disability, assessment techniques, and instructional strategies. Emphasis is placed upon the development of an inclusive lesson plan based on student needs in the field experience classroom. Characteristics addressed include learning, behavioral, social-emotional, and communicative abilities and needs for students with mild and intense support needs. Issues related to cultural differences and family impact will also be addressed. A field-based component is included.

Learning Outcomes: 1. Know theoretical and historical perspectives of special education. 2. Demonstrate knowledge of both legal (Federal and State) and ethical guidelines as it relates to education and services for individuals with

disabilities including the Individuals with Disabilities Education Act (IDEA), Section 504 and Americans with Disabilities Act (ADA). 3. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students with disabilities including etiologies and outcomes. 4. Know the importance of the role of families as it relates to special education and the potential impact of language, culture, and family background have on the delivery of special education services. 5. Know the educators' role (special education and general education) in assessing, collaborating and teaching individual academic, social, communication, daily living, and employment goals for individuals from birth to 21. 6. Learn strategies for creating an inclusive learning environment that includes individualized instructional strategies/supports for one or more individuals with disabilities. 7. Learn how to select and use appropriate formal and informal assessments that minimize bias. 8. Justify how planned strategies/supports address the learning needs of one or more individuals with disabilities. 9. Learn technologies to support instruction for students with disabilities.
Credits: 2.00

EDPS 27001 - Characteristics Of Individuals With Mild Disabilities

Credit Hours: 3.00. This course addresses the characteristics of students with mild disabilities and the social, legal, and ethical issues that surround their academic and social-emotional concerns, educational experiences, implications and life-long outcomes. This course has a shared field experience with EDPS 36201.

Learning Outcomes: 1. Engage in legal discourse involving students with mild disabilities. 2. Demonstrate knowledge and understanding of mild disabilities. 3. Engage in data-driven decision making regarding lesson plan development. 4. Design a lesson plan that meets the needs of target learner with a mild disability. Credits: 3.00

EDPS 30000 - Student Leadership Development

Credit Hours: 1.00 to 3.00. Leadership in students is developed through lectures and experiential activities. Topic areas include leadership styles; campus organizational structures; program planning; social and intellectual activities; human relations and cultural differences; motivation; team building; public relations. Permission of instructor required.

Credits: 1.00 to 3.00

EDPS 30100 - Peer Counseling Training

Credit Hours: 1.00 to 3.00. Students are trained to help peers deal with their problems and concerns. Training modules are used to build knowledge and skills in the duties of peer helpers; student development, communication, goal setting, and use of community resources are stressed. (EDPS 30100 and 30100 are for Horizon students only.) Permission of instructor required.

Credits: 1.00 to 3.00

EDPS 30101 - Motivation To Learn

Credit Hours: 3.00. This course introduces students to current social-cognitive and sociocultural theories of motivation for learning and academic achievement, and research framed by those theories. Both individual-level and contextual factors associated with motivation will be considered. The course will also address applications of theory in educational settings, including motivational interventions.

Learning Outcomes: 1. Be familiar with predominant social-cognitive theories of motivation and their related constructs. 2. Understand how social-cognitive and socio-cultural approaches to studying motivation differ conceptually, methodologically, and empirically. 3. Be familiar with a range of methodologies that are used to measure student motivation, and strengths and weaknesses of each. 4. Understand and think critically about research design issues in motivation research, including descriptive correlational, quasi-experimental, and design research. 5. Understand the implications of motivation for student learning and achievement, and how this association is affected by affective, behavioral, and cognitive

engagement. 6. Be familiar with proximal and distal contextual factors that are associated with motivation, and reasons for those associations. 7. Be familiar with ways that teaching and learning practices can facilitate or impede optimal student motivation. Credits: 3.00

EDPS 30102 - Social-Emotional Aspects Of Learning In Diverse Environments

Credit Hours: 3.00. The course examines the role of social emotional competence in learning and builds understandings of the inter-relationships between theory, empirical evidence, and instructional practice. It takes the perspective that experiences across different learning contexts are interrelated and may influence each other in reciprocal ways. The course views social-emotional dimensions of learning as: embedded in person-environment transactions; tied to specific instructional (formal and/or informal) contexts over time; co-evolving with cognition and language; critical to psychological, behavioral, and learning outcomes. The focus is on intersection of social-emotional competence, learning, and instruction. The course is intended to provide the foundations (theoretical and empirical) that can help those interested in formal and informal instructional environments make informed educational decisions by considering the social-emotional dimensions of learning.

Learning Outcomes: 1. Students will develop familiarity with major theoretical perspectives that inform social and emotional development in learning contexts. 2. Students will be able to define and distinguish core theoretical principles and connect them to empirical evidence and instructional practices in formal and informal learning contexts. 3. Students will be able to think critically about and evaluate the characteristics of different learning environments (and the instructional practices within these environments) and their relationship to learner development. 4. Students will develop familiarity with research methods for studying and assessing social development in different contexts. 5. Students will be familiar with key dimensions of social-emotional competence. 6. Students will develop the ability to think critically about the dimensions of social-emotional competence and their links to learner development in different contexts. 7. Students will be familiar with the social processes that operate in key contexts. Credits: 3.00

EDPS 30200 - Adolescents Classroom Teacher

Credit Hours: 3.00. Students will develop understanding of physical, intellectual, emotional and social development of learners. Emphasis on individual differences and behavior patterns that influence the establishment of an orderly, healthy learning environment, and upon the teacher as an influence of the learning environment.

Credits: 3.00

EDPS 30400 - Assessment And Transition (Data-Based Decision-Making)

Credit Hours: 3.00. This course addresses assessment techniques and transition planning in special education, with applications to curriculum. It includes norm-referenced and curriculum-based measurement, error analyses, observational ratings, data-based decision-making, and transition planning from early intervention to post-secondary settings.

Learning Outcomes: 1. Apply their understanding of specialized curricula to inform their programmatic and instructional decisions for individuals with exceptionalities across a variety of contexts and the continuum of placement options (CEC 3.2) 2. Develop, select, administer, analyze, and interpret multiple measures of student learning, behavior, and the classroom environment to evaluate and support classroom and school-based systems of intervention for students with and without exceptionalities (CEC 4.1). 3. Develop, select, and administer multiple, formal and informal, culturally and linguistically appropriate measures and procedures that are valid and reliable, to contribute to eligibility determination for special education services CEC 4.2). 4. Assess, collaboratively analyze, interpret, and communicate students' progress toward measurable outcomes, using technology as appropriate, to inform both short and long-term planning, and make ongoing adjustments to instruction (CEC 4.3). 5. Utilize appropriate

progress monitoring skills in order to develop individualized education plans (IEPs) for students. Credits: 3.00

EDPS 30500 - Special Education Seminar: Perspectives On Disability

Credit Hours: 1.00. This course is designed to broaden student understanding of disability by exploring across related fields including disability studies, neurodiversity, speech language development, and behavioral characteristics. The goal of this seminar is for students to make connections between special education theory and practice and theories and views of disability beyond special education. Through lecture, discussion, and reflection, students will learn about the construct of disability and how individual strengths, needs, services, and supports extend across the lifespan and beyond the special education classroom.

Learning Outcomes: 1. Identify key theories on disability and describe practices for how these theories can influence teacher practices across various education field placements. 2. Reflect critically on their own learning and the learning of others, gaining insight into themselves, into teaching/learning, and into issues of diversity, equity and social justice. 3. Complete a minimum of 20 hours in the required field experience setting. 4. Demonstrate professional attitudes and conduct that facilitate learning and convey a positive image of the education profession. Credits: 1.00

EDPS 30900 - Systematic And Explicit Instruction

Credit Hours: 3.00. Students will learn evidence based instructional strategies for students with disabilities. The key components of systematic and explicit instruction will be explored. Students will learn how to use explicit instructional strategies to foster engagement and motivation. Methods for implementing systematic instruction across academic, functional, communication, social, and behavior goals will be addressed. Additionally, implementation in a variety of settings including 1:1, small group, and large group settings will be explored. Planning for generalization and maintenance of skills will also be addressed.

Learning Outcomes: 1. Contrast and compare a range of pedagogical models (e.g. Constructivist, Cognitive, Behavioral, etc) in special education. 2. Use formative and summative assessment to identify students current level of performance and inform instructional planning and decision making. 3. Identify instructional strategies necessary for promoting engagement, motivation, and opportunities to respond. 4. Identify components of systematic instruction. 5. Identify and implement a variety of strategies necessary for preparing the setting to support learning. 6. Demonstrate understanding of how to use flexible grouping to meet individual and large group needs. Credits: 3.00

EDPS 31001 - Characteristics Of Individuals With Disability Who Require Intense Intervention

Credit Hours: 3.00. This course addresses the characteristics of individuals who require intense intervention and how learning, behavioral, social-emotional, and communicative needs impact their lives. This course will also explore the cultural differences, legal and ethical guidelines, family impact, transition to adulthood, and wraparound services. A field experience will provide opportunities to observe and participate in a school setting (early childhood through age 21).

Learning Outcomes: 1. Identify the academic, behavioral, social-emotional, cognitive, communication, and motor/physical characteristics of students requiring intense intervention. 2. Understand how language, culture, family background, and environment impact the education and development of individuals requiring intense intervention. 3. Investigate services within the school and community based on the individual target learner and his/her family needs. 4. Demonstrate ability to assess and address individual academic, social, communication, daily living, and employment goals EC-21. Credits: 3.00

EDPS 31100 - Supporting Exceptional Learners: Foundations And Mathematics

Credit Hours: 3.00. Teaching students with special needs

requires the ability to locate evidence-based interventions, implement those interventions with fidelity, and track student performance over time. Mathematics is a content area in which success or failure yields major ramifications for postsecondary success. This course will cover the common math interventions employed for mild to severe disabilities across grade levels K-12.

Learning Outcomes: 1. Develop standards-based lesson plans for math that consider individual abilities, interests, learning environments, and cultural and linguistic factors. 2. Use technologies to support instructional assessment, planning, and delivery of mathematics for individuals with exceptionalities. 3. Identify strategies for teaching to mastery and promote generalization of learning in mathematics for both fluency and world problem solving. 4. Produce standards-based lesson plans for numeracy that incorporate evidence-based practices, classroom resources (e.g. peer and paraprofessional), and technological supports for use with students who have diverse learning needs. Credits: 3.00

EDPS 31200 - Inclusive Practices In Cross-Content Curriculum

Credit Hours: 3.00. This course aims to teach best practices for cross-content integration in an inclusive or self-contained classroom. It develops pre-service teacher understanding of core curricula along with how to integrate the curricula across subject areas. This course will also cover curricula to implement a well-rounded education (e.g., visual arts, dance, theater, music, etc.), provide methods for inclusive practices within the content, and discuss the implementation of collaborative approaches to cross-content planning and delivery.

Learning Outcomes: 1. Apply understanding of curricula across curricular content areas to develop integrated units of study which provide a well-rounded education. 2. Develop curricular content knowledge in order to develop learning progressions for individuals with exceptionalities. 3. Select appropriate curricula for individuals with exceptionalities across multiple content areas. 4. Teach cross-disciplinary knowledge and skills (e.g., critical and creative thinking, problem-solving) through integrated lesson planning and curricular units of study. 5. Implement cross-content curriculum across a wide range of settings through collaborative practices. Credits: 3.00

EDPS 31500 - Collaborative Leadership: Interpersonal Skills (UCC: OC)

Credit Hours: 3.00. The purpose of this course is to provide integrated study of listening as a collaborative leadership skill necessary for interpersonal and intrapersonal development. Focus is on the development of professional listening skills, and the understand of the role listening plays in collaborative leadership conflict resolution, interviewing, team building, and ethics.

University Core Curriculum (UCC): (UCC: OC)
Learning Outcomes: 1. Identify the essential elements of collaborative leadership. 2. Explain the importance of interpersonal and oral communication skills to the process of collaborative leadership. 3. Understand how interpersonal and oral communication skills interact with thoughts, feelings, and behaviors. 4. Explain the importance of interpersonal skills in the understanding basic human motivation. 5. Demonstrate solid interpersonal and oral communication skills in class presentations; skills related to initiating and sustaining positive and collegial relationships, engaging in difficult conversations, and conveying meaning. Credits: 3.00

EDPS 31600 - Collaborative Leadership: Cross-Cultural Settings (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the cultural nuances of leadership in the United States as well as around the world. This course will include impact of globalism as a context for leadership, conflict resolution in a global environment, and other important factors that impact culturally diverse or global teams.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Better understand what a culture is, broadly defined, and how it functions. 2. Better understand the importance

of culturally aware, knowledgeable, and skillful leaders. 3. Increase professional and personal self-awareness in relation to leadership in diverse settings. 4. Better understand the importance of making cultural issues central for constructive conflict management. 5. Understand the complexity of leader-other interaction and impact of psycho-social variables on this interaction. Credits: 3.00

EDPS 31700 - Collaborative Leadership: Mentoring

Credit Hours: 3.00. The purpose of this course is to provide a theoretical and experiential overview of the basic elements of mentoring as a key aspect of effective collaborative leadership. The hallmark of this course is the inclusion of a service-learning component in which students will be paired with undergraduate mentees and required to participate in weekly mentoring meetings for the duration of the semester. This learning experience is designed to promote development of the knowledge, skills, and dispositions required for competent mentorship. Emphasis on peer mentoring.

Learning Outcomes: 1. Differenitate among various types, purposes, roles of mentoring/mentors. 2. Identify the essential elements of effective mentoring relationships. 3. Examine and discuss the ethical considerations involved in mentoring. 4. Acquire knowledge regarding how issues of diversity interact with the process of mentoring. 5. Evaluate empirical findings associated with mentoring. 6. Consider various approaches to evaluating mentoring and the outcomes of mentoring programs. Credits: 3.00

EDPS 32000 - Happiness And Well-Being: Introduction To Positive Psychology

Credit Hours: 3.00. Happiness and Well-Being: An Introduction to Positive Psychology is an undergraduate course designed to provide students with an introduction to the field of positive psychology while also learning valuable, impactful life skills that can improve individual well-being, resilience, flow, happiness, and mindfulness for those enrolled. The course is designed in such a way time is devoted to both lecture and discussion based learning as well as experiential activities in the classroom designed to expose students to positive psychology constructs. Students will be exposed to strength oriented approaches to understanding human behavior, the instillation of hope and optimism, and multiple other positive psychology concepts that augment understanding of psychology. Students should be willing to participate in experiential exercises using positive psychology methods designed to promote self-awareness and growth. Though this course derives material from psychology, applications of the material can be made across fields and majors; thus, all students will benefit from better understanding human behavior, happiness, and well-being from an inclusive, positive psychology perspective. This class introduces the student to the major topics of the growing area of positive psychology. Students will learn theories, techniques and research associated with methods that promote happiness and psychological well-being. This introductory class will begin the journey into positive psychology and provides a foundation for further study of applied psychology and counseling at the graduate level.

Learning Outcomes: 1. Understand the importance of balancing psychological understanding by integrating positive psychology concepts and positive assets/characteristics into conceptualization of deficit and difficulty most often found in psychology. 2. Develop an understanding of positive psychology concepts and their practical implications. 3. Identify the impact that positive psychology concepts can have in your specific fields and future careers. 4. Understand human social behavior from a lens that incorporates understanding of the positive assets with individuals, communities, and systems. 5. Develop the ability to implement positive psychology concepts in your own life with the hope of improving well-being and happiness. Credits: 3.00

EDPS 32600 - Health, Wellness, And Adaptive Physical Education

Credit Hours: 3.00. Through a blend of theoretical knowledge and practical application, students will acquire the skills necessary to design and implement effective programs that promote overall student wellness. Students will gain a comprehensive understanding of health, wellness, and physical education of school-aged children with and without disabilities: emphasizing the importance of inclusive instruction. Additionally, students in this course will examine the responsibilities and opportunities for teachers in supporting and

enhancing student health, with an emphasis on developing effective strategies for creating a healthy and safe learning environment for everyone.

Learning Outcomes: 1. Identify and explain how nutrition and common diseases promote health-related fitness and are associated with disease and injury prevention, for students with and without disabilities. 2. Identify and explain how, basic functions and structures of human body systems, including human growth and development, basic motor skills, movement patterns, and physical activities, promote participation and responsible behaviors and safety in various physical activities for students with and without disabilities. 3. Identify and describe the influence of family, peers, culture, media, technology, as well as student interpersonal relationships and communication, have on various health behaviors for students with and without disabilities. 4. Assess, design, and perform evidence-based health, wellness, and physical education instruction, for students with and without disabilities in promoting their overall health and physical well-being. Credits: 3.00

EDPS 32700 - Classroom Assessment

Credit Hours: 1.00 to 3.00. Evaluating the impact of instruction on student performance is one of the most important skills for an educator. Effective teachers ask themselves, "How do I know if students are truly learning? Are they meeting educational objectives in the content area?" Using well-chosen assessment approaches, teachers can address these questions. In this course, students will acquire assessment literacy: the ability to gather accurate information about student achievement, and use that information to make instructional decisions that will improve learning. Course activities will focus on assessment tasks relevant to P- 12 classroom settings.

Learning Outcomes: 1. Create a long -term assessment plan. 2. Develop constructed-response tasks with scoring rubrics that are clearly written, aligned with content-area performance goals, and free of bias. 3. Make reasonable interpretations of classroom and large-scale assessment results for individual learners and use these interpretations to inform instructional plans. 4. Provide informative feedback to learners about their assessment results. Credits: 1.00 to 3.00

EDPS 33500 - Reading Instruction For Tier 1 And Tier 2

Credit Hours: 2.00 to 3.00. Given the needs of variety of needs of readers throughout the educational system, this class will focus on effective interventions from the primary grades through high school. Instructors will present a balance of theoretical and practitioner-oriented aspects of reading development and instruction. The course will also examine evidence-based science of reading approaches designed to ensure all students have access to effective, researched-based literacy instruction.

Learning Outcomes: 1. Establish an understanding of P-12 science of reading principles and practices. 2. Develop an understanding of effective Tier 1 and Tier 2 reading instruction. 3. Understand how to implement Tier 1 and Tier 2 reading practices in a classroom. 4. Establish an understanding of reading difficulties/disabilities. 5. Extend knowledge of unique needs of struggling readers. Credits: 2.00 to 3.00

EDPS 34100 - Introduction To Philosophical Underpinnings And Concepts Of Applied Behavior Analysis

Credit Hours: 3.00. This course is the first of four courses in the Applied Behavior Analysis pathway for undergraduates in teacher licensure programs and is also part of the course content required to become a Board Certified Assistant Behavior Analyst (BCaBA). The course will provide an introduction into the primary concepts and principles of applied behavior analysis. Students will be introduce to the fundamental knowledge and experiences for understanding Applied Behavior Analysis principles, concepts, and techniques, including operant behavior, reinforcement, punishment, choice, antecedent stimulus control, and verbal behavior. Students learn concepts and principles to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. This course includes a field placement.

Learning Outcomes: 1. Define and provide examples of behavior, response, and response class. 2. Define and provide examples of

stimulus and stimulus class. 3. Define and provide examples of respondent and operant conditioning. 4. Define and provide examples of positive and negative reinforcement contingencies. 5. Define and provide examples of schedules of reinforcement. 6. Define and provide examples of positive and negative punishment contingencies. 7. Define and provide examples of automatic and socially mediated contingencies. 8. Define and provide examples of unconditioned, conditioned, and generalized reinforces and punishers. 9. Define and provide examples of operant extinction. 10. Define and provide examples of stimulus control. 11. Define and provide examples of discrimination, generalization, and maintenance. 12. Define and provide examples of motivating operations. 13. Define and provide examples of rule-governed and contingency-shaped behavior. 14. Define and provide examples of verbal operants. Credits: 3.00

EDPS 34200 - Applied Behavior Analysis - Assessment And Intervention

Credit Hours: 3.00. This course is one of four courses in the Applied Behavior Analysis pathway for undergraduates in teacher licensure programs and is also part of the course content required to become a Board Certified Assistant Behavior Analyst (BCaBA). This course offers the interventionist with the techniques for designing, implementing, and evaluating instructional and behavioral interventions grounded in the theories of applied behavior analysis. Specifically, the learner will be exposed to techniques for measuring target academic, behavior, social and adaptive skills, as well as methods for displaying and interpreting data. Additionally, learners will design interventions, and monitor progress and will be exposed to the foundational concepts and methods of ABA including defining behaviors, collecting data, and understanding the three-term contingency of behavior. This course includes a field placement.

Learning Outcomes: 1. Identify and define the basic concepts of applied behavior analysis including the foundations of ABA, interrelated domains, and dimensions of ABA. 2. Identify factors to consider when selecting target goals including client and environmental factors. 3. Define target skills utilizing observable and measurable terms including all components of an appropriate learning goal. 4. Identify measurable dimensions of behavior and appropriate measurement procedures, including advantages and disadvantages of each. 5. Demonstrate knowledge about the various single subject research designs and variations of each, including advantages and disadvantages of each, including those most appropriate for practice and ongoing documentation. 6. Identify potential interventions based on assessment results as well as client/student preferences and current repertoires. 7. Use stimulus prompts and fading (e.g., errorless, most-to-least, least-to-most, prompt delay, stimulus fading). 8. Describe the role of imitation and modeling in learning and demonstrate procedures for implementation. 9. Define stimulus control and strategies for establishing. 10. Describe and implement discrete trial and naturalistic teaching arrangement. Credits: 3.00

EDPS 34201 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to curricular materials, curriculum development, and programs for gifted, creative, and talented (GCT) students. It serves the needs of pre-service teachers who are preparing to teach gifted students in mixed-ability, general education or specialized classrooms. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students. Major assignments will assess students' understanding and application of foundational concepts related to the education of students with gifts, creativity, and talent. Permission of instructor required.

Learning Outcomes: 1. Determine the degree of alignment between a gifted program's stated goals, continuum of services, and curriculum resources. [NAGC-CEC Standards (2013): 2.4, 3.1, 3.3, -4.4, 4.5, 5.1-5.3, 5.5, 6.1, 7.3] 2.

Describe the most widely used curriculum and program models in gifted education. [NAGC-CEC Standards (2013): 3.1, 5.1, 5.2, 6.1] 3. Determine which curriculum and program model(s) would work best at the elementary, middle, and high school levels in your school district. You may conclude that particular models "fit" different grade levels better than others. [NAGC-CEC Standards (2013): 3.1, 3.4, 4.4, 5.1, 5.2, 6.1]. 4. Justify the use of differentiation to meet the academic needs of gifted students. [NAGC-CEC Standards (2013): 3.2-3.4, 4.2, 4.4, 5.1] 5. Evaluate educational materials and practices to assess their suitability for use with high-ability students. [NAGC-CEC Standards (2013): 2.4,3.3, 4.1-4.4, 5.1-5.3, 6.1] 6. Practice designing and revising lessons to incorporate instructional strategies well-suited for high-ability students. [NAGC-CEC Standards (2013): 2.1-2.4, 3.1-3.4, 4.2, 4.4, 4.5,5.1-5.5] Credits: 3.00

EDPS 34501 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students and provides you with knowledge and skills needed to effectively support healthy psychosocial development through your work with gifted students. As well as providing an overview of the characteristics and needs of gifted students, we will also discuss special populations of gifted learners, diversity issues, family and peer relationships, and current educational approaches and counseling interventions, including considerations for career development for gifted students. Permission of instructor required.

Learning Outcomes: 1. Recognize the social and affective characteristics and needs of high-ability students; describe and apply research-based practices to support their affective developments across home, school, and community. [NAGC-CEC Standards: 1.1, 1.2, 2.1] 2. Practice designing products that incorporate meaningful and engaging social and affective components that promote social-emotional well-being, including coping skills, proactive, adaptive behaviors, performance skills, and social skills. [NAGC-CEC Standards: 2.1-2.3, 3.1, 3.4, 4.5, 5.1] 3. Discuss characteristics and needs of subpopulations of high-ability learners and the implications for academic instruction, ethical leadership development, and/or counseling interventions. [NAGC-CEC Standards: 2.1-2.3, 4.1-4.5, 6.1, 6.3] 4. Increase knowledge and experience through regular participation in class discussion boards, interaction with gifted students and their parents, and completion of an in-depth, original affective case study of a high-ability students K-12. [NAGC-CEC Standards: 3.1, 4.3, 4.5, 7.1-7.2] Credits: 3.00

EDPS 36100 - Use Of Assessment Techniques In Special Education

Credit Hours: 3.00. Assessment techniques for the exceptional child, with applications to curriculum. Includes norm-referenced and curriculum-based measurement, error analyses, and observational ratings. Admission to Teacher Education Program, passage of Gate A.

Credits: 3.00

EDPS 36201 - Positive Behavioral Supports

Credit Hours: 0.00 to 3.00. This course provides an overview of the theory, principles, and application of applied behavior analysis within positive behavior interventions and support. The course focuses on pre-service teacher preparation in designing and implementing group and individual behavior supports. Emphasis is on universal supports, targeted interventions, and data-driven decision-making.

Learning Outcomes: 1. Identify the basic principles of behavior and provide real-world examples. 2. Create behavioral expectations and design a corresponding behavior matrix. 3. Design class-wide reinforcement systems. 4. Identify interventions to promote social emotional learning for all learners. 5. Apply data-driven decision making to provide and evaluate a multi-tiered systems of support. 6. Design tier-two targeted supports to teach

appropriate behavior. 7. Define behavior. 8. Select appropriate behavior measurement system. 9. Measure and graph behavior to assist in data-driven decision making. Credits: 0.00 to 3.00

EDPS 36300 - Psychoeducational, Medical, And Physical Aspects Of Individuals With Disabilities

Credit Hours: 3.00. Introduction to characteristics of individuals with mild and severe intellectual disabilities: defining characteristics, etiological factors, assessment, social, legal and educational issues, and basic physical or medical disability management issues and techniques. Admission to Teacher Education Program, passage of Gates A required.

Learning Outcomes: 1. Demonstrate the knowledge of the roles and responsibilities of the educational team. 2. Demonstrate the knowledge of instructional strategies needed to promote independence. 3. Demonstrate the knowledge of motor tone and motor patterns. 4. Demonstrate the knowledge of proper positioning, lifting, and handling techniques. 5. Demonstrate the knowledge of feeding and toileting techniques. 6. Demonstrate the knowledge of infection control. 7. Demonstrate the knowledge of assessment and monitoring techniques of major health conditions. Credits: 3.00

EDPS 40099 - Topics In Design Based Research, Assessment And Evaluation

Credit Hours: 3.00. Design-Based Research (DBR) is inquiry that is driven by educational practice- the desire to understand and improve the practice of teaching and learning. Learning scientist employ DBR in order to implement innovative designs for teaching and learning in a variety of formal and informal educational settings (e.g., schools, museums, and extramural clubs) and to conduct research no teaching and learning that occurs in the context of their design innovations. The focus of this course is to help students develop a set of core competencies for systemically studying the teaching and learning of science in designed environments.

Learning Outcomes: 1. Understand the various forms of design-based research that are conducted in education. 2. Critically evaluate the strengths and limitations of examples of design-based research in the literature on science teaching and learning. 3. Develop a proposal for a design-based research study and present this proposal, both orally and in writing to a review panel of peers (classmates). Credits: 3.00

EDPS 40200 - P-12 Reading Methods For Exceptional Learners

Credit Hours: 2.00 to 3.00. This course is designed to meet the expectations of CEC, NCTQ, IDA and REPA 3 and prepare students in the science of reading for exceptional learners (including students with dyslexia and those with intensive needs) in Tiers 2 and 3. This course will provide implementation details on Response to Intervention (RTI) and Multi-tiered Systems of Support (MTSS). The course will present strategies and programs used in strategic and intensive intervention efforts for those learners needing additional, unique, and/or more focused remediation efforts. Topics will include understanding reading intervention research, the behavior analytic and learning sciences' contributions to understanding the reading process, the sequence of learning to read (systematic instruction), reading to learn, and the five components of reading instruction for P-12 learners. This course will specifically address the REPA 3 Standard: Focused work using (interventions that are direct, explicit, and multi-sensory) as a component of scientifically-based reading.

Learning Outcomes: 1. Review the five components of effective reading instruction for those in P-3 and those in grades 4-12. 2. Explain the models for remediation of prereading/reading difficulties and describe how they function: RTI, MTSS. 3. Describe and demonstrate how to use various screeners and progress monitoring assessments for P-12 students in Tiers 2 and 3. 4. Describe the meaning of direct and systematic instruction. 5. Demonstrate mastery of Corrective Reading sounds. 6. Demonstrate methods of increasing student engagement. 7. Discuss strategies to enhance content area reading performance. 8. Illustrate a scope and sequence for reading remediation for readers needing strategic and intensive intervention. 9. Explain how reading instruction can be made more explicit for those

needing more focused efforts 10. Demonstrate how to provide systematic and explicit small group/one-on-one reading instruction. 11. Describe Big Direct Instruction and published scientifically-based programs that are designed based on the science of reading instruction and demonstrate how they are implemented. 12. Describe the use of Universal Design for Learning and assistive technology approaches to increase access to reading materials and/or improve reading skills. Credits: 2.00 to 3.00

EDPS 40300 - Individual Social, Emotional, Behavioral Supports

Credit Hours: 3.00. This course is designed to prepare students with advanced knowledge and skills in designing and delivering individualized social-emotional and behavioral supports for learners. Emphasis will be placed on functional behavior assessment and function-based interventions and supports. Learning Outcomes: 1. Identify the advanced principles of behavior and provide classroom examples. 2. Articulate the connection between social-emotional skills and challenging behavior. 3. Define learner behaviors. 4. Select an appropriate behavior measurement system for learner outcomes. 5. Measure and graph learner behavior. 6. Conduct a functional behavior assessment. 7. Develop and implement a behavior support plan. 8. Analyze learner data to guide educational programming decisions. Credits: 3.00

EDPS 41001 - Collaboration And Transition Practices For Individuals With Disabilities

Credit Hours: 3.00. This course addresses the professional collaborative practices for special educators, who work with school age students with disabilities. The topics of this course include collaboration with professionals, ancillary personnel, agencies, and families, problem-solving and dealing with conflict, co-teaching, and transition planning from early intervention to post-secondary settings. The possible products from this course include community resources, transition plans, co-teaching plans, and family interviews. No undergraduate student may be enrolled in this undergraduate course until they have been admitted to the teacher education program and passed Gates A and B. Learning Outcomes: 1. Become familiar with the legal requirements of IDEA and other related laws, both federal and state as they relate to collaboration and transition. 2. Demonstrate proficiency in writing and interpreting transition plans. 3. Demonstrate knowledge in the use of both formal and informal assessments in determining student transition needs and supports. 4. Develop comprehensive plans for community-based instruction (including ecological inventories, site analyses, site development, instructional strategies, behavior management plans, data collection). 5. Demonstrate knowledge of interagency collaboration, professional development, and community resource development for the purpose of providing effective transition services. 6. Demonstrate a basic understanding of the government benefits (e.g., SSI, AFDC) for which persons with disabilities may be eligible. They will be familiar with the impact of work or other financial resources on maintaining these benefits. 7. Know about accessing and implementing information related to school and post-school private resources for persons with disabilities in the areas of government benefits, vocational services, estate planning, independent living, social and recreational services, transportation services, community integration and related services. 8. Demonstrate an understanding of the issues and barriers encountered by students, parents, and service providers as students with disabilities transition between grade and school levels. 9. Identify solutions to issues and barriers for all parties as individuals with disabilities transition through grade and school levels. Credits: 3.00

EDPS 41700 - Special Education Knowledge And Skills For General Educators

Credit Hours: 3.00. This course is the capstone course for the Special Education certificate and pathway. This course is

designed to expose students to innovative strategies and best practices for promoting inclusive education. Students in this course will develop the habits of ongoing training and professional development to support the variety of student needs in inclusive general education classes.

Learning Outcomes: 1. Describe shared instructional responsibility and the roles of school personnel who support the educational needs of students with disabilities. 2. Provide equitable access to and participation in the general curriculum for students with disabilities. 3. Know where to access current educational research that informs practice in the field. 4. Understand their responsibility for implementing IEP's. 5. Understand school policies regarding special education including those regarding referral, assessment, eligibility, and services for students with disabilities. 6. Understand when to consult with others who possess specialized expertise. 7. Understand students who have disabilities within the broader context of their families, cultural backgrounds, socioeconomic classes, languages, communities and peer/social groups. 8. Reflect on practices. Credits: 3.00

EDPS 42100 - Supporting Exceptional Learners: Social Studies And Science

Credit Hours: 3.00. This course is designed to prepare special educators to deliver social studies and science content to children and adolescents with disabilities across PK-12 settings. It will also prepare special educators to make programmatic and instructional decisions related to least restrictive environment, appropriate educational supports, assistive technology, accommodations, and modification specific to science and social studies instruction. This course includes assignments that will be linked to EDPS 46100 the Special Education Student Teaching Residency.

Learning Outcomes: 1. Use knowledge of general and specialized social studies curricula to individualize learning for individuals with exceptionalities. 2. Use knowledge of general and specialized science curricula to individualize learning for individuals with exceptionalities. 3. Use strategies to enhance language development and communication skills of individuals with exceptionalities across social studies and science content area. Credits: 3.00

EDPS 43000 - Creating And Managing Learning Environments

Credit Hours: 0.00 to 3.00. The purpose of this course is to enable you to develop a supportive, challenging, and growth-enhancing classroom community for students in elementary grades. Teachers need insightful understanding and strong skills to create a classroom community that enhances achievement, welcomes diversity, makes effective use of technology, and provides appropriate educational experiences for students with diverse needs, backgrounds, and developmental levels.

Learning Outcomes: 1. Develop skills for building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 0.00 to 3.00

EDPS 43010 - Secondary Creating And Managing Learning Environments

Credit Hours: 1.00 to 3.00. This course is designed to develop advanced pre-service teachers' skills in recognizing classroom processes and understanding how teachers' beliefs and practices affect secondary students' engagement, learning, and motivation. It focuses on Effective Teaching - what it is, what it looks like, and different ways to enact it in the classroom.

Learning Outcomes: 1. Develop skills for

building classroom communities. 2. Analyze different approaches to classroom discipline and the effects of those approaches on the cognitive, social, and emotional development of diverse students. 3. Develop a personal philosophy of classroom discipline. 4. Understand how student diversity, developmental levels, technology, instructional design, room arrangement, and assessment techniques influence the classroom community and climate. 5. Develop strategies for effective management of professional time and tasks. 6. Learn how to collaborate with colleagues and parents to enhance student learning and development. 7. Develop a comprehensive plan for creating and managing the learning environment in a real or simulated teaching situation. Credits: 1.00 to 3.00

EDPS 44100 - Introduction To Ethics And Practice Of Applied Behavior Analysis

Credit Hours: 3.00. This course is the final course in the Applied Behavior Analysis pathway for undergraduates in teacher licensure programs and is also part of the course content required to become a Board Certified Assistant Behavior Analyst (BCaBA). This course will address the professional and ethical responsibilities of behavior analysts. Key issues of responsible conduct as it relates to areas such as confidentiality, consent, consultation, treatment planning, and research will be discussed and applied through case studies. Learners will be able to consider ABA techniques within the bounds of both legal and ethical frameworks.

Learning Outcomes: 1. Demonstrate understanding of BACB guidelines for the responsible conduct of applied behavior analysis. 2. Discuss scenarios involving ethical issues and describe appropriate solutions using BACB guidelines. 3. Identify appropriate ethical practices in ABA research. 4. Demonstrate understanding of empirically validated practices vs pseudoscience and non-validated practices within the context of service delivery. Credits: 3.00

EDPS 44200 - Advanced Intervention In Applied Behavior Analysis

Credit Hours: 3.00. This course is one of four courses in the Applied Behavior Analysis pathway for undergraduates in teacher licensure programs and is also part of the course content required to become a Board certified Assistant Behavior Analyst (BCaBA). This course will provide fundamental knowledge and experiences for understanding instructional and behavior interventions grounded in the principles of Applied behavior Analysis including a pivotal response training, functional communication training, video modeling, self-management, social skills training, and augmentative and alternative communication (AAC). Students learn procedures to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. Students will also learn strategies for consultation with other service providers as well as practices for effective supervision of others such as paraeducators.

Learning Outcomes: 1. Identify, distinguish between, and provide examples of core (basic and advanced) concepts and principles in the field of behavior analysis. 2. Describe the concepts of motivating operations and stimulus control and demonstrate application to instruction. 3. Demonstrate procedures for implementing functional communication training and describe the principles of ABA involved. 4. Describe processes and demonstrate procedures for implementing a variety of instructional strategies including pivotal response training, peer mediating learning, video modeling, augmentative and alternative communication, social skills training. 5. Describe strategies and procedures for implementing group contingencies. 6. Describe and demonstrate how to implement self-management programs. 7. Synthesize procedures for supervising implementors (e.g. paraeducators) through implementation of ABA strategies including behavior skills training. 8. Discuss strategies for consulting with other school and community-based providers including parents. Credits: 3.00

EDPS 45200 - Global Studies Seminar

Credit Hours: 1.00. (EDCI 45200) The course builds on students' international cross-cultural experiences, particularly Study Abroad. The course is required for those wishing to complete the Global Studies minor in the College of Education.

Learning Outcomes: 1. Discuss economic, social, and cultural diversity within a global context. 2. Describe the cultural, social and historical dynamics that influence individuals and groups. 3. Explain the perspective of the culture of another country through the study of world languages, arts, spiritual traditions, mythology/literature, and/or through study abroad. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. 5. Clearly communicate a central message with the supporting materials. Credits: 1.00

EDPS 45900 - Assistive Technology (UCC: STS)

Credit Hours: 3.00. Use of technological applications in special education, including microcomputers, interactive video, auditory and visual enhancement, and other adaptive devices with individuals experiencing disabilities including learning disabilities, intellectual disabilities, sensory and physical disabilities. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Gain knowledge of the various types and forms of assistive technology. 2. Demonstrate an ability to discuss AT and services. 3. Conduct a professional presentation related to assistive technology. 4. Present a valid technology for repurposing. Credits: 3.00

EDPS 45901 - Assistive Technology (UCC: STS)

Credit Hours: 1.00. This course explores the use of Universal Design for Learning as a framework for Differentiated Instruction. Additionally, this course addresses the use of Augmentative and Alternative Communication and Assistive Technology by individuals with disability requiring mild, moderate, and intense intervention.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand the principals of UDL as a framework for differentiated instruction. 2. Understand the legal and ethical issues regarding UDL, Differentiated Instruction, AAC, and AT. 3. Assess individuals with disability for appropriate technology services and devices. 4. Demonstrate data-based decision-making to differentiate instruction and/or identify appropriate technology of a target learner requiring mild, moderate, or intense intervention. Credits: 1.00

EDPS 46000 - Strategies For Teaching Individuals With Mild And Moderate Disabilities Primary & Elementary Grades

Credit Hours: 3.00. This course is designed to prepare future special educators to plan and provide content area instruction in the core content areas to primary and elementary students with mild and moderate disabilities. Course content will include information on assessment, instructional design, and development of individualized education programs, research-based practices for promoting academic and behavioral growth, and content area literacy and numeracy, and your professional role as a teacher of students with mild disabilities. This course has a required concurrent enrollment in EDPS 46100.

Learning Outcomes: 1. Identify the legal requirements of academic goals and learning supports within individualized education plans (IEPs) and demonstrate understanding of assessment and monitoring procedures necessary to evaluate student progress. 2. Identify the principal instructional arrangements common to P-6 settings for students with mild disabilities, how the arrangement impacts classroom organization, and how to modify the arrangement to meet individual student needs. 3. Identify the common characteristics of evidence-based behavioral and instructional strategies implemented in P-6. These include class-wide (Tier 1) and targeted (Tier II) interventions. 4. Produce standards-based lesson plans for literacy and numeracy that incorporate evidence-based practices,

classroom resources (e.g., peer and paraprofessional), and technological supports for use with students who have diverse learning differences. 5. Distinguish between accommodations, modifications, and interventions within the assessment, teaching and IEP development process. Credits: 3.00

EDPS 46100 - Practicum In Strategies For Teaching Individuals With Disabilities

Credit Hours: 1.00 to 6.00. Practicum experience in assessment and teaching of individuals with disabilities. Experience in design, delivery, implementation, and evaluation of instruction. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A and B.

Learning Outcomes: 1. Provide instruction that is responsive to student differences and promotes development and learning for all students. 2. Match expectations to the unique characteristics, abilities, developmental levels, and behavior of students. 3. Identify characteristics of students with disabilities and design classroom accommodations. 4. Adjust instruction according to student needs and performances. 5. Use a variety of evidence-based instructional strategies. 6. Plan and deliver standards-based, data-driven differentiated instruction that actively engages students in the learning process. 7. Demonstrate an appreciation and concern for students as individuals and interact with them in positive ways that encourage and teach appropriate behavior. 8. Model effective use of language. 9. Demonstrate effective classroom and behavior management and establish a positive, productive, and safe learning environment with high expectations for all students. 10. Integrate instructional technology by creating instructional materials, delivering instruction using technology, or encouraging student use of technology in assignments. 11. Reflect on practices. 12. Engage in professional development activities to remain current with best practices. 13. Collaborate effectively with colleagues, parents, and others to increase the effectiveness of instruction and engage in professional growth. Credits: 1.00 to 6.00

EDPS 46300 - Teaching Individuals With Severe Disabilities

Credit Hours: 3.00. Education of individuals with severe or multiple disabilities. Application of innovative technology, design of individual educational programs, strategies and methods for instruction, evaluation of instruction, community-based instruction, generalization and maintenance of skills. Admission to Teacher Education Program, passage of Gate A required.

Learning Outcomes: 1. Demonstrate the knowledge of the various aspects of trial management. 2. Demonstrate the knowledge of the ability to record, graph, and interpret ongoing data of student performance. 3. Demonstrate the knowledge of the ability to apply the principles of learning and strategies of instruction. 4. Demonstrate the knowledge of the components of community referenced curriculum and community-based instruction. 5. Demonstrate the knowledge of the inclusionary/collaborative strategies for students with severe disabilities. Credits: 3.00

EDPS 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDPS 49100 - Topics And Issues In Education

Credit Hours: 1.00 to 3.00. Provides student with opportunity to strengthen preparation through study of selected educational topics and issues based upon individual needs and interests. One topic is considered in each enrollment.

Credits: 1.00 to 3.00

EDPS 49500 - Practicum In Gifted Education

Credit Hours: 3.00. The Practicum in Gifted, Creative, and Talented (GCT) Education is designed to be the culminating experience for those who are pursuing the GCT pathway as part of their teacher education undergraduate licensure program, with or without Indiana licensure. The overall goal of the course is derived from Standard 6 of the NAGC-CEC Teacher Preparation Standards in Gifted and Talented Education. Includes experiential learning. Required for those seeking GCT pathway in teacher education.

Learning Outcomes: 1. Develop as reflective practitioners who set and evaluate their progress toward personal goals for professional growth. 2. Create professional networks that can be sustained beyond the practicum experience. 3. Practice continuous improvement in teaching gifted, creative, and talented students. 4. Demonstrate the key ideas, standards, guiding principles, theories, models, and instructional strategies learned in EDPS 24000, 24800, 54200, & 54500. 5. Formalize philosophies of and personal identities as practitioners of GCT education. Credits: 3.00

EDPS 49800 - Supervised Teaching- Special Education (UCC: OC)

Credit Hours: 1.00 to 16.00. A student planning to enroll in EDCI 49600, EDCI 49800, EDCI 49900; EDPS 49800, EDPS 49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. Admission to Teacher Education Program, passage of Gates A, B, and C.

University Core Curriculum (UCC): (UCC: OC)
Credits: 1.00 to 16.00

EDPS 49900 - Supervised Teaching Or Practicum In Endorsement Area

Credit Hours: 3.00 to 9.00. A student planning to enroll in EDCI 49600 , EDCI 49800 , EDCI 49900; EDPS 49800 , EDPS 49900, EDPS 56100, or EDPS 56600 in the spring or fall semester of any academic year must secure, complete, and submit a student teaching application form between the middle of September and November 1 preceding the academic year during which he or she will be enrolled in the course. Failure to file the application during or prior to this time will make it virtually impossible for the student to receive a student teaching assignment for that year. Application forms may be obtained in and submitted to Room 3241, Liberal Arts and Education Building. Teaching full time in an endorsement area in a school classroom under the supervision of the teacher in charge of the class and a University supervisor. No undergraduate students may be enrolled in any of these undergraduate courses until they have been admitted to teacher education. completion of education courses required for the endorsement area and admittance to teacher education program.

Credits: 3.00 to 9.00

EDST 20010 - Educational Policies And Laws

Credit Hours: 1.00 to 3.00. The interactive course will provide an understanding of the history of schooling in the United States. A special emphasis will be placed on reviewing historical and contemporary educational policies and educational laws as each subject is critical to understanding social, historical, and cultural issues in the United States. Focus will also be on contemporary applications of historical ideas in the classroom and in school systems.

Learning Outcomes: 1. Know how education laws and policies influenced the American education system and vice versa. 2. Understand how race, ethnicity, gender, and social class have affected schooling experiences. 3. Evaluate how schools reflect societal, political, and cultural values historically. 4. Link these larger issues to reflective teaching practices. Credits: 1.00 to 3.00

EDST 49000 - Individual Research And Teaching Experience

Credit Hours: 1.00 to 8.00. Primarily for teacher candidates requiring special, individualized experience in research or teaching. Permission of instructor required.

Credits: 1.00 to 8.00

EDST 49100 - Topics And Issues In Education

Credit Hours: 1.00. Provides student with opportunity to strengthen preparation through study of selected educational topics and issues based upon individual needs and interests. One topic is considered in each enrollment.

Credits: 1.00

College of Engineering

College of Engineering page

Overview

Highly Ranked

U.S. News and World Report has ranked our programs in the Top 10 nationwide, with our graduate program at No. 4, our undergraduate program at No. 9, and online graduate program at No. 3. Purdue's College of Engineering has the largest top 10 undergraduate engineering program in the U.S. The College includes 13 academic programs, all with high rankings; Agricultural and Biological Engineering is No. 1 for graduate and undergraduate studies.

Accelerated Growth

Purdue's College of Engineering is rapidly accelerating progress toward the Pinnacle of Excellence at Scale. Among the signs, we have more than 10 federally funded centers, each with at least $10 million in research funding; we are constructing the largest academic facility on campus and preparing to erect a building for leading-edge hypersonics research; and we are the first non-medical public college to raise more than $1 billion in philanthropic gifts in a campaign.

Beyond the Classroom: Interdisciplinary, Global, Diverse Learning

Beginning in their first year, students have abundant opportunities to augment and enrich their education through experiential learning and contributions to world-improving technologies. Teaching and research programs **transcend traditional academic and grade-level boundaries, often engaging industry, government, alumni and other university partners**. Leveraging our diversity and incorporating all perspectives, we're **equipping students to excel in an ever-evolving and increasingly global economy**. G.R.I.T.+ initiatives offer Purdue Engineers experiential learning opportunities, such as study and work abroad, industry co-ops and internships, hands-on research, community service, and entrepreneurship projects.
To find out more about Purdue Engineering, check out the rest of this Web site. You can also contact us, or please come for a visit to see what Purdue and you can do together.

Engineering Departments

College of Engineering Administration	School of Engineering Education
School of Aeronautics and Astronautics	Division of Environmental and Ecological Engineering
Department of Agricultural and Biological Engineering	School of Industrial Engineering
Weldon School of Biomedical Engineering	School of Materials Engineering
Davidson School of Chemical Engineering	School of Mechanical Engineering
Lyles School of Civil and Construction Engineering	School of Nuclear Engineering
Elmore Family School of Electrical and Computer Engineering	

Admissions (website)

First-Year Engineering at Purdue

The First-Year Engineering (FYE) program is the entry point for all beginning engineering students. In the FYE program, students complete foundational coursework in math, science,

engineering, and communications (oral and written). After this common first year, students choose their discipline of engineering and start to follow the plan of study of a particular degree program. The mission of this student-oriented program is to advise, prepare and retain outstanding students for degree programs in Purdue's College of Engineering.
See First-Year Engineering for more information.

Advising Information

Talk to an FYE Advisor

- make an appointment to meet with your FYE advisor
- learn about the walk-in schedule for FYE advisors or for Student Representatives of Professional Engineering Schools
- other common advisor questions

Contact Information

Office of the Dean of Engineering

Purdue University
Neil Armstrong Hall of Engineering, Suite 3000
701 West Stadium Ave.
West Lafayette, IN 47907-2045
E-mail: deanofengineering@purdue.edu
Phone: +1 (765) 494-5345
FAX: +1 (765) 494-9321

For additional faculty and staff contact information, consult our directory.

College of Engineering Administration

Systems Certificate information

Global Engineering Studies Minor

Innovation and Transformational Change Minor

ENGR 10000 - First-Year Engineering Lectures

Credit Hours: 0.00 or 1.00. An introduction to the engineering profession.

Credits: 0.00 or 1.00

ENGR 10300 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small group seminars led by faculty designed to introduce a specific topic, problem, or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or to assist in their decision of an engineering degree program.

Credits: 1.00

ENGR 10301 - Introduction To Engineering In Practice

Credit Hours: 1.00. Weekly small seminars led by faculty designed to introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Seminars are designed to help students explore a single area of engineering and/or assist in their decision of an engineering degree. Permission of department required.

Learning Outcomes: 1. Introduce a specific topic, problem or discipline of engineering to First-Year Engineering students. Credits: 1.00

ENGR 10351 - Space Engineering Seminar

Credit Hours: 1.00. The purpose of this course is to help you see and appreciate the multi-disciplinary nature of space engineering, to give you an awareness that will aid you in developing your career. Space engineering includes a vast number of topics where expertise is needed by industry and NASA and a good understanding of this if vital to finding opportunities for your own interest and expertise to start you on a career.

Learning Outcomes: 1. Identify multiple career paths pursued by people in aerospace with various degrees; including those of people still working in aerospace and those of people who used their aerospace engineering degree as a

basis for a career in a different field. 2. Recognize the broad range of products, topics, applications and systems on which aerospace engineers work. 3. Understand the variety of topical expertise needed for space commerce and exploration. 4. Have an awareness of issues related to inclusion and intercultural teams. Credits: 1.00

ENGR 10400 - Introduction To Engineering And Purdue

Credit Hours: 1.00. Weekly small group seminars led by upper-class engineering students, enabling a broader understanding of engineering disciplines at Purdue, covering skills and techniques for academic success, and offering instruction and practice in career preparation and employment-finding skills.

Learning Outcomes: 1. Successfully transition to Purdue by balancing academic and personal life. 2. Develop life skills it takes to succeed as an engineering student. 3. Understand the academic and career opportunities within the different fields of engineering. 4. Develop a mentor-mentee relationship with your Peer Mentors. 5. Develop a network of classmates with whom to study and socially interact. 6. Learn about Purdue University resources. 7. Learn more about the fields of engineering you want to study and with which you may work. Credits: 1.00

ENGR 10500 - First-Year Engineering Seminar

Credit Hours: 1.00. A selection of invited lectures, participation exercises, and lab tours designed to acquaint exceptionally well-motivated students with opportunities to enhance their undergraduate engineering education through independent study, special research projects, overseas study, and other opportunities that may be available for students who are inclined to seek extraordinary challenges.

Credits: 1.00

ENGR 11700 - First-Year Engineering Honors Seminar

Credit Hours: 3.00. A course in computer programming, covering fundamentals of the C programming language. Other language(s) or materials will be covered to prepare Honors students to do the best possible work in their professional school courses. Students will be introduced to structured problem-solving and top-down programming techniques. Laboratory exercises will accelerate learning of fundamental materials through supervised repetitive practice, while more traditional individual and team projects will provide practice in the decomposition and solution of larger problems.

Credits: 3.00

ENGR 12600 - Engineering Problem Solving And Computer Tools

Credit Hours: 3.00. Introduction to the solving of open-ended engineering problems and the use and of computer software, including UNIXTM, computer communications, spreadsheets, and MATLAB. Explicit model-development activities are utilized, and students are expected to develop skill at working in teams. This is emphasized both in laboratories and on projects.

Credits: 3.00

ENGR 13000 - Transforming Ideas Into Innovations (UCC: IL)

Credit Hours: 4.00. This introductory course to engineering teaches skills in managing complex problems related to design, systems analysis with computational tools, and academic professional development. Through multiple experiences, students will learn effective methods to design and analyze behaviors of complex engineering systems with an eye for innovation. These experiences will develop their skills in teaming, project management, logical reasoning, sustainability, coupled with oral, written and visual communication for multiple audiences. This course also develops students ability to build computational tools (e.g., Python, MATLAB and Excel) to analyze the performance of systems using fundamental concepts associated with physical science and data science (e.g., mathematical modeling, data processing, numerical modeling, statistics). Professional identify development is critical to preparing students for making an informed decision in their choice of major and the development of professional skills to succeed in that major. Therefore, the course includes learning experiences to help them gather and process information about all the engineering academic pathways they could choose at Purdue. Permission of instructor required.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 4.00

ENGR 13100 - Transforming Ideas To Innovation I (UCC: IL)

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering, introduces students to the engineering professions using multidisciplinary, societally relevant content. Developing engineering approaches to systems, generating and exploring creative ideas, and use of quantitative methods to support design decisions. Explicit model-development activities (engineering eliciting activities, EEAs) engage students in innovative thinking across the engineering disciplines at Purdue. Experiencing the process of design and analysis in engineering including how to work effectively in teams. Developing skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Use a problem formulation and solving process to translate written problem statements into a mathematical model that allows for a logical comparison of approaches and tradeoffs in an engineering design. 3. Communicate technical information orally and visually and develop basic knowledge and introductory skills for cross-cultural communication. 4. Explain how an engineering problem solving process in related to a design process. 5. Apply a design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 6. Implement simple algorithmic solutions to engineering problems and in design using the most appropriate engineering tool. 7. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 8. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13200 - Transforming Ideas To Innovation II

Credit Hours: 2.00. A partnership between Schools and Programs within the College of Engineering continues building on the foundation developed in ENGR 13100. Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. Extending skills in project management engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., Excel and MATLAB).

Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 8. Apply a systems approach in solving engineering problems and in undertaking design projects. 9. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 10. Exhibit a work ethic appropriate for the engineering profession. Credits: 2.00

ENGR 13300 - Transforming Ideas To Innovation, EPICS/VIP (UCC: IL)

Credit Hours: 2.00. Introduces students to the engineering professions using multidisciplinary, societally relevant content. Students will develop engineering approaches to systems, generate and explore creative ideas, and use quantitative methods to support design decisions. Students will experience

the process of design and analysis in engineering including how to work effectively in teams, and will develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel and MATLAB). An emphasis will be placed on computing logic development and builds upon the co-requisite experience of the students in the EPICS class.

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Examine and analyze career information from various resources to make informed decisions about which engineering discipline to pursue. 2. Develop metacognitive skills in evaluating own teamwork and leadership abilities, recognizing how own behavior impact the whole team, and make team process adjustments when necessary. 3. Explain critical and diverse use of modeling in engineering to understand problems, represent solutions, compare alternatives, make predications, etc. 4. Use multiple models, estimation, and logic to triangulate and evaluate information coming from various data sources. 5. Collect, analyze, and represent data to make informative explanations and persuasive arguments. 6. Develop a logical problem solving process which includes sequential structures, conditional structures, and repetition structures for fundamental engineering problems. 7. Solve fundamental engineering problems using computer tools. 8. Perform basic file management tasks using an appropriate computer tool. 9. Work effectively and ethically as a member of a technical team. 10. Develop a work ethic appropriate for the engineering profession. 11. Reflect on personal and team performance to achieve continuous improvement. Credits: 2.00

ENGR 14100 - Honors Creativity And Innovation In Engineering Design I (UCC: IL)

Credit Hours: 3.50. This course introduces students to the engineering professions using multidisciplinary, societally relevant content. Students develop engineering approaches to systems, generate and explore creative and innovative ideas, and use of computational methods to support design decisions. Design challenges and projects engage students in innovative thinking across the engineering disciplines at Purdue. Students experience the process of design and analysis in engineering including how to work effectively in teams. Students also develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools (e.g., Excel®, LabView®, MATLAB®, and Python).

University Core Curriculum (UCC): (UCC: IL) Learning Outcomes: 1. Describe the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Understand and apply engineering fundamentals and basic engineering science concepts to model, analyze, predict build, and evaluate an object of engineering interest using a design process. 3. Develop the ability to evaluate complex systems. 4. Develop strategies to facilitate generating creative ideas for complex design challenges. 5. Show how the engineering problem solving is related to the design process. 6. Use the engineering problem solving process to translate written problem statement into a mathematical model that is suitable for algorithmic development. 7. Communicate technical information to justify decision made during a problem solving situations (e.g. design, troubleshoot, or product selection). 8. Develop a logical and systematic problem solving process and use that process for software development, which includes sequential structures, conditional structures, and repetition structures. 9. Implement simple algorithmic forms of engineering models/problems using the most appropriate computer tool (LabVIEW, MATLAB, and Python). 10. Perform basic file management tasks using an appropriate computer tool. 11. Demonstrate appropriate knowledge and behaviors for effective and ethical membership on a technical team (i.e., teaming skills). 12.

Develop skills for cross-cultural communication. 13. Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

ENGR 14200 - Honors Creativity And Innovation In Engineering Design II

Credit Hours: 3.50. This course continues building on the foundation developed in ENGR 14100 . Students take a more in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students extend and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., C, Excel®, LabView®, MATLAB®, and Python).

Learning Outcomes: 1. Describe, in greater depth, the engineering disciplines at Purdue and the interrelationships among them as well as know what graduates of at least three disciplines of engineering do. 2. Apply engineering fundamentals and basic engineering science concepts to create feasible engineering solutions that are justifiable. 3. Use a problem identification process to create written engineering criteria to satisfy a problem. 4. Use an engineering formulation and solving process to translate an engineering scenario into a mathematical model. 5. Explain how an engineering problem solving process relates to a design process. 6. Design a process to communicate technical information orally and visually and demonstrate skills for cross-cultural communication. 7. Further development of strategies to facilitate generating creative ideas for complex design challenges. 8. Apply an engineering problem solving and design process to: generate ideas, model, analyze, predict, and build an innovative object of engineering interest taking into consideration its societal and environmental impact. 9. Implement complex algorithmic solutions to engineering problems/designs using the most appropriate computer tool (C , Excel, LABVIEW, MATLAB, and Python) and be able to explain your rationale for your choice. 10. Apply a systems approach in solving engineering problems and in undertaking design projects. 11. Synthesize your knowledge of effective and ethical membership on a technical team (i.e., teaming skills) to appropriately behavior. 12 Exhibit a work ethic appropriate for the engineering profession. Credits: 3.50

ENGR 16100 - Honors Introduction To Innovation And The Physical Science Of Engineering Design I (UCC: IL/SCI)

Credit Hours: 4.00. This course introduces students to the engineering profession using physics-based, multidisciplinary, societally relevant content. Students develop engineering approaches to systems, generate and explore creative and innovative ideas, and use of computational methods to support design decisions. In particular, the students will develop the ability to model and investigate physical systems at the microscopic and macroscopic levels with a focus on vectors analysis, linear momentum, angular momentum, work-energy, and solid material interactions. Design challenges and projects will explore a wide range of natural phenomena experimentally and computationally (utilizing MATLAB and Python) and engage students in innovative thinking across the engineering disciplines at Purdue. They will learn the basics of descriptive statistics, data analysis, sensitivity analysis, and decision-making. Students experience the process of design and analysis in engineering including how to work effectively in teams. Students also develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, and modern engineering tools.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Discuss the engineering education process, courses, and options, explain and compare engineering job functions and roles, and use this information to prepare a moderately well-informed course of study for academic and career success (3). 2. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and demonstrating a personal growth mindset to thoughtfully pursue course activities and the course as a whole (2). 3. Plan

and implement systematic design processes using formal engineering management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (6). 4. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 5. Describe a wide range of physical phenomena using a few fundamental physical laws (12). 6. Learn how to implement a unified approach that relates microscopic behavior to macroscopic behavior. These include mechanical theories based on particle, spring, and material models (10). 7. Model natural phenomena using computer simulations (5). 8. Demonstrate professional communication skills in the areas of technical writing to produce engineering reports, in presentations to convey engineering evidence and findings verbally and graphically to audiences, and in interpersonal communication to work with other members of the class (2). 9. Work alongside individuals with diverse backgrounds, utilizing the team environment to learn interdependently, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 10. Evaluate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (5). 11. Incorporate the consideration of engineering ethics, including social, safety, and sustainability issues into instances of engineering thinking and engineering problem solving so that the broader impacts of engineering work are evaluated and accounted for (3). 12. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, visualization, significant digits, and the problem presentation method to engineering applications (2). 13. Display proficiency in the applications of engineering content knowledge including basic statistics (5). Credits: 4.00

ENGR 16200 - Honors Introduction To Innovation And The Physical Science Of Engineering Design II (UCC: IL/SCI)

Credit Hours: 4.00. Students will take an in-depth and holistic approach to integrating multiple disciplines perspectives while constructing innovative engineering solutions to open-ended problems. The students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. The students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g. MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control in an effort to identify and characterize physical material systems.
*(Both ENGR 16100 AND ENGR 16200 are required to meet the IL or SCI requirement)

University Core Curriculum (UCC): (UCC: IL/SCI) Learning Outcomes: 1. Utilize knowledge of the engineering education process, courses, and options, and engineering job functions and roles to prepare a final course of study for academic and career success (3). 2. Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories (10). 3. Apply the unified approach to material interactions to a broad array of applications including asteroids, black holes, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity (7). 4. Model natural phenomena using computer simulations (7). 5. Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem

solving to ensure that the broader impacts of engineering work are consistently evaluated and accounted for (3). 6. Display proficiency in the applications of engineering content knowledge including statistics, statics, mechanics of materials, the universal accounting equation, electrical theory, and design of experiments (8). 7. Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole (2). 8. Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and House of Quality to design innovative products and systems (2). 9. Investigate and decompose systems in order to design and construct mathematical or computer models that can be employed to better understand or control the systems (6). 10. Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms (5). 11. Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class (3). 12. Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon (3). 13. Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning (3). 14. Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering challenges (2). Credits: 4.00

ENGR 17600 - Professional Internship I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by department with cooperation of participating employers. Students submit a summary report.

Credits: 0.00

ENGR 18000 - Minorities In Engineering Seminar

Credit Hours: 1.00. Explores the challenges that minority engineering students have in making a smooth and informed transition to college from high school. The content and activities may be of particular interest to engineering students from underrepresented groups as they adjust to the University's environment. The course provides a setting for entering students to explore career opportunities in the various fields of engineering. Open to all entering engineering students.

Credits: 1.00

ENGR 18500 - Engineering Career Planning

Credit Hours: 1.00. An engineering-oriented course designed to assist students in planning for their educational, career, and personal development. Individual and group projects, computer-aided guidance. Course will incorporate autobiographies, resumes, and academic and career planning exercises. Interest inventories and personal appraisal surveys will be utilized. Computer-based guidance systems will be utilized, including ESCAPE (Engineering Specific Career Advisory Problem-solving Environment). (Eight-week session)

Credits: 1.00

ENGR 19400 - Women In Engineering Seminar

Credit Hours: 1.00. An overview of the career opportunities for women in engineering. The content and activities of the course may be of particular interest to women. Speakers from a variety of engineering organizations discuss their career paths and share their strategies for success. Students also meet weekly in

small groups led by engineering seniors for additional information, interaction, and support from their peers in engineering. Open to all entering engineering students.

Credits: 1.00

ENGR 19500 - First-Year Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

ENGR 19700 - Introduction To Programming Concepts

Credit Hours: 2.00. Basic concepts and applications of software programming for solving engineering problems. Topics include techniques for developing structured algorithms, data input and output, conditional statements, loops, recursion, functions, arrays, and elementary concepts in mathematical programming. Examples, homework, and applications of programming concepts make extensive use of the C programming language.

Credits: 2.00

ENGR 20000 - Cooperative Education Practice I

Credit Hours: 1.00. A semester or summer of external, full time, related career experiences designed to enhance the student's preparedness for an intended career with business, industry or government agency. A comprehensive written report on the internship practice is required. A minimum of 10 weeks and 200 hours are required for credit.

Credits: 1.00

ENGR 20010 - Engineering Career Enrichment Internship I

Credit Hours: 1.00. Semester of external career related experiences designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit.

Credits: 1.00

ENGR 23099 - Cooperative Education Seminar I

Credit Hours: 1.00 or 2.00. (PSY 23099) This seminar course is optional for Co-Op students when they are on campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least one Co-Op work term. May be repeated once after the second work term. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Learn from the experiences of other participants and apply that knowledge to the situation. Credits: 1.00 or 2.00

ENGR 25000 - Cooperative Education Practice II

Credit Hours: 1.00. A semester or summer of external, full time, related career experiences designed to enhance the student's preparedness for an intended career with business, industry or government agency. A comprehensive written report on the internship practice is required. A minimum of 10 weeks and 200 hours are required for credit.

Credits: 1.00

ENGR 25010 - Engineering Career Enrichment Internship II

Credit Hours: 1.00. Semester of external career related experiences designed to enhance the student's preparedness for entering and initial or second career.

Credits: 1.00

ENGR 26099 - Learning While Working Full-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4.

Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 27199 - Professional Practice Flex Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience. Credits: 0.00

ENGR 27299 - Professional Practice Flex Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience. Credits: 0.00

ENGR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 29600 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the freshmen/sophomore level on a temporary basis to test the viability of offering the course on a permanent basis.

Learning Outcomes: n/a Credits: 0.00 to 6.00

ENGR 29701 - Global Engineering Orientation

Credit Hours: 1.00. Forum in preparation of study and work abroad. Understanding of cultural differences and collaborating across cultural boundaries, professionalism and ethics in foreign

work and academic environments, leadership and teamwork options in foreign environments. Permission of instructor required.

Learning Outcomes: 1. Be provided with foundation in global engineering communication skills. 2. Outline teamwork and leadership opportunities available through participation in the global engineering community. 3. Be provided with globally diverse and multicultural experiences and discuss case studies to prepare them for upcoming international internships and semester study abroad. 4. Identify resources available for academic studies and industrial work experience abroad. 5. Develop a strong ethical framework and cultural sensitivity to prepare for the global professional workplace. Credits: 1.00

ENGR 30301 - Business Essentials Executive Forum

Credit Hours: 2.00. This course will provide undergraduate engineering students access to Purdue Engineering alumni working in the C-suite, as well as basic knowledge regarding the understanding of corporate financial statements. The forum is a lecture-discussion course featuring executives from engineering firms, tech companies, and other organizations. Emphasis is placed on the actual practice of leadership in corporate America, on career selection and mobility, on styles of leadership, and on other business topics not normally covered in undergraduate engineering courses.

Learning Outcomes: 1. Have a fundamental understanding of basic financial statements, ratios, and methods used to make business decisions. 2. Understand the backgrounds, traits, qualities, and mindsets of Purdue undergraduate engineering alumni at the executive level. 3. Acquire up-to-date knowledge of business essentials needed for corporate leadership. 4. Discover career opportunities for engineers in the business function of organizations. Credits: 2.00

ENGR 30500 - Fundamentals Of Innovation Theory And Practice

Credit Hours: 3.00. This course is designed to provide students with initial exposure to the fundamental patterns, mindsets, behaviors, attributes, tools, and methods employed in the innovative activity of individuals and organizations. Emphasis is placed on understanding and effectively utilizing techniques to systematically drive innovation that are drawn from the fields of business, design, problem-solving, engineering, and the social sciences. Lecture, in-class small group activities, and individual and team assignments are employed across an array of contemporary socio-technical challenges to provide students with the opportunity to apply conveyed theory and methods to rigorously structure problems, understand involved stakeholders, utilize innovation motifs and analogical reasoning to develop robust views of potential solutions spaces, tailor solution design to stakeholder context, consider the full suite of functional, social, and emotional dimensions that could influence solution prioritization, and document and systematically assess underlying solution assumptions to iterate toward a viable and sustainable forward-looking plan that could achieve target outcomes. This course counts toward, serves as a required entry course for, the College of Engineering Minor in Innovation and Transformational Change.

Learning Outcomes: 1. Develop working knowledge of established innovation forms and motifs. 2. Demonstrate ability to link innovation motifs to specific classes of problems. 3. Understand, and be able to pursue, the core aspects of an end-to-end innovation process. 4. Recognize the mental models, mindsets and behaviors of innovators. 5. Gain awareness of the approaches various forms of organizations take to systematically innovate. 6. Acquire leadership and communication skills through teamwork, oral presentations, and written deliverables. Credits: 3.00

ENGR 31000 - Engineering In Global Context (UCC: STS)

Credit Hours: 3.00. This course provides students with opportunities to study how engineering is intertwined with larger economic, social, cultural, and technological dynamics in an era of intensified globalization. Its major goals are to help students understand and appreciate what engineering is, how engineers are trained, what engineers do, and how engineering and society interact. The course approaches these themes through discussion of: the relation and interaction of engineering, science, technology, and society; the historical origins and development of engineering as a profession; diversity issues in engineering and other STEM fields; engineering in cross-national/cultural contexts; and contemporary challenges related to globalization, ethics, and sustainability. In summary, the

course is designed to help students understand what it means to identify as, and/or work with, engineers. Recitation sections and/or independent projects (at the instructor's discretion) provide further opportunities for students to expand their knowledge and improve their skills in relation to course themes.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe and evaluate the specific kinds of knowledge and methods typically employed by engineers, including in comparison with other professional fields. 2. Understand the historical development of engineering education and the engineering profession in the United States. 3. Recognize how national differences are important in engineering work, including by comparing and contrasting different national cultures and styles of engineering. 4. Explain the significance of diversity in engineering education and professional practice, including by evaluating competing perspectives on diversity in different historical and sociocultural contexts. 5. Understand contemporary trends and issues related to globalization, ethics, social responsibility, and sustainability, and interpret their significance in relation to engineering education and practice. 6. Demonstrate written communication capabilities at the level of emerging or higher (as defined by the Purdue Core Curriculum guidelines). Credits: 3.00

ENGR 33099 - Cooperative Education Seminar II

Credit Hours: 1.00 or 2.00. This seminar is optional for Co-Op students when they are on campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least two Co-Op work terms. May be repeated once after the fourth work term. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Receive feedback from the instructor and seminar participants. 4. Continue professional development. Credits: 1.00 or 2.00

ENGR 35000 - Cooperative Education Practice IV

Credit Hours: 1.00. A semester or summer of external, full time, related career experiences designed to enhance the student's preparedness for an intended career with business, industry or government agency. A comprehensive written report on the internship practice is required.

Credits: 1.00

ENGR 36099 - Learning While Working Full-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36199 - Learning While Working Part-Time Co-Op I

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-

20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 36299 - Learning While Working Part-Time Co-Op II

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 37399 - Professional Practice Flex Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience. Credits: 0.00

ENGR 37499 - Professional Practice Flex Co-Op IV

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by

the student summarizing their experience. Credits: 0.00

ENGR 37599 - Professional Practice Flex Co-Op V

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. In the Flex Co-Op program, students must work for their first employer for a minimum of two work sessions, and then have the option to continue for one-to-three additional work sessions; or, after completing two work sessions with the first employer, the student may elect to start with a second employer. If the student elects to change employers, they must notify their first employer and their Faculty Coordinator in writing at the conclusion of the second work session. The student must commit to work for the second Co-Op employer for a minimum of two work sessions. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses course outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a technical report written by the student summarizing their experience. Credits: 0.00

ENGR 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report Credits: 0.00

ENGR 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report Credits: 0.00

ENGR 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in Engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report Credits: 0.00

ENGR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in engineering.

Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39501 - Breakthrough Thinking Complex Challenges

Credit Hours: 3.00. This course is intended to help students understand and effectively employ the principles underlying breakthrough thinking. Students will participate in cross-disciplinary teams to design solutions to a complex societal challenge in conjunction with a partner organization, in an experiential learning setting. Case discussions of historical breakthroughs will be used to introduce techniques for the identification of opportunities, the design of solutions, and the launch, test, and iteration of such solutions. Emphasis will be placed on the effective use of techniques from various fields, such as business, design, problem-solving, engineering, and the social sciences.

Credits: 3.00

ENGR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ENGR 39600 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the junior level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 0.00 to 6.00

ENGR 39602 - Undergraduate Experiential Training - Research

Credit Hours: 0.00. This course is meant to promote meaningful reflection on the different experiential learning research environments a student may participate in such as Summer Undergraduate Research Fellowship and Research for Pay internship. Additional data will be collected on each student's experience regarding pay, project, position, etc. Assignments will include goal setting, goal evaluation, reflection, and resume writing. Guidance will be provided within the Brightspace page and throughout the pre/post-experience survey assignments. Permission of instructor required.

Learning Outcomes: 1. Have enhanced critical thinking, problem-solving skills, and intellectual growth. 2. Gain practical skills, research methodologies, and confidence in their abilities. 3. Be better prepared for graduate studies. Credits: 0.00

ENGR 39603 - Undergraduate Experiential Training - Semiconductors

Credit Hours: 0.00. This course is meant to promote meaningful reflection on the different experiential learning environments a student may participate in which focus on workforce development and the acquisition and practice of technical skills. This course will supplement the Summer Training Awareness & Readiness for Semiconductions (STARS) program. Additional data will be collected on each student's experience regarding pay, project, position, etc. Assignments will include goal setting, goal evaluation, reflection, public speaking as it relates to the workforce domain, and resume writing in addition to industry/sector-specific technical training. Guidance will be provided within the Brightspace page and throughout the pre/post-experience survey assignments. Permission of instructor required.

Learning Outcomes: 1. Have enhanced critical thinking, problem-solving skills, and intellectual growth. 2. Gain practical skills, research methodologies, and confidence in their abilities. 3. Be better prepared for the semiconductor sector-specific technical training. Credits: 0.00

ENGR 39697 - Global Engineering Projects

Credit Hours: 1.00 to 3.00. Students will work in teams to formulate solutions to engineering problems. Project topics will focus on a problem outside the U.S. and/or incorporate teammates from international universities. International teams may work remotely with the possibility for international travel and in-person collaboration. Permission of instructor required.

Learning Outcomes: 1. Obtain practical skills through engagement in a real-life project utilizing engineering principles. 2. Enhance communication and teamwork skills through experience working on a diverse team. Credits: 1.00 to 3.00

ENGR 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of Instructor required.

Learning Outcomes: 1. The Director of the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students after each academic work session b) assess course outcomes via student evaluation of work sessions, supervisor evaluation of student and work session technical report Credits: 0.00

ENGR 39700 - Global Engineering Experience

Credit Hours: 1.00. Forum for students participating in an international internship or study abroad experience. Students will complete weekly guided writing assignments during the first 15 weeks of their international experience. Assignments will aid students with integration into the host community. Students will demonstrate increased awareness of the nature and complexities of intercultural communication by applying various theories to their lived experiences. To be taken concurrently with international internship/study abroad experience. Permission of instructor is required.

Learning Outcomes: 1. Apply cultural theories to their personal experiences. 2. Deepen understanding of cultural differences, inter-cultural communication and their cultural competency. 3. Develop strategies to bridge cultural gaps and the ability to identify, manage, communicate and apply emotions effectively and appropriately. 4. Understand challenges of studying or working in a foreign country and develop a strong ethical framework and cultural sensitivity to succeed in a global workplace. Credits: 1.00

ENGR 39799 - GEARE Domestic Internship

Credit Hours: 0.00. Domestic internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with domestic employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the GEARE program requirements b) assess course outcomes via student evaluation of work sessions and work session technical report Credits: 0.00

ENGR 39899 - GEARE Global Internship

Credit Hours: 0.00. Global internship experience for GEARE program. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students to obtain professional practice with global employers within industry, government or small business. Permission of instructor required.

Learning Outcomes: 1. The Assistant Director of Global Professional Practice Programs in the Office of Professional Practice serves as the facilitating body to: a) moderate the progress of students through the requirements of the GEARE program requirements b) assess course outcomes via student evaluation of work sessions and work session technical report Credits: 0.00

ENGR 40400 - Instruction, Mentorship And Leadership

Credit Hours: 1.00. This course provides students with valuable mentorship, leadership, and instructional opportunities through participation in the College of Engineering mentorship programs. The weekly seminar will feature a combination of student-led discussions, guest speakers, and practical team-building skills.

Learning Outcomes: 1. Articulate the core tenets of their own philosophy of mentorship. 2. Apply effective mentoring strategies to overcome the challenges of mentorship. 3. Evaluate their own mentorship ability and style, as well as evaluate their own mentorship needs. 4. Build effective relationships with mentees. Credits: 1.00

ENGR 40600 - Engineering Ambassador Leadership Seminar

Credit Hours: 1.00. Students will engage in a weekly seminar that includes topics such as leadership, professional skills, teamwork, and Purdue culture. Students will utilize these skills while representing Purdue College of Engineering to current and prospective students, alumni, donors, legislators, and other supporters of Purdue College of Engineering. Student must be selected as a College of Engineering Ambassador; be currently enrolled full-time in the College of Engineering; have completed no less than three academic semesters at Purdue; have a cumulative GPA of 2.8 or higher. Permission of department required.

Learning Outcomes: 1. Provide students with theoretical and experiential basis from which they may acquire and enhance their knowledge and skills in the areas of: Leadership principles and models; Purdue structure, culture, and engineering education opportunities; Personal/professional effectiveness, including teamwork and public speaking. 2. Provide students with the opportunity to develop a personal philosophy of leadership that includes an understanding of self, others, and community. Credits: 1.00

ENGR 43099 - Cooperative Education Seminar III

Credit Hours: 1.00 or 2.00. This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least three Co-Op work terms. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Learn for the experiences of other participants and apply that knowledge to the situation. Credits: 1.00 or 2.00

ENGR 46099 - Learning While Working Full-Time Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46399 - Learning While Working Part-Time Co-Op III

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year

terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 46499 - Learning While Working Part-Time Co-Op IV

Credit Hours: 0.00. Co-Op is an academic program with oversight by assigned Faculty Coordinators who serve as the instructor for participating students. Learning While Working participants are undergraduate students who work part-time (10-20 hours per week) in paid computer science, engineering, polytechnic, or management positions during the academic year terms (fall and spring semesters) for an employer with a local operations or offering a remote work opportunity. During the summer term, Learning While Working students work in full-time positions at any location offered by the employer. During the academic year, Learning While Working students register for a full-time course load, and also for this zero-credit hour Learning While Working course. During the summer term, Learning While Working students register for a zero-credit hour Co-Op course. This course will help students set goals for their work experiences and reflect on skill growth and receive feedback from their employer supervisor and Purdue Co-Op supervisor. Prerequisite: Student must be eligible to participate in the Cooperative Education (Co-Op) program and have written documentation of valid work session with approved Co-Op employer. Permission of instructor required.

Learning Outcomes: 1. Set goals for a work experience. 2. Articulate how classroom learning is applied to the workplace. 3. Translate work experiences to their resume. 4. Articulate how the work experience improved skills such as communication, teamwork, and problem-solving. Credits: 0.00

ENGR 49001 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multi-disciplinary student teams directly apply cumulative learning to address selected parts of a real-world complex societal challenge in close collaboration with a partner organization, in an experiential learning format. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation. Permission of instructor required.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually-exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services, and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversion methodologies and the role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Understand combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of

design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion, and retention of new solutions. Credits: 3.00

ENGR 49400 - Women In Engineering Senior Seminar: Gender In The Workplace

Credit Hours: 1.00. This course provides junior and senior engineering students an opportunity to maximize their earning potential, promotion opportunities, and retention within engineering or related fields. Enrolled students will 1) become aware of and discuss solutions for internal and external barriers which can prevent women from reaching their greatest potential in the workforce; 2) enhance professional development and transition skills required to move successfully from an academic to professional environment; and 3) acquire skills and knowledge to serve as engineering role models/ambassadors for diverse populations. The content and activities of the course may be of particular interest to women. Permission by instructor required.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 1.00

ENGR 49600 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the senior level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 0.00 to 6.00

ENGR 49700 - Global Engineering Capstone

Credit Hours: 1.00. Forum for students returning from international internship and/or study abroad experience. Students will explore personal development resulting from the international experience as it relates to changes in world-view, understanding of culture, interpersonal skills and career aspirations. They will learn to highlight international experiences on resumes and in interviews. Students will apply and share their cultural knowledge through structured activities and summarize their entire global experience through a poster presentation. To be taken in semester following international internship/study abroad experience. Permission of instructor is required.

Learning Outcomes: 1. Identify skills gained through the international experience. 2. Able to highlight experiences on resumes and in interviews. 3. Apply skills to current and future inter-cultural situations and develop a strong ethical framework and cultural sensitivity to succeed in a global workplace. Credits: 1.00

EPCS 10100 - First Year Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS 10100 gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's sophomores, juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. May be repeated for credit.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on

multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 10200 - First Year Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Participants in EPCS 10200 gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Working with team's sophomores, juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 10200 is offered for two credits and is intended for students who have exhibited significant achievement in EPCS 10100 and desire the level of responsibility that is appropriate for two credits. May be repeated for credit. Permission of department required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 11100 - First Year Participation In EPICS I (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one-year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and education organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project team for two or more semesters. First-year students participating in EPCS gain insight into the specific project, and more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected to attend all team meetings. Under mentorship from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

EPCS 12100 - First Year Participation In EPICS II (UCC: STS)

Credit Hours: 1.00. Together, Engineering Projects in Community Service (EPICS) courses create a vertical project track under which students work in multidisciplinary teams on long-term engineering-based design projects. Projects of at least one year in duration are intended to solve real problems that are defined in consultation with "customers" from not-for-profit community and educational organizations. EPCS courses are open to students from all disciplines; each student contributes expertise in his/her academic discipline. Each team consists of a mix of first-year, sophomores, juniors, and seniors. Students are encouraged to participate in an EPICS project for two or more semesters. First-year students participating in EPICS gain insight into the specific project, and more generally, into the design and development process. Under mentorship

from upper-level students and instructors, they perform and report upon design tasks consistent with their level of discipline expertise.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Ability to apply material from their discipline to the design of community-based projects. 2. Understanding of design as a start-to-finish process. 3. Ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Awareness of the customer. 5. Ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Ability to communicate effectively with audiences with widely-varying backgrounds. 7. Awareness of professional ethics and responsibility. 8. Appreciation of the role that their discipline can play in social contexts. Credits: 1.00

EPCS 20100 - Sophomore Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). Sophomores participating in EPCS 20100 gain insight into the specific project, and, more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 20100 is offered for one credit.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 20200 - Sophomore Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Sophomores participating in EPCS 20100 gain insight into the specific project, and, more generally, into the design and development process. They attend planning and reporting meetings with the customer and are expected attend all team meetings. Under the mentorship of the team's juniors and seniors they perform and report upon tasks consistent with their level of discipline expertise. EPCS 20200 is offered for two credits. Permission of instructor required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand the design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 30100 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material

from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 30200 - Junior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). The responsibilities of juniors include working with the seniors in the planning and organization of the project, contributing to the design process, problem-solving by contributing expertise from their discipline, meeting with the customer, and the mentorship of sophomores and freshmen. EPCS 30200 is offered for two credits. The EPICS procedures manual provides information on expected relative workload for EPCS 30100 and EPCS 30200 students. May not be taken concurrently with EPCS 30100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 40100 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 1.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100/EPCS 40200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 40100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40200 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 1.00

EPCS 40200 - Senior Participation In EPICS (UCC: STS)

Credit Hours: 2.00. Continuation of EPCS courses (see EPCS 10100). Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the freshman, sophomores and juniors. Seniors using EPCS 40100 /40200 to fulfill capstone or design requirements where approved for their

major may be required to satisfy additional course requirements specified by their degree program. EPCS 40200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 40100 and EPCS 40200 students. May not be taken concurrently with EPCS 40100 .

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Able to apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Able to identify and acquire new knowledge as a part of the problem-solving/design process. 4. Aware of the customer. 5. Able to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Able to communicate effectively with audiences with widely-varying backgrounds. 7. Aware of professional ethics and responsibility. 8. Appreciate the role that their discipline can play in social contexts. Credits: 2.00

EPCS 41100 - Senior Design Participation In EPICS

Credit Hours: 1.00. Continuation of EPICS courses. Seniors using EPCS 41100 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41100 is offered for 1 credit. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41200 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsibility. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 1.00

EPCS 41200 - Senior Design Participation In EPICS

Credit Hours: 2.00. Continuation of EPICS courses. Seniors using EPCS 41200 to fulfill capstone or design requirements where approved for their major may be required to satisfy additional course requirements specified by their degree program. EPCS 41200 is offered for 2 credits. The EPICS procedures manual provides information on expected relative workload for EPCS 41100 and EPCS 41200 students. Seniors are responsible for the management tasks of planning and organizing their team project activity. They are expected to contribute expertise from their discipline to the design of the team's projects throughout most of the design process phases of problem identification, specification development, design, production, and deployment. Seniors will also meet with the customer and mentor the first year, sophomores and juniors. May not be taken concurrently with EPCS 41100 .

Learning Outcomes: 1. An ability to apply material from their discipline to the design of community-based projects. 2. An understanding of design as a start-to-finish process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An awareness of the customer. 5. An ability to function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. An ability to communicate effectively with audiences with widely-varying backgrounds. 7. An awareness of professional ethics and responsiblity. 8. An appreciation of the role that their discipline can play in social contexts. Credits: 2.00

EPCS 49000 - EPICS Special Topics Course

Credit Hours: 1.00 to 3.00. Projects of special interest outside the scope and structure of the standard EPICS courses. Interested students seek a faculty advisor in their area of special

interest and together prepare a brief description of the work to be undertaken. Permission of instructor required.

Credits: 1.00 to 3.00

GEP 10000 - Global Design Team I

Credit Hours: 1.00. Global Design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 1.00

GEP 20000 - Global Design Team II

Credit Hours: 0.00 to 2.00. Global Design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 0.00 to 2.00

GEP 30000 - Global Design Team III

Credit Hours: 1.00 to 3.00. Global Design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 1.00 to 3.00

GEP 40000 - Global Design Team IV

Credit Hours: 1.00 to 3.00. Global design Team (GDT) brings together undergraduate and graduate students from different disciplines inside and outside of the College of Engineering, to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses, and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic, and GPA. Department approval required.

Learning Outcomes: 1. Real-world, full-cycle design experience in the context of a different culture and geographical region. 2. Increased global awareness and competence. 3. Global humanitarian impact. Credits: 1.00 to 3.00

VIP 17910 - First-Year Participation In Vertically Integrated Projects (VIP) Lim (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management,

intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies, and development tools. Permission of department required.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17911 - First Year Participation In Vertically Integrated Projects (VIP) I (UCC: STS)

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design

experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17912 - First Year Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 17920 - First Year Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership,

create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 27910 - Sophomore Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools. Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 27920 - Sophomore Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional

development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 27930 - Sophomore Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design

experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 3.00

VIP 37900 - Participation in Vertically Integrated Projects (VIP)

Credit Hours: 0.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Permission of instructor required.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 0.00

VIP 37910 - Junior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 3.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design

experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 37920 - Junior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 37930 - Junior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for

undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

VIP 47910 - Senior Participation In Vertically Integrated Projects (VIP) Lim

Credit Hours: 1.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically integrated teams (first year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in a limited number of professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive

environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 1.00

VIP 47920 - Senior Participation In Vertically Integrated Projects (VIP) (UCC: STS)

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47921 - Senior Design Participation In Vertically Integrated Projects (VIP) I

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified

needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47922 - Senior Design Participation In Vertically Integrated Projects (VIP) II

Credit Hours: 2.00. This course provides an opportunity for undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in weekly lectures and professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product (device, system, process, software, etc.) that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environmental, and societal contexts. Credits: 2.00

VIP 47930 - Senior Participation In Vertically Integrated Projects (VIP) Ext

Credit Hours: 3.00. This course provides an opportunity for

undergraduate students to engage in authentic and extended research and design projects related to active research areas of Purdue faculty members and national, international, and industry-sponsored design challenges. Students will work on interdisciplinary and vertically-integrated teams (first-year through seniors) with faculty and graduate student mentors to address these real-world research and design challenges. Students will participate in professional development activities that include topics related to design, research, documentation and technical writing, communication, leadership and teamwork, ethics, project management, intellectual property, information literacy, and introduction to a broad range of applicable research topics, technologies and development tools.

Learning Outcomes: 1. Apply engineering design to create a product that meets the specified needs of this engineering design experience with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 2. Develop and conduct experimentation, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of the product of this engineering design experience. 3. Identify, formulate, and solve complex engineering problems arising from this engineering design experience by applying principles of engineering, science, and mathematics. 4. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives associated with this design experience. 5. Communicate effectively with a range of audiences appropriate to this design experience in both a written report and oral presentation. 6. Acquire and apply new knowledge as needed, using appropriate learning strategies to complete the engineering design experience associated with this course. 7. Recognize ethical and professional responsibilities associated with this engineering design experience and make informed judgments which must consider the impact of the product of this engineering design experience in global, economic, environment, and societal contexts. Credits: 3.00

First-Year Engineering

First-Year Engineering

First Year Engineering Program Requirements - Other Options

School of Aeronautics and Astronautics

Aeronautical and Astronautical Engineering

The curriculum emphasizes the disciplines of aerodynamics, aerospace systems, astrodynamics and space applications, propulsion, structures and materials, dynamics and control, and further provides courses that integrate these disciplines into the design of flight vehicles to perform the required mission.
The field of aeronautical and astronautical engineering addresses the challenging problems encountered in the design and operation of many types of aircraft, missiles, and space vehicles and places a constant demand on research and development groups for an even greater understanding of basic physical phenomena.
Employers from around the world contact the School of Aeronautics and Astronautics with information regarding positions available within their organizations.

Mission Statement

To serve the State of Indiana and our Nation by providing degree granting programs - recognized as innovative learning experiences - that prepare students to be exceptional, recognized contributors to aeronautical and astronautical engineering in industry, government laboratories and universities.
To develop and maintain quality graduate research programs in technical areas relevant to Aeronautics and Astronautics and to foster a collegial and challenging intellectual environment necessary to conduct enabling and breakthrough research for aerospace systems.

Faculty (website)

Contact Information

School of Aeronautics and Astronautics
Neil Armstrong Hall of Engineering
701 West Stadium Avenue
West Lafayette, IN 47907-2041
Phone: (765)494-5157
Fax: (765)494-0307

Graduate Information

For Graduate Information please see Aeronautics and Astronautics Graduate Program Information .

Aeronautical and Astronautical Engineering, BSAAE

Space Engineering Certificate

AAE 20000 - Undergraduate Sophomore Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn the requirements for earning a BSAAE degree. 2. Learn advising and registration processes in AAE. 3. Learn professional ethics. 4. Learn current events in Aerospace Engineering. Credits: 0.00

AAE 20300 - Aeromechanics I

Credit Hours: 3.00. Fundamental concepts and principles of bodies in motion, with applications to aeronautical and astronautical problems. Subjects covered include rectilinear motion, curvilinear motion, rotation, and plane motion. The static equilibrium and quasistatic equilibrium situations are treated as a part of motion in which the acceleration is zero. Problems involving impact, separation, work, and energy are considered.

Learning Outcomes: 1. Compute velocities and accelerations for any type of motion. 2. Compute angular velocities and accelerations of rigid bodies. 3. Model forces and apply Newton's Laws in particle dynamic problems. 4. Model forces and solve general statics of bodies problems. Credits: 3.00

AAE 20400 - Aeromechanics II

Credit Hours: 3.00. Loads on aircraft. Strain, stress, and equations of equilibrium. Description of aircraft structures and materials. Torsion of shafts. Fuselage and wing structures. Symmetrical bending and stiffness analysis of solid and stringer-panel box beams. Structural failures.

Learning Outcomes: 1. Describe the material behavior of deformable bodies when subjected to loads. 2. Create and use free-body diagrams to compute resultant support forces and moments. 3. Compute internal force and moment distributions. 4. Properly select and use materials based upon their mechanical properties. 5. Compute stresses, strains, deformation and displacements of basic structural components. 6. Predict structural integrity based on the calculations. 7. Apply these ideas for analysis of components related to aerospace applications. Credits: 3.00

AAE 20401 - Aeromechanics II Laboratory

Credit Hours: 1.00. Introduction to strain gauges, dial gauges, and photoelasticity. Tensile test. Torsion of solid and hollow propeller shafts. Stress concentration around skin cut-outs. Bending of symmetrical box wing beams. Combined axial and flexural test of aircraft stringers. Buckling of slender stringers.

Credits: 1.00

AAE 25100 - Introduction To Aerospace Design

Credit Hours: 3.00. The role of design in aerospace engineering. Introduction to aerodynamics, performance, propulsion, structures, stability and control, and weights. Layout and general arrangement of aerospace vehicles. Design concept generation and selection. Computational methods for design. Trade studies and graphical optimization. Conceptual design exercise involving aircraft, spacecraft, or both. Technical

presentations and communication for aerospace engineering.

Learning Outcomes: 1. Acquire and apply basic technical knowledge about aerospace engineering. 2. Develop intuition about aerospace engineering and aerospace vehicles. 3. Understand and implement the design process for aerospace systems. 4. Use computers in aerospace design. 5. Solve problems as part of a team. 6. Design an aerospace vehicle/system. 7. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

AAE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 30000 - Undergraduate Junior Seminar

Credit Hours: 0.00. The courses are intended to provide a forum for guest speakers, organizational and informational meetings with undergraduates, and to provide a venue for discussion of professional development.

Learning Outcomes: 1. Learn how to program options within the AAE degree and how to choose them. 2. Learn how to interview. 3. Learn how to get an internship or other engineering experience. 4. Learn professional ethics. 5. Learn about current events in Aerospace Engineering. Credits: 0.00

AAE 30100 - Signal Analysis For Aerospace Engineering

Credit Hours: 3.00. Signal processing and spectral analysis for aerospace engineering. Fourier and fast Fourier transforms. Vibration analysis; estimation of natural frequencies, wing vibrations. Introduction to linear circuits, operational amplifiers and filtering. Noise suppression.

Credits: 3.00

AAE 33300 - Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluids and conservation equations for mass, momentum, and energy. Viscous and inviscid incompressible flow. Lift and drag in subsonic flow. Introduction to compressibility and boundary layers. Potential flow.

Learning Outcomes: 1. Calculate hydrostatic pressure distributions, forces, and moments. 2. Calculate aerodynamic forces and moments from pressure and shear stress distributions. 3. Apply similitude to scale data. 4. Apply global conservation of mass and momentum (Control Volume analysis) to engineering systems. 5. Apply Bernoulli's equation to relate velocity and pressure. 6. Calculate velocity and pressure fields using potential theory. 7. Apply the Navier-Stokes Equations to obtain exact solutions and compute shear stress and other flow quantities. 8. Apply the Blasius Boundary Layer Solution and integral methods to obtain

boundary-layer flow properties. Credits: 3.00

AAE 33301 - Fluid Mechanics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Experiments in incompressible viscous flow; flow measurement and visualization; laminar and turbulent boundary layers; wakes.

Learning Outcomes: 1. Measure and differentiate between absolute, differential, and gauge pressure. 2. Make basic pressure and velocity measurements. 3. Utilize elementary flow visualization tools. 4. Deduce fluid physics information from flow visualization. 5. Calculate flow characteristics such as Reynolds number, friction factor, pressure and drag coefficient from laboratory measurements. 6. Identify and discuss foundation-level fluid phenomena including boundary layers, wakes, laminar to turbulent transition, turbulence, flow separation, drag on a body, and surface pressure distributions. 7. Design an experiment to meet a defined objective, conduct the experiment, analyze the data, and draw conclusions. Credits: 1.00

AAE 33400 - Aerodynamics

Credit Hours: 3.00. Incompressible airfoil and lifting line theory. Steady and unsteady, one-dimensional, linear and nonlinear flows. Normal shock waves. Steady, supersonic, two-dimensional linear and nonlinear flows. Oblique shock waves. Perturbation theory for wings and bodies. Design applications.

Credits: 3.00

AAE 33401 - Aerodynamics Laboratory

Credit Hours: 1.00. A laboratory course designed to illustrate various aerodynamic phenomena. Airfoil pressure distribution. Finite wing lift, drag, and moment. Supersonic flow around bodies. Shock waves.

Credits: 1.00

AAE 33800 - Thermal Sciences

Credit Hours: 3.00. A fundamental course covering a range of topics selected from the disciplines of engineering thermodynamics, fluid mechanics, heat transfer and combustion, with an emphasis on their application to propulsion. This is an entry level course to prepare students for advanced analysis of propulsion and energy systems. Upon completion of this course, students are expected to be able to apply fundamental principles to perform thermodynamic analysis for thermophysical problems involving fluid flow, heat transfer and combustion.

Learning Outcomes: 1. Identify types of problems from thermo-fluid systems. 2. Perform heat conduction analysis for steady and unsteady problems. 3. Perform analysis for radiation heat transfer. 4. Develop deeper understanding of the laws of thermodynamics and their applications to various problems. 5. Apply fundamentals of fluid mechanics to various fluid flow problems. 6. Analyze convection heat transfer problems. 7. Conduct analysis of simple combustion systems such as adiabatic or chemical equilibrium. 8. Analyze simple thermo-fluid systems using fundamentals we learn from the class. Credits: 3.00

AAE 33900 - Aerospace Propulsion

Credit Hours: 3.00. Survey of air-breathing and rocket propulsion systems for AAE students not in the propulsion option. Thermodynamic cycles, analysis of air-breathing systems and components. Rocket Equation, rocket cycles, liquid and solid propellants, chemical equilibrium.

Learning Outcomes: 1. Knowledge of propulsion applications that use gas turbine engines and rockets. 2. Understanding of the Brayton cycle and ability to calculate enthalpy and work balance. 3. Ability to solve mass, momentum, and energy balances using a control volume approach. 4. Ability to perform top-level performance and sizing calculations of gas turbine engines. 5. Ability to apply Euler's work equation to compressors and turbines to calculate work. 6. Ability to use the Rocket Equation to calculate impulse requirements and size rocket thrusters. Credits: 3.00

AAE 34000 - Dynamics And Vibrations

Credit Hours: 3.00. Kinematics and kinetics of particles and

rigid bodies. Topics include a particle in orbit, systems of particles, vibrations, Euler's equations of motion, Eulerian angles, and aerospace vehicle dynamics.

Learning Outcomes: 1. Analyze the free and forced response of a spring/mass/damper. 2. Formulate the EOMs of particles, systems of particles and rigid bodies. 3. Solve the EOMs numerically. 4. Understand the various forms of Euler angles and be able to apply them to rigid body dynamics. 5. Simulate the motion of a spacecraft in MATLAB. Credits: 3.00

AAE 35103 - Aerospace Systems Design

Credit Hours: 3.00. Aerospace system lifecycle and design process. Stakeholder needs elicitation and requirements generation. Quality function deployment and hierarchical objective trees. Concept generation and creativity techniques. Introduction to safety, risk, cost and value analysis. Critical evaluation of the applicability of systems engineering techniques in specific contexts. Application of these techniques to a team semester design project.

Learning Outcomes: 1. Identify appropriate tools, methods and processes to formulate an aerospace system design problem including realistic constraints from technical, economic, social, political, safety, and other relevant contexts. 2. Apply those tools, methods and processes to generate solutions to the aerospace system design problem. Credits: 3.00

AAE 35200 - Structural Analysis I

Credit Hours: 3.00. Properties of wing and fuselage sections. Beam-column moments. Torsion of thin-walled and skin-stringer multiple-cell sections. Nonsymmetrical bending of skin-stringer wing sections. Flexural shear in open and closed thin-walled and skin-stringer sections. Loads and stresses in the rib system. Cutouts and shear lag. Modified beam theory for wing and fuselage design. Deflection by energy method. Introduction to composite structures.

Learning Outcomes: 1. Use analytical/empirical tools for determining the distribution of load (or displacement) in typical aerospace components. 2. Understand and implement the procedures for relating applied loads (or displacements) to component "failure." 3. Select of materials to resist structural failure. 4. Be exposed to other professional development topics are also to be presented as time permits (e.g., technical communications, teamwork issues, economic considerations, engineering ethics, case histories, regulatory and certification, topics, etc.). Credits: 3.00

AAE 35201 - Structural Analysis I Laboratory

Credit Hours: 1.00. Location of shear center. Torsion of thin-walled open and closed sections. Torsion of multiple-cell, thin-walled section. Nonsymmetrical bending of skin-stringer cross section. Shear lag effect. Bending of composite beam.

Credits: 1.00

AAE 36400 - Control System Analysis

Credit Hours: 3.00. Modeling and analysis of dynamical systems with aerospace applications. Laplace transforms, transfer functions, block diagrams. Transient and steady-state response of dynamical systems. Root Locus, Bode, Nyquist methods for control systems analysis. Introduction to controller design.

Credits: 3.00

AAE 36401 - Control Systems Laboratory

Credit Hours: 1.00. Enhance student awareness of control systems by providing hands-on experience using dynamic systems representative of air and space vehicles. Design of a control system from start to finish by mapping requirements into control solutions through the process of modeling, identification, and controller design (PID and Lead-Lag).

Credits: 1.00

AAE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

AAE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

AAE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

AAE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AAE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in aeronautics and astronautics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

AAE 40000 - Undergraduate Senior Seminar

Credit Hours: 1.00. A lecture-demonstration series emphasizing evaluation of career options, identification and development of professional skills. Example of career-related topics include choosing a job, and post graduate education in engineering or other disciplines. Examples of professional skills topics covered include interviewing, writing, and ethics. Assessment of student achievement of AAE program learning outcomes.

Learning Outcomes: 1. Learn how to get a job 2. Learn how to get into graduate school (and why) 3. Learn how to succeed in the workplace 4. Learn about current events in Aerospace Engineering Credits: 1.00

AAE 41200 - Introduction To Computational Fluid Dynamics

Credit Hours: 3.00. Introductory course in the formulation and application of finite difference methods for solving fluid flow problems. Classification of partial differential equations and formulation of well-posed problems. Discrete approximation of partial differential equations: stability, consistency, and convergence. Finite-volume formulations. Survey of methods for solving hyperbolic, elliptic, and parabolic problems. Formulation of discrete boundary conditions. Application of methods to one- and two-dimensional flow problems.

Credits: 3.00

AAE 41600 - Viscous Flows

Credit Hours: 3.00. Navier-Stokes equations, boundary layer theory, frictional drag and heating, separation and transition. Turbulent flows. Computational methods for laminar and turbulent flows.

Credits: 3.00

AAE 41800 - Zero-Gravity Flight Experiment

Credit Hours: 3.00. Team-based design-build-test engineering experience to maximize the benefits of student participation in the NASA Reduced Gravity Student Flight Opportunity Program (or similar). Gravity, orbits, and weightlessness. Low-gravity capillary fluid physics, scaling laws, and components. Experiment design for multiple short zero gravity test times. Technical proposal writing, design for manufacturability, experiment fabrication, planning, testing, and execution.

Credits: 3.00

AAE 42100 - Flight Dynamics And Control

Credit Hours: 3.00. Flight vehicle rigid-body equations of motion; linearization via small perturbation techniques. Trim analysis, static and dynamic stability, aerodynamic stability derivatives and control effectiveness. Vehicle transfer functions, stability augmentation, aircraft handling qualities. Introduction to flexible vehicle effects.

Credits: 3.00

AAE 43200 - Orbital Analysis

Credit Hours: 3.00. The design and operation of spacecraft is a multidisciplinary endeavor covering many aspects of engineering. This course introduces the physics of the orbits and the space environment near the Earth as well as mission trajectory analysis including constraints, launch windows, ground tracks, some communications and tracking, some constellations, relative motion and contingencies.

Learning Outcomes: 1. Apply basic technical knowledge about spacecraft trajectory and architecture requirements. 2. Understand the physics and demonstrate intuition behind motion in space. 3. Design and characterize orbits. 4. Define launch geometry, time windows, and maneuvers to reach the operative orbits. 5. Retrieve orbital information from ground tracks and characterize spacecraft visibility from ground. Credits: 3.00

AAE 43800 - Air-Breathing Propulsion

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of propulsion systems for air-breathing aerospace vehicles. Ramjet, turbojet, turbofan and turboprop cycle analysis. Propeller analysis and design. Analysis of flow through inlets, combustors, nozzles, compressors, and turbines. Component matching. Not open to students with credit in ME 43800.

Learning Outcomes: 1. Determine the thrust and fuel consumption of gas turbine and turboprop engines. 2. Understand advantages/disadvantages of turbojet, turboprop, turbofan, and ramjet air-breathing propulsion systems. 3. Understand the thermodynamics of the Brayton cycle and how they contribute to overall propulsion system performance. 4. Understand the role and fundamental performance of gas turbine components. 5. Determine the basic performance and/or design of axial turbines and compressors. 6. Determine the basic performance of air breathing combustors.
Credits: 3.00

AAE 43900 - Rocket Propulsion

Credit Hours: 3.00. Flight mechanics and the propulsion system requirements for terrestrial and interplanetary flight. Converging-diverging nozzle analysis and design. Thermochemistry of propellants and performance calculations. Solid rocket motor interior ballistics and design. Thrust chamber and turbo machinery analysis and design. Liquid rocket engine cycle analysis and design. Elements of nuclear and electric propulsion systems.

Learning Outcomes: 1. Determine the thrust and fuel consumption of gas turbine and turbo prop engines. 2. Understand advantages/disadvantages of turbojet, turboprop, turbofan, and ramjet air-breathing propulsion systems. 3. Understand the thermodynamics of the Brayton cycle and how they contribute to overall propulsion system performance. 4. Understand the role and

fundamental performance of gas turbine components. 5. Determine the basic performance and/or design of axial turbines and compressors. 6. Determine the basic performance of air-breathing combustors. Credits: 3.00

AAE 44000 - Spacecraft Attitude Dynamics

Credit Hours: 3.00. Description of orientation, angular velocity, and angular acceleration in terms of direction cosines, Euler parameters, and angles. Forces and moments acting on space vehicles. Attitude stability of various types of satellites in circular and elliptic orbits. Spin stabilization and gravity gradient torques. Gyroscopic devices and energy dissipation. Introduction to attitude control.

Credits: 3.00

AAE 45000 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the aerospace curriculum. Components include analysis methods for preliminary design, development of an initial vehicle concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with spacecraft, rocket and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Demonstrate design viability through testing, both real and virtual. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

AAE 45100 - Aircraft Design

Credit Hours: 3.00. Senior students perform a team-based aircraft design, requiring application of the education and skills developed in the aerospace curriculum. Aircraft mission requirements include engine cycle selection and airframe/engine integration, performance, stability and control, structures, human factors, avionics, sensors, and manufacturing processes. The teams present oral and written reports on their designs.

Learning Outcomes: 1. Deepen your knowledge of topics relevant to aircraft design. 2. Identify and formulate the design requirements for an aircraft. 3. Conduct a set of trade studies to make decisions about the aircraft design. 4. Describe an aircraft design that is likely to meet the set of requirements. 5. Use modern engineering tools to complete the design process. 6. Apply engineering knowledge and skills acquired in previous classes to the design problem. 7. Solve problems as part of a team. Credits: 3.00

AAE 45400 - Design Of Aerospace Structures

Credit Hours: 3.00. Design/failure criteria for aerospace structures, materials selection, introduction to manufacturing methods, structural assemblies, component details, concurrent engineering, and interdisciplinary design teams.

Credits: 3.00

AAE 49000 - Special Problems In Aeronautical Engineering

Credit Hours: 0.00 to 18.00. Hours and credit to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

AAE 49700 - Independent Study In Aerospace Engineering

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest outside the scope of the standard undergraduate curriculum. Interested students seek a faculty advisor in their area of special interest and together prepare a brief description of the work to be undertaken. Permission of instructor required.

Credits: 0.00 to 6.00

Department of Agricultural and Biological Engineering

All information is available at the main department:

Department of Agricultural and Biological Engineering

Weldon School of Biomedical Engineering

Biomedical Engineering

Students in the Weldon School of Biomedical Engineering learn to apply tools from engineering and life sciences to design solutions for challenges in human biology, medicine, and healthcare delivery.
Biomedical Engineering students complete coursework in math, physics, chemistry and the life science in combination with engineering principles and design courses to understand the physical and chemical properties of human tissues, computational modeling and analyses of biomedical data, molecular transport, biomechanics, human physiology, and biomedical systems and instrumentation. Essential experiential and practical training includes small group problem-based and inquiry-based learning, study abroad programs, internships with a broad range of medically related companies, research in faculty labs, and engineering design projects to solve real medical needs.
The home of the Weldon School of Biomedical Engineering is the Martin C. Jischke Hall of Biomedical Engineering (MJIS), a $25M, 91,000 sq. ft. facility opened in 2006. This state-of-the-art building is specifically designed to enhance both teaching and research. In 2019, an $18M, 30,000 sq. ft. Innovation Wing was added to support the continued growth of biomedical engineering in the 21st century.
Programs of focus and faculty expertise include imaging, instrumentation, engineered biomaterials and biomechanics, and quantitative cellular and systems engineering.

Faculty

https://engineering.purdue.edu/BME/People

Contact Information

Weldon School of Biomedical Engineering
Purdue University
206 S. Martin Jischke Drive
West Lafayette, IN 47907-2032
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Weldon BME Undergraduate Program
BME Undergraduate Webpage
WeldonBMEUndergrad@purdue.edu

Graduate Information

For Graduate Information please see Biomedical Engineering Graduate Program Information .

Biomedical Engineering, BSBME

BME 19500 - Selected Topics In Biomedical Engineering

Credit Hours: 0.00 to 4.00. Specialized topic areas in BME for which there are not specific courses, workshops, or individual study plans, but having sufficient student interest to justify the formalized teaching of a course.

Learning Outcomes: 1. Students will gain knowledge of topics relevant to the practice and research in Biomedical Engineering. Credits: 0.00 to 4.00

BME 20200 - Thermodynamics In Biomedical Engineering

Credit Hours: 3.00. The major objective for this course is to understand and exploit basic principles of thermodynamics as they apply to biological systems and biological processes.

Specifically, the course will focus on biological processes across scales: from the nanometer scale of biomolecules, the micrometer scale of cells, the millimeter and meter scales of tissues and organisms, all the way up to the 100+ meter scale for bioprocess equipment and industry-scale production with a focus on dynamic behaviors of systems. The course can be loosely classified into two parts: (i) guiding principles and fundamental equations for thermodynamics in biological and biomedical engineering, and (ii) applications of engineering principles to the study of biological systems.

Learning Outcomes: 1. Understand basic principles of Mass, Energy, and Entropy balance equations that describe thermodynamic processes. (SO 1, 6, 7) 2. Apply the following concepts to solve problems in the biological engineering and biomedical engineering disciplines: First & Second Law of Thermodynamics; Open vs closed systems; Balances of mass, heat, work, and entropy/energy flow; Reversibility/irreversibility. (SO 1, 6, 7) 3. Gain knowledge of main factors that determine numerical values of physical-chemical properties associated with bioprocesses. (SO 7) 4. Solve problems for thermodynamic processes using the computer. (SO 1, 2, 5, 7) 5. Develop the attitudinal dimensions of computational thinking: Confidence in dealing with complexity; Persistence in working with difficult problems; Tolerance for ambiguity; The ability to deal with open-ended problems; The ability to communicate and work with others to achieve a common goal or solution. (SO 2) 6. Gain experience in working with non-linear systems and systems away from equilibrium. (SO 1, 6) Credits: 3.00

BME 21400 - Introduction To Biomechanical Analysis

Credit Hours: 3.00. The goal of this course is to provide a foundation in biomechanics (analysis of forces, moments, and stresses) that will allow students to quantify the loads in the skeleton as well as design surgical tools and total joint replacements. In addition to the topics on vectors, particle equilibrium, and rigid body mechanics one would expect in a classical mechanics course, biomedical engineers must also have a working knowledge of skeletal anatomy. Consequently, anatomical descriptions and anthropometric data will be incorporated throughout the course. As part of the implant design, students will also be introduced to more advanced topics in mechanics such as Hertz contact theory, shear-lag theory, and composite beam theory.

Learning Outcomes: 1. Understand particle statics, rigid body statics, and the mechanics of deformable solids and their applications to problems in orthopedics. 2. Analyze selected biomechanical systems and measurements at a range of biologically relevant length scales. 3. Evaluate quality and reliability of assumptions and methods used in selected biomechanics applications. Credits: 3.00

BME 21401 - Biomechanical Analysis Laboratory

Credit Hours: 1.00. This course provides hands-on training in engineering and biological principles of biomechanics. Topics include translation of theoretical vector and equilibrium calculations to three-dimensional body problems, computer aided design and finite element analysis, harvest and storage of biological samples, and tension, compression and bending testing with mechanical testers. A design project reinforces the mechanical testing skills learned in class, combining skill-building in group work and experimental design. This course will prepare students for deeper study of biomechanics.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. 2. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (SO 4). 3. Implement the experimental design process, including proper maintenance of a design laboratory notebook and use of appropriate statistical analysis methods, as it applies to mechanical performance of materials used for medical device design (SO 6). 4. Employ fundamental tools, testing procedures,

and analyses relevant to computer-assisted design (CAD), FEA, and biomechanics, for rapid prototype development, analysis of mechanical properties of tissues, materials, and devices (SO 7). 5. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 1.00

BME 22000 - Biomolecules: Structure, Function, And Engineering Applications

Credit Hours: 3.00. Classes of molecules (biomolecules) such as sugars, lipids, proteins, and nucleic acids that form the cellular components of living organisms. Explores the chemistry behind the structure and function of these important classes of biological molecules. Hydrogen-bonding, hydrophobic forces, electrostatic interactions along with other weak interactions discussed with reference to their importance in biomolecular systems in an engineering context.

Learning Outcomes: 1. Describe the importance of regulatory guidance documents and voluntary consensus standards as they relate to the design, development, and testing of new therapeutic and diagnostic devices. Credits: 3.00

BME 22201 - Introductory Biomeasurements

Credit Hours: 3.00. The foundations of basic circuit theory are introduced including voltage-current characteristics of resistive and reactive elements, Ohm's and Kirchhoff's Laws, equivalent sources, transformations and superposition, transient response, instantaneous and average power, AC impedance, dynamic response of first and second order systems. Permission of department required.

Credits: 3.00

BME 22400 - Biomeasurements Lab

Credit Hours: 1.00. Laboratory exercises will reinforce the foundations of basic circuit theory. Electronic instruments are used in the context of biomedical signal measurement and processing and include the use of oscilloscopes, function generators, transducers, electrodes, biopotential amplifiers and digital data collection and analysis. Laboratory exercises utilize industrially relevant instruments for measurement and acquisition of time varying signals arising from electronic and bioelectric sources. Permission of department required.

Credits: 1.00

BME 23100 - Bioinstrumentation and Circuit Theory

Credit Hours: 3.00. In this course, we'll delve into the core principles of circuit theory, covering topics such as voltage-current relationships in resistive and reactive components, Ohm's Law, Kirchhoff's Laws, and source equivalency. We will also explore advanced concepts like transient responses, AC impedance, and the dynamic behavior of first and second-order systems. Students will gain proficiency in phasor analysis of sinusoidal signals, complex number calculations, signal sampling, and spectral analysis. We'll also touch on linear time-invariant systems, frequency response, and both the design and implementation of filters. A portion of the course will focus on control systems via the s-domain. To enrich your understanding and skill set, we will also introduce programming through Python, which will facilitate data processing and deepen your conceptual grasp. This course serves as a preparatory steppingstone for BME 33000 (Bioelectricity), equipping you with the essential physics knowledge and skills required for more advanced studies.

Learning Outcomes: 1. Reflect on your knowledge and experiences that contribute to your understanding of what it means to be an engineer. Credits: 3.00

BME 23101 - Bioinstrumentation and Circuit Theory Lab

Credit Hours: 1.00. Introduction of laboratory instruments used to measure physiological events. Stimulation and conduction of electric signals within the mammalian nervous system and other excitable tissues are demonstrated. Fundamental circuit elements and concepts include resistance, capacitance, inductance, op-amps, impedance, voltage, current, power, and frequency, following the content introduced in BME 231. Fundamental analog measurement concepts include adequate bandwidth and amplitude and phase linearity. Integrative design project emphasizes the practical aspects of quantitative physiological measurements. This course is to prepare learners with sufficient physics knowledge and lab skills to pursue the Bioinstrumentation and Imaging Depth Areas. Moreover, students are introduced to programming (using Python) to deepen the understanding of basic concepts and learn basic skills in data processing. SPICE software will be used throughout the course to design/simulate various analog circuits.

Learning Outcomes: 1. Appraise the validity of established bioelectricity hypotheses and circuit models based on quantitative physiological measurements. 2. Document procedures,

measurements, and subsequent data analysis in clear and cohesive laboratory reports. 3. Design an analog bioinstrumentation measurement system meeting prescribed specifications to accurately record a physiological event. 4. Design and simulate analog circuits using SPICE. 5. Create simple Python code to plot, analyze, and denoise physiological data. Build functions to simulate a simple bioinstrumentation system. 6. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. Credits: 1.00

BME 24101 - Introductory Biomechanics

Credit Hours: 3.00. This course uses didactic lecture material to introduce students to the principles of mechanics and how these concepts apply to musculoskeletal tissues. Permission of department required.

Credits: 3.00

BME 24300 - Biomechanics Laboratory

Credit Hours: 1.00. This course uses laboratory experiments to introduce students to the principles of mechanics and how these concepts apply to musculoskeletal tissues. Permission of department required.

Credits: 1.00

BME 25600 - Physiological Modeling In Human Health

Credit Hours: 3.00. Introduction to the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. Engineering skills taught and practiced within the context of human disease, injury, and illness on extended problem sets which include mathematical modeling and problem solving with appropriate documentation. Main physiological systems of focus are cardiovascular, pulmonary, and renal, and common afflictions thereof.

Learning Outcomes: 1. Understand the physiology and medicine underlying practical problems in biomedical engineering, especially with respect to medical device development. 2. Understand the process of mathematical modeling of human anatomy and physiology, including technical description of objectives, methods, results, and conclusions from modeling exercises. Credits: 3.00

BME 28000 - Frontiers In Biomedical Engineering

Credit Hours: 1.00. This course introduces the rapidly emerging field of biomedical engineering by exposing students to a wide range of research activities in the Weldon School and to a variety of experiential learning opportunities. Topics addressed include career paths, professional development opportunities, and career development skills including creating a plan of study, informational and job interviewing, writing a resume, technical writing, preparing effective oral presentations, and peer-editing.

Learning Outcomes: 1. Construct a logical and articulate argument in written format from independent collection of information. 2. Construct and deliver a logical and articulate oral presentation based on independent collection of information. 3. Evaluate oral and/or written presentations for clarity and content. 4. Identify and/or describe how biomedical engineering solutions affect society 5. Identify multiple career pathways that are available to a biomedical engineer. 6. Recognize opportunities that enhance professional career development. 7. Recognize contemporary issues impacting biomedical engineering. Credits: 1.00

BME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 29500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

BME 29600 - Biomedical Engineering Projects

Credit Hours: 1.00 to 4.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report is required. Permission of instructor required.

Credits: 1.00 to 4.00

BME 30200 - Professional Development And Design In Biomedical Engineering

Credit Hours: 2.00. This course explores design, career, and professional topics in Biomedical Engineering. To prepare students for capstone and engineering practice, students will engage in case study design encompassing conceptualization, requirements generation and system design. Essential design elements such as user need, ideation, constraints, regulatory, and documentation will be reviewed and applied. Additional career and professional topics include resume writing, interviewing, and professional conduct; post-graduate education and life-long learning; and industrial, clinical, and research opportunities in Biomedical Engineering.

Credits: 2.00

BME 31300 - Biofluid Mechanics

Credit Hours: 3.00. Fundamental concepts and principles of fluid mechanics in the context of biomedical applications. Governing equations of flow and transport are derived from the first principles and applied to conditions characteristic of the human circulatory system.

Learning Outcomes: 1. Formulate differential equations and determine appropriate boundary conditions to model biomedical fluid mechanics problems. 2. Apply conservation laws of flow physics to describe the fluid flow in various geometries, particularly for flow in a cylindrical tube. 3. Recognize and quantitatively describe flow conditions characteristic of blood flow in human circulation in health and disease. Credits: 3.00

BME 31400 - Experimental Methods In Biomechanics

Credit Hours: 3.00. This course focuses on the concepts and applications of mechanics, imaging, and instrumentation methods towards evaluating experimental biomechanics at multiple length scales. Core concepts include mechanics of materials, dynamics, contact theory, and the simplifying assumptions and standardizations often needed to conduct experiments on biomaterials and living systems. Experimental methods may include atomic force microscopy, digital image correlation, and motion analysis.

Learning Outcomes: 1. Understand solid mechanics and dynamics principles and concepts underlying experimental methods. 2. Apply mathematical equations and underlying assumptions of biomechanics to experimental methods. 3. Analyze selected biomechanical systems and measurements across a range of relevant length scales. 4. Evaluate quality and reliability of assumptions and methods used in selected biomechanics applications. Credits: 3.00

BME 32000 - Introduction To Biomaterials Science And Engineering

Credit Hours: 3.00. This junior-level course will introduce fundamental materials science and biomaterial concepts to BME students and will lay the foundation for more advanced courses in biomaterials and tissue engineering. The course will introduce the vocabulary and technical concepts in biomaterials science relevant for problems in medical device, biotechnology, or biomaterials industries. The course material will present phenomena at the intersection of materials science and biology.

Learning Outcomes: 1. Identify the basic classes of biomaterials and understand their chemical makeup. 2. Understand the relationship between chemical structure and biomaterial properties. 3. Understand interactions of implantable biomaterials with proteins and cells. 4. Describe the major components of the biological response to implanted materials. 5. Select basic in vitro and in vivo tests to evaluate material biocompatibility. 6. Understand regulations and standards that dictate biomaterial testing. Credits: 3.00

BME 32001 - Biomolecules And Biomaterials Laboratory

Credit Hours: 1.00. Introductory laboratory experience focused on engineering concepts and practices in the analysis of biomolecules and cells. Topics include fundamental quantitative techniques of analysis, methods of isolation, identification, and quantification of biomolecules and cells, and analysis of integrated biosystems. Concludes with student-driven design project.

Learning Outcomes: 1. Independently describe the theoretical basis of, and put into practice, fundamental analytical tools and techniques used in the isolation, characterization, and quantification of biomolecules and cells. 2. Collect, record, process, statistically analyze and report experimental data related to the analysis of biomolecules and cells in an accurate and understandable manner. 3. Conceptually design a simple analytical method and/or tool for solving a medically-relevant problem based upon detection/analysis of a specific biomolecular or cellular related abnormality. Credits: 1.00

BME 32200 - Probability, Statistics, And Applications In Biomedical Engineering

Credit Hours: 3.00. Probability theory and statistical methods are developed for life science applications. Analytical tools such as hypothesis testing, estimation of moments, sampling theory, correlation and spectral analysis are developed and applied to identifying underlying processes in biological systems, developing realistic models of physiological processes, designing experiments, and interpreting biological data.

Learning Outcomes: 1. Solve probability problems with biomedical engineering applications using the basic axioms of probability (1). 2. Describe the fundamental properties of probability density functions with applications to single and multivariate random variables (1,6). 3. Describe the functional characteristics of probability density function frequently encountered in life-science research such as the Binomial, Uniform, Gaussian, and Poisson (1,6). 4. Calculate confidence intervals and levels of statistical significance using fundamental measures of expectation and variance for a given biological data set (6). 5. Quantify the correlation between sets of random processes for given mathematical functions and biological data sets (1,6). 6. Identify the distribution function underlying a given biological process or medical application (1,6). 7. Model and describe behavior of biological systems by means of random processes (1,3). 8. Apply basic statistical concepts including descriptive statistics, Bayes Theorem, statistical inference, and hypothesis testing to biological and medical systems (1). 9. Design a statistical experiment using appropriate control and test conditions (1,6). 10. Apply statistical tools (e.g. Student's t-test) to interpret experimental results (1,6). 11. Apply statistics testing to the evaluation and acceptance of medical

processes, devices, and systems (1). Credits: 3.00

BME 33000 - Bioelectricity

Credit Hours: 3.00. Fundamentals of bioelectricity of the mammalian nervous system and other excitable tissues. Passive and active forms of electric signals in both the single cell and cell-cell communication, tissue and systematic bioelectricity, mathematical analysis including Nernst equation, Goldman equation, linear cable theory, and Hodgkin-Huxley Model of action potential generation and propagation.

Learning Outcomes: 1. Examine, describe, and solve membrane models underlying bioelectrical function and physiology. This includes but is not limited to ion-channel dynamics, membrane filtering, sub-threshold signaling, action-potential generation and propagation, chemical signaling, and basic neural circuit dynamics. 2. Formulate and appreciate the intricate similarities between silicon circuits and biological circuits. Specifically, by interfacing the two in simple recording and stimulation experiments. Furthermore, this objective will also introduce the students to instrumentation techniques to map currents and voltages from cells. 3. Solidify basic quantitative techniques in solving bioelectrical dynamics. This includes but is not limited to the use of ODE's and PDE's in solving signal propagation, Hodgkin-Huxley dynamics, and neural circuit dynamics. Overall, this will provide a sound theoretical framework to begin exploring electrophysiological devices with biomedical engineering applications.

Credits: 3.00

BME 33100 - Biosignals And Systems

Credit Hours: 3.00. This course applies mathematical analysis tools to biological signals and systems. Frequency analysis, Fourier and Laplace transforms, and state equations are used to represent and analyze continuous and discrete-time biosignals. Classic feedback analysis tools are applied to biological systems that rely on negative feedback for control and homeostasis.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Write correctly and clearly in forms and styles appropriate for communications professions and audiences.

Credits: 3.00

BME 33400 - Biomedical Computing

Credit Hours: 3.00. This course explores computational approaches to analyzing biological data and solving biological problems. Students will fit and interpret biological data, apply probabilistic and differential equation modeling techniques to biological processes, and assess numerical tools for biomedical applications. Special attention is given to the built-in analysis functions of MATLAB.

Credits: 3.00

BME 35200 - Cell And Tissue Mechanics

Credit Hours: 3.00. This course will explore the biological principles of cellular/tissue behaviors and properties. Topics include: fundamental concepts of cellular structure and tissue organization, biomolecular elements and their properties, cell shape, cell adhesion and migration, mechanotransduction, pattern formation in embryos, and stem cell and tissue regeneration.

Credits: 3.00

BME 35400 - Cell And Tissue Laboratory

Credit Hours: 1.00. This course develops quantitative biomechanical methods to analyze cell/tissue behavior and properties and to solve biomechanical engineering problems. Topics include: bio viscoelasticity, failure, filament dynamics, membrane dynamics, biofluid dynamics, cellular dynamics, and tissue dynamics.

Credits: 1.00

BME 35600 - Mathematical Models And Methods In Physiology

Credit Hours: 3.00. This course uses real-world engineering problems to introduce advanced analytical tools and concepts

relevant to biomedical engineering design. Each topic is briefly introduced, and students work in small teams to investigate physical mechanisms involving human anatomy and physiology using mathematical models and methods. Group work is done during scheduled class periods and other times by arrangement. Topics include brain concussions and protective helmets, origin of the electrocardiogram and bi-ventricular pacing, and deep brain stimulation for Parkinson's disease. Mathematical methods include coupled linear and nonlinear differential equations, finite element analysis, and simulated annealing. Creation of custom computer code is required. Students prepare extensive and detailed written technical reports. A midterm and a final examination encourage individual accountability and understanding.

Learning Outcomes: 1. Accurately describe, with proper use and pronunciation of medical terms, the anatomy of a selected body organ or system, and a related disease process after independently conducting research using resources from various sources including the Internet. 2. Create a useful biomechanical model of a body organ or tissue, describing the function of the body organ system in terms of algebra, calculus, and/or governing differential equations, evaluating constants in mathematical models on the basis standard normal physiology and routine medical observations. 3. Write full length technical research progress reports and discuss the strengths and limitations of a particular mathematical model, with graphs and charts and a comprehensive bibliography of relevant research literature. 4. Correctly solve equations, including second order, linear differential equations, and systems of equations, including coupled linear or nonlinear differential equations, by the method of undetermined coefficients, via programming in MATLAB or a suitable computational engine including the use of arrays and subroutines. 5. Effectively work in diverse teams, both face-to-face and online, to enhance productivity and eliminate errors, while reconciling theoretical calculations with experimental observations and validating mathematical models by comparison with known analytical solutions. Credits: 3.00

BME 35700 - Foundations Of Biomedical Data Science

Credit Hours: 3.00. This course presents foundational data science methods for analysis of complex biological datasets encountered in biomedical engineering research and applications. After a brief (1-2 weeks) introduction and review of mathematical concepts necessary for data science, the course will cover representative areas of regression, supervised machine learning, unsupervised machine learning, model evaluation, and uncertainty quantification. Assignments and exams will focus on practical examples spanning basic science, engineering, and medical applications.

Learning Outcomes: 1. Identify the appropriate statistical tests to analyze data fitting a given probability distribution. 2. Propose an analysis plan for large datasets that tests a hypothesis or answers an exploratory analysis question. 3. Implement the appropriate computational model for their analysis plan and interpret the model results with appropriate consideration of uncertainty. Credits: 3.00

BME 36000 - Introduction To Biomedical Imaging

Credit Hours: 3.00. The main focus of this course is on basic principles and modes of major bioimaging modalities. This course covers image characterization, interactions of electromagnetic radiation with tissue, fundamental principles in imaging and detection, and modes of imaging modalities (e.g., reflection, transmission, absorption, and emission). Conventional bioimaging modalities will be used to teach the topics. This course is particularly aimed at students in science and engineering interested in gaining a conceptual understanding of several critical biological and biomedical imaging methods, including optical microscopy, ultrasound, X-ray imaging, computed tomography, nuclear medicine, magnetic resonance imaging, and mobile health. Overall, this course provides a conceptual framework for biomedical imaging in a reasonably concise and understandable format (with minimal mathematical approaches).

Learning Outcomes: 1. Explain the principles of conventional Bioimaging modalities. 2. Distinguish advantages and disadvantages of each modality. 3. Describe utilizations of imaging in biological and medical fields. 4. Determine appropriate bioimaging methods for particular studies and applications. Credits: 3.00

BME 38000 - Professionalization In Biomedical Engineering

Credit Hours: 2.00. This active learning course covers standards of practice, regulatory and legal requirements, and moral and ethical issues; increases awareness of career paths; and addresses current and emerging trends and challenges at the frontiers of the field of biomedical engineering. Most class sessions will consist of a short introduction to a topic followed by a breakout session for active investigation of the topic. During the breakout sessions, course instructors will be available to guide discussion and answer questions.

Learning Outcomes: 1. Recognize and describe professional and ethical codes of conduct, and ethical dilemmas which pertain to a practicing biomedical engineer. 2. Use basic technical writing skills to clearly and concisely synthesize relevant technical information, data, and ideas from multiple sources. 3. Generate personal statements, curriculum vitae and other professional documents that are used in choses career pathways that are available to biomedical engineers. 4. Describe contemporary issues in biomedical engineering and understand their impact on personal and public health. 5. Identify skills and opportunities that enhance professional career development. Credits: 2.00

BME 38100 - Implantable Materials And Biological Response

Credit Hours: 3.00. BME 381 combines biomaterials, their biological response, and interactions between implantable materials and biological systems. Materials science of implantable materials; overview of implantable biomaterials and interactions between implants and biosystem; in vitro and in vivo biocompatibility tests; and specific examples on implant-tissue interactions, biocompatibility, and evaluation tools are presented.

Credits: 3.00

BME 38300 - Implantable Materials Laboratory

Credit Hours: 1.00. BME 38300 is a corequisite course to BME 38100, supplementing the basic science of BME 38100 with quantitative, analytical examples and problems related to fundamental engineering principles in implantable materials. Topics include: microstructure, phase transformation, processing and design issues related to major engineering materials used for implantation purposes.

Credits: 1.00

BME 38800 - Applied Biomaterials

Credit Hours: 3.00. This course covers foundational knowledge in the fields of materials science and engineering. Emphasis is placed on the materials used in biomedical applications and the relationship between material properties and the performance of these biomaterials.

Learning Outcomes: 1. Describe the structure-function relationship between chemical and bulk properties of materials. 2. Provide examples of biomedical applications for different classes of materials. 3. Identify material properties that are critical for the proper function of metallic, polymeric, ceramic, and composite biomaterials. 4. Interpret phase diagrams for single- and multiple-component materials. 5. Describe corrosion of metals and degradation of polymers and identify the possible consequences of each. 6. Select appropriate biomaterials for specific applications, considering function, biocompatibility, and relevant engineering constraints. 7. Propose appropriate processing techniques for improving material properties for specific biomaterial applications. 8. Identify the important biomaterial design criteria for specific biomedical applications. 9. Communicate effectively, both in oral and written formats, with regards to biomaterials science and engineering. Credits: 3.00

BME 38900 - Junior Experimental Design Laboratory

Credit Hours: 2.00. Practical experience with engineering design principles is presented through inquiry-based modules. Each module contains computer simulation, experimental design, implementation, and data analysis. Modules address biomedical applications in different areas of BME.

Learning Outcomes: 1. Use theoretical equations from fluid, heat, and mass transport to describe, model, analyze, and explain

biomedical data. 2. Design experiments to investigate biomedical transport phenomena, collect relevant data, and compile a comprehensive report that clearly demonstrates the findings and implications of the data. 3. Work in a term to simulate and experimentally model biomedical transport, and use peer-and self-reviews to describe how each team member contributed to group efforts. Credits: 2.00

BME 39000 - Professional Development And Design In Biomedical Engineering

Credit Hours: 2.00. Introduction to a diverse spectrum of current topics relevant to the technical, professional, and career aspects of Biomedical Engineers. The course topics will focus on the early stages of the design process (e.g. need identification, problem formulation, innovation and idea generation), professional communication skills (e.g. written and oral reporting and documentation), and ethics of biomedical design and research (e.g. ethical codes and decision making, animal care and use in research and testing, authorship and intellectual property, social and environmental impact of design).

Learning Outcomes: 1. Able to identify medical needs relevant to Biomedical Engineering solutions, an understanding of realistic constraints which impact biomedical engineering design 2. Understand ethical and professional responsibilities which impact design 3. Understand the need for a multidisciplinary team to solve biomedical engineering design projects. 4. Able to independently acquire knowledge from a variety of sources including biology and medicine as well as other engineering disciplines. 5. Able to communicate effectively in written form and evaluate written reports 6. Able to identify a career development pathway that is relevant to their personal identity and training as Biomedical Engineers. Credits: 2.00

BME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

BME 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in biomedical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BME 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

BME 40100 - Mathematical & Computational Analysis Of Complex System Dynamics In Biology, Medicine, & Healthcare

Credit Hours: 3.00. An introduction to analysis of complex system dynamics that appear in biology, medicine, and healthcare. Key topics include nonlinear dynamical concepts associated with phase plane, bifurcation, stability diagram, oscillation, and chaotic systems along with concepts from discrete systems and stochastic processes. These topics are taught within the context of mathematical and computational models related to both non-communicable diseases (i.e. cancer) and communicable diseases (i.e. HIV/AIDS). Courses projects are drawn from recent literature.

Learning Outcomes: 1. Graphically, analytically, and numerically analyze nonlinear dynamical models and numerically analyze discrete-event and stochastic models of biological, medical, or healthcare systems. 2. Describe possible behaviors of a given system, including how a system may be manipulated within the inherent boundaries. 3. Present, in oral and written format, an analysis and critique of the application of dynamical modeling of a biological system to solve or understand an engineering problem. Credits: 3.00

BME 40500 - Biomedical Engineering Design Project

Credit Hours: 4.00. Design and management of biomedical engineering projects. Teams design and implement a solution to a biomedical engineering problem utilizing skills gained in previous course work. Oral and written presentation of design and demonstration of function are required.

Credits: 4.00

BME 41100 - Quantitative Physiology

Credit Hours: 3.00. This course applies systems theory and explores feed forward and feedback control in the context of physiological systems. Control, frequency response, and linear systems concepts are applied to action potential generation, motor control, heart rate regulation, and other physiological processes.

Credits: 3.00

BME 41101 - Quantitative Physiology In Biomedical Engineering

Credit Hours: 4.00. This course is an introductory course in physiological systems and an introductory course in classical feedback control theory for biomedical engineers. It aims to apply systems theory and classical feedforward and feedback control in the context of physiological. Control, frequency response, and linear systems concepts are applied to action potential generation, motor control, heart rate regulation, and other physiological processes. Approximately a third of the course will be devoted to physiological systems, a third to classical control theory and a third to the application of classical control and systems theory to physiological systems.

Learning Outcomes: 1. Describe major physiological features the neuromuscular, cardiac, pulmonary, and renal systems. 2. Analyze, reduce and implement a dynamic in-silico model of a Plant (standard engineering systems and physiological systems) using linear systems theory descriptors in the frequency and state-space domains. 3. Analyze the characteristics of the linearized Plant model and design a classical feedback controller . 4. Define specifications of the normal operation of a system in nominal operation. 5. Analyze the system stability of a Plant. 6. Analyze frequency response and construct Bode plots. 7. Work in teams to understand and implement a model of a physiological system. 8. Group project work and reporting. Credits: 4.00

BME 41400 - Computational Mechanics In Biomedical Engineering

Credit Hours: 3.00. Teaches modeling methods for biomedical engineering problems with focus on fluid/solid mechanics. Students are introduced to the most common numerical techniques in biomedical engineering and will learn the applications of these techniques to biomechanical problems at various length scales, such as cardiac contraction and blood flow. The first half of this course focuses on modeling based on ordinary differential equation (ODE) and partial differential equation (PDE) as well as on how we integrate these equations analytically or numerically using software packages such as MATLAB. The other half focuses on fundamentals of fluid/solid mechanics and also on the application of COMSOL or similar software to solving relevant biomechanical problems.

Learning Outcomes: 1. Solve biomechanical problems involved with physical situations of real biomedical systems by formulating ordinary and partial differential equations and solving the equations via MATLAB. 2. Investigate complicated fluid flows observed in biomedical systems by applying knowledge in fluid mechanics and using COMSOL. 3. Analyze stress and strain of biomedical materials by applying continuum mechanics and using COMSOL. Credits: 3.00

BME 43000 - Introduction To Bioimaging

Credit Hours: 3.00. Provides a conceptual framework for understanding the theory and technical principles behind major Bioimaging modalities. The main focus is on basic principles and modes of imaging involving interactions of electromagnetic radiation with biological tissue. Main concepts include imaging and detection, modes of imaging modalities (e.g. reflection, transmission, absorption, and emission), and basic image characterizations. Applications include several critical biological and biomedical imaging methods, such as optical microscopy, ultrasound, X-ray imaging, computed tomography, positron emission tomography, and magnetic resonance imaging. Demonstrations of conventional Bioimaging modalities are used to teach the topics.

Credits: 3.00

BME 43100 - Neural Engineering

Credit Hours: 3.00. An introduction to Neural Engineering - an emerging field of developing and applying engineering solutions to research or translational problems concerning the brain. The course will cover a broad range of topics about neural sensing, modeling, stimulation, interface, and prosthetics. Course projects are drawn from real-world problems and experimental data.

Learning Outcomes: 1. Analyze neural signals in various spatial and temporal scales. 2. Examine relationships between neural activity and sensation/behavior. 3. Identify existing ways and mechanisms to modulate neural circuit functions. 4. Identify existing applications of neural prosthetics, implants, and robotics. 5. Identify, formulate, and solve engineering problems in brain research. 6. Apply knowledge of mathematics, science and engineering to neural data. Credits: 3.00

BME 44200 - Biofluid Mechanics

Credit Hours: 3.00. This course explores fluid mechanics in the context of the human circulatory system. Principal equations are derived from differential analysis of fluid flow, and models of characteristic flow conditions are fully analyzed. Biofluid mechanics, vessel biomechanics, and hemodynamic analysis of the circulation system will also be discussed.

Credits: 3.00

BME 45000 - Deep Learning For Medical Imaging

Credit Hours: 3.00. Teaches the foundation of neural network (aka Deep Learning) approaches and applications to medical imaging: or how to create computable models of biological neural systems, in particular large-scale neural networks, for processing medical images and data. Drawing inspiration from neuroscience and statistics, Deep Learning introduces the basic background on neural networks, presents computable neuron models and extends to large networks of neurons. Students study deep learning with both real and artificial neural networks, along with methods of deep learning about the environment by applying back propagation, Boltzmann machines, auto-encoders, convolutional neural networks and recurrent neural networks. Students will explore how Deep Learning is impacting our understanding of intelligence and contributing to the practical design of automatic medical imaging tools that are able to augment expert medical personnel, enhance diagnosis accuracy and speed, and lower health-care costs.

Learning Outcomes: 1. Understand and simulate a large biological neural network with several million of neurons. 2. Design and use a bio-inspired deep-learning network for

application in medical imaging. 3. Write algorithms that learn to segment, track, categorize, and classify objects of interest. Credits: 3.00

BME 46000 - Cardiovascular Mechanical Support And Devices

Credit Hours: 3.00. Designed to expose students to state-of-the-art medical technologies being utilized in the treatment of patients with cardiovascular diseases, the course emphasizes the role of the biomedical engineer in the design, development and implementation of these technologies for therapeutic impact. Students completing this course will have an understanding of the role of biomedical engineers in clinical engineering and clinical research. The three components of the course, didactic presentations and discussions, laboratory dissections, and clinical shadowing are integrated throughout to teach concepts such as cardiovascular physiology, heart failure and vascular disease, treatments and treatment complications, and future directions. Clinical experts in cardiovascular diagnosis and treatment are frequent guest lecturers.

Learning Outcomes: 1. Identify key anatomical and physiological features of the cardiovascular system. They will learn this by dissecting mice and pig hearts, viewing illustrations, and both reading research articles and the textbook focused on EKGs. 2. Identify unmet clinical needs and practice brainstorming possible solutions by writing an in depth report and giving an oral presentation based on both the course material and their clinical experiences. 3. Recognize fundamental engineering concepts used to design and utilize cardiovascular medical devices by writing shadow reports based on their immersion within a clinical setting. 4. Describe and diagnose various cardiac and vascular diseases by completing a mid semester and final examination covering the course material. 5. Explain the role of a biomedical engineer in the development and implementation of cardiovascular disease treatment in healthcare by interacting with multiple health care professionals during and after their guest lectures. Credits: 3.00

BME 46100 - Transport Processes In Biomedical Engineering

Credit Hours: 3.00. This course explores engineering principles in mass and other transport processes in biological systems. Topics covered include diffusion, convection, reaction kinetics, transport in porous and fluid mediums, etc. Mathematical models of transport are developed and applied to biomedical problems and physiological systems such as the kidney/renal and oxygen/arterial systems.

Credits: 3.00

BME 47000 - Biomolecular Engineering

Credit Hours: 3.00. The course covers key chemical concepts one needs in order to modify existing biomolecules, link biomolecules with other (bio)molecules, link biomolecules with inorganic entities, create composite (bio)structures, modify specific properties of biomolecules, alter/enhance biomolecule functionality. Taken together, the rational application of these biological, chemical, and engineering tools can be used to; engineer new biomolecules, design sensors for molecular detection, create diagnostic tests, develop new imaging modalities, and design and test novel biomaterials, to name a few examples.

Learning Outcomes: 1. Describe and discuss the physiochemical properties of biomolecules. 2. Design new molecules to perform new functions. 3. Able to critically analyze literature on biomolecular engineering. Credits: 3.00

BME 48900 - Senior Design Project Lab

Credit Hours: 2.00. The biomedical engineering design process is completed starting from a preliminary system design. Student will work with their teammates to implement (e.g. build, test, iterate and evaluate) a solution to address a biomedical engineering problem statement and meet the technical specifications set forth. The resulting project design is presented and evaluated through an oral presentation, laboratory demonstration, and a final written document.

Learning Outcomes: Students will have demonstrated the ability to: 1. Integrate and

apply knowledge and skills obtained in earlier work with new concepts and practices essential to the design and testing of a system or device to meet desired needs. 2. Implement the engineering design process and project management within the context of relevant design constraints. 3. Effectively communicate skills in oral and written form, both individually and as part of a team. 4. Explain/discuss realistic design constraints, including regulatory issues, societal influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. Credits: 2.00

BME 48901 - Senior Design Project Lab

Credit Hours: 3.00. The biomedical engineering design process is completed starting from a preparatory design course, BME 39000, through a preliminary system design, build and test in Senior Design Project Lab. Students will work with their teammates to implement (e.g. build, test, iterate and evaluate) a solution to address a biomedical engineering problem statement and meet the technical specifications set forth. The resulting project design is presented and evaluated through an oral presentation, laboratory demonstration, and a final written document.

Learning Outcomes: 1. Demonstrate ability to integrate and apply knowledge and skills obtained in earlier course work with new concepts and practices essential to the design and testing of a system or device to meet desired needs. 2. Implement the engineering design process and project management within the context of relevant design constraints. 3. Effectively communicate skills in oral and written form, both individually and as part of a team. 4. Explain/discuss realistic design constraints, including regulatory issues, societal influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. Credits: 3.00

BME 49000 - Professional Elements Of Design

Credit Hours: 1.00. This course advances and enhances design tools, concepts, and knowledge relevant to biomedical engineering design. Students work individually and in small teams to investigate the topic within the context of their specific senior design project in preparation for their lab. Topics include project management, human and animal subjects, ethics, regulatory affairs, literature and patent searching, and entrepreneurship.

Learning Outcomes: 1. Effectively communicate skills in oral and written form, both individually and as part of a team. 2. Explain/discuss realistic design constraints, including regulatory issues, social influences, and ethical and professional responsibilities of biomedical engineers, as related to the engineering design process. 3. Generate and justify solutions to a medical and/or biological problems that addresses customer needs and realistic constraints. Credits: 1.00

BME 49100 - Biomedical Engineering Design I

Credit Hours: 3.00. This course prepares students for engineering practice through a major design experience, encompassing conceptualization, requirements generation, and system and detailed design. Essential design constraints will be reviewed and applied including: safety, economics, and manufacturability. The course encompasses lectures, case studies, team formation, project assignments and generation of initial design.

Credits: 3.00

BME 49101 - Biomedical Engineering Design

Credit Hours: 2.00. This course prepares students for engineering practice through a major design experience, encompassing conceptualization, requirement generation, and system and detailed design. Essential design constraints will be reviewed and applied including: safety, economics, and manufacturability. The course encompasses lectures, case studies, team formation, project assignments and generation of initial design.

Learning Outcomes: 1. Identify and formulate the design problem, including bringing precision to the problem statement through a requirements specification. 2. Use critical

thinking in the design process. 3. Conduct design using an organized design process, including planning, literature search, requirements specification, consideration of alternative approaches, determination of strategies, and design reviews. 4. Conduct design using design principles. 5. Apply engineering principles, mathematics, and science in engineering design, including methods, tools and techniques. 6. Apply technical knowledge to design, including methods, tools and techniques. 7. Analyze and interpret data. 8. Apply analytical tools and techniques to solve a design problem at the interface of engineering and biology. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a progress report, adhering to the specified format using an appropriate writing style, grammar, and spelling. Credits: 2.00

BME 49200 - Biomedical Engineering Design II

Credit Hours: 3.00. This course continues the design experience from BME 491 with verification, validation, and re-design of student projects. Regulatory and ethical design constraints will be discussed. Oral presentation and report writing are required. Learning Outcomes: 1. Use critical thinking in the testing and redesign process. 2. Make appropriate measurements necessary for testing the design, addressing the problems associated with the interaction between living and nonliving systems. 3. Apply engineering principles, mathematics, and science in engineering redesign, including methods, tools and techniques. 4. Apply technical knowledge to testing and redesign, including methods, tools and techniques. 5. Analyze and interpret testing and verification data. 6. Discuss ethical issues in engineering design for biological and medical applications. 7. Determine ways to test a design to determine its functionality (success of the design). 8. Apply knowledge of regulatory constraints to engineering design. 9. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 10. Write a final report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 11. Make an oral presentation using effective visual aids. Credits: 3.00

BME 49500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 4.00. Specialized topic areas for which there are no specific courses, workshops, or individual study plans, but having sufficient student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

BME 49800 - Biomedical Engineering Projects

Credit Hours: 1.00 to 4.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report is required. Permission of instructor required.

Credits: 1.00 to 4.00

Davidson School of Chemical Engineering

Chemical Engineering Overview

Chemical Engineering remains a premier source of well-educated, well-prepared chemical engineers, educating students using innovative technologies and fostering an environment that inspires leading-edge research.
Chemical engineers work in a wide range of industries with worldwide impact. Applications include energy; pharmaceuticals and biological materials; the nutritional value of food; environmental protection and restoration; materials for computing, sensing, and communications; personal care, home care, and home health products; and system and data management.

Chemical engineers rely on their knowledge of mathematics and science - particularly chemistry - to overcome technical problems in industry and society. While the chemist studies basic chemical reactions, the chemical engineer applies the results of chemical research and transforms laboratory processes into efficient, full-scale processes or facilities. With their strong problem-solving skills and fundamental background in mathematics, physics, chemistry and biology, chemical engineers can seize opportunities to translate industrial problems into competitive advantages. Currently, chemical engineers demand among the highest salaries for college graduates with a bachelor's degree.
Research here is currently being conducted with polymers and materials, nanoscale science and engineering, fluid mechanics, catalyst design and engineering, sensors, biotechnology, and many others.

Faculty

https://engineering.purdue.edu/ChE/People/ptFaculty

Contact Information

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Graduate Information

For Graduate Information please see Chemical Engineering Graduate Program Information .

Chemical Engineering, BSCHE

CHE 20000 - Chemical Engineering Seminar

Credit Hours: 1.00. An orientation course to inform students of the various areas in chemical engineering, to assist them in selection of electives suited to their particular abilities and interest, and to instill a sense of professional ethics and responsibility. Lectures drawn from all fields of chemical engineering.

Learning Outcomes: 1. Demonstrate an understanding of the need for academic and professional integrity and ethical behavior. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Demonstrate an appreciation of the need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 20100 - Cooperative Seminar I

Credit Hours: 0.00. Lectures by faculty and students on subjects that relate the academic work and the industrial experience. Written reports on the industrial experience are required and will include a documentation of the student's success in finding application of specified academic activities. For students returning from the first and second work periods.

Credits: 0.00

CHE 20500 - Chemical Engineering Calculations

Credit Hours: 4.00. Quantitative applications of steady-state mass and energy balances to solve problems involving multi-component systems and multi-unit chemical processes. Single-component and multi-component phase equilibria, single-reaction and multiple-reaction stoichiometry, coupled mass and energy balances, chemical processes involving bypass and recycle streams.

Learning Outcomes: 1. Estimate physical properties of real chemical systems. 2. Evaluate introductory single-component and multi-component phase equilibria and incorporate these concepts into solutions of mass and energy balance problems. 3. Solve steady state and transient mass and energy balance problems for both reacting and non-reacting systems with or without recycle using analytical and computational methods. 4. Work professionally and ethically in teams to solve new mass and energy balance problems. 5. Identify contemporary chemical engineering problems, including their societal, environmental, and global impacts. Credits: 4.00

CHE 21100 - Introductory Chemical Engineering Thermodynamics

Credit Hours: 4.00. Basic principles and concepts of thermodynamics applied to chemical engineering problems; use of basic thermodynamic functions of enthalpy, entropy, free energy to solutions, phase equilibria, and chemical equilibria; thermodynamic processes and efficiencies; equations of state; and relation of macroscopic to molecular properties.

Learning Outcomes: 1. Apply the First Law of thermodynamics in the analysis of closed and open systems. 2. Apply the Second Law of thermodynamics in the analysis of closed and open systems, and reversible and irreversible processes, including power cycles. 3. Derive and apply thermodynamic relations and relationships between thermodynamic potentials. 4. Estimate the physical properties of ideal and non-ideal fluids. 5. Use chemical potentials, fugacities and activity coefficients to analyze the phase equilibrium behavior of ideal and non-ideal fluids. 6. Use chemical potentials, fugacities and activity coefficients to evaluate single and multi-component chemical reaction equilibria for ideal and non-ideal fluids. 7. Utilize computational tools in the solution of thermodynamics problems. Credits: 4.00

CHE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 30000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 20000. Lectures to acquaint the junior students with professional ethics, career choices, including graduate studies, and services of professional societies.

Learning Outcomes: 1. Identify the wide range of career opportunities offered by the Bachelor in Chemical Engineering degree. 2. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the

professional practice of chemical engineering. 3. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 4. Demonstrate an appreciation of the need for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 30100 - Cooperative Seminar II

Credit Hours: 0.00. Continuation of CHE 20100 . For students returning from the third and fourth work periods.

Credits: 0.00

CHE 30600 - Design Of Staged Separation Processes

Credit Hours: 3.00. The application of equilibria and mass and energy balances for the design of staged separation processes. Use of various equilibrium data and thermodynamic principles for the design of batch and continuous distillation, absorption, stripping, and extraction systems. Stagewise calculations and graphical methods for design of binary systems. Design of multicomponent separators. Determination of stage efficiency and column size.

Learning Outcomes: 1. Utilize the concepts and relations of phase equilibria, particularly VLE, in the analysis, design, and simulation of separation processes. 2. Use mass and energy balances in the analysis of separation processes. 3. Use the McCabe-Thiele diagram for the solution of problems in binary separations. 4. Use reflux and multi-stage cascades to increase separation of a given component. 5. Use process simulators for binary and multi-component systems to solve, understand, and design separation processes. 6. Apply the basic principles of distillation, absorption/stripping, extraction and other unit operations for the solution of problems in separations. 7. Identify the safety aspects of various separation processes. 8. Communicate effectively the results of a designed separation process in writing. Credits: 3.00

CHE 32000 - Statistical Modeling And Quality Enhancement

Credit Hours: 3.00. Statistical modeling methods, design of experiments, error analysis, curve fitting and regression, analysis of variance, confidence intervals, quality control and enhancement: emphasizes preparation for designing chemical engineering laboratory experiments and analyzing data.

Learning Outcomes: 1. Utilize the concepts of probability for use with the normal and t distributions, confidence intervals, and hypothesis testing. 2. Apply least squares fitting of data by use of linear algebra with computers. 3. Apply regression and model building from data with experimental error obtained with replicates to establish an adequate model. 4. Design experiments for single and multiple factors and apply regression to model the results. 5. Apply propagation of error and sources of variation or variance components. 6. Apply statistical quality control and improvement with various charts such as average, range, and cusum (concepts of consumer and producer risk and capability index are included). Credits: 3.00

CHE 33000 - Principles Of Molecular Engineering

Credit Hours: 3.00. Application of concepts of atomic and molecular bonding, solid microstructure, phase equilibria, and rate processes to the design of solid materials for specific engineering objectives.

Credits: 3.00

CHE 34800 - Chemical Reaction Engineering

Credit Hours: 4.00. Application of kinetic rate equations, mass balances and energy balances to the analysis and design of chemical reactors involving homogeneous and heterogeneous chemical reactions. Chemical equilibria, kinetic rate equations for homogeneous and heterogeneously catalyzed reactions, design of ideal isothermal reactors, effects of non-isothermal operation, effects of diffusion in porous catalysts and non-ideal mixing in continuous flow reactors.

Learning Outcomes: 1. Apply fundamental material balances to derive the design

equations for CSTR, PFR, PBR, and batch reactors. 2. Derive rate expressions from both elementary steps and reaction kinetics data for both homogeneous and heterogeneous reactions. 3. Use material and energy balances with kinetic data for both single and multiple reactions to design and analyze the behavior of isothermal and non-isothermal reactors. 4. Utilize effectiveness factors governing the coupling of reaction and diffusion in the description of heterogeneously catalyzed reactions. 5. Work professionally and ethically in teams to conduct reaction-based laboratory experiments. 6. Effectively report results in written form and practice safety as an integral part of laboratory work. 7. Apply appropriate computational tools for the solution of chemical reaction engineering problems. Credits: 4.00

CHE 37700 - Momentum Transfer

Credit Hours: 4.00. Differential (microscopic) and integral (macroscopic) mass, momentum, and energy balances. Newtonian and non-Newtonian fluids. Fluid statics. One-dimensional steady and transient laminar flows. Turbulence. Dimensional analysis and similarity. Friction factors and drag coefficients. Applications to engineering analysis of practical problems. Introduction to numerical analysis and visualization of flows.

Learning Outcomes: 1. Explain the physical properties of a fluid and the consequences of such properties on fluid flow. 2. Apply momentum and/or force balances to the analysis of problems in hydrostatics. 3. Apply mass, momentum and energy balances for the solution of problems involving inviscid, steady flow. 4. Use appropriate macroscopic and microscopic mass, momentum, and energy balances to analyze steady laminar and turbulent flow of incompressible fluids in conduits and past submerged bodies. 5. Apply dimensional analysis and kinematic similarity for the interpretation of experimental fluid flow data and the design of fluid transfer equipment. 6. Utilize appropriate mass, momentum and energy balances for the design of fluid transfer equipment (pipelines, agitated vessels, pumps, etc.) and to analyze its operation. 7. Work professionally and ethically in teams to conduct fluid mechanics-based laboratory experiments. 8. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CHE 37800 - Heat And Mass Transfer

Credit Hours: 4.00. Macroscopic and differential energy balances. Heat transfer coefficients for free and forced convection and phase change. Conductive and radiative heat transfer. Applications to heat transfer equipment design and compressible fluid flow. Macroscopic and differential species balances. Mass transfer coefficients and analogies. Mass transfer with and without chemical reaction. Mass transfer equipment design.

Learning Outcomes: 1. Identify and explain the three mechanisms of heat transfer: conduction, convection, and radiation. 2. Apply microscopic and macroscopic thermal energy balances incorporating Fourier's Law for the solution of problems describing steady-state and transient conduction, including convective heat transfer. 3. Utilize mass and thermal energy balances for the design of heat transfer equipment and the analysis of its operation. 4. Identify and explain the two main mechanisms of mass transfer: convection and diffusion. 5. Apply microscopic and macroscopic species mass balances incorporating Fick's Law for the solution of problems describing steady-state and transient diffusion, including relevant rate equations and convective mass transfer. 6. Identify and apply the analogies between momentum, heat, and mass transfer. 7. Utilize mass balances and appropriate phase equilibrium relations for the design of continuous mass transfer equipment and the analysis of its operation. 8. Work professionally and ethically in teams to conduct heat and mass transfer-based laboratory

experiments. 9. Effectively report results in written form and practice safety as an integral part of laboratory work. Credits: 4.00

CHE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Receive feedback from the instructor and seminar participants. 4. Continue professional development. Credits: 0.00

CHE 38499 - Professional Practice Cooperative IV

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Varies due to students academic work sessions. Credits: 0.00

CHE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in chemical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

CHE 40000 - Chemical Engineering Seminar

Credit Hours: 1.00. Continuation of CHE 30000. Lectures to acquaint the senior students with professional ethics, services of professional societies, and help them in the transition from being an undergraduate student to becoming a successful professional or graduate student.

Learning Outcomes: 1. Demonstrate an understanding of the need for developing leadership skills, professional integrity and ethical decision making in the professional practice of chemical engineering. 2. Demonstrate an understanding of contemporary issues encountered in the professional practice of chemical engineering including business practices, environmental, health, and safety issues and other public interests. 3. Identify the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 4. Demonstrate an appreciation of for engaging in life-long learning to maintain and enhance the professional practice of chemical engineering. Credits: 1.00

CHE 40100 - Cooperative Seminar III

Credit Hours: 1.00 to 3.00. Continuation of CHE 30100. For senior students returning from the last work period.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the chemical engineering profession. 3. Receive feedback from the instructor and seminar participants. 4. Continue professional development. Credits: 1.00 to 3.00

CHE 41100 - ChE Undergraduate Research

Credit Hours: 1.00 to 4.00. Experience in chemical engineering science research or development; either directed or independent work that can be experimental or theoretical. Permission of instructor required.

Learning Outcomes: 1. Gain skills and experiences through independent research projects in Chemical Engineering. Credits: 1.00 to 4.00

CHE 41200 - Chemical Engineering Design Research Problems

Credit Hours: 1.00 to 4.00. Experience in chemical engineering design research or development; either directed or independent work that can be experimental or theoretical. Permission of instructor required.

Credits: 1.00 to 4.00

CHE 42000 - Process Safety Management And Analysis

Credit Hours: 3.00. Develop knowledge of process safety management and analysis in the process industries, including hazard identification, hazard analysis and risk management.

Learning Outcomes: 1. Demonstrate knowledge and understanding of the elements of process safety management. 2. Apply the techniques, analytical skills, and modern computational tools necessary for performing process safety calculations in the design of safety. 3. Demonstrate an understanding and appreciation of the need for professional integrity and ethical decision making to promote safety in the workplace. 4. Be able to pro-actively identify and analyze safety hazards. 5. Demonstrate an understanding of the detrimental effects of the unsafe operation of chemical facilities on environmental, health, and safety issues and other public interests. Our graduate will be aware of the wide-reaching effects that engineering decisions have on society, our global community and our natural environment. 6. Demonstrate knowledge and understanding of risk management tools, programs and processes associated with process safety. Credits: 3.00

CHE 43500 - Chemical Engineering Laboratory

Credit Hours: 4.00. Quantitative experimental study of projects involving problems in fluid mechanics and heat and mass transfer or operation and evaluation of equipment; projects include analysis and data-based design of operations involving mass transfer such as distillation, absorption, drying, humidification, etc; study of rates and equilibria in simple chemical reaction systems; study of chemical processes;

application of methods of data analysis in practice; some library work; emphasis on group work, report writing, and oral communication.

Learning Outcomes: 1. Determine the intrinsic performance data required to complete the design of a given process or process equipment. 2. Design and conduct an experimental program to determine the required performance data. 3. Use the requisite performance data to obtain a technically feasible and economical design to meet desired needs. 4. Effectively report experimental results, performance data analyses and process designs both orally and in writing. 5. Use appropriate analytical and computational tools for the analysis and design of experiments. 6. Work effectively as a member of an engineering team in a professional and ethical manner, including different team roles. 7. Practice appropriate experimental safety measures. Credits: 4.00

CHE 44200 - Chemistry And Engineering Of High Polymers

Credit Hours: 3.00. Introduction to basic principles of polymer engineering, including the chemical structure and use of a variety of industrial polymers, polymerization mechanisms and kinetics, techniques for molecular and morphological characterization, polymer processing, and a variety of engineering properties.

Credits: 3.00

CHE 45000 - Design And Analysis Of Processing Systems

Credit Hours: 4.00. Use of process synthesis methods and concepts; detailed design of unit operation equipment, the economics of chemical plants and flow sheet optimization methods. Synthesize, develop, and evaluate a preliminary design of a chemical process that meets market requirements for a specific product. Analysis of design alternatives using case studies and optimization methods.

Learning Outcomes: 1. Apply systematic strategies for synthesizing chemical process designs that involve conventional unit operations. 2. Describe both the difference between steady state and batch chemical processes and the implications on their design and operation. 3. Demonstrate the ability to obtain reliable information on industrial chemical processes, process operating parameters, equipment costs, cost of chemicals and materials, and associated safety and environmental hazards. 4. Describe the role of physical property estimates on process design and be able to use appropriate physical property estimation methods in unit operations design. 5. Estimate the capital and operating cost of a process and to assess its profitability. 6. Use process simulators and other tools to perform detailed analyses for the successful design of a chemical plant. 7. Communicate effectively project progress and final results in a professional manner both orally and in writing. 8. Work effectively in a team to execute open-ended design projects with time-bound deliverables in a professional and ethical manner, including different team roles. Credits: 4.00

CHE 45600 - Process Dynamics And Control

Credit Hours: 3.00. Dynamic response and control of chemical processing equipment, such as heat exchangers, chemical reactors, and absorption towers. Use is made of fundamental techniques of servomechanism theory, such as block diagrams, transfer functions, and frequency response. Introduction to advanced control techniques.

Learning Outcomes: 1. Develop a physically relevant mathematical model as a surrogate for a chemical process. 2. Apply appropriate analytical and computer packages for analyzing the process control behavior based on the developed model. 3. Design, model, and test a hierarchical control system on a complex process. 4. Describe the role of process control in meeting stringent safety, economic, environmental, societal, and corporate goals. 5. Describe the building blocks of process control

and their synthesis for providing complete process control solutions. 6. Work effectively in a team to execute process control computer-based assignments in a professional and ethical manner. Credits: 3.00

CHE 46100 - Biomedical Engineering

Credit Hours: 1.00. An introduction to the field of biomedical engineering, with particular stress on the chemical engineer's role.

Credits: 1.00

CHE 46300 - Applications Of Chemical Engineering Principles

Credit Hours: 3.00. Team-based design projects in materials transport, heat transfer, mass transfer, separations, chemical reactors. Emphasis on team operation and decision-making. Consideration of current technical challenges, societal and economic issues.

Learning Outcomes: 1. Demonstrate ability to apply principles of chemical engineering to design practical systems. 2. Participate in team-based projects to understand team operation and decision-making. 3. Gain experience in and appreciation of the need for individual learning about new systems, equipment, etc. 4. Understand the role of the engineer in promoting safe operation and consideration of environmental issues in technical decisions. 5. Develop an appreciation of current issues and challenges which you may well be addressing as professionals. Credits: 3.00

CHE 49500 - Chemical Engineering Study Abroad

Credit Hours: 1.00 to 3.00. Short term study abroad experience to expose chemical engineering undergraduate students to the academic and industrial environments across the globe. Each experience location play an important economic role and offer good examples of industrial and engineering development, as well as allow for interaction with Purdue alumni, and cultural aspects through immersion during their time abroad.

Learning Outcomes: 1. Demonstrate an awareness of cultural diversity, personal growth and intercultural competency while also gaining career readiness and leadership skills that are relevant for a global world. Credits: 1.00 to 3.00

CHE 49700 - Special Topics In Chemical Engineering

Credit Hours: 1.00 to 4.00. Primarily designed for subject areas for which there is no specific course offered. Areas of study will deal with topics that have enough student interest to justify the teaching of specialized courses on a trial basis. The course can be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 1.00 to 4.00

CHE 49800 - Undergraduate Thesis Research I

Credit Hours: 3.00. Individual research projects for students completing an undergraduate thesis. Requires prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Credits: 3.00

CHE 49900 - Undergraduate Thesis Research II

Credit Hours: 3.00. Individual research projects for students completing an undergraduate thesis. Continuation of CHE 49800. Includes submission of written thesis and public oral presentation. Permission of instructor required.

Credits: 3.00

Lyles School of Civil and Construction Engineering

Lyles School of Civil and Construction Engineering

About Civil and Construction Engineering

Civil and Construction Engineers shape communities, protect natural habitats, and establish global standards by creating safe forms of shelter, protecting our coastlines and waterways, supplying clean energy, providing access to clean water and sanitation, and

allowing for safe and efficient movement of people and goods and more. Graduates are prepared to tackle critical challenges-from enhancing infrastructure resilience to advancing environmental sustainability. Two degree programs are offered by the School: Bachelor of Science in Civil Engineering (**BSCE**) and Bachelor of Science in Construction Engineering (**BSCNE**).

The skillsets needed by a successful Civil and Construction Engineer include: strong math, science, and computer skills; creativity; ability to collaborate and communicate with a wide array of audiences; and an aptitude for applying science and engineering methods to solve problems. The curriculum offered by the Lyles School of Civil and Construction Engineering is designed to help students develop these skills and prepare them for their careers after graduation.

Graduates from the Lyles School of Civil and Construction Engineering find successful careers in both private and public organizations here in the US and abroad. Civil and Construction Engineers have a broad range of flexible options in where and how they work. Because our graduates have a tangible impact in our communities and on the environment, they can work anywhere. Civil and Construction engineers also have the option of working in the field or in an office or both. Our graduates work on a diverse range of projects in engineering design, consulting, construction, aviation/aerospace, energy, water resources/environment, transportation industries and more.

Two Bachelor's Degree Programs are offered by the School:

Civil Engineering is broad and encompasses planning, designing, building, and operating the infrastructure systems that create and sustain our communities while also protecting and preserving the natural environment. Students can focus in any of the nine specialty areas or remain general. 30 credits of technical electives allow students flexibility to design their academic plan to fit their passion and interests.

Construction Engineering is the discipline focused on the planning, design, management, and execution of construction projects, with a commitment to safety, sustainability, and community stewardship. Students will find the degree program offers a comprehensive blend of theory and practice, emphasizing a strong industry-driven curriculum that incorporates curriculum-based experiential learning including three 12-week internships.

https://engineering.purdue.edu/CCE/People/faculty

Contact Information

Lyles School of Civil and Construction Engineering
Delon and Elizabeth Hampton Hall of Civil Engineering
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West Lafayette, IN 47907-2051
CCE Main Office: (765) 494-2166 Contact us!

Graduate Information

For Graduate Information please see Civil Engineering Graduate Program Information .

Architectural Engineering Minor

Civil Engineering, BSCE

Construction Engineering, BSCNE

Construction Engineering Minor

CE 19100 - Civil Engineering Practice I

Credit Hours: 0.00. Practice in industry and written reports of this practice. For cooperative program students only.

Credits: 0.00

CE 20300 - Principles And Practice Of Geomatics

Credit Hours: 4.00. This course provides a broad overview of geomatics engineering including fundamental principles required for practical geomatics applications. This course includes subjects in traditional surveying, GPS surveying, remote sensing, photogrammetry, laser scanning, and Geographic Information Systems (GIS). Basic concepts on

these subjects are applied to solve practical problems in various civil engineering applications; including computations for engineering project control and construction layout; theory of error propagation; fundamental concepts of horizontal and vertical curves; topographic mapping using various geospatial data acquisition technologies from ground, air, and space; GIS for visualization and analysis of geospatial data.

Learning Outcomes: 1. Design and execute a leveling survey. 2. Design and execute a traverse survey. 3. Use survey data to produce a topographic map. 4. Perform horizontal and vertical curve computations. 5. Collect GPS/RTK/RTN data with survey grade accuracy. 6. Perform remote sensing image classification. 7. Measure digital photographs and perform camera calibration. 8. Use software to generate 3D point cloud from digital imagery. 9. Perform multi-image bundle block adjustment. 10. Manipulate 3D point cloud data from a laser scanner, and extract engineering parameters. 11. Select appropriate geodetic references and map projections for geomatics applications. 12. Collect and register geospatial data from multiple sources for engineering applications. 13. Map and visualize collected geospatial data. Credits: 4.00

CE 21101 - Thermal And Energy Sciences

Credit Hours: 3.00. This course includes applications of thermal science and energy fundamentals to civil engineering topics. Emphasis is placed on fundamental concepts of properties of materials, work, heat, internal energy, entropy, equilibrium, and relations derived from the first and second laws of thermodynamics. Example applications include: power plants; fluid flow in ducts/pipes; thermal properties of building/construction materials and processes; geothermal systems; heating, ventilation, and air conditioning (HVAC) processes; energy balances in buildings; refrigeration; hydroelectric power; contaminant transport in air, water, and soil; climate change; the urban heat island effect; and energy use in the transportation sector.

Learning Outcomes: 1. Explain the principles of mass and energy conservation and their use in civil engineering applications. 2. Evaluate thermodynamic systems and several forms of work, energy, and heat transfer. 3. Apply conservation of mass and energy for closed systems and control volume processes. 4. Explain the second law of thermodynamics, entropy changes, and device efficiencies. Credits: 3.00

CE 22200 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. The objective of this course is to introduce concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity of construction equipment as well as the costs associated with construction equipment and construction labor. 4. Calculate the peak financial requirement for a given project based on project revenue and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

CE 27000 - Introductory Structural Mechanics

Credit Hours: 4.00. Loads; structural forms; analysis of axially loaded members, flexural members, torsional members; combined loading conditions; buckling. Basic behavioral characteristics of structural elements and systems illustrated by laboratory experiments.

Credits: 4.00

CE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of

department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29202 - Contemporary Issues In Civil Engineering

Credit Hours: 2.00. This course provides a forum on issues in the civil engineering profession in a contemporary context. Topics include professionalism and ethics, entrepreneurship, cultural differences, and collaborating globally. Students have interactions with engineering faculty and professionals outside the University. Guidance on the preparation of individual plans of study and information on civil engineering career options are provided. Students learn and apply fundamental aspects of written communication in professional settings. Emphasis is placed on delivery of technical and managerial content. Students will compile a professional portfolio of communication assignments, including lab reports prepared in other CE courses.

Learning Outcomes: 1. Ability to communicate effectively. 2. Ability to understand the impact of engineering solutions in a global and societal context. 3. Knowledge of contemporary issues, particularly with respect to nuclear topics. 4. Understanding of professional and ethical responsibility. Credits: 2.00

CE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 29700 - Basic Mechanics I (Statics)

Credit Hours: 3.00. Statics of particles. Rigid bodies: equivalent systems of forces, equilibrium. Centroids and centers of gravity. Static analysis of trusses, frames, and machines. Friction. Area moments of inertia.

Learning Outcomes: 1. Utilize fundamental vector mechanics concepts to understand, explain, and describe the behavior of particle and rigid-body equilibrium. 2. Determine centroids and moments of inertia of areas. 3. Analyze the behavior of typical engineering components using force and moment equilibrium. Credits: 3.00

CE 29800 - Basic Mechanics II Dynamics

Credit Hours: 3.00. Kinematics of particles. Kinetics of particles and systems of particles. Kinematics of rigid bodies. Mass moments of inertia. Kinetics of rigid bodies. Mechanical vibrations.

Credits: 3.00

CE 29900 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Topics vary. Projects, special topics, or supplemental instruction. Arrange Hours and Credit. Permission of instructor required.

Credits: 0.00 to 18.00

CE 31100 - Architectural Engineering

Credit Hours: 3.00. This course introduces energy efficiency, thermal comfort, indoor environmental quality and green building design concepts. The course covers engineering fundamentals required for the design and analysis of building systems such as thermodynamics, fluid mechanics, heat and mass transfer, light and sound transmission. The course presents engineering principles and selected applications related to hydrothermal analysis of building enclosures, air conditioning processes in heating, ventilating and air conditioning systems, building illumination, and building acoustics.

Learning Outcomes: 1. Identify and analyze the characteristics of building environmental loads,

building construction, and building operations as they define the requirements for a comfortable and healthy indoor environment. 2. Demonstrate knowledge of thermodynamics , fluid mechanics, heat and mass transfer, photometric quantities and sound transmission for use in building design. 3. Identify, formulate and solve realistic Architectural Engineering problems related to hygrothermal analysis of building enclosures, air conditioning processes in Heating Ventilating and Air Conditioning Systems, pipe and duct flow, building illumination and building acoustics. 4. Demonstrate an understanding of building systems integration to achieve efficient operation. Credits: 3.00

CE 32201 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. The objective of this course is to continue an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed faculties. Building on the broad framework introduced in the prerequisite course, this course develops further ability with analytical tools and extends the basic foundation for advanced topics in construction engineering and management. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Demonstrate an ability to design a process to meet desired needs within realistic constraints. Credits: 3.00

CE 33100 - Engineering Materials II

Credit Hours: 3.00. A continuation of CE 23100.

Credits: 3.00

CE 33500 - Civil Engineering Materials

Credit Hours: 4.00. An introduction to the relationships between fundamental structure of materials and their properties presented through a combination of materials science and engineering approaches. Emphasis on materials of particular interest for civil engineering applications, including metals, aggregates, portland cement concrete, bituminous materials, asphalt binders, asphalt mixtures, wood, polymers, composites, and masonry. Laboratory exercises illustrate atomic structure, elastic and inelastic properties, and demonstrate applications of selected principle of mechanics, testing of aggregates, as well as designing and testing of asphalt and concrete mixtures.

Learning Outcomes: 1. Formulate equations that describe the properties of composite materials based on boundary conditions, assumptions and constituent properties. 2. Design and conduct experiments, as well as to analyze and interpret data. 3. Use non-destructive tests to estimate material properties. 4. Use non-destructive test to locate flaws in engineering systems. 5. Compare and contrast strength of materials and fracture mechanics solutions. 6. Use mathematics, science and engineering principles to estimate the influence of cracks on the mechanical response of engineering materials. 7. Use scientific and engineering principles to predict the elastic and viscoelastic of a material. 8. Interpret engineering properties from test data. 9. Use standardized test procedures to describe the properties of engineering materials. 10. Use mathematical, scientific and engineering principles to compute the influence of material proportions on the structure property relationships for concrete materials. 11. Design the proportions for a concrete mixture. 12. Explain the relationship between the properties

of an asphalt mixture and its performance. 13. Select engineering materials for specific applications. 14. Communicate effectively using graphs. 15. Communicate effectively using an executive summary. 16. Communicate effectively using an engineering report. 17. Communicate the expected accuracy obtained from engineering data. Credits: 4.00

CE 34000 - Hydraulics

Credit Hours: 3.00. Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments.

Credits: 3.00

CE 34300 - Elementary Hydraulics Laboratory

Credit Hours: 1.00. The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Credits: 1.00

CE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

CE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (EEE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

CE 36100 - Transportation Engineering

Credit Hours: 3.00. Transportation functions; transportation systems, including land, air, and marine modes; transportation system elements, including traveled way, vehicle, controls, and terminals; techniques of transportation system planning, design, and operation.

Credits: 3.00

CE 37100 - Structural Analysis I

Credit Hours: 3.00. Stress resultants (reactions, axial forces, shear forces, and bending moments) for beams and framed structures. Deflections of beams and frames by geometric methods (moment-area theorems and applications; conjugate beam analogy). Analysis of statically indeterminate beams and frames by classical stiffness methods; slope deflection and moment distribution. Influence functions and their applications.

Credits: 3.00

CE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

CE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

CE 38300 - Geotechnical Engineering I

Credit Hours: 3.00. Introduction to the nature and origin of soils and rocks; engineering significance of geologic landforms and soil deposits; identification and engineering classification of soils; engineering behavior and properties of soils; permeability, compressibility, shearing resistance; soil compaction.

Credits: 3.00

CE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

CE 39201 - Technical Communication In Civil Engineering

Credit Hours: 2.00. This course will build upon the technical communication components of CE 29202 , adding instruction in oral communication, projects, and working in teams. This course involves both individual and team assignments intended to offer students the opportunity to practice preparing and delivering written correspondence and reports, as well as oral presentations. These activities may be coordinated with other CE courses being taken by students in CE 39201.

Learning Outcomes: 1. Know the value of clear and concise communication. 2. Understand the audience and structuring of communications. 3. Employ the forms of arguments/reasoning. 4. Apply knowledge of scientific vocabulary and technical data-driven communication. 5. Work effectively in teams. 6. Employ issue analysis to plan team project work. 7. Understanding of good listening; oral communications. 8. Employ PowerPoint and visual communications effectively. 9. Deliver team technical presentations. 10. Develop and present lab reports. 11. Knowledge to prepare ""How-To"" video project. 12. Conduct meetings; running brainstorming sessions. 13. Develop persuasive presentations. 14. Prepare effective resumes, cover letters, and job searches. 15. Employ job interview skills. Credits: 2.00

CE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39500 - Fundamentals Of Innovation Theory And Practice

Credit Hours: 3.00. This course is designed to provide students with initial exposure to the fundamental patterns, mindsets, behaviors, attributes, tools, and methods employed in the innovative activity of individuals and organizations. Emphasis is placed on understanding and effectively utilizing techniques to systematically drive innovation that are drawn from the fields of business, design, problem-solving, engineering, and the social sciences. Lecture, in-class small group activities, and individual and team assignments are employed across an array of contemporary socio-technical challenges to provide students with the opportunity to apply conveyed theory and methods to rigorously structure problems, understand involved stakeholders, utilize innovation motifs and analogical reasoning to develop robust views of potential solutions spaces, tailor solution design to stakeholder context, consider the full suite of functional, social, and emotional dimensions that could influence solution prioritization, and document and systematically assess underlying solution assumptions to iterate toward a viable and sustainable forward-looking plan that could achieve target outcomes. This course counts toward, serves as a required entry course for, the College of Engineering Minor in Innovation and Transformational Change.

Learning Outcomes: 1. Develop working knowledge of established innovation forms and motifs. 2. Demonstrate ability to link innovation motifs to specific classes of problems. 3. Understand, and be able to pursue, the core aspects of an end-to-end innovation process. 4. Recognize the mental models, mindsets and behaviors of innovators. 5. Gain awareness of the approaches various forms of organizations take to systematically innovate. 6. Acquire leadership and communication skills through teamwork, oral presentations, and written deliverables. Credits: 3.00

CE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in civil engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

CE 39700 - Undergraduate Professional Internship

Credit Hours: 0.00. Professional experience in Civil Engineering. This internship experience is intended to complement the student's academic coursework and help prepare the student for a career as a practicing engineer. Program coordinated by school with cooperating employers. A written report is required. Permission of department required.

Credits: 0.00

CE 39800 - Introduction To Civil Engineering Systems Design

Credit Hours: 3.00. An introduction to engineering economy and systems analysis. A systematic approach to the engineering method of design and problem solving.

Credits: 3.00

CE 41300 - Building Envelope Design And Thermal Loads

Credit Hours: 3.00. This course discusses the basic thermal processes in buildings and presents comprehensive methods for thermal design of envelope assemblies in commercial and residential buildings. The first part of the course includes steady-state transient conduction through envelope assemblies, convection and radiation heat transfer in buildings, solar radiation and solar gains, thermal performance of windows, internal gains, ventilation and infiltration. The second part of the course considers surface and room energy balance equations and presents analytical and computational models for calculation of hourly heating and cooling loads throughout the year. Climate-based standards, passive solar design, advanced energy guides, and innovative technologies for high performance buildings are discussed. The course also includes a design project on analytical heating/cooling load calculations for a commercial building.

Learning Outcomes: 1. Calculate heat transfer through envelope assemblies for commercial and residential buildings. 2. Solve energy balance equations for building surfaces and room air. 3. Calculate solar and internal gains and predict transient hourly heating and cooling loads for a building throughout the year using analytical and computational models. 4. Design building envelopes according to national standards. 5. Understand principles of passive solar design and the application of innovative envelope technologies. Credits: 3.00

CE 41400 - Building Mechanical And Electrical System Design

Credit Hours: 3.00. This course covers the design of building mechanical and electrical systems. In the first part of the course students learn principles of designing and integrating heating, ventilation, and air conditioning systems into building air delivery systems, mechanical cooling and heating technologies, duct design and layout, blower and pump selection, and hydronic systems. They also learn to design heating, ventilation, and air conditioning systems within the constraint of achieving satisfactory occupant thermal comfort in buildings. The second part of the course covers design concepts related to building electrical systems; including, single and three-phase power systems, motors, transformers, switching, and relays. The course includes a design project related to mechanical and electrical systems for a commercial building.

Learning Outcomes: 1. Utilize building thermal load information together with a knowledge of industry standards and numerical methods to design and integrate efficient heating, ventilation, and air conditioning systems into commercial and residential buildings. 2. Understand the benefits and drawbacks of conventional and innovative mechanical systems, and identify appropriate opportunities for the selection and integration of both. 3. Evaluate the performance and estimate energy consumption of common mechanical systems and components. 4. Understand the operating characteristics and appropriately size the components that are integrated into building electrical systems. Credits: 3.00

CE 44000 - Urban Hydraulics

Credit Hours: 3.00. Sources and distribution of water in urban environment, including surface reservoir requirements, utilization of groundwater, and distribution systems. Analysis of sewer systems and drainage courses for the disposal of both wastewater and storm water. Pumps and lift stations. Urban planning and storm drainage practice.

Credits: 3.00

CE 44200 - Introduction To Hydrology

Credit Hours: 3.00. Description, measurement, and analysis of hydrologic processes: precipitation, evapotranspiration, infiltration, and runoff. Hydrograph analysis: unit and synthetic unit hydrographs and flood routing. Statistical analysis of hydrologic data. Fundamentals, budget, and yield analysis of groundwater flows; well hydraulics. Case studies illustrating the application of principles in both surface and groundwater flows.

Credits: 3.00

CE 44300 - Introductory Environmental Fluid Mechanics

Credit Hours: 3.00. Kinematics of fluid flow. Differential

equations for environmental fluid flows, including effects of variable density and rotation. Ideal fluid flow; boundary layer approximation; turbulence; water waves.

Credits: 3.00

CE 45600 - Wastewater Treatment Processes

Credit Hours: 3.00. (EEE 45600) Fundamental design principles and practice of wastewater treatment to prepare students for designing wastewater treatment systems. The major topics include design and construction process, preliminary treatment of wastewater, primary treatment, wastewater microbiology, secondary treatment, nitrogen removal, phosphorus removal, attached microbial growth, secondary settling, disinfection and post-aeration, tertiary treatment, and wastewater plant residuals management.

Learning Outcomes: 1. Understand design principles and practice of wastewater treatment. 2. Apply the knowledge to select the best process to treat wastewater. 3. Design a wastewater treatment component or process to meet water quality goals. 4. Critically review relevant literature or contemporary issues in wastewater treatment. Credits: 3.00

CE 45700 - Air Pollution Control And Design

Credit Hours: 3.00. Fundamental concepts and design procedures for the removal of particulates, gases, and toxic air pollutants from waste gas streams. Problem assessment; characterization of exhaust gas streams; fan characteristics.

Credits: 3.00

CE 46100 - Roadway And Pavement Design

Credit Hours: 3.00. Design of highway and airport pavement systems, subgrades, subbases and bases, soil stabilization, flexible and rigid pavements; cost analysis and pavement selection; quality control; drainage; earthwork; pavement evaluation and maintenance.

Credits: 3.00

CE 46300 - Highway Transportation Characteristics

Credit Hours: 3.00. Analysis of basic characteristics of highway transportation systems and the elements influencing these characteristics: drivers, vehicles, pedestrians, flow, density, speed, travel time, delay, stream flow, intersection performance, capacity, accidents, traffic demand, and parking. Techniques used include experimental observation, deterministic and probabilistic queueing theory, probability and statistics, and graphical analysis.

Credits: 3.00

CE 47000 - Structural Steel Design

Credit Hours: 3.00. The elements of structural steel design, including tension members and their connections; structural connections, including welding, and high-strength bolts; compression members; rolled and built-up flexural members; and combined axial and flexural loading effects.

Credits: 3.00

CE 47300 - Reinforced Concrete Design

Credit Hours: 4.00. Design and behavior of reinforced concrete beams, one-way slabs, and columns.

Credits: 4.00

CE 47400 - Structural Analysis II

Credit Hours: 3.00. Determination of deflections by the method of virtual work; analysis of trusses, continuous beams, and frames by direct stiffness method; approximate methods of analysis.

Credits: 3.00

CE 47900 - Design Of Building Components And Systems

Credit Hours: 3.00. Design of simple floor and roof systems and load bearing walls; uses of building materials; fundamentals of design of metal form decking, steel joists, masonry (beams, columns and load bearing walls), and timber (beams, trusses, and mechanical connections).

Credits: 3.00

CE 48300 - Geotechnical Engineering II

Credit Hours: 3.00. Subsurface investigations and techniques for sampling soils, lateral earth pressures, and stability of retaining structures; stability of earth slopes; shallow and deep foundations design.

Credits: 3.00

CE 49700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

CE 49800 - Civil Engineering Design Project

Credit Hours: 3.00. Planning, design, and analysis of a civil project; an integrated and realistic group project involves as much as possible all major aspects of the civil engineering profession.

Credits: 3.00

CE 49900 - Research In Civil Engineering

Credit Hours: 0.00 to 18.00. Credit arranged. Permission of instructor required.

Credits: 0.00 to 18.00

CEM 18000 - Construction Engineering Pre-Professional Development

Credit Hours: 1.00. Online course consisting of 8 sessions and 1 module (10 hour OSHA training) is intended to be completed before the student's first work session (internship) in order to prepare the student in the form of oral and written communication that will assist them in being successful in their experiential learning opportunities within industry. This course will also introduce the students to the construction industry relative to office and field requirements and introduce the student to professional skills that will be needed for their experiential learning opportunities including but not limited to: verbiage and acronyms, tools, software platforms, and general business etiquette and ethics.

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an understanding of professional and ethical responsibility. 3. Demonstrate ability to communicate effectively. 4. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 6. Demonstrate knowledge of contemporary issues. Credits: 1.00

CEM 20100 - Life Cycle Engineering And Management Of Constructed Facilities

Credit Hours: 3.00. This course introduces concepts relating to the engineering and construction of facilities throughout their life cycle. Topics that will be explored include the nature of the construction industry, construction contracts, legal and management organization of construction companies, basics of the design and construction process, as well as an introduction to the role of estimating and project scheduling. Cost, time, safety and quality concepts of construction management relationships will also be discussed. Prerequisite: First Year Engineering Curriculum must be completed.

Learning Outcomes: 1. Work with construction schedules and determine which activities are critical to the timely completion of the project. 2. Identify different types of construction contracts and specifications. 3. Calculate the productivity and the costs associated with construction equipment labor. 4. Calculate the peak financial requirement for a given project based on project revenues and expenses. 5. Understand the importance of safety on the construction site. 6. Understand the principles involved in estimating and controlling costs on a construction project. Credits: 3.00

CEM 28000 - Construction Engineering Professional Development I

Credit Hours: 1.00. This course will prepare the student for professional practice in construction engineering including information on careers and issues in construction industries; History and Culture of the U.S. Construction Industry; Engineering Ethics and Preparation for Leadership. Information and assistance is also provided related to minors and selections associated with the plan of study; student's organizations; opportunities for construction research and community outreach at Purdue. Guest speakers with be utilized to enhance the experience. The guest speakers include industry partners as well as faculty and staff. There will be an emphasis on written and oral communication.

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to function on multidisciplinary teams. 4. Demonstrate an ability to identify, formulate, and solve

engineering problems. 5. Demonstrate an understanding of professional and ethical responsibility. 6. Demonstrate ability to communicate effectively. 7. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 8. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 9. Demonstrate knowledge of contemporary issues. 10. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

CEM 29100 - Construction Internship II

Credit Hours: 0.00. Second of three internship periods and a continuation of that described. Typically, experience emphasizes the office-based activities of the sponsor.

Credits: 0.00

CEM 29199 - Experiential Learning Session I

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify

areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 29299 - Experiential Learning Session II

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 29700 - Experimental Course

Credit Hours: 1.00 to 6.00. This course is required to assist in the development and testing of new courses for either residential or online delivery. Initially, there may be more residential courses than online due to faculty availability and/or workload.

Learning Outcomes: 1. Introduce students to essential elements of engineering theories, practices, and applications in the field of

construction engineering. Courses may address two or more ABET outcomes. 2. Able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. 3. Able to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 4. Able to communicate effectively with a range of audiences. 5. Able to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 6. Able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 7. Able to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. 8. Able to acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00 to 6.00

CEM 30100 - Project Control And Life Cycle Execution Of Constructed Facilities

Credit Hours: 3.00. This course continues an introduction to construction management and engineering concepts for future engineers, contractors and owner representatives involved at different stages in the life-cycle of constructed facilities. Specifically, this course focuses on the principles, tools, and procedures used in the construction industry for project selection and financing, advanced planning and scheduling techniques, resource management, and project monitoring.

Learning Outcomes: 1. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. 2. Able to design a process to meet desired needs within realistic constraints. Credits: 3.00

CEM 32100 - Construction Engineering Materials Lab

Credit Hours: 1.00. The nature and performance of materials under load stress. Important engineering materials for evaluation of physical and mechanical properties include ferrous and nonferrous metals, plastics, bituminous materials, Portland cement, aggregates, concrete, timber, and particulate systems.

Learning Outcomes: 1. Evaluate the behavior and properties of engineering materials. 2. Assess the nature and performance of materials under load: Theory vs. Reality. 3. Facilitate the understanding of the strength and weakness of major construction engineering materials and their application. 4. Design and conduct experiments, and analyze and interpret data. Credits: 1.00

CEM 32400 - Human Resource Management In Construction

Credit Hours: 3.00. Introduce a broad set of fundamental topics regarding management of people in engineering and construction organizations in the U.S. Subjects include labor-management relations (laws, regulations and practices affecting construction workers and organizations); worker motivation, productivity, and training; roles and practices of managers; construction safety; management of quality.

Learning Outcomes: 1. Understand managerial aspects of the engineering and construction industry. 2. Know the background and the principal laws and practices concerning labor-management relations for the union and nonunion jobs. 3. Know current management practices involving worker supply and demand, workforce training, EEO and workforce diversity, professional ethics and construction safety. 4. Gain basic knowledge to help you become an effective manager in engineering and construction organizations. 5. Enhance communication skills. Credits: 3.00

CEM 35100 - Foundations Of Architectural Design (UCC: HUM)

Credit Hours: 3.00. Contemporary humans spend most of our time directly engaging with architecture; it is the context in which

we live our lives. This course introduces the demands ('tasks') and methods ('tools') inherent to the practice of architectural design. In other words, the problems architects address through design and the ways in which they do so. These two sets of topics are presented in tandem through historical and contemporary examples, along with selected case-studies and readings. Success in the course will provide a foundation for richly experiencing, critically assessing, and productively engaging the development of our built environment.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify features exhibiting distinct qualities (historical, cultural, technical, etc.) in built examples. 2. Explain how an architectural design may have developed as it did. 3. Demonstrate how ideas from one source can be applied to the analysis of another. 4. Distinguish how a case study example exhibits specific traits. Credits: 3.00

CEM 38000 - Construction Engineering Professional Development II

Credit Hours: 1.00. This course will build upon the topics discussed in CEM 28000 to further prepare students for their work in the construction industry. A focus of this class will be on presentation skills. By utilizing the first or last hour of CEM 42500 - Construction Practice Project, the students of CEM 38000 will have the opportunity to present and also participate as an audience and active participant in CEM 42500 Construction Practice Project. The presentations of CEM 38000 will consist of their required Summer Internship Reports, which are a compilation of the work they have completed and skills they have learned in their first two internships (CEM 19100 and CEM 29100).

Learning Outcomes: 1. Demonstrate an ability to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. Demonstrate an ability to identify, formulate, and solve engineering problems. 4. Demonstrate an understanding of professional and ethical responsibility. 5. Demonstrate an ability to communicate effectively. 6. Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Demonstrate recognition of the need for, and an ability to engage in life-long learning. 8. Demonstrate knowledge of contemporary issues. Credits: 1.00

CEM 39100 - Construction Internship III

Credit Hours: 0.00. Third, and last, of required internships. It typically emphasizes the project management activities of the sponsor. Actual assignments to a student may vary from sponsor to sponsor.

Credits: 0.00

CEM 39399 - Experiential Learning Session III

Credit Hours: 0.00. The Construction Engineering and Management (CEM) curriculum-based experiential learning courses allow students to bridge the gap between classroom theory and real-world practice through intentional partnerships with industry leaders. Students are systematically and deliberately aligned with industry partners to immerse themselves in authentic, real-world scenarios within the construction engineering and management field. Student experiences will be captured in the assigned courses (listed below) to document the learning outcomes based on carefully crafted learning objectives encompassing a range of essential skills and competencies necessary for success in the industry. The courses represent experiential learning work sessions with industry partners as a full-time employee charged with responsible work activities/tasks. Our primary goal is cultivating a holistic understanding of key concepts while fostering critical thinking, problem-solving abilities, and professional development. For additional information and best practices, please refer to the Experiential Learning Handbook A Guide for Students and Supervisors in Purdue's Construction Engineering and Management Program Fifth Edition 2022.

Learning Outcomes: 1. Communicate ideas, information, and progress updates professionally, both verbally and in written form, with colleagues, supervisors, and external stakeholders. 2. Demonstrate the ability to pay attention to detail and ensure thoroughness in completing assigned tasks, projects, and reports within specified timelines and quality standards; utilizing codes, standards, and standard operating procedures. 3. Understand and apply safety protocols, regulations, and

best practices in the construction industry to ensure a safe working environment for themselves and their colleagues. They will make informed decisions regarding safety in their work and when overseeing the work of others. 4. Gain a comprehensive understanding of field operations within the construction industry, including hands-on experience with equipment, tools, materials, and procedures commonly used in the field. 5. Acquire fundamental knowledge and skills related to estimating, including cost estimation, quantity take-offs, bidding processes, and interpreting project specifications and drawings. 6. Develop a foundational understanding of project management principles and practices, including project planning, scheduling, budgeting, resource allocation, risk management, and client communication. 7. Demonstrate the ability to adapt to changing project requirements, solve problems creatively, identify potential issues, and propose practical solutions to overcome challenges encountered during the internship experience. 8. Participate in team-based projects, collaborate with diverse teams, contribute ideas, respect diverse perspectives, and demonstrate effective interpersonal skills to achieve common goals. 9. Uphold professional ethics, integrity, and accountability in all aspects of their work, including respecting confidentiality, adhering to company policies and procedures, and conducting themselves honestly and fairly. 10. Use reflective practices to evaluate their internship experiences, identify areas for improvement, set personal and professional goals, seek feedback from mentors and supervisors, and demonstrate a commitment to lifelong learning and professional development. Credits: 0.00

CEM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in Construction Engineering and Management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CEM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in Construction Engineering and Management. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CEM 39700 - Experimental Course

Credit Hours: 1.00 to 6.00. This course is required to assist in the development and testing of new courses for either residential or online delivery. Initially, there may be more residential courses than online due to faculty availability and/or workload.

Learning Outcomes: 1. Introduce students to essential elements of engineering theories, practices, and applications in the field of construction engineering. Courses may address

two or more ABET outcomes. 2. Able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics. 3. Able to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 4. Able to communicate effectively with a range of audiences. 5. Able to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 6. Able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 7. Able to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. 8. Able to acquire and apply knowledge as needed using appropriate learning strategies. Credits: 1.00 to 6.00

CEM 40100 - Critical Thinking In Construction Engineering

Credit Hours: 3.00. This course introduces the concepts of critical thinking and why acting in our 'comfort zone' can result in discomfort. Students will explore a number of simulated and actual problems that challenge understanding of the situation and require additional investigation or analysis. Problems will cover the entire building life-cycle from development of a project plan, through design, project risk analysis for bidding, controlling the project, project recovery, and project handover. Guest speakers will present examples of projects where critical thinking was applied to resolve project issues or avoid a significant error.

Learning Outcomes: 1. Understand the complex nature of construction through the schematic nature of design and the physical realities of construction sequences and processes. 2. Explore different approaches to accomplishing the same goal. 3. Learn from several case studies where solutions may appear obvious but where the better solution is less obvious. Professional writing and presentation skills are required. 4. Evaluate a specific construction case in depth and report on their findings and recommended approach. Credits: 3.00

CEM 42501 - Construction Engineering Capstone I

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design. Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and in construction internships.

Learning Outcomes: 1. Know phases and aspects of construction project planning, engineering, and management at the project level. 2. Know complexities and uncertainties of planning and decision-making in a realistic environment. 3. Know how construction activities by the constructor are influenced by owner needs and project design basis and features. 4. Demonstrate methods and skills of oral and written communication. 5. Demonstrate methods, techniques and experience of working in teams. Credits: 2.00

CEM 42502 - Construction Engineering Capstone II

Credit Hours: 2.00. The capstone senior design course for construction engineering and management majors. Working in teams in a realistic engineering practice environment, students use an actual construction project to accomplish open-ended project planning and systems design. Course covers construction project strategy, cost estimating and bidding, constructability analysis, project scheduling, contract conditions, project organization, site analysis and development, safety and quality management, and information systems design.

Comprehensive written submittals and oral presentations require integration of knowledge gained in previous courses and in construction internships.

Learning Outcomes: 1. Able to read a contract and determine the scope of work to be provided and under what terms. 2. Able to assemble a schematic design and design development set of plans & specifications representative of the schedule and budget. 3. Able to create appropriate types of schedules based on work composition using various scheduling programs. 4. Able to select the appropriate equipment, labor resources, and materials including temporary structure to perform the work. 5. Able to develop an estimate and budget based on plans and specifications. Credits: 2.00

CEM 43100 - Introduction To Facility Engineering And Management

Credit Hours: 3.00. This course introduces students to the field of facility engineering and management, the operation of constructed facilities to ensure efficient operation, meet stakeholder needs, and preserve the facility for its intended life. The course is a technical elective for Construction Engineering and Management students who are familiar with the delivery of capital construction projects and provides an owner/operator perspective of capital construction and ongoing operations. The course focuses on the different capital construction types (buildings, roads, bridges, tunnels, water treatment facilities, and industrial facilities). Guest speakers will be used to present the challenges specific to individual facility types. Methods and tools to develop the needed management and annual operational plans for facilities will be used. Case studies will be used to demonstrate the application of methods and tools.

Learning Outcomes: 1. Understand what is required to operate and manage a constructed facility. 2. Describe what resources are needed to operate and manage facilities of different types. 3. Examine the needs of individual facility types to ensure successful operation. 4. Analyze a facility to determine what is required for planning purposes. Credits: 3.00

CEM 45100 - Integrative Building Design

Credit Hours: 3.00. This course introduces the architectural and constructive challenges of comprehensive, integrated building design. In lectures, the range of constituent systems (active and passive) that combine to produce contemporary buildings will be presented with particular attention to the specific parameters and metrics that drive their functionality and performance. The central project is an extended exercise in design modeling: applying iterative refinements to introduce additional layers of systemic complexity and to respond to specific analytical measures of building performance. Success in this course will support the ability to productively contribute to building and construction projects from a variety of specific roles.

Learning Outcomes: 1. Understand building systems fundamentals. 2. Apply knowledge of building systems to a model case. 3. Compare the outcomes of different design/system application choices. 4. Develop a design solution based on a range of input parameters. 5. Communicate project outcomes clearly and effectively. Credits: 3.00

CEM 45500 - Temporary Structures In Construction

Credit Hours: 3.00. This course will cover the design and construction of various temporary structures and systems used in building and transportation construction. The course describes not only design issues of temporary structures such as formwork, falsework, bracing, earth retention systems, scaffolding, cofferdams, and so forth by providing lectures and design examples, but it also covers business aspects associated with the design and construction of temporary structures in the real world such as business practice, legal aspects, and design philosophy.

Learning Outcomes: 1. Develop an understanding of design and performance of various systems. 2. Develop an understanding of the importance and value of these systems and the responsibilities that will be carried into a professional career. Credits: 3.00

CEM 45600 - Design-Build Project Delivery Method For Engineers

Credit Hours: 3.00. This course presents traditional project delivery methods and contrasts them with design-build project delivery. The course focuses on the principles, tools, and procedures used in the design-build project delivery method. It provides students with sufficient education to become certified (following additional examination) by the Design Build Institute of America as an Associate Member and dependent on employment experience, a full Member. Traditional project delivery methods, Design-Bid-Build, Construction Manager as

Agent, 'Fast Track', and other 'rip and read' methods are losing popularity to project delivery methods that take a more collaborative approach. Collaboration requires a different way of thinking about a capital construction project and working with others in project delivery. Constructors must move from a transactional, arms-length relationship where the project is viewed as a low-price commodity to a full-suite delivery of services resulting in a high-value product. This requires collaboration with the Owner and other members of the project delivery process, something that has been missing from traditional project delivery methods. Active student participation is required. Student participation will be facilitated through assigned presentations, in-class projects, field trips to local projects, and guest lectures. Students who complete the course and achieve DBIA's minimum requirements (Fundamentals of Project Delivery, Principles of Design-Building Project Delivery, Post Award, and Contracts & Risk Management) will be eligible for recognition by DBIA.

Credits: 3.00

CEM 45700 - Inland Navigation Engineering

Credit Hours: 3.00. This course teaches detailed elements of Inland Navigation Structures, primarily in the United States. Students will become familiar with how waterways are conceived, planned, designed and constructed. Engineering Design Manuals for Locks and Dams will be reviewed. A primary focus will be on a new Corps of Engineers Lock and Dam currently under construction. The students will thoroughly review the Plans and Specifications as well as Construction Photos and Videos taken during construction. Various marine construction equipment and techniques will be presented.

Learning Outcomes: 1. Describe the attributes of all major project delivery methods, procurement methodologies, and contracting approaches. 2. Identify the appropriate project delivery method based on owner requirements. 3. Evaluate the attributes of design-build project delivery. 4. Assess the critical elements of the request for qualifications/request for proposals (RFQ/RFP) process and overall project management for design-build projects. 5. Understand the risk management and contract implications of a design-build project versus other project delivery methods. 6. Apply the attributes learned in this course to case studies. 7. Be prepared to be a meaningful participant on a real design-build project. Credits: 3.00

CEM 48500 - Legal Aspects Of Construction Engineering

Credit Hours: 3.00. This course will cover legal principles and landmark cases relevant to civil and construction engineering. Specific subjects covered include contracts, torts, agency, professional liability, labor laws, insurance, expert testimony, arbitration, patents and copyrights, sureties and ethics.

Learning Outcomes: 1. Read, comprehend and interpret construction contract plans and specifications for lock and dam facilities and other inland navigation structures. Through detailed study of project plans and specs as well as construction photos, students will be taken through the process of building these facilities from planning through construction. 2. Understand how a lock and dam facility functions. 3. Identify various components of lock and dam structures. 4. Understand various types of marine equipment necessary to construct a navigation facility in the dry or wet.

Credits: 3.00

CEM 49700 - Construction Engineering Projects

Credit Hours: 0.00 to 4.00. Topics vary. Permission of department required.

Credits: 0.00 to 4.00

CEM 50100 - Leadership And Advanced Project Management

Credit Hours: 3.00. This course will focus on the first ten years of the student's professional career. It will introduce concepts relating to development of the leader-manager, advanced project management techniques that will assist the student towards success in the construction industry, and developing a business plan on starting a small engineering or construction company. Guest speakers provide learning from entrepreneurs who got their start utilizing the systems taught in the course.

Learning Outcomes: 1. Recognize the importance of their personal values, attitudes, and communication skills in developing the leader-manager within. 2. Understand that modern leadership is "Taking people from where they are to where they have never been" and that "Leaders build leaders". 3. Work within

a team atmosphere and understand conflict management. 4. Develop their planning skills with specific focus on Lean Construction and story boarding & resource leveling techniques. 5. Understand the importance and impact that marketing and relationship development can have on the individual construction company's success and survival. 6. Expand their financial and cash management skills, including real estate development. 7. Develop business plans for an emerging engineering or construction business. Credits: 3.00

Elmore Family School of Electrical and Computer Engineering

About Electrical and Computer Engineering

Electrical and Computer engineering encompasses all areas of research, development, design, and operation of electrical and electronic systems and their components, including software. Emphasis in such varied areas as bioengineering, circuit theory, communication sciences, computers and automata, control systems, electromagnetic fields, energy sources and systems, and materials and electronic devices is available. Two degree programs are offered by the School: Bachelor of Science in Electrical Engineering (BSEE) and Bachelor of Science in Computer Engineering (BSCmpE).

Engineers in both fields must have a strong background in mathematics and physics, a broad base in the humanities, and a command of the English language in order to provide the scope of knowledge essential for optimum professional growth. The curriculum offered by the School of Electrical and Computer Engineering meets these objectives.

Graduates from the School of Electrical and Computer Engineering are sought after by all major industries. Electrical engineers hold many unusual and challenging positions in the aerospace, chemical, nuclear, automotive, medical, metallurgical, textile, railway, petroleum, and other basically non-electrical industries, as well as in computers, electronics, communications, power, and other electrical industries. Their professional roles span industrial activity, research, development, design, production, marketing, operation, field testing, and maintenance of many types of equipment for government, industry, farm, and home.

Two degree programs are offered by the school:

Electrical Engineering encompasses the development, design, research, and operation of electrical and electronic systems and components. Disciplines include VLSI and circuit design, communication and signal processing, computer engineering, automatic control, fields and optics, energy sources and systems, and microelectronics and nanotechnology.

Computer Engineering is a specialization within electrical and computer engineering offering an in-depth education in both hardware and software aspects of modern computer systems.

Electrical and Computer Engineering provides students with a versatile education that will prove valuable looking toward a professional future. Along with problem-solving and design skills, students develop a strong foundation in math, science, and core electrical/computer engineering fundamentals. This skillset prepares them for research and development positions in industry, management, sales, teaching, medical school, and law school.

At Birck Nanotechnology Center, engineers and scientists conduct research in emerging fields where new materials and tiny structures are built atom by atom or molecule by molecule.

Faculty

https://engineering.purdue.edu/ECE/People/Faculty

Contact Information

Purdue University
Elmore Family School of Electrical and Computer Engineering
Electrical Engineering Building
465 Northwestern Ave.
West Lafayette, Indiana 47907-2035
ph (765) 494-3540

Graduate Information

For Graduate Information please see Electrical and Computer Engineering Graduate Program Information .

Electrical and Computer Engineering Minor

Artificial Intelligence/Machine Learning Minor

Microelectronics and Semiconductors Minor

Computer Engineering, BSCMPE

Electrical Engineering, BSEE

ECE 19595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 20001 - Electrical Engineering Fundamentals I

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC), 1st order, and alternating-current (AC) circuits are subsequently discussed. Besides electrical devices and circuits, basic electronic components including diodes and transistors as well as their primary applications are also discussed.

Learning Outcomes: 1. Ability to analyze linear resistive circuits. 2. Ability to analyze 1st order linear circuits with sources and/or passive elements. 3. Ability to analyze electronic circuits with diodes and transistors. Credits: 3.00

ECE 20002 - Electrical Engineering Fundamentals II

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies. Permission of Department required.

Learning Outcomes: 1. Analyze 2nd order linear circuits with sources and/or passive elements. 2. Compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Compute responses to linear circuits using transfer function and convolution techniques. 4. Analyze and design transistor amplifiers at low, mid and high frequencies. 5. Ability to work with transmission line models to analyze circuits at high-frequency. 6. Use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 20007 - Electrical Engineering Fundamentals I Lab

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20001: Electrical Engineering Fundamentals I; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not

taught in ECE 20001.

Learning Outcomes: 1. Select and use electronic measurement instruments competently. 2. Design, wire, and troubleshoot electronic circuits. 3. Simulate electronic circuits. 4. Keep a laboratory notebook and prepare a formal laboratory report. 5. Function on an interdisciplinary team that draws on diverse backgrounds. 6. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 7. Demonstrate knowledge of laboratory safety precautions. Credits: 1.00

ECE 20008 - Electrical Engineering Fundamentals II Lab

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20002 Electrical Engineering Fundamentals II; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

Learning Outcomes: 1. Ability to competently select, use, and automate electronic measurement instruments. 2. Design, wire, and troubleshoot electronic circuits. 3. Ability to simulate electronic circuits. 4. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications. 5. Demonstrate knowledge of laboratory safety precautions. 6. Maintain laboratory notes and create professional experiment reports. Credits: 1.00

ECE 20200 - Linear Circuit Analysis II

Credit Hours: 3.00. Continuation of ECE 20100. Use of Laplace Transform techniques to analyze linear circuits with and without initial conditions. Characterization of circuits based upon impedance, admittance, and transfer function parameters. Determination of frequency response via analysis of poles and zeros in the complex plane. Relationship between the transfer function and the impulse response of a circuit. Use of continuous time convolution to determine time domain responses. Properties and practical uses of resonant circuits and transformers. Input - output characterization of a circuit as a two-port. Low and high-pass filter design.

Learning Outcomes: 1. Able to compute impedances and admittances of components and circuits. 2. Able to compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques. 3. Able to compute responses to linear circuits using transfer function and convolution techniques. 4. Able to analyze and compute responses of linear circuits containing mutually couples inductors and ideal transformers in the s-domain. 5. Able to analyze basic two port circuits using the various types of two port parameters and be able to construct such parameters from a given circuit. 6. Able to analyze and design basic LP, BP, HP and resonant circuits in the s-domain. Credits: 3.00

ECE 20400 - Introduction To Electrical And Electronic Circuits

Credit Hours: 4.00. Students will learn basics of electrical and electronic circuits including introduction to analog and digital electronic circuits. Measurement of electrical signals using meters, probes, and oscilloscopes are covered in the laboratory component of the course. Circuits are designed for minimum hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

Credits: 4.00

ECE 20700 - Electronic Measurement Techniques

Credit Hours: 1.00. Experimental exercises in the use of laboratory instruments. Voltage, current, impedance, frequency, and wave form measurements. Frequency and transient response. Elements of circuit modeling and design.

Credits: 1.00

ECE 20800 - Electronic Devices And Design Laboratory

Credit Hours: 1.00. Laboratory experiments in the measurement of electronic device characteristics. Design of biasing networks, small signal amplifiers, and switching circuits.

Credits: 1.00

ECE 20869 - Discrete Math For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Learning Outcomes: 1. Define, reason about, and operate on sets using basic set operations and Recursive definition. [1,7] 2. Represent and verify entailment arguments in predicate logic, both syntactically and semantically. [1,3,7] 3. Argue carefully using a variety of informal proof techniques, including mathematical induction. [1,3,7] 4. Count in a wide range of settings including permutations, combinations, countable infinities, and recurrence equations. [1,7] 5. Define and reason about functions and binary relations and work with their useful properties. [1] 6. Have an ability to define finite-state automata and regular expressions for languages, and relate these formalisms using non-determinism. [1,7] 7. Formulate algorithmic problems as decision problems and reason about their decidability and scalable solvability. [1,7] Credits: 3.00

ECE 20875 - Python For Data Science

Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Learning Outcomes: 1. Understand of regular expressions [1, 2]. 2. Use Python to write data analyses [1, 2, 6]. 3. Explain when data analyses are appropriate [1, 2, 3, 6]. 4. Explain the results of data analyses [2, 3, 5]. 5. Incorporate classes in their Python programs [1, 2, 6]. 6. Incorporate associative arrays in their programs [1, 2, 6]. Credits: 3.00

ECE 21000 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE and BSCmpE degree requirements, and professional development.

Credits: 1.00

ECE 25500 - Introduction To Electronic Analysis And Design

Credit Hours: 3.00. Diode, bipolar transistor, and FET circuit models for the design and analysis of electronic circuits. Single and multistage analysis and design; introduction to digital circuits. Computer-aided design calculations, amplifier operating point design, and frequency response of single and multistage amplifiers. High-frequency and low-frequency designs are emphasized.

Learning Outcomes: 1. Able to identify and correctly utilize the external lead structure and basic electrical characteristics of common semiconductor devices (pn junctions, MOSFETs, ad BJTs). 2. Able to analyze and design d.c. bias circuits. 3. Able to utilize d.c. and a.c. models of semiconductor devices in both analysis and design. 4. Able to analyze and design single and multistage amplifiers at low, mid and high frequencies. 5. Able to use a CAD tool (e.g., SPICE) in circuit analysis and design. Credits: 3.00

ECE 26400 - Advanced C Programming

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C programming knowledge should include basic syntax, control structures, and file I/O, as well as experience in declaring and using functions.

Learning Outcomes: 1. Ability to read and write C programs that use files. 2. Ability to read and write C programs that use structures. 3. Ability to read and write C programs that use dynamic data structures. Credits: 3.00

ECE 27000 - Introduction To Digital System Design

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Learning Outcomes: 1. Analyze and design CMOS logic gates. 2. Analyze and design combinational logic circuits. 3. Analyze and design sequential logic circuits. 4. Analyze and design computer logic circuits. 5. Realize, test, and debug practical digital circuits. Credits: 4.00

ECE 28200 - UNIX Programming For Engineers

Credit Hours: 1.00. Introduction to the UNIX operating system, including the UNIX file system, UNIX tools, and utilities. Introduction to Shell programming. The emphasis will be on how these tools/utilities are utilized in the Computing Engineering field.

Credits: 1.00

ECE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 29401 - Electrical And Computer Engineering Sophomore Seminar

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree requirements, professional writing and multicultural and professional development.

Learning Outcomes: 1. Knowledge of the ECE educational objectives and required outcomes. 2. Knowledge of the BSEE and/or BSCmpE degree requirements. 3. Ability to prepare a satisfactory plan-of-study. 4. Ability to write effectively in the English language. 5. Appreciation for ethical, professional and academic conduct. Credits: 1.00

ECE 29595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate

effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 29600 - Electrical And Computer Engineering Projects

Credit Hours: 0.00 to 18.00. Projects in Electrical and Computer Engineering. Permission of Department required.

Learning Outcomes: 1. Ability to apply knowledge of mathematics, science, and engineering. 2. Recognition of the need for, and an ability, to engage in life-long learning. 3. Ability to use techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 0.00 to 18.00

ECE 30010 - Introduction To Machine Learning And Pattern Recognition

Credit Hours: 3.00. Intelligent information processing, search and retrieval, classification, recognition, prediction and optimization with machine learning and pattern recognition algorithms such as neural networks, support vector machines, decision trees and data mining methods, current models and architectures, implementation topics especially in software, applications in areas such as information processing, search and retrieval of internet data, forecasting (prediction), classification, signal/image processing, pattern recognition, optimization, simulation, system identification, communications, control, management and finance. Topics covered will also be illustrated with the software package MATLAB and related toolboxes. Permission of instructor required.

Learning Outcomes: 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. An ability to function on multi-disciplinary teams. 5. An ability to identify, formulate, and solve engineering problems. 6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. 7. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. Credits: 3.00

ECE 30100 - Signals And Systems

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Learning Outcomes: 1. Able to classify signals (e.g., periodic, even) and systems (e.g., causal, linear) and an understanding of the difference between discrete and continuous time signals and systems. 2. Able to determine the impulse response of a differential or difference equation. 3. Able to determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties (e.g., time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fractions expansions. 5. Able to determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain, an ability to apply the Sampling theorem, reconstruction, aliasing, and Nyquist's

theorem to represent continuous-time signal in discrete time so that they can be processed by digital computers. Credits: 3.00

ECE 30200 - Probabilistic Methods In Electrical And Computer Engineering

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Credits: 3.00

ECE 30411 - Electromagnetics I

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic waves and transmission lines, which is continued in ECE 30412.

Learning Outcomes: 1. Work with electrostatic fields and find electric and potential fields from charge distributions including the presence of dielectric materials. 2. Work with magnetostatic fields and find magnetic fields from current distributions including the presence of magnetic materials. 3. Work with time varying fields including wave propagation. 4. Work with transmission lines in the time and frequency domains. Credits: 3.00

ECE 30412 - Electromagnetics II

Credit Hours: 3.00. Electromagnetics II builds on Electromagnetics I (ECE 31100) and emphasizes time-varying electromagnetic fields. Both fundamental understanding and an appreciation for applications that span all technologies related to electrical and computer engineering are emphasized. The topics covered include: Maxwell's equations, plane waves, transmission lines, waveguides and cavities, and antennas and radiation. Applications addressed relate to photonics, communications, and imaging and sensing. More generally, illustrations cover the basic principles on which devices and systems used every day operate.

Learning Outcomes: 1. Understand time-varying fields and Maxwell's equations. 2. Understand plane electromagnetic waves. 3. Understand the theory and application of transmission lines. 4. Understand waveguides and cavity resonators. 5. Understand antennas and radiating systems. Credits: 3.00

ECE 30414 - Elements Of Fiber Optics, Lasers And Optoelectronics

Credit Hours: 3.00. Fundamental of photonics, guided-wave optics, optical fibers, lasers, photon detectors, integrated optical components, optical information processing, devices in communication and sensor applications. Topics include generation, transformation, modulation and detection of laser beams and their applications.

Learning Outcomes: 1. Analyze simple optical systems including dielectric slabs, thin lenses, reflectors, and optical resonators. 2. Analyze optical waveguides, examine fiber modes and waveguide properties. 3. Know the operations of gas lasers, semiconductor lasers and light emitting diodes. 4. Know the operational principles of optical detectors, including various optical detection schemes. 5. Understand of the key components of optical fiber communication systems. 6. Understand of novel concepts in photonics, including ultrafast optics, photonic crystals, optical interconnects, metal optics, and metamaterials. Credits: 3.00

ECE 30415 - Fiber Optics And Lasers Laboratory

Credit Hours: 1.00. This laboratory course exercises in lasers, modulation of laser beams, fiber components and systems. It covers some simple optical measurements like Power and beam spot measurement of Gaussian beams. Students learn about lens-pinhole spatial filters and beam expanders. Fourier transform, convolution and correlation are covered. Characteristics of LEDs and ILDs are shown. Students become familiar with optical fibers related experiments like Fiber-optic microbend intensity sensors, Electrooptic modulation, Fiber optic Mach-Zehnder interferometer etc. Students also learn how to build laser systems based on the knowledge acquired from previous labs and with some simple set up. Finally there is a

final project where students can design a practical optical instrument based on their knowledge from the lab.

Learning Outcomes: 1. Handle basic optical components and equipment properly. 2. Assemble and align necessary optical components to perform simple optical experiments. 3. Design and test simple fiber communication systems. Credits: 1.00

ECE 30416 - Basics Of Engineering Optics

Credit Hours: 3.00. Fundamental of photonics, guided-wave optics, optical fibers, lasers, photon detectors, integrated optical components, optical information processing, devices in communication and sensor applications. Topics include generation, transformation, modulation and detection of laser beams and their applications.

Learning Outcomes: 1. Analyze simple optical systems including dielectric slabs, thin lenses, and reflectors. 2. Model Gaussian beams and the transformation of beams. 3. Analyze and design polarization systems, including polarizers and wave plates. 4. Know of optical interferometers and the operations of interferometers such as the Michelson, Fabry-Perot and double-slit. 5. Analyze diffraction patterns. Credits: 3.00

ECE 30417 - Engineering Optics Laboratory

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and basic applications of geometrical optics, beams, polarization optics, wave optics and Fourier optics. Permission of instructor required.

Learning Outcomes: 1. Handle basic optical components and equipment properly. 2. Assemble a set of optical components to perform simple optical measurements. 3. Design and test simple free-space optical measurements and instruments. Credits: 1.00

ECE 30500 - Semiconductor Devices

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode, Schottky diode, BJT, and MOSFET. Presents information about a wide variety of other devices including solar cells, LEDs, HBTs, and modern field-effect devices. Systematically develops the analytical tools needed to solve practical device problems.

Credits: 3.00

ECE 30600 - Electronic Circuits And Systems Laboratory

Credit Hours: 1.00. Experiments in electronic circuits and systems, including spectral analysis techniques, sampling, distortion measurements, random signals, signal-to-noise ratio and correlation.

Credits: 1.00

ECE 30653 - Introduction To Nanotechnology And Quantum Science & Technology

Credit Hours: 3.00. This interdisciplinary course offers an introduction to nanotechnology and quantum science and technology for undergraduate students in science and engineering. The students will develop understanding of interdisciplinary nature of these fields and utilize concepts in physics, chemistry and mechanics to describe and analyze unique properties of quantum and nanoscale objects. The course will provide the opportunity to get exposed to highly interdisciplinary nature of today's most active and rapidly expanding fields of research and technologies.

Learning Outcomes: 1. Define major types of nanoparticles and their sources. 2. Illustrate by simple calculations unique physical properties of nanoscale objects, e.g. calculate de Broglie wavelength, surface energy, melting point. 3. Describe basic nanostructure measurement methods. 4. Give examples of economic benefits of nano and quantum technology. 5. Describe approaches for managing security, health and environmental risks. Credits: 3.00

ECE 30700 - Electromagnetic Fields And Waves Laboratory

Credit Hours: 1.00. Experimental exercises illustrating concepts in electric and magnetic fields, transmission lines, electromagnetic fields, simple waveguides, and antennas.

Credits: 1.00

ECE 30800 - Systems Simulation And Control Laboratory

Credit Hours: 1.00. Instruction and laboratory exercises in the

solution of differential equations that arise in the modeling of physical systems. Instruction in the principles of operation and design of linear control systems.

Credits: 1.00

ECE 30834 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. Permission of department required.

Learning Outcomes: 1. An understanding of the design issues for creating raster graphics. 2. An ability to apply rendering techniques to an actual computer graphics problem and associated datasets. 3. An understanding of object transformations, representations, transformations and perspective projections. 4. An understanding of color, illumination, and shading techniques. 5. An understanding of the rendering and rasterization techniques. 6. An understanding of the application of computer graphics techniques to visualization, animation, and computer aided design. Credits: 3.00

ECE 30861 - Software Engineering

Credit Hours: 3.00. Introduction to the technical and social aspects of software engineering principles, with special emphasis on the process, methods, and tools needed to develop and test quality software products and systems.

Learning Outcomes: 1. Conduct object-oriented design and use unified modeling language. 2. Understand different models of software development processes. 3. Analyze requirements and write project specifications. 4. Develop a team software project on time and meet the specifications successfully. Credits: 3.00

ECE 30862 - Object-Oriented Programming In C++ And Java

Credit Hours: 3.00. C++ and Java programming languages, including classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function, overloading and overriding, function name overload resolution, container classes, and template classes.

Learning Outcomes: 1. An understanding of the concepts of inheritance and polymorphism. 2. An ability to overload operators in C++. 3. An understanding of the difference between function overloading and function overriding. 4. An ability to incorporate exception handling in object-oriented programs. 5. An ability to use template classes and the STL Library in C++. 6. An ability to write object-oriented programs of moderate complexity in Java. 7. An ability to write programs with multiple threads and use synchronization among threads. Credits: 3.00

ECE 30864 - Software Engineering Tools

Credit Hours: 1.00. This course will acquaint students with the toolkit of the modern software engineer. Students will learn the tools surrounding the software application itself, e.g., tools for software process, software construction, and software deployment. Examples include: integrated development editors (IDEs), version control systems, project management, bug tracking, scripting languages, testing aids, deployment technologies.

Learning Outcomes: 1. Use orchestration languages to manipulate diverse software systems. 2. Understand testing tools to assess software reliability and correctness. 3. Use software management tools. 4. Have an awareness of software deployment technologies and tradeoffs. Credits: 1.00

ECE 31032 - Power Systems Engineering

Credit Hours: 3.00. Introduction to the economic operation of power systems, three-phase circuit analysis, modeling of transformers and transmission lines, steady-state network analysis using a power flow, analysis during faults and state estimation.

Learning Outcomes: 1. Understand the function of the main components in a power system, and the basis of their circuit models. 2. Build a

system representation from components' circuit models and to apply solution techniques to certain operational needs. Credits: 3.00

ECE 31033 - Power Electronics

Credit Hours: 3.00. Introduction to the fundamental operating principles of power conditioning circuits that are currently being used to effect power flow from AC to DC and vice versa. Emphasis is on the relationship between form and function of these circuits. Circuits discussed will include AC/DC line-commutated converters, DC/DC converters, DC/variable frequency converters, resonant converters, and AC/AC converters. Computer simulations will be used as a part of the coursework.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a microcontroller-based digital system. 2. Understand the engineering design process. 3. Function on a multidisciplinary team. 4. Be aware of professional and ethical responsibility. 5. Communicate effectively, in both oral and written form. Credits: 3.00

ECE 31100 - Electric And Magnetic Fields

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credits: 3.00

ECE 31500 - Fundamentals Of Electrical Energy Engineering

Credit Hours: 3.00. Resistive circuit analysis with controlled sources. Sinusoidal frequency response, filters and Bode plots. Complex power in AC circuits, ideal transformers and three-phase power. Power electronic circuits including diodes, transistor switches, rectifiers and AC-DC converters. Magnetic circuits, magnetic materials and B-H curves. Transformer equivalent circuit models. No credit will be given for ECE majors.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering. 2. Design and construct experiments, as well as to analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, societal, political, ethical, health and safety, manufacturability, and sustainability. 4. Function on multi-disciplinary teams. 5. Identify, formulate, and solve engineering problems. 6. Understanding of professional and ethical responsibility. 7. Communicate effectively. Credits: 3.00

ECE 32100 - Electromechanical Motion Devices

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Learning Outcomes: 1. Analyze/design electromagnetic circuits/devices. 2. Understand the concepts and principles of electromagnetic energy conversion. 3. Understand the concept of time-varying transformations in the analysis of time-varying systems. 4. Analyze dc machines. 5. Understand converters for dc drives. 6. Analyze brushless dc machines. 7. Analyze induction machines. Credits: 3.00

ECE 32300 - Electromechanical Motion Devices And Systems Laboratory

Credit Hours: 1.00. Experiments closely coordinated with ECE 32100 involving measurement of fundamental parameters of various electromechanical devices using modern instrumentation techniques. Computer simulation is used to predict steady-state and dynamic operating characteristics. Comparison of predicted and measured performance is emphasized.

Learning Outcomes: N/A Credits: 1.00

ECE 32600 - Engineering Project Management

Credit Hours: 3.00. (ME 32600) Project management is an important skill that is needed in the private and public sectors as well as specialty businesses. This course will explore the challenges facing today's project managers and will provide a broad understanding of the project management environment focused on multiple aspects of the project.

Learning Outcomes: 1. Use library resources and internet resources to find information

necessary for the project. 2. Use critical thinking in its design process. 3. Use creative approaches when necessary to obtain project objectives. 4. Analyze and interpret data. 5. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 6. Write a project report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 7. Make an oral presentation using effective visual aids. 8. An understanding of professional and ethical responsibility. 9. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 10. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ECE 32700 - Engineering Economics

Credit Hours: 3.00. (ME 32700) Engineering Economics is designed as an overview of economics with a focus on how it relates to the practice of engineering. Topics include interest formulas, rate of return, life cost analysis, depreciation, taxes, and cash flow.

Learning Outcomes: 1. Understand the terminology used in engineering economic analysis. 2. Understand time-value-of-money concepts such as net present worth analysis, equivalent uniform annual worth analysis, benefit/cost analysis, internal rate of return analysis, loans, leveraging, and fixed-income investment analysis. 3. Understand the criteria for making economic-based decisions. 4. Analyze before-tax and after-tax cash flows. 5. Understand economic risk analysis techniques. 6. Conduct minimum life cycle cost tradeoffs between initial and repair costs. 7. Formulate economic solutions to real-world case study problems. 8.Demonstrate capability to use Excel spreadsheet analysis in solving economic problems. 9. Experience working in a project team to solve an economic problem and make a presentation of the solution using PowerPoint. 10. Write a project report, adhering to the specified format for business reports using appropriate writing style, grammar, and spelling. 11. Learn how to estimate costs and perform an economic analysis in support of capstone design and other term projects. 12. Develop cash flow analysis problem solving techniques for passing exams including the Engineering Economics portions of the EIT exam. Credits: 3.00

ECE 33700 - ASIC Design Laboratory

Credit Hours: 2.00. Introduction to standard cell design of Application Specific Integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and verification.

Learning Outcomes: 1. Design combinational and sequential logic in a variety of styles and awareness of resource usage. 2. Use, modify, create scripts to control logic synthesis. 3. Create a test bench and use it to verify a design that incorporates multiple sequential blocks. 4. Place, route, and verify timing of an ASIC design. 5. Determine the RTL architecture implied by HDL code of moderate complexity. 6. Explain the difference between various ASIC and digital system design approaches - standard cell, full custom, and programmable device. Credits: 2.00

ECE 34000 - Simulation, Modeling, and Identification

Credit Hours: 3.00. Investigation and evaluation of design problems through simulation of systems described by ordinary differential and difference equations. Development of simulation models from physical parameters and from experimental data. Topics include continuous, discrete, and hybrid models of electrical, mechanical, and biological systems. Laboratory experiences demonstrate concepts studied in text and lecture.

Credits: 3.00

ECE 36200 - Microprocessor Systems And Interfacing

Credit Hours: 4.00. An introduction to basic computer organization, microprocessor instruction sets, assembly language programming, and microcontroller peripherals.

Learning Outcomes: 1. Show ability to program a microcontroller to perform various tasks. 2. Show an ability to interface a microcontroller to various devices. 3. Show an ability to effectively utilize microcontroller peripheral. 4. Show an ability to design and implement a microcontroller-based embedded system. Credits: 4.00

ECE 36800 - Data Structures

Credit Hours: 3.00. Provides insight into the use of data structures. Topics include stacks, queues and lists, trees, graphs, sorting, searching, and hashing.

Learning Outcomes: 1. Understand various basic data structures, including stacks, queues, and trees. 2. Able to analyze time complexity and space complexity of algorithms. 3. Able to apply appropriate sorting and searching algorithms for a given application. 4. Able to apply graph theoretic techniques, data structures and algorithms for problem solving. 5. Able to design and implement appropriate data structures and algorithms for engineering applications. Credits: 3.00

ECE 36900 - Discrete Mathematics For Computer Engineering

Credit Hours: 3.00. This course introduces discrete mathematical structures and finite-state machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

Credits: 3.00

ECE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 38200 - Feedback System Analysis And Design

Credit Hours: 3.00. In this course, classical concepts of feedback system analysis and associated compensation techniques are presented. In particular, the root locus, Bode diagram, and Nyquist criterion are used as determinants of stability.

Credits: 3.00

ECE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39401 - Professional Communications And Diversity

Credit Hours: 1.00. This course provides ECE students with practice in relevant aspects of communication. Topics include: successfully seeking employment, working effectively in teams,

delivering engaging presentations, and leveraging the advantages and challenges of diversity and inclusion.

Learning Outcomes: 1. Ability to function effectively on a team whose members create a collaborative and inclusive environment, plan tasks, and meet objectives. 2. Communicate effectively with a range of audiences. 3. Develop and explain solutions to engineering problems, taking public health and cultural factors into consideration. Credits: 1.00

ECE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 39600 - Industrial Practice Seminar I

Credit Hours: 1.00. A special seminar for cooperative education and curricular practical training students. Permission of instructor required.

Learning Outcomes: 1. Understanding of how an engineering internship or co-op work experience benefits academic and career goals. Credits: 1.00

ECE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

ECE 40020 - Sound Reinforcement System Design

Credit Hours: 3.00. An introduction to computational tools used in the measurement and analysis of electro-acoustic systems, and their application to sound reinforcement system

engineering. Service learning based projects, serving the needs of community clients, provide the context for application of sound reinforcement system design principles and practices.

Learning Outcomes: 1. An ability to apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design a sound reinforcement system. 2. An understanding of the engineering design process. 3. An ability to function on a multidisciplinary team. 4. An awareness of professional and ethical responsibility. 5. An ability to communicate effectively, in both oral and written form. Credits: 3.00

ECE 40100 - Engineering Ethics and Professionalism

Credit Hours: 1.00. Some ethical, social, political, legal, and ecological issues that practicing engineers may encounter. (ECE 401 and ME 401 are cross-listed courses; students may not get credit for both ECE 401 and ME 401.)

Credits: 1.00

ECE 40400 - Introduction To Computer Security

Credit Hours: 3.00. Introduction to security issues related to the operation of computers and the workings of computer networks. Topics covered include introduction to cryptography, authentication protocols, digital signature algorithms, internet vulnerabilities, worms and virus propagation, denial of service attacks, etc. The students will also learn how to design firewalls to protect a system against unwanted intrusions. Permission of department required.

Credits: 3.00

ECE 40655 - Digital Integrated Circuit Analysis And Design

Credit Hours: 3.00. As applied to digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential, and dynamic logic circuits are considered. While the focus of the course is on CMOS technology, bipolar, nMOS, and BiCMOS circuits are introduced as well. SPICE is used as both an analysis and design tool. Semiconductor memory circuits are also discussed.

Learning Outcomes: 1. Demonstrate a basic knowledge of CMOS IC processing and layout. 2. Demonstrate an understanding of CMOS inverter operation, both static and dynamic. 3. Demonstrate an understanding of CMOS combinational logic circuit design and analysis. 4. Demonstrate an understanding of basic CMOS arithmetic circuits. 5. Demonstrate an understanding of CMOS digital array design. 6. Demonstrate an understanding of basic CMOS sequential logic analysis. 7. Demonstrate an understanding of memory technologies and designs. 8. Demonstrate an ability to design, and analyze and simulate a CMOS digital circuit. Credits: 3.00

ECE 40656 - CMOS Analog And Mixed Signal Integrated Circuits

Credit Hours: 3.00. This course is a review of technology and modeling of CMOS transistors; Analysis, and design of CMOS monolithic integrated circuits for analog and mixed-signal applications. Consideration of amplifier circuit design, and fabrication techniques with circuit simulation using Cadence. Simple and advanced CMOS operational amplifiers, comparators, sample and hold circuits, switch capacitor circuits and data converters; Design of analog and mixed-signal circuit building blocks.

Learning Outcomes: 1. Design a simple single-stage amplifier in a standard CMOS technology and verify the design using simulation. 2. Design a simple CMOS operational amplifier and verify the design using simulation. 3. Design an advanced operational amplifier in a standard CMOS technology and verify the design using simulation. 4. Analyze a voltage comparator in a standard CMOS technology and verify the design using simulation. 5. Analyze a sample and hold circuit and perform simulations. 6. Analyze a switched capacitor circuit and perform simulations. 7. Analyze a data-convertor circuit. Credits: 3.00

ECE 40801 - Introduction To Computer Vision

Credit Hours: 3.00. This course is an introduction to computer vision. The course will cover both classical and deep-learning approaches to recognizing objects in images and activities in video. Topics to be covered include scene classification, object localization, segmentation, and activity recognition. The course will cover both the theory behind methods to solve these

problems as well as how they are implemented in systems like PyTorch. Permission of department required.

Learning Outcomes: 1. Construct and train a neural network. 2. Construct and train an object detector. 3. Construct and train an activity classifier. 4. Work in a team to construct a solution to a computer vision problem. Credits: 3.00

ECE 40802 - Introduction To Natural Language Processing

Credit Hours: 3.00. This course is an introduction to modern natural language processing and computational linguistics. This course covers morphological, syntactic, semantic, and pragmatic processing as well as applications such as information extraction, question answering, and machine translation. This course will cover fundamental topics as well as recent advances from the literature.

Learning Outcomes: 1. Design and implement a natural language parser. 2. Construct a semantic representation from natural-language input. 3. Train and use a neural network for NLP. 4. Use natural-language technology to construct and demo a new application. Credits: 3.00

ECE 40862 - Software For Embedded Systems

Credit Hours: 3.00. This course provides an introduction to software design for embedded computing systems. Major topics covered include the importance of time and timing in embedded systems, embedded software organization (FSM-based program design, polled loop systems, foreground-background systems, event driven architectures, multi-tasking, etc.), real-time scheduling and real-time operating systems, wired/wireless networked embedded systems, debugging techniques for embedded software, and advanced topics such as memory-safe programming, implementing reentrant functions, and minimizing code space, memory usage, and power consumption. The course features a series of integrated assignments using state-of-the-art embedded hardware platforms, embedded software design tools, and real-time operating systems that reinforce the concepts taught in the lectures.

Learning Outcomes: 1. Understand the embedded software design process and tools used. 2. Understand various software architectures for embedded systems. 3. Apply advanced debugging techniques to embedded software. 4. Analyze and implement real-time embedded applications. 5. Design and implement distributed applications for networked embedded systems. Credits: 3.00

ECE 40875 - Data Mining Basic Concepts And Techniques

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, such as the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering, classification, anomaly detection, recommendation and graph analysis. The applications of these techniques in real-world decision making in various domains, such as science, business, biology, health care, transportation, will be discussed.

Learning Outcomes: 1. Describe and explain the process of data mining. 2. Formulate problems in real-world applications into data mining tasks and solve the problems using data mining techniques. 3. Implement software programs that conduct data mining and evaluate the output of data mining programs. 4. Work in a team and present data mining solutions to people in scientific or other disciplines. Credits: 3.00

ECE 41015 - Introduction To Smart Grid

Credit Hours: 3.00. This course is an introduction to the concepts of data communications, cybersecurity, and information privacy on a smart-grid environment. Understanding the differences between power grid employed worldwide since the end of the 19th century and the new power grid system with distributed energy sources, this course outlines the key issues involved in enhancing: the distribution system, engaging electricity demand and utility regulation. Students will learn the main challenges and solutions to mitigate the issues associated with the integration of variable energy resources, transmission expansion and the impact of distributed generation and electric vehicles.

Learning Outcomes: 1. Describe the operation of conventional power grid systems including its generation, transmission and distribution, and the new power grid system with distributed energy sources along the transmission and distribution lines. 2. Develop simplified models

to describe different components on both traditional and the smart grid. 3. Design and specify renewable energy systems (e.g., solar and wind energy sources) as well as storage devices (e.g., batteries) connected to the smart grid. 4. Develop load flow analysis of power grids. 5. Understand the main data communications standards. 6. Classify the cybersecurity vulnerabilities and understand the risks of an attack on the grid. Credits: 3.00

ECE 41023 - Electromechanical Motion Control

Credit Hours: 3.00. The operation, analysis, and control of electromechanical systems are covered, including a treatment of electromechanical devices, power electronics, and control systems. Sample applications include servo-systems, propulsion drives, and variable-speed rotational equipment.

Learning Outcomes: 1. Understand the structure, design, and operating characteristics of dc drive systems including dc/dc converters, associated switching strategies, dynamic-average-value models, and speed/position/trajectory motion control systems. 2. Understand the structure, design and operating characteristics of brushless dc drive systems including dc/ac inverters, associated switching strategies, dynamic-average-value models, and speed/position/trajectory motion control systems. 3. Understand the operating principles and control of stepper motors including the design of optimum acceleration/deceleration profiles. 4. Understand the operating principles and control of field-oriented induction motor drives. 5. Understand the structure, operating characteristics, and modeling of switched reluctance motor drive systems. Credits: 3.00

ECE 41200 - Introduction To Engineering Optics

Credit Hours: 3.00. The control and characteristics of optical radiation are covered. Applications to optical instrumentation, thin films, holography, and polarizing optics are discussed.

Learning Outcomes: 1. Analyze simple optical systems (dielectric slabs, thin lenses, reflectors). 2. Model Gaussian beams and the transformation of beams. 3. Analyze and design polarization systems, including polarizers and wave plates. 4. Know optical interferometers and the operations of interferometers such as the Michelson, Fabry-Perot and double-slit. 5. Analyze diffraction patterns. Credits: 3.00

ECE 41300 - Introduction To Optics Laboratory

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and applications of geometrical optics, polarization optics, wave optics, and Fourier optics.

Learning Outcomes: 1. Design, construct, and test a simple optical system by assembling a set of optical components. 2. Test the operation of simple interferometers. 3. Make holograms using lab equipment. 4. Design practical optical system (e.g.; barcode scanner, laser microphone, etc.) and analyze its performance. Credits: 1.00

ECE 41400 - Elements Of Electro And Fiber Optics

Credit Hours: 3.00. Introduction to the use of lasers, fiber and integrated optical components and devices in communication and sensory applications. Topics include generation, transformation, modulation, deflection, and detection of laser beams, and their applications in fiber communication sensory systems.

Credits: 3.00

ECE 41500 - Electro- And Fiber Optics Laboratory

Credit Hours: 1.00. Laboratory exercises in lasers, hologram, modulation and deflection of laser beams, fiber components, and systems.

Credits: 1.00

ECE 43200 - Elements Of Power System Engineering

Credit Hours: 3.00. Fundamental concepts of power system analysis, transmission line parameters, basic system models, steady-state performance, network calculations, power flow solutions, fault studies, symmetrical components, operating

strategies, and control.

Learning Outcomes: 1. Understand the function of the main components in a power system, and the basis of their circuit models. 2. Able to build a system representation from components' circuit models and to apply solution techniques to certain operational needs. Credits: 3.00

ECE 43201 - Elementary Power Systems Engineering

Credit Hours: 3.00. Fundamental concepts of power systems analysis, transmission line parameters, basic system models, steady state performance, network calculations, power flow solutions, fault studies, symmetrical components, operating strategies and control.

Learning Outcomes: 1. Understand the functions of the main components in a power system, and the basis of their circuit models. 2. Build a system representation from components' circuit models and to apply solution techniques to certain operational needs. Credits: 3.00

ECE 43500 - Object-Oriented Design Using C++ And Java

Credit Hours: 3.00. Review of OO design with C++ and Java. Difficulties caused by multiple inheritances in C++. Taking advantage of Run-Time Identification in C++. Multi-threading, AWT, and Network Programming in Java. Discussion of Java applets, beans, and servlets. Unified modeling language. Use-case analysis. Constructing conceptual models. System sequence diagrams. "Gang of Four" design patterns. Case studies. Permission of instructor required.

Credits: 3.00

ECE 43700 - Computer Design And Prototyping

Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, datapath design, control strategies, pipelining, memory hierarchy, and I/O interface design.

Credits: 4.00

ECE 43800 - Digital Signal Processing With Applications

Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; short-time spectral analysis and synthesis; linear predictive coding. Image processing: two-dimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credits: 4.00

ECE 44000 - Transmission Of Information

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Learning Outcomes: 1. Recognize and analyze in the time and frequency domain the performance of amplitude and frequency modulated analog communications systems in the presence of noise. 2. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of analog systems, which include bandwidth and signal to noise ratio. 3. Recognize and analyze in the time and frequency domains the performance of various digital modulation formats, including ASK, QAM, PSK, and FSK in the presence of noise. 4. Understand the importance, computation, and measurement using modern test equipment of standard performance measures of digital systems which include bandwidth and hit error probability. 5. Understand the basics of information theory and error control codes including the effect of error control codes on the bandwidth and bit error probability of digital systems. Credits: 4.00

ECE 44100 - Distributed Parameter Systems

Credit Hours: 3.00. Transient and steady-state behavior of transmission lines, wave guides, antennas, propagation, noise, microwave sources, and system design.

Credits: 3.00

ECE 45300 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts developed in the last 25 years which constitute the fundamentals of nanoelectronics and mesoscopic physics, assuming a minimal set of prerequisites. Topics covered include the new Ohm's law, conductance quantization, the nanotransistor, spin valves, thermoelectricity, quantum systems and the non-equilibrium Green's function (NEGF) method.

Learning Outcomes: 1. Ability to perform semiclassical analysis of charge flow in nanoelectonic devices. 2. Ability to perform semiclassical analysis of spin flow and heat flow in nanoelectronic devices. 3. Ability to perform quantum analysis of nanoelectonic devices.

Credits: 3.00

ECE 45500 - Integrated Circuit Engineering

Credit Hours: 3.00. Analysis, design, and fabrication of silicon bipolar and MOSFET monolithic integrated circuits. Consideration of amplifier circuit design and fabrication techniques with circuit simulation using Spice-2. Integrated operational amplifiers with difference amplifiers, current sources, active loads, and voltage references. Design of IC analog circuit building blocks.

Credits: 3.00

ECE 45600 - Digital Integrated Circuit Analysis And Design

Credit Hours: 3.00. As applied t digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential, and dynamic logic circuits are considered. While the focus of the course is on CMOS technology, bipolar, nMOS, and BiCMOS circuits are introduced as well. SPICE is used as both an analysis and design tool. Semiconductor memory circuits are also discussed.

Credits: 3.00

ECE 45700 - Electronic Design Laboratory

Credit Hours: 1.00. Laboratory exercises illustrating the design and application of electronic circuits. Case studies of circuits presently in existing instruments, such as the color television receiver sampling oscilloscope, are used as a basis for the circuits investigated or designed. Pulse and analog circuits studied, as well as high voltage and power supplies. Signal processing, modulation, and sampling are used to demonstrate the circuits as interconnected into a complete system.

Credits: 1.00

ECE 46300 - Introduction To Computer Communication Networks

Credit Hours: 3.00. An introduction to the design and implementation of computer communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet success. Topics include: digital transmission and multiplexing, protocols, MAC layer design (Ethernet/802.11), LAN interconnects and switching, congestion/flow/error control, routing, addressing, performance evaluation, internetworking (Internet) including TCP/IP, HTTP, DNS etc. This course will include one or more programming projects.

Learning Outcomes: 1. An understanding of the fundamental principles underlying packet switching networks, and different Local Area Network technologies. 2. An ability to implement network protocols using network socket programming. 3. An understanding of the key principles behind retransmission protocols, congestion control algorithms, and TCP. 4. An understanding of the basic concepts of routing.

Credits: 3.00

ECE 46800 - Introduction To Compilers And Translation Engineering

Credit Hours: 4.00. The design and construction of compilers and other translators. Topics include compilation goals, organization of a translator, grammars and languages, symbol tables, lexical analysis, syntax analysis (parsing), error handling, intermediate and final code generation, assemblers, interpreters, and an introduction to optimization. Emphasis is on engineering a compiler or interpreter for a small programming language - typically a C or Pascal subset. Projects involve the stepwise implementation (and documentation) of such a system. Department permission required.

Credits: 4.00

ECE 46900 - Operating Systems Engineering

Credit Hours: 4.00. The design and construction of operating systems for both individual computers and distributed (networked) systems. Basic concepts and methods for managing processor, main memory, block-structured storage, and network resources are covered. Detailed examples are

taken from a number of operating systems, emphasizing the techniques used in networked versions of UNIX. These techniques are applied to design improvements of portions of a simplified, networked, UNIX-based operating system; the improvements are implemented and their performance is evaluated in laboratory experiments.

Credits: 4.00

ECE 47000 - Curricular Practical Training

Credit Hours: 0.00. An electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan of study and help prepare him/her for his/her future role as a practicing engineer. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job minimum period of employment is required. This course may not be taken in successive semesters. Permission of department required.

Credits: 0.00

ECE 47001 - Part-Time Curricular Practical Training

Credit Hours: 0.00. A part-time electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan of study and help prepare him/her for his/her future role as a practicing engineer. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Build skills realted to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ECE 47100 - Embedded Microcontroller, Microprocessor, and DSP-Based Systems

Credit Hours: 3.00. A structured approach to the development and integration of embedded microcontroller/microprocessor/DSP-based systems. The course provides students with design experience of embedded systems. The course covers the microprocessor selection, the configuration of peripheral components, and the hardware abstraction techniques. The course also covers the C programming techniques for embedded systems and using a fixed point microprocessor for floating point calculations.

Credits: 3.00

ECE 47300 - Introduction To Artificial Intelligence

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Learning Outcomes: No change Credits: 3.00

ECE 47700 - Digital Systems Senior Project

Credit Hours: 4.00. A structured approach to the development and integration of embedded microcontroller hardware and software that provides senior-level students with significant design experience applying microcontrollers to a wide range of embedded systems (e.g., instrumentation, process control, telecommunications, and intelligent devices). The primary objective is to provide practical experience developing integrated hardware and software for embedded microcontroller systems in an environment that models one which students will most likely encounter in industry. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a microcontroller-based digital system. 2. Understand the engineering design process. 3. Function on a multidisciplinary team. 4. Be aware of professional and ethical responsibility. 5. Communicate effectively, in both oral and written form. Credits: 4.00

ECE 48300 - Digital Control Systems Analysis And Design

Credit Hours: 3.00. The course introduces feedback computer controlled systems, the components of digital control systems, and system models on the z-domain (z-transfer functions) and on the time domain (state variable representations.) The objectives for system design and evaluation of system performance are considered. Various discrete-time controllers are designed including PID-controllers, state and output feedback controllers, and reconstruction of states using observers. The systems with the designated controllers are tested by simulations.

Learning Outcomes: 1. Understand digital feedback control systems. 2. Know constructing discrete-time mathematical model system. 3,

Know the analyzing system behavior using discrete-time model and evaluating the system performance. 4. Know to use controller design techniques to make the system behavior satisfy specified design objectives. 5. Evaluate and test the system performance using digital simulations. Credits: 3.00

ECE 49022 - Electrical Engineering Senior Design Projects

Credit Hours: 4.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics). Lectures require use of the I-Clicker system.

Learning Outcomes: 1. Apply knowledge obtained in earlier coursework and to obtain new knowledge necessary to design and test a system, component, or process to meet desired needs. 2. Understand the engineering design process. 3. Function on an interdisciplinary team. 4. Acquire an awareness of professional and ethical responsibility. 5. Develop effective communication skills, both oral and written. Credits: 4.00

ECE 49401 - Professional Communication Capstone

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and plans for professional growth.

Learning Outcomes: 1. Communicate effectively with a range of audiences. 2. Function effectively on a team whose members together create a collaborative and inclusive environment, plan tasks, and meet objectives. 3. Ability to make informed judgments based ethical and professional responsibilities in engineering situations, giving consideration to global, economic, environmental, and/or societal contexts. Credits: 1.00

ECE 49500 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

Credits: 1.00 to 4.00

ECE 49595 - Selected Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Able to design and conduct experiments, as well as to analyze and interpret data. 3. Able to design a system, component, or process to meet desired needs. 4. Able to function on a multidisciplinary team. 5. Able to identify, formulate, and solve engineering problems. 6. Understand the professional and ethical responsibility. 7. Able to communicate effectively. 8. Understand the impact of engineering solutions in a global and societal context. 9. Recognize the need for, and an ability to engage in, life-long learning. 10. Know the contemporary issues. 11. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00 to 5.00

ECE 49600 - Electrical And Computer Engineering Projects

Credit Hours: 0.00 to 18.00. Arrange Hours and Credit. Topics vary. Permission of department required.

Learning Outcomes: 1. Apply fundamental laws of electrical and electronic circuits to analyze systems and circuits. 2. Assemble and test circuits (virtual and real), measuring electrical

quantities using standard instrumentation. 3. Decompose a system into functional blocks; and in some applications, blocks into circuits. 4. Utilize technology to control electronic circuit actions. 5. Utilize structured problem solving techniques to analyze fundamental applications in electronics. 6. Demonstrate knowledge of and apply electrical safety. Credits: 0.00 to 18.00

School of Engineering Education

School of Engineering Education

Within the School of Engineering Education, two distinct degree options are offered. Interdisciplinary Engineering Studies (IDES) and Multidisciplinary Engineering (MDE) are each unique pathways that serve student populations with different career interests. In particular, the IDES degree is often referred to as a "pre-professional school" program, which offers a bachelor of science degree (BS). Alternatively, MDE confers a bachelor of science in engineering (BSE). Further details of each program follow below.

The **Multidisciplinary Engineering** (MDE) mission, goals, and objectives are designed to prepare graduates to practice engineering. Typically, a plan of study is developed around a focused concentration. Students may develop their own individual plan of study or select one of these established concentrations:

- Acoustical Engineering
- Engineering Management
- General Engineering
- Visual Design Engineering
- Lighting Engineering
- Nano-Engineering
- Humanitarian Engineering
- Theatre Engineering (Limited Enrollment)
- Educational Engineering (not a teaching certified program)

Interdisciplinary Engineering Studies (IDES) is for students who want an engineering education but do not plan to practice engineering. Students are often looking ahead to attending a professional school, such as Medical School, or looking for some engineering coursework and other broad educational exposure. Choose from these concentrations:

- Engineering Science Studies
- Pre-Professional Engineering Studies (In preparation for a professional school: Pre-Med; Pre-Law; Pre-Vet; etc)

Students must complete the requirements of the First-Year Engineering Program to be accepted into either IDES or MDE. These programs offer students the opportunity to advance to graduate school or pursue a career in industry.
Features of these undergraduate programs include:

- Flexible plan of study
- Limited enrollment
- Student planning is required in collaboration with intensive advisor counseling

Faculty

Students interested in pursuing undergraduate research opportunities in the School of Engineering Education are encouraged to contact faculty who conduct research in their areas of interest. A comprehensive list of engineering faculty is provided here.

Contact Information

Questions can be directed to the following offices.
School of Engineering Education
Purdue University
Neil Armstrong Hall of Engineering, Room 1300
701 W. Stadium Avenue
West Lafayette, IN 47907
e-mail: engr-info@purdue.edu
phone: (765) 494-9713
fax: (765) 494-5819
Advising: ide@ecn.purdue.edu

Interdisciplinary Engineering Studies/Pre-Medical Engineering Studies Concentration, BS

Multidisciplinary Engineering/General Engineering Concentration, BSE

Multidisciplinary Engineering/Acoustical Engineering Concentration, BSE

Multidisciplinary Engineering/Educational Engineering Concentration, BSE

Multidisciplinary Engineering/Engineering Management Concentration, BSE

Multidisciplinary Engineering/Humanitarian Engineering Concentration, BSE

Multidisciplinary Engineering/Lighting Concentration, BSE

Multidisciplinary Engineering/Nano Engineering, BSE

Multidisciplinary Engineering/Theatre Engineering Concentration, BSE

Multidisciplinary Engineering/Visual Design Engineering Concentration, BSE

Interdisciplinary Engineering Studies/Engineering Science Studies Concentration, BS

ENE 49800 - Undergraduate Research In Engineering Education

Credit Hours: 1.00 to 3.00. Individual research projects for students with the approval of their academic advisors. Requires prior approval of, and arrangement with, a faculty research advisor in the Department of Engineering Education. Written and oral final reports are required. Permission of instructor required.

Credits: 1.00 to 3.00

IDE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the

professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 30100 - Professional Preparation In Interdisciplinary Engineering

Credit Hours: 1.00. Seminar covering topics required for professional preparation of engineers including functioning in teams, communication, ethics, global and societal impacts, how people learn, and contemporary issues impacting and impacted by engineering.

Learning Outcomes: 1. Communicate effectively to a range of audiences. 2. Recognize ethical & professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. 3. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. 4. Acquire and apply new knowledge as needed, using appropriate learning strategies. Credits: 1.00

IDE 36000 - Multidisciplinary Engineering Statistics

Credit Hours: 3.00. Statistical methodology is critical to the engineering problem-solving process. This course introduces engineering students to the role of statistics in problem-solving, and to the design and presentation of simple models and experiments. An emphasis will be placed on using computer software to perform statistical analyses and to the interpretation of the software results. This is a recommended course for the MDE statistics elective. Permission of instructor is required.

Learning Outcomes: 1. Describe the role of statistics in engineering. 2. Construct and interpret summary statistics and visual data displays using computer software. 3. Apply probability models to describe uncertainty and to make decisions. 4. Perform statistical analyses using computer software and to interpret the software results. 5. Construct simple empirical models from data, and design simple controlled experiments. 6. Formulate research questions, collect and analyze data, and present findings through a written report and oral presentation. 7. Work effectively in problem-solving teams and carry out meaningful performance assessments of individual team members. Credits: 3.00

IDE 38199 - Professional Practice Three-Session Coop I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

IDE 38299 - Professional Practice Three-Session Coop II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

IDE 38399 - Professional Practice Three-Session Coop III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

IDE 38500 - Design Methodologies For Diverse Stakeholders

Credit Hours: 3.00. This course focuses on engineering design methodologies with a concern for the needs of diverse stakeholders. The course brings together topics drawn from a variety of disciplines (including anthropology, education, psychology, human-computer interaction and engineering) to introduce interdisciplinary engineering approaches to: (1) design tools, systems, and/or environments to support cognitive processes and (2) engage in human-centered and learner-centered design. The semester design project provides a context for students to apply these methods. Permission of Instructor required.

Learning Outcomes: 1. Learn about cognitive

processes (including learning processes), how to design products, processes and environments to support cognition. 2. Learn methodologies and develop skills to be able to apply human-centered principles in the design of interfaces, every-day products and learning environments, whether in industrial or academic settings. 3. Engage in reflective practices to connect the course material to previous learning experiences as well as personal learning goals, with a goal of furthering their life-long learning skills. Credits: 3.00

IDE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IDE 39699 - Professional Practice Internship

Credit Hours: 0.00. Internship experience in multidisciplinary engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

IDE 48000 - Engineering Ethics In Interdisciplinary Contexts

Credit Hours: 3.00. The purpose of this course is to provide students with tools and strategies to reason through situations with ethical issues that they may encounter as engineering students and in their future careers. To this end, this course seeks to enhance students' awareness of ethical issues in interdisciplinary engineering contexts, ability to reason through ethical challenges in diverse engineering contexts, courage to respond to ethical issues in their future practice, ability to work effectively on teams, and the ability to communicate with others.

Learning Outcomes: 1. Identify ethical issues affecting ethical engineering practice in interdisciplinary engineering contexts. 2. Apply a consistent reasoning process toward ethical issues in an engineering context and formulate appropriate courses of action to respond to the issue. 3. Feel prepared to respond to ethical issues they may encounter in their future work. 4. Collaborate on interdisciplinary teams while

considering and responding to challenging ethical scenarios. 5. Communicate ethical considerations to their peers and other key stakeholders. Credits: 3.00

IDE 48300 - Multidisciplinary Engineering Analysis And Decision Making

Credit Hours: 1.00. Application of product evaluation, cost estimating, and product/project feasibility and viability analysis from multidisciplinary perspectives in the context of new product development. Topics include exposure to company success measures, quantitative and qualitative analysis, sensitivity analysis, cost-benefit analysis, project comparisons, new product life-cycle analysis, and related engineering decisions. Topics are explored through case-based, industrially focused examples. The course centers on the creation and use of analytical spreadsheets with computer tools/software for routine engineering analysis and decision-making.

Learning Outcomes: 1. Analyze and interpret data. 2. Design, subject to economic constraints. 3. Identify, formulate, and solve engineering problems. 4. Impact engineering in global, economic, environmental, and societal context. 5. Use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 1.00

IDE 48400 - Multidisciplinary Engineering Design Methodology

Credit Hours: 1.00. Engineering design methods targeted for MDE students. Introduction to Multidisciplinary Teams, Design Project Scoping and Task Clarification, Design Data Acquisition & Management, Design Communication & Iteration. and Design Review Processes. Permission of department required.

Learning Outcomes: 1. Apply math, science and engineering. 2. Analyze and interpret data. 3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 4. Identify, formulate, and solve engineering problems. 5. Impact engineering in global, economic, environmental and societal context. 6. Know contemporary issues that affect engineering and how engineering can impact these issues. Credits: 1.00

IDE 48500 - Multidisciplinary Engineering Design Project

Credit Hours: 3.00. Capstone design experience for multidisciplinary engineering students. Physical system or process system design projects, related to contemporary or potential problems involving interdisciplinary teams of engineers. Permission of instructor required.

Learning Outcomes: 1. Function as an effective member of a multidisciplinary team. 2. Demonstrate leadership in a team context. 3. Apply a systemic approach to the early design stages of the product life cycle. 4. Identify and verify stakeholder needs and thus develop valid design requirements. 5. Idently competing technical, commercial, socio-environmental issues. 6. Use advanced informtion seeking and computer knowledge management tools. 7. Synthesize a conceptual design for a complex product, machine or system. 8. Use advanced computer tools to model and test the behaviour of design ideas. 9. Estimate the life cycle costs of a system at the conceptual phase. 10. Manage technical and other types of risk in early stages of the design process. 11. Demonstrate effective project management and apply professional judgement. 12. Conduct professional design reviews. Credits: 3.00

IDE 48700 - Multidisciplinary Engineering Senior Professional Development

Credit Hours: 1.00. Senior professional development covers and assesses students in Multidisciplinary Engineering professional outcomes including, teamwork, professional and ethical responsibility, communication, impact of engineering in context, lifelong learning, impact of contemporary issues, and leadership. Methods to obtain a professional position after graduation.

Learning Outcomes: 1. An ability to function on multidisciplinary teams. 2. An understanding of professional and ethical responsibility and actions that are congruent with this

understanding. 3. An ability to communicate effectively by speaking and writing. 4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 5. An understanding of how one learns and recognition of the need for lifelong learning. 6. A knowledge of how contemporary issues affect engineering and how engineering can impact these issues. 7. An understanding of the principles, applications and importance of leadership. Credits: 1.00

IDE 49500 - Special Topics In Interdisciplinary Engineering

Credit Hours: 1.00 to 4.00. Primarily designed for interdisciplinary engineering subject areas for which there is no specific course offered, but for which there is sufficient student interest to justify teaching a specialized course on a trial basis. May be repeated for credit as long as the topic being taught is not repeated.

Credits: 1.00 to 4.00

Division of Environmental and Ecological Engineering

EEE Main Page

About Environmental and Ecological Engineering

Environmental and Ecological Engineering (EEE) offers BS, MS and PhD degrees that train students to approach problems from an integrated perspective, considering both environmental issues and ecological interactions. This high-impact method addresses challenges in the built environment, while also striving to understand interactions between the human and natural worlds.

Of the 14 "Grand Challenges of Engineering" identified by the National Academy of Engineering, six are in the environmental and ecological engineering domain. A degree in Purdue EEE teaches graduates to apply their technical expertise in systems engineering, biology, and chemistry to develop holistic strategies to protect human and environmental health, design sustainable systems and technologies, and manage Earth's limited resources and ecosystems so they will be available for generations to come.

Our program is led by a multidisciplinary community of faculty jointly appointed in EEE and schools/departments including Agricultural and Biological Engineering, Agronomy, Civil Engineering, Forestry and Natural Resources, Industrial Engineering, Materials Engineering, and Mechanical Engineering.

Our curriculum is distinctive in that it focuses on both Classic Environmental Engineering, which develops processes to treat, control, and manage contaminated media, and Industrial Sustainability, which deals with designing and managing engineering systems to avoid waste and preserve natural resources.

Purdue EEE was established in 2006 with this two-pronged philosophy in mind. Our students and faculty address the management of industrial waste within water, soil and air, while also identifying its origins to prevent environmental challenges before they start.

EEE graduates are equipped to enter a wide range of employment sectors in environmental and engineering fields, such as consulting and engineering services, manufacturing, industrial and construction, government, municipal and public service, non-governmental organizations (NGOs), and academia.

Faculty

Contact Information

Division of Environmental and Ecological Engineering
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Graduate Information

Go to information for this department

Environmental and Ecological Engineering, BSEEE

Environmental and Ecological Engineering Minor

EEE 23000 - Engineering Economics And Environment

Credit Hours: 3.00. This course introduces life cycle analysis concepts; every process and material involved in an object's life is accounted for in a system boundary to quantify the effect an item has on the world's environment. Students will become familiar with how materials are sourced from nature, how they are processed into components, how those components are assembled into consumer items, how the consumer item continues to require resources, and how the item is eventually disposed. Particular focus is given to how each of these topics impacts societies and environments at both local and global scales.

Learning Outcomes: 1. Design engineering and manufacturing systems with reduced environmental and ecological impact using industrial ecology principles. 2. Describe principles of life cycle analysis (LCA), including its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. Identify common relationships and dynamics in complex systems, including environmental systems, socio-economic systems, and engineered systems. 4. Conduct a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 5. Quantify the physical inputs and outputs of specific engineering processes that comprise a product life cycle. 6. Demonstrate awareness of the roles and responsibilities of stakeholders in complex contemporary environmental issues. 7. Identify implicit and explicit impacts on various stakeholder groups from policies and decisions on environmental issues and engineering solutions. 8. Develop an equitable engineering design proposal. Credits: 3.00

EEE 25000 - Environmental, Ecological, And Engineering Systems

Credit Hours: 3.00. An overview of systems thinking and examples, and applications to environmental, ecological, and engineering systems. Students will develop an understanding of complex and global systems, along with the tools and analysis methods required to deal with them. Basic environmental and ecological science concepts are also included.

Learning Outcomes: 1. Understand the types of relationships and dynamics common in complex systems, including environmental systems, ecological systems, and engineering systems. 2. Able to apply fundamental systems tools and modeling approaches to a wide variety of engineering, environmental, and ecological problems. 3. Understand the foundational concepts and vocabulary of global environment and ecological systems. 4. Appreciate the complexity of contemporary issues related to society and EEE, including and understanding of the roles and responsibilities of stakeholders. Credits: 3.00

EEE 29001 - Introduction To Environmental & Ecological Engineering Seminar

Credit Hours: 2.00. Guest presenters, peer panelists, and small group discussions introduce students to the knowledge, skills, and abilities needed in order to exhibit the highest levels of professionalism & stewardship expected of an Environmental and Ecological Engineering graduate. Topics include planning a course of study; internship, research, study abroad opportunities; career planning and placement skills; professional responsibility and ethics; and functioning as a professional.

Learning Outcomes: 1. Communicate professionally in both formal and informal settings. 2. Create career documents (e.g., resumes, cover letters, LinkedIn Profiles) that demonstrate professionalism and critical thinking. 3. Understand how their actions and/or inactions are perceived in professional settings. 4. Identify and justify their curricular path at Purdue University. 5. Identify a variety of curricular, extra-curricular, and professional opportunities that will best support the

achievement of their career goals. Credits: 2.00

EEE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 29500 - Experimental Course

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 30000 - Environmental And Ecological Systems Modeling

Credit Hours: 3.00. Introduction to computational methods for describing physical, chemical, and microbiological processes that occur in natural and engineered aqueous systems, including rivers and lakes, and within water and wastewater treatment systems. Emphases on understanding and conceptualizing important processes, data analysis, algorithm development, and competency in the use of programming tools.

Learning Outcomes: 1. Apply simple models to natural and engineered systems. 2. Identify processes critical to proper formulation of ecological and environmental models. 3. Formulate models to analyze specific issues concerning natural waters and wastewaters. 4. Encode model algorithms into common software packages. 5. List limitations and assumptions of classic and self-formulated models. Credits: 3.00

EEE 35000 - Introduction To Environmental And Ecological Engineering

Credit Hours: 3.00. Introduction to water pollution, air pollution, noise, hazardous and solid wastes, and their control. Environmental impact statements and global pollution issues. Field trips required.

Learning Outcomes: 1. An ability to apply material balance tools to environmental systems. 2. An ability to describe the different types of air, soil, and water pollutants and how they affect environmental quality on a local or global scale. 3. An ability to explain the principles of water, wastewater, air, soil, and hazardous waste treatment processes. 4. An ability to describe the professional and ethical responsibility of engineers in the context of environmental management. 5. An ability to describe the key roles and responsibilities of public institutions and private organizations in managing environmental resources. Credits: 3.00

EEE 35500 - Engineering Environmental Sustainability (UCC: STS)

Credit Hours: 3.00. (CE 35500) An introduction to the examination of global-scale resource utilization, food, energy and commodity production, population dynamics, and their ecosystem impacts.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Students will be creative thinkers that can collect and analyze appropriate data and information, and perform necessary quantitative analysis to develop original and innovative management strategies for real-world sustainability problems. 2. Students will be able to individually and in teams skillfully communicate in writing, orally, and with multimedia their ideas and conclusions about managing sustainability issues in a manner that increases knowledge and understanding of the audience. 3. Students will be critical thinkers that can identify the environmental, social, political, and economic dimensions of technical challenges and evaluate their own and others' perspectives in forming logical opinions and conclusions. 4. Students will be able to effectively identify information needs, efficiently acquire appropriate information, and critically evaluate and use it in an ethical and scholarly fashion to gain understanding of and communicate about sustainability issues, challenges, and strategies. 5. Students will become global citizens and socially aware by gaining knowledge of diverse international and cultural perspectives and display social responsibility and leadership in managing sustainability issues, ultimately increasing their global literacy. 6. Students will learn how to be a productive team member, constructively evaluate their own and others' performances, resolve conflicts effectively and encourage the willing contributions of everyone. Credits: 3.00

EEE 36000 - Environmental And Ecological Engineering Laboratory

Credit Hours: 1.00 to 3.00. An introduction to laboratory methods of analysis of Environmental and Ecological Engineering systems. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes experimental design, treatment of data, the analytical determination of chemical and biological constituents in water, soil, and air; analysis of environmental and ecological engineering processes; analysis of life-cycle characteristics and impacts of consumer products and commodities; methods of prevention and remediation of manufacturing waste streams.

Learning Outcomes: 1. Ability to acquire experimental data and evaluate experimental error and variability. 2. Understanding of data reduction, analysis and presentation. 3. Ability to produce professional technical communication of experimental conclusions. 4. Ability to summarize results of quantitative analysis to propose management strategies for environmental problems. Credits: 1.00 to 3.00

EEE 36001 - Water Quality And Treatment Laboratory

Credit Hours: 3.00. Laboratory procedures are described and performed that examine chemical, physical, and biological properties and constituent concentrations of natural waters. In addition, water treatment process experiments are performed to show how constituent concentrations can be altered during water treatment processes. Procedures include the analytical determination of several chemical and biological constituents in water by titrimetric, colorimetric, or chromatographic methods, whereas treatment processes include reactor design, pH adjustment, ion exchange, lime softening, coagulation, and disinfection.

Learning Outcomes: 1. Apply physical, chemical, and biological principles to each experimental procedure or measurement technique. 2. Conduct laboratory experiments, making quantitative measurements to assess water quality and water treatment process performance. 3. Organize, report, and graphically display experimental data in common software packages. 4. Analyze and evaluate experimental data on its quality and significance (i.e., usefulness). 5. Identify issues (i.e., problems) with data collection and data uses. Credits: 3.00

EEE 36002 - Environmental Sustainability For Industry, Laboratory

Credit Hours: 3.00. This lab course provides an opportunity for students to gain hands-on experience with the physical and analytical tools of industrial sustainability. These include

experimental methods for product testing and air quality measurement; design and planning of experiments; statistical interpretation of experimental data; design and environmental assessment of building energy use, combustion systems, and electrical circuits; and life-cycle management of electronic equipment and other household products. Students are encouraged to complete their statistics requirement.

Learning Outcomes: 1. Develop a hypothesis and design experiments to test the hypothesis. 2. Conduct/interpret statistical analysis of experimental results. 3. Describe power and energy demand in multiple contexts including electricity, combustion, and heat transfer. 4. Propose energy efficiency solutions and evaluate their economic and environmental consequences. 5. Design and measure the material and environmental impacts of a product's life cycle, including production, waste handling, and end-of-life scenarios. 6. Produce technical reports that clearly communicate methods, results, and conclusions for a professional audience. Credits: 3.00

EEE 38000 - Environmental Chemodynamics

Credit Hours: 3.00. Introduction to chemical thermodynamics and general equilibrium processes in environmental and ecological engineering systems. Introduction to the first and second laws of thermodynamics; properties of pure substances; ideal and real gases; thermodynamic cycles and processes; heat transfer and combustion; and chemical equilibrium in aquatic solutions, including equilibria between phases and reaction equilibria. Emphasis is on understanding and conceptualizing important processes, and competency in thermodynamic calculations.

Learning Outcomes: 1. Apply the First and Second Laws of thermodynamics to closed and open systems. 2. Understand, identify, and quantify the environmental impacts of closed and open systems, based on mass and energy transfer. 3. Analyze full-scale systems, and compare actual and theoretical operation. 4. Understand the structure and reactivity of environmentally relevant organic compounds. 5. Calculate concentrations of different components in equilibrium and non-equilibrium environmental systems. Credits: 3.00

EEE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in Environmental and Ecological Engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 38500 - Environmental Soil Chemistry

Credit Hours: 4.00. (AGRY 38500) Designed as an upper-level introductory course covering environmental soil chemistry concepts in framework most applicable to inorganic and organic chemical contamination of soil and water resources and intended for students in environmental science fields that may not have a strong chemistry and/or math background. (el.5).

Learning Outcomes: 1. Demonstrate proficiency in their chosen discipline that incorporates knowledge, skills, technology, and professional conduct. 2. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 3. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 4. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 5. Demonstrate the ability to work effectively as part of a problem-solving team. 6. Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own. 7. Demonstrate ability to apply social, economic,

political, and environmental principles to living in a global community. 8. Demonstrate awareness of civic responsibility to community and society at large. 9. Demonstrate skills necessary for lifelong learning. Credits: 4.00

EEE 39000 - Environmental And Ecological Engineering Professional Practice Seminar

Credit Hours: 1.00. Seminar lectures and discussions to introduce students to aspects of professional practice within Environmental and Ecological Engineering. Topics include career planning and placement skills, professional responsibility and ethics, functioning as a professional, and other current important topics in the profession. Students will interact with several practicing Environmental and Ecological Engineers.

Learning Outcomes: 1. Develop professional skills that will allow them to enter into the professional Environmental and Ecological Engineering field. 2. Gain an understanding of major professional issues. 3. Begin development of a personal approach to ethical professionalism. 4. Gain experience in professional communication. 5. Gain knowledge of the range of opportunities available in the profession. Credits: 1.00

EEE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39500 - Experimental Course

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credits. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 39699 - Professional Practice Internship

Credit Hours: 0.00. One-session professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the

professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 43000 - Industrial Ecology And Life Cycle Analysis

Credit Hours: 3.00. The outputs and processes associated with industrial systems are examined, with special emphasis placed on interactions of these systems with environmental and ecological systems. A full product life cycle perspective is stresses, including energy and material flows, processes used to produce materials and realize products, and the management of end-of-life products.

Learning Outcomes: 1. An understanding of the principles of industrial ecology and an ability to apply these principles to specific engineering and manufacturing systems in order to create designs with reduced environmental and ecological impact. 2. Knowledge of life cycle analysis (LCA), its different forms, its limitations, its endpoints, and the common tools, techniques, and databases available to assist in LCA. 3. The ability to perform a limited life cycle analysis on an industrial product or process, with a defined analysis goal. 4. An understanding of the complex interactions between industrial and environmental systems. Credits: 3.00

EEE 45600 - Wastewater Treatment Processes

Credit Hours: 3.00. (CE 45600) Fundamental design principles and practice of wastewater treatment to prepare students for designing wastewater treatment systems. The major topics include design and construction process, preliminary treatment of wastewater, primary treatment, wastewater microbiology, secondary treatment, nitrogen removal, phosphorus removal, attached microbial growth, secondary settling, disinfection and post-aeration, tertiary treatment, and wastewater plant residuals management.

Learning Outcomes: 1. Understand design principles and practice of wastewater treatment. 2. Apply the knowledge to select the best process to treat wastewater. 3. Design a wastewater treatment component or process to meet water quality goals. 4. Critically review relevant literature or contemporary issues in wastewater treatment. Credits: 3.00

EEE 47200 - Community-Engaged Engineering & Design

Credit Hours: 3.00. Utilizing a transdisciplinary approach in a real-world, client-based service-learning design experience, students will lead the design and implementation of community-engaged sustainability projects integrating not only their discipline-specific knowledge, but community partner and stakeholder knowledge as well. This course will require travel outside of class to community partner sites to collaborate in the design process. Sustainability projects to improve the health and wellness of communities will be implemented at multiple sites. The complex and dynamic relationships between social, economic, environmental, and political sectors in such community-engaged projects will be investigated.

Learning Outcomes: 1. Display social responsibility, civic engagement, and leadership in addressing sustainability issues: evaluate and apply diverse perspectives from multiple stakeholders to site-specific design solutions; connect and extend academic knowledge to improve the health and wellness of communities; take informed, responsible action to address ethical, social, and environmental challenges related to sustainability at partner sites; communicate project efforts in a creative, well-organized, and logical manner. 2. Design novel, context-appropriate solutions to sustainability issues using a transdisciplinary knowledge production model: describe the interconnectivity between environmental, social, political, and economic issues surrounding technical solutions; apply a transdisciplinary knowledge production model; propose solutions to open-ended design problems that demonstrate a deep comprehension of the issues. 3. Engage in the complexities of a

negotiated design process occurring between multiple stakeholders in a professional and ethical manner: demonstrate empathy and adaptability in working with teammates and stakeholders with varied skills, talents, abilities, and work strategies; create project deliverables that demonstrate cohesive stakeholder functionality; critically evaluate personal and others' contributions to the overall success of the projects. Credits: 3.00

EEE 48000 - Environmental And Ecological Engineering Senior Design

Credit Hours: 1.00 to 3.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems. Permission of department required.

Learning Outcomes: 1. An ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. An understanding of the complete design process and an ability to perform the process. 3. An ability to identify and acquire new knowledge as a part of the problem-solving/design process. 4. An ability to function on multidisciplinary teams. 5. An ability to communicate professional design and design decisions effectively. 6. An awareness of professional ethics and responsibility of engineers. 7. An appreciation of the role of engineering and of EEE in social contexts. Credits: 1.00 to 3.00

EEE 48001 - Environmental And Ecological Engineering Senior Design I

Credit Hours: 1.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems. Permission of department required.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Have an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 1.00

EEE 48002 - Environmental And Ecological Engineering Senior Design II

Credit Hours: 2.00. Senior-level environmental and ecological engineering design projects. Projects will integrate knowledge and skills earlier in the degree program and stress the application of the design process to interdisciplinary environmental and/or ecological engineering systems.

Learning Outcomes: 1. Have an ability to apply material and concepts from previous EEE coursework to an innovative design project. 2. Have an understanding of the complete design process and an ability to perform the process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Have an ability to function on multidisciplinary teams. 5. Communicate professional design and design decisions effectively. 6. Gain an awareness of professional ethics and responsibility of engineers. 7. Gain an appreciation of the role of engineering and of EEE in social contexts. Credits: 2.00

EEE 48100 - Reflective Practitioner

Description: Credit Hours: 1.00. Reflective practice is a term coined by Donald Schon in The Reflective Practitioner (1983). Reflective practice is the capacity to reflect on action to engage in a process of continuous learning. Reflective practice can be an important tool in practice-based professional learning settings where people learn from their own professional experiences, rather than from formal learning or knowledge transfer. It may be the most important source of personal professional development and improvement. It is also an

important way to bring together theory and practice. A person who reflects throughout their practice is not just looking back on past actions and events, but is taking a conscious look at emotions, experiences, actions, and responses, and using that information to add to their existing knowledge base and reach a higher level of understanding. Critical reflection as part of experiential education generates, deepens, and documents learning. As a result of this course, you will be able to articulate the value of your experiential education opportunities toward marketing yourself for potential job opportunities and develop the skills needed to become a reflective practitioner for promotional growth in your future career. Permission of department required.

Learning Outcomes: 1. Reflect on experiential education experiences; Identify knowledge and skills gained from experiences; Identify connections between experiences and disciplinary knowledge. 2. Apply theories and concepts to practical sustainability problems; Identify ways in which individual actions within experiences contributed to improving sustainability; Identify ways to individually contribute to improving sustainability in future professional practice. 3. Synthesize experiential education experiences into a career development plan; Articulate strengths and weaknesses observed within experiences; Develop a self-improvement plan for future professional practice; Identify a potential career path; Synthesize knowledge and skills gained into high-quality LinkedIn page and Strengths Statement. Credits: 1.00

EEE 49500 - Experimental Course

Credit Hours: 0.00 to 6.00. Topics Vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 49800 - Environmental And Ecological Engineering Projects

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credits. Permission of instructor required.

Credits: 0.00 to 6.00

School of Industrial Engineering

About Industrial Engineering

Industrial engineers design, analyze, and manage complex human-integrated systems such as manufacturing systems, supply chain networks, and service systems. These systems typically consist of a combination of people, information, material, and equipment. In such systems industrial engineers determine how to optimize the system for maximum efficiency, effectiveness, throughput, safety, or some other objective of interest to the stakeholders of the system. To achieve these objectives, an industrial engineer draws upon knowledge of mathematics, along with physical, engineering, management, and behavioral sciences to function as a problem-solver, innovator, designer, coordinator, and system integrator.
Industrial engineers are employed in and apply their skills in an extremely wide range of organizations, including manufacturing industries, service industries, and governmental agencies.
The complexity of these organizations and the emphasis on increased effectiveness, efficiency, and productivity have led to a growing need for industrial engineering analysis and design, resulting in an increased demand for industrial engineering graduates. This increased demand recognizes the modern industrial engineer's versatility and responsiveness to the challenges of a rapidly changing society. Industrial engineering is one of the nation's largest and most rapidly growing engineering professions.
The industrial engineering program prepares graduates for careers in all phases of industrial engineering and enables them to perform both technical and managerial functions that require scientific and engineering backgrounds. By combining the study of science, mathematics, engineering fundamentals, design, and management principles, an industrial engineering education provides a unique background and a sound basis for lifelong career development in engineering practice, research, or management.
Senior design projects consist of a real-world application of IE principles by teaming students with a local industry in Indiana. Teams have taken on full-scale projects like designing floor layouts for factories and hospitals, designing operations to improve system efficiency, reducing time and waste in processing, allocating resources to optimize system performance, and developing a safety plan for preventing work-related injuries.

Faculty

https://engineering.purdue.edu/IE/People/Faculty

Contact Information

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Graduate Information

For Graduate Information please see Industrial Engineering Graduate Program Information .

Manufacturing Minor

A minor in Manufacturing is available to students in the College of Engineering and Polytechnic Institute.

Industrial Engineering, BSIE

IE 20000 - Industrial Engineering Seminar

Credit Hours: 0.00. An orientation course to inform students of the major options in the industrial engineering program, assistance in selection of appropriate electives to meet career objectives, introduction to the faculty, and selection of an academic advisor.

Credits: 0.00

IE 23000 - Probability And Statistics In Engineering I

Credit Hours: 3.00. An introduction to probability and statistics. Probability and probability distributions. Mathematical expectation. Functions of random variables. Estimation. Applications oriented to engineering problems.

Credits: 3.00

IE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 30000 - Honors Program Seminar

Credit Hours: 0.00. An orientation course intended for juniors who have demonstrated exceptional academic ability and desire to conduct meaningful independent research or solve unique engineering design projects during their senior year of study.

Credits: 0.00

IE 33000 - Probability And Statistics In Engineering II

Credit Hours: 3.00. Introduction to statistical inference and experimental design. Correlation, regression, single and multi-factor ANOVA, non-parametric methods. Applications to statistical quality control.

Learning Outcomes: 1. Use statistical software packages (e.g. Minitab) to perform statistical tests. 2. Compute and interpret statistical confidence, tolerance, and prediction intervals given engineering and scientific data. 3. Conduct and interpret parametric statistical

tests (e.g. t-test, ANOVA) on engineering and scientific data. 4. Conduct and interpret non-parametric statistical tests on engineering and scientific data. 5. Conduct and interpret regression analysis on engineering and scientific data. 6. Determine the appropriate statistical test or procedure to use on engineering and scientific data. 7. Design basic factorial experiments and conduct basic statistical process control analysis. Credits: 3.00

IE 33200 - Computing In Industrial Engineering

Credit Hours: 3.00. Introduction to computing in industrial engineering. Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Credits: 3.00

IE 33500 - Operations Research - Optimization

Credit Hours: 3.00. Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.

Credits: 3.00

IE 33600 - Operations Research - Stochastic Models

Credit Hours: 3.00. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.

Credits: 3.00

IE 34300 - Engineering Economics

Credit Hours: 3.00. Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Not open to students with credit in CE 39400.

Learning Outcomes: 1. Learn how to evaluate the financial worth of an engineered project. 2. Learn how to choose between multiple engineering projects. 3. Learn how economic concepts affect cash flows associated with projects. Credits: 3.00

IE 37000 - Manufacturing Processes I

Credit Hours: 3.00. Principal manufacturing processes; metal cutting, grinding and metal forming operations, machine tools, and tools and tooling. Nontraditional machining and welding. Introduction to computer-aided manufacturing and computer-aided graphics and design, N/C programming, robots, and flexible manufacturing systems. Classroom and laboratory demonstrations included. Not open to students with credit in ME 36300.

Credits: 3.00

IE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional practice with qualified employers in industry, government, or small business and a comprehensive written report of this practice. Professional Practice students only. Permission of department required.

Credits: 0.00

IE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional practice with qualified employers in industry, government, or small business and a comprehensive written report of this practice. Professional Practice students only. Permission of department required.

Credits: 0.00

IE 38300 - Integrated Production Systems I

Credit Hours: 3.00. Basic concepts in the design and operational control of integrated production systems. Includes topics on facility layout and material handling, material flow and information flow, resource and capacity planning, and shop floor control and scheduling.

Credits: 3.00

IE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional practice with qualified employers in industry, government, or small business and a comprehensive written report of this practice. Professional Practice students only. Permission of department required.

Credits: 0.00

IE 38600 - Work Analysis And Design I

Credit Hours: 3.00. Fundamentals of work methods and measurement. Applications of engineering, psychological, and physiological principles to the analysis and design of human work systems.

Credits: 3.00

IE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in industrial engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

IE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business and a comprehensive written report of this practice. Permission of department required.

Credits: 0.00

IE 43100 - Industrial Engineering Design

Credit Hours: 3.00. Capstone design experience for industrial engineering students involving analysis and synthesis of unstructured problems in practical settings. Students work in teams to formulate issues, propose solutions, and communicate results in formal written and oral presentations. Prerequisite: all 30000-level industrial engineering courses required for the BS IE degree.

Credits: 3.00

IE 47000 - Manufacturing Processes II

Credit Hours: 3.00. The interrelations of materials, processes, and design with various aspects of manufacturing.

Credits: 3.00

IE 47200 - Imagine, Model, Make

Credit Hours: 3.00. This course develops a holistic view of an initial competency in engineering design by conceiving, designing, manufacturing, and optimizing a system component such as a complex structural part. Activities include hand sketching, CAD modeling, and operation of CNC machining equipment for rapid prototyping. Tolerance requirements will be verified and optimized prior to the fabrication of the part in the laboratory using rapid prototyping techniques. The focus is on the design process itself as well as the complementary roles of human creativity and computational methods and tools.

Learning Outcomes: 1. Create any object using 3D CAD design software (modeling, texturing, and animation). 2. Evaluate and optimize 3D designs for different manufacturing processes and materials. 3. Apply the principles of engineering tolerance to 3D CAD design. 4. Use rapid prototyping techniques (laser cutting, laser engraving, injection molding, and 3D printing) to

manufacture 3D CAD designs. Credits: 3.00

IE 47400 - Industrial Control Systems

Credit Hours: 3.00. Introduction to automatic controls with reference to automation of industrial machines and processes, including linear dynamic systems, feedback control, and elements of systems analysis. Introduction to digital control.

Learning Outcomes: 1. Able to design basic control systems using block diagrams. 2. Able to determine the feedback equation of block diagrams. 3. Able to interpret state-space models. 4. Able to compute state-spaced equations. 5. Able to conduct basic dynamic modeling of a control system. 6. Able to classify a linear time-invariant system into known classes. 7. Able to compute the dynamic response of a control system. Credits: 3.00

IE 48100 - Introduction To System Simulation

Credit Hours: 3.00. The course presents a general introduction to simulation concept and methodology. It covers simulation modeling in specialized simulation environments. Practical application of simulation to diverse systems will be discussed. Proper design and analysis of the simulation experiment is emphasized. Permission of department required.

Learning Outcomes: 1. Construct discrete-event simulation models using a representative simulation software package. 2. Identify different types of simulation models and determine scenarios where each would be appropriate. 3. Perform analysis of data for the development of input models. 4. Design simulation experiments and conduct statistical analysis. 5. Verify and validate a simulation model. Credits: 3.00

IE 48400 - Integrated Production Systems II

Credit Hours: 3.00. Extensions of topics on the design and operational control of integrated production systems. Includes production databases, facility layout, material handling, advanced control and scheduling, and physical distribution. Case studies, lab assignments, and projects.

Credits: 3.00

IE 48600 - Work Analysis And Design II

Credit Hours: 3.00. Continuation of IE 38600 . Applications of engineering, computer sciences, information sciences, and psychological principles and methods to the analysis and design of human work systems.

Credits: 3.00

IE 49000 - Special Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Special topic courses and projects of contemporary importance or of special interest that are outside the scope of the standard undergraduate curriculum. Permission of instructor required.

Credits: 1.00 to 6.00

IE 49500 - Industrial Practices Seminar

Credit Hours: 1.00. Solution of industrial engineering problems, with particular emphasis on current industrial experience obtained through the cooperative engineering education program. For cooperative program students only.

Credits: 1.00

IE 49900 - Research In Industrial Engineering

Credit Hours: 1.00 to 6.00. Individual research projects for students with honors standing, or other students with the approval of their advisors. Permission of instructor required.

Credits: 1.00 to 6.00

School of Materials Engineering

An Overview

Materials Engineering

Materials have enabled improvement in the products humans use since the beginning of recorded history. For example without the development of high purity silicon most of today's electronic devices would not exist. New low density, high stiffness composite materials have replaced metals and wood in tennis racquets. The performance of these materials stems from their properties which depend on their microscopic structure, also known as microstructure. Microstructure in turn

depends upon materials processing, the fabrication of materials into functional shapes. Materials Engineering is the study of the interrelationships between processing, structure, properties and performance of materials.
Materials engineers study the structure and composition of materials on scales ranging from the electronic and atomic through the microscopic to the macroscopic. They develop new materials, improve traditional materials and are key people in the manufacturing process to produce materials reliably and economically. They seek to understand phenomena and to measure materials properties of all kinds, and they predict and evaluate the performance of real materials as structural or functional elements in engineering systems. Employment opportunities span all types of industry, such as aerospace, automotive, chemical, electronic, energy and primary material-producing companies.

Faculty

https://engineering.purdue.edu/MSE/People/ptFaculty

Contact Information

School of Materials Engineering
Neil Armstrong Hall of Engineering
701 West Stadium Avenue
West Lafayette, IN 47907-2045
Telephone: (765) 494-4100
FAX: (765) 494-1204
E-mail regarding academic programs:
MSEAdvisor@purdue.edu

Graduate Information

For Graduate Information please see Materials Engineering Graduate Program Information .

Materials Engineering, BSMSE

Materials Science and Engineering Minor

MSE 19000 - Introduction To Materials Engineering

Credit Hours: 1.00. An introduction to materials science and engineering. Emphasis on the "processing, structure, properties, performance" relationships that lead to the development of materials for society's needs. Examples drawn from the major materials classes.

Learning Outcomes: 1. Recognize and give examples of the "processing, structure, properties, performance" relationships for the major materials classes. Credits: 1.00

MSE 23000 - Structure And Properties Of Materials

Credit Hours: 3.00. The relationship between the structure of materials and the resulting mechanical, thermal, electrical, and optical properties. Atomic structure, bonding, atomic arrangement; crystal symmetry, crystal structure, habit, lattices, defects, and the use of X-ray diffraction. Phase equilibria and microstructural development. Applications to design.

Learning Outcomes: The learning outcomes for this course have more than 2,000 characters. Please see the course catalog for the learning outcomes. Credits: 3.00

MSE 23500 - Second Year Materials Engineering Laboratory

Credit Hours: 3.00. Laboratory experiments using standard equipment to measure material properties, characterize material structure and composition, and explore processing methods to form functional shapes, and modify properties of the formed shapes. Experiments are carried out with metal, ceramic, and polymeric materials to illustrate property-structure-processing relationships.

Learning Outcomes: 1. Identify and properly utilize primary sources and online databases to find information about material structures, properties, and processing techniques. 2. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 3. Apply characterization techniques appropriate for the class of material analyzed. 4. Assess validity of experimental data and recognize experimental factors affecting data. 5. Accurately and clearly report engineering data using figures, graphs, and tables and proper statistical methods. 6. Display effective written communication in

technical reports. Credits: 3.00

MSE 25000 - Physical Properties In Engineering Systems

Credit Hours: 3.00. Class connects math, science and engineering practice and applications. Presents foundational aspects of engineering problem solving, use of computer math tools for engineering problem solving, basic engineering statics, dynamics and mechanics, group problem solving approaches, and introductory aspects of design and materials selection.

Credits: 3.00

MSE 26000 - Thermodynamics Of Materials

Credit Hours: 3.00. Fundamental laws of thermodynamics and their applications to material systems; criteria for equilibrium; reaction and phase equilibria; properties of solutions; thermodynamic origins of phase diagrams.

Learning Outcomes: 1. Understand the concept of equilibrium, material properties, and equations of state. Examples: Define extensive and intensive variables; Define equilibrium material properties for gases, solids and liquids; Stipulate requirements for a thermodynamic equation of state. 2. Understand and apply the first and second law of thermodynamics to describe material properties, phase transformations, chemical reactions, and processing operations. Examples: Construct equations of state to describe elastic and inelastic solids that comply with the laws of thermodynamics. For example, construct equations of state for elastic solids, dielectric materials, and magnetic systems. Construct equations of state to describe the response of dielectric materials, in compliance with the laws of thermodynamics. 3. Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams. Incorporation of experimental data into analytical and numerical descriptions of phase diagrams. Examples: Understand and apply the concept of regular solution for the description of spinodal decomposing solids; Understand the concepts of chemical potential, activity, activity coefficient, and apply it to graphically build Gibbs free energy descriptions to perform simple calculations; Construct temperature-composition diagrams for regular solutions; Construct and Identify thermodynamically consistent phase diagrams. 4. Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes. Examples: Develop an ability to read, collect, and report in technical report format reliable thermodynamic data to calculate the phase diagram of iron; Review the scientific literature of multiferroic materials and put it in the context of the Laws of Thermodynamics. Synthesize the acquired knowledge in technical paper format. 5. Develop expertise on the mathematics of thermodynamic systems. Examples: Formulate differential expressions that comply with the laws of thermodynamics; Develop an ability to apply Maxwell relations to establish mathematical expressions between the different thermodynamic quantities; Apply the concept homogeneous functions, Gibbs-Duhem relation, etc., to construct equations of state that are first-order homogeneous functions; Understand the reaches and limitations of the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases. 6. Ability to apply simple models describing the transformation of different forms of energy, and its application to technological systems. Examples: Piezoelectric actuators, Elastic solids, Chemical Actuators, Superconductors. 7. Understand and apply the effects of surfaces and interfaces on the macroscopic properties of materials, phase transformations, and industrial processing operations. Examples: Understand the effect of surface energy on the melting point, solubility limit, etc.; Understand and apply the effect of

surface tension on the construction of single-component and binary phase diagrams. 8. Apply the laws of thermodynamics to make sense of the scientific literature and use them to formulate consistent models. Examples: Research the scientific literature to formulate theoretical and Mathematica-based models to describe the Ag-Cu phase diagram (reported in technical paper format). Credits: 3.00

MSE 27000 - Atomistic Materials Science

Credit Hours: 3.00. Introductory course with an atomistic view point on material properties. Three primary class sections: bonding crystallography and statistical mechanics. Bonding topics include introduction to quantum mechanics, emphasis on understanding of metallic, ionic and covalent bonding. Crystallography topics include crystal descriptions and symmetry principles. Statistical mechanics development with application to electronic and thermodynamic properties.

Credits: 3.00

MSE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 33000 - Processing And Properties Of Materials

Credit Hours: 3.00. An introduction to the relationships between the processing of materials and their properties. Heat treating, forming, casting, consolidation, and other more material-specific manufacturing processes. Elucidation of the role of phenomena such as heat flow, mass diffusion, nucleation, interfacial tension, elastic and plastic deformation, precipitation, grain growth.

Credits: 3.00

MSE 33500 - Materials Characterization Laboratory

Credit Hours: 3.00. The principles of analytical methods for characterization of materials for structure and composition; optical microscopy, scanning electron microscopy, X-ray spectroscopy and diffraction, atomic absorption, emission spectroscopy, and mass spectrometry. Laboratory experiments in X-ray spectroscopy, X-ray diffraction, optical microscopy, and scanning electron microscopy.

Credits: 3.00

MSE 34000 - Transport Phenomena

Credit Hours: 3.00. Mechanism and rates of heat, mass, and momentum transfer. Macroscopic and differential energy, mass, and momentum balances. Application to systems with phase transformations and chemical reaction.

Credits: 3.00

MSE 36700 - Materials Processing Laboratory

Credit Hours: 3.00. This laboratory is intended as an intensive experience in processing techniques used for ceramics, metals, and polymers. Sintering of a ceramic, casting and post-processing (work hardening, heat treatment, etc.) of a metal, and preparation and extrusion of a polymer are the suggested processes. The measurements (e.g., powder size, compaction force, temperature, grain size, molecular weight) applicable to the successful processing of the material and the final properties (e.g., hardness, ductility, strength, stiffness) will be emphasized.

Learning Outcomes: 1. Demonstrate the use of a variety of processing techniques for metals, ceramics, and polymers and to identify the changes in microstructure and properties they cause. 2. Demonstrate effective written communication in lab reports. 3. Demonstrate effective oral communication in final project presentation. 4. Characterize the physical mechanisms that underlie the basic interactions between macroscopic shaping processes and microstructure development for the core bulk processing routes of each of the main classes of materials and how they relate to properties. 5. Assess validity of experimental data and recognize experimental factors affecting data. 6. Identify specific processing capabilities and limitations for the main classes of materials. Credits: 3.00

MSE 37000 - Electrical, Optical, And Magnetic Properties Of Materials

Credit Hours: 3.00. An introductory course to provide basic background on the behavior of materials; electronic band structure, electronic and ionic conduction, electronic processes in semiconductors, dielectric, optical, and magnetic properties, and superconductivity; emphasis is on the relation between the properties and the structural aspects of materials.

Credits: 3.00

MSE 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain practice with qualified employers within industry, government, or small business. Permission of Department required.

Credits: 0.00

MSE 38200 - Mechanical Response Of Materials

Credit Hours: 3.00. This course encompasses deformation-based microscopic mechanisms, including dislocation motion, diffusion, and viscoplasticity. Macroscopic mechanical response of metals, ceramics, polymers, and composites will be related to elasticity and plasticity concepts for single crystal, polycrystalline, and amorphous materials. Practical design considerations for deformation will be included as well as an introduction to fracture mechanisms.

Learning Outcomes: 1. Conversant with conventional nomenclature, units and notation of mechanical behavior. Examples: Stress, strain, yield strength, fracture strength; yield criteria, flow rules, creep, fracture. 2. Estimate relative ranges and values for important properties of common engineering materials. Examples: Young's modulus at room temperature for steels versus most polymers; yield strength ranges for ductile metals. 3. Recognize mechanisms for important mechanical behaviors. Examples: Plastic deformation by dislocation glide; plastic deformation by molecular rearrangement; dilatant deformation processes; strengthening mechanisms in crystalline solids. 4. Predict mechanical responses based on given information. Examples: Will yielding occur given a stress state and properties? Will fracture occur given a stress state and properties? How will the material change shape for the applied deformation? Which slip system(s) will be operative? 5. Explain the fundamental basis for important deformation mechanisms or processes. Examples: Dislocation glide, cross-slip, dislocation climb, precipitation strengthening; molecular orientation; Nabarro-Herring creep; plane strain fracture. 6. Apply the mechanisms of deformation to component design or alloy design. Credits: 3.00

MSE 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain practice with qualified employers within industry, government, or small business. Permission of Department required.

Credits: 0.00

MSE 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain practice with qualified employers within industry, government, or small business. Permission of Department required.

Credits: 0.00

MSE 39000 - Materials Engineering Seminar

Credit Hours: 0.00. Presentation and discussion of current topics in materials engineering.

Credits: 0.00

MSE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in materials engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSE 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in Materials Engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Develop the ability to function on multi-disciplinary teams and receive the broad education necessary to understand the impact of engineering solutions in global, economics, environmental and societal context. Credits: 0.00

MSE 42000 - Structure And Properties Of Organic Materials

Credit Hours: 3.00. This course presents information on the chemical and physical structure and basic material properties of organic materials, including synthetic plastics and specialty polymers and surfactants as well as select natural materials (e.g., proteins, carbohydrates, lipids). Fundamental concepts from organic chemistry will be presented along with descriptions of how the chemical and physical structures of organic molecules directly impact the properties of bulk materials over multiple length scales, from the molecular-level to the macroscale. This course will prepare students to be successful in higher-level polymer and soft material elective courses in materials engineering.

Learning Outcomes: 1. Describe atomic-scale bonding and identify common hydrocarbon units in organic molecules and describe common organic reactions involving those units. 2. Select the appropriate characterization techniques for chemical structures, physical structures, and bulk material properties and interpret basic data from selected techniques. 3. Explain how

macromolecules are synthesized and outline the most common synthesis reactions. 4. Distinguish between chemical and physical structures or organic materials and classify different structures into appropriate material length scales. 5. Explain important structure-property relationships over multiple length scales. Credits: 3.00

MSE 43000 - Materials Processing And Design I

Credit Hours: 3.00. Experience in the initiation and execution of a specific materials project or study involving research, processing, and design; a written proposal on the project prepared by the student under the supervision of an individual faculty member; oral progress report at the end of the semester.

Learning Outcomes: 1. Ability to apply knowledge of mathematics, science, & engineering to problems in materials engineering. 2. Ability to exhibit effective oral and written communication skills. 3. Recognition of the need for, and an ability to engage in life-long learning. 4. A knowledge of contemporary issues, particularly as they relate to materials engineering. Credits: 3.00

MSE 44000 - Materials Processing And Design II

Credit Hours: 3.00. Continuation and completion of the materials project or study initiated in MSE 43000 and presentation of a written dissertation on the results and conclusions. Competence in technical writing is emphasized in the preparation of the dissertation.

Learning Outcomes: 1. Exhibit effective oral and written communication. 2. Become aware of the complexity of working in teams to achieve goals, including issues related to the importance of individual ownership of project assignments, communication, leadership roles, establishing goals, and recognizing a diversity of talents among group members. 3. Have a basic understanding of different ethical systems, including legal positivism, ethical egoism, utilitarianism, deontological, etc. 4. Understand consequences of unethical behavior in the profession. 5. Understand and apply the basic tools of engineering design. 6. Draw simple logic diagrams that relate the important precedent relationships for tasks required to complete an engineering program. 7. Develop and learn necessary modelling, processing and characterization tools needed to successfully execute the project. 8. Use statistical analysis to infer conclusions from experiments. Credits: 3.00

MSE 44500 - Materials Engineering Systems Analysis And Design

Credit Hours: 3.00. Integration of materials engineering core coursework with statistical, economic and environmental considerations for analysis and design of systems. Analysis of primary materials processing operations using mathematical and statistical models for predicting interactive effects and process optimization. Specification of materials and processes for mechanical designs, incorporating properties assessment and tradeoffs, cost analysis, and performance optimization with multiple constraints.

Learning Outcomes: 1. Translate performance attributes in a given design to the corresponding nominal material properties. 2. Derive and apply material indices to materials selection for single- and multi-objective designs using the CES materials database and software tools. 3. Specify manufacturing processes for a given component design (material, shape, production rate) using basic cost modeling. 4. Apply a computational model for simulating a materials production and/or processing operation. 5. Quantify material properties, processing and performance variability using statistical methods. Examples: error analysis, probability distributions, sampling theory, statistic intervals and statistical process control charts. 6. Perform basic calculations for engineering cost analysis and use those results to make choices among trade-offs in product design or process operation. 7. Locate and evaluate design information for specific materials and

processes. Examples: testing standards, processing specifications, commercial data and patents. 8. Apply quantitative trade-off strategies in selection of materials for designs with conflicting objectives. 9. Apply computational models for materials production and/or processing operations to predict interactive effects of inputs on material quality, production rates, cost minimization, and environmental impact. 10. Optimize material and process selection simultaneously, based on refined functional relationships between processing, properties and costs. Credits: 3.00

MSE 48900 - Ethics In Engineering Practice

Credit Hours: 3.00. Presentation and discussion of common ethical theories, including ethical egoism, legal positivism, utilitarianism, duties and rights, and virtue ethics. Application of these theories to the practice of engineering, including professionalism, codes of ethics, trust and loyalty, confidentiality, whistle blowing, respect for legitimate authority, risk and reliability, and fraud. Examples of application of ethical theory and case studies drawn from across the engineering profession and include discussion of the interrelated technical and ethical issues.

Learning Outcomes: 1. Identify and discuss common ethical theories. 2. Describe how these theories apply these theories to the practice of engineering. 3. Analyze case studies of failures of engineering products and organizations. Credits: 3.00

MSE 49000 - Directed Studies In Materials Engineering

Credit Hours: 1.00 to 3.00. Supplementary individual instruction for students from other engineering schools enrolled in 30000-50000 level MSE courses. Permission of instructor required.

Credits: 1.00 to 3.00

MSE 49700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 49900 - Research In Materials Engineering

Credit Hours: 0.00 to 18.00. Available upon prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Credits: 0.00 to 18.00

School of Mechanical Engineering

Overview

Mechanical Engineering is, simply, applying engineering principles to machines that have movement. If you think that sounds all-encompassing, well, you're right. Mechanical Engineering is the broadest of all Engineering majors, and their students can do just about anything, because they have a broad understanding of the principles of mechanical sciences, thermal-fluid sciences, control systems and design.
In the job world, you can take these skills to almost any industry. Many Mechanical Engineering students end up in the automotive or manufacturing industries, but many also pursue biotech, law, renewable energy, electronics, or any number of emerging industries. NASA loves Purdue students, and many mechanical engineers find places in the aerospace and defense industries. And some ME graduates don't go into engineering at all, but use their problem-solving skills to start a business, or go into sales or management. The foundational know-how of Mechanical Engineering will serve you, wherever in the world you choose to go.

Faculty (website)

Mechanical Engineering has approximately 90 faculty members, pursuing research in numerous fields. Are you interested in doing research as an undergrad? Contact a faculty member whose research interests you.

Contact Information

ME Undergraduate Office
Mechanical Engineering Building, Room 2008
585 Purdue Mall
West Lafayette, IN 47907-2088

Phone: (765) 494-5689
Fax: (765) 494-0051
Email: meundergrad@purdue.edu

Graduate School

Interested in Graduate School? Learn more about the opportunities for you

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Engineering and Public Policy Minor

A minor in Engineering and Public Policy is available to students in the College of Engineering.

Intellectual Property Law for Engineers Minor

A minor in Intellectual Property Law is available to students in the College of Engineering.

Sustainable Engineering Minor

Mechanical Engineering, BSME

Motorsports Engineering, BSMSPE (Indianapolis Only)

ME 16400 - Geometric And Annotation Modeling

Credit Hours: 3.00. This course focuses on CAD-based modeling and engineering graphics standards (national - ANSI/ASME and international - ISO), including coordinate and geometric dimensioning and tolerancing practices. It covers principles and techniques of three-dimensional surface and solid modeling. This course teaches students how to model real-world engineering objects and assemblies using the capabilities of commercial CAD systems. Conceptual, preliminary and detailed part and assembly models are assigned as exercises to reinforce the classroom lectures. This course teaches the graphics language and standards necessary for engineering students to read, understand, and sign off engineering drawings and documents. Students are required to detail (create engineering drawings) their CAD models, demonstrating their ability to both read and apply graphic standards.

Learning Outcomes: 1. Improve sketching. 2. Understand wireframe, surface and solid modeling techniques found in a modern commercial CAD package. [3] 3. Create CAD models of basic machine components and assemblies. [2] 4. Design and create CAD models of average to complex mechanical components. [2] 5. Understand the approaches and processes used in component and assembly modeling, i.e., top-down and bottom-up design. [2] 6. Read and understand engineering drawings composed of multiple views with standard dimensioning and tolerancing nomenclature. [3] 7. Read and understand engineering drawings that contain geometric dimensioning and tolerancing symbols. [3] 8. Use of standards for geometric modeling, dimensioning, and tolerancing. [2] 9. Work in collaboration with fellow teammates to accomplish both the learning of the CAD tool and the executing of the modeling projects. [5] Credits: 3.00

ME 19800 - PMEA Leadership Program

Credit Hours: 1.00. A weekly seminar that includes topics such as leadership, professional skills, teamwork, and the Mechanical Engineering culture. Students will utilize these skills while representing Mechanical Engineering to current and prospective students, alumni, donors, and other visitors to the school.

Learning Outcomes: 1. Able to function effectively with a student run team whose members create a collaborative and inclusive environment, plan events, and meet the objectives of the ME Undergraduate Program. 2. Communicate effectively with a range of audiences. 3. Develop a personal philosophy of leadership that includes an understanding of self, others, and community. Credits: 1.00

ME 19900 - How Stuff Works

Credit Hours: 1.00. An introduction to Mechanical Engineering for First-Year Engineering students interested in exploring a

career in ME. The course is student led and involves a mix of presentations from successful mechanical engineers about their chosen careers coupled with fun hands-on experiences related to better understand how everyday products work from a mechanical engineering perspective. A variety of common products are disassembled, evaluated, and reassembled to understand the underlying engineering design and fabrication fundamentals. Little or no mechanical experience is required.

Learning Outcomes: 1. Learn from successful alumni about their career paths and common products that they have helped to design and market. 2. Become familiar with common products and how they work. 3. Gain hands-on experience and develop your mechanical aptitude by dissecting products, studying the basic engineering and operation of the products and reassembling the products. 4. Become familiar with common engineering terminology used in describing the various parts and assemblies of products. Credits: 1.00

ME 20000 - Thermodynamics I

Credit Hours: 3.00. First and second laws of thermodynamics, entropy, reversible and irreversible processes, properties of pure substances. Application to engineering problems.

Learning Outcomes: 1. Provide a thorough understanding of the basic concepts of thermodynamics, (i.e., 1st and 2nd law). 2. Apply the basic concepts of thermodynamics to the solution of practical problems. 3. Develop a systematic approach to problem-solving skills. 4. Cultivate a strong work ethic in students. Credits: 3.00

ME 22001 - Fundamentals Of Energy Materials

Credit Hours: 3.00. This course examines the chemistry and structure of materials and their correlation with various electrochemical properties including their suitability for use in conversion and storage of electrochemical energy, energy related materials, and chemical and renewable energy sources.

Credits: 3.00

ME 22501 - Mechanical Engineering Laboratory I

Credit Hours: 1.00. Experiments in thermodynamics, parametric design and component fabrication.

Credits: 1.00

ME 22510 - Energy Engineering Laboratory I

Credit Hours: 1.00. Experiments on testing of thermodynamics, parametric design and electrochemistry.

Credits: 1.00

ME 23900 - Introduction To Data Science For Mechanical Engineers

Credit Hours: 1.00. Introduction to data science for sophomore mechanical engineers with no prior knowledge of the topic; Overview of Python basics using Jupyter notebooks; review of probability theory as the language of uncertainty, Monte Carlo sampling for uncertainty propagation; basics of supervised (Bayesian generalized linear regression, logistic regression, deep neural networks, convolutional neural networks), and unsupervised learning (k-means clustering, principal component analysis, Gaussian mixtures).

Learning Outcomes: 1. Represent uncertainty in parameters in engineering or scientific models using probability theory. 2. Propagate uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Solve basic supervised learning tasks, such as regression and classification. 4. Solve basic unsupervised learning tasks, such as clustering, dimensionality reduction, and density estimation. 5. Develop and apply various Python coding skills. 6. Load and visualize data sets in Jupyter notebooks. 7. Visualize uncertainty in Jupyter notebooks. 8. Recognize basic Python software (e.g., Pandas, numpy, scipy, scikit-learn) and advanced Python software (e.g., pytorch, pyrho, Tensorflow) commonly used in data analytics. Credits: 1.00

ME 24000 - Basic Engineering Mechanics

Credit Hours: 4.00. This course is an introductory mechanics course in energy engineering, covers force systems and couples, equilibrium, centroids, friction, kinematics, kinetics of particles & rigid body, Newton's second law, energy, and momentum methods; equations of motions, and application to machine elements. Permission of department required.

Credits: 4.00

ME 25001 - Mechanical Engineering Laboratory II

Credit Hours: 1.00. Experiments on data analysis, hands-on programming with devices and fabrication.

Credits: 1.00

ME 25010 - Energy Engineering Laboratory II

Credit Hours: 1.00. Experiments on testing of thermodynamics, parametric design and electrochemistry.

Credits: 1.00

ME 26000 - Sustainable Energy

Credit Hours: 3.00. The objective of this course is to familiarize the students with various forms of available energy. The concept of these energies in terms of efficiency, raw material, safety, economy and environmental impact will be introduced. Permission of department required.

Credits: 3.00

ME 26201 - Design, Ethics, And Entrepreneurship

Credit Hours: 2.00. Basic concepts of the design process. Innovative engineering design of real life applications. Engineering ethics topics. Fundamentals of Entrepreneurship. Design projects focus on open-ended problems. Design modeling, simulation, documentation and communication. Implementation and use of modern computer tools in solving design problems and completing team design projects in the area of Energy Engineering.

Credits: 2.00

ME 26300 - Introduction To Mechanical Engineering Design, Innovation And Entrepreneurship

Credit Hours: 3.00. The product design process. Development of product design specifications using customer inputs, benchmarking, product/market research and patent review. Concept generation and evaluation using brainstorming, functional decomposition, modeling and decision matrices. Detailed product design including assembly, economic analysis, CAD, and bill of materials. Oral and written design reviews. Key skills developed include teamwork, communication, project planning, innovation, design, and entrepreneurship.

Learning Outcomes: 1. Instill the philosophy that real engineering design problems are open-ended and multifaceted. 2. Teach a systemic design methodology. 3. Provide guidance in applying engineering principles to open-ended problems. 4. Develop the ability to mathematically model and analyze engineering systems. 5. Sharpen skills in leadership, teamwork, communication, project planning, innovation, design and entrepreneurship. 6. Instill a philosophy of professional and ethical behavior. 7. Provide a foundation for the rest of the mechanical engineering curriculum and future careers. Credits: 3.00

ME 26400 - Introduction To Manufacturing For Mechanical Design

Credit Hours: 3.00. Introduction to manufacturing processes for typical engineering materials. Basics of material properties and behavior for manufacturing processes. Material selection and manufacturing process selection for mechanical design. Hands-on projects in the lab reinforce the knowledge of manufacturing processes.

Learning Outcomes: 1. Understand material properties and behavior for design and manufacturing. 2. Gain a fundamental knowledge of manufacturing processes. 3. Gain knowledge of the practice of measurements and manufacturing processes through laboratory experiments. 4. Enhance knowledge on the selection of materials and manufacturing processes for product design. 5. Enhance technical communication skills through short technical lab reports. Credits: 3.00

ME 27000 - Basic Mechanics I

Credit Hours: 3.00. Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

Learning Outcomes: 1. Develop an understanding of static equilibrium and stresses in statically-determinate structures and how to apply them to engineering systems. 2. Learn a systematic approach to problem solving. 3. Foster effective mathematical and graphical

communication skills. Credits: 3.00

ME 27200 - Mechanics Of Materials

Credit Hours: 3.00. Kinematic and dynamic analysis of linkages and mechanical systems. Analytical and graphical approaches to analysis. Vector loop and relative velocity/acceleration solutions. Design and analysis of cams and gears. Static and dynamic balancing. Design for strength of various machine components. Reliability principles. Design documentation and communication. Laboratory experiments on mechanical design and strength.

Credits: 3.00

ME 27400 - Basic Mechanics II

Credit Hours: 3.00. Review and extension of particle motion to include energy and momentum principles. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. Three-dimensional kinematics and kinetics of rigid bodies. Linear vibrations, with emphasis on single-degree-of-freedom systems.

Credits: 3.00

ME 28500 - Industrial Practice I

Credit Hours: 0.00. Professional practice of engineering in industry. Comprehensive written report of this experience required. For cooperative program students only.

Credits: 0.00

ME 28600 - Industrial Practice II

Credit Hours: 0.00. Professional practice of engineering in industry. Comprehensive written report of this experience required. For cooperative program students only.

Credits: 0.00

ME 29000 - Global Engineering Professional Seminar (UCC: STS)

Credit Hours: 1.00. Forum on contemporary issues in the global profession of mechanical engineering. Professionalism and ethics. Interactions with engineering faculty and with professionals outside the University. Quizzes on assigned readings in the areas of globalization, cultural difference and collaborating across cultural boundaries. Individually developed professional profiles describe technical interests and convey awareness of ethical responsibilities in global context.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Provide a solid foundation in global engineering skills. 2. Introduce the in global engineering community and encourage active involvement with professional associations such as ASME and SAE to develop teamwork and leadership skills. 3. Explore the ME Curriculum and identify resources available for planning a academic program including global literacies (language and area studies) and for obtaining diverse industrial experience appropriate for developing global competencies. 4. Support the development of a strong ethical framework for global professional workplace, including an appreciation for cultural differences, as a responsible member of the global engineering community. Credits: 1.00

ME 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking,

problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 29500 - Engineering Topics

Credit Hours: 1.00 to 5.00. Topics of contemporary importance of special interest that are outside the scope of the standard undergraduate curriculum can be offered temporarily under the selected topics category until the course receives a permanent number. Typically offered Summer Fall Spring.

Credits: 1.00 to 5.00

ME 29601 - Experimental Courses

Credit Hours: 0.00 to 6.00. Experimental classes offered at the freshman or sophomore level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 0.00 to 6.00

ME 29700 - Mechanical Engineering Sophomore Projects

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest. Students submit a summary report. Permission of instructor required.

Credits: 0.00 to 6.00

ME 30000 - Thermodynamics II

Credit Hours: 3.00. Properties of gas mixtures, air-vapor mixtures, applications. Thermodynamics of combustion processes, equilibrium. Energy conversion, power, and refrigeration systems.

Credits: 3.00

ME 30800 - Fluid Mechanics

Credit Hours: 3.00. Continuum description, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Bernoulli's equation along a streamline and with head losses. Flow over submerged bodies, boundary layers. Viscous flows in pipes, turbomachinery, system performance. One-dimensional gas dynamics.

Learning Outcomes: 1. Develop the ability to identify and classify the various types of flows one may encounter. 2. Develop (from rigorous first principles) the control volume formulation of the basic laws with emphasis on conservation of mass and Newton's 2nd law. 3. Apply the control volume formulation of the basic laws to model physical systems. Credits: 3.00

ME 30801 - Fluid Mechanics Laboratory

Credit Hours: 1.00. This course is the lab component of an already established ME 30900 Fluid Mechanics (4 cr) course, which is now being split into an ME 30800 (3 cr) Fluid Mechanics lecture course, and the material covered in this new ME 30801 (1 cr) Fluid Mechanical Laboratory. The content of both of these courses remains unchanged. The splitting of the lab from the lecture will enable better enrollment load balancing in the existing ME undergraduate laboratory facilities. Details of this new laboratory are outlined in the appended material below.

Learning Outcomes: 1. Know physical experiments in fluid mechanics. 2. Know application of fluid mechanics theory and fundamental concepts to measuring and analyzing fluid systems and flows. 3. Learn a laboratory design project on a flow system reinforces the design process. Credits: 1.00

ME 31002 - Fundamentals Of Fluid Mechanics

Credit Hours: 3.00. Continua, velocity fields, fluid statics, basic conservation laws for systems and control volumes, dimensional analysis. Euler and Bernoulli equations, viscous flows, boundary layers, flows in channels and around submerged bodies, and one-dimensional gas dynamics.

Credits: 3.00

ME 31401 - Fundamentals Of Heat And Mass Transfer

Credit Hours: 3.00. Fundamental principles of heat transfer by conduction, convection, and radiation; mass transfer by diffusion and convection. Application to engineering situations.

Credits: 3.00

ME 31500 - Heat And Mass Transfer

Credit Hours: 4.00. Fundamentals of heat transfer by conduction, convection, and radiation; mass transfer by convection. Relevance to engineering applications.

Learning Outcomes: 1. Develop the ability to identify the relevant transport processes (heat, momentum and energy) when confronted with a particular problem. [1, 7] 2. Develop the ability to model and analyze heat and mass transfer processes. [1, 2, 3, 5, 7] 3. Augment the ability to design and conduct experiments to solve open-ended engineering problems. [2, 3, 5, 6, 7] 4. Reinforce technical written and oral communication skills through a formal project report. [3, 4, 5] Credits: 4.00

ME 31600 - Fluid Mechanics

Credit Hours: 3.00. Continua, velocity fields, fluid statics, basic conservation laws for systems and control volumes, dimensional analysis. Euler and Bernouilli equations, viscous flows, boundary layers, flows in channels and around submerged bodies, and one-dimensional gas dynamics.

Credits: 3.00

ME 32300 - Mechanics Of Materials

Credit Hours: 3.00. Integrated approach to mechanics of materials emphasizing mechanics fundamentals as applied to machine design applications. Stress and strain in machine elements; mechanical properties of materials; extension, torsion, and bending of members; thermal stress; pressure vessels; static indeterminacy, stress transformation, Mohr's circle.

Credits: 3.00

ME 32301 - Mechanics Of Materials Laboratory

Credit Hours: 1.00. Experimental methods and techniques employed for the measurement of mechanical properties and evaluation of mechanical structures. Application of mechanics of materials and fundamental concepts to measuring and analyzing mechanical structures. A laboratory design project on mechanical structures.

Learning Outcomes: 1. Conduct simple experiments and analyze data. 2. Enhance systematic problem-solving skills and sharpen written-communication skills through short technical laboratory memos. 3. Complete a design project on a mechanical structure. Credits: 1.00

ME 32500 - Dynamics Of Physical Systems

Credit Hours: 3.00. Development and solution of linear models; translational and rotational mechanical systems, electrical systems, electromechanical systems, thermal systems, hydraulic systems. The Laplace transform, transfer functions, and Bode plots, state variable representation and solutions. Computer analysis and simulation.

Learning Outcomes: 1. Develop a mathematical model generally consisting of ordinary differential equations for a given system. 2. Determine the equilibrium conditions, and where appropriate, obtain a linearized model for a nonlinear system. 3. Rearrange the equations that make up the system model in a new form suitable for an analytical solution and use them to build and simplify block diagrams. 4. Solution for a first order system by the method of time domain response. 5. Use Laplace transform method to find the time response, to determine the role of the transfer function on the system response, and where appropriate, to find the time constraints, damping ratios, and undamped natural frequencies. 6. Use a suitable software (i.e. Simulink - Matlab) to simulate and analyze the behavior of the dynamic systems. 7. Use block diagrams and computer simulations as aids in modeling and analysis of dynamic systems. Credits: 3.00

ME 32501 - Mechanical Engineering Laboratory III

Credit Hours: 1.00. Experiments on testing of Mechanics of Materials and Fluid Mechanics.

Credits: 1.00

ME 32510 - Energy Engineering Laboratory III

Credit Hours: 1.00. Experiments on testing of Fluids Mechanics and energy engineering.

Credits: 1.00

ME 32600 - Engineering Project Management

Credit Hours: 3.00. (ECE 32600) Project management is an

important skill that is needed in the private and public sectors as well as specialty businesses. This course will explore the challenges facing today's project managers and will provide a broad understanding of the project management environment focused on multiple aspects of the project.

Learning Outcomes: Upon successful completion of the course, students should be able to 1. Use library resources and internet resources to find information necessary for the project. 2. Use critical thinking in its design process. 3. Use creative approaches when necessary to obtain project objectives. 4. Analyze and interpret data. 5. Function effectively on a multi-disciplinary team through mutual support, consensus seeking, cooperation, and sharing responsibility. 6. Write a project report, adhering to the specified format using an appropriate writing style, grammar, and spelling. 7. Make an oral presentation using effective visual aids. 8. An understanding of professional and ethical responsibility. 9. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 10. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ME 32700 - Engineering Economics

Credit Hours: 3.00. (ECE 32700) Engineering Economics is designed as an overview of economics with a focus on how it relates to the practice of engineering. Topics include interest formulas, rate of return, life cost analysis, depreciation, taxes, and cash flow.

Credits: 3.00

ME 33000 - Modeling And Analysis Of Dynamic Systems

Credit Hours: 3.00. Introduction to dynamic engineering systems; electrical, mechanical, fluid, and thermal components; linear system response; Fourier series and Laplace transform.

Credits: 3.00

ME 33010 - Modeling And Measurements Of Dynamic Systems

Credit Hours: 3.00. This course will cover the fundamentals of instrumentation, measurement, and dynamic systems modeling. Design, selection, and usage of the instrumentation systems and the interpretation of experimental results are also introduced. Basic concepts of measurements methods, measurement system response, assessment, uncertainty analysis of measured data, sensors, signal conditioning, recording / display devices, digital techniques, instrument interface, and measurement theories on stress and strain, temperature, pressure, fluid flow and velocity will also be covered. Additionally, fundamentals of dynamic systems including mechanical, electrical, and electromechanical systems will be introduced. Laplace transform, block diagram, transient and frequency response of linear first and second order system will be covered as well.

Credits: 3.00

ME 34001 - Instrumentation And Measurement Systems

Credit Hours: 2.00. Modeling and formulation of differential equations for dynamic systems, including mechanical vibratory systems, thermal systems, fluid systems, electrical systems, and instrumentation systems. Analysis of dynamic systems and measuring devices including transient response and frequency response techniques, mechanical systems, transducers, and operational amplifiers. Consideration of readout devices and their responses to constant, transient, and steady-state sinusoidal phenomena. Calibration and data analysis techniques are introduced. Both analog and digital computation are included.

Credits: 2.00

ME 34400 - Introduction To Engineering Materials

Credit Hours: 3.00. Introduction to the structure and properties of engineering materials, including metals, alloys, ceramics, plastics, and composites. Characteristics and processing affecting behavior of materials in service.

Credits: 3.00

ME 34600 - Renewable Energy Systems And Design

Credit Hours: 3.00. This course is designed to introduce the system and design of energy conversion and storage devices for renewable energy sources. Students will first learn about energy sources available on earth including kinetic, solar, and chemical. Next, the course will provide students with a review of the thermodynamic concepts behind energy constant and

energy transfer via an energy conversion device. Finally, this course will tie together concepts of renewable energy sources and thermodynamics teaching students about design elements for energy conversion and storage devices, in which renewable energy sources are converted and stored. Permission of Instructor required.

Credits: 3.00

ME 35001 - Mechanical Engineering Laboratory IV

Credit Hours: 1.00. Experiments on testing of Dynamic Systems, Heat & Mass transfer, and Materials.

Credits: 1.00

ME 35010 - Energy Engineering Laboratory IV

Credit Hours: 1.00. Experiments on testing of heat and mass transfer, and energy engineering.

Credits: 1.00

ME 35200 - Machine Design I

Credit Hours: 4.00. Introduction to the principles of design and analysis of machines and machine components. Design for functionality, motion, force, strength, and reliability. Review of fatigue failure theories and analysis of fatigue stresses. Laboratory experience provides open-ended projects to reinforce the design process.

Credits: 4.00

ME 35400 - Machine Design

Credit Hours: 3.00. Design, analysis, and selection of machine components for fluctuating loading. Application of design fundamentals to mechanical components and integration of components to form systems. Open-ended design projects reinforce the design process.

Learning Outcomes: 1. Apply Statics, Dynamics, and Strength of Materials to the realization of machine components. 2. Understand fatigue failure mechanisms 3. Apply fatigue failure theories to create reliable mechanical components. 4. Select standard machine components and materials. 5. Enhance problem-solving and communication skills through design projects. Credits: 3.00

ME 35401 - Machine Design Laboratory

Credit Hours: 1.00. Physical experiments on static and fatigue failure of mechanical parts. Application of failure theories to design of mechanical components and systems. Open-ended design projects to reinforce the design process.

Learning Outcomes: 1. Experiment on static and fatigue failure. 2. Compare theory with physical experiments and simulation. 3. Apply failure theories to design of machines. 4. Learn open ended design projects. Credits: 1.00

ME 36300 - Principles And Practices Of Manufacturing Processes

Credit Hours: 3.00. Manufacturing processes for engineering materials, both metallic and non-metallic. Fundamentals of manufacturing processes with a "hands-on" laboratory sequence. Analysis and design of processes for various engineering materials and their link to engineering design. Hands-on experiences through laboratory experiments and demonstrations. Not open to students with credit in IE 37000.

Credits: 3.00

ME 36400 - Systematic Engineering Design

Credit Hours: 3.00. The engineering design process including planning and clarification, conceptual design, embodiment design, and detail design. Identification of customer requirements and development of engineering specifications. Concept generation and selection. Rules and guidelines for embodiment design. Design considerations including quality, modularity, manufacturing, assembly, and economics. Detail design to support manufacturing.

Learning Outcomes: 1. Understand and apply a systematic design method. 2. Understand customer needs and translate needs to engineering specifications. 3. Generate concepts and use ideation techniques. 4. Develop layouts using embodiment design techniques. 5. Generate designs that are manufacturable. 6. Communicate design effectively to various stakeholders. 7. Work effectively in a team environment. 8. Acquire and apply new knowledge and tools to support the design process. Credits: 3.00

ME 36500 - Measurement And Control Systems I

Credit Hours: 3.00. The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general

importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques noise and error analysis are covered.

Learning Outcomes: 1. Provide a fundamental knowledge of the theory of measurement sciences. (A2, A3, A4) 2. Gain knowledge of the practice and art of measurements through laboratory experiments. (A2, A3, A4) 3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. (A2, A3, A4) Credits: 3.00

ME 37200 - Design Of Mechanisms

Credit Hours: 3.00. Kinematic and dynamic analysis of linkages and mechanical systems. Analytical and graphical approaches to analysis. Vector loop and relative velocity/acceleration solutions. Design and analysis of cams and gears. Static and dynamic balancing. Design documentation report writing and communication.

Credits: 3.00

ME 37500 - Measurement And Control Systems II

Credit Hours: 3.00. This course provides an introduction to modeling electrical, mechanical, fluid, and thermal systems containing elements such as sensors and actuators used in feedback control systems. Modeling techniques based on physical laws and principles are used to generate subsystem and system transfer functions. Closed-loop system analysis will include the use of proportional, integral, and derivative elements to control system response.

Learning Outcomes: 1. Introduce a systematic and unified system level modeling of lumped dynamic systems in different domains using first principles. (A2, A3) 2. Provide necessary mathematical tools for analyzing and predicting the performance of an engineered system based on its dynamic response. (A2, A3) 3. Provide an introductory treatment of designing feedback controllers to achieve closed-loop stability and specified system performance. (A2, A3) Credits: 3.00

ME 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

ME 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

ME 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

ME 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to

identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

ME 39600 - Professional Internship II

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit a summary report.

Credits: 0.00

ME 39699 - Professional Practice Internship

Credit Hours: 0.00. Professional experience in mechanical engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Permission of department required.

Credits: 0.00

ME 39700 - Selected Topics In Mechanical Engineering

Credit Hours: 0.00 to 6.00. Topics of contemporary importance or of special interest in Mechanical Engineering. Permission of instructor required.

Credits: 0.00 to 6.00

ME 40600 - Robust Design, Standards And Contemporary Issues

Credit Hours: 1.00. The role of standards, robust design and lifelong learning in engineering design. Application to contemporary issues.

Credits: 1.00

ME 40700 - HVAC Design

Credit Hours: 3.00. The fundamentals required to design and analyze HVAC systems used in buildings. This includes the fundamentals of the thermodynamics of HVAC systems and buildings, the thermodynamics of moist air (psychometrics), calculating building heating / cooling loads, application of HVAC equipment to buildings, HVAC component analysis, energy reduction strategies. Application to real building designs.

Credits: 3.00

ME 41200 - Additive Manufacturing: Fundamentals, Equipment, And Applications

Credit Hours: 3.00. Introduction to additive manufacturing through lecture and project-based learning. The focus is additive process fundamentals, materials, characterization, and testing. Students will develop and understanding of processes and equipment for additive manufacturing; design for additive manufacturing; Implementation of Additive Manufacturing for Product Applications.

Learning Outcomes: 1. Understand the fundamentals of materials, properties, and testing for additive manufacturing. 2. Develop understanding of processes and equipment for additive manufacturing. 3. Understand design(s) for additive manufacturing with material(s) and process(es) for application specific functionality. 4. Complete a project based on product innovation or novel research. Credits: 3.00

ME 41300 - Noise Control

Credit Hours: 3.00. Fundamentals of acoustic waves. Psychoacoustics and theories of hearing. Environmental and building acoustics. Measurement methods and common instrumentation. Noise control methods. Machinery noise. Community reaction. Legal aspects. Design-oriented semester project. Course work in differential equations.

Credits: 3.00

ME 41400 - Thermal-Fluid Systems Design

Credit Hours: 3.00. Application of basic heat transfer and fluid flow concepts to design of thermal-fluid systems. Emphasis on design theory and methodology. Design experience in thermal-fluid area such as piping systems, heat exchangers, HVAC, and energy systems. Design projects are selected from industrial applications and conducted by teams.

Credits: 3.00

ME 41500 - Energy Systems Engineering

Credit Hours: 3.00. Application of Thermodynamics, fluid mechanics, and heat transfer fundamentals to the design of energy systems. Applications include thermal regulation in buildings, electronic equipment, energy generation, conversion, and storage, manufacturing processes, and combustion processes. Beyond the fundamentals, this course will focus on design and analysis techniques, including analysis of energy costs, economics, and environmental issues.

Credits: 3.00

ME 41800 - Engineering Of Environmental Systems And Equipment

Credit Hours: 3.00. Design and analysis of systems and equipment used in conditioning buildings. Review of fundamentals in thermodynamics, heat transfer, fluid mechanics, economics, non-linear equation solving, optimization. Analysis of building heating and cooling requirements for design and annual energy use. Design and selection of equipment.

Credits: 3.00

ME 42301 - Introduction To Nanotechnology

Credit Hours: 3.00. The course introduces students to the scale of nanotechnology, materials used in nanotechnology, forces acting in nanomaterials, electronic and mechanical behaviors on the nanometer scale, and applications in industries and life sciences. Nano-versus micro-technology in the evaluation of potential risks and benefits will be covered with emphasis on their impact on society.

Learning Outcomes: 1. Describe the status of nanotechnology infrastructure and products in the USA in instrumentation, devices, materials, and applications. 2. Compare nanotechnology to micro-technology issues. 3. Demonstrate knowledge of nanotechnology standards, tools, and Nano-manufacturing. 4. Explain the features of nanoscale electronics. 5. Communicate team project or team research term paper work through oral presentation and technical report. Credits: 3.00

ME 42501 - Mechanical Engineering Laboratory V

Credit Hours: 1.00. Experiments on testing of Mechanical Measurements and Control Systems.

Credits: 1.00

ME 42510 - Energy Engineering Laboratory V

Credit Hours: 1.00. Experiments on testing of mechanical measurements, control systems and alternative energy systems.

Credits: 1.00

ME 43000 - Power Engineering

Credit Hours: 3.00. Rankine cycle analysis, fossil-fuel steam generators, energy balances, fans, pumps, cooling towers, steam turbines, availability (second law) analysis of power systems, energy management systems, and rate analysis.

Credits: 3.00

ME 43300 - Principles Of Turbomachinery

Credit Hours: 3.00. Unified treatment of principles underlying fluid mechanic design of hydraulic pumps, turbines and gas compressors. Similarity and scaling laws. Cavitation. Analysis of radial and axial flow machines. Blade element performance. Radial equilibrium theory. Centrifugal pump design. Axial compressor design.

Learning Outcomes: 1. Understand principles of operation of pumps, fans, compressors and turbines. 2. Develop the ability to size and select turbomachinery for a specific application. 3. Develop the ability to analyze the performance of turbomachinery. 4. Master the concepts of classic mean-line and quazi-3D design methods. Credits: 3.00

ME 43400 - Gas Turbines For Power And Propulsion

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet,

turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component matching and off-design performance. Coursework in thermodynamics and fluid mechanics.

Learning Outcomes: 1. Apply basic performance characteristics of shaft power gas turbine engines. 2. Apply basic performance characteristics of gas turbines for aircraft propulsion. 3. Apply cycle analysis. 4. Apply component performance analysis. 5. Apply design and off-design operation. Credits: 3.00

ME 43500 - Dynamical Systems

Credit Hours: 1.00. This course introduces the modeling and analysis of dynamical systems providing the tools for problem-solving of complex mechanical, electromechanical, and aerospace systems. The course focuses on providing a unified approach to derive equations of motion of diverse linear systems the solution of which can be obtained in generic fashion. The course is designed to draw from differential equations, dynamics, and control systems courses, thereby unifying seemingly diverse concepts and tools under the dynamical systems umbrella.

Learning Outcomes: 1. Gain familiarization with energy-based methods for equations of motion derivation. 2. Understand derivation and analysis of linear dynamical systems via canonical forms of equations of motion. 3. Gain familiarization with general solution approaches to linear dynamical systems. Credits: 1.00

ME 44000 - Automotive Prime Movers: Green Engines And Clean Fuel

Credit Hours: 3.00. Internal combustion engines (ICE), hybrid engines (HE), fuel-cell engines (FCE), and alternative/renewable fuels. ICEs topics- engines with advanced combustion systems such as clean diesels, direct-injection spark-ignition engines (DISI), and low-temperature combustion (LTC) compression-ignition. HE topics- different components of hybrid engines and the powertrain design. FCE topics- fundamentals of fuel cells and automotive applications. Clean fuel topics- biofuels, hydrogen, and natural gas, as well as, other cleaner fossil fuels for automotive applications. Well-to-wheel energy and cost analysis of prime mover designs/fuels.

Learning Outcomes: 1. Relate processes in automotive prime movers to engineering fundamentals. 2. Study low-carbon emitting, and LEV, ULEV, SULEV, PZEV, and ZEV prime mover designs. 3. Study prime mover designs that are alternative to conventional combustion engines. 4. Study cleaner alternatives to conventional fossil fuels. 5. Carry out analysis of prime mover designs and fuel alternatives to identify cost and energy tradeoffs. Credits: 3.00

ME 44400 - Computer-Aided Design And Prototyping

Credit Hours: 3.00. Introduction to advanced computer-aided design (CAD) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional and marketable product. Projects include use of the advanced design tools to produce a working prototype that is manufacturable. Application to design, manufacturing, and analysis.

Credits: 3.00

ME 44700 - Compressible Flow And Renewable Kinetic Energy

Credit Hours: 3.00. This course is designed to introduce compressible flow, turbomachines and design of kinetic energy conversion and storage devices for wind, wave and tidal renewable energy sources. Students will first learn about compressible flow, turbomachines concepts and kinetic energy sources available on earth. Next, the course will provide students with analysis, design parameters and control renewable kinetic energies.

Credits: 3.00

ME 45500 - Vehicle Design And Fabrication

Credit Hours: 3.00. Open-ended project course to design and build competitive prototype vehicles. Integration of design concept formulation, engineering analysis and testing, and prototype fabrication. Product development activities in a hands-on setting. Design constraints imposed by manufacturing limitations, funding constraints and market competition. Permission of instructor required.

Learning Outcomes: 1. Apply the design process to the design of a vehicle. 2. Apply engineering fundamentals to evaluate the design of a vehicle. 3. Apply team-work skills to management of the Mini-Baja or Formula SAE teams. 4. Learn the effect of design choices by building and testing students' designs. Credits: 3.00

ME 45900 - Mechanism And Machine Theory

Credit Hours: 3.00. Introduction to the principles of the analysis and design of mechanisms and machinery. Design for functionality, motion constraints, inertia force effects, and static and dynamic balancing.

Learning Outcomes: 1. An understanding of the kinematics of mechanisms. 2. An understanding of the kinetics and dynamics of machines. 3. Enhance problem-solving techniques in mechanism and machine theory. 4. Appreciation of the design of different types of machinery. Credits: 3.00

ME 46200 - Capstone Design

Credit Hours: 3.00. Concurrent engineering design concept is introduced. Application of the design is emphasized. Design problems from all areas of mechanical engineering are considered.

Credits: 3.00

ME 46300 - Engineering Design

Credit Hours: 3.00. Application of the design process to the design of various engineering components and systems. Mathematical modeling in design is emphasized. Design problems from all areas of mechanical engineering are considered.

Learning Outcomes: 1. Reinforce the philosophy that engineering design problems are open-ended and multifaceted. [1, 2, 3, 5] 2. Exercise a collaborative design methodology. [2, 3, 4, 5, 6, 7] 3. Broaden skills in leadership, teamwork, communication, project planning, innovation, design, and entrepreneurship. [3, 5] 4. Experience the application of core course materials, engineering design methods, and testing to practical open-ended design problems. [1, 2, 6] 5. Reinforce a philosophy of professional and ethical behavior. [4] 6. Provide a practical foundation for knowledge acquisition and continued learning as needed in students' future careers. [7] Credits: 3.00

ME 47500 - Automatic Control Systems

Credit Hours: 3.00. Controller design in frequency domain with introduction to digital systems and control.

Credits: 3.00

ME 48200 - Control System Analysis And Design

Credit Hours: 3.00. (MSTE 36000) Classical feedback concepts, root locus, Bode and Nyquist techniques, state-space formulation, stability, design applications. Students may not receive credit for both ECE 38200 and ME 48200.

Credits: 3.00

ME 48900 - Introduction To Finite Element Analysis

Credit Hours: 3.00. Introduction to finite element analysis with focus on linear elasticity and heat transfer. Matrix analysis and assembly of solutions. Strong form and weak form as a general solution process for differential equations.

Learning Outcomes: 1. Introduce concepts of finite element analysis. 2. Learn the use of matrix methods for solution of truss structures. 3. Learn strong and weak form for the solution of differential equations. 4. Learn how to define finite elements and finite element approximations. 5. Learn how to solve weak form formultions as a finite element approximation. 6. Apply these concepts to linear elastic and heat transfer problems. 7. Apply a commercial finite element code to linear elastic and heat transfer problems. 8. Understand the use of the Finite Element Analysis in engineering practice. Credits: 3.00

ME 49200 - Technology And Values

Credit Hours: 3.00. The impact of science and technology on personal and societal value systems. The special responsibility of engineers. Practical methods for using human values to guide future technological developments. Societal problems considered: warfare, energy, overpopulation, resource depletion, and environmental degradation. Interdisciplinary approaches stressed. Offered in alternate years.

Credits: 3.00

ME 49601 - Experimental Courses

Credit Hours: 1.00 to 6.00. Experimental classes offered at the junior or senior level on a temporary basis to test the viability of offering the course on a permanent basis.

Credits: 1.00 to 6.00

ME 49700 - Mechanical Engineering Projects

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest outside the scope of the standard undergraduate curriculum. Interested students seek a faculty advisor in their area of special interest and together prepare a brief description of the work to be undertaken. Permission of instructor required.

Credits: 1.00 to 6.00

ME 49800 - Research In Mechanical Engineering I

Credit Hours: 0.00 to 6.00. Individual research projects for students with honors classification. Requires prior approval of, and arrangement with, a faculty research advisor. Honors classification. Permission of instructor required.

Credits: 0.00 to 6.00

ME 49900 - Research In Mechanical Engineering II

Credit Hours: 0.00 to 6.00. Continuation of ME 49800. Requires submission of a written thesis, public presentation, and oral defense of the research project. Honors Classification. Permission of instructor required.

Credits: 0.00 to 6.00

MSPE 29000 - Motorsports Engineering Seminar

Credit Hours: 1.00. An overview of the motorsports industry including types of vehicles, types of competition, careers available, historical perspective, development of pertinent technologies, and brief discussions of engineering related topics that will be covered in more detail in future classes. Interactions with motorsport and mechanical engineering faculty along with motorsports engineers currently working in the industry. Professionalism and ethics are discussed along with topical discussions as related to the motorsports industry in the areas of globalization, cultural differences, and collaboration across cultural boundaries.

Learning Outcomes: 1. Demonstrate knowledge of the motorsports industry and recognize techniques, skills and modern tools of the motorsports industry. 2. Apply current knowledge and solve introductory problems relevant to the motorsports industry. 3. Possess a general knowledge of the history and evolution of motor racing nationally and internationally. 4. Develop technical writing skills beyond those learned in first-year engineering. 5. Recognize professional, ethical, and societal responsibilities in the context of the motorsports industry. Credits: 1.00

MSPE 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 29701 - Computer Modeling For Motorsports

Credit Hours: 2.00. An introductory course detailing methods for designing and modeling motorsports components using Computer Aided Design (CAD) software.

Learning Outcomes: 1. Understand Bottom-up Design of systems and components. 2. Utilize modern engineering tools to model components as solid models in 3 dimensions. 3. Utilize modern engineering tools to generate detail two-dimensional detail drawings of components. 4. Utilize modern engineering tools to model and constrain component assemblies in 3 dimensions. 5. Communicate thoughts and ideas. Credits: 2.00

MSPE 29800 - Programming And Computer Modeling For Motorsports

Credit Hours: 2.00. Introductory course detailing methods for creating virtual models of vehicle systems for design, analysis and optimization. Virtualization methods include object-oriented programming techniques for creating mathematical models in Excel, Matlab and Python. Students will learn the basics of data regression consistent with the analysis methods conducted in the motorsports industry. The methods introduced through this course lay the foundation for advanced courses in vehicle design, simulation, and analysis.

Learning Outcomes: 1. Introductory understanding of Object-Oriented Programming using Excel VBA and C#. Credits: 2.00

MSPE 31201 - Business of Motorsports

Credit Hours: 0.00 or 3.00. This course covers the unique aspects of the motorsports industry, especially race teams, including organizations, budgeting, marketing, and sponsorships through an examination of literature and guest speakers.

Credits: 0.00 or 3.00

MSPE 31700 - Motorsports Practicum I

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a professional motorsports organization.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team. 10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 32000 - Motorsports Design I

Credit Hours: 3.00. Introduction to the principles of design and analysis of vehicle subsystems and components within those subsystems. Vehicle subsystems are reviewed and evaluated for functionality, and reliability with emphasis on the utilization of analytical tools in design. Analytical methods developed in vehicle dynamics are utilized to support the understanding of forward and reverse engineering principles.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to solution of design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively. Credits: 3.00

MSPE 33000 - Systems Engineering For Motorsports

Credit Hours: 3.00. Systems engineering encompasses the engineering knowledge to specify, design, program and analyze the electrical systems of a motorsports vehicle. The course will explore those systems to provide the engineering foundation in instrumentation, data analysis, data reduction, and system programming. Project work will supplement the learning outcomes through direct engagement of designing and specifying a data system for a motorsports vehicle, manufacturing a motorsports vehicle sensor loom, and

programming the communication pathways between different vehicle electrical systems.

Learning Outcomes: 1. Understand the fundamentals of the data acquisition systems installation, operation, software, and maintenance, while appreciating the importance of data integrity 2. Understand the implications of design decisions when designing the data acquisition system or designing around the data acquisition system. 3. Understand the limitations and possibilities of the data acquisition system. 4. Utilize data acquisition analysis tools to properly import and display data signals. 5. Understanding on how to write math channels to interpret and analyze data. 6. Initial understanding of how recorded data represents vehicle and driver performance. 7. Utilize motorsports wiring tools to manufacture a motorsports sensor harness. 8. Understand the basics of digital car communication including the math associated with communicating digital signals throughout the vehicle. Credits: 3.00

MSPE 33001 - Data Acquisition For Motorsports I

Credit Hours: 2.00. This course introduces students to motorsports data acquisition systems and the associated hardware and software that are comprised therein. A hands-on lab component is included int he class where in students learn how to specify a motorsports data system, understand vehicle network communication and build a motorsport industry standard data acquisition wiring harness.

Credits: 2.00

MSPE 33100 - Data Acquisition For Motorsports II

Credit Hours: 3.00. This course explores the appliaction of vehicle dynamics principles to motorsport vehicles. Students will utilize engineering software tools to develop motorsport engineering worksbooks for vehicle performance analysis. Driver performance analysis and race strategy topics are introduced to provide the student with the full fundamentals of race engineering.

Credits: 3.00

MSPE 34000 - Dynamic Signals And Systems

Credit Hours: 3.00. Introduction to dynamic engineering systems and continuous-time and discrete-time signals, mechanical electromechanical components, linear system response, Fourier and Laplace Transforms. The course is designed to teach the student the basic concept for modeling the behavior of dynamic systems.

Credits: 3.00

MSPE 35000 - Computer Aided Design And Manufacturing

Credit Hours: 3.00. This course provides the basis for the computer-aided engineering and analysis skills needed in the Motorsports Industry. The ability to visualize and conceptualize a real part in the physical world and produce graphical representations of it in 2D and 3D in Solidworks or an equivalent is a primary objective. Further skills to be developed include the ability to produce large assemblies of such parts with appropriate tolerancing, free form surfacing, casting shapes and casting machining, 2D drawings for use in 3D sheet metal fabrication including shrink and stretch, use of 3D models to facilitate Finite Element Analysis, Conversation of CAD model to programming of CAM machining.

Learning Outcomes: 1. Apply knowledge of mathematics, science, and engineering to problems involving the design and manufacturing of components and systems. 2. Design a system, component, or process to meet desired needs. 3. Identify, formulate, and solve engineering problems involving the design and manufacturing of components and systems. 4. Use the techniques, skill, and modern engineering tools necessary for engineering practice. Credits: 3.00

MSPE 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking,

problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in motorsports engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MSPE 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

MSPE 41400 - Motorsports Design II

Credit Hours: 3.00. This is the culminating course in the Motorsports Engineering Plan of Study, tying together concepts from all the other courses in the curriculum, and requires a capstone design project representative of a real world project with the Motorsports Industry.

Learning Outcomes: 1. Apply knowledge of mathematics, science and engineering to the solution of complex and comprehensive design problems relative to the motorsports industry. 2. Design a system, component, or process to meet desired needs pertinent to the motorsports industry. 3. Function on a multi-disciplinary team. 4. Identify, formulate, and solve engineering problems. 5. Recognize professional and ethical responsibility. 6. Communicate effectively in written reports and oral presentations. 7. Use the technique, skill, and modern engineering tools necessary for engineering practice in the motorsports industry. Credits: 3.00

MSPE 41700 - Motorsports Practicum II

Credit Hours: 1.00. This course engages students in a hands-on experiential learning opportunity in which they participate in the design, fabrication, assembly, and preparation of a race vehicle just as they might when engaged with a race team in the motorsports industry. Students will be expected to show mastery of at least 12 of the 12 skills outlined in the Course Objectives.

Learning Outcomes: 1. Conceptual design work capable of taking a rough concept to a preliminary design configuration. 2. Use of Solidworks, or equivalent, to do basis component design. 3. Analysis of designs using engineering fundamentals and/or FEM. 4. Practical fabrication experience. 5. Practical at-track experience through student competitions or track days. 6. System management of a vehicle subsystem. 7. Data analysis. 8. Project management. 9. Marketing/business aspects relative to operation of a small race team.

10.Applied simulation. 11.Documentation of process and/or analysis. 12.Mentoring new students to the team. Credits: 1.00

MSPE 42600 - Internal Combustion Engines

Credit Hours: 3.00. This course will cover fundamentals of hybrid electric and battery electric transportation systems with particular emphasis on high performance vehicles. It will cover powertrain configurations of Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), and Battery Electric Vehicle (BEV). Component sizing and energy management topics will also be covered.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools needed for design and analysis of engines. 2. Apply current knowledge and adapt to emerging applications in engine development. 3. Conduct, analyze and interpret experiments and apply results to improve processes. 4. Function effectively on teams. 5. Identify, analyze and solve technical problems. 6. Communicate effectively. Credits: 3.00

MSPE 43100 - Race Engineering

Credit Hours: 3.00. Motorsports engineering knowledge obtained throughout the curriculum are brought together to create foundational knowledge in the discipline. Analytical tools in Excel or Matlab along with data analysis tools from Cosworth or Motec are utilized to guide the application of motorsports engineering principles to vehicle performance optimization. Race strategy topics are investigated to provide foundational knowledge beyond vehicle system.

Learning Outcomes: 1. Utilize Excel or Matlab to analyze vehicle systems and performance. 2. Utilize Cosworth Toolbox or Motec i2 software to analyze vehicle systems and performance. 3. Calculate fuel error and its impact on race strategy. 4. Understand tire degradation principles and its impact on race strategy. 5. Write technical reports to disseminate the technical information in a clear and concise manner. Credits: 3.00

MSPE 47200 - Vehicle Dynamics

Credit Hours: 3.00. Analytical and mathematical model development of the automotive and motorsports vehicles to understand how key vehicle parameters influence vehicle performance. Areas of focus include rectilinear motion, lateral motion, suspension kinematics, tire dynamics and drivetrain modeling.

Learning Outcomes: 1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools necessary for analysis of vehicle dynamics and design of vehicle systems. 2. Apply current knowledge and adapt to emerging applications appropriate to the topic of vehicle dynamics. 3. Conduct, analyze and interpret experiments and apply experimental results to improve processes. 4. Apply creativity in the design of systems, components or processes appropriate to program objectives. 5. Function effectively on teams. 6. Identify, analyze and solve technical problems. 7. Communicate effectively. Credits: 3.00

MSPE 48200 - Motorsports Aerodynamics

Credit Hours: 3.00. A focused introductory course into the study of aerodynamics principles as applied to automotive and motorsports vehicles. Broad range of topics introduce students to the complexity of fluid flow in and around the vehicle. Analytical methods including Computational Fluid Dynamics are utilized to emphasize key aerodynamics principles taught in the course.

Learning Outcomes: 1. Students will understand the basics of aerodynamic analysis and design as applied to motorsports vehicles. 2. Students will be able to apply Computational Fluid Dynamics modeling and analysis techniques to motorsports design. 3. Students will be able to integrate the various aspects of motorsports modeling and design. Credits: 3.00

MSPE 49000 - Motorsports Engineering Independent Study

Credit Hours: 1.00 to 3.00. This is an independent study course

for students wishing to pursue advanced studies under the direction of a faculty advisor. Permission of instructor required.

Credits: 1.00 to 3.00

MSPE 49700 - Motorsports Design Project

Credit Hours: 3.00. This is an independent study version of the MSPE 41400 culminating course in the Motorsports Engineering Plan of Study, tying together concepts from all the other courses in the curriculum, and requires a capstone design project representative of a real world project within the Motorsports Industry. Permission of instructor required.

Credits: 3.00

MSPE 49900 - Motorsports Engineering Special Topics

Credit Hours: 1.00 to 3.00. This is a special topics course for students wishing to pursue advanced studies under the direction of a faculty advisor. Permission of instructor required.

Credits: 1.00 to 3.00

School of Nuclear Engineering

Overview

Nuclear engineering is firmly grounded in the understanding and application of modern physics. It has demonstrated vast potential for growth in power generation, medicine, industrial processes, plasmas, space technologies, and national defense. **Nuclear engineers** at Purdue contribute to such advanced technologies as fission and fusion power generators, new medical technologies and procedures, improved food safety, advanced materials processing, advanced imaging, and the safe treatment and disposal of spent nuclear fuel.
Indiana's first and only nuclear reactor has its home in Purdue University's Electrical Engineering Building. It headlines field trips for high-school juniors and seniors who participate in demonstrations and experiments. Students in the undergraduate program have an opportunity to work with the reactor in their courses.

Faculty (website)

School of Nuclear Engineering (website)

Contact Information

School of Nuclear Engineering
Purdue University
363 North Grant Street, #5281
West Lafayette, IN 47907
General Contact Information: Phone: (765) 494-5739
General Information email: ne@purdue.edu

Graduate Information

For Graduate Information please see Nuclear Engineering Graduate Program Information .

Nuclear Engineering, BSNE

Nuclear Engineering Minor

NUCL 11000 - Introduction To Energy Engineering

Credit Hours: 1.00. This course, designed for first-semester freshmen, reviews and discusses the history of energy use by the world, the relation between energy usage and quality of life, the social impact of energy use, and the environmental constraints on energy usage. In particular, the role that engineering disciplines play in solving energy problems will be discussed. The full impact that the various energy alternatives have on economic and environmental issues will be reviewed in order to provide a rational basis for energy choices for the future.

Credits: 1.00

NUCL 12000 - Freshman Research Project

Credit Hours: 1.00. In this course, the student performs a small independent project in nuclear engineering under direct faculty supervision.

Credits: 1.00

NUCL 20000 - Introduction to Nuclear Engineering

Credit Hours: 3.00. A course designed to acquaint students with the field of nuclear engineering and design. Concepts of fission, fusion, radioactivity, and neutron physics are introduced. Modern applications of nuclear technology, including nuclear medicine, food preservation, space reactors and propulsion.

Learning Outcomes: 1. Demonstrate an ability to solve typical radiation and nuclear reactor calculations. 2. Demonstrate an understanding of the fundamental concepts and principles of nuclear engineering. 3. Understand and describe the societal impact of nuclear engineering and the need for nuclear education, regardless of career field. 4. Introduction to reactor physics. 5. Basic knowledge of radiation interaction with matter. 6. Application of nuclear energy in biomedical and industrial applications. Credits: 3.00

NUCL 20500 - Nuclear Engineering Undergraduate Laboratory I

Credit Hours: 2.00. A laboratory course designed for the study of the properties of radiation, radioactive material, and radiation detectors. The hazards of radiation and safe handling techniques are emphasized.

Credits: 2.00

NUCL 27300 - Mechanics Of Materials

Credit Hours: 3.00. Analysis of stress and strain; equations of equilibrium and compatibility; stress-strain laws; extension, torsion, and bending of bars; membrane theory of pressure vessels; combined loading conditions; transformation of stresses and principal stresses; elastic stability, elected topics.

Credits: 3.00

NUCL 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 29800 - Sophomore Seminar

Credit Hours: 0.00. Career areas in nuclear engineering, job opportunities, areas of related study, topics of current interest, orientation, professional ethics, and responsibility.

Credits: 0.00

NUCL 30000 - Nuclear Structure And Radiation Interactions

Credit Hours: 3.00. Review of atomic properties and introduction to nuclear models. Discussion of radioactive decay and the interaction of nuclear radiation and reaction products with matter. Energetics and cross-sections of nuclear reactions with applications to problems typical of nuclear engineering.

Credits: 3.00

NUCL 30500 - Nuclear Engineering Undergraduate Laboratory II

Credit Hours: 2.00. Continuation of NUCL 20500 . Experiments with scintillation detectors, multichannel analyzers, neutron detectors, the subcritical pile, and the reactor will be performed. Measurements will be made to demonstrate neutron activation analysis techniques, neutron slowing down, neutron flux distributions, and the effects of control rods on neutron fluxes.

Credits: 2.00

NUCL 31000 - Introduction To Neutron Physics

Credit Hours: 3.00. Development of diffusion theory for neutrons. Neutron interactions and development of one-group neutron diffusion theory with point, plane, and fission sources. Application to one- and two-region reactors. Introduction to buckling, multiplication constants, critical size, neutron slowing down, and resonance capture. Applications using two-group theory.

Credits: 3.00

NUCL 32000 - Introduction To Materials For Nuclear Applications

Credit Hours: 3.00. Nuclear environments and materials selection for nuclear applications, bonding, crystal structure and symmetry, defects and irradiation, chemical thermodynamics, phase equilibria, phase transformations, and corrosion in nuclear systems and design.

Credits: 3.00

NUCL 32500 - Nuclear Materials Laboratory

Credit Hours: 3.00. Nuclear materials laboratory that evaluates various characterization techniques and technologies, tensile properties, hardness, fracture toughness, microstructures, X-ray diffraction, electron microscopy, mechanical properties of thin-films, NDE techniques and data acquisition in materials characterization techniques.

Learning Outcomes: 1. Understanding of what materials are, and how they perform and fail. 2. Understand the conceptual tools dealing with materials phenomena. 3. Be able to communicate with professionals about materials problems. 4. Be able to address the limitations of materials in design, and improve them.

Credits: 3.00

NUCL 35000 - Nuclear Thermal-Hydraulics I

Credit Hours: 3.00. The first of an integrated two-course sequence introducing the concepts of nuclear reactor thermal transport and associated hydraulics with applications to design and safety. Macroscopic balances, dimensional analysis, and flow measurement. Fluid behavior, momentum transfer, and applications to reactor systems and design.

Credits: 3.00

NUCL 35100 - Nuclear Thermal-Hydraulics II

Credit Hours: 3.00. Emphasis is given to the fluid transport of heat from reactor fuel elements. Heat transfer in fluids, analogies, and applications to reactor coolant channel analysis. Two-phase flow and convective boiling. Radiative heat transfer. Applications to safety analysis and reactor design.

Credits: 3.00

NUCL 35500 - Nuclear Thermohydraulics Laboratory

Credit Hours: 3.00. Laboratory course corresponding to NUCL 35000 and NUCL 35100 . Various fluid flow and heat transfer phenomena applied to nuclear reactor systems and design.

Credits: 3.00

NUCL 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

NUCL 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

NUCL 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Professional Practice students only. Permission of department required.

Credits: 0.00

NUCL 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and

teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in nuclear engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUCL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

NUCL 39800 - Junior Seminar

Credit Hours: 0.00. Continuation of NUCL 29800 .

Credits: 0.00

NUCL 40200 - Engineering Of Nuclear Power Systems

Credit Hours: 3.00. Principles and practice of power plant systems with design applications; thermal cycles, heat transport, mechanical designs, control, safety analysis, shielding analysis, fuel cycles; resources, optimization, options, waste management. Fusion and alternate energy sources.

Credits: 3.00

NUCL 41000 - Introduction To Reactor Theory And Applications

Credit Hours: 3.00. Intermediate treatment of reactor theory and its relevance to routine design engineering calculations, including introduction to transport theory, criticality evaluation, multi-group theory, isotopic depletion, and concludes with short overview of multi-level reactor design calculations, critical experiments, and treatment of neutronic uncertainties. List of Topics: Derivation of Boltzmann transport equation, and its reduction to steady state and time dependent diffusion equation. Introduction to multi-group theory, and evaluation of group parameters in both wide and narrow resonance approximations. Introduction to homogenization theory, and evaluation of lattice parameters. Evaluation of criticality condition for bare and reflected reactor geometries. Development of discretization techniques for the time-dependent multi-group diffusion theory equation. Reactor kinetics, reactivity coefficients and reactivity balance equation. Flowchart of multi-level reactor design calculations. Introduction to critical experiments and startup reactor physics test. Sources and treatment of uncertainties in reactor calculations.

Learning Outcomes: 1. Develop an understanding of reactor physics value for engineering design calculations, and to learn how it is applied to make engineering design decision regarding material choice, composition, type, and operating conditions to sustain and control chain reactor over reactor operating horizon. 2. Learn how to develop a computer code to solve a reactor physics problem. Credits: 3.00

NUCL 42001 - Radiation Interaction With Materials And Applications

Credit Hours: 3.00. Fundamental of radiation interaction with materials and applications, types of radiation and radiation sources, physical mechanisms of radiation interaction with solids, radiation damage, ion mixing, applications in nuclear fission and fusion reactors, applications in materials synthesis.

Learning Outcomes: 1. Learn the types and sources of radiation. 2. Understand the physical mechanisms of radiation interaction with materials and model these interactions quantitatively. 3. Understand and model the phenomenon of radiation damage to bulk, surfaces and interfaces. 4. Relate the concepts of radiation damage to neutron interaction with solids in both fission and fusion reactors. 5. Understand the technological applications of radiation interaction with materials. Credits: 3.00

NUCL 44900 - Senior Design Proposal

Credit Hours: 1.00. The course outcome is the writing and presentation of a proposal for the senior design project, NUCL 45000 . The tasks include the selection of project design topics (various nuclear engineering components and systems designs), the selection of teams, introduction to design process, team management, communication, and engineering ethics, literature and patents survey, initiation of design activities and familiarization with design tools (for example software).

Credits: 1.00

NUCL 45000 - Design In Nuclear Engineering

Credit Hours: 3.00. Application of the design process to the project design topics identified in NUCL 44900 . The design process usually includes, but not limited to, mathematical modeling in design, neutronic, thermal-hydraulics and safety studies, risk assessment, economics, policy and regulation, environmental impact.

Credits: 3.00

NUCL 46000 - Introduction To Controlled Thermonuclear Fusion

Credit Hours: 3.00. Energy resources and the potential role of nuclear fusion. Ignition and breakeven conditions for fusion power plants. Particle and energy confinement in linear and toroidal magnetic fields. Review of magnetic and inertial confinement experiments and conceptual reactor configurations.

Credits: 3.00

NUCL 47000 - Fuel Cell Engineering

Credit Hours: 3.00. The principles of electromechanical energy conversion for a single fuel cell, fuel cell stack, process engineering in the fuel and oxidizer supply systems. Principles, components, operation and performance for alkaline, phosphoric acid, solid polymer, molten carbonate and solid oxide fuel cells. Provides broad insight into science, technology, system design, and safety concerns in design and operation of fuel cells.

Credits: 3.00

NUCL 48000 - Nuclear Engineering Technical Communications

Credit Hours: 3.00. This course makes students aware of the importance of communication skills-written, oral, graphical and interpersonal-in a successful nuclear engineering career and gives them the opportunity to develop and practice those skills. Students will learn how to access, evaluate, use and synthesize relevant technical literature. In addition, through the writing and speaking assignments, students develop team work skills, gain an understanding of professional and ethical responsibilities of engineering, learn to write a simple propose and learn about selected contemporary global economic, social and political issues, particularly with respect to nuclear topics.

Learning Outcomes: 1. Ability to communicate effectively. 2. The ability to understand the impact of engineering solutions in a global and societal context. 3. A knowledge of contemporary issues, particularly with respect to nuclear topics. 4. An understanding of professional and ethical responsibility. Credits: 3.00

NUCL 49000 - Independent Study In Nuclear Engineering

Credit Hours: 1.00 to 6.00. Projects or research of contemporary importance or special interest. Interested students seek a faculty advisor in their area of special interest and together prepare a brief description of the work to be undertaken. May be taken for 1-6 credits in Fall, Spring, or Summer. May be repeated as many times as desired, but only 6 credits may be counted for the technical elective requirement. Permission of instructor required.

Learning Outcomes: 1. Learning objectives vary based on varying coursework. Credits:

1.00 to 6.00

NUCL 49700 - Selected Topics In Nuclear Engineering

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Learning Outcomes: 1. Learning objectives will vary with coursework. Credits: 1.00 to 3.00

NUCL 49800 - Senior Seminar

Credit Hours: 0.00. Lectures to acquaint the senior students with professional ethics, job opportunities, graduate schools, continuing study, and services of professional societies.

Credits: 0.00

Exploratory Studies

Department of Exploratory Studies

Explorer Ambassadors

Who We Are

https://www.purdue.edu/exploratory/

Exploratory Studies is a program that helps students discover the major that best reflects their interests and ambitions. Students are given the space and time to explore, balanced with professional guidance intended to encourage students' proactive career research and reflection. Some key features of our program include the following:

- Exploring students will take EDPS 10500, Academic and Career Planning, in their first semester. This is a full semester, 3-credit, graded course that allows students to "try on" and evaluate many majors and careers before having to commit to one.
- Each student is assigned an experienced academic advisor who is familiar with all Purdue schools and degree programs. Our advisor to student ratio is kept at 1:150, which allows advisors time to really get to know their advisees!
- A unique course schedule is created for students specifically tailored to their interests and ambitions. We strive for a balance of University Core requirements and available major courses.
- Students can remain in Exploratory Studies for up to four semesters (two Fall-Spring school years) but can declare their major any time during that period!

Our **vision** for Exploratory Studies to "be an exemplary advising program in the nation for exploratory students" has remained unchanged since its inception and is recognized by many as a model program for how to successfully support undecided students through their journey.

Our History

In April 1995, the Purdue University Senate approved a three-year pilot program for beginning, exploratory, undecided freshmen students. This pilot, called the Undergraduate Studies Program (USP), was modeled after a program at The Pennsylvania State University. In August 1996, 212 students started with USP. In February 1999, the Purdue University Senate approved USP as a permanent program for entering freshmen students, effective August 1999.

In June 2001, the University Division of the Office of the Dean of Students was merged with USP, adding reentry, readmit, and change of degree objective continuing students to the population served by USP.

In 2013, USP changed its name to Exploratory Studies.

Our Mission

The mission of Exploratory Studies at Purdue University is to assist and empower students to:

- IDENTIFY strengths, interests, and values
- EXPLORE academic and career possibilities
- REFLECT on the intersection of self-discovery and future career goals

We value:

- Affirming the uniqueness of individual students
- Relationship-building and open conversations
- Curiosity and open-mindedness
- Fostering a growth mindset
- Coaching and mentoring

• Diversity in our community

Minimum Admission Requirements

- **Beginners:** Admissions High School Course Requirements
- **Transfers: (for undecided students)**

Purdue admits to individual majors. Transfer students must meet Purdue's overall transfer criteria, as well as any major-specific requirements. Before you apply, check the requirements for transfer to Exploratory Studies: https://www.purdue.edu/exploratory/prospective/transfer-students.php

Minimum GPA: 2.7

Additional Requirements: At the time of enrollment, CANNOT have more than 30 graded hours (or the equivalent quarter or trimester hours) of courses taken in college or 45 graded hours of college courses and concurrent/dual high school credit combined. Required to enroll in EDPS 10500 during first semester on campus.

CODO Requirements

To be eligible to CODO into Exploratory Studies, a student must have no more than 83 completed college credits.

- Credit counted toward completed college credits includes the following: credit earned by exam, transfer credit, credit earned in P/NP courses, credit for courses in which students earned Fs, and credit for currently enrolled courses.
- Students bringing into Exploratory Studies 77-83 completed college credits should be able to complete the requirements necessary to CODO to a degree-granting program at the completion of one semester in Exploratory Studies.

NOTE: All students who CODO into Exploratory Studies and maintain a freshman classification (going into the 2nd term) MUST take EDPS 10500 "Academic & Career Planning" in Exploratory Studies:
https://www.purdue.edu/exploratory/prospective/edps-10500.php
Link to course syllabus:
https://sswis.mypurdue.purdue.edu/CourseInsights/

Contact Information

Exploratory Studies
Sixth Floor, Young Hall
155 S. Grant Street
West Lafayette, IN 47907

Phone: (765) 494-0843

Fax: (765) 496-1139

E-mail: exploratory@purdue.edu

Advising Directory:
https://www.purdue.edu/advisors/directory/index.php

Explorers, DS

College of Health and Human Sciences

Health Main Photo

Overview

In the College of Health and Human Sciences (HHS), we seek to improve the quality of human lives by generating groundbreaking knowledge and educating excellent practitioners to help us all invent our best lives. This creative and dynamic interdisciplinary college is uniquely positioned to solve some of the most pressing challenges of our time. Our people, academic programs, research and engagement efforts focus on developmental health and wellness, healthy lifestyles and vital longevity, and sustainable and thriving organizations and communities. We see tremendous opportunity for HHS to make pioneering discoveries in areas such as digital health and wellness, optimal nutrition and obesity prevention, and vital longevity and end-of-life care.
HHS prepares students for dynamic careers in the ever-expanding fields of health and human sciences. You'll be amazed by the wide-range of career options HHS majors can offer. Just click on the links below and see for yourself!

- Health and Kinesiology
- Health Sciences
- Hospitality and Tourism Management
- Human Development and Family Sciences
- Nursing
- Nutrition Science
- Psychological Sciences
- Public Health
- Speech, Language, and Hearing Sciences

Today's competitive workplace demands more than just classroom learning. HHS offers students experiences beyond the classroom, such as undergraduate research, study abroad, real world healthcare training (clinicals) and internships.

HHS Pass / Not-Pass Policy

Students enrolled in the College of Health & Human Sciences may take courses under the Pass / Not-Pass option subject to the following regulations:

1. A maximum of 24 credits of elective courses under the Pass / Not-pass grading option can be used toward graduation requirements
2. A student may elect the Pass / Not-Pass option for elective courses only, unless a department / academic unit requires that a specific departmental course/s be taken Pass / Not-Pass.
3. The option may not be adopted for any courses used to fulfill any HHS minor requirements.
4. In addition to elective courses, students may elect to take University Core Curriculum (UCC) courses Pass / Not-Pass; however, some major Plans of Study require courses that also fulfill UCC foundational outcomes.In such cases, students may not elect the Pass / Not-Pass option.
1. If the Pass / Not-Pass option is exercised for a UCC course, students must pass the course in which the foundational outcome is addressed based on Purdue's approved grading scale (including a grade of P). Passing the course indicates that the student has satisfactorily met the foundational outcome **(Provost Curriculum FAQ).**
5. If a student elects to take a course P/NP, the student will indicate which course is taken P/NP at the time the student registers. Standard registration procedures, such as the rules governing drop/add, withdrawal from courses, etc., will be followed. The deadlines for when the grade mode of a course can be modified can be found on the drop/add/modify calendar.
6. The Pass / Not-Pass option cannot be elected for a course that already appears on a student's academic record, with the exception of when a student repeats a course previously taken with the Pass / Not-Pass option.
7. A student who passes a course, which is required by an HHS department / academic unit, under the option, while enrolled in another school or college at Purdue University, and switches / CODOs into an HHS program, will be required to complete the course for a grade. With departmental / academic unit approval, switch/CODO students could use a P/NP course to satisfy a program requirement.

PROCEDURAL NOTE:

Regarding "G" of the proposed policy: until the University Educational Policy and Curriculum (EPC) Committee amends the current repeat regulation, the Registrar will permit exceptions to repeat with a grade if previously taken P/N in another program with an e-mail from the advisor indicating it is a degree requirement.

Admissions

Successful completion of all Teacher Education Program (TEP) Requirements, including a minimum 2.5 Teacher Education Overall GPA are required to progress beyond each TEP Milestone. All Professional Education courses,

including Learner Specialty Concentration/Pathway courses, must be completed with no grade lower than a "C" and no "I" (Incompletes). Degree requirements must be fulfilled to qualify for TEP completion. A minimum passing score on all required licensure examinations and completion of licensure requirements are necessary to be eligible for an Indiana Instructional Educator License.
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- Summary of Teacher Education Milestones
- Licensure Information
- Technology Integration- Blended and Online Teaching (Ti-BOT)

Summary of Teacher Education Milestones

Admission to Teacher Education Program

Admission to the Teacher Education Program (TEP) is directly granted upon acceptance and enrollment at Purdue University, West Lafayette. The Teacher Education Program is aligned with national and state accreditation and licensure standards, regulations, and rules; university guidelines; and prescribed Plan(s) of Study (POS) as defined by Admission Year or as otherwise authorized by the Office of Teacher Education and Licensure (OTEL).

TEP Program Progression by Milestone (Milestones A-F)

Successful TEP progression and completion are achieved by attaining each TEP Milestone at or above Standard as outlined within the 2025-2026 Program Requirements and Milestones for each individual content area/major and as referenced and assigned within the 2025-2026 University Catalog, 2025-2026 Teacher Education Program Directory, the Brightspace course 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements, Plan(s) of Study (POS), and course syllabi.

Required Brightspace Course

Every incoming 2025-2026 Teacher Education (TE) student will be enrolled in the REQUIRED 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements Brightspace course. This course serves as the official/primary manner for which the Office of Teacher Education and Licensure (OTEL) will communicate and monitor cohort-specific requirements, milestones, timelines, notifications, tutorials, actions, student engagement, etc. for each TE student. Course commitment is continuous beginning upon arrival to the university and concludes when Milestones A-F are attained.

Course Substitutions

Course substitutions must fulfill degree requirements, associated Teacher Education Program (TEP) key and/or common assessments, and licensure standards/requirements. Prior approval by the Office of Teacher Education and Licensure is required for all course substitutions.

Milestone A: Methods Qualified

Milestone A - Teacher Education Program Progression Status

- Exceeds Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone A Criteria as defined by Content Area/Admission

Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.

- Milestone A Decision Deferred to Milestone B: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone A - Review Schedule

- Conducted - Close of Spring Semester 2026
- Decision/Notification - Early Fall Semester 2026

1. 2.50/4.00 Overall GPA (at time of Milestone A review)
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone A review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete three (3) Ti-BOT badges (at the time of Milestone A review).
7. No unresolved Professional Dispositions issues/concerns.
8. Adhere to the Criminal Background Check Policy.
9. Complete TEP Brightspace Assignments, including but not limited to attendance at the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
10. Attend the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
11. Submit the Teacher Education Program Agreement (TEPA).
12. Identify via the Teacher Education Program Agreement (TEPA) one of four chosen Learner Specialty Pathways. Learner Specialty Concentration/Pathway requirements are specific to individual content area/major.

Milestone B: Student Teaching/ Placement

Milestone B - Student Teaching Placement

- Exceeds Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone B Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone B Decision Deferred to Milestone C: Reserved for transfer students. Additional time is necessary to acquire an adequate number of

measurable Milestone outcomes.

Milestone B - Review Schedule

- Conducted - Close of Fall Semester 2027
- Decision/Notification - Early Spring Semester 2028

1. 2.50/4.00 Overall GPA (at time of Milestone B review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone B review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete five (5) total Ti-BOT badges (at the time of Milestone B review).
7. No unresolved Professional Dispositions issues/concerns.
8. Complete TEP Brightspace Assignments.
9. Attend the mandatory Student Teaching Clinical Acceptance Process (CAP) Workshop provided by the Office of Clinical Practice (OCP) AND submit your CAP Application as directed by OCP.

- Expanded Student Teaching practicums and full-time Student Teaching occur over two consecutive semesters.
- Verify from the CAP Application projected Student Teaching semester/year.

Milestone C: Student Teaching Authorization

Milestone C - Student Teaching Authorization

- Exceeds Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone C Criteria as defined by Content Area/Admission Year.

Milestone C Criteria must be attained At Standard before the Office of Teacher Education and Licensure (OTEL) will authorize enrollment reinstatement for Student Teaching.

Milestone C - Review Schedule

- Conducted - Close of Fall Semester 2028
- Decision/Notification - Early Spring Semester 2029

1. 2.50/4.00 Overall GPA (at time of Milestone C review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional

requirements in the Purdue University Catalog).

4. *Be in Good Standing with the University (at time of Milestone C review).
5. **Successful completion and target met on Foundations Portfolio (submission and target met on Common Lesson Plan in Semester 7).
6. ***Successfully complete ten (10) total Ti-BOT badges (at the time of Milestone C review).
7. Successfully complete all Professional Education (including Foundation and Methods), Learner Specialty Pathway, and degree courses prior to student teaching (Semester Eight).
8. Attempt all required content test(s) before the Student Teaching semester per the timeline below; Test Requirements (ets.org)

Content Test Attempts for Major

For Fall Student Teaching: Official Score Reports due to OTEL no later than July 1.

For Spring Student Teaching: Official Score Reports due to OTEL no later than December 1.

Content Test Attempts for Pathways/Concentrations (High Ability and English Language Learning)

For Fall Student Teaching: Test Registrations received in OTEL by May 15th confirming a test date scheduled no later than June 30th.

For Spring Student Teaching: Test Registrations received in OTEL by October 15th confirming a test date scheduled no later January 31st.

Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts; If completing a Learner Specialty Pathway that leads to licensure (High Ability or English Language Learners), the associated content exam must be attempted prior to the Student Teaching (Semester 8).

9. No unresolved Professional Dispositions issues/concerns.
10. Adhere to the Criminal Background Check Policy.

Milestone D: Teacher Education Program Completion

Milestone D - Teacher Education Program Completion

- Exceeds Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone D Criteria as defined by Content Area/Admission Year.*

Milestone D - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-C met.
2. 2.50/4.00 Overall GPA (at time of Milestone D review).
3. Professional Education (including

Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".

4. Verify degree is conferred on Transcript/Academic Record.
5. *Be in Good Standing with the University (at time of Milestone D review).
6. No unresolved Professional Dispositions issues/concerns.
7. ****Successful completion and target met on all Common Assessments (submission and target met on CPAST and edTPA in Semester 8).

Milestone E: Licensure Eligible

Successful completion of the Purdue University Agricultural Education Program, Agricultural Education, BS, and the State of Indiana licensure requirements for an Indiana REPA 3 Initial Instructional License in Career and Technical Education (CTE): Agriculture (5-12) and *Blended and Online Teaching (5-12).

Milestone E - Licensure Eligible

- Exceeds Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone E Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone E - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-D met.
2. Resolve any holds on academic records (if applicable).
3. Successfully complete the required pedagogy test; Test Requirements (ets.org). Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
4. Successfully complete all required content test(s) Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
5. For all Career and Technical Education (CTE) majors ONLY- Verify that the required number of clock hours has been completed and received by your advisor. Students must complete 4,000 clock hours of successful employment in the appropriate CTE area, or 1,500 clock hours of supervised work in the appropriate CTE area under an approved Teacher Education Program or an equivalent combination.

Milestone F: Licensure Action(s)

Milestone F - Licensure Actions

- Exceeds Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone F Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone F - Review Schedule

- Conducted - Upon Licensure Application - Summer 2029
- Decision/Notification - Upon Formal Action

1. Milestones A-E met.
2. Complete and upload with your Indiana License Application CPR/Heimlich Maneuver/AED certification or card (must include a hands-on, face-to-face skills demonstration).
3. Complete and upload with your Indiana License Application documentation of Suicide Prevention certification (training must be at least one hour).
4. Submit Indiana License Application online via Licensing Verification and Information System (LVIS) at https://license.doe.in.gov/.
5. Allow three weeks (given all licensure criteria are met) for Purdue University to certify and the Indiana Department of Education (IDOE) to grant the Indiana License.
6. After receipt of an Indiana License, apply for out-of-state licensure (if desired).

*For purposes of reports and communications to other institutions or agencies, and in the absence of any further qualifications of the term, a student shall be considered in Good Standing unless the student has been dismissed, suspended, or dropped from the University and not readmitted. A student is considered in Good Academic Standing if both a student's semester and cumulative GPA are above a 2.00/4.00.

**Foundation Courses linked with the Foundations Portfolio Common Assessments include EDCI 20002, EDCI 28500, EDCI 35000, EDPS 20001, EDPS 23500, EDPS 24800, EDPS 32700, EDPS 36201, EDPS 43010, and EDST 20010. These may be subject to change.

***The Blended and Online Teaching (5-12) License is required for students on Admission Year Fall 2024-Spring 2025. The Blended and Online Teaching (Ti-BOT) License requirements are embedded into coursework for all Teacher Education Undergraduate majors. Some exceptions apply.

****Common Assessments include Foundations Portfolio, Field Experience Dispositions, CPAST, edTPA, Common Lesson Plan, and Licensure. Common Assessments for Early Childhood Education and Special Needs align with the National Association for the Education of Young Children (NAEYC).

Beginning July 1, 2025 - According to the Indiana State Board of Education, students seeking an Initial Indiana License in a content area involving literacy instruction, including special education, must obtain a licensure addition in Early Literacy (P-5), as required under IC 20-28-5-19.7.

Licensure Information

The Office of Teacher Education and Licensure (OTEL) is the formal liaison with the Indiana Department of Education and serves as the official repository for Purdue West Lafayette Teacher Education Program Progression and Licensure actions. OTEL maintains and permanently retains a *Teacher Education Program and Licensure Credential Portfolio* for each current and former Purdue University Teacher Education Candidate/Student. OTEL provides reliable, career-long guidance on Indiana Teacher Education and Licensure Standards, Rules, and

Procedures. Indiana Licensing Rules and Regulations are subject to change by the Indiana State Board of Education, Indiana Department of Education (IDOE), and/or the Indiana General Assembly.

Advising

Academic advising is essential to student success at Purdue University. The central goal for the academic advising relationship is to assist students in the purposeful creation of an educational plan that includes curricular, co-curricular and extracurricular goals, objectives, and activities.
For information about academic advising and what you can expect, click here.
Click the following link for a listing of HHS academic advisors: HHS Student Services Directory

Contact Information

HHS student services staff members are located in offices in the Hampton, Lambert, Johnson, Marriott, and Young Halls. Our central office location is in Young Hall, 6th floor. Please feel free to stop by and schedule an appointment, request information and a tour, or just ask a question.
Office of Student Services
College of Health and Human Sciences
Young Hall, 6th floor
155 S. Grant Street
West Lafayette, IN 47907-2114
Phone: (765) 494-8533
E-mail: hhsundergrad@purdue.edu

HHS 10100 - Introduction To Health And Human Sciences

Credit Hours: 1.00. This course is intended to introduce the various programs, majors and academic units within the College of Health and Human Sciences (HHS). In addition to providing an overview of each academic unit and the majors contained within, the course content is also structured to introduce students to career pathways within each respective unit.

Learning Outcomes: 1. Describe the majors and academic units within the College of Health and Human Sciences, and their various specializations. 2. Identify the various career paths, professions, and post-baccalaureate educational opportunities available to students in each major. 3. Describe resources available to students to help establish a strong foundation for success at Purdue. Credits: 1.00

HHS 30000 - Peer Mentoring In The Health And Human Sciences

Credit Hours: 1.00. This course will explore mentoring through training, practice, and reflection. Sophomores, juniors, and seniors in the College of Health and Human Sciences must be selected as HHS mentors prior to taking this course. Student mentors will actively participate in peer mentoring in one-on-one and group settings, use knowledge and skills gained in training and reflect on their experiences. Permission of instructor required.

Learning Outcomes: 1. Use skills and knowledge developed through training, course participation, and their own experiences to mentor first-year students for college success. 2. Recognize and reflect on how mentoring knowledge, relationships and skills align with and impact their future personal and professional goals. Credits: 1.00

HHS 30100 - Peer Mentoring Leadership In The Health And Human Sciences

Credit Hours: 2.00. This course will explore mentoring and leadership through training, practice, and reflection. Juniors and seniors in the College of Health and Human Sciences must be selected as HHS Core Leadership Team mentors prior to taking this course. Student mentors will actively participate in peer mentoring in one-on-one and group settings, develop activities for their peers, use knowledge and skills gained in training, and reflect on their experiences. Permission of instructor required.

Learning Outcomes: 1. Use skills and knowledge developed through training, course participation, and their own experiences to mentor 1 first-year student for college success and 5-8 undergraduate peer mentors for mentoring success. 2. Plan, lead, and execute group mentor/mentee engagement activities. 3. Recognize and reflect on how mentoring knowledge, relationships and skills align with and impact their future personal and professional goals. Credits: 2.00

HHS 40000 - Intercultural Learning In Health And Human Sciences - Lived Experiences

Credit Hours: 1.00 to 6.00. This course focuses on intercultural learning in health and human sciences through direct experiences in a foreign country, whose culture is unique as a whole yet diverse across its different regions. Students will be guided in cognitive and affective learning through observing the destination's culture and society and interacting with its people. By direct exposure to the local customs, health conditions, history, human relations, lifestyle, and religion as they travel across the foreign destination, students are expected to develop a deeper appreciation and empathy for cultural values and traditions that are different from their own. The course will emphasize the students' understanding of how individuals and communities can benefit from learning about others in improving their quality of life. Permission of instructor required.

Learning Outcomes: 1. Report an increase in their intercultural openness and willingness to interact with people who are culturally different from themselves through daily program activities. 2. Describe their own growing cultural self-awareness and report on cultural norms that shape their identity and biases. 3. Demonstrate curiosity about other cultures in relation to health conditions and human relations and begin to describe deeper interest in learning about additional cultures. 4. Exhibit an appreciation of a sense of place defined by cultural values, traditions, customs, and history that are different from their own through hands-on and interactive activities in the settings of health and human sciences. 5. Discover the impacts of political, economic, and environmental factors on the physical and subjective well-being of the local people as well as their overall quality of life. 6. Identify and explain the key elements of interdependence required for the co-existence and human relations among peoples of different cultural backgrounds. 7. Identify how biases, stereotypes, and perceptions are formed with regard to other cultural groups. 8. Demonstrate self-confidence, travel-related skills, and a deeper appreciation for the increasingly interconnected world of many cultures. Credits: 1.00 to 6.00

Department of Health and Kinesiology

Health & Kinesiology Overview

Purdue University's Department of Health and Kinesiology (HK) confronts issues related to health through research, student learning and community engagement that focuses on human movement, sports performance and management, exercise and fitness, and disease prevention. Utilizing a multidiscipline, team approach, Health and Kinesiology is a leader in faculty-led, student-centered research.

We are shaping the future by preparing the next generation - HK students - to help others develop and sustain a healthy and active lifestyle. From physical activity and health professionals to researchers and policymakers, HK graduates are tackling global health concerns across the lifespan. We invite you to explore our website to learn more about HK's degree options, hands-on learning, facilities, and outstanding faculty.

Faculty

Contact Information

Department of Health and Kinesiology
Purdue University
Lambert Fieldhouse
800 West Stadium Avenue
West Lafayette, IN 47907-2046
Phone: (765) 49-43170
Fax: (765) 49-61239

Graduate Information

For Graduate Information please see Health and Kinesiology Graduate Program Information .

Kinesiology, BS

HK 10000 - Foundations Of Kinesiology

Credit Hours: 3.00. This course will provide an introduction to the physical and behavioral sciences underlying kinesiology, the study of human movement. The course will cover foundational concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. The course will take an interdisciplinary perspective, exploring both key concepts in each of these sub-areas of kinesiology, and how they are integrated to understand problems in human movement, exercise, physical activity, sport, and healthy lifestyles.

Learning Outcomes: 1. Explain basic concepts in exercise physiology, biomechanics, motor behavior, sport and exercise psychology, and sociology and history of physical activity. 2. Apply and integrate concepts from the sub-disciplines of kinesiology to better understand human behavior. Credits: 3.00

HK 13500 - Introduction To Health And Kinesiology

Credit Hours: 1.00. Overviews the disciplines of health and kinesiology. Students explore skills and academic interests in theses areas. Describes career opportunities and options for graduate study. Provides strategies for professional and portfolio development. Students complete five hours of community service per semester. Permission of instructor required.

Credits: 1.00

HK 21000 - History And Philosophy Of Physical Education

Credit Hours: 2.00. Introduction to the history and philosophy of physical education to prospective teachers. Emphasis is placed on the impact of societal history on physical education and the role of philosophic thinking in curricular activities. For majors and minors only.

Credits: 2.00

HK 21300 - Clinical Field Experience In Health And Fitness

Credit Hours: 0.00 to 3.00. This course is a coordinated clinical/professional experience designed to expose students to various positions within the wellness community and how clinical interactions are embedded within fitness centers. In addition to weekly in-person class meetings, students will observe and practice professional and foundational skills at different clinical sites. Professional communication, interdisciplinary interactions, and self-reflection are key skills developed in this practicum.

Learning Outcomes: 1. Describe effective and critically assess client-provider interactions, including professionalism in physical presentation and verbal/written communication. 2. Demonstrate the following personal/professional competencies needed in future clinical roles: communication skills, teamwork, customer service, leadership, independence, and initiative. 3. Professionally carry out all expected duties/responsibilities and identify individual strengths and areas for improved growth. 4. Develop a personalized health, fitness, and wellness philosophy, based on interactions with individual clients. Credits: 0.00 to 3.00

HK 22200 - Foundations For The Health And Fitness Professional

Credit Hours: 3.00. Designed to introduce the emerging Health and Fitness professional to current trends in health and physical activity and provide effective hands-on methodology for implementation of physical activity and exercise in different settings. Students will be able to identify the role of a clinician, coach, trainer, etc. Students will obtain skills in client consultation, program design and strategies for implementing programs to the general population. Students will also be introduced to the skills and knowledge required for working with clinical populations. This course is designed to help students prepare for future clinical practice and certification.

Learning Outcomes: 1. Review current national health and physical activity status, guidelines, and implications. 2. Learn basic health screenings and fitness assessments. 3. Discover effective interaction and consultation skills with patients/clients in different settings. 4. Establish a knowledge base for basic cardiorespiratory fitness and muscular conditioning exercise prescription. 5. Assess, instruct, evaluate, and apply various exercise techniques. 6. Develop comprehensive exercise programs for general population and begin developing a working framework to modify

exercise programs for clinical population. 7. Establish and practice basic instruction /coaching skills to implement as a clinician. 8. Obtain knowledge and skills related to methodologies and practices for alter professional application. Credits: 3.00

HK 25300 - Principles Of Motor Development

Credit Hours: 3.00. This course provides an introduction to motor development from a life-span perspective. Students will learn how infants develop from mainly reflexive beings into children and adults that are capable of interacting with the world in a goal-directed manner. This course specifically examines how changes in physical growth, aging, and maturation of the central nervous system influence motor performance. Finally, the decline of motor skills associated with advanced age is discussed.

Learning Outcomes: 1. Students will be able to describe how motor skills develop in children and decline in older adults. 2. Students will be able to apply the principles of motor development to clinical, education, and sport sciences settings. Credits: 3.00

HK 25800 - Foundations Of Motor Skill Learning

Credit Hours: 3.00. Concepts and principles of motor skill learning, with emphasis on the acquisition and retention of gross movement and sport skills.

Credits: 3.00

HK 26300 - Biomechanical Foundations Of Motor Skills

Credit Hours: 3.00. Fundamental anatomical and mechanical concepts and procedures for analyzing motor skills, with particular reference to sport, dance, and aquatic activities.

Learning Outcomes: 1. Describe motion with mechanical and anatomical terminology. 2. Quantify linear and angular characteristics of motion. 3. Describe and quantify the cause and effect relationship between force and motion. 4. Collect, analyze and interpret biomechanical measures of human movement. Credits: 3.00

HK 26400 - Principles Of Motor Learning, Development, And Biomechanics

Credit Hours: 3.00. This course surveys the fundamental processes and variables related to motor development, motor learning, and biomechanics. Students will be exposed to concepts relevant to teaching motor skills and critical issues to increase knowledge of human movement.

Learning Outcomes: 1. Describe motion with mechanical and anatomical terminology. 2. Describe the linear and angular characteristics of motion. 3. Describe the relationship between force and motion. 4. Define terms of motor control. 5. Define the optimal conditions for learning new skills. 6. Describe how factors related to the individual, task, and environment affect the learning of skills movement. 7. Define terms of development, growth, and maturation. 8. Describe reflexes and motor milestones. 9. Describe the development of body control, reaching and locomotion. Credits: 3.00

HK 28500 - Fieldwork In Athletic Training - Collegiate

Credit Hours: 1.00. Students will learn about and explore the athletic training profession through classroom and experiential learning in an intercollegiate setting. Under supervision of the certified athletic trainer, students will observe facility operations and duties of the athletic trainer. Topics of instruction include history of athletic training, governance, and professional foundation and ethics.

Learning Outcomes: 1. Define athletic training and the athletic training profession. 2. Know the location of athletic facilities, athletic training supplies and equipment. 3. Demonstrate proper opening and closing procedures of the Purdue athletic training rooms. 4. Properly perform cleaning and maintenance of facility athletic training room equipment. 5. Learn proper inventory and equipment check-out procedures. 6. Articulate the history of the profession and important milestones and prominent individuals who shaped the profession. 7. Describe the governance of the profession and the

advantages and disadvantages associated with the current governance structure. Credits: 1.00

HK 28600 - Fieldwork In Athletic Training - Secondary School

Credit Hours: 1.00. Students will learn about and explore the athletic training profession through classroom and experiential learning in secondary school setting. Under supervision of the certified athletic trainer, students will observe facility operation and duties of the athletic trainer. Topics of instruction include basics of taping and wrapping, selection and fitting of protective equipment, and principles of risk management.

Learning Outcomes: 1. Discuss the differences in wound care techniques. 2. Select the appropriate technique to dress and care for a wound. 3. Select and apply basic taping and wrapping procedures commonly used in athletic training on a simulated patient. 4. Discuss the legal principles of equipment liability. 5. Select and apply protective equipment commonly used by patients in contact-collision sports. Credits: 1.00

HK 28700 - Fieldwork In Athletic Training - Clinic/Industry

Credit Hours: 1.00. Students will learn about and explore the athletic training profession through classroom and experiential learning in an emerging athletic training setting. Under supervision of the certified athletic trainer, students will observe facility operations and duties of the athletic trainer. Topics of instruction include basics of wound care, setup and operation of therapeutic modalities, and basic rehabilitation principles.

Learning Outcomes: 1. Define risk management and discuss how it applies to athletic training settings. 2. Inventory an athletic training facility and appraise the risk management strategies used. 3. State the differences between different methods of stretching. 4. Demonstrate proper flexibility and stretching techniques. 5. Match the appropriate stretching technique to a patient condition or injury. 6. Discuss correct application techniques for basic cryotherapy and thermotherapy modalities. 7. Administer a simulated treatment for a patient using the appropriate modality. Credits: 1.00

HK 30200 - Applied Clinical Anatomy

Credit Hours: 3.00. An introduction to the regional anatomical study of the human body for undergraduate allied health students. Lectures will be supplemented by observation and demonstration of prosected cadaver material, radiographs, osteology, and surface anatomy.

Credits: 3.00

HK 30500 - Injury Assessment I

Credit Hours: 4.00. A guided lecture and laboratory experience designed to teach the student injury assessment techniques normally required of an athletic trainer. Topics include splinting and transportation, equipment fitting and fabrication, lower extremity injury evaluation, taping and bracing.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the lower extremities and spine. 2. Identify different methods of prevention for many injuries commonly seen in the lower extremities and spine. 3. Identify common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Explain gender differences in the musculoskeletal system and the impact on injury management for the lower extremities. 5. Identify anatomical growth and development characteristics of males and females in the following stages: pre-adolescent and adolescent. 6. Demonstrate general treatment and rehabilitation protocols to use with injuries in the lower extremities. 7. Demonstrate general treatment and rehabilitation protocols to use with injuries in the spine. 8. Identify the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of injuries/illness commonly seen in the upper extremities and spine. 9. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity and spinal conditions. 10. Explain the different

psychomotor test characteristics - validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 11. Synthesize test psychometric data to select appropriate tests and measures during assessment. 12. Formulate a clinical question and perform a literature search to answer the question. Credits: 4.00

HK 30800 - Athletic Health Care

Credit Hours: 3.00. Provides students with foundational knowledge and skills for the prevention, recognition, and management of common athletic injuries and illnesses, as well as emergency conditions encountered by sports medicine professionals.

Learning Outcomes: 1. Identify basic components of an athletic injury/illness prevention program. 2. Acquire knowledge related to athletic protective equipment and prophylactic braces. 3. Develop an understanding of the physiological effects of injury in order to provide proper treatment and care. 4. Develop practical knowledge of the mechanisms, signs, and associative anatomy for common athletic injuries associated with the upper extremity, lower extremity, head, spine, and thorax. 5. Develop practical knowledge related to the recognition and treatment of environmental conditions. This will include an understanding of appropriate hydration requirements for physical activity. 6. Develop an understanding of the acute care and emergency management of athletic injuries. Credits: 3.00

HK 31300 - Clinical Field Experience In Healthcare

Credit Hours: 3.00. This course will provide students with observation in various clinical settings. Students will establish a mentor with at least 1 site. Students may choose to pursue observations in various patient care environments, such as, physical therapy, occupational therapy, physician clinics, cardiac rehab, etc. Permission of department required.

Learning Outcomes: 1. Observe patient/practitioner interactions and patient centered care. 2. Demonstrate basic skills related to medical practices in the field (i.e., therapy techniques, treatment modalities, medical procedures, patient assessment/screening, etc.). 3. Describe how skills and content learned in previous courses can be applied to a clinical setting. 4. Explain current best practices and scope of care necessary in their clinical setting. 5. Model the behaviors and skills appropriate to the profession and clinical setting. Credits: 3.00

HK 31500 - Group Fitness Leadership

Credit Hours: 2.00. This course is designed to provide students with an overview of the educational concepts, program design, and instruction/leadership skills needed to design and teach instructor-led exercise programs for small (2-3 individuals) and large (10+) groups with and without music. The course will include basic analysis and application of safe and effective exercise procedures for all fitness levels. Students will be expected to lead group classes throughout the semester as assigned by the course instructor. Preparedness and ability to execute will be assessed. This course is designed to help students prepare of future clinical practice and certification as an ACSM Certified Clinical Exercise Physiologist.

Learning Outcomes: 1. Develop an appropriate sequence of movement in an instructor-led exercise program: to include methods of linear transitions, combination techniques, and building sequence development. 2. Modify instructor-led exercise programs for special health and physical concerns. 3. Develop, design and implement group based muscle conditioning programs for healthy adults. 4. Develop the ability to lead/coach components of a group physical activity sessions. Credits: 2.00

HK 31600 - Foundations Of Strength And Conditioning

Credit Hours: 2.00. This course will provide students with an in-depth analysis of strength and conditioning principles, and application strategies to cardiorespiratory conditioning, strength training, and flexible exercise. Students will assess the foundational application of anatomy, physiology, and biomechanics to various forms of exercise training based on

standards of the American College of Sports Medicine, National Strength and Conditioning Association, and the National Academy of Sports Medicine. A major focus of this class will also prepare students to instruct and coach on an individual level to ensure proper mechanics, engagement, and execution of exercise movement. This course is designed to help students prepare for future clinical practice and certification as an ACSM Certified Clinical Exercise Physiologist.

Learning Outcomes: 1. Identify and define skeletal and muscle anatomy, physiology, and biomechanics as related to cardiorespiratory activity, resistance training, and flexibility. 2. Identify and define the Human Movement System and causes of dysfunction/impairment that can effect exercise outcomes. 3. Perform, assess, and instruct various resistance training exercises. 4. Develop a program for cardiorespiratory health, strength and flexibility. Credits: 2.00

HK 31800 - Strength And Conditioning And Exercise Instruction Across The Lifespan

Credit Hours: 3.00. This course is designed to provide students with an overview of educational concepts, program design and instructional/leadership skills for designing and instructing exercise programs. Students will obtain hands-on experience conducting exercise programs for strength and conditioning, cardiorespiratory fitness, and flexibility throughout the semester. Students will learn to work with a variety of populations throughout the semester. Students will be evaluated on their effectiveness in designing and instruction exercise sessions for both individual and group-led scenarios. This course is designed to help students prepare for future clinical practice and certifications, such as the ACSM Certified Clinical Exercise Physiologist. Must have CPR/AED, First Aid certifications.

Learning Outcomes: 1. Describe musculoskeletal anatomy, physiology and biomechanics related to exercise and the effects of resistance training, cardiorespiratory training and flexibility. 2. Perform fitness assessments and client intake interviews to acquire clients' baseline fitness, health history, exercise background and goals, to allow for proper exercise program development. 3. Develop and administer group exercise and/or group personal training classes incorporating muscle conditioning, aerobic training, HIIT, circuit training, etc. 4. Develop and implement resistance training programs for client/s based upon initial assessment data and intake information, and adjust the program throughout the semester. 5. Describe modifications and appropriate precautions required when developing and instructing exercise programs for populations with special health/physical concerns. Credits: 3.00

HK 32700 - Introduction To Sports Management

Credit Hours: 3.00. This course introduces the foundations and principles of sport management, focusing on the leadership, administration, business practices, and operation of sport organizations at all levels. This course offers students the opportunity to gain information and an understanding of the various practices and procedures associated with sport management and the sport industry. Students are presented with an overview of the business of sport, including a variety of different career opportunities in a multitude of sport settings as they explore the value of professional management within sport organizations. Finally, this course uses a semester-long major project that allows students to use the skills and knowledge gained from lectures, readings, and discussions to develop a comprehensive business plan integrating the various modules and topics from the semester into a cohesive administrative plan.

Learning Outcomes: 1. Describe the career possibilities in sport management, as well as the skills and strategies necessary to be successful in the field. 2. Explain the development of the sport business industry and the defining characteristics of the modern sport business industry. 3. Identify concepts of management theory and how these concepts help managers and sport organizations succeed. 4. Explain the central role that leadership plays in sport organizations and how leadership theories apply to management. 5. Identify the characteristics, similarities, and differences among various sport management sites (community, interscholastic), intercollegiate, professional, and international sport). 6. Recognize the unique characteristics of sport marketing and how a marketing plan is

linked to an organization's mission, values, and strategy. 7. Recognize the necessary steps in managing a facility and a corresponding risk management plan. 8. Demonstrate the components and workings of sport media and its interaction with the sport industry, including the increasing influence of social media and the internet within the sport industry. 9. Describe the basic principles of economics as they pertain to the sport industry and be able to describe the business structure of sport organizations. 10. Discuss the social and cultural significance of sport in our society. Credits: 3.00

HK 32800 - Business Of Professional Sports

Credit Hours: 3.00. This course examines the rise and growth of professional sport into a multibillion-dollar industry worldwide that is both an economic giant as well as a pop cultural phenomenon. The course takes a look at the historical development of professional sport while also examining current trends that continue to shape the industry. Students learn the basics of how pro leagues and teams operate by participating in an interactive and engaging fantasy sports simulation that sees them create their own league and manage and operate their own team. In the simulation, students deal with issues real-life pro sports managers have to address every day, including roster construction and management, pricing their product, and marketing and branding their franchise and league overall.

Learning Outcomes: 1. Explain fundamental economic concepts, particularly as these concepts relate to the sports industry. 2. Analyze differences in organizational structure across the major American sports leagues, such as the generation and distribution of revenues, restrictions on player salaries, and the promotion of competitive balance. 3. Discuss the interplay between sports leagues and antitrust policy and the seminal court cases that have led to full and/or partial exemptions to federal antitrust laws for certain leagues. 4. Compare and contrast the various funding mechanisms state and local municipalities have used to attract and/or keep a sports franchise as well as critically analyze the economic benefits of a sports franchise to a city. 5. Explain the labor market in professional sports, particularly the determination of player salaries and key disputes between player unions and league management. Credits: 3.00

HK 34500 - The Coaching Of Interscholastic Sports

Credit Hours: 2.00. Discussion and practical experience in organizing, training, and coaching interscholastic athletes in a selected sport. A partial list of sports that may be selected: baseball, basketball, football, gymnastics, soccer, swimming, track/field/cross country, volleyball, and wrestling.

Credits: 2.00

HK 34600 - Field Experience In Coaching

Credit Hours: 2.00. Students will be assigned to assist in coaching a team in a public-, parochial-, or selected university-sponsored program. A partial list of sports available: baseball, basketball, football, gymnastics, soccer, swimming, track/field/cross country, volleyball, and wrestling. Permission of instructor required.

Credits: 2.00

HK 36800 - Exercise Physiology I

Credit Hours: 3.00. Physiological concepts and principles underlying human responses and adaptations to exercise stress. Included are selected methods and techniques of assessing physiological function in the laboratory setting.

Credits: 3.00

HK 37200 - Sport And Exercise Psychology I

Credit Hours: 3.00. This course focuses on social and psychological factors related to participation in sport, exercise, and physical activity. The class explores both (a) how social and psychological factors influence participation and performance in physical activity, and (b) how sport, exercise, and physical activity participation affects psychological well-being. Topics include personality, socialization, learning and feedback, stress and coping, self-perceptions, motivation, and psychological methods for enhancing personal development and physical performance.

Learning Outcomes: 1. Develop an understanding of social and psychological processes that operate in physical activity. 2. Acquire the knowledge to successfully apply

social psychological principles within a variety of physical activity settings. Credits: 3.00

HK 37600 - History Of Sport

Credit Hours: 3.00. A prior course in American or world history is recommended but not required. A survey of historical events that have shaped classical and modern sport, with a focus on recent history of American sport.

Learning Outcomes: 1. Examine the historical themes, factors, and particular events influencing the nature of sport within the larger context of United States history and culture. 2. Describe how sport shaped aspects of American culture and identify the critical place of sport in the emergence of American culture. 3. Investigate the ways gender, race, ethnicity, and class have influenced sporting experiences in the past and present, and determine the cultural and human diversity within sports in the United States. Credits: 3.00

HK 40900 - Seminar In Sports Medicine

Credit Hours: 3.00. A review of selected medical aspects of sports. Liberal use of guest medical professionals. A broad look at the field of sports medicine.

Learning Outcomes: 1. Explain the various professional disciplines within the sports medicine profession and those healthcare providers that interact with athletic training. 2. Explore current trends at the state, district and national level in athletic training involving clinical practice or education. 3. Develop athletic training students' understanding of contemporary medical information required in different sports medicine practice settings. Credits: 3.00

HK 41500 - Exercise As Medicine

Credit Hours: 3.00. Provide students with the concepts, techniques, and skills to investigate the scientific evidence on physical activity and health; and to design and implement interventions to make physical activity a part of daily campus culture. Permission of instructor required.

Learning Outcomes: 1. Recognize and describe the consequences of regular physical activity (PA) and inactivity on individual and community health. 2. Recognize and describe the causes of and solutions for health disparities in communities. 3. Develop activities to promote physical activity on campus. 4. Develop activities to promote physical activity through social media and online content. 5. Evaluate the success of activities promoting physical activity. Credits: 3.00

HK 42100 - Health Screening And Fitness Evaluation And Design

Credit Hours: 3.00. This course provides the learner with the knowledge and skills to successfully administer and interpret the results of health evaluations and fitness assessments for the purposes of analysis and the development of individualized exercise programs.

Learning Outcomes: 1. Apply specific physiological principles to individual physical health prescription: Cardiovascular Health, Body Composition, Posture, Muscular Strength, Muscular Endurance, Flexibility, ROM. 2. Explain verbally identified fitness assessment tests as would to a client indicating what, why, and how they are each performed. 3. Administer pre-exercise screening questionnaire/informed consent and identify needs for a medical clearance. 4. Administer accurately identified fitness assessment tests to a client and classify results. Credits: 3.00

HK 42200 - Basic Concepts In Exercise Program Design

Credit Hours: 3.00. Introduces basic program design concepts and rationale to design fitness programs for healthy adults emphasizing cardiovascular training, strength training, flexibility training, and balance.

Learning Outcomes: 1. Design and implement a safe and effective warm up and cool down protocol specific to the individual. 2. Create and implement well-planned, individualized, and progressive resistance training programs. 3.

Develop progressive and individualized cardiovascular training programs. 4. Describe the role of exercise in healthy weight management. 5. Apply the scientific concepts to design exercise programs to improve athletic performance and optimize fitness in non-athlete healthy persons. Credits: 3.00

HK 42700 - Sports Marketing

Credit Hours: 3.00. This course introduces and examines marketing within various levels of the sport industry, with an emphasis on consumer behavior, branding, and sponsorship. This course first introduces students to the marketing of sport services, sport teams, and sport programs by examining basic marketing strategies as they relate specifically to sport settings. Second, the course examines key consumer behaviors regarding sport fans and sport fan communities. Finally, the course enables students to formulate original and creative sport marketing mixes to provide students with the hands-on practice necessary to become an effective sport marketer.

Learning Outcomes: 1. Explain the unique characteristics of sport marketing. 2. Recognize what motivates individuals to engage in sport-related consumer behavior. 3. Identify practices for developing and socializing sport fans and sport fan communities. 4. Interpret data sources for segmenting, targeting, and positioning strategies within sport. 5. Synthesize existing marketing ideas in original ways. 6. Formulate and analyze sponsorship proposals. 7. Design and implement sport marketing strategies characterized by high degrees of innovation, divergent thinking, and risk-taking. Credits: 3.00

HK 42800 - Sports Facility And Event Management

Credit Hours: 3.00. This course is meant to introduce students to the foundations and principles of effective facility and event management. Sport facilities and the types of events they can host are essential components to understanding the field of sport management. In this course, we will explore the concepts of facility design, planning, systems, risk management, marketing, and ownership. In terms of event management, we will explore the concepts of event creation, impact on hosts, marketing/sponsorship, and the potential positive and negative outcomes of sport events.

Learning Outcomes: 1. Define and apply key facility and event management terminology and concepts to the sport and recreation industry. 2. Engage critically with facility and event management sites and evaluate the potential positive and negative outcomes associated with sport facility and/or sport event development. 3. Display the ability to organize, coordinate, and execute operational plans for various sizes of facilities and events. Credits: 3.00

HK 44300 - Neuroscience Of Movement

Credit Hours: 3.00. In this course students will learn about the neuroscience behind the control, sensation and perception of human movement. The course is divided into five sections. In the first section, students learn about the sensory systems with human movement. In the second section, students learn about the basic CNS building blocks underlying movement control and perception. In the third section, the control of balance and locomotion is the central topic. In the fourth section, students learn about the higher brain functions involved in cognition. The final section of the class examines issues regarding learning, development, and brain plasticity.

Learning Outcomes: 1. Able to describe basic principles of the neuroscience behind the control of human movement. 2. Able to apply principles of the neuroscience of movement to clinical, educational, research, and sports science setting using specialized laboratory equipment. Credits: 3.00

HK 44400 - Balance Rehab In Older Adults

Credit Hours: 3.00. In this course, students learn about the decline in motor function that occurs in older adults and techniques to improve motor function in an older population. Topics include decreased balance control, loss of muscle strength, and declines in adaptive locomotion as a function of age. Students enrolled in this class also participate in an off-campus lab. In the lab, students are paired with an older adult and use the knowledge gained in lecture to improve the motor function of the older adult. This class provides students with a unique opportunity to gain hands-on experience working with an older population. Permission of instructor required.

Learning Outcomes: 1. Describe the declines in motor function that occur in older adults. 2. Critically assess intervention research with aims

to improve motor function in older adults. 3. Describe and evaluate types of interventions and their effectiveness. 4. Use quantitative equipment to assess balance and mobility of younger and older adults. Credits: 3.00

HK 45300 - Motor Coordination And Development

Credit Hours: 3.00. An advanced undergraduate motor development course that examines the processes and coordination principles related to motor behavior development across the life span. Material and concepts are concentrated around specific skills areas and SPAN a broad range of ages and theoretical approaches.

Learning Outcomes: 1. Describe how motor abilities develop in infancy and childhood both in typically developing and clinical populations. 2. Apply basic research designs in motor developments to clinical populations. Credits: 3.00

HK 45800 - Principles Of Motor Control And Learning

Credit Hours: 3.00. Discussion of the principles of motor learning and control. Relevant research literature will be surveyed with an historical perspective. Students will be expected to design and/or conduct a mini research project.

Credits: 3.00

HK 46300 - Analysis Of Human Motion

Credit Hours: 3.00. An analytic approach to the mechanical analysis of human motion, including modeling procedures and computer-generated display techniques.

Credits: 3.00

HK 46500 - Research Methods

Credit Hours: 3.00. This course will be conducted in a lecture/lab format. The lectures will introduce the basic knowledge necessary to understanding the entire research process as it is found in health and kinesiology. The laboratories will be designed to give students practice in discovering research questions, preparing research proposals, evaluating existing research, and applying research to practical problems.

Learning Outcomes: 1. Describe the nature of research and the scientific method. 2. Describe the different types of research conducted within health and kinesiology, and the value of each type of research. 3. Provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating research in basic and applied settings. 4. Identify a potential topic/issue to examine and conduct a review of the existing research literature and summarize and critically evaluate a research article. 5. Describe the steps involved in developing a research proposal, collecting and analyzing data, and reporting the results of a research project. Credits: 3.00

HK 46800 - Advanced Exercise Physiology II

Credit Hours: 3.00. An advanced undergraduate course in the area of exercise and human performance. Further examination of the physiological mechanisms and theories involved in the exercise response.

Credits: 3.00

HK 46900 - Exercise Testing And Prescription In Special Populations

Credit Hours: 3.00. Examines responses to exercise testing and prescription in healthy adults compared to exercise responses and special considerations for individuals with chronic diseases and conditions and issues of concern to pregnant women, children, and older adults, among others.

Learning Outcomes: 1. Identify the difference in testing and prescription for individuals with chronic conditions. 2. Evaluate critically the risks and benefits associated with exercise participation. 3. Apply appropriate emergency procedures in various exercise settings. 4. Deliver unique exercise programs to special populations. Credits: 3.00

HK 47200 - Sport And Exercise Psychology II

Credit Hours: 3.00. Course presents topics not covered in PE 37200 and emphasizes application of psychological principles in sport and exercise settings. Topics include group dynamics, psychological benefits of exercise; exercise addiction; body image; leadership and communication; and performance enhancement principles and techniques.

Learning Outcomes: 1. Describe the basic principles of the psychological processes in sport and exercise contexts. 2. Synthesize and apply theoretical and empirical knowledge in sport and exercise psychology through active learning processes and interaction with fellow students. 3. Apply critical thinking, group interaction, public speaking, research, and writing skills. Credits: 3.00

HK 47600 - Olympic Games: Ancient And Modern

Credit Hours: 3.00. A historical study of the nature and significance of the ancient and modern Olympic Games. Topics include genesis of the games; evolution of events; the amateur ideal; social, economic, and commercial influences; politics; modern controversies; and various reform movements.

Credits: 3.00

HK 47700 - Sport And Exercise Psychophysiology

Credit Hours: 3.00. The purpose of this course is to give students an understanding of the psychological, behavioral, and social processes as related to and revealed through physiological principles and events underlying human movements in the context of sport and exercise. This course will utilize traditional lectures combined with student-led group discussions to examine topics including, but not limited to, the following: (1) introduction, principles, and measurements of psychophysiology, (2) psychophysiological characteristics of optimal mental state and superior performance, (3) biofeedback and neurofeedback training in performance enhancement, and (4) acute and chronic effects of sport and exercise participation on cognition and emotion.

Learning Outcomes: 1. Describe and explain the study of psychophysiological processes that operate in the context of human movements in sport and exercise. 2. Describe and explain the methods and theories in the study of sport and exercise psychophysiology. 3. Evaluate major sport and exercise psychophysiology studies on topics such as enhancements in athletic performance, cognition, and emotion in terms of their methods, results, conclusions, and implications. 4. Analyze and synthesize concepts and theories across topics, readings, and discussions. 5. Communicate ideas in writing and group discussion in a clear, coherent, and logical style. 6. Acquire the knowledge to apply psychophysiological principles within sport and exercise settings. Credits: 3.00

HK 49000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for undergraduate students. Permission of instructor required.

Credits: 1.00 to 3.00

HK 49100 - Research Experience In Health & Kinesiology

Credit Hours: 1.00 to 3.00. Individualized activities related to a faculty member's research in health and kinesiology appropriate for undergraduate students; no project presentation required. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 3.00

HK 49500 - International Special Topics

Credit Hours: 1.00 to 3.00. Course taken during an international experience that is recognized by the university. Permission of department required.

Credits: 1.00 to 3.00

HK 49600 - Mentored Research In Kinesiology

Credit Hours: 1.00 to 3.00. Students are engaged in a research project under the guidance of a faculty member in one of the areas of inquiry in the kinesiology major. Permission of instructor required.

Credits: 1.00 to 3.00

PES 11100 - Lifetime Fitness

Credit Hours: 2.00. Provides students opportunities to assess levels of physical fitness, develop an exercise plan, and experience activities designed to improve cardiovascular condition, strength, and flexibility. Presents current findings and provides laboratory experiences regarding techniques of initiation, maintaining, and evaluating personal fitness. For non-H&K majors only.

Credits: 2.00

PES 11200 - Aquatic Movement Forms

Credit Hours: 1.00. Instruction and practice in aquatic movement forms. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: beginning swimming; intermediate swimming; advanced swimming; synchronized swimming.

Credits: 1.00

PES 11400 - Exercise And Conditioning

Credit Hours: 1.00. Instruction and practice in various types of exercise programs. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: body conditioning; exercise and fitness; exercise to music; jogging and running; swimnastics; relaxation techniques; weight training; exercise and principles of weight control.

Learning Outcomes: 1. Articulate the benefits of regular physical activity. 2. Explain the importance of training intensity relative to efficiency in engagement of physical activity. 3. Participate in a regular physical activity program, and reflect on what they have learned/gained throughout each session.

Credits: 1.00

PES 11500 - Individual And Dual Movement Forms I

Credit Hours: 1.00. Instruction and practice in individual and dual movement forms conducted in an indoor setting. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: badminton; billiards; bowling; fencing; judo; karate; beginning gymnastics; intermediate gymnastics; squash; racquetball; yoga; kung fu; personal defense. Special fee required.

Credits: 1.00

PES 11600 - Individualized And Dual Movement Forms II

Credit Hours: 1.00. Instruction and practice in individual and dual movement forms conducted mainly in outdoor settings. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: beginning golf; intermediate golf; advanced golf; bicycling; beginning tennis; intermediate tennis; advanced tennis; track and field. Special fee required.

Credits: 1.00

PES 11700 - Team Movement Forms

Credit Hours: 1.00. Instruction and practice in team movement forms. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: basketball; field hockey; lacrosse; softball; soccer; power volleyball I; power volleyball II.

Credits: 1.00

PES 11800 - Horseback Riding

Credit Hours: 1.00. Instruction and practice in hunter seat equitation. Class meets off campus, and students are expected to provide their own transportation. Following is a partial list of offerings: beginning; intermediate; advanced; combined training.

Credits: 1.00

PES 12000 - Officiating

Credit Hours: 1.00. Theory and practice in officiating movement forms. Students select from the activities listed in the current schedule of classes. Following is a partial list of activities: basketball; field hockey; gymnastics; swimming; softball; volleyball; track and field.

Credits: 1.00

PES 14600 - Advanced Golf Applications

Credit Hours: 1.00. Designed for the student who has either already taken PES 11600, or established themselves as a golfer by having a golf handicap, or by playing on a golf team in the past. Students learn methods to improve course management and strategies on the golf course. Students will receive intense levels of one on one instruction, utilizing video to analyze every student's swing. In addition to instruction, a league will be formed in which the students play 9 holes each week.

Learning Outcomes: 1. Play golf at an advanced level. 2. Identify dysfunctional movement. 3. Apply corrective measures to dysfunctional movement. 4. Develop course management strategies. 5. Effectively participate in team communications and competitive golf. Credits: 1.00

School of Health Sciences

HS pic 17-18

About Health Sciences

Undergraduate majors in Purdue's School of Health Sciences (HSCI) prepare students for fulfilling health-related careers. Our challenging curriculum offers a common core of courses in mathematics, physics, biology, and chemistry. Within Health Sciences, students have the opportunity to participate in multiple health-related student organizations, gain real-world experience through internships, and conduct groundbreaking undergraduate research. Graduates from the School of Health Sciences have found excellent success in gaining employment and admission to professional school programs including medicine, dentistry, physical therapy (PT), occupational therapy (OT), optometry, public health, and physician assistant (PA) as well as other graduate programs.

Recent alumni of the School of Health Sciences work for a variety of companies including Google, Amazon.com, Johnson & Johnson, Subaru, Alcoa, Indiana State Department of Health, Purdue University, Indiana State Police, IU Health, St. Elizabeth Hospital, Lyondell Basell, and Flint Hills Resources.

Contact Information

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Graduate Information

For Graduate Information please see Health Sciences Graduate Program Information .

Medical Laboratory Sciences, BS

Radiological Health Sciences: Pre-Medical Physics Concentration, BS

Radiological Health Sciences: Health Physics Concentration, BS

Occupational and Environmental Health and Safety Minor

Occupational and Environmental Health Sciences, BS

Biomedical Health Sciences/Interdisciplinary Health Science Concentration, BS

Biomedical Health Sciences/Pre-Medicine Concentration, BS

Biomedical Health Sciences/Pre-Dentistry Concentration, BS

Biomedical Health Sciences/Pre-Optometry Concentration, BS

Biomedical Health Sciences/Pre-Physician Assistant Concentration, BS

Radiological Health Sciences: Radiation Health and Safety Concentration, BS

Radiological Health Sciences Minor

HSCI 10100 - Introduction To The Health Sciences Professions

Credit Hours: 2.00. This course will present an overview of the fields in both the preventive, Public Health, as well as the clinical, Private Health, sides of the Allied Health Science Professions as it presents the holistic nature of health maintenance. Students will have the opportunity to hear from health professionals practicing in the allied health and preprofessional concentrations as well as from School of Health Sciences faculty in their areas of expertise in the fields of industrial hygiene, ergonomics, radiological sciences, toxicology and environmental health science.

Credits: 2.00

HSCI 11000 - Careers And Research In Occupational And Environmental Health

Credit Hours: 1.00. The goal of this course is to familiarize students to the variety of research and careers available within the broad field of environmental and occupational health. The course will focus on two areas: current research in occupational and environmental health and careers in occupational and environmental health. This content will be delivered through interactive lectures and discussions with a variety of guest speakers as well as HSCI faculty. Advice and guidance on applying for internships/jobs in the field will also be provided. A highlight of the event is a student/professional networking event which will be coordinated towards the end of the program.

Learning Outcomes: 1. Understand and apply key terms within occupational and environmental health. 2. Describe current research in occupational and environmental health. 3. Describe the extent and variety of careers available in occupational and environmental health. 4. Deliver an oral presentation about a contemporary issue in occupational and environmental health. Credits: 1.00

HSCI 13000 - Introduction To Medical Laboratory Science

Credit Hours: 1.00. An introduction to career opportunities in medical technology. Preprofessional and professional requirements. A survey of the major clinical laboratory departments and their applications to patient care and management. Discussion and interpretation of some of the major diagnostic tests, i.e., for cardiac enzymes, cholesterol, blood cells, diabetes, and drug monitoring.

Learning Outcomes: 1. Have a clearer and more in depth understanding of the field of medical laboratory science. 2. Have an appreciation for the diverse disciplines and thus career opportunities within this field. 3. Have an opportunity to engage in and contribute to your own knowledge gain. 4. Have the ability to translate a simple job description into an exciting professional career. Credits: 1.00

HSCI 13100 - Introduction To Medical Terminology

Credit Hours: 3.00. This self-paced learning course is designed to familiarize the student with terms used in medicine. Each body system will be studied individually. Word roots, prefixes, and suffixes will be used to build words relating to the system. Diagnostic and symptomatic terms will be introduced. CTL:IPO 1820 Medical Terminology

Learning Outcomes: 1. Offer a comprehensive vocabulary that can be used in the medical field. 2. Become proficient in the medical language. 3. Build confidence with this vocabulary that will open new doors to each student. Credits: 3.00

HSCI 19000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for freshmen students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 19501 - School Of Health Sciences Freshman Honors Seminar

Credit Hours: 1.00. This course is for Freshman students in the School of Health Sciences Honors Program. This course consists of a 50-minute weekly seminar meeting designed to orient and familiarize Freshman HSCI Honors students with the

School of Health Sciences including research areas and current topics in public health and biomedical research. Students will interact with guest speakers and expand their knowledge base in health science research. In addition to the seminar, students will be matched to a faculty mentor in a research area of their interest during the fall semester. Students will develop and design a research project with their faculty mentor (to be conducted in HSCI 19601 during the spring semester). In the spring semester, students will enroll in the seminar series (HSCI 19501) and in the research project course (HSCI 19601) to complete their project. Each student will be responsible for presenting and reporting on their research project during the spring seminar series. Permission of departmental required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Learn basic research skills such as how to do a literature search and report research findings. 3. Learn how to give and evaluate a research presentation. Credits: 1.00

HSCI 19601 - School Of Health Sciences Freshman Honors Project

Credit Hours: 1.00. This course is for Freshman students in the School of Health Sciences Honors Program. In this course students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students enroll in this course during the spring semester concurrently with HSCI 19501 . During the fall semester in HSCI 19501 , students will be matched to a faculty mentor in the research area of their choice and complete a Project Description Form based upon the work to be completed during this course. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least weekly or biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Some students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

HSCI 20100 - Principles Of Public Health Science (UCC: STS)

Credit Hours: 3.00. This course begins with a definition of public health and a review of its history and its role in disease prevention. The basic tools of public health practice, vital statistics and epidemiology, are then presented. After gaining an understanding of how these tools are used in assessing the health status of a community, the etiology and control of infectious and non-infectious threats to our health will be examined. The course concludes with risk analysis as a basis for public health policy determination.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 20200 - Essentials Of Environmental, Occupational, And Radiological Health Sciences (UCC: STS)

Credit Hours: 3.00. This course is designed to introduce the essential concepts of Environmental, Occupational, and Radiological Health Science. The principles of these three fields including the environmental impacts on human health and disease, environmental toxicology, occupational health concerns, contemporary occupational health issues, radioactivity, and the human health effects of exposure to ionizing radiation will be discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

HSCI 22500 - Healthcare Leadership And Safety

Credit Hours: 3.00. This course will present topics related to effective leadership and management strategies within an organization. The course will focus on implementation of these strategies from a health and safety perspective. Specific leadership and management topics to be discussed include communication strategies, motivation, conflict management, negotiation, ethics, and professional development. In addition, important safety topics, such as fire & life safety, workplace violence, terrorism, hazard communication, and slip & fall hazards will also be addressed.

Learning Outcomes: 1. Discuss principles of and various levels of leadership. 2. Explain ethical issues in health & safety and justify a response to those issues. 3. Explain principles of motivation and effective application to health and safety leadership. 4. Relate conflict management approaches to workplace issues. 5. Develop a fire and life safety plan for the

workplace. 6. Recognize situations in which violence may occur in the workplace and identify strategies to prevent incidents from occurring. Credits: 3.00

HSCI 26000 - Clinical Urinalysis And Body Fluid

Credit Hours: 1.00 to 10.00. Clinical Urinalysis And Body Fluid.

Credits: 1.00 to 10.00

HSCI 29000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for sophomore students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 29501 - School Of Health Sciences Sophomore Honors Seminar

Credit Hours: 1.00. This course is for sophomore students in the School of Health Sciences Honors Program. This course consists of a 50-minute weekly seminar meeting to discuss current topics in health science, public health, and biomedical research. Students will interact with guest speakers and expand their knowledge base in health sciences research. In addition, each student will be responsible for presenting and reporting on their ongoing honors research project. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Build on the skill to give and evaluate a research presentation. Credits: 1.00

HSCI 29601 - School Of Health Sciences Sophomore Honors Project

Credit Hours: 1.00. This course is for Sophomore students in the School of Health Sciences Honors Program. In this course, students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students enroll in this course in both fall and spring semesters (concurrently with HSCI 29501 in the spring semester). An updated Project Description Form will be due at the beginning of each semester based on the progress and any changes to the research plan. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least weekly or biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Some students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

HSCI 30500 - Basics Of Oncology

Credit Hours: 3.00. This course will introduce the student to the biology of cancer and some basics of oncology. Focus will be placed on what makes cancer different from normal tissues and how those differences can be leveraged for diagnostic and treatment purposes. This course will touch on topics of epidemiology, cancer biology, common therapeutic and diagnostic approaches, and other considerations of cancer care.

Learning Outcomes: 1. Identify the major risk factors of cancer. 2. Understand the difference between cancer and normal tissue. 3. Enumerate the major hallmarks of cancer. 4. Explain the link between cancer biology and diagnostic imaging. 5. Describe how cancer therapies target the hallmarks of cancer. Credits: 3.00

HSCI 31000 - Imaging In Medicine

Credit Hours: 3.00. This course will introduce students to develop essential understandings of all primary medical imaging techniques utilized in hospitals such as Computer tomography, X-ray imaging, MRI, Ultrasound and Nuclear medicine imaging modalities. The course will cover basic scientific principles of each modality and introduce their underlying clinical requirements and applications. In addition, this course introduces the student to human anatomy as seen in the transverse, coronal, and sagittal planes. Anatomy of the brain, thorax, abdomen, and pelvis will be studies using CT and MRI images. Normal anatomy, anatomic variants, and selected pathologies will be discussed in the various body regions.

Learning Outcomes: 1. Understand (at an elementary level) the physical basis and limitations of diagnostic imaging techniques and

correctly distinguish between the following imaging techniques: plain X-rays, CT scans, MRI scans, PET scans and ultrasound. 2. Differentiate major anatomical regions and identify major anatomical structures in the transverse, coronal, and sagittal plane. 3. Acquire basic knowledge of the fundamental principles and techniques of all the major imagine modalities including, CT, MRI, Ultrasound and nuclear medicine (PET and SPECT). 4. Understand basic sectional (transverse, sagittal and coronal) anatomy in medical imaging. Credits: 3.00

HSCI 31200 - Radiation Science Fundamentals

Credit Hours: 3.00. This course introduces principles and concepts related to nuclear energetics, radioactive decay, the interactions of ionizing radiation with matter, and the human health effects of exposure to ionizing radiation. Fundamental concepts related to atomic and sub-atomic physical processes as well as relevant aspects of modern physics are briefly reviewed. Students gain practical experience and enhance their understanding of radiation protection by participating in a radiological emergency response exercise (RERE).

Learning Outcomes: 1. Have a sense of scale for the atomic and sub-atomic world with regard to size and energies involved. 2. Recognize the major types of radioactive decay, calculate the rates of particle emission, and apply the theory of radioactive decay to decay chains, medical imaging applications and radio dating. 3. Describe and apply the mechanisms of interactions of radiation with matter. 4. Explain and apply mechanisms of radiation detection and quantification. 5. Know and quantify the biological effects of exposure to radiation using dosimetry principles. 6. Be proficient at manipulating the physical quantities and systems of units used in the radiological sciences and at applying critical thinking and problem-solving skills. Credits: 3.00

HSCI 31300 - Principles Of Radiation Detection And Measurement

Credit Hours: 2.00. Course presents an introduction to the principles of radiation detection and measurement, including statistical models, counting statistics, error analysis, detection limits, ionization chambers, proportional counters, GM counters, scintillation counters, gamma-ray spectroscopy, solid-state detectors, TLDs, track-etch and bubble detectors.

Learning Outcomes: 1. Understand the fundamentals of 3 types of ionization radiation. 2. Understand radiation safety. 3. Understand how to choose the radiation detection devices that fit for a specific purpose. 4. Understand what their capabilities and limitations are. 5. Understand how to interpret and use the output from radiation detectors. 6. Understand medical applications of radiation or radioactive materials. 7. Understand basic principles to detect the radioactive materials injected into human or animal subjects. 8. Understand different nuclear imaging procedures. 9. Understand fundamentals of molecular imaging. 10. Understand the receptor-based radiotracers for imaging and radiotherapy. Credits: 2.00

HSCI 33300 - Introduction To Immunology

Credit Hours: 3.00. Introduction to Immunology will meet twice weekly and provide an overview of this evolving field of science with an emphasis on the clinical implications and application of learned knowledge. The immunologic mechanisms associated with the normal and abnormal immune response will be discussed and students will put this knowledge into practice by directing their own case study. In addition, a number of common clinical concerns with respect to immunity will be reviewed. Furthermore, we will explore the critical role our knowledge of this branch of science plays in patient diagnosis, treatment and care both now and in the future.

Learning Outcomes: 1. Have solid understanding of the science of Immunology and the Immune Response. 2. Have an appreciation for the complexity of the immune system, its cellular components, its regulation and implications of its dysfunction. 3. Have a clearer understanding of the clinical applications

and implications of the immune response. 4. Have enhanced knowledge of the course material. 5. Have the ability to transfer the written word into practical application of its principles. Credits: 3.00

HSCI 33400 - Lung Physiology And Medicine

Credit Hours: 2.00. This course will explore the normal functioning of the respiratory system, along with a variety of diseases and disorders affecting this system. Special emphasis will be placed upon diseases which result from, or are aggravated by, environmental pollutants. The course will begin with discussing the anatomy and physiology of the respiratory system. Individual lung disorders will then be discussed with consideration of the sources of air pollution contaminants and the interaction of those contaminants with normal lung tissue.

Learning Outcomes: 1. Describe the normal anatomy and physiology of the respiratory system. 2. Identify the lung volumes and how lung volumes relate to lung capacities. 3. Describe the pathophysiology of major types of lung disorders. 4. Relate lung disorders to air pollution contaminants. Credits: 2.00

HSCI 33500 - Heart Physiology And Medicine

Credit Hours: 2.00. This course will provide a discussion about diseases affecting the heart and cardiovascular system. The normal anatomy and physiology of the heart and blood vessels with be discussed. Various diseases of the heart and vasculature, including atherosclerosis, cardiomyopathies, valvular heart disease, hypertension, and stroke will be explored. Included in the discussion of each disease process will be environmental agents, which are associated with disease development and progression.

Learning Outcomes: 1. Describe the normal anatomy of the hear. 2. Discuss the cardiac steps of the cardiac cycle. 3. Describe disease processes of the heart and blood vessels. 4. Identify environmental exposures associated with an increased risk of heart disease. Credits: 2.00

HSCI 33600 - Eye Physiology And Disease

Credit Hours: 2.00. This course will cover the fundamental structure and function of the eye and visual nervous system. Brief review lectures will be provided on basic cell biology and neuroscience to provide a strong foundation for topics such as phototransduction, retinal neural circuit function, and disease etiology. The first half of the course will be focused on the normal and healthy anatomy and physiology of the eye. The second half the course will be focused on eye and visual diseases and their associated pathophysiology and clinical manifestations. This part of the course will include lessons on eye imaging techniques and cutting-edge treatments used for detection and treatment of eye diseases. This course will be beneficial for any student interest in clinical or medical research, and highly recommended for those interested in optometry, ophthalmology, and visual research careers. Permission of department required.

Learning Outcomes: 1. Describe the normal anatomy of the eye and visual pathways in the brain. 2. Discuss neural circuit and cell signaling pathways in phototransduction. 3. Describe the cellular etiology of ocular disease processes. 4. Understand the basic approaches to studying and assessing eye function. Credits: 2.00

HSCI 34500 - Introduction To Occupational And Environmental Health Sciences

Credit Hours: 3.00. Principles of occupational health (industrial hygiene) and environmental health as related to anticipation, recognition, evaluation, and control of hazards in the workplace and the surrounding community. Emphasis is on hazards of chemicals and their role in occupationally and environmentally related diseases. Historical basis and current legislation are discussed. In addition, the principles of epidemiology, toxicology, exposure standards, and respiratory protection are addressed.

Learning Outcomes: 1. Discuss the historical background of the fields of occupational and environmental health and events leading to the establishment of current related regulations. 2. Understand the major principles and terminology of toxicology, epidemiology, and environmental exposure assessment as they are applied to environmental and occupational health. 3. Understand the units of airborne contaminant concentration, and be able to perform basic calculations and conversions involving these concentrations. 4. Identify classes of environmental contaminants, their major health effects, and typical environments where they are of concern. 5. Understand the

operations of OSHA, NIOSH, EPA, ACGIH, their important interactions with industry, and their principle types of regulations and/or guidelines. 6. Understand the use of different types of respiratory protective equipment. Credits: 3.00

HSCI 34600 - Industrial Hygiene Engineering Control

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Describe/understand different approaches for controlling exposures in the occupational environment, and give hypothetical and real situations in terms of the best control methods. 2. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a complete ventilation system. 3. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 4. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to prevent it in the workplace. 5. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 6. Synthesize and apply knowledge of the IH paradigm (AREC) in analyzing practical industrial hygiene/occupational health problems. Credits: 4.00

HSCI 34800 - Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. Sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Explain the rationale of the sampling strategy. 2. Perform basic sampling procedures for certain gases, vapors, particulates, noise, and heat, including proper selection, set-up, and operation of equipment. 3. Summarize the basic principles of the sampling procedures and explain why they function as they do. 4. Describe the limitations of sampling and analysis in real-world situations and how to deal with them. 5. Collect, analyze, interpret, and summarize laboratory data into a well-written report. 6. Describe the advantages as well as the difficulties of working together on a team. Credits: 3.00

HSCI 35300 - Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and frontline employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the frontline employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the frontline employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the frontline employees and upper management together in their vision of a safe and healthy workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting

safety training in an organization. 5. Plan an effective safety management system for an organization. 6. Demonstrate group and team building strategies as it relates to health and safety. Credits: 3.00

HSCI 36000 - Everyday Toxicology: Poisonings From Clinics To Courtrooms

Credit Hours: 2.00. Exposure to chemicals happens every day in human life through the living environment and diet; yet the health impact and toxicological consequences of these exposures are often unknown to general populations. This 300-level course examines basic concepts of toxicology in human health as they apply to the exposure of environmental agents, e.g., chemicals, metals, and poisons in daily life and attempted poisoning in criminal cases and political assassins. With an emphasis on historical accounts of poisonings and case analyses, the course describes commonly encountered chemicals and poisons, their symptoms, clinical diagnosis, basic toxicological mechanisms, and medical interventions. Students will also learn some of the large-scale environmental and occupational incidents that have led to legal actions, and the role of toxicology in forensic investigation of purposed poisoning. The course is ideal to students who are inspired to become a future healthcare professional in any of the health-oriented pre-professional programs or students with majors in biomedical health sciences, environmental and occupational health sciences, medical laboratory science, and/or public health.

Learning Outcomes: 1. Define the concepts of poisoning, forensics, and toxicology. 2. Describe the dose-response relationship and routes of exposure for common chemicals. 3. Discuss common poisons from a historical perspective. 4. Explain signs and symptoms, diagnosis, and treatments related to typical poisons. 5. Illustrate basic biological mechanisms leading to adverse health outcomes. 6. Understand professions and duties involved in the field of clinical toxicology. Credits: 2.00

HSCI 39000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for junior students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 39501 - School Of Health Sciences Junior Honors Seminar

Credit Hours: 1.00. This course is for Junior students in the School of Health Sciences Honors Program. This course consists of a 50-minute weekly seminar meeting to discuss current topics in health science, public health, and biomedical research. Students will interact with guest speakers and expand their knowledge base in health sciences research. In addition, each student will be responsible for presenting and reporting on their ongoing honors research project. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Build on the skill to give and evaluate a research presentation. Credits: 1.00

HSCI 39601 - School Of Health Sciences Junior Honors Project

Credit Hours: 1.00. This course is for Junior students in the School of Health Sciences Honors Program. In this course, students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students enroll in this course in both the fall and spring semesters (and concurrently with HSCI 39501 in the spring semester). An updated Project Description Form will be due at the beginning of each semester based on the progress and any changes to the research plan. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Some students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of departmental required.

Learning Outcomes: 1. Gain an understanding of the research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

HSCI 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

HSCI 40000 - International Special Topics

Credit Hours: 1.00 to 8.00. Courses taken during an International experience that is recognized by the University. Permission of Department required.

Credits: 1.00 to 8.00

HSCI 41500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. The course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the state and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. Group exercises and simulations in applied nuclear security scenarios will complement lectures. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. Obtain a broad picture of nuclear security components and their interconnections, and of the planning of nuclear security activities at the state and facility level. 2. Learn the basic concept of nuclear security. 3. Learn the basics of nuclear security planning at the facility and state level. 4. Learn proliferation efforts, framing them within the historical and security-related context. 5. Create a foundational understanding of relevent security, safeguards and nonproliferation treaties and agreements. 6. Leverage existing technical knowledge in coming to policy conclusions. 7. Develop both a regime and state specific knowledge base. 8. Illustrate understanding through technical and policy oriented exercises. 9. Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts. Credits: 3.00

HSCI 42000 - Applied Anatomy For Medicine

Credit Hours: 4.00. With a focus on preparing students to be practitioners of health sciences, Applied Anatomy for Medicine (HSCI 42000) will build upon the foundational knowledge of form and function obtained in prerequisite courses through enhancement of the relationship between bony structures, musculature, innervation, vascular perfusion, and interconnectedness with respect to human health. The significance of regional anatomy and important anatomical landmarks from a clinical perspective will be learned. The incorporation of student driven dissection will promote a more comprehensive understanding of the correlation between structure, function, dysfunction and disease signalments. The integration of clinical application and case study investigation will facilitate the transition from learner to practitioner.

Learning Outcomes: 1. Identify the bones, associated bony prominences, muscles, innervation, action and vascular perfusion. 2. Identify and demonstrate the relationship between superficial and deep structures including dermatome maps. 3. Identify regional anatomy and important clinical landmarks, and aid in deciphering imaging diagnostics. 4. Identify anatomical design both in health as well as modifications due to disease. 5. Understand the critical role anatomical design plays in the maintenance of health, development and manifestation of disease, diagnostic assessment, intervention and treatment. Credits: 4.00

HSCI 44400 - Exposure Assessment In OEHS

Credit Hours: 3.00. Exposure assessment is an essential component of Environmental Health Science and industrial hygiene. This course provides students basic scientific knowledge of exposure assessment, with emphasis on practical aspects of exposure science, including study design, data and measurement collection, data analysis, and results interpretation and presentation. Course topics include major exposure media and pathways (air, water, food, soil, etc.) and important exposure routes (inhalation, ingestion, dermal absorption); exposure measurement and assessment; strengths and weaknesses of various exposure assessment techniques, how to link exposure assessment with environmental health,

and human subject research in exposure studies. The course includes case studies and group projects. Students are expected to develop entry-level skills for designing exposure studies applicable to human exposure monitoring, epidemiologic investigations and health risk assessment.

Learning Outcomes: 1. Describe basic components of exposure assessment studies. 2. Design a study to conduct basic assessments of exposure to chemical hazards at workplace or in a community setting. 3. Obtain and analyze existing data, collect and analyze measurement data, prepare technical reports, and present results. 4. Discuss ethical and professional responsibilities in exposure studies. 5. Function effectively on a team that identify, evaluate and solve problems related to exposures in occupational and environmental settings. Credits: 3.00

HSCI 44500 - Industrial Hygiene Internship

Credit Hours: 2.00. Discussion class based on applied work experience as an industrial hygiene assistant or technician at an industrial, consulting, hospital, government, or education and research institution. Topics covered also include professional and ethical aspects derived from students' work experiences. Written and oral reports as well as other classroom assignments. Restricted to industrial hygiene majors who have completed an acceptable industrial hygiene work experience.

Credits: 2.00

HSCI 44600 - Applied Industrial Hygiene

Credit Hours: 3.00. This course allows the student to synthesize his or her basic industrial hygiene fundamentals to understand how they apply in the real world. Issues faced by industrial hygienists will be addressed by a variety of guest speakers. Class projects add to the diversity of this senior capstone course.

Credits: 3.00

HSCI 44700 - Global Workplace Health

Credit Hours: 2.00. This course will examine health and safety issues, particularly those which occur in the work setting, in various countries around the world. A particular focus will be toward developing countries in which the regulatory environment and resources to control hazards are less than those of more developed countries. Students will participate through an established professional organization. They will virtually work on specific projects in various countries, with the goal of improving the health and safety environment.

Learning Outcomes: 1. Identify exposures to harmful environmental agents which may adversely affect human health. 2. Apply their knowledge and skills of occupational health to recommend methods to reduce exposure to harmful environmental agents. 3. Be able to function as part of team to address issues involving human health. 4. Be able to describe the differences in exposure to hazardous agents for different parts of the world. 5. Obtain a knowledge of current events and identify how the events relate to disparities in human health across different cultures and countries. 6. Obtain an understanding of professional ethics in relation to differing health and safety policies. Credits: 2.00

HSCI 45100 - Clinical Biochemistry

Credit Hours: 1.00 to 10.00. This course is designed to provide principles of biochemistry for clinical application for medical technologists. The course encompasses an introduction to carbohydrate, amino acid, and lipid metabolism. Also included are lectures on basic endocrinology, enzymes, and biosynthesis of steroid hormones. Physiological principles are stressed with respect to liver, lung, and kidney function. Special emphasis is placed on correlation of the theoretical and clinical areas.

Credits: 1.00 to 10.00

HSCI 45200 - Clinical Chemistry

Credit Hours: 1.00 to 10.00. This course is designed to provide the medical technologist with the principles and application of clinical chemistry. Methods of instrumental analysis include a variety of automated procedures, electrophoresis, immunoelectrophoresis, immunodiffusion, radioisotopes, steroids, hormone assay, and toxicology. Quality control for clinical chemistry is included. Supervised clinical laboratory experience is offered, with students rotating through the various areas of clinical chemistry on a sequential rotational basis.

Credits: 1.00 to 10.00

HSCI 45300 - Clinical Hematology

Credit Hours: 1.00 to 10.00. Study of the functions, maturation, and morphology of blood cells. Blood cells, platelets, and reticulocyte counting procedure. Experiences in the study of

cellular content of other body fluids are offered. Lectures and laboratory are designed to teach techniques of sedimentation rates, hematocrits, corpuscular indices, hemoglobin red cell fragility, and special staining procedures. Also, routine and special coagulation studies are taught. Supervised experience in clinical hematology offers opportunities for study in routine and special hematology and coagulation procedures.

Credits: 1.00 to 10.00

HSCI 45400 - Clinical Immunohematology

Credit Hours: 1.00 to 10.00. A review of serologic principles and technical fundamentals of transfusion practice; a comprehensive consideration of all blood groups, with emphasis on ABO and Rh-Hr blood group systems. Extensive practice is gained in pre-transfusion techniques and antibody identification in the laboratory. Other blood types and antigen-antibody relationships are taught in laboratory and lectures. Also included are blood donor room procedures; preparation of blood components; correlation of blood component therapy with disease states; quality control of all reagents, procedures, and equipment used; and laboratory safety measures, all of which offer the best patient care and protection of laboratory personnel.

Credits: 1.00 to 10.00

HSCI 45500 - Clinical Microbiology

Credit Hours: 1.00 to 10.00. Lectures and clinical laboratory experience in diagnostic procedures as aids to the diagnosis of human disease. Proper selection of techniques for the isolation and identification of medically important bacteria. Special emphasis is placed on newer methods for anaerobic bacteria identification. Also includes lectures and laboratory identification in the fields of mycology and microbacteriology, with emphasis on isolation and identification. Practical applications of fluorescent antibody tests are performed.

Credits: 1.00 to 10.00

HSCI 45700 - Clinical Parasitology

Credit Hours: 1.00 to 10.00. Techniques of specimen examination, identification of cysts and ova, life cycles of parasites.

Credits: 1.00 to 10.00

HSCI 45800 - Clinical Serology

Credit Hours: 1.00 to 10.00. Lectures and a laboratory experience in serology, including the preparation of antigen, flocculation tests for syphilis, heterophile antibody tests, creative proteins, RA test, FTA, rubella testing. Also included are lectures in immunology that include classifications of immunoglobulins; mechanism of antibody formation; immune response; types of antigen-antibody reactions; and theories of radioimmunoassay.

Credits: 1.00 to 10.00

HSCI 46000 - Clinical Urinalysis

Credit Hours: 1.00 to 10.00. Routine analysis, chemical tests, sediment identification, renal function tests, pregnancy tests.

Credits: 1.00 to 10.00

HSCI 46500 - Introduction To Laboratory Education And Management

Credit Hours: 1.00 to 3.00. A study of the principles and techniques of clinical instruction, and inservice and continuing education as well as administration and supervision.

Credits: 1.00 to 3.00

HSCI 48500 - Health Physics Internship

Credit Hours: 1.00 to 8.00. Applied work experience as a health physics assistant or technician at a nuclear power generating station, government laboratory, hospital, or education and research institution. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 49000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for senior students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 49200 - Professional Experience In Health Sciences Internship

Credit Hours: 0.00 to 3.00. Professional experience in Health Sciences. This experiential offering is coordinated by Health Sciences in cooperation with participating employers. Students will submit company evaluations related to the experience or summary reports and assignments related to professional development in Occupational, Environmental or other Health Sciences areas. Permission of department is required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in a professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase knowledge of the application of occupational, environmental or other areas of

health sciences in a professional capacity. Credits: 0.00 to 3.00

HSCI 49501 - School Of Health Sciences Senior Honors Seminar

Credit Hours: 1.00. This course is for Senior students in the School of Health Sciences Program. This course consists of a 50-minute weekly seminar meeting to discuss current topics in health science, public health, and biomedical research. Students will interact with guest speakers and expand their knowledge base in health sciences research. In addition, each student will be responsible for presenting and reporting on their ongoing honors research project. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Build on the skill to give and evaluate a research presentation. Credits: 1.00

HSCI 49601 - School Of Health Sciences Senior Honors Project

Credit Hours: 1.00. This course is for Senior students in the School of Health Sciences Honors Program. In this course, students will earn credit for work completed on their Honors Project under supervision of their faculty mentor. Students will enroll in this course in both fall and spring semesters (and concurrently with HSCI 49501 in the spring semester). An updated Project Description Form will be at the beginning of each semester based on the progress and any changes to the research plan. Course meeting times and frequency are to be set by the student and faculty mentor with an estimated commitment of 3-4 hours per week. Hours are to be arranged between the student and the faculty mentor, with at least weekly or biweekly meetings set aside for a one-on-one session between the student and faculty mentor. Students may also be matched to professional mentors off campus depending on their interests and future goals. The regular meeting times should be set during the first week of class. Working hours must not conflict with other course obligations or consume too much of students' study time. Permission of department required.

Learning Outcomes: 1. Gain an understanding of the current research areas in health sciences. 2. Develop and design an honors research project specific to the student's research interests. 3. Conduct and complete an individualized research project to gain further understanding of the student's specific research area of interest. Credits: 1.00

White Lodging-J.W. Marriott Jr. School of Hospitality and Tourism Management

About White Lodging-J.W. Marriott Jr. School of Hospitality and Tourism Management

At Purdue's White Lodging-J.W. Marriott, Jr. School of Hospitality and Tourism Management (HTM), we redefine industries by transforming the way people engage with the world. As experience engineers, our students develop the expertise to empower financial security, elevate hospitality and tourism, revolutionize retail, and drive sales innovation.
Whether guiding clients toward financial well-being in Financial Counseling and Planning, designing unforgettable guest experiences in Hospitality and Tourism Management, creating immersive commerce in Retail Management, or developing customer-driven strategies in Selling and Sales Management, our graduates leave ready to make an impact.
Through a combination of academic rigor, hands-on learning, and industry collaboration, we prepare students to think critically, solve complex challenges, and create meaningful connections. Here, learning extends beyond the classroom into real-world applications that drive innovation and elevate professional success.

Faculty (website)

White Lodging-J.W. Marriott Jr. School of Hospitality and Tourism Management (website)

Contact Information

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Graduate Information

For Graduate Information please see Hospitality and Tourism Management Graduate Program Information

Financial Counseling and Planning, BS

Retail Management, BS

Selling and Sales Management, BS

Hospitality and Tourism Management, BS

Event and Meeting Management Minor

HTM International Studies Minor

CSR 10000 - Introduction To CSR

Credit Hours: 1.00. A workshop to familiarize students with the CSR department, department majors, advising resources, and major requirements. Special emphasis on basic freshman survival skills.

Credits: 1.00

CSR 10300 - Introduction To Personal Finance

Credit Hours: 3.00. This course will provide knowledge and skills for young adults to be active, informed, and rational managers of their financial life. The course will particularly address the following 4 areas of personal finance. Managing money: Why it's useful to plan ones financial affairs, budgeting, being an informed manager of ones money and consumer of financial products. Financing large items using savings and credit: Know how credit works, how to use it wisely, and how to avoid over indebtedness. Learn savings strategies to maximize the growth of your money. Using financial markets: What are the different ways to invest, and how to make them work for you and your objectives (such as retirement). Managing risk: How to use financial tools (such as insurance) to protect yourself against risk. The course will emphasize age-relevant knowledge and practical advice, with the objective to help students make better financial decisions and adopt better financial behaviors for the long term.

Learning Outcomes: 1. Estimate their budget, according to basic general principles of accounting, and use it to improve their financial situation by matching expenses to income and smartly planning for the long-term. 2. Decide whether to use savings and/or credit to finance large purchases, which implies being able to save in the most appropriate and rewarding way, and distinguishing between the benefits and drawback of various sources and types of loans. 3. Invest in financial markets wisely using appropriate financial instruments, based on their personal situation at any point in time (including planning for retirement). 4. Identify and implement the best financial products to protect themselves against risk (e.g. different types of insurance). 5. Make financial decisions in an informed and carefully thought-out manner, including reaching out to appropriate resources and advice when necessary. Credits: 3.00

CSR 12800 - Introduction To Apparel Design

Credit Hours: 3.00. This course introduces the fundamentals of the Apparel industry, design, and assembly through lectures, discussions, readings and application in an Apparel laboratory. The student will learn the proper operation of industrial garment production equipment. Further, the course will introduce the manufacturing standards of apparel assembly through garment construction, principles of fit and fiber, and fabric performance.

Learning Outcomes: 1. Explain the basics of the nature, materials, producers, and markets of and for fashion and the apparel industry. 2. Identify basic apparel assembly and design techniques, principles of fit, and fiber and fabric performance characteristics within specific types of garments. 3. Operate garment

production equipment in a safe and appropriate manner. Credits: 3.00

CSR 20000 - Professional Development In Consumer Science

Credit Hours: 1.00. Professional Development in Consumer Sciences & Retailing is a required course that will provide the necessary techniques to manage job search skills and career development for both current and future professional needs. The covered topics will expose students to on-campus resources, opportunities to gain key networking skills, and establish their professional identity to better prepare students for the current job market.

Learning Outcomes: 1. Provide life-long job search skills. 2. Enable students to effectively navigate career fairs & networking events. 3. Educate students about Purdue's resources regarding career and academic development. 4. Develop student's professional documents. 5. Assist students in creating their personal professional brand. 6. Perpare students on the transition from college to the professional world. Credits: 1.00

CSR 20100 - Introduction To Professional Sales

Credit Hours: 3.00. Introduction to sales process, business to business communication strategies, and expectations of a sales professional.

Learning Outcomes: 1. Describe the operationalization of sales and the purchasing function within a business. 2. Define the variety of sales roles and determine best fit. 3. Demonstrate the skills necessary to succeed in a sales role. 4. Apply sales process to a role play sales call. Credits: 3.00

CSR 20900 - Introduction To Retail Management

Credit Hours: 3.00. Retail career paths, management training, merchandise control, organization and service structure, and a comparison of store types.

Credits: 3.00

CSR 21500 - Textile Industry

Credit Hours: 3.00. Fundamentals of the textile industry addressing the lifecycle of textile products beginning with the source and properties of textile fibers to the steps in the production of textile products and their impact on product performance and consumer satisfaction. Generate an awareness of the global textile industry as it relates to the impact on the environmental and social communities. Emphasis on retail, apparel, and interior design applications.

Learning Outcomes: 1. Predict fabric performance and end-use based on knowledge of fibers, yarns, fabric constructions, and finishes. 2. Possess a working knowledge of the many facets of processing textiles from raw materials to the finished product, including laws and requirements that regulate textile labeling. 3. Generate awareness of the scope and complexity of the global textile industry as well as the challenges it faces, environmentally and socially. 4. Assess the impact of consumer buying behavior, use, care and disposal decisions on textiles and related industries. Credits: 3.00

CSR 22000 - Apparel Design I

Credit Hours: 3.00. Introductory course that deals with the evolution of apparel design through the principles of flat pattern design, three-dimensional draping, and computer-aided design (CAD for pattern design). Fundamentals for apparel design. Students create designs for a basic, sleeveless, collarless top.

Learning Outcomes: 1. Recognize and apply the creative process: inspiration, designer's resources, visual consumer, garment engineering, and fashion sketching. 2. Recognize, name, and use pattern making tools, equipment, and terminology. 3. Produce and apply the use of a croquis (sketch/design/inspiration) book. 4. Create and continuously add personal designs and inspirations of design to a croquis book. 5. Understand and apply proper use of fabric grain in pattern making and draping. 6. Drape a set of basic block patterns to properly fit an industrial model form: bodices, skirts and sleeves. 7. Understand and apply the use of design principles #1 dart manipulation, and other

patternmaking design details. 8. Create and sketch an original design, complete the patterns, and complete the assembly of: a sleeveless/collarless garment to fit the upper torso only or both upper and lower torso. Credits: 3.00

CSR 22100 - Apparel Design II

Credit Hours: 3.00. Continued development of apparel design from concept to finished product through the application of flat pattern design, draping, and computer-aided design. Building on the introductory course to create apparel wear design that includes sleeves, collars, blouses/shirts, dresses, pants, and skirts. Introduction to pattern grading manually and through CAD, and marker for apparel production.

Learning Outcomes: 1. List, define, and apply sewn products industry and patternmaking terminology as related to apparel design. 2. Measure the human figure and industrial model form for the development and drafting of patterns for apparel. 3. Identify and appropriately make sure of various patternmaking / drafting tools. 4. Apply principles of flat pattern drafting to the production of patterns for original design apparel items of pants, collars, sleeves, and skirts. 5. Apply the principles of draping to the production of patterns for original design apparel items of skirt, pants, collars, sleeves, and torso. 6. Render presentation boards for color story, design inspirations / sketches, target customer profile, item selection of line or collection, fabric trim selection, and technical sketches (flats or production drawings). 7. Create, render, and continuously add personal designs and inspirations of design to a croquis book. 8. Create original design garments from conception of design through rendering to drafted patterns to assembled garment. Credits: 3.00

CSR 28200 - Customer Relations Management

Credit Hours: 3.00. A course that provides insight into the structure and working of customer relations management and its role in business and government agency. Analysis of how consumer needs, complaints, and education are handled. Customer relations' management in the real world and techniques used in managing customer relations toward the goal of maximizing customer satisfaction. This course has a real-world focus and is more applied than the usual introductory course.

Credits: 3.00

CSR 30000 - Field Experience In Retail Management

Credit Hours: 1.00. Approved in-service training, a total of 140 hours; development of activities plan; and report of activities. Recommended for semesters 3,4,5, or 6. Advance approval of director and employer and attendance at pre- and post-organizational meeting is required. Permission of instructor required.

Credits: 1.00

CSR 30700 - Field Experience In Selling And Sales Management

Credit Hours: 1.00. Approved in-service training and supervised work experience in selling and sales management. Total of 140 hours required with in-depth report and analysis of activities. Permission of department required.

Learning Outcomes: 1. Provide exposure to career options in a real world setting through direct practice or by observation and interaction with colleague at the internship site. 2. Apply theory and relevant coursework in a professional setting, where the student will combine academic and work site assignments. 3. Advance skills and professional experience to enhance the student's career development. Credits: 1.00

CSR 30900 - Leadership Strategies

Credit Hours: 3.00. Provides knowledge of humanistic processes that contribute to development of effective leadership.

Learning Outcomes: 1. Identify leadership principles and skills for the 21st-century organization. 2. Understand and apply ethical leadership. 3. Connect theory to applied solutions. 4. Apply critical thinking to leadership

principles through in-class discussion and written assignments. Credits: 3.00

CSR 31000 - Buying Of Merchandise

Credit Hours: 3.00. Principles of volume buying applicable to department, chain, specialty, and independent stores.

Learning Outcomes: 1. Demonstrate knowledge of the buying and merchandising functions, and their role in a retail organization. 2. Describe definitions and concepts of terminology related to merchandising math. 3. Apply basic mathematical concepts to solve typical merchandising problems and make decisions. 4. Use data to analyze and evaluate the performance of merchandising strategies. Credits: 3.00

CSR 31500 - Relationship Selling

Credit Hours: 3.00. This course focuses on long-term relationship selling. The course is organized around a seven-step selling process which has proven to be effective. The course adds to this process some principles of marketing and business strategy. The elements are necessary for the success of professional salesperson both in successful prospecting and making strategic choices as to how to allocate their time within the territory. Important to the learning process is actually practice of principles. Students will do various exercises of principles such as prospecting and negotiation. At the end of the semester, students will hone the skills learned through the semester with a series of role plays designed to put them in position of both seller and buyer.

Learning Outcomes: 1. Recognize that selling is a process which can be taught versus an innate trait. 2. Have an organized approach to the process of selling which can be applied to any industry. 3. Know principles of marketing and strategy which students can apply to the selling process. 4. Know principles of negotiation and handling objections both through class assignments and role playing. 5. Know how to do effective product presentation and frame benefits to the clients through a series of role play scenarios. Credits: 3.00

CSR 32300 - Visual Merchandising

Credit Hours: 3.00. Creative experimentation, production, and analysis of promotional formats for merchandising of product in a retail setting. Study of the elements and principles of design and their application for promotion of retail merchandise and/or services.

Credits: 3.00

CSR 32800 - Apparel Art And Design

Credit Hours: 3.00. Exploration and experimentation of creative rendering of apparel design through the use of various media. Opportunity for the students to develop their own unique style of illustrating fashion.

Credits: 3.00

CSR 33100 - Consumer Behavior

Credit Hours: 3.00. An interdisciplinary survey of consumer behavior theory focused on psychological, sociological, and cultural influences on consumer choice and use of products and services. Credit will not be given for both CSR 33100.

Credits: 3.00

CSR 33200 - Cross-Cultural Marketing And International Retailing

Credit Hours: 3.00. Examination of marketing/retail practices used to target domestic and global consumer market segments. Development of successful retail and marketing strategies is stressed.

Credits: 3.00

CSR 34100 - Luxury Brand Management

Credit Hours: 3.00. Students examine the innovation and creativity that foster the development of luxury brands in the current business environment. A key facet of this course is the opportunity to develop unique brand strategies that generate social, aesthetic, quality, and emotional value for luxury consumers. Students learn the ways brands tailor services, products, and experiences to achieve these goals.

Learning Outcomes: 1. Define the psychological and cultural elements of luxury brand experiences. 2. Explain the connections between service excellence, craftsmanship, and creative direction within the management of luxury brands. 3. Analyze social, economic, and technological trends within the luxury

market. 4. Describe the ethical and social challenges of managing luxury brands. 5. Develop strategies that create brand prestige and generate value for luxury consumers. Credits: 3.00

CSR 34200 - Personal Finance

Credit Hours: 3.00. The class covers a comprehensive discussion of investments, consumer credit, insurance and retirement issues. The goal is to show how these components are interconnected in order to create a complete picture of financial health of an individual. CTL:IPO 1811 Personal Finance

Credits: 3.00

CSR 34400 - Fundamentals Of Negotiations

Credit Hours: 3.00. This course is designed to be relevant to the broad spectrum of bargaining "problems" that are traditionally faced by the manager, sales personnel and financial advisors. The course explores the processes of bargaining and negotiation as social and managerial activities. Special emphasis will be given to the areas of interpersonal and interpersonal and intergroup conflict, in addition to the interpersonal influence techniques and the tactics and strategies involved with improved bargaining and negotiation. The major purpose of the course is for each student to gain insight into his or her own negotiating style and to become a more effective negotiator, as well as a more astute observer of social process. The course will involve extensive use of cases, role-plays, and related participative activities, enhanced by rigorous self-review and introspection.

Learning Outcomes: 1. Explore the major concepts and theories of the psychology of bargaining and negotiation. 2. Understand the dynamics of interpersonal and intergroup conflict and its resolution. 3. Help develop the sophistication to analyze bargaining and conflict relationships. 4. Learn about your own individual "bargaining" style. 5. Development appropriate negotiation strategies and tactics for specific situations. Credits: 3.00

CSR 35700 - Retail Technology: Merchandise Planning And Allocation

Credit Hours: 3.00. The application of software technology in retail merchandising, planning and allocation systems. Builds on basic knowledge of buying functions utilizing industry software, to develop skills needed in higher-order planning and allocation of merchandise. Students apply knowledge and skills through simulations with real-world data.

Learning Outcomes: 1. Explain the relationship between planning and buying merchandise. 2. Explain the relationship between allocation and supply chain. 3. Evaluate the effects of planning/allocation on revenue & profit. 4. Demonstrate analytical skills through the application of industry software, to make effective merchandising decisions. Credits: 3.00

CSR 36300 - Retail Technology: Category Management

Credit Hours: 3.00. Category management is used by retailers and consumer products companies to reduce costs and increase revenue, based on consumer behavior. Technology to implement category management is used at all levels of the value chain, from producer to procurement to the retail store. Students in this course learn about the theory behind category management from both sales and retail perspectives, then apply that knowledge using industry software to create and analyze visual and data sales plans.

Learning Outcomes: 1. Demonstrate via discussion and examination, concepts of space planning and category management. 2. Create planograms using space planning knowledge and skills. 3. Develop a sales plan utilizing category management process and sales data. 4. Analyze effects on profit and revenue based on category management applications and planogram sales data. 5. Design a retail space that includes: consumer purchasing decisions, coordinates product selection and supply, shelf merchandising, promotion and pricing. Credits: 3.00

CSR 38600 - Risk Management

Credit Hours: 3.00. The course includes principles of insurance, analysis and evaluation of risk exposures, legal aspects of insurance, insurance needs and analysis, policy selection, and insurance company selection and due diligence. Types of insurance that are studied include: property and casualty, health, life, long-term care, disability and general business liability.

Credits: 3.00

CSR 39000 - Undergraduate Special Problems

Credit Hours: 1.00 to 6.00. Individual participation, supervised reading, laboratory or field experiments, or research in special areas of the field. Permission of instructor required.

Credits: 1.00 to 6.00

CSR 39500 - Special Projects

Credit Hours: 1.00 to 6.00. Individual participation in supervised undergraduate project. Open to qualified upperclassmen. Permission of department required.

Credits: 1.00 to 6.00

CSR 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for CFS Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Credits: 1.00 to 3.00

CSR 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an International experience that is recognized by the University. Permission of department required.

Credits: 1.00 to 6.00

CSR 39900 - Undergraduate Special Topics In CSR

Credit Hours: 1.00 to 6.00. Various topics that may change from semester to semester are presented by CSR faculty. Permission of department required.

Credits: 1.00 to 6.00

CSR 40300 - Retail Management Internship

Credit Hours: 3.00. A supervised full-time internship in retail and related industries. This experience will enable students to further develop their professional interests and skills. Prior field experience and completion of application and pre-approval of internship by internship director and attendance at pre- and post-organization meetings is required. Permission of department required.

Credits: 3.00

CSR 40400 - Strategic Management For Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. Through the analysis of internal and external forces, students develop strategies to help an organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of an organization. The course is structured to enhance students' analytical, critical thinking, and verbal skills by integrating academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Demonstrate through effective written and oral communication, the ability to conduct a strategic situational analysis of a service organization. 2. Develop a business strategy for a service organization. 3. Integrate and apply prior knowledge areas from your major to propose a functional strategy that aligns with the strategic vision of your service organization. Credits: 3.00

CSR 40600 - E-Retailing

Credit Hours: 3.00. To provide understanding of the technological and retail infrastructure that underlines doing retailing over the internet. Build an understanding of business strategies over the net. To identify management issues and consumer issues in e-retailing.

Learning Outcomes: 1. Understand the technological and retail infrastructure that underlies doing retailing over the Internet. 2. Learn the vocabulary to discuss e-retailing. 3. Build and understand business strategies over the Internet. 4. Acquire power to exploit any business opportunities that jump out your way. 5. Provide the ability to get your hands dirty and use some of the most important net marketing tools. 6. Understand the "business case" for Internet commerce in retailing (or other business). 7. Identify management issues in e-retailing. 8. Understand the consumer issues in e-retailing. 9. Acquire skill sets that allow a competitive market advantage in interviews, jobs and careers. Credits: 3.00

CSR 41500 - Sales Force Management

Credit Hours: 3.00. An introduction to sales force management. An examination of the sales force management process, including principles of recruiting and selecting, training, compensation, motivation, supervision, and evaluation. Planning skills, including sales force deployment and the role of the sales force in sales forecasting, are also covered.

Learning Outcomes: 1. Identify the appropriate balance between the theoretical, analytical, and pragmatic dimensions of professional sales management through discussions and examples of the diverse sales concepts, issues and activities. Credits: 3.00

CSR 41600 - Retail Supply Chain Management

Credit Hours: 3.00. Supply chain management is a set of approaches utilized to efficiently integrate all parties of the supply chain to fulfill a request from a customer. Companies like Amazon, Zara, Walmart, Toyota, Dell, and Procter & Gamble are proof that excellence in supply chain management is a must to achieve industry leadership. With increasing competition around the globe, supply chain management is both a challenge and an opportunity for companies. The main goal of this course is to introduce you to the key concepts and techniques that will allow you to analyze, manage and improve supply chain processes for different industries. The course is a combination of lectures, case studies, in-class exercises, and games with the goal of defining key tradeoffs that managers need to understand and evaluate to successfully manage complex supply chains. Quantitative tools designed to evaluate these tradeoffs will be studied and used extensively throughout the course. Topics that will be covered in this course include: Managing inventory, forecasting in supply chains, the optimal design of the supply chain, transportation and distribution, bullwhip effects and dealing with uncertainty, sourcing and supply contracts.

Learning Outcomes: 1. Develop an understanding of how supply chain management can improve operations efficiency and market responsiveness under uncertainty. 2. Utilize and apply theories, concepts, and optimization techniques in analyzing, managing and improving supply chain processes for various industries. 3. Obtain skills to assess supply chain performance and make recommendations to enhance supply chain competitiveness in today's business environment. 4. Identify current issues and trends in global supply chain management such as sustainability, consumer health, and national security. Credits: 3.00

CSR 41800 - Selling And Sales Management Capstone

Credit Hours: 3.00. A capstone course in advanced professional selling taught in a seminar format and designed to prepare students for the transition from student to professional. Students are introduced to practitioner-focused issues involved in long-term, major B2B account sales and an emphasis is placed on professional presentation skills. Students will complete a senior group research project and a major account sales project. Professional dress code from business-casual to full-business attire required based on the scheduled day-to-day activity.

Learning Outcomes: 1. Construct a complete selling and sales management program (term project). 2. Demonstrate the ability to analyze selling and sales management situations, and apply skills to solving selling and sales management problems and developing effective selling strategies (exams; quizzes; class exercises). 3. Identify how diversity, ethical, global, and multicultural considerations affect the selling and sales management decision-making processes (exams; class exercises). 4. Demonstrate effectively communication skills by the presentation of a research project in an oral presentation and in a written paper (term project presentations and project updates). Credits: 3.00

CSR 42100 - Apparel Design III

Credit Hours: 3.00. Creation of apparel product line or collection from concept to consumer. Application of principles of apparel design from rendering, technical sketches, pattern design, pattern grading, marker making, and construction of several apparel garments from the line or collection.

Credits: 3.00

CSR 48000 - Financial Counseling And Planning Internship

Credit Hours: 1.00. Supervised internship in the financial

services industry. The experience will enable students to develop their professional interest and skills. Attendance at a pre-planning meeting required. Permission of department required.

Credits: 1.00

CSR 48100 - Ethics And Behaviors In Financial Planning

Credit Hours: 3.00. As research in behavioral finance makes increasingly clear, understanding the psychology of financial behaviors is a critical skill for financial planners. Simultaneously, understanding ethical challenges to financial planners' own behaviors, and complying with new and ever more complex regulations, is a key requirement of successful and relevant financial planning and advice-giving. The course will enable students to be better financial planners by reviewing rules of behaviors for financial planners, improving students' capacity to provide fiduciary advice, and enhance their ability to integrate psychological insights into customers' financial behavior throughout the financial planning process.

Learning Outcomes: 1. Identify ethical issues and compliance matters in the field of financial counseling and planning. 2. Evaluate client and planner attitudes, values, biases, behaviors, and their impact on the financial planning relationship. 3. Demonstrate understanding of The CFP Board's Code of Ethics and Professional Responsibility and Rules of Conduct; Disciplinary Rules and Procedures, and Financial Planning Practice Standards. 4. Apply basic knowledge of behavioral finance and its impacts on clients' financial needs (including in times of crisis). Credits: 3.00

CSR 48400 - Consumer Investment And Savings Decisions

Credit Hours: 3.00. A survey of consumer investment alternatives, with emphasis on financial assets.

Learning Outcomes: 1. Analyze investment decisions and investment risk management through portfolio management, capital market equilibrium and asset pricing theories. Credits: 3.00

CSR 48500 - Case Studies In Financial Planning

Credit Hours: 3.00. Financial planning principles and practice. Course utilizes a case study approach toward financial planning for upper- and middle-income households. Business calculator required.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the content found within the Financial Planning curriculum and effectively apply and integrate this information in the formulation of a financial plan. 2. Effectively communicate the financial plan, both orally and in writing, including information based on research, peer, colleague or simulated client interaction and/or results emanating from synthesis of material. 3. Collect all necessary and relevant qualitative and quantitative information required to develop a financial plan. 4. Analyze personal financial situations, evaluating clients' objectives, needs, and values to develop an appropriate strategy within the financial plan. 5. Demonstrate logic and reasoning to identify the strengths and weaknesses of various approaches to a specific problem. 6. Evaluate the impact of economic, political, and regulatory issues with regard to the financial plan. 7. Apply the CFP Board Financial Planning Practice Standards to the financial planning process. Credits: 3.00

CSR 48600 - Retirement Planning And Employee Benefits

Credit Hours: 3.00. Analysis of employee benefit plans, retirement needs analysis, and types of retirement plans including employer-sponsored plans and participant-directed plans.

Learning Outcomes: 1. Evaluate a client's retirement income and savings need. 2. Explain important provisions of Social Security, The Affordable Care Act and Medicare. 3. Differentiate between individual Retirement Arrangements including those used by individuals and small businesses. 4. Know the rules relating to qualified retirement plans. 5. Conduct an in-depth analysis of qualified plans (e.g. defined benefit, profit sharing, 401(k)

plans, stock bonus plans, and ESOPs). 6. Employ rules and strategies for appropriate retirement decumulation. 7. Understand deferred compensation plans, stock option plans, and planning for executive compensation. Credits: 3.00

CSR 49000 - Independent Study

Credit Hours: 1.00 to 4.00. Independent study. Permission of instructor required.

Credits: 1.00 to 4.00

CSR 49700 - Honors Research Project

Credit Hours: 1.00 to 4.00. The completion of the independent honors research project for CFS Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Credits: 1.00 to 4.00

HTM 10010 - Exploring Transformational Experiences In Hospitality And Tourism

Credit Hours: 1.00. In an age where experiences have become the new currency, businesses must adapt and thrive in the experience economy to succeed. This course introduces students to the concept of transformational experiences within the experience economy, providing them with the knowledge and skills needed to navigate this dynamic landscape. Students will gain a better understanding of where their passions lie within the broader scope of hospitality and tourism, preparing them for academic and career-related success.

Learning Outcomes: 1. Describe transformational experiences that drive business success in the experience economy. 2. Outline current and trending transformational experiences in hospitality, tourism, and affiliated industries. 3. Identify potential career paths within hospitality, tourism, and affiliated industries. Credits: 1.00

HTM 10100 - Hospitality And Tourism Student Seminar

Credit Hours: 1.00. Course assists the student new to Purdue to become acquainted with the Purdue system and with the HTM department and program. Information presented to assist students with developing strategies for academic and career-related success at Purdue.

Learning Outcomes: 1. Describe the curriculum of the Hospitality and Tourism Management Department; the Purdue University registration process and apply that knowledge to plan their academic program and develop a schedule each semester at Purdue. 2. Use the principles of time management in planning their time commitments. 3. Demonstrate individual skills and interests related to career choice. 4. Define and apply civic engagement principles in the local community in service to a non-profit hospiitality or tourism related business. 5. Create a professional resume and understand the interview process in searching for employment. Credits: 1.00

HTM 14100 - Financial Accounting For The Service Industries

Credit Hours: 3.00. In today's ever-changing service industry, a strong grasp of financial accounting is crucial for effective financial management and business success. In this course, students will learn the practical skills needed to create accurate financial statements, analyze financial data, and make informed decisions.

Learning Outcomes: 1. Demonstrate an understanding of fundamental accounting principles, including the double-entry system and accrual accounting, to accurately record financial transactions and prepare financial statements. 2. Demonstrate proficiency in preparing, analyzing, and interpreting financial statements, such as income statements, balance sheets, and cash flow statements. 3. Demonstrate ability to accurately adjust for depreciation and amortization. 4. Explain and demonstrate the accounting procedures for merchandising, inventories, cost of goods, payroll, and receivables and payables. 5. Explain the principles of internal control and the role of ethics in financial reporting. Credits: 3.00

HTM 16200 - Introduction To Event And Meeting Planning Industry

Credit Hours: 3.00. Upon completion of this course, students will have a comprehensive overview of the event and meeting industry. Topics will include the supply and demand side of event and meeting management, the basic planning process needed for any event or meeting, sustainability, business ethics, and keeping pace with current industry trends through guest lectures from event and meeting planners.

Learning Outcomes: 1. Develop a comprehensive overview of the essential supply and demand components of the event industry including corporations, associations, and the government in terms of organization, type, decision makers, attendees, and marketing efforts. 2. Compare and contrast the advantages and disadvantages of major venues of hotels, convention centers, conference centers, cruise ships, and unusual venues to those who demand and plan events. 3. Identify the key players and pioneers of the event planning industry. 4. Identify the basic needs of event planners and consumers. 5. Identify the basic principles and concepts of sustainability as applied to the event management industry. 6. Summarize the major characteristics of event planning with respect to planning, directing, organizing, controlling and assessing events. 7. Identify ethical business practices associated with the event industry. Credits: 3.00

HTM 17300 - Tourism Systems

Credit Hours: 3.00. Tourism is a global phenomenon impacting destination communities, incorporating a range of hospitality-related businesses and organizations, and enriching the lives of tourists and residents alike. This course examines key elements of tourism systems, how these elements interact to deliver unique travel experiences, and how destination stakeholders can use tourism for sustainable development. The course will strengthen students' understanding of tourism systems while preparing them to successfully engage in it for a variety of career options in tourism and hospitality industries.

Learning Outcomes: 1. Explain the tourism system including the roles of travelers, tourism businesses and destinations, and other tourism system components. 2. Describe the impacts of tourism and the basic components of sustainable tourism practices. 3. Identify the key principles of destination marketing and management. 4. Describe key factors that influence consumer travel behavior including personal, interpersonal, and environmental factors. 5. Describe how to apply experience design principles to develop tourism products, services, and experiences. Credits: 3.00

HTM 18000 - Hospitality Operations

Credit Hours: 3.00. Hospitality leaders require a deep understanding of the fundamental principles and practical aspects of managing operations within the dynamic and fast-paced hospitality industry to effectively run a business. This course will address topics including principles of management, organizational structures, managerial decision-making, hospitality metrics, and the responsibilities of managers. Through these topics, the course will strengthen students' understanding of the hospitality industry as it exists today while preparing them for the industry of the future.

Learning Outcomes: 1. Describe the key principles of management. 2. Identify organizational structures, including brands, management, and ownership. 3. Compute key hospitality metrics. 4. Explain how work groups in major types of hospitality businesses interconnect. 5. Understand the responsibilities of leaders in hospitality operations. Credits: 3.00

HTM 18100 - Introduction To Lodging Management

Credit Hours: 3.00. History, features, operation procedures and management of lodging facilities both in the United States and in other parts of the world. The course involves an experiential learning component.

Learning Outcomes: 1. Describe the evolution of the lodging sector in the United States (U.S.) and around the world. 2. Identify hotel types, brands as well as management and ownership structures in 21st century lodging business. 3. Describe how work is organized in hotels. 4. State the duties and responsibilities of positions within lodging business. 5. Describe and critically evaluate front office and housekeeping procedures in hotels. 6. Identify internal and

external reports (such as the STR Report) commonly used in lodging business. 7. Compute basic key performance indicators (KPIs) (such as occupancy percent, ADR, RevPar). 8. Discuss some of the latest technological advances in lodging business. 9. Describe common unethical practices and innovative strategies in reducing such practices in lodging business. 10. Describe other tourism business sectors that interconnect with lodging. Credits: 3.00

HTM 18101 - The Union Club Hotel Experience

Credit Hours: 1.00. Hospitality businesses are complex operations requiring unique managerial approaches to deliver exceptional guest and employee experiences. The Union Club Hotel is ideally positioned to expose students to managerial roles in a multi-million-dollar asset. Students will shadow managers who oversee hotel departments and interact with corporate leaders through this experiential course while learning how managers ensure an exceptional guest experience, provide a positive employee experience, and execute efficient hospitality operations. The knowledge gained in this course is transferable to all hospitality businesses, making this course valuable for all.

Learning Outcomes: 1. Identify principles of management as demonstrated by managers of a hospitality operation. 2. Describe how various departments of a hospitality business interconnect to deliver the guest experience. 3. Describe the importance of fostering a positive work environment for hospitality employees. Credits: 1.00

HTM 19100 - Sanitation And Health In Foodservice, Lodging, And Tourism

Credit Hours: 3.00. This course introduces students to the foodservice component of the Hospitality and Tourism industry and explores food safety and other health-related issues. Application of sanitation principles in restaurants, hospitals, schools, hotels, cruise ships, airlines, and international travel are covered. Students must pass a National Sanitation Certification Examination to receive credit.

Learning Outcomes: 1. Identify the causative agents, symptoms, contributing factors to foodborne illnesses, and the processes used to prevent foodborne illnesses from occurring. 2. Describe how food should be safely handled from purchasing through service to the customer. 3. Describe the role and responsibilities of federal and state governments, local regulatory agencies, and foodservice managers in promoting and maintaining consumer food safety. 4. Describe the overall foodservice inspection system, how inspections are conducted, and how managers should use inspections to improve their food safety. 5. Describe additional health issues relevant to the foodservice, lodging and travel industries and what these industries should do in regards to these health issues. 6. Describe how to effectively communicate with government agencies and the general public as part of normal operations and during crisis management. 7. Describe what and how food safety training of employees should be done. Credits: 3.00

HTM 20000 - Career Exploration And Development Seminar

Credit Hours: 1.00. Successfully pursuing a career takes time and intentional effort to build the required expertise to compete in today's job market. As part of the professional development curriculum, this course is designed to equip students with essential skills and knowledge to start the journey in their chosen careers. Through interactive discussions, practical exercises, and guest speakers, students will gain insights into various aspects of career planning, job search strategies, personal branding, and professional growth. The course aims to help students become confident, proactive, and well-prepared professionals as they begin their time at university, while aligning with the National Association of Colleges and Employers Career Readiness Competencies.

Learning Outcomes: 1. Identify personal strengths, skills, and interests using the Strengths Finder Assessment and describe how these align with the National Association of Colleges and Employers Career Readiness Competencies. 2. Construct a professional profile, identifying areas for development in building a personal brand. 3. Explore competencies sought by employers for an

internship or entry-level position and how they link to individual skills and strengths. 4. Demonstrate proficiency in a professional interview. Credits: 1.00

HTM 20200 - Hospitality And Tourism Work Experience

Credit Hours: 1.00. This course is a supervised paid industry work experience in the hospitality and tourism industry. Students are required to present a signed agreement from their employer prior to initiating employment. Students are also required to prepare a series of work and reflective reports. A minimum of 320 work hours is required for completion during either a summer or semester period. Permission of department required.

Learning Outcomes: 1. Develop skills necessary to seek their first positions in a hospitality organization. 2. Develop skills to analyze issues in a hospitality organization through the use of various required work experience reports. 3. Analyze the culture and work environment in an organization and determine its strengths and weaknesses. 4. Identify the functions of the various departments within the specific type of operation in which they work. 5. To be able to distinguish between engaged employees and those employees who are disengaged. 6. Describe effective customer service encounters versus those which were not handled properly by their organization. Credits: 1.00

HTM 21200 - Leading For Success In Service Industries

Credit Hours: 3.00. Effective leaders possess knowledge of organizational behavior and skills which provide the capacity to enhance organizational performance. Drawing upon leadership and organizational behavior theories, this course will provide students with the tools necessary to lead teams in service industries. Areas of focus include understanding individual differences and team dynamics, motivating and developing employees, effective decision-making, communication, influence, diversity, and leading change. This course will include preparation for a leadership development certificate, such as the Dale Carnegie Leadership certificate, to be earned upon successful completion of the course.

Learning Outcomes: 1. Describe the roles of managers and leaders in hospitality and tourism and the concepts of organizational efficiency and effectiveness. 2. Identify and explain basic management principles of planning, organizing, directing and controlling as applied to the hospitality and tourism business. 3. Identify basic leadership skills that effective managers in the hospitality and tourism industry possess, including business communication, motivation, decision making, and change management. 4. Identify contemporary management and leadership issues facing the hospitality and tourism industry. 5. Explain the basics of human behavior in organizations, including individual behavior and team dynamics. 6. Discriminate between ethical and non-ethical behaviors on the part of individuals inside and outside the organization. 7. Analyze the impacts of culture and diversity on organizations. Credits: 3.00

HTM 21800 - Creating Experiences For A Diverse Society

Credit Hours: 3.00. This course will provide students with knowledge and skills related to diversity, equity, and inclusion (DEI), and provide students an opportunity to actively increase their cultural competence to help them work with others effectively in professional settings. The course provides frameworks, terminology, and tools for engaging in productive conversations around difficult topics related to DEI. Students use critical and reflective thinking, as well as effective problem solving to create inclusive experiences for all stakeholders.

Learning Outcomes: 1. Define and apply terminology and concepts related to diversity, equity, and inclusion (DEI). 2. Develop awareness and knowledge of DEI best practices to create inclusive experiences for all stakeholders. 3. Demonstrate an understanding of issues related to DEI within the White Lodging-J.W. Marriott, Jr. School of Hospitality and Tourism Management disciplines. 4. Engage in inclusive and interdisciplinary collaborations. 5. Apply best practices to address and propose solutions to current DEI topics within students' academic disciplines. 6.

Demonstrate effective oral, written, and visual communication. Credits: 3.00

HTM 23100 - Marketing In Service Industries

Credit Hours: 3.00. Marketing plays a crucial role in service industries, addressing unique service challenges. Its importance lies in engaging customers, establishing trust and credibility, distinguishing from competitors, boosting revenue, and fostering sustainable growth and success. This course equips students with a customer-centric approach to service industry marketing, emphasizing the integral role of marketing in a service organization's strategic planning. The course exposes students to service marketing principles, components, and marketing practices.

Learning Outcomes: 1. Explain the unique challenges in marketing and managing services. 2. Describe the role of marketing in supporting the strategic direction of a service organization. 3. Evaluate the role of the service marketing mix in solving marketing related problems and promoting the overall success for service organizations. Credits: 3.00

HTM 24100 - Managerial Accounting In Service Industries

Credit Hours: 3.00. Interpreting, analyzing, and making decisions based on financial data are core management competencies critical for business success. This course is designed to enable students to interpret and analyze financial data within dynamic and fast-paced service industries. This course focuses on the application of accounting principles, financial tools, and decision-making strategies in service industries.

Learning Outcomes: 1. Analyze financial statements to evaluate company performance and make recommendations. 2. Utilize cost behavior to make pricing decision. 3. Prepare financial budgets and conduct variance analysis. 4. Prepare the statement of cash flows and develop strategies for cash management. 5. Use time value of money to make investment decisions. Credits: 3.00

HTM 25500 - Advanced Spreadsheet Techniques For Hospitality And Tourism Management

Credit Hours: 2.00. This course builds upon information and skills obtained in an entry-level-computing course. It will take students to the next level by introducing them to more advanced techniques used in Hospitality, Tourism, Retail, and Sales Management.

Learning Outcomes: 1. Demonstrate proper utilization of spreadsheet techniques to effectively organize and analyze data for management presentations. 2. Explain the purpose of selected spreadsheet techniques and describe how they are used in Hospitality, Tourism, Retail, and Sales Management. 3. Demonstrate advanced spreadsheet techniques, such as: Advanced Spreadsheet Formulas; Statistical Analysis; Validating Data Entry; Conditional Formatting; Advanced Charting Techniques; Pivot Tables; Spreadsheet Dashboards; Recording and Using Spreadsheet Macros; Power Query; Advanced Cell/Column/Row/Table Formatting; Creating Templates. Credits: 2.00

HTM 25501 - Fundamentals Of Excel And Data Analytics In Service Industries

Credit Hours: 3.00. The proper application of data analytics is important for optimizing the performance of service enterprises. Spreadsheet programs make it easy to manage and visualize data as well as perform basic data analyses. Microsoft Excel is one of the primary tools used for business reporting and decision-making tasks. In this course, students will receive hands-on training in a wide range of Excel functionalities including using functions and formulas, working with tables, creating charts, and analyzing data using PivotTables. This course will use practical, real-world applications to train students how to make business decisions.

Learning Outcomes: 1. Apply built-in Excel functions and create formulas necessary to analyze data. 2. Apply data visualization techniques to identify and communicate business issues. 3. Demonstrate proficiency using Excel to formulate and solve business problems. Credits: 3.00

HTM 26200 - Festivals And Special Events

Credit Hours: 3.00. This course offers a comprehensive overview of the theory and procedures associated with the

coordination of festivals and special events. Essential topics will include the conceptualization, planning, coordination, sponsorship, marketing, funding, staffing, legal issues, and assessment of festivals and special events. Students will gain hands-on experience by volunteering to work a minimum of six hours to set up, help coordinate, or tear down a large-scale festival or special event.

Learning Outcomes: 1. Classify the types and purpose of festivals and special events. 2. Compare and contrast traditional events and meetings to festivals and special events. 3. Develop a basic understanding of the size and scope and the employment potential of festivals and special events. 4. Describe the key steps necessary to plan, manage, staff, organize, and assess the stated objectives of a festival or special event. 5. Knowledge of economic, financial, and accounting principles and practices of festivals and special events. 6. Apply the principles of sustainability to festivals and special events. 7. Read relevant research and apply it to festival and special events management. 8. Differentiate between ethical and non-ethical business practices. Credits: 3.00

HTM 29001 - Food And Beverage Management

Credit Hours: 3.00. Food and beverage (F&B) operations are integral to the hospitality and tourism industry. This course equips students with the foundational knowledge needed to directly manage commercial and non-commercial F&B operations and successfully partner with external F&B providers in lodging, events, tourism, and other hospitality settings. Students are introduced to how F&B processes are integrated with marketing, procurement, and financial management. Students must pass accredited industry recognized certification exams.

Learning Outcomes: 1. Describe food and beverage (F&B) operations terminology, processes, equipment, and technology. 2. Demonstrate management competency in responsible and safe service of food and beverages by passing accredited exams in food protection management and safe service of alcohol. 3. Demonstrate how menu development and management contribute to the success of F&B operations. 4. Analyze ethical dilemmas in F&B operations. Credits: 3.00

HTM 29101 - The John Purdue Room Restaurant Experience

Credit Hours: 2.00. Hospitality enterprises are complex, requiring experience in operations and customer service to ensure organizational success. The John Purdue Room (JPR) is uniquely positioned to provide students with experiential learning in a restaurant operation. Students rotate through staff and management positions in various roles. Production methods, equipment and product flow are covered in the back-of-the-house, while customer service and service recovery techniques are practiced in the front-of-the-house. Management skills learned and practiced in the JPR are transferable to all service industries.

Learning Outcomes: 1. Demonstrate the principles of exceptional customer service. 2. Demonstrate the styles of service, proper table set-up, and food presentation and delivery. 3. Demonstrate the appropriate use of food ingredients and preparation methods. 4. Demonstrate safe food handling, sanitation, and workplace safety practices. 5. Demonstrate effective teamwork, including professional behavior, cooperating with peers, and handling group dynamics. Credits: 2.00

HTM 29102 - Introduction To Foodservice Management

Credit Hours: 3.00. An introduction to food preparation methods and service techniques in quantity food settings. Students become familiar with ingredients and culinary terminology, and learn to read, write and evaluate menus. Recipe conversion, inventory and costing skills are developed. Production methods, equipment, and product flow are examined. Front-of-the-house service techniques as well as front-and-back-of-the-house interactions will be studied.

Learning Outcomes: 1. Describe kitchen operations including culinary terminology, basic cooking methods, equipment and technology, and basic food handling skills, such as food preparation, safety, and quality. 2. Describe service techniques including a la carte and buffet setup and service, cycle of service

(ordering through payment), tableside cooking and service recovery. 3. Describe and demonstrate proper kitchen management systems, such as cost control, inventory control, sales history, and menu development. 4. Explain the importance of timing and quality production in regards to the distribution of goods and services. 5. Describe the relationship between international foods and factors, such as geography, climate, and culture. 6. Identify current foodservice trends, such as: healthy food, menu labelling, and sustainability. 7. Discriminate between ethical and non-ethical behavior on the part of individuals and organizations. Credits: 3.00

HTM 29700 - Introduction To Honors Research

Credit Hours: 1.00. Introduces students to the design and implementation of an honors research project.

Credits: 1.00

HTM 30000 - Semester Internship Experience In Hospitality And Tourism

Credit Hours: 0.00. Mechanism to recognize students in the Purdue system the semester they are off campus participating in an approved semester internship program with a hospitality company. Permission of department required.

Credits: 0.00

HTM 30200 - Hospitality And Tourism Industry Internship I

Credit Hours: 1.00 or 2.00. Opportunities for learning through professional work experience that is practical, meaningful, and aligned with career aspirations are important for career development, planning, and goal setting. As part of the professional development curriculum, this internship course provides students with entry-level experience within the hospitality and tourism industry, broadening their exposure and understanding of the industry to explore potential career paths. Guided by the Ray Kavanagh Career Center and the National Association of Colleges and Employers (NACE) Career Readiness Competencies, students apply what they are learning in the classroom to the workplace.

Learning Outcomes: 1. Develop and apply interviewing and negotiating skills during the process of seeking and being hired into an internship. 2. Recall and explain the strengths and weaknesses of departments and work units from the hospitality operation in which they interned. 3. Describe and explain interactions with the hospitality operation's guests and the development of a positive service oriented attitude. 4. Compare and contrast the differences and similarities of management styles and leadership skill of the supervisors they worked with; evaluate the effectiveness of supervisor or manager; analyze which type of style or skill fits best with their style. 5. Identify new and different experiences encountered during the internship; distinguish the positive and negative aspects of the experience, and appraise these experiences as to their value to their future Hospitality management career. 6. Recall coursework related knowledge and apply and demonstrate this knowledge in areas of Human Resource Management, Finance, Management, Law, and other applicable areas in a hospitality organization. 7. Synthesize the total internship learning experience by completing comprehensive management reports. Credits: 1.00 or 2.00

HTM 31100 - Procurement Management For Foodservice

Credit Hours: 3.00. Identifies and describes food, supplies, and related merchandise used in the foodservice industry. Provides methods and criteria for recognizing quality, evaluating, specifying, purchasing, and inspecting these products. Discusses the use of technology in the purchasing component of the foodservice industry.

Learning Outcomes: 1. Explain foodservice procurement principles such as steps in the procurement process, procurement-menu relationship, quality standards, and vendor relations. 2. Explain factors impacting procurement decisions such as ethics, government regulations, global economic conditions, sustainability, distribution sales channels, technology, competitors, consumer

behavior, and skills and knowledge of buyers. 3. Apply foodservice procurement principles, factors, and data analysis to formulate decisions related to product, quantity, price, supplier/producer/manufacturer, and inventory management. Credits: 3.00

HTM 31200 - Talent Management For Service Industries

Credit Hours: 3.00. Service organizations are labor-intensive, requiring effective talent management to be successful. Managers must be able to attract, develop, motivate, and retain employees to deliver exceptional service. Building on leadership skills and management principles, this course will emphasize the strategic role of human resource management with topics that span the lifecycle of a job (e.g., recruitment, selection, training, performance management, compensation, etc.). Students will explore the science behind effective talent management, developing knowledge and skills that will prepare them to manage a growing and diverse workforce.

Learning Outcomes: 1. Explain the importance of the various elements of strategic human resource management and their contribution to organizational performance. 2. Critique human resource practices by applying theories and research. 3. Create solutions that would address current human resource issues in service industries such as associate engagement, diversity, ethics, and employee well-being. Credits: 3.00

HTM 31400 - Franchising

Credit Hours: 3.00. The study of franchise administration, operations, and marketing, with a special emphasis on hospitality-related franchises. Includes a study of the legal regulation of franchises, the franchisee-franchisor relationship, and unique problems in operating a franchise.

Credits: 3.00

HTM 31500 - Club Management And Operations

Credit Hours: 3.00. A study of the organization, administration, operation, and opportunities within the private club industry, with emphasis on the manager's duties.

Learning Outcomes: 1. Describe the various types of clubs, and the job of a club manager, including attributes of successful club managers. 2. Describe the career prospects in managing clubs; the issues facing clubs today and prospects for the future of the club industry. 3. Explain the fundamentals of good human resource management as it applies to clubs. 4. List issues that are unique or particularly significant to clubs, including legal, technological and financial issues. 5. Explain the differences and similarities between clubs and public hospitality operations. 6. Describe and discuss the products, activities and services in the club industry and how a manager works toward identifying, understanding and improving these in their club. Credits: 3.00

HTM 31700 - Business Etiquette For Managers

Credit Hours: 1.00. A review of contemporary standards of human interaction in the workplace. How manners, etiquette and style affect and enhance everyday dealings with others.

Credits: 1.00

HTM 32200 - Hospitality Facilities Management

Credit Hours: 3.00. Technical and managerial issues relating to the operation and maintenance of the physical plant and equipment in hospitality industry facilities.

Learning Outcomes: 1. Develop systematic solutions to a wide range of facility management problems and evaluate those potential solutions to ensure they are fiscally sound. 2. Explain how systems within a facility function, and what is involved in keeping them functioning properly. 3. Describe what's involved in operating a maintenance department and evaluate their efforts. 4. Describe how to make facilities more sustainable reduce its negative environment impact both during construction and operation. 5. Describe the different regulatory requirements that apply to hospitality facilities such as building codes, licensing, and permit requirements and state the importance of compliance with those requirements. Credits:

3.00

HTM 33100 - Hospitality And Tourism Sales And Service

Credit Hours: 3.00. Application of sales and customer service methods used to generate revenues for hospitality and tourism businesses. Emphasis is placed on a hands-on assignment which requires students to identify a product that they will market and sell, as well as participate in a sales blitz.

Learning Outcomes: 1. Develop systematic solutions to a wide range of facility management problems. 2. Explain how systems within a facility function, and what is involved in keeping them functioning properly. 3. Describe what's involved in operating a maintenance department and evaluate their efforts. 4. Describe the functions of the major pieces of food service equipment and how to purchase each. 5. Describe how operations can conserve utilities and the basic criteria for LEED certification. 1. Apply marketing principles to the sales process in hospitality and tourism industry. 2. Distinguish between ethical and non-ethical behaviors on the part of sales professionals. 3. Identify the buying style of the customer and adapt sales pitch and pace to maximize sales potential. 4. Design a strategy to work with others to accomplish sales goals. 5. Identify, market, and sell a tangible product to the general public. 6. Apply professionalism and customer service principles to the sales process. 7. Apply fundamental accounting skills to formulate, monitor, and accomplish self-imposed sales goals. 8. Apply sales techniques in an actual hospitality and tourism business setting. Credits: 3.00

HTM 34100 - Operations Control And Analysis In The Hospitality Industry

Credit Hours: 3.00. Applications of the control process and quantitative analysis to effectively manage an efficient and profitable hospitality business. The emphasis is on planning budgets, controlling operational activities, and evaluating performance.

Learning Outcomes: 1. Explain the importance of control process to the success of an operation. 2. Describe behavior of costs and evaluate their effects on the operating income in the hospitality industry. 3. Analyze and interpret financial statements. 4. Establish appropriate cost standards and procedures in each state of the product cycle. 5. Construct a labor schedule that will satisfy customer demand, meet employee requests, and keep labor cost down. 6. Apply regression, moving average, and exponential smoothing to forecasting revenue and customer counts. 7. Identify and eliminate excessive food and beverage costs and describe how to eliminate them. 8. Develop an operating budget based on revenue and expense forecasts. 9. Apply revenue management concepts to create demand and maximize revenue for the given demand in restaurants. 10. Prepare visual representations of operational and financial data. Credits: 3.00

HTM 34200 - Financial Management For Service Industries

Credit Hours: 3.00. To create value for owners, managers need to understand the implications of long-term investment and the importance of securing finance to ensure sustainable growth. The primary purpose of this course is to understand the role of financial management, to learn analytic concepts and managerial tools for making capital investment decisions and to become familiar with major financial instruments and concepts such as time value of money, risk-return, capital budgeting, cost of capital, and capital structure.

Learning Outcomes: 1. Identify financial management roles and describe the agency problem in hospitality and tourism businesses. 2. Demonstrate proficiency in using Excel to model cash flows and calculate returns in the capital budgeting process. 3. Explain how the risk-return relationship affects cost of capital and stocks/bonds valuation. 4. Explain how capital structure affects firm value and dividend decisions. Credits: 3.00

HTM 35700 - Disruption And Innovation In Hospitality & Tourism

Credit Hours: 3.00. Hospitality and tourism businesses face unprecedented industry shifts requiring proactive leaders. Through this course students will develop an innovative mindset, rethink the status quo, and amplify their creative thinking in designing solutions to current and future business challenges.

Learning Outcomes: 1. Describe innovation theories and trends. 2. Explain how building and sustaining a culture of innovation is a competitive advantage. 3. Describe the core aspects of an end-to-end innovation process. 4. Develop and evaluate innovative solutions to product and service challenges. Credits: 3.00

HTM 36200 - Event And Meeting Management

Credit Hours: 3.00. The principles and practices of event and meeting management will be covered in this course, including: strategic event planning process, project management, risk management, financial management, human resources, stakeholder management, meeting or event design, site location and management, marketing, professionalism, and ethics. Students will gain hands-on experience planning, directing, organizing and controlling a small-scale event.

Learning Outcomes: 1. Determine the purpose of a meeting and identify the relationship of a meeting to organizational strategy. 2. Develop and manage a budget for a meeting/event. 3. Develop the complete plan to meet the goals and objectives of the event (such as reserving rooms, securing meeting space, transportation, and food and beverage). 4. Review the event to determine if the goals and objectives were met. 5. Differentiate between ethical and non-ethical business practices. 6. Work with a team to plan, direct, organize and control a small scale event. Credits: 3.00

HTM 37000 - Sustainable Tourism And Responsible Travel

Credit Hours: 3.00. This course will examine issues associated with sustainability in the hospitality and tourism industry. It will examine how principles of sustainable development and the triple bottom line (economic, social and environmental) are applied to hospitality and tourism. The course will address sustainability across a variety of tourism sectors including destination management, lodging, restaurants and meetings. The course will also examine consumer issues associated with sustainability.

Learning Outcomes: 1. Define sustainability and describe its applications in the tourism and hospitality system. 2. Explain the relationship between tourism and the UN Sustainable Development Goals/Grand Challenges. 3. Describe the components of sustainability programs in tourism and hospitality organizations. 4. Analyze sustainability programs in various tourism sectors to determine their effectiveness in achieving social and environmental goals. 5. Apply and evaluate environmental performance programs in the hospitality industry. 6. Explain the major consumer issues associated with sustainability in the tourism and hospitality industry. 7. Identify and explain principles of ethics as applied to the tourism industry. 8. Identify career opportunities associated with sustainability in tourism and hospitality. Credits: 3.00

HTM 37200 - Global Tourism Geography (UCC: BSS)

Credit Hours: 3.00. Introduction and analysis of specific world travel destinations, including the exploration of geographic features, customs and tradition, population centers, visitor attractions, political, religious, language and other cultural differences as these relate to the hospitality and travel industry. The course is designed to teach students specific geographic knowledge and develop a deeper understanding and empathy for cultural values and traditions that exist outside their own culture.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Identify and explain the interactions of tourism with the culture, economy, and environment of global destinations. 2. Identify international travel patterns and explain their impact on tourism management in promoting cultural understanding and global peace. 3. Locate various countries, major cities, natural wonders,

historic sites and other tourism attractions, both man-made and natural. 4. Describe how the physical environment in specific geographic regions affects the ability of humans to live there and influences inbound and outbound travel. 5. Explain how political, economic, and environmental factors affect travel both positively and negatively. 6. Explain international travel patterns and identify the major travel generating and travel receiving areas. 7. Compare and contrast different cultures throughout the world with your home culture. Identify and explain key differences and their influence on travel. 8. Identify and explain the key elements of interdependence required for the existence of modern day world travel. Credits: 3.00

HTM 38110 - Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management plays a vital role in guiding service businesses to allocate resources efficiently, understand customer behavior, stay competitive, and achieve long-term sustainability and profitability. This course provides students with the theoretical foundation and practical applications of revenue management in service industries. The course cultivates students' revenue optimization mindset and analytical skills. Students will have the opportunity to earn an industry-recognized certification.

Learning Outcomes: 1. Describe the evolution of revenue management in lodging business. 2. Explain commonly used terms in revenue management. 3. Describe the duties and responsibilities of the hotel revenue manager. 4. Demonstrate knowledge of common revenue management activities. 5. Apply the concepts of constrained capacity, market segmentation, and differential pricing when setting prices. 6. Forecast demand. 7. Explain the trade-off between dilution and spoilage when allocating capacity. 8. Set Booking limits with overbooking policies. 9. Explain the role of distribution channels in market competition. 10. Apply revenue management fundamentals to other areas of lodging business such as to food and beverage and meeting and events in hotels. 11. Differentiate between ethical and unethical practices in revenue management. 12. Identify latest technologies used in revenue management. 13. Discuss contemporary issues affecting revenue management." Credits: 3.00

HTM 38600 - Fundamentals Of Hotel Asset Management

Credit Hours: 3.00. The value of a hotel is based on both its operation and the real estate holding. A successful manager needs to understand the relationship between operations and the management of the real estate asset. Hotel asset management involves overseeing operating performance and real estate planning with the goal of achieving long-term profitability and enhancing the value of the hotel property. This course will introduce students to the principles and practices of hotel asset management including real estate management, contracts, as well as the planning and execution of hotel investments. Students with an interest in hospitality finance and real estate investment are encouraged to take graduate-level courses in this area and explore the finance and real estate minors following the successful completion of this course.

Learning Outcomes: 1. Explain the foundations and process of asset management. 2. Identify the key issues related to planning and managing real estate and physical assets. 3. Analyze the effects of contracts on hotel operations and asset value. 4. Apply financial theories and concepts in planning and executing hotel investments. Credits: 3.00

HTM 39000 - Undergraduate Special Problems

Credit Hours: 0.00 to 6.00. Individual or group participation in supervised reading, laboratory experiences, field experiences, or research in special areas of the field. Permission of instructor required.

Credits: 0.00 to 6.00

HTM 39001 - Undergraduate Research In Hospitality And Tourism Management

Credit Hours: 1.00 to 3.00. This course allows undergraduate students to gain valuable experience and knowledge through research in the hospitality and tourism industry. Permission of instructor required.

Learning Outcomes: 1. Demonstrate a basic

understanding of research by participating in a research project under the supervision and guidance of a HTM faculty member. Credits: 1.00 to 3.00

HTM 39200 - Classical Cuisine

Credit Hours: 1.00. Supervised hands-on cooking experience to enhance competencies needed in professional cooking. Permission of instructor required.

Credits: 1.00

HTM 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for CFS Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Credits: 1.00 to 3.00

HTM 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an international experience that is recognized by the University.

Credits: 1.00 to 6.00

HTM 39900 - Special Topics In HTM

Credit Hours: 1.00 to 6.00. Various topics that may change from semester to semester are presented by HTM faculty.

Credits: 1.00 to 6.00

HTM 40000 - Career Mastery: Navigating Your Career And Professional Development Seminar

Credit Hours: 1.00. Successful professionals possess a strong sense of self and the ability to observe the world around them, reflecting, synthesizing, and responding effectively. As the capstone to the professional development curriculum, students have the ability to refine these skills through discussion and reflection in this seminar-style course. Guided by the National Association of Colleges and Employers (NACE) Career Readiness Competencies, this course focuses on honing various aspects of personal and professional development, with a focus on contemporary issues in the workplace, ensuring students are prepared to be effective leaders. Students will be confident, proactive, and well-prepared professionals with a mindset required to successfully transition into the professional world.

Learning Outcomes: 1. Demonstrate a strong sense of professional self-awareness, leadership competencies, and areas for future development. 2. Refine personal brand that best positions self in the competitive job market. 3. Critique complex workplace issues to formulate effective leadership strategies. 4. Formulate a career plan trajectory to achieve identified career goals post-graduation. Credits: 1.00

HTM 40200 - Hospitality And Tourism Industry Internship II

Credit Hours: 1.00. Career development is an ongoing process of refinement and reflection of professional aspirations as one moves along their career path accumulating work experience. As part of the professional development curriculum, and building on the HTM 30200 entry-level internship experience, this course provides students with a graduate-ready experience in their chosen field, focusing on leadership skill development. Through hands-on experiences and guided learning, students gain real-world professional experience while refining their leadership abilities. Students reflect on their performance to foster personal growth in preparedness for careers post-graduation.

Learning Outcomes: 1. Apply theoretical knowledge gained in the classroom to the workplace. 2. Practice career readiness competencies as defined by National Association of Colleges and Employers (NACE) to entry-level management experience. 3. Demonstrate proficiency in effective leadership skills and styles relevant to an entry-level management position. 4. Assess leadership skill development and strengths through self-reflection. Credits: 1.00

HTM 41100 - Hospitality And Tourism Law

Credit Hours: 3.00. Legal issues can damage or even destroy businesses. The primary goal of this course is to educate students to identify behaviors and situations that are likely to result in legal liability for themselves and their operation. By identifying potential legal liabilities, students will be able to develop strategies to reduce their exposure and better determine when to involve a lawyer. Topics include court procedures, civil rights, contracts, negligence, legal and ethical relationships with patrons, employment law, real estate law, ethics, and risk management. Students will use critical thinking and effective problem-solving to analyze cases and determine potential ways to reduce the likelihood of similar legal problems in the future.

Learning Outcomes: 1. Discuss the framework of the legal system and how a case progresses. 2. Analyze legal and ethical standards for hospitality and tourism enterprises including interactions with guests, other patrons, tenants, suppliers, and employees to determine potential consequences if they have not been met. 3. Analyze torts impacting hospitality and tourism enterprises and describe their legal impacts. 4. Describe the dynamics of risk management and develop strategies to mitigate losses. Credits: 3.00

HTM 42200 - Hospitality Facilities Design And Management

Credit Hours: 3.00. The facility is the largest asset for most hospitality operations and profoundly impacts guest experience. How it is designed and managed can be the difference between operational success and failure. The primary goal of this course is to foster student understanding of facility design and physical plant maintenance. Students will learn standard language and concepts along with problem-solving and project management techniques to enable cost-effective decisions in creating a physical environment that maximizes the guest experience.

Learning Outcomes: 1. Explain how systems within a facility function and are maintained in a cost-effective, environmentally friendly manner that meets regulatory requirements and promotes a welcoming, safe environment for employees and guests. 2. Analyze a wide range of facility design and physical plant problems and improvement opportunities to develop cost-effective solutions using systematic problem-solving techniques. 3. Apply standard project management tools and techniques to design a hospitality facility space, including physical plant elements, that promotes a positive guest experience that is ergonomically friendly to guests and employees. Credits: 3.00

HTM 43600 - Customer-Centric Service Design And Management

Credit Hours: 3.00. This course explores and informs the design, management, and innovative strategies of customer-centric firms through the theoretical and empirical services management literature. The course uses conceptual frameworks and cases from a variety of industry sectors.

Learning Outcomes: 1. Describe and apply basic service management principles. 2. Identify strategies that satisfy both customer needs and business performance. 3. Create a service blueprint and use it to inform service design or redesign. 4. Explain how service management differs from customer service. 5. Perform a service audit. 6. Design service strategies. 7. Describe how to develop a service centric culture. 8. Develop strategies that optimize tangible and intangible returns on service excellence. Credits: 3.00

HTM 44100 - Financial Management For The Hospitality Industry

Credit Hours: 3.00. This course deals with subjects and issues facing a financial manager in the hospitality and tourism industry. The primary purposes of this course are to understand the role of financial management, to learn analytic concepts and managerial tools for making capital investment decisions and to become familiar with major financial instruments and concepts such as time value of money, risk-return, capital budgeting, cost of capital, capital structure.

Learning Outcomes: 1. Identify financial management roles and describe the agency problem in hospitality and tourism businesses. 2. Explain financial statements and perform financial statement analysis. 3. Utilize financial concepts/tools such as the time value of money. 4. Apply applicable capital budgeting techniques to the hospitality and tourism industry. Determine initial investment cash flows. 5. Explain the concepts of risk/return, and risk preference, investment portfolio, and the Capital Asset Pricing Model (CAPM). 6. Explain the cost of capital concept, cost of debt and stock, weighted average cost of capital, and marginal cost and investment decisions. 7. Explain a firm's capital structure and describe how to choose optimal capital structure. 8. Explain dividend fundamentals and describe factors

affecting dividend policy. 9. Describe interest rates, bond valuation, and stock valuation.
Credits: 3.00

HTM 44300 - Hospitality Operations Control And Analysis

Credit Hours: 3.00. To be successful, a business must maximize revenue and efficiently control costs. This course will equip students with the knowledge and skills needed to plan, analyze, and control service operations. Students will learn essential managerial skills such as establishing operational standards, forecasting sales, budgeting, controlling, and evaluating performance throughout the product cycle.

Learning Outcomes: 1. Identify and monitor operational standards at each stage of the product cycle. 2. Analyze financial statements to identify the strengths and weaknesses of a business. 3. Make business decisions based on the cost structure and business environment. 4. Forecast future demand based on historical and advanced booking data. 5. Develop operational plans and incorporate in operations budgeting.
Credits: 3.00

HTM 46200 - Advanced Event And Meeting Management

Credit Hours: 3.00. Advanced aspects of meeting and event management principles and practices will be covered in this course. A focus is placed on: strategic planning, project management, finance and risk management, event design, site management, and ethics.

Learning Outcomes: 1. Formulate mission, goals and objectives to ensure effective meeting management and monitor and evaluate activities to ensure they meet desired outcomes and contribute to event effectiveness and sustainability. 2. Management meeting or event to achieve mission, goals and quality standards within the meeting's scope, time and budget. 3. Prepare and determine program components and sequence; development selection criteria for, negotiate and execute contracts for speakers; determine food and beverage requirements; design environment (themes and decor) and requirements for staging and technical equipment and production; develop admittance credential systems and related crowd management control systems. 4. Develop, monitor and revise project budget; monitor revenue streams and cash flow; make ongoing effective decisions and wise resource allocations; manage registration processes. 5. Identify and analyze risks for a specific meeting. 6. Develop and implement risk management plans to reduce the probability and impact of undesirable situations. 7. Differentiate between ethical and non-ethical business practices.
Credits: 3.00

HTM 49000 - Independent Study

Credit Hours: 1.00 to 4.00. Independent study. Permission of instructor required.

Credits: 1.00 to 4.00

HTM 49110 - Wine Sommelier Certification

Credit Hours: 1.00. This course involves the application of previously learned information about the principles of wine including vine growing, wine production, sensory evaluation of wine and practices involved in selection and sales of wine in a foodservice establishment. Students are immersed in the analysis and application of the principles and practices of the Guild of the Master Sommelier Program including Level one Certification. Student must be at least 21 years of age.

Learning Outcomes: 1. Describe the historical role of the wine sommelier and the purpose of the International Guild of the Master Sommelier. 2. Identify the major global wine producing regions in terms of Terroir, wine grape growing and wine making practices and traditions specifying whether the region is an Old World or New World area. 3. Identify wine production methods, quality standards, merchandising and pairing with food items for any given wine product. 4. Identify, describe and apply the Guild of the Master Sommelier Wine Evaluation process to specific wine types. 5. Identify and describe (given a specific wine producing

region) the quality control system for that region or area and the wine production factors that are controlled through those regulations; a representative wine for each specific wine producing sub-region and/or district of that region, and specific production steps and wine production terms for the wine produced there. Credits: 1.00

HTM 49111 - Beverage Operation Management

Credit Hours: 1.00. This course teaches students the historical background and modern day principles and management practices regarding the production, selection, purchasing, storage, and service of beverage alcohol in all aspects of the hospitality industry. Students must pass the ServSafe Responsible Service of Alcohol certification examination to earn course credit.

Learning Outcomes: 1. Describe the historical role of alcoholic beverages and the beverage operation in our society. 2. Describe and explain the strategies involved in management of a modern day operation selling beverage alcohol including the design and layout of the operation. 3. Identify the components necessary to manage a successful beverage operation, including purchasing, distribution, and security of beverage alcohol; cost control and pricing strategies; maintaining and controlling inventory. 4. Identify and describe how legal, ethical and social responsibilities impact the management of a beverage alcohol operation. 5. Identify, describe and apply the principles, policies and actions necessary to serve beverage alcohol in a responsible manner. 6. Identify the role of marketing and merchandising in the overall management of a beverage operation. Credits: 1.00

HTM 49112 - Management And Service Of Beverage Alcohol

Credit Hours: 2.00. This course introduces the principles and practices associated with the production of beverage alcohol in the hospitality industry. Lectures and structured tastings will guide students in identifying and describing the unique characteristics of fermented beverages commonly found in the hospitality industry. Course fee. Students will be tasting alcohol as part of this course, they need to be at least 21 years of age to do so legally. Department permission required.

Learning Outcomes: 1. Identify and describe the categories of beverage alcohols including spirits, wine, beer, and ale including the factors involved in the fermentation and distillation of beverage alcohols. 2. Describe and explain the major global wine producing regions and production practices, product varieties, characteristic flavors, service styles, and appropriate food pairings associated with wine. 3. Identify and describe the agricultural principles associated with viticulture, such as geography, climate, harvesting, and dominant grape varietals, and their impact on wine production. 4. Describe and explain regional differences in the labeling of wine. 5. Identify and describe the specific factors unique to wine, through structured tastings. 6. Describe and explain the production methods, styles and characteristics associated with the production of beers, ciders, ales, and distilled beverage alcohols. 7. Identify and describe the specific factors unique to beer, ciders and ales, through structured tastings. 8. Identify and describe the specific factors unique to distilled beverage alcohols, through structured tastings. Credits: 2.00

HTM 49200 - Advanced Foodservice Management

Credit Hours: 4.00. Utilize managerial skills and techniques with planning, organizing, directing and controlling a full-service restaurant operation. Management teams of two to three students develop, market, and operate a restaurant that is open to the public. Emphasis is placed on utilizing effective management skills to create a high-quality, profitable operation with well planned systems and highly motivated, organized employees.

Learning Outcomes: 1. Identify and apply the principles of idea generation and brainstorming in the development of a restaurant concept;

demonstrate the ability to design a menu and marketing campaign responsive to the economic and aesthetic requirements of the concept. 2. Demonstrate the ability to forecast production schedules and staffing needs; explain and demonstrate the ability to work cohesively in a team environment, and demonstrate an appropriate level of professional supervision of a restaurant concept. 3. Apply principles of production flow and timing; demonstrate facility and equipment operation and maintenance and demonstrate competency in utilizing a POS system in the current restaurant concept. 4. Apply principles of purchasing and selection of materials; product storage and rotation and service quality appropriate to the current restaurant concept. 5. Demonstrate the ability to analyze and effectively decrease food costs and increase contribution margins to the current restaurant concept. 6. Identify and apply principles of safety and sanitation (in accordance with Indiana law), and principles of quality food production and wine service to the current restaurant concept. 7. Describe and apply an appropriate ethical standard of conduct in dealings with customers, staff, fellow students and instructors in all parts of the lab and classroom experience. Credits: 4.00

HTM 49201 - Hospitality Operation Management And Leadership

Credit Hours: 4.00. Students apply managerial skills and techniques in organizing, directing and controlling a full-service restaurant operation as they rotate through a variety of managerial positions. Students will also participate in lectures, assignments, and projects on topics related to leadership, such as interpersonal communications (emphasis on culture, gender and age differences), ethical leadership (emphasis on integrity and credibility), public speaking, teamwork and critical thinking. Permission of department required.

Learning Outcomes: 1. Design and implement a marketing campaign targeting one or more of the food service operations. 2. Work cohesively in a team environment, and demonstrate an appropriate level of professional supervision of a restaurant. 3. Coordinate production flow and sequence of service to maximize service quality. 4. Demonstrate facility and equipment operation and maintenance in the restaurant. 5. Apply principles of purchasing and selection of materials, product storage, and rotation appropriate to the restaurant. 6. Identify and apply principles of food safety and sanitation, responsible alcohol service, and quality food production in the restaurant. 7. Describe and apply appropriate ethical standards in dealings with customers, staff, fellow students and instructors in all parts of the lab and classroom experience. 8. Demonstrate the ability to analyze and effectively decrease food costs and increase contribution margins to the current restaurant concept. 9. Compare and contrast issues associated with leading employees from different cultures, ages and genders. 10. Practice interpersonal communication skills by delegating, coaching, and presenting feedback. 11. Evaluate leadership issues in terms of ethics, integrity, and credibility. Credits: 4.00

HTM 49700 - Honors Research Project

Credit Hours: 1.00 to 4.00. The completion of the independent honors research project for CFS Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Credits: 1.00 to 4.00

HTM 49900 - Feasibility Studies And Business Development In Hospitality And Tourism

Credit Hours: 3.00. The study of business development. The course will cover all stages in the feasibility and development process. Emphasis will be on strategic planning, design of systems, models and problem analysis, leading to the opening of a successful hospitality or tourism business.

Learning Outcomes: 1. Review, prepare and present the various components that are involved in a feasibility study. 2. Assess the

various aspects of and create a situational/operational analysis for a hospitality or tourism operation. 3. Explain the various perspectives and operations philosophies. 4. Assess various management and operations philosophies. 5. Analyze and evaluate project planning and project management activities from conceptualization to completion. 6. Evaluate between ethical and unethical behaviors on the parts of individuals when preparing and presenting feasibility studies to potential investors and interested others. Credits: 3.00

HTM 49901 - Strategic Management In Service Industries

Credit Hours: 3.00. Effective management of organizational resources in a coherent and seamless manner is necessary to realize a competitive advantage. By analyzing internal and external forces, students develop strategies to help a service organization realize its goals and objectives. Through the application of concepts, tools, and principles of strategy development and competitive advantage, this course emphasizes strategy formulation, implementation, and evaluation to ensure the long-term success of a service organization. The course is structured to enhance students' analytical, critical thinking, and communication skills by integrating their academic and experiential knowledge from previous functional courses such as accounting, finance, marketing, operations, human resources, etc.

Learning Outcomes: 1. Integrate and apply prior knowledge areas from the HTM curriculum in developing a business. 2. Develop and analyze the feasibility, situational, and operational aspects of a hospitality and tourism business. 3. Select and implement an appropriate business model in development of a business plan. 4. Describe the characteristics of a successful business and apply that knowledge to mitigate situational and operational risks. 5. Evaluate between ethical and unethical behaviors on the parts of individuals when preparing and presenting a business development plan to potential stakeholders. 6. Prepare and present a business development plan. Credits: 3.00

Division of Consumer Science

FCSE pic 17-18

About the Division of Consumer Science

The **Division of Consumer Science** is passionate about providing transformative scholarship, teaching, and research in order to make a difference in people's lives. Our goal is to equip students with the education and experience needed to succeed and make an impact in their chosen fields. The faculty and staff serve the needs of students, industry, and the community by focusing talents and resources to improve people's lives and meet the needs of the future.
Our **undergraduate majors** in the department include: Financial Counseling and Planning, Selling and Sales Management, and Retail Management. Students in Retail Management can choose an optional concentration in Apparel Design and Technology

Faculty (website)

Division of Consumer Science (website)

Contact Information

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Graduate Information

For Graduate Information please see Consumer Science Graduate Program Information .

Department of Human Development and Family Science

HDFS pic 17-18

About the Department of Human Development and Family Science

The Department of Human Development and Family Science develops knowledge, skills, and programming to promote people's well-being, from the youngest to the oldest ages, and across a wide variety of settings and contexts. The department is widely regarded as a leader in the study of families and individuals of all ages. The department's academic programs prepare specialists at the bachelor's and PhD levels. Faculty conduct significant research on a range of critical issues facing individuals and families in today's society. And, the department employs innovative outreach efforts that extend knowledge to policymakers, employers, professionals, and citizens in Indiana and beyond.

At the undergraduate level, the Human Development and Family Science Department prides itself on providing an educational experience which includes great academic preparation, personal attention, and real-world experience. Each of the majors in the department includes multiple opportunities for hands-on experience applying students' new knowledge to real-life situations. In particular, each major includes a required capstone experience focused on in-depth, applied, experiential learning.

Please click here to view our welcome video.

Faculty (website)

Department of Human Development and Family Science (website)

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Graduate Information

For Graduate Information please see Human Development and Family Studies Graduate Program Information .

Developmental and Family Science, BS

Early Childhood Education and Exceptional Needs, BS

Family and Consumer Sciences Education, BS

Human Development and Family Science Minor

Human Services, BS

Gerontology Certificate

HDFS 10000 - Orientation To Current Issues In Human Development And Family Science

Credit Hours: 1.00. Introduction to fields related to Human Development and Family Science, including majors and career paths. You will meet faculty, alumni, and professionals working in related areas. You will be matched with an advanced student mentor who will help you learn how to become successful as a HDFS student and beyond. Required of all students majoring in the department. Non-majors interested in learning more about HDFS majors are also welcome.

Learning Outcomes: 1. Demonstrate an understanding of the field of Human Development and Family Studies, including the disciplines represented, the topics studied, and associated careers. 2. Identify the program options in HDFS and distinguish the requirements for his/her major by establishing a personal plan of study. 3. Establish relationships with fellow students, student mentors, and faculty. Credits: 1.00

HDFS 20100 - Introduction To Relationship And Family Science (UCC: BSS)

Credit Hours: 3.00. An examination of interpersonal processes involved in forming and maintaining quality relationships with family members and close others. Emphasis is on relationship dynamics and family functioning across the life course. Also considered are linkages between relationship and family processes and the broader social environment. Basic components of the research process will be introduced.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Apply family and relationship theories to the unique interactions and dynamics within families and close relationships. 2. Recognize the diversity of relationships and families in our society. 3. Examine interaction patterns within families and close relationships. 4. Describe the importance of relationship and family science. Credits: 3.00

HDFS 21000 - Introduction To Human Development (UCC: BSS)

Credit Hours: 3.00. This course provides an introduction to the development of individuals from the prenatal period to adulthood and old age. Theories and research findings related to physical growth, cognitive and language development and social and emotional development will be discussed. CTL: Developmental Psychology.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify key physical, cognitive, emotional, and social characteristics at each life stage. 2. Identify the basic tenets of leading theories in human development. 3. Distinguish among prominent methods used in developmental research and identify their strengths and weaknesses. 4. Explain the relationships among different domains of development (i.e. biological, psychological, and social) and how they affect one another across the life course. 5. Make predictions about developmental outcomes that are grounded in theory. Credits: 3.00

HDFS 22500 - Human Development Across Cultures

Credit Hours: 3.00. This course provides a basis for interdisciplinary exploration of cross-cultural human development and family relations throughout the lifespan. Key topics include international variation in cultural understandings of parent-child relationships, gender roles, education, work, social relationships, and health/wellness. Students will explore professional applications in an increasingly globalized world.

Learning Outcomes: 1. Understand and respect the diversity of children, youth and families around the world. 2. Identify how family values and traditions vary across cultures and how these variations have emerged within broader ecologies (e.g., economics, treaties, history) of the culture. 3. Articulate processes of intergenerational transmission of culture with a

particular focus on parent-child relationships. 4. Compare and contrast various cultural responses to issues important to children and families, such as conceptions of childhood, gender roles, education, and work-family relationships. 5. Describe how individual characteristics such as friendship, altruism, leadership, academic achievement, delinquency, conflict management, aggression, and morality vary across cultures. 6. Analyze the reasons for migration and immigration and their impacts on children and families. 7. Develop skills for working across cultures, including cross-cultural communication and adapting to culture contrasts when interacting with those from a culture different from one's own. Credits: 3.00

HDFS 26000 - Young Children With Exceptional Needs

Credit Hours: 3.00. A broad overview of learner characteristics and service delivery models for young children (birth-8 years) who are at-risk or have identified disabilities. Students gain understanding of disabilities in young children, of laws relating to persons with disabilities, and roles of special and general educators in providing services to students with identified disabilities.

Learning Outcomes: 1. The student will demonstrate knowledge of: (a) Philosophical, historical, and legal foundations of special education. (b) How principles of development, motivation, behavioral and cognitive learning theories are related to learner differences. (c) Characteristics of learners with exceptionalities, including individual and group diversity that may impact learning. (d) Issues related to environmental and personal barriers that hinder accessibility and acceptance of persons with disabilities and their families. (e) Applicable laws, rules and regulations, and procedural safeguards regarding the planning and implementation of early children special education interventions, including management of behaviors, of children with special learning needs. (f) Issues related to teacher professionalism and ethical practice. 2. The student will demonstrate skills to: (a) Articulate current issues in special education. (b) Define and describe and characteristics of learners with exceptionalities. 3. The student will demonstrate appropriate dispositions regarding: (a) The right of all children through the age of 21 to receive a free and appropriate public education. (b) Access to the natural environment and to the general curriculum as the starting point for special education and early intervention services. Credits: 3.00

HDFS 28000 - Diversity In Individual And Family Life (UCC: BSS)

Credit Hours: 3.00. Students are introduced to aspects of individual and family life in diverse cultures, particularly racially and/or ethnically diverse families in the United States. The nature of relationships between dominant and minority cultures is considered. Implications of diversity for practice with diverse populations are emphasized throughout the course.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand why and how individuals and families are diverse. 2. Comprehensively explore and synthesize evidence about cultural values, family patterns, and historical experiences of major groups in the United States. 3. Analyze how individual and family lives are mutually influenced by societal systems (e.g., economy, government, media). Credits: 3.00

HDFS 30500 - Biosocial Foundations Of The Family

Credit Hours: 3.00. Family ties and family processes in the promotion of individual health and management of disease across the life course are covered. Course reviews research on families and health from multiple disciplinary perspectives.

Learning Outcomes: 1. Describe evolutionary and biosocial theory as the basis of development, using a life course perspective from conception through old age. 2. Identify the

key biological systems involved in behavior, and how they are measured in biosocial research. 3. Explain the direct implications for biological and environmental interactions for families, children, adolescents, and adults. Credits: 3.00

HDFS 31000 - Guidance In Early Childhood

Credit Hours: 3.00. This course presents a developmental, child-centered approach to the guidance and discipline of young children, including children with disabilities. Influential theories, relevant research, and effective guidance methods for the early childhood teachers and other professionals working with young children and families, including families from different cultural and economic backgrounds, are discussed. Admitted to Gate B.

Learning Outcomes: 1. Understand the primary components of child guidance at different developmental stages. 2. Plan and implement developmentally appropriate methods of child guidance and discipline. 3. Understand the influential theoretical perspectives of child guidance/discipline. 4. Modify expectations and guidance strategies appropriately for children with diverse abilities, family demographic characteristics, and cultural backgrounds. 5. Promote and create environments and lessons that prevent challenging behaviors. 6. Demonstrate desirable modeling of behavior. 7. Increase understanding and skills surrounding effective communication with children and parents about child guidance. 8. Gain critical knowledge of the importance of understanding diverse family and community characteristics and how they influence child behavior. 9. Increase understanding and skills for engaging with families, other educators,
and practitioners on child guidance. 10. Demonstrate growth in professionalism as early childhood educators. Credits: 3.00

HDFS 31100 - Child Development

Credit Hours: 3.00. This course addresses the study of development from infancy through childhood. It includes processes of physical, cognitive, language, social, and emotional development. Processes are discussed within the framework of historical and contemporary theories and current research. In addition, it covers topics related to methodologies used in the study of infant and child development. Finally, the conditions of children in different parts of the world are considered.

Learning Outcomes: 1. Define the concept of development and describe the differences between normative and individual development. 2. Identify the pioneers of the study of development and their contributions to the study of child development. 3. Describe the importance of developmental theories and the methodologies used to study child development. 4. Describe the most important theories of child development. 5. Describe important milestones of prenatal development. 6. Describe the motor, perceptual, cognitive, and socio-emotional developmental milestones during infancy, toddlerhood, and childhood. 7. Describe major contextual challenges to psychological development faced by the majority of children in the world. Credits: 3.00

HDFS 31200 - Adult Development

Credit Hours: 3.00. An in-depth study of developmental processes from the transition to adulthood through old age. Particular emphasis is placed on understanding the influence of contexts on adult development.

Learning Outcomes: 1. Identify biological, psychological, social, and demographic aspects of adult development and how they interact over time. 2. Identify theoretical perspectives on human development, and apply them in understanding life trajectories. 3. Understand and apply the process of doing research in adult development. 4. Communicate academic ideas clearly and effectively. Credits: 3.00

HDFS 31300 - Adolescent Development

Credit Hours: 3.00. An overview of the normative developmental changes that occur during adolescence, with specific attention to individual and relational adjustment.

Learning Outcomes: 1. Critically evaluate popular conceptions of adolescence and adolescents. 2. Compare and contrast theoretical perspectives on normative development during adolescence. 3. Identify the diversity in the developmental pathways during adolescence. 4. Acquire a framework for assessing the connections between interpersonal development and the larger social context. Credits: 3.00

HDFS 31400 - Atypical Child Development

Credit Hours: 3.00. Atypical child development from conception to adolescence can emerge from genetic, medical/health, educational, psychological, and/or contextual factors. This course will survey factors (e.g., premature birth, obesity, neurodevelopmental disorders, learning difficulties, child abuse, and war) that contribute to atypical child development. It will assess how and when typical and atypical developmental trajectories diverge and the roles of measurement and intervention.

Learning Outcomes: 1. Describe at least three theories of atypical child development. 2. Differentiate typical and atypical child development and describe the roles measurement/assessment may play in this distinction. 3. Identify biological and contextual factors that may promote resilience or atypical development during the following developmental periods: prenatal, infancy, early to middle childhood, and adolescence. Credits: 3.00

HDFS 31801 - Developmental Assessment

Credit Hours: 3.00. This course provides an introduction to the variety and characteristics of developmental assessments for young children, birth to age 8. Students learn formal and informal strategies for documenting individual development and learning; linking assessment and instruction; and, the use of assessment for determining eligibility for early intervention/early childhood special education. Students learn partnering with families, other professionals, as well as cultural and ethical issues in assessment.

Learning Outcomes: 1. Explain appropriate uses of assessment with young children, birth - 8 years of age, for instruction and intervention. 2. Describe the appropriate use of standardized and non-standardized approaches to assessment with young children, including family-centered assessment strategies. 3. Describe and be able to apply the linked systems of assessment, intervention, and evaluation, including in the context of IEP/IFSP development, progress monitoring, and program evaluation. 4. Conduct assessments, accurately interpret results, and critically evaluate assessment data. 5. Explain approaches to inclusion of family members in assessments, including identification of resources and priorities, and strategies for communicating assessment results to families. 6. Describe ethical considerations in assessment as well as cultural, language, and developmental differences that effect assessment implementation and outcomes. 7. Exhibit growth in professional behavior related to assessment of young children and for the field of early childhood education / early childhood special education. Credits: 3.00

HDFS 32500 - Health And Health Care For Children And Families

Credit Hours: 3.00. This course discusses leading causes of child health problems as well as examines the child and family reactions and adjustment to illness and disability. A developmental perspective on coping with health problems from early childhood through adolescence is presented. An overview on global child health disparities is also addressed.

Learning Outcomes: 1. Discuss the impact of illness on children, adolescents, and families. 2. Examine and analyze the leading causes of child and adolescent health. 3. Examine and compare health disparities among national and international children. 4. Determine the complexities and implications of health care policy and barriers to access to care on children, adolescents and families. 5. Determine the importance of implementing family centered

care and interdisciplinary collaboration while providing care for children and adolescents. 6. Identify professional opportunities in child and family health. Credits: 3.00

HDFS 33000 - Sexuality And Family Life

Credit Hours: 3.00. Provides the student with a basic knowledge of human sexuality as it pertains to individuals, couples and families. The course is designed to be helpful to students who will become family life educators as well as to be helpful to students as individuals, spouses, and parents.

Learning Outcomes: 1. Construct a basic knowledge of human sexuality as it pertains to family relations in the personal and professional settings. 2. Compare and describe social, cultural, historical, and technological trends and the interrelationships between these trends and their impact on sexuality, family relations, and personal values and attitudes. 3. Differentiate and examine the many different aspects of sexuality including biological, developmental, medical, cultural, historical, and interpersonal. 4. Demonstrate knowledge that helps to develop a better understanding of students' own feelings and attitudes related to sexuality and how those attitudes and feelings influence their beliefs about individuals, couples, and families. Credits: 3.00

HDFS 33100 - Skills For Helping Professionals In Individual, Family And Group Settings

Credit Hours: 3.00. This course is an introduction to skills commonly used in helping professions, including relationship-building skills, beginning interviewing skills, and group process skills. Attention is paid to cultural competence and professional ethics. This course includes a weekly lab experience involving practice of the helping skills, as well as a service-learning project in which helping skills are used in a community setting.

Learning Outcomes: 1. Use basic helping skills effectively in both individual and group contexts. 2. Evaluate your own helping interactions and those of others, including making constructive suggestions for improvement. 3. Design, implement, and reflect on a service-learning project that uses helping skills in a community setting. 4. Contribute to your team's successful service-learning project and provide leadership to the team as appropriate. 5. Reflect on your experiences in the course through your writing and use those reflections to promote development toward your own professional goals. Credits: 3.00

HDFS 33200 - Stress And Coping In Contemporary Families

Credit Hours: 3.00. Examines theoretical perspectives related to family stress and resilience in multicultural and diverse family settings, and connects these perspectives to empirical work on family dynamics, coping, and dysfunction across the lifespan. Topics such as economic stress and poverty, immigrant families, single-parent families, homeless families, adoption, military families, maltreatment, and families coping with illness are explored. The class focuses on environmental, cultural, as well as biological contributions to both risk and resilience processes in individuals and families.

Learning Outcomes: 1. Describe theory and research concerning family stress, coping and social support. 2. Understand how an individual's or family's context plays a role in his/her exposure to and coping with stressors. 3. Explain how individual, familial and environmental processes contribute to risk and resilience in individuals and families. 4. Apply the principles of Family Stress Theory and Risk and Resilience Theory to case studies of families. 5. Demonstrate an ability to understand and empathize with total life experiences (physical. psychological, social) of others by identifying possible motivations/explanations for individual and family behavior. Credits: 3.00

HDFS 34100 - Working With Parents

Credit Hours: 3.00. This course focuses on developing and maintaining effective relationships between parents and professionals working with children, within the context of family-centered practices. Issues related to cultural, linguistic, economic, and developmental differences that affect relations between families and professionals are examined.

Learning Outcomes: 1. Demonstrate an understanding of the development tasks and concerns of parents across the life course. 2. Demonstrate an understanding of the content and design of innovative professional practices and program strategies that seek to promote positive parenting outcomes or reduce/prevent unhealthy parenting outcomes in each developmental stage of parenting. 3. Demonstrate an understanding of how diverse family characteristics and circumstances shape the developmental tasks, concerns, and needs of parents. 4. Demonstrate an understanding of the implications of diverse family characteristics and circumstances for professional practices and program strategies aimed at supporting parents. 5. Demonstrate an understanding of how to creatively work with students colleagues to develop an original program idea that supports parents during a particular developmental stage. Credits: 3.00

HDFS 34300 - Assessment And Case Management

Credit Hours: 3.00. This course is an introduction to case management as a service delivery approach for helping individuals and families in need. This course provides opportunities to practice basic helping and case management skills such as building rapport, assessing client needs, developing intervention plans, professional ethics, and professional writing.

Learning Outcomes: 1. Explain the case management approach to addressing the health and human service needs of children, adults, and families. 2. Differentiate among the various phases and task responsibilities of case management. 3. Analyze how individual differences in human development and motivation for change influence case management work. 4. Apply basic assessment and case management skills in practice interviews with individuals and families. 5. Demonstrate professional documentation and writing ability through the preparation of assessment reports, case notes, and intervention plans. 6. Demonstrate professional helping capacities such as ethical behavior and reflective practice. Credits: 3.00

HDFS 34600 - Research Design And Program Evaluation

Credit Hours: 3.00. This course is an introduction to research methods as used in community programs for children and families including review and application of existing research literature, generating research questions, conducting program needs assessments, evaluating processes and outcomes of existing programs, designing and interpreting applied research studies, and understanding ethical responsibilities in the use and application of research. Instruction has been designed to provide the skills necessary to use existing research and generate new data to benefit programs.

Learning Outcomes: 1. Understand the role of research (and the necessity of using strong research methodology) in the acquisition of knowledge. 2. Acquire knowledge, skills, and professional perspectives for the comprehension, application, analysis, synthesis, interpretation, and evaluation of research/finding. 3. Become familiar with the methods and tools of research, including common research search engines. 4. Develop the basic knowledge and skills needed to understand the research process, including generating a research question, designing a study, analyzing data, and interpreting results. 5. Understand the ethics of conducting and using/not using empirical research findings in academic and professional practice settings. 6. Demonstrate an ability to apply research results to ethical decision making practice. 7. Develop an appreciation for the value of research in improving the quality of professional practice. 8. Write a critical and comprehensive review of the literature on a topic of educational or professional significance and design a research study (using the APA formatting style) as part of a research proposal. 9. Effectively present

research studies and findings to a group. Credits: 3.00

HDFS 34800 - Administration Of Social Service Not-For-Profit Organizations

Credit Hours: 3.00. This course introduces students to aspects of not-for-profit management identified as keys by leaders in existing agencies. Students will prepare themselves for specifically establishing, building, working in and leading not-for-profit organizations.

Learning Outcomes: 1. Demonstrate knowledge, comprehension, analysis and application supporting competence in the defining features of nonprofit management by interactively thinking critically and creatively to develop a board of directors; design a strategic plan; write a corresponding operations plan; diagram an evaluation logic model; prepare a budget; making a fund raising ask; write a fund raising letter; write a grant proposal; write a press release; and make oral presentations. 2. Demonstrate knowledge, comprehension, application, analysis and synthesis by interactively solving an administrative problem in a nonprofit agency case study and presenting the solution. Credits: 3.00

HDFS 39000 - Special Topics In HDFS

Credit Hours: 1.00 to 6.00. Supervised readings, discussion, lectures and/or research on special topics in family and individual development. Permission of instructor required.

Credits: 1.00 to 6.00

HDFS 39800 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an international experience that is recognized by the University.

Credits: 1.00 to 6.00

HDFS 40000 - Social Studies In Preschool And Primary Grades

Credit Hours: 2.00. This course focuses on teaching social studies in preschool and primary grade classrooms. It covers the developmental foundations and curriculum applications of social studies teaching in pre-kindergarten and of social studies in primary grades and includes ways to plan, implement and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of social studies in early childhood, including supporting children's understanding of themselves and the diverse nature of their communities, history, economics, citizenship, leadership, and civics and government. 2. Explain appropriate strategies for facilitating children's development of social studies skills. 3. Plan, implement, and evaluate developmentally appropriate instruction in social studies, including responding to the needs of diverse learners. 4. Demonstrate an understanding of Indiana State Standards for social studies for children from birth-3rd grade. 5. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 2.00

HDFS 40500 - Language, Literacy, And Social Studies In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching language, literacy and social studies in preschool and primary-grade classrooms. It covers the developmental foundations and curriculum applications of language, literacy and social studies teaching in pre-kindergarten and of social studies in primary grades and includes ways to plan, implement and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English.

Learning Outcomes: 1. Understand the purposes and importance of reading and writing in early childhood classrooms and homes, including the importance of supporting children's vocabulary, language comprehension, alphabet knowledge, phonemic awareness, and concept and functional use of print. 2. Understand the purposes and importance of social studies in early childhood, including supporting children's understanding of themselves and the diverse nature of their communities, history, economics,

citizenship, leadership, and civics and government. 3. Understand strategies for facilitating children's development of language, literacy, and social studies skills. 4. Plan, implement, and evaluate developmentally appropriate instruction in language, literacy, and social studies, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for literacy and social studies for children from birth-3rd grade (www.doe.in.gov/primetime/foundations and http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml). 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus. Credits: 3.00

HDFS 40510 - Literacy In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching literacy in preschool and primary-grade classrooms. It covers the developmental foundations and curriculum applications of literacy teaching in pre-kindergarten and primary grades and includes ways to plan, implement, and evaluate developmentally appropriate instruction for children with and without disabilities and children who are learning English. Field hours will be required.

Learning Outcomes: 1. Describe the purposes and importance of reading and writing in early childhood classrooms and homes, including the importance of supporting children's vocabulary, language comprehension, alphabet knowledge, phonemic awareness, and concept and functional use of print. 2. Explain the science of reading, particularly the current state of reading research and implications of research for reading instruction. 3. Practice strategies for facilitating children's development of literacy skills. 4. Plan, implement, and evaluate developmentally appropriate instruction in literacy including responding to the needs of diverse learners. 5. Describe the importance and demonstrate the use of Indiana State Standards for literacy for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus. Credits: 3.00

HDFS 40600 - Mathematics In Preschool And Primary Grades

Credit Hours: 4.00. This course focuses on teaching mathematics in preschool and primary grade classrooms. It covers the developmental foundations and curriculum applications of mathematics teaching and includes ways to plan, implement and evaluate developmentally appropriate mathematics instructions for children with and without disabilities and children who are learning English. Field-based experiences in preschool or primary-grade classrooms are included.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching mathematics. 2. Demonstrate an understanding of how children think about mathematical concepts. 3. Identify key mathematics knowledge that children need to learn during the early childhood and primary years 4. Critically and creatively plan, implement, and evaluate developmentally appropriate instruction in mathematics, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Mathematics for children from birth-3rd grade (www.in.doe.gov/primetime/foundations.html and http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml). 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Note: A 3 hour/week field experience provides students the opportunity to apply knowledge to practice as reflected in objectives 4-6 above. Credits: 4.00

HDFS 40800 - Early Intervention / Early Childhood Special Education: Issues And Professional Practices

Credit Hours: 4.00. An introduction to the field of early intervention / early childhood special education including its origin, services, and practices in working with young children ages birth through eight with or at risk for developmental delays and disabilities and their families. Designing curriculum, environments, and services where all children are included, have equal opportunity for access and engagement, and feel a sense of belonging is addressed. For Early Childhood Education and Exceptional Needs majors only. A field experience in preschool or primary-grade classrooms is included.

Learning Outcomes: 1. Discuss origins of early intervention / early childhood special education including key legislation affecting young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 2. Describe the value of and process for fostering family participation and professional-family collaboration in order to plan and implement family concerns, priorities, and access resources in intervention and education of young children (0-8) who have or are at risk for developmental delays and disabilities and their families. 3. Explain considerations including individualized and culturally / linguistically appropriate service delivery models, assessment, and curriculum for designing and organizing learning environments and experiences for young children (0-8) who have or are at risk for developmental delays and disabilities. 4. Evaluate, select, implement, and reflect on individually and culturally/linguistically appropriate evidence-based instructional strategies and interventions for young children (0-8) who have or are at risk for developmental delays and disabilities. 5. Utilize appropriate teaming and collaboration models, skills, processes, and strategies to engage with families and other professionals in the development of individualized intervention and transition plans. 6. Discuss current issues in providing effective early intervention / early childhood special education services for young children and their families. 7. Exhibit growth in professional behavior related to the field of early intervention / early childhood special education. Credits: 4.00

HDFS 40900 - Science In Preschool And Primary Grades

Credit Hours: 3.00. This course focuses on teaching science in preschool and primary grade classrooms. Developmental foundations and curriculum applications of science teaching including ways to plan, implement and evaluate developmentally appropriate science instruction for young children with and without disabilities and those who are learning English.

Learning Outcomes: 1. Describe principles of developmentally appropriate early childhood education and intervention as they relate to teaching science. 2. Demonstrate an understanding of how children think about science concepts at developmental levels between birth and 8 years. 3. Demonstrate understanding of critical approaches to scientific thinking. 4. Understand key science knowledge and skills that children need to learn from Pre-K to Grade 3 as represented in current science education standards. 5. Assess children's science knowledge, skills, and dispositions, and use the assessment data to plan science education activities. 6. Plan, implement, and evaluate developmentally appropriate classroom science activities, including responding to the needs of diverse learners. 7. Demonstrate positive dispositions and skills of an early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

HDFS 41200 - Professionalism And Music And Movement In Early Childhood

Credit Hours: 3.00. This course focuses on foundations of

professionalism in early childhood education and early childhood special education. Additionally, this course discusses music and movement in early learning environments. It covers the developmental foundation and curriculum applications of music and movement activities and includes ways to plan, implement and evaluate developmentally appropriate music and movement instruction for children with and without disabilities and children who are learning English.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of the ethical and professional standards in early childhood education, including the importance of maintaining confidentiality, respecting diversity, teaming will colleagues, and upholding the well-being of children and families. 2. Describe principles of developmentally appropriate early childhood education and intervention as they relate to music and movement in early childhood and primary grades. 3. Demonstrate an understanding of children's development of creative expression through music and movement. 4. Plan, implement, and evaluate developmentally appropriate visual music and movement instruction, including responding to the needs of diverse learners. 5. Demonstrate an understanding of Indiana State Standards for Physical Education and Health and Music for children from birth-3rd grade. 6. Demonstrate the dispositions and skills of a developing early childhood teacher, as described in this syllabus and in the practicum evaluation. Credits: 3.00

HDFS 41500 - Approaches To Early Childhood Education

Credit Hours: 3.00. The historical and theoretical basis for early childhood education and early intervention is emphasized. Relations between theory and practice are examined and illustrated with model early childhood programs. Addresses cultural/developmental diversity, ethics, and standards in early childhood education and intervention.

Learning Outcomes: 1. Discuss recommended practices in early childhood education and early intervention, including historical and theoretical sources and reasons for these practices with young children. 2. Describe, evaluate, and apply ideas from influential early childhood curriculum models while incorporating cultural and developmental diversity among young children, families, and the profession. 3. Clearly articulate to others your theoretical assumptions, goals, and practices as an early childhood professional. 4. Describe ethical guidelines and best practice recommendations for early childhood teachers and early interventionists and be able to apply those principles to everyday problems in early childhood education and early intervention. 5. Read, think, speak, and write about the course material, demonstrating your development as a professional, with increased confidence that what you do every day as a teacher is grounded in theory, recommended best practices, cultural sensitivity, and research-based knowledge. Credits: 3.00

HDFS 41800 - Understanding Autism

Credit Hours: 3.00. (PSY 41800, SLHS 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associated with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of

ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

HDFS 42000 - Developmental Foundations Of Infant And Toddler Curriculum

Credit Hours: 3.00. Study of typical and atypical development in infants and toddlers as well as implication for practice. Focuses on infant toddler developmental assessment and designing and implementing learning activities in all developmental areas and enhancing parent/professional relationships. Includes a practicum experience with infants and toddlers.

Learning Outcomes: 1. Acquire knowledge of the needs, normal development patterns, and important variations in development (including delays and disabilities) of children from prenatal period to 3 years. 2. Acquire skills in designing, maintaining, and evaluating safe, supportive, stimulating environments for infants and toddlers. 3. Acquire knowledge and skills in implementing developmentally-appropriate and culturally-appropriate assessment and programming for infants and toddlers. 4. Acquire skills providing basic care, education, and guidance for children under 3 years that may be applied in child care settings, family homes, or health care settings. 5. Acquire skills in developing supportive caregiving relationships with infants and toddlers. 6. Acquire skills in collaborating with key adults in infants' and toddlers' lives, including parents, other family members, and allied professionals. Credits: 3.00

HDFS 43030 - Human Development And Family Studies Student Mentors

Credit Hours: 1.00 to 3.00. Advanced undergraduate students selected for this opportunity to serve as mentors to beginning and prospective HDFS students in the department's orientation course (HDFS 10000). Mentors will be matched with a small group of students with similar major/career interests. Mentors will lead small group discussions, provide guidance and feedback, and otherwise serve as a role model to the students. Mentors will receive support and training to be effective in this role. Permission of instructor required.

Learning Outcomes: 1. Develop and communicate a thorough understanding of what they have done to achieve success throughtout their college career. 2. Act as role models to beginning and prospective HDFS students. Credits: 1.00 to 3.00

HDFS 44000 - Expanded ECEEN Student Teaching

Credit Hours: 1.00 to 3.00. This is a full semester of supervised expansion of student teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will occur the semester prior to full-time student teaching and be supervised by an HDFS faculty member and the classroom cooperating teacher. Monthly HDFS sponsored professional development seminars will also be required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Division for Early Childhood of the Council for Exceptional Children. 3. Engage in developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. Credits: 1.00 to 3.00

HDFS 45000 - Supervised Teaching In Inclusive Programs For Young Children (UCC: OC)

Credit Hours: **16.00.** This is 16 full-time weeks of supervised teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will be supervised by a HDFS faculty member and the classroom cooperating teacher. Monthly HDFS-sponsored professional development seminars and additional teacher education meetings will also be required. This will partially fulfill requirements for the Indiana Early Childhood Education and the Early Childhood Special Education teaching license. Admission to Student Teaching required.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Council for Exceptional Children. 3. Design developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the student teaching environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. 5. Create and conduct one-to-one, small group and/or large group instruction, guidance, intervention, and developmental activities in the student teaching environment. 6. Design and implement appropriate child assessment and evaluation procedures that influence the teaching and learning process. 7. Evaluate their own teaching practices through self-reflection and the analysis of child learning Credits: 16.00

HDFS 45010 - Supervised Teaching In Inclusive Programs For Young Children

Credit Hours: 12.00. This is 16 full-time weeks of supervised teaching in an approved environment that serves children ages birth through 3rd grade with and without disabilities. This experience will be supervised by a HDFS faculty member and the classroom cooperating teacher. Monthly HDFS-sponsored professional development seminars and additional teacher education meetings will also be required. This will partially fulfill requirements for the Indiana Early Childhood Education and the Early Childhood Special Education teaching license. Admission to Student Teaching required.

Learning Outcomes: 1. Apply previously acquired knowledge to the care and education of all young children including those with various abilities and disabilities. 2. Demonstrate competency in the application of the standards outlined for early childhood professionals by the National Association for the Education of Young Children and the Council for Exceptional Children. 3. Design developmentally appropriate instruction and intervention strategies based on community, school and classroom resources that meet the various needs of all young children in the student teaching environment. 4. Demonstrate the ability to work as part of an educational/intervention team for appropriate care and education of all young children. 5. Create and conduct one-to-one, small group and/or large group instruction, guidance, intervention, and developmental activities in the student teaching environment. 6. Design and implement appropriate child assessment and evaluation procedures that influence the teaching and learning process. 7. Evaluate their own teaching practices through self-reflection and the analysis of child learning. Credits: 12.00

HDFS 45100 - Internship & Career Preparation For Human Services

Credit Hours: 2.00. This course includes an overview of HDFS-related professions, self-evaluation, career search skills, exploration of internship opportunities, and professional development. Students will complete arrangements for their field placement.

Learning Outcomes: 1. Assess career interests and identify potential internship sites. 2. Create a professional cover letter and resume. 3. Identify how resources available at the Purdue

Center for Career Opportunities (CCO) and its website (myCCO) can be used in the job/internship search. 4. Develop skills and strategies for conducting an effective job/internship. 5. Develop and apply professional interview skills. 6. Demonstrate professional behavior through the successful and timely completion of course assignments. 7. Demonstrate preparation for the transition from student to intern. Credits: 2.00

HDFS 45400 - Internship & Career Preparation For Developmental And Family Science

Credit Hours: 2.00. This course includes an overview of HDFS-related professions, self-evaluation, career search skills, exploration of internship opportunities, and professional development. Students will complete arrangements for their field placement.

Learning Outcomes: 1. Assess career interests and identify potential internship sites. 2. Create a professional cover letter and resume. 3. Identify how resources available at the Purdue Center for Career Opportunities (CCO) and its website (myCCO) can be used in the job/internship search. 4. Develop skills and strategies for conducting an effective job/internship search. 5. Develop and apply professional interviewing skills. 6. Demonstrate professional behavior through the successful and timely completion of course assignments. 7. Demonstrate preparation for the transition from student to intern. Credits: 2.00

HDFS 45500 - Human Services Capstone Internship

Credit Hours: 6.00 or 12.00. Supervised full-time or half-time internship in human services, doing work typical of an entry-level bachelor-degreed professional. Students will integrate and build upon knowledge developed during their studies in human services. Students will use and enhance their skills in direct service to client or indirect service. Students will work in the placement setting secured during HDFS 45400. Example field placement sites include: government or community agencies; social service agencies; hospitals; and recreational settings. Permission of Department required. Must be a student in good academic standing during the internship semester.

Learning Outcomes: 1. Synthesize previously acquired and new knowledge about individual development, family processes, and broader social contexts and apply it to their responsibilities in their internship setting. 2. Demonstrate skills in direct service to children, adults, and/or families in the planning, evaluation, management, or support of human services programs. 3. Exhibit professional work attitudes and behavior. Credits: 6.00 or 12.00

HDFS 45800 - Development And Family Science Capstone Internship

Credit Hours: 6.00. Supervised internship for the Developmental & Family Science major, doing work typical of an entry-level bachelor-degreed professional. Students will integrate and build upon knowledge developed during their studies in developmental and family science. Students will use and enhance their skills in child development, family and community health, or another area related to developmental and family science. Students will work in the placement setting secured during HDFS 45400. Must be a student in good academic standing during the internship semester. Permission of Department required.

Learning Outcomes: 1. Synthesize previously acquired and new knowledge about individual development, family processes, and broader social contexts and apply it to responsibilities in the internship setting. 2. Demonstrate relevant workplace skills including direct service to clients, program development and evaluation, and/or other appropriate tasks. 3. Exhibit professional work attitudes and behavior. Credits: 6.00

HDFS 49000 - Independent Study

Credit Hours: 1.00 to 4.00. Independent study. Permission of instructor required.

Credits: 1.00 to 4.00

HDFS 49101 - Mentored Research In Human Development And Family Studies I

Credit Hours: 3.00. Independent study in which student engages in research under the supervision of a faculty member.

Involves developing a research proposal, beginning the project, and submitting a summary of the project plan and progress. First semester of a two-semester sequence to fulfill the requirements of the capstone thesis for the Developmental & Family Science major. Permission of instructor required.

Learning Outcomes: 1. Critically and creatively synthesize knowledge and skills gained as a DVFS major, using them in a research project of the student's interest. 2. Synthesize and apply previously acquired and new knowledge of the HDFS field through in-depth exploration of a topic of interest. 3. Observe and participate in the research process, including generating a written report of the project. 4. Work collaboratively with a research mentor and/or research team. 5. Make decisions using the logic of the scientific method. Credits: 3.00

HDFS 49102 - Mentored Research In Human Development And Family Studies II

Credit Hours: 3.00. Independent study in which student engages in research under the supervision of a faculty member. Involves completing a research project, writing up the results, and presenting the results to a new audience. Second semester of a two-semester sequence to fulfill the requirements of the capstone thesis for the Developmental & Family Science major. Permission of instructor required.

Learning Outcomes: 1. Critically and creatively synthesize knowledge and skills gained as a DVFS major, using them in a research project of the student's interest. 2. Synthesize and apply previously acquired and new knowledge of the HDFS field through in depth exploration of a topic of interest. 3. Observe and participate in the research process, including generating a written report of the project. 4. Work collaboratively with a research mentor and/or research team. 5. Make decisions using the logic of the scientific method. Credits: 3.00

School of Nursing

About

The School of Nursing is responsible for administering all degree programs in nursing offered at the West Lafayette campus of Purdue University.

A broad liberal and scientific education is necessary to prepare baccalaureate nursing program students for professional nursing practice. The Purdue University School of Nursing curriculum provides each student with a firm foundation in the liberal arts, supportive sciences, and professional education. Education of the professional nurse is enriched by a diverse faculty who have clinical expertise and scholarly achievement by participation in continuing education and in professional nursing organizations.

Following successful completion of the program of study, the nursing graduate may apply to take the National Council Licensure Examination (NCLEX) for licensure as a registered nurse (RN). There are specific requirements for eligibility to take the examination. Any person who applies to the Indiana State Board of Nursing for license to practice as a registered nurse must not have been convicted of a crime that has a direct bearing on the person's ability to competently practice or have committed an act that would constitute a ground for disciplinary sanction under Indiana statutes.

Eligibility requirements in other states may vary. You may request a copy of eligibility requirements by writing to the Board of Nursing in the state in which you are seeking licensure.

Faculty

Contact Information

Undergraduate Programs
School of Nursing
Johnson Hall, Room 109
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West Lafayette, IN 47907-2069
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Graduate Information

For Graduate Information please see Nursing Graduate Program Information .

Nursing, BSN

Accelerated Nursing, BSN

NUR 10800 - Introduction To Nursing

Credit Hours: 1.00. Introduce students entering the nursing profession to foundations of the baccalaureate nursing curriculum, including concepts, competencies, mandatory requirements and responsibilities within the profession. Students are introduced to the rigor of the curriculum and begin to build a sense of community within the Purdue School of Nursing.

Learning Outcomes: 1. Explain the relationship between the Essentials of Baccalaureate Education for Professional Nursing Practice document and Purdue's baccalaureate nursing curriculum. 2. Describe the roles of the professional nurse in the healthcare delivery system. 3. Describe individuals, families, communities, and populations as consumers of nursing care. 4. Reflect upon personal and professional responsibilities in relation to the nursing profession. 5. Communicate in oral and written form at a professional level. 6. Identify personal behaviors necessary for success in an academic and professional career. 7. Engage in student and/or nursing organizations as an aspect of professional growth and development. Credits: 1.00

NUR 10900 - Introduction To Nursing II

Credit Hours: 1.00. Using knowledge acquired in NUR 10800 students will examine the profession of nursing and their role and responsibilities within the profession. Topics to be discussed include informatics and technology, the importance of professional communication in oral and written form, the global image of nursing, wellness and self-care, and preparation for progression into the sophomore year. Permission of department required.

Learning Outcomes: 1. Demonstrate the ability to communicate in oral and written form at a professional level. 2. Explore the roles of the professional nurse in both domestic and global healthcare delivery systems. 3. Examine the role of social media and its impact on healthcare. 4. Identify components of effective and ineffective communication in the healthcare environment. 5. Discuss the use of informatics in documenting the management of patient care. 6. Identify skills and personal behaviors necessary for success in an academic and professional career. Credits: 1.00

NUR 21801 - Health Assessment And Essentials Of Nursing Practice I

Credit Hours: 5.00. Focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client centered safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients from the healthy to chronically ill populations. 2. Develop critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 3. Discuss the impact of evidence based nursing research in guiding practice. 4. Identify the effect of personal values and beliefs on professional practice. 5. Develop basic physical and psychosocial clinical

assessment skills for the client across the lifespan, including interviewing techniques, and comprehensive history and physical exam. 6. Employ basic principles of documentation to describe clinical findings. 7. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 8. Use informatics appropriately in simulation and in the clinical setting. 9. Identify methods and resources for personal and professional growth. Credits: 5.00

NUR 21901 - Pathopharmacology I

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort and the pharmacotherapies utilized as treatment for alterations and disease states. This introductory knowledge provides the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe primary regulatory mechanisms affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and alteration in comfort. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations in body structure and function affecting homeostasis; metabolic processes; immune response; circulation; renal elimination; fluid/electrolyte and acid/base balance; sensory perception and comfort. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting homeostasis, metabolic processes, immune response, circulation, renal elimination, fluid/electrolyte and acid/base balance, sensory perception and comfort. 4. Idenify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contraindications, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22001 - Essentials Of Nursing Practice II

Credit Hours: 5.00. Continues to expand on the professional nursing role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients in the clinical setting. 2. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 3. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 4. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 5. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 6. Identify client adaption and coping strategies when adjusting to changes along the health-wellness continuum. Credits: 5.00

NUR 22101 - Pathopharmocology II

Credit Hours: 3.00. An introduction to the study of underlying changes in primary physiologic regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function and the

pharmacotherapies utilized as treatment for alterations and disease states. This course builds on the learning objectives from Pathopharmacology I to provide the foundation for the understanding and practice of general nursing.

Learning Outcomes: 1. Describe the primary regulatory mechanisms affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 2. Recognize the clinical manifestations of disease resulting from genetic/genomic and physiologic alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 3. Describe selected diagnostic, therapeutic and pharmacologic interventions in the prevention and treatment of alterations affecting respiratory, hematologic, endocrine, neurologic, neuromuscular, gastrointestinal and reproductive function. 4. Identify major drug classifications and pharmacokinetic processes utilized in the prevention and treatment of disease with emphasis on selected, frequently prescribed medications. 5. Identify primary indications, contradictions, mechanism of action, potential side effects and adverse reactions of frequently prescribed medications in order to integrate pharmacologic knowledge into the overall therapeutic plan for restoring or maintaining homeostasis. 6. Identify factors which contribute to safe medication practice, risk reduction and prevention of misuse or abuse of pharmacotherapy. Credits: 3.00

NUR 22201 - Population Health

Credit Hours: 2.00. A comprehensive introduction to population health concepts and practices through examination of philosophy, purpose, functions, activities and tools. Multiple determinants (genetics, cultural, social, and behavioral factors) that influence population health and illness are explored including the contribution of these factors to health disparities. Population-focused initiatives for health promotion and disease prevention are examined within the context of local to global public health systems.

Learning Outcomes: 1. Describe the context and scope of public health from a historical and modern perspective. 2. Describe the methodology used by public health to define and address population health issues. 3. Identify public health's interprofessional nature and the contributions of different disciplines to improving population health. 4. Describe the ethical, legal, organizational, financial, and structural aspects of the current US and selected global health care delivery systems. 5. Discuss the contribution that biostatistics, epidemiology, information technology, and evidence-based practice make in improving health and preventing, detecting and minimizing the impact of disease and injuries. 6. Explain how multiple determinants (genetics/genomics, social, behavioral, environmental factors) contribute to specific population health outcomes from a local to global perspective. 7. Describe the principles needed to understand population health issues including planning, implementing and evaluating interventions across the lifespan. 8. Identify public health's roles in addressing the needs of vulnerable populations and eliminating health disparities across the lifespan. Credits: 2.00

NUR 22301 - Foundations Of Research And Evidence-Based Practice (UCC: IL)

Credit Hours: 3.00. Students gain foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. Students learn the principles of research process and identify strengths and limitations of research articles in relation to EBP in nursing and healthcare.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently to Information Literacy Competency Standards for Higher Education. 3.

Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical practice. 5. Examine economic, legal and ethical issues related to conducting research. Credits: 3.00

NUR 22401 - Nursing Practice Foundations I: Health Assessment

Credit Hours: 4.00. Designed for second degree students, this course focuses on the beginning concepts and principles for the professional nurse while developing fundamental skills in a nursing process framework. Through lecture and clinical experience, learners begin to apply skills in communication and assessment. Emphasis is placed on developing physical examination skills, obtaining health histories and performing client-centered, safe nursing care to meet basic healthcare needs in diverse populations across the lifespan.

Learning Outcomes: 1. Develop beginning critical thinking skills relating to the practice of nursing in a variety of healthcare settings. 2. Discuss the impact of evidence based nursing research in guiding practice. 3. Identify the effect of personal values and beliefs on professional practice. 4. Develop basic physical and psychosocial clinical assessment skills for the client across the lifespan including interviewing techniques, and comprehensive history and physical exam. 5. Employ basic principles of documentation to describe clinical findings. 6. Demonstrate ethical and legal accountability of professional nursing actions, including client confidentiality. 7. Use informatics appropriately in simulation and in the clinical setting. 8. Identify methods and resources for personal and professional growth. Credits: 4.00

NUR 22501 - Nursing Practice Foundations II: Fundamentals

Credit Hours: 4.00. Designed for second degree students, this course continues to expand on the professional nurse role supported by fundamental concepts and principles of the nursing process in lecture and clinical settings. Learners apply communication, assessment and nursing skills while caring for the needs of clients in diverse populations across the lifespan.

Learning Outcomes: 1. Apply the nursing process to clients representing healthy to chronically ill populations. 2. Use beginning critical thinking and clinical judgment when providing safe, quality nursing care to patients in the clinical setting. 3. Apply culturally sensitive clinical interventions using evidence-based-practice (EBP). 4. Apply principles of physical assessment and history taking to develop plans of care using the nursing process for clients across the lifespan. 5. Evaluate the effectiveness of nursing interventions on short-term and long-term client goals. 6. Develop appropriate evaluation criteria to determine clinical outcomes that meet professional standards of care. 7. Identify client adaptation and coping strategies when adjusting to changes along the health-wellness continuum. Credits: 4.00

NUR 22601 - Topics In Nursing Research And Evidence-Based Practice

Credit Hours: 3.00. Introduces foundational competencies for evidence-based practice (EBP), including computer literacy, information literacy, and professional communication. The principles of research process and strengths and limitations of research articles in relation to EBP in nursing and healthcare are identified.

Learning Outcomes: 1. Describe the principles of research and the process of EBP in relation to nursing and healthcare. 2. Use information and information technologies ethically, legally, and proficiently according to Information Literacy Competency Standards for Higher Education. 3. Explain the purpose and methodology of various types of quantitative and qualitative research designs in nursing and healthcare. 4. Evaluate the quality of research evidence to determine scientific merit, strengths and limitations relevant to clinical research. 5.

Examine economic, legal, and ethical issues related to conduction research. 6. Discuss the process of translating research evidence into practice. 7. Demonstrate the characteristics of an innovator that are necessary for EBP, which include leadership, a sense of inquiry, flexibility to change, awareness of self and of the environment, effective communication, critical thinking, lifelong learning, and professionalism. Credits: 3.00

NUR 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 31401 - Health Alterations In Adults I

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of well-being as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in tissue integrity related to surgical interventions, cellular division, reproductive function, elimination, nutrition and sensory function that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision-making when caring for diverse populations of adults experiencing selected illnesses. 2. Utilize the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related (including gerontologic) pathophysiology when providing care to diverse populations of adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence- based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to client, client's family, and other members of the healthcare team. 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes. 10. Utilize patient care technologies, information systems, and communication devices to access, retrieve,

organize and communicate information in a professional manner. Credits: 6.00

NUR 31501 - Nursing Of Childbearing Families

Credit Hours: 5.00. Promotes the development of nursing skills when caring for families and their newborns during uncomplicated and/or complicated childbearing experiences within a variety of clinical settings. Emphasizes the study and application of the nursing process, integrating evidence based practice while meeting the health and safety needs of diverse childbearing families.

Learning Outcomes: 1. Integrate theory and evidence to guide nursing practice and clinical decision-making throughout the care of childbearing families. 2. Incorporate childbearing family participation throughout health promotion, disease prevention, and risk reduction processes. 3. Address the childbearing family's developmental, physiologic, and psychological needs. 4. Assess ethical, legal, and sociocultural influences on resource utilization and compassionate maternal-child health care delivery. 5. Design targeted plans of care via a partnership with childbearing families, intra- and interprofessional teams, professional organizations, and institutions. 6. Utilize information technology to enhance learning, practice, and communication. Credits: 5.00

NUR 31601 - Integration Seminar I

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and obstetrical diagnoses. Through the course activities the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medical-surgical and obstetrical populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

NUR 31701 - Health Alterations In Adults II

Credit Hours: 6.00. One of two courses focusing on providing nursing care to adults with an emphasis on the application of the nursing process to assist diverse populations reach their optimal level of wellbeing as they experience health care across the delivery system continuum. Emphasis will be on promoting clinical reasoning skills, integrating best practices, and ensuring patient safety. The course concentrates on adults experiencing alterations in health related to oxygenation, circulatory dynamics, endocrine regulation, neurological regulation, immune regulation and musculoskeletal dynamics that typically result in hospitalization.

Learning Outcomes: 1. Integrate theory and evidence from the sciences and humanities to inform practice and influence clinical decision making when caring for diverse populations of adults experiencing selected illnesses. 2. Demonstrate appropriate use of the nursing process to assist diverse populations of adults to optimize wellness and compensate for self-care deficits. 3. Integrate standards of practice, current clinical research findings, knowledge of genomics and age-related pathophysiology when providing care to adults experiencing health alterations. 4. Collaborate with members of the health care team in the promotion of wellness and self-care in diverse populations of adults. 5. Demonstrate personal and professional growth, and skill development when providing evidence-based, legal, ethical, compassionate, and culturally sensitive nursing care to adult clients. 6. Communicate transition of care needs of adult clients to the client, client's family, and other members of the health care team 7. Utilize principles of teaching and learning to educate adults across the continuum of care. 8. Monitor client outcomes to evaluate

the effectiveness of psychobiological interventions. 9. Revise plans of care based on an ongoing evaluation of patient outcomes that emphasize client safety and evidence-based practice. 10. Use patient care technologies, information systems, and communication devices to access, retrieve, organize and communicate information in a professional manner. Credits: 6.00

NUR 31801 - Psychiatric And Mental Health Nursing

Credit Hours: 5.00. Focuses on providing nursing care that supports mental health and the care of persons with mental illness while providing a conceptual integration of the nursing process, theories, and research from the biopsychosocial sciences and humanities. Demonstrates the relevance of psychiatric-mental health nursing concepts to all areas of professional practice.

Learning Outcomes: 1. Examine the effects of myths, stereotypes, stigma, values, beliefs and culture on the practice of psychiatric nursing. 2. Compare past, current, and projected systems in delivery of evidence based mental health care and its social implications. 3. Identify legal and ethical implications involved in the practice of psychiatric mental health nursing. 4. Utilize the nursing process in the phases ofthe therapeutic nurse-client relationship to delineate the complex needs of clients with psychiatric disorders.. 5. Identify the principles of communication and therapeutic relationships in the care of clients with psychiatric disorders. 6. Determine specific nursing care interventions for acute and serious behavioral health issues that demonstrate developmentally and culturally appropriate strategies. 7. Utilize the ANA Standards of Psychiatric and Mental Health Nursing Practice as a basis for safe and competent care. 8. Incorporate theory, research and evidence from the psychobiological sciences, biological sciences, and humanities into an evidenced based practice approach to psychiatric nursing care. 9. Utilize client care technologies, information systems, and communication resources to access, organize and communicate information in a professional manner. 10. Establish therapeutic, collaborative relationships with members of the interdisciplinary treatment team. 11. Demonstrate personal and professional growth and skill development when providing evidence-based nursing care to clients with psychiatric disorders. Credits: 5.00

NUR 31901 - Integration Seminar II

Credit Hours: 1.00. In this course, students will be challenged to identify appropriate nursing interventions for patients with a combination of medical and psychiatric diagnoses. Through the course activities, the students will be challenged to look at healthcare from a patient perspective.

Learning Outcomes: 1. Discuss the application of communication strategies in relationships with dynamic and complex patient populations. 2. Evaluate the use of critical thinking processes in one's nursing practice with medically and psychologically unstable populations. 3. Discuss effectiveness and efficiencies of implementation of health promotion strategies with assigned patients. 4. Apply ethical nursing principles to clinical practice experiences 5 Examine patient advocacy opportunities from clinical practice experiences. 6. Incorporate research evidence when discussing selected clinical nursing practice problems. Credits: 1.00

NUR 33001 - Nursing Peer Mentors

Credit Hours: 2.00. Peer mentorship role to assist students entering the nursing profession to develop an understanding of the foundations of the baccalaureate nursing curriculum, including concepts, competencies, mandatory requirements, and responsibilities within the profession. To help students acclimate to college and begin to build a sense of campus community and community within the Purdue School of Nursing. Important attributes of a peer mentor are the desire to develop and help others, an openness to spending time with diverse individuals who may not share a common background, values, or goals, and a willingness to share failures and personal

experiences to provide valuable opportunities for learning. A peer mentor should have a growth mindset and learning attitude, skill in developing others through active listening, asking open-ended questions, self-reflection, and providing feedback, and the ability to commit time and energy to the mentoring relationship. Permission of department required.

Learning Outcomes: 1. Actively create supportive, intentional relationships with mentees based on mutual trust, respect, and accountability that create a safe space for mentees to work towards personal learning goals. 2. Provide objective guidance and feedback to mentees based on personal experiences navigating the University and School of Nursing environment. 3. Facilitate reflective thinking by asking thought-provoking questions that seek deeper meaning and help the mentee become more self-aware of strength and growth opportunities. 4. Serve as a role model for personal growth and learning by employing practices of goal setting, seeking feedback, and reflection for one's own development during the mentoring relationship. Credits: 2.00

NUR 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in nursing. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

NUR 39699 - Professional Practice Internship

Credit Hours: 0.00. Program coordinated by Nursing with cooperation of participating employers and the Office of Professional Practice. Students will submit summary reports and company evaluations related to the experience. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional nursing context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Incorporate knowledge of the nursing profession and practice, basic nursing

principles, and principles and practice of ethical responsibilities in professional work. Credits: 0.00

NUR 39801 - International Special Topics

Credit Hours: 1.00 to 6.00. Course taken during an international experience that is recognized by the University. Permission of department required.

Learning Outcomes: 1. Course outcomes will vary depending upon specific study abroad experience in which the student participates. Credits: 1.00 to 6.00

NUR 39900 - Special Topics

Credit Hours: 0.00 to 3.00. Hours, credit, and subject matter to be arranged by faculty.

Credits: 0.00 to 3.00

NUR 41001 - Issues In Professional Nursing

Credit Hours: 2.00. Promotes the use of critical thinking, clinical reasoning, and active learning to analyze contemporary issues related to professional nursing practice. Issues and key trends surrounding social determinants of health policy and economics, regulatory agencies, political action, cultural diversity, practice competency, nursing informatics and ethics are used as a framework. Permission of department required.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Evaluate historical components and current nursing practice that impact healthcare systems. 3. Demonstrate understanding of the impact of local, state, national and global regulations on healthcare trends and healthcare policy. 4. Evaluate the impact that economic, political, cultural, and social concerns have on the role of professional nursing and the healthcare delivery system. 5. Articulate the value of pursuing practice excellence, life-long learning, engagement, self care, and resilience in professional nursing practice. 6. Utilize inquiry, analysis, information literacy, nursing informatics to address practice issues, ambiguity, and unpredictability in the healthcare systems. Credits: 2.00

NUR 41401 - Pediatric Nursing

Credit Hours: 5.00. Explores factors influencing the health and wellness of children and families. Students will apply principles, concepts and research from the health and human sciences to the care of children and families across the health-illness continuum. A structured clinical component focuses on clinical reasoning and evidence based practice. Students will provide family centered care to healthy, at risk and ill children across a variety of clinical settings.

Learning Outcomes: 1. Integrate family theories; growth and development; genomics; environmental and psychosocial factors in the care of children across the health-illness continuum. 2. Integrate nursing concepts into evidence based nursing practice for children and families across a variety of health care settings. 3. Apply knowledge of information technologies to improve health outcomes of children and families. 4. Evaluate environmental and psychosocial risk factors for children and families. 5. Adapt nursing care to families, recognizing their diverse needs, ethnicity, culture, and values. 6. Evaluate the collaborative role of the nurse with other health care disciplines in the provision of comprehensive nursing care for healthy, at risk, and ill children. 7. Demonstrate a spirit of inquiry, responsibility and accountability within legal, ethical, professional and organizational parameters. Credits: 5.00

NUR 41501 - Public Health Nursing

Credit Hours: 5.00. Utilize health promotion, maintenance, education and disease prevention in coordinating and providing population-focused care to individuals, families and aggregates in the community. A variety of clinical settings are used to offer students a broad, comprehensive perspective of public health nursing, a field that synthesizes content from nursing, social and public health sciences. Collaboration with the community and implementation of population-focused interventions foster critical thinking and independent decision making in the delivery of nursing care.

Learning Outcomes: 1. Synthesize concepts, theories, knowledge and practice from nursing, social and public health sciences. 2. Examine the structure, function, and influence of historical, political, social, environmental, cultural, and ethical factors to the health of individuals, families, and communities. 3. Collaborate with interdisciplinary healthcare and human service providers to address the health needs of individuals, families, and communities. 4. Utilize principles, concepts, models, theories and research to guide culturally sensitive nursing care and public health practice of individuals, families, and communities. 5. Explore the delivery of public health nursing services to diverse and vulnerable populations. 6. Formulate client teaching strategies that address the principles of disease prevention and health promotion to clients across the lifespan. 7. Evaluate interventions implemented using community and family resources to address mutually identified health needs of clients. 8. Use principles of caseload management, in the delivery of safe, quality public health nursing services that reflect legal, ethical, and professional standards. 9. Apply national health objectives in planning interventions to meet the individual, system, and community level needs of diverse populations. 10.Utilize health care technology to improve health outcomes of individuals, families, and communities. 11.Integrate the role of advocacy into the delivery of care to individuals, families, and communities. Credits: 5.00

NUR 41701 - Leadership In Nursing

Credit Hours: 3.00. Studies the components of nursing leadership and management functions with an emphasis on critical thinking, problem solving, communication, and team building within the context of experiential problem-based group projects. This course will provide specific practice and evaluation of strategic and financial planning, conflict management, delegation, and complex change. Competencies to be gained, at a novice level, include professional communication, sound ethical and legal judgments within personal and organizational frameworks, leadership skills in the management and evaluation of others, and an understanding of the drivers of healthcare change and finances.

Learning Outcomes: 1. Synthesize concepts of nursing leadership and management in relation to the role of the professional nurse, nurse leader, and manager in promoting safe and quality care. 2. Organize a quality improvement project by utilizing project management strategies, quality improvement principles, and evidence-based practices to promote system changes in healthcare delivery. 3. Utilize concepts of professional communication, delegation, and evaluation of healthcare team members with an awareness of ethical, professional, social, and legal issues implicit to nursing leadership and management. 4. Describes economic, policy, social, and organizational factors that influence the professional nurse and healthcare systems. 5. Evaluate the impact of professional and unprofessional behaviors on healthcare delivery and professional interactions and presentations through knowledge of nursing standards of excellence. Credits: 3.00

NUR 41901 - Professional Nursing: Evolution As A Clinician And Leader

Credit Hours: 3.00. Incorporate the use of critical thinking, clinical reasoning, and active learning in analyzing contemporary issues related to professional nursing practice and obtaining professional nursing licensure. Issues surrounding political action, socio-legal concerns, cultural diversity and ethics in nursing practice are used as a framework.

Learning Outcomes: 1. Analyze standards of nursing care and regulations related to credentialing and certification. 2. Articulate the value of pursuing practice excellence, life-long learning, and engagement in professional nursing practice including membership in professional organization, completion of

continuing education, and specialty certifications. 3. Integrate principles of evidence-based practice, ethical decision-making, inter-professional communication, and advocacy to answer complex questions related to the practice setting. 4. Evaluate the impact of local, state, national and global health policy on the healthcare system. 5. Differentiate the professional nurse's role in health policy development and implementation. 6. Apply effective study habits and test taking strategies to enhance performance on the NCLEX-RN exam. Credits: 3.00

NUR 42001 - Transition To Professional Nursing Practice

Credit Hours: 4.00. This course challenges students to use critical thinking and clinical reasoning to identify, prioritize and evaluate nursing interventions for clients with complex healthcare issues. Students interact with members of the healthcare team and clinical faculty to practice effective leadership, delegation and supervision of nursing students in clinical environments.

Learning Outcomes: 1. Apply sound clinical judgment, professional behavior, communication, collaboration and integration of best practice in clinical settings. Demonstrate/apply professional behavior, communication, collaboration and sound clinical judgment by integrating best practice in clinical settings. 2. Utilize the nursing process when caring for clients with complex healthcare needs. 3. Articulate the value of pursuing practice excellence, life-long learning, patient advocacy and engagement in professional nursing practice. 4. Demonstrate effective leadership, delegation and supervision when collaborating with members of the healthcare team. 5. Assume personal responsibility for professional growth. 6. Analyze system barriers that effect quality healthcare delivery in patients affected by complex conditions. Credits: 4.00

NUR 43001 - NCLEX Review

Credit Hours: 2.00. The NCLEX-Prep is a pre-graduation comprehensive review of nursing content implemented in the senior year. The course is utilized as supplemental to assist with overall content review. Students will use their ATI account to access the content and will be assigned an ATI educator. The course is used to assist students to prepare for the ATI Comprehensive Predictor (Program Exit Exam), and NCLEX (National Council Licensure Examination).

Learning Outcomes: 1. Demonstrate an increased understanding of nursing content related to NCLEX. 2. Develop a study base for post-graduate RN content review. 3. Improve test-taking strategies specifically for NCLEX. 4. Increase individual awareness of content deficits. 5. Recognize the need for continued preparation after graduation. Credits: 2.00

Department of Nutrition Science

About

Nutrition Science is a multidisciplinary science at the core of health, wellness, and quality of life. An education in Nutrition Science incorporates the human perspective to a foundation of strong basic sciences such as biochemistry, physiology, and statistics with experiential learning.

The department offers many opportunities for students to work and learn in a clinical research setting. With this kind of education and training, Purdue's Nutrition Science graduates are prepared to become the future leaders in nutrition and food science.

The department offers undergraduate study in the following areas:

- Dietetics
- Nutrition, Fitness, and Health
- Nutrition Science

The department also offers two undergraduate minors:

- Foods and Nutrition
- Nutrition

Faculty

Contact Information

Department of Nutrition Science
Stone Hall
700 W. Mitch Daniels Blvd.
West Lafayette, IN 47907
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Graduate Information

For Graduate Information please see Nutrition Science Graduate Information .

Foods and Nutrition Minor

Nutrition and Dietetics, BS

Dietetics/Nutrition, Fitness and Health, BS

Nutrition Science, BS

Nutrition, Fitness, and Health, BS

Nutrition Minor

NUTR 10500 - Nutrition In The 21st Century

Credit Hours: 1.00. Overview of the discipline of nutrition science including undergraduate and professional opportunities, research and critical thinking requirements.

Learning Outcomes: 1. Show an awareness of the scope of nutrition. 2. Relate approaches for studying nutrition. 3. Demonstrate basic knowledge and critical thinking skills. Credits: 1.00

NUTR 10600 - Introduction To The Profession Of Dietetics

Credit Hours: 1.00. Overview of the dietetics profession, including standards, ethics, educational and employment opportunities, and professional credentialing. Spring semester offered only through distance learning.

Learning Outcomes: 1. Describe the profession of dietetics and future trends. 2. Recognize the education preparation needed to pursue careers in dietetics including different education models of becoming an entry-level dietitian. 3. Demonstrate knowledge of the supervised practice experience application process. 4. Identify the credentialing of dietetic practitioners. 5. Recognize the major professional organizations in dietetics such as the Academy of Nutrition and Dietetics, state affiliates and district dietetic associations, and dietetic practice groups and the roles of each. 6. Demonstrate the ability to develop a professional development portfolio, resume, and cover letter. 7. Develop an understanding of professionalism related to dietetics including interviewing skills, professional etiquette, professional ethics, and professional practice standards. 8. Develop skills for planning a career in dietetics such as self-assessment, goal setting, networking, job search strategies, and timeline establishment. Credits: 1.00

NUTR 10700 - Introduction To Nutrition Science

Credit Hours: 1.00. An overview of professional opportunities for nutrition scientists. Introduces tools and resources available for becoming a nutrition scientist.

Learning Outcomes: 1. To identify and describe the current professional opportunities for nutrition scientists. 2. To comprehend the educational preparation necessary to pursue a career as a nutrition scientist. 3. To name and become knowledgeable about the functions of, and advantages of belonging to, major professional organizations in nutrition science

such as the American Society of Nutrition. 4. To apply modern information technology to the problem of discovering scientifically valid nutrition science information. Credits: 1.00

NUTR 12500 - Food Safety Certification And Career Development

Credit Hours: 1.00. Training in ServSafe food safety certification program.

Learning Outcomes: 1. Select appropriate food safety and sanitation practices according to ServSafe guidelines. 2. Assess professional development using resume and student portfolio. Credits: 1.00

NUTR 20200 - Principles Of Food Preparation And Nutrition

Credit Hours: 4.00. Chemical, physical, microbiological, and nutritional principles of food preparation. Functions and sources of nutrients, their relationship to a healthy lifestyle and incorporating the benefits into marketing of foodservice.

Credits: 4.00

NUTR 20500 - Food Science I

Credit Hours: 3.00. Chemical and physical composition of foods: their changes during processing, storage, and preparation.

Learning Outcomes: 1. Gain a better understanding of food science and human nutrition. 2. Gain expertise in technical writing, research methodology, scientific literature searching, scientific methods, interpreting research, food technology, culinary techniques and terminology, food safety and sanitation, sensory evaluation, food ingredient functionality, and basic food preparation. Credits: 3.00

NUTR 24500 - Rookie Experience In Sports Nutrition

Credit Hours: 1.00. For students without prior experience within the specialty dietetics practice of sports nutrition, this course provides traditional and experience-based learning in a Division I Collegiate sports setting. Guest speakers will present on various aspects of the athletics work setting. Basics of sports nutrition are taught and students must pass an exam to progress to NUTR 34500 , Continuing Experience In Sports Nutrition. Written application and interview process required prior to instructor approval. Permission of Instructor required.

Learning Outcomes: 1. Describe healthful and performance-enhancing nutrition habits of student-athletes through active participation in project groups. 2. Recognize well-established scientific concepts, controversies, experts and resources in the field of sports nutrition. 3. Demonstrate work-enhancing skills/qualities like initiative, leadership, creativity, communication, cooperation, commitment and enthusiasm. 4. Apply information-literacy skills to accomplish goals of project groups. Credits: 1.00

NUTR 29700 - Introduction To Honors Research

Credit Hours: **2.00.** Introduces students to the design and implementation of an honors research project.

Learning Outcomes: 1. Identify the requirements for graduation with honors from Nutrition Science. 2. Define specific goals for completion of their Honors Project. 3. Recognize the benefits of graduating with honors. 4. Discuss research currently being done in Nutrition Science. 5. Identify faculty interested in serving as mentors for students pursuing Honors Research Projects in Nutrition Science. 6. Locate and obtain research articles relevant to their research project. 7. Write appropriate citations for research articles. 8. Explain the scientific method and research ethics. Credits: 2.00

NUTR 30300 - Essentials Of Nutrition (UCC: SCI)

Credit Hours: 3.00. Basic nutrition and its application in meeting nutritional needs of all ages. Credit not given for both FN 30300 and FN 31500. CTL: Human Nutrition

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Identify, describe, and explain the essential components of the diet and how they are used in the body to maintain health. 2. Identify, describe and explain the

information and tools used for assessment of nutritional status. 3. Critically evaluate the quality of your own diet and identify how to improve for optimal health. 4. Identify and explain the link between chronic diseases and diet. 5. Identify and describe food safety guidelines and concerns. 6. Identify, describe, and explain specific nutritional needs throughout the life cycle. Credits: 3.00

NUTR 31500 - Fundamentals Of Nutrition

Credit Hours: 3.00. Basic principles of nutrition and their application in meeting nutritional needs during the life cycle.

Learning Outcomes: 1. Recognize the ""fundamentals of nutrition"". 2. Discuss substances in foods needed in adequate amounts for energy, growth, reproduction and health and explain the identity, acquisition, utilization, and excretion of nutrients. 3. Explain the science of nutrition which includes the action, interaction, and balance of food, nutrients and other substances within food in relation to health and disease. 4. Describe nutrient ingestion, digestion, absorption, transport, metabolism, interaction, storage, and excretion. 5. Show appropriate diet selection under different circumstances such as: different states of the life cycle, disease states, and in the prevention of chronic diseases. 6. Develop the groundwork for future courses where information learned in this course will be applied to the design of diet therapies or diet prescriptions, design of diet recommendations for general audiences, selection of our own diets, and understanding the mechanisms of action and interactions of nutrients. Credits: 3.00

NUTR 33000 - Diet Selection And Planning

Credit Hours: 3.00. Diet selection for health maintenance in culturally diverse populations based on current dietary guides with utilization of the computer for diet evaluation.

Learning Outcomes: 1. Identify and select evidence-based tools and methods for assessing, planning, and evaluating diets for individuals without special dietary needs. 2. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 3. Use current information technologies to locate and apply evidence-based guidelines and protocols. 4. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups. Credits: 3.00

NUTR 33200 - Nutrition Counseling

Credit Hours: 3.00. Develop communication skills and counseling techniques necessary to elicit nutrition-related behavior changes in individuals.

Learning Outcomes: 1. Identify the nutrition professional's role and scope of practice in nutrition counseling. 2. Describe ethical considerations in nutrition counseling. 3. Describe the helping relationship and theories of behavior change. 4. Describe and apply counseling strategies to assist clients in behavior change. 5. Demonstrate understanding of the impact of age, gender, culture, literacy and personality on nutrition counseling. 6. Compare and contrast counseling skills best for the in-patient vs. the out-patient. 7. Describe and apply counseling strategies important to successful weight management, eating disorders, chronic disease and end of life. Credits: 3.00

NUTR 34000 - Field Experience In Nutrition, Fitness And Health

Credit Hours: 1.00 to 3.00. Field experience in NFH-related setting that provides an opportunity for the application of the classroom experience. For NFH majors only. The student secures his/her own field experience, which must be approved by the NFH program coordinator in order to receive academic

credit.

Credits: 1.00 to 3.00

NUTR 34500 - Continuing Experience In Sports Nutrition

Credit Hours: 1.00. Traditional and experience-based learning within the specialty dietetics practice of sports nutrition in a Division I Collegiate sports setting. Guest speakers will present on various aspects of the athletics work setting. Students must pass an exam given in NUTR 24500 , Rookie Experience In Sports Medicine, to enroll. Permission of Instructor required.

Learning Outcomes: 1. Describe healthful and performance-enhancing nutrition habits of student-athletes through active participation in project groups. 2. Recognize well-established scientific concepts, controversies, experts and resources in the field of sports nutrition. 3. Demonstrate work-enhancing skills/qualities like initiative, leadership, creativity, communication, cooperation, commitment and enthusiasm. 4. Apply information-literacy skills to accomplish goals of project groups. Credits: 1.00

NUTR 35000 - Dietetics Practicum In Quantity Food Production

Credit Hours: 1.00 to 3.00. Supervised on-the-job experience related to the food service management in health care facilities, schools, community programs, etc. Student is responsible for arrangement and approval of the experience through the supervising food service manager or dietitian and the course instructor. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge gained from coursework to actual work situations. 2. Develop skills related to management of food service. 3. Design and complete a project appropriate for a food service operation. Credits: 1.00 to 3.00

NUTR 36500 - Physiology And Nutrition During The Life Cycle

Credit Hours: 3.00. Physiology and Nutrition During the Life Cycle explores the life stages of pregnancy, childhood, adulthood and older adulthood from physiological, social, and behavioral perspectives, focusing on the biological underpinnings of special nutritional needs for each life stage for optimal growth and development, maturation, aging, and overall health and well-being.

Learning Outcomes: 1. Describe physiological, social and behavioral components involved with human growth and development, maturation, and aging, seen in the life stages of pregnancy, childhood, adulthood and older adulthood and the impact on nutrition and health. 2. Describe special nutritional needs and recommended guidelines of the life stages of pregnancy, childhood, adulthood, and older adulthood. 3. Locate, interpret, evaluate and use professional literature to make ethical evidence-based practice decisions. 4. Use current information technologies to locate and apply evidence-based guidelines and protocols. 5. Demonstrate the ability to apply knowledge of the role of environment, food, and lifestyle choices to develop interventions to affect change and enhance wellness in diverse individuals and groups throughout the life cycle. Credits: 3.00

NUTR 37500 - Foods And Nutrition Internship

Credit Hours: 1.00 to 4.00. Food science or nutrition professionally related work experience in industry, institutions, or business. Permission of instructor required.

Credits: 1.00 to 4.00

NUTR 39000 - Independent Undergraduate Research

Credit Hours: 1.00 to 3.00. Individual research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 39100 - Independent Study

Credit Hours: 1.00 to 3.00. Independent scholarly activity undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Increase knowledge base and/or application in nutrition science.

Credits: 1.00 to 3.00

NUTR 39200 - Undergraduate Instruction In Nutrition

Credit Hours: 1.00 to 5.00. Problems dealing with various aspects of nutrition. Permission of instructor required.

Learning Outcomes: 1. Develop extensive knowledge base and/or application in nutrition science. Credits: 1.00 to 5.00

NUTR 39700 - Directed Honors Research

Credit Hours: 1.00 to 3.00. Directed independent honors research for Honors College and Department of Nutrition Science Honors Program students. Students must select a faculty advisor for the course. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 3.00

NUTR 39800 - International Special Topics

Credit Hours: 1.00 to 3.00. Course taken during an international experience that is recognized by the University.

Credits: 1.00 to 3.00

NUTR 40000 - Executive In The Classroom

Credit Hours: 1.00. Lecture and discussion, featuring industrial and business executives in food-related areas. Emphasis is placed on careers in the food industry.

Credits: 1.00

NUTR 41100 - Dietetics Career Planning

Credit Hours: 1.00. This course will prepare students to successfully apply and interview for dietetics supervised practice experience, jobs and graduate programs.

Learning Outcomes: 1. Students will prepare resumes, personal statements, and sample applications. 2. Students will use available resources to develop skills in interviewing. 3. Students will identify the steps and deadlines for applying to graduate school and supervised practice programs. Credits: 1.00

NUTR 41500 - Practicum In Nutrition, Fitness, And Health

Credit Hours: 2.00. Application of nutrition and exercise knowledge and skills by performing assessments, interpreting data, designing and implementing programs, documenting progress, and counseling of an adult client.

Learning Outcomes: 1. Collect, analyze, and interpret nutrition and fitness assessment data. 2. Organize aspects of interaction with the client (educational materials, short- and long-term planning, etc.). 3. Use critical thinking and counseling skills to elicit pertinent client information, evaluate client feedback, and guide the client toward positive changes. 4. Accurately and concisely document interactions with client. 5. Creatively apply nutrition and fitness knowledge. 6. Communication effectively with the client. 7. Evaluate effectiveness of intervention; make necessary changes. 8. Develop critical thinking skills and professional judgment to recognize and manage the"" gray"" areas of one-on-one wellness counseling/coaching. 9. Utilize information technology and other methods of inquiry to accomplish all of the above. Credits: 2.00

NUTR 42400 - Communication Techniques In Foods And Nutrition

Credit Hours: 3.00. Communication of foods and nutrition information to lay and professional audiences through oral, written, and mass media channels.

Learning Outcomes: 1. Students are able to demonstrate how to locate, interpret, evaluate and use professional literature to make ethical evidence-based decisions. 2. Students are able to use current technologies to locate and apply evidence-based guidelines and protocols, such as the ADA Evidence Analysis Library, Cochrane Database of Systematic Reviews and the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality, National Guideline Clearinghouse Web

sites. 3. Students are able to demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public. 4. Students are able to demonstrate assertiveness, advocacy, and negotiation skills to the situation. 5. Students are able to develop an educational session or program/educational strategy for a target population. Credits: 3.00

NUTR 42600 - Laboratory In Community Nutrition

Credit Hours: 3.00. Application of previous knowledge and communication skills in nutrition of community settings, such as school nutrition, health facilities, and federal or state nutrition programs.

Learning Outcomes: 1. Perform as a community nutritionist and complete the competencies as outlined in the Learning Outcomes for Supervised Practice Form. Credits: 3.00

NUTR 43000 - Public Health Nutrition

Credit Hours: 2.00. Assessment of nutritional needs of the community and the programs that service these needs.

Learning Outcomes: 1. Explain the impact of a public policy position on dietetics practice. 2. Explain the impact of health care policy and administration, different health care delivery systems and current reimbursement issues, policies and regulations on food and nutrition services. Credits: 2.00

NUTR 43600 - Nutritional Assessment

Credit Hours: 2.00. Nutrition assessment in humans, including anthropometric, biochemical, clinical, and dietary assessment.

Learning Outcomes: 1. Explain, compare and contrast techniques used to assess the nutrition status of individuals and groups in clinical, community and research settings. 2. Utilize the nutrition care process to obtain, verify and interpret data, and ultimately, to make decisions about the nature and cause of nutrition-related problems. Credits: 2.00

NUTR 43700 - Macronutrient Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the macronutrients, carbohydrate, lipids and protein in humans integrating physiology, biochemistry, and nutrition with a focus on maintaining optimal health and preventing disease.

Learning Outcomes: 1. Describe the processes of digestion, absorption, utilization and function of macronutrients in humans. 2. Relate macronutrients to the regulation and processes of biochemical physiology. 3. Explain the cellular and molecular mechanisms related to macronutrient metabolism. 4. Identify the role of macronutrient metabolism in the etiology and pathophysiology of disease. Credits: 3.00

NUTR 43800 - Micronutrient And Phytochemical Metabolism In Human Health And Disease

Credit Hours: 3.00. Metabolism of the micronutrients and phytochemicals in humans integrating physiology, biochemistry and nutrition with a focus on maintaining optimal health and preventing disease.

Credits: 3.00

NUTR 44200 - Foodservice Systems Management

Credit Hours: 3.00. Systems approach to foodservice management. Foodservice operations based on nutritional goals of the target market. Food sanitation and safety, management of human resources, and supervision. Emphasis on applications to health-care facilities.

Learning Outcomes: 1. Identify and describe the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 2. Apply management and business theories and principles to the development, marketing and delivery of programs or services. 3. Determine costs of services or operations, prepare a budget and interpret financial data. 4. Apply the principles of human resource management to different situations. 5. Apply safety principles related to food, personnel and consumers. Credits: 3.00

NUTR 44300 - Laboratory In Foodservice Systems Management

Credit Hours: 9.00. Application of knowledge relating to foodservice. Responsibilities may include communication skills and tasks equivalent to supervising foodservice operations.

Learning Outcomes: 1. Prepare you for an entry-level job in food service management, and to introduce you to the fundamentals of management required for the competent practice in other areas of dietetics. Credits: 9.00

NUTR 45300 - Food Chemistry

Credit Hours: 4.00. Application of fundamental laws and concepts of chemistry, physics, and biology to the properties, composition, and storage of foods.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Recognize and predict how chemical structures and reactions influence sensory and analytical properties of food. 3. Explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives, and evaluate the validity of health controversies related to these ingredients. 5. Design, execute, and explain (via oral and written reports) a food experiment using the scientific method. Credits: 4.00

NUTR 45400 - Food Chemistry Laboratory

Credit Hours: 2.00. From this course, students should be able to: Assess and interpret analytical and sensory properties of food; Assess how chemical structures and reactions influence sensory and analytical properties of food; Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques; Explain chemical function of food additives; Design, report on, and critique food experiments using the scientific method.

Learning Outcomes: 1. Assess and interpret analytical and sensory properties of food. 2. Assess how chemical structures and reactions influence sensory and analytical properties of food. 3. Demonstrate and explain physical and chemical reactions in foods/beverages during preparation and processing techniques. 4. Explain chemical function of food additives. 5. Design, report on, and critique food experiments using the scientific method. Credits: 2.00

NUTR 46100 - Laboratory In Medical Nutrition Therapy

Credit Hours: 10.00. Application of previous knowledge and communication skills of medical nutrition therapy in the hospital/patient care setting to ultimately include responsibilities equivalent to staff relief.

Learning Outcomes: 1. Perform as a clinical nutritionist and complete the competencies as outlined in the Learning Outcomes for Supervised Practice Form. Credits: 10.00

NUTR 46500 - Laboratory In Engagement

Credit Hours: 3.00. Culminating experiences in community nutrition, foodservice, medical nutrition therapy, public health, research and/or nutrition related business. Placements will be arranged based on individual student's preferred track in long-term care facilities, hospitals, public health or community agencies, and/or business and industry.

Learning Outcomes: 1. Perform at entry level as dietician and in placements arranged based on individual student's preferred track in long-term care facilities, hospitals, public health or community agencies, and/or business and industry. Credits: 3.00

NUTR 48000 - Medical Nutrition Therapy I

Credit Hours: 4.00. Nutrition assessment in humans and introduction to the nutrition care process. Application of the nutrition care process to various disease states.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical evidence-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered

Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify nutrition-related problems for medical nutrition therapy. Credits: 4.00

NUTR 48100 - Medical Nutrition Therapy II

Credit Hours: 3.00. Application of the Nutrition Care Process in various disease states and conditions to prepare students for supervised practice programs.

Learning Outcomes: 1. Demonstrate how to locate and interpret professional literature to make ethical-based practice decisions. 2. Utilize current information technologies to locate evidence-based guidelines and protocols. 3. Locate and understand established guidelines to a professional practice scenario. 4. Identify the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services. 5. Utilize the nutrition care process to make decisions and to identify nutrition-related problems for medical nutrition therapy. Credits: 3.00

NUTR 48800 - Topics In Nutrition, Fitness, And Health

Credit Hours: 3.00. This course critically evaluates the interrelationships between nutrition and exercise and their impact on physical performance and health. Concepts combining nutritional sciences and exercise physiology will be presented. Emerging science and controversies in the current literature will be discussed.

Learning Outcomes: 1. Value the integration of nutrition and exercise for human health promotion, especially related to dietary macronutrients and energy. 2. Discuss current controversial topics in nutrition and fitness and special topics. 3. Practice scientific literature searching, critical evaluation and interpretation of research, technical and scientific writing, and oral communication skills. Credits: 3.00

NUTR 49000 - Independent Undergraduate Research

Credit Hours: 1.00 to 4.00. Independent research projects undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Students will improve their critical thinking skills in nutrition science. 2. Students will conduct hypothesis-driven research projects. Credits: 1.00 to 4.00

NUTR 49100 - Independent Study

Credit Hours: 1.00 to 4.00. Independent scholarly activity undertaken with faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Increase knowledge and/or application in nutrition science. Credits: 1.00 to 4.00

NUTR 49200 - Undergraduate Instruction In Nutrition

Credit Hours: 1.00 to 5.00. Problems dealing with various aspects of nutrition. Permission of instructor required.

Learning Outcomes: 1. Develop extensive knowledge base and/or application in nutrition science. Credits: 1.00 to 5.00

NUTR 49500 - Undergraduate Seminar In Foods And Nutrition

Credit Hours: 1.00. Instruction and application of concepts for effective oral presentations in the field of nutrition sciences.

Learning Outcomes: 1. To enhance your critical thinking skills. 2. To develop and enhance your oral communication skills. 3. To enhance your ability to make effective visuals for presentations. Credits: 1.00

NUTR 49600 - Evaluation Of Nutrition Science Research

Credit Hours: 3.00. Evaluation of nutrition science research as it relates to health and disease.

Learning Outcomes: 1. Distinguish between data and interpretation through the practice of reading, analyzing, critiquing, and discussing

nutrition science research articles. 2. Access and integrate the contribution of multiple research studies to an area of nutrition science rresearch and its impact on health and disease. 3. Explain, orally and in writing, the evaluation of nutrition science research. 4. Identify and assess the validity of sensational nutrition science research presented in media. Credits: 3.00

NUTR 49700 - Honors Research Project

Credit Hours: 1.00 to 3.00. The completion of the independent honors research project for Honors College and Department of Nutrition Science Honors Program students. Must have an approved Honors Project Proposal. Permission of instructor required.

Learning Outcomes: 1. Demonstrate critical thinking skills in nutrition science. 2. Present and defend hypothesis-driven research project. Credits: 1.00 to 3.00

Department of Psychological Sciences

About

Psychology is the study of behavior and mental processes (thought) where the focus is on individuals. The word psychology comes from the Greek words "psyche" (mind) and "logos" (knowledge of). Psychology, as a recognized field of study, has only been around for a little over a hundred years, but people have had discussions of human behavior for centuries.

The Department of Psychological Sciences at Purdue is consistently among the top 50 psychology departments in the US (out of more than 300). The many professors you will have in class wear a number of different hats. They conduct and publish research that advances the field of psychology and train graduate students.

With a bachelor's degree in psychology, your career opportunities will be many and varied. You could obtain advanced training in Psychology or seek a career in affiliated fields such as clinical social work, social work, mental health counseling, marriage & family therapy, or school counseling. Another option is to enroll in a graduate program in such fields as law, medicine, or business. Your knowledge of psychology will be invaluable in all these areas. You may also choose to take a job immediately after graduation, in diverse settings such as a hospital, group home, government agency, business or industry, applying your skills in areas such as personnel selection, advertising, consumer-product research, or public opinion polling. Because you will learn about many aspects of psychology while at Purdue, you will be well-prepared for many career opportunities.

Areas of Psychology

- Mental health, various forms of mental illness, and other facets of Clinical Psychology
- Perception, attention, memory, and other facets of Cognitive Psychology
- Industrial / Organizational Psychology
- Arousal, brain functioning, and other facets of Behavioral Neuroscience
- Statistics, measurement of human characteristics, and other facets of Mathematical and Computational Cognitive Science
- Stereotyping, attitudes, relationships, social influence and other facets of Social Psychology

Faculty (website)

Contact Information

Psychological Sciences
Psychological Sciences Building
703 Third Street
West Lafayette, IN 47907
Phone: (765) 494-6061
Fax: (765) 496-1264

Graduate Information

For Graduate Information please see Psychological Sciences Graduate Program Information .

Brain and Behavioral Sciences, BS

Psychological Sciences, BS

Psychology Minor

PSY 10000 - Introduction To The Science And Fields Of Psychology (UCC: IL)

Credit Hours: 1.00. An introduction to psychology as a science and as a profession.

University Core Curriculum (UCC): (UCC: IL)
Credits: 1.00

PSY 12000 - Elementary Psychology (UCC: BSS)

Credit Hours: 3.00. Introduction to the fundamental principles of psychology, covering particularly the topics of personality, intelligence, emotion, abnormal behavior, attention, perception, learning, memory, and thinking. As part of their learning experience, students participate in psychological experiments. CTL:ISH 1020 Introduction To Psychology

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

PSY 12300 - Beyond Mental Health: The Science Of Well-Being (UCC: BSS)

Credit Hours: 3.00. This course seeks to provide a scientific and psychological account of well-being - its definition, determinants, and outcomes. We address questions such as: How do we go about measuring happiness? Can happiness enhance longevity and health? What interventions can promote happiness? What types of societies are happier? This course will engage and challenge students not only intellectually, but also experientially as we work on enhancing happiness in our lives and in the lives of others around us.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Outline the history of well-being research. 2. Identify key antecedents of well-being. 3. Explain and distinguish among different scientific theories of well-being. 4. Describe the positive outcomes of happiness for individuals and societies. 5. Discuss the scientific process of studying well-being. 6. Apply positive psychology techniques to their own their lives. 7. Identify and locate resources that promote mental health and well-being.
Credits: 3.00

PSY 20000 - Introduction To Cognitive Psychology

Credit Hours: 3.00. A survey of psychology as the science of mental life, covering theories and research in perception, reading, attention, consciousness, imagery, memory and its improvement, problem solving, creativity, decision-making, and artificial intelligence.

Learning Outcomes: 1. Describe basic aspects of visual perception and visual imagery. 2. Explain the role of attention in cognition. 3. Describe basic representations and processes of memory. 4. Understand high-level cognitive functions such as reasoning, problem solving, and language. 5. Understand how cognitive neuroscience can inform cognitive psychology.
Credits: 3.00

PSY 20100 - Introduction To Statistics In Psychology

Credit Hours: 3.00. An introduction to the development and application of statistical, quantitative, and measurement techniques pertinent to the psychological sciences. Fundamental concepts of numerical assignment, sampling theory, distribution functions, experimental design, inferential procedures, and statistical control. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand basics of descriptive statistics and how to calculate them. 2. Understand foundational logic underlying inferential statistics (probability, sampling distributions, and the logic of hypothesis testing). 3. Understand statistical techniques used to evaluate competing hypotheses as used in psychology and other social sciences, and the circumstances under which they should be used. 4. Understand how to interpret results from SPSS, a software package that is commonly used in the field of psychology for statistical analysis. 5. Understand how to apply statistical reasoning and how to properly collect, describe, and interpret data. Credits: 3.00

PSY 20300 - Introduction To Research Methods In Psychology

Credit Hours: 3.00. The use of scientific method in psychology. Lecture covers principles of collecting and interpreting data, using examples of research from many areas of psychology. In the laboratory portion, the student uses many different techniques from various areas of psychology. Should be taken at Purdue University, West Lafayette.

Learning Outcomes: 1. Understand and produce research that adheres to the highest ethical standards. 2. Identify distinguishing features of good science, bad science and junk science. 3. Critically evaluate research findings. 4. Understand how study designs are used to answer research questions. 5. Present and interpret experimental data in an APA-style paper. Credits: 3.00

PSY 22200 - Introduction To Behavioral Neuroscience

Credit Hours: 3.00. An introduction to how the nervous system controls behavior. Topics include evolution and comparative psychobiology, the neuroscience of sensation and perception, the neuroscience of motivation, neuropsychology, and cognitive neuroscience.

Learning Outcomes: 1. Describe the basic structure and function of the brain including neuroanatomy and neural communication. 2. Explain how the central nervous system processes internal and external stimuli. 3. Explain how experience influences current and future behavior. 4. Discern normal from abnormal brain function and describe its influence on behavior. Credits: 3.00

PSY 23099 - Cooperative Education Seminar I

Credit Hours: 1.00 or 2.00. (ENGR 23099) This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Prerequisite: Student must have completed at least one Co-Op work term. May be repeated once after the second work term. Can be taken for two credits subsequent to completing two back-to-back work terms. Instructor permission required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand knowledge of the engineering profession. 3. Learn from the experiences of other participants and apply that knowledge to the situation. Credits: 1.00 or 2.00

PSY 23500 - Child Psychology

Credit Hours: 3.00. Not open to students with credit in PSY 36000. General principles of children's behavior and development, from conception to adolescence, including sensory and motor development, and basic psychological processes such as learning, motivation, and socialization.

Credits: 3.00

PSY 23900 - The Psychology Of Women

Credit Hours: 3.00. The purpose of the course is to provide an overview of the psychology of women. Topics include stereotyping, women and achievement, aggression and power, the psychological concept of androgyny, and attitudes toward feminism.

Credits: 3.00

PSY 24000 - Introduction To Social Psychology

Credit Hours: 3.00. Not open to students with credit in SOC 34000 . A broad survey in current knowledge about human social behavior. Topics covered include aggression, attraction and love, social influence, attitudes and attitude change, nonverbal communication, leadership, prejudice and discrimination, and application of social psychology to law, medicine, and other fields. CTL:ISH 1024 Social Psychology

Credits: 3.00

PSY 24400 - Introduction To Human Sexuality

Credit Hours: 3.00. This course will provide a broad survey of research on human sexuality from a psychosocial perspective. Topics covered include research methods, gender identity, sexual orientation, reproductive anatomy, typical and atypical sexual behavior, and sexual difficulties and their treatments. CTL:ISH 1022 Human Sexuality

Credits: 3.00

PSY 27200 - Introduction To Industrial-Organizational Psychology

Credit Hours: 3.00. Survey of psychological principles and research methods relevant to organizations and industry. Topics covered include research methodology, individual differences, personnel selection, performance measurement, training,

motivation, job satisfaction, emotions, work stress, and leadership.

Learning Outcomes: 1. Provide instruction and covers material to assist students in obtaining a broad perspective on the field of Psychological Sciences. Credits: 3.00

PSY 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 29200 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various introductory-level topics in Psychology that may be offered on a semester-by-semester basis by Purdue Psychological Sciences faculty or by non-Purdue faculty/instructors as part of a student's study abroad program.

Learning Outcomes: 1. Provide breadth of coverage across the diverse field of Psychological Sciences. Credits: 1.00 to 3.00

PSY 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

PSY 30500 - Understanding And Analyzing Psychological Data

Credit Hours: 3.00. This course is an upper level undergraduate statistics course for students in psychology and related fields who are interested in conducting or understanding quantitative research. Students should have successfully completed an introductory statistics course (e.g., PSY 20100). The course will begin with an accelerated review of fundamentals concepts (e.g., data visualization, central limit theorem, probability) and then will focus primarily on regression.

Learning Outcomes: 1. Demonstrate advanced conceptual understanding of foundational statistical principles. 2. Demonstrate ability to correctly analyze data by hand and using SPSS. 3. Demonstrate skills in managing their own data. 4. Demonstrate the ability to comprehensively analyze and interpret the results of correlation, simple regression, multiple regression, and two-way interaction models. 5. Demonstrate proper interpretation. 6. Demonstrate the ability to accurately report results of statistical analyses in APA format. Credits: 3.00

PSY 30600 - Understanding And Analyzing Experiments

Credit Hours: 3.00. This course helps to prepare students for independent research. Students (1) develop an understanding of group-based statistical analyses, such as t-tests and ANOVA; (2) formulate and present a research idea based on statistical tools covered in class; and (3) get experience using statistical software to analyze data.

Learning Outcomes: 1. Determine which statistics to use, how to use them and how to interpret their findings using data for conventional experimental designs in psychological sciences. 2. Interpret current research in psychological sciences. 3. Give oral presentations based on research. 4. Develop and advance personal research interests. Credits: 3.00

PSY 31000 - Sensory And Perceptual Processes

Credit Hours: 3.00. A survey of the study of psychological experiences caused by stimulation to the senses. Topics include theory and research in seeing, hearing, touching, smelling, and tasting as experienced by humans and other animals.

Credits: 3.00

PSY 31100 - Human Memory

Credit Hours: 3.00. A survey of theories and research about how humans remember information and why they often forget. Topics include research on amnesia, forgetting, and sensory memory systems as well as on practical issues such as how to improve memory.

Learning Outcomes: 1. Explain how the science of human and memory enriches understanding of the human mind. 2. Describe what learning and memory are, how they work, and why they work that way. 3. Critically apply the science of learning and memory to evaluate ideas presented in popular media. Credits: 3.00

PSY 31400 - Introduction To Learning

Credit Hours: 3.00. This course attempts to make clear the theoretical and practical implications of learning principles and findings. Various theories of learning are examined and the implications of these theories, and the learning approach generally, for a variety of practical problems are emphasized.

Credits: 3.00

PSY 32400 - Introduction Cognitive Neuroscience

Credit Hours: 3.00. (SLHS 30100) Introduction to the neural bases of complex human mental abilities. Emphasis on integrating research from cognitive science, brain-scanning techniques, and the lesion technique. Topics include perception, attention, memory, language, motor control, planning/decision-making and consciousness.

Credits: 3.00

PSY 32700 - Psychology Of Helping

Credit Hours: 3.00. This course is designed to provide a broad but rigorous, undergraduate-level comprehensive overview of contemporary scientific research on prosocial processes from the perspective of personality and social psychology.

Learning Outcomes: 1. Demonstrate a comprehensive mastery of the mechanisms and processes associated with prosocial behavior. 2. Demonstrate an ability to think creatively about research on prosocial processes. 3. Demonstrate an understanding of how research on prosocial behavior is planned and conducted. 4. Demonstrate how prosocial processes are integrated with more general interpersonal processes and social relations. Credits: 3.00

PSY 33099 - Cooperative Education Seminar II

Credit Hours: 1.00 or 2.00. This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Permission of instructor required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand their knowledge of professions in Psychological Sciences. 3. Learn from the experiences of other participants so that they may apply their knowledge to their situation. Credits: 1.00 or 2.00

PSY 33500 - Stereotyping And Prejudice

Credit Hours: 3.00. This course examines the topics of stereotyping, prejudice, and discrimination from a social psychological perspective. Relying on empirical findings and relevant theoretical approaches, the course moves beyond lay opinions to explore the social psychological foundations and forms of stereotyping and prejudice, and to examine various strategies for reducing intergroup biases.

Credits: 3.00

PSY 33600 - Issues In Developmental Psychology

Credit Hours: 3.00. Survey of current issues in developmental psychology and methods for studying these problems. The topics selected for intensive examination reflect contemporary developmental research issues and may involve different-aged children or adults.

Credits: 3.00

PSY 33700 - Social Cognition

Credit Hours: 3.00. A survey of theory and research on the role of thought processes in social behavior (a combination of social and cognitive psychologies). Topics include causal attribution, person perception, stereotyping, impression formation, event memory, and social judgment.

Credits: 3.00

PSY 34200 - Introduction To Psychology Of Personality

Credit Hours: 3.00. This course integrates empirical studies (observational, correlational, experimental) with classical and current personality theories. Topics include the biological foundations of personality, self-esteem, extraversion, sex role orientation, authoritarianism, and personality disorders. Minimum competence is assumed in basic experimental design and correlations.

Learning Outcomes: 1. Define personality from a scientific psychological perspective. 2. Discuss the strengths and weaknesses of the methods and sources of data for personality researchers. 3. Describe biological and trait models of personality. 4. Discuss the relationship between personality, psychopathology, personality disorders and psychotherapy. 5. Describe how culture and environment interact with personality. Credits: 3.00

PSY 35000 - Abnormal Psychology

Credit Hours: 3.00. Various forms of mental disorders from the standpoint of their origin, treatment, prevention, social significance, and relation to problems of normal human adjustment. CTL:ISH 1023 Abnormal Psychology

Learning Outcomes: 1. Demonstrate an understanding of the historical, ethical, and cultural contexts of psychopathology. 2. Compare and contrast major historical and contemporary theoretical perspectives on psychopathology. 3. Demonstrate an understanding of the scientific bases of the etiology, assessment, classification, diagnosis, and treatment of psychopathology. Credits: 3.00

PSY 35200 - Introduction To Neuropsychology

Credit Hours: 3.00. This course is an examination of the effects of various types of brain damage on human behavior, the methods used to assess brain damage, and evaluation of research studies on human brain damage and behavior.

Learning Outcomes: 1. Describe effects of damage to different human brain areas on behavior. 2. Discuss what effects of brain damage teach us about brain function and organization. 3. Describe approaches used to study human brain damage. 4. Critically evaluate published research studies on human brain damage and behavior. Credits: 3.00

PSY 35400 - Close Relationships

Credit Hours: 3.00. This course introduces undergraduate college students to major topics in psychological research on intimate relationships. There are many types of close relationships. This primarily focuses on relationships that currently are, will be soon, or at one point were, romantic involvements. A goal is to educate students on current research findings concerning intimate relationships.

Learning Outcomes: 1. Navigate relevant research and demonstrate understanding and of relationship science. 2. Judge the accuracy of portrayals of relationships in the general media. 3. Describe the mechanics underlying close relationships. 4. Demonstrate the ability to read and understand published studies concerning close relationships. Credits: 3.00

PSY 36700 - Adult Development And Aging

Credit Hours: 3.00. Theory and research on adult development from young adulthood through the elderly years. Course covers biological, cognitive, personality, and social issues. Topics include vocational choice, marriage, parenthood, the empty nest, menopause, memory and aging, retirement, widowhood, longevity, and death and dying.

Credits: 3.00

PSY 37600 - Attention And Cognitive Control

Credit Hours: 3.00. This upper-level undergraduate course provides an overview of research and theory related to attention and cognitive control. The first half of the course focuses on selective attention to locations, objects, and features, as well as the role of attention in memory and skilled performance. The second half focuses on divided attention and cognitive control in multitasking situations, as well as aspects of adaptive, hierarchical, and inhibitory control. The goal of the course is to provide you with an understanding of major theoretical views, key experimental findings, and common research procedures related to attention and cognitive control.

Learning Outcomes: 1. Define selective

attention to locations, objects, and features. 2. Describe the relationship between eye movements and attention. 3. Identify the limits of attention. 4. Describe the role of attention in memory and skilled performance. 5. Discuss divided attention, dual-task, task switching performance, task interruption and mind wandering. 6. Identify aspects of adaptive and hierarchical control. Credits: 3.00

PSY 38000 - Behavior Change Methods

Credit Hours: 3.00. Application of behavioral learning principles to problems in living. Self-paced learning format covers design and evaluation of behavior modification programs, with practical and ethical issues. Relevant to work with children, adults, clinical patients, athletes, etc., in schools, institutions, and everyday situations.

Credits: 3.00

PSY 39000 - Research Experience In Psychology

Credit Hours: 1.00 to 3.00. Involvement in an ongoing research project in the Department of Psychological Sciences. Up to 6 credits may be taken for a letter grade. Additional credits after 6 must be taken as Pass/No Pass. Permission of instructor required.

Learning Outcomes: 1. Apply principles of research methodology within a lab setting, as appropriate for lab role. 2. Demonstrate ethical behavior in the conduct of psychological research. 3. Demonstrate professional communication skills through interactions with principal investigators, graduate students, lab personnel, and research participants. Credits: 1.00 to 3.00

PSY 39100 - Readings In Psychology

Credit Hours: 1.00 to 3.00. In-depth reading on a specific topic in psychology under the guidance of a faculty member, often in preparation for PSY 49800. Permission of instructor required.

Credits: 1.00 to 3.00

PSY 39200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by Psychological Sciences department faculty.

Credits: 1.00 to 3.00

PSY 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in psychological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to

identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PSY 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

PSY 39800 - Independent Research In Psychology

Credit Hours: 3.00. Students will conduct an independent research project related to research that is ongoing in the lab. Students will discuss theories and ideas related to the project, and plan and execute a thesis. Duties may include data coding and entry; participating in the planning of the research and the development of research materials; executing the research with responsibility for all aspects of data collection. Students are expected to be involved in the research project for an average of nine hours per week. Permission of instructor required.

Learning Outcomes: 1. Learn about many aspects of conducting research, such as human or animal subject issues, experimental design, interpreting results, relating results to theory, etc. 2. Learn how psychological questions can be answered through research. Credits: 3.00

PSY 40100 - Language And The Brain

Credit Hours: 3.00. (SLHS 40100) This course is an overview of the neutral systems that underlie the core components of language, including speech perception and production, reading and writing, morphology, syntax, semantics, and discourse. During the past few decades, there has been an unprecedented increase in studies on these topics, due in large part to the widespread use of highly sensitive brain mapping techniques that enable researchers to identify relationships between particular brain areas and particular language functions. The findings that have been emerged from this recent explosion of research are exciting and important for several reasons. They provide fresh insights into the nature of the uniquely human capacity for language, and they have significant implications for understanding and treating language disorders that result from brain injury.

Learning Outcomes: 1. Understand the main methods for investigating the neural substrates of language. 2. Understand the classic and progressive aphasia syndromes. 3. Basic neural underpinnings of the core aspects of language. 4. Critically evaluate research on language. 5. Critically evaluate research on language and the brain. Credits: 3.00

PSY 40300 - Psycholinguistics

Credit Hours: 3.00. (PSY 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

PSY 40400 - Honors Research Seminar I

Credit Hours: 3.00. Part one of a research series aimed at providing a structured learning experience to help students develop the basic research skills needed in order to conduct psychological research. Students will be expected to develop a research plan to be completed in concert with PSY 40500. Permission of department required.

Credits: 3.00

PSY 40500 - Honors Research Seminar II

Credit Hours: 3.00. Part two of a research series aimed at providing a structured learning experience to help students develop the basic research skills needed in order to conduct psychological research. Students will be expected to develop a

research plan to be completed in concert with PSY 40400. Permission of department required.

Credits: 3.00

PSY 41800 - Understanding Autism

Credit Hours: 3.00. (HDFS 41800, SLHS 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history of ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associated with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

PSY 42100 - Alcohol Use And Disorders

Credit Hours: 3.00. The goal of this course is to provide students with a broad understanding of the biological bases of alcohol abuse and alcoholism. The course will cover neuroanatomical, neurochemical and biological systems that regulate the biological and behavioral response to alcohol. Coverage will also include discussions of the role of environment, age, gender, among other factors that influence the response to alcohol and propensity toward abuse and addiction. The course will also cover the neuroscience of treatment and relapse.

Learning Outcomes: 1. Acquire knowledge about alcohol's effects on the brain and behavior. 2. Demonstrate knowledge about the major theories of addiction. 3. Critically evaluate primary research about the neuroscience of alcohol. 4. Discuss and apply learned knowledge about the neuroscience of alcohol and theories of addiction to ""real-world"" situations. 5. Communicate proficient critical thinking skills about the neuroscience of alcohol through writing. Credits: 3.00

PSY 42200 - Genes and Behavior

Credit Hours: 3.00. An examination of genetic influences on behavior, including the mechanisms of genetic influence, methods of gene manipulation, and the role of genes in development and evolution. Genetic influences on mental illness, learning, memory, and intelligence are considered.

Credits: 3.00

PSY 42600 - Language Development

Credit Hours: 3.00. (SLHS 30900) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

Credits: 3.00

PSY 42800 - Drugs And Behavior

Credit Hours: 3.00. Discussion of the variety of drugs that affect the nervous system and behavior. Emphasis will be upon a discussion of the physiological and pharmacological bases for the use and misuse of drugs in our society.

Credits: 3.00

PSY 42900 - Hormones And Behavior

Credit Hours: 3.00. Discussion of the mechanisms and effects of endocrine hormones and brain peptides on sexual

differentiation, sexual behavior, learning, response to stress, maternal behavior, and weight regulation.

Credits: 3.00

PSY 43099 - Cooperative Education Seminar III

Credit Hours: 1.00 or 2.00. This seminar course is optional for Co-Op students when they are on-campus. In this course, students share their work experiences, receive feedback from the instructor and seminar participants, and continue their professional development. Permission of instructor required.

Learning Outcomes: 1. Develop oral and written presentation skills. 2. Expand their knowledge of professions in Psychological Sciences. 3. Learn from the experiences of other participants so that they may apply their knowledge to their situation. Credits: 1.00 or 2.00

PSY 43200 - Social Psychology In Film

Credit Hours: 3.00. This course examines theory and research in experimental social psychology and uses popular films to assist in provoking thought and analysis of the theory and research.

Learning Outcomes: 1. Correctly interpret research findings from experimental social psychology. 2. Apply these findings to various films. 3. Formulate written ideas about films that are grounded in social psychological theory. Credits: 3.00

PSY 43400 - Neurobiology Of Disease

Credit Hours: 3.00. This course explores the neurobiological basis of disorders of the nervous system and psychiatric disease. Students will learn various neurological disorders that affect behavior, the associated cellular and molecular mechanisms, and current treatment strategies.

Learning Outcomes: 1. Demonstrate how to search for scientific literature and compare/contrast peer-reviewed articles with news media. 2. Identify, discuss, examine, and critically evaluate the basic mechanisms and clinical features of diseases of the nervous system. 3. Describe research on the biology of various neurological and psychiatric disorders. 4. Discuss and critique research papers on ground breaking discoveries related to underlying mechanisms and treatments of various neurological and psychiatric disorders. 5. Generate analogies and craft models that represent human neurological and psychiatric diseases. Credits: 3.00

PSY 43600 - Foods And Behavior

Credit Hours: 3.00. This course examines aspects of the scientific study of eating and drinking; its effects on individual health and well-being; broader implications of psychology, culture and society on eating and drinking; the effects of food policy on food and beverage intake and well-being. Topics to be covered include physiological signals affecting hunger and satiety, social norms and influences regarding food intake, identifying sources of food and its constituents, disordered food intake, malnutrition, poverty and food, and the influence of food and agriculture industries on food choices and consumption.

Learning Outcomes: 1. Describe how the scientific method applies to questions related to ingestive behavior. 2. Discuss how constituents of food contribute to physical and emotional well-being. 3. Describe biological, social and cultural factors that influence food choice. 4. Critically evaluate how society and culture influence eating and drinking habits. Credits: 3.00

PSY 43700 - Behavioral And Neural Systems Of Learning And Memory

Credit Hours: 3.00. The purpose of this course is to integrate insights on learning and memory from behavioral and neuroscience perspectives based on animal and human research. How brain regions underlie different categories of learning will be covered. Discussions on how these types of learning contribute to clinical disorders, such as anxiety and addiction disorders.

Learning Outcomes: 1. Examine how brain regions underlie different categories of learning. 2. Discuss how types of learning contribute to clinical disorders. 3. Compare and contrast insights on learning and memory from

behavioral and neuroscience perspectives based on animal and human research. 4. Comprehend and discuss behavioral processes, brain substrates and clinical perspectives for each topic covered. Credits: 3.00

PSY 43800 - Introduction To Clinical Psychology

Credit Hours: 3.00. This course introduces students to the field of clinical psychology and will provide a broad overview of the roles and responsibilities that fall under the rubric of clinical psychology, with a particular emphasis on psychological assessment and intervention. Focus is on the professional responsibilities of a clinical psychologist (i.e., how clinical psychology is applied in practice), rather than the study of psychopathology per se.

Learning Outcomes: 1. Describe professional responsibilities of a clinical psychologist. 2. Discuss methods used by clinical psychologists to assess and diagnose disorders. 3. Describe specific types of interventions used to treat psychological disorders. 4. Discuss special concerns related to diagnosing and treating children and adolescents. Credits: 3.00

PSY 44300 - Aggression And Violence

Credit Hours: 3.00. An intensive examination of the nature of human aggression. Among the topics covered will be (1) theoretical perspectives concerning such behavior; (2) social conditions that encourage its performance; and (3) means for its prevention and control.

Credits: 3.00

PSY 46400 - Research Ethics In Psychological Sciences

Credit Hours: 3.00. Research Ethics broadly refers to the application of everyday values, such as fairness, honesty, and objectivity to scientific research. This course is designed to provide broad coverage of the ethical standards that research scientists must follow and allow exploration of various real-world ethical issues in the psychological sciences.

Credits: 3.00

PSY 47300 - Selection And Performance Appraisal In Organizations

Credit Hours: 3.00. Classic and current issues in employee selection and the appraisal of employee performance will be discussed. Topics addressed will include: Equal Employment Opportunity and unfair discrimination, developing effective selection and placement strategies, evaluating employee performance, and understanding the performance appraisal process.

Learning Outcomes: 1. Define and apply the major theories related to personnel selection and performance appraisal. 2. Describe recent research findings and apply those findings to issues related to personnel selection and performance appraisal. 3. Design and develop personnel selection and performance appraisal systems that are fair, valid, and legally appropriate. 4. Demonstrate the ability to evaluate personnel selection and performance appraisal systems with respect to their fairness, validity, and legality. 5. Perform a job analysis. Credits: 3.00

PSY 47500 - Work Motivation And Job Satisfaction

Credit Hours: 3.00. Psychological processes and current theories of work motivation and job satisfaction and their practical implications.

Credits: 3.00

PSY 48400 - The Psychology Of Consciousness

Credit Hours: 3.00. A survey of psychological experiments and theory in consciousness. An emphasis is placed on altered states of consciousness such as dreaming, hypnosis, drug-induced changes in consciousness, and meditation; and comparison with ordinary consciousness is made.

Credits: 3.00

PSY 49200 - Internship In Psychology

Credit Hours: 3.00. Experiential, supervised training in various areas of psychology-related fields including human factors, human resources, mental health-related organizations, research labs, and supervised living institutions. Usually taken in junior or senior year. Permission of instructor required.

Learning Outcomes: 1. Broaden experiences by exposure to professional settings related to psychological sciences. 2. Experience the importance and relevance of ideas learned in

course work. 3. Increase repertoire of skills and experiences related to job placement or further education after graduation. 4. Develop skill working in a group/team. Credits: 3.00

PSY 49800 - Senior Research

Credit Hours: 3.00. Student conducts and writes a report on an individual research project under the guidance of a faculty member. Permission of instructor required.

Learning Outcomes: 1. Demonstrate expertise with the processes and procedures of research in psychological sciences. 2. Design and conduct a research project related to psychological sciences. Credits: 3.00

Department of Public Health

About Public Health

The Department of Public Health prepares students who have a passion for helping others to use science-based approaches to make healthier communities. Our faculty, students and alumni work as educators, researchers, practitioners, and policy makers to tackle challenges affecting the health and well-being of a variety of populations. We engage in groundbreaking, interdisciplinary research with individuals, families, communities, and societies to address the social determinants of health and health inequities at local, national and global levels. Our focus is on disease prevention and health promotion, and we are committed to social justice and the belief that health is a human right.

We offer a Bachelor of Science (BS) degree in public health as well as a 4+1 Master of Public Health (MPH) degree. All undergraduate and graduate students can customize their course selections to match their particular interests in the field of public health and complete a practicum to gain real-world work experience in a public health setting. Graduates of Purdue University's Department of Public Health are well positioned to start in a variety of public health work settings or to continue to graduate school or professional programs.

The department is a member of the Association of Schools and Programs in Public Health (ASPPH), and the Master of Public Health graduate program is **accredited by the Council on Education for Public Health** (CEPH).

Join us to take your passion for helping others to the next level!

Faculty (website)

Department of Public Health (website)

Contact Information

Public Health
Purdue University
Matthews Hall, Room 223
812 W. Mitch Daniels Blvd.
West Lafayette, IN 47907
Phone: (765) 496-1826

Public Health, BS

PUBH 10000 - Introduction To Public Health

Credit Hours: 1.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health and disease. 3. Understand the government's role in matters pertaining to the health of the public. 4. Explain the role of public health in medical care and identify the principal problems in the US healthcare system. 5. Achieve a basic understanding of the two major analytical methods of public health: epidemiology and biostatistics. 6. Identify the principal environmental determinants of health. 7. Understand the health challenges that confront major vulnerable populations. 8. Have knowledge of major and widespread challenges to good health: smoking, obesity, chronic

disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health. 10. Describe future challenges in public health. Credits: 1.00

PUBH 10001 - Introduction To Public Health

Credit Hours: 3.00. This course serves as an introduction to the field of public health. Topics include identification of the principal determinants of health and how they affect individuals and populations, the role of government and public health professionals in health and healthcare, and critical and emerging issues in public health in the US and around the world.

Learning Outcomes: 1. Acquire a basic understanding of the field of Public Health. 2. Identify the principal determinants of health. 3. Explain the role of public health in society. 4. Understand the government's role in matters pertaining to the health of the public. 5. Understand the role of health disparities in public health. 6. Achieve a basic understanding of the major investigative tool in public health: Epidemiology. 7. Identify the principal environmental determinants of health. 8. Know major and widespread challenges to good health: smoking, obesity, chronic disease, violence, and social and economic inequities. 9. Recognize critical and emerging issues in global health, including the current pandemic. Credits: 3.00

PUBH 20200 - Health In The Time Of Pandemics: An Introduction (UCC: STS)

Credit Hours: 3.00. This course will introduce students to basic concepts about health and disease through examination of the sweeping effects of pandemics. In addition to reviewing the effects directly related to human health and healthcare systems, the course will provide an interdisciplinary overview of the social, political, and economic consequences of infectious disease outbreaks and the range of local, national, and global responses to address them. The course will be taught by faculty members representing the broad diversity of disciplines within the College of Health and Human Sciences (HHS), with additional specific contributions from faculty representing other disciplines outside HHS.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Outline the historical and epidemiologic context of epidemics and pandemics. 2. Identify ethical, environmental, political, social and economic impacts of pandemics across the human lifespan. 3. Analyze the public health and social responses to pandemics at the local, national, and global levels. 4. Describe examples of scientific and technological developments, including novel vaccines, diagnostic tests, telehealth and other service delivery innovations, and the costs, benefits, and ethical implications for individuals and global society. Credits: 3.00

PUBH 20500 - Basic Public Health Studies

Credit Hours: 3.00. Examination of basic scientific concepts as applied to the problems and issues in selected areas of human health behavior with particular attention to their influence on population and individual health. Restricted to students enrolled in major degree programs for which this course is a requirement.

Learning Outcomes: 1. Discuss the nature of public health promotion and disease prevention in the US. 2. List the leading causes of death and describe leading theories of health behavior. 3. Define the components of psychological health and describe the basic traits shared by psychologically healthy people. 4. Describe the nature of stress, the physiology of the stress response, and the relationship of stress to health/disease; identify the major sources of stress in contemporary society and discuss interventions for stress management. 5. Discuss categories of drugs, routes of administration and drug interactions. 6. Describe the relationship of alcohol, tobacco and caffeine to health and disease. 7. Describe the general concepts of nutrition, list and explain the recommendations made to the public by various health agencies to decrease risk of chronic disease. 8. Describe various theories of obesity, discuss concepts of weight

management, define/describe body image and the disordered eating continuum, define anorexia and bulimia nervosa, and list symptomatology and risk factors. 9. Discuss the relationship of physical activity and physical fitness to health and/or disease and provide rationale (based on evidence from exercise epidemiology) for the recommendations made to the public concerning activity/exercise participation. 10. Describe the anatomy and basic functions of the cardiovascular system and the prevalence/incidence of heart disease, identify risk factors and describe the features of atherogenesis and other diseases of the heart and vascular system. 11. Describe the prevalence and incidence of the various types of cancer and identify cancer risk factors. 12. Describe the prevalence and incidence of diabetes and list risk factors for diabetes. Credits: 3.00

PUBH 22000 - Sexuality And Health

Credit Hours: 3.00. Deals with various aspects of human sexuality and sexual behavior and their impact upon individual health. Health concerns related to sexual behavior.

Credits: 3.00

PUBH 22500 - Contemporary Women's Health

Credit Hours: 3.00. Examines behavioral, psychological, and sociocultural aspects of women's experience in healthcare systems. Includes the influence of factors such as age, social class, and ethnicity on women's roles as recipients and providers of health care.

Credits: 3.00

PUBH 23000 - Community, Culture And Social Justice From A Public Health Perspective

Credit Hours: 3.00. The course provides an introduction to the concepts of community, culture, and social justice. The interaction between community, cultural, ethical, social, economic, environmental, political and social justice dynamics that shape health will be explored.

Learning Outcomes: 1. Identify and understand the social determinants of health. 2. Describe how community, cultural, ethical, social, economical, environmental, political and social justice shape human health both locally and globally using a social determinants of health framework. 3. Learn about theories of justice related to the field of public health. 4. Understand community developmental theoretical frameworks dimensions associated with the social change, such as empowerment, community participation, and capacity building. 5. Identify roles and responsibilities of the public health educator, other practitioners, and community members as agents of change. 6. Compare and contrast the concepts of health inequities, health disparities and health inequalities. Credits: 3.00

PUBH 23500 - Stress And Human Health

Credit Hours: 3.00. Course is designed to provide an understanding of stress and stress management, including the physiology of the stress response, the relationship between stress and disease, potential sources of stress, and methods of intervening to prevent and/or relieve stress.

Credits: 3.00

PUBH 24000 - Global Health

Credit Hours: 2.00. This course introduces students to current challenges, debates, and efforts at solutions in global public health with a focus on low-and middle-income countries. It provides an interdisciplinary overview of topics that include measures of health and disease, health disparities, communicable and non-communicable diseases, women's health, maternal and child health, food systems and nutrition, health systems, and global cooperation. It also highlights the central role of data in achieving the global health agenda. Permission of department required.

Learning Outcomes: 1. Identify major issues and trends in global health and their drivers, with a focus on low and middle-income countries. 2. Characterize the determinants of health and risk factors for conditions of importance to global health. 3. Identify key issues in health disparities between and within countries. 4. Describe the role of data in

informing and driving decision-making and actions in global health. 5. Formulate evidence-based arguments for or against global health policies or interventions. Credits: 2.00

PUBH 25000 - Intercultural Development In Public Health And Human Sciences

Credit Hours: 3.00. There is a high demand for students to be prepared to work efficiently and effectively across different cultures. Whether working on sustainable and thriving communities and organizations, promoting healthy lifestyles, disease prevention, or developmental health and wellness, the need to develop cultural bridging skills is important for effectively helping individuals and their communities. The course teaches students how to develop a deeper appreciation and empathy for cultural values and traditions that are different from their own, learn how to cultivate a cultural worldview, become more aware of their own cultures, foster intercultural openness and curiosity, and how to communicate across cultures.

Learning Outcomes: 1. Identify important cultural dimensions between US and other cultures. 2. Describe mindfulness and demonstrate how it applies to both their student life on campus as well as their public health and human sciences careers. 3. Engage in mindfulness techniques for self-reflection. 4. Formulate various techniques to focus on present situations and choose the appropriate method for various healthcare situations. 5. Learn and practice how to regulate their emotions during stressful situations in public health and human sciences. 6. Construct specific techniques to question their predisposed judgments of familiar and new people, places and things. 7. Assess and interpret cultural situations in order to plan and interact with others from different cultures in healthcare and human services. 8. Reflect on their cultural interactions and identify and develop new ways to interact in future cultural interactions in health and human services (synthesis and application). Credits: 3.00

PUBH 29500 - Internship & Career Preparation

Credit Hours: 1.00. This course provides students with professional competencies in identification and development of professional resources that aid in a greater understanding and preparation for careers in public health. Upon completion of the course, students will be prepared to seek an internship and apply concepts learned to their professional development experiences.

Learning Outcomes: 1. Define and conceptualize individual areas of study as a professional discipline, including its purpose, goals, trends, professional expectations, types of settings, etc. 2. Identify procedures for internship preparation. 3. Demonstrate the ability to develop a professional cover letter and resume. Credits: 1.00

PUBH 30500 - Health Education In Elementary Schools

Credit Hours: 3.00. The problems of physical health, mental health, and safety of the school-aged child are considered, with emphasis on ways in which the elementary teacher meets his or her responsibilities and opportunities for promoting pupil health.

Learning Outcomes: 1. Define terms related to health, coordinated school health programs (CSHP), and comprehensive school health education (CSHE). (IPSB 19) 2. Describe the health status of, and health risk behaviors of, children and adolescents. (IPSB 2) 3. Describe factors related to the health status and health behaviors of children and adolescents. (IPSB 7) 4. obtain needs assessment data related to child health and learning and the health risk behaviors of adolescents. (IPSB 1, 2) 5. Describe the relationship between health risk behaviors and CSHE. (IPSB 19) 6. Describe CSHP and components of CSHP. (IPSB 8) 7. Describe interrelationships between the components of CSHP including CSHE. (IPSB 8) 8. Provide rationale for CSHP and CSHE. (IPSB 8) 9. Develop plans for promoting collaborative efforts among health and education agencies and organizations for CSHP

and CSHE. (IPSB 6) 10. Use technology to retrieve resources for CSHP and CSHE. (IPSB 16) 11. Describe the role elementary and middle school teachers in CSHP and CSHE. (IPSB 9) 12. Define terms and identify concepts related health education planning, needs assessment, skills, content, methods, and assessment. (IPSB 5, 6, 10, 11, 12, 13, 18) 13. Secure, describe, and demonstrate strategies for teaching and assessing health education content and skills. (IPSB 13, 18, 20) 14. Develop a scope and sequence for elementary health education. (IPSB 3) 15. Identify and demonstrate strategies for handling sensitive health issues. (IPSB 17) 16. Secure, describe, and demonstrate strategies for involving families in CSHE. (IPSB 15) 17. Secure, describe, and demonstrate strategies for integrating health education with at least one other academic area. (IPSB 14) 18. Develop a resource kit for planning, implementing, assessing, and evaluating instruction in CSHE (IPSB 16) Credits: 3.00

PUBH 32000 - Health Behavior And Health Promotion

Credit Hours: 3.00. Introduces health behavior theory and practice in the context of health promotion and education. Examines individual, interpersonal, and community approaches to explaining and predicting health behavior and emphasizes their application to interventions in health promotion and education.

Learning Outcomes: 1. Identify basic theories, concepts and models from a range of social and behavioral disciplines that are used in public health research and practice. 2. Apply different health behavior theories and models in the U.S. and internationally to important public health issues such as tobacco use, physical inactivity, poor diet, etc. 3. Identify the causes of social and behavioral factors that affect health of individuals and populations. 4. Describe the role of social and community factors in both the onset and solution of public health problems. 5. Specify multiple targets and levels of intervention for social and behavioral science programs and/or policies. 6. Understand theoretical constructs from an ecological perspective; Understand theories and models relevant at multiple levels of behavioral influence, including the individual, interpersonal, community, and organizational levels. Credits: 3.00

PUBH 32500 - Methods Of Health Promotion And Education

Credit Hours: 3.00. Methods and materials of health promotion and education; preparation and use of content and materials related to health concerns of target populations. A variety of strategies and media are covered with theoretical and practical applications.

Credits: 3.00

PUBH 36500 - Public Health Research Methods

Credit Hours: 3.00. The course is designed to help you (1) develop an understanding of the nature of research and the scientific method in public health, (2) acquire an appreciation for the different types of research conducted within public health, and (3) provide an overview of the ethical, conceptual, and logistical considerations involved in designing, conducting, and critically evaluating public health research in basic and applied settings.

Learning Outcomes: 1. Explain and discuss the public health research process. 2. Identify or develop sound public health research questions and hypotheses, and discuss appropriate methods for testing the hypotheses. 3. Demonstrate appropriate techniques regarding data collection in public health. 4. Interpret research findings and discuss their implications relative to public health. Credits: 3.00

PUBH 38000 - Public Health Policy

Credit Hours: 3.00. This course will provide the opportunity to examine and analyze the financing, organization and delivery of health care in the U.S. and how these core elements are shaped and influenced by health care policy and decision-making.

Learning Outcomes: 1. Describe the role of policy, law and government relations in health care and public health. 2. Explain how federal, state, and local health policy is made. 3. Identify and critique the difference between population health and individual health. 4. Explain the policy interests between the public good (public health) and individual rights. 5. Explain the organization of the health care system, including principles and examples of health insurance and health care finance. 6. Describe health care policy formulation and implementation. 7. Explain and apply health policy principles to the policy topics discussed in class. Credits: 3.00

PUBH 40000 - Human Diseases And Disorders

Credit Hours: 3.00. The major communicable and noncommunicable diseases and disorders that afflict modern man, with particular emphasis upon the etiology, epidemiology, and ecology of these diseases and disorders.

Learning Outcomes: 1. Describe risk factors and modes of transmission for infectious and chronic diseases and how these diseases affect both personal and population health. 2. List the leading causes of mortality and morbidity, and health disparities among local, regional, and global populations. 3. Discuss major local, national, and global health challenges. 4. Explain the influence that science and technology have on individual and population health. 5. Describe the multiple determinants of health. Credits: 3.00

PUBH 40500 - Principles Of Epidemiology

Credit Hours: 3.00. The study of the distribution of diseases in human populations and factors that influence these distributions.

Learning Outcomes: 1. Interpret results of statistical analyses found in public health studies. 2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. 3. Identify key sources of data for epidemiological purposes. 4. Identify the principles and limitations of public health screening programs. 5. Describe a public health problem in terms of magnitude, person, place, and time. 6. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussions of health issues. 7. Comprehend basic, ethical, and legal principles pertaining to the collection, use, and dissemination of epidemiological data. 8. Apply the basic terminology and definitions of epidemiology. 9. Calculate basic epidemiology measures. 10. Communicate epidemiologic information to lay and professional audiences. 11. Draw appropriate inferences from epidemiologic data. 12. Evaluate the strengths and limitations of epidemiologic reports. Credits: 3.00

PUBH 48000 - Internship For Public Health

Credit Hours: 9.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques they have mastered in the classroom to a professional work experience in the field. Each student in the Public Health Major at Purdue University is required to perform a 400 hour internship experience that meets the expectations of the student, the internship/practicum site, and the University. The internship is to be a culminating experience representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Must have completed all other major requirements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge, skills, and abilities to be applied through the practicum experience within the areas of a) Administration, b) Program Development, c) Supervising Programs, d) Agency Operations. 2. Demonstrate professional and ethical decision making skills, verbal and written communication skills, and an ability to work with various needs of diverse populations. 3. Demonstrate professional

relationships that present themselves as part of the organization with staff and clientele throughout their practicum experience. 4. Assess, plan, implement, and evaluate a research or facility enhancing major project within the practicum site. Credits: 9.00

PUBH 49000 - Special Topics In Public Health

Credit Hours: 0.00 to 6.00. Various public health topics that may change from semester to semester. Department persmission required.

Learning Outcomes: 1. Outcomes vary due to nature of variable course topics. Credits: 0.00 to 6.00

PUBH 49200 - Mentored Research In Public Health

Credit Hours: 3.00. Designed to provide a research learning activity for undergraduate students majoring in Public Health. Students will gain research and presentation experience under the guidance of a supervising public health faculty member. Permission of instructor required.

Learning Outcomes: 1. Explain and discuss the research process. 2. Identify or develop sound public health research questions and hypotheses, and discuss appropriate methods for testing the hypotheses. 3. Demonstrate appropriate techniques regarding data collection in public health. 4. Interpret research findings and discuss their implications relative to public health. Credits: 3.00

Department of Speech, Language, and Hearing Sciences

About Speech, Language, and Hearing Sciences

Speech, Language, and Hearing Sciences (SLHS) is a top-ranked program that offers an undergraduate major focused on the science of human communication, and disorders affecting our ability to communicate effectively. In SLHS you will learn about the mechanisms underlying our ability to hear sounds, understand language, speak efficiently, and swallow safely. You will gain foundational knowledge in the evaluation, treatment, and research driving the field of human communication and its disorders. Students use this knowledge to solve problems and impact communities across the state and country.
SLHS is housed in Lyles-Porter Hall and offers audiology clinics, speech, language, and swallowing clinics, and state-of-the-art research laboratories. The SLHS major provides students with the foundational tools for a variety of career opportunities in healthcare. Our courses fulfill requirements needed to enter graduate programs in speech-language pathology or audiology. The major also provides students the opportunity to pursue specialized research interests within the field of communication sciences and disorders.

Contact Information

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Graduate Information

For Graduate Information please see Department of Speech, Language, and Hearing Sciences (Graduate).

Speech, Language, and Hearing Sciences, BS

SLHS 11000 - Exploring The Science And Practice Of Speech, Language, And Hearing Sciences

Credit Hours: 1.00. The Speech, Language, and Hearing Sciences (SLHS) Learning Community will provide SLHS majors with an opportunity to connect with each other, with SLHS graduate students, and with SLHS faculty. Students will be exposed to a variety of different learning and career opportunities within the SLHS field. Participants will also enroll in SLHS 11500 (Introduction to Communication Sciences and Disorders).

Learning Outcomes: 1. Understand the role of speech-language pathologists and audiologists in the community. 2. Understand the breadth and scope of career opportunities in the major. 3. Understand how and why the sciences of speech, language, and hearing can improve human lives. Credits: 1.00

SLHS 11500 - Introduction To Communicative Disorders (UCC: STS)

Credit Hours: 3.00. Nature, systems, and causes of communicative disorders and the principal methods used for remediation.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

SLHS 13000 - Perception, Action, And Cognition In The Speech, Language, And Hearing Sciences (UCC: IL)

Credit Hours: 3.00. This course provides a broad introduction to basic science topics that underlie research in the speech, language, and hearing sciences. Topics center around biological and psychological aspects of perception (especially hearing), action (especially speech production), and cognition (especially language). Topics are addressed in terms of developing an understanding of material drawn from popular media aimed at interested non-specialists, including long-form journalism, essays and editorials, documentaries, TEDtalks, popular films and TV shows, etc.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Provide an overview of fundamental biological and psychological aspects of perception, action, and cognition.

Credits: 3.00

SLHS 21500 - Exploring Audiology And Hearing Science (UCC: STS)

Credit Hours: 3.00. This course will introduce students to the discipline of hearing science and to the clinical profession of audiology, with a focus on the unique and exciting aspects of the auditory system. Students will be introduced to the acoustic properties of environmental and speech sounds in relation to hearing loss, the fundamental anatomical and physiological bases of hearing, normal development of hearing and auditory behaviors, history and scope of practice in Audiology, hearing disorders across the life span and assessment and intervention techniques used to manage hearing disorders in children and adults. Guest speakers will include hearing researchers from Purdue University who will talk about their specific research, audiologists from Purdue University and the community who will talk about clinical practice and individuals with hearing disorders who will speak about their personal stories.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

SLHS 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. (ENGL 22700) Credit will not also be awarded for both SLHS 22700 and LC 26100. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

SLHS 30100 - Introduction To Cognitive Neuroscience

Credit Hours: 3.00. (PSY 32400) Introduction to the neural bases of complex human mental abilities. Emphasis on integrating research from cognitive science, brain-scanning techniques, and the lesion technique. Topics include perception, attention, memory, language, motor control, planning/decision-making, and consciousness.

Credits: 3.00

SLHS 30200 - Hearing Science

Credit Hours: 3.00. An introduction to the scientific foundations of auditory sensation and perception. The course covers those aspects of acoustics most pertinent to understanding auditory processing of simple and complex sounds (e.g. speech and music), the anatomy and physiology of the peripheral and central auditory systems, and a range of auditory perceptual phenomena and their physiological correlates.

Learning Outcomes: 1. Define the physical parameters of sound waves and explain how waves propagate through a medium. 2. Characterize the effects of systems on signals in both the time and frequency domains. 3. Describe the transmissions of sound through the anatomical structures in the peripheral auditory system. 4. Describe the neural coding of simple and complex sounds. 5. Describe the fundamental aspects of auditory sensation and perception. 6. Describe the basic physiological correlates of auditory sensation and perception. Credits: 3.00

SLHS 30300 - Anatomy And Physiology Of The Speech Mechanism

Credit Hours: 3.00. This course provides an introduction to the anatomical and physiological bases of the speech mechanism with an emphasis on the neural, respiratory, laryngeal, and supralaryngeal subsystems.

Learning Outcomes: 1. Develop knowledge of the major subsystems underlying speech and language production. 2. Identify major anatomical structures associated with speech production. 3. Describe the physiology of speech production. Credits: 3.00

SLHS 30600 - Introduction To Phonetics

Credit Hours: 3.00. Credit will not be given for both SLHS 30600 and LING 31500. An introduction to articulatory phonetics, speech sounds in languages of the world, and principles and symbols of the International Phonetic Alphabet. Extensive practice in phonetic transcription.

Credits: 3.00

SLHS 30900 - Language Development (UCC: STS)

Credit Hours: 3.00. (PSY 42600) Specific nature, sequence, and pattern of oral language development from birth through adolescence. Numerous examples illustrating the nature of language acquisition and approaches to the study of children's language are presented. Linguistic and psychological explanations of the sequence of development are discussed.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

SLHS 31000 - Introduction To Audiology: Foundations, Assessment And Management

Credit Hours: 3.00. This course will cover the breadth of audiology practice beginning with foundational content on the acoustic properties of environmental and speech sounds in relation to hearing loss, the fundamental anatomical and physiological bases of hearing, typical development of hearing and auditory behaviors, and the history and scope of practice in Audiology. Clinical topics will include hearing disorders across the lifespan, as well as assessment and intervention techniques used to manage hearing disorders in children and adults. Threaded throughout the course will also be activities designed to develop personal intercultural competence to enhance students' ability to work with diverse patients in a clinical setting.

Learning Outcomes: 1. Explain the basic properties of sounds, and structure and functions of the parts of the ear. 2. Explain the importance of obtaining a thorough case history and be able to write a case history report. 3. Interpret audiograms to determine types of hearing loss and mark audiograms. 4. Explain different management options for hearing loss including device fitting and aural rehabilitation. 5. Describe why intercultural competence is important for clinicians (and everybody) in this diverse world and develop your personal intercultural competence. Credits: 3.00

SLHS 40100 - Language And The Brain

Credit Hours: 3.00. (PSY 40100) This course is an overview of the neutral systems that underlie the core components of language, including speech perception and production, reading and writing, morphology, syntax, semantics, and discourse. During the past few decades, there has been an unprecedented increase in studies on these topics, due in large part to the widespread use of highly sensitive brain mapping techniques that enable researchers to identify relationships between particular brain areas and particular language functions. The findings that have been emerged from this recent explosion of research are exciting and important for several reasons. They provide fresh insights into the nature of the uniquely human capacity for language, and they have significant implications for understanding and treating language disorders that result from brain injury.

Learning Outcomes: 1. Understand the main methods for investigating the neural substrates

of language. 2. Understand the classic and progressive aphasia syndromes. 3. Basic neural underpinnings of the core aspects of language. 4. Critically evaluate research on language. 5. Critically evaluate research on language and the brain. Credits: 3.00

SLHS 40200 - Introduction To Hearing Loss Treatment And Management

Credit Hours: 3.00. This course provides a broad introduction to audiological treatment and management of hearing loss and its associated challenges. Course topics include an overview of current technology options, including hearing aids, cochlear implants, assistive listening devices, and tinnitus treatment devices. This course emphasizes appropriate counseling techniques, communication strategies, and patient-centered treatment considerations.

Learning Outcomes: 1. List the protected rights for individuals with hearing loss under the Americans with Disabilities Act. 2. Describe the audiological and lifestyle factors that determine hearing-aid, cochlear-implant, and assistive listening device (ALD) candidacy. 3. Describe the available treatments for individuals with tinnitus. 4. Describe the various types of communication strategies used by individuals with hearing loss and their communication partners. 5. Describe various counseling approaches and their role in patient-driven treatment and management of hearing loss. Credits: 3.00

SLHS 40300 - Psycholinguistics

Credit Hours: 3.00. (SLHS 40300) This course aims to introduce students to the current, research-based understanding of how different aspects of language (such as word perception, language acquisition, or speech production) are represented in the mind. In addition, it will introduce some of the research methods employed by language scientists for gaining insight into such a representation. This course also aims to help students learn how to critically evaluate research data used to support various theories about psychological and neural foundations of language knowledge.

Learning Outcomes: 1. Understand main theories and empirical findings about psychological and neural foundations of language knowledge. 2. Explain how experimental work is used to inform models of language processing. 3. Critically evaluate research data used to support such models. 4. Write evaluation of empirical work in a clear and concise manner. Credits: 3.00

SLHS 40400 - End Of Life Care And Management

Credit Hours: 3.00. We will discuss end of life care and management, primarily from the perspective of speech-language pathologists and audiologists. We will read books, chapters, and articles to gain broad perspectives on end of life, death and dying, and advanced care planning. We will discuss alternative breathing and nutritional interventions, along with their advantages and disadvantages. We will consider methods of counseling patients and families at end of life. We will cover advanced care planning, health care proxies, advanced directives, palliative care (including hospice). Guest speakers with expertise in related areas will be engaged to provide students with a strong background in these topics.

Learning Outcomes: 1. Understand cultural and individual differences in approaches to end of life care and management. 2. Describe advanced care planning, health care proxies, advanced directives, and palliative care and resources available to support families with these needs. 3. Understand the role of allied health professionals (especially speech-language pathologists and audiologists) in serving patients and families facing end of life decisions. 4. Describe alternative breathing and nutritional interventions commonly used at end of life and the advantages and disadvantages of these interventions for patient care at end of life. Credits: 3.00

SLHS 40500 - Science Of Reading

Credit Hours: 2.00. This course offers an extensive review of the scientific evidence regarding how children learn to read and best practices in teaching reading to typically achieving and struggling readers. Emphasis is placed on informed assessment, the five elements of reading and how to provide an interdisciplinary approach to reading instruction that is explicit, systematic, and cumulative.

Learning Outcomes: 1. Describe the

developmental process of learning to read detailing the five elements of reading. 2. Assimilate knowledge of linguistic concepts required for the development of reading skills. 3. Identify appropriate tools used to assess literacy development in school-age children to determine strengths and weaknesses of children with reading difficulties. 4. Discuss performance on literacy tasks, outline intervention needs and possible supports. 5. Communicate results to stakeholders conveying the reading profile of children and their needs. Credits: 2.00

SLHS 40600 - Introduction To Neurodegenerative Disorders

Credit Hours: 3.00. This course is an upper-level elective course for undergraduates in the SLHS major and others who are interested in learning more about neurodegenerative disorders and the effect these disorders have on the cranial sensorimotor system. This course assumes a basic knowledge of the anatomical and physiological bases of the speech mechanism (SLHS 30300) with an emphasis on the neural, respiratory, laryngeal, supralaryngeal, and aerodigestive subsystems. Information presented in this course will build on that basic knowledge and will focus on the effect of neurodegeneration on each of these systems through lectures, article reviews, case-based discussions, and disease-specific group presentations.

Learning Outcomes: 1. Develop additional knowledge of the anatomy and physiology of the central and peripheral nervous system and the basic anatomy of the motor system. 2. Develop problem-solving skills to differentiate between a variety of neurodegenerative disorders. 3. Develop the skills needed to read and critique relevant publications in the field of neurodegeneration. 4. Develop the skills to discuss evaluation of cranial sensorimotor behaviors. 5. Discuss current treatment options for neurodegenerative disorders. Credits: 3.00

SLHS 40700 - Culturally And Linguistically Diverse Children With Communication Disorders

Credit Hours: 3.00. This course provides students with an overall understanding of typical speech and language development, and communication disorders, across cultural-linguistic groups and issues related to the assessment of and intervention with children from culturally and linguistically diverse populations.

Learning Outcomes: 1. Describe typical speech and language development across cultural-linguistic groups. 2. Develop skills for the formal and informal assessment of speech and language abilities of children speaking dialect(s), speaking more than one language, and/or speaking language(s) other than English. 3. Describe approaches to assessment and intervention when clinicians do and do not speak the child's language(s). 4. Begin to design intervention programs for infants and children who exhibit a range of communicative deficits, and who are from culturally and linguistically diverse populations. Credits: 3.00

SLHS 40800 - Introduction To Voice, Upper Airway, And Swallowing Disorders

Credit Hours: 3.00. This course is focused disorders of the larynx and the affect they have on speaking, breathing, and swallowing. This course assumes a basic knowledge of the anatomical and physiological bases of the speech mechanism (SLHS 30300) with an emphasis on the respiratory, laryngeal, and aerodigestive subsystems. Information presented in this course will build on that knowledge and will focus on the etiologies and characteristics of voice, upper airway, and swallowing impairments and the role of speech-language pathologist in assessing and treating these conditions.

Learning Outcomes: 1. Identify normal anatomy and physiology of the larynx and aerodigestive tract. 2. Describe etiologies and characteristics of disorders associated with the larynx and aerodigestive tract resulting in voice, upper airway, and swallowing impairments. 3. Analyze the clinical presentations of various voice, upper airway, and swallowing disorders. 4. Identify the role of the Speech-Language Pathologist with regards to these disorders. Credits: 3.00

SLHS 40900 - Introduction To The Neural Bases Of Speech And Hearing

Credit Hours: 3.00. An introduction to the neuroanatomy and neurophysiology of the sensory and motor systems involved in speech and hearing. Topics covered include general neuroscience principles, methods for studying the nervous system, and neural mechanisms underlying speech and hearing. The course also introduces disordered systems and contemporary speech and auditory neuroscience research topics.

Learning Outcomes: 1. Demonstrate basic knowledge of neuroscience including general neuroanatomy, neurophysiology, and cellular mechanisms. 2. Identify critical neural structures and neurophysiology involved in hearing and speaking. 3. Describe important neural mechanisms underlying auditory processing and speech production. 4. Develop basic understanding of the neuroscience methods, communication disorders, and ongoing research topics in speech, language, and hearing sciences. Credits: 3.00

SLHS 41000 - Evolution Of Language

Credit Hours: 3.00. This course provides an overview of what is known and what is hypothesized about the evolution of human language. Issues include how we can study evolution of language and speech, how human language compares to animal communication, what neural resources are needed for language use and what is known about how such resources developed in the human brain (perception, production, auditory and visual).

Learning Outcomes: 1. Be familiar with the basic approaches and controversies regarding how language evolved, and for what purpose. 2. Evaluate various hypotheses with respect to relevant data. 3. Become familiar with some new views on human language, including spoken language, sign language, and gesturing. 4. Develop critical thinking in the form of the ability to read and understand an argument for or against a particular theory of language evolution. Credits: 3.00

SLHS 41100 - Speech Vs Sign: Perception, Production, Structure

Credit Hours: 3.00. This course offers a 'compare and contrast' of signed languages and spoken languages, and in the process provides a review of what students have learned about language and speech in their other classes. Issues covered include the definition of 'language', understanding the interaction of cognition and language, neural resources necessary for use of language in speech and in signing, the relationship between gesture and sign languages, and perception and production in both modalities.

Learning Outcomes: 1. Identify and explain similarities and differences in the grammars of sign and spoken languages, from the structure inside single syllables and word formation to the level of sentences and discourse. 2. Articulate a broader definition of 'language'. For example, they will be able to explain the parts of signs that perform the same functions as consonants and vowels making up syllables, the different types of morphemes such as classifiers that are found in sign and spoken languages (even though not in English), the differences between hearing people's gestures and signs in a sign language, and the impact of visual vs. auditory modality on the perception and production of these languages. 3. Explain how claims about sign language structure are tested using standard procedures. 4. Describe how signal-level 'sign science' is done and how it compares to acoustic/articulatory level speech science. 5. Explain why simultaneous fluent speech and fluent ASL are not possible (physically, cognitively, linguistically). 6. Describe differences between auditory and visual systems with respect to light and sound, neural wiring, and spatial and temporal processing. 7. Explain how and why acquisition of speech and sign are similar and different at cognitive, neural, and linguistic levels, and provide examples for each comparison. 8. Apply this comparison to explain educational and clinical implications of the relative roles of sign

and spoken languages in the context of severe to profound deafness. Credits: 3.00

SLHS 41200 - Pediatric Audiology

Credit Hours: 3.00. This course will cover the breadth of pediatric audiology practice including the historical developments in pediatric audiology, as well as assessment, hearing disorders, and management of hard-of-hearing infants, toddlers, young children, and adolescents. Threaded throughout the course will also be activities designed to develop personal intercultural competence to enhance students' ability to work with diverse patients in a clinical setting.

Learning Outcomes: 1. Describe age-appropriate assessment procedures for infants, toddlers, and older children. 2. Describe family-centered counseling methods. 3. Describe the etiology and signs and symptoms of common hearing disorders in children. 4. Describe management options for hard-of-hearing children. 5. Describe why intercultural competence is important for clinicians (and everybody) in this diverse world and develop your personal intercultural competence. Credits: 3.00

SLHS 41800 - Understanding Autism

Credit Hours: 3.00. (HDFS 41800, PSY 41800) This course will explore the etiology, neuroscience, diagnosis, and treatment of autism spectrum disorder (ASD). Approached from a multi-disciplinary perspective this course brings together gene, brain, and behavioral sciences with the aim of developing a better understanding of autism. The course will begin with an overview of ASD as a complex behavioral phenotype. This will include discussion of the history ASD and the expansion of the diagnostic criteria associated with the disorder. This introduction will be followed by several classes in which we will examine some of the key domains of impairment in ASD: reciprocal social interaction, language and communication, and restricted and repetitive behaviors. We will also consider the deficits associate with, but not defining of ASD, and examine co-morbid conditions frequently present in individuals with ASD. We will then address the topics of brain architecture, neurochemistry, and genetics and gene expression, all of which we will attempt to relate back to the behavioral features of autism. We will end the course with a review of treatment practices and their efficacy and an examination of impact of ASD on the family and society.

Learning Outcomes: 1. Describe and explain the behavioral characteristics used to diagnose ASD. 2. Describe and explain the strategies and symptoms used in the early identification of ASD. 3. Describe and explain the current theoretical perspectives about the causes of ASD and the increasing prevalence of the disorder. 4. Describe and explain the current scientific knowledge on the genetic and neurobiological underpinnings of ASD and how these are related to behavioral symptoms. 5. Describe and explain the range of available evidence-based and non-evidenced-based interventions for ASD. 6. Critically evaluate the empirical research findings as well as media reports related to ASD. Credits: 3.00

SLHS 41900 - Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of selected topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary by course. This is an experiential course number, learning outcomes will be different for each course designed under this number. Credits: 1.00 to 3.00

SLHS 42000 - Introduction To Developmental Speech And Language Disorders

Credit Hours: 3.00. Students cannot receive credit for both AUS 42000 and AUS 42200. Introduction to disorders of speech and language in children. Characteristics of these disorders, methods of evaluation, and intervention procedures are discussed.

Credits: 3.00

SLHS 43000 - Speech-Language Disorders In Health Care Settings

Credit Hours: 3.00. Presents speech-language disorders across the lifespan, encountered in a variety of health care settings. Discusses the etiology, evaluation, and management of these disorders; addresses administrative structures, team approaches, and reimbursement issues in health care settings.

Learning Outcomes: 1. Understand the types of organic and neurogenic disorders of communication that are within the scope of

practice for a speech-language pathologist. 2. Understand the types of health-care settings where a speech-language pathologist may work. 3. Understand aspects of evaluating communication disorders that are organically and neurologically based. 4. Understand aspects of treating communication disorders that are organically and neurologically based. 5. Understand the roles of a speech-language pathologist and other personnel on a variety of client intervention teams. Credits: 3.00

SLHS 44400 - Introduction To Research In Communication Sciences And Disorders

Credit Hours: 3.00. An introduction to fundamental concepts of research in the basic and clinical disorder aspects of speech, language, and hearing processes. Among topics to be covered are research design/strategies, model and theory development, research ethics and data collection and interpretation. Permission of instructor required.

Credits: 3.00

SLHS 44900 - Introduction To Clinical Practice In Communication Disorders

Credit Hours: 3.00. A course designed to provide instruction in basic diagnostic procedures and therapeutic approaches to speech, language, and hearing disorders.

Learning Outcomes: 1. To expose students to clients who have a variety of speech, language, and/or hearing disabilities in order to develop an understanding of the nature of communication disorders across a wide age-span and diverse cultures 2. To familiarize students with clinical methods in Audiology and Speech-Language Pathology through video and live observations, lectures, discussions, and readings. 3. To assist students in developing a professional approach to inter-personal interactions and practices in the field of communication disorders 4. To help students gather and organize resources related to the assessment and treatment of individuals with communication disorders 5. To provide opportunities for students to complete and document 25 hours of observation in the field of communication disorders. Credits: 3.00

SLHS 46000 - Assessment Audiology And Aural Rehabilitation Across The Lifespan

Credit Hours: 4.00. This course will provide an introduction to disorders of the auditory system, the basic assessments that are used to diagnose disorders, and habilitation/rehabilitation. The laboratory provides practical instruction in the procedures discussed in class.

Learning Outcomes: 1. Describe and explain the basic battery of audiological tests. 2. Perform these tests. 3. Interpret the results of the test battery. 4. Describe and explain devices and strategies used for habilitation/rehabilitation. Credits: 4.00

SLHS 49000 - Directed Study Special Problems

Credit Hours: 1.00 to 6.00. Designed for student to work with individual instructors on special topics of interest. Permission of instructor required.

Credits: 1.00 to 6.00

SLHS 49800 - Undergraduate Research Experience

Credit Hours: 1.00 to 4.00. The course allows students an opportunity to obtain first-hand experience with research in speech, language, and hearing sciences. Permission of instructor required.

Credits: 1.00 to 4.00

John Martinson Honors College

John Martinson Honors College

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- Mission
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Welcome to the John Martinson Honors College

Community of Scholars

Purdue University's John Martinson Honors College fosters collaborative learning, promotes individual research and community engagement, and prepares students for a global world. We encourage you to participate actively in this community, both inside and out of the classroom.

Mission

Our mission is to create and foster well-rounded, well-educated global leaders. We work to create student leaders on campus who impact society from their very first semester. The four pillars, our primary tenets, come together to help us accomplish this mission. They are: leadership development, undergraduate research, community and global experiences, and interdisciplinary academics.

Leadership Development

- Opportunities and Experiences - Numerous opportunities and experiences exist for students to develop leadership skills crucial for academic and professional success.
- Student Organizations - Our student-driven organizations provide opportunities to make a difference in the Honors College, the campus, surrounding communities, and beyond.
- Interdisciplinary Teamwork - Living and learning in an interdisciplinary environment fosters increased involvement and helps develop problem-solving skills.
- Student Mentorship - Peer mentors help in facilitating the first-year course and lead groups of students working on projects.

Undergraduate Research

- Undergraduate Research - Undergraduate research is a built-in component of honors learning, broadening each student's understanding of global issues.
- World-class Faculty - Honors students have the opportunity to work with the top instructors on campus, most of whom are award-winning professors.
- Scholarly Project - The scholarly project involves students in the creation of new knowledge.
- Interdisciplinary Breadth - Interdisciplinary seminars help students understand the many complexities and issues crossing disciplines.

Community and Global Experiences

- Global Experience - Students engage with visiting scholars and international classmates from across the world, creating intercultural bonds of friendship.
- Collaboration - Hailing from diverse geographical and educational backgrounds, honors students practice the collaborative skills and approaches for addressing issues in the global economy.
- Faculty Engagement - Our faculty is engaged with the students both inside and outside the classroom.
- Honors Activities - Honors College activities provide ways to forge friendships within the community as well as to develop a culture of giving and engagement.

Interdisciplinary Academics

- Interdisciplinary Thinking - Honors courses are comprised of students from all disciplines from across the university, allowing for open dialogue and collaboration.
- Lateral Learning - Through discussion-based honors courses, students learn from one another daily.
- National and International Scholarships Office (NISO) - The professionals at NISO mentor students through the application process for prestigious scholarships.
- Global Learning - Students are exposed to a variety of global travel opportunities that lead to academic and personal growth.

Contact Information

To learn more, schedule a campus visit, or meet with a current Honors College student, please contact the John Martinson Honors College main office at 765-494-2929.

Purdue University John Martinson Honors College
Honors College & Residences
1101 Third Street
West Lafayette, IN 47906
Phone: (765) 494-2929

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HONR 12000 - Introduction To Research

Credit Hours: 3.00. In this course you will take an idea and blow it up. You will "blow it up" to better understand its elements, and its connections to various ways of creating knowledge. Then you will take the resultant pieces and use them to construct a research plan that's inclusive of at least two forms of inquiry.

Learning Outcomes: 1. Create a research proposal from some idea, observation, or problem that interests you, so that you can implement the plan as you launch your undergraduate academic journey. Credits: 3.00

HONR 19900 - Interdisciplinary Honors - Introductory Seminar

Credit Hours: 1.00 to 6.00. These introductory topic seminars are designed to open intellectual horizons and allow opportunities for learning by inquiry in a collaborative environment. Courses are limited to 20 participants or less, may be team-taught, and emphasize close interaction between the professor(s) and the students.

Learning Outcomes: 1. Sharpen critical thinking skills and interdisciplinary understanding. 2. Learn project-based inquiry, research thinking, and collaborative skills. Credits: 1.00 to 6.00

HONR 19901 - Honors First Yr Experience I

Credit Hours: 1.00. All JMHC students take this 1 credit course each semester (fall and spring) of their first year. This "Honors First Year Experience" is designed to introduce students to college-level honors education. Learning outcomes include how to be flexible thinkers, inclusive collaborators, and ethical leaders. In fall, students explore interdisciplinary topics in small seminars with dedicated faculty and work in groups with JMHC student mentors in "world readiness" labs.

Learning Outcomes: 1. Identify and analyze complex and global issues/events/perspectives. 2. Identify approaches to interdisciplinary scholarship. 3. Evaluate and summarize literature from multiple disciplines. 4. Practice strategies for inclusive and equitable engagement across differences through in-class discussions and group activities. 5. Recognize the mission of the JMHC - what the college stands for, what it offers to students, and what students can offer the JMHC community. 6. Develop inclusive and equitable collaborative and teamwork skills. Credits: 1.00

HONR 19902 - Honors First Yr Experience II

Credit Hours: 1.00. All JMHC students take this course each semester (fall and spring) of their first year. This course is designed to introduce students to college-level honors education. Learning outcomes include how to be flexible thinkers, inclusive collaborators, and ethical leaders. This course is the second half of the required course sequence taken by all students entering the Honors College. Restricted to Honors College students.

Learning Outcomes: 1. Identify and analyze complex and global issues/events/perspectives. 2. Identify approaches to interdisciplinary scholarship. 3. Evaluate and summarize literature from multiple disciplines. 4. Practice strategies for inclusive and equitable engagement across differences through in-class discussions and group activities. 5. Recognize the mission of the JMHC - what the college stands for, what it offers to students, and what students can offer the JMHC community. 6. Develop inclusive and equitable collaborative and teamwork skills. Credits: 1.00

HONR 19903 - Interdisciplinary Approaches In Writing (UCC: IL/WC)

Credit Hours: 3.00. This course is a writing-intensive course in which students learn how to find, evaluate, and use credible information, how to express themselves well in a variety of different written genres, and how to write for different audiences.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. The ability to

express themselves in writing clearly and concisely. 2. An understanding of different written genres and their characteristics. 3. An understanding of context and audience. 4. The ability to select and convey the appropriate content. 5. The ability to organize and format a written work. 6. An awareness and appreciation of writing style. 7. The ability to comment upon another's writing in a productive way. 8. The skills to improve their own writing through revision. 9. The ability to locate and evaluate credible information. 10. The ability to use and document information successfully and ethically. Credits: 3.00

HONR 22000 - Community Of Inquiry

Credit Hours: 2.00. This course is for new members of the Honors College community, who entered as continuing Purdue students or transferred to Purdue. It, being your first or one of your first courses in the Honors College, is designed to help you hone some of the fundamental learning outcomes of an honors education: interdisciplinary thinking, critical thinking, problem-solving, research thinking, collaboration, and global awareness. You will also engage with the pillars of the Honors College and develop community within the Honors College. To accomplish these objectives, the course is simultaneously project-based and experiential. You will work in multi-disciplinary teams on applied research that emphasizes critical and multi-dimensional thinking about real-world problems. Through project-based learning, you will move your skills beyond identifying and understanding a problem to identifying and formulating solutions to that problem. The problem addressed in the course is local or global in scope and has social, economic, political, and/or environmental implications for our local and/or global community as well as begs a multi-disciplinary, innovative solution. Continuing in the vein of experiential learning and of building your honors ethos, you will attend events (some as a class, others individually) and participate in programs in the Honors College and across campus that embody the Honors College's pillars: Community and Global Engagement, Leadership, Research, and Interdisciplinary Academics. You will curate a schedule of events that take place during the semester and reflect on these experiences. Permission of department required.

Learning Outcomes: 1. Develop interdisciplinary thinking, critical thinking, problem solving, research thinking, collaboration, and global awareness. Credits: 2.00

HONR 22100 - Exploring Place (UCC: BSS)

Credit Hours: 3.00. "Exploring Place" is an examination of the cultural, social and historical dynamics that influence communities and relationships of a site. Blending independent study and distance learning, in this experiential learning course, the student and the instructor work together to design an individualized, in-depth study of the place in which the student is located. This study will be attentive to the social, cultural, political, economic, and other forces that have shaped this place historically and today, while also focusing on community life and the relationships between residents, institutions, organizations, and others. Exploring Place offers students the opportunity to better understand the people and places around them, expand their worldviews, and increase their self-awareness as they engage within these spaces and understand their place in them.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Create a plan of study that will serve as a guide for all of your activities in this course. 2. Identify and distinguish among different worldviews that shape how individuals or groups behave or perceive the world. 3. Identify and develop another intercultural competency for which you would like to accomplish personal growth. 4. Synthesize pertinent scholarly literature in order to establish a theoretical framework for understanding selected topic. 5. Collect and analyze primary data in order to describe and explain relationships among groups and culture of a place. Credits: 3.00

HONR 22200 - Solutions Lab Global

Credit Hours: 2.00. In this course, students from Purdue University (West Lafayette, Indiana) and at universities abroad will collaborate virtually in interdisciplinary teams to identify solutions to a major global challenge. Each semester, the theme of the global challenge changes. At the start of the course, students at both universities will meet together as a class to learn about the topic from a range of disciplinary perspectives through guest lectures, assigned readings, and class discussions. Students will then be divided into interdisciplinary teams with members from both universities and provided a prompt related to the semester's theme. Teams will spend several weeks of the course focused on researching, developing, and packaging their solutions, before presenting them publicly at the end of the term. In addition to increasing

knowledge of the topic and improving teamwork skills, students in this course will advance in intercultural knowledge, skills, and attitudes through their international collaborative experience.

Learning Outcomes: 1. Increase basic knowledge of global pandemics and their effects on societies. 2. Gain new perspectives on the social implications of design emerging from multiple academic disciplines. 3. Analyze global issues and challenges, as well as potential solutions, from multiple cultural perspectives and the positions of multiple stakeholders around the world. 4. Advance research and teamwork skills through the completion of a group project and presentation addressing real-world problems. 5. Practice intercultural communication skills and other intercultural competencies through in-class activities and discussions, and through group work completed in international, cross-cultural teams. 6. Develop deeper intercultural self-awareness through reflective thinking and journaling. Credits: 2.00

HONR 29500 - Interdisciplinary Honors - Independent Experience

Credit Hours: 1.00 to 3.00. Individual experiential projects undertaken with faculty supervision. Permission of instructor required.

Credits: 1.00 to 3.00

HONR 29900 - Interdisciplinary Honors - Experiential Learning

Credit Hours: 1.00 to 6.00. These interdisciplinary topics seminars are designed to offer experiential learning on campus, in the community, and around the world. Courses are limited to 20 participants or fewer, may be team-taught, and emphasize close interaction between the professor(s) and the students. Students will participate in active learning exercises that may include study away and study abroad, workshops, research and creative skill building, community collaboration, and/or service learning. Seminar topics will vary from semester to semester.

Credits: 1.00 to 6.00

HONR 29901 - Interdisciplinary Honors - Honors Mentors

Credit Hours: 2.00. This hands-on course provides leadership training to the continuing Honors College students selected to work as mentors for the required, first-year honors course. Students work closely with a faculty instructor. Restricted to Honors College students. Department permission required.

Learning Outcomes: 1. Demonstrate self-understanding and continuous learning. 2. Demonstrate communication skills. 3. Demonstrate systems thinking, planning, and solving. 4. Demonstrate teamwork and collaboration. 5. Demonstrate ethics and personal responsibility. Credits: 2.00

HONR 31000 - Space-Time!

Credit Hours: 3.00. In Space-time!, we will explore how our relationship to space and time has changed over human history. We will focus primarily on the last two centuries and how interconnected changes in science, technology, and culture altered our sense of the scope, age, and nature of the reality around us. The ideas around space and time offer us an occasion to see how arts, philosophy, sciences, and our own experiences shape the way we see the world. Students, too, will explore the cross-influences of arts, philosophy, and sciences, as they write their own creative works, engage complex ideas from new perspectives, and expand their imaginations.

Learning Outcomes: 1. Develop an appreciation for how the progression of science is intertwined with culture and how certain creative genres -- like science fiction -- explore, interrogate, and even progress scientific ideas. 2. Develop skills for exploring new ideas, engaging multiple perspectives, and synthesizing diverse ideas to create more a complex or nuanced understanding of the world around them. 3. Develop skills for raising novel questions, exploring multiple perspectives, and synthesizing divergent ideas. Credits: 3.00

HONR 31100 - Replicants

Credit Hours: 3.00. From ancient mythology to Blade Runner 2049, the creation of artificial bodies has captured the human imagination. This course asks: how do the materials we use to re-create the human body affect the way that we construct our humanity? We will examine the different materials people have used to replicate the body throughout history. The course is organized thematically by materials such as wood, wax, silicone, and digital media. This course emphasizes hands-on learning; we will cast wax masks, sculpt clay figurines, and create automata, among other experiential activities. The types

of replicants we will study in this course range from voodoo dolls to Real Dolls, death masks to Deep Fakes, and statues to cyborgs. For the final project, you will choose a case study of a replicant to write about in an exploratory paper.

Learning Outcomes: 1. Understand core concepts of materiality theory, including the material turn and theories of the body, and compare how these concepts are used by multiple scholarly disciplines. 2. Apply these concepts to your own academic discipline and interests. 3. Evaluate and apply diverse cultural and historical practices of material use and reproduction of the human form across cultures and over time. 4. Have developed your own imaginative and complex perspective on the course material. 5. Have developed critical reading, analytical, and communication skills through engagement with scholarly writing, group discussion, small group work, leading discussion, and writing assignments. Credits: 3.00

HONR 31200 - Jazz

Credit Hours: 3.00. Jazz artists "speak to each other in the language of music." In Jazz, we will explore the nature of this artistic conversation with many of its cultural influences, geographical variations, and temporal iterations. Throughout our time together we will interrogate varying facets of the social impact such a conversation facilitates. Furthermore, we will explore the musical language of jazz with its power to make collective performance stronger. And we will investigate the ways in which this artists' talk became the "talk of the town" and country as a medium through which people could break from dominant cultures. We will make sense of and process our journey by creating our own jazz ensemble, featuring the layered textures of our lives as inspiration for the note and lyric.

Learning Outcomes: 1. Articulate jazz conceptually. 2. Create connections between jazz and a democratic community. 3. Represent jazz creatively. Credits: 3.00

HONR 31300 - Science, Technology, & Society (UCC: STS)

Credit Hours: 3.00. Science and technology are deeply intertwined with the distribution of costs and benefits in human society, underscoring the need for critical perspectives. This project-based course will examine the social and ethical implications of science and technology using interdisciplinary methodologies/approaches. Students will have the opportunity to address questions such as: How have particular scientific discoveries and technologies emerged or evolved? How have they shaped society, and how has society shaped science and technology? How have science and technology compounded social inequalities (race, class, gender), and how can they be changed to reduce inequalities? Topics that will be explored will vary each semester.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 2. Describe ethical implications of technological and scientific developments. 3. Explain how social factors have shaped the development and application of science. 4. Explain how social factors have shaped the development science and technology, including tools and strategies by which societies promote, constrain, or otherwise influence scientific and technical innovation. Credits: 3.00

HONR 31400 - The Human Epoch (UCC: BSS)

Credit Hours: 3.00. In this course, students will explore the entangled relations between humanity and the environment from multiple social contexts and time periods. Throughout the class, students will read, analyze, and discuss interdisciplinary scholarship from the social and behavioral sciences. Classroom activities will take the form of discussion, projects and group assignments, and writing assignments, with an emphasis on peer-to-peer learning. Students will create a project aimed at a public audience that demonstrates knowledge about key course topics and communicates connections between social/behavioral knowledge and personal, civic, ethical, or global decisions and policies. As a result of taking this course, students will be able to understand and evaluate critical questions about humanity and its ecologies, recognize the importance of those questions for various audiences, and draw connections between course materials and their own perspectives about the world.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Demonstrate knowledge of major concepts, theoretical perspectives, empirical patterns, and/or historical contexts within a given social or

behavioral domain. 2. Identify the strengths and weaknesses of contending explanations or interpretations for social, behavioral, or historical phenomena. 3. Recognize the extent and impact of diversity among individuals, cultures, or societies in contemporary or historical contexts. 4. Identify examples of how social, behavioral, or historical knowledge informs and can shape personal, civic, ethical, or global decisions and responsibilities. Credits: 3.00

HONR 31500 - Across Differences (UCC: HUM)

Credit Hours: 3.00. To understand and combat systemic injustices, our students must be equipped to engage with the historical and present-day racial and ethnic "reckonings" that define the United States, and large parts of the globe. This course offers students an opportunity to focus on cultural landscapes/contexts, to learn how race and ethnicity permeate cultural texts, genres, and industries. The course trains students to recognize how race-and-ethnicity-based inequities intersect with issues of class, gender, and/or sexuality, and how these intersections articulate themselves in/through culture. Students will grapple with the colonial, national, transatlantic, trans-cultural, and diasporic underpinnings of culture. Topics that will be explored will vary each semester, but to attend to the diverse ways in which students learn and demonstrate their learning, all sections will use interdisciplinary materials like songs, films, video games, sporting events, poems, neighborhood maps, photographs, fine art pieces, oral histories, interviews, and newspapers, in addition to traditional/scholarly publications.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize and describe humanistic, historical, or artistic works or problems and patterns of the human experience, especially those related to matters of race, ethnicity, and difference. 2. Apply disciplinary methodologies, epistemologies, and traditions of the humanities and the arts to better engage with historical and present-day debates about race and ethnicity. 3. Analyze and evaluate texts, works, objects, events, or ideas in their cultural, intellectual, or historical contexts to recognize how race and ethnicity-based inequities intersect with issues of class, gender, and/or sexuality. 4. Create, interpret, or reinterpret artistic and/or humanistic works through performance, analysis or criticism to grapple with how difference is inscribed onto cultural landscapes and contexts. 5. Analyze diverse narratives and evidence in order to explore the complexity of colonial, national, transatlantic, trans-cultural, and diasporic human experiences across space and time. Credits: 3.00

HONR 39500 - Interdisciplinary Honors - Independent Study

Credit Hours: 1.00 to 3.00. Individualized course of study undertaken with faculty supervision. Permission of instructor required.

Credits: 1.00 to 3.00

HONR 39900 - Interdisciplinary Honors - Special Topics Seminar

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of honors seminars that stress interdisciplinary understanding, intellectual flexibility, creative thought, and group discussion. Topics vary by semester. Open to students at all levels.

Credits: 1.00 to 6.00

HONR 46000 - Technological Justice (UCC: STS)

Credit Hours: 3.00. In this course, students will study interdisciplinary approaches to technology ethics for responding to today's pressing technological dilemmas in a range of contexts, from healthcare, mass incarceration, and airport security to social media, smart cities, and space travel. Students will grapple with how historical and present-day inequalities, institutional environments, decision-making cultures, and regulatory systems impact the technological design process and distribution of technology's risks and rewards in society. We will ask ourselves how relations of power inform the ways technologies are designed and experienced, as well as how power shapes dominant and insurgent approaches to achieving technological justice. The primary deliverable in this class is for you to conceive of and carry out your own "Technological Justice" Project, based on your interests, passions, and personal and/or professional goals.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Gain an interdisciplinary

understanding of critical interventions into tech ethics from both scholarly and popular culture perspectives. 2. Recognize and critically analyze how values, goals, assumptions, and ideas of social differences are embedded in technological designs and shape ethics discourse (with particularly attention to race, gender, class, and ability). 3. Analyze and reflect critically on the societal impacts of technologies in a variety of contexts. 4. Conceive, conduct, and present an original interdisciplinary research project that demonstrates a sophisticated understanding of the relationship between technology, social issues, and justice. Credits: 3.00

HONR 46100 - Well-Being

Credit Hours: 3.00. Copenhagen, Zurich, Helsinki, Stockholm, and Tokyo are the five most livable cities in the world according to MONOCLE's 2021 Quality of Life Index. They are the highest-ranking cities when using metrics to measure crime, emergency services' response time, transportation networks, cycling culture, food, drink, retail, and the number of independent bookshops. MONOCLE's Quality of Life survey is one among the many that exist to rank the world's best cities, but wealth is one theme that emerges from among the varying indices and their respective results. The metrics, indeed the participants responding to the metrics, represent populations of people with high levels of discretionary income. How might the metrics reflect different values if these indices include a different kind of participant, such as the urban poor?

Learning Outcomes: 1. Investigate indicators of community well-being related to quality of life with urban poor communities. Credits: 3.00

HONR 46200 - Protein Design With FoldIt

Credit Hours: 3.00. The protein folding problem is a grand challenge in biology. How does a protein's amino acid sequence dictate its three-dimensional structure? FoldIt is an online game in which players determine the most stable folded structure of hypothetical proteins that have been predicted by unique computer algorithms to perform specific functions in the cell. Students in this course will be introduced to the mechanics of the FoldIt software to fold computer-predicted proteins into their native structures as well as design novel proteins that can bind and deactivate the COVID-19 spike protein.

Learning Outcomes: 1. Demonstrate knowledge of the fundamental principles underlying protein folding and design. 2. Demonstrate knowledge of the protein structure prediction and design problems. 3. Design novel 3D protein structures using the FoldIt software. 4. Develop responsible and ethical research practices. 5. Read, summarize, and analyze scientific research articles. 6. Construct a literature review. 7. Create, present, and evaluate scientific research posters. 8. Develop strategies to translate research to the general public. 9. Critically reflect upon and articulate their learning and growth as a researcher. Credits: 3.00

HONR 46300 - Research Thinking Portfolio

Credit Hours: 2.00. This course establishes a new pathway for Honors completion through a critical engagement with the Undergraduate Research pillar of the college. This course will empower Honors students to leverage their research, scholarly, and creative experiences in curricular as well as co- and extra-curricular experiences toward completing the HC curriculum. Our course will combine workshops, hands-on laboratories, group discussion, and one-on-one meetings. The major assignment is a reflective portfolio, which will serve as a record of your past experiences and an opportunity to reflect on the ways in which your time as an Honors College student has shaped your research thinking and helped prepare you for life beyond the university. Successful completion of the course fulfills the scholarly project requirement of the HC curriculum.

Learning Outcomes: 1. Understand the place of research in institutions of higher education and society. 2. Identify a question, the answer to which makes a contribution to an existing body of knowledge or creative practice. 3. Read, analyze, and synthesize information from scholarly literature and/or traditions of creative practice. 4. Demonstrate knowledge of disciplinary and/or interdisciplinary skills, methods, and abilities appropriate for the research/creative question. 5. Recognize and respond to ethical responsibilities of their research projects. 6. Communicate their findings in both oral and/or written formats.

Credits: 2.00

HONR 46400 - Scholarly Project

Credit Hours: 3.00. This course fulfills the scholarly project requirement of the Honors College curriculum. Students will engage in original research projects that produce new knowledge.

Learning Outcomes: 1. Identify a question, the answer to which makes a contribution to an existing body of knowledge or creative practice. 2. Read, analyze, and synthesize information from scholarly literature and/or traditions of creative practice. 3. Demonstrate knowledge of disciplinary and/or interdisciplinary skills, methods, and abilities appropriate for their research/creative question. 4. Evaluate and interpret their findings. 5. Recognize and respond to ethical responsibilities of their research/creative projects. 6. Communicate their findings in both oral and/or written formats. Credits: 3.00

HONR 49500 - Honors Independent Research

Credit Hours: 1.00 to 6.00. Individualized research under faculty supervision. Permission of instructor required.

Learning Outcomes: 1. Improve research skills. 2. Develop research thinking. 3. Create new knowledge. Credits: 1.00 to 6.00

HONR 49900 - Honors Research Project

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of faculty-led collaborative research projects. Topics will vary by semester. Permission of department required.

Credits: 1.00 to 6.00

HONR 59901 - Research Mentorship Development Program

Credit Hours: 3.00. The Research Mentorship Development Program is designed for Purdue based on a nationally recognized curriculum and prepares graduate students or postdocs to mentor undergraduates in research. Effective mentoring of undergraduate researchers requires specific skillsets and approaches. Implementation of these strategies can lead to a productive and mutually beneficial experience for both students and their mentors. The course is designed for graduate students who plan to work with new researchers in their labs or research groups and who plan to enter academia or pursue careers in which they will mentor others in scholarship or research. Graduate students or postdocs selected for the program are matched with honors students who are interested in research. Permission of department required.

Learning Outcomes: 1. Communicate more effectively with mentees. 2. Align mentor and mentee expectations. 3. Assess their mentee's understanding of core concepts and technical skills in the research field. 4. Foster their mentee's confidence and ability to conduct independent research. 5. Implement concrete strategies for addressing issues of diversity. 6. Articulate and constructively review their own approach to mentoring. 7. Cultivate research ethics with their mentees. 8. Promote professional development of their mentees. 9. Build a community of practice with other mentees. Credits: 3.00

College of Liberal Arts

Liberal Arts Photo

Overview

With over 40 different majors, as well as numerous minors and certificates, the College of Liberal Arts will help you develop the communication, collaborative, and analytical skills that will prepare you to achieve your personal and professional goals in our fast-changing world. Liberal Arts students work side-by-side with STEM students, mindful that complex challenges demand creative, collaborative, multi-faceted, innovative, and meaningful solutions. The College of Liberal Arts develops students who are independent, creative thinkers, and problem solvers who contribute to their communities as productive, engaged citizens working as a force for good in the world.
Think Broadly. Lead Boldly.

College of Liberal Arts (website)

Contact Information

Office of the Dean

Purdue University College of Liberal Arts
Beering Hall of Liberal Arts and Education,
Room 1290
100 North University Street
West Lafayette, Indiana 47907-2098
Phone: 765 494-3663
Fax: 765 494-3660
Online feedback form
Visit the Dean's Office web site

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Academic Advising

Current students may schedule appointments with their academic advisor by visiting Beering Hall of Liberal Arts and Education room 1114 or by logging on
to: https://purdue.campus.eab.com
The College of Liberal Arts Academic Advising Office has walk-in hours from 9:00 am-12:00 noon and 1:00 pm-4:00 pm, Monday-Friday; with the exception of university breaks, holidays, or vacations.

Academic Advising Office
BRNG 1114
Phone: 765 494-3670
Fax: 765 496-1910
Purdue University TDD Relay Service
765 496-1343
More about voice services

Future Students

Undergraduate Student Recruitment, Office of Future Students
BRNG 1168
Phone: 765 494-6291
Fax: 765 496-1910
Email: newstudent@purdue.edu

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Other Offices in the College of Liberal Arts

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Business Office
BRNG 1274
Phone: 765 494-3657
Fax: 765 494-3660

Liberal Arts Career Center
BRNG 1289
Phone: 765 495-2356
Fax: 765 494-3660
Email: CLACareers@purdue.edu

Cornerstone Integrated Liberal Arts
BRNG 1166
Phone: 765-494-9695
Fax: 765-494-1910

Development and Alumni Relations Office
BRNG 1280
Phone: 765-494-2711
Fax: 765-494-3660
Office of Diversity and Inclusion Initiatives
BRNG 1120
Phone: 765-494-4034
Fax: 765-494-1910
Office of CLA Information Technology
BRNG 3268
Phone: 765 496-6333
Fax: 765 494-3660
Email: ithelp@purdue.edu

College of Liberal Arts Marketing and Communications
BRNG 1290
Phone: 765 496-3663
Fax: 765 494-3660

College of Liberal Arts Study Abroad and International Programs
BRNG 1114
Phone: 765 496-1916

Admissions (website)

College of Liberal Arts Major Change (CODO) Requirements
Successful completion of all Teacher Education Program (TEP) Requirements, including a minimum 2.5 Teacher Education Overall GPA are required to progress beyond each TEP Milestone. All Professional Education courses, including Learner Specialty Concentration/Pathway courses, must be completed with no grade lower than a "C" and no "I" (Incompletes). Degree requirements must be fulfilled to qualify for TEP completion. A minimum passing score on all required licensure examinations and completion of licensure requirements are necessary to be eligible for an Indiana Instructional Educator License.
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- Summary of Teacher Education Milestones
- Licensure Information
- Technology Integration- Blended and Online Teaching (Ti-BOT)

Summary of Teacher Education Milestones

Admission to Teacher Education Program
Admission to the Teacher Education Program (TEP) is directly granted upon acceptance and enrollment at Purdue University, West Lafayette. The Teacher Education Program is aligned with national and state accreditation and licensure standards, regulations, and rules; university guidelines; and prescribed Plan(s) of Study (POS) as defined by Admission Year or as otherwise authorized by the Office of Teacher Education and Licensure (OTEL).

TEP Program Progression by Milestone (Milestones A-F)
Successful TEP progression and completion are achieved by attaining each TEP Milestone at or above Standard as outlined within the 2025-2026 Program Requirements and Milestones for each individual content area/major and as referenced and assigned within the 2025-2026 University Catalog, 2025-2026 Teacher Education Program Directory, the Brightspace course 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements, Plan(s) of Study (POS), and course syllabi.

Required Brightspace Course
Every incoming 2025-2026 Teacher Education (TE) student will be enrolled in the REQUIRED 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements Brightspace course. This course serves as the official/primary manner for which the Office of Teacher Education and Licensure (OTEL) will communicate and monitor cohort-specific requirements, milestones, timelines, notifications, tutorials, actions, student engagement, etc. for each TE student. Course commitment is continuous beginning upon arrival to the university and concludes when Milestones A-F are attained.

Course Substitutions
Course substitutions must fulfill degree

requirements, associated Teacher Education Program (TEP) key and/or common assessments, and licensure standards/requirements. Prior approval by the Office of Teacher Education and Licensure is required for all course substitutions.

Milestone A: Methods Qualified

Milestone A - Teacher Education Program Progression Status

- Exceeds Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone A Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone A Decision Deferred to Milestone B: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone A - Review Schedule

- Conducted - Close of Spring Semester 2026
- Decision/Notification - Early Fall Semester 2026

1. 2.50/4.00 Overall GPA (at time of Milestone A review)
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone A review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete three (3) Ti-BOT badges (at the time of Milestone A review).
7. No unresolved Professional Dispositions issues/concerns.
8. Adhere to the Criminal Background Check Policy.
9. Complete TEP Brightspace Assignments, including but not limited to attendance at the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
10. Attend the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
11. Submit the Teacher Education Program Agreement (TEPA).
12. Identify via the Teacher Education Program Agreement (TEPA) one of four chosen Learner Specialty Pathways. Learner Specialty Concentration/Pathway requirements are specific to individual

content area/major.

Milestone B: Student Teaching/ Placement

Milestone B - Student Teaching Placement

- Exceeds Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone B Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone B Decision Deferred to Milestone C: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone B - Review Schedule

- Conducted - Close of Fall Semester 2027
- Decision/Notification - Early Spring Semester 2028

1. 2.50/4.00 Overall GPA (at time of Milestone B review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone B review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete five (5) total Ti-BOT badges (at the time of Milestone B review).
7. No unresolved Professional Dispositions issues/concerns.
8. Complete TEP Brightspace Assignments.
9. Attend the mandatory Student Teaching Clinical Acceptance Process (CAP) Workshop provided by the Office of Clinical Practice (OCP) AND submit your CAP Application as directed by OCP.

- Expanded Student Teaching practicums and full-time Student Teaching occur over two consecutive semesters.
- Verify from the CAP Application projected Student Teaching semester/year.

Milestone C: Student Teaching Authorization

Milestone C - Student Teaching Authorization

- Exceeds Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone C Criteria as defined by Content Area/Admission Year.

Milestone C Criteria must be attained At

Standard before the Office of Teacher Education and Licensure (OTEL) will authorize enrollment reinstatement for Student Teaching.

Milestone C - Review Schedule

- Conducted - Close of Fall Semester 2028
- Decision/Notification - Early Spring Semester 2029

1. 2.50/4.00 Overall GPA (at time of Milestone C review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone C review).
5. **Successful completion and target met on Foundations Portfolio (submission and target met on Common Lesson Plan in Semester 7).
6. ***Successfully complete ten (10) total Ti-BOT badges (at the time of Milestone C review).
7. Successfully complete all Professional Education (including Foundation and Methods), Learner Specialty Pathway, and degree courses prior to student teaching (Semester Eight).
8. Attempt all required content test(s) before the Student Teaching semester per the timeline below; Test Requirements (ets.org)

Content Test Attempts for Major

For Fall Student Teaching: Official Score Reports due to OTEL no later than July 1.

For Spring Student Teaching: Official Score Reports due to OTEL no later than December 1.

Content Test Attempts for Pathways/Concentrations (High Ability and English Language Learning)

For Fall Student Teaching: Test Registrations received in OTEL by May 15th confirming a test date scheduled no later than June 30th.

For Spring Student Teaching: Test Registrations received in OTEL by October 15th confirming a test date scheduled no later January 31st.
Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts; If completing a Learner Specialty Pathway that leads to licensure (High Ability or English Language Learners), the associated content exam must be attempted prior to the Student Teaching (Semester 8).

9. No unresolved Professional Dispositions issues/concerns.
10. Adhere to the Criminal Background Check Policy.

Milestone D: Teacher Education Program Completion
Milestone D - Teacher Education Program Completion

- Exceeds Standard: *Meets Milestone D Criteria as*

defined by Content Area/Admission Year and recognized on Dean's List.

- At Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone D Criteria as defined by Content Area/Admission Year.*

Milestone D - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-C met.
2. 2.50/4.00 Overall GPA (at time of Milestone D review).
3. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
4. Verify degree is conferred on Transcript/Academic Record.
5. *Be in Good Standing with the University (at time of Milestone D review).
6. No unresolved Professional Dispositions issues/concerns.
7. ****Successful completion and target met on all Common Assessments (submission and target met on CPAST and edTPA in Semester 8).

Milestone E: Licensure Eligible

Successful completion of the Purdue University Agricultural Education Program, Agricultural Education, BS, and the State of Indiana licensure requirements for an Indiana REPA 3 Initial Instructional License in Career and Technical Education (CTE): Agriculture (5-12) and *Blended and Online Teaching (5-12).

Milestone E - Licensure Eligible

- Exceeds Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone E Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone E - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-D met.
2. Resolve any holds on academic records (if applicable).
3. Successfully complete the required pedagogy test; Test Requirements (ets.org). Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
4. Successfully complete all required content test(s) Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
5. For all Career and Technical Education (CTE) majors ONLY- Verify that the required number of clock hours has been completed and received by your advisor. Students must

complete 4,000 clock hours of successful employment in the appropriate CTE area, or 1,500 clock hours of supervised work in the appropriate CTE area under an approved Teacher Education Program or an equivalent combination.

Milestone F: Licensure Action(s)

Milestone F - Licensure Actions

- Exceeds Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone F Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone F - Review Schedule

- Conducted - Upon Licensure Application - Summer 2029
- Decision/Notification - Upon Formal Action

1. Milestones A-E met.
2. Complete and upload with your Indiana License Application CPR/Heimlich Maneuver/AED certification or card (must include a hands-on, face-to-face skills demonstration).
3. Complete and upload with your Indiana License Application documentation of Suicide Prevention certification (training must be at least one hour).
4. Submit Indiana License Application online via Licensing Verification and Information System (LVIS) at https://license.doe.in.gov/.
5. Allow three weeks (given all licensure criteria are met) for Purdue University to certify and the Indiana Department of Education (IDOE) to grant the Indiana License.
6. After receipt of an Indiana License, apply for out-of-state licensure (if desired).

*For purposes of reports and communications to other institutions or agencies, and in the absence of any further qualifications of the term, a student shall be considered in Good Standing unless the student has been dismissed, suspended, or dropped from the University and not readmitted. A student is considered in Good Academic Standing if both a student's semester and cumulative GPA are above a 2.00/4.00.

**Foundation Courses linked with the Foundations Portfolio Common Assessments include EDCI 20002, EDCI 28500, EDCI 35000, EDPS 20001, EDPS 23500, EDPS 24800, EDPS 32700, EDPS 36201, EDPS 43010, and EDST 20010. These may be subject to change.

***The Blended and Online Teaching (5-12) License is required for students on Admission Year Fall 2024-Spring 2025. The Blended and Online Teaching (Ti-BOT) License requirements are embedded into coursework for all Teacher Education Undergraduate majors. Some exceptions apply.

****Common Assessments include Foundations Portfolio, Field Experience Dispositions, CPAST, edTPA, Common Lesson Plan, and Licensure. Common Assessments for Early Childhood Education and Special Needs align with the National Association for the Education of Young Children (NAEYC).

Beginning July 1, 2025 - According to the Indiana State Board of Education, students seeking an Initial Indiana License in a content area involving literacy instruction, including special education, must obtain a licensure addition in Early Literacy (P-5), as required under IC 20-28-5-19.7.

Licensure Information

The Office of Teacher Education and Licensure (OTEL) is the formal liaison with the Indiana Department of Education and serves as the official repository for Purdue West Lafayette Teacher Education Program Progression and Licensure actions. OTEL maintains and permanently retains a *Teacher Education Program and Licensure Credential Portfolio* for each current and former Purdue University Teacher Education Candidate/Student. OTEL provides reliable, career-long guidance on Indiana Teacher Education and Licensure Standards, Rules, and Procedures. Indiana Licensing Rules and Regulations are subject to change by the Indiana State Board of Education, Indiana Department of Education (IDOE), and/or the Indiana General Assembly.

Advising

Academic advisors work with students, faculty, staff, departments and administration to maintain and improve the academic experience in the College of Liberal Arts and Purdue University as a whole. As advisors, we are committed to supporting each student in developing and implementing an individualized plan for academic and career success.

Specifically, we are committed to...

- Emerging as a leader in Liberal Arts education and scholarship.
- Strengthening the Undergraduate Experience by fostering relationships to better mentor and support students during their time at Purdue.
- Staying knowledgeable about the courses, study abroad and events that will benefit students.
- Expanding our corporate relationships and actively helping students secure internships and jobs.
- Continuously innovating to offer meaningful and relevant educational options for Purdue undergraduates.

Click here for Purdue 101 - College of Liberal Arts - Purdue University.

College of Liberal Arts 3 Year Degree Programs

The College of Liberal Arts offers the opportunity for students to many of its majors in three years. Degree in 3 allows students to enter the work force or graduate school a year earlier than traditional plans of study while providing a cost-effective way to complete an undergraduate degree. Degree in 3 is a combination of cost-savings and the opportunity to accelerate your future and achieve your goals. The College of Liberal Arts offers the Degree in 3 year option in the following majors:

- Anthropology
- Asian Studies
- Classical Studies - Classical Languages Track , Classical Studies, BA (Literature & Culture Track), and Classical Studies, BA (Material Culture & History Track)
- Communication
- English - Creative Writing , Global Context , Literature , Professional Writing
- Film & Video, BA
- French
- German
- History
- Law and Society
- Linguistics
- Philosophy
- Political Science - Political Science: American

Politics Concentration, BA; Political Science: Comparative and International Politics Concentration, BA; Political Science: Environmental Politics and Policy Concentration, BA; Political Science: Law and Political Thought Concentration, BA; Political Science: National and International Security Concentration, BA; Political Science: Politics of Groups, Organizations, and Representation Concentration, BA; Political Science: Public Policy Concentration, BA
- Professional Writing
- Sociology, BA
- Spanish
- Studio Arts and Technology
- Theatre

College of Liberal Arts Degree+ Program

Degree+ offers students the opportunity to complete an undergraduate Liberal Arts Bachelor of Arts degree program in combination with another undergraduate degree program at Purdue University West Lafayette. Students who are actively pursuing a major in both the Liberal Arts and another college/school (College of Agriculture, College of Education, College of Engineering, College of Health and Human Sciences, Krannert School of Management, College of Pharmacy, Purdue Polytechnic Institute, College of Science, and College of Veterinary Medicine) will have the Liberal Arts core waived while maintaining progress toward completion of the outside degree program.
Why choose? Degree+ enables Purdue students to pursue multiple areas of academic interest in a manageable way. Feed both sides of your brain with Degree+.

Office of the Dean

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Fax: 765 494-3660

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BRNG 1114
Phone: 765 496-1916

College of Liberal Arts Administration

About the Program

The Purdue Liberal Arts community is one of continual learning. We push boundaries, create change, and are a force for good in the world.
Whether in the classroom or in the real world, we emerge as leaders and analytical thinkers. It's what we've been taught, it's how we think. Our innovation and creativity spark conversations and question the status quo. We like the challenge of solving problems and reimagining how things work. Our skills are sought after.
And whether we are aspiring journalists or lawyers, business leaders or community leaders, activists or actors, our analytical thinking and communication skills make us invaluable in our careers and our communities.
We are change agents. We are leaders. We are innovators. This is who we are.

Faculty

Faculty Directory

Contact Information

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Academic Advising and Prospective Students

Academic Advising Office

BRNG 1114

Phone: 765 494-3670

Fax: 765 496-1910

Undergraduate Future Students

BRNG 1168

Phone: 765 494-6291

Fax: 765 496-1910

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More about voice services

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West Lafayette, Indiana 47907-2098

Office of Alumni Relations and Special Events

BRNG 1280

Phone: 765 494-2711

Fax: 765 494-3660

Email: claevents@purdue.edu

Business Office

BRNG 1274

Phone: 765 494-3657

Fax: 765 494-3660

Office of Career Development

BRNG 1114

Phone: 765 496-2487

Fax: 765 494-1910

Development Office

BRNG 1280

Phone: 765 494-2711

Fax: 765 494-3660

Diversity Initiatives

BRNG 1114

Phone: 765 494-4297

Fax: 765 494-1910
Office of Information Technology
BRNG 3268
Phone: 765 496-6333
Fax: 765 494-3660
Email: ithelp@purdue.edu

Office of Interdisciplinary Studies

BRNG 1289

Phone: 765 496-1848

Fax: 765 494-3660

Economics, BA

Cornerstone Certificate

Pre-Economics (Liberal Arts)

BAND 11000 - Marching Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Mandatory participation required in Marching Band Workshop one week prior to start of fall classes which conflicts with Boilermaker Gold Rush. Workshop covers similar orientation to Gold Rush. Do enroll in BAND 11000 during summer registration prior to the workshop and audition process.

Credits: 2.00

BAND 11100 - Symphony Orchestra

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11200 - American Music Review

Credit Hours: 2.00. Singers and pianists only. American Music Review is a jazz big band plus 4-5 singers open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11300 - Jazz Ensemble

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved. Permission of instructor required.

Credits: 2.00

BAND 11400 - Basic Jazz

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11500 - String Orchestra

Credit Hours: 2.00. The rehearsal, study, and performance of string orchestra music from the classical, romantic and contemporary areas of composition.

Credits: 2.00

BAND 11600 - Symphonic Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11700 - Concert Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11800 - Collegiate Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 11900 - Varsity Band

Credit Hours: 2.00. Open through audition. Additional lab and activity fees involved.

Credits: 2.00

BAND 12000 - Applied Music Studies

Credit Hours: 1.00. Private study on individual wind, string, and percussion instruments. Additional fees involved. Permission of instructor required.

Credits: 1.00

BAND 12100 - Symphony Orchestra

Credit Hours: 2.00. Symphony Orchestra.

Credits: 2.00

BAND 12200 - American Music Review

Credit Hours: 2.00. American Music Review.

Credits: 2.00

BAND 33000 - Summer Concert Bands

Credit Hours: 2.00. Continuation of BAND 32000.

Credits: 2.00

BAND 33100 - Summer Jazz Bands

Credit Hours: 2.00. Continuation of BAND 33000.

Credits: 2.00

BAND 34000 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 34100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 35000 - Wind Ensemble I

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year. Permission of instructor required.

Credits: 2.00

BAND 35100 - Instrument Ensemble Colloquium

Credit Hours: 2.00. Instrument Ensemble Colloquium.

Credits: 2.00

BAND 36000 - Wind Ensemble II

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the

contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 36100 - Instrument Ensemble Colloquium

Credit Hours: 2.00. Instrument Ensemble Colloquium.

Credits: 2.00

BAND 43000 - Summer Concert Bands

Credit Hours: 2.00. Summer Concert Bands.

Credits: 2.00

BAND 43100 - Summer Jazz Bands

Credit Hours: 2.00. Summer Jazz Bands.

Credits: 2.00

BAND 44000 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 44100 - Renaissance Ensemble

Credit Hours: 2.00. A survey of renaissance and baroque ensemble literature to be played on appropriate instruments. Reproductions of renaissance and baroque wind, stringed, and brass instruments are available for use in the Department of Bands.

Credits: 2.00

BAND 47000 - Wind Ensemble III

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 47100 - Ensemble Colloquium

Credit Hours: 2.00. Ensemble Colloquium.

Credits: 2.00

BAND 48000 - Wind Ensemble IV

Credit Hours: 2.00. The University Wind Ensemble is an organization composed of 42 instrumentalists selected by audition from staff, graduate students, and symphony band members. Concentrating on the rehearsal and performance of contemporary wind music of a highly virtuoso and concertante nature, it offers its members extensive opportunities to rehearse and study works of considerable difficulty from the contemporary area of composition as well as some aspects of the baroque and classical fields. This organization meets once a week throughout the academic year.

Credits: 2.00

BAND 48100 - Ensemble Colloquium

Credit Hours: 2.00. Ensemble Colloquium.

Credits: 2.00

GS 11900 - Introduction To Academic Programs At Purdue

Credit Hours: 1.00. To provide a comprehensive program describing each of the baccalaureate degree-granting schools at Purdue. The course is designed to assist students in the clarification of their degree objectives. Not open to students who have completed GS 115.

Credits: 1.00

GS 12000 - Summer Beginners Seminar I

Credit Hours: 1.00. Early Start students, as incoming freshmen, will learn the ins and outs of higher education - more specifically of Purdue University - and how to effectively manage their time and create successful personal habits. Whether it is learning the university course management system, understanding the bus routes, or navigating the world of financial aid, this seminar will prepare incoming students for success at Purdue's campus. Additionally, students will go through a series of lectures focused on creating successful habits, including, but not limited to: time management, study skills, cultural awareness, goal setting, and interpersonal communication.

Learning Outcomes: 1. Identify how to utilize extra- and co-curricular campus resources as related to personal and academic success. 2. Compare the unique nuances of the culture of a

collegiate environment vs. high school environment. 3. Demonstrate effective communication skills with faculty, staff and peers. 4. Select strategies to aid in increasing their comfort as they navigate the transition between the cultures of a collegiate environment vs. high school environment. Credits: 1.00

GS 12001 - Summer Beginners Seminar II

Credit Hours: 1.00. This seminar course is designed for students to reflect on the hopes, assumptions, and questions they bring with them as they begin their college experience at Purdue University. The class will support student success by introducing students to campus resources, establishing connections with the campus community, expanding study skills learned during high school, and implementing appropriate time management strategies.

Learning Outcomes: 1. Create and strengthen connections with the Purdue University community. 2. Describe appropriate study skills and time management strategies related to academic success. 3. Outline areas of growth in relation to student development. 4. Identify appropriate campus resources to support timely graduation. Credits: 1.00

GS 17500 - Information Strategies

Credit Hours: 0.00 or 1.00. Designed to build and sharpen students' information-gathering skills. Guides students in developing systematic methods for finding, evaluating, and presenting information. Organization and use of electronic and print tools will be explained through discussion, hands-on exercises, and homework assignments.

Credits: 0.00 or 1.00

GS 19501 - Preparing For Your Undergraduate Research Experience

Credit Hours: 1.00. This course is for prospective Purdue undergraduate researchers who are interested in conducting undergraduate research or creative endeavors. Purdue students who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs. Throughout the course, students will develop components for a final application packet to submit to a research team or program they choose.

Learning Outcomes: 1. Identify professional and personal goals sought from an undergraduate research experience. 2. Learn research skills such as assessing literature credibility and compiling a review of the topic important to all fields. 3. Utilize online and in person resources and programs to assist in locating and applying to undergraduate research experiences. 4. Evaluate research programs/projects to determine how they fit within personal and professional goals. 5. Create and submit an application/proposal including a resume and personal statement for research programs/projects. Credits: 1.00

GS 19505 - Introduction Of Research Essentials - Getting Started

Credit Hours: 1.00. This course is for prospective Purdue undergraduate researchers who are within their first two years at Purdue who are interested in conducting undergraduate research or creative endeavors. New Purdue Boilermakers who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs to prepare for a project in the following semester. Throughout the course, students will develop components for a final application packet to submit to a research team or program they choose while focusing on the transition to college expectations regarding research-related topics. Must be a first-year or second-year student. Permission of instructor required.

Learning Outcomes: 1. Learn about the nature of research and how it can expand your undergraduate experience. 2. Develop a community of first-year and second-year Boilermakers interested in conducting research or creative endeavors. 3. Explore research opportunities available to undergraduate students by connecting with research faculty, professional staff, and active student researchers. 4. Learn research skills important to all disciplines such as accessing and assessing literature, recording research efforts, conducting ethical research, and communicating research. 5. Evaluate research

programs/projects to determine how they fit within personal and professional goals. 6. Create and submit an application/proposal including a resume and personal statement for research programs/projects. 7. Present your research interests and an oral presentation. Credits: 1.00

GS 19700 - Purdue Promise First-Year Experience Course

Credit Hours: 1.00. A combined lecture and experiential seminar course for new Purdue Opportunity Awards scholars. The course will focus on the transition issues for these first-year students. Permission of instructor required.

Learning Outcomes: 1. Be introduced to Purdue resources such as MyPurdue, Blackboard, and Purdue University policies. 2. Learn and discuss topics pertaining to becoming a college student/young professional, such as email communication habits, appropriate class demeanor, and how to work best with instructors and advisors. 3. Learn about the available resources at Purdue, such as the Division of Financial Aid, Office of the Dean of Students, Writing Lab, Center for Career Opportunities, Student Wellness Office, etc. via presentations from the respective offices to become more confident in self-efficacy and self-advocacy as college students. Credits: 1.00

GS 19900 - Strategies For A Successful First Year

Credit Hours: 3.00. This course focuses on student adjustment to university life and development skills. Content includes testing to determine skills, attitudes, and interests; group activities to foster student adjustment; and training in computer usage, time management, and University policies. Open to Horizons students only.

Credits: 3.00

GS 20000 - Preparing Tomorrow's Leaders: Purpose And Connection

Credit Hours: 1.00. A one-credit course designed to provide Purdue Promise students with skills and connections to be successful at Purdue and post graduation. This course will provide Purdue Promise students in their second year with a foundation in leadership and career development skills.

Learning Outcomes: 1. Research/write and implement an academic and career plan. 2. Learn about emotional intelligence; thus taking greater responsibility for their own behaviors and learning. 3. Be exposed to and encouraged to Purdue avenues of leadership with the university. 4. Learn about work and internship opportunities. 5. Refine job search skills (resume, cover letters) and register with CCO Express. 6. Continue to explore and make connections with campus multicultural and diversity programs. Credits: 1.00

GS 21000 - Leadership Development Seminar

Credit Hours: 1.00. A one-credit course designed to provide Orientation Programs students with skills and connections to be successful leaders at Purdue and beyond. This course will provide students a foundation in leadership skills. Students must be selected as a Team Supervisor for Orientation Programs, and have permission of instructor, to enter the course.

Learning Outcomes: 1. Explore and identify leadership styles and competencies of successful college students and student leaders. 2. Analyze personal values and leadership styles to understand a student's growth and behavior as a leader. 3. Develop and enhance life skills, self-awareness, and personal strengths to become productive individuals. 4. Recognize backgrounds and cultures different from their own and identify techniques for interaction. 5. Enhance preparation for the role as a Team Supervisor for Boiler Gold Rush. Credits: 1.00

GS 22000 - Summer Session Special Topics

Credit Hours: 1.00 to 6.00. This course is designated for a wide range of topics that stress interdisciplinary understanding, creative thought, and group discussion. Topics vary by semester. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 6.00

GS 29000 - Study Skills Seminar

Credit Hours: 2.00 or 3.00. Designed to help students improve their college grades by learning to study more efficiently and effectively. Deals with improving study habits, such as time scheduling, attitudes, and specific study skills, such as note-taking, listening, test-taking, memory techniques, and reading skills.

Learning Outcomes: 1. Develop self-regulation skills around learning strategies. 2. Develop critical and creative skills. 3. Learn to apply strategies to other courses. Credits: 2.00 or 3.00

GS 29001 - Academics Success Skills

Credit Hours: 1.00. Designed to help students improve their college grades by learning to study more effectively.

Learning Outcomes: 1. Develop self-regulation skills around learning strategies. 2. Develop study habits and specific study skills. 3. Learn to apply strategies to other courses. Credits: 1.00

GS 29501 - Understanding Your Undergraduate Research Experience I

Credit Hours: 1.00. This course is for Purdue undergraduates who are part of an active research project and/or creative endeavor. Students will hone skills necessary for reflecting on and completing these experiences. During this course, students will utilize their research experience to apply skills including but not limited to: managing time with a research project, communicating research findings, using Purdue Libraries' resources, and providing constructive feedback to peer researchers. Students will deliver elevator pitches on their own research projects and critique pitches from their peers.

Learning Outcomes: 1. Communicate research to various audiences with an oral research elevator pitch and a written research abstract. 2. Provide constructive feedback, interact with peers, and incorporate feedback in your work. 3. Define skills and attributes you have developed and expanded as a result of your involvement in an undergraduate research experience. 4. Develop and expand your network of peer researchers within and across disciplines. 5. Reflect on and apply transferable skills necessary to be a successful undergraduate researcher. Credits: 1.00

GS 39501 - Understanding Your Undergraduate Research Experience II

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build upon the previous course and focus on research data collection, analysis, and communication for current Purdue undergraduate researchers. During this course, students will learn and discuss various forms of data and collection practices. Students will develop their own academic poster to present their research project's data and implications.

Learning Outcomes: 1. Learn about quantitative and qualitative research methods and discuss how to utilize both in a research project. 2. Create and present an academic poster applying data visualization best practices. 3. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

GS 39505 - Research Peer Mentoring Training

Credit Hours: 1.00. This course is for current or past Purdue undergraduate researchers who want to learn how to serve as peer mentors to undergraduate researchers early in their careers. This course will train students on how to create mutually beneficial and productive mentorships. This course will provide research-based best practices for mentoring newer student researchers while developing as a cohort of new research mentors. This course is especially useful for those students who enjoy supporting peer researchers or plan to continue into more formal mentorship roles as a senior undergraduate researcher, graduate student, or research supervisor in academia or industry. Permission of instructor required.

Learning Outcomes: 1. Explore multiple strategies for effective mentoring with case studies, discussions, and readings. 2. Learn how to transition from a researcher to a peer mentor. 3. Create a mentoring philosophy statement and present your philosophy with peers. 4. Develop preparatory steps for effective mentorship dissolution. Credits: 1.00

GS 40400 - Horizons Advanced Career Preparation

Credit Hours: 1.00. Horizons Advanced Career Preparation is designed to assist students in beginning their transition from college to the workforce or graduate school. The emphasis of the course is placed on self-exploration, career search skills, graduate school preparation, professional conduct, and financial planning.

Learning Outcomes: 1. Understand self-authorship through evaluation of strengths and talents. 2 Navigate a process of personal exploration focused on future career objectives. 3. Develop and refine resume or curriculum vitae. 4. Enhance skills as they relate to ongoing job search or graduate school preparation. 5. Educate navigating a professional setting. 6. Develop financial literacy as it relates to budgeting, loans, and savings. Credits: 1.00

GS 40500 - Advancing Tomorrow's Leaders: Preparing For Employment And Life After College

Credit Hours: 1.00. A one-credit course designed to prepare Purdue Promise students for the next chapter of their professional journey through the reflection of past experiences and the acquisition of new knowledge, expectations, and skills necessary to be successful citizens and employees post-graduation. This course is only for students in the Purdue Promise program. Permission of instructor required.

Learning Outcomes: 1. Identify expectations of post-graduation life. 2. Be informed of benefits, insurance, paycheck, and tax information. 3. Learn how to navigate their new positions and organizations-cultures, co-workers, supervisors, and workplace challenges. 4. Learn how to maintain marketability in the job market. 5. Learn the necessary life skills of living in a new town, with transitions, new financial obligations, and new responsibilities. 6. Reflect upon their college experience and how it has prepared them for their transition out of college. Credits: 1.00

GS 41000 - Advancing Tomorrow's Scholars: Graduate And Professional School Preparation

Credit Hours: 1.00. A one-credit course designed to prepare Purdue Promise students for a smooth transition into graduate or professional school. This course will inform Purdue Promise students of the necessary preparation, required paperwork, and skills needed to be successful in post-baccalaureate education. This course is only for students participating in the Purdue Promise program. Permission of instructor required.

Learning Outcomes: 1. Be informed of graduate school timelines, checklists, and necessary steps to apply. 2. Learn how to select a good graduate program for themselves. 3. Write a personal statement. 4. Learn ways to finance graduate school prior to starting and once in graduate school. 5. Learn the necessary life skills of living in a new town, with new transitions, and new responsibilities. 6. Reflect upon their college experience and how it has prepared them for their transition out of college. Credits: 1.00

GS 49000 - Directed Reading In General Studies

Credit Hours: 1.00 to 4.00. Reading to be done under the direction of the instructor in the particular field of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

GS 49501 - Beyond Undergraduate Research

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build on the previous courses (GS 29501, 39501) and focus on continuing their education in graduate or professional school. During this course, students will learn and discuss the various phases of identifying, selecting, applying to and funding graduate or professional school programs. Students will also gain a deeper comprehension of the qualities and skills that make research mentors effective while developing skills they will need to be successful mentees and peer mentors. Students will conduct research to identify potential programs of interest and develop a statement of purpose.

Learning Outcomes: 1. Categorize graduate or professional school qualities that fit skills and meet professional needs. 2. Identify qualities and skills necessary to act effectively as a

research mentor and as a research mentee to a future graduate/professional advisor. 3. Create a statement of purpose to include in graduate/professional school applications. 4. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

SCLA 10100 - Transformative Texts, Critical Thinking And Communication I: Antiquity To Modernity (UCC: IL/WC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This first course in the sequence introduces students to great texts from antiquity to the birth of the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Write with clarity, coherence, and concision in a variety of genres. 2. Demonstrate an importance of rhetorical situations and choices for a variety of audiences and contexts. 3. Demonstrate critical thinking about writing through reading, analysis, discussion, composing and revising texts in a range of genres. 4. Apply a clear understanding of the process of writing (including drafting, revising, editing, proofreading, and collaborating with others and providing feedback); and successfully organize, present, and communicate meaning to fellow readers in at least 8,000 words of polished writing. 5. Identify, analyze, and evaluate the claims of a variety of print, digital, audio and visual sources. 6. Engage critically with transformative texts, drawing on multiple perspectives including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 10200 - Transformative Texts, Critical Thinking And Communication II: Modern World (UCC: OC)

Credit Hours: 3.00. The primary goal of the course is to provide students with a foundational knowledge of transformative literature from around the world as well as fundamental reading, writing, speaking and analytical skills. This second course in the sequence introduces students to great texts from the modern era. Its goal is to create life-long learners, open to the world, and sensitive to other points of view. It exposes students from across the university to the ideas, skill-set and inspiration that animates from the liberal arts, and it also introduces them to liberal arts faculty.

University Core Curriculum (UCC): (UCC: OC) Learning Outcomes: 1. Demonstrate effective, professional delivery, designing and adapting appropriate verbal appeals through vocal intonation and non-verbal cues. 2. Distinguish and apply appropriate informative, persuasive, explanatory, interrogatory and argumentative strategies and techniques in the discussions and in formal presentations. 3. Organize presentations with effective supporting materials. 4. Locate and evaluate effective sources of information. 5. Engage critically with transformative texts, drawing on multiple perspectives, including the individual, the historical, and the contemporary. Credits: 3.00

SCLA 11000 - Language And Cultural Exchange I: Self In Context (UCC: HUM)

Credit Hours: 3.00. The course takes a social science-based approach to investigating the American university by examining contemporary college life, the history of the American academy, social and environmental issues on campus, and opportunities for engagement with the wider community. Students will improve their speaking, listening, reading, writing skills in English so that they can actively participate in social and academic communication.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Speak English more fluently. 2. Read English more fluently. 3. Communicate in English with increased clarity (writing effective academic sentences and paragraphs; speaking on familiar topics). 4.

Develop and apply a process for cross-cultural comparison and reflection. Credits: 3.00

SCLA 11100 - Language And Cultural Exchange II: Texts And Contexts

Credit Hours: 3.00. Students will continue to develop the foundational language skills and knowledge that they need to succeed in their other classes at Purdue and to prepare for further academic and professional opportunities. Students will also deepen their understanding of American culture and improve their ability to think about cultural differences in positive ways. In a sense, this class will be a bridge to help you transition to other language-intensive courses at Purdue where you need to read, write, and speak frequently and/or work in groups (such as business, engineering, literature, public speaking, and social sciences).

Learning Outcomes: 1. Speak and read English more fluently. 2. Present academic topics to an audience with increased clarity and within time constraints (write effective, short academic essays; present information orally to an academic audience). 3. Understand reasons and practices for using outside sources in an American academic context. Credits: 3.00

SCLA 11500 - Introduction To Career Decisions

Credit Hours: 1.00. This course is designed to guide the student through self-exploration and an investigation of the world of work. The class format will be short lectures followed by class discussions and activities. Not open to students who have completed GS 11900.

Credits: 1.00

SCLA 19100 - Special Topics In Liberal Arts

Credit Hours: 1.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum. Permission from instructor required.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 1.00 to 3.00

SCLA 20000 - Cornerstones In Constitutional Law (UCC: BSS)

Credit Hours: 3.00. In this interdisciplinary course, students read case law to understand legal reasoning and constitutional doctrines and identify major constitutional conflicts. It explores how the forces of technology, economics, politics, environmental change, scientific development, and medicine transform constitutional law.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the key principles and doctrines of U.S. constitutional law through engaging with case law in written and oral communication. 2. Effectively apply these key constitutional principles and doctrines through written and oral communication to issues related to each of the five Cornerstone tracks through assessments targeting modules in each track. 3. Assess and consider constitutional arguments and counterarguments and demonstrate the ability to develop and articulate arguments from different positions through detailed case briefs and oral arguments. 4. Analyze how constitutional law decisions affect the development of political, social, economic, technological and medical institutions. Credits: 3.00

SCLA 29100 - Special Topics In Liberal Arts

Credit Hours: 1.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum. Permission from instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 3.00

SCLA 30000 - Liberal Arts Influentials

Credit Hours: 1.00. As a lecture/discussion course, Liberal Arts Influentials features speakers from a diverse range of Liberal Arts majors and introduces students to the myriad career opportunities available to Liberal Arts graduates. Speakers represent careers in the arts, media, industry, politics and more. Students are encouraged to initiate dialogue with working professionals. Only students enrolled in the College of Liberal Arts may register for GS 30000: LA Influentials.

Learning Outcomes: 1. Identify how the liberal arts influence and contribute to society, globalization, and world issues and how the liberal arts prepare students for meaningful and satisfying career. 2. Develop a better understanding of how these influences and

contributions can be applied to their professional and personal development. 3. Network with key Liberal Arts alumni. Credits: 1.00

SCLA 31500 - Internship Development Strategies

Credit Hours: 1.00. This course offers sophomore and junior students the opportunity to gain key skills to prepare for a professional internship. Topics range from "Why intern" to conducting searches, to resumé writing and interview techniques to establishing a professional identity.

Credits: 1.00

SCLA 32000 - Theories And Methods Of Mentoring Academic Writers Across The Disciplines

Credit Hours: 3.00. A practicum to teach undergraduates the theories and methods of mentoring academic writers across the disciplines in the one-to-one setting of a writing lab.

Learning Outcomes: 1. Describe and apply theoretical concepts and specific tutoring strategies to meet student needs. 2. Identify best practices for teaching writing and mentoring rhetorical awareness in writing lab interactions and develop their own unique, robust toolbox of strategies. 3. Demonstrate awareness of genre and different expectations for writing across the disciplines, cultivating the ability to adapt, riff, and improvise according to the rich dynamics of a consultation. 4. Identify and analyze affective, behavioral, and cognitive dimensions of writing and learning and their role in writing consultation. 5. Develop a professional identification with writing center studies and demonstrate knowledge of the field through application of its shared language and theories. 6. Practice metacognition by reflecting on their composing processes and relating their experiences in the classroom and at the OWL to the larger context of writing center studies. 7. Propose an inquiry that enters into a scholarly conversation within contemporary writing center studies research and assess its potential impact for consulting practices at the OWL. 8. Use the insights gained within the course to support the Purdue campus community. Credits: 3.00

SCLA 39000 - Special Credit For Study Abroad In Liberal Arts

Credit Hours: 1.00 to 4.00. This course number is for assignment of credits in studies in Liberal Arts earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

SCLA 39100 - Special Topics In Liberal Arts

Credit Hours: 1.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum. Permission from instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 3.00

SCLA 41500 - Senior Job Search Seminar

Credit Hours: 2.00. This course is designed to get LA seniors actively started on their job search. Highly intensive assignments, in-class activities, presentations and projects are designed to better prepare students for all aspects of the job search process.

Credits: 2.00

SCLA 49000 - Directed Reading

Credit Hours: 1.00 to 3.00. Designed for a student to work with an instructor on a topic of special interest.

Credits: 1.00 to 3.00

SCLA 49100 - Special Topics In Liberal Arts

Credit Hours: 0.00 to 3.00. Special topics, varying from semester to semester. Course content will be drawn from areas not dealt within the regular curriculum.

Credits: 0.00 to 3.00

SCLA 49105 - Liberal Arts Undergraduate Research Experience

Credit Hours: 0.00. This course is for students in the Dammon Dean's Scholars program or the Margo Katherine Wilke Undergraduate Research program. This course is required each

semester a student participates in either program. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of research activity. Credits: 0.00

SCLA 49500 - Special Credit For Study Abroad In Liberal Arts

Credit Hours: 1.00 to 4.00. This course number is for assignment of credits in studies in Liberal Arts earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

Department of Anthropology

About Anthropology

Anthropology considers humankind from a holistic perspective that aims for an understanding of how culture, biology, history and language intersect. *Students have the option to enroll in one of seven new 12-unit Concentrations in several specialty areas within the Anthropology major, including* Anthropology of Health , Applied Anthropology , Archaeological Sciences , Bioarchaeology and Forensic Anthropology , Biological Anthropology , Cultural Anthropology , and Ecological and Environmental Anthropology . Our faculty ably cover a range of substantive, methodological and theoretical areas in courses that provide students with a solid grounding in anthropological perspectives.

Undergraduates have an opportunity for hands-on experience and training in archaeological and bioanthropological methods. Students enjoy participating in the student club P.A.S.T. (Purdue Anthropology Society). Also offered are internship and field work experience.

Our honors program provides a capstone experience for students. The year-long program enables students to focus on a particular empirical issue in an anthropological sub-discipline and to write an honors thesis based on that research.

Please visit the Department of Anthropology for more information.

Faculty

Anthropology Department Directory

Contact Information

The Department of Anthropology's main office is located in Stone Hall, Suite #303 on the campus of Purdue University in West Lafayette, Indiana.

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West Lafayette, Indiana 47907-2059
Phone: (765) 496-7400 Fax: (765) 496-7411

General Information:
anthropology@purdue.edu
765-496-7400

Graduate Information

For Graduate Information please see Anthropology Graduate Program Information .

Anthropology Minor

Anthropology, BA

Anthropology Honors, BA

Anthropology, BS

Science and Technology Studies Certificate

ANTH 10000 - Being Human: Introduction To Anthropology (UCC: BSS)

Credit Hours: 3.00. Introduces anthropology's holistic approach to human nature and behavior. This course uses the tools of cultural, biological, archaeological, and linguistic anthropology to follow the human journey of uniformity and diversity through time and across space.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Describe the basic concepts and applications of anthropology, including biological, cultural, archaeological, and linguistic anthropology. 2. Recognize the

deep social and biological histories that have shaped contemporary life. 3. Examine processes of ongoing biological and social change that influence the environment, social organization, language, and other aspects of the world they experience. Credits: 3.00

ANTH 20100 - Introduction To Archaeology And World Prehistory (UCC: BSS)

Credit Hours: 3.00. Introduction to the ideas and practices of archaeology that are used in the contemporary study of human prehistory. Emphasis is placed on the social and technological changes that accompanied major turning points in the human past, including the earliest stone tools, the development of farming, through the advent of writing and monumental architecture among ancient states.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize the principles of archaeology and how we study the ancient past. 2. Describe and analyze archaeological phenomenon using archaeological terms. 3. Relate dates, places, and significance of major cultural and technical transformations in prehistory. 4. Evaluate how archaeology is represented in popular media. Credits: 3.00

ANTH 20300 - Biological Bases Of Human Social Behavior (UCC: BSS)

Credit Hours: 3.00. This course is an introduction to human social behavior from the perspective of biological anthropology, with special emphasis on human evolution and non-human primates. Topics include aggression, communication, learning, maturation, sexuality, and the evolution of social systems.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Demonstrate understanding of core concepts and theories of human evolutionary biology and ecology. 2. Describe key components of human life course evolution and hunter-gatherer lifestyles. 3. Analyze the evolutionary mechanisms underlying behavioral variation across primates. 4. Assess cross-cultural variation in food acquisition, mating, parenting, and social systems. Credits: 3.00

ANTH 20400 - Human Origins (UCC: SCI)

Credit Hours: 3.00. Surveys our evolutionary journey, from fossil primates to modern humans, through a review of evolutionary theory and genetics, the fossil evidence for current theories in human evolution with insight from modern non-human primates, and the influence of environmental stressors on modern human biological variation.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Define and explain the mechanisms of evolution and genetic inheritance. 2. Identify the characteristics of non-human primates and describe their behavior, ecology, and evolutionary relationships to humans. 3. Describe primate and human evolution as seen in the fossil record. 4. Explain how evolutionary processes have led to contemporary human variation and behavior. Credits: 3.00

ANTH 20500 - Human Cultural Diversity (UCC: BSS)

Credit Hours: 3.00. Offers an engaging introduction to concepts, themes, methods, and ethical concerns that guide research and analysis in cultural anthropology. Students will learn how to identify and interpret the complexities of human culture - what makes cultures different, and in what ways are they more alike than we might assume? Topics include: race and racism; ethnicity and nationalism; gender; sexuality; kinship, family, and marriage; class and inequality; the global economy; politics and power; religion; and health and illness.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recognize cultural anthropology's historical legacies and contemporary realities. 2. Identify and explain key concepts in cultural anthropology. 3. Demonstrate understanding of how culture intersects with political, economic, and social institutions, including the relationship between power and inequality. 4. Recognize how anthropological theories and methods can provide insight into contemporary life and human experiences. Credits: 3.00

ANTH 21000 - Technology And Culture (UCC: STS)

Credit Hours: 3.00. This course explores the social dimensions of technology from the perspective of ancient, modern, and post-modern society. Topics include the origins of particular technologies; processes of technical development and dissemination; the politics of everyday artifacts; virtual identities; and technologies of the body. Suggested courses (not pre-requisite): ANTH 10000, 20100 and/or 20500.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Describe the origins and social consequences of technologies. 2. Analyze technology as a social process and debate the inevitability of technological progress. 3. Interpret the complex interplay between technical fields and social identity. 4. Summarize science and technology over time and across diverse places. Credits: 3.00

ANTH 21200 - Culture, Food And Health

Credit Hours: 3.00. This course is designed to provide an introduction to the field of Nutritional Anthropology in which we will examine issues related to diet, health and illness from holistic anthropological perspectives.

Learning Outcomes: 1. Develop an understanding of the theoretical basis of nutritional anthropology. 2. Recognize core methods of nutritional anthropology. 3. Describe evolutionary and cross-cultural approaches to the study of food and nutrition. 4. Analyze the intersection of biology and culture in regard to eating practices. 5. Evaluate information on food and nutrition that is shared in the popular media. Credits: 3.00

ANTH 21500 - Introduction To Forensic Anthropology

Credit Hours: 3.00. Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. This course introduces students to methods used to recover and positively identify human remains, and to evaluate trauma and taphonomy in medico-legal situations. Topics include an overview of historical and current developments in the field. Students will develop a comprehensive understanding of the sequential order of applied work from the search for forensic scenes through the recovery of remains, and skeletal analysis in the laboratory.

Learning Outcomes: 1. Understand the legal context in which anthropologists work in both state and federal courts by the standards of the US medico-legal system. 2. Explain the statistical approaches to forensic anthropological problems by analysis of problem sets. 3. Gain general knowledge about the methods of the biological profile (age, sex, ancestry, stature and pathology) to improve competency and understand the errors associated with each method by review and evaluation of relevant literature. 4. Explain the biological basis of the components of the biological profile by advancing reasonable conclusions. 5. Critically examine the use of the terms race and ancestry in forensic contexts by group discussion. Credits: 3.00

ANTH 23000 - Gender Across Cultures (UCC: BSS)

Credit Hours: 3.00. Explores gender and sexuality from a cross-cultural perspective. Draws on case studies to explore the complexities of women's and men's lives. Examines gender hierarchies, gender in a globalized world, and the cultural construction of sexuality and gender.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Explain how culture influences the social constructions of sex, gender, and sexuality. 2. Recognize the diversity of genders and sexualities globally and over time. 3. Demonstrate understanding of how gender intersects with other social processes and institutions. 4. Identify the role of power structures, violence, and inequity in constructing and maintaining gender conventions. Credits: 3.00

ANTH 23500 - The Great Apes

Credit Hours: 3.00. Students will learn the behavior and conservation of our closest relatives and how early ape studies changed our understanding of what it meant to be human.

Topics include gender in science, ethics of research and cross-cultural understandings.

Learning Outcomes: 1. Identify the geographic distribution as well as the anatomical and behavioral traits that characterize great ape species. 2. Explain the major achievements of and challenges to great ape research in the wild and captivity. 3. Demonstrate an understanding of why and how anthropologists use great apes to model human evolution. 4. Describe the ethical issues of conducting research on our closest living relatives and conserving them in the wild. Credits: 3.00

ANTH 24000 - Medicine, Science, And Culture

Credit Hours: 3.00. This course explores the intersections of medicine, science, and culture as powerful shapers of our lives and the world today. Anthropology broadly studies the human experience to help explain how our bodies, biologies, and beliefs inform what "medicine," "health," "illness," and "healing" come to mean in diverse and cross-cultural contexts. The course will cover foundations in medical anthropology by exploring a range of topics and applications.

Learning Outcomes: 1. Describe what medical anthropology is and what medical anthropologists do. 2. Analyze the dynamic intersections of medicine, science, and culture. 3. Explain what medical anthropology contributes to understanding the multiple dimensions of health, illness, and healing. 4. Apply anthropological frameworks to real-world examples. Credits: 3.00

ANTH 25400 - Archaeological Hoaxes, Myths And Frauds

Credit Hours: 3.00. This course examines why the ancient past inspires so many theories about aliens, dark conspiracies, lost civilizations, and apocalyptic predictions. Topics include the popularity of pseudoscientific theories in American culture and the historical contexts in which common pseudoscientific ideas have emerged; why they persist in the face of archaeological evidence; and the role of pseudo-archaeology in the growing antagonism toward scientific expertise. Through an understanding of datasets and methods archaeologists use to evaluate claims about the past, the course goes beyond debunking ancient aliens and Atlantis to develop important critical thinking skills to evaluate evidence and recognize pseudo-scientific arguments in the media.

Learning Outcomes: 1. Evaluate the difference between a scientific and a pseudoscientific claim about the human past. 2. Explain the techniques and scientific methods archaeologists use for evaluating hypotheses or claims about the past. 3. Examine the role and popularity of pseudoscientific theories in American culture and the historical contexts in which popular pseudoscientific ideas have emerged. 4. Articulate how seemingly harmless fringe theories are entangled with larger narratives of cultural memory and erasure among past societies and their descendants. Credits: 3.00

ANTH 25600 - Archaeology Of Beer

Credit Hours: 3.00. Alcoholic beverages are an important aspect of foodways, the cultural practices and values surrounding food and drink. This course provides an overview of the ancient origins of beer and other alcoholic beverages globally, and examines the cultural context and social role of these innovations through a combination of archaeology, material culture studies, historical texts, and ethnography. In addition to examining archaeological case studies of the production and consumption of beer and other alcoholic beverages, topics to be covered include: evolution of brewing and fermenting technology, biology and chemistry of brewing and fermentation, residue and materials analysis, origins of agriculture, emergence of social complexity, sexual division of labor, social identity (gender, class, ethnicity), and recent trends in production and consumption.

Learning Outcomes: 1. Identify the role of Anthropology in understanding the production and consumption of alcohol in cultures past and present. 2. Evaluate several different theoretical and methodological approaches within the field of Archaeology. 3. Assess and debate the role that the innovation of alcohol might have played in the origins of agriculture and social complexity in different times and places in the past. 4. Analyze and explain innovations in brewing technology over time. 5. Describe and explain the way in which identity is shaped by the production and consumption of beer. These

learning outcomes will be achieved by reading, evaluating, and summarizing course material (lectures, readings, and films) at regular intervals throughout the course and by engaging in regular group discussions. 6. Outcomes will be assessed by examining student performance on quizzes, exams, and article summaries, as well as participation in class discussion. Credits: 3.00

ANTH 28200 - Introduction To LGBTQ Studies

Credit Hours: 3.00. (WGSS 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding if the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

ANTH 30600 - Quantitative Methods For Anthropological Research

Credit Hours: 3.00. This course provides an introduction to the broad statistical methods used throughout the 4-fields of Anthropology. It covers elementary probability theory, basic concepts of statistical inference and study design. The course will motivate statistical methods through data analysis and visualization. It is designed for students who intend to focus in an anthropological discipline. It would also benefit a variety of students interested in 1) quantitative science literacy and planning for graduate work, 2) joining the workforce and becoming part of the educated citizenry. There are no prerequisites from the Statistics or Mathematics Departments.

Learning Outcomes: 1. Acquire the ability to explain anthropological data collection methods, their limitations and effect on inference. 2. Summarize data numerically and visually and perform data analysis using statistical software. 3. Describe the unified nature of statistical inference. 4. Learn applications of analytical methods for single variables or for relationships between two variables to describe natural phenomena and make data-based decisions. 5. Analyze numerical response variables using a single or multiple explanatory variables to investigate relationships between variables. 6. Interpret results correctly, effectively, and in context without relying on statistical jargon. 7. Gain skills to assess data-based claims and evaluate data-based decisions. Credits: 3.00

ANTH 30700 - The Development Of Contemporary Anthropological Theory

Credit Hours: 3.00. Explores the history of anthropological theories pertaining to the understanding of commonality and variation in human biology, behavior, society, and cultures as they have developed over the approximately two centuries since anthropology was founded as a separate discipline. Considers those social, cultural, and historical factors that have influenced the history of anthropological ideas. Permission of instructor required.

Learning Outcomes: 1. Explain the role of theory for knowledge production. 2. Demonstrate understanding of major anthropological theories, including the assumptions behind and methods associated with them. 3. Apply theoretical perspectives within anthropology to analyze contemporary issues. 4. Demonstrate professionalization in research, analysis, peer review, and presentation skills. Credits: 3.00

ANTH 30800 - Critical Data Studies

Credit Hours: 3.00. Critical Data Studies (CDS), is an interdisciplinary field that addresses the ethical, legal, socio-cultural, epistemological and political aspects of data science, big data and digital infrastructure. This course focuses on current topics in critical data studies scholarship. Particular emphasis will be given to democratic and participatory approaches to algorithm design and responsible data management, curation and dissemination. Students will develop tools and methods to help scholars think critically and identify issues of concern to Local Communities. This is a research and

writing intensive course.

Learning Outcomes: 1. Engage in current debates surrounding data science, big data and digital infrastructure from an anthropological perspective. 2. Acquire anthropological tools and methods to analyze societal impact of emergent technologies. 3. Learn to demonstrate collaboration, public engagement and scholarly communication skills. 4. Apply anthropological frameworks to novel research problems. Credits: 3.00

ANTH 31000 - Mortuary Practices Across Cultures

Credit Hours: 3.00. Explores how death is treated or has been treated in diverse world cultures and time periods. Death is viewed as an expression of social behavior and as an expression of symbolic meaning.

Credits: 3.00

ANTH 31200 - The Archaeology Of Ancient Egypt And The Near East

Credit Hours: 3.00. Selected topics on the archaeology of ancient Near Eastern cultures in Mesopotamia, the circum-Mediterranean area, Egypt, and the Nile Valley, emphasizing an anthropological interpretation of the political, social, religious, and economic systems that contributed to their development.

Learning Outcomes: 1. Summarize the rise and development of civilization in the Near East and North Africa from 10,000 years ago to 331 BC. 2. Distinguish the emergence and strategies of governance between these neighboring regions. 3. Recognize the historical and cultural context that gave rise to the Great Pyramids, cuneiform writing, and other significant achievements in the region. 4. Interpret the Near East and North Africa within Western historical narratives and popular imaginings. Credits: 3.00

ANTH 31300 - Archaeology Of North America

Credit Hours: 3.00. Archaeological overview of North America emphasizing Indigenous cultures prior to the arrival of Europeans, but including Contact and Post-Contact communities of the Historic Period. Topics will include the peopling of the Americas, culture and environment, social complexity, and Cultural Resource Management.

Learning Outcomes: 1. Describe the general historical outline for North America's past. 2. Summarize the diversity of peoples and cultures that existed in North America. 3. Explain how North American archaeologists gather information and interpret the past. 4. Recognize how contemporary archaeologists engage with other stakeholders in North America's past. Credits: 3.00

ANTH 32700 - Environment And Culture

Credit Hours: 3.00. This course provides a general overview to the field of environmental anthropology, and surveys key methods, and theories that anthropologists use to interpret human-environment interactions. Topics include culture ecology, agroecology, ethnobiology, political ecology, and environmental justice.

Learning Outcomes: 1. Identify and explain the key theories in environmental anthropology. 2. Identify several cross-cultural examples of human-environment interactions. 3. Distinguish between anthropological approaches and other disciplines that study the environment. 4. Apply the theories and methods learned in this course to real world environmental issues. 5. Demonstrate professional skills in research, analysis, presentation and peer review. Credits: 3.00

ANTH 33500 - Primate Behavior

Credit Hours: 3.00. This course is an introduction to the primate order and primate studies. The emphasis is on field studies. Ecological influences on social organization and behavior, learning, play, and communication will be considered as adaptations within an evolutionary framework.

Learning Outcomes: 1. Understand the diversity of anatomical and behavioral traits in primates, and how that diversity is taxonomically organized. 2. Describe the science of primatology, critically evaluate scientific research on primates, and contextualize primatology within Anthropology and closely related fields. 3. Communicate an

understanding of the relationships among primates and their ecosystems as well as the ecological, evolutionary, and social forces that shape their lives. 4. Appreciate the complexities of the work of preserving and managing primate populations. Credits: 3.00

ANTH 33600 - Human Variation

Credit Hours: 3.00. Biological differences between human individuals and groups, causes of variations, the role of genetics, concepts of race, and the interrelationship between the social and biological meanings of race will be considered.

Learning Outcomes: 1. Describe the scientific basis of human diversity from evolutionary and biocultural perspectives. 2. Evaluate statements in scientific literature about biological and cultural variation. 3. Explain how humans are continuing to change. 4. Analyze articles in the popular press that deal with human differences. Credits: 3.00

ANTH 33700 - Human Diet: Origins And Evolution

Credit Hours: 3.00. This course will survey humans evolving relationship with food over the last few million years; from our Plio-pleistocene origins (foraging) through the origins of agriculture to modern industrial food production.

Learning Outcomes: 1. Explain "the human diet," its evolution, and its range of variation. 2. Summarize the role that dietary studies have played in the development of anthropological and biological theory. 3. Identify primate dietary adaptations and explain how these adaptive traits inform human evolution studies. 4. Describe major dietary issues faced by humans today. Credits: 3.00

ANTH 34000 - Global Perspectives On Health

Credit Hours: 3.00. This course examines health issues and risks faced by individuals around the world, but especially in resource poor geographical areas. We will explore in-depth the gendered, ethnic, cultural, and class dimensions that underlie the patterning of disease and illness worldwide.

Learning Outcomes: 1. Describe what anthropology contributes to the study of health globally and over time. 2. Explain how diverse communities around the world define health and organize health care. 3. Analyze the social and historical influences on health inequities. 4. Apply anthropological theories and methods to contemporary health issues. Credits: 3.00

ANTH 34100 - Culture And Personality

Credit Hours: 3.00. A cross-cultural survey stressing different basic personality types and the processes by which adult personality is acquired. Case studies of selected non-Western cultures will be used to provide comparative perspective.

Learning Outcomes: 1. Explain in words and diagrams the dialectical relations among culture, personality, and cognition. 2. Distinguish and relate childhood and adult processes of enculturation and socialization. 3. Appraise how, why, and to what extent every individual and every society is unique, comparable to some others, and similar to all others. Credits: 3.00

ANTH 34600 - Pregnancy, Birth, And Babies

Credit Hours: 3.00. This course examines human universal patterns and cross-cultural variation in pregnancy, birth, and infant care practices, using evolutionary and biocultural perspectives. Students will connect course themes to current events and controversies, such as medical models of birth, public breastfeeding, and parent-infant co-sleeping.

Learning Outcomes: 1. Identify evolutionarily novel aspects of the human reproductive pattern. 2. Compare birthing, infant feeding, and infant care practices across human societies using a biocultural framework. 3. Evaluate contemporary medical controversies surrounding pregnancy, birth, and babies critically. Credits: 3.00

ANTH 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American speech communities and the culture at large.

Credits: 3.00

ANTH 37300 - Anthropology Of Religion

Credit Hours: 3.00. Anthropological theories of the origin, development, and functions of religion, ritual, and myth. Data drawn from western and non-western societies, with special emphasis on the relationship of religion to social structure, cultural patterns, and social change.

Learning Outcomes: 1. Explain anthropological approaches to the study of religious belief systems. 2. Investigate religious and cultural differences using anthropological skills. 3. Describe a diversity of faiths and worldviews. 4. Summarize the key ways that humans of the past and present have sought to make sense of the mysteries of life and the sacred. Credits: 3.00

ANTH 37700 - Anthropology Of Hunter-Gatherer Societies

Credit Hours: 3.00. Selective global survey of societies whose mode of subsistence is/was based on the collection of wild food resources. Topics to be covered include: the development and current state of theory, ecology, social organization, land use, demography, subsistence rights, and worldview.

Learning Outcomes: 1. Explain the forager lifestyle and the range of variation that researchers continue to discover. 2. Summarize the role that hunter-gatherer studies have played in the development of anthropological and biological inquiry and theory. 3. Recognize why the hunter-gatherer lifestyle has persisted as a human adaptation for as long as it has and how knowledge derived from its study can help scientists understand humanity. 4. Describe major issues faced by foragers and their descendants today. Credits: 3.00

ANTH 37900 - Native American Cultures (UCC: BSS)

Credit Hours: 3.00. General survey of Native cultures of the Americas. Topics to be covered include prehistory, language, religion, aesthetics, culture contact and change, contemporary issues, and social, economic and political organization.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

ANTH 38000 - Using Anthropology In The World

Credit Hours: 3.00. The use of anthropology in practical contexts. What anthropological practice is, how it originated, how it can be applied in non- academic and interdisciplinary contexts and careers. The main contemporary issues surrounding anthropological practice, including training, ethics, relevance, and rigor. For majors and non-majors.

Learning Outcomes: 1. Describe applied anthropology and how the field has evolved over time. 2. Analyze the major issues, controversies, and opportunities of applied anthropology. 3. Identify key methods and skills that applied anthropologists use in their careers. 4. Explain how anthropology can be applied in non-academic and interdisciplinary settings. 5. Demonstrate how to prepare for a career in anthropological practice, and/or use anthropology in their future career. Credits: 3.00

ANTH 38400 - Designing For People: Anthropological Approaches

Credit Hours: 3.00. This course is about designing for people. You will use anthropological knowledge and skills to better understand human and technology interactions. With students from other fields, you will learn how to apply an anthropological perspective to human centered design and design with the needs of a specific user group in mind.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

ANTH 38500 - Community Engagement In Anthropology

Credit Hours: 3.00. This course offers hands-on service learning experience with local community organizations involved with minority and immigrant populations. Part of the semester will include class meetings to explore issues and experiences of immigrant and ethnic groups in the U.S.

Learning Outcomes: 1. Explain the ethical, historical, and theoretical approaches and challenges of conducting community-engaged anthropological research. 2. Design community-engaged research projects involving ethical approaches to partnerships, methods, and data analysis. 3. Apply course concepts to real-life situations by conducting community-engaged research with a community partner. 4. Summarize final research findings to a community partner. Credits: 3.00

ANTH 39000 - Individual Research In Anthropology

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of anthropology under the guidance of an anthropology faculty member. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

ANTH 39200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Various topics in anthropology that may change from semester to semester are presented by anthropology faculty members.

Credits: 1.00 to 3.00

ANTH 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ENGL 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish, paraphrase, and translate different disciplinary perspectives on these key environmental and sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

ANTH 40500 - Ethnographic Methods

Credit Hours: 3.00. This course introduces students to the basic methods of ethnographic research: the collection, analysis, and presentation of data derived from the systematic, direct observation of human behavior and interviewing of key informants. Students are required to complete a field project.

Learning Outcomes: 1. Identify and synthesize key theoretical and methodological approaches to ethnographic field work in the following broad domains: 1) research ethics, 2) data collection (field notes, participant observation, interviewing, visual and digital methods), 3) data management, and 4) communication of research results. 2. Demonstrate scientific and scholarly literacy through critical discussion, production of scholarly reports, and public dissemination of research efforts. 3. Develop qualitative competence and problem solving skills in an active learning environment through practical data collection and processing exercises. Credits: 3.00

ANTH 41001 - Senior Capstone In Anthropology

Credit Hours: 3.00. Culminating experience required for all anthropology majors. Course synthesizes four-field anthropology coursework and training, and discusses academic/career options that benefit from anthropological training. Major element of the course will include synthesis paper and presentation, senior portfolio, and professional development.

Learning Outcomes: 1. Reflect on their development as an anthropologist and articulate their degree's value in pursuit of their professional interests and goals. 2. Articulate a synthetic anthropological research question, and write a well-thought out and properly cited research paper using their accumulated research skills. 3. Think critically about the role of anthropology in addressing the Grand Challenge facing society in the 21st Century. Credits: 3.00

ANTH 41400 - Introduction To Language And Culture

Credit Hours: 3.00. An exploration into the nature of human communication, particularly the structures, functions, and substance of human language. Focus is on the interpenetration of language, culture and cognition, on the evolution of language and speech, and on their uses in everyday life.

Learning Outcomes: 1. Explain the separate biological origins and functions for human language and speech/sign (languaging). 2. Distinguish communication, language, and languaging, as these relate to individual cognition and to collective culture and society. 3. Differentiate language and languaging, and written forms for each. 4. Discuss how language and languaging reciprocally shape both cognition and culture. Credits: 3.00

ANTH 41800 - Field Methods In Cultural Anthropology

Credit Hours: 1.00 to 9.00. Introduces basic field methods in Cultural Anthropology. Topics may include ethnographic or other interviewing techniques and methods of inquiry into any of the broad topics covered by Cultural Anthropology. Permission of department required.

Learning Outcomes: 1. Understanding the use of anthropological methods such as participant observation, ethnographic analysis and general interviewing techniques. Credits: 1.00 to 9.00

ANTH 42500 - Archaeological Method And Theory

Credit Hours: 3.00. Introduction to the theory and methods of contemporary American archaeology. Basic field and laboratory methods are placed in the context of theoretical viewpoints and problems. Major theoretical issues in the field are explored, showing the integration of American archaeology with anthropology.

Learning Outcomes: 1. Summarize the history of archaeology and theoretical frameworks used in interpreting the past. 2. Discuss field and laboratory techniques that archaeologists use to analyze material remains from the archaeological record and reconstruct past human behavior. 3. Describe prehistoric cultural practices including diet and subsistence, migrations, social and political organization. 4. Identify the contributions of archaeology to today's society through various professions inside and outside academic settings. Credits: 3.00

ANTH 42800 - Field Methods In Archaeology

Credit Hours: 1.00 to 9.00. Introduces basic field and laboratory methods in contemporary archaeology: methods of site survey, mapping, and excavation through the excavation of archaeological sites; the basics of archaeological data analysis and classification, and the computer-based analysis of archaeological data. Permission of instructor required.

Learning Outcomes: 1. Describe, document, and record archaeological data and their spatial relationships in the field. 2. Apply basic archaeological field methods, including excavation, mapping, and data recording. 3. Practice database management, including sorting and labeling artifacts and samples, and maintaining a catalog of data. Credits: 1.00 to 9.00

ANTH 43600 - Human Evolution

Credit Hours: 3.00. This class examines the fossil evidence for

human evolution and theories proposed to explain the development that led from the origin of primates to modern humans. This course will include lectures, exercises with fossil casts, presentation, and discussions.

Learning Outcomes: 1. Explain the analytical and research methods used in hominin paleobiology. 2. Identify important research questions within human paleobiology as well as theoretical approaches and methods used to evaluate them. 3. Describe the relevant fossil evidence to investigate the evolution of the primate lineage. 4. Demonstrate understanding of evolutionary processes, particularly those that shaped the biocultural evolution of modern humans. 5. Evaluate interpretations of the hominin fossil record and appraise the strengths and weaknesses of current debates in human evolution. Credits: 3.00

ANTH 43800 - Field Methods In Biological Anthropology

Credit Hours: 1.00 to 9.00. Introduces basic laboratory methods in Biological Anthropology. Topics may include analysis of human or primate nutritional and biological markers or laboratory methods in the analysis of human skeletal populations. Permission of department required.

Learning Outcomes: 1. Understanding the use of anthropological methods such as anthropometric measurements, primate behavioral observations and/or general interviewing techniques. 2. Students will gain an appreciation for ethical issues in biological anthropological research. Credits: 1.00 to 9.00

ANTH 48200 - Sexual Diversity In Global Perspectives

Credit Hours: 3.00. This course focuses on anthropological and interdisciplinary research in the study of sexuality with particular attention to lesbian, gay, bisexual and transgender identities. It explores historical, theoretical and ethnographic work on sexualities and genders in the US and globally.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

ANTH 49700 - Senior Honors Seminar

Credit Hours: 3.00. A critical examination of some major works in anthropology and sociology, both classical and modern, and of some current theoretical and substantive issues in these disciplines. Open only to students in the departmental honors program.

Credits: 3.00

ANTH 49800 - Senior Honors Paper

Credit Hours: 3.00. Requires a substantial paper on a topic approved by the instructor. The student is expected to work closely with the instructor on the paper's content and style. A presentation of the results of the work is made at the end of the semester. Open only to students in the departmental honors program.

Credits: 3.00

Brian Lamb School of Communication

About the Brian Lamb School of Communication Program

Many Purdue undergraduates experience the communication program, as each year more than 4,000 students across campus take a presentational speaking course from the Brian Lamb School of Communication (BLSC). Students who choose to major in communication within the Lamb School may focus their studies in one of eight areas of concentration:

- Business Communication
- Communication of Science and Technology
- General Communication
- Health Communication
- Interpersonal Communication
- Media and Mass Communication
- Political and Civic Communication

• Public Relations and Strategic Communication

The Lamb School has dedicated, full-time advisors who help students with course planning and career development and student organizations that provide opportunities for professional and scholarly growth. Graduates find careers in fields ranging from public relations to management, from law to ministry, and in areas such as sports and health.

Both inside and outside the classroom, Lamb School students build experiences to prepare them for careers. Our students produce live news shows and video news magazines, create a lifestyle TV show that airs on a local network affiliate, operate a student-run PR agency, and work in teams with local nonprofits to get real-world experience in public relations.

The communication program offers many international opportunities. In addition to the many programs available through the university's study abroad office, Lamb School students can also study in many communication-specific programs. Semester exchanges can send students to Australia, Singapore, or Denmark, and summer programs in recent years have included Sydney, Australia; Stockholm, Sweden; and Siena, Italy.

In partnership with the Center for C-SPAN Scholarship and Engagement, the Lamb School offers "Boilers Go to DC" summer programs including class, internship, and fellowship options.

All Lamb School concentrations can be completed in three years. These course arrangements have the same number of total hours (120), and the same number of major hours (43), but those hours can be compressed into three years. Please visit Three Year Degree for more information.

Faculty

Brian Lamb School of Communication Department Directory

Contact Information

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Graduate Information

For Graduate Information please see Communication Graduate Program Information .

Communication Minor

Communication: Business Communication Concentration, BA

Communication: General Communication Concentration, BA

Communication: Communication of Science and Technology Concentration, BA

Communication: Health Communication Concentration, BA

Communication: Interpersonal Communication Concentration, BA

Communication: Media and Mass Communication Concentration, BA

Communication: Political and Civic Communication Concentration, BA

Communication: Public Relations and Strategic Communication, BA

Pre-Communication

COM 10000 - Introduction To Communication Studies

Credit Hours: 1.00. This semester-long course will introduce students to many opportunities offered by the Brian Lamb School of Communication. Permission of department required.

Learning Outcomes: 1. Engage with curriculum resources to create a plan of study that satisfies university, college and departmental requirements and complements their academic and professional goals. 2. Describe the field of communication to a person not engaged in the field. 3. Identify and use university, college and school resources applicable to their academic and professional goals. Credits: 1.00

COM 10200 - Introduction To Communication Theory

Credit Hours: 3.00. Overview of approaches treating communication as an individual, functional activity and as a social, structuring activity. Covers definitions and models of communication, core processes (interpretations, sending, receiving), structures (language, nonverbal behavior), and key contexts (personal, organizational, public).

Credits: 3.00

COM 11400 - Fundamentals Of Speech Communication (UCC: OC)

Credit Hours: 3.00. A study of communication theories as applied to speech; practical communicative experiences ranging from interpersonal communication and small group process through problem identification and solution in discussion to informative and persuasive speaking in standard speaker-audience situations. NOTE: Concurrent registration is not permitted for ENGL 10600 and COM 11400. CTL:ICM 1103 Fundamentals Of Public Speaking

University Core Curriculum (UCC): (UCC: OC)

Credits: 3.00

COM 20400 - Critical Perspectives On Communication (UCC: WC)

Credit Hours: 3.00. Introduction to critical thinking and writing about communication. Draws on humanistic and qualitative traditions to help students learn and apply critical approaches to understanding communication.

University Core Curriculum (UCC): (UCC: WC)

Credits: 3.00

COM 21000 - Addressing Public Issues

Credit Hours: 3.00. Survey of argumentation and persuasion theories addressing contemporary public issues. Readings and discussions on cultural norms, audience reasoning, civic discourse, and constructing appeals addressing policies and practices. Preparation of appeals for public campaigns and social movements.

Learning Outcomes: 1. Describe argumentation and persuasion theories as applied to contemporary public issues. 2. Identify cultural norms, values, and beliefs of diverse communities contribute to civic discourse and audience reasoning. 3. Construct written and oral appeals addressing public issues, policies, and practices. Credits: 3.00

COM 21200 - Approaches To The Study Of Interpersonal Communication (UCC: BSS)

Credit Hours: 3.00. A study of the basic characteristics of human communication and the theoretical and practical implications of these characteristics for various forms of oral communication. CTL:ICM 1101 Interpersonal Communication

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

COM 21700 - Science Writing And Presentation (UCC: OC)

Credit Hours: 3.00. Students learn to effectively communicate scientific and technical information both verbally and in writing to a variety of audiences.

University Core Curriculum (UCC): (UCC: OC)

Learning Outcomes: Will update at a later date.

Credits: 3.00

COM 22400 - Communicating In The Global Workplace (UCC: BSS)

Credit Hours: 3.00. This introductory course explores communication issues that arise in the global workplace. The course develops an appreciation of the relationship among culture, communication, and ways of organizing and doing business.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Critically analyze communication issues arising in culturally diverse organizations in the global environment by utilizing conceptual and theoretical frameworks. 2. Develop intercultural competencies for better managing communication issues in the global workplace by developing practical strategies for contemporary organizations operating in multiple cultures. 3. Explain macro social trends that are impacting global organizations by illustrating current examples. Credits: 3.00

COM 25000 - Mass Communication And Society

Credit Hours: 3.00. A survey of the print, broadcast, and film media in their relationship and influence on society. Study topics include: mass communication theories, documentaries, commercialism, news media, media effects and control, feedback, educational broadcasting, and audience analysis. CTL:ICM 1102 Introduction To Mass Communication

Credits: 3.00

COM 25100 - Communication, Information, And Society (UCC: IL/STS)

Credit Hours: 3.00. This course provides an introduction to information and communication technologies, including media and computer-related technologies. Basic information and technical literacy skills are developed, while discussing fundamental concepts of mediated communication in 21st century contexts.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Discuss implications of new technologies for individuals, institutions, and society. 2. Exercise basic information literacy skills through hands-on exercises involving new technologies. 3. Analyze impact of media technologies on communication behavior. 4. Write and make presentations that include new media technologies. Credits: 3.00

COM 25200 - Writing For Mass Media

Credit Hours: 3.00. Labor intensive course teaches basics of newspaper writing, broadcast writing, news releases, and online journalism.

Credits: 3.00

COM 25300 - Introduction To Public Relations

Credit Hours: 3.00. An analysis of public relations theory and practice from their origins to the present. From a communication perspective, the course examines public relations environments, audiences, and message strategies.

Credits: 3.00

COM 25600 - Introduction To Advertising

Credit Hours: 3.00. An analysis of commercial persuasion from colonial times to the era of mass communication. The course examines the structure of advertising messages, how they are adapted to specific audiences, and the social settings in which they occur.

Credits: 3.00

COM 25700 - Public Relations Techniques

Credit Hours: 3.00. This class introduces students to a range of public relations techniques, with a focus on writing. From press releases to new media, this class offers practice and feedback on how to use common public relations tools.

Learning Outcomes: 1. Match appropriate PR techniques to a given situation. 2. Write a press release correct in form, content, grammar and spelling. 3. Compose a SWOT analysis for an actual organization. 4. Use at least two new media technologies to create PR messages. Credits: 3.00

COM 26099 - Professional Practice Parallel Co-Op Summer I

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are

undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 26100 - Introduction To Digital Video Production

Credit Hours: 3.00. Basic production principles and practices. Emphasis on preplanning and conceptualizing skills in addition to practical production techniques. Required for admission to all television production courses. Permission of department required.

Credits: 3.00

COM 27100 - Podcasting

Credit Hours: 3.00. This directed study is designed as an introduction to podcasting. Students in the course will learn about the structure and development of podcasting campaigns, then create their own weekly recording. Recording begins in the third week of classes, giving students 14 opportunities to develop their program.

Learning Outcomes: 1. Develop an idea for a podcast. 2. Write a treatment for a podcast. 3. Pitch the idea for a podcast to an audience. 4. Create a production outline. 5. Produce a budget for the work produced and identify potential funding sources for the project. 6. Execute an advertising campaign for a podcast. 7. Coordinate a schedule for a podcast recording. 8. Evaluate the finished production and the experience of creating that work. Credits: 3.00

COM 28500 - Introduction To Publication Design

Credit Hours: 3.00. Introduction to pre-press production of professional-quality publications. Emphasis on computer applications for publication layout, design and production. Topics include composition, readability, typography, graphic resolution, and color management systems.

Learning Outcomes: 1. Demonstrate knowledge of graphic composition and layout principles when designing publications. 2. Use industry-standard computer software accomplish basic and advanced pre- press publication design and production tasks. 3. Solve common design and production problems encountered in the communication workplace, including those related to readability, resolution, color and composition. 4. Use appropriate professional terminology when communicating with editors, designers, printers and other vendors on particular projects. 5. Seek bids that result in reliable cost estimates from printers and other vendors. 6. Consider ethical implications and professional communication responsibilities when making editorial and design decisions. Credits: 3.00

COM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry

principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 30300 - Intercultural Communication

Credit Hours: 3.00. Study of the complex relationship between culture and communication in a variety of interpersonal, group, organizational, and computer-mediated settings. Application of theory and research to development of the knowledge, attitudes, and skills associated with intercultural communication competence.

Credits: 3.00

COM 30301 - Mentored Intercultural Communication Experience

Credit Hours: 1.00 to 3.00. This class is intended as a companion to a study abroad or international internship experience. Through a series of guided assignments that integrate experiential activities embedded in the host community with reflective writing that solicits feedback from both peers and an intercultural mentor, students will be challenged to develop intercultural competencies while living in a different culture.

Learning Outcomes: 1. Demonstrate awareness of their own cultural rules and biases by explicitly articulating in reflections and discussions how their experiences have shaped their attitudes and behaviors. 2. Exhibit understanding of cultural differences in verbal and nonverbal communication by successfully completing tasks with team members from other cultural and linguistic backgrounds. 3. Interpret experiences from more than one perspective by seeking out answers to questions about another culture, suspending judgement about another system of values and norms for behavior, and expressing empathy for another point of view. 4. Present effective arguments about their development of intercultural competencies during their study abroad by setting and assessing the achievement of intercultural learning goals and constructing a narrative that illustrates their new skills to prospective employers. Credits: 1.00 to 3.00

COM 30390 - Intercultural Dialogue Facilitator Training

Credit Hours: 1.00. This theoretical and practical training introduces students to intercultural peer dialogue methodology and effective facilitation techniques. Students will engage in scaffolded dialogue experiences first as participants and then as co-leaders, building skills through reflection and guidance from a mentor. Permission from the Instructor is required.

Learning Outcomes: 1. Articulate theories and models of effective intercultural dialogue. 2. Engage in dialogue to experience models of facilitation. 3. Identify developmental needs as an intercultural dialogue leader. 4. Practice co-leading dialogue with a mentor. 5. Reflect on facilitation experiences. Credits: 1.00

COM 30399 - Intercultural Dialogue Facilitation Practicum

Credit Hours: 1.00. In an internship model, students apply the training they received in the Intercultural Dialogue Facilitator Training course. The aim of this course is to provide students with opportunities to hone their leadership and communication skills by facilitating peer dialogues. Each student taking this course is paired with a mentor who provides feedback to students and guides their goal-setting and reflection. The course may be repeated with other dialogue topics and/or participants for additional credit.

Learning Outcomes: 1. Apply theories and models of effective intercultural dialogue in facilitation in order to support student groups and serve the larger campus community. 2.

Demonstrate communication skills (listening and observing, summarizing and distilling information, verbal and nonverbal expression) in leading intercultural dialogue. 3. Respond to contextual factors in dialogues to meet the needs of participants. 4. Engage in continuous learning by reflecting on facilitation experiences. 5. Identify areas for continued growth as a dialogue leader, and setting and accomplishing individualized goals for facilitation skill development. Credits: 1.00

COM 30400 - Quantitative Methods For Communication Research

Credit Hours: 3.00. Introduction to the development and application of quantitative research methods pertinent to communication problems. Fundamental concepts of problem identification, reliability and validity of both measurement and research design, and statistical analyses of data.

Credits: 3.00

COM 31100 - Copy Editing

Credit Hours: 3.00. Study of, and practice in, copyreading and headline writing. Laboratory practice includes copy editing on video-display terminals.

Credits: 3.00

COM 31200 - Rhetoric In The Western World

Credit Hours: 3.00. An explanation of major theoretical and philosophical concepts concerning rhetoric; the relationships between rhetoric and political, social, and personal decisions are explored. Ancient and modern authors will be read.

Credits: 3.00

COM 31400 - Advanced Presentational Speaking

Credit Hours: 3.00. Development of a marked degree of skill in the composition and delivery of various types of speeches including presentations in corporate board rooms, orientation meetings, banquet halls, public forms. Special emphasis on speeches related to the student's major vocational area.

Credits: 3.00

COM 31500 - Speech Communication Of Technical Information

Credit Hours: 3.00. The organization and presentation of information of a practical technical nature. Emphasis is placed upon the study, preparation, and use of audiovisual materials in such presentations.

Credits: 3.00

COM 31800 - Principles Of Persuasion

Credit Hours: 3.00. Persuasion and its effects, ranging from individual influences to societal impacts. Various perspectives and models of persuasion are examined, including classical and modern approaches. Both theoretical and pragmatic considerations are introduced.

Learning Outcomes: 1. List the major areas of study in the field of persuasion. 2. Analyze and critique persuasive techniques. 3. Apply theories of persuasion to explain everyday circumstances. Credits: 3.00

COM 32000 - Small Group Communication

Credit Hours: 3.00. A study of group thinking and problem-solving methods; participation in, and evaluation of, committee, and informal discussion groups. Focus on the roles, networks, and messages employed by small group communicators.

Credits: 3.00

COM 32400 - Introduction To Organizational Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communication behavior in organizational settings. Units cover message processing, leadership communication, communication climates, communication training, and communication audits. Students participate in an organizational simulation in some sections.

Learning Outcomes: 1. Use the vocabulary of concepts and theories related to organizational communication. 2. List historical, current, and future communication issues facing organizations. 3. Apply theoretical perspectives and concepts to organizational communication situations and settings. 4. Reflect on their own experience with organizations. Credits: 3.00

COM 32500 - Interviewing: Principles And Practice

Credit Hours: 3.00. Theory and practice of methods in selected interview settings: informational, employment, and persuasive. Emphasis on communication between two persons, questioning

techniques, and the logical and psychological bases of interpersonal persuasion.

Credits: 3.00

COM 32800 - Diversity At Work: A Rhetorical Approach

Credit Hours: 3.00. Introduces students to theories and experiences related to issues dealing with both diversity in the workplace and diversity at work to change or influence the world.

Credits: 3.00

COM 33000 - Theories Of Mass Communication

Credit Hours: 3.00. An examination of mass communication theories and theorists. Readings and discussion of McLuhan, Lippman, De Fleur, Lazarsfeld, Schramm, Stephenson, and other significant contributors.

Credits: 3.00

COM 33200 - Television Production

Credit Hours: 3.00. Basic principles of producing, writing, and directing for television. Treats program types and television criticism, and explores creative treatment of visual, artistic, and nonverbal elements of communication in television. Permission of department required.

Learning Outcomes: 1. Utilize the terminology used in studio production settings. 2. Conceptualize a studio production. 3. Script a studio production using correct industry format. 4. Develop critical viewing/listening skills and analytical abilities necessary to evaluate the content of video productions. 5. Demonstrate the proper operation of studio production equipment. 6. Work constructively as a member of a production team. 7. Produce a television studio program. 8. Direct a television studio program from a prewritten script. Credits: 3.00

COM 33600 - Advertising Media Strategy

Credit Hours: 3.00. Theory and practice of advertising as applied to advertising media strategy. Students build on a foundation of integrated marketing communication to develop digital advertising campaigns.

Learning Outcomes: 1. Explain how practitioners develop advertising campaigns. 2. Design and execute digital marketing plans. 3. Offer suggestions and feedback to classmates in a constructive manner. Credits: 3.00

COM 33701 - Producing Digital Advertising

Credit Hours: 3.00. This course is designed as an advanced level production course. Through lectures, discussions, critiques, screenings, and various exercises, you will gain experience designing video advertisements. You will develop and refine critical viewing/listening abilities to effectively analyze video content for aesthetic elements and overall message. Additionally, you will apply production techniques pertaining to producing, directing, shooting and editing in the creation of projects for real clients. The coursework consists of three major video projects, and a series of assignments organized under the corporate role that would be performing those tasks.

Learning Outcomes: 1. Work with a client in the development of a digital media advertisement. 2. Develop the concept for a digital media advertisement. 3. Pitch the idea for a digital media advertisement. 4. Write the script for a digital media advertisement. 5. Coordinate the production schedule for a digital media advertisement project. 6. Supervise videography for a digital media advertisement. 7. Complete post-production for a digital media advertisement. 8. Critique the final edit of a digital media advertisement. Credits: 3.00

COM 35100 - Mass Communication Ethics

Credit Hours: 3.00. A survey of various ethical approaches applied to situations confronting contemporary mass communicators, including misrepresentation in newsgathering, protection of sources, suppression of information, reporting of terror and violence, pressure from management and advertisers, and reporter bias.

Credits: 3.00

COM 35200 - Mass Communication Law

Credit Hours: 3.00. Study of Anglo-American traditions and trends as well as current American conditions of the laws of libel, privacy, fair comment and criticism, privilege, property rights, and copyright as such factors affect the print journalist and the broadcaster. Emphasis is on existing state and federal regulations and precedents.

Credits: 3.00

COM 35300 - Problems In Public Relations

Credit Hours: 3.00. Approaches to problems in public relations as they occur in industry, government, education, social agencies, and other institutions.

Learning Outcomes: 1. Develop an attitude of professionalism and tact. 2. Expand existing knowledge about theories in the practice of public relations. 3. Gain a greater understanding of the use of the tools of public relations practice. 4. Recognize types of public relations challenges and how to address them. 5. Work effectively and efficiently as a strong team member. 6. Write and edit well, and know how to improve at both. 7. Feel an increase in self-confidence and professionalism that will help with career advancement. Credits: 3.00

COM 35600 - Problems In Advertising

Credit Hours: 3.00. Approaches to problems in advertising as they involve the planning, creation, and evaluation of commercial messages.

Credits: 3.00

COM 36000 - Forensics Practicum

Credit Hours: 1.00. Forensics is the study and practice of evidence-based argumentation. This course cultivates skills associated with researching and constructing arguments - and then applies these skills to contemporary societal, national, and global issues with an eye turned toward generating practicable solutions. Students will be required to move beyond passively consuming information to critically appraising information related to broadly general as well as highly specific and technical topics. The course also emphasizes the development of advanced argumentation and communication skills, as well as the application and adaptation of these skills to diverse audiences. Permission of instructor required.

Learning Outcomes: 1. Explain technical aspects of argumentation and public speaking. 2. Locate, interpret, and explain arguments from texts in different disciplines. 3. Formulate original arguments and objections. 4. Speak in a public setting following best practices. Credits: 1.00

COM 36001 - Mock Trial Practicum

Credit Hours: 1.00. This course prepares students to represent Purdue University in American Mock Trial Association competitions by focusing on legal reasoning, argumentation, and advocacy. Mock Trial students will become familiar with the United States' legal system and conduct a trial over a fictional civil or criminal case. Students develop and deliver opening statements, introduce and examine testimonial, physical, and demonstrative evidence, examine and cross examine witnesses, and develop and deliver closing statements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the underlying theory and content of specific laws through class discussions and exercises. 2. Locate, interpret, and explain information contained within the American Mock Trial Association's (AMTA's) annual case by reading assigned texts and participating in class discussion and exercises. 3. Formulate original arguments, objections, and replies within a legal setting by participating in class discussion and exercises, and through written assignments. 4. Deliver oral arguments, objections, and replies in accord with courtroom procedures by participating in mock trial exercises inside and outside of class. Credits: 1.00

COM 36099 - Professional Practice Parallel Co-Op Summer II

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the

employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 36100 - Multiplatform Journalism

Credit Hours: 3.00. This course is an introduction to video journalism, including critical examination of various styles of video journalism from news websites to local TV news to national/international television news programs. Students will produce video stories using video cameras and audio equipment to record interviews and natural sound, learn professional lighting techniques, find stories, interview for video, write scripts, review video journalism ethics, and related content.

Learning Outcomes: 1. Demonstrate a working knowledge of camera/audio recording and editing for video journalism stories. 2. Define and describe basic television/digital terms and concepts. 3. Gather, write and produce news content for television and digital platforms. 4. Demonstrate a working knowledge of journalism ethics and news-media literacy. Credits: 3.00

COM 36199 - Professional Practice Parallel Co-Op Semester I

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 36200 - Broadcast Performance

Credit Hours: 3.00. This course will immerse students in both the foundational concepts of broadcasting and nuanced performance techniques necessary to take the craft to the next level as on-camera/on-air presenters. Through hands-on, experiential learning, students will refine existing journalistic and creative skills (such as prior reporting, video production, hosting, anchoring, or online media experience) and also develop new talents and portfolio pieces.

Learning Outcomes: 1. Produce on-camera segments that tell stories via studio, field, and social media. 2. Apply technical and creative skills necessary to produce and air basic broadcast programming by completing assigned class projects. 3. Comprehend, define, and analyze essential studio and broadcasting concepts by writing scripts to use in class practicals. Credits: 3.00

COM 36299 - Professional Practice Parallel Co-Op Semester II

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid

positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American English in African American speech communities and the U.S. culture at large.

Learning Outcomes: 1. Distinguish descriptive from prescriptive linguistics. 2. Explain how the history of the slave trade affected the development of African American English. 3. Compare and contrast features of African American English with other varieties of English and other Creole languages. 4. Describe features of African American English using tools from the linguist's toolbox (syntax, phonology, semantics, dialectology). 5. Provide examples of important legal cases concerning the education of African American children. 6. Explain how African American culture has helped shape modern American English. 7. Identify language prejudice in popular media. Credits: 3.00

COM 37200 - Communication In Relationships

Credit Hours: 3.00. An examination of communication in personal relationships (including dating and marital relationships, friendships, and families) and professional relationships (including co-worker and supervisor-supervisee relationships and relationships in specific professions, such as doctor-patient and attorney-client).

Credits: 3.00

COM 37400 - Social Interaction Skills: Assessment And Development

Credit Hours: 3.00. An examination of several major communication skills and procedures for their development. Focus is on skill measurement, methods of enhancement, assessment of training programs, and personal skill development. Skills examined include those for conversing, managing conflict, providing support, and influencing.

Credits: 3.00

COM 37600 - Communication And Gender

Credit Hours: 3.00. Course is based on the assumption that studies of gender and communication are intertwined. Focus is on communication processes that create symbols of gender and how those processes recreate the meanings of gender in the lives of individuals and groups.

Credits: 3.00

COM 37800 - Introduction To Health Communication

Credit Hours: 3.00. This course will serve as an introduction to the many ways that communication shapes health and health practices. Course content includes: 1) current healthcare structure in the United States; 2) communication in the healthcare organization; 3) provider-patient communication; 4) patient-support provider communication; 5) models of health behavior change and campaigns; and 6) crisis communication and health.

Learning Outcomes: 1. Identify and apply theories relevant to health communication. 2. Identify how communication practices shape and affect health. 3. Provide a comparative analysis of issues of diversity in healthcare. 4. Tailor health communication materials to improve health literacy. 5. Design and implement health campaign. Credits: 3.00

COM 38100 - Gender And Feminist Studies In Communication

Credit Hours: 3.00. This course examines the ways in which

communication constructs and maintains our conceptions of gender. It explores different approaches to the study of gender and feminist issues in public, organizational, and mass communication.

Credits: 3.00

COM 38399 - Professional Practice Cooperative Education III

Credit Hours: 0.00. Co-Op is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. The program is coordinated by the Office of Professional Practice with cooperation of participating employers. Students submit a written summary report of their experience and evaluations of the company and their performance. Permission of instructor required.

Credits: 0.00

COM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in communication. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

COM 40700 - Social Media And News Organizations

Credit Hours: 3.00. An exploration of how traditional news providers use social media to disseminate information to mass audiences and correct practices using such technologies.

Learning Outcomes: 1. Produce professional journalistic stories using alternate formats. 2. Choose appropriate social media to adapt to different audiences for optimal news dissemination. 3. Create social media content by applying basic mobile audio and video editing skills. Credits: 3.00

COM 40800 - News Magazine Production

Credit Hours: 3.00. Students plan, write and produce a weekly video news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts.

4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 40900 - Video Journalism

Credit Hours: 3.00. Students plan, write and produce a weekly news magazine to be aired on Boiler TV.

Learning Outcomes: 1. Discover, conceptualize, shoot and edit stories appropriate for a news magazine. 2. Define and describe basic television terms and concepts and apply them in a production environment. 3. Evaluate the content, production elements and overall effectiveness of television news scripts. 4. Operate basic digital electronic newsgathering equipment provided for this course. 5. Write scripts, shoot and edit non-linear basic television news stories on digital equipment using Final Cut Pro. 6. Demonstrate a working knowledge of television production terms and procedures. 7. Submit usable video and sound bites to professional newscasts. 8. Create a professional-quality resume reel necessary for gaining employment as a TV journalist. Credits: 3.00

COM 41100 - Communication And Social Networks

Credit Hours: 3.00. This course explores the growing area of networks. The class focuses on understanding how social structure influences our everyday life by examining the ways individuals, groups, and entities are tied together. Permission of instructor required.

Learning Outcomes: 1. Understand the foundation of social network theory and analysis. 2. Read work in the area of networks. 3. Learn how networks are related to the social phenomena of your own personal interest. 4. Gather basic understanding of gathering network data. Credits: 3.00

COM 41500 - Discussion Of Technical Problems

Credit Hours: 3.00. Principles of speech communication related to interpersonal and group discussions on technical topics and problems; practice in using these modes in situations typically encountered by technologists.

Credits: 3.00

COM 41600 - United States Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the U.S.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Able to create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Able to write correctly and clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

COM 41900 - Judgment And Decision Making

Credit Hours: 3.00. This course is designed to foster an understanding, critique and analysis on issues related to judgment and decision processes. Permission of instructor required.

Learning Outcomes: 1. Encourage the application of theories of judgment and decision making to applied decision contexts. 2. Explore the interplay between communication and decision-making theories. 3. Acquire some practical, general skills for decision-making that

are useful in everyday life and work contexts. Credits: 3.00

COM 42300 - Leadership, Communication And Organizations

Credit Hours: 3.00. This course explores leadership from a communication perspective. It examines topics such as leadership styles, leading change, influencing others, emotional intelligence, burnout, and engagement. Permission of instructor required.

Learning Outcomes: 1. Able to assess leadership styles. 2. Examine the relationship between leaders and followers in organizations. 3. Critique the literature in the area of communication and leadership. Credits: 3.00

COM 43500 - Communication And Emerging Technologies

Credit Hours: 3.00. Both historical and contemporary perspectives of the reciprocal influence of new and changing technologies and the processes and practices of communication. The impact of print, telegraph, telephone, radio, and television will be surveyed, along with cable systems, direct broadcast satellites, and videotext.

Credits: 3.00

COM 44400 - Introduction To Communication And Social Entrepreneurship

Credit Hours: 3.00. This class introduces students to the roles that communication and innovation play in social entrepreneurship. It explores activities of entrepreneurs, ethics and skill development at the individual and organizational levels, and communication functions in not-for-profit and social venture space.

Learning Outcomes: 1. Identify the major components of communication and social change. 2. Describe the social economy. 3. Articulate how both social entrepreneurship and social innovation benefit society. 4. Describe the difference between nonprofit organizations (NPs), social action efforts, NGOs and social enterprises, as well as traditional entrepreneurship, social entrepreneurship, social intrapreneurship and social innovation. 5. Explain how social enterprises function in different sectors and regions, of various sizes, with vastly different missions. 6. Articulate the challenges social entrepreneurs face as they startup, develop, and communicate with various publics. 7. Identify the best approaches and communication tools that can be deployed to assist in ""getting out the message"" about NP goals and objectives. Credits: 3.00

COM 44700 - The Television Documentary

Credit Hours: 3.00. Study and application of principles of documentary television formats. Students will research an appropriate topic for documentary treatment and produce that program during the semester. Documentary formats examined include news, biographical, ethnographic, and documentary drama.

Credits: 3.00

COM 44900 - Media Management

Credit Hours: 3.00. An introduction to management for mass media outlets. The course will explore management styles and techniques in a variety of media situations, including radio, television, and internet-based business models. Topics such as business structure, advertising and promotion, programming, and leadership style will be included in the discussion. This class is designed as both a philosophical and practical model. Students will discover the theories and principles behind the structure of media businesses, as well as put those ideas into practice in real world situations. Students in the course will be responsible for the programming and promotion of the Brian Lamb School of Communication's channel space on Boiler TV. A mini internship experience is introduced in the second half of the semester, giving the student an opportunity to sample what these opportunities are like.

Learning Outcomes: 1. Define the roles of a media manager. 2. Program a media outlet's weekly schedule. 3. Promote a media outlet's programming to a target audience. 4. Produce a case study of an active media outlet. 5. Identify the characteristics of an effective media manager. 6. Work constructively as a member of a management team. 7. Create a long-range plan of operation for a media outlet. 8. Present findings from a media case study. 9. Conduct a programming and promotion meeting with a team. Credits: 3.00

COM 45100 - Feature Writing

Credit Hours: 3.00. Examination of magazine staff organization, market analysis, and editorial content. Study of, and practice in, the writing of a variety of nonfiction materials for magazines. Emphasis is on the adaptation of topics and presentations to editorial policies and reader groups.

Learning Outcomes: 1. Understand the stylistic, formatting and structural differences between a typical media article and a feature. 2. Research and produce long-form feature articles for newspapers/magazines, newsletters and other communication platforms. 3. Manage interviews for long-form features - what to seek from the interviewee and what to look for beyond. 4. Write different kinds of features: Informational, instructional and promotional. Credits: 3.00

COM 45600 - Advertising Writing

Credit Hours: 3.00. The theory and practice of copy writing in various advertising contexts.

Credits: 3.00

COM 46099 - Professional Practice Parallel Co-Op Summer III

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 46399 - Professional Practice Parallel Co-Op Semester III

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 46400 - American Political Communication

Credit Hours: 3.00. This course examines the content, processes, and effects of communication within the American political system. Designed for students to experience the breadth of the field of political communication, the course emphasizes relevant theories and practical skills.

Learning Outcomes: 1. Acquire an awareness and understanding of how and why institutions and agents in American politics communicate as well as use media. 2. Apply theoretical approaches to media effects, journalism,

political campaigns, and critical issues of race and gender to practical political communication situations. Credits: 3.00

COM 46499 - Professional Practice Parallel Co-Op Semester IV

Credit Hours: 0.00. Cooperative Education (Co-Op) is an academic program with oversight provided by assigned Faculty Coordinators who serve as the Instructor for participating students. Parallel Co-Op program participants are undergraduate students, who work part-time (more than 11 hours per week and less than 30 hours per week) in paid positions during the academic year terms (fall and spring semesters) for an employer with a local business or office. During the summer term, Parallel Co-Op students work in part-time or full-time positions at any location offered by the employer. A minimum of a one-year commitment is required for Parallel Co-Op students and employers. During the academic year, Parallel Co-Op students register for 6 to 11 credit hours of academic course load, and also for an appropriate 0-credit hour Parallel Co-Op course that carries half-time student status to recognize the academic impact of the experience. The combination of both academic courses and Parallel Co-Op course registrations provides students with full-time status. During the summer term, Parallel Co-Op students register for a zero-credit hour Parallel Co-Op Summer course that carries full-time student status. Permission of Instructor required.

Learning Outcomes: 1. After each work session, the instructor assesses learning outcomes via student evaluation of the work session, supervisor evaluation of the student's performance, and a work report written by the student summarizing their experience. Credits: 0.00

COM 47800 - Health Communication Campaigns

Credit Hours: 3.00. This course is an introduction to the processes and theories that are used to design both informational and persuasive health communication campaigns. The course will also introduce students to proper evaluation procedures to determine a campaign's efficacy. Students will be able to contribute to their portfolios by applying theory and primary research in the construction of a health communication campaign plan for a client.

Learning Outcomes: 1. Identify and perform the various stages of implementing a health communication campaign through course readings, discussions, and the creation of their final projects. 2. Apply formative research techniques and analyze relevant data in the creation of their final projects. 3. Identify the major theories and their essential components used in building health communication campaigns, and apply their components in course assignments. 4. Assess prior and current campaign efforts to understand their effectiveness and also recognize their limitations. Credits: 3.00

COM 47900 - Introduction To Risk Communication

Credit Hours: 3.00. This course introduces students to theories that show how people express, perceive, exchange, and deliberate information about risk as well as how this understanding can be used to improve risk communication practice. This course examines risk communication theory and practice from multiple perspectives including social, psychological, cultural, and communicative.

Learning Outcomes: 1. Describe how and why major approaches to risk communication have shifted over time. 2. Explain cognitive and affective processes involved in individuals' risk perception in domains of science, health, and environmental issues. 3. Analyze different communication models and theories applicable to risk communication. 4. Discuss alternative interpersonal communicative public participation practices for deliberating risk information. Credits: 3.00

COM 48900 - Research Experience In Communication

Credit Hours: 1.00 to 3.00. This course grants credit to students who participate in structured research projects within the Brian Lamb School of Communication. Permission of instructor required.

Learning Outcomes: 1. Students will gain understanding of how communication research is conducted. 2. Students will receive hands-on experience in areas such as data collection, data analysis, interpretive skills, or research writing. 3. Students considering graduate

studies will gain insight into whether or not they want to pursue such a direction. 4. Students will develop relationships with faculty members that might lead to mentoring, advice, and/or letters of recommendation. 5. Students will gain experience that might enhance their prospects for graduate studies. Credits: 1.00 to 3.00

COM 49000 - Internship In Communication

Credit Hours: 1.00 to 6.00. Experiential, supervised training in public relations, journalism, telecommunication, oral interpretation, speech education, organizational communication, or public communication. Usually given in junior or senior year. Usually gives two credits per internship experience. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to apply concepts learned in the classroom to real-world working environments and to develop a realistic view of the workplace through internships. Credits: 1.00 to 6.00

COM 49100 - Special Topics In Communication

Credit Hours: 1.00 to 3.00. Intensive study of selected topics, varying from semester to semester, from the literature or practice of communication. Course content will be drawn from areas not dealt with in the regular curriculum and may include such topics as photojournalism, economic reporting, and campaign communication. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of a specialized area of communication and its common applications. Credits: 1.00 to 3.00

COM 49101 - Boiler Communication

Credit Hours: 1.00. This course provides a practical, hands-on approach to public relations by working in student-led teams to produce comprehensive, strategic communication campaigns for actual clients. The course also includes many opportunities for professional development and portfolio building.

Learning Outcomes: 1. Experience a real public relations campaign. 2. Develop professionally to be able to start a public relations career. 3. Use creativity and critical thinking to help clients with public relations needs while engaging in social responsibility. Credits: 1.00

COM 49500 - Special Topics In Public Relations And Rhetorical Advocacy

Credit Hours: 3.00. In-depth study of a particular area of public relations and rhetorical advocacy. Students read, discuss, and write about contemporary applications of public relations, advertising and rhetoric. Possible offerings include Integrated Marketing Communication, Persuasion and Social Protest, Communication Campaigns.

Credits: 3.00

COM 49501 - Sports Media Relations

Credit Hours: 3.00. This course examines the role of public relations and mass media in sports communication. It provides an understanding of the operation of sports media and communication and how sports information departments perform their functions. Emphasis is on written communication from athletics communication perspective.

Learning Outcomes: 1. Develop a clear understanding of the day to day responsibilities of sports public relations professionals. 2. Develop attention-grabbing writing skills that reflect an understanding of news judgment. 3. Learn about press box and game-management operations at a sports event, including news conference set-up and execution, coordination of interview requests, quote-gathering, and information and statistics updates and distribution. 4. Create promotional, multimedia content at a sports event, including written features, press releases, social media, video and infographics. 5. Explore communication strategies used by sports media relations professionals in breaking-news situations. 6. Study the evolution of the relationship between media and sports organizations. 7. Learn about the scope of responsibilities of sports media relations professionals, including the coordination of managed news events and special events, the production of media guides, the execution of publicity campaigns, and crisis communications. 8. Understand the effects of evolving technology and social media on sports media relations. Credits: 3.00

COM 49502 - Travel Writing

Credit Hours: 3.00. Travel writing is writing about places, persons, and things in other places-also writing about how to travel, when to travel, and advice on traveling-all with the reader in mind. It's about relaying your travel experiences to others so that they may emulate them or at the very least not make the same mistakes you did. And it's writing about things in your own back yard that are exotic to everyone else-a local farmer's market, historic site, restaurant, museum. In this class, you will explore the various ways travel writers can excite and assist readers.

Learning Outcomes: 1. Gain experience in writing effectively. 2. Identify typical features of travel writing genres. 3. Use research and observation as building blocks for travel writing. 4. Produce a variety of articles within this genre. 5. Understand the "business" of travel writing. Credits: 3.00

COM 49503 - Public Relations For Social Change

Credit Hours: 3.00. The overarching goal of this course is for students to work cooperatively with a community partner to identify, define and address that organization's PR problems and opportunities from a long-term, in-house perspective, building on the work of previous students and incorporating social change theory from a relationship management perspective of PR. The applied work of this course will have the dual benefit of providing students the opportunity to gain contextualized, real-world experience at PR problem-solving and advancing the mission of a nonprofit organization that is important to the wellbeing of the Greater Lafayette community as a whole.

Learning Outcomes: 1. Construct and devise a strategic and mission-focused PR plan and critically evaluate its effects. 2. Explain and demonstrate how storytelling and community relations PR strategies can be used as tools for social change. 3. Describe how their own PR skillsets can be means for future civic engagement. 4. Develop an increased sense of efficacy when it comes to matters of civic engagement and PR practice. 5. Develop a broader view of how PR as a discipline can be applied within a community. Credits: 3.00

COM 49504 - Social Media For Social Good

Credit Hours: 3.00. Nonprofit organizations advance their missions through communication. This course is designed to introduce students to the use of social media by nonprofit organizations to create their brand and reach stakeholders. It will focus on best practices and critically assess local nonprofits return on social media investment.

Learning Outcomes: 1. Discuss the importance of social media to nonprofits for communicating, marketing, public relations, and fundraising. 2. Discuss the measurement of social media effectiveness in communicating messages and in fundraising. 3. Conduct a social media audit. 4. Develop a nonprofit social media strategy. Credits: 3.00

COM 49505 - Sports Communication

Credit Hours: 3.00. This class will help students learn to think critically about sports communication, but it will also help students learn to do sports communication. Through the use of sports books and movies, guest speakers, field trips, and case studies, students will learn not only about sports communication as a field of study and a profession, but also how they can be more thoughtful consumers of sports communication in its various forms.

Learning Outcomes: 1. Describe multiple ways that sports communication constructs and maintains culture. 2. Explain changes in sports communication related to race and gender. 3. List five key events in the last 100 years of sports communication. 4. List and analyze issues related to naming in sports. 5. Create a basic sports crisis communication plan. 6. Frame labor-management sports communication issues from both perspectives. Credits: 3.00

COM 49507 - Executive Communication

Credit Hours: 3.00. This course defines executive communication, offers a rationale for its importance, provides a catalog of deliverables (or tactics) involved in the practice, teaches students how to create those deliverables, and provides students with the tools to serve as strategic advisors to senior leaders. The ultimate goal of the course is to help students become more well-rounded and successful communication

professionals.

Learning Outcomes: 1. Describe the breadth, depth and nuance of executive communication. 2. Create various internal and external executive communication deliverables. 3. Conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis of an executive's communication. 4. Define and execute the role of serving as a strategic communication advisor to an executive. 5. Learn from and connect with established communication professionals.

Credits: 3.00

COM 49600 - Special Topics In Corporate Communication

Credit Hours: 3.00. This course offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments on current issue in corporate communication. Topics may include diversity in the workplace, organizational assessments, or spirituality in organizations. Permission of instructor required.

Credits: 3.00

COM 49700 - Special Topics In Mass Communication

Credit Hours: 3.00. Offers students the opportunity to explore in-depth, thorough readings, lectures and written assignments, a current topic or trend in Media, Technology and Society. Possible offerings include Media and Social Change, Online Communities, and Technology and International Communication.

Credits: 3.00

COM 49701 - Live Sports Broadcasting Summer

Credit Hours: 1.00. In this experiential Live Sports Broadcasting course in partnership with the Lafayette Aviators, students will have the opportunity to work in the studio at Loeb Stadium in Lafayette, operate cameras on the field, produce promotional material to be used before, during, and after games, and interview players for segments on The Purdue Channel. The class spans the home season of the Aviators. Students are expected to register for all 3 1-credit modules in a summer. Permission of instructor required.

Learning Outcomes: 1. Demonstrate live sports broadcasting techniques including: studio operation, camera operation, play-by-play and commentary. 2. Interview athletes and staff for broadcast. 3. Develop promotional videos for The Purdue Channel and/or the Aviators.

Credits: 1.00

COM 49702 - Video Games And Society

Credit Hours: 3.00. This course focuses on video games as a form of mass communication. Primarily, this focus entails understanding how video games communicate to mass audiences, using features distinctive to video games, and how that communication might impact game players (i.e., media psychology). There is a secondary focus on how game players communicate with each other. The course will primarily examine these issues from social scientific perspectives. Topics include the influence of society on game creation, the impact of games on players, gaming cultures, and game industries.

Learning Outcomes: 1. Identify and apply key communication concepts and theories that inform video game creation and consumption. 2. Compare video game features and creation processes. 3. Evaluate positive and negative effects of video games. 4. Describe the video game industry and surrounding culture. Credits: 3.00

Department of English

About the English Program

In April 2019 *College Magazine* ranked Purdue's English Department #1 school in the U.S for English majors. We offer students skills in critical thinking and creative problem-solving; the ability to conduct research; facility with language and written and oral communication; respect for diversity; and the capacity to explain complexities as succinctly as possible. You can choose from five B.A. programs: English (focused on literature), English Education, Creative Writing, English in a Global Context and Professional Writing.

Purdue has several student organizations for English students which include the Student Association, Haraka Writers, and the Professional Writers Club.

The Purdue Online Writing Lab (OWL) offers a vast library of resources ranging from style guides to instructional material to assist Purdue students. OWL also is an international resource, with a Web site that receives nearly 100 million hits a year from more than 125 different countries.

Faculty

English Department Directory

Contact Information

Mailing Address
Department of English
Purdue University
500 Oval Drive
West Lafayette, IN 47907-2038
Phone: (765) 494-3740
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Please visit the Department of English for more information.

Graduate Information

For Graduate Information please see English Graduate Program Information .

Creative Writing Minor

English Minor

Creative Writing, BA

Professional Writing, BA

Professional Writing Minor

English: Global Context Concentration, BA

English: English Literature Concentration, BA

ENGL 10400 - English Composition I

Credit Hours: 3.00. Emphasis on the organization of the expository theme. Directed writings of themes based on personal experience, on the relationship between experience and language, and on the relationship between experience and ideas.

Credits: 3.00

ENGL 10500 - English Composition II

Credit Hours: 3.00. The second half of the basic composition sequence. Extensive practice in writing clear and effective prose. Instruction in logic, structure, and style.

Credits: 3.00

ENGL 10600 - First Year Composition With Conferences (UCC: IL/WC)

Credit Hours: 4.00. This 4-credit hour composition course includes student-teacher conferences. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 4.00

ENGL 10800 - First Year Composition (UCC: IL/WC)

Credit Hours: 3.00. In this 3-credit hour composition course students should expect an emphasis on self-guided work. Students in this course produce between 7,500-11,500 words of polished writing (or 15,000-22,000 total words, including drafts

or the equivalent). Within the course, students will learn to write with a rhetorical awareness of diverse audiences, situations, and contexts; critically think about writing and rhetoric through reading, analysis, and reflection; provide constructive feedback and incorporate feedback into their own writing; perform research and evaluate sources to support claims; and engage multiple digital technologies for different purposes.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate rhetorical awareness of diverse audiences, situations, and contexts. 2. Compose a variety of texts in a range of forms, equaling at least 7,500-11,500 words of polished writing (or 15,000-22,000 words, including drafts). 3. Critically think about writing and rhetoric through reading, analysis, and reflection. 4. Provide constructive feedback to others and incorporate feedback into their writing. 5. Perform research and evaluate sources to support claims. 6. Engage multiple digital technologies to compose for different purposes. Credits: 3.00

ENGL 19500 - Introducing English

Credit Hours: 1.00. This introductory seminar familiarizes students with the different majors in English as well as potential career opportunities, introduces them to departmental and College of Liberal Arts resources, and promotes community through participation in English Department activities. These include visits to the Writing Lab (English) and the Career Center (CLA); common read book discussions; & more.

Learning Outcomes: 1. Define the different majors and concentrations within English. 2. Identify important resources in the English Department and College of Liberal Arts. 3. Articulate key concepts related to the Department's annual common read. 4. Produce well-reasoned written essays about assigned the reading and activities. Credits: 1.00

ENGL 20102 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods through critical inquiry. 4. Create a process for developing and completing a digital project. Credits: 3.00

ENGL 20200 - Engaging English (UCC: HUM)

Credit Hours: 3.00. This theme-based course introduces students to the field of English, and provides foundational liberal arts skills. It teaches, for instance, critical and creative thinking, reading, and writing using a variety of genres, texts, and media.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of English Studies. 2. Apply multiple critical approaches to define cultural complexities. 3. Apply knowledge of written and visual literacies for working with diverse media. 4. Explain and apply different methods of reading. 5. Explain and apply foundational skills of English Studies, such as close reading, written persuasion and argument through evidence. Credits: 3.00

ENGL 20300 - Introduction To Research For Professional Writers

Credit Hours: 3.00. Introduction to research sources and methods useful for professional writers, including electronic resources. Focus on collecting print and online information, interviewing, surveying, and conducting observations; and on evaluating, summarizing, analyzing, and reporting research.

Credits: 3.00

ENGL 20400 - Special Topics In Writing

Credit Hours: 3.00. A course in writing, with the special topic selected by the instructor.

Credits: 3.00

ENGL 20500 - Introduction To Creative Writing

Credit Hours: 3.00. Practice in writing short prose narratives and poetry for students who have finished composition and wish to develop their skills further. Workshop criticism. CTL:IEL 1230 Introduction To Creative Writing

Learning Outcomes: 1. Compose original poetry. 2. Compose original fiction. 3. Analyze and critique peer work by using the vocabulary of craft.. Credits: 3.00

ENGL 20700 - Introduction To Rhetoric & Argument

Credit Hours: 3.00. Introduces the art, science, and practical applications of rhetoric through ancient, contemporary, and transcultural concepts. Helps students gain a grounded understanding of rhetoric and its application in everyday life and professional contexts. This course will feature the application of persuasion in diverse fields and for diverse purposes. Students will learn to apply rhetorical principles to written, visual, and multimodal forms.

Learning Outcomes: 1. Articulate a comprehensive understanding of the evolution of rhetoric, from ancient to contemporary theorists. 2. Summarize the role of proofs in human communication and evaluate how rhetorical strategies can be used in persuasive messaging. 3. Develop and apply skills in identifying, analyzing, and employing rhetorical frameworks to enhance persuasive communication strategies. 4. Select rhetorical strategies appropriate for written, visual, and multimodal forms. Credits: 3.00

ENGL 21500 - Inventing Languages

Credit Hours: 3.00. "Invented languages" include linguistic systems created for fictional worlds, such as Dothraki (Game of Thrones), Na'vi (Avatar), Elvish (Lord of the Rings) and Klingon (Star Trek), as well as languages invented for international communication by real speakers, such as Esperanto. In this course, you will study these systems, learn the major properties of natural human languages, and construct your own rudimentary languages.

Learning Outcomes: 1. Understand the characteristics and goals of various invented languages from linguistic, cultural, and historical perspectives. 2. Show mastery of basic concepts of language structure and language typology. 3. Elucidate mastery of basic concepts of sociolinguistics, historical linguistics, and linguistic anthropology. 4. Explain how natural languages has influenced the development of invented languages. 5. Construct a rudimentary language system and create a back story, dictionary, grammar, and sample text. Credits: 3.00

ENGL 21700 - Figures Of Myth And Legend I: Monsters (UCC: HUM)

Credit Hours: 3.00. This course traces specific monster case studies across a variety of genres and media from the ancient to the modern period. It explores the way monsters define and police the boundaries of what it means to be human, and provide a common language for crystallizing specific social, ethnic, and national practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Explain the relationship between monsters and nationalism/national identity. 2. Explain disability theory and the cultural coding of unusual bodies. 3. Produce written, verbal, and visual communication that demonstrates critical thinking, creative problem solving, empathy, and visual literacy. 4. Apply historical and global awareness. Credits: 3.00

ENGL 21800 - Figures Of Myth And Legends II: Heroes And Villains (UCC: HUM)

Credit Hours: 3.00. This class offers in-depth explorations of the larger-than-life leaders (on the side of good, and sometimes evil, too) who have become models for how we think of heroism, charisma, and what it means to seek and wield power over others. From the chivalric Knights of the Round Table to the frightening energy of the Viking comitatus bands, it will show that no models of mythic leadership come without their complications--or admirable qualities.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Compare legal and cultural ethical codes across different cultures. 2. Define models of leadership to understand different versions of heroism, villainy, manliness, and gender coding of behavior. 3. Demonstrate knowledge of how the past influences present social modes and mores. 4. Argue through textual evidence across a variety of media. Credits: 3.00

ENGL 21900 - Figures Of Myth And Legend III: Magic And Marvels (UCC: HUM)

Credit Hours: 3.00. This course surveys stories of elves, fairies, wizards, witches, etc., and explores the allure of all things marvelous, strange, and magical. It considers how language itself constitutes a kind of magic; examines magic as technology and vice versa, since, as Arthur C. Clarke famously declared: "Any sufficiently advanced technology is indistinguishable from magic"; and seeks to understand how people across history have used stories of magic to reinforce (mystify) or upend (defamiliarize) the status quo.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Compare a variety of imaginative texts from Anglophone and other cultures, and be able to analyze them critically. 2. Define how both magic and science are not fixed but rather variable and culturally specific. 3. Demonstrate knowledge of how stories code difference, and either reinforce (mystify) or upend (defamiliarize) the status quo. 4. Argue through textual evidence across a variety of media. Credits: 3.00

ENGL 22002 - Technology And Play

Credit Hours: 3.00. This course introduces students to games, as well as investigating innovations and controversies in the gaming industry. It will explore theories of play, how technological innovations and business practices in both digital and analog gaming (through board games, video games, tabletop games, and esports) mediate or structure the experience of play. It will also survey the rise of myriad gaming subcultures, including celebrity streamers and esports.

Learning Outcomes: 1. Identify important categories of games. 2. Demonstrate critical thinking skills of observation, explanation, and interpretation to assess sociological and cultural trends in the different spaces of gaming. 3. Produce original work using logic, creativity, and interpretive skills examining different games and industry practices. Credits: 3.00

ENGL 22300 - Literature And Technology (UCC: STS)

Credit Hours: 3.00. This class uses literature to explore how technological innovation both enables and constrains creativity. It also explores how technology has been represented in literature, and examines the relationship between literature and new media.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Define technology and its implications. 2. Employ multiple approaches to critical thinking well-suited to cultural complexities. 3. Demonstrate written, visual, and technological literacies while working with diverse media. 4. Demonstrate creativity through remediation (moving information from one medium to another) and iteration. 5. Explain the relationship between information and digital media production. 6. Explain and employ multiple critical approaches to narrative and storytelling. Credits: 3.00

ENGL 22400 - Literature, Money, And Markets

Credit Hours: 3.00. This course explores the interconnections among markets, business and its management, and literature. It examines representations of traditional markets (industry, finance, and global trade) as well as alternative markets (the market in bodies, the black market, and the digital marketplace economy). The course will present a wide-ranging survey of canonical texts, orienting the reader as to how classics from Chaucer to Dickens are engaged in the business of thinking about business. But it will also engage with alternative viewpoints and contemporary concerns about business practices, literature, and individual consciousness in the techno-digital age.

Learning Outcomes: 1. Define "market". 2. Apply historical knowledge to explain current business systems. 3. Explain literature's power to inform economic practices. 4. Apply traditional and visual literacy to produce market

analysis. Credits: 3.00

ENGL 22500 - Literature, Inequality, And Injustice (UCC: HUM)

Credit Hours: 3.00. This course introduces students to literature addressing inequality and social justice. Questions will include: What is social justice? How do literary works reproduce or resist dominant ideologies? How does literature provide tools to map social and economic formations? What role have literary works played in emancipatory and egalitarian political movements? Readings and comparison of these texts will help examine how literature maintains a variety of communities.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. State knowledge about diversity and inclusion (including, but not limited to, histories of race, gender, and class). 2. Produce effective written and verbal communication that demonstrates critical thinking, creative problem solving, and empathy. 3. Access and analyze information across a range of media. Credits: 3.00

ENGL 22600 - Narrative Medicine (UCC: STS)

Credit Hours: 3.00. "Narrative Medicine" encompasses stories about the interior lives of doctors and medical professionals, the complexities of medicine past and present, and health-care for patients and their families. Ultimately, this course emphasizes the essential role of rhetoric and storytelling in the face of medical crisis and uses stories about illness and disability to explore the human condition.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Explain medicine from a humanistic perspective. 2. Explain contemporary health issues. 3. Define storytelling as an intellectual and empathic discourse. 4. Analyze fictional and factual narratives (stories). Credits: 3.00

ENGL 22700 - Elements Of Linguistics (UCC: BSS)

Credit Hours: 3.00. A summary of what is known about human language, its structure, its universality, and its diversity; language in its social setting; language in relation to other aspects of human inquiry and knowledge. CTL:IEL 1260 Introduction To Linguistics

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

ENGL 22800 - Language And Social Identity

Credit Hours: 3.00. This course introduces linguistic diversity, including regional, cultural, and stylistic variation within a single language, code-switching in bilingual communities, and colonial, immigrant, Creole, indigenous, and sign languages. It also explores the role of language in supporting various types of social identity (e.g., age, gender, social class, race, ethnicity) as well as power structures that enable discrimination against less powerful groups.

Learning Outcomes: 1. Distinguish empirically-grounded facts about linguistic diversity and language use from popular attitudes and opinions that are not based in facts. 2. Recognize the legitimacy and systematic structure of all language varieties. 3. Describe the phonetic, lexical, grammatical, and pragmatic features as found in the language of different groups, through close analysis of primary linguistic data. 4. Show how individuals use linguistic features to help construct their social identities, through the close examination of case studies. 5. Recognize forms of linguistic discrimination as depicted in the popular media and as enacted in the education system, the workplace, the judicial system, and daily life. Credits: 3.00

ENGL 22900 - Creole Languages And Cultures

Credit Hours: 3.00. This course introduces the concept of pidgin and creole languages across the world, with a focus on English-based pidgins and creoles. It addresses their geographical distribution and some of their cultural manifestations such as music, food and literature on both sides of the Atlantic. The course presents a general view of the historical events that led to the formation of creole languages and to the development of the African diaspora. We will consider different varieties of creole languages and (their) cultures including English-based creoles in West Africa such as Kru (Liberia and Sierra Leone), Nigerian Pidgin and Cameroonian Pidgin; in the Caribbean such as Jamaican, San Andreas, Nicaraguan and Limonense, contrasting them with the Spanish-based creole Palenquero; and the three most predominant creoles in the U.S. Louisiana Creole, Gullah and Hawaii Creole, to understand their characteristics and their history. We will explore the ways in which the languages

manifest in the music and literature of the contexts where they are spoken. Finally, we will consider the African diaspora as a fundamental thread that ties (English-based) creole languages and peoples together. In exploring these issues, the course will draw on a variety of theoretical concepts and traditions from sociolinguistics, creole studies and African American studies.

Learning Outcomes: 1. Identify the cultural and linguistic legitimacy and importance of creole languages in the world. 2. Describe general historical events that led to the development and origin of creole languages. 3. Distinguish general cultural and grammatical features in creole languages that differ from non-creole languages. 4. Show how individuals use creole languages in literature and music. 5. Identify attitudes towards creole languages, the language's relationship to the African diaspora, and its relationship to linguistic diversity in North America. Credits: 3.00

ENGL 23000 - Great Narrative Works (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of great narratives from Homer's Odyssey to the present, considering works from a variety of cultures and time periods in order to develop an understanding of their ideas, structures, styles, and cultural values.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ENGL 23100 - Introduction To Literature

Credit Hours: 3.00. Reading and discussion of great works of various types to develop an understanding of their ideas, structures, and styles. Includes poetry, drama, biography, essay, and prose fiction. CTL:IEL 1270 Appreciation Of Literature

Credits: 3.00

ENGL 23200 - Thematic Studies In Literature

Credit Hours: 3.00. Examination of a particular theme, such as the hero, death, or the city, and the techniques by which it is treated in various literary works, usually in more than one genre. Current offerings available from counselors.

Credits: 3.00

ENGL 23400 - Literature And The Environment (UCC: STS)

Credit Hours: 3.00. Literary study of nature writing; writing from the natural sciences; and canonical poetry, fiction, and essays through an ecological lens. Introduces students to ecocritical thought and environmental literary history.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and discursive conventions of literature about the environment. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 23700 - Introduction To Poetry (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of poetry from different periods aimed at enhancing the student's understanding of genre, form, and style; how poetry grows out of and speaks to its historical moment; and how poetry addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate introductory knowledge of a range of genres, topics, and literary conventions of poetry. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 23800 - Introduction To Fiction (UCC: HUM)

Credit Hours: 3.00. Reading and discussion of fiction from different periods aimed at enhancing the student's understanding of genre, form, and style; how fiction grows out of and speaks to its historical moment; and how fiction addresses pressing social issues.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate

introductory knowledge of a range of genres, topics, and literary conventions of fiction. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 24000 - British Literature Before 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the medieval to the Romantic period.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Romantic period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Romantic literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 24100 - British Literature After 1789 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from the Romantic period on.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the Romantic period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about literature from the Romantic period to the present based on appropriate use of textual evidence. Credits: 3.00

ENGL 24900 - Great British Books

Credit Hours: 3.00. Why are British books so compelling? This course examines the dynamic history of British literature and explores how canonical and contemporary texts shaped the cultural landscape of Britain, the British Empire, and the world.

Learning Outcomes: 1. Identify and make convincing arguments about major genres of British literature, including essays, journals, autobiographies, poetry, drama, and fiction. 2. Identify the diversity of peoples, interests, and ideologies within British literature and culture, and the texts that define them. 3. Define and analyze how literary texts both reflect and produce culture. 4. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

ENGL 25000 - Great American Books (UCC: HUM)

Credit Hours: 3.00. What makes great American books so compelling? This course examines the dynamic history of American literature and explores how canonical and contemporary books have shaped the cultural landscape of the U.S. and the world.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions related to great American books. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American books based on appropriate use of textual evidence. Credits: 3.00

ENGL 25700 - Literature Of Black America

Credit Hours: 3.00. A survey of literature written by black American authors. Close attention is paid to the history of black literature and to the historical context in which it was written, as well as to the texts of major works by black writers.

Credits: 3.00

ENGL 26200 - Greek And Roman Classics In Translation

Credit Hours: 3.00. Study of important works of Greek and Roman literature, their intrinsic literary values, and their influence on later European and American writing and thinking.

Credits: 3.00

ENGL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of literary studies and the liberal arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

ENGL 26600 - World Literature: From The Beginnings To 1700 A.D. (UCC: HUM)

Credit Hours: 3.00. (CMPL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. CCN: IEL 1250 World Literature 1

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 26700 - World Literature: From 1700 A.D. To The Present (UCC: HUM)

Credit Hours: 3.00. (CMPL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature. Typically offered Summer Fall Spring. CCN: IEL 1251 World Literature 2

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

ENGL 27600 - Shakespeare On Film (UCC: HUM)

Credit Hours: 3.00. Considers the relation of the written text of five or six Shakespeare plays to multiple film versions from a wide variety of times and cultures, e.g., the United States, England, France, Italy, Japan, Denmark, India, and Russia. Typically offered Fall Spring Summer.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explore a selected set of Shakespeare's plays through a comparative analytical lens. 2. Compare and contrast various film versions of Shakespeare's plays in their respective contexts. 3. Respond to the films and written texts through reflective and critical writings and discussions. Credits: 3.00

ENGL 27900 - The American Short Story In Print And Film

Credit Hours: 3.00. Analysis of American short stories of the nineteenth and twentieth centuries, their filmed versions, their printed scenarios, and critical writings about the tales and their adaptations.

Credits: 3.00

ENGL 28000 - Games, Narrative, Culture

Credit Hours: 3.00. This is an introduction to the field of game studies, and to games as narrative and cultural media. We will look at the stories games tell; the way their narrative elements or plot devices intersect with the culture around the games and gaming itself; and how all these things come together to affect game design, meaning, and play.

Learning Outcomes: 1. Demonstrate knowledge of key concepts in both game studies and narrative theory in order to critique a game's systems and narrative elements. 2. Articulate how a game's narrative and the industry's workplace practices are situated in specific historical and cultural contexts. 3. Demonstrate critical thinking skills suited to cultural and historical complexities. 4. Articulate concise, coherent arguments about the effects of writing, narrative, and workplace practices and policies on the video game industry and a game's audience. Credits: 3.00

ENGL 28600 - The Movies (UCC: HUM)

Credit Hours: 3.00. Introduction to the movies from classic to contemporary films. Typically offered Fall Spring.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to classic and contemporary films. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about classic and contemporary films based on appropriate use of evidence. Credits: 3.00

ENGL 30100 - Ways Of Reading

Credit Hours: 3.00. Introduction to literary theory and practice. Close reading of and significant writing about selected literary texts informed by a variety of critical and/or theoretical perspectives.

Learning Outcomes: 1. Identify various theoretical approaches to literature, and then apply them to literary texts. 2. Define important literary terms, genres, and conventions within their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned arguments about literary texts based on appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

ENGL 30400 - Advanced Composition (UCC: IL/WC)

Credit Hours: 3.00. Designed for students who wish additional training in composition beyond the basic requirements. Extensive practice in the writing of mature expository, critical, and argumentative prose. (The course satisfies the Indiana certification requirement of three hours of advanced composition.)

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Produce over 8,000 words of polished, rhetorically effective writing, fit for the academy, work, and civic life. 2. Use strategies of close reading and sound research methods for depth of understanding, expansion of knowledge, and honing critical acumen. 3. Apply rhetorical principles and techniques to a variety of writing tasks. 4. Read primary texts on rhetorical history and theory in order to understand them and use them. 5. Expand your knowledge of how persuasion permeates all aspects of life - verbal, visual, and material and increased your ability to discern better and worse forms of influence and argument. Credits: 3.00

ENGL 30600 - Introduction To Professional Writing

Credit Hours: 3.00. Development of skill in analyzing rhetorical situations in the workplace. Practice in planning, writing, evaluating, and revising a variety of documents typical of those used in the arts and industry.

Learning Outcomes: 1. Understand the basic rhetorical theories that underlie professional and technical writing. 2. Explore issues and challenges in professional writing in a variety of professional and technical contexts. 3. Produce critical writing on rhetorical issues in the field. 4. Solve workplace or organizational problems using writing. Credits: 3.00

ENGL 30900 - Digital Design And Production

Credit Hours: 3.00. The development of the ability to write and design documents using electronic publishing technologies.

Students will receive instruction in writing, graphics, and publishing software and will write, design, produce, and critique a number of publications.

Learning Outcomes: 1. Understand the foundational principles of document design and gain practical experience with contemporary design tools. 2. Build portfolio pieces that employ a design thinking approach, both in content and execution 3. Apply theories of document design to a variety of different genres directed to different audiences and rhetorical purposes. Credits: 3.00

ENGL 31600 - Craft Of Fiction From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of fiction with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of fiction, statements of aesthetics and craft, and various fictional forms.

Learning Outcomes: 1. Analyze published fiction by applying terms of fiction craft. 2. Identify the effects of fiction forms by articulating their differences and/or similarities. 3. Analyze their own fiction by applying the terms of fiction craft. Credits: 3.00

ENGL 31700 - Craft Of Poetry From A Writer's Perspective

Credit Hours: 3.00. This course focuses on the craft of poetry with some consideration of its underlying principles from a writer's perspective. Topics of study may include works of poetry, statements of aesthetics and craft, and various poetic forms.

Learning Outcomes: 1. Analyze published poetry by applying terms of poetry craft. 2. Identify the effects of poetry forms by articulating their differences and/or similarities. 3. Analyze their own poetry by applying the terms of poetic craft. Credits: 3.00

ENGL 32001 - Rhetoric, Artificial Intelligence, And Technology

Credit Hours: 3.00. This course examines the relationships between rhetoric and generative artificial intelligence (AI) using classical and contemporary rhetorical theory. While exploring how AI can support writing, students will gain insights into the challenges posed by AI, including issues of ethics, freedom, privacy, and sustainability. Includes application of rhetorical principles to the design and critique of new technologies.

Learning Outcomes: 1. Use knowledge of rhetorical history and contemporary rhetorical theory to evaluate the emergence of generative artificial intelligence (AI). 2. Write and design workplace documents by engaging common elements of AI tools, such as prompts and training data. 3. Integrate AI tools with other writing tools to create persuasive and informative content in diverse media. 4. Develop ethical approaches to using AI in research, persuasion, and critique. Credits: 3.00

ENGL 32101 - Content Strategy & Rhetoric

Credit Hours: 3.00. This course explores common methods for intentionally auditing, developing, and managing content across multiple media. Students will consider how different audiences and purposes shape how content is structured and delivered in varying rhetorical contexts and diverse media. Emphasizes both analytical and technical elements of content strategy.

Learning Outcomes: 1. Create and implement content strategies aligned with organizational goals and tailored to specific audiences, contexts, and purposes. 2. Perform content audits and inventories using common approaches such as lifecycle development and user testing. 3. Articulate how specific needs influence the structure and delivery of content across multiple media. 4. Use tools such as content management systems to engage and inform relevant stakeholders and contributors. Credits: 3.00

ENGL 32200 - Word, Image, Media (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the study of images, their relationship to language, and their functions in media. From decoding advertising messages to analyzing digital journalism, students will learn how images and their viewers make meaning in a variety of media contexts.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze images using

multiple critical methods. 2. Explain how images and their viewers make meaning. 3. Explain what role images play (or have played) in our cultures. 4. Explain what it means to negotiate so many images in our daily lives. 5. Produce effective written, verbal, and visual communication that demonstrates critical thinking, creative problem solving, empathy, and visual literacy. 6. Access and analyze information. Credits: 3.00

ENGL 32700 - English Language I: History And Development

Credit Hours: 3.00. Introduction to the history of the English language, its sounds, inflections, words, and sentence structures. Cultural and historical events affecting this history, and the interplay between language and literature.

Credits: 3.00

ENGL 32800 - English Language II: Structure And Meaning

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on syntax and semantics, including parts of speech, sentence structure, and meaning. Implications of recent theory for the teaching of English. Credit will not be given for both ENGL 32800 and LING 32100 .

Credits: 3.00

ENGL 32900 - English Language III: Sound And Form

Credit Hours: 3.00. The structure of American English and its dialects, with emphasis on phonology and morphology. Implications of recent theory to the teaching of English.

Credits: 3.00

ENGL 33000 - Games And Diversity

Credit Hours: 3.00. This course looks critically at diversity in games, game development, and in the larger mainstream games community. Students will analyze and play games that related to women, minorities, members of the LGBTQ community, and/or those who lack access because of disability.

Learning Outcomes: 1. Analyze a game's narrative based on a specific frame of diversity (i.e. gender, ethnicity, sexuality, and/or disability). 2. Explain how video games relate to contemporary cultural issues. 3. Use evidence-based arguments to defend a position related to video games and diversity. Credits: 3.00

ENGL 33200 - Games And User Experience (UX)

Credit Hours: 3.00. This course connects gamers and their experiences with games by developing ways to harvest gaming experiences for the improvement of games. We aim to prepare you to better understand gaming experiences, use those understandings to improve games in development, and be able to think and write critically about those experiences.

Learning Outcomes: 1. Identify and address the variables affecting usability investigation. 2. Articulate and employ methods for collecting and processing usability/user experience information about games. 3. Practice evidence-based arguments on game development and improvements. Credits: 3.00

ENGL 34100 - Topics In Science, Literature, And Culture

Credit Hours: 3.00. This course focuses on issues in and representation of science and technology in various texts, including literature, film, science, and theory. May be repeated for credit only under a different topic.

Credits: 3.00

ENGL 34200 - Legal Fictions

Credit Hours: 3.00. This course explores legal conflicts through literature. It uses the narratives created by the cat-and-mouse of procedural dramas, emotionally charged trial scenes, and dramatic courtroom struggles, to introduce different schools of jurisprudence, and to critically examine the decisions made by those with social and legal governing power.

Learning Outcomes: 1. Explain the intersections of legal and literary practice. 2. Define different schools or theories of jurisprudence. 3. Explain and analyze legal and cultural complexities. 4. Construct sustained and persuasive arguments based on textual evidence. Credits: 3.00

ENGL 34300 - Labor And Literature

Credit Hours: 3.00. This course introduces its students to the transformative synergy between the labor of literature and labor within literature. In contrast to accepting the marketplace as a

societal monolith, the readings illustrate the role of labor in creation. This course will examine labor taken in its broadest sense, from the labor of self-fashioning to the labor of industries; the labor of life and the labor of destruction and the implications of the laboring body from market creation to market collapse. Diverse readings range from traditional literary staples to modern representations of the labor market.

Learning Outcomes: 1. Explain who is allowed to participate in, and who is excluded from financial, economic, and other markets, and why. 2. Explain both individual and institutional roles in the labor market. 3. Define diverse worldviews of what constitutes labor. 4. Write reasoned arguments about labor and its connections to literature. Credits: 3.00

ENGL 34400 - Environmental Ethics, Policy, And Sustainability

Credit Hours: 3.00. Environmental Ethics, Policy and Sustainability is an interdisciplinary course designed to open new pathways into ethical and eco-critical inquiry in the Anthropocene age. The course analyzes disciplinary differences in approaching the ethical, the human, and environmental problems such as sustainability, development, biodiversity, global security, and climate change. Students will explore what it means to be ethical in and through an interrogation of our contemporary conceptions of what it means to be human. These interrogations in turn will prompt us to reconsider human creations such as knowledge, culture, and technology, which will push us to genuinely think how humans as a species situate their creations within the realm of what they call Nature. Students will be introduced to the history of environmental studies in the discipline, to the rise of what is now known as "postcolonial ecocriticism" to theoretical inquiry into modern technology, and to other recent developments in the fields of environmental studies.

Learning Outcomes: 1. Learn, describe, and relate key developments in environmental ethics. 2. Distinguish and translate different perspectives concerning ethical challenges. 3. Comprehend the efficacies of environmental positions, and learn to push the boundaries of different disciplinary approaches to environmental dilemmas. 4. Evaluate the limitations of positions and the complex frameworks surrounding ethical problems in order to offer more imaginative and resilient solutions. Credits: 3.00

ENGL 34500 - Games And World Building

Credit Hours: 3.00. Every game designer and gamer knows that there is more to narrative than just words on a page and more to worldbuilding than images on a screen. This course looks at the ways that narrative worlds get built-in games. We will begin by looking at the narrative elements in analog games that have been the foundation of many digital games and move on to look at the elements in digital games that come together to form the worlds.

Learning Outcomes: 1. Comprehend theoretical texts about game design and world building and demonstrate this by discussing them in class and with written assignments. 2. Analyze digital and analog games for specific world building techniques and strategies and demonstrate this via class discussion and written assignments. 3. Synthesize what they have learned about world building from theoretical texts and gameplay and demonstrate this by applying it to a final project in which they design their own game worlds. Credits: 3.00

ENGL 35000 - American Literature Before 1865 (UCC: HUM)

Credit Hours: 3.00. A historically oriented survey of genres, authors, and texts from European colonization to the U.S. Civil War. CTL:IEL 1210 American Literature I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the pre-Civil War period. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35100 - American Literature After 1865 (UCC: HUM)

Credit Hours: 3.00. A survey of American literature from the Civil War to the present. CTL:IEL 1211 American Literature II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions from the post-Civil War period on. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about post-Civil War literature based on appropriate use of textual evidence. Credits: 3.00

ENGL 35200 - Native American Literature

Credit Hours: 3.00. Study of literature by Native American authors in a variety of genres-novels, short stories, poetry, autobiography--using literary analysis, as well as historical, legal, and ethnographic materials.

Credits: 3.00

ENGL 35400 - Asian American Literature

Credit Hours: 3.00. Study of Asian American Literature covering issues such as immigration, identity, class, and gender.

Credits: 3.00

ENGL 35800 - Black Drama

Credit Hours: 3.00. A critical analysis and discussion of selected representative works by African American dramatists - from William Wells Brown to the moderns.

Credits: 3.00

ENGL 35900 - Black Women Writers

Credit Hours: 3.00. (AAS 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

ENGL 36000 - Gender And Literature (UCC: HUM)

Credit Hours: 3.00. An introduction to feminist approaches to the study of literature, including poetry, drama, fiction, and/or autobiography. Examines how gender intersects with race, ethnicity, sexual orientation, and class in shaping authorship, reading, and representation.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ENGL 36500 - Literature And Imperialism (UCC: HUM)

Credit Hours: 3.00. A study through cultural and theoretical works of the impact of imperialism on the ruling nations.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism/colonialism. 2. Develop a foundational knowledge of the historical contexts of and theoretical approaches to literary texts: gain an introductory knowledge of postcolonial literary theory. 3. Improve close reading and textual analysis skills. 4. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 36600 - Postcolonial Literatures

Credit Hours: 3.00. A study of Third World Literature, film, and theory that emerged during and after Western rule.

Learning Outcomes: 1. Develop an appreciation and analytical understanding of non-Western literature and culture from the formerly colonized world. 2. Develop a foundational knowledge of historical contexts, scholarly approaches, and theoretical perspectives to literary text formulate significant critical questions about language, gender, sexuality, race, and/or ethnicity and how identity shapes our lives, experiences, institutions, and cultures, particularly in the context of imperialism / colonialism. 3. Gain a complex understanding of global cultures. 4. Gain an introductory knowledge of postcolonial literary theory. 5. Improve close reading and textual

analysis skills. 6. Improve critical thinking skills: improve formal writing skills: use textual evidence to support their views, effectively incorporating (and correctly citing) primary and scholarly secondary sources in their writing and class discussion. Credits: 3.00

ENGL 36700 - Mystery And Detective Fiction (UCC: HUM)

Credit Hours: 3.00. An introduction to the detective genre, examining its origins, its characteristics, and its intersections with empiricism, forensic science, race, class, gender, sex, and empire.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Be familiar with the generic conventions of, and theoretical approaches to, the detective genre. 2. Use detective fiction to improve students' historical, cultural, and global awareness. 3. Practice analyzing, interpreting, and synthesizing information within and across texts and other media. 4. Practice successful academic writing, including a debatable thesis, as well as appropriately-selected and presented evidence. Credits: 3.00

ENGL 37300 - Science Fiction And Fantasy (UCC: HUM)

Credit Hours: 3.00. Representative works of science fiction and fantasy examined in relation to both mainstream and popular literature. Emphasis is on technique, theme, and form.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ENGL 37401 - Studies In British Literary History

Credit Hours: 3.00. This class focuses on one of several important British literary-historical periods, ranging from medieval English to modern British literature. In it, students will examine individual authors and texts while also gaining a wider understanding of their historical context. Students will also engage with a variety of genres and practice numerous critical approaches to literature.

Learning Outcomes: 1. Identify and construct arguments about genres of, and theoretical approaches to, historical literature. 2. Explain the diversity of peoples, interests, and ideologies with specific British literacy-historical periods. 3. Show how literary artifacts are both agents and reflections of culture. 4. Construct written arguments that demonstrate historical, cultural, and global awareness. 5. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

ENGL 37700 - Modern And Contemporary Poetry

Credit Hours: 3.00. A study of poetry in English from the twentieth century to the present.

Learning Outcomes: 1. Identify the form and analyze the significances of modern and contemporary poems. 2. Discuss modern and contemporary poems in relation to their historical, cultural, and aesthetic contexts. 3. Produce well-reasoned and written arguments about modern and contemporary poems. Credits: 3.00

ENGL 37800 - Studies In American Literary History

Credit Hours: 3.00. This class focuses on one of several important American literary-historical periods: colonial, nineteenth-, or twentieth- and twenty-first-century literature. In it, students examine individual authors and texts while also gaining a wider understanding of their historical context. Students also will engage with a variety of genres and practice numerous critical approaches to literature.

Learning Outcomes: 1. Identify and construct arguments about genres of, and theoretical approaches to, historical literature. 2. Explain the diversity of peoples, interests, and ideologies with specific American literary-historical periods. 3. Show how literary artifacts are both agents and reflections of culture. 4. Construct written arguments that demonstrate historical, cultural, and global awareness. 5. Produce successful academic writing, including a debatable thesis, and appropriately presented evidence. Credits: 3.00

ENGL 37900 - The Short Story

Credit Hours: 3.00. A study of the development and features of the short story genre.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and literary conventions related to the short story genre. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about short stories based on appropriate use of textual evidence. Credits: 3.00

ENGL 38000 - Issues In Rhetoric And Public Life (UCC: IL/WC)

Credit Hours: 3.00. Study of how language and media create belief and change. Examines ancient and contemporary rhetorical theory as it applies to public discourse, media, and technology.

University Core Curriculum (UCC): (UCC: IL/WC) Learning Outcomes: 1. Demonstrate knowledge of a range rhetorical techniques and practices in the public realm, past and/or present. 2. Discuss those techniques and practices in relation to their diverse historical, cultural, and technological contexts. 3. Produce well-reasoned written arguments about the rhetorical techniques and practices they study using appropriate forms of research and evidence. Credits: 3.00

ENGL 38100 - The British Novel (UCC: HUM)

Credit Hours: 3.00. Survey of British novels ranging from the eighteenth- to the twenty-first centuries.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and literary conventions related to the British novel. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about British novels based on appropriate use of textual evidence. Credits: 3.00

ENGL 38200 - The American Novel (UCC: HUM)

Credit Hours: 3.00. A survey of American novels ranging from the eighteenth century to the twenty-first-centuries.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of topics and literary conventions related to the American novel. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about American novels based on appropriate use of textual evidence. Credits: 3.00

ENGL 38600 - History Of Film To 1950

Credit Hours: 3.00. This survey crosses the divide between the silent film era and the "talkies" to explore narrative, experimental, and documentary styles of feature films from the 1890s to 1950.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to film from its origins through the mid-twentieth century. 2. Discuss those topics and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about pre-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 38700 - History Of Film Since 1950

Credit Hours: 3.00. A survey of narrative, experimental, and documentary styles of feature films from the mid-twentieth century to the present.

Learning Outcomes: 1. Demonstrate knowledge of a range of topics and conventions related to films from the mid-twentieth century. 2. Identify and articulate connections among these topics and conventions as they relate to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about

post-1950 films based on appropriate use of evidence. Credits: 3.00

ENGL 38900 - Literature For Children (UCC: HUM)

Credit Hours: 3.00. This course surveys eighteenth, nineteenth-century, and early-twentieth-century literature for children, including the so-called "golden age" of children's myth, fairy tales, and fantasy, as well as domestic fiction for girls and adventure books for boys.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Know important genres of children's literature as well as their historical, cultural, and aesthetic contexts. 2. Know important theoretic approaches to the study of children's literature as well as debates about the ethics of writing for children. 3. Empathize through considering perspectives on childhood from authors whose life experiences are different from students' own. 4. Write clearly and produce elements of academic writing, including a thesis, as well as appropriately selected, evaluated, and presented textual evidence. Credits: 3.00

ENGL 39000 - Practicum In Tutoring Writing

Credit Hours: 1.00 to 3.00. A practicum to teach undergraduates to teach writing in the one-to-one setting of a writing lab.

Credits: 1.00 to 3.00

ENGL 39100 - Composition For English Teachers

Credit Hours: 3.00. Exploration of the theory, research, and pedagogy of teaching writing at the secondary level. Topics include the development of writing assignments and related activities, the study of writing process models, and the evaluation of student work in a variety of genres.

Learning Outcomes: 1. Design lesson plans for secondary writing instruction. 2. Incorporate writing-process strategies into assignments and activities. 3. Develop prompts for student writing in a variety of genres. 4. Map instructional activities to formal state or national curricular standards. 5. Reflect on differentiating lessons for diverse learners. Credits: 3.00

ENGL 39200 - Young Adult Literature

Credit Hours: 3.00. This course examines the construct of Young Adult Literature as a genre crafted specifically for adolescents. Using both classic and contemporary novels, as well as relevant theoretical and research texts, this course explores how YA literature is defined, what it offers to adolescent readers, and how it is situated in the literary landscape.

Learning Outcomes: 1. Read, respond to, and analyze selected works of Young Adult literature in order to think critically about various concepts and issues connected to the genre. 2. Explore, analyze, and critique the extent to which selected Young Adult literature affects and reflects teenage life. Credits: 3.00

ENGL 39300 - Interdisciplinary Approaches To Environmental And Sustainability Studies

Credit Hours: 3.00. (ANTH 39300) This course is the lynchpin of the undergraduate Certificate in Environmental and Sustainability Studies. It will present a series of case studies, core concepts, and problem questions that integrate the following three academic approaches: 1) Human Dimensions and Environment/Sustainability, 2) Engineering and Environment/Sustainability, and 3) Environmental/Sustainability Sciences.

Learning Outcomes: 1. Identify, describe, and relate the diverse causes (social, cultural, political, ethical, economic, historical, scientific, and engineered) and consequences of pressing environmental and sustainability challenges, such as climate change, resource scarcity, biodiversity, population growth. 2. Distinguish, paraphrase, and translate different disciplinary perspectives on these key environmental and sustainability challenges. 3. Familiarize themselves with the efficacies, and learn to push the boundaries, of different disciplinary approaches by comparing and contrasting solutions to environmental issues. 4. Combine different disciplinary approaches by synthesizing reorganizing, and reformulating

diverse viewpoints. 5. Demonstrate ability to communicate across disciplines on environmental and sustainability problems. Credits: 3.00

ENGL 39600 - Studies In Literature And Language

Credit Hours: 1.00 to 3.00. A course in the study of a special topic directed by an instructor in whose particular field of specialization the content of the course falls.

Learning Outcomes: 1. Students will think critically about course content. 2. Students will read and write reflectively and critically about course content. 3. Students will engage in course discussions, either online or face-to-face, which encourage critical thought and personal engagement. Credits: 1.00 to 3.00

ENGL 39900 - Beyond English

Credit Hours: 3.00. This class is designed for third- and fourth-year English majors. It will help students translate the worth of English and the humanities to the world beyond the university, providing them with tools to articulate their achievements and prepare for their professional and adult lives.

Learning Outcomes: 1. Be familiar with economic, scientific, and humanistic arguments for the value of English and the humanities. 2. Practice speaking clearly, writing persuasively, and collaborating effectively. 3. Enhance career preparation and professionalization. Credits: 3.00

ENGL 40600 - Review Writing

Credit Hours: 3.00. Intensive practice in the writing of book, film, and theatre criticism, as well as reviews of musical programs and art exhibits. Readings in critics to serve as possible models. Audience analysis of newspapers and periodicals that would be potential markets.

Credits: 3.00

ENGL 40700 - Intermediate Poetry Writing

Credit Hours: 3.00. Study and practice of methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems by using effective imagery, line breaks, stanzas, compression, and linguistic playfulness; 2. Produce a portfolio of poems by revising according to suggestions received in workshop and in individual conferences with the instructor. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary poetry. Credits: 3.00

ENGL 40800 - Creative Writing Capstone

Credit Hours: 3.00. This course will focus on the writing and revision of the capstone thesis in Creative Writing, consisting of a substantial portfolio of either fiction or poetry with an introductory essay. Workshop, discussion of published writing, and individual conferences will form the center of the course with readings, lecture, and discussion of various literary topics. Permission of instructor required.

Learning Outcomes: 1. Master specific topic on either poetry or fiction writing by giving a formal in-class presentation. 2. Master either poetry or fiction writing by producing a portfolio of their own creative work. 3. Understand their aesthetic by producing a formal essay which analyzes their creative writing. Credits: 3.00

ENGL 40900 - Intermediate Fiction Writing

Credit Hours: 3.00. Study and practice of methods of composing fiction, with a primary emphasis on the student's own work. Workshop criticism and discussion of published fiction.

Learning Outcomes: 1. Write and revise fiction by using effective character development, plot and scene. 2. Produce a polished fiction by revising according to suggestions received in workshop. 3. Be cognizant of the range of the genre by reading and discussing key works of modern and contemporary fiction. Credits: 3.00

ENGL 41100 - Studies In Major Authors

Credit Hours: 3.00. A study of the literary, critical, or cinematic works of one or two influential authors or directors. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of the works of a particular author. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41200 - Studies In Genre

Credit Hours: 3.00. A study of literary or cinematic works that share distinctive formal features. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate detailed knowledge of a single literary genre. 2. Discuss that genre in relation to its diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41300 - Studies In Literature And History

Credit Hours: 3.00. A study of literature or film produced during a well-defined historical period from the view of its social, political, religious, and economic contexts. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions of a particular period in history. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41400 - Studies In Literature And Culture

Credit Hours: 3.00. A study of literature or film from the perspective of the cultural norms and values it expresses, celebrates, and challenges. A project-based capstone seminar containing a significant research component. May be repeated for credit only with a different topic.

Learning Outcomes: 1. Demonstrate knowledge of the relationship between literary texts and their culture. 2. Discuss those relationships in light of texts' diverse historical and aesthetic contexts. 3. Produce a substantial work or project: a research essay; a digital humanities project; a scholarly edition; or a comparable service learning project. Credits: 3.00

ENGL 41900 - Multimedia Writing

Credit Hours: 3.00. Explores the rhetorical and cultural aspects of multimedia design, implementation and publishing. Students will create a broad spectrum of multimodal texts such as digital videos, podcasts and Web sites. The course focuses on preparing students to adapt to ever-changing media landscapes.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Design multimedia documents and digital texts that include attention to accessibility and usability. 4. Communicate complex information via a variety of mediums and or genres. 5. Use common tools for creating multimedia and integrating visuals in written documents. Credits: 3.00

ENGL 42000 - Business Writing

Credit Hours: 3.00. This course helps students become better business writers, across a wide range of audiences, for multiple purposes, and in a variety of media. This course engages business-related material with an awareness of audience needs and contexts. It prepares students to address problems in the workplace, social, or global levels.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to

specific rhetorical contexts, problems, and situations. 3. Compose effective, field-specific business documents through a process of analysis and revision. 4. Create business documents in collaborative, distributed, and/or networked environments. 5. Adapt to workplace specific writing practices. Credits: 3.00

ENGL 42100 - Technical Writing

Credit Hours: 3.00. This course teaches the practice and principles of technical writing. The course emphasizes rhetorical approaches to research and writing, teaching concepts such as usability and accessibility. Students write diverse technical documents such as memos, technical reports, documentation and websites.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Communicate complex technical information, processes and procedures in a variety of genres. 4. Compose effective, industry specific, technical documents that emphasize the importance of usability and accessibility for the rapidly changing field of technical writing. 5. Produce team-written technical projects for specific contexts and industries. Credits: 3.00

ENGL 42201 - Writing For The Health And Human Sciences

Credit Hours: 3.00. This course applies rhetorical principles to the writing of health, hospitality, nutrition and other related fields. It will prepare students to write in diverse modalities for technical, professional and lay audiences.

Learning Outcomes: 1. Use theories of rhetoric to develop texts, think critically, solve problems, and engage with the needs of diverse audiences. 2. Apply data-driven approaches to specific rhetorical contexts, problems, and situations. 3. Employ theories and approaches of medical and science writing to adapt to the rapidly changing industries of healthcare and public health. 4. Compose effective healthcare and public health documents with an awareness of the accessibility and usability needs of patients, providers and caregivers. 5. Communicate complex healthcare and public health information while writing both individually and in teams. Credits: 3.00

ENGL 42400 - Writing For High Technology Industries

Credit Hours: 3.00. Applies principles of effective professional writing to the planning, production, and evaluation of computer user manuals and other writing tasks.

Learning Outcomes: 1. Communicate technical knowledge through writing. 2. Think and write about writing in high technology workplaces. 3. Write concisely, precisely, and with economy of language. 4. Become familiar with the best practices and procedures for documenting advanced technologies. 5. Become familiar with adapting technical language and requirements for a non-specialist audience. 6. Become familiar with composing and delivering policies or new procedures to colleagues or co-workers. 7. Become familiar with practical strategies for improving your resume, conduct, and online presence. Credits: 3.00

ENGL 43201 - Editing And Publishing

Credit Hours: 3.00. Editing and Publishing is a professional writing workshop that teaches students how to proofread, copyedit, substantive edit, and global edit documents. Students will learn how to navigate the publishing industry and work with authors on print, electronic, online, and multimedia documents.

Learning Outcomes: 1. Understand how the publishing industry operates, especially from an editor's perspective. 2. Apply the four levels of edit (global editing, substantive editing, copyediting, and proofreading) in an editorial project. 3. Work collaboratively with authors to produce clearly written and persuasive documents. 4. Edit document design and graphics in a document. 5. Interact with

publishers to bring a text from manuscript form into a published manuscript. Credits: 3.00

ENGL 43300 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants is a professional writing workshop that teaches students to write workplace proposals and grants in for-profit and not-for-profit companies and organizations. Students will also learn how to write business plans, a specialized form of proposal.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Generate new ideas for businesses, products, and services. 3. Organize proposals and grants using various proposal genres. 4. Write in a plain and persuasive style that is appropriate to readers. 5. Design documents in ways that make information accessible. 6. Edit and revise proposals and grants. 7. Work with authors, customers, and funding agencies to sharpen the message of a proposal or grant. Credits: 3.00

ENGL 43400 - Science And Medical Writing

Credit Hours: 3.00. Science and Medical Writing is a professional writing workshop that teaches students how to write in medical and scientific fields. Students will learn the genres and conventions that are used by medical writers and science writers, as well as editors in these fields.

Learning Outcomes: 1. Analyze rhetorical situations to determine needs of readers and contexts. 2. Identify the appropriate genre for a writing project. 3. Edit and proofread scientific and medical documents. 4. Design documents that pertain specifically to medical and scientific texts. 5. Create and effectively use tables, charts, and graphics common in the sciences and medicine. 6. Develop skills for working with authors and publishers in scientific and medical fields. Credits: 3.00

ENGL 43900 - Topics In Disability Studies

Credit Hours: 3.00. Explores cultural, social, and political meanings and effects of disability in relation to literature and/or rhetoric. Specific topics will vary.

Learning Outcomes: 1. Discuss the strengths and weaknesses of different models for understanding disability. 2. Understand ways normalcy is socially constructed. 3. Identify cultural practices that exclude disabled people. 4. Compare and contrast disability with other identity categories such as race, gender, and sexuality. 5. Discuss ways in which culture defines disability as impairing one's subjectivity and even humanity. 6. Analyze literary representations of disabled characters. 7. Examine the role of disability in literary works more broadly. Credits: 3.00

ENGL 44200 - Shakespeare

Credit Hours: 3.00. Shakespeare's dramatic craftsmanship, poetry, humor, characterization, psychology, and modern pertinence illustrated in representative tragedies, comedies, and history plays.

Credits: 3.00

ENGL 44300 - Craft Seminar

Credit Hours: 3.00. Study of fiction, poetry, creative nonfiction, storytelling, and/or hybrid form theory and techniques, both in published texts and student manuscripts. Students produce multiple texts and drafts. Workshop criticism. Can be taken up to three times for credit.

Learning Outcomes: 1. Develop a greater understanding of the form and theory of fiction, poetry, creative nonfiction, storytelling, and/or hybrid texts. 2. Read published creative texts, including very recent texts, in order to understand the conventions of and current practices within the field. 3. Read, discuss, and offer feedback on other students' drafts. 4. Draft and revise multiple pieces to produce high-quality, polished work suitable for submission to creative publications. Credits: 3.00

ENGL 46000 - Studies In Women's Literature

Credit Hours: 3.00. A study of literary works by women according to a specific theme, historical period, genre, or culture, e.g., Nineteenth-Century Women Novelists, Madness in Women's Writing, Caribbean Women Writers. May be repeated

only with different topic.

Credits: 3.00

ENGL 46200 - The Bible As Literature: The Old Testament

Credit Hours: 3.00. A study of the Old Testament - Pentateuch, Prophets, and other books such as Psalms, Proverbs, Job, and Ecclesiastes - with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 46300 - The Bible As Literature: The New Testament

Credit Hours: 3.00. A study of the New Testament, with emphasis on its unique literary characteristics.

Credits: 3.00

ENGL 47000 - Advanced Topics In Rhetorical Studies

Credit Hours: 3.00. Study of rhetorical theories and practices past and present. Includes readings in primary texts in the history and theory of rhetoric. May be repeated for credit with a different topic.

Learning Outcomes: 1. Demonstrate advanced understanding of rhetorical concepts, theories, and practices. 2. Analyze and assess rhetorical situations from which arguments are generated; evaluate arguments and their public, institutional, or organizational success; produce arguments in a variety of genres and forms. 3. Demonstrate understanding of how and why rhetoric accomplishes its work from a variety of perspectives across the humanities and sciences. Credits: 3.00

ENGL 48800 - Internship In Professional Writing

Credit Hours: 3.00 to 6.00. This course provides on-the-job experience in various kinds of professional writing, combined with a seminar in applied rhetoric. Students work in selected internship settings, participate in seminar discussions of their work, and read selections appropriate to their internship. Permission of instructor required.

Credits: 3.00 to 6.00

ENGL 49000 - Worksite Internship Practicum

Credit Hours: 1.00 to 3.00. Course facilitates the transition between an English undergraduate degree and the workplace or professional life. The course has two components: a professor-guided component and a practicum component in a chosen area. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 49200 - Literature In The Secondary Schools

Credit Hours: 3.00. Exploration of the theory, research and pedagogy supporting the teaching of literature at the secondary level. Topics include text selection, instructional strategies, adolescent literacy, student engagement and the use of alternative texts.

Credits: 3.00

ENGL 49400 - Research Practicum For Undergraduates

Credit Hours: 2.00 or 3.00. This course introduces students to research techniques and trains them to participate in a research laboratory or a professor-sponsored research project. Permission of instructor required.

Credits: 2.00 or 3.00

Department of History

About the History Program

Purdue's approach to the study of history is equally varied among politics, society, culture, gender, race, war, diplomacy, science, and technology. The Department of History is deeply involved in educating students to think critically, with courses that teach not only what happened in the past but also how the past informs the present. History majors acquire skills in critical thinking and communication.

Historians inform modern discussions about the future of science and technology, medicine and public health, politics, society, culture, gender, race, war, and diplomacy. We do this in part by preparing students for graduate studies and careers in law, public policy, government, education, business, and many other fields. In our courses students acquire skills-how to research, read critically, write effectively, communicate verbally-and a sense of judgment that serve them well at Purdue University and prepare them for careers in a wide range of fields and occupations.

Within the history program, you also have opportunities to take honors courses, study abroad, do internships and research projects, and learn from our award-winning faculty. We invite you to come learn more!

Faculty

Department of History Directory

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Please visit the Department of History for more information.

Graduate Information

For Graduate Information please see History Graduate Program Information .

History Minor

History, BA

History Honors, BA

Medical Humanities Certificate

History of Science Technology and Medicine Minor

History of Science, Technology, and Medicine, BA

HIST 10001 - Issues In African-American History

Credit Hours: 3.00. Study and analysis of selected historical issues and problems of general import. Topics will vary from semester to semester but will usually be broad subjects that cut across fields, regions, and periods. May be repeated with different topics for a maximum of 9 credit hours.

Credits: 3.00

HIST 10300 - Introduction To The Medieval World (UCC: HUM)

Credit Hours: 3.00. Barbarians, kings, queens, peasants, witches, saints, teachers, students, heretics, Moslems, Jews, Christians, love, death, monks, farm life, city life, ordinary men, women, and children as Europe develops from A.D. 500 to 1500.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 10400 - Introduction To The Modern World (UCC: HUM)

Credit Hours: 3.00. Traces the expansion of Europe into the Americas, Africa, and Asia. The French Revolution, nationalism, and the development of western European states from the era of the Reformation to the present are studied.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 10500 - Survey Of Global History (UCC: HUM)

Credit Hours: 3.00. A survey of the interaction between the civilizations of Asia, Africa, Europe, and the Americas since 1500, with attention to cultural comparisons over time, and to the implications of global interdependence for the environment, health, economy, and geopolitics.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 12300 - History At Work

Credit Hours: 1.00. Students will learn how history majors' distinctive skills and expertise can help them achieve success in many different careers. Participants will explore the value of historical thinking in daily life, including causality, contingency, and contextualization, and will refine practical reading, thinking, and communication skills crucial to career success. Permission of department required.

Learning Outcomes: 1. Summarize the arguments of a historical journal article (secondary source) and apply their understanding of how historical research is produced and evaluated to an analysis of that source's significance to the discipline. 2.

Identify professional opportunities such as jobs, internships, and calls for conferences, prizes, and article proposals. 3. Create CVs/resumes and cover letters/personal statements that highlight their skills and accomplishments, and that are tailored to the professional opportunities for which they are applying. 4. Investigate different career paths available to history majors, and assess their own strengths and interests in relation to those career options. 5. Discuss and advocate for the importance of historical thinking in the workplace and in daily life. Credits: 1.00

HIST 15100 - American History To 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the development of American political, economic, and social institutions from the early explorations and colonial settlements through Reconstruction. CTL:ISH 1010 American History I

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 15200 - United States Since 1877 (UCC: HUM)

Credit Hours: 3.00. A study of the growth of the United States from 1877 to the present. The new industrialism, agrarian problems, depression, the New Deal, the two world wars, the cold war, and similar topics are analyzed. CTL:ISH 1011 American History II

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 20100 - Special Topics In History

Credit Hours: 3.00. This variable title course deals with broad historical topics that transcend and telescope traditional analytical, chronological, and geographical boundaries. Content will vary with the instructors teaching the class.

Credits: 3.00

HIST 21000 - The Making Of Modern Africa (UCC: HUM)

Credit Hours: 3.00. This course provides students with a comprehensive introduction to modern African history from 1800 to the present. Using a variety of films, novels and scholarly resources, we will examine the major historical forces that have shaped African lives over the last two centuries. Emphasis will be placed on African experiences of slavery, colonialism, liberation struggles, and post-independence national building. Students will also learn to analyze contemporary African issues within a larger historical context.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand modern African history and the state of Africa today. 2. Learn how to interpret historical texts from a number of different epistemic positions (i.e. paying attention to race, class, gender, sexuality, nation and other axes of ""difference""). 3. Expect to develop stronger writing skills, as well as to improve on critical thinking and oral articulation. Credits: 3.00

HIST 21100 - The Global Field: World Soccer And Global History (UCC: HUM)

Credit Hours: 3.00. This is an introductory course to the history of soccer, on and off of the pitch. It studies the history of the game itself as well as the international economic, political, social, and cultural trends that shaped it.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand a major global phenomenon and its relationship with nations and societies around the world. 2. Learn how to look critically at the same problem (soccer) from the perspective of more than one discipline. 3. Develop communication, writing skills and critical thinking. Credits: 3.00

HIST 22100 - History Behind The Headlines

Credit Hours: 3.00. This course introduces undergraduate students to the study of history and provides an overview of the various ways history is communicated outside the academy in narrative nonfiction, journalism, museum exhibitions, policy documents, political speeches, advertising, podcasts, television, film, and social media.

Learning Outcomes: 1. Identify and assess the ways in which history is presented to the public. 2. Produce a compelling historical argument based on a thorough assessment of primary and secondary sources. 3. Design a history communication project for public and non-expert

audiences. Credits: 3.00

HIST 22800 - English History To 1688

Credit Hours: 3.00. This course is designed to survey the growth and development of English society from its beginning through the seventeenth century. Emphasis is put upon those institutions and events that influenced the establishments of the English legal system.

Credits: 3.00

HIST 22900 - English History Since 1688

Credit Hours: 3.00. A continuation of HIST 22800 . Emphasis is placed upon Great Britain as a world and imperial power. Attention is given particularly to the industrial revolution, the growth and achievements of democratic institutions, and the role Britain has played in Western civilization in recent times.

Credits: 3.00

HIST 23005 - Hitler's Europe

Credit Hours: 3.00. This course will examine the rise, seizure, and consolidation of power by the Nazi Party and will trace the development of Adolf Hitler from a provincial Austrian to dictator of Nazi Germany.

Learning Outcomes: 1. Explain how and why Adolf Hitler and the Nazis seized and exercised power, and the consequences for Germany and Europe. 2. Distinguish between secondary and primary sources and critically read both types of sources; synthesize information and arguments from both types of sources. 3. Evaluate biography as a historical genre; engage in independent historical interpretation with the use of primary and secondary sources. 4. Compose analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. Credits: 3.00

HIST 23800 - History Of Russia From Medieval Times To 1861 (UCC: HUM)

Credit Hours: 3.00. This course explores the main characteristics of early Russian society, culture and politics. Topics include: the Kievan principalities, Orthodox Christianity, the Mongols, the rise of Moscow, the Petrine reforms, peasant and national rebellions, revolutionary movements, and the Tsarist empire to the Crimean War.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major geographical features of the Russian homeland, the Baltics, Belarus, Ukraine, the Caucuses, Central Asia, the Volga-Urais, Siberia, and the Far East. 2. Trace and describe the main historical characteristics of Russian culture, social structure, and political life from the earliest origins under the Viking conquests to the emancipation of the serfs in 1861. 3. Analyze what the Russians both gave and took from the hundreds of Caucuses, Siberian, Central Asian, and European peoples, whom they gathered into the all-Russian state. 4. Understand the sources of Russia's triumphs and tragedies through the empire's consolidation of autocracy and serfdom. 5. Create a game-style simulation on the topic Russia's Circular Frontier and the Rise of Muscovy. Credits: 3.00

HIST 23900 - History Of Russia From 1861 To The Present (UCC: HUM)

Credit Hours: 3.00. This course surveys the paths of the Russian empire through economic modernization, social transformation, and World War I; the revolutionary regimes of Bolshevism, Leninism, and Stalinism; World War II and the Cold War; the collapse of the USSR; and the new Eurasian states.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major geographical features of the Russian land empire from its European borders, through the Caucasus and Central Asian frontiers, to the steppes and forests of Asia. 2. Trace and describe the main historical characteristics of Russian culture, social structure, and political life from the Great Reforms of the late empire (1861) to the present regime. 3. Analyze why, twice in recent times (1917 and 1991), the state collapsed under the weight of its own contradictions, driven in part by the pace of European and American modernization. 4. Understand how Russian history is a metaphor

for global history, a study of the crises posed by the world revolution of western values. 5. Create a game-style simulation of the topic The Genesis and Structure of the Stalinist State. Credits: 3.00

HIST 24000 - East Asia And Its Historic Tradition (UCC: HUM)

Credit Hours: 3.00. Survey of the great historic traditions of China, Japan, and Korea from earliest times to approximately 1600, with special attention to state formation, society, intellectual, philosophical, and religious developments, and the visual, musical, and literary arts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24100 - East Asia In The Modern World (UCC: HUM)

Credit Hours: 3.00. The response of China, Japan, and Korea to the coming of the West in modern times, with special stress on the effect of Western ideas and machines. Approximately 1600 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24300 - South Asian History And Civilizations (UCC: HUM)

Credit Hours: 3.00. Survey history of India, Pakistan, and Bangladesh, from the origins of South Asian civilization to the present. Topics include ancient India, the Mughal Empire, the colonial experience, the independence movement, and conflict and popular culture.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 24600 - Modern Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course explores the political, social, and cultural factors that have contributed to the formation of the modern Middle East. Course includes short stories and a selection of documentary films from the region.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 25000 - United States Relations With The Middle East And North Africa (UCC: HUM)

Credit Hours: 3.00. This course examines US relations with the Middle East and North Africa since World War II.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gained a deeper understanding of the patterns and processes shaping US relations with the Middle East and North Africa. 2. Thought historically and critically about approaches to the study of US relations with the Middle East and North Africa. 3. Used primary source evidence to analyze fundamental issues in US relations with the Middle East and North Africa. 4. Sharpened critical reading, thinking, writing, and discussion skills in order to defend an independent argument. Credits: 3.00

HIST 27100 - Introduction To Colonial Latin American History (1492-1810) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the principle historical themes of Latin America during the colonial period (roughly, from 1492 to 1810). No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate a grasp of the historical forces that in many ways laid the foundation for present-day Latin America. 2. Express understanding of how these major political, social, economic, and cultural issues unfolded in different ways in Latin America, with respect to region, time, and culture. Credits: 3.00

HIST 27200 - Introduction To Modern Latin American History (1810 To The Present) (UCC: HUM)

Credit Hours: 3.00. The purpose of this general survey course is to introduce students to the study of the major economic, political, social, and cultural processes that shaped modern Latin American nations since independence. No prior knowledge of Latin American history is required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a broad understanding of the modern history of Latin America. 2. Become familiar with the major economic, political, social, and cultural

processes that shaped the nations of the continent. Credits: 3.00

HIST 27800 - Money, Trade, And Power: The History Of Capitalism

Credit Hours: 3.00. This course examines the origins of capitalist institutions and their changes over time, including banks, joint-stock companies, and modern corporations -- all viewed with respect to their impact on industrialization, colonial expansion, business cycles, and the emergence of a global economy.

Learning Outcomes: 1. Explain the history of capitalism based on a combination of readings, course lectures, and course discussions. 2. Develop compelling historical arguments and demonstrate your understanding of the course material through examinations. 3. Write clear and concise analytical papers based on templates and feedback supplied by the professor. Credits: 3.00

HIST 28000 - Science And Society In Western Civilization I (UCC: HUM/STS)

Credit Hours: 3.00. A survey of the main lines in the development of science and society in Western civilization from earliest times to Newton's discovery of gravitation. Beginning with prehistory and Egyptian and Mesopotamian civilizations, the course treats in more detail the Greeks and Romans. The course then considers science during the Middle Ages, examining the transmissions of ancient science and its incorporation into the body of Christian doctrines. The course concludes with the new efforts of physicians and astronomers to free their studies from the influence of the Church and antiquity, and the new accommodations between science and society during the Scientific Revolution.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 28100 - Science And Society In Western Civilization II (UCC: HUM/STS)

Credit Hours: 3.00. This course considers Western science and society from the time of Newton to the present. Beginning with Copernicus to Newton, topics next include biological classification, modern chemistry, and the onset of the industrial revolution. For the nineteenth century the course stresses the maturation of biology. Darwinian evolution, the dynamic synthesis and electromagnetic studies, and the second industrial revolution. In the twentieth century, the course covers modern physics, the life sciences, the understanding of the universe, and the interaction between pure and applied science. The course concludes with some of the modern social and political problems which science caused by its success.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 28200 - Science And Society In The Twentieth Century World (UCC: HUM/STS)

Credit Hours: 3.00. An introductory survey emphasizing cultural contexts, relationships with other institutions, and the lives of major figures. Covering selected major achievements as well as the problems these generate. Neither science nor engineering background is required.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society during the Twentieth Century. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society during the Twentieth Century. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contributions of different social groups in science and society during the Twentieth Century. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science during the Twentieth Century. Credits: 3.00

HIST 28400 - The Computer Age From Babbage To The Blockchain

Credit Hours: 3.00. In this course we will explore the history of computing-from the pre-electronic days through the computer's ascent in the twentieth century to the various electronic computing and communications technologies that surround us today. This course will investigate why there was a desire to create computing machines in the first place, the economic and political arrangements that brought computers into existence, the debates over what computers could (and should) be used for, the development of the IT profession, and the gradual shift from computers being room-sized specialty machines to everyday objects that people carry around in their pockets.

Learning Outcomes: 1. Identify social, economic, political, and historic factors that have shaped the development and application of computer technology. 2. Describe the history of computing and its relevance for the world today. 3. Locate primary source materials, critically analyze those sources by considering their context and the reasons for their creation. 4. Examine work produced by, and arguments made by, historians. 5. Discuss the role that computers play in everyday life with an expansive view of the wide breadth of computerized systems that surround us. Credits: 3.00

HIST 30000 - Eve Of Destruction: Global Crises And World Organization In The 20th Century (UCC: HUM)

Credit Hours: 3.00. Using a variety of case studies, this course considers 20th-century turning points -- often violent and disastrous ones -- in an emerging global conversation about urgent world problems and their possible solutions.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 30105 - Big History: Time And Scale

Credit Hours: 3.00. This course explores Big History, a new form of world / global history. Like all forms of world history, Big History transcends the limitations of nation-centered perspectives. Drawing on the history of science and environmental history, Big History considers the many forces (physical, biological, environmental, social, and political) that drive change across time.

Learning Outcomes: 1. Examine, interpret, and explain trends in Big History / World History at multiple scales. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to Big History. 3. Identify and explain the major themes of Big History. 4. Write about the role of Big History and social implications of science. Credits: 3.00

HIST 30200 - Historical Topics

Credit Hours: 3.00. This variable-title course deals with broad historical topics that transcend and collapse traditional analytical, chronological, and geographic boundaries. Content will vary with faculty member teaching the class.

Learning Outcomes: 1. Students will acquire a perspective on and basic understanding of the course content. 2. Students will engage in integrative learning as they examine the course content that transcends and collapses traditional analytical, chronological, and geographic boundaries. 3. Students will develop their creative and critical thinking skills. 4. Students will strengthen their information literacy and improve their writing skills. Credits: 3.00

HIST 30305 - Food In Modern America (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the kitchen as an architectural space, a place of labor and food production, and an arena for technological innovation in modern American history. Cooking and eating reflect cultural sentiments about modernity, progress, ethnicity, and family, and the politics of how society nourishes bodies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Think historically and critically about the cultural consequences of technologies related to eating and food preparation. 2. Think historically and critically about approaches to the study of national identify and culture expressed through food. 3. Appreciate the circumstances and history of kitchen design in relation to raced and gendered identities, home space, and food preparation. 4. Understand and recognize how assumptions about food production during the late 19th and 20th centuries in the United States reflected notions about labor, modernity, and progress. 5. Understand the difference between secondary and primary sources. Students will analyze and interpret primary documents related to kitchens, cooking, and food preparation. They also will understand the competing and conflicting nature of historical interpretation. 6. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 30400 - America In The 1960s (UCC: HUM)

Credit Hours: 3.00. Surveys the turbulent history of the 1960s America. Topics include: the Kennedy, Johnson, and Nixon presidencies; postwar liberalism and conservatism; insurgent political and social movements; the counterculture; the sexual revolution; rock 'n roll; and the Vietnam War.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 30505 - The United States In The World 1898-Present (UCC: HUM)

Credit Hours: 3.00. This course explores the central issues and themes of American foreign relations during the twentieth century with a primary focus on the expansion of American political military, economic, and cultural power.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand how and why the United States transformed from a relatively minor regional power in the nineteenth century into the global power we recognize today. 2. Understand innovative ways in which historians are expanding our understanding of Americans' role in the world. 3. Understand the often competing and conflicting nature of historical interpretation and encourage assessment of various forms of primary source evidence to form conclusions about the United States' place and experience in the world. Credits: 3.00

HIST 30605 - Technology And War In U.S. History (UCC: HUM/STS)

Credit Hours: 3.00. War has been a central component of U.S. statecraft from the war of independence through the war on terror. This lecture class examines the complicated relationship between technology and war from the colonial period through the present day.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain understanding about the importance of technologies to the development of techniques

of war in the context of U.S. history. 2. Contemplate the role of technology in shaping society and of society in shaping technology. 3. Consider ethical questions about the use and effects of technologies in war. 4. Sharpen critical analytical, reading, and writing skills. 5. Sharpen their ability to use primary and secondary source materials as evidence in persuasive written argument. 6. Improve ability to work as a team. 7. Practice public speaking skills. Credits: 3.00

HIST 30701 - History Of Artificial Intelligence: Minds And Machines

Credit Hours: 3.00. This course examines the long history of efforts in automating human cognition. Historically, the attempts to automate human cognitive functions - from the mere reckoning of numbers to complex decision-making have been entangled with heated debates about what counts as good, proper, and desirable thinking; whose thinking machines should emulate; and whether the thinking of some humans is inferior to that of machines. In this course, we will examine how the invention of calculating machines - analogue and then digital - has developed in tandem with philosophical and scientific theories of human thinking and intelligence. In their turn, the latter developed as a response to changing social, political, and economic currents.

Learning Outcomes: 1. Critique the epistemological foundations and ethical implications of past and present approaches to the automation of human cognition. 2. Use primary sources to make arguments about the role of social, political, economic, and cultural currents that have historically provided the impulses for research and development in the automation of human cognition. 3. Assess historical scholarly arguments about social, economic, and political power asymmetries surrounding artificial intelligences. 4. Create websites to use text, imagery, and video content and effectively communicate how social factors have historically shaped the development of artificial intelligence. Credits: 3.00

HIST 30705 - History Of Data: How Data Became Big

Credit Hours: 3.00. This course offers a long history of Big Data. The first module focuses on how states collected data from the 16th to 19th centuries. Here we will focus on mortality bills, census, statistics, and accounting tables. In the second model, we will pay special attention to data collection and privacy in the 20th century. In the third module, students will explore how previous developments in data collection were applied to the new developments in analog and digital computing. The final weeks of the course will focus on present-day artificial intelligence, big data, their technical limitations, and the ways they often amplify, exploit, and contribute to a wide array of social problems.

Learning Outcomes: 1. Understand a variety of historical contexts that have shaped how we use, collect, and analyze data in the 21st century. 2. Assess historical arguments about the place of data in the growth of state bureaucracies, colonialism, eugenics, national security, warfare, and scientific research made in scholarly secondary sources. 3. Use primary sources to make arguments about the historical contingency of the ways practitioners have been using data to solve state problems. 4. Develop critical thinking about data-empowered algorithms and envision a human-centered and ethical way of creating and implementing data technologies. Credits: 3.00

HIST 30801 - American Eugenics

Credit Hours: 3.00. This course explores the pre-history and history of American eugenics, as well as its afterlives. It analyzes how Americans have used scientific ideas to grapple with questions of heredity and human worth from the Early Republic to the present. We will explore the social and political uses of phrenology, physiognomy, and eugenics, and consider how those scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering.

Learning Outcomes: 1. Read and discuss primary sources. 2. Interpret how scientific knowledge has been applied in human lives and society from the 18th century to the present. 3. Analyze major themes in the history of

eugenics. 4. Investigate how and why specific ideas about human value and genetic worth arise in specific historical contexts. 5. Critique the extent to which scientifically discredited ideas do and do not shape modern studies in demography, genetics, social work, and genetic engineering. Credits: 3.00

HIST 30805 - History Of Life Sciences

Credit Hours: 3.00. This course will examine the development of life sciences from 1750 to the present, introducing students to critical problems related to biology and society through the study of primary and secondary sources. The "life sciences" include all the sciences that deal with life as an organic entity. A prominent theme in this historical treatment is the impact of social and political ideas on the life sciences. Topics will include theories of life, the origin of life, taxonomy and classification, theories of development, natural selection, genetics, eugenics, science and religion, the evolutionary synthesis, biodiversity, ecology and environmentalism, sociobiology, the discovery of DNA, cognition and the brain, and gender in science. Students will develop crucial skills in the interpretation of primary and secondary sources, research, analysis, and presentation.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical material. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 30902 - History Of Biotechnology

Credit Hours: 3.00. This class examines historical intersections between engineering and biology in the Western world. The course begins by considering several possible meanings of "biotechnology." It examines how and why different biotechnologies from the life sciences, biology, and medicine have arisen in specific historical contexts, changed over time, and affected society from the late 19th century to the present. We will study vaccines and beer-making in the 19th century, cell culture, birth control pills, and DNA sequencing in the 20th century, and 21st-century genome editing and synthetic biology, for example. Overall, this course argues that biotechnologies have always forced human beings to consider whether living and non-living entities are made up of the same fundamental "stuff," the implications of manipulating living things, and the nature of life itself.

Learning Outcomes: 1. Identify and describe examples of biotechnologies. 2. Describe the role of biotechnology in history and its relevance for society today. 3. Explain major themes in the history of biotechnology, such as how biotechnologies have changed through time and impacted society by way of their interactions with (for example) ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class. 4. Investigate the history and social impacts of a biotechnology of their choosing that has not been discussed in depth in this class. 5. Explain how and why this biotechnology arose in a specific historical context, changed over time, and impacted (or impacts) society (using historical methods). Credits: 3.00

HIST 30905 - History Of Environmental Science

Credit Hours: 3.00. This course introduces students to various approaches to environmental science through time. It considers critical problems related to the environment and society. The "environmental sciences" include all the sciences that deal with the Earth's physical and organic environments.

Learning Outcomes: 1. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence within an essay format. 2. Formulate and write cogent arguments based on research with primary and secondary historical materials. 3. Evaluate and employ appropriate technology in the collection and analysis of data used as evidence for the required critical essays. Credits: 3.00

HIST 31000 - Historical Geography

Credit Hours: 3.00. Survey of historical geography.

Learning Outcomes: 1. Analyze geographical sources for historical information, and historical sources for geographical information. 2.

Explain how historical processes act across space. 3. Synthesize temporal and spatial information into original conclusions about history. Credits: 3.00

HIST 31005 - The Civil War And Reconstruction, 1850 To 1877 (UCC: HUM)

Credit Hours: 3.00. A survey of the American Civil War and Reconstruction, covering the intense sectional conflict of the 1850s; the military, social, economic, and political aspects of the war; and the political and economic reconstruction that followed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and explain the causes, fighting, and outcomes of the American Civil War and Reconstruction. 2. Understand, analyze, and evaluate different interpretations of the war. Credits: 3.00

HIST 31205 - The Arab-Israeli Conflict

Credit Hours: 3.00. This class traces the emergence of political fault lines in Ottoman Palestine, the immigration of European Jews in the Interwar Era and after World War II, the divisive policies of the British Mandate, the establishment of a Jewish state and the subsequent wars between Israel and surrounding Arab countries. In the end, students study religion as one part of a complex struggle for control over regional resources.

Learning Outcomes: 1. Increase understandings of the political, economic and cultural forces that acted as a catalyst for the Arab-Israeli conflict and continue to underpin and stir them. 2. Reflect on the symbols (monuments, songs, literature, film, language) of Israeli and Palestinian nationalism in order to understand culture productions within conflict. 3. Assess narratives of the Arab-Israeli conflict in film, memoir and other documents in order to develop the skills necessary to read and argue about the past, particularly in a conflict in which historical interpretation itself can be skewed due to political aims. 4. Improve written and oral communication skills while improving analytical skills pertaining to complex issues. 5. Increase global fluency, or student knowledge about diverse cultures. Credits: 3.00

HIST 31305 - Medical Devices And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of material cultures of health care in the United States. The class will analyze how technological innovation has become central to medicine over the last two centuries and how we are coping with the consequences, both intended and unintended, of our reliance upon such medical devices. We will look at identities associated with medical devices, the ways in which disease is constructed, how technologies contribute to the naming of maladies, and implications for emergent bioengineering and biotechnologies.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to medicine. 2. Understand and recognize how assumptions about health influence the practice of science and development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 31405 - Science, Technology, Engineering And Mathematics (STEM) And Gender (UCC: HUM/STS)

Credit Hours: 3.00. Scientific and technological innovation has been a cornerstone of American identity. How science and technology matters to gender, and gender matters to science and technology, will be explored through studying amateur and professional scientists and engineers, industrialization, education, sexual division of labor, and home and work spaces in twentieth-century America. Examining technological, scientific, and engineering innovation through the lens of gender reveals changing relationships between men and women in modern America.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Appreciate the circumstances and history of technological innovation in relation to gender. 2. Understand and recognize how assumptions about gender may influence the practice of science and

development of technologies during the late 19th and 20th centuries. 3. Analyze the design of objects to understand cultural consequences of their use. 4. Develop skills for reading critical historical commentaries and evaluating them. 5. Gain ability to question technological artifacts, practice, and knowledge in historical context. Credits: 3.00

HIST 31505 - American Beauty (UCC: HUM)

Credit Hours: 3.00. This course explores twentieth-century gender history in the United States through the concept of beauty. Ideals about beauty intersect with politics, economics, technological developments, medical innovations, and nation building. A critical examination of beauty as seen through advertising, pageants, and material culture, yields insight about modern womanhood, everyday life, and identify formation in the twentieth-century United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Appreciate the ways that beauty has been pursued by individuals, health practitioners, corporations, and media cultures since 1900. 2. Understand and recognize how assumptions about gender have influenced the way that beauty is constructed and experienced at different places and times. 3. Think historically and critically about the culture consequences of technologies related to beauty. 4. Think historically and critically about approaches to the study of beauty in modern American history. 5. Understand the difference between secondary and primary sources. 6. Analyze and interpret primary documents related to beauty cultures. 7. Understand the competing and conflicting nature of historical interpretation. 8. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 31700 - A History Of The Christian Church And The Expansion Of Christianity I

Credit Hours: 3.00. A history of the emergence of Christianity, the development of the Christian church, and the impact of Christian thought and institutions upon western Europe prior to the Reformation.

Credits: 3.00

HIST 31905 - Christianity In The Global Age

Credit Hours: 3.00. This course examines the social, cultural, economic, legal, and religious dynamics of global Christianity in its emerging centers of Latin America, Asia, and Africa during the 20th and 21st centuries.

Learning Outcomes: 1. Understand key issues in the global Christianity in 20th and 21st centuries. 2. Distinguish between secondary and primary sources, and be able to critically read both types of sources. 3. Synthesize information and arguments from both types of sources. 4. Engage in independent historical analysis with the use of primary and secondary sources. 5. Write analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. 6. Research a contemporary topic using a variety of international sources and write a report analyzing the issue in the context of longer historical developments. Credits: 3.00

HIST 32105 - Spain: The First Global Empire, 1469-1713

Credit Hours: 3.00. This course examines the history of Spain's global empire from the unification of the kingdoms of Castile and Aragon to the War of the Spanish Succession. Topics include Spain's European possessions, overseas empire, ruling dynasty, society, and culture.

Learning Outcomes: 1. Assess the mechanisms that made the Spanish imperial system successful and, likewise, appraise its inherit weaknesses. 2. Distinguish the different stages in the development of the Spanish empire. 3. Judge the extent of the Spanish empire's impact on international politics and regional histories. 4. Evaluate the substantial cultural output of the period. Credits: 3.00

HIST 32300 - German History (UCC: HUM)

Credit Hours: 3.00. A survey of German history from the earliest times until the present. After a brief description of the

medieval empire, we will turn to the Germany of Bismarck and Hitler and its successor states. A recurring theme will be the struggle between forces of liberalism and democracy and those of authoritarianism and militarism.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 32400 - Modern France (UCC: HUM)

Credit Hours: 3.00. A survey of modern France since 1789, including political, social, industrial, and institutional development. Emphasis is also placed upon the colonial and international aspects of French history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 32501 - Twentieth Century Europe Through Autobiography

Credit Hours: 3.00. Merits and limitations of autobiographies as sources for 20th-century European history.

Credits: 3.00

HIST 32900 - History Of Women In Modern Europe (UCC: HUM)

Credit Hours: 3.00. This course examines women's experiences and constructions of femininity in Europe from 1789 to the present, including women in revolutions, state intervention in the family, changing ideas of sexuality, women's movements, women in socialism and fascism, and women in war.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will understand the history of women in modern Europe from 1789 to the present by analyzing women's experiences and the social and cultural constructions of femininity as well as the different contexts of class, ethnicity, and nationality in the history of European women. 2. They will think historically and critically about women's participation in revolutions; state interventions in the family; working lives of women; ideals and practices of sexuality; the middle-class model of domesticity and women's responses to it; the role of women and femininity in imperialism; women in socialism, under fascism, and in the transition from communism to capitalism; women's experiences of two world wars; and the rise of feminist movements and contemporary feminisms in Europe. 3. Students will understand the difference between secondary and primary sources. They will read and interpret primary source materials, including fiction, autobiography, and other historical documents including those written by women. 4. Students will develop their critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 33205 - The Nuclear Age (UCC: HUM/STS)

Credit Hours: 3.00. Once seen as a revolutionary and exceptional, nuclear technologies have become central to many aspects of life in the U.S. This course uses the history of nuclear technologies to trace how American society has grappled with technological change.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Write a persuasive essay evaluating nuclear energy as a source of power, using primary and secondary historical sources to support your claims. 2. Create a compelling argument about how societies cope with technological change, using the history of nuclear technologies as a central example. 3. Summarize the importance of nuclear technologies in US history, drawing on primary and secondary historical sources introduced in the course. Credits: 3.00

HIST 33505 - Nationalism And Socialism In East Central Europe

Credit Hours: 3.00. This course examines how the peoples of East Central Europe engaged and coped with the most influential ideologies of the 20th century; with special attention to the weaknesses of the interwar and postwar regimes, strategies of modernization, survival, and dissent.

Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities which have shaped modern east central European society, culture, and politics. 2. Think historically and critically about approaches to the study of East Central European history, including the outcomes of

ideological experimentation, and perspectives on how this region fits into a broader global context. 3. Use primary source evidence to analyze fundamental problems in modern East Central European history in individual writing and group work. 4. Sharpen critical reading, thinking, writing, and discussion skills. Credits: 3.00

HIST 33605 - Global LGBTQ History

Credit Hours: 3.00. This course will examine sexual and gender diversity during the last two centuries of accelerating global interconnectivity. Although the US-derived framework of LGBTQ+ identities has become increasingly popular, people around the world have and continue to understand themselves in a multitude of ways that extend beyond this current acronym. This course will discuss the rich complexity of sexual cultures across the world as well as how they connect through global processes, such as colonialism, warfare, and migration, that have defined the nineteenth and twentieth centuries.

Learning Outcomes: 1. Identify ways different societies under examination have understood gender and sexual diversity in the past. 2. Differentiate lines of scholarly analysis in the field of LGBTQ+ history. 3. Apply queer theory to primary source analysis. 4. Develop original research projects based in/relating to existing scholarship. 5. Connect contemporary concerns to historical study. 6. Develop research projects for a public audience. Credits: 3.00

HIST 33700 - Europe Since 1945

Credit Hours: 3.00. This course traces the history of Europe, west and east, from 1945 to the present. Once viewed as a success story, culminating in the collapse of eastern European communism, developments after 1990 - such as the breakup of Yugoslavia, the European debt crisis, and the War in Ukraine - call this simplistic narrative into question. This course will consider Cold War division, decolonization, and political protest alongside democratization and economic recovery.

Learning Outcomes: 1. Explain broad themes in postwar European history, including the Cold War as geopolitical process and a historical framework, the role of decolonization in shaping European politics, the impact of social movements, and the distinctions and overlaps between different economic systems. 2. Read historical scholarship for arguments, evidence, and contributions to the field and assess their effectiveness in these areas. 3. Craft a persuasive argument supported by primary and secondary source evidence that makes an intervention into the historical literature on a chosen topic. 4. Interpret a diverse range of historical sources and assess their utility in understanding the past, paying attention to form, perspective, and limitations. 5. Present historical research clearly and accessibly to different audiences using a variety of media formats. Credits: 3.00

HIST 33805 - History Of Human Rights (UCC: HUM)

Credit Hours: 3.00. This course explores human rights' genealogy and uneven historical development from Atlantic Revolutionary articulations through the late 20th Century and experience of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain a deeper understanding of the patterns and processes, ruptures and continuities in the human rights history narrative, which have shaped today's world, its politics, ideas, and ambitions. 2. Explore how human rights connects us to other people, places and times. 3. Analyze fundamental problems in human rights in history in individual writing and in group work and be engaged in an environment of open inquiry to exchange ideas and interpretations of human rights concepts. 4. Be better prepared to negotiate the variable applications of human rights concepts in today's globalized world. Credits: 3.00

HIST 33900 - Traditional China

Credit Hours: 3.00. Chinese civilization from its origins to the end of the Ming Dynasty. Attention is divided equally between political and cultural history, giving emphasis to the

development of traditional institutions in Chinese society as well as to art, literature, religion, and philosophy.

Credits: 3.00

HIST 34000 - Modern China (UCC: HUM)

Credit Hours: 3.00. Chinese history from the Qing Dynasty (1644) to the present, with emphasis on the period since 1800. Attention given to internal developments and China's response to Western thought and material accomplishments. Nationalism and communism in the twentieth century are examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34300 - Traditional Japan (UCC: HUM)

Credit Hours: 3.00. The course considers Japanese civilization from its origins to the establishment of the Tokugawa Shogun (1603). Divided between political and cultural history, it will emphasize the development of traditional institutions in Japanese society, religion, philosophy, art, and literature.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34400 - History Of Modern Japan (UCC: HUM)

Credit Hours: 3.00. A survey of Japanese history from the nineteenth century to the present, including Japan's response to Western expansionism, the formation of the modern state, political parties, industrialization, the Pacific War, the American Occupation, the postwar "economic miracle," and Japan today.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 34505 - Arabs in American Eyes

Credit Hours: 3.00. This course explores Arab-American relations over the past 300 years, using American writings on the Middle East and North Africa as a prism for viewing evolving conceptions of national identity and global power in the United States.

Learning Outcomes: 1. This course will improve students' ability to communicate their ideas in a small classroom setting. 2. The assigned course materials will encourage them to think more broadly in terms of primary sources, for students will be required to analyze classic works of literature, films and art. 3. Their writing skills will improve, because students will be required to synthesize and analyze assigned course materials in thematic essay questions designed to improve their ability to define a thesis statement and also to defend it. Credits: 3.00

HIST 34705 - History Of Religion In America

Credit Hours: 3.00. This course examines the history of religion in the United States from the colonial period to the present. It traces the evolution of religious life in America and religion's influence on American politics, society, and culture.

Learning Outcomes: 1. Summarize and compare American religious movements and analyze their significance in American history and society. 2. Distinguish between secondary and primary sources and critically read both types of sources; synthesize information and arguments from both types of sources. 3. Engage in independent historical interpretation with the use of primary and secondary sources; research an historical religious figure, movement or event, and evaluate its influence on American religious history. 4. Compose analytical essays in fluid English prose with thesis statements, clear organization, and appeals to concrete evidence. Credits: 3.00

HIST 34901 - The First World War (UCC: HUM)

Credit Hours: 3.00. This course is designed to explore the origins, course, meaning, and lasting legacy of World War I.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students are expected to understand the origins, course, and results of World War I. 2. Students are expected to understand the consequences that the war had on today's world. Credits: 3.00

HIST 35100 - The Second World War (UCC: HUM)

Credit Hours: 3.00. A study of the diplomacy, economic mobilization, and military operations of World War II, 1939-1945.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HIST 35205 - Death, Disease And Medicine In Twentieth Century American History (UCC: HUM/STS)

Credit Hours: 3.00. This course examines the history of disease, dying, and medicine in the United States in the 20th century.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify and explain the relationship between science and culture and interdisciplinarity. 2. Analyze texts and cultural artifacts about medicine. 3. Identify medical practice and how it is informed by context and culture. Credits: 3.00

HIST 35305 - Sports In America

Credit Hours: 3.00. Today sports virtually dominate American culture. From fantasy leagues and 24-hour a day news shows to business decisions and off-the-field troubles to the games themselves, sports entertain Americans at the same time as they define American culture and social norms. This course will look at the growth of the sport industry in the 20th Century. It will examine the lives and importance of Babe Ruth, Joe Louis, Jackie Robinson, Muhammad Ali, and other athletes, as well as the economic, social, and medical impact of the games we watch.

Learning Outcomes: 1. Comprehend the role that sports has played in American society. 2. Analyze the centrality of race in sports and in America more broadly. 3. Apply their course knowledge to a range of professions in one of the largest industries in America; namely, in television and other media, marketing, management, etc. 4. Hone their active writing skills for effective professional application. Credits: 3.00

HIST 35500 - History Of American Military Affairs (UCC: HUM)

Credit Hours: 3.00. Surveys American military policy from the colonial militia to the atomic age. Covers major wars and limited wars. The course also investigates the peacetime military functions, i.e., the Navy's role in diplomacy and the Army's involvement in Indian affairs.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 35900 - Gender In East Asian History (UCC: HUM)

Credit Hours: 3.00. Examination of the construction of tradition and modernity in East Asia through the lens of gender. Topics include the influence of "Confucian" ethics; gender and imperialism, nationalism and revolution; and social change in the aftermath of war and decolonization.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 36105 - History Of Science, Technology, And Environment In Pre-Modern East Asia

Credit Hours: 3.00. This course explores developments in scientific, technological, and ecological history specifically in Pre-modern East Asia. In this class, we will read basic theories and methods in the history of science and technology, as well as basic debates and questions that challenge scholars studying the history of science, technology, and the environment in a non-western pre-modern context. We will explore how society, culture, and politics affect knowledge production and people's engagement with nature, and how these interactions, in turn, shaped society, culture, and politics. All readings are in English. No prior knowledge of East Asia is necessary.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural, economic, and social experiences and/or structures shaped the history of science and society in pre-modern East Asia. 2. Discuss examples of scientific and technological changes and the costs and benefits for individuals and specific societies. 3. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 4. Investigate the diversity of human experience in pre-modern East Asia, explain how social factors such as ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, have shaped the development or application of science and technology, including tools and strategies by which societies promote, constrain, or otherwise

influence scientific and technical innovation. 5. Identify and explain the major themes of the history of science, technology, and environment, write about the role of science in society, and describe ethical implications of technological and scientific developments. Credits: 3.00

HIST 36305 - The History Of Medicine And Public Health (UCC: HUM/STS)

Credit Hours: 3.00. The purpose of this course is to provide students with a historical understanding of the role public health and medicine has played in American history during the 19th and 20th centuries. How does the health status of Americans reflect and shape the U.S.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Understand how and why public health has evolved over the course of the past two centuries. 2. Identify and analyze how scientific beliefs and social anxieties contribute to policies and practices of medicine and health. 3. Develop critical thinking skill to assess the impact of public health reforms on everyday life. Credits: 3.00

HIST 36405 - Patient Voices In The History Of Medicine

Credit Hours: 3.00. This course examines the history of medicine in the United States from the early twentieth century to the present by starting with patient voices, which provide a glimpse into the experience of illness. Using patient reflections as the primary lens through which to examine the history of medicine, topics covered include historical changes and historical decision making related to the diagnostic process, therapeutic interventions, access to care, and medical institutions. The course also examines how assumptions about gender, race, and class have shaped differential health outcomes such as mortality rates, time to diagnosis, and determination of treatment approach and efficacy.

Learning Outcomes: 1. Identify in written and oral communication key features of the U.S. medical system by examining how patient experiences have changed over time and in different contexts. 2. Analyze how assumptions about race, gender, and class can affect the experience of illness, access to care, and health outcomes. 3. Engage with primary sources such as journal entries, memoirs, newspaper articles, artwork, and audiovisual material to identify patient perspectives and place them in historical context, and to illustrate how social, cultural, political, and economic factors have shaped the practice of medicine. 4. Reflect on the ethical issues that have arisen in medicine using patient voices as a lens to examine the impact of technology on the illness experience. 5. Examine patient experiences to make an argument about the history of medical practice, such as the diagnostic process or therapeutic approaches, using historical methods. Credits: 3.00

HIST 37005 - Queens And Empresses In Early Modern Europe

Credit Hours: 3.00. This course explores the lives and legacies of queens and empresses in early modern Europe within the wider context of gender, political authority, culture, and monarchy. Students will be introduced to new scholarly approaches to the study of female rulership.

Learning Outcomes: 1. Compare the legal, cultural, and symbolic aspects of queenly authority across monarchies and centuries applying the relevant vocabulary and conceptual frameworks. 2. Evaluate the political intervention of various individual queens and empresses taking into account the many variables that shaped their rule. 3. Distinguish the ways in which queens and empresses shaped national histories as well as European international politics and culture. Credits: 3.00

HIST 37100 - Society, Culture, And Rock And Roll (UCC: HUM)

Credit Hours: 3.00. Surveys American society and culture through the prism of rock and roll music. Looks at politics, gender, race, and class in the postwar era to examine and explain the social, economic, and technological forces that shaped rock and roll.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37200 - History Of The American West

Credit Hours: 3.00. This course explores the history of the trans-Mississippi and Pacific west from the early 17th century to the late 19th century. The diverse experiences of the inhabitants and the environmental transformations are the central themes of the course.

Learning Outcomes: 1. Understand the environmental and human history of the American west. 2. Be aware of the complicated and overlapping experiences of the inhabitants of the west including, but not limited to, the diverse indigenous population and the myriad groups of settlers from Asia, South and Central America, Europe, and the US. 3. Gain a new appreciation of how diverse populations interacted with multiple environments of the American west and the ongoing impact of that legacy on our modern times. 4. Build upon and improve skills as critical thinkers and readers. 5. Enhance skills in oral communication and analytical writing. Credits: 3.00

HIST 37500 - Women In America Since 1870 (UCC: HUM)

Credit Hours: 3.00. A survey of the history of women in the United States from 1870 to the present.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37600 - History Of Indiana

Credit Hours: 3.00. Economic, political, and social history of Indiana from the state's earliest beginnings as a part of the old Northwest Territory to the present.

Credits: 3.00

HIST 37700 - History And Culture Of Native America (UCC: HUM)

Credit Hours: 3.00. This course explores the societies of Native North America in a historical context, from pre-historic times to the present, examining Native world views and belief systems to understand their historical relations with each other, and with Europeans and their descendants.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 37901 - The Corporation In East Asia, 1600-Present

Credit Hours: 3.00. This course explores the rise of major corporations in modern East Asia, including China, Japan, Korea, Taiwan, and Vietnam, from 1600 to the present. Students will develop skills in contextualizing primary sources and scholarly works to form their own insights into the interactions between corporations, society, and the state. This course provides invaluable insights into the intersections of economic power, political authority, and social change in the modern era.

Learning Outcomes: 1. Examine case studies of major East Asian corporations, to understand their role in shaping regional economies and global markets. 2. Analyze the historical trajectory of corporations, their socio-economic impact and political ramifications in East Asia, from 1600 to the present. 3. Evaluate the complex relationships between corporations, society, and state in East Asia critically, considering factors such as industrialization, colonialism, and globalization. 4. Develop advanced skills in source evaluation, analytical thinking, and academic writing through choosing appropriate primary sources and scholarly literature. Credits: 3.00

HIST 37902 - The Silk Road And Pre-Modern Commerce

Credit Hours: 3.00. This course introduces the history of the Silk Road - a complex network of trade routes that connected China with the rest of Eurasia over land and sea - and its role in fostering cultural and material exchanges between the peoples it connected. It will revisit key moments of the Silk Road in pre-modern history to understand how Eurasia was connected through vast networks of traders and caravans, and will situate temporally and geographically the main states, actors, objects, religions, and ideas that have populated the roads, oasis towns, and steppe territories constituting the Silk Road.

Learning Outcomes: 1. Demonstrate a basic understanding of historical contexts, major concepts, and theoretical perspectives in the history of pre-modern Silk Road trading routes across time and place. 2. Identify diverse

historical groups, cultures, and commercial interests on Silk Road networks. 3. Compare and contrast the strengths and weaknesses of contending scholarly interpretations of the conflicts and connections along the Silk Road. 4. Develop advanced skills through source evaluation, analytical thinking, and academic writing through choosing appropriate primary sources and scholarly literature. 5. Evaluate how historical knowledge informs and can shape global decisions and responsibilities in today's world. Credits: 3.00

HIST 38001 - History Of United States Agriculture (UCC: HUM/STS)

Credit Hours: 3.00. This course surveys the main development in North American agricultural history, emphasizing the continental United States. Topics include early American agriculture, the plantation system, land policy, scientific and technological change, agrarian politics, water rights, migrant labor, and agricultural policy.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Gain a broad understanding of the major economic, social, political, scientific and technological development in the history of American agriculture. 2. Analyze the causes, consequences, and significance of the major events and issues that have influenced the agricultural history of the United States. Credits: 3.00

HIST 38105 - American Indians And Film

Credit Hours: 3.00. This course investigates ways that Hollywood filmmakers influenced public perceptions of Native American history and culture through feature films. Students explore issues of race, gender, class, ethnicity, ideology, and nature, as well as the work of indigenous filmmakers.

Learning Outcomes: 1. Recognize aesthetic and narrative practices in modern film through discussion and written analysis. 2. Recognize and understand the genesis and impact of stereotypes of Native Americans perpetuated through film in classroom discussions and written assignments. 3. Articulate key trends in American filmmaking and the evolving representations of Native Americans through in-class presentations. 4. Investigate and critically analyze films produced by non-Native and Native filmmakers in a research essay. Credits: 3.00

HIST 38200 - American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Survey of the fundamental principles of American constitutionalism and dominant trends in judicial interpretation, from the creation of the Constitution to the period of the New Deal.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38300 - Recent American Constitutional History (UCC: HUM)

Credit Hours: 3.00. Intensive study of constitutional questions and Supreme Court answers from the period of the Warren Court to present. Particularly emphasized are the areas of segregation, civil rights, and civil liberties and guarantees for personal rights.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 38400 - History Of Aviation (UCC: HUM/STS)

Credit Hours: 3.00. A comparative history of human flight and air power (in Europe, the Americas, and Asia) from its origin in the early inventors and pilots, through its reflection in the popular media, to the global development of civil and military aviation.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 38505 - Media, Politics And Popular Culture (UCC: HUM)

Credit Hours: 3.00. This class examines the relationship of media, politics, and popular culture over the course of the twentieth century in American history. Students trace how new media shaped political institutions and practices and afforded opportunities for political change.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the historical

development in American political, cultural, economic, and social structures by examining primary and secondary sources. 2. Analyze primary and secondary sources to explain how and why these historical developments happened. 3. Pursue original primary research about a specific topic in American history and synthesize primary and secondary materials to advance on original arguments about the roots, shape, and implications of a historical moment. 4. Interrogate modern media myths with an analysis of primary sources that will allow students to go beyond popular narratives of history and understand a more complicated historical reality. 5. Recognize the historical roots of contemporary political debates. 6. Understand the relationship between politics and popular culture in ways that will allow students to navigate the contours of the mass media, entertainment, and the American political process more effectively. Credits: 3.00

HIST 38605 - Land Of The Indians: Native Americans In Indiana

Credit Hours: 3.00. This course offers a survey of Native American and Indigenous history and culture in the historic region encompassing the modern state of Indiana. The course opens in the pre-Columbian era and is organized chronologically to the present day.

Learning Outcomes: 1. Read, analyze, and synthesize archeological data and research through written analyses and discussions. 2. Read, analyze, and synthesize primary historical documents and research through written analyses and discussions. 3. Demonstrate increased knowledge and cultural awareness of the significance of Native Americans in Indiana's history through examination and written analyses. 4. Critique both scholarly and popular accounts of the history of indigenous people in the region and state and express those ideas through oral presentations and classroom discussion. Credits: 3.00

HIST 38700 - History Of The Space Age (UCC: HUM/STS)

Credit Hours: 3.00. The historical interaction between human values and space exploration in the contemporary age, focusing on issues of global interdependence. Topics include the international competition in rocketry, the Cold War in space, the moon missions, space disasters, and satellite technology.

University Core Curriculum (UCC): (UCC: HUM/STS) Credits: 3.00

HIST 39400 - Environmental History Of The United States (UCC: HUM)

Credit Hours: 3.00. This is a mid-level survey designed to provide students of environmental science with historical background and students of history with the unique perspective of environmental history.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

HIST 39500 - Junior Research Seminar

Credit Hours: 3.00. Variable title seminar for history majors in their junior year intended to teach historical skills, including research in primary sources, analytical skills, and forming historical arguments. It is a writing-intensive course and counts as one of the major requirements.

Learning Outcomes: 1. History majors will learn historical skills such as primary source research and analysis and how to form historical arguments. 2. Acquire analytical skills sufficient to distinguish between primary and secondary sources, to analyze arguments and interpretations, and to recognize interpretive conflicts. 3. Engage in integrative learning. 4. Develop the ability to recognize, analyze and incorporate primary source material into scholarly investigations and analyses. 5. Improve their information literacy and enhance their creative thinking. 6. Strengthen skills in critical thinking and oral communication. 7. Improve their writing skills. Credits: 3.00

HIST 39600 - African American History To 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history to 1877 that emphasizes Black Americans' African origins and their experiences in the transatlantic slave trade, American slavery, Colonial America and the early United States as well as their fight for abolition and freedom during the Civil War and Reconstruction.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 39800 - African American History Since 1877 (UCC: HUM)

Credit Hours: 3.00. This course covers major themes in African American history from 1877 that focus on Black Americans' struggle to overcome social, economic, and political oppression and to win basic civil and human rights while making valuable contributions to American society.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain a knowledge and understanding of the relationship between the experiences of African Americans and United States history as a whole. 2. Gain an understanding and knowledge of the political, economic, and social processes that shaped African American history. 3. Learn how to ""think historically"" by placing documents written in the past in their historical contexts, and to consider the relationship of the past to the present. Credits: 3.00

HIST 40000 - Great Books And The Search For Meaning

Credit Hours: 3.00. This intellectual-history course discusses the meanings of the Great Books within their particular historical contexts and the universal quest for self-understanding, focusing on good and evil; mystery and reason; the nature of power; and what it means to be human.

Learning Outcomes: 1. Read and think critically about a wide variety of texts that are significant in the history of civilization. 2. Write and speak with intelligence and eloquence. 3. Gain a greater understanding of history, of their humanity, and of social and political relationships. 4. Become culturally literate, better able to understand the varied cultural models of their world, and better prepared to meet the needs of global citizenship. Credits: 3.00

HIST 40300 - Europe In The Reformation

Credit Hours: 3.00. A study of decay and renewal in European society, 1300 to 1650. Concentrates on the Protestant and Catholic Reformation and religious wars, but also covers the Northern Renaissance, the New Monarchies, and the discovery and exploration of the New World.

Credits: 3.00

HIST 40500 - The French Revolution And Napoleon

Credit Hours: 3.00. A study of revolutionary France from the fall of the ancient regime to the Congress of Vienna. Divided in emphasis between the period of the revolution and the era of Napoleon, the course stresses social, political, ideological, and institutional developments.

Credits: 3.00

HIST 40600 - Rebels And Romantics: Europe 1815-1870

Credit Hours: 3.00. Examines the dramatic social, cultural, and political developments in Europe following the defeat of Napoleon through various rebellious and romantic personalities, as well as figures who supported conservative or reformist solutions to the upheavals of industrialization, revolution, and nationalism.

Credits: 3.00

HIST 40700 - Road To World War I: Europe 1870-1919

Credit Hours: 3.00. Studies the increase in Europe's wealth and power through conquest, industrialization, and nation-state rivalries, along with the social stress and cultural anxiety that culminated in World War I; examines the war from the perspectives of both combatants and civilians.

Credits: 3.00

HIST 40800 - Dictatorship And Democracy: Europe 1919-1945

Credit Hours: 3.00. This course examines the fleeting triumph of democracy across Europe. Followed by the rise of fascism, communism, and Nazism. Emphasis will be placed on broad economic, social, and cultural transformations as well as individual choices to resist or conform.

Credits: 3.00

HIST 41005 - History Of The American Presidency (UCC: HUM)

Credit Hours: 3.00. Using a historical perspective, examines the shifting role of the presidency in the American imagination and the cultural, social, and economic changes that have wrought political developments in public functions and expectations of the modern presidency.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the historical development in American political, cultural, economic, and social structures by examining primary and secondary sources. 2. Analyze primary and secondary sources to explain how and why these historical developments happened. 3. Pursue original primary research about a specific topic in American history and synthesize primary and secondary materials to advance an original argument about the roots, shape, and implications of a historical moment. 4. Interrogate the role of the modern American presidency in American political life with an analysis of primary sources that will allow students to go beyond popular biographies of presidents and understand a more complicated historical reality of the debate about the responsibilities and nature of the office. 5. Recognize the historical roots of contemporary political debates about the presidency and the constitutional authority of the institution. 6. Understand the modern American presidency in ways that will allow students to better navigate the American political process more effectively. Credits: 3.00

HIST 41300 - Modern European Imperialism: Repression And Resistance

Credit Hours: 3.00. This course examines the expansion, transformation and collapse of 19th and 20th-century European empires, focusing on colonial encounters and relationships. Students should come to the course familiar with major developments, events and themes in modern European and/or global history.

Learning Outcomes: 1. Contextualize and compare important events and moments in the history of European imperialism and decolonization. 2. Analyze and evaluate how historians interpret the past, and examine how this past continues to shape the present. 3. Analyze an array of historical sources and types of evidence, historical narratives, first-person accounts and commentaries, scholarly interpretations, visual imagery and fictional portrayals, as well as the setting in which these sources were produced. 4. Craft original arguments supported by historical and textual evidence in class discussions and weekly writing assignments. Credits: 3.00

HIST 41505 - Gender And Politics In Early Modern Europe

Credit Hours: 3.00. This course explores the role of gender (its discourse as well as its practice) in the emergence, consolidation, and centralization of European political systems from the Renaissance to the French Revolution, such as princely courts, republics and monarchies.

Learning Outcomes: 1. Appraise the role of men, women, and gender discourse in the evolution of the main political systems of early modern Europe from the fifteenth to the eighteenth centuries. 2. Evaluate the mechanisms and power structures that included or excluded early modern women and men in the political process. 3. Apply the conceptual framework of gender and politics to a specific case study in 10-12-page analytical paper. Credits: 3.00

HIST 42100 - Honors Historical Methods

Credit Hours: 3.00. Designed as a prequel to Honors Thesis; this course introduces the Honors students to various advanced interpretative approaches to history and methods of historical research. Students also choose their topic for their Honors Thesis and begin research.

Credits: 3.00

HIST 42200 - Honors Thesis In Historical Research

Credit Hours: 3.00. Designed as a sequel to HIST 42100 (Honors Historical Methods); this course is intended as the culminating academic experience for students in the Department of History Honors Program. It will require the completion of an undergraduate thesis in history. Permission of instructor required.

Credits: 3.00

HIST 42300 - Advanced Topics In Modern Germany

Credit Hours: 3.00. This course offers a reading-intensive study of a specific period or theme in modern German history. Semester-long topics might include Imperial Germany; Weimar Germany; Divided Germany (1945-1990); or thematic studies on culture, religion, or military affairs.

Learning Outcomes: 1. Convey an understanding of the course material. 2. Designed to improve students' ability to communicate their ideas in a small classroom setting. 3. Enhance students' ability to analyze historical monographs critically. 4. Teach students to synthesize a semester's worth of reading in thematic essay questions. Credits: 3.00

HIST 43900 - Communist China

Credit Hours: 3.00. The evolution of the Communist movement (1921-1949) and the development of the Communist government (since 1949) in China. Attention is given to political, economic, social, and cultural changes.

Credits: 3.00

HIST 44100 - Africa In The Twentieth Century

Credit Hours: 3.00. A problem-oriented course in the modern history of Africa from 1880 to 1975. It analyzes origins of African nationalism, European colonialism, racial conflict, and war leading to the independence revolution of the 1960s and 1970s.

Credits: 3.00

HIST 45000 - The English Landscape:Integrating History, Horticulture & Landscape Architect

Credit Hours: 3.00. Intensive four weeks in residence in Corsham, UK with visits to significant sites to examine the intersections between human culture and the natural environment that results in the developed landscape. Permission of instructor required.

Credits: 3.00

HIST 46000 - American Colonial History

Credit Hours: 3.00. An investigation of the foundation of the American colonies, their place in the British imperial structure, and the eventual conflict of imperial exigencies with colonial self-interest and national feeling.

Credits: 3.00

HIST 46100 - The Revolutionary Era, 1763 To 1800

Credit Hours: 3.00. An analysis of the origins, nature, and consequences of the American Revolution; of the achievements and difficulties of the new nation under the Articles of Confederation; of the drafting and adoption of the Constitution; and of the initial political, economic, and social progress of the United States under the Federalists.

Credits: 3.00

HIST 46700 - The Emergence Of Modern America

Credit Hours: 3.00. Examines the changes in American society between 1877 and 1932. The course covers such issues as the rise of industry, the growth of consumerism, the shift to a multi-ethnic society, imperialism, Populism, Progressivism, World War I, and the 1920s.

Credits: 3.00

HIST 46800 - Recent American History

Credit Hours: 3.00. Examines the issues that shaped American society, politics, foreign policy, and culture from 1932 to the present. Covers the Great Depression, World War II, the Cold War, and the Vietnam War as well as the social, cultural, and economic impact of those events.

Credits: 3.00

HIST 46900 - Black Civil Rights Movement

Credit Hours: 3.00. This course will examine the origins, dynamics, and consequences of the modern black civil rights movement by exploring how struggles for racial equality and full citizenship worked to dismantle entrenched systems of segregation, repression, and discrimination within American society and culture.

Credits: 3.00

HIST 47005 - Women And Health In America (UCC: HUM)

Credit Hours: 3.00. This course examines the historical relationship between women and health by exploring a number of critical themes that have affected women's health in the United States.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Analyze the ways in which societal assumptions about gender, health and sickness, along with race and class, help to determine the course of treatment. 2. Analyze the role of primary sources in contributing to our understanding of women's health. Credits: 3.00

HIST 47300 - History Of The South

Credit Hours: 3.00. Geographic, economic, cultural, social, and political aspects of the South. The significance of such figures as Jefferson, Jackson, Calhoun, Jefferson Davis, and Woodrow Wilson. The emphasis is on the evolution of the intellectual climate.

Credits: 3.00

HIST 47600 - The Civil War In Myth And Memory

Credit Hours: 3.00. This seminar will explore how the Civil War has been celebrated and/or remembered from 1865-present.

Credits: 3.00

HIST 47700 - Native American Women's History

Credit Hours: 3.00. This course studies the history of indigenous women in North America from pre-contact to the present era, examining their roles through the experience of colonization and decolonization underscoring issues of sovereignty, identity, activism, kinship, public images, and stereotypes.

Credits: 3.00

HIST 48005 - Madness And The Asylum In The United States

Credit Hours: 3.00. This course explores how Americans have understood insanity and asylums. We analyze historical concepts of insanity, the evolution of asylums, how psychiatrists have debated therapeutics, and how ordinary people have experienced treatments and diagnoses.

Learning Outcomes: 1. Gain knowledge of some of the major debates in the history of insanity. 2. Be able to identify a research question, conduct primary source research, and form a thesis. 3. Use a variety of databases to assemble a range of primary sources. 4. Learn to interrogate and compare primary sources for viewpoint and implicit value system. 5. Gain knowledge of some of the major theoretical approaches and frameworks used for studying the history of insanity. 6. Be able to discuss ideas and research in formal writing and in seminar discussion. Credits: 3.00

HIST 48500 - Topics In American Political History

Credit Hours: 3.00. This course deals with broad thematic and chronologically defined topics in American political history from the Revolutionary Era to the late twentieth century. Content will vary with the faculty member teaching the class.

Credits: 3.00

HIST 48800 - History Of Sexual Regulation In The United States

Credit Hours: 3.00. This course will illuminate broad themes in the historical regulation of sexual violence, consensual sex, and homosexuality. Student will understand and analyze how cultural, social, religious, and moral ideologies have influenced conceptions of deviant and normative sexuality in the United States.

Learning Outcomes: 1. Students will be able to articulate verbally and in writing what they have learned about the nineteenth and twentieth century history of sexual regulation. 2. Students will be able to identify and analyze the cultural and religious values which informed sexual regulation. 3. Students will develop a deeper

understanding of how regulations and reform worked by conducting primary source research and synthesizing it into written arguments. Credits: 3.00

HIST 49200 - Seminar In Historical Topics

Credit Hours: 3.00. Course description will vary according to specific topic proposed to study.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will develop the ability to distinguish between primary and secondary sources. 3. Students will analyze arguments and interpretations, and recognize interpretive conflicts. 4. Students will strengthen skills in oral communication. 5. Students will improve their information literacy and engage in creative and critical thinking. 6. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49400 - Science And Society In American Civilization

Credit Hours: 3.00. This course examines the development of science in the United States from colonial times to the present. Emphasis in the earlier periods is placed on comparison and contrast of the American scene with that of Europe. Subsequent treatment deals with industrialization, and maturation of the American scientific community, and the increasing social effects of science. Among those considered are the forces making for urbanization, for greater interdependence among science, industry and government, and for repercussions in intellectual affairs.

Learning Outcomes: 1. Examine, interpret, and explain how personal, political, cultural economic, and social experiences and/or structures shaped the history of science and society. 2. Analyze data using historical methodologies to evaluate causal arguments and analyze assertions, assumptions, and explanatory evidence related to the history of science and society. 3. Investigate the diversity of human experience within Western culture, considering, for example, ethnicity, gender, language, race, religion, sexual orientation, age, culture, disability, and social class, and appreciate the contribution of different social groups in science and society. 4. Identify and explain the major themes of the history of science and write about the role of science in society and social implications of science. Credits: 3.00

HIST 49500 - Research Seminar In Historical Topics

Credit Hours: 3.00. This course is designed to train history majors in the fundamentals of historical research and writing. Course descriptions vary according to specific topics proposed for study by instructors.

Learning Outcomes: 1. Students will acquire a perspective on and advanced understanding of the course content. 2. Students will learn historical skills such as primary source research and analysis and how to form historical arguments. 3. Students will advance their information literacy and creative and critical thinking, acquire analytical skills sufficient to distinguish between primary and secondary sources. 4. Students will learn to analyze argument and interpretations and recognize interpretive conflicts. 5. Students will become familiar with multi-draft writing and the revision process. Credits: 3.00

HIST 49900 - History Internship

Credit Hours: 1.00 to 3.00. This course allows students to earn credit for internships. Examples of qualified internships would include work with museums, historical societies, and various units of government. Credit and course requirements arranged with the instructor. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

School of Interdisciplinary Studies

About the Interdisciplinary Studies Program

The School of Interdisciplinary Studies (SIS) incorporates the various interdisciplinary programs in the College of Liberal Arts ranging from area studies, ethnic studies, to comparative studies. While each of our programs share the value of interdisciplinarity, our approaches range from multidisciplinary-in which people from different disciplines collaborate, interdisciplinary-in which knowledge and methods from different disciplines are integrated, to transdisciplinary-in which a new unity of intellectual frameworks are created beyond the originating disciplines. Despite this variation in approach, our programs all recognize the need and value of interdisciplinary approaches to integrate and synthesize knowledge to provide a fuller understanding of a topic. The School of Interdisciplinary Studies is a community of faculty and students enjoying an environment of rigorous and innovative intellectual inquiry.
The School of Interdisciplinary Studies (SIS) consists the following interdisciplinary programs: African American Studies, American Studies, Asian American Studies, Comparative Literature, Critical Disability Studies, Film & Video Studies, Global Studies, Jewish Studies, Latin American & Latino Studies, Linguistics, Native American and Indigenous Studies, Peace Studies, Religious Studies, and Women, Gender & Sexuality Studies.

Faculty

School of Interdisciplinary Studies Department Directory

Contact Information

Purdue University College of Liberal Arts
Beering Hall of Liberal Arts and Education, Room 1290
100 North University Street
West Lafayette, Indiana 47907-2098
Phone: 765 494-3663
Fax: 765 494-3660

Academic Advising Office

BRNG 1114

Phone: 765 494-3670

Fax: 765 496-1910

Undergraduate Future Students

BRNG 1168

Phone: 765 494-6291

Fax: 765 496-1910

Email: newstudent@purdue.edu

Office of Interdisciplinary Studies

BRNG 1289

Phone: 765 496-1848

Fax: 765 494-3660
Please visit the School of Interdisciplinary Studies for more information.

Graduate Information

For Graduate Information please see Interdisciplinary Studies Graduate Program Information .

Latin American and Latino Studies Minor

School of Interdisciplinary Studies

Women's, Gender & Sexuality Studies, BA

Religious Studies, BA

African American Studies Minor

American Studies Minor

Asian American Studies Minor

Global Liberal Arts Studies Minor

Jewish Studies Minor

LGBTQ Studies Minor

Native American and Indigenous Studies Minor

Religious Studies Minor

Women's, Gender, & Sexuality Studies Minor

African American Studies, BA

American Studies, BA

Jewish Studies, BA

Linguistics, BA

Global Studies, BA

Critical Disability Studies Minor

Islamic Studies Minor

Digital Humanities Certificate

Linguistics Minor

AAS 27100 - Introduction To African American Studies (UCC: HUM)

Credit Hours: 3.00. Introduction to the philosophical and methodological principles underlying Afro-American studies. Dimensions of the black experience, including history, education, politics, psychology, economics, religion, social organization, and art, will be covered, and the requisite academic tools and sources will be examined.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AAS 27700 - African American Popular Culture

Credit Hours: 3.00. This course focuses on the production of popular culture through African-based and non African-based traditions among African Americans in the United States. Pop culture forms covered include film, theatre, visual arts, literature, dance, sports, music and religious traditions.

Credits: 3.00

AAS 35900 - Black Women Writers

Credit Hours: 3.00. (ENGL 35900) This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

AAS 37000 - Black Women Rising

Credit Hours: 3.00. This course examines the rise of black women and their impact on economic, social, and cultural issues.

Credits: 3.00

AAS 37100 - The African American Experience

Credit Hours: 3.00. Focus on specific topics of the personal experiences of blacks, in Africa and the diaspora, including black identity, black culture, and the relationships between blacks and society.

Credits: 3.00

AAS 37300 - Issues In African American Studies

Credit Hours: 3.00. Focuses on a specific topic that relates to selected issues in the life, history, and culture of peoples of African ancestry.

Credits: 3.00

AAS 37500 - The Black Family

Credit Hours: 3.00. This course considers and examines the black family as a social institution, focusing on both recent research as well as more descriptive accounts of issues concerning the black family.

Credits: 3.00

AAS 37600 - The Black Male

Credit Hours: 3.00. This course examines critically the factors contributing to the deteriorating status of African American males and the positive ways of coping with that experience. Includes an overview of research perspectives defining current knowledge on the subject.

Credits: 3.00

AAS 39200 - Caribbean History And Culture

Credit Hours: 3.00. This course introduces students to the rich and varied literary texts produced by black women writers. Literary analysis, along with a consideration of historical, cultural, gender, and racial contexts will be emphasized.

Credits: 3.00

AAS 47300 - Blacks In Hollywood Film

Credit Hours: 3.00. A history of the representation of blacks in mainstream film throughout the twentieth century.

Credits: 3.00

AAS 47400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers research techniques used by researchers to observe and to interpret scholarly investigation on race, class and gender from an African-American perspective.

Credits: 3.00

AAS 49000 - Directed Readings In African American Studies

Credit Hours: 3.00. This course allows students to create an independent course of study with an instructor on a topic relevant to the African, African American, or African Diasporic experience.

Credits: 3.00

AAS 49100 - Special Topics In African American Studies

Credit Hours: 1.00 to 4.00. Special Topics in African American Studies addresses special topics or projects under the direction of the instructor in the field of African American or African Diasporic Studies. The course may vary from 1-4 credit hours. It may be taught as a lecture or as a lecture with a lab.

Credits: 1.00 to 4.00

AMST 10100 - America And The World (UCC: WC)

Credit Hours: 3.00. This course examines the evolution of American culture as the United States transitioned from a relatively isolated country at the end of the 19th century to an active shaper of a global community by the 21st century. We will examine ways in which American Culture shaped and was shaped by international relationships that transcend nation states. We will explore reactions to, and the results of, the spread of American culture both inside and outside the United States. By studying traditional cultural forms like art, music, design, literature, film, and technology the course will build a foundation from which to understand the configuration of American culture. Yet the course will also emphasize American culture expression, that in the forms of television, advertising, sport, cartoons, social media, video games, fashion, food, drugs, and automobiles, have transcended the geographical boundaries of the United States to engage in global interplays of material cultural exchange.

University Core Curriculum (UCC): (UCC: WC) Learning Outcomes: 1. Identify the major themes and issues prompted by the term American Culture. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Recognize important issues that occur among peoples in an increasingly interconnected and interdependent world. 5. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 6. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

AMST 20100 - Interpreting America (UCC: HUM)

Credit Hours: 3.00. Introduction to the interdisciplinary study of American culture, history, and society in its national and global contexts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify the major themes and issues prompted by the term

American. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest American identities. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze aspects of American culture using interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on that analysis, and communicate them effectively verbally and in writing. Credits: 3.00

AMST 21000 - Sport In American Culture (UCC: BSS)

Credit Hours: 3.00. This course engages critical questions regarding sport and its role in American culture. It examines the ways sport serves as a key site for the study of larger social issues and social problems, including how race, gender, social class and other social locations are simultaneously reproduced and challenged in and through sport. The course also explores the relationships between sport and other major social institutions, such as the economy, education, politics, and media.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Understand sport as a social construction. Understand sport as a contested activity. 2. Identify and explain the relationships of sport to other institutions in society, including politics, education, economy, and the media. 3. Explain the role of sport in central social issues, including race/racism, gender/sexism, class, homophobia, and violence. 4. Apply academic theories and concepts to the study of sport. Credits: 3.00

AMST 22000 - Technology And Play (UCC: HUM)

Credit Hours: 3.00. This course introduces students to games, as well as investigating innovations and controversies in the gaming industry. It will explore theories of play, how technological innovations and business practices in both digital and analog gaming (through board games, video games, tabletop games, and esports) mediate or structure the experience of play. It will also survey the rise of myriad gaming subcultures, including celebrity streamers and esports.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify important categories of games. 2. Demonstrate critical thinking skills of observation, explanation, and interpretation to assess sociological and cultural trends in the different spaces of gaming. 3. Produce original work using logic, creativity, and interpretive skills examining different games and industry practices. Credits: 3.00

AMST 25000 - An Introduction To American Protest Movements: What Are They? What Can They Do? How Can We Make One? (UCC: HUM)

Credit Hours: 3.00. In this course, we will study the reasons people in the United States have historically decided to create social movements, tactics and strategies they use to make and sustain those movements, obstacles to their success, and ways of judging their victories. The course will draw on scholarship on social movements from various fields, especially the field of American Studies. Because social movements are created by ordinary people, we will use a variety of sources they leave behind: speeches, testimonials, pamphlets, historical accounts, autobiographies, manifestos. We will also explore scholarship on social movements to try to understand how best to record and analyze the work social movements do. The course seeks to provide students an understanding of the role of protest movements in American history. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge across a range of chronological, cultural and geographic areas. 2. Show an understanding the ways protest movements shape American culture. 3. Describe how different aspects or types of human endeavor and experience may be connected. 4. Identify the roots of contemporary issues and challenges, with attention to social values and the role of identity in the human experience. 5. Apply a critical perspective to evaluating arguments, including the quality of sources, the validity of the interpretations of those sources, and the soundness of the argument's use of evidence to support that interpretation. 6. Formulate and support an argument in a well-focused, logically

organized piece of writing. Credits: 3.00

AMST 30100 - Perspectives On America

Credit Hours: 3.00. Advanced interdisciplinary study of American culture, history, and society in their national and global contexts.

Credits: 3.00

AMST 31000 - Invention, Innovation, And Design (UCC: HUM/STS)

Credit Hours: 3.00. This course focuses on the various ways that invention, innovation, and design shape the modern world. We will investigate the forms, uses, and meanings of a diverse set of objects, networks, and systems that influence the ways we live. We will explore these ideas through the concepts of consumption, waste, and "smart" to gain a deeper understanding of how material infrastructures influence human existence. This project-based course will use readings, discussions, and critical reflections to inform a series of hands-on projects to understand our roles as designers, creators, and users of science, technology, and material culture. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms invention, innovation, and design. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through designed objects. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze invention, innovation and design through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 32000 - Understanding The National Football League

Credit Hours: 3.00. This course counters the cultural myth that sports are "simply a form of entertainment" or "an escape from reality" and takes seriously the notion that sports matter as a social, cultural, and political force. Students will use academically informed inquiry and investigation to examine broader cultural dynamics through a critical examination of the National Football League. Course topics include how the NFL shapes social identities including race, gender, sexuality, and American identity, the connection between football and militarism, the relationship between the NFL and commercialism, the role the NFL plays in the triad of men's violence, among other topics.

Learning Outcomes: 1. At the end of this course you will be able to summarize the evidence and conceptual arguments that the NFL is a cultural institution by which we can understand American society by exploring key topics covered in course in class activities, film response papers, and exams. 2. At the end of the course you will be able to explain how the National Football League matters as a social, political, and cultural force. 3. At the end of the course, you will be able to respond, from a critically informed academic perspective, to common sense beliefs that the NFL is simply "entertainment" or an "escape from reality." Credits: 3.00

AMST 32500 - Sports, Technology, And Innovation (UCC: HUM/STS)

Credit Hours: 3.00. This course examines how science, technology, engineering, and data analysis reshape sports. Traditionally, sports have been understood as competitions between humans. However, recent technoscientific developments have altered this arrangement and have changed the ways sports are played. We have reached a place where heated competitions not only take place on the fields of play, but also within scientific and engineering laboratories. The fundamental question this project-based course will address is: how will new and emerging scientific knowledge and technological innovations transform sports? We will explore topics ranging from football, baseball, basketball, and soccer, to e-sports, fantasy sports, and sports analytics.

University Core Curriculum (UCC): (UCC: HUM/STS) Learning Outcomes: 1. Identify the major themes and issues prompted by the terms sports, technology, and innovation. 2. Assess the multiple processes by which people express, institutionalize, celebrate, and contest meaning through the play and consumption of

sports. 3. Appreciate the cultural diversity of the American experience, especially in terms of class, ethnicity, gender, and race. 4. Develop the skills to analyze sporting invention, innovation, design, and culture through the use of interdisciplinary source materials, research methodologies, and intellectual approaches. 5. Reach independent conclusions based on research-based analysis and communicate them effectively verbally, in writing, and through project-based assignments. Credits: 3.00

AMST 33000 - American Car Culture

Credit Hours: 3.00. The automobile has become one of the most influential technologies of the 20th century, and continues to impact American life in the 21st. This course will examine the immense social, political, technological, and environmental impacts of the car on American culture; and take an interdisciplinary approach to the understanding the automobile industry, its production systems, its marketing strategies, and the way automobiles reflect the changing landscapes of consumer tastes and values over time.

Learning Outcomes: 1. Identify the various technological innovations that contributed to mass production of the automobile. 2. Understand how automotive design shaped American society. 3. Recognize the cultural effects of widespread automobile use in the United States. Credits: 3.00

AMST 49000 - Senior Capstone In American Studies

Credit Hours: 6.00. Interdisciplinary senior capstone project in American Studies. Permission of department required.

Learning Outcomes: 1. Conceptualizing a research project from two or more disciplinary perspectives, conducting original research designed to reveal key aspects of American culture past or contemporary, and presenting interdisciplinary research findings in verbal, visual, or an approved creative form. Credits: 6.00

ASAM 24000 - Introduction To Asian American Studies (UCC: HUM)

Credit Hours: 3.00. A general introduction to Asian American history and culture, with a focus on the diverse and multifaceted experiences of peoples of Asian descent in America and their contributions to U.S. culture and society.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ASAM 34000 - Contemporary Issues In Asian American Studies

Credit Hours: 3.00. Overviews various issues in contemporary Asian American Studies through theoretical and literary readings combined with examinations of popular media. Topics examine the multiple intersections of race, ethnicity, class, gender, and sexuality.

Credits: 3.00

ASAM 34200 - Special Topics In Asian American Studies

Credit Hours: 3.00. This course will focus on specific issues and themes in Asian American Studies.

Learning Outcomes: 1. Explore specific topics in Asian American Studies. 2. Acquire knowledge and critical skills pertinent to the examination of Asian American issues, texts and other cultural materials. Credits: 3.00

ASAM 49000 - Special Topics In Asian American Studies

Credit Hours: 3.00. Various topics in Asian American studies, changing from semester to semester as presented by different instructors.

Learning Outcomes: 1. Vary due to the variable nature of the course. Credits: 3.00

CDIS 23900 - Introduction To Disability Studies

Credit Hours: 3.00. Introduces students to the principles of and debates within disability studies. Topics explored include ideas of normalcy; the social model of disability; history of eugenics and its current manifestations; relations between disability and other identity categories; issues of social and physical access; cultural representations of disabled people.

Learning Outcomes: 1. Identify different models of understanding disability. 2. Understand the

ways normalcy is socially constructed. 3. Distinguish between impairment and disability. 4. Offer informed opinions on current eugenic practices. 5. Compare and contrast disability to other identity categories such as race, gender, and sexuality. 6. Identify exclusionary practices that marginalize disabled people. Credits: 3.00

CDIS 29000 - Special Topics In Critical Disability Studies

Credit Hours: 3.00. Various topics in critical disability studies, changing from semester to semester as presented by different instructors.

Learning Outcomes: 1. Vary due to variable nature of course. Credits: 3.00

GSLA 10100 - Global Awareness

Credit Hours: 3.00. This course surveys a range of global issues to develop an understanding and appreciation of the major geographical and cultural areas of the world and the issues that both unite and divide such areas and their people. The course will examine key political, economic, social, historical and cultural patterns that define our modern world. It encourages students to raise 'big' questions about what processes and institutions helped constitute the modern moment, as well as about the dynamic interactions between our social world and the natural one. This is a gateway course for prospective Global Studies Majors and Minors.

Learning Outcomes: 1. Develop critical thinking. 2. Develop cultural competence. 3. Understand communication across cultures. 4. Develop ethical decision making. Credits: 3.00

GSLA 30100 - Theories Of Global Studies (UCC: HUM)

Credit Hours: 3.00. The course is designed to introduce students to the major schools of thought in Global and International Studies. It provides students with critical tools to explore the interconnectedness of our world from multiple perspectives. The course will expose students to a variety of international scholars who have understood Global Studies to be more than globalization. Instead, it introduces contested issues and contradictory positions concerning the meaning and significance of globalization.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Gain an understanding of key theoretical approaches to the question of globalization and its role in the discipline of Global Studies. 2. Learn how to evaluate competing and opposing analytical frameworks. 3. Apply a theoretical framework to a concrete problem or case. Credits: 3.00

GSLA 39100 - Special Topics In Global Studies

Credit Hours: 3.00. This variable title course deals with topics that explore a range of experiences and analytical perspectives clustered around the contemporary global experience. The course will vary in subject matter but focus on the challenges and rewards of a globalized world as articulated through topics such as cross-border histories, music, gender, racial formations, film, and economic development. Content will vary with the instructors teaching the course.

Learning Outcomes: 1. Understand, by definition but also by analytical variation, the range of lived experiences and critical perspectives that encompass the contemporary global experience. 2. Recognize the cultural, economic, and political characteristics that define contemporary globalization. 3. Think and write analytically about contemporary globalization through topics such as national or regional histories, music, gender and/or racial formations, film, literature, politics, and economics. Credits: 3.00

GSLA 48000 - Senior Interdisciplinary Capstone Project In Global Studies I

Credit Hours: 3.00. The senior capstone course for Global Studies majors is designed to give students the chance to define and complete a research project of personal interest, and to integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001. The capstone courses are offered to students in their senior year to be completed the final two semesters of their major. Students will assemble a committee of two or more faculty members willing to direct their work. The Director of Global Studies will be an ex-officio member of the committee. Students will incorporate their prior coursework (including foreign language training), study abroad, and/or internships into their final project. The capstone may be, but is not limited to, a senior honors project, a multimedia project, service learning, or directed research. Timeline for a successful capstone project: Spring of Sophomore year: After three semesters of coursework, the student will start defining an area of interest or passion that will form the basis of their capstone research.

Junior Year: The student will select courses in their interest area. They will also start speaking to faculty members in the field in order to assemble their committee. Spring of Junior Year: Students will finalize their faculty committee to direct their research. Fall of Senior Year: Research Semester, as directed by the committee. GSLA 48000. Spring of Senior Year: Complete project. GSLA 48001.

Learning Outcomes: 1. Demonstrate an awareness of Global issues through academic inquiry and extracurricular engagement. 2. Critically apply multi-perspective research frameworks to a concrete problem or case. 3. Recognize historic roots of Global inequality. 4. Develop intercultural competence and demonstrate empathy for difference. Credits: 3.00

GSLA 48001 - Senior Interdisciplinary Capstone Project In Global Studies II

Credit Hours: 3.00. The senior capstone is a year-long course for which Global Studies majors enroll in consecutive semesters. Its primary goal is for students to define and complete a research project of personal, academic, and/or professional interest, as they integrate the interdisciplinary aspects of their entire curricula into one project. Students must complete GSLA 48000 and GSLA 48001 in order to complete the Global Studies major.

Learning Outcomes: 1. Varies per student project/ capstone. Credits: 3.00

IDIS 20100 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods through critical inquiry. 4. Create a process for developing and completing a digital project. Credits: 3.00

IDIS 29000 - Interdisciplinary Topics

Credit Hours: 0.00 to 6.00. Course topics and patterns will vary.

Credits: 0.00 to 6.00

IDIS 49000 - Directed Reading In Interdisciplinary Studies

Credit Hours: 1.00 to 3.00. Reading under the direction of the instructor in a particular field of study. Permission of instructor required.

Credits: 1.00 to 3.00

IDIS 49100 - Special Topics In Interdisciplinary Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of the instructor in a particular field of specialization.

Learning Outcomes: 1. Formulate significant research questions and conduct research relevant to those questions. 2. Consider a topic from multiple perspectives. 3. Demonstrate critical thinking and problem-solving abilities. 4. Demonstrate effective communication skills. Credits: 1.00 to 4.00

JWST 33000 - Introduction To Jewish Studies (UCC: HUM)

Credit Hours: 3.00. An interdisciplinary course touching on the full range of Jewish experience from antiquity to the present. Several members of the Jewish Studies faculty and guest lecturers participate, representing such fields as anthropology, history, language, literature, philosophy, politics, religion, and sociology.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LALS 25000 - Introduction To Latin American And Latino Studies

Credit Hours: 3.00. Interdisciplinary and integrative presentation and examination of the historical, political,

economic, and cultural processes of Latin America, from independence to the present followed by an analysis of scholarly works that include theoretical models, methodological strategies, and analytical approaches to learning about US Latinos. Special emphasis is placed on the immigrant experience and its role in the incorporation of Latinos into the US society.

Credits: 3.00

LALS 26000 - U S Latino Culture

Credit Hours: 3.00. This course uses an interdisciplinary approach to study Latino culture in the United States through art, film, literature, music and theater.

Credits: 3.00

LALS 30100 - Latin American Literary And Cultural Studies

Credit Hours: 3.00. Focuses on Latin American literatures and cultural products, such as film, music, and/or art. As a variable-topics course, individual sections may variously focus on South and/or Central America, Mexico, the Caribbean, U.S. Latina/o populations, or any combination of the above. Individual sections may also examine major cultural and historical movements, and/or canonical and emerging authors and artists. May be repeated for credit.

Credits: 3.00

LALS 30300 - Latin American Languages And Linguistics

Credit Hours: 3.00. Focuses on the languages and linguistic practices of Latin American and/or U.S. Latina/o populations, also including the Caribbean. As a variable-topics course, individual sections may variously focus on the nature and structure of specific languages, as well as the study of their dialects, semantics, and histories; the history, structure, uses, and educational concerns of Latin American indigenous, Caribbean Creole and/or U.S. Latina/o speech communities; or any combination of the above. May be repeated for credit.

Credits: 3.00

LALS 34700 - Latin American Politics

Credit Hours: 3.00. Focuses on major aspects of Latin American and/or U.S. Latina/o politics and development. As a variable-topics course, individual sections may variously focus on U.S. foreign policy toward countries in Latin America, the U.S.'s historical role in the politics of the Western hemisphere, the impact of the military on political development, the dynamics of Latin American industrialization, Latin America's changing international role, Latinas/os's political participation in the United States, or any combination of the above. Individual sections may also Latin American political thought from the colonial period through the present day.

Credits: 3.00

LALS 35500 - Political Economy Of Latin America

Credit Hours: 3.00. Examines the salient issues of the 21st century in the political economy of Latin America. The first part introduces students to the historical evolution of the region's economy and its socio-economic and political determinants. Then it focuses on topical inquiry, analyzing key policy areas, frameworks and choices at the core of the current political economy of the region's countries: fiscal and industrial policies, monetary and financial policies and policies on trade, migration and inequality, energy and the environment.

Credits: 3.00

LALS 40100 - Special Topics In Latin American/Latino Studies

Credit Hours: 3.00. Investigation of a special topic in Latin American or US Latina/o studies. The topic will vary from semester to semester.

Credits: 3.00

LALS 40200 - Directed Reading In Latin American/Latino Studies

Credit Hours: 1.00 to 6.00. Directs the reading of students with special interests in Latin American or U.S. Latina/o studies. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 6.00

LING 20100 - Introduction To Linguistics (UCC: BSS)

Credit Hours: 3.00. Basic concepts of linguistics and methods of analysis of language; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax, and semantics, and to problem-solving techniques, with material drawn from a variety of languages.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

LING 31100 - Fundamentals Of Phonology And Morphology

Credit Hours: 3.00. Basic concepts and tools of phonological and morphological analysis viewed through the material of American English. Current theoretical approaches to phonology and morphology, including word-formation processes and

applications.

Credits: 3.00

LING 31500 - Elements Of Phonetics

Credit Hours: 3.00. Introduction to articulatory phonetics. Mechanisms of production of speech sounds. Sounds of languages of the world, ear training for discriminating speech sounds, and practice in broad and narrow phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be given for both LING 31500 and SLHS 30600.

Credits: 3.00

LING 32100 - Foundations Of Syntax And Semantics

Credit Hours: 3.00. Introduction to syntactic and semantic analysis based on American English and its dialects. Underlying structure and its relation to meaning. Analysis of parts of speech, constituent phrases, sentence structure, representations, ambiguity, and applications of current theory. Credit will not be given for both LING 32100 and ENGL 32800 .

Credits: 3.00

LING 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American English in African American speech communities and the United States culture at large.

Credits: 3.00

LING 39800 - Special Topics In Linguistics I

Credit Hours: 3.00. Investigation of a special topic in linguistics. The topic will vary from semester to semester. Permission of instructor required.

Credits: 3.00

LING 47000 - TENL Practicum

Credit Hours: 3.00. As the final course of the TENL program, the Practicum builds on participants' knowledge and skills of teaching multilingual learners by revisiting previous learning in the TENL program. This course requires participants to demonstrate mastery and application of concepts covered in previous courses (e.g., oral language progression, literacy development, test construction, domains/subsystems of language, language teaching methodologies, etc.) and assesses what participants currently know and believe about English language instruction, literacy acquisition, and approaches to professional development. Experiential learning or fieldwork in a classroom setting is required. In order to qualify for TENL certification, students must obtain a grade of C or higher in all TENL courses.

Credits: 3.00

LING 49000 - Directed Reading In Linguistics

Credit Hours: 1.00 to 4.00. Independent study and reading on a topic in linguistics directed by a faculty member. Permission of instructor required.

Credits: 1.00 to 4.00

LING 49800 - Special Topics In Linguistics II

Credit Hours: 3.00. Investigation of a special topic in linguistics. The topic will vary from semester to semester. Permission of instructor required.

Credits: 3.00

LING 49900 - Research In Linguistics

Credit Hours: 1.00 to 3.00. Undergraduate research into a designated topic in linguistics. Permission of instructor required.

Credits: 1.00 to 3.00

MARS 22000 - Introduction To Medieval And Renaissance Studies

Credit Hours: 3.00. An introduction to the interdisciplinary study of the Middle Ages and Renaissance.

Credits: 3.00

REL 20000 - Introduction To The Study Of Religion (UCC: HUM)

Credit Hours: 3.00. This course will introduce students to the academic study of religion through an exploration of various methodologies available for a critical, reflective investigation of the study of religion.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

REL 20100 - Interpretation Of The New Testament

Credit Hours: 3.00. An investigation of the religious content of the Christian Scriptures in light of the historical, social, and intellectual contexts out of which they emerged. Other canons and extra-canonical interpretations of the New Testament will also be investigated.

Credits: 3.00

REL 20200 - Interpretation Of The Old Testament

Credit Hours: 3.00. An investigation of the religious content of documents Christians call the "Old Testament" in light of the historical, social, and intellectual contexts out of which they arose. The student will be introduced to problems and methods in their interpretation.

Credits: 3.00

REL 20300 - Theology Of Paul

Credit Hours: 3.00. A critical examination of the Pauline and Deutero-Pauline epistles, the book of Acts, and other first century texts associated with Paul of Tarsus. Students will be introduced to problems and methods in the interpretation of ancient texts.

Credits: 3.00

REL 20400 - Introduction To Christian Theology

Credit Hours: 3.00. This course is an introductory survey of the goals and aims of theology in the Christian tradition. Focus is on the content of Christian theology, its methodological presuppositions and principles of development.

Credits: 3.00

REL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (PHIL 33000) A study of the history, teaching, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

REL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (PHIL 33100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

REL 24000 - Engaging Religious Diversity (UCC: HUM)

Credit Hours: 3.00. The course offers students case-based explorations of local and global religious diversity in various cultural contexts. Religious diversity in secular spaces and the significance of religion for shaping community identities will be examined from multiple disciplinary perspectives. Students will analyze religious representations and influences in the public sphere by studying examples from different genres and media. Additionally, this course offers students opportunities to improve their religious literacy and gain real-world experience through experiential learning projects.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify religious values and practices from multiple traditions. 2. Explain the importance of engaging religious diversity in various contexts. 3. Analyze interactions between religion and civic participation. 4. Evaluate the role of religion in shaping identities. 5. Assess public representations of religion. Credits: 3.00

REL 25000 - A History Of The Christian Afterlife

Credit Hours: 3.00. An exploration of the ways Christians have envisioned the afterlife, including New Testament descriptions. Apocryphal notions, Patristic conceptions, mystical and 19th century descriptions of heaven as sexual union, and 20th century understandings of the afterlife as a "process of education".

Credits: 3.00

REL 26400 - The Bible As Literature (UCC: HUM)

Credit Hours: 3.00. A literary study of selections from the Old and New Testaments as examples of Hebrew and early Christian literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain the methods, objects of study, and applications of Interdisciplinary Studies and Liberal Arts, especially related to the Bible. 2. Employ critical approaches from basic building blocks to more advanced ones suited to cultural complexities. 3. Explain and employ different genres of reading, including argument through evidence and close reading. 4. Demonstrate written and visual literacies by analyzing diverse media. 5. Demonstrate knowledge of and proficiency in different types of writing, including argument through evidence and written

persuasion. 6. Demonstrate content knowledge of specific Biblical books and their genres. Credits: 3.00

REL 31700 - Ancient Judaism And Early Christianity

Credit Hours: 3.00. This course is a study of the emergence of Judaism and the rise of Christianity out of roots in the history of ancient Israel. This will include noticing the effects of Greek culture, evidence of anti-Semitism and admiration of the Jews, conversion in a setting of religious pluralism, and the development of Jewish and Christian self-definition in this climate.

Credits: 3.00

REL 31800 - The Bible And Its Early Interpreters

Credit Hours: 3.00. This course will start with observation of the development of early themes in later parts of the Hebrew Bible and proceed to the on-going influence of these themes in Jewish literature outside the Hebrew canon (apocrypha, pseudepigrapha, targums, midrash, Josephus, Philo, and other Hellenistic Jewish authors), as well as in pagan literature of this era and in early Christian literature, particularly the New Testament.

Credits: 3.00

REL 35100 - Christian Mysticism

Credit Hours: 3.00. A critical, historical examination of the development of Christian mystical thought, beginning with its earliest intimations in the Hebrew Scriptures, the thought of Plato and Aristotle and continuing through Patristic, Medieval, Renaissance, Reformation, Counter-Reformation and Modern periods to the present.

Credits: 3.00

REL 45000 - Christian Ethics

Credit Hours: 3.00. The course explores the historical development of Christian moral theology, from pre-Christian times to the present. It includes a study of Biblical moral conceptions, patristic, medieval, Enlightenment, modern, and contemporary understandings of Christian ethics.

Credits: 3.00

REL 45100 - Christology

Credit Hours: 3.00. The course examines the historical development of Christological doctrine in the Christian faith from the age of the New Testament to the late 20th/early 21st century, paying special attention to the New Testament and conciliar formulations.

Credits: 3.00

REL 45200 - Systematic Theology

Credit Hours: 3.00. An introduction to the nature, tasks, and methods of what Christians have called "systematic theology", historically conceived through an exploration of the writings of figures such as Augustine, Aquinas, Melancthon, John Calvin, Barth, and Paul Tillich.

Credits: 3.00

REL 49100 - Special Topics In Religious Studies

Credit Hours: 3.00. Investigation of a special topic in Religious Studies. The topic will vary from semester to semester.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

WGSS 28000 - Women's, Gender, And Sexuality Studies: An Introduction (UCC: BSS/HUM)

Credit Hours: 3.00. An introductory survey of the concepts and research data in the new scholarship on women. Topics covered include biology, sexuality, socialization, family and work, creativity, and politics.

University Core Curriculum (UCC): (UCC: BSS/HUM) Credits: 3.00

WGSS 28100 - Variable Topics In Women's, Gender, And Sexuality Studies

Credit Hours: 1.00 to 4.00. This course examines in-depth particular topics from the introductory course in Women's Studies. It addresses gender issues for both men and women. Possible topics include gender and popular culture, women's bodies, body image, and health, masculinities, queering gender and gender transgression.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and

identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 28200 - Introduction To LGBTQ Studies (UCC: BSS)

Credit Hours: 3.00. (ANTH 28200) This course offers students an introduction to the interdisciplinary study of lesbian, gay, bisexual, transgender and queer lives. It provides a basic grounding in theories of sexuality and LGBT histories, identities and movements in the U.S. and globally.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Students will gain a broad overview of the cultural history of sexualities both in the West and globally from the pre-modern era to the contemporary period. They will grasp the way sexual and gender identities change over time and across space. They will analyze how sexual identity intersects with gender, race, and class. They will develop a theoretical understanding of the social construction of sexuality, sexual identities and transgender identities. Credits: 3.00

WGSS 38000 - Comparative Studies In Gender And Culture (UCC: BSS)

Credit Hours: 3.00. This course expands students' understanding of gender issues by exploring the multicultural diversity of women's lives. It examines how race, class, sexuality, and culture interact and shape society and ecology in the United States and in a global context.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the diversity of feminist thought within the U.S. and globally. 2. Summarize the following concepts: 1) sex and gender; 2) social construction and essentialism; 3) oppression; 4) privilege; 6) resistance and social activism. 3. Analyze how gender operates as system of social stratification and differentiation in major arenas of social life such as home and family, work, politics, education, and sexuality across various cultural contexts. 4. Define some of the multi and trans-cultural interactions among gender, race, class, sexuality, and national belonging and some of the ways in which ""woman/women"" and ""man/men"" is a constructed category that is historically and culturally shaped. 5. Demonstrate an understanding of activist awareness and commitment to women's and LGBTQ+ issues from a multi/trans-cultural and global perspective. 6. Make explicit connections between matters discussed in this class and the events and interactions of your daily life. Credits: 3.00

WGSS 38100 - Women Of Color In The United States

Credit Hours: 3.00. Explores the diversity of racial and ethnic groups in the United States with a particular emphasis on the histories, experiences, and cultural contributions of women of color. Provides a broad introduction to the intersections of gender, race and ethnicity.

Credits: 3.00

WGSS 38200 - Love, Sex And Sexuality

Credit Hours: 3.00. Explores intimate relationships and marriage practices in Western and non-Western societies from a historical and comparative perspective. Examines the changes in love and marriage in Greco-Roman societies, medieval and modern Europe, China, India and the Muslim world, among others.

Credits: 3.00

WGSS 38300 - Women, Work, And Labor

Credit Hours: 3.00. Examines race, class and gender issues as they affect working women in America. Covering women's work from domestic labor to informal economies to factories, topics include women's participation in trade unions, wage inequalities, family leave policies and sexual harassment.

Learning Outcomes: 1. Have acquired a broad comprehension of the work, including economic activity often not recognized as "work", that women typically have performed or is typically associated with women, world-wide and since the onset of industrialization. 2. Be capable of evaluating current global economic and cultural systems that impact what kinds of labor contemporary women perform, the conditions under which they work, and the nature of the gendered systems of labor that prevail in the U.S. and elsewhere. 3. Gain appreciation for the significance of women's unpaid or underpaid care-work, relational work, affective labor, and the "reproductive" labor underpinning global capitalism and industrialism. 4. Place their own personal lives and contexts within an analytical framework informed by feminist, Marxist, and intersectional perspectives on work and labor. Credits: 3.00

WGSS 39000 - Variable Topics In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Variable topics under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

WGSS 48000 - Feminist Theory

Credit Hours: 3.00. Intensive study of a variety of contemporary and international feminist theories from an interdisciplinary perspective. Provides an overview of major trends, critical approaches, and diverse viewpoints in the field of feminist theory.

Credits: 3.00

WGSS 48200 - Interdisciplinary Studies In Sexuality

Credit Hours: 3.00. This course offers an interdisciplinary introduction to recent work in lesbian and gay studies in various fields, including literature, history, film, cultural theory, medicine, law, and studies of sexuality.

Learning Outcomes: 1. Develop an in-depth understanding of the cultural and historical processes that shape sexual identities and practices in different cultural contexts globally. 2. Assess the impact of political, cultural, and global ideologies on systems of gender and sexuality. 3. Think critically about sexual and gender representations in the US and globally. 4. Develop an advanced understanding of queer and feminist theories of sexuality. Credits: 3.00

WGSS 48300 - Feminisms In Global Perspective

Credit Hours: 3.00. Explores feminist struggles through the writings of First and Third World feminist scholars. Focuses on feminist projects within and against colonial, nationalist, religious and global contexts. Includes Third World feminist critiques of Western feminisms.

Credits: 3.00

WGSS 48500 - Feminist Perspectives On Film

Credit Hours: 3.00. In this course, students investigate the gendered and intersectional meanings ascribed to or generated by popular cinematic and other mass-distributed visual texts, with particular attention to the way that visual media have

impacted women's participation in public culture over the last century and a half. This course is highly conceptual, asking students to learn to recognize power relations hiding within visual entertainments and embedded within the experience of everyday life, with the goal of deepening their understanding and appreciation of the experience of spectatorship and visuality as a central element of modern American and contemporary global mass culture.

Learning Outcomes: 1. Appreciate the ideological work that entertainment and mass cultural texts such as popular films perform. 2. Analyze popular visual texts including film and video for the meanings and power relations they invoke. 3. Apply feminist and queer theorizing of gender, gender identity, and sexuality to visual texts. 4. Assess the intersectional impact that popular film and cinema have had on women and sexual minorities. 5. Understand the ways that American popular film, particularly those produced in Hollywood for mass distribution, has shared American culture and global relationships since the inception of cinema in the late 19th century. Credits: 3.00

WGSS 49200 - Practicum In Women's, Gender, and Sexuality Studies

Credit Hours: 2.00 to 4.00. This course is designed to integrate knowledge derived from women's studies scholarship with practical experience. Students will define their own projects in consultation with women's studies faculty. Periodic conferences and written reports required. Permission of instructor required.

Credits: 2.00 to 4.00

WGSS 49900 - Independent Study In Women's, Gender And Sexuality Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of the instructor in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Understand the basic principles of feminist critical race, queer, class, transgender, and crip theories and methods. 2. Operationalize intersectional transnational analysis using the basic principles of social location, privilege, and oppression. 3. Cultivate critical consciousness and reflexive thinking that enable interventions that foster equity and social justice. 4. Acquire knowledge of and skills in anti-oppression activism. 5. Understand the regulatory functions of social institutions and identify strategies for transforming them to maximize their liberatory potential and minimize oppression. 6. Execute justice-oriented critiques of historical developments and current perspectives associated with feminist, anti-racist, queer, class, and literary and film studies. 7. Analyze how cultural values about identity and social location such as gender, sexuality, race, ethnicity, class, caste, nationality, immigrant status, ability, religious affiliation, structure societies locally and globally to create inequity and privilege. Credits: 1.00 to 4.00

School of Languages and Cultures

Overview

About the Languages and Cultures Program

Our School offers undergraduate courses in language, literature, linguistics, culture, civilization, and film. We provide instruction in the target languages as well as some courses in English, in face to face, online, and blended formats, and instruction for heritage speakers of Chinese and Spanish. Language clubs and honorary societies, guest lectures, international film series, coffee and tea conversation hours, and theater performances help enhance our students' knowledge and experience of other languages and cultures.

SLC faculty members cover a richly diverse range of research areas and have received international acclaim for their scholarship, as well as many prestigious teaching awards for their performance in the classroom. The following notable scholarly publications are edited by faculty and staff in the department: Proceedings of the Japanese Literary Studies (PAJLS), *Purdue Studies in Romance Literatures* (PSRL); and *Global Business Languages*.

One of SLC's strengths lies in its offerings of classes in

languages for specialized purposes. These classes equip students with the practical communication skills they will need for using the target language while studying or traveling abroad, participating in internships, or preparing for globally oriented career paths. Such classes include business and scientific language classes at various levels and languages, as well as Medical Spanish and Spanish for the Professions. Certificates of achievement in languages for specialized purposes are in development and will give students tangible documentation of their practical language coursework; for an example, click here to view the one already available in German.
The Center for Technology-Enhanced Language Learning and Instruction (TELL Center) supports technology-oriented research and development applicable to foreign language instruction. The Center is committed to disseminating and sharing research results and developed products through a variety of channels for the betterment of the field of foreign language education. The Center has developed an online speaking practice/assessment/research platform, Speak Everywhere. It has been fully commercialized by e-Language Learning LLC and is available world-wide. For inquiries, use the Inquiry/Support link of the product website."
Study abroad is an important part of a language education, and our faculty and staff work in close collaboration with the Office of Programs for Study Abroad to find our students the best university programs in other countries.

Faculty

School of Languages and Cultures Directory

Contact Information

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Please visit the School of Languages and Cultures for more information.

Graduate Information

For Graduate Information please see Languages and Cultures Graduate Program Information .

Spanish: World Languages Teaching Concentration, BA

Russian, BA

Japanese, BA (Language & Culture Track)

Italian Studies, BA

German, BA (Language & Culture Track)

French, BA (Language & Culture Track)

Classical Studies, BA (Classical Languages Track)

Spanish Minor

Russian Minor

Portuguese Minor

Japanese Minor

Italian Minor

German Minor

Classical Studies Minor

Arabic Language and Culture Minor

Asian Studies Minor

Chinese Minor

Asian Studies, BA

Comparative Literature, BA

Classical Studies, BA (Material Culture & History Track)

Classical Studies, BA (Literature & Culture Track)

Business French Minor

Spanish for the Professions Minor

French Cultural Studies Minor

ASL and Deaf Studies Minor

Chinese Studies, BA (Language & Culture Track)

Spanish, BA (Language & Culture Track)

Chinese Studies: World Languages Teaching Concentration, BA

French: World Languages Teaching Concentration, BA

Classical Studies: World Languages Teaching Concentration, BA

German: World Languages Teaching Concentration, BA

Japanese: World Languages Teaching Concentration, BA

French Minor

Korean Studies Minor

World Food Cultures Certificate

ARAB 10100 - Standard Arabic Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to Modern Standard Arabic: the writing and sound systems, and systematic presentation of basic grammatical structures. Reading, writing, and vocabulary building are emphasized throughout. The course also includes an introduction to Arab culture. No previous knowledge of Arabic required. Permission of department required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify, recognize, and produce correctly Arabic sounds and letters in aural and written texts. 2. Demonstrate familiarity with the Arabic syntactic structures. 3. Produce practical written information including completed forms, directions, and instructions on familiar topics. 4. Demonstrate conversational skills including discussing school, family, and occupations; telling time; discussing schedules and dates; and expressing likes and dislikes. 5. Formulate questions and distinguish functional phrases for talking about themselves and their families. 6. Identify language comprehension by reading, reporting on, and or writing about short passages and translating basic sentences. Credits: 3.00

ARAB 10200 - Standard Arabic Level II (UCC: HUM)

Credit Hours: 3.00. Further study of Modern Standard Arabic. Continued presentation of the basic structures of Arabic grammar and expansion of vocabulary. Reading and writing will be emphasized.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify language comprehension by reading, reporting on, and or writing about long segments of Arabic text and speech. 2. Use simple grammatical and syntactic structures in daily communication. 3. Compose simple sentences and short paragraphs. 4. Demonstrate language comprehension by discussing familiar topics with peers. Credits: 3.00

ARAB 11100 - Elementary Standard Arabic Conversation I

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Group discussions in Standard Arabic on practical topics.

Credits: 1.00

ARAB 11200 - Elementary Standard Arabic Conversation II

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in Standard Arabic on practical topics. May be taken concurrently with ARAB 10200.

Credits: 1.00

ARAB 12100 - Qur'anic Arabic Level I

Credit Hours: 3.00. Introduces students with knowledge of the Arabic alphabet and elementary Arabic word structure to the basic elements of Qur'anic Arabic and provides them with foundational knowledge of classical Arabic lexicon and grammar. Students will gain insights into the organizational structure of different words and short phrases as they explore the nature of Qur'anic Arabic, its diction, morphology and vocabulary that are crucial for understanding the text. In this course, students will also expand their vocabulary as they work through exercises focusing on identifying the importance of rendering sounds for correct reading, recitation and morphology of different words through sample excerpts from short chapters of the Qur'an. Students can take this course for language credit to meet course requirements in all fields that require a language. Permission of instructor required.

Learning Outcomes: 1. Recognize basic features of Qur'anic language. 2. Analyze short excerpts. 3. Identify key Qur'anic vocabulary and its meaning. 4. Distinguish important features of word order in relation to meaning. 5. Apply learned language rules to short excerpts. Credits: 3.00

ARAB 12200 - Qur'anic Arabic Level II

Credit Hours: 3.00. Continues students' development and mastery of Qur'anic Arabic and expands the foundational knowledge of classical Arabic lexicon and grammar gained in ARAB 121. Students will gain insights into the morphology and

syntax of the Arabic of the Qur'an and explore Qur'anic Arabic, its diction, morphology and vocabulary that are crucial for understanding the meaning of the text. In this course, students will also expand their vocabulary as they work through exercises focusing on identifying the importance of rendering sounds for correct reading, recitation and morphology of different words through sample excerpts from short chapters of the Qur'an. Students can take this course for language credit to meet course requirements in all fields that require a language.

Learning Outcomes: 1. Understand a range of lexical items of the Qur'anic vocabulary within context. 2. Analyze basic concepts and principles of Qur'anic grammar, morphology and syntax. 3. Apply key Qur'anic vocabulary and identify its meaning. 4. Distinguish important features of word order in relation to meaning. 5. Recognize basic phonological concepts relative to Qur'anic vocabulary. Credits: 3.00

ARAB 20100 - Standard Arabic Level III (UCC: HUM)

Credit Hours: 3.00. This course is designed to allow students to use the grammar and vocabulary acquired in the first two semesters in dealing with specific social situations. Continued improvement of conversational, reading, and writing abilities and expansion of vocabulary.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 20200 - Standard Arabic Level IV (UCC: HUM)

Credit Hours: 3.00. Increased mastery of the four language skills, with emphasis on reading and translation using materials from literary classical and modern Arabic. The course includes a study of some parts of the Koran.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 21100 - Elementary Standard Arabic Conversation II

Credit Hours: 1.00. Continuation of ARAB 11200. May be taken concurrently with ARAB 20100.

Credits: 1.00

ARAB 21200 - Elementary Standard Arabic Conversation IV

Credit Hours: 1.00. Continuation of ARAB 21100. May be taken concurrently with ARAB 20200.

Credits: 1.00

ARAB 22400 - Arabic Level IV: Business Arabic

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed toward use of Arabic for business purposes, including language needed for business negotiations, financial situations, travel, and memo writing. Aspects of cultural and social appropriateness needed in business situations in the Arab world.

Learning Outcomes: 1. Improve skills of speaking, writing, reading and listening in Arabic, with emphasis on business situations. 2. Understand the cultural appropriateness and cultural conventions that characterize Arabic business situations. 3. Know how to write basic business letters, memos, notices, and short reports in Arabic. 4. Have skills that facilitate both business visits and pleasure travel to Arabic-speaking countries, such as making hotel reservations, using various types of transportation, dealing with customs, and filing official forms and other documents. 5. Have an expanded vocabulary including specific terminology used in trade, finance, banking, accounting, and business transactions. Credits: 3.00

ARAB 23000 - Arabic Literature In Translation

Credit Hours: 3.00. Survey of Arabic literature, from the classical to the postmodern period. Emphasis on connections between literary works and contemporary life. Conducted in English; no knowledge of Arabic required.

Credits: 3.00

ARAB 23900 - Arab Women Writers (UCC: HUM)

Credit Hours: 3.00. Survey of Arab women writers from North Africa, the Middle East, and Arab communities in the Western world. Emphasis on issues of sexuality, marriage, work, travel and immigration. Conducted in English; no knowledge of Arabic required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ARAB 28000 - Arabic Culture (UCC: HUM)

Credit Hours: 3.00. A historical and literary survey of defining characteristics of Arabic culture from pre-Islamic times to the modern period.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 28100 - Introduction To Islamic Civilization And Culture

Credit Hours: 3.00. This course is a survey of broad currents in the cultures, thought and civilization of the Muslim world. It emphasizes religious, intellectual and cultural trends, social and political structures and contemporary issues of Muslim societies within the current global cultural world. Taught in English.

Learning Outcomes: 1. Gained understanding of the basic teachings of Islam, sources of Islamic civilization and culture, its historical development and major aspects of Islamic thought and art through today. 2. Make connections and understand the interplay among religion, politics, culture and other forms of artistic expression. 3. Provide students with tools to undertake further research about the cultures of Islam and examine the impact Islam makes in lives of communities and contemporary problems facing Muslims in a globalized cultural world. Credits: 3.00

ARAB 30100 - Standard Arabic Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Arabic speaking, listening, reading, and writing abilities, using materials dealing primarily with the everyday life and civilization of Arabic-speaking countries, from various sources (newspapers, poetry, chapters from the Qu'ran). Conducted primarily in Arabic.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 30200 - Standard Arabic Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading and composition skills in Standard Arabic, using materials dealing with ideas and events that have shaped the Arabic-speaking culture. Conducted primarily in Arabic.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

ARAB 33000 - The Middle East On Film

Credit Hours: 3.00. This course offers an introduction to films produced in the Middle East and on Middle Eastern Cultures. In this class, we will view films from the Arab world, including North Africa, and the large Middle Eastern region. Parallel to film screening, students will read critical and analytical material that provide background as well as commentary and analysis of cultural and historical contexts on content of films and their making. The course will examine a series of topics such as identity politics, religious affiliation, gender, immigration, belonging, homeland and exile. We will also situate the films within the aesthetic traditions of production and reception and analyze how they provide critical perspectives and insights in central issues in the cultures of Middle Eastern cultures. The overarching goal of the class is to provide students with a solid understanding of the function of cinema and films in representation of the evolution and transformation of the cultures and societies of the region and the issues central to how communal and individual identities in the Middle Eastern region are shaped. The class will also equip the students with skills to analyze meaning making and the role of technical aspects such as cinematography, body language, script, setting and acting in the creation of characters. All films will be screened with English subtitles.

Learning Outcomes: 1. Assess formal and technical elements of Middle Eastern film cultures. 2. Analyze how social and cultural themes are represented in visual means and through the screen. 3. Identify and explain the important aspects of film making in the film industries of the region. 4. Construct critical responses to how cinematic work uses aesthetics to mediate culture. 5. Evaluate the role of films in articulating major shifts and movements in the cultures of the region. Credits: 3.00

ARAB 33400 - North African Literature And Culture

Credit Hours: 3.00. A view of the culture and society of the Maghreb (Morocco, Algeria, Tunisia, and Libya). Emphasis on issues of race, politics, religion, and gender through literature and other forms of artistic expression, including film and music. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Increase ability to think

critically about other cultures and societies and appreciate cultural differences. 2. Investigate key cultural, social and political issues that have shaped cultures and societies in North Africa. 3. Develop understanding of contemporary questions such as nationalism, politics, religion and ethnicity in the region as represented through materials (literary and/or visual) from/about North Africa. 4. Develop and improve analytical skills (both oral and written) and enhance their abilities to comprehend, interpret, and analyze texts. 5. Expand familiarity and knowledge about core societal and cultural issues of this region and connect to contemporary events in the various countries and communities in North Africa. Credits: 3.00

ARAB 49000 - Special Topics In Arabic

Credit Hours: 1.00 to 4.00. Study of a selected topic in Arabic literature or culture. The topic will be announced in advance. Conducted in English; readings in English. Permission of instructor required.

Learning Outcomes: 1. Vary due to the nature of the course. Credits: 1.00 to 4.00

ASL 10100 - American Sign Language I (UCC: HUM)

Credit Hours: 3.00. A basic introduction to American Sign Language. This course introduces students to the tools for mastering the grammar at a basic expressive and receptive level. Introduction to cultural and historical aspects of ASL and the deaf community.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ASL 10200 - American Sign Language II (UCC: HUM)

Credit Hours: 3.00. A continuation of ASL 10100. Further study of the language with more emphasis on receptive and expressive conversational skills. Includes readings of research studies relevant to lectures.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand and manage more complex interactions involving expanded ASL lexical signs, grammatical rules, and sentence structure (syntax). 2. Demonstrate an expanded conversational and narrative skill in ASL using both concrete and abstract concepts. 3. Exhibit the ability to use appropriate ASL grammatical features and functions of the language used in dialogues and story-telling that includes non-manual grammatical signals, and prosodic features of intensity and characterizations. 4. Demonstrate an understanding of and respect for Deaf people and ASL by engaging appropriate conversation strategies used in the Deaf Community and applying their ASL skills within and beyond the school settings. Credits: 3.00

ASL 20100 - American Sign Language III (UCC: HUM)

Credit Hours: 3.00. A more advanced study of American Sign Language. Further development of receptive and expressive skills using more advanced material. Continued emphasis on cultural and historical aspects in relation to the evolution of the language and language usage.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ASL 20200 - American Sign Language IV (UCC: HUM)

Credit Hours: 3.00. A continuation of ASL 20100. Includes some introduction to linguistic structure, especially classifiers, temporal sequencing and aspect, and conversational regulators.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ASL 28000 - American Deaf Community: Language, Culture, And Society

Credit Hours: 3.00. The linguistic, cultural, and societal context of the deaf community in America. Both historical and contemporary aspects of deaf identity will be included, with an emphasis on the central role that ASL plays in the lives of deaf individuals.

Credits: 3.00

ASL 30100 - American Sign Language V

Credit Hours: 3.00. This course is a continuation of ASL 20200 (5th in sequence of courses in ASL). Features of Level 5 are expanded student discourse, advanced ASL structure and vocabulary, roleshift variations, formal storytelling, text analysis and formal/informal presentations.

Learning Outcomes: 1. Students will learn and demonstrate advanced grammatical uses of ASL in conversations and in storytelling. 2. Students will develop increasingly complex receptive and expressive skills in ASL discourse: how sign movements can be modified to change meaning; how and when facial expressions occur; and how body, head, and eye movements are used in phrasing and agreement. 3. Students will demonstrate fluent and appropriate communication skills with competent/native users of ASL by maintaining a high degree of grammatical accuracy. 4. Students will demonstrate increased understanding and appreciation of noted ASL artists performing handshape stories, cheers, songs, poetry, storytelling, and legends. 5. Students will be able to compare, contrast, and exchange opinions on current issues in the field of Deaf and ASL studies. Credits: 3.00

ASL 30200 - American Sign Language Advanced-Level VI

Credit Hours: 3.00. This course is a sequential course in the advanced study of American Sign Language (ASL) with emphasis on basic concepts of language based ASL. This is an application of language usage in ASL in which students will gain an advanced understanding and mastery of ASL grammar. Includes instruction in semantic and grammatical accuracy and appropriate discourse strategies in a variety of communication contexts. Students utilize advanced receptive and expressive skills.

Learning Outcomes: 1. Identify the appropriate use of ASL semantics and conceptual signs. 2. Apply intermediate-to-advanced ASL grammatical features to informal and formal styles. 3. Compose narratives and presentations in ASL. 4. Discuss, debate, and exchange information and perspectives of ASL and Deaf culture. Credits: 3.00

ASL 36100 - The Structure Of American Sign Language I: Phonology And Morphology

Credit Hours: 3.00. Linguistic study of ASL, including the following: phonological features of individual signs (hand shape, orientation, location, movement) and how those features shift when placed in a stream of signs; morphological features of signs, including compounding and lexicalization of fingerspelled words; grammar, focusing on typical word orders found in ASL sentences; meaning of signs and how those meanings have shifted over time (as well as how those meanings shift for particular dialects); and typical pragmatic features of conversation in ASL. Knowledge of ASL is required.

Learning Outcomes: 1. Demonstrate increased vocabulary and grammatical structures necessary to interact with deaf people accurately in ASL. 2. Develop an understanding of the principles of ASL linguistic structure through study of ASL grammar. 3. Articulate the differences between ASL and English grammars. 4. Demonstrate appropriate structure and pragmatics when interacting with deaf and hard of hearing people. 5. Develop an intercultural awareness of the differences between deaf and hearing communities and will learn to adjust their behavior accordingly. Credits: 3.00

ASL 36200 - The Structure Of American Sign Language II: Syntax, Semantics And Language Use

Credit Hours: 3.00. This course introduces students who already have prior knowledge of linguistics (e.g., phonetics, phonology, and morphology) to three areas of study in linguistics: Syntax, Semantics, and language use. Linguistic study of ASL, including the following: Syntax includes units on basic sentence types, lexical categories, word order, time and aspect, verbs, and the function of the spaces. Semantics includes the meanings of individual signs and sentences. Language in Use includes Black ASL, Variation and Historical Change. Bilingualism and language acquisition will be also covered. ASL Discourse has the ways that signed conversations among deaf people differ from speaking conversation of hearing people, why these differences exist, and why they are culturally important. Knowledge of ASL is required.

Learning Outcomes: 1. Compare and differentiate the basic characteristics of signed and spoken languages by text reading. 2.

Identify and describe the structure and use of American Sign Language with attention to sociolinguistic rule concerning ASL in the Deaf community by observing the film resources. 3. Apply linguistic knowledge by comparing, identifying parts and relationships of all languages, spoken and signed. 4. Develop an intercultural awareness of the differences between deaf and hearing communities and will learn to adjust their behavior accordingly. Credits: 3.00

ASL 39000 - Undergraduate Research In American Sign Language

Credit Hours: 3.00. This course is designed to allow for the investigation of topics related to the linguistic structure of ASL, populations of ASL language learners, sub-populations of the Deaf Community at the undergraduate level. Permission of instructor required.

Credits: 3.00

CHNS 10100 - Chinese Level I (UCC: HUM)

Credit Hours: 4.00. A comprehensive course in elementary Mandarin, designed to develop basic proficiency in listening, speaking, reading, and writing. Systematic coverage of syntactical patterns. After oral foundation work, 20 characters are introduced each lesson in unsimplified and simplified forms.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Make short statement and ask simple questions, primarily by relying on memorized utterances but occasionally by expanding these through simple recommendations of those elements. 3. Identify a limited number of character components and high-frequency characters in areas of immediate need. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Write simple fixed expressions and limited memorized material and some recombination thereof. Credits: 4.00

CHNS 10200 - Chinese Level II (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of elementary Mandarin. Students will complete study of basic syntactical patterns. Character recognition will be built to 500.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. 2. Ask and answer questions, initiate and respond to simple statements and maintain face-to-face conversation. 3. Read, for basic survival and social needs, simple connected specially prepared material and can puzzle out pieces of some authentic material as it reflects similarity to specially prepared material and/or high-frequency oral vocabulary and structure. 4. Read for instructional and directional purposes, standardized messages, such as some prices in stores, time/date on schedules, etc. 5. Meet limited practical writing needs. Credits: 4.00

CHNS 20100 - Chinese Level III (UCC: HUM)

Credit Hours: 4.00. A course in intermediate Mandarin, with integrated spoken and written tracks emphasizing the cultural contexts of usage. Mastery of more advanced syntactic patterns, with enriched vocabulary. Character recognition built to 800. Introduction to Chinese dictionaries.

University Core Curriculum (UCC): (UCC: HUM) Credits: 4.00

CHNS 20200 - Chinese Level IV (UCC: HUM)

Credit Hours: 4.00. A continuation of the study of intermediate Mandarin. Development of enhanced oral narrative skills and listening comprehension skills through audio-visual supplements. Short exercises in expository composition. Character recognition built to 1,100-plus. Introduction to Chinese newspaper.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 4.00

CHNS 24100 - Introduction To The Study Of Chinese Literature (UCC: HUM)

Credit Hours: 3.00. Class reading and discussion of selected Chinese poetry, prose, and drama; introduction to the methods of literary criticism, applied to the reading of Chinese literary discourse. Texts, discussion, and written assignments primarily in Chinese. Permission of instructor required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28000 - Topics In Chinese Civilization And Culture (UCC: HUM)

Credit Hours: 3.00. Selected topics on Chinese civilization and culture including history and geography, Confucianism, contemporary China, education, family, international cultural and economic cooperation. Course materials also cover most current issues on and in Chinese-speaking communities. Lectures in English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 28100 - Introduction To Chinese Food Culture

Credit Hours: 3.00. Selected topics on Chinese food history, production, preparation, festivals, as well as food in literature, film, business and folk beliefs. Discussion will also include civilization and food as cultural diplomacy. Lectures in English.

Learning Outcomes: 1. Knowledge of evolution of Chinese food history. 2. Learn main concepts of Chinese cooking and gastronomy. 3. Acquire appreciation of the important food-related works in Chinese literature. 4. Learn current trend of food culture in China. 5. Acquire appreciation and understand cultural and historical aspects on major Chinese teas, wines, and snacks in association with their respective geographic features; folk beliefs on medicinal usages of Chinese teas and wines; and the etiquette regarding tea art, wine drinking, drinker's wager game, and snack serving. Credits: 3.00

CHNS 28500 - Chinese Calligraphy

Credit Hours: 1.00. Principles and techniques of writing Chinese characters. The aesthetics of Chinese calligraphy, its function as an art form, and its role in Chinese culture. Emphasis on training and practice in calligraphic writing. Conducted in English.

Credits: 1.00

CHNS 30100 - Chinese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 30200 - Chinese Level VI (UCC: HUM)

Credit Hours: 3.00. Continued development of Chinese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization from a variety of sources with stronger emphasis on authentic texts, e.g., newspapers, magazines, television, recent literature, etc.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

CHNS 31300 - Reading And Writing Practice

Credit Hours: 3.00. Concentration on further development of reading and writing abilities for students with conversational proficiency, using materials primarily from modern social and cultural studies, including annotated literary texts. Conducted in Chinese.

Credits: 3.00

CHNS 33000 - Introduction To Chinese Cinema (UCC: HUM)

Credit Hours: 3.00. This course surveys the development of the Chinese cinema from its beginning to the present. Films from the mainland as well as Taiwan and Hong Kong will be examined in-depth for their aesthetic quality and techniques, and equally important, against their socio-historical, political, economic and cultural contexts. The class is conducted in English. Films are all in Chinese with English subtitles.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Become familiar with the cinema syntax. 2. Understand the development of Chinese cinema in a global context. 3. Understand modern Chinese society and culture through cinema. 4. Develop a critical

mind over the political, social and cultural issues presented in cinema. Credits: 3.00

CHNS 34100 - Chinese Literature I: Traditional Chinese Literature

Credit Hours: 3.00. Reading and discussion of selected classical Chinese texts from major writers and genres. Introduction to methods of literary criticism as applied to Chinese literature. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 34200 - Chinese Literature II: Modern Chinese Literature

Credit Hours: 3.00. Study of selected poetry, drama, and fiction from the twentieth century. Students will read and discuss major authors and texts and will write critical essays on literary topics. Texts, discussion, and written assignments are largely in Chinese.

Credits: 3.00

CHNS 39900 - Special Study Abroad Credit In Chinese

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Chinese earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

CHNS 40100 - Chinese Level VII (UCC: HUM)

Credit Hours: 3.00. Continued development of Mandarin Chinese speaking, listening, reading, and writing skills. Emphasis will be upon modern, everyday language and culture (with some introduction to traditional culture) using various sources such as textbooks, newspapers, and literary works.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 40200 - Chinese Level VIII (UCC: HUM)

Credit Hours: 3.00. Further development of Mandarin Chinese speaking, listening, reading, and writing skills. Materials will include advanced textbooks and original texts such as newspapers and literary works.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CHNS 49000 - Special Topics In Chinese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

CLCS 18100 - Classical World Civilizations (UCC: BSS)

Credit Hours: 3.00. Course introduces students to "Classical" civilizations on three continents (Europe, Africa, and Asia) demonstrably interconnected by an ancient world system. Course focuses on essential themes of past civilization: religion, philosophy, surviving texts, gender relations, urbanism, technology, social and political formations.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

CLCS 22000 - Topics In Classical Literature

Credit Hours: 3.00. Selected topics in Greek and Roman literature. All readings in English translation.

Learning Outcomes: 1. Gain a detailed historical understanding of the development of a specific genre or topic within ancient Greek and Roman literature. 2. Ability to appreciate and intelligently discuss major themes in ancient Greek and Roman literature through close reading of representative texts. 3. Ability to identify specific examples of the influence of the ancient Greek and Roman literature on the literature of the later western world. Credits: 3.00

CLCS 23010 - Survey Of Greek Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Introduction to Ancient Greek literature from homer to Plato. All readings in English.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Greek literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within

the shifting historical, political and social contexts of the ancient Greek world; and 3. Be equipped to trace the influences of ancient Greek literature on the literatures of the later western world. Credits: 3.00

CLCS 23100 - Survey Of Latin Literature (UCC: HUM)

Credit Hours: 3.00. Highlights of literature written in Ancient Rome at times of political, social, and intellectual turbulence. Reading (all in English) includes Vergil's Aeneid, as well as selections from other influential Latin texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have broader and more detailed grasp of the history of ancient Latin literature, including the development of specific genres (epic, lyric, choral, tragedy, comedy, historical and philosophical prose); 2. Be able to appreciate the place and role of literature within the shifting historical, political and social contexts of the ancient Roman world; and 3. Be equipped to trace the influences of Latin literature on the literatures of the later western world. Credits: 3.00

CLCS 23200 - Classical Roots Of English Words (UCC: HUM)

Credit Hours: 3.00. This is an introduction to English etymology with emphasis on building vocabulary. Students will learn English derivatives from both classical Greek and Latin. All texts to be read in English.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

CLCS 23300 - Comparative Mythology (UCC: HUM)

Credit Hours: 3.00. Comparative study of the myths of major ancient cultures, with emphasis on shared typological features.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of principal characters, narratives, and themes in the myths of a number of representative ancient world cultures (Mesopotamian, Egyptian, Celtic, Aztec, Mayan, East Asian, African); 2. Be able to appreciate the many functions of myths within ancient societies, namely to explain natural events, support religious practices, and underwrite social and political power; and 3. Be able to identify recurrent patterns and themes in the myths of historically disparate ancient and modern cultures. Credits: 3.00

CLCS 23400 - Medical And Scientific Terminology From Greek And Latin Roots

Credit Hours: 3.00. Ninety to ninety-five percent of scientific technical vocabulary and medical terminology come from Latin and Greek roots and affixes. This course will enable students in scientific and medical disciplines to develop a foundational core of Greek and Latin roots and affixes from which they will be able to decipher and easily commit to memory the core terminology in the various sciences and medicine.

Learning Outcomes: 1. Know the foundational core of Greek and Latin roots and affixes from which medical and scientific terminology has been derived. 2. Decipher complex and specialized scientific and medical terms based on the knowledge of their Greek and Latin roots. 3. Decipher unfamiliar terminology in their fields by learning how the roots combine dynamically to form words as scientific and medical innovation requires an ever-increasing need for new terms. 4. Enable students to absorb information in their fields more easily by demystifying the complexities of their specialized vocabularies used in their disciplines. Credits: 3.00

CLCS 23500 - Introduction To Classical Mythology (UCC: HUM)

Credit Hours: 3.00. Study of the myths of western antiquity, as represented in ancient Greek and Latin texts and images.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a detailed grasp of the principal characters, narratives, and themes of Greek mythology; 2. Be able to appreciate the many functions of myths within ancient Greek society, namely to explain natural events, support religious practices, and underwrite

social and political power; and 3. Be able to identify modern myths and appreciate the role they continue to play within all societies. Credits: 3.00

CLCS 23600 - Ancient World Onscreen

Credit Hours: 3.00. How film represents ancient Mediterranean civilizations and retells ancient myths; how cinematic renderings of ancient history shape views of the past and how these are affected by contemporary sensibilities. No knowledge of Greek or Latin required.

Learning Outcomes: 1. Have a detailed historical grasp of the ways in which the ancient Greek and Roman worlds have found expression in modern cinema; 2. Be able to appreciate how ancient texts fare when translated into the radically different artistic medium of film; and 3. Be able to discuss intelligently what forces influence how we choose to see and represent the ancient western world. Credits: 3.00

CLCS 23700 - Gender And Sexuality In Greek And Roman Antiquity (UCC: HUM)

Credit Hours: 3.00. How identities based on gender, sexual behavior and sexual desire, and socio-economic status are established in ancient Greece and Rome. Exploration of why these ancient views of gender and sexuality remain of continuing importance in the 21st century. All readings in English.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn core information about ancient Greek and/or Roman cultures. 2. Learn to analyze gender identities and conventions surrounding sexuality in various communities with different socio-political structures. 3. Develop methods for historically sensitive investigation of materials (literary and/or visual) from ancient cultures. 4. Systematically improve analytical skills as writers, readers, and speakers. Credits: 3.00

CLCS 23800 - The Tragic Vision (UCC: HUM)

Credit Hours: 3.00. Greek and Roman tragedy from their beginnings until today. Readings in English from representative authors such as Aeschylus, Sophocles, Euripides, and Seneca; later receptions of ancient tragedy in drama and other media. Course may include performance, theories of comedy and tragedy, or recent and current expressions of the tragic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand a detailed historical development of ancient Greek tragic through close reading of representative samples of the genre. 2. Appreciate and intelligently discuss major themes in Greek tragedy as they relate to both ancient and modern views of what is "tragic". 3. Identify specific examples of the influence of ancient Greek tragedy on the drama of the later western world. Credits: 3.00

CLCS 23900 - The Comic Vision (UCC: HUM)

Credit Hours: 3.00. This course investigates Greek and Roman comedy from their beginnings until today. The course will feature readings in English from representative authors such as Aristophanes, Menander, Plautus, and Terence, as well as later receptions of ancient comedy in drama and other media. This course may include performance, theories of comedy and tragedy, theories of humor, or recent and current expressions of the comic in film and other media.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Have a detailed historical understanding of the development and evolution of ancient Greek and Roman comedy. 2. Be able to appreciate and intelligently discuss major themes in Greek and Roman comedy as they relate to both ancient and modern views of what is "comic" or humorous. 3. Be able to identify specific examples of the influence of ancient Greek and Roman comedy on the drama of the later western world. Credits: 3.00

CLCS 28000 - Topics In Classical Civilization

Credit Hours: 3.00. Selected topics in Ancient Civilization.

Learning Outcomes: 1. Students will have a broader and more detailed grasp of issues that relate to the social, economic, and political institutions that structured ancient communities

throughout Asia Minor and the Mediterranean basin. This will allow them to appreciate the confluences of factors and forces that contribute to the formation of cultures and civilizations in the ancient world. Credits: 3.00

CLCS 33700 - The Ancient Epic

Credit Hours: 3.00. Study of the epic in four ancient cultures, with emphasis on its structure, nature, and social functions. Readings may include Gilgamesh, Iliad, Odyssey, Aeneid, Beowulf, Tain, Mahabharata, and others.

Learning Outcomes: 1. Gain an enhanced understanding of the nature and development of the genre of epic through close reading of representative samples of the genre from different ancient cultures. 2. Ability to appreciate and intelligently discuss major themes in epic as they relate to both ancient and modern views of the heroic. 3. Ability to identify specific examples of the influence of ancient epic on the literature of the later western world. Credits: 3.00

CLCS 38000 - Alexander The Great And Hellenistic World (UCC: HUM)

Credit Hours: 3.00. Course examines the career of Alexander the Great and the rise of Macedonia in the Hellenistic Era. Topics include the emergence of Macedonia under Philip II; the achievements of Alexander the Great; and the wars of succession following his demise.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

CLCS 38100 - Julius Caesar: Statesman, Soldier, Citizen

Credit Hours: 3.00. Course Examines the career of Julius Caesar by focusing on events from Caesar's birth (100 BCE) through his assassination in 44 BCE. Course places Caesar's complex personality within the context of political, military, economic, social, and cultural upheaval during the Late Roman Republic.

Credits: 3.00

CLCS 38300 - The Roman Empire

Credit Hours: 3.00. Course examines developments from the Augustan Settlement to the end of the Roman Empire (27 BCE - 476 CE), along with aspects of religious, social, sexual and material culture throughout the Mediterranean at that time.

Credits: 3.00

CLCS 38400 - Ancient Western Medicine

Credit Hours: 3.00. Historical and cultural study of Western medicine, from Mesopotamian origins to the late Roman Empire, based on written texts and archaeological evidence. Addresses the development of rational medical frameworks against the background traditional beliefs about illness as a sign of demonic possession, and charts the growth of the medical profession from individual avocation to institutional practice.

Learning Outcomes: 1. Summarize the key forces affecting the development of Western medicine from its origins to late antiquity in the form of an extended essay or paper. 2. Create a compelling, original argument that relates habits of rational thinking about the human body in antiquity to the conceptual frameworks used to diagnose its behaviors. 3. Respond critically to a representative medical text from antiquity in a capstone research project. Credits: 3.00

CLCS 38500 - Science, Medicine And Magic In The Ancient West (UCC: HUM)

Credit Hours: 3.00. Study of the development of the idea of rationality in the West through examination of the evolution of Greek and Roman sciences, with emphasis on medicine and astronomy.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Gain a detailed historical understanding of the development of ancient Greek and Roman science, especially medicine and astronomy, against the background of traditional beliefs in magic. 2. Ability to appreciate and intelligently discuss major issues in ancient science as they relate to both ancient and modern views of what is "rational" and "scientific". 3. Ability to identify specific examples of the influence of ancient science on later western scientific theory and practice.
Credits: 3.00

CLCS 38600 - Ancient Greek Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Greece, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the ancient Greek world from the Mycenaean to the Hellenistic period. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 38700 - Roman Religion

Credit Hours: 3.00. Study of the religious beliefs and practices of ancient Rome, based on written, artistic, and archaeological evidence of their forms and functions.

Learning Outcomes: 1. Have a broader and more detailed grasp of belief systems and religious behaviors of the Roman world from the earliest sources to the third century CE. 2. Be better able to assess the representation of religious experience in other religious traditions with greater historical perspective and methodological sophistication. 3. Be able to express themselves on issues of religion more clearly and with more understanding, both orally and in writing. Credits: 3.00

CLCS 48000 - Potters And Society In Antiquity

Credit Hours: 3.00. Course covers the range of eastern Mediterranean ceramics encountered in Rough Cilicia Archaeological Survey Project from the Bronze Age to the Later Roman Empire. Course also explores strategies employed by archaeologists and historians to exploit ceramics as research materials.

Credits: 3.00

CLCS 48100 - Culture And Society In The Age Of Pericles

Credit Hours: 3.00. Course explores interrelationships between the emergence of Greek democracy and the cultural, political, social, and economic rise of Athens in the fifth century BCE. More broadly, course surveys history of the Greek world from the Late Bronze Age to 362 BCE.

Credits: 3.00

CLCS 48300 - Republican Rome

Credit Hours: 3.00. Course examines the military, political, economic, and social developments that enabled the Roman people to expand from an Italian city-state to a trans-Mediterranean empire, and the consequences that initiated the decline and transition in their republican form of government.

Credits: 3.00

CLCS 49900 - Special Topics In Classics

Credit Hours: 1.00 to 4.00. Special Topics in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CMPL 23000 - Crossing Borders: Introduction To Comparative Literature

Credit Hours: 3.00. (LC 23000) Foundations for comparison of works in different languages, thematic (philosophical, sociological, psychological), and structural (genre, composition, use of linguistic devises); parallel interrelation of theme and structure in works of different literatures. The importance of literary norms and systems of genres. Examination of crosscurrents in different literatures during successive periods of development.

Learning Outcomes: 1. Provide familiarity with the original languages that lie behind English translations of world literature. 2. Relate a particular culture to the larger patterns of world literature to gain an appreciative of cultural diversity and global awareness of class, ethnicity, gender, and race. 3. Provide practical experience in oral communication through class presentations and reports and projects. 4. Provide practical experience in oral communication through class presentations and reports and projects. 5. Provide appropriate level practice in information literacy related to

the study of comparative literature, including researching source materials, research methodologies, and intellectual approaches. Credits: 3.00

CMPL 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (LC 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

CMPL 26600 - World Literature: From The Beginnings To 1700 A D (UCC: HUM)

Credit Hours: 3.00. (ENGL 26600) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

CMPL 26700 - World Literature: From 1700 A D To The Present (UCC: HUM)

Credit Hours: 3.00. (ENGL 26700) World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

CMPL 33000 - International Cinema

Credit Hours: 3.00. This course is designed to develop students' seeing, reading, speaking, writing, and critical thinking skills, and especially to improve visual competency, awareness of visual culture, and knowledge of selected international cinema. All films will be shown with English subtitles.

Learning Outcomes: 1. Explain and assess different ways of seeing as an introduction to understanding visual theory. 2. Demonstrate understanding of the concepts and techniques of cinematography, processing, and reading images and film. 3. Recognize, select, and justify choices for seeing and interpreting the visual. 4. Identify and analyze culturally-conditioned references. Credits: 3.00

CMPL 49000 - Special Topics In Comparative Literature

Credit Hours: 3.00. Topics vary from section to section.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 3.00

FR 10100 - French Level I (UCC: HUM)

Credit Hours: 3.00. A beginning French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. Permission of department

required. CTL:IWL 1901 French Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain and produce biographical information about themselves and others in the French language. 2. Identify necessary information by asking questions about people and things in the French language. 3. Solve a simple survival situation such as ordering food and beverages in the French language. 4. Compose with language by combining learned elements in the French language. Credits: 3.00

FR 10200 - French Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 10100 . CTL:IWL 1902 French Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 10500 - Accelerated Basic French (UCC: HUM)

Credit Hours: 3.00. This is an accelerated beginning-level course designed to develop language proficiency in French. The course will help students progress toward competence in speaking, listening, reading, and writing, as well as toward knowledge of French and Francophone cultures. The course focuses on active language use. Students will interact meaningfully with classmates and develop communicative strategies. Course will be taught in French. Permission of Department required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of French language in specific contexts by reading French texts. 2. Identify appropriate use of French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken French in the form of dialogues and presentations. Credits: 3.00

FR 11200 - Elementary French Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice to enhance communicative competence. Small group discussions in French on practical topics.

Learning Outcomes: 1. Develop elementary listening skills and improve oral French proficiency. 2. Acquire elementary vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in French. Credits: 1.00

FR 20100 - French Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate French course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1903 French Level III

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 20200 - French Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of FR 20100 . CTL:IWL 1904 French Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 20500 - Accelerated Intermediate French (UCC: HUM)

Credit Hours: 3.00. This course is an accelerated intermediate-level course designed to develop language proficiency in French. The course will help students progress toward competence in speaking, listening, reading and writing, as well as toward knowledge of French and Francophone cultures. The course focuses on active language use. Students will interact meaningfully with classmates and develop communicative strategies. Course will be taught in French.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of French language in specific contexts by reading French texts. 2. Identify appropriate use of French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken French in the form of

dialogues and presentations. Credits: 3.00

FR 21200 - Intermediate French Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in French on practical topics. Not open to students enrolled in or having credit for FR 30100 or above.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral French proficiency. 2. Acquire intermediate vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in French. Credits: 1.00

FR 22400 - Professional French I

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills will be developed toward use of French for business purposes. Course materials cover daily business dealings as well as national and international trade.

Learning Outcomes: 1. Discuss the main aspects of the French professional world (hierarchy, professional versus personal relationships, etc.). 2. Accomplish simple administrative tasks in French such as give/answer a phone call, make an appointment. 3. Behave appropriately in a French professional context. Credits: 3.00

FR 23000 - French Literature In Translation

Credit Hours: 3.00. Reading and analysis of selected French writers and their works, with particular emphasis on the social, political, and intellectual climate of their times. The course content will change from semester to semester. Knowledge of French not required.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 24100 - Introduction To The Study Of French Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from France and the Francophone world; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in French.

Credits: 3.00

FR 28000 - Second-Year French: Special Topics

Credit Hours: 3.00. Selected topics on the civilization, culture, and literature of France. Lectures and readings primarily in English, but knowledge of French at the first-year level necessary.

Credits: 3.00

FR 30100 - French Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of French speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in France and the other French-speaking countries from various sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Analyze French language in specific contexts by reading French texts. 2. Analyze French language in specific contexts by listening to audio recordings and watching videos of spoken French. 3. Compose French texts by focusing on a set of grammatical rules and standards in the language. 4. Produce extended discourse in spoken French in the form of dialogues and presentations. 5. Compare and contrast French culture with other cultures through interaction with French oral and written texts. Credits: 3.00

FR 30200 - French Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in French on the basis of materials dealing with the ideas and events that have shaped present-day France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 31200 - Advanced French Conversation

Credit Hours: 1.00. One credit hour advanced French conversation focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative

competence. Discussions in French on various topics. Course may be taken concurrently with FR 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral French proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in French.

Credits: 1.00

FR 32300 - French For Engineering

Credit Hours: 3.00. This course is an intermediate/advanced French course emphasizing vocabulary and structures necessary for communication within the context of the working world. In this course, students will further develop their speaking, listening, reading, and writing abilities through the study of specialized vocabulary from the engineering and technology sciences. Conducted in French.

Learning Outcomes: 1. Understand, explain, and apply a broad range of vocabulary related to engineering and technology. 2. Read, understand, and analyze specific engineering and technical topics in French. 3. Describe particular engineering problems in simple terms.

Credits: 3.00

FR 32400 - Professional French II

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills at an intermediate level will be developed toward the use of French for business purposes. Course materials cover daily business dealing as well as national and international trade.

Learning Outcomes: 1. Discuss specific aspects of the French professional world, such as the role of the French government in the economy. 2. Accomplish administrative tasks in French (write a professional letter, reports, etc.). 3. Behave appropriately in a French professional context. Credits: 3.00

FR 33000 - French Cinema (UCC: HUM)

Credit Hours: 3.00. A general survey of major French cinematic trends from the earliest examples (Melies, Lumiere) to the New Wave (Chabrol, Truffaut, Resnais, Godard, etc.), with a discussion of the historical, social, political, aesthetic, and literary contexts. The French film in relation to world cinema. The relationship between the French cinema and French literature. Reading and analysis of scripts and historical and critical materials. Knowledge of French not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

FR 34100 - French Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. Reading of selected poetry, prose, and theatre of France from the Middle Ages through the Enlightenment in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 34200 - French Literature II: The 19th And 20th Centuries

Credit Hours: 3.00. Reading of selected French poetry, novels, theatre, and short fiction of the 19th and 20th centuries in historical and cultural context. Readings, discussion, and papers in French.

Credits: 3.00

FR 38000 - Special Topics In French Culture And Civilization

Credit Hours: 3.00. Selected topics on the contemporary civilization of the French-speaking world and on the development of its culture throughout history. Explores trends in society, daily life, the arts, ideas, and technology. Conducted in French.

Credits: 3.00

FR 39400 - Special Topics In French Literature

Credit Hours: 3.00. Studies a particular aspect in French literature (e.g., theme, device, character type, motif, place) by reading a varied selection of works of different genres, styles and/or periods. Readings, discussion, and papers in French.

Credits: 3.00

FR 39600 - Special Topics In French Language Science

Credit Hours: 3.00. Examines a particular aspect entailed in the study of French language, e.g., language acquisition and teaching, language in society, regional dialects of France, French around the world, French creoles. Conducted in French.

Credits: 3.00

FR 39900 - Special Study Abroad Credit In French

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in French earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

FR 40100 - French Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of French speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in France and the other French-speaking countries. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 40200 - French Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in French. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in French.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

FR 41200 - Advanced French Conversation II

Credit Hours: 1.00. This course is designed to help students build advanced listening skills and oral proficiency in French through classroom discussions. Students will be expected to actively participate in classroom discussions, prepare for class, and utilize the target language only. No textbook is needed.

Learning Outcomes: 1. Build French speaking and comprehension skills through classroom discussions. 2. Explain and assess relevant texts and audio materials in the target language. 3. Formulate ideas based on texts and audio materials as expressed in written and oral French. Credits: 1.00

FR 42400 - Professional French III

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Discuss the main aspects of the French professional world, notably the role of the French government. 2. Present professional interests verbally and in writing (such as conduct and have a job interview, compose resume and write a cover letter to answer a specific job offer). 3. Accomplish simple administrative tasks in French (write a professional letter, give/answer a phone call, make an appointment, etc.). 4. Behave appropriately in a French professional context. Credits: 3.00

FR 44300 - Introduction To Francophone Literature

Credit Hours: 3.00. The study of the most representative Francophone poets, playwrights, and novelists from various countries, such as Leopold Senghor, Aime Cesaire, Jacques Romain, Gabrielle Roy, Michel Tremblay, Mohamed Dib.

Credits: 3.00

FR 48000 - French Civilization

Credit Hours: 3.00. The study of modern French life, with special emphasis on the customs and daily life of the people. Lectures in French.

Credits: 3.00

FR 49100 - Special Topics In French

Credit Hours: 1.00 to 4.00. This course will be offered as a guided reading or independent study course on a topic of mutual interest in French or Francophone literature, culture, film, or linguistics, to the student and faculty. Permission of instructor required.

Learning Outcomes: 1. Learning objectives will vary due to the nature of the course. Credits: 1.00 to 4.00

GER 10100 - German Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in German reserved exclusively for students who have had less than two years of German at the ninth-grade level or above. Students with two years or more of previous German study may not take this course for credit. Permission of department required. CTL:IWL

1920 German Level I

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos of spoken German. 4. Compose German sentences by focusing on the set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 10200 - German Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 10100 . CTL:IWL 1921 German Level II

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 10500 - Accelerated Basic German (UCC: HUM)

Credit Hours: 4.00. This course is a first-year course in German, which covers two semesters in one. The course is appropriate for students who would like to accelerate the process of learning German, including GEARE students, graduate students, and others. The course will be conducted primarily in German and will use all modes of communication: interpersonal, presentational, and interpretive. The course book facilitates learning in context through the use of an integrated video program. The students are trained in the audio-visual interpretive mode of communication that is essential to carry out daily activities in Germany, and to be able to read and react to a variety of German texts.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading a variety of German texts and by listening to audio recordings of spoken German. 2. Identify German cultural aspects by watching videos in spoken German language integrated in the book. 3. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken German in the form of dialogues and presentations and respond appropriately to questions and statements related to everyday life. Credits: 4.00

GER 11200 - Elementary German Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in German on various topics.

Learning Outcomes: 1. Develop listening skills and improve oral German proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language. Credits: 1.00

GER 20100 - German Level III (UCC: HUM)

Credit Hours: 3.00. A lower intermediate German course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts, and listening to audio recordings, and watching videos of spoken German. 2. Compose German sentences by focusing on a set of grammatical rules and standards in the language. 3. Produce sentences in spoken German in the form of dialogues and presentations. Credits: 3.00

GER 20200 - German Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of GER 20100 . CTL:IWL 1923 German Level IV

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 20500 - Accelerated Intermediate German (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate level course in German designed to achieve second year language proficiency

in German. The course is appropriate for students who would like to accelerate the process of learning German.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading a variety of German texts. 2. Identify German cultural aspects by watching videos in spoken German language integrated in the book. 3. Identify appropriate use of German language in specific contexts by listening to audio recordings of spoken German. 4. Compose grammatically correct German sentences by observing the norms and standards of the language. 5. Produce sentences in spoken German in the form of dialogues and presentations and respond appropriately to questions and statements related to everyday life. Credits: 4.00

GER 21200 - Intermediate German Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in German conversation to enhance communicative competence. Small group discussions in German on various topics. Not open to students enrolled in or having credit for GER 30100 or above.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral German proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen, and discuss relevant intermediate texts in the target language. Credits: 1.00

GER 22300 - German Level IV: Science And Engineering

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills, directed toward use of German in science and technology. Work on grammar as needed. Use of materials from recent publications in science and technology. Introduction to general and technical vocabulary. Conducted primarily in German. Credit will not be given for both GER 20200 and 22300.

Learning Outcomes: 1. Identify appropriate use of German language in specific contexts by reading German texts about science, engineering, and business. 2. Identify appropriate use of German language in specific contexts by listening to audio recordings about science, engineering, and business in spoken German. 3. Identify appropriate use of German language in specific contexts by watching videos about science, engineering, and business in spoken German. 4. Compose German sentences about science, engineering, and business by focusing on a set of grammatical rules and standards in the language. 5. Produce sentences in spoken German in the form of dialogues and presentations that deal with science, engineering, and business. Credits: 3.00

GER 22400 - German Level IV: Business German

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed toward use of German for business purposes. Work on grammar as needed. Course materials cover daily business dealings as well as national and international trade, living conditions, environmental and social problems.

Credits: 3.00

GER 23000 - German Literature In Translation (UCC: HUM)

Credit Hours: 3.00. Reading and analysis of selected German writers and their works, with particular emphasis on the social, political, and intellectual climate of the times. The course content will change from semester to semester. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

GER 24100 - Introduction To The Study Of German Literature

Credit Hours: 3.00. An introduction to the study of German literature based on an overview of the formal elements of poetry, fiction, and drama as well as basic concepts of literary theory. Texts in German; conducted primarily in German.

Learning Outcomes: 1. Identify common characteristics of primary literary genres (e.g. prose, poetry, drama) as exhibited during one or

more time periods in German-language cultures. 2. Discuss (in German) selected literary works that are written in German in respect to their main themes and to devices that help writers convey the texts' meaning, such as symbolism, metaphor, irony, and allusion. 3. Compose (in German, with the aid of a dictionary) analytical essays that examine the relationship between the content, style, and sociohistorical context of selected literary texts. Credits: 3.00

GER 28000 - German Special Topics

Credit Hours: 3.00. Selected topics on the civilization and culture of German speaking countries. Lectures and readings all in English. No knowledge of German necessary.

Learning Outcomes: 1. Students will explore in depth a particular aspect of life in German-speaking countries, leading to their increased understanding not only of those cultures, but also, by comparison, of their own culture. Credits: 3.00

GER 28100 - Beer And Brewing In German Culture

Credit Hours: 3.00. Course about beer and brewing and its role as a cultural product in shaping the identity of regional areas in Germany, Austria, and Switzerland, and its influence on science, religion, economics, politics, and history. The course will give students an overview of the relationship between beer and brewing to other disciplines, allowing them to connect the topics covered to their own fields of study. Conducted in English.

Learning Outcomes: 1. Demonstrate an understanding of the central importance of beer and brewing in German-speaking culture and its relation to other fields of study. 2. Examine the representation of beer in German texts (in English) and other forms of art. 3. Analyze how beer and brewing contribute to the creation of national identities. 4. Identify historical, political, religious, societal, and economic issues as they pertain to beer and brewing in German-speaking culture. Credits: 3.00

GER 30100 - German Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of German speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Germany from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 30200 - German Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in German on the basis of materials dealing with the ideas and events that have shaped present-day Germany. Conducted primarily in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 31200 - Advanced German Conversation

Credit Hours: 1.00. One credit hour advanced German conversation course focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative competence. Discussions in German on various topics. Course may be taken concurrently with GER 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral German proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen, and discuss relevant intermediate texts in the target language. Credits: 1.00

GER 32300 - German Level VI: Science And Engineering

Credit Hours: 3.00. This is an alternative course to GER 30200. Continued development of German speaking, listening, reading, and writing abilities, using materials from recent publications in science and technology. Building of general and technical vocabulary. Conducted in German.

Learning Outcomes: 1. Identify and use science- and engineering-related German vocabulary. 2. Read, understand, and discuss specific articles about science and engineering In German. 3. Speak and write about specific

topics in science and engineering Inn German. 4. Gain cultural knowledge and competence in the German business world, specifically the world of science and engineering. Credits: 3.00

GER 33000 - German Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of major German contributions to the cinema from the earliest period to the present. Emphasis on relevant aesthetic theories and on the schools of literature and painting that served as sources. Evaluation of the German film on the basis of social, artistic, and political criteria. Knowledge of German not required.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and describe the major movements and trends of German film history of the 20th and 21st centuries. 2. Analyze the cinematography of representative German films. 3. Interpret the explicit and implicit meanings of representative German films. Credits: 3.00

GER 34100 - German Literature I: From The Middle Ages To The 18th Century

Credit Hours: 3.00. Reading and discussion of selected texts (poetry, prose, dramatic texts, cultural documents, and artworks) in German from the Middle Ages to the Eighteenth Century.

Credits: 3.00

GER 34200 - German Literature II: From The 18th Century To The 21st Century

Credit Hours: 3.00. Reading and discussion of selected texts in German with the dual context of literary movements and historical developments between the 18th and 21st centuries.

Credits: 3.00

GER 39900 - Special Study Abroad Credit In German

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in German earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

GER 40100 - German Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of German speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Germany. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

GER 40200 - German Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in German. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted in German.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Compose essays in German after reading authentic German articles and books. 2. Discuss current events in German based on print and media sources from German-speaking countries. 3. Formulate arguments during debate in German through group discussion. 4. State their opinions in German on recordings, television shows, and texts. 5. Describe information in German from graphs, charts, diagrams, and pictures. Credits: 3.00

GER 42400 - Business German

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Learning Outcomes: 1. Learn and practice vocabulary and cultural knowledge that is applicable to business situations in German-speaking countries. 2. Compare business practices in German-speaking countries with those in the United States, and will be able to discuss the similarities and differences in German. Credits: 3.00

GER 48000 - German Civilization

Credit Hours: 3.00. The study of modern German life, with

special emphasis on the daily life and customs of the people. Lectures in German.

Credits: 3.00

GER 49800 - Advanced Topics In German

Credit Hours: 3.00. Special topics on literature, linguistics and culture of contemporary German-speaking countries. Conducted in German.

Credits: 3.00

GREK 10100 - Ancient Greek Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to the grammar of Attic Greek of the Classical period, and first forays into the reading of connected prose. Emphasis on accidence, syntax, and vocabulary building.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Explain foundational Ancient Greek grammar and demonstrate familiarity with core vocabulary. 2. Bring together their knowledge of Ancient Greek grammar and vocabulary, creating clear English translations by analyzing basic texts adapted from Ancient Greek literature. 3. Apply this knowledge of grammar and vocabulary to writing simple sentences in Ancient Greek, and translating from English to Ancient Greek. Credits: 3.00

GREK 10200 - Ancient Greek Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of the study of Attic Greek grammar and reading of connected prose of the Classical period.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn basics of reading and translating ancient Greek, completing their introduction to core vocabulary, grammar, and syntax. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

GREK 10500 - Accelerated Introductory Ancient Greek

Credit Hours: 4.00. This course is an accelerated beginning-level course designed to develop language proficiency in Ancient Greek. The course will help students progress toward competence in reading and writing, as well as toward knowledge of Ancient Greek culture. The course focuses on developing deep understanding of Greek syntax and morphology and building strategies for fluent and accurate reading of ancient texts. Primary language of instruction is English.

Learning Outcomes: 1. Differentiate the syntactic structures used in Ancient Greek sentences and longer texts based on the study of model sentences. 2. Compose sentences in Ancient Greek by focusing on a set of grammatical rules and standards in the language. 3. Recite Ancient Greek aloud with accuracy and fluency and demonstrate their ability in in-class text readings and recordings. 4. Infer the meaning of unknown vocabulary in context by reading stories. 5. Identify and analyze grammatical forms in the Greek contexts in which they are used. 6. Generate smooth-flowing and elegant English translations of the Greek, attending to inherent differences in style and structure. Credits: 4.00

GREK 20100 - Ancient Greek Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in New Testament Greek, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop skills in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Learn how to apply foundational knowledge of ancient Greek grammar and syntax to readings in the New Testament. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 20200 - Ancient Greek Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in ancient Greek, designed to consolidate students' knowledge of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce and extend skills as readers and translators by studying archaic, classical or post-classical Greek literature. 2. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending vocabulary through etymological connections. Credits: 3.00

GREK 34300 - Greek Oratory

Credit Hours: 3.00. A study of ancient Greek (Attic) orators from textual, historical, and social perspectives.

Credits: 3.00

GREK 34400 - Greek Epic

Credit Hours: 3.00. Readings and discussion of the Greek epic, including selected passages from Homer and Hesiod.

Credits: 3.00

GREK 35300 - Greek Tragedy

Credit Hours: 3.00. Reading and discussion of selected Greek tragedies of the 5th century BCE.

Credits: 3.00

GREK 35400 - Greek Comedy

Credit Hours: 3.00. Readings and discussion of selected Greek comedies of the 4th and 5th centuries BCE.

Credits: 3.00

GREK 44600 - Greek Historians

Credit Hours: 3.00. A study of the writings of the classical historians in the original Greek.

Credits: 3.00

GREK 49000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

HEBR 10100 - Modern Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to Modern Hebrew: the writing and sound systems, and systematic presentation of basic structures. All language skills - reading, writing, speaking, and comprehension - are emphasized. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 10200 - Modern Hebrew II (UCC: HUM)

Credit Hours: 3.00. Continuation and extension of the first semester. The course aims to develop fluency in reading, comprehension, and spoken language. Knowledge of grammar and vocabulary is expanded.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 12100 - Biblical Hebrew Level I (UCC: HUM)

Credit Hours: 3.00. The first semester of biblical Hebrew will present the basic elements of the language, including alphabet, vocabulary, and grammar. No previous knowledge of Hebrew required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 12200 - Biblical Hebrew Level II (UCC: HUM)

Credit Hours: 3.00. The second semester of biblical Hebrew will continue the study of reading, vocabulary and grammar, based on selections from the Hebrew Bible.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

HEBR 20100 - Modern Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking,

and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading both in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 20200 - Modern Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. Extensive practice in reading, speaking, and writing Hebrew, based on a variety of subjects from daily life and literature. Continued study of grammar and reading in the modern language.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22100 - Biblical Hebrew Level III (UCC: HUM)

Credit Hours: 3.00. The third semester of biblical Hebrew focuses on reading and translation of extended passages form the Pentateuch and the use of textual criticism.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 22200 - Biblical Hebrew Level IV (UCC: HUM)

Credit Hours: 3.00. The fourth semester of biblical Hebrew exposes the student to both narrative and poetic sections of the Bible.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

HEBR 28400 - Ancient Near Eastern History And Culture

Credit Hours: 3.00. This course is a survey of the development of the ancient Near East, from its pre-history to Alexander the Great. It emphasizes the evolutions of various Near Eastern cultures in their many manifestations; art, government, agriculture, economics, philosophy, religion, ethics, and science. Taught in English.

Learning Outcomes: 1. Understand the difference between pre-history and history. 2. Understand various ancient and modern ideas of the purpose of writing history. 3. Understand how the invention of writing and the origins of cities were coordinate developments. 4. Understand something of the flow of empires that succeeded each other, eventually displaced by the empire of Alexander the Great, whose conquests shaped the contours of the world much as we know it. 5. Become aware how art reflects the development of thought and idealism; how ideas of human government evolved; how religion, science, agriculture, and much else developed as empires built onto those they displaced. Credits: 3.00

HEBR 38000 - Israel And The Modern World: Cinema, Literature, History And Politics (UCC: HUM)

Credit Hours: 3.00. Critical survey/exploration of major traits of Israeli culture through a variety of media: literature, film and music, in the larger context of Judaism, Zionism, as well as the creation of a new state and culture. Conducted in English; no knowledge of Hebrew is necessary.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand the depth of Modern Israel cultural, political and historical complexity. 2. Understand the richness of Israeli culture. 3. Understand Israeli political-social problems and its influence on world affairs. 4. Development of modern Israeli cinema and literature in reference to their historical and political groundings. 5. Mastery of major historical events, major films, major literary figures, and major social/political problems.
Credits: 3.00

HEBR 38300 - Kabbalah And Jewish Mysticism: Secret Knowledge In Judaism

Credit Hours: 3.00. This course critically explores the roots, history, symbolism and major characteristics of the Jewish mystical tradition known as Kabbalah.

Learning Outcomes: 1. Identify and describe the key terms, concepts, texts, and figures in Jewish mysticism. 2. Consider the case of Jewish mysticism in the general context of religious mysticism and evaluate the applicability of general concepts to specific, tradition-based examples, and vice versa. 3. Gain insight into the inner world of esoteric

religiosity and its texts. 4. Learn the crucial influence of Jewish mysticism on Christianity, Islam and on European history as well as on the evolvement of Western civilization. 5. Become familiar with the symbolic, phenomenological approach to mystical texts and experiences as practiced in the academic study of religions. 6. Learn the art of hermeneutics: interpretation and unpacking of original, historical and hagiographical texts, and the dramatic ramifications of reading these kinds of texts in translation. 7. Develop critical thinking and oral communication skills through course readings and class discussions, presentations and through work on directed individual projects. 8. Develop writing and research skills by writing weekly papers and a research paper. Credits: 3.00

HEBR 38500 - The Holocaust In Modern Hebrew Literature

Credit Hours: 3.00. This course critically examines the Holocaust and the ways in which it has influenced modern Hebrew literature, the role it plays, and how it is represented in modern Hebrew literature. Conducted in English; no knowledge of Hebrew is necessary.

Credits: 3.00

ITAL 10100 - Italian Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Italian course with emphasis on communicative skills (listening and speaking), literacy (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize familiar words and very basic phrases. 2. Speak and write simple phrases and sentences. 3. Interact in a basic way, provided the other person is prepared to repeat or rephrase things at a slower rate of speech and help the student to formulate the intended thought. 4. Ask and answer simple questions in areas of immediate need or on very familiar topics. Credits: 3.00

ITAL 10200 - Italian Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of ITAL 10100.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Speak a series of simple phrases and sentences to describe commonly discussed topics. 2. Develop a basic understanding of simple social exchanges. 3. Write short, simple sentences related to areas of immediate needs. 4. Read short, simple texts, by identifying predictable information. Credits: 3.00

ITAL 10500 - Accelerated Basic Italian (UCC: HUM)

Credit Hours: 3.00. An accelerated basic Italian course that substitutes for ITAL 10100 and ITAL 10200 . Knowledge of a foreign language required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 11200 - Elementary Italian Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group discussions in Italian on various topics.

Learning Outcomes: 1. Develop listening skills and improve oral Italian proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language. Credits: 1.00

ITAL 20100 - Italian Level III (UCC: HUM)

Credit Hours: 3.00. A continuation of ITAL 10200 .

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 20200 - Italian Level IV (UCC: HUM)

Credit Hours: 3.00. An intermediate Italian course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 20500 - Accelerated Intermediate Italian (UCC: HUM)

Credit Hours: 3.00. An accelerated second-year Italian course with focus on furthering the development of listening, reading, speaking and writing abilities at the intermediate level.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

ITAL 21200 - Intermediate Italian Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in Italian conversation to enhance communicative competence. Small group discussions in Italian on various topics. Not open to students enrolled in or having credit for ITAL 30100 or above.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral Italian proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language.
Credits: 1.00

ITAL 23100 - Dante's Divine Comedy

Credit Hours: 3.00. Reading and discussion of Dante's Divine Comedy. The major critical approaches to Dante's masterpiece will be reviewed. All readings, papers, and examinations will be in English.

Credits: 3.00

ITAL 28000 - Italian Culture And Civilization (UCC: HUM)

Credit Hours: 3.00. Course focuses on salient aspects of Italian culture and civilization from the Middle Ages to the present. In English.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Demonstrate knowledge of Italian culture and its legacy in the world. 2. Identify crucial developments of Italian society and culture of the time studied. 3. Situate the arts, literature, and music of Italy in their historical context. 4. Become aware of the political and national struggles that Italy faced throughout the centuries. 5. Be introduced to key figures from different fields of studies whose work, inventions, and discoveries changed and are still changing our world perspectives.
Credits: 3.00

ITAL 28100 - The Italian Renaissance And Its Scientific And Cultural Impact On Western Civilization (UCC: HUM)

Credit Hours: 3.00. This course introduces students to the most important cultural and scientific writings of the Italian Renaissance, and shows the pivotal influence of the Renaissance on the development of Western civilization as a whole. Classes and readings entirely in English; no knowledge of Italian needed.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Become acquainted with the canonical works of the Italian Renaissance that have had a major influence on modern Western thought and will develop a broad understanding of the Renaissance. 2. Become familiar with different literary genres such as poetry, comedy, novellas, treatises and dialogues, and will develop the tools necessary to approach them critically within the cultural and political context that produced them. 3. Improve their critical and writing skills. Credits: 3.00

ITAL 28500 - Intercultural Migration To Italy In Film, Literature, And Art (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the complexities of recent migrations to Italy through the perspectives of film, literature, and art. The course covers a wide range of topics, from a historical and geographical overview of migrations to Italy, to the hotly debated issues of immigration policies, Italian citizenship law, human rights and social justice, and the process of reimagining the Italian identity in more diverse and inclusive terms. Course taught in English. No Italian knowledge required.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Define the historical context, geographical routes, and reasons of migration to Italy. 2. Explain the impact of migration on Italian demographics, economy, and Italian identity ("Italianità"). 3. Compare

diverse cultural representations of migration to Italy with diverse representations of migration in their own cultural contexts. 4. Outline the intersections between migration and the issues of citizenship, human rights, and social justice in Italian and their own cultural context. 5. Reflect on their intercultural learning in the domain of curiosity, openness, empathy, and global awareness. Credits: 3.00

ITAL 30100 - Italian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Italian speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Italy from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Students will develop oral communication skills in Italian at advanced level through classroom discussions, presentations, and interpersonal communication. 2. Students will expand and refine their competence to comprehend, analyze, and interpret texts in Italian through integrated reading and discussion of different genres of authentic texts in Italian through integrated reading and discussion of different genres of authentic texts. 3. Students will expand and refine their written proficiency in Italian by producing a variety of genre-specific texts in Italian. 4. Students will expand their knowledge of Italian culture and their cross-cultural proficiency through the use of aural, visual, and written texts in Italian. Credits: 3.00

ITAL 30200 - Italian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Italian, on the basis of materials dealing with the ideas and events that have shaped present-day Italy. Conducted primarily in Italian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 31200 - Advanced Italian Conversation

Credit Hours: 1.00. One credit hour advanced Italian conversation course focused on the development of oral and aural skills for self-expression. Course provides students with guided practice in conversation to enhance communicative competence. Discussions in Italian on various topics. Course may be taken concurrently with ITAL 30100, 30200, 34100 and 34200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in Italian. Credits: 1.00

ITAL 33000 - The Italian Cinema (UCC: HUM)

Credit Hours: 3.00. The development and evolution of Italian cinema after World War II. The class will center on the viewing and discussion of films and will survey a broad spectrum of directors and styles. Knowledge of Italian not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 33300 - The Spirit Of Italian Comedy (UCC: HUM)

Credit Hours: 3.00. This course explores various types of Italian comedy, focusing on theater and cinema. Particular emphasis will be given to Renaissance theater, commedia dell'arte, Goldoni, Pirnadello, Dario Fo, and to the new generation of Italian comedians. In English.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

ITAL 33500 - Italian-American Cinema

Credit Hours: 3.00. This course offers an overview of the major filmmakers associated with the representation of Italian Americans in the United States film world. Students will view and discuss major filmmakers and their films, and will write critical essays on film topics. Conducted in English.

Credits: 3.00

ITAL 34100 - Italian Literature I: From The Middle Ages To The Enlightenment

Credit Hours: 3.00. This is the first course of a two-semester

sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 34200 - Italian Literature II: From Romanticism To The Present

Credit Hours: 3.00. This is the second course of a two-semester sequence presenting an overview of Italian literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 38100 - Italian And Italian American Food Culture (UCC: HUM)

Credit Hours: 3.00. This course provides a comprehensive exploration of the rich and diverse food cultures of Italy and Italian American communities. Through a combination of historical, cultural, visual, and culinary perspectives, students will gain an in-depth understanding of the traditions, influences, and innovations that have shaped Italian and Italian-American cuisine.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify and articulate the historical and cultural significance of Italian and Italian American food traditions. 2. Summarize evidence, such as cookbooks, food memoirs, and other cultural artifacts, to understand the complexity of the human experience as expressed through food. 3. Interpret and critique culinary works, exploring the intersection of food, culture, and art. 4. Critically compare texts, recipes, and culinary practices within the cultural, intellectual, and historical contexts of Italy and the Italian American experience. 5. Reflect on the impact of socio-cultural and historical factors on the development of Italian and Italian American cuisine. Credits: 3.00

ITAL 39300 - Special Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will focus on particular aspects of Italian literature, cinema or culture. No knowledge of Italian required.

Credits: 3.00

ITAL 39400 - Special Topics In Italian Literature

Credit Hours: 3.00. This course studies a particular aspect in Italian literature (e.g., a theme, device, character type, motif, place) by reading a varied selection of works of different genres, styles, and/or periods. Readings, discussion, and papers in Italian.

Credits: 3.00

ITAL 39900 - Special Study Abroad Credit It Italian

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Italian earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

ITAL 49300 - Advanced Topics In Italian Literature Or Cinema

Credit Hours: 3.00. This course will analyze in depth particular aspects of Italian literature, cinema or culture. No knowledge of Italian necessary.

Credits: 3.00

JPNS 10100 - Japanese Level I (UCC: HUM)

Credit Hours: 3.00 or 4.00. A basic study of standard Japanese. Students will be introduced to spoken and written forms of the language from the beginning. Language form and use are equally emphasized. Relevant cultural aspects. Hiragana, Katakana, and 85 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Distinguish and pronounce sounds in Japanese. 2. Read and write hiragana, katakana, and 45 kanji. 3. Exchange greetings, introduce and talk about themselves. 4. Tell time. 5. Describe daily routines and leisure activities. 6. Ask about places and indicate locations and distance. 7. Recognize basic cultural aspects of social interaction. Credits: 3.00 or 4.00

JPNS 10200 - Japanese Level II (UCC: HUM)

Credit Hours: 3.00 or 4.00. A continuation of the study of elementary Japanese. Task-oriented activities will be incorporated to encourage language use as well as pattern practice for linguistic accuracy. Relevant cultural aspects will be introduced. 120 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express their preferences. 2. Make requests. 3. Express quantities and talk about prices. 4. Extend invitations and order food at restaurants. 5. Describe people and address family members. 6. Describe weather, seasonal holidays and annual events. 7. Read and write a total of 130 kanji. 8. Compose simple letters in Japanese on familiar topics. Credits: 3.00 or 4.00

JPNS 20100 - Japanese Level III (UCC: HUM)

Credit Hours: 3.00 to 4.00. A study of intermediate Japanese. Occasional use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice are used to facilitate learning of the spoken and written language. 110 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Express physical conditions, ask for help, and give suggestions. 2. Make and describe travel plans and work plans. 3. Express future plans and what to do to achieve future objectives. 4. Ask for favors and offer help. 5. Ask for and give directions. 6. Make polite requests. 7. Read and write a total of 250 kanji. Credits: 3.00 to 4.00

JPNS 20200 - Japanese Level IV (UCC: HUM)

Credit Hours: 3.00 to 4.00. A continuation of intermediate Japanese. Active use of authentic materials for listening and reading practice. Task-oriented exercises, communicative activities, and pattern practice for learning of the spoken and written language. 150 Kanji.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe experiences of gift giving and receiving. 2. Express preferences and selections. 3. Explain procedures and important points. 4. Describe events, make small talk, and express one's conjectures and opinions. 5. Describe customs, regulation and express appreciation, and ask for permission to do something. 6. Express complaints, request change of behavior, express apologies. 7. Express respect to social superiors. 8. Read and write a total of 350 kanji. Credits: 3.00 or 4.00

JPNS 23000 - Japanese Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected texts from major writers and genres. The course provides a broad survey of the Japanese literary tradition and its cultural and historical background. Emphasis may vary from year to year. Knowledge of Japanese not required.

Credits: 3.00

JPNS 24100 - Introduction To The Study Of Japanese Literature

Credit Hours: 3.00. Reading and discussion of selected Japanese poetry, prose, and drama; introduction to methods of literary criticism, applied to the reading of Japanese literary discourse. Texts, discussion, and written assignments largely in Japanese.

Credits: 3.00

JPNS 28000 - Introduction To Modern Japanese Civilization

Credit Hours: 3.00. A survey of modern Japanese culture. Various aspects are covered, such as geography, economy, society, the political system, family, education, traditional arts, business, and language. Current issues will be discussed in a timely manner. Lectures in English.

Credits: 3.00

JPNS 30100 - Japanese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Japanese speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in Japan from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

JPNS 30200 - Japanese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Japanese, on the basis of materials dealing with the ideas and events that have shaped present-day Japan. Conducted primarily in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 31300 - Intermediate Reading In Japanese I

Credit Hours: 3.00. This course provides students with further study in reading Japanese at the intermediate level. The course also reviews and introduces 500 basic kanji.

Credits: 3.00

JPNS 33000 - Japanese Cinema

Credit Hours: 3.00. A survey of the development of Japanese cinema after World War II. The class focuses on the viewing and discussion of the films and examines a variety of directors with different styles and thematic messages.

Credits: 3.00

JPNS 34100 - Japanese Literature I: Modern Japanese Literature

Credit Hours: 3.00. Selected reading of poetry, drama, and fiction of modern Japanese literature. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Japanese.

Credits: 3.00

JPNS 36100 - Elementary Survey Of Japanese Linguistics

Credit Hours: 3.00. This course surveys all areas of Japanese Linguistics, including phonetics, phonology, morphology, syntax, semantics, and pragmatics, focusing on systematizing fragmentary knowledge students are assumed to have acquired through Japanese language courses.

Credits: 3.00

JPNS 36300 - Relationship Of Japanese Language And Society

Credit Hours: 3.00. This course examines the Japanese language with reference to the way the language is being used in the Japanese society. Particular areas include keigo (honorific language), aizuchi (backchannel), silence, gender issues, in-group vs. out-group.

Credits: 3.00

JPNS 39900 - Special Study Abroad Credit In Japanese

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Japanese earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

JPNS 40100 - Japanese Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on the development of Japanese speaking, reading, and writing abilities, focusing on materials dealing with culture and the arts of Japan. Conducted mostly in Japanese.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 40200 - Japanese Level VIII (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of Fourth Year Japanese I. It continues work on the acquisition of advanced-level proficiency in speaking, listening, reading and writing. Students are given opportunities to understand the main ideas of extended discourse, to read texts which are linguistically complex, and to write about a variety of topics.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

JPNS 44200 - Manga And Anime

Credit Hours: 3.00. In this class, students will study the globally popular art forms of Japanese comic books, known as manga, and cartoons, known as anime, from an academic perspective. We will approach the study of these media via the disciplines of literary studies, art history, visual culture studies, and the study of popular culture. While examining manga and anime as visual and literary media, we will consider topics including Japanese history, the environment, war, gender, sexuality, family, tradition, religion, philosophy, Japan's relationship to the globe, and genres of popular literature such as fantasy, horror, and science fiction. Materials to be covered include historical illustrated fiction of the 18th and 19th centuries (the prehistory of manga), foundational manga from the post-WWII era, manga by women writers, contemporary popular manga, anime films that ignited the global anime phenomenon, and anime films by the latest major directors.

Learning Outcomes: 1. Identify major writers,

directors, texts, themes, and artistic traditions within the media of manga and anime. They will establish a foundation on which to support future study of Japanese culture, literature, art, and society, as well as other global traditions of literature and the arts. 2. Assess formal structures, aesthetic values, social practices, worldviews, points of emphasis, and gaps or omissions in the texts that they read. They will also learn the practice of visual analysis, or the ability to carefully describe and interpret visual details and information. 3. Compose, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 4. Identify the ways in which text and image are combined to create meaning in visual-verbal narratives through the study of primary materials and academic articles. 5. Read manga in Japanese, which will introduce students to various forms of colloquial, formal, and informal linguistic registers. Practice listening to spoken Japanese by watching animated films. (Optional: For those with advanced language skills) Credits: 3.00

JPNS 48500 - Culinary Culture Of Japan

Credit Hours: 3.00. Advanced-level language and culture course about the food of Japan. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of Japan. Students will further develop their speaking, listening, reading and writing abilities in Japanese. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience. Conducted entirely in Japanese. Permission of department required.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Japanese about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance. 5. Examine the Japanese food heritage and impact in the United States. Credits: 3.00

JPNS 49000 - Special Topics In Japanese Language

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

KOR 10100 - Korean Level I (UCC: HUM)

Credit Hours: 4.00. This course is the first half of the Elementary Korean language sequence. It is designed for those who have no prior (or very limited) knowledge of Korean. Lecture will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Emphasis is placed on the fundamentals of listening, speaking, reading, and writing. In addition, students will be exposed to everyday life contexts (e.g., language use, culture, etc.) likely to be encountered in contemporary Korean society.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Assess the meaning of limited vocabulary and some simple questions or statements auditorily and visually in the context of everyday events, such as greetings, introductions, giving directions, expressing needs, and making requests in Korean. 2. Construct short statements and ask simple questions by combining grammatical and lexical items using spoken Korean in a limited number of content areas, particularly if strongly supported by the situational context. 3. Identify meanings communicated in written Hangul, a Korean writing system, related to basic language use and immediate needs, such as prices in stores, dates on schedules, and short letters, messages, or memos relating information relevant to various aspects of student life. 4. Construct simple fixed expressions and limited memorized material by combining grammatical and lexical items in

written form using Hangul. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, pop lyrics, or traditional grams. Credits: 4.00

KOR 10200 - Korean Level II

Credit Hours: 4.00. This course is the second half of the elementary Korean language sequence. As a continuation of KOR 10100, the main purpose of this course is to expand on the study of the Korean language and culture. The class will introduce new material and explain conversational patterns considering grammatical, lexical, and pragmatic aspects of Korean. Some class meetings will be conducted entirely in Korean. Students continue to learn vocabulary, pronunciation, grammar, and the writing system by practicing Korean to achieve Novice High level of speaking, listening, reading, and writing.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of recombinations of learned elements applied to a limited number of contexts, such as organizing a party, shopping, placing orders, making telephone calls, describing symptoms of illness and scheduling appointments. 2. Solve communicative problems related to uncomplicated, basic communicative tasks and social situations, such as making an apology, accepting and declining invitations, and making polite requests and suggestions by identifying linguistic meanings and producing new linguistic content. 3. Identify meanings expressed in written materials with emphasis on survival and immediate needs, such as memos, messages, postcards, journal entries, brief narratives, and short letters relating information relevant to various aspects of student life. 4. Produce simple texts of a few paragraphs such as skit, messages, short letters, and brief narratives by recombining learned material in Korean. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

KOR 20100 - Korean Level III

Credit Hours: 4.00. This course is the first half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Low proficiency level. Some class meetings are conducted entirely in Korean. Students practice reading and listening comprehension, grammar, vocabulary building, and conversations that require a variety of styles, pragmatic considerations, and knowledge of Korean cultural topics. Skills for simple narration and written report will be enhanced. Students rely on authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess sentence-length utterances auditorily and visually that consist of a sufficient amount of vocabulary and expressions to communicate in a variety of situations covered in the course. 2. Apply basic components of Korean grammatical structures to construct standard Korean sentences to express creative ideas and to make comparisons. 3. Solve communicative problems related to a variety of uncomplicated social situations by asking and answering questions. 4. Compose written language in Korean to meet practical writing needs, such as short personal letters and journals. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

KOR 20200 - Korean Level IV

Credit Hours: 4.00. This course is the second half of the intermediate Korean language sequence. The main purpose of this course is to expand on the study of the Korean language and culture, and develop an Intermediate Mid proficiency level. Some class meetings are conducted entirely in Korean. The course provides students with further conversational and grammatical skills. Students practice reading comprehension, grammar, vocabulary, and conversation using textbooks and authentic materials for introduction of Korean culture and authentic language usage.

Learning Outcomes: 1. Assess paragraph-length texts and oral discourse to comprehend texts and dialogue in the classroom. 2. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 3. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 4. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 5. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 4.00

KOR 24100 - Introduction To Korean Literature

Credit Hours: 3.00. This course will introduce students to major trends, genres, perspectives, and ideas in Korean literature, including poetry, essays, and short stories, from the early 20th century up to the present day. Covering significant historical milestones such as the Japanese Colonial Period, Liberation Day, and the post-liberation era, the literary works discussed in this course offer diverse perspectives on these time periods. By exploring prominent themes, forms, and literacy techniques, students will gain insight into modern Korean literary traditions within the evolving context of Korean culture and society. The language of instruction will be in English.

Learning Outcomes: 1. Analyze major literary themes and evaluate narrative strategies of the works of literature. 2. Interpret the use of symbolism, characteristic stylistic features, and nuances of the language's literary aspects. 3. Develop an understanding of the dynamic interplay between literary texts and their cultural and historical contexts. 4. Formulate analytical skills and learn how to research, structure, and edit essays in the humanities. Emphasis will be placed on developing organizational and editing skills, as are widely applicable across fields of study. 5. Identify literary Korean in various forms, aiming to familiarize them with the nuances of the language's literary aspects. Credits: 3.00

KOR 28000 - Special Topics In Korean Language

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on Korean language topics such as history of Korean language, Korean linguistics, Korean dialects, Korean sociolinguistic studies, applied linguistic foci in Korean language, etc.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 28200 - Korean Culture And Society

Credit Hours: 3.00. This course explores Korean culture from antiquity to the present. Students will investigate the dynamic political and social forces that have shaped Korean history, comparing and contrasting them with those of other Asian countries. Various hands-on activities include an introduction to Korean cuisine, traditional musical instruments and costumes, and other cultural artifacts and practices.

Learning Outcomes: 1. Build a solid understanding of contemporary Korean culture and social issues. 2. Construct structured arguments about Korea, utilizing academic discourse, through several assignments. 3. Identify facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 4. Establish an analytical framework for K-pop culture and their fan culture. Credits: 3.00

KOR 30100 - Korean Level V

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas-speaking, listening, reading, and writing-in Korean at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. Emphasis will be on the appropriate use of Korean in a variety of situations including schools, companies, and formal/informal meetings. This course also enables students to understand Korean culture and history and to develop cross-cultural insights by comparing Korean society with US society. Korean history, image of Korea, and current social trends in Korea will be discussed for a solid understanding of Korean culture in which Korean language is embedded.

Learning Outcomes: 1. Obtain knowledge about

linguistic structures and language-related cultures through linguistic and cultural analysis and synthesis of various types of data. 2. Apply their linguistic and cultural knowledge to comprehend (reading and listening) and produce (writing and speaking) language. 3. Assess paragraph-length texts and oral discourse to comprehend provided texts and dialogue in the classroom. 4. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 5. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 6. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 7. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 3.00

KOR 30200 - Korean Level VI

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas-speaking, listening, reading, and writing-in Korean at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. Emphasis will be on the appropriate use of Korean in a variety of situations including schools, companies, and formal/informal meetings. This course also enables students to understand Korean culture and history and to develop cross-cultural insights by comparing Korean society with US society. Korean history, image of Korea, and current social trends in Korea will be discussed for a solid understanding of Korean culture in which Korean language is embedded.

Learning Outcomes: 1. Obtain knowledge about linguistic structures and language-related cultures through linguistic and cultural analysis and synthesis of various types of data. 2. Apply their linguistic and cultural knowledge to comprehend (reading and listening) and produce (writing and speaking) language. 3. Assess paragraph-length texts and oral discourse to comprehend provided texts and dialogue in the classroom. 4. Explain orally in Korean topics that are based on personal experiences in order to successfully interact with native speakers on a prepared topic. 4. Analyze, learn, and produce forms of polite speech, forms to describe past experience, and forms to express supposition. 5. Compose written language in Korean to meet practical writing needs that address the present, past, and some hypothetical situations. 6. Describe facts and evidence related to Korean history, culture, and daily life through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional grams. Credits: 3.00

KOR 33000 - Introduction To Korean Cinema

Credit Hours: 3.00. This course examines Korean society and culture through cinematic representations. Through film, the course provides a broad understanding of the major social and political changes in Korean society, as well as a brief history of Korean cinema and the transformations in the structure of the Korean film industry. Students will learn to identify major directors such as Park Chan-wook, Lee Chang-dong, and Bong Joon-ho, films, and genres. All films will be screened with English subtitles.

Learning Outcomes: 1. Appreciate how film can be understood and used as a cultural and social form that can explain Korean society and culture. 2. Build an understanding of various cinematographic techniques. 3. Learn how to interpret a broad-based understanding of contemporary Korean culture and social issues. 4. Identify elements of genre in Korean cinema through facts and evidence related to Korean history, culture, and daily life through reading Korean media texts and watching films. 5. Develop and communicate their ideas orally and in writing. Credits: 3.00

KOR 38000 - Special Topics In Korean Culture

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on traditional, historical, social, and political themes of Korea.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

KOR 38100 - Introduction To Korean Food Culture

Credit Hours: 3.00. This course is an advanced-level language and culture course that uses food as a lens for understanding the history, cultures, and society of Korea. It covers gastronomy, history, ideologies of modern Korean cuisine, and other aspects of daily life related to Korean traditions. Through this course, students will enhance their proficiency in speaking, listening, reading, and writing in Korean. They will explore a range of topics connected to the eating, making, and representation of food. The primary language of instruction will be Korean, with some supplementary reading material in English.

Learning Outcomes: 1. Interpret the culture, history, and ideologies of modern Korea through the lens of food. 2. Discuss diet, cooking, eating and food culture topics using a broad range of vocabulary and advanced grammatical structures. 3. Identify main cultural trends in food production and consumption. 4. Recognize main ingredient, food categories and their historical significance in Korean diets. Credits: 3.00

KOR 40100 - Korean Level VII

Credit Hours: 3.00. This course aims to help students develop their language skills in four areas (speaking, listening, reading, and writing) at the advanced level. It covers grammar and vocabulary, reading comprehension, fluency, conversation manners, and public speaking. By dealing with various topics on authentic materials including news, articles on websites, and short stories, this course enables students to enhance linguistics knowledge and skills and also helps them to understand Korean culture, history, and current issues in Korea. It is expected that students will be able to discuss various topics and express opinions fluently in both spoken and written language.

Learning Outcomes: 1. Assess discourse-length texts to comprehend provided texts and dialogue in the classroom. 2. Explain the main ideas and most supporting details in connected discourse of paragraphs on a variety of general interest topics in written and spoken Korean. 3. Analyze, learn, and produce forms in informal and formal settings, provide lengthy and coherent narrations, present opinions on a number of issues, and provide structured arguments to support them. 4. Compose written language in Korean to demonstrate the ability to write about various topics with good control of frequently used structures and vocabulary, by using paraphrasing and elaboration to provide clarity. 5. Describe facts and evidence related to Korean history, culture, and society through simple authentic texts and materials such as magazines, drama skits, movies, K-pop lyrics, or traditional games. Credits: 3.00

KOR 48000 - Special Topics In Korean Studies

Credit Hours: 3.00. This course will be offered as a variable-title course focusing on topics related to contemporary Korean culture, arts, literature, etc. Or an internship totaling approximately 100-120 hours per semester or summer in Korea may also be credited through this course.

Learning Outcomes: 1. Learning outcomes vary due to nature of course. Credits: 3.00

LATN 10100 - Latin Level I (UCC: HUM)

Credit Hours: 3.00. Introduction to classical Latin language. Focus on grammar, syntax, vocabulary, and elementary readings.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Learn the basics of reading and translating Latin, including the first half of the core grammar syntax. 2. Improve understanding of English by enriching their vocabulary through etymological connections and through sensitivity to grammatical structures and stylistic choices. Credits: 3.00

LATN 10200 - Latin Level II (UCC: HUM)

Credit Hours: 3.00. Second semester introduction to Latin. Focus on grammar, syntax, vocabulary, and elementary

readings in classical Latin and the language of the Vulgate.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to learn the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Improve their understanding of English by enriching their vocabulary through etymological connections and by increasing their awareness of grammatical structures and stylistic choices. Credits: 3.00

LATN 10500 - Accelerated Basic Latin

Credit Hours: 4.00. Foundational Latin grammar course designed to prepare students to read classical and post-classical Latin in a single intensive semester. Focus on grammar, syntax, vocabulary, and elementary readings. The accelerated Latin course assumes *no* previous knowledge of Latin and makes it possible for the diligent student to be able to read *any* Latin prose or poetry (with a dictionary) after a single semester. (Upon completion students will be prepared to enroll in Latin 201.)
Learning Outcomes: 1. Recite Latin texts aloud (with accurate pronunciation, meaningful phrase grouping, and appropriate voice inflection) by imitating models they have heard in class. 2. Analyze Latin texts by identifying and describing the basic elements of Latin grammar, sentence structure, and style. 3. Translate intermediate level un-adapted Latin texts into English. 4. Compose complex sentences while writing a short story in Latin. Credits: 4.00

LATN 20100 - Latin Level III (UCC: HUM)

Credit Hours: 3.00. Intermediate reading course in Latin, designed to strengthen students' grasp of grammar and syntax, broaden vocabulary, and develop foundational skills in reading and translation.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Read and translate simple Latin literature independently and read and translate more complex literature with suitable help from commentaries and instructor. 3. Improve understanding of English through increased sensitivity to grammatical structures and stylistic choices and by extending their vocabulary through etymological connections. Credits: 3.00

LATN 20200 - Latin Level IV (UCC: HUM)

Credit Hours: 3.00. Upper intermediate reading course in Latin prose and poetry, designed to consolidate students' grasp of grammar and syntax, broaden vocabulary, and develop precision and confidence in reading and translation.
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Continue to reinforce knowledge of the basic grammar, vocabulary, and syntax needed for reading and translating Latin. 2. Apply foundational knowledge to selections from complex and stylistically sophisticated Latin literature. 3. Improve understanding of English by enriching their vocabulary and through increased sensitivity to grammar and style. Credits: 3.00

LATN 31500 - Latin Paleography I

Credit Hours: 3.00. This course gives students the opportunity to work with original medieval Latin manuscripts, involving transcription and translation, as well as study of the creation, care, and preservation of rare manuscripts.
Learning Outcomes: 1. Work with unedited and as yet untranslated Latin texts. 2. Transcribe Latin documents and produce original translations. 3. Address and solve complex syntactical challenges. 4. Identify fields tangential to Latin and Classics discipline, such as mediaeval history, art history, religious and biblical studies, music, etc. 5. Demonstrate an understanding of digital humanities. Credits: 3.00

LATN 34300 - Roman Oratory (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by the published versions of speeches performed in ancient Rome.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin. 2. Discover the importance of oratory in Roman politics and culture. 3. Develop understanding and enjoyment of Latin prose style. Credits: 3.00

LATN 34400 - Roman Epic (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of social, political, and rhetorical issues raised by epics such as Vergil's Aeneid, Ovid's Metamorphoses, or other hexameter poetry.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improve skills as readers and translators of Latin poetry. 2. Increase understanding of the importance of hexameter poetry in Roman culture and subsequent literary tradition. Credits: 3.00

LATN 34500 - Roman Elegy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman Elegy, including selected passages from such authors as Catullus, Tibullus, Propertius, and Ovid.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 34600 - Roman Rhetoric (UCC: HUM)

Credit Hours: 3.00. Development of advanced Latin reading skills, alongside exploration of the social, political and literary questions raised by Roman rhetorical theory.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop more advanced skills as readers and translators of Latin literature. 2. Analyze Roman perspectives on communication and will discover how influential thinkers assessed the role of literature and speech in Roman society. Credits: 3.00

LATN 34700 - Roman Comedy (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman comedy, including selected works of Plautus and Terence.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Have a greater facility in translating Latin in general, and Latin verse in particular. 2. Study of texts representative of this genre will enhance their understanding and appreciation not simply of other pieces of Roman literature, but also of western comedy as a whole, whose roots are in the comedies of Plautus and Terence. 3. Focus on the background of Roman comedy will also enable students to recognize important connections between literature and its social contexts. Credits: 3.00

LATN 44200 - Roman Lyric Poetry (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of selections from Roman lyric poetry, with special attention to Catullus and Horace.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44300 - Roman Satire (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman satire, including selected passages from Horace, Juvenal, Petronius, and Seneca.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44400 - Roman Philosophers (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman philosophical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44500 - Roman Encyclopedists (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of texts representative of Roman encyclopedism, including selected passages from Pliny the Elder, Aulus Gellius, and Nonius Marcellus.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 44600 - Roman Historians (UCC: HUM)

Credit Hours: 3.00. Readings and discussion of Roman historical texts.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

LATN 49000 - Directed Reading In Latin

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Permission of instructor required.

Credits: 1.00 to 3.00

LC 10100 - Special Topics in Languages and Cultures I

Credit Hours: 0.00 to 5.00. Special topics in Foreign Languages. Permission of department required.

Learning Outcomes: 1. Varies due to nature of course. Credits: 0.00 to 5.00

LC 10200 - Special Topics In Foreign Languages II

Credit Hours: 0.00 to 4.00. Topics vary. Permission of department required.

Credits: 0.00 to 4.00

LC 20100 - Special Topics In Foreign Languages III

Credit Hours: 0.00 to 4.00. Topics vary. Permission of department required.

Credits: 0.00 to 4.00

LC 20200 - Special Topics In Foreign Languages IV

Credit Hours: 0.00 to 4.00. Special Topics in Foreign Languages IV. Permission of department required.

Credits: 0.00 to 4.00

LC 23000 - Crossing Borders: Introduction To Comparative Literature

Credit Hours: 3.00. (CMPL 23000) Foundations for comparison of works in different languages, thematic (philosophical, sociological, psychological) and structural (genre, composition, use of linguistic devices); parallel interrelation of theme and structure in works of different literatures. The importance of literary norms and systems of genres. Examination of crosscurrents in different literatures during successive periods of development.

Learning Outcomes: 1. Provide familiarity with the original languages that lie behind English translations of world literature. 2. Relate a particular culture to the larger patterns of world literature to gain an appreciative of cultural diversity and global awareness of class, ethnicity, gender, and race. 3. Provide practical experience in oral communication through class presentations and reports and projects. 4. Provide practical experience in oral communication through class presentations and reports and projects. 5. Provide appropriate level practice in information literacy related to the study of comparative literature, including researching source materials, research methodologies, and intellectual approaches. Credits: 3.00

LC 23100 - Fairytale, Folktale, Fable

Credit Hours: 3.00. This course provides an overview of fairytale, folklore, and fable traditions across various cultures and historical periods, as well as an examination of their ongoing influence on contemporary cultures. Taught in English.

Learning Outcomes: 1. Gain an intercultural knowledge of human cultures as well as global citizenship and awareness. 2. Make comparisons and connections about the interplay and the importance of such traditional tales among various cultures of the world. 3. Enable students to develop both their written communication and their oral communication skills. 4. Develop critical thinking, creative thinking, and in some instances, ethical reasoning. 5. Develop information literacy skills and the integrative knowledge, not only through classwork, but also through assignments and projects. Credits: 3.00

LC 23500 - East Asian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected East Asian poetry, prose, and drama. Focus will be on the traditions of China and Japan, but may include works of other cultures such as Korea. Emphasis may vary yearly, stressing traditional or modern literatures.

Credits: 3.00

LC 23700 - Our Common Bond: Languages And Cultures In A Global Context

Credit Hours: 3.00. (CMPL 23700) Students learn what lies behind the concept of Liberal Arts: the capabilities, insights and skills of individuals who think critically and freely. It exposes students from across the university to the ideas, skill-set and inspiration that emanates from the liberal arts. They will be introduced to the discipline of Comparative Literature by examining the specific roles that languages and cultures play in the globalized world. The course also demonstrates how a Language and Cultures degree will put students at a greater advantage in career opportunities.

Learning Outcomes: 1. Trace how various cultures have shaped our contemporary models of higher education through written and oral assignments. 2. Describe how literary texts from various cultures provided the catalyst for major political and social events throughout history. 3. Identify the impact that literary endeavors have in the development of scientific, medical, corporate, environmental and political ideas. 4. Articulate clearly why a Liberal Arts education that focuses on languages and intercultural competency is both valuable and marketable in today's global context. Credits: 3.00

LC 23900 - Women Writers In Translation (UCC: HUM)

Credit Hours: 3.00. An examination of international female writers' literary creativity in the context of women's studies and feminist theory, as articulated in their specific cultural and geographical milieu. Course content will vary in terms of cultural focus. In English.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop skills in writing, reading, critical thinking, and oral expression. 2. Gain knowledge of female literary traditions in different geographical milieu and time periods. 3. Increase awareness of the ways in which women writers reflect upon and resist stereotypes of women in literature, and how this process may differ across cultures. 4. Understand fundamental concepts in women's gender and sexuality studies. Credits: 3.00

LC 26100 - Introduction To The Linguistic Study Of Foreign Languages (UCC: BSS)

Credit Hours: 3.00. Overview of linguistics and the role of language in society; fundamental concepts of linguistic analysis. The course focuses on linguistic phenomena found in French, German, Russian, and Spanish, with material, examples, and assignments drawn primarily from those languages whenever appropriate.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

LC 26300 - Introduction To Computational Linguistics

Credit Hours: 3.00. This course introduces students to computational linguistics, a subfield of linguistics that studies natural languages from a computational perspective. The course covers both the theoretical and engineering topics ranging from aspects of formal linguistic structure to tools of language technology. The course will provide an understanding of the essential characteristics and differences between fields of inquiry such as computational linguistics, natural language processing (NLP), machine learning, and artificial intelligence (A.I.). There are no prerequisites and students are not expected to have any previous programming background, although the course introduces students to Python 3 programming language. Python is the ideal choice for NLP and AI due to its robust capabilities, strong community support, flexibility, and readability. It is a requirement for all NLP practitioners.

Learning Outcomes: 1. Identify and describe key concepts of and common methods in computational linguistics. 2. Explain the role of computational linguistics in the broader context of linguistics and artificial intelligence. 3. Implement computational linguistics tasks with robust Pythonic code using state-of-the-art NLP libraries such as natural language processing toolkit (NLTK) and spaCy. 4. Acquire the ability to write programming projects in Python. 5. Analyze linguistic patterns in a natural language using Pythonic coding skills. Credits: 3.00

LC 26500 - Introduction To Neurohumanities

Credit Hours: 3.00. This course introduces students to the main developments in the neurohumanities particularly since the 1990s, with focus on cognitive literary and cultural studies. The course emphasizes not only the role of psychology, neuroscience, evolutionary biology, and other STEM and social

scientific fields in interpreting cultural artifacts, but also how literary and cultural studies contribute significantly to those fields. Students will learn skills which will enable them to consider and interpret works of art, broadly defined, through a highly interdisciplinary cognitive-studies lens as they explore how the humanities are intricately intertwined with the sciences.

Learning Outcomes: 1. Identify the main focal points of cognitive literary and cultural studies and trace their developments over the past four decades. 2. Analyze the reciprocal influence of humanistic cognitive studies and scientific fields. 3. Explain the primary debates within and surrounding cognitive studies in the humanities. 4. Implement one or more approaches from cognitive studies to analyze a literary work, film, or other cultural artifact. Credits: 3.00

LC 26600 - World Literature: From The Beginnings to 1700 A D

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

LC 26700 - World Literature: From 1700 A D To The Present

Credit Hours: 3.00. World literature in translation. A comparative and chronological survey of the masterpieces of Eastern and Western literature.

Learning Outcomes: 1. Demonstrate knowledge of a range of genres, topics, and literary conventions characteristic of world literatures. 2. Discuss those genres, topics, and conventions in relation to their diverse historical, cultural, and aesthetic contexts. 3. Produce well-reasoned written arguments about the literature they study based on appropriate use of textual evidence. Credits: 3.00

LC 28000 - Special Topics In Languages And Cultures

Credit Hours: 3.00. Special topics relating to world languages and cultures.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

LC 28100 - Introduction To World Food Cultures (UCC: HUM)

Credit Hours: 3.00. This course introduces students to global food culture and world gastronomy. It covers different aspects of food studies such as food representations in art and literature, national identity, culinary traditions, and world trade and migration in respect to food. This course will give students a broad overview of the relation between food and many other disciplines, allowing them to connect the topics addressed to their own fields of study. Conducted in English. No prerequisites.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Recognize the central importance of food in every culture and its relation to other fields of study. 2. Compare food representations in literary texts and other forms of art. 3. Analyze how food contributes to the creation of national identities. 4. Recognize the main challenges of global food production, circulation, and consumption. 5. Examine the food heritage and impact of different cultures in the United States. Credits: 3.00

LC 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the

profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 30000 - World Literature Through The Photographic Lens

Credit Hours: 3.00. The course critically explores the photographic characteristics of modern world literature. It examines the deep, dynamical, and fascinating relationship between photography and literature.

Learning Outcomes: 1. Demonstrate critical understanding of the ways and manners literary works interact with photographic images. 2. Comprehend the relationship between the sense of vision, language and thought. 3. Demonstrate ability to critically appraise cultural differences, social problems and historical changes. 4. Identify, analyze, and evaluate literary theories, art criticism, historical analysis and philosophical musings. 5. Create, develop and hone a sense of aesthetics as well as a personal writing style while engaging in literary and art criticism. Credits: 3.00

LC 32300 - Global Sustainable Engineering

Credit Hours: 1.00 or 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 or 3.00

LC 33100 - Comparative Literature In Translation

Credit Hours: 3.00. A course in the study of a special topic related to works in several foreign literatures, directed by an instructor whose particular field of specialization will be highlighted.

Credits: 3.00

LC 33200 - Global Horror Cinema (UCC: HUM)

Credit Hours: 3.00. The course introduces horror cinema across the globe, through the technical and thematic analysis of different subgenres and domestic trends. In addition to building analytical skills regarding film concepts and theories, the course is designed to implement critical skills in film studies, cultural studies, and global studies.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply film studies-related terms for technical and thematic analysis of film sequences. 2. Demonstrate a deeper knowledge of horror film industries across the globe. 3. Analyze the domestic and international contexts in which films are released (history, politics, social movements). 4.

Investigate intersectional questions of gender, race, and class in connection with film analysis and film production. 5. Develop critical approaches to a variety of horror subgenres. Credits: 3.00

LC 33300 - The Middle Ages On Film (UCC: HUM)

Credit Hours: 3.00. Introduction to the Middle Ages through films in various languages and genres from the beginning of film history to the present. Reading literary, historical, legal, and film theory texts in conjunction with the films, students critically analyze representations of the Middle Ages and the cultural context from which these emerge.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

LC 33800 - Language Through Films

Credit Hours: 3.00. The course critically explores language(s) via the medium of cinema where language plays a key role in the film. It is intended to introduce students to the fundamental place language occupies within human experience, to advance knowledge of some of the features of the system of language, develop a sharper ear for language, a better understanding of its nature, and a livelier interest in all its manifestations. The course will be taught in English and films will be shown with subtitles.

Learning Outcomes: 1. Identify the main building blocks of language. 2. Examine the universal characteristics of the many languages humans speak. 3. Appraise the relationship between language, cognition, emotion and world view. 4. Re-evaluate their thinking regarding the acquisition of a second language. 5. Access the significant position language plays within societies and cultures. Credits: 3.00

LC 36100 - Sound And Form In Language

Credit Hours: 3.00. Examination of the nature of sound systems (phonology) and form systems (morphology) of language, as well as techniques of phonological and morphological analysis, using material from various languages. Central focus on phonetic and phonological structure, and on inflectional and derivational morphology.

Credits: 3.00

LC 36800 - Sociolinguistic Study Of African American English

Credit Hours: 3.00. A study of the history, structure, uses, and educational concerns of African American English in African American speech communities and the U.S. culture at large.

Credits: 3.00

LC 37100 - Phonetics Of Foreign Languages

Credit Hours: 3.00. Introduction to articulatory phonetics for students of foreign languages. Mechanisms of production of speech sounds. Production and discrimination of sounds of other languages; contrast with English sounds; practice in pronunciation and phonetic transcription. Introduction to the International Phonetic Alphabet (IPA). Credit will not be awarded for more than one of SLHS 30600 , LING 31500 , and LC 37100.

Credits: 3.00

LC 38500 - The Holocaust In World Literature And Film

Credit Hours: 3.00. This course explores the representation of the Holocaust through a wide range of literary and historical texts and films. The course provides sociohistorical context for these works, while also grappling with philosophical questions of representation such as how - or even should - the atrocities of genocide be represented aesthetically and fictionally? Drawing on both primary and secondary sources, the course gives students a nuanced understanding of the difficulties of representations that are based in part on fallible human memory, but also of the crucial importance of giving voice to those who experienced the trauma of the Holocaust. Students will further develop their critical thinking skills by analyzing literature and film that documents a variety of ways in which this watershed event of the 20th century has been represented and interpreted.

Learning Outcomes: 1. Analyze filmic and literary representations of the Holocaust in respect to themes, historical context, and narrative and filmic strategies of representation. 2. Demonstrate knowledge of the historical events surrounding the Holocaust. 3. Discuss the Holocaust from nuanced ethical and moral perspectives, with consideration of the vantage points of its victims, traumatized survivors, perpetrators, passive bystanders, and resistance fighters. 4. Evaluate the roles of memory, first-person and eyewitness testimony,

and other types of documentation of the Holocaust, reflecting on the challenges of representing these tragic events and the implications for historiography. Credits: 3.00

LC 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in language and culture. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

LC 39900 - Special Study Abroad Credit In Foreign Languages

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in foreign languages earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

LC 47500 - Theories Of Teaching World Languages

Credit Hours: 3.00. This course is designed to assist you in the process of becoming a skilled professional who can teach world language(s). You will gain experiential hours in the secondary classroom. You will also develop an understanding of the connection between effective language teaching and successful language learning, be able to think critically about your own teaching and teaching materials and gain an understanding of various theories, methods, approaches, and techniques in world language teaching. Areas of emphasis include the nature of language learning theories, early approaches to language pedagogy, communicative language teaching methodology, the relationship between theory and practice, aspects of the interaction between speakers in the classroom, skills-based theories, sociocultural perspectives, individual differences between learners, and usage-based approaches to second language acquisition.

Learning Outcomes: 1. Identify various theories of foreign language learning. 2. Describe various theories of foreign language teaching. 3. Analyze how student learning is influenced by different types of instructional practices. 4. Recognize how theories of individual and collaborative learning strategies affect student engagement. 5. Compare and contrast how diverse learners process information and develop language learning skills. Credits: 3.00

LC 49000 - Special Topics In Foreign Languages And Literatures

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

LC 49900 - Research In Foreign Languages

Credit Hours: 1.00 to 3.00. Undergraduate research into a topic in foreign languages. Permission of instructor required.

Credits: 1.00 to 3.00

PTGS 10100 - Portuguese Level I (UCC: HUM)

Credit Hours: 3.00. A beginning course in Portuguese.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Describe themselves, their families, school, music and preferred foods using the present and preterite verb tenses. 2. Identify and locate specific characteristics of the geography of Brazil, including the north, northeast, south and southeastern regions and evaluate the impact that demographics has had on migration, religion, and culinary habits. 3. Assess the role of education in Brazil and its impact on the family and society in the country's different regions. Credits: 3.00

PTGS 10200 - Portuguese Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of PTGS 10100.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PTGS 10500 - Accelerated Portuguese (UCC: HUM)

Credit Hours: 3.00. Accelerated acquisition of basic Portuguese for speakers of Spanish or another romance language. Capitalizes on students' backgrounds in related languages to build skills in listening comprehension, reading comprehension, basic writing, and conversation. Knowledge of a romance language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PTGS 20100 - Portuguese Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Portuguese course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Discussing personal relations and academic studies. 2. Giving and receiving directions to a destination and/or in order to complete a task. 3. Preparing short oral presentations on topics related to Portuguese and Brazilian cultures. 4. Writing short essays on specified topics. Credits: 3.00

PTGS 20200 - Portuguese Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of PTGS 20100 .

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PTGS 23500 - Luso-Brazilian Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Brazilian and Portuguese literature, with an emphasis on transatlantic cultural traditions and creative responses to contemporary social challenges. Knowledge of Portuguese not required.

Learning Outcomes: 1. Identify and explain exemplary texts from Brazilian and Portuguese literature, by reading them and discussing them with classmates and the professor. 2. Identify significant aspects of Luso-Brazilian culture, through discussions of examples found in assigned readings. 3. Explain how challenges relating to racial relations, social class and everyday ethics may be addressed in different ways by another culture, through comparing their own approaches with those found in the texts. 4. Discuss how literature relates to culture and to the analysis of social challenges, because of identifying societal implications of numerous readings. 5. Explain the importance of satire as a coping mechanism and corrective for social problems, by commenting on

assigned texts in a personal journal. 6. Discuss how literature relates to culture and to the analysis of social challenges, through identifying societal implication of numerous readings. 7. Write persuasively about significant aspects of colonial and post-colonial relationships, by composing and revising essays about literary texts. Credits: 3.00

PTGS 30100 - Portuguese Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Portuguese speaking, listening, reading and writing abilities, using materials dealing primarily with everyday life and civilization in the Portuguese-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Portuguese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PTGS 30200 - Portuguese Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Portuguese on the basis of materials dealing primarily with the ideas and events that have shaped present-day Portuguese-speaking countries. Conducted primarily in Portuguese.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PTGS 33000 - Brazilian, Portuguese, And African Cinema

Credit Hours: 3.00. Screening and analysis of selected films from Portuguese-speaking countries: Brazil, Portugal, Angola, Mozambique, Cape Verde, Guinea-Bissau, S. Tome and Principe, with discussion of their cultural contexts (colonial/post-colonial societies; cross-Atlantic relationships; racial diversity; minority/majority issues). Knowledge of Portuguese not required.

Credits: 3.00

PTGS 39800 - Topics In Portuguese

Credit Hours: 3.00. Advanced studies of particular aspects of Portuguese (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussion, and papers in Portuguese.

Credits: 3.00

PTGS 39900 - Special Study Abroad Credit In Portuguese

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Portuguese earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

PTGS 49800 - Advanced Topics In Portuguese

Credit Hours: 3.00. Advanced studies of particular aspects of Portuguese (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussion, and papers in Portuguese.

Credits: 3.00

RUSS 10100 - Russian Level I (UCC: HUM)

Credit Hours: 4.00. A beginning course in Russian which builds basic skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook units. 3. Read and understand basic texts in Russian related to everyday activities. 4. Write a paragraph using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Begin learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 10200 - Russian Level II (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 10100. Further work on developing skills in speaking, oral comprehension, reading, and writing in Russian through class participation, structured conversation, and short writing assignments.

University Core Curriculum (UCC): (UCC: HUM)
Learning Outcomes: 1. Understand additional

details as well as the main ideas in short conversations which deal with topics covered in the course. 2. Take part in simple conversations on everyday topics presented in the textbook and other class materials. 3. Read and understand simple texts in Russian related to everyday activities. 4. Write a few paragraphs using simple but coherent sentences about situations and events discussed in class and in the textbook. 5. Continue learning to recognize, appreciate, and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 11100 - Conversation Supplement To Russian Level I

Credit Hours: 1.00. Basic development of intonation patterns, formulas for question and response in a variety of situations. Activization of basic Russian vocabulary and grammar. May be taken concurrently with RUSS 10100.

Credits: 1.00

RUSS 11200 - Conversation Supplement To Russian Level II

Credit Hours: 1.00. Guided practice in conversation based on vocabulary and grammar learned in RUSS 10200. May be taken concurrently with RUSS 10200.

Credits: 1.00

RUSS 20100 - Russian Level III (UCC: HUM)

Credit Hours: 4.00. An intermediate-level course designed to develop higher skills in speaking, listening, reading, and writing Russian, as well as in intercultural competence and communication through further work on conversational and writing ability. Students work individually and in small groups using authentic reading and audio materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both simple conversations on everyday topics and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain simple conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important life events, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 20200 - Russian Level IV (UCC: HUM)

Credit Hours: 4.00. Continuation of RUSS 20100. Development of Russian language skills at the higher intermediate level in speaking, listening, reading, writing, and in cultural competence. Conversational and writing ability receive prominence, as well as a review of Russian grammar. Students continue working with authentic reading and audio materials individually and in small groups.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Understand both ordinary conversations and messages such as short news items, brief interviews, or advertisements, delivered at normal speed. 2. Maintain ordinary conversations on everyday topics as presented in class and in the textbook. 3. Read and understand ordinary original texts in Russian related to everyday activities. 4. Write a report, an article, or a letter about important topics, as discussed in class. 5. Expand their factual knowledge about everyday customs, key events, and prominent persons in Russian and Soviet culture with the goal to enhance their intercultural appreciation and communication skills. 6. Recognize, appreciate and compare similarities and differences between their own culture and Russian culture. Credits: 4.00

RUSS 21100 - Conversation Supplement To Russian Level III

Credit Hours: 1.00. Guided practice in conversation based on vocabulary, grammar, and readings covered in RUSS 20100. May be taken concurrently with RUSS 20100.

Credits: 1.00

RUSS 21200 - Conversation Supplement To Russian Level IV

Credit Hours: 1.00. Guided practice in conversation, based on vocabulary, grammar, and readings covered in RUSS 20200. May be taken concurrently with RUSS 20200.

Credits: 1.00

RUSS 29800 - Special Topics In Russian

Credit Hours: 3.00. Studies of particular aspects of Russian (e.g. culture, civilization, linguistics, literature, film, etc.) by examining varied selection of works. Readings, discussion, and papers in English.

Credits: 3.00

RUSS 30100 - Russian Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Russian speaking, listening, reading, and writing abilities, using material dealing primarily with everyday life and civilization in the Soviet Union from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 30200 - Russian Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Russian, on the basis of materials dealing with the ideas and events that have shaped present-day Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 31100 - Russian Conversation I

Credit Hours: 1.00. Guided practice in conversation on a variety of assigned and spontaneous topics to enhance communicative competence and develop oral and aural abilities. Small group discussions in Russian on various topics. May be taken alone or concurrently with RUSS 30100 or above. May be repeated for credit.

Learning Outcomes: 1. Improve their speaking ability in Russian. 2. Improve their aural comprehension in Russian. 3. Acquire new vocabulary and grammar. 4. Preserve their language ability in a semester when they are not taking a course in the regular sequence of language study. Credits: 1.00

RUSS 33000 - Russian And East European Cinema (UCC: HUM)

Credit Hours: 3.00. Viewing and analysis of significant Russian and East European films. Evolution of the Russian and East European cinema, its place in world cinema, and its relation to cultural, political, and social trends. Cinematic adaptation of literary and theatrical works. Knowledge of Russian or East European languages not required.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 33100 - Post-Soviet Russian Cinema

Credit Hours: 3.00. Viewing and analysis of significant post-Soviet Russian films, providing an understanding of the nuanced sociopolitical situation in contemporary Russia. Evolution of Russian cinema in the post-Soviet era, its place in world cinema, and its relation to cultural, political, and social trends. The course builds an understanding of the Russian political, historical, and cultural context through an exploration of cinematic artistry. It presents and analyzes films that depict aspects of contemporary Russia, covering subjects from the collapse of the Soviet Union to the rise and hold on power of Vladimir Putin, through cinematic adaptation of literary and theatrical works. Conducted in English. Knowledge of Russian is not required.

Learning Outcomes: 1. Have an understanding and appreciation of contemporary (post-Soviet) Russian cinema. 2. Have familiarity with 21st-century cinematographic techniques as implemented in Russian cinema. 3. Discuss the artistic merits of prominent Russian films and their relevance in the historical, social, political, and cultural context of the corresponding time period. 4. List and discuss a number of Russian films which are considered important milestones in the development of post-Soviet cinematography. 5. Identify prominent contemporary Russian directors and actors, and describe their contribution to cinematography. Credits: 3.00

RUSS 34100 - Russian Literature In The Nineteenth Century

Credit Hours: 3.00. Selected Russian poetry, prose, and drama from the Kievan period to 1900 in historical and cultural context. Students will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role of literature in 19th century Russian culture and society. 2. Situate the works they read in their historical and political content. 3. Improve understanding of the way literary works function through various artistic devices. 4. Improve ability to perform close readings of literary texts. 5. Increase ability to write analytical papers supporting a thesis. 6. Increase ability to conduct and present independent research. 7. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 34200 - Revolution, Repression, Renewal: Soviet Literature And Beyond

Credit Hours: 3.00. Selected Russian poetry, prose, and drama of the 20th century in historical and cultural context. Students will read and discuss major authors and texts and will write critical essays on literary topics. Conducted largely in Russian.

Learning Outcomes: 1. Understand the role and position of literature in the Soviet Union. 2. Situate the works they read in their historical and political context. 3. Understand the relationship between writers, the Soviet state, and the means of disseminating texts. 4. Improve understanding of the way literary works function through various artistic devices. 5. Improve ability to perform close readings of literary texts. 6. Increase ability to write analytical papers supporting a thesis. 7. Increase ability to conduct and present independent research. 8. Confront the philosophical and ethical questions raised by these works. Credits: 3.00

RUSS 38000 - Russian Culture And Civilization I

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia, starting with the founding of the Kievan state and continuing to the last days of the Russian Empire. No knowledge of Russian is required.

Learning Outcomes: 1. Understand the forces and circumstances (geographical, historical, political) that shaped the Russian state and gave rise to its distinctive forms of culture. 2. Understand the distinction between rossiskoe (Russian as pertains to the polity) and russkoe (ethnically and linguistically Russian), and improve understanding of Russia as a multi-ethnic state. 3. Discover the contributions of non-ethnic Russians to Russian culture. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. 5. Increase ability to read critically and write persuasively. Credits: 3.00

RUSS 38100 - Russian Culture And Civilization II

Credit Hours: 3.00. This course traces the intellectual and cultural development of Russia from the revolutionary period to the present. No knowledge of Russian is required.

Learning Outcomes: 1. Increase understanding of the interactions between revolutionary politics and revolutionary art, and explore the role of art in a political society while encountering various strategies authors, composers, etc. used to navigate between creative impulses and political requirements. 2. Move beyond the simplistic dichotomy of propaganda vs. dissidence and explore the complex gradations between the extremes of official anti-Soviet culture. 3. Increase knowledge of the relationship between cultural production, distribution, and consumption and the forms that culture takes. 4. Develop an appreciation for the artistic value of examples of Russian literature, music, and the pictorial arts. Credits: 3.00

RUSS 39900 - Special Study Abroad Credit In Russian

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Russian earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

RUSS 40100 - Russian Level VII (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Russian speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in Russia and the Soviet Union. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

RUSS 40200 - Russian Level VIII (UCC: HUM)

Credit Hours: 3.00. Further advanced work on speaking, listening, reading, and writing abilities in Russian. Course materials will cover a variety of topics illustrated by film and other media, both print and nonprint. Conducted primarily in Russian.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Improve proficiency in the four language skills: speaking, listening, writing, and reading. 2. Achieve a proficiency of Intermediate High to Advanced Low (ACTFL scale), Level 3 (State Department Scale). 3. Gain greater familiarity with various elements of Russian society and both high and popular culture. Credits: 3.00

RUSS 41100 - Advanced Russian Conversation I

Credit Hours: 1.00. Guided practice in conversation on a variety of advanced assigned and spontaneous topics to enhance communicative competence and develop oral and aural abilities. Small group discussions in Russian on various topics. May be taken alone or concurrently with RUSS 40100 or above. May be repeated for credit.

Learning Outcomes: 1. Improve their speaking ability in Russian. 2. Improve their aural comprehension in Russian. 3. Acquire new vocabulary and grammar. 4. Preserve their language ability in a semester when they are not taking a course in the regular sequence of language study. Credits: 1.00

RUSS 42400 - Business Russian

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

RUSS 49700 - Topics In Russian Literature

Credit Hours: 3.00 to 6.00. This course provides in-depth study of a particular author or facet of the Russian literary tradition. Possible topics include Dostoevsky and His Age; The Art and Thought of Leo Tolstoy; Russian Romanticism: Pushki, Gogol, Lermontov; The Russian Stage: Theater in Russia and the Soviet Union.

Learning Outcomes: 1. Increase familiarity with various writers, movements, and other aspects of the Russian literary tradition. 2. Improve understanding of the ways in which Russian writers confronted moral and artistic problems in their works. 3. Able to contextualize Russian literary works in the historical and cultural context in which they appeared. 4. Increase ability to read critically and write persuasively. 5. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

RUSS 49800 - Topics In Russian Culture

Credit Hours: 3.00 to 6.00. This course provides a sustained examination of some aspect of Russian culture or a topic relevant to Russian cultural studies. Topics may include Russia Confronts the East; The Caucasus: An Introduction; Popular Culture in Russia.

Learning Outcomes: 1. Attain an in-depth understanding of a particular movement, feature, or aspect of Russian culture. 2. Improve knowledge of Russian history and society as it pertains to cultural development. 3. Increase ability to read critically and write persuasively. 4. Become acquainted with the resources available for further pursuit of topics in Russian cultural history. Credits: 3.00 to 6.00

SPAN 10100 - Spanish Level I (UCC: HUM)

Credit Hours: 3.00. A beginning Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1910 Spanish Level I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe themselves, their friends and families, their personal interests and activities using the present and preterit verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, hobbies, holidays, daily schedules, food, and shopping. Credits: 3.00

SPAN 10200 - Spanish Level II (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 10100. CTL:IWL 1911 Spanish Level II

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Describe aspects of daily life and communicate in personal and professional situations using the present and various past verb tenses. 2. Identify and describe salient aspects of Hispanic culture from around the world. 3. Summarize and discuss orally and in written form short readings on a variety of topics about the Hispanic world, including university life, daily schedules, food, social engagement, and technology. Credits: 3.00

SPAN 10500 - Accelerated Basic Spanish (UCC: HUM)

Credit Hours: 4.00. Accelerated Basic Spanish course that substitutes for SPAN 10100 and 10200.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify appropriate use of Spanish language in specific contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a set of grammatical rules and standards in the language. 4. Produce sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

SPAN 11200 - Elementary Spanish Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in conversation to enhance communicative competence. Small group; discussions in Spanish on various topics. Not open to students enrolled in or having credit for SPAN 20100 or above.

Learning Outcomes: 1. Develop listening skills and improve oral Spanish proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss relevant texts in the target language. Credits: 1.00

SPAN 20100 - Spanish Level III (UCC: HUM)

Credit Hours: 3.00. An intermediate Spanish course with emphasis on communicative skills (listening and speaking), literacy skills (reading and writing) and culture. CTL:IWL 1912 Spanish Level III

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate mastery of grammatical structure and syntax, formation of plural nouns, noun-adjective agreement, verb conjugation, through the application of the communicative pedagogy (teaching in context) in the use of the basic learning skills (reading, writing, speaking and listening) by: 2. Discussing personal relations and academic studies. 3. Giving and receiving directions to a destination and/or in order to complete a task. 4. Writing short essays (maximum 250 words) on specified topics. Credits: 3.00

SPAN 20200 - Spanish Level IV (UCC: HUM)

Credit Hours: 3.00. Continuation of SPAN 20100. CTL:IWL 1913 Spanish Level IV

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate control of most structures, considerable breadth of vocabulary, and appropriate communicative competence. 2. Develop the linguistic and analytic skills needed for advanced study in Spanish. 3. Be able to communicate in an academic setting, critically assess ideas and texts, and be able to present them in writing to an academic audience. 4. Show the knowledge of the rich cultural, geographical, and linguistic variety of the Spanish-speaking world. Credits: 3.00

SPAN 20500 - Accelerated Intermediate Spanish (UCC: HUM)

Credit Hours: 4.00. An accelerated intermediate Spanish course that substitutes for SPAN 20100 and 20200.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify appropriate use of Spanish language in a variety of contexts by reading Spanish texts. 2. Identify appropriate use of Spanish language in specific contexts by listening to audio recordings and watching videos of spoken Spanish. 3. Compose Spanish sentences by focusing on a broad set of grammatical rules and standards in the language. 4. Produce a variety of sentences in spoken Spanish in the form of dialogues and presentations. Credits: 4.00

SPAN 21200 - Intermediate Spanish Conversation

Credit Hours: 1.00. Development of oral skills for self-expression. Guided practice in Spanish conversation to enhance communicative competence. Small group discussions in Spanish on various topics.

Learning Outcomes: 1. Develop intermediate listening skills and improve oral Spanish proficiency. 2. Acquire new vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen and discuss relevant intermediate texts in the target languages. Credits: 1.00

SPAN 22400 - Spanish Level IV: Business Spanish

Credit Hours: 3.00. Practical reading, writing, speaking, and listening comprehension skills directed towards use of Spanish for business purposes. Course materials cover a variety of business aspects in several professions.

Credits: 3.00

SPAN 23100 - Cervantes' Don Quixote

Credit Hours: 3.00. Reading and discussion of Cervantes' masterpiece. All readings, discussion, papers, and examinations will be in English.

Credits: 3.00

SPAN 23500 - Spanish American Literature In Translation

Credit Hours: 3.00. Reading and discussion of selected masterpieces of Spanish American literature. The course context will change from semester to semester. Knowledge of Spanish not required.

Credits: 3.00

SPAN 24100 - Introduction To The Study Of Hispanic Literature

Credit Hours: 3.00. Reading and discussion of selected poetry, prose, and theatre from Spain and Spanish-speaking America; introduction to critical discourse and basic concepts of literary theory. Texts, discussion, and written assignments in Spanish.

Learning Outcomes: 1. Gain understanding of literature produced in the Spanish speaking world. 2. Develop the ability to talk effectively about and interact with literature in Spanish. 3. Write specific types of texts for analyzing Spanish literature. Credits: 3.00

SPAN 28000 - Second-Year Spanish: Special Topics

Credit Hours: 3.00. Selected topics on the civilization, culture, and literature of Spain and Spanish America. Lectures and readings primarily in English, but knowledge of Spanish at the first-year level necessary.

Credits: 3.00

SPAN 30100 - Spanish Level V (UCC: HUM)

Credit Hours: 3.00. Continued development of Spanish

speaking, listening, reading, and writing abilities, using materials dealing primarily with everyday life and civilization in the Spanish-speaking countries from a variety of sources (e.g., newspapers, magazines, TV, recent literature, etc.). Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop oral communication skills in Spanish at advanced level through classroom discussions, presentations, projects, and interpersonal communication. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of different genres of authentic texts and video clips in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of genre-specific texts in Spanish. 4. Expand their knowledge of Hispanic culture and their cross-cultural proficiency of the Spanish-speaking world through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30200 - Spanish Level VI (UCC: HUM)

Credit Hours: 3.00. Further work to develop speaking, listening, reading, and writing abilities in Spanish on the basis of materials dealing with the ideas and events that have shaped the present-day Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and expand intermediate-advanced proficiency in Spanish oral communication skills through discovery in various media, presentations, group work, and interpersonal communication. 2. Expand and refine their written proficiency in Spanish by producing a variety of essays, project, and other written assignments. 3. Expand and enhance their knowledge of the diverse Spanish-speaking world and their cross-cultural proficiency through the use of aural, visual, and written texts in Spanish. Credits: 3.00

SPAN 30500 - Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is intended for the student whose home language is Spanish, but whose education has been exclusively in English. The students will first learn to read and write their native dialects and then the standard language using the orthographic norms of the standard language.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 30801 - Advanced Spanish For Heritage Speakers (UCC: HUM)

Credit Hours: 3.00. This course is a continuation of SPAN 30500 . It is an advanced grammar course designed for Spanish-English bilinguals exposed to Spanish as a minority/native language during early childhood or adolescence but who have not received formal instruction or education in the language. It aims to develop advanced grammar and writing skills.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Gain more advanced writing and composition skills in Spanish. 2. Gain more advanced knowledge of Spanish grammar. 3. Gain more enhanced ability to understand, critically evaluate and summarize written texts. 4. Gain more enhanced sociolinguistic competence of their heritage language. 5. Be much better prepared for upper-level courses in Spanish linguistics and literatures. Credits: 3.00

SPAN 31200 - Advanced Spanish Conversation

Credit Hours: 1.00. One credit hour advanced Spanish conversation course focused on guided practice in conversation to enhance communicative competence. Discussions in Spanish on various topics. Course may be taken concurrently with SPAN 30100, 30200, 40100 or 40200.

Learning Outcomes: 1. Develop advanced listening skills and improve oral Spanish proficiency. 2. Acquire advanced vocabulary and grammar through discovery in various media and conversation. 3. Read, view, listen to and discuss assigned materials in Spanish. Credits: 1.00

SPAN 32100 - Introduction To Spanish For The Professions

Credit Hours: 3.00. Continued work at the advanced-intermediate level with a focus on vocabulary and grammar for contexts in a wide variety of professional settings. Conducted primarily in Spanish.

Learning Outcomes: 1. Build upon and improve intermediate Spanish language skills. 2. Develop necessary vocabulary for communication in the target language within broader professional contexts. 3. Create real-world scenarios that facilitate, promote, and practice professional communication in the target language. 4. Incorporate trade-specific situations that are relevant and applicable to each student and his/her respective field of study, while covering the broader implications of these contexts. 5. Promote personal and meaningful application of material through personalized activities and projects that students could use as part of their job search. 6. Examine and present current news events through articles, websites, and videos. Credits: 3.00

SPAN 32200 - Spanish For The Health Professions

Credit Hours: 3.00. Intermediate level course directed towards the use of Spanish in the health care professions. It covers specialized vocabulary from the medical fields, as well as grammar and syntax with the goal of developing speaking, listening, reading and writing abilities. Students will have the opportunity to apply their skills in practical contexts and discuss cultural considerations.

Learning Outcomes: 1. Prepare students to communicate effectively in the health professional field. 2. Study of specialized vocabulary of the health sciences. 3. Apply their skills in a practical classroom setting. 4. Gain cultural, legal, and ethical awareness about the use of Spanish in their interaction with Spanish speaking patients. Credits: 3.00

SPAN 32300 - Global Sustainable Engineering

Credit Hours: 1.00 to 3.00. The main goal of this course is to encourage students to think like global engineers by focusing curricular activities on engineering case studies from a humanistic-engineering perspective. The case studies examined in the course may include past, present, and hypothetical engineering successes and failures; analyses will require engineering skills combined with understanding of cultural perspectives of local communities and cultural context (i.e., sociological, anthropological, and historical information and analyses that contribute to cultural understanding). This humanities-infused approach will encourage students to develop a new mindset--a way of seeing current and hypothetical engineering plans, projects, and impacts through local communities' pasts and presents, unique values, perspectives, and daily ways of life. Taught in Spanish.

Learning Outcomes: 1. Discuss various approaches to engineering problems in class meetings or online discussion boards. 2. Analyze global engineering problems from engineering and humanistic perspectives evidenced in written case study responses and assessments. 3. Apply concepts of systems thinking and design thinking and express them in individual and group activities. 4. Explain the application of humanistic fields of study to engineering problems. Credits: 1.00 to 3.00

SPAN 32400 - Cultural Engineering Research In Spanish

Credit Hours: 1.00 to 3.00. The course will apply principles examined and mindsets developed during the Humanities-Informed Engineering Projects course to engineering projects in situ during an internship in the Spanish-speaking world. The local context of the students in this class (i.e., internship abroad) allows students to gain knowledge and practice with a humanistic-engineering framework situated in a particular community and professional setting. There are two, multistep main projects in this course: 1) Case study project and 2) Spanish language use and development project. To connect language learning and intercultural competence more strongly to the humanistic-engineering framework set up in the prior course, this course is conducted in Spanish.

Learning Outcomes: 1. Define the humanities and their application to an engineering career. 2. Identify key components of communicative competence. 3. Apply the concept of

communicative competence by developing and tracking their professional language goals. 4. Formulate opinions about the concepts of systems thinking and design thinking and express them via a written reflection assignment. 5. Expand their engineering problem-solving approaches to include a humanities-informed perspective, which involves considerations relating to context, stakeholders, history, culture, economics, technical issues, etc. Credits: 1.00 to 3.00

SPAN 32500 - Spanish For Engineering And Technology

Credit Hours: 3.00. This is an intermediate-level course directed towards the use of Spanish in Engineering and Technology professions. It covers specialized vocabulary from the different technical areas, as well as grammar and syntax, with the goal of developing speaking, listening, reading, and writing abilities. Students will have the opportunity to apply their skills in practical contexts, including job interviews, internships, formal presentations and communication in the workplace.

Learning Outcomes: 1. Recognize and apply a broad range of engineering and technical-related vocabulary. 2. Read, understand, and discuss specific engineering and technical topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific engineering problems in Spanish. Credits: 3.00

SPAN 33000 - Spanish And Latin American Cinema (UCC: HUM)

Credit Hours: 3.00. Screening and analysis of selected Spanish and Latin American films with readings and discussions relative to their historical, social, political, aesthetic, literary, and linguistic contexts. No knowledge of Spanish required.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

SPAN 33500 - The Literature Of The Spanish-Speaking Peoples In The United States

Credit Hours: 3.00. Study of selected poetry, fiction, theatre, and essays written in the United States by Spanish-speaking writers; includes readings in the literature written in Spanish and English as well as bilingual poetry and prose. Conducted in Spanish and English.

Credits: 3.00

SPAN 34100 - Hispanic Literature I: Poetry And Drama

Credit Hours: 3.00. Reading of selected poetic and dramatic texts from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Credits: 3.00

SPAN 34200 - Hispanic Literature II: Prose

Credit Hours: 3.00. Reading of selected novels and short fiction from Spain and Spanish-speaking America in their historical and cultural contexts. Readings, discussion, and papers in Spanish.

Learning Outcomes: 1. Develop intermediate- to advanced-level oral communication skills in Spanish through classroom discussions, presentations, and group work. 2. Expand and refine their competence to comprehend, analyze, and interpret texts in Spanish through integrated reading and discussion of authentic texts in Spanish. 3. Expand and refine their written proficiency in Spanish by producing a variety of analytical essays and writing assignments in Spanish. Credits: 3.00

SPAN 36100 - The Structure Of Spanish I: Phonetics And Phonology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a contrastive Spanish/English perspective. One session per week devoted to pronunciation improvement.

Credits: 3.00

SPAN 36200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish, focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Develop specific knowledge of the linguistic analysis of Spanish morphosyntax, through lectures, quizzes, take-home assignments and midterm exams, students. 2. Apply this knowledge of Spanish morphosyntax to linguistic theorizing in general but most importantly to their own learning process of the Spanish language through integrated readings and discussions, exams, and projects. 3. Examine linguistic phenomena related to Spanish morphosyntax and morphology by using explicit knowledge of word-level phenomena (e.g., derivational and inflectional morphology, the lexicon) as well as phrase and sentence-level phenomena (e.g., interrogative formation, subject-verb inversion, relative clauses, clitic expression and movement, passivation), through lectures, quizzes, take-home assignments and midterm exams. Credits: 3.00

SPAN 36600 - Spanish In The United States

Credit Hours: 3.00. The course explores the linguistic profile of established and emerging Spanish-speaking communities in the United States. Topics addressed are the current demographic profiles of Spanish speakers, the historical presence of Spanish, language identity, the meaning of linguistic landscapes, American Spanish and its speakers in the media and social institutions, as well as the varieties of Spanish in the U.S. The course is conducted in Spanish.

Learning Outcomes: 1. Describe Spanish-speaking populations in the U.S. considering their diverse histories. 2. Use course-related concepts and terms accurately in class discussions and written texts. 3. Examine the experience of Spanish-speakers in the U.S. through course activities. 4. Investigate the sociopolitical position of language through course readings and data analysis. 5. Identify a topic of research and conduct research to contribute to our knowledge of Spanish or Spanish speakers in the U.S. Credits: 3.00

SPAN 38000 - Spanish Language And Culture Abroad

Credit Hours: 1.00 to 6.00. This course must be taken concurrently with participation in an experiential learning opportunity abroad (e.g., study abroad, internship) that requires a period abroad in a Spanish-speaking location. The course will guide students to improve their Spanish language abilities and gain cultural knowledge about their experiential learning location. This course, coupled with the immersion experience, will enhance student learning through Spanish language activities and also cultural research projects. Permission of instructor is required.

Learning Outcomes: 1. Identify important moments of daily learning and reflect on them in written form in Spanish. 2. Explain experiences in the Spanish-speaking location through conversations in Spanish with a peer. 3. Compare experiences and problems encountered through conversations in Spanish with a peer; formulate possible solutions to problems if encountered in the future. 4. Research cultural surroundings and present findings in various modes of communication (e.g., presentational, written). 5. Assess learning during the immersion period in a summative way, reflecting on language and cultural learning through the creation of a final presentation project. Credits: 1.00 to 6.00

SPAN 39800 - Special Topics In Spanish

Credit Hours: 1.00 to 3.00. Studies of particular aspects of Spanish (e.g., culture, civilization, literature, linguistics, film, art, politics, etc.) by examining a varied selection of works. Readings, discussions, and papers in Spanish.

Learning Outcomes: 1. Recognize and apply a broad range of hospitality and tourism-related vocabulary. 2. Read, understand, and discuss specific hospitality and tourism topics in Spanish. 3. Write texts in different styles using appropriate structures and vocabulary. 4. Hold a conversation about specific problems in hospitality and tourism in Spanish. Credits: 1.00 to 3.00

SPAN 39900 - Special Study Abroad Credit In Spanish

Credit Hours: 1.00 to 4.00. This course number is for assignment after the fact of credits in Spanish earned while enrolled at a foreign university on a Study Abroad program which cannot be appropriately accommodated under an established Purdue course number. It is not for use for courses offered at or conducted by Purdue.

Credits: 1.00 to 4.00

SPAN 40100 - Spanish VII: Advanced Spanish In Context: Celebrations And Traditions (UCC: HUM)

Credit Hours: 3.00. Advanced work on development of Spanish speaking, listening, reading, and writing abilities, focusing on materials dealing primarily with culture and the arts in the Spanish-speaking countries. Conducted primarily in Spanish.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Respond critically in Spanish to a movie from a Spanish speaking country, paraphrase its plot, and discuss the major themes by writing an essay on a specific topic. 2. Appraise, assess and compare different sources, by researching a culture topic in Latin America and making a 10-15 minute presentation in Spanish to the class. Credits: 3.00

SPAN 40200 - Spanish VIII: Advanced Spanish In Context: Contemporary Issues (UCC: HUM)

Credit Hours: 3.00. Spanish 40200 is a content-based course that includes an overview of Spanish grammar. Students will therefore be required to learn a considerable amount of information about the different aspects of the Hispanic, Peninsular and Latin American culture that will include history, politics, art, gastronomy, music, traditions, and literature, among others.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Develop and demonstrate an advanced level of listening, speaking, reading and writing skills through the study of content-based materials. 2. Acquire a broad panoramic view of the different cultures and traditions in the Hispanic world, including Hispanics in the U.S. (The specific area of studies will be Central America and Caribbean South America.) 3. Identify and compare cultural traits through the study of history, art, food, pop culture, literature, music, current events and other aspects. 4. Demonstrate the ability to interpret and critique the culture through different types of written and oral materials, and reflect on how these topics relate to their own values and experiences. Credits: 3.00

SPAN 41201 - Advanced Spanish Conversation II

Credit Hours: 1.00. This course is designed to help students use and improve their Spanish speaking and comprehensive skills. Students will be expected to actively participate in classroom discussions, prepare for class, and utilize the target language only. No textbook is needed.

Learning Outcomes: 1. Build Spanish speaking and comprehension skills through classroom discussions. 2. Explain and assess relevant texts and audio materials in the target language. 3. Formulate ideas based on texts and audio materials as expressed in written and oral Spanish. Credits: 1.00

SPAN 41500 - Spanish Translation And Interpreting

Credit Hours: 3.00. Introduction to the Translation and Interpretation Studies field for Spanish speakers. High level of competence in Spanish required. Overview of translation theory, methodology, and practice both in class and in real settings. Includes a service learning component. Conducted in English and Spanish.

Learning Outcomes: 1. Have an overview of the translation studies field in its relation to Linguistics, Literature, Media, Sciences, and Second Language Acquisition. 2. Understand the different methodologies used for translation and interpretation. 3. Learn the ethics, standards and rules of the profession. 4. Practice different types of translation (technical, scientific, literary, legal medical, etc.) and interpretation (simultaneous, consecutive, over

the phone, conference, etc.). 5. Understand the basic principles of cross-cultural communication. Credits: 3.00

SPAN 41900 - Directed Tutoring In Spanish

Credit Hours: 1.00 to 4.00. Guided practicum in tutoring Spanish, operation of a tutorial laboratory, and the rationale for audio tutorial second language learning. Students learn tutorial techniques, grade homework, and maintain records under the supervision of the SPAN 10100 -SPAN 10200 course chairperson and experienced teaching assistants. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 42400 - Business Spanish

Credit Hours: 3.00. A study of the terminology and techniques used in commercial transactions, including the interpretation and writing of business materials. Development of the four language skills, with emphasis on writing and speaking.

Credits: 3.00

SPAN 44400 - Advanced Communication In Spanish

Credit Hours: 3.00. Advanced-level communication course that delves into oral and written communication within the Spanish-speaking world, emphasizing cultural context and practical application. This course explores complex grammar structures, pronunciation, lexical variations, and intercultural differences in authentic scenarios. Students will enhance their Spanish language proficiency, focusing particularly on oral expression. Taught in Spanish.

Learning Outcomes: 1. Engage in advanced formal and informal Spanish conversations across various settings. 2. Identify and apply different language functions used in everyday oral communication. 3. Discern and explain cultural nuances in both spoken and unspoken communication and analyze prevalent communication styles in Spanish. 4. Investigate and discuss contemporary topics related to the Spanish world fluently in Spanish, in written and oral form. 5. Explore and critique facets of Spanish-speaking cultures, contrasting them with personal cultural norms and traditions. Credits: 3.00

SPAN 48000 - Spanish Civilization

Credit Hours: 3.00. The study of modern Spanish life, with special emphasis on social institutions and customs. Lectures in Spanish.

Learning Outcomes: 1. Locate and name the autonomous communities of Spain on the map. 2. Distinguish the different languages spoken there from written samples and audio recordings. 3. Explain in Spanish key differences and similarities between the regions through succinct summaries of historical, geographical, gastronomical, and political influences. Credits: 3.00

SPAN 48100 - Spanish Culture

Credit Hours: 3.00. The development of the cultural life of the Spanish people as reflected in the geography, history, music, art, and architecture of Spain. Lectures in Spanish.

Learning Outcomes: 1. Catalogue and describe in Spanish the major historical epochs of Spain. 2. Correctly identify major works of painting and music, and locate them temporally, geographically, and by cultural movement or period. 3. Debate accurately Spain's current regional conflicts through knowledgeable assessment of the historical evolution of the language, literature, commerce, and agriculture. Credits: 3.00

SPAN 48200 - Latin American Civilization

Credit Hours: 3.00. Outline of Latin American history; the cultural heritage from Spain and from the pre-Spanish civilizations; the intellectual, social, and cultural progress of the Latin American countries. Lectures in Spanish.

Learning Outcomes: 1. Identify and locate the major groups of Latin America's indigenous peoples on the map and assess their historical trajectory through primary and secondary texts, group discussion and debate, and written reports. 2. Survey in Spanish from a historical perspective the rise and development of Colonial Latin American institutions through

critical readings, written and oral presentations. 3. Summarize in Spanish the key forces leading up to and following the 19th-century wars of Independence by assessing regional military and political strategies and by generating written and oral reports. Credits: 3.00

SPAN 48300 - Latin American Culture

Credit Hours: 3.00. Study of Latin American cultures and U.S. Latino culture, from pre-Columbian times to the present. The course will focus on selected aspects of the cultures of Latin American groups. Conducted in Spanish.

Learning Outcomes: 1. Identify and describe in Spanish contemporary aesthetic expressions in art, music, literature, film and architecture generated by Latin America's and U.S. Latino's diverse cultures through written exams and oral presentations. 2. Demonstrate a deeper cross-cultural understanding of key similarities and differences between Latin American countries, including U.S. Latino cultures, through critical assessment of contemporary social, political, and cultural movements. 3. Integrate multiple disciplines, perspectives, and methods of analysis of Latin American and U.S. Latino cultures through presentational language abilities in Spanish. Credits: 3.00

SPAN 48500 - Food And Culture In The Hispanic World

Credit Hours: 3.00. Advanced-level language and culture course about food culture in the Spanish-speaking world. It covers gastronomy, celebrations, history, art, mythology, and other aspects of daily life related to the culinary traditions of the Hispanic countries. Students will further develop their speaking, listening, reading and writing abilities in Spanish. They will have the opportunity to apply their skills in practical contexts and discuss cultural considerations, as well as participate in some hands-on cooking experience.

Learning Outcomes: 1. Recognize and apply a broad range of food related vocabulary and advanced grammatical structures. 2. Communicate in Spanish about diet, cooking, eating and food culture topics. 3. Identify main cultural trends in food production and consumption. 4. Recognize the main ingredients and their historical significance in the Latin American and Spanish diets. Credits: 3.00

SPAN 49800 - Advanced Topics In Spanish

Credit Hours: 1.00 to 3.00. Advanced studies of particular aspects of Spanish (e.g. culture, civilization, literature, linguistics, film, etc) by examining a varied selection of works. Readings, discussion, and papers in Spanish.

Credits: 1.00 to 3.00

Department of Philosophy

About the Philosophy Program

The Department of Philosophy offers courses of study leading to the B.A. in Philosophy, B.A. in Artificial Intelligence, and Ph.D. In addition to research specializations from across the field of contemporary analytic philosophy, the department's faculty also exhibit particular strengths in the history of philosophy, philosophy of mind and cognitive science, as well as in continental European philosophy.

Philosophy graduates are well poised to be successful in a variety of industries, including education, government and law, medicine, technology, writing and editing, management and customer service, and many more. This is due to the valuable skills developed through the study including critical thinking, focused analysis, clear communication in both written and verbal communication, forming positions and providing reasoning for that position, while also being able to consider the strengths and weaknesses of alternative options and proposals, as some examples. Click here to learn more about the advantages of pursuing a philosophy degree.

It is also known that philosophy graduates who apply to medical school, law school, and other graduate programs have a high acceptance rate and perform better on the GRE, LSAT, and GMAT. *USA Today* has reported that of those who have gone on to law school, philosophy majors have performed better than students in any other major, which suggests that philosophy may be an ideal background for those intending to attend law school.

Faculty

Department of Philosophy Directory

Contact Information

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Undergraduate Future Students
BRNG 1168
Phone: 765 494-6291
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Email: newstudent@purdue.edu
Please visit Philosophy for more information.

Graduate Information

For Graduate Information please see Philosophy Graduate Program Information.

Philosophy Minor

Philosophy, BA

About the Program

The Philosophy curriculum provides the opportunity to study a wide range of philosophical issues from a diverse array of philosophical traditions, methodologies and perspectives. Students engage important portions of their intellectual heritage through the writings of influential philosophers of the past and present, and acquire a sense of the influence of these figures on the broader society and culture.
Please visit Philosophy for more information.

3 Year Degrees

The College of Liberal Arts offers the opportunity for students to complete their degree in three years. Degree in 3 majors allow students to enter the work force or graduate school a year earlier than traditional plans of study while also providing a cost-effective way to complete an undergraduate degree.
Students can complete the three-year option with or without AP credit by adding summer sessions to traditional coursework in Fall and Spring semesters. Degree in 3 offers a great combination of cost-savings and the opportunity to accelerate your future and achieve your goals.

Human Rights Studies Minor

Department of Philosophy

Artificial Intelligence, BA

PHIL 11000 - The Big Questions: Introduction To Philosophy (UCC: HUM)

Credit Hours: 3.00. The basic problems and types of philosophy, with special emphasis on the problems of knowledge and the nature of reality. CTL:ISH 1050 Introduction To Philosophy
University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate familiarity with several of the basic problems of philosophy, with a special emphasis on the problems of knowledge and the nature of reality. 2. Demonstrate exposure to and knowledge of some of the central ideas from some major figures in the history of philosophy, including Plato, Descartes, and at least one ""British Empiricist."" 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 11005 - I Play, Therefore I Am: Introduction To Philosophy Through Video Games (UCC: HUM)

Credit Hours: 4.00. This course uses video games to demonstrate many of the fundamental problems of philosophy. To better understand the philosophical problems presented in text, students will watch online walkthroughs and live demonstrations of video games in class. Students will also engage with these problems through active learning by occasionally playing video games.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify historical and contemporary philosophical problems by reading assigned texts, and viewing demonstrations of or playing video games. 2. Demonstrate knowledge of the central ideas of major figures in the history of philosophy by participating in class activities and discussions, and through written assignments. 3. Explain, defend and discuss complex philosophical ideas, theories, and perspectives in assigned texts and demonstrations of video games through in class activities, presentations, and written assignments. 4. Critique and evaluate the significance of philosophical problems to the contemporary world, and potential responses to those problems, through in class activities, discussions, and written exam responses. 5. Construct sound, well-reasoned arguments, and communicate them clearly by participating in class activities and discussions, and through written assignments. Credits: 4.00

PHIL 11100 - Introduction To Ethics (UCC: HUM)

Credit Hours: 3.00. A study of the nature of moral value and obligation. Topics such as the following will be considered: different conceptions of the good life and standards of right conduct; the relation of nonmoral and moral goodness; determinism, free will, and the problem of moral responsibility; the political and social dimensions of ethics; the principles and methods of moral judgment. Readings will be drawn both from contemporary sources and from the works of such philosophers as Plato, Aristotle, Aquinas, Butler, Hume, Kant, and J. S. Mill. CTL:ISH 1051 Ethics

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate exposure to and knowledge of the views and approaches to specific issues in ethics as presented in the writings of important moral philosophers, including Aristotle, Kant, and Mill. 2. Recognize important ethical concepts and ethical theories, including virtue ethics, deontological ethics, and consequentialist ethics. 3. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written communication. 4. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 5. Develop critical thinking and writing skills. Credits: 3.00

PHIL 11400 - Global Moral Issues (UCC: HUM)

Credit Hours: 3.00. A systematic and representative examination of significant contemporary moral problems with a focus on global issues such as international justice, poverty and foreign aid, nationalism and patriotism, just war, population and the environment, human rights, gender equality, and national self-determination.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Acquire a thorough understanding of a comprehensive selection of global moral issues, including the concepts and theories that are essential to understanding and discussing these issues. 2. Acquire skills in the analysis and evaluation, as well the construction, of the kind of arguments needed for justifying personal opinion on ethical issues. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 11500 - Philosophy: What Are You Going To Do With That?

Credit Hours: 1.00. This course is designed for all philosophy majors, but is open to anyone interested in minor/majoring in philosophy. The format for this course is based on three components: reading and reflection, along with in-class discussion; in-class guest speakers who will address various topics in philosophy as a field, and/or professionalization

(both within and outside of academia); and short written exercises, often done in class, which are designed to build up to the final project. Most classes will begin with a guest speaker giving a brief introduction to a particular area or topic within philosophy. Students will have a short reading assigned for each class period that will be discussed with the instructor following the guest's presentation. The course readings will be, as best as possible, related to the area/topic introduced by the guest. Certain classes will be dedicated solely to career/professionalization interests and will feature guests with expertise in these areas. The professionalization experts will help students develop their career goals, identify possible internships and scholarships to pursue while a student at Purdue, and develop career goals for after they have graduated. Finally, certain classes will be dedicated to writing and the development of the final project, which will include a proposed 8-semester path of study, a polished resume/CV, and career/professionalization goals.

Learning Outcomes: 1. Devise academic and professional goals by preparing professionalization documents including a CV/resume. 2. Construct an eight semester plan of study toward completion of a degree in philosophy by listing courses of interest and forecasting future course load. 3. Identify argument structures in philosophical writing by reading assigned texts. 4. Assess and critique issues in various areas of philosophy by participating in classroom and group discussions. Credits: 1.00

PHIL 12000 - Critical Thinking (UCC: IL)

Credit Hours: 3.00. This course is designed to develop reasoning skills and analytic abilities, based on an understanding of the rules or forms as well as the content of good reasoning. This course will cover moral and scientific reasoning, in addition to ordinary problem solving. This course is intended primarily for students with nontechnical backgrounds.

University Core Curriculum (UCC): (UCC: IL) Credits: 3.00

PHIL 15000 - Principles Of Logic (UCC: QR)

Credit Hours: 3.00. A first course in formal deductive logic; mechanical and other procedures for distinguishing good arguments from bad. Truth-tables and proofs for sentential (Boolean) connectives, followed by quantificational logic with relations. Although metatheoretic topics are treated, the emphasis is on methods.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: Will add at a later date. Credits: 3.00

PHIL 20000 - Fun And Other Untimely Values

Credit Hours: 3.00. We'll explore the nature of fun, the metaphysics and value of games, and a host of related topics like play, humor, awesomeness, and happiness. We'll think about how these are related to each other, to some of the less paradigmatically fun elements of life like work, morality, striving, and idleness, and how they each might best contribute a life worth living. Philosophic discussion of what gives a life meaning or makes it worth living tend to veer into heavy, sometimes morose territory. In this class we'll go in the opposite direction.

Learning Outcomes: 1. Develop the ability to critically think about the role of the plurality of different, sometimes competing values. 2. Synthesize and organize a variety of ideas, information, and dense prose. 3. Summarize arguments in clear and concise ways. 4. Conceptualize and explain the line of reasoning that a text is putting forth. Credits: 3.00

PHIL 20600 - Introduction To Philosophy Of Religion (UCC: HUM)

Credit Hours: 3.00. The course encourages critical reflection on traditional and contemporary views about God and other religious ideas. Topics include arguments for God's existence, the problem of evil, understanding the divine attributes, miracles, religious pluralism, and life after death. CTL:ISH 1052 Philosophy Of Religion

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Demonstrate familiarity with one or more conceptions of God and with arguments for and against the coherence of such conceptions. 2. Demonstrate a familiarity with some of the arguments for and against God's existence and with some of the objections to those arguments. 3. Recognize the importance of and demonstrate familiarity with multiple religious ideas and beliefs. 4. Develop the ability to present, explain, defend and critically evaluate complex philosophical ideas, theories, and perspectives, in oral and written

communication. 5. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. Credits: 3.00

PHIL 20700 - Ethics For Technology, Engineering, And Design (UCC: STS)

Credit Hours: 3.00. This course is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life as an engineer or designer. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this a framework to specific, concrete cases. Together, these components work toward your development as a better engineer and a more responsible global citizen. The readings, case studies, and exercises are geared towards the development of a well-researched original case study that you will present to the class, which is informed by your past experiences and future aspirations related to engineering.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Develop an understanding of professional and ethical responsibilities in technology, engineering, and design (TED). 2. Understand and assess ethical problems in TED contexts. 3. Analyze and assess the impact of engineering solutions in global, economic, environmental, and societal contexts. 4. Understand the effects of technological engineering and design solutions in different cultural environments. 5. Apply abstract ethical frameworks to concrete situations. 6. Develop critical thinking skills. 7. Develop and deploy analytical skills in ethical contexts. 8. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 20800 - Ethics Of Data Science (UCC: STS)

Credit Hours: 3.00. As applications of data science permeate more aspects of our lives, new and important ethical issues are arising. However, especially because we are entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.
University Core Curriculum (UCC): (UCC: STS)
Learning Outcomes: 1. Identify ethical issues associated with applications of data science in a variety of professional settings, by reading assigned texts, viewing/listening to assigned media content, and participating in classroom and group discussions. 2. Apply general ethical principles to the specific, concrete actions of individuals, corporations, governments and other organizations. 3. Construct sound, well-reasoned arguments, and communicate them clearly, by participating in classroom and group discussions as well as writing assignments. 4. Develop a case study of their own, by submitting a written essay that applies the case study procedure. Credits: 3.00

PHIL 21900 - Philosophy And The Meaning Of Life (UCC: HUM)

Credit Hours: 3.00. Does life have meaning? If so, in what sense? If not, does this matter? Does the answer depend on the existence of God and an afterlife? What, if anything, makes existence worthwhile? Might the question - 'does life have meaning?' - be malformed? This course explores these and related questions, as well as answers to them, with the aim of teaching students to think critically and rigorously about matters

of perennial existential importance. In previous iterations of this course, readings have been chosen from the following writers: Kierkegaard, Nietzsche, Dostoevsky, Kafka, Marcel, Heidegger, Camus, Sartre, Jaspers, de Beauvoir, Ortega, and Merleau-Ponty.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 22100 - Introduction To Philosophy Of Science (UCC: STS)

Credit Hours: 3.00. An introduction to the scope and methods of science and to theories of its historical development. Topics include scientific revolutions, theories of scientific method, the nature of scientific discovery, explanation, and the role of values in scientific change.

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

PHIL 22300 - Fate And Free Will (UCC: HUM)

Credit Hours: 3.00. This course encourages critical reflection on the nature and possibility of human freedom in a world like ours that appears to be determined by unchanging causal and physical laws. Topics include the compatibility of free will and determinism, the possibility of moral responsibility without free will, and the incentives (if any) for future planning if our future fate is already sealed.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Enhance critical thinking skills. 2. Enhance ability to analyze relatively complex philosophical arguments. Credits: 3.00

PHIL 22500 - Philosophy And Gender (UCC: HUM)

Credit Hours: 3.00. An examination of the beliefs, assumptions, and values found in traditional and contemporary philosophical analyses of women. A range of feminist approaches to knowledge, values, and social issues will be introduced.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Improved knowledge of human cultures, creative thinking, critical thinking, integrative learning. Credits: 3.00

PHIL 22700 - Science And Religion

Credit Hours: 3.00. Are science and religion irrelevant to each other? Or can one of them challenge, support, shape, presuppose, explain-or explain *away*-the other? This course examines how science in general, as well as specific scientific disciplines such as evolutionary biology, physical cosmology, and cognitive science, are related to religion in general, and to particular religious traditions.

Learning Outcomes: 1. Identify specific ways in which science and religion appear to be in tension and specific ways in which they appear to support one another. 2. Demonstrate familiarity both with attempts to resolve alleged tensions between science and religion and with attempts to challenge claims that science and religion support one another. 3. Present, explain, defend, and evaluate complex philosophical perspectives on the relationship between science and religion, in oral and written communication. 4. Locate, interpret, understand, and evaluate philosophical arguments encountered in complex texts on the relationship science and religion. Credits: 3.00

PHIL 23000 - Religions Of The East (UCC: HUM)

Credit Hours: 3.00. (REL 23000) A study of the history, teachings, and present institutions of the religions of India, Southeast Asia, China, and Japan. This will include Hinduism, Jainism, Sikhism, Buddhism, Confucianism, Taoism, Shintoism, and Zoroastrianism.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Inter-culteral knowledge. Credits: 3.00

PHIL 23100 - Religions Of The West (UCC: HUM)

Credit Hours: 3.00. (REL 23100) A comparative study of the origins, institutions, and theologies of the three major Western religions, Judaism, Christianity, and Islam.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Information literacy. 2. Human cultures. 3. Creative thinking. 4. Integrative learning. Credits: 3.00

PHIL 24000 - Social And Political Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of some major social and political philosophers from Plato to contemporary authors. Issues such as justice, rights and freedom, community, and the "globalized"

future will be considered.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 24100 - Philosophy, Politics, And Economics

Credit Hours: 3.00. Many important issues, such as environmental pollution, global poverty, and the proliferation of nuclear weapons, have philosophical, political, and economic aspects. Accordingly, his interdisciplinary course deals with issues of interest to philosophers, political scientists, and economists alike. Possible topics to be studied include: the basis for political authority, game theory and rational choice, property rights, market advantages and market failures, justice, equality, and freedom.

Learning Outcomes: 1. Develop a competent understanding of fundamental issues arising at the intersection of philosophy, politics, and economics, and to begin (or advance) the process of learning to think more clearly, deeply, and consistently about them on one's own. 2. Develop greater critical thinking skills, especially in connection with controversial social and political issues. 3. Improve one's ability to write critically, carefully, and creatively about matters of great importance. Credits: 3.00

PHIL 24200 - Philosophy, Culture, And The African American Experience (UCC: HUM)

Credit Hours: 3.00. The purpose of this course is to consider African American based or inspired conceptions of Western philosophy and new visions of what it is to do philosophy sensitive to culturally rooted diversity.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 25501 - Introduction To Cognitive Science: Minds, Brains, And Machines

Credit Hours: 3.00. This will provide an introduction to foundational topics in the philosophy of mind. We will consider the relationship between the mind and the body, and the mental to the physical more generally. We'll ask, and look at some candidate answers to, questions like "What is a mind, and what are its component parts? How does a mind work? How are minds related to brains, and to the physical bodies that they seem to animate and control? How do minds represent the world around them? What is a self? What is the nature of consciousness and subjective experience? Could other animals, aliens, computers, robots or other types of entities have minds, or be conscious? How would we know? How can empirical efforts like the cognitive sciences help shed light on these questions? Could scientific theories of the mind supplant our intuitive conceptions of the mind? If so, what would be the implications?"

Learning Outcomes: 1. Analyze the main arguments for different theories in the philosophy of mind, such as dualism, behaviorism, and functionalism. 2. Develop original arguments that apply concepts from class to real-life current events. 3. Evaluate the implications of different theories for ethical, political, and social issues. Credits: 3.00

PHIL 25601 - Philosophy And Artificial Intelligence

Credit Hours: 3.00. Just what is it to be artificially intelligent and what will be AIs impact on our future? This course tackles these questions using an interdisciplinary and historically anchored approach beginning with the development of AI to arrive at a more holistic, socially- and ethically-ensconced account of what it means to be artificially intelligent. Will AI agents change the nature of work? Can they be used to regulate individuals and their opportunities through automated algorithms and sorting software? What are the human and environmental costs of a full-throated adoption of AI? This class will arm you with the philosophical and historical background to begin to devise and weigh the creative opportunities and challenges posed by this future. We'll first consider traditional questions and issues in the philosophy of computation, epistemology, ethics and justice before turning to home onto a series of specific challenges that may include issues of AI in equity, AI and the law, AI and gender, AI and labor, AI and policy, the future of AI, and whether we can even design 'ethical' AI.

Learning Outcomes: 1. Examine the theoretical foundations of AI. 2. Identify ethical and epistemological implications of emerging AI technologies. 3. Evaluate policy challenges posed by AI technologies. Credits: 3.00

PHIL 25701 - Moral Minds: The Nature Of Right And Wrong

Credit Hours: 3.00. This course will explore questions about the nature of morality that lie at the intersection of philosophy and psychology. Is genuine altruism possible, or is everybody selfish deep down? Is moral thinking driven by reason or emotion? Is there such a thing as moral character? Is anyone ever truly

responsible for their actions? Do facts about our evolutionary history undermine objective morality? Is empathy...bad? What makes someone a jerk? We'll also think about what happens to moral psychology when it gets plugged into social media algorithms and polarized political environments.

Learning Outcomes: 1. Identify and analyze major debates in moral psychology. 2. Explain the major theories in the history of moral psychology. 3. Apply lessons from moral psychology to contemporary moral problems, such as climate change or the spread of misinformation. Credits: 3.00

PHIL 26000 - Philosophy And Law

Credit Hours: 3.00. A discussion of philosophical issues in the law: a critical examination of such basic concepts in law as property, civil liberty, punishment, right, contract, crime and responsibility; and a survey of some main philosophical theories about the nature and justification of legal systems. Readings will be drawn from both law and philosophy.

Credits: 3.00

PHIL 27000 - Biomedical Ethics (UCC: STS)

Credit Hours: 3.00. An examination of the moral problems raised by developments in medicine and the biomedical sciences. Topics include abortion, reproductive technologies, euthanasia and physician-assisted suicide, experiments involving human subjects, and health care delivery.

University Core Curriculum (UCC): (UCC: STS)
Credits: 3.00

PHIL 27500 - The Philosophy Of Art (UCC: HUM)

Credit Hours: 3.00. A survey of the principal theories concerning the nature, function, and value of the arts from classical times to the present.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 28000 - Ethics And Animals (UCC: HUM)

Credit Hours: 3.00. An exploration through the study of major historical and contemporary philosophical writings of basic moral issues as they apply to our treatment of animals. Rational understanding of the general philosophical problems raised by practices such as experimentation on animals or meat-eating will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 29000 - Environmental Ethics (UCC: HUM)

Credit Hours: 3.00. An introduction to philosophical issues surrounding debates about the environment and our treatment of it. Topics may include endangered species, "deep ecology," the scope and limits of cost-benefit analyses, and duties to future generations.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 29300 - Selected Topics In Philosophy

Credit Hours: 1.00 to 3.00. A critical examination of some special topic or topics in philosophy. Details concerning topics selected for treatment in a given semester may be obtained in advance from the Department of Philosophy. Sections of this course may sometimes be initiated by students upon petition to the department.

Credits: 1.00 to 3.00

PHIL 30000 - Philosophy Of AI: Foundations And Theoretical Issues

Credit Hours: 3.00. This class will examine some of the underlying philosophical questions and issues that arise when we think carefully about the nature of machines that are meant to model our own minds and replicate intelligence. Topics will include the nature of computation, intelligence, deep learning, and mind design. While no technical background is assumed, some readings will include technical elements.

Learning Outcomes: 1. Explain basic topics in the philosophy of artificial intelligence. 2. Identify philosophical perspectives that contribute to understanding and explaining artificial intelligence. 3. Explain basic differences among types of artificial intelligence and machine learning systems. 4. Evaluate claims about the capabilities and limitations of artificial intelligence systems. Credits: 3.00

PHIL 30100 - History Of Ancient Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of Greek philosophy from its beginning in the Milesian school through the Presocratics to Plato and Aristotle.

University Core Curriculum (UCC): (UCC: HUM)
Credits: 3.00

PHIL 30200 - History Of Medieval Philosophy (UCC: HUM)

Credit Hours: 3.00. A survey of the main trends and figures of medieval philosophy, with an emphasis on metaphysics, epistemology, and ethics. Readings (in English translation) may include Augustine, Boethius, Avicenna, Anselm, Abelard, Maimonides, Aquinas, Scotus, Ockham and Suarez.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 30300 - History Of Modern Philosophy (UCC: HUM)

Credit Hours: 3.00. Concentrates on the major philosophical writers from the Renaissance to the beginning of the nineteenth century: Descartes, Hobbes, Spinoza, Locke, Leibniz, Berkeley, Hume, Kant. Some in other areas, e.g., Galileo, Newton, Calvin, are also considered.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 30400 - Nineteenth-Century Philosophy (UCC: HUM)

Credit Hours: 3.00. A study of the major movements and directions of nineteenth-century philosophy, including such figures as Hegel, Comte, Mach, Schopenhauer, Nietzsche, Mill, Royce and Peirce.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

PHIL 30600 - Twentieth-Century Philosophy

Credit Hours: 3.00. A critical examination of the main currents of contemporary philosophical thought, such as pragmatism, analytic philosophy, phenomenology, and existentialism, and other recent developments. The course will cover selected works of such philosophers as Russell, Wittgenstein, Peirce, Whitehead, Heidegger, and Sartre.

Credits: 3.00

PHIL 31000 - Classical Chinese Philosophy

Credit Hours: 3.00. In this course, we will survey the classic works of classical Chinese philosophy (c. 600-200 BCE). We will focus on seven major philosophers (and their followers): Kongzi (Confucius), Mozi, Mengzi (Mencius), Zhuangzi, Laozi, Xunzi, and Han Feizi. We will use their work to consider topics such as: the nature and value of morality, the proper role of ritual in human life, whether human nature is good or bad, how one becomes a moral person, the proper role and function of government, and more. In addition to introducing the competing traditions of Confucianism, Mohism, Daoism, and Legalism, the course will help students to develop basic philosophical skills as they develop and defend their own views on these topics. No knowledge of Chinese is expected.

Learning Outcomes: 1. Identify the central views of classical Chinese philosophers by reading primary texts. 2. Explain these views in their own words, and relate them to alternative views, by writing summaries (as part of ""position evaluation"" assignments). 3. Apply these views and arguments to questions arising in their own lives through in-class discussion of assigned reading questions. 4. Extract arguments from prose text and analyze them, both through in-class exercises and as part of ""position evaluation"" assignments. 5. Assess the value of these arguments via in-class group discussion and final papers. 6. Formulate original arguments regarding topics discussed by Chinese philosophers via in-class group discussion and final papers.e philosophers via in-class group discussion and final papers.

Credits: 3.00

PHIL 31400 - Philosophy Of Artificial Intelligence: Ethical, Social, And Political Issues

Credit Hours: 3.00. This course introduces students to the fundamentals of ethical, social, and political analysis of AI. By developing critical thinking, argumentative, and philosophical skills, students will engage with questions surrounding the development, risks, responsibilities of and surrounding AI. Students will learn the tools necessary to address these issues through reasoned argument and reflection.

Learning Outcomes: 1. Identify key normative, ethical, social, and political issues raised by the development and use of AI technologies. 2. Analyze philosophical arguments about the use of AI for both empirical plausibility and ethical validity. 3. Argue for novel positions in the philosophy of AI utilizing students' own reflection and analysis. Credits: 3.00

PHIL 31500 - Philosophy Of Money

Credit Hours: 3.00. This course is primarily concerned with the nature and ethics of money-how money functions as a social fact and how we relate to money and let it affect our character. After a brief exploration of the functions of money, the course will take up the different forms of the money supply (which also includes bank deposits and credit).

Learning Outcomes: 1. Articulate and explain the nature of money. 2. Distinguish and evaluate several theories of the nature of money. 3. Apply these concepts to ethical questions regarding the role of money in our lives. Credits: 3.00

PHIL 32200 - Philosophy Of Technology

Credit Hours: 3.00. A philosophical examination of the nature and history of technology, as well as its complex impact on humans and the world.

Learning Outcomes: 1. Critically evaluate the impact technology has upon our lives and the world. 2. Analyze and interpret a significant body of primary works in philosophy of technology. 3. Develop their ability to read, analyze, and write about complex texts. 4. Demonstrate their familiarity with the major questions and traditions in the philosophy of technology. 5. Reflect on the socially responsible creation and use of technology. 6. Critically scrutinize the nature, value, and challenges to technology as an intellectual and cultural institution. 7. Pose critical questions about the future directions of technology and explore whether any ethical vision guides the development of technology. Credits: 3.00

PHIL 32600 - Business Ethics

Credit Hours: 3.00. Philosophic examination of such topics as morality and self-interest, freedom and coercion, distributive justice, limits of the law, moral and legal rights, fair equality of opportunity, justice between nations. These topics are seen from a new perspective when they are connected to discussions of fair wages and capitalism, legal constraints on manufacturers and advertisers, affirmative-action programs, environmentalism, and multinational corporations.

Learning Outcomes: 1. Distinguish ethics from law and regulation, and relate ethics to economic systems such as markets and firms. 2. Explore classical ethical theories including virtue ethics, deontology and consequentialism. 3. Examine role responsibilities and professional ethics for agents, principals, managers, and employees. Credits: 3.00

PHIL 35000 - Philosophy And Probability

Credit Hours: 3.00. This course introduces the student to mathematical probability and its philosophical applications. Topics may include theories of probability, Hume's problem of induction, Goodman's paradox, and the foundations of scientific reasoning.

Credits: 3.00

PHIL 35501 - Major Questions In Cognitive Science

Credit Hours: 3.00. The philosophy of cognitive science uses tools from philosophy, psychology, neuroscience, linguistics, and computer science to answer foundational questions about how the mind works. In this course, we'll survey a range of contemporary debates in the philosophy of cognitive science, focusing on topics like the distinction between perception and cognition, the relationship between memory and imagination, the relationship between language and thought, whether there exist basic emotions and more.

Learning Outcomes: 1. Compare and contrast the different theoretical frameworks for the study of cognition. 2. Analyze contemporary debates in cognitive science. 3. Evaluate implications of cognitive science for ordinary psychological concepts, such as belief, memory, perception, reasoning, and emotion. Credits: 3.00

PHIL 40200 - Studies In Medieval Christian Thought

Credit Hours: 3.00. A survey of medieval (and patristic) philosophical theology. Issues include the nature and existence of God, religious language, and doctrines such as the Trinity, Incarnation, and Atonement. Readings (in English translation) will include, among others, Augustine, Boethius, Anselm, and Aquinas.

Credits: 3.00

PHIL 40300 - Moral Psychology And Climate Change

Credit Hours: 3.00. This course investigates the ethical challenges posed by climate change in conjunction with the deep cognitive and motivational factors that shape our individual and collective responses to it. Current research on human moral psychology is examined, drawing on work from a range of disciplines. Ethical theories concerning the unique moral challenges posed by a threat that spans national borders and human generations are considered. Strategies for addressing climate change that try to avoid our common cognitive foibles, and to leverage what we know about human moral capacities for collective action, are examined.

Learning Outcomes: 1. Identify the structure, thesis statement, and main lines of argumentation in written work of philosophers and psychologists, and also to analyze the arguments by breaking them down into their component parts, and formulating their own objections. 2. Discuss a wide variety of issues and sources surrounding moral psychology, from philosophers, psychologists, biologists, economists and anthropologists; they will develop this ability by summarizing and commenting on the assigned readings in weekly blog posts. 3. Compare the threat raised by climate change to other existential threats by reporting on the way different kinds of threats are processed cognitively. 4. Appraise the strengths and weaknesses of different strategies for addressing climate change, as assessed from the point of view of the state of the art understanding of human cognition and moral motivation; they will write a research paper that assesses the pros and cons of such strategies. 5. Identify common cognitive blind spots, predictable irrationalities, and motivational hurdles, and will be able to use this to appreciate the scope of the collective action problems associated with climate change; they will develop these skills by reading academic texts devoted to these issues. Credits: 3.00

PHIL 40400 - Advanced History Of 19th Century Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in 19th-century philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of 19th-century philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 40600 - Intermediate Philosophy Of Religion

Credit Hours: 3.00. An intensive study of some important problems such as the existence of God, the problem of evil, immortality, or the nature of religion. Or the religious philosophy of some significant thinkers such as Buber, Berdyaev, Tillich, Barth, Maritain, or Chardin may form the content of the course. Subject matter may vary.

Credits: 3.00

PHIL 40700 - Advanced History Of Ancient Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in ancient philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of ancient philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 40900 - Advanced History Of Medieval Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in medieval philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of medieval philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 41000 - Mock Trial Practicum

Credit Hours: 1.00. This course prepares students to represent Purdue University in American Mock Trial Association competitions by focusing on legal reasoning, argumentation, and advocacy. Mock Trial students will become familiar with the United States' legal system and conduct a trial over a fictional civil or criminal case. Students develop and deliver opening statements, introduce and examine testimonial, physical, and demonstrative evidence, examine and cross examine witnesses, and develop and deliver closing statements. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the underlying theory and content of specific laws through class discussions and exercises. 2. Locate, interpret, and explain information contained within the American Mock Trial Association's (AMTA's) annual case by reading assigned texts and participating in class discussion and exercises. 3. Formulate original arguments, objections, and replies within a legal setting by participating in class discussion and exercises, and through written assignments. 4. Deliver oral arguments, objections, and replies in accord with courtroom procedures by participating in mock trial exercises inside and outside of class. Credits: 1.00

PHIL 41100 - Modern Ethical Theories (UCC: HUM)

Credit Hours: 3.00. An examination of the major controversies in the history of modern ethics, including: the place of reason in ethics, the basis of moral obligation, and the relation between science and morals.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

PHIL 41300 - Advanced History Of Modern Philosophy

Credit Hours: 3.00. This course offers a comprehensive exploration of pivotal topics and influential figures in modern philosophy. Students will engage with the profound transformations in philosophical thought during this period.

Learning Outcomes: 1. Identify some of the central issues of modern philosophy. 2. Engage critically with difficult philosophical texts. 3. Write evaluative, argumentative papers. Credits: 3.00

PHIL 41400 - Advanced Topics In Philosophy Of Artificial Intelligence

Credit Hours: 3.00. This course focuses on specific issues in the philosophy of machine learning and artificial intelligence more broadly. It is primarily aimed at students (a) in the BA in AI degree, and/or (b) who have taken several other courses on the philosophy of mind, cognitive science, and AI in the department. Students will learn how to critically analyze issues from the cutting edge of AI, write about such issues with depth and insight, and apply their insights to new and emerging questions in the field.

Learning Outcomes: 1. Demonstrate understanding of cutting-edge issues in the philosophy of artificial intelligence. 2. Analyze and produce arguments in the field. 3. Evaluate proposals for the future of artificial intelligence across different theoretical and applied dimensions. Credits: 3.00

PHIL 41500 - Philosophy Practicum

Credit Hours: 1.00 to 3.00. This course is for philosophy students who are pursuing internship, research opportunities, and professional experience in various fields, industries, and sectors. The aim of this course is for students to apply concepts and skills they have gained in the philosophy curriculum to research and professional experience. The applicable skills students can bring to their internship/research/professional experience include logic, analytical reasoning, critical thinking, written and oral communication, textual analysis, and persuasive argumentation. Students can take the course up to two times for no more than 6.00 total credits. Internships and research positions can be offered remotely or on-site.

Learning Outcomes: 1. Learning objectives for this course will vary depending on the internship/professional experience aligned with the student's enrollment. Credits: 1.00 to 3.00

PHIL 41600 - Philosophy And Political Economy

Credit Hours: 3.00. An examination of the philosophical foundations of economic and political institutions and the reciprocal relationships between such institutions. Topics include foundations of systems of property and exchange; the problem of externalities; theories of the firm; constitutional design; democratic theory; public goods provision; rent-seeking and public choice; lobbying and campaign finance; the moral

and legal limits of markets; public-private entanglement.

Learning Outcomes: 1. Explicate core concepts in philosophy and political economy. 2. Understand how these concepts are relevant to justifying institutions. 3. Apply these concepts to generate novel arguments and insights in original research. Credits: 3.00

PHIL 42100 - Philosophy Of Science

Credit Hours: 3.00. An examination of central issues in philosophy of science. Topics include theories of explanation, confirmation, reduction, laws, the status of theoretical entities, and the epistemological foundations of scientific theories.

Credits: 3.00

PHIL 42400 - Recent Ethical Theory (UCC: HUM)

Credit Hours: 3.00. A philosophical examination of significant issues in recent ethical theory and metaethics, such as the nature of value, obligation, virtue, rationality, moral knowledge, the status of ethical sentences, practical applications, and the relationship between ethics and science or religion.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Acquire a thorough understanding of the concepts and theories in ethics and metaethics. 2. Become more familiar with important ethical issues and with conceptions of value that continue to shape our world. 3. Develop critical thinking skills. 4. Develop skills in analytical writing and in clear and precise oral communication. Credits: 3.00

PHIL 42500 - Metaphysics

Credit Hours: 3.00. A concentrated investigation of some of the basic problems concerning essence, existence, time, space, substance, causality, permanence, and change. Readings and discussions will center on representative metaphysical thinkers.

Credits: 3.00

PHIL 43200 - Theory Of Knowledge

Credit Hours: 3.00. An analysis of selected texts on knowledge and rationality. Topics such as the following will be considered: foundationalism, coherentism, internalism, externalism, skepticism, contextualism, empiricism, rationalism, analyses of epistemic concepts, and the Gettier problem.

Credits: 3.00

PHIL 43500 - Philosophy Of Mind

Credit Hours: 3.00. An examination of some central issues in the philosophy of mind. Attention is given to such topics as the knowledge of other minds, the relation between mind and body, the nature of persons, and the analysis of certain relevant concepts such as action, emotion, and perception. Readings are selected primarily from the writings of contemporary philosophers.

Credits: 3.00

PHIL 44000 - Advanced Topics In Political Philosophy

Credit Hours: 3.00. An examination of central issues in political philosophy. The course will focus on topics such as theories of justice, authority, legitimacy; questions about foundational political values like freedom, equality, and community; and methodological issues concerning ideal versus non-ideal theory, contractualism versus contractarianism; political versus comprehensive liberalism; and nationalism versus cosmopolitanism.

Learning Outcomes: 1. Recognize and differentiate between competing theories of justice, legitimacy, and authority. 2. Identify and reconstruct philosophical arguments. 3. Argue philosophically about first- and second-order questions concerning political philosophy. Credits: 3.00

PHIL 45501 - Studies In Cognitive Science

Credit Hours: 3.00. The subject matter will alternate between an in-depth study of a particular aspect of cognition (e.g., memory, belief, concepts) and a study of a specific explanatory framework in the philosophy of cognitive science (e.g., the computational theory of mind, predictive processing, gene-culture co-evolution).

Learning Outcomes: 1. Analyze advanced debates in contemporary cognitive science. 2. Evaluate the distinct theoretical approaches to cognition employed in psychology, neuroscience, and computer science, respectively. 3. Construct arguments to resolve conceptual problems and move current debates forward. Credits: 3.00

PHIL 46500 - Philosophy Of Language

Credit Hours: 3.00. An examination of some of the central issues in the philosophy of language, such as meaning, reference, truth, propositions, and speech acts.

Credits: 3.00

PHIL 49000 - Advanced Topics In Philosophy

Credit Hours: 1.00 to 3.00. An advanced study of a significant topic in philosophy.

Learning Outcomes: 1. Demonstrate familiarity with several advanced problems of philosophy. 2. Develop the ability to present, explain, defend and critically evaluate advanced philosophical ideas, theories, and perspectives, in oral and written communication. 3. Develop the ability to locate, interpret, understand and evaluate philosophical arguments encountered in complex philosophical texts within the contexts and traditions that inform those arguments and texts. 4. Develop critical thinking and writing skills. Credits: 1.00 to 3.00

Department of Political Science

About the Political Science Program

Political Science is the study of governments, their institutions, policies, and processes, and the study of people, their beliefs, their decision-processes, their attitudes and behavior. Political Science uses rigorous research methods and scientific perspectives to examine the complex and challenging problems facing United States and all regions of the world. We offer innovative coursework in international relations, public policy, American politics, environmental politics, technology and politics, and comparative politics.

Faculty

Department of Political Science Directory

Contact Information

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Please visit Political Science for more information.

Graduate Information

For Graduate Information please see Political Science Graduate Program Information .

Environmental Politics and Policy Minor

Political Science Minor

Environmental and Sustainability Studies Certificate

Public Policy Certificate

Political Science: American Politics Concentration, BA

Political Science: Comparative and International Politics Concentration, BA

Political Science: Environmental Politics and Policy Concentration, BA

Political Science: Law and Political Thought Concentration, BA

Political Science: Public Policy Concentration, BA

Political Science: National and International Security Concentration, BA

Political Science: Politics of Groups, Organizations, and Representation Concentration, BA

POL 10100 - American Government And Politics (UCC: BSS)

Credit Hours: 3.00. A study of the nature of democratic government, the U.S. Constitution, federalism, civil rights, political dynamics, the presidency, Congress, and the judiciary. CTL:ISH 1002 American Government

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Identify the basic theories and concepts used in the study of American politics. 2. Explain the institutions, processes, and values that underpin American political behavior and events. 3. Apply the knowledge gained to function and perform as an educated citizen. Credits: 3.00

POL 12000 - Introduction To Public Policy And Public Administration (UCC: BSS)

Credit Hours: 3.00. An introduction to the fields of public policy and public administration. Processes of policy formation and administration are examined. Different approaches to evaluating and improving public policies are discussed.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 13000 - Introduction To International Relations (UCC: BSS)

Credit Hours: 3.00. An analysis of the fundamentals of international law, organization, and politics, particularly as relevant to contemporary international relations. CTL:ISH 1003 Introduction To World Politics

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 14100 - Governments Of The World (UCC: BSS)

Credit Hours: 3.00. An introduction to the politics and government in selected foreign countries. The course presents the tools and background needed to understand contemporary events in the world beyond the United States. Readings and discussions pay special attention to democratization and development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 15000 - Introduction To Political Thought

Credit Hours: 3.00. Introduction to basic concepts in political philosophy, such as conflict and community, justice and the good society, the origins of democracy, and the intersections of class, race, gender, and sexuality. Selected classical and contemporary political thinks covered.

Credits: 3.00

POL 20000 - Introduction To The Study Of Political Science

Credit Hours: 3.00. Introduction to basic concepts and methods of political science. Basic concepts including, among others, power, justice, authority, ideology, and democracy, and a variety of quantitative and qualitative methods of analysis will be explored.

Credits: 3.00

POL 20400 - Spies And Lies: Studies In Intelligence And National Security

Credit Hours: 3.00. This course examines the role that the collection, analysis, and dissemination of intelligence plays in US foreign policy and national security. We will unpack the missions and methods of the US Intelligence Community. Who

does what? What are the different challenges for those engaged in the different aspects of intelligence? Why is the intelligence community configured like it is? We will also spend time with more contemporary topics in intelligence. What role does intelligence play meeting future national security and foreign policy challenges? What is the role of intelligence in modern warfare, including cyber-warfare? What role does intelligence play in a liberal democracy? What should intelligence oversight look like?

Learning Outcomes: 1. Gain a better understanding of the complexities of our intelligence community and the role it plays in protecting against threats to our nation's security and achieving foreign policy objectives. 2. Understand the structure of the US Intelligence Community and how it's changed over time. 3. Understand how intelligence is collected, analyzed, disseminated, and utilized by policymakers. 4. Understand new threats and challenges facing the Intelligence Community. Credits: 3.00

POL 22200 - Women, Politics, And Public Policy (UCC: BSS)

Credit Hours: 3.00. An introduction to women's participation in politics, with an emphasis on America. Structural and attitudinal conditions limiting women's political roles and contemporary efforts to change women's status in society through politics.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

POL 22300 - Introduction To Environmental Policy (UCC: BSS/STS)

Credit Hours: 3.00. (FNR 22310) Study of decision making as modern societies attempt to cope with environmental and natural resources problems. Focuses on the American political system, with some attention to the international dimension. Current policies and issues will be examined.

University Core Curriculum (UCC): (UCC: BSS/STS) Learning Outcomes: 1. Learn fundamental principles, generalizations, and theories related to policy development, with a focus on environmental and natural resource policy. 2. Learn to apply course material to improve thinking, problem solving, and decisions relevant to natural resource and environmental issues. 3. Learn to analyze and critically evaluate ideas, arguments, and points of view. Credits: 3.00

POL 22800 - Data Science And Public Policy

Credit Hours: 3.00. This course is an introduction to the politics and policies of data science and "big data." Students will (1) gain an understanding of how public policy is made, including the role of data in policymaking; (2) learn about whether and what policies govern the use of data in various applications (such as autonomous vehicles, ownership of health care data, etc.); and (3) explore the ethical, legal, and social implications of data science and big data.

Learning Outcomes: 1. Analyze the public policymaking process. 2. Define and apply data science and public policy concepts. 3. Examine and discuss the ethical, legal, and social implications of big data and data science. 4. Prepare a policy brief to make recommendations about the use of social or political data. Credits: 3.00

POL 22900 - Emerging Problems In Political Science

Credit Hours: 1.00 to 3.00. This course focuses on problems and issues that are beginning to be recognized as worthy of public discussion or policy action, or that may be new areas of expertise and interest for our faculty members. We use it to introduce new topics and approaches, including experimental pedagogies, courses that involve travel, and the like. The content of the course varies from one offering to the next. Possible topics are Bioethics and Politics, Food Policy, and Bicycle Politics.

Credits: 1.00 to 3.00

POL 23000 - Introduction To Peace Science

Credit Hours: 3.00. This course provides an introduction to the field of peace science, the systematic study of the causes and consequences of conflict between and within states, including conflict resolution and strategies for creating sustainable peace.

Learning Outcomes: 1. Identify the elements of conflict, including the stakeholders, their motivations, and their decision-making processes. 2. Describe the complexities of why conflicts get started, how and why they escalate

or de-escalate, and how and why outsiders get involved. 3. Compare and evaluate explanations for how and why conflicts end and factors that increase the likelihood of enduring peace. Credits: 3.00

POL 23100 - Introduction To United States Foreign Policy (UCC: BSS)

Credit Hours: 3.00. Designed to introduce students to the major themes and issues in contemporary U.S. foreign policy. Lectures, discussion, and readings will examine such areas as U.S. relationships with the major powers, the Third World, and international organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 23200 - Contemporary Crises In International Relations

Credit Hours: 3.00. The focus of this course will be on major world crises, such as in the Middle East and Southern Africa, and ways in which these crises may be analyzed.

Credits: 3.00

POL 23400 - The Politics Of Terrorism

Credit Hours: 3.00. This class examines the phenomenon of terrorism and counterterrorism. Why do terrorists do what they do? What can governments do to stop them? We will begin with issues of definition, and theoretical and empirical approaches to the study of terrorism. We will then delve into the history and evolution of the tactic (taking time to study some of the more notorious organizations). At this point in time it is critical that we look at both domestic-particularly in the United States-and transnational forms of terrorism. The study of terrorism is rife with puzzles that we will explore. Why resort to violence in the first place? How and why do groups evolve over time? How and why do some groups end, and others continue for years? Why are some individuals/groups not classified as terrorists? What are the consequences of terrorism? We will also look closely at counterterrorism policy. What are the most effective ways to respond to terrorism? What doesn't work? How do policies differ between states? To what extent is there global cooperation on counterterrorism? We will conclude the class by taking a critical look at US counterterrorism policy and the massive counterterrorism apparatus that has developed in the aftermath of the attacks of September 11, 2001. Should counterterrorism dominate US national security priorities to the degree it does?

Learning Outcomes: 1. Understand the leading theories and concepts for understanding terrorist behavior. 2. Have a greater understanding of counterterrorism strategies and their impact on terrorist organizations/lone wolfs. 3. Identify current trends and make predictions about the future of both terrorism and counterterrorism. 4. Think analytically about global threats. Credits: 3.00

POL 23500 - International Relations Among Rich And Poor Nations (UCC: BSS)

Credit Hours: 3.00. Introduction to the major themes in the contemporary international relations among rich and poor nations. Examines such areas as North-South relations, interdependence, international organizations, and global development.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 23700 - Modern Weapons And International Relations (UCC: STS)

Credit Hours: 3.00. This course introduces the student to the roles that modern weapons systems play in contemporary international relations.

University Core Curriculum (UCC): (UCC: STS)

Credits: 3.00

POL 25801 - Introduction To Tech Diplomacy In International Affairs

Credit Hours: 3.00. This course is an overview and introduction to the field of tech diplomacy in international affairs and foreign policy. It explores the risks and opportunities of emerging technology in international relations and potential strategies in governance, foreign policy, and diplomacy to address them.

Learning Outcomes: 1. Define and summarize the key features of tech diplomacy, including its principles and goals. 2. Explain the relationships between technology, globalization, international relations, and foreign policy. 3. Analyze new and ongoing challenges in international affairs posed by emerging technology and draw conclusions about how tech diplomacy approaches might address such challenges. Credits: 3.00

POL 30000 - Introduction To Political Analysis (UCC: IL)

Credit Hours: 3.00. An introduction to the study of politics, its basic concepts and major areas of concern; also review of important research techniques, including methods of data collection and analysis.

University Core Curriculum (UCC): (UCC: IL)

Credits: 3.00

POL 31000 - Methods Of Philosophy, Political Science, And Economics

Credit Hours: 3.00. This course introduces students to the basic concepts, techniques, and tools used in philosophical, political, and economic analyses through the lens of rational choice theory. Starting with the foundations of rationality and individual rational choice, the course advances to examining rational choice in groups through game theory and social choice theory. The course concludes by analyzing how rational decision-making operates within institutional frameworks, such as the firm.

Learning Outcomes: 1. Explain key concepts in rational choice theory, such as Pareto efficiency, ordinal and cardinal utility, Nash equilibrium, and backwards induction. 2. Apply formal rational choice models to philosophical, political, and economic problems. 3. Translate real-world scenarios into abstract representations. 4. Assess the limitations of rational choice theories and models. Credits: 3.00

POL 31400 - The President And Policy Process

Credit Hours: 3.00. A study of presidential leadership as the embodiment of social forces and as reflective of the personality of the incumbent; the president as national leader reflecting national myths and ideologies; the growth of the presidency; issues and forces affecting the continuity of presidential leadership; the degree of institutionalization of the presidency.

Credits: 3.00

POL 32300 - Comparative Environmental Policy

Credit Hours: 3.00. Comparative study of environmental policy development and processes in industrialized democracies, former and current communist states, and developing nations.

Credits: 3.00

POL 32600 - Black Political Participation In America (UCC: BSS)

Credit Hours: 3.00. An examination of African American political participation in the United States. Analyzes political culture and socialization, with a focus on the interaction between African Americans and actors, institutions, processes, and policies of the American system of politics and governance.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 32700 - Global Green Politics (UCC: BSS)

Credit Hours: 3.00. Analysis and assessment of the nature of global environmentalism, its connections with other new social movements, and its impact on domestic and international politics worldwide, with particular attention to green political parties and nongovernmental organizations.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 32930 - Topics In Global Politics And International Relations

Credit Hours: 3.00. Variable topic course that examines conflict, competition, and cooperation in global politics and international relations. Students examine the historical background of the topic and apply current political science theories to understand the institutions, participants, and outcomes. Course may be repeated for a maximum of 9 credit hours.

Learning Outcomes: 1. Identify and explain the major theories related to the course topic covered in this course. 2. Explain the emergence of the modern global system of nation-states and the position of non-state actors within the topic area of the course. 3. Evaluate how differences in political interests, identities, and material circumstances affect international cooperation and conflict related to the topic of the course. Credits: 3.00

POL 33500 - China And The Challenges Of Globalization (UCC: BSS)

Credit Hours: 3.00. Globalization is a very popular topic, resulting in a lot of loose and poorly thought-through talk and writing around the subject. The view taken in this course is that to understand current processes of globalization we need to examine it in less broad and amorphous ways by focusing on its specific manifestations. Thus, this course focuses on how China has managed the challenges of globalization. China is a particularly useful case study because it failed the challenges of globalization in the late 19th and early 20th centuries. For an ancient civilization such as China, this failure had tremendous

impact on its national pride. The Chinese refer to this historical juncture as the "century of shame." Towards the end of the 20th century and the onset of the 21st, China faced again the challenges of globalization and has arisen to the tasks in a spectacular fashion, transforming a largely rural and agriculture economy into the world's second largest economic power. This amazing transformation is leading some to proclaim that the 21st century will belong to China!

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Recall basic facts about China's geography, people, economy, and culture. 2. Identify key historical moments in China's engagement with globalization. 3. Demonstrate a clear grasp of the concept of globalization and contending definitions of it. 4. Apply knowledge to explain how China has dealt with challenges of globalization. Credits: 3.00

POL 34500 - West European Democracies In The Post-Industrial Era

Credit Hours: 3.00. An introduction to the political institutions and processes in West European democracies. The course focuses on the ability of Western democracy to survive the transition to the post-industrial era.

Credits: 3.00

POL 34700 - Introduction To Latin American Politics

Credit Hours: 3.00. Major aspects of Latin American politics and development. Questions such as the impact of the military on political development, the dynamics of Latin American industrialization, and Latin America's changing international role will be explored.

Credits: 3.00

POL 34800 - East Asian Politics

Credit Hours: 3.00. The course will examine East Asian politics and society, with special emphasis on Japan.

Credits: 3.00

POL 35200 - Selected Topics In Political Theory

Credit Hours: 3.00. This course is intended to provide a more narrowly focused analysis of selected problems and topics, giving special emphasis to their conceptual frameworks and their significance in the history of political philosophy. This course also will allow students to see the practical role of the political theorist by stressing the methods and criteria used in the selection, formulation, and solution of problems in political philosophy. Course topics will be different each semester.

Credits: 3.00

POL 36000 - Women And The Law (UCC: BSS)

Credit Hours: 3.00. An introductory survey of women's legal status in America. Topics include constitutional law, marriage and divorce, reproductive rights, employment discrimination, and crimes of violence.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 37200 - Indiana Government And Politics (UCC: BSS)

Credit Hours: 3.00. An examination of the political and governmental organization of the state of Indiana. Includes the political and historical development of Indiana state government and comparison of policies and institutions with those of other states.

University Core Curriculum (UCC): (UCC: BSS)

Credits: 3.00

POL 37300 - Campaigns And Elections

Credit Hours: 3.00. This course analyzes the role of political parties, issues, candidates, media, funding, and electoral and campaign strategies in presidential, congressional, and state campaigns. Contemporary election examples will be utilized.

Credits: 3.00

POL 40200 - Topics In Political Research Methods

Credit Hours: 3.00. This variable topics course in political methodology acquaints students with the scientific process of political research by applying different research designs and methodological approaches to analyzing political data. Students must complete POL 30000 before taking this course. This variable topic course may be repeated for up to 9 credit hours.

Learning Outcomes: 1. Apply research methods to analyze data and communicate results to specialists and non-specialists. 2. Evaluate and select appropriate research methods for political science research questions. 3. Utilize commonly used software applications to analyze data. 4. Assess the benefits and limits of different research methods for making valid descriptive

and causal claims, noting differences in internal and external validity. Credits: 3.00

POL 40300 - Field Experience In Political Science

Credit Hours: 1.00 to 9.00. Students are able to earn credit for internships in federal, state, and local government offices as well as with political parties, campaign organizations, nonprofit organizations, legislative bodies, and interest groups. Credit and course requirements to be arranged with the instructor. Permission of instructor required.

Credits: 1.00 to 9.00

POL 40301 - Local Partner Internship In Political Science

Credit Hours: 3.00. This course in Political Science offers experiential learning opportunities to qualified junior and senior political science majors. These competitive internships allow students to explore a political science-related field, apply classroom knowledge and skills, and gain valuable work experience for academic credit. Employers recognize that the most qualified graduates come into the workforce with a combination of strong academic preparation and practical on-the-job experience. Political science internship partners include city and county governments, non-profit agencies, political parties, and other community organizations. Public policies affect every aspect of community life, and our internship partners enable students to experience first-hand the impact of government actions on local organizations' work and the constituencies they serve. POL 403 internships provide the opportunity to develop and refine skills that are important to academic success, career readiness, and personal growth. All internships for credit must be approved by the Department of Political Science through the application process. Students can only take either POL 40301, 40302, or 40303 once for a letter grade and 3 credit hours. Students have the option to take up to 6 additional credit hours as Pass/Not Pass by enrolling in POL 40300. Internships can be paid or unpaid. Some internships require a background check. Permission of department required.

Learning Outcomes: 1. Explore a political science-related field to help discern a career path after college. 2. Develop professional skills and gain valuable on-the-job experience in preparation for the workforce and to gain a competitive edge in the job market. 3. Apply classroom knowledge and skills to societal problems in the real world. 4. Learn first-hand how political and social issues affect communities and how local governments and organizations seek to address them. 5. Recognize the versatility and value of a political science degree. Credits: 3.00

POL 40302 - Self-Initiated Internship In Political Science

Credit Hours: 3.00. This course in Political Science offers the opportunity to complete a self-initiated internship for academic credit. Employers recognize that the most qualified college graduates come into the workforce with a combination of strong academic preparation and practical on-the-job experience. Internships strengthen resumes and law and graduate school applications. All internships for credit must be approved by the Department of Political Science through the application process. Students can only take either POL 40301, 40302, or 40303 once for a letter grade and 3 credit hours. Students have the option to take up to 6 additional credit hours as Pass/Not Pass by enrolling in POL 40300. Internships can be on-site or virtual, or a hybrid. Internships can be paid or unpaid. Some internships require a background check. Permission of department required.

Learning Outcomes: 1. Explore a political science-related field to help discern a career path after college. 2. Develop professional skills and gain valuable experience in preparation for the workforce and to gain a competitive edge in the job market. 3. Apply classroom knowledge and skills to real-world issues in a professional setting. 4. Recognize the versatility and value of a political science degree. 5. Strengthen applications to law school and graduate school. Credits: 3.00

POL 40700 - Field Experience In Undergraduate Research Collaboratory

Credit Hours: 3.00. Students earn credit for research with Department of Political Science Faculty and Advanced Graduate Students. Collaboratory members might engage in activities such as data collection and processing, survey design, and data analysis and visualization. Entry into the Collaboratory is managed by the Department of Political Science through an application process. Graded option available to students who have taken POL 300A and are pursuing the Research Intensive Concentration for Political Scientists.

Learning Outcomes: 1. Analyze research approaches and demonstrate skills in an

academic research environment. 2. Identify important topics in political science research ethics and the ethical conduct of human subjects research. 3. Demonstrate communication and teamwork skills on a collaborative project. Credits: 3.00

POL 41000 - Political Parties And Politics

Credit Hours: 3.00. An analysis of the nature and functioning of U.S. political parties in terms of social and economic forces that shape our political system. Interactions among political parties, pressure groups, and formal government structures are emphasized throughout. Special attention is devoted to political leadership, nominating processes, campaign management, voting behavior, and other important aspects of American politics.

Credits: 3.00

POL 41100 - Congress: Structure And Functioning

Credit Hours: 3.00. A study of how Congress actually operates. Formal and informal power structures within both chambers and roles of the individual members of Congress are analyzed. Attention is directed to latent, as well as manifest, functions of legislative, investigative, and other major activities of Congress. The problem of bringing expertise to bear on the legislative process is considered throughout.

Credits: 3.00

POL 41300 - Analysis Of Political Attitudes And Behavior

Credit Hours: 3.00. A broad-based survey of human political attitudes and behavior and the forces that underlie them, utilizing contemporary research tools to examine and evaluate theoretical claims. Examines how people respond to information about politics, communicate about politics, form attitudes and preferences about politics, and their political interactions with other individuals, groups, and nations. Introduces survey research methodology, its uses, and its challenges in measuring political attitudes and behavior.

Learning Outcomes: 1. Compare and contrast foundational and contemporary theories that explain political attitudes and behavior. 2. Critically evaluate sources of information about public opinion and understand how to communicate, accurately, the results from survey research. 3. Synthesize course knowledge to create a theoretically-grounded analysis of political attitudes or behavior using empirical data and appropriate research methods. 4. Describe and explain to specialists and non-specialists the theories and empirical evidence of the causes and consequences of political attitudes and behavior. Credits: 3.00

POL 41500 - US Politics And The Media

Credit Hours: 3.00. This course examines the roles and influences of the mass media on American politics generally and with particular emphasis on election campaigns and the evolving political culture of the United States.

Learning Outcomes: 1. Understand how media influence perceptions of political issues and events. 2. Recognize the importance of media in the formation and maintenance of individual attitudes and public opinion. 3. Create and analyze political messages in the context of campaigns. 4. Understand gender, race, ethnicity, sexual orientation, and other forms of diversity in relation to mass and political communications. 5. Write correctly and clearly in forms and styles appropriate for communications professions and audiences. Credits: 3.00

POL 42300 - International Environmental Policy

Credit Hours: 3.00. Environmental policy development in the international arena, with attention to international law, international organizations, and transboundary environmental problems.

Credits: 3.00

POL 42500 - Environmental Law And Politics

Credit Hours: 3.00. This course provides an introduction to statutory and case law relating to environmental policy. Regulatory schemes in environmental policy and the legal framework for environmental regulation are presented. Market alternatives to various regulatory mechanisms will also be treated.

Credits: 3.00

POL 42800 - The Politics Of Regulation

Credit Hours: 3.00. Politics and policies of federal and state regulatory agencies. Explanations of regulatory agency behavior, arguments for and against government regulation, and alternatives to government regulation.

Credits: 3.00

POL 42900 - Contemporary Political Problems

Credit Hours: 3.00. Contemporary political problems in the United States affecting the interpretation of democracy, human rights and welfare, social pressures, and intergovernmental relations.

Credits: 3.00

POL 43000 - Selected Problems In International Relations

Credit Hours: 3.00. An in-depth analysis of selected problems in international relations.

Credits: 3.00

POL 43200 - Selected Problems In World Order

Credit Hours: 3.00. An in-depth analysis of how selected problems in international relations are treated within international organizations.

Credits: 3.00

POL 43300 - International Organization

Credit Hours: 3.00. A study of the structure and functions of the United Nations and associated agencies, with an emphasis on the role of this system in contemporary international relations.

Learning Outcomes: 1. Define and explain the theoretical significance of certain international relations concepts used by scholars and policy-makers to analyze world affairs. These include but are not limited to: IGO, NGO, sovereignty, transnationalism, networks, humanitarian missions, G-77, international security, United Nations, peacekeeping, international institutions, realism, anarchy, constructivism, multilateralism, human rights. 2. Understand the history, structure and purposes of the United Nations in some detail. 3. Identify ways in which international politics may be reflected in, and shaped by, the politics within particular international organizations like the UN, both by observing UN politics and through an experiential in-class simulation. 4. Identify and evaluate ways the international system may be changing, and why. 5. Read course materials and reflect on their meaning, both in writing and discussion. 6. Choose an international ""problem,"" analyze ways to solve it, and present your ideas and analysis. Credits: 3.00

POL 43500 - International Law

Credit Hours: 3.00. A study of international legal theories, principles, and practices, with an emphasis on the role and utility of law in contemporary international relations.

Credits: 3.00

POL 43801 - International Human Rights

Credit Hours: 3.00. This course exposes students to the politics of international human rights through reading, lectures, film, discussion, and student research. Topics include the concept of human rights, international law related to the protection of human rights, empirical research on political and economic causes of human rights violations in individual countries, and research on prevention efforts and remedies for past violations. This political science course is also part of Purdue's Human Rights Minor program.

Learning Outcomes: 1. Comprehend the interrelated legal and philosophical concepts pertaining to human rights as understood in theory and practice. 2. Analyze particular historical and ongoing situations of human rights violations. 3. Evaluate causes of and solutions for international human rights violations. Credits: 3.00

POL 43900 - United States Foreign Policy Making

Credit Hours: 3.00. An analysis of the decision-making process in United States foreign policy.

Credits: 3.00

POL 45000 - Game Theory And Strategy In Political Science

Credit Hours: 3.00. This course introduces students to the basics of game theory and its applications in political science. The course will cover foundational concepts in game theory, including strategic rationality, best responses, normal and strategic form games, backward induction, and games of incomplete information. Students will complete problem sets to demonstrate mastery of these subjects. We will also apply these basic game theoretic tools to important problems in political science to better understand the dynamics of bargaining, coercion, reassurance, cooperation, and other key concepts.

Learning Outcomes: 1. Demonstrate mastery of key game theoretic concepts, including utility theory, best responses and equilibrium, backward induction, and incomplete information. 2. Solve basic game theoretic problems and derive equilibria of both normal form and strategic form games with both simultaneous and sequential moves. 3. Apply game theoretic concepts to explain actions and outcomes in important contemporary and historical cases in political science, policy, and politics. Credits: 3.00

POL 45801 - Tech Diplomacy And Emerging Technology

Credit Hours: 3.00. This course explores how emerging technologies in various sectors can disrupt global power structures and international relationships. Students will analyze case studies and apply international relations theories to understand the opportunities and risks and develop skills communicating with policy and lay audiences.

Learning Outcomes: 1. Explain the risks and opportunities of emerging technology for international relations and how they shape goals for tech diplomacy. 2. Demonstrate the key features of a policy brief, a white paper, and principles of effective communication of technical information to policy and lay audiences. 3. Analyze and communicate information about emerging threats and opportunities in fields of emerging technology. 4. Propose strategies to address emerging threats and opportunities using principles and practices of tech diplomacy. Credits: 3.00

POL 46000 - Judicial Politics

Credit Hours: 3.00. A survey of judicial processes as they operate in America. Both trial courts and appellate courts will be examined in light of the procedures with which they operate. The external social, economic, and political pressures surrounding courts and the impact courts have on society will be considered.

Credits: 3.00

POL 46100 - Constitutional Law I

Credit Hours: 3.00. A survey of selected areas of constitutional law, considering the political and social influences as well as the doctrinal forces that have produced these policies and interpretations.

Credits: 3.00

POL 46200 - Constitutional Law II

Credit Hours: 3.00. An examination of the development of individual rights and civil liberties through constitutional law and interpretation of the Bill of Rights and Civil War Amendments. Both doctrinal and political pressures will be discussed to illustrate the evolution of these rights.

Credits: 3.00

POL 46400 - Legal Writing, Ethics, And Professionalism

Credit Hours: 3.00. This class is designed to provide students with the practical skills and knowledge they will need to embark on an internship or career in the legal environment. The class will focus on legal ethics, writing and research skills.

Learning Outcomes: 1. Explain the basic principles of legal ethics and recognize common ethical issues in law practice. 2. Identify ways to address legal issues, expectations, and consequences for lawyers and their staff. 3. Draft several standard legal documents. 4. Demonstrate ability to conduct basic legal research and write a professional report. Credits: 3.00

POL 49100 - Political Science Senior Seminar

Credit Hours: 3.00. This is a variable-title seminar focusing on contemporary issues in political science at the senior level. It is part of the "capstone" experience for political science majors.

Credits: 3.00

POL 49300 - Interdisciplinary Undergraduate Seminar

Credit Hours: 1.00 to 3.00. An undergraduate seminar devoted to an interdisciplinary examination of social, economic, political, and intellectual movements, using the faculty resources of the participating departments. Subject matter will vary. Each offering of the seminar will be approved by a committee of department heads from the sponsoring departments. Permission of instructor required.

Credits: 1.00 to 3.00

POL 49500 - Undergraduate Research Experience

Credit Hours: 1.00 to 3.00. Students are able to earn credit by working on a research project with a faculty member. Students will become familiar with all phases of the research process. Credit and course requirements are arranged with the instructor. Permission of instructor required.

Credits: 1.00 to 3.00

POL 49505 - Undergraduate Research Experience Capstone

Credit Hours: 3.00. Students are able to earn credit by working on a research project with a faculty member to count as capstone credit on plan of study. Students will become familiar with all phases of the research process. Credit and course requirements are arranged with the instructor. Permission of department required.

Learning Outcomes: 1. Learn the systematic collection of data for quantitative and qualitative analysis. 2. Apply research methods and discuss how to utilize effectively in a research project related to the discipline. 3. Develop writing and oral communication proficiencies through completion of semester long paper and/or presentation. 4. Collaborate on research work with faculty mentor or peers. Credits: 3.00

Department of Sociology

About the Sociology Program

The Sociology undergraduate program offers students the opportunity to examine the organization, structure, societal changes among the various social groups. Never has there been a greater need for sociological understanding and research focused on the problems and issues of our time. We combine rigorous methods of inquiry and analysis to examine social problems pertaining to uncertainty about the economy, health care, labor market, race and ethnic relations, mass media, the environment, social movements, shifting gender arrangements and issues, deviance and social control, and religion are just some of the issues you will study as a sociology major. The Sociology Department is home to the Social Research Institute (SRI). Purdue has a student chapter of Alpha Kappa Delta, a sociology/law and society organization. Students interested in legal professions and occupations are encouraged to join the Purdue Pre-Law Club. Law and Society majors may pursue a service learning course in their third or fourth year.

Faculty

The Department of Sociology Directory

Contact Information

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Please visit Sociology for more information.

Graduate Information

For Graduate Information please see Sociology Graduate Program Information .

Law and Society Minor

Sociology Minor

Law and Society, BA

About the Program

Law and society is a sociology major emphasizing concepts, theories, and research methods as applied to the study of law and law-related structures and processes. Coursework encompasses a variety of areas including deviant behavior, juvenile delinquency, the role of law in society, family law, and the sociology of police. These areas of study are intertwined with other crucial sociological concerns such inequality, power, social organization, social psychology, social change, race, gender, culture, and communication.
Please visit Law and Society for more information.

3 Year Degrees

The College of Liberal Arts offers the opportunity for students to complete their degree in three years. Degree in 3 majors allow students to enter the work force or graduate school a year earlier than traditional plans of study while also providing a cost-effective way to complete an undergraduate degree.

Students can complete the three-year option with or without AP credit by adding summer sessions to traditional coursework in Fall and Spring semesters. Degree in 3 offers a great combination of cost-savings and the opportunity to accelerate your future and achieve your goals.

Digital Criminology, BS

Sociology, BA

SOC 10000 - Introductory Sociology (UCC: BSS)

Credit Hours: 3.00. A survey course designed to introduce the student to the scene of human society. Fundamental concepts, description, and analysis of society, culture, the socialization process, social institutions, and social change. Students of junior or senior standing should take SOC 31200, unless they are sociology or law and society majors. CTL:ISH 1060 Introduction To Sociology

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Explain what it means to have a sociological imagination. 2. Use and evaluate theoretical and methodological tools sociologists use to study society. 3. Apply your sociological imagination to examine a variety of social behaviors and inequalities. Credits: 3.00

SOC 22000 - Social Problems (UCC: BSS)

Credit Hours: 3.00. Contemporary problems at the community, society, and international levels, focusing on patterns of social organization and social change in American society, with concentration on such topics as technological militarism and war, poverty, racism, political protest, and cybernation. CTL:ISH 1061 Social Problems

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Describe the cultural, social, and historical dynamics that influence how we construct social problems. 2. Identify the strengths and weaknesses of contending explanations or interpretations of major social problems. 3. Critique proposed solutions to major social problems. Credits: 3.00

SOC 26700 - Religion In The Modern World

Credit Hours: 3.00. A sociological overview of religious change in the modern world covering topics such as secularization, religious freedom, religious and ethnic conflicts, the mutual impacts between religion and various social institutions, such as

the family, economy, politics, education, and international relations. The thematic and regional foci may vary when the course is offered in different semesters, but the course will emphasize the sociological approach to understanding religion from a global-comparative perspective.

Learning Outcomes: 1. Summarize the key teachings and practices of the major religions in various regions of the world. 2. Describe the general social characteristics of religious believers in various regions of the world. 3. Explain the major social and political events and their impacts on religious change, or religious impacts on social and political events. 4. Learn to appreciate religious diversity in the increasingly globalizing world. Credits: 3.00

SOC 27500 - Sociology Of Aging And The Life Course (UCC: BSS)

Credit Hours: 3.00. An examination of research on the social context of human aging, including demographic and developmental changes. A life course perspective is emphasized for studying health, life events, and quality of life. Considers exceptional longevity in comparative perspective.

University Core Curriculum (UCC): (UCC: BSS)

Learning Outcomes: 1. Comprehension of the basic concepts, theories, and methods of the sociology of aging. 2. Think sociologically and write more clearly. 3. Application of course content in personal and vocational experiences. Credits: 3.00

SOC 28500 - Criminal Law And Procedure

Credit Hours: 3.00. This course will introduce students to the fundamental role of law in the American criminal justice arena with an overview on general legal principles, the contemporary form and function of criminal laws in today's American society. The course provides a survey on Substantive Criminal Laws emphasizing definitions of a criminal act, elements of criminal culpability, constitutional limitations on declaring certain conduct criminal, and the purposes of punishment. An overview on criminal procedure defined through federal and state case law will guide understanding on guidelines governing lawful law enforcement procedures and practices, courtroom decorum and admissibility. Emphasis is given on the role of technology in law enforcement to include Fourth Amendment search and seizure, Fifth Amendment right of privacy and electronic surveillance, self-incrimination, and other topics concerning balance of powers pertaining to rights of citizens and rights of state.

Learning Outcomes: 1. Identify and summarize the elements necessary to establish a crime and criminal liability. 2. Demonstrate knowledge about crime and criminality from perspectives of legal definition and criminal intent. 3. Apply important concepts from precedent case laws to draw conclusions about procedural outcomes. Credits: 3.00

SOC 31000 - Race And Ethnicity

Credit Hours: 3.00. This course is a sociological examination and analysis of the presence and significance of race and ethnicity in our society. The purpose of this course is to provide a foundation and critical framework for assessing the origins and manifestations of race and ethnicity. Race and ethnicity have historically been one basis for differentiation and stratification in the United States and other societies, and this persists today. In this course, we will examine the emergence of race and ethnicity as concepts, and how they shape our everyday lives. We will be guided by the following questions: Why do we study race and ethnicity? How and why are they relevant in our society? How do we experience race and ethnicity, and how has this changed over time? Topics include multiculturalism and diversity; media representations; racism and discrimination; colorism; racial hierarchies; immigration; and different domains of racial inequality.

Learning Outcomes: 1. Identify the role of race and ethnic identity in social and professional environments. 2. Identify, define and explain the Americanization process consistent with ethnic group's integration, assimilation, and/or acculturation into American status. 3. Become familiar with principle terms, concepts, and theories of the field of race and race relations. Credits: 3.00

SOC 32400 - Criminology

Credit Hours: 3.00. (CRJU 32400) Nature and cause of crime; methods of dealing with adult and juvenile offenders, consideration of present programs for the social treatment of crime in the light of needed changes.

Learning Outcomes: 1. Develop a sociological perspective on crime. 2. Comprehend the foundational terms, theories, and concepts of criminology. 3. Think critically about current issues related to crime. Credits: 3.00

SOC 32600 - Social Conflict And Criminal Justice (UCC: BSS)

Credit Hours: 3.00. This course examines the dynamics of social conflict, with a special focus on legal institutions and criminological processes. Students will learn to think more analytically about the causes of social conflict, its dynamics, and strategies for resolution.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Become familiar with classic theories of social conflict and social order. 2. Understand why society needs dissent. 3. Understand strategies for conflict resolution. Credits: 3.00

SOC 32700 - Crime, Deviance And Mass Media

Credit Hours: 3.00. Various forms of mass media are used to explore the sociology of crime and deviance. Topics may include white collar crime, juvenile delinquency, street crime, sexuality and sexual orientation, hate crimes, deviance and community. Assignments include quizzes and short papers.

Learning Outcomes: 1. Able to identify concepts associated with specific theoretical perspectives and be able to describe these concepts. 2. Able to use these concepts to the media forms presented in the class. 3. Use the concepts to craft explanations for characters' actions in the fictional films. 4. Able to conduct analyses of the news that conform to accepted methodological standards of quantitative and qualitative research. Credits: 3.00

SOC 32800 - Criminal Justice

Credit Hours: 3.00. Introduction to institutionalized responses of society to the problem of crime. Analysis of the administration of justice in each of the major components of the criminal justice system and laws regulating their operations. Some consideration given to comparative criminal justice. CTL:ISH 1030 Introduction To Criminal Justice

Learning Outcomes: 1. Demonstrate an understanding of the Criminal Justice System in the United States, including the relationships between federal, state and local units of government. 2. Demonstrate an understanding of the pathway which an individual follows from first arrest to incarceration. 3. Demonstrate an understanding of the differential criminalization and sanctions connected to domestic, street, and corporate forms of violence and crime. 4. Demonstrate an understanding of the influence of class, race/ethnicity and gender in criminal justice. 5. Demonstrate an understanding of the major policy debates regarding crime control and criminal justice. Credits: 3.00

SOC 33400 - Urban Sociology

Credit Hours: 3.00. Development of the city and its functions; types of social behavior in cities; influences of city life on personality; city planning.

Credits: 3.00

SOC 33500 - Political Sociology (UCC: STS)

Credit Hours: 3.00. Analysis of the social and social psychological sources of routine political participation such as voting and interest group activity, and nonroutine political action such as protest movements and revolution; the organization of power at the community, national, and international level; and political ideology.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Have a basic understanding of sociological theories of the state 2. Acquire an understanding of recent social and political science explanations of political processes and events 3. Apply sociological principles to make sense of current world events and to contribute to social debates 4. Comprehend different opportunities to influence political decisions by average citizens. Credits: 3.00

SOC 33800 - Global Social Movements

Credit Hours: 3.00. Explores dynamics of social movements in the world; emphasizes movements in non-western world. Examines emergences of movements, mobilization, tactical actions and consequences, and formal and informal organizations within movements to understand how international, national and local structures affect people.

Credits: 3.00

SOC 33900 - Sociology Of Global Development

Credit Hours: 3.00. Analysis of the causes and consequences of global development. Topics include: globalization; colonialism and decolonization; food insecurity and dependency; industrialization, poverty and inequality; migration; debt and trade; women's empowerment; global health; rights and social change; and sustainable development. This course will introduce you to the study of global development and globalization. The primary questions we will address are: What is development? What is globalization and what is its relationship with development? How have the processes of global development produced inequalities among nations, regions, races, genders, and classes? Is there a "developing" world and a "developed" world? If so, what are their differences and how do they relate with each other? How have some developing countries become more developed than others? What roles do corporations, the state, and civil society organizations play in the processes of global development? How is global development interrelated with the physical environment, inequalities of consumption, and the environmental crisis? How do people resist the inequalities and perceived injustices of global development through global social movements? How are we interconnected economically, politically, culturally, socially, and ecologically with people all over the world? What are the possible futures of development? To address these issues, our focus will be on the developing world, our scope will be global and long-term, our methodology will be historical-comparative, and our perspective will be social-scientific and critical.

Learning Outcomes: 1. Demonstrate knowledge of the causes and consequences of global development. 2. Outline the strengths and weaknesses of the basic theoretical perspectives on global development. 3. Identify the key historical events that have led to the project of global development. 4. Apply sociological analysis to different complex and power dynamics. 5. Describe how small- and large-scale projects might contribute to or hinder sustainable development. Credits: 3.00

SOC 34000 - General Social Psychology

Credit Hours: 3.00. Social influences on the individual and processes of social interaction. Individual attitudes and behavior as related to socialization, social norms, social roles, communication and propaganda, and other social influences. Among the interaction processes considered are interpersonal attraction, influence, leadership, cooperation, and conflict. Not open to students with credit in PSY 24000.

Learning Outcomes: 1. Develop an understanding of how politics has been approached and analyzed by sociologists over time, and an appreciation for the important thinkers and historical events that have shaped these approaches. 2. Identify specific areas of political polarization and political consensus in contemporary American politics, including where we find evidence of partisan asymmetry. 3. Demonstrate ability to develop and communicate sociological insights as they relate to political history and contemporary political dynamics, both in class and in written assignments. Credits: 3.00

SOC 34400 - Environmental Sociology (UCC: BSS)

Credit Hours: 3.00. This course introduces students to the interplay between human societies and environmental problems. The most challenging environmental problems we face are rooted in human activities. Why do some environmental problems come to be viewed as problems and others do not? How did environmental problems come to be viewed differently by different social groups? How do we motivate the necessary social support to address these problems? Answers to these kinds of questions and others are what we will consider in this class.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Develop students' ability to summarize (in both oral and written form) the key cultural and structural forces that shape how individuals view environmental problems and their solutions. 2. Develop their ability to engage in in-class discussions of the assigned readings in a way that contributes to everyone's understanding of the material. 3. Synthesize what they have learned from over the course to answer a novel question about the society-environment relationship. Credits: 3.00

SOC 34500 - Analyzing Culture On TV

Credit Hours: 3.00. This course uses television shows to explore sociological perspectives on culture. The premise of this class is that we can learn a great deal about how culture is

constructed, shared, consumed, and contested from watching (and critically analyzing) television shows. We will read theoretical and empirical work about how culture is defined in the social sciences and some of the leading approaches to studying culture in sociology, and then use those concepts to analyze popular television shows. The study of culture centrally concerns the place of meaning in human life, and we will explore how television shapes and is shaped by culture. We will consider how signs, symbols, language, conceptual structures, forms of knowledge, and forms of power interact to create meaning in our life. Cultural change both produces and is produced by changes in meaning, and we will investigate how cultural change occurs, with a focus on topics like changes to American cultures of love, work, religion, and politics.

Learning Outcomes: 1. Identify key concepts and theories central to the sociology of culture through readings and written responses. 2. Explain how cultural change occurs and how power and inequality are central to the ways cultural norms change through papers and class discussions. 3. Describe how television both reflects and shapes American culture through papers and class discussions. 4. Apply concepts from sociology of culture to critically evaluate popular media through papers and workshops. Credits: 3.00

SOC 35000 - Sociology Of Family

Credit Hours: 3.00. Designed to provide an understanding of contemporary courtship, marriage, and family interaction as cultural, social, and social-psychological phenomena. Consideration of the major sources of marital strain and conflict within a heterogeneous, rapidly changing society.

Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Understand the experiences of people suffering from chronic illness. Credits: 3.00

SOC 35200 - Drugs, Culture, And Society (UCC: BSS)

Credit Hours: 3.00. The course provides an overview of the social and cultural underpinnings of drug use across societies. Students engage with various topics, including addiction, global markets, drug epidemics, public policy, and cross-cultural differences in drug use.

University Core Curriculum (UCC): (UCC: BSS) Credits: 3.00

SOC 35600 - Hate And Violence

Credit Hours: 3.00. Examines the causes of and solutions to hatred and violence. Concepts such as anti-Semitism, discrimination, hate crimes, prejudice, racism, bullying, homosexual prejudice, terrorism and other topics will be addressed. This course uses experiential activities, videos, guest speakers and classroom discussion.

Learning Outcomes: 1. Apply sociological approaches and concepts to the study of hate and violence. 2. Identify some of the causes of hate and violence, as well as the forces that perpetuate hate and violence. 3. Identify and critically evaluate institutional responses to hate and violence. 4. Empirically examine an organized effort to work against hate and violence. Credits: 3.00

SOC 36700 - Religion In America

Credit Hours: 3.00. Examines the social dimensions of religion in American life; religion in American culture; social profiles of America's religious groups, trends in individual religious commitment; and religion's impact on American life.

Learning Outcomes: 1. Describe the sizes and influences of major (and some minor) religious groups in America and how these sizes and influences have changed over the past 50 years. 2. Explain and evaluate the influence of religious groups and ideas on at least one other important aspect of social life. 3. Explain ways in which trends in American society over the past 50 years (e.g., changing gender roles, political shifts, etc.) are bringing about changes in American religion. Credits: 3.00

SOC 36800 - The Social Significance Of Religion

Credit Hours: 3.00. Examines religion's relationship with family, work, politics, gender, war and peace, race and ethnicity, health, crime and deviance, education, law, and poverty. Content differs each time course is taught.

Credits: 3.00

SOC 36900 - Religion And Chinese Society

Credit Hours: 3.00. This course provides an overview of various religions in contemporary China, examines religiosity at the micro, meso and macro levels, and discusses the mutual impacts between religion and social, cultural and political life in Chinese societies.

Learning Outcomes: 1. Summarize the key teachings and rituals of the major religions in Chinese society. 2. Describe the general social characteristics of religious believers in contemporary Chinese society. 3. Explain the major social and political events and their impacts on religious change. 4. Appreciate religious diversity and cultural significance in the increasingly globalizing world. Credits: 3.00

SOC 37400 - Medical Sociology (UCC: BSS)

Credit Hours: 3.00. Medical sociology provides an overview of the social determinants of health and health disparities, the experience of illness and being a patient, the organization of the medical profession, and the health care system in the United States as well as other areas of the world.

University Core Curriculum (UCC): (UCC: BSS)
Learning Outcomes: 1. Articulate the contours of health disparities in the contemporary US. 2. Hold an informed discussion about current debates surrounding the organization of the health care system. 3. Have a greater understanding of the experiences of people suffering from chronic illness. Credits: 3.00

SOC 37700 - Sociology Of Mental Health

Credit Hours: 3.00. Examines social influences and consequences of mental health and illness. Considers definitions of psychological disorders, stress, stigma, labeling, and treatments.

Learning Outcomes: 1. Understand sociological approaches to mental health and illness. 2. Become familiar with issues in the history of mental illness and treatment. 3. Evaluate the origins and consequences of social policies toward mental disorder. 4. Examine the emergence and application of specific categories of mental disorder. 5. Examine the integration of social and biomedical approaches to mental illness. Credits: 3.00

SOC 38100 - Data And Society

Credit Hours: 3.00. We are currently witnessing amazing technological innovations brought about by the production, accumulation, and analysis of unimaginable amounts of data. These technologies are disrupting industries, creating new classes of wealthy and poor, and providing novel opportunities for social control and resistance. This course will look at how the increasing centrality of data is changing our world. Among the questions we will answer: What's so big about Big Data? How intelligent is artificial intelligence? Why does everyone want my data? Will there still be jobs when I graduate?

Learning Outcomes: 1. Outline the development of machine learning technologies from expert systems to neural nets. 2. Explain why data has become a precious resource, and the positive and negative effects this change has engendered. 3. Critically appraise potential dangers of artificial intelligence and automation as well as their potential benefits. Credits: 3.00

SOC 38200 - Introduction To Statistics In Sociology

Credit Hours: 3.00. Introduction to the basic techniques of statistical analysis applicable to sociological data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis.

Learning Outcomes: 1. Identify the relevance of statistics to everyday life. 2. Understand how descriptive and inferential statistics are used and described in sociological research. 3. Compute and interpret univariate and bivariate statistics. Credits: 3.00

SOC 38300 - Introduction To Research Methods In Sociology

Credit Hours: 3.00. Introduction to the methods of data collection and analysis and to the use of the scientific method of social research. Formulation of hypotheses and research designs for their testing. Elementary principles for the conduct of experiments, observation and interviewing, documentation, content analysis, and surveys. Relationship between social research and social theory.

Learning Outcomes: 1. Understand the conditions needed to establish social causation in social research. 2. Become familiar with major approaches to collecting data for social research. 3. Understand practices to achieve valid measurement and representative samples. Credits: 3.00

SOC 39000 - Individual Research In Sociology

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of sociology under the guidance of a Sociology faculty member. Permission of instructor required.

Credits: 1.00 to 3.00

SOC 39100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Various topics in sociology that may change from semester to semester are presented by Sociology faculty members.

Credits: 1.00 to 3.00

SOC 39103 - Applied Internship In Sociology

Credit Hours: 0.00 to 3.00. Internships offer experiential learning opportunities where students can apply classroom knowledge and develop practical skills while earning academic credit. Permission of department required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 0.00 to 3.00

SOC 40200 - Sociological Theory

Credit Hours: 3.00. An advanced critical treatment of the theories, concepts, and methods of sociology. A basic course required of undergraduate majors in sociology.

Credits: 3.00

SOC 40900 - Social Networks

Credit Hours: 3.00. Social networks are patterns of social relationships among people, organizations, and other entities (words, events, etc.) that allow communication and influence and provide a context for social life. This course considers social networks both on and off the internet that are important in people's lives for finding dates, getting jobs, maintaining friends and family, finding and maintaining identities, belonging to groups, and communication and influence more generally.

Learning Outcomes: 1. Communicate the essentials of nodes and relationships that compose networks in words and visualizations. 2. Identify patterns in social networks that have consequences for both individual people and social systems. 3. Identify sources of social relationships and patterns of relationships that then have further consequences for people and social systems. 4. Summarize and make sense of basic social network data. 5. Recognize social networks in forms beyond Facebook, Instagram, Twitter, etc. Credits: 3.00

SOC 41100 - Social Inequality

Credit Hours: 3.00. Examination of systems of class and caste, with special attention to the United States; status, occupation, income, and other elements in stratification.

Learning Outcomes: 1. Challenge misconceptions about the nature and origins of social inequalities. 2. Critically apply social inequality research to their own social environments. 3. Construct arguments about social inequalities' causes and consequences. Credits: 3.00

SOC 41900 - Sociology Of Law

Credit Hours: 3.00. Provides an overview of American legal thought and legal processes. Major topics include definitions of law; anthropological studies of law; origin and development of law; jurisprudence; police behavior; lawyers and courts; deterrent and labeling effects of legal sanctions.

Learning Outcomes: 1. Understand how official law and law-in-action can differ. 2. Identify key theories in sociology of law. 3. Apply socio-legal theoretical concepts to real-world examples. Credits: 3.00

SOC 42100 - Juvenile Delinquency

Credit Hours: 3.00. A study of social and psychological factors influencing individual delinquent behavior patterns. Emphasis on preventive and rehabilitative programs and the role of community agencies such as social service agencies, juvenile courts, and youth authorities. Visits to selected organizations and institutions.

Learning Outcomes: 1. Understand the causes and consequences of juvenile crime on

individuals, families, and society. 2. Understand the prevalence and types of juvenile delinquency in the United States. 3. Learn the basic theories of juvenile crime. 4. Assess the theories onset of, recidivism, and desistance from crime. 5. Assess effects of social factors in delinquency, such as parents, siblings, family structure, and peers. 6. Know the history of and reasons for the juvenile justice system. 7. Critically evaluate the juvenile justice system and social response to juvenile crime. 8. Identify and evaluate multiple local organizations and institutions that intervene or act in juvenile delinquency prevention, rehabilitation, or response. Credits: 3.00

SOC 42300 - Field Practicum In Sociology And Law And Society

Credit Hours: 4.00. Field experience in criminal justice system or social services. Students serve as "interns" in a criminal justice or social service agency one day (or its equivalent) per week, under the supervision of agency personnel. Application of theory and empirical research findings to field problems. Permission of instructor required.

Learning Outcomes: 1. Learn professional skills from a working professional. 2. Discover the relation between academic and practical knowledge Credits: 4.00

SOC 42600 - Social Deviance And Control

Credit Hours: 3.00. Sociological and social psychological study of social control and social deviance. Emphasis on theoretical frameworks and empirical research. Consideration also given to specific areas such as substance abuse, suicide, violence, and deviant collective behavior.

Learning Outcomes: 1. Develop a sociological perspective on deviance and social control. 2. Comprehend the foundational theories, concepts, and terms involved in the study of deviance and social control. 3. Think critically about current issues related to deviance and social control. Credits: 3.00

SOC 42900 - Sociology Of Protest (UCC: BSS)

Credit Hours: 3.00. This course focuses on the sociological study of protest. Topics include protest emergence, individual reasons for participation in protest, and outcomes. Course readings cover protest in the United States as well as other cultural contexts.

University Core Curriculum (UCC): (UCC: BSS)
Credits: 3.00

SOC 43000 - Sociology of Aging

Credit Hours: 3.00. Examination of the theories of aging, problems confronting older persons, and programs designed to assist the elderly. Consideration of social aspects of aging in the U.S. in the areas of retirement, employment, housing, income, health care, and the family relationships with cross-cultural and a historical comparisons.

Credits: 3.00

SOC 43200 - Work In Contemporary America

Credit Hours: 3.00. Examines meaning and organization of work in technological society, including job satisfaction, alienation, mobility, conflict, stratification, and unemployment and the impact of race-sex composition of occupations on mobility and politics. Also considers relations with colleagues, organization, clients, and public.

Learning Outcomes: 1. Knowledge of core sociological concepts and theories regarding work. 2. Develop the ability to use these tools to critically analyze historical and contemporary issues of work in society. Credits: 3.00

SOC 45000 - Gender Roles In Modern Society

Credit Hours: 3.00. A critical examination of the complementary roles of men and women, with particular attention to problems of role adjustment in the contemporary United States. The neofeminist movement and countermovements. Role conflicts and adjustments in such areas as family, education, employment, and the political arena.

Credits: 3.00

SOC 46100 - Health And Social Behavior

Credit Hours: 3.00. This course provides a sociological examination of health and illness, with a particular focus on social position (e.g., race, socioeconomic status, gender), stress and social support, and health care. Goals for this course include developing critical thinking skills, understanding the

broader implications of issues related to health, and thinking creatively about potential societal solutions to these issues.

Learning Outcomes: 1. Understand the ways in which social factors influence health and social behavior as well as the broader implications of these issues. 2. Develop critical thinking skills through critical writing and classroom discourse on issues related to the sociology of health and illness. 3. Apply a sociological perspective to potential solutions to health-related issues.

Credits: 3.00

SOC 48900 - Research Internship In Sociology And Law And Society

Credit Hours: 3.00 to 6.00. Course organized around internship experience in organizations that collect or analyze data from surveys, social media, focus groups, interviews, or experiments. Completion of 60 credits with a minimum GPA of 3.0, including 15 credits of Sociology with a minimum grade of B in SOC 10000, SOC 38200, and SOC 38300. Permission of instructor required.

Learning Outcomes: 1. Able to do and disseminate social science research in a real world setting. 2. Apply social science data collection and analysis techniques in a real world setting. 3. Evaluate research critically.

Credits: 3.00 to 6.00

SOC 49300 - Interdisciplinary Undergraduate Seminar

Credit Hours: 1.00 to 3.00. An undergraduate seminar devoted to an interdisciplinary examination of social, economic, political, and intellectual movements, using the faculty resources of the participating departments. Subject matter will vary. Each offering of the seminar will be approved by a committee of department heads from the sponsoring departments. Permission of instructor required.

Credits: 1.00 to 3.00

SOC 49700 - Senior Honors Seminar

Credit Hours: 3.00. A critical examination of some major works in sociology and anthropology, both classical and modern, and of some current theoretical and substantive issues in these disciplines. Open only to students in the departmental honors program.

Credits: 3.00

SOC 49800 - Senior Honors Paper

Credit Hours: 3.00. The production of a major paper on a topic selected by the student in consultation with the instructor. The students will meet early in the semester for orientation and discussion of topics; in the middle of the semester for progress reports; and late in the semester for presentation and critique of their papers. Open only to students in the departmental honors program.

Credits: 3.00

Patti and Rusty Rueff School of Design, Art, and Performance

About the Patti and Rusty Rueff School of Design, Art, and Performance

The Patti & Rusty Rueff School of Design, Art, and Performance offers undergraduate and graduate programs in the traditional studio arts, art education, art history, industrial design, visual communication design, interior design, film and video production, theatre, dance and music. The Rueff School's main facility, Yue-Kong Pao Hall, includes the Nancy T. Hansen Theatre, Carole and Gordon Mallett Theatre and the Rueff Galleries. The exciting calendar of lectures, performances, workshops and exhibitions in Pao Hall and across the campus are open to the community.

Our internationally-acclaimed faculty publish, teach, exhibit, lecture and perform across the country and around the world. We are a vibrant community of thinkers, artists, performers, creators, composers and makers. Join us for an exceptional and inspiring education in the arts at a world-class university.

The Rueff School is accredited by the **National Association of Schools of Art and Design** and by the **National Association of Schools of Theatre**.

Faculty

Patti and Rusty Rueff School of Design, Art, and Performance Directory

Contact Information

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Graduate Information

For Graduate Information please see Visual and Performing Arts Graduate Program Information .

Art and Design Studio Minor

Art History Minor

Dance Minor

Electronic and Time-Based Art Minor

Music History and Theory Minor

Theatre Design and Production Minor

Theatre Minor

Art History, BA

Integrated Studio Arts, BFA

Industrial Design Professional Program, BFA

Interior Design Professional Program, BFA

Sound for the Performing Arts, BA

Studio Arts and Technology, BA

Theatre, BA

Visual Arts Education, BA

Visual Communication Design, BFA

Theatre Lighting Certificate

Visual Arts Design Education, BA

Music Technology Certificate

Music: Music Technology Concentration, BA

Music: General Music Studies Concentration, BA

Interdisciplinary Performance, BA

Sports Studies and Production Certificate

Film & Video Studies Minor

Film & Video, BA

Design Studies, BA

Music: Jazz Studies Concentration, BA

Music: Music Theory & Composition Concentration, BA

AD 10500 - Design I

Credit Hours: 3.00. Two-dimensional design fundamentals: concepts and processes. Studio problems are used to introduce concepts, vocabulary, and skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of two-dimensional media and computer applications.

Learning Outcomes: 1. Identify basic design principles within two-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work and the work of others. Credits: 3.00

AD 10600 - Design II

Credit Hours: 3.00. Three-dimensional fundamentals: concepts and processes. Studio problems introduce design concepts, vocabulary, and construction skills applicable to continued study in a variety of visual disciplines. Includes introduction to a variety of 3-D media and 3-D computer graphics concepts.

Learning Outcomes: 1. Identify basic design principles within three-dimensional media and computer applications. 2. Apply principles of design effectively within a series of studio project/problems. 3. Critique and assess the application of basic design principles in their own work, and the work of their peers. Credits: 3.00

AD 11300 - Basic Drawing (UCC: HUM)

Credit Hours: 3.00. An introduction to drawing and sketching as a means of communication of ideas. CTL:IFA 1320 Drawing.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Develop and strengthen observational, perceptual, and creative drawing skills. 2. Apply drawing skills across a variety of media, practices, and concepts. 3. Evaluate drawings through constructive criticism. Credits: 3.00

AD 11400 - Drawing II

Credit Hours: 3.00. Continuation of AD 11300 ; emphasis is given to the exploration of a variety of media, the structuring of pictorial space, and figure drawing.

Learning Outcomes: 1. To increase and widen drawing skills. 2. To understand pictorial space as structured through design composition. 3. Be able to discuss art in an educated manner. Credits: 3.00

AD 11700 - Black And White Photography (UCC: HUM)

Credit Hours: 3.00. An introductory course in silver-based photographic processes and creative image making. Emphasis is on the development of camera and darkroom techniques, and fostering critical thinking skills related to the traditions and aesthetics of black and white photographic practice.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate how to operate analog film cameras. 2. Apply skills learned to create black and white film developing and printing processes. 3. Evaluate

and analyze the history and critical theory of analog photography. Credits: 3.00

AD 11900 - Color Photography

Credit Hours: 3.00. Introductory course in creative use of color photographic processes and studio practices. Emphasis is on the acquisition of digital cameras, studio, and digital printing skills which enable students to successfully perceive and structure images reflecting color's formal, symbolic, and emotional impact.

Learning Outcomes: 1. Apply knowledge of capturing and processing color digital imagery. 2. Demonstrate learned skills in color correction and image enhancement using image-editing software. 3. Illustrate understanding of conceptual dialogue using photography and color, and compile a portfolio of images that reflect the understanding. Credits: 3.00

AD 12500 - Introduction To Interior Design (UCC: HUM)

Credit Hours: 3.00. Introductory survey of interior spaces and their impact upon the physical, social, psychological, and aesthetic needs of people. Critical evaluation of concepts in the interior design profession and related fields will be emphasized.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Apply concept that well-designed environments are products of a design process that encompasses both functionality and aesthetics. 2. Describe how interior environments can influence human behavior. 3. Relate the sociological, psychological, physiological, and economic aspects to the design of interiors. 4. Identify and use professional terminology in the field of interior design. Credits: 3.00

AD 13000 - Interior Design Communication

Credit Hours: 3.00. Spatial studies, conceptual ideation, and methods of communicating in various two- and three-dimensional media.

Learning Outcomes: 1. Produce basic design drawing and architectural lettering. 2. Apply the use of line weights when sketching and drawing when visualizing design ideas. 3. Explain architectural and interior design vocabulary. 4. Construct one- and two-point perspectives. 5. Apply basic skills and knowledge of AutoCAD Drafting Software. Credits: 3.00

AD 13200 - Introduction To Museums And Archives

Credit Hours: 3.00. This course is an introduction to the structures, history, theories, and professional practices in museums and archives. In addition to providing an overview, this course provides students with career exploration in museums and archives through analyzing opportunities in various professional tracks. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Explain the historical foundations of museums and archives. 2. Identify basic organizational structures and career paths of museums, galleries, archives, and special collections libraries. 3. Analyze the value and educational mission of museums, galleries, archives, and special collections across multiple disciplines. 4. Interpret contemporary theories and practices within museums, galleries, archives, and special collections. 5. Apply learning to future opportunities in chosen specialties, majors, and career fields. Credits: 3.00

AD 14600 - Design Drawing I

Credit Hours: 3.00. Problems in the skills and methods of professional design drawing. Emphasis on development of drawing as a conceptual tool and as part of the design process. Concentration on the media and techniques used in contemporary design drawing.

Learning Outcomes: 1. Identify and apply the fundamentals of industrial design drawing, including line quality, perspective, and proportions. 2. Develop a habit of regular drawing exercises and warm-ups to enhance their creativity and skill. 3. Apply design drawing techniques to effectively communicate and visualize design concepts. 4. Understand

the basics of presentations and storytelling. 5. Demonstrate entry-level research to product design. Credits: 3.00

AD 19000 - Special Topics In Art And Design

Credit Hours: 1.00 to 3.00. Topics will vary. Permission of department required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 3.00

AD 20000 - Beginning Painting

Credit Hours: 3.00. This course is an introduction to painting, emphasizing fundamental painting techniques and materials in conjunction with varied subject matter. Traditional and nontraditional approaches and their art historical meanings will be examined and applied.

Learning Outcomes: 1. Recognize, identify and employ techniques and methods from both historical and contemporary painting. 2. Create quality craftsmanship and employ professional practice in painting. 3. Demonstrate a comprehension of course content through implementing the use of grisaille, glazing, value, color, line, texture and mark making within painting. Credits: 3.00

AD 20100 - Art For Elementary School Teachers

Credit Hours: 3.00. Art theory and experiences, curriculum theory, and materials preparatory for instruction of elementary school children. No undergraduate students may be enrolled in this course until they have been admitted to teacher education and a copy of this acceptance is on file.

Learning Outcomes: 1. Apply visual arts methods to develop appropriate lessons to construct students' knowledge. 2. Utilize two- and three-dimensional media commonly used by elementary students to teach art production and encourage the expression of ideas. 3. Assess elementary students' artistic development levels and design activities to meet their artistic needs in the classroom. 4. Apply elements of art, principles of design, interpretation skills, and judgment conclusions to evaluate and respond to works of art and to foster that ability in their elementary students. Credits: 3.00

AD 20200 - Introduction To Art Education

Credit Hours: 2.00. Lectures, readings, and discussions covering the history, theory, and professional literature of art education.

Learning Outcomes: 1. Analyze children's artistic development to understand its stages and implications for teaching. 2. Evaluate works of art and learn how to develop that ability in their students. 3. Analyze components of visual arts curriculum, assessment, and art education programming. 4. Demonstrate knowledge and skill with teaching techniques appropriate for various teaching levels. 5. Compare art instruction at various levels of public -school education. Credits: 2.00

AD 20500 - Design III

Credit Hours: 3.00. Problems in two- and three-dimensional design, utilizing a variety of tools, materials, and processes. Study is made of the interaction between designer and society, involving concepts in art, psychology, technology, anthropology, and history.

Learning Outcomes: 1. Demonstrate a practical understanding of visual communication design. 2. Modify visual hierarchies to convey ideas clearly and effectively. 3. Apply professional approaches to design problem-solving. 4. Utilize visual language vocabulary and design knowledge to communicate ideas. 5. Identify and explain the basics of typography, page structure, and sequencing. Credits: 3.00

AD 20600 - Studio In Visual Communication Design

Credit Hours: 3.00. Investigation of visual communication design theory, history, skills, and methodology, as well as preparation of art and mechanicals for graphic arts reproduction.

Learning Outcomes: 1. Transition from fundamental design skills to advanced graphic

design applications. 2. Introduce layout/grid systems and their theoretical and practical applications. 3. Introduce students to the fundamentals of typography, exploring the relationships between type and image. 4. Increase proficiency in graphic software in the context of graphic design projects. 5. Gain a better understanding of the history of graphic design. 6. Develop more advanced problem-solving skills. 7. Prepare students for the Sophomore Review, and advanced junior- and senior-level design courses. Credits: 3.00

AD 21300 - Life Drawing I

Credit Hours: 3.00. Introduction to drawing the human figure with emphasis upon structure and gesture.

Learning Outcomes: 1. Develop fundamental technical and perceptual skills of figure drawing. 2. Identify and describe major anatomical features of the human body. 3. Compose sound figurative compositions using basic design principles, foundation drawing techniques, and a variety of drawing materials. Credits: 3.00

AD 21500 - Materials And Processes

Credit Hours: 3.00. An introductory course in the selection of materials and processes as relevant to design, with laboratory experiences in the safe and proper use of tools and equipment. Required of students wishing extensive access to A&D tools and equipment.

Learning Outcomes: 1. Demonstrate proper and safe handling of tools and machinery through design fabrication. 2. Develop and apply time management skills to manage a rigorous workload effectively. 3. Produce designs that reflect aesthetic and material awareness through curated projects. Credits: 3.00

AD 22000 - Computers In Art

Credit Hours: 3.00. Introduction to computer graphics concepts and the electronic image as a fine art form. Emphasis is placed on personal expression, using the computer as a two-dimensional art tool.

Learning Outcomes: 1. Demonstrate individualized forms of creative expression through the use of computers and art. 2. Create a series of creative projects incorporating a range of digital techniques. 3. Critique and assess their creative work and the work of their peers. Credits: 3.00

AD 22600 - History Of Art To 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from their beginnings to the end of the Middle Ages. CTL:IFA 1311 Art History I

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Use field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22700 - History Of Art Since 1400 (UCC: HUM)

Credit Hours: 3.00. Review of painting, sculpture, and architecture from 1400 to present. CTL:IFA 1312 Art History II.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Identify important developments in the history of western art and visual culture. 2. Understand field-specific vocabulary. 3. Analyze and interpret artistic works in their cultural, intellectual, and historical contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 22800 - Visual Communication Design Computing I

Credit Hours: 3.00. An introductory course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using

industry standard design software specifically Adobe Illustrator and Adobe InDesign. 2. Experiment with and iterate through image-making utilizing various methods and vector-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Increase ability to generate and choose intensely metaphoric imagery to enhance visual communication. 5. Understand and use design terminology and design principles. 6. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22900 - Visual Communication Design Computing II

Credit Hours: 3.00. An intermediate course in visual design computing programs used in the study and production of visual communication design.

Learning Outcomes: 1. Develop skills using industry standard design software specifically Adobe Photoshop and Adobe XD. 2. Experiment with and iterate through image-making utilizing various methods and pixel-based digital techniques. 3. Strengthen conceptual image-making skills. 4. Understand and use design terminology and design principles. 5. Strengthen attention to detail and craft knowledge. Credits: 3.00

AD 22901 - Visual Communication Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Visual Communication Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Visual Communication Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

AD 23000 - Interior Design I

Credit Hours: 3.00. Study of behavior patterns, perceptions, needs, and usage of three-dimensional space through conceptual solutions to human environments. Interior design theory and application of design process through analysis, research, and synthesis will be explored.

Learning Outcomes: 1. Develop design communication skills through freehand and instrument drawing tools that can be used in both design and presentation work. 2. Explore a wide range of drawing media such as pencil, markers, and colored pencils to develop design communication skills. 3. Develop the ability to make informed and sensitive decisions regarding the use of color in presentation work. 4. Further develop speed and accuracy in constructing perspectives and renderings. Credits: 3.00

AD 23300 - Electronic Media Studio

Credit Hours: 3.00. Introductory class to artistic practices on the computer. Students will work with digital still images, sounds, stop-frame animation and HTML-based websites and learn how to connect simple sensors to the computer to control digital images and sounds interactively.

Learning Outcomes: 1. Apply key concepts from a variety of new media art practices by relating them to their own ideas developed in this class. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Produce a variety of artworks, such as animations, soundscape compositions and basic audio-visual systems by the creative application of technology. Credits: 3.00

AD 23400 - Art And Design Internship Preparation

Credit Hours: 1.00. Introduction and preparation for Art & Design Internship experience. Students will develop a resume, cover letter, and other resources in their search for a suitable internship placement.

Learning Outcomes: 1. Students will have the

opportunity for design work experience from the internship program that will familiarize the students with the culture and environment of the professional studio and professional practice. Credits: 1.00

AD 23500 - Materials And Processes II

Credit Hours: 3.00. Problems in three-dimensional design, incorporating materials, production processes, and applications of current technology, emphasizing aspects of society and technology. An introduction to complete industrial design problems, including problem definition, concepts, resource information, design development, final proposals, and presentation techniques.

Learning Outcomes: 1. Apply knowledge of design for manufacturing and use of materials by creating and fabricating selected projects. 2. Evaluate the aesthetics, ergonomics, and manufacturability of designs by participating in in-class design critiques. 3. Utilize skills to analyze an existing product and redesign it with an expanded function. Credits: 3.00

AD 23600 - Lighting Fundamentals For Photography

Credit Hours: 3.00. Introductory course in understanding electronic strobe lighting. Begins with a review of basic lighting principles and a series of problem-solving assignments, which introduce control, and applications of electronic strobe lighting. Still life photography and portraiture are emphasized and covers on-location lighting.

Learning Outcomes: 1. Gain an understanding of the basic principles of light and how to use those principles to light photographic subject matter. 2. Gain a basic understanding of the function of photographic lighting equipment. 3. Compile a portfolio of images that demonstrate a skill set learned regarding product and portrait and simple space lighting. Credits: 3.00

AD 24000 - Interior Drafting And Drawing

Credit Hours: 3.00. Basic drafting and drawing techniques used in residential and small commercial buildings. Emphasis on interior projects, on multi-view drawing, isometrics, perspective, and architectural construction drawings, and rendering techniques.

Learning Outcomes: 1. Learn to explore different concepts and present their ideas through sketches, design drawings, and final models for a small multilevel residential project. 2. Further develop hand sketching, drafting, AutoCAD, and model building skills to communicate their ideas and solutions in the residential remodel. 3. Research and apply information on furniture, stairs, equipment, plumbing, and other elements for a small house project. 4. Execute a comprehensive set of construction drawings for a multilevel residential remodel including floor plans, electrical plans, elevations, details and schedules. Credits: 3.00

AD 24200 - Ceramics I (UCC: HUM)

Credit Hours: 3.00. An introduction to ceramic materials and processes used in creating wheelthrown and hand-formed pottery and sculpture. Emphasis on contemporary interpretations of traditional forms. Freshman and Sophomore students have priority.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate the technical basics of using clay as a material for both sculptural and thrown work. 2. Compare the applications of slips, stains, glazes, and wax resist in oxidation and reduction glazes and firings from Cone 04 to Cone 10 temperatures. 3. Create ceramics and functional work using hand building and learn how to center and throw on the wheel with design intention. 4. Apply skill in hand building figurative work with exact proportions. 5. Demonstrate successful making of clay from dry chemicals and how to recycle clay using a clay mixer and pugmill. Credits: 3.00

AD 24600 - Design Drawing II

Credit Hours: 3.00. Continuation of the work done in A&D 245. Emphasis on development of skills and presentation quality design drawing.

Credits: 3.00

AD 25000 - Interior Design II

Credit Hours: 3.00. Introduction to space planning methodology applied to small-scale residential and nonresidential environments. Human factors and user requirements, physical and psychological, will be emphasized. Interior materials, components, and special environmental concerns will be explored.

Learning Outcomes: 1. Identify principles of human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Generate multiple solutions to solve a specified design problem, through ideation sketches, drawings, and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definitions and organization, to a specified design problem. 4. Communicate ideas developed in the design process through written, graphic, and oral communication. 5. Assess designed environments as an aesthetic art form within a functional environment. Credits: 3.00

AD 25001 - Interior Design Sophomore Review

Credit Hours: 0.00. Sophomore Review is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Interior Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Submit selected projects and design portfolio to the Interior Design faculty members and be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

AD 25100 - History Of Photography I (UCC: HUM)

Credit Hours: 3.00. An introduction of the history of photography from the medium's inception until 1950. Emphasis is placed on understanding photographs from a variety of aesthetic, social, and cultural perspectives, including those of race, class, and gender.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 25500 - Art Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the problems overcome by mankind in the origins and growth of art.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

AD 25600 - Presentation Techniques

Credit Hours: 3.00. Studio preparing students for project presentations. Classes will cover graphic techniques, including page layout, typography, portfolio formats, perspective drawings, photography, and verbal communication.

Learning Outcomes: 1. Create original designs using iterative visualization techniques to improve and refine their design concepts. 2. Develop computer-aided design skills to present these design concepts. 3. Demonstrate 3-D computer modeling skills. 4. Demonstrate computer rendering skills. Credits: 3.00

AD 25601 - Industrial Design Sophomore Review

Credit Hours: 0.00. This course is a qualifying assessment supervised by faculty members to monitor student learning and progress. Students who do not pass the review will be ineligible for Industrial Design upper-level studio courses. Permission from department required.

Learning Outcomes: 1. Present selected projects and design portfolio to the Industrial Design faculty members. 2. Be assessed by faculty to identify the student's strengths, abilities, and areas of needed improvement. Credits: 0.00

AD 26001 - Advanced Drafting And Visualization For Interiors

Credit Hours: 3.00. Advanced drafting and visualization for interior design. Students learn advanced technology skills to detail, draw, visualize, and manipulate architectural spaces, interior furnishings, and objects.

Learning Outcomes: 1. Discuss 3D techniques,

visualization processes, and technologies impacting the field of interior design. 2. Critique the quality of two- and three- dimensional graphic representation of an interior design project. 3. Create digital models and renderings that communicate interior design ideas utilizing a combination of software programs. Credits: 3.00

AD 26200 - Jewelry And Metalwork I

Credit Hours: 3.00. An introduction to the design and execution of hand-wrought jewelry and metalwork.

Learning Outcomes: 1. Plan, and design functional and meaningful original small-scale metal objects and jewelry. 2. Create small scale metal sculptures and jewelry. 3. Demonstrate skill in sawing, filing, sanding and soldering and apply these techniques to produce small-scale metal sculptures and jewelry. Credits: 3.00

AD 26300 - Book Arts

Credit Hours: 3.00. This course engages students in the art of the book as a creative practice. The course includes an introduction to book arts concepts, structures, bindings and methods of image making. Emphasis is placed on form and content relationships, construction, and artistic development.

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of book artists and book arts concepts. 2. Develop technical skills in book structures, binding, paper folding and surface treatment. 3. Demonstrate skill in printmaking and mono-printing methods to create imagery and content. 4. Design artwork using existing and innovative book structures with a focus on concept, form and content relationships. 5. Create book art works utilizing multiple dimensions including surface (2D), space & form (3D), time & movement (4D). 6. Evaluate and critique the work of self, peers, and contemporary book artists. Credits: 3.00

AD 26500 - Relief Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of woodcut, linocut, collagraph, and related media. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Create contemporary personal work with expressive and original ideas informed by the study of historic and contemporary relief printmaking artists and art concepts. 2. Demonstrate relief printmaking through carving multiple printing materials, printing by hand, using a printing press, and through multiple-layered registration. 3. Invent, solve, and self-assess visual problems using concept, content, design, color, composition, and sketchbook during the creative process and printing. 4. Describe and analyze the work of professional printmaking artists, self and peers. 5. Demonstrate knowledge and technical skills in carving skills and making fully inked prints. Credits: 3.00

AD 26600 - Silkscreen Printmaking (UCC: HUM)

Credit Hours: 3.00. An introduction to the techniques of silkscreen printmaking on paper, including the uses of handmade and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting, and framing art, and professional practices.

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

AD 26700 - Digital Imaging

Credit Hours: 3.00. An introductory course in the creative generation and digital enhancement of photo-related imagery. Emphasis is on the development of technical and critical thinking skills, as well as fostering an awareness of pertinent theoretical issues in digital age.

Learning Outcomes: 1. Gain knowledge of intermediate and advanced Photoshop. 2. Gain an understanding of constructed image making in photography using Photoshop. 3. Understand contemporary artists whose photographic works

generated through computer manipulation. 4. Gain knowledge of theoretical and historical concerns regarding post photography. Credits: 3.00

AD 27000 - Constructed Textiles

Credit Hours: 3.00. A beginning class in non-loom constructed textile techniques such as macram and card-weaving. Emphasis on three-dimensional design in fiber using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 27100 - Dyed Textiles

Credit Hours: 3.00. Beginning course in non-screen fabric dyeing techniques such as tie-dye and batik. Survey of historical surface design for contemporary interpretations in both two and three dimensions.

Credits: 3.00

AD 27500 - Beginning Sculpture (UCC: HUM)

Credit Hours: 3.00. An introductory course in sculpture, exploring basic concepts, techniques, and materials. Problems in class will emphasize individual student's aesthetic understanding of techniques and inventive use of materials.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Students will be introduced to contemporary sculptors and their work with the aims of providing a historical background for the study and appreciation of sculpture as a medium and providing resources that students can relate to their own creative processes as artists. 2. Students will proceed through an individually developed series of problems and solutions. Where appropriate, additional historical and contemporary references related to the individual students' specific creative investigations will be provided. 3. Technical demonstration will also be provided as needed by individual students. Credits: 3.00

AD 28000 - Human Behavior And Designed Environment

Credit Hours: 3.00. This foundation course examines issues pertaining to the environment's effects on human behavior and how humans' physiological, informational, and social needs impact the design of interior spaces. Specific topics explored include: personal and social use of space, proxemics, ergonomics, anthropometrics, cultural factors and universal design.

Learning Outcomes: 1. Describe and discuss the bio-social, psychological, and cultural characteristics of human beings and how this influences specific design attributes of the built environment. 2. Recognize, recall, and interpret basic concepts within the domain of Environment and Behavior Studies (EBS) to explain the effects environmental aspects have on which groups of people, under what sets of conditions, and why. 3. Demonstrate learning, through written and oral communication, how people both shape and are shaped by the characteristics of space, form, light, color, objects, materials, and other details which make up the designed environment. 4. Employ a process for integrating mechanisms of these two-way interactions between people and environments into the framework of design. 5. Illustrate understanding and appreciation of philosophical contexts and dynamic interrelationships of culturally diverse people and their connection with the environment. Credits: 3.00

AD 28500 - Interior Components And Materials

Credit Hours: 3.00. Study of surface materials and subsystems and their application to architectural interior spaces. Emphasis on specification guidelines, including product performance, building codes, fire, safety, and health regulations.

Credits: 3.00

AD 29000 - Special Topics In Art And Design

Credit Hours: 1.00 to 3.00. Topics will vary. Permission of department required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Credits: 0.00

AD 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 29900 - Collections Management In Museums And Archives

Credit Hours: 3.00. This course provides discussion and application of collections management in museums and archives. Students will learn the systems, organizational methods, descriptive processes, ethical/legal considerations, and administration best practices within these cultural heritage institutions. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Understand application of collections systems within their fields. 2. Identify current issues in collections management. 3. Compare and contrast collections management between archives and museums. 4. Demonstrate standards and best practices in collections management. Credits: 3.00

AD 30000 - Life Drawing II

Credit Hours: 3.00. Emphasis is given to organizing the figure in pictorial space.

Learning Outcomes: 1. Draw successful figure drawings through use of gesture, exploration of media, and application of basic art and design principles. 2. Apply expressive and conceptual frameworks to develop their artistic voices. 3. Apply critical thinking skills both as a group and on their own. Credits: 3.00

AD 30200 - Theory And Practice Of Elementary School Art

Credit Hours: 3.00. Theory and practice of art education for elementary school from early childhood through middle childhood. Restricted to art education majors.

Credits: 3.00

AD 30300 - Art In Middle/Junior High Schools

Credit Hours: 3.00. Theory and practice of art education for early adolescent students in the middle/junior high school.

Credits: 3.00

AD 30400 - Video Art

Credit Hours: 3.00. Introduction to digital video as a creative medium for artistic expression. Students will record, digitize, edit and distribute digital video content and author a digital portfolio of their work in the form of an interactive DVD.

Learning Outcomes: 1. Analyze key ideas in the field of Video Art by preparing a research presentation on the practice of an individual video artist or collective. 2. Assess their own creative work as well as the work of their peers through group discussions and critiques. 3. Create a variety of video artworks by the creative use of the video camera, editing strategies and postproduction techniques. Credits: 3.00

AD 30500 - Industrial Design I

Credit Hours: 3.00. Introduction to design principles in processes employing basic problem-solving techniques. Emphasis will be placed on man's interaction with form, thought processes, procedures, craftsmanship, and use of materials. Acceptance into professional industrial design concentration by successful performance in the mandatory portfolio review. Prerequisites: Passing mandatory portfolio review.

Learning Outcomes: 1. Improve functions, meet

production needs efficiently, refine aesthetics, and always keep the user in mind. 2. Control advanced computer modeling, to be able to model complex forms accurately. 3. Create presentations that effectively communicate the student's design ideas. Credits: 3.00

AD 30600 - Industrial Design II

Credit Hours: 3.00. An analysis of design through organic and aesthetic principles, natural solutions, and man-made systems. Skills and techniques for communication of creative design solutions. Rapid visualization, rendering, model making, and working models will be stressed.

Credits: 3.00

AD 30701 - History Of Contemporary Photography

Credit Hours: 3.00. This course examines evolution of major themes in contemporary photography (Digital era to Present) from a variety of aesthetic, social, and cultural perspectives, fostering an awareness of pertinent theoretical issues.

Learning Outcomes: 1. Learning the history of contemporary art photography from the digital revolution to present. 2. Learning photography's multiple roles including technique and utilitarian function, sociopolitical context, and aesthetics, especially photography in the digital age. 3. Ability to recognize the characteristics of significant photographic works from 1980-present. 4. Understanding of how photographic pictures may reflect ideas and values of a given culture period. Credits: 3.00

AD 31100 - Ancient Greek Art

Credit Hours: 3.00. The great variety of Greek art, which helped lay the foundation of Western artistic tradition, is presented in several different media and over a period of several centuries. The social context and cultural context of Greek art, especially its humanistic values, is emphasized. Offered every two years.

Learning Outcomes: 1. Learn how Greek art was formed and how it developed over a period of centuries from its origins in the Geometric period to its climax in the Hellenistic era. 2. Gain a broad historical perspective and learn how to evaluate individual works of art, and to view them within a larger cultural and social context. 3. Develop writing proficiency. Credits: 3.00

AD 31200 - Ancient Roman Art

Credit Hours: 3.00. The history of Roman art in several different media is studied, from its origins to the end of the Empire, stressing the social and historical content of this art and its legacy to the modern world. Architecture, sculpture, painting and mosaics are emphasized along with small-scale arts such as jewelry, ceramics, and glass. Offered every two years.

Learning Outcomes: 1. Gain a broad perspective on the history of Roman art, viewing it in relation to Roman society as a whole and seeing how it reflects Roman cultural values. 2. Evaluate individual works of Roman art for both their style and content, and to see how they fit into the historical development of Roman art over a period of centuries. 3. Improve writing ability. Credits: 3.00

AD 31400 - Experimental Drawing

Credit Hours: 3.00. Individual development of students' drawing abilities and skills at intermediate and advanced levels, emphasizing drawing as primary means of expression, experimentation with materials, and exposure to many different modes of creating in the area of drawing.

Learning Outcomes: 1. Communicate visually through the use of a variety of drawing materials, some structured assignments, and individual projects. 2. Form an understanding of historical and contemporary artists' use of drawing as a primary means of expression. 3. Build a vocabulary integral to the critical thinking process. Credits: 3.00

AD 31500 - Design Methodology

Credit Hours: 3.00. This course will cover the fundamental concepts of design methodology. Studies in various problem-solving and research methods as they apply to the designer and society.

Learning Outcomes: 1. Design three-dimensional forms with attention to aesthetic and functional aspects. 2. Create presentations

that effectively communicate the students' design ideas to diverse audiences. 3. Apply design research skills, including market mapping, ethnographic observation, and ergonomic analysis, to inform design decisions. 4. Develop skills in collaborative design, emphasizing teamwork, communication, and problem-solving. Credits: 3.00

AD 31600 - Seminar On Ideas In Industrial Design I: Design And Society

Credit Hours: 3.00. A study of design and the designer and the factors in society that affect his or her work.

Credits: 3.00

AD 31800 - Fundamentals Of Interactive Multimedia Design

Credit Hours: 3.00. Fundamental issues of interactive multimedia design: Animation, interface design, and experience design from a visual communications perspective.

Learning Outcomes: 1. Produce proposals, storyboards, and project reports. 2. Propose and implement visual communication design strategies for digital media projects. 3. Produce design solutions by applying compositional, typographical, and design elements and principles of new media design. 4. Apply design skills associated with the use of interface design (GUI). 5. Apply design skills associated with the use of digital color theory based on the RGB and HSB Color systems. 6. Apply design skills associated with the use of experience design concepts. 7. Continue to develop computing skills (Illustrator, Photoshop, AdobeAero, etc.). 8. Develop design skills to work collaboratively, presential, and remotely. 9. Develop illustrational and story-telling design abilities. Credits: 3.00

AD 31900 - Web Design For Visual Communication

Credit Hours: 3.00. Introduction to web-based design from a visual communication application.

Learning Outcomes: 1. Design web application prototypes by proposing creative concepts and producing media assets. 2. Apply visual storytelling to web design by incorporating visual communication strategies. 3. Demonstrate teamwork skills in web design by participating in group discussions while sharing ideas and receiving feedback for project improvement. Credits: 3.00

AD 32600 - Physical Computing

Credit Hours: 3.00. Introduction to electronics and computer vision for artists. Students learn to create expressive audiovisual systems that can respond to events in the physical world (movement, light/temperature change, sound, touch, etc.) through custom interfaces.

Learning Outcomes: 1. Analyze key ideas in the field of Physical Computing by preparing a research presentation on the practice of an individual artist or collective. 2. Critique their own creative work as well as the work of their peers through group discussions. 3. Produce a variety of interactive artworks by the creative use of the Arduino microcontroller, simple electronic circuitry, and coding techniques. Credits: 3.00

AD 33000 - Interior Design III

Credit Hours: 3.00. Study of advanced space-planning criteria and selection of furnishings, equipment, materials, and finishes. Design considerations for special populations (e.g., disabled, aged, low-income) will be explored.

Learning Outcomes: 1. Design functional and creative spaces based on the needs of specific building conditions or requirements. 2. Create design solutions through the execution of conceptual diagrams, realistic visualization techniques and 3-dimensional modeling. 3. Apply information on building codes and the special requirements of barrier-free design and design for physically challenged individuals or groups in design projects. 4. Produce interior materials, furnishings and finishes for

commercial spaces in keeping with those needs and as outlined in the design project. Credits: 3.00

AD 33100 - Digital Video Production And Aesthetics

Credit Hours: 3.00. This course is a basic studio introduction to video production and how video can be used as an artistic medium in conjunction with the students' photography. Topics include video/film formats, lighting, audio, editing, distribution, experimental, commercial and music video, production paperwork and extensive time spent on mastering the camera. Classes will consist of hands-on demonstrations, and critiques.

Learning Outcomes: 1. Demonstrate DSLR cameras. 2. Demonstrate basic to intermediate lighting for Video Production. 3. Obtain knowledge on commercial video production: music video and commercial advertisement video. Credits: 3.00

AD 33200 - Visual Communication Design I

Credit Hours: 3.00. A course designed to introduce the student to projects that will develop an understanding of basic problem-solving techniques in the areas of publication and promotional graphics. Acceptance into professional VCD sequence via mandatory portfolio review.

Learning Outcomes: 1. Provide opportunities to explore the elements and principles of design and process as they relate to typography and letter forms. 2. Engage students' conceptual skills in branding design. 3. Further strengthen students' ability to create effective visual communications by way of complex problems emphasizing critical thinking, design process and presentation. Credits: 3.00

AD 33300 - Photo Silk Screen

Credit Hours: 3.00. Advanced study of the techniques of photo silkscreen and light-sensitive stencils. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 33400 - New Media Culture

Credit Hours: 3.00. This lecture course provides a historical overview of the development of new media art. In their research, project papers, and practical assignments, students explore issues of media criticism, technology's impact on culture and society and visions of media utopias.

Learning Outcomes: 1. Summarize the key characteristics of new media based on course texts and artistic examples. 2. Analyze and critique new media-related texts and cultural productions through group discussion and oral presentation. 3. Apply project-based methods to respond creatively and critically to the material history and social context of new media. Credits: 3.00

AD 33700 - Commercial And Professional Practice In Photography

Credit Hours: 3.00. This course introduces students the skills necessary to attain entry-level employment in the photographic field and familiarizes students with the vocabulary, procedures, and working realities specific to occupations in the field of photography in the areas of photo-journalism, magazine illustration, advertising/web design, and fine arts. Permission of department required.

Learning Outcomes: 1. To prepare materials related to practical application within photographic industry. 2. To learn techniques and strategies for job searches, interviewing, and developing portfolio presentation skills. 3. To produce three parts portfolio consisting of a print portfolio, on-line web portfolio, and job interview portfolio. Credits: 3.00

AD 33800 - Advanced Interior Design Communication

Credit Hours: 3.00. Study of graphic design fundamentals and application of interior design visual presentation. To provide a foundation for developing proficiency in the use visual communication design in interior design presentation. Offered 3rd year in the Interior Design BFA program of study.

Learning Outcomes: 1. Learn graphic design fundamentals and techniques as a tool for communicating interior design. 2. Develop the skills, ability, and judgement to visualize, develop, and communicate interior design ideas through graphic representation. 3. Strengthen a

student's interior design portfolio through review and organization of contents. 4. Learn to graphically represent design ideas, design processes, and design outcomes. Credits: 3.00

AD 33900 - Women Artists (UCC: BSS)

Credit Hours: 3.00. A critical overview of the lives, works, and experiences of women artists from the late 19th century to the present, examining the social and cultural challenges they faced, and reflecting on the changing roles women have played in art and society.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks and artists. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about women artists and women art by contextualizing and analyzing them and selecting artworks to illustrate your comments. 4. Apply the knowledge they will have acquired to analyze and write about artworks we would not have studied in class. Credits: 3.00

AD 34000 - Furniture Development

Credit Hours: 3.00. This course is an introduction to furniture design. The focus of this course is information relevant to furniture design including: basic ergonomics, structural techniques and materials and processes. Additional pertinent information regarding new and ongoing design trends will be explored. A mid-semester field trip to a major furniture manufacturer and/or design studio is offered. Students will design and build two of the following objects: a small freestanding shelving unit, small table, bench, table top object or stool. Students must pass mandatory portfolio review for this course.

Learning Outcomes: 1. Increase knowledge of materials and processes including furniture design construction methods. 2. Gain a basic understanding of ergonomics. 3. Increase aesthetic sensibility. 4. Develop an awareness of contemporary issues and trends in furniture design. 5. Design and build an original piece of furniture by the end of the class. Credits: 3.00

AD 34200 - Ceramics II

Credit Hours: 3.00. A continuation of AD 24200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 34300 - Northern Renaissance Art

Credit Hours: 3.00. The development of a mature North European art originating in the International Gothic tradition and culminating in the works of Albrecht Durer, Jerome Bosch, and Pieter Bruegel, the Elder.

Learning Outcomes: 1. Be familiar with the history of the period in general and with major artists in particular. 2. Show the ability to read and think critically about a work of art, to look carefully at a work and to discuss what he or she is seeing. 3. Be able to describe clearly a work of art and to compare it to other works and artists of the period. 4. Be able to write an explanation of how a work of art illustrates a particular theme or idea in clear and understandable prose with correct spelling and punctuation in paragraphs that lead logically from one to another. 5. Show the ability to follow instructions and pay attention to detail in the preparation and presentation of research citing sources accurately. Credits: 3.00

AD 34400 - Latin American Art Since 1900

Credit Hours: 3.00. This course offers a critical yet comprehensive overview of modern and contemporary art from Latin America. It focuses on major artists, whose works and contributions are considered in both their specific socio-cultural context and in a larger art historical perspective.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist or artwork. 4. Discuss historical events, social

forces and cultural trends that have had an influence on a particular style, artist or artwork. 5. Build the knowledge and understanding of Latin America art. 6. Develop the analytical and writing skills through textual studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 34600 - Italian Renaissance Art

Credit Hours: 3.00. A study of the painting, sculpture and architecture of Italy between 1300 and 1545 AD, including artists such as Leonardo da Vinci, Raphael and Michelangelo. The course will also relate these works of art to the culture, religion, politics, economics and social life of the period.

Learning Outcomes: 1. Identify paintings, sculptures and other artworks made in Italy between the 14th and 16th centuries. 2. Discuss similarities and differences between works of art and between artistic styles. 3. Place artworks within the proper historical context, explaining the connection between the objects and the social and cultural environment in which they were created. 4. Explain in clear prose how works of art illustrate specific themes or ideas. Credits: 3.00

AD 34700 - Lighting For Interior Environments

Credit Hours: 3.00. The study of illuminating principles, design criteria, specifications and environmental systems applied to architectural interiors in public and private spaces.

Learning Outcomes: 1. Describe the fundamentals of lighting, seeing and lighting on color. 2. Identify the range of sources for information and research about light and controlling light in the spatial environment. 3. Explain the effects of lighting on human behavior and well-being. 4. Design appropriate applications of luminaires in terms of function, aesthetics, sustainability, and accessible design. 5. Assess the environmental impact of illumination strategies and decisions. Credits: 3.00

AD 34800 - History Of Islamic Art

Credit Hours: 3.00. Islamic art, one of the world's richest artistic traditions, is surveyed from its origins in the 7th century AD to the modern day. All types of artistic media, from large to small-scale, are included and seen against the background of the Islamic religion and history.

Learning Outcomes: 1. Identify important developments in the history of Islamic art and visual culture. 2. Identify and use field-specific vocabulary. 3. Explain the social, political, cultural, economic, religious, and technological contexts of the production, use, and reception of major works of Islamic art and architecture. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 34900 - Motion Design

Credit hours: 3.00. This introductory course includes projects, exercises, lectures, and technique demonstrations to cover critical areas like animation, kinetic typography, and motion principles. It aims to broaden students' understanding of Motion Design's scope, focusing on critical thinking, methodology, and technical skills for project execution. Emphasizing the design process and concept development, the course examines Motion Design's influence on visual culture. Students learn to apply visual principles effectively, preparing them for diverse media projects.

Learning Outcomes: 1. Memorize motion design vocabulary and describe its evolution and current trends. 2. Demonstrate your design skills through direct application. 3. Evaluate the work of others, providing constructive feedback and interpreting criticism. 4. Demonstrate your comprehension of motion design's influence and its integration with graphic design fundamentals. Credits: 3.00

AD 35000 - Interior Design IV

Credit Hours: 3.00. Study of large-scale public and social spaces, emphasizing interior systems and components. Application of design for historic preservation, renovation, or adaptive reuse will be considered.

Learning Outcomes: 1. Apply principles of

human physiological, social, and psychological factors in the process of solving a specified design problem, as supported by evidence. 2. Create multiple ideas, which solve a specified design problem, through ideation sketches, drawings and models. 3. Apply design elements and principles that support design concepts, including principles of spatial definition and organization. 4. Describe ideas developed in the design process through written, graphic and oral communication. Credits: 3.00

AD 35900 - Medieval European Art

Credit Hours: 3.00. A comprehensive study of the varied art forms in Western Europe from the decline of the Roman Empire until the beginnings of the Italian Renaissance: 500 A.D. to 1500 A.D.

Learning Outcomes: 1. Identify important developments in the history of medieval European visual culture. 2. Identify and use field-specific vocabulary. 3. Compare and contrast works of art in relation to their social, political, cultural, economic, religious, and technological contexts. 4. Apply the knowledge acquired in this class to artists, artworks, and cultural developments not studied in class. Credits: 3.00

AD 36101 - The Constructed Image

Credit Hours: 3.00. An intermediate level course focusing on the production of creative images constructed in the studio and in the field. Projects will address the planning and design of photographic images through the use of set design, styling, and post-production. Students will investigate both historical and contemporary trends in the art of the photographically-constructed image.

Learning Outcomes: 1. Construct and compose images using set design, styling, collage, and photomontage. 2. Develop communication skills to successfully interpret proposals and instructions from clients. 3. Analyze theoretical and historical concerns regarding constructed images and demonstrate an understanding of those concerns. 4. Develop visual communication and conceptual image making skills. 5. Develop techniques of creating photographically constructed images and demonstrate an understanding of those techniques. Credits: 3.00

AD 36200 - Jewelry And Metalwork

Credit Hours: 3.00. Lost wax casting and mold making, mechanisms and stone setting for jewelry and metalwork.

Learning Outcomes: 1. Students will be able to design and make wax and non-wax models for jewelry and small metal projects by reductive, addictive, and construction processes. 2. Students will learn to sprue, invest and cast their models by the lost wax centrifugal and vacuum casting methods. 3. They will learn to make waste molds and reusable rubber molds to produce their jewelry projects. 4. They will learn to make mechanisms for jewelry and settings for incorporating stones or other nonmetal materials into their jewelry. Credits: 3.00

AD 36300 - Documentary Photography

Credit Hours: 3.00. This course is an introduction to the great tradition of documentary photography. Students learn to see the world around them in a new way and produce a documentary project. The course requires reading and writing about photography, as well as making photography on a regular basis. The class emphasis is on thinking about why people photograph, what photographs do and do not mean to us, and on doing documentary work, on telling stories with photographs.

Learning Outcomes: 1. Understand the history of documentary photography. 2. Demonstrate a narrative photography experimented through personal, social, cultural, topographical politics. Credits: 3.00

AD 36500 - Intermediate Painting

Credit Hours: 3.00. A studio course concentrating on the development of conceptual and technical skills of painting. This

course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 36600 - Visual Communication Design II

Credit Hours: 3.00. Field trips may be required. The study of corporate graphics and visual identity programs.

Learning Outcomes: 1. Build expertise in problem-solving and expanding a brand visually based on market research. 2. Practice synthesizing research, critical dialogue (feedback), and Critiques within an iterative design process. 3. Develop skills to construct/combine graphic form using various digital tools, software, and screen-based media as well as print and 3D objects. 4. Create system designs and brand identities. 5. Strengthen attention to detail and craft knowledge. 6. Strengthen ability to pitch ideas and create viable solutions for real-world clients. Credits: 3.00

AD 36800 - Etching And Intaglio Printmaking

Credit Hours: 3.00. An introduction to the techniques of etching, engraving, aquatint, drypoint, collagraph, monoprint, and related processes. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 36900 - Lithographic Printmaking

Credit Hours: 3.00. An introduction to the techniques of stone and plate lithography. Emphasis on fine art conceptual issues, creativity, matting and framing art, and professional practices.

Credits: 3.00

AD 37000 - Woven Textiles

Credit Hours: 3.00. A beginning course in loom-woven textiles and pattern drafting. Emphasis on two- and three-dimensional design in fiber, using historical textile structures as the basis for contemporary interpretations.

Credits: 3.00

AD 38000 - Baroque Art

Credit Hours: 3.00. A survey of European art and architecture during the 17th century, focused on Italy and the Netherlands, and emphasizing some of their leading painters. Works of art are seen in a broad social and cultural context, including the Counter-Reformation and the rise of capitalism.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources as well as writing exercises. Credits: 3.00

AD 38100 - Alternative Photographic Processes

Credit Hours: 3.00. This course is designed to explore methods and concepts for creating photographs using alternative and historic processes. Through technical workshops and assigned projects students will become well-versed in medium and large format film cameras, as well as various 19th century processes.

Learning Outcomes: 1. Know various types of 19th century photographic processes. 2. Know large format photographic cameras. 3. Understand visual language and aesthetics of early photographic processes and printing methods. Credits: 3.00

AD 38200 - A Global History Of Modern Art

Credit Hours: 3.00. A study of artistic circulations and cultural exchanges between Europe, Asia, Africa, and the Middle East since the 18th century, designed to examine the history of modern art in a global and critical way.

Learning Outcomes: 1. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 2. Compare and contrast them by perceiving and reflecting on their differences and similarities. 3. Interpret statements made about global artistic circulations by contextualizing and analyzing

them and selecting artworks to illustrate their comments. 4. Apply knowledge acquired to analyze and write about artworks not studies in class. 5. Build knowledge and understanding of global art and develop analytical and written skills. Credits: 3.00

AD 38300 - Modern Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of Modern art from Impressionism to Surrealism, designed to help students understand the radical transformations art and society underwent in that period, and reflect upon the influence of new technologies, scientific discoveries, and world events on artistic creation.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Recognize artworks, artists, and movements, list specific information that distinguishes them, and recall their major contributions. 2. Identify and explain historical events, social forces, and cultural trends that have had an influence on these artworks, artists, and movements. 3. Compare and contrast them by perceiving and reflecting on their differences and similarities. 4. Interpret statements made about Modern art by contextualizing and analyzing and selecting artworks to illustrate your comments. 5. Apply the knowledge acquired to analyze and write about artworks not studied in class. 6. Develop analytical and writing skills through weekly writing exercises. Credits: 3.00

AD 38400 - Contemporary Art (UCC: HUM)

Credit Hours: 3.00. A comprehensive overview of the visual arts from the 1940's to the present, designed to help students understand the cultural, social, and historical dynamics that influence artistic creation, and reflect upon the artists' role in contemporary societies.

University Core Curriculum (UCC): (UCC: HUM) Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Develop analytical and writing skills through textual studies of primary and secondary sources, as well as written exercises. Credits: 3.00

AD 38500 - History Of Interior Design

Credit Hours: 3.00. A survey of the historical changes in interior design and architecture from the 18th century to the present in their social, cultural, and political contexts. The course situates the history of interior design within broader debates about the social uses of space and the cultural significance of architecture and interiors.

Learning Outcomes: 1. Discuss stylistic and technical changes in interior design and architecture from the 18th century to the present. 2. Discuss the social, political, and cultural context of design. 3. Analyze of primary sources and artifacts related to the history of interiors. 4. Analyze and discuss scholarly readings on the history of interiors design and architecture. 5. Conduct primary and scholarly research on the history of interior design and architecture. Credits: 3.00

AD 38900 - Introduction To Curatorial Practices

Credit Hours: 3.00. This course will introduce students to historical forms of display and curation. Students will discuss the museum in our society, the different forms of display, and the role of the curator. The primary purpose of this course is to provide students with an understanding of how museums work as educational and political spaces, and the ways in which history, geography, cultural difference, and social hierarchies are mapped through exhibition practices.

Learning Outcomes: 1. Discuss the field of curation including its history and contemporary issues. 2. Analyze exhibitions and installations in modern museums. 3. Debate the role of the museum in society, the different forms of display, and the role of the curator. Credits: 3.00

AD 39100 - History Of Chinese Art

Credit Hours: 3.00. A historical survey of the visual arts and architecture of China from antiquity to the present. Emphasis will be placed on the relation of a broad range of art forms to their social and cultural contexts.

Learning Outcomes: 1. Identify individuals who have made a major contribution to a style or period. 2. Compare artworks by identifying their differences and similarities. 3. Define terms and concepts in relation to a particular style, artist, or artwork. 4. Discuss historical events, social forces, and cultural trends that have had an influence on a particular style, artist, or artwork. 5. Build knowledge and understanding of Chinese art. 6. Develop analytical and writing skills through textural studies of primary and secondary sources, as well as writing exercises. Credits: 3.00

AD 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39500 - History Of Design (UCC: STS)

Credit Hours: 3.00. A survey of the historical development of design from the industrial revolution to the present that examines the influence of new technologies, materials, and style on design practice as well as the role of design in shaping the technologies and things of everyday life. Throughout the course, students will analyze design within the broader social, cultural, and political context of production, consumption, and use.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Identify a range of styles from the 18th century to the present. 2. Critically analyze primary source material (artifacts/designed objects, images, and text). 3. Discuss important developments in the history of design. 4. Discuss the social, political, cultural, economic and technological context of design production, consumption, and use. Credits: 3.00

AD 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in art and design. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

AD 39600 - Art Museum Practices

Credit Hours: 3.00. This course examines art museums as cultural institutions with varied collections, serving an important social role. Museum administration and operation are discussed, as are exhibition preparation and museum architecture; a few field trips are required. Museum careers also are explored.

Credits: 3.00

AD 39700 - Sustainability In The Built Environment

Credit Hours: 3.00. The study of philosophical concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants. To provide a foundation for evaluation of materials, processes, and applications of design components for environmentally responsible. Field trips will be required.

Learning Outcomes: 1. Define sustainability and assess the ways that sustainable design strategies, processes, and products may be integrated effectively into the built environment. 2. Identify complex social, ecological, and economic dimensions that affect the well-being of humans, neighborhoods, communities, and ecological systems. 3. Apply critical thinking skills to explain how green building methods affect the way built environments are designed, constructed, and operated. 4. Utilize appropriate methodological tools to analyze sustainable problems and provide environmentally responsible solutions for a green-building scenario. 5. Articulate a comprehensive, progressive world view that integrates diverse approaches to sustainability. 6. Utilize USGBC materials and other educational sources to explain the LEED rating system, LEED professional credentials, and Green Building principles and techniques preparatory to obtaining the LEED Green Associate credential. Credits: 3.00

AD 40000 - Advanced Painting

Credit Hours: 3.00. A studio course concentrating on the development of an advanced body of work built upon the conceptual and technical skills of painting. This course is designed to help individual students gain a greater awareness of their personal creative goals and to foster means of expression.

Credits: 3.00

AD 40200 - Art In Secondary School

Credit Hours: 3.00. Theory and practice of art education for adolescent and young adult students in the secondary school. Required prior to professional semester.

Credits: 3.00

AD 40400 - Moldmaking And/Or Wheel-Throwing Production Techniques In Ceramics

Credit Hours: 3.00 to 6.00. This course will teach mold-making or wheel-throwing (depending on the individual student's interest) with a view to creating ceramic objects suitable for commercial mass-production. Both tableware and/or sculptural objects will be explored. For the wheel-throwing option the students must have at least one year of high school throwing or AD 24200 with a grade of at least "B" or permission of instructor. For the mold making and casting option only, students must be an Art and Design student or have permission of instructor.

Learning Outcomes: 1. The student will learn how to design a model, make the model from clay, make a mold of the designed model (or found object), cast and assemble cast ceramics pieces for possible commercial mass-production. If choosing the wheel-throwing option, the student will learn advanced techniques of throwing and assembling parts to make either functional and sculptural objects for mass-production. 2. Students will also learn simple glazing techniques, and have the option of learning how to screen print and use decals on their final products. Credits: 3.00 to 6.00

AD 40500 - Industrial Design III

Credit Hours: 3.00. Design projects emphasizing sophisticated problem-solving methods. Design projects will stress diversity of industrial design and will trace the development of products from initial concept, research, and development through production.

Credits: 3.00

AD 40600 - Industrial Design IV

Credit Hours: 3.00. Design of products in their relation to economic, physiological, psychological, and behavioral patterns of the consumer. Emphasis upon total thought processes to allow environmental considerations as well as technological realities.

Credits: 3.00

AD 41500 - Professional Techniques

Credit Hours: 3.00. Research development for product design, with emphasis on socioeconomic concerns and documentation techniques. Portfolio refinement, including verbal, written, and other visual documentation and presentation skills in various media, such as drawing. Photography and computer-generated graphics will be stressed.

Credits: 3.00

AD 41600 - Seminar On Ideas In Industrial Design II: Design And Creative Problem Solving Methods

Credit Hours: 3.00. A study of creative problem solving methods as used by the designer in his or her work.

Credits: 3.00

AD 41700 - Variable Topics In Electronic And Time-Based Art

Credit Hours: 3.00. Examination of thematic or specialized topics reflecting the most recent developments and contemporary artistic practices in Electronic and Time-Based Art. Permission of department required.

Learning Outcomes: 1. Use essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production. 2. Able to analyze key works and artists in the emerging field of Electronic and Time-Based Art. Credits: 3.00

AD 42100 - Advanced Studies In Photography And Related Media I

Credit Hours: 3.00. The first of two advanced level courses in photography/related media focusing on production of a formally and conceptually coherent body of work. Course emphasizes development of studio and critical thinking skills, and initiates investigation of the creative process.

Learning Outcomes: 1. Create a photographic series using advanced techniques and processes. 2. Evaluate the work of contemporary working photographers.

3. Define photographic terminology related to a contemporary and commercial photography practice. Credits: 3.00

AD 43000 - Interior Design V

Credit Hours: 3.00. Design of multi-use complex environments, emphasizing program and problem solving, facility planning, building systems, and materials technology. Application of alternative presentation technologies will be explored.

Learning Outcomes: 1. Apply appropriate code and accessibility regulations to commercial design solutions. 2. Use advanced level of space planning strategies in the design of large corporate interior spaces. 3. Identify appropriate evidence that can inform the solution of a design problem. Credits: 3.00

AD 43100 - Visual Communication Design III

Credit Hours: 3.00. The advanced study of communication concepts of poster and poster application in current media.

Learning Outcomes: 1. Demonstrate the ability to initiate and develop creative concepts; evaluate creative work; apply current technology; and communicate effectively. Credits: 3.00

AD 43200 - Visual Communication Design IV

Credit Hours: 3.00. The study of product identity, packaging, and branding.

Learning Outcomes: 1. Demonstrate ability to initiate and develop creative concepts; present and evaluate creative work; apply current technology related to the profession. Credits: 3.00

AD 43400 - Professional Practice For Visual Communication Designers

Credit Hours: 2.00. Specific professional practice topics for the visual communication designer. Topics include contracts,

professional associations, ethics, portfolio and resume preparation, self-promotion and exhibition of creative work, the job market and the future of the profession. Field trips may be required.

Learning Outcomes: 1. Develop proficiency in the use of career search media and tools. 2. Develop a practical understanding of the visual communications job market. 3. Seek functional solutions that meet specific visual communication career goals 4. Develop an expanded ability to generate contacts and leads for employment or graduate school. 5. Strengthen student's design portfolio through review and organization of contents. Credits: 2.00

AD 44000 - Interior Detailing And Construction

Credit Hours: 3.00. The process of designing, detailing, specifying, and constructing interior environments. Emphasis on teams, building systems, architectural drawing, and building codes.

Credits: 3.00

AD 44200 - Ceramics III

Credit Hours: 3.00. A continuation of AD 34200 ; according to student needs in creating ceramic forms, a variety of in-depth experiences: experimental kiln building and firing techniques, methods of ceramic construction, surface treatment, and clay and glaze formulation.

Credits: 3.00

AD 45400 - Modern Architecture

Credit Hours: 3.00. A study of nineteenth- and twentieth-century architecture.

Credits: 3.00

AD 46200 - Metalsmithing

Credit Hours: 3.00. Metal forming and metalsmithing processes for small metal objects and jewelry.

Learning Outcomes: 1. Identify and utilize traditional jewelry and metalsmithing tools and materials in art metal projects. 2. Design and construct specialized tooling for metalworks. 3. Utilize newly developed tools into the fabrication of jewelry and other metal projects. Credits: 3.00

AD 46500 - Professional Practice

Credit Hours: 3.00. The study of professional office and business procedures for the practice of interior design. Includes project administration, contracts, forms, and documents as used in the marketplace.

Credits: 3.00

AD 46800 - Printmaking III

Credit Hours: 3.00. Advanced studies in selected printmaking processes including relief, silkscreen, lithography, intaglio and book arts. Emphasis on color printmaking, photomechanical methods, fine art conceptual issues, creativity, and professional practices.

Learning Outcomes: 1. Create strong contemporary personal work in printmaking with expressive and original ideas. 2. Cultivate personal style through self-directed artist research, image development and experimentation in printmaking. 3. Demonstrate advanced technical skill in one or more printmaking mediums. 4. Acquire advanced technical skills to create multi-colored prints utilizing color, layering, and registration. 5. Describe and critique the work of professional printmaking artists, self and peers. Credits: 3.00

AD 47000 - Advanced Studies In Textiles

Credit Hours: 3.00. A textile seminar and studio course in advanced textile design, with the purpose of developing a personal direction and competence in textiles as fiber art.

Credits: 3.00

AD 47800 - Internship In Art And Design

Credit Hours: 1.00 to 8.00. Intensive exposure to professional experience through supervised internship in art-and-design-related firms, departments, or studios. Consent to enroll, amount of credit, placement, and evaluation to be approved and coordinated by department.

Learning Outcomes: 1. Experience culture and environment of a professional studio and

professional practice related to their major course of study in Art and Design. Credits: 1.00 to 8.00

AD 49000 - Special Problems In Art And Design

Credit Hours: 1.00 to 6.00. Individual problems in art and design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

AD 49100 - Special Topics In Art

Credit Hours: 1.00 to 4.00. Topics will vary.

Learning Outcomes: 1. Vary due to the nature of the course. Credits: 1.00 to 4.00

AD 49900 - Studio Arts Professional Practice/Senior Exhibition

Credit Hours: 3.00. Study of professional practice in the contemporary art world: ethics, gallery, exhibition, studio practice, writing, visual documentation, and business of art. Seniors meet throughout spring semester to organize, install, and de-install Fine Arts Senior Exhibition.

Learning Outcomes: 1. Develop a professional artist statement and resume. 2. Identify and discuss trends in contemporary professional art practices. 3. Design a digital art portfolio. 4. Demonstrate skills necessary to organize and install art exhibitions. Credits: 3.00

AD 59000 - Special Art Problems

Credit Hours: 1.00 to 6.00. Individual problems in art history, appreciation, design, crafts, drawing, and painting. Credit dependent upon amount of work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

DANC 10100 - Modern Dance Technique I

Credit Hours: 2.00. An introduction to the techniques and principles of modern dance.

Learning Outcomes: 1. Demonstrate elementary level performance of skills and principles of Modern Dance technique. 2. Perform basic dance movement with personal expression. 3. Demonstrate fundamental bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 10200 - Ballet I

Credit Hours: 2.00. An introduction to the techniques and principles of classical ballet.

Learning Outcomes: 1. Demonstrate essential ballet skills, principles and techniques used in ballet. 2. Demonstrate correct use of ballet terminology. 3. Recognize and define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor. Credits: 2.00

DANC 10300 - Jazz Dance I

Credit Hours: 2.00. An introduction to the principles of jazz dance techniques: alignment, isolations, rhythmic patterns, and basic locomotion.

Learning Outcomes: 1. Perform basic skills of the body including coordination, proper alignment, and musicality through movement phrases and exercises aligned with Jazz Dance Techniques. 2. Demonstrate an elementary understanding of core principles, techniques and histories under the broad umbrella of Jazz Dance Technique. 3. Demonstrate a fundamental understanding of Jazz Dance vocabulary and basic body anatomy. Credits: 2.00

DANC 10400 - Hip Hop I

Credit Hours: 2.00. This is an introductory-level course where students will explore the different styles, vocabularies, and grooves of dance styles under the Hip Hop umbrella. Students will learn elements of choreography, freestyling (also known as improvisation), and grooves of varying Hip Hop dance genres.

Learning Outcomes: 1. Identify the pioneers and "Five Elements of Hip Hop" dance and culture. 2. Integrate the movement vocabulary from class into freestyle and choreography. 3. Develop bodily and spatial awareness, mobility, and strength. 4. Demonstrate understanding of

foundational movements through freestyle practices, choreography, and movement vocabulary. Credits: 2.00

DANC 20100 - Modern Dance Technique II

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 10100.

Learning Outcomes: 1. Demonstrate confident performance of skills and principles of Modern Dance technique. 2. Perform dance movement with personal expression and artistry. 3. Demonstrate increased bodily and spatial awareness, mobility, and strength. Credits: 2.00

DANC 20200 - Ballet II

Credit Hours: 2.00. A continuation of the principles and techniques of classical ballet addressed in DANC 10200.

Learning Outcomes: 1. Demonstrate advanced ballet skills, principles and techniques used in ballet, with focus on increased strength and coordination. 2. Demonstrate correct use of ballet terminology. 3. Define ballet as a historical classical art form. 4. Perform for an audience all three parts of ballet class: barre, center and across the floor, as well as various ballet variations. Credits: 2.00

DANC 20300 - Jazz Dance II

Credit Hours: 2.00. A continuation and refinement of the jazz dance concepts and movement vocabulary addressed in DANC 10300.

Credits: 2.00

DANC 23000 - Biomechanics Of Dance, Movement And Strength

Credit Hours: 2.00. This course will provide conceptual and experiential understanding of biomechanical approaches to dance technique. Through studio, lecture, movement exercises and assignments, the students will learn to perform all types of dance and movement with ease, strength and economy of motion.

Learning Outcomes: 1. Integrate movement patterns that are efficient, stable and mobile. 2. Develop the ability to identify problem areas in dance and movement technique. 3. Know tools for developing successful skills. Credits: 2.00

DANC 24000 - Dance Composition

Credit Hours: 3.00. An introduction to the theory and practice of the principles and utilization of choreographic tools; movement exploration, manipulation of basic dance elements, development of movement themes, and application of compositional dance forms.

Learning Outcomes: 1. Learn the systematic application of choreographic tools which will allow them to create a coherent dance composition. 2. Increase awareness for dance composition and understand its value and meaning as both a creator and observer. 3. Learn to discuss and critique dance choreography. Credits: 3.00

DANC 24500 - Practicum In Dance Performance And Production

Credit Hours: 1.00 to 2.00. Open through audition. The study and practice of dance rehearsal, performance and basic concert production techniques, culminating in a main-stage dance concert. Permission of instructor required.

Learning Outcomes: 1. Demonstrate understanding of professional dance company member responsibilities and processes by learning choreography as assigned and performing at the highest standard. 2. Demonstrate personal artistry as a dancer and dependability as an ensemble member through rehearsals, technical preparations and performances. 3. Demonstrate interpersonal collaboration skills in creative process. Credits: 1.00 to 2.00

DANC 26000 - Dance Improvisation

Credit Hours: 3.00. In this course students explore a variety of techniques for creating movement. While physically researching concepts from a broad spectrum of improvisational artists, students expand their boundaries and definitions of dance, art and creativity. Important concepts include choice making, moving from internal motivations, and ensemble collaboration. All backgrounds in dance and movement are welcome, and will

benefit from this course.

Learning Outcomes: 1. Demonstrate multiple approaches to create unique dance movement spontaneously. 2. Formulate and participate in improvised solo and group dance performances. 3. Generate qualities of movement and elements of dance composition through improvisation. 4. Evaluate the many critical roles of improvisation in the art of dance. Credits: 3.00

DANC 26100 - Contact Improvisation

Credit Hours: 3.00. This course is both a physical practice and philosophical exploration of the techniques and underlying premise of this contemporary partner dance form. CI training involves a practice of movement improvisation while developing the body's ability to attend to the effects of gravity, muscle tone, and anatomical structures on dancing solo and in partnership. While increasing their body awareness, respect, sensitivity and connection, students learn about collaborative community creativity, which can be applied in other settings including design, performance, and social activism. DANC 26000 is a good preparation for this course, but not required. Course may be repeated for credit.

Learning Outcomes: 1. Demonstrate basic skills of solo movement in group dance setting. 2. Demonstrate basic skills of partnering using weight sharing and touch. 3. Model nonverbal communication with a partner. 4. Improve awareness and perception of the body. Credits: 3.00

DANC 30000 - Performance Production

Credit Hours: 3.00. This course teaches many aspects of producing a performance, from backstage to onstage. Students will learn the technical aspects of creating a professional performance by both observing performance production and developing an actual performance, which this semester is the Xperimental 2024 Concert. Students may participate in the production in a variety of active roles; however, they will be exposed to all aspects through observation, participation, and discussion. Production roles include: director and assistant director, choreographer, performer, lighting design and staging, sound design and technical support, and stage crew (stage manager, house manager, ticket manager, setup and strike support). Occasional class sessions cover skills to enhance your knowledge of some areas of production such as sound design, and lighting technology. For many students who are at the university level, the art of performance is defined almost totally by the act of being on stage performing, in studios or on stages. This course is designed to invite students to learn about all the activities that are done behind the scenes in order for live performances to be presented to an audience. We will discuss what is involved in both large institutional performance spaces, and compare this to our university performance. Then we will discuss what this scenario looks like for performance professionals after college. This course will greatly enhance students' ability to produce their own events in the future, and develop greater appreciation for the collaborative nature of live performance as art form.

Learning Outcomes: 1. Plan and create a small live performance production. 2. Identify the necessary components of a production of a professional performance and explain the key collaborative interactions among them. 3. Practice basic skills for working performers and producers including those relating to technology and business. Credits: 3.00

DANC 30100 - Modern Dance Techniques III

Credit Hours: 2.00. A continuation and refinement of the modern dance techniques and principles addressed in DANC 20100. Emphasis placed on expressive qualities of movement.

Learning Outcomes: 1. Demonstrate strong performance of skills and principles of Modern Dance technique. 2. Perform complex movement with personal expression and artistry. 3. Evaluate the art of Modern Dance and examine its value and meaning as both a creator and observer. Credits: 2.00

DANC 34500 - Choreography

Credit Hours: 3.00. This course focuses on methods and practices of choreographing contemporary dance works. It teaches the choreographic process: how to create original movement and expand and build both solo and group dance works. Basic compositional elements of exploring and manipulating movement and structuring choreographed material are utilized. The development of production elements are taught to support choreographic intent. Highly recommended before enrolling in this course: DANC 24500 and DANC 30100.

Learning Outcomes: 1. Identify and apply choreographic tools to create a coherent dance composition. 2. Analyze dance composition and understand its value and meaning as both a

creator and observer. 3. Express individual artistry through dance composition. Credits: 3.00

DANC 34600 - Intermediate Choreography

Credit Hours: 1.00 or 2.00. A study of selected principles underlying the design of group performance in modern dance. Permission of instructor required.

Learning Outcomes: 1. Analyze and research methods for constructing and choreographing a group dance work. 2. Demonstrate ability to craft, edit and stage a piece of choreography for a professional-level dance performance. 3. Demonstrate growth in interpersonal and leadership skills while working with the group of dancers cast in their dance work. Credits: 1.00 or 2.00

DANC 35000 - Dance For The Camera

Credit Hours: 3.00. An introduction to technical and aesthetic techniques to create screendance or dance film, with an emphasis on camera use, editing techniques, development and production of choreographic projects designed specifically for film format.

Learning Outcomes: 1. Demonstrate how to use a camera and capture dance footage. 2. Demonstrate basic skills in non-linear digital video editing with attention to motion and action editing in dance. 3. Analyze the art of screendance and examine its value and meaning as both a creator and observer. 4. Create a sense of personal expression and artistry through crafting dance film projects. Credits: 3.00

DANC 35100 - Intermedia Dance Technology

Credit Hours: 3.00. An introduction to dance and intermedia within the choreographic process. Integration of movement and various forms of technology which might involve digital images, film, animation, programming, sensors, sound, lighting and/or robotics.

Learning Outcomes: 1. Demonstrate new approaches to choreography by integrating intermedia technology into the dance-making process. 2. Apply basic skills for creating or implementing film, digital media, sound editing, and/or programming. 3. Analyze intermedia dance technology works. 4. Develop awareness of dance intermedia technology art and examine its value and meaning as both a creator and observer. 5. Build a sense of personal expression and artistry through the composition of intermedia dance technology works. Credits: 3.00

DANC 36800 - Dance Sound Design

Credit Hours: 1.00. The study and application of sound design for dance, with emphasis on creation of sound scores for Modern Dance concerts. Instructor permission required.

Learning Outcomes: 1. Feel comfortable researching sound and music. 2. Feel more comfortable using an audio sequencer and other associated software to create a dance sound design. 3. Gain valuable experience integrating the finished design into the dance performance. 4. Add an important credential to the resume and portfolio. Credits: 1.00

DANC 37800 - Survey Of Concert Dance History (UCC: HUM)

Credit Hours: 3.00. This course is a broad survey of concert dance history predominately in the 20th and 21st century in Western cultures. The direct relationship and influence of the culture, training, choreographic, and performative records of dance practices, to socio-political ideologies of gender, race, sexuality, and national identities will be the area of investigation. Students will read, watch, research and actively participate in discussion regarding important dance figures, movements, eras, and their social and cultural reverberations. Dance's relationship to other art practices throughout history will also be a subject of lecture and discussion.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Demonstrate understanding of the foundational underpinnings of concert dance history. 2. Identify specific choreographers and their works of art in oral and written communication. 3. Recognize concert dance contexts in order to speak and write clearly about them. 4.

Demonstrate an awareness of the relationships and interactions between dance and culture. Credits: 3.00

DANC 37900 - The Art Of Protest: An Examination Of The Role Of Arts, Artists, Activism, & Social Transformation

Credit Hours: 3.00. Throughout history, art has been used to advocate for political movements and provoke social action and transformation. This course examines the role of the arts and the artist and their relationship to activism throughout history and beyond. We will investigate how art has been used as a tool to transform cultural perspectives, alter policies, and promote social change. We will explore a range of artists whose methodologies, materials and approach challenge the cultural norms. From printmakers to musicians, to choreographers, to performance artists, students will engage and evaluate the act of art-making as a tactic of resistance and the responses to those acts. We will investigate readings that argue for and against the need for artists to make work that politically challenge their society. Once a foundation of knowledge has been laid, we will turn to the creative process through an investigation of materials and practices - performance, mixed media, and photography. Students will research, watch, discuss, create, and perform their own projects that promote social transformation.

Learning Outcomes: 1. Demonstrate effective oral and written communication in formal assignments, critical analysis, and class presentations. 2. Demonstrate through creative projects how art, culture, and activism have a direct and interactive relationship. 3. Investigate and critically engage with artists whose work transform cultural perspectives, alter policies, provide socio-political commentary, and promote social change. 4. Analyze seminal art and historical and philosophical texts that articulate the role and importance of political art. Credits: 3.00

DANC 49000 - Special Problems In Dance

Credit Hours: 1.00 to 3.00. Individual readings, topics, or projects in dance. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the topic. Credits: 1.00 to 3.00

FLM 24100 - Foundations Of Cinema Production

Credit Hours: 3.00. The course introduces students to the principles and practice of professional video production. Through lectures, viewing, discussions, and laboratory exercises, students will acquire the tools necessary to transform their concepts, or those of their clients, into successful video productions.

Learning Outcomes: 1. Summarize the cinema production process. 2. Apply visual storytelling concepts and techniques to the cinema production process. 3. Plan and create productions, making use of the cinema process. 4. Identify a variety of professional and career opportunities. Credits: 3.00

FLM 29100 - Special Topics In Film/Video Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Objectives vary per topic. Credits: 1.00 to 4.00

FLM 29102 - Special Topics In Live Production

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29105 - Special Topics In Screenwriting

Credit Hours: 1.00 to 4.00. Special topics or projects under the

direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29106 - Special Topics In Cinematography

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29107 - Special Topics In Editing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 29108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 32100 - Live Production I: Theater/Music/Arts

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as narrative development.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 32200 - Live Production I: Fall/Winter Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Fall/Winter sports include Cross Country, Soccer, Volleyball, Football, Swimming & Diving, Wrestling, Basketball, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 32300 - Live Production I: Winter/Spring Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of live sports video production. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Winter/Spring sports include Swimming & Diving, Wrestling, Basketball, Baseball, Softball, Tennis, Golf, or Track & Field.

Learning Outcomes: 1. Demonstrate an understanding of the technique and technology of live camera, live audio, and simple broadcast graphics. 2. Examine storytelling in a live multi-camera production. 3. Identify career options and job types within live production. Credits: 1.00 to 4.00

FLM 33000 - International Cinema

Credit Hours: 3.00. This course is designed to develop students' seeing, reading, speaking, writing, and critical thinking skills, and especially to improve visual competency, awareness of visual culture, and knowledge of selected international cinema. All films will be shown with English subtitles.

Learning Outcomes: 1. Explain and assess different ways of seeing as an introduction to understanding visual theory. 2. Demonstrate understanding of the concepts and techniques of cinematography, processing, and reading images and film. 3. Recognize, select, and justify choices for seeing and interpreting the visual. 4. Identify and analyze culturally conditioned references. Credits: 3.00

FLM 35100 - Screenwriting

Credit Hours: 3.00. Students will gain a working knowledge of basic narrative elements and how these elements work to form a story. Writing and re-writing a three-act outline and an original screenplay will give you an understanding of script language and process.

Learning Outcomes: 1. Identify Aristotelian Three-Act Structure as applied to the screenplay. 2. Develop a specific technique of writing based on the course teachings. 4. Critique the work of self and others, including proper and professional screenplay formatting. 5. Determine methods to assess success or failure of writer's intent. Credits: 3.00

FLM 36100 - Cinematography

Credit Hours: 3.00. This intermediate course in Cinematography will further prepare the student to use the technology of the camera as a basis for the art and visual storytelling of motion pictures. The student will also receive the basic background needed for understanding the skills and processes of a single camera production environment.

Learning Outcomes: 1. Discuss production techniques in film and video using the vocabulary of the industry. 2. Explore the production process for single camera environments. 3. Demonstrate an understanding of basic shot types and execute examples of these shots. 4. Demonstrate an understanding of the technology of capturing the moving image. 5. Identify career options and job types within film and video production. Credits: 3.00

FLM 37100 - Editing I

Credit Hours: 3.00. The course introduces students to the principles of film and video editing. Projects, discussions, demonstrations, and hands-on exercises expose students to the technical and artistic aspects of the editing process.

Learning Outcomes: 1. Summarize the basic concepts involved in the editing process. 2. Compare and contrast historical and modern approaches to film and video editing. 3. Develop proficiency with industry standard software. 4. Execute an example of the editing process under strict time constraints. Credits: 3.00

FLM 37200 - Editing II

Credit Hours: 3.00. This course instructs students in advanced principles of film and video editing and color grading. Projects, discussions, demonstrations, and hands-on exercises expose students to the technical and artistic aspects of the editing process.

Learning Outcomes: 1. Develop an increased understanding of the art, technique, and philosophies of the editing process 2. Examine the concepts involved in the color grading process and visual effects. 3. Demonstrate techniques for basic color grading and visual effects. 4. Develop further proficiency with industry standard software. Credits: 3.00

FLM 41000 - Internship In Film/Video/Media Production

Credit Hours: 1.00 to 4.00. Internships in one of the professional areas of film, video or media production. Internships are supervised by appropriate faculty in a particular field of specialization. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

FLM 42200 - Live Production II: Fall/Winter Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of Producing and Directing live sports video and television. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Fall/Winter sports include Cross Country, Soccer, Volleyball, Football, Swimming & Diving, Wrestling, Basketball, or Track & Field. Permission of instructor required.

Learning Outcomes: 1. Identify career options and job types within live event production. 2. Operate the core components of a live video system, including a switcher, replay system, and advanced broadcast graphics. 3. Create examples of visual storytelling using live, multi-

camera, production techniques. Credits: 1.00 to 4.00

FLM 42300 - Live Production II: Winter/Spring Sports

Credit Hours: 1.00 to 4.00. This experiential course furthers the students' understanding of Producing and Directing live sports video and television. Lecture combined with various production experiences increase the students' proficiency with professional technology and equipment as well as the art and storytelling of the craft. Potential Men's and Women's Winter/Spring sports include Swimming & Diving, Wrestling, Basketball, Baseball, Softball, Tennis, Golf, or Track & Field. Permission of instructor required.

Learning Outcomes: 1. Identify career options and job types within live event production. 2. Operate the core components of a live video system, including a switcher, replay system, and advanced broadcast graphics. 3. Create examples of visual storytelling using live, multi-camera, production techniques. Credits: 1.00 to 4.00

FLM 44200 - Directing The Narrative Short Film

Credit Hours: 3.00. Students will gain knowledge of all phases of film production in the course of completing multiple short films. This class will emulate standard film industry practices and guidelines.

Learning Outcomes: 1. Summarize the overall film production process. 2. Create examples of each stage of the production process. 3. Construct multiple complete films, in the roles of Director and/or Assistant Director, using professional and industry standard techniques based upon the production process. 4. Evaluate completed films for content and technique. Credits: 3.00

FLM 44600 - Producing Non-Fiction Video

Credit Hours: 3.00. This advanced course builds on previous knowledge and exposes students to the role of an independent video producer. By working with real-world clients on real-world projects, students will gain valuable experience in guiding productions from start to finish. Additionally, students will learn basic fundamentals of entrepreneurship and business skills designed to begin to prepare students to form their own video production business.

Learning Outcomes: 1. Summarize an understanding of the art, technique, philosophies, and business of the video production. 2. Construct budgets and business plans. 3. Organize, plan, and create video productions simulating professional processes and techniques. 4. Develop and produce multiple unique projects by working closely with real-world clients. Credits: 3.00

FLM 49100 - Special Topics In Film/Video Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Varies due to nature of course. Credits: 1.00 to 4.00

FLM 49102 - Special Topics In Live Production

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49103 - Special Topics In International Cinema

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49104 - Special Topics In Directing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49105 - Special Topics In Screenwriting

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49106 - Special Topics In Cinematography

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49107 - Special Topics In Editing

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49108 - Special Topics In Cinema Studies

Credit Hours: 1.00 to 4.00. Special topics or projects under the direction of an instructor in a particular field of specialization.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 4.00

FLM 49900 - Capstone In Film/Video/Media Production

Credit Hours: 2.00 or 4.00. The Capstone in Film/Video/Media Production is intended to be the culminating experience of the Film/Video Studies or Film/Video and Theatre Production major. Each student Students will create a project of their own design. Students will pitch their project ideas to the program director and/or faculty and should develop a project based around their future career goals. Example areas include narrative/fiction cinema, documentary/non-fiction filmmaking, television production, live event production, etc. Students will fulfill the role of Writer/Producer/Director for their project (and potentially Director of Photography, Editor, etc.). This creative work will culminate in a presentation to an audience. Permission of instructor required.

Learning Outcomes: 1. Develop a complete and significant project idea/vision/creative work. 2. Plan out the execution of the creative work. 3. Assemble a team with which to craft the developed vision. 4. Complete the work to a professional level of quality. 5. Present the work to an audience with a Q&A session. Credits: 2.00 or 4.00

MUS 10100 - Discovery Forum

Credit Hours: 0.00. Discovery Forum is a weekly gathering where music majors and faculty perform, share research, compositions, arrangements or other related topics associated with music today. It is a forum where new approaches and ideas about music can be presented. No prior coursework required.

Learning Outcomes: 1. Describe diverse genres and approaches to music making. 2. Explain to others appropriate concert etiquette, how to present musical scholarship to an audience, and how to speak publicly about music. 3. Communicate new perspectives and ideas regarding musical structure, design, performance, and research. Credits: 0.00

MUS 11200 - Fundamentals Of Music (UCC: HUM)

Credit Hours: 3.00. Fundamentals of music notation, ear training, and music reading.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Understand music notation, rhythmic structure, meter, scales, blues form, chords, basic musicianship and ear training, and fundamentals of songwriting. Credits: 3.00

MUS 13200 - Music Theory I (UCC: HUM)

Credit Hours: 3.00. Course comprises instruction in melodic and harmonic processes in tonal music; development of analytic, listening and piano techniques with musical equipment. Music reading ability is required, verified through Placement Exam.

University Core Curriculum (UCC): (UCC: HUM)

Learning Outcomes: 1. Notate and identify (visually and aurally) keys, intervals, rhythms and meters, melodic and harmonic relationships, phrase structure, formal processes in diatonic tonal music. 2. Harmonize a melody, realize a figured bass and understand the three basic diatonic chord progressions. 3. Perform at the piano: diatonic chord progressions, melodies with chordal accompaniments, arpeggios. 4. Sing diatonic melodies in simple and compound meters. Credits: 3.00

MUS 13300 - Music Theory II

Credit Hours: 3.00. A variety of styles and forms of music serve to exemplify melodic and harmonic processes and voice-leading practices in diatonic tonal music. Activities include analytic reading of musical scores, developing musical listening skills, and acquiring functional piano techniques.

Learning Outcomes: 1. Have a theoretical and practical understanding of the following: diatonic chord progressions; voice leading practices; nonchord tones; period forms; figured bass; secondary dominants; chromatic harmonies. Credits: 3.00

MUS 16100 - Class Piano And Musicianship I

Credit Hours: 3.00. A study of essential keyboard skills that include reading beginning level piano pieces, major and minor scales, transposition, sight reading and adding chords to a given melody. The musicianship includes essential aural skills: rhythmic dictation, interval and chord identification, and rhythmic and melodic dictation.

Learning Outcomes: 1. Play elementary level piano music, transpose, sight read, and add chords to a melody. 2. Take rhythmic and melodic dictation and recognize intervals and chords. Credits: 3.00

MUS 16200 - Class Piano And Musicianship II

Credit Hours: 3.00. A continuation of MUS 16100 that includes reading intermediate level piano pieces, sight reading, scales, transposition and adding chords to a melody. The musicianship component includes intermediate level aural skills, rhythmic and melodic dictation, intervals, chordal and harmonic dictation.

Learning Outcomes: 1. Play intermediate level piano music, transpose, sight read and add chords to a melody. 2. Take rhythmic and melodic dictation, recognize intervals, and chord progressions. Credits: 3.00

MUS 17100 - Jazz Improvisation I

Credit Hours: 2.00. This course is an introduction to the development of beginning jazz improvisational and theoretical skills for all instrumentalists and vocalists. Fundamentals theoretical and musicianship skills are addressed through practical application, guided listening, dictation, transcription, harmonic and rhythmic analysis, and performance of standard jazz repertoire.

Learning Outcomes: 1. Explain the fundamentals of jazz theory and musicianship. 2. Write or transcribe a jazz solo from a recording. 3. Explain and notate jazz harmonies and voicings using established forms of analysis. 4. Describe various jazz styles in performance. 5. Perform selected jazz repertoire. 6. Perform an improvised jazz solo. Credits: 2.00

MUS 23200 - Music Theory III

Credit Hours: 3.00. A study of Renaissance and Baroque contrapuntal practices that will include writing two-part compositions in each style. The course will also cover music theory in the early Romantic era concentrating on composers such as Schubert, Mendelssohn, Schumann and Brahms.

Learning Outcomes: 1. Demonstrate a theoretical understanding of Renaissance (16th century) counterpoint, Baroque (18th century) counterpoint, and Romantic Era (19th century) harmonic practice. 2. Analyze the structural elements of music from the 16th through 19th centuries. 3. Produce original two-part and piano compositions in the Renaissance, Baroque, and Romanic Era styles. Credits: 3.00

MUS 23300 - Music Theory IV: Contemporary Music

Credit Hours: 3.00. A study of music theory from the late Romantic era through current practice. Students may be asked to compose works in a variety of styles that include late Romanticism, Impressionism, Neoclassicism, Atonality, Pointillism, Minimalism, Sound-Mass Composition, Indeterminacy, Ambient music, Graphic Notation and Neoromanticism.

Learning Outcomes: 1. Demonstrate a theoretical understanding of harmonic practice from the Late Romantic Era through the contemporary period. 2. Analyze the structural elements of music from the Late Romantic Era through the contemporary period. 3. Produce original compositions in the styles associated with the Late Romantic Era through the

contemporary period. Credits: 3.00

MUS 25000 - Music Appreciation (UCC: HUM)

Credit Hours: 3.00. The traditions, forms, and styles of classical music. Other types of music may be examined as well. (Students may register through the Continuing Education Student Learning Center at the Tech Statewide locations via distance education.) CTL:IFA 1330 Music Appreciation

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 27000 - Computer Skills In Music

Credit Hours: 3.00. Learn essential music technology skills that include computer based music notation practices, fundamentals of music synthesis and sequencing and basic recording practices.

Learning Outcomes: 1. Understand theoretical and practical conventions of musical notation, fundamentals of MIDI (musical instrument digital interface), computer-based music notation programs, music synthesis and sequencing techniques and basic digital audio recording techniques. Credits: 3.00

MUS 27100 - Jazz Improvisation II

Credit Hours: 2.00. This course is a continuation of MUS 17100, Jazz Improvisation I. Students will continue to develop their jazz improvisation skills that include scale development, pattern playing, guided listening, dictation, transcription skills, harmonic, melodic and rhythmic studies as well as performing standard jazz repertoire. Students should have at least two years of previous experience in band, orchestra, choir, or piano study prior to enrolling in this course. Students will be required to perform in class. Prerequisites for this class are MUS 13200, Music Theory I and MUS 17100, Jazz Improvisation I or consent of the department.

Learning Outcomes: 1. Define common terminology and techniques used in jazz. 2. Explain common chord progressions found in jazz. 3. Demonstrate common linear approaches to jazz improvisation. 4. Explain similarities and differences between various jazz styles and how they impact improvisation. 5. Perform effective jazz solos. Credits: 2.00

MUS 29200 - Music, Media, And Technology

Credit Hours: 3.00. This course explores the broad dimensions of technology and media as they impact music and society. Elements of recorded and live music making and performance will be analyzed. An attempt will be made to become more aware of other technologies that hold promise for performance, entertainment, and distribution. The end goal of this course is to have each student become a reflective music consumer, producer, and curator, curious about technological pos-sibilities of media and music, willing to explore its many dimensions.

Learning Outcomes: 1. Survey trends in media throughout the 20th and 21st century to gain awareness of technologies as they relate to music. 2. Analyze recording and performance standards of mediated music. (music that is not performed acoustically and live) 3. Build confidence discussing media and technological advances in musical performance and recording. Credits: 3.00

MUS 32100 - Songwriting

Credit Hours: 3.00. This course is an introduction to contemporary songwriting. Topics covered will include the study of contemporary chord progressions, melodic development, essential songwriting forms and lyric writing. Students will analyze and compose original songs that will cover a wide range of musical styles and genres including folk, country, pop, rock, jazz and hip-hop. Students interested in Art Song composition should take MUS 34100 or 34200, Composition I-II. Prerequisites include MUS 13200, Music Theory I and MUS 27000, Computer Skills in Music or consent of department.

Learning Outcomes: 1. Demonstrate a theoretical and practical understanding of contemporary songwriting. 2. Explain traditional and contemporary harmonic and melodic practice in songwriting. 3. Define common terms such as verse, chorus, bridge, refrain and hook. 4. Analyze and compose works in simple forms such as binary, ternary, AABA and blues forms. 5. Explain and demonstrate common features of various beats and styles associated with songwriting: samba, bossa nova, swing, bop, funk, hip-hop. 6. Analyze and write effective lyrics. 7. Create original songs.

Credits: 3.00

MUS 32400 - Teaching Music In The Elementary School

Credit Hours: 3.00. Develops basic musicianship through singing, playing instruments, reading and writing music, listening and moving to music. Surveys music teaching methods and materials. Includes lesson planning, experiences in teaching, and observation of children in music classes.

Learning Outcomes: 1. Advocate for the importance of music's inclusion (or exclusion, if desired) in the elementary classroom. 2. Develop curricula that appropriately advances the musical abilities, appreciation, and understanding of children. 3. Perform by singing and playing instruments both alone and in a group. 4. Synthesize appropriate terms to describe musical performance and recording. 5. Connect music to a variety of societal, cultural, and historical contexts. Credits: 3.00

MUS 32800 - Jazz Theory, Composition And Arranging

Credit Hours: 3.00. This course is an introduction to contemporary jazz theory, composition and arranging practices. Topics covered will include the study of chord and scale constructions, substitutions, analyzing and building harmonic progressions, modal functions, identifying various styles and idioms, and writing for combo and big band. Students will learn how to compose in various jazz styles and score their works for small and large ensembles. Prerequisites: MUS 13300, Music Theory II and MUS 27000, Computer Skills in Music or consent of instructor.

Learning Outcomes: 1. Explain common chords, scales and modes used in contemporary jazz music. 2. Define common terms used in jazz arranging and composition. 3. Explain and demonstrate common features of various jazz styles. 4. Create original jazz compositions and arrangements. Credits: 3.00

MUS 34100 - Music Composition I

Credit Hours: 3.00. Learn essential musical composition skills common in the 20th and 21st Centuries through various writing and analytical projects.

Learning Outcomes: 1. Define melodic and harmonic developments in the 20th and 21st Centuries. 2. Define common terms and techniques used in musical composition today. 3. Create original musical compositions. Credits: 3.00

MUS 34200 - Music Composition II

Credit Hours: 3.00. A continuation of Music Composition I with emphasis upon musical techniques after WWII through various writing and analytical assignments. Permission of instructor required.

Learning Outcomes: 1. Understand theoretical and practical musical developments since WWII, Modern contrapuntal practice, serialism, set theory, minimalism, Postmodernism, and large ensemble compositional approaches. Credits: 3.00

MUS 34500 - History Of Rock Music

Credit Hours: 3.00. This course is a survey of the major trends, styles, and genres of rock music from the earliest recordings to the present day. It focuses on the work of the artists and groups who have proven to have the most enduring significance.

Learning Outcomes: 1. Analyze song form as well as instrumentation. 2. Describe and distinguish between various rock genres and their chronological development in history. 3. Describe rock music's influence on society and culture. 4. Demonstrate fluency in the fundamentals of music. Credits: 3.00

MUS 35100 - Studio Piano

Credit Hours: 2.00. Students will study and perform selected piano or digital keyboard literature with the focus on improving their technical and interpretive performance skills. Students will also learn about particular historical, analytical or technical issues related to work(s) studied.

Learning Outcomes: 1. Explain the difference between various musical styles. 2. Perform scales, arpeggios and other common musical patterns. 3. Perform selected musical repertoire. 4. Explain phraseology, articulation, and dynamics. 5. Explain how to improve technique. Credits: 2.00

MUS 35200 - Studio Voice

Credit Hours: 2.00. Students will study and perform selected works for voice from a wide range of styles, and genres within a masterclass setting. The instructor will demonstrate important issues related to voice performance and work with the students in both private and group settings. Students will be required to perform works in class. This course may be repeated.

Learning Outcomes: 1. Demonstrate music style and interpretation in legit/art song and/or contemporary singing. 2. Vocally produce scales, arpeggios and other musical patterns. 3. Prepare and perform selected musical repertoire. 4. Interpret and explain phraseology, articulation, dynamics, etc. 5. Demonstrate elements of vocal dexterity and technical facility. Credits: 2.00

MUS 36000 - Singing For The Theatrical Stage

Credit Hours: 2.00. A workshop/lab in which students explore how to sing musical theater repertoire for the stage. Students will learn about musical theater auditioning, character analysis and development through song, and performance on stage as a singing actor. The course will have both in-class and out-of-class performance opportunities as well as research experiences that use performance-based methods to explore oneself in social contexts (autoethnography). It is recommended that students have at least two years of singing experience prior to taking this course. Exceptions may be made with instructor's approval. The course may be repeated.

Learning Outcomes: 1. Incorporate and explain musical and theatrical decisions through the singing of musical theater repertoire. 2. Develop and perform a repertoire of appropriate materials for musical theater auditions. 3. Create new art through performance-based research and musical media that can be disseminated on stage and online. 4. Evaluate and describe one's own performance as well as others through reflection and criticism. 5. Analyze musical theater performances, characters, and scripts to better perform as a singing actor. Credits: 2.00

MUS 37000 - Introduction To Instrumental And Choral Conducting

Credit Hours: 3.00. This course is an introduction to instrumental and choral conducting. Topics covered will include the study of essential skills necessary to lead vocal and instrumental ensembles that will involve warmup techniques, choral and instrumental tone production, baton and directing patterns, ensemble organizational leadership and score analysis. Prerequisites include MUS 13300, Music Theory II or consent of the department.

Learning Outcomes: 1. Define common terms used in musical scores. 2. Demonstrate a wide variety of conducting hand and baton patterns. 3. Explain how musical analysis can influence conducting. 4. Explain standard organizational and leadership approaches in conducting musical groups. 5. Explain frequent errors made by conductors. Credits: 3.00

MUS 37500 - Selected Topics In Music

Credit Hours: 3.00. A study of a specific genre in music (symphony, opera, chamber music, etc.) or the works of a single composer.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 3.00

MUS 37600 - World Music (UCC: HUM)

Credit Hours: 3.00. Exploration of musical traditions around the globe through lectures, readings, recordings, DVDs, and performances. Students will discover how cultural traditions, life rituals, arts, and other traditions influence each region's expression of music.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 37800 - Jazz History (UCC: HUM)

Credit Hours: 3.00. A historical and stylistic study of jazz.

University Core Curriculum (UCC): (UCC: HUM) Credits: 3.00

MUS 38100 - Music History I: Antiquity To Mozart

Credit Hours: 3.00. Survey of the development of Western European music history from antiquity to Mozart.

Learning Outcomes: 1. Able to listen to a piece composed between antiquity to 1800 and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38200 - Music History II: Beethoven To The Present

Credit Hours: 3.00. Survey of the development of Western European music history from Beethoven to the present.

Learning Outcomes: 1. Able to listen to a piece composed between and the present day and compare it to other pieces, recognize its genre, describe its stylistic features, suggest possible composer and date, place it in historical context, describe its social function, describe performance practice, and describe composer, performer and audience for this piece. Credits: 3.00

MUS 38300 - Digital Audio Recording And Production I

Credit Hours: 3.00. This course is an introduction to digital audio recording and production practices. Topics covered will include design and structure of sound studios, musical sequencing and recording, microphones, fundamentals of sound reinforcement, and sound editing. Students will be required to develop music recording projects.

Learning Outcomes: 1. Explain the fundamentals of musical acoustics. 2. Define digital audio and MIDI (Musical Instrument Digital Interface) terminology. 3. Explain and demonstrate the principles of music recording (studio and live mixes). 4. Explain and demonstrate the fundamentals of sound reinforcement (live sound performances). 5. Explain and demonstrate microphone selection and placement. 6. Design a recording studio. 7. Explain and demonstrate musical sequencing and digital audio editing. 8. Explain and demonstrate how to combine digital sequenced data with natural acoustic sounds. 9. Create professional mixes: adding reverb, compression, special effects, etc. Credits: 3.00

MUS 38400 - Digital Record And Production II

Credit Hours: 3.00. This course is a continuation of MUS 38300, Digital Audio Recording and Production I. Topics covered will include advanced musical sequencing, multitrack audio recording, audio signal processing, mixing, mastering and advanced audio and digital production. Students will be required to develop music recording and production projects.

Learning Outcomes: 1. Explain and demonstrate multitrack recording, mixing, analog and digital effects processing, sampling, use of specialized filters and audio tools such as vocoders and other electronic instruments to shape and edit sound. 2. Explain and demonstrate advanced musical sequencing and digital audio editing. 3. Explain and demonstrate issues and techniques used when combining digital sound with acoustic instruments and voices. 4. Create professional mixes that use reverb, compression, and special effects, etc. 5. Explain and demonstrate techniques used in combining sound and music to video and film productions. Credits: 3.00

MUS 49000 - Guided Reading In Music

Credit Hours: 1.00 to 6.00. For students with specialized needs and interests in the field. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 6.00

THTR 13300 - Acting I

Credit Hours: 3.00. Beginning training and exercises in the basic elements of acting, including vocal and physical preparation, sensory awareness, releasing the imagination, and a basic understanding of action an objective. Staging exercises and terminology are emphasized.

Learning Outcomes: 1. Become familiar with the techniques and practices of acting: vocal and physical techniques, analysis and interpretation.

2. Understand the concepts of given circumstances, action, objective, obstacle, character and conflict, and utilize these in basic scene work. 3. Communicate the play's idea through the medium of character in a scene from a published play. Credits: 3.00

THTR 15001 - Introduction To Drafting

Credit Hours: 1.00. An introduction to hand and computer-aided drafting techniques for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of typical hand drafting equipment. 2. Demonstrate basic computer-aided drafting skills and techniques. 3. Demonstrate proper application of USITT Graphic Standards in scenery, lighting, sound and construction drafting, in both manual practice and CAD. Credits: 1.00

THTR 15002 - Introduction To Scenery Construction Tools And Techniques

Credit Hours: 1.00. An introduction to common tools, techniques, and practices in scenery production for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate proper and safe use of basic woodworking tools, metal working tools, and personal protective equipment common to scenery construction. 2. Demonstrate proper use of basic theatrical stage equipment. 3. Demonstrate basic scenic construction and working techniques. Credits: 1.00

THTR 15003 - Introduction To Rigging For Theatre

Credit Hours: 1.00. An introduction to rigging techniques and equipment for theatre and live entertainment. Permission of Instructor required.

Learning Outcomes: 1. Identify and demonstrate the proper use of single-purchase counterweight systems. 2. Identify and demonstrate proper use of PPE (personal protective equipment) for rigging. 3. Identify and demonstrate safe usage of typical static rigging equipment (basket, sling, turnbuckle, etc.). 4. Demonstrate proper installation and safe usage of chain motors and truss rigging. 5. Calculate safe working loads. Credits: 1.00

THTR 16000 - Introduction To Scene Design And Technology

Credit Hours: 2.00. This course is designed to introduce the students to the process and tools of scene design and technology.

Credits: 2.00

THTR 16100 - Introduction To Costume Design And Technology

Credit Hours: 2.00. Introduction to analytical, artistic, and practical skills required when creating costumes for theatre. Beginning training in elements and principles of design, rendering and presentation skills. Elementary instruction in costume construction, including hand and machine sewing, costume crafts, and basic patterning.

Credits: 2.00

THTR 16200 - Introduction To Light Design And Technology

Credit Hours: 2.00. A course that introduces the student to the basic equipment and design process of stage lighting design.

Credits: 2.00

THTR 16300 - Introduction To Sound Design And Technology

Credit Hours: 2.00. Introduction to theatre sound design and technology for general theatre students. Involvement in Department of Theatre production program.

Learning Outcomes: 1. Develop the necessary elements for a sound design. 2. Locate resources within the sound area for Purdue Theatre. 3. Participate as an efficient member of a sound crew. Credits: 2.00

THTR 16400 - Introduction To Theatre Organization And Management

Credit Hours: 2.00. A theoretical study of performing arts management and backstage operations from audition through performance. Techniques of scheduling, production

management, stage management, technical direction, house management, safety issues, and emergency procedures.

Credits: 2.00

THTR 20100 - Theatre Appreciation (UCC: HUM)

Credit Hours: 3.00. Understanding and appreciation of the theatre's role in the modern world, dramatic structure and analysis, the actor, director, designer, and critic; attendance at current stage productions; class discussion of production elements. CTL:IFA 1302 Theatre Appreciation

University Core Curriculum (UCC): (UCC: HUM)

Credits: 3.00

THTR 21300 - Voice For The Actor

Credit Hours: 2.00. Designed to heighten the actor's awareness of the vocal instrument. Elementary vocal techniques will be practiced to expand the student's vocal flexibility and range. Emphasis on freeing habitual vocal tensions and teaching the student the fundamentals of vocal health.

Learning Outcomes: 1. Understand and apply the vocal techniques required of the actor and practice a specific vocal warm-up procedure. 2. Recognize and use effectively the phonetic alphabet in your text work. 3. Hear, feel, and evaluate healthy vocal practices. 4. Understand and employ the bodily structures that allow for sound production and how to feel/adjust sound placement. 5. Develop and explore new ways in which to use your voice to support your acting work/how the voice can convey an emotional journey and create character (and the technical demands that accompany it) that you can apply to your work after this course. Credits: 2.00

THTR 23300 - Acting II

Credit Hours: 3.00. Continued development of the basic acting tools of objectives, actions, justification, and personalization; continued vocal and physical work; introduction of script and character analysis; and the introduction of audition techniques. The course will use material from contemporary dramatic literature in the rehearsal process. Prerequisite: THTR 133. Instructor permission required for non-majors.

Learning Outcomes: 1. Practice and incorporate relaxation, physical, vocal, and sense memory exercises into a daily warm-up. 2. See, connect, and respond to a partner within improvised scenarios. 3. Read plays with insight and imagine the experience of the characters in the given circumstance of a play. 4. Analyze and break scenes down into beats, with each beat having a clear action and objective. 5. Analyze, rehearse and publicly perform an open scene, and a contemporary monologue and scene.

Credits: 3.00

THTR 23500 - Vocal/Physical Preparation

Credit Hours: 2.00. Vocal/Physical Preparation is designed to increase and deepen student's physical awareness, develop physical and vocal stamina, flexibility and strength, modify habitual modes of expression, expand vocal and physical range, and increase student's ability to respond expressively.

Learning Outcomes: 1. Aware of dysfunctional and limiting vocal and physical patterns. 2. Reduce tension, increase flexibility, improve balance and coordination, and expand expressive range. 3. Develop a grounded, focused and dynamic theatrical presence. 4. Integrate breath, voice and movement in solo and group performance. 5. Create a personalized training program that prepares you for the challenges of the profession. Credits: 2.00

THTR 25300 - Intro To Audio System Documentation

Credit Hours: 3.00. This course explores the creation and interpretation of production deliverables for theatrical audio systems. Through hands-on exercises and the study of industry-standard documentation, students will learn to draft, interpret, and apply audio system design drawings. Emphasis will be placed on creating clear and precise documentation that can be used by technicians, designers, and production teams in a theatrical environment.

Learning Outcomes: 1. Recognize standard symbols and notation used in audio system documentation. 2. Construct detailed signal flow diagrams, block diagrams, and rack layouts for theatrical sound systems. 3. Apply industry-standard software and techniques for creating

professional AV system documentation. Credits: 3.00

THTR 25400 - Drafting For Theatre

Credit Hours: 3.00. Projects course in drafting for the theatre using graphic standards and presentations techniques accepted in the performing arts industry.

Credits: 3.00

THTR 25600 - Stage Make-Up

Credit Hours: 2.00. Study of facial anatomy, the aging process, the principles of light and shadow, and character analysis. Theory and practice in the basic techniques of applying stage makeup.

Credits: 2.00

THTR 26300 - Introduction To Sound Studios

Credit Hours: 3.00. An introduction to theories and techniques of audio production.

Learning Outcomes: 1. Identify fundamental functions of a sound system, explain their operations and demonstrate a basic ability to manipulate their characteristics in simple audio productions. 2. Produce music and audio recordings that demonstrate an ability to meet basic audio technical and production standards. Credits: 3.00

THTR 27100 - Script Interpretation

Credit Hours: 3.00. This course introduces several approaches to the creative interpretation of a dramatic script, giving students experience in applying both analytical methods and sensory-intuitive lenses of interpretation.

Learning Outcomes: 1. Interpret your sensory-intuitive responses to a script. 2. Demonstrate an understanding of the world of the play. 3. Analyze key structural components of a script. 4. Communicate your interpretation through multiple means (written, oral, visual, etc.). Credits: 3.00

THTR 29000 - Special Topics In Theatre

Credit Hours: 1.00 to 3.00. Topics will vary.

Credits: 1.00 to 3.00

THTR 32300 - Acting: Movement For The Actor

Credit Hours: 3.00. Designed to heighten body awareness in movement and stillness. Characterization techniques will be practiced that expand the student's flexibility, aerobic capacity, strength, agility, and range of self-expression. Emphasis on freeing habitual tension patterns through the exploration of expressive movement.

Credits: 3.00

THTR 33300 - Acting III

Credit Hours: 3.00. Application of foundational acting techniques to specific disciplines. May be repeated for credit. Instructor permission required for non-majors.

Learning Outcomes: 1. Identify, define, describe and demonstrate the basic principles of the craft of acting. 2. Identify, define, describe and demonstrate the basic terminology of stage technique. 3. Identify, define and describe the basic principles of script & character analysis. 4. Read, investigate, interpret and articulate your analysis of specific plays from the canon of 20th and 21st Century realistic dramatic literature. 5. Develop critical thinking as it applies to your own work, your peers' work and in production work. Credits: 3.00

THTR 33400 - Acting III: Acting For The Camera

Credit Hours: 3.00. Continued development of acting technique, as it relates to challenges unique to acting on film, television and commercials. Students will develop an effective process for on-camera performance. Class exercises/presentations are recorded, viewed and critiqued by the students and the instructor.

Learning Outcomes: 1. Acquire the ability to distinguish and differentiate between techniques used for acting for the live theatre and acting for the camera. 2. Successfully analyze new types of dramatic text (e.g., TV scenes, commercial copy, film scripts, etc.). 3. Demonstrate a general knowledge of the Terminology used for acting for the camera. 4. Develop actor's skills with on-camera blocking, business, subtext and

reactions. 5. Develop skills that are specific for on-camera auditions. Credits: 3.00

THTR 33600 - Rehearsal And Performance II

Credit Hours: 1.00 or 2.00. The study and practice of rehearsal techniques and stage performance. Students will be assigned to acting and stage management duties in experimental and major stage productions. Permission of instructor required.

Credits: 1.00 or 2.00

THTR 35300 - Audio Technology I

Credit Hours: 3.00. This course introduces the fundamental principles of audio technology with a focus on live sound reinforcement. Topics covered include acoustics, audio signal flow, microphone techniques, mixing consoles, and loudspeaker systems.

Learning Outcomes: 1. Identify key vocabulary in room acoustics and components of audio systems. 2. Apply industry best practices and standards in system designs and design documentation. 3. Demonstrate understanding of the functions of major audio equipment such as mixing consoles, amplifiers, loudspeakers, and digital signal processing. Credits: 3.00

THTR 35400 - Painting For The Stage

Credit Hours: 3.00. The principles and practice of painting for the stage. Study of tools, media, and techniques used in traditional scenic painting, costume painting, and the creation of dimensionality on various surfaces. Offered alternate years.

Credits: 3.00

THTR 36000 - Scenic Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into an environment for dramatic action. Emphasis on the interrelationship among all aspects of production and how the scenic element becomes a building block toward total picturization. Offered alternate years.

Credits: 3.00

THTR 36100 - Costume Design

Credit Hours: 3.00. Theory and principles of design specifically applied to stage costume design. Emphasis on the interrelationship of all aspects of production and how the costume becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 36200 - Light Design

Credit Hours: 3.00. A project course in utilizing the principles of design as they can convey an environment and its qualities to further dramatic action. Emphasis on the interrelationship among all aspects of production and how light becomes a building block toward total picturization. Offered in alternate years.

Credits: 3.00

THTR 36300 - Sound Design

Credit Hours: 3.00. Project course in utilizing the principles of design as they can be formed into auditory response and environment. Emphasis on the interrelationship among all aspects of production and how sound becomes a building block toward total picturization. Majors have priority. Offered alternate years.

Credits: 3.00

THTR 36800 - Theatre Production II

Credit Hours: 1.00 to 2.00. The study and application of theatre practices. Students will be assigned to all levels of departmental production of applied practice. Permission of instructor required.

Credits: 1.00 to 2.00

THTR 38000 - Histories Of Theatre

Credit Hours: 3.00. Variable topics in theatre and performance history. Emphasis on the study of the works, aesthetics, and innovations of a theatrical form/genre alongside social, cultural, economic, and political contexts.

Credits: 3.00

THTR 38100 - Theatre And Performance Historiography

Credit Hours: 3.00. Historiographic analysis of theatre, drama, and performance of the 20th and 21st centuries. Emphasis on the relationship between modern and contemporary performance to world history from social, political, and cultural perspectives. Course includes both written and practical components. Prerequisites: THTR 201, THTR 271.

Learning Outcomes: 1. Interpret plays, performances, and performance theory from the 20th and 21st century. 2. Analyze theatre and performance histories through a combination of

historical research, critical questioning, and practical application. 3. Demonstrate how political, economic, and cultural structures impact theatre and performance histories of the 20th and 21st Century. 4. Demonstrate skills in research, collaboration, and oral presentation. Credits: 3.00

THTR 39000 - Directed Study Of Special Theatre Problems

Credit Hours: 1.00 to 3.00. An undergraduate level, individualized, and intensive study of any aspect of theatre required by the student's plan of study. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 43300 - Acting IV

Credit Hours: 3.00. Adaptation of acting techniques to professional applications.

Learning Outcomes: 1. Develop and demonstrate the application of metrical analysis. 2. Identify the poetic devices in classical text and demonstrate these in performance. 3. Demonstrate critical thinking skills of analysis, interpretation and application. 4. Analyze Shakespeare's characters in reference to their historical period. 5. Develop a systematic approach for performing classical text. Credits: 3.00

THTR 44000 - Directing: Page To Stage

Credit Hours: 3.00. This course focuses on theoretical and practical understanding of the essential principles and fundamentals of directing for the stage. Students will learn a proven directorial methodology and engage in essential research and written and practical presentations throughout. Permission of instructor required.

Learning Outcomes: 1. Identify, classify, and critique elements of drama and the requirements of production with depth and imagination. 2. Analyze plays for production. 3. Articulate aspects of student's own personal aesthetic orally, visually, and in writing. 4. Integrate skills in play analysis, intuitive contemplation, research, composition techniques, and various rehearsal strategies to stage dramatic texts. 5. Evaluate creative decisions and processes. Credits: 3.00

THTR 45800 - Problems In Theatre Technology

Credit Hours: 1.00 to 3.00. A tutorial in technical theatre. Available for students who wish to do more extensive work in theatre technology. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 46800 - Problems In Theatre Design

Credit Hours: 1.00 to 3.00. A tutorial in theatre design. Available for students who wish to do more extensive work in the design aspects of production. Permission of instructor required.

Credits: 1.00 to 3.00

THTR 47902 - Capstone Project

Credit Hours: 3.00. Students will develop, present, and reflect upon a performance event based on the research framework developed in THTR 49701: Capstone Preparation in the subsequent semester. Students will demonstrate their learning through a focused experience that requires the integration and application of the full breadth of skills and knowledge gained during the course of study. These events are ideally collaborative, but solo project proposals are allowed. Capstone Project includes the rehearsal process and performance at the end of the semester, with a reflection submitted during finals week. The instructor will meet with students through the course of the semester to mentor this performance/production-based process. Permission of instructor required.

Learning Outcomes: 1. Collaborate with other artists, designers, and craftspeople from different disciplines. 2. Devise unique performances and relate them to historical, aesthetic, and personal contexts. 3. Implement creative development and reflection process utilizing practice-as-research approaches. Credits: 3.00

THTR 48400 - Performance, Media, And Technology

Credit Hours: 3.00. This course explores the intersection of performance, media, and technology from the early 20th century through present day, examining how technological innovations

have transformed performance practices and audience experiences.

Learning Outcomes: 1. Describe the historical development of media and technology in 20th and 21st-century performance. 2. Apply theories of liveness, remediation, intermediality, and mediatization toward analysis of contemporary performance practices. 3. Assess the impacts of new media on concepts such as narrative, space, text, and embodiment. 4. Generate strategies for conceptualizing projects that integrate media into performance. Credits: 3.00

THTR 49000 - Special Topics In Theatre

Credit Hours: 1.00 to 3.00. Topics will vary.

Credits: 1.00 to 3.00

THTR 49701 - Capstone Preparation

Credit Hours: 3.00. Students will build the research-as-practice framework and development structure for a performance that will be realized during THTR 49702: Capstone Project in the subsequent semester. This proposal will evolve out of research that will include examining works related to the research enquiry of the topic identified in their proposal as well as practice-as-research frameworks to determine which frameworks fit the performance. The instructor will meet with students through the course of the semester to mentor this research-based process. All requests for space, equipment, costume and props, production staff and monetary support, as well as the creative idea of the project, must approved by the semester's end. Permission of instructor required.

Learning Outcomes: 1. Collaborate with other artists, designers, and craftspeople from different disciplines. 2. Devise unique performances and relate them to historical, aesthetic, and personal contexts. 3. Design a creative development and reflection process utilizing practice-as-research approaches. Credits: 3.00

Libraries and School of Information Studies

Organization and Purpose

Purdue Libraries and School of Information Studies is a non-degree granting department that offers innovative graduate and undergraduate courses and certificates on several different information-focused topics.

Courses

Purdue Libraries and School of Information Studies offers both graduate and undergraduate courses in fields such as information and data literacy, digital humanities and geographic information systems, systematic reviews, digital citizenship and information ethics, and foundational concepts in undergraduate research. ILS courses may meet elective, core curriculum, or certificate requirements for your major and other programs.

Certificates

Purdue Libraries and School of Information Studies offers two graduate certificates: Digital Humanities, co-sponsored by the College of Liberal Arts, and Geographic Information Science, in collaboration with seven colleges at Purdue University. We also co-sponsor an undergraduate Digital Humanities Certificate with the College of Liberal Arts.

Contact Us:

Telephone:
(765) 494-2900
Address:
Libraries Administration
504 West State Street
West Lafayette, IN 47907-2058

Contact Us | Purdue Libraries

ILS 23500 - SPIRaL, Part I: Commencing Information Literacy Research

Credit Hours: 2.00. Over the course of a year-long research experience, SPIRaL undergraduate researchers engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. In the first half of the semester, SPIRaL students will explore the information literacy literature to build a foundation for our research this year. In this early part of the semester, students will be introduced to the different views scholars have of information literacy, the various research approaches they employ, and the range of real-world information challenges information literacy researchers attend to with their research. Students will use the insights from the existing information literacy and information challenges research to inform the research study they will carry out over the year. In second part of the fall semester, students will commence original research that addresses a need or gap in the literature. Students will apply data collection methods and reflect on the affordances of qualitative research approaches in pursuing knowledge about information literacy's role in addressing information challenges. Across this year-long research experience, the SPIRaL research team will aim to: 1. expand what is known about the role information literacy can play in addressing significant information challenges in the world, and 2. enrich the information literacy research community by welcoming new and passionate undergraduate researchers into this work.

Learning Outcomes: 1. Analyze the range of scholarly perspectives, research approaches, and real-world information challenges information literacy researchers attend to with their research. 2. Use insights from information literacy research to conduct a qualitative research study investigating the role information literacy may play in addressing various information challenges. 3. Apply qualitative research methods to collect data for our research study that will investigate the role information literacy may play in addressing various information challenges. 4. Employ a practice of reflection and act upon reflective insights to operate effectively on team-based research. Credits: 2.00

ILS 24900 - Collections Management In Museums And Archives

Credit Hours: 3.00. This course provides discussion and application of collections management in museums and archives. Students will learn the systems, organizational methods, descriptive processes, ethical/legal considerations, and administration best practices within these cultural heritage institutions. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Understand application of collections systems within their fields. 2. Identify current issues in collections management. 3. Compare and contrast collections management between archives and museums. 4. Demonstrate standards and best practices in collections management. Credits: 3.00

ILS 30000 - Information, Culture, And Society

Credit Hours: 3.00. Information and information systems shape our beliefs, influence decision-making, define our collective knowledge, and are integral to being an informed, responsible, and engaged citizen in our modern world. This course will examine the intricate relationship between information and society to better understand how information ecosystems, constituted by various technologies and practices, shape and are shaped by individual identities, structures of power, and ethical considerations/human values. Using an interdisciplinary and team-based approach, students will gain essential skills to navigate their information-rich world.

Learning Outcomes: 1. Identify and apply frameworks to critically evaluate the impact of information and technology on cultural norms, values, and societal structures. 2. Explore the concept of information identity, including how individuals and communities construct their identities through information consumption and production, and critically analyze the impact of information identity on culture and society. 3. Explain the components of information ecosystems, including producers, consumers, intermediaries, and technologies, and how they interact within different cultural and societal contexts. 4. Analyze the power structures in information ecosystems, including the privileged access and control of certain individuals or groups, and explain how these power dynamics intersect with social constructs like race, gender, class, and ethnicity to shape cultural and societal dynamics. 5. Articulate ethical

principles related to information ownership, privacy, censorship, transparency, and research in various contexts. Credits: 3.00

Department of Information Studies

Digital Humanities Certificate

Information Studies Minor

ILS 10000 - Introduction To Information Studies

Credit Hours: 3.00. This course will provide a foundation for navigating and engaging with the information-rich world. Students will define and assess information in order to address real-world situations; map their information landscape and effectively engage with information systems as well as human sources of information; develop a practice of critical and ethical information use; and conceptualize, apply, and examine the strategies for information and knowledge management, production, and dissemination. Students will examine the societal impact and implications of information and information privilege to explore the applications and consequences of information, in addition to examining data practices and methods. This will provide students with an opportunity to strengthen their research and information literacy skills, reflect in an informed and critical manner, and give them the tools to successfully make ethical, evidence-based decisions in the academic and professional context.

Learning Outcomes: 1. Identify different types of primary and secondary information formats and how they are created. 2. Analyze the societal, historical, and political significance of information. 3. Identify and explain different types of information-seeking behaviors. 4. Demonstrate ethical attribution of sources in their own information production. 5. Critically evaluate information. 6. Synthesize information in order to make ethical and evidence-based decisions. 7. Identify interested parties, such as scholars, experts, archives, organizations, governments, and industries, who might produce or house information about a topic and then determine how to access that information. 8. Match information needs and search strategies to appropriate search tools. 9. Design and refine needs and search strategies. 10. Understand how information systems (i.e., collections of recorded information) are organized in order to access relevant information. 11. Understand how and why information is selected for long-term preservation and access. 12. Organize information in situationally relevant ways. 13. Explain different forms of information dissemination. 14. Explore different professional pathways and career options in relation to information. 15. Analyze and criticize forms of preservation. Credits: 3.00

ILS 10300 - Introduction To Data Lifecycle Management

Credit Hours: 1.00. Introduces concepts of the management of data throughout its lifecycle. Understanding different types of data and their functions. Managing data in the context of a particular discipline or profession. Finding and evaluating data purposefully. Using data ethically and responsibly. Creating and sharing data for reuse, accountability, and enhancement. Making decisions and communicating using data, including data analysis and visualization. Protecting and archiving data.

Learning Outcomes: 1. Describe the data lifecycle and types of data that are used in their discipline or profession. 2. Discuss the ethical and responsible use of data. 3. Locate and evaluate datasets for reuse that are relevant to their research or work. 4. Apply a variety of introductory data collection, analysis, and visualization techniques. 5. Understand the basics of securing, archiving, and sharing data. Credits: 1.00

ILS 13200 - Introduction To Museums And Archives

Credit Hours: 3.00. This course is an introduction to the structures, history, theories, and professional practices in museums and archives. In addition to providing an overview,

this course provides students with career exploration in museums and archives through analyzing opportunities in various professional tracks. Students will learn valuable skills applicable to their individual career path, such as curatorial and archival literacy, verbal and written communication, and research best practices.

Learning Outcomes: 1. Explain the historical foundations of museums and archives. 2. Identify basic organizational structures and career paths of museums, galleries, archives, and special collections libraries. 3. Analyze the value and educational mission of museums, galleries, archives, and special collections across multiple disciplines. 4. Interpret contemporary theories and practices within museums, galleries, archives, and special collections. 5. Apply learning to future opportunities in chosen specialties, majors, and career fields. Credits: 3.00

ILS 17500 - Information Strategies For Hospitality & Tourism Management (UCC: IL)

Credit Hours: 1.00. This course will provide students with a framework of information search skills and problem-solving they can utilize in their area of study and in everyday life. It will also incorporate technology literacy components with active learning. Class sessions will consist of lecture, group discussion, demonstrations, and in-class activities and out-of-class activities. The course is intended for first-semester freshman students. Department permission required.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Develop the ability to access information and determine what different sources are needed for problem solving. 2. Develop a foundation in problem-solving to use discovered information effectively and efficiently. 3. Develop a knowledge-base into the full array of information available (scholarly articles, market reports, quality websites, and other types of information). 4. Learn to prioritize sources based on credibility and relevance. 5. Accurately cite the information you find. 6. Use retrieved information to accomplish a specific purpose and present information clearly and persuasively using a range of technology tools and media. Credits: 1.00

ILS 18000 - Preparing For Your Undergraduate Research Experience

Credit Hours: 1.00. This course is for prospective Purdue undergraduate researchers who are interested in conducting undergraduate research or creative endeavors. Purdue students who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs. Throughout the course, students will develop components for a final application packet to submit to a research team or program they choose. Department permission required.

Learning Outcomes: 1. Identity the professional and personal goals sought from an undergraduate research experience. 2. Learn research skills such as assessing literature credibility and compiling a review of the topic important to all fields. 3. Utilize online and in-person resources and programs to assist in locating and applying to undergraduate research experiences. 4. Evaluate research programs/projects to determine how they fit within personal and professional goals. 5. Create and submit an application/proposal including a resume' and personal statement for research programs/projects. Credits: 1.00

ILS 19500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics from the practice of information and data science, varying from semester to semester. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of department required.

Learning Outcomes: 1. Examine critically and apply information and data science to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 20100 - Introduction To Digital Humanities

Credit Hours: 3.00. This is an interdisciplinary foundational course that combines theory and practice to teach students in

and about digitally mediated culture. Accordingly, this course fosters a critical understanding of the digital and its implication for the development of a technologically driven society. Students will be introduced to digital inquiry and critical practice and explore the ways that the digital transforms knowledge acquisition and production across the humanities, social sciences and sciences. Students will engage in readings and activities that help them form substantive perspectives on the digital formulations and practice through digital technologies and tools. Students will also experiment with digital methods and tools by building a digital project. This course places an emphasis on engaged learning through online and in-class discussion, digital activities, and collaborative work. Permission of instructor required.

Learning Outcomes: 1. Identify various concepts and methods in digital humanities. 2. Apply a variety of methods and tools to conduct digital humanities research. 3. Research the transformative potential of digital methods through critical inquiry. 4. Create a process for developing and completing a digital project. Credits: 3.00

ILS 23000 - Data Science And Society: Ethical Legal Social Issues

Credit Hours: 3.00. This course provides an introduction to Ethical, Legal Social Issues (ELSI) in Data Science. Students will be introduced to interdisciplinary theoretical and practical frameworks that can aid in exploring the impact and role of Data Science in society. This is a writing intensive course. Students will work individually and on collaborative assignments.

Learning Outcomes: 1. Engage in current debates surrounding professional and research ethics, roles and responsibilities in Data Science. 2. Examine emerging legal and policy issues which impact Data Science. 3. Reflect critically on the relationship between Data Science and political, social and cultural change. 4. Learn collaboration, public engagement and scholarly communication skills. Credits: 3.00

ILS 23600 - SPIRaL, Part II: Conducting Information Literacy Research

Credit Hours: 1.00. Over the course of a year-long research experience, SPIRaL undergraduate researchers engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. The second semester of SPIRaL builds upon the work completed in the previous semester. We will spend the first half of the semester analyzing the data collected last semester. We will then present our research approach, findings, and implications in various scholarly venues.

Learning Outcomes: 1. Analyze data collected in semester 1 to investigate the role information literacy may play in addressing various information challenges. 2. Present information literacy research (including methods/processes, findings, and insights) to diverse audiences and stakeholders (the SPIRaL research group, ILS researchers, Purdue campus). 3. Employ a practice of reflection and act upon reflective insights to operate effectively on team-based research. 4. Recognize the value of information literacy research in addressing information challenges that impact society. Credits: 1.00

ILS 25000 - Introduction To Geographic Information Systems

Credit Hours: 3.00. Geographic Information Systems (GIS) plays an important role in many disciplines as a tool for data management, query, visualization, and analysis. It can be used for natural resource management, environmental studies, agriculture, as well as social and political studies. This course will introduce students the basic knowledge about GIS, including the fundamental concepts of GIS, data models and management strategies, as well as some basic spatial analysis skills. Practical work will be introduced and completed using Esri ArcGIS Pro software. Permission of department required.

Learning Outcomes: 1. Understand fundamental GIS concepts, data models. 2. Apply basic spatial analysis methods and applications. 3. Apply spatial thinking to solve problems. 4. Create professional maps, web maps, and mobile maps. 5. Apply GIS data skills. Credits: 3.00

ILS 28000 - Understanding Your Undergraduate Research Experience I

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to hone skills necessary for successfully reflecting on and completing the experience. During this course, students will utilize their research experience

to apply skills such as managing time with a research project, communicating your research, utilizing Purdue Libraries' resources, and providing feedback to peer researchers. Students will deliver research pitches about their own project and provide critiques to others' pitches. Department permission required.

Learning Outcomes: 1. Communicate research to various audiences with a research pitch and a research abstract. 2. Provide constructive feedback and interact with peers and apply comments to your work. 3. Define skills/attributes from your undergraduate research experience. 4. Develop and expand a network of researchers within your unit and among other peer researchers. 5. Reflect on and apply transferable skills necessary to be a successful undergraduate researcher. Credits: 1.00

ILS 29000 - Independent Study In Information Science

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue. Plan of Study and assessment method are agreed upon by faculty and student prior to course registration.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

ILS 29500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 30100 - Data Foundations, Tools, And Applications

Credit Hours: 3.00. Data are everywhere. Data permeates every aspect of our lives, from journalistic reporting to workplace projects to artificial intelligence applications. This course covers the basics of the data research lifecycle, including locating and managing datasets, along with applying different methods and tools a to craft compelling stories about data. Students will learn the difference between data and information and how to transform raw data into information to be communicated to a wider audience. This course offers unique skills for students from any discipline who want to discover the world of data.

Learning Outcomes: 1. Understand the differences between data and information. 2. Navigate the basics of data management, ethics, and analysis. 3. Explore different datasets and their lifecycles. 4. Apply fundamental methods--and tools--of data location, analysis, cleaning, and visualization. 5. Create an original data story with and about data. Credits: 3.00

ILS 33000 - The Age Of Mis/Dis/Malinformation

Credit Hours: 3.00. In our current moment, often known colloquially as the "Information Age," the veracity of information is of incredible importance, yet we see the viral spread and consumption of "bad" information: misinformation, disinformation, and malinformation. These three forms of information are spread globally regarding every event. Even though more people have access to information sources than ever before, we still are living in the age of mis/dis/malinformation.

Learning Outcomes: 1. Apply theoretical frameworks to think critically about our information ecosystems. 2. Respond critically, thoughtfully, and empathetically to the problematic of mis/dis/malinformation. 3. Reflect on the impact of mis/dis/malinformation on everyday people, nations, and information ecosystems. 4. Engage philosophical and critical debates about information from a range of disciplines. 5. Recognize the various ways in which prominent social-media platforms facilitate the spread of mis/dis/malinformation. Credits: 3.00

ILS 33100 - Conspiracy Theories

Credit Hours: 3.00. In the information age, we have witnessed a dramatic resurgence of paranoia and violence, fueled by the very technologies meant to provide access to knowledge and information. In this course, we will uncover conspiracies together, seeking to understand how such strange ideas originate and spread.

Learning Outcomes: 1. Apply theoretical frameworks to think critically about conspiracy theories within American culture. 2. Respond critically, thoughtfully, and empathetically to the problematic of American conspiracism. 3. Reflect on the impact of conspiracy theories on the American public sphere, families, and information ecosystems. 4. Engage philosophical and critical debates about conspiracy theories from a range of disciplines. 5. Recognize the various ways in which prominent social media platforms facilitate the spread of conspiracy theories. Credits: 3.00

ILS 33500 - SPIRaL, Part I: Commencing Information Literacy Research

Credit Hours: 2.00. Over the course of a year-long research experience, you will engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. In the first half of the semester, you will explore the information literacy literature to build a foundation for our research this year. In this early part of the semester, you will be introduced to the different views scholars have of information literacy, the various research approaches they employ, and the range of real-world information challenges information literacy researchers attend to with their research. You will use the insights from the existing information literacy and information challenges research to inform the research study you will carry out over the year. In the second part of the fall semester, you will commence original research (IRB #) that addresses a need or gap in the literature. You will apply data collection methods and reflect on the affordances of qualitative research approaches in pursuing knowledge about information literacy's role in addressing information challenges. Across this year-long research experience, the SPIRaL research team will aim to: 1. expand what is known about the role information literacy can play in addressing significant information challenges in the world, and 2. enrich the information literacy research community by welcoming new and passionate undergraduate researchers into this work. Permission of department required.

Learning Outcomes: 1. Analyze the range of scholarly perspectives, research approaches, and real-world information challenges information literacy researchers attend to with their research. 2. Use insights from information literacy research to conduct a qualitative research study investigating the role information literacy may play in addressing various information challenges. 3. Apply qualitative research methods to collect data for our research study that will investigate the role information literacy may play in addressing various information challenges. 4. Employ a practice of reflection and act upon reflective insights to operate effectively on team-based research. Credits: 2.00

ILS 33600 - SPIRaL, Part II: Conducting Information Literacy Research

Credit Hours: 1.00. Over the course of a year-long research experience, SPIRaL undergraduate researchers engage in original research to investigate how information literacy-in its many forms-can inform real-world solutions to contemporary information challenges, such as mis/disinformation. The second semester of SPIRaL builds upon the work completed in the previous semester. We will spend the first half of the semester analyzing the data collected last semester (IRB 2024-84). We will then present our research approach, findings, and implications in various scholarly venues. Across this year-long research experience, the SPIRaL research team will aim to: 1. expand what is known about the role information literacy can play in addressing significant information challenges in the world, and 2. enrich the information literacy research community by welcoming new and passionate undergraduate researchers into this work. Permission of department required.

Learning Outcomes: 1. Analyze data collected in semester 1 to investigate the role information literacy may play in addressing various information challenges. 2. Effectively present information literacy research (including methods/processes, findings, and insights) to diverse audiences and stakeholders (the SPIRaL research group, ILS researchers, Purdue campus). 3. Employ a practice of reflection and act upon reflective insights to

operate effectively on team-based research. 4. Recognize the value of information literacy research in addressing information challenges that impact society. Credits: 1.00

ILS 38000 - Understanding Your Undergraduate Research Experience II

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build upon the previous course and focus on research data collection, presentation, and communication for current Purdue undergraduate researchers. During this course, students will learn and discuss various forms of data and collection practices. Students will develop their own academic poster to present their research project's data and implications. Students are encouraged to present their poster at one of Purdue's undergraduate research conferences near the end of the semester. This course is the second course taken as undergraduate researchers and introduces material at this advanced level. This higher-division course is normally scheduled for juniors and seniors. Department permission required.

Learning Outcomes: 1. Learn about quantitative and qualitative research methods and discuss how to utilize both in a research project. 2. Create and present an academic poster applying data visualization best practices. 3. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

ILS 39500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digitals scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Department approval required.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 48000 - Beyond Undergraduate Research

Credit Hours: 1.00. This course is for current Purdue undergraduate researchers to build on previous courses and focus on continuing their education in graduate or professional school. During this course, students will learn and discuss the various phases of identifying, selecting, applying to and funding graduate or professional school programs. Students will also gain a deeper comprehension of the qualities and skills that make research mentors effective while developing skills they will need to be successful mentees and peer mentors. Students will conduct research to identify potential programs of interest and develop a statement of purpose. Department permission required.

Learning Outcomes: 1. Categorize graduate or professional school qualities that fit skills and meet professional needs. 2. Identify qualities and skills necessary to act effectively as a research mentor and as a research mentee to a future graduate/professional advisor. 3. Create a statement of purpose to include in graduate/professional school applications. 4. Reflect on and apply transferable skills of an undergraduate researcher for future success. Credits: 1.00

ILS 49000 - Independent Study In Information Science

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue. Plan of Study and assessment method are agreed upon by faculty and student prior to course registration.

Learning Outcomes: 1. Variable but agreed upon by faculty and student prior to course registration. Credits: 1.00 to 3.00

ILS 49500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00

to 4.00

ILS 51400 - Information Skills For Health Professionals

Credit Hours: 1.00. This course is designed to help you develop essential information skills to support your professional goals and prepare you to succeed in graduate or professional school in the health sciences. Learn how to navigate PubMed and other subject-specific databases, and differentiate between various types of research articles. Become adept at saving, organizing, and annotating articles so you can easily locate them, "cite while you write," and share them with your classmates or research group. Prepare for writing for publication. And avail yourself of the resources and services academic libraries provide, beyond books and journals, to support your coursework and research.

Learning Outcomes: 1. Plan for comprehensive literature searches by clearly defining your information need and mapping search terms to those concepts. 2. Find information relevant to your information needs using appropriate subject database(s), including the use of keywords or prescribed vocabulary, and available search facets. 3. Evaluate the level of evidence presented by research reports on the basis of their methodologies. 4. Save, organize, and use materials in multiple formats (journal articles, books, book chapters, web sites) using a citation management system. 5. Explain what evidence-based practice means to you in the context of your career goals. Credits: 1.00

ILS 52000 - Introduction To Systematic Review For The Health Sciences

Credit Hours: 3.00. This course will introduce systematic review methodology of published health sciences literature. Students will learn to form research questions, develop inclusion and exclusion criteria, search for evidence, manage data, and assess the risk of bias.

Learning Outcomes: 1. Analyze and articulate the sequential steps encompassing the systematic review process. 2. Construct and refine a reproducible and systematic search strategy tailored to specific research inquiries. 3. Execute the management of citation data to support systematic review processes. 4. Design a systematic review protocol adhering to established guidelines and standards. Credits: 3.00

ILS 54000 - Critical GIS: Theory And Applications

Credit Hours: 3.00. This course will provide students with a critical overview of the role power, culture, justice and injustice, and oppression have played in the practice and history of cartography. In this hands-on course students will learn the basic GIS skills and techniques that will help them understand place and space through critical theories of race, gender, sexuality, indigeneity, class, ability, colonialism, and the State. We will engage theoretical texts on mapping and social justice to identify how GIS and maps can expose and resist oppression and inequality. Students will apply critical theory through the practice of critical cartography to analyze a course-related topic of their choosing and use GIS tools to create an original project. Students will move away from the traditional research paper and engage with a digital research platform that enhances research impact and scholarship reach while applying such tools to interrogate the power dynamics contained within them. It provides the opportunity to serve as a tool for community collaborations in social activism as a shareable document. This class is designed to offer an interdisciplinary approach to place-based research and its connections to social justice.

Learning Outcomes: 1. Engage theoretical texts related to GIS, mapping, and critical theory. 2. Critique the role of GIS in resisting or reinforcing power structures. 3. Implement GIS and mapping techniques to respond to important sociopolitical issues. 4. Create original maps related to topics discussed in the course. Credits: 3.00

College of Pharmacy

Overviewopt_Pharm_3

Founded in 1884, Purdue's College of Pharmacy consistently ranks among the 10 best pharmacy programs in the nation. Numerous research opportunities, an innovative teaching pedagogy, and world-renowned, caring faculty create a cutting edge learning environment. Employers are drawn by the quality, depth and experiential opportunities provided to Purdue pharmacy graduates. The College of Pharmacy is making a difference locally and globally.

Undergraduate Program

The Purdue College of Pharmacy offers an undergraduate program in Pharmacy.
The Bachelor of Science in Pharmaceutical Sciences (BSPS) is a four-year undergraduate program that consists of multidisciplinary basic sciences related to drug discovery, development, and commercialization. A degree in this program does not allow graduates to become licensed pharmacists.

Professional Program

Doctor of Pharmacy (Pharm D) - Students who meet all prerequisites, may apply to the PharmD program. Graduates of this 4-year professional program prepares students to sit for the national and pharmacy law licensure exams to practice pharmacy.

Graduate Programs

The Purdue College of Pharmacy boasts one of the oldest and most-respected graduate programs in the U.S. Each of the three departments of the Purdue College of Pharmacy offer graduate programs:

- Industrial and Molecular Pharmaceutics
- Medicinal Chemistry and Molecular Pharmacology
- Pharmacy Practice

Each department offers a PhD degree program. All of these programs require strong undergraduate preparation, including completion of a Bachelor's Degree for admission.
A combined-degree program allows students in the third year of the PharmD program to begin work on a Pharmacy PhD program while completing the PharmD curricula. Through a judicious choice of electives and research rotations, such students can save up to two years on the total time required for the PhD program. Additional information can be found by reading the full program description.
For more information, please contact Dr. Danzhou Yang, the Associate Dean for Graduate Programs.

Continuing Education Programs

The College's continuing education programs offer several non-degree certificate programs.

Admissions (website)

College Advising (website)

Contact Information

Prospective Undergraduate and Professional Program Students

Contact the Office of Student Services for information regarding our degrees offered and/or to arrange a visit.
Phone: (765) 496-6885
E-mail: pharmacy-oss@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Contact Marie Martin-Murphy in the Office of Student Services for information on programs for under-represented populations.
Phone: (765) 494-1364
E-mail: mmartinm@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Contact PharmD Admissions for information about pre-pharmacy coursework completed off-campus.
Phone: (765) 496-3773
E-mail: pharmacy-admissions@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Current Students (website)

Future students (website)

Prospective Graduate Students

The College's graduate programs are administered by three departments in the College - Industrial and Molecular Pharmaceutics, Medicinal Chemistry and Molecular Pharmacology, and Pharmacy Practice (includes Pharmacy Administration). Contact the graduate program in which you are interested. Some faculty in the College participate in the University's interdisciplinary graduate programs, which can be contacted directly.

For general questions, contact Jaime Moffatt, Administrative Assistant for Graduate Affairs:
Phone: (765) 494-1362
Fax: (765) 494-7880
E-mail: jmoffat@purdue.edu
Office: Room 112 RHPH (Robert Heine Pharmacy Building)

College of Pharmacy Administration

Overview

The Purdue College of Pharmacy, consistently ranked among the 10 best pharmacy programs in the nation, offers a uniquely diverse range of undergraduate and graduate study opportunities. A total of 10 different programs and 700 pharmacy practice experiences prepare students for a range of top-paying careers in the fields of pharmacy, pharmaceutical sciences, and the health sciences.

Undergraduate and Professional Programs

The Purdue College of Pharmacy offers one undergraduate and one professional program:

- The Pharmaceutical Sciences, BS is a four-year undergraduate program that consists of multidisciplinary basic sciences related to drug discovery, development, and commercialization. A degree in this program does not allow graduates to become licensed pharmacists.
- The Pharmacy, Pharm.D is a four-year professional degree program, which requires completion of a recognized pre-pharmacy program. Successful completion of this degree allows you to sit for the licensing exam to practice pharmacy.

Faculty (website)

College of Pharmacy Administration Website (website)

Contact Information

Prospective Undergraduate and Professional Program Students
Contact the Office of Student Services for information regarding our degrees to arrange a visit.
Phone: (765) 496-6885
E-mail: pharmacy-oss@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Prospective undergraduate and professional students who are interested in visiting the College and learning about programs for under-represented populations are urged to contact the Office of Diversity Initiatives to arrange for their visit.

Contact PharmD Admissions for information about pre-pharmacy coursework completed off-campus.
Phone: (765) 496-3773
E-mail: pharmacy-admissions@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Pharmaceutical Sciences, BS

PHSC 10000 - Introduction To Pharmacy And Pharmaceutical Sciences

Credit Hours: 1.00. This first semester pre-pharmacy course is designed to provide the pre-pharmacy student with an introduction to the profession of pharmacy and to Purdue University College of Pharmacy. The topics presented in this course will allow the pre-pharmacy students to develop informed perspectives on: pharmacy summer employment opportunities for students; pharmacy career opportunities; current pharmacy practice trends; the importance of professionalism, values, and ethics as it pertains to the profession; resume and cover letter development; the College's curriculum, admissions process, and course registration process.

Learning Outcomes: 1. Describe various pharmacy career paths and opportunities. 2. Discuss professionalism as it relates to the profession. 3. Discuss current pharmacy practices trends in various settings. 4. Develop a resume. 5. Develop a cover letter. 6. Describe the College's admissions process. Credits: 1.00

PHSC 20000 - Introduction To Pharmacy And Admissions Process

Credit Hours: 2.00. A second orientation course to provide students interested in pre-pharmacy an introduction to the profession of pharmacy and to the Purdue University College of Pharmacy. Topics include personal development, academic program and career planning, pharmacy career opportunities, professionalism and ethics, and the Pharm.D. curriculum and the pharmacy admissions process. The course builds on PHPR 10000, but students are not required to have taken that course in order to enroll in this course.

Learning Outcomes: 1. Identify personal strengths and weaknesses and a plan to build on this knowledge. 2. Recognize the variety of traditional and non-traditional career options available in pharmacy. 3. Develop a personal plan for career development. 4. Reflect on how ethics and professionalism apply to the pharmacist's practice role. 5. Obtain information to be able to outline the content and structure of the Pharm.D. curriculum as well as to be able to explain the professional program application process. Credits: 2.00

PHSC 20100 - Bachelor Of Science In The Pharmaceutical Sciences Orientation II

Credit Hours: 1.00. This seminar course is designed to enhance the BSPS student's professional skills career exploration and prepare for post-graduation employment. It provides the academic content to link experiences in professional fields to study in Pharmaceutical Sciences as well as social, economic and intellectual forces that shape views and work experiences. The intent is to prepare the student to successfully transfer skills to workplace. Typically taken in the junior year. The course builds on IMPH 10000, but students are not required to have taken that course. The course consists of a mix of on-line modules and assignments and in-person class sessions.

Learning Outcomes: 1. Build on-the-job skills; and develop and cultivate professional skills and relationships. 2. Analyze self-assessment of performance, professional expectations and ethical issues involved with being professional. 3. Articulate how classroom-acquired knowledge applies to real-world situations. 4. Explore critical topics that will assist the transition into a professional environment. 5. Reflect on professional development goals and needs. Credits: 1.00

PHSC 20400 - Organic Chemistry I

Credit Hours: 3.00. A study of the compounds of carbon on a functional group basis, with particular emphasis on those organic compounds of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning

and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

PHSC 20401 - Organic Chemistry I Laboratory

Credit Hours: 1.00. Laboratory experiments to accompany PHSC 20400 performing laboratory experiments involving the methods of purification, reactions, and synthesis of organic compounds.

Learning Outcomes: 1. Perform lab exercises that demonstrate some of the principles studied in PHSC 20400 Organic Lecture. 2. Complete "dry lab" and "wet chemistry" experiments that directly relate to the contents that are covered in PHSC 20400 lecture. 3. Work together in groups to gather and analyze data in several lab exercises. Credits: 1.00

PHSC 20500 - Organic Chemistry II

Credit Hours: 3.00. PHSC 20500 is a continuation of PHSC 20400. You will learn the principles of organic chemistry with an emphasis on reactions of pharmaceutically important classes of compounds. This course presents organic chemistry concepts that are essential for understanding various topics in biochemistry and principles of drug action. You will continue to apply the fundamentals learned in general chemistry to the functional classes of compounds that are most important in pharmaceutical and biological chemistry.

Learning Outcomes: 1. Utilize the basic and advanced principles of organic chemistry to explain the chemical reactivity of various organic compounds. 2. Identify the functional groups present in various pharmaceutically and biochemically relevant compounds; be able to predict their physical and chemical behavior at physiological conditions. 3. Enhance critical thinking skills and be able to solve complex multi-step problems in a systematic manner. 4. Embrace the tenets of collaborative learning and interact with peers effectively in various professional as well as informal settings. Credits: 3.00

PHSC 20501 - Organic Chemistry II Lab

Credit Hours: 1.00. This course has been designed to help you apply the concepts of organic chemistry and to enhance your understanding of the subject. This lab is an extension of the PHSC 20401 laboratory, and you will continue to use the concepts and techniques that you learned in organic chemistry I.

Learning Outcomes: 1. Perform lab exercises demonstrating some of the principles studied in lecture. 2. Complete "wet chemistry" experiments directly related to the reactions that are covered in lecture. 3. Learn about and engage in several analytical and purification techniques like thin-layer chromatography and column chromatography. Credits: 1.00

PHSC 20800 - Biochemistry For Pharmaceutical Sciences

Credit Hours: 3.00. The overall objectives of this course are to increase students' biomedical understanding and knowledge and their ability to apply that understanding and knowledge. This requires the students in this course to learn and understand the facts, concepts, and formulaic processes, and to become skilled at applying what they have learned.

Learning Outcomes: 1. The student must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries: a. Basic principles of thermodynamics and kinetics and their role in defining chemical processes. b. The relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics. Credits: 3.00

PHSC 40000 - Research Methodology And Pharmacokinetic Concepts

Credit Hours: 1.00. This course is designed to provide students with a working knowledge of fundamental concepts in pharmacokinetics and research methodology. In particular, students will learn the importance of determining and deploying the pharmacokinetics of experimental therapeutic agents to appropriately design and analyze preclinical studies in drug discovery.

Learning Outcomes: 1. Define the concepts of clearance, volume of distribution, half-life, and systemic availability. 2. Define the key concepts

for quantifying drug response, including ED50, EC50, Emax, IC50, and TD50. 3. Describe the key elements of hypothesis formulation and testing. 4. Define the terms specificity, selectivity, and sensitivity as they regard to experimental data. 5. Use basic concepts of experimental methodology, design a basic study to determine the pharmacokinetics of a drug in a species after intravenous administration of an experimental drug. 6. Provide EC50 data from cell studies on the effects of an experimental drug, design a study to determine the dose needed to achieve the EC50 in a given species. 7. Formulate a hypothesis and design a study to determine the effects of an experimental agent on a model disease, including measures of reproducibility and appropriate data analysis. 8. Design a basic study to assess the reproducibility of an assay. Credits: 1.00

PHSC 42200 - Immunology

Credit Hours: 3.00. This course exposes students to the basic principles of immunology, teaches students to use those principles to understand the cause of immunological disease and the basis of immunoprophylaxis and immunotherapy, and provides students with sufficient information to understand the principles and challenges of gene therapy and the application of genomics to future drug development.

Learning Outcomes: 1. The basic components of the immune system and their roles in innate and adaptive immunity. 2. The development and function of lymphocytes in adaptive immunity. 3. The molecular basis of antibody diversity. 4. How antigens are recognized by T cells. 5. How B cells develop and function in the body. 6. How T cells develop in the body and differentiate into specialized subsets. 7. How lymphocytes undergo positive and negative selection. 8. How B cells and T cells are activated and participate in adaptive immunity. 9. The basis of MHC polymorphism and the role on the immune response. 10. How the complement system is activated and plays its role in immune responses. 11. How the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. How the body remembers a previous infection. 13. The types and causes of immunodeficiency diseases. 14. How infection with HIV affects the immune system. 15. How the immune system sometimes recognizes harmless antigens (allergic reactions). 16. How the immune system can damage healthy tissue. 17. The basis and practice of immunization. 18. How the immune system complicates organ transplantation. 19. How the immune system recognizes cancer cells and can be used to combat cancer. Credits: 3.00

PHSC 42400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy.

Learning Outcomes: 1. Understand the basic principles of pathophysiology and pharmacology. 2. Understand the basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and

effectively communicate with various audiences. 5. Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHSC 42800 - Dosage Forms I

Credit Hours: 3.00. The purpose of this course is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Provide an understanding of the relationship between dosage forms, the design of dosage forms, including how to turn molecules into medicines, and drug delivery and the physicochemical properties and structures of drug molecules. 2. Enable students to comprehend the underlying principles of drug product quality and be able to apply them to engage in critical thinking of drug stability, formulation, and delivery. 3. Recognize the importance of physiological conditions on the design, selection, and performance of dosage forms. 4. Build up the knowledge in drug development and delivery and develop problem-solving skills. 5. Build a solid foundation for understanding the role of formulations in drug therapy. Credits: 3.00

PHSC 42900 - Dosage Forms II

Credit Hours: 2.00. The purpose of this course is to educate beginning pharmacy students to thoroughly understand the basic physical-chemical principles involved in preparing liquid and semisolid dosage forms and controlled drug delivery systems used in the practice of pharmacy.

Learning Outcomes: 1. Explain the basic scientific principles involved in the performance of liquid dosage forms, including solution, emulsion, and suspension, and their chemical and physical stability. 2. Explain the basic scientific principles involved in controlled drug delivery and nanomedicine and list examples. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including transdermal and mucosal routes. 4. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and iso-osmolality, IV bags and drip sets. 5. Explain how biopharmaceuticals including peptides, proteins, and nucleic acids are formulated and advise on their handling in clinical pharmacy setting. 6. Advise patients on the proper use and storage of dosage forms and understand the relationship of dosage form selection to clinical outcomes. 7. Explain unique properties of veterinary products. Credits: 2.00

PHSC 43600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. The overall objective of this course is to expand students' knowledge of biochemistry obtained in the prerequisite one-semester Biochemistry course to understanding advanced aspects of human biochemistry related to pharmaceutical sciences.

Learning Outcomes: 1. Apply an advanced understanding and knowledge of biochemistry to pharmaceutical sciences and the practice of pharmacy. 2. Demonstrate advanced understanding of biochemistry including integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex

biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and the development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and the advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Understand the molecular basis of many idiopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseased of aberrant molecular transport; including the mechanisms of DNA damage and repair and the mechanisms of action of antimetabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented as well as demonstrate understanding of the each content area is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHSC 44400 - Drug Classes And Mechanisms

Credit Hours: 3.00. This course provides an overview of the major therapeutic classes of pharmaceuticals. It integrates basic principles of medicinal chemistry and pharmacology in order to achieve an understanding of drug mechanisms. The major classes of drugs that are covered are those targeting the autonomic nervous, endocrine system, cardiovascular system, renal system, respiratory system and central nervous system, in addition to chemotherapy drugs and drugs targeting infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease. Lectures will focus on representative drugs to illustrate key concepts related to mechanisms of action.

Learning Outcomes: 1. Attain knowledge and understanding of the major drug classes. 2. Attain knowledge of the relationships among mechanisms of action, drug interactions, and adverse reactions. 3. Gain the ability to critically analyze primary literature. 4. Gain an appreciation for research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. Credits: 3.00

PHSC 46000 - Drug Discovery And Development I

Credit Hours: 3.00. Focuses on the strategies, current methods and technologies used in early stage pre-clinical research to discover, validate and select lead drug candidates.

Learning Outcomes: 1. A variety of college outcomes related to: conceptual competence, scientific comprehension, integrative competence, critical thinking and decision-making abilities, communication skills and abilities, responsible use of professional values and ethical principles, and group interaction and citizenship. Credits: 3.00

PHSC 46100 - Drug Discovery And Development II

Credit Hours: 3.00. The course focuses on the process of drug development from pre-formulation to unit operations. The emphasis is on the scientific principles behind every step in moving from a drug molecule to its products.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the following theoretical foundations and apply these to basic anatomy/physiology, delivery of drugs from various dosage forms, relationship between chemical structure and dosage form selection, influences of pharmacokentics on formulation and dosage form design, unit operations of drug manufacturing. 2. Demonstrate comprehension of major scientific discoveries and methods. 3. Be able to use mathematical variables to analyze physical and pharmacokentic properties of a drug compound. 4. Meld theory and abilities in a practical setting to identify and provide solutions of related problems. 5. Examine issues rationally logically, and coherently. 6. Be able to read, write, speak, listen, use data, media, and appropriate technologies to send and respond effectively to communications for

varied audiences and purposes. 7. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances, in particular, working together in their term-projects. Credits: 3.00

PHSC 48500 - Intercultural And Global Health Issues

Credit Hours: 2.00. This course is designed to meet the University Embedded Outcomes of Intercultural Knowledge, and Global Citizenship and Social Awareness. Students will discuss and develop presentations (verbal and written) about various intercultural and global health issues.

Learning Outcomes: 1. Examine health issues that have global and/or cross-cultural impact. 2. Identify and articulate personal insights about intercultural and global health issues. 3. Develop and present an oral and poster presentation in a seminar fashion. Credits: 2.00

RPMP 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Outcomes will be determined between the instructor and student based on specific projects. Credits: 1.00 to 3.00

RPMP 49100 - Introduction To Nuclear Pharmacy

Credit Hours: 1.00. This course will serve as an introduction to nuclear pharmacy practice and serve as the first course in the nuclear pharmacy elective series. Successful completion of the nuclear pharmacy series can be used to meet the 200 hour didactic training requirement set forth by the Nuclear Regulatory Commission (NRC) towards achieving Authorized User status. This course will provide basic information about the profession of nuclear pharmacy, as well as an introduction to radioactive material and radiation safety concepts. The course will conclude with guest lectures from practitioners in several different areas of nuclear pharmacy practice to provide information about the different areas of practice available to nuclear pharmacists.

Learning Outcomes: 1. Describe nuclear pharmacy and nuclear medicine and the role of these areas of practice. 2. Review the history of nuclear pharmacy practice. 3. Understand concepts relating to the medical use of ionizing radiation. 4. Identify methods used to monitor and minimize radiation exposure. 5. Recognize basic principles of radiation biology and how radiation interacts with humans. 6. Understand the role of radiation monitoring in nuclear pharmacy practice. 7. Review basic regulatory oversight for nuclear pharmacy and PET pharmacy practice. 8. Describe the role of nuclear pharmacists in various practice settings. Credits: 1.00

RPMP 49200 - Basics Of Nuclear Pharmacy Practice

Credit Hours: 2.00. This course emphasizes some of the daily tasks performed by nuclear pharmacists when working in the nuclear pharmacy.

Learning Outcomes: 1. Understand the fundamentals of radiation and radiation safety. 2. Know the principles of instrumentation used in nuclear pharmacy and understand the use of these instruments as related to daily practice. 3. Understand the theoretical foundations of the profession of nuclear pharmacy. 4. Meld theory and abilities in the practice setting. 5. Develop a basic knowledge base to enable a student to practice the profession (ex. summer internships). Credits: 2.00

RPMP 49300 - Regulatory Considerations For Nuclear Pharmacy Practice

Credit Hours: 2.00. This is the second course in the nuclear pharmacy series, with an emphasis on the regulatory oversight of nuclear pharmacy practice. While the previous course dealt with radiation safety issues, this course outlines how these safety skills relate to the regulatory requirements set forth by the various regulatory agencies.

Learning Outcomes: 1. Provide a basic overview of the various regulatory agencies that oversee nuclear pharmacy practice. 2. Relate practical radiation safety skills and tasks to their

regulatory requirements. 3. Utilize clinical reasoning skills to address practical related problems. Credits: 2.00

RPMP 49400 - Clinical Aspects Of Nuclear Pharmacy Practice

Credit Hours: 2.00. This course will be offered as a lecture course with some interactive discussion and problem solving applications. In addition, students will be required to complete several distance learning activities that relate to/enhance the materials that will be covered in the lecture period. This course is the final course in the NUPH series that can be used to count toward the 200 hours of didactic training required for Authorized Nuclear pharmacist (ANP) status.

Learning Outcomes: 1. Understand the principles of drug design, radiopharmaceutical chemistry, product compounding and clinical applications as they apply to the currently available radiopharmaceutical products. 2. Understand the differences between SPECT and PET radiopharmaceuticals. 3. Understand the role of nuclear medicine procedures in the diagnostic and therapeutic workup of patients with certain clinical conditions. Credits: 2.00

RPMP 49500 - Applied Nuclear Pharmacy

Credit Hours: 3.00. This is the 4th course offered in the nuclear pharmacy series, with an emphasis on the skills needed for the preparation and dispensing of radiopharmaceuticals, with additional focus on the importance of quality assessment. In addition, we will emphasize clinical problem-solving skills to identify sources of problems that may occur during preparation or imaging when using various radiopharmaceuticals.

Learning Outcomes: 1. Understand the various techniques specific to the preparation of a variety of radiopharmaceutical products. 2. Enhance skills in kit selection, specific compounding requirements, radiochemical purity testing and dispensing of final doses for patient use. 3. Utilize practical pharmaceutical compounding skills including sterile product preparation guidelines as they apply to radiopharmaceutical preparation. 4. Utilize critical thinking skills to identify and problem-solve operational and clinical problems that arise when preparing various radiopharmaceuticals. Credits: 3.00

RPMP 49600 - Case Studies In Clinical Nuclear Medicine

Credit Hours: 1.00 or 2.00. Introduction to the clinical applications of radiopharmaceutical drug products and the associated practice of nuclear medicine, through analysis of a series of current clinical case studies. Factors examined include: patient medical history, with emphasis on recent diagnostic procedures and pharmacotherapy; radiopharmaceutical selection, dosage, and preparation; possible contraindications for the nuclear medicine procedure and associated interventional agents; diagnostic findings; and the impact of study outcome on subsequent patient treatment. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Independent study regarding Radiopharmaceutical case studies. Credits: 1.00 or 2.00

Department of Industrial & Molecular Pharmaceutics

Overview

The Department of Industrial & Molecular Pharmaceutics (IMPH) is involved in teaching and research in pharmaceutics, with emphasis on the following three minors: industrial pharmacy, pharmacokinetics/biopharmaceutics, and physical pharmacy.

Welcome to the Purdue University Department of Industrial & Molecular Pharmaceutics! This is the place to find out more about our department's ongoing research, graduate degree programs, recent news and upcoming events.

Our mission is:

- **to educate and train students** to become leading pharmaceutical scientists and pharmacists
- **to advance scientific discovery and development**, with an emphasis on pharmaceutical formulation, manufacturing and drug delivery, and
- **to contribute** to the advancement of the pharmaceutical sciences through outreach and public service.

We're an academic department within the College of Pharmacy, located in the R. E. Heine Pharmacy Building (RHPH) on the

main (West Lafayette) campus of Purdue University. For contact information, please see the Administration page.
Eric J. Munson, PH.D.
Dane O. Kildsig Chair and Department Head
Dept. of Industrial & Molecular Pharmaceutics

Faculty (website)

College of Pharmacy Administration Website (website)

Department of Industrial & Molecular Pharmaceutics (website)

Contact Information

Industrial & Molecular Pharmaceutics
Postal address:
Department of Industrial & Molecular Pharmaceutics, Purdue University
Heine Pharmacy Building
575 Stadium Mall Drive
West Lafayette, IN 47907-2091
Phone: (765) 494-1450
Fax: (765) 494-6545
Office: RHPH 124A (Robert E. Heine Pharmacy Building)

Graduate Information

For Graduate Information please see Industrial and Molecular Pharmaceutics Graduate Program Information .

IMPH 10000 - Pharmaceutical Sciences Orientation

Credit Hours: 1.00. An orientation course for incoming freshmen or CODO students enrolled in the Bachelor of Sciences in the Pharmaceutical Sciences program. Provides an introduction to the scope of the program, the career opportunities for graduates, the curriculum rationale, and the faculty and staff support structure.

Credits: 1.00

IMPH 45100 - Industrial Practical Training

Credit Hours: 1.00. Course allows students to gain practice-related employment experience in industrial pharmacy. Students receive credit for practical experience in the session when they participate in the practical experience and complete the course paper requirement. Pre-approval of enrollment through ISS is required prior to employment experience. Permission of instructor required.

Learning Outcomes: 1. Ensure pharmaceutical science students receive early exposure to the most common career paths taken by today's graduates and gain a first-hand perspective of industry responsibilities and activities in their roles. This contributes to a foundation for gaining appreciation of the strategies for continually evolving requirements and skills in industry. 2. Provides pharmaceutical science students with opportunities to have early in their program observation of scientists providing services, particularly those that address Pharmaceutical Science Outcome Ability Goals. These include Conceptual Competence, Scientific Comprehension, Mathematical Competence, Integrative Competence, Critical Thinking and Decision Making Abilities, Communication Skills and Abilities, Responsible Use of Professional Values and Ethical Principles, Social Awareness and Social Responsibility, Professional Abilities and Habits, and Group Interaction and Citizenship. See the ""Student Handbook"" for specific descriptions of the components of these outcome abilities. 3. Provide pharmaceutical science students with early industry exposure that illustrates the reasons they need in-depth learning of the basic and applied sciences and a commitment to lifelong learning for professional effectiveness. 4. Provide pharmaceutical science students with experiences and learning in applications that are essential to evolving professional responsibilities in an industrial setting. 5. Contribute to pharmaceutical science student

development as well as providing the vision and motivation to become a positive scientific influence or change agent. 6. Broaden students' perspectives on career pathways and foster initiatives to enhance career planning. Credits: 1.00

IMPH 49000 - Special Topics

Credit Hours: 1.00 to 6.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest, utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 6.00

Department of Medicinal Chemistry and Molecular Pharmacology

Overview

The mission of the Department of Medicinal Chemistry and Molecular Pharmacology (MCMP) is to serve the citizens of Indiana, the United States and the world through discovery, learning and engagement that integrates the basic chemical and biological sciences for the improvement of human health. The Department of MCMP is an academic department in the College of Pharmacy. It is located in the R. E. Heine Pharmacy Building (RHPH) and in the Arthur E. Hansen Building (HANS) on the main (West Lafayette) campus of Purdue University.

Faculty (website)

Department of Medicinal Chemistry and Molecular Pharmacology (website)

Contact Information

Postal address

Department of Medicinal Chemistry and Molecular Pharmacology
Purdue University
R. E. Heine Building
575 Stadium Mall Drive
West Lafayette, IN 47907-2091

Campus Mail Address

MCMP, RHPH

Main Office

Room 202, Robert E. Heine Pharmacy Building
Phone: (765) 49-41403
Fax: (765) 49-41414

Graduate Program Inquiry

Phone: (800) 563-3568
Email: mcmp_grad_prog@pharmacy.purdue.edu

Graduate Information

For Graduate Information please see Medicinal Chemistry and Molecular Pharmacology Graduate Program Information .

MCMP 49000 - Special Topics

Credit Hours: 1.00 to 3.00. A course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest, utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Credits: 1.00 to 3.00

Department of Pharmacy Practice

Overview

The Department of Pharmacy Practice (PHPR) at Purdue

University is an academic department in the College of Pharmacy. It is located in the R. E. Heine Pharmacy Building on the main (West Lafayette) campus of the University and also has facilities in Sidney & Lois Eskenazi Hospital on the Indiana University Medical Center campus in Indianapolis. See the Administration page for information on how to contact the Department of Pharmacy Practice.

The mission of the Department of Pharmacy Practice is to demonstrate excellence through performance in the areas of discovery, learning, and engagement. The Department consists of 20 tenure-track faculty, 22 clinical faculty, and over 600 affiliate faculty preceptors. Many faculty practice in specialized areas such as: drug information, critical care, ambulatory medicine, cardiology, outcomes research, infectious disease, pharmacokinetics/pharmacodynamics, managed care, and pharmacy administration.

The experience and knowledge of the faculty of the Department of Pharmacy Practice enable professional degree students to receive excellent didactic and experiential training necessary to become well-rounded practitioners. The professional curriculum includes general, scientific, and patient centered content that prepares Doctor of Pharmacy graduates to deliver effective and cost-efficient pharmaceutical care.

The Department of Pharmacy Practice supports the College of Pharmacy's vision by:

- Providing education to students that enables them to acquire in-depth expertise in the pharmaceutical, social/economic management, and related sciences in order to function as educators and scientists in higher education, government service, and the pharmaceutical and healthcare industries
- Serving the community by engaging in scholarly activities that lead to improvements in healthcare delivery and enhance health outcomes
- Fostering innovation in research through interdisciplinary collaboration with other schools/colleges within Purdue, other national/international universities, and pharmacy practitioners to enhance to profession body of knowledge resulting in practice advancement
- Contributing to the profession of pharmacy by participation in leadership roles in pharmaceutical organizations and community programs

The Department also has extensive research opportunities for graduate and post-graduate pharmacists leading to M.S. and Ph.D. degrees in either Clinical Pharmaceutical Sciences or Health Services Outcomes and Policy. The Graduate Academic Program is directed toward the education and maturation of pharmacists in principles and techniques of research dealing with problems in the clinical, administrative, and educational aspects of pharmacy. These programs also encourage students to develop sound teaching techniques through appropriate coursework and supervised experience.

Pharmaceutical Sciences Website

Graduate Information

For Graduate Information please see Pharmacy Practice Graduate Program Information .

CLPH 43500 - Pediatric Pharmacotherapy

Credit Hours: 2.00. This elective course will focus on the pharmacotherapeutics and pathophysiology of the more common disorders that apply to the pediatric population. The purpose of the course is to discuss the relevant differences between the adult and pediatric population in regards to the diagnosis, treatment options, desired therapeutic outcomes and therapeutic drug monitoring parameters. Instruction will be provided through a combination of lectures, case discussions, homework assignments, and group presentations.

Credits: 2.00

CLPH 44800 - Therapeutic Case Studies

Credit Hours: 2.00. This course is intended to complement instruction of other courses in the second professional year of the Doctor of Pharmacy curriculum and to review many of the topics previously addressed in the Integrated Pharmacotherapy courses and Professional Program Laboratories. It is hoped that students who elect this course will enhance their development of a strong foundation of knowledge, clinical skills and abilities in order to meet the school's professional outcome abilities. Team-based problem-solving methodology will be utilized to discuss patient cases related to topics covered in the IP sequence.

Learning Outcomes: 1. Demonstrate knowledge, skills, and attitudes about drug therapy monitoring and intervention, interpretation of patient and laboratory data, patient interviewing, and interpretation/resolution of drug interactions. 2. Apply material from previous and current course work in the curriculum to cases and scenarios involving patients from a variety of patient care

settings. 3. Demonstrate clinical decision making skills related to the generation of treatment algorithms for disease-based management and pharmaceutical care plans for individual patients. 4. Demonstrate verbal communication skills with both patients and other health care professionals through class discussions, role playing, and group interaction. 5. Describe and demonstrate basic physical assessment skills necessary to monitor drug therapy. 6. Exhibit knowledge of generic names, brand names, and dosing of commonly used drug products. 7. Describe the professional role of the pharmacist in providing pharmaceutical care to a diverse patient population with a variety of patient care needs in different settings. Credits: 2.00

CLPH 44900 - Introduction To Psychiatric Pharmacy Practice

Credit Hours: 1.00. This course that provides an overview of psychiatric pharmacy practice, introduction to stigma and diversity issues in mental illness, and disease state overviews in a lecture format. In one class period, the students are able to interact with 4th year pharmacy students and/or pharmacy residents who have worked or are working in the area of psychiatric pharmacy. Four of the class periods also provide live presentations and interactions with persons living with severe mental illness and mental health workers who work with them. Mental Health America of Tippecanoe County works with the instructor to schedule these live presentations. Students are assessed for attendance and participation and also for a reflection written about each class period.

Credits: 1.00

CLPH 45000 - Formulary Dossier Management

Credit Hours: 1.00. This course will focus on preparing students for competing in the annual Academy of Managed Care Pharmacy (AMCP) P&T Competition and is intended to give students a variety of experiences that will enhance their knowledge in analyzing complex therapeutic and pharmacoeconomic data, research and public presentation. The course offers an opportunity for students to engage in simulated formulary management by utilizing comparative studies andcost-effectiveness analysis to make real-life decisions on whether or not to add a drug to hospital or health plan formulary. Students will be paired into teams with each team consisting of 4 students. Each team will work independently to analyze the product dossier and prepare a monograph and presentation for the local and/or national competition. Course lectures will focus on information needed to accurately and adequately prepare students in completing the above noted tasks. Class participation is expected, and students will need to be able to engage in selfdirected learning outside of class to complete the project in a timely manner. All students are welcome. This course is not intended to focus on students from a specific professional year.

Learning Outcomes: 1. Demonstrate the ability to accurately and reliably analyze drug information sources. 2. Demonstrate understanding of basic statistical methodologies used in clinical trials and research design. 3. Demonstrate the ability to accurately interpret pharmacoeconomic data with respect to its impact on new medical treatments. 4. Demonstrate effective written communication skills with regards to monograph composition and presentation. 5. Demonstrate effective public speaking and presentation skills by conduction a PowerPoint presentation in a confident, organized and engaging manner. 6. Demonstrate the ability to reliably critique journal articles and clinical research trials based on design, methodology and results and to accurately assess statistical and clinical significance. Credits: 1.00

CLPH 45100 - Pharmacy Practical Training

Credit Hours: 1.00. Course allows students to gain practice-related employment experience in a pharmacy setting. Pre-approval of enrollment through ISS is required prior to employment experience. Permission of instructor required.

Learning Outcomes: 1. Ensure pharmacy students receive early exposure to the most common career paths taken by today's graduates and gain a first-hand perspective of pharmacists' responsibilities and activities in their roles. This contributes to a foundation for gaining appreciation of strategies for continually evolving patient care roles in practice. 2. Provide pharmacy students with early

observation of pharmacists providing pharmacy services that particularly address the following Professional Program (Pharm.D.) Outcome Ability Goals: Integrative (Practice-related) Competence, Critical Thinking and Decision Making Abilities, Communication Skills and Abilities, Responsible Use of Professional Values and Ethical Principles, Social Awareness and Social Responsibility, Professional Abilities and Habits, and Group Interaction and Citizenship. See the ""Student Handbook"" for specific descriptions of the components of these outcome abilities. 3. Provide pharmacy students with early practice exposure that illustrates the reasons that pharmacists need in-depth learning of the basic and applied sciences and a commitment to lifelong learning for professional effectiveness. 4. Provide pharmacy students with experiences and learning in care-giving that is essential to evolving a patient-centered care role. 5. Contribute to pharmacy student development of a personal practice philosophy (professionalization) as well as a vision and motivation to become a positive practice change agent. 6. Broaden students' perspectives on career pathways and foster initiatives to enhance career planning. Credits: 1.00

CLPH 45300 - Advanced Primary Literature Evaluation: A Focus On Therapeutic Issues

Credit Hours: 2.00. The purpose of this elective course is to enhance the primary literature evaluation skills of the student prior to clerkship rotations. The course is designed to meet the needs of students with an interest in pursuing post-graduate training programs to enhance their ability to discuss the medical literature. Instruction is provided through a combination of lectures and class discussions of recently published literature articles with a cardiovascular focus.

Learning Outcomes: 1. At the completion of this course, the student will be able to: 2. Discuss the basic fundamentals of clinical research. 3. Understand and interpret statistical data in the published literature. 4. Evaluate published literature as it pertains to study design, validity of results and application to treatment of specific patients and practice. 5. Explain research outcomes from a clinical, economic and humanistic standpoint. 6. Discuss the strengths/weaknesses of published current primary literature. 7. Present a journal club and debate current primary literature. Credits: 2.00

CLPH 45400 - Advanced Practice In Psychiatric Pharmacy

Credit Hours: 2.00. The purpose of this course is to provide the student with knowledge and insight regarding the use of medications in persons with mental illness. Instruction will be provided in the following areas (but not limited to): (1) psychiatric disease states; (2) psychiatric medications - usual dosing, adverse effects, drug interactions; (3) clinical use of psychiatric medications in psychiatric pharmacy practice; (4) useful and appropriate monitoring parameters; (5) the interaction of medical illness in the treatment of psychiatric disorders; (6) strategies to improve medication adherence and minimize adverse events; (7) utilization of recognized treatment guidelines in clinical care. Case-based learning will be utilized to emphasize important points in clinical use and monitoring of psychiatric medications and disorders. Permission of instructor required.

Learning Outcomes: 1. Define and understand the DSM-IV, TR diagnostic criteria for selected psychiatric disorders. 2. Recognize significant co-morbid psychiatric and medical disorders common in the psychiatric population. 3. Classify psychiatric medications based upon FDA-approved and evidence-based reasons for use. 4. Characterize psychiatric medications based upon common reason for use, neuropharmacology and mechanism of action, significant adverse events & warnings for use, drug interactions, dosage forms, and usual dose ranges. 5. Develop techniques for the critical evaluation of psychiatric literature. 6. Apply the psychiatric literature to the clinical treatment of psychiatric disorders. 7. Identify applicable treatment guidelines and develop strategies for implementing guidelines in clinical practice. 8.

Discuss the impact of substance dependence upon the treatment of psychiatric illness. 9. Identify drug interactions and adverse events related to complicated psychiatric medication regimens and make sound recommendations for drug therapy. 10. Identify potential medication adherence issues and made recommendations to improve medication use and patient outcomes in clinical practice. 11. Develop an understanding of the psychiatric treatment team and the role of the pharmacist. 12. Apply knowledge learned to clinical case examples. 13. Proactively participate and interact during in-class case discussions. Credits: 2.00

CLPH 45700 - Pharmaceutical Care In Developing Countries

Credit Hours: 2.00. This elective will emphasize the major disease states, rational drug selection, especially with a limited medication formulary, desired therapeutic outcomes, and the provision of complete pharmaceutical care to patients in developing countries. The impact of drug therapy on health care, economics, and quality of life for diverse populations will be emphasized. Students will prepare to provide care in a cross-cultural environment in which resources are limited. Instruction is provided through a combination of lectures, discussions, and presentations. Enrollment is limited to Doctor of Pharmacy students (068) DP-C status or by consent of course coordinator.

Credits: 2.00

CLPH 45900 - International Advanced Pharmacy Practice Experience Preparation

Credit Hours: 1.00. This course is designed to help students who are participating in rotations based in London, Wales, Kenya or Colombia be prepared to practice upon arrival into your specified country. The course content will include intercultural learning, travel preparation and practice site knowledge. Permission of department and instructor permission required.

Learning Outcomes: 1. Develop an understanding of local culture and the impact on patient care and travel in London/Colombia/Wales/Kenya. 2. Recognize the patient care process in the setting (UK, Kenya, Colombia) and how this will be utilized to care for patients and provide pharmaceutical care. 3. Identify the appropriate steps of the travel preparation process. 4. Describe the four core competencies associated with intercultural learning. 5. Recognize learning styles, communications styles and Hofstede's continua in the context of international experiences and pharmacy practice. 6. Recognize conflict styles and how this may relate to working abroad. 7. Recognize empathy, compassion, openness and their role in healthcare. Credits: 1.00

CLPH 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course to be used to relate to, and supplement, an existing course. Subject matter and method of approach individually directed by instructor. Permission of instructor required.

Credits: 1.00 to 3.00

HSOP 45200 - Social Aspects Of Pharmacy Practice

Credit Hours: 2.00. A survey of selected social and behavioral models and related issues that affect the contemporary practice of pharmacy. Special emphasis is given to the interdependent roles of the patient, the pharmacist, and the physician.

Credits: 2.00

HSOP 46800 - Community Pharmacy Management

Credit Hours: 3.00. Principles, practices, and case studies related to the organization, operation, and control of community pharmacies.

Credits: 3.00

HSOP 48200 - Marketing Pharmaceutical Products

Credit Hours: 2.00. Examination of the channels of distribution for pharmaceutical products, including research-intensive and generic manufacturers, drug wholesalers, independent and chain community pharmacies, non-pharmacy retailers, prescription benefit managers, and third-party payers. Areas of special emphasis include new product development, product distribution, advertising and promotion, Rx-to-OTC switching, and product pricing and payment policies.

Credits: 2.00

HSOP 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Credits: 1.00 to 3.00

NUPH 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course for superior students to be used in relation to, and to supplement, an existing course; an in-depth approach to topics of current interest utilizing the original literature as prime source material. A laboratory project may be included. Permission of instructor required.

Credits: 1.00 to 3.00

NUPH 49100 - Introduction To Nuclear Pharmacy

Credit Hours: 1.00. This course will serve as an introduction to nuclear pharmacy practice and serve as the first course in the nuclear pharmacy elective series. Successful completion of the nuclear pharmacy series can be used to meet the 200 hour didactic training requirement set forth by the Nuclear Regulatory Commission (NRC) towards achieving Authorized User status. This course will provide basic information about the profession of nuclear pharmacy, as well as an introduction to radioactive material and radiation safety concepts. The course will conclude with guest lectures from practitioners in several different areas of nuclear pharmacy practice to provide information about the different areas of practice available to nuclear pharmacists.

Learning Outcomes: 1. Describe nuclear pharmacy and nuclear medicine and the role of these areas of practice. 2. Review the history of nuclear pharmacy practice. 3. Understand concepts relating to the medical use of ionizing radiation. 4. Identify methods used to monitor and minimize radiation exposure. 5. Recognize basic principles of radiation biology and how radiation interacts with humans. 6. Understand the role of radiation monitoring in nuclear pharmacy practice. 7. Review basic regulatory oversight for nuclear pharmacy and PET pharmacy practice. 8. Describe the role of nuclear pharmacists in various practice settings. Credits: 1.00

NUPH 49200 - Basics Of Nuclear Pharmacy Practice

Credit Hours: 1.00. This course emphasizes some of the daily tasks performed by nuclear pharmacists when working in the nuclear pharmacy.

Learning Outcomes: 1. Understand the fundamentals of radiation and radiation safety. 2. Know the principles of instrumentation used in nuclear pharmacy and understand the use of these instruments as related to daily practice. 3. Understand the theoretical foundations of the profession of nuclear pharmacy. 4. Meld theory and abilities in the practice setting. 5. Develop a basic knowledge base to enable a student to practice the profession (ex. summer internships). Credits: 1.00

NUPH 49300 - Regulatory Considerations For Nuclear Pharmacy Practice

Credit Hours: 2.00. This is the second course in the nuclear pharmacy series, with an emphasis on the regulatory oversight of nuclear pharmacy practice. While the previous course dealt with radiation safety issues, this course outlines how these safety skills relate to the regulatory requirements set forth by the various regulatory agencies.

Learning Outcomes: 1. Provide a basic overview of the various regulatory agencies that oversee nuclear pharmacy practice. 2. Relate practical radiation safety skills and tasks to their regulatory requirements. 3. Utilize clinical reasoning skills to address practical related problems. Credits: 2.00

NUPH 49400 - Clinical Aspects Of Nuclear Pharmacy Practice

Credit Hours: 2.00. This course will be offered as a lecture course with some interactive discussion and problem solving applications. In addition, students will be required to complete several distance learning activities that relate to/enhance the materials that will be covered in the lecture period. This course is the final course in the NUPH series that can be used to count toward the 200 hours of didactic training required for Authorized Nuclear pharmacist (ANP) status.

Learning Outcomes: 1. Understand the

principles of drug design, radiopharmaceutical chemistry, product compounding and clinical applications as they apply to the currently available radiopharmaceutical products. 2. Understand the differences between SPECT and PET radiopharmaceuticals. 3. Understand the role of nuclear medicine procedures in the diagnostic and therapeutic workup of patients with certain clinical conditions. Credits: 2.00

NUPH 49500 - Applied Nuclear Pharmacy

Credit Hours: 2.00. This is an elective course that consists of lecture, laboratory, and distance education components which will count as part of the 200 hours of didactic training required for Authorized Nuclear Pharmacist (ANP) status. This course focuses on the preparation, dispensing and clinical applications of radiopharmaceutical products.

Learning Outcomes: 1. Understand the preparation of a variety of radiopharmaceutical products. 2. Enhance skills in kit selection, product specific compounding requirements, radiochemical purity testing and dispensing of final doses for patient use. 3. Utilize practical pharmaceutical compounding skills including sterile product preparation guidelines as they apply to radiopharmaceutical preparation. 4. Identify clinical applications of products being prepared in the nuclear pharmacy laboratory. 5. Identify and problem solve clinical issues related to various radiopharmaceuticals. Credits: 2.00

NUPH 49600 - Case Studies In Clinical Nuclear Medicine

Credit Hours: 1.00 or 2.00. Introduction to the clinical applications of radiopharmaceutical drug products and the associated practice of nuclear medicine, through analysis of a series of current clinical case studies. Factors examined include: patient medical history, with emphasis on recent diagnostic procedures and pharmacotherapy; radiopharmaceutical selection, dosage, and preparation; possible contraindications for the nuclear medicine procedure and associated interventional agents; diagnostic findings; and the impact of study outcome on subsequent patient treatment. Permission of instructor required.

Credits: 1.00 or 2.00

PHPR 42700 - Pharmacy Leadership Seminar

Credit Hours: 2.00. This course is specifically designed to mentor enthusiastic leaders and enhance their ability to become an effective leader in the practice of pharmacy. The objective of this course is not to build a leader, rather to augment the characteristics the particular leader possesses. Students have the opportunity to partake in a variety of activities including the development of a proposal with implementation plan to address a current school-wide issue. A variety of outside speakers share their leadership experiences with the class. The course has a maximum enrollment and requires instructor approval to enroll. Students interested in enrolling in the course must submit a course application packet. Students are assessed on written reflections, oral presentation, written reports, and a group project.

Credits: 2.00

PHPR 45000 - Introduction To Institutional Pharmacy Practice

Credit Hours: 1.00. An overview of the delivery of pharmaceuticals and the provision of clinical and administrative services to patients in institutional settings is presented along with the various roles pharmacists play both within the pharmacy department and the institution. Course content focuses on the provision of services and career development rather than on drug therapy. The course features a series of presentations by practitioners from a variety of practice settings. Enrollment is limited to Doctor of Pharmacy students or by consent of course coordinator.

Credits: 1.00

PHPR 45500 - Medicare In Pharmacy Practice

Credit Hours: 1.00. Elective course providing an in-depth review of Medicare and related topics beyond that covered in the core curriculum. A service-learning component involving hands-on experience with Medicare beneficiaries is part of the course requirements.

Credits: 1.00

PHPR 48000 - Self-Care Pharmacy Practice I

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme

throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem-solving process. Course activities, readings and homework assignments will provide students with illustration of how the problem-solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Colds, Coughs, Allergies.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48200 - Self-Care Pharmacy Practice II

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem-solving process. Course activities, readings and homework assignments will provide students with illustration of how the problem-solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Gastrointestinal Disorders.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48300 - Self-Care Pharmacy Practice III

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem solving process. Course activities, readings and homework assignments will provide students with illustration of how the problem solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Dermatology.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given

category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48400 - Self-Care Pharmacy Practice IV

Credit Hours: 1.00. This course is specifically designed to provide students with guided experience in the application of knowledge acquired during previous professional course work to the solution of simulated problems which occur in self-care pharmacy practice. Specifically, the course is designed to introduce students to the appropriate selection and use of nonprescription medications and devices for the treatment of minor health complaints by patients. A principle theme throughout the course is that the solution of all self-care problems (i.e., regardless of the context in which they occur) involves the application of the same basic problem-solving process. Course activities, readings and homework assignments will provide students with illustration of how the problem-solving process can be applied to specific self-care situations that arise in practice. Active learning methods will be employed to involve students directly in the actual application of this process to simulated practice problems. Topics: Determined by students taking PHPR 48300.

Learning Outcomes: 1. Identify underlying cause(s). 2. Identify common signs and symptoms. 3. Recognize category I active ingredients in a given nonprescription drug category. 4. Identify common side effects for a given category of nonprescription drugs. 5. Identify contraindications to the use of a given category of nonprescription drugs or devices. 6. Recognize information that should be shared with patients relative to the use of a nonprescription drug or device in a given category. 7. Identify indications for use of a nonprescription drug or device in a given category. 8. Recognize nondrug measures commonly employed its treatment or prevention. 9. Recommend an appropriate course of action for a given patient who seeks self-care advice. Credits: 1.00

PHPR 48600 - Beyond Ecstasy

Credit Hours: 1.00. The goal of the course is to augment the students' knowledge about commonly used street drugs including: pharmacology and mechanisms of action; interactions and adverse effects; law enforcement and policing; available support and treatment for addiction, abuse, and misuse; and the role of pharmacists.

Learning Outcomes: 1. Explain the role of the pharmacist in the prevention, treatment, and recovery process of addiction/substance abuse. 2. Discuss treatment agreements for controlled substance use. 3. List signs and symptoms of addiction and toxicities associated with street drugs. 4. Describe community-based programs designed to treat addicts. Credits: 1.00

PHPR 48900 - Complementary And Alternative Medicine

Credit Hours: 1.00. This course is intended to expose students in health care fields to alternative health care practices used by people around the world.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the theoretical foundations of the profession and apply these to individual practice settings. 2. Meld theory and abilities in the practice setting to enhance positive patient outcomes. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 5. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. 6. Demonstrate an understanding of self, the

strengths and challenges of cultural diversity, and the historic responses of society in times of rapid change. 7. Effectively self-asses and satisfy learning and continuous professional development on an ongoing basis. 8. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances. Credits: 1.00

PHPR 49000 - Special Topics

Credit Hours: 1.00 to 3.00. An honors course to be used to relate to, and supplement, an existing course. Subject matter and method of approach individually directed by instructor. Permission of instructor required.

Credits: 1.00 to 3.00

PHRM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 31600 - Drug Abuse/Addiction Education

Credit Hours: 1.00. An overview of alcoholism and other chemical addictions. Students are given the information and experience necessary to present a five-hour drug abuse education program to the public and specifically middle school students. Course is taught by undergraduate pharmacy students with oversight by staff.

Learning Outcomes: 1. Describe the pharmacology involved with classes and specific substances of abuse. 2. Discuss aspects (i.e., social, genetic predisposition, intervention, treatment) associated with the disease of chemical addiction. 3. Describe the role of the Pharmacist Recovery Network (PRN). 4. Present a drug abuse/addition program (5 hours) to a class of sixth grade students. Credits: 1.00

PHRM 38199 - Industrial Practice I

Credit Hours: 1.00. Professional practice of pharmaceutical sciences in industry. Comprehensive written report of this experience required. For cooperative program students only enrolled in the College of Pharmacy. Permission of Department required.

Learning Outcomes: 1. Applying fundamental principles of the pharmaceutical sciences studied in the classroom environment. 2. Learning to work effectively with others and in teams. 3. Clarifying opportunities best suited to individual aptitudes and interests. 4. Gaining confidence in the application of skills and abilities. 5. Developing foundation for transition into the job environment following graduation. Credits: 1.00

PHRM 38299 - Industrial Practice II

Credit Hours: 1.00. Professional practice of pharmaceutical sciences in industry. Comprehensive written report of this experience required. For cooperative program students only enrolled in the College of Pharmacy. Permission of Department

required.

Learning Outcomes: 1. Applying fundamental principles of the pharmaceutical sciences studied in the classroom environment. 2. Learning to work effectively with others and in teams. 3. Clarifying opportunities best suited to individual aptitudes and interests. 4. Gaining confidence in the application of skills and abilities. 5. Developing foundation for transition into the job environment following graduation. Credits: 1.00

PHRM 38399 - Industrial Practice III

Credit Hours: 1.00. Professional practice of pharmaceutical sciences in industry. Comprehensive written report of this experience required. For cooperative program students only enrolled in the College of Pharmacy. Permission of Department required.

Learning Outcomes: 1. Applying fundamental principles of the pharmaceutical sciences studied in the classroom environment. 2. Learning to work effectively with others and in teams. 3. Clarifying opportunities best suited to individual aptitudes and interests. 4. Gaining confidence in the application of skills and abilities. 5. Developing foundation for transition into the job environment following graduation. Credits: 1.00

PHRM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in pharmacy. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and team work. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHRM 39699 - Pharmaceutical Science Internship Experience

Credit Hours: 1.00 to 3.00. Professional practice with qualified employers within the pharmaceutical industry. Pre-approval of enrollment by the BSPS Committee is required as well as completion of a course paper. Department and instructor permission required.

Learning Outcomes: 1. Ensure pharmaceutical science students receive early exposure to the

most common career paths taken by today's graduates and gain a first-hand perspective of industry responsibilities and activities in their roles. This contributes to a foundation for gaining appreciation of the strategies for continually evolving requirements and skills in industry. 2. Provide pharmaceutical science students with opportunities to have early in their program observation of scientists providing services, particularly those that address Pharmaceutical Science Outcome Ability Goals. These include Conceptual Competence, Scientific Comprehension, Mathematical Competence, Integrative Competence, Critical Thinking and Decision-Making Abilities, Communication Skills and Abilities, Responsible Use of Professional Values and Ethical Principles, Social Awareness and Social Responsibility, Professional Abilities and Habits, and Group Interaction and Citizenship. See the ""Student Handbook"" for specific descriptions of the components of these outcome abilities. 3. Provide pharmaceutical science students with early industry exposure that illustrates the reasons they need in-depth learning of the basic and applied sciences and a commitment to lifelong learning for professional effectiveness. 4. Provide pharmaceutical science students with experiences and learning in applications that are essential to evolving professional responsibilities in an industrial setting. 5. Contribute to pharmaceutical science student development as well as providing the vision and motivation to become a positive scientific influence or change agent. 6. Broaden students' perspectives on career pathways and foster initiatives to enhance career planning. Credits: 1.00 to 3.00

PHRM 40500 - Mindfulness

Credit Hours: 1.00. The goal of the course is to introduce students to intercultural development, identify stressors in life, and learn simple methods to reduce stress of pharmacy students. This introductory course comprises of class activities/discussions and assignments. *It is very important that respect is demonstrated by being considerate, courteous, and professional, and by maintaining confidentiality of others' information*. *There are no exams in this course.*

Learning Outcomes: 1. Facilitate learning through group discussion and presentation styles. 2. Enhance written, verbal, and nonverbal communication skills. 3. Increase awareness of professional and personal image in healthcare settings. 4. Develop professional and personal confidence and curiosity. Credits: 1.00

PHRM 41000 - Professional Communications

Credit Hours: 1.00. Professional communications will focus on developing verbal, written, and nonverbal communication skills. The goals of the course are to augment the students' knowledge about soft and hard communications, reinforce necessary skills for interactions and engagement in various healthcare settings, and develop professional and personal confidence. Class participation is expected and the format will be active learning with very few lectures. All pharmacy students are welcome - this course is not intended to focus on any particular group or class. This course comprises of home study and class discussions. *All discussions in class shall remain confidential. There are no exams in this course.*

Learning Outcomes: 1. Facilitate learning through group discussion and presentation styles. 2. Enhance written, verbal, and nonverbal communication skills. 3. Increase awareness of professional and personal image in healthcare settings. 4. Develop professional and personal confidence and curiosity. Credits: 1.00

PHRM 41900 - Experiential Reflections In The Pharmaceutical Sciences

Credit Hours: 0.00. This course meets the requirement for the experiential component of the BSPS program in the College of Pharmacy. Students will be required to submit a written reflection on a practical experience of a minimum of 8 weeks duration that was accomplished in the past year. This reflection will include a description of the location, duration, and type of practical experiences. Students will provide a summary of key learning through the experience and how it has impacted their

career plans. Students will also be required to submit a letter from their practical experience supervisor confirming the dates, place, and nature of the experience. Permission of department and instructor required.

Learning Outcomes: 1. Demonstrate proficiency in technical writing using clear, concise, logical progression of thought. 2. Demonstrate a general understanding of how different areas of expertise must come together in order to discover and develop pharmaceutical products. 3. Demonstrate the ability to reflect on career goals and opportunities. Credits: 0.00

PHRM 42500 - Pharmacy Leadership And Innovation Forum

Credit Hours: 1.00. This course introduces students to emerging trends and career opportunities in pharmacy and the pharmaceutical sciences through exposure to leaders in professional and corporate environments.

Learning Outcomes: 1. Principles of management and administration. 2. Synthesize information to draw logical conclusions. 3. Interact with other pharmacists, physicians, nurses, and other healthcare professionals to achieve positive patient outcomes. 4. Demonstrate values consistent with the provision of quality healthcare to all patient groups and populations. 5. Demonstrate awareness of key issues and debates in healthcare. 6. Demonstrate awareness of and ability to analyze internal and external factors that influence the practice of pharmacy and healthcare in an attempt to resolve practice-related problems. Credits: 1.00

PHRM 42700 - Conversations About Death And Dying

Credit Hours: 1.00. This course is open to all years of the professional pharmacy program or others with instructor permission. This course provides opportunity for open discussion of the topics of death and dying in the provision of healthcare.

Learning Outcomes: 1. Explore personal and professional feelings, beliefs, and attitudes regarding death and dying. 2. Reflect on your feeling and beliefs related to death and dying. 3. Discuss with another person their feelings, beliefs, and attitudes about death and dying. 4. Practice communication skills around death and dying. 5. Investigate a topic related to death and dying. 6. Explore the roles of health care professionals in E-o-L care. 7. Develop a personal end-of-life portfolio. 8. Compare and contrast different burial options. 9. Distinguish between different end-of-life documents. 10. Describe the components needed for a will. 11. Describe hospice and palliative care. 12. Identify issues around Physician-Assisted Dying. Credits: 1.00

PHRM 43600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. The overall objective of this course is to expand students' knowledge of biochemistry obtained in the prerequisite one-semester Biochemistry course to understanding advanced aspects of human biochemistry related to pharmaceutical sciences.

Learning Outcomes: 1. Apply an advanced understanding and knowledge of biochemistry to pharmaceutical sciences and the practice of pharmacy. 2. Demonstrate advanced understanding of biochemistry including integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and the development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and the advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Understand the molecular basis of many idiopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseased of aberrant

molecular transport; including the mechanisms of DNA damage and repair and the mechanisms of action of antimetabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented as well as demonstrate understanding of the each content area is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

PHRM 43900 - Vulnerable And Underserved Patient Care

Credit Hours: 2.00. The goal of this course is to increase knowledge of the challenges faced by underserved patient populations and ways healthcare providers can assist patients in overcoming these challenges. The course also provides exposure and experience in patient care provided in two rural federally qualified health centers (FQHCs). Students will be able to challenge preconceived notions that they may have about underserved populations and learn the impact that pharmacists can have in caring for these populations.

Learning Outcomes: 1. Discuss and reflect on one's individual views and cultural attitudes and beliefs regarding vulnerable and underserved populations. 2. Recognize characteristics of patients who are at increased risk for health and health care disparities. 3. Identify obstacles to medication adherence in vulnerable and underserved patients. 4. Summarize the roles of different individuals in the delivery of health care for vulnerable and underserved patients. 5. Analyze ethical and legal issues affecting vulnerable and underserved populations. 6. Examine financial barriers a patient may face in accessing social and health care services. 7. Identify barriers and challenges faced by vulnerable and underserved patients and consider these when developing and modifying patient care plans. 8. Demonstrate the role of pharmacists in caring for underserved and vulnerable populations. Credits: 2.00

PHRM 44200 - Introduction To The Pharmaceutical Industry

Credit Hours: 2.00. While providing an overview of the pharmaceutical industry, this course focuses on the drug development process, including clinical research, regulatory affairs, pharmacovigilance and marketing. Pharmaceutical company executives serve as guest lecturers and discuss their individual areas of expertise.

Learning Outcomes: 1. Acquire a working knowledge of the organizational structure in the pharmaceutical industry and the role the Food and Drug Administration (FDA) plays in the provision of drug development. 2. Know multiple divisions within a pharmaceutical company including, but not limited to: Regulatory Affairs, Clinical Trial Development, Pharmacovigilance, Medical Information, and Health Outcomes. 3. Know the types of attitudes, skills, abilities, and training that are necessary for pharmacists to possess to effectively work with a variety of other professionals in the pharmaceutical industry. 4. Build a network of professionals within the pharmaceutical industry for resources and guidance as he/she determines his/her career path. Credits: 2.00

PHRM 45600 - Pharmaceutical Care Of Diabetes

Credit Hours: 1.00. The purpose of this course is for students to obtain a comprehensive knowledge of the pharmaceutical care of diabetes. Students will participate in class discussions related to patient cases and learn about effective communication with patients with diabetes. In class discussions will expose the students to patient case scenarios in which they will gain an appreciation for the complexities involved with diabetes, construct evidence-based treatment plans, and enhance overall understanding of effective diabetes management. This course provides a platform for shaping future pharmacists into excellent caregivers for patients with diabetes. Permission of instructor required.

Learning Outcomes: 1. Approximate the number of carbohydrates in a variety of foods. 2. Recommend: a) Diabetes oral medication initiation doses and dose adjustments; b) Insulin initiation doses and dose adjustments; c) Non-insulin injectable initiation doses and dose adjustments; d) Individualized medication recommendation changes. 3. Know the basic

settings and methods for operating continuous glucose monitoring (CGM) devices. 4. Identify patients with diabetes who would benefit from CGM. 5. Initiate and titrate dosing for insulin injections and insulin pumps. 6. Educate a patient with diabetes on effective insulin pump use. 7. Know basic concepts surrounding the use of motivational interviewing for patients with diabetes. 8. Describe different opportunities for pharmacists to become involved in diabetic care and processes for becoming a Certified Diabetes Educator (CDE) or Board-Certified in Advanced Diabetes Management (BC-ADM). 9. Identify effective strategies to communicate with patients with diabetes. 10. Identify the role of APPE students in a variety of settings relevant to patients with diabetes. Credits: 1.00

PHRM 46400 - Preparing For Postgraduate Residency Program

Credit Hours: 2.00. This elective course will focus on preparing for the pharmacy residency program selection process. The purpose of this course is to discuss various aspects of the selection process, provide students with guidance regarding each step of the process, and provide feedback regarding materials such as curriculum vitaes (CVs), letters of intent, and thank you notes. This course is intended to guide the students through the process using events, which normally occur during the residency search including pre-Midyear preparation, navigating American Society of Health-System Pharmacists (ASHP) Midyear, the post-Midyear application and interview process, and the Match. Permission of instructor required.

Learning Outcomes: 1. Develop short-term and long-term professional and personal goals. 2. Discuss reasons why you want to complete a residency/post graduate training program. 3. Research residency programs and prepare a residency rank list based on professional and personal career goals. 4. List various ways in which residency program information can be obtained and evaluate programs based on your particular areas of interest. 5. Explain the general process involved in the residency search including navigation of ASHP Midyear Meeting, application and interview timeline, the Match process, and the post-Match process. 6. Identify key components of being a successful resident. 7. Revise a CV based on peer and faculty feedback and give appropriate feedback on others' CVs. 8. Create a professional, polished CV that can be continually updated. 9. Create a letter of intent appropriate for a residency program application. 10. Develop a complete residency application for multiple programs. 11. Demonstrate appropriate verbal and non-verbal interview skills. 12. Demonstrate professionalism throughout all course activities and interactions. 13. Demonstrate an inquisitive mindset by asking questions and actively seeking out answers to your inquires. Credits: 2.00

PHRM 46600 - Pharmaceutical Care In Oncology

Credit Hours: 1.00. This course aims to expand students' understanding of hematology and oncology topics. After completion, the student should be able to apply course concepts to actual patient cases. CLPH 49000 will be collaboratively taught by oncology pharmacists and residents from the greater Indianapolis area hospitals. Students will be exposed to relevant topics including current events, supportive care, bone marrow transplant, renal cell carcinoma, specialty pharmacy administration and leadership, oral chemotherapy, palliative care and career paths in oncology pharmacy.

Learning Outcomes: 1. Demonstrate critical thinking and decision making assessed through current event discussions and patient case presentations. 2. Demonstrate communication skills and abilities assessed through current event discussions and mock patient counseling experience. 3. Demonstrate information literacy assessed through current event discussions. 4. Demonstrate professionalism and ethics assessed through current event discussions and palliative care case/discussions. 5. Demonstrate competence and social awareness assessed throughout all discussions and projects as it pertains to individuals with the

diagnosis of cancer. Credits: 1.00

PHRM 46800 - Clinical Integration And Application

Credit Hours: 2.00. This is an elective class which gives participants more experience working up patient cases with multiple complications and an opportunity to make recommendations to a team. The material for each case will be derived from actual cases and topics will include continuity of care problems, typical problems/diseases seen in hospitalized patients, and a host of other chronic illnesses. During the 3-week class, students will have 1-1.5 hours to work on a patient case in class and address challenges faced in the clinical setting. The second half of class will be used for students to present their recommendations to a "medicine team" (made up of your classmates and teachers). Students will be responsible for creating a pharmacist problem list and making verbal drug therapy recommendations. The majority of the grade will come from in-class participation with other points coming from online quizzes, communication exercises, and follow-up answers from clinical questions.

Learning Outcomes: 1. Utilize the Pharmacists' Patient Care Process (PCPP) when evaluating and synthesizing patient care plans 2. Identify and prioritize medical problems for a complex patient each class period. 3. Interpret patient cases through the identification of pertinent objective and subjective data each class period. 4. Formulate and adjust a patient specific, evidence-based treatment plan for each identified medical problem daily. 5. Present audience appropriate, patient specific recommendations using evidence-based medicine as necessary. 6. Identify and apply relevant literature, including, but not limited to practice guidelines, landmark trials, and case reports to each patient case. 7. Prepare and communicate a drug information response including appropriate citations when requested. 8. Demonstrate the ability to self-assess one's performance and identify areas for continual professional development. Credits: 2.00

PHRM 49000 - Special Topics

Credit Hours: 0.00 to 3.00. Subject matter and method of approach individually directed by instructor. Permission of instructor required.

Learning Outcomes: 1. The development of professional skills and increased knowledge base of pharmaceutical subject matter. Credits: 0.00 to 3.00

PHRM 49500 - Pharmaceutical Research Special Topics

Credit Hours: 1.00 to 3.00. Ongoing involvement in pharmaceutical research. Pharmaceutical research subject matter and method of approach individually directed by instructor. Permission of instructor required.

Learning Outcomes: 1. Develop professional skills. 2. Increase knowledge base of pharmaceutical subject matter. 3. Direct research exposure and experience. Credits: 1.00 to 3.00

PHRM 82400 - Principles Of Pathophysiology And Drug Action

Credit Hours: 3.00. This course introduces the basic principles of pathophysiology, pharmacodynamics, toxicology and medicinal chemistry necessary to understand the therapeutic use and adverse actions of drugs. The course will integrate and apply concepts of science courses, including organic chemistry, biochemistry, anatomy and physiology into an understanding of the basic fundamentals of disease processes, toxicology and drug actions. Thus, this course will provide students with the basic background necessary to understand and apply pharmacotherapeutics to the practice of pharmacy. Prerequisite: MCMP 20400, 20500, 20800, and BIOL 20300, 20400 or 30100, 30200. Departmental permission required.

Learning Outcomes: 1. Conceptual Competence: Pathophysiology, Principles of pharmacology. 2. Scientific Comprehension: Basic principles of thermodynamics and kinetics and their role in defining chemical processes; Basic principles of drug design and their chemical and biochemical mechanisms of drug action. 3. Critical Thinking and Decision Making Abilities: Synthesize information in order to draw logical conclusions; Provide evidence-based support for arguments, recommendations and solutions; Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4.

Communication Skills and Abilities: Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 5. Responsible use of Professional Values and Ethical Principles: Exhibit professional behavior at all times in congruence with the pharmacist code of ethics. 6. Professional Abilities and Habits: Demonstrate the ability to self-access and take needed steps to achieve competence; exhibit positive, professional, empathic attitudes and behaviors in all intra- and interprofessional communications. Credits: 3.00

PHRM 82800 - Dosage Forms I

Credit Hours: 3.00. The purpose of Dosage Forms I is to provide a foundation in the basic concepts of pharmaceutics that are the foundation of drug delivery. The course begins by presenting the molecular basis for aqueous and lipid solubility of drugs, pharmacokinetic principles that are related to dosage forms, mechanisms by which excipients or manufacturing processes affect bioavailability, and chemical kinetics applied to the shelf-life of dosage forms. The pharmaceutics principles are then applied to successively more complex liquid dosage forms: solution, emulsion, and suspension. The excipients that are required to prepare the dosage forms: buffers, preservatives, emulsifiers, suspending agents, wetting agents, etc., and the method of preparing each dosage form in both a compounding and manufacturing setting are covered.

Learning Outcomes: 1. Explain the basic scientific principles involved in drug delivery such as dissolution, chemical stability, physical stability, content uniformity, and bioavailability. 2. Describe the essential scientific principles involved in the design of solutions, emulsions, suspensions, as well as dermatological and ophthalmic dosage forms. 3. Evaluate the quality parameters of dosage forms that are involved in product selection. 4. Analyze and interpret the results of bioequivalence studies that are important in product selection. 5. Advise patients on the proper use and storage of liquid dosage forms. Credits: 3.00

PHRM 83600 - Biochemistry For Pharmaceutical Sciences II

Credit Hours: 2.00. This course provides instruction in biochemistry that builds on basic knowledge by presenting content on advanced aspects of human biochemistry for students in pharmaceutical sciences. The content emphasizes the integration of biochemical knowledge and the application of biochemical understanding to medically relevant situations including disease etiology, medical diagnosis, disease research, drug discovery, drug and toxin mechanisms of action, and mechanism of drug metabolism.

Learning Outcomes: 1. Understanding and knowledge of biochemistry to an advanced level and to increase the ability to apply that understanding and knowledge to pharmaceutical sciences and the practice of pharmacy. 2. Advanced understanding of biochemistry includes integration of multiple areas of metabolism in the causation of disease and in physiologic homeostasis; biochemical signal transduction paradigms and concepts; the basis of complex biotechnology methods for disease diagnosis and disease research (recombinant DNA, proteomics, genomics, metabolomics), and development of experimental therapeutics (gene transfer, reverse genetics, siRNA); and advanced aspects of molecular transport, membrane function, enzyme kinetics, and the enzymology of drug metabolism. 3. Application of biochemical understanding and knowledge includes understanding the molecular basis of many idopathic and acquired metabolic disease, of inborn disorders of metabolism, of diseases of aberrant molecular signaling, and of diseases of aberrant molecular transport. It also includes the mechanisms of DNA damage and repair and the mechanisms of action of anti-metabolites and of synthetic therapies for metabolic disorders. 4. Demonstrate proficient knowledge of each of the content areas presented in this course, as well as demonstrate understanding of the concepts in

each content area presented in this course ta is sufficient for accurate application of those concepts to novel situations. Credits: 2.00

Polytechnic Institute

College of Technology Main Photo

College Overview

The Purdue Polytechnic Institute, previously named the College of Technology, is one of 10 colleges at Purdue University offering undergraduate and graduate degrees. The college includes seven academic schools, departments, and divisions:

• Aviation and Transportation Technology
• Engineering Technology
• Computer and Information Technology
• Computer Graphics Technology
• Construction Management Technology
• Military Science & Technology
• Technology Leadership & Innovation.

The academic programs in the Purdue Polytechnic combine theory-based applied learning, team-based projects, integrated humanities studies, competency-based credentialing, and a series of experiential components such as industry-sponsored senior capstone projects, internships, global immersions, and certification-earning activities. The Polytechnic learning experience is designed to produce graduates who not only have deep technical knowledge and applied skills in their chosen discipline, but also possess problem-solving, critical thinking, communication, and leadership skills sought by industries and communities.

Admissions

Successful completion of all Teacher Education Program (TEP) Requirements, including a minimum 2.5 Teacher Education Overall GPA are required to progress beyond each TEP Milestone. All Professional Education courses, including Learner Specialty Concentration/Pathway courses, must be completed with no grade lower than a "C" and no "I" (Incompletes). Degree requirements must be fulfilled to qualify for TEP completion. A minimum passing score on all required licensure examinations and completion of licensure requirements are necessary to be eligible for an Indiana Instructional Educator License. [[permalink=12524|new:{'title':1}]][[/permalink]]

- Summary of Teacher Education Milestones
- Licensure Information
- Technology Integration- Blended and Online Teaching (Ti-BOT)

Summary of Teacher Education Milestones

Admission to Teacher Education Program

Admission to the Teacher Education Program (TEP) is directly granted upon acceptance and enrollment at Purdue University, West Lafayette. The Teacher Education Program is aligned with national and state accreditation and licensure standards, regulations, and rules; university guidelines; and prescribed Plan(s) of Study (POS) as defined by Admission Year or as otherwise authorized by the Office of Teacher Education and Licensure (OTEL).

TEP Program Progression by Milestone (Milestones A-F)

Successful TEP progression and completion are achieved by attaining each TEP Milestone at or above Standard as outlined within the 2025-2026 Program Requirements and Milestones for each individual content area/major and as referenced and assigned within the 2025-2026 University Catalog, 2025-2026 Teacher Education Program Directory, the Brightspace course 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements, Plan(s) of Study (POS), and course syllabi.

Required Brightspace Course

Every incoming 2025-2026 Teacher Education (TE) student will be enrolled in the REQUIRED 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements Brightspace course. This course serves as the official/primary manner for which the Office of Teacher Education and Licensure (OTEL) will communicate and monitor cohort-specific requirements, milestones, timelines, notifications, tutorials, actions, student engagement, etc. for each TE student. Course commitment is continuous beginning upon arrival to the university and concludes when Milestones A-F are attained.

Course Substitutions

Course substitutions must fulfill degree requirements, associated Teacher Education Program (TEP) key and/or common assessments, and licensure standards/requirements. Prior approval by the Office of Teacher Education and Licensure is required for all course substitutions.

Milestone A: Methods Qualified

Milestone A - Teacher Education Program Progression Status

- Exceeds Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone A Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone A Decision Deferred to Milestone B: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone A - Review Schedule

- Conducted - Close of Spring Semester 2026
- Decision/Notification - Early Fall Semester 2026

1. 2.50/4.00 Overall GPA (at time of Milestone A review)
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone A review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete three (3) Ti-BOT badges (at the time of Milestone A review).
7. No unresolved Professional Dispositions issues/concerns.
8. Adhere to the Criminal Background Check Policy.
9. Complete TEP Brightspace Assignments, including but not limited to attendance at the

mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).

10. Attend the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
11. Submit the Teacher Education Program Agreement (TEPA).
12. Identify via the Teacher Education Program Agreement (TEPA) one of four chosen Learner Specialty Pathways. Learner Specialty Concentration/Pathway requirements are specific to individual content area/major.

Milestone B: Student Teaching/ Placement

Milestone B - Student Teaching Placement

- Exceeds Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone B Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone B Decision Deferred to Milestone C: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone B - Review Schedule

- Conducted - Close of Fall Semester 2027
- Decision/Notification - Early Spring Semester 2028

1. 2.50/4.00 Overall GPA (at time of Milestone B review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone B review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete five (5) total Ti-BOT badges (at the time of Milestone B review).
7. No unresolved Professional Dispositions issues/concerns.
8. Complete TEP Brightspace Assignments.
9. Attend the mandatory Student Teaching Clinical Acceptance Process (CAP) Workshop provided by the Office of Clinical Practice (OCP) AND submit your CAP Application as directed by OCP.

- Expanded Student Teaching practicums and full-time Student Teaching occur over two consecutive semesters.
-

Verify from the CAP Application projected Student Teaching semester/year.

Milestone C: Student Teaching Authorization

Milestone C - Student Teaching Authorization

- Exceeds Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone C Criteria as defined by Content Area/Admission Year.

Milestone C Criteria must be attained At Standard before the Office of Teacher Education and Licensure (OTEL) will authorize enrollment reinstatement for Student Teaching.

Milestone C - Review Schedule

- Conducted - Close of Fall Semester 2028
- Decision/Notification - Early Spring Semester 2029

1. 2.50/4.00 Overall GPA (at time of Milestone C review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone C review).
5. **Successful completion and target met on Foundations Portfolio (submission and target met on Common Lesson Plan in Semester 7).
6. ***Successfully complete ten (10) total Ti-BOT badges (at the time of Milestone C review).
7. Successfully complete all Professional Education (including Foundation and Methods), Learner Specialty Pathway, and degree courses prior to student teaching (Semester Eight).
8. Attempt all required content test(s) before the Student Teaching semester per the timeline below; Test Requirements (ets.org)

Content Test Attempts for Major

For Fall Student Teaching: Official Score Reports due to OTEL no later than July 1.

For Spring Student Teaching: Official Score Reports due to OTEL no later than December 1.

Content Test Attempts for Pathways/Concentrations (High Ability and English Language Learning)

For Fall Student Teaching: Test Registrations received in OTEL by May 15th confirming a test date scheduled no later than June 30th.

For Spring Student Teaching: Test Registrations received in OTEL by October 15th confirming a test date scheduled no later January 31st.

Code Purdue University (1631) as both the attending institution AND as a score recipient

for ALL exam attempts; If completing a Learner Specialty Pathway that leads to licensure (High Ability or English Language Learners), the associated content exam must be attempted prior to the Student Teaching (Semester 8).

9. No unresolved Professional Dispositions issues/concerns.
10. Adhere to the Criminal Background Check Policy.

Milestone D: Teacher Education Program Completion

Milestone D - Teacher Education Program Completion

- Exceeds Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone D Criteria as defined by Content Area/Admission Year.*

Milestone D - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-C met.
2. 2.50/4.00 Overall GPA (at time of Milestone D review).
3. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
4. Verify degree is conferred on Transcript/Academic Record.
5. *Be in Good Standing with the University (at time of Milestone D review).
6. No unresolved Professional Dispositions issues/concerns.
7. ****Successful completion and target met on all Common Assessments (submission and target met on CPAST and edTPA in Semester 8).

Milestone E: Licensure Eligible

Successful completion of the Purdue University Agricultural Education Program, Agricultural Education, BS, and the State of Indiana licensure requirements for an Indiana REPA 3 Initial Instructional License in Career and Technical Education (CTE): Agriculture (5-12) and *Blended and Online Teaching (5-12).

Milestone E - Licensure Eligible

- Exceeds Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone E Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone E - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-D met.
2.

Resolve any holds on academic records (if applicable).

3. Successfully complete the required pedagogy test; Test Requirements (ets.org). Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
4. Successfully complete all required content test(s) Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
5. For all Career and Technical Education (CTE) majors ONLY- Verify that the required number of clock hours has been completed and received by your advisor. Students must complete 4,000 clock hours of successful employment in the appropriate CTE area, or 1,500 clock hours of supervised work in the appropriate CTE area under an approved Teacher Education Program or an equivalent combination.

Milestone F: Licensure Action(s)

Milestone F - Licensure Actions

- Exceeds Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone F Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone F - Review Schedule

- Conducted - Upon Licensure Application - Summer 2029
- Decision/Notification - Upon Formal Action

1. Milestones A-E met.
2. Complete and upload with your Indiana License Application CPR/Heimlich Maneuver/AED certification or card (must include a hands-on, face-to-face skills demonstration).
3. Complete and upload with your Indiana License Application documentation of Suicide Prevention certification (training must be at least one hour).
4. Submit Indiana License Application online via Licensing Verification and Information System (LVIS) at https://license.doe.in.gov/.
5. Allow three weeks (given all licensure criteria are met) for Purdue University to certify and the Indiana Department of Education (IDOE) to grant the Indiana License.
6. After receipt of an Indiana License, apply for out-of-state licensure (if desired).

*For purposes of reports and communications to other institutions or agencies, and in the absence of any further qualifications of the term, a student shall be considered in Good Standing unless the student has been dismissed, suspended, or dropped from the University and not readmitted. A student is considered in Good Academic Standing if both a student's semester and cumulative GPA are above a 2.00/4.00.

**Foundation Courses linked with the Foundations Portfolio Common Assessments include EDCI 20002, EDCI 28500, EDCI 35000, EDPS 20001, EDPS 23500, EDPS 24800, EDPS 32700, EDPS 36201, EDPS 43010, and

EDST 20010. These may be subject to change.

***The Blended and Online Teaching (5-12) License is required for students on Admission Year Fall 2024-Spring 2025. The Blended and Online Teaching (Ti-BOT) License requirements are embedded into coursework for all Teacher Education Undergraduate majors. Some exceptions apply.

****Common Assessments include Foundations Portfolio, Field Experience Dispositions, CPAST, edTPA, Common Lesson Plan, and Licensure. Common Assessments for Early Childhood Education and Special Needs align with the National Association for the Education of Young Children (NAEYC).

Beginning July 1, 2025 - According to the Indiana State Board of Education, students seeking an Initial Indiana License in a content area involving literacy instruction, including special education, must obtain a licensure addition in Early Literacy (P-5), as required under IC 20-28-5-19.7.

Licensure Information

The Office of Teacher Education and Licensure (OTEL) is the formal liaison with the Indiana Department of Education and serves as the official repository for Purdue West Lafayette Teacher Education Program Progression and Licensure actions. OTEL maintains and permanently retains a *Teacher Education Program and Licensure Credential Portfolio* for each current and former Purdue University Teacher Education Candidate/Student. OTEL provides reliable, career-long guidance on Indiana Teacher Education and Licensure Standards, Rules, and Procedures. Indiana Licensing Rules and Regulations are subject to change by the Indiana State Board of Education, Indiana Department of Education (IDOE), and/or the Indiana General Assembly.

Advising

Students in the Polytechnic Institute must meet with their advisor at least once per semester.

Meeting with your Advisor

- Some majors have group advising sessions, others have individual advising appointments or walk-in hours.
- Your advisor will email you with information about the procedure used in your department.

Preparing for your Advising Session

- Determine how many credit hours you want to take.
- Compile a list of courses and alternates that you would like to take.
- Determine that you meet all the prerequisites for the courses you want to take.
- Once the Schedule of Classes is available, make sure course times work together.

Topics Typically Covered in an Advising Session

- Progress toward your degree.
- Appropriate courses for the next semester.
- Academic standing.
- Internships, career fairs, and other non-academic opportunities.
- Registration PIN release (PINs will not be released by phone, email or text message).
- Other questions a student may have.

Contact Information

Purdue Polytechnic Institute
West Lafayette, IN 47907
(765) 494-4935
E-mail: choosepolytechnic@purdue.edu

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Polytechnic Institute Administration

Overview

Propel ideas into reality

Welcome to the fast lane. At the Polytechnic Institute, you'll discover how to harness the power of technology to have an immediate impact.
From making a smartphone brilliant to creating video games to improve a child's health, technology is the springboard for faster, greener and healthier solutions.
In our team-based labs you'll test ideas, take things apart and put them back together - only better. You'll learn side-by-side with professors who have worked in the industry and thrive on combining theory, imagination and real-world application. In this innovative environment, you'll learn by doing - gaining deep technical knowledge and applied skills in your chosen discipline as well as the problem-solving, critical-thinking, communication and leadership skills employers desire.
Companies like Amazon, Boeing, Caterpillar, Motorola, Honeywell Aerospace and Rolls-Royce know us well - they come knocking for our big-picture-thinking leaders.

Faculty

Polytechnic Institute Website

Contact Information

For more information on the Polytechnic Institute, please visit https://polytechnic.purdue.edu/.
They can be reached at 765-494-4935 or at choosetechnology@purdue.edu.

Graduate Information

For Graduate Information please see Polytechnic Administration Graduate Program Information .

Advanced Global Technology Minor

Multidisciplinary Technology, BS (Statewide)

About the Program

From businesses to industries to government, Purdue's multidisciplinary technology program will give you the skills to focus on the management, operation, and maintenance of complex technological systems. In this program you'll prepare for a career that requires knowledge in industrial and manufacturing technologies as well as quality assurance and plant supervision. The skills you gain will help your employers become more efficient and safe.
Purdue Polytechnic Vincennes students receive their A.S. degree from Vincennes University before continuing on with the B.S. with Purdue Polytechnic. Each plan of study below corresponds with a different A.S. major that feeds into the B.S. program.

- Computer Integrated Manufacturing - Industrial Maintenance
- Computer Integrated Manufacturing/Robotics
- Drafting and Design/CAD
- Electronics Technology
- Machine Trades - Injection Molding
- Machine Trades - Tool & Die

PTEC 10801 - Guided Exploration I

Credit Hours: 3.00. Part one of the first in a series of transdisciplinary, real-world, project-based work and conversations exploring the intersections of humanities and technology, social and natural sciences. Projects emphasize design thinking; collaboration; communication; hands-on prototyping; testing; assessing. Learners will engage in individual and team project work and conversations that will change in scale and scope based on the learner's experience, goals, and learning needs. Permission of department required.

Learning Outcomes: 1. Demonstrate a

developing level of understanding of issues related to the intersection of science, technology, and quantitative reasoning using project-based techniques to address unstructured, real-world problems. 2. Demonstrate a developing level of understanding and skill with individual and team based project work. 3. Demonstrate a developing level of understanding of issues related to the intersection of technology and culture using a variety of effective communication techniques. 4. Demonstrate a developing level of information literacy using a variety of effective communication techniques. Credits: 3.00

TECH 10000 - Technology Freshman Seminar

Credit Hours: 1.00. Technology Freshman Seminar.

Credits: 1.00

TECH 10001 - Polytechnic Success Seminar

Credit Hours: 1.00. This course is designed to provide information about the University environment, as well as to serve as an academic and socially supportive atmosphere, to aid the Polytechnic student in making the successful transition from high school to college. Permission of instructor required.

Learning Outcomes: 1. Identify student support services on campus in relation to personal and academic success. 2. Use appropriate tools and technologies that support and align with student success. 3. Demonstrate effective communication skills with faculty, staff and peers Identify and demonstrate traits consistent with effective time management and goal setting. Credits: 1.00

TECH 10100 - Women In Technology: Exploring The Possibilities

Credit Hours: 1.00. An in-depth view of the emerging role of women in technology. Presentations by career professionals and faculty in a variety of technology disciplines will increase familiarity with the diversity of programs within the school. Academic and interpersonal skills and strategies needed to succeed in technology careers, and issues such as balancing work and family, will be addressed.

Credits: 1.00

TECH 10500 - Introduction To Engineering Technology

Credit Hours: 3.00. Introduction to the different disciplines incorporated in engineering technology as well as the skill set needed to be a successful student in engineering technology. Focus will be on individual and professional development, problem identification, developing analytical skills, time and resource management, project planning, design, implementation and evaluation, and oral and written communication in the engineering technology profession.

Learning Outcomes: 1. Understand systematic approach to problem solving and design. 2. Understand measurement systems and the difference between fundamental and derived units. 3. Convert units between measurement systems and within measurement systems. 4. Perform dimensional analysis on complex engineering equations. 5. Understand significant figures, approximation, and rounding of results. 6. Appreciate the use of triangle trigonometry in the analysis of engineering systems. 7. Solve complex engineering equations. 8. Interpolate tabulated data. 9. Utilize spreadsheets for engineering calculations, data analysis, and data presentation. 10. Understand how to set up a laboratory experiment, gather and analyze data, and present the results in a proper format. 11. Students should understand professional registration and have an appreciation for professionalism and ethics in their careers. Credits: 3.00

TECH 11000 - Freshman Honors Seminar

Credit Hours: 1.00. A first-year honors seminar designed to inform and challenge technology students. Discussion will include a broad range of technology and intellectual issues. By invitation or permission of the instructor. Permission of instructor required.

Credits: 1.00

TECH 12000 - Design Thinking In Technology (UCC: IL/STS)

Credit Hours: 3.00. Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Write a narrowly focused problem statement. 2. Apply ethnographic methods to understand technological problems. 3. Develop a search strategy, access technical databases and evaluate results and source quality. 4. Create a technical report documenting results of the design process. 5. Manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment. 6. Apply strategies of ideation to develop novel and innovation solutions. 7. Demonstrate rapid prototyping solutions for purposes of design, testing and communication. Credits: 3.00

TECH 19900 - Special Topics In Technology

Credit Hours: 1.00 to 3.00. Special topics in Technology; subject matter to be arranged.

Credits: 1.00 to 3.00

TECH 22000 - Designing Technology For People

Credit Hours: 3.00. Innovating in our complex world requires understanding people and the issues and challenges they face. This unique course brings together perspectives from technology and anthropology to address this by exploring ethnographic studies of people and technology interactions. Through this process, students will practice the problem scoping skills necessary to identify and define problems and begin to generate appropriate design solutions. In addition, students will learn how to observe and talk with people about technology and discuss a range of ways people use technology. Accordingly, the course will focus on human-centered design and how to empathize with people during the design process. This will allow students to learn how to identify opportunities for innovation that emerge when designers carefully observe and listen to humans using technology and/or experiencing problems with current technology. Note: This class engages the material in both the classroom and innovation labs.

Learning Outcomes: 1. Identify opportunities for innovation that emerge from ethnographic studies and divergent thinking approaches to design. 2. Apply diverse team approaches to address open-ended and ill-defined design problems. 3. Describe and apply ethical decision-making to real-world design settings. 4. Demonstrate documentation of the design process from ethnography through choosing a design idea to make, including fieldnotes, drawings and digital presentation techniques. Credits: 3.00

TECH 23199 - Professional Practice Extensive Seminar II

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical profession. Credits: 1.00

TECH 25000 - Technology Cooperative Education Practice II

Credit Hours: 1.00 to 3.00. Semester of external career related experiences designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required. Typically offered Fall Spring Summer.

Learning Outcomes: 1. Translate theory in to practice 2. Behave appropriately in the

professional work environment. 3. Work within the ethical framework of the industry. Credits: 1.00 to 3.00

TECH 27199 - Professional Practice Extensive Seminar I

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions. Credits: 1.00

TECH 28155 - Technology Study Abroad

Credit Hours: 1.00 to 6.00. Faculty-led, short-term, study abroad experience with a technology-related focus. Topics and learning outcomes will vary by course offering. Instructor permission required.

Learning Outcomes: 1. Learning outcomes will vary by course offering. Credits: 1.00 to 6.00

TECH 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating exmployers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1.Apply knowledge to identifying and solving problems in the professional context. 2.Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3.Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 29900 - Special Topics In Technology II

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of technology provided by technology faculty.

Credits: 1.00 to 3.00

TECH 30000 - Technology Cooperative Education Practice III

Credit Hours: 1.00 to 3.00. Semester of external career related experiences designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required.

Credits: 1.00 to 3.00

TECH 30010 - Technology Career Enrichment Internship III

Credit Hours: 1.00 to 3.00. Semester of external career related experience designed to enhance the student's preparedness for entering an initial or secondary career. A minimum of 10 weeks and 200 hours are required. Instructor permission required.

Credits: 1.00 to 3.00

TECH 30100 - Renewable Energy Systems

Credit Hours: 3.00. Course provides the students with an introduction to renewable energy sources. Topics include photovoltaic, solar thermal systems, fuel-cells, hydrogen, wind power, waste heat, bio-fuels, wave/tidal power, geothermal

power and hydroelectric. Analysis of technical, economic, environment, politics, and social policy are integral components of the course.

Credits: 3.00

TECH 30300 - Energy Efficiency And Auditing

Credit Hours: 3.00. Course discusses fundamentals of energy efficiency and energy auditing. Students will analyze audit data, research energy improvement measures, and prepare recommendations. Topics include energy audit process, energy audit reports, energy bill analysis, economic analysis, audit instrumentation, and will include a subset of the following: building envelope, electrical system, HVAC system, waste heat recovery, lighting, cogeneration, and other prevalent commercial/industrial systems.

Credits: 3.00

TECH 31000 - Seminar For Technology Transfer Students

Credit Hours: 1.00 to 4.00. A seminar and bridge course for Transfer Single Articulation Pathway Associate Degree graduates in EET and MET to prepare them for success in junior and senior technical classes.

Learning Outcomes: 1. Apply knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities. 2. Conduct standard tests and measurements to conduct, analyze, and interpret experiments, and to apply experimental results to improve processes. 3. Understand the need for an ability to engage in self-directed continuing professional development. 4. Know the impact of engineering technology solutions in a societal and global context. 5. Commit to quality, timeliness, and continuous improvement. Credits: 1.00 to 4.00

TECH 32000 - Technology And The Organization

Credit Hours: 3.00. A course intended to provide students with experiences mirroring what they will encounter in the world of work. Students will participate in interdisciplinary teams to explore technology solutions. Course topics include public policy, regulatory and ethical issues, teaming and leadership, and project management. Permission of department required.

Learning Outcomes: 1. Identify, apply and address public policy issues relevant to technology solutions. 2. Understand how technology solutions are developed, implemented, and maintained within a regulatory framework. 3. Identify, apply and address organizational ethics including conflicts of interest and individual ethical responsibilities. 4. Demonstrate the ability to function effectively in interdisciplinary teams. 5. Demonstrate effective oral and written communication skills. 6. Demonstrate project management competencies. Credits: 3.00

TECH 33000 - Technology And The Global Society

Credit Hours: 3.00. The intersection of technology, globalization, and society is at the core of this course. Students examine socio-cultural issues related to the development and use of technology across intercultural contexts, explore perspectives and principles behind global technology influences, and examine the complexities and ethical nuances of technology and innovation.

Learning Outcomes: 1. Reflect on the perceptions of cultural norms, interactions, gender roles, societal ethics, and religions in order to examine their potential impact on industry and society. 2. Evaluate digital media and socio-cultural information sources to predict their influence on individual and social interactions and perspectives. 3. Conduct formal and informal reflections about oneself and others, manage one's emotions in situations of differences, and apply techniques to bridge cultural differences. 4. Assess worldwide technology needs by examining global efforts, innovations, and issues that impact contemporary society. Credits: 3.00

TECH 33099 - Professional Practice Extensive Seminar III

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is

intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions. Credits: 1.00

TECH 33199 - Professional Practice Extensive Seminar IV

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical profession. Credits: 1.00

TECH 34000 - Prototyping Technology For People

Credit Hours: 3.00. Innovating in our complex world requires us to think strategically and make the best decisions possible for both designing and business development. Accordingly, this unique course brings together perspectives from technology and business management to iteratively prototype innovative solutions to student-selected problems. This process will include creating prototypes in a variety of media, using the appropriate methods/tools, as well as exploring the processes and biases related to how people process information and make decisions. This type of work will help to guide the innovation process by gaining insights from testing prototypes and interacting with people to deepen one's understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. At the conclusion of the course, students will pitch a viable design solution and business model for a validated problem to a variety of potential investors and/or stakeholders. Note: This class engages the material in both the classroom and innovation labs. Students of all levels of experience, will explore tools/programs related to computer aided design, 3D printing, app development, and digital prototyping.

Learning Outcomes: 1. Recognize biases in how people process information, conducting user tests and interviews to gain insights from prototypes to make business development decisions. 2. Engage in decision-making strategies to develop prototypes in a variety of media (digital and/or physical) for the level of fidelity necessary to communicate, understand, and test innovative ideas/designs. 3. Select and use appropriate methods/tools/equipment to make decisions and prototype innovative ideas. 4. Revise designs to reflect a deepening understanding of customer needs, market segments, costs of goods, competitor operations, and market strategies. 5. Pitch a viable design solution/business model for a validated problem to a variety of potential investors and/or stakeholders. Credits: 3.00

TECH 34099 - Professional Practice Seminar I

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions. Credits: 1.00

TECH 35000 - Technology Cooperative Education Practice IV

Credit Hours: 1.00 to 3.00. Semester of external career related experience designed to enhance the student's preparedness for entering an initial or secondary career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required.

Credits: 1.00 to 3.00

TECH 35010 - Technology Career Enrichment Internship IV

Credit Hours: 1.00 to 3.00. Semester of external career related experience designed to enhance the student's preparedness for entering an initial or second career. A minimum of 10 weeks and 200 hours are required for credit. Instructor permission required.

Credits: 1.00 to 3.00

TECH 35099 - Professional Practice Seminar II

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions.

Credits: 1.00

TECH 36099 - Professional Practice Seminar III

Credit Hours: 1.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions.

Credits: 1.00

TECH 38155 - Technology For Study Abroad

Credit Hours: 1.00 to 6.00. Faculty-led, short-term, study abroad experience with a technology-related focus. Topics and learning outcomes will vary by course offering. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering

Credits: 1.00-6.00

TECH 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems.

Credits: 0.00

TECH 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems.

Credits: 0.00

TECH 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems.

Credits: 0.00

TECH 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to

professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in technology. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

TECH 39699 - Professional Practice Internship

Credit Hours: 0.00 to 3.00. Professional practice with qualified employers within industry, government, or small business. Permission of instructor required.

Learning Outcomes: 1. Apply pertinent knowledge in identifying and solving problems. Credits: 0.00 to 3.00

TECH 39900 - Special Topics In Technology III

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of technology provided by technology faculty.

Credits: 1.00 to 3.00

TECH 40000 - Technology Study Abroad

Credit Hours: 1.00 to 8.00. This course is utilized to record credits earned through participation in Purdue study abroad programs. Permission of instructor required.

Credits: 1.00 to 8.00

TECH 43099 - Professional Practice Extensive Seminar V

Credit Hours: 2.00. Optional co-op seminar course where students advance their professional development through sharing their work experiences and receiving feedback from the instructor and other co-op students. Seminar enrollment is intended to occur in the first on-campus semester following a co-op work session.

Learning Outcomes: 1. Communicate recent co-op session experiences through an oral presentation. 2. Write a professional document. 3. Show how knowledge gained from other co-op students' experiences may apply to future professional experiences. 4. Describe how other co-op students' experiences have expanded their knowledge of technical professions. Credits: 2.00

TECH 48155 - Technology Study Abroad

Credit Hours: 1.00 to 6.00. Faculty-led, short-term, study abroad experience with a technology-related focus. Topics and learning outcomes will vary by course offering. Instructor permission required.

Learning Outcomes: 1. Learning outcomes will vary by course offering. Credits: 1.00 to 6.00

TECH 49100 - Senior Seminar For Engineering Technology

Credit Hours: 1.00. A seminar course for programs in Engineering Technology that evaluates current practices and trends in engineering and technological industry through active learning processes. Typically offered Fall Spring.

Learning Outcomes: 1. Understand the need for and an ability to engage in self-directed continuing professional development through particular active learning processes. 2. Understand the current practices and trends in engineering and technological industry. 3. Develop critical thinking ability on the current practices and trends in engineering and technological industry through various active learning processes. 4. Analyze the impact of engineering technology solutions in a societal and global context and further develop competence in applying learned knowledge on potential applications of engineering and technology. Credits: 1.00

TECH 49600 - Senior Design Project Proposal

Credit Hours: 1.00. Capstone problem identification and solution design course demonstrating synthesis of technical, professional, and general knowledge for senior engineering technology students. Proposal presentation is required.

Credits: 1.00

TECH 49700 - Senior Design Project

Credit Hours: 2.00. Teams will develop innovative solutions based on proposal outcomes in TECH 49600 for current issues in the engineering technology profession, workplace, or community. Project deliverable, presentation, and written report are required.

Learning Outcomes: 1. Present reports (oral or written) at each stage of the project. 2. Determine if the functional specifications of a project based on abstract concepts. 3. Design a block diagram for a project. 4. Determine the theoretical design based on functional specifications. 5. Write and implement a project test-plan. Credits: 2.00

TECH 49900 - Special Topics In Technology IV

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of technology provided by technology faculty.

Credits: 1.00 to 3.00

School of Aviation and Transportation Technology

Overview

Purdue University has been a leader in aviation education since the mid-1950s. The School of Aviation and Transportation Technology offers seven majors at the bachelor's degree level. The curriculum touches all areas of the aviation industry, including design, flight, and business.
With our focus on industry partnerships, undergraduate students have access to real-world projects, networking opportunities and up-to-date information that make them desirable future employees and leaders. Flexible scheduling can also help you get into the workforce sooner.

Faculty

School of Aviation and Transportation Technology Website

Contact Information

School of Aviation and Transportation Technology
1401 Aviation Drive
West Lafayette IN 47907-2015
Phone: 765.494.5782
Email: atinfo@purdue.edu

Graduate Information

For Graduate Information please see Aviation and Transportation Technology Graduate Program Information .

Professional Flight Technology, BS

Aviation Management, BS

Aeronautical Engineering Technology, BS

Unmanned Aerial Systems, BS

Aeronautical Technology, BS (Statewide)

About the Program

You can earn your Purdue University bachelor's degree in aeronautical technology in two years if you already have an aviation-related Vincennes University associate's degree. Your Purdue coursework builds on the skills you learned during your first two years at Vincennes while it expands your career options. Your classes and labs will also be at the Aviation Technology Center at the Indianapolis International Airport.

Special features:

- Flexible curriculum based on your career goals
- Internship and other work experience opportunities at aviation-related companies surrounding Indianapolis International Airport
- Access to Aviation Technology Center labs: Advanced Composites Laboratory, Air Traffic Control/Computer Laboratory, FAA-approved flight simulator, Avionics Laboratory, Non-Destructive Testing Laboratory, and Materials Processing Laboratory

Course topics include:

- Operations management
- Safety problems
- Aviation finance
- Human factors in aviation
- Aviation law

Unmanned Aerial Systems Minor

AT 10000 - Introduction To Aviation Technology

Credit Hours: 1.00. An introduction to the Department of Aviation Technology and its curricula as well as an overview of the aviation industry and associated careers. Aviation safety practices and human factors issues are discussed. An overview of aviation regulations and the regulatory process is included.

Learning Outcomes: 1. Recall key facts about the School of Aviation and Transportation Technology (SATT) and curricula. 2. Describe the aviation industry and career opportunities within the industry. 3. Identify key components of the aviation regulatory process. 4. Examine safety and human-factors elements of the aviation industry. Credits: 1.00

AT 10200 - Aviation Business

Credit Hours: 3.00. A discussion of the financial structure and operation of the aviation industry including aircraft and aerospace design parameters, as well as aviation financial and industrial processes. The course will cover material relevant to the overall structure of the aviation industry including history, current status of aerospace manufacturers, commercial airlines, and general aviation as well as governmental aviation agencies and international aviation. Commercialization of space and current issues in aviation will also be covered.

Learning Outcomes: 1. Understand the historical background of the numerous aspects of the air transportation industry. 2. Explain the general concepts of the national and international aviation legal system. 3. Describe the overall design and operation concepts of airports. 4. Understand the concepts utilized in air traffic control. 5. Describe the international aviation weather observation and dissemination system. 6. Understand the role of aviation as it relates to environmental problems. Credits: 3.00

AT 10300 - Aerospace Vehicle Propulsion And Tracking Systems

Credit Hours: 3.00. This course is an introduction to propulsion systems used in aerospace vehicles. The student will learn terminology, component parts, and operational theory of propulsion systems. Course topics covered are reciprocating and turbine engine operation theory as well as rocket propulsion systems. including electrical, fuel, fire, ignition and lubrication.

Operational and regulatory fuel requirements are discussed. Emerging technologies and environmental practices will be explored.

Learning Outcomes: 1. Demonstrate familiarity with the theory, principles of operation, types of aeronautical propulsion systems. 2. Understand various manufacturer and FAA publications concerning maintenance of aircraft power plants and accessories. 3. Understand safety issues associated with fuels, energy, and their interaction with environmental polices. Credits: 3.00

AT 10600 - Basic Aircraft Science

Credit Hours: 3.00. An introduction to federal regulatory systems and associated publications. Includes aircraft nomenclature, theory of flight, and fundamentals of the aviation industry. Introduces weight and balance procedures. Permission of department required.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment. Credits: 3.00

AT 10901 - Introduction To Uncrewed Aircraft System Operations

Credit Hours: 3.00. This course will provide students the aeronautical knowledge required to operate a small UAS in the National Airspace. Students are introduced to various aspects of uncrewed aviation operations, which includes UAS system types and components, regulations and operational approvals, and indoctrination to the civil and commercial applications of UAS. Through the use of UAS simulation technology, students will develop basic small UAS flight skills and successfully complete various UAS operational scenarios. Upon successful completion of the course students will be prepared to obtain a Federal Aviation Administration (FAA) Remote Pilot Certificate with a Small UAS Rating. Permission of department is required.

Learning Outcomes: 1. Obtain an FAA Remote Pilot Certificate with a Small UAS Rating. 2. Understand small UAS terminology and technology. 3. Comply with regulatory framework and understand various UAS approval processes. 4. Understand basic small UAS operating procedures. 5. Appreciate and gain perspective on how to safely operate UAS in the national airspace system. 6. Using simulation technology, demonstrate basic small UAS flight maneuvers and execute basic flight operations. Credits: 3.00

AT 11200 - Introduction To Operational Aviation Safety

Credit Hours: 1.00. This course teaches students about industry safety standards and the School of Aviation and Transportation Technology's Safety Program. This course will emphasize applying various safety models to accident case studies and reported incidents.

Learning Outcomes: 1. Identify safety models commonly used by flight operations. 2. Differentiate amongst commonly used safety models. 3. Given a case study/safety report, students will be able to apply the appropriate safety model to the event. Credits: 1.00

AT 11501 - Experiential Honors Project IA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. The Center for

Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Describe the process of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications.

Credits: 0.00 to 3.00

AT 11600 - Aircraft Science For Engineering Technology

Credit Hours: 3.00. Required for AET. This course is an introduction to theory of flight, aircraft nomenclature, aircraft configurations, high speed flight, and helicopter configurations and rotor dynamics. Covers lift/drag and concepts for flight at an engineering technology level beyond that of flight ground school. Federal regulatory systems for aircraft design and persons other than flight personnel and associated technical documents are covered. Introduces center of gravity theory, defines how to locate centers of gravity, and introduces weight and balance procedures for engineering technology, not covered by flight ground school. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Able to correctly identify the major components of an aircraft, know the proper names of these components, and be able to explain the fundamentals of why aircraft are configured as they are. 2. Able to accurately calculate the lift and drag of an airfoil, and be able to explain the effects of atmospheric conditions on the airfoil. 3. Able to explain the characteristics of subsonic, transonic, and supersonic flight, be able to identify the associated shock waves, and be able to describe the characteristics and effects of these shock waves. 4. Able to define the basic types of helicopter rotor systems, explain how movements of helicopters are controlled, and be able to explain helicopter rotor aerodynamics. 5. Able to define the proper conditions for weighing an aircraft, understand the proper technical documents needed and be able to calculate an aircraft's weight and balance. 6. Able to successfully demonstrate on time performance of required activities. 7. Demonstrate the ability to analyze and distill, in writing, information in a dynamic environment.

Credits: 3.00

AT 11601 - Experiential Honors Project IB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Completion of AT 11501 with a grade of B or higher is required. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Describe the process of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications.

Credits: 0.00 to 3.00

AT 11901 - Uncrewed Aerial Systems: Safety And Risk Management

Credit Hours: 3.00. This course discusses the fundamental concepts of Safety and Risk Management and their application to UAS operations. The course will provide insight into strategies for developing and implementing a formal safety management system (SMS) that effectively supports an organization's UAS operations. In addition, students will gain an understanding of ethical decision-making and its relationship to safety. Laboratory exercises provide students practical

application of this knowledge to various UAS operational scenarios, which includes utilizing SMS principles in assessing risks and developing appropriate mitigations. Must possess a valid FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Understand and demonstrate the application of safety and risk management principles to UAS operations. 2. Exemplify the UAS regulatory environment, which includes related regulatory approval and waiver processes. 3. Understand and apply technical data sources to evaluate UAS airworthiness and system health, to include ground and flight testing, troubleshooting, maintenance and repair. 4. Demonstrate the ability to plan and safely complete basic UAS missions that are regulatory compliant. 5. Understand and demonstrate ethical decision-making. Credits: 3.00

AT 12700 - Publications Records And Regulations

Credit Hours: 3.00. Required for AET. This course provides students with the concepts, and information to understand the regulations and publications specific to aviation and aerospace vehicle repair and maintenance. The privileges and limitations of the 14 CFR Part 65 airmen certificates are covered, as well as the regulations governing repair facilities and repair stations. The specific forms and records, and the proper disposition of those records are covered. In addition, aircraft technical drawings and prints are examined and the student is to develop the ability to read and comprehend aircraft drawings, as well as make drawings/sketches for vehicle repair and/or alteration. Precision measuring equipment is covered as is the hardware specific to aviation and aerospace. Inspection procedures and conformity checks are covered. Engine run up operations for inspection purpose are covered. This course teaches topics in the curriculum required by 14 CFR Part 147 as outlined in the School of Aviation and Transportation Technology's Part 147 Operations Manual approved by the FAA, and provides specific knowledge and skills needed for FAA certification examinations.

Learning Outcomes: 1. Identify the privileges and limitations of their 14 CFR Part 65 certificates. 2. Complete all appropriate forms and records related to aircraft maintenance and repair operations. 3. Solve problems and answer technical questions using these materials. 4. Read and interpret the output of precision measuring devices and be able to take precision measurements. 5. Identify various types of AN, MS, and NAS hardware, and understand the appropriate use of aircraft hardware. 6. Start, operate, and functionally check a reciprocating engine. Credits: 3.00

AT 14400 - Private Pilot Lectures

Credit Hours: 4.00. A study of the subject areas and information needed to operate as a private pilot in the aviation environment. The FAA private pilot written exam will be offered to those who qualify after taking the Lecture Course offering.

Learning Outcomes: 1. Recall the aeronautical subject areas required by the FAA as a private pilot. 2. Analyze aspects of professionalism and decision making within the aviation environment. 3. Compare and contrast the reference information available covering a given aviation concept or best practice. 4. Explain to team members about issues requiring resolution or input. 5. Demonstrate the knowledge, skills, and abilities to manage, lead, and empower others to efficiently address organizational and group needs and objectives. Credits: 4.00

AT 14500 - Private Pilot Flight

Credit Hours: 2.00. In this course, the student will receive the necessary dual flight instruction and solo flight time to qualify for the FAA Private Pilot Certificate under Part 61 of the Federal Aviation Regulations.

Learning Outcomes: 1. Demonstrate proficiency in take-offs and landings. 2. Demonstrate proficiency in flight at minimum controllable airspeed, including stalls and recoveries. 3. Demonstrate proficiency in planning and execution of cross-country flights using various means of navigation. 4. Demonstrate proficiency in night operations and simulated instrument flight. 5. Demonstrate proficiency in abnormal and emergency procedures. Credits: 2.00

AT 20200 - Aerospace Vehicle Systems Design, Analysis And Operations

Credit Hours: 3.00. Introduction to the design and engineering analysis of various systems found on modern aircraft and aerospace vehicles. Operational theory will also be presented for specific aircraft. Systems include electric power distribution, digital data, instrumentation, hydraulic, pneumatic, environmental, flight management, and autoflight.

Learning Outcomes: 1. Describe transport category aircraft systems. 2. Diagram the basic electrical and electronic systems design on modern airacraft. 3. Understand how major aircraft systems work together. Credits: 3.00

AT 20300 - Aviation Operations Management

Credit Hours: 3.00. This course provides a forum for investigating contemporary issues facing the aviation and aerospace industries. Major topics include aviation operation, human resources, fiscal, and technology management.

Learning Outcomes: 1. Understand the operational aspects of managing a large aerospace enterprise. 2. Describe airline and aerospace operations financing. 3. Discuss the trends in technology and the future roles and possibilities of various technical implementations in the industry. Credits: 3.00

AT 20501 - Statics For Aerostructures

Credit Hours: 3.00. This course provides an introduction to the static analysis of aerostructures. Force systems, resultants and equilibrium, moments, distributed loads, and centroids as they relate to aeronautical structures are studied. CAD software is introduced.

Learning Outcomes: 1. Determine the resultant of multiple vectors. 2. Draw free-body diagrams and apply equilibrium equations to those diagrams. 3. Demonstrate an understanding of the analysis of distributed loads in aerostructures. 4. Develop knowledge of internal forces and moments in structural members. 5. Develop an ability to calculate centroids and moments of inertia. 6. Use CAD software to represent and analyze aerostructures. Credits: 3.00

AT 20700 - Introduction To Aircraft Systems

Credit Hours: 3.00. Principles and design concepts of aircraft operating systems are covered. Emphasis is given to flight control, electrical, environmental, hydraulic, pneumatic, pressurization, oxygen, heating, cooling, fire protection, and ice and rain protection systems. Also included are theory of operation and design of aircraft instruments and associate systems.

Learning Outcomes: 1. Learn the function and operational principles aircraft instruments. 2. Learn the function of various components in a system for maintaining a healthful and comfortable environment in an aircraft. 3. Study, inspect, and check ice, rain, and fire control aircraft systems. 4. Determine the location of the elements in the aircraft and become familiar with the function and operating procedures for the typical system found on light single or light twin engine aircraft. 5. Learn to recognize various fittings and their application when used for rigid tubing and flexible hose. 6. Learn the use of tools and FAA Regulations in relation to aircraft tube and hose fabrication. 7. Learn the basic fundamentals of hydraulic systems, power, components and control. 8. Learn the different hydraulic fluids, seal design and system compatibility used in hydraulic systems. Credits: 3.00

AT 20802 - Aircraft Materials

Credit Hours: 3.00. In this course students study aluminum and composite materials used in aircraft. The course covers elements of design, fabrication, final assembly, and testing. Students also study the practical application of statics for airframe loads.

Learning Outcomes: 1. Use tools for the fabrication, final assembly, and testing of materials. 2. Use and apply technical information, including drawings, sketches, blueprints, charts, and graphs. 3. Analyze damage and design repairs to aircraft materials. 4. Demonstrate the basic skills of oxyacetylene

welding and the concepts of welded repair design. 5. Apply the concepts of statics as they relate to airframe structural members. Credits: 3.00

AT 20900 - Autonomous Aircraft Technology And Maintenance I

Credit Hours: 3.00. This course introduces fundamental concepts of autonomous aircraft technology and maintenance. Topics include history, airframe and powerplant selection, regulations governing uncrewed systems, airspace descriptions, safety, autonomous system programming and calibration, data package options, weather, system maintenance and repair, manual flight training, and aerodynamics and flight controls for autonomous aircraft.

Learning Outcomes: 1. Reflect on the history of UAS and project the future growth of UAS. 2. Analyze data sources to determine flight feasibility and mitigate hazards. 3. Collaborate effectively as a crew member both in the lab and in the field. 4. Design and print flight ready 3D model. 5. Assess airspace and flight feasibility by submission of FAA waiver application. 6. Demonstrate effective design choices. Credits: 3.00

AT 21000 - Ground Trainer I

Credit Hours: 1.00. Included in this course are maneuvers to develop basic attitude instrument flying skills, including tracking, holding, and approach procedures. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in attitude instrument flying skills 2. Demonstrate proficiency in the use of enroute and approach navigation methods 3. Demonstrate proficiency in holding and arc maneuvers Credits: 1.00

AT 21100 - Ground Trainer II

Credit Hours: 1.00. This course is designed to develop a higher degree of coordination and judgement through additional experience in the flight training device. This course will continue to prepare the student for the FAA Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations. 2. Demonstrate proficiency in emergency aircraft operations. 3. Demonstrate proficiency in cross-country navigation procedures. Credits: 1.00

AT 21200 - Operational Risk Assessment

Credit Hours: 1.00. This course gives students a comprehensive understanding of industry incident risk assessment and analyses. Students will learn about Safety Management Systems (SMS) feedback loop processes and techniques utilized to find root causes. Additionally, residual risks of real-world mishaps during flight operations will be examined.

Learning Outcomes: 1. Determine root causes from provided safety reports. 2. Produce a risk analysis from provided safety reports. 3. Extrapolate substitute and residual risk from provided safety reports. Credits: 1.00

AT 21500 - Experiential Honors Project IIA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed the AT 11601 course. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 21600 - Experiential Honors Project IIB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed AT 21500 with a grade of B or higher. The Center for Research and Education in Advanced Transportation

Ecosystems (CREATE) approval is required to register. Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 21900 - Autonomous Aircraft Technology And Maintenance II

Credit Hours: 3.00. This course will further develop skills and understanding of autonomous aircraft technology and maintenance. Emphasis will be on design, selection, construction, flight test, evaluation, and repair, of stabilized uncrewed aircraft. Students will work hands-on with open-source flight controllers to perform autonomous missions. Additionally, students will design and deploy scenario-specific sensors using student-constructed rotorcraft. Students will be expected to demonstrate their sensor payload through lab and field demonstration and professional documentation.

Learning Outcomes: 1. Apply flight principles to building a UAS capable of performing a specific operation. 2. Analyze and compare flight characteristics of UAS under different environmental and physical conditions. 3. Predict and compare flight characteristics of UAS using different components and configurations. 4. Integrate custom sensor payload into UAS design. 5. Safely and efficiently coordinate automated flights with team members. 6. Develop an enterprise-ready online user manual for UAS and sensor payload. Credits: 3.00

AT 22300 - Human Factors For Flight Crews

Credit Hours: 3.00. This course explores the fundamental concepts of single pilot and multi-crew human factors issues. The first part of the course focuses on the physiological factors that affect single pilot aeronautical decision-making. The second part examines human error, threat and error management, and domains of crew resources management. The third segment utilizes team-building exercises, case study presentations, and a formal assignment to emphasis course learning outcomes.

Learning Outcomes: 1. Examine the relationship of human factor issues to aviation safety 2. Examine crew resource management fundamentals in single and multi-crew environments. 3. Apply appropriate decision-making and problem-solving skills in team situations. Credits: 3.00

AT 23300 - Ethics And Aviation

Credit Hours: 3.00. This discussion-oriented class is an introduction to the principles of ethical theory and the application of that theory to practical problems associated with the aviation industry. Actual aviation case studies are used to illustrate major concepts.

Learning Outcomes: 1. Apply ethics to historical situations in aviation. 2. Apply ethics to current situations in aviation. 3. Discuss case studies centered on ethical situations in aviation. Credits: 3.00

AT 24302 - Commercial Flight I Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to develop a higher degree of coordination and judgment through additional experience in more advanced flight maneuvers and cross-country flying under Part 141 of the Federal Aviation Regulations. It will start to prepare the student for the FAA Commercial Pilot Certificate. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in takeoffs, landings, and flight at minimum controllable airspeed. 2. Demonstrate proficiency in advanced commercial pilot maneuvers. 3. Demonstrate proficiency in cross-country flight and electronic navigation. 4. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

AT 24802 - Commercial Flight II Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to finish preparation for the FAA Commercial Pilot Certificate practical exam. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in advanced commercial pilot maneuvers. 2. Demonstrate proficiency in cross-country flight and electronic navigation. 3. Demonstrate proficiency in night, abnormal, and emergency operations. Credits: 2.00

AT 24900 - Instrument Flight Lectures

Credit Hours: 3.00. A study of the operation of flight instruments and radio navigation aids, federal aviation regulations pertinent to instrument flight, meteorology, instrument charts, instrument flight planning, and air traffic control procedures. Preparation for the FAA Instrument Rating written examination.

Learning Outcomes: 1. Demonstrate competency in aircraft flight instruments and navigation systems. 2. Demonstrate competency in the Federal Aviation Regulations for instrument flight. 3. Demonstrate competency in using instrument enroute charts, approach charts, SIDS and STARS in IFR flight planning. 4. Demonstrate knowledge in conducting instrument approaches and holding patterns. 5. Demonstrate knowledge in aviation weather and aviation weather services. Credits: 3.00

AT 25200 - Aviation Projects

Credit Hours: 3.00. This course will introduce the students to group projects in collaboration with industrial partners in aviation. A new project will be conducted each semester. Students will participate in the development of project goals, conducting field research, and developing a final course document and presentation. Travel outside of the normal assigned classroom time might be required. Permission of Department required.

Learning Outcomes: 1. Become familiar with the conduct of an industry research project. 2. Work in small research teams. 3. Develop presentation skills. Credits: 3.00

AT 25302 - Instrument Flight Under Federal Aviation Regulations Part 141

Credit Hours: 2.00. This course is designed to prepare the student for the FAA Instrument Rating under Part 141 of the Federal Aviation Regulations. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in holding procedures, instrument approaches, and IFR cross-country procedures. 2. Accomplish Instrument rating Practical Test. Credits: 2.00

AT 25400 - Commercial Flight Lectures

Credit Hours: 3.00. The course is designed to review the principles of flight, aircraft systems, pertinent federal aviation regulations, and airman publications and service in order to prepare the student for the FAA Commercial Pilot written examination.

Learning Outcomes: 1. Explain selected concepts from previous flight and ground courses. 2. Describe advanced aircraft systems and appropriate regulations needed in commercial operations. 3. Complete the Commercial Pilot Written Exam. Credits: 3.00

AT 26200 - Basic Aircraft Powerplant Technology

Credit Hours: 4.00. A study of the design, construction, and operating practices of aircraft reciprocating and small gas turbine engines. Laboratory exercises emphasize airworthiness evaluation, fault-isolation techniques, and standard service/maintenance practices.

Learning Outcomes: 1. Compare and contrast different types of reciprocating engines. 2. Explain the principles of the Otto cycle. 3. Explain Volumetric Efficiency. 4. Identify the importance of reciprocating engine designs and construction. 5. Demonstrate the ability to operate and troubleshoot a reciprocating engine. Credits: 4.00

AT 26502 - Aircraft Electrical Systems

Credit Hours: 3.00. An in-depth study of aircraft electrical components, both individually and as systems in the aircraft. DC electrical circuits, series and parallel circuits, magnetism, and electromagnetism are covered, as are DC power systems, schematics, and aircraft wiring practices. Aircraft charging systems, main power distribution, solid state electronics,

batteries, and motors are also discussed.

Learning Outcomes: 1. Develop an understanding of electrical principles as they relate to aircraft system operation. 2. Construct, analyze, and isolate faults in circuits. 3. Demonstrate troubleshooting procedures for direct currently electrical aircraft components and power distribution circuits. Credits: 3.00

AT 26700 - Fixed And Rotary Wing Assemblies

Credit Hours: 3.00. An overview of various fixed and rotary wing components and systems. Flight control systems, landing gear, fuel systems, wheels, brakes, and rotor systems are among the subjects studied.

Learning Outcomes: 1. Read, analyze, and interpret technical instructions. 2. Complete a set of aviation maintenance related tasks. 3. Jack, hoist, shore, level, and weigh an aircraft and calculate its weight and balance. 4. Knowledge of radio communications and aircraft mooring. 5. Operate a helicopter rotor balancing computer and balance a helicopter main and tail rotor. Credits: 3.00

AT 27200 - Introduction To Composite Technology

Credit Hours: 3.00. An introduction to basic composite materials, processes, construction, testing, and repair. Students will work with a variety of wet and pre-impregnated fiber and matrix systems including glass, aramid fiber, and carbon-graphite.

Learning Outcomes: 1. Demonstrate familiarity with wet lay, prepreg, and VARTM processes. 2. Use solid modeling software for part design, drafting, and composite design. 3. Demonstrate understanding of basic CNC machining, mold-making, and curing, 4. Repair damaged composite structures. Credits: 3.00

AT 27800 - Nondestructive Testing For Aircraft

Credit Hours: 3.00. A study of nondestructive testing methods used to evaluate the structural integrity of airframes, engines, and components. Magnetic particle, liquid penetrant, electromagnetic, ultrasonic, and radiographic inspection are covered.

Learning Outcomes: 1. Learn basic concepts and procedures for effective Penetrant Testing, different systems (white light, black light), sequences and evaluation of defects. 2. Learn basic concepts and procedures for effective Magnetic Particle Testing, system set up and checks, calculation of amperage used, identification of issues of materials and choice of methods, evaluation of defects. 3. Learn basic concepts and procedures for effective Eddy Current Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different wave forms on indications, and evaluation of defects. 4. Learn basic concepts and procedures for effective Ultrasonic Testing, system set up and checks, calculation of frequencies used, identification of issues of materials and effects of different methods (surface, though, etc.) and evaluation of defects. Credits: 3.00

AT 28600 - National Airspace Systems Operations

Credit Hours: 3.00. An introduction to the technical procedures involved in operating unmanned Aerial Systems in the air traffic control system. Flight operations and procedures will be covered. Weather theory and flight regulations as they apply to UAS operations will also be discussed.

Learning Outcomes: 1. Demonstrate operation of a UAS simulator. 2. Understand and apply appropriate federal aviation regulations as they apply to UAS operations. 3. Understand the principles of flight and flight control as they apply to UAS vehicles. Credits: 3.00

AT 29000 - Aviation Project

Credit Hours: 1.00 to 4.00. Independent study primarily for sophomore students who wish to pursue study and development work in special areas. Subject material must be arranged with the instructor before enrolling in the course. Permission of instructor required.

Learning Outcomes: 1. Vary based upon

individual contract. Credits: 1.00 to 4.00

AT 30702 - Advanced Aircraft Systems

Credit Hours: 3.00. An in-depth study of aircraft components and operation with an emphasis on transport-category aircraft. Systems covered include fuel, environmental, fluid-power, flight control, fire protection, ice-control, warning, and auxiliary power. Practical projects utilize small ad transport-category aircraft.

Learning Outcomes: 1. Demonstrate an understanding of the terminology of systems analysis and design. 2. Demonstrate proper project planning ability. 3. Demonstrate knowledge of the industrial safety culture and the ability to analyze all safety issues of the project, including team member safety. 4. Determine system airworthiness. 5. Develop troubleshooting skills in an industry environment. Credits: 3.00

AT 30802 - Aircraft Materials Processes

Credit Hours: 3.00. A study of the processes by which aircraft materials are converted into usable components. Laboratory activities include machining, welding, and analysis of material properties.

Learning Outcomes: 1. Demonstrate familiarity with the basic operations of lathes and mills, maintaining close tolerances on work. 2. Demonstrate familiarity with the various properties and strength attributes of aerospace materials and their measurement and application. 3. Demonstrate familiarity with the basic concepts of damage-tolerant repair design. 4. Demonstrate familiarity with the concept of aircraft reliability control as used to support large transport category aircraft. 5. Use teamwork and communication skills to produce parts and/or assemblies. Credits: 3.00

AT 30900 - Unmanned Autonomous Aerial Systems

Credit Hours: 3.00. This course includes the construction and flight test demonstration of fully autonomous aircraft. System performance will be monitored in real time. Post flight analysis, with system performance evaluation and optimization will be covered.

Learning Outcomes: 1. Understand power, autopilot, telemetry, and manual flight systems. 2. Understand telemetry systems. 3. Evaluate systems for possible EMI interference, provide corrective actions. 4. Program flight with multiple waypoints, loiter, return to launch, and landing. 5. Explain EMI reduction techniques and vibration control measures. 6. Identify information available from and determine practical uses of telemetry. Credits: 3.00

AT 30901 - Introduction To UAS Sensor Technology

Credit Hours: 3.00. This course introduces students to multiple forms of UAS sensors and core fundamentals of Remote Sensing and Geospatial Technology. Students will be introduced to basic data capture and processing techniques and to effectively apply different forms of UAS sensors to real-world applications.

Learning Outcomes: 1. Identify and define core geospatial and remote sensing technology concepts. 2. Effectively associate and relate UAS sensor technology with related portions of the electromagnetic spectrum. 3. Identify and explain geographic coordinate systems and projections. 4. Process and Create UAS data products within a Geographic Information System. Credits: 3.00

AT 31100 - Aerospace Internship

Credit Hours: 3.00. This course consists of placing the student in an existing business or research unit within the department. Students will function as interns as they develop and manage business and/or operational processes within these units. This experience prepares students for the externship experience in the follow-on course.

Learning Outcomes: 1. Solicit and gain a position as an intern in a departmental business or research unit. 2. Successfully complete the requirements of the internship. 3. Develop and deliver a presentation on the work accomplished during the internship. Credits: 3.00

AT 31400 - Operational Safety Mitigation

Credit Hours: 1.00. This course provides students with a hands-on learning experience within the Professional Flight Safety program. Students will use data and evidence from real-world safety reports to assess risks, develop control measures, and generate proposals that may be implemented into flight operations. Students will gain a clearer understanding of how flight operations and safety operations collaborate to mitigate hazards.

Learning Outcomes: 1. Recommend solutions for a risk assessment by using the data and evidence collected from a provided event. 2. Develop a mitigation proposal for an operational circumstance. Credits: 1.00

AT 31500 - Experiential Honors Project IIIA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed the AT 21600 course. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 31600 - Experiential Honors Project IIIB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed AT 31500 with a grade of B or higher. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 31900 - Uncrewed Aircraft Systems: Applications, Data, And Documentation

Credit Hours: 3.00. Focused on applying uncrewed aircraft technology to specific data gathering missions. Sensor types, mounting selection, and control will be demonstrated. Emphasis will be placed on sensor payloads, mission planning, and data acquisition. Post-flight data processing and analysis will be conducted using GIS and Remote Sensing software applications. All specifications and procedures will be documented in an industry-accepted format.

Learning Outcomes: 1. Develop missions for fully autonomous aircraft. 2. Monitor and control system performance in real-time. 3. Conduct post-flight data analysis, with system performance evaluation and optimization. Credits: 3.00

AT 32001 - Advanced Aviation Operations

Credit Hours: 3.00. This course covers modern principles for managing complex global aviation maintenance, ground and aerospace manufacturing operations. Particular emphasis is placed on "system-of-systems" and organizational resilience concepts in air vehicle lifecycle maintenance, aerospace manufacturing and airport surface/gate operations. Principles of Data Science, systems-thinking, process visualization, emerging technologies and modern workforce challenges and their impact on global sustainable airworthiness, safety, quality and performance reliability are covered in-depth.

Learning Outcomes: 1. Compare/contrast historic versus modern day aviation operations management philosophies and the crucial role of the modern 5P operations management paradigm. 2. Analyze and describe disruptive

technology advances driving modern aviation and aerospace operations and the role of Data Science in air vehicle design and lifecycle management. 3. Analyze the tightly coupled nature and system failure modes in high consequence aviation/aerospace operations. 4. Apply System-of-Systems, Resilience Engineering, Safety II and other next generation operations management concepts to problem-based case studies and current issues in aviation and aerospace. 5. Demonstrate understanding of aviation/aerospace industry workforce competency models including applied roles of innovation, teamwork and problem-solving. Credits: 3.00

AT 32501 - Advanced Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who are preparing for careers as professional pilots or dispatchers and require an advanced knowledge of the impact of weather on aviation operations.

Learning Outcomes: 1. Develop increased awareness of meteorology and its application to aviation operations. 2. Demonstrate knowledge of aviation meteorological concepts, with an emphasis on meteorological hazards for instrument flight operations. 3. Demonstrate the use of aviation weather data types and sources. 4. Develop expertise in obtaining and evaluating appropriate weather data, and in integrating these data into the preflight planning required for a professionally-flown instrument flight. Credits: 3.00

AT 32700 - Advanced Transport Flight Operations

Credit Hours: 3.00. This course addresses advanced aviation topics to include high speed aerodynamics, automated cockpit instrumentation, domestic/international flight operations, and global navigation.

Learning Outcomes: 1. Explain subsonic and transonic aerodynamic principles and how they relate to aircraft design and performance. 2. Analyze issues related to CFIT, upset recovery, wind shear, in-flight and low altitude wake encounters, volcanic ash, anti-de-icing, and crossing restrictions/climb and descent planning. 3. Interpret RNP, RNAV, GPS, and Q route IFR charts. 4. Reflect upon, and internalize concepts of professional conduct and professionalism as a professional aviator. Credits: 3.00

AT 33502 - Avionics Systems

Credit Hours: 3.00. This course covers the theory of operation and applications of common electrical components used in various aircraft circuits. The theory and mathematical relationships of alternating current, reactance, impedance, and phase shift are examined. Operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems are investigated.

Learning Outcomes: 1. Demonstrate the theory of operation and application of common electrical components used in various aircraft circuits. 2. Demonstrate the operational theory, installation practices, and troubleshooting concepts of common aircraft communication and navigation systems. 3. Explain the theory and mathematical relationship of alternating current, reactance, impedance, and phase shift. Credits: 3.00

AT 33800 - Airline Management

Credit Hours: 3.00. This course is a detailed study of airline management principles and processes. Topics include airline, economics, organization, forecasting, marketing, alliances, pricing, scheduling, finance, fleet planning, labor relations and air freight. Business ethics pertaining to airlines are introduced.

Learning Outcomes: 1. Explain the economic characteristics and the management structure of the commercial airline industry. 2. Explain forecasting, marketing, pricing, scheduling, fleeting planning, labor relations, financing, and air cargo operations. 3. Demonstrate oral and written communication skills on topics related to the airline industry. 4. Discuss global geography in relation to the international aviation industry.

Credits: 3.00

AT 34001 - Aerospace Business Statistics

Credit Hours: 3.00. This course provides an introduction to business statistics with a specific focus on managerial decision making in the aerospace industry. The course will focus on aircraft leasing and value determination. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to perform their own analyses.

Learning Outcomes: 1. Demonstrate proficiency in the use of statistics to describe aerospace processes. 2. Successfully employ inferential statistics to facilitate aerospace managerial decision making. 3. Demonstrate proficiency in the use of software tools to facilitate statistical analyses. Credits: 3.00

AT 35100 - Flight Instructor Flight

Credit Hours: 2.00. Flight training in preparation for flight instructor certification. Instructional techniques are demonstrated and practiced by the student. Heavy emphasis is placed on student practice teaching of all maneuvers. FAA Commercial Pilot Certificate with Instrument Airplane Rating required. Permission of department required.

Learning Outcomes: 1. Able to perform, critique and analyze all Private Pilot maneuvers. 2. Able to perform, critique and analyze all Commercial Pilot maneuvers. 3. Able to teach all knowledge areas for the Private Pilot Certificate. 4. Able to teach all knowledge areas for the Commercial Pilot Certificate. 5. Able to teach aircraft systems. 6. Accomplish the Flight Instructor Airplane Practical Test. Credits: 2.00

AT 35200 - Flight Instructor Lectures

Credit Hours: 4.00. The course teaches techniques of flight and ground instruction, analysis of maneuvers, aircraft performance, and federal aviation regulations applicable to flight instructors. Some practice teaching will be required. Preparation for the FAA written exam is included.

Learning Outcomes: 1. Know the definitions, objectives, elements, and common errors for all items listed in the FAA practical test standards. 2. Know the learning process, elements of effective teaching, student evaluation and testing, course development, lesson planning and classroom training techniques. 3. Know Flight Instructor privileges and limitations, record keeping and eligibility requirements. 4. Know Flight Instructor endorsements for student pilots, private pilot, and commercial pilot applicants. Credits: 4.00

AT 35300 - Multi-Engine Flight

Credit Hours: 1.00. This course prepares the student for the FAA multi-engine rating. Dual flight instruction is conducted in a multi-engine aircraft. Individual ground instruction will be arranged.

Learning Outcomes: 1. Explain the design and operation of multiengine aircraft systems. 2. Develop proficiency in handling engine power failures. 3. Develop proficiency in flight at minimum controllable airspeeds including stalls. 4. Develop proficiency in takeoffs and landings. 5. Develop proficiency in abnormal and emergency procedures. Credits: 1.00

AT 35400 - Turbine Flight Operations Lecture

Credit Hours: 2.00. A study of corporate aircraft systems and operations and an orientation to operational procedures.

Learning Outcomes: 1. Locate Federal Aviation Regulations related to oxygen requirements. 2. Describe turbine aircraft systems, associated cockpit procedures and checklist usage. 3. Compute turbine basic weight & balance and flight planning calculations. 4. Demonstrate safety and security procedures related to the operation of turbine aircraft. Credits: 2.00

AT 35900 - Airport Management

Credit Hours: 3.00. This course is a study of the history and development of contemporary airport facilities. Areas of study will include FAA airport design requirements, master plans, and airport operations. Field trips may be required.

Learning Outcomes: 1. Understand how airports are managed. 2. Describe and understand the issues and challenges facing airport managers.

Credits: 3.00

AT 36201 - Aviation Operations

Credit Hours: 3.00. This course introduces students to the principles of managing a complex aviation operation. Students will be assigned active roles in monitoring and reporting on aircraft flight and maintenance practices. Every student will be assigned a role as part of a small group whose responsibility is to gather appropriate information, develop reports, and conduct practical research tasks as assigned. Weekly and monthly group meetings will be conducted similar to those found in the airline industry with students playing an active role in these meetings.

Learning Outcomes: 1. Become familiar with the operation of a functioning flight operation. 2. Develop research and presentation skills appropriate to those utilized in airline management. 3. Work within a team as well as how to lead a team. Credits: 3.00

AT 36302 - Fundamentals Of Powerplant Systems

Credit Hours: 4.00. This course covers powerplant systems, including fuel metering devices, ignition systems, and propeller and propeller-related systems. Students learn to use the special tools required for these systems, and the processes for inspection, repair, and overhaul. Airworthiness evaluation and determination is stressed, as are testing and fault diagnosis procedures. The properties and operating characteristics of aircraft fuels are also covered.

Learning Outcomes: 1. Demonstrate the ability to support, maintain, and overhaul powerplant systems. 2. Apply standard testing protocol and procedures to powerplant systems. 3. Develop an understanding of technical information related to powerplant systems. 4. Develop an understanding of fuel characteristics and operation. Credits: 4.00

AT 36900 - Air Traffic Control

Credit Hours: 3.00. An introduction to the principles of air traffic control, including tower and en route separation. Navigation theory as it relates to the ATC system will be explained, as will the theory of operation of ATC radar and computer systems.

Learning Outcomes: 1. Operate ATC simulation equipment. 2. Understand the basic information required to perform the duties of an air traffic controller. 3. Understand operations in the National Airspace System. Credits: 3.00

AT 37002 - Advanced Aircraft Powerplants

Credit Hours: 3.00. This course covers the design, construction, operation, and overhaul practices of aircraft reciprocating and small gas-turbine engines. Airworthiness evaluation, fault-isolation techniques, and standard service and maintenance practices are emphasized. Dimensional and visual inspection and testing of engines following overhaul are stressed, as well.

Learning Outcomes: 1. Demonstrate knowledge of engine operation theory. 2. Demonstrate familiarity with and ability to apply troubleshooting and fault analysis procedures. 3. Develop and follow a plan for the complete overhaul and return to service of an engine. Credits: 3.00

AT 37200 - Aircraft Maintenance Practices

Credit Hours: 3.00. An in-depth study of practices and procedures used to ensure that an aircraft is maintained in an airworthy state. Aircraft publications and maintenance methodology are emphasized.

Learning Outcomes: 1. Develop inspection skills, techniques and associated practices using appropriate technical publications, form, records, tools and equipment. 2. Make airworthiness determinations concerning airframe, engine, propeller and component parts used in the construction of aircraft. 3. Complete the paperwork, records and job card entries for returning aircraft to service according to aircraft industry standards. Credits: 3.00

AT 37600 - Aircraft Gas Turbine Engine Technology I

Credit Hours: 4.00. Basic aircraft gas turbine engine theory, nomenclature, component design, turbine engine systems, operation, and fault isolation techniques are emphasized. Turbine engine maintenance, overhaul, operation, and inspection procedures are studied in detail.

Learning Outcomes: 1. Understand the basic operating principles of gas turbine engines. 2.

Understand the operation and function of the major components of the gas turbine engine. 3. Understand the operation, function and troubleshooting of gas turbine engine systems. 4. Explain the basic procedures and operations used or encountered in maintaining airworthiness of gas turbine engines. Credits: 4.00

AT 38100 - Aviation Security

Credit Hours: 3.00. This course introduces the challenges and complexity of aviation security faced by aviation professionals across the industry. It traces the evolution of current security approaches and explores technologies and processes targeting threat mitigation and improved operational efficiency.

Learning Outcomes: 1. Understand the literature in the student's field. 2. Exhibit the highest level of professionalism in the aviation security industry. 3. Solve problems in aviation security. 4. Work effectively as part of a team. 5. Conduct basic research, interpret ad analyze the data and make useful presentations based on that research. Credits: 3.00

AT 38201 - Advanced Flight Instructor Lecture

Credit Hours: 3.00. A discussion of instructional techniques for flight and ground instruction with a focus on instrument and multi-engine flight. This course includes analysis of maneuvers, aircraft performance, and federal aviation regulations applicable to flight instructors. Some practice teaching will be required. Preparation for the FAA practical tests for instrument instructor and multi-engine instructor are included.

Learning Outcomes: 1. Understand and explain the definitions, objectives, elements, and common errors for all items listed in the FAA practical test standards. 2. Understand and demonstrate the learning process, elements of effective teaching, student evaluation and testing, course development, lesson planning, and classroom training techniques. 3. Understand the privileges and limitations, record keeping, and eligibility requirements applicable to certified flight instructors. 4. Appropriately utilize flight instructor endorsements for private pilots, instrument rated pilots, commercial pilots, and multi-engine rated pilot applicants. Credits: 3.00

AT 38300 - Instrument And Multiengine Instructor Flight

Credit Hours: 1.00. This course prepares the student for the FAA Flight Instructor Instrument and Multiengine Instructor ratings. All flight instruction is conducted in a multi-engine aircraft.

Learning Outcomes: 1. Explain and demonstrate the definitions of objectives, elements, and errors common during the performance of instrument and multi-engine maneuvers. 2. Perform, critique and analyze all instrument and multi-engine maneuvers. 3. Demonstrate the ability to teach all required knowledge areas for the instrument and multi-engine ratings in both the aircraft and the classroom. 4. Demonstrate proficiency in flight planning, instrument flight procedures, and simulated aircraft operations including preflight takeoff, departure, holding patterns, approach/missed approach, and normal landing procedures. 5. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 1.00

AT 38500 - Design Support Analysis

Credit Hours: 2.00. This course is designed to teach students interested in engineering design, design support, customer support, or aerospace manufacturing, the elements of product support and the analysis of design as related to the manufacturability, maintainability, and supportability of aerospace products. The students will be expected to complete a life cycle cost analysis and logistics plan for a design.

Learning Outcomes: 1. Able to break the system into its functional groups. 2. Determine the Mean Time Between Failure of the system and the Availability of the system. 3. Determine the Life Cycle Cost of ownership of the system. 4. Determine the facilities, staffing, tooling, and spare parts requirements for a system. Credits: 2.00

AT 38700 - Turbine Aircraft Simulation Lab

Credit Hours: 2.00. This course is a laboratory flight experience in a turbine aircraft flight simulator emphasizing normal and abnormal aircraft operations. Emphasis is on FAA-required flight procedures for pilot certification and safe operation of turbine powered aircraft. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in flight planning, instrument flight procedures, and simulated aircraft operations. 2. Demonstrate proficiency in preflight, takeoff, departure, holding patterns, approach/missed approach, and normal landing procedures. 3. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 2.00

AT 38800 - Large Aircraft Systems

Credit Hours: 3.00. This course introduces transport aircraft limitations, systems, and systems operation. Topics include turbojet aircraft powerplants, flight instruments, electrical power, air-conditioning, pressurization, hydraulic, and flight control systems. Emphasis is aircraft and systems manufacturer's design and operational philosophies.

Learning Outcomes: 1. Define large aircraft systems terminology and nomenclature. 2. Understand the theory and basic operation of major aircraft systems. 3. Describe aircraft and system manufacturer's design philosophies. 4. Explain how major aircraft systems work together. Credits: 3.00

AT 39300 - Industrial Practice III

Credit Hours: 1.00. Industrial practice and experience in participating industry. Requires written report of the experience.

Credits: 1.00

AT 39400 - Industrial Practice IV

Credit Hours: 1.00. Industrial practice and experience in participating industry. Requires written report of the experience.

Credits: 1.00

AT 39500 - Turbine Aircraft Simulation Laboratory

Credit Hours: 1.00. This course is a laboratory flight experience in a turbine aircraft flight simulator, emphasizing normal and abnormal aircraft operations. Emphasis is on FAA-required flight procedures for pilot certification and safe operation of turbine-powered aircraft. Students seeking an FAA type rating must receive a grade of at least a B- in AT 35300. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in flight planning, instrument flight procedures, and simulated aircraft operations. 2. Demonstrate proficiency in preflight, takeof, departure, holding patterns, approach/missed approach, and normal landing procedures. 3. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 1.00

AT 39600 - Turbine Aircraft Flight Laboratory

Credit Hours: 1.00. This course is a laboratory flight experience in a turbine-powered aircraft, emphasizing normal and abnormal aircraft operations. Emphasis is on FAA-required flight procedures for certification and safe operation of turbine-powered aircraft. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations and instrument flying procedures as well as flight planning. 2. Demonstrate proficiency in preflight, takeoff, departure, holding patterns, approach/missed approach, and normal landing procedures. 3. Demonstrate proficiency in operating all aircraft systems in both normal and abnormal situations. Credits: 1.00

AT 40300 - Airman Certification Procedures

Credit Hours: 1.00. A survey of the procedures for obtaining federal certification as an Aircraft Maintenance Technician.

Learning Outcomes: 1. Review Airmen Certification Standards for Aircraft Mechanic Certificate for Airframe and Powerplant ratings. 2. Complete General, Airframe, and Powerplant written test. Credits: 1.00

AT 40400 - Turbojet Copilot Operations

Credit Hours: 1.00. Provides students who are selected to

participate in the turbojet copilot program with classroom, simulator, and flight instruction in turbojet systems and operation. Permission of instructor required.

Credits: 1.00

AT 40500 - Turbojet Copilot Practicum I

Credit Hours: 1.00. This course provides students with copilot flight experience in a corporate-type turbojet aircraft. Student copilots gain experience in turbojet systems and operation, high-speed/high altitude ATC procedures, advanced navigation, and high-altitude meteorology. Permission of instructor required.

Credits: 1.00

AT 40900 - Advanced Air Mobility: Management And Operations

Credit Hours: 3.00. UAS capstone course. Application of AAM technologies across multiple commercial-type operations, including certification, application, and management. A demonstration of the cumulative knowledge and skills learned in previous UAS courses. Requires current FAA Part 107 Remote Pilot Certificate.

Learning Outcomes: 1. Demonstrate the application of safety and risk management principles to AAM operations. 2. Examine the AAM entrepreneurial ecosystem and formulate a business prospectus based on current industry trends and regulatory policy. 3. Assess technical data sources to evaluate system health, to include ground and flight testing, troubleshooting, maintenance and repair, system configuration and payload integration. 4. Demonstrate the ability to plan, manage, and execute various AAM missions safely, legally, and efficiently. Credits: 3.00

AT 41101 - Aerospace Internship II

Credit Hours: 3.00. Students will be placed in an external industry-sponsored position that exists either within the department or at a location specified by the sponsor. Students will function as interns as they develop and manage business and/or operational processes within these units.

Learning Outcomes: 1. Solicit and gain a position as an intern in a selected external business or research unit. 2. Successfully complete the requirements of the externship. 3. Develop and deliver a presentation on the work accomplished during the externship. Credits: 3.00

AT 41200 - Aviation Finance

Credit Hours: 3.00. The course will focus on the financial knowledge needed to operate and evaluate aviation businesses. Content will cover the impact of financial decisions on operational outcomes that add/decrease value to an aviation company's bottom line. Case studies will be utilized to demonstrate practical aspects of financial decisions as they relate to organizational performance and profitability.

Learning Outcomes: 1. Explain common financial reports and their impact on operations. 2. Demonstrate reading and construction of cash flow, profit and loss, and balance sheets and explain how they are related. 3. Explain hedging concepts and how to build a selective hedging program to mitigate risk. 5. Analyze financial measurements and explain how they affect operational decisions for bottom line improvements. Credits: 3.00

AT 41501 - Experiential Honors Project IVA

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed the AT 31600 course. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 41600 - Airline Indoctrination

Credit Hours: 2.00. This course provides the background knowledge required to serve as a crewmember operating a transport-category airplane. Topics include aircraft systems, airline operations, and FAR Part 121 regulations.

Learning Outcomes: 1. Demonstrate knowledge of air carrier operating procedures and techniques, including cockpit scans and flows. 2. Demonstrate knowledge of transport-category aircraft systems. 3. Demonstrate working knowledge of applicable Federal Aviation Regulations. Credits: 2.00

AT 41601 - Experiential Honors Project IVB

Credit Hours: 0.00 to 3.00. This is an interdisciplinary course open to all majors with a GPA of 3.0 or higher. Students must have completed AT 41501 with a grade of B or higher. The Center for Research and Education in Advanced Transportation Ecosystems-CREATE (approval is required to register). Each course provides students hands-on experience in addressing a specific real-world problem with a broad societal impact, some of these projects may be supported by an industry partner. CREATE will seek industry partners, help define the scope and deliverables associated with each project and invite students to participate. Permission of instructor required.

Learning Outcomes: 1. Explain in detail the theory of experiential learning. 2. Apply the experiential learning theory to reflect on their observations of self, others, and the learning process to discern specific knowledge/skills acquired as well as conditions conducive to their learning. 3. Synthesize the implications of their observations and learning to broad societal implications. Credits: 0.00 to 3.00

AT 41901 - Advanced Air Mobility Capstone

Credit Hours: 3.00. The conclusion and demonstration of the cumulative knowledge and skills learned within the UAS curriculum. Students will engage in a series of assignments that will guide them toward proposing and researching a capstone project that demonstrates knowledge gained in UAS and AAM topics. Students are expected to focus on the development of deliverable products that demonstrate their skills as effective UAS operators.

Learning Outcomes: 1. Engage in applied UAS and AAM research that applies skills and knowledge gained in UAS curriculum. 2. Focus on deliverable products that demonstrate marketable skills as a UAS pilot and operator. 3. Develop a strong foundation upon which to pursue UAS and AAM in the workplace or further graduate research. Credits: 3.00

AT 42101 - Managerial Economics In Aviation

Credit Hours: 3.00. This course explores the process of making managerial decisions based on modern economic principles and concepts, and provides the student with a set of tools that can be used to make those decisions. Marginal analysis, forecasting, and cost analysis concepts are introduced, as are game-theoretic and probabilistic decision-making models. Bargaining strategies and linear programming tools are covered, as well.

Learning Outcomes: 1. Identify the practices of a functioning operations department in aviation businesses. 2. Analyze flight operations data similar to those utilized in the aviation industry. 3. Apply aviation operations theory to solve aviation industry related challenges in a group setting. Credits: 3.00

AT 43300 - Supervised Aviation Experience

Credit Hours: 0.00 to 3.00. Supervised aviation experience directed toward providing orientation, background, and insight into flight or ground operations. Permission of department required.

Learning Outcomes: 1. Explore career alternatives prior to graduation. 2. Integrate theory and practice. 3. Assess interests and abilities in their field of study. 4. Learn to appreciate work and its function in the economy. 5. Develop work habits and attitudes necessary for job success. 6. Develop communication, interpersonal and other critical skills in the job interview process. 7. Build a record of work experience. 8. Acquire employment contacts leading directly to a full-time job following graduation from college. Credits: 0.00 to 3.00

AT 43500 - Supervised Instructional Experience

Credit Hours: 1.00 to 4.00. This course provides students with experience as instructors in an aviation classroom or laboratory environment under the supervision of faculty. In addition to the supervisory skills gained, students will become knowledgeable in task planning and communication techniques. Permission of department required.

Credits: 1.00 to 4.00

AT 43800 - Airline Operations

Credit Hours: 3.00. Students in this course study airline operations in depth. Topics include marketing, route analysis, aircraft selection, financial analysis, federal regulations, and scheduling. Currently industry problems are discussed as well.

Learning Outcomes: 1. Demonstrate knowledge of the characteristics, scope, and economic influence of an airline. 2. Develop operations management skills by creating aircraft schedules, forecasting fuel pricing, and budgeting for quality programs. 3. Analyze airline financial statements. Credits: 3.00

AT 43900 - Aviation Command Leadership

Credit Hours: 2.00. Examination of pilot professional development and strategies for career planning and industry advancement. Emphasis is placed on leadership, command training, and mentorship for pilots throughout their career.

Learning Outcomes: 1. Examine regulatory requirements, policies, and procedures that impact authority and leadership. 2. Demonstrate techniques for reinforcing high standards of professionalism. 3. Assemble knowledge and skills necessary for effective leadership. 4. Create a 5 year professional development plan to become an effective leader. Credits: 2.00

AT 44502 - Aircraft Electronics

Credit Hours: 3.00. A study of the computer-based electronic systems used to control both flight and engine parameters on modern aircraft. The course examines the various systems with an emphasis on how each component integrates into the electronic structure of the aircraft.

Learning Outcomes: 1. Demonstrate an understanding of design, operation, and troubleshooting concepts of advanced digital and analog systems found on modern aircraft. Credits: 3.00

AT 45100 - Airport Operations

Credit Hours: 3.00. This course is an in-depth examination of airport operations for air carrier and general aviation airports, with a strong emphasis on practical problem solving of current operational issues facing local and area airports.

Credits: 3.00

AT 45200 - Aviation Global Experience Seminar

Credit Hours: 1.00. This course prepares students for faculty-led study trips and similar international experiences for which direct course credit is not available.

Credits: 1.00

AT 45300 - Aviation Global Experience

Credit Hours: 0.00 to 3.00. Supervised international study experience for AT students for which direct course credit not available. Specific objectives, requirements, and credit determined by the Aviation Technology department.

Credits: 0.00 to 3.00

AT 45400 - Human Factors in Aviation

Credit Hours: 3.00. Students investigate the disciplines known as human factors and ergonomics and how they apply to various aviation career areas from a management perspective. Common industry models and error management strategies will be studied and evaluated.

Credits: 3.00

AT 45900 - Airport Manager Certification

Credit Hours: 3.00. This course prepares students for the certified manager exam offered by the American Association of Airport Executives (AAAE). This certificate is the first step toward industry accreditation as an airport manager and director.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental aviation safety and security principles as they apply to the national and international aviation environment. 2. Develop the ability to identify and provide realistic recommendations to

resolve national and international aviation deficiencies. 3. Demonstrate understanding of alternative views in order to balance historical and modern interpretation of airspace and airfield needs for aircraft operation. Credits: 3.00

AT 47200 - Advanced Composite Technology

Credit Hours: 3.00. Students will perform a variety of fabrication, testing, and repair tasks using specialized composite fibers, matrices, and core materials.

Learning Outcomes: 1. Understand composite part manufacturing process and tooling. 2. Describe different composite part manufacturing process. 3. Understand complex composite materials design solutions and applications. 4. Obtain knowledge of part manufacturing and machining. 5. Design machining tool path using computer-aided manufacturing (CAM) software. 6. Proficient with computer numerical control (CNC) milling machine. 7. Operate different equipment for composite part manufacturing and machining process. Credits: 3.00

AT 47500 - Aviation Law

Credit Hours: 3.00. A study of the fundamental legal and aviation law principles as they apply to the various participants in the aviation industry. Special emphasis is placed on contemporary aviation law issues such as pilot, flight instructor, and mechanic liability; product liability; and aviation insurance.

Learning Outcomes: 1. Understand the fundamental aviation law principles as they apply to the various stakeholders in the national and international aviation environment. 2. Apply pertinent knowledge in identifying and solving problems. Credits: 3.00

AT 47600 - Aircraft Gas Turbine Engine Technology II

Credit Hours: 3.00. This is a study of turbofan engines and systems. Engine installation, testing, and operational procedures are stressed. Emphasis is placed on performance evaluation, data calculations, and predictions of operational properties. Turbofan design theory, operational efficiencies, and fault isolation are discussed.

Learning Outcomes: 1. Operate the test cell and perform parameter recording and thrust evaluations. 2. Given an operable engine installation, remove the engine and simulate procedures to be followed to store the engine. 3. Inspect, perform routine service and troubleshooting on turbine engine fuel system. 4. Using the manufacturer's recommended procedures, simulate adjustment of the fuel metering system and electronic fuel control on a turbine engine. 5. Inspect, check, service, troubleshoot, and repair turbine engine airflow, pressure and temperature measurement systems. Credits: 3.00

AT 47700 - Aircraft Maintenance Practicum

Credit Hours: 1.00. This course provides the knowledge, information and experience required for aviation professionals to interact safely in a general aviation environment.

Learning Outcomes: 1. Demonstrate familiarity with activities related to general, airframe and powerplant maintenance tasks. 2. Demonstrate the ability to safely perform in a general aviation maintenance environment. Credits: 1.00

AT 47900 - Control Tower Operator

Credit Hours: 3.00. This course includes a review of air traffic control procedures, federal aviation regulations, and aviation weather observation and reporting. It is designed to prepare students to pass the FAA Control Tower Operators Examination.

Learning Outcomes: 1. Understand the operation of FAA air traffic control facilities. 2. Understand air traffic communication process, including formatting of authorized communications, phraseology and control symbology. 3. Identify the purpose the VFR, IFR, and dVFR flight plans and uses of such by ATC. 4. Identify the purpose of basic FAA orders and manuals. Credits: 3.00

AT 48000 - Advanced Aviation Manufacturing (Lean Six Sigma Methodologies)

Credit Hours: 3.00. Course is a selective choice in the AET program. This is a study of advanced aviation manufacturing principles, lean six sigma methodologies and project management basics. Permission of instructor required.

Learning Outcomes: 1. Develop the competencies to utilize required advanced manufacturing processes to operate a manufacturing facility. 2. Cultivate the ability to utilize advanced process quality planning methods to implement a quality program in a manufacturing facility. 3. Gain the knowledge and experience required to effectively implement supply chain management techniques and logistic programs in a manufacturing facility. 4. Incorporate an effective continuous improvement process to be utilized and promoted throughout the curriculum. 5. Select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities. 6. Select and apply knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies. 7. Conduct standard tests and measurements; to conduct, analyze, and interpret experiments. 8. Apply project-based learning techniques to improve processes, and communicate a commitment to quality, timeliness, and continuous improvement. All the objectives listed are crucial in the manufacturing world. Credits: 3.00

AT 48100 - Aviation Safety Problems

Credit Hours: 3.00. This course provides the opportunity for students to study problems associated with aviation safety. Particular attention will be given to the formulation of specific recommendations for improvements in aviation safety.

Learning Outcomes: 1. Familiar with the fundamental safety theories and possible applications. 2. Understand the characteristics human errors. 3. Identify and analyze the casual factors of a mishap. 4. Explain the process of emergency response and accident prevention programs. Credits: 3.00

AT 48400 - Transport Aircraft Operations Simulation Laboratory

Credit Hours: 4.00. This course provides jet turbine-type aircraft simulator experience, allowing students to engage in typical aircraft maneuvers in visual and instrument atmospheric conditions. The laboratory lessons emphasize aircraft procedures in normal and abnormal flight or equipment conditions, focusing on crew resources management, applicable flight regulations, and aircraft systems knowledge in a scenario-based experiential learning environment.

Learning Outcomes: 1. Demonstrate familiarization with normal & non-normal aircraft operations and instrument flying procedures. 2. Perform routine IFR/VFR procedures and crew resource management per industry standards. 3. Demonstrate effective teamwork, communication, leadership, resilience, and decision-making skills. 4. Manipulate flight deck switches accurately in accordance with standard operating procedures. 5. Demonstrates the ability to explain aircraft systems and their interrelatedness. Credits: 4.00

AT 48700 - Transport Aircraft Simulation Laboratory

Credit Hours: 2.00. This is a laboratory course conducted in a turbine-type aircraft simulator. This course emphasizes normal instrument and aircraft procedures as well as aircraft systems and cockpit resource management. Permission of department required.

Learning Outcomes: 1. Demonstrate proficiency in normal aircraft operations and instrument flying procedures as well as flight planning. 2. Demonstrate proficiency in crew coordination, normal procedures, instrument procedures, flight planning, and crew resource management. 3. Familiar with the procedures required of all

cockpit positions. 4. Demonstrate proficiency in the operation of all aircraft systems in normal and abnormal situations. Credits: 2.00

AT 48900 - Capstone For Professional Flight Students

Credit Hours: 3.00. This capstone for Professional Flight students course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous knowledge of the student's curriculum. It also allows students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Analyze current literature to determine current aviation problems. 2. Plan a project within a small team utilizing effective communication and problem-solving skills. 3. Demonstrate the ability to combine knowledge, skills, and experiences from different areas and sources to create new applications. Credits: 3.00

AT 49000 - Aviation Project

Credit Hours: 1.00 to 6.00. Independent study for junior and senior students who wish to pursue study and developmental work in special areas. Subject matter must be arranged with the instructor before enrolling in the course. Permission of instructor required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 6.00

AT 49200 - Aircraft Airworthiness Assurance

Credit Hours: 3.00. Students apply foundational airworthiness assurance principles from the aviation and aerospace industries, performing maintenance and inspection tasks on the school's large transport category laboratory aircraft. They research OEM data to develop and test air vehicle work instructions, incorporating modern maintenance and inspection practices like MSG-3, Reliability Centered Maintenance, and global Safety and Quality standards and Industry 4.0 data science frameworks relating to air vehicle maintenance. They also practice essential participative team and leadership competencies, taking on leadership roles with their laboratory peers as technical team members in a live airport ramp environment.

Learning Outcomes: 1. Recall and explain the definitions, key components and location of U.S. and global regulatory guidance related to Airworthiness, Safety Management Systems (SMS), Quality Management Systems (QMS) and Reliability Centered Maintenance (RCM) for MRO and Aerospace Advanced Manufacturing operations. 2. Use OEM and FAA technical data/guidance for standard maintenance practices, perform air vehicle maintenance and inspection tasks using the lab's large airplane. 3. Create technical Work Instructions and air vehicle General Familiarization Training using OEM data, demonstrating compliance to airworthiness and quality standards for large air vehicles. 4. Demonstrate key leadership and team coordination competencies for working with hazardous air vehicle systems, technologies and processes. Credits: 3.00

AT 49300 - Industrial Practice V

Credit Hours: 1.00. Industrial practice and experience in participating industry. Requires written report of the experience.

Credits: 1.00

AT 49401 - Capstone Project Proposal

Credit Hours: 2.00. Students will study all aspects of a possible capstone project and will develop a proposal for conducting an applied research project.

Learning Outcomes: 1. Integrate knowledge and skills to design a process/product/service improvement or process/product/service design applicable to the academic major. 2. Develop a project plan. 3. Demonstrate the application of problem-solving skill using knowledge gained in previous coursework and/or experience. Credits: 2.00

AT 49501 - Applied Capstone Research Project

Credit Hours: 1.00. Students will complete the applied capstone project defined in AT 49401.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation

of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 1.00

AT 49600 - Applied Research Proposal

Credit Hours: 2.00. Students perform a structured analysis of an industry-based problem or design challenge, producing a professionally written project proposal. Students engage all aspects of a product or process engineering design proposal including problem analysis, identifying design requirements, conceptualizing, and communicating a solution. Students incorporate rigorous research and industry methodologies like Quality Functional Deployment, Failure Mode and Effects Analysis, literature reviews, and project cost/ROI estimates to create and defend a written project proposal.

Learning Outcomes: 1. Integrate knowledge and skills to create a written project proposal reflecting proficiency at professional industry standards. 2. Demonstrate application and proper use of problem-solving methods, tools and research practices salient to the aviation andaerospace industry. 3. Apply life-long learning skills and competencies to acquire the knowledge, skills and resources required to complete the project. Credits: 2.00

AT 49700 - Applied Research Project

Credit Hours: 3.00. Students transform their product/process design proposal created in the proposal design course into a requirements-driven, functional product. During design, they employ rigorous R&D criteria and metrics, global quality, safety, and other industry-based standards, tracking and reporting project development using Technology Readiness Level criteria. For deployment and test phases they incorporate human subject certification, protocols, and develop user-test measures using quantitative and qualitative analysis. The course deliverable is a final written report and functional project demonstration/presentation.

Learning Outcomes: 1. Integrate knowledge and skills to implement a process/product/service improvement or process/product/service design for design, aircraft operations, or maintenance. 2. Develop, deploy, and validate a project from a proposal. 3. Demonstrate the application of research, design, and test methodologies. 4. Demonstrate the application of problem-solving skills and technical knowledge gained throughout the curriculum. Credits: 3.00

AT 49800 - Aviation Technology Capstone

Credit Hours: 3.00. The Aviation Technology Capstone course encourages teamwork in small groups on a substantial project. The intent of this course is to provide a capstone experience that integrates the material and previous experience of the student's curriculum. It also provides an opportunity for students to recognize and evaluate the interrelationship of their general education courses with the courses taken for their major.

Learning Outcomes: 1. Complete a project that integrates previously learned material in an original manner. 2. Conduct a critical evaluation of previously published information. 3. Submit a project in a format compatible with business, industry and/or academic standards. Credits: 3.00

AT 49900 - Aviation Technology

Credit Hours: 1.00 to 4.00. Hours, credit, and subject matter to be arranged by staff. Permission of department required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 4.00

School of Construction Management Technology

Overview

Purdue University's School of Construction Management Technology offers a bachelor's degrees accredited by the American Council for Construction Education, awarded for the high level of educational experience and quality provided. One of the strengths of the program comes from the hands-on learning that provides applicable experience in a real-world environment. A part of this experience comes from the minimum 800 hours of construction experience that each undergraduate student is required to complete prior to graduation. Because of its history and leadership within the industry, the school benefits from an extensive list of industry partners.

Faculty

School of Construction Management Technology Website

Contact Information

Building Construction Management Department
Knoy Hall, Room 453
401 N.Grant St.
West Lafayette, IN 47907
Phone: 765.494.2459
Email: cminfo@purdue.edu

Graduate Information

For Graduate Information please see Building Construction Management Graduate Program Information .

Construction Graphics Minor

Building Information Modeling, BS

Construction Management Minor

Design and Construction Integration, BS

Design and Construction Integration Minor

Interior Architecture, BS (Indianapolis Only)

Construction Management, BS

ARCH 11700 - Construction Drafting And CAD

Credit Hours: 3.00. Introduction to drafting and CAD fundamentals, with emphasis on architectural and civil engineering topics. Development of basic drafting skills, using orthographic projections, auxiliary views, pictorial drawings, and drafting conventions. Students may not receive credit for both ART 116 and ART 117.

Credits: 3.00

ARCH 12000 - Introduction To Construction Drafting With Building Information Modeling (BIM)

Credit Hours: 3.00. Introduction to drafting fundamentals using Building Information Modeling (BIM), an intelligent 3D model-based process that equips architecture, engineering, and construction professionals with the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. Autodesk Revit will be the software presented.

Credits: 3.00

ARCH 15500 - Residential Construction

Credit Hours: 3.00. Wood frame construction through a semester project requiring planning, preliminary, and working drawings. Outside lab assignments are required.

Credits: 3.00

ARCH 21000 - History Of Architecture I

Credit Hours: 3.00. Survey of styles and influence of cultures which led to the development of architecture and engineering from the earliest times to the early 20th century.

Credits: 3.00

ARCH 22200 - Commercial Construction

Credit Hours: 3.00. Preparation of preliminary and working drawings for an intermediate-size commercial or institutional building.

Credits: 3.00

ARCH 22300 - 3D Architectural Modeling I

Credit Hours: 3.00. This course will study graphic solutions to visualizing interior spaces and environments by utilizing 3D modeling software. Students will learn the fundamentals and advanced toolset in the 3D modeling software Trimble SketchUp while working on a semester long visualization project.

Credits: 3.00

ARCH 32300 - 3D Architectural Modeling II

Credit Hours: 3.00. This course has been designed to expand

the students' knowledge, creativity, and technique when creating 3D digital models and renderings. This class should not be the students' introduction into Autodesk Revit Software, but a course developed to refine modeling and rendering skills. Topics include but are not limited to: understanding the use of architecture, materials, lighting, etc.

Credits: 3.00

ARCH 32500 - Building Science & Energy

Credit Hours: 3.00. The study and practice of interior lighting with an emphasis on environmentally efficient lighting systems and energy economy. Through the design process and execution of luminaire layouts, students will examine the visual process, lamp and luminaire selection, calculation methods, lighting controls and evaluation of effective solutions.

Credits: 3.00

CM 10000 - Introduction To Construction Management (UCC: STS)

Credit Hours: 3.00. This course is a survey of the construction industry. Topics include the overall construction process, career opportunities in the construction industry, an introduction to construction materials as well as management and technology tools used in the industry. There will be an emphasis on construction specific vocabulary.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Recognize the evolution of the construction management role, the future of the construction industry, and prepare for a career in the industry. 2. Describe the basic sequence of work as well as a broad overview of basic materials and methods for a general construction project. 3. Know the evolution and growing demand for technology in construction. 4. Identify resources for student success at Purdue and life-long learning. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 3.00

CM 15000 - Construction Management Fundamentals

Credit Hours: 6.00. This introductory course focuses on construction materials, methods, and contracts for basic commercial and residential projects. Students will develop essential skills in quantity estimating, construction plan reading, and project documentation. Students will participate in hands-on lab exercises that aim to connect theory with practice. The course includes OSHA 10-hour instruction, with students earning OSHA 10-hour certification cards upon completion, further emphasizing the importance of safety in construction practices.

Learning Outcomes: 1. Identify materials, means, and methods for a construction project throughout the entire project lifecycle. 2. Recognize project controls required during the pre-construction and construction phases of a construction project. 3. Explain project planning tasks relevant to a construction project. 4. Comprehend project administration on a construction project and the required documentation and technology available within the current construction industry. 5. Convey professionalism by practicing proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 16000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Learning Outcomes: 1. Understand fundamentals of surveying including the theory and practice of surveying. 2. Perform surveying computations of grade, direction, traverse adjustment, area, and horizontal and vertical curve geometry. 3. Perform field measurements using basic and modern surveying equipment. 4. Perform tasks within a group effectively and efficiently. Credits: 3.00

CM 16400 - Graphics For Civil Engineering And Construction

Credit Hours: 2.00. This course introduces the fundamentals of

construction engineering graphics and computer-aided documentation, focusing on their application in civil engineering and construction-related professions. Emphasizing the future of digital communication in the industry, students will explore advanced visualization and analysis techniques through the integration of sketching, computer-aided design (CAD), and emerging technologies. The course covers industry-standard graphic conventions, database management strategies, and methods for generating, interpreting, and sharing precise geometric models. Students will develop skills in creating, manipulating, and analyzing 2D and 3D visualizations to effectively communicate and solve complex construction problems in a dynamic, technology-driven environment.

Learning Outcomes: 1. Understand the Role of Construction Graphics: Demonstrate knowledge of the history, theories, and importance of engineering design processes and graphics in construction, including their role in real-world problem-solving and communication. 2. Apply Geometric and Graphic Standards: Develop proficiency in creating and solving 2D and 3D geometric forms and applying construction graphic standards and codes to engineering problems. 3. Utilize Computer Graphics and Visualization: Effectively use computer-aided design (CAD) tools and 3D visualization skills to analyze, solve, and communicate construction challenges. 4. Enhance Communication Through Graphic Conventions: Present solutions clearly and accurately using appropriate 2D and 3D graphical communication standards and conventions. Credits: 2.00

CM 20002 - Intermediate Pre-Construction Management

Credit Hours: 4.00. A project course covering intermediate level commercial, residential, heavy/civil, and industrial construction projects. Students will expand their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Calculate design components of a construction project during the pre-construction phase. 2. Produce project controls required during the pre-construction phase of a construction project. 3. Construct pre-planning documents relevant to beginning a construction project. 4. Apply project administration to a construction project utilizing the required documentation and technology available within the current construction industry. Credits: 4.00

CM 21500 - Mechanical Construction

Credit Hours: 3.00. Principles of code, design, methods, and materials are applied to plumbing, heating, ventilation, and air conditioning systems for buildings. The comprehension of mechanical construction plans and specifications is emphasized through exercises in mechanical estimating.

Learning Outcomes: 1. Relate materials, means, & methods for the MEP scope to a construction project throughout the project lifecycle. Prepare a list of CSI Divisions for the MEP scope and outline the MEP scope of work for a construction project; Propose sustainability concepts to the materials, means, and methods for the MEP scope of a construction project; Schedule work sequence for the MEP scope of construction phases of a project; Apply QA/QC documents and procedures required for the MEP scope during the construction phase. 2. Apply company management concepts to the MEP scope of a construction project during the construction phase. Create financial management plan required to complete the MEP scope of a construction project; Demonstrate interpersonal relations related to the MEP scope on a construction project; Integrating technology use on the MEP scope of a construction project during the construction phase. 3. Show professionalism by applying proper communication, team work, rules & regulations, and level of detail required within a construction company and on a construction jobsite. Demonstrate leadership skills within a team-based project; Utilize management skills required to complete tasks within a construction project; Practice teamwork utilizing the

strengths of the individuals within the team; Apply oral and written communication skill required within a construction project; Use ethics in all decision making and daily activities in a construction project. Credits: 3.00

CM 21601 - Electrical Construction

Credit Hours: 2.00. Principles of code and basic concepts in electrical theory, materials, methods, design and estimating are applied to electrical systems for buildings. Comprehension of electrical construction plans and specifications as well as installation exercises are emphasized through lab experiences.

Learning Outcomes: 1. Demonstrate thorough knowledge of all documents normally used in the electrical construction process including plans and specifications. 2. Recognize the applications of commonly used types of electrical materials required in building construction. 3. Interpret and evaluate materials selection, installation methods, and proper sizing and installation techniques using the National Electrical Code. 4. Illustrate the ability to effectively interact with building construction professionals regarding electrical construction. 5. Recall the names, nicknames, applications and rules for commonly used materials in the electrical contracting industry. 6. Construct proper electrical systems schematics. 7. Assemble the correct components and arrange them correctly to demonstrate basic electrical circuit knowledge. 8. Inspect electrical installations and identify rudimentary National Electrical Code violations. Credits: 2.00

CM 23301 - Mechanical, Electrical And Piping Systems In The Built Environment

Credit Hours: 3.00. An introductory course dealing with construction materials and methods related to building systems, focusing on mechanical, electrical, and piping (MEP) systems. Students will acquire fundamental skills in MEP construction plan reading, quantity estimating, basic systems' design and construction execution through lectures, laboratories and integrated project team exercises.

Learning Outcomes: 1. Recognize the basic principles and components of mechanical, electrical and piping (MEP) systems. 2. Explain the components of a given MEP system based on reading plan and specifications information. 3. Demonstrate the ability to understand conceptual cost and schedule of MEP systems. 4. Trace basic MEP systems lines, such as piping, lighting, and mechanical ducts. 5. Show an understanding of professionalism by applying proper communication, teamwork, rules & regulations, and level of detail required within a built environment business and on a construction jobsite. Credits: 3.00

CM 26000 - BIM I: Arch Modeling & Presentation Development

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers (IVCM) with essential skills in Building Information Modeling (BIM) for architectural design and marketing. Students will learn to create detailed, accurate 3D models and immersive visualizations that enhance construction workflows and serve as powerful marketing tools. By integrating BIM with project management, students will gain the technical and creative skills needed to transform complex construction data into persuasive visual content for clients and stakeholders.

Learning Outcomes: 1. Create accurate and detailed architectural Building Information Models, integrating design intent and construction data, while coordinating with other disciplines. 2. Demonstrate proficiency in creating high-quality visualizations, including renderings, animations, and walkthroughs, to develop professional presentations that clearly and persuasively communicate design concepts, project details, and potential construction impacts to stakeholders and clients. 3. Incorporate project management data, such as material quantities, cost estimates, and timelines, into models, preparing students for decision-making roles in construction management. 4. Develop the ability to manage BIM models throughout the project lifecycle, ensuring accuracy, version control, and alignment with evolving project

objectives, while preparing professional-grade presentations tailored to client needs. Credits: 3.00

CM 26200 - Introduction To Construction Graphics

Credit Hours: 3.00. Study of graphic solutions to problems conditioned by traditional and emerging construction document standards. Construction document creation is based on current architectural engineering and construction (AEC) standards with a focus on residential settings. Introductory 2D documentation will progress into 3D modeling techniques.

Learning Outcomes: 1. Employ graphic strategies in typical construction communication environments. 2. Relate construction graphics theories to real-world practices. 3. Produce graphic solutions to appropriate problems. 4. Show functional literacy in a variety of construction types. 5. Demonstrate construction print reading skills. 6. Identify and utilize construction graphic standards. Credits: 3.00

CM 27000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Learning Outcomes: 1. Analyze force systems acting at a single point. 2. Analyze force systems that are non-concurrent. 3. Analyze/design cable systems. 4. Analyze/design trusses by graphical and numerical methods. 5. Analyze/design pinned frames. 6. Analyze/design 3-hinged arches. 7. Trace the live and dead loads throughout a building structure. Credits: 3.00

CM 30002 - Advanced Pre-Construction Management

Credit Hours: 4.00. A project course covering advanced level commercial, residential, heavy/civil, and industrial construction projects. Students will further develop their understanding of construction company management, design, cost, project controls, and safety.

Learning Outcomes: 1. Select design systems for a construction project during the pre-construction phase. 2. Illustrate project controls required during the pre-construction phase of a construction project. 3. Analyze pre-planning tasks relevant to beginning a construction project. 4. Differentiate project administration on a construction project utilizing the required documentation and technology available within the current construction industry. 5. Demonstrate professionalism by analyzing proper communication, teamwork, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 4.00

CM 30101 - Introduction To Construction Company Financial Management

Credit Hours: 2.00. An introduction to methods for recognizing revenue for long-term construction contracts and each method's impact on financial statements. Includes introduction to analysis of financial statements and their use in developing company budgets, projecting cash needs, pricing construction projects, and forecasting the impact of business decisions on construction company profit.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction contractor. 2. Identify the unique accounts required for percentage of completion revenue recognition, describe what the account represents, and indicate on which statement the account is found. 3. Interpret the outcomes of line-item analysis, vertical analysis, horizontal analysis, and cost-volume-profit analysis utilizing construction company financial statement data. 4. Perform a profit center analysis of an income statement. 5. Prepare an annual budget for a construction company given source documents. 6. Analyze the impact of various decisions on company profits by applying the cost-volume-

profit financial analysis technique. 7. Select the appropriate overhead and profit allocation technique given example company cost structures and compute minimum company overhead and profit mark-up rates. 8. Prepare a monthly company budget given the annual budget and other appropriate information. 9. Compare the monthly budget prepared to actual data. 10. Compare and contrast profit and cash flow for the construction company. 11. Prepare a cash flow projection by applying the company monthly budget. Credits: 2.00

CM 31000 - Equipment And Field Operations

Credit Hours: 3.00. Study of heavy equipment used in construction operations with an emphasis on equipment selection, application, cost, productivity, safety, and economics.

Learning Outcomes: 1. Understand each of the construction equipment functions and applications for construction operations. 2. Use the technique and method presented in class to: analyze ownership and operating costs; analyze earthwork volume, mass diagram, and hauling distance; analyze compaction operations; analyze power requirements; analyze dozer operation; analyze scraper operation; analyze excavator operation; analyze hauling operation; understand asphalt mix production and placement; understand concrete and concrete equipment operation; understand crane operation. Credits: 3.00

CM 31500 - Applied Construction Practice I

Credit Hours: 3.00. This course provides a supervised pre-professional learning experience, enabling students to apply their skills and knowledge while gaining practical, on-the-job training. It's designed to offer students an exciting hands-on progressive learning experience while helping employers shape and prepare their future workforce. Students are required to maintain full-time documented employment with an approved employer for the duration of the course. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficient use of construction management skills and concepts to successfully perform duties as assigned by direct supervisor. 2. Work cooperatively as a team member on construction projects. 3. Demonstrate oral and written communication skills to facilitate project delivery. 4. Demonstrate professionalism. 5. Develop independent planning and organizational skills. Credits: 3.00

CM 32500 - Applied Construction Practice II

Credit Hours: 3.00. This course provides a supervised pre-professional learning experience, enabling students to apply their skills and knowledge while gaining practical, on-the-job training. It's designed to offer students an exciting hands-on progressive learning experience while helping employers shape and prepare their future workforce. Students are required to maintain full-time documented employment with an approved employer for the duration of the course.

Learning Outcomes: 1. Demonstrate proficient use of construction management skills and concepts to successfully perform duties as assigned by direct supervisor. 2. Work cooperatively as a team member on construction projects. 3. Demonstrate oral and written communication skills to facilitate project delivery. 4. Demonstrate professionalism. 5. Develop independent planning and organizational skills. Credits: 3.00

CM 33000 - Design And Construction I

Credit Hours: 6.00. A course which introduces students to projects and the design information of the built environment as communication tools representing space and proportion. Through a blend of lectures and studio work, students obtain working knowledge of the traditions, documents and standards utilized in the planning for a built structure. Students will also experience how design decisions and programing are influenced by a multitude of outside influences.

Learning Outcomes: 1. Develop basic projects, sketches and pre-projects related to the built environment using appropriate design conventions. 2. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics and technical demands into consideration at the same time. 3. Analyze

relevant precedents in order to make informed design choices. 4. Explain the feasibility analysis, supervision and coordination of integrated projects. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

CM 33100 - Design And Construction II

Credit Hours: 6.00. A course where students exert criticism and evaluation of existing design through a blend of lectures and studio work. Students will be exposed to typical impediments to the design of the built environment as they demonstrate integrative decision making in creating an aesthetic and functional design program that meet the needs of society in a resource efficient and sustainable manner. Students will regularly critique the work of others and have their work critiqued as they seek to shape and implement informed design decisions.

Learning Outcomes: 1. Exercise criticism in relation to built environment design disciplines by taking user needs, aesthetics, cost, schedule, safety and technical demands into consideration at the same time. 2. Identify sustainability, efficiencies and resource conservation principles to be applied in the built environment. 3. Elaborate sketches, two-dimension drawings or three-dimension models using standard design conventions to aid in the design and construction coordination. 4. Demonstrate the skills associated with making integrated decisions across multiple systems and variables in the completion of a design project. 5. Demonstrate professionalism by analyzing proper communication, team work, rules & regulations, and level of detail required within an integrated approach to the design and construction of the built environment. Credits: 6.00

CM 33200 - Architectural Design, Construction Techniques And Society

Credit Hours: 3.00. A course in which students will be exposed to the evolution of architecture and building techniques that influenced the western built environment. Emphasis will be given to the use of appropriate vocabulary and also how social and cultural factors have influenced the design of the built environment throughout the centuries. The course will survey topics from XVII century to recent times.

Learning Outcomes: 1. Recognize architectural and technical traditions of the Western culture. 2. Identify relationships between cultural patterns and social responsibilities of designers. 3. Recognize ways that history or related arts, humanities and technologies influence the built environment. 4. Use appropriate architectural and technical vocabulary. Credits: 3.00

CM 36000 - BIM II: Modeling & Advanced Techniques

Credit Hours: 3.00. This course prepares future Integrated Virtual Construction Managers to master advanced Architectural Building Information Modeling (BIM) while also focusing on Structural and MEPF (Mechanical, Electrical, Plumbing, and Fire Protection) systems. Through hands-on projects, students will gain expertise in multi-disciplinary BIM coordination, clash detection, spatial coordination, and simulation techniques, essential for avoiding design and construction conflicts. Emphasizing interdisciplinary collaboration, the course equips students with the technical and managerial skills to efficiently manage complex building projects from design through construction.

Learning Outcomes: 1. Master creating detailed 3D models for architectural, structural, and MEPF components using industry standards, ensuring design accuracy and compliance with building codes and standards. 2. Demonstrate the ability to coordinate architectural, structural, and MEPF models, using clash detection tools to identify and resolve conflicts and ensure seamless integration across disciplines. 3. Apply collaborative BIM practices to facilitate communication and coordination among project stakeholders, ensuring alignment of design and construction elements throughout the project. 4. Use models to visualize building systems and project phases, supporting design reviews, construction planning, and informed decision-

making throughout the project lifecycle. Credits: 3.00

CM 36200 - Construction Competition

Credit Hours: 2.00. This is a multi-disciplinary course where students from several majors work together as a team, developing a proposal for a construction of development project, which is presented at a student competition. Topics include a variety of project types, including land development, design/build, residential, commercial and heavy highway. Permission of instructor required.

Learning Outcomes: 1. Write competition required documents and/or presentation. 2. Collaborate successfully in groups. 3. Demonstrate professional communication towards stakeholders involved in the competition they participate (team mates, competition organizers and/or instructors). Credits: 2.00

CM 36400 - Jobsite Management

Credit Hours: 3.00. Examination of construction project management on the jobsite. Topics include, submittals, record keeping, jobsite layout, meetings, negotiations, dispute resolution, labor relations, safety, subcontracting, quality, cost control, waste management, changes, claims, progress payments, and project closeout.

Learning Outcomes: 1. Understand and explain the fundamentals of project management. 2. Understand and explain the project team. 3. Understand and explain the use of construction documents on the jobsite. 4. Understand and explain submittals, samples, and shop drawings. 5. Understand and explain documentation and record keeping at the jobsite. 6. Understand and explain meetings, negotiations, and dispute resolution. 7. Understand and explain jobsite labor relations and control. 8. Understand and explain personnel and safety management. 9. Understand and explain subcontracting and purchasing. 10. Understand and explain project quality management. 11. Understand and explain time and cost controls. 12. Understand and explain waste and environmental management and sustainable construction practices. 13. Understand and explain computerized project administration. 14. Understand and explain building information modeling (BIM). 15. Understand and explain changes and claims. 16. Understand and explain progress payments. 17. Understand and explain project closeout. Credits: 3.00

CM 36500 - BIM For Project Managers And Field Supervision

Credit Hours: 2.00. One of the most important components of the construction industry is to visualize the project during its design, construction and over entire life cycle of structure, enabling invested parties to change/adjust the project. A construction project manager' job description is a person who can plan and oversee a construction project from initiation to close with the help of software, technology, resources and a reasonable budget. BIM has delivered a significant impact all aspects and types of AEC projects in terms of economic as well as technical viability. BIM plays a vital role in the management of the project. A project manager can leverage the capability of BIM to deliver a successful construction project and BIM reduces the burden on the project manager of manually calculating and managing tasks. It seems clear that for a construction project to be successful today, project managers would do well to adopt BIM technology. This course is the start that seeks to better understand & address student needs as a on job-site project manager utilizing advanced technologies coupled with Building Information Modeling to produce a form of Building Information Management. It will be given across the multiple disciplines/curricula in anticipation of integrating said new technologies extracted from BIM. Permission of instructor required.

Learning Outcomes: 1. Identify key components of BIM used in Field office. 2. Identify key aspects of LOD (and what trades are most beneficial) needed in BIM for field office operations. 3. Improve Field and Office processes (and communication) utilizing BIM. 4. Facilitate and improve Coordination of discipline models. 5. Introducing the engineering design process in a quick, easy, and visible way. 6. Bridging the physical and digital model within field office. 7. Integrating hands-on experience with technology utilized in field. Credits: 2.00

CM 36800 - Reinforced Concrete And Steel Construction And Design

Credit Hours: 3.00. This course examines the design and behavior of reinforced concrete and steel structures, with a focus on analyzing concrete members under moments, shear, and axial forces. Students will explore the influence of material properties on structural performance and study the design of reinforced concrete components (beams, columns, slabs) and steel members, applying industry codes and standards. The course integrates theoretical, experimental, and practical aspects of structural design, equipping students with the skills to proportion and understand concrete and steel elements for real-world construction management applications.

Learning Outcomes: 1. Explain the influence of material properties (e.g., concrete strength, steel yield stress) on the structural performance and behavior of reinforced concrete and steel elements under different loading conditions. 2. Analyze reinforced concrete and steel structural elements subjected to different types of loads (moment, shear, axial forces) and determine their strength, stability, and serviceability. 3. Assess the effectiveness of design solutions for reinforced concrete and steel structures critically considering factors such as cost, material selection, and long-term performance. 4. Develop comprehensive structural designs for reinforced concrete and steel members, integrating theoretical principles with practical design constraints to ensure safety, economy, and efficiency. 5. Communicate complex structural design concepts and calculations effectively through technical drawings, reports, and presentations to clients, contractors, and other stakeholders. Credits: 3.00

CM 37000 - Heavy Civil Construction Management

Credit Hours: 3.00. This course will focus on the construction of roads, bridges, and other major transportation-related infrastructure. Topics include construction of concrete pavements, asphalt pavements, deep foundations, and underground utilities. Management of traffic, road construction safety, quality and master planning will also be covered.

Learning Outcomes: 1. Explain terminology and construction requirements for embankments and aggregate bases. 2. Develop a plan for highway construction equipment. 3. Compare the procedures and techniques for construction, rehabilitation, and maintenance of asphalt and concrete pavements. 4. Apply quality control techniques in highway construction. Credits: 3.00

CM 37100 - Industrial Construction Management

Credit Hours: 3.00. This course will focus on the design and construction of industrial systems and processes including Infrastructure for energy, chemical, and water/wastewater systems. Topics studied include piping, welding, heavy lift cranes, and high voltage systems.

Learning Outcomes: 1. Explain the construction procedures for large industrial processes and contracting methods. 2. Calculate forces from heavy crane lifts and multi-crane lifts. 3. Analyze work procedures related to piping, welding, and high voltage electrical installation. Credits: 3.00

CM 37200 - Planning, Design, And Construction Process For The Healthcare Built Environment

Credit Hours: 3.00. This course will focus on the construction of healthcare facilities including hospitals, clinics, nursing homes and laboratories. The course will emphasize the interrelationship of planning, design, and construction.

Learning Outcomes: 1. Identify the key market segments of the healthcare built environment. 2. Classify the unique requirements for healthcare planning, design, and construction. 3. Analyze job opportunities within healthcare for construction management students. Credits: 3.00

CM 37300 - Healthcare Construction Management - Systems, Occupied Space Work, And Related Industries

Credit Hours: 3.00. This course will focus on the construction of healthcare facilities and include topics related to infectious materials control, disruption avoidance, rapid technology changes, emergency routes, and advanced mechanical and electrical systems.

Learning Outcomes: 1. Analyze building systems in healthcare construction. 2. Define the processes required to work within occupied spaces. 3. Identify the related industries in healthcare other than traditional hospitals. Credits: 3.00

CM 37400 - Mechanical And Electrical Construction Management I

Credit Hours: 3.00. This course will focus on the process of analyzing the elements of mechanical, electrical, and plumbing (MEP) construction inherent in producing a MEP construction estimate. Topics include using work product documentation to present and shape the proposal, establishing a conceptual framework of the estimating process, examining commercial/industrial methods and materials, symbol identification, equipment application, and studying the estimating process sequence from project overview to final pricing.

Learning Outcomes: 1. Interpret MEP construction drawings, specifications and bid documents. 2. Describe the estimating process, including the concepts of labor, material, profit, and overhead. 3. Prepare a final bid summary, including quantity takeoff and required pricing. Credits: 3.00

CM 37500 - Mechanical And Electrical Construction Management II

Credit Hours: 3.00. This course will focus on an in-depth investigation of the elements of mechanical, electrical, and plumbing (MEP) construction on real-world projects. The student will be involved in investigating the equipment and components for the MEP systems and selecting the optimum project delivery method. Estimating will include topics such as solar arrays, EV charging, electrical vehicle charging station projects, smart grids, and energy conservative strategies and equipment. Cost saving strategies will also be examined for MEP system installations utilizing Building Information Modeling (BIM), pre-fabrication, and value engineering.

Learning Outcomes: 1. Interpret MEP construction drawings and specifications at an MEP contractor level of competency. 2. Evaluate the design and provide value engineering options. 3. Explore value engineering methods to reduce labor and material costs and increase profit. 4. Research technology projects to review the latest technology trends in MEP installations. Credits: 3.00

CM 37600 - Residential Construction Management-Green Construction And Sustainability

Credit Hours: 3.00. A study of the best building practices in residential construction, based upon the National Green Building Standard and other national green/sustainable building practices.

Learning Outcomes: 1. Explain the goals of green and sustainable construction guidelines as it pertains to residential structures. 2. Describe the potential benefit of building green for both building professionals and their customers. 3. Explain the relationship between building science and the disciplines of green building and remodeling. 4. Describe different green building programs and incentives for different states. 5. Apply green buildings practices and principles to existing residential construction. Credits: 3.00

CM 37700 - Residential Construction Management Design-Build

Credit Hours: 3.00. A study of the design-build project delivery system for residential construction, including home design fundamentals, construction methods, disability code requirements, building code requirements, and aging-in-place design coupled with best practices of universal design.

Learning Outcomes: 1. Describe concepts relating to universal design-build and aging in place when designing residential construction. 2. Describe specific design solutions for various client requirements including but not limited to ADA, Aging in Place, etc. 3. Identify special considerations for estimating and scheduling a design-build project. 4. Identify considerations and recommendations for executing the job while the client is in residence. 5. Discuss common design-build business challenges and practical tips and tools to overcome them. Credits: 3.00

CM 37800 - Wood And Timber Construction And Design

Credit Hours: 3.00. This course focuses on designing and constructing wood and timber structures, combining historical techniques and modern innovations. Students will study traditional timber framing methods alongside contemporary practices such as cross-laminated timber, glulam beams, and other engineered wood products. The course emphasizes analyzing, designing, and constructing safe, efficient, and sustainable timber structures, preparing students to integrate classic craftsmanship and cutting-edge technologies in construction projects. Practical design assignments and case studies will provide real-world timber construction exposure.

Learning Outcomes: 1. Evaluate the load-bearing capacities of different types of timber materials and structures using appropriate engineering calculations and software tools. 2. Apply principles of timber construction design to determine the most appropriate materials and techniques for specific construction projects based on structural requirements, cost-efficiency, aesthetics, and environmental impact such as resource sustainability, energy use, and lifecycle carbon footprints in timber materials and designs. 3. Analyze case studies of successful timber structures to identify key design principles, safety considerations, and sustainability practices used in their construction. 4. Design innovative timber structures that integrate traditional craftsmanship with modern technologies, ensuring both functionality and aesthetic appeal. 5. Communicate timber construction ideas and designs effectively through clear technical drawings, reports, and presentations to peers, instructors, and industry professionals. Credits: 3.00

CM 38000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Learning Outcomes: 1. Understand, apply, and analyze fundamentals of geotechnical engineering and construction techniques associated with various types of soil conditions. 2. Conduct various soil lab testing and create lab reports. 3. Use the knowledge of soils and foundation engineering and applications to: create lab reports as written communication; analyze engineering properties of soils; analyze different soil types and field exploration; analyze soil compaction; analyze permeability of water in soils; analyze subsurface stress, consolidation, and shear strength of soil; analyze shallow and deep foundation load, design, and construction; analyze lateral earth pressure and retaining wall structure. Credits: 3.00

CM 38800 - Temporary Structures In Construction

Credit Hours: 3.00. This course provides an in-depth exploration of temporary structures used to support construction operations. Topics include the design, application, and removal or integration of systems such as concrete formwork, scaffolding, shoring, cofferdams, underpinning, slurry walls, and construction dewatering systems. Students will study the technical aspects of these structures, which are either dismantled once permanent works are self-supporting or are incorporated into the finished project. The course emphasizes practical knowledge and safety considerations for the use of temporary structures in the construction industry.

Learning Outcomes: 1. Analyze the potential risks associated with the use of temporary structures and evaluate the effectiveness of safety measures for mitigating these risks. 2. Evaluate different methods for designing and constructing temporary structures, considering factors like material properties, load-bearing capacity, and site conditions. 3. Design a temporary structure for a construction project, incorporating technical specifications, safety considerations, and cost-effectiveness. 4. Demonstrate the ability to integrate temporary structures into a larger construction project,

ensuring minimal disruption and maximum safety during the build process. 5. Propose an integrated solution for managing temporary structures throughout a construction project, from design and installation to removal or incorporation into the finished project. Credits: 3.00

CM 40000 - Construction Capstone I

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of pre-construction management into a capstone project.

Learning Outcomes: 1. Design systems for a construction project during the pre-construction phase. 2. Create project controls required during the pre-construction phase of a construction project. 3. Evaluate pre-planning tasks relevant to be beginning a construction project. 4. Generate project administration for a construction project utilizing the required documentation and technology available within the current construction industry. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 43300 - Risk Management And Legal Issues In Design And Construction Integration

Credit Hours: 2.00. An advanced course dealing with risk management and legal issues as they pertain to the interaction of designers, contractors, and owners. Students will learn to identify and mitigate potential risks that may affect the multiple stakeholders and the business organizations they represent during design and construction activity. The course will also deal with trust and teamwork issues within collaborative processes in the built environment.

Learning Outcomes: 1. Identify potential risks for designers, contractors, and owners in a collaborative construction industry environment. 2. Understand potential trust issues that inhibit collaboration within the architecture, engineering, and construction (AEC) industry. 3. Develop mitigation measures to reduce risk and increase collaboration within architecture, engineering, and construction interactions. 4. Use clear and precise questions and consider diverse points of views when reasoning. 5. Demonstrate ability to gather, assess, record, and compare relevant information in order to support conclusions and related consequences. Credits: 2.00

CM 45000 - Construction Capstone II

Credit Hours: 6.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. 4. Design site planning for a construction project throughout the construction lifecycle. 5. Display professionalism by creating proper communication, team work, rules and regulations, and level of detail required within a construction company and on a construction jobsite. Credits: 6.00

CM 45001 - Construction Capstone II

Credit Hours: 3.00. A project course covering specialized construction projects related to a student's area of concentration within the construction management program. Students will synthesize their previous knowledge of construction management into a capstone project.

Learning Outcomes: 1. Evaluate materials, means, and methods required for a construction project throughout the project lifecycle. 2. Interpret company management concepts for a

construction project during the construction phase. 3. Create project controls required during the construction phase of a construction project. Credits: 3.00

CM 45701 - Construction Safety

Credit Hours: 3.00. This course will examine the impact of safety on the construction industry, including in-depth discussions on the application of the Occupational Safety & Health Administration (OSHA) Safety and Health Standards for the construction industry. The emphasis of this course is to provide training for job sited supervisory personnel. This course will also fulfill the requirements for the OSHA 30-Hour Card.

Learning Outcomes: 1. Identify the role of OSHA in the construction industry and examine current issues related to safety. 2. Acquire knowledge of jobsite safety management and company safety risk management. 3. Identify and evaluate jobsite hazards, including abatement strategies and procedures. 4. Complete the requirements for an OSHA 30-hour card in Construction Safety & Health Administration. Credits: 3.00

CM 46000 - BIM IV: Model Creation & Management Utilizing Cloud

Credit Hours: 3.00. This course explores the impact of cloud-based technologies on managing construction projects with Building Information Modeling (BIM), emphasizing remote collaboration and real-time data access. Students will gain hands-on experience with industry-leading platforms like Autodesk Construction Cloud, learning to manage 3D discipline-specific models, coordinate teams, and oversee project workflows from any location. By integrating cloud-based management with BIM, the course prepares students to lead modern, digitally connected construction projects.

Learning Outcomes: 1. Manage construction projects using cloud-based BIM tools, enabling real-time collaboration, data sharing, and communication among group members as well as sponsors. 2. Coordinate multidisciplinary teams remotely, integrating project data from design to construction while ensuring seamless collaboration. 3. Master cloud-based technology to leverage data analytics that optimize construction workflows, which allow them to make informed decisions, and automate project processes for improved efficiency and reduced risk generating automated reports, and track key metrics such as timelines, budgets, and safety. 4. Apply best practices in data management within cloud-based BIM platforms, ensuring secure storage, version control, and efficient risk management through clash detection and issue resolution. Credits: 3.00

CM 46200 - Applications Of Construction Documentation II

Credit Hours: 3.00. Creating, archiving, integrating, qualifying and utilizing computer-generated, three-dimensional architectural models in a light commercial construction enterprise. Topics include components of MEP, fire protection, blueprint reading and 4D BIM scheduling. Credit cannot be obtained for both CM 36000 and CM 46200.

Learning Outcomes: 1. Learn, decipher, and apply parametric and geometric technologies to AEC problems. 2. Explain where new and emerging software technologies can be applied in the industry. 3. Program database-driven parametric objects for use in various projects. 4. Explain how parametric technologies can benefit the production homebuilder. 5. Develop leadership and life-long learning skills applicable to the construction industry. 6. Incorporate renderings and 3D models into drawing sets for effective communication. 7. Prepare effective marketing materials for residential and commercial industry. Credits: 3.00

CM 46500 - BIM V-Capstone

Credit Hours: 3.00. This capstone course offers an immersive, hands-on experience in integrating emerging technologies with Building Information Modeling (BIM) to transform construction project management into Integrated Virtual Construction Management. Students will use and manipulate tools like drones, IoT, 3D scanning, robotics, AR/VR, and AI-driven analytics to develop innovative solutions, enhancing project planning, monitoring, and execution through real-world simulations. By the end, students will demonstrate mastery in

leveraging these technologies, culminating in a capstone project that showcases their ability to solve complex construction challenges.

Learning Outcomes: 1. Integrate emerging technologies such as IoT, drones, 3D scanning, AR/VR, and robotics into BIM workflows to enhance project planning, monitoring, and execution. 2. Develop end-to-end BIM models incorporating cost estimation, scheduling, site management, and real-time data integration using advanced tools and technologies. 3. Manage construction projects using cloud-based BIM tools for collaboration, coordination, and communication among multi-disciplinary teams. 4. Apply data analytics, AI, machine learning, and sustainability practices within BIM to optimize project performance, predict risks, and enhance safety and operational efficiency throughout the construction lifecycle. 5. Experiment with cutting-edge construction technologies, gaining hands-on experience in real-world research and development (R&D) practices as they explore innovative solutions to complex construction management challenges. Credits: 3.00

CM 47500 - Construction Costs

Credit Hours: 2.00. A study of construction costs, including analysis of field records, job cost accounting, job cost control, and determination of unit prices.

Learning Outcomes: 1. Define the underlying concepts of construction cost control. 2. Prepare a construction project cash flow forecast using the project budget and time schedule. 3. Calculate construction project cost performance by measuring costs to-date, projecting remaining costs, and calculating variances at completion in terms of materials, subcontracts, general conditions, and project equipment. 4. Analyze construction labor cost performance using earned value, trending, and variance analysis. 5. Make capital acquisition decisions using time value of money concepts. Credits: 2.00

CM 49000 - Construction Work Experience II

Credit Hours: 1.00. This course completes a student's required 800 hours of work experience within the construction industry. Students will be required to share their experiences with faculty and other construction management students. Permission of department required.

Learning Outcomes: 1. Create an oral presentation sharing experience(s) acquired within the construction industry. 2. Write a formal paper summarizing knowledge gained through the requirement of work experience. 3. Critique fellow students on their written and oral communications of experiences. Credits: 1.00

CM 49900 - Special Topics In Construction

Credit Hours: 0.00 to 4.00. Variable title, variable credit course (Independent Study). Hours, subject matter, and credit to be arranged by staff. Permission of Instructor required.

Learning Outcomes: 1. Develop an increased knowledge in select topics related design and/or construction management. Credits: 0.00 to 4.00

CM 53100 - Facilities Contract Management

Credit Hours: 3.00. This course will teach you the basics of contracts for use in management of facilities. The purpose of the course is not to teach you how to write contracts. Instead, you will learn key principles of contract law so that you can better understand how an agreement is made and what terms become part of that agreement. Knowledge from this course will help the facility manager navigate the contractual process, from negotiating terms to dealing with potential disputes. Areas of focus will include real estate contracts, negotiations, managing risks and disputes, and the uniform commercial code. An emphasis will also be placed on contracts related to construction projects.

Learning Outcomes: 1. Interpret the phases of facility management from design/acquisition to final disposition using principles of acquisition, installation, operations, maintenance, outsourcing, renovation and disposition of building systems, structure, interiors, exterior and grounds. 2. Identify the skills needed to

strategically lead process, the organization, stakeholders and technologies in an ethically responsible way. 3. Interpret corporate real estate finance, management and transactional execution. 4. Integrate written, oral, aural, and graphic communication skills through repetitive assessment and evaluation of industry appropriate genre. Credits: 3.00

CM 53400 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology. Permission of instructor required.

Learning Outcomes: 1. Understand the history of quality and apply those concepts to contemporary quality issues. 2. Analyze internal and external organization customer needs in terms of contemporary quality concepts. 3. Synthesize the balance between cultural and technological organizational transformation. 4. Analyze the role of Lean, Six Sigma and TPS in modern process design and optimization and contemporary quality management. 5. Synthesize Lean and Six-Sigma roles and responsibilities. 6. Utilize Lean and Six Sigma philosophies, methodologies and tools; statistical analysis tools; quality assurance auditing techniques; and quality training concepts. 7. Design materials for present basic Lean Six Sigma training aids. Credits: 3.00

CM 55800 - Advanced Construction Management For Disaster Recovery

Credit Hours: 3.00. Prepares construction project professionals to better plan and deliver post-disaster built environment and infrastructure restoration and reconstruction services. Emphasizes differences between conventional construction and disaster recovery work, considering projects of larger scope and including international concerns. Technical facets of restoration processes introduced to advise comprehensive management. Includes executive-level management case study with team solution. Permission from department required.

Learning Outcomes: 1. Explain the special environmental and personal conditions and concerns that often confront construction project professionals performing disaster recovery. 2. Improve planning for major disaster recovery projects. 3. Explain how to execute major disaster recovery projects. 4. Select appropriate restorative, demolition, and waste disposal techniques for common recovery projects. Credits: 3.00

CM 59900 - Facilities Management Directed Project

Credit Hours: 1.00 to 3.00. The Directed Project is defined as an applied research project that is more extensive and sophisticated than a graduate-level independent study and less formal than a master's thesis. The overall objective of the requirement is to engage in a facilities management related study focused in industry, business or education. The focus is to be placed on a topic with practical implications rather than original research.

Learning Outcomes: 1. Identify a business or industry relevant solution to a technology related problem. 2. Define and/or validate a business or industry relevant problem. 3. Address a technological problem in a systematic and replicable manner. 4. Use technical/professional research and/or development procedures effectively. 5. Identify criteria for success/solution of the problem. 6. Gather information appropriate to the problem by employing business research procedures. 7. Document the research and development activity in a manner that permits replication and assessment of key decisions and alternatives. 8. Write effectively in a form customary to business and industry, using APA format. 9. Prepare and deliver a presentation in a form customary to business and industry. Credits: 1.00 to 3.00

CMGT 12000 - Materials And Methods

Credit Hours: 3.00. Introduction to common construction

terminology, materials, methodologies, building codes, structural fundamentals, and contract documents related to buildings, industrial facilities, and infrastructure. Field trips to production / fabrication facilities for each type of material (wood, steel, concrete, and masonry).

Credits: 3.00

CMGT 15000 - Surveying

Credit Hours: 3.00. Fundamental concepts and practical applications related to measurement of vertical and horizontal distances and angles using the tape, level, and total station. Computations of grades, traverses, areas, and curves. Basic concepts and applied use of topography, contours, and topographical maps.

Credits: 3.00

CMGT 21000 - Quantity Take-Off

Credit Hours: 3.00. Study of methods to estimate material quantities for construction projects. Topics include, interpreting construction drawings, fundamental construction technology, quantity take-offs. Excel and take-off software are used.

Credits: 3.00

CMGT 25000 - Mechanical And Electrical Systems

Credit Hours: 3.00. Methods for design, construction and inspection of mechanical and electrical systems for buildings. Emphasis on heating and cooling loads, equipment selection, duct and pipe sizing, codes, safety installation, inspection, commissioning, and estimating. Responsibilities of the general contractor for HVAC (heating, ventilating, and air-conditioning), electrical and plumbing work.

Credits: 3.00

CMGT 26000 - Statics

Credit Hours: 3.00. Forces acting on bodies at rest, including coplanar, concurrent, and non-concurring systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regards to lateral and gravity loads.

Credits: 3.00

CMGT 31000 - Cost Estimating

Credit Hours: 3.00. Study of methods to estimate quantities and costs for material, labor and equipment; establishing direct overhead and markups including indirect overhead and profit for a construction project; software applications for estimating; conceptual estimating procedures; and subcontractor qualifications and scope of work.

Credits: 3.00

CMGT 32000 - Scheduling And Project Control

Credit Hours: 3.00. A study of the planning and control of construction schedules. Topics include Gantt charts, critical path method (CPM) network scheduling, and monitoring and controlling the schedule. Lab work includes the application of MS Project for creating, presenting, revising, updating and controlling construction schedules.

Credits: 3.00

CMGT 33000 - Contract Administration And Specifications

Credit Hours: 3.00. Study of the contractual organization and administration of a construction project. Topics include, analysis of delivery systems, working with contracts, general and special conditions of the contract, specifications, project communication, payment applications, change orders and close out. Project management software is used.

Credits: 3.00

CMGT 35000 - Materials Testing

Credit Hours: 2.00. Laboratory and field testing of structural materials to determine their mechanical properties and behavior under load. Materials included are steel, aluminum, concrete, wood, and asphalt.

Credits: 2.00

CMGT 36000 - Strength Of Materials

Credit Hours: 3.00. Stress-strain relationships of construction materials. Consideration of strength issues related to major classes of engineering materials including steel, concrete, and wood. Composite analysis; shear forces and bending moments in beams. Introduction to analysis and design of steel and wood beams and columns, beam deflections.

Credits: 3.00

CMGT 38000 - Infrastructure Planning, Engineering, And Economics

Credit Hours: 3.00. Introduction to the planning and analysis of infrastructure projects. The focus will be on the prioritization, stewardship, management and decision-making roles within the division of a large public works agency. This course will cover municipal infrastructure system, infrastructure alternatives,

financial and economic analyses, environmental and social impact assessment, uncertainty and risk-benefit analysis, sustainability, and public-private partnerships including numerous case studies.

Credits: 3.00

CMGT 39000 - Construction Experience III

Credit Hours: 1.00. Supervised pre-professional learning experience that allows students to apply their skills and knowledge in a professional setting. This experience is designed to enhance the student's preparedness for an intended career in the construction profession. A minimum of 400 work-hours is required.

Credits: 1.00

CMGT 41000 - Equipment And Field Operations

Credit Hours: 3.00. Study of heavy equipment used in construction operations with an emphasis on equipment selection, application, cost, productivity, safety, and economics.

Credits: 3.00

CMGT 42000 - Safety And Inspection

Credit Hours: 3.00. Study of safety regulations, practices, policies, and procedures required for construction projects. Topics include, accident investigation, record keeping, OSHA reporting requirements, inspections, and hazards. Included is an OSHA safety card.

Credits: 3.00

CMGT 43000 - Jobsite Management

Credit Hours: 3.00. Examination of construction project management on the jobsite. Topics include, submittals, record keeping, jobsite layout, meetings, negotiations, dispute resolution, labor relations, safety, subcontracting, quality, cost control, waste management, changes, claims, progress payments, and project closeout.

Credits: 3.00

CMGT 44000 - Project Management Capstone

Credit Hours: 3.00. Students apply the knowledge and skills, acquired during their construction management program of study, to simulate the construction management process on an actual construction project. Includes role playing and a formal oral presentation.

Credits: 3.00

CMGT 45000 - Structural Systems And Analysis

Credit Hours: 3.00. Analysis of the structural characteristics of common construction materials, including: wood, steel, concrete, masonry, and light gauge metal in order to integrate structural elements into complete structural systems in the construction of modern buildings and structures to withstand gravity, wind, earthquake, and other environmental forces.

Credits: 3.00

CMGT 46000 - Soils And Foundations

Credit Hours: 3.00. Study of soils and foundations in the construction projects. Topics include, fundamental soil engineering theories, properties of soils, soil classification, compaction, permeability, stress, shear strength, consolidation, and bearing capacity.

Credits: 3.00

INT 10300 - Introduction To Interior Design

Credit Hours: 3.00. An overview of the field of interior design, its history, and theory. An application of the principles and elements of interior design. Basic hand drafting. This course is for those who are seeking or considering a degree in Interior Design.

Credits: 3.00

INT 12400 - Space Planning For Interiors

Credit Hours: 3.00. Introduction to the fundamentals of design for human activity, standards for space, programming, and graphic communication. Requirements for ADA and Universal Design will be included.

Credits: 3.00

INT 12500 - Color And Lighting Of Interiors

Credit Hours: 3.00. Exploration of the physiological, psychological, and phenomenal aspects of color and light in interior spaces. Application includes specification and selection of lighting fixtures and light sources.

Credits: 3.00

INT 15100 - Textiles For Interiors

Credit Hours: 3.00. An extensive study of textiles: fiber types, yarn production, fabric construction, finishing, coloring, and printing. Application of textiles for use in residential and commercial interiors.

Credits: 3.00

INT 20200 - Interior Materials And Applications

Credit Hours: 3.00. Analyzes information related to use of

surfacing materials applied as interior finishes in interior design projects. The role of green design is introduced, and ecological issues are integrated into each category of materials analyzed.

Credits: 3.00

INT 20400 - History Of Interiors And Furniture I

Credit Hours: 3.00. A survey of historical development of interiors, furniture and decorative arts from early history to 1800 (early neoclassic). Emphasis on design motifs, ornamentation and furniture styles.

Credits: 3.00

INT 22400 - Residential Interior Design Studio

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered. The course will utilize computer-aided drafting and design (CAD).

Credits: 3.00

INT 22600 - Commercial Interiors I

Credit Hours: 3.00. This studio course emphasizes the elements used by designers in the development of nonresidential space. Studies include technological and building requirements; building and life-safety codes; square footage and space planning standards. Organizational, ergonomic, technical, spatial and environmental factors will be considered.

Credits: 3.00

INT 30200 - Three-Dimensional Design

Credit Hours: 3.00. This studio class examines the fundamentals of three-dimensional design, detailing and documentation, along with 3D thinking and visualization of design solutions sensitive to functional, ergonomic and aesthetic objectives.

Credits: 3.00

INT 30400 - History Of Interiors And Furniture II

Credit Hours: 3.00. The continuation of a survey of historical development of interiors, furniture, and decorative arts beginning with 1650 Colonial America through the 20th century. Emphasis is on design motifs, ornamentation, and furniture styles. Adaptation and use of period styles within contemporary design are included.

Credits: 3.00

INT 32400 - Residential II: Housing Design

Credit Hours: 3.00. This studio class will emphasize the design of residential space, recognizing design development as a process. Space design, working drawings, plans, and client presentations also will be covered.

Credits: 3.00

INT 32600 - Commercial Interior Design Studio II

Credit Hours: 3.00. This studio course emphasizes the elements used in development of nonresidential space. Studies include technological and building requirements; building and life-safety codes, ADA guidelines, square footage and space planning standards.

Credits: 3.00

INT 42600 - Evidence-Based Design

Credit Hours: 3.00. This studio-based course emphasizes the principles of evidence-based design in modern practice. Students will acquire working knowledge of best practices with relation to healthcare or similar environments based on empirical data.

Credits: 3.00

INT 42800 - Interior Design Capstone Design Project

Credit Hours: 3.00. In this B.S. Capstone course the designer tackles a semester long advanced design problem by applying the design process from project obtainment through construction documents. This class is team-taught and must be taken in conjunction with INTR 48000.

Credits: 3.00

INT 45200 - Interior Building Systems

Credit Hours: 3.00. A survey course of building systems that covers the design implications of heating, air-conditioning, plumbing and electrical systems of both residential and commercial buildings. Sustainable technologies such as solar energy for heating, cooling, or hot water heating, day-lighting, and recycling systems will be included.

Credits: 3.00

INT 45300 - Business Practices Of Interior Design

Credit Hours: 3.00. Business principles and practices as they relate to the interior design profession. Includes business formation and management, professional ethics and organization, certification and licensing issues, design liability, and project management.

Credits: 3.00

INT 48000 - Senior Portfolio

Credit Hours: 3.00. This course will assist the student with developing a professional level portfolio and related materials which may be used in interviewing for an Interior Design position, and provides an opportunity to showcase all academic work created at this institution. Topics and activities include branding, resume preparation, website design, social media management, interviewing, and the creation of various related portfolio materials.

Credits: 3.00

INT 49500 - Sustainable Design In Engineering And Technology

Credit Hours: 3.00. In this multidisciplinary course students will create industrial ecological solutions within their unique disciplines. A theoretical framework on Green Design is used to identify and apply green concepts while working on multidisciplinary teams. Environmental concerns for better air quality and global environmental issues are explored.

Credits: 3.00

Department of Computer and Information Technology

Overview

The Department of Computer and Information Technology (CIT) at Purdue provides educational opportunities that apply information technology (IT) to solve societal problems. Degree programs in information systems, network engineering technology, systems analysis and design, and cyber security focus software development, systems integration, data management, and computer networks.

Faculty (website)

Contact Information

Computer Information Technology Department
Knoy Hall
Room 255
401 N. Grant St.
West Lafayette, IN 47907
Phone: 765-494-2560
Email: cit@purdue.edu

Contact an advisor

Graduate Information

For Graduate Information please see Computer and Information Technology Graduate Program Information .

Computer and Information Technology, BS

Computer and Information Technology Minor

Computing Infrastructure and Network Engineering Technology, BS

Data Analytics, Technologies, and Applications, BS

Computing Systems Analysis & Design, BS

Cybersecurity, BS

CIT 20200 - Networking Fundamentals

Credit Hours: 3.00. This course will provide students with the fundamental skills necessary to design, implement, troubleshoot and manage a small to medium sized Local Area Network. Students will gain hands-on experiences in a lab environment, configuring a client server network, working with connectivity devices, troubleshooting hardware and software issues. Students will explore topics including network performance, network management and network security.

Credits: 3.00

CIT 20300 - Information Security Fundamentals

Credit Hours: 3.00. This course provides students with an

overview of the field of Information Security and Assurance. Students will explore current encryption, hardware, software and managerial controls needed to operate networks and computer systems in a safe and secure manner. In addition, students will participate in a semester project to re-enforce key concepts such as policy development and business contingency planning.

Credits: 3.00

CIT 20700 - Data Communications

Credit Hours: 3.00. This course provides the foundation for the understanding of data communication systems and computer networks. Topics include information representation and transmission, medium types and configuration, telephony, error handling, TCP/IP and internetworking, and diagnostic techniques.

Credits: 3.00

CIT 21200 - Web Site Design

Credit Hours: 3.00. This course is designed to give students an introduction to web site design and site creation. The course involves learning current standard XHTML fundamentals, CSS and design concepts. The proper design approach for constructing Web site and related techniques will also be covered.

Credits: 3.00

CIT 21300 - Systems Analysis And Design

Credit Hours: 3.00. This course provides students with the concepts, processes, and tools of system analysis and systems design. Object-oriented methods and tools are utilized with a focus on developing web-based interfaces and prototypes.

Credits: 3.00

CIT 21400 - Introduction To Data Management

Credit Hours: 3.00. Introduction to basic database development concepts. Extensive exploration of data manipulation using a relational DBMS and SQL. Students develop database applications using the most current database technologies.

Credits: 3.00

CIT 21500 - Web Programming

Credit Hours: 3.00. This course will provide students with the knowledge and techniques of introductory web programming.

Credits: 3.00

CIT 24200 - Introduction To ASP.Net Programming

Credit Hours: 3.00. This course will provide students with the tools and techniques to build dynamic Web sites using the ASP.Net programming environment. Students gain hands-on experience building a database-driven Web site.

Credits: 3.00

CIT 27000 - Java Programming I

Credit Hours: 3.00. This course is an introduction to the Java Programming language. Students will learn the syntax of the language, how to use objects, classes, and methods, and will perform programming exercises that illustrate how Java is used in stand alone applications and applets.

Credits: 3.00

CIT 30400 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation using programmatic extensions to Structured Query Language (SQL). Topics include advanced data manipulation, stored procedures, triggers, and query optimization.

Credits: 3.00

CIT 30900 - Cybersecurity And Network Programming

Credit Hours: 3.00. Course teaches students skills necessary to develop programs and scripts to solve cybersecurity and networking problems such as automating manual tasks, parsing data, and data analysis. Students gain hands-on experience, combining the theory and practice of relevant tools, techniques, and programming technologies used in daily real-world cybersecurity and networking profession.

Credits: 3.00

CIT 31300 - Commercial Web Site Development

Credit Hours: 3.00. This project-based course will have students develop a data driven web site to support business processes. Students will utilize both client and server side languages in developing the site.

Credits: 3.00

CIT 32000 - Quantitative Analysis III

Credit Hours: 3.00. A continuation of statistical inference introduced in Quantitative Analysis II with emphasis on confidence intervals, hypothesis testing, analysis of variance, forecasting including linear regression and correlation, and quality control as they apply to information technology.

Credits: 3.00

CIT 32700 - Wireless Communication

Credit Hours: 3.00. Students will learn about the growing range of wireless technologies and their applications. The course will explore the fundamentals of each wireless technology from basic signaling properties to current and future market uses. Students will have the opportunity to gain hands-on experience with various wireless technologies.

Credits: 3.00

CIT 34400 - Database Security

Credit Hours: 3.00. This course will cover fundamentals of database security, data auditing, basic security models, and best practices. Topics may include security architecture, access control policies, auditing and monitoring. The course combines lectures with hands-on activities through lab sessions and an application oriented project using a database system such as Oracle or SQL Server.

Credits: 3.00

CIT 35600 - Network Operating Systems Administration

Credit Hours: 3.00. Design and administration of network servers and workstations. Focus on basic network concepts such as user account administration, resource allocation, security issues and internet service management.

Credits: 3.00

CIT 37300 - Visual Design For Software

Credit Hours: 3.00. Examination of best practices in software interface development for a variety of platforms. A study of the integration of visual elements into the systems analysis and design process, based on business and technical requirements. Topics include study of common design patterns, a review of prototyping tools, multi-modal design concepts, navigation strategies, and user acceptance testing.

Credits: 3.00

CIT 37400 - Systems And Database Analysis

Credit Hours: 3.00. Intensive exploration of application and database analysis in a synergistic environment. Students engage in collaborative, project-based activities to learn about project management, requirements analysis, modeling, prototyping, employing problem solving, and team-building skills. Object-oriented and data modeling tools are used to apply class concepts.

Credits: 3.00

CIT 38100 - Unix Programming And Administration

Credit Hours: 3.00. This course will teach students to effectively administer and develop applications in Linux/Unix. Emphasis will be on the ability to read, write, and debug shell script programs. An exploration of Windows scripting languages will also be covered.

Credits: 3.00

CIT 40200 - Design And Implementation Of Local Area Networks

Credit Hours: 3.00. The design, implementation, and configuration of local area networks. Students install the necessary hardware and software to set up a LAN server with several clients. Students will explore topics including "inter-networking", network management, network performance, and security.

Credits: 3.00

CIT 40600 - Advanced Network Security

Credit Hours: 3.00. This course provides students with the in-depth study and practice of advanced concepts in applied systems and networking security, including security policies, access controls, IP security, authentication mechanisms and intrusion detection and protection.

Credits: 3.00

CIT 41500 - Advanced Network Administration

Credit Hours: 3.00. In this course, students will learn advanced concepts for installing, configuring and securing various types of network servers including enterprise, web and mail servers. The course also covers the documentation of network systems infrastructure and the testing of hardware and software network components.

Credits: 3.00

CIT 41800 - Native Android Application Development

Credit Hours: 3.00. This advanced programming course gives students hands-on experience developing applications for Google mobile computing devices running the Android operating system. Students will build data-driven and location-aware applications using object-oriented software design patterns common to mobile application development. A variety of data storage and remote datasource-driven applications will be introduced.

Credits: 3.00

CIT 42100 - Big Data Analytics

Credit Hours: 3.00. This course will cover both the fundamentals and concepts of data analytics. The focus is on emerging advanced data analytics techniques and their applications to practical problems for different disciplines, such as IT, health care, and economics. Machine learning algorithms and distributed computing environments will be explored. Students will apply these advanced techniques in labs and a project to resolve an applied problem and identify scientific findings by using public data sets. A project report is required at the end of the course.

Credits: 3.00

CIT 43100 - Applied Secure Protocols

Credit Hours: 3.00. This course will emphasize the applied facets of cryptography for the information assurance and security professional. By the end of the course students will be able to apply important cryptographic principles and tools to allow networks to communicate securely.

Credits: 3.00

CIT 44400 - Advanced Database Design

Credit Hours: 3.00. This course addresses enterprise data management and logical database design concepts with an emphasis on needs determination and data modeling skills from an organizational perspective. Students will create data models and apply forward and reverse engineering techniques and will work through the full life cycle of the development of a software application. A project-based learning approach is used in this course.

Credits: 3.00

CIT 45100 - IT Security Risk Assessment

Credit Hours: 3.00. Students will learn the basic tools of security risk assessment and risk management. Students will be able to identify and assess security risk, conduct information asset valuation, and apply risk control strategies. Other topics discussed will be: security policies, NIST Security Models, and training education and awareness. At the end of the course students will be able to assess vulnerabilities and document them according to published assessment standard.

Credits: 3.00

CIT 47900 - Database Implementation And Administration

Credit Hours: 3.00. Extends knowledge of database concepts. Topics include physical database design, client/server implementation and database administration. Given a logical database design, students develop physical database structures and implement a database application. Students carry out database design, construction, administration, and programming activities using client/server technology.

Credits: 3.00

CIT 48500 - The Living Lab

Credit Hours: 1.00 to 6.00. The Living Lab allows students to apply networking, security, database, website, and application development concepts and techniques learned from prior CIT courses to internal and/or external projects. The Living Lab emulates an industry IT department in which students work on one or more projects as part of an IT team. Permission of instructor required.

Credits: 1.00 to 6.00

CNIT 10500 - Introduction To C Programming

Credit Hours: 3.00. This course is an introduction to computer programming using the "C" language. The emphasis is on structured programming principles, and understanding the basic concepts that apply to engineering problems. Among topics covered in this course are: problem solving using top down design, using flowcharts to explain the program logic, selection structure, repetition structure, bitwise operations, arrays, pointers, strings, passing arguments, and sequential files.

Learning Outcomes: 1. Practice and apply basic programming concepts in weekly labs and assignments. 2. Construct programming solutions using different coding structures in C. 3. Illustrate the ability to design and build user defined functions in C. 4. Practice the use of one-dimensional Arrays, Struct, and Files in C programing. Credits: 3.00

CNIT 13600 - Personal Computing Technology And Applications

Credit Hours: 3.00. This course provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management; word processing; spreadsheets; presentation graphics; electronic mail; personal information management; and internet browsing, searching, and publishing.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with

information systems and computers. 3. Identify components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 15501 - Introduction To Software Development Concepts

Credit Hours: 3.00. This course introduces fundamental software development concepts common to most programming languages. Topics include problem solving and algorithm development, debugging, programming standards, variables, data types, operators, decisions, repetitive structures, modularity, arrays, user interface construction, software testing and debugging. A broad range of examples will be used throughout the course to show how each programming concept applies to real life problems.

Learning Outcomes: 1. Define key application development terms. 2. Explain the importance of programming to different domain areas. 3. Identify advantages and disadvantages of using an IDE to write program code. 4. Use debugging tools to find program errors. 5. Use data types, variables, constants, arithmetic operators, relational operators, logical operators, decisions, loop, functions, and arrays when writing computer programs. Credits: 3.00

CNIT 16100 - Introduction To Programming And Data Management For Smart Manufacturing

Credit Hours: 3.00. This course introduces a programming language and provides an overview of coding, data analysis and data manipulation in a database. Topics include fundamentals of programming, introduction to data manipulation and analysis, and an introduction to relational databases and the Structured Query Language (SQL).

Learning Outcomes: 1. Understand, write, modify and debug computer programs to solve small to intermediate business problems in the Smart Manufacturing Domain. 2. Use built-in tools and data structure in the programming language to perform indexing, dropping entries, sorting, and filtering the data. 3. Use built-in methods and SQL query capabilities to access, manipulate and analyze manufacturing or supply chain data. Credits: 3.00

CNIT 17500 - Visual Programming

Credit Hours: 3.00. This course introduces event-driven application development and programming using a visual programming environment. Topics include problem solving and program design, control structures, objects and events, user interface construction, documentation, and program testing. Credit may be established in only one of: CPT 15500 or CPT 17500 or CPT 25000. PC literacy required.

Learning Outcomes: 1. Demonstrate a basic knowledge of OOP and GUI design. 2. Manipulate the numeric and textual data in a program. 3. Use the right coding structure, sequential, selection and repetition, to solve a problem. 4. Store and manipulate large amount of data in a program. Credits: 3.00

CNIT 17600 - Information Technology Architectures

Credit Hours: 3.00. A conceptual and technological survey of information technology architectures inclusive of operating systems, network operating systems, distributed systems architectures, and distributed application architectures. Interoperability between these architectural components is explored. Current technology and trends in each architectural element are reviewed. PC literacy required.

Learning Outcomes: 1. Describe complexities, interoperations, & integration of hardware and software system components and architectures. 2. Analyze and describe operating systems, resource management, & security functions. 3. Apply knowledge of system architecture to solve complex problems. Credits: 3.00

CNIT 18000 - Introduction To Systems Development

Credit Hours: 3.00. This course introduces information systems development. Topics include types of information systems, system development, database management systems, and problem solving. Students will read/create UML, ERD, and data flow diagrams to model information system objects, data, processes, and logic. Labs emphasize modeling and SQL/QBE querying to prepare students for later systems, programming, and database classes. Given user requirements students will design, construct, and test a personal computer information

system. PC literacy required.

Learning Outcomes: 1. Construct information systems using appropriate tools and techniques. 2. Demonstrate system modeling concepts, tools, and techniques. 3. Analyze data design concepts and data structures. 4. Apply systems development life cycle (SDLC) concepts. 5. Identify information systems components. Credits: 3.00

CNIT 18101 - Topics In Computer Information Technology I

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 18200 - System And Organizational Security

Credit Hours: 3.00. This class focuses on the security of the design, procurement, testing, analysis and maintenance of components that are integrated into larger systems. Protecting organizations from cybersecurity threats and managing risk to support the successful accomplishment of the organization's mission is also covered.

Learning Outcomes: 1. Describe how cybersecurity is essential in the requirements definition, design, procurement, and testing phases of the system life-cycle. 2. Discuss how security governance, compliance, and policies impact organizational business decisions. 3. Explain the importance of business continuity, disaster recovery, and incident management and their role in cybersecurity planning. 3. Analyze the various risk management models. 4. Demonstrate how analytical tools inform the risk management and assessment process. Credits: 3.00

CNIT 19900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter arranged by staff. Individual study under directed leadership of professor. Primarily for students with special aptitudes. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CNIT 24000 - Data Communications And Networking

Credit Hours: 3.00. This course provides a comprehensive introduction to data communications and networks. Topics include communication standards and concepts, protocols, the Open Systems Interconnect (OSI) model, point-to-point communication, and local area networks. Business issues from both provider and user perspectives are discussed. Current technology and trends in each architectural element are reviewed.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 24200 - System Administration

Credit Hours: 3.00. This course provides a comprehensive introduction to system administration. Topics include authentication and authorization, directory services, system management and system security. Emphasis is placed on enterprise level systems.

Learning Outcomes: 1. Explain systems administration concepts as applied to business environments. 2. Design, construct, troubleshoot, and administer an enterprise-class application environment using Microsoft Windows-based client and server software. 3. Describe, install, and maintain an enterprise-class application environment in a virtualized environment. 4. Plan and execute a cutover from a physical computing environment to a virtualized computing environment. 5. Produce

written reports that document project work performed in the laboratory. Credits: 3.00

CNIT 25501 - Object-Oriented Programming Introduction

Credit Hours: 3.00. This course introduces software development concepts common to modern object-oriented programming languages. Topics include: intermediate data types, decisions, repetitive structures; methods; arrays and collections; encapsulation, inheritance, and polymorphism; exception handling; data persistence; Database Management System (DBMS) connectivity; user interface construction; software testing and debugging; and working in teams.

Learning Outcomes: 1. Build and apply object-oriented design concepts on a regular basis through exercises and labs. 2. Construct a complex project. Credits: 3.00

CNIT 27000 - Cybersecurity Fundamentals I

Credit Hours: 3.00. This course introduces cybersecurity fundamentals and concepts. Security models that provide a basis for overarching security solutions are introduced to provide a basis for discussion. Risks and vulnerabilities are examined along with technical controls that can be used to mitigate them. The role of security policy and the incident management framework are examined. Emphasis is placed on building a strong foundation for further study in the field.

Learning Outcomes: 1. Identify factors driving the need for cybersecurity and their associated risk. 2. Compare and contrast common cybersecurity models. 3. Identify and classify common types of information technology threats, risks, and vulnerabilities. 4. Explain and demonstrate how technical controls (access management, cryptography, firewalls, etc.) can be implemented to mitigate threats and vulnerabilities. 5. Explain and interpret the key steps in cybersecurity incident management. 6. Compare and contrast the roles of security policy and management. Credits: 3.00

CNIT 27100 - Cybersecurity Fundamentals II

Credit Hours: 3.00. Course will investigate additional foundational ideas in cybersecurity and serves as a survey course in the field. The course provides extended exposure to utilizing tools to secure/harden aspects of info systems such as mandatory access control, wireless security, hardware security, cloud security and others.

Learning Outcomes: 1. Generate policy and governance decisions for high-risk information systems. 2. Implement technical controls to mitigate threats and vulnerabilities in modern networks and systems. 3. Analyze information systems to determine appropriate secure provisioning actions. Credits: 3.00

CNIT 27200 - Database Fundamentals

Credit Hours: 3.00. A study of relational database concepts. These concepts include data design, modeling, and normalization; the use of Structured Query Language (SQL) to define, manipulate, and test the database; programmatic access to a database and practical issues that database developers must handle.

Learning Outcomes: 1. Design an entity relationship diagrams (ERD) for a business problem domain. 2. Write Structured Query Language (SQL) queries to effectively present data/information from a database. 3. Employ critical thinking to a team-based project of database design. Credits: 3.00

CNIT 28000 - Systems Analysis And Design Methods

Credit Hours: 3.00. Comprehensive introduction to information systems development. Topics include the systems analyst, the systems development life cycle, methodologies, development technology, systems planning, project management, systems analysis, systems design, systems implementation, and systems support. Introduction to tools and techniques for systems development.

Learning Outcomes: 1. Identify the stages of the systems development life cycle and the different systems methodologies used to implement it. 2. Apply requirements analysis strategies and requirements-gathering techniques to determine business requirements. 3. Analyze an as-is system or a to-be system by applying appropriate tools for analysis modeling. 4. Design a system by applying appropriate tools for design modeling. 5. Apply project management techniques and tools for

software development. 6. Perform as a functional member of a team and enact teamwork skills. Credits: 3.00

CNIT 28101 - Topics In Computer Information Technology II

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 28500 - Topics In Programming Languages

Credit Hours: 3.00. A programming course in one or more programming languages not covered in other CPT courses. Application of structured or event-driven program design, construction, debugging, testing, and documentation techniques. Topics, projects, and languages vary with course offering.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 29900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 6.00. Hours and subject matter to be arranged by staff. Individual study under directed leadership of professor. Primarily for students with special aptitudes. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

CNIT 30600 - Game Development I: Core Skills And Technologies

Credit Hours: 3.00. (CGT 24500) This course introduces students to the fundamental technologies and skill sets required to develop video games. Students will be taught agile development methodologies in a team-based environment.

Learning Outcomes: 1. Demonstrate a moderate level of individual skill with a commercial game engine. 2. Demonstrate the ability to observe game mechanics and reproduce them. 3. Acquire competency in each of the following domains: 3D and 2D level creation, basic art asset creation, visual programming basics, implementing game mechanics. 4. Demonstrate the ability to complete a market-ready video game in a team-based production environment. 5. Demonstrate the ability to implement agile production techniques. Credits: 3.00

CNIT 30800 - Game Development II: Design And Psychology

Credit Hours: 3.00. (CGT 25500) This course examines video game design, theory, and development from aesthetic, psychological, and technical perspectives. Students will gain experience with a commercial game development platform. Advanced game development techniques will be taught in this course.

Learning Outcomes: 1. Deconstruct and analyze an existing game and define its essential elements as per various theories of game design. 2. Identify major psychological paradigms and how they are applied in video game experiences. 3. Demonstrate proficiency in applying behavior modification principles in video games. 4. Demonstrate individual technical proficiency with a commercial game engine. 5. Complete a market-ready video game in a team-based production environment. 6. Implement agile production techniques. Credits: 3.00

CNIT 31500 - Systems Programming

Credit Hours: 3.00. This course introduces concepts of lower level systems programming in C/C++ on a UNIX/Linus operation system platform. Command level development, algorithms, data structures, iteration and recursion, algorithms and analysis will be covered.

Learning Outcomes: 1. Develop applications for the command line. 2. Identify number systems and perform arithmetic operations. 3. Develop programs on Linux/UNIX operating systems. 4. Develop C/C++ programming proficiency. 5. Explain and use linear and tree-based data structures and algorithms. 6. Analyze algorithms. 7. Explain and use iteration and recursion. 8. Explain and use techniques of memory management. 9. Explain and use object-oriented programming in systems

environments. 10. Explain and use text and binary file I/O. Credits: 3.00

CNIT 32000 - Policy, Regulation, And Globalization In Information Technology

Credit Hours: 3.00. This course provides students with opportunities to study how technology is intertwined with larger economic, social, cultural, and ethical dynamics in an era of intensified globalization. The course examines technology in a global environment. Students will explore concepts and issues related to law, policy, regulation, outsourcing, offshoring, globalization, global competitiveness, global communications, cultural differences and quality of life issues. Students will examine ethical situations that arise as a result of the impact of technology. In summary, the course is designed to help students understand what it means to identify as, and/or work with, technology in a global environment.

Learning Outcomes: 1. Understand cultural traditions, societal ethics and the impact of culture on industry. 2. Understand issues with leading international teams and managing international projects. 3. Identify and apply public policy issues relevant to technology solutions. 4. Understand the logistics of international travel including the use of passports and visas. 5. Identify, apply and understand organizational ethics including conflicts of interest and individual ethical responsibilities. Credits: 3.00

CNIT 32200 - Research Methodology And Design

Credit Hours: 3.00. This course will discuss scientific research versus pseudoscience, experimental vs. quasi-experimental designs, different research controls and validity issues, and how study designs are used to answer research questions. Students will gain hands-on experience conducting observational and experimental research designs, and the process of writing a formal research paper.

Learning Outcomes: 1. Describe and produce ethical research. 2. Identify distinguishing features of good science vs. pseudoscience. 3. Critically evaluate different research methodologies and designs. 4. Present and interpret research data in a formal research paper. Credits: 3.00

CNIT 32300 - Basic Cyberforensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyberforensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyberforensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 32500 - Object-Oriented Application Development

Credit Hours: 3.00. This course focuses on using object-oriented programming languages in the development of modern, business applications. Topics include object-oriented design, encapsulation, object interfaces, inheritance, aggregation, abstract classes, polymorphism, data structures, and exception handling.

Learning Outcomes: 1. Understand object-oriented concepts and architectures. 2. Understand software development motivations to use object-oriented design and development. 3. Demonstrate how to design and create classes and objects. 4. Understand the use of polymorphism and overloading. 5. Demonstrate how to design and use inheritance. 6. Understand how to apply a high-level integrated development environment to develop systems. 7. Demonstrate how to design, use and extend exception handling. 8. Demonstrate how to design, use and extend textual and binary data streams. 9. Understand how to integrate persistent data storage using RDBMS. 10. Understand the development of distributed systems and n-level architectures. Credits: 3.00

CNIT 34000 - UNIX Administration

Credit Hours: 3.00. This course focuses on the tasks and issues involved in the administration of UNIX systems. Topics include installation, networking, software management, scripting, and user management. In the laboratory portion of the course, students implement and maintain UNIX systems.

Learning Outcomes: 1. Understand the theory and practice of administering UNIX based operating systems. 2. Install and maintain UNIX operating systems. 3. Implement and maintain basic UNIX services including file sharing, e-mail, and X-Windows. 4. Secure UNIX operating systems. 5. Write and maintain UNIX shell scripts. 6. Integrate UNIX and Windows systems. Credits: 3.00

CNIT 34010 - UNIX Fundamentals

Credit Hours: 1.00. This course focuses on the use and basic administration of UNIX systems. Topics include installation, networking, software management, user management, and security of UNIX systems.

Learning Outcomes: 1. Describe and utilize basic UNIX system commands. 2. Install and maintain UNIX operating systems. 3. Secure UNIX systems. Credits: 1.00

CNIT 34210 - Storage Area Networking

Credit Hours: 2.00. This course introduces storage area network (SAN) technologies. Storage area networking concepts, architectures, protocols, and best practice implementation techniques are examined. Techniques for remotely booting systems over a SAN are covered. Students implement and maintain an industry standard SAN and network booting solutions.

Learning Outcomes: 1. Compare and contrast various enterprise storage architectures. 2. Implement and maintain storage area network services. 3. Utilize storage area network services from different client operating systems. 4. Install and configure a network boot environment for multiple operating systems. Credits: 2.00

CNIT 34220 - Network Administration

Credit Hours: 2.00 or 3.00. This course focuses on the tasks and issues involved in the installation and administration of distributed computing systems. Topics include the administration of network operating systems and network system interoperability. Students will implement and maintain a comprehensive network service infrastructure.

Learning Outcomes: 1. Understand, implement, and maintain network services such as DNS, PKI, e-mail, and web. 2. Research and solve hardware and software implementation problems in laboratory projects. 3. Produce written reports that document project work performed in the laboratory. 4. Work cooperatively as a team to implement solutions. Credits: 2.00 or 3.00

CNIT 34400 - Network Engineering Fundamentals

Credit Hours: 3.00. This course presents the foundations and intermediate levels of understanding required to effectively design, implement, and manage today's networked environments. Details of basic models; network addressing and operations; network protocol interactions; and enterprise-class hardware applications of both wired and wireless networks are provided. Students will gain experience with enterprise-class hardware through laboratory projects and assignments.

Learning Outcomes: 1. Understand, implement, and maintain stable, enterprise-class switched and/or routed networks. 2. Demonstrate knowledge of advantages/disadvantages of different types of networks. 3. Describe hardware operations in terms of functionality, manageability, and security. 4. Research and solve hardware and software implementation problems. 5. Utilize command line tools for basic system administration tasks and objectives. 6. Discuss issues relevant to the management of network devices as presented in lecture and assigned readings. Credits: 3.00

CNIT 34500 - Internetwork Design And Implementation

Credit Hours: 3.00 or 4.00. This is an advanced course in

network architecture. Students learn to design and implement local and wide area networks capable of simultaneous transport of real-time traffic and multiprotocol data over packet-switched and circuit-switched networks. An emphasis is placed on the integration of diverse communications technologies, while considering the effects of engineering decisions on overall performance, from both business and technology perspectives.

Learning Outcomes: 1. Understand the operation of shortest path spanning trees in internetworks. 2. Perform IP subnetworking to correctly size and allocate addressing to network devices. 3. Perform IP supernetworking to correctly size and allocate addressing to network devices. 4. Identify the correct network architecture to deploy a given set of requirements. 5. Deploy dynamic routing protocols. 6. Design, deploy, test, and maintain enterprise-class internetworks. 7. Demonstrate an understanding of medium characteristics, modulation and multiplexing techniques, physical layer framing structures used in data networks. Credits: 3.00 or 4.00

CNIT 34600 - Wireless Networks

Credit Hours: 3.00 or 4.00. This course introduces wireless networking. Topics include fundamental wireless communication concepts, wireless local area networks (LANs), and cellular systems. Wireless specific protocol elements are addressed in typical application environments. Data communications in multiple wireless environments are emphasized. In the laboratory section, students implement wireless solutions and integrate them into wired LAN environments.

Learning Outcomes: 1. Create and troubleshoot 802.11 wireless networks, as well as demonstrating integration into wired networks, devices and infrastructure. 2. Explain RF fundamentals, measurements and propagation theory. 3. Differentiate pertinent wireless networking standards, particularly those within the scope of the IEEE 802.11 standard. 4. Understand the underlying principles of the 802.11 MAC and how it relates to the upper and lower layers of the OSI model. 5. Implement wireless network security solutions and standards. Credits: 3.00 or 4.00

CNIT 35500 - Mobile Programming

Credit Hours: 3.00. This is an advanced programming course that teaches students the skills necessary to develop applications for mobile computing devices (e.g. Smartphones and tablet computers). Combining theory and practice, this course gives students hands-on experience with the latest technologies, tools and techniques used to develop mobile software solutions for business and entertainment.

Learning Outcomes: 1. List the popular mobile device platforms and market share. 2. Understand the difference between developing apps for mobile devices and developing apps for PCs and servers. 3. Understand user interface design concepts specific to mobile devices. 4. Demonstrate how to persist app data to a mobile device. 5. Develop casual games that use essential game programming concepts. 6. Demonstrate how to use graphics programming techniques for drawing shapes, text, and sprites. 7. Develop apps that use more than one processing thread. 8. Develop apps that communicate with code running on a server. Credits: 3.00

CNIT 37000 - Introduction To Cryptography

Credit Hours: 3.00. Cryptography is an essential component to protect information in cyber systems. This course introduces the inner workings of cryptographic primitives and how to correctly use them. Specifically, the course covers cryptographic algorithms, protocols and techniques. The algorithms illustrate the art of encryption and secure hashing. The cryptographic protocols will expose the students to the world of building trust in an untrusted environment. Cryptographic techniques used in key management and algorithm choice will be explored.

Learning Outcomes: 1. Identify important real-world applications associated with cryptography. 2. Describe the major components of encryption techniques within symmetric and asymmetric cryptography. 3. Describe the major components of integrity protection and related properties. 4. Choose and apply appropriate cryptographic techniques to a plausible real-world security problem. Credits: 3.00

CNIT 37100 - Cyberlaw And Ethics

Credit Hours: 3.00. This course focuses on Cyberlaw, a legal framework of cyber activities and cyber operations subject to a diverse array of international, constitutional, U.S. federal, and state law and regulatory policies. Students will learn fundamental concepts designed to help ensure that the cyber operations in which they participate are consistent with the laws, regulations, and values of the society they serve.

Learning Outcomes: 1. Describe and explain the basic structures and roles of government in formulating and enforcing cyber policy and law. 2. Describe and explain the evolution of the legal foundations of cyberlaw specifically constitutional and statutory roots of privacy, speech, cyber operations, jurisdiction, electronic surveillance, and intellectual property. 3. Justify policies affecting the practice of cybersecurity. 4. Evaluate ethical issues in the professional practice of cybersecurity. Credits: 3.00

CNIT 37200 - Database Programming

Credit Hours: 3.00. This course explores advanced database programming techniques for enterprise-wide databases and their implementation. It uses programmatic extensions to Structured Query Language (SQL) supported by today's enterprise-class Relational Database Management Systems (RDBMS). Topics include advanced data manipulation, storage considerations, data transformation techniques to enhance interoperability of data, stored procedure and trigger design and implementation, and query optimization.

Learning Outcomes: 1. Deconstruct and explain database management system concepts and workable alternatives for contemporary database implementations. 2. Translate how triggers, procedures, and functions form the basis of methods that can be used to implement object-oriented capabilities in a relational database environment. 3. Analyze and improve declarative integrity constraints and security concerns in database implementation. 4. Design and apply triggers, procedures, and constraints for a given database model. Credits: 3.00

CNIT 38000 - Advanced Analysis And Design

Credit Hours: 3.00. This course is an advanced study of system analysis and design methods and techniques used by systems analysts to develop information systems. Object-oriented tools and the Unified Modeling Language (UML) will be used for describing object structure and behavior, and use cases will be used for modeling functional processes. Topics include rapid development concepts, application architecture and system design, transition from object-oriented analysis and models to components and services, graphical user interface design, web interface design, prototyping, and commercial software package integration. Emphasis is also placed on the use of an object-oriented CASE tool. This course surveys other important skills for the systems analyst, such as fact-finding (requirements discovery), communications, project management, and cost-benefit analysis.

Learning Outcomes: 1. Identify appropriate tools for modeling and implementing various systems aspects. 2. Apply use case and object modeling using Unified Modeling Language (UML) to a systems project. 3. Understand the Systems Development Life Cycle (SDLC) as an analytical problem solving approach to systems development. 4. Apply systems development tools and techniques during various stages of systems development. 5. Develop a system concept based on a given set of system requirements. Credits: 3.00

CNIT 38101 - Topics In Computer Information Technology III

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 38301 - Packaged Application Software Solutions

Credit Hours: 3.00. This course introduces knowledge, skills, tools, and techniques used to select and implement packaged application software solutions, both small and large (including ERP). Topics will include the make-verses-buy decision, critical success factors for packages, economic analysis, requirements analysis, identifying vendors and products, request for proposals, analysis of vendor proposals, decision analysis, implementation service providers, contracting for software and service, implementation project planning, life-cycle architecture,

software installation and configuration, business process redesign organizational change management, integration with legacy system, customization verses adaptation, data conversion, system and application testing, training and support, system cutover and post go-live considerations. The course will focus on best practices, and consequences of less than best practices. This course will benefit students with career aspirations as systems analysts, business analysts, consultants, data and database administrators, and IT managers.

Learning Outcomes: 1. Describe holistically, in intelligent conversation, the make-versus-buy decision, criteria, implications, and implementation process differences. 2. Analyze and revise a Request for Proposal (RFP) more maximum efficiency and effectiveness. 3. Score a set of condensed software package proposals and submit a recommendation for the "best fit" for an organization. 4. Develop a checklist for analyzing a set of contracts for a software license and its implementation services. 5. Develop a project plan for the implementation of software packages. Credits: 3.00

CNIT 38501 - Advanced Systems Design And Integration

Credit Hours: 3.00. A continuation of CNIT 38000 with an emphasis on knowledge, skills, tools, and techniques that systems analysts and architects use to translate functional systems requirements into design specifications that can be subsequently implemented. Students will learn methods for developing specifications that fulfill desired quality properties such as performance, scalability, maintainability, security, privacy, and protection of corporate property, interoperability, and usability, to name a few. Special emphasis is placed on integrating new systems with older systems, as well as with business processes. This course takes a holistic view of design and integration that specifies a complete information technology or information systems solution from the perspectives of different stakeholders, and from different systemic viewpoints and perspectives. Increasingly, the result of design and integration is referred to as a solution's architecture.

Learning Outcomes: 1. Describe holistically, in intelligent conversation, the design and architecture of information technology solutions. 2. Identify and evaluate current and emerging technologies and assess their applicability to address an IT solution's needs. 3. Apply a comprehensive framework for IT solution architecture to an approved problem domain. 4. Document accurately system representations of multiple architectural and design "concerns" of an IT solution, from the perspectives of different stakeholders. 5. Work effectively in teams and communicate effectively with various stakeholders of an architectural description of an IT solution. Credits: 3.00

CNIT 39000 - Supervised Practicum

Credit Hours: 1.00 to 3.00. An instructor-directed practicum designed to combine University study with work experience directly related to the student's plan of study. Designed to be scheduled during a regular semester. Credit awarded upon the completion of department-approved project. Maximum of three credit hours may be applied to the CIT bachelor degree.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CNIT 39200 - Enterprise Data Management

Credit Hours: 3.00. This course examines advanced design techniques and physical issues relating to enterprise-wide data management. Topics include advanced design concepts, enhanced modeling and constructs, objects and unstructured and semi-structured data in databases, data management in non-business contexts, implementation of an enterprise data architecture, and data quality and stewardship.

Learning Outcomes: 1. Describe and apply enterprise information solutions through the design and implementation of architectures for complex databases. 2. Create and analyze a database solution based on user needs, physical and logical design options, and environmental constraints. 3. Use Entity/Relationship Modeling and database normalization techniques based on business requirements. Credits: 3.00

CNIT 39900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 4.00. Hours and subject matter to be arranged by staff. Primarily for students with special aptitudes.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 4.00

CNIT 40500 - Software Development Methodologies

Credit Hours: 3.00. This course explores methodologies and practices commonly used in contemporary software development projects. Topics include programming standards, code ownership and accountability, source code management and version control, productivity and quality metrics, software testing, and software process maturity models.

Learning Outcomes: 1. Demonstrate a level of proficiency in software development process and project topics. 2. Understand what is needed to work in and lead a team developing comprehensive software projects. 3. Understand the advantages and disadvantages of software development process models. 4. Understand the ramifications of in house vs. outsourcing of software development projects. 5. Analyze and evaluate the various software development methodologies available. 6. Understand and be able to implement requirements traceability to software modules. 7. Understand and be able to implement software testing procedures. 8. Identify, monitor, and document risks involved with software and software development. 9. Produce reports detailing the proper implementation of a software development methodology or technology. 10. Understand change management as applied to software. 11. Understand software project, process and product metrics. 12. Understand software quality concepts and the processes required to ensure software quality. 13. Understand the issues of accountability, responsibility, and certification as they apply to software professionals. 14. Understand intellectual property rights as applied to software. Credits: 3.00

CNIT 41500 - Advanced Coding Security

Credit Hours: 3.00. This course allows students to gain proficiency in secure coding principles. Security risks from common coding errors are examined. Techniques for integrating secure coding practices into the development process is detailed with an emphasis on ensuring that applications are designed and implemented with proper security requirements.

Learning Outcomes: 1. Analyze and apply secure coding standards and practices. 2. Understand common programming errors that lead to software vulnerabilities. 3. Demonstrate independent critical thinking and problem solving skills for effective mitigation strategies of security flaws. 4. Understand and apply systems development methodologies. Credits: 3.00

CNIT 41700 - Critical Infrastructure Security

Credit Hours: 3.00. In the socio-political context of nation state sponsored threat actors and cyber cold wars, critical infrastructure (such as water supply and power generation) is a strategic target for attackers. This course investigates the current threat landscape and vulnerabilities in critical infrastructure. Students then investigate system and network architectural solutions to the problem. Students build a model industrial system and will implement these protections in their model environment.

Learning Outcomes: 1. Assess system architectures of industrial control networks to identify sources of vulnerability. 2. Analyze the threat landscape associated with industrial control environments. 3. Build and validate controls in a model industrial control network. Credits: 3.00

CNIT 42000 - Basic Cyber Forensics

Credit Hours: 3.00. This course introduces students to the fundamentals of cyber forensics and cyber-crime scene analysis. The various laws and regulations dealing with computer forensic analysis are discussed. Students are introduced to the emerging international standards for cyber forensic analysis, as well as a formal methodology for conducting computer forensic investigations.

Learning Outcomes: 1. Identify the role of computers as an integral part of an information system. 2. Define terminology associated with information systems and computers. 3. Identify the various components of a computer system. 4. Demonstrate proficiency in the use of various

business application packages. 5. Discuss various social issues associated with computers and information systems. Credits: 3.00

CNIT 42100 - Mobile Forensics

Credit Hours: 3.00. This course will help students understand the issues, techniques, and vulnerabilities of small scale digital device forensics. Emphasis will be placed on the forensically sound acquisition, preservation, analysis and presentation of small scale digital devices as evidence. Specific investigations will cover devices such as Personal Digital Assistants (PDA's), Cell Phones, and Smart Phones.

Learning Outcomes: 1. Identify various mobile devices. 2. Compare the characteristics of mobile devices. 3. Distinguish potential evidence found on mobile devices and ubiquitous systems. 4. Inspect forensically sound evidence from mobile devices and ubiquitous systems. 5. Produce a report for a courtroom presentation. Credits: 3.00

CNIT 42200 - Cyber Criminology

Credit Hours: 3.00. This course examines both the traditional and contemporary forms of cybercrime, including hacking, insider threat, Internet child pornography, cyberbullying, hacktivism, and cyberterrorism. Students will learn how computers can be either the target (e.g., hacking) or the tool (e.g., child pornography) for committing cybercrimes. In addition, this course will apply a variety of sociological, psychological, and criminological theories to help explain, "Why do some people engage in cybercrimes when others do not?" Theories discussed include: social learning theory, space transition theory, routine activity theory, social cognitive theory, techniques of neutralization, and personality characteristics.

Learning Outcomes: 1. Juxtapose traditional and contemporary forms of cybercriminal behavior. 2. Apply theoretical (psychological, sociological, criminological) concepts to different cybercrimes. 3. Analyze and synthesize empirical literature on theory and cybercriminal behavior. Credits: 3.00

CNIT 42300 - Advanced Cyberforensics

Credit Hours: 3.00. This course covers specialized and advanced content in digital forensics discipline. The focus of the course is on advancing and expanding the knowledge of the students regarding digital forensics investigation process particularly on emerging and contemporary technologies. Application of best practices in cyberforensics are emphasized in this course.

Learning Outcomes: 1. Identify components and sources of digital evidence in emerging technologies. 2. Apply digital forensics best practices to preserve, acquire, examine, analyze, and report digital evidence. 3. Correlating digital evidence collected from various devices for an investigation. 4. Present and communicate the digital forensics process for an investigation. Credits: 3.00

CNIT 42500 - Advanced Mobile Programming

Credit Hours: 3.00. This programming course teaches students the skills necessary to develop complex applications for mobile computing devices (e.g. smartphones and tablet computers). This course gives students hands-on experience developing mobile applications that use advanced features found on the latest mobile computing devices.

Learning Outcomes: 1. Develop applications for mobile devices that use advance features of mobile devices. 2. Develop apps that use more than one processing thread. 3. Develop apps that communicate with code running on a server. 4. Understand ways to earn money from a mobile application. Credits: 3.00

CNIT 43500 - Advanced Network Services

Credit Hours: 3.00. This course covers the concepts and technologies required to deploy advanced network services such as telephony and television over modern data networks. The underlying network structure and enabling services will be detailed along with a comprehensive analysis of protocols and services required to deploy such services.

Learning Outcomes: 1. Determine the relevant critical business and technical needs in order to develop a IP Telephony design framework. 2. Describe the technologies used in Voice over IP and select the appropriate hardware and software components to support a proposed IP telephony design. 3. Install, configure, and secure an IP Telephony solution. 4. Describe effective troubleshooting methods to resolve

issues in IP Telephony Networks. Credits: 3.00

CNIT 44500 - Advanced Internetwork Routing And Switching

Credit Hours: 3.00. This course extends routing and switching knowledge with specific attention given to emerging trends. This course focuses on the concepts of traffic shaping, advanced exterior gateway routing protocols, label switching technologies, and quality of service. The necessary perspectives of integration of these topics into enterprise networks are addressed in both lecture and laboratory.

Credits: 3.00

CNIT 44600 - Advanced Wireless Networks

Credit Hours: 3.00. This course is an advanced course in wireless networking. Building on knowledge gained from the introductory wireless local area network course, this course addresses wireless network design and implementation on a large scale. Topics include mesh networking, broadband wireless access, backhauling, WiMAX and cellular systems. The laboratory portion of the course includes implementing and simulating these technologies in an outdoor setting.

Learning Outcomes: 1. Understand current WLAN, WMAN and WWAN design and implementation strategies. 2. Understand the increasing roles that WLANs, WMANs, WWANs are playing to increase mobility and augment wire line high throughout technologies. 3. Design and configure Metropolitan and Wide Area scaled wireless networks based on a given business scenario or problem. 4. Understand wireless data and telecommunications terminology and jargon. 5. Understand the basic underpinnings of important wireless technologies and wireless internet provider management issues. 6. Conduct successful outdoor site surveys with different equipment and standards. 7. Be able to discuss wireless data and telecommunication issues with professionals in an informed and intelligent manner. 8. Formulate a checklist regarding existing and/or new wireless data/telecommunication systems and infrastructure. Credits: 3.00

CNIT 45500 - Network Security

Credit Hours: 3.00. This course explores business, conceptual, and technological aspects of network security for voice and data networks. The course deals with the analysis, design, implementation, and management issues surrounding effective network security. Key concepts and technology include virus protection, firewalls, authentication, encryption, wireless security, security protocols, physical security, and network security architecture and policy development.

Learning Outcomes: 1. Evaluate information technology systems to determine security weakness. 2. Design and implement secure information technology infrastructure. 3. Analyze and design packet filter solutions for typical information technology solutions. Credits: 3.00

CNIT 45600 - Wireless Security And Management

Credit Hours: 3.00. This course is an advanced course concerning security and management issues as they apply to wireless networking. Students will gain knowledge on the problems and solutions the wireless industry face when implementing large scale networks. Issues addressed include encryption weaknesses, security methodology tradeoffs, large scale network management techniques and systems, and advanced wireless network architecture. The laboratory portion of the course enforces the learning outcomes with hands-on experiences in implementing secure, manageable complex wireless networks.

Learning Outcomes: 1. Implement solutions for centralized wireless network management approaches. 2. Design networks exploring tradeoffs between various security and management models and tools. 3. Demonstrate knowledge of currently available penetration testing tools. 4. Extend the security and management domains to large-scale wireless (WWAN) networks. Credits: 3.00

CNIT 46000 - High Performance Computing Systems

Credit Hours: 3.00. This course provides an introduction to high performance, cluster, and grid computing from a systems perspective. The driving outcome for this course is for students to understand and apply high performance computing concepts,

architectures, and software components to develop and operate a high performance computing environment. Topics include: high performance computer architectures, network architectures for High Performance Computing (HPC), commodity and open-source cluster architectures, and software systems.

Learning Outcomes: 1. Understand factors that motivate the use and development of high performance computers and supercomputing systems. 2. Demonstrate skill in developing high performance computing systems. 3. Understand the continuum of high performance computing architectures. 4. Understand appropriateness of each architecture type to problem solving for a wide variety of applications. 5. Understand the effects of communications architecture and performance characteristics on application performance. 6. Demonstrate the use of commodity components in high performance computing and the trends and forces that motivate their use. 7. Demonstrate the use of tools and techniques of cluster and high performance computing. Credits: 3.00

CNIT 46100 - Parallel Data Systems

Credit Hours: 3.00. This course provides an introduction to the techniques and technologies used in high performance computing for developing, using and managing high performance data systems. Topics covered in this course will focus on aspects of the design, implementation, and use of high performance storage systems progressively from the hardware layer through the operating system up to the application level. Topics will include: commodity hardware and novel architectural storage components; the architecture and use of parallel file systems, including PVFS2 and Lustre; reliability and scheduling; virtualization and fault tolerant strategies for Petascale computing; system architectures for data intensive computing and workflows; parallel I/O systems; and grid and cloud computing architectures. The driving outcome for this course is for students to understand and apply advanced high performance computing concepts, architectures, and software components to develop and operate a high performance computing environment.

Learning Outcomes: 1. Understand the factors that motivate the use and development of high performance parallel storage systems. 2. Understand the importance of fast data rates to the efficient use of HPC systems and processors, and the effects of poor I/O on application performance. 3. Develop a high performance storage system by building, benchmarking and optimizing a small commodity-based storage system based on the Linux operating system and other open source software packages. 4. Understand the storage hierarchy, and the speeds, feeds, and costs at each level. 5. Understand the technological characteristics of components at each level of the storage hierarchy, and the effects of these technologies on reliability and performance. 6. Understand the range of interconnection technologies available for parallel data systems, and the effects of these technologies on storage performance. 7. Understand the range of storage technologies available and the design of high performance storage systems that are cost effective and reliable. Credits: 3.00

CNIT 47000 - Incident Response Management

Credit Hours: 3.00. This course will bridge business operations to IT support of the critical systems that support day-to-day operations. Techniques to detect anomalous behaviors through the configuration and monitoring of modern Intrusion Detection systems, analyzing and decoding network flows, system logs, and reports is covered along with appropriate remediation actions. Multiple approaches, theories, standards, and suggestions for incident response handling will be examined.

Learning Outcomes: 1. Assess vulnerabilities, threats, and risk to business computing assets, and align response strategies with business requirements. 2. Design, assess, and apply enterprise-level incident response plans. 3. Analyze information systems to detect common attack techniques, malicious applications, network activities, and anomalies; apply results of causal analysis to implement continuous process improvement. Credits: 3.00

CNIT 47100 - Vulnerability Analysis And Testing

Credit Hours: 3.00. This course will focus on advanced security techniques often referred to as vulnerability analysis or network

penetration testing (pen testing). Students will learn the methods, techniques, and tools to test the security of computer networks, infrastructure and applications. The activities will be based in an environment that allows testing and "hacking" that does not risk possible legal, ethical, and network availability issues.

Learning Outcomes: 1. Apply extensive knowledge of current security standards and methodologies. 2. Understand the increasing need for LAN and WAN network management and available methods. 3. Demonstrate the differences between wireless and wire-line security and network penetration and compromise points. 4. Create secure network environments based on specifications and scenarios. 5. Actively test various network designs and scenarios for sensitivity to know vulnerabilities and take corrective actions in a timely manner. Credits: 3.00

CNIT 47200 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using a variety of methods. Students will have "hands-on" opportunities using tools to assist in these efforts. Permission from instructor required.

Learning Outcomes: 1. Examine key data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision-making purposes. 3. Evaluate the effectiveness of extracted knowledge and insights on decision-making. Credits: 3.00

CNIT 47700 - Blockchain

Credit Hours: 3.00. This course focuses on blockchain technologies. As IT practitioners and cybersecurity professionals, knowing the inner workings of blockchain technology is necessary for career preparation and development. This course aims to demystify blockchain technology by looking into its fundamental aspects, such as data structure, network consensus, economic incentives, security and privacy, applications, and regulations.

Learning Outcomes: 1. Identify enabling techniques for blockchain technology. 2. Describe the data structure and network layer of the Bitcoin blockchain. 3. Describe major components of blockchain, such as consensus, incentivization, and smart contracts. 4. Classify and analyze the security and legal issues of blockchain and cryptocurrency. Credits: 3.00

CNIT 48000 - Managing Information Technology Projects

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that project managers use to plan, staff, estimate, and manage information technology projects. Special emphasis is placed on learning and applying the concepts of managing scope, risk, budget, time, expectations, quality, people, communications, procurement, and externally provided services. Students will apply project management technology and techniques to business problems.

Learning Outcomes: 1. Understand the genesis of project management and its importance to improving the success of information technology projects. 2. Demonstrate knowledge of project management terms and techniques. 3. Use Microsoft Project and other software to help plan and manage information technology projects. 4. Appreciate the importance of good project management. Credits: 3.00

CNIT 48101 - Topics In Computer Information Technology IV

Credit Hours: 3.00. This variable title course is used to pilot new course offerings.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 48200 - Six Sigma Data Quality For Continuous Improvement

Credit Hours: 3.00. A study of data quality for Six Sigma level of improvement, applying a Six Sigma DMAIC (Define, Measure, Analyze, Improve and Control) improvement methodology, utilizing information tools and techniques. The course addresses advanced topics in statistical based continuous improvement, data quality; and Big Data Analytics concepts, as pertains to systematic problems. An embedded certificate in SS is included in the body of knowledge.

Learning Outcomes: 1. Explain how Six Sigma principles are used for continuous improvement. 2. Apply the DMAIC and Big Data approach in

solving team based, project based problems. 3. Demonstrate understanding of data quality principles as applied to compelling business cases. Credits: 3.00

CNIT 48300 - Applied Machine Learning

Credit Hours: 3.00. In the past decade, we have observed the expeditious evolution and tremendous applications of machine learning, such as unmanned vehicle, autonomous language translation, and smart healthcare. This course will introduce both the fundamental knowledge and design/application insights of machine learning techniques via a series of hands-on real-world examples. The overall aim is to provide the students with a good understanding of machine learning technologies, building machine learning models, and applying machine-learning technologies to address real-world problems. In this course, students will also have an opportunity to explore the cutting-edge machine learning technologies, such as deep learning, adversarial attacks, and meta learning, and develop their own machine learning-based solutions.

Learning Outcomes: 1. Demonstrate both the fundamental knowledge and design/application insights of the state-of-the-art machine learning techniques. 2. Implement machine learning models. 3. Apply machine learning techniques to solve real-world problems. Credits: 3.00

CNIT 48400 - Applications In Data Science

Credit Hours: 3.00. Students investigate practical applications of Data Science and evaluate their effectiveness in guiding decision making. Students will employ tools to assist in these efforts.

Learning Outcomes: 1. Extract knowledge and insights from a variety of datasets. 2. Evaluate the effectiveness of extracted knowledge and insights. 3. Examine the ethical and social implications of data-driven decision making and policies and one's own ethical and social responsibilities when working with data. Credits: 3.00

CNIT 48700 - Database Administration

Credit Hours: 3.00. This course explores tools and techniques for managing an organization's database technology. Topics include database architecture, database technology installation, database creation and maintenance, Database Management System (DBMS) operation and troubleshooting, and database performance tuning. In the laboratory, students engage in activities performed by a typical database administrator.

Learning Outcomes: 1. Describe the architecture of a database management system. 2. Perform the roles of a database administrator including storage and user management, and data persistence. 3. Apply the principles and methods of performance tuning on a database management system. Credits: 3.00

CNIT 48900 - Advanced Topics In Database Technology

Credit Hours: 3.00. This course will provide students with a chance to explore contemporary issues in the database arena. These issues may be related to new or breakthrough concepts, technologies, and techniques.

Learning Outcomes: 1. Vary by course offering. Credits: 3.00

CNIT 49000 - Senior Project

Credit Hours: 1.00 to 3.00. Team industrial experience for seniors who undertake a significant controlled project experience for an actual client and problem. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CNIT 49800 - Undergraduate Research

Credit Hours: 0.00 to 3.00. This course is used for tracking undergraduate research credits. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 3.00

CNIT 49900 - Topics In Computer And Information Technology

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Possible individual study under directed leadership of professor. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

Department of Computer Graphics Technology

The Department of Computer Graphics Technology touches all aspects of computer graphics, from animation to scientific visualization, and from user experience to game studies. Research projects on these topics push the boundaries of how the medium can be used, while the variety of degree options prepare students to be practitioners and managers in an array of computer graphics-related careers. With eight areas of specialization to choose from, undergraduate computer graphics students can align their plan of study with their talents. Real-world projects and research opportunities help students put theories into practice.
The five-year combined BS/MS Degree Program in Computer Graphics Technology enables outstanding students to complete the Bachelor of Science in a Computer Graphics Technology major and the Master of Science in Computer Graphics Technology in a total of five years, rather than six years or more (if pursued separately). Visit the Computer Graphics Technology website for additional information about this option.

Faculty

Department of Computer Graphics Technology Website

Contact Information

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West Lafayette, IN 47907
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Graduate Information

For Graduate Information please see Computer Graphics Technology Graduate Program Information .

Web Programming & Design, BS

UX Design, BS

Data Visualization, BS

Animation And Visual Effects, BS

Game Development, BS

Themed Entertainment Design, BS (Indianapolis Only)

Themed Entertainment Design Minor

CGT 10100 - Introduction To Computer Graphics Technology

Credit Hours: 3.00. This course introduces students to the Computer Graphics Technology program, and prepares them for the program curriculum. It serves both as the Freshman Experience course, and the fundamental introduction to Computer Graphics. In addition to academic career planning and utilization of institutional resources, students also investigate the definitions and applications for Computer Graphics, the history and knowledge base for Computer Graphics, and critically examine potential Computer Graphics career pathways.

Learning Outcomes: 1. Demonstrate comprehension of the basic principles of CGT. 2. Engage practicing professionals, current students, faculty, counselors, and alumni to discover opportunities within the department, college, and university to develop and validate a CGT plan of study. 3. Identify and utilize basic strategies for team building, planning, investigation and presentation. 4. Identify and utilize opportunities to participate in activities focused on critical thinking, teamwork, project management, potential social impact, ethics and communication. 5. Evaluate current technical skill level and demonstrate investigation into or

competent entry skill in a CGT area of interest. Credits: 3.00

CGT 10101 - Foundations Of Computer Graphics Technology

Credit Hours: 2.00. This course provides a foundational overview of computer graphics. The topics include the applications of computer graphics in today's world, basic technical elements of computer graphics, a review of current and future career opportunities in the field, and areas of potential research and study in computer graphics technology.

Learning Outcomes: 1. Demonstrate comprehension of the basic principles of CGT. 2. Engage practicing professionals, current students, faculty, counselors and alumni to discover opportunities within the department, college and university to develop and validate a CGT plan of study. 3. Identify and utilize basic strategies for team building, planning, investigating and presentation. 4. Identify and utilize opportunities to participate in activities focused on critical thinking, teamwork, project management, potential social impact, ethics and communication. 5. Evaluate current technical skill level and demonstrate investigation into or competent entry skill in a CGT area of interest. Credits: 2.00

CGT 10501 - Introduction To Games (UCC: STS)

Credit Hours: 3.00. Students learn the history of computer game design. Students engage in learning activities that help them remember basic game design principles. These principles are then applied using simple exercises within game engine technology.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Recall key facts about computer game design history. 2. Understand principles of computer game design. 3. Apply computer game design principles in exercises on paper and in game engine technology. 4. Analyze computer games via written critiques. Credits: 3.00

CGT 11000 - Technical Graphics Communications

Credit Hours: 3.00. This course is an introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.

Learning Outcomes: 1. Describe the importance of engineering/technical graphics in the design of made products. 2. Communicate engineering ideas using visual techniques. 3. Utilize two and three dimensional geometry for engineering and technical applications. 4. Apply basic industry graphics standards to engineering design. 5. Sketch basic freehand representations of technical concepts. 6. Demonstrate proficiency using basic 3D computer-aided design (CAD) processes. Credits: 3.00

CGT 11100 - Designing For Visualization And Communication

Credit Hours: 3.00. An introductory design course for computer graphics majors. Students develop an understanding of the basic design elements and principles, composition, and typography through exercises and projects. The focus is on visual thinking, exploring the relationship between type and image, and developing multiple solutions to a given problem.

Learning Outcomes: 1. Distinguish the elements and principles of visual design and composition. 2. Describe the foundational principles of Color Theory. 3. Describe the relationship between type and image. 4. Critique visual communications and design solutions. Credits: 3.00

CGT 11200 - Sketching For Visualization And Communication

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication, and creativity within a sketching metaphor. Exercises and projects in graphic theory, problem solving, and sketching skill development provide students with activities that focus on further development within the discipline. A variety of sketching techniques are used to gather critical information and transform data into effective communication instruments.

Learning Outcomes: 1. Awaken creativity and problem-solving through the means of sketching. 2. Develop fine motor skills: Becoming a artisan. 3. Explore Aesthetics as it pertains to sketching. 4. Learn and practice professional methods of look development. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11505 - Scripting And Computational Thinking

Credit Hours: 3.00. This course introduces the students to computer programming, computational thinking, and the mathematics of graphics programming. The act of programming is viewed through the lenses of Decomposition, Pattern Matching, Abstraction and Algorithms and then applied to writing some simple games in current scripting languages. No prior programming experience is required. The principal objective of the course is to provide a working knowledge of programming fundamentals to game designers and artists as well as to prepare game programmers for more advanced game programming coursework. As computer programming is an applied discipline, this course uses an active learning approach that combines lecture time with extensive lab assignments.

Learning Outcomes: 1. Apply the elements of computational thinking to programming tasks. 2. Use scripting languages in a well-structured way to implement math-based graphical solutions. 3. Use scripting languages to create gameplay within a game engine. 4. Use the mathematics of 2D and 3D graphics programming. Credits: 3.00

CGT 11600 - Geometric Modeling For Visualization And Communication

Credit Hours: 3.00. A core introductory computer graphics course that provides entry-level experiences in geometric modeling. Students develop geometric analysis and modeling construction techniques and processes to produce accurate computer models for graphic visualization and communication.

Learning Outcomes: 1. Problem-solve and create through the means of 3D modeling. 2. Develop fine motor skills: Becoming a digital artisan. 3. Explore Aesthetics as it pertains to 3D modeling. 4. Learn and practice professional methods of 3D modeling. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 11700 - Illustrating For Visualization And Communication

Credit Hours: 3.00. This foundation course stresses the use of pictorial illustration for visualization and communication. Various projection systems are introduced with discussion focusing on the appropriate use of view and system utilized to accentuate and provide clear communication. A variety of digital tools are used to construct, extract and render pictorial views using vector and raster tools.

Credits: 3.00

CGT 11800 - Fundamentals Of Imaging Technology

Credit Hours: 3.00. This course provides a foundation for the development and use of raster and vector images for a variety of industries. Full-color images and illustrations are produced using computer technologies, with a focus on both technical and aesthetic aspects. Topics include color theory and perception, surface and lighting analysis, rendering techniques, and technical characteristics.

Learning Outcomes: 1. Combine typography, images, colors, and other design elements to create organized visual relationships. 2. Communicate new ideas formulating them into visual concepts. 3. Apply the principles of color, resolution, and imaging formats effectively. 4. Adapt digital images for print, web, animation, and software apps. Credits: 3.00

CGT 12300 - Animation Foundations

Credit Hours: 3.00. In this course, students are introduced to the core concepts and principles of animated motion. The course includes an overview of animation history and the evolution of animation technology. Principles of animation production are explored through practical exercises executed in a range of animation software types. These exercises will familiarize students with different approaches to creating animated motion, with a focus on keyframed digital animation.

Learning Outcomes: 1. Identify the sequence of major milestones in the history of animation technology, style and industry. 2. Demonstrate fundamental animation skills and principles including anticipation, squash & stretch, timing, easing and motion arcs. 3. Create animated

images of objects and characters in digital animation software that communicate believable motion. 4. Arrange and manipulate geometric objects and systems in digital animation software, creating a range of defined outputs including still images and image sequences suitable for animation workflows. Credits: 3.00

CGT 14100 - Internet Foundations Technologies And Development

Credit Hours: 3.00. (CNIT 14100) The course explores the history, architecture, and development of the World Wide Web. Current tagging and scripting languages are covered in a tool-independent environment. Topics also include authoring tools, design, graphic and multimedia formats, and commerce, implementation, and security issues. PC literacy required.

Learning Outcomes: 1. Develop web content using client-side technologies. 2. Create production documentation to meet project requirements. 3. Create media for successful inclusion on websites. 4. Deploy web application to common servers and mobile platforms. 5. Evaluate finished solution against criteria set forth in production-documentation for the provided project. Credits: 3.00

CGT 14700 - Visual Effects Introduction

Credit Hours: 3.00. This course introduces students to the visual effects techniques using common methodologies and tools. Topics include procedural frameworks, 3D pipeline implementation, vector operations, and simulating physical phenomena for entertainment graphics. Special emphasis is placed on achieving aesthetically please entertainment-grade graphics using visual effects techniques.

Learning Outcomes: 1. Describe visual effects pipeline. 2. Implement simple simulations using common visual effects tools and techniques. 3. Explore options for visual effects career pathways. 4. Create aesthetically pleasing visual effects using production tools and techniques. Credits: 3.00

CGT 17207 - User Experience Design Experience Studio I

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students learn about the roles they can pursue and build foundational collaboration and project management skills. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Participate actively and contribute to team activities. 2. Identify and use project management tools. 3. Explore areas of UX specialization. 4. Explain project objectives in a professional manner. Credits: 3.00

CGT 17208 - User Experience Design Studio I: Fundamentals (UCC: STS)

Credit Hours: 3.00. Introduction to the fundamental components of human-centered design, focusing on interactive computer systems. Students learn the basic tenets and methods of user-centered design, including usability and visual design principles, user research, and low-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Conduct basic analysis of situations, clients, and problems using data gathering and analysis techniques. 2. Articulate problem statements. 3. Create concepts that address the issues in the problem statement. 4. Demonstrate basic application of principles of visual and interaction design to create low-fidelity prototypes. 5. Apply the fundamental components of user-centered design. 6. Articulate the core values of user-centered design. Credits: 3.00

CGT 20100 - Portfolio Presentation

Credit Hours: 2.00. This course has been designed to introduce students to the standard practices used in business and industry to identify potential employees in graphics related positions. Lectures will cover professional conduct when searching for employment and graphics standards expected in a professionally developed portfolio.

Learning Outcomes: 1. Demonstrate how to systematically identify, evaluate, and select individual pieces of the student's own work to be included in a professional looking portfolio. 2. Demonstrate an ability to evaluate and select the appropriate technology to create an online

portfolio with appropriate domain name which can be sent to potential employers during position internship and job searches. 3. Explain the value in lifelong learning and ongoing professional development in their chosen field and how this goal may be accomplished. 4. Identify internship opportunities, both locally and nationally. Credits: 2.00

CGT 20200 - Motion And Video I

Credit Hours: 3.00. The movement of graphics and incorporation of video is become ever prevalent within commercial production. No longer are these elements done solely by the Hollywood elite or used strictly within the film industry. Professionals are utilizing all kinds of tools in digital video, audio, graphic design and animation to create moving elements that tell a story and communicate concepts to solve communication problems. Students will learn basics in the production process, framing and movement, key framing, and design principles. Students will also learn basics in client relationship and business etiquette. Initial projects will focus on commercial creation and the utilization of typography as it relates to storytelling.

Credits: 3.00

CGT 20400 - Introduction To Themed Attraction Design

Credit Hours: 3.00. An introduction to immersive attraction; including the consideration of operations, graphics, engineering, technology and design. Students will apply their knowledge in narration and graphic principles to concept projects in immersive spaces.

Credits: 3.00

CGT 20500 - Portfolio Review

Credit Hours: 0.00. Portfolio review for students in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content. Credits: 0.00

CGT 21100 - Raster Imaging For Computer Graphics

Credit Hours: 3.00. Digital images are produced using a variety of computer technologies. Advanced color theory, surface rendering, and light control are emphasized in relation to technical illustration, hardware characteristics, and software capabilities.

Learning Outcomes: 1. Demonstrate understanding of the primary attributes and differences between vector and raster graphics and their application to various communicative products and tasks. 2. Demonstrate understanding of analog and digital data forms and the conversion processes relating to digital imaging. 3. Appropriately use common imaging application features such as layers, channels, paths, filters, color adjustment and correction tools, histograms, color mode tools, and calibration tools. 4. Demonstrate understanding of input, manipulation, and output technologies related to raster graphics. 5. Demonstrate understanding of color theory, color models, color systems, and the physiological and psychological effects of color in raster imaging. 6. Demonstrate understanding of miscellaneous raster graphics issues such as file formats, compression technologies, vector to raster conversion methods and the legal implications of copyrights, trademarks, licenses, and releases. 7. Demonstrate skill and proficiency in creating professional raster graphics for all types of output including: textures for use in 3D environments, photographic reproduction, digital illustration, web delivery, CD-ROM multimedia, and self-promotion. Credits: 3.00

CGT 21500 - Computer Graphics Programming I

Credit Hours: 3.00. This course focuses on programming fundamentals, logic, and problem solving necessary for advancement into upper level CGT courses. A cross-section of languages and technologies will be introduced and demonstrated.

Learning Outcomes: 1. Understand basic programming concepts such as variables, data types, selection and repetition control structures, arrays, files, and methods and functions. 2. Create simple object-oriented applications. 3. Demonstrate an understanding

of the similarities between several different programming or scripting languages. 4. Demonstrate the ability to apply knowledge to different computer graphics software applications. Credits: 3.00

CGT 21600 - Vector Imaging For Computer Graphics

Credit Hours: 3.00. Full-color vector illustrations for a variety of uses are produced using computer methods. Color theory, surface analysis, and rendering techniques are emphasized as they apply to vector-based illustrations.

Learning Outcomes: 1. Have completed all assignments associated with this course and earned a passing grade. 2. Have reviewed all lectures online, attended all meeting sessions, and have participated in class discussions on a weekly basis. 3. Be able to demonstrate their knowledge in all the areas listed within the course outcomes. 4. Master the principles of creativity as they pertain to graphics design. 5. Demonstrate their techniques for effective ideation and creative brainstorming. 6. Execute design projects established in current multimedia technologies and best practices. 7. Use appropriate design vocabulary utilizing the concepts of visual grammar and marketing language. 8. Explain and demonstrate the importance of deadlines in a multimedia production schedule. 9. Produce quality pieces for their student portfolios. Credits: 3.00

CGT 21801 - Open Studio - Interactive Art And 3D Animation

Credit Hours: 3.00. This interdisciplinary course invites Purdue students to reflect on global culture, location and society, while simultaneously learning practical knowledge in programming, interactive visualization, locative media, 3D modeling and animation. The class integrates field trips, brainstorming sessions and technical training to create context-based interactive art.

Learning Outcomes: 1. Design and create interactive and multimedia works for display. 2. Investigate cultural differences in a globalized context. 3. Identify properties of teamwork as a tool for the creation of new multimedia projects. 4. Demonstrate technical knowledge through the development of 3D models and animations. 5. Synthesize graphics programming fundamentals. Credits: 3.00

CGT 22000 - Prop Asset Creation

Credit Hours: 3.00. This course prepares students to become skilled environmental prop artists, focusing on the creation of 3D assets that enhance and contribute to the overall depth and atmosphere of digital environments. Students will learn to design and model various digital props, such as products, weapons, vehicles, rides, furniture, foliage, and other objects that populate and bring life to digital worlds. Additionally, the course will cover the creation of physical 3D printed assets, allowing students to bring their digital designs into the physical world. Through the use of visual references and concept art, students will develop 3D models while adhering to specific technical constraints.

Learning Outcomes: 1. Develop 3D prop assets that effectively enhance digital and physical environments functionality, reinforcing they contribute to immersive experiences that resonate with the audience and leave a lasting impression. 2. Apply best practices in polygonal modeling, with a strong focus on maintaining optimal topology and adhering to polygon count constraints for efficient asset creation. 3. Identify effective methods for sourcing high quality visual references, maintaining the quality and relevance of reference images and concept art before the modeling and texturing stages. 4. Develop Level of Detail (LOD) props, taking into account the proximity of the 3D prop to the digital camera and how this influences the polygon count and texture resolution applied to the asset. Credits: 3.00

CGT 24100 - Introduction To Computer Animation

Credit Hours: 3.00. This course introduces the knowledge base on which digital animation and spatial graphics technology are founded and developed. Emphasis will be placed on developing a working knowledge of the mechanics of

3D geometric formats, spline-based modeling with polygon mesh & NURBS, procedural mapping of raster images, simplified polygon modeling, rendering methods, hierarchical linking, and kinematic fundamentals.

Learning Outcomes: 1. Explain the basic concepts of animating objects over a specific amount of time. 2. Apply appropriate design parameters to achieve a pre-defined animation outcome. 3. Define and explain clearly production timeline needs associated with animation projects. 4. Create animation along a timeline using various techniques such as anticipation, follow through, squash & stretch, balance, gravity, etc. for desired motion. Credits: 3.00

CGT 24500 - Game Development I: Core Skills And Technologies

Credit Hours: 3.00. (CNIT 30600) This course introduces students to the fundamental technologies and skill sets required to develop video games. Students will be taught agile development methodologies in a team-based environment.

Learning Outcomes: 1. Demonstrate a moderate level of individual skill with a commercial game engine. 2. Demonstrate the ability to observe game mechanics and reproduce them. 3. Acquire competency in each of the following domains: 3D and 2D level creation, basic art asset creation, visual programming basics, implementing game mechanics. 4. Demonstrate the ability to complete a market-ready video game in a team-based production environment. 5. Demonstrate the ability to implement agile production techniques. Credits: 3.00

CGT 24600 - Compositing I

Credit Hours: 3.00. This course focuses on applying node-based video compositing techniques as applied to 3D visual effects and animation. Students explore the major areas of video compositing, including node-based workflows, integration with 3D animation and visual effects tools, image tracking, rotoscoping, and chroma keying. Special emphasis is placed on creating aesthetically pleasing video composites using production tools and techniques.

Learning Outcomes: 1. Implement video composite using node-based compositing tools. 2. Apply color correcting techniques. 3. Given a multichannel render, properly composite it into a final product. 4. Apply common compositing techniques. 5. Integrate 3D renders and video in an aesthetically pleasing manner. Credits: 3.00

CGT 24700 - Visual Effects - Particles And Procedural Effects

Credit Hours: 3.00. This course focuses on simulating and rendering particles. Special emphasis is placed on volumes, sparks, dust, and smoke effects. Techniques for minimizing render times and meeting production requirements are explored. Emphasis is placed on the use of production tools and techniques to create aesthetically pleasing graphics.

Learning Outcomes: 1. Create efficient particle simulations. 2. Render particle simulations properly. 3. Apply approved mathematical formulas to create simulations for entertainment graphics. 4. Optimize simulations based on time and production project parameters. 5. Implement common visual effects. Credits: 3.00

CGT 24800 - Visual Effects - Pyrotechnics And Destruction Effects

Credit Hours: 3.00. This course focuses on the application of visual effects methodology to create effects based on destruction techniques and pyrotechnics. Students implement projects using methods for simulating destruction, fire, and smoke. Emphasis is placed on using production tools and techniques to produce realistic and aesthetically pleasing graphics.

Learning Outcomes: 1. Implement destruction simulations using production tools and techniques. 2. Implement fire and smoke simulations using production tools and techniques. 3. Integrate destruction and fire simulations to meet the needs of 3rd party video compositing team. 4. Render simulations realistically within the provided time and computational constraints. Credits: 3.00

CGT 25001 - Computer Graphics Professional Practices I

Credit Hours: 1.00. CGT 25001 is a course in the CGT professional practices sequence, with a focus on student professional development and communications in the field of computer graphics. Emphasis will be placed on industry engagement for the development and refinement of a student's professional resume and portfolio; and professional communications practices necessary for securing professional practical work experience. CGT 25001 will be taught in a seminar format with one meeting per week focused on guest speakers, status checks for portfolio and resume development, and professional networking.

Learning Outcomes: 1. Develop a professional portfolio. 2. Develop a professional resume and revise during the semester. 3. Write a professional narrative that outlines skills, goals, and desired career direction. 4. Understand interviewer/interviewee expectations. Credits: 1.00

CGT 25100 - Principles Of Creative Design

Credit Hours: 3.00. This course is an exploration of conceptualization and problem-solving using the integration of type and image as both visual and verbal communication. Topics such as systems of organization, visual hierarchy, creativity, typography, color, and navigation are introduced and explored.

Credits: 3.00

CGT 25300 - Front-End Web Development

Credit Hours: 3.00. This is a course in Front-End Web Development that emphasizes the importance of JavaScript, its libraries, and other front-end technologies in crafting engaging and interactive user interfaces. The JavaScript programming language has been the backbone of modern front-end web development. It enables developers to create dynamic content that enriches the user experience and interaction on websites. This course will cover the fundamental ideas of JavaScript. Students will learn to use the Document Object Model (DOM) in JavaScript to make web pages that can update and change in real-time. Students will also explore various JavaScript libraries or other front-end technologies that help streamline the development process and allow for the creation of complex user interfaces with less code.

Learning Outcomes: 1. Develop skills and proficiency in creating professional interactive components using HTML, JavaScript, JavaScript libraries, and CSS. 2. Demonstrate understanding of front-end programming. 3. Create interactive front-end user interfaces for websites. 4. Systematically develop content for the Web, from concept to implementation. 5. Further enhance cognitive skills in problem-solving, debugging, and programming. Credits: 3.00

CGT 25500 - Game Development II: Design And Psychology

Credit Hours: 3.00. (CNIT 30800) This course examines video game design, theory, and development from aesthetic, psychological, and technical perspectives. Students will gain experience with a commercial game development platform. Advanced game development techniques will be taught in this course.

Learning Outcomes: 1. Deconstruct and analyze an existing game and define its essential elements as per various theories of game design. 2. Identify major psychological paradigms and how they are applied in video game experiences. 3. Demonstrate proficiency in applying behavior modification principles in video games. 4. Demonstrate individual technical proficiency with a commercial game engine. 5. Complete a market-ready video game in a team-based production environment. 6. Implement agile production techniques. Credits: 3.00

CGT 25600 - Principles Of User Experience Design

Credit Hours: 3.00. This course introduces students to the process of user-centered design of computer systems humans interact with. Students learn how to draw upon principles of usability and user interface design rooted in human psychology and user research in order to conceptualize, prototype, and evaluate computer systems. Topics include processes such as user research, conceptual design, prototyping, and evaluation and concepts such as visual hierarchy, usability, information architecture, navigation, and more. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Apply the user-centered design process (UCDP) to create visual digital interfaces. 2. Demonstrate the user-centered design approach. 3. Apply the design process to

create computer interfaces. 4. Apply visual principles to interface design. 5. Apply usability principles to interface design. 6. Conduct usability research. Credits: 3.00

CGT 26505 - Video Game Level, Mission, And World Design

Credit Hours: 3.00. This course teaches the techniques required to make game environments and levels from a game level design perspective. Students learn the process of designing play spaces through a structured process of paper design, blockout, and iteration. Architectural principles are discussed, in addition to case studies from published games. Environment art and lighting techniques are discussed and implemented, all with the goal of enhancing the interactivity of the given play space.

Learning Outcomes: 1. Analyze game levels and environments using concepts from architecture. 2. Plan game levels by using design documentation. 3. Construct a complete game level or environment. 4. Assemble compelling action-gameplay experiences using industry best practices. 5. Apply principles from cinematography to video game environments. Credits: 3.00

CGT 27000 - Introduction To Data Visualization

Credit Hours: 3.00. This course is designed for students with little or no background in Data Visualization. It provides an introductory examination of data visualization through lecture, readings and hands-on experience with current visualization tools. Students will obtain an overview of the various types of data, the fundamentals of the visualization process for information and scientific visualization, and examine detail visualizations workflows that aim to answer "when" (temporal data), "where" (geospatial data), "what" (topical data), and "with whom" (trees and networks) questions when visualizing data. After taking the course students will have both the theoretical foundation and practical skills needed to create insightful visualizations for a wide range of data types.

Learning Outcomes: 1. Differentiate between information and scientific visualization. 2. Appreciate the visualization process. 3. Identify five major information visualization types: charts, tables, graphs, geospatial maps and network maps. 4. Articulate which visualization tool to use for specific data formats. 5. Compare and evaluate different techniques of data representation. Credits: 3.00

CGT 27001 - Topics In Data Visualization

Credit Hours: 1.00. This course provides students with first-hand knowledge about the field of data visualization and explore a collection of competencies that will help students think through, think about, and think with visual representation of data. Students will explore and examine current careers in data visualization and learn what skills they should work to refine in preparation for future internships and jobs. This course will provide insight into current data visualization literacy requirements in today's data driven world.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 1.00

CGT 27108 - User Experience Design Studio II: Screen

Credit Hours: 3.00. Intermediate exploration of various approaches to human-centered design. Students learn intermediate research and design methods and create high-fidelity prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct intermediate analysis of situations, clients, and problems using multiple approaches to problem framing. 2. Create a variety of concepts that address the issues in the problem statement. 3. Use intermediate data gathering and analysis techniques to inform design decisions. 4. Demonstrate intermediate application of principles of visual and interaction design to create high-fidelity prototypes. 5. Distinguish among major approaches to user-centered design. 6. Compare and contrast the core

values of various approaches to user-centered design. Credits: 3.00

CGT 27207 - User Experience Design Experience Studio II

Credit Hours: 3.00. This course allows students to practice as a UX designer in a company-like environment. Students continue to develop their abilities and contribute significantly to projects. Projects utilize a human-centered design approach to provide a rich user experience.

Learning Outcomes: 1. Articulate the skills needed to pursue a career in data visualization. 2. Understand the need for visualization skills and identify area in data visualization that interests them for future study. 3. Demonstrate the ability to interpret, recognize, appreciate, and understand information presented through visible actions, objects, and symbols. 4. Demonstrate their ability to work in a team environment, articulate and co-presenting results. Credits: 3.00

CGT 27208 - User Experience Design Studio III: Cross-Channel

Credit Hours: 3.00. Advanced exploration of cross-channel approaches to human-centered design such as service design that span digital and physical experiences. Students utilize principles of usability and user experience to create and evaluate physical prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct advanced analysis. 2. Create a variety of concepts that address the issues of situations, clients, and problems that demonstrate an awareness of multiple user touchpoints. 3. Use physically-based techniques for data gathering and analysis to inform design decisions. 4. Demonstrate application of human factors principles to create physical prototypes. 5. Distinguish among popular processes and methodologies for UX. 6. Explain how design philosophy impacts design practice. Credits: 3.00

CGT 27500 - Data Visualization II

Credit Hours: 3.00. This course provides a practical introduction to exploratory data analysis and data mining to better inform data visualization applications. The course introduces a practical approach for making sense out of data. Students are introduced to issues inherent to the data analysis process or data mining projects. The course covers: (1) how to ***prepare*** data prior to analysis, (2) how to ***generate*** summaries of the data, (3) how to ***identify*** non-trivial facts, patterns and relationships in the data and (4) how to ***create*** models from the data to better understand the data and make predictions. After data is analyzed students will use the data visualization process and techniques to ***visually represent*** the data. The course will also introduce the use of high-level programming languages for data analysis and data visualization.

Learning Outcomes: 1. Prepare data prior to analysis. 2. Identify patterns and relationships in the data. 3. Use programming languages for visualizing data at an introductory level. Credits: 3.00

CGT 28500 - Cross Cultural Game Development

Credit Hours: 3.00. This course presents current methods of design and development of digital games for extra-cultural audiences. Students are instructed using an experiential learning model in which multi-cultural student teams lead independent game development projects targeted at a non-native cultural audience. Topics include: dimensions of cultural, game engine scripting, art asset utilization, ethnographic data collection methods, cross-cultural team building, cultural observation, and project management. This course is taught in the US but is co-taught as a distance learning course with a foreign partner institution. Students who take 28500 may not also take 28510 (the study abroad version of the course).

Learning Outcomes: 1. Create an engaging game for culturally non-native audience using a 3D game engine. 2. Identify cultural dimensions using ethnographic methods. 3. Collaborate effectively within a multi-cultural team. 4. Present a finished game and supporting research to a non-native culture. 5. Synthesize cultural experiences into a set of functional guidelines. Credits: 3.00

CGT 29000 - Computer Graphics

Credit Hours: 1.00 to 3.00. Course topics will be determined by

the CGT faculty. Hours and subject matter shall be arranged by the instructor and approved by the CGT curriculum committee. This course will not be used for independent study.

Learning Outcomes: 1. Vary by course offering.

Credits: 1.00 to 3.00

CGT 29900 - Selected Topics In Computer Graphics

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff.

Credits: 1.00 to 3.00

CGT 30505 - Portfolio II

Credit Hours: 0.00. Students present online portfolios, and the course instructors review and give feedback to help direct students' online presence in efforts to meet industry standards.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content.

Credits: 0.00

CGT 30800 - Prepress Production And Design

Credit Hours: 3.00. This course focuses on the process of designing, creating, and preparing documents for commercial printing. Students will develop proficiency with publishing software. Topics include page layout, font and image management, color, printing processes, papers, bindings and proofing methods. Projects emphasize designing single and multi-page documents for business and advertising such as identities, flyers, brochures, forms, catalogs, newsletters and booklets.

Learning Outcomes: 1. Create sketches and roughs for conception and planning of print documents. 2. Apply design principles to the creation of original print documents and content elements. 3. Manage all content elements and prepare documents for printing. 4. Demonstrate proficiency laying out documents and applying effects using a prevailing computer based page layout package. 5. Discuss the different types of print documents as well as their components and purposes. 6. Discuss the issues related to color processes and color printing. 7. Demonstrate knowledge of papers, inks, and bindings. 8. Create print products that show an understanding of the principles of page design and organization. Credits: 3.00

CGT 30900 - Internship In Computer Graphics Technology

Credit Hours: 2.00 or 3.00. Internship course in computer graphics technology. Practical experience totaling at least 240 hours in computer graphics technology. Permission of department required.

Learning Outcomes: 1. Vary by course offering.

Credits: 2.00 or 3.00

CGT 31300 - Digital Painting I For Computer Graphics

Credit Hours: 3.00. This course introduces students to digital painting techniques for graphical visualization and communication. Topics include industry standard practices and instruction in digital brush creation, digital mark making, value under painting, color palettes, and lighting and rendering to produce various computer graphics.

Credits: 3.00

CGT 31400 - Advanced Motion Design

Credit Hours: 3.00. This course builds on the basic principles of motion design. Students will learn advanced techniques in visual storytelling, puppetry/rigging and integration of 3D elements into the design environment. Advanced design principles will also be discussed as sell as post-production techniques for animators with a focus on commercial production.

Credits: 3.00

CGT 31500 - Computer Graphics Programming II

Credit Hours: 3.00. A continuation of the study of computer graphics programming concepts with an emphasis on interactive graphics and application development. Topics include polygon tessellation, vector imaging, interactive programming techniques, application development, and game development.

Learning Outcomes: 1. Demonstrate proficiency in using Modern C++ (14/17) relative to Classic C++. 2. Demonstrate working knowledge of the shader-based programmable graphics pipeline. 3. Demonstrate ability to extend the functionality of a game engine using C++. 4. Work on a team to research an advanced topic related to computer graphics. 5. Deliver a content lesson based on team

research that includes a presentation with learning exercises. Credits: 3.00

CGT 31700 - Planning And Communicating Themed Attraction Design

Credit Hours: 3.00. Building on students knowledge of narrative creation and design, students will learn about the fundamentals of operations, graphics, engineering, technology and design to create theme-based immersive attractions. This course will focus on design concepts, technical design, management and creation of immersive experiences.

Credits: 3.00

CGT 31800 - Animation Preproduction

Credit Hours: 3.00. This course introduces students to industry standard practices of preproduction for animation, and demonstrates how these processes relate to the creation of large-scale graphics productions.

Learning Outcomes: 1. Identify, evaluate, and solve written problems using visual techniques. 2. Demonstrate an understanding of the different animation preproduction processes. 3. Demonstrate the ability to perform animation preproduction research and development. 4. Develop the successful conceptualization and design of background environments. 5. Develop the successful conceptualization and design of story characters. 6. Identify, evaluate, and understand the impact of storytelling through cameras and cinematography principles. 7. Develop a completed storyboard sequence. 8. Develop a completed color script. 9. Identify, evaluate, and utilize industry standard graphics software. Credits: 3.00

CGT 31901 - Experience Lab

Credit Hours: 3.00. This course provides students with hands-on experience in a student-run design studio environment. Students will work on real-world projects, including paid project work from corporate sponsors, collaborating with clients and peers to develop professional design solutions as well as have the opportunity to apply for internship credit. The course emphasizes project management, client communication, and the application of design principles in a practical setting. Additionally, students will have the opportunity to enter their work in design competitions when possible/available.

Learning Outcomes: 1. Analyze client needs and project requirements to develop comprehensive project briefs and timelines. 2. Create innovative design solutions that effectively address client objectives and constraints. 3. Evaluate design concepts through peer reviews and feedback sessions to refine and improve final deliverables. 4. Apply project management tools and techniques to successfully execute and deliver design projects on time. Credits: 3.00

CGT 32101 - Digital Illustration

Credit Hours: 3.00. This course applies fundamental computer graphics concepts of visualization, communication and creativity using a painting metaphor. Exercises and projects in graphic theory, problem solving and painting skill development provides students with projects that focus on further development within the digital illustration discipline. A variety of traditional digital drawing and painting techniques are used to transform concepts into communicative visual artifacts.

Learning Outcomes: 1. Design a workflow for creative project research. 2. Identify visual styles and techniques of illustration 3. Exhibit advanced conceptual and technical imaging skills. 4. Create concept art for environments. 5. Apply concepts of perspective, anatomy and lighting to create realistic digital paintings. 6. Create evocative illustrations for physical and digital outputs. 7. Analyze entrepreneurial aspects of digital art marketing and promotion through public exhibits and other venues. Credits: 3.00

CGT 32500 - Animation For Games

Credit Hours: 3.00. In game industry, computer animation is the foundation giving life to human-like virtual characters. A thorough understanding of the motion capture and interactive computer animation is a requisite element of the game development process. This course introduces students to the fundamental techniques and skills required to develop animations for video games using a modern motion capture device and software packages. Students are taught using lectures and lab sessions. The focus of this course is primarily on the technical, artistic, and functional dimensions of animation

for games, prioritizing the required technical skills. Production of user controller interactive virtual characters is required.

Learning Outcomes: 1. Demonstrate a moderate level of motion capture animation and animation programming with a commercial game engine. 2. Demonstrate the ability to develop character animations and multi-character interaction for games. 3. Acquire competency in each of the following domains: motion capture, motion retargeting, motion cleaning, footskate removal, character controller implementation. 4. Demonstrate the ability to complete an interactive multi-character story. 5. Demonstrate the ability to develop highly realistic animation for video game using a motion capture system. Credits: 3.00

CGT 32505 - Player-Centered Approaches To Designing Games

Credit Hours: 3.00. This course is designed for students interested in games user research to deepen their understanding of designing engaging games, through feedback from real players and evaluation of design decisions. The course is divided into two sections: The first half of the semester focuses on the fundamentals of player-centered research approaches, that explain the role of games user research and play testing in the game development process, mental models for player-centered design approaches and designing experiments to measure behavioral and experiential metrics for design impact. The second half of the course is dedicated to case studies of design failures in games. Students will be involved in design exercises that use an iterative data-driven approach to enhance game design elements.

Learning Outcomes: 1. Describe the core concepts of games user research and explain how it can improve player experiences. 2. Identify the appropriate research method based on different design needs, plan and execute games user research studies on live game development projects. 3. Identify design problems and effectively communicate research results to game development team. 4. Demonstrate data-driven approaches to iteratively enhance design elements for better player experience. 5. Apply cross-cultural design approaches in game design process for enhancing end-user experience. Credits: 3.00

CGT 32600 - Graphics Standards For Product Definition

Credit Hours: 3.00. Introduction to product data exchange and interoperability standards, ANSI and NIST product documentation standards, product modeling standards, methodologies for technology selection, implementation, and evaluation. This course supports the product archival and communication processes in a PLM environment.

Credits: 3.00

CGT 32800 - Business Of Themed Entertainment

Credit Hours: 3.00. This course provides an insider's look at the skills needed to succeed in themed entertainment industry as well as provide an overview of the experience economy. Students will get an insider understanding of the project process, working with outside vendors, team communication, common constraints and budgeting.

Credits: 3.00

CGT 33300 - Modeling For Entertainment Graphics

Credit Hours: 3.00. This course offers students a chance to comprehensively explore Polygon Modeling, with consideration of how choices made in modeling can affect all other aspects of the animation pipeline.

Learning Outcomes: 1. Evaluate polygon models based on topology and polygon budget. 2. Build polygon models appropriate for level of detail sculpting and detailing. 3. Unwrap polygon models with minimal UV shells, maximizing texture space. 4. Texture and detail polygon models with appropriate shaders, achieving a desired result. 5. Render polygon models in a format appropriate for demo reel review. 6. Correct topological errors in conversion from NURBS to Polygons. 7. Identify challenges in conversion of two-dimensional drawings to three-dimensional models. Credits: 3.00

CGT 33500 - Game Scripting

Credit Hours: 3.00. Students gain a deeper understanding into video game scripting. Utilizing a common project, students use scripted objects to customize and enhance a small existing game. While the projects are individualized for the student, they are trained to utilize best practices for team based, industry applications of their work. Permission of department required.

Learning Outcomes: 1. Create reusable game objects that perform useful functions in standard video game genres. 2. Reinforce proper techniques in scripting. 3. Achieve mastery of Unreal blueprint scripting and visual scripting generally. 4. Learn how to drive gameplay with imported data. 5. Achieve a rudimentary baseline of C++ scripting. 6. Become familiar with Visual Studio. Credits: 3.00

CGT 34000 - Digital Lighting And Rendering For Computer Animation

Credit Hours: 3.00. The development of a working knowledge of perspective display of three-dimensional models and the resulting effects of projected light sources on shade, shadow, color, texture, and atmospheric effects in architecture, product illustration, and animation. Emphasis will be placed on lighting design, analysis, and photorealistic simulation for commercial graphic applications.

Learning Outcomes: 1. Complete guided exercises to learn the basic concepts of lighting & compositing. 2. Observe, photograph and paint reference imagery of real-world lighting scenarios. 3. Analyze professional examples of lighting to understand the desired outcomes. 4. Understand how to use state-of-the-art Shading, Lighting, Compositing and Animation packages. 5. Assemble and texture scenes for lighting. 6. Plan and execute a creative vision by art directing an original lighting sequence. Credits: 3.00

CGT 34100 - Motion For Computer Animation

Credit Hours: 3.00. An applied course covering three-dimensional computer graphic animation for graphics specialists and professionals involved in the use of technical design, time and motion study, surface texture mapping, digital lighting, color, and the technology required to produce computer animations for commercial applications in manufacturing design, marketing, and training.

Learning Outcomes: 1. Complete all the assigned readings, assignments, and any other quizzes or tests associated with this course and earned a passing grade. 2. Review all lectures online, attended all meeting sessions, and have participated in class discussions on a weekly basis. 3. Able to demonstrate their knowledge in all the area listed within the General Goals of the course. Credits: 3.00

CGT 34505 - Environment Modeling For Games

Credit Hours: 3.00. This course teaches the techniques and principles needed to create realistic three-dimensional virtual environments rendered in game engines. This course will examine design, modeling, material creation and lighting of environments displayed in a real-time game engine environment. Amongst the topics that will be covered is: Direct input modeling, procedural modeling, digital sculpting, material authoring and real-time lighting using current 3D tools.

Learning Outcomes: 1. Explore and practice methods for environment creation by means of 3D modeling. 2. Develop fine motor skills: Refining the digital artisan's skillset in modeling. 3. Explore Aesthetics as it pertains to environment design. 4. Learn and practice professional methods. 5. Practice creating and curating a portfolio/online body of work. Credits: 3.00

CGT 34600 - Digital Video And Audio

Credit Hours: 3.00. Covers the use of digital technologies for video and audio in multimedia, hypermedia, and animation products. Students examine the methods for creating, sampling, and storing digital video and digital audio and the constraints placed on these media assets when used for media-based products. Emphasis is placed upon the technology of digital video and audio, including formats, data rates, compressors, and the advantages and disadvantages of the different technologies.

Learning Outcomes: 1. Demonstrate understanding of the principles editing. 2. Solve video compositing problem by using masking, tracking, color correcting, and animation. 3. Properly compress a digital video when given a set of constraints. 4. Author interactive video

disks (Blue-ray) using standard authoring tools. 5. Set up a solution to stream video. Credits: 3.00

CGT 34800 - Photorealistic Shaders

Credit Hours: 3.00. This course focuses on the creation and application of photorealistic custom shaders to visual effect problems. Students learn to tender common material photorealistically using common industry tools and techniques. Emphasis is placed on meeting specified aesthetic and photorealistic requirements within computationally constrained environments.

Learning Outcomes: 1. Create custom shaders for common platforms. 2. Create photorealistic shaders when given photographic references. 3. Optimize shaders within the constraints of available resources. 4. Create shaders to meet aesthetic requirements. Credits: 3.00

CGT 35000 - Experiential Branding And Storytelling

Credit Hours: 3.00. This course explores the role of branding and storytelling in creating memorable user experiences. Students will learn how to develop brand narratives and design cohesive brand experiences across multiple touchpoints, including advertising, social media, and emerging technologies. The course will also cover storytelling techniques, empathy, and measuring campaign effectiveness using key performance indicators.

Learning Outcomes: 1. Develop compelling brand narratives that resonate with target audiences. 2. Design cohesive brand experiences across digital and physical spaces, including spatial computing and immersive technology. 3. Apply storytelling frameworks to create engaging and immersive user experiences. 4. Measure the effectiveness of campaigns using key performance indicators. 5. Create prototypes of branded experiences for evaluation, incorporating empathy and emotional journey mapping, while maximizing accessibility and universal design. Credits: 3.00

CGT 35100 - Interactive Multimedia Design

Credit Hours: 3.00. This course introduces the many facets of interactive multimedia design and production. Students are introduced to authoring programs used for information delivery, with special attention focused on the integration of various media assets for communication. There is also concentration on the storage, management, and retrieval of media assets in a production environment. Considerable time is spent on the systematic design of interactive media products to meet specified goals of communication.

Credits: 3.00

CGT 35300 - Principles Of Interactive And Dynamic Media

Credit Hours: 3.00. This course explores the development of interactive and dynamic media components for web and interactive media products. The course examines the design, creation and integration of 2D animation, 2D games, text, sound, video, programming, and databases for use in web and other interactive media.

Learning Outcomes: 1. Develop skills and proficiency in creating interactive components using HTML5, JavaScript libraries, and CSS. 2. Demonstrate understanding of JavaScript programming. 3. Develop beginning to moderately complex front-end designs. 4. Understand the emerging capabilities of delivering Web content. 5. Extend the ability to systematically develop content for the Web, from concept to implementation. Credits: 3.00

CGT 35400 - Design Management

Credit Hours: 3.00. This course focuses on the development and management of design systems, project management, and collaboration within design teams. Students will learn how to create and implement effective design systems, manage projects, and lead design teams. The course will cover techniques for collaboration, communication, and the use of AI tools in prototyping and project management. Through the creation of high-fidelity prototypes, students will gain practical experience in applying these management and design system skills.

Learning Outcomes: 1. Understand the principles of design systems and their implementation. 2. Apply project management techniques to design projects. 3. Collaborate effectively within design teams. 4. Utilize modern tools for prototyping and project management. 5. Evaluate to refine design

systems based on user feedback and testing. Credits: 3.00

CGT 35500 - Character Creation For Photorealism And Stylism

Credit Hours: 3.00. This course explores both the artistic and technical aspects of 3D character modeling and texturing, providing a comprehensive foundation in digital character creation. Students will begin with an in-depth study of anatomy and proportion, critical for the accurate construction of characters in a digital environment. Emphasis will be placed on developing strong anatomical knowledge and topology skills, which are essential for producing high-quality characters that achieve both photorealism and stylization for various entertainment and practical applications. Mastery of these traditional concepts and techniques will enable students to create portfolio quality character models that align with industry standards.

Learning Outcomes: 1. Analyze the principles of correct anatomical proportions essential for the creation of both bipedal and quadrupedal characters, maintaining anatomical accuracy in digital character design. 2. Apply optimal topology techniques in character construction, optimizing the model for efficient rigging and animation processes. 3. Utilize reference photographs and concept sketches to create accurate photorealistic and stylistic character models, preserving accuracy to visual references and artistic intent. 4. Create stylized characters by strategically exaggerating realistic caricatured body features, achieving consistency with the character's visual style and environment. Credits: 3.00

CGT 35600 - Web Programming, Development And Data Integration

Credit Hours: 3.00. A course focusing on the development of dynamic content and applications to facilitate information distribution. The course stresses development strategies for managing the rapidly changing information of corporations and organizations for just-in-time distribution, using authoring programs to create interactive multimedia products that utilize database management systems, file systems, and XML to provide a method for visualizing and manipulating that data. Significant time is spent on intermediate to advanced programming and scripting.

Learning Outcomes: 1. Demonstrate an understanding of how to use server-side technology to develop dynamic database-driven websites and personalize content for users. 2. Integrate server-side and client-side technology in developing web applications. 3. Demonstrate an understanding of the logic behind web applications. 4. Create projects using server-side technologies to be used in a database-driven Web project. 5. Show understanding of basic database design, theory, and application. Credits: 3.00

CGT 36500 - Game Development Practicum

Credit Hours: 3.00. This course provides an opportunity for teams of game developers to focus on a project without distraction by competing course deliverables. Students propose a game project and spend the entire semester working only on that project. Course instructors will function as facilitators, producers, and supervisors, helping each student team scaffold their work such that all course goals are met.

Learning Outcomes: 1. Decompose a large term game development project into an actionable sequence of smaller development tasks. 2. Face emergent open-ended development challenges and either solve them or adapt to them as project goals require. 3. Set short-term game production goals and consistently meet them. 4. Self-evaluate completed work and iterate as necessary to ensure it meets the project's quality goals. 5. Accept and incorporate criticism regarding one's work and use it to improve one's craft. 6. Deliver criticism constructively that is in service to meeting project quality goals. 7. Maintain group cohesion and morale across a physically separated accordance with industry best productions practices. 8. Internalize and structure individual work habits in accordance with industry best production practices. Credits: 3.00

CGT 36700 - Previsualization In Themed Entertainment

Credit Hours: 3.00. This course provides an overview of themed entertainment development from concept to previsualization and communication. Students will have the opportunity to take initial concepts for themed experiences and visualize them to communicate to multiple external audiences.

Credits: 3.00

CGT 37000 - Interactive Data Visualization

Credit Hours: 3.00. Data visualization is the art and science of putting quantitative numbers into pictorial or graphical format that are easy for users to understand, use, and take action upon the data. In this course, we will learn basic data visualization design principles, theories, data management skills, and fundamental web technologies to design and develop web based interactive date visualizations. The students will be able to design the proper visual representations of the data based on the data's characteristics, business needs, and prospective users.

Learning Outcomes: 1. Demonstrate understating of different types of data, their characteristics, relations, and business purpose. 2. Compare and choose proper visualization methods to represent the data based on the characteristic and purpose. 3. Apply perception theories and design principles in visualization design. 4. Utilize web toolkits and technologies to develop simple data visualization. 5. Develop an interaction information visualization system to represent data from different aspects. Credits: 3.00

CGT 37108 - User Experience Design Studio IV: Strategy

Credit Hours: 3.00. Advanced exploration of strategic human-centered design that aligns user experience with organizational strategy and business goals, using approaches such as agile, waterfall, and lean UX. Students utilize visual, information, and usability principles as well as various approaches and methods of human-centered design to create interactive digital prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using advanced data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems that aligns with the client organizational strategy and business goals. 3. Demonstrate fluent application and evaluation of visual and interaction design principles by using advanced prototyping techniques to create interactive prototypes. 4. Demonstrate the ability to make recommendations for appropriate major design approaches and methodologies that fit a particular design situation and team. 5. Articulate their design identity and personal design philosophy. Credits: 3.00

CGT 37207 - User Experience Design Experience Studio III

Credit Hours: 3.00. This course provides students with opportunities to explore opportunities in a company-like environment. Students are knowledgeable project members and beginning to transition into subject matter experts and managers. Projects utilize human-centered design principles to provide a rich user experience.

Learning Outcomes: 1. Create and manage teams, resources, and activities. 2. Create and manage project strategy. 3. Demonstrate depth in one or more UX specializations. 4. Champion UX approaches to diverse stakeholders in a professional manner. Credits: 3.00

CGT 37208 - User Experience Design Studio V: Specialization

Credit Hours: 3.00. This course prepares students to lead complex and strategic design projects. Students become proficient in the most advanced approaches, methods and techniques of human-centered design. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct expert analysis using expert data gathering and analysis techniques to inform design decisions. 2. Create a variety of concepts for situations, clients, and problems to advance stakeholder strategies and goals. 3. Demonstrate advanced application

and evaluation of visual and interaction design principles by using advanced prototyping techniques to create working interactive digital prototypes. 4. Demonstrate the ability to lead UX teams through the user-centered design processes, employing appropriate approaches, processes and methodologies. 5. Practice human-centered design in concordance with their personal design philosophy. Credits: 3.00

CGT 37500 - Game Audio

Credit Hours: 3.00. Students learn the basics of audio production as it relates to game development. Students edit and create audio effects using off-the-shelf tools and implement these sounds in a game engine. Microphones, digital audio workstations, and sound effect libraries are utilized in a framework that focuses on direct implementation into interactive media.

Learning Outcomes: 1. Analyze existing audio library sounds effects and edit them according to a project's requirements. 2. Identify game audio scripting techniques and translate these into their own work. 3. Analyze and explain the theory of implementing music into games and interactive media. 4. Develop techniques for using software and equipment for the creation of game audio effects. 5. Implement audio effects and music into a commercial game engine. Credits: 3.00

CGT 37700 - Scientific Visualization

Credit Hours: 3.00. This course is an introduction to the use of computer graphics to help user gain insight into scientific datasets. Applications from atmospheric science, medicine and physics will be explored. Topics will include the fundamental approaches to scalar-valued data (volume rendering, iso-surface extraction), vector-valued data (glyphs, streamlines), and tenors-valued data (ellipsoidal, quadric and super quadric glyphs).

Learning Outcomes: 1. Describe sources of scalar-, vector-, and tensor-valued data and the properties of the data. 2. Assess the effectiveness of given visualization techniques. 3. Explain the differences between multiple approaches to visualization. 4. Create effective scientific visualizations using the vTk library, or tools based on vTk. Credits: 3.00

CGT 38500 - Game Production

Credit Hours: 3.00. This course uses intensive project-based, student-led learning in game development to cultivate skills in quality assurance, leadership, communication, time management, contingency planning, technology integration, autonomy and accountability. Students act in an executive role with students in other project-oriented classes and in so doing cultivate supervisory production experience. Each student must engage with instructors and students to hone real-world hard and soft skills through situated experiences and student-led teaching opportunities. Student producers must develop a functioning development pipeline, meet regularly with their teams, and maintain industry-standard documentation and project management processes. Permission of Instructor required.

Learning Outcomes: 1. Lead a team of novice developers to achieve all production goals for their semester project. 2. Build a functional asset pipeline that accommodates team needs while maintaining steady output. 3. Implement and document game development processes according to industry-accepted standards. 4. Maintain group cohesion and morale while motivating all team members to produce their best work. 5. Implement agile production techniques in a small-group game development project. Credits: 3.00

CGT 39000 - Computer Graphics

Credit Hours: 1.00 to 3.00. Course topics will be determined by the CGT faculty. Hours and subject matter will be arranged by the instructor and approved by the CGT curriculum committee.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 40100 - Immersive Virtual Realities

Credit Hours: 3.00. This practical production course serves as the culmination of the knowledge and skills acquired throughout the degree program. Students will apply their expertise in immersive media by developing a comprehensive production project that demonstrates proficiency in virtual world building, prop creation, and animation. Projects may be undertaken

individually or collaboratively and can range from photorealistic to stylistic in design. The final deliverable may take various forms, including virtual reality experiences, online social environments, or other innovative mediums. This course emphasizes creativity, technical execution, and conceptual depth, allowing students to showcase their unique artistic and technical vision.

Learning Outcomes: 1. Produce an immersive reality project that exemplifies both artistic creativity and technical proficiency, incorporating advanced principles of design, animation, and interactive media. 2. Implement concepts and techniques acquired throughout the degree program into a fully developed project, demonstrating expertise in an individual and collaborative production. 3. Analyze instructor feedback and implement revisions to enhance the quality, effectiveness, and coherence of the project. 4. Design immersive worlds, assets, characters, and animations, integrating all essential components to craft a unified and engaging experience customized to a target audience. Credits: 3.00

CGT 40200 - Motion And Video II

Credit Hours: 3.00. This course builds on the principles of motion design and video production. Students will learn advanced techniques in effects and integration of video and motion elements with the goal of creating realistic production and animation to be used in commercial production.

Learning Outcomes: 1. Identify two ways that video and motion graphics can be utilized within the same project. 2. Demonstrate a working knowledge of motion paths within a project. 3. Demonstrate effective techniques for working with a client. 4. Provide examples of professional and non-professional motion and video productions. 5. Develop a video reel for professional use. Credits: 3.00

CGT 40400 - Self Promotion For Computer Graphics

Credit Hours: 3.00. This course has been designed to introduce students to the professional practice of branding oneself as commonly used in industry. Students will learn how to critique their own work, and the work being done by peers in the industry.

Credits: 3.00

CGT 40500 - Senior Portfolio Review

Credit Hours: 0.00. Portfolio review for seniors in Computer Graphics Technology.

Learning Outcomes: 1. Create a portfolio approaching industry standards in content.

Credits: 0.00

CGT 40700 - Current And Future Trends In Themed Attraction Design

Credit Hours: 3.00. Students will learn about current trends in immersive attractions. Current technologies will be explored that can be used to enhance the narrative in a themed immersive space. Students will explore technologies, narrative techniques and integration of engineering.

Credits: 3.00

CGT 41100 - Contemporary Problems In Applied Computer Graphics

Credit Hours: 3.00. Groups will identify, design, qualify, manage, create, and present a final project relative to existing or emerging issues within applied computer graphics. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. The course concludes with faculty, peers, and practicing professionals evaluating oral, written, and media presentations of final projects.

Credits: 3.00

CGT 41101 - Contemporary Problems In Applied Computer Graphics I

Credit Hours: 2.00. Groups will identify, design, qualify, and plan a final project relative to existing or emerging issues within applied computer graphics. This project will be done in conjunction with industry and faculty engagement. Activities and experiences will explore related topics such as project planning and management, user expectations, interpersonal communications skills, and quality management. This course is followed by CGT 41201 which includes the execution and evaluation of the capstone project planned in CGT 41101.

Learning Outcomes: 1. Utilize a provided project specification to develop a project completion plan. 2. Develop an appropriate project evaluation plan using accepted techniques. 3.

Implement basic project management principles to assign team member tasks, required resources, and time allocations. Credits: 2.00

CGT 41201 - Contemporary Problems In Applied Computer Graphics II

Credit Hours: 2.00. CGT 41201 is the second course in the CGT applied computer graphics capstone sequence with a focus on execution and evaluation of the senior capstone project. Emphasis will be placed on industry engagement for the execution of the project plan that was developed in CGT 41101. Students will work in teams to execute the project plan; develop and execute a project evaluation plan, and make a professional final presentation to industry members, faculty, and peers. Students will execute a project refinement process based on feedback received and incorporate that into a final presentation and project report. CGT 41201 will be taught in a seminar format with one meeting per week focused on project status checks, evaluation plan development and execution, and project presentations.

Learning Outcomes: 1. Execute a project plan to produce a substantial graphics product. 2. Develop and execute an evaluation plan of their capstone project. 3. Develop professional presentations incorporating external feedback and project results. 4. Produce a major project report for their capstone project, including project management, rationale, and substantial findings. Credits: 2.00

CGT 41600 - Senior Design Project

Credit Hours: 3.00. This capstone course requires students to engage in a substantive endeavor directed at solving problems related to computer graphics. Activities include the creation and management of graphic systems and media assets per the requirements of the senior design proposal. Students are required to demonstrate professional attitudes and attributes in the timely completion and presentation of their project.

Credits: 3.00

CGT 42500 - Game Design

Credit Hours: 3.00. This course is about the discovery, summarization, application, analysis, and synthesis of novel game design techniques. Discovery and summarization are done through research and in-class presentations. These presentations are then used to create prototypes in the game engine of the student's choice. Students are expected to collect data on these prototypes. This data is then used to iterate on the prototypes throughout the semester. The course culminates in a polished prototype that is published on any valid public gaming platform or student portfolio. This is an advanced course that assumes the student has existing skills in game creation (particularly game scripting, game art, and game design). Permission of instructor required.

Learning Outcomes: 1. Discover novel game design techniques. 2. Demonstrate new game design ideas by creating functional prototypes in a game engine. 3. Discover and apply current game design theory. 4. Recognize current game design trends in modern games. 5. Communicate complex game design ideas to an audience. 6. Synthesize new ideas from concepts learned from research and collaborative work in class. 7. Collect and evaluate playtesting data. 8. Publish a small game prototype on a gaming platform. Credits: 3.00

CGT 42600 - Industry Applications Of Simulation And Visualization

Credit Hours: 3.00. This course focuses on developing mathematically accurate physical-visual simulations of mechanisms, systems, and assemblies. Topics include physical system analysis; coordinate systems; inverse kinematics; linear, rotational, and reciprocating motion. Simulations will be created using modeling technology, programmed scripting, and diverse software.

Credits: 3.00

CGT 43500 - Virtual Reality And 3D User Interfaces

Credit Hours: 3.00. The purpose of this course is twofold: (a) to provide students with a deep understanding of the fundamentals of virtual reality environments and 3D user interfaces and (b) to offer students practical experience with consumer-grade virtual reality systems. Students will explore the challenges of developing and analyzing virtual reality systems and 3D user interfaces that are effective and comfortable, motivated by design goals and constrained by the real world. We will also explore the relationship of virtual reality to entertainment, medical, and manufacturing domains.

Learning Outcomes: 1. Discover novel virtual reality interaction techniques. This is accomplished via student research, instructor presentations, and student presentations. 2.

Demonstrate new virtual reality design ideas by creating functional prototypes in a game engine. 3. Apply theory to create virtual reality experiences that will generate intuitive interactions and believable experiences for the user. 4. Apply programming knowledge to create interactive experiences in virtual reality environments. 5. Communicate complex virtual reality design ideas to an audience. 6. Synthesize new ideas from concepts learned from research and collaborative work in class. 7. Collect and analyze user experience data. Credits: 3.00

CGT 44200 - Production For Computer Animation

Credit Hours: 3.00. An applied course covering advanced spline modeling techniques, lighting techniques, applied shading, motion dynamics and controllers, particle systems, application customization programming, and pre-production development and planning. Study of emerging advancements in computer animation and spatial graphic technologies will be included.

Learning Outcomes: 1. Identify career opportunities in computer graphics and related industries. 2. Assess, classify and critique peer and professional-level portfolios in relation to industry roles 3. Define major project outcomes that align with specific career pathways. 4. Develop and manage production plans for a major entertainment graphics project. 5. Manage teams or individual tasks to execute defined goals within entertainment graphics projects. 6. Create professional portfolio or showreel pieces that demonstrate industry relevant skills. Credits: 3.00

CGT 44201 - Advanced Portfolio Development For Digital Media Careers

Credit Hours: 3.00. This course is designed to provide students the opportunity to complete self-driven projects to enhance and showcase their skills to potential employers. Students will learn about professional expectations of a variety of jobs in computer graphics and digital media, including but not limited to Animation, Games, Visual Effects, and Interactive Design. They will develop the skills to receive and provide feedback, refine expertise in their chosen area of specialization by proposing and executing relevant projects, culminating in the creation of job application materials and an online portfolio which displays the completed works.

Learning Outcomes: 1. Explore Digital Media career opportunities and determine a path that best fits one's goals. 2. Create new materials and curate a strong portfolio showcasing individual skills and interests. 3. Evaluate peer projects to train one's critical eye. 4. Develop a plan and vision for pursuing one's desired career path. 5. Understand the recruiting process and the expectations of the industry to prepare strong, tailored application materials. Credits: 3.00

CGT 44400 - The History And Technique Of Visual Effects In Film

Credit Hours: 3.00. This lecture-based course presents the history and technique of special or visual effects in film from the 19th Century (George Me'lie's) to the current digital age of visual effects. Emphasis is placed on the use of effects in fantasy, science fiction, and horror genres. These effects can range from the recreation of historical venues, to fictional characters and to worlds not yet seen. This course serves not only to address this facet of the history of film and cinema, but also the techniques and technology of visual effects including practical effects, miniatures, stop-motion, makeup, mechanical effects, optical effects, motion control, and the digital realm.

Credits: 3.00

CGT 44500 - Procedural Methods For Game Development

Credit Hours: 3.00. This course teaches a procedural approach to game development ranging from geometric modeling techniques, crowd simulation, particle systems, fluid simulation and flame simulation. The course will examine procedural nondestructive workflows that can be translated into real-time assets for game development. Students will learn how to set up nodal and parameter based graphs that carry the ability to be interactively updated and changed, thus having the flexibility expected in an industry pipeline.

Learning Outcomes: 1. Implement non-destructive procedurally modeled and aesthetically pleasing assets while demonstrating an understanding of scalable UVs. 2. Implement assets within game engine

environment, harnessing the advanced procedural production in an optimized real-time setting. 3. Create asset movement through implementation of simple expressions to drive procedural animations. 4. Create finished and refined renders for use in visualization and sequenced flipbook animations. 5. Demonstrate knowledge of pre-rendered particle systems and an understanding of transference to real-time applications. 6. Demonstrate mastery of rigid body dynamics to create in-game destruction sequence. Credits: 3.00

CGT 44600 - Post-Production And Special Effects For Computer Animation

Credit Hours: 3.00. A variety of commercial applications of technical animation and spatial graphics are analyzed and produced, with special emphasis upon client development, design, organization, scripting, storyboarding, technical production, management, and evaluation.

Learning Outcomes: 1. Describe the business model of film and animation production. 2. Understand script development and analysis as they relate to production. 3. Demonstrate image acquisition in the production environment. 4. Demonstrate an understanding of final finishing and distribution processes. Credits: 3.00

CGT 45000 - Professional Practices

Credit Hours: 3.00. This course prepares students for professional employment in Computer Graphics related professions. Topics include ethical and legal issues, contracts, copyright, and freelancing as well as portfolio planning, design, preparation, and presentation.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 3.00

CGT 45001 - Computer Graphics Professional Practices II

Credit Hours: 1.00. Preparation for professional employment in computer graphics professions. Topics covered include professional and technical writing, correspondence, corporate and freelance employment considerations; portfolio planning; and interviewing. Students will arrange interviews and portfolio reviews.

Learning Outcomes: 1. Develop and implement technical writing skills. 2. Practice professional correspondence. 3. Create a technical resume. 4. Develop interviewing skills. Credits: 1.00

CGT 45100 - Multimedia Application Development

Credit Hours: 3.00. This course focuses on the development of applications that manipulate media assets. Significant time is spent on intermediate to advanced programming and scripting as well as the synchronization of aural and graphical components. Students are required to plan, design, and implement a major project, and a final presentation is required.

Credits: 3.00

CGT 45300 - Multisensory Experience Design

Credit Hours: 3.00. This course examines the design of experiences that engage multiple senses. Students will explore how to create immersive environments that utilize sound, touch, and other sensory inputs to enhance user interaction. The course will also cover the integration of physical technology, such as microcontroller-driven physical computing, with digital screens.

Learning Outcomes: 1. Understand the principles of multisensory experience design. 2. Design environments that engage multiple senses. 3. Incorporate sound, touch, and other sensory inputs into designs. 4. Evaluate the impact of multisensory elements on user experience. 5. Create prototypes of multisensory experiences for testing, blending physical technology with digital screens. 6. Ensure accessibility by designing UX experiences that accommodate users with disabilities, incorporating assistive features and inclusive design principles. Credits: 3.00

CGT 45400 - Innovative Experience Design

Credit Hours: 3.00. This course explores advanced design techniques for creating impactful experiences studying various fields such as sports, gaming, social media, charitable causes, fintech, and healthcare. Students will learn to incorporate empathy, accessibility, and AI into their designs to address human-centered challenges. The course will also focus on

collaboration, engaging with clients, improving communication skills and confidence, and evaluation of created work.

Learning Outcomes: 1. Apply innovative design techniques to create impactful experience through design efficiency and effectiveness. 2. Integrate empathy and accessibility into design processes. 3. Study and develop solutions for human-centered challenges in a variety of emerging fields. 4. Collaborate with clients, engage effectively, and improve communication skills. 5. Evaluate and test user experiences to gather feedback and improve designs. Credits: 3.00

CGT 45600 - Advanced Web Programming, Development And Data Integration

Credit Hours: 3.00. This course presents the advanced technologies available for use on the World Wide Web and within corporate intranet environments. Emphasis and discussion is focused on the advantages and disadvantages of these technologies as well as on implementation to create unique solutions for business and industry. Strategies for planning, development, and implementation will be discussed and demonstrated. Significant time is spent on advanced programming and scripting as well as manipulation and visualization of data from various sources, including robust database management systems. Students are required to plan, design and implement a major project.

Learning Outcomes: 1. Demonstrate understanding of ASP.NET, C#, and the .NET Framework. 2. Create and compile advanced dynamic web projects using ASP.NET technology. 3. Demonstrate understanding of advanced database applications and SQL. 4. Show understanding of the logic behind advanced web applications. 5. Integrate front-end and back-end technologies in developing professional web applications. Credits: 3.00

CGT 47000 - Data Visualization Studio

Credit Hours: 3.00. This course will teach students design and develop interactive data visualization systems to communicate and analyze complicated datasets. Students will learn interaction and visual design principles, draw from human perception and cognition theories, and focus on hands-on practice of developing interactive data visualization systems that enable users to see, understand, and analyze complex data and relations. At the end of the class, students will apply the design principles and use proper technologies to create a comprehensive interactive visualization system for data analysis.

Learning Outcomes: 1. Demonstrate understanding of design principles from perspectives of human perception, cognition, and design. 2. Choose the correct visual format based on the data, relations, and data usage. 3. Recognize the common problems in information visualization dashboard design. 4. Demonstrate the ability to process, filter, and transform data for visualization. 5. Utilize proper visual forms, visual analysis techniques, and practices for analyzing basic types of data and data relationships. 6. Develop complex interactive information visualizations system with multiple visualizations for communication and data analysis. Credits: 3.00

CGT 47407 - UXD Experience Studio VI Management

Credit Hours: 3.00. This is an advanced-level course where students are project managers in a company-like environment within the Purdue Experience Studios. Students learn about management expectations within a UX design company as they work with multi-level teams on corporate-sponsored projects. Projects utilize a human-centered design approach with an emphasis on designing for the user experience. Students learn how to manage team leadership, including training project owners by planning, organizing, and running training and mentoring workshops. Permission of instructor required.

Learning Outcomes: 1. Participate in setting up multiple teams with the goal of creating balanced and successful teams. 2. Conduct effective 1on1 meetings to manage junior student's personal growth plan. 3. Implement team-building skills with structured activities and workshops. 4. Solve teamworking conflicts in a fair and effective manner. 5. Demonstrate depth in UX management by documenting your skill development and growth throughout the semester in a written reflection document. 6. Create an activity log of the process, goals, and

outcomes to train new student managers. 7. Train junior students how to communicate UX approaches to diverse stakeholders in a professional manner. 8. Teach successful meeting etiquette, including agendas, action items, and follow-ups to junior students. Credits: 3.00

CGT 47500 - Applied Games Research

Credit Hours: 3.00. This course teaches fundamental concepts in scientific methodology, such as hypothesis formation, experimental design, methodology, data collection and analysis, reporting of findings, quantitative and qualitative methods, sampling, ethical research practices, and regulatory compliance. It also teaches practical skills such as manuscript preparation, publication, and funding strategies. Though the course is oriented toward applying these concepts and skills in a Games context, the lessons are broadly applicable, and students from other areas within the department are welcome to enroll with instructor permission.

Learning Outcomes: 1. Construct original manuscripts and research proposals that integrate quantitative and qualitative methodologies, applying the scientific method to investigate complex topics. 2. Assess peer manuscripts and published scientific papers for clarity, logic, writing quality, and the validity of conclusions, providing constructive critiques. 3. Implement research, writing, and analytical techniques to address problem scenarios, recommend appropriate methodologies, and complete exercises, quizzes, and exams. 4. Design a collaborative research study by integrating course concepts, planning, and preparing for an independent team project. Credits: 3.00

CGT 48500 - Honors Game Production

Credit Hours: 3.00. This course provides an opportunity for students to acquire real-world experience working as a game studio producer for one or more student Career Project (capstone) teams. Students may enroll in this course via invitation only. As this is an Honors course, students are expected to bear greater individual responsibility and produce very high quality results. Students should be capable of working with a high degree of autonomy and be prepared to adapt to open-ended problems and deliverables expectations that may shift according to project needs. Student producers will coordinate development efforts and logistics between Career Project teams (CGT 365) and the various Outsourcer courses that the Career Project teams depend upon. Students must function as leaders and accept responsibility for their team's results. This course fulfills the requirement for work experience as defined by the CGT department. Permission of instructor required.

Learning Outcomes: 1. Negotiate and manage relationships between multiple clients and providers. 2. Create actionable, sustainable development plans with their teams. 3. Master industry-standard project management groupware to track and assign work items to their teams. 4. Solve or adapt to emergent open-ended production challenges. 5. Identify production blockages and proactively foresee future blocks. 6. Accept and incorporate criticism regarding one's work and use it to improve their craft. 7. Deliver criticism constructively toward meeting project quality goals. 8. Reflect on one's own work and evaluate how their experience contributed to the overall project and articulate how the experience helped them grow in their discipline. 9. Maintain group cohesion and morale while motivating all team members to produce their best work. 10. Implement agile production techniques in multiple small-group game development projects. Credits: 3.00

CGT 49000 - Computer Graphics

Credit Hours: 1.00 to 3.00. Senior-level course topics will be determined by the CGT faculty. Hours and subject matter shall be arranged by the instructor and approved by the CGT curriculum committee. This course will not be used for independent study.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 49100 - Special Topics In Computer Graphics

Credit Hours: 1.00 to 6.00. A variable title, variable content

course pertaining to problems and research in graphical methods and representation. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering.

Credits: 1.00 to 6.00

CGT 49800 - Undergraduate Research In Computer Graphics Technology

Credit Hours: 1.00 to 3.00. Students will conduct research in the area of computer graphics technology with a primary investigator. The primary focus of the course is to contribute to ongoing research, while learning current research techniques. Contributing to research design, analyzing data, determining courses of action, developing critical thinking, and presenting results are emphasized. Requires prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Learning Outcomes: 1. Demonstrate subject-matter competency, integrating appropriate theoretical and conceptual frameworks. 2. Conduct research using generally accepted methods appropriate for the research question. 3. Demonstrate critical thinking skills. 4. Evaluate, synthesize, and apply ethical issues facing researchers. Credits: 1.00 to 3.00

CGT 49900 - Selected Tropics in Computer Graphics

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff.

Credits: 1.00 to 3.00

CIT 22000 - Quantitative Analysis II

Credit Hours: 3.00. A continued investigation into the problem solving tools and techniques that focus on both hardware systems and quantitative data analysis. The course is designed for CIT majors in their second full year of study.

Credits: 3.00

School of Engineering Technology

Overview

In Purdue's engineering technology degree programs, students learn about - and more important, practice - designing, building, testing, and refining in several engineering technology fields. From electrical to manufacturing to mechanical to industrial, engineering technology classes, labs, and projects help you develop processes and products to make a better world.

Faculty

School of Engineering Technology Website

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Contact an advisor

Graduate Information

For Graduate Information please see Engineering Technology Graduate Program Information .

Supply Chain Engineering Technology Minor

Product Lifecycle Management Minor

Audio Engineering Technology, BS

Electrical Engineering Technology Minor

Robotics Engineering Technology, BS

Automation and Systems Integration Engineering Technology, BS

Mechatronics Engineering Technology, BS

Industrial Engineering Technology Certificate (Statewide)

Energy Engineering Technology, BS

Smart Manufacturing Enterprise Minor

Supply Chain & Sales Engineering Technology, BS

Mechanical Engineering Technology, AS (Statewide)

Engineering Technology, BS (Statewide)

Industrial Engineering Technology, BS

About the Program

The Industrial Engineering Technology major is part of the Industrial Engineering Technology program. The industrial engineering technology program is accredited by the Engineering Technology Accreditation Commission of ABET, https://www.abet.org, under the commission's general criteria and program criteria for Industrial Engineering Technology and similarly named programs.

When you major in industrial engineering technology at Purdue University, you will gain skills to prepare you for a wide variety of career options: manufacturing plants, government agencies, hospitals, healthcare organizations, retail companies, and more. You will focus on both technical and human-centered approaches to technology management. You will learn how to manage and coordinate engineering operations and lead projects from design to implementation. Coursework is enhanced with an overview of business and economics.

Industrial Engineering Technology Website
School of Engineering Technology Major Change (CODO) Requirements

Smart Manufacturing Industrial Informatics, BS

Digital Enterprise Systems, BS

Mechanical Engineering Technology, BS

Computer Engineering Technology, BS

Electrical Engineering Technology, BS

ECET 11600 - Electrical Circuits

Credit Hours: 3.00 or 4.00. This course covers circuit components, R, L, C; voltage; current; power; Ohm;s law, Kirchhoff' laws; series and parallel circuits; electrical measurements; sinusoidal voltages; currents; impedances; transformers; motors; polyphase systems, and the National Electrical Code. This course is a service course for non-ECET majors.

Learning Outcomes: 1. Identify and recognize electrical safety practices. 2. Identify the terminology associated with current, voltage, and dc circuits. 3. Convert from one unit of

measure to another. 4. Draw schematic circuits of batteries, and calculate the total voltage and current available for different series, parallel, and series-parallel cell and battery connections. 5. Accurately read resistor color code and verily & the results with an ohm meter. 6. Compute total resistance for series, parallel, and series-parallel circuits. 7. Measure total resistance for series, parallel, and series-parallel circuits. 8. Solve problems involving power, current and voltage. 9. Solve unknown values in series, parallel, and series-parallel dc circuits. 10. Identify the terminology associated with magnetism inductance and capacitance. 11. Demonstrate how capacitance reacts in a circuit. 12. Identify the terminology associated with alternating current. 13. Setup an Oscilloscope and accurately measure. 14. Describe and accurately measure RMS, peak, and peak-to-peak voltages. 15. Explain the effects of capacitor and inductors in AC circuits. 16. Solve for capacitive and inductive reactance in AC circuits. 17. Demonstrate the characteristics of a series RC Network. 18. Work with others in laboratory problem solving. Credits: 3.00 or 4.00

ECET 15500 - Digital Fundamentals II

Credit Hours: 3.00. A continuation of ECET 10900. Sequential logic circuits, flip-flops, counters, finite state machines, programmable logic devices, shift registers, logic families, and introductory computer concepts.

Credits: 3.00

ECET 15700 - Electronics Circuit Analysis

Credit Hours: 4.00. Capacitors, inductors, switching circuits, transformers, rectifiers, linear regulators, dependent sources, operational amplifiers, BJT- & MOSFET-based small-signal amplifiers, waveform generation, and programmable analog devices are studied. Circuit fundamentals such as Kirchhoff's laws are utilized in analysis and design of circuits. Computer simulation is used.

Credits: 4.00

ECET 16400 - Applied Object-Oriented Programming

Credit Hours: 3.00. Problem solving and computing with emphasis on electrical engineering technology applications. Introduction to an object programming language as applied to solving electrical technology problems.

Credits: 3.00

ECET 17700 - Data Acquisition And Systems Control

Credit Hours: 3.00. Fundamental electrical parameters and measurement techniques are introduced. These are then applied to implementing power interfaces, actuators and sensors. Modules that provide signal conditioning, data conversion, filtering and controllers are evaluated. A full, closed loop control system is built and evaluated.

Learning Outcomes: 1. Make laboratory measurements using digital multi-meters, oscilloscopes, and a microcomputer. 2. Implement and evaluate the performance of each of the following elements at the module level while calculating key circuit parameters: Switching and linear power interfaces; Light, sound, motion, and temperature actuators and sensors; Amplifiers, signal conversion, and filters. On/off, linear, and computer controllers. 3. Evaluate the static and the dynamic performance of a closed loop system constructed of the elements from items 1 and 2 above. Credits: 3.00

ECET 17900 - Introduction To Digital Systems

Credit Hours: 3.00. This course introduces computing systems and defines the major classes of computing devices. Sequential and concurrent operations, along with logic and control structures, are covered. Knowledge of fundamental computing principles is discovered. Common software tools are used to create, test, and debug systems. Systems are constructed from standard blocks with a focus on subsystem operation and performance, troubleshooting/debugging and testing. Common applications of embedded systems are introduced.

Learning Outcomes: 1. Develop and utilize algorithms and flowcharts to create microcontroller applications to solve a given problem. 2. Apply the fundamental control

structures and logic operations to control program flow within microcontroller applications. 3. Demonstrate the ability to convert numbers between number systems (bases) and compute arithmetic operations within microcontroller applications. 4. Utilize the primary tools used to create, test, and debug computing system hardware and software components. 5. Construct electronic hardware systems to solve a given microcontroller problem. Credits: 3.00

ECET 20700 - AC Electronics Circuit Analysis

Credit Hours: 4.00. AC circuits including the j operator, phasors, reactance and impedance are studied. Circuit laws, network theorems, and the fundamental concepts of Fourier analysis are applied and used in the study of topics such as passive filters, IC filters, amplifiers, resonant circuits, single-phase and three-phase circuits. Computer aided analysis of circuits is used.

Credits: 4.00

ECET 20900 - Introduction To Microcontrollers

Credit Hours: 4.00. This course is an introduction to microcontroller hardware and software, focusing on embedded control applications. Interconnections of components, peripheral devices, bus timing relationships, structured C-language programming, debugging, input/output techniques, and use of PC based software development tools are studied.

Credits: 4.00

ECET 22400 - Electronic Systems

Credit Hours: 3.00. This course is a survey of key electrical and electronics systems, their basic performance and applications. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Computer systems are presented with a microprocessor and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.

Learning Outcomes: 1. Apply Ohm's Law and Kirchhoff's Laws to series and parallel DC circuits. 2. Define, measure, and apply sinusoidal parameters in passive RLC circuits. 3. Explain power generation and distribution. 4. Use a microprocessor to input, output, and manipulate digital and analog signals. 5. Apply diodes, transistors, analog ICs, ADC and DAC to control the performance of a motor. Credits: 3.00

ECET 22700 - DC And Pulse Electronics

Credit Hours: 3.00. Capacitors, inductors, oscillators, rectifiers, bipolar and MOSFET power switches, switching power supplies, half-and full-H bridges, switching audio power amplifiers, and linear regulators are studied. Computer-aided analysis of circuits is utilized.

Learning Outcomes: 1. Explain the characteristics of capacitors, inductors, rectifier diodes, Zener diodes, IC regulators, bipolar junction transistors (BJTs), field effect transistors (MOSFETS), and general purpose operational amplifiers. 2. Apply the principles of circuit analysis to the following: switching and linear power supplies, op-amp based amplifiers, BJT and MOSFET switches, Class D amplifier, wave shape generators, RC and RL circuits. 3. Simulate circuits and compare actual data to simulated data. 4. Construct electronic circuit according to a given schematic. 5. Measure electrical parameters, using digital multimeters, signal generators, and oscilloscopes. 6. Interpret laboratory experiment data. Credits: 3.00

ECET 22900 - Concurrent Digital Systems

Credit Hours: 3.00. This course establishes a foundation for concurrent digital systems. Common methods of describing digital circuit operation are studied along with the techniques for translation between any two methods. Basic building blocks of digital systems are defined and applied. Analysis techniques for combinational and sequential logic circuits or subsystems are covered. Computer-based development tools, programmable logic devices, and technical reference sources are used to build, test, and evaluate digital systems.

Learning Outcomes: 1. Translate between any two forms of logic circuit descriptions: English, Boolean equation, Truth Table, Logic Diagram, Timing Diagram, Hardware Description

language. 2. Anticipate the output of functional blocks given the current inputs or a recent event. 3. Validate the operation of any logic circuit using the simulator, Function generator, oscilloscope or DVM. Credits: 3.00

ECET 23110 - Electrical Machines

Credit Hours: 3.00. An introduction to the fundamental concepts and applications of transformers, induction motors, and single-phase and three-phase power systems. Design and optimization of power systems based on National Electrical Code guidelines. Laboratory experiments in the design, operation, and measurement of electromechanical systems.

Learning Outcomes: 1. State and practice the principles of electrical safety. 2. Apply the principles of circuit analysis to calculate real, reactive, and apparent power in single and three-phase circuits. 3. Explain the operating principles of electric machines and transformers. 4. Use mathematical models to solve engineering technology power problems. 5. Design basic power and motor circuits in accordance with applicable standards (NEC, etc.), including sizing wires, circuit breakers or fuses, and overload protection. 6. Understand the application of NEC Chapter 2 Wiring and Protection, Article 230 (see Figure 1) and Chapter 4 Equipment for General Use, Article 430 (see Figure 2). 7. Use Joint International Congress (JIC) standard drafting practices and symbols to construct a ladder diagram. 8. Understand how to properly size the components for a defined application. 9. Understand and compare the characteristics of electric motors. 10. Understand the ethical consideration of the elimination of PCB's as transformer and cooling liquid. Credits: 3.00

ECET 23120 - Industrial Controls

Credit Hours: 3.00. An introduction to Industrial Controls with a focus on relay logic and PLC logic. Design and optimization of control systems based on National Electrical Code guidelines and methods for development of schematics and coding for industrial controls. Laboratory experiments in the design, coding, operation, and documentation of industrial control systems.

Credits: 3.00

ECET 27000 - Electronics Prototype Development And Construction

Credit Hours: 3.00. This course introduces project planning and basic concepts in electronic design automation (EDA). The student develops a portion of an electronic system by utilization of EDA, design for testing, design for manufacturability (DFM), and component selection techniques. New construction methods and testing techniques are introduced.

Learning Outcomes: 1. Design an electronic device or system to accomplish a given task. 2. Demonstrate appropriate electronic assembly techniques. 3. Develop and execute appropriate testing techniques on electronic devices and systems. 4. Apply appropriate software applications to develop a prototype. 5. Apply graphical communication techniques to convey technical information. 6. Apply principles of design for manufacturability and design for testing to a project. 7. Employ teaming methods on a project. Credits: 3.00

ECET 27400 - Wireless Communications

Credit Hours: 3.00. The theory and techniques of wirelessly sending information (voice, music, data) from one location to another is studies from a systems point of view. This includes a signal analysis, modulation techniques, transmitters, receivers, low noise amplifiers, and filters in the RF frequency spectrum. In addition, special topics of current interest are introduced. This course incorporated a student-based communication design and analysis laboratory.

Learning Outcomes: 1. Perform power calculations, such as dB, dBm, dBuV. 2. Describe, identify and apply Fourier concepts communication signals and systems, such as wave shapes, signal mixing, carrier waves. 3. Evaluate, describe and calculate the effects of noise on communication circuits and systems. 4. Demonstrate the concepts and applications of amplitude, frequency, and phase modulation techniques. 5. Describe and compare the

operation of various receiver and transmitter blocks and systems. 6. Describe and apply the concepts of EMC, EMI and RFI to RF components, circuits and systems. 7. Describe and apply the fundamentals of cellular communication, such as frequency reuse, spread spectrum techniques and network technologies. 8. Describe and apply the fundamentals of digital communications, such as coding, bandwidth and modulation techniques. 9. Demonstrate use of RF laboratory equipment including the spectrum analyzer and RF generator. Credits: 3.00

ECET 27700 - AC And Power Electronics

Credit Hours: 3.00. AC Circuits including the j operator, phasors, reactance and impedance are studies. Circuit laws, network theorems, and the application of circuit analysis techniques to amplifiers used in power electronics, including power MOS devices, thyristors, and other appropriate applications. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Calculate phasor and time domain representation of a sine wave. 2. Analyze series, parallel and series-parallel passive and active AC circuits. 3. Analyze multi-loop, multi-source AC circuits using advanced techniques. 4. Analyze and design given series and parallel resonance circuits. 5. Compute the average voltage, rms voltage and power produced by a wide variety of waveshapes using integral definitions. 6. Describe the linear performance of MOS devices. 7. Analyze and design linear power amplifiers using op amps and MOS devices. 8. Apply thyristors, snubbing, thyristor triggers and proportional interfaces. 9. Evaluate the performance of a variety of AC circuits, using appropriate standard laboratory measurement procedures and simulations. Credits: 3.00

ECET 27900 - Embedded Digital Systems

Credit Hours: 3.00. A course emphasizing the advanced applications of embedded digital systems. Topics include embedded system architecture, use of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupts.

Learning Outcomes: 1. Solve problems by the application of C programs emphasizing I/O and peripherals. 2. Demonstrate knowledge and skill in the application of parallel ports, counter-timers, programmable counter arrays, serial ports and interrupts. 3. Demonstrate a conceptual understanding of embedded microcontroller system hardware system design. 4. Demonstrate the use of software development tools such as an editor, an assembler, a C compiler, a linker and locator, an object-to-hex converter, etc. 5. Demonstrate fluency in the language of advanced microprocessors. Credits: 3.00

ECET 28400 - Computer Communications

Credit Hours: 4.00. An introductory course in data communication systems. The hardware and software issues in computer communications are studied. Emphasis on hands-on experience in computer communications, such as cabling, use of communication devices and media, choice of networking topologies, protocols, and platforms.

Credits: 4.00

ECET 28404 - Contemporary Communication System

Credit Hours: 4.00. An introductory course in communications that introduces and evaluate basic concepts and principle of contemporary communication systems. The hardware and software issues in contemporary communications are studied. Emphasis is given on experiential experience in the signals and systems used in contemporary communications such as types of signals and systems use of communication devices and media choice of networking technologies protocols and platforms. Permission of department required.

Learning Outcomes: 1. Describe communication systems and their basic underlying characteristics. 2. Analyze signals in the time and frequency domains. 3. Explain the necessity and the concept of modulation in communication systems. 4. Explain the concept and the use of signal-to-noise ratio and its importance to communication systems. 5. State

the relationship between bandwidth and information rate for a given communication system. 6. Describe and contrast different types of modulation schemes. 7. Solve problems that demonstrate the overall concept of computer communications and networking technologies. 8. Describe and explain various types of computer networks, network topologies. 9. Describe the basis of data communications and computer networking, such as: digital signals, serial and parallel transmission, communication modes, digital encoding and error detection methods used in networking. 10. Describe and explain the function of each layer in the OSI Reference Model. 11. Describe and explain how local area networks are configured and specified. 12. Describe and explain how data is transmitted through interconnected networks from both hardware and software aspects. 13. Describe the TCP / IP protocol used for transporting Internet messages. 14. Describe the application of multiplexer, de-multiplexer, types of multiplexing accesses, and switching technology. 15. Describe and explain the applications of networking interconnection devices such as repeaters, bridges, routers, and gateways. 16. Explain the Internet architecture, TCP / IP, IP, Ipv6, and contemporary interconnect models. 17. Describe and explain how WAN and some special types of interconnected networks, such as industrial networks are setup. 18. Demonstrate skills for life-long learning through term project presentation by locating, evaluating and applying relevant information using external resources such as the Internet, data books, trade publications and library resources. Credits: 4.00

ECET 29801 - Laboratory Teaching Aide In Electrical Engineering Technology

Credit Hours: 1.00 to 3.00. This course allows a student to serve as an undergraduate teaching aide in the laboratory. The student will work with and support a course instructor in the undergraduate teaching labs. Hours, subject matter, and credit to be arranged by faculty. Course content applies toward the EET Professional Experience requirement. Department and Instructor permission required.

Learning Outcomes: 1. Explain and communicate lab steps clearly. 2. Recognize problems and implement troubleshooting techniques. 3. Demonstrate operation and use of test equipment. Credits: 1.00 to 3.00

ECET 29900 - Selected Electrical Engineering Technology Subjects

Credit Hours: 0.00 to 6.00. Hours and subject matter to be arranged by staff. Permission of instructor required.

Learning Outcomes: 1. Vary due to the content of the project and will be approved by the EET curriculum subcommittee. Credits: 0.00 to 6.00

ECET 30200 - Introduction To Control Systems

Credit Hours: 4.00. This first course in industrial controls is applications oriented and includes on-off type open- and closed-loop control systems, and analog-based systems. Major topics include relay and programmable controller-based systems.

Credits: 4.00

ECET 30201 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices and common practices associated with control systems with a primary focus on industrial implementations. Additionally, the course provides a hierarchical examination of the implantation of control theory. Programmable logic controllers serve as the primary platform for presenting applications in interfacing and control of electromechanical and pneumatic devices. Electrical industrial safety standards are presented and emphasized throughout the course.

Learning Outcomes: 1. Demonstrate an understanding of common electrical, pneumatic, and mechanical safety standards and practices. 2. Identify, describe, and compute the parameters of key functional blocks of a basic control system. 3. Describe, interpret and implement control scenarios in ladder logic, flow chart and programmatic forms. 4. Construct,

program and trouble shoot basic control circuits and systems using programmable logic controllers. Credits: 3.00

ECET 30700 - Analog Network Signal Processing

Credit Hours: 4.00. This is an advanced course in network analysis that stresses network theorems and solutions of time- and frequency-domain problems. Transform circuit and signal analysis using Laplace and Fourier techniques are developed, culmination in active filter design applications. Software techniques, such as MATLAB(r) and LabVIEW(tm), to solve mathematical problems are employed.

Credits: 4.00

ECET 30903 - Advanced Embedded Microcontrollers

Credit Hours: 3.00. This course emphasizes advanced applications of embedded microcontrollers, included are microcontroller architecture, use of advanced programmable counter/timer arrays, interrupts, multi-tasking, analog interfaces, hardware abstraction and their peripherals. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Designate and setup a linker to specify memory spaces for code, data, constants, and I/O. 2. Use a real-time high-level code debugger to test and debug programs including instruction stepping, setting up breakpoints and examining variables. 3. Use standard C-language coding conventions. 4. Manipulate I/O bits (clear and set) using C language logic instructions and bit-fields. Credits: 3.00

ECET 31800 - Foundations Of Audio Electronics

Credit Hours: 3.00. The design, fabrication, and testing of the electronics that comprise audio signal transduction, transmission, processing, amplification and delivery to a loudspeaker are studied at an introductory level. Computer-aided analysis of circuits is used.

Learning Outcomes: 1. Quantify and measure sound and signal levels in terms of dB. 2. Convert dB, crest factor, THD, and frequency cut-off specifications into circuit design parameters. 3. Interface circuitry to microphones and loud speakers. 4. Design, build, and test a small audio system containing differential transmitters, differential amplifiers, simple active filters summers/mixers, class AB and class D power and bridged audio power amplifiers. Credits: 3.00

ECET 32100 - Introduction To Nanotechnology

Credit Hours: 3.00. This course explores the downsizing of electronic and mechanical devices and introduces the field of nanotechnology. Properties of nanomaterials and the tools of nanotechnology are studied. Interdisciplinary research and commercial applications are reviewed. The course involves participation in research seminars and hands-on laboratory experiences with nanotechnology instrumentation.

Learning Outcomes: 1. Identify the basic concepts behind nanotechnology. 2. Describe the tools of nanotechnology. 3. Develop a model of the Scanning Probe Microscope. Credits: 3.00

ECET 32300 - Introduction To Electric Vehicle Systems

Credit Hours: 3.00. The course is an introduction to electric vehicle (EV) technology analysis and configuration. The course explores the integrated mechanical and electrical power and control systems including the management of integrated power and control systems within an electric vehicle. Students perform detailed analysis of and develop design approaches for electrically powered vehicles.

Learning Outcomes: 1. Calculate horsepower requirements for various electric vehicle configurations. 2. Calculate efficiency of an electric vehicle. 3. Compare and contrast the various types of motors/controllers and their associated benefits and limitations. 4. Compare and contrast the various battery technologies related to electric vehicles. Credits: 3.00

ECET 32700 - Instrumentation And Data Acquisition Design

Credit Hours: 3.00. This course builds upon the prerequisite knowledge and covers implementation of electric systems to measure and record mechanical, electrical, and biological parameters. Signal characteristics, transducer specification and selection, signal conditioning and transmission design, data conversion, software, and an overall system error budget are

developed.

Learning Outcomes: 1. Differentiate appropriate transducers for sensing various signals, including mechanical, biological, and electrical. 2. Design, simulate and verify signal conditioning circuits. 3. Implement analog-to-digital converters and examine conditioned data for sampling and quantization effects. 4. Create software programs to interface with analog-to-digital converters, process data, and display or utilize the results. 5. Evaluate common sources of errors in instrumentation systems. Credits: 3.00

ECET 32900 - Advanced Embedded Digital Systems

Credit Hours: 3.00. This course focuses on the study and application of real-time embedded systems. Real-time operating systems (RTOS) are introduced and applied. Students learn and use programming and scripting languages to discover the advantages and limitations of RTOS application in the lab.

Learning Outcomes: 1. Define, compare and contrast embedded systems terms and the concepts of soft and hard real time. 2. Identify and explain real time operating system operational concepts. 3. Demonstrate the application of software design, documentation, and version control tools. 4. Demonstrate the application of an RTOS application programming interface and testing techniques to evaluate embedded system functional correctness and performance. Credits: 3.00

ECET 33300 - Power Electronics In Energy Systems

Credit Hours: 3.00. A study of fundamentals and applications of switch-mode DC-DC and DC-AC power electronic converters. The emphasis is given to hardware development aspects. Students will learn how to safely work with high power and high voltage circuits.

Learning Outcomes: 1. Describe how power electronics enable energy efficiency in various applications such as energy conservation, renewable energy, and transportation. 2. Design and build switch mode DC-DC and DC-AC converters using commercially available components. 3. Develop closed loop control circuits for DC-DC converters using voltage mode and peak-current mode methods. 4. Simulate power electronic circuits. Credits: 3.00

ECET 33400 - Embedded Cross-Platform Interface And Communication

Credit Hours: 3.00. Project-oriented, hands-on study of embedded communication protocols, advanced OOP targeted for hand-held devices and low power embedded systems interface. A PC based OS with cross-platform development environments designing system solutions targeted for device platforms and interfacing with microcontroller systems. Topics include microcontrollers, SoC, various OS platforms, RTOS, embedded IoT protocols.

Learning Outcomes: 1. Use cross-platform development tools to design embedded solutions for low-power devices. [Problem Solver: ABET 3-1] 2. Be able to interface, and analyze sensors and actuator wired and wireless embedded communication protocols. [Problem Solver: ABET 3-4] 3. Be able to work in project teams to design, test, and implement robotic (low power device) control across multiple platforms. [Innovator: ABET 3-2 and Communicator: 3-5] Credits: 3.00

ECET 33700 - Continuous Systems Analysis And Design

Credit Hours: 3.00. This is an advanced course in continuous systems analysis and design. Systems may include RCL circuits, op amp circuits, and DC permanent magnet motors. Systems analyses using differential equations and Laplace Transform techniques are developed, culminating in active filter and closed loop PID system design. Software tools, circuit simulation, and advance calculators are used to solve differential, integral, and differential equation problems.

Learning Outcomes: 1. Analyze first and second order circuits using differential equations and Laplace transforms. 2. Analyze and identify the output response of first-order and second-order systems with regards to gain, resonance, and damping. 3. Use Laplace transforms to analyze

and tune the performance of a linear system with proportional-integral-derivative (PID) negative feedback. 4. Use Laplace transforms to analyze and design 1st through 4th order active filters. 5. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 3.00

ECET 33900 - Digital Signal Processing

Credit Hours: 3.00. The course introduces students to the fundamental principles associated with processing discrete time signals. The architecture, instruction set and hardware and software development tools associated with a fixed point general purpose VLSI digital signal processor are examined. Some common real-time applications are implemented such as digital filters and DFT-based spectral estimation on a typical fixed point digital signal processor.

Learning Outcomes: 1. Describe the architectural features of a DSP and relate these to the DSP kernel equation. 2. Manipulate different binary number formats associated with a fixed point DSP. 3. Develop and debug simple programs that involve SOPs, modulo addressing, scaling and extraction of result, and common DSP program structures. 4. Describe the consequences and limitations of sampling baseband signals including the Nyquist rate and bandwidth, quantization noise, aliasing, frequency folding, reconstruction, spectrum of sampled baseband signals. 5. Express a sampled deterministic analog signal in closed mathematical form and expanded form using the unit sample. 6. Express a sampled signal in terms of the Z transform, in expanded and closed form. 7. Describe the relationship between the transfer function and impulse response in an LTI system. 8. Describe the operation of convolution and its implementation using hand calculations, mathematical software packages, and a fixed-point DSP. 9. Design and analyze FIR filters with the aid of a mathematical software package such as MATLAB. Credits: 3.00

ECET 34900 - Advanced Digital Systems

Credit Hours: 3.00. This course investigates complex digital systems that are implemented with field programmable gate arrays (FPGAs) using concurrent and sequential digital design techniques. Applications will include interfacing with analog signals and memory systems.

Learning Outcomes: 1. Design FPGA solutions for given digital design problems using a hardware description language (HDL). 2. Design FPGA solutions for given digital problems using a high-level sequential programming language for embedded processors. 3. Design FPGA solutions by decomposing a system into concurrent and sequential functional blocks and using hierarchical system development techniques. 4. Verify digital designs using simulation and hardware prototyping. 5. Analyze and design memory subsystems. 6. Apply ADC and DAC circuits to interface digital systems with analog devices/systems. Credits: 3.00

ECET 35100 - Instrumentation Applications For Technology

Credit Hours: 3.00 or 4.00. Introduction to the basic concepts and terminology of instruments. This course covers the procedures and techniques essential to measurement of physical quantities (such as pressure, flow, temperature, and level measurements) and analysis of that data. Students will use data acquisition systems and computer control software to complete laboratory exercises.

Credits: 3.00 to 4.00

ECET 35901 - Computer Based Data Acquisition Applications

Credit Hours: 3.00. This course focuses on the study and application of computer based data acquisition (DAQ) systems. Concepts of high resolution and high throughput data acquisition are introduced and applied. Students learn and use programming and scripting languages to discover the interfacing, advantages and limitations of computer based (DAQ) systems.

Learning Outcomes: 1. Define, compare and contrast common data acquisition terms. 2. Analyze the advantages and limitations of DAQ

systems. 3. Demonstrate proficiency with software tools and computer based data acquisition. 4. Develop user-friendly applications for the purpose of DAQ system control. 5. Collect, analyze, and reduce data from a system for the purpose of written and oral reporting. Credits: 3.00

ECET 36400 - Fundamentals Of Electromagnetics

Credit Hours: 3.00. This course introduces the fundamentals of electromagnetics in both theory and application. Wave propagation, transmission lines, port parameters, antenna theory, and antenna design are studied. Other topics include Maxwell's equations, propagation losses, RF signal measurement, impedance matching, and Smith chart applications.

Learning Outcomes: 1. Demonstrate knowledge of transmission line theory and application. 2. Apply and analyze transmission line systems using Smith carts. 3. Demonstrate the fundamentals and use of port parameters. 4. Design impedance matching networks using analytical methods and Smith charts. 5. Demonstrate and apply electromagnetic theory. 6. Describe and apply the fundamentals of electromagnetic wave propagation. 7. Design, simulate and analyze antennas. 8. Use RF simulation software for the analysis and design of RF circuits. 9. Demonstrate the use of RF laboratory equipment including the vector network analyzer, spectrum analyzer and RF generator. Credits: 3.00

ECET 36900 - Applied Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course provides fundamental knowledge of integrated computer imaging or vision systems for sensing, quality control and automation applications. Fundamental basis of optics, illumination, camera types with associated technologies, and image acquisition to develop a customized computer imaging or vision systems will be covered. Algorithms for image processing, image analysis and pattern recognition will also be covered. Emerging technologies-based integrated computer vision or imaging system for sensor system, inspection, quality control and automation in different sectors (medical, manufacturing, security, construction etc.) will be examined. Parallel laboratory hands-on experience will allow the students to apply and validate the concepts learned in the lecture.

Learning Outcomes: 1. Identify different components of a computer vision/imaging system and their needs. 2. Identify and specify different components of a computer imaging system for selected different applications. 3. Interpret and implement different operations related to image processing, image analysis and image understanding. 4. Evaluate different real-world case studies to learn from successes and failures related to computer imaging system-based devices or components. 5. Formulate or create tentative solution for selected real world applications. Credits: 3.00

ECET 37100 - Automation, Instrumentation, and Process Control

Credit Hours: 3.00 or 4.00. A project-oriented course combining key areas of automation, instrumentation and process control. The course covers automatic testing, computer interfacing, data collection, robotic controls, programmable logic controllers, and graphical process control software. A final project is an integrated system.

Credits: 3.00 or 4.00

ECET 37201 - Continuous Control Electronics

Credit Hours: 3.00. A study of the electronic design of the elements of closed-loop analog and digital systems. Topics include characteristics of process and servo systems, analysis and design of the electronics used to acquire the process variable; condition, transmit, and receive the signal; implement a single loop control algorithm, and provide proportional power. Several sensor types and interpretation of their static and dynamic specifications are included. Controllers employed include student designed analog, and embedded microprocessor, and commercial single loop controllers. Software is used to model components and analyze open and closed-loop systems.

Learning Outcomes: 1. Evaluate the performance of a closed loop system. 2. Use simulation software to analyze a control system. 3. Select sensors to meet given performance parameters. 4. Design, implement, and analyze the electronic circuits necessary to interface

with sensors, covert-transmit-receive-scale signals, produce control signals, and apply continuous power to actuators. 5. Select, install, document, tune, and troubleshoot SISO (single input-single output) closed-loop systems. Credits: 3.00

ECET 37300 - Applied Electronic Drives

Credit Hours: 3.00. This course covers operational principles and application development consideration of all subsystems that make up electric drives: electric machines, power-electric based converters, mechanical system requirements, feedback controller design, and the interaction of drives with the utility grid. State of the art drive development tools are introduced through hands-on activities.

Learning Outcomes: 1. Describe the structure of electronic drive systems and their role in various applications such as flexible production systems, energy conservation, renewable energy, and transportation, making electric drives an enabling technology. 2. Understand the basic principles of power electronics in drives using switch-mode converters and pulse width modulation to synthesize the voltages in dc and ac motor drives. 3. Understand the operation of DC, AC, and brushless DC motors. 4. Construct and test traditional and electronic drive circuit for above motors. 5. Analyze various signals present in electric drive to evaluate drive performance. 6. Learn speed control of the above machines. Credits: 3.00

ECET 37600 - Electrical Energy Systems

Credit Hours: 3.00. This course is an introduction to a wide range of electrical energy systems technologies. Topics include fundamentals of energy conversion, which includes large- and small-scale generation, energy storage, and end-use. Processes include coal, nuclear, solar, wind, hydro, and biomass and their application in central and distributed power systems. The power grid, micro-grids, and smart grid technologies are also explored. The goal is to introduce students to the breadth of technology in the rapidly growing and changing field of energy systems.

Learning Outcomes: 1. Demonstrate the process cycles, theory of operation, and roles of significant equipment for various energy conversion, energy storage, and power distribution technologies. 2. Characterize and calculate power, efficiency, environmental, and economic quantities related to various energy conversion, energy storage, and power distribution technologies. 3. Discuss problems and trending solutions related to power and energy systems such as technological limitations, environmental impacts, and economic limitations both locally and worldwide. Credits: 3.00

ECET 38001 - Global Professional Issues In Engineering Technology

Credit Hours: 3.00. This course addresses professional ethics, legal issues, professional development, technology transfer, and corporate culture as they relate to EET graduates and our global society. Information relating to personal job and career choices, resumes, and interviews are included.

Learning Outcomes: 1. Demonstrate awareness in areas of intercultural knowledge and effectiveness. 2. Demonstrate awareness in areas of ethical reasoning. 3. Demonstrate awareness in areas of global citizenship and social awareness. 4. Identify applications of professional and ethical responsibilities including respect for diversity. 5. Demonstrate the ability to engage in self-directed continuing professional development. 6. Demonstrate knowledge of the impact of engineering technology solutions in a societal and global context. Credits: 3.00

ECET 38100 - Electrical Distribution Systems

Credit Hours: 4.00. A study of the design and operation of electric distribution systems including estimated demand, demand calculations, energy conservation, faults on power systems, power quality, power factor improvement, electric rates, voltage drops, protective devices, illumination, and the applicable portions of the National Electric Code (NEC). Both new facilities and additions to existing facilities are included.

Credits: 4.00

ECET 38404 - Fundamentals Of Contemporary Signal Of Processing

Credit Hours: 4.00. Fundamentals of processing techniques applied to signals and systems in both time and frequency domains are studies. Both continuous-time and discrete-time linear systems are introduced. Analysis methods such as: Fourier series, Fourier transform, bilateral Laplace transform, difference equations, discrete-Time Fourier transform, bilateral 7-Transform are introduced. Common applications such as waveform generation, FIR and IIR digital filtering, DFT and FFT based spectral analysis and filtering are covered. Use of software tools is emphasized throughout the course. Department permission required.

Learning Outcomes: 1. Classify various types of signals and systems. 2. Determine the impulse response of a differential or difference equation. 3. Determine the response of linear systems to any input signal by convolution in the time domain. 4. Understand the definitions and basic properties of Fourier series, Fourier transforms, bilateral Laplace transforms, Z transforms, and discrete time Fourier transforms. 5. Compute the transforms and inverse transforms of basic examples. 6. Determine the response of linear systems to any input signal by transformation to the frequency domain, multiplication, and inverse transformation to the time domain. 7. Adhere to Nyquist sampling principles when developing a signal processing problem solution. 8. Calculate coefficients for FIR filter and IIR filter. Explain the fundamental source of the equations used. 9. Write programs to implement FIR filter and IIR filter. 10. Use a software simulation package to analyze system stability. 11. Convert a z-transform equation into a difference equation and implement it in software. 12. Generate the equivalent time-domain signal of a z-transform. 13. Generate the DFT of a number sequence. 14. Explain the output of a DFT based on the number of samples and sampling frequency. 15. Demonstrate self-learning ability by presenting a paper on any signal processing application to explain the application and its relevance.

Credits: 4.00

ECET 38502 - Introduction To Automotive Electronics Laboratory

Credit Hours: 1.00. This course is a laboratory study of automotive electronics components and systems. The main topics are electronic circuit fundamentals, sensor characterization and signal conditioning, and actuator control.

Credits: 1.00

ECET 38600 - Building Electrical Codes And Standard Practices

Credit Hours: 3.00. A course in the design of building wiring, machine wiring and electrical control systems using relevant codes and standards to layout commercial and industrial facilities and manufacturing processes.

Learning Outcomes: 1. Identify codes and standards that pertain to the design and installation of building electrical systems. 2. Choose proper components for a wiring application. 3. Use commercial power system analysis software to assist in the design of an electrical distribution system. 4. Design lighting for office, industrial, and other areas. 5. Apply the appropriate standards to provide proper protection for electoral circuits. 6. Calculate balanced, three-phase short-circuit currents for a distribution system in accordance with applicable standards. Credits: 3.00

ECET 38800 - Analog IC Applications

Credit Hours: 3.00. This course is a study of the applications of analog integrated circuits. Topics include linear amplifiers, IC specifications, linear regulators, waveform generation, linear and switched-capacitor active filters, and nonlinear circuit applications. Computer aided analysis of these circuits is also presented.

Learning Outcomes: 1. Analyze and design a wide variety of digitally controlled analog circuits, selecting among several alternative configurations, accounting for the non-ideal IC behavior, and selecting appropriate devices. 2. Evaluate the performance of a variety of analog circuits, using appropriate standard laboratory

measurement procedures, and simulations. Credits: 3.00

ECET 39000 - Lab Assistant In Electrical Engineering Technology

Credit Hours: 0.00 to 3.00. This course allows a student to serve like an employee as an undergraduate teaching assistant in the laboratory, lab exercise/apparatus developer, or undergraduate researcher. Hours, subject matter, and credit to be arranged by faculty. Course content applies toward the EET Professional Experience requirement. Permission of instructor required.

Learning Outcomes: 1. Meet the expectations of an employer. 2. Behave professionally in employer/ employee relationship. 3. Behave professionally in employee/client relationship. 4. Manage time and resources to meet expectations. Credits: 0.00 to 3.00

ECET 41500 - Digital Hardware Modeling Using Hardware Description Languages (HDL)

Credit Hours: 3.00. This course introduces students to various contemporary Hardware Description Languages (HDL) for modern digital logic systems. The course will emphasize on Verilog HDL. It covers logic-synthesis and high-level-synthesis in the context of HDL coding constructs for platform-independent and dependent technologies applicable to modern semiconductor industry testing. Students are also exposed to the subset of HDL that may be used for synthesis of custom logic for edge devices. HDL simulation and synthesis labs and projects are performed using commercial and/or academic VLSI CAD tools.

Learning Outcomes: 1. Gain proficiency in popular HDL for modeling digital systems. 2. Use CAD tools to synthesize HDL code. 3. Verify/validate results through simulation and testing. 4. Identify effective HDL constructs for reconfigurable programmable logic vs. custom logic. 5. Apply HDL in real-world projects, including the development of complex digital systems for emerging technologies. Credits: 3.00

ECET 42301 - Electrical Vehicle Integration And Fabrication

Credit Hours: 3.00. This course requires students to develop a detailed design, develop a time/action plan, perform research on existing electronic vehicle systems, develop a procurement plan for electronic vehicle components, design and fabricate custom electric vehicle components, and construct an electric vehicle. The completed electric vehicle is extensively tested for safety, performance, and energy efficiency.

Learning Outcomes: 1. Design and fabricate custom electrical vehicle components. 2. Execute the construction of an electrical vehicle. 3. Measure energy efficiency of an electrical vehicle. 4. Implement appropriate electric vehicle instrumentation for various electric vehicle configurations. 5. Optimize an electric vehicle configuration for maximum efficiency. Credits: 3.00

ECET 42800 - Audio Electronics-Selected Topics

Credit Hours: 3.00. Define, implement, and evaluate the performance of the electronic elements in a professional audio system such as preamplifiers, signal encoding and transmission, signal reception and decoding, mixers, post processors, power amplifiers, limiting and protection, and intelligent power supplies. Both analog and digital signal processing may be implemented in each of the electronic elements.

Learning Outcomes: 1. Define parameters used to specify the performance of the electronic elements of a professional grade audio system. 2. Specify the electronic elements in a professional grade audio system to satisfy a given set of parameters. 3. Design, implement, and evaluate the electronic elements in a professional grade audio system. Credits: 3.00

ECET 42801 - Advanced Acoustics And Audio Engineering Technologies

Credit Hours: 3.00. This course introduces topics on acoustics and audio features/elements from hardware and/or software perspectives. Topics covered include the preparation and augmentation of audio data and designing, implementing, and evaluating the audio data using AI machine learning. This course also investigates electro-acoustic applications, their hardware element details, and their contributions to the system. This will pave students' understanding of the state-of-the-art technology in the acoustic and audio engineering technology field.

Learning Outcomes: 1. Define sound features that are both speaker-independent and -dependent. 2. Analyze acoustic/audio signals using AI machine learning. 3. Investigate electro-acoustic transducers and applications. 4. Review and evaluate acoustics/audio-related state-of-arts technology. Credits: 3.00

ECET 43000 - Electrical And Electronic Product And Program Management

Credit Hours: 3.00. This course deals with the planning of electrical and electronic products and projects. Research methods are studied to support new product development including customer needs and the development of engineering requirements. Formal techniques such as functional decomposition, top-down and bottom-up design techniques are studied. Planning and design alternatives to meet cost, performance, and user-interface foals are emphasized. Technical topics are revisited with emphasis on new applications. The various types and levels of new product system tests are studied. New product planning, scheduling, and management techniques are studied, along with the usage of software tools for project scheduling and management. Creativity is stressed, and the different approaches taken by the designers are compared and discussed.

Learning Outcomes: 1. Apply the engineering design lifecycle process. 2. Evaluate customer needs as part of the definition of the solution to a problem. 3. Evaluate alternative designs to solve a problem and then decide on the most appropriate design to pursue. 4. Define a workable plan to create a design to solve a product development problem. 5. Plan and construct a Gantt chart to be followed during senior design. 6. Write a formal technical proposal to be carried through in senior design. Credits: 3.00

ECET 43100 - International Capstone Project Planning And Design

Credit Hours: 3.00. The course deals with the planning and execution of an industry sponsored senior capstone project carried out jointly with students from a foreign academic institution. Project management and systems engineering methods are studied to support the development of solutions to open-ended problems proposed by industry. Formal techniques such as functional decomposition, top-down and bottom-up, requirement matrix, analysis of alternatives are studied and applied to the projects. Project planning techniques including work breakdown structures, Gantt charts and resource planning are studied and applied to meet cost, performance and project goals. The various types and levels of new system tests are studied and applied. Electronic and internet communication tools shall be used to maintain team and project progress. Foreign travel shall be required for at least one face to face team meeting during the execution of the project. Permission of Instructor required.

Learning Outcomes: 1. Apply the engineering design lifecycle process. 2. Evaluate customer requirements and constraints as part of problem definition. 3. Evaluate multiple design solutions and quantitatively select optimal solution. 4. Define a workable design plan to solve the industry problem. 5. Plan and construct a Gantt chart to be followed during the project. 6. Produce appropriate project documentation. 7. Interact appropriately regarding international cultural diversity particularly in project planning and execution. Credits: 3.00

ECET 43400 - PC Systems II

Credit Hours: 4.00. Real-time PC-based operating systems. Programming Graphical User Interface in C++. Embedded PC hardware, busses, and peripheral programming. Writing and integrating device drivers.

Learning Outcomes: 1. Write GUI programs using an object-oriented language. 2. Write programs that require multiple threads. 3. Write a server-client data transfer program using TCP/IP calls. 4. Write a program that handles interrupts in an OS environment. 5. Write a program that transfers data on a Serial Port. 6. Write a program that controls a peripheral using the I2C bus. 7. Write programs that generate time intervals using timers. 8. Examine communications via typical device busses. Credits: 4.00

ECET 43600 - Electrical Power Transmissions, Distribution, And Smart Control

Credit Hours: 3.00. A course on the simple modeling and simulation of the power grid systems, power flow analysis, and

advanced meter infrastructure (AMI). The fundamentals learned in this course will be useful in the study of the effects of distributed energy resources and storage in Smart Grid environment.

Learning Outcomes: 1. Explain the role of components of electrical power transmission and distribution network. 2. Identify characteristics of DC and AC transmission lines and cable systems. 3. Identify the characteristics of various power system loads and power quality issues. 4. Calculate and simulate power flow in a power systems network. 5. Explain how to stabilize power systems. 6. Apply Advanced Meter Infrastructure (AMI) as it is used in Smart Grid applications. Credits: 3.00

ECET 43900 - Advanced Digital Signal Processing

Credit Hours: 3.00. The course builds on the basic principles and applications of Digital Signal Processing with a view to implementing advanced DSP techniques. These techniques are chosen to form some of the building blocks that are used in specialization areas such as the biomedical, communications and energy management fields.

Learning Outcomes: 1. Write and debug basic DSP applications on a VLSI DSP 2. Write and debug advanced DSP techniques and applications drawn from areas such as communications and biomedical signal processing. 3. Embed software modules from DSP libraries into specific applications. Credits: 3.00

ECET 44200 - Programming Robots With ROS

Credit Hours: 3.00. Robot Operating Systems (ROS) will be used as a programming platform to explore the topics of computer vision, SLAM (Simultaneous Localization and Mapping), path planning, grasping, and social interaction in robotic systems, as well as programming large systems for physical interaction with the world. Self-contained implementation projects are core to the class. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of matrices is assumed.

Learning Outcomes: 1. Apply software versioning techniques to the programming of large software projects with hardware in-the-loop. 2. Build ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 3. Apply basic software engineering techniques to designing and documenting software. 4. Apply and evaluate computer vision techniques based on templates to track objects in 2-D. 5. Synthesize 3-D computer vision techniques for 3-D sensors from 2-D algorithms. 6. Analyze and evaluate hardware sensors with respect to specific software task needs. 7. Apply SLAM methods to real-world scenes to interpret the world on real hardware in real-time. 8. Analyze execution times and evaluate trade-offs in computational hardware performance with respect to sensor data throughput. 9. Implement feedback controllers and tune for specific hardware characteristics. 10. Apply manual path planning techniques to 2-D and 3-D maps extracted from SLAM algorithms. 11. Apply automatic path planning tools and software to 2-D and 3-D maps extracted from SLAM algorithms. Credits: 3.00

ECET 44400 - Wireless Systems: Design And Measurement

Credit Hours: 3.00. In this course wireless RF signals and microwave circuit designs are studied. Topics include signal analysis, RF signal measurement, microstrip design and analysis, Smith chart applications, RF circuit design, s-parameters, power dividers and couplers, filter design, and advanced RF PCB layout.

Learning Outcomes: 1. Apply knowledge of RF component non-idealities. 2. Design, simulate and test RF amplifiers, filters, and power dividers. 3. Apply RF test methods and procedures to RF components, circuits and systems. 4. Demonstrate microstrip and stripline analysis and design. 5. Apply RF simulation software for the analysis and design of RF

circuits. 6. Demonstrate printed circuit board layout techniques for high frequency applications. 7. Demonstrate the use of RF laboratory equipment including the vector network analyzer, spectrum analyzer and RF generator. Credits: 3.00

ECET 46000 - Project Design And Development

Credit Hours: 3.00. An extensive individual or small group design project is carried out with guidance from a faculty advisor. This course includes determining customer requirements, considering design alternatives, prototyping, project integration, and testing. The project is completed as a robust prototype. The course concludes with a formal written report and a presentation of the project to faculty and invited industrial guests.

Learning Outcomes: 1. From a formal project proposal, create a functional prototype to solve the given problem. 2. Utilize a software scheduling package to plan and track the progress of a project. 3. Weigh design alternatives for customer requirements, efficiency, reliability, and cost. 4. Apply formal test procedures to the developed prototype. 5. Analyze the data acquired during testing of the prototype. 6. Present a project orally to a specific audience. 7. Write a technical report including conclusions and recommendations for further work. Credits: 3.00

ECET 46100 - International Capstone Project Execution

Credit Hours: 3.00. This course completes the development and execution of an international industry sponsored senior capstone project carried out jointly with students from a foreign academic institution. Project management and systems engineering methods are applied in the development of solutions to open-ended problems proposed by industry. Design tools including failure mode and effects analysis and configuration management are studied and applied. A manufacturing plan supported by both in process and validation test plans are developed and applied to demonstrate compliance to project requirements. The project is completed with the generation of a proof of concept demonstration that satisfies project requirements. The course concludes with a formal written report and presentation. Electronic and internet communication tools shall be used to maintain team and project progress. Foreign travel shall be required for at least one face to face team meeting during the execution of the project. Permission of Instructor required.

Learning Outcomes: 1. Create a functional proof of concept (POC) to solve the given problem. 2. Plan and track progress on the project utilizing a software scheduling package. 3. Apply formal test procedures to the developed proof of concept. 4. Analyze test data and draw valid conclusions on the POC compliance to project requirements. 5. Present a project to an industrial sponsor and faculty audience. 6. Write a technical report. 7. Interact appropriately regarding international cultural diversity particularly in project planning and execution. Credits: 3.00

ECET 47600 - Smart Grid Technology And Applications

Credit Hours: 3.00. This smart-grid (SG) technology and applications is designed to introduce new topics related to distributed generation, micro-grids, renewable energy sources, and smart home applications. Topics covered include design, modeling, control, and analysis of smart-grid systems. Concepts dealing with computational intelligence, decision support systems, smart metering, optimization, and energy storage are addressed. The laboratory component will provide students with hands-on experience in the utilization of smart-grid technologies and applications.

Learning Outcomes: 1. Identify fundamental elements and structure of smart grids and microgrids including communication networks. 2. Model, simulate, and analyze various distributed energy resources. 3. Interpret and implement smart grids computational techniques using decision support tools and optimization. 4. Evaluate different real-world case studies for smart grids applications. 5. Develop effective solutions for real-world applications considering environmental issues, standards, and regulations related to smart grids. Credits: 3.00

ECET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

ECET 48400 - Digital Wireless Systems

Credit Hours: 3.00. This course investigates the theory and implementation of digital wireless systems for current and next generation communication systems. Cognitive radio systems and technologies will be studied and implemented.

Credits: 3.00

ECET 48404 - Emerging Information, Communication And Technologies

Credit Hours: 4.00. An advanced course in the Computer Engineering Technology program that introduces and evaluates emerging systems, services and applications in information, communication, and technologies (ICT) areas. In the laboratory, students use utilities to evaluate and analyze various emerging subjects so that certain level of mastery f the subjects can be demonstrated. Permission of department required.

Learning Outcomes: 1. Facilitating students' critical thinking ability on the emerging subjects of the internet, internet protocols and the delivery of communication services using the internet by focusing on the fundamentals of these systems and applications. 2. Developing competence in analysis and application of technologies in computer networking. 3. Developing competence in analysis and application of technologies in telecommunications and wireless communications. 4. Understanding the operations and development trends of emerging technologies in ICT areas. Credits: 4.00

ECET 49000 - Senior Design Project Phase I

Credit Hours: 1.00 or 2.00. An extensive individual design and/or analytical project performed in consultation with one or more faculty advisors. Collaboration with representatives of industry, government agency, or community institutions is encouraged. Evidence of extensive and thorough laboratory performance is required. PHASE I includes, but is not limited to, faculty acceptance of project proposal, defining and limiting project objectives, initial research and source contacts, procurement of materials, and periodic progress reports.

Credits: 1.00 or 2.00

ECET 49100 - Senior Design Project Phase II

Credit Hours: 2.00 to 5.00. PHASE II includes, but is not limited to, continued research and finalized design, oral presentation to faculty and other interested parties, and a written technical report.

Learning Outcomes: 1. Demonstrate the elements of System Design Principles. 2. Apply principles of Electrical Engineering Technology theory, problem solving techniques, and practical laboratory knowledge to design, implement, test, and bring to completion of a working project. 3. Demonstrate sufficient written communications skills. 4. Demonstrate sufficient oral communication skills. Credits: 2.00 to 5.00

ECET 49300 - Ethics And Professionalism In Technology

Credit Hours: 1.00. Factors involved in the ethical decision making in engineering and technology professions on both a local and global scale will be presented. Workplace issues such as socio-economic and cultural differences, professionalism, ethical codes, employee and community safety, whistle blowing, diversity and sexual harassment will be discussed. Case studies will guide student activities.

Credits: 1.00

ECET 49900 - Electrical Engineering Technology

Credit Hours: 1.00 to 9.00. Hours and subject matter to be arranged by staff. Cannot be used to replace EET 48000, 49600, or 49700. Permission of instructor required.

Learning Outcomes: 1. Vary with the project,

and are subject to EET curriculum subcommittee approval. Credits: 1.00 to 9.00

ECET 54100 - Robotics And Cyber-Physical Systems Seminar

Credit Hours: 0.00 to 1.00. This course is a series of lectures from eminent local, national, and international researchers in the field of robotics, cyber-physical systems, and related areas (such as computer vision, autonomy, wearables, etc.).

Learning Outcomes: 1. Understand the state-of-the-art of research and practice in robotics and cyber-physical systems. Credits: 0.00 to 1.00

ENGT 10200 - Industrial Technology Aerospace Studies

Credit Hours: 3.00. This course introduces students to the world of aeronautics, flight, and engineering. Students apply scientific and engineering concepts to design materials and processes that measure, repair, improves, and extend aeronautical systems.

Learning Outcomes: 1. Explain the principles of atmospheric and space flight. 2. Apply concepts of orbital mechanics, using industry-standard software. 3. Explore career opportunities in aerospace engineering and technology. Credits: 3.00

ENGT 10300 - Industrial Technology Exploring Civil Engineering And Architecture

Credit Hours: 3.00. Students learn various aspects of civil engineering and architecture, apply their knowledge to designing and development of a commercial property. Students learn about documenting their project, problem-solving, and communications in the civil engineering community.

Learning Outcomes: 1. Apply aspects of building and site design for commercial projects. 2. Use industry-standard 3-D architectural software to document work. 3. Compare/contrast the roles of architects and civil engineers. 4. Explore various career opportunities in civil engineering and architecture. Credits: 3.00

ENGT 10500 - Industrial Technology Introduction To Design

Credit Hours: 3.00. This course develops students' problem-solving skills, with emphasis placed upon the concept of developing a three-dimensional model of an object. Students focus on the application of visualization processes and tools currently used in the design and manufacturing environments.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Create detailed technical drawings. 3. Present design solutions to stakeholders. 4. Explore the economic, environmental, and societal impact of engineering solutions. Credits: 3.00

ENGT 10600 - Industrial Technology Digital Electronics

Credit Hours: 3.00. This course is the study of applied digital logic. Students will study the application of electronic logic circuits and apply Boolean logic to the solution of problems. Students will design circuits, export their design to a printed program that generates printed circuit boards, and construct the design using electronic components.

Learning Outcomes: 1. Design digital electronic circuits. 2. Apply various number systems and logic gates. 3. Design combinational and sequential circuits. 4. Use industry-standard software to design/simulate digital circuits. Credits: 3.00

ENGT 10700 - Industrial Technology Principles Of Engineering

Credit Hours: 3.00. This course explores various engineering systems and manufacturing processes. Students examine how the field of engineering technology addresses social and political consequences of technological change.

Learning Outcomes: 1. Apply the engineering design process to real-world problems. 2. Explain mechanical systems, including simple/compound machines, mechanisms, and motion. 3. Design basic electrical circuits. 4. Explore applications of robotics and automation in engineering. Credits: 3.00

ENGT 10800 - Industrial Technology Computer-Integrated Manufacturing

Credit Hours: 3.00. This course builds on students' solid modeling skills to develop manufactured products. Students evaluate products using mass property analysis, make

appropriate modifications, and use prototyping equipment to produce three-dimensional models of the solutions.

Learning Outcomes: 1. Use computer-aided design and computer-aided manufacturing software to optimize production workflows. 2. Use computer numerical control machines to transform digital designs into physical products. 3. Integrate robotic systems to improve efficiency and precision. 4. Analyze economic aspects of manufacturing. Credits: 3.00

ENGT 10900 - Industrial Technology Engineering Design And Development

Credit Hours: 3.00. In this capstone course students work in teams to design and construct a solution to an engineering problem, applying the knowledge and skills previously developed. Students maintain a portfolio of their design and development activities. Teams are responsible for making final presentations of the solution to an engineering review panel.

Learning Outcomes: 1. Apply the engineering design process. 2. Conduct research to support design decisions. 3. Present and defend design decisions. 4. Explore the societal, ethical, and environmental impacts of engineering. Credits: 3.00

ENGT 18000 - Engineering Technology Foundations

Credit Hours: 3.00. This course introduces School of Engineering Technology students to resources and skills that will help them to be successful in their studies and ultimately in their careers. The skills needed to define and solve technical problems in engineering technology are developed. Instruction is given in analytical and computational problem-solving techniques. Application of software for analysis and communication is emphasized. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Select the most appropriate degree program. 2. Apply algebraic and trigonometric skills to solve engineering technology problems. 3. Apply computational tools to address engineering technology problems. 4. Identify professional issues in engineering technology. 5. Plan and execute a strategy for success in a chosen degree program. Credits: 3.00

ENGT 18100 - Engineering Technology Applications

Credit Hours: 1.00. Basic electrical, electronics, mechanical, and process laboratory skills are introduced, including simple troubleshooting techniques and safety practice. Relevant engineering technology projects are emphasized.

Learning Outcomes: 1. Operate safely in a lab environment. 2. Use standard lab instrumentation to take measurements accurately. 3. Communicate relevant experimental results. 4. Complete an engineering technology team project. Credits: 1.00

ENGT 18200 - Gateway To Engineering Technology

Credit Hours: 4.00. This course introduces School of Engineering Technology students to the resources and skills needed to define and solve technical problems, which will help them be successful in their studies and ultimately in their careers. Instruction is given in analytical and computational problem-solving techniques. The application of software for analysis and problem-solving is emphasized. Foundational principles for electrical, industrial, manufacturing, and mechanical engineering technology are studied. Teamwork, global and societal concerns, and professional ethics are integrated into course.

Learning Outcomes: 1. Develop an academic pathway for success in the student's selected major. 2. Select appropriate strategies and technologies to solve technical problems. 3. Apply foundational principles and tools of electrical, industrial, manufacturing, and mechanical engineering technology to address technical problems. 4. Apply computational tools to address technical problems. 5. Work in a team to solve an engineering technology problem. 6. Demonstrate awareness of professional standards, practices, culture, and issues in engineering technology. Credits: 4.00

ENGT 22670 - Sustainable Energy Technologies: An International Perspective

Credit Hours: 3.00. This course is a survey of sustainable energy technologies taught at Ostfalia University in Wolfenbuttel, Germany during the two-week International Summer University Program. Wind, Solar, Hydro-electric, Hydrogen Fuel Cell, Biomass, and other technologies are studied along with the future of Nuclear and Coal powered generation. The economic aspects of shifting to renewable energy sources by Germany are presented. Field trips to energy-related industries and historic cities occur nearly every day. Permission of instructor required.

Learning Outcomes: 1. Increase intercultural awareness. 2. Identify various sustainable energy technologies. 3. Describe technological issues associated with each generation method. 4. Explain economic issues associated with implementation of sustainable energy. 5. Identify events in history that shaped the German culture. Credits: 3.00

ENGT 29000 - Special Topics In ENGT

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of engineering technology is provided by SOET faculty, subject to SOET curriculum subcommittee approval. Hours, subject matter, and credit to be arranged by faculty. Permission of department required.

Learning Outcomes: 1. Learning outcomes will match the course content and are subject to SOET curriculum subcommittee approval. Credits: 1.00 to 3.00

ENGT 29900 - Engineering Technology Project

Credit Hours: 1.00 to 3.00. Independent project or study of a special topics is conducted under the supervision of appropriate SOET faculty. Hours and subject matter must be arranged with the instructor and approved by the SOET curriculum subcommittee before enrolling in the course. Permission of department required.

Learning Outcomes: 1. Learning outcomes will depend on the content of the project and will be approved by the SOET curriculum subcommittee. Credits: 1.00 to 3.00

ENGT 39000 - Special Topics In Engineering Technology

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of engineering technology is provided by SOET faculty, subject to SOET curriculum subcommittee approval. Hours, subject matter, and credit to be arranged by faculty. Permission of department required.

Learning Outcomes: 1. Learning outcomes will be reviewed by the SOET CC subcommittee as part of the course proposal. Credits: 1.00 to 3.00

ENGT 39900 - Engineering Technology Project

Credit Hours: 1.00 to 6.00. Independent project or study of a special topic is conducted under the supervision of appropriate SOET faculty. Hours and subject matter must be arranged with the instructor and approved by the SOET curriculum subcommittee before enrolling in the course. Permission of department required.

Learning Outcomes: 1. Learning outcomes vary, and will be approved by the SOET curriculum subcommittee. Credits: 1.00 to 6.00

ENGT 48000 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

ENGT 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering

design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

ENGT 48100 - Engineering Technology Capstone II

Credit Hours: 3.00. This is the second course of two-term capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final solution recommendations. Credits: 3.00

ENGT 49000 - Special Topics In Engineering Technology

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of engineering technology is provided by SOET faculty, subject to SOET curriculum subcommittee approval. Hours, subject, matter, and credit to be arranged by faculty. Permission of department required.

Learning Outcomes: 1. Learning outcomes will vary, and are subject to SOET curriculum subcommittee approval. Credits: 1.00 to 3.00

ENGT 49900 - Engineering Technology Project

Credit Hours: 1.00 to 6.00. Independent project or study of a special topic is conducted under the supervision of appropriate SOET faculty. Hours and subject matter must be arranged with the instructor and approved by the SOET curriculum subcommittee before enrolling in the course. Permission of department required.

Learning Outcomes: 1. Learning outcomes will vary with the project, and are subject to SOET curriculum subcommittee approval. Credits: 1.00 to 6.00

HETM 22500 - Healthcare Technology Diagnostics And Repair

Credit Hours: 3.00. This course will explore fundamental repair theory and applications of technology used in the clinical setting, switching logic and controls, and systems repair in medical devices.

Credits: 3.00

HETM 24000 - The Technology Of Patient Care

Credit Hours: 3.00. This course provides an overview of medical equipment used in the hospital and other medical environments to diagnose and treat patients. Sensors and physiological signals will be explained. Equipment found in various hospital departments and medical specialties will also be discussed. Patient safety and regulations will be emphasized.

Credits: 3.00

HETM 31500 - Introduction To Imaging Modalities

Credit Hours: 3.00. The fundamentals of diagnostic imaging equipment will be explored. The principles of x-ray based systems will be explored. Components and features of MRI, ultrasound, PET, and nuclear medicine will be discussed. Image storage and communication protocols will be presented.

Credits: 3.00

HETM 40200 - Healthcare Device System Security

Credit Hours: 3.00. Students explore the clinical applications of computer networks, integrated medical devices, interoperability, and electronic medical records. Special emphasis will be on security and HIPAA compliance associated with physiological data. Hands-on learning will involve campus-area hospitals.

Credits: 3.00

HETM 44000 - Codes, Regulations And Patient Safety

Credit Hours: 3.00. This course explores applicable NFPA 99, JCAHO, CLIA, FDA and other regulatory agencies and their regulations governing medical equipment in the clinical environment. Case studies will be used to provide examples of interpretation and application.

Credits: 3.00

HETM 46000 - Systems Engineering Technology For Healthcare

Credit Hours: 3.00. Participants will gain insight into the analysis of multiple-entity clinical systems involving healthcare technology. Focus will include process analysis and improvement to satisfy clinical customer needs. Course content will explore the interdisciplinary efforts related to support the development, verification, deployment, integration, operations and user training of complex systems involving healthcare technology, as well as the creation of information about system performance associated with management decision making.

Credits: 3.00

HETM 49000 - Project Planning And Design

Credit Hours: 1.00. Students are expected to prepare an individual design in collaboration with industry and/or the clinical setting. This course will introduce the applications of project management to the student's design. Topics include project scope, scheduling, resource limitations, stakeholder interactions, delivery and quality assurance.

Credits: 1.00

HETM 49300 - Healthcare Engineering Technology Management Ethics And Professionalism

Credit Hours: 1.00. Students will explore ethical, social, political, legal and ecological issues that practicing BMET's may encounter. Particular emphasis will be placed on patient safety and privacy issues.

Credits: 1.00

IET 10400 - Industrial Organization

Credit Hours: 3.00. A detailed survey of organizational structures, operational, financial, marketing, and accounting activities; duties of management, planning, control, personnel, safety, wages, policy, and human factors necessary for effective management. Not open to students taking, or with credit in, IE 36600.

Credits: 3.00

IET 11100 - Introduction To Manufacturing And Supply Chain Systems

Credit Hours: 3.00. A survey of organizational units and their function within an enterprise, including a brief history of organizations. The course emphasizes a systems perspective and how decisions in one area impact the entire system. Topics include operations, financial, marketing, planning, quality control, process strategy, logistics, and safety.

Learning Outcomes: 1. Explain the purpose and function of various organizational units within an enterprise. 2. Describe how the enterprise is a system of interrelated parts. 3. Explain the impact of risk on the enterprise system. 4. Critically analyze current processes to identify areas of improvement. 5. Predict how a suggested change impacts the system. Credits: 3.00

IET 15000 - Quantitative Methods For Technology

Credit Hours: 3.00. Application of statistical techniques to typical problems in technology. Topics include data collection, descriptive statistics calculation, hypothesis testing, sampling, continuous and discrete distribution, probability, ANOVA, and related topics. The course also introduces the use of spreadsheet and other software to solve statistical calculations. Introduction to SPC is included. Basic metrology, concepts of gage and meter calibration calculations, instrument linearity, repeatability, reproducibility, sensitivity, precision, and instrument control are included.

Credits: 3.00

IET 19000 - Topics In Industrial Technology

Credit Hours: 1.00 to 3.00. Hours, credit, and subject matter to be arranged by staff. This is not for independent study. Permission of instructor required.

Credits: 1.00 to 3.00

IET 21400 - Introduction To Supply Chain Management Technology

Credit Hours: 3.00. This course is an introduction to supply chain management technology. Topics include supply chain functions including how to organize a supply chain, supply chain strategy, supply chain process mapping, and use of supply chain technologies, analysis, and performance measurements.

Learning Outcomes: 1. Describe the building blocks of supply chain strategy. 2. Explain the steps involved in designing a global supply chain network. 3. Plan and coordinate operations across the supply chain. 4. Describe key elements required to manage product flow. 5. Use enterprise resource planning (ERP) software to manage supply chain operations. Credits: 3.00

IET 23500 - Introduction To Systems Thinking And Process Improvement

Credit Hours: 3.00. This course provides the foundation for technology systems processes and practices. The content covers the discussion of current systems issues, basic systems technology processes, and the role of systems engineering professionals in a global business environment. Topics include basic principles of systems thinking, the concepts of performance and cost measures, alternative design concepts, lean processes, and sustainable life-cycle management within an enterprise and across the supply chain.

Learning Outcomes: 1. Describe the essential system components and their interrelationships. 2. Identify, analyze, and generate solutions to problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles for managing and operating basic systems. 5. Identify opportunities for system improvement. 6. Explain the impact of risk on the enterprise system. Credits: 3.00

IET 28100 - Industrial Safety

Credit Hours: 3.00. A course designed to develop understanding of, and insight into, the basic aspects of accident prevention and safety. Specific attention will be given to (1) the psychological aspects of accident prevention; (2) the principles of accident prevention; (3) the practical aspects of planning, implementing, and maintaining a safe environment; and (4) standards, current laws, and regulations. Field trips may be required.

Credits: 3.00

IET 31300 - Technology Innovation And Integration: Bar Codes To Biometrics

Credit Hours: 3.00. This course provides the foundation for automatically capturing data in a system. The content covers an introduction to technology used in automatic identification and data capture systems, including: bar codes; radio frequency identification; smart cards, and biometrics. Topics also include an immersive semester project that examines the integration of these technologies, as well as advanced problem-solving.

Learning Outcomes: 1. Describe the essential components of an AIDC system. 2. Evaluate and propose solutions to AIDC system-related problems. 3. Clearly and effectively communicate findings and results. 4. Describe principles of integrating and managing AIDC systems. 5. Identify opportunities for system improvement. Credits: 3.00

IET 31600 - Statistical Quality Control

Credit Hours: 3.00. This course introduces the application of statistical and probability tools to develop, implement, and maintain effective quality assurance in technology and service systems. A systems approach to product or service quality from inception to disposal is employed. Factors affecting variation in quality are studied. The concepts and implications of quality from a global business environment are examined.

Learning Outcomes: 1. Describe the role and importance of quality planning, implementation, and control in manufacturing and service industries. 2. Apply quality improvement tools to solve problems. 3. Apply basic statistics to solve quality control problems. 4. Construct various control charts. 5. Apply fundamental probability concepts. 6. Examine the role of "code of ethics" and ethical practices in business and industry. 7. Communicate basic quality concepts. Credits: 3.00

IET 33100 - Advanced Industrial Safety And Health Management

Credit Hours: 3.00. An introduction to OSHA and standards development for occupational health in general industry. Special emphasis is on fire protection and egress, flammable and combustible liquids, electrical, personal protective equipment, machine guarding, industrial hygiene/blood-borne pathogens, ergonomics, and ISO 9000/14000 integration.

Learning Outcomes: 1. Explain the purpose of the Occupational Safety and Health Administration (OSHA). 2. Describe the fundamental requirements of each of the General Industry Regulations in 29 CFR 1910. 3. Apply the General Industry Regulations in real-life scenarios within the workplace. 4. Explain how to prepare for the OHSA workplace inspection. 5. Create an adequate training plan for workplace employees. 6. Identify readily available resources for creating a workplace free from recognized hazards. Credits: 3.00

IET 33400 - Economic Analysis For Technology Systems

Credit Hours: 3.00. This course examines techniques of

economic analysis for systems technologists, engineers, and leaders who evaluate and determine the financial attractiveness of multiple alternatives. Emphasizes economic feasibility and applying time value of money concepts to cost-volume-profit decisions. Topics include present worth, rate of return, benefit-cost, payback, breakeven analysis, depreciation, economic optimization, and decision-making under uncertainty.

Learning Outcomes: 1. Apply compound interest factors to establish economic equivalencies. 2. Use present worth analysis to evaluate alternatives. 3. Use annual worth analysis to evaluate alternatives. 4. Calculate the internal rate of return for a project. 5. Apply economic analysis concepts to personal finances. Credits: 3.00

IET 33520 - Human Factors For Technology Systems

Credit Hours: 3.00. This course provides the foundation for examining the intersection of people, technology, policy, and work across technology systems. Topics include the evaluation, analysis, and design recommendations for improving the safety and efficiency of human-technology interactions.

Learning Outcomes: 1. Describe the relationship between human factors and technology systems. 2. Solve human-machine interaction problems, using appropriate human factors principles. 3. Recommend actions to correct safety deficiencies in existing environments. 4. Apply principles of innovation to design, conduct, and document a human factors study. Credits: 3.00

IET 33610 - Risk Analysis And Assessment

Credit Hours: 3.00. This course introduces the tools for identifying and analyzing inherent risks associated with the decision-making process. The challenges of quantitative risk assessment are introduced using decision trees, influence diagrams, and probability models. The concepts of risk index, options, avoidance, prevention, and reduction are discussed in the context of technology systems.

Learning Outcomes: 1. Identify and characterize organizational threats. 2. Assess the vulnerability of critical assets to specific threats. 3. Determine the probability and consequences of events. 4. Identify methods to reduce risks. 5. Prioritize risk reduction measures. Credits: 3.00

IET 33620 - Total Productive Maintenance

Credit Hours: 3.00. This course emphasizes the importance of effective maintenance planning and execution for efficient and economical operation of service or technology systems. A systems approach to maintenance planning is taken. Maintenance activities are discussed from reliability and productivity perspectives in the context of technology systems. Semester-long, team-based research project is typically required.

Learning Outcomes: 1. Differentiate among the various types of maintenance activities. 2. Calculate failure rate, mean time between failures, reliability, and maintenance cost versus profit. 3. Identify various state-of-the-art technologies and applications in PM and PDM maintenance management. 4. Evaluate maintenance management philosophies, organization, and practices of a manufacturing entity. 5. Articulate maintenance management philosophies and practices for manufacturing entities. Credits: 3.00

IET 34200 - Warehouse And Inventory Management

Credit Hours: 3.00. A course designed to develop understanding of types of warehouses, methods of organizing the warehouse environment, and determining efficient inventory control procedures. Technology applications related to the management of warehouse and inventory stock-keeping units (SKU) are investigated. Storage of inventory, placement of inventory, picking, packing, shipping, and other internal logistics management topics will be explored.

Learning Outcomes: 1. Identify activities associated with inventory and warehouse management. 2. Explain the relationship of inventory and warehouse management to supply chain management with other various functional areas, including corporate strategy. 3. Design various warehouse activities under given circumstances. 4. Describe material/distribution requirements planning (MRP/DRP) systems. Credits: 3.00

IET 34250 - Purchasing And Contract Management

Credit Hours: 3.00. This course examines the processes by which goods and services are acquired through purchasing and contract management. Topics include procurement, contract strategies, source selection, identifying contract type, product liability and risk, the bid process and response evaluation; contract risk assessment, contract negotiation, and contract law.

Learning Outcomes: 1. Classify key components of the purchasing and contract processes. 2. Explain product and service selection methods. 3. Identify key documents used in the purchasing and contract processes. 4. Explain negotiation roles and processes. 5. Describe key legal and ethical considerations for purchase orders and contracts. Credits: 3.00

IET 34300 - Technical And Service Selling

Credit Hours: 3.00. A study of sales models and techniques for technical and service sales in business-to-business environments, including development of channel relationships, long-term sales agreements, customer relationship management efforts, total cost of ownership tools and complex sales presentations. Covers critical sales skills such as e-economy sales and marketing, lead management, building credibility, consultative selling, ethical negotiations, and sustainable product management.

Learning Outcomes: 1. Explain the roles of technical and service sales in business to business channels. 2. Describe the relationship between personal selling and marketing. 3. Describe critical influencing factors on organizational buyer behavior. 4. Describe various types of buying situations and typical sales agreements. 5. Demonstrate a personal selling communication model. 6. Describe customer relationship management. Credits: 3.00

IET 34350 - Business To Business Sales Management

Credit Hours: 3.00. This course covers key topics in sales management while emphasizing customer relationship management, sales productivity, and the effects of technology on the sales function. Topics include analyzing multiple channel models; establishing sales plans; incentivizing and motivating the sales force; and evaluating, monitoring, and managing the effectiveness of the sales force.

Learning Outcomes: 1. Describe the responsibilities and challenges of sales in the management role. 2. Describe strategic sales planning; supporting sales recruitment, hiring, and training, evaluation and performance feedback. 3. Demonstrate a variety of data analytic techniques to forecast sales, establish sales goals, and create budgets. 4. Explain sales productivity measures used to establish and manage sales territories. 5. Describe the appropriate use of technology in managing sales. Credits: 3.00

IET 35000 - Engineering Economy

Credit Hours: 3.00. Examines the concepts and techniques of analysis useful in evaluating the worth of systems, products, and services in relation to their cost. The objective is to help students grasp the significance of the economic aspects of engineering and to become proficient in the evaluation of engineering proposals in terms of worth and cost. Project analysis will require computer proficiency. Not open to students who have credit for IET 25000.

Credits: 3.00

IET 36400 - Total Quality Control

Credit Hours: 3.00. This course is aimed at determining customer needs and wants and interpreting these into design during production, follow-up on field performance, and feeding back quality information to further improve the quality system.

Credits: 3.00

IET 41100 - Applications Of Lean And Six Sigma Methodologies

Credit Hours: 3.00. This hands-on course focuses on emerging business practices that are geared toward making an organization more effective and efficient. Highlighted topics will include use of lean and six sigma methodologies in today's business environments. These methods are used for achieving long term profits through customer satisfaction, waste elimination, and elevation of employee skills to eliminate waste and defects at the source. Application of these methods in various environments such as service, health care and manufacturing organizations will be explored. Students are expected to work in teams to apply systematic problem solving

processes to solve case studies and/or real-world issues. Supporting concepts such as implementation of new business practices and culture change will also be explored.

Credits: 3.00

IET 41400 - Financial Analysis For Technology Systems

Credit Hours: 3.00. The course provides students with financial tools needed by managers in technical and service fields. Topics include financial statement analysis, using common-sized statements and financial ratios; the strategic profit model; total cost of ownership; pricing for profitability; margin management; cash flow cycles; and budgeting. A corporate financial analysis project is typically required.

Learning Outcomes: 1. Describe the key components of income statements and balance sheets. 2. Calculate financial ratios necessary to evaluate corporate performance. 3. Calculate typical complex business transactions. 4. Prepare a cash budget for a company. 5. Recommend courses of action for maintaining a stable cash flow. 6. Calculate and interpret the strategic profit model. 7. Evaluate and select the best corporate investment opportunity. Credits: 3.00

IET 43530 - Operations Planning And Management

Credit Hours: 3.00. A study of enterprise operations and management, demand forecasting, capacity analysis, research and development, production, personnel, and sales. Examples of the procedures necessary to provide a product or service are included. The course focuses on the tools necessary to solve problems, such as decision analysis, linear programming, transportation modeling, enterprise resource planning (ERP) systems, and forecasting models. Field trips may be required and industry-sponsored research projects are typically completed.

Learning Outcomes: 1. Explain key concepts of operations planning and management. 2. Explain the importance of enterprise resource planning (ERP) in technology systems management and supply chain operations. 3. Apply quantitative methods to solve operations management problems. 4. Define a problem, develop solution alternatives, and communicate findings to appropriate audiences. Credits: 3.00

IET 43540 - Facilities Planning And Material Handling

Credit Hours: 3.00. This course takes a systematic approach to design of facilities and material handling systems for effective and lean production of goods and services. An array of qualitative and quantitative tools and techniques are introduced and utilized, emphasizing lean principles, waste reduction, and overall efficiency of operations. Flow analysis and optimization tools, including computer simulation, are introduced. Strong emphasis is placed on a comprehensive semester-long team project as an integral component of this course.

Learning Outcomes: 1. Calculate various elements of time study and Takt time. 2. Apply various flow analysis tools. 3. Apply the principles of line balancing. 4. Calculate the efficiency of an assembly line. 5. Calculate facility space requirements. 6. Develop a systematic approach to layout and resource planning, incorporating basic material handling systems. Credits: 3.00

IET 43630 - Design Of Experiments

Credit Hours: 3.00. Introduction to statistical design of experiments. The course examines the difference between single, multivariate, and factorial experimental designs. Concepts of optimization and response surface methodologies are introduced. The course focuses on interpreting and communicating experimental results.

Learning Outcomes: 1. Formulate null and alternate hypotheses. 2. Apply appropriate statistical tests. 3. Design an appropriate experiment to test a hypothesis. 4. Differentiate between main effects and interaction effects. 5. Distinguish between factorial and fractional factorial designs. 6. Apply response surface methodology. Credits: 3.00

IET 43640 - Lean Six Sigma

Credit Hours: 3.00. A study of the Lean Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. The course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Lean Six Sigma methodology; and provides preparation for the Green

Belt Certification exam.

Learning Outcomes: 1. Explain how Lean Six Sigma principles are used for process improvement. 2. Apply the DMAIC method to solve technical systems problems. 3. Design/conduct experiments. 4. Analyze/interpret experiment results. 5. Communicate experiment findings. Credits: 3.00

IET 44275 - Global Transportation And Logistics Management

Credit Hours: 3.00. A study of the various aspects of logistics. The development, implementation, and control of physical transportation systems, product distribution, warehousing, and inventory policy models will be emphasized. A working knowledge of third and fourth-party logistics and transportation strategies will be analyzed. The impact of logistics and transportation in the global environment will be discussed.

Learning Outcomes: 1. Describe the role of logistics and its relationship to other functional areas of business within a single firm and within the supply chain. 2. Explain various management and control techniques in logistics. 3. Apply statistical principles to evaluate the relative worth of cost-savings initiatives in the logistics industry. 4. Describe how enterprise resource planning (ERP) systems are used to manage logistics and transportation functions. Credits: 3.00

IET 44500 - Strategic Supply Chain Management

Credit Hours: 3.00. A course designed to build upon previous courses with subjects related to managing a distribution enterprise. Modules in sales management, financial analysis, strategic planning, logistics, purchasing, and the legalities of distributor and manufacturer relationships will be combined with case studies to provide students with practice in establishing policy and making decisions from the manager's point of view. Field trips may be required.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision making. Credits: 3.00

IET 45400 - Statistical Process Control

Credit Hours: 3.00. Online process control including design and analysis of process control charts and sampling plans.

Learning Outcomes: 1. Know Operating Characteristics and Average Run Length curves. 2. Apply advanced control chart methods like short run, EWMA, CUSUM and DNOM charts. 3. Determine process capability indices, Cp, Cpk, Pp, Ppk, and Cpm. 4. Apply Taguchi loss function. 5. Apply design of experiments methodology. 6. Have knowledge of statistical tolerancing. Credits: 3.00

IET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

IET 48390 - Industrial Engineering Technology Capstone I: Problem Identification And Analysis

Credit Hours: 3.00. This is the first semester of a two-semester capstone sequence, which focuses on an industry-based, team approach to problem-solving. An array of qualitative and quantitative tools is used to identify and analyze an industrial or business process. Data collection, process maps, flow analysis, Pareto chart, computer simulation, and other optimization tools

will be used to identify problem areas and possible solutions.

Learning Outcomes: 1. Use appropriate research/design processes to identify problems or areas for improvement. 2. Participate effectively in teams. 3. Collect sufficient data to qualitatively and quantitatively describe/evaluate the problem. 4. Identify learning needs/knowledge gaps needed in order to complete projects(s). 5. Propose and properly document a potential design solution or process improvement. 6. Demonstrate ethical conduct, describing societal, environmental, and economic implications of proposed solutions. Credits: 3.00

IET 48395 - Industrial Engineering Technology Capstone II: Project Design

Credit Hours: 3.00. This is the second course of two-semester capstone sequence, addressing an industry-based problem. The focus of the course is on designing and implementing an acceptable solution to the project/problem.

Learning Outcomes: 1. Participate effectively in teams. 2. Use appropriate research and discipline processes to design a solution. 3. Develop a final project report, properly acquiring, using, and citing sources. 4. Identify limitations/improvements as well as strengths of the design solution. 5. Present final design recommendations. Credits: 3.00

IET 48490 - Supply Chain Management Technology Capstone I: Strategic Planning

Credit Hours: 3.00. This course is the first of two integrative capstone courses for senior-level students. The focus is on how firms formulate, implement, and evaluate strategies. Teams of students will integrate program knowledge, coupled with strategic-management techniques learned, to make decisions and help chart the future of different organizations. The major responsibility of students in the capstone courses is to make objective strategic decisions and to justify them through oral and written communication.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision making. Credits: 3.00

IET 48495 - Supply Change Management Technology Capstone II: Strategic Analytics

Credit Hours: 3.00. This course is the second of two integrative capstone courses for senior-level students. Students will continue working in teams using a variety of planning and decision-making models to work with organizations to solve problems and make sound decisions. The major responsibility of students in the capstone courses is to make objective strategic decisions and to justify them through oral and written communication.

Learning Outcomes: 1. Develop, evaluate, and implement business strategies needed to successfully manage supply chain operations. 2. Describe a strategic planning model appropriate for use in supply chain operations. 3. Apply concepts, models, and methods that are useful in strategic development. 4. Apply analytics and techniques for strategic decision-making. 5. Develop business evaluation and critical thinking skills. 6. Describe the basic philosophies underlying ethical decision-making. Credits: 3.00

IET 49000 - Special Topics In Industrial Engineering Technology

Credit Hours: 1.00 to 3.00. Supervised individual research in industrial engineering technology topics. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes will vary for each instance the course is offered. Credits: 1.00 to 3.00

IET 49900 - Industrial Engineering Technology

Credit Hours: 1.00 to 9.00. Hours and subject matter to be arranged by staff. Course may be repeated for credit.

Credits: 1.00 to 9.00

MET 10200 - Production Design And Specifications

Credit Hours: 3.00. The design, evaluation, and documentation of engineering specifications required of manufacturability and assembly are introduced. Emphasis is on CAD-based details, assemblies, design layouts, equipment installations, and related industrial practices.

Learning Outcomes: 1. Follow current American National Standards practices in generating a complete assembly/detail dimensioned set of drawings. 2. Use references to verify design intent by calculating and documenting via standard practices, allowable limits and multi-part fits. 3. Seek answers to questions on technical specification, company procedures, products or services. Credits: 3.00

MET 11100 - Applied Statics

Credit Hours: 3.00. Force systems, resultants and equilibrium, trusses, frames, beams, and shear and moments in beams are studied.

Learning Outcomes: 1. Determine the resultant of several vectors. 2. Draw complete free-body diagrams. 3. Apply the equations of equilibrium to free-body diagrams. 4. Calculate the axial loads in truss members and the pin reactions for various mechanisms and frames. 5. Locate the centroid of a composite geometric quantity. Credits: 3.00

MET 11300 - Mechanics Applications

Credit Hours: 1.00. Concepts of mechanics are applied to structures, machine components, and frames. Stresses and deformations resulting from axial, shear, torsional, and flexural loads are considered. Kinematics and kinetics of motion are introduced.

Learning Outcomes: 1. Solve linear and rotational kinematics problems that are based on constant or linearly-varying acceleration. 2. Apply the principles of dynamic equilibrium to solve linear particle and rotational kinetics problems. 3. Calculate axial stress, shear stress, bearing stress, torsional stress, and flexural stress. 4. Use material properties and design factors to confirm simple loading of machines, frames, beams, and columns. Credits: 1.00

MET 14300 - Materials And Processes I

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of metals and ceramics commonly used in industry is presented. Problem solving skills are developed in the areas of materials selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure, characteristics and properties of metals and ceramics. 2. Understand the common manufacturing processes used for metals and ceramics. 3. Communicate with colleagues in the field using the vocabulary of metals and ceramics and their manufacturing processes. 4. Conduct, analyze and interpret standard material tests for metals and ceramics. 5. Describe key design considerations for components made of metals and ceramics. Credits: 3.00

MET 14400 - Materials And Processes II

Credit Hours: 3.00. An overview of structures, properties, processing, and applications of polymers, composites, laminates, biomaterials, green materials, nanomaterials, and pharmaceuticals commonly used in industry is presented. Problem solving skills are developed in the areas of material selection, evaluation, measurement, and testing.

Learning Outcomes: 1. Understand the structure and characteristics of major polymers, and related industry terminology. 2. Conduct standard polymer material tests. 3. Describe key design considerations for polymer process equipment components. 4. Describe fibers, matrices, and fabrication techniques related to various composite materials. 5. Identify green materials and green manufacturing strategies. 6. Describe biomaterials and biomedical device manufacturing concepts. Credits: 3.00

MET 16000 - Analytical And Computational Tools In MET

Credit Hours: 3.00. The skills needed to solve technical problems in mechanical engineering technology are developed. Instruction is given in analytical and computational problem-solving techniques. The electronic calculator, the factor-label method of unit conversions, engineering graphs, and the computer are used to solve problems. Computer emphasis is on spreadsheet analysis, graphics, and generation of technical reports through the integrated use of software packages. Credit will not be granted for MET 16000 and MET 16200 or MET 16300.

Credits: 3.00

MET 16200 - Computational Analysis Tools In MET

Credit Hours: 1.00. Instruction is given in analytical and computational problem-solving techniques. The electronic calculator, the factor-label method of unit conversions, and engineering graphs are used to solve technical problems in mechanical engineering technology. Credit will not be granted for both MET 16000 and 16200.

Learning Outcomes: 1. Demonstrate algebraic techniques for solving systems of equations. 2. Demonstrate geometric understanding related to areas and volumes of shapes. 3. Demonstrate trigonometry techniques of basic trigonometric functions, theorems, and laws. 4. Apply U.S. Customary and S.I. units in calculations. 5. Apply linear interpolations of tabular data. 6. Draw graphs using software. Credits: 1.00

MET 16400 - Computing In Engineering Technology

Credit Hours: 3.00. Fundamental programming concepts are introduced using an interpreted high level programming language. Programming topics such as variable types, arrays, input/output tasks, and conditional and repetition executions will be applied to address technical problems seen in the first two years of engineering technology curricula.

Learning Outcomes: 1. Write programs to perform calculations. 2. Apply conditional and repetition logic to produce intended results. 3. Obtain input data for program manipulation. 4. Produce output data for subsequent use. Credits: 3.00

MET 20400 - Production Drawing

Credit Hours: 3.00. Application of principles of engineering drawing to design layout, detail, and assembly. A 2D PC CAD-centered laboratory.

Credits: 3.00

MET 21100 - Applied Strength Of Materials

Credit Hours: 4.00. The principles of strength, stiffness, and stability are introduced and applied primarily to mechanical components.

Learning Outcomes: 1. Find internal shear and internal bending moment within a structure due to the external loading. 2. Undertsand basic mechanical properties of materials and cross-sectional/area properties of structures and apply them. 3. Identify and calculate the stress present due to internal loads. 4. Identify potential maximum stress locations and calculate the principle stresses and the maximum shear stress. 5. Calculate deflection in statically determinate structures. Credits: 4.00

MET 21102 - Applied Strength Materials Lab

Credit Hours: 1.00. This laboratory course focuses on testing of materials to determine their physical and mechanical properties. Students will verify physical testing through computer analysis using appropriate computer application and prepare reports from data secured from such tests and analysis.

Learning Outcomes: 1. Demonstrate an understanding of the basic principles of Strength of Materials. 2. Apply previous analytical skills from mathematics and MET prerequisite courses to new areas of application. Therefore, demonstrate proficiency in performing strength of materials experimentation. 3. Show understanding of "Stress and Strain Transformation." 4. Demonstrate proficiency in determination of Combined Stresses and beam deflection. 5. Conduct experiments involving equipment compliant with industry standards and perform

calculations on experimental results to assist in analyzing data. 6. Draw conclusions concerning material behavior under various testing and/or loading conditions and prepare lab reports using a structured approach. Credits: 1.00

MET 21300 - Dynamics

Credit Hours: 3.00. Kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.

Learning Outcomes: 1. Identify the type of solution method required for dynamics problems. 2. Use kinematics, work/energy principles, conservation of energy, impulse/momentum, or conservation of momentum to solve dynamics problems. 3. Identify the correct coordinate system type for various dynamics problems. 4. Calculate the mass moment of inertia for basic and composite shapes. 5. Use mass moment of inertia when solving a dynamics problem. Credits: 3.00

MET 21400 - Machine Elements

Credit Hours: 3.00. The methods developed in statics, dynamics, and strength of materials are applied to the selection of basic machine components. The fundamental principles required for the selection of individual elements that compose a machine are developed. Selected course topics are included as computer exercises.

Learning Outcomes: 1. Apply principles and methods from statics, dynamics, and strength of materials to the selection of machine components. 2. Develop skill in using, reading, and interpreting necessary materials such as tables, charts, graphs, and industrial catalogs as part of appropriate problem solution. 3. Use the underlying concepts and theories of machine elements to select appropriate solution methods for specific problem solutions. Credits: 3.00

MET 22000 - Heat And Power

Credit Hours: 3.00. Heat/Power is an introduction to the principles of thermodynamics and heat transfer. Basic thermodynamic processes are used to evaluate the performance of energy-based systems such as internal combustion engines, power plants, and refrigeration equipment.

Learning Outcomes: 1. Determine properties of gases, steam, and refrigerants. 2. Analyze fixed mass and steady flow control volume systems and devices. 3. Apply fundamental concepts of the 2nd Law of Thermodynamics to heat-work energy conversion and thermal efficiency. Credits: 3.00

MET 22010 - Heat-Power Laboratory

Credit Hours: 1.00. Laboratory course that introduces the principles of thermodynamics and heat transfer through energy systems. Permission of department required.

Learning Outcomes: 1. Apply the First Law of Thermodynamics and conversation of mass to analyze when testing fixed mass (closed) and steady flow control volume (open) systems and devices. 2. Understand the fundamental concepts of the Second Law of Thermodynamics and their application. Apply them to conversations between heat and work and to thermal efficiency. 3. Test thermodynamic systems involving cycles such as Otto, Diesel, Rankine, and refrigeration cycles. 4. Identify and operate laboratory equipment typically used in measurement and analysis of thermal systems. 5. Use application software for analyzing, documenting, and presenting the results of technical work. Credits: 1.00

MET 23000 - Fluid Power

Credit Hours: 3.00. This course consists of the study of compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions, and controls.

Learning Outcomes: 1. Design hydraulic and pneumatic systems. 2. Compute various properties related to fluids and fluid power systems using appropriate mathematical

equations and tools. 3. Analyze both hydraulic and pneumatic fluid power systems and their relevant components. 4. Demonstrate the efficient use of various components as part of a fluid power system. 5. Analyze the results from standard computing and simulation tools to create presentations and reports. Credits: 3.00

MET 24500 - Manufacturing Systems

Credit Hours: 3.00. This course surveys the manufacturing processes and tools commonly used to convert cast and molded, formed, and joined materials into finished products. It includes the fundamentals of material removal, measurement, statistical quality control, assembly processes, process planning and optimization, CNC programming and automated manufacturing.

Learning Outcomes: 1. Select and use appropriate measurement instruments and quality control methods, interpret their results, recognize potential issues and resolve them. 2. Select appropriate machining operations, appropriate tooling, and determine basic process parameters. 3. Recognize basic features of a manufacturing system and methods for its improvement towards cellular manufacturing. Credits: 3.00

MET 28400 - Introduction To Industrial Controls

Credit Hours: 3.00. This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.

Learning Outcomes: 1. Identify and explain the fundamental operation of various discrete input devices and output actuators that are commonly used with PLC-based control systems. 2. Identify, describe, and effectively use the core instructions contained in a PLC's instruction set. 3. Demonstrate the ability to successfully use the PLC programming software to perform common programming tasks. 4. Read writing diagrams and wire I/O devices. Credits: 3.00

MET 29000 - Special Topics In MET

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of Mechanical Engineering Technology is provided by MET faculty, subject to MET curriculum subcommittee approval.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

MET 29900 - Mechanical Engineering Technology

Credit Hours: 1.00 to 3.00. Independent project or laboratory work is conducted under the supervision of appropriate MET faculty. Hours and subject matter must be arranged by instructor and approved by MET curriculum subcommittee. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

MET 30200 - CAD In The Enterprise

Credit Hours: 3.00. Theory and practice of management, use and integration of computer-aided design systems, and related engineering tools and practices are studied as they are applied in the industrial enterprise. Emphasis is on course projects.

Learning Outcomes: 1. Operate a variety of CAD software packages to create models, assemblies, and fully annotated mechanical and electrical drawings that adhere to accepted drafting standards. 2. Appropriately apply GD&T, fits and tolerances to complex mechanical assemblies. 3. Develop practical system designs and part designs that are capable of being manufactured, including visual, calculated, and simulated analysis to assure design validity. 4. Transfer CAD files of various file formats to CAM software and set up simple tool path operations for machining. Credits: 3.00

MET 31000 - Computer-Aided Machine Design

Credit Hours: 3.00. Introduction to the use of specialized programs to analyze machine components such as shafts, linkages, springs, and cams. Use of finite element analysis to analyze mechanical systems.

Credits: 3.00

MET 31100 - Experimental Strength Of Materials

Credit Hours: 3.00. Selected advanced topics from the areas of mechanics of materials, structures, stress analysis, and strain measurements are considered. Basic electronic strain gage circuits and instrumentation are presented, with emphasis on transducer applications.

Learning Outcomes: 1. Calculate principal stresses, maximum shear stress, and principal direction in a plane when given the loading condition. 2. Select, locate and mount strain gages for the measurement of strain in an experimental structure. 3. Analyze the stress in a structure based on the strain data when given appropriate material information. 4. Perform an open-ended experimental investigation in solid mechanics using strain gages or other experimental stress methods. Credits: 3.00

MET 31300 - Applied Fluid Mechanics

Credit Hours: 3.00. The fundamental principles of fluid mechanics are developed, including properties of fluid, pressure, hydrostatics, dynamics of fluid flow, friction losses, and sizing of pipes. Emphasis is on problem solving.

Learning Outcomes: 1. Apply hydrostatic equations to static and dynamic fluid problems. 2. Solve problems involving flow over immersed bodies. 3. Analyze piping systems for closed conduit flow. 4. Select pumps to optimize open and closed loop flow systems. Credits: 3.00

MET 31400 - Applications Of Machine Elements

Credit Hours: 3.00. The methods developed in statics, dynamics, and strength of materials are applied to the selection of basic machine components (gears, shafts, bearings, chain and belt drives, clutches and brakes, and motors).

Learning Outcomes: 1. Analyze and design chain and belt drive systems. 2. Analyze, design, and select appropriate gears for a machine. 3. Identify motors that are appropriate to use in a machine with specific components and loading criteria. 4. Analyze a machine to select rolling element bearings based on loading and life requirements. 5. Design clutches and brakes that store and/or transfer rotational energy. Credits: 3.00

MET 31500 - Applied Mechanism Kinematics And Dynamics

Credit Hours: 3.00. Displacements, velocities, and accelerations are determined using graphical, semi-graphical, and numerical analyses of rotational and translational motions of common mechanisms such as linkages, cams, gears, screws, and chains as well as their loading.

Learning Outcomes: 1. Categorize and model common mechanisms, including their degrees of freedom. 2. Determine the displacements, velocities, and accelerations in common linkages. 3. Analyze and synthesize common mechanisms (e.g., linkages, cams, gears, screws, belts, chains, shafts). 4. Use software in kinematic analysis and synthesis. Credits: 3.00

MET 31601 - Mechanics Of Machine Design

Credit Hours: 3.00. Concepts of stress and strain analysis under combined loadings are introduced. Analyses emphasize use of von Mises stress, Mohr's circle, static failure theories, and fatigue failure criteria. Structural joints and buckling are also analyzed.

Learning Outcomes: 1. Analyze stresses in mechanical bodies and structures subjected to combined loadings. 2. Apply static failure criteria in the analysis and design of mechanical bodies. 3. Apply fatigue assessment methods in the analysis and design of mechanical bodies subjected cyclic loadings. 4. Perform buckling analysis in columns. 5. Analyze structural joints. Credits: 3.00

MET 31700 - Machine Diagnostics

Credit Hours: 3.00. A broad spectrum of equipment behavior is introduced through the study of four major operating parameters: vibration, noise, temperature, and lubrication. Emphasis is placed on measurement and analysis of data using diagnostic instrumentation and techniques found in modern process and manufacturing plants.

Learning Outcomes: 1. Determine the equation of motion for a single degree of freedom

vibrating system. 2. Experimentally determine system vibration characteristics. 3. Understand and apply the principles for condition-based maintenance to diagnose machinery problems. 4. Develop and complete an open-ended diagnostics project. Credits: 3.00

MET 31800 - Applied Room Acoustics

Credit Hours: 3.00. Concepts of acoustics are applied to rooms, automotive applications, speakers, musical instruments, audio electronics, and other areas of interest. Modeling and design skills are developed through applied labs and a semester project. Lectures and mathematical exercises are combined with hands-on labs and a semester project to link abstract and physical concepts. As part of the semester project, a special fee will be assessed to be used towards materials for the semester project.

Learning Outcomes: 1. Analyze sound in terms of amplitude and frequency content. 2. Analyze the signal chain in a sound system (course will use a typical commercial sound system as a basis for discussion). 3. Describe the basic types of room treatments for different acoustical environments. 4. Describe the basic function of filters. 5. Analyze acoustic spaces using modeling software. 6. Design the acoustic performance of an enclosed space given representative physical and economic requirements. Credits: 3.00

MET 32000 - Applied Thermodynamics

Credit Hours: 3.00. Following a review of fundamental concepts, advanced power and refrigeration cycles are analyzed. Applications such as gas mixtures, air-vapor mixtures, and chemical reactions of combustion processes are presented.

Learning Outcomes: 1. Use thermodynamic properties of gases and vapors in system analysis. 2. Apply the first and second laws of thermodynamics to real and ideal systems. 3. Analyze thermodynamic cycles (e.g., Otto, Diesel, Brayton, Rankine, vapor compression). 4. Compute properties of gas mixtures. Credits: 3.00

MET 32800 - CAD/CAM For Mechanical Design Drafting

Credit Hours: 3.00. Basic operation of mechanical design-drafting. A PC CAD (2D and 3D) laboratory-centered course introducing the basic steps involved in the geometric design of mechanical parts. This class provides an overview and continues into a detailed investigation of parametric modeling. Parametric modeling concepts will be applied to problems using standard industrial practices. Students must possess a solid background in engineering or technical graphics.

Credits: 3.00

MET 33400 - Advanced Fluid Power

Credit Hours: 3.00. Hydraulic and pneumatic circuits and their steady state and time-variant behavior as it affects the selection and design of components and systems used in fluid power transmission and motion control are studied. Emphasis is placed on industrial and mobile applications, but the principles also apply to aerospace, marine, and other fluid power systems.

Learning Outcomes: 1. Utilize the applicable laws of fluid mechanics to compute the requirements of fluid power systems. 2. Utilize computer software to evaluate starting and stopping transient behaviors in hydraulic systems. 3. Design motion control strategies with various actuators and valves to accomplish a specified task with hydraulic and pneumatic systems. 4. Analyze the performance of various pumps and compressors and specify the appropriate pump or compressor for a hydraulic or pneumatic system. Credits: 3.00

MET 33800 - Manufacturing Processes

Credit Hours: 4.00. Course covers basic fabrication and material removal manufacturing processes. Areas studied include casting, forging, material joining, forming, basic metal removal mechanisms, automated manufacturing processes, dimensional metrology for quality control and manufacturing process planning. The course emphasizes the selection and application of the various manufacturing processes. Permission of department required.

Credits: 4.00

MET 34500 - Welding Processes

Credit Hours: 3.00. Welding processes, equipment, and

weldments are studied. An in-depth look is taken into welding processes, welding problems, quality control, inspection methods, welding filler metals, welding equipment, and weldment design.

Learning Outcomes: 1. Understand welding variables and processes. 2. Specify appropriate welding processes, equipment, and consumables for various welding operations. 3. Perform cost estimations for different weldments. 4. Write basic weld procedure specifications. Credits: 3.00

MET 34600 - Advanced Materials In Manufacturing

Credit Hours: 3.00. Metals, polymers, ceramic, and composite materials are studied. Crystal structure, molecular behavior, and the effects of various processes on material properties are considered. Course emphasizes the development and control of material properties to meet engineering requirements and specifications.

Learning Outcomes: 1. Describe common materials and major manufacturing processes. 2. Understand the process-property interaction for materials and manufacturing processes, including the major processes in strengthening materials. 3. Describe methods for measuring material properties. 4. Describe microstructure evolution of materials during casting, hot working, cold working, and heat treating processes. 5. Use appropriate tools for materials design and selection. Credits: 3.00

MET 34800 - Engineering Materials

Credit Hours: 4.00. An overview of structures, properties and applications of metals, polymers, ceramics, and composite materials is presented. Problem-solving skills are developed in material selection, evaluation, measurement, and testing. Laboratory activities include testing various properties of different materials, and the selection of materials for engineering application. Permission of department required.

Credits: 4.00

MET 34900 - Stringed Instrument Design And Manufacture

Credit Hours: 3.00. Concepts, knowledge, and skills in experimental mechanics, production processes, and design are integrated to manufacture a working musical instrument. Production concerns such as fixture design, process variability, and validation testing comprise key course elements.

Learning Outcomes: 1. Demonstrate understanding of the product development process. 2. Manage project and time to complete individual and team goals. 3. Synthesize design, manufacturing, and testing constraints, resulting in a working product. Credits: 3.00

MET 35000 - Applied Fluid Mechanics

Credit Hours: 3.00. The fundamentals of fluid mechanics including properties of fluid, pressure, hydrostatic force on submerged areas; kinematics and dynamics of fluid flow; friction losses and sizing of pipe.

Credits: 3.00

MET 36000 - Heating, Ventilating, And Air-Conditioning

Credit Hours: 3.00. A study of heat losses, heat-producing equipment, and cooling equipment in addition to the design of the direct systems. Includes controls and cost estimating for commercial, industrial, and residential systems. Codes and standards are emphasized throughout the course.

Credits: 3.00

MET 37900 - Introduction To Aerospace Technology

Credit Hours: 3.00. An overview of flight vehicle design is introduced through designing and making radio controlled model flight vehicles. Aerodynamic forces, dynamics and longitudinal stability are studied. Students will make airframes, integrate the controls, and test fly the resulting vehicles.

Learning Outcomes: 1. Evaluate minimum and maximum speed, climb rate, and power requirements for a flight vehicle. 2. Summarize stability parameters for a flight vehicle. 3. Explain basic performance characteristics of turbine and rocket engines. 4. Estimate performance of a flight vehicle using analysis or a simulation software package. 5. Prototype a model flight vehicle. Credits: 3.00

MET 38200 - Controls And Instrumentation For Automation

Credit Hours: 3.00. Study of the procedures and techniques essential to industrial measurement and transmission of data is provided in the areas of microprocessor control, process control, and automated testing. Concepts of hysteresis, repeatability, weighted signals, span, suppression, range, and closed loop control are emphasized.

Learning Outcomes: 1. Evaluate and select sensors for a given application based on relevant specifications. 2. Select a data acquisition system based on the requirements of a given application. 3. Explain how process gain, dead band, and lag affect the performance of a closed loop control system. 4. Tune a closed loop PID controller. Credits: 3.00

MET 39200 - Laboratory Assistant In Engineering Technology

Credit Hours: 0.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Intended for upper division students. Course content meets the MET Professional Experience requirement. Permission of department and instructor required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 0.00 to 3.00

MET 40100 - Capstone Projects I

Credit Hours: 3.00. This course deals with the planning for capstone projects. Methods to develop engineering requirements to meet project needs and formal design techniques are studied. Planning and design alternatives to meet cost, performance, and user-interface goals are emphasized. System tests and measurements are considered. Project planning, scheduling, and management techniques are studied. Different design approaches are compared.

Learning Outcomes: 1. Apply the engineering design lifecycle process. 2. Evaluate customer needs when defining a solution. 3. Evaluate design alternatives to determine the most appropriate design to pursue. 4. Define a plan for project development. 5. Propose a solution to a technical problem. Credits: 3.00

MET 40200 - Capstone Projects II

Credit Hours: 3.00. This is the second of two courses in a capstone project sequence. Project management and system engineering methods are applied to solving an engineering problem. Permission of instructor required.

Learning Outcomes: 1. Create a functional prototype. 2. Weigh design alternatives for requirements, efficiency, reliability, and cost. 3. Apply formal test procedures, including data analysis. 4. Present project results orally and in writing. Credits: 3.00

MET 41100 - Introduction To The Finite Element Method

Credit Hours: 3.00. The finite element method is introduced, with emphasis on modeling and interpretation of results. Linear static problems are solved using commercial FEA software, and FEA results are verified through laboratory tests and/or theoretical calculations. Topics include trusses, frames, plane stress/strain, torsion, 3D structures, buckling, and natural frequency/mode shape analyses.

Learning Outcomes: 1. Select and use the appropriate element type in the construction of FEA models for linear static, buckling, and frequency and mode shape analyses. 2. Demonstrate knowledge of meshing, symmetry, and the application of loads and constraints in the construction of FEA models. 3. Understand and demonstrate the use of mechanical testing, analytical calculation, and verification problems as a check on FEA solution accuracy. 4. Perform and open-ended design problem involving the application of FEA in a linear static or thermal problem. Credits: 3.00

MET 41400 - Design Of Mechanical Projects

Credit Hours: 3.00. Application of the fundamental principles of mechanical, hydraulic, and electrical technology to the design of mechanical systems. Discussion of the design process and continuation of topics in the design of machine elements. A semester design project is required.

Credits: 3.00

MET 42100 - Air Conditioning And Refrigeration

Credit Hours: 3.00. Heat gains and losses, heat-producing equipment, cooling, and refrigeration equipment are studied.

System design is presented, including controls and instrumentation for commercial, industrial, and residential systems.

Learning Outcomes: 1. Recognize and explain the operation of common refrigeration and air conditioning equipment. 2. Evaluate the performance of refrigeration and air conditioning equipment. 3. Use appropriate instrumentation for accurate measurements of HVAC&R equipment performance. 4. Identify equipment, operating strategies, or management practices that encourage energy conservation and sustainable buildings. 5. Apply standard industry practices to the design of HVAC&R systems. Credits: 3.00

MET 42200 - Power Plants And Energy Conversion

Credit Hours: 3.00. The theories and skills learned from prerequisite coursework are applied to the analysis and design of power plants and their systems and to selected technologies of energy conversion. Industrial procedures and methods are emphasized.

Learning Outcomes: 1. Identify the efficiency of power cycles. 2. Detect and locate major components in power generation circuits and renewable power generating systems. 3. Evaluate turbines and cooling water systems. 4. Identify various types of fuel available in the utility industry and renewable energy sources. 5. Describe typical power plant pollutants. 6. Identify current technologies and policies that impact the development of new power plants. Credits: 3.00

MET 42600 - Internal Combustion Engines

Credit Hours: 3.00. Introduces the operating principles of internal combustion engines with emphasis on performance, efficiency, and emissions. Students will evaluate engine performance through geometric, kinematic, and thermodynamic analysis. Introduces advanced thermodynamic cycles and trends in internal combustion engine technology.

Learning Outcomes: 1. Describe the principles of internal combustion engine operation. 2. Calculate engine geometric and operating parameters. 3. Analyze engine performance through kinematic, kinetic, and thermodynamic calculations. 4. Evaluate advanced engine technologies and explain their impact on emissions and performance. 5. Describe the social and environmental impact of internal combustion engines from historical and contemporary perspectives. 6. Design an internal combustion engine for use in an on-road or off-road vehicle system. Credits: 3.00

MET 43200 - Hydraulic Motion Control Systems

Credit Hours: 3.00. Hydraulic feedback motion control systems, types, and applications are studied. Simulation and performance of closed loop control systems with single and multiple signal paths are emphasized. Dynamic system performance is predicted and evaluated. System parameters including accuracy, response speed, fluid compressibility effects, load disturbances, and nonlinear behavior of the components are studied.

Learning Outcomes: 1. Identify the origins, development and applications of servo mechanisms. 2. Explain hydraulic system and component nonlinearities such as friction, deadband, backlash, and hysteresis. 3. Recognize control terms, definitions, and fluid power components of a hydraulic system. 4. Evaluate transfer functions and their use in predicting the performance of a system. 5. Utilize computer software simulation tools to investigate the dynamic performance of simple control loops. 6. Develop methods for improving hydraulic system stability through the use of simulation tools. Credits: 3.00

MET 43600 - Pneumatic Motion Control Systems

Credit Hours: 3.00. The application of pneumatic motion control systems to industrial motion control and robotics is studied. Circuit design with control logic of both fluid and electronic types is stressed, as applied to pneumatic point-to-point and proportional controls. Control designs are implemented, tested, and evaluated in the laboratory.

Learning Outcomes: 1. Identify the internal parts and the operation of pneumatic

components. 2. Design pneumatic systems integrating electronic input/output controls. 3. Construct single and multiple pneumatic cylinder/motor systems utilizing directional control valve technology. 4. Evaluate pneumatic control systems using simulation software. 5. Estimate the power loss due to air leakage in a pneumatic system. 6. Design closed loop control systems used in diverse pneumatic applications. Credits: 3.00

MET 44200 - Plastics Manufacturing Systems

Credit Hours: 3.00. Basic control theory, heat transfer, machine design principles, and basic polymer science are applied to analysis and design of polymer manufacturing systems. Emphasis is placed on thermoplastics processes such as extrusion and injection molding. Projects include design of new machinery, major renovations of existing processes, and automation of processes.

Learning Outcomes: 1. Understand the terms and principles of mold and pattern design for plastics manufacturing. 2. Develop a solid understanding of factors that drive plastics manufacturing processes. 3. Use simulation software for pre manufacturing analysis and compare to the actual part once manufactured. 4. Explain how to conduct a design of experiments process to make basic recommendations related to product and/or process design which would allow more efficient manufacturing. 5. Develop an understanding of the common polymers and appropriate application for different manufacturing processes. Credits: 3.00

MET 44301 - Joining Processes

Credit Hours: 3.00. Topics cover joining technologies such as fastening, welding, brazing/soldering, adhesive, and diffusion bonding processes of metals, ceramics, plastics, and composites. The materials, processes, destructive and non-destructive evaluation, and design aspects of these technologies as well as current production practices will be presented. Emphasis will be placed on identification and optimization of key processing parameters. Students will be exposed to commonly used technologies, equipment, and methods for joint design, formation, testing, and optimization to better understand key parameters and process variables, and their influence on optimum joint designs.

Learning Outcomes: 1. Understand the operating principles, advantages and limitations of commonly used joining processes, including application to optimize joint design. 2. Develop a solid understanding of the response of materials to joining processes and joint functionality. 3. Identify the key parameters of major joining processes and their optimization in various production and product design scenarios. 4. Apply common techniques for quality measurement and control to joining processes. 5. Recommend changes to product and/or process design for more efficient manufacturing. Credits: 3.00

MET 44400 - Applied Metallurgy

Credit Hours: 3.00. Metals used in common engineering applications are studied to determine how their properties are achieved. Photomicrographic and other methods are employed to investigate the alloying, hotworking, coldworking, and heat treating processes of these metals. Detection, identification, and diagnosis of metal failure are included.

Learning Outcomes: 1. Understand common metallurgical processes and their effects on the microstructures and mechanical properties of alloys. 2. Identify phases in alloys using microscopes. 3. Correlate phases to the deformation and failure of alloys. 4. Apply knowledge that has been learned in the class to solve real world problems. Credits: 3.00

MET 44500 - Applied Metalcasting

Credit Hours: 3.00. This course applies metalcasting principles from concept through final product. Students design and optimize essential elements of casting systems using both simulation and fabrication methods and testing.

Learning Outcomes: 1. Apply sound design and manufacturing principles in the production of metal-cast products. 2. Design effective and efficient molds for multiple metal-cast products. 3. Apply methods to effectively identify, prevent

and correct common product defects. 4. Demonstrate effective use of applicable software optimization tools. 5. Safely demonstrate metalcasting production techniques and practices. Credits: 3.00

MET 45100 - Manufacturing Quality Control

Credit Hours: 3.00. (MFET 45100) Quality control practices used in manufacturing industries; management, statistical control charts, reliability, sampling plans, economics, computer methods, and test equipment are presented and applied. Credit will not be granted for both MET 45100 and MFET 45100.

Learning Outcomes: 1. Apply the theory, principles, and applications of various quality management philosophes. 2. Measure and collect data in a variety of manners using technical standards related to sampling plans and quality process documentation. 3. Work in teams to conduct measurement system analysis and statistical process control (SPC). 4. Develop a solid understanding of how to utilize common quality management tools. 5. Conduct quality control experiments commonly used in industry for different manufacturing processes. Credits: 3.00

MET 45200 - Advanced GD&T Concepts Applied To Product Quality

Credit Hours: 3.00. This course explores the theory and application of Geometric Dimensioning and Tolerance (GD&T) to measurement systems and the programming necessary to insure product quality.

Learning Outcomes: 1. Develop a comprehensive understanding of GD&T standards and callouts and how they apply to product quality. 2. Develop and demonstrate a comprehensive understanding of the critical components, capabilities, and software of CMMs and similar product measurement systems. 3. Apply uncertainty principles to measurement data to determine critical parameters associated with CD&T controls of product quality. Credits: 3.00

MET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MET 48200 - Mechatronics

Credit Hours: 3.00. Fundamental concepts and applications of practical mechatronics are presented, with emphasis on product design, systems integration, and functional relationships between mechanical structure, sensor data, precision actuators, power resources, embedded microcontrollers, control logic, and drives. Students gain hands-on experience with mechatronics components and measurement equipment which is applied in a team-based design-build mechatronics system project.

Learning Outcomes: 1. Describe the design and operation of mechatronics. 2. Demonstrate input/output characteristics of microcontroller and its interfacing. 3. Create a mechatronic system solution to a given problem. 4. Explain programming and interfacing issues involved in the design of mechatronic system. Credits: 3.00

MET 49000 - Special Topics In MET

Credit Hours: 1.00 to 3.00. Group instruction in new or specialty areas of mechanical engineering technology is provided by MET faculty, subject to MET curriculum subcommittee approval. Hours, subject matter, and credit to be arranged by faculty.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00 to 3.00

MET 49900 - Mechanical Engineering Technology

Credit Hours: 1.00 to 6.00. Independent project or study of a special topic is conducted under the supervision of appropriate MET faculty. Hours and subject matter must be arranged with the instructor and approved by the MET curriculum subcommittee before enrolling in the course. Permission of instructor required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 1.00 to 6.00

MFET 10301 - Geometric Modeling Applications

Credit Hours: 3.00. This course provides an introduction to the process of 3D geometric CAD modeling, and the construction techniques used in the creation of constraint-based solid and surface models used in engineering disciplines. Part modeling and assembly modeling are included, as well as manipulation of the geometric model to derive variant designs. Emphasis is on the use of the engineering design process as a problem-solving method to capture modeling behavior to enable the downstream use of 3D data in the overall product design process, and its re-use in the product lifecycle.

Learning Outcomes: 1. Demonstrate fluency in constraint-based modeling techniques using commercial CAD tools. 2. Understand the role of geometric modeling in the product lifecycle. 3. Create effective 3D CAD data to support the incorporation of design intent. 4. Manipulate a solid model database to support geometry re-use in a PLM setting. 5. Understand the primary differences between constraint-based, NURBs, behavioral and polygonal modeling and their application to various communicative problems and tasks. Credits: 3.00

MFET 11301 - Product Data Management

Credit Hours: 3.00. This course provides an understanding of the types of data generated and used in the product lifecycle, the current tools and methodologies in the management of that data, and system analysis and implementation techniques for using PDM as the backbone supporting a company's product development and implementation activities. Interaction between various enterprise systems is discussed.

Learning Outcomes: 1. Develop a significant understanding of concepts, applications, and procedures involved in the controlling, protecting, and accessing product definition data. 2. Understand and apply Product Data Management (PDM) technologies and methods in a Product Lifecycle Management (PLM) environment. 3. Use a PDM system from the end-user perspective, simulating various workflows. 4. Understand basic principles of project management. 5. Understand the creation and importance of object metadata. 6. Describe the relevance of PDM in model-based enterprises. Credits: 3.00

MFET 15900 - Introduction To The Smart Manufacturing Enterprise

Credit Hours: 1.00. This course serves as an introduction to modern smart manufacturing methods and processes. The course explores the manufacturing enterprise in different industry contexts to illustrate multiple, varied paths to inform students of multiple career opportunities.

Learning Outcomes: 1. Define the multiple areas that rely on the manufacturing process and connected enterprise. (Case studies, guest speakers) 2. Demonstrate understanding of the fundamentals of historical technology evolution and potential future trends of manufacturing through Industry 1.0, Industry 2.0, Industry 3.0, Industry 4.0, etc. 3. Identify potential manufacturing methods and processes in modern smart manufacturing. (Case studies, guest speakers) 4. Apply knowledge of different manufacturing methods to design a prototype of a manufacturing process. (prototyping and presentation) Credits: 1.00

MFET 16300 - Foundations In Geometric Modeling And Data Management

Credit Hours: 2.00. This course introduces the process of 3D geometric modeling, and the construction techniques used in the creation of constraint-based solid and surface models. Part modeling and assembly modeling are included, as well as manipulation of the geometric model. Emphasis is on the use of the design process as a problem-solving method and the capture of design intent and modeling behavior to enable the downstream use of 3D solid and surface modeling databases. The role of the 3D model in the overall product design process and the place of the geometric product definition in the product lifecycle are covered. Product Data management (PDM) and Product Lifecycle Management (PLM) are covered as they

relate to the design process.

Learning Outcomes: 1. Distinguish between the different product design processes. 2. Explain the most appropriate design process for a given project. 3. Leverage project management techniques to manage individual and group work. 4. Explain the importance of freehand sketching as a communication tool for the designer. 5. Construct clear freehand Multiview and pictorial freehand sketches to convey design ideas. Credits: 2.00

MFET 20301 - Model-Based Definition

Credit Hours: 3.00. This course provides experience in the development of model-based product definition through the use of contemporary modeling tools and the application of ASME dimensional standards. This course also covers product data exchange and interoperability standards from the perspective of neutral and proprietary data formats and models. Long-term archival concepts are also covered.

Learning Outcomes: 1. Explain the significance of 2D and 3D CAD model standards relative to industrial practice. 2. Describe the elements and process of 3D model-based definition. 3. Incorporate model-based definition techniques into the CAD model database and technical documentation when creating geometry. 4. Implement modeling techniques that support long-term archival of product data. 5. Develop standard parts libraries which incorporate industrial standard parts specifications. 6. Select appropriate file format(s) for the communication of CAD data through different toolsets and data exchange media. 7. Develop basic literacy in interpreting technical documentation. Credits: 3.00

MFET 20401 - Data Capture, Collection, Analysis, And Visualization In Smart Manufacturing

Credit Hours: 3.00. This course provides an introduction as well as hands-on experience in data analysis and visualization in the Smart Manufacturing environment. It introduces students to the role of data in a Smart Manufacturing Enterprise, concepts and techniques of data analytics, and design principles for creating effective data visualization to facilitate managerial decision-making. This course is part of Smart Manufacturing Enterprise Fundamentals and should be taken after completing Introduction to the Smart Manufacturing Enterprise course.

Learning Outcomes: 1. Describe the types of data existing in a Smart Manufacturing Enterprise, and how data are used to support strategic, tactical, and operational decisions in smart manufacturers. 2. Perform descriptive, diagnostics, and predictive analytics on a manufacturing/supply chain dataset. 3. Solve a small manufacturing/supply chain optimization problem with Excel Solver. 4. Explain what visual qualities are important to convey data and apply design principles in creating visualizations. 5. Combine data analytics and visualization to provide insights into manufacturing/supply chain datasets. Credits: 3.00

MFET 21301 - Simulation And Visualization Applications

Credit Hours: 3.00. This course provides an investigation of predictive and documentary capabilities of engineering simulation and visualization tools. The course is based on concepts derived from theoretical computer graphics and related industrial standards, as well as the use of the geometric model-based product definition.

Learning Outcomes: 1. Describe the processes of simulation and visualization methods and tools. 2. Select and use appropriate simulation and visualization tools for specific PLM tasks. 3. Describe the role of product data models to enhance the processes of engineering design optimization and verification. 4. Develop skills of communication and project management through written assignments, individual, and group projects. 5. Define and apply the fundamentals of technical simulation and visualization with CAx tools in a PLM environment. Credits: 3.00

MFET 23000 - Industrial Internet Of Things, Networks, And Systems I

Credit Hours: 3.00. This course provides an introduction to Industrial Internet of Things (IIoT) devices, networks, and standards in the context of converged information technology (IT) and operations technology (OT) industrial automation systems. Course topics include an examination of IT and OT networks, hardware, architecture, protocols, standards, and security practices in the context of industrial applications.

Learning Outcomes: 1. Explain the concept of Industrial Internet of Things (IIoT) and the enabling technologies. 2. Describe IT and OT development and detail differences in priorities and capabilities. 3. Design, implement, and analyze an integrated industrial network. 4. Configure host-level and network-level technical security controls in IT and OT systems. 5. Apply industry standards and reference architectures to ensure best practices in the selection, deployment, and operation of IIoT devices. Credits: 3.00

MFET 23100 - Industrial Internet Of Things, Networks, And Systems II

Credit Hours: 3.00. This course offers a practical exploration of Industrial Internet of Things (IIoT) in converged information and operations technology (IT/OT) industrial automation systems. Course topics include IT and OT reference architectures, industrial network convergence, standards, and security practices in the context of Edge, hybrid, and Cloud-based industrial applications. Specific focus is given to integrating and securing networked industrial devices with local and cloud-based IT systems in greenfield and brownfield scenarios.

Learning Outcomes: 1. Apply industry standards to develop a basic industrial network for converged IT/OT smart manufacturing systems. 2. Demonstrate the implementation of key security components required for converged IT/OT industrial networks. 3 Describe the role, characteristics, and requirements of safety systems in smart manufacturing. 4. Implement batch and real-time computation and basic machine learning models in an automated system. Credits: 3.00

MFET 24100 - Automatic Control Systems

Credit Hours: 3.00. This course provides students with a comprehensive understanding of feedback control systems and their practical implementation. Students will learn modeling and simulations of linear/linearized dynamic systems, stability study, time domain analysis, frequency domain analysis, root-locus method, design of PID control, compensators, derivation of control law, and system performance analysis through hands-on exercises and simulations. The curriculum emphasizes applications of mechatronics, robotics, and mechanical/electrical engineering technology fields.

Learning Outcomes: 1. Utilize the fundamental concepts for feedback control system design. 2. Create mathematical models of dynamic systems. 3. Analyze the performance of control systems through simulations. 4. Optimize controller parameters for desired system behavior. 5. Apply control theory to real-world engineering problems. Credits: 3.00

MFET 24800 - Industrial Robot Programming And Applications

Credit Hours: 3.00. This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of industrial robots. Topics covered include the introduction of robotics, robot classifications, robot programming, end-of-arm tooling, safety considerations, automation sensors, and robot and system integration.

Learning Outcomes: 1. Describe the fundamentals of robotics. 2. Create robot programs for various applications. 3. Implement robot applications that use peripheral devices or sensors. Credits: 3.00

MFET 25000 - Smart Manufacturing Cloud Computing Applications

Credit Hours: 3.00. This course introduces concepts and principles of cloud computing and the virtualization of computing resources and services for smart manufacturing applications. The fundamental topics of cloud computing will be addressed, including virtually processing, storing, modeling and analyzing of data in the cloud environment. Fundamental concepts about cloud tools, applications, and services from a production and manufacturing perspective will be presented.

Learning Outcomes: 1. State the challenges and advantages of cloud computing in smart manufacturing. 2. Explain the concepts and principles of cloud computing such as a

scalability, elasticity, agility, fault tolerance, disaster recovery and networking. 3. Recognize the models, tools, and service types offered by the different cloud platforms for smart manufacturing applications. 4. Select strategies for managing and optimizing cloud computing resources for different manufacturing applications. 5. Apply techniques in clouding computing to model and manage manufacturing data. 6. Build manufacturing apps using cloud based platform tools and services. Credits: 3.00

MFET 29000 - Special Topics In Manufacturing Engineering Technology

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of Manufacturing Engineering Technology is provided by Technology faculty, subject to MFET curriculum subcommittee approval.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

MFET 29200 - Projects In Automation, Robotics And Mechatronics

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Course is for supervised project development, subject to MFET curriculum subcommittee approval. Intended for lower division students. Permission of instructor required.

Learning Outcomes: 1. Successfully complete a project of limited scope. 2. Document and manage a project using accepted project management principles. 3. Demonstrate effective oral and written communication skills. Credits: 1.00 to 3.00

MFET 29900 - Manufacturing Engineering Technology Independent Project

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by instructor and approved by the MFET curriculum committee. Primarily for third- and fourth-semester students with special interests. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

MFET 30301 - Digital Manufacturing

Credit Hours: 3.00. This course investigates digital manufacturing methods, tools, and processes. Topics include additive and subtractive production techniques, CNC tools, geometric dimensioning and tolerance, model-based definition, measurement instruments and metrology, and scanning techniques for geometry validation.

Learning Outcomes: 1. Describe the differences between additive and subtractive manufacturing. 2. Create a simple CNC program to drive a desktop mill, lathe, and cutter. 3. Understand the basic steps to moving CAD data through a CAM system to drive a machine. 4. Use measurement techniques and model-based data to inspect a manufactured part. 5. Use 3D scanning technology to validate a manufactured part. Credits: 3.00

MFET 31301 - The Business Of Managing Digital Product Data

Credit Hours: 3.00. This course provides experience in the business-related aspects of PLM tools and methods. Topics include identifying specifications and roles for system users within an organization, creating database models for digital product information, workflows, virtual machine installation and configuration of PLM systems, budgeting, and benchmarking.

Learning Outcomes: 1. Identify specifications and requirements for users of PLM systems. 2. Identify user roles and create them with appropriate permissions in a PLM system. 3. Install and configure a PLM system to be used by student teams. 4. Develop the product data model consistent with user requirements. 5. Conduct basic benchmarking and budgeting activities for a PLM deployment. Credits: 3.00

MFET 32100 - Nature-Inspired Design And Materials

Credit Hours: 3.00. In this course, students will work at the intersection of nature, design, materials, and devices. We will begin by exploring structures in nature, from the microscale to the macroscale. Inspired by nature, teams will design structures, objects, tools, machines, or sensors that incorporate aesthetic elements inspired by their exploration and observation of nature. These designs will then be realized through 3-D printing and will

be realized in a proof-of-concept device.

Learning Outcomes: 1. Differentiate among general multi-physics engineering principles. 2. Design 3D structures creatively, using nature inspiration, art, and engineering software. 3. Evaluate 3D structures from the aesthetic and engineering perspective. 4. Fabricate sensors and other electrical devices, implementing nature-inspired structures. 5. Develop teamwork ethics, especially from diversified backgrounds. Credits: 3.00

MFET 34100 - Process And Continuous Control Applications

Credit Hours: 3.00. An examination of devices, algorithms, strategies, and standards used in smart manufacturing continuous process and control serves as the basis of this course. Concepts include Proportional, Integral, & Derivative Control (P&ID), loop modeling, transfer functions, PID design, implementation and tuning. Course laboratories focus on implementing and tuning systems using industry-grade hardware and devices.

Learning Outcomes: 1. Explain the importance of control systems in the management of a continuous process. 2. Apply fundamental control theory concepts and models to a process or continuous control scenario. 3. Document process control applications, using recognized standards and symbology. 4. Apply controller algorithms and tuning methods to refine the performance of control loops. 5. Determine appropriate control architecture and hardware for single and multiple loop systems. Credits: 3.00

MFET 34400 - Automated Manufacturing Processes

Credit Hours: 3.00. Shop floor components of computer-integrated manufacturing are explored. Emphasis is focused on current applications and programming practices of various computer-automated manufacturing processes and technologies. Topics include CAD/CAM integration, computer-assisted numerical control programming for 2 ½ and 3-axis contouring, and CNC program verification.

Learning Outcomes: 1. Use integrated CAD/CAM tools in the successful manufacture of a product. 2. Program and execute CNC programs on a multi-axis milling machine or lathe. Credits: 3.00

MFET 34800 - Introduction To Robot Kinematics

Credit Hours: 3.00. This course introduces the fundamentals of robotics with an emphasis on solutions to the kinematics problems of serial robotic manipulators. It covers robot modeling and simulation, forward kinematics, inverse kinematics, analysis of robot motion and static forces, and trajectory planning.

Learning Outcomes: 1. Create the kinematics model of a robotic manipulator. 2. Solve forward and inverse kinematics problems of a robotic manipulator. 3. Analyze the motion and static forces of a robotic manipulator. 4. Plan trajectories of a robotic manipulator. Credits: 3.00

MFET 35000 - Smart Manufacturing Systems Modeling & Simulation

Credit Hours: 3.00. This course addresses application of industrial internet of things (IIoT) for modeling and simulation of smart manufacturing assets, processes, and operations. Emphasis is on synchronizing modeling/simulation with real-time data to develop innovative services, create efficiencies, and enable productivity improvement in smart factories.

Learning Outcomes: 1. Describe the convergence of the physical and digital worlds, technology, and standards of IIoT-aided modeling and simulation. 2. Implement process data modeling and application to various types of plant data (drives, pumps, production lines) using real-time, historical, and event-based data. 3. Develop digital/virtual-cloud representation models to be mirrored onto physical manufacturing systems. 4. Create digital twin (DT) models using data from IIoT devices for monitoring and automating control of smart connected assets. 5. Construct DT-oriented simulation model for IoT-aided manufacturing system for applications in productivity, reliability, efficiency, and predictive maintenance operations. 6. Develop application

of augmented reality and manufacturing model proxies in diagnostic and troubleshooting operations. Credits: 3.00

MFET 35100 - Mixed Reality Smart Manufacturing Applications & Design

Credit Hours: 3.00. The course investigates development strategies, use cases, and mixed reality (MR) application in industrial IoT (IIoT)-based smart manufacturing systems. Emphasis is on superimposing digital content onto physical systems, integrating data from smart and connected manufacturing production operations, processes, and machines.

Learning Outcomes: 1. Outline the benefits and applications of mixed reality (MR) offers in smart manufacturing environments. 2. Link the MR concepts, industrial IoT (IIoT) technologies, and development approaches with smart manufacturing applications. 3. Develop proficiency in using hardware, software tools and technologies to design and prototype effective MR applications for manufacturing. 4. Design and develop MR user interfaces and interaction techniques for augmented human-machine systems. Credits: 3.00

MFET 35200 - Smart Manufacturing Production Information Systems

Credit Hours: 3.00. An examination of smart manufacturing information systems with particular focus on applications for horizontal- and vertically-integrated manufacturing organizations. Topics include cloud-based integrated information systems to provide connectivity, visibility, and analytics of production and shop-floor execution systems and integrating manufacturing execution, manufacturing operations management, and enterprise resource planning (ERP) systems.

Learning Outcomes: 1. Apply ISA-95 standards for horizontal and vertically integrated smart manufacturing operations using Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and Enterprise Resource Planning (ERP) systems. 2. Apply cloud infrastructure and data concepts for storing, distributing, and accessing manufacturing enterprise data for planning, scheduling, management, and production control. 3. Implement real-time, batch, and streaming data processing techniques for visualization and analytics of production data. 4. Apply cloud-based Manufacturing Execution System (MES), Manufacturing Operations Management (MOM) and ERP for creating efficiency, optimization, and control of production operations. Credits: 3.00

MFET 36100 - Machine Learning And Manufacturing Analytics

Credit Hours: 3.00. Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions.

Learning Outcomes: 1. Explain the benefits machine learning and artificial intelligence have in manufacturing. 2. Describe the fundamental principles, core concepts and operations involved with developing machine learning applications. 3. Apply commonly used machine learning algorithms for smart manufacturing applications. 4. Apply cloud-based automated machine learning tools to develop models and applications to perform intelligent manufacturing operations and analytics. Credits: 3.00

MFET 36300 - Intelligent Manufacturing Systems I

Credit Hours: 3.00. This course investigates how artificial intelligence, industrial IoT, and big data are used to enable predictive analytics with machine learning. Emphasis is on optimizing production processes, improving productivity, quality, efficiency, and integrating predictive maintenance applications in smart manufacturing operations.

Learning Outcomes: 1. Apply appropriate machine learning algorithms for improving and optimizing manufacturing operations. 2. Enable predictive analytics with machine learning for maintenance operations. 3. Evaluate

manufacturing processes using machine learning. 4. Identify and solve manufacturing problems using machine learning and root cause analysis. 5. Describe how data- and knowledge-based systems are used in product and design lifecycles. Credits: 3.00

MFET 36400 - Intelligent Manufacturing Systems II

Credit Hours: 3.00. Artificial intelligence (AI), machine learning (ML), industrial IoT (IIoT), and big data are applied to enable predictive analytics with machine learning for optimizing processes and operations in a horizontally-integrated smart manufacturing value-chain network.

Learning Outcomes: 1. Integrate cloud platforms with industrial big data, advanced analytics, AI/ML, and IIoT in a horizontally integrated supply chain network. 2. Implement data, analytics, and machine learning to create insights and drive decision-making in a horizontally integrated value chain network. 3. Describe how intelligent systems are connected to physical assets via IIoT infrastructure to automate inventory, and asset management across a manufacturing value chain network. 4. Apply predictive modeling, analytics, and AI/ML techniques to optimize material management, production planning, scheduling, and supply operations across a manufacturing value chain network. Credits: 3.00

MFET 37100 - Introduction To Precision Machine Design

Credit Hours: 3.00. This is a multidisciplinary course focusing on engineering techniques that are employed to design and develop high-precision automation products equipped with precision mechanisms. Fine mechanisms and precision instruments will be used to illustrate the concepts and applications. Topics covered include design strategy, high-precision mechanical components, sensors and measurement, servo control, design for controllability, control software development, controller hardware as well as automated error detection and recovery.

Learning Outcomes: 1. Utilize principles of precision machine and mechanism design for smart and precision machinery. 2. Design electromechanical components and systems using multidisciplinary techniques. 3. Design smart machinery with sensing, transmission, actuation technologies, and machine control strategies. 4. Perform product value analysis and product life performance analysis of precision machines. Credits: 3.00

MFET 37400 - Manufacturing Integration I

Credit Hours: 3.00. The fundamentals of data communications and local area networks are taught in order to show students how to integrate modern manufacturing systems. Emphasis is on the various levels of communications between shop floor computers, PLCs, robots, and automatic identification equipment. Database technology is used as an integration tool. This course prepares students for the MFET capstone course.

Learning Outcomes: 1. Achieve communications between various types of controls and devices. 2. Interface various peripheral manufacturing devices using networking and serial communications. Credits: 3.00

MFET 39200 - Advanced Projects In Automation, Robotics, And Mechatronics

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Course is for supervised project development, subject to MFET curriculum subcommittee approval. Intended for upper division students. Instructor of permission required.

Learning Outcomes: 1. Successfully complete a project of limited scope. 2. Document and manage a project using accepted project management principles. 3. Demonstrate effective oral and written communication skills. Credits: 1.00 to 3.00

MFET 39500 - Smart Manufacturing Enterprise Organization And Operations

Credit Hours: 3.00. This course provides an introduction and overview of dealing with organizational change management needed to address existing cultures within organizations dealing with the digital transformation required to implement a Smart Manufacturing Enterprise. It introduces students to the cultural and organizational barriers that exist and the theories, tools, and

best practices used to overcome them.

Learning Outcomes: 1. Summarize the barriers to organizational change management. 2. Describe the tools, techniques and theories that are employed to overcome organizational and cultural barriers within and organization. 3. Describe the impact that AI will have on the workforce and SMART manufacturing. 4. Provide examples of the drivers, enablers and compelling forces for Industry 4.0's advancement. 5. Define the Industry 4.0 framework and be able to outline the various systems used and their role in SMART Manufacturing organizations. 6. Illustrate the role and importance of IT+OT, Cyber Physical Systems, analytics, and BIG Data driving decisions in SMART manufacturing organizations. 7. Identify the integration points of Machine-, Factory, and Enterprise-level activities using MES, FEMS, ERP, QMS, & PLM for connecting people, process, and machines across the manufacturing value chain. Credits: 3.00

MFET 41000 - Introduction To Additive Manufacturing

Credit Hours: 3.00. This course covers topics in additive manufacturing (AM) technologies. Topics include the AM benefits and drawbacks of additive as compared to subtractive manufacturing, additive manufacturing process and material selection, design for additive manufacturing, support structure generation, printing process planning, and quality control techniques, such as monitoring, inspection, and surface modification.

Learning Outcomes: 1. Describe the concepts, benefits, and application of additive manufacturing. 2. Select appropriate additive manufacturing processes and material for producing parts. 3. Design 3D objects for additive manufacturing considering the process requirements. 4. Develop strategies and practices incorporating appropriate quality control techniques. Credits: 3.00

MFET 44000 - Smart Manufacturing Autonomous Human Robot Systems

Credit Hours: 3.00. This course explores robot cognition with application of intelligent human-robot systems in unstructured manufacturing environments. Topics include intelligent robotics, machine learning, machine vision, and human-robot interaction with particular emphasis on applications for smart manufacturing.

Learning Outcomes: 1. Describe the fundamental concepts of autonomous mobile and field robotics and human-robot interaction in unstructured smart manufacturing environments. 2. Apply intelligent sensory perception algorithms and robot control through sensory feedback for visual and tactile sensing as modalities for human-robot interaction. 3. Identify machine perception approaches and deep-learning techniques to help robots acquire interactive skills. 4. Apply algorithms for spatial representation, mapping and localization with real-time robot control strategies integrated with machine perception approaches for applications in smart manufacturing environments. Credits: 3.00

MFET 44100 - Robotics and IoT Seminar

Credit Hours: 0.00 or 1.00. The Robotics Seminar is a series of lectures from eminent local, national and international researchers in the field of robotics and the internet of things (IoT) and related areas, such as computer vision, autonomy, cyber-physical systems, wearables, etc.

Learning Outcomes: 1. Conduct a search of published papers, articles and materials on the web of relevance to a seminar topic. 2. Analyze a presentation in the context of prior published papers and materials on the web. 3. Evaluate the claims of a presentation with respect to researched material. Credits: 0.00 or 1.00

MFET 44200 - Programming Robots With ROS

Credit Hours: 3.00. Robot Operating Systems (ROS) will be used as a programming platform to explore the topics of

computer vision, SLAM (Simultaneous Localization and Mapping), path planning, grasping, and social interaction in robotic systems, as well as programming large systems for physical interaction with the world. Self-contained implementation projects are core to the class. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of matrices is assumed.

Learning Outcomes: 1. Apply software versioning techniques to the programming of large software projects with hardware in-the-loop. 2. Build ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 3. Apply basic software engineering techniques to designing and documenting software. 4. Apply and evaluate computer vision techniques based on templates to track objects in 2-D. 5. Synthesize 3-D computer vision techniques for 3-D sensors from 2-D algorithms. 6. Analyze and evaluate hardware sensors with respect to specific software task needs. 7. Apply SLAM methods to real-world scenes to interpret the world on real hardware in real-time. 8. Analyze execution times and evaluate trade-offs in computational hardware performance with respect to sensor data throughput. 9. Implement feedback controllers and tune for specific hardware characteristics. 10. Apply manual path planning techniques to 2-D and 3-D maps extracted from SLAM algorithms. 11. Apply automatic path planning tools and software to 2-D and 3-D maps extracted from SLAM algorithms. Credits: 3.00

MFET 47100 - Electric Machines

Credit Hours: 3.00. This course provides a comprehensive introduction to electrical machines fundamentals, three-phase circuits, electromagnetic principles, AC and DC motors, transformers, magnetism in motors, energy conversion in electric machines as well as their industrial and commercial applications.

Learning Outcomes: 1. Utilize working principles of electric machinery for design and performance analysis. 2. Master application of three-phase circuits, transformers, electromagnetic field analysis, electrical/mechanical energy conversion and efficiency, and interaction between motors and power systems. 3. Develop teamwork and problem-solving skills through electric machine projects. 4. Select and integrate electric machines in multidisciplinary systems. Credits: 3.00

MFET 48001 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 48002 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for

implementing a technical solution. Credits: 3.00

MFET 48003 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 48004 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 48005 - Engineering Technology Capstone I

Credit Hours: 3.00. This is the first course of a two-term senior capstone sequence. The skills needed to define, design and develop engineering technology solutions are introduced and developed. Planning and designing alternatives that meet cost, performance, and user-interface goals are emphasized. Project planning, scheduling, and management techniques are studied. Different design approaches are compared. Teamwork, global and societal concerns, and professional ethics are integrated into course projects.

Learning Outcomes: 1. Apply the engineering design process to engineering technology problems. 2. Evaluate customer needs when defining a solution. 3. Determine a preferred solution. 4. Define and develop a plan for implementing a technical solution. Credits: 3.00

MFET 49000 - Special Topics In Manufacturing Engineering Technology

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faculty. Group instruction in new or specialty areas of Manufacturing Engineering Technology is provided by Technology faculty, subject to MFET curriculum subcommittee approval.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

MFET 49900 - Manufacturing Engineering Technology Independent Project

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by instructor and approved by MFET curriculum committee. Primarily for seventh- and eighth-semester students with special interests. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

Division of Military Science and Technology

The Division of Military Science and Technology in the Purdue Polytechnic Institute was approved by the Purdue University Board of Trustees July 18, 2014.

The division is the academic and administrative home to the three ROTC programs on campus.

ROTC program web sites:

•Army ROTC

•Air Force ROTC

•Naval ROTC

Aerospace Studies Minor

Military Science and Leadership Minor

Naval Science Minor

AFT 11000 - Heritage And Values I

Credit Hours: 1.00. A survey course designed to introduce students to the United States Air and Space Forces and provides an overview of the basic characteristics, missions, and organization of the Air and Space Forces.

Learning Outcomes: 1. Describe general aspects of the Department of the Air Force. 2. Describe leadership fundamentals for Air Force Officers. 3. Identify service benefits and opportunities for officers serving in the Air Force. 4. Explain the history and evolution of the United States Air Force and Space Force. 5. Demonstrate fundamental written and verbal communication skills. Credits: 1.00

AFT 12000 - Heritage And Values II

Credit Hours: 1.00. A survey course designed to introduce students to the United States Air and Space Forces and provides an overview of the basic characteristics, missions, and organization of the Air and Space Forces.

Learning Outcomes: 1. Describe general aspects of the Department of the Air Force. 2. Describe leadership fundamentals for Air Force Officers. 3. Identify service benefits and opportunities for officers serving in the Air Force. 4. Explain the history and evolution of the United States Air Force and Space Force. 5. Demonstrate fundamental written and verbal communication skills. Credits: 1.00

AFT 20220 - Air Force ROTC Leadership Laboratory

Credit Hours: 1.00. Leadership Laboratory (LLAB) is a dynamic and integrated grouping of leadership developmental activities designed to meet the needs and expectations of prospective Department of the Air Force second lieutenants and to complement the AFROTC academic program. It is a student planned, organized, and executed practicum conducted under the supervision of the Detachment Commander and Operations Flight Commander.

Learning Outcomes: 1. Explain and practice the Air Force Core Values - Integrity First, Service before Self, and Excellence in All We Do. 2. Discuss characteristics of the Air/Space Force way of life. 3. Practice basic leadership, followership, and teamwork skills. 4. Demonstrate the mental and physical skills necessary to succeed in the AFROTC Field Training Environment. 5. Apply intermediate leadership, followership, and teamwork skills. Credits: 1.00

AFT 23000 - Team And Leadership Fundamentals I

Credit Hours: 1.00. Provides a fundamental understanding of both leadership and team building. The lessons and course flow are designed to prepare students for field training and leadership positions in the detachment.

Learning Outcomes: 1. Explain Air Force core values. 2. Discuss examples of how Air Force core values were used throughout Air and Space Force history. 3. Describe the employment of Air and Space power from institutional, doctrinal, and historical perspectives. 4. Demonstrate basic Air Force verbal and written communication skills. Credits: 1.00

AFT 23100 - Air Force ROTC Leadership Laboratory III

Credit Hours: 1.00. Cadets experiment with and develop leadership/management skills. Study of Air Force customs and courtesies, drill and ceremonies, and giving military commands; instructing, correcting, and evaluating the preceding skills, and study the Air Force officer environment.

Credits: 1.00

AFT 24000 - Team And Leadership Fundamentals II

Credit Hours: 1.00. Provides a fundamental understanding of both leadership and team building. The lessons and course flow

are designed to prepare students for field training and leadership positions in the detachment.

Learning Outcomes: 1. Explain Air Force core values. 2. Discuss examples of how Air Force core values were used throughout Air and Space Force history. 3. Describe the employment of Air and Space power from institutional, doctrinal, and historical perspectives. 4. Demonstrate basic Air Force verbal and written communication skills. Credits: 1.00

AFT 35100 - Leading People And Effective Communication I

Credit Hours: 3.00. Leading People and Effective Communication utilizes student's field training experience to take a more in-depth look at leadership. Special emphasis is placed on enhancing communication skills, and why that is important as a leader. Students have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

Learning Outcomes: 1. Compare and contrast individual leadership skills and approaches. 2. Analyze personal leadership strengths and weaknesses. 3. Explain the responsibility and authority of an Air Force officer. 4. Explain Air Force officer's duties and responsibilities as a subordinate leader. 5. Practice the Air Force officer's responsibilities in the counseling and feedback process. 6. Evaluate and apply concepts of ethical behavior. 7. Evaluate and analyze concepts, principles, and theories of quality in Air Force leadership and management. 8. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. Credits: 3.00

AFT 36100 - Leading People And Effective Communication II

Credit Hours: 3.00. Leading People and Effective Communication uses the student's field training experience to take a more in-depth look at leadership. Special emphasis is placed on enhancing communication skills, and why that is important as a leader. Students have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors.

Learning Outcomes: 1. Compare and contrast individual leadership skills and approaches. 2. Analyze personal leadership strengths and weaknesses. 3. Explain the responsibility and authority of an Air Force officer. 4. Explain Air Force officer's duties and responsibilities as a subordinate leader. 5. Practice the Air Force officer's responsibilities in the counseling and feedback process. 6. Evaluate and apply concepts of ethical behavior. 7. Evaluate and analyze concepts, principles, and theories of quality in Air Force leadership and management. 8. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. Credits: 3.00

AFT 40220 - Air Force ROTC Leadership Laboratory

Credit Hours: 1.00. Leadership Laboratory (LLAB) is a dynamic and integrated grouping of leadership developmental activities designed to meet the needs and expectations of prospective Department of the Air Force second lieutenants and to complement the AFROTC academic program. It is a student planned, organized, and executed practicum conducted under the supervision of the Detachment Commander and Operations Flight Commander.

Learning Outcomes: 1. Demonstrate the supervision, management, and leadership skills expected of an Air/Space Force Officer. 2. Apply and evaluate advanced leadership, followership, and teamwork concepts. 3. Plan to transition from the AFROTC environment to that Active Duty Service environment. 4. Apply and evaluate the advanced supervision, management, and leadership skills expected of an Air/Space Force Officer. Credits: 1.00

AFT 47100 - National Security, Leadership Responsibilities, And Commissioning Preparation I

Credit Hours: 3.00. National Security/Commissioning Preparation is designed for college seniors and gives them the foundation to understand their role as military officers and how they are directly tied to our National Security Strategy. It is an

overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

Learning Outcomes: 1. Describe the basic elements of national security policy and process. 2. Identify the basic Air Force and Space Force warfighting domains. 3. Describe the roles of the military in society. 4. Discuss current domestic and international issues affecting the military profession. 5. Describe fundamental provisions of the military justice system. 6. Describe the responsibility, authority, and functions of an Air Force commander. 7. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. 8. Plan for life as a second lieutenant. Credits: 3.00

AFT 48100 - National Security, Leadership Responsibilities, And Commissioning Preparation II

Credit Hours: 3.00. National Security/Commissioning Preparation is designed for college seniors and gives them the foundation to understand their role as military officers and how they are directly tied to our National Security Strategy. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level.

Learning Outcomes: 1. Describe the basic elements of national security policy and process. 2. Identify the basic Air Force and Space Force warfighting domains. 3. Describe the roles of the military in society. 4. Discuss current domestic and international issues affecting the military profession. 5. Describe fundamental provisions of the military justice system. 6. Describe the responsibility, authority, and functions of an Air Force commander. 7. Demonstrate listening, speaking, and writing skills in Air Force-specific formats. 8. Plan for life as a second lieutenant. Credits: 3.00

MSL 10100 - Introduction To The Army

Credit Hours: 1.00 to 2.00. An introduction to the army, the profession of arms, and basic soldier skills. Students learn what it means to be a professional in the U.S. Army. The overall focus is introducing them to the Army Leadership Requirements Model and the Reserve Officers' Training Corps (ROTC) program, its purpose in the Army, and its advantages for the student. Other topics include map reading, land navigation, fieldcraft, first aid, and individual/team movement techniques.

Learning Outcomes: 1. Demonstrate proficiency in mission command philosophy. 2. Demonstrate proficiency in mission command leader and commander tasks. 3. Demonstrate proficiency in mission command staff tasks. 4. Demonstrate proficiency in mission command systems. 5. Demonstrate capacity in creative critical thinking. 6. Demonstrate proficiency in communications skills. 7. Demonstrate proficiency in cultural awareness, cross cultural competencies in the strategic environment of 2025 and beyond. 8. Pursue Comprehensive Fitness / Resiliency Skills and Performance Enhancement Skills. 9. Pursue lifelong learning, self-assessment, and goal setting. 10. Demonstrate proficiency in Army and Joint doctrine. 11. Support Army policies, programs, and processes. 12. Demonstrate technical and tactical competency. Credits: 1.00 to 2.00

MSL 10200 - Foundations Of Leadership

Credit Hours: 1.00 to 2.00. An introduction to the personal challenges and competencies that are critical for effective leadership. Topics include critical thinking, time management, goal setting, and communication. The course emphasizes the communications process and the importance for leaders to develop essential skills to effectively communicate in the Army. Basic squad-level tactics will be reinforced.

Learning Outcomes: 1. Apply critical thinking and problem-solving, using troop-leading procedures (TLP). 2. Demonstrate map reading and land navigation skills. 3. Explain the value of diversity and the officer's role in leading change. 4. Describe the fundamentals of the Army as a profession. Credits: 1.00 to 2.00

MSL 20100 - Leadership And Ethics

Credit Hours: 2.00 to 3.00. An examination of leadership and ethics through the study and analysis of famous leaders. Army

values and ethics and their relationship to the Law of Land Warfare is stressed. Emphasizes the philosophy of military service and how military leaders can apply values and ethics to a variety of situations they might encounter in the Army.

Learning Outcomes: 1. Apply Army core values and ethics to different situations that officers may encounter as a leader. 2. Explain the relationship between Army Values, the Law of Land Warfare, and the philosophy of military service. 3. Develop a personal leadership philosophy and style. Credits: 2.00 to 3.00

MSL 20200 - Army Doctrine And Decision Making

Credit Hours: 2.00 to 3.00. The course explores using analytical techniques, creative-thinking skills, and the Army problem-solving process to help with situational decision making. Troop-leading procedures (TLP) and operational orders (OPORD) are used to explain Army Doctrine and symbology. Topics include using unified land operations, offensive operations, and defensive operations in squad-level tactics.

Learning Outcomes: 1. Apply analytical techniques, creative-thinking skills, and the Army problem-solving process. 2. Explain Army doctrine and symbology, using TLPs and OPORDs. 3. Explain how squad tactics are used in unified land operations, offensive operations, and defensive operations. Credits: 2.00 to 3.00

MSL 30100 - Training Management And The Warfighting Function

Credit Hours: 3.00 to 4.00. Examines how the Army operates through warfighting functions. Emphasizes planning, preparing, and executing training for small-unit tactics.

Learning Outcomes: 1. Describe the fundamentals of training management. 2. Explain how the Army operates through the warfighting functions. 3. Plan, prepare, and execute training for a squad conducting small-unit tactics. Credits: 3.00 to 4.00

MSL 30200 - Applied Leadership In Small Unit Operations

Credit Hours: 3.00 to 4.00. An examination of the fundamentals of direct-level leadership and small-unit tactics at the platoon level in preparation for Cadet Summer Training Advance Camp. Emphasizes the planning, coordinating, navigating, motivating, and leading a platoon to execute a mission.

Learning Outcomes: 1. Describe the fundamentals of direct-level leadership and small unit tactics at the platoon level. 2. Explain how the Army operates through the warfighting functions. 3. Plan, coordinate, and lead a platoon to execute a mission. Credits: 3.00 to 4.00

MSL 40100 - The Army Officer

Credit Hours: 3.00 to 4.00. An examination of Army officer development to include planning, resourcing, and assessing training at the small-unit level. Topics include counseling subordinates, evaluating performance, values and ethics, career planning, legal responsibilities, and programs that support Army officers in these endeavors.

Learning Outcomes: 1. Describe Army programs that support counseling subordinates and evaluating performance, values and ethics, career planning, and legal responsibilities. 2. Explain how to plan, prepare, execute, and continuously assess training at the company level. Credits: 3.00 to 4.00

MSL 40200 - Company Grade Leadership

Credit Hours: 3.00 to 4.00. This course explores the roles and responsibilities of company-grade Army officers with respect to unified land operations. Emphasizes the knowledge, skills and abilities required of junior officers in preparation for commissioning.

Learning Outcomes: 1. Describe company grade officer roles and responsibilities pertaining to unified land operations. 2. Demonstrate officership as it pertains to a U.S. Army Second Lieutenant. Credits: 3.00 to 4.00

MSL 49000 - Directed Studies In Military Science

Credit Hours: 1.00 to 3.00. Individual readings, topics, or projects in military science appropriate for advanced undergraduate students. Permission of instructor required.

Credits: 1.00 to 3.00

NS 11000 - Introduction To Naval Science

Credit Hours: 3.00. This course is a general introduction to the USN and USMC that emphasizes organizational structure, warfare components and assigned roles/missions of USN/USMC. It covers all aspects of naval service from its relative position within the DoD to the specific warfare community/career paths and includes basic elements of leadership and USN and USMC core values. The course provides students with initial exposure to many elements of naval culture and provides the conceptual framework/working vocabulary for students to use on summer cruise.

Learning Outcomes: 1. Demonstrate proficiency in USN and USMC customs, such as the hand salute, uniform preparation, and flag etiquette. 2. Describe the departmental organizations of the USN and USMC. 3. Define the various watch-standing roles of shipboard personnel. 4. Describe the general career path of the various unrestricted line communities in the Navy and Marine Corps. 5. Describe all rank insignia of the armed forces. 6. Explain institutional values and ethics of the Department of the Navy. Credits: 3.00

NS 20200 - Naval Science Laboratory

Credit Hours: 2.00. This lab is designed to develop students morally, mentally, and physically and to imbue in them the highest ideals of duty, honor, and loyalty. Topics shall cover general Navy/Marine Corps mission and policies, force protection, operational security, watch standing, physical fitness, nutrition, stress management, and other professional development subjects not normally included in the curriculum of the Naval Science Courses. Laboratory periods may also be used on an occasional basis to supplement the Naval Science Courses and provide additional time for projects, such as navigation chart work. Open to Naval ROTC students only.

Learning Outcomes: 1. Complete the Navy or Marine Corps physical fitness tests with passing scores. 2. Demonstrate proficiency in close-order drill. 3. Complete a dress uniform inspection with a passing score. 4. Demonstrate proper military courtesies. 5. Describe the basics of military customs, ceremonies, and traditions. 6. Demonstrate exemplary personal and professional behavior in accordance with standards of conduct expected of a professional military officer. 7. Demonstrate the basic principles of the Navy and Marine Corps' Warrior Toughness program. Credits: 2.00

NS 21200 - Naval Ships Systems II (Weapons)

Credit Hours: 3.00. This course outlines the theory and employment of weapons systems. Students explore the processes of detection, evaluation, threat analysis, weapon selection, delivery, guidance, and explosives. Fire control systems and major weapons types are discussed, including capabilities and limitations. The physical aspects of radar and underwater sound are described. Facets of command, control, communications, computers, and intelligence are explored as a means of weapons system integration. The tactical and strategic significance of command and control warfare and information warfare is discussed.

Learning Outcomes: 1. Explain the choice of weapon, given the defined threat's capabilities. 2. Define the capabilities and limitations of Naval Ship weaponry. 3. Identify, visually, a ship's array of antennae and communication components. 4. Describe the importance of command and control warfare. 5. Analyze the moral and ethical responsibilities of leaders and their use of firepower. Credits: 3.00

NS 21300 - Sea Power And Maritime Affairs

Credit Hours: 3.00. This course is a study of the U.S. Navy and sea power's influence on history and the political process. Students will explore the major events, attitudes, personalities, and circumstances that have imbued the U.S. Navy with its proud history and rich tradition. It deals with issues of national imperatives in peacetime, as well as war, varying maritime philosophies that were interpreted into naval strategies/doctrines, budgetary concerns that shaped force realities, and the pursuit of American diplomatic objectives. It concludes with a discussion of the Navy's strategic and structural changes at the end of the Cold War and its new focus, mission, and strategy in the post-September 11, 2001 world.

Learning Outcomes: 1. Describe the impact and significance of geography and Sea Lines of Communication on maritime strategy and naval operations. 2. State the mission and basic organization of the Navy and Marine Corps. 3. Describe the current organization of the

Department of the Navy. 4. Describe significant events in U.S. naval history. 5. Describe the evolution of the Navy and Marine Corps including the origins. 6. Describe the importance of power projection by seaborne forces and cite historical examples. 7. Describe the significant historical developments of naval weapons systems, platforms, tactics, techniques, and procedures. Credits: 3.00

NS 21400 - Naval Leadership And Management

Credit Hours: 3.00. Introduces the student to many of the fundamental concepts of leading Sailors and Marines, which shall be expanded upon during the continuum of leadership development throughout NROTC. It develops the elements of leadership vital to the effectiveness of Navy/Marine Corps officers by reviewing the theories and parameters of leadership and management within and outside of the Naval Service and progressing through values development, interpersonal skills, management skills, and application theory. Practical applications are explored through the use of experiential exercises, readings, case studies, and laboratory discussions.

Learning Outcomes: 1. Explain the differences between management and leadership. 2. Describe sources of leader power and related influence tactics. 3. Describe the interaction between the leader, the followers, and the situation. 4. Describe the building blocks of leadership skills and how they impact a leader's effectiveness. 5. Perform a leadership personality analysis and interpret its results. 6. Describe rational and emotional approaches to organizational changes. 7. Apply leadership concepts to a written analysis of a real-world leader. Credits: 3.00

NS 31000 - Naval Navigation

Credit Hours: 3.00. This course is an in-depth study of the theory, principles, procedures, and application of plotting, piloting, and electronic navigation, as well as an introduction to maneuvering boards. Students learn piloting techniques, the use of charts, the use of visual and electronic aids, and the theory of operation of both magnetic and gyrocompasses. Students develop practical skills in plotting and electronic navigation. Other topics include tides, currents, effects of wind/weather, voyage planning, and an application and introduction to the international/inland rules of navigation.

Learning Outcomes: 1. Explain the theory and practice of navigation at sea. 2. Describe the environmental weather factors affecting naval operations. 3. Describe the sources of environmental products/predictions, forecasts available to naval units underway. 4. Demonstrate relative motion and the capability to solve problems associated with relative motion using maneuvering boards. 5. Demonstrate proper use of the Rules of the Road preventing collisions at sea. Credits: 3.00

NS 31100 - Naval Operations And Seamanship

Credit Hours: 3.00. This course is a continued study of relative motion, formation tactics, and ship employment. It includes introductions to naval operations and operations analysis, ship behavior and characteristics in maneuvering, applied aspects of ship handling, afloat communications, naval command and control, naval warfare areas, and joint warfare.

Learning Outcomes: 1. Explain the theory of relative motion as it applies to vessels at sea. 2. Describe the fundamentals of the U.S. Navy's systems of communications used on sea-going vessels. 3. Demonstrate proper use of the Rules of the Road preventing collisions at sea. 4. Discuss the many issues relating to ship handling and Naval Officers' responsibility. 5. Demonstrate relative motion and the capability to solve problems associated with relative motion using maneuvering boards. 6. Perform the proper use of Standard Commands during Conning Officer Virtual Environment (COVE) lab. 7. Explain the doctrines of Naval Warfare, Command and Control, and Joint Operations. Credits: 3.00

NS 33000 - Evolution Of Warfare

Credit Hours: 3.00. The purpose of Evolution of Warfare is to imbue students with an understanding of the origins of modern warfighting theory through an analysis of historical philosophies, domains, tactics and technology. Through a study of military history, students explore the timeless fundamentals of armed conflict as well as the central role of innovation. They will apply

these fundamental warfighting concepts to historic amphibious and expeditionary operations through guided analysis and decision games.

Learning Outcomes: 1. State the major cultural, technological, organizational, and doctrinal transformations in warfare. 2. State the operational history of amphibious and expeditionary warfare. 3. Recite the warrior ethos. 4. Describe the relationship between the tactical, operational, and strategic level of warfare. 5. Describe the origins of current USMC and Joint doctrine, especially MCDP 1 and MCDP 1-0. 6. Apply symmetric and asymmetric principles across all warfighting domains. 7. Apply knowledge from historical conflicts to modern and future challenges. 8. Demonstrate fundamental writing and speaking skills required of a marine officer. 9. Demonstrate a tactical mindset and effective decision-making. Credits: 3.00

NS 35000 - Naval Ship Systems-Engineering

Credit Hours: 3.00. In this course, students learn detailed ship design, hydrodynamic forces, stability, propulsion, electrical theory and distribution, hydraulic theory and ship control, and damage control. The course includes basic concepts of theory/design of steam, gas turbine, diesel, and nuclear propulsion.

Learning Outcomes: 1. Explain the first and second laws of thermodynamics and how they apply to naval ship systems. 2. Understand the difference between thermal and mechanical energy and how to transfer between the two to produce propulsion. 3. Explain how energy is stored onboard US naval vessels and the ways that stored energy is converted into propulsion. 4. Describe each step of a thermodynamic cycle and be able to apply them to various heat engines. 5. Draw the steam cycle on a temperature/entropy graph and describe each process. 6. Describe the role of various auxiliary equipment in a propulsion plant. 7. Describe the basic damage control process and the initial ship-wide response to fire and flooding. Credits: 3.00

NS 41300 - Naval Leadership And Ethics

Credit Hours: 3.00. This course completes the final preparations of ensigns and second lieutenants for service in the Navy and Marine Corps. The course integrates an intellectual exploration of Western moral traditions and ethical philosophy with a variety of topics, such as military leadership, core values, professional ethics, the UCMJ and Navy regulations, and discussions relating to the roles of enlisted members, junior and senior officers, command relationships, and the conduct of warfare. The course provides midshipmen with a foundation of moral traditions, combined with a discussion of actual current and historical events in the Navy and Marine Corps, to prepare them for the roles and responsibilities of leadership in the Naval Service of the 21st century. Permission of instructor required.

Learning Outcomes: 1. Explain the role of commissioned officers as members of the U.S. Armed Forces and the obligations and responsibilities assumed by taking the oath of office, including the constitutional requirement for civilian control. 2. Explain the naval officer's roles and responsibilities as a member of the profession of arms. 3. Explain the significance of special trust and confidence vested in commissioned officers. 4. Explain the Uniform Code of Military Justice (UCMJ), the practice of military law, and the applications of regulations as they may involve a junior officer in the performance of duties. 5. Explain the purpose, scope, and constitutional basis of Navy regulations and the UCMJ, relating them to personal conduct in the military service. 6. Explain the professional, moral, and ethical responsibilities of the naval officer. 7. Explain the relationship of integrity, moral courage, and ethical behavior to authority, responsibility, and accountability. 8. Demonstrate, by personal example, the professional attributes and behaviors of a naval officer. 9. Describe how leadership by example influences an officer's ability to effectively lead

in an organization. Credits: 3.00

NS 44000 - Fundamentals Of Maneuver Warfare

Credit Hours: 3.00. The purpose of this course is to introduce the student to the foundational concepts and history of the USMC as the premier maneuver warfighting organization. It is a theoretical class that utilizes both historical examples from previous military operations as well as current doctrine, developing an individual who is both a critical thinker and scholar in the profession of arms. The goal is to educate the student to read military history analytically.

Learning Outcomes: 1. Describe the role of the United States Marine Corps as a premier amphibious warfare fighting institution. 2. Describe specific successful amphibious-based maneuver warfare operations throughout Marine Corps history. 3. Describe how amphibious warfare ties into general warfare, serving as a subset of total warfare. 4. Perform an analysis of historical influences upon current tactical, operational and strategic implications of maneuver warfare practices used in current and future operations. 5. Recite a basic understanding of Marine Corps doctrine that facilitates successful sea-based operations, requiring ship-to-shore movements. Credits: 3.00

SFT 11000 - Foundations Of The Space Force I

Credit Hours: 1.00. A survey of officership, professionalism, communications skills, the Space Force organization and its mission. Emphasis is placed on helping students understand what they will experience as a Space Force officer.

Learning Outcomes: 1. Explain the military role of the US Space Force. 2. Describe leadership fundamentals, service benefits, and opportunities for officers. 3. Explain how the Space Force has evolved from a historical perspective. 4. Explain the Space Force's Guardian Commitment as an ethical framework. 5. Demonstrate the fundamentals of communicating effectively. Credits: 1.00

SFT 12000 - Foundations Of The Space Force II

Credit Hours: 1.00. A survey of Space Force installation design and location, Space Force professions, principles of spaceflight and the space environment, geopolitics, defense policy and strategy, and the Space Force's partner services in the Department of Defense. Emphasis is placed on helping students understand what they will experience as a Space Force officer.

Learning Outcomes: 1. Explain the evolution of the Space Force from its beginning in the Air Force to the present-day. 2. Describe the structure of the Space Force and its overarching mission. 3. Apply basic orbital mechanics, properties of the space environment, and how they affect spacecraft. 4. Communicate the capabilities of space operations and applications to joint functions. 5. Demonstrate the fundamentals of communicating effectively. Credits: 1.00

SFT 23000 - Evolution Of Space Power

Credit Hours: 1.00. An exploration of Space Force heritage and leaders and an examination of distinctive space power capabilities and functions. Its purpose is to instill an appreciation of space power development and employment, while continuing to develop cadet communication skills.

Learning Outcomes: 1. Communicate the evolution of rocketry and space power throughout history. 2. Describe the employment of space power from an institutional, doctrinal, and historical perspective. 3. Explain the similarities and differences between the US space program and international partners and competitors. 4. Apply the Full-Range Leadership Model to Space force scenarios. Credits: 1.00

SFT 24000 - Team And Leadership Fundamentals

Credit Hours: 1.00. This course provides a

fundamental understanding of both leadership and team building. Topics include leadership principles, conflict and stress management, and ethical decision making in the context of space Force officership.
Learning Outcomes: 1. Apply the Space Force's Guardian Commitment as an ethical framework in the context of Space Force officership. 2. Describe the employment of space power from an institutional, doctrinal, and historical perspective. 3. Employ the necessary conflict management styles as appropriate for a Space Force officer. 4. Explain how resiliency strategies can be used to mitigate stress in the military environment. Credits: 1.00

SFT 35100 - Space Security, Law, Policy, And Doctrine I

Credit Hours: 3.00. An examination of space law and policy at the national and international levels with particular focus on the Outer Space Treaty of 1967 and the United Nations' Remote Sensing Principles. Students examine how these laws and policies are viewed in real-world situations.
Learning Outcomes: 1. Explain the historical development of space law and policy. 2. Compare and contrast Space Force doctrine and joint doctrine. 3. Compare and contrast space law, policy, and doctrine in the historical context of space security. 4. Describe current U.S. Space policy and law. Credits: 3.00

SFT 36100 - Space Security, Law, Policy, And Doctrine II

Credit Hours: 3.00. This course address the use of space power as an instrument of national power, emphasizing Space Force doctrine, joint doctrine, and space as an operational domain of war. Students examine both the United States' and other nations' space security programs and how international partners and adversaries view and apply space power.
Learning Outcomes: 1. Explain the application of space power through unified space action. 2. Compare and contrast Space Force doctrine and joint doctrine. 3. Compare and contrast space law, policy, and doctrine in historical contexts of space security. 4. Explain how Space Force core competencies support national policy. Credits: 3.00

SFT 47100 - National Security, Leadership Responsibilities, And Commissioning Preparation I

Credit Hours: 3.00. This course examines security challenges around the world and identifies how the Space Force and the other services are organized and employed in response to those challenges. Topics include fundamental aspects of command, the military justice system, and effective communication.
Learning Outcomes: 1. Describe the basic process of developing national security policy. 2. Explain the Space Force warfighting domains and their interrelationships. 3. Discuss current domestic and international issues affecting the military profession 4. Explain the purpose and legal requirements of the Uniform Code of Military Justice. 5. Identify the responsibilities, authorities, and functions of a Space Force commander. Credits: 3.00

Department of Technology Leadership and Innovation

Dept of TLI main page pic

Overview

The Department of Technology Leadership & Innovation prepares students to lead the development and successful introduction of high-tech solutions in business, industry, and the classroom. Faculty members are experts in helping organizations improve, and their research reflects the latest in helpful solutions. From teaching tomorrow's teachers to understanding the nuances in each technological challenge, the department focuses on improving and shaping the future of technology and its uses.

Faculty

Department of Technology Leadership and Innovation Website

If you're a technology enthusiast with a passion for people, TLI offers the perfect major for you.

•Leading

•Managing

•Teaching

Contact Information

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155 S. Grant St.
West Lafayette, IN 47907
Phone: 765.494.5599
Email: tliinfo@purdue.edu

Graduate Information

For Graduate Information please see Technology Leadership and Innovation Graduate Program Information .

Organizational Leadership, BS

Engineering Technology Education, BS

Human Resource Development, BS

Design and Innovation Minor

Teaching Secondary Education Computational Thinking Certificate

Human Resource Management Certificate (Indianapolis and Statewide)

Leadership Series Certificate (Indianapolis and Statewide)

Organizational Leadership Minor

OLS 25200 - Human Relations In Organizations

Credit Hours: 3.00. A survey of the concepts that provide a foundation for the understanding of individual and group behavior in organizations. Special emphasis on typical interpersonal and leadership relationships.

Credits: 3.00

OLS 26300 - Ethical Decisions In Leadership

Credit Hours: 3.00. This class is for students interested in discussing and contemplating the difficult legal and ethical situations facing managers in all sizes and types of organizations. Students in this class will read and discuss a variety of writings on ethics in the workplace and also analyze both written and videotaped legal/ethical scenarios.

Credits: 3.00

OLS 27400 - Applied Leadership

Credit Hours: 3.00. Introduction to applied leadership in the context of organizational functions, structures, and operation.

Credits: 3.00

OLS 29801 - Leadership Seminar I For ET Student Leaders

Credit Hours: 0.00 or 1.00. New student peer leaders in Engineering and Technology will receive training to facilitate a mentoring relationship, lab, and/or recitation within the School of Engineering and Technology's formal and PLTL programs. Selected topics focus on leadership styles, group dynamics, facilitation techniques, collaborative learning techniques, redirecting strategies, and student motivation. Permission of department required.

Credits: 0.00 or 1.00

OLS 30200 - Leadership And Economic Aspects Of Sustainability

Credit Hours: 3.00. The main focus of this course is to learn how organizations make sustainability work in their organizations. You will learn about the triple bottom line (environment, social and economic aspects of business

decisions) and how to make "sustainability" thrive in an organization. This course will look at how organizations: describe the benefits of sustainability for corporations and society; build a framework for implementing corporate sustainability; lead and design strategies for corporate sustainability; organize, perform evaluations and create reward systems for sustainability; implement social, environmental, and economic measuring systems; improve corporate processes, products, projects for sustainability; and manage reports for sustainability. This course will view various examples of sustainable practices in organizations, such as, Interface, Novartis, CEMEX, DuPont, Timberland, and Chiquita Brands, which are making sustainable practices thrive in their organization.

Credits: 3.00

OLS 32700 - Leadership For A Global Work Force

Credit Hours: 3.00. This course is for present and future leaders interested in the increasingly diverse global workforce. The course will present a variety of leadership issues including expatriate assignments, international business strategies and their cultural and managerial impact, and a review of business practices around the world.

Credits: 3.00

OLS 33100 - Occupational Safety And Health

Credit Hours: 3.00. A presentation of the aspects of occupational safety and health that are essential to the organizational leaders. Special emphasis is placed on developing an understanding of the economic, legal, and social factors related to providing a safe and healthy work environment.

Credits: 3.00

OLS 34400 - Employee Benefits

Credit Hours: 1.00 to 3.00. This course will promote an understanding of employee benefit programs. Students will learn about the strategic importance of employee benefits and approaches to planning a benefits program while applying the legal, regulatory, and industry influences on employee benefits practices.

Credits: 1.00 to 3.00

OLS 34600 - Critical Thinking And Ethics

Credit Hours: 3.00. A course in complex problem solving and creative thinking with an emphasis on the ethical impacts of these solutions.

Learning Outcomes: 1. Define various approaches to the study of ethics in leadership. 2. Recognize and apply laws and regulations that affect ethical behavior in business and industry. 3. Work through processes to better identify what are real problems and perceived problems. 4. Use various techniques to ensure the real problem is identified and generate solutions. 5. Relate methods and concepts learned to new situations in order to solve problems. 6. Identify necessary steps to evaluate and implement solutions. 7. Develop individual problem solving and analytical skills. 8. Identify ethical, legal, and global challenges facing organizational leaders. Credits: 3.00

OLS 34800 - Human Resources Analytics

Credit Hours: 1.00 to 3.00. This course provides insight into uses of analytics in Human Resources (HR), why it is important, and how HR analytics add value to organization. Students will explore resources that will align an organization's mission and goals with key metrics and benchmarks.

Credits: 1.00 to 3.00

OLS 35100 - Innovation And Entrepreneurship

Credit Hours: 3.00. An in-depth study of innovation in existing organizations, as well as entrepreneurship in start-up businesses, franchises, family-owned firms, and other business formats.

Learning Outcomes: 1. Define the nature, skills, and spirit of entrepreneurs. 2. Conduct market research to develop innovative business model. 3. Conduct an industry analysis to identify competitors and industry trends. 4. Explain the benefits of selecting a diverse leadership team and employee pool. 5. Create and evaluate a business plan. Credits: 3.00

OLS 36800 - Employment Law

Credit Hours: 3.00. This course covers the regulatory environment of the employment relationship. Topics will include discrimination and Title VII of the Civil Rights Acts of 1964, recruitment and selection, affirmative action, rights of union and nonunion employees, Fair Labor Standards Act, Equal Pay Act, employee benefit plans, unemployment compensation, and right

to discharge.

Credits: 3.00

OLS 37100 - Project Management

Credit Hours: 3.00. This course provides the basics of the project management discipline and allows the student to apply these skills in team-based situations.

Credits: 3.00

OLS 37500 - Training Methods

Credit Hours: 3.00. Principles, practices, and methods of employee training. Introduction to systematic training program design, development, and evaluation. Emphasis is on the supervisor as a trainer.

Learning Outcomes: 1. Define the role training and development plays in sustaining a competitive advantage across the full array of modern organizations. 2. Explain how training is a systemic process and how it relates to the overall leadership, supervision, and human resource management system of an organization. 3. Describe the purpose and scope of a training needs assessment and plan, including its key components in designing training systems in leadership, supervision, and human resource management system of an organization. 4. Compare and contrast various training delivery methods, citing advantages and disadvantages of each. 5. Describe the essential principles of adult learning and intervention evaluation in developing and designing a training program in leadership, supervision, and human resource management system of an organization.

Credits: 3.00

OLS 37600 - Human Resource Issues

Credit Hours: 3.00. Analysis and discussion of case problems concerning typical leadership and personnel situations that impact upon the supervisor/manager. Emphasis directed toward development of attitude, philosophy, analytical ability, and problem-solving skills within the working environment.

Credits: 3.00

OLS 37800 - Labor And Management Relations

Credit Hours: 3.00. An introduction to, and overview of, the fundamental concepts of labor relations, collective bargaining, and dispute resolution procedures. An international comparative analysis is used to assess some of the legal, economic, and political structures of labor relations.

Credits: 3.00

OLS 38300 - Human Resource Management

Credit Hours: 3.00. This course teaches an overview of the human resource function in organizations today. Case studies are used to explore applications of human resource principles.

Credits: 3.00

OLS 38500 - Leadership Strategies For Quality And Productivity

Credit Hours: 3.00. Knowledge and applied leadership skills essential for establishing and continuously improving organizational effectiveness by forestalling and solving workplace problems.

Credits: 3.00

OLS 38600 - Leadership For Organizational Change

Credit Hours: 3.00. Introduction to and overview of fundamental concepts of leading organizational change. Topics include setting the stage for organizational change, implementing organizational change, sustaining organizational change, and the role of the change manager. Concepts and frameworks taught in this course are applicable to change at multiple scales from small enterprises and large corporations to communities and ecosystems.

Learning Outcomes: 1. Identify organizational culture and transformation readiness. 2. Apply various change management frameworks to leading organizational change. 3. Understand the role organizational culture plays in change and transformation. 4. Identify the effect of technological change on organizations, communities, and society. 5. Develop and apply a change management framework. Credits: 3.00

OLS 38800 - Leadership Through Teams

Credit Hours: 3.00. The group process, team development and

exploration of dynamics that impact group and team performance.

Learning Outcomes: 1. Identify various principles and theories of group dynamics. 2. Plan and lead effective meetings. 3. Provide opportunities to become skilled participant-observers of team processes. 4. Demonstrate the behavior of the team leader and team members in molding work groups into high performance teams. 5. Demonstrate the process of human communications in small group context. 6. Use communication skills to more competently solve problems in task-oriented groups. 7. Use personal knowledge and interpersonal skills in dealing with people in all group types. 8. Analyze and comprehend why teams are functional or dysfunctional.

Credits: 3.00

OLS 39000 - Leadership Theories And Processes

Credit Hours: 3.00. This course integrates knowledge and skills from all associate level OLS courses and allows students to define, reflect upon, and improve their leadership abilities.

Credits: 3.00

OLS 39801 - Leadership Seminar II For ET Student Leaders

Credit Hours: 0.00 or 1.00. This course introduces ET student peer leaders to the knowledge, attitudes, and inner resources needed to be an effective leader. Students will utilize their first hand experiences to obtain the techniques to improve their leadership skills. Permission of department required.

Credits: 0.00 or 1.00

OLS 39900 - Special Topics

Credit Hours: 1.00 to 6.00. Hours and subject matter to be arranged by staff.

Credits: 1.00 to 6.00

OLS 39901 - Special Topics In Project Management

Credit Hours: 3.00. Hours and subject matter to be arranged by faculty/staff. Primarily for upper-division majors with specific interests in project management. Permission of instructor required.

Learning Outcomes: 1. Vary with topic of each offering. Credits: 3.00

OLS 42300 - Green Organizations: Global Responsibility For Environmental And Economic Necessity

Credit Hours: 3.00. This course is interdisciplinary-emphasizing sustainability, engineering, manufacturing, technology, and leadership processes for the purpose of being environmentally responsible, cost effective, and socially responsible including guest lecturers, group discussions, and tours of businesses, locally or in other countries. Typically offered Summer Fall Spring.

Credits: 3.00

OLS 45000 - Advanced Project Management

Credit Hours: 3.00. An introduction to project management concepts and practices in the context of human resource development projects.

Learning Outcomes: 1. Apply the Project Management Institute's methodology to plan a project in the training and development field. 2. Apply instructional development methodology.

Credits: 3.00

OLS 45400 - Gender And Diversity In Management

Credit Hours: 3.00. Today's workforce is composed of employees with a variety of individual differences, including race, gender, LGBTQ+, culture, national origin, mental and physical disabilities and age. This course will use the knowledge of diversity, equity, inclusion and ethical responsibilities to develop effective leadership.

Learning Outcomes: 1. Define managing diversity, valuing diversity and affirmative action. 2. Compare American cultural values with non-American cultural values. 3. Describe the major diversity issues, including inclusion, equity and ethical responsibilities, encountered in the workplace. 4. Explain how federal anti-discrimination laws affect the management of diversity and ethical responsibilities. 5. Describe how leaders can effectively manage diversity, inclusion, equity and ethical responsibilities. 6. List the major components of

a diversity/inclusion program. Credits: 3.00

OLS 47700 - Conflict Management

Credit Hours: 3.00. A study of the methods for dealing with innerpersonal, interpersonal, and political disputes by means generally outside the traditional court system. Students will investigate the theoretical and practical aspects of conflict assessment, negotiation, problem solving, mediation, and arbitration.

Learning Outcomes: 1. Interpret and summarize major conflict management concepts. 2. Apply course conflict management concepts to new situations and real-world applications. 3. Assess conflict situations and apply appropriate methods to mitigate conflict. 4. Demonstrate ability to handle difficult people and situations. Credits: 3.00

OLS 47900 - Staffing Organizations

Credit Hours: 3.00. An applications-oriented study of key concepts in staffing organizations, including principles and issues in conducting job analysis; preparing job descriptions/specifications; and screening/selecting employees. Special emphasis on the design, validation, and operation of high-volume staffing systems.

Credits: 3.00

OLS 48400 - Leadership Strategies For Quality And Productivity

Credit Hours: 3.00. A study of how organizational leaders create an environment conducive to high levels of employee self-motivation, quality, and productivity (TQM). Actual case situations are used to illustrate the application of course content.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

OLS 48700 - Leadership Philosophy

Credit Hours: 3.00. A review of current managerial, education, and development theories and practices; discussions of fundamental social, economic, and political changes affecting business and the art of managing; implications of these changes for individual development and continued growth.

Learning Outcomes: 1. Discuss disparate texts/writings on leadership from different eras and cultures. 2. Exhibit familiarity with a philosophical approach to studying leadership. 3. Explain a personal leadership philosophy. Credits: 3.00

OLS 48900 - Digital Transformation

Credit Hours: 3.00. This course covers the role of digital transformation and what it means for companies. This course includes practicums in digital transformation, including business transformation strategies, and AI driven insight.

Learning Outcomes: 1. Describe the foundations of Industry 4.0. 2. Explain the history of digital transformation. 3. Evaluate business collaboration in the modern workplace. 4. Synthesize performance management goals and objectives. Credits: 3.00

OLS 49000 - Senior Research Project

Credit Hours: 1.00 to 6.00. Opportunity to study specific problems in the field of personnel, safety, supervision, and training under the guidance of an OLS faculty member.

Credits: 1.00 to 6.00

OLS 49100 - Internship Program

Credit Hours: 3.00 (West Lafayette and Tech Statewide); 1.00 to 3.00 (Calumet and North Central). A practicum designed to combine University study with work experience directly related to the student's plan of study. Permission of department required.

Learning Outcomes: 1. Apply organizational leadership theory in a corporate environment. Credits: 3.00 or 1.00 to 3.00

OLS 49101 - Internship Experiences

Credit Hours: 2.00. A practicum designed to combine University study with work experience directly related to the student's plan of study. Includes a design of an optimal interning experience as well as a written final paper and oral presentation covering the student's internship experience. Permission of department required.

Learning Outcomes: 1. Compare and contrast internship experiences of different types of organizations. 2. Describe the internship experience. 3. Evaluate the effectiveness of the internship experience. Credits: 2.00

OLS 49900 - Special Topics In Organizational Leadership And Supervision

Credit Hours: 1.00 to 3.00. Hours and subject matter to be arranged by staff. Permission of instructor required.

Credits: 1.00 to 3.00

TCM 18000 - Exploring Intercultural technical Communication

Credit Hours: 3.00. This course will explore issues in diverse technical communication workplace settings using Intergroup Dialogue. Students will explore intercultural communication, conflict resolution, social identity, community, and social justice with diverse groups. A component of this class will be engaging with clients, co- facilitators, and/or guest speakers. Topics in this course will include a variety of social identities including (but not limited to) race/ethnicity, nationality of origin/citizenship, gender, sex, sexual orientation/attraction, SES/social class, age, religion/spirituality, ability/disability status, body size/type, level of education.

Credits: 3.00

TCM 21800 - Introduction To Engineering Technical Reports

Credit Hours: 1.00. This integrated technical communication course introduces foundational skills for technical reports in engineering. Students will practice a recursive writing process and use techniques for analyzing content for different audiences and purposes.

Credits: 1.00

TCM 22000 - Technical Report Writing

Credit Hours: 3.00. Extensive application of the principles of clear writing in industrial reporting, with emphasis on adaptation to the audience; organization of ideas; and a concise, objective writing style.

Credits: 3.00

TCM 22200 - Introduction To Technical Documentation

Credit Hours: 1.00. This integrated technical communication course introduces foundational skills for creating effective technical documentation.

Credits: 1.00

TCM 24000 - Tools For Technical Communications

Credit Hours: 3.00. This course introduces students to how to use software tools that technical communicators need for contemporary workplace practice. The course will develop students' conceptual knowledge of the capabilities and limitations of software that professionals use to create, deliver, and manage, technical communication. Included are principles of how technical communicators learn to use new software and how they evaluate its suitability for use in specific situations.

Learning Outcomes: 1. Describe and use basic, common tools for creating, managing, and delivering technical communication. 2. Explain concepts and features of commonly used technical communication software tools. 3. Explain how commonly-used technical communication tools fit into or alter processes of creating technical communication 4. Evaluate and recommend technical communication tools that meet the needs of specific situations.

Credits: 3.00

TCM 25000 - Career Planning In Engineering And Technology

Credit Hours: 1.00. Course will guide you through a systematic, hands-on approach to making career-related decisions. The course assumes that career planning is an ongoing process and requires understanding of self and one's environment; therefore, you will leave the course with the necessary tools to find and acquire an internship, co-op, or job now and in the future.

Credits: 1.00

TCM 31000 - Technical And Scientific Editing

Credit Hours: 3.00. The course focuses on techniques for editing functional technical and scientific products in academic and professional settings.

Credits: 3.00

TCM 32000 - Written Communication In Science And Industry

Credit Hours: 3.00. Analysis of current writing practices in technology and science, especially in organizational settings. Practice in designing and preparing reports for a variety of purposes and audiences.

Credits: 3.00

TCM 34000 - Correspondence In Business And Industry

Credit Hours: 3.00. The development and application of strategies and skills for writing letters for business and industry in technology and engineering. Applications may include resumes and letters of application, informational and persuasive letters, and in-house memoranda.

Credits: 3.00

TCM 35000 - Visual Technical Communication

Credit Hours: 3.00. Topics covered in this class include methods and principles of creating visual technical communication, basics of visual design, visualization of technical data, usability of visual technical communication products, the role of technical communicators in the workplace, and modern technology available to technical communicators.

Learning Outcomes: 1. Explain and apply basic principles of designing print and electronic products that communicate both visually and textually. 2. Analyze technical communication products that others have created in order to determine how the visual elements fit the communication situation. 3. Develop project management skills for technical communication context. Credits: 3.00

TCM 35800 - Technical Reporting Analysis And Development

Credit Hours: 1.00. This integrated technical communication course builds advanced technical reporting skills including analysis, synthesis, and development of technical content, structure, and style for technical audiences.

Credits: 1.00

TCM 35900 - Technical Data Reporting And Presentation

Credit Hours: 1.00. This integrated technical communication course builds advanced data reporting and presentation skills for technical and non-technical workplace audiences.

Credits: 1.00

TCM 36000 - Communication In Engineering Practice

Credit Hours: 2.00. The application of rhetorical principles to written and oral communication in the engineering professions. Planning, drafting, and revising professional engineering reports; planning and delivering oral presentations; organizing information; developing persuasive arguments.

Credits: 2.00

TCM 38000 - Technical Communication In The Healthcare Professions

Credit Hours: 3.00. Focuses on the writing demands of the healthcare industry and so includes principles of clear writing, concise style, and organized ideas. Students examine and write documents for audiences in their medical and clinical organizational contexts.

Credits: 3.00

TCM 41500 - Technical Communication For Design Projects

Credit Hours: 1.00. This integrated course applies advanced principles and theories of technical communication in a senior design project. Students will create and manage effective oral and written communication for workplace contexts.

Credits: 1.00

TCM 41600 - Advanced Technical Communication For Design

Credit Hours: 1.00. Students in this course integrate advanced technical communication principles as they complete senior projects.

Learning Outcomes: 1. Analyze the audiences for presentation of technical information. 2. Prepare and present technical information to technical and non-technical audiences. 3. Analyze data and create advanced visuals appropriate for technical reports. 4. Use presentation software effectively. 5. Work effectively in teams to plan, organize, and hold effective meetings. 6. Describe and use an advanced recursive planning and revision process for technical presentations and reports. Credits: 1.00

TCM 42000 - Field Experience In Technical Communication

Credit Hours: 1.00 to 3.00. Full- or part-time work in technical communications, supervised by a qualified professional in the cooperating organization and a faculty advisor. Requires periodic written and oral reports and final written and oral

reports on work experience and assigned readings. Credit varies with scope of projects. Meets RISE criteria. May be repeated for a total of 4 credit hours. Permission of instructor required.

Credits: 1.00 to 3.00

TCM 42500 - Managing Document Quality

Credit Hours: 3.00. (ENG W532) This course examines and applies principles of creating technical publication in order to pursue quality management of the process. Students will produce effective publications by identifying and intervening in crucial points in documentation cycle - planning, researching, designing, drafting, reviewing, testing, and revising.

Credits: 3.00

TCM 43500 - Portfolio Preparation

Credit Hours: 1.00. Preparation of professional portfolio for review by faculty or subject matter experts. Includes readings and development of a professional career plan.

Credits: 1.00

TCM 49000 - Capstone In Technical Communication

Credit Hours: 3.00. This capstone course will apply skills and abilities from previous course work to complete activities and projects that demonstrate competence appropriate for technical communication workplaces. Students will reflect on and synthesize what they have learned throughout their technical communication studies and how that knowledge can be applied to future careers. Permission of instructor required.

Learning Outcomes: 1. Use a recursive communication process including planning, drafting, revising, and reviewing multiple versions of products. 2. Design information, perform tasks, and develop deliverables that meet audience and purpose needs. 3. Design usable content to meet compliance and production guidelines. 4. Manage projects to meet scheduled deadlines and monitor and report your progress. use advanced elements of technical and information literacy. 5. Analyze critically ethical issues in technical communication. Credits: 3.00

TCM 49900 - Issues in Technical Communcation

Credit Hours: 1.00 to 3.00. Topics of current and specialized interest for technical communicators. Hours and subject matter arranged by staff.

Credits: 1.00 to 3.00

TCM 56000 - Technical And Scientific Communication In Academic Contexts

Credit Hours: 3.00. Develop reading, writing, and speaking skills for academic success as an engineering, science, or technology graduate student. Students analyze the structure, claims, and evidence of written documents and oral presentations. Students simulate these presentations and write similar documents to gain practical experience for successful writing and speaking in academic contexts.

Learning Outcomes: 1. Analyze examples of academic engineering, technical, and/or scientific written products and oral presentations to discover and identify conventions of discipline-specific content selection, organization, uses of visuals, and stylistic features. 2. Plan, prepare, and produce written and oral presentations, reports, and papers on engineering, technology, and science topics to technical and nontechnical audiences using the appropriate conventions for their fields. 3. Evaluate their own and other students' work, and provide constructive advice and feedback to colleagues as they develop their documents and presentations. Credits: 3.00

TLI 10000 - Organizational Leadership Career Orientation

Credit Hours: 1.00. In this course students are introduced to potential organizational leadership-related career paths. Topics include introduction to organizational leadership careers, self-assessment and career alignment, and networking and professional development.

Learning Outcomes: 1. Define various organizational leadership-related career paths. 2. Apply self-assessment techniques to identify personal strengths and areas for development. 3. Examine the role of professional networks in careers. Credits: 1.00

TLI 11200 - Foundations Of Organizational Leadership

Credit Hours: 3.00. A survey of individual and organizational behavioral concepts and principles that provide a foundation for leadership in technology organizations. The focus will be toward the understanding of behaviors necessary for effective organizational leadership, including concepts of work in a technology-rich environment.

Learning Outcomes: 1. Define the foundational theories, concepts, and practices of organizational behavior and technology leadership. 2. Use self-assessment for identifying behaviors and skills of technology leadership. 3. Define and implement reflective practice for leadership growth. 4. Explain the systematic study of organizational behavior. 5. Describe dimensions of technology as they relate to the organizational behavior and leadership. Credits: 3.00

TLI 11500 - Foundations Of Conflict Competence: Navigating Conflict For Growth And Resolution

Credit Hours: 3.00. This course equips students with the knowledge and skills necessary to become conflict-competent individuals who can turn conflicts into opportunities for growth, learning and building stronger connections with others. Participants will understand conflict competence, explore different conflict resolution approaches, develop strategies for repairing relationships harmed by conflict and identify university resources available to assist with conflicts.

Learning Outcomes: 1. Explain the concept of conflict competence. 2. Expand understanding and use of a range of conflict strategies to improve relationships. 3. Increase awareness of methods for repairing relationships harmed by conflict. 4. Identify campus resources to assist with conflicts. Credits: 3.00

TLI 15200 - Business Principles For Organizational Leadership

Credit Hours: 3.00. This course will introduce the topic of applied organization leadership in the context of working organizations. Topics include basic functions, structures, and operations of organizations, and an introduction to reading and understanding balance sheets, cash flow statements, and profit-loss statements.

Learning Outcomes: 1. Identify the business information that organizational leaders are expected to know to comprehensively manage the function and operation of profit and not-profit organizations. 2. Describe the major functions of business, including: operations, finance, marketing, and information technology. 3. Interpret balance sheets, cash flow statements, and profit-loss statements. 4. Explore how organizations use technology to become competitive entities in global business environments. Credits: 3.00

TLI 15500 - Foundations Of Learning In Human Resource Development

Credit Hours: 3.00. This course explores the concept of learning within the interdisciplinary field of Human Resource Development, focusing on how people learn in different environments in the workplace - both formal (e.g., training) and informal (e.g., on the job). The course will cover theoretical frameworks, learning methods, and practical applications to enhance workplace learning and outcomes.

Learning Outcomes: 1. Understand key theories and concepts of learning in HRD. 2. Analyze the impact of cognitive, social, and cultural factors on workplace learning. 3. Explain the role of technology in workplace learning. 4. Evaluate assessment and evaluation approaches in workplace learning. 5. Apply learning principles to real-world workplace challenges. Credits: 3.00

TLI 16100 - Prototyping In Engineering/Technology Education

Credit Hours: 3.00. Design, make, and innovate! This course provides basic instruction on the proper and safe use of tools and equipment used to prototype innovative ideas. This includes 3D printers, laser cutters/engravers, fabrication tools/equipment, CNC mills/routers, and microcontrollers/microcomputers.

Learning Outcomes: 1. Demonstrate the technical competencies to properly and safely operate common prototyping equipment and tools. 2. Apply knowledge of materials properties to select the appropriate materials for a desired prototype. 3. Create operations process flow charts

for planning product development. 4. Test prototypes in real situations to gather data related to their performance. Credits: 3.00

TLI 20000 - Organization Leadership Career Exploration

Credit Hours: 1.00. In this course students continue their exploration of organizational leadership-related career opportunities. Topics include resume building and internship search strategies, interview skills and professional etiquette, and identifying and securing internships.

Learning Outcomes: 1. Apply resume-building strategies to highlight organizational leadership experiences. 2. Create a professional digital presence through relevant platforms. 3. Evaluate the impact of experiential learning on personal and professional development. Credits: 1.00

TLI 21300 - Project Management

Credit Hours: 3.00. Project management is an ad hoc technique for accomplishing specialized missions or work. Examples of projects include research and development studies, consulting projects, reorganizations efforts, implementation of total quality management, installation of new equipment, advertising campaigns, construction or other one-time efforts. This course will provide a leadership approach to project management, including team development and team selection.

Learning Outcomes: 1. Demonstrate ability to function effectively in teams. 2. Document and manage a project using accepted project management principles. 3. Identify strategies for managing organizational stakeholders. 4. Demonstrate effective oral and written communication skills. Credits: 3.00

TLI 25500 - Foundations Of Human Resource Development

Credit Hours: 3.00. Much has been discussed about the importance of people in organizations, difficulties within organizations, and challenges faced by today's organizations. This course covers the field of human resource development (HRD) as an important area of practice within organizations. The course provides an introduction to HRD theories, principles, concepts, and practices. It provides foundations through the study of history, current paradigms, and perspectives on the future of the field of HRD while specifically focusing on training and development, organization development, and career development as organizational functions within HRD.

Learning Outcomes: 1. Conduct a learning assessment. 2. Conduct a performance assessment. 3. Write training performance improvement objectives. 4. Describe core HRD functions. 5. Describe methods of HRD program evaluation. Credits: 3.00

TLI 26200 - Foundations Of Integrated STEM Education

Credit Hours: 3.00. This course provides students with a conceptual understanding of an integrated approach to teaching Science, Technology, Engineering, and Mathematics (STEM). Integrated STEM pedagogies include project/problem-based (PBL), design-based, and inquiry-based approaches to teaching. Students engage in a co-teaching model to deliver STEM instruction and observe local K-12 classrooms.

Learning Outcomes: "1. Identify foundational learning theories that blend an integrated approach to teaching. 2. Identify common practices for scientists, technologists, engineers, and mathematicians and similarities with other STEM careers. 3. Describe the key tenants of PBL, design-based, and scientific inquiry-based approaches to teaching content. 4. Create integrated STEM lessons that address two STEM subjects and state/national standards. Credits: 3.00

TLI 26500 - Teaching The TE Of STEM

Credit Hours: 3.00. A course for teacher education majors that provides rationale and techniques for integrating engineering and technological literacy into the K-12 mathematics and science curriculum. Experiences focus on the engineering design process, mechanisms, robotics, strength of materials, electrical circuits, and electronics.

Learning Outcomes: 1. Describe the national importance of the integrative nature of the K-12 STEM curriculum. 2. Describe how technology and engineering can be integrated into K-12 mathematics and science. 3. Demonstrate hands-on learning activities appropriate to

integrate technology and engineering into the K-12 STEM curriculum. Credits: 3.00

TLI 29000 - Independent Study In Technology Leadership And Innovation

Credit Hours: 1.00 to 3.00. Supervised individual study in technology leadership and innovation topics. Permission of instructor required.

Credits: 1.00 to 3.00

TLI 29900 - Special Topics In Technology Leadership & Innovation

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faulty. Group instruction in new or specialty areas of Technology Leadership and Innovation is provided by Technology faculty, subject to TLI Curriculum Committee approval.

Credits: 1.00 to 3.00

TLI 30000 - Organizational Leadership Career Transition

Credit Hours: 1.00. In this course students prepare to make the transition from organizational leadership students to organizational leadership professionals. Topics include career planning and advancement, professional networking and relationship building, and transitioning successfully from college to career.

Learning Outcomes: 1. Demonstrate career planning and advancement strategies. 2. Apply effective networking strategies for professional growth. 3. Synthesize achievements into a professional portfolio for presentation. Credits: 1.00

TLI 31400 - Leading Innovation In Organizations

Credit Hours: 3.00. This course provides the foundation for understanding the manner in which companies capture innovation and use it to set themselves apart from competitors. Topics covered include the attributes of organizations that are successful in fostering a culture of innovation; the characteristics and roles of leaders and members in innovative organizations; managerial processes and organizational systems that facilitate the successful development, commercialization, and adoption of innovative technologies, products, and services; and methods used to measure innovation-related outcomes.

Learning Outcomes: 1. Describe the characteristics of successful innovations. 2. Explain how innovations develop from ideas to successful outcomes. 3. Analyze practices and strategies that lead to the successful development and adoption of innovations. 4. Communicate how innovation strategies help organizations succeed in competitive markets. 5. Identify managerial behaviors that foster a culture of innovation among employees. 6. Differentiate the attributes of successful leaders and employees in innovative organizations. 7. Analyze methods used to measure innovation-related outcomes. Credits: 3.00

TLI 31500 - New Product Development

Credit Hours: 3.00. This course introduces the process of technological innovation and new product development from concept to commercialization. Topics covered include ideation, R&D, prototyping (design and modeling), testing for quality, the patent process, intellectual property rights, marketing and cost evaluation.

Learning Outcomes: 1. Describe the process of innovation as it relates to new product development. 2. Identify quality standards and testing procedures for new products. 3. Describe the patent process. 4. Explain methods for protecting domestic and international intellectual property rights. 5. Describe the process for conducting market research. Credits: 3.00

TLI 35510 - Training And Talent Development

Credit Hours: 3.00. This course is designed to develop theoretical and applied perspectives on needs assessment, design, development, delivery, and evaluation of training and development in organizational contexts. Emphasis is placed on assessing learning and performance outcomes throughout the training and development process. Implication of training to talent development are also highlighted in a highly automated workplace.

Learning Outcomes: 1. Conduct a training needs assessment. 2. Analyze job tasks for purposes of planning training activities. 3. Write training learning objectives. 4. Describe an

instructional system design process. 5. Describe methods of training program evaluation. 6. Identify talent development approaches in a digitalized economy. Credits: 3.00

TLI 35520 - Organization Development And Change

Credit Hours: 3.00. This course provides an introduction to major theories, concepts, skills and techniques for the practice of organization development processes and interventions using a consultancy approach. Implications for organizational change are integrated as part of an OD effort.

Learning Outcomes: 1. Describe the historical roots and theoretical underpinnings of organizational development. 2. Apply the action research model for professional practice. 3. Effectively participate in small groups. 4. Identify intervention strategies at the individual, small group, and large systems levels. 5. Conduct organization development analysis. Credits: 3.00

TLI 35530 - Strategic Human Resources

Credit Hours: 3.00. This course equips you with the skills to lead strategic human resource initiatives, enhancing your understanding of how HR strategy impacts organizational performance. Strategic Human Resources involves aligning HR practices with organizational goals to optimize the value of human capital. As future HR professionals, you will learn to contribute significantly to strategic planning and organizational success by leveraging human talent strategically and effectively.

Learning Outcomes: 1. Design and execute HR strategies that align with organizational goals and enhance overall performance. 2. Assess how various HR practices contribute to achieving strategic objectives and improving organizational outcomes. 3. Apply HR strategies to various case studies from actual company/industry scenarios to address key business issues and leverage human capital effectively. 4. Gain a deep understanding of the principles and theories underlying strategic HR and their application in real-world scenarios. 5. Identify and propose solutions to current strategic business issues faced by HR professionals in today's dynamic workplace. Credits: 3.00

TLI 35540 - Staffing Organizations

Credit Hours: 3.00. This course provides an overview of the processes by which organizations staff positions with both internal and external applicants. The course covers theory, research, and legal foundations that inform organizational staffing actions. Topics include staffing strategy and context, measurement of staffing effectiveness, job/competency analysis, human resource planning, recruitment and job choice, retention, and internal and external selections practices.

Learning Outcomes: 1. Describe the role of staffing to support an organization's strategy and to improve productivity. 2. Develop a model for staffing an organization that supports company's human resources strategy and sustains productive operations. 3. Describe the key legal compliance issues associated with staffing organizations. 4. Develop recruitment plans using both internal and external recruitment. 5. Design a selection process that incorporates a variety of assessment methods and a supporting decision method for candidate selection. 6. Develop a workforce retention program for an organization. Credits: 3.00

TLI 35550 - Compensation And Rewards

Credit Hours: 3.00. This course examines the compensation and reward structures of organizations. It covers the planning and implementation of a total compensation system, including job evaluation, salary survey and analysis, benefits, and development of a structured pay system. Included are behavior implications and legal compliance issues related to compensation and rewards.

Learning Outcomes: 1. Differentiate traditional, incentive, and person-focused pay systems. 2. Describe the process of building internally consistent compensation systems. 3. Build a market-competitive compensations system. 4. Differentiate discretionary versus legally required benefits. Credits: 3.00

TLI 35560 - Employment And Labor Law For The Human Resource Professionals

Credit Hours: 3.00. This course provides a foundation for understanding the impact of labor laws and legal issues in organizations. Topics include corporate social responsibility, employment law, environmental issues, conflict resolution, and global challenges.

Learning Outcomes: 1. Select and apply legally and practically appropriate staffing techniques according to basic principles of validity and reliability. 2. Articulate the value of employee training, development, job design, and job enrichment. 3. Summarize basic components of compensation plans and performance evaluation systems, assess potential deficiencies, and compare elements as they relate to organizational objectives. 4. Apply major labor laws to employment practices in employee relations, health, safety and security, and to consider the connection between labor relations practices and outcomes. 5. Articulate unique challenges throughout HRM related to practice in public, private, and non-profit sectors. 6. Compare HRM practices and policies from varying perspectives, evaluate source credibility, and draw conclusions based on that information. Credits: 3.00

TLI 35570 - Job Analysis And Job Design

Credit Hours: 3.00. This course demonstrates procedures for analyzing tasks related to specific jobs. Topics include collecting occupational data and information, the relevance of job analysis on individual and organizational performance, impact on training and development, and associated legal issues.

Learning Outcomes: 1. Explain the background and progression of job analysis techniques. 2. Collect information about jobs and develop an organized job analysis report. 3. Conduct job analysis. 4. Effectively utilize the Dictionary of Occupational Titles and O*NET to gain occupational information. 5. Recognize HR Information System and its relationship with compliance with federal and state regulations/Laws. 6. Analyze jobs within an organization for the purpose of developing training or recommending other performance interventions. 7. Demonstrate various uses of job analysis. 8. Articulate the role of a job analysis in the improvement of organizational performance. Credits: 3.00

TLI 35580 - The Individual And Organizational Performance

Credit Hours: 3.00. This course develops an understanding of the principles and theoretical foundations of individual and organizational performance management. Emphasis is placed on the perspectives, methodology, and theoretical frameworks as well as applications for performance management from the perspective of human resources professionals.

Learning Outcomes: 1. Develop an understanding of the principles and theoretical foundations of individual and organizational performance management. 2. Identify and analyze performance problems in an organizational system. 3. Identify and evaluate interventions in performance improvement at different levels (individual, team/process and organizational). 4. Understand human resource approaches to individual and organizational performance management. 5. Examine various technologies for managing individual and organizational performance. Credits: 3.00

TLI 36100 - Engineering And Technology Education Instructional Planning And Evaluation

Credit Hours: 3.00. This course addresses selecting content, writing instructional objectives, planning lessons, preparing a unit of study, and evaluating student progress. Emphasis is placed on evaluating instruction and student achievement to include developing valid, reliable testing instruments as they relate to measuring student achievement in the cognitive, affective, and psychomotor domains.

Learning Outcomes: 1. Demonstrate instructional planning skills related to the delivery of engineering/technology education to both middle-level and high school students. 2. Prepare lesson plans, a unit of study, and

evaluation instruments. 3. Appraise instructional material effectiveness and propose revisions for improvement. 4. Prepare appropriate assessment instruments that align with identified learning objectives. Credits: 3.00

TLI 36700 - Teaching Design And Innovation I

Credit Hours: 3.00. This course focuses on the development of appropriate engineering design knowledge and skill required to effectively teach middle and high school engineering/technology education courses by infusing engineering design into the curriculum. Students will use 3-D solid modeling software, rapid prototyping, and other design technologies as they engage in the engineering design process through an open-ended engineering design challenge.

Learning Outcomes: 1. Display the ability to teach students to develop skills for living in a knowledge-based, technological society using design-based pedagogical approaches. 2. Use the engineering design process to solve open-ended, ill-defined problems. 3. Demonstrate the ability to teach basic engineering design techniques. Credits: 3.00

TLI 45560 - Professional Internship In Human Resources

Credit Hours: 3.00. The undergraduate internship course is designed as a culminating learning experience for students nearing graduation. Students have an opportunity to seek out practical work experience related to human resources to use knowledge acquired in the classroom. The course will serve as a professional development opportunity helping students reflect and build upon their experiences gained through the required 500-hours human resources related work.

Learning Outcomes: 1. Learn and grow personally and professionally from an internship experience. 2. Express gained competencies and skills through evidence and critical reflection. 3. Receive, evaluate and apply constructive performance feedback and evaluation, as assessed by the internship supervisor. 4. Understand one's self in a professional context. 5. Integrate HRD theory and professional practice. Credits: 3.00

TLI 45570 - Global Human Resources

Credit Hours: 3.00. This course prepares students to lead human resource activities within a global, technology-driven economy and business environment. Topics include recruitment, training and development processes, cultural issues, policies and regulations within a global and international context.

Learning Outcomes: 1. Identify the main differences between domestic and international human resources. 2. Understand the challenges of international business dynamics on international human resources and the procedures for preparing employees for international assignments. 3. Understand how managing expatriates helps to improve their performance and minimize their business failures in international assignments. 4. Recognize that training and development of expatriates is a key factor for their success in their assignments. 5. Understand the complexity of international human resources and the need for staffing international human resources in accordance to the models of business organizations. 6. Recognize the challenges of repatriation of expatriates and develop the skill to minimize their stress in the parent country organizations. 7. Recognize the need for balancing the process international human resource adaptation and standardization in the host country. 8. Identify relevant theories on performance management in the context of international human resources. 9. Develop intercultural knowledge and competence. Credits: 3.00

TLI 45580 - Human Resource Information Systems And People Analytics

Credit Hours: 3.00. This class surveys Human Resource Information Systems (HRIS) to understand how they facilitate communication processes, policy implementations and change management. Big data is transforming how firms recruit and develop talent and this course introduces concepts and methods for making better through people analytics.

Learning Outcomes: 1. Translate the origins of HR Information Technology to an organization; and infer the need to obtain involvement and commitment from others to set in place mechanisms to affect successful Human Resources Information System Programs and strategies. 2. Develop an understanding of basic systems and the criteria for success in using HR software in organizations. 3. Identify HR Information Systems trends. 4. Detail various approaches to Human Resources Information systems design, selection and implementation and define characteristics of current Human Resource Information technology implementation strategies. 5. Recognize HR Information System and its relationship with compliance with federal and state regulations/Laws. 6. Explain benefits of new technologies in recruiting and training in individual development of employees. 7. Describe and discuss the various HR Portal and associated programs and their associated values, costs, and benefits to the organization. 8. Students will employ statistical software to conduct quantitative analyses, for example to predict the potential of applicants to improve hiring decisions or to evaluate the effectiveness of training and talent development programs. 9. Students will learn how to manage the workforce and how to take advantage of analytics in their decision making process. Credits: 3.00

TLI 45590 - Foundations Of Human Resources Capstone

Credit Hours: 3.00. This course synthesizes all of the required and secondary content areas described in the SHRM HR Curriculum Guidelines. Students will prepare for the SHRM Certified Professional (SHRM-CP) exam while demonstrating their accumulated knowledge and in the area of human resources.

Learning Outcomes: 1. Reflect on the entire HR-related areas. 2. Synthesize all HR-related knowledge, skills, and competencies. 3. Engage in test-taking for obtaining licensure. 4. Demonstrate an understanding of all HR-related concepts, terms, applications, and processes. 5. Successfully complete mock SHRM-CP exams. Credits: 3.00

TLI 45800 - Leadership For Competitive Advantage

Credit Hours: 3.00. Organizations who consistently outperform competitors realize bottom-line impact through efficient leveraging of organizational strategy, leadership, internal and external talent acquisition, organizational culture, and marketing strategies. This course will explore the relationships between these areas and introduce organizational tools and concepts to enable the student to recognize and build capacity for sustainable competitive advantage in technology organizations.

Learning Outcomes: 1. Describe characteristics of adaptable organizations. 2. Assess existing organizational strategic alignments. 3. Design organizational systems for sustainable competitive advantage. 4. Implement organizational systems for sustainable competitive advantage. Credits: 3.00

TLI 45810 - Internship Program

Credit Hours: 1.00. An internship designed to combine university study with work experience directly related to the student's plan of study. Permission of department required.

Learning Outcomes: 1. Apply organizational leadership theory in a corporate environment. Credits: 1.00

TLI 45820 - Internship Program Seminar

Credit Hours: 2.00. An internship designed to combine university study with work experience directly related to the student's plan of study. Includes reflection on interning experience as well as a written final paper and oral presentation covering the student's internship experience. Permission of department required.

Learning Outcomes: 1. Compare and contrast internship experiences of different types of organizations. 2. Describe the internship experience. 3. Evaluate the effectiveness of the internship experience. Credits: 2.00

TLI 46000 - Teaching Design And Innovation II

Credit Hours: 3.00. This course expands the engineering design process, incorporating rapid prototyping and other fabrication technologies to create a specified solution. The course emphasizes process flow chart planning and logistics of engineering/technology education laboratory management. Prototypes will be tested in real situations and data gathered on performance. Designs will be revised to reflect a deeper understanding of manufacturing and use, being sensitive to structure, function, and behavior from a systems-level perspective. Intellectual property, marketing, and infrastructure will be discussed.

Learning Outcomes: 1. Describe the complexity of implementing design solutions. 2. Select appropriate fabrication technologies. 3. Operationalize performance criteria into measurable variables. 4. Gather data to make rational decisions, which are transparent and justifiable. 5. Optimize design solutions and perform iteratively in the design process. Credits: 3.00

TLI 46100 - Engineering/Technology Teacher Lab Planning

Credit Hours: 3.00. This course provides future engineering/technology education teachers with information on designing, organizing, and managing engineering/technology education facilities. An in-depth study of specific laboratory requirements related to safety is covered. Management skills related to students, equipment, and supplies are addressed. Students design an engineering/technology education laboratory.

Learning Outcomes: 1. Develop techniques for planning and organizing laboratory tools, supplies, and equipment for efficient and educationally sound laboratory operation. 2. Explain the importance of safety in engineering/technology education facilities and prescribed methods of rendering facilities safe for student activities. 3. Describe government requirements and mandates related to the engineering/technology education laboratory. 4. Develop a system for inventory, purchase, and maintenance of equipment and supplies for an instructional facility. 5. Design an engineering/technology education laboratory. Credits: 3.00

TLI 46200 - Methods Of Teaching Engineering/Technology Education

Credit Hours: 3.00. Students identify a variety of instructional techniques appropriate for teaching engineering/technology education. Students will present lessons and develop evaluation instruments to determine student achievement. Methodological insights and understanding for teaching technical subject matter is stressed.

Learning Outcomes: 1. Demonstrate skills in delivering instruction using various teaching methods. 2. Demonstrate different techniques for addressing cognitive, affective, and psychomotor domains of learning. 3. Design and prepare teacher-made lesson materials. 4. Demonstrate skills in delivering instruction using various teaching methods. Credits: 3.00

TLI 49000 - Independent Study In Technology Leadership And Innovation

Credit Hours: 1.00 to 3.00. Supervised individual study in technology leadership and innovation topics. Permission of instructor required.

Credits: 1.00 to 3.00

TLI 49800 - Undergraduate Research In Technology Leadership And Innovation

Credit Hours: 1.00 to 3.00. Students will conduct research in the area of technology leadership and innovation with a primary investigator. The primary focus of the course is to contribute to ongoing research, while learning current research techniques. Analyzing data, determining courses of action, developing critical thinking, and presenting results are emphasized. Requires prior approval of, and arrangement with, a faculty research advisor. Permission of instructor required.

Learning Outcomes: 1. Demonstrate subject-matter competency, integrating technology theories. 2. Conduct research using generally accepted methods appropriate for the research question. 3. Demonstrate critical thinking skills. 4. Explain various ethical issues facing researchers in technology. Credits: 1.00 to 3.00

TLI 49900 - Special Topics In Technology Leadership & Innovation

Credit Hours: 1.00 to 3.00. Hours, subject matter, and credit to be arranged by faulty. Group instruction in new or specialty areas of Technology Leadership and Innovation is provided by Technology faculty, subject to TLI Curriculum Committee approval.

Credits: 1.00 to 3.00

College of Science

CoS Homepage

The College of Science encompasses the physical, life, computational, and mathematics sciences, offering 41 disciplinary degree programs and seven interdisciplinary science programs. The leadership of our renowned scholars and researchers drives an ever-expanding culture of discovery and innovation which embraces all perspectives as we endeavor to solve the grand challenges that face our world. Nearly 350 tenure-track faculty conduct world-changing research and deliver a transformative education to more than 1750 graduate students and 6000 undergraduates. We are a community of learners that develops practical solutions to today's toughest challenges.
By extension, College of Science students are innovation leaders whose disciplinary technical expertise and exemplary problem-solving skills are in high demand. Industry, professional schools, and graduate programs equally value our students for their professional skills and ability to drive discovery in a highly diverse global environment collaboratively. Each undergraduate program blends courses and experiences that create a unique path for each student as they pursue disciplinary interests and personal and professional goals through minors, certificates, and experiential learning opportunities, including research and Study Abroad programs. For example, the Learning Beyond the Classroom certificate, open only to science students, blends career and professional; service, citizenship, and leadership; and domestic and international diversity experiences to bring real-world know-how to the classroom experience.

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Departmental Pages

- Science Administration
- Biological Sciences
- Chemistry
- Computer Science
- Earth, Atmospheric and Planetary Sciences
- Mathematics
- Physics and Astronomy
- Statistics

Admissions

More Information

Successful completion of all Teacher Education Program (TEP) Requirements, including a minimum 2.5 Teacher Education Overall GPA are required to progress beyond each TEP Milestone. All Professional Education courses, including Learner Specialty Concentration/Pathway courses, must be completed with no grade lower than a "C" and no "I" (Incompletes). Degree requirements must be fulfilled to qualify for TEP completion. A minimum passing score on all required licensure examinations and completion of licensure requirements are necessary to be eligible for an Indiana Instructional Educator License.
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- Summary of Teacher Education Milestones
- Licensure Information
- Technology Integration- Blended and Online Teaching (Ti-BOT)

Summary of Teacher Education Milestones

Admission to Teacher Education Program

Admission to the Teacher Education Program (TEP) is directly granted upon acceptance and enrollment at Purdue University, West Lafayette. The Teacher Education Program is aligned with national and state accreditation and licensure standards, regulations, and rules; university guidelines; and prescribed Plan(s) of

Study (POS) as defined by Admission Year or as otherwise authorized by the Office of Teacher Education and Licensure (OTEL).

TEP Program Progression by Milestone (Milestones A-F)

Successful TEP progression and completion are achieved by attaining each TEP Milestone at or above Standard as outlined within the 2025-2026 Program Requirements and Milestones for each individual content area/major and as referenced and assigned within the 2025-2026 University Catalog, 2025-2026 Teacher Education Program Directory, the Brightspace course 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements, Plan(s) of Study (POS), and course syllabi.

Required Brightspace Course

Every incoming 2025-2026 Teacher Education (TE) student will be enrolled in the REQUIRED 2025-2026 Purdue University Undergraduate Teacher Education Program Requirements Brightspace course. This course serves as the official/primary manner for which the Office of Teacher Education and Licensure (OTEL) will communicate and monitor cohort-specific requirements, milestones, timelines, notifications, tutorials, actions, student engagement, etc. for each TE student. Course commitment is continuous beginning upon arrival to the university and concludes when Milestones A-F are attained.

Course Substitutions

Course substitutions must fulfill degree requirements, associated Teacher Education Program (TEP) key and/or common assessments, and licensure standards/requirements. Prior approval by the Office of Teacher Education and Licensure is required for all course substitutions.

Milestone A: Methods Qualified

Milestone A - Teacher Education Program Progression Status

- Exceeds Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone A Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone A Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone A Decision Deferred to Milestone B: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone A - Review Schedule

- Conducted - Close of Spring Semester 2026
- Decision/Notification - Early Fall Semester 2026

1. 2.50/4.00 Overall GPA (at time of Milestone A review)
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).

4. *Be in Good Standing with the University (at time of Milestone A review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6. ***Successfully complete three (3) Ti-BOT badges (at the time of Milestone A review).
7. No unresolved Professional Dispositions issues/concerns.
8. Adhere to the Criminal Background Check Policy.
9. Complete TEP Brightspace Assignments, including but not limited to attendance at the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
10. Attend the mandatory TEP Orientation hosted by the Office of Teacher Education and Licensure (OTEL).
11. Submit the Teacher Education Program Agreement (TEPA).
12. Identify via the Teacher Education Program Agreement (TEPA) one of four chosen Learner Specialty Pathways. Learner Specialty Concentration/Pathway requirements are specific to individual content area/major.

Milestone B: Student Teaching/ Placement

Milestone B - Student Teaching Placement

- Exceeds Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone B Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone B Criteria as defined by Content Area/Admission Year. NOTE: A Professional Disposition/Student of Concern is submitted and prescribed, Intervention required. Schedule a meeting with Academic Advisor.
- Milestone B Decision Deferred to Milestone C: Reserved for transfer students. Additional time is necessary to acquire an adequate number of measurable Milestone outcomes.

Milestone B - Review Schedule

- Conducted - Close of Fall Semester 2027
- Decision/Notification - Early Spring Semester 2028

1. 2.50/4.00 Overall GPA (at time of Milestone B review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone B review).
5. **Successful progression in Foundation Courses and associated Foundation Portfolio Common Assessments.
6.

***Successfully complete five (5) total Ti-BOT badges (at the time of Milestone B review).

7. No unresolved Professional Dispositions issues/concerns.
8. Complete TEP Brightspace Assignments.
9. Attend the mandatory Student Teaching Clinical Acceptance Process (CAP) Workshop provided by the Office of Clinical Practice (OCP) AND submit your CAP Application as directed by OCP.

- Expanded Student Teaching practicums and full-time Student Teaching occur over two consecutive semesters.
- Verify from the CAP Application projected Student Teaching semester/year.

Milestone C: Student Teaching Authorization

Milestone C - Student Teaching Authorization

- Exceeds Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year and recognized on Dean's List.
- At Standard: Meets Milestone C Criteria as defined by Content Area/Admission Year.
- Below Standard: Does not Meet Milestone C Criteria as defined by Content Area/Admission Year.

Milestone C Criteria must be attained At Standard before the Office of Teacher Education and Licensure (OTEL) will authorize enrollment reinstatement for Student Teaching.

Milestone C - Review Schedule

- Conducted - Close of Fall Semester 2028
- Decision/Notification - Early Spring Semester 2029

1. 2.50/4.00 Overall GPA (at time of Milestone C review).
2. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
3. Fulfill degree requirements as projected (2.00/4.00 Graduation GPA- see additional requirements in the Purdue University Catalog).
4. *Be in Good Standing with the University (at time of Milestone C review).
5. **Successful completion and target met on Foundations Portfolio (submission and target met on Common Lesson Plan in Semester 7).
6. ***Successfully complete ten (10) total Ti-BOT badges (at the time of Milestone C review).
7. Successfully complete all Professional Education (including Foundation and Methods), Learner Specialty Pathway, and degree courses prior to student teaching (Semester Eight).
8. Attempt all required content test(s) before the Student Teaching semester per the timeline below; Test Requirements (ets.org)

Content Test Attempts for Major

For Fall Student Teaching: Official Score Reports due to OTEL no later than July 1.

For Spring Student Teaching: Official Score Reports due to OTEL no later than December 1.

Content Test Attempts for Pathways/Concentrations (High Ability and English Language Learning)

For Fall Student Teaching: Test Registrations received in OTEL by May 15th confirming a test date scheduled no later than June 30th.

For Spring Student Teaching: Test Registrations received in OTEL by October 15th confirming a test date scheduled no later January 31st.
Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts; If completing a Learner Specialty Pathway that leads to licensure (High Ability or English Language Learners), the associated content exam must be attempted prior to the Student Teaching (Semester 8).

9. No unresolved Professional Dispositions issues/concerns.
10. Adhere to the Criminal Background Check Policy.

Milestone D: Teacher Education Program Completion

Milestone D - Teacher Education Program Completion

- Exceeds Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone D Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone D Criteria as defined by Content Area/Admission Year.*

Milestone D - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-C met.
2. 2.50/4.00 Overall GPA (at time of Milestone D review).
3. Professional Education (including Professional Education electives) and Learner Specialty Pathway course grades "C" or higher, no "I" (Incomplete), no "Pass/Fail".
4. Verify degree is conferred on Transcript/Academic Record.
5. *Be in Good Standing with the University (at time of Milestone D review).
6. No unresolved Professional Dispositions issues/concerns.
7. ****Successful completion and target met on all Common Assessments (submission and target met on CPAST and edTPA in Semester 8).

Milestone E: Licensure Eligible

Successful completion of the Purdue University Agricultural Education Program, Agricultural Education, BS, and the State of Indiana licensure requirements for an Indiana REPA 3 Initial Instructional License in Career and Technical Education (CTE): Agriculture (5-12) and *Blended and Online Teaching (5-12).

Milestone E - Licensure Eligible

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- Exceeds Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone E Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone E Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone E - Review Schedule

- Conducted - Upon Degree Conferral - Close of Spring Semester 2029
- Decision/Notification - Early Summer 2029

1. Milestones A-D met.
2. Resolve any holds on academic records (if applicable).
3. Successfully complete the required pedagogy test; Test Requirements (ets.org). Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
4. Successfully complete all required content test(s) Code Purdue University (1631) as both the attending institution AND as a score recipient for ALL exam attempts.
5. For all Career and Technical Education (CTE) majors ONLY- Verify that the required number of clock hours has been completed and received by your advisor. Students must complete 4,000 clock hours of successful employment in the appropriate CTE area, or 1,500 clock hours of supervised work in the appropriate CTE area under an approved Teacher Education Program or an equivalent combination.

Milestone F: Licensure Action(s)

Milestone F - Licensure Actions

- Exceeds Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year and recognized on Dean's List.*
- At Standard: *Meets Milestone F Criteria as defined by Content Area/Admission Year.*
- Below Standard: *Does not Meet Milestone F Criteria as defined by Content Area/Admission Year and the State of Indiana.*

Milestone F - Review Schedule

- Conducted - Upon Licensure Application - Summer 2029
- Decision/Notification - Upon Formal Action

1. Milestones A-E met.
2. Complete and upload with your Indiana License Application CPR/Heimlich Maneuver/AED certification or card (must include a hands-on, face-to-face skills demonstration).
3. Complete and upload with your Indiana License Application documentation of Suicide Prevention certification (training must be at least one hour).
4. Submit Indiana License Application online via Licensing Verification and Information System (LVIS) at https://license.doe.in.gov/.
5. Allow three weeks (given all licensure criteria are met) for Purdue University to certify and the Indiana Department of Education (IDOE) to grant the Indiana License.
6.

After receipt of an Indiana License, apply for out-of-state licensure (if desired).

*For purposes of reports and communications to other institutions or agencies, and in the absence of any further qualifications of the term, a student shall be considered in Good Standing unless the student has been dismissed, suspended, or dropped from the University and not readmitted. A student is considered in Good Academic Standing if both a student's semester and cumulative GPA are above a 2.00/4.00.

**Foundation Courses linked with the Foundations Portfolio Common Assessments include EDCI 20002, EDCI 28500, EDCI 35000, EDPS 20001, EDPS 23500, EDPS 24800, EDPS 32700, EDPS 36201, EDPS 43010, and EDST 20010. These may be subject to change.

***The Blended and Online Teaching (5-12) License is required for students on Admission Year Fall 2024-Spring 2025. The Blended and Online Teaching (Ti-BOT) License requirements are embedded into coursework for all Teacher Education Undergraduate majors. Some exceptions apply.

****Common Assessments include Foundations Portfolio, Field Experience Dispositions, CPAST, edTPA, Common Lesson Plan, and Licensure. Common Assessments for Early Childhood Education and Special Needs align with the National Association for the Education of Young Children (NAEYC).

Beginning July 1, 2025 - According to the Indiana State Board of Education, students seeking an Initial Indiana License in a content area involving literacy instruction, including special education, must obtain a licensure addition in Early Literacy (P-5), as required under IC 20-28-5-19.7.

Licensure Information

The Office of Teacher Education and Licensure (OTEL) is the formal liaison with the Indiana Department of Education and serves as the official repository for Purdue West Lafayette Teacher Education Program Progression and Licensure actions. OTEL maintains and permanently retains a *Teacher Education Program and Licensure Credential Portfolio* for each current and former Purdue University Teacher Education Candidate/Student. OTEL provides reliable, career-long guidance on Indiana Teacher Education and Licensure Standards, Rules, and Procedures. Indiana Licensing Rules and Regulations are subject to change by the Indiana State Board of Education, Indiana Department of Education (IDOE), and/or the Indiana General Assembly.

Advising

Seeing a College of Science Academic Advisor

The academic advising relationship in the College of Science is a dynamic coaching, teaching, and educational collaboration where students and advisors work in partnership to attain personal, academic, and professional goals. This goal is accomplished through intentional interactions that foster informed, student-driven decisions. As a result, the academic advising experience is essential to establishing meaningful educational, career, and life goals that align with each student's values, interests, and abilities.

Our advising practice is predicated on the belief that purposeful individualized attention promotes each student's success and increases student retention through the development of academic maturity, the ability to embrace and overcome challenges, and the development of personal and academic integrity. College of Science advisors seek to encourage and inspire student engagement with their university, the global community, and the work of scientific discovery.

Advising Appointment Options

Scheduled Advising Appointments
Students may schedule 30-minute appointments with their assigned advisors:

- to register for Fall/Spring semesters, Summer terms
- for in-depth advising questions
- for academic/degree planning, graduate/professional school planning and career development
- to discuss and receive support in addressing personal and academic challenges
- for general questions and concerns

Students must be on time for their scheduled appointments. Late arrivals of more than 5 minutes may result in a cancellation of your appointment.

Make an Appointment with your advisor.

Drop-in Appointments
Drop-in appointments are used to drop/add courses, resolve scheduling conflicts, complete paperwork, and address time-sensitive questions. Appointments are kept to 10 minutes and may not be used for registration or degree planning purposes. Drop-in appointments are on a first-come, first-served basis, and therefore, students are not guaranteed to see their advisor during scheduled drop-in times if the number of students to be seen is greater than the time allotted. Students must see their assigned advisor unless there is an immediate need. Before visiting your advising office for a drop-in appointment, check drop-in times. Times are updated the Friday before the following week. Note: drop-in times **ARE** subject to change without notice.

CODO Drop-in Appointments
Students interested in a change of program (CODO) to the College of Science should consult the Non-College of Science Drop-in Schedule and review College of Science CODO requirements for their intended program before speaking with a Science advisor.

Advising Policy for Students Who Will Pursue a non-College of Science Program

Two Semester Advising Policy:
Students who enter the College of Science with immediate plans to pursue a non-science academic program are eligible for two semesters of academic advising and PIN releases as they work towards a successful CODO to their intended program. If CODO requirements are unmet by the end of their first year, students must request a CODO to another academic program or the Bridge Program while they continue to pursue their degree goals.

Four Semester Advising Policy:
Students who pursue a College of Science curriculum but later determine they would like to pursue an alternate program outside the College will have four semesters to CODO, starting with the first semester of enrollment in the College. However, a request may be made for approval of the 5th Semester Advising Policy if a student is close to meeting CODO requirements and has provided course recommendations from an advisor in their intended program.

Contact Information

Mailing address:
Purdue University College of Science
Young Hall, 6th Floor
West Lafayette, IN 47907
scienceadvising@purdue.edu

College of Science

College of Science Core Requirements

[[permalink=2756|new:{'title':1}]]Composition and Presentation Core[[/permalink]]
[[permalink=2977|new:{'title':1}]]Computing Core[[/permalink]]
[[permalink=3938|new:{'title':1}]]Cultural Diversity (Language and Culture)[[/permalink]]
[[permalink=2759|new:{'title':1}]]General Education Core[[/permalink]]
[[permalink=2760|new:{'title':1}]]Great Issues in Science[[/permalink]]
[[permalink=2762|new:{'title':1}]]Laboratory Science Core[[/permalink]]
[[permalink=2975|new:{'title':1}]]Mathematics Core[[/permalink]]
[[permalink=2761|new:{'title':1}]]Multidisciplinary Experience Core[[/permalink]]

[[permalink=2976|new:{'title':1}]]Statistics Core[[/permalink]]
[[permalink=2757|new:{'title':1}]]Teambuilding and Collaboration Core[[/permalink]]

College of Science Academic Advising Policy Guide

The College of Science maintains policies that govern each student's relationship with the College and their path to degree completion. CoS policies work in tandem with University regulations and are maintained to ensure a standard and equitable experience for all students. University regulations provide information for all Purdue students on the structure, policy, regulations, and procedures that govern their relationship with the University in academic and personal progress toward their ultimate educational goals. Students are encouraged to see their academic advisor regarding questions or the need for further information regarding any policies in this policy guide.

College of Science Policies

•Advising and Registration Policies
•Science Core Curriculum Policies
•4th Semester Undesignated Student Advising Policy
•Course Repeat Policy

Pass/Not Pass Option Policy

In addition to letter grade options, traditionally assigned to indicate the level of performance in classwork, an alternate grading system, the pass/not pass option, has been established. This option gives students the opportunity to broaden their education with minimal concern for grades earned. A student who is enrolled in a course under this option has the same obligations as those who are enrolled in the course for credit with letter grade.
The Purdue Student Regulation for Semester Grades states: 2. For Credit Courses Taken under Pass/Not-Pass Option P: Passing grade; equivalent to grade A+, A, A-, B+, B, B-, C+, C or C-. N: Not passing.

College of Science P/NP Option Policy

- Free electives and courses at the 50000-level general education requirement may be applied to meet degree requirements.
- The pass/not-pass grade mode may be entered for courses not required by a student's major(s), minor(s), or the science core curriculum.
- Grade mode Passing is equivalent to a minimum grade of C- had a letter grade been awarded.
- Students may use the pass/not-pass option for up to 20% of the 120-credit requirement for graduation and for up to two courses per academic year (Fall-Summer).
- The pass/not-pass option cannot be elected for a course that has already been completed with a letter grade. University Regulation.
- Students may take elective credit while abroad using the P/NP mode. In the case of universities which only post P/NP, the University will apply a calculation process to determine a letter grade (University Regulations).
- Department of Languages and Cultures P/NP policy and Language Placement results. Students must take advanced coursework for a letter grade to receive credit for lower-level language courses.

Spring 2020 Pass/No Pass Regulation Exemption
All courses completed in the Pass mode are approved to meet any College of Science undergraduate degree requirement for Spring 2020 only.

Advising Appointment Policy

Students schedule 30-minute appointments with their assigned advisors:

- to register for Fall/Spring semesters, Summer terms
- for in-depth advising questions
- for academic/degree planning, graduate/professional school planning and career development
- to discuss and receive support in addressing personal and academic challenges
- for general questions and concerns

Students must be on time for their scheduled appointments. Late arrivals of more than 5 minutes may result in a cancellation of an appointment.

Make An Advising Appointment

Registration Appointment Policy

Students will be contacted by their academic advisor each semester to schedule a registration appointment. Only one registration appointment may be scheduled at a time. Students who cannot attend their scheduled appointment are expected to cancel the appointment. If a student misses two scheduled registration appointments, they must wait until the open registration period to schedule a final registration appointment. There are no exceptions to this policy.

Registration PIN Policy

College of Science students must meet with their academic advisors each semester to discuss their degree progress, course choices, and experiential learning options. Registration PIN's are released once a student and their advisor meet and agree upon courses for the subsequent semester. There are no exceptions to this policy.

Drop-in Appointment Policy

Drop-in appointments are used to drop/add courses, resolve scheduling conflicts, complete paperwork, and address time-sensitive questions. Appointments are kept to 10 minutes and may not be used for registration or degree planning purposes. Drop-in appointments are on a first-come, first-served basis, and therefore, students are not guaranteed to see their advisor during scheduled drop-in times if the number of students to be seen is greater than the time allotted. Students must see their assigned advisor unless there is an immediate need. Before visiting your advising office for a drop-in appointment, check drop-in times

Contact Information

Mailing address:
Purdue University College of Science
150 N. University St
West Lafayette, IN 47907

Directories

- Science Administration
- Office of Undergraduate Education
- Departments
- Science IT

Phone and Fax

Academic Advising Office

- 765-494-1771 (office)
- 765-496-3015 (fax)

Science Administration

- 765-494-1729 (office)
- 765-494-1736 (fax)

Science IT Helpline

- 765-494-4488

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College of Science Core Requirements

- Composition and Presentation
- Computing
- General Education
- Great Issues in Science
- Laboratory Science
- Language and Culture

- Mathematics
- Multidisciplinary Experience
- Statistics
- Teambuilding and Collaboration

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College of Science Administration

About the Department of Science Administration

During their Purdue career, students take advantage of the many benefits of the College of Science. From Nobel Prize-winning faculty to undergraduate research opportunities and study abroad opportunities to facilities found in the international spotlight, the College of Science offers a springboard to academic and career aspirations.

Faculty

Contact Information

Mailing address:
Purdue University College of Science
150 N. University St
West Lafayette, IN 47907
Directories
- Science Administration
- Office of Undergraduate Education
- Departments
- Science IT

Phone and Fax:
Student Advising Office
- 765-494-1771 (office)
- 765-496-3015 (fax)

Science Administration
- 765-494-1729 (office)
- 765-494-1736 (fax)

Science IT Helpline
- 765-494-4488

Contact Individual College of Science Group	General Email Address	Contact Person	Contact's Email
Advising	scienceadvising@purdue.edu	Anthony Wade, Receptionist	wade34@purdue.edu
Graduate Education & International Programs	gradinfo@purdue.edu	Korena Vawter, Admin Asst.	vawterk@purdue.edu
Dean's Office - Speech/Appearance Request		Angie Teel, Sr. Operations Manager	teel@purdue.edu
Research		Nicki Morris, Sr. Admin Asst.	morri333@purdue.edu
Academic Affairs		Angie Teel, Sr. Operations Manager	teel@purdue.edu
Undergraduate Education		Kelley Farrell, Sr. Admin Asst.	howe7@purdue.edu
Diversity	ScienceDiversity@purdue.edu	Connie Kaspar Wise, Assoc Director	brophyc@purdue.edu

Strategic Relations		Nicki Morris, Sr. Admin Asst.	mori333@purdue.edu
Recruiting	sciencerecruiting@purdue.edu	Admin Asst.	bcottrel@purdue.edu
K-12 Outreach	K12science@purdue.edu	Bill Bayley, Director	wbayley@purdue.edu
Special Events & Alumni Relations	scienceevents@purdue.edu	Matt Sampson, Assistant Director of Special Events	mjsampson@purdueforlife.org
Science Advancement	japarker@prf.org	Jimmy Parker, Chief Development Officer	japarker@purdueforlife.org
Science IT	sciencehelp@purdue.edu	call 765.494.4488	

Science Education: Physics Concentration, BS

Interdisciplinary Science, BS (Earth, Atmospheric, and Planetary Sciences)

Interdisciplinary Science, BS (Computer Science)

Interdisciplinary Science, BS (Statistics)

Interdisciplinary Science, BS (Biology)

Interdisciplinary Science, BS (Mathematics)

Interdisciplinary Science, BS (Chemistry)

Interdisciplinary Science, BS (Physics)

Science Education: Earth Space Science Concentration, BS

Science Education: Chemistry Concentration, BS

Science Education: Biology Concentration, BS

Applications in Data Science Certificate

Learning Beyond the Classroom Certificate

Biomolecular Design, BS

SCI 10000 - Multicultural Leadership Seminar

Credit Hours: 1.00. Exposes students to career opportunities via presentations from corporate and academic representatives; provides an opportunity for minority science students to share concerns and to become aware of existing academic and non-academic support systems on campus. Provides an overview of the significant contributions to the sciences by minority groups; reinforces good study habits for academic success.

Credits: 1.00

SCI 19100 - Part-Time Curricular Practical Training

Credit Hours: 0.00. A part-time scientific work experience for Science majors. This internship experience is intended to complement the student's academic plan of study and help prepare for a future role as a practicing scientist. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job description must be provided to the Dean of Science's office for approval before registration will be permitted. A minimum period of employment is required. Permission of department required.

Credits: 0.00

SCI 19500 - Special Topics In Science

Credit Hours: 0.00 to 3.00. This is a special projects course that will be used for special circumstances with individual study or for experimental courses, pointed toward students who are first- or second-year students.

Credits: 0.00 to 3.00

SCI 20100 - Special Topics: Integrated Science And Engineering Learning Community

Credit Hours: 1.00. This course will expose students to interdisciplinary problems scientists and engineers routinely need to solve. Students will gain an appreciation for working with individuals from diverse disciplines and backgrounds. Participation in hands-on activities is a key component of the course.

Credits: 1.00

SCI 21000 - Teaming Principles

Credit Hours: 1.00. College of Science students will learn the principles and concepts involved in teaming, such as recognizing different learning styles, developing shared goals, addressing conflict, utilizing collaborative problem solving and utilizing strengths of team members. These foundations will allow students to enter collaborative situations, such as lab groups and study sections, fully prepared to maximize the value of their educational experiences as well as develop positive working relationships with their fellow students.

Learning Outcomes: 1. Demonstrate the ability to work on a team. 2. Learn the concepts involved in team building and collaboration, such as leadership, developing shared goals, and utilizing strengths of team members. These foundations will allow students to enter collaborative situations, such as lab groups, study sections and work environments, fully prepared to maximize the value of their educational experiences as well as develop positive working relationships with their fellow students. Credits: 1.00

SCI 29000 - Special Topics In Science

Credit Hours: 3.00. Introductory, integrated science course for engineering and science students. Beginning lectures will cover the basic chemistry of life, the organization of cells. This will be followed by more advanced topics such as photosynthesis. Each topic will emphasize how understanding the biological system requires concepts and tools from other disciplines such as chemistry and physics. Permission of instructor required.

Credits: 3.00

SCI 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and

company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 29500 - Intercultural Leadership Seminar

Credit Hours: 0.00 to 3.00. This is a special projects course that will be used for special circumstances with individual study or for experimental courses, pointed toward students who are first- or second-year students. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 3.00

SCI 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 39500 - Special Topics In Science

Credit Hours: 0.00 to 3.00. This is a special topics course that will be used for special circumstances with individual study or for experimental courses.

Credits: 0.00 to 3.00

SCI 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in general sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

SCI 49000 - Topics In Science For Undergraduates

Credit Hours: 1.00 to 5.00. Selected interdisciplinary topics. Offered as a scheduled course when appropriate. Also available for supervised reading and reports of an interdisciplinary nature. Permission of instructor required.

Learning Outcomes: 1. Demonstrate the ability to communicate well, both orally and in writing. 2. Demonstrate the ability to work on a team. Credits: 1.00 to 5.00

Department of Biological Sciences

About the Biological Sciences Program

Discovery. This word captures our purpose, commitment, and vision. As a leading department in a major research university, our mission is to effectively integrate learning, discovery, and engagement **in an inclusive environment**. The best learning is experiential, and leads to a clear understanding of how discoveries are made, how science is conducted, and how ideas are communicated. The best learning is facilitated by faculty who are active in research and who can **all** engage students in the excitement of biology. And the best learning results in alumni who are well-prepared to successfully pursue their chosen careers.
As we discover the many facets of biocomplexity, from vast ecosystems to the structure and function of individual molecules, we remain committed to our mission. Our faculty, staff, and students are engaged with the communities of science and education, the worlds of industry and business, and our alumni and friends. To each individual who joins us, we promise opportunities to experience the excitement of discovery in biology. We welcome and encourage you to become a part of our team-as a student, alumnus, corporate partner, scientific collaborator, or a member of our faculty and staff. Join us on our journey of learning, discovery, and engagement. Discover Biology at Purdue!

Department of Biological Sciences Website

Faculty

Contact Information

The Department of Biological Sciences address is:
915 W. State Street West Lafayette, IN 47907-2054

Main Office
Contact person: Amanda Jenkins
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Fax No. is: (765) 494-0876

Graduate Information

For Graduate Information please see Biological Sciences Graduate Program Information .

Neurobiology and Physiology, BS

Microbiology, BS

Health and Disease, BS

Genetics, BS

About the Program

Genetics is the science of information transfer from one generation to another. We learn the laws of inheritance in all creatures big and small, how they evolve and how they change. On the molecular level we learn about DNA and RNA, on the cellular level we discover what makes a cell cancerous, and on an organismal level we examine the reproductive habits of various organisms. Crucial principles include the structure, function, and transmission of genes. Laboratory techniques explore genetic engineering from the "inside." Genetics is crucial to all of biology, hence a genetics major has great flexibility. This is excellent preparation for advanced study in biological sciences, law, genetic counseling, and many health-related professions.

Genetic Biology Website
Biological Sciences Major Change (CODO) Requirements

Ecology, Evolution, and Environmental Biology, BS

Cell, Molecular, and Developmental Biology, BS

Biology, BS

Chemical Biology & Biochemistry, BS

Biological Sciences Minor

BIOL 11000 - Fundamentals Of Biology I (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Principles of biology, focusing on diversity, ecology, evolution, and the development, structure, and function of organisms.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Students will understand the principles of how energy is obtained, stored and used in biological processes. 10. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 11. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 12. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 13. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 14. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 15. Students will understand ways in which organisms interact ecologically with each other and their environment. 16. Students will understand how evolutionary forces influence organisms to produce adaptations. 17. Students will exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 18. Students will exhibit proficiency in population and quantitative genetics. 19. Students will be familiar with taxonomic and phylogenic relationships among organisms. 19. Students can extend basic ecological principles to species and ecosystem conservation. 20. Students will use and understand the scientific method, including how to generate hypotheses and predications, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts

and theories of genetics. 22. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 23. Students will be able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 24. Students will acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 25. Students will be able to demonstrate an understanding of the scientific method including hypothesis generation Credits: 4.00

BIOL 11100 - Fundamentals Of Biology II (UCC: SCI)

Credit Hours: 4.00. This course is designed primarily to provide an introduction to the principles of biology for students in agriculture and health sciences. Continuation of BIOL 11000 . Principles of biology, focusing on cell structure and function, molecular biology, and genetics.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 4.00

BIOL 11200 - Fundamentals Of Biology (UCC: SCI)

Credit Hours: 2.00. This course is designed primarily to provide an introduction to the principles of biology. BIOL 11200, 11300 is a two-semester principles of biology sequence that introduces students to the major concepts of the discipline, with emphasis on the experimental and logical basis of the information presented. BIOL 11200/11300 includes lectures on diversity and evolution, and on the development, structure, and function of organisms, cell structure, cell function, ecology, genetics, biochemistry, and molecular biology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

BIOL 11300 - Fundamentals Of Biology (UCC: SCI)

Credit Hours: 2.00. This course is designed primarily to provide an introduction to the principles of biology. BIOL 11200, 11300 is a two-semester principles of biology sequence that introduces students to the major concepts of the discipline, with emphasis on the experimental and logical basis of the information presented. BIOL 11200/11300 includes lectures on diversity and evolution, and on the development, structure, and function of organisms, cell structure, cell function, ecology, genetics, biochemistry, and molecular biology.

University Core Curriculum (UCC): (UCC: SCI) Credits: 2.00

BIOL 11500 - Biology Resource Seminar (UCC: IL)

Credit Hours: 1.00. This course is designed to help integrate new biology students into the Department of Biological Sciences, to help them adjust to university life, and to assist them in developing academic and intellectual survival skills using the medium of introductory Biology courses. The course meets twice a week in groups of 20-25 students. Each section is led by an academic advisor and an undergraduate teaching intern. The class periods have an on-going emphasis on connecting students to one another as resources while learning information, critical thinking skills and problem-solving strategies. Topics include bioethics, time management, available academic resources, biology majors and curricula and career development. Students are exposed to opportunities in undergraduate research, summer internships, the study abroad program, and teaching internships. Throughout the course, students are encouraged to plan their college education rather than merely choose their courses. Permission of department required.

University Core Curriculum (UCC): (UCC: IL) Credits: 1.00

BIOL 12100 - Biology I: Diversity, Ecology, And Behavior (UCC: SCI/STS)

Credit Hours: 2.00. Creates a framework for ordering biology by examining the unity and diversity of life on earth with an emphasis on ecology, genetics, population biology, evolution, and behavior.

University Core Curriculum (UCC): (UCC: SCI/STS) Credits: 2.00

BIOL 13100 - Biology II: Development, Structure, And Function Of Organisms (UCC: SCI)

Credit Hours: 3.00. Principles of development of plants and animals and the relationship between the structure and function of selected systems of these organisms.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

BIOL 13500 - First Year Biology Laboratory (UCC: SCI)

Credit Hours: 2.00. Laboratory exercises emphasizing student mastery of basic laboratory skills needed to succeed in the biological sciences; intended for beginning (first-year) biology majors.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate depth in major. Credits: 2.00

BIOL 14501 - First Year Biology Laboratory With Neuro Research Project (UCC: SCI)

Credit Hours: 2.00. This laboratory course has been designed under the goals of the Center for Authentic Science Practice in Education (CASPiE) which aims to expose students to novel research as a means to teach them laboratory science. This course is designed to engage students in authentic research while acquiring necessary skills and concepts to be successful as a biology major. Our topic is Neuroanatomy of Auditory Pathways. We will begin with a series of skills and knowledge building weeks and then transition into independent research projects that culminate in a public presentation of the data in a poster session. In this course, students will learn the fundamentals in neurobiology as well as use sophisticated analysis and instrumentation to answer a research question. Critical thinking in experimental design as well as interpretation and communication of data will be stressed. The goals for this course are to gain a foundation in basic biological measurements and techniques, hone the analytical skills, appreciate the excitement of scientific discovery, and have fun along the way. Permission of department required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14503 - First Year Biology Lab: Disease Ecology-Honors

Credit Hours: 2.00. The course will engage students in authentic research and acquiring the necessary skills and concepts to be a successful biology major. Our research topic will be disease ecology in freshwater systems. Disease ecology is a growing field investigating the causes and effects of pathogen transmission and epidemics, primarily in natural populations. We will begin with a series of skill and knowledge-building laboratories, and then transition into student-led research projects that culminate in a presentation of the results in a poster session. Students will learn the fundamentals of disease ecology, basic laboratory techniques, how to perform scientific experiments, and gain experience communicating findings to other scientists and the public.

Learning Outcomes: 1. Perform basic laboratory techniques needed to succeed as a Biology major. 2. Formulate a testable question and hypothesis. 3. Design and conduct a laboratory study to address a research question. 4. Read and critique scientific journal articles. 5. Communicate scientific ideas and results through oral and written formats. Credits: 2.00

BIOL 14504 - First Year Lab: Diet Disease And Immune System-Honors

Credit Hours: 2.00. We are what we eat! The food we put into our bodies not only gives us the nutrients, vitamins and minerals we need to live, but it can also influence other ways in which our bodies function, right down to how well our immune system works. The immune system plays a critical role in defending our body from infection, but can also contribute to autoimmune disease when the immune response becomes dysregulated. Importantly, autoimmune disease is currently skyrocketing in countries that consume a "Western Diet" (i.e., high salt, high sugar, low fiber), suggesting that these dietary components, or lack thereof, may contribute to dysregulation of the immune response. CD4+ T cells, a kind of immune cell, play an important role in the immune system as they control the balance between protective immunity and autoimmune disease. Recent evidence indicates a strong correlation between "Western Diet" and dysfunction of this important immune cell type. Therefore, our goal is to examine the effects of these dietary components on CD4+ T cell function and how this might contribute to autoimmune disease. Students will work in teams and cover a distinct subset of microbial or dietary components. As such, each student will learn the necessary skills to perform scientific experiments starting from the literature search, experimental design, carrying out controlled experiments, interpreting results and conveying the results to the greater scientific community.

Learning Outcomes: 1. Learn how to work in a real laboratory setting and acquire useful laboratory skills while learning how to develop a hypothesis, design experiments to test these hypotheses. 2. Learn how to present their findings to their peers and others in a written and oral format. 3. Develop skills to be able to read scientific literature in their topic area and discuss these findings with their peers. Credits: 2.00

BIOL 14505 - First Year Biology Lab: Phages To Folds-Honors

Credit Hours: 2.00. Students will learn how to use bioinformatics to study a gene sequence of their choice from the local SEA-PHAGES program. Students will then use molecular biology and biophysical techniques to characterize their gene product. The goal of each project will be to gain insight into the 3-dimensional fold of each of these mysterious novel phage genes. Students will work in teams but will have their own individual project such that each student will learn the necessary skills to perform scientific experiments starting from the bioinformatics to cloning to purification to structural characterization to communicating their findings to others.

Learning Outcomes: 1. Acquire the fundamental skills and concepts necessary to be successful as a biology major and as a research scientist. 2. Learn how to perform basic laboratory techniques. 3. Learn to work effectively as a team. 4. Design and execute experiments. 5. Evaluate and interpret data critically, read and discuss research articles, and to disseminate their research in written and oral formats. Credits: 2.00

BIOL 19500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 19700 - Biology Freshman Honors Seminar

Credit Hours: 1.00. Discussion meetings with Freshman Honors students to cover various aspects of freshman biology, research opportunities in biology, and career choices in biology. Open only to students in the Biological Sciences Honors Program. The credit may be used only toward free electives. Permission of department required.

Credits: 1.00

BIOL 20100 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 2.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

BIOL 20200 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 2.00. BIOL 20200 is the second semester of a two-semester course that includes two 50-minute lectures designed to give the student a basic understanding of the anatomy, organization and function of the human body. To assist the student in mastering the subject matter, there will be introductory lectures on the basic concepts of biochemistry and cell biology before the major topics of the course are dealt with. These topics include the organization of the human body; muscle and bone; the nervous system (including the special senses); the cardiovascular system, respiration; digestion; metabolism; excretion; fluid, electrolyte, and acid-base balance; the endocrine system; reproduction and genetics. The subject matter will be related to relevant questions of clinical or health-related importance. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

BIOL 20300 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. A survey of normal structure and function of the human organism. The human is treated as an open system with the capacity to transport material, transform energy, and maintain a homeostatic state. The capacities and limitations of the human to cope with changes in the environment are emphasized. All major systems of the human body and their functions are examined in relation to the living organism. Integrated into the study of the human organism are laboratory

exercises that emphasize the essentials of human anatomy and physiology. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students demonstrate subject-matter competency, including the mastery of biological theories. 11. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 12 Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 13 Students demonstrate subject-matter competency, including the mastery of biological theories. 14 Demonstrate an understanding of concepts and theories of genetics. 15 Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20400 - Human Anatomy And Physiology (UCC: SCI)

Credit Hours: 4.00. Continuation of BIOL 20300 . Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 6. Cellular Processes: Students will understand the role of macromolecules in cellular processes

such as DNA replication, RNA transcription, protein translation, and metabolism. 7. Energy: Students will understand the principles of how energy is obtained, stored and used in biological processes. 8. Scope: Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 9. Scope: Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 10. Students will demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 11. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 12. Students demonstrate subject-matter competency, including the mastery of biological theories. 13. Demonstrate an understanding of concepts and theories of genetics. 14. Students will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. Credits: 4.00

BIOL 20500 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Unifying concepts of biology taught with materials appropriate for future elementary school teachers. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

BIOL 20600 - Biology For Elementary School Teachers (UCC: SCI)

Credit Hours: 3.00. Continuation of BIOL 20500. Does not satisfy requirements for College of Science Majors. Not available for credit toward graduation for majors in the Department of Biological Sciences.

University Core Curriculum (UCC): (UCC: SCI)
Credits: 3.00

BIOL 22100 - Introduction To Microbiology

Credit Hours: 4.00. The isolation, growth, structure, function, heredity, identification, classification, and ecology of microorganisms; their role in nature; and significance to man. Not available for credit toward graduation for majors in the Department of Biological Sciences. CTL: Microbiology for the Health Sciences

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, and interpreting data in a meaningful way. 4. Be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Understand the principles of how energy is obtained, stored and used in biological processes. 7. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 8. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal levels. 9. Understand how evolutionary forces influence organisms to produce adaptations. 10. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity,

metabolism, and gene expression regulation as well as key metabolic control mechanisms. 11. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 12. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 13. Acquire knowledge of disease-causing microorganisms that includes an understanding of humoral, cell-mediated and non-specific immune responses, as well as the molecular basis for bacterial and viral pathogenesis. 14. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 15. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 16. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 4.00

BIOL 23000 - Biology Of The Living Cell

Credit Hours: 3.00. An introduction to modern cell biology for students who may not have taken a previous college course in biology. All students with the appropriate prerequisites are welcome, and this course will be of special interest to students from engineering, chemistry, physics and computer science. This course will provide a solid foundation in modern cell biology concepts for engineers and students from other disciplines.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23100 - Biology III: Cell Structure And Function

Credit Hours: 3.00. An introduction to modern cell biology through an examination of the physical and chemical properties that lead to an understanding of the molecular basis for cell function.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 4. Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 5. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 6. Students will understand the principles of how energy is obtained, stored and used in biological processes. 7. Graduates will understand the chemical and physical principles that govern biochemical and physiological processes. 8. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 9. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 10. Demonstrate proficiency with professional skills by practicing biologists including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 23101 - Bioinstrumentation Lab

Credit Hours: 1.00. Introduction of laboratory instruments used to measure physiological events. Stimulation and conduction of electric signals within the mammalian nervous system and other excitable tissues are demonstrated. Fundamental circuit elements and concepts include resistance, capacitance, inductance, op-amps, impedance, voltage, current, power, and frequency, following the content introduced in BME 231. Fundamental analog measurement concepts include adequate bandwidth and amplitude and phase linearity. Integrative design project emphasizes the practical aspects of quantitative physiological measurements. This course is to prepare learners with sufficient physics knowledge and lab skills to pursue the Bioinstrumentation and Imaging Depth Areas. Moreover, students are introduced to programming (using Python) to deepen the understanding of basic concepts and learn basic skills in data processing. SPICE software will be used throughout the course to design/simulate various analog circuits.

Credits: 1.00

BIOL 23200 - Laboratory In Biology III: Cell Structure And Function

Credit Hours: 2.00. Laboratory exercises designed to illustrate the properties, functions, and growth of prokaryotic and eukaryotic cells and to introduce the student to modern experimental methods used to study cells and their separated components.

Credits: 2.00

BIOL 24100 - Biology IV: Genetics And Molecular Biology

Credit Hours: 3.00. An introduction to the principles of classical genetics and to molecular genetics. Topics covered are transmission of the genetic material (both in eukaryotes and prokaryotes); changes in the genetic material, structure, and function of the genetic material; and the manipulation of genetic material (recombinant DNA technology).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 3. Students will understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 4. Graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher level. 5. Students who complete the CMB BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 6. Students who complete the CMB BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. 7. Students will exhibit proficiency in population and quantitative genetics. 8. Students will demonstrate an understanding of concepts and theories of genetics. 9. Students will demonstrate an understanding of laboratory skills used in genetics. 10. Students will exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms.
Credits: 3.00

BIOL 24200 - Laboratory In Biology IV: Genetics And Molecular Biology

Credit Hours: 2.00. Experiments in classical and modern genetics and exercises to acquaint the students with basic techniques in molecular biology.

Credits: 2.00

BIOL 28600 - Introduction To Ecology And Evolution

Credit Hours: 2.00. Evolutionary processes and ecological principles associated with individuals, populations, communities, and ecosystems. Topics include genetic drift, natural selection, adaptation, life tables, population dynamics, competition, predation, biodiversity, and ecological stability, with emphasis on natural systems.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Understand the principles of how energy is obtained, stored and used in biological processes.8. Understand the chemical and physical principles that govern biochemical and physiological processes.9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability.10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels.11. Demonstrate subject-matter competency, including the mastery of biological theories.12. Demonstrate proficiency

with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.13. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.14. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.15. Demonstrate knowledge of the path leading to specific careers in biology.16. Demonstrate subject-matter competency, including the mastery of biological theories.17. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science.18. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society.19. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way.20. Demonstrate knowledge of the path leading to specific careers in biology.21. Understand ways in which organisms interact ecologically with each other and their environment. 22. Understand how evolutionary forces influence organisms to produce adaptations. 23. Acquire knowledge of the ways in which animals communicate with each other. 24. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 25. Exhibit proficiency in population and quantitative genetics. 26. Be familiar with taxonomic and phylogenetic relationships among organisms. 27. Extend basic ecological principles to species and ecosystem conservation. 28. Experience working with organisms in natural settings. 29. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 30. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design. Credits: 2.00

BIOL 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry

principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 29300 - Sophomore Seminar: Planning Your Future In Biology

Credit Hours: 1.00. Biology 29300 is a one-credit course designed for sophomores in the Department of Biological Sciences. This course will help students maximum the remainder of their undergraduate career. The course will cover biology career information and suggestions for professional development. Students will learn about the various disciplines that make up modern Biological Sciences. Students will learn about opportunities in undergraduate research and tour a research laboratory. In-depth presentations from biology alumni from a variety of fields are featured. Assignments include a Plan of Study, a resume, and a written paper evaluating the career path of one alumni speaker and describing the student's response to the presentation.

Learning Outcomes: 1. Demonstrate the ability to communicate well, both orally and in writing. 2. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 29400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by freshman and sophomores. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 29500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, or laboratory work selected for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 31200 - Great Issues Genomics And Society

Credit Hours: 3.00. The course will revolve around genomics, the science and technology involved in determining the sequence of the entire DNA complement in an organism. Almost everyone has heard of the human genome project, but fewer are aware of the spectacular technical progress in this field and the fact that many thousands of genomes have been sequenced. Until recently, most of these have been microorganisms, but technological and computational progress has made it progressively easier and cheaper to sequence the genomes of higher organisms. This field may have more of an impact on your future lives than almost any other field of the life sciences - mostly because it touches on all areas of study. The course will focus on the impact that genomes will have in selected areas. It will begin with a basic understanding of the science and technology that gave rise to our current capabilities in sequencing and the fact that technology continues to provide greater capacity and cheaper prices. You will soon see that every field in the College of Science is well represented in the science and technology. We will then go on to see how genomics influences many topics that affect our daily lives and can possibly provide answers to some critical questions (or at least pose better questions): What is the basis of personalized medicine? What does genomics tell us about the genealogy of mankind? What impact will genomics have on our future food supply and our ability to feed a population of 9 billion people? What is the human microbiome and what does that mean to me? Similarly, what is the gut microbiome, the mouth microbiome, etc? What impact will genomics have on the development of alternative energy sources, especially biofuels? In every area, we will discuss the scientific challenges, but also the ethical and societal implications. In most cases, there is no one right answer, but a series of choices that can be guided by ethical considerations.

Learning Outcomes: 1. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. Credits: 3.00

BIOL 31800 - The COVID-19 Pandemic

Credit Hours: 3.00. The course will cover the COVID-19

pandemic caused by the SARS-CoV-2. It will provide a window onto the intersection of science and society and the challenges created when leaders and the populace are inadequately informed. We will explore the biology of the virus and the disease caused by it. The primary literature will be reviewed with the aim of critically evaluating data and understanding the basis of inferences or lack thereof. Vaccine and antiviral approaches will be discussed. Historical approaches to pandemics, comparative analyses of responses by countries and states, investigations into the origins of SARS-CoV-2, and various conspiracy theories will be topics of deliberation. We will see how achieving scientific understanding is a dynamic process. The COVID-19 scientific literature will be dissected with a focus on publication ethics. Students will each make an oral presentation and write an essay on a relevant topic thereby allowing them to fulfill graduation requirements. These assignments will require the demonstration of the capacity to report data, organize the material, and convey it using formal English. All sources will need to be documented and assessed for credibility. The initial tranche of classes will be lectures by the Professor with discussion. Most of the remaining classes will be student presentations on assigned topics with moderation by the Professor. Guest lectures by appropriate experts will also be included.

Learning Outcomes: 1. Understand viruses as a life form. 2. Recognize science as the basis for public policy. 3. Evaluate sources critically. 4. Conduct and present research on media and scientific publications. 5. Write a thoughtful, thorough, well-written and ethical article. Credits: 3.00

BIOL 32101 - Experimental Design And Quantitative Analysis Honors

Credit Hours: 3.00. This course is aimed at preparing students in experimental design and quantitative analysis specifically as applied to Life Sciences in order to read the scientific literature critically, generate scientific questions, hypotheses and predictions, design research studies, analyze the data statistically, and communicate results. The course will use R and RStudio, which are open-source platforms that are increasingly used in the scientific community to analyze data quantitatively.

Learning Outcomes: 1. Understand the logic behind the scientific method in Life Sciences. 2. Be able to pose research questions, hypotheses, and predictions. 3. Understand the benefits and limitations of statistical testing. 4. Design a research study following experimental design principles. 5. Understand and critically assess data collection. 6. Interpret and visualize the results of statistical tests. 7. Communicate and present quantitative results effectively (i.e., writing the Results section of a scientific paper). 8. Run statistical analyses and generate publication quality figures in R. Credits: 3.00

BIOL 32701 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

BIOL 32800 - Principles Of Physiology

Credit Hours: 4.00. This course is designed to provide students with an introduction to physiology with an emphasis on cellular mechanisms that underlie anatomical and physiological adaptations used by animals to survive in their habitat. Topics covered will range from cellular respiration to the physical limits of animal performance as we deconstruct and then reconstruct the body to examine how animals can live in extreme environments. Goals for this course are for students to gain a foundation in basic physiological principles, to learn about the integrative nature of the systems of animals, and to appreciate how and why animals have evolved and strategies to help them survive in their unique environment.

Learning Outcomes: 1. Learn the integrative nature of the functioning of different cells, tissues, organs, and organ systems in maintaining adequate conditions for the proper functioning of vertebrate animals. 2. Learn the detailed mechanisms underlying the function of selected physiological systems from the level of the macromolecules to the system as a whole

(ex. Cardiovascular system). 3. Appreciate the conserved nature of the fundamental functioning of cells and systems across many different animals from invertebrates to vertebrates. 4. Gain practical experience with some selected systems in the laboratory. 5. Learn how to design and execute independent experiments and take the results from those experiments and analyze and orally present them to the class. 6. Learn how to work as part of a collaborative team. Credits: 4.00

BIOL 36700 - Principles Of Development

Credit Hours: 2.00. This course deals with the process by which genes in a fertilized egg control cell behavior in the embryo and so determine the nature of the animal or plant. The emphasis is on early development and the laying down of body plan and organ systems in various model systems (Drosophila, nematode, Arabidopsis, zebrafish, mouse, chick, and frog).

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 2.00

BIOL 36701 - Principles Of Development Lab

Credit Hours: 1.00. This laboratory will offer students the experience working with different model systems to observe developmental processes, examine key regulatory gene expression, and manipulate gene functions used in different biochemical, molecular and genetic approaches.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students who complete the CMD DS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 7. Students who complete the CMD BS program will have a broad understanding of the principles governing the development of multi-cellular animals and plants. Credits: 1.00

BIOL 38700 - Macromolecules

Credit Hours: 2.00. The goal is to expose students to the world of macromolecules, their physicochemical properties, the influence of these properties on function and structure, and how these properties are determined and exploited. Permission of department required.

Learning Outcomes: 1. Describe the types of macromolecules. 2. Describe the biophysical and biochemical properties of macromolecules. 3. Describe how biophysical and biochemical properties are determined. 4. Describe how these physicochemical properties are exploited in various biotechniques. Credits: 2.00

BIOL 39300 - Preparing For Your Future In Biology

Credit Hours: 1.00. Biology 39300 is a one-credit course for junior and seniors in the Department of Biological Sciences. This course will help students begin to prepare for life after Purdue. Students will learn about interviewing, job searching, graduate and professional school searching, resumes, industrial practices, and how to evaluate job/school offers. Construct a polished image on top of your solid biology foundation! Get the job or get admitted to the school you want.

Learning Outcomes: 1. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 39500 - Special Assignments

Credit Hours: 0.00 to 18.00. Reading, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in biological sciences. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

BIOL 39600 - Premedical Planning Seminar

Credit Hours: 0.00. This course is designed for sophomore and junior students who are planning to attend medical school. The

course offers information and advice on the MCAT, the application process, the personal statement, the interview, and letters of recommendation. Students in the course will also formulate an alternative career plan. The course meets the first 10 weeks of the semester.

Credits: 0.00

BIOL 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credits: 0.00

BIOL 39800 - Biology Teaching

Credit Hours: 3.00. Supervised teaching experience for juniors. Must have approval of course instructor in advance. Permission of instructor required.

Credits: 3.00

BIOL 41500 - Introduction To Molecular Biology

Credit Hours: 3.00. An introduction to modern molecular biology techniques and how they are used to address current topics in gene regulation. Emphasis will be placed on experimental procedures and model systems, such as site-directed mutagenesis of isolated genes and their subsequent introduction into prokaryotic and eukaryotic cells. Topics will address the molecular control mechanisms associated with DNA replication, RNA transcription, RNA processing, and differential gene expression.

Credits: 3.00

BIOL 41600 - Viruses And Viral Disease

Credit Hours: 3.00. The objective of this course is to provide students with an introductory understanding of viruses and their impact on human health. The course will be divided into two sections. During the first section, we will discuss the cellular and organismal events that occur following virus infection, including viral entry, replication, modulation of cell biology by viral proteins, the host immune response to infection, evasion of the immune response by viruses, and resulting virus-induced disease. The emphasis of this first section will be on the general strategies used by viruses to establish and maintain infection in a population. In the second section, we will discuss in relative detail our current understanding of select important human viruses including influenza, HIV, smallpox, the herpesviruses, and tumor-causing viruses. The objective of this section will be to understand how the unique aspects of each virus's biology affect the outcome of infection with these pathogens. In addition to virus-associated diseases, we will discuss potential ways that viruses may provide symbiotic benefits to their hosts and thereby shape the course of human evolution. Throughout the course, we will emphasize societal and political aspects of virology and virus-derived technologies, including vaccine development, the use of viruses as gene therapy vectors, and the threat of viral bioterror of bio-error.

Credits: 3.00

BIOL 41919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion. Permission from the department is required.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 42000 - Eukaryotic Cell Biology

Credit Hours: 3.00. Composition, structure, regulation, and growth of eukaryotic cells.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collections and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students

demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Students will understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Macromolecules: Students will be familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Cellular Processes: Students will understand the role of macromolecules in cellular processes such as DNA replication, RNA transcription, protein translation, and metabolism. 9. Scope: graduates will understand the chemical and physical principles that govern biochemical and physiological process. 10. Scope: graduates will understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Students who complete the CMD BS program will have a broad understanding of the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. Credits: 3.00

BIOL 43200 - Reproductive Physiology

Credit Hours: 3.00. This course provides an integrated approach to examining how tissues interact to regulate reproductive processes. Each section begins by describing fundamental commonalities of a reproductive event in a variety of species. This is followed by an emphasis on the difference in the details of that event among species. Students will be strongly encouraged to initiate and participate in discussions related to course topics during class. To gain a deeper understanding of physiological processes, students are asked to select a current research article related to reproductive physiology. Students are then required to present an analysis of article to the class in a formal presentation. Some of the topics to be covered in lecture include ovarian and testicular function, the hypothalamic-pituitary-gonadal axis, fertilization, establishment of the placenta, maternal support of pregnancy, parturition, and lactation.

Credits: 3.00

BIOL 43600 - Neurobiology

Credit Hours: 3.00. This course will cover key aspects in molecular, cellular, and developmental neurobiology. Topics include: Cell biology of neurons and glia, electrophysiological properties of neurons, electrical and chemical signaling between neurons, synaptic integration and plasticity, development and regeneration of the nervous system, nervous system diseases. Up-to-date research findings and techniques will be included. A basic knowledge of cell biology and protein structure and function is strongly recommended.

Learning Outcomes: 1. Understand the organization and function of the major cell types of the nervous system. 2. Understand the underlying mechanisms of membrane, local graded and action potentials. 3. Differentiate between electrical and chemical signaling. 4. Explain the steps of nervous system development. 5. Identify major parts of the nervous system and their function. 6. Understand the underlying causes of major nervous system diseases. Credits: 3.00

BIOL 43800 - General Microbiology

Credit Hours: 3.00. An examination of microbial diversity that emphasizes the interrelationship of bacteria and their environments. This includes aspects of cell composition, metabolism, and growth of microorganisms.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 3. Demonstrate knowledge of the path leading to

specific careers in biology. 4. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 5. Be familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 6. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 7. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 8. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 9. Demonstrate an understanding of prokaryotic cell structure and the major physiological processes of microorganisms that are critical for metabolism, function, and utilization of ecological niches. Credits: 3.00

BIOL 43900 - Laboratory In General Microbiology

Credit Hours: 2.00. Includes enrichment cultures to isolate microorganisms, studies of cell composition, measurements of cell growth, and examination of enzyme regulation.

Credits: 2.00

BIOL 44100 - Biology Senior Seminar In Genetics

Credit Hours: 1.00. This is a required course for genetics majors. It provides exposure to current research in genetics and molecular biology via invited faculty speakers. Students enrolled in the course who have actively participated in research also give a presentation on their own work. Other students are assigned to review current literature in one aspect of the semester's topic. The topic selected for review is in an area of current research in genetics and may vary from year to year.

Credits: 1.00

BIOL 44201 - Introductory Module: Protein Expression

Credit Hours: 2.00. This is a project-oriented course designed to give the student exposure to laboratory research through a series of five-week modules. During this five-week introductory module, the students will learn the basics of expression, isolation, and characterization of recombinant proteins in *E. coli* using SDS-PAGE and Western blotting. In the first half of the course, students work initially with one recombinant DNA construct and then are given a second construct to use to identify the protein expressed. *Note: additional hours as needed for particular experiments.

Learning Outcomes: 1. Learn principles and basic lab techniques related to protein works such as: Bradford Assay, SDS-PAGE, Western Blot and GST affinity purification. 2. Review their knowledge on over-expression of protein using recombinant DNA cloning in E. coli and other expression systems. 3. Learn experimental design, result analysis and troubleshooting area also emphasized. 4. Learn real lab experience when they design and perform the final project by their own. Credits: 2.00

BIOL 44202 - Animal Physiology

Credit Hours: 2.00. This is a project-oriented course designed to give the student exposure to laboratory research through a series of five-week modules. This module involves measurements of respiratory, cardiovascular, neural and renal function. When appropriate measurements are made in both rats and humans.

Learning Outcomes: 1. Conduct both animal and human physiological experiments and to learn how to deal with the complexities inherent in live animal experiments. 2. Appreciate the advantages and limitations involved in both human and animal experiments. 3. Learn basic surgical anatomy and surgical anatomy and surgical procedures. 4. Gain an appreciation for the accurate measurement, analysis, evaluation and interpretation of physiological results. 5. Gain some practice in presenting and explaining results to a group. Credits: 2.00

BIOL 44203 - Bacterial Synthetic Biology Laboratory

Credit Hours: 1.00. This course will provide an introduction to state-of-the-art bacterial molecular genetics using the intestinal bacterium *Escherichia coli* as a model cell.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Understand the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 3. Demonstrate an understanding of concepts and theories of genetics. 4. Demonstrate an understanding of laboratory skills used in genetics. 5. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 6. Demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. Credits: 1.00

BIOL 44205 - Introduction To LabVIEW

Credit Hours: 1.00. This is an introductory course for LabVIEW programming. During this five-week module students will learn proper data acquisition techniques and be introduced to the fundamentals of the LabVIEW graphical programming environment. Through LabVIEW, students will learn the tools to develop programs capable of acquiring, processing, analyzing, saving and displaying data for engineering and scientific applications.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 44207 - Exploration Of Protein Structure

Credit Hours: 1.00. This module is a hands-on exploration of the principles of enzyme structure. Students will use computers to retrieve and inspect protein structures from publicly available databases. Through the performance and analysis of sequence structural alignments, students will explore the relationship between primary, secondary and tertiary structures and the final active form of a protein.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00

BIOL 44211 - Laboratory In Anatomy And Physiology

Credit Hours: 1.00. This module will study various organs, and also discuss diseases associated with it. The heart, brain, kidney, stomach, liver etc. will be studied in detail using histology, dissection, and instrumentation. Emphasis will be

placed on problem solving using various case studies. The students will be required to give presentation.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. Credits: 1.00

BIOL 44212 - Microscopy And Cell Biology

Credit Hours: 1.00. In this five-week module, students will learn how to prepare specimens for viewing by fluorescence microscopy. Specimens include mammalian tissue culture cells and zebrafish embryos. The emphasis will be on the staining of the cytoskeleton in these preparations, utilizing antibodies and fluorescence probes. The specimens will be viewed by wide-field and confocal laser scanning fluorescence microscopy. Images will be acquired, processed and analyzed by modern computational methods. Students will learn the basics of cell culture, immunocytochemistry, fluorescence microscopy, digital image processing and data analysis. At the end of the course, students prepare a PowerPoint presentation of their images and data.

Learning Outcomes: 1. Students demonstrate proficiency with skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. Credits: 1.00

BIOL 44215 - Multidisciplinary Design Of Systems And Devices For Physiology Measurements

Credit Hours: 2.00. This physiology laboratory course will provide an opportunity for undergraduates from the College of Science (Department of Biology) to collaborate with students in other colleges (Agriculture, Education, Engineering, Health and Human Science & Technology) to experience and learn how to operate effectively as part of an interdisciplinary team to address physiological problems in the cardiovascular system, respiratory system and in biological transport. Specifically it will emphasize how these teams can use information, tools, techniques and theories from their disciplines to solve problems that are beyond the scope of any single discipline. In this process, the students will develop an appreciation of both engineering design and the classic hypothesis-driven experimental science as tools to solve complex real-world problems. This course will promote effective communication, systems thinking, laboratory skills, self-management and professional ethics. Students will learn to measure and quantify biological changes, analyze data (including statistical analysis) and interpret its meaning as it applied to the larger physiological question at hand. These skills will be necessary for teams to efficiently function in an interdisciplinary setting both in future courses and more importantly when they enter the workforce.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and

interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. 6. Student will demonstrate an in depth knowledge of nervous system function at the systems, cellular and molecular level. 7. Students will demonstrate the ability to measure dynamic changes in living organisms, tissues, and cells. Credits: 2.00

BIOL 44400 - Human Medical Genetics

Credit Hours: 3.00. An intermediate-level survey course of human genetics with a balanced review of both Mendelian and molecular aspects. Review of current development and application of DNA technology emphasized.

Learning Outcomes: 1. Describe the basic principles of human genetics in the context of human diseases. 2. Acquire the capability to comprehend and learn new discoveries in human medical genetics. 3. Develop a foundation to analyze social and ethical consequences of the advancement in human medical genetics. 4. Acquire the basic knowledge in human medical genetics to succeed in professional or graduate degrees in the medical fields. Credits: 3.00

BIOL 44600 - Molecular Bacterial Pathogenesis

Credit Hours: 3.00. This course will focus on the interface of classical cell biology and microbiology, with emphasis on the exploitation of mammalian host cell by medically relevant pathogens, such as Yersinia, Salmonella, and Listeria. This course will cover the molecular mechanisms of infectious diseases. It will introduce modern cellular microbial strategies for studying the complex interaction between pathogens and their host cells. Topics and readings will be prepared from the most current literature.

Credits: 3.00

BIOL 47500 - Senior Seminar In Neurobiology

Credit Hours: 1.00. Students are required to give a 30-45 minute talk based on primary journal articles chosen from a list on current developments in neuroscience or a related topic of the students choice. They are also required to read and contribute questions about each paper, and to provide anonymous feedback to each presenter.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. 4. Understand scientific methods. 5. Interpret and analyze primary literature in biology. 6. Interpret data in a meaningful way. Credits: 1.00

BIOL 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (CS 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the

role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

BIOL 48100 - Eukaryotic Genetics

Credit Hours: 3.00. This course presents the fundamental concepts of classical and modern molecular genetics in eukaryotic systems, using examples from the model genetic organisms, yeast, Drosophila, Caenorhabditis, Arabidopsis, maize, mice and humans. These concepts are applied to solving problems of genetic analysis. Recent advances in developmental, cancer, and behavioral genetics and genomics, and applications of genetic technology, are used to demonstrate the impact that modern genetics makes at the cutting edge of biological research.

Credits: 3.00

BIOL 48300 - Great Issues: Environmental And Conservation Biology

Credit Hours: 3.00. Concerned with the application of ecological principles to environmental issues, the course introduces fundamental ecology, emphasizing the interplay of theoretical models, natural history, and experimentation. New research developments are stressed, with the outlook for application to environmental management and restoration. Whole-biosphere issues, such as the loss of biological diversity, frame a focus at the population level to understand local and global extinction and community stability. In-depth case studies of endangered ecosystems (both temperate and tropical), with computer modeling, field trips, and discussions of policy formulation, demonstrate the range of tools and information necessary to accomplish coexistence of humans with the rest of nature.

Credits: 3.00

BIOL 49400 - Biology Research

Credit Hours: 1.00 to 4.00. Supervised individual research performed by juniors and seniors. Project must be approved by the Honors Committee, Department of Biological Sciences. Honors Research Program students should register for BIOL 49900. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

BIOL 49500 - Special Assignments

Credit Hours: 0.00 to 18.00. Readings, discussions, written reports, seminar presentations, and field or laboratory work provided for enrichment in special areas of the biological sciences. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 49700 - Biology Honors Seminar

Credit Hours: 1.00. Required of all students participating in honors research. Discussions and presentations of research, including seminars by those students who are completing their honors research thesis.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues

in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. 6. Understand how biochemistry contributes to improvements in human health, industry, and broader scientific understanding. 7. Become familiar with the biogenesis, structure, and chemistry of the basic types of macromolecules important in cells: nucleic acids, proteins, and membranes, and with the organic and inorganic molecules important in cellular metabolism. 8. Understand the chemical and physical principles that govern biochemical and physiological processes. 9. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 10. Understand how chemical and biochemical processes relate to biological function at the molecular, cellular, organismal, and higher levels. 11. Understand the compositions and formations of cellular structures, the molecular basis underlying cellular processes, and the links between diseases and aberrant gene functions. 12. Understand the principles governing the development of multi-cellular animals and plants. 13. Understand ways in which organisms interact ecologically with each other and their environment. 14. Understand how evolutionary forces influence organisms to produce adaptations. 15. Acquire knowledge of the ways in which animals communicate with each other. 16. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 17. Be familiar with taxonomic and phylogenetic relationships among organisms. 18. Extend basic ecological principles to species and ecosystem conservation. 19. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 20. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 21. Demonstrate an understanding of concepts and theories of genetics. 22. Demonstrate an understanding of laboratory skills used in genetics. 23. Exhibit proficiency in the physiology, biochemistry, and genetics of bacteria including diversity, metabolism, and gene expression regulation as well as key metabolic control mechanisms. 24. Become familiar with taxonomic, ecological, and phylogenetic relationships among microorganisms including biogeochemical nutrient cycling, microbial diversity, and the biotechnological application of microbes to address environmental and energy problems. 25. Able to demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 26. Able to demonstrate technical competency in basic microbiological laboratory techniques and common molecular biology techniques that exploit the use of microbes. 27. Able to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 28. Able to demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. 29. Demonstrate an understanding of prokaryotic cell structure. Credits: 1.00

BIOL 49800 - Biology Teaching

Credit Hours: 3.00. Supervised teaching experience for juniors and seniors. Must have approval of course instructor in advance. Permission of instructor required.

Credits: 3.00

BIOL 49900 - Biology Honors Thesis Research

Credit Hours: 1.00 to 4.00. Research under the guidance of a scientist. Submission of honors tutorial petition and consent of faculty tutor and Honors Committee. Permission of department required.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 1.00 to 4.00

Department of Chemistry

Overview

The Department of Chemistry is located centrally on the Purdue campus and is housed in the *Richard B. Wetherill Laboratories(WTHR)* and the *Herbert C. Brown Laboratory of Chemistry(BRWN)*. Students, faculty, and staff have access to world class facilities both for teaching and research.

Our Mission | Our Vision

The Department is home to:

- 52 faculty members
- 350 undergraduate students
- 310 graduate students
- 90 support personnel

In the 2013 Academic Ranking of World Universities (Shanghai Rankings), our departments ranked 20th world-wide and 13th nationally.

The Department of Chemistry offers a Bachelor of Science in Chemistry (ACS accredited), a Bachelor of Science and a minor in Chemistry. The department also offers an Honors program and the opportunity to participate in Cooperative Education Program.

Honors Program

The Department of Chemistry has an honors program for superior students. Participation can begin during the sophomore year, and a student will be assigned to advanced sections in chemistry courses. During the junior and senior years, a student engages in undergraduate research, participates in research seminars and completes honor courses. The undergraduate research experience (CHM 49900 or equivalent) is to be a minimum of six credits. In addition, the student must write an honor's thesis based on the CHM 49900 work. The faculty advisor will read the thesis and the student will give a presentation of the research.

Admission to the chemistry honors program must be made by the end of the junior year. The honors student is expected to achieve and maintain a scholastic graduation index of at least 3.40. Students fulfilling requirements of the chemistry honors program will be graduated "with honors in chemistry". The honors program has been approved by the Royal Society of Chemistry.

Cooperative Education Program

The Department of Chemistry participates in the Cooperative Education Program. This program requires five years and involves the option of 3 or 5 work period sessions, either semester or summer modules, with a cooperating company in the chemical industry. As a student gains experience, she or he is given increasingly responsible industrial assignments and receives more compensation. A student can enter the program meeting the following requirements: has completed two semesters of chemistry and has a chemistry index of 2.80. Information is available from the Coordinator of Cooperative Education in the Department of Chemistry. Check with your advisor for further information.

Department of Chemistry Website

Faculty

Contact Information

Head: Professor Chris Hrycyna
Graduate Admissions: Dr. Stephen Hoffmann, Assistant Head
Undergraduate Information: Dr. Christine Schertz
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West Lafayette, Indiana 47907-2084
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Graduate Information

For Graduate Information please see Chemistry Graduate Program Information .

Chemistry, BS

Chemistry (ACS), BSCH

Biochemistry (Chemistry), BSCH

Chemistry Minor

CHM 10000 - Preparation For General Chemistry

Credit Hours: 3.00. An introduction to the basic ideas and laboratory techniques of chemistry, together with relevant parts of algebra and elementary physics. Intended for those whose background does not permit them to proceed directly with a general chemistry course. Not available for credit toward graduation in the School of Science.

Credits: 3.00

CHM 11100 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. A basic introduction to the principles of chemistry including matter and energy, nomenclature, measurement, atomic structure, nuclear chemistry, chemical bonding, stoichiometry, classification of chemical reactions, kinetics, equilibria, gas laws, liquids, and solids. CTL:IPS 1721 Elementary General Chemistry w/lab

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Demonstrate skill in carrying out mathematical (e.g., algebraic, geometric, logical statistical) procedures flexibly, accurately, and efficiently to solve problems. 2. Explain how scientific explanations are formulated, tested and modified or validated. 3. Distinguish between scientific and non-scientific evidence and explanations. 4. Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. 5. Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. 6. Use current models and theories to describe, explain, or predict natural phenomena. 7. Locate reliable sources of scientific evidence to construct arguments related to real-world issues. Credits: 3.00

CHM 11200 - General Chemistry (UCC: SCI)

Credit Hours: 3.00. Continuation of CHM 11100 . Liquids and solids; solutions; chemical kinetics; equilibrium; acids and bases; oxidation and reduction; electrochemistry; descriptive chemistry of the metals and nonmetals; introduction to organic chemistry; nuclear chemistry. Not available for credit toward graduation in the School of Science.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

CHM 11500 - General Chemistry (UCC: SCI)

Credit Hours: 4.00. Stoichiometry; atomic structure; periodic properties; ionic and covalent bonding; molecular geometry; gases, liquids, and solids; crystal structure; thermochemistry; descriptive chemistry of metals and non-metals. Required of students majoring in science and students in engineering who are not in CHM 12300. One year of high school chemistry or one semester of college chemistry required. CTL:IPS 1721 General Chemistry I w/lab

University Core Curriculum (UCC): (UCC: SCI)

Credits: 4.00

CHM 11510 - General Chemistry I

Credit Hours: 3.00. The foundational general chemistry course for engineering, science, and some agricultural majors. Prior knowledge of chemistry is strongly suggested. Topics covered can include thermochemistry, nuclear chemistry, quantum theory and atomic structure, periodic trends, models in bonding, shapes of molecules, intermolecular forces, organic chemistry, synthetic and biological polymers, and phase changes.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts

and principles in chemistry, including the basic theory involved in chemical bonding, structure, reactions, and thermodynamics. Credits: 3.00

CHM 11520 - General Chemistry I - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11510. Topics covered can include lab safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11530 - General Chemistry I - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11510. Topics covered can include safety, measurement, thermodynamics, quantitative analysis, stoichiometry, chromatography, and crystallography.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Making connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 11600 - General Chemistry (UCC: SCI)

Credit Hours: 4.00. A continuation of CHM 11500 . Solutions; quantitative equilibria in aqueous solution; introductory thermodynamics; oxidation-reduction and electrochemistry; chemical kinetics; qualitative analysis; further descriptive chemistry of metals and nonmetals. CTL:IPS 1722 General Chemistry II w/lab

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Able to use theory to understand/predict experimental observations.

2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. Credits: 4.00

CHM 11610 - General Chemistry II

Credit Hours: 3.00. A continuation of CHM 11510 (General Chemistry I). Topics covered can include solutions, quantitative equilibria in aqueous solutions, thermodynamics, oxidation-reduction and electrochemistry, chemical kinetics, qualitative analysis, and further descriptive chemistry of metals and nonmetals.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate and understand key concepts and principles in chemistry, including the basic theory involved in chemical reactions, thermodynamics, equilibrium, and kinetics. Credits: 3.00

CHM 11620 - General Chemistry II - Laboratory (UCC: SCI)

Credit Hours: 1.00. In-person laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibria.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by using calculations and mathematical analysis techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. 8. Use safe practices, proper chemical hygiene, and standard protocols while in a laboratory. 9. Collect and record digital data sets using modern data collection techniques including wireless data collection and cloud-based data storage. 10. Work with a partner(s) to accomplish laboratory work. 11. Experience chemistry in-person through direct use of chemicals, laboratory equipment, and instrumentation to complete a laboratory experiment. Credits: 1.00

CHM 11630 - General Chemistry II - Virtual Laboratory (UCC: SCI)

Credit Hours: 1.00. Online laboratory class to accompany CHM 11610. Topics covered can include chemical reactions, thermodynamics, equilibrium, rates, kinetics, quantitative analysis, and acid-base equilibrium.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand how scientific equipment and analog and/or digital instruments are used to obtain data measurements. 2. Understand safe laboratory practices and proper chemical hygiene methods associated with an experiment. 3. Develop observational skills during experiments to collect quality data and articulate observations in their laboratory reports. 4. Maintain ethical and trustworthy recordkeeping and reporting methods: recording data precisely, deciding on when a data set is kept or discarded for the experiments performed. 5. Analyze experimentally obtained data by use calculations and mathematical analysis

techniques, such as graphical analysis of data sets. 6. Interpret experimental data and analyze this data using scientific models, concepts, representations, and equations. 7. Use evidenced-based reasoning to make claims and critique results. Make connections between lab results and the theories/concepts learned in lecture. Credits: 1.00

CHM 12500 - Introduction To Chemistry I (UCC: SCI)

Credit Hours: 5.00. Principles of chemistry including stoichiometry; atomic structure and chemical bonding; properties of gases, liquids, and solids; thermochemistry; descriptive inorganic chemistry. Recommended for entering students intending to major in chemistry. One year of high school chemistry or one semester of college chemistry required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Demonstrate competency of chemistry concepts through solving of numerical-based chemistry problems. 2. Demonstrate a mastery of concepts, theories, and ideas of chemistry topics specific to this course. 3. Connect chemistry topics in this course to real-world problems and solutions that you and others experience. 4. Meet laboratory learning objectives. Credits: 5.00

CHM 12600 - Introduction To Chemistry II (UCC: SCI)

Credit Hours: 5.00. A continuation of CHM 12500 . Properties of solutions; chemical equilibrium calculations; elementary thermodynamics; oxidation-reduction reactions and electrochemical cells; rates of reaction; qualitative analysis; descriptive chemistry.

University Core Curriculum (UCC): (UCC: SCI) Credits: 5.00

CHM 12901 - General Chemistry With A Biological Focus (UCC: SCI)

Credit Hours: 5.00. An accelerated and comprehensive one-semester general chemistry course that emphasizes principles that are important in biological systems. This course is designed to cover the essential elements of general chemistry traditionally covered in a two semester series. Topics to be covered include: Stoichiometry and chemical equations; atomic theory and structure; periodic properties; electronegativity; ionic and covalent bonding; non-covalent forces; bond energies; Lewis structures; molecular geometry; gases, liquids, and solids; solutions, quantitative equilibria in aqueous solution; acid/base chemistry and buffers; introductory thermodynamics; oxidation-reduction; electrochemical and membrane potential; colligative properties; chemical and enzyme kinetics; nuclear chemistry; coordination chemistry. One year of high school chemistry is required.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Develop an understanding of universal physical laws as they apply in chemistry. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data and to make quantitative/structural measurements and interpret results. Credits: 5.00

CHM 13600 - General Chemistry Honors (UCC: SCI)

Credit Hours: 4.00. A sophisticated treatment of the principles of chemistry. Atomic structure and bonding, spectroscopy, equilibria, thermodynamics and kinetics. Includes weekly laboratory experiments. Two years of high school chemistry recommended. Students with a grade of C or better in CHM 13600 who need 8 hours of credit in general chemistry may request credit for CHM 11500.

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

CHM 18300 - Cooperative Work Experience I

Credit Hours: 0.00. Cooperative Work Experience. Must be accepted for the program by the Cooperative Education Program coordinator.

Credits: 0.00

CHM 18400 - Cooperative Work Experience II

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 19400 - Freshman Chemistry Orientation

Credit Hours: 1.00. Designed to provide incoming chemistry majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the chemistry department

including degree options, co-op program, undergraduate research, careers in chemistry, use of spreadsheet software, graphing packages, and drawing programs for chemical structures. Attendance and performance on assigned projects are the basis of the assigned grades.

Credits: 1.00

CHM 19700 - Chemistry Freshman Honors Research

Credit Hours: 1.00. Supervised individual research performed by student.

Credits: 1.00

CHM 20000 - Fundamentals Of Chemistry

Credit Hours: 2.00. Integrative study of core concepts in chemistry that play a major role in governing the physical world. These core concepts are taught within the framework of important societal issues, such as atmospheric chemistry and nutrition. The pedagogy of this course is designed to provide reflective, interactive and hands-on-learning experiences that will assist elementary education majors to develop useful instructional strategies for their own classrooms. Required of students in elementary education program in the School of Education. Not available for credit toward graduation in the School of Science.

Credits: 2.00

CHM 22400 - Introductory Quantitative Analysis

Credit Hours: 4.00. Introduction to titrimetric, gravimetric, and instrumental methods of analysis; principles of separation processes, including chromatography; recognition and evaluation of possible sources of error. Required of students majoring in biology who do not take CHM 32100 .

Credits: 4.00

CHM 22404 - Quantitative Analysis

Credit Hours: 3.00. Introduction to approaches analytical chemists use to analyze the composition of matter, including statistics, calibration, and understanding chemical equilibrium (acid/base, complexation, solubility, polyprotic acid treatment, acid/base/redox/precipitation titrations); general approaches to analysis at the trace level; recognition and evaluation of possible sources of error and how error propagates; introduction to how light interacts with matter (and how analytical chemists can take advantage of this).

Learning Outcomes: 1. Understand the fundamentals and figures of merit of different analytical techniques. 2. Learn how to properly select an analytical technique for accurate quantitative determination. 3. Perform accurate quantitative measurements. 4. Use Excel or Google Sheets or Python for data analysis and plotting. 5. Analyze the results and determine the experimental uncertainty. 6. Report the experimental data properly. 7. Perform statistical analysis. Credits: 3.00

CHM 24100 - Introductory Inorganic Chemistry

Credit Hours: 4.00. Descriptive inorganic chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Required of students majoring in chemistry.

Credits: 4.00

CHM 25500 - Organic Chemistry For The Life Sciences I

Credit Hours: 3.00. A study of aliphatic and aromatic hydrocarbons and their simple derivatives in terms of (a) structure, bonding, etc.; (b) general syntheses and reactions; and (c) a logical modern rationale for fundamental phenomena as supported by reactivity orders, orientation effects, stereochemistry, and relative rates. Recommended for biology majors.

Learning Outcomes: 1. Gain understanding of the fundamental principles of organic chemistry and to apply those principles to solve problems. 2. Observe the world on a molecular level and to understand how organic chemistry applies to biology and everyday life. 3. Understand at a fundamental level how molecules look and behave. 4. Relate the structure and reactivity of molecules to observable physical/chemical properties. 5. Describe Life Processes in terms of molecular phenomena. Credits: 3.00

CHM 25501 - Organic Chemistry For The Life Sciences Laboratory I

Credit Hours: 1.00. Laboratory experiments to accompany CHM 25500, illustrating methods of separation, instrumental methods of analysis, and the more common techniques and methods for preparing various types of organic compounds.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and

characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25600 - Organic Chemistry For The Life Sciences II

Credit Hours: 3.00. A continuation of CHM 25500 with various functional groups such as the carboxyl, amino, etc., and including such polyfunctional natural products as carbohydrates and peptides.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Plan chemical transformations. 4. Recognize and understand chemical instrumentation and spectroscopy. Credits: 3.00

CHM 25601 - Organic Chemistry For The Life Sciences Laboratory II

Credit Hours: 1.00. A continuation of CHM 25501. Experiments are designed to illustrate principles discussed in CHM 25600.

Learning Outcomes: 1. Learn through practical experience the isolation, purification, and characterization of organic compounds through processes including liquid-liquid extraction, evaporation, solid-phase chromatography, distillation and infrared spectroscopy. 2. Learn through practical experience the use of simple methods to carry out reactions discussed in organic chemistry lectures and how to isolate and characterize the products. Credits: 1.00

CHM 25700 - Organic Chemistry

Credit Hours: 4.00. Introductory organic chemistry. Emphasis is on structure, nomenclature, reactions, and theory as applied to simple organic compounds. This course is designed for students who require a one semester overview in preparation for biochemistry. Not recommended for majors in the College of Science. Both CHM 25700 + CHM 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Learning Outcomes: 1. Students will be able to use theory to understand/predict experimental observations. 2. Students will be able to demonstrate an understanding of the physical properties and molecular understanding of chemical reactivity and materials. 3. Students will be able to plan and perform chemical transformations based on functional groups, stereochemistry, and reaction conditions. 4. Students will be familiar with IUPAC nomenclature for organic compounds. Credits: 4.00

CHM 25701 - Organic Chemistry Laboratory

Credit Hours: 1.00. Laboratory experiments designed to accompany CHM 25700 and to illustrate methods of separation, identification, and preparation of selected organic molecules. Both CHM 25700 + 25701 = CTL:IPS 1723 Organic And Biochemistry w/lab

Credits: 1.00

CHM 26100 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemical engineering. If not a chemical engineering major, see CHM 26505 Organic Chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural

conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1, E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26200 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26100, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries. Credits: 3.00

CHM 26300 - Organic Chemistry Laboratory I

Credit Hours: 1.00. Laboratory experiments designed to illustrate the lecture material of CHM 26100. Elementary laboratory techniques essential to organic chemistry are introduced, followed by the actual syntheses and purification of compounds discussed in CHM 26100.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26400 - Organic Chemistry Laboratory II

Credit Hours: 1.00. A continuation of CHM 26300 in that the experiments are designed to illustrate principles discussed in CHM 26200. A major portion of the course is devoted to methods employed in organic qualitative analysis. The student is expected to identify several unknown compounds and mixtures.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 1.00

CHM 26500 - Organic Chemistry Laboratory I

Credit Hours: 2.00. Similar to CHM 26300 except that a larger number and more sophisticated organic syntheses are required. The preparations are designed not only to illustrate the classical reactions discussed in CHM 26100 or 26505, but to allow for an extrapolation of the principles involved to other systems.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular

understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26505 - Organic Chemistry I

Credit Hours: 3.00. A comprehensive study of the chemical principles underlying aliphatic and aromatic compounds. The syntheses and reactions of these materials are discussed. Modern theory and stereochemistry are stressed to illustrate the logic inherent in the subject matter and to demonstrate the predictability of many chemical transformations. Recommended for students majoring in chemistry.

Learning Outcomes: 1. Draw the structures (geometries and structures) of carbon-based molecules) using acceptable representations and identify common classes of organic compounds. 2. Draw and recognize resonance forms of a structure (resonance structures) and assess their importance. 3. Determine the name of organic compounds by using the IUPAC naming system. Predict the structure when given the name. Recognize its common name. 4. Recognize the 3-dimensional shapes of molecules, as determined by structural conformation and stereochemistry. 5. Use mass spectrometry and IR and NMR spectroscopy to determine the structures of organic molecules. 6. Describe chemical processes with energy diagrams, and apply thermodynamics and kinetics toward understanding reactions and mechanisms. 7. Compare the differences between substitution (SN 1, SN2) and elimination (E1,E2) reactions. 8. Describe the important reactions of alkenes and alkynes and the mechanisms by which they occur. Credits: 3.00

CHM 26600 - Organic Chemistry Laboratory II

Credit Hours: 2.00. A continuation of CHM 26500. All experiments are designed to illustrate the principles discussed in CHM 26200 or 26605. A major portion of the course is devoted to the methods employed in organic qualitative analysis. The student is expected to identify unknowns and mixtures and is introduced to some modern instrumental techniques.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 26605 - Organic Chemistry II

Credit Hours: 3.00. A continuation of CHM 26505, but a broader scope. The chemistry of a variety of functional groups is discussed. Theory is employed extensively to demonstrate the coherence underlying seemingly diverse transformations. Qualitative organic analysis is introduced, with particular emphasis on spectroscopic methods.

Learning Outcomes: 1. Learn to recognize recurring themes and patterns of reactivity of functional groups. 2. Develop an understanding of organic structure-property relationships. 3. Use spectrometric and spectroscopic techniques to determine the structures of organic molecules. 4. Apply an understanding of reaction mechanisms to new transformations of organic molecules. 5. Recognize different classes of biomacromolecules, lipids, and synthetic polymers. 6. Recognize the role that organic chemistry plays as an enabling science in pharmaceutical, agricultural, electronic/photonic materials and commodity chemical industries.

Credits: 3.00

CHM 26700 - Organic Chemistry Laboratory I Honors

Credit Hours: 2.00. Laboratory experiments designed to accompany the lecture material of CHM 26505, but at an advanced level. Modern instrumentation is introduced to supplement the usual elementary laboratory techniques of organic chemistry. Multistep syntheses are employed to illustrate and supplement the reactions discussed in CHM 26505.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Able to plan and perform chemical transformations. 5. Able to recognize and use chemical instrumentation and spectroscopy. 6. Able to identify and handle hazardous materials. Credits: 2.00

CHM 26800 - Organic Chemistry Laboratory II Honors

Credit Hours: 2.00. A continuation of CHM 26700. Experiments, more sophisticated than those in CHM 26600, are designed to illustrate and extend the concepts presented in CHM 26605. A major portion of the course is devoted to organic qualitative analysis. The student is expected to identify unknown compounds by classical methods as well as by the use of modern instrumentation like infrared gas chromatography and nuclear magnetic resonance.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Document scientific information and experimental data and write scientific reports, with graphical presentation of data. 4. Plan and perform chemical transformations. 5. Recognize and use chemical instrumentation and spectroscopy. 6. Identify and handle hazardous materials. Credits: 2.00

CHM 28400 - Cooperative Work Experience III

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 29000 - Selected Topics In Chemistry For Lower-Division Students

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

CHM 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 29400 - Sophomore Chemistry Seminar

Credit Hours: 1.00. Discussion of undergraduate research opportunities, upper-division courses, career opportunities, laboratory safety, use of the library and chemical information, and topics of current interest in chemistry. Required of sophomores majoring in any chemistry curriculum.

Credits: 1.00

CHM 32100 - Analytical Chemistry I

Credit Hours: 4.00. Quantitative measurements on complex chemical systems that show matrix effects or require isolation of a component prior to its determination; general approaches to quantitative problems at the trace level; critical comparisons of competitive procedures with emphasis on principles of separation processes, including chromatography; recognition and evaluation of possible sources of error; approaches for optimizing conditions so as to minimize time and/or effort required to attain prescribed levels of accuracy and precision. Required of students majoring in chemistry.

Credits: 4.00

CHM 32300 - Analytical Chemistry I Honors

Credit Hours: 4.00. Open to students in the chemistry honors program. Topical coverage similar to CHM 32100. Laboratory will include a group of core experiments plus special experiments designed by students and staff to study original problems related to analytical chemistry.

Credits: 4.00

CHM 32700 - Bioanalytical Chemistry

Credit Hours: 4.00. This course focuses on the detection, quantification, and characterization of proteins, nucleic acids, lipids, carbohydrates, and small bioactive molecules. Principles and applications of various analytical techniques, including spectroscopy, chromatography and mass spectrometry, will also be discussed.

Learning Outcomes: 1. Know standard methods to detect and quantify biomolecules. 2. Understand the mechanism of standard bioanalytical measurements and evaluate their relative precision, accuracy, and ease of use. 3. Choose an appropriate analytical method for detection or quantification of a biological molecule in a given situation and adapt or design components. Credits: 4.00

CHM 33300 - Principles Of Biochemistry

Credit Hours: 3.00. Structure and function of biologically important molecules. Intended for students in life sciences.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to have a molecular understanding of chemical reactivity in biochemical systems. 3. Able to carry out calculations related to Biochemistry. 4. Able to understand energetics and kinetics of biochemical transformations. 5. Able to apply concepts of general chemistry and organic chemistry to biochemical systems.

Credits: 3.00

CHM 33900 - Biochemistry: A Molecular Approach

Credit Hours: 3.00. This is a comprehensive one-semester biochemistry course that emphasizes molecules and molecular reaction mechanisms, building upon the principles conveyed in general chemistry and organic chemistry. This course is designed to cover the essential elements of biochemistry traditionally covered in a two semester series. Topics to be covered include: Amino acids, peptides and proteins, molecular models and structure-function relationships, enzymes, enzyme kinetics and enzyme mechanisms, carbohydrates and carbohydrate metabolism, aerobic metabolism, lipids and membranes, lipid metabolism, nitrogen metabolism and integration and regulation of metabolism. Special emphasis will be placed on connections between biochemical principles and the fields of medicine, human health and disease, nutrition and biotechnology. This course should serve as excellent preparation for higher-level biochemistry courses as well as standardized pre-health professional exams. CHM 33900 was designed as the 4lh semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, this course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think as a scientist. 2. Demonstrate the ability to communicate well in writing. 3. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 4. Employ knowledge of the general components of prokaryotic and eukaryotic cells, such as molecular, microscopic, macroscopic, and three-

dimensional structure, to explain how different components contribute to cellular and organismal function. 5. Demonstrate knowledge of how biomolecules contribute to the structure and function of cells.. 6. Demonstrate knowledge of molecular interactions and their importance in biological systems. 7. Demonstrate knowledge of the principles of chemical thermodynamics and kinetics that drive biological processes in the context of space (i.e., compartmentation) and time: enzyme-catalyzed reactions and metabolic pathways, regulation, integration, and the chemical logic of sequential reaction steps. 8. Recognize major types of functional groups and chemical reactions that occur in biological systems. 9. Apply understanding of the concepts of chemical reactivity and chemical kinetics to predict biochemical processes. 10. Apply knowledge of the chemistry of covalent carbon compounds to explain the molecular mechanisms of biochemical enzyme reactions. 11. Demonstrate knowledge of thermodynamic criteria for spontaneity of physical processes and chemical reactions and the relationship of thermodynamics to chemical equilibrium as they apply to biological systems. 12. Explain maintenance of homeostasis in living organisms by using principles of mass transport, energy balance, and feedback and control systems. Credits: 3.00

CHM 33901 - Biochemistry Laboratory

Credit Hours: 1.00. CHM 33901 is a laboratory course based on two modules from the Undergraduate Research Inspired Experimental Chemistry Alternatives (URIECA) developed at MIT that are designed to introduce students to cutting-edge research topics in biochemistry. The course provides students with a research-inspired laboratory experience that introduces standard biochemical techniques in the context of investigating a current research topic, for example, acquired resistance to cancer drugs. Techniques include protein expression, purification, and gel analysis, PCR, site-directed mutagenesis, kinase activity assays, and protein structure viewing. CHM 33901 was designed as the 4th semester of the 1-2-1 competency-based curriculum transformation in chemistry as it applies to pre-health professional and life science students at Purdue. However, the course is open to other students who meet the prerequisites.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Develop an understanding of the scientific process. 3. Develop the ability to document scientific information and experimental data. 4. Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated. 5. Develop observational and interpretive skills through hands-on laboratory or field. 6. Demonstrate ability to measure with precision, accuracy, and safety. 7. Operate basic biochemistry laboratory instrumentation for scientific measurement. 8. Articulate scientific questions and hypotheses, design experiments, acquire data, perform data analysis, and present results in project-based research. 9. Apply knowledge of basic principles of chemistry and their applications to the understanding of biological systems. 10. Make quantitative/structural measurements and interpret results. 11. Demonstrate the ability to work on a team. 12. Demonstrate the ability to communicate well, both orally and in writing. Credits: 1.00

CHM 34200 - Inorganic Chemistry

Credit Hours: 3.00. Interpretation and correlation of the reactions and properties of inorganic compounds in terms of their electronic and molecular structures. A survey of the preparations and reactivities of important compounds of the representative elements, with an emphasis on group trends. The elementary chemistry of the transition metals, including magnetic and spectral properties of coordination compounds.

Learning Outcomes: 1. Able to use theory to understand universal physical laws as they apply to chemistry. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity

and materials. 3. Able to develop problem-solving skills: identifying the objective. 4. Able to plan and perform chemical transformations. 5. Able to carry out calculation related to specific chemistry topics. 6. Able to make connections between different courses/subdisciplines in chemistry. Credits: 3.00

CHM 34201 - Inorganic Chemistry Laboratory

Credit Hours: 1.00. Laboratory work to accompany CHM 34200 .

Credits: 1.00

CHM 34800 - Bioinorganic Chemistry

Credit Hours: 3.00. The fundamentals and applications of metals in biology.

Learning Outcomes: 1. Learn the basics of metal-ligand bonding. 2. Gain an understanding of the interplay between metals and biological molecules. 3. Learn how metals and biomolecules work together to bring about chemistry that either component can achieve alone. 4. Be introduced to the places that metals exist in natural systems. 5. Learn the role of metals in biology. 6. Solve problems involving the role of inorganic chemistry in biological systems using knowledge of the relevant chemistry. Credits: 3.00

CHM 37000 - Topics In Physical Chemistry

Credit Hours: 3.00. Kinetic theory of gases; statistical thermodynamics; quantum mechanics; atomic and molecular structure and spectroscopy; properties of ionic phases. May not be used to satisfy requirements for graduation in chemistry.

Credits: 3.00

CHM 37200 - Physical Chemistry

Credit Hours: 4.00. Principles of physical chemistry with emphasis on chemical thermodynamics and kinetics, illustrated examples from the biological sciences. Intended primarily for students in the life sciences. Other topics include physical and chemical equilibria, quantum mechanics, and spectroscopy.

Learning Outcomes: 1. Use theory to understand/predict experimental observations. 2. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Understand the connections of different courses/subdisciplines in chemistry. 4. Understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 4.00

CHM 37300 - Physical Chemistry I

Credit Hours: 3.00. Physical chemistry of matter. Properties of gases, liquids, and solids; equations of state; thermodynamics; energy, heat, and work; entropy; spontaneity and equilibrium; chemical potential; chemical equilibrium; phase diagrams; colligative properties.

Learning Outcomes: 1. Understand universal physical laws as they apply to chemistry. 2. Use theory to understand/predict experimental observations. 3. Demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 4. Develop problem-solving skills: identifying the objective. 5. Carry out calculations related to specific chemistry topics. 6. Understand energetics and kinetics of chemical transformations. 7. Reduce complex problems into simpler components. Credits: 3.00

CHM 37301 - Physical Chemistry Laboratory I

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37300.

Learning Outcomes: 1. Gain some familiarity with modern instrumentation methods in Physical Chemistry, including UV/Vis spectroscopy and pressure-detected chemical kinetics. 2. Learn Python programming syntax for reading, plotting, and fitting experimental data. 3. Understand how the abstract principles described in CHM 37300 show up in the real

world. 4. Learn good laboratory notebook habits for recording and organizing experimental data. Credits: 1.00

CHM 37400 - Physical Chemistry II

Credit Hours: 3.00. Physical chemistry of molecules. Wave properties of matter; quantum mechanics of translation, rotation, and vibration; atomic structure; molecular orbitals; quantum states; statistical mechanics; chemical kinetics; collision theory; transition state theory.

Learning Outcomes: 1. Give examples that demonstrate the fundamental principles in quantum mechanics. 2. Apply simple quantum mechanical models such as particle-in-a-box to atomic and molecular structures to predict wave functions and calculate energy levels. 3. Interpret simple optical spectroscopy of atoms and molecules based on quantum mechanical principles. Credits: 3.00

CHM 37401 - Physical Chemistry Laboratory II

Credit Hours: 1.00. A physical chemistry laboratory course that will provide students with hands-on experience that illustrates the core concepts presented in the associated physical chemistry lecture course CHM 37400.

Learning Outcomes: 1. Use modern physical chemistry instrumentation. 2. Collect and analyze data with Python. 3. Interpret data and uncertainties. 4. Demonstrate fundamental principles experimentally of quantum mechanics. 5. Perform Raman spectroscopy to identify various materials. 6. Perform a quantum chemistry simulation with Gaussian software. Credits: 1.00

CHM 37409 - Professional Practice I

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Industrial practice fee is attached to this course.

Credits: 0.00

CHM 37509 - Professional Practice II

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Industrial Practice fee is attached to this course.

Credits: 0.00

CHM 38600 - Cooperative Work Experience IV

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39500 - Chemistry Honors Seminar

Credit Hours: 1.00. Seminar for junior honors students.

Credits: 1.00

CHM 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in chemistry. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CHM 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate depth in major. Credits: 0.00

CHM 42400 - Instrumental Analysis

Credit Hours: 4.00. Principles and application of optical and electrical methods of chemical analysis, including topics in instrumentation.

Learning Outcomes: 1. Able to write scientific reports, with graphical representation of data. 2. Able to document scientific information and experimental data. 3. Able to use theory to understand/predict experimental observations. 4. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 5. Able to develop problem-solving skills: identifying the objective. 6. Able to make quantitative/structural measurements and interpret results; evaluate data for quality and reliability. 7. Able to recognize and use chemical instrumentation and spectroscopic methods. 8. Able to organize data for meaningful interpretation, including causes of experimental error, limitations of data. 9. Able to use statistics to judge limitation of data; use math to understand data. 10. Able to reduce complex problems into simpler components. 11. Able to practice professional behavior: reliability, punctuality, efficiency. Credits: 4.00

CHM 43300 - Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry, with in-depth coverage of biology at a molecular level. Topics covered include the classes of biological macromolecules, enzyme kinetics and inhibition, and significant metabolic pathways.

Learning Outcomes: 1. Understand the defining features of all four classes of macromolecules (Nucleic acids, Proteins, Lipids and carbohydrates) in detail. 2. Understand enzyme kinetics and various classes of inhibitors. 3. Develop an understanding for various metabolic pathways including glycolysis, gluconeogenesis, the citric acid cycle, electron transport chain, oxidative phosphorylation, glycogen metabolism, glycogen metabolism at a cellular level in healthy and diseased patients. 4. Able to predict biochemical outcome in case of specific defect in a pathway. 5. Develop an in depth understanding of central foundations of biology at a molecular level. Credits: 3.00

CHM 43800 - Introduction To Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins. Topics include DNA technology, recombinant proteins, bioinformatics, genetic modifications, gene expression and the interactions between nucleic acids and proteins.

Learning Outcomes: 1. Understand basics of DNA technology: isolation, amplification, synthesis, sequencing, and cloning. 2.

Understand basics of recombinant protein: expressing in prokaryotic and eukaryotic cells, introducing mutations. 3. Understand bioinformatics. 4. Understand introducing genetic modifications to plants and animals and stem cells. 5. Control gene expression and genome editing. 6. Examine nucleic acid interactions and protein interactions, and their application in diagnosis. Credits: 3.00

CHM 44400 - Cosmochemistry

Credit Hours: 3.00. Stellar evolution, nucleosyntheses, and chemical abundances. Origin, composition, and structure of the solar system and objects in it. Cosmochronology with particular emphasis on meteorites. Emphasis upon recent developments in planetology. Offered in alternate years.

Credits: 3.00

CHM 46200 - Intermediate Organic Chemistry

Credit Hours: 3.00. Theory and application of organic chemistry and reaction mechanisms to organic synthesis and contemporary research topics in closely related areas. Topics include stereochemistry, reactive organic intermediates, molecular orbital theory, photochemistry, organic materials chemistry, and chemical biology.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to plan and perform chemical transformations. 4. Able to present a formal oral summary of a topic in organic chemistry and receive feedback. 5. Able to write a scientific report using the format of the Chemical Society. 6. Able to practice computer literacy: use available online and database tools, especially in the Organic Chemistry field. Credits: 3.00

CHM 47509 - Professional Practice III

Credit Hours: 0.00. Professional practice with qualified employers within industry, government, or small business. Industrial Practice fee is attached to this course.

Credits: 0.00

CHM 48100 - Environmental Chemistry

Credit Hours: 3.00. Survey of chemical aspects of environmental problems and the application of chemistry to their solution. Topics will include atmospheric pollution problems, groundwater pollution and waste disposal problems, inorganic water pollutants, and the occurrence and fate of toxic organic compounds and other substances in the environment.

Learning Outcomes: 1. Able to use theory to understand/predict experimental observations. 2. Able to demonstrate an understanding of the physical properties and a molecular understanding of chemical reactivity and materials. 3. Able to understand the connections of different courses/subdisciplines in chemistry. 4. Able to understand the connections between chemistry and current events, everyday occurrences and other scientific disciplines. Credits: 3.00

CHM 48700 - Cooperative Work Experience V

Credit Hours: 0.00. Cooperative Work Experience.

Credits: 0.00

CHM 49000 - Selected Topics In Chemistry For Upper-Division Students

Credit Hours: 1.00 to 4.00. Topics vary.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

CHM 49400 - Junior-Senior Chemistry Seminar

Credit Hours: 1.00. Major emphasis on developing skills in oral and written presentations by students. The subject matter can be library material and/or accomplishments in undergraduate or co-op research. Department permission required.

Credits: 1.00

CHM 49900 - Special Assignments

Credit Hours: 1.00 to 5.00. Undergraduate research. Individual research projects undertaken under faculty direction. Permission of instructor required.

Learning Outcomes: 1. Provide students with an official record of participation in undergraduate research. 2. Provide a practical

means for professional training beyond regular coursework. 3. Learn research methodologies, build analytical thinking and problem-solving skills. 4. Develop technical and professional written and verbal communication skills. 5. Develop team building and research project management skills. Credits: 1.00 to 5.00

Department of Computer Science

Department of Computer Science

Purdue Computer Science is one of the country's top-ranked programs. Faculty members are shaping the future of information technology through cutting-edge research. Students can take courses that include such topics as artificial intelligence and machine learning, security and cryptography, software engineering, networking, operating systems, graphics and animation, competitive programming, distributed systems, information systems, and bioinformatics. Computer Science graduates pursue careers in software engineering, data science, systems development, animation and visualization, computational finance, consulting, information security, wireless systems, embedded systems, and biotechnology. Many also go on to graduate or professional school in areas such as engineering, business, law, or medicine.

The Department also offers a Data Science program. A major in data science puts graduates at the forefront of an emerging field and prepares them for an exciting career at the intersection of computer science and statistics. Data Science is the interdisciplinary field of inquiry that uses quantitative and analytical methods to help gain insights and predictions based on big data. Students learn about key computational methods and statistical techniques and develop the deep analytical thinking skills needed to reason reliably, intelligently and creatively from data. The vast amounts of data generated every day has created a data-rich and data-driven world. The data science major opens pathways to careers in virtually every area of society, from healthcare, security and sustainability to education, business and economics.

The department is located in the Lawson Computer Science Building, which opened in 2006. In addition to offering an inviting and comfortable environment, the building is equipped with cutting-edge networking and computing technologies, including 10-gigabit Ethernet cabling and wireless access throughout the building. There are four classrooms, five instructional labs, five research labs, and a student activity center. The building also offers students a variety of interaction areas, and a deli-style café and espresso bar. A 16-by-9 foot tiled video wall is used for a variety of purposes, including notices of campus events, workshop and colloquium speakers, news and information, sporting events, research demonstrations, and class projects.

The Purdue Computer Science Department offers a Bachelor of Science (BS), a minor in computer science, or a 5-year combined BS/MS degree. The department also offers an Honors Program, and the opportunity to participate in the Cooperative Education Program.

Computer Science Website

Faculty

Contact Information

General Department Contact
Purdue University
Department of Computer Science
305 N. University Street
West Lafayette, IN 47907-2107
Phone: (765) 494-6010
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Graduate Information

For Graduate Information please see Computer Science Graduate Program Information .

Computer Science Honors: Database and Information Systems, BS

Computer Science Minor

Data Science First Year (CS)

Computer Science: Algorithmic Foundations, BS

Computer Science: Computational Science And Engineering, BS

Computer Science: Computer Graphics and Visualization, BS

Computer Science: Database and Information Systems, BS

Computer Science: Programming Languages, BS

Computer Science: Security, BS

Computer Science: Systems Software, BS

Computer Science Honors: Computational Science and Engineering, BS

Computer Science Honors: Computer Graphics and Visualization, BS

Computer Science Honors: Programming Language, BS

Computer Science Honors: Security, BS

Computer Science Honors: Software Engineering, BS

Computer Science Honors: Systems Software, BS

Computer Science Honors: Algorithmic Foundations, BS

Artificial Intelligence, BS

Data Science, BS (CS)

Computer Science: Machine Intelligence, BS

Computer Science: Software Engineering, BS

Computer Science Honors: Machine Intelligence, BS

CS 10100 - Digital Literacy (UCC: STS)

Credit Hours: 3.00. Survey of the digital world, computers as multi-purpose machines, digital information, definition of programming, computers everywhere (the Internet of things), computers that perform simultaneous computations, how apps work, data storage and searching, databases, digital audio, graphics, video, computer networks and the Internet, the World Wide Web and Internet sharing services, network and Internet performance, real-time services, artificial intelligence, cloud computing, security, and privacy. CS students may take course for elective credit only.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Understand how to decide the disk size needed when purchasing a

computer or smart phone. 2. Understand why smart phones, desktop, and laptop computers have more than one processor (such as dual-core and quad-core devices). 3. Understand why computers are embedded in appliances and automobiles. 4. Understand why saving a document is required after changes are made and what a computer does when one saves a document. 5. Understand why music is available in a variety of digital formats, such as m4a, mp3, and wav. 6. Understand why someone acquires an Internet service that is 10 times faster than their current service, it is unlikely that web pages will load 10 times faster. 7. Understand when someone uses the Internet to communicate with a person who is halfway around the world, how the information travels between the two computers. 8. Understand why when someone streams a movie, they have to wait before the movie starts playing. 9. Understand why a computer may be able to fool you into thinking a human is really answering your questions. 10. Understand whether it is possible for a computer to control a car and navigate it through traffic on an actual highway. 11. Understand how, if you receive an email message that appears to come from a friend asking you to click on a link to see a Facebook page, you can tell whether it is safe to click the link or not. 12. Understand where, when you upload a video to a cloud service (e.g., YouTube), the video is stored 13. Understand whether if a new virus appears, the virus protection software on your computer will prevent the virus from infecting your computer. 14. Understand whether or not if your bank's URL begins with "https", a criminal who wiretaps your Internet connection can see each keystroke you send to the bank. Credits: 3.00

CS 15900 - C Programming

Credit Hours: 3.00. Fundamental principles, concepts, and methods of programming in C, with emphasis on applications in the physical sciences and engineering. Basic problem solving and programming techniques; fundamental algorithms and data structures; and use of programming logic in solving engineering problems. Students are expected to complete assignments in a collaborative learning environment. Credit cannot be obtained for both CS 15900 and any of CS 15600, CS 15800 and CS 18000.

Learning Outcomes: 1. Understand the fundamental principles, concepts and methods of computer programming. 2. Use the C programming language to developing solutions in the domains of physical sciences, mathematics, and engineering. 3. Demonstrate the ability to function as part of a technical team to generate a solution to a programming problem. 4. Analyze alternative algorithm designs to implement solutions that make efficient use of limited resources of the computer. Credits: 3.00

CS 17600 - Data Engineering In Python

Credit Hours: 3.00. The course introduces students to programming fundamentals in Python, including loops, functions and different data types, and provides an introduction to data engineering including working with common data formats and learning the basics of data wrangling. Students will format, extract, clean, filter, transform, search, combine, summarize, aggregate, and visualize a diverse range of data sets. Python libraries including Matplotlib and Pandas are used.

Learning Outcomes: 1. Write Python code using loops, decision statements, and functions. 2. Explain how arguments are passed in Python functions and how the scope of variables impacts execution. 3. Use the operations on lists, tuples, and dictionaries to perform appropriate data manipulations. 4. Using Matplotlib, create informative plots and other data visualizations. Explain the key qualities of good visualizations. 5. Creating and manipulating DataFrames using Pandas. 6. Create Python code as well as methods in Pandas to select, search, change, and summarize data in tables. 7. Explain how to

identify and fill in missing values in data. 8. Apply Pandas functions combine and merge datasets, perform a range of data aggregations, groupings and cross tabulations. 9. Given multiple data sets, demonstrate how to summarize, transform, combine the data sets, and aggregate and visualize the resulting data set. Credits: 3.00

CS 17700 - Programming With Multimedia Objects

Credit Hours: 4.00. Introduction to computers and programming: number representations, primitive data types and operations, basic control structures, programming applets and applications using graphical user interfaces, programming for detecting events and performing actions, processing multimedia objects such as images and sounds. Throughout the course, examples are drawn from a variety of fields in the natural sciences. Not open to CS majors with a grade of C or better in CS 18000 . Not open to non-CS majors with a grade of C or better in any course in computer programming.

Credits: 4.00

CS 18000 - Problem Solving And Object-Oriented Programming

Credit Hours: 4.00. Problem solving and algorithms, implementation of algorithms in a high level programming language, conditionals, the iterative approach and debugging, collections of data, searching and sorting, solving problems by decomposition, the object-oriented approach, subclasses of existing classes, handling exceptions that occur when the program is running, graphical user interfaces (GUIs), data stored in files, abstract data types, a glimpse at topics from other CS courses. Intended primarily for students majoring in computer sciences. Credit cannot be obtained for both CS 18000 and any of 15600, 15800 and 15900. Not open to students with credit in CS 24000.

Learning Outcomes: 1. Understand solving problems by analyzing the problem, designing an algorithm, and programming the solution. Credits: 4.00

CS 18200 - Foundations Of Computer Science

Credit Hours: 3.00. Logic and proofs; sets, functions, relations, sequences and summations; number representations; counting; fundamentals of the analysis of algorithms; graphs and trees; proof techniques; recursion; Boolean logic; finite state machines; pushdown automata; computability and undecidability.

Learning Outcomes: 1. Understand discrete mathematical tools, facts, and reasoning relevant to computer science. Credits: 3.00

CS 18300 - Professional Practice I

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 18400 - Professional Practice II

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 19000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 19100 - Freshman Resources Seminar

Credit Hours: 1.00. This course is intended to integrate freshman majors in computer sciences into the department, help them adjust to university life, and assist them in developing academic and intellectual survival skills. Weekly recitation sections enable the students to work in teams. Strongly recommended for freshmen. The credit may be used only toward free electives.

Credits: 1.00

CS 19300 - Tools

Credit Hours: 1.00. This course is designed to introduce new Computer Science students to various programming tools which will aid them in their Computer Science classes, personal projects, and software development job experiences.

Learning Outcomes: 1. Understand Unix/Linux commands for navigating directories and files and manipulating files and folders. 2. Understand terminal commands for searching and input/output redirection. 3. Understand shells such as sh, csh, ksh, tcsh, bash, zsh. 4. Understand debugging via print statements and general debugger concepts. 5. Understand version control via Git and Github, source

control, workflow, commit, collaboration, pull, push, create and pushing a new repository, cloning, branches, merging, and conflicts. 6. Understand vim including mouseless navigation, normal/insert mode, copy/paste, search/replace, and saving/quitting. Credits: 1.00

CS 19700 - Freshman Honors Seminar

Credit Hours: 1.00. A seminar dealing with the history, context, and future of computer science. Open only to students in the Computer Sciences Honors Program. The credit may be used only toward free electives.

Credits: 1.00

CS 21100 - Competitive Programming I

Credit Hours: 2.00. CP1 teaches applied algorithmic ideas and problem solving techniques to solve programming interview and competitive programming questions including usage of basic data structures such as [array, set, map, stack, queue, deque, priority queue], the four main algorithm paradigms: [complete search, greedy, divide and conquer, dynamic programming], other algorithmic ideas including [binary search the answer/bisection, meet-in-the-middle, prefix sum and difference arrays, two pointers, sliding window], and basic graph algorithms covering [strongly/connected components, floodfill, topological sort, shortest paths].

Learning Outcomes: 1. Differentiate between categories of problems in computer science including complete search, greedy, divide and conquer, dynamic programming, and various types of graph problems, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to all major categories of problems in computer science (listed in LO1). 3. Use new/novel algorithms to solve problems. 4. Recognize key characteristics of certain problem types listed in LO1. 5. Classify a problem by those key characteristics. 6. Deconstruct a problem into subproblems that can be solved individually. 7. Assemble those subproblems into a complete solution. 8. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 9. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 10. Reflect on how one came up with a solution to a problem to better recognize patterns in problem types. 11. Debug programs by generating custom test cases based on problem constraints. Credits: 2.00

CS 23500 - Introduction To Organizational Computing

Credit Hours: 3.00. People and organizations, decision-making, information systems, telecommunications, desktop systems, integration tools, collaboration and groupware, multimedia, authoring multimedia documents, emerging technologies. May not be taken for credit by Computer Science majors.

Credits: 3.00

CS 24000 - Programming In C

Credit Hours: 3.00. The UNIX environment, C development cycle, data representation, operators, program structure, recursion, macros, C preprocessor, pointers and addresses, dynamic memory allocation, structures, unions, typedef, bit-fields, pointer/structure applications, UNIX file abstraction, file access, low-level I/O, concurrency.

Learning Outcomes: 1. Understand programming principles and techniques for problem solving in the C programming language. Credits: 3.00

CS 24200 - Introduction To Data Science

Credit Hours: 3.00. (STAT 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and

selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

CS 24300 - Artificial Intelligence Basics

Credit Hours: 3.00. This course provides an introduction to foundational areas of artificial intelligence and current techniques for building intelligent systems. As an entry-level course for Artificial Intelligence, the primary goals of this course are: Teach fundamental building blocks of an intelligent system, namely, knowledge representation; learning; model validation, diagnosis, and visualization; reasoning and decision-making; probabilities and uncertainty in AI. Provide students with first-hand experiences in building a working machine learning and an automated reasoning system. Provide an overview of current state-of-the-art technologies in multiple domains of artificial intelligence. Broaden the students' horizon and spark their interests via learning about exciting applications of artificial intelligence in many aspects of human society.

Learning Outcomes: 1. Use data processing and implement learning and reasoning algorithms using Python. 2. Determine how to represent knowledge in an AI system. 3. Build a first-hand machine learning system. Know and be able to build all basic components of the entire machine learning pipeline, including data collection, wrangling, cleaning, model selection, training, cross-validation, and diagnosis. 4. Master the mathematical theory behind linear regressors and classifiers. 5. Build a first-hand automated reasoning system, learn how to formulate real-world problems as constraint programs, solve reasoning problems and make complex decisions using AI. 6. Produce a reasoning system using depth-first search. 7. Demonstrate basic knowledge of the full landscape of AI: game playing, causality, fairness/bias/ethics, uncertainty handling, reinforcement learning. Credits: 3.00

CS 25000 - Computer Architecture

Credit Hours: 4.00. Digital logic: transistors, gates, and combinatorial circuits; clocks; registers and register banks; arithmetic-logic units; data representation: big-endian and little-endian integers; ones and twos complement arithmetic; signed and unsigned values; Von-Neumann architecture and bottleneck; instruction sets; RISC and CISC designs; instruction pipelines and stalls; rearranging code; memory and address spaces; physical and virtual memory; interleaving; page tables; memory caches; bus architecture; polling and interrupts; DMA; device programming; assembly language; optimizations; parallelism; data pipelining.

Learning Outcomes: 1. Students understand the function of basic hardware, including fundamentals of digital logic, processors, memory, and I/O. Credits: 4.00

CS 25100 - Data Structures And Algorithms

Credit Hours: 3.00. Running time analysis of algorithms and their implementations, one-dimensional data structures, trees, heaps, additional sorting algorithms, binary search trees, hash tables, graphs, directed graphs, weighted graph algorithms, additional topics.

Learning Outcomes: 1. Understand fundamental data structures, fundamental algorithms, and their implementation. Credits: 3.00

CS 25200 - Systems Programming

Credit Hours: 4.00. Low-level programming; review of addresses, pointers, memory layout, and data representation; text, data, and bss segments; debugging and hex dumps; concurrent execution with threads and processes; address spaces; file names; descriptors and file pointers; inheritance; system calls and library functions; standard I/O and string libraries; simplified socket programming; building tools to help programmers; make and make files; shell scripts and quoting; Unix tools including sed, echo, test, and find; scripting languages such as awk; version control; object and executable files (.o and a.out); symbol tables; pointers to functions; hierarchical directories; and DNS hierarchy; programming embedded systems.

Learning Outcomes: 1. Have an appreciation and ability for low-level (systems) programming and debugging. Credits: 4.00

CS 25300 - Data Structures And Algorithms For DS/AI

Credit Hours: 3.00. This course gives a broad introduction to the most important data structures and algorithms in computer science. The emphasis is on data structures and their use in algorithms relevant for data science and AI and their applications. The course focuses on developing and comparing efficient implementations, assessing suitability of data structures for massive data sets, and understanding effective use, modifications, and extensions. This course will not fulfill CS 25100 requirement for any Computer Science major or minor.

Learning Outcomes: 1. Apply an asymptotic analysis to given code and explain its significance. 2. Analyze asymptotic performance of data structures and algorithms with respect to time and space. 3. Describe different implementations of a data structure and explain when what implementation is most efficient. 4. Demonstrate how to add functionality to a data structure to efficiently handle new operations and queries. 5. Assess how the choice of data structures and algorithm design methods impacts the performance of programs. 6. Make effective and appropriate use of data structures such as stacks, queues, linked lists, hash tables, Bloom filters, priority queues, dictionaries, search trees, tries, and graphs. Credits: 3.00

CS 28400 - Professional Practice III

Credit Hours: 0.00. Professional Practice. Permission of instruction required.

Credits: 0.00

CS 28401 - Professional Practice Part-Time

Credit Hours: 0.00. Professional Practice Part-Time. The instructor determines the adequacy of the student's preparation for the work assignment proposed by the prospective employer for the student. Permission of Instructor required.

Credits: 0.00

CS 29000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 29100 - Sophomore Development Seminar

Credit Hours: 1.00. Presentations by corporate partners about careers in computer science. Presentations by faculty about careers in academia and research. Students learn about upper-division courses, tour research laboratories, and attend job fairs.

Credits: 1.00

CS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical

responsibility in professional work. Credits: 0.00

CS 30700 - Software Engineering I

Credit Hours: 3.00. An introduction to the methods and tools of software engineering; software life cycle; specification and design of software, software testing, cost and effort estimation; laboratory exercises with design, testing, and other tools.

Learning Outcomes: 1. Architect and design quality software. 2. Contrast and critique software lifecycle models. 3. Create software using current software engineering tools, methods, and concepts. 4. Work together on a team in a productive and professional manner. 5. Inspect and test software and documentation. Credits: 3.00

CS 31100 - Competitive Programming II

Credit Hours: 2.00. CP2 teaches experienced programmers additional techniques to solve interview and competitive programming problems and builds on material learned in CP1. This includes specific algorithmic techniques such as [shortest paths, topological sort, MST, union find, range queries], advanced algorithms surrounding trees and DAGs, advanced problem types in [dynamic programming, backtracking/simulation, mathematics, string processing], and more. It can be viewed as a programming complement to CS 38100, with some overlap in content.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including backtracking/simulation, advanced dynamic programming, advanced graphs (including trees and DAGs), mathematics, string processing, and range queries, as well as subcategories in each of these categories. 2. Implement well-known solutions (as discussed in class) to advanced categories of problems in computer science (listed in LO1). 3. Identify when a problem spans multiple categories of problems (as listed in LO1) 4. Design algorithms to solve problems that span multiple categories of problems. 5. Use new/novel algorithms to solve advanced problems. 6. Recognize key characteristics of certain problem types listed in LO1. 7. Classify an advanced problem by those key characteristics. 8. Deconstruct an advanced problem into subproblems that can be solved individually. 9. Determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 10. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 11. Reflect on how one came up with a solution to a problem in order to better recognize patterns in problem types. Credits: 2.00

CS 31400 - Numerical Methods

Credit Hours: 3.00. Iterative methods for solving nonlinear equations; direct and iterative methods for solving linear systems; approximations of functions, derivatives, and integrals; error analysis.

Credits: 3.00

CS 33400 - Fundamentals Of Computer Graphics

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. CS 31400 is recommended.

Credits: 3.00

CS 34800 - Information Systems

Credit Hours: 3.00. File organization and index structures; object-oriented database languages; the relational database model with introductions to SQL and DBMS; hierarchical models and network models with introductions to HDDL, HDML, and DBTG Codasyl; data mining; data warehousing; database connectivity; distributed databases; the client/server paradigm; middleware, including ODBC, JDBC, CORBA, and MOM.

Learning Outcomes: 1. Learn about different data models (relational, graph, and document) used in different database systems. 2. Learn how to pose complex database queries in SQL and NoSQL languages as well as theoretical

query languages. 3. Gain an introductory background in indexing. 4. Learn about transactions and concurrency control. 5. Differentiate between OLTP and OLAP applications. Credits: 3.00

CS 35100 - Cloud Computing

Credit Hours: 3.00. Introduction to cloud computing. Cloud data center infrastructure, public and private clouds, servers and virtualized servers, data center networks and virtualized networks, virtualized disk, file, and object storage, the concept of scale-out, algorithms and programming systems used in the design and implementation of cloud-native software, especially using containers and orchestration systems, microservices, serverless designs, controller-based designs, edge and fog computing, security in a cloud environment, programming models.

Learning Outcomes: 1. Describe physical facilities and virtualized technologies used in a cloud data center. 2. Understand major algorithms and programming paradigms used to build cloud-native software. 3. Design and deploy containerized software in a cloud environment. 4. Demonstrate orchestration of container software. Credits: 3.00

CS 35200 - Compilers: Principles And Practice

Credit Hours: 3.00. Should not be taken concurrently with CS 35400. The theory and practice of programming language translation, compilation, and run-time systems, organized around a significant programming project to build a compiler for a simple but nontrivial programming language. Modules, interfaces, tools. Data structures for tree languages. Lexical analysis, syntax analysis, abstract syntax. Symbol tables, semantic analysis. Translation, intermediate code, basic blocks, traces. Instruction selection, CISC and RISC machines. Liveness analysis, graph coloring register allocation. Supplemental material drawn from garbage collection, object-oriented languages, higher-order languages, dataflow analysis, optimization, polymorphism, scheduling and pipelining, memory hierarchies.

Learning Outcomes: 1. Provides students with an understanding of how a computer program is converted into elementary code that causes the computer to produce the output intended by the programmer. Credits: 3.00

CS 35300 - Principles Of Concurrency And Parallelism

Credit Hours: 3.00. Important concepts, models, algorithms, abstractions, and implementation aspects of concurrent and parallel programs. Topics include: techniques used to describe concurrent programs (e.g., threads, events, co-routines, continuations), abstractions for shared-memory and message-passing programs, relaxed memory models, livelock and deadlock detection, lock-free algorithms, data races and atomicity, scheduling techniques, process calculi, and software transactions.

Learning Outcomes: 1. This course provides students the vocabulary and concepts to better understand how to design and program scalable multicore processors. Credits: 3.00

CS 35400 - Operating Systems

Credit Hours: 3.00. Should not be taken concurrently with CS 35200. Introduction to operating systems. Computer system and operating system architectures, processes, inter-process communication, inter-process synchronization, mutual exclusion, deadlocks, memory hierarchy, virtual memory, CPU scheduling, file systems, I/O device management, security.

Learning Outcomes: 1. Provides students with an understanding of the fundamentals of computer operating systems. Credits: 3.00

CS 35500 - Introduction To Cryptography

Credit Hours: 3.00. An introduction to cryptography basics: Classic historical ciphers including Caesar, Vigenere, and Vernam ciphers; modern ciphers including DES, AES, Pohlig-Hellman, and RSA; signatures and digests; key exchange; simple protocols; block and stream ciphers; network-centric protocols.

Learning Outcomes: 1. Understand the basic concepts and proof techniques in cryptography. 2. Develop skills to define and evaluate the security of existing schemes. 3. Construct provably secure schemes for common cryptographic tasks. Credits: 3.00

CS 36100 - Great Issues In Computer Science

Credit Hours: 3.00. This course provides an overview of current and essential professional and ethical issues in computing and their impact on society. Topics specialize in the impact of computing, including algorithmic bias, motives behind design

decisions, data ethics, privacy and security, and legal issues. The goal of this course is to equip students with the framework and context necessary to think critically about the impact of computing. Discussions and readings will include current events.

Learning Outcomes: 1. Identify the causes behind some contemporary ethical concerns in computing. 2. Apply critical thinking and analytical abilities to a conversation around the impact of computing on society. 3. Apply reasoning to real-world case studies to analyze the ramifications of unethical practices. 4. Appreciate the importance of diverse experiences, thoughts, and backgrounds in Computer Science, both in academia and industry. 5. Understand some legal issues, privacy impacts, social issues, and other topics as they apply to computing. Credits: 3.00

CS 37300 - Data Mining And Machine Learning

Credit Hours: 3.00. This course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focuses on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation.

Learning Outcomes: 1. Identify key elements of data mining and machine learning algorithms. 2. Understand how algorithmic elements interact to impact performance. 3. Understand how to choose algorithms for different analysis tasks. 4. Analyze data in both an exploratory and targeted manner. 5. Implement and apply basic algorithms for supervised and unsupervised learning. 6. Accurately evaluate the performance of algorithms, as well as formulate and test hypotheses. Credits: 3.00

CS 38001 - C++ Programming

Credit Hours: 1.00. This course builds on the CS 24000 (Programming In C) course to teach C++ extensions. This 5-week one-credit course teaches C++ programming and helps students improve their understanding of object-oriented programming. It also teaches how to use an Integrated Development Environment (IDE) when programming in C++.

Learning Outcomes: 1. Understand how to program in C++. 2. Understand how to program in object-oriented languages in general. 3. Understand how to implement some basic Software Patterns in C++. 4. Understand how to use an IDE when programming in C++. Credits: 1.00

CS 38002 - Advanced Java Programming

Credit Hours: 1.00. This course builds on the Java course CS 18000 (Problem Solving And Object Oriented Programming) to teach advanced topics in Java. This 5-week one-credit course will teach advanced topics such as Network Programming in Java, JDBC, JNI, and J2EE to write web applications in Java. You will also improve your understanding of Object Oriented Programming.

Learning Outcomes: 1. Understand advanced features such as Network Programming in Java, J2EE, JDBC, Java Swing, and JNI. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

CS 38003 - Python Programming

Credit Hours: 1.00. This course teaches the Python programming language assuming that students have already taken a course in computer programming. This 5-week one-credit course teaches the Python language, the most common modules used in Python, as well as how to write Python web applications.

Learning Outcomes: 1. Understand how to write applications in Python. 2. Understand how to improve programming skills in object-oriented languages. Credits: 1.00

CS 38100 - Introduction To The Analysis Of Algorithms

Credit Hours: 3.00. Techniques for analyzing the time and space requirements of algorithms. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

Learning Outcomes: 1. Use big O-notation to give asymptotic time and space bounds of

algorithms. 2. Explain the use of big-Omega, big-Theta, and little-o notations. 3. Use recurrence relations to determine the time complexity of recursive algorithms. 4. Solve recurrence relations commonly arising in algorithm design. 5. Give examples that illustrate time-space trade-offs of algorithms. Credits: 3.00

CS 38600 - Professional Practice IV

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 39000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 5.00

CS 39100 - Junior Resources Seminar

Credit Hours: 1.00. This seminar course engages a number of outside speakers who typically present information on the role of research in computer science, how the research components of computer science relate to each other, approaches to software development in industry, different types of application development paradigms, technological trends, and societal, ethical, and legal issues. The credit may be used only toward free electives.

Credits: 1.00

CS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in computer science. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

CS 39699 - Professional Practice Internship

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Learning Outcomes: 1. Identify the practices, protocols, and key skills used for various positions of a particular organization and/or industry in which they are working. 2. Reflect on their professional growth, personal development, and the practical application of

theoretical knowledge within their chosen field. 3. Refine and reassess their own career goals as a result of the experience. Credits: 0.00

CS 39700 - Honors Seminar

Credit Hours: 0.00. A seminar for all sophomores, juniors, and seniors in the Computer Sciences Honors Program. Meets eight times each semester under the supervision of the Honors coordinator. The meetings focus on honors research projects, helping students to identify appropriate projects and form groups, and providing a forum for juniors and seniors to report on their projects as required in the honors program.

Credits: 0.00

CS 40700 - Software Engineering Senior Project

Credit Hours: 3.00. A capstone course combining all the concepts students have learned in the Software Engineering Track: software and software engineering, working as a team leader and as a team member, Agile Software Development, Scrum Software Development, Version Control, basing software development on reusable technology, developing requirements (User Stories and Use Cases), modelling with classes, design patterns, focusing on users, modelling interactions and behavior, architecting and designing software, testing and inspecting, managing the software development process. This is a project course. Students are organized into 4-6 student teams. Each team completes a full-semester software engineering project. Each team creates a Project Charter, Product Backlog, Design, and for 3 Sprints -- Planning Document, Demo, Retrospective Document. The final demo is a formal presentation.

Learning Outcomes: 1. Understand the software development process. 2. Understand the best methods to plan, analyze, design, test, measure, and manage software projects. 3. Understand agile methodologies in general and specifically Scrum. 4. Understand how to use version control systems in a team software engineering project. 5. Understand that good people are one of, if not the most important, requirements for successful projects. 6. Understand how to work on a team project as a team leader and/or team member. Credits: 3.00

CS 40800 - Software Testing

Credit Hours: 3.00. Preliminaries: errors and testing; software quality, requirements, behavior, and correctness; testing, debugging, verification; control flow graphs, dominators; types of testing; Test selection: from requirements, finite state models, and combinatorial designs; regression testing and test minimization; Test adequacy assessment: control and data flow; mutation based; testing tools.

Learning Outcomes: 1. Understand the basic technology related to software testing and debugging. 2. Differentiate between reliability and correctness. 3. Understand the impact of the saturation effect on the test process and its cost. 4. Understand the relationship between software development and test processes. 5. Apply a variety of black box test generation methods manually and using tools. 6. Use test adequacy criteria and understand their respective cost and effectiveness. 7. Select appropriate software test tools for a given testing task. Credits: 3.00

CS 41100 - Competitive Programming III

Credit Hours: 2.00. CP3 teaches experienced programmers additional techniques to solve competitive programming problems and builds on material learned in CP1 and CP2. This includes algorithmic techniques in topics such as [network flow, computational geometry, graph matching, NP-hard problems]. Primarily, CP3 prepares students to compete in programming contests, which means most class time is focused on simulating contest environments and teaching teamwork and communication alongside problem practice.

Learning Outcomes: 1. Differentiate between advanced categories of problems in computer science including network flow, computational geometry, graph matching, and NP-hard problems, as well as subcategories in each of these categories. 2. Extrapolate generalized solutions and problem-solving strategies across advanced categories listed in LO1 as well as in general competitive programming categories. 3. Design algorithms to solve problems that span multiple advanced categories of problems, combining categorical solutions in complex ways. 4. Use new/novel algorithms to solve advanced problems. 5. Deconstruct an advanced problem into subproblems that can be

solved individually. 6. Quickly determine runtime and space usage of a potential solution using big-O notation to judge if the potential solution will work. 7. Create an efficient solution to a problem based on analysis of the problem type, the deconstructed problem parts, and the time and space constraints of the problem. 8. Communicate ideas quickly and concisely to other competitive programmers to create efficient solutions. Credits: 2.00

CS 42200 - Computer Networks

Credit Hours: 3.00. Undergraduate-level introduction to computer networks and data communication. Low-level details of media, signals, and bits: time division and frequency division multiplexing; encoding; modulation; bandwidth, throughput, and noise. Packet transmission: Local Area Network (Ethernet, FDDI) and Wide Area Network technologies (ATM); wireless networks; network interconnection with repeaters, bridges, and switches; DSU/CSU; xDSL and cable modems. Internetworking: router-based architecture; IP addressing; address binding with ARP; datagram encapsulation and fragmentation; UDP and TCP, retransmission; protocol ports; ICMP and error handling. Network applications: client/server concept; port demultiplexing; program interface to protocols (API); use by clients and servers; domain name system; TELNET; Web technologies including HTTP, CGI, Java; RPC and middleware; network management.

Credits: 3.00

CS 42600 - Computer Security

Credit Hours: 3.00. A survey of the fundamentals of information security. Risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.

Learning Outcomes: 1. Apply the notions of threat, vulnerability, attack, countermeasure, security objectives, and adversarial models when analyzing security of computer and information systems. 2. Explain the main authorization mechanisms and access control models, and their applicability in different situations. 3. Explain security issues related to password and other authentication mechanisms. 4. Explain the different types of malware, the mechanisms of their propagation, and the strengths and limitations of different defense mechanisms. 5. Identify the threats and vulnerabilities for a networked environment, and explain different countermeasures, and their effectiveness. 6. Explain the vulnerabilities brought about by modern web-based application and services, different countermeasures, and their effectiveness. Credits: 3.00

CS 43400 - Advanced Computer Graphics

Credit Hours: 3.00. Advanced concepts and techniques of computer graphics. The course covers, in complete detail, going from a scene representation to a raster image without using OpenGL or other graphics packages. The course develops a complete graphics implementation in which the students implement every aspect of the graphics pipeline. This involves a substantial software project in C/C++.

Credits: 3.00

CS 43900 - Introduction To Data Visualization

Credit Hours: 3.00. The course offers an introduction to the fundamentals principles, design strategies, and techniques needed to visually communicate, explore, and analyze data. The course focuses primarily on the visual representation of inherently non-spatial data (e.g., tables and spreadsheets, graphs and networks, trees, text, and time series), but also considers the visualization of maps and of data in geospatial context.

Learning Outcomes: 1. Describe the main visualization techniques and explain their strengths and limitations. 2. Select the most perceptually effective visual encoding for a given data attribute. 3. Perform a principled critique of an existing data visualization. 4. Design an effective data visualization solution for a given data set to address a specific data analysis objective. 5. Create interactive web-based visualizations using open-source software libraries. Credits: 3.00

CS 44000 - Large Scale Data Analytics

Credit Hours: 3.00. This course provides an integrated view of the key concepts of modern algorithmic data analytics. It focuses on teaching principles and methods needed to analyze large datasets in
order to extract novel, transformative insights for the underlying application. The course emphasizes the duality between formulating questions that can be answered by statistical data analysis tools (the statistical perspective) and the algorithmic challenge of actually extracting such answers using available parallel and distributed computational resources from massive datasets. The topics cover three areas: (1) algorithmic concepts necessary for big data analytics, (2) big data systems, including data management and programming, and (3) advanced analytic methods to address characteristics of real-world big data problems.

Learning Outcomes: 1. Identify techniques appropriate for solving a data analytics challenge. 2. Load and manipulate data in distributed computing environments. 3. Apply computing paradigms to effectively write efficient and scalable algorithms for data analysis pipelines. Know limitations, design details and design decisions of these algorithms. 4. Apply mixed-precision optimization and parallel learning algorithms to modern machine learning algorithms. 5. Present results in methods appropriate for domain experts. Credits: 3.00

CS 44100 - Data Science Capstone

Credit Hours: 3.00. The Capstone course aims at providing students with an opportunity to integrate their accumulated knowledge and technical and social skills in order to identify and solve realistic or real-world data science problem, with an emphasis on the application domain. Capstone projects are often sponsored by corporate partners or by academic or non-academic research groups. The Capstone course serves as preparation for students entering into the profession of Data Science. Students will conduct a team-based project through the entire data science pipeline, by following the six phases of the CRISP-DM (Cross-Industry Standard Process for Data Mining) methodology. Students get experience in working as teams, participating in project planning, writing reports, and giving presentations.

Learning Outcomes: 1. Identify the business objectives in a complex problem. 2. Develop appropriate data science goals and project plan. 3. Implement the appropriate data pre-processing and analysis models. 4. Evaluate the above models and interpret results with respect to the "business" objectives. 5. Present the project outcomes through written reports and digital/oral presentations. Credits: 3.00

CS 44800 - Introduction To Relational Database Systems

Credit Hours: 3.00. An in-depth examination of relational database systems including theory and concepts as well as practical issues in relational databases. Modern database technologies such as object-relational and Web-based access to relational databases. Conceptual design and entity relationship modeling, relational algebra and calculus, data definition and manipulation languages using SQL, schema and view management, query processing and optimization, transaction management, security, privacy, integrity management.

Learning Outcomes: 1. Learn data modeling: physical, logical and conceptual data models, the entity-relationship model. 2. Study logical and Physical Design and interaction with operating systems, disk Storage, Basic File Structures, Hashing, Indexing. 3. Learn the relational database model and implementation and performance issues. 4. Understand transaction Processing, concurrency control, atomicity control and recovery control. 5. Understand database privacy, integrity, and security. 6. Understand data mining, data warehousing, online analytical processing, and information retrieval. 7. Understand Cloud computing and Distributed Database Systems architectures, Big Data, Hadoop, MapReduce, and NoSQL. 8. Recognize performance issues. Credits: 3.00

CS 45600 - Programming Languages

Credit Hours: 3.00. Concepts for structuring data, computation, and whole programs. Object-oriented languages, functional languages, logic- and rule-based languages. Data types, type checking, exception handling, concurrent processes, synchronization, modularity, encapsulation, interfaces, separate compilation, inheritance, polymorphism, dynamic binding, subtyping, overloading, beta-reduction, unification.

Credits: 3.00

CS 45800 - Introduction To Robotics

Credit Hours: 3.00. Any intelligent robot system interacting with our environment needs to have perception, planning, and control methods in its cognition process. The perception module outlines the robot's procedures to gather and interpret sensory observations into world models. The underlying planning and control modules use those world models to plan robot behaviors and their interaction with our natural environments. Therefore, this course will cover the fundamental topics in robot perception, planning, and control to design general-purpose robot cognition algorithms. Overall, this course is divided into four modules: Robot perception: This covers fundamental techniques needed for robot localization and mapping from raw 3D sensory data. Robot planning: This module will discuss robot behavior planning techniques such as A*, RRT*, and trajectory optimization. Robot Control: This introduces basic control techniques such as PID controller to execute the robot's planned behaviors in the real world. Robot Learning: This part will briefly introduce machine learning techniques for robot decision-making and control.

Learning Outcomes: 1. Formulate and solve the robot perception problems. 2. Identify the robot constraints, define their degree of freedom, and formulate their planning and control problems. 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. 4. Identify limitations in existing classical robot algorithms and understand their formal guarantees. 5. Evaluate and assess current best practices and mechanisms for robot programming. 6. Develop a skill for robot programming from perception to low-level control using standard methods. Credits: 3.00

CS 47100 - Introduction To Artificial Intelligence

Credit Hours: 3.00. Students are expected to spend at least three hours per week gaining experience with artificial intelligence systems and developing software. Basic problem-solving strategies, heuristic search, problem reduction and AND/OR graphs, knowledge representation, expert systems, generating explanations, uncertainty reasoning, game playing, planning, machine learning, computer vision, and programming systems such as Lisp or Prolog.

Learning Outcomes: 1. Develop understandings of various applications of AI. 2. Recognize problems where AI techniques are applicable. 3. Implement and apply basic principles of AI in solutions that require problem-solving, inference, learning, and planning. 4. Understand how to evaluate various AI techniques and make appropriate selections. Credits: 3.00

CS 47300 - Web Information Search And Management

Credit Hours: 3.00. This course teaches important concepts and knowledge of information retrieval for managing unstructured data such as text data on Web or in emails. At the same time, students will be exposed to a large number of important applications. Students in the course will get hands on experience from homework and a course project. The first part of the course focuses on general concepts/techniques such as stemming, indexing, vector space model, and feedback procedure. The second part of the course shows how to apply the set of techniques on different applications such as Web search, text categorization, and information recommendation.

Learning Outcomes: 1. Understand the important concepts and techniques of information retrieval and how to apply these techniques to a set of important or real world applications. Credits: 3.00

CS 47500 - Human-Computer Interaction

Credit Hours: 3.00. The goal of this course is to teach students how to design useful and usable interactive systems that address important needs of people. Students will experience the entire user-centered design life cycle, from need finding to usability evaluation. Topics covered in the course include user-centered design principles, usability heuristics, need-finding methods such as semi-structured interviews and contextual inquiry, quick prototyping techniques, usability evaluation methods such as hallway testing and human-subjects user study, and theories about user interaction and decision making. As we are entering a new era of AI, the course will also include a brief introduction on how to apply the HCI principles and techniques to AI-powered systems. This course is project-based. Students will form project teams among themselves to work on a semester-long project and apply the user-centered design principles, theories, and techniques that they have learned in class to build a useful and usable interactive system such as a mobile application. This course is also highly interactive, including a series of design studios and in-class activities that require active participation, communication, and

discussion with other students.

Learning Outcomes: 1. Apply HCI methods such as semi-structured interviews and contextual inquiries to uncover user needs and realistic problems that can be solved by computational methods. 2. Apply user-centered design principles to iteratively develop interface designs to address those needs. 3. Develop prototypes to concretize a design idea in different levels of fidelity. 4. Critique a design idea or prototype and pinpoint design flaws and usability issues based on commonly agreed upon design principles and usability heuristics. 5. Iteratively evaluate and improve upon the prototypes based on feedback from potential users. 6. Communicate design ideas and findings to target users, other designers, funders, etc. 7. Work in a team and succeed. Credits: 3.00

CS 47800 - Introduction To Bioinformatics

Credit Hours: 3.00. (BIOL 47800) Bioinformatics is broadly defined as the study of molecular biological information, targeting particularly the enormous volume of DNA sequence and functional complexity embedded in entire genomes. Topics will include understanding the evolutionary organization of genes (genomics), the structure and function of gene products (proteomics), and the dynamics of gene expression in biological processes (transcriptomics). Inherently, bioinformatics is interdisciplinary, melding various applications of computational science with biology. This jointly taught course introduces analytical methods from biology, statistics and computer science that are necessary for bioinformatics investigations. The course is intended for junior and senior undergraduates from various science backgrounds. Our objective is to develop the skills of both tool users and tool designers in this important new field of research.

Learning Outcomes: 1. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 2. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate knowledge of the path leading to specific careers in biology. 5. Understand the role of evolution of creating and modifying the macromolecular components of the cell, and in creating biological complexity and variability. 6. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 7. Demonstrate an understanding of laboratory skills used in genetics. 8. Demonstrate knowledge of how evolutionary forces impact and shape microbial function and activity. 9. Demonstrate an understanding of the scientific method including hypothesis generation and testing, data collection, analysis, and interpretation. Credits: 3.00

CS 48300 - Introduction To The Theory Of Computation

Credit Hours: 3.00. Turing machines and the Church-Turing thesis; decidability; halting problem; reducibility; undecidable problems; decidability of logical theories; Kolmogorov complexity; time classes; P, NP, NP-complete; space classes; Savitch's theorem, PSPACE-completeness, NL-completeness; hierarchy theorems; approximation theorems; probabilistic algorithms; applications of complexity to parallel computation and cryptography.

Credits: 3.00

CS 48700 - Professional Practice V

Credit Hours: 0.00. Professional Practice. Permission of instructor required.

Credits: 0.00

CS 48900 - Embedded Systems

Credit Hours: 3.00. Software for embedded systems; programming with extreme constraints on memory, storage, and processing power; programming models, including synchronous, asynchronous, and concurrent; programming systems that run forever; use of Finite State Machines (FSMs); review of embedded hardware and available boards; asynchronous and synchronous serial connections (e.g., RS232 and SPI); General Purpose I/O (GPIO) pins; relays, servos, and other peripherals; design for low power; battery characteristics; systems that communicate over computer networks and the Internet; current industry practices; design of embedded projects; working in teams. CS 35200 (Compilers) and CS 35400 (Operating Systems) are recommended, but not required.

Learning Outcomes: 1. Understand basics of embedded systems. 2. Understand how and why many Internet of Things (IoT) devices use the cloud. 3. Understand how embedded systems are employed in a variety of situations, including smart homes and buildings, security systems, cars, and planes. 4. Understand the three basic programming models, and when each is appropriate. 5. Understand how synchronous and asynchronous serial devices operate. 6. General characteristics of batteries and which type of battery is appropriate for various embedded designs. 7. Understand the use of relays and how embedded logic that operates on low voltage can control high voltage peripherals. 8. Understand why systems that use sensors and actuators must be calibrated. 9. Understand how to build and demonstrate a working embedded system.

Credits: 3.00

CS 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields. Permission of instructor required.

Credits: 1.00 to 5.00

CS 49700 - Honors Research Project

Credit Hours: 3.00. One semester of the project may be counted as one of the seven computer science courses at or above the 300 level required for the bachelor's degree. One more semester, if approved by the honors coordinator, can be used as a free elective. A group research project directed by Computer Sciences faculty members. Each group must submit a technical report describing its work and the results obtained.

Credits: 3.00

CSCI 23000 - Computing I

Credit Hours: 4.00. The context of computing in history and society, information representation in digital computers, introduction to programming in a modern high-level language, introduction to algorithms and data structures, their implementation as programs.

Credits: 4.00

CSCI 24000 - Computing II

Credit Hours: 4.00. Continues the introduction of programming begun in CSCI 23000, with a particular focus on the ideas of data abstraction and object oriented programming. Topics include programming paradigms, principles of language design, object-oriented programming, programming and debugging tools, documentation, recursion, linked data structures, and an introduction to language translation.

Credits: 4.00

CSCI 24100 - Introduction To Web Design

Credit Hours: 3.00. Introduction to writing content for the Internet and World Wide Web. Emphasis on servers, hand-coded HTML, Cascading Style Sheets and extending HTML with other Web technologies.

Credits: 3.00

CSCI 31100 - Advanced Database Programming, Oracle

Credit Hours: 3.00. Focus on the concepts and skills required for database programming and client server development. Concepts will apply to any modern distributed database management system. Emphasis on developing Oracle SQLPlus scripts, PL/SQL server side programming, and Oracle database architecture. Students with programming experience in ODBC compliant languages will be able to practice connecting such languages to an Oracle database. Lecture and laboratory.

Credits: 3.00

CSCI 31700 - Computation For Scientific Applications

Credit Hours: 3.00. Prerequisite: N207 or equivalent. This course gives a survey and overview of popular computational software used in multiple scientific domains to support data processing and scientific research. This class focuses on teaching how to use software to efficiently process data in terms

of modeling, simulating, visualizing and data-mining. Fundamental concepts related to scientific computing are introduced briefly.

Credits: 3.00

CSCI 34000 - Discrete Computational Structures

Credit Hours: 3.00. Theory and application of discrete mathematics structures and their relationship to computer science. Topics include mathematical logic, sets, relations, functions, permutations, combinatorics, graphs, Boolean algebra, digital logic, recurrence relations, and finite-state automata.

Credits: 3.00

CSCI 36100 - Fundamentals Of Software Project Management

Credit Hours: 3.00. Tools and techniques used to manage software projects to successful completion. Problem solving focus to learn specification development and management, program success metrics, UML modeling techniques, code design and review principles, testing procedures, usability measures, release and revision processes, and project archival.

Credits: 3.00

CSCI 36200 - Data Structures

Credit Hours: 3.00. A study of the design and analysis of data structures and algorithms. Abstract data types: arrays, stacks, queues, lists, trees, graphs, etc. Algorithms: sorting, searching, hashing. File structures: organization and access methods.

Credits: 3.00

CSCI 36300 - Principles Of Software Design

Credit Hours: 3.00. (ECE 37200) This course is designed to teach students best practices in designing and implementing object-oriented systems of high quality. To accomplish this task, we start with an overview of software design patterns and their role in developing high-quality software. We then begin surveying different design-level software design patterns, such as the Bridge, Strategy, Wrapper Facade, and Visitor software design patterns. Next, we touch on software design patterns for building distributed systems. Finally, we finish the course by surveying software anti-patterns, which are common design mistakes that negatively impact system quality, such as degrading performance as the system scales in size and complexity. Students will have the opportunity to apply learned techniques on several programming projects throughout the semester.

Learning Outcomes: 1. Understand and define the purpose of software design patterns. 2. Identify and describe the design goal and intent of different design patterns. 3. Know what software design pattern to apply to a particular problem. 4. Apply techniques for implementing and debugging object-oriented software systems. 5. Apply techniques for identifying design flaws that negatively impact system quality. Credits: 3.00

CSCI 40300 - Introduction To Operating Systems

Credit Hours: 3.00. Operating system concepts; history, evolution and philosophy of operating systems. Concurrent processes, process coordination and synchronization, CPU scheduling, deadlocks, memory management, virtual memory, secondary storage and file management, device management, security and protection, networking, distributed and real-time systems.

Learning Outcomes: 1. Learn computer systems structures. 2. Learn operating systems structures. 3. Study processes & threads. 4. Perform CPU scheduling. Credits: 3.00

CSCI 41400 - Numerical Methods

Credit Hours: 3.00. Error analysis, solution of nonlinear equations, direct and iterative methods for solving linear systems, approximation of functions, numerical differentiation and integration, numerical solution of ordinary differential equations. Not open to students with credit in CSCI 512.

Credits: 3.00

CSCI 43200 - Security In Computing

Credit Hours: 3.00. An introduction to computing security to include Cryptography; Identity and authentication; Software security; Operating system security; Trusted operating system design and evaluation; Network threats and defenses; Security management; legal aspects of security; Privacy and ethics.

Learning Outcomes: 1. Learn about cryptography, identity, and authentication. 2. Identify different types of software security, operating system security, trusted operating system design. 3. Discuss the legal aspects of security, privacy, and ethics. Credits: 3.00

CSCI 44300 - Database Systems

Credit Hours: 3.00. Relational database systems: architecture, theory, and application. Relational data structure, integrity rules, mathematical description, data manipulation. Standard SQL and its data manipulation language, engineering aspects of database design in industry, introduction to non-relational database systems.

Credits: 3.00

CSCI 44800 - Biometric Computing

Credit Hours: 3.00. Biometrics is capturing and using physiological or behavioral characteristics for personal identification. It is set to become the successor to the PIN. This course will introduce computational methods for the implementation of various biometric technologies including face and voice recognition, finger print and iris identification, and DNA matching.

Learning Outcomes: 1. Learn behavioral characteristics for biometric identification. 2. Discuss biometric traits and theories. 3. Implement real-world biometric technologies.

Credits: 3.00

CSCI 45000 - Principles Of Software Engineering

Credit Hours: 3.00. Tools and techniques used in software development. Lifecycle concepts applied to program specification, development, and maintenance. Topics include overall design principles in software development; the use of structured programming techniques in writing large programs; formal methods of program verification; techniques and software tools for program testing, maintenance, and documentation.

Credits: 3.00

CSCI 48400 - Theory Of Computation

Credit Hours: 3.00. Introduction to formal languages and automata theory; finite automata, regular expressions, regular languages, context-free languages and pushdown automata, context sensitive languages, Turing machines, undecidability, P and NP. Design and analysis techniques for divide-and-conquer algorithms, greedy algorithms, dynamic programing, amortized analysis.

Credits: 3.00

CSCI 48900 - Data Science

Credit Hours: 3.00. The course will cover data manipulation, analysis, and visualization. Statistical modeling, dimension reduction and techniques of supervised and unsupervised learning. Introduction to software technologies used in data science and applications in science, government and industry.

Learning Outcomes: 1. Understand and describe various aspects of machine learning, statistics and soft engineering skills used in industrial and academic data science. 2. Demonstrate and apply knowledge through class competitions, blog assignment and a final project. 3. Communicate data analyses effectively through written reporting and oral presentations. Credits: 3.00

CSCI 49000 - Topics In Computer Sciences For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading and reports in various fields.

Credits: 1.00 to 5.00

CSCI 49500 - Explorations In Applied Computing

Credit Hours: 1.00 to 6.00. Explorations in Applied Computing is an undergraduate capstone experience. Students will work in teams, advised by faculty and external liaisons, to solve real-world computing problems. This hands-on experience will cultivate technical expertise, utilization of analytical thinking, quantitative reasoning, project management skills, and communication skills.

Credits: 1.00 to 6.00

CSCI 49600 - Computer Science Internship Capstone

Credit Hours: 3.00. A professional experience providing students the opportunity to incorporate material learned in CSCI coursework in a supervised internship position. The approved internship position will cultivate technical expertise, utilization of analytical thinking, quantitative reasoning, project management skills, and communication skills.

Credits: 3.00

Department of Earth, Atmospheric, and Planetary Sciences

Overview

The Department of Earth, Atmospheric, and Planetary Sciences (EAPS) is dedicated to providing a top-rate education for undergraduate and graduate students, as well as being dedicated to contributing to our sciences through research. EAPS is the multidisciplinary department of the College of Science, requiring the use of mathematics, physics, chemistry, statistics, and computer science to research problems; along with state of the art computer and laboratory facilities for calculation, visualization, and experimentation. Our programs intersect disciplines, with faculty and students studying in fields such as energy and the environment, severe weather science, planetary exploration, and geodata science. Our faculty, students and staff are dedicated to the department's mission, strategic plan, and fostering an environment of diversity and inclusivity. Guided by our values, we continue to expand, recruiting top-notch academic staff. I welcome you to contact us or check our website at eaps.purdue.edu if you are interested in learning more about the work that we do and the programs that we offer.

Department of Earth, Atmospheric, and Planetary Sciences Website

Faculty

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Graduate Information

For Graduate Information please see Department of Earth, Atmospheric, and Planetary Sciences (Graduate).

Planetary Sciences, BS

Geology and Geophysics, BS

Environmental Geoscience, BS

Atmospheric Science, BS

Atmospheric Science Minor

Earth and Planetary Sciences Minor

The department is pulling out the Atmospheric minor from the larger EAPS minor to make it easier for students to create a clear and usable minor. That means the EAPS minor needs a name change and an update to the requirements to reflect the removal of the Atmospheric Science courses. This can benefit students within our department by allowing Atmospheric Science majors to add the Earth and Planetary minor. We see this benefiting others throughout the university, creating a clear path to an Earth and Planetary minor.

EAPS 10000 - Planet Earth (UCC: STS)

Credit Hours: 3.00. An introduction to the Geosciences-Earth science, oceanography, atmospheric science and astronomy. The course emphasizes topics (earthquakes, volcanoes, ocean pollution, climate change, severe weather, etc.) that are of general interest and relevance, and the interconnections between various Earth processes. CTL:IPS 1730 Earth Science

University Core Curriculum (UCC): (UCC: STS) Credits: 3.00

EAPS 10400 - Oceanography (UCC: STS)

Credit Hours: 3.00. Origin of the oceans and marine life. Seafloor spreading and marine geology; currents, waves, and tides; marine organisms and ecology; beaches and nearshore life. Man's use and abuse of the sea, including contemporary problems and future opportunities. The role of oceans in climate and evolution of the biosphere.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand ocean and coastal processes. 2. Understand potential future impacts of ocean and other environmental changes. Credits: 3.00

EAPS 10500 - The Planets (UCC: SCI)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about the origin and characteristics of the bodies in our Solar System, including planets, moons, asteroids, comets, exoplanets beyond, and the search for extraterrestrial life. We'll discuss how solar systems form and die, the origin of the terrestrial versus giant planets and their orbits, the evolution of planetary surfaces due to

asteroid impacts and volcanism, the development of atmospheres, the formation of planetary rings, the origin of moons, the hazards of space travel, and why Pluto IS a planet.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Place your home in context with the Universe (cosmic geography). 2. Understand how the solar system came to be. 3. Understand the basic structure of the solar system and Earth's place in it. 4. Understand the processes that shape the surfaces of the planets. 5. Learn about past, current, and future exploration of space. Credits: 3.00

EAPS 10600 - Geosciences In The Cinema (UCC: STS)

Credit Hours: 3.00. This course is designed for science and non-science majors alike to learn about natural hazards based on the depictions of such hazards in movies. Topics include earthquakes, tsunamis, volcanoes, tornadoes, hurricanes, climate change, asteroid impacts, space exploration, and wildfires. The course focuses on the accuracy of the depiction of natural hazards in the movies, the underlying processes that control their formation and the dangers they represent, how they influence society, and how students can prepare for them and keep themselves safe.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Understand how scientists explore natural hazards, make observations, and develop theories. 2. Explain the processes that control natural hazards and where and when they are likely to occur. 3. Know the natural hazards inherent to a student's location and be able to plan how to keep themselves safe in the event of such an occurrence. 4. Critically assess the reasonableness of depictions of natural hazards in the media. Credits: 3.00

EAPS 10900 - The Dynamic Earth

Credit Hours: 3.00. This course covers the formation and development of the solid earth, atmosphere, hydrosphere, and bio-sphere. The course studies the whole earth as a system of many interacting parts and focuses on the changes within and between these parts. This course is intended for all majors in earth and atmospheric sciences.

Credits: 3.00

EAPS 11100 - Physical Geology (UCC: SCI)

Credit Hours: 3.00. Geologic processes and the development of land forms. Laboratory covers the study of minerals and rocks, the interpretations of topographic and geologic maps, and field investigations. CTL: Physical Geology

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 11200 - Earth Through Time (UCC: SCI)

Credit Hours: 3.00. The history of the planet Earth from its beginnings to the present. This course will explore the causes and effects of processes that have changed the Earth's surface and subsurface through time, the impacts of these changes on the evolution of life, and how scientist interpret Earth history from the geologic record. The laboratory will provide hands-on experience in interpreting various geologic and fossil records. This course may be taken on its own, or as a year-long lab series with EAPS 11100 . EAPS 11100 and EAPS 11200 will fulfill the two course sequence laboratory experience outside the major department.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 11600 - Earthquakes And Volcanoes (UCC: SCI)

Credit Hours: 3.00. A survey class on earthquakes and volcanoes. Topics include earthquake hazards and forecasting, the use of seismic waves to investigate the earth's interior, volcanoes and tectonics, volcanic hazards, and the influence of volcanoes on climate. Examples of recent and historic earthquakes and volcanic eruptions are presented.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 11700 - Introduction To Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. The weather/climate system. Solar variability and Milankovitch Theory. Atmospheric scales of motion. Chemistry of greenhouse gases and aerosols. Fundamental laws of meteorological dynamics and radiation. Weather systems, air masses and fronts. Severe storms, hurricanes and tornadoes. (Required for atmospheric sciences majors.).

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Appreciate the temporal and spatial scales of climate change, from

Milankovitch Theory and glacial/interglacial regions, to the anthropogenic effects of greenhouse gases (GHG's). 2. Appreciation of how weather events collectively and cumulatively, lead to the establishment of climate. 3. Understand the basic scales of atmospheric motion (space and time) and the classification of weather events into these scales (planetary, synoptic, mesoscale and microscale). 4. Understand the definition of aerosols and GHG's and their relation to weather and climate. 5. Understand the four basic laws of radiation (beginning with Planck's Law). 6. Understand the fundamental laws of atmospheric motion, and some general principles of weather prediction. 7. Understand the basic principles of cloud physics, from CCN to cloud formation and precipitation. 8. Understand the First Law of Thermodynamics, and the general concepts of thermal convection, including lapse rates and the concept of latent heat release. 9. Understand the behavior, including simulation and differences, of geophysical columnar vortices, from dust devils to tornadoes to hurricanes. 10. Understand the broad context of atmospheric science, from solar physics and space weather, to meteorology and lower atmosphere weather phenomena. 11. Understand how the planetary atmospheric circulation establishes a jet stream and the semi-permanent pattern of wind and pressure belts (e.g., the trade winds and the westerlies). 12. Understand the formation and movement of air masses and fronts, including the formation of Extratropical Cyclones. 13. Understand the formation of thunderstorms, including severs thunderstorms, hail and tornadoes. 14. Understand tornado climatology in the USA, the tornado intensity scale, taxonomy and climate considerations such as ENSO pattern of El Nino and La Nina. 15. Understand weather hazards in the field of aviation, particularly thunderstorm phenomena (such as hail and downburst winds). 16. Understand a basic review of weather/climate and energy (from wind farms to climate changes). Credits: 3.00

EAPS 11800 - Introduction To Earth Sciences

Credit Hours: 3.00. Introduction to a range of topics in Earth Science, including: Origin and geological history of Earth, including geological records of climate and evolution; Earth materials (minerals and rocks); Chemical and physical composition and structure of the Earth; Rock weathering, erosion, and sedimentary processes; Geological timescale; Geologic structures including their map and field expression; Tectonic processes; The hydrological cycle with emphasis on groundwater and physical and chemical oceanography; Energy and mineral resources; Astrobiology. (Required for Geology and Geophysics and Earth and Space Science Teaching majors.)

Credits: 3.00

EAPS 12000 - Introduction To Geography (UCC: STS)

Credit Hours: 3.00. Introduction to the major themes of modern geography, designed to enhance your spatial thinking skills, geographic literacy, and to help you understand the relevance of geographic concepts and how they relate to our changing world. This course will expand your awareness of global issues and provide you with tools to understand how the world around you changes at local, regional, and global scales.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Interpret geographic data and identify and understand spatial relationships linking humans and the environment. 2. Use geographic tools introduced in the course (e.g. Google Earth, MapMaster). 3. Understand how and why people organize themselves and move as a function of economic, social, historical and cultural forces. 4. Understand how weather and climate are linked to natural and human induced climate change, and links between the atmosphere and biosphere through water and nutrient cycles. 5. Understand how processes within and on the Earth are reflected in the landscape and how erosions, transport and

deposition re-shape landscapes. 6. Understand the resource concept and be able to make connections between distribution of resources and balancing competing interests. Credits: 3.00

EAPS 12500 - Environmental Science And Conservation (UCC: STS)

Credit Hours: 3.00. (AGRY 12500, FNR 12500, NRES 12500) Introduction to environmental science and conservation includes topics in ecological principles, conservation and natural resource management, human impacts on the environment, toxic waste disposal, climate change, energy, air and water pollution, environmental geology and geologic hazards.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe the issues, facts and concepts central to a broad range of environmental and conservation topics. 2. Form opinions on controversial topics, explaining what they think we should do regarding topics in the news. 3. Describe the work done in five scientific disciplines, ecology, environmental science, resource management, conservation biology, and environmental geology. Credits: 3.00

EAPS 12900 - Earth System Dynamics (UCC: SCI/STS)

Credit Hours: 3.00. Provides foundational knowledge and critical thinking skills to discuss the Earth's changing climate and environment and their impacts. Introduces how the components of the Earth system - atmosphere, hydrosphere, lithosphere, and biota -- interact with each other in response to various forcings. Course is designed to enhance learners' geospatial-temporal thinking skills and geoscience literacy, as well as analyze some of the 'what if' scenarios using a 'systems approach'.

University Core Curriculum (UCC): (UCC: SCI/STS) Learning Outcomes: 1. Describe the various sub-systems inside the Earth system and conceptualize how they interact. 2. Apply facts and concepts about geospatial-temporal phenomena when relevant events arise in real life. 3. Develop the ability to analyze the Earth system from personal, community to global scales. 4. Connect available evidence in real life to climate change impacts for decision- and policy-making. Credits: 3.00

EAPS 13700 - Freshman Seminar In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. Seminar presented by guests in different fields of the Earth and Atmospheric Sciences to expose students to the range of topics included in the department and in possible career paths.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths in the EAPS program. Credits: 1.00

EAPS 13800 - Thunderstorms And Tornadoes (UCC: SCI)

Credit Hours: 3.00. Not open to juniors and seniors majoring in atmospheric science. An elementary treatment of the physical structure of the atmosphere and the dynamical conditions that lead to the development of convective clouds, thunderstorms, and severe weather (including tornadoes, hail, wind, rain, lightning, and flash floods). This course will also focus on storm climatology, the socioeconomic impact of severe weather, as well as prediction, detection, warnings, and safety procedures. Analysis of severe weather events will include tornado movies and case studies of ground/aerial surveys of storm damage.

University Core Curriculum (UCC): (UCC: SCI) Credits: 3.00

EAPS 19100 - Introductory Topics In Earth And Atmospheric Science

Credit Hours: 1.00 to 3.00. Introductory special topics in earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 20000 - Water World: Processes And Challenges In Global Hydrology (UCC: STS)

Credit Hours: 3.00. Introduction to the Hydrological Sciences designed for undergraduate students. Course uses an Earth-

systems approach to emphasize the interconnections and feedback between the hydrosphere, geosphere, biosphere, and atmosphere. Course topics will include: global water-balance, techniques for measuring components of the water-balance, hydrological uncertainties, groundwater, surface-water, vadose zone, forest and watershed hydrology, global change hydrology, human and climate impacts on water resource, and water on the worlds.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Create, analyze, and evaluate water-balances. 2. Define and recognize the importance of the groundwater, surface-water, and vadose zone water systems, and explain interactions and interconnections between these three systems. 3. Evaluate human and climate impacts on water resources and explain how hydrological processes impact biodiversity and ecological functioning. 4. Create conceptual models for how these systems may change with growing human populations, land development and deforestation, and climate change. Credits: 3.00

EAPS 20500 - Fundamentals Of Planetary Science

Credit Hours: 3.00. This course provides a quantitative understanding of the fundamental principles that govern the behavior of planetary systems, including their atmospheres, surfaces, interiors, and orbital dynamics. This course is intended to be a quantitative follow-on to EAPS 10500, and aims to provide students with hands-on experience with physics-based problem solving, scientific programming, and developing research projects. Lecture periods will include lectures as well as group work on problems, and lab periods will focus on programming projects in Python. By the end of the course, students will have a strong foundation in the principles and techniques of planetary science and be well-prepared to engage in upper-year courses and conduct planetary science research. It is recommended that students have completed EAPS 10500 The Planets, PHYS 17200 Modern Mechanics or equivalent, and have some previous programming experience (preferably in Python).

Learning Outcomes: 1. Apply principles of classical physics to investigations of planetary orbital dynamics, surfaces, interiors, and atmospheres. 2. Write and debug basic data analysis, graphical display, and numeric computation code in Python. 3. Come up with a science question, conduct a literature review, test hypotheses using real data or models, and present an informed assessment. Credits: 3.00

EAPS 22100 - Survey Of Atmospheric Science (UCC: SCI)

Credit Hours: 3.00. (NRES 23000) An introductory course for both science and nonscience students. A general study of the atmosphere, basic meteorological principles, and weather systems. Relationships of the changing atmosphere to climate ozone depletion, and other contemporary issues.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of meteorological phenomena using fundamental principles of physics and chemistry. 2. Learn a unified approach that relates the behavior of air parcels acting under forces to the observed weather and climate. 3. Represent weather parameters quantitatively on maps and charts. 4. Identify the principal threat to the stratospheric ozone shield and the gases responsible for the greenhouse effect. 5. Understand the Coriolis effect and how it determines wind direction and circulation in cyclones and anticyclones in the Northern and Southern Hemispheres. 6. Identify conditions that lead to the formation of hazardous weather. Credits: 3.00

EAPS 22500 - Science Of The Atmosphere (UCC: SCI)

Credit Hours: 3.00. This course provides a quantitative introduction to how to use the laws of physics to understand the behavior of the Earth's atmosphere. Emphasizes key processes that govern the climate system and the weather phenomena that arise within it. Topics covered may include the Earth's energy balance, heat transfer, the greenhouse effect, atmospheric convection, precipitation, the general circulation, the Coriolis effect, atmospheric chemistry, weather systems, weather forecasting, and climate change.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Solve simple quantitative problems by manipulating equations, plugging in numbers, and checking units. 2. Visualize how our atmosphere varies

in space and time by interpreting graphs and maps of atmospheric data as a function of latitude, longitude, and/or height/pressure. 3. Use key physical laws to explain (mathematically and in words)...Physical properties (composition, density, temperature, pressure, specific humidity, relative humidity) of our atmosphere; How energy transfer between the Sun, Earth, and outer space affect the properties of our atmosphere; How horizontal variability in air properties gives rise to circulations, such as the jet stream. Credits: 3.00

EAPS 22700 - Introduction To Atmospheric Observation And Measurements

Credit Hours: 3.00. Survey of principal techniques, tool, and instruments used in atmospheric science research. Students work on research projects designed in coordination with EAPS faculty. Topics are complimentary to those covered in EAPS 22500 and may include either observational analysis, numerical modeling, or both. Topics to be covered include hypothesis formulation, literature search, training on the necessary instruments and numerical modeling tools, experiment design and execution, statistical analysis, student-designed experiment revision, scientific writing, and presentation of findings to the class and interested EAPS faculty.

Learning Outcomes: 1. Formulate testable scientific hypotheses. 2. Survey published scientific literature. 3. Identify commonly used atmospheric measuring systems and their principles of operation. 4. Operate basic meteorological instruments and analyze their data. 5. Design and execute an experiment to test a hypothesis. 6. Present their findings both orally and in writing. Credits: 3.00

EAPS 23000 - Laboratory In Atmospheric Science

Credit Hours: 2.00. A laboratory course that introduces the fundamentals of atmospheric science through quantitative exercises. The theoretical exercises include the vertical structure of the atmosphere, the Earth's energy budget, atmospheric moisture, saturation and stability, clouds and precipitation and atmospheric motion. Data and map analysis exercises include mid-latitude cyclones, thunderstorms and tornadoes, hurricanes and controls of climate. Prior or current course work in introductory atmospheric science is required. This course may not be taken for credit by students in the atmospheric science option of the Department of Earth and Atmospheric Sciences.

Credits: 2.00

EAPS 23001 - Laboratory In Atmospheric Science: Introduction To Weather And Climate Datasets

Credit Hours: 2.00. This course is a Python-based introduction to the array of weather and climate datasets freely available on the internet in an online computational laboratory setting. The course will emphasize the importance of having data be freely available and "FAIR" (Findable, Accessible, Interoperable, Reusable) from the point of view of the philosophy of science, from a data science perspective, and from a practical "how to do it" perspective.

Learning Outcomes: 1. Write Python code to read in, plot, and perform simple analyses using a wide range of weather and climate datasets (observations, numerical weather forecasts, reanalysis, climate models) in different formats that are publicly available on the internet. 2. Visualize weather and climate data in maps and graphs. 3. Communicate weather and climate information clearly and concisely to non-experts using weather and climate data visualizations. Credits: 2.00

EAPS 24300 - Mineralogy

Credit Hours: 4.00. Elements of crystallography, physical and chemical properties of rock-forming minerals, and minerals of economic importance. Origin and occurrence of minerals. Prior course work in dynamic earth or physical geology is required.

Learning Outcomes: 1. Know the major element geochemistry of common rock forming minerals that occur in earth, the terrestrial planets, and in meteorites. 2. Understand that minerals form the geochemical reservoirs from which rock materials are derived. 3. Have competence in the rules of crystallography, be able to determine symmetry elements in 1-, 2-, and 3-demensions, and understand how to index different parts of crystals using common notations. 4. Identify rock forming minerals and

selected accessory and ore minerals in hand sample. 5. Learn the theory and methods of optical mineralogy, spectroscopy, X-ray diffraction, and electron microbeam analysis. 6. Learn the thermodynamics phase equilibria in rock and mineral systems, and the basic petrology of igneous, metamorphic and sedimentary rocks. Credits: 4.00

EAPS 24400 - Earth Materials II

Credit Hours: 4.00. The study of common igneous, sedimentary, and metamorphic rocks. The origin and occurrence of rocks, weathering, and alteration processes. Prior course work in earth materials or mineralogy is required.

Credits: 4.00

EAPS 30100 - Oil!

Credit Hours: 3.00. Petroleum is a common thread that interweaves Geoscience with the Political-Economic history of the 20th century. Its dominance in current society has major repercussions on our current and future society and environment. The unequal distribution of petroleum and natural gas, coupled with innovative geologists and engineers, has set the stage for the modern geo-political world. This course is a unique survey into the multitude of aspects of petroleum -- from its formation to "resource wars".

Learning Outcomes: 1. Enlighten and enable self-discovery of this major past, present and future issue in human civilization. 2. Understand the selected major oil-gas basins. 3. Learn Technical writing. 4. Examine case examples of past unethical corporate or private behaviors and how these were eventually resolved or remain a concern (e.g., monopoly building and later bread-up of Standard Oil; Ecuador pollution cases;; CIA involvement with Iranian government overthrow in 1950s to restore oil company monopoly; corruption in African and other ""oil-cursed"" nations; atmospheric pollution of cities; major oil spills; etc.). 5. Learn exactly how a hydrogen-fuel car would function, including engineering costs; or exactly how ozone is produced in car-dominated cities in the summer. This multidisciplinary course also includes aspect of social change, role of oil-gas in national politics, climate effects, and the petrochemical industry products. 6. Understand petroleum basins and the importance of hydrocarbons in history/society/climate is essential. This OIL! Course is unique in placing the geological aspects into the broader context of social, international and environmental concerns. Credits: 3.00

EAPS 30900 - Computer-Aided Analysis For Geosciences

Credit Hours: 3.00. Application of computer analysis techniques including error analysis, line and surface fitting, spatial and temporal correlations, contouring, interpolation, and map projections. These methods are discussed in terms of specific geologic applications. All exercises and examples are developed using commercial mathematical software package. A three-hour-per-week computer laboratory tutorial provides hands-on experience with the techniques discussed in class. Prior course work in computer programming is required.

Learning Outcomes: 1. Carry out computational solutions to a given range of data analysis problems. 2. Select the appropriate analysis and visualization approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 31000 - Introductory Statistics For Geosciences

Credit Hours: 3.00. Introductory course in statistics and quantitative reasoning for students in geosciences. Topics covered include probability distributions of discrete and continuous random variables, simulation, confidence intervals and hypothesis tests for one and two samples, inference for regression and correlation.

Learning Outcomes: 1. Understand basic concepts of probability and statistics, and gain a solid basis for practical application of statistical methods in geosciences. 2. Obtain hands-on experience in resampling methods to handle data without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. 3. Use statistical software to analyze data and interpret results.

Credits: 3.00

EAPS 31201 - Earth Systems Science For Elementary Teachers (UCC: SCI)

Credit Hours: 3.00. An Earth Systems Science perspective draws upon the wealth of Earth systems science research in both content and pedagogy. This approach has served as a guiding framework for how students learn, engage in, and develop deep understandings of the interconnections among Earth's many different systems of geosphere, hydrosphere, atmosphere, and biosphere and the important role that human civilization plays in affecting Earth's other systems. This course takes an Earth Systems Science approach - an emerging transdisciplinary endeavor - to build students' understanding of the structure and functioning of the Earth as a complex, adaptive system.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. View the Earth as a component of an interconnected system. 2. Investigate the accretion of the solar system and Earth and their respective histories. 3. Scale and model the solar system. 4. Model tectonic plates and different plate boundaries. 5. Analyze atmospheric conditions and make short-term weather predictions. 6. Recognize and evaluate Earth's resources. 7. Create a plan to address multiple interrelated challenges. 8. Evaluate the natural environment for anthropomorphic affects. 9. Develop critical thinking and problem-solving skills. 10. Apply guided-inquiry methods to learning. Credits: 3.00

EAPS 31500 - Biogeochemistry

Credit Hours: 3.00. The course examines the main element cycles of Earth: carbon, oxygen/hydrogen, nitrogen, sulfur, phosphorous, and trace metals, and how they are interconnected from terrestrial, aquatic/ocean, and atmospheric perspectives. General chemistry concepts such as equilibrium, free energy, electrochemistry are used to understand the energetics of the cycles. Connection between the cycles and environmental problems, such as climate change and air pollution will be emphasized.

Learning Outcomes: 1. Construct a mental model of the Earth system and the flow of elements among different parts of the system. 2. Examine modern problems caused by human perturbation of the main biogeochemical cycles. 3. Perform basic research tasks and present scientific findings. Credits: 3.00

EAPS 31900 - Exploring Earth Through Time

Credit Hours: 3.00. The course will explore the history of the Earth from its beginning 4.5 billion years ago to the present. Our understanding and insight into the history of the Earth has greatly expanded during the last several decades. Emphasis will be placed on the relationships of tectonic processes that shaped the surface of the Earth and the evolution of the Earth's biosphere. The course will also examine how the role of evolution of life has played in the history of the atmosphere and oceans.

Credits: 3.00

EAPS 32500 - Aviation Meteorology

Credit Hours: 3.00. This course is designed for students who have an interest in topics in meteorology applied to aviation operations with emphasis on meteorological hazards for instrument flight. Topics covered include obtaining and evaluating weather data, review of synoptic meteorology, map analysis, the ICAO standard atmosphere, pressure and altimetry, atmospheric thermodynamics, moisture and stability, low-IFR operations, aircraft icing, turbulence, thunderstorms and associated hazards, and interpretation and use of radar and satellite imagery. Prior course work in introductory atmospheric science and pre-calculus is required.

Credits: 3.00

EAPS 32700 - Climate, Science And Society

Credit Hours: 3.00. This course will examine the broad problems of climate change by examining the relationship between science, politics, and society by using climate change as a lens through which to examine larger issues. Students will be encouraged to identify similar themes in their own experiences as emerging scientists, engineers and global leaders. Adequate preparation to write essays and perform basic arithmetic calculations needed. Prior knowledge of climate change science is not necessary.

Learning Outcomes: 1. Able to think logically and creatively. 2. Able to apply knowledge to practical situations. 3. Able to respond flexibly as situation changes. 4. Understand ethical issues, particularly in Science. 5. Appreciate diverse experiences, thoughts, backgrounds. 6. Understand and appreciate Science in the world

environment. Credits: 3.00

EAPS 34400 - Igneous And Metamorphic Petrology

Credit Hours: 4.00. This course provides an overview of igneous and metamorphic petrology including, but not limited to, the following topics: experimental petrology and phase diagrams, melting of the Earth's interior, understanding the relationship between mineralogy, chemical composition, and physical conditions, relating magmatism and metamorphism to different tectonic environments, and exploring the similarities, and differences, between magmatism on Earth and other planetary bodies. The lectures and labs emphasize developing a basic understanding of petrology and petrologic processes, rather than the simple memorization of terms, definition, and facts.

Learning Outcomes: 1. Understand how petrologists determine the origin of common igneous and metamorphic rocks and the data that supports current interpretations. 2. Describe the types of igneous and metamorphic rocks that would be found in different tectonic settings. 3. Interpret and understand phase diagrams and how they are constructed. 4. Link mineralogy to chemical compositions and understand how compositions can change during melting, fractional crystallization, or open-system metamorphism. 5. Understand how metamorphic rocks can be utilized to quantitatively constrain the physical conditions that a rock experienced. 6. Gain confidence in understanding and using scientific methods and information to interpret igneous and metamorphic rocks. Credits: 4.00

EAPS 35200 - Structural Geology

Credit Hours: 3.00. This course deals with the nature and evolution of structures in rock deformed naturally by flow and fracture, as deduced from experimental, theoretical and field studies. Specific topics include: structures in three dimensions using descriptive geometry and stereonets, field measurements of rock geometry, tensors, strain and stress, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop, the structure and mechanics of mountain belts. Students will be expected to show competency with using a general set skills, techniques, and tools commonly used by professional geoscientists.

Learning Outcomes: 1. Interpret geologic structures in three dimensions using descriptive geometry, stereonets, and field measurements of rock geometry. 2. Evaluate quantitatively observations of the deformation in the crust using basic stress and strain theory, the theory of brittle and plastic rock behavior, theory and field observation of folds and faults, structural analysis of an outcrop. 3. Recognize the structures and give a mechanical explanation for the development of mountain belts. 4. Apply these skills in the field. Credits: 3.00

EAPS 35300 - Earth And Planetary Surface Processes

Credit Hours: 3.00. Introduction to a variety of topics in sediment transport and deposition, emphasizing linkages between active processes, landscape evolution, and the rock record. Comparisons will be made between surface processes occurring on Earth and other planetary bodies in the Solar System. Topics include: introductory fluid mechanics; sediment transport by water, ice, and wind, and the development of fluvial bed forms, glacial landscapes, and sand dunes; groundwater geochemistry and the development of karst and caves; impact cratering; comparative planetology. Each major topic is accompanied by field projects that emphasize local geologic history.

Learning Outcomes: 1. Apply fluid dynamics to sediment transport and rock dissolution using physics, chemistry, and calculus. 2. Use dimensionless variables (e.g., Reynolds number, Froude number, Shields number, Drag coefficient) to solve problems in diverse fluid flows (e.g., water, ice, wind, soil, and debris flows). 3. Identify and quantify processes responsible for shaping Indiana's landscape, including mega flooding, glaciation, wind, and karst. 4. Interpret landscape form in terms of geologic processes occurring in the Solar System. 5. Identify sedimentary structures and relate them to active surface processes. 6. Observe and measure active processes in the field. 7. Organize and write a formal scientific paper. Credits: 3.00

EAPS 35400 - Earth And Planetary Geophysics

Credit Hours: 3.00. This course will explore geophysical processes from the scales of individual stresses that deform rocks, to plate motions, to planetary-scale interiors and phenomena. Emphasis will be focused on sources of stress and how this stress is manifested, heat transfer, and fluid processes. Seismic waves, gravity data, planetary shape, and what information they provide about the interior of solid planets will be discussed. The course material will be applied to Earth, other rocky worlds like the Moon and Mars, and icy moons like Europa and Enceladus. This course is an introduction to geophysical processes and serves as a stepping-stone to upper level geophysics courses such as EAPS 35200, EAPS 45000, and EAPS 55700.

Learning Outcomes: 1. Describe the interior structures of Earth and other planets and large moons, and how we know them. 2. Describe how heat and fluids are transferred within the Earth and other planets and large moons. 3. Describe how interior processes in the Earth are ma09nifested in plate tectonics, and how they result in other tectonic regimes on other planets and large moons. 4. Apply quantitative skills to geophysical problems. 5. Critically evaluate a scientific study and orally communicate your evaluation. Credits: 3.00

EAPS 36000 - Great Issues In Climate Change And Society

Credit Hours: 3.00. This course develops basic skills and knowledge critical to analyze issues of energy use, climate change, and sustainability that incorporate both societal and scientific perspectives. The goal of this course is not to arrive at particular consensus solutions to the problems associated with these issues but instead to foster an informed (through information literacy) debate that will ultimately be waged as solutions are sought. Working in teams the students work throughout the semester to complete a capstone teamwork project and a group presentation. Counts for Great Issues course in College of Science.

Learning Outcomes: 1. Understand/interpret the complex issues related to energy (production and use) policy and climate change. 2. Recognize the basic ethical, technological, political, and economic issues influencing the production of renewable and fossil energy. 3. Identify, distinguish, and use credible/factual information sources to establish a defensible viewpoint on these issues. Credits: 3.00

EAPS 36400 - Natural Hazards: Science And Society

Credit Hours: 3.00. This course will investigate the role of data and science in policy and decision-making as it relates to natural hazard resiliency. The scientific fundamentals of specific hazards will be introduced along with an explanation of how available data, various policies, programs, and real-time decisions can impact a community's response and recovery from disasters. Guest speakers describe their role in specific disasters, and in framing the policies and decisions made in the aftermath of the natural hazards. This course counts as a Great Issues course in the College of Science for Juniors and Seniors.

Learning Outcomes: 1. Demonstrate the ability to write knowledgeably and persuasively about the issues examined. 2. Use statistics and data ethically in the discussion of great issues. 3. Work as an active and contributing member of a team. 4. Transmit accumulated knowledge in effective written and oral presentations. Credits: 3.00

EAPS 36700 - Survey Of Planetary Atmospheres

Credit Hours: 3.00. This course is intended to serve as an introduction to the diversity of planetary atmospheres in our solar system and beyond for those without an atmospheric science background. Topics to be covered in this class include: The basic structure and properties of an atmosphere, how planetary atmospheres form / are eroded, the balance of radiation and its effect on atmospheric motions, the presence and formation of hazes, clouds, and aerosols, fundamental atmospheric compositions and chemistry, the connections between planetary interiors, surfaces, and atmospheres, and how we measure and interpret observations of exoplanet atmospheres. To achieve this, we will learn about Earth's atmosphere and us our terrestrial template to compare, contrast, and explore the atmospheres of other astronomical bodies.

Learning Outcomes: 1. Gain familiarity with the different types of planetary bodies and the atmospheres that are present on them. 2. Recall the main properties of planetary atmospheres in our solar system. 3. Identify and apply the general properties of the

atmospheres. 4. Understand the effect of radiation and distribution of energy in an atmosphere. 5. Recognize the importance of chemical reactions and pathways. 6. Identify the ways in which atmospheres are formed, lost, and evolved. 7. Make simple predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. Credits: 3.00

EAPS 37500 - Great Issues - Fossil Fuels, Energy And Society

Credit Hours: 3.00. Prosperity of the 20th century was based on abundant and cheap energy; during the 21st century we will be faced with difficult challenges. Our society will face higher energy prices, decline of petroleum based fuels supplies, increased environmental effects of fossil fuels usage, and the challenge of solving the technological problems of developing alternative fuels. This course will review the structure, economics, and geopolitical issues faced by fossil fuel industries and the mitigation strategies that will be needed to change to low fossil fuel use society based on low polluting renewable energy sources. Counts for Great Issues course in College of Science for Juniors and Seniors.

Credits: 3.00

EAPS 38500 - Principles Of Engineering Geology

Credit Hours: 3.00. Application of geology to evaluation of design and construction problems relating to dams, highways, tunnels, and reservoirs; review of construction material sources and their utilization. A field investigation is required. Prior course work in mineralogy, petrology or geology for engineers is required.

Credits: 3.00

EAPS 39000 - Geologic Field Methods

Credit Hours: 3.00. Introduction to geologic mapping principles on quadrangle (7 1/2 min., 15 min., 1:250,000 scales) maps. Application of aerial photography, GPS, and GIS techniques. Emphasis on construction of cross sections, measurement of stratigraphic sections, and preparation of geologic reports. Several weekend field exercises will be required.

Credits: 3.00

EAPS 39100 - Topics In Earth And Atmospheric Sciences

Credit Hours: 1.00 to 4.00. Intermediate special topics in the earth and atmospheric sciences. Permission of instructor required.

Credits: 1.00 to 4.00

EAPS 39500 - Astrobiology

Credit Hours: 3.00. Course explores current ideas on how life originated on Earth and may have originated elsewhere in the universe. Lectures will cover zones of habitability in stellar systems, planetary surface and atmosphere evolution and the environment of the early Earth. Topics include how life on Earth functions and its earliest evolution, SETI, planetary quarantine, panspermia, mass extinctions and the potential for life elsewhere in our own solar system.

Learning Outcomes: 1. Know the outlines of how life developed on the Earth, the principal requirements for life to originate and persist, what features makes a planet (in our system or around other stars) habitable for life. 2. Understand how extrasolar planets are found and what limitations exist in our knowledge of those planets. 3. Understand how NASA is seeking for life on Mars and elsewhere in the solar system, why we are concerned about quarantining spacecraft and returned samples. 4. Acquainted with the rationale and methods of the SETI search for intelligent life in the universe. Credits: 3.00

EAPS 40000 - Planetary Sciences Senior Capstone

Credit Hours: 3.00. In this course, students will use the knowledge they have gained as part of their education at Purdue to develop a comprehensive science-driven planetary exploration strategy. First, students will review the history of planetary exploration. Next, students will understand the current landscape for planetary exploration including missions and instruments which will soon fly. Throughout the course, student-led research and presentation exercises will build to the development of a mission concept for planetary exploration.

Learning Outcomes: 1. Understand of the history of planetary exploration and the major science questions that influenced the designs of historical, ongoing, and proposed spacecraft missions. 2. Make effective and engaging scientific presentations and posters using the

Assertion-Evidence model. 3. Understand how the grant proposal writing and evaluation process works within the NASA ROSES grant proposal system, including knowing how to: 4. Write proposals for competitive grant programs, such as NASA ROSES. 5. Evaluate grant proposals to determine their scientific merit. 6. Participate in a proposal peer review panel discussion. 7. Learn to write proposal evaluation peer review reports in a style consistent with NASA ROSES proposal peer review panel guidelines. 8. Become an effective team member in a science-driven spacecraft mission proposal design study. Credits: 3.00

EAPS 40700 - Earth And Planetary System Science

Credit Hours: 3.00. This class will explore the major components of the Earth System-the atmosphere, the hydrosphere (ocean + cryosphere), the biosphere, and the solid Earth-and their interactions, both today and through time. Topics include (1) the evolution of earth's climate system, from global glaciation to ice-free states in the past to future anthropogenic climate change scenarios; (2) how the circulation of the atmosphere, ocean, and solid earth shape the distribution of chemicals and life through time; (3) how life has transformed Earth's surface environments; and (4) the interplay between atmospheres, oceans, geology, and life on other worlds.

Learning Outcomes: 1. Describe the components of the Earth System and their interactions. 2. Discuss how the Earth system has evolved from its formation to present-day. 3. Understand the role of humans in the Earth System and scenarios for future Earth System evolution. 4. Consider how other planetary systems may resemble or differ from the Earth System. Credits: 3.00

EAPS 41900 - Internship In Environmental Geosciences

Credit Hours: 1.00 to 6.00. This course provides students with an opportunity to gain practical work experience in environmental geoscience. The student works with a faculty advisor to set up an internship consisting of the equivalent of at least six weeks of full-time employment with a government agency, business, or consulting company. Internships typically involve field, laboratory, and office work. A portion of the internship may be part-time work during a regular semester, but at least three consecutive weeks must be full-time work. One credit hour per week of unpaid internship. Six week internship. Prior course work in upper level EAPS courses is required. Permission of department required.

Credits: 1.00 to 6.00

EAPS 42000 - Global Change Modeling

Credit Hours: 3.00. Understanding, monitoring, and modeling global environmental change. Each session examines the response of the interrelated earth systems to different geological, ecological, atmospheric, oceanic, or societal impacts. Topics include global warming, major biogeochemical cycles, atmospheric ozone, coevolution of life and climate, asteroid impacts, and ecological disruptions. The laboratory uses object-oriented modeling software and current NASA satellite data. No prior knowledge of computer programming is required.

Credits: 3.00

EAPS 42100 - Atmospheric Thermodynamics

Credit Hours: 3.00. (AGRY 43100) Structure and composition of the atmosphere. Thermodynamics of dry and moist air, including adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in introductory atmospheric science, second semester physics or thermodynamics is required.

Credits: 3.00

EAPS 42200 - Atmospheric Dynamics I

Credit Hours: 3.00. (AGRY 43200) A study of the general system of equations governing mass and momentum changes in the atmosphere; special horizontal wind representations, thermal wind relationships; circulation, vorticity, divergence, and vertical motion. Prior course work in atmospheric thermodynamics and differential equations is required.

Credits: 3.00

EAPS 42300 - Atmospheric Dynamics II

Credit Hours: 3.00. (AGRY 43300) An extension of EAPS 42200, with emphasis on perturbation theory and hydrodynamics stability, air mass and frontal theory, barotropic and baroclinic models, wave cyclone theory, and numerical weather prediction.

Credits: 3.00

EAPS 42501 - Physics Of Climate

Credit Hours: 3.00. To understand climate we describe and synthesize physical processes in the atmosphere and their coupling to the ocean, ice, and land. We quantitatively explore climatology with an equal balance of physical principles and scrutiny of available modern data. Topics include: visualization of atmospheric/land surface/oceanographic climatological data sets; theories of climate dynamics; and climate change. Beginning with radiative balance and simple energy balance models, the course progresses toward understanding the effects of radiative-convective forcing and rotation on the fluid envelopes. Analysis of data in an interactive computer-enabled environment is an important part of the course. By the end of this course, the student should know how the Earth System behaves at large scales and grasp the physical understandings of why.

Learning Outcomes: 1. Quantitatively describe climatology, climate variability, and climate change through physical principles and modern climate data. 2. Use radiative equilibrium, radiative-convective equilibrium, and energy balance models to make predictions of climate change and compare with observations. 3. Describe and synthesize atmosphere and ocean dynamics, large-scale circulation patterns, and interactions with ice and land surfaces. 4. Analyze major contemporary atmospheric science problems and phenomena, such as global warming, ozone hole, El Nino, etc., and the information provided by past climates on Earth. Credits: 3.00

EAPS 43100 - Synoptic Laboratory I

Credit Hours: 1.00. (AGRY 44100) Analysis of vertical distributions of temperature and moisture with applications to adiabatic and pseudo-adiabatic processes, hydrostatic stability, and air mass determination. Prior course work in atmospheric thermodynamics is required.

Credits: 1.00

EAPS 43200 - Synoptic Laboratory II

Credit Hours: 1.00. Analysis of horizontal distributions of pressure, temperature, wind, vorticity, and vertical motions. Applications to synoptic-scale wave propagation. Prior course work in atmospheric thermodynamics and synoptic lab I is required.

Credits: 1.00

EAPS 43300 - Synoptic Lab III

Credit Hours: 1.00. (AGRY 44300) Diagnoses of midtropospheric wave propagation and growth. Analysis of surface pressure fields and fronts and their relationships to upper air features. Extensive use is made of teletype and facsimile weather information. Prior course work in atmospheric dynamics and synoptic lab II is required.

Credits: 1.00

EAPS 43400 - Weather Analysis And Forecasting

Credit Hours: 3.00. (AGRY 44400) In-depth study of contemporary weather analysis and forecasting techniques and problems. Extensive use is made of teletype and facsimile data and numerical weather prediction guidance provided by the National Meteorological Center.

Credits: 3.00

EAPS 43500 - Severe Storms Field Work

Credit Hours: 3.00. This four-week summer course will focus on prediction, instrumented field observations, and case study analysis of severe storms. Students will receive instruction in severe storm forecasting, real-time radar interpretation, safe observation of severe storms, teamwork, and careers in research meteorology. During a field trip, students will deploy meteorological instrumentation in support of the instructors' research efforts. Students are required to deliver weather briefings and evaluate their forecasts. Permission of instructor required.

Learning Outcomes: 1. Lead the group (in pairs) in a complete day of atmospheric science field program activities. 2. Evaluate the quality of your severe weather forecast. 3. Expand your knowledge of paths and skills necessary for a successful career in meteorology. Credits: 3.00

EAPS 44500 - Spacecraft Design

Credit Hours: 3.00. Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the planetary sciences curriculum. Components include analysis methods for preliminary design, development of an initial spacecraft and mission concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams.

Learning Outcomes: 1. Understand and implement the design process for aerospace

systems. 2. Solve problems as part of a team. 3. Conduct open-ended, iterative tasks associated with science operation, science objectives, and mission design and system integration. 4. Properly integrate a variety of systems and sub-systems within a spacecraft, rocket and mission to demonstrate design feasibility. 5. Learn how to generate a Science Traceability Matrix. 6. Prioritize design requirements and organize work schedules. 7. Use formal, structured design methods to develop superior products that meet or surpass customer expectations. 8. Give oral presentations and write technical reports required of design engineers. Credits: 3.00

EAPS 44600 - Geochemistry

Credit Hours: 3.00. This course provides an overview of the processes controlling the distribution of elements within the solid Earth as well as the hydrosphere and atmosphere.

Learning Outcomes: 1. Describe the distribution of elements in our Solar System and throughout the Earth. 2. Explain the distribution of elements as a function of their physical properties and chemical affinities. 3. Use principles of thermodynamics to explain why particular reactions or phase assemblages are expected at different equilibrium conditions. 4. Develop simple models to explain the exchange of elements between different Earth reservoirs and the chemical evolution of these reservoirs through time. 5. Describe applications of geochemistry to big picture research questions in Earth, atmospheric, and planetary science. Credits: 3.00

EAPS 45000 - Physics And Chemistry Of Solid Earth

Credit Hours: 4.00. Physics of the earth's interior, including seismic velocity and density structure, seismic wave propagation, and gravitational and magnetic fields. Thermal history of the earth. Chemical and mineralogical composition of the earth, radioactivity, isotopes, and geochronology. Magma generation, crustal evolution, and tectonic models. Prior course work in chemistry, physics, calculus, earth materials, and plate tectonics is required.

Credits: 4.00

EAPS 47400 - Sedimentary Geology

Credit Hours: 4.00. Systematic study of continental and marine depositional environments. Interpretation of sedimentary facies, structures, and microfacies. Principles and applications of stratigraphy, including applications of paleontology, field relations, paleomagnetism, well logs, seismic reflections, and chemistry. Field investigations may be required. Prior course work in earth materials, mineralogy and petrology is required.

Learning Outcomes: 1. Understand core areas of sedimentary geology, and interpret a wide range of earth processes on different temporal and spatial scales. 2. Develop proficiency interpreting depositional processes and environments of ancient sedimentary strata through bedrock exposures, well logs, and drill cores. 3. Demonstrate skills of interpretive analysis and critical thinking with respect to geological problems involving temporal and spatial relationships. 4. Develop writing abilities through scientific reports that will be written individually, revised based on instructor and peer feedback, and subsequently integrated into a comprehensive basin analysis report. 5. Demonstrate competence in collecting scientific data, including field observations and field and analytical measurements. Specifically, demonstrate competency in collecting the following field datasets from outcrops: paleocurrent indicators, lithofacies associations, stratigraphic sections, and facies architectures. 6. Conduct effective independent and collaborative investigations. Specifically, develop your ability to work both independently and collaboratively during acquisition, analysis, and dissemination of scientific datasets as part of basin analysis project. Credits: 4.00

EAPS 47500 - Geology And Geophysics Field Camp - Wasatch-Uinta Field Camp

Credit Hours: 6.00. The Wasatch-Uinta Field Camp is a six-week capstone course designed to prepare students for successful careers in the geosciences. This course emphasizes scientific methodology and traditional techniques that provide a strong foundation for the broad range of modern technologies used by today's industry, academic, government and private workforces. Students learn to develop research strategies, collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, and construct geologic maps and cross sections. Field exercises are located in geologically ideal locations in the Wasatch and Uinta mountains of Utah, the San Rafael Swell of southeastern Utah, Grand Teton National Park in Wyoming, and the Carlin-type gold deposits of Nevada. The Wasatch-Uinta Field Camp was established in 1967 by the University of Minnesota. The camp is operated by a consortium that currently includes Purdue University, the University of Minnesota-Duluth, University of Wisconsin-Madison, the University of Nebraska, and the University of Illinois.

Learning Outcomes: 1. Learn how to make systematic geological observations and also collect relevant data using a Brunton compass. This includes the ability to identify rock types and minerals and primary and secondary geological structures and require skills and information learned in mineralogy, petrology (igneous, metamorphic, and sedimentary), structural geology, and stratigraphy. 2. Collect field observations and measurements, compile detailed rock descriptions, measure stratigraphic sections, which will be used to construct geologic maps and cross sections. 3. Navigate in the field using topographic maps, and compasses. Proficiency in field navigation is crucial for locating and completing field studies. 4. Develop skills in interpreting geological history, including the sequence of events and the geological evolution of an area based on field observations. 5. Deal with incomplete or ambiguous data and will be required to formulate hypotheses, make educated inferences, and solve geological problems based on limited information. 6. Enhance their ability to work effectively in a team, collaborating with peers on field projects, and communicating geological findings through clear and concise field notes, maps, and reports. 7. Learn to conduct geological fieldwork safely is paramount. Students should be able to identify potential hazards in the field, adhere to ethical and legal guidelines for collecting samples, and understand the importance of preserving natural landscapes. Learn best practices for safely conducting a field study. Credits: 6.00

EAPS 47700 - Earth And Planetary GIS

Credit Hours: 3.00. In this course, students will learn to display and analyze Earth and planetary data using geographic information systems (GIS). Students will learn how to find and work with data from various sources, including satellites and spacecraft missions. Using a variety of spatial data, students will make maps and visualizations of data, perform analyses using a range of toolboxes, and implement workflows in geoprocessing.

Learning Outcomes: 1. Communicate applications of GIS in the real world. 2. Locate geospatially relevant datasets in online repositories. 3. Organize and manage files (and their appropriate formats) used within GIS software. 4. Identify limitations and gaps in remote sensing datasets. 5. Design and implement a workflow to analyze remote sensing data. 6. Create maps and figures that visualize products within a geospatial analysis workflow. 7. Describe a goal (i.e., hypothesis being tested) that geospatial analysis can address, as well as the data inputs, steps in the workflow, and outcome (i.e., results) of the analysis in the form of a webpost that can be shared with employers and other GIS users. Credits: 3.00

EAPS 49000 - Field Geology In Rocky Mountains

Credit Hours: 6.00. Field studies in sedimentary, igneous, and metamorphic terrains. Studies may involve geologic mapping, stratigraphic section measuring, structural analysis and

interpretation, geomorphic interpretation, and interpretation of geologic history. Field excursions include visits to several classical geologic localities in the Colorado Plateau, Great Basin, and Rocky Mountains with discussions and interpretations of features observed. Transportation fee plus room and board at field station required. Rigorous field work requires physical conditioning. Six-week session, including field excursion. Prior course work in earth materials, surface processes, and plate tectonics is required. Permission of instructor required.

Learning Outcomes: 1. Maintain a professional notebook where observations are recorded as primary data such as rock descriptions and sketches. 2. Write well-structured, professional unit descriptions from provided rock description data sheets, or from virtual images, virtual microscope. 3. Plan an efficient field check for a mapping area, address areas of uncertainty and plan pathways through field. 4. Record and organize observations into interpretations through geologic sketches from outcrop-to field-area-scale. 5. Use unit descriptions to interpret geologic history. 6. Extrapolate from discrete observations to fully mapped terrains, using geologic principles to guide decision making. 7. Interpret and project geologic data mapped on the surface into the subsurface through cross-sectional development.
8. Synthesize notes and sketches, mapped geologic data and cross-cutting relationships to determine relative chronology and geologic history. 9. Synthesize observations and interpretations in notes, maps, and cross-sections into a written geologic report. 10. Work more effectively in a team. Credits: 6.00

EAPS 49700 - Earth And Atmospheric Sciences Undergraduate Readings And Research

Credit Hours: 1.00 to 6.00. Supervised reading and/or research in various fields. Permission of instructor required.

Credits: 1.00 to 6.00

Department of Mathematics

Overview

The Department of Mathematics is one of seven departments making up Purdue's College of Science. The Department has an international reputation as an outstanding center for mathematics.
The Department offers Bachelor of Science and Doctor of Philosophy degrees. Bachelor of Science programs include Actuarial Science, Applied Mathematics, Core Mathematics, Data Science, Honors Mathematics, Mathematics and Computer Science, Mathematics for Business, Mathematics Education, and Mathematics and Statistics.
The Department's 70 professors are actively involved in current developments in many major areas of mathematics. Faculty research interests can be found in the Faculty Research Areas list in our Faculty directory.
Please explore our website or contact us directly (see below) for more information about our undergraduate or graduate programs, faculty, research, job opportunities or information on how to support us. The annual department newsletter, PUrview, is a good place to read about Departmental news.

Department of Mathematics

Faculty

Contact Information

The Department's Main Office (Room 835 of the MATH building) is open from 8am to 5pm on all weekdays, except University holidays. The main office is closed from 12 to 1 p.m. in the summer. A phone number for the department is (765) 494-1901. The full address is:
Department of Mathematics
Purdue University
150 North University Street
West Lafayette, Indiana 47907-2067

Undergraduate Programs

Undergraduate Mathematics Information

Admissions Information (Includes application forms and online application)

Graduate Information

For Graduate Information please see Mathematics Graduate Program Information .

Mathematics/Statistics, BS

Mathematics/Computer Science, BS

Mathematics Honors, BS

Mathematics Education, BS

Mathematics, BS

Mathematics/Business, BS

Applied Mathematics, BS

Actuarial Science, BS

Actuarial Science Honors, BS

Mathematics Minor

The Mathematics Minor provides a strong background in mathematics for students majoring in some other discipline.

Data Science, BS (Mathematics)

Data Science First Year (Math)

MA 10800 - Mathematics As A Profession And A Discipline

Credit Hours: 1.00. A seminar course for undergraduate students interested in majoring in an area of mathematics at Purdue. The purpose is to build prospective mathematics majors' awareness of opportunities to enhance their experiences at Purdue and of career paths available for graduates with a good mathematical background. The format of most classes is a presentation and discussion with an invited speaker/guest, including experts on a different aspect of mathematics in our world today. This course is recommended for undergraduates in their first or second year at Purdue.

Credits: 1.00

MA 11100 - Algebra

Credit Hours: 3.00. This is an algebra review course for students not prepared for MA 15200, 15300, or 15900. Topics covered: real numbers, linear functions, solving linear equations and systems of linear equations, absolute value equations and inequalities, rational expressions, complex numbers, proportions, solving quadratic equations.

Learning Outcomes: 1. Use qualitative graphs to describe situations. 2. Graph linear equations. 3. Find the slope of a line. 4. Interpret the meaning of slope for equations, graphs, and tables. 5. Find and use linear equations. 6. Identify linear functions. 7. Use function notation to make predictions. 8. Interpret and apply slope as a rate of change. 9. Use graphs, tables, substitution, and elimination to solve systems. 10. Use linear inequalities in one variable to make predictions. 11. Apply properties of exponents. 12. Simplify expressions that have rational exponents. 13. Add, subtract and multiply polynomial expressions and functions. 14. Factor trinomials of the form x2 + bx + c; factor out the GCF. 15. Factor polynomials and special binomials. 16. Use factoring to solve polynomial equations. 17. Solve quadratic equations by using the square root property and by completing the square. 18. Find the domains of rational functions and simplify rational expressions. 19. Add, subtract, multiply, and divide rational expressions. 20. Solve rational equations. 21. Simplify radical expressions. 22. Add, subtract, and multiply radical expressions. 23. Solve radical equations.

Credits: 3.00

MA 13700 - Mathematics For Elementary Teachers I

Credit Hours: 3.00. Designed for prospective elementary school teachers. Problem solving. Numerical reasoning including self-generated and conventional algorithms. Whole and fractional number systems, elementary number theory. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. To model and perform arithmetic operations in bases other than base ten. 2. To convert numbers to scientific notation and perform arithmetic operations in scientific notation. 3. To perform operations with signed numbers. 4. To use properties of addition and multiplication to facilitate arithmetic. 5. To determine when two fractions are equivalent, decimals and percents. 6. To use divisibility rules to determine greatest common factors to decide whether numbers are prime. Credits: 3.00

MA 13800 - Mathematics For Elementary Teachers II (UCC: QR)

Credit Hours: 3.00. Elementary school teachers must understand how multiplication gives rise to exponents and how to represent, interpret, and compute exponents from problem situations. They must also understand how to represent practical situations using algebraic and fractional expressions, and verbally interpret graphs of functions. They have to know basic concepts of probability theory. This course covers conceptual and practical notions of exponents and radicals; algebraic and rational functions, algebraic equations and inequalities, systems of linear equations, polynomial, exponential, and logarithmic functions. Notions of probability.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To conceptually understand and correctly perform algebraic operations, solve algebraic equations of degree two, perform operations with exponents and radicals, sketch graphs of certain polynomial, exponential and logarithmic functions. 2. To understand inequalities involving linear functions. 3. To solve 2x2 systems of equation. 4. To understand basic notions of probability, including combinations, permutations, probability of one and/or another event and conditional probability. Credits: 3.00

MA 13900 - Mathematics For Elementary Teachers III

Credit Hours: 3.00. Geometric, measurement and spatial reasoning in one, two and three dimensions as the basis for elementary school geometry. Metric and non-metric geometry, transformation geometry. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Differentiate between various polygons based on number of sides and measures of angles. 2. Find the sum of the measures of the interior angles of a polygon. 3. Draw nets for polyhedra. 4. Differentiate between various types of polyhedra including all regular polyhedra. 5. Determine number of lines of symmetry for a plane figure and orders of rotational symmetry. 6. Determine number of planes of symmetry for a solid figure as well as axes of rotational symmetry. 7. Recognize and draw shapes that tessellate the plane and solid figures that tessellate space. 8. Determine dimensions of similar planar figures. 9. Determine surface area and volume of similar solid figures. 10. Construct perpendicular bisectors and parallel lines using a compass and straightedge. 11. Recognize and draw rigid motions of shapes including translations, reflections and rotations. 12. Determine area of plane figures and surface area and volume of solid figures. 13. Use the Pythagorean Theorem to determine diagonals of solid figures. Credits: 3.00

MA 15300 - College Algebra (UCC: QR)

Credit Hours: 3.00. Exponents and radicals; algebraic and fractional expressions. Equations and inequalities, systems of linear equations. Polynomial, exponential, and logarithmic functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the School of Science. CTL:IMA 1601 College Algebra

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Correctly perform algebraic operations, to solve algebraic equations of degree two, to perform operations with exponents and radicals. 2. Sketch graphs of certain polynomial, exponential and logarithmic functions. 3. Solve systems of equations and inequalities. Credits: 3.00

MA 15400 - Trigonometry (UCC: QR)

Credit Hours: 3.00. While MA 15400 is a continuation of MA 15300, the course MA 15300 is not a prerequisite. It is suggested that students have a C- or better in MA 15300 or a B- or better in MA 15200. Topics covered include the trigonometric functions, analytic geometry, laws of sines and cosines, vectors, dot product, conic sections, and rational functions. Not open to students with credit in MA 15900. Not available for credit toward graduation in the College of Science.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand and be able to use trigonometric functions, inverse trigonometric functions, analytic geometry, laws of sines and cosines, vectors and the dot product to solve application problems. 2. Learn about conic sections (ellipses, hyperbolas and parabolas) and rational functions. Credits: 3.00

MA 15555 - Quantitative Reasoning (UCC: QR)

Credit Hours: 3.00. This course will cover important mathematical ideas, including proportion, weighted averages, linear models, exponential models, basic probability and statistics, and some algebra, by using concrete real-world problems. It will not be a prerequisite for any other mathematics course.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Learn proportion and how to apply it to unit conversions, percentage, sales tax and discounts, and inflation. 2. Learn weighted averages and how they apply to the consumer price index and other examples. 3. Learn paradoxes involving weighted averages. 4. Learn linear models and how they apply to electricity bills, income taxes, and climate change. 5. Learn exponential growth and how it applies to compound interest and other financial issues. 6. Learn basic probability theory and how it applies to insurance and games of chance. 7. Learn how algebra is related to the other things learned. Credits: 3.00

MA 15800 - Precalculus - Functions And Trigonometry (UCC: QR)

Credit Hours: 3.00. Functions, Trigonometry, and Algebra of calculus topics designed to fully prepare students for all first semester calculus courses. Functions topics include Quadratic, Higher Order Polynomials, Rational, Exponential, Logarithmic, and Trigonometric. Other focuses include graphing of functions and solving application problems. Not Available for credit toward graduation in the College of Science. Students may not receive credit for both MA 15400(Inactive) and MA 15800. Students may not receive credit for both MA 15900 and MA 15800.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. An understanding of the concept of a function. 2. An ability to graph and interpret the graphs of a wide variety of functions. 3. An ability to develop mathematical models and solve a variety of application problems, using various types of equations, systems of equations, and functions. 4. An understanding the concept of an inverse function and how to apply that in particular with exponential, logarithmic and trigonometric functions. 5. An understanding of graphical transformations of functions. 6. An understanding of Polar Equations and the ability to graph Polar Equations. Credits: 3.00

MA 15900 - Precalculus

Credit Hours: 5.00. Algebra and trigonometry topics designed to prepare students for calculus. (Not available for credit toward graduation in the College of Science.)

Learning Outcomes: 1. Understand the basic properties of linear functions, including their graphs and applications. 2. Model physical and economic situations using exponential functions and solve problems related to the model. 3. Have a computational facility and conceptual understanding of functions, including compositions of functions, inverse functions,

and graphs of functions. 4 Use logarithms to solve exponential equations and to solve problems using exponential models. 5. Understand the basic properties of polynomial functions, including their graphs and applications, with a special emphasis on quadratic functions. 6. Understand the unit circle definition of sine and cosine and be able to generate formulas for general sinusoidal functions. 7. Solve trigonometric equations and applied problems using inverse trigonometric functions. 8. Understand the ways in which a trigonometric expression can be represented and have the facility converting between these representations. 9. Determine geometric and algebraic properties of conic sections. Credits: 5.00

MA 15910 - Introduction To Calculus

Credit Hours: 3.00. A survey of differential and integral calculus. Applications to the agricultural, life, managerial, and social sciences. Not available for credit toward graduation in the School of Science.

Learning Outcomes: 1. To create functional models. 2. To create and simplify difference quotients. 3. To compute basic limits of functions and to apply limit laws. 4. To compute derivatives and to apply basic rules of differentiation. 5. To use derivatives in graphing and solving basic optimization problems. Credits: 3.00

MA 16010 - Applied Calculus I (UCC: QR)

Credit Hours: 3.00. Topics include trigonometric and exponential functions; limits and differentiation, rules of differentiation, maxima, minima and optimization; curve sketching, integration, anti-derivatives, fundamental theorem of calculus. Properties of definite integrals and numerical methods. Applications to life, managerial and social sciences. CTL:IMA 1604 Calculus - Short I

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. To create functional models and simplify difference quotients, compute limits of functions and apply limit laws. 2. To compute derivatives of elementary functions, including exponential, logarithmic and trigonometric functions, and apply rules of differentiation. 3. To sketch the graph of functions with the help of differentiation techniques, find maxima and minima of functions; optimization problems. 4. To computes integrals of some elementary functions and apply the Fundamental Theorem of Calculus. 5. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16019 - Applied Calculus I For Technology

Credit Hours: 4.00. This course develops topics from analytical geometry and introduces differentiation and integration.

Learning Outcomes: 1. Demonstrate ability to calculate derivatives of polynomial, power, and rational functions and their compositions. 2. Demonstrate ability to apply derivatives to solve technology-related problems. 3. Demonstrate ability to compute integrals of polynomials, power, and rational functions and their compositions. 4. Demonstrate ability to apply integrals to solve technology-related problems. Credits: 4.00

MA 16020 - Applied Calculus II (UCC: QR)

Credit Hours: 3.00. This course covers techniques and applications of integration; infinite series; differentiation and integration of functions of several variables; maxima and minima, optimization; differential equations and initial value problems. CTL:IMA 1605 Calculus - Short II

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Use techniques of integration to find areas between curves and compute volumes of solids of revolution. 2. Analyze the convergence of infinite series and power series, Taylor series expansions. 3. Compute derivatives of functions of several

variables and use them to find maxima and minima of functions. 4. Perform multiple iterated integration. 5. Use differential equations for modeling simple real-life situations. 6. Solve first order linear initial value problems and separable equations. 7. Topics to be covered at a level required to perform standard applications related to life sciences, management and technology. Credits: 3.00

MA 16100 - Plane Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 5.00. Introduction to differential and integral calculus of one variable, with applications. Some schools or departments may allow only 4 credit hours toward graduation for this course. Designed for students who have not had at least a one-semester calculus course in high school, with a grade of "A" or "B". Not open to students with credit in MA 16500 . Demonstrated competence in college algebra and trigonometry.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation techniques. 4. To find maxima and minima of functions; optimization problems 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions Credits: 5.00

MA 16200 - Plane Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 5.00. Continuation of MA 16100 . Vectors in two and three dimensions, techniques of integration, infinite series, conic sections, polar coordinates, surfaces in three dimensions. Some schools or departments may allow only 4 credit hours toward graduation for this course.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 5.00

MA 16290 - Data Science Labs: Calculus

Credit hours: 1.00. This course consists of weekly computer laboratories which apply concepts learned in Calculus I and II to data science problems. Main topics covered include function sampling and approximation, numerical differentiation, numerical integration, Jupyter notebooks, introductory Python programming, object oriented programming, and data acquisition with microcontrollers and sensors.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python 2. 4. Acquire basic object oriented programming skills. 5. Acquire and interpret sensor data. Credits: 1.00

MA 16500 - Analytic Geometry And Calculus I (UCC: QR)

Credit Hours: 4.00. Introduction to differential and integral calculus of one variable, with applications. Conic sections. Designed for students who have had at least a one-semester calculus course in high school, with a grade of "A" or "B", but are not qualified to enter MA 16200 or MA 16600 or the advanced placement courses MA 17300 or the honors calculus course MA 18100. Demonstrated competence in college algebra and trigonometry. CTL:IMA 1602 Calculus - Long I

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. To compute limits and to apply limit laws. 2. To apply rules of differentiation to compute derivatives of elementary functions. 3. To sketch graphs of functions with the aid of differentiation

techniques. 4. To find maxima and minima of functions; optimization problems. 5. To compute integrals of some elementary functions and to apply the Fundamental Theorem of Calculus to compute areas of certain planar regions. Credits: 4.00

MA 16600 - Analytic Geometry And Calculus II (UCC: QR)

Credit Hours: 4.00. Continuation of MA 16500 . Vectors in two and three dimensions. Techniques of integration, infinite series, polar coordinates, surfaces in three dimensions. Not open to students with credit in MA 16200 . CTL:IMA 1603 Calculus - Long II

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Apply techniques of integration (integration by parts, trigonometric substitution and partial fractions) to compute areas of planar regions, volumes of solids of revolution and areas of surfaces of revolution, work, moments and centers of mass of homogeneous laminas. 2. Apply tests of absolute convergence of series to find the interval of convergence of some power series. 3. Find the Taylor and Maclaurin series of some exponential, rational and trigonometric functions. 4. Use polar coordinates to make it possible to sketch the graphs of some curves. 5. Understand the definition of a Riemann sum, and should be able to apply elementary approximation methods of integration. Credits: 4.00

MA 17000 - Introduction To Actuarial Science

Credit Hours: 2.00. (STAT 17000) An introduction to actuarial science from the point of view of practicing actuaries from life insurance, casualty insurance and consulting; introduction to insurance and the mathematical theory of interest; application of spreadsheets to problems related to actuarial science.

Learning Outcomes: 1. Describe different expressions of interest rates. Calculate an equivalent rate given another rate. 2. Calculate the present value of a set of cash flows. 3. Apply basic probability principles. 4. Describe and apply different types of probabilities used by actuaries. 5. Calculate the expected present value of a set of cash flows. 6. Describe basic types of insurance and their characteristics. 7. Define and apply basic components of insurance. Examples: premium, claim, deductible, coverage, limit, coinsurance, insured, owner. 8. Describe the ratemaking process. Calculate the rate of a simple insurance product. 9. Describe the pricing process. Calculate the price of a simple insurance product. 10. Describe different accounting regimes and their purposes. 11. Define a policy reserve. Calculate a simple policy reserve. 12. Define a loss reserve. Calculate a simple loss reserve. 13. Demonstrate a basic level of knowledge by applying Excel to solve problems. Credits: 2.00

MA 18300 - Professional Practicum I

Credit Hours: 0.00. Professional Practicum. For Cooperative Education students only; must be accepted for the program by the cooperative program coordinator. Permission of department required.

Credits: 0.00

MA 19000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Learn about mathematical thinking and practice. Credits: 1.00 to 5.00

MA 25000 - Problem Solving In Probability

Credit Hours: 2.00. (STAT 25000) This course is designed to teach techniques for solving problems in probability theory which are relevant to the actuarial sciences. It is intended to help actuarial students prepare for the Society of Actuaries and Casualty Actuarial Society Exam P/1. Credit of Examination is not available for this course.

Credits: 2.00

MA 26100 - Multivariate Calculus (UCC: QR)

Credit Hours: 4.00. Planes, lines, and curves in three dimensions. Differential calculus of several variables; multiple integrals. Introduction to vector calculus. Not open to students with credit in MA 17400 or 27100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Know the equations for lines, planes and quadric surfaces in three dimensional space, and understand how these equations relate to the geometry. 2. Understand the relationship between vector functions and parametrized motion; know how to calculate velocity, acceleration, arc length and curvature. 3. Know the meaning of partial derivatives and how to calculate them. Know the multivariable chain rule. 4. Know the meaning of the gradient, how to calculate it, and how to apply it to directional derivatives and maximum and minimum values. 5. Understand the meaning of double and triple integrals; know how to compute them and how to apply them. 6. Understand the meaning of vector fields and line integrals. Know Green's theorem and be able to apply it. 7. Understand the meaning of surface integrals and know how to calculate them. Know Stokes' theorem and be able to apply it. Credits: 4.00

MA 26190 - Data Science Labs: Multivariate Calculus

Credit Hours: 1.00. This course consists of weekly computer laboratories which apply concepts learned in Multivariate Calculus (Calculus III) to data science problems. The students will also practice programming in Python and use sensors and microprocessors to acquire data. Topics covered include representation and perception of color, motion detection in videos, and construction of a planimeter based on Green's theorem.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python. 4. Acquire and interpret sensor data. Credits: 1.00

MA 26200 - Linear Algebra And Differential Equations (UCC: QR)

Credit Hours: 4.00. Linear algebra, elements of differential equations. Not open to students with credit in MA 26500 or 26600.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the properties of and standards methods of solving first-order differential equations and linear differential equations of second and higher orders. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 4.00

MA 26500 - Linear Algebra (UCC: QR)

Credit Hours: 3.00. Introduction to linear algebra. Systems of linear equations, matrix algebra, vector spaces, determinants, eigenvalues and eigenvectors, diagonalization of matrices, applications. Not open to students with credit in MA 26200, 27200, 35000 or 35100.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the basic properties of matrices. 2. Learn how to solve systems of linear equations. 3. Learn the basic properties of determinants. 4. Learn about linear independence, spanning sets and bases in the context of vector spaces. 5. Learn the theory of inner product spaces and how it applies to least-squares approximations. 6. Learn the theory of eigenvalues and eigenvectors and how it applies to systems of differential equations. Credits: 3.00

MA 26600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 3.00. First order equations, second and n'th order linear equations, series solutions, solution by Laplace transform, systems of linear equations. It is preferable but not required to take MA 26500 either first or concurrently. Not open to students with credit in MA 26200, 27200, 36000, 36100, or 36600.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Understand the properties of and able to solve first-order differential equations, linear differential equations of second and higher orders, and linear systems of differential equations. 2. Understand and able to apply basic numerical methods for solving initial value problems. 3. Understand the properties of Laplace transforms and able to apply to solving differential equations and initial value problems. 4. Apply differential equations to mechanical, physical, and biological models. Credits: 3.00

MA 27101 - Honors Multivariate Calculus (UCC: QR)

Credit Hours: 5.00. This course is the Honors version of MA 26100, Multivariate Calculus; it will also include a review of infinite series. The course is intended for first-year students who have credit for Calculus I and II. There will be a significant emphasis on conceptual explanation, but not on formal proof. Permission of department is required.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Know techniques of vector algebra and be able to apply these to the geometry of space; in particular they will be able to find equations for lines and planes in space. 2. Find equations for standard surfaces in space. 3. Use vector methods to analyze motion in space, and calculate arc length and curvature. 4. Acquire a conceptual and computational knowledge of infinite series; in particular they will be able to test for convergence, and to do calculations with power series. 5. Understand the meaning of partial derivatives in various situations, and will be able to calculate with them. 6. Know the multivariable chain rule and its meaning, and will be able to apply it to calculate derivatives in various situations. 7. Know the meaning of directional derivatives and how to calculate them. 8. Find tangent planes. 9. Find and classify extreme values and saddle points and use the method of Lagrange multipliers. 10. Know the meaning of multiple integrals and how to calculate them. 11. Know the meaning of line integrals and surface integrals and how to calculate them. 12. Know Green's theorem, Stokes' theorem, and the divergence theorem and their applications. Credits: 5.00

MA 27300 - Introduction To Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some of the fundamental concepts of financial mathematics and their application to business situations and basic risk management. Includes discussions of interest rates, discount rates, annuity valuation, bond valuation, cash flow valuation, spot rates, forward rates, Macaulay duration, modified duration, convexity, immunization, and asset-liability management. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Credits: 3.00

MA 27900 - Modern Mathematics In Science And Society

Credit Hours: 3.00. The course covers topics in combinatorics and probability applied to real life situations such as the paradoxa of democracy, weighted voting, fair division, apportionment, traveling salesmen, the mathematics of networks, Fibonacci numbers, golden ratio, growth patterns in nature, mathematics of money, symmetry, fractals, censuses and surveys, random sampling, sample spaces, permutations and uniform probability spaces.

Learning Outcomes: 1. The students will gain knowledge, overview, and understanding in several fundamental mathematical subdisciplines which fall into four basic categories: voting and apportionment; growth; management of networks; data analysis. 2. Students will assimilate these mathematical ideas while applying them to practical everyday

questions, and in turn gain an understanding how real-life programs give rise to development of mathematical theories. Credits: 3.00

MA 29000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

MA 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 30100 - An Introduction To Proof Through Real Analysis

Credit Hours: 3.00. An introduction to abstract reasoning in the context of real analysis. Topics may include axioms for the real numbers, mathematical induction, formal definition of limits, density, decimal representations, convergence of sequences and series, continuity, differentiability, the extreme value, mean value and intermediate value theorems, and cardinality. The emphasis, however, is more on the concept of proof than on any one given topic.

Credits: 3.00

MA 30300 - Differential Equations And Partial Differential Equations For Engineering And The Sciences

Credit Hours: 3.00. This is a methods course for juniors in any branch of engineering and science, designed to follow MA 26200 or MA 26600. Materials to be covered are: linear systems of ordinary differential equations, nonlinear systems, Fourier series, separation of variables for partial differential equations, and Sturm-Liouville theory.

Learning Outcomes: 1. Learn the theory of systems of first order linear differential equations and methods for solving them. 2. Learn qualitative theory of systems of nonlinear differential equations. 3. Learn the Laplace transform method for solving differential equations. 4. Learn about Fourier series and Sturm-Liouville theory and how to use them to solve separable partial differential equations. Credits: 3.00

MA 32500 - History Of Mathematics

Credit Hours: 3.00. The purpose of this course is to help students understand and appreciate the growth and development of mathematical ideas across various cultures. Students will study the achievements of people who have made significant contributions to the development of both ancient and modern mathematical concepts.

Learning Outcomes: 1. Gain an appreciation for mathematics as a central human pursuit, driven by both curiosity and practical applications. 2. Analyze the biographical details of key mathematical figures, understanding their contributions to the field. 3. Establish

connections between mathematics and diverse academic disciplines, contemporary events, and the interrelationships among different branches of mathematics. 4. Explore the historical and contemporary development of mathematics across societal, cultural, and geographic boundaries. 5. Understand the evolving significance of mathematics within various global cultures and societies. Credits: 3.00

MA 34100 - Foundations Of Analysis

Credit Hours: 3.00. An introductory course in rigorous analysis, covering real numbers, sequences, series, continuous functions, differentiation, and Riemann integration. MA 30100 is helpful but not required.

Credits: 3.00

MA 34900 - Signals And Systems For Mathematicians

Credit Hours: 3.00. This course introduces the mathematical framework for the description, analysis and processing of signals such as music, speech and images. Main topics covered include signal representations in different bases; continuous-time signal sampling; and signal processing by linear and time-invariant systems.

Learning Outcomes: 1. Describe and analyze continuous-time and discrete-time signals in different bases. 2. Understand the relation between a continuous-time signal and a sampling of that signal, including methods to reconstruct a continuous-time signal from its samples and applicability conditions. 3. Describe and analyze the properties of continuous-time and discrete time systems in different bases. 4. Construct linear and time-invariant systems to process continuous-time and discrete-time signals. Credits: 3.00

MA 34990 - Data Science Labs: Signals And Systems

Credit Hours: 1.00. This course consists in weekly computer laboratories. The laboratories introduce students to the application of concepts learned in Signals and Systems or Fourier Analysis course to Data Science problems. The courses also provide opportunities to practice programming in Python and use sensors and microprocessors to acquire and manipulate data.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python. 4. Acquire and interpret sensor data. Credits: 1.00

MA 35100 - Elementary Linear Algebra (UCC: QR)

Credit Hours: 3.00. Systems of linear equations, finite dimensional vector spaces, matrices, determinants, eigenvalues and eigenvector applications to analytical geometry. Not open to students with credit in MA 26500.

University Core Curriculum (UCC): (UCC: QR)

Learning Outcomes: 1. Solve systems of linear equations using concepts such as vector spaces, linear dependence, and Gaussian elimination. 2. Understand and test for linear independence, calculate the dimension of vector spaces, and apply the rank-nullity theorem in various contexts. 3. Define and apply linear transformations, including matrix multiplication, inverses, LU factorization, and coordinate transformations. 4. Compute and understand determinants, including their use in calculating matrix inverses and practical applications such as volume calculations. 5. Analyze and compute eigenvectors and eigenvalues, and apply diagonalization techniques. Credits: 3.00

MA 35301 - Linear Algebra II

Credit Hours: 3.00. Theoretical background for methods and results that appear in MA 35100. Inner products, orthogonality, and applications including least squares.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of vector space, subspace, linear combination of vectors, linear dependence and linear independence, bases and dimension. 2. Perform rigorous proofs using the definitions of linear transformation and the null space and range of a linear transformation.

3. Exhibit a clear understanding of the relationship between composition of linear transformation and matrix multiplication. 4. Understand elementary matrices and their use in describing the solution set of a system of linear equations. 5. Understand that the determinant function on n x n matrices with entries in a field F is a function that may be defined recursively, and may be uniquely defined as an alternating multilinear form which takes the identity matrix to 1. 6. Perform rigorous proofs involving eigenvalues and eigenvectors. 7. Understand and be able to apply conditions for a linear operator on a finite-dimensional vector space to be diagonalizable. 8. Preform calculations with Gram-Schmidt, least squares and related topics. 9. Students should be able to do rigorous proofs involving inner product spaces and related topics. Credits: 3.00

MA 36200 - Topics In Vector Calculus

Credit Hours: 3.00. Multivariate calculus; partial differentiation; implicit function theorems and transformations; line and surface integrals; vector fields; theorems of Gauss, Green, and Stokes. Credit granted for only one of MA 36200 and MA 51000 .

Credits: 3.00

MA 36600 - Ordinary Differential Equations (UCC: QR)

Credit Hours: 4.00. An introduction to ordinary differential equations with emphasis on problem solving and applications. The one-hour computer lab will give students an opportunity for hands-on experience with both the theory and applications of the subject.

University Core Curriculum (UCC): (UCC: QR) Learning Outcomes: 1. Learn the statement of the theorem of existence and uniqueness of solutions of first order differential equations and standard methods of solving linear, and some special non-linear, differential equations of first order. 2. Interpret solutions qualitatively. 3. Learn how to construct mathematical models. 4. Learn the standard methods of solving linear homogenous differential equations of constant coefficients of arbitrary order. 5. Learn methods to solve nonhomogeneous differential equations of constant coefficients of arbitrary order. 6. Learn basic numerical methods for solving differential equations. 7. Learn about the applications of differential equations to mechanical, physical, and biological models. 8. Learn the theory of eigenvalues and eigenvectors and how they apply to systems of linear differential equations. 9. Learn how to analyze systems of nonlinear differential equations (optional). 10. Learn Laplace transforms and their applications to differential equations (optional). Credits: 4.00

MA 37300 - Financial Mathematics

Credit Hours: 3.00. A mathematical treatment of some fundamental concepts of financial mathematics and their application to real world business situations and basic risk management. Includes discussions of valuing investments, capital budgeting, valuing contingent cash flows, yield curves, spot rates, forward rates, short sales, Macaulay duration, modified duration, convexity, and immunization. Provides preparation for the SOA/CAS Actuarial Exam FM/2.

Learning Outcomes: 1. Define and recognize concepts related to the time value of money, and will be able to do calculations involving these concepts. 2. Define and recognize concepts related to annuities and cash flows, and will be able to do calculations involving these concepts. 3. Define and recognize concepts related to loans, and will be able to do calculations involving these concepts. 4. Define and recognize concepts related to bonds, and will be able to do calculations involving these concepts. 5. Define and recognize concepts related to general cash flows and portfolios, and will be able to do calculations involving these concepts. 6. Dfine and recognize concepts related to immunization, and will be able to do calculations involving these concepts. 7. Define

and recognize concepts related to interest rate swaps, and will be able to do calculations involving these concepts. Credits: 3.00

MA 37400 - Mathematical Foundations For Machine Learning

Credit Hours: 3.00. This course combines data, computation, and inferential thinking to solve challenging problems. In this class, we explore key areas of machine learning including question formulation, statistical inference, predictive modeling, and decision making. Through a strong emphasis on data-centric computing, and quantitative critical thinking, this class covers key principles and techniques of machine learning. These include algorithms for machine learning methods including regression, classification, and clustering; and statistical concepts of measurement error and prediction.

Learning Outcomes: 1. Identify a machine learning related data-science problem, formulate questions, visualize the data, and identify features, and conduct statistical inference, and derive prediction algorithms. 2. Know how to use a computer programming tool (e.g. Python or Matlab) to draw samples from important distributions. 3. Understand linear machine learning models for regression problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for regression problems. 4. Understand linear machine learning models for classification problems; know how to use a computer programming tool (e.g. Python or Matlab) to implement the linear machine learning models for classification problems. 5. Know how to build kernel methods; in particular, Gaussian process methods, and how to use a computer programming tool (e.g. Python or Matlab) to implement kermel methods. 6. Understand the concept of mixture models and the Expectational-Maximization algorithm and how to use a computer programming tool (e.g. Python or Matlab) to implement mixture models and the Expectational-Maximization algorithm. 7. Understand the sampling methods and perform computations for Markov Chain Monte Carlo. Credits: 3.00

MA 37500 - Introduction To Discrete Mathematics

Credit Hours: 3.00. Induction, permutations, combinations, finite probability, relations, graphs, trees, graph algorithms, recurrence relations, generating functions. Problem solving in all these areas. Credit granted for only one of MA 27600 and 37500.

Credits: 3.00

MA 38500 - Introduction To Logic

Credit Hours: 3.00. Propositional calculus and predicate calculus with applications to mathematical proofs, valid arguments, switching theory, and formal languages.

Credits: 3.00

MA 38600 - Professional Practicum IV

Credit Hours: 0.00. Professional Practicum. Permission of department required.

Credits: 0.00

MA 39000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in

professional work. Credits: 0.00

MA 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in mathematics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

MA 41600 - Probability

Credit Hours: 3.00. (STAT 41600) An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.

Credits: 3.00

MA 41690 - Data Science Labs: Probability

Credit Hours: 1.00. This course consists in weekly computer laboratories. The laboratories introduce students to the application of concepts learned in an introductory Probability course to Data Science problems. This course also provides opportunities to practice programming in Python and use sensors and microprocessors to acquire and manipulate data.

Learning Outcomes: 1. Use mathematical tools to process and extract information from data. 2. Interact with Jupyter notebooks. 3. Write applications in Python. 4. Acquire and interpret sensor data. Credits: 1.00

MA 42100 - Linear Programming And Optimization Techniques

Credit Hours: 3.00. Solution of linear programming problems by the simplex method, duality theory, transportation problems, assignment problems, network analysis, dynamic programming.

Credits: 3.00

MA 42500 - Elements Of Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions; differentiation of complex functions; power series, uniform convergence; integration, contour integrals; elementary conformal mapping.

Learning Outcomes: 1. Apply complex number theory and understand algebraic and geometric representations. 2. Solve complex equations and analyze limits, continuity, and differentiability. 3. Use Cauchy-Riemann equations to identify analytic functions. 4. Evaluate integrals using Cauchy's integral theorem and formula. 5. Apply the residue theorem for evaluating integrals in engineering and science problems. 6. Use Taylor and Laurent series to expand complex functions. 7. Solve boundary value problems in fluid dynamics, electrostatics, and potential theory. 8. Apply complex analysis techniques to engineering and science applications. Credits: 3.00

MA 42800 - Introduction To Fourier Analysis

Credit Hours: 3.00. Topics include: Fourier series, convolutions, kernels, summation methods, Fourier transforms, and applications to the wave, heat, and Laplace equations.

Learning Outcomes: 1. Know applications of Fourier series to problems in physics and other areas. 2. Know convergence theorems and proofs for Fourier series. 3. Know the relationship between convolutions and Fourier series. 4. Know applications of Fourier transforms to problems in physics and other areas. Credits: 3.00

MA 43200 - Elementary Stochastic Processes

Credit Hours: 3.00. An introduction to some classes of stochastic processes that arise in probabilistic models of time-dependent random processes. The main stochastic processes studied will be discrete time Markov chains and Poisson processes. Other possible topics covered may include continuous time Markov chains, renewal processes, queueing networks, and martingales.

Learning Outcomes: 1. Identify a verbal description of a stochastic process, identify the process as a Markov process and compute the transition matrix for the Markov process. 2. Compute the stationary distribution of a Markov process and use this to draw conclusions on the long-term asymptotic behavior of the stochastic process using appropriate limit theorems for Markov processes. 3. Understand what conditions are necessary to be able to apply the main limit theorems for Markov chains; also, students should be able to give examples of Markov chains where these limit theorems do not hold because the assumptions of the theorems are violated. 4. Calculate hitting probabilities or expected hitting times of a Markov chain by solving a system of linear equations. 5. Know how to use mathematics software (e.g. Matlab) to perform computations for Markov chains on large state spaces. 6. Understand the thinning and superposition properties of Poisson processes and how to use these properties in computations. Credits: 3.00

MA 44000 - Honors Real Analysis I

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces. Topics include the completeness property of real numbers, topology of Euclidean spaces, Heine-Borel theorem, convergence of sequences and series in Euclidean spaces, limit superior and limit inferior, Bolzano-Weierstrass theorem, continuity, uniform continuity, limits and uniform convergence of functions, Riemann or Riemann-Stieltjes integrals.

Learning Outcomes: 1. Perform rigorous proofs using the definitions of open sets, closed sets, connected sets, compact sets, interior points, boundary points, cluster points, finite sets, infinite sets, and denumerable sets in Euclidean spaces. 2. Perform rigorous proofs of convergence or divergence for sequences or series in Euclidean spaces. 3. Determine points of continuity and existence of limits using rigorous proofs for functions whose domain and range are in Euclidean spaces. 4. Perform rigorous proofs that a sequence of functions converges uniformly or does not converge uniformly on a subset of a Euclidean space. 5. Know and be able to apply the definition and related theorems on the existence of Riemann or Riemann-Stieltjes integrals. Credits: 3.00

MA 44200 - Honors Real Analysis II

Credit Hours: 3.00. Real analysis in one and n-dimensional Euclidean spaces--continued from MA 44000. Topics include mappings of Euclidean spaces and their derivatives, multivariable chain rule, inverse function theorem and implicit function theorem, sets with content and integration in n dimensions, the integrability theorem, Jacobian and change of variables theorem, related topics.

Learning Outcomes: 1. Determine points at which derivatives exist and compute linear approximations for mappings of Euclidean spaces. 2. Perform rigorous applications of the multivariable chain rule, inverse function theorem and implicit function theorem in

Euclidean spaces. 3. Apply the integrability theorem on the existence of Riemann integrals of functions in bounded sets in Euclidean spaces. 4. Perform rigorous applications of the change of variables theorem for integrals of functions on smooth transformations of domains in a Euclidean spaces. Credits: 3.00

MA 45000 - Algebra Honors

Credit Hours: 3.00. This course, which is essentially the first half of MA 55300, is recommended for students wanting a more substantial background in algebra than is afforded by MA 45300, in particular students intending to do graduate work in science or engineering. Topics include the elements of number theory and group theory; unique factorization in polynomial rings and in principal ideal domains.

Credits: 3.00

MA 45300 - Elements Of Algebra I

Credit Hours: 3.00. Fundamental properties of integers, polynomials, groups, rings, and fields, with emphasis on problem solving and applications. Not open to students with credit in MA 45000.

Learning Outcomes: 1. Demonstrate knowledge of: divisibility properties of integers and polynomials, structure theory of groups and examples of groups, structure theory of rings and examples of rings, basic theory of fields. 2. Demonstrate knowledge of the proofs of facts covered in the course. Credits: 3.00

MA 45401 - Galois Theory Honors

Credit Hours: 3.00. This course will give a thorough introduction to Galois theory. Galois theory is a fundamental tool in many areas of mathematics, including number theory and algebraic geometry. This course will increase students' mathematical maturity and prepare them for graduate school. Topics include finite extension fields and their symmetries, ruler and compass constructions, complex roots of unity, solvable groups, and the solvability of polynomial equations by arithmetic and radical operations. This course is intended for third- or fourth-year students who have taken MA 45000 (Algebra Honors) or MA 45300 (Elements of Algebra I).

Learning Outcomes: 1. Know the historical background of Galois theory. 2. Know the classical version which addresses questions about roots of polynomials and the modern formulation in terms of abstract algebra. 3. Know about finite extension fields and their symmetries. 4. Know how Galois theory answers ancient questions about ruler and compass constructions. 5. Know about cyclotomic fields generated by complex roots of unity. 6. Know how Galois theory answers questions about the solvability of polynomial equations by arithmetic and radical operations. Credits: 3.00

MA 46000 - Geometry

Credit Hours: 3.00. This course begins at the high-school level and then moves quickly to intermediate and advanced topics including an introduction to non-Euclidean geometry. Emphasis on proofs.

Learning Outcomes: 1. Learn geometry topics included in the Indiana state standards. 2. Learn to solve a wide range of geometry problems. 3. Learn the meaning of definition, axiom, theorem, and proof, and use these words correctly. 4. Learn the proofs in book I of Euclid's elements. 5. Learn some basic ideas of non-Euclidean geometry. Credits: 3.00

MA 46200 - Elementary Differential Geometry

Credit Hours: 3.00. The geometry of curves and surfaces based on familiar parts of calculus and linear algebra. An introduction to the study of differentiable manifolds and Riemannian geometry.

Credits: 3.00

MA 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities,

and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

MA 48100 - Advanced Problem-Solving Seminar

Credit Hours: 3.00. Seminar intended to prepare students for the national Putnam examination in mathematics. There is no formal prerequisite, but students should be familiar with basic elements of Linear Algebra, Analysis, Geometry and Trigonometry.

Learning Outcomes: 1. Learn about various, more advanced techniques of how to approach Olympiad undergraduate type problems within areas such as number theory, combinatorics, algebra, analysis and geometry. 2. Learn various angles of approaching a proof and how to properly conceptualize it. 3. Learn how to properly write (justify) the arguments within a mathematical proof at a high rigor level imposed by the Putnam contest. Credits: 3.00

MA 48200 - Advanced Short Term Actuarial Mathematics

Credit Hours: 3.00. This course provides comprehensive coverage of a wide range of advanced short-term actuarial analysis techniques including severity and aggregate models, parametric models' estimation and selection, parametric and empirical credibility, and reserving, pricing for short-term insurance coverages. This course prepares actuarial students for the SOA Exam ASTAM: Advanced Short-Term Actuarial Mathematics.

Learning Outcomes: 1. Understand and apply methods for modeling severity and aggregate loss distributions, including creating new distributions and comparing tail behaviors. 2. Analyze the impact of coverage modifications and inflation on loss modeling in insurance. 3. Estimate parameters using the maximum likelihood method and assess the asymptotic normality of the maximum likelihood estimator for a function of parameters. 4. Select models based on graphical and score-based approaches and perform goodness-of-fit tests. 5. Evaluate credibility concepts, including limited fluctuation credibility, Bayesian credibility with conjugate priors, and Bühlmann and Bühlmann-Straub models. 6. Apply techniques for estimating unpaid losses, incurred but not reported (IBNR) losses, and project losses using trend analysis, as well as calculate overall average rates, rate changes, and risk classification differential changes. Credits: 3.00

MA 48400 - Seminar On Teaching College Algebra And Trigonometry

Credit Hours: 3.00. This course is a seminar on the teaching of mathematics for our best undergraduate mathematics education students. It provides supervised teaching experience along with a chance for the students to perfect their knowledge of algebra before going on to be high school teachers. Students who take this class will also teach a section of MA 15300. Permission of instructor required.

Credits: 3.00

MA 48700 - Professional Practicum V

Credit Hours: 0.00 or 1.00. Professional Practicum. Permission of department required.

Credits: 0.00 or 1.00

MA 49000 - Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 6.00. Supervised reading courses as well as special topics courses for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 6.00

MA 49500 - Advanced Topics In Mathematics For Undergraduates

Credit Hours: 1.00 to 5.00. Advanced topics courses in mathematics for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

Department of Physics and Astronomy

Overview

The Department of Physics and Astronomy serves the citizens of Indiana, the United States and the world through discovery that expands knowledge in the field of physics and closely related sciences, through conveyance of this knowledge to our students in an excellent learning environment, and through engagement in which we share our skills, knowledge, and enthusiasm with diverse communities beyond the University.
At present we have 60 faculty members, 22 postdocs and research scientists, 154 graduate students, and 231 undergraduate physics majors. These individuals conduct research across a broad spectrum of physics:
Accelerator mass spectrometry
Applied physics, experimental
Astrophysics, experimental and theoretical
Atomic, molecular, and optical (AMO) physics, experimental and theoretical
Biophysics, experimental and theoretical
Condensed matter physics, experimental and theoretical
Geophysics, experimental
High energy nuclear physics, experimental and theoretical
High energy particle physics, experimental and theoretical
Physics education
Planetary physics
Quantum Information Science
Our faculty members are recognized as world leaders in their respective fields. Included in our ranks are a member of the National Academy of Sciences, a member of the national academy of engineering, a winner of the Hamburg Prize for Theoretical Physics, the immediate past president of the National Association for Research in Science Teaching, 3 AAAS fellows, and 10 APS fellows.
On campus, the department occupies two buildings, the "Physics Building" (originally named the Charles Benedict Stuart Laboratory of Applied Physics) and an attached two-story subterranean laboratory complex containing offices, work rooms, and laboratories dedicated to accelerator mass spectrometry, the Purdue Rare Isotope Measurement Laboratory (PRIME Lab). We also make use of campus facilities in Purdue's Discover Park, particularly the Birck Nanotechnology Center and the Bindley Bioscience Center. Off campus, we participate in research that occurs at the Large Hadron Collider at CERN, Argonne National Laboratory, Brookhaven National Laboratory, Fermilab, the Stanford Linear Accelerator, and several observatories around the globe.
Our department has undergraduate programs in Physics, Honors Physics, Applied Physics, Applied Honors Physics, and Physics Teaching. We also have undergraduate minors in both Astronomy and Physics. Our graduate program offers both M.S. and PH.D. Degrees with a wide variety of specializations.
All physics major students must complete the majority of upper level (300 level and above) physics courses in residence at Purdue. Students can use transfer credits for no more than 50 percent of the upper level physics courses in order to receive a Physics and Astronomy B.S. Degree.
Through our outreach programs we bring our love of physics to thousands of elementary and high school students and their teachers every year. Classroom visits are complete with demonstrations hands-on learning activities. Teachers receive high-quality, content-based professional development in our workshops and through summer research opportunities.

Department of Physics and Astronomy Website

Faculty

Contact Information

Mailing Address
Department of Physics and Astronomy
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Department directory
General questions
physcontacts@purdue.edu

Graduate Information

For Graduate Information please see Physics and Astronomy Graduate Program Information .

Physics, BS

Physics Honors, BS

Applied Physics, BS

Applied Physics Honors, BS

Astronomy Minor

Physics Minor

Quantum Science Minor

Astrophysics, BS

ASTR 12300 - Our Place In The Universe: From The Solar System To Distant Cosmos (UCC: STS)

Credit Hours: 3.00. This course is intended for students interested in learning about everything in the cosmos, from the Solar System, stars, our Galaxy, and other external galaxies now and in the distant past. Key physical principles in understanding these topics will be covered at the non-calculus level. The key space missions that enabled space explorations as well as their challenges and societal impact will be also discussed.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Identify a wide range of phenomena seen in the Solar System and in the night sky and explain the key physical principles responsible for them. 2. Understand the technical challenges in space exploration and the technological developments that overcame them. 3. Develop an appreciation of our place on our planet and in the Solar System in a broader context of the history of the universe as we understand it. 4. Connect our understanding and discoveries in astronomy to the larger changes in society and the development of human civilization and provide biographical information about transformative figures in astronomy research. Credits: 3.00

ASTR 26300 - Descriptive Astronomy: The Solar System (UCC: SCI)

Credit Hours: 3.00. A descriptive course in astronomy intended for non-physics majors. Topics include properties of stars, stellar birth and death; the Hertzsprung-Russel diagram; binary systems; red giants and white dwarfs; supernova; neutron stars and black holes; galaxies; cosmology and the big bang; and dark matter. Includes required night-sky observing sessions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Think as a scientist by using critical thinking and analytical inquiry, in particular to understand our universe in terms of the laws of physics. 2. Apply basic scientific methods to the solution of astrophysical problems. 3. Use the scientific method and theories to analyze our universe. 4. Provide scientific explanations of the nature of the universe. 5. Acquire an appreciation for our place in the cosmos. Credits: 3.00

ASTR 26400 - Descriptive Astronomy: Stars And Galaxies (UCC: SCI)

Credit Hours: 3.00. A descriptive, nonmathematical course in astronomy intended for non-physics majors. Topics include: properties of stars; stellar birth and death; the Hertzsprung-Russel diagram; main sequence stars; binary systems; stellar clusters; red giants and white dwarfs, nova and supernova; neutron stars and black holes; galaxies and the cosmological red shift. Includes required observing sessions. Not available to students with credit in ASTR 36400.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Able to explain the evolution of our Universe as well as its constituents, such as stars and galaxies. 2. Able to demonstrate how this cosmic perspective impacts your lives, personal decision, or views on societal issues. 3. Able to relate astrophysical observations to basic physical concepts. Credits: 3.00

ASTR 36300 - The Solar System

Credit Hours: 3.00. This course is intended for students in science or engineering. The components of the course consist of an overview of solar system objects and an overview of the physical processes that control the evolution of solar system objects since formation. The overview of solar system includes observations of the Sun, planets, asteroids and Kuiper-belt objects, comets, and interplanetary dust. Specific processes that are discussed include hydrostatic equilibrium, orbital dynamics, radioactive decay, and heat flow. The role of these processes in shaping planetary surfaces and atmosphere is

explored.

Learning Outcomes: 1. The students will acquire extensive knowledge on the solar system, including its formation and evolution. Credits: 3.00

ASTR 36400 - Stars And Galaxies

Credit Hours: 3.00. This course is intended for students in Science or Engineering. This is the second of a two-semester introductory sequence on astronomy and astrophysics, although it is designed to be a standalone course. It is intended mainly for Science and Engineering majors who are comfortable with calculus-based contents. The course provides an overview on the formation and evolution of stars, galaxies, and clusters of galaxies. Selected topics that are covered in more detail include stellar structure and atmosphere, properties of black holes, neutron stars, and white dwarfs, galactic dynamics, and dark matter in galaxies and clusters of galaxies.

Learning Outcomes: 1. The students will acquire extensive knowledge on the properties of stars and galaxies. Credits: 3.00

ASTR 37000 - Cosmology

Credit Hours: 3.00. Intended for science and engineering majors. Basic physics and math knowledge will be assumed. The picture of how the Universe came to be and how it has evolved has recently come into sharp focus. This progress is the result of improved observational techniques that have resulted in high resolution images of very distant galaxies, a more accurate mapping of the Large Scale Structure of the Universe or the high resolution picture of the young universe provided by Cosmic Microwave Background observations. We will present a historical perspective of how ideas and data have shaped Cosmology through the centuries. In addition, we will review the theoretical models that are in agreement with the current observations. Our goal will be to provide the students with a broad overview of the current research in Cosmology with an eye toward stimulating the students curiosity about the many questions still awaiting answers in this field.

Learning Outcomes: 1. Students will acquire extensive knowledge and a broad overview of Cosmology, the study of how the Universe came to be and how it has evolved. Credits: 3.00

PHYS 10400 - First Year Physics Seminar

Credit Hours: 1.00. A one-credit course for first-year Physics majors designed to develop concepts and skills in team building, time management, and professional development that complement the students' academic and research training. Talks from a broad range of speakers are included.

Learning Outcomes: 1. Demonstrate the ability to form high performing teams. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths of the Physics programs. Credits: 1.00

PHYS 15200 - Mechanics (UCC: SCI)

Credit Hours: 0.00 to 5.00. Statics, uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; hydrostatics and hydrodynamics; simple harmonic motion; wave motion and sound.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Learn the basic theories of mechanics and their application, including uniform and accelerated motion; Newton's laws; circular motion; energy, momentum, and conservation principles; dynamics of rotation; gravitation and planetary motion; properties of matter; simple harmonic and wave motion. Credits: 0.00 to 5.00

PHYS 17200 - Modern Mechanics (UCC: SCI)

Credit Hours: 4.00. Introductory calculus-based physics course using fundamental interactions between atoms to describe Newtonian mechanics, conservation laws, energy quantization, entropy, the kinetic theory of gases, and related topics in mechanics and thermodynamics. Emphasis is on using only a few fundamental principles to describe physical phenomena extending from nuclei to galaxies. 3-D graphical simulations and numerical problem solving by computer are employed by the student from the very beginning. CTL:IPS 1753 Calculus-based Physics I

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in mechanics and thermodynamics using only a

few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to mechanics and thermodynamics. Credits: 4.00

PHYS 19000 - Special Assignments

Credit Hours: 1.00 to 4.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Learning Outcomes: 1. Understand physics and physical laws of nature by learning beyond what is offered by currently available fixed-title courses. Credits: 1.00 to 4.00

PHYS 19400 - Freshman Physics Orientation

Credit Hours: 1.00. Designed to provide incoming physics majors with the academic, survival, and computational skills to make a successful transition from high school to college. Discussion of opportunities within the Department including degree options, co-op program, undergraduate research, careers in physics, use of spreadsheet software, graphing packages, and drawing programs. Attendance and performance on assigned projects are the basis of the Pass/Not Pass requirement.

Credits: 1.00

PHYS 21400 - The Nature Of Physics (UCC: SCI)

Credit Hours: 3.00. Development of basic concepts and theories in physics; a terminal survey course designed for non-science majors. CTL:IPS 1750 Survey Of Physical Science

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 21500 - Physics For Elementary Education (UCC: SCI)

Credit Hours: 2.00. The curriculum draws heavily on Project 2061 Benchmarks and NRC Science Education Standards for content and nature of science materials and focuses on middle school learning goals (especially those with strands at elementary level). Each learning goal was expanded to finer-grained target ideas creating more steps to make concepts more understandable and explicit. Activities were designed to enable students to develop deep conceptual understanding of each target area and the structure and sequence were guided by research on student learning. In this class social interactions are used to clarify ideas and to encourage peer teaching. The students' understandings are based on prior knowledge. The class is based on a constructivist framework where new understandings are scaffolded from partial to incomplete understandings, and those are refined over time.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 2.00

PHYS 21600 - Introduction To Science-Based Dating

Credit Hours: 3.00. An introduction to age determination techniques used in archaeology and the earth sciences. Various techniques currently in use, and their impact on our understanding of the past, will be described qualitatively. Topics covered include dating by use of Carbon 14, thermoluminescence, tree rings, and fission tracks, and surface exposure dating by use of cosmogenic nuclides.

Credits: 3.00

PHYS 21700 - Introduction To Current Physics And Forefront Research Honors

Credit Hours: 1.00. This course introduces new physics majors to current physics and the research areas of the department. There are multiple sections with each section having eight or less students meeting with a professor. The course is part seminar, part interactive discussion and questions and answers and part laboratory visits to research areas. Topics cover a wide range including the evolution of the Universe, astrophysics, elementary particle physics, nuclear physics, geophysical dating, nanoscience and imaging. Topics evolve to match current physics and the interests of the students.

Credits: 1.00

PHYS 21800 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI)

Learning Outcomes: 1. Analyze physical circumstances according to Newton's Laws of motion properly. 2. Apply basic conservation laws and and to recognize the circumstances in which they apply. 3. Use physical terms such as energy, acceleration, momentum, impulse, velocity, etc., properly. Credits: 4.00

PHYS 21900 - General Physics II (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, primarily for technology students.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Learn the basic theory and application of electricity, magnetism, dc and ac circuits; geometrical and physical optics; topics in modern physics. Credits: 4.00

PHYS 22000 - General Physics (UCC: SCI)

Credit Hours: 4.00. Mechanics, heat, and sound, for students not specializing in physics. CTL:IPS 1751 Algebra-based Physics I

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Be familiar with the important modes of human thought that are the foundations of science. 2. Possess effective foundation skills: read, write, and speak with comprehension, clarity and precision; identify substantive knowledge and disciplinary methods; develop information literacy skills; reason quantitatively as means of gaining and creating knowledge and drawing reliable conclusions. 3. Demonstrate the ability to think critically and to solve problems using the foundation skills: evaluate their ideas and the ideas of others based upon disciplined reasoning; understand the traditions that have formed one's own and other cultures; be able to articulate their ideas in appropriate media. Credits: 4.00

PHYS 22100 - General Physics (UCC: SCI)

Credit Hours: 4.00. Electricity, light, and modern physics, for students not specializing in physics. CTL:IPS 1752 Algebra-based Physics II

University Core Curriculum (UCC): (UCC: SCI) Credits: 4.00

PHYS 23000 - Physical Science For Elementary Education (UCC: SCI)

Credit Hours: 3.00. The course is aimed at facilitating future elementary teachers to learn physical science that will prepare them to teach these concepts to future elementary students grades K-6. The course will be focused on learning physical science by doing science i.e. developing understanding by collaborative activities and discussion in the laboratory and lecture and communicating your ideas to others. The course will have one 50-minute lecture and two 110-minute laboratory meetings each week. The course content is consistent with the CAEP (Council for the Accreditation of Educator Preparation) K-6 Elementary Teacher Preparation Standards (Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching in *Physical Science* and *Engineering Design*) and the NGSS (Next Generation Science Standards) Disciplinary Core Ideas (DCIs) for the Physical Sciences (*Physical Sciences* PS1, PS2, PS3, and PS4) as well as many of the Science and Engineering Practices (SEPs). The course will be divided into four units: 1) Matter and Interactions, 2) Motion and Stability, 3) Energy, and 4) Waves and their applications. All of these units will be delivered through the paradigm of solving engineering design problems. Engineering design involves many different practices: problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and apply physical science concepts (matter and interactions, motion and stability, energy, waves and their applications) at a level deeper than but necessary to teach elementary school. 2. Understand and apply the engineering design process, including problem definition, model development and use, investigation, analysis and interpretation of data, application of mathematics and computational thinking, and determination of solutions. Credits: 3.00

PHYS 23300 - Physics For Life Sciences I

Credit Hours: 4.00. Physics For Life Sciences I builds upon prerequisite knowledge in college level biology, chemistry, and mathematics to present introductory physics that will be useful for applying physical principles, insights, and problem solving approaches for students with life science majors. Content will feature the Newtonian framework with emphasis on friction, drag and viscosity, random motion and diffusion, fluid flow, the Coulomb force, molecular forces and bonding, momentum, conservation of energy, entropy, and the first and second laws of thermodynamics.

Learning Outcomes: 1. Understand how motion in realistic biological systems (e.g. cells, biomolecules) is governed by forces. 2. Understand how molecular binding is described

in terms of energy. 3. Understand how diffusion is governed on a microscopic level. 4. Have insight into how the first and second laws of thermodynamics constrain basic processes in living systems. Credits: 4.00

PHYS 23400 - Physics For Life Sciences II

Credit Hours: 4.00. Physics For Life Sciences II builds upon prerequisite knowledge in college level biology, chemistry, and mathematics, as well as on Physics For Life Sciences I, to develop an understanding of how energy, entropy, enthalpy, and Boltzmann distributions affect the dynamics of living systems, of how electric fields and potentials are applied to fluids and membranes, and how the physics of harmonic oscillators, waves, sound, optics, photons, and quantized states are relevant to biological systems and the tools used for their study.

Learning Outcomes: 1. Understand the connection between microscopic phenomena and macroscopic consequences in terms of energy, entropy, and the laws of thermodynamics for biological systems. 2. Apply simple electrostatic principles to membrane potentials and other biological examples. 3. Understand how wave phenomena and quantized states are important for characterizing biomolecules. Credits: 4.00

PHYS 23500 - Seminar In Careers In Physics

Credit Hours: 1.00. Course is designed to help physics majors evaluate different career options. Permission of instructor required.

Credits: 1.00

PHYS 24100 - Electricity And Optics (UCC: SCI)

Credit Hours: 3.00. Electrostatics, current electricity, electromagnetism, magnetic properties of matter. Electromagnetic waves, geometrical and physical optics.

University Core Curriculum (UCC): (UCC: SCI)

Credits: 3.00

PHYS 25100 - Heat, Electricity And Optics

Credit Hours: 5.00. Heat, kinetic theory, elementary thermodynamics, heat transfer. Electrostatics, AC/DC circuits, electromagnetism, magnetic properties of matter; geometrical and physical optics.

Learning Outcomes: 1. Compute force, field, and potential energy and combine these in a variety of rich contexts (e.g., forces on dipoles). 2. Compute electric fields due to various charge configurations. 3. Compute electric fields in matter in equilibrium. 4. Compute magnetic fields from sources. 5. Apply microscopic circuit analysis techniques. 6. Apply macroscopic circuit analysis techniques. 7. Compute forces on charges in magnetic fields. 8. Compute fields using Gauss's and Ampere's Law. 9. Compute EMF between two points in situations where flux is changing. 10. Compute radiative field from accelerating charges. 11. Compute interaction of EM Waves with matter. 12. Heat and Thermodynamics: reason about thermodynamic problems using the concepts of heat, work, temperature and thermal energy. Credits: 5.00

PHYS 25200 - Electricity And Optics Laboratory

Credit Hours: 1.00. Selected experiments in electric fields, magnetic fields, steady-state and transient DC circuits, thermodynamics, and optics.

Learning Outcomes: 1. Demonstrate the ability to think and function as a scientist. 2. Demonstrate the ability to communicate well, both orally and in writing. 3. Demonstrate the ability to understand the role of scientific observation of Nature in uncovering the Laws of Physics. Credits: 1.00

PHYS 27000 - Special Topics In Physics

Credit Hours: 1.00 to 5.00. Specialized topics in physics. Permission of department required.

Credits: 1.00 to 5.00

PHYS 27200 - Electric And Magnetic Interactions (UCC: SCI)

Credit Hours: 4.00. Calculus-based physics course using concepts of electric and magnetic fields and an atomic description of matter to describe polarization, fields produced by charge distributions, potential, electrical circuits, magnetic

forces, induction, and related topics, leading to Maxwell's equations and electromagnetic radiation and an introduction to waves and interference. 3-D graphical simulations and numerical problem solving by computer are employed throughout.

University Core Curriculum (UCC): (UCC: SCI) Learning Outcomes: 1. Understand and describe a wide range of physical phenomena in electricity and magnetism using only a few fundamental principles of physics. 2. Learn a unified approach that relates microscopic behavior to macroscopic behavior. 3. Model natural phenomena quantitatively. 4. Apply all this to a range of topics related to electricity and magnetism. Credits: 4.00

PHYS 29000 - Special Assignments

Credit Hours: 0.00 to 3.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Credits: 0.00 to 3.00

PHYS 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 29500 - Outreach Assistance As Service Learning

Credit Hours: 1.00 to 3.00. Physics 29500 is a service learning class available to students willing and able to deliver physics lessons to K-12 classrooms and to other public events. Students are required to prepare and rehearse labs/activities so they are able to offer professional presentations. Students are also required to maintain a reflection journal, where they record notes about their experiences. Although efforts are made to work around students' schedules, students should have at least on open morning or afternoon each week (preferably 2-3) that allows them to visit an assigned site on a regular, consistent basis. One credit is equivalent to 32 hours of involvement in preparation and/or delivery of activities, and journaling time. Prerequisites: desire, commitment, dependability responsibility.

Credits: 1.00 to 3.00

PHYS 30600 - Mathematical Methods Of Physics I

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include one-and multi-variable calculus, complex numbers and functions of a complex variable, and vector calculus. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 30700 - Mathematical Methods Of Physics II

Credit Hours: 3.00. Discussion of wide-ranging physics problems from mechanics, E&M, thermal, and modern physics with emphasis on reviews and introductions of mathematical methods and techniques that are essential in such discussion. Relevant mathematical methods include vectors, matrices and

normal modes as well as ordinary and partial differential equations. Intended primarily for sophomore physics majors.

Learning Outcomes: 1. Students will acquire capacity to apply essential mathematical methods and techniques to physics problems. Credits: 3.00

PHYS 31000 - Intermediate Mechanics

Credit Hours: 4.00. For students familiar with calculus. Elements of vector algebra; statics of particles and rigid bodies; theory of couples; principle of virtual work; kinematics; dynamics of particles and rigid bodies; work, power, and energy.

Learning Outcomes: 1. To Understand order in Nature as contained in the Laws of Physics. The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 4.00

PHYS 31700 - Special Nuclear Materials

Credit Hours: 3.00. This Great Issues course addresses the impact of science and technology of the special nuclear materials (so designated by Congress as they could be used to make nuclear weapons as well as to produce low-cost electric power) on society and the ethical issues that arise. The course is designed to be a dynamic, interactive learning experience, and topics covered range from the technical issues involved in searching, transporting, and safely utilizing these materials to social and economic impact of these activities, and to the ethical and philosophical issues presented by the flow of modernity.

Learning Outcomes: 1. Able to think and function as a scientist. 2. Demonstrate breadth of knowledge. 3. Demonstrate knowledge of a subfield of physics: The student demonstrates knowledge of the diverse applications of physical laws in fundamental physics, in various branches of science and in applied science and engineering. 4. Able to communicate well both orally and in writing. 5. Able to collaborate as part of a team. Credits: 3.00

PHYS 32200 - Intermediate Optics

Credit Hours: 3.00. Wave optics and properties of light, including reflection, refraction interference. Fraunhofer and Fresnel diffraction dispersion, polarization, double refraction, introduction to lasers and holography.

Credits: 3.00

PHYS 32300 - Research With Big Data I

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

PHYS 32400 - Research In Big Data II

Credit Hours: 3.00. This course is to conduct physics research in a class-based environment. As such, we will perform authentic research, defined as work with the potential for results that are of interest to the scientific community. We will work with large data sets, such as those collected by survey telescopes, dark matter experiments, or detectors at the Large Hadron Collider.

Learning Outcomes: 1. Gain confidence in scientific abilities by experiencing a full scientific cycle from stating the problem and formulating the hypothesis, to data analysis and drawing conclusions. 2. Train in scientific communication, team skills, and soft skills. Credits: 3.00

PHYS 33000 - Intermediate Electricity And Magnetism

Credit Hours: 3.00. Electrostatics; electric currents; magnetostatics; electromagnetic induction; Maxwell's equation; electromagnetic waves.

Credits: 3.00

PHYS 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis

is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum aspects are distinctly different from classical predictions. Credits: 2.00

PHYS 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrödinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrödinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

PHYS 34300 - Modern Physics Laboratory

Credit Hours: 1.00. Laboratory experiments to support PHYS 34200.

Credits: 1.00

PHYS 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

PHYS 34500 - Optics Laboratory I

Credit Hours: 1.00. Laboratory experiments in geometrical and physical optics and spectrometry.

Credits: 1.00

PHYS 34900 - Introduction To Quantum Computing

Credit Hours: 3.00. This is a first course in quantum information and quantum computing, for students who have already had an introduction to quantum science. Linear algebra and some probability theory will be presented and used throughout this course. The basic postulates of quantum mechanics will motivate the applications to qubits, cryptography, quantum computation, algorithms, error correction, and other current topics.

Learning Outcomes: 1. Explain the difference between classical and quantum computation. 2. Understand the essential role of quantum entanglement. 3. Appreciate the role of eigenstates in quantum cryptography. 4. Explain the historical significance of Shor's algorithm in establishing the field of quantum computing. 5. Demonstrate the ability to write a quantum computing program. Credits: 3.00

PHYS 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

PHYS 38199 - Professional Practice I

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Credits: 0.00

PHYS 38299 - Professional Practice II

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Credits: 0.00

PHYS 38399 - Professional Practice III

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business.

Credits: 0.00

PHYS 39000 - Special Assignments

Credit Hours: 1.00 to 4.00. Readings, discussions, written reports, or laboratory work selected for enrichment in special areas of physics. Permission of instructor required.

Learning Outcomes: 1. Understand physics and physical laws of nature by learning beyond what is offered by currently available fixed-title courses. Credits: 1.00 to 4.00

PHYS 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in physics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

PHYS 41000 - Physical Mechanics I Honors

Credit Hours: 3.00. Newtonian, Lagrangian, and Hamiltonian mechanics. Emphasis on point mass mechanics. Free, driven, and damped harmonic motion, central force problem.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 3.00

PHYS 41100 - Physical Mechanics II Honors

Credit Hours: 2.00. Continuation of mechanics in PHYS 41000 . Coupled systems, general theory of small oscillations, the vibrating string, perturbation theory. Rigid body motion. Motion of charged particles in electromagnetic fields. Elements of continuum mechanics.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Classical Mechanics. Credits: 2.00

PHYS 41600 - Thermal And Statistical Physics Honors

Credit Hours: 4.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential and Grand Canonical Ensemble; classical and quantum ideal gases; chemical reactions; phase equilibria; critical phenomena.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 4.00

PHYS 41610 - Thermal And Statistical Physics

Credit Hours: 3.00. Thermal equilibrium; first, second, and third laws; entropy; probability and statistics; canonical ensembles; chemical potential; classical and quantum ideal gases; phase equilibria; critical phenomena.

Learning Outcomes: 1. Understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and the ability to apply the core physics subject of Thermal and Statistical Physics. Credits: 3.00

PHYS 42200 - Waves And Oscillations

Credit Hours: 3.00. Physics of waves and oscillations including sound, elastic waves, and electromagnetic waves such as light. Topics range from the theory of simple harmonic oscillators, transverse modes of a continuous string, and physical optics including interference, Fresnel and Fraunhofer diffraction, and resolution, to diffraction of X-rays and electrons by crystals. Optionally includes topics such as nonlinear waves and surface waves.

Credits: 3.00

PHYS 43000 - Electricity And Magnetism I Honors

Credit Hours: 3.00. Electrostatics, solutions of Poisson's equation in spherical and cylindrical coordinates, macroscopic and microscopic theory of dielectrics, electrostatic energy, conduction; magnetostatics, electromagnetic induction, and magnetic properties of matter.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 3.00

PHYS 43100 - Electricity And Magnetism II Honors

Credit Hours: 2.00. A continuation of PHYS 43000 . Magnetic energy; applications of Maxwell's equations to a.c. circuits, filters, transmission lines, waveguides, and antennae; Lienard-Wiechert potentials.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Electromagnetism. Credits: 2.00

PHYS 45000 - Intermediate Laboratory

Credit Hours: 2.00. Laboratory primarily intended for junior year physics majors. Assorted experiments in optics and other fields using lasers, photodiodes, computers, and other modern technology.

Learning Outcomes: 1. Students will acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. Credits: 2.00

PHYS 46000 - Quantum Mechanics I Honors

Credit Hours: 3.00. Limits of classical physics, wave packets. Bohr model, atomic systems, Schrodinger equation, eigen-functions, one-dimensional potentials, wave mechanics general structure, multiparticle systems, Pauli principle, operator methods.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 46100 - Quantum Mechanics II Honors

Credit Hours: 3.00. Angular momenta, radial equation, operators, matrices, spin, time-independent perturbation theory, electron-electromagnetic field interaction, hydrogen atom, structure of atoms, molecules, radiation; selected topics in radiative transitions, collision theory, solids, nuclei, elementary particles and their symmetries.

Learning Outcomes: 1. To understand order in nature as contained in the Laws of Physics: The student exhibits the knowledge of and ability to apply the core physics subject of Quantum Mechanics. Credits: 3.00

PHYS 47000 - Special Topics In Physics

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Credits: 1.00 to 5.00

PHYS 49000 - Special Assignments

Credit Hours: 1.00 to 3.00. Reading, laboratory work, or research in special areas of physics. Intended for upperclass students. Permission of instructor required.

Credits: 1.00 to 3.00

QSCI 34000 - Quantum Science Laboratory

Credit Hours: 2.00. Physics experiments will be conducted that emphasize how quantum behavior differs from classical physics, including particle interference, entanglement, photon-electron scattering, and electron charge-to-mass ratio. Special emphasis is given to keeping a professional lab notebook, error analysis and data plotting, and interpretation of experimental results. Lecture hour will cover underlying physics and exploration of lab results.

Learning Outcomes: 1. Acquire the ability to understand design of a physics experiment, to develop experimental techniques and tools, to analyze and interpret data, and to draw and present physical conclusions. 2. Conduct physics experiments where the quantum

aspects are distinctly different from classical predictions. Credits: 2.00

QSCI 34202 - Introduction To Quantum Science

Credit Hours: 3.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 3.00

QSCI 34400 - Introduction To Quantum Science

Credit Hours: 4.00. This course offers an introduction to quantum mechanics, exploring how it has transformed our understanding of the physical world and revolutionized modern technology. The concepts will be illustrated with a variety of contemporary physics results and applications, including relativistic effects and a brief overview of the emerging field of quantum information science and engineering.

Learning Outcomes: 1. Understand key concepts in quantum mechanics, including wave-particle duality, superposition, entanglement, and the uncertainty principle. Apply these concepts to predict the behavior of quantum magnets (spins) and quantum light (photons). 2. Learn the wavefunction, the Schrodinger equation, and probability and measurement outcomes in quantum mechanics. Solve the Schrodinger equation in simple model systems and use the results to understand atom spectra, nuclear reactions, molecular bonds, and electronic motion in solids (including semiconductors and superconductors). 3. Understand how quantum mechanics has enabled many modern technologies, including lasers, transistors, solar cells, magnetic resonance imaging, electron microscopy, and the global positioning system. Understand basic ideas of the theory of relativity and relativistic effects in contemporary quantum science. 4. Gain an overview of the emerging field of quantum information science and engineering by exploring quantum computing, quantum communication, and quantum sensing. Credits: 4.00

QSCI 34900 - Introduction To Quantum Computing

Credit Hours: 3.00. This is a first course in quantum information and quantum computing, for students who have already had an introduction to quantum science. Linear algebra and some probability theory will be presented and used throughout this course. The basic postulates of quantum mechanics will motivate the applications to qubits, cryptography, quantum computation, algorithms, error correction, and other current topics.

Learning Outcomes: 1. Explain the difference between classical and quantum computation. 2. Understand the essential role of quantum entanglement. 3. Appreciate the role of eigenstates in quantum cryptography. 4. Explain

the historical significance of Shor's algorithm in establishing the field of quantum computing. 5. Demonstrate the ability to write a quantum computing program. Credits: 3.00

QSCI 36000 - Quantum Mechanics

Credit Hours: 3.00. Contemporary approach to quantum science that combines traditional quantum mechanics with aspects of quantum information science. Primary topics include quantum states, operators, measurement, spin, angular momentum, entanglement, qubits, and the Schrodinger Equation. Special attention is given to the Einstein-Podolsky-Rosen paradox, quantum cryptography, and an introduction to quantum computing.

Learning Outcomes: 1. Utilize the fundamental assumptions of quantum mechanics to distinguish between classical and quantum physics. 2. Solve the Schrodinger equation when applied to standard examples of constant potentials, including harmonic oscillators and the hydrogen atom. 3. Apply quantum measurement concepts and entanglement to describe the fundamental physics behind quantum cryptography and quantum computing. Credits: 3.00

Department of Statistics

Overview

Purdue University's Department of Statistics is one of the first dedicated Statistics programs in the country. From its inception as a Statistical Laboratory in 1947, it has been a prominent center of statistical research and has grown to become one of the largest Statistics departments in the United States. By pursuing foundational research in probability, statistical theory and methodology, and computational statistics, combined with interdisciplinary research in statistical genetics and bioinformatics, machine learning, computational finance, industrial Statistics, and other fields across Purdue University's campus, the Department of Statistics continues the proud tradition of making fundamental contributions to science while developing new methodologies, theories, and algorithms for statistics and machine learning. It has been a consistently top-ranked department among Statistics departments in the United States. In a world where data are being generated faster than they can be analyzed, the Department of Statistics promotes the design of meaningful experiments, observational studies, and surveys for data collection, the development of analysis and modeling methodologies for performing rigorous and valid inferences from the collected data, as well as the computational algorithms necessary to perform rigorous and valid inferences from the collected data and informed decision making based on the results of data analyses.

Housed in both Haas Hall and the Mathematical Sciences Building, the department's diverse faculty work to advance the frontiers of statistical science and data science in both theory and applications. They seek to provide learning environments that produce well-educated data scientists, statisticians, probabilists, and quantitatively literate people. They have a long history of providing cutting-edge learning environments conducive to successful and impactful graduates: https://www.stat.purdue.edu/alumni/profiles/index.html. Through their interdisciplinary partnerships, the faculty, staff, and students of the department bring the strengths of the statistical sciences to address significant societal needs.

The department offers an undergraduate degree in Statistics, allowing students to focus on either Applied Statistics or Mathematical Statistics. Partnership with the Department of Mathematics also provides the opportunity to major in Actuarial Science, while a collaboration with the Department of Computer Science enables undergraduates to pursue a Data Science major. Undergraduates from a range of disciplines can minor in Statistics as well. Graduate students have access to an array of certificate, MS, and PhD programs with distinct concentrations and collaborative opportunities.

As of March 2021, there are 36 tenured and tenure-track professors, 5 emeriti faculty, 12 adjunct and courtesy faculty members, 5 visiting professors, and 16 lecturers who form the Department of Statistics faculty. The department has approximately 538 undergraduate students majoring in Statistics and/or Actuarial Science (a joint major with the Department of Statistics), and 410 student have the major Data Science. The department has 173 graduate students, 95 are Ph.D. students and 78 are M.S. students.

Department of Statistics Website

Faculty

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Graduate Information

For Graduate Information please see Statistics Graduate Program Information .

Statistics Honors, BS

Statistics: Math Emphasis, BS

Applied Statistics, BS

Statistics Minor

Data Science, BS (Statistics)

Data Science First Year (Statistics)

Biostatistics Certificate

STAT 10100 - Freshman Orientation Seminar

Credit Hours: 1.00. A one-credit course for first-year Statistics/Mathematics majors designed to develop concepts and skills in team building, time management, and professional development that complement the students' academic and research training. Talks from a broad range of speakers are included.

Learning Outcomes: 1. Demonstrate the ability to communicate with peers & speakers in classroom. 2. Demonstrate the ability to locate and use academic success resources. 3. Demonstrate understanding of time management and study skills. 4. Demonstrate knowledge in the utilization of Purdue degree planning tools. 5. Demonstrate understanding of the academic requirements and career paths. Credits: 1.00

STAT 11300 - Statistics And Society (UCC: IL/STS)

Credit Hours: 3.00. This course is an introduction to statistical literacy and the cultivation of critical thinking skills. Statistical concepts are learned through practical application in the context of contemporary societal issues and debates. Some of the concepts explored include the statistical problem-solving process, data collection methodologies such as surveys and experiments, the ethical considerations entailed in data acquisition, the relationship between variables, the assessment of validity and reliability in the measurement of variables, analysis and graphical representation of single and multiple variables, as well as statistical inference. Furthermore, the curriculum actively encourages the development of critical thinking abilities with a specific focus on data-related inquiries.

University Core Curriculum (UCC): (UCC: IL/STS) Learning Outcomes: 1. Distinguish between and qualify methods of data collection. 2. Interpret graphs and statistical analyses. 3. Express and calculate the likelihood of events. 4. Create a narrative from statistical analysis. Credits: 3.00

STAT 17000 - Introduction To Actuarial Science

Credit Hours: 2.00. (MA 17000) An introduction to actuarial science from the point of view of practicing actuaries from life insurance, casualty insurance and consulting; introduction to insurance and the mathematical theory of interest; application of spreadsheets to problems related to actuarial science.

Learning Outcomes: 1. Describe different expressions of interest rates. Calculate an equivalent rate given another rate. 2. Calculate the present value of a set of cash flows. 3. Apply basic probability principles. 4. Describe and apply different types of probabilities used by actuaries. 5. Calculate the expected present value of a set of cash flows. 6. Describe basic types of insurance and their characteristics. 7. Define and apply basic components of insurance. Examples: premium, claim, deductible, coverage, limit, coinsurance, insured, owner. 8. Describe the ratemaking

process. Calculate the rate of a simple insurance product. 9. Describe the pricing process. Calculate the price of a simple insurance product. 10. Describe different accounting regimes and their purposes. 11. Define a policy reserve. Calculate a simple policy reserve. 12. Define a loss reserve. Calculate a simple loss reserve. 13. Demonstrate a basic level of knowledge by applying Excel to solve problems. Credits: 2.00

STAT 19000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the freshman level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Discover data science and professional development opportunities to prepare for a career. 2. Design efficient search strategies to acquire new data science skills. 3. Devise the most appropriate data science strategy to answer a research question. Credits: 1.00 to 5.00

STAT 22500 - Introduction To Probability Models

Credit Hours: 3.00. An introduction to basic probability. Emphasis is placed on formulation of models and applications. Probability calculus, standard distributions, random variables, and moments. Credit cannot be given for more than one of STAT 22500, 31100, or 41600.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify various discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand the Normal distribution and how to use the Standard Normal Table. 4. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 5. Have a foundation in statistical methodology including the basics of hypothesis testing. Credits: 3.00

STAT 24200 - Introduction To Data Science

Credit Hours: 3.00. (CS 24200) This course provides a broad introduction to the field of data science. The course focuses on using computational methods and statistical techniques to analyze massive amounts of data and to extract knowledge. It provides an overview of foundational computational and statistical tools for data acquisition and cleaning, data management and big data systems. The course surveys the complete data science process from data to knowledge and gives students hands-on experience with tools and methods. Basic knowledge of Python required. Computer Science majors cannot count this course as a degree requirement but can take it for credit as a free elective if taken before CS 37300, 34800, 47100, 47300, 44800.

Learning Outcomes: 1. Use Python, R, and selected tools to scrape, clean, process, and visualize data. 2. Apply data management techniques to prepare, parse, manipulate, and store data. 3. Use statistical methods to summarize data and identify relationships. 4. Explain how to formulate new hypotheses and draw accurate conclusions from data. 5. Apply statistics and computational analysis to make predictions based on data. 6. Apply basic computer science concepts such as modularity, abstraction, and encapsulation to data analysis problems. 7. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations. Credits: 3.00

STAT 25000 - Problems Solving In Probability

Credit Hours: 2.00. (MA 25000) This course is designed to teach techniques for solving problems in probability theory which are relevant to the actuarial sciences. It is intended to help actuarial students prepare for the Society of Actuaries and Casualty Actuarial Society Exam P/1. Credit by Examination is not available for this course. MA/STAT 41600 is strongly recommended.

Credits: 2.00

STAT 29000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the sophomore level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Design efficient search strategies in order to acquire new data science skills. 2. Devise the most appropriate data science strategy in order to answer a research question. 3. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 5.00

STAT 29199 - Cooperative Experience I

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 29299 - Cooperative Experience II

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 30100 - Elementary Statistical Methods (UCC: IL)

Credit Hours: 3.00. Introduction to statistical methods with applications to diverse fields. Emphasis on understanding and interpreting standard techniques. Data analysis for one and several variables, design of samples and experiments, basic probability, sampling distributions, confidence intervals and significance tests for means and proportions, correlation and regression. Software is used throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 35000, 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: college algebra.

University Core Curriculum (UCC): (UCC: IL)

Learning Outcomes: 1. Students will be introduced to statistical methods and be able to apply them to multiple fields of study. 2. Students will be able to understand, interpret standard statistical techniques, analyze data for one variable and for several variables, calculate and use confidence intervals and significance test for means and proportions, understand the design of samples and experiments, perform and understand basic probability calculations, perform simple and multiple regression procedures, and understand correlation. Credits: 3.00

STAT 30301 - Probability And Statistics For Business

Credit Hours: 3.00. This course provides fundamentals for describing data, probability theory, and statistical inference. Topics include exploratory data analysis, discrete and continuous probability distributions, sampling techniques, sampling distributions, confidence intervals and hypothesis tests for means and proportions, and 1 -sample variance, and hypothesis tests about the distributions of categorical variables. Students will utilize Microsoft Excel 2019 or 365.

Learning Outcomes: 1. Understand basic terminology, set theory, and counting rules related to probability. 2. Identify selected discrete and continuous probability models/distributions and apply them to answer probability questions. 3. Understand, interpret standard statistical techniques/methods, analyze data, calculate and use confidence intervals and hypothesis tests for means and proportions, understand the design of samples and experiments. 4. Understand basic terms, graphs, and symbols and be able to interpret

statistics in the media. Credits: 3.00

STAT 31100 - Introductory Probability

Credit Hours: 3.00. An introduction to basic probability with some theoretical background as well as applications to the physical sciences and engineering. Formulation of probability problems, general probability rules, conditional probability and Bayes Theorem, and discrete and continuous random variables and their properties. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Determine appropriate methods for determining probabilities and conditional probabilities. 2. Use of distribution functions involving mass functions and cumulative distribution functions. 3. Use of specific distribution functions for both discrete and continuous random variables including means and variances. 4. Use of distribution functions involving more than one variable. Credits: 3.00

STAT 35000 - Introduction To Statistics

Credit Hours: 3.00. This course provides a data-oriented introduction to applied statistics, covering exploratory data analysis, experimental design, probability distributions, simulation, sampling distributions, and the Central Limit Theorem. Students will learn the fundamentals of statistical inference, including confidence intervals and hypothesis tests for population means, paired and independent comparisons of means, analysis of variance, and regression. The course emphasizes hands-on experience with statistical software and is primarily intended for students majoring in the mathematical sciences. Prerequisite: two semesters of college calculus.

Learning Outcomes: 1. Understand basic terms, graphs, and symbols and be able to interpret statistics in the media. 2. Understand and be able to explain statistical processes and be able to fully interpret statistical results. 3. Understand why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations. 4. Be able to use a statistical package (R or SAS) to analyze data and interpret result. 5. Big Ideas in Statistics: variability, distributions, and models; causation vs correlation; practical significance vs statistical significance, etc. Credits: 3.00

STAT 35500 - Statistics For Data Science

Credit Hours: 3.00. An introduction to methodologies for data analysis and simulation. Populations and sampling. Distributions and summaries of distributions. Algorithms for sampling and resampling. Foundational statistical concepts including confidence intervals, hypothesis testing, correlation. Introduction to classification and regression. Essential use is made of statistical software throughout. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, 30301, 35000, 35500, 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Utilize simulations to generate data (statistical simulations). 2. Explain sampling distributions, their properties, and methods for resampling (Statistical Reasoning). 3. Explain foundational concepts such as confidence intervals, hypothesis testing, correlations, etc., and apply these concepts in statistical process (Statistical Concepts). 4. Assess statistical problems, and justify and apply statistical methods used to solve the problem (Statistical Thinking). Credits: 3.00

STAT 38199 - Professional Practice Co-Op I

Credit Hours: 0.00. Professional experience in Statistics. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 38299 - Professional Practice Co-Op II

Credit Hours: 0.00. Professional experience in Statistics. Program coordinated by Office of Professional Practice with

cooperation of participating employers. Students submit a summary report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 38399 - Professional Practice Co-Op III

Credit Hours: 0.00. Professional experience in Statistics. Program coordinated by Office of Professional Practice with cooperation of participating employers. Students submit a summary report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Increase understanding of the profession and practice, basic professional principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the junior level for undergraduates are given under this number. Permission of instructor required.

Learning Outcomes: 1. Acquire new data science skills. 2. Devise the most appropriate data science strategy in order to answer a research question. 3. Apply data science techniques in order to answer a research question about a big data set. 4. Apply techniques for documenting, testing, sharing and creating a repository for code. 5. Apply the best workflow practices in data science. Credits: 1.00 to 5.00

STAT 39399 - Cooperative Experience III

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39499 - Extensive Cooperative Experience IV

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 39599 - Extensive Cooperative Experience V

Credit Hours: 0.00. Professional experience in statistics. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional context. 2. Advance skills related to professional preparation, critical thinking,

problem solving, communication and teamwork. 3. Increase understanding of the profession and practice, basic industry principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

STAT 41600 - Probability

Credit Hours: 3.00. (MA 41600) An introduction to mathematical probability suitable as preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem. Credit cannot be given for more than one of STAT 22500, 31100, or 41600. Prerequisite: multivariate calculus.

Credits: 3.00

STAT 41700 - Statistical Theory

Credit Hours: 3.00. An introduction to the mathematical theory of statistical inference, emphasizing inference for standard parametric families of distributions. Properties of estimators. Maximum likelihood estimation. Sufficient statistics. Hypothesis tests and confidence intervals. Distribution theory for common statistics based on normal distributions, including linear regression. Bayesian Statistics include posterior inference, posterior mean, maximum a-posteriori estimator, credible intervals, and Bayesian hypothesis testing.

Learning Outcomes: 1. Understand and able to use inference for standard parametric families of distributions; properties of estimators; Bayes and maximum likelihood estimation; sufficient statistics; properties of test of hypotheses; distribution theory for common statistics based on normal distributions. Credits: 3.00

STAT 41800 - Computational Methods In Data Science

Credit Hours: 3.00. This course introduces essential computational methods in modern data science, focusing on simulation, resampling, Bayesian data analysis, and the utilization of large language models (LLMs) in data science workflows. Students will learn foundational simulation techniques, such as random variable generation through the inverse cumulative distribution function and rejection sampling. The course provides an overview of Frequentist and Bayesian inference, highlighting their theoretical foundations and practical applications. Key resampling methods, including bootstrapping and cross-validation, will be explored as tools for assessing variability, constructing confidence intervals, and validating predictive models. The course also emphasizes the practical and responsible use of LLMs in data science pipelines, including tasks such as text preprocessing, feature extraction, and leveraging pre-trained models to enhance data analysis and annotation. The course culminates in a capstone project where students will synthesize their learning by designing and implementing comprehensive solutions to real-world data science problems, demonstrating both theoretical understanding and practical implementation skills.

Learning Outcomes: 1. Apply simulation techniques, including Monte Carlo methods, transformation approaches, and rejection sampling, to analyze probabilistic behavior in data science applications. They will compare and evaluate Frequentist and Bayesian inference paradigms by examining their theoretical foundations, identify their strengths and limitations, and explain their roles in statistical modeling and decision-making. Students will design, implement, and assess resampling methods, focusing on both nonparametric and parametric forms of the bootstrap, to estimate variability, construct confidence intervals, and improve statistical estimates through bias correction techniques. They will learn the principles of cross-validation, analyze its role in model assessment, and apply it to compute model performance metrics, detect overfitting and underfitting, and select models with reliable predictive accuracy using Python libraries. 2. Construct and interpret posterior distributions and credible intervals, apply Markov Chain Monte Carlo methods to approximate posteriors, and evaluate the role of prior distributions in Bayesian inference. In addition, students will utilize large language models in creative and practical ways within data science workflows, such as contextual data augmentation, feature engineering, and integrating structured and unstructured data to enhance predictive models, addressing

challenges such as privacy and reliability. The course will culminate in a capstone project where students will synthesize selected course topics to design, develop, and present robust solutions to real-world data science challenges. By integrating computational methods, statistical principles, and real-world datasets, students will demonstrate their ability to create effective, data-driven solutions that showcase both theoretical understanding and applied expertise. Credits: 3.00

STAT 42000 - Introduction To Time Series

Credit Hours: 3.00. An introduction to time series analysis suitable for students of actuarial science, engineering, and the sciences. Model building and forecasting with ARMA and ARIMA models. Basic financial volatility models (ARCH and GARCH). Resampling methods for confidence intervals. Basics of spectral analysis, including spectral density estimation and periodograms.

Learning Outcomes: 1. Manage time series data; extract subset of time series data. 2. Visualize time series data. 3. Understand trend and correlation. 4. Model time series data. 5. Forecast of time series data. Credits: 3.00

STAT 47201 - Fundamental Long Term Actuarial Mathematics

Credit Hours: 4.00. Mathematical foundation of actuarial science, emphasizing probability models for life contingencies as the basis for analyzing life insurance and life annuities and determining premiums and reserves. This course provides the background for Course MLC of the Society of Actuaries and Course 3L of the Casualty Actuarial Society.

Learning Outcomes: 1. Understand and use decrement models in conjunction with interest rate models to evaluate insurance, annuities, and investments. 2. Apply models to calculate actuarial values, gross and net premiums, and benefit and expense reserves. Among the decrement models learned will be standard mortality, models, static mortality table models, and continuous time Markov chains in both a single decrement and multiple decrement environment. Credits: 4.00

STAT 47301 - Introduction To Arbitrage-Free Pricing Of Financial Derivatives

Credit Hours: 3.00. This course exposes students to a number of financial economics concepts related to arbitrage-free option pricing in the binomial market model and the Black-Scholes model. Specific models include (1) Options and parity relationship between options; (2) Option Pricing under the Binomial model; (3) Option Pricing under the Black-Scholes model; (4) Option hedging and the market maker's overnight profit; (5) Black Scholes theory with Brownian motion and Ito calculus; (6) Risk-neutral option pricing and Monte Carlo valuation; (7) Stochastic interest rates and Stochastic Volatility. This course provides the background for Couse MFE of the Society of Actuaries and Course 3F of the Casualty Actuarial Society.

Learning Outcomes: 1. Use arbitrage-free option pricing in the binomial market model and the Black-Scholes model. 2. Adapt the binomial setting to computing exotic and path-dependent option prices, including the determination of optimal exercise. 3. Follow marking-to-market strategies for approximate discrete delta hedging. Credits: 3.00

STAT 47401 - Statistics For Risk Modeling I

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for the Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of several important analytic methods, including the following: Linear regression models; Generalized linear models; Principle components analysis; Decision trees; Cluster analysis. Credits: 3.00

STAT 47500 - Life Contingencies II - EXPIRED - PL*

Credit Hours: 2.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200 and STAT 47201. Permission of instructor required.

Credits: 2.00

STAT 47501 - Advanced Long Term Actuarial Mathematics

Credit Hours: 3.00. This course covers advanced life contingencies topics such as multiple decrement models, joint life models, pension models, and profit emergence and testing for insurance products. It builds on the basic life contingent models learned in STAT 47200.

Learning Outcomes: 1. Understand key concepts concerning multiple state mortality/morbidity and joint life mortality models for insurance and annuity contracts. 2. Understand key concepts concerning estimation and construction of multiple state and joint life models for insurance and annuity contracts. 3. Perform calculations on the present value random variables associated with benefits and expenses for any of the models in the first learning objective. 4. Analyze emerging surplus, and to set premiums and reserves, using profit testing. 5. Understand how retirement benefits are accrued, valued, and funded. 6. Understand various types of equity-linked life insurance guarantees, options that are embedded in life insurance and annuity contracts and be able to price, reserve and hedge the risk inherent in these options. Credits: 3.00

STAT 47701 - Statistics Risk Modeling II

Credit Hours: 3.00. This course introduces various statistics learning methods for analyzing insurance data. The main objective is to prepare actuarial science students for Exam SRM: Statistics for Risk Modeling of the Society of Actuaries.

Learning Outcomes: 1. Understand the basics of linear regression models. 2. Understand the basics of generalized linear models. 3. Understand the basics of decision trees. 4. Understand the basics of principle components analysis. 5. Understand the basics of cluster analysis. Credits: 3.00

STAT 47902 - Fundamental Short Term Actuarial Mathematics

Credit Hours: 3.00. This course aligns with one of the Society of Actuaries examinations. The course will cover the learning objectives for a portion of the Society of Actuaries Examination STAM. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Calculate moments, percentiles, and generating functions. 2. Describe how changes in the parameters affect the distribution. 3. Recognize classes of distributions, including extreme value distributions, and their relationships. 4. Create new distributions by multiplication by a constraint, raising to a power, exponentiation, and mixing. 5. Identify the applications to which each distribution may apply and explain why. 6. Apply the distribution to an application, given the parameters. 7. Compare two distributions based on various characteristics of their tails, including moments, ratios of moments, limiting tail behavior, hazard rate function, and mean excess function. Credits: 3.00

STAT 49000 - Topics In Statistics For Undergraduates

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the senior level for undergraduates are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

College of Veterinary Medicine

Veterinary Nursing

Welcome from Dr. Bret D. Marsh, Dean of the Purdue College of Veterinary Medicine

Welcome to Purdue University College of Veterinary Medicine, where passion for animal and human health meets world-class education, research, and hands-on experience.

Here, you will find multiple pathways to a career in veterinary medicine-whether you are pursuing a Doctor of Veterinary Medicine degree, training to become a Veterinary Nurse/Technician, or advancing your expertise through Graduate Studies. Explore our programs and discover how Purdue can help you turn your passion into a profession

Overview

Purdue University's Veterinary Nursing Program is accredited by the American Veterinary Medical Association (AVMA). In order to practice as a credentialed (RVT, CVT, LVT) veterinary technician/nurse, most states require applicants be graduates of an accredited veterinary technology program and have passed the Veterinary Technician National Exam (VTNE). As a credentialed veterinary technician, the graduate is qualified to legally perform medical and surgical nursing, nurse-anesthetist duties, imaging, laboratory testing and dental hygiene as a member of a veterinary team. Specialty certifications are available in many subspecialties. For further information, see www.navta.net.
We offer four degree options:

- Bachelor of Science in Veterinary Nursing
- Associate of Applied Science (on-campus)
- Bachelor of Science in Veterinary Nursing Completion - for graduates of AVMA accredited veterinary technology programs wishing to complete a Bachelor of Science degree.
- Associate of Applied Science (distance learning)

Purdue Advantage:

- Rated #1 in the nation in a listing of the Top 50 Veterinary Technician Programs for 2019 by TheBestColleges.org
- 90% first-time pass rate for the Veterinary Technology National Exam (VTNE)
- Class size is limited to thirty students, keeping the faculty/instructor-to-student ratio below the national average.

Admissions

On-Campus Admission Requirements

- Bachelor of Science in Veterinary Nursing
- Associate of Applied Science (on-campus)
- Bachelor of Science in Veterinary Nursing Completion, for graduates from AVMA accredited veterinary technology programs wishing to complete a Bachelor degree.

Distance Learning Admission Requirements

- Associate of Applied Science (distance learning)

For questions on admissions requirements and procedures, contact the Purdue University Office of Admissions.
Office of Admissions
Schleman Hall of Student Services
475 Stadium Mall Drive
West Lafayette, IN 47907-0544
admissions@purdue.edu
765-494-1776

Student Services

The role of the College of Veterinary Medicine Student Services Center is to provide for recruitment, admissions, student life and career transition in the College of Veterinary Medicine. Whether you are a prospective student, a current student, or even an alum of our College, please feel free to contact our office and our staff will point you in the right direction. Schedule a Visit to the College of Veterinary Medicine

College of Veterinary Medicine
625 Harrison Street
West Lafayette, IN 47907
Phone: (765) 494-7607
pvmstudentservices@purdue.edu

Veterinary Nursing Program Office

The role of the Veterinary Nursing Program Office is to provide support and assistance to prospective and current students. Whether you are a prospective student, a current student, or even an alum of our College, please feel free to contact our office and our staff will point you in the right direction. Academic advising is a partnership between the student and advisor. Advisors empower students, assist with goal achievement, and support students with academic and personal concerns. Advisors assist students with the development and implementation of plans for academic success, and personal and career development. Students are proactive and seek assistance. They are informed and review their degree requirements and monitor their academic progress and reach out to their advisors with any questions and concerns.

Meet our Team

College of Veterinary Medicine Administration

About the Veterinary Nursing Program vet2

Veterinary Nursing Education

The Purdue Veterinary Nursing Program is fully accredited by the American Veterinary Medical Association (AVMA) and is a science based veterinary nursing program.
As an integral part of the veterinary team, veterinary nurses perform a wide range of veterinary skills:

- Radiology
- Nursing care, including pre and post-surgical care
- Anesthesia
- Client education

While a majority of veterinary nurses enter the profession in private veterinary practice, there are many other employment opportunities:

- Humane Societies and animal control facilities
- Industry
- Biomedical Research
- Veterinary Sales

Credentialing (certification, licensure, or registration) is required in the majority of states in the United States. Candidates for credentialing must pass a national and/or state examination. Most states require that only graduates of Veterinary Nursing programs accredited by the American Veterinary Medical Association (AVMA) are eligible to take the national credentialing exam and to become credentialed.

Veterinary Nursing, BSVN

Veterinary Nursing Distance Learning, AAS

Veterinary Nursing, AAS

VM 10200 - Careers In Veterinary Medicine

Credit Hours: 1.00. Overview of the field of veterinary medicine presently and as anticipated for the future. Presentations will include descriptions and discussions of the nature of the professional activity, organization of veterinary medicine, career opportunities, issues confronting the profession, and the admission requirements of the profession.

Learning Outcomes: 1. Understand the veterinary medical admission requirements and processes. 2. Determine and reflect on the cost of your veterinary medical education. 3. Understand the career opportunities in veterinary medicine. 4. Have an appreciation of the local-to-global perspective of veterinary medicine. 5. Have an awareness of issues of animal and human well-being addressed by veterinary medicine. Credits: 1.00

VM 10500 - Intro To Veterinary Nursing - DL

Credit Hours: 1.00. An introduction to the profession of Veterinary Technology will be presented. It will include the many roles of veterinary technicians on the veterinary teams in practice and non-practice areas. Learning skills with an emphasis on medical terminology will be covered to help the student develop a foundation of medical vocabulary for future

courses.

Learning Outcomes: 1. Describe the various roles of veterinary technicians on practice and non-practice veterinary teams. 2. Select appropriate strategies for dealing with personal and emotional issues confronting veterinary technicians. 3. Discuss the historical events that influenced the development of the veterinary technology profession. 4. Discuss legal and ethical issues related to the veterinary technology profession. 5. Analyze roots and affixes of medical terms as a foundation of learning medical terminology. 6. Identify common occupational hazards encountered in veterinary medicine and utilize appropriate strategies to mitigate their effects. 7. Utilize appropriate tools and strategies to be a successful online learner. Credits: 1.00

VM 10800 - Veterinary Nursing Career Exploration

Credit Hours: 1.00. This course will introduce students to basic concepts related to the veterinary technology profession. The course will provide an introduction to the various career opportunities within the veterinary healthcare profession as well as a general introduction to the attributes and traits of veterinary medical professionals. Veterinary technology as a career will be explored to promote understanding of the responsibilities of the veterinary technician and technologist in the veterinary medical field. Enrollment restricted to non-veterinary technology majors and first-year veterinary technology students. Second through fourth-year veterinary technology students may not register for this course.

Learning Outcomes: 1. Communicate knowledge of the veterinary technology profession's history. 2. Demonstrate understanding of the roles of veterinary technicians and technologists within the veterinary healthcare team. 3. Describe current legal and ethical issues in veterinary medicine. 4. Describe diversity issues in veterinary medicine. 5. Explain academic standards for the veterinary technology program. 6. Successfully navigate the admissions process for non-veterinary technology majors. 7. Apply appropriate study skills. 8. Explain appropriate use of animals in teaching and research. 9. Describe various career opportunities available within the veterinary technology profession. Credits: 1.00

VM 10900 - Veterinary Nursing Learning Community

Credit Hours: 1.00. This Learning Community course is designed for freshman in the Veterinary Nursing Program and is focused on new student integration, providing resources available on campus to facilitate student success in the first year, creating community, and introduce students to Purdue and the Program.

Learning Outcomes: 1. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 2. Engage in outside activities to build community with classmates, upperclassmen, and instructors. 3. Understand the importance of being engaged in veterinary nursing as a new student. 4. Expand knowledge of the available resources offered by Purdue University, the College of Veterinary Medicine, and the Veterinary Nursing Program that facilitate student success. 5. Demonstrate proper classroom etiquette, and how to conduct oneself appropriately when interacting with faculty, academic advisors, DVM students, upperclassmen, and other members of the campus community. Credits: 1.00

VM 11400 - Anatomy I - DL

Credit Hours: 2.00. This course is the first of two courses in the distance learning program that presents an introduction to the study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orienting the animal for diagnostic procedures and to aid in evaluating

the diagnostic imaging results obtained by such procedures. 3. Be able to identify anatomical structures on dissected specimens, skeletons, radiographs, and anatomical models. 4. Be able to integrate the anatomical differences and similarities of the common domesticated species studies in this course. Credits: 2.00

VM 11600 - Anatomy II - DL

Credit Hours: 2.00. This course is the second of two courses in the distance learning program that presents an introduction to the study of the major body systems and topographic relationships of the major domesticated species, with emphasis on the carnivore.

Learning Outcomes: 1. Obtain a basic understanding of principles that will assist with comparing anatomical structures of the domesticated animals. 2. Develop a mental structural image of the dog in order to facilitate positioning and orientating the animal for diagnostic procedures and to aid in evaluating the diagnostic imaging results obtained by such procedures. 3. Identify anatomical structures on dissected specimens; skeletons; radiographs; and anatomical models. 4. Integrate the anatomical differences and similarities of the common domesticated species studied in this course. Credits: 2.00

VM 11700 - Anatomy - DL

Credit Hours: 3.00. This course will introduce students to the general anatomy of mammalian body systems and biological processes, with an emphasis on domestic animals. The course will review body systems and comparative anatomy between canine, feline, equine, and ruminant species. It will focus on anatomy of the immune, cardiovascular, nervous, muscular, respiratory, renal, endocrine, reproductive, and digestive systems.

Learning Outcomes: 1. Describe directional, anatomical, and regional terms of major domestic species. 2. Discuss the different anatomical structures within the organ and body system levels. 3. Identify anatomical structures on images, radiographs, anatomical models, and live animals. 4. Compare and contrast between the anatomical components of the immune, nervous, muscular, cardiovascular, respiratory, renal, endocrine, reproductive, and digestive systems. 5. Evaluate comparative anatomy between major domestic species. Credits: 3.00

VM 12000 - Introduction To Veterinary Nursing I

Credit Hours: 1.00. This is the first in a two-course sequence for first-year Veterinary Nursing students. This course will introduce students to the Veterinary Nursing program and profession focusing on new student integration, providing resources available on campus to facilitate student success, and entry-level professional skill development. Students will learn and apply professional attributes of the veterinary medical professional.

Learning Outcomes: 1. Develop effective interpersonal communications skills to increase their ability to communicate within the veterinary medical team. 2. Explore career options within the field of Veterinary Nursing. 3. Cultivate a shared sense of community at Purdue through relationships with peers and instructors. 4. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 5. Understand the importance of being engaged in veterinary nursing as a new student. 6. Expand knowledge of the available resources offered by Purdue University, the College of Veterinary Medicine, and the Veterinary Nursing Program that facilitate student success. 7. Demonstrate proper classroom etiquette and how to conduct oneself appropriately when interacting with faculty, academic advisors, DVM students, upperclassmen, and other members of the campus community. Credits: 1.00

VM 12100 - Introduction To Veterinary Nursing II

Credit Hours: 1.00. This is the second in a two-course sequence for first-year Veterinary Nursing students. This course introduces the various opportunities within the veterinary healthcare profession as well as a general introduction to the

attributes and traits of veterinary medical professionals. Students will learn about veterinary clinical education and expectations and continue to explore the profession by speaking with current professionals and observing current practices.

Learning Outcomes: 1. Broaden awareness and knowledge of opportunities and challenges involved in veterinary nursing. 2. Understand attributes and traits of veterinary medical professionals and be able to apply those in a clinical education setting. 3. Explore the Veterinary Nursing Profession by speaking with current professional(s) and observing current practices. Credits: 1.00

VM 13500 - Physiology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to general physiology of the mammalian body systems and the general physiological process with emphasis on domestic animals. This course will address the functions of the different systems and homeostasis; the functions of the cell; the different compartments and solute transport; blood and defense; general functions of the nervous system, reflexes and special senses; the function of the nerve and muscle; cardiovascular system; and digestive system.

Learning Outcomes: 1. Discuss the major physiological functions of blood, and the cardiovascular, nervous, muscle, and digestive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 13600 - Physiology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that addresses the functions of the kidney and its role in regulation of extracellular volume and acid-base; respiration, mechanics of respiration and its control, transport of gases and hypoxia; physiology of the endocrine system, functions of the gonads, fertilization, pregnancy, parturition and lactation.

Learning Outcomes: 1. Discuss the major physiological functions of the respiratory, renal, endocrine, and reproductive systems and identify the organs that make each system. 2. Explain the principle of homeostasis and the use of feedback loops to control physiological systems. 3. Discuss the different physiological processes that occur at the cellular, organ, and system level. 4. Explain how changes in one system may impact other body systems. 5. Use appropriate terminology to effectively communicate information that is related to physiology and veterinary science. Credits: 1.00

VM 13700 - Physiology - DL

Credit Hours: 2.00. This course will introduce students to the general physiology of mammalian body systems and biological processes, with an emphasis on domestic animals. The course will place emphasis on the function of cellular components, blood, the immune system, and the physiology of the cardiovascular, nervous, muscular, respiratory, renal, endocrine, reproductive, and digestive systems.

Learning Outcomes: 1. Compare and contrast between the functions of the immune, nervous, muscular, cardiovascular, respiratory, renal, endocrine, reproductive, and digestive systems. 2. Discuss the different physiological processes that occur at the cell, organ, and system level. 3. Summarize the contribution of different systems to homeostasis, the maintenance of relatively constant conditions in the cellular environment. 4. Describe examples of disorders and diseases related to the body systems and identify appropriate treatments. Credits: 2.00

VM 14000 - Introduction To Veterinary Technology

Credit Hours: 1.00. This course provides an orientation to the profession of Veterinary Technology.

Learning Outcomes: 1. Become familiar with the various facets and career opportunities in the

field of Veterinary Technology. Credits: 1.00

VM 14001 - Small Animal Nursing I - DL

Credit Hours: 3.00. This is the first of two courses involving nursing and management of the small animal patient. This is the introduction to small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Introduce the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the fundamental techniques involved with reproduction, neonatal care, and pediatrics of small animals. Credits: 3.00

VM 14700 - Surgical Nursing - DL

Credit Hours: 1.00. This course is designed to instruct veterinary technician students in the basic principles of veterinary operating room protocols and sterilization of surgical supplies commonly used within a veterinary hospital. Emphasis will be placed upon key concepts of surgical preparation of the patient, and the role of the circulating nurse and surgical nurse. In addition, the concepts of proper instrument care, sterilization procedures and inventory rotation will be covered.

Learning Outcomes: 1. Know the basic roles of circulating or surgical nurse. 2. Present fundamental techniques of aseptic technique. 3. Know the concepts of sterilization of instruments and inventory rotation. Credits: 1.00

VM 14801 - Large Animal Nursing I - DL

Credit Hours: 2.00. This is the first of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary facility.

Learning Outcomes: 1. Discuss the impact of livestock health from "farm to fork", including markets. 2. Explain fundamental livestock health management and nursing concepts to clients. 3. Identify and discuss the commonalities and variations that exist between livestock species. 4. Identify the concepts of nursing care and develop a care plan for the livestock patient. 5. Know the basics of herd health management and regulatory issues of large animal species. 6. Present the fundamental techniques used in herd health management. Credits: 2.00

VM 15001 - Clinical Pathology I - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of cytological sample handling and evaluation.

Learning Outcomes: 1. Introduce the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. 3. Serve as a prerequisite course for the Clinical Pathology clinical mentorship. Credits: 2.00

VM 20100 - Medical Math And Terminology For Veterinary Nursing

Credit Hours: 1.50. A didactic course which presents the basic skills that will be used in all nursing courses and in the overall curriculum. In addition, the course introduces medical math and terminology used in veterinary medicine. Students will complete exercises utilizing math concepts for dosage calculations, conversions, proper notation, dispensing medications, fluid therapy calculations, and percent solutions. Students will use medical terminology including prefixes, roots, and suffixes of medical terms to complete exercises. This knowledge will be utilized in didactic courses and labs as well as in clinical rotations. Students will learn normal temperature, pulse and respiration values for various species. There will be both in-class and study components.

Learning Outcomes: 1. Utilize medical math to calculate drug dosages, dispense medications, fluid therapy rates, and percent solutions. 2. Apply medical math concepts to perform

conversions and use proper notation. 3. Understand and utilize medical terminology in didactic classes, laboratories, and clinic rotations. 4. Know normal temperature, pulse and respiration values for various species and report abnormalities. 5. Apply diversity and inclusion skills as they apply in veterinary medicine. 6. Discuss compassion fatigue and euthanasia in veterinary medicine. Credits: 1.50

VM 20200 - Pharmacy Procedures - DL

Credit Hours: 1.00. This course introduces students to the concepts of pharmacy procedures used in veterinary practice. Concepts covered in this course include basic record keeping, safe handling of drugs and chemicals, inventory control, calculation of amount of drugs to be dispensed or dosed, reading prescriptions, labeling drug containers, compounding, and drug regulatory matters that impact the veterinary hospital pharmacy.

Learning Outcomes: 1. Know the basics of pharmacy procedures; inventory control and regulations on how drugs are to be dispensed or stored. 2. Present the concepts of safe handling of cytotoxic drugs and chemicals. 3. Develop and practice doing dosage calculations. Credits: 1.00

VM 20500 - Small Animal Nursing Mentorship I - DL

Credit Hours: 1.50. This is the first of three clinical mentorships in small animal nursing. This clinical mentorship will require the veterinary technician student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of history taking, physical examination, simple diagnostic sample collection, parenteral and oral administration of medication, and venipuncture. Permission of department required.

Learning Outcomes: 1. Perform the basics of examination; monitoring; and history taking of veterinary patients. 2. Perform the basics of restraint. 3. Perform the basics of topical and parenteral administration of drugs. 4. Perform the basics of basic grooming and patient hygiene procedures. 5. Perform competence techniques for collecting urine and taking ear swabs for diagnostic procedures. Credits: 1.50

VM 20501 - Small Animal Nursing Mentorship I - DL

Credit Hours: 2.50. This is the first of three Clinical Mentorships in Small Animal Nursing. This Clinical Mentorship will require the student to work with a veterinary facility to perform tasks under the supervision of a clinical mentor (veterinarian or credentialed veterinary technician). This Clinical Mentorship focuses on the principles of history taking, physical examination, simple diagnostic sample collection, parenteral and oral administration of medication, and venipuncture. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Demonstrate proper examination, monitoring, and history taking of veterinary patients. 2. Demonstrate handling and restraint in dogs and cats. 3. Perform topical and parenteral administration of drugs. 4. Perform grooming and patient hygiene procedures. 5. Utilize the proper techniques for collecting urine and ear samples for diagnostic testing. Credits: 2.50

VM 20600 - Small Animal Nursing Mentorship II - DL

Credit Hours: 1.00. This is the second of three clinical mentorships in small animal nursing. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of venipuncture, catheter placement, various methods of urine collection, vaginal cytology, dental prophylaxis, and ECG tracings. Permission of department required.

Learning Outcomes: 1. Perform a jugular venipuncture of veterinary patients. 2. Perform the placement of peripheral catheters. 3.

Perform urine collection by urinary catheter and cystocentesis. 4. Perform the basics of collection and preparation of vaginal cytology. 5. Perform techniques for completing enemas; stomach tubing and diagnostic ECG tracings. 6. Perform a complete dental prophylaxis. Credits: 1.00

VM 20700 - Small Animal Nursing Mentorship III - DL

Credit Hours: 1.00. This is the third of three clinical mentorships in small animal nursing. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of oncology, dermatology, ophthalmology, and emergency care procedures. Permission of department required.

Learning Outcomes: 1. Perform fine needle aspiration of veterinary patients. 2. Perform Tru-Cut biopsy. 3. Perform sample collection for dermatophyte culture. 4. Perform Schirmer Tear Test; a fluorescein stain test. 5. Perform use of a Schiotz tonometry. 6. Perform dilation of the eye and examination of the internal eye structures. 7. Perform history on a critical patient. 8. Perform physical examination on a critical patient. 9. Perform hospitalized patient care; record keeping and observation. 10. Perform the placement of a jugular IV catheter. 11. Perform calculating; monitoring and maintaining correct IV fluid rate for critical care patients. 12. Perform the collection of an arterial blood gas sample from femoral artery. 13. Perform first aid procedures. 14. Demonstrate closed chest CPR. Credits: 1.00

VM 20800 - Farm Animal Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of basic handling, nursing, and diagnostic techniques used in large animal medicine. Permission of department required.

Learning Outcomes: 1. Perform handling and restraint techniques on cattle, sheep, goats, and swine. 2. Perform knot-tying techniques. 3. Perform assistance with food animal bandaging techniques. 4. Perform food animal sample collection techniques. 5. Perform animal injection techniques. 6. Perform data collection techniques in food animals (TPR, etc.). 7. Perform techniques for administration of oral medications in the ruminant. 8. Perform placement and maintenance of indwelling catheters in food animals. 9. Perform determination of age food animals. 10. Perform the California Mastitis Test (CMT) technique. Credits: 1.00

VM 20900 - Equine Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the principles of handling, restraint, and equine nursing care. Tasks to be documented include restraint and handling techniques, data collection, basic nursing care, and administration of medication and treatments. Permission of department required.

Learning Outcomes: 1. Perform equine restraint and handling techniques. 2. Determine age of horses. 3. Perform placement and maintenance of indwelling catheters in horses. 4. Perform data collection techniques in horses (TPR, etc.). 5. Perform hoof care and grooming techniques in horses. 6. Perform sample collection techniques in horses. 7. Perform proper placement of a mouth speculum in a horse. 8. Perform equine injection techniques. 9. Perform application of leg and tail wraps in a horse. Credits: 1.00

VM 21000 - Small Animal Anesthesia Mentorship - DL

Credit Hours: 2.00. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of anesthesia from induction, maintenance to recovery. Permission of department required.

Learning Outcomes: 1. Perform the basics of history and physical exam pertinent to anesthesia. 2. Perform the basics of patient

care before, during and after anesthesia. 3. Perform the basics of proper record keeping for patients under anesthesia. 4. Perform the basics of induction of general anesthesia in the small animal. 5. Perform the basics of patient monitoring and recovery from anesthesia. Credits: 2.00

VM 21100 - Food Animal And Equine Anesthesia-Clinical Mentorship-DL

Credit Hours: 1.00. This mentorship focuses on the principles of large animal anesthesia from induction and maintenance to recovery. Students will be required to complete projects and participate in discussions related to large animal anesthesia cases.

Learning Outcomes: 1. Demonstrate knowledge of history and physical exam pertinent to large animal anesthesia. 2. Discuss large animal patient care before, during and after anesthesia. 3. Demonstrate proper record keeping for patients under anesthesia. 4. Discuss large animal anesthesia cases related to aspects of induction, maintenance and patient monitoring, and recovery from anesthesia. Credits: 1.00

VM 21200 - Surgical Nursing Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work in a veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of operating room procedures, patient and instrument preparation for surgery and the duties of the circulating nurse and the scrub nurse. Permission of department required.

Learning Outcomes: 1. Perform the basics of instrument identification and care. 2. Perform the basics of sterilization of surgical packs and single instruments. 3. Perform the basics of patient preparation for surgical procedures. 4. Perform the basics of personal preparation for surgical procedures. 5. Perform the duties of the circulating and surgical nurse. Credits: 0.50

VM 21201 - Surgical Nursing Mentorship - DL

Credit Hours: 1.00. This clinical mentorship will require the student to work in a veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of operating room procedures, patient and instrument preparation for surgery and the duties of the circulating nurse and the scrub nurse. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Identify commonly used surgical instruments. 2. Perform instrument care. 3. Sterilize surgical packs and single instruments. 4. Prepare dog and cat patients for common surgical procedures. 5. Prepare yourself as the circulating and or surgical nurse aseptically for surgical procedures. 6. Perform the duties of a circulating and a surgical nurse. Credits: 1.00

VM 21300 - Microbiology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or microbiologist). This Clinical Mentorship focuses on the motor skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques. Permission of department required.

Learning Outcomes: 1. Perform collection of microbiology samples for culture and inoculating culture media. 2. Perform techniques for staining and completing differential tests on microbiology samples. Credits: 0.50

VM 21400 - Parasitology Mentorship - DL

Credit Hours: 0.50. This Clinical Mentorship will require the student to practice several tasks under the supervision of a clinical mentor (veterinarian, credentialed veterinary technician, or parasitologist). This Clinical Mentorship focuses on the motor

skills required to obtain samples, prepare specimens for examination, and perform technician-level diagnostic techniques.

Learning Outcomes: 1. Perform techniques for collecting samples for fecal examination. 2. Perform techniques for testing for intestinal parasites and heartworms. 3. Perform techniques for collection of samples and examination for external parasites. Credits: 0.50

VM 21500 - Small Animal Diagnostic Imaging Mentorship I - DL

Credit Hours: 1.00. This is the first of two clinical mentorships in diagnostic imaging. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of film loading, processing, presentation for viewing radiographs, care and maintenance of processors, and imaging of the thorax and abdomen. Permission of department required.

Learning Outcomes: 1. Perform the basics of film loading and unloading. 2. Perform the basics of automatic processing and manual processing. 3. Perform the basics of film labeling and presentation for viewing. 4. Perform the basics of caring for the automatic and manual processing units. 5. Perform the techniques for obtaining diagnostic views of the thorax and abdomen. Credits: 1.00

VM 21600 - Small Animal Diagnostic Imaging Mentorship II - DL

Credit Hours: 1.50. This is the second clinical mentorship in small animal diagnostic imaging. This mentorship requires the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the preparation of a technique chart, imaging of the shoulder, radius, ulna, stifle, spine, skull, and pelvis. Permission of department required.

Learning Outcomes: 1. Perform techniques for preparing a technique chart. 2. Perform diagnostic views: shoulder, radius/ulna, stifle, spine skull, pelvis, maxillary molars and premolars, mandibular molars and premolars, intraoral dental film: Mandibular premolars, Maxillary premolars. Credits: 1.50

VM 21700 - Equine Diagnostic Imaging Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the student to work with a food animal/equine veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the imaging of the carpus, fetlock, tarsus, navicular projection, P3 views, and the dorsoproximal-palmarodistal view. Permission of department required.

Learning Outcomes: 1. Produce diagnostic radiographic carpus images in the equine patient. 2. Produce diagnostic radiographic fetlock images in the equine patient. 3. Produce diagnostic radiographic tarsus images in the equine patient. 4. Produce diagnostic radiographic Coffin Bone images in the equine patient. Credits: 0.50

VM 21701 - Equine Diagnostic Imaging Mentorship - DL

Credit Hours: 1.00. This clinical mentorship will require the student to work with an equine veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the imaging of the carpus, fetlock, tarsus, navicular projection, P3 views, and oblique radiographic views. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Produce diagnostic radiographic carpus images in the equine patient. 2. Produce diagnostic radiographic fetlock images in the equine patient. 3. Produce diagnostic radiographic tarsus images in the equine patient. 4. Produce diagnostic radiographic Coffin Bone images in the equine patient. Credits: 1.00

VM 21800 - Small Animal Diagnostic Imaging Mentorship - DL

Credit Hours: 2.00. This mentorship will require the student to work with a small animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This mentorship focuses on the principles of radiographic presentation for viewing radiographs, radiation safety, usage of a radiographic technique chart and log, imaging of the thorax and abdomen, imaging of orthopedic areas (thoracic limb, pelvic limb, skull), dental intraoral imaging. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Demonstrate proper radiographic presentation techniques. 2. Label radiographic images according to machine standard conventions accurately. 3. Utilize a radiographic technique chart and a radiographic log to ensure accurate exposure settings. 4. Perform diagnostic radiographic imaging of the thorax and abdomen of feline and canine patients while adhering to radiation safety protocols. 5. Obtain high-quality orthopedic radiographic images of the thoracic and pelvic limb, and skull while maintaining proper radiation safety. 6. Execute full-mouth intraoral dental radiography with proper positioning and techniques while following proper radiation safety. Credits: 2.00

VM 22100 - Laboratory Animal Health II -DL

Credit Hours: 1.00. This course is the second of two courses that provide basic instruction in the concepts of laboratory animal health management to the veterinary technician student. This course will place an emphasis on the care of laboratory animals as well as specific procedures that are used in laboratory animal medicine.

Credits: 1.00

VM 22300 - Pharmacy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship will require the veterinary technician student to work with a veterinary care facility to practice tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of drug order fulfillment, reconstitution of medications, correct storage of medications (including controlled substances), safe handling of hazardous medications, and inventory control procedures. Permission of department required.

Learning Outcomes: 1. Interpret accurately a DVM medication order and transcribe that order onto a prescription label of the appropriate type for the container used, with appropriate information on the label. 2. Interpret accurately DVM orders for an oral solid and an oral liquid medication and fill the orders. 3. Interpret accurately DVM orders and reconstitute a medication for dispensing and a vaccine for administration to a patient. 4. Dispense an oral liquid medication and topical medication to a client, explaining medication administration, administration devices, and special instructions if indicated. 5. Describe appropriate storage and record keeping of controlled substances in a veterinary practice. 6. Describe the process for pharmacy inventory in a facility and critique the process. 7. Describe safe storage and handling of biological and hazardous medications. Credits: 0.50

VM 22400 - Necropsy Mentorship - DL

Credit Hours: 0.50. This clinical mentorship focuses on the motor skills and techniques in performing a basic prosection (necropsy). Tasks include basic necropsy technique, techniques for sample collection and storage, and safety issues related to handling animal specimens. Course is offered as Distance Learning. Permission of department required.

Learning Outcomes: 1. Perform the basics of necropsy on a non-preserved animal. 2. Perform techniques for sample collection, storage and shipping from a necropsied animal. 3. Perform techniques for handling rabies

suspect bodies and samples safely. 4. Perform the proper storage and disposal of dead animals. Credits: 0.50

VM 22500 - Advanced Clinical Mentorship - DL

Credit Hours: 1.50. This clinical mentorship will require the student to complete 120 hours of additional work experience while completing a series of selected projects related to veterinary medicine. Permission of department required.

Learning Outcomes: 1. Perform 120 hours experience in a practice. 2. Describe cases and procedures. 3. Perform quality improvement project related to the functioning of the veterinary facility. 4. Perform client education. 5. Perform a presentation to the public or peer group. Credits: 1.50

VM 22501 - Parasitology - DL

Credit Hours: 2.00. This course provides basic instruction in the concepts of parasitology to the veterinary technician student. Emphasis will be on the basic information needed to accurately identify parasites commonly encountered in veterinary medicine. Emphasis will also be placed on life cycles and zoonotic aspects of the parasites covered.

Learning Outcomes: 1. Identify parasite diagnostic stages. 2. Describe the life cycles, transmission, basic pathogenesis, zoonotic aspects, adult parasite predilection site, clinical manifestations and parasitic control methods for parasites. 3. Apply appropriate public health information to clients regarding the common parasites of domestic animals. Credits: 2.00

VM 22600 - Lab Animal Mentorship - DL

Credit Hours: 1.00. This clinical mentorship focuses on the motor skills involved with the basic handling, restraint, administration of medication and nursing care of laboratory animals. Permission of department required.

Learning Outcomes: 1. Perform the basics of handling and restraint of rabbits and rodents. 2. Perform the determination of sex of rabbits and rodents. 3. Perform the basics of drug and medication administration in rabbits and rodents. 4. Perform the basics of blood collection in rabbits and rodents. Credits: 1.00

VM 22700 - Clinical Pathology Mentorship - DL

Credit Hours: 2.00. This clinical mentorship will require the student to work with a laboratory, small or large animal veterinary care facility to practice several tasks under the supervision of a clinical mentor. This clinical mentorship focuses on the principles of blood film evaluation for different species, manual and automated CBCs, normal and abnormal cellular morphology, urinalysis, chemistry panels, and differentials. Permission of department required.

Learning Outcomes: 1. Perform a total protein and packed cell volume. 2. Perform a unopette WBC and platelet count. 3. Perform manual and automated evaluation of normal and abnormal CBCs. 4. Perform urinalysis, chemistry panels and electrolyte screenings. 5. Perform ELISA testing and hormone assay. 6. Perform morphology evaluation and differentials. Credits: 2.00

VM 22701 - Clinical Pathology Mentorship - DL

Credit Hours: 1.00. This mentorship will require the student to work with a laboratory within a small or large animal veterinary care facility to complete clinical pathology tasks under the supervision of a clinical mentor. The mentorship tasks will focus on the principles of microscope use, urinalysis, blood sample collection and preparation, manual and automated CBCs, differentials, chemistry panels, coagulation, crossmatch, and normal vs. abnormal cellular morphology. In order to achieve the goals for this Clinical Mentorship, the tasks must be performed to the level of competency as outlined by the criteria for each task. The submitted videos should demonstrate proficiency in performing skills that have been learned and practiced until the student feels comfortable. While occasional guidance from the mentor is acceptable during the learning phase, video submissions must show that the student can execute the task independently, smoothly, and competently without excessive direction or outside assistance. All tasks must be performed without reliance on the Task Verification Form or other written sources during the video. Video demonstration of each skill should reflect the ability to perform the skill autonomously, as would be expected in clinical practice.

Learning Outcomes: 1. Demonstrate appropriate use, care, and cleaning of microscopes. 2. Prepare blood samples for chemistry panel. 3. Properly prepare and accurately evaluate a blood film, including a

normal and abnormal differential. 4. Properly collect, process, and accurately evaluate cellular findings for vaginal and auricular cytology. 5. Perform, read, and record results of the following- basic urinalysis, packed cell volume, total protein, and hematology panel (CBC), chemistry panel and agglutination test, coagulation test, crossmatch procedure. Credits: 1.00

VM 22800 - Integrations - DL

Credit Hours: 2.00. This course will provide instruction in the concepts problem based learning for the nursing process (patient evaluations, interventions, and desire resolutions) using a cased based approach. This course will integrate foundational knowledge form anatomy, physiology, with the information in the veterinary nursing courses. Cases will involve different domestic animal species.

Learning Outcomes: 1. Identify and apply the components of nursing process (physical exam, patient history, SOAP). 2. Explain the rationale for using the nursing process as it relates to veterinary patient care. 3. Identify and explain how patient interventions change the physiology of the animal. 4. Integrate and apply knowledge from foundation courses to understand the rationale behind nursing intervention in clinical cases. 5. Identify individual strengths in problem solving as a part of a small group. 6. Apply the elements of critical thinking in case studies. Credits: 2.00

VM 22900 - Lab Animal Medicine - DL

Credit Hours: 2.00. This course will provide instruction in the concepts of Laboratory Animal Health Management to the veterinary technician student. This course will place an emphasis on the information needed to work with laboratory animals as well as issues that apply to laboratory animal medicine along with the care of laboratory animals and exotics and specific procedures that are used in laboratory animal and exotic pet medicine. Students are expected to achieve a level of understanding of laboratory animal care and management so that they will be able to communicate effectively with the veterinarian and other individuals.

Learning Outcomes: 1. Explain the concepts of animal welfare and animal rights. 2. Introduce the student to the basic concepts of laboratory animal medicine. 3. Explain basic laboratory animal housing and environmental control concepts. 4. Identify the basic concepts of experimental methodology. 5. Introduce the student to the different laboratory animals and exotic pocket pets. 6. Explain basic restraint, husbandry, and anesthesia of laboratory animals and pocket pets. Credits: 2.00

VM 23000 - Public & Occupational Health -DL

Credit Hours: 1.00. This is the first of two courses that provide basic instruction in the concepts of workplace safety related to the veterinary technician. This course will place an emphasis on the basic information needed to recognize hazards commonly encountered and the steps that should be taken to reduce the risk of exposure to hazards. Other practical aspects of public health will be discussed.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Locate current information related to veterinary medical occupational hazards. 4. Communicate appropriate safety principles to colleagues and the public. Credits: 1.00

VM 23001 - Small Animal Nursing II - DL

Credit Hours: 2.50. This is the second of two courses involving nursing and management of the small animal patient. This course continues the concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Demonstrate the basics of small animal nursing care. 2. Present the fundamental techniques used in small animal nursing care. 3. Introduce the nursing aspects of managing common small animal diseases. 4. Introduce small animal breeds. 5. Present the

fundamental techniques involved with critical care and management of common diseases of small animals. Credits: 2.50

VM 23100 - Diagnostic Imaging - DL

Credit Hours: 3.00. This course involves principles of imaging that are necessary for the performance of diagnostic imaging procedures in a veterinary hospital. This course provides an introduction to x-ray generation, image formation, exposure factors, scatter radiation, grids, film, screens, safety, basic terminology, positioning, darkroom techniques, artifact identification, advanced positioning techniques for the small animal, large animal techniques, contrast techniques, technique charts, basic ultrasound, diagnostic imaging in exotic animals.

Learning Outcomes: 1. Explain the basic and advanced concepts of diagnostic imaging for small and large animal patients. 2. Describe fundamental techniques used in setting up, taking, and developing radiographs. 3. Explain concepts of safe use of radiographic equipment. 4. Present key points on assessment of radiographic technique. 5. Describe techniques used in large animal, exotics, and special procedures. 6. Explain the process required to develop a radiographic technique chart. 7. Explain the basic information regarding ultrasound. 8. Differentiate the uses for CT/MRI. Credits: 3.00

VM 23200 - Principles Of Anesthesia - DL

Credit Hours: 3.00. This course involves the basic principles of anesthesia and anesthetic delivery for the veterinary technician. This course focuses on the preparation of the patient for anesthesia, the agents used as pre-anesthetics, induction agents and general anesthesia, the physiologic impacts of anesthesia on the body, multi-species anesthetic techniques (small animal, large animal/equine, pocket pets), managing high risk patients, anesthetic complications, and pain management.

Learning Outcomes: 1. Discuss the preparation of the patient and equipment for anesthesia. 2. Explain the agents used, advantages/disadvantages, and indications/contraindications of pre-anesthetics, induction agents and general anesthetic agents. 3. Describe the physiologic impacts of anesthesia on the body. 4. Explain the different anesthetic techniques required for multiple species (small animal, bovine, equine, porcine, small ruminant, and pocket pets). 5. Discuss the management of high risk patients. 6. Recognize anesthetic complications and the steps to prevent. 7. Discuss the options for pain management in all species. Credits: 3.00

VM 23300 - Optho, Derm & Oncology - DL

Credit Hours: 1.00. This course involves the instruction of nursing and management of small animal patients related to ophthalmology, dermatology, and oncology. It presents concepts of small animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient, and preventative medicine related to these specific clinical disciplines. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Know the basics of ophthalmology; dermatology and oncology. 2. Present the fundamental techniques used in ophthalmology; dermatology and oncology. 3. Know the nursing aspects of managing some common small animal diseases. Credits: 1.00

VM 23400 - Microbiology - DL

Credit Hours: 2.00. This course is designed to enable the veterinary technician to satisfactorily collect and process specimens, and characterize and identify microorganisms that may be encountered in veterinary practice situations. This course will introduce microorganisms commonly encountered in veterinary medicine. Different laboratory techniques will be illustrated.

Learning Outcomes: 1. Identify the common microorganisms seen in veterinary medicine and describe characteristics of each and the diseases that they cause including zoonotic implications that may be applicable. 2. Apply biochemical tests to aid in the identification of microorganisms. 3. Explain appropriate public health information to clients regarding the diseases of domestic animals caused by common microorganisms. Credits: 2.00

VM 23500 - Pharmacology I - DL

Credit Hours: 1.00. This course is the first of two courses in the distance learning program that presents an introduction to the principles of pharmacy and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs, and dosage calculations.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of pharmaceuticals. Credits: 1.00

VM 23600 - Pharmacology II - DL

Credit Hours: 1.00. This course is the second of two courses in the distance learning program that presents an introduction to the principles of therapeutics and pharmacology for the veterinary technician. Emphasis will be placed upon key concepts of how drugs work, terminology commonly used with therapeutic agents, important mechanisms and side effects of commonly used veterinary drugs.

Learning Outcomes: 1. Recognize groups of drugs, their mechanisms, clinically relevant side effects and therapeutic responses. 2. Perform appropriate drug calculations accurately. 3. Describe proper handling and storage of pharmaceuticals. Credits: 1.00

VM 23701 - Large Animal Nursing II - DL

Credit Hours: 3.00. This is the second of two courses involving nursing and health management of the large animal patient. This is the introduction to large animal patient care and treatment that a technician will be expected to provide in a veterinary practice. It includes techniques, equipment, client education, management of the hospitalized patient and preventative medicine. Emphasis will be on the role of the veterinary technician in the veterinary facility.

Learning Outcomes: 1. Explain fundamental individual patient management and nursing concepts to clients. 2. Identify the concepts of nursing care and develop a care plan for the individual patient. 3. Explain the basics of individual patient management of the large animal species. 4. Present the fundamental techniques used in individual patient management. Credits: 3.00

VM 23900 - Dentistry - DL

Credit Hours: 0.50. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs 5. Develop and provide client education. Credits: 0.50

VM 24000 - Nutrition - DL

Credit Hours: 1.00. This course will provide an overview of nutritional concepts as they apply to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as the therapeutic use of diets as they relate to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediataric stages to adulthood. 5. Define specific differences in diets based upon breeds (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of

the technician and veterinarian. Credits: 1.00

VM 24100 - Occupational & Public Health I

Credit Hours: 1.00. This course will cover selected zoonotic diseases, occupational hazards and safety issues, related to the veterinary health care team and veterinary facility.

Learning Outcomes: 1. Select and utilize the appropriate measures to prevent occupational safety incidents and facility safety incidents. 2. Mitigate the effects of an occupational safety incident or facility safety incident. 3. Understand where to find current information related to veterinary medical occupational hazards. 4. Effectively communicate appropriate safety principles to colleagues. Credits: 1.00

VM 24200 - Integrations I

Credit Hours: 1.00. An introduction to problem based learning of the nursing process (patient evaluations, interventions, and desired resolutions) using a case based approach. This course will integrate foundational knowledge from anatomy, physiology, with information in the veterinary nursing courses. Cases will involve different domestic animal species. Students will learn using a variety of teaching modalities (lecture, group work, problem based learning).

Learning Outcomes: 1. Identify and apply the components of nursing process (physical exam, patient history, SOAP). 2. Explain the rationale for using the nursing process as it relates to veterinary patient care. 3. Identify and explain how patient interventions change the physiology of the animal. 4. Integrate and apply knowledge from foundation courses to understand the rationale behind nursing intervention in clinical cases. 5. Identify individual strengths in problem solving as a part of a small group. 6. Use verbal and written communication skills appropriately with other members of the veterinary team, with clients, and the general public. Credits: 1.00

VM 24300 - Clinic Rotations I

Credit Hours: 1.50. This course will provide the basic learning situations for developing the techniques required of veterinary technicians in pharmacy, radiology, surgery, medical nursing, and ancillary areas. Total clinic hours 9/week.

Learning Outcomes: 1. Become acquainted with clinical areas, personnel, responsibilities and basic procedures. 2. Perform basic nursing duties as they are learned in concurrent courses and by experience. 3. Become familiar with the veterinary team concept and its benefit to patient care. Credits: 1.50

VM 24400 - Clinical Rotations II

Credit Hours: 1.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed basic nursing duties learned in previous courses and as they are learned in concurrent courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 1.50

VM 24500 - Veterinary Management Topics - DL

Credit Hours: 1.50. This course is the first of two courses that provide basic instruction in the concepts of a veterinary technician's role in the management of day-to-day operations of a veterinary clinic. This course will emphasize problems related to ethical and liability issues, medical records, inventory, marketing and fees, writing cover letters and resumes, and job interviews. Students must be currently working/volunteering at least 10-15 hours a week at a veterinary facility.

Learning Outcomes: 1. Plan and manage a job search in the veterinary profession. 2. Analyze the ethical issues that can confront veterinary technicians. 3. Apply effective strategies for communicating with clients and coworkers and providing excellent client service and client retention. 4. Develop and implement appropriate strategies for marketing a practice's products and services. 5. Develop and implement appropriate strategies for inventory management, fee-setting strategies and medical records management. Credits: 1.50

VM 24800 - Animal Disease - DL

Credit Hours: 2.00. This course is a survey of common small animal and large animal diseases, their clinical signs, and how these signs can be explained by physiology and pathophysiology. The zoonotic potential for the disease and the role of the veterinary technician in the treatment, management, and education of client/owner of the affected animal is also emphasized.

Learning Outcomes: 1. Identify the key features of common small animal and large animal disease. 2. Explain the role of the veterinary technician in the management of these diseases. 3. Explain the zoonotic potential and public health potential of these disease to clients and peers. Credits: 2.00

VM 24900 - Clinical Rotations III

Credit Hours: 3.50. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities, and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 3.50

VM 25001 - Clinical Pathology II - DL

Credit Hours: 2.00. This course is the second course that provides basic instruction in the concepts of Clinical Pathology to the veterinary technician student. This course will include hemostasis; immunohematology; the basic concepts of clinical chemistry; urinalysis evaluation; and the fundamentals of cytological sample handling and evaluation.

Learning Outcomes: 1. Understand the basics of clinical pathology. 2. Present fundamental techniques used in performing various laboratory tests. Credits: 2.00

VM 25100 - Medical Math And Terminology For Veterinary Technicians

Credit Hours: 0.50. This course will introduce students to fundamental medical terminology and basic math and dosage calculations commonly used in veterinary medicine. The course includes both classroom and on-line components.

Learning Outcomes: 1. The student will be able to identify and recognize the part of a medical term, define the meaning of commonly used prefixes combining forms and suffixes, recognize and correctly apply approximately 350 basic medical terms. 2. The student will be able to recognize the importance of spelling and pronouncing medical terms correctly. 3. The student will be able to calculate doses of medication and fluid administration rates for patients. 4. The student will be able to calculate concentrations of percent solutions, and calculate amount of a medication to dispense given the dosage and drug concentration or strength. Credits: 0.50

VM 32300 - Laboratory Animals & Exotic Pet Medicine-VN

Credit Hours: 2.00. This course will cover the proper methods of restraint, daily care, nursing techniques, and housing needs for the common species of laboratory animals.

Learning Outcomes: 1. Understand nutritional requirements, physiological data, anesthesia, blood collection, drug administration, handling, sexing, and common diseases of laboratory rodents, primates, and lagomorphs as well as non-traditional pets including small mammals, fish, amphibians, reptiles, and birds. 2. Familiarization with laboratory housing, environmental control, and environmental enrichment concepts. 3. Familiarization with basic genetics and breeding programs of laboratory animals. 4. Understand sanitation and hygiene procedures as they relate to laboratory animal management. 5. Introduce concepts of experimental methodology and regulatory compliance within laboratory animal medicine. 6. Introduce wildlife triage and wildlife nursing techniques. Credits: 2.00

VM 34200 - Integrations II

Credit Hours: 1.00. A continuation to problem based learning of the nursing process using a case based approach. This course will integrate foundational knowledge from anatomy, physiology, veterinary nursing courses, clinical pathology, pharmacology, anesthesia diagnostic imaging, microbiology and parasitology. Cases will involve different domestic animal species and laboratory animals. Students will learn using a variety of teaching modalities (lecture, group work, problem-based learning).

Learning Outcomes: 1. Apply previous knowledge of the nursing process. 2. Apply the elements of critical thinking in case studies. 3. Integrate and apply knowledge from other courses to explain the rationale behind nursing cases. 4. Identify individual strengths of all members in problem solving as a part of small group learning. Credits: 1.00

VM 34210 - Integrations-VN

Credit Hours: 2.00. This course will give an introduction to problem-based learning of the nursing process (patient evaluations, interventions, and desire resolutions) using a case-based approach. This course will integrate foundational knowledge from anatomy, physiology, and information in the veterinary nursing courses. This course will draw on fundamentals and concepts learned from all courses to this point including pharmacology, diagnostic imaging, parasitology, small animal nursing, and large animal nursing, so as to enable you to apply knowledge of understanding of clinical cases. Cases will involve different domestic animal species.

Learning Outcomes: 1. Integrate and apply knowledge from foundational coursework. 2. Identify and apply the components of the veterinary nursing process. 3. Follow evidence-based medicine practices and relate to patient case scenarios. 4. Utilize critical thinking skills to apply the veterinary nursing process to patient case scenarios. 5. Use verbal and written communication skills appropriately with other members of the veterinary team. Credits: 2.00

VM 34300 - Clinic Rotations IV-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34400 - Clinic Rotations V-VN

Credit Hours: 5.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increased awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Performed nursing duties learned in previous courses and by experience. 3. Participated in the utilization of the veterinary team concept and contributed to its patient care benefits. Credits: 5.00

VM 34500 - Veterinary Management Topics I-VN

Credit Hours: 1.50. The course will introduce students to concepts related to working in and managing a veterinary practice. Emphasis will be on client communication and education as well as facilitating a job search, interviewing and cover letter and resume creation.

Learning Outcomes: 1. Create a professional cover letter and resume. 2. Properly prepare for and participate in employment interviews. 3. Utilize techniques that build excellent relationships by exceeding client expectations, providing great client service and building a rapport with clients. 4. Utilize techniques for handling emotional or difficult clients. 5. Utilize techniques for working with special needs clients. 6. Explain the grief process. 7. Discuss professionalism and legal and ethical issues related to the veterinary technology profession. 8. Describe the ways in which fees are set for products and services at a veterinary clinic. 9.

Define marketing and describe how marketing strategies can be used in a veterinary clinic setting. 10. Describe inventory management strategies. 11. Identify professional organizations related to veterinary technology and veterinary practice management. Credits: 1.50

VM 36500 - Laboratory Animal Management-VN

Credit Hours: 3.00. This course will cover the principles of laboratory animal science for the technologist (veterinary and LATG). Concepts of facility management, animal health and diseases, regulatory issues, compliance, and instrumentation will be presented.

Learning Outcomes: 1. Gain a broader knowledge of facility design, facility management, regulatory compliance, disaster planning and fiscal management. 2. Gain exposure to research protocol development, animal use alternatives, and the use of non-rodent models in research. 3. Gain an in-depth look at rodent breeding colony management and animal health. Credits: 3.00

VM 39000 - Practicum

Credit Hours: 4.00. Veterinary technologist level off-campus experience in one area of interest totaling 480 hours over 12 weeks.

Credits: 4.00

VM 40900 - International Veterinary Medicine

Credit Hours: 0.50. The course will consist of a series of lectures and discussions addressing international aspects of veterinary medicine. The course will include the following topics: foreign animal diseases, biosecurity, animal welfare and ethics, veterinary medicine around the world, food security, and cultural competence.

Learning Outcomes: 1. Become familiar with international issues that impact the veterinary profession. 2. Develop an understanding of the role that veterinary professionals play in global education and global health. 3. Develop respect for diverse people and cultures. 4. Develop an understanding of the skills required for working across cultures. 5. Develop the knowledge and skills necessary to keep themselves and others safe when traveling internationally and to maximize the benefits of their experience. Credits: 0.50

VM 41001 - International Practicum

Credit Hours: 4.00. The student will experience an integrated employment situation combined with veterinary team interaction to augment his/her specialized CoVM clinical learning experiences. The student will work under the direct supervision of a licensed veterinarian or credentialed veterinary technician designee of tech veterinarian. The student is required to complete a pre-departure orientation with the PVM Director of International Programs.

Learning Outcomes: 1. Perform technical duties in medical and surgical nursing, imaging, laboratory procedures, anesthesia, and client interaction when working in a practice setting. 2. Perform tech duties required of the position in the industry setting. 3. Observe and record the case cycle concept of vet med in its components of history, assessment, problem listing, interventions and actions, potential problems encountered, patient outcomes and evaluations, and discharge planning as it pertains to veterinary nursing. 4. Identify and critically address management issues. 5. Create and deliver an oral presentation. 6. Develop communication skills. Credits: 4.00

VM 41003 - International Veterinary Medicine for the Veterinary Nurse - Directed Experience

Credit Hours: 0.50 to 2.00. This course allows veterinary technology students to participate in a unique faculty/staff-led veterinary learning experience in an international location. Credit will be assigned on the basis of 0.5 credit for each 45-60 hours of student effort, up to a max of 2 credits. In most instances, one week of experience will equal 0.5 credit. Each veterinary learning experience will be designed by the faculty/staff leader to accomplish specific learning goals in the focused area of study. The course will vary in length from 1-4 weeks depending on the specific experience.

Learning Outcomes: 1. Increase student's understanding of a focused area of veterinary medicine in its international context. 2. Develop

an understanding of the importance of a global education. 3. Increase awareness of global health issues. 4. Become aware of international veterinary career options. 5. Encourage leadership development and diversity awareness. 6. Develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 7. Foster relationships between Purdue University and international colleagues. Credits: 0.50 to 2.00

VM 42500 - Veterinary Technician Grand Rounds

Credit Hours: 0.00. Provides a regular forum to bring those in the college together, focused around their common interest in veterinary medicine. Case-based presentations emphasize the basic pathophysiology of disease and clinical investigation and demonstrate the interactions between the clinical and basic sciences.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to international educational opportunities that are available to them. 3. Expose students to the breadth of career opportunities that are available to veterinarians, veterinary technicians, and veterinary technologies. Credits: 0.00

VM 44100 - Occupational & Public Health II-VN

Credit Hours: 1.00. The course covers selected aspects of public health and safety related to the veterinary health care team, patient, client and public.

Learning Outcomes: 1. Able to select and utilize the appropriate measures to assist in preventing problems or mitigate their effects. 2. Able to seek, select, compile and effectively communicate appropriate material to their colleagues, the clients and public. Credits: 1.00

VM 44200 - Veterinary Management Topics II-VN

Credit Hours: 1.50. This course is a continuation of the first veterinary practice management course. It will introduce students to concepts related to leading a veterinary medical team and managing the day-to-day management of the veterinary practice. Emphasis will be on human resources, marketing and financial management.

Learning Outcomes: 1. Describe the attributes of a good leader. 2. Create a personal financial plan (i.e. budget) use credit wisely. 3. Describe strategies for recruiting, managing, and motivating employees. 4. Utilize techniques for proper delegation of work within a veterinary facility. 5. Create effective client surveys. 6. Use social media to effectively market a veterinary facility. 7. Create and interpret financial statements. 8. Describe techniques used for controlling expenses at a veterinary facility. 9. Assess a veterinary facility's financial performance by utilizing industry benchmarks. Credits: 1.50

VM 44300 - Clinic Rotations VI-VN

Credit Hours: 2.00. This course will provide clinical learning situations for developing techniques required for veterinary technicians in surgery, medical nursing, clinical pathology, radiology, pharmacy, and ancillary areas.

Learning Outcomes: 1. Increase awareness of clinical areas, personnel, responsibilities and basic procedures. 2. Perform nursing duties learned in previous courses and by experience. 3. Participate in the utilization of the veterinary team concepts and contributed to its patient care benefits. Credits: 2.00

VM 44400 - Veterinary Technology Clinical Orientation

Credit Hours: 3.00. This course is an intensive experience and clinical orientation to the Veterinary Teaching Hospital for graduates from another AVMA accredited Veterinary Technology program who wish to complete a BS degree at Purdue University. This course is a four week long, full day rotation (40 hours per week).

Learning Outcomes: 1. Function effectively in the clinical ancillary areas of the Veterinary Teaching Hospital complex. 2. Demonstrate

compliance with VTH policies and procedures. 3. Demonstrate an understanding of Purdue nursing methodologies and skills utilized in the VTH. 4. Self-identify areas of technical skills which will require further development to attain standards of performance expected of Purdue Veterinary Technologists. 5. Perform nursing duties assigned by instructors, and participate as a fully functioning member of the veterinary team and effectively contribute to patient care. Credits: 3.00

VM 44500 - Senior Project-VN

Credit Hours: 4.00. This is an independent study course in which the student engages in learning activities to enhance their knowledge in a particular area of veterinary technology of their choosing, demonstrate effective oral and written communication, and apply analysis, integration, and syntheses to achieve a solution.

Learning Outcomes: 1. Acquisition of knowledge at the veterinary technologist level in an area of interest or focus. 2. Demonstrate effective oral communication. 3. Demonstrate effective written communication. 4. Demonstrate the ability to analyze, integrate, and synthesize a solution to solve a problem. Credits: 4.00

VM 45000 - Animals in Emergencies - Disaster Management-VN

Credit Hours: 1.00. The course is intended to assist animal care providers in understanding the incident command system and developing plans that improve the care of and mitigating the impact of disasters on livestock and pets.

Learning Outcomes: 1. Increase awareness and preparedness among animal care providers regarding animals in disasters. 2. Describe how the Incident Command System (ICS) is involved in managing animals in disasters. 3. Identify potential hazards and threats in their area - Describe how hazards affect animals and what can be done to reduce the impact of those hazards, including animal suffering and economic losses. 4. Assist in developing effective plans for managing animals in emergencies. Credits: 1.00

VM 45100 - Contemporary Topics In Life Skills-VN

Credit Hours: 1.00. This course will introduce the student to a variety of different skills needed to be successful after graduating from college. It will introduce students to concepts related to managing a job search and evaluating job offers, establishing and using credit, investing, saving, risk assessment and managing college debt.

Learning Outcomes: 1. Effectively manage personal finances and devise an appropriate plan for saving for retirement. 2. Discuss the pros and cons of using credit and strategies for monitoring credit on an on-going basis. 3. Describe appropriate strategies for the effective management of time and stress. 4. Organize and execute an effective job search. 5. Compare and contrast renting vs. buying a home and describe the mortgage process. 6. Implement appropriate strategies for managing student loan debt. 7. Manage risk via the utilization of appropriate types of insurance (life, car, house, health, disability, etc.). 8. Gather the appropriate information needed to file taxes and utilize the most advantageous form for filing taxes. Credits: 1.00

VM 45300 - The Role Of The Clinical Research And Diagnostic Technician

Credit Hours: 1.00. This course is aimed for the student with an interest in clinical trial research or diagnostic medicine. The student will gain a broader knowledge of the vital team role the clinical research technician/nurse and diagnostic laboratory technician plays. The student will gain exposure to the various laboratories in a diagnostic laboratory and the clinical research laboratory. Enrollment minimum is 5 students per semester.

Learning Outcomes: 1. Understand the importance of the technician/nurse in clinical research and diagnostic laboratories. 2. Increase knowledge of the different equipment and supplies used in diagnostic laboratories for the different laboratories. 3. Understand the importance of standard operating procedures and validation of diagnostic tests. 4.

Understand the clinical research's role in implementing new procedures. Credits: 1.00

VM 45400 - Animal Rehabilitation And Physiotherapy

Credit Hours: 1.00. This course is an introduction to physical rehabilitation of the veterinary patient. It is designed to instruct students in the basic principles of rehabilitation. This course will introduce the fundamentals needed in clinical practice.

Learning Outcomes: 1. The student will be able to apply the principles of biomechanics and anatomy to the movement of animal patients. 2. The student will be able to identify clinical situations where physical rehabilitation may be applicable to patient care and develop a basic therapeutic exercise plan for a canine, feline or equine patient. Credits: 1.00

VM 45500 - Equine Behavior-VN

Credit Hours: 1.00. This course is an in-depth look at equine behavior beyond the basics covered in the nursing courses. It is designed to show how the environment in which the horse is kept can affect its behavior. This course will also demonstrate how the study of behavior is applied in equine welfare and to the solution of practical problems and problem behavior in the equine patient.

Learning Outcomes: 1. The student will be able to understand the natural behavior of the equine patient, recognize the different behaviors of equines in various working environments. 2. The student will be able to discuss methods used to assess the welfare of equines, appreciate the specific welfare issues associated with equines, and evaluate the current research in equine behavior and welfare. Credits: 1.00

VM 45600 - Advanced Ophthalmology-VN

Credit Hours: 1.00. This course is an in-depth look at ocular anatomy and physiology, use of exam equipment, diagnostic techniques, imaging, pharmacology, surgical instrument identification, cleaning, and care of instruments, surgical nursing, surgical procedures, anesthesia protocols and concerns that are associated with these procedures.

Learning Outcomes: 1. Identify ophthalmic surgical instruments. 2. Explain care and use of ophthalmic surgical instruments. 3. Identify and locate ocular lesions. 4. Explain anesthetic protocols for various ophthalmic surgeries. 5. Explain the when, why, and how of advanced exam techniques including imaging. 6. Identify commonly used ophthalmic medications and relate them to ocular physiology and the treatment of eye conditions. 7. Comprehend proper equine restraint and sedation protocols. 8. Describe an equine pre purchase exam. 9. Compare and contrast "field" ophthalmology with "in clinic" ophthalmology. 10. Evaluate ophthalmic issues for sport/show horses and medication rules. 11. Identify ocular lesions associated with systemic disease. Credits: 1.00

VM 45700 - Advanced Neurology-VN

Credit Hours: 1.00. This course will focus on neuroanatomy and neurophysiology as well as explore a variety of common neurologic diseases and the basic pathophysiology behind those disease processes. Students will also learn proper nursing care techniques associated with patients with these diseases.

Learning Outcomes: 1. Become knowledgeable with the functional anatomy of the nervous system. 2. Localize lesions to regions of the brain, spinal cord or peripheral system. 3. Become familiar with a variety of neurologic diseases commonly presented to general or private practice and demonstrate an organized approach to identifying these diseases. 4. Ability to understand the basic principles of nursing care for neurologic diseases. Credits: 1.00

VM 45800 - Advanced Surgical Nursing And Anesthesia

Credit Hours: 1.00. This course is an in-depth look at small animal surgical nursing, surgical procedures, surgical instrumentation, wound management and the physiological reason certain anesthetic protocols are used. Students will learn using a variety of teaching modalities.

Learning Outcomes: 1. Identify and explain the physical exam findings and physiological

changes of a patient that is a possible surgical case. 2. Explain the physiological reasons and pharmacological impact for anesthetic protocol choices for the critical patient. 3. Maintain and troubleshoot surgical instrumentation. 4. Explain different pain management including epidurals, ring blocks and brachial plexus blocks. 5. Explain the additional critical surgical nursing components that are required for the neonatal and critical care surgical patient. 6. Explain wound management and identify the nursing skills required to care for the patient with the problematic wound. Credits: 1.00

VM 49000 - Topics In Veterinary Medicine

Credit Hours: 0.50 to 5.00. Advanced study in the field of animal health and practice of veterinary medicine. Permission of instructor required.

Credits: 0.50 to 5.00

Department of Basic Medical Sciences

Overviewvet8

The Department of Basic Medical Sciences (BMS) offers graduate programs leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D) degrees. The Department emphasizes integrative studies that are applicable to animal and human health. Discovery activities range from studies of molecular and cellular processes to studies of the whole animal, in areas of cell and tissue growth, differentiation, regeneration, and numerous aspects of cancer biology. BMS faculty currently have active research programs in the areas of cancer biology; musculoskeletal biomechanics and skeletal adaptation; neural development, mechanisms of injury and regeneration; tissue dynamic spectroscopy; cellular and molecular screening; and high throughput analysis of cell function. Our directory of faculty research interests describes in more detail the exciting research that is conducted in BMS.

Faculty

Department of Basic Medical Sciences Website

Contact Information

Basic Medical Sciences
Purdue University College of Veterinary Medicine
Basic Medical Sciences Department
625 Harrison St.
West Lafayette, IN 47907-2026
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Graduate Information

For Graduate Information please see Basic Medical Sciences Graduate Program Information .

BMS 20100 - Applied Domestic Animal Anatomy With Clinical Correlations I

Credit Hours: 2.00. This course is the first of two in the Purdue College of Veterinary Medicine, Department of Basic Medical Sciences distance learning program covering the basic anatomy of common domestic animals. We will focus on the canine and comparative anatomy of the equine, ruminant, and human, especially where species differentiations exist. The information is organized according to body systems. Clinical correlations are used to emphasize the importance of the basic anatomy. Permission of instructor required.

Learning Outcomes: 1. Obtain a basic understanding of principles that can assist with comparing anatomical structures of major domestic species. 2. Develop mental images of the animal to assist in knowing the orientation of structures in the living animal. 3. Know enough basic anatomy to understand the results obtained from imaging techniques. 4. Identify anatomical structures on dissected images, radiographs, anatomical models and live animals. Credits: 2.00

BMS 20200 - Applied Domestic Animal Anatomy With Clinical Correlations II

Credit Hours: 2.00. This course is the second of two in the Purdue College of Veterinary Medicine, Department of Basic Medical Sciences distance learning program covering the basic anatomy of common domestic animals. We will focus on the canine and comparative anatomy of the equine, ruminant, and human, especially where species differentiations exist. The information is organized according to body systems. Clinical

correlations are used to emphasize the importance of the basic anatomy. In this second course we cover thoracic, abdominal and head anatomy. Permission of instructor required.

Learning Outcomes: 1. Obtain a basic understanding of principles that can assist with comparing anatomical structures of major domestic species. 2. Develop mental images of the animal to assist in knowing the orientation of structures in the living animal. 3. Know enough basic anatomy to understand the results obtained from imaging techniques. 4. Identify anatomical structures on dissected images, radiographs, anatomical models and live animals Credits: 2.00

BMS 23100 - Anatomy-VN

Credit Hours: 4.00. Gross and microscopic study of body systems and topographic relationships in major animal species. Laboratory consists of dissection as well as study of living animals.

Learning Outcomes: 1. Identify the Musculoskeletal. Students will be able to identify, draw and describe function of, in models, radiographs and live animals: major bones and bony prominences; major muscles; major nerves; major blood vessels associated with limbs; and describe long bone development. 2. Identify the Thorax. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of lungs, esophagus, trachea, major vessels, nerves and heart; pathway of blood through heart; position of thoracic and pleural cavities; and important topography. 3. Identify the Abdomen. Students will be able to identify, draw and describe, in models, radiographs and live animals: position of major GI and reproductive organs, major vessels, and nerves; GI and UG development; position of abdominal and peritoneal cavities; and important topography. 4. Identify the Head and Neck. Students will be able to identify and describe, in models, radiographs and live animals: major bones of skull; number teeth; major cavities of skull; major features of the eye and ear; major glands, vessels and nerves of the neck and skull; major topography of the head and neck; and major parts and function of the brain. Credits: 4.00

BMS 23200 - Physiology-VN

Credit Hours: 2.00. Basic mammalian physiology, which covers general physiological processes with emphasis on domestic animals. Laboratory experiences and demonstrations form a major part of the laboratory instruction.

Learning Outcomes: 1. Describe and explain the functions of body fluids. The types of formed elements in blood and their functions. 2. Describe and explain the functions of the central and peripheral nervous systems. 3. Describe and explain the types of muscles in the body and their functions. 4. Describe and explain the regulation of the functions of the heart, lungs, kidneys, endocrine glands and gonads. 5. Describe and explain the regulation of blood pressure, gas exchange in the lungs and acid-base balance. 6. Describe and explain the hormonal regulation of metabolic processes and reproduction. Credits: 2.00

BMS 23300 - Introduction To Pharmacology-VN

Credit Hours: 0.50. This course introduces the concepts and terminology of pharmacology including basic terminology, pharmacokinetics, and pharmacodynamics.

Learning Outcomes: "1. Explain what the different types of drugs names are. 2. Recognize the characteristics of different solid and liquid dosage formulations. 3. Explain the significance of the terminology used in drug references to describe drugs. 4. List and describe the criteria for acceptable extra-label use of drugs. 5. Describe the difference between OTC and prescription drugs. 6. Explain the factors that affect movement of drug molecules throughout the body. 7. Describe the requirements for prescriptions and drug labels.

8. Describe the characteristics of each route of drug administration. 9. Read and write abbreviations commonly used in drug orders accurately. 10. Explain physiological factors that change the way drugs move through the body. 11. Describe regulations and warnings surrounding dispensing containers. 12. Describe factors that alter the way drugs are absorbed, distributed, metabolized, and excreted. 13. Describe reasons and procedures for handling and storing drugs. 14. Explain the interaction between drugs and receptors and how that produces cellular effects. 15. Describe legal requirements for dispensing and storage of controlled substances. 16. Describe how pharmacokinetics and pharmacodynamics impact every drug treatment. 17. Describe special storage and handling requirements for cytotoxic and hazardous drugs. 18. Describe the issues surrounding and guidelines required for acceptable drug compounding. Credits: 0.50

BMS 23400 - Clinical Physiology: A Problem Solving Approach-Distance Learning

Credit Hours: 1.00. This course will provide the physiological basis for clinical functions and medical interventions of the animal. The course is designed to: 1. Complement and expand students' understanding of concepts taught in the general physiology course (BMS 23200, Physiology for Veterinary Technicians); 2. Emphasize how understanding basic physiological concepts can help in solving clinical cases; 3. Promote critical thinking, team work, communication skills and problem solving.

Learning Outcomes: 1. Define basic physiological terms related to the cases presented. 2. Describe basic physiological concepts related to each case. 3. Apply understanding of basic physiological concepts to sort out pathophysiology and solve clinical cases. 4. Explain how knowledge of physiology helps in understanding why particular treatments are used for treating clinical cases. 5. Describe how treatments help to restore the basic physiology of organ system and the animal as a whole. 6. List his/her contribution that helped his/her team in problem solving clinical cases 7. Be able to obtain, evaluate, and use information to solving clinical cases. 8. Be able to effectively communicate peers, clinicians, and clientele. 9. Be able to function as part of a team. Credits: 1.00

BMS 23700 - Applied Physiology With Clinical Correlations I

Credit Hours: 2.00. This course introduces students to the general physiology of mammalian body systems and physiological processes. This course will address the functions of the different systems and homeostasis; the functions of the cell and its different compartments; solute transport, blood and immunity; general functions of the nervous system, reflexes and special senses; the functions of the nerve and muscle, the cardiovascular system; and the digestive system. The course provides the basic physiological concepts of various organ systems and clinical correlations that emphasize how understanding of basic physiological concepts help students solve problems. The clinical correlations and the students-centered learning activities are deigned to promote critical thinking, team work, communication skills, and problem solving. The targeted undergraduate students are: Pre-vet students, animal science majors, wildlife majors, and students in biological sciences and biomedical engineering, and other students interested in use of animals as models for human diseases. Permission of instructor required.

Learning Outcomes: 1. Describe the organs that makes each system and list the major functions of each system. 2. Explain how each system activities are regulated. 3. Discuss the different physiological processes that occur at cells, organs, and systems levels. 4. Compare and contrast between the functions of regulatory systems and other systems in the body. 5. Summarize the contribution of different systems to the maintenance of the internal environment in which cells live. 6. Use basic physiological concepts to understand clinical correlations. Credits: 2.00

BMS 23800 - Applied Physiology With Clinical Correlations II

Credit Hours: 2.00. This course introduces students to general physiology of mammalian body systems and general

physiological processes, with emphasis on domestic animals. The course addresses the functions of the different systems, and the specific functions of the respiratory, renal, endocrine, and reproductive systems. Students will be introduced to ailments that result from malfunctions in each system. The course provides the basic physiological concepts of various organ systems and clinical correlations that emphasize how understanding basic physiological concepts can help in solving problems. The clinical correlations and the students-centered learning activities are deigned to promote critical thinking, team work, communication skills, and problem solving. The targeted undergraduate students are: Pre-vet, students, animal science majors, wildlife majors, and other interested students in biological sciences and biomedical engineering. Permission of instructor required.

Learning Outcomes: 1. Describe the organs that make the respiratory, renal, endocrine and reproductive systems, and list the major functions of each system. 2. Explain how each system activities are regulated. 3. Discuss the different physiological processes that occur at cells, organs, and systems levels 4. Compare and contrast between the functions of regulatory systems and other systems in the body. 5. Summarize the contribution of different systems to the maintenance of the internal environment in which cells live. 6. Use basic physiological concepts to understand clinical correlations. Credits: 2.00

BMS 33100 - Pharmacology-VN

Credit Hours: 1.50. This course introduces the concepts of drugs used in the different body systems. Mechanisms of action, side effects, and therapeutic applications are presented.

Learning Outcomes: 1. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the GI tract. 2. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of cardiovascular system. 3. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the respiratory tract. 4. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases of the endocrine systems. 5. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-inflammatory drugs. 6. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary drugs used to treat diseases/conditions of the nervous system. 7. Identify, describe the mechanisms of action, and describe the major side effects, contraindications or warnings for common veterinary anti-parasitic drugs. Credits: 1.50

Department of Comparative Pathobiology

Overviewvet6

Welcome to the Department of Comparative Pathobiology. Comparative Pathobiology is the study of disease phenomena basic to all species including humans, at the molecular, cellular, organismal and ecosystem level. Our faculty, staff and students are involved in research and learning in a variety of areas including pathobiology, infectious diseases and vaccines, cancer biology, nanomedicine, toxicology, disease surveillance and human-animal interactions.

Faculty

Department of Comparative Pathobiology Website

Contact Information

Comparative Pathobiology

Sanjeev Narayanan, BVSc, PhD
Professor and Head, Department of Comparative Pathobiology

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Graduate Information

For Graduate Information please see Comparative Pathobiology Graduate Program Information .

CPB 25500 - Clinical Pathology-VN

Credit Hours: 4.00. Basic instruction in clinical pathology, including theory and techniques of hematology, clinical chemistry, urinalysis, cytology, and specimen handling.

Learning Outcomes: 1. Have a clinically relevant working knowledge and mastery of laboratory skills related to erythrocytes (red blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of RBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal RBCs; C. Define anemia and classify anemia by mechanisms and RBC indices; D. Accurately perform laboratory analysis of blood samples to produce relevant erythrocyte data for an erythrogram. 2. Have a clinically relevant working knowledge and mastery of laboratory skills related to leukocytes (white blood cells) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe, or identify from questions, features of WBC production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal WBCs; C. Accurately describe abnormal leukograms using proper medical terminology and categorize the clinical significance of these abnormalities (e.g., inflammation, stress, excitement, neoplasia, etc.); D. Accurately perform laboratory analysis of blood samples to produce relevant leukocyte data for a leukogram. 3. Have a clinically relevant working knowledge and mastery of laboratory skills related to platelets (thrombocytes) of common domestic and exotic species covered in this course. This includes the ability to: A. Describe or identify from questions features of platelet production, function and circulation as described in lectures and labs; B. Correctly describe and identify from photomicrographs or microscopy the morphology of normal and abnormal platelets/thrombocytes; C. Define thrombocytopenia and thrombocytosis and describe major mechanisms for each; D. Accurately perform laboratory analysis of blood samples to provide accurate estimates of platelet numbers. 4. Have a clinically relevant working knowledge and mastery of laboratory skills related to analysis of urine. This includes the ability to: A. Accurately perform a complete urinalysis including the physical, chemical and sediment examination; B. Identify normal and abnormal urine elements by microscopy, gross visual examination and photographs. 5. Have a clinically relevant working knowledge and mastery of laboratory skills related to diagnostic cytology. This includes the ability to: A. Collect and process fluids, skin and subcutaneous samples, and vaginal cytologic preparations; B. Correctly classify cytologic preparations as normal, malignant or inflammatory; C. Recognize and describe normal and abnormal leukocytes in cytologic preps. This includes visual recognition and/or description of the following features: macrophage activation, neutrophil degeneration, lymphocyte reactivity; D. Recognize and distinguish between bacteria & fungal organisms; E. Classify stages of the reproductive cycle based on vaginal cytology

from dogs and cats. 6. Correctly associate specific clinical chemistry tests with their primary organ of involvement (e.g., kidney, liver, etc.), process (e.g., acid-base) or class of analyte (e.g., electrolytes). 7. Have a clinically relevant working knowledge and mastery of the physiology of hemostasis and how that relates to common laboratory tests for hemostasis disorders. This includes the ability to: A. Correctly categorize the role of key elements of hemostasis into primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis; B. Select appropriate tests to assess disorders of primary hemostasis, secondary hemostasis, anticoagulation or fibrinolysis. 8. Have a clinically relevant working knowledge and mastery of in-house serologic testing. Credits: 4.00

CPB 35100 - Microbiology-VN

Credit Hours: 2.00. Biology and laboratory identification of bacteria and fungi that cause infectious diseases in animals. Emphasis will be placed on the collection of specimens for culture, the isolation and identification of pathogenic organisms, and antibiotic susceptibility testing. Procedures and commercial systems available to veterinary practices will be utilized.

Learning Outcomes: 1. Select appropriate samples for laboratory diagnostics of infectious disease. 2. Perform basic microbiological techniques used in the laboratory setting of a veterinary hospital. (for example: Gram stain, catalase test, oxidase test, inoculate an agar plate for isolated colonies, Kirby Bauer test). 3. Identify organisms from an "unknown sample" using a variety of tests. 4. Create a shortlist of differential diagnoses for infectious disease cases. 5. Implement biosafety protocols (for example: personal protective equipment, isolation of animals). 6. Differentiate the biology of bacteria, viruses, and fungi. 7. Prevent and control the spread or introduction of infectious diseases. 8. Explain zoonotic diseases to laypeople. Credits: 2.00

CPB 35200 - Parasitology-VN

Credit Hours: 2.00. Biology and life cycles of selected protozoan, helminth, and arthropod parasites of veterinary importance. Emphasis will be placed on laboratory procedures for the identification of common parasites of domestic and laboratory animals.

Learning Outcomes: 1. Identify gross and microscopic parasite stages that help in disease diagnosis. 2. Select and perform the appropriate assays used in laboratory diagnosis of parasitic infections. 3. Summarize parasite life cycle, pathogenesis and clinical signs of various parasitic diseases. 4. Advocate the methods of parasite control and prevention. 5. Create a safety plan to prevent zoonotic disease transmission. Credits: 2.00

CPB 46400 - Clinical Toxicology-VN

Credit Hours: 2.00. The common toxicants and advanced topics on the drugs most commonly encountered in veterinary medicine. Emphasis is on mechanisms, indications, contraindications, and proper applications and handling of these drugs. Permission of department required.

Learning Outcomes: 1. Appropriately use and understand common terminology used in toxicology and clinical toxicology. 2. Describe the medical rationale and specific drugs used as emetics, cathartics, and other compounds used to decrease animal exposure to ingested toxicants. 3. Ask the appropriate questions during a history to help better identify toxicosis cases and to identify potential sources for intoxication. 4. Describe the mechanism of action for commonly encountered drug toxicants, herbal/diet supplement intoxications, household toxicants, insecticides, rodenticides, herbicides, toxic plants, and toxic animal envenomation. 5. Describe the general presenting clinical appearance and any key clinical signs characteristic of common veterinary toxicants. 6. Describe the diagnostics

and treatment protocols used for common veterinary toxicants. 7. Identify means by which clients/animal owners can reduce the risk of intoxicant of animals by toxicants. Credits: 2.00

CPB 48000 - Seminar In Animal Welfare And Human-Animal Interaction-VN

Credit Hours: 2.00. This course will be required for students involved in the interdisciplinary Animal Welfare and Societal Concerns program of study. Seminar in Animal Welfare and Human-Animal Interaction is for discussion of current topics in animal welfare and other areas involving the interaction of humans and animals. Outside speakers will present their perspectives in various areas. Journal articles will also be presented and discussed.

Learning Outcomes: 1. Demonstrate the use of human-animal interaction theories and science to explain common human-animal interactions. 2. Demonstrate the use of an animal welfare conceptual framework and scientific components to assess an animal welfare situation (Lord et al., 2017). 3. Synthesize, formulate and communicate an informed view of contemporary or emerging human-animal interaction and animal welfare issues, including scientific and sociological influences and professional responsibilities. Credits: 2.00

Department of Veterinary Clinical Sciences

Overviewvet7

Welcome to the Department of Veterinary Clinical Sciences. The VCS department is one of three departments in the Purdue University College of Veterinary Medicine. Our mission is to educate members of the veterinary health care team and biomedical community, to create and communicate knowledge, and to provide outstanding clinical service for the citizens of Indiana and surrounding region.

The department offers graduate programs leading to the Master of Science (MS; thesis or non-thesis) and Doctor of Philosophy (PhD) degrees. We also provide excellent opportunities for Post-DVM students to further their training through specialty residency programs in anesthesiology, cardiology, diagnostic imaging, emergency and critical care medicine, large animal internal medicine, large animal surgery, neurology, oncology, ophthalmology, radiation oncology, small animal internal medicine, and small animal surgery.

Faculty

Department of Veterinary Clinical Sciences Website

Contact Information

Veterinary Clinical Sciences
The VCS department office is located in Lynn Hall, Rm. 1352.
Hours: Monday - Friday, 8:00am - 5:00pm
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Graduate Information

For Graduate Information please see Veterinary Clinical Sciences Graduate Program Information .

VCS 21000 - Veterinary Nursing Techniques For The Small Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, small animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and implement common restraint techniques used for various small animal species. 2. Measure the temperature, pulse, and respiratory rates, and provide an explanation of the normal parameters. 3. Identify and explain different sites for injections and venipuncture. 4. Identify common breeds of canines and felines and describe normal behavior of each species. 5. Conduct a comprehensive patient history and perform a thorough, standardized physical examination. 6. Engage in discussions with clients about routine preventive care, including recommended vaccinations for different large

animal species. Credits: 2.00

VCS 21100 - Veterinary Nursing Techniques For The Large Animal

Credit Hours: 2.00. This course will introduce students to concepts related to normal, healthy, large animal patients. This course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients, including vaccinations that are recommended for large animal species. 4. Collect diagnostic samples from large animals. 5. Administer medications via common routes to large animals. 6. Identify common breeds of horses, cattle, swine, goats and sheep. Credits: 2.00

VCS 22100 - Veterinary Nursing Techniques For The Normal Animal (SA & LA)

Credit Hours: 4.00. The course will introduce the students to concepts related to normal, healthy large and small animal patients. The course includes both lecture and laboratory components.

Learning Outcomes: 1. Describe and apply common methods of restraint used for large animals and small animals. 2. Take a detailed patient history and perform a thorough physical exam. 3. Discuss well-patient care with clients including vaccinations that are recommended for both large and small animal species. 4. Collect diagnostic samples from small and large animals. 5. Administer medications via common routes to small and large animals. 6. Identify common breeds of dogs, cats, horses, cattle, swine, and sheep. Credits: 4.00

VCS 22200 - Dentistry-VN

Credit Hours: 1.00. This course is an introduction to veterinary dentistry for the technician, with emphasis on basic dental anatomy, pathologies and treatments, dental charting, intraoral radiography, dental cleaning and periodontal disease management.

Learning Outcomes: 1. Identify tooth anatomy and perform dental charting. 2. Recognize common pathologies and understand treatment approaches. 3. Perform oral exams and dental cleaning. 4. Produce diagnostic intraoral radiographs. 5. Develop and provide client education. Credits: 1.00

VCS 22300 - Surgical Nursing-VN

Credit Hours: 1.50. This course is an introduction to the surgical environment and all aspects related to the principles of asepsis and the practice of sterile technique. Students will learn using a variety of teaching modalities (lecture, group work, laboratory experience).

Learning Outcomes: 1. Identify basic surgical instruments. 2. Explain the principles of aseptic technique. 3. Perform the duties of surgical nurse. 4. Perform the duties of the circulating nurse. 5. Explain procedures to prepare items for sterilization and the techniques used for sterilization. 6. Demonstrate bandaging techniques for both large and small animal patients. 7. Identify the phases of wound healing. Credits: 1.50

VCS 22400 - Small Animal Nursing I

Credit Hours: 2.00. This course will introduce students to nursing and diagnostic techniques for small animals and the body response to disease.

Learning Outcomes: 1. Recognize and report conditions of hospitalized small animal patients. 2. Provide appropriate nursing care to hospitalized patients. 3. Place IV catheters in small animal patients and administer fluids appropriately. 4. Perform diagnostic procedures and exams for small animal patients. 5. Provide technical assistance to a DVM for diagnostics and therapeutics. 6. Recognize emergent conditions and provide appropriate treatment. 7. Perform basic training techniques with dogs. Credits: 2.00

VCS 22500 - Large Animal Nursing I

Credit Hours: 2.00. This course builds on concepts learning in VCS 22100 related to normal, healthy large animal patients. It also introduces the students to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify and explain the nursing concepts of hospitalized and post-op LA patients. 2. Select and apply nursing concepts to the LA patient. 3. Place an IV catheter in a large animal patient and identify the problems that can occur from long term catheterization. 4. Describe milking procedures and the tests used to identify problems. 5. Collect diagnostic samples from large animals. 6. Administer medications via common routes to large animals. 7. Calculate fluid therapy rates for LA patients. 8. Identify the appropriate uses for bandages, splints, casts. 9. Identify the steps utilized in intensive neonatal care and medical emergencies. Credits: 2.00

VCS 22600 - Principles Of Anesthesia-VN

Credit Hours: 2.00. This course is an introduction to surgical nursing and anesthesia. The principles of asepsis and sterile technique will be introduced and demonstrated by staff and in some cases, practiced by the student. The basics of anesthesia will be introduced and practiced by the student.

Learning Outcomes: 1. Identify basic surgical instruments. 2. State the principles of aseptic technique. 3. Identify breaks in aseptic technique. 4. Perform open gloving. 5. Perform aseptic personnel scrub; gowning and closed gloving. 6. Identify the parts of an anesthesia machine. 7. Know the function of the above parts. 8. Trace the flow of oxygen through an anesthetic machine, with rebreathing and nonbreathing systems. 9. Identify rebreathing and nonbreathing systems. 10. Practice monitoring principles and identify normal parameters. 11. Identify a variety of analgesic and anesthetic drugs. 12. Begin to identify and state the uses and classifications of these drugs. 13. Perform general anesthesia; from physical exam through recovery. Credits: 2.00

VCS 22800 - Small And Large Animal Nutrition-VN

Credit Hours: 1.00. This course will introduce students to an overview of nutritional concepts as it applies to common domestic small and large animal species and selected exotic companion/avian pets. Basic concepts for understanding nutritional needs for all species will be introduced as well as therapeutic use of diets as it relates to animal nursing.

Learning Outcomes: 1. Assess normal nutritional requirements of the animal (ruminant vs. monogastric) as they apply to physiological processes. 2. Explain BCS evaluation as it relates to obesity, weight loss, and weight management programs. 3. Identify adult, pediatric and geriatric nutritional needs. 4. Describe the changing nutritional needs from pediatric stages to adulthood. 5. Define specific differences in diets based upon breed (large vs. small, selected breed well dog needs). 6. Compare, contrast and analyze food labels. 7. Evaluate diets and dietary supplements, nutraceuticals, hay, feed and pasture management. 8. Plan and perform nutritional counseling/weight management programs by educating clients on dietary needs of pets and livestock, incorporating the roles of the technician and veterinarian. Credits: 1.00

VCS 25100 - Introduction To Diagnostic Imaging-VN

Credit Hours: 0.50. This course is an introduction to veterinary diagnostic imaging and is designed to instruct the veterinary technician student in the basic principles of imaging, necessary to perform imaging tasks within a veterinary hospital. This course will introduce the fundamentals needed in the clinical imaging rotations and in practice.

Learning Outcomes: 1. Apply the principles of physics and x-ray machine anatomy, to the generation of X-rays. 2. Calculate and utilize exposure factors in the production of diagnostic quality radiographs. 3. Appreciate the

importance of radiation safety, personal protective equipment and occupational health. 4. Employ the best combinations of grids, intensifying screens, cassettes and film to reduce scatter and produce diagnostic quality radiographs. 5. Develop and process radiographic film using processing chemicals and appropriate darkroom techniques. 6. Troubleshoot exposure, processing and handling problems with non-diagnostic films. Credits: 0.50

VCS 25200 - Diagnostic Imaging-VN

Credit Hours: 2.00. Provides an introduction to imaging of domestic animals. Emphasis will be placed on radiological principles and techniques, darkroom procedures and design, preparing technique charts for various X-ray units, animal positioning, and radiation safety.

Learning Outcomes: 1. Recall and apply diagnostic imaging guidelines and safety procedures. 2. Produce diagnostic images of soft tissue and orthopedic projections of both small and large animal patients. 3. Produce diagnostic images of skull projections of small animal patients. 4. Perform diagnostic contrast studies of the circulatory, renal and gastrointestinal systems. 5. Utilize computed and digital imaging systems to produce diagnostic images of both large and small animal patients. 6. Assist with performing diagnostic ultrasound scans of small animal patients. 7. Possess a basic understanding and introductory working knowledge of CT, MRI and Nuclear Medicine scanning procedures on both small and large animal patients. Credits: 2.00

VCS 32100 - Large Animal Nursing II

Credit Hours: 2.00. This course build on concepts learned in VCS 22100 and VCS 22500 related to normal, healthy large animals patients. It also introduces the student to higher level patient care for the large animal patient.

Learning Outcomes: 1. Identify the key principles associated with herd health management. 2. Understand the role of regulatory issues in large animal medicine. 3. Demonstrate an understanding of the common diseases affecting large animal species. 4. Develop an understanding of naturally occurring toxic plants. Credits: 2.00

VCS 32200 - Small Animal Nursing II

Credit Hours: 2.00. This course will cover management of hospitalized patients, client education, and preventative medicine programs. Emphasis will be on the role of the veterinary technician in the veterinary hospital.

Learning Outcomes: 1. Describe basic information about small animal medicine conditions to clients. 2. Educate clients regarding preventative small animal medicine. 3. Utilize knowledge of small animal medical conditions to provide nursing care to patients. 4. Utilize knowledge of small animal medical conditions to anticipate DVM needs for diagnosis and treatment of hospitalized patients. Credits: 2.00

VCS 46700 - Medical Equipment & Maintenance-VN

Credit Hours: 2.00. A laboratory in the utilization, care, and maintenance of electronic equipment used in veterinary diagnostics.

Learning Outcomes: 1. Develop an integrated knowledge base of the functions of the selected equipment. 2. Select, evaluate, and adjust selected equipment to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. 3. Recognize and respond appropriately to the selected equipment malfunctions or inappropriate equipment setup to ensure proper function and provide maximum benefit to ensure safety of the patient and staff. Credits: 2.00

VCS 46800 - Advanced Emergency And Critical Care For Veterinary Nurses

Credit Hours: 2.00. This course is a culmination of previously

studied clinical skills, disease processes, and small animal nursing that is focused on transferring knowledge to practical use. The course will be taught utilizing emergency and critical care case studies to highlight disease processes, physiology, critical thinking skills, and the role of the veterinary nurse in providing high level patient care. The course goal is to prepare graduates to respond to emergent and critical patient scenarios in all types of small animal veterinary practices.

Learning Outcomes: 1. Identify veterinary emergency situations utilizing patient vital signs and knowledge of disease processes. 2. Identify common emergency disease processes and anticipate patient treatments based on observations. 3. Anticipate changes in patient status by utilizing critical thinking skills. 4. Apply important communication skills to improve teamwork. 5. Recognize indicators of mental health issues in self. Credits: 2.00

Office of the Provost

Provost - Teaching and Learning

Entrepreneurship and Innovation Certificate

ENTR main Pic

Quantum Information Science and Technology Certificate

ENTR 20000 - Introduction To Entrepreneurship And Innovation

Credit Hours: 3.00. This course introduces students to the process of turning ideas, inventions, and innovations into new business ventures. It covers foundational entrepreneurial concepts and practices, as well as the leadership, teamwork, and communication skills required of individuals who choose to become entrepreneurs or to act entrepreneurially in established organizations. It serves as the first required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Explain how innovation and entrepreneurship drive economic growth. 2. Use creativity and ideation techniques to identify market opportunities. 3. Evaluate the feasibility of new venture opportunities using secondary market research. 4. Interpret financial statements, profit and loss, and breakeven analysis. 5. Identify sources of funding for new ventures. 6. Understand how to prepare a proper legal and ethical foundation for a new venture. 7. Describe the role of intellectual property protection in the venture development process. 8. Define the roles of diverse individuals on an entrepreneurial team. 9. Prepare and deliver persuasive business presentations. Credits: 3.00

ENTR 31000 - Marketing And Management For New Ventures

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course) to bring students through the process of launching a new venture. Students work in teams to develop and validate business models for potential startups. This occurs through experiential activities including gathering feedback from potential customers, creating forecasts, developing a go-to-market strategy, and pitching to investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Validate new business concepts and business models. 2. Conduct primary market research with prospective customers. 3. Apply the financial knowledge necessary for sales forecasting and cash flow management. 4. Evaluate methods to acquire and manage financial resources for a proposed venture. 5. Persuade investors and partners to support an entrepreneurial venture. 6. Identify and recruit talent for an entrepreneurial team. 7. Participate effectively as a team member or leader. Credits: 3.00

ENTR 31500 - Business Planning For Social Entrepreneurship

Credit Hours: 3.00. This course builds on entrepreneurship

concepts and skills developed in ENTR 20000 (prerequisite course) to understand the differences, benefits, and opportunities associated with social impact business models. Students work in teams on experiential activities including gathering customer feedback, creating forecasts, developing a strategy, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Develop convincing social enterprise business models. 2. Conduct feasibility analysis. 3. Create pro-forma financial statements. 4. Understand legal, regulatory, and ethical issues social entrepreneurs face. 5. Understand the process of recruiting, hiring, and developing a new venture team. 6. Identify sources of funding and investor needs. 7. Persuade potential investors to support a social impact venture. 8. Participate effectively as a team member or leader. Credits: 3.00

ENTR 32500 - Global Entrepreneurship And Innovation

Credit Hours: 3.00. This course builds on the foundational skills developed in ENTR 20000 (prerequisite course), to provide students with a comprehensive understanding of entrepreneurship in a global context. It explores the differences, challenges, and opportunities associated with developing international ventures and expanding into overseas markets. Through topic lectures, case studies, and experiential team projects, students will gain insight into global trends, cultural nuances, business models, strategies, and pitching to stakeholders and investors. Students can choose ENTR 31000, ENTR 31500, or ENTR 32500 to serve as the second required core course for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify economic, political, technological, ethical, and cultural factors influencing entrepreneurship in global settings. 2. Develop cross-cultural awareness to navigate diverse business environments. 3. Conduct feasibility analysis for international venture establishment and expansion. 4. Recognize critical aspects of global supply chains and associated business implications. 5. Describe international funding sources and currency considerations. 6. Explore global entrepreneurship and innovation ecosystems as scalability engines. 7. Understand the process of recruiting, hiring, and developing a global team. 8. Participate effectively as a team member or leader. Credits: 3.00

ENTR 39000 - Special Topics In Entrepreneurship And Innovation

Credit Hours: 1.00 to 3.00. The requested course will provide the opportunity to develop courses which fulfill the "option" course requirement for the Certificate in Entrepreneurship and Innovation Program. Option courses are designed to provide depth in certain disciplines related to entrepreneurship and innovation, and/or entrepreneurship and innovation in relation to specific industries or markets.

Credits: 1.00 to 3.00

ENTR 39699 - Internship And Research Experiences

Credit Hours: 0.00. Interns for Indiana internships work experience with participating employers. Students submit a summary report and company evaluation. Through a mutual selection process, students may be placed as interns with entrepreneurial companies. Placements are determined through a screening process based upon students' skills and experiences gained through their major fields of study. Fulfills a capstone requirement for the Certificate in Entrepreneurship and Innovation Program. Contact the Office of Professional Practice. Permission of instructor required. Discovery Park Undergraduate Research Internships. Check the DURI website for further information. https://www.purdue.edu/discoverypark/duri/.

Learning Outcomes: 1. Gain skills and experiences through their major fields of study. Credits: 0.00

ENTR 46000 - Internship And Career Preparation Seminar

Credit Hours: 1.00. This course is a distance option course for the Certificate in Entrepreneurship and Innovation. It equips students with professional skills based on entrepreneurship competencies. Students develop resources to illustrate their skills, talents, abilities, and goals to increase career preparedness. They learn what it takes to successfully transfer academic skills to a workplace setting and develop an entrepreneurial mindset that sets them apart from other job seekers.

Learning Outcomes: 1. Improve self-awareness of professional skills development through

assessments and reflection. 2. Create a professional brand through an improved LinkedIn profile, resume review, interviewing, and networking skills. 3. Showcase educational and professional skills in an e-portfolio or website. Credits: 1.00

ENTR 47000 - Gender, Diversity And Leadership

Credit Hours: 3.00. This course serves as an option course for the Certificate in Entrepreneurship and Innovation. It provides a social and historical perspective of gender and diversity in leadership and entrepreneurship, as well as practical skills students can use to develop their own leadership abilities. This highly interactive course provides the opportunity for students to meet with diverse leaders from a variety of organizations. Topics of social, political, and economic interest are covered, as are discussions of current issues and research relevant to leadership success.

Learning Outcomes: 1. Define the social, cultural, organizational, and historical dimensions of gender and leadership. 2. Identify contemporary gender and leadership issues. 3. Practice communication, negotiation, and other skills relevant to leadership success. Credits: 3.00

ENTR 48000 - Entrepreneurial Leadership And Careers

Credit Hours: 3.00. This course prepares students for entrepreneurial careers by requiring them to apply the knowledge and skills learned in prerequisite entrepreneurship courses to the development of their professional goals and networks. Students explore how they can use their entrepreneurial talents, skills, and interests in a variety of ways, including launching startups, joining family businesses, or being intrapreneurs in established organizations. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Identify unique personal entrepreneurial strengths to help shape career decisions. 2. Understand the practical application of team building and leadership. 3. Explore different types of entrepreneurial careers in startups and large organizations. 4. Research and interview entrepreneurs about career pathways. 5. Use secondary research to assess potential employers and their alignment with personal goals. 6. Explore options for using entrepreneurial skills within existing organizations. 7. Understand key elements of personal financial planning and management. 8. Build a personal brand and use social media platforms to expand professional networks. 9. Create a personal business plan. Credits: 3.00

ENTR 48100 - Consulting For Emerging Enterprises

Credit Hours: 3.00. This course is an experiential course that requires students to apply the knowledge and skills learned in prerequisite entrepreneurship courses to a real-world consulting project for a startup, small business, or non-profit organization. Student teams use a three-stage consulting model to guide project contracting, data gathering, and value creation for the client. In-class time focuses on developing consulting knowledge and competencies that are applied directly to client interactions and project execution. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation. Class size is limited. Permission of the instructor is required.

Learning Outcomes: 1. Develop consulting skills through a hands-on consulting engagement. 2. Think strategically about a small business in a complex and changing environment. 3. Practice leadership and organization skills by establishing priorities, setting expectations, and completing objectives within a team. 4. Effectively use consulting tools and practices to analyze operations establish priorities for improving effectiveness and growing the business. 5. Collaborate with clients by establishing positive relationships, building trust, sharing information, educating, learning, and solving problems. 6. Create value for a consulting client through tangible deliverables including new methods, processes, systems, products and services that will have a lasting impact on the long-term growth of the business. 7. Network with entrepreneurs and service providers from a variety of disciplines. Credits: 3.00

ENTR 48200 - Venture Planning Studio

Credit Hours: 3.00. This course is an experiential course that brings students through the process of creating a startup company as they would in a real-world business incubator or venture studio. They apply knowledge and methodologies related to design thinking, lean startup, financial planning, and fundraising to develop robust business models. Students can bring their own ideas to the course or contribute to one that will be identified. The purpose of this course is to develop in students the confidence and competence to transform a venture idea into a viable startup company. The course serves as a capstone for the Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Use design thinking to generate new ideas for to solve stakeholder problems. 2. Employ Customer Forces and Jobs to Be Done models and methodologies to inform a Lean Canvas. 3. Create unique value propositions and concepts for new products, technologies, or services. 4. Conduct customer interviews to identify market opportunities and risks. 5. Define cost structure, pricing, and go-to-market strategy. 6. Develop pro-forma financial statements. 7. Build a minimal viable product (if appropriate). 8. Present a persuasive investor pitch deck. Credits: 3.00

ENTR 49000 - Senior Level Special Topics In Entrepreneurship And Innovation

Credit Hours: 1.00 to 3.00. The requested course will provide the opportunity to develop capstone courses for the Certificate in Entrepreneurship and Innovation Program. Capstone courses are designed to provide students with the opportunity to apply the knowledge acquired in Certificate Program "core" and "option" courses to hands-on, real world activities related to entrepreneurship and innovation.

Credits: 1.00 to 3.00

Purdue Systems Collaboratory

See Systems Certificate for more information about the certificate.

Purdue Systems Collaboratory website

Systems Certificate

SYS 30000 - It's A Complex World - Addressing Global Challenges (UCC: STS)

Credit Hours: 3.00. The main goal of this course is to address grand challenges that are of global concern - such as environmental sustainability and energy use, natural and human disasters, and political and economic development - using the ideas and tools of complex adaptive systems. The course exploits the broad expertise of the four faculty members by treating these challenges from diverse disciplinary perspectives, from the biological and physical sciences, to the social sciences, to engineering. By way of a set of case studies, students will analyze the features of these challenges which make them complex, and seek to explain and find solutions to the problems that arise in each case. Their treatment of the cases will be informed by published research and computer simulation. Students will actively participate in discussions regarding these global challenges, and contribute to the progress of the class using oral and written presentations. The course will culminate with a final project completed by teams composed of students from different disciplines.

University Core Curriculum (UCC): (UCC: STS) Learning Outcomes: 1. Describe global challenges using engineering, biological, physical, and social scientific perspectives, including attention to the interdependence of the different perspectives. 2. Explain the fundamental concepts of 'complex adaptive systems, ' including applications to different global challenges. 3. Develop basic proficiency in applying computer modeling to represent the behavior of complex systems, with applications to the global challenges. 4. Apply the concepts and tools of complexity research to develop a group-based proposal of comprehensive policies/solutions/strategies in a new and unresolved problem area. Credits: 3.00

SYS 35000 - Systems Methods

Credit Hours: 3.00. Introduction to modeling tools and methods for understanding and designing systems. Topics include:

defining the problem; defining and validating stakeholders' needs; system modeling and types of models; defining and modeling system behavior; defining and modeling functional, physical and allocated system architectures; and evaluating and modeling the tradeoffs between alternative system designs.

Learning Outcomes: 1. Emphasize patterns of systems thinking. 2. Introduce systems modeling and design processes and methods. 3. Introduce model-based systems analysis and design. 4. Provide practice in using model-based systems tools. Credits: 3.00

SYS 40000 - Systems Praxis (UCC: STS)

Credit Hours: 3.00. Engineers, social scientists, and managers frequently bring people and technology together to address complex problematic situations in an equitable way that benefits people and the environment. Multiple systems concepts and methods have been developed to address these situations, and typical courses in systems focus on a relatively small portion of the rich assortment of available approaches to addressing systems problems. This course introduces students to multiple systems concepts and methods via readings and class lecture. The students then apply these concepts and methods on team-based projects. The course will emphasize critical thinking about how the concepts and methods are applicable to the problematic situations of the projects and how well the project teams were able to perform the required activities.

University Core Curriculum (UCC): (UCC: STS)

Learning Outcomes: 1. Learn about group project team formation, operation, and evaluation. 2. Learn and apply the viable system model in a team environment. 3. Learn and apply critical systems heuristics and soft systems methodology in a team environment. 4. Learn and apply a collection of functionalist systems methods in a team environment. 5. Develop written and oral communication products to present results. Credits: 3.00

SYS 49000 - Topics In Systems

Credit Hours: 1.00 to 6.00. This is an UG Level variable title course for topics related to Systems (Systems Thinking, Systems Engineering, Systems Dynamics, etc.). UG students can enroll in this course to do independent study or individual project with the instructor. Permission of instructor required.

Learning Outcomes: 1. Outcomes will be defined by the syllabus for each proposed instance of the course. Credits: 1.00 to 6.00

SYS 59000 - Projects In Systems

Credit Hours: 1.00 to 6.00. This is a Graduate Level variable title course for topics related to Systems (Systems Thinking, Systems Engineering, Systems Dynamics, etc). Graduate students and seniors can enroll in this course to do independent study or individual project with the instructor. Permission of instructor required.

Learning Outcomes: 1. Outcomes will be defined by the syllabus for each proposed instance of the course. Credits: 1.00 to 6.00

Office of Professional Practice

Professional Practice Programs

Purdue's Office of Professional Practice (OPP) offers work-integrated learning experiences and provides students an advantage in career readiness with course work and hands-on learning/training during their time at Purdue. OPP supports students within the academic environment of the institution and its global partners, participates in academic research within the field of professional practice and assists academic units with enhanced employer engagement. Committed to fostering a holistic student experience, OPP offers formal programs in Co-op, internship and research formats. OPP also facilitates the Global Engineering Alliance for Research and Education (GEARE), Purdue's premier international work experience program. Purdue designs Professional Practice programs to combine practical on-the-job experiences with the classroom training of a four-year college curriculum.

Extensive Industry Co-op Certificate

The extensive Industry Co-op Certificate is awarded to students who have gained 18 months or more of full-time work experience related to their academic field of study. Students will register for a cooperative education course during each academic term for which they are engaged in full-time work with an employer. Students are required to complete five work terms. Students should have a progressive experience, with multiple work terms occurring at the same employer. Students may change employers one time. Students must complete all

necessary requirements specific to their academic discipline.

Industry Co-op Certificate

The Industry Co-op Certificate is awarded to students who have gained about one year of full-time work (at least one fall/spring semester) experience related to their academic field of study. Students will register for a cooperative education course during each academic term for which they are engaged in full-time work with an employer. Students are required to complete a minimum of three work terms. Students should have a progressive experience, with a minimum of two work terms occurring with the same employer. Students must complete all necessary requirements specific to their academic discipline.

Message from the Director

Office of Professional Practice Website

Program Information

Program Availability by Discipline

Undergraduate Co-op Program

Master's Co-op Program

GEARE Program

Learning While Working

Milestones Technical Courses

Interns for Indiana

Contact Us

Have questions? Email us at propractice@purdue.edu to schedule an appointment.

Office of Professional Practice
Potter Engineering Center, Rm. 114
500 Central Drive
West Lafayette, IN 47907
Phone: (765) 494-7430
Email: propractice@purdue.edu

Extensive Industry Co-op Certificate

Industry Co-op Certificate

Pharmaceutical Manufacturing Certificate

Semiconductors and Microelectronics Certificate

Learning While Working Certificate

Innovation for Public Service Certificate

OPP 10100 - Changing The World With Chips

Credit Hours: 1.00. On a weekly basis, students will be exposed to semiconductor industry professionals representing some of the largest companies in the world. Students will learn about new technologies, semiconductor products and applications, and career opportunities relevant to a variety of academic disciplines. This course is a requirement for the Semiconductor and Microelectronics certificate and serves as a gateway to a variety of research and internship opportunities relevant to the semiconductor industry.

Learning Outcomes: 1. Understand what a semiconductor is and its relevance to technological advancements and the economy. 2. Understand the components of the semiconductor industry and the broad range of companies involved in this industry. 3. Understand career paths for various academic disciplines within the semiconductor industry. 4. Learn about additional opportunities to develop skills relevant to the semiconductor industry. 5. Start building a network of industry professionals who can help you achieve your career goals. Credits: 1.00

The Data Mine

Data Mine

The Data Mine is a living, learning and research-based community created to introduce students to data science concepts and equip them to create solutions to real-world problems. Members of The Data Mine will be part of a team, living, studying and ultimately, performing data-driven research together. The Data Mine is part of Purdue University's Integrative Data Science Initiative, which is designed to train students across all majors with the data literacy needed to succeed in a data-driven world.
Our Mission: *Data Science for ALL*
The Data Mine is open to students from any major of study. Students will learn some of the skills most sought after by companies and graduate programs. No computational background is required. The key trait for joining The Data Mine is the desire to learn data science in a rigorous, but welcoming environment.

TDM 10100 - The Data Mine Seminar I (UCC: IL)

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

University Core Curriculum (UCC): (UCC: IL)
Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 10200 - The Data Mine Seminar II

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 11100 - Corporate Partners I

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science

capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 11200 - Corporate Partners II

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 19000 - The Data Mine Special Topics

Credit Hours: 1.00 to 5.00. Supervised reading course or special topics course at the freshman level for undergraduates are given under this number.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 5.00

TDM 20100 - The Data Mine Seminar III

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 20200 - The Data Mine Seminar IV

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and

basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 21100 - Corporate Partners III

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 21200 - Corporate Partners IV

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 29000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science

capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

TDM 30100 - The Data Mine Seminar V

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 30200 - The Data Mine Seminar VI

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 31100 - Corporate Partners V

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data

science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 31200 - Corporate Partners VI

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 39000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

TDM 40100 - The Data Mine Seminar VII

Credit Hours: 1.00. The Data Mine is a supportive environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 40200 - The Data Mine Seminar VIII

Credit Hours: 1.00. The Data Mine is a supportive environment

for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 41100 - Corporate Partners VII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 41200 - Corporate Partners VIII

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 49000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. The Data Mine is a supportive

environment for students in any major from any background who want to learn some data science skills. Students will gain hands-on experience with computational tools for representing, extracting, manipulating, interpreting, transforming, and visualizing data, especially big data sets, and in effectively communicating insights about data. Topics include: the R environment, Python, visualizing data, UNIX, bash, regular expressions, SQL, XML and scraping data from the internet, as well as selected advanced topics, as time permits.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

College of Pharmacy (Professional)

OverviewPharmacy Main Photo

Founded in 1884, Purdue's College of Pharmacy consistently ranks among the 10 best pharmacy programs in the nation. Numerous research opportunities, an innovative teaching pedagogy, and world-renowned, caring faculty create a cutting edge learning environment. Employers are drawn by the quality, depth and experiential opportunities provided to Purdue pharmacy graduates. The College of Pharmacy is making a difference locally and globally.

Professional Program

Doctor of Pharmacy (Pharm D) - Students who meet all prerequisites, either through the Purdue Pre-Doctor of Pharmacy non-degree program or through alternative plans of study, may apply to the PharmD program. Graduates of this 4-year professional program prepares students to sit for the national and pharmacy law licensure exams to practice pharmacy.

A combined-degree program allows students in the third year of the PharmD program to begin work on a Pharmacy PhD program while completing the PharmD curricula. Through a judicious choice of electives and research rotations, such students can save up to two years on the total time required for the PhD program. Additional information can be found by reading the full program description.

For more information, please contact Dr. Danzhou Yang, the Associate Dean for Graduate Programs.

Continuing Education Programs

The College's continuing education programs offer several non-degree certificate programs.

Admissions (website)

College Advising (website)

Prospective Professional Program Students

Contact the Office of Student Services for information regarding our degrees offered and/or to arrange a visit.
Phone: (765) 496-6885
E-mail: pharmacy-oss@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)
Contact Marie Martin-Murphy in the Office of Student Services for information on programs for under-represented populations.
Phone: (765) 494-1364
E-mail: mmartinm@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)
Contact PharmD Admissions for information about pre-pharmacy coursework completed off-campus.
Phone: (765) 496-3773
E-mail: pharmacy-admissions@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

PHRM 80000 - Integrated Pharmacotherapy I

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80100 - Integrated Pharmacotherapy II

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and

apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80200 - Integrated Pharmacotherapy III

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80300 - Integrated Pharmacotherapy IV

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic

decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80400 - Integrated Pharmacotherapy V

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80500 - Integrated Pharmacotherapy VI

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and

terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80600 - Integrated Pharmacotherapy VII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80700 - Integrated Pharmacotherapy VIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various

therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80800 - Integrated Pharmacotherapy VIIII

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine, reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non-pharmacologic) for the given disease states within this course and design a patient-specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 80900 - Integrated Pharmacotherapy X

Credit Hours: 2.50. This integrated pharmacotherapy course will develop knowledge and skills regarding the physiology, pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, pharmaceutics, and pharmacotherapeutics relevant to diseases and drugs associated with the autonomic, endocrine, pulmonary systems. It is essential that pharmacists understand the underlying pathophysiology of endocrine,

reproductive, and gastrointestinal diseases and conditions, and the current and developing therapeutic strategies utilized to provide optimal patient care as a future clinical pharmacist, regardless of pharmacy setting.

Learning Outcomes: 1. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 2. Evaluate various therapeutic alternatives (both pharmacologic and non- pharmacologic) for the given disease states within this course and design a patient specific therapeutic regimen. Assess the effectiveness of therapy on the basis of clinical and laboratory parameters. 3. Interpret and utilize patient case summaries, patient databases, medical abbreviations, and terminology in the overall management of patients. 4. Demonstrate critical thinking and decision-making skills to develop a process for recognizing, analyzing, and resolving a drug therapy-related problem. 5. Describe the pathophysiologic processes responsible for the given disease states within this course and integrate this knowledge into the therapeutic decision-making process. 6. Develop habits of an independent and life-long learner by completing assigned readings, reviewing necessary background information when needed, addressing objectives not covered in class, asking questions to solidify learning, and continually performing a self-evaluation of one's own knowledge and skills. 7. Integrate and apply information from previous basic science and clinical courses in the curriculum and from other experiences to promote health improvement and disease prevention and to solve patient therapeutic problems. Credits: 2.50

PHRM 81000 - Basics Of Immunology

Credit Hours: 1.00. The goal of PHRM 81000 (Basics of Immunology) is to expose the student to the basic principles of immunology and enable the student to use these principles to understand how the immune system combats infections. This goal will be achieved through online recorded lecture and out of class reading assignments and quizzes. The student will be expected to understand basic immunological concepts and apply this knowledge to solving problems involving the integration of the various components of the immune system.

Learning Outcomes: 1. Discuss the basic components of the immune system and their roles in innate and adaptive immunity. 2. Discuss the development and function of lymphocytes in adaptive immunity. 3. Discuss the molecular basis of antibody diversity. 4. Discuss how antigens are recognized by T cells. 5. Discuss how B cells develop and function in the body. 6. Discuss how T cells develop in the body and differentiate into specialized subsets. 7. Discuss how lymphocytes undergo positive and negative selection. 8. Discuss how B cells and T cells are activated and participate in adaptive immunity. 9. Discuss the basis of MHC polymorphism and the role in the immune response. 10. Discuss how the complement system is activated and plays a its role in immune responses. 11. Discuss how the cellular components of the innate and adaptive immune systems combine to generate an effective response against pathogens. 12. Discuss how the body remembers a previous infection. Credits: 1.00

PHRM 81100 - Integrated Case Studies I

Credit Hours: 1.00. This is the first course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic,

patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81200 - Integrated Case Studies II

Credit Hours: 1.00. This is the second course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient

problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81300 - Integrated Case Studies III

Credit Hours: 1.00. This is the third course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81400 - Integrated Case Studies IV

Credit Hours: 1.00. This is the fourth course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic,

patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting, within the Pharmacist's Patient Care Process framework. Clearly detail your process to explain what information is relevant to collect/assess. Identify a method for organizing collected information that contributes to an effective monitoring approach. And complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. Prioritize patient problems based on clinical setting/encounter. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. Develop solutions to address barriers related to the social drivers of health. Adjust recommendations with new or unanticipated information. And create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81500 - Integrated Case Studies V

Credit Hours: 1.00. This is the fifth course in a series of five courses focused on aiding in the individual professional development of student pharmacists through a focus on systematic, holistic patient work up grounded in the Pharmacists' Patient Care Process (PPCP). These courses place a heavy emphasis on refining a student's own systematic patient work-up and monitoring approach, practicing holistic, patient- specific care plan development, and refining other skills to prepare students for experiential education. The cases used in each class simulate actual patient cases which include continuity of care challenges, typical problems/diseases seen across pharmacy settings (e.g., ambulatory care, community, hospital, etc.), and multiple chronic diseases. The cases will include topics within the corresponding Integrated Pharmacotherapy (IPT) courses as well as integrating previous IPT content and topics not within IPT. Class time will be spent working up patients individually and as a team, discussing the monitoring/PPCP process, identifying and applying drug information resources, and verbally communicating pharmacotherapy plans to peers and faculty. The complexity of patient cases and volume of patients cared for will increase throughout the case series sequence. All course activities are designed to help enhance the transition into introductory and advanced pharmacy practice experiences.

Learning Outcomes: 1. Develop your own standardized approach for systematic and effective patient workup and monitoring for use in any clinical setting within the Pharmacist's Patient Care Process framework. a. Clearly detail your process to explain what information is relevant to collect/assess. b. Identify a method for organizing collected information that contributes to an effective monitoring approach. c. Complete patient workup in an efficient (or timely) manner. 2. Create a holistic patient-specific, evidence-based pharmacotherapy plan for one or more patients that includes both pharmacologic and non-pharmacologic management strategies. a. Prioritize patient

problems based on clinical setting/encounter. b. Utilize evidence-based resources (primary literature, guidelines, etc.) in the selection and adjustment of pharmacotherapy for the delivery of care to every patient. c. Develop solutions to address barriers related to the social drivers of health. d. Adjust recommendations with new or unanticipated information. e. Create a detailed monitoring plan to achieve prioritized goals of therapy. 3. Communicate patient workup processes and/or pharmacotherapy plans clearly to a variety of audiences (e.g., patients, providers, pharmacists, other healthcare team members, etc.). 4. Refine your professional identity (the ability to think, act, and feel like a pharmacist) through development of your own standardized workup and monitoring process, development of patient-specific, evidence-based pharmacotherapy plans, and reflective communication activities. Credits: 1.00

PHRM 81600 - Introduction To Patient-Centered Care

Credit Hours: 2.00. This course teaches students the key communication principles and skills necessary to deliver direct patient care and interact with other health care professionals. This includes developing cultural self-awareness, evaluating patient comprehension, and improving personal communication skills.

Learning Outcomes: 1. Apply the steps of the PPCP to collect and analyze patient-specific information, assess the information, develop and implement a patient-centered plan, and follow-up once the plan has been implemented. 2. Identify patient-specific factors and incorporate these aspects into patient care. 3. Demonstrate effective communication skills for patients, caregivers, peers, and other healthcare providers. 4. Develop strategies to appropriately adjust behavior or communication style based on cultural and communication considerations to optimize patient care. 5. Begin to develop a structured clinical thought process when presented with a patient case. 6. Work effectively within a group of peers to evaluate a patient's case and complete clinical documentation. Credits: 2.00

PHRM 81700 - Introduction To Self-Care

Credit Hours: 2.00. This course introduces students to the principles and practices of self-care and over-the-counter (OTC) medications. Students will learn to assess and recommend appropriate self-care treatments for common conditions, considering patient-specific factors. The course covers nonprescription medications, including their pharmacology, indications, contraindications, and proper use. It also teaches techniques for evaluating patient symptoms and determining when self-care is appropriate versus when to refer to a healthcare provider. Additionally, students will explore strategies for educating patients on lifestyle modifications and preventive measures to maintain health and well-being. By the end of the course, students will be equipped with the knowledge and skills to confidently guide patients in self-care practices and make informed recommendations for OTC therapies.

Learning Outcomes: 1. Identify common self-care conditions and describe both non-therapeutic and therapeutic treatment options for non-prescription management of self-care conditions. 2. Apply therapeutic knowledge to patient care. By the end of this course, students will be able to effectively apply the Pharmacist Patient Care Process (PPCP) to gather and assess patient information, identify patient-specific factors, and make informed decisions regarding self-care and non-prescription therapies. 3. Demonstrate advanced communication and drug information skills. Credits: 2.00

PHRM 81800 - Professional Identity Formation And Leadership

Credit Hours: 1.00. This course is designed to enhance the PharmD P-1 student's professional skills, career exploration and prepare for internships, post-graduation employment or continuing education plans. It provides academic content to link experiences in professional fields to study in pharmacy as well as social, economic and intellectual attitudes that shape views and work experiences. It also introduces Professional Identity Formation (PIF), which is defined as "a complex and transformational process of internalizing a profession 's core

knowledge, skills, values and beliefs, resulting in an individual "thinking, acting and feeling" like a member of that professional community." (AACP) The course will build the student's professional skills and attitudes, with activities and experiences, intended to advance professional, personal, and career development. The topics and activities are purposely designed and implemented to ensure an array of opportunities for students to document competency of advocacy, self- awareness, leadership, and professionalism.

Learning Outcomes: 1. Prepare for a transition to a professional career setting after graduation through self-reflection, self-assessment of performance, and goal setting, while learning tools and strategies to navigate personal and professional values and interests. 2. Understand the importance of on-the-job training and experiential opportunities; and learn how to develop and cultivate professional skills and relationships. 3. Articulate professional expectations and learn how to navigate ethical issues involved with being a professional. 4. Identify personal leadership traits and skills while understanding multiple leadership and communication styles. 5. Identify career interests or goals and understand the pathways to different careers in pharmacy. Credits: 1.00

PHRM 82000 - Professional Skills Laboratory I

Credit Hours: 2.00. Experiments, computer simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82100 - Professional Skills Laboratory II

Credit Hours: 2.00. Continuation of PHRM 82000 with emphasis upon modules that provide laboratory practice experience designed to integrate basic science concepts and practice applications. Small group problem-solving methodology will be utilized as appropriate.

Learning Outcomes: 1. Theoretical foundations of the profession are presented and reinforced as well as scientific comprehension. 2. Theory and practice are brought together in most laboratories. 3. Critical thinking and decision-making abilities are employed in solving problems through case studies and recitation. 4. Group interaction and communication skills are addressed through small group activities. 5. Other professional outcome ability goals incorporated in several modules are the evaluation of patient data, scientific literature, and pharmaceutical products followed by making specific recommendations and documentation of services. Credits: 2.00

PHRM 82200 - Pharmacy Skills And Patient Counseling

Credit Hours: 2.00. Pharmacy Skills and Patient Counseling is a two credit hour, required first professional year experiential course combining practical experience in the Purdue University Pharmacy with lecture. Students are monitored by faculty instructors, staff pharmacists and Advanced Pharmacy Practice Experience (APPE) students. Students must have a valid Social Security number the first week of class.

Learning Outcomes: 1. Recall and apply brand and generic names, common uses, strengths, doses, side effects and counseling points of commonly used medications. 2. Recall and apply federal and state laws. 3. Obtain pertinent patient information during the prescription intake process. 4. Recall and apply commonly used pharmacy abbreviations, conversions, and computer software functions. 5. Process and

dispense new and refilled prescriptions according to federal and state law requirements. Credits: 2.00

PHRM 82500 - Integrated Pharmacotherapy I

Credit Hours: 6.00. This course will serve as an integrated approach to the physiology/pathophysiology, medicinal chemistry, pharmacology, pharmacokinetics/ pharmaceutics, and pharmacotherapeutics of the following topics: fluids/electrolyte pharmacotherapy, renal diseases, acid/base disorders, clinical nutrition, autonomic nervous system (ANS), pulmonary diseases, hematology, immunology, and rheumatology. The emphasis of this course is knowledge and skill development. Also in the process of completing the objectives, attitudes toward the role of the pharmacist and patient-related issues will be imparted.

Learning Outcomes: 1. Conceptual Competence: The student must demonstrate evidence-based knowledge of the following theoretical foundations of the profession and apply these to individual practice settings. Basic anatomy/physiology; Pathophysiology; Diagnostic methods and decision making; Principles of pharmacology; Relationship between chemical structure and biological activity; Delivery of drugs from various dosage forms; Pharmacotherapy; Drug interactions; Treatment guidelines. 2. Scientific Comprehension: The students must demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries. Basic principles of drug design and the chemical and biochemical mechanisms of drug action; The relevance of molecular biology, biochemistry, and pharmacogenomics and apply key principles of disease states and therapeutics. 3. Mathematical Competence: The students must be able to use mathematical variables to analyze physical, biological, and socioeconomic phenomena. Perform error-free mathematical calculations with regard to drug dosing and pharmacokinetics. 4. Integrative (Practice-related) Competence: The student must be able to meld theory and abilities in the practice setting to enhance positive patient outcomes. Provide patient-centered pharmaceutical care; Promote health improvement and disease prevention; critically evaluate patient data, literature sources, and drug products; provide specific, sound, cost effective, evidence-based drug and healthcare recommendations; design, implement, and evaluate patient specific pharmacotherapeutic regimens; select the proper drug, dose, and dosage form for a specific patient; design strategies to monitor patients' drug regimens for therapeutic and toxic effects of medications; design strategies to avoid or manage drug interactions and adverse drug events; identify and implement strategies to encourage patient adherence to therapeutic interventions. 5. Critical Thinking and Decision Making Abilities: The student must examine issues rationally, logically, and coherently; and shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar context. Synthesize information in order to draw logical conclusions; provide evidence-based support for arguments, recommendations, and solutions; demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. Credits: 6.00

PHRM 82600 - Introduction To Patient Centered Care

Credit Hours: 4.00. The introductory course teaches students the key communication principles and skills necessary to deliver patient care and interact with other health care professionals. This includes performing basic physical assessments, evaluating patient comprehension, and improving personal communication skills.

Learning Outcomes: 1. Identify and perform physical assessment techniques based on disease states. 2. Demonstrate the ability to interpret and use assessment values

appropriately. 3. Demonstrate communication skills to effectively advise and counsel patients. 4. Demonstrate effective communication skills when conveying patient information or therapeutic recommendations to healthcare providers. 5. Develop strategies to appropriately adjust behavior or communication style based on cultural and communication considerations in order to optimize patient care. 6. Develop strategies to modify therapeutic regimens based on an assessment of patient readiness and motivation. 7. Develop strategies to address issues related to patient adherence to therapeutic recommendations. 8. Demonstrate skills to interview patients, evaluate medication regimens, respond to health-related needs, and develop an action plan for addressing therapeutic issues. Credits: 4.00

PHRM 82900 - Dosage Forms II

Credit Hours: 2.00. Education in the use of dosage forms to deliver drugs. Collaboration with peers and other members of the health care team regarding the proper use of the various dosage forms so that the desired therapeutic objective is achieved.

Learning Outcomes: 1. Explain the basic scientific principles involved in administering sterile solutions, including factors needed to maintain sterility, solution isotonicity and isoosmolality, IV bags and drip sets. 2. Explain the basic scientific principles involved in the performance of solid dosage forms, including amorphous and crystalline solids, polymorphism, dissolution, diffusion, chemical and physical stability, bioequivalence and bioavailability. 3. Explain the factors involved in absorption of drugs from solid dosage forms administered by various routes, including oral, buccal, rectal, subcutaneous and transdermal routes. 4. Evaluate quality parameters for solid dosage forms, as an aid to product selection. 5. Advise patients on the proper use and storage of solid dosage forms, and understand the relationship of dosage form selection to clinical outcomes. 6. Explain the factors involved in the use of generic versions of solid dosage forms and their influence on therapeutic outcomes, including the ability to identify drugs for which switching to a generic form should be approached with caution. Credits: 2.00

PHRM 83100 - Health Care Systems

Credit Hours: 2.00. This course is envisioned as a primarily didactic course whose main purpose is to provide students with an introduction to the structures and functions of the United States Health Care System. It is also designed to provide the student an opportunity to compare and contrast the methods used in other countries to address the needs of society for provision of health care to its members.

Learning Outcomes: 1. Able to meld theory and abilities in the practice setting to enhance positive patient outcomes. 2. Promote health improvement and disease prevention. 3. Identify and implement strategies to encourage patient adherence to therapeutic interventions. 4. Examine issues rationally, logically, and coherently, and shall acquire evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 5. Sythesize information in order to draw logical conclusions. 6. Provide evidence-based support for arguments, recommendations, and solutions. 7. Read, write, speak, listen, and use media, and appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 8. Demonstrate the ability to present ideas, plans, and data in appropriate written formats to succinctly and effectively communicate with various audiences. 9. Interact with other pharmacists, physicians, nurses, and other healthcare professionals to achieve positive patient outcomes. 10. Interact with technicians and other support staff to

develop and maintain a positive and productive work environment. 11. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. 12. Maintain professional competence through sound judgment, ethical behavior, adherence to legal guidelines and socioeconomic principles. 13. Demonstrate values consistent with the provision of quality healthcare to all patient groups and populations. 14. Demonstrate an understanding of self, the strengths and challenges of cultural diversity, and the historic responses of society in times of rapid change. 15. Demonstrate awareness of key issues and debates in healthcare. 16. Self-assess and satisfy learning and continuous professional development on an ongoing basis. 17. Take an active role in professional and community organizations and promote advocacy for key healthcare and professional initiatives. 18. Demonstrate awareness of and be able to analyze internal and external factors that influence the practice of pharmacy and healthcare policy in an attempt to resolve practice-related problems. 19. Demonstrate effective interpersonal and intergroup behaviors in a variety of situations and circumstances. 20. Demonstrate awareness of the roles of various healthcare professionals in multiple healthcare environments. Credits: 2.00

PHRM 83300 - Introduction To Case Studies

Credit Hours: 1.00. This course will focus on medical terminology, discovery of different sections of a patient chart, exploration of the components of a SOAP note and other documentation types, orientation to the teaching electronic medical record (tEMR), and reinforcement of the Pharmacists' Patient Care Process (PPCP) with a focus on what is unique or different in the care provided by a pharmacist. A primarily online method for content delivery will be utilized. Multiple in person case-based sessions will be incorporated throughout the semester. Material covered is meant to supplement and augment that gained in PHRM 82600, PHRM 82500, and the PPL sequence.

Learning Outcomes: 1. Introduce students to basic medical terminology, electronic medical records and clinical documentation types. 2. Create a foundation for development of necessary case review skills incorporating the components of the PPCP. Credits: 1.00

PHRM 83400 - Pharmaceutical Calculations

Credit Hours: 1.00. Mastery of pharmaceutical calculation skills is vital and PHRM 83400 prepares students to apply calculation problem solving skills to clinical practice. PHRM 83400 prepares students to perform pharmaceutical calculations necessary for prescription/drug order preparation, compounding dosage forms, and medication dosage calculations based on patient specific factors. Pharmacists must perform error-free pharmaceutical calculations. Correct calculations contribute as much to pharmaceutical care as the newest methods/guidelines for diagnosis, treatment, and prevention. The development of problem solving skills with pharmaceutical calculations is an important component of this course. In addition, practice and repetition of problems is necessary to develop confidence as well as accuracy. Appropriate documentation of work/set up and numerical answers (including units) is required. Approaches to minimize errors and maximize accuracy with pharmaceutical calculations are emphasized.

Learning Outcomes: 1. Describe the role of pharmaceutical calculations in the provision of pharmaceutical care. 2. Perform accurate/error-free pharmaceutical calculations in an organized, clear, and appropriately documented format. 3. Express numerical answers in a clear manner which includes units and appropriate use of zeros with decimal points. 4. Interpret abbreviations and professional nomenclature in prescriptions/drug orders. 5. List the equivalents/conversion factors for the systems of measurement used in pharmacy (i.e., metric, apothecary, avoirdupois, and household). 6. Convert from one unit to another between and within the various systems of measurement used in pharmacy. 7. Calculate quantities of ingredients necessary to reduce or enlarge a pharmaceutical formula. 8. Define and appropriately utilize specific gravity in pharmaceutical calculations. 9. Define and

perform pharmaceutical calculations using various expressions of concentration [i.e., percentage (i.e., W/V, V/V, W/W), ratio strength, milligram percent, parts per million] used in pharmacy. 10. Calculate a patient's body surface area (BSA) utilizing a nomogram and/or BSA formula and apply in dose determinations. 11. Calculate ideal body weight (IBW) and estimated creatinine clearance (CrCl) rates and apply in dose determinations. 12. Calculate body mass index (BMI) from a standard formula. 13. Calculate appropriate medication dosages based on patient specific factors. 14. Calculate admixed intravenous (IV) solution quantities/volumes. 15. Calculate intravenous (IV) solution flow rate. 16. Perform the calculations necessary to prepare isotonic compounded solutions. 17. Perform calculations for the preparation and use of stock solutions. 18. Perform calculations for altering product strength by dilution or concentration. 19. Solve problems associated with compounding in contemporary practice. Credits: 1.00

PHRM 83500 - Principles Of Pharmacokinetics

Credit Hours: 3.00. This course introduces the theory and concepts of pharmacokinetics and biopharmaceutics. It provides the student with a foundation for more advanced therapeutic concepts in subsequent courses. The learner will develop expertise in quantifying drug absorption, distribution and elimination from concentration vs. time data or urinary drug excretion vs. time data to estimate primary pharmacokinetic parameters. Use of these parameters is required to design and modify individual drug-dosing regimens.

Learning Outcomes: 1. Describe the general physiological processes and factors that influence drug dissolution, absorption, distribution, metabolism and excretion. 2. Define and describe the pharmacokinetic features of parallel, sequential, and reversible first-order processes. Define and describe the pharmacokinetic features of zero-order and first-order, and Michaelis-Menten processes. 3. Anticipate the effects of altering rate and extent of absorption, clearance, volume of distribution on the amount of drug in the body following an oral dose. 4. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance dose of drugs eliminated by first-order kinetics. 5. Collect relevant patient information and relevant drug information data in order to calculate the appropriate loading and maintenance dose of a drug. 6. Design and modify dosing regimens given patient-derived information such as plasma concentration vs. time data and dosing regimen. 7. Quantitatively draw the concentration vs. time curves when clearance, volume of distribution or bioavailability changes and explain how the curves have changed. 8. Define and describe relative and absolute bioavailability the factors controlling bioavailability from various routes of administration. Determine if absorption or elimination rate-limits drug absorption kinetics. 9. Describe the pharmacokinetic parameters that determine the time course of active metabolite disposition. Determine if formation or elimination rate-limits active metabolite kinetics. 10. Describe drug disposition based upon physiological determinants in terms such as organ perfusion, unbound intrinsic clearance, free fraction in plasma and in tissue. 11. Describe, with examples, how altered physiology (e.g., renal disease, liver disease, pregnancy, advanced age) affects the disposition of drugs. Define and describe the principles of hemodialysis and how this alters the disposition of drugs. 12. Define steady-state concentration and describe the controlling factors following a constant rate intravenous infusion. Use pharmacokinetic parameters to predict drug concentrations during and after a constant rate infusion, with or without a bolus

dose. 13. Define and describe the pharmacokinetic parameters and equations used to calculate the loading and maintenance doses of drugs. Predict the rate and extent of drug accumulation for a given regimen of fixed dose and interval. 14. Define and describe the basic models used to characterize the kinetics of effect (pharmacodynamics). Credits: 3.00

PHRM 83800 - Interprofessional Education (IPE) Experience I

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Describe the role of team-based care in helping patients or clients to navigate the complexity of the healthcare system. 2. Explain roles and responsibilities of team members represented at the learning event. 3. Recognize the value of interprofessional team practice. 4. Recognize the value of actively seeking the contributions of other professions and perspectives. Credits: 0.50

PHRM 83900 - Interprofessional Education (IPE) Experience II

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Use specific communication tools and methods within a team setting. 2. Describe the roles within the team and how they relate to the team as a whole. 3. Assess their role within the team and ways to improve their contributions to the team. 4. Identify ways to improve team effectiveness and performance. Credits: 0.50

PHRM 84000 - Professional Skills Laboratory III

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts from the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as the development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84100 - Professional Skills Laboratory IV

Credit Hours: 2.00. Experiments, simulations, case studies, and problem sets that actively involve the student in problem-solving, applying and interrelating important concepts form the core courses taught that semester.

Learning Outcomes: 1. Theoretical foundations of the profession, including scientific comprehension. 2. Development of practice skills. 3. Critical thinking and decision-making. 4. Group interaction and communication skills. 5. Evaluation of patient data, scientific literature and pharmaceutical products as well as development and documentation of patient-specific recommendations. Credits: 2.00

PHRM 84200 - Community Pharmacy IPPE

Credit Hours: 3.00. A 3-credit hour required experiential course in the summer before the 2nd year of professional Doctor of Pharmacy program. Students learn community pharmacy operations and patient counseling skills.

Learning Outcomes: 1. Perform basic functions and skills in a community practice setting. 2. Document a minimum of 160 hours of performance-based experience in a community pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in community practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the community pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in community pharmacy. 12. Reflect on new information learned. 13. Describe and reflect on the community pharmacy work environment and staffing. 14. Describe and reflect on the steps involved in the prescription filling and dispensing. 15. Formulate and describe opinions on the quality of patient care. 16. Describe and reflect on common causes of medication errors and methods of prevention and apply knowledge to suggest system improvements. 17. Conduct an effective, conversational interview with a patient about medication use. 18. Review the patient's medications in relation to their condition(s) or disease(s). 19. Describe common problems/barriers patients encounter with medications. 20. Utilize pharmacy references and document sources of information. 21. Formulate an opinion on the value of pharmacists' involvement in patient care. 22. Prepare a formal recommendation letter to a healthcare provider. 23. Reflect on successes of the assignment and self-assess the need for improvement. Credits: 3.00

PHRM 84300 - Population Health Management

Credit Hours: 3.00. Pharmacists are increasingly called upon to participate in the management of large population-based programs requiring managed care principles and a basic understanding of the healthcare system models, healthcare payment models, and the principles of pharmaceutical outcome research. These activities require knowledge and skills relative to comparative effectiveness research, pharmacoepidemiology, and Pharmacoeconomics. The core content of this three-credit hour course will include managed care principles, health care disparities, health care financing, actual and potential pharmacist roles in health systems and managed care, and specialty pharmacy.

Learning Outcomes: 1. Describe the foundations of population health and the related factors influencing the health and wellness of a defined community. 2. Compare and contrast population health and public health. 3. Define and employ the terminology associated with population health. 4. Identify and stratify perspective populations used in providing healthcare. 5. Describe epidemiologic principles used in the provision of population health. 6. Compare the similarities and differences, and potential conflict in providing individual versus population health. 7. Locate, interpret, and evaluate demographic and population health data. 8. Describe the importance of population health to pharmacy and in providing healthcare to communities and within healthcare systems. 9. Identify the inequities in the provision of healthcare in the US and in certain sub-populations. 10. Describe key factors responsible for the inequities in healthcare. 11. Describe and contrast the delivery of and resources utilized in providing healthcare across the life span. 12. Describe how insurance coverage impacts the access to healthcare in the US. 13. Analyze the link between social

factors and health outcomes. 14. Describe and evaluate management strategies and tools used to provide healthcare to populations of patients. 15. Recognize and apply the theoretical foundations of Pharmacoeconomics, pharmacoepidemiology, and health outcomes research to the provision of healthcare and pharmacy services within population health. 16. Describe the importance of a robust primary care foundation in the provision of population health. 17. Describe the components and potential vulnerabilities of the pharmaceutical supply chain and the role that pharmacists play in maintaining a safe and robust supply of pharmaceutical and medical supplies to all patient groups. 18. Formulate strategies for engaging stakeholders in population health interventions. 19. Describe the principles of managed care and select those strategies most appropriate for populations of patients. 20. Discuss key components of integrated population health management and how value-based care payment models are being used to influence provider and patient behaviors. 21. Describe the role of specialty pharmacy in the provision of healthcare services. 22. Describe the role of digital innovation in the provision of population healthcare services. 23. Interpret the data set to suggest management strategies, given a scenario with population data. 24. Analyze the application of population health interventions in real-world settings. 25. Describe key leadership strategies that pharmacists and use to build teams, lead, and implement population health initiatives. Credits: 3.00

PHRM 84400 - Integrated Pharmacotherapy II

Credit Hours: 6.00. This course will provide an integrated approach to instruct the students in physiology, pathophysiology, pharmacology, medicinal chemistry, and therapeutics relevant to diseases of the endocrine and cardiovascular systems. When applicable, special emphasis will be placed on presenting the interrelationships between deficits in endocrine function and cardiovascular disease. In addition, students will study and critique current therapeutic approaches and opinions in the application of replacement therapy with natural, synthetic, or recombinant hormone preparations.

Learning Outcomes: 1. Know basic anatomy/physiology. 2. Know Pathophysiology. 3. Know diagnostic methods and decision making. 4. Know Principles of pharmacology. 5. Know relationships between chemical structure and biological activity. 6. Know delivery of drugs from various dosage forms. 7. Know Pharmacotherapy. 8. Know Drug interactions. 9. Know Treatment guidelines. 10. Know basic principles of drug design and the chemical and biochemical mechanisms of drug action. 11. Know the relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics. 12. Perform error-free mathematical calculations with regard to drug dosing and pharmacokinetics. 13. Provide patient-centered pharmaceutical care. 14. Promote health improvement and disease prevention. 15. Evaluate patient data, literature sources, and drug products. 16. Provide specific, sound, cost effective, evidenced-based drug and healthcare recommendations. 17. Design, implement, and evaluate patient specific pharmacotherapeutic regimens. 18. Select the proper drug, dose, and dosage form for a specific patient. 19. Design strategies to monitor patients' drug regimens for therapeutic and toxic effects of medications. 20. Design strategies to avoid or manage drug interactions and adverse drug events. 21. Identify and implement strategies to encourage patient adherence to therapeutic interventions. 22. Synthesize information in order to draw logical conclusions. 23. Provide evidence-based support for arguments, recommendations, and solutions. 24. Demonstrate the ability to make sound decisions given complex scenarios in a

time-constrained environment. 25. Present information to colleagues and other healthcare practitioners, and the general public, regarding drug therapy and related topics. 26. Demonstrate awareness of key issues and debates in healthcare. 27. Demonstrate cultural competence that includes awareness of the impact that cultural, social, and ethnic differences can play in the provision of healthcare and the workplace. 28. Discuss and remain open to differences of opinion and defend rational opinions that differ from those of other healthcare professionals. Credits: 6.00

PHRM 84500 - Integrated Pharmacotherapy III

Credit Hours: 6.00. This course will develop knowledge and skills regarding the physiology/ pathophysiology, medicinal chemistry, pharmacology, pharmacokinetics/pharmaceutics, and pharmacotherapy of specific cardiovascular diseases, neurology diseases, and psychiatric disorders.

Learning Outcomes: 1. Explain structure-function relationships of drugs used for the management of ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine, headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. 2. Explain the pharmacology of drugs used for the management of ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine, headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. 3. Describe the pathophysiologic processes responsible for specific disease states and integrate this knowledge into the therapeutic decision making process. 4. Evaluate various therapeutic alternatives for a given disease state in light of specific patient factors and design a patient-specific pharmacotherapeutic regimen. This will include assessing the effectiveness of therapy on the basis of clinical and laboratory parameters. 5. Describe adverse effects associated with drugs used for the management of ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine/headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. 6. Design evidence-based drug therapy treatment plans for patients with ischemic heart disease, heart failure, arrhythmias, Parkinson's disease, dementia/Alzheimer's disease, seizure disorders, MS, migraine/headache, psychotic disorders, bipolar disorder, depression, anxiety/sleep disorders, ADHD, pediatric psychiatric disorders, eating disorder, pain management, neuropathic pain, narcolepsy, and substance dependence. Credits: 6.00

PHRM 84700 - Principles Of Pharmacogenomics

Credit Hours: 2.00. This course is designed to introduce the theory and concepts of pharmacogenetics, pharmacogenomics, and precision medicine. The course will provide the student learner broad knowledge for advanced integrated therapeutic strategy based on a patient's genetic information. The learner will develop expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized data and pharmacogenomic information. This course offers a platform for shaping next-generation pharmacists into an era of precision medicine.

Learning Outcomes: 1. Broad knowledge for advanced integrated therapeutic strategy on

patient's genetic information. 2. Develop expertise in informed patient care by selecting the proper drug, dose, and/or dosage form for a specific patient care based on personalized data and pharmacogenomics information. Credits: 2.00

PHRM 84800 - Principles Of Drug Information And Literature Evaluation

Credit Hours: 3.00. This course is designed to provide students with the fundamental skills needed for the provision of drug information in pharmacy practice. Emphasis is placed on the evaluation, interpretation, and practical implications of primary medical literature on the delivery of pharmaceutical care. Four recently published clinical trials will be reviewed and discussed throughout the semester to illustrate contemporary issues in the interpretation of biomedical research.

Learning Outcomes: 1. Discuss the fundamentals and importance of drug information skills for all pharmacists. 2. Demonstrate effective verbal communication skills in obtaining pertinent background and patient-specific information when receiving drug information requests. 3. Demonstrate effective written communication of drug information. 4. Demonstrate familiarity with contemporary drug information retrieval technology and the ability to conduct a thorough and systematic search of the tertiary and primary literature. 5. Demonstrate the ability to judge the reliability of various tertiary sources of drug information. 6. Demonstrate an understanding of the role of the Internet in providing accurate and timely drug information. 7. Demonstrate the ability to incorporate drug information, patient-specific factors, and other pertinent information in the delivery of pharmaceutical care. 8. Describe the hierarchy of study designs as it relates to level of evidence. 9. Explain the general principles of observational and experimental research designs used to answer drug information questions. 10. Explain fundamental regulatory and ethical principles involved in human subjects research. 11. Differentiate between internal and external validity of clinical trial results. 12. Apply the principles of literature evaluation to analyze recent clinical trial results. 13. Understand and interpret statistical tests commonly used in contemporary biomedical literature. 14. Delineate between statistical significance and clinical significance. 15. Interpret the usefulness of clinical trial data for making evidence-based practice decisions. Credits: 3.00

PHRM 84900 - Population Health Management

Credit Hours: 2.00. This two-credit hour course aims to provide students with the core knowledge and basic skills used in managing the health of populations. Core content will include managed care principles, pharmacist involvement in managed care, and program designs. The course will also provide instruction in the topic areas of pharmacoepidemiology and pharmacoeconomics.

Learning Outcomes: 1. Become prepared for work in managed care settings. 2. Understand of the concepts and computations used in pharmacoepidemiology, pharmacoeconomics, decision analysis, and comparative effectiveness research. 3. Know the tools needed to conduct new drug evaluations and formulary reviews and therapeutics committees. 4. Understand basic driving forces behind policy analysis as it relates to ongoing healthcare reform and pipeline drug products. Credits: 2.00

PHRM 85000 - Immunization Certification

Credit Hours: 1.00. The purpose of the course is to provide immunization training certification for students in the Doctor of Pharmacy program. Certification is awarded based on completion of the Pharmacy-Based Immunization Delivery program content that is provided through the American Pharmacists Association (APhA). All students will be expected to have completed immunization training as a graduation requirement.

Learning Outcomes: 1. Provide comprehensive immunization education and training. 2. Provide pharmacists with the knowledge, skills, and

resources necessary to establish and promote a successful immunization service. 3. Teach student pharmacists to identify at-risk patient populations needing immunizations. 4. Teach student pharmacists to administer immunizations in compliance with legal and regulatory standards. Credits: 1.00

PHRM 85200 - Public Health Pharmacy

Credit Hours: 3.00. The course is designed to provide the pharmacy student with a comprehensive overview of key public health and wellness principles and related to self-care and nonprescription products as they impinge upon the ability of patients to assume active roles and function effectively on their own behalf in health promotion and disease prevention, detection, and treatment.

Learning Outcomes: 1. Identify key public health issues. 2. Describe the profession of pharmacy's role in public health initiatives. 3. Retrieve information about various aspects of key public health issues. 4. Interpret information about various aspects of key public health issues. 5. Educate others about various aspects of key public health issues. Credits: 3.00

PHRM 85400 - Interprofessional Education (IPE) Experience III

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year pharmacy students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. This course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry, and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Recognize similarities and differences in the "Code of Ethics" for two or more different professions. 2. Consider how similarities and differences across professions influence caregivers' decisions and understanding of health and heath care priorities. 3. Describe health and healthcare as inclusive of people, populations, and communities. 4. Explain how everyone in the healthcare team shares accountability to improve prevention and healthcare outcomes. 5. Demonstrate effective methods of communicating with team members to clarify each person's role and responsibilities. 6. Discuss the importance of teamwork in person-centered and community-focused care. 7. Demonstrate active listening, while encouraging ideas and opinions of others. 8. Identify ways to improve team performance. Credits: 0.50

PHRM 85500 - Interprofessional Education (IPE) Experience IV

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e., medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include

learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 86000 - Professional Skills Laboratory V

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care.

Learning Outcomes: 1. Synthesize information in order to draw logical conclusions. 2. Provide evidence-based support for arguments, recommendations, and solutions. 3. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86100 - Professional Skills Laboratory VI

Credit Hours: 2.00. This course is an interdisciplinary laboratory course that presents a practical application of scientific and clinical knowledge in the context of patient-centered pharmaceutical care. It serves as a one credit hour course. In accordance with university policy, this course may require up to three hours of work weekly outside of the arranged class time.

Learning Outcomes: 1. Synthesize information in order to draw logical solutions. 2. Provide evidence-based support for arguments, recommendations, and solutions. 3. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. 4. Effectively present information to colleagues, other healthcare practitioners and instructors. 5. Exhibit professional behavior at all times in congruence with pharmacist code of ethics. Credits: 2.00

PHRM 86200 - Institutional Pharmacy Introductory Pharmacy Practice Experience

Credit Hours: 2.50. A 2.5-credit hour required experiential course in the summer prior to the third year of the professional Doctor of Pharmacy program. Students learn basic institutional pharmacy operations and sterile product compounding.

Learning Outcomes: 1. Perform basic functions and skills in an actual practice setting. 2. Document a minimum of 160 hours of performance-based experience in an institutional pharmacy. 3. Demonstrate professional and ethical standards of conduct. 4. Reflect on the degree of professionalism displayed by pharmacy practitioners at the site. 5. Recognize and describe exemplary pharmacy operations and dispensing practices. 6. Debate the advantages and disadvantages of a variety of career options in institutional practice. 7. Self-assess learning within the scope of the experience. 8. Conduct an effective, conversational interview with a pharmacist. 9. Discuss and describe in writing the institutional pharmacist's role. 10. Discuss and describe in writing common problems/barriers that pharmacists encounter in the workplace. 11. Discuss and describe in writing important aspects, advantages, and disadvantages of a career in institutional pharmacy. 12. Reflect on new information learned. 13. Describe the institutional pharmacy work environment and staffing. 14. Describe the steps involved in the medication order filling and dispensing process. 15. Formulate an opinion on the quality of patient care. 16. Review common causes of medication errors and methods of prevention. Credits: 2.50

PHRM 86400 - Integrated Pharmacotherapy IV

Credit Hours: 6.00. This course will develop knowledge and skills regarding the physiology, pathophysiology, medicinal chemistry, pharmacology, pharmacokinetics, pharmaceutics, and pharmacotherapeutics of oncology and hematologic

malignancies, hepatic disorders, gastrointestinal disorders, and women's and men's health. This knowledge will be utilized in subsequent integrated pharmacotherapy modules, skills labs and practice experience that follow.

Learning Outcomes: 1. Demonstrate evidence-based knowledge of the theoretical foundations of the profession and apply these to individual practice settings. 2. Demonstrate comprehension of major scientific discoveries and use of the scientific method to make these discoveries. 3. Meld theory and abilities in the practice setting to enhance positive patient outcomes. 4. Examine issues rationally, logically, and coherently; and shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. Credits: 6.00

PHRM 86500 - Integrated Pharmacotherapy V

Credit Hours: 6.00. This course provides an integrated approach to the physiology, pathophysiology, medicinal chemistry, pharmacology, pharmacokinetics, pharmacodynamics and pharmacotherapeutics of infectious diseases. It covers a vast array of microbiological pathogens, including bacteria, fungi, viruses, mycobacteria, parasites, protozoa and malaria.

Learning Outcomes: 1. Develop competence in basic anatomy/physiology, pathophysiology, diagnostic methods and decision making, principles of pharmacology, relationship between chemical structure and biological activity, delivery of drugs from various dosage forms, pharmacotherapy, drug interactions, and treatment guidelines. 2. Develop competence in basic principles of drug design and the chemical and biochemical mechanisms of drug action, basic principles that affect drug release from dosage form, drug absorption, distribution, metabolism, excretion, and toxicology and the impact of those properties on clinical pharmacokinetics and pharmacodynamics, and the relevance of molecular biology, biochemistry, immunology, and pharmacogenomics and apply key principles to disease states and therapeutics. 3. Perform error-free mathematical calculations with regard to drug dosing and pharmacokinetics. 4. Provide patient-centered pharmaceutical care. 5. Promote health improvement and disease prevention. 6. Critically evaluate patient data, literature sources, and drug products. 7. Provide specific, sound, cost-effective, evidence-based drug and healthcare recommendations. 8. Design, implement, and evaluate patient specific pharmacotherapeutic regimens. 9. Select the proper drug, dose, and dosage form for a specific patient. 10. Design strategies to monitor patients' drug regimens for therapeutic and toxic effects of medications. 11. Design strategies to avoid or manage drug interaction and adverse drug events. 12. Identify and implement strategies to encourage patient adherence to therapeutic interventions. 13. Synthesize information in order to draw logical conclusions. 14. Provide evidence-based support for arguments, recommendations, and solutions. 15. Demonstrate the ability to make sound decisions given complex scenarios in a time-constrained environment. Credits: 6.00

PHRM 86600 - Biotech/Advanced Parenteral Dosage Forms

Credit Hours: 2.00. This course covers the different types of parenteral products derived from biotechnology. The lectures encompass the origin, chemical characteristics and therapeutic use of biopharmaceuticals. This course builds on the concepts and skills gained by the student from taking Dosage Forms II (PHRM 82900) and Professional Program Laboratory II (PHRM 82100).

Learning Outcomes: 1. List and describe the different types of biotechnology derived therapies. 2. Ability to describe the different types of pharmaceutical products in this area, their origin, and the delicate connection that exists between the proper handling and compounding of biotech based products and

their therapeutic activity. 3. List and identify the advanced systems used in hospitals for the delivery of biotech products as well as parenteral products in general. Credits: 2.00

PHRM 86700 - Introduction To The Advanced Pharmacy Practice Experience

Credit Hours: 1.00. The Introduction to Advanced Pharmacy Practice Experience (APPE) course was designed to provide students with the tools needed to be successful clerkship students. Students will participate in a variety of activities, including case studies, group work, evaluations and assessment, review of therapeutic topics, and student/preceptor panel interactions. Activities will be supplemented by didactic lecturing for each topic. The activities and lecture topics were selected based on feedback from previous clerkship students, preceptors, and faculty, and are intended to de-mystify the clerkship experience. This course prepares students to enter the clerkship year with the ability to successfully submit required clerkship forms, evaluate preceptors and peers, avoid common clerkship student mistakes, document clinical interventions, review medical charts, and prepare for therapeutic and pharmacokinetic responsibilities.

Learning Outcomes: 1. Explain how to register for rotations. 2. Recall clerkship policies and procedures. 3. List the forms which should be submitted to the Office of Experiential Learning after each rotation. 4. Critique preceptors and rotations constructively and assess peer performance on oral and written work. 5. Apply strategies to maximize the clerkship experience to each assigned rotation. 6. Cite the rotation portfolio requirements. 7. List handy drug information resources to use during rotations. 8. Explain ways to handle "tough situations" during rotations. 9. Document complete clinical interventions using Clinical Measures software. 10. Provide pharmacokinetic recommendations using provided equations and tools. 11. List ways to succeed on non-patient-care rotations. 12. List ways to prepare for post-graduate training during rotations. 13. Recall important information from common disease states encountered while on rotation. Credits: 1.00

PHRM 86800 - Patient Safety And Informatics

Credit Hours: 3.00. This course provides core knowledge and skills needed by pharmacists to promote patient safety and use the tools of healthcare informatics; understand the landscape, epidemiology and culture of patient safety data privacy and security. Case studies will address disclosure of medication errors and reporting adverse events. Informatics tools such as computer order entry, electronic medical record systems, health information exchanges, and decision support will be explained. The use of informatics tools to promote patient safety will be emphasized.

Learning Outcomes: 1. Conceptual competency. 2. Integrative competence. 3. Critical thinking and decision making. 4. Communication skills and abilities. 5. Responsible use of professional values and ethical principles. 6. Social awareness and social responsibility. 7. Professional abilities and habits. Credits: 3.00

PHRM 86900 - Practice Management And Marketing Of Professional Services

Credit Hours: 2.00. Introduces essential pharmacy practice managerial skills including personnel management, addressing conflict, CQI, change management and leadership. Builds upon these skills in the development of a business plan to implement an innovative pharmacy service.

Learning Outcomes: 1. Explain key concepts and legal stipulations related to hiring, performance assessment and communicating with work associates and employees. 2. Explain the characteristics that best describe themselves in a work setting (DiSC) and how these affect individual and team work. 3. Describe the four steps in LEAN theory and apply it to a variety of health care settings and its place in overall quality improvement measures. 4. Ascertain data and statistics about the practices and populations of a specific health care market. 5. Develop marketing materials based on a target audience(s). 6. Conceptualize and project the financial and clinical impact of a new product or service on an existing organization/system. 7. Justify and

defend an innovative service or product. 8. Write a complete business plan addressing, at minimum, an executive summary, purpose, background, program description, financial projections and conclusion/summary. 9. Present on an innovative pharmacy service covering pertinent and persuasive information. 10. Justify and defend an innovative service or product. Credits: 2.00

PHRM 87000 - Health Policy Applications

Credit Hours: 1.00. This course will explore policy issues that influence health care. The course will provide students opportunities to apply material from prior courses in Health Systems, Population Health Management, and Public Health as it relates to the impact of health policy. Students will gain an understanding of how policy development must address competing interests and goals, and how policy can influence the scope of pharmacist's professional roles. Timely materials on current policy, current policy debates, and professional advocacy will be discussed.

Learning Outcomes: 1. Discuss health policy drivers that impact the current healthcare market. 2. Discuss the impact of various national and state health policies influence on how health care is organized, delivered, and financed. 3. Evaluate potential consequences of specific national, state, and local health policies on health systems, providers, and patients. 4. Identify the process and challenges regarding pursing state legislative health policy change. 5. Analyze healthcare policies and identify opportunities to modify policy to advance the profession of pharmacy. 6. Generate and evaluate policy development strategies to affect health care access, health care quality, and health care cost. Credits: 1.00

PHRM 87100 - Jurisprudence

Credit Hours: 2.00. An in depth study of federal and Indiana laws, regulations, and rules affecting pharmacy practice. Primary emphasis is on Retail and Hospital Pharmacy settings. Lecture is supported by an instructor-created text covering the Food, Drug, and Cosmetic Act (21 USC), the Controlled Substances Act 21 CFR 1300 et. seq. and Indiana Food and Drug law IC 25-26-13 et. seq. and Indiana rules 856 IAC-1-43.

Learning Outcomes: 1. Identify acts that are covered by statute, regulation, and/or rule, and what and where those are. 2. Passing the national licensing examination on laws (MPJE "Multistate Pharmacy Jurisprudence Examination" developed, administered and graded by the National Association of Boards of Pharmacy). Credits: 2.00

PHRM 87400 - Interprofessional Education (IPE) Experience V

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives

related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 87500 - Interprofessional Education (IPE) Experience VI

Credit Hours: 0.50. An Interprofessional Learning Anchor (IPLA) is a common event or experience in which all P1-P4 students will participate. The purpose of this course is to provide first through fourth professional year students with an interprofessional education (IPE) activity, and expose them to concepts related to interprofessional care and practice. The course will also involve interaction and collaboration with students and professionals from other healthcare disciplines (i.e. medicine, nursing, social work, physical therapy, dentistry and others). This course will feature one to three components offered over the Fall and/or Spring academic semesters.

Learning Outcomes: 1. Continue Purdue College of Pharmacy as a dependable, respected, and valued partner in interprofessional practice and education at the school, university, state, national, and international levels. 2. Establish interprofessional education as an established core activity for all Doctor of Pharmacy students in the Purdue College of Pharmacy. 3. Develop professional leadership to support the establishment, expansion, continuation, and improvement of interprofessional practice and education. 4. Design, implement, and evaluate educational programs in which teamwork, shared learning, and collaborative practice are explicitly connected to improve individual and population health outcomes. 5. Assess and expand community and practice interprofessional partnerships that include learners as a resource to improve individual and population health. 6. Lead scholarship initiatives related to interprofessional education on non-academic medical center campuses. Credits: 0.50

PHRM 88000 - Advanced Pharmacy Practice Experience

Credit Hours: 3.00. This final year begins in May and continues through the following April. The 36 weeks of rotation are broken down as follows: 4 weeks Hospital Operations 2, 4 weeks Community Pharmacy Operations 2, 8 weeks Ambulatory rotations, 4 weeks inpatient rotations, and 16 weeks General Electives (4 of which must be additional patient care rotation).

Learning Outcomes: 1. The purposes, uses, and effects of their medications and related therapy. 2. Achievable therapeutic outcomes with estimated time frame. 3. Drug cautions and side effects in relation to the patient's condition. 4. Medication cost issues. 5. Relevant lifestyle modifications (i.e. weight loss and smoking cessation) and non-drug therapies. 6. Use, storage, side effects, and dosage of nonprescription drugs. 7. The appropriate selection of over-the-counter medications in response to patient's condition/needs. 8. Appropriate patient's comprehension of student's counseling (i.e. final verification step). Credits: 3.00

College of Veterinary Medicine (Professional)

Welcome from Dr. Bret D. Marsh, Dean of the Purdue College of Veterinary Medicine

DVM2020Welcome to Purdue University College of Veterinary Medicine, where passion for animal and human health meets world-class education, research, and hands-on experience. Here, you will find multiple pathways to a career in veterinary medicine-whether you are pursuing a Doctor of Veterinary Medicine degree, training to become a Veterinary Nurse/Technician, or advancing your expertise through Graduate Studies. Explore our programs and discover how Purdue can help you turn your passion into a profession.

Overview

The role of the veterinarian in our society has continually evolved as new challenges arise. The educational pathway to becoming a veterinarian is the 4-year Doctor of Veterinary Medicine curriculum which allows you access to the many veterinary career options. Today's veterinarian has a multitude of career opportunities not only in private practice, but also in public practice, corporate practice, industry, public health, food resource management, wildlife conservation, and marine biology. Veterinary researchers participate in the cutting-edge advancements in veterinary medicine that may lead the way to applications in human medicine. The diversity of this profession is exciting, rewarding and limited only by your imagination.

Office of Admissions & Recruitment

The role of the College of Veterinary Medicine Office of Admissions & Recruitment is to facilitate the admissions process for all prospective students. The office provides one-on-one feedback appointments, prospective student visits, admissions presentations, and more. Please feel free to contact our office and our team will help you on your path to veterinary school.
Prospective Students: Students interested in a veterinary medical education at Purdue must complete 2 - 3 years of required course work to be eligible to apply to our program. Required courses must be completed with a "C -" grade (1.7 on a 4.0 scale) or better in each course and applications must maintain a competitive cumulative grade point average. Applicants must also have a cumulative GPA (including all course repeats) of no less than 3.10 to receive consideration. Applicants with questions regarding the available courses to meet pre-requisites offered at their undergraduate institution should email vetadmissions@purdue.edu for pre-requisite course determination. For specific information regarding the DVM Program admissions process, please visit the following site**.** DVM Program
Contact Information
Office of Admissions & Recruitment
625 Harrison Street
Room 1186
West Lafayette, IN 47907
Phone: (765) 496-5000
College of Veterinary Medicine

Admissions & Program Information

- DVM Program
- Veterinary Scholars Program

Student Resources

- PVM Student Handbook
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This is information for all Purdue students on the structure, policy, regulations, and procedures of the University that govern their relationship to the University in both academic and personal progress toward their ultimate educational goals. It is designed as a reference, with direct quotations from the University Code where applicable, covering the basic areas relating to all students on the campus.
Each of the three campuses maintains additional administrative policies specific to their needs and structure. Individual colleges, schools and departments may adopt distinct procedures, standards or guidelines, all of which must be consistent with these system-wide policies. The Helpful Links page provides a list of where this additional information may be found.
There may be problems or questions of detail, particularly with reference to policies or procedures of a student's instructor, school, or housing facility, for example, which can be answered only by the staff directly involved. Where a question regarding interpretation of a policy or procedure arises, a student should consult the Office of the Dean of Students, the Office of the Registrar, an academic advisor, a school counseling office or other appropriate office. For the comprehensive list of all university policies, please see the University Policy Office website.
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- Student Housing
- PVM Student Organizations
- Vet Shoppe: Official Store of the Purdue University College of Veterinary Medicine
- Current student resources and forms

Preparing for the Admissions Process

- Required courses and course descriptions (Pre-Veterinary minimum course requirements)
- Evaluation criteria
- Combined Degree Program (combined DVM / MS or Ph.D. for research/academic careers)
- Transfer Admission Criteria
- Cost of a professional education
- Qualifying for Resident Tuition Status
- Prospective Student Frequently Asked Questions
- Admitted Applicant Statistics
- Veterinary Medical School Admissions Requirements (Assoc. of American Veterinary Medical Colleges)
- Veterinary Medical Colleges Application Service (VMCAS)

Veterinary Medicine, DVM

BMS 80100 - Gross Anatomy Of The Dog And Cat

Credit Hours: 3.50. Study of the anatomy of the body systems and the topographic relationships of the dog and cat.

Learning Outcomes: 1. Obtain a basic understanding of principles that can be transferred to the anatomical structures of the live dog. 2. Develop mental images of the animal to assist in positioning and orientation of structures in the living animal. To assist in diagnostic procedures and evaluating the results obtained from imaging techniques. 3. Be able to identify anatomical structures on dissected specimens, skeletons, radiographs, and anatomical models. Credits: 3.50

BMS 80200 - Comparative Anatomy

Credit Hours: 4.00. A comparative study of the body systems and the topographic relationships of the major domestic species. This course is an extension of BMS 80100 and will continue to build on anatomical knowledge so that it may be applied to multiple domestic species.

Learning Outcomes: 1. Describe major anatomical principles of structure and function and identify and describe major anatomical structures which are common among domestic species; demonstrate the ability to translate and apply that knowledge to other species. 2. Use specific topographical and palpable landmarks in horses, ruminant species, and pigs to locate clinically important underlying structures and viscera for purposes of physical examination, imaging and other diagnostics, and therapeutic procedures. 3. Be able to identify major and clinically important anatomical structures on skeletal and other anatomical models; radiographs; cadavers; and live domestic animals (horses, ruminant species, pigs). 4. Identify and describe the major structural components of birds, using domestic poultry as a model, and demonstrate an understanding of structure-function inter-relationships in the avian body. Credits: 4.00

BMS 80300 - Applied Anatomy Of The Dog And Cat

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 150-minute laboratory sessions, plus a comprehensive final exam. This course builds on basic anatomical knowledge and explores, in depth, the anatomy relevant to medical and surgical conditions of the dog and cat. Laboratory will utilize anatomical models, cadavers as animal

models, electronic resources, and limited use of live animals for clinical examinations.

Credits: 1.00

BMS 80400 - Applied Anatomy Of The Horse

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 120-to-150-minute laboratory sessions, plus a comprehensive final exam. Course material is based upon clinical conditions of the horse that have an anatomical basis or emphasis. Laboratory sessions include topographical anatomy; joint and nerve injections and performance of other clinical procedures; use of multimedia learning aids; and dissection of the head, neck, viscera, and legs.

Learning Outcomes: 1. Recognize, describe and demonstrate the features, positions, and topographical locations of normal anatomical structures which are necessary for conduct of physical examination, including rectal palpation; diagnostic procedures, including contemporary imaging procedures; medical and surgical treatment of common disorders; and necropsy examination of equid animals. 2. Identify relevant landmarks and be able to perform the most commonly conducted intra-articular injections; intra-synovial injections; and desensitization of nerves to produce of local and regional anesthesia ("nerve blocks") in horses. Explain the anatomical basis of each procedure, as well as the rationale underlying the procedures, and the level of diagnostic and therapeutic specificity of each procedure. 3. Describe structure-function inter-relationships of clinically important organs and structures in horses, particularly as they relate to commonly encountered clinical abnormalities. Credits: 1.00

BMS 80500 - Applied Anatomy Of Production Animals

Credit Hours: 1.00. Consists of seven 50-minute lectures and/or discussion periods and seven 120-to-150-minute laboratory sessions, plus a comprehensive final exam. Course material is based upon clinical conditions of the production animals that have an anatomical basis or emphasis. Laboratory sessions include topographical anatomy; joint and nerve injections and performance or other clinical procedures; use of multimedia learning aids; and dissection of the head, neck, viscera, and legs.

Learning Outcomes: 1. Recognize, describe and demonstrate the features, positions, and topographical locations of normal anatomical structures which are necessary for conduct of physical examination, including rectal palpation; diagnostic procedures, including contemporary imaging procedures; medical and surgical treatment of common disorders; and necropsy examination of mammalian production animals. 2. Describe structure-function inter-relationships of clinically important organs and structures in production animals, particularly as they relate to commonly encountered clinical abnormalities and disorders. 3. Recognize and describe anatomical structures associated with commonly encountered surgical disorders in production animals. 4. Identify relevant landmarks and be able to perform the most commonly conducted procedures to accomplish local and regional anesthesia in production animals. Explain the anatomical basis of each procedure, as well as the rationale underlying the procedures, and the level of diagnostic and therapeutic specificity of each procedure.

Credits: 1.00

BMS 80700 - Veterinary Cell And Tissue Biology Design I

Credit hours: 2.50. The first of a two-semester sequence of courses, emphasizing developmental and microstructural foundations of structural differentiation of cell, tissue, and organ systems. Emphasis is placed upon principles, fundamental concepts, and applicable details as well as comparative aspects of general importance for veterinary medicine and biomedical research. That you have some background in biochemistry and cell biology is assumed.

Learning Outcomes: 1. Recognize and interpret normal microscopic structure, using the language and conventions of medicine. 2. Understand development resulting in normal structure. 3. Understand relationships of cellular organelles and inclusions to cellular, tissue,

organ, and whole animal physiology. 4. Develop skills to effectively use a light microscope for critical observation, identification, and analysis, of cell, tissue, organ, and embryonic microstructure. 5. Develop an awareness of species characteristics and variations of structure that reflect physiology, artifact, gerontology, and pathology. 6. Develop an awareness of links between cellular and tissue structure to other disciplines of veterinary medicine and biomedical sciences (e.g. physiology, gross anatomy). 7. Develop approaches to nurture the "active learning" process required to develop and maintain competency as a veterinarian and/or biomedical scientist. Credits: 2.50

BMS 80800 - Veterinary Cell And Tissue Biology Design II

Credit Hours: 2.00. All lectures will focus on mammalian microanatomy with species differences and aim to include also a brief comparative description for Avian microanatomy when applicable. Structural and molecular basis of cellular processes that are the foundation of fertilization, embryogenesis, histogenesis, and basic tissue specialization in domesticated animals. Structure and function of macromolecules and organelles that mediate signal transduction, differentiation, and integration within a whole animal.

Learning Outcomes: 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine; 1. Recognize, interpret, and communicate images of normal microscopic structure, using the language and conventions of medicine. 2. An understanding of the relationship of development to normal microscopic structure. 3. An understanding of the molecular mechanisms of fundamental biological phenomena that signal and result in expression of the structures that underlie normal development and cellular physiology. 4. An understanding of the relationships of cellular organelles and inclusions to tissue, organ, and whole-animal physiology. 5. The skills to effectively use the light microscope for critical observation, analysis, and identification of cell, tissue, organ, and embryonic microstructure. 6. An awareness of selected species characteristics as well as structural variation representing physiology, artifact, gerontology, and pathology. 7. An awareness of significant links of cellular and tissue design to other disciplines of veterinary medicine and biomedical sciences. 8. An appreciation of the utility and necessity of the active learning process for developing and maintaining competency as a veterinarian and/or biomedical scientist. Credits: 2.00

BMS 81000 - Foundations In Basic Medical Sciences

Credit Hours: 1.50. The overall objective of this course is to provide the incoming first year DVM students the basic, foundational science principles upon which they will base study of the DVM curriculum. Emphasis is upon basic principles and fundamental concepts of: animal body organization and terminology; cellular and whole body metabolism; macromolecules, membranes, transport, biosynthetic processes, cellular communication/signal transduction, cell cycle and growth regulation, gene expression and embryonic development.

Learning Outcomes: 1. Know the terms of position and orientation of the animal body. 2. Know basic principles of cellular and whole body metabolism, including anabolism, catabolism and homeostasis. 3. Know the properties and composition of key cellular molecules. 4. Know the structure and function of biological membranes, mechanisms of cellular transport and generation of action potential. 5. Know the mechanisms of cellular communication and signal transduction, including types of secreted signals, structure/function of various receptors, and key mechanisms by which the signal elicits a cellular response. 6. Know the growth factor signaling and the cell cycle; the terms oncogene and tumor suppressor. 7. Know the basic

principles of transcription, organization of the animal genome, epigenetic regulation, and molecular mechanisms involved in embryonic development. 8. Know the basic stages of embryogenesis, and genesis of four basic tissues. 9. Know the identify by light and electron microscopy key components of animal cell structure, epithelial cell modifications, and structures/organs of the 10 mm embryo. Credits: 1.50

BMS 81100 - Physiology Of Domestic Animals I

Credit Hours: 3.00. General physiological process of mammals with special emphasis on domestic animals; normal interactions between large populations of cells, organs, organ systems and integrated functions of an entire animal; homeostatic mechanisms, physiology of body fluids and blood formed elements, muscle and cardiovascular systems.

Learning Outcomes: 1. Provide an overview of physiology of mammalian body systems (Body fluids, blood, muscle, cardiovascular system) and general physiological processes (e.g. homeostasis), with emphasis on domestic animals 2. Provide an overview of the integrated function of the different physiological systems and how they are regulated. 3. Familiarize the student with the organization of cells and the functions of the blood, muscle, and cardiovascular system. Credits: 3.00

BMS 81200 - Physiology Of Domestic Animals II

Credit Hours: 4.00. Continuation of Physiology of Domestic Animals I (BMS 81100). Survey of the principles, concepts and mechanisms of physiological processes with special emphasis on interactions between large populations of cells, tissues, organ systems and integrated functions of domestic animals of importance to veterinary medicine. The organ systems covered are respiratory, renal, digestive, endocrine, and reproductive.

Learning Outcomes: 1. Regulation of functions of the lungs, kidneys, stomach, digestive system, endocrine glands & gonads. 2. Processes and regulation of gas exchange in the lungs. 3. Roles of electrolytes and the regulation of acid-base. 4. Regulation of physiological & biochemical processes in stomach, small and large intestines. 5. Hormonal regulation of metabolic processes. 6. Regulation of reproduction. Credits: 4.00

BMS 81300 - Principles Of Pharmacology

Credit Hours: 1.50. Introduction to pharmacokinetics and pharmacodynamics, ethical dimensions of drug use in veterinary medicine, and drug categories that integrate well with other first-year subjects (e.g., drugs that alter endocrine/reproductive function). Emphasis is placed on general principles and prototypical drugs.

Credits: 1.50

BMS 81400 - Basic And Applied Pharmacology I

Credit Hours: 3.00. BMS 81400 follows BMS 81300 and includes the study of drugs with actions related to the nervous system and the immune system at large, anticancer drugs, antiviral drugs, and drugs targeted to organ specific pathologies - e.g. cardiac, intestinal, pulmonary, and renal pathologies.

Credits: 3.00

BMS 81401 - Pharmacology Principles And Applications

Credit Hours: 4.00. This is the first of two pharmacology courses in the DVM curriculum. The first part of this course encompasses an introduction to basic concepts necessary to understand and optimally administer and deliver therapeutic drugs, such as pharmacokinetics, pharmacodynamics, dose forms, dosing regimen and prescriptions. In the second part of the course, drugs are studied not only based on their pharmacological class, but also based on the organs and systems on which they act (e.g., heart and vascular system, lungs, autonomous neuronal pathways, respiratory system, endocrine system, etc.). This course also covers the pharmacology of cancer therapy and drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics). Journal club sessions are included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make informed decisions regarding administration (dosage, duration of treatment, combination with other drugs) of a

class of drugs or a specific drug as appropriate, depending on the patient's vital and pathological characteristics and mechanisms of action of specific drugs or drug classes. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Discuss how drugs used for a particular disease might have an impact on the development of another disease. 5. Discuss the principles and issues behind drug tolerance and addiction and the risk of abuse. 6. Explain the methods of drug delivery developed to reduce drug toxicity and/or improve efficacy. Credits: 4.00

BMS 81500 - Veterinary Neuroscience

Credit hours: 2.00. This course provides an introduction to neuroscience and its diagnostic application in veterinary medicine. Students will acquire terminology describing the anatomy and basic physiology that characterize neural systems. Integration of function/structure relationships will be introduced in lectures and laboratories, by reference to case studies, and by problem-solving.

Learning Outcomes: 1. Acquire of basic knowledge in neuroscience that will enable insightful diagnosis of diseases affecting the nervous system. 2. Know the parts of the nervous system described in each lecture/lab by their name, location, anatomic relationship to other parts and structures and their integrative function. Students will be able to describe how the nervous system of domestic mammals is organized and how these components contribute to nervous system function. 3. Acquire the ability to communicate this information effectively. 4. Know or logically theorize the physiological basis for any dysfunction that might arise due to specific pathological processes and anatomical lesions in the nervous system. The student will begin to develop an appreciation for the clinical signs and altered behavior that occurs following damage to or disorders of nervous system components. 5. Provide an introduction to the utility of the basic Neurological Exam in the diagnosis of nervous system disease. Credits: 2.00

BMS 81600 - Applied Pharmacology II

Credit Hours: 1.50. This DVM curriculum course covers drugs used to fight pathogens (antifungals, antibiotics, antivirals, antiparasitics), and drugs for immunomodulation and cancer therapy. New topics are introduced according to upcoming developments in drug use such as pharmacogenomics. A journal club session is included to directly relate pharmacology instruction to topics currently debated in the field.

Learning Outcomes: 1. Convey the mechanisms of action and adverse effects of classes of drugs and specific drugs used in veterinary medicine, taking into account anatomical, physiological, biochemical and molecular aspects. 2. Be able to make an informed decision regarding the administration (dosage, duration of treatment, combination with other drugs) of a class of drugs or a specific drug as appropriate, depending on the patient vital and pathological characteristics. 3. Explain monitoring procedures for possible side effects based on classes/groups of drugs and specific drugs as appropriate. 4. Understand, anticipate and resolve (whenever possible) resistance to drugs. 5. Apply principles behind the interaction between environment and the organism that guide precision medicine. Credits: 1.50

BMS 81900 - Endocrine And Neural Basis Of Seasonal Activities Of Birds And Mammals In The Wild

Credit Hours: 1.00. This one-credit elective course will be offered to first and second year veterinary students annually (third year students may also take it). The course will explore the physiological basis of seasonal activities of mammals and birds in the wild. An emphasis will be placed on the neural and endocrine changes that are associated with the seasonal and cyclical activities including breeding, hibernation, migration, etc.

Learning Outcomes: 1. Understand the influences of environmental factors and cues by being exposed to the several activities of

mammals and birds in the wild such activities. 2. Learn theendocrine and neural pathways that mediate the dictates of the environment. Credits: 1.00

CPB 81900 - Veterinary Toxicology

Credit Hours: 2.00. This course will provide an introduction to small and large animal toxicology. It will cover the most common toxicoses encountered in veterinary medicine with emphasis on recognizing clinical signs of toxicoses, discerning differential diagnoses for these cases, and assigning appropriate diagnostic tests. Prerequisites: Completion of first year in the DVM program.

Learning Outcomes: 1. Recognize the most common toxicoses encountered in veterinary toxicology. 2. Identify sources of exposure for the most common toxicoses encountered in veterinary toxicology. 3. Explain the mechanisms of toxicity for the most common toxicoses encountered in veterinary medicine. 4. Identify the best samples to submit for diagnostic toxicology tests. 5. Formulate differential diagnoses for toxicoses based on clinical signs, blood chemistries, and diagnostic tests through critical thinking. 6. Explain the typical treatments (symptomatic and supportive) and antidotes that can be given to animals exposed to toxins/toxicants. Credits: 2.00

CPB 83300 - Preventative Avian Medicine Practice

Credit Hours: 1.00. This course will cover practical veterinary management of commercial poultry. The first portion of the course will concentrate on types of commercial poultry and management of large flocks. In addition, the course will include environmental impact of commercial poultry farms, waste management, and animal welfare. Management of waste and animal welfare are crucial components of veterinary and agricultural workers. The students need to appreciate the intricacies of poultry production to be able to assess the welfare, environmental, and public health regulations pertaining to the poultry industry. Introduction to the role of the poultry veterinarian in non-traditional practice will also be covered.

Learning Outcomes: 1. Identify the types of commercial flocks. 2. Create assessments of the rearing and management of all types of commercial poultry. 3. Evaluate the impact of commercial poultry on the environment. 4. Create a flock animal welfare plan. 5. Identify the various career options for poultry veterinarians in allied industry. Credits: 1.00

CPB 84000 - Use And Care Of Laboratory Animals

Credit Hours: 1.00. Topics will include the history of animal use in research; ethical thought related to animal use in research; alternatives; government regulatory requirements; statistical considerations in designing animal studies; animal models; use of the National Agricultural Library Animal Welfare Information Center; biology, husbandry, techniques, and diseases of common laboratory animal species; hygiene and occupational health; biohazard control; perioperative care and aseptic surgical techniques; anesthesia; analgesia; and euthanasia.

Learning Outcomes: 1. Understand the basics of animal research regulations. 2. Understand the difference between animal welfare vs. animal rights. 3. Know the use, important anatomy/physiology, care, and diseases of common animal species used in research. Credits: 1.00

CPB 84100 - Use And Care Of Laboratory Animals II

Credit Hours: 1.00. Priority will be given to students that have completed CPB 84000. This course teaches skills useful for the role of a laboratory animal veterinarian. Course is project-based and includes hands-on techniques in laboratory rodents.

Learning Outcomes: 1. Understand basics of rodent health monitoring, facility design and protocol review. 2. Gain hands-on experience in handling rodents and performing techniques. 3. Understand common research procedures in non-rodent species. 4. Use critical thinking to work through clinical cases. Credits: 1.00

CPB 85100 - General Pathology

Credit Hours: 3.00. An overview of the basic cellular reactions that develop in response to injurious agents. Focuses on the gross and microscopic alterations in tissues, events leading to the development of those alterations, and the consequences of those changes on the health of animals. Includes degenerative, necrotic, inflammatory, and neoplastic changes in various

animal species.

Learning Outcomes: 1. Understand the events involved in the development and outcome of disease in animals. 2. Master a medical vocabulary, by using the language of medicine and pathology in both written and oral forms. 3. Recognize diseased tissue both grossly and microscopically, offer a reasonable explanation of the sequence of events that led to the development of these tissue changes, and predict the effect of these changes on the life of the host. 4. Identify the types of injury that may affect the host and describe the range of pathologic alterations that occur in response to these injuries. 5. Develop diagnostic thinking skills and learning skills. 6. Recognize the importance of a solid knowledge of pathology as a basis for veterinary medicine and surgery, and other fields of veterinary medicine. 7. Observe examples of normal and diseased organs and tissues. 8. Learn to use medical terminology (including pathologic terms) in an appropriate manner. 9. Examine examples of the histopathologic alterations discussed in lecture. 10. Use of histopathology as a basis for inquiry on various aspects of a disease or pathologic condition. 11. Correlate gross pathologic lesions with the expected microscopic alterations. (Describe the anticipated microscopic lesions, if given the gross alterations and vice versa.)

Credits: 3.00

CPB 85204 - Veterinary Parasitology

Credit Hours: 3.00. Covers the important helminth, protozoal and arthropod diseases of animals. Emphasis is placed on the pathogenesis, epidemiology, clinical features, diagnosis, control, and zoonotic implications of protozoal and arthropod infections in this semester of the course.

Learning Outcomes: 1. Master a medical terminology for parasites, by using the language of medicine, pathology and parasitology in both written and oral forms. 2. Understand general aspects of veterinary parasitology including life cycles, pathogenesis, diagnostic methods, and anthelmintic drugs. 3. Explain how the important parasites are transmitted and maintained in nature and/or domestic environments. 4. Identify the types of clinical problems and pathology caused by the various parasites and be able to explain the basic pathogenesis of these changes for the parasites. Correlate clinical and gross and microscopic pathologic findings due to these parasites. 5. For important parasites, predict the clinical presentation if given the pathologic lesions. Identify the expected pathologic lesions if given the clinical presentation. 6. Recognize important parasites grossly and/or microscopically, focusing especially on clinical parasitology diagnostics, i.e. recognition of helminth eggs, larvae, cysts, oocysts, etc. in fecal or other samples. 7. Explain the methods and rationale for treatment and control of parasitic infections. 8. Understand the zoonotic importance of certain parasites, and how they are dealt with from a veterinary public health standpoint. 9. Develop diagnostic thinking skills, computer literacy skills, and learning skills. 10. Recognize the importance of a solid knowledge of parasitology in the practice of veterinary medicine and surgery, and other fields of veterinary medicine.

Credits: 3.00

CPB 85300 - Principles Of Veterinary Immunology

Credit Hours: 2.00. An overview of the fundamental concepts of immunology, with an emphasis on the immune system of domestic animals and comparative immunology. Focuses on the interactions between the host and microbial pathogens and on mechanisms that underlie hypersensitivity reactions, autoimmune diseases, and immune deficiencies. Discusses the principles of vaccination and serologic tests.

Learning Outcomes: 1. Explain the basic principles by which the immune system functions. 2. Describe the mechanisms by which

the immune system protects the host against infectious diseases and can be mobilized to treat cancer. 3. Explain the role of aberrant immune responses in hypersensitivity reactions, allergies and in autoimmune diseases. 4. Outline the immunological principles of vaccines and vaccination. 5. Identify the principles of immunoassays. 6. Explain the mechanisms of action of drugs that inhibit immune responses and drugs that target specific immune mechanisms. Credits: 2.00

CPB 85400 - Principles Of Epidemiology

Credit Hours: 1.00. An introduction to the principles of epidemiology as it relates to evaluating and describing the health of human and animal populations. An emphasis is placed on the appropriate use by veterinarians of information derived from epidemiologic studies in making clinical decisions regarding the diagnosis, treatment, prognosis, and prevention of disease in individual patients. A goal is to demonstrate why epidemiology is considered by some as "a basic science for clinicians."

Credits: 1.00

CPB 85401 - Epidemiology And Evidence-Based Veterinary Medicine

Credit Hours: 2.00. The fundamentals of descriptive and analytical epidemiology will be developed as they relate to problems in veterinary and comparative medicine. A primary goal of the course is to expose future health professionals to the information and thought processes that are essential for critically evaluating the medical literature and for making decisions regarding health care for individuals and populations.

Learning Outcomes: 1. Characterize different epidemiological study designs, including experimental studies, clinical trials, and commonly used observational studies such as cross-sectional, cohort, and case-control studies. 2. Interpret basic epidemiologic measures, including prevalence and incidence measures for disease occurrence and ratio and difference measures for association. 3. Implement causal thinking by assessing potential bias, confounding and random error. 4. Understand basic terminology of infectious disease epidemiology. 5. Understand methods of disease surveillance and their corresponding strengths and weaknesses 6. Describe the steps in an outbreak investigation. 7. Define sensitivity, specificity, false positive fraction and false negative fraction and use them to compare discriminative performance of different diagnostic tests. 8. Interpret numeric results commonly presented in journal articles such as odds ratio, 95% CI, and p-value. 9. Critically appraise evidence presented in clinical studies and scientific research articles. Credits: 2.00

CPB 85500 - Veterinary Hematology And Cytology

Credit Hours: 2.00. Provides an overview of veterinary hematology and cytology. Normal morphology and function of the cells of the hematopoietic system are reviewed. Laboratory analyses of the different cell types are discussed. The responses of the hematopoietic cells that can be seen during different disease processes are presented. Fundamentals of veterinary diagnostic cytology are introduced.

Learning Outcomes: 1. Explain the development of hematopoietic cells, their function, and control of hematopoiesis, emphasizing features and growth factors that are clinically significant. Apply these concepts, in conjunction with clinical & physical findings, to interpret laboratory data (CBC and bone marrow findings). 2. Name and explain the characteristic findings or 'patterns' anticipated on CBC and bone marrow response for common hematologic disorders in domestic animals and their etiology. 3. Discuss the characteristic features of reactive (benign) and malignant disorders of red blood cells, white blood cells, and platelets with respect to their diagnosis, etiology, and prognosis. 4. Develop microscopic skills including estimating cell density or counts and identification of normal and abnormal blood cells, morphologic changes and inclusions within these cells. 5. Demonstrate use microscope to evaluate a cytology specimen.

Describe features that suggest an inflammatory, hyperplasia, versus a specific neoplasia process. Explain the type of inflammatory response seen with various infectious or non-infectious etiologies and be able to identify agents. Observe and describe general cytologic features of malignancy and of different malignant cell populations (round cell, mesenchymal, or epithelial). Credits: 2.00

CPB 85602 - Veterinary Bacteriology And Mycology

Credit Hours: 4.00. The lecture portion provides an introduction to bacterial and fungal agents of animal diseases. The taxonomy, morphology, and physiology of the organisms are discussed. Pathogenic features of the infectious agents and host responses to infection will be emphasized. Epidemiology, diagnosis, and control of the various diseases will be presented. The laboratory portion of the course covers laboratory safety, sterilization and disinfection in addition to microbiological techniques, antimicrobial susceptibility testing and interpretation, and identification of cultured bacteria and dermatophytes.

Learning Outcomes: 1. Develop basic knowledge of clinically relevant bacterial and fungal agents of disease in animals, including taxonomy, virulence factors, and pathogenesis (including transmission), with less emphasis on diagnosis and treatment (though these will be discussed). The course includes a brief introduction to antimicrobial chemotherapy and judicious use of antimicrobial agents. 2. Learn which agents are considered zoonotic or of other public health importance (e.g. foodborne pathogens, bioterrorism potential, etc.). 3. Practice basic microbiology laboratory techniques. Credits: 4.00

CPB 85603 - Veterinary Bacteriology And Mycology

Credit Hours: 3.00. An overview of bacterial and fungal pathogens of veterinary species. Topics will include discriminating features of the organisms, the pathogenesis of diseases caused by these agents, diagnostics, management and therapeutics.

Learning Outcomes: 1. Compile a list of differential diagnoses based on clinical presentation and signalment. In other words, associate specific bacterial and fungal agents with animal species and affected body sites. 2. Evaluate the properties of organisms (Gram pos/neg; Cocci/rod; Anaerobes/aerobes, etc.) on the differential diagnoses list in order to develop a diagnostic plan. 3. Describe laboratory test methods used in diagnosis of bacterial and fungal diseases. 4. Recognize bacterial and fungal pathogens that are zoonotic or reportable. 5. Outline the pathogenesis of an organism from the host encounter, entry/multiplication/spread to damage to the host. 6. Understand basic mechanisms of action, basic spectrum of activity, and major safety and legal concerns of antibacterial and antifungal therapeutics and disinfectants. 7. Select appropriate therapy and control/prevention based on understanding of pathogens and therapeutic agents. Credits: 3.00

CPB 85700 - Veterinary Systemic Pathology

Credit Hours: 5.00. Provides coverage of system specific pathologic terminology and characteristic pathologic responses of the various body systems to injury. This is followed by presentation of representative examples of diseases of various etiologies, including, but not limited to, infectious and noninfectious diseases.

Learning Outcomes: 1. Recognize and describe diseased tissue grossly and microscopically, explain the sequence of events in the development and outcome of observed lesions, explain the interplay among different organs or tissues, and predict the effect of the response to injury on the host. 2. Correlate clinical and pathologic findings. Predict the organ/tissue site and nature of expected lesions when given the clinical presentation. Predict clinical signs when given the gross or microscopic lesions. 3. Correlate gross lesions (or lack thereof!) with

histologic, cytologic, and molecular changes. 4. Categorize lesions as degeneration or necrosis, inflammation, circulatory disturbance, or disturbance of growth. Recognize that a given lesion may (and often does) fall into more than one category. 5. Formulate a logical and practical differential diagnosis based on the host signalment, the affected organ or tissue, the lesion categorization, and environmental influences (risk factors, seasonal or geographical influences, etc.). Credits: 5.00

CPB 86000 - Veterinary Virology

Credit Hours: 3.00. Principles of medical virology and discussions of important viral diseases of animals.

Learning Outcomes: 1. Know the definition of the diseases. 2. Describe brief history of the disease including current geographical distribution and importance. 3. Describe the virus as to classification, host range, important aspects of replication, and resistance to environment. 4. Outline the signs of the disease. 5. Understand pathogenesis, distribution and fate of virus, immunological responses. 6. Provide description of important gross and histological lesions that may explain pathogenesis. 7. Understand methods used to make presumptive and specific diagnoses. 8. Describe epidemiology - important methods of spread, vectors if involved, seasonality, etc. 9. Describe immunity - as it relates to vaccination, types of vaccines, and their use. 10. Recognize public health significance, if any. 11. Control of the disease including area (state, national, or international) control programs and "on the farm" control where pertinent. Credits: 3.00

CPB 86100 - Veterinary Clinical Chemistry

Credit Hours: 2.00. Laboratory techniques and interpretation of laboratory data as profiled by organ system are presented. Integration of data to explain pathophysiologic changes as an aid to diagnosis, prognosis and progression of disease is emphasized.

Learning Outcomes: 1. Organize routine tests appropriately into diagnostic profiles that best characterize abnormalities in acid-base, the urinary system, the hepatobiliary system, exocrine pancreas (pancreatitis), muscle, endocrine pancreas, adrenal gland, thyroid gland and parathyroid gland. 2. Describe relevant physiology for each test involved in biochemical profiling, describe relevant mechanisms for alterations from normal, list differentials and prioritize differential lists based on other laboratory and clinical information. 3. Recommend follow-up testing that may lead to a definitive diagnosis where appropriate. 4. Integrate CBC data interpretations (e.g., from CPB 85500 - Veterinary Hematology & Cytology) with biochemical profiling results. 5. Characterize and diagnose disorders of hemostasis based on integration of clinical findings with hemostasis-specific and associated laboratory testing. The student will be able to: Explain the physiology of primary, secondary, & tertiary hemostasis, and anticoagulation, including the correct association of the "key elements" of hemostasis with each process; Correctly associate assays for hemostasis with the stage/process that they evaluate and interpret abnormal results. Credits: 2.00

CPB 86200 - Clinical Epidemiology For Companion Animals

Credit Hours: 1.00. Fundamentals of experimental epidemiology and clinical decision-making are explored, particularly as they relate to the practice of companion animal medicine. Methods for disease detection and prevention are emphasized in catteries and kennels. The computer laboratories illustrate the software available for problem-solving in population medicine.

Credits: 1.00

CPB 86300 - Epidemiology For Livestock Production

Credit Hours: 1.00. Study of the fundamental concepts for epidemiologic implications in livestock production, including design of epidemiologic studies in livestock populations, investigation of disease outbreaks, use of diagnostic tests, infectious disease control, and animal health economics. Rationale, strategies, and concepts of animal disease control are emphasized with examples.

Credits: 1.00

CPB 86900 - Veterinary Public Health And Zoonoses

Credit Hours: 2.00. A survey of fundamental topics on diseases that are caused by viral, bacterial, rickettsial, and parasitic agents and are known to be transmissible from animals to humans, as well as those diseases that are common to humans and animals. Topics emphasize the epidemiology and methods for prevention and control of these diseases in animal and human populations. Food safety and foodborne diseases, with particular emphasis on foods of animal origin, are discussed. Risk assessment of occupational and environmental health conditions to which veterinarians are likely to be exposed in training or the workplace also is covered.

Learning Outcomes: 1. Identify and mitigate risks to human and animal health encountered by the veterinary profession and by others through direct and indirect animal contacts (e.g., food, meat, milk). 2. Communicate about risks pertaining to environmental hazards and zoonotic diseases to professional and lay audiences. 3. Evaluate data and scientific reports related to one health critically. 4. Identify emerging and exotic diseases of animals and understand appropriate responses to them. Credits: 2.00

CPB 87000 - Diagnostic Veterinary Cytology

Credit Hours: 1.00. A combination of didactic and wet laboratory microscopic sessions are used to demonstrate applications of diagnostic cytology. Consists of weekly sessions with a brief lecture overview of the basic cytologic features of a particular organ system followed by microscopic review of collected cytology material from that particular organ system. The didactic and laboratory sessions are supplemented by Internet-based and digital-format archived images for student review.

Learning Outcomes: 1. Evaluate a cytology slide including, but not limited to, inflammatory and neoplastic lesions. 2. Describe the features of the slide in such a way as to clearly convey thoughts and justify provided interpretation. 3. Understand the limitations of cytology and provide medically sound comments to advance the case. Credits: 1.00

CPB 88300 - Public Health

Credit Hours: 3.00. This course is designed for senior veterinary students to fulfill their interests in public health and preventive veterinary medicine. There will be a classroom and field component, focusing on topics including epidemiology, food safety, infectious diseases, environmental health and health communications. Visits to various agencies will complement the course material by offering inside views of the day to day operations of the facilities as well as the career experiences of the employees working in them. Students will also gain field experience in actual or devised research projects that will include activities such as study design, questionnaire development, collecting epidemiologic data, date input, analysis, and interpretation. Students will be asked to design a study, produce an information brochure, and prepare a verbal presentation for elementary school children about topics relating to being safe with your pets. Total clinic hours 129.

Learning Outcomes: 1. Understand the varied roles veterinarians play in the physical, mental and social well being of people. 2. Know the state and federal agencies involved in the U.S. public health system. 3. Use their epidemiological skills to investigate disease outbreaks and critically evaluate epidemiological studies. 4. Assess disease risks resulting from animal exposure in targeted human populations. 5. Assess disease risks resulting from food production and drinking water systems. 6. Understand the role of the veterinarian in biosecurity and responding to animal emergencies resulting from natural or man-made disasters. 7. Know how to communicate effectively with the public and media. Credits: 3.00

CPB 88400 - Laboratory Animal Medicine

Credit Hours: 3.00. Students will participate in laboratory animal medicine practice which can include facility inspections, protocol review, preventative medicine, monitoring disease status, and diagnosis and treatment of spontaneous diseases in laboratory animals. Total clinic hours 129.

Learning Outcomes: 1. Understand the role the laboratory animal veterinarian has within the research facility. 2. Understand how a research facility is run by working with management, animal care staff, regulatory staff, and veterinary staff. 3. Understand animal husbandry of common laboratory species such as rodents, pigs, and dogs. 4. Understand colony health monitoring and research protocol review. 5. Review and critique recent literature.

Credits: 3.00

CPB 88501 - Necropsy I

Credit Hours: 1.00. This is one of three concurrent courses (CPB 88501, CPB 88502, CPB 88503) in which senior veterinary students will be enrolled. Students will actively participate in the diagnostic necropsy service within the ADDL. The student is expected to gain basic clinical experience and training in necropsy and diagnostic pathology as they contribute to and support the practice of veterinary medicine. Students are expected to actively assist faculty in performing necropsies, discuss pathophysiology of cases and submit reports of their observation. Total clinic hours 43.

Credits: 1.00

CPB 88502 - Microbiology I

Credit Hours: 1.00. This is one of three concurrent courses (CPB 88501, CPB 88502, CPB 88503) in which senior veterinary students will be enrolled. This course is designed for senior veterinary students to gain additional training in diagnostic microbiology (bacteriology, mycology, virology and molecular diagnostics) in relation to clinical diseases. Students will actively participate in self study and discussion of selected diagnostic microbiology cases as well as hands-on logistically approached laboratory procedures for culture and isolation of microbial agents. The students are expected to be proficient and competent in veterinary diagnostic microbiology at the end of rotation. Total clinic hours 43.

Credits: 1.00

CPB 88503 - Clinical Pathology I

Credit Hours: 1.00. This is one of three concurrent courses (CPB 88501, CPB 88502, CPB 88503) in which senior veterinary students will be enrolled. In addition to clinical pathology, students must be enrolled in microbiology and diagnostic pathology (necropsy). The main goal of this rotation is to insure that each participant is at a level of competency that every graduating senior should have attained. Through a combination of self study and small group periods in a classroom as well as on a multi-headed microscope, a set of core objectives will be explored. These objectives have been chosen as a representation of basic clinical pathology skills that students should have mastered to practice veterinary medicine competently. In addition, an approved journal article or comparable piece of literature will be evaluated and summarized. An objective examination at the end of the rotation will test the student's knowledge of the objectives. Total clinic hours 43.

Credits: 1.00

CPB 88600 - Diagnostic Pathology

Credit Hours: 3.00. Advanced training in diagnostic approaches to identification of the causes and pathogenesis of disease in mammals. Total clinic hours 129.

Credits: 3.00

CPB 88700 - Avian Medicine

Credit Hours: 3.00. This course is designed for senior veterinary students to receive advanced training in avian disease diagnosis and health management in commercial poultry flocks. Critical poultry infectious and non-infectious diseases will be discussed. The student will visit production facilities for layers, broilers, turkeys, or ducks. Vaccination and medication programs for these species will be discussed. Necropsy experience will be gained from poultry, game bird, and pet bird accessions to the Animal Disease Diagnostic Laboratory (ADDL). Total clinic hours 129.

Credits: 3.00

CPB 88800 - Microbiology II

Credit Hours: 3.00. This course is designed for senior veterinary students to gain advanced training in clinical microbiology in relation to clinical diseases. Microbial diseases of veterinary importance and zoonotic significance will be addressed. Students will actively pursue selected microbiology accessions to the Animal Disease Diagnostic Laboratory (ADDL) in depth by applying problem-based learning approach, using correct laboratory procedures, and searching related literature to reach microbiological diagnosis and conclude the cases. Written reports, oral presentations, case discussion will be highlighted in the rotation to enrich the learning experience and insure the proficiency and competency in veterinary clinical microbiology. Total clinic hours 129.

Credits: 3.00

CPB 88900 - Clinical Pathology II

Credit Hours: 3.00. This advanced clinical pathology rotation is designed to take the core skills mastered in CPB 88503 and expand on them. Through daily interaction to the consulting office on clinical cases, students will learn to critically evaluate cytologic and hematologic specimens as well as laboratory data. Activities that the student will engage in include the resident's journal club, weekly clinical pathology rounds, large animal clinical pathology rounds and other small group sessions with residents and pathologists. The goal for the rotation is to begin building a broad base of experience to continue building on in the future. Total clinic hours 129.

Credits: 3.00

VCS 80110 - Veterinary Skills And Competencies I

Credit Hours: 2.50. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism, and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate basic safety, husbandry, and restraint of dogs, cats, food animals, and horses. 2. Demonstrate basic principles of hygiene and bio-security. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications per oz. to dogs, cats, food animals, and horses. 5. Demonstrate correct calculation of IV fluid dosing. 6. Demonstrate knowledge of basic medical equipment use. 7. Demonstrate knowledge of surgical instrumentation, needles, and suture material. 8. Demonstrate ability to perform complete basic physical examination of a dog, cat, food animal, and horse. 9. Demonstrate effective use of non-verbal communication. 10. Demonstrate an understanding of stress management techniques. 11. Demonstrate an understanding of social media's impact on a professional career and client relationships. 12. Demonstrate an understanding of the principles of collegiality with respect to competition and the impact of dishonesty in a professional setting. 13. Demonstrate an awareness of the risks for and methods for prevention of suicide. 14. Demonstrate an understanding of the definition of cyberbullying and methods to protect yourself. 15. Demonstrate an ability to manage conflict within the veterinary team. 16. Demonstrate an understanding of the laws and policies of veterinary medicine. 17. Demonstrate an understanding of USDA identification techniques. Credits: 2.50

VCS 80120 - Veterinary Skills And Competencies II

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals.

Learning Outcomes: 1. Demonstrate competency in the advanced restraint of dogs, cats, food animals, and horses. 2. Demonstrate basic safety, husbandry, and restraint of avian and exotic species. 3. Demonstrate ability to take, record, and communicate appropriate history information. 4. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses. 5. Demonstrate ability to safely and appropriately perform jugular venipuncture of cats, dogs, food animals, and horses using models. 6. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a cat, dog, food animal, and horse. 7. Demonstrate ability

to perform a FNA and prepare a slide for cytology. 8. Demonstrate ability to collect specimens for diagnostic lab submission. 9. Demonstrate ability to operate radiographic equipment. 10. Demonstrate ability to position for abdominal radiographs in small animals. 11. Demonstrate ability to perform PCV/TP, blood glucose, I-Stat, and USG diagnostics. 12. Demonstrate ability to create understandable discharge instructions which foster client compliance. 13. Demonstrate an understanding of student loan information and re-payment options. 14. Demonstrate effective communication within the veterinary team. 15. Demonstrate effective communication with owners about finances and be able to provide estimates for medical recommendations. Credits: 2.00

VCS 80130 - Introduction To Population Medicine And Veterinary Ethics

Credit Hours: 2.00. This course will introduce first year veterinary students to the fundamental principles of population medicine. This will include concepts behind population versus individual animal medicine, population animal industries and their management practices, population animal diseases, outbreak investigation, regulatory medicine, and interactions between wild and domestic animals. Following an introduction to population medicine, students will shift to a discussion of veterinary ethics and its application to various animal industries. Students will explore basic concepts in animal use ethics and welfare, ethical and moral reasoning, and critical thinking and problem solving in population medicine.

Learning Outcomes: 1. Develop an understanding of the concepts of population medicine and compare and contrast those to individual animal medicine. 2. Acquire a basic understanding of the production animal industries and management practices employed by those industries. 3. Attain a familiarity of the major disease challenges common to each of the animal populations presented. 4. Be able to intelligently approach a disease outbreak investigation and recommend sound basic sampling, management, and treatment options. 5. Understand and appreciate the role of regulatory medicine in disease control. 6. Understand and appreciate the wild and domestic animal interactions and challenges. 7. Review basic concepts in ethics of animal use and animal welfare science. 8. Illustrate how ethics and moral reasoning may be used to resolve contentious animal issues of relevance to veterinary medicine. 9. Develop skills in critical thinking and collaborative problem solving relative to population medicine. 10. Enhance information gathering, assimilation, and communication skills. Credits: 2.00

VCS 80140 - Fundamental Principles Of Comparative Nutrition

Credit Hours: 2.00. This course will cover fundamental aspects of comparative nutrition building on knowledge from veterinary comparative anatomy and physiology courses. Multiple species will be discussed to provide the student a broad-based foundational knowledge in key nutritional concepts, including feeds and feeding assessment and the animal's physiologic state/lifestage. The student will learn how physiologic status will impacts energy needs and nutritional adequacy, on an individual and/or group basis. The student will also develop skills in forage identification, pet food assessment, and when the individual/group is at risk of nutrient deficiency.

Learning Outcomes: 1. Discuss with the owner/client the nutritional assessment of the animal/herd, incorporating physiologic state and concerns involving environment, food, or feeding management. 2. Identify and assess common feeds and forages. 3. Explain the role of nutrition throughout the lifecycle for health to support growth, lactation, and gestation as well as adult maintenance to include aging. 4. Complete a nutritional history, whether herd or individual, to be used in assessment of health status and likelihood of risk for nutritional deficiencies or toxicities. 5. Calculate energy needs based on lifestage or physiologic status. 6. Perform assessment of pet foods to determine nutritional adequacy. 7. List the

unique dietary requirements of small mammals and reptiles. Credits: 2.00

VCS 80210 - Veterinary Skills And Competencies III

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital. Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via SQ and IM to dogs, cats, food animals, and horses (using cadavers). 2. Demonstrate safe and appropriate jugular and peripheral venipuncture of dogs, cats, food animals, and horses (using models). 3. Demonstrate ability to collect and submit venous samples for hematology and chemistry. 4. Demonstrate ability to collect and submit voided urine samples. 5. Demonstrate ability to perform a physical examination including abdominal assessment and rectal palpation of a dog, cat, food animal, and horse. 6. Demonstrate ability to perform a cardiologic examination in dogs, cats, food animals, and horses. 7. Demonstrate ability to perform a neurologic examination in dogs, cats, food animals, and horses. 8. Demonstrate four techniques for oxygen administration. 9. Demonstrate ability to correctly and aseptically place an IV catheter (in models) of large and small animals. 10. Demonstrate intubation of dogs and cats. 11. Demonstrate understanding of regulatory paperwork, the completion of the USDA accreditation modules, and the ability to perform tuberculosis and brucellosis testing. 12. Demonstrate ability to measure systemic blood pressure using both Doppler and oscillometric techniques. 13. Demonstrate ability to perform a bone marrow aspirate and bone marrow core biopsy. 14. Demonstrate ability to correctly set up and position for thoracic radiographs. 15. Demonstrate ability to complete one- and two-hand ties, instrument ties and square knots. 16. Demonstrate ability to prepare Diff-quick staining on cytologic samples. 17. Demonstrate understanding of the principles of OR conduct and correct gowning and gloving protocols. 18. Demonstrate ability to measure SpO2 via pulse oximetry. 19. Demonstrate ability to perform a diagnostic and 10 lead EKG. 20. Demonstrate appropriate telephone communication and etiquette with owners and fellow veterinarians. 21. Demonstrate understanding communication strategies to improve treatment compliance. 22. Demonstrate understanding of their personal credit score-both its calculation and impact. 23. Demonstrate knowledge of Veterinary Teaching Hospital protocols for patients in ICU and wards. 24. Demonstrate understanding of the use of the Omincell. 25. Demonstrate ability to complete patient rounds with ICU technicians. 26. Demonstrate knowledge of Veterinary Teaching Hospital and Animal Disease Diagnostic Lab forms and protocols for sample submission. 27. Demonstrate ability to perform and interpret SNAP tests. 28. Demonstrate ability to complete drug calculations, write prescriptions for medications, and write a veterinary feed directive. Credits: 2.00

VCS 80220 - Veterinary Skills And Competencies IV

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well

as, self-paced training in the veterinary skills lab. Students will further develop these skills through the care of teaching animals. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate safe and appropriate administration of medications via IV to dogs, cats, food animals, and horses. 2. Demonstrate ability to perform biopsies of dogs, cats, food animals, and horses and to submit specimen to the diagnostic laboratory. 3. Demonstrate ability to perform basic regional anesthetic techniques. 4. Demonstrate understanding of the anatomy of, types of, and testing of anesthetic machines. 5. Demonstrate understanding and use of various feeding tubes in small animals. 6. Demonstrate ability to properly position small animals for radiographs of limbs. 7. Demonstrate ability to correctly operate fluid and syringe pumps. 8. Demonstrate understanding of FAMACHA scoring. 9. Demonstrate ability to place nasal oxygen cannula, perform nebulization, and coupage. 10. Demonstrate ability to perform end-tidal CO2 monitoring. 11. Demonstrate ability to pass orogastric tubes and esophageal feeders on ruminant models. 12. Demonstrate ability to perform injections and venipuncture on live animals both small and large. 13. Demonstrate ability to establish rapport with a client in an emergency situation. 14. Demonstrate ability to communicate appropriately in situations involving ethical issues. 15. Demonstrate understanding of educational debt to income level and options to manage educational debt repayment. 16. Demonstrate understanding of appropriate reporting of reportable diseases and foreign animal disease investigations. Credits: 2.00

VCS 80301 - Veterinary Clinical Skills I

Credit Hours: 2.00. This course introduces students to the clinical environment in the Veterinary Teaching Hospital (VTH). Students will assist with treatments of patients and participate in activities of the various clinical services. Students will be assigned daytime and after-hours shifts. Laboratory sessions will address clinical skills, client communication skills, financial management, professionalism and wellness.

Credits: 2.00

VCS 80302 - Veterinary Clinical Skills II

Credit Hours: 2.00. This course is a continuation of VCS 80301 Clinical Skills I. Students will work with 4th year veterinary students in VTH. Students will assist with treatments of patients and participate in activities of the various clinical services. Students will be assigned daytime and after-hours shifts. Laboratory sessions will address clinical skills, client communication skills, financial management, professionalism and wellness.

Credits: 2.00

VCS 80310 - Veterinary Skills And Competencies V

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective compassionate communication with clients about euthanasia. 2. Demonstrate ability to pass nasoesophageal, nasogastric, orogastric, and esophageal feeders in various species. 3. Demonstrate ability to safely perform enteral feeding with a syringe and syringe pump. 4. Demonstrate ability to perform equine dental examination and dental float. 5. Demonstrate ability to administer, monitor, and prepare transfusions with various blood products. 6. Demonstrate ability to place intraosseous and multiple lumen jugular catheters in small animals. 7. Demonstrate ability to perform urinary catheterization and use a closed urinary collection system. 8. Demonstrate ability to perform a complete ophthalmic examination in dogs, cats, food animals, and horses. 9.

Demonstrate ability to perform a complete orthopedic examination in small animals. 10. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 11. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 80320 - Veterinary Skills And Competencies VI

Credit Hours: 2.00. This course is designed to allow students to develop competence in communication, husbandry, diagnostic, and therapeutic skills of veterinary medicine and surgery. In addition, instruction will be delivered in the areas of veterinary business, professionalism and health professional wellness. Instruction will be provided by online modules, hands-on laboratories using models, cadavers, and live animals, as well as, self-paced training in the veterinary skills lab. Students will also complete observational assignments and treatment duties in the Veterinary Teaching Hospital.

Learning Outcomes: 1. Demonstrate effective communication regarding medical errors. 2. Demonstrate ability to perform transtracheal wash in small animals. 3. Demonstrate ability to perform a dermatologic exam and intradermal skin testing in large and small animals. 4. Demonstrate ability to perform ultrasound examinations of limbs. 5. Demonstrate ability to perform ultrasound guided cystocentesis. 6. Demonstrate ability to perform abdominocentesis, periocardiocentesis, and thoracocentesis in large and small animals. 7. Demonstrate ability to monitor and observe patients and then record and report their medical observations. 8. Demonstrate ability to complete patient care orders. Credits: 2.00

VCS 80400 - Behavior In Domestic Animals

Credit Hours: 1.00. Instruction in basic principles of behavior; factors determining normal and abnormal behavior; and the different types of learning. The main domestic species will be characterized in terms of their normal behavior with which behavior problems are most important in the different species.

Learning Outcomes: 1. Apply the principles of learning to behavior analysis and modification. 2. Characterize the domestic species in terms of their normal behavior. 3. Identify environmental factors contributing to abnormal behavior and compromising their welfare. 4. Utilize knowledge on behavioral development and environmental and management effects on behavior for problem prevention and strengthening the human-animal bond. 5. Integrate behavioral knowledge into veterinary medicine and its practice. Credits: 1.00

VCS 80500 - Small Animal Behavioral Therapy

Credit Hours: 1.00. Provides information on the diagnosis, treatment, and prevention of behavior problems of dogs and cats, with emphasis on differential diagnosis of behavioral problems and behavioral pharmacology. Topics include aggression, anxiety related problems, inappropriate elimination, client counseling, and problem prevention. Client interaction and the question of euthanasia for behavioral problems is also discussed.

Learning Outcomes: 1. Identify stress signs as well as the mood (positive or negative) in dogs and cats by reading their body language. 2. Apply behavior knowledge into veterinary practice. 3. Formulate a diagnostic work-up for the more common behavior problems in companion animals and arrive at a list of differential diagnoses. 4. Choose the appropriate behavior modification techniques to prevent developing behavior problems. 5. Compare and contrast the various FDA approved drugs and dosing regimen to treat the more common behavior problems in companion animals. 6. Interact efficiently and compassionately with owners of patients with a behavior problem and discuss the question of behavior-related euthanasia. 7. Discuss welfare topics relating to small animals intelligently. Credits: 1.00

VCS 80600 - Small Animal Medicine And Surgery I

Credit Hours: 3.50. An overview of clinical approach to common medical and surgical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases

affecting each body system. The focus is on diagnosis and treatment of common diseases encountered in small animal clinical practice.

Credits: 3.50

VCS 80610 - Small Animal Medicine I

Credit Hours: 3.50. This course is the first in a series that provides an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 3.50

VCS 80616 - Small Animal Clinical Nutrition

Credit Hours: 1.00. This nutrition course presents the established knowledge of metabolism and physiological chemistry pertaining to nutrients and the control of biochemical pathways at the gene, cell, organ, and system level. The goal of this course is to provide the fundamentals of nutrient metabolism while discussing nutritional modification in the management of disease. At the completion of this course, the veterinary student should be proficient in recognizing a nutrition-related problem in a clinical patient, conducting a thorough nutritional assessment, and constructing appropriate nutritional strategies for both the pet and client. The veterinary student will achieve an understanding of systemic metabolism that can be applied to the contemporary practice of veterinary medicine.

Learning Outcomes: 1. Explain the role of the practitioner in incorporating evidence-based nutrition plans for all life stages. 2. List the components of a complete nutritional assessment for both dogs and cats. 3. Define the role of nutrition throughout the lifecycle for health to support proper growth, maturation, aging, lactation, and gestation. 4. Describe the impact of nutrient deficiency for each lifestage. 5. Demonstrate ability to calculate daily energy needs for all lifestages, during illness, and for weight loss programs. 6. Identify key nutrients of concern in common diseases and identify the key characteristics found in the nutrient profile of an appropriate therapeutic diet. 7. Develop a nutritional plan for common nutritional problems presented to a small animal practitioner. 8. List options for assisted-feeding to include potential limitations for each technique. Credits: 1.00

VCS 80620 - Small Animal Medicine II

Credit Hours: 1.50. This is the second course in a series providing an overview of clinical approaches to common medical diseases of dogs and cats. A systems approach is used to teach the major concepts of diseases affecting each body system. The focus of this course is disease recognition based on initial medical information (ex. signalment, presenting complaint, physical examination), diagnosis, and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop a problem-based approach to common medical diseases in the dog and cat. 2. List clinical signs for common medical diseases in the dog and cat. 3. Create a differential diagnoses list after integrating initial medical information. 4. Describe the diagnostic approach to common medical diseases in the dog and cat. 5. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. 6. Describe treatment options for common medical diseases of the dog and cat and the advantages and disadvantages of each option. Credits: 1.50

VCS 80630 - Small Animal Surgery

Credit Hours: 2.50. This course will teach basic surgical principles applicable across species such as suture materials

and patterns and principles of hemostasis. Common surgical diseases affecting the various body systems of dogs and cats will be discussed with a focus on pre- and postoperative care. Routinely performed surgical procedures (neuter, spay, C-section) will be discussed. Orthopedic topics will include bone healing, management of musculoskeletal trauma, fracture management, and fundamentals of external and internal fracture stabilization techniques for dogs and cats. The course will conclude with discussions of select musculotendinous conditions, principles of amputation and joint and limb salvage, and an introduction to principles of physical therapy.

Learning Outcomes: 1. Explain correct preparation of the surgical site, draping and procedures for maintaining aseptic technique. 2. Identify commonly used surgical instruments, suture materials, and suture patterns and explain the indications for their use. 3. Explain the indications, procedures and complications of surgical procedures common in general practice such as ovariectomy, ovariohysterectomy, castration, cesarean-section/hysterotomy, enterotomy, gastrotomy, and cystotomy. 4. Recognize the clinical signs associated with common surgical diseases of the upper airway, ear, gastrointestinal tract, and urinary tract and formulate appropriate diagnostic and treatment plans. 5. Explain principles for surgical management of tumors. 6. Recognize different types of wounds and recommend appropriate steps for initial wound management. 7. Describe the process of bone healing and explain the principles of fracture fixation to optimize bone healing. 8. Describe fractures based on type, classification and location. 9. Explain the diagnosis, perioperative management, and treatment options for common fractures and joint injuries involving appendicular bones and mandible. 10. Formulate a diagnostic plan for common orthopedic diseases. 11. Explain the etiology, pathophysiology, diagnosis, and medical and surgical treatment of developmental and degenerative joint diseases of dogs. 12. Explain the etiology, pathophysiology, diagnosis, and treatment of developmental and acquired multicentric diseases of the long bones of dogs. 13. Explain the etiology, pathophysiology, diagnosis, and treatment of more common musculotendinous conditions. 14. Explain the indications, principles and anticipated outcomes for amputations, arthrodesis, and limb salvage procedures. 15. Describe the basic principles, modalities, goals, and anticipated outcomes of current physical therapy and rehabilitation therapies. Credits: 2.50

VCS 80700 - Small Animal Medicine And Surgery II

Credit Hours: 2.00. An overview of clinical approach to common medical and surgical diseases of dogs and cats. A systems approach is used to teach the major concepts of disease affecting each body system. The focus is on diagnosis and treatment of common diseases encountered in small animal clinical practice.

Credits: 2.00

VCS 80800 - Equine Medicine And Surgery

Credit Hours: 2.50. Diagnostic methods and prevention, control, and treatment regimens for common diseases affecting horses. Issues related to diseases of regulatory importance (epidemic and exotic) are discussed. Students also learn about surgical correction of selected problems and elective surgical procedures.

Credits: 2.50

VCS 80801 - Equine Medicine

Credit Hours: 2.50. Core course focused on the major equine diseases and preventive medicine/herd health (biosecurity, vaccination, parasite control, dental disease). The course will cover pathogenesis, diagnosis, and treatment/management of these conditions or syndromes.

Learning Outcomes: 1. List the names of the common diseases affecting equines, the causal agent(s) or predisposing/risk factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems affecting equines. 3. Identify clinically relevant and practical management changes or

therapies that are used to treat and control common diseases of equines. 4. Formulate a biosecurity plan for a farm dealing with an outbreak of a contagious equine disease. 5. Critically evaluate current literature and apply evidence-based medicine (EBM) to equine cases and clinical decision making. Credits: 2.50

VCS 80900 - Ruminant Medicine And Surgery

Credit Hours: 2.00. Diagnostic methods and prevention, control, and treatment regimens for common diseases affecting ruminants. Issues related to food quality assurance and safety, and diseases of regulatory importance (epidemic and exotic). Surgical correction of selected problems and elective surgical procedures.

Credits: 2.00

VCS 80910 - Food Animal Medicine

Credit Hours: 4.00. This course focuses on the major infectious, metabolic, and parasitic diseases of ruminants, camelids, swine, poultry and other avian flocks. The pathogenesis, diagnosis, and treatment of these conditions or syndromes will be reviewed. Additionally, the course will cover proper management, including vaccinations and animal husbandry, to prevent the development of these conditions.

Learning Outcomes: 1. List the names of the common diseases of ruminants, the causal agent(s) or predisposing factors, and underlying mechanisms associated with these diseases. 2. Create a differential diagnosis list and select suitable diagnostic procedures for problems in ruminants/camelids. 3. Describe management changes or therapeutic methods that are used to treat and control common diseases of ruminants. 4. Discuss the important issues of food safety, quality assurance, and health regulations as they relate to the ruminant industries. Swine 5. List the names of the common diseases of swine and their causal agent(s), predisposing factors, and where possible, underlying mechanisms. 6. Develop a differential diagnosis list and select a suitable diagnostic plan to determine the definitive diagnosis. 7. Describe management changes or therapeutic methods to prevent, control, and treat common swine diseases/problems. Poultry 8. Provide students with a basic practical knowledge of avian medicine. After completing this course, students are expected to be able to: 9. Identify the economical and public health diseases of flocks. 10. Identify the proper diagnostic tests needed to diagnose each disease. 11. Explain the economic and public health consequences of each disease. 12. Design treatment and prevention strategies for each disease. Credits: 4.00

VCS 80920 - Large Animal Surgery

Credit Hours: 2.50. This course will cover the core fundamentals of surgical diseases of multiple large animal species, including the horse, bovine, small ruminants and camelids. Case management approaches are utilized to provide examples of disease conditions affecting these large animal species.

Learning Outcomes: 1. Present core large animal surgical diseases of horses, cattle, small ruminants, pigs, and camelids. 2. Present surgical management of large animal diseases. Credits: 2.50

VCS 81000 - Swine Production Medicine

Credit Hours: 1.00. Diagnostic methods and prevention, control, and treatment regimens for common diseases affecting swine. Issues related to food quality assurance and safety and diseases of regulatory importance (epidemic and exotic) are discussed.

Credits: 1.00

VCS 81100 - General Surgery Laboratory

Credit Hours: 1.00. Introduction to basic skills in surgery and anesthesia. Models are used to learn basic skills of instrument use, tissue handling, dissection, and suturing. Students will progress to common anesthetic and surgical procedures on live and cadaver animals.

Credits: 1.00

VCS 81101 - Small Animal Surgery Lab I

Credit Hours: 1.50. Introduction to basic skills in surgery and anesthesia. Models are used to learn basic skills of instrument use, ligation, dissection, and suturing. Students will progress to common anesthetic and surgical procedures on live and cadaver animals. The live animal surgery will teach physical examination, formulating an anesthetic plan, anesthetic induction, maintenance and recovery, as well as feline spay and neuter.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Scrub, gown and glove correctly, and maintain aseptic technique in the operating room. 5. Prepare the surgical site and drape correctly. 6. Name and correctly use each general surgical instrument. 7. Efficiently perform one-handed ties, two-handed ties, and instrument ties to make square knots. 8. Correctly place basic suture patterns. 9. Correctly and gently handle tissues and apply appropriate hemostatic techniques. 10. Open the abdomen through a ventral midline abdominal incision and close it properly. 11. Correctly and safely perform ovariohysterectomy and castration in cats. 12. Perform the emergency procedures of chest tube placement and tracheotomy tube placement. 13. Induce and maintain general anesthesia and monitor the anesthetized patient. 14. Safely recover an animal from general anesthesia. 15. Perform cardiopulmonary resuscitation. 16. Administer postoperative care, including analgesic therapy, and detect postoperative complications. 17. Keep appropriate medical records. Credits: 1.50

VCS 81200 - Principles Of Anesthesia, Surgery, And Emergency Medicine

Credit Hours: 2.00. Introduction to basic principles of anesthesiology and surgical practice. The principles of aseptic technique, operating room protocol, tissue handling, hemostasis, and wound repair. Principles of emergency medicine, including shock therapy, fluid therapy, and trauma management.

Credits: 2.00

VCS 81201 - Principles Of Veterinary Anesthesiology

Credit Hours: 2.00. Introduction to basic principles of anesthesiology. Pharmacology of anesthesia and analgesic drugs, anesthetic equipment, monitoring, regional and local anesthetic techniques, pain management and anesthesia care of multiple species and special disease considerations will be covered.

Learning Outcomes: 1. Learn the pharmacology and clinical effects of (and indications and contraindications for) common preanesthetic agents, including anticholinergic agents, tranquilizers and sedatives. 2. Learn the basic principles of general anesthesia of small and large animals. 3. Understand the pharmacology and clinical effects of (and indications and contraindications for) various injectable and inhalant anesthetics. 4. Learn the principles of local and regional anesthesia and understand how they are applied in the clinical setting. To learn the pharmacology of local anesthetic drugs 5. Learn how to evaluate a patient preoperatively and determine the appropriate choice of anesthetic, monitor the patient during general anesthesia and recovery, and recognize and treat emergencies. 6. Learn anesthetic techniques suitable for a variety of species and how to apply them in various clinical settings. 7. Learn how to anesthetize patients with a variety of medical conditions. 8. Learn the principles of pain management and apply them to a variety of clinical situations. Credits: 2.00

VCS 81210 - Small Animal Primary Care And Wellness

Credit Hours: 2.00. This course will discuss conditions that are commonly treated in small animal primary care practice. Topics will include wellness and preventative care for dogs and cats at all lifestages, dental care, diagnosis and management of common oral and skin diseases, and emergency medicine. Humane euthanasia and palliative care will also be discussed.

Learning Outcomes: 1. Explain the role the

primary care veterinarian has developing and implementing lifestage wellness programs. 2. Describe the key goals of a wellness program for each lifestage. 3. Describe vaccine and infectious disease screening programs for both cat and dog including available preventative medications. 3. Demonstrate standard procedure for oral evaluation, oral care to include dental cleaning and extractions. 4. Recognize common dermatologic diseases in the dog and cat and describe treatment to resolve these medical problems. 5. Demonstrate common dermatologic diagnostics procedures. 6. Explain key concepts of companion animal patients presenting as a primary care emergency patient: shock, coagulation abnormalities, oxygenation abnormalities, and sepsis. 7. Solve common fluid therapy problems addressed in both primary care hospitals and in primary care emergency practices. 8. Explain key concepts of palliative care, humane euthanasia, and natural death. Credits: 2.00

VCS 81300 - Diagnostic Imaging

Credit Hours: 1.00. In the first half of the core diagnostic imaging course, emphasis is on how images are made using current technology. Although radiography is emphasized, imaging modalities such as ultrasonography, computed tomography, magnetic resonance imaging, scintigraphy, and thermography are discussed. In the second half of the course, types of lesions that can be observed in large and small animals with the various imaging modalities are explained. The course is offered once annually, and its successful completion is required for any of the elective courses offered by Diagnostic Imaging.

Credits: 1.00

VCS 81400 - Comparative Theriogenology

Credit Hours: 1.00. Basic aspects of reproduction in large and small animals, including obstetrics and genital diseases, on a single animal or group basis are covered.

Credits: 1.00

VCS 81410 - Comparative Theriogenology

Credit Hours: 2.00. This course develops a broad clinical knowledge of common reproductive management strategies and clinical conditions associated with reproduction in the major domestic species. It provides information and strategies for the conduct of breeding soundness examinations and infertility work-ups in the male; estrous cycle characteristics, diagnostics and control in females; breeding management strategies, pregnancy diagnosis, and management of gestation; investigation and control strategies for pregnancy loss; management of parturition and treatment of dystocia; normal postpartum changes and diseases of the peripartum period and the pathophysiology and treatment of uterine infections. Material will be presented in both comparative and species-specific manner. Students should review reproductive anatomy and physiology notes in preparation for this course.

Learning Outcomes: 1. Be conversant with core reproductive principles of all major species (bovine, equine, small animals with canine as the model, porcine, small ruminants). 2. Understand similarities and differences in the physiological basis of key reproductive events across species. 3. Integrate knowledge from various disciplines to understand clinical situations pertaining to the reproductive health of animals on an individual or herd basis. 4. Understand the pathophysiology, clinical presentations, therapies, and prognoses for clinical issues pertaining to the reproductive health of animals on an individual or herd basis. Credits: 2.00

VCS 81500 - Ophthalmology

Credit Hours: 1.00. This course is an introduction to veterinary comparative ophthalmology. It covers the anatomy of the eye, diagnosis, pathophysiology, and treatment of the ocular diseases commonly seen in companion and food animal species: canine, feline, equine, avian, bovine, caprine, ovine, porcine, lagomorphs. Covers pharmacology as it relates to medications used to treat ocular disease.

Learning Outcomes: 1. Acquire basics of normal ocular anatomy and physiology, common ophthalmic diseases in all species for general practice, including their pathophysiology clinical presentations, therapies, and prognoses. 2. Become familiar with ophthalmic terminology. 3. Gain a basic knowledge of the diseases of the

anterior and posterior segments of the eye, the eyelids, and the globe. 4. Use correct ophthalmic terminology to describe ocular conditions. 5. Recognize common ocular conditions involving the adnexa, globe, and orbit. 6. Create a list of differential diagnoses for the conditions covered in class. 7. Determine appropriate diagnostic plans for the conditions covered in class. 8. Determine appropriate treatment plans and give an accurate prognosis for the conditions covered in class. 9. Learn the ocular medications listed on the ocular pharmacology sheet handed out in class and will know indications, contra-indications, and frequency for all medications. Credits: 1.00

VCS 81700 - Achieving Success In Private Practice

Credit Hours: 1.50. Provides a foundation for the application of practice management principles. Focuses on operations management, financial management, human resource management, and marketing management.

Learning Outcomes: 1. Improve communication skills - clients, staff, public speaking, listening, team building. 2. Gain financial skills - personal (financial awareness, educational debt management) and business (cost controls, compensation). 3. Increase career skills - interviewing, resume development, job search, jurisprudence of the profession. 4. Gain business skills - value management, marketing techniques, human resources, inventory. 5. Develop risk management skills - establishing policies/practices consistent with medical laws, practice best practices to ensure patient safety (i.e., appropriate medication calculations/dosing and administration). Credits: 1.50

VCS 81800 - Small Animal Surgery Laboratory I

Credit Hours: 0.50. Common orthopedic and soft tissue surgical procedures are performed on cadaver and live animals.

Credits: 0.50

VCS 81802 - Small Animal Surgery Laboratory II

Credit Hours: 1.50. This course will build on VCS 81100 by emphasizing the importance of proper basic surgical skills (instrument carriage, suturing, knot tying). Surgical skills will be expanded by performing several procedures on cadaveric tissue: abdominal approaches, gastrointestinal surgery, urogenital surgery, wound management, amputations. One lab will be dedicated to ophthalmologic procedures. Ovariohysterectomies and castrations will be performed on live dogs and cats to further develop the students' surgical skills as well as skills in physical examination, formulating an anesthetic plan, anesthetic induction, maintenance & recovery and postoperative care.

Learning Outcomes: 1. Demonstrate effective teamwork. 2. Communicate clearly and effectively with peers, faculty and staff. 3. Provide excellent patient care to teaching animals and animals from the humane society. 4. Safely perform elective surgery on patients using aseptic techniques for surgeon and patient, gentle tissue handling and dissection, secure vessel ligation, good hemostasis and appropriate suturing technique and patterns; and instrument carriage. 5. Be proficient at opening and closing abdominal incisions. 6. Explain common soft tissue surgical procedures performed in small animals. 7. Safely anesthetize, monitor and recover a small animal patient from anesthesia. 8. Explain the indications and general techniques for basic ophthalmic procedures. Credits: 1.50

VCS 81900 - Small Animal Dentistry

Credit Hours: 3.00. Students will be involved with the evaluation and treatment of small animal dentistry patients. Patient activity will occur during four days of the week. On the fifth day, procedure labs using cadaver specimens will be held. Daily patient discussions will occur, topic/additional patient rounds may also be presented on the fifth day. A complete spectrum of small animal dentistry treatments is provided by the clinical service. Therefore, the students will be involved with all levels of dental/oral care. For students enrolled in Small Animal/Companion Animal and mixed animal tracks. Total clinic hours 129.

Credits: 3.00

VCS 82000 - Small Animal Surgery Laboratory II

Credit Hours: 0.50. More advanced soft tissue and orthopedic surgical techniques are practiced on cadaver and live animals.

Credits: 0.50

VCS 82100 - Clinical Neurology

Credit Hours: 3.00. Students will be directly or indirectly involved in the evaluation, treatment and care of patients present to the neurology/neurosurgery service. Cadaver work may supplement the clinical experience. Students will be expected to accomplish the objectives of the Neurology/Neurosurgery block and to develop greater knowledge, clinical judgment, diagnostic capabilities and neurologic examination skills that would enable them to manage more complex cases, such as intervertebral disc disease, seizures, encephalopathies and neuropathies.

Learning Outcomes: 1. Perform a neurologic examination. 2. Neurolocalize basic lesions effectively. 3. Perform a physical rehabilitation examination. 4. Treat, using a variety of physical rehabilitation modalities and therapeutic exercises, various orthopedic and neurologic conditions. Credits: 3.00

VCS 82200 - Large Animal Surgery I

Credit Hours: 0.50. Basic surgical training in large animals, including both soft tissue and orthopedic procedures.

Learning Outcomes: 1. Provide students with the opportunity to develop their basic skills and knowledge in large animal surgery through performance of common surgical procedures, preoperative evaluation and post-operative case management. 2. Enhance the students' clinical application of large animal surgery principles and techniques taught in didactic courses. Credits: 0.50

VCS 82300 - Large Animal Surgery II

Credit Hours: 0.50. More advanced surgical training in large animals, including both soft tissue and orthopedic procedures.

Learning Outcomes: 1. Provide students with the opportunity to develop their basic skills and knowledge in large animal surgery through performance of common surgical procedures, preoperative evaluation and post-operative case management. 2. Enhance the students' clinical application of large animal surgery principles and techniques taught in didactic courses. Credits: 0.50

VCS 82501 - Ruminant Theriogenology

Credit Hours: 1.50. This course will cover clinically pertinent aspects of ruminant reproduction in more detail than prerequisite courses, including obstetrics and genital diseases on an individual and group basis. The laboratory portion will teach the proper techniques for rectal palpation and reproductive ultrasound in ruminants. Principles of embryo recovery and transfer will be practiced.

Learning Outcomes: 1. Recognize normal and abnormal reproductive function in the individual animal and herd. 2. Develop reasonable corrective actions for abnormal reproductive function and prognosis for return to normal. 3. Understand how to manipulate the reproductive cycle, and apply appropriate manipulations to various clinical scenarios. 4. Recognize dystocia and outline a plan to correct the dystocia. 5. Recognize common peripartum complications and create a plan to correct the abnormalities. 6. Understand the basics of assisted reproductive technologies in the bovine. Credits: 1.50

VCS 82700 - Small Animal Imaging

Credit Hours: 2.00. A continuation of VCS 81300 . Specific diseases of small animals where imaging is part of the diagnosis are discussed. Emphasis is on radiography and ultrasonography. The use of alternate imaging modalities is discussed where appropriate.

Credits: 2.00

VCS 82701 - Diagnostic Imaging

Credit Hours: 3.00. This course covers basic mechanisms of image generation and interpretation. The first half of the course deals with principles of image formation and the introduction to advanced imaging modalities. A synopsis of the principles of radiobiology and radiation safety is offered. The second part of the course features imaging interpretation based on previously

mastered imaging principles. The third part of the course builds the foundation of film reading and interpretation such as radiographic anatomy and radiographic signs of specific disease conditions. This course serves as a foundation for the fourth-year diagnostic radiology rotation.

Learning Outcomes: 1. Describe the basic operation of an x-ray machine, including the components of the x-ray tube. 2. Understand the relationship of kVp, mAs and exposure time to x-ray production. 3. Know the fundamental properties of x-rays and gamma rays. 4. Know technical factors that affect detail, density, distortion and contrast in the generation of the x-ray image. 5. Know the reason for using a grid and the construction of a grid. See textbook. 6. Understand the terms latitude and scale of contrast as they relate to radiographic exposure. 7. Describe the differences between and applications of medium (par), high speed and slow speed intensifying screens. 8. Know the advantages and disadvantages of using digital versus conventional radiography. 9. Know the basics of analog radiographic processing-what happens during development, rinse, fixation and washing. 10. Know the common artifacts that are produced in the darkroom, i.e., fixer versus developer spills, exhausted developer, static electricity, light leakage, improper temperature or mixing of chemicals and screen-based problems. See textbook. 11. Be familiar with the basic radiation protection measures used by veterinary workers. 12. Know the major effects (cancer induction, teratogenesis, etc.) of ionizing radiation and cellular mechanisms (free radical production, DNA damage, and mutation) involved in radiation injury. 13. Have a working knowledge of how an ultrasound machine functions and how ultrasonic images are interpreted (terminology). 14. Be familiar with imaging principles and advantages of nuclear medicine imaging. 15. Understand the difference between CT and MR imaging, and their relative indications in veterinary medicine. 16. Know the advantages and disadvantages of CT and MR imaging over radiography. 17. Know which imaging modalities are used to provide physiologic information. 18. Know how to name x-ray projections. 19. Understand the concept of "windowing" as it relates to digital forms of imaging. 20. Understand differences between file types for digital imaging, e.g., DICOM (.dcm), TIFF (.tif), JPEG (.jpg). 21. Recognize abnormal radiographic findings of commonly seen disease conditions in small animals. 22. Describe radiological findings according to Roentgen signs. 23. Formulate a meaningful differential diagnosis for commonly seen radiographic abnormalities in small animals. Credits: 3.00

VCS 82800 - Clinical Rotation In Neurology And Physical Rehabilitation

Credit Hours: 3.00. The first week of the 3-week block, students will spend 100% of the time on the neurology service. Weeks 2 and 3 of the block, the students will spend 100% of the time on the physical rehabilitation service. The course is a 3.0-credit elective clinical rotation. Currently, the neurology service receives three days per week (M, W, F), and the physical rehabilitation service receives new appointments one day per week (T) and recheck appointments daily (M-F). A PVM clinician will lead this elective rotation. The majority of cases will be small animal patients, but some exposure to large animal, equine and small ruminant cases may take place. Students are also expected to practice clinical and technical skills which are required for each service.

Learning Outcomes: 1. Gain experience in performing physical/neurological examinations, localizing lesions, generating differential diagnoses, and selecting an appropriate treatment plan for animals presented to the Neurology service. 2. Integrate knowledge to provide patient care, including medical management, preoperative, surgical, and postoperative care of client-owned animals. This includes principles of analgesia, fluids, drugs, nutrition, exercise limitations and/or rehabilitation. 3. Develop greater knowledge,

clinical judgement, surgical/technical skills, and diagnostic capabilities that enable management of more complex cases. 4. Increase the student's clinical experience in diagnosis and treatment of common ailments for which physical rehabilitation is recommended. 5. Develop exposure to both orthopedic and neurologic conditions in the more chronic stage of treatment. Typically students are exposed to such conditions during the peridiagnosis period. This rotation would give students exposure to disease and post-operative healing 2-8 weeks following diagnosis/surgical repair. 6. Learn how to appropriately select PT modalities for a patient. 7. Learn how to appropriately use different PT modalities. 8. Learn how to perform goniometry and limb girth. 9. Learn how to perform a gait lab analysis and how to interpret the findings. 10. Learn how to perform therapeutic exercises such as massage and range of motion. 11. Improve oral and written communication skills and medical documentation. 12. Practice the principles of teamwork and professionalism through interactions with faculty/clinicians, colleagues, technicians, and pet owners. Credits: 3.00

VCS 82900 - Equine Imaging

Credit Hours: 1.00. A continuation of VCS 81300 . Specific diseases of horses where imaging is part of the diagnosis are discussed. Emphasis is on radiography and ultrasonography. The use of alternate imaging modalities is discussed where appropriate.

Credits: 1.00

VCS 83100 - Equine Theriogenology Laboratory

Credit Hours: 1.00. This elective course provides the student with the opportunity to become proficient in all aspects of mare reproductive management. Palpation of the mare's reproductive tract will be emphasized. It also allows students to enhance their abilities to recognize reproductive problems and to formulate and carry out a diagnostic and therapeutic plan.

Learning Outcomes: 1. Safely and competently perform a transrectal palpation and ultrasound of the reproductive tract of the mare. 2. Acquire basic understanding of managing the mares estrous cycle for breeding based on transrectal and ultrasound findings. 3. Obtain entry level knowledge of common procedures including caslick, vaginoscopy, endometrial biopsy, uterine culture and cytology, artificial insemination, uterine lavage and flushing. Credits: 1.00

VCS 83200 - Equine Lameness

Credit Hours: 0.50. Advanced study of equine lameness, with a focus on the performance horse. Physical examination of the locomotor system, lameness diagnosis, and the establishment of a prognosis are emphasized.

Credits: 0.50

VCS 83201 - Equine Lameness

Credit Hours: 2.00. Advanced study of equine lameness with a focus on the performance/sport horse. Physical examination of the locomotor system (axial and appendicular), diagnosis, treatment, and establishment of a prognosis are emphasized through lecture and laboratory sessions.

Learning Outcomes: 1. Examine a horse for lameness and be able to identify which limb is lame and then formulate and execute a diagnostic plan to be able to reach a definitive diagnosis and then develop a treatment plan and prognosis. 2. Recognize the pathognomonic abnormal gaits for the forelimb and hind limb in horses. 3. Examine equine radiographs and identify common diseases of the joints and explain the difference between the various advanced imaging modalities and when would be appropriate to utilize them. 4. Explain the importance and basic principles of farriery and demonstrate how to properly remove a shoe from a hoof. 5. Recognize the common lameness conditions in horses and describe their basic treatment options and prognoses. Credits: 2.00

VCS 83300 - Advanced Equine Medicine

Credit Hours: 1.00. A continuation of VCS 50800.

Credits: 1.00

VCS 83400 - Food Animal Surgery

Credit Hours: 0.50. A continuation of Large Animal Surgery for students with a selected interest in large animal/mixed practice. Surgical diseases of cattle are emphasized.

Credits: 0.50

VCS 83700 - Clinical Nutrition For Ruminants And Swine

Credit Hours: 1.00. Current information on nutritional requirements of cattle and pigs, along with the relationships between nutrients and outcomes when nutrients are under- or oversupplied in different phases of the life cycle of cattle and pigs. Specific rations and nutritional requirements of cattle and pigs. Students will be expected to evaluate nutritional problems.

Credits: 1.00

VCS 83800 - Swine Production Medicine

Credit Hours: 1.00. Introduction to production and health management in swine herds. The concept of the model herd is introduced, and the use of records in the diagnosis of problems and maximizing production efficiency is covered. The focus is herd-based and includes problem-solving.

Credits: 1.00

VCS 83901 - Beef Production Medicine

Credit Hours: 1.00. The goal of this course is to present the concepts of beef production medicine to prepare the student to formulate plans to solve herd problems. The topics of herd health, fertility, nutrition, records, genetics, marketing and environment will be discussed and students will work in groups to solve real herd issues. An optional herd visit will also be available to all students.

Learning Outcomes: 1. Focus on owner's goals for herd improvements and make recommendations to achieve herd goals. 2. Research questions during case-based exercises and formulate a plan to solve the problems. 3. Utilize the divisions of health, records, nutrition, genetics, marketing, environment and fertility when formulating herd reports. 4. Demonstrate an understanding the economics of beef production. 5. Be prepared to enter a high level practice where beef production medicine is an emphasis. Credits: 1.00

VCS 83902 - Dairy Production Medicine

Credit Hours: 1.00. The goal of this course is to present the concepts of dairy production medicine to prepare the student to formulate plans to solve herd problems. The topics of dairy cow nutrition (including ration balancing programs), calf nutrition and management, records analysis including the use of PCDart computer program, vaccination programs, and animal welfare evaluations. Additionally, students will be exposed to team troubleshooting and performing farm evaluations. Outside speakers may be used as content experts.

Learning Outcomes: 1. Demonstrate an understanding of how to successfully evaluate the "roadblocks" for improving the production and animal health of individual dairy farms. 2. Demonstrate an understanding of the concepts of herd-based medical and management decisions vs. individual animal medicine. 3. Gain exposure to fundamentals of monitoring health and productivity based on herd parameters. 4. Gain exposure to concepts and computer programs for dairy nutrition and records analysis. 5. Be prepared to enter progressive dairy practices. Credits: 1.00

VCS 83903 - Cattle Production Medicine

Credit Hours: 1.50. "Production medicine" is an important part of modern bovine veterinary practice. This course will demonstrate this role of production medicine in bovine practice and the potential value to the producer and veterinarian. Topics discussed during the class will include cattle nutrition (including exposure to ration balancing programs), calf nutrition and management, records analysis including the use of computer programs, mastitis and milk quality measurements, economics, and animal welfare evaluations exposure to different facets of the beef industry (cow/calf, stocker, feedlot) and the differences in management in those systems, genomics, and immunology/vaccinology. Additionally, students will be exposed to team troubleshooting and performing farm evaluations. Outside speakers may be used as content experts.

Credits: 1.50

VCS 84000 - Small Ruminant/Llama Medicine

Credit Hours: 1.00. The pathogenesis, diagnosis, treatment, and prevention of common diseases of small ruminants and llamas.

Credits: 1.00

VCS 84101 - Advanced Ophthalmology

Credit Hours: 0.50. This course is an advanced course in ophthalmology covering topics not covered in the core ophthalmology course. Species discussed will include canine, feline, equine, bovine, ovine, caprine and exotic species. Topics include vision and neuro-ophthalmology, surgery, ocular emergencies, ocular manifestations of systemic disease, ocular examination, and diagnostic techniques and modalities specific to diseases of the eye.

Learning Outcomes: 1. To provide students with advanced instructions in clinical ophthalmology and diagnostic testing for diseases of the eye. Credits: 0.50

VCS 84300 - Successful Practice Skills

Credit Hours: 0.50. Builds upon the foundation for the application of practice management principles learned in VCS 51700. Focus is in the areas of communications and relationships with clients, staff, and colleagues; leadership development; and key essentials of practice operation for the prospective associate (or practice director).

Learning Outcomes: 1. Develop a vision for your career and understand the process of goal setting. 2. Understand types of practice ownership and the process to become an owner/partner. 3. Explain key ingredients for practice growth and financial success. Credits: 0.50

VCS 84400 - Client Communications - Companion Animal Practice

Credit Hours: 0.50. The course will be taught in a discussion format utilizing small group exercises and role-plays. The goal is to demonstrate and describe effective client communication skills. Because effective client communication is a learned skill, the course will provide multiple opportunities for students to practice and refine their skills. Students who participate in this course will be videotaped working through a scenario with a simulated client. While being videotaped and then watching oneself can be very uncomfortable and potentially embarrassing, it is a great way to improve communication skills and is worth the potential momentary discomfort.

Learning Outcomes: 1. Learn basic communication skills that are effective in client, other professional and personal interactions. 2. Identify their current communication strengths and weaknesses in a fun, non-threatening environment. 3. Learn techniques to build on those strengths and improve areas of difficulty. 4. Learn communication strategies that can be used in difficult client situations. 5. Practice communication skills and receive targeted feedback through class discussions, role plays and a videotaped encounter with a simulated client. Credits: 0.50

VCS 84600 - Advanced Small Animal Medicine

Credit Hours: 2.00. An advanced course dealing with selected diseases of dogs and cats. Designed for the student who is focusing on small animal or companion animal practice. A systems approach is used to teach the major concepts of diseases affecting each body system. Focuses on diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics covered in this elective include endocrinology, nephrology, gastroenterology, and immune-mediated diseases.

Credits: 2.00

VCS 84601 - Small Animal Medicine III

Credit Hours: 2.00. An advanced elective course focused on selected diseases of dogs and cats. Designed for the student who is considering entering either small animal exclusive practice, mixed animal practice, or companion animal practice. A systems approach is used to teach the major concepts of diseases affecting each body system while developing a deeper understanding of common diseases in the dog and cat. This course will concentrate on the diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics in this elective include nephrology, urology, oncology, endocrinology, infectious diseases, cardiology, gastroenterology (includes liver and pancreas).

Learning Outcomes: 1. List clinical signs for selected medical diseases in the dog and cat. 2. Explain diagnoses for dogs and cats in each organ system. 3. Describe treatment of selected medical diseases in the dog and cat. 4. Apply a

problem-based approach to selected medical diseases in the dog and cat. 5. Describe diagnostic approach for selected medical diseases in the dog and cat. 6. Integrate knowledge obtained in core small animal medicine courses with selected diseases to develop an expanded differential diagnoses list for common clinical presentations. 7. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. Credits: 2.00

VCS 84700 - Advanced Small Animal Specialties

Credit Hours: 2.00. An advanced course dealing with selected diseases of dogs and cats. Designed for the student who is focusing on small animal or companion animal practice. A systems approach is used to teach the major concepts of diseases affecting each body system. Focuses on diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics included in this elective include cardiology, dermatology, neurology, and oncology.

Credits: 2.00

VCS 84701 - Small Animal Medicine IV

Credit Hours: 2.00. An advanced elective course focused on selected diseases of dogs and cats. Designed for the student who is considering entering either small animal exclusive practice, mixed animal practice, or companion animal practice, following graduation. A systems approach is used to teach the major concepts of diseases affecting each body system while developing a deeper understanding of common diseases in the dog and cat. This course will concentrate on the diagnosis and treatment of diseases commonly encountered in small animal clinical practice. Topics in this elective include neurology, respiratory, oncology, dermatology, and immune-mediated diseases.

Learning Outcomes: 1. List clinical signs for selected medical diseases in the dog and cat. 2. Explain diagnoses for dogs and cats in each organ system. 3. Describe treatment of selected medical diseases in the dog and cat. 4. Apply a problem-based approach to selected medical diseases in the dog and cat. 5. Describe diagnostic approach for selected medical diseases in the dog and cat. 6. Integrate knowledge obtained in core small animal medicine courses with selected diseases to develop an expanded differential diagnoses list for common clinical presentations. 7. Analyze initial medical information and diagnostics and differentiate between common medical diseases in the dog and cat. Credits: 2.00

VCS 84800 - Advanced Small Animal Surgery

Credit Hours: 1.50. An advanced course dealing with selected surgical diseases of dogs and cats. Designed for the student who will be practicing on small animals (small animal, companion animal, or mixed animal track). A systems approach is used to teach important concepts of surgical diseases and procedures affecting each body system. Focuses on the diagnosis and treatment of diseases commonly encountered in small animal practice.

Learning Outcomes: 1. Identify minimally invasive surgical equipment. 2. Explain the diagnostic and therapeutic approaches to hepatic and biliary surgical disease. 3. Discuss special considerations with thoracic surgery and surgical management of more common intrathoracic diseases. 4. Explain wound reconstruction options for various types of wounds including the advantages and disadvantages of each technique. 5. Develop a diagnostic and treatment plans for dogs and cats with common fractures and joint injuries involving appendicular bones and mandible. 6. Describe the etiology, pathophysiology, diagnosis, and treatment of more common musculotendinous conditions. 7. Explain the basic principles, modalities, goals, and anticipated outcomes of current physical therapy and rehabilitation therapies. 8. List currently available physical therapy modalities and identify commonly used equipment. Credits: 1.50

VCS 85000 - Small Animal Dentistry

Credit Hours: 0.50. A thorough understanding and practical knowledge of the oral examination, dental prophylaxis, and tooth extraction. The principles of endodontics, periodontics, orthodontics, and restorations are discussed. Techniques useful

in oral surgery, such as dental bonding and intra-oral splinting are presented.

Credits: 0.50

VCS 85100 - Medicine And Surgery Of Nontraditional Pets

Credit Hours: 2.00. An overview of clinical approach to common medical and surgical diseases of nontraditional pets. Focuses on diagnosis and treatment of common diseases encountered in small animal clinical practice.

Learning Outcomes: 1. Develop an understanding of problem-solving approaches to medical and surgical problems in exotic pets. 2. Develop an understanding of common husbandry and nutritional needs of various exotic pets. 3. Develop an integrated knowledge base of common medical and surgical diseases. 4. Problem-solve using an integrated understanding of anatomy, physiology, pathology, pathophysiology, clinical pathology, pharmacology, parasitology, bacteriology, virology, immunology, diagnostic imaging, and physical diagnostic techniques. Credits: 2.00

VCS 85300 - Small Animal Emergency And Critical Care

Credit Hours: 1.00. The emergently-ill pet is a frequent scenario for both primary care private practices and the primary emergency care center. Due to the unpredictable nature of these clinical scenarios, this course provides the veterinary student the knowledge to quickly assess and stabilize pets using standard of care protocols. Common presentations and diseases are used to reinforce key concepts in emergency and critical care medicine.

Learning Outcomes: 1. Describe the fundamental approach to triage for the emergent patient. 2. Recognize and describe common emergency scenarios in small animal practice. 3. Interpret clinical data in a case scenario and create identify appropriate stabilization plan. 4. List the Rule of 20 used in assessing and monitoring critical patients. 5. Identify different point-of-care instruments used for patient assessment and monitoring. Credits: 1.00

VCS 86000 - Emergency Medicine/ICU

Credit Hours: 0.00. Designed to teach principles of intensive medical care. Advanced monitoring, critical care technology, and nursing care principles are applied as appropriate for patients under the supervision of their attending clinician.

Credits: 0.00

VCS 86001 - Small Animal Emergency And Critical Care

Credit Hours: 3.00. This course is designed to provide an extensive three-week experiential clinical rotation that is focused on small animal emergency and critical care. The student will participate in receiving, triaging, and treating small animal emergency cases, as well as monitoring and treating critically ill small animal patients admitted to the Veterinary Teaching Hospital. Rounds will be topic and case oriented. For students in all tracks.

Learning Outcomes: 1. Understand and be able to execute the principles of patient triage. 2. Develop an understanding of the variety of cases seen in emergency situations. 3. Understand how to effectively evaluate and treat various levels of emergency, trauma, and critical care patients. 4. Understand and learn client communication skills utilized during emergency situations. 5. Understand the practical elements related to providing cost-effective, efficient and quality veterinary care for emergency patients. 6. Learn the principles and develop the skills for various critical care procedures and techniques. Credits: 3.00

VCS 86002 - Small Animal Emergency And Critical Care II

Credit Hours: 3.00. This course is designed to provide an intensive 3-week experiential clinical rotation that is focused on small animal emergency and critical care. The student will participate in receiving, triaging, evaluating emergency cases as well as monitoring and treating critically ill small animal patients admitted to the Veterinary Teaching Hospital. There will be a focus on providing additional opportunities for the student to participate in and perform advanced critical care techniques.

Learning Outcomes: 1. Teach and encourage the students to maximally utilize the "Veterinary Team" to provide efficient and effective quality

veterinary care in emergency situations. 2. Help the students develop an understanding of physiologic and pathophysiologic principles as related to emergency and critical care patients. 3. Teach the students the principles and proper execution of patient triage. 4. Help the students develop an understanding of the depth and diversity of the clientele and types of cases seen in emergency situations. 5. Teach the students to appropriately assess an emergent or trauma patient as well as formulate and implement a diagnostic and therapeutic plan for the emergent or trauma patient. 6. Teach the students to appropriately assess the critical care patient as well as formulate and adjust diagnostic and therapeutic plans for those critical care patients. 7. Teach the students the principles and skills associated with various monitoring modalities associated with emergency and critical care. 8. Teach the students client communication skills utilized during emergency situations or when discussing critical care patients. 9. Teach the students the practical elements related to providing cost effective, efficient and quality veterinary care for emergency patients. 10. Teach the students the principles and skills associated with various emergency and critical care procedures and techniques. 11. Teach the students to effectively utilize the problem oriented medical record format as it applies to the emergency patient to facilitate appropriate and thorough documentation and communication. 12. Teach the students to pursue case related information or a topic in appropriate depth using appropriate resources and to effectively communicate and apply this knowledge. Credits: 3.00

VCS 86003 - Small Animal After-Hours Care & ICU Rotation

Credit Hours: 3.00. This course is designed to provide experience in the principles of intensive medical care and management of hospitalized small animal cases. This course will provide learning opportunities for students to practice skills and to gain experience assessing and working with hospitalized patients in the intensive care unit (ICU) and hospital wards during after-hours shifts (including evenings, overnights, and weekends dependent upon student numbers) while working with attending clinician(s) and nursing staff. As emergency caseload and ICU populations are unscheduled and their timing is unpredictable, there may be both in-hospital shifts as well as times that students are on call during this rotation. (129 clinical hours)

Learning Outcomes: 1. Demonstrate appropriate sanitation for an ICU run. 2. Demonstrate appropriate sanitation for an ICU cage. 3. Identify and use all the common equipment in the ICU: doppler blood pressure unites, oscillometric blood pressure unites, continuous ECG monitoring, syringe pumps, IV fluids pumps (all models), omnicell, various warming unites. 4. Empty and quantify drains and urine collection bags using appropriate aseptic technique. 5. Demonstrate appropriate knowledge and utilization of the Snyder oxygen cage. 6. Set up the oxygen cage door and provide oxygen in the cage. 7. Set up and provide flow-by oxygen. 8. Use PPE appropriately for isolation and barrier patients. 9. Place peripheral IV catheters (3 placements minimum during the rotation). 10. Wrap IV catheters appropriately (including central lines). 11. Place a urinary catheter (either indwelling or temporary) at least once during the rotation. 12. Meet a fellow student or clinician at the door of ICU with a patient that they would like to check into ICU. Take the patient from the student or clinician and set up the cage, catheter, fluids, medications, etc. required to allow the student or clinician on the case to focus on writing the treatment orders. 13. Draw up all medications required overnight for all cases in the ICU if not already completed by the student on the case after checking with the student or clinician to ensure the animal is continuing to receive those medications overnight. 14. Note missing

information on ICU treatment sheets. Contact the clinician or student on the case to obtain that missing information (ex. clinician phone numbers, call parameters, etc.). 15. Be comfortable and competent contacting a clinician about a situation where the call parameters dictate that the clinician be called. Document the information discussed on the phone. Communicate the information to the technicians. Complete the doctor's directive.
Credits: 3.00

VCS 86004 - Large Animal After-Hours & Emergency Rotation

Credit Hours: 3.00. This course is designed to provide experience in the principles of intensive medical care and management of large animal emergency cases. Students will work with the attending clinician(s) and nursing staff to care for the emergency and critical care cases admitted to the hospital. As emergency cases are unscheduled and their timing is unpredictable, there will be both in-hospital shifts as well as times that students are on call during this rotation. (129 clinical hours)

Learning Outcomes: 1. Assess and develop a diagnostic and/or treatment plan for emergency large animal patients in a timely manner reflecting the urgency of the particular case. 2. Interpret diagnostic tests and utilize them to make clinical decisions in the ongoing management of emergency large animal patients. 3. Utilize clinical monitoring modalities associated with emergency and critical case cases in large animals to assess and correctly identify changes in a patients' clinical status. 4. Perform competently entry-level clinical procedures on large animal emergency and critical care patients. 5. Work effectively as part of a team in delivering emergency health care to large animal patients, including client and team communications, case triage and patient transfer. 6. Complete an accurate medical record, including history, physical examination, progress notes and surgical reports (when applicable) for emergency large animal patients.
Credits: 3.00

VCS 86100 - Small Animal Medicine I

Credit Hours: 3.00. Basic clinical experience and training in the art and science of small animal medicine. Total clinic hours 129.
Credits: 3.00

VCS 86201 - Small Animal Surgery - Soft Tissue I

Credit Hours: 3.00. Students will be expected to participate in the evaluation, treatment, and care of patients, learning from clinical case material, reviewing topics, and reading the surgical literature. Students will perform elective neutering procedures as the primary surgeon and assist in other surgical procedures. Students will participate in surgery rounds at least once each day, with every student researching and discussing the theoretical aspects of cases and making a formal case or topic presentation to other students and faculty at least once during the course. Total clinic hours 129.
Credits: 3.00

VCS 86202 - Small Animal Surgery - Orthopedic I

Credit Hours: 3.00. Students will be expected to participate in the small animal orthopedic service. Students will be expected to participate in the evaluation, treatment and care of patients, learning from clinical case material, reviewing topics, and reading the surgical literature. Students will gain experience performing orthopedic and neurologic examinations and localizing lesions. Students will participate in surgery rounds at least once each day, with every student researching and discussing the theoretical aspects of cases and making a formal case or topic presentation to other students and faculty at least once during the course.
Credits: 3.00

VCS 86203 - Shelter Medicine And Surgery

Credit Hours: 3.00. Students will spend two weeks performing elective surgery on shelter animals in the mobile surgery unit and one week working at an off-campus shelter. The mobile surgery unit, staffed by a DVM faculty member and a full-time RVT will operate 4 days per week, estimated 12 hours per day. Students will perform independent study on the day they do not participate in mobile surgery. During the one week at the shelter, students will work approximately 50 hours spread over 5 days of the week assisting the shelter medicine veterinarian in all aspects of shelter medicine. There will be a limit of 4 students per block, with a maximum of 3 students participating in the mobile surgery unit at any time. Preference will be given to students who are planning to specialize in shelter medicine.

Learning Outcomes: 1. Improve their knowledge, technical skills, and competence in small animal elective surgery and anesthesia, including pediatric surgery, so that they will be able to safely anesthetize and, with high quality and attention to detail, perform a dog spay in 45 minutes or less. 2. Gain insight into issues in shelter medicine, including small animal population medicine, infectious disease control, animal welfare and pet relinquishment issues. 3. Improve their physical examination and patient evaluation skills, anatomical knowledge, efficiency of movement, and interpersonal communication skills. 4. Foster relationships between Purdue University and local animal shelters. Credits: 3.00

VCS 86204 - Clinical Rotation In Shelter Medicine At IndyHumane

Credit Hours: 3.00. The course is a 3-week clinical rotation at the Humane Society of Indianapolis, 7929 N. Michigan Road, Indianapolis, IN 46268, under the supervision of on-site staff veterinarians serving as mentors. The student will assist the on-site mentors in ongoing day-to-day veterinary assessment, medical care, surgical treatment including spay/neuter, preventive care including vaccinations, and infectious disease control involving shelter animals (primarily dogs and cats).

Learning Outcomes: 1. Increase the student's understanding of the ongoing day-to-day application of small animal medicine and surgery in the shelter medicine context. 2. Apply principles of infectious disease prevention and control in shelter housing and to shelter animals. 3. Apply surgical principles in spay/neuter procedures on shelter animals. 4. Apply clinical and communication skills during on-site vaccine clinics, performing wellness exams and determining appropriate preventive medicine plans for each patient. 5. Apply behavioral and medical assessment of new animals at intake. 6. Develop an understanding of management skills and principles needed in the operation of a municipal animal shelter.

Credits: 3.00

VCS 86300 - Small Animal Community Practice

Credit Hours: 3.00. Provides students with training in outpatient small animal medicine and client communication. Special emphasis is placed on preventive medicine. Students are required to write one paper as arranged with the instructor. Total clinic hours 129.

Credits: 3.00

VCS 86400 - Dermatology/Behavior

Credit Hours: 3.00. During the 3-week block, students will spend 50% of time in each service (7.5 total contact days for each service). Currently the Dermatology service receives 2 days a week and the Behavior service receives 2 days a week. On the fifth business day the students will take care of follow-ups from clients as well as in-house consultations. Students are also expected to practice clinical and technical skills which are required for each service. This elective rotation provides opportunities in dermatology to perform a thorough dermatologic assessment of the patient including dermatological history and physical examination of the skin and adnexa, identification and description of skin lesions and formulation of a reasonable list of differential diagnoses. The students will be involved in performing and interpreting skin scrapings, trichogram, cytology, bacterial cultures, fungal cultures, skin biopsy, and otoscopic/video-otoscopic exam. In aptitude for diagnosing and treating a variety of dermatologic conditions. Finally, the students will have the opportunity to develop the art of client communication and client education in veterinary dermatology.

Credits: 3.00

VCS 86502 - Large Animal Medicine I

Credit Hours: 3.00. Clinical training in problem solving of medical diseases, performance of diagnostic procedures, treatment, and care of individual animals. Emphasis on bovine cases. Total clinic hours 129.

Credits: 3.00

VCS 86600 - Large Animal Surgery I

Credit Hours: 3.00. Students are exposed to, and responsible for, case-oriented problem-solving experiences with large animal surgical diseases, including lameness. Students may have an opportunity to focus on a particular species during a portion of the basic block. The basic block includes the development of skills and capability with the principles of surgery (e.g. anesthesia, asepsis, and wound healing) as applied to large animal patients. The basic block experience is directed to primary level care. Total clinic hours 129.

Credits: 3.00

VCS 86700 - Equine Field Service I

Credit Hours: 3.00. This course will provide training in outpatient and ambulatory equine medicine, surgery, theriogenology, and preventive medicine.

Learning Outcomes: 1. Develop a consistent clinical thought process and logical approach to cases. 2. Demonstrate proficient clinical skills with routine procedures. 3. Practice equine field medicine as a contributing and inclusive team member. Credits: 3.00

VCS 86800 - Equine Field Service II

Credit Hours: 3.00. Provides students with training in outpatient and ambulatory equine medicine, surgery, theriogenology, and preventive medicine. Special emphasis on client communications and computerized practice management is provided. A special project in practice management is required. Total clinic hours 129.

Learning Outcomes: 1. Develop a consistent clinical thought process and logical approach to cases. 2. Demonstrate proficient clinical skills with routine procedures. 3. Practice equine field medicine as a contributing and inclusive team member. Credits: 3.00

VCS 87000 - Clinical Cardiology

Credit Hours: 3.00. Students will actively participate in diagnostic and therapeutic procedures in all veterinary species with an emphasis on small animals. Students will be instructed and actively perform such diagnostic and therapeutic procedures including: electrocardiography, echocardiography, blood pressure determination and catheter placement. Students will be given exposure to invasive procedures such as angiography, intracavitary pressure determinations, PDA embolization, balloon valvuloplasty and pacemaker implantation. Students will receive "active" clinical instruction as well as lectures in the form of teaching rounds. Current concepts in cardiovascular medicine will be emphasized. Total clinic hours 129.

Credits: 3.00

VCS 87100 - Small Animal Medicine II

Credit Hours: 3.00. Additional clinical experience and training in the art and science of small animal medicine. Total clinic hours 129.

Credits: 3.00

VCS 87102 - Oncology I

Credit Hours: 3.00. This block is designed to provide maximum exposure to clinical and comparative oncology. Students will develop skills necessary to fully evaluate and treat canine and feline cancer patients. Students will receive two weeks of exposure to the medical oncology clinic and one week of exposure to the radiation oncology clinic. Students will gain experience with various biopsy techniques and with therapeutic modalities including chemotherapy and radiation therapy. Independent study of relevant current literature is expected. The oncology student will concentrate on handling oncology patients but will have general internal medicine responsibilities during non-clinic hours.

Credits: 3.00

VCS 87104 - Clinical Investigation In Oncology II

Credit Hours: 3.00. This elective will allow senior students the opportunity to investigate a problem in clinical oncology. The problem and method of investigation will be defined by the student and instructor. Methods of investigation available could include: 1) prospective or retrospective studies relating to the diagnosis, biological behavior, and treatment of specific canine or feline neoplasms, and 2) in vitro evaluation of tumor cells (e.g. cell culture). Oncology rounds attendance and case responsibility in oncology will also be expected. The experience gained in this course may aid in preparing the student to enter graduate or residency training. An expanded course description for the specific problem to be investigated must be placed on file in the departmental office and in the office of the Associate Dean of Academic Affairs. Total clinic hours 129. Permission of instructor required.

Credits: 3.00

VCS 87105 - Pet Practice

Credit Hours: 6.00. Advanced instruction and clinical experience in dermatologic medicine. Students participate fully in diagnostics, therapeutics, patient management, drug studies, and research activities. Extensive self-study materials are available. Small Animal Community Practice: Students will receive training in primary care small animal and exotic pet medicine, behavior, theriogenology, client preventive medicine and overall pet wellness to promote the family-pet bond. Students will be required to write one paper as arranged with instructor.

Credits: 6.00

VCS 87201 - Clinical Veterinary Anesthesiology

Credit Hours: 3.00. This course will provide clinical training in anesthesiology. Students may focus on large animals, small animals, or a mixture of the both. The students will participate in daily rounds to discuss case work-up as well as advanced topics in anesthesia that are not covered in other courses. Topics may include mechanical ventilation, blood gas interpretation, neuromuscular blockade, and adjunctive anesthetic procedures (epidural analgesia, brachial plexus block, etc.).

Credits: 3.00

VCS 87202 - Small Animal Surgery - Soft Tissue II

Credit Hours: 3.00. Students will be expected to assume greater responsibility for evaluation, treatment, and care of patients while developing greater knowledge, clinical judgment, and diagnostic capabilities that enable them to manage more complex cases. Students will learn from clinical case material, reviewing topics, and reading the surgical literature and will be given more responsibility for case management. Students will perform elective neutering procedures as the primary surgeon and assist in other surgical procedures. Students will participate in surgery rounds at least once each day, with every student researching and leading case discussions, demonstrating more initiative and independence. Each student will make a formal case or topic presentation to other students and faculty at least once during the course. Total clinic hours 129.

Credits: 3.00

VCS 87203 - Small Animal Surgery - Orthopedic II

Credit Hours: 3.00. Students will be expected to assume greater responsibility for evaluation, treatment, and care of patients while developing greater knowledge, clinical judgment, and diagnostics capabilities that enable them to manage more complex cases. Students will be expected to learn from clinical case material, reviewing topics, and reading the surgical literature. Students will gain additional experience performing orthopedic examinations.

Credits: 3.00

VCS 87502 - Large Animal Medicine II

Credit Hours: 3.00. Advanced clinical training in problem-solving of medical diseases, performance of diagnostic procedures, treatment, and care. Students may be allowed to spend up to three working days off campus to work with a veterinarian engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 87600 - Large Animal Surgery II

Credit Hours: 3.00. Students have advanced responsibility for large animal surgical patients with a species focus. Students are expected to conduct the appropriate presurgical physical examination, assist with the surgery, and be responsible for the postoperative care of most primary care level patients and many secondary care level patients. Total clinic hours 129.

Credits: 3.00

VCS 87700 - Large Animal Lameness

Credit Hours: 3.00. Students are exposed to, and responsible for, case-oriented problem-solving experiences with large animal lamenesses and orthopedic diseases. The case exposure is primarily equine, but lameness students are expected to help with food animal lamenesses and orthopedics, as a comparative biomedical approach to studying locomotion and the musculoskeletal system. Depending upon the availability of lameness cases, lameness students will participate with the general clinic responsibilities and emergency duty in the large animal surgery. Students may be allowed to spend up to three days off campus to work with a veterinarian engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 87800 - Swine Production Medicine I

Credit Hours: 3.00. Advanced training and extensive experience in working with swine herds on a herd health management program. Total clinic hours 129.

Credits: 3.00

VCS 87900 - Bovine Theriogenology And Production Medicine I

Credit Hours: 3.00. Training and experience in working with reproductive management problems in dairy and beef herds. The importance of herd records in assessing performance and health is stressed, and training is provided in the use of computerized recording systems and ration formulation programs. Total clinic hours 129.

Credits: 3.00

VCS 87902 - Comparative Theriogenology

Credit Hours: 3.00. Training and experience in working with reproductive management problems in dairy and beef herds.

The importance of herd records in assessing performance and health is stressed, and training is provided in the use of computerized recording systems and ration formulation programs. Total clinic hours 129.

Credits: 3.00

VCS 87903 - Bovine Theriogenology And Production Medicine II

Credit Hours: 3.00. Advanced training in the areas of embryo transfer, embryo grading, artificial insemination, oviduct patency tests, and ultrasound use in ambulatory food animal practice. Training will also focus on repeat breeder cows. Additional responsibilities will be designated in the areas of herd health, production medicine and the recognition of disease processes.

Credits: 3.00

VCS 87905 - Advanced Beef Cow-Calf Production Medicine

Credit Hours: 3.00. This course is designed to provide an intensive 3-week experiential clinical rotation that is focused on beef cow-calf production medicine. The students will spend about 50% of the time on herd visits and about 50% on research and writing up herd reports. Each student will be responsible for a specific area of focus on each herd visit. Purdue students taking the block will be available for back-up emergency duty on days when they are on campus.

Learning Outcomes: 1. Become increasingly proficient at taking a thorough history. 2. Improve active listening skills. 3. Develop skills in oral and written communication. 4. Learn to evaluate and analyze beef herd records and to make recommendations for improvement where indicated. 5. Learn how to find credible sources of information when the answer to a question is not known. 6. Learn the difference between a differential diagnosis and speculation. One is good and one is bad. 7. Learn to develop a team of experts to help you solve problems outside your areas of expertise. 8. Maintain a positive attitude and open-mindedness toward change. 9. Understand the economics of beef production. 10. Accept responsibility for lifelong learning and continuing education by keeping current with advances in the profession. When you're through learning, you're through. Credits: 3.00

VCS 87910 - Bovine Field Service I

Credit Hours: 3.00. Students will be trained and experience working with individual animal and herd health issues in an ambulatory setting. Students will have the opportunity to participate in after-hours emergencies on a voluntary basis. In addition, students will have the opportunity to provide routine veterinary services at the Purdue ASREC Dairy and Beef Unit. Students may elect to schedule up to five business days of the rotation at a farm animal focused private practice.

Learning Outcomes: 1. Manage a range of individual animal and herd health issues. 2. Prescribe and/or administer medications to farm animals based on current best practices. 3. Communicate effectively with producers concerning their individual animal's or herd's veterinary service needs. Credits: 3.00

VCS 87920 - Bovine Field Service II

Credit Hours: 3.00. Advanced training in the areas of embryo transfer, embryo grading, artificial insemination, oviduct patency tests and ultrasound use in ambulatory food animal practice. Training will also focus on repeat breeder cows. Additional responsibilities will be designated in the areas of herd health, production medicine and the recognition of disease processes.

Learning Outcomes: 1. Manage a range of individual animal and herd health issues. 2. Prescribe and/or administer medications to farm animals based on current best practices. 3. Communicate effectively with producers concerning their individual animal's or herd's veterinary service needs. Credits: 3.00

VCS 88000 - Ruminant (Dairy) Production Medicine I

Credit Hours: 3.00. Training and faculty-directed independent study in dairy production medicine. Emphasis is on health and management from the newborn calf to the lactating dairy cow. Particular attention is paid to nutritional management, herd monitoring, and herd records analysis. Additionally, vaccination programs, facilities, and welfare auditing will be covered. The block may be customized according to the interests of the students enrolled. A limited amount of time is spent on individual animal care. Farm visits to observe different management styles and to provide troubleshooting of herd problems will also be scheduled during the block. Students may be allowed to spend up to five working days off-campus to work with a veterinarian

engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 88001 - Ruminant (Dairy) Production Medicine II

Credit Hours: 3.00. This course is meant to build on the knowledge gained in VCS 88000 and is directed at students that are focused on future intensive dairy practice. The structure of the block will be similar to VCS 88000, but there will be more in-depth discussion of ration building, records analysis, and mild quality. Additional farm visits will also be performed to provide exposure to different types of dairy farms that will be encountered in dairy practice.

Credits: 3.00

VCS 88002 - Clinical Veterinary Services For The Indiana State Fair

Credit Hours: 3.00. The course is a 3-credit clinical rotation. A PVM clinician will lead this elective 3-week clinical rotation. Students will spend 3 weeks providing veterinary care to all exhibition animals at the Indiana State Fair. The veterinary services provided include health assessment during check-in, assessment of ill animals, and on-call service after business hours. The majority of cases will be swine and cattle, but can also include horses, poultry, and small ruminants.

Learning Outcomes: 1. Increase the student's clinical experience in diagnosis and treatment of common disease conditions in a wide variety of species. 2. Develop communication skills in an environment which presents diverse interactions (ex. client, general public). 3. Develop leadership skills. 4. Develop an understanding of regulatory medicine, to include animal welfare, for livestock exhibition. 5. Increase the student's exposure to disease biosecurity and control. Credits: 3.00

VCS 88100 - Small Animal Medicine III

Credit Hours: 3.00. Further clinical exposure with emphasis on cases in the student's area of interest. A faculty mentor will be assigned to each student. Total clinic hours 129.

Credits: 3.00

VCS 88300 - Clinical Investigation In Theriogenology

Credit Hours: 3.00. Provides senior students an opportunity to investigate a clinical problem in a laboratory situation. The student is expected to apply one of the many research techniques available in the school to address the question. The experiences gained may allow the candidate to pursue graduate and residency training in theriogenology. An expanded course description for the specific problem to be investigated must be placed on file in the departmental office and in the office of the associate dean of academic affairs. Total clinic hours 129.

Credits: 3.00

VCS 88400 - Equine Theriogenology Clinical Rotation

Credit Hours: 3.00. This 3-week rotation will offer students the opportunity to work directly with the Equine Theriogenology in-house service. Students will be able to observe and manage both mares and stallions with reproductive conditions commonly seen in practice. The rotation may include management of hospitalized high-risk mares during their gestation, mares with hospitalized neonates that need reproductive evaluation and treatment, and dystocia diagnosis and treatment.

Learning Outcomes: 1. Perform record keeping/maintenance to facilitate successful breeding management of horses. 2. Describe mare management strategies for pregnancy establishment. 3. Choose appropriate pharmacologic treatments for successful timed artificial insemination protocols. 4. Collect and analyze equine semen for proper calculation of breeding doses for cooled or cryopreserved semen and describe proper shipment or storage of the semen. 5. Perform breeding soundness evaluations for mares and stallions. Credits: 3.00

VCS 88500 - Large Animal Medicine III

Credit Hours: 3.00. Advanced clinical training with focused interest in a specialized type of practice, in-depth training in internal medicine, or participation in large animal related research activities. Students may be allowed to spend up to three working days off campus to work with a veterinarian engaged in practice in the student's area of interest. This experience should enhance the student's education by complementing experience gained on campus. The short off-campus experience should be arranged with the professor of record of the course at least 30 days prior to the beginning of the block.

Credits: 3.00

VCS 88600 - Large Animal Surgery III

Credit Hours: 3.00. Students at this level are expected to function with greater independence, carrying out the history, physical examination, and postoperative care of all elective and certain emergency/intensive care patients of the species of their choice. Depending upon the capabilities and competence of the student, as determined by the surgery faculty and staff, he or she will have the opportunity to conduct supervised surgical procedures. Students may be allowed to spend up to three days off campus to work with a veterinarian engaged in practice in the student's area of interest. This off-campus experience should enhance the student's education by complementing experience gained on campus.

Credits: 3.00

VCS 88601 - Large Animal Surgery III Food Animal

Credit Hours: 3.00. This course will focus on food animal surgery and lameness and will only be offered 1-2 times per year. Students will be expected to function with greater independence than during LAS I and II, carrying out the history, physical examination and postoperative care of elective and certain emergency/intensive care patients. Depending upon the capabilities and competence of the student, as determined by the surgery faculty and staff, he/she will have the opportunity to conduct supervised surgical procedures. This block will focus on food animal surgical diseases through seminars, in-clinic hands-on laboratory sessions, rounds discussions and an emphasis on food animal clinical cases. Total clinic hours 129.

Credits: 3.00

VCS 88602 - Clinical Veterinary Services At Caesars Entertainment Equine Specialty Hospital

Credit Hours: 3.00. In this 3-week rotation students will assist the staff with diagnosis and treatment of sports-related conditions including lameness diagnosis and treatment, evaluation and treatment of upper respiratory diseases, and diagnosis and treatment of a variety of surgical conditions such as lacerations and traumatic injuries to the musculoskeletal system. Students will assist in advanced diagnostic imaging including nuclear imaging and CT imaging with a unit that allows horses to be imaged while standing. A dynamic endoscope is available for use on the track to evaluate upper respiratory disease while the horse is exercising. Students will perform lameness examinations under guidance of the staff clinicians and will be expected to participate in after-hours emergencies. Rounds will be held daily when horses are hospitalized. The caseload is not limited to racing Thoroughbred horses but includes a diverse population of sport horses including Standardbred racehorses, working Quarter Horses, and hunter-jumper and dressage horses.

Learning Outcomes: 1. Become proficient in performing physical examinations, localizing lesions, generating differential diagnoses, and selecting an appropriate treatment plan for horses presented to the hospital with lameness and other sports medicine conditions. 2. Become familiar with the indications and application of advanced diagnostic imaging modalities. 3. Able to diagnose and create a treatment plan for common sports related injuries. 4. Learn to integrate knowledge to provide patient care, including medical management, preoperative, surgical, and postoperative care of client-owned horses. This includes principles of analgesia, surgical treatment and exercise limitations and/or rehabilitation. 5. Develop greater knowledge, clinical judgment, technical skills, and diagnostic capabilities that enable management of more complex cases of sport horses. 6. Learn numerous aspects of sport horse medicine including regional anesthesia, intra-articular anesthesia and intra-articular medications. 7. Observe procedures, such as orthopedic and respiratory surgeries, under both sedation with local anesthesia and under general anesthesia thereby expanding their knowledge on surgical treatment of sports injuries. 8. Scrub in to assist surgeons on elective surgical cases and emergency conditions such as lacerations when feasible based upon procedures being performed. 9. Learn and master bandaging and administration of medications orally, intravenously, and intramuscularly. 10. Practice teamwork and professionalism through interactions with faculty/clinicians, colleagues, technicians, and horse owners. Credits: 3.00

VCS 88800 - Swine Production Medicine II

Credit Hours: 3.00. This course is a faculty-directed independent study. Students are expected to use campus,

state, and national resources to deal with herd problems. The goal is to bring the knowledge base of the student to the entry level expected for a swine practitioner. Emphasis is placed on veterinary services needed to maintain top production efficiency in swine herds. Total clinic hours 129.

Credits: 3.00

VCS 89100 - Diagnostic Imaging

Credit Hours: 3.00. Clinical training and experience in radiology and ultrasound imaging as it contributes to the practice of veterinary medicine. Seminars are based on small animal imaging. Total clinic hours 129.

Credits: 3.00

VCS 89101 - Veterinary Diagnostic - Ultrasound

Credit Hours: 3.00. This rotation will provide opportunity for hands-on small animal ultrasound imaging. The student will have the opportunity to pre-scan the patients prior to actual scan by the radiologist. By doing so, the student will learn the ultrasound scanning techniques and real-time interpretation of ultrasonography. In addition, students will observe the scanning of veterinary patients by the radiologist and will be asked to participate in ultrasonography interpretation.

Credits: 3.00

VCS 89200 - Veterinary Forensic Medicine

Credit Hours: 1.00. The definition of forensic medicine is a science that deals with the relation and application of medical facts to legal problems. The primary role of a forensic specialist is to provide law enforcement officials, judges, and jury members with the information necessary to make decisions (decision to prosecute, render a verdict, etc.) regarding a case. This elective course is designed to expose students to the many situations where veterinary medicine and the law intersect.

Learning Outcomes: 1. Introduce students to the scope of interaction between legal authorities and veterinary medicine. 2. Understand how to collect materials and write reports that can be used in a legal case. 3. Know about the use of forensic investigation to document animal neglect and cruelty. Credits: 1.00

VCS 89300 - Shelter Animal Medicine

Credit Hours: 1.00. The Shelter Animal medicine course will be offered to second and third year veterinary students. The course will cover topics essential to understanding the complexity of population medicine in a shelter environment and related welfare issues. Topics to be covered include animal shelter models (no-kill/adoption guarantee, tradition, etc.), population medicine and disease control as it relates to the environment and the animals, critical care in a shelter environment, foster care, neonatal care of shelter animals, population statistics, animal behavior and relinquishment issues, abuse and cruelty, legal and ethical issues, euthanasia, and developing and implementing animal disaster plans.

Learning Outcomes: 1. Develop a clear understanding of shelter population management and factors that affect it. 2. Be familiarized with the medical aspect of caring for animals in a shelter environment. 3. Recognize and understand the factors surrounding animal relinquishment and the challenges faced caring for them. 4. Incorporate acquired knowledge and apply it to a real-life shelter situation.

Credits: 1.00

VCS 89400 - Comparative Ophthalmology I

Credit Hours: 3.00. Students are given the opportunity to develop the technical skills needed to test for vision and examine each ocular structure for abnormalities. The rotation includes clinical experience and instruction in veterinary (comparative) ophthalmology with participation in the diagnosis, therapy, and management of clinical cases and various research activities. A seminar presentation and/or special project is required. Total clinic hours 129.

Credits: 3.00

VCS 89500 - Purdue Veterinary Hospital Practicum

Credit Hours: 0.00. Students will be assigned to work on a service in the Purdue Veterinary Hospital (PVH) over one-half of the December-January holiday period. The student will gain hands-on practical experience in the diagnosis and treatment of patients presented to the PVH. The student will also gain some experience managing emergent cases. Total clinic hours 45.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00

VM 80900 - International Veterinary Medicine

Credit Hours: 0.50 or 1.00. The course will consist of eight lectures addressing international aspects of the following topics: zoonotic diseases, food hygiene, biosecurity, animal welfare, animal husbandry, infectious diseases, cultural competence, veterinary medical education, and role of international

organizations in animal health. Participating students will be required to choose an internationally relevant topic of interest to research. The last session of the course will be a poster session in which each student will present and discuss a poster. The posters will be evaluated by a panel of 3-4 faculty members and a grade assessed. Permission of Department required.

Learning Outcomes: 1. Students should be familiar with the international issues that impact the veterinary profession. 2. Understand the role that veterinarians play in global health and education. 3. Have respect for diverse people and cultures and develop skills for working across cultures. 4. Students gain skills and knowledge to keep themselves safe when traveling overseas. Credits: 0.50 or 1.00

VM 81000 - Veterinary Externship

Credit Hours: 6.00. A six-week or 280-contact-hour work experience, under the direct supervision of a veterinarian, in a facet of veterinary medicine selected as a career goal by the student.

Credits: 6.00

VM 81001 - International Veterinary Experience

Credit Hours: 1.00 to 6.00. This course will allow veterinary students to establish a unique veterinary learning experience in their area of interest in an international location. Each veterinary learning experience will be designed by the student with input from faculty advisor and the professor of record. Permission of instructor required.

Learning Outcomes: 1. Develop an understanding of the importance of global education. 2. Increase awareness of global health issues. 3. Develop awareness of international veterinary career opportunities. 4. Encourage leadership development and diversity awareness. 5. Develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 6. Foster relationships between Purdue university and international colleagues. Credits: 1.00 to 6.00

VM 81003 - International Veterinary Medicine-Directed Experience

Credit Hours: 1.00 to 6.00. This course allows veterinary students to participate in a unique faculty-led veterinary learning experience in an international location. Credit will be assigned on the basis of 1 credit for each 45-50 hours of student effort up to a maximum of 6 credits. In most instances, one week of experience will equal one credit. Each veterinary learning experience will be designed by the faculty leader to accomplish specific learning goals in the focuses area of study. The course will be offered in the summer and will vary in length from 1-6 weeks depending on the specific experience.

Learning Outcomes: 1. To increase the student's understanding of a focused area of veterinary medicine in its international context. 2. To develop an understanding of the importance of a global education. 3. To increase awareness of global health issues. 4. To become aware of international veterinary career opportunities. 5. To encourage leadership development and diversity awareness. 6. To develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 7. To foster relationships between Purdue University and international colleagues. Credits: 1.00 to 6.00

VM 81004 - Conservation Medicine And Exotic Pet Medicine And Surgery In Czech Republic And Austria

Credit Hours: 3.00. This course is a 3-week international rotation for 2nd and 3rd year DVM students in Czech Republic and Austria. Students will spend 4-8 days in UVPS clinics and several days onsite at Zoo Brno. Additional lectures, animal science and behavior experience in both countries. Permission of department required.

Learning Outcomes: 1. Increase understanding of zoo, wildlife and exotic pet medicine in its international context. 2. Increase awareness of global conservation and health issues. 3. Develop an understanding of the importance of a global education. 4. Develop an understanding of the unique issues encountered

in exotic pet medicine in central Europe. 5. Develop an understanding of caring for collections of several large urban zoos. 6. Increase awareness of international veterinary career opportunities. 7. Encourage development of leadership skills and diversity awareness. 8. Foster relationships between Purdue University, UVPS Brno, VetMedUni, as well as zoo colleagues at Zoo Brno, Zoo Praha and the Vienna Zoo. Credits: 3.00

VM 81005 - Pre-Clinical Practicum In Veterinary Medicine

Credit Hours: 1.00 to 3.00. This practicum will provide international students with hands-on experience working in a modern veterinary practice or other veterinary medical setting. The student will gain experience working as a member of the veterinary team and participate in wellness care as well as diagnosis and treatment of disease using contemporary equipment and facilities.

Learning Outcomes: 1. Develop skills for restraint and handling of domestic animals. 2. Develop physical examination skills by examining normal and ill animals. 3. Develop technical skills such as sample collection, catheter placement and medication administration. 4. Gain experience administering anesthetics and correctly monitoring anesthetized patients and postoperative patients. 5. Practice surgical preparation techniques. 6. Become familiar with surgical anatomy by observing and assisting with surgical procedures. 7. Develop an understanding of the operation of a modern, full-service veterinary hospital in the U.S. Credits: 1.00 to 3.00

VM 81006 - Veterinary Externship I

Credit Hours: 3.00. A three-week (140 contact hour) work experience, under the direct supervision of a veterinarian, in a facet of veterinary medicine selected as a career goal by the student. Students are required to spend the entire three weeks at externship site(s). Splitting time between two externship sites is permitted by approval by Instructor of Record. Arrangements for the externship are the responsibility of the student and the supervising veterinarian. All cost are paid by the student, but the student may receive compensation (stipend or hourly) from the veterinarian.

Learning Outcomes: 1. Develop medical and surgical skills in the area of practice which meet their career goals. 2. Develop knowledge of management practices including inventory, human resources and practice economics. 3. Build communication techniques with both the public and other veterinary healthcare staff. Credits: 3.00

VM 81007 - Veterinary Externship II

Credit Hours: 3.00. A three-week (140 contact hour) work experience, under the direct supervision of a veterinarian, in a facet of veterinary medicine selected as a career goal by the student. Students are required to spend the entire three weeks at externship site(s). Splitting time between two externship sites is permitted by approval by Instructor of Record. Arrangements for the externship are the responsibility of the student and the supervising veterinarian. All cost are paid by the student, but the student may receive compensation (stipend or hourly) from the veterinarian.

Learning Outcomes: 1. Develop medical and surgical skills in the area of practice which meet their career goals. 2. Develop knowledge of management practices including inventory, human resources and practice economics. 3. Build communication techniques with both the public and other veterinary healthcare staff. Credits: 3.00

VM 82000 - Applications And Integrations I

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, but not limited to, tutorial group evaluation, peer evaluation, self-evaluation, and comprehensive content and process examinations. Introductory session on hematology, clinical chemistry and radiography will be included to facilitate student interpretation of testing used in the cases.

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill

in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the students understanding of how the basic science material provides the foundation for solving problems, thereby increasing the student's perception of relevance, motivation, and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 82500 - Current Issues In Veterinary Medicine

Credit Hours: 0.00. This course provides a regular forum to bring PVM students and faculty together to discuss current issues facing the veterinary profession. Topics will vary depending upon current events and opportunities to feature guest lecturers. Time-shifting may be done to accommodate special events such as PVM Research Day.

Learning Outcomes: 1. Increase student awareness of current issues facing the veterinary profession and provide a forum for discussion. 2. Expose students to the breadth of career opportunities that are available to veterinarians. 3. Expose students to international educational opportunities that are available to them. 4. Discuss topics that will enhance the DVM curriculum, such as: a. Current events/topics; b. Research; c. Diversity and inclusion; d. Wellness; e. Animal welfare. Credits: 0.00

VM 83000 - Applications And Integrations II

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials and research problems. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include material from VM 82000 and other current DVM courses (anatomy, physiology, etc.).

Learning Outcomes: 1. Improve the student's retention of learned information and continue to build a working knowledge base that the student will expand and utilize to solve clinical problems throughout his/her career. 2. Increase the students responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical

curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis-formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills including utilizing appropriate resources to adequately. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 84000 - Applications And Integrations III

Credit Hours: 2.00. This course uses a small group tutorial, problem-oriented approach to understanding how basic science concepts are integrated into clinical aspects of veterinary medicine. Students are expected to identify learning issues, resolve identified gaps in their knowledge base, integrate information across disciplines, and practice/develop problem-solving skills using simulated case materials. Evaluation of students will be based upon, tutorial group evaluation, peer evaluation, self-evaluation, and a comprehensive content and process evaluation, which will include materials from previous classes (VM 82000/83000 and other freshman DVM courses) as well as the current DVM coursework (hematology, parasitology, bacteriology, pharmacology and pathology).

Learning Outcomes: 1. Increase the student's responsibility for his/her own learning and instill in each student a sense of commitment to and enthusiasm for his/her own education. 2. Improve the student's retention of learned information for a longer period of time by providing a forum in which students have to integrate information from multiple disciplines in order to solve a problem. 3. Improve the student's understanding of how the basic science material provides the foundation for solving problems, thereby increasing the students perception of relevance, motivation and retention of basic science information. 4. Create a continuum from the pre-clinical curriculum into the clinical curriculum so that students are exposed to clinical information earlier while simultaneously reinforcing basic science concepts later in the curriculum. 5. Help students develop the skills of acquiring and integrating information and applying the information to solve a problem early in the curriculum, and provide continued opportunities to practice and refine that skill. 6. Practice the problem-solving method of hypothesis formulation/speculation, investigation, refinement, and conclusion/diagnosis. 7. Increase the student's awareness of the ethical and societal issues in veterinary medicine through discussion of the ethical, legal, and socioeconomic ramifications of the clinical cases presented. 8. Foster the development of self-assessment skills and appropriate habits for expanding both knowledge and skills. 9. Encourage students to develop good teamwork skills, interpersonal communication skills, and the skills needed to work cooperatively with peers of differing backgrounds, career orientations, and personalities. Credits: 2.00

VM 86000 - Early Origins Of Veterinary Medicine Seminar

Credit Hours: 1.00. Students will study the very early origins of man's fascination with animals from the Paleolithic era, and the roots of veterinary medicine in Mesopotamia, Ancient Egypt, and East and South Asia. Particular attention will be paid to works of art that help demonstrate man's fascination with

animals and their well-being. This course is appropriate for students with no previous study of history or art history.

Learning Outcomes: 1. Appreciate and understand the history of the human-animal bond that ultimately led to the establishment of a respectable veterinary profession based on comparative medicine dedicated to the health of animals. 2. Explain the early history of man's fascination with animals and how this led to the development of the human-animal bond. 3. Cite examples of art that demonstrate the development of the human-animal bond. 4. Trace the development of early animal care and explain the veterinary origins in Ancient Egypt, East and South Asia. 5. Compare the role of animal "doctors" in Mesopotamia, and animal care in Ancient Egypt. 6. Describe the prehistory and speculation regarding the domestication of animals. 7. Explain the roots of veterinary medicine in East and South Asia. Credits: 1.00

VM 86500 - History Of Veterinary Medicine From Marshals, Horse Doctors, Cow Leeches, The First Schools Of VM

Credit Hours: 1.00. The students will study the history of marshals, horse doctors, cow leeches, and authors, an emphasis on the launching of European veterinary education with a rationale for a veterinary profession, and the history of the first official schools of veterinary medicine in France (Lyon and Alfort), concluding with the history of the increasing demand for veterinary schools. Particular attention will be paid to works that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history. Special note: This syllabus and course schedule is subject to revisions as needed throughout the semester. Students will be given advance notice of any change.

Learning Outcomes: 1. Appreciate and understand the history of veterinary progress that ultimately led to the establishment of a respectable veterinary profession based on comparative medicine dedicated to the health of animals. 2. Cite examples of books that demonstrate the development of veterinary medicine from the sixteenth to the nineteenth centuries. 3. Trace the progress in understanding diseases that led to veterinary progress. 4. Describe the history of animal care from the Middle Ages to the nineteenth century. 5. Explain the roots of equine medicine in Europe that led to the first schools of veterinary medicine in France. Credits: 1.00

VM 86600 - Pathogenic Bacteria, Viruses, Mayhew, Darwin, And Mendel

Credit Hours: 1.00. Students will study the golden age of pathogenic bacteriology from the 1860s to the end of the nineteenth century; the discovery of viruses; the development of immunological products; intractable vector-borne hemoprotozoal parasitic diseases; horse-doctoring in the nineteenth century; care of animals used in transport, war and sport; and will conclude with Darwin's natural selection and Mendel's fractional inheritance. Particular attention will be paid to works that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history.

Learning Outcomes: 1. Explain the history of progress in bacterial etiology of animal diseases. 2. Explain the significance of Jenner's cowpox vaccine, Pasteur's discovery of attenuation and the production of vaccine strains, including rabies. 3. Trace the progress in understanding diseases that led to veterinary progress. 4. Describe the special contribution of Edward Mayhew to horse-doctoring in the nineteenth century. 5. Discuss the care of animals used in transport, war, and sport. 6. Explain the significance of the work of Charles Darwin, Gregor Mendel, and the interpretation of life's blueprint (DNA). Credits: 1.00

VM 86700 - Veterinary Medicine Comes Of Age

Credit Hours: 1.00. Students will study early veterinary contributions to biomedical science; how livestock production was enhanced by veterinary specialists; companion animal medicine; bioethics, animal experimentation, and sentience; overcoming the exclusion of women, and the evolving spectrum of opportunity in veterinary careers. Particular attention will be paid to works that help demonstrate man's fascination with animals and their well-being. This course is appropriate for

students with no previous study of history or art history.

Learning Outcomes: 1. Discuss the fine tradition in veterinary anatomy, physiology, pharmacology, and veterinary leadership in early twentieth-century parasitology. 2. Explain Rudolf Virchow's reform in cellular pathology, the contributions of William Osler, Duncan McEachran, and others to veterinary medicine, and the establishment of the Bureau of Animal Industry. 3. Make the historical case for a veterinary role in public health. 4. Describe the transformation of veterinary surgery and practice through the contributions of Sir Frederick Hobday, and the establishment of the American Animal Hospital Association. 5. Discuss early activists who protested animal abuses in society. 6. Discuss the new profession from 1762 to the present time, and overcoming the exclusion of women. Credits: 1.00

VM 87000 - History Of Veterinary Medicine From The Ancient Greeks Through The Renaissance Seminar

Credit Hours: 1.00. The students will study the contributions of the ancient Greeks and Romans to the development of animal doctors. The veterinary highpoint during the Byzantine Empire and Arabian medical and veterinary progress will also be studied. Animals in the Dark Ages, equine and canine medicine in Medieval Europe, and the Italian roots of the Renaissance in medical sciences will be studied. Particular attention will be paid to works of art that help demonstrate man's fascination with animals and their well-being. This course is appropriate for students with no previous study of history or art history.

Learning Outcomes: 1. Appreciate and understand the history of veterinary progress that ultimately led to the establishment of respectable veterinary profession based on comparative medicine dedicated to the health of animals. 2. Explain the history of man's fascination with animals in Ancient Greece and Rome and how this led to the development of veterinary medicine. 3. Cite examples of art that demonstrate the development of veterinary medicine. 4. Trace the development of early Arabian medical and veterinary progress. 5. Describe the history of animal care in the Dark Ages. 6. Explain the roots of equine and canine medicine in Medieval Europe, and describe the Italian Renaissance in medical science. Credits: 1.00

VM 87800 - Swine Herd Health And Diagnostic Pathology

Credit Hours: 3.00. Arrange total clinic hours 129. Advanced training and experience in working with swine herds on a herd health management program (see VCS 87800 , 129 clinic hours) and advanced training in diagnostic approaches to identification of the causes and pathogenesis of disease of mammals (see VCS 88600 , 129 clinic hours).

Credits: 3.00

VM 89000 - Topics In Veterinary Medicine

Credit Hours: 0.50 to 5.00. Advanced study in the field of animal health and practice of veterinary medicine. Permission of instructor required.

Credits: 0.50 to 5.00

VM 89100 - Special Topics In Veterinary Medicine Arranged

Credit Hours: 3.00. Opportunities for as many as 50 off-campus, three-week blocks are available for each fourth-year class. Only educational experiences that have no comparable coverage in the Purdue DVM curriculum will be acceptable. Permission of instructor required.

Credits: 3.00

VM 89400 - International Veterinary Medicine-Directed Clinical Experience

Credit Hours: 1.00 to 3.00. This course allows veterinary students to participate in a unique faculty-led veterinary learning experience in an international location. Credit will be assigned on the basis of 1 credit for each 45-50 hours of student effort up to a maximum of 3 credits. In most instances, one week of experience will equal one credit. Each veterinary learning experience will be designed by the faculty leader to accomplish specific learning goals in the focuses area of study. The course will be offered at various times during the clinical year and will vary in length from 1-3 weeks depending on the specific experience.

Learning Outcomes: 1. To increase the

student's understanding of a focused area of veterinary medicine in its international context. 2. To develop an understanding of the importance of a global education. 3. To increase awareness of global health issues. 4. To become aware of international veterinary career opportunities. 5. To encourage leadership development and diversity awareness. 6. To develop an understanding of the unique issues in veterinary medicine in the geographic location of the experience and be able to communicate these to their colleagues. 7. To foster relationships between Purdue University and international colleagues. Credits: 1.00 to 3.00

VM 89401 - Clinical Rotation In Small Animal Medicine In Switzerland

Credit Hours: 3.00. This course is a 3-credit clinical rotation. A faculty member will lead this elective 3-week clinical rotation in Switzerland. Students will spend one week each participating in rotations in small animal medicine and related disciplines at the University of Zurich, University of Bern, and one or two private veterinary clinics in Switzerland or southern Germany. The Purdue faculty member leading the rotation each year will spend one week at each rotation site. During time that the Purdue faculty member is not with the students at rotation sites, on-site mentors will supervise the students' clinical experience.

Learning Outcomes: 1. Increase understanding of small animal medicine in its international context. 2. Increase awareness of global health issues. 3. Develop an understanding of the importance of a global education. 4. Develop an understanding of the unique issues encountered in small animal medicine in Switzerland and central Europe. 5. Become aware of international veterinary career opportunities. 6. Encourage development of leadership skills and intercultural competency. 7. Foster relationships between Purdue University, University of Zurich, University of Bern, and international colleagues in private veterinary practice. Credits: 3.00

VM 89900 - Veterinary Medicine Topics

Credit Hours: 0.50 to 6.00. This is a variable title/variable credit course for VM.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.50 to 6.00

Office for Graduate Students and Postdoctoral Scholars

Graduate Administration (Graduate)

Interdisciplinary Biomedical Sciences, PHD

Foundations of Data Science, Post-Baccalaureate Certificate

International Development, Post-Baccalaureate Certificate

Foundations of Artificial Intelligence, Post-Baccalaureate Certificate

Interdisciplinary Biomedical Sciences, MS

GRAD 50100 - PULSe Scientific Communications

Credit Hours: 1.00. To begin to create an atmosphere in which students learn to communicate across disciplinary lines by providing the opportunity to develop skills in presenting and evaluating research results. Students will develop short scientific presentations, an abstract, and a poster and learn to present their findings to others and to ask and answer questions from their peers. Permission of department required.

Learning Outcomes: 1. To improve your ability to organize and present research presentation. 2. To gain experience with the skills required to prepare material for presentation. 3. To learn more about the faculty and students in PULSe. Credits: 1.00

GRAD 50200 - Interdisciplinary AI Fundamentals: Bridging Knowledge

Credit Hours: 1.00. This course provides foundational concepts for AI for those in both MSAI majors. This course covers the history of AI, the foundations of artificial reasoning and knowledge, and practical skills for communicating about AI technology, projects, and workflow. This graduate course, designed to be accessible to learners with diverse backgrounds, serves as a foundational introduction to the field of AI. Whether you come from a technical or non-technical background, this course will provide you with a solid grasp of AI concepts, principles, and their real-world applications. To be successful in this course, we encourage students to know math (e.g., algebra and calculus) and a basic understanding of programming (e.g., R, Python, or Java).

Learning Outcomes: 1. Describe the foundations of artificial reasoning, knowledge, and trace the historical development of AI. 2. Explain the basic concepts, terminologies, and applications of different AI algorithms, developing a problem-solving mindset applicable to various domains. 3. Examine the diverse range of AI applications across varied industries. 4. Explain the role human factors and social context play in the development of artificial intelligence. Credits: 1.00

GRAD 50300 - AI Essentials: A Non-Technical Introduction

Credit Hours: 2.00. This course provides students on the translator track a foundation in the principles and methodologies of Artificial Intelligence (AI) to empower them to actively engage in interdisciplinary collaborations. With a focus on the essentials of AI, machine learning, and natural language processing, students will gain the knowledge and skills needed to bridge the gap between language and technology. Students will leverage AI tools and techniques to enhance translation efficiency, accuracy, and engagement in the ever-evolving digital landscape. Students will have a foundation in the methodology so they can effectively participate in interdisciplinary collaborations, serving as a valuable resource for industries where language and technology converge.

Learning Outcomes: 1. Explain the basic concepts and applications of different AI algorithms and how they apply for specific fields for application or research purposes. 2. Describe the types of data inputs and outputs used in different AI applications. 3. Define a project and apply basic AI approaches in a programming environment. 4. Communicate methods and results of an AI project to specialists and non-specialists. Credits: 2.00

GRAD 50400 - Advanced AI Fundamentals For Technical Professional

Credit Hours: 2.00. Artificial Intelligence (AI) is the driving force behind the transformation of industries, research, and technology. For students with a highly technical background, this 2-credit hour graduate course offers a deep dive into the fundamental principles, theories, and applications of AI. Specifically, this course will introduce students to the field of data mining and machine learning, which sits at the interface between statistics and computer science. Data mining and machine learning focus on developing algorithms to automatically discover patterns and learn models of large datasets. This course introduces students to the process and main techniques in data mining and machine learning, including exploratory data analysis, predictive modeling, descriptive modeling, and evaluation. To be successful in this course students should have experience with programming such as Python and R and have a background that includes calculus, linear algebra, algorithms, and probability theory.

Learning Outcomes: 1. Identify key elements of Artificial Intelligence (AI) and Machine Learning (ML) algorithms. 2. Understand how to choose AI/ML algorithms for different analysis tasks. 3. Analyze data in both an exploratory and targeted manner using AI and ML approaches. 4. Implement and apply basic AI/ML algorithms for supervised and unsupervised learning. 5. Accurately evaluate the performance of AI/ML algorithms, as well as formulate and test hypotheses. Credits: 2.00

GRAD 50500 - Foundations In Data Science

Credit Hours: 3.00. This course is the inaugural course in the Master of Science in Data Science program. Tailored for

students with a technical background, this course provides a comprehensive introduction to key concepts, statistical techniques, and tools foundational to the field of data science. The syllabus integrates hands-on experience, ethical considerations, programming refresher, and agile project management principles to equip students with a robust foundation for their data science journey.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of core data science concepts and articulate the significance of data in various domains. 2. Acquire skills to perform exploratory data analysis, identify patterns, and make informed decisions based on statistical inference. 3. Analyze ethical dilemmas arising in data-driven contexts, apply ethical decision-making models, and navigate the legal implications of data handling and analysis. 4. Demonstrate a comprehensive understanding of programming fundamentals and the application of agile methodologies to manage and execute data science projects. 5. Access, navigate, and employ Purdue's computing resources available through Purdue's Rosen Center for Advanced Computing (RCAC). Credits: 3.00

GRAD 50600 - Big Data Tools And Technologies

Credit Hours: 3.00. This course is designed to equip students with the essential skills to handle big data effectively. It covers proficiency in big data technologies, scalable data processing techniques, and the integration of big data tools into data science workflows.

Learning Outcomes: 1. Demonstrate proficiency in big data technologies. 2. Apply scalable data processing techniques to handle large datasets. 3. Integrate big data tools into comprehensive data science workflows. 4. Demonstrate proficiency with cloud computing. Credits: 3.00

GRAD 50700 - Cross Domain Data Communication And Visualization

Credit Hours: 3.00. This course focuses on the proficient use of data communication strategies and competencies. The course will focus on identifying data narratives, generating stories from data, illustrating with powerful and self-explanatory visualization, and basic principles of ethical use of non-data narrative frames for data communication. Designed for students with a technical background pursuing a Master of Science in Data Science, this course aims to enhance students' ability to extract and communicate meaning and narratives from raw data and visually represent it.

Learning Outcomes: 1. Create effective and aesthetically pleasing data visualizations. 2. Communicate complex data findings clearly to diverse audiences. 3. Utilize interactive visualization techniques for dynamic exploration of datasets. 4. Develop the ability to integrate ethics and data privacy considerations effectively when communicating with data. Credits: 3.00

GRAD 50800 - Data Analytics

Credit Hours: 3.00. This course provides an in-depth exploration of advanced data analysis techniques, predictive modeling, ensemble methods, and proficiency in data manipulation and transformation. It is designed for students with a technical background pursuing a Master of Science in Data Science.

Learning Outcomes: 1. Apply advanced data analysis techniques to extract meaningful insights from complex datasets. 2. Implement predictive modeling and ensemble methods for accurate data-driven predictions. 3. Demonstrate proficiency in data manipulation and transformation techniques. Credits: 3.00

GRAD 50900 - Applied Machine Learning: From Foundations To Latest Advances

Credit Hours: 3.00. This course provides an in-depth exploration of machine learning algorithms and data mining techniques, building on the foundational concepts introduced in the Foundations of Data Science course. Students will develop a comprehensive understanding of various machine learning algorithms, focusing on practical applications and hands-on experience. Additionally, the course will cover data mining techniques for dimension reduction and pattern discovery.

Learning Outcomes: 1. Demonstrate a comprehensive understanding of popular machine learning algorithms, including supervised and unsupervised learning techniques. 2. Demonstrate the ability to

analyze mathematical foundations and principles behind machine learning models. 3. Understand the nuances of applying various machine learning models, emphasizing the trade-offs between performance, computational complexity, and interpretability. 4. Students will actively explore unsupervised learning techniques, emphasizing clustering algorithms, and recognizing their vital role in solving real-world challenges. 5. Demonstrate proficiency into the fundamental principles of deep learning and investigate recent advancements, such as optimization using diffusion models, learning from unlabeled data using consistency models, and decentralized data processing through federated learning. Credits: 3.00

GRAD 51000 - ESE Colloquium/Seminar I

Credit Hours: 2.00. This 2-semester sequence (2 credits in fall and 1 credit in spring) is a first-year requirement of all ESE IGP students. The series is designed to build critical and resilience thinking skills, and improve oral and written communication through critique writing, panel forums, and mini, oral presentations while promoting camaraderie among the ESE IGP.

Learning Outcomes: 1. Identify your dogmas and recognize your biases towards learning how to remove your biases and learn how to minimize filtering readings and others' opinions through your own dogmas. 2. Gain a breadth of understanding on topics around sustainability and environmental challenges and different disciplinary approaches to a problem. 3. Increase your critical thinking skills, your ability to synthesize material, and improve your written communication skills. 4. Increase your oral communication ability, your ability to process others' opinions, and build camaraderie. 5. Improve your ability to think independently, to re-evaluate your assessment through input of others, and the process for approaching complex problems. Credits: 2.00

GRAD 51100 - ESE Colloquium/Seminar II

Credit Hours: 1.00. This 2-semester sequence (2 credits in fall and 1 credit in spring) is a first-year requirement of all ESE IGP students. The series is designed to build critical and resilience thinking skills, and improve oral and written communication through critique writing, panel forums, and mini, oral presentations while promoting camaraderie among the ESE IGP.

Learning Outcomes: 1. Increase your ability to work together, synthesize information, and present orally as a team. 2. Increase your ability to work with others towards consensus, facilitate discussion towards a common goal, and to approach the challenges from marketing to implementation of a symposium event. Credits: 1.00

GRAD 55000 - Fellowship And Grant Application Writing

Credit Hours: 2.00. Fellowship Application Writing is open to any graduate student who is interested in applying for fellowships and other grant opportunities. Graduate students will be taught how to write personal statements, research statements, and extended research plans that they can submit for fellowship applications. Organization of research background, methods, and significance will be emphasized. Writing mechanics and addressing grant agency requirements and procedures will also be covered. Additionally, fellowship and grant opportunities will be discussed along with professional communication skills.

Learning Outcomes: 1. Analyze the different types of fellowship opportunities currently available to them as well as form broad knowledge of postdoc and faculty grants. 2. Practice and evaluate proofreading skills to gain experience in editing fellowship application writings and be able to apply advanced proofreading skills to future writing projects. 3. Compose persuasive documents using a grant proposal writing style with appropriate formatting and organization and analyze their writing with grant agency criteria. 4. Synthesize and refine competitive personal statements, research plans, and statements of previous research to use for various fellowship

applications. Credits: 2.00

GRAD 58800 - Online Master Of Science In Data Science-Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a real-world data science problem, with an emphasis on the application domain. The capstone course for the OMSDS provides students with practical experience applying the collective set of skills developed through the OMSDS program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams of 3-5 students each, will work with a product owner to scope out the project via a project charter that will include a timeline, milestones, and metrics that will yield benefits and a strategy for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using data science that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

GRAD 58900 - Master Of Science In Artificial Intelligence Capstone

Credit Hours: 3.00. The capstone course aims to provide students with an opportunity to integrate their accumulated knowledge, technical, and social skills to identify and solve a realistic or real-world artificial intelligence problem, with an emphasis on the application domain. The capstone course for the MSAI provides students with practical experience applying the collective set of skills developed through the MSAI program to complete a professional project in support of a private, public, or non-profit partner. Students, in teams, will select a target beneficiary, arrange a consultation, develop a problem statement, a project plan that will yield benefits, and a strategy for measuring the outcome of the project compared to a baseline.

Learning Outcomes: 1. Identify the public, non-profit, or business objectives in a complex problem. 2. Evaluate and define an applied problem using AI that requires practical analysis and recommendations / and analytic output to a stakeholder. 3. Design a professional-level applied project that provides meaningful input to a targeted beneficiary. 4. Evaluate the proposed solution and interpret results concerning the "business" objectives. 5. Demonstrate an understanding of translational communication skills by communicating technical information to both technical and non-technical audiences. Credits: 3.00

GRAD 59000 - Special Topics

Credit Hours: 1.00 to 3.00. Hours and credits to be arranged. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 1.00 to 3.00

GRAD 59500 - Independent Study

Credit Hours: 1.00 to 6.00. This course provides a means of independent study of a special problem or research topic. Although not required, it is likely that a major result of the course will be a conference or journal publication. This course does not substitute for master's research credit on the plan of study. Permission of instructor required.

Learning Outcomes: 1. Outcomes will depend upon the agreed deliverables for the course. Credits: 1.00 to 6.00

GRAD 59800 - MS Non-Thesis Research

Credit Hours: 1.00 to 18.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Permission of instructor required.

Learning Outcomes: 1. Outcomes defined at the time of offering. Credits: 1.00 to 18.00

GRAD 60000 - Mentoring Intercultural Growth: Theory And Application

Credit Hours: 3.00. The ability to mentor intercultural competence, the capacity to interact effectively across

differences of many kinds is a key expectation of today's leaders. This course supports your ability to mentor others' intercultural development by building your own and by engaging in experiential learning, reflective practices, and knowledge acquisition. Topics explored include mentorship, learning theories, facilitation, assessment, and frameworks for intercultural competence and diversity, equity, and inclusion.

Learning Outcomes: 1. Articulate new self-awareness (e.g., of your own cultural identity and habitual behaviors) as an intercultural mentor, noting areas for potential growth. 2. Demonstrate foundational knowledge of models, frameworks, and practical approaches to bridging differences from the intercultural/global and diversity/inclusion realms. 3. Design and implement learning interventions for the development of intercultural competence. 4. Utilize appropriate formative and summative methods of assessing learners' intercultural development. Credits: 3.00

GRAD 60200 - Peer To Peer Mentoring For ESE IGP Students

Credit Hours: 1.00. This Peer-to-Peer (P2P) mentor experience is geared to enhance the professional development of our ESE students and foster enhanced success and professional development for our first year students. The P2P mentors meet once a week with Independent of GRAD 59000 and also meet with GRAD 59000 . P2P mentors have to shape the syllabus for each semester including identifying readings; develop, lead, and facilitate classroom activities through both traditional and innovative and creative strategies; and provide verbal and written input on weekly student critiques. Permission of instructor required.

Learning Outcomes: 1. Learning to develop creative and innovative teaching strategies. 2. Develop skills for fostering student written and oral communication. 3. Develop skills for fostering an inclusive and safe environment. 4. Develops skills for selecting course materials, planning course activities, and grading student performance. Credits: 1.00

GRAD 61000 - Grant Training Program I

Credit Hours: 1.00 to 3.00. This variable topic course is designed to be used by any department at WL needing to offer a training program associated with research grants such as those required by certain NIH, NSF or other grant agencies or programs. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid out for 600-level courses. Credits: 1.00 to 3.00

GRAD 61100 - Grant Training Program II

Credit Hours: 1.00. This variable topic course is designed to be used by any department at WL needing to offer a training program associated with research grants such as those required by certain NIH, NSF or other grant agencies or programs. Instructor permission required. Prerequisite: GRAD 61000.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid out for 600-level courses. Credits: 1.00

GRAD 61200 - Responsible Conduct Of Research

Credit Hours: 1.00. Overview of values, professional standards, and regulations that define responsible conduct in research. Students learn the values and standards of responsible research through readings and lecture/discussion and practice application of these values and standards to research situations through class discussion of case studies from life sciences research. Students must be registered for M.S. or Ph.D. thesis research in their home department.

Credits: 1.00

GRAD 68900 - Special Seminars

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. For use in interdisciplinary seminars and in other cases where general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 0.00 to 18.00

GRAD 69000 - Special Topics

Credit Hours: 1.00 to 8.00. This variable topic course focuses on advanced study of technical and professional research topics, primarily for doctoral students.

Learning Outcomes: 1. Learning outcomes for

the course will be variable based upon the specific instance of the course. 2. Outcomes will be require to meet the expectations laid our for 600-level courses. Credits: 1.00 to 8.00

GRAD 69300 - Interdisciplinary Internship/Practicum

Credit Hours: 0.00 to 18.00. For the use of interdisciplinary programs and in other situations when appropriate departmental courses are not available or general Graduate School identification is desirable. To be used only with the consent of the dean of the Graduate School.

Credits: 0.00 to 18.00

GRAD 69500 - Doctoral Independent Study

Credit Hours: 1.00 to 6.00. This course provides a means of independent study of a special problem under the guidance of a graduate faculty member who holds a terminal degree. It is assumed that projects in this course are research projects independent of one's doctoral research. Although not required, it is likely that a major result of the course will be a conference or journal publication. This course does not substitute for dissertation research credit on the plan of study. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes will be dependent on the content of the course. Credits: 1.00 to 6.00

GRAD 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Outcomes defined at the time of offering. Credits: 1.00 to 18.00

GRAD 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Joint and Special Programs (Graduate)

Gerontology, Post-Baccalaureate Certificate

Advanced Methodologies in the Behavioral, Social, and Health Sciences, Post-Baccalaureate Certificate

Corporate Training and Communication, MS

Secondary STEM Education with Initial Licensure, MS

Graduate Studies, MS

Interdisciplinary Studies, MS

Intercultural Competence Mentorship, Post-Baccalaureate Certificate

Applied Geospatial Analytics, MS

Artificial Intelligence and Machine Learning, MSAI (OL)

Artificial Intelligence Management and Policy, MSAI (OL)

Data Science, MSDS (OL)

ENTR 50000 - Technology Commercialization Seminar

Credit Hours: 2.00. This course is a seminar that focuses on topics related to technology realization, commercialization, and entrepreneurship. Topics pertaining to these areas are covered through readings, class discussion, and presentations by invited speakers.

Learning Outcomes: 1. Evaluate a new technology in terms of its value proposition and product/market fit. 2. Document how to conduct market analysis and customer development. 3. Give examples of why intellectual property protection, legal business formation, and contracts are important to startup companies. 4. Describe why raising money is essential for technology entrepreneurship. 5. Differentiate the various resources supporting entrepreneurs in the community. Credits: 2.00

ENTR 50100 - Technology Commercialization Practicum

Credit Hours: 2.00. This course introduces a variety of cross-disciplinary topics to develop the skills needed to realize technology. Each week, students learn specific methodologies and techniques and apply these through case studies and class projects.

Learning Outcomes: 1. Conduct market research for a new technology. 2. Define market segments through market analysis. 3. Evaluate business models for a new technology. 4. Develop a go-to-market strategy for a new venture. 5. Create and deliver an investor pitch for a new venture. Credits: 2.00

ENTR 59000 - Graduate Level Special Topics In Entrepreneurship And Innovation

Credit Hours: 1.00 to 3.00. The requested course will provide the opportunity for graduate students to participate in entrepreneurship courses focused on the skills and knowledge necessary to launch and lead new business ventures, the examination of the feasibility and market potential of new technologies, and/or the development of business plans.

Learning Outcomes: 1. Acquisition of the skills and knowledge necessary to launch and lead new ventures. 2. Examination of the feasibility and market potential of new products or technologies. 3. The development of business plans for new ventures. Credits: 1.00 to 3.00

SYS 50000 - Perspectives On Systems

Credit Hours: 3.00. This course provides an introduction to, and references for, each of four distinct approaches to SE concepts and tools. Individual assignments and team projects will be based on readings from these multiple approaches and selected case studies. Participants will be encouraged to bring their own prior expertise and examples to the discussions and projects. While the course will discuss quantitative topics (including cybernetics, feedback control systems, and statistical process control), the course itself will emphasize a more interdisciplinary conceptual integration rather than stand-alone analysis of these topics.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognize the need for, and an ability to engage in life-long learning. 8. Acquire knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

SYS 51000 - Tools And Methodologies For Designing Systems

Credit Hours: 3.00. Introduction to modeling tools and methods for designing engineered systems. Topics include: defining the design problem; defining and validating stakeholders' and

system requirements; discrete mathematics for system modeling; defining and modeling system operational scenarios; the system development life cycle; defining and modeling functional, physical, and allocated architectures; evaluating and modeling the tradeoffs between alternative architectures; and defining the system qualification process.

Learning Outcomes: 1. Apply the discrete mathematics concepts of set theory, relations and functions, and graph theory to characterize and analyze the functional and structural aspects of models for designing engineered systems. (1, 3) 2. Critique different approaches for system development life cycles and for systems engineering processes. (1, 2) 3. Define an engineered system's context. (1, 4) 4. Define and critique a functional model of a system development life cycle using a model-based systems engineering tool. (1, 2, 4) 5. Define and critique models of the functional architectures of an engineered system using a model-based systems engineering tool. (1, 2, 4) 6. Define a system's stakeholders and define formal system I/O requirements. (1, 2, 3) 7. Audit a set of formal system I/O requirements for completeness. (1, 2, 4) 8. Define models of the physical architecture of an engineered system using a model-based systems engineering tool. (1, 2, 4) 9. Apply an option creation technique to generate alternative physical architectures. (1, 2) 10. Define an allocated architecture of an engineered system using a model-based systems engineering tool. (2, 4) 11. Define the relationship of stakeholder's requirements to design trade-off objectives. (1, 2) 12. Define models of the interfaces of an engineered system using a model-based systems engineering tool. (1, 2, 4) 13. Critique a functional model of early validation using a model-based systems engineering tool. (1, 2, 4) 14. Understand alternative graphical modeling approaches for data modeling, process modeling, and behavior modeling. (1, 2) 15. Define and model uncertainty, value, and risk preference for evaluating design tradeoffs between alternative system architectures. (1, 2, 3, 4) Credits: 3.00

SYS 52000 - Systems Engineering Processes And Professional Competencies

Credit Hours: 3.00. This course covers life cycle processes performed by system engineers and soft skills essential to being a successful system engineer. Topics include systems engineering technical processes, technical management processes, organizational strategies and operations supporting system development, tailoring of processes to industry sectors and domains, cross-cutting systems engineering methods, specialty engineering, systems engineering competencies, and relevant soft skills. Permission of instructor required.

Learning Outcomes: 1. Identify the organization, content, and key principles of the INCOSE Systems Engineering Handbook. 2. Critique primary literature on systems engineering practices and competencies and apply these concepts to the practice of systems engineering. 3. Synthesize systems engineering life cycle processes and competencies to create tailored applications of the concepts for an industry or organization. 4. Identify key components of INCOSE systems engineering certification and create a certification application. 5. Create a professional development plan through self-assessment of systems engineering professional competencies. Credits: 3.00

SYS 53000 - Practical Systems Thinking

Credit Hours: 3.00. Practical systems thinking is designed to give students a sense of how problem solving happens in the real world. This is accomplished through case examples and group projects.

Learning Outcomes: 1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Function on multidisciplinary teams. 3. Identify, formulate, and solve engineering

problems. 4. Understand professional and ethical responsibility. 5. Communicate effectively. 6. Acquire the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. 7. Recognition of the need for, and an ability to engage in life-long learning. 8. Acquire the knowledge of contemporary issues. 9. Prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Credits: 3.00

TDM 50100 - The Data Mine Seminar

Credit Hours: 1.00. Intended for any student across campus desiring broad coverage of data science and analytics topics.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00

TDM 51100 - Corporate Partners

Credit Hours: 3.00. Students in The Data Mine Corporate Partners Learning Community will work in groups with Corporate Partner mentors on a variety of projects. They will analyze real data related to questions that the Corporate Partner proposes. Most projects will last for a full academic year (late August through late April), with multiple reports and presentations given more frequently. The mentor is expected to meet with the students weekly by Microsoft Teams, or (more rarely) in person. Students are expected to actively participate in these meetings and in all individual and group work. The goal of the course is to help students build impactful industry related skills in data science, visualization, and data engineering. The Data Mine staff also has data scientists who can assist students with technical questions focused on the skills being built and the research conducted. Students can work on real-world industry facing issues that have a high value add for the corporate partner.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 3.00

TDM 59000 - The Data Mine Special Topics

Credit Hours: 1.00 to 3.00. Focused topical coverage of data science and analytic topics intended for any student across campus.

Learning Outcomes: 1. Discover data science and professional development opportunities in order to prepare for a career. 2. Explain the difference between research computing and basic personal computing data science capabilities in order to know which system is appropriate for a data science project. 3. Design efficient search strategies in order to acquire new data science skills. 4. Devise the most appropriate data science strategy in order to answer a research question. 5. Apply data science techniques in order to answer a research question about a big data set. Credits: 1.00 to 3.00

Office of Interdisciplinary Graduate Programs (OIGP)

The Office of Interdisciplinary Graduate Programs

The Office of Interdisciplinary Graduate Programs (OIGP) was established in 2004 to promote and facilitate cross-disciplinary research at Purdue. Since its inception, enrollment in igp's has nearly doubled.
A high point of the year is the OIGPs Annual Spring Reception. A mix of poster and PowerPoint presentations, the reception highlights the breadth and depth of interdisciplinary research at Purdue. Over 90 students participated in this year's event including graduate students from interdisciplinary programs and those working on collaborative projects from programs outside of the OIGP.
The office has created an Interdisciplinary Graduate Programs Student Advisory Board (IGPSA) that gives students a direct voice to the Graduate School. The IGPSA represents the diverse needs of interdisciplinary students, and seeks new avenues of recognition for IGP students at the university.
The interdisciplinary graduate programs under the OIGP umbrella include: American Studies, Comparative Literature, Linguistics, Comparative Medicine, Computational Life Sciences, Computational Science and Engineering, Ecological Sciences and Engineering, Food Science, Gerontology, Information Security, Ingestive Behavior, Life Sciences, Nutrition, Philosophy and Literature, Women's Studies, and the Independent Interdisciplinary Graduate Program.

Information Security, MS

Inclusive Excellence, Post-Baccalaureate Certificate

Information Security, PHD

Purdue University Interdisciplinary Life Science (PULSe), MS or PHD

Interdisciplinary Genetics Concentration (GR)

College of Agriculture (Graduate)

Graduate Degree

A master's or doctoral program in the College of Agriculture will be specialized and flexible to prepare students to meet their professional objectives. the college offers a growing number of multidisciplinary graduate degree programs, using directed experiences and courses from faculty members in one or more Purdue departments or colleges. Business and industry, government, and academic institutions throughout the world recruit College of Agriculture graduates for leading positions.

Contact Information

College of Agriculture
615 Mitch Daniels Blvd.
West Lafayette, IN 47907-2053
Email: exp@purdue.edu
Phone: 765-494-8470

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College of Agriculture Administration (Graduate)

Spatial Data Science, Post-Baccalaureate Certificate

Agriculture, MAGR

AGR 59500 - Current Topics In Agriculture, Natural Resources, And Related Sciences

Credit Hours: 1.00 to 3.00. Critical examination of developments in specialized and emerging areas of agriculture not taught in other courses. Some topics include lecture, lab, directed reading or independent study. Students must have graduate standing or obtain permission of instructor.

Learning Outcomes: 1. Enhanced discipline knowledge for agriculture, natural resources

and related sciences. 2. Enhanced oral and written communication skills. 3. Develop critical and creative thinking skills, mastery of ethics in research. 4. Enhanced professional development skills. Credits: 1.00 to 3.00

NRES 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays. Learning Outcomes: 1. Discuss the complexity of involving stakeholders in decisions about landscape management. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

Department of Agricultural and Biological Engineering (Graduate)

Website: **https://engineering.purdue.edu/ABE/foryou/graduate**

Department/School Head

Nathan S. Mosier

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Adjunct Faculty	Courtesy Faculty
R. P. Kingsly Ambrose Dennis Buckmaster Natalie Carroll Keith Cherkauer Kari Clase Bernard Engel William Field Jane Frankenberger Margaret Gitau Konstantina Gkritza Klein Ileleji Michael Ladisch John Lumkes Nathan Mosier Ganesan Narsimhan Jiqin Ni Martin Okos D. Marshall	Somali Chaterji Sadegh Dabiri Meng Deng Vincent Duffy Abigail Engelberth Jian Jin Shweta Singh Robert Stwalley Mohit Verma	Fernanda da Cunha Shawn Ehlers John Evans Upinder Kaur Caitlin Proctor Ankita Raturi Kurt Ristroph Karthik Sankaranarayanan Lizhi Shang Halis Simsek Yaguang Zhang	Indrajeet Chaubey Jingqiu Chen Dirk Maier Sara McMillan Rabi Mohtar Christian Renschler Kevin Solomon Mark Williams Eduardo Ximenes	Laura Bowling Carlos Corvalan Melba Crawford Jose Garcia Bravo Allen Garner Leopold Green Jacob Hosen Jen-Yi Huang Jinha Jung James Krogmeier Stephen Lindemann Venkatesh Merwade Brittany Newell David Umulis Mark Ward

Porterfield Jenna Rickus Dharmendra Saraswat Roger Tormoehlen Andrea Vacca				

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Academic Programs

The Purdue University Department of Agricultural and Biological Engineering graduate program is currently ranked #1 by U.S. News & World Report and has been nationally ranked for more than a dozen years. State-of-the-art facilities and internationally-known faculty support an average of 100 on-campus ABE graduate students per year and 150 graduate students through ABE's hybrid Biotechnology Innovation & Regulatory Science program. Our innovative research creates products and processes that address national and global challenges in food, energy, water, health, and the environment.

Agricultural and Biological Engineering, PHD

Hybrid Vehicle Systems ABE, Post-Baccalaureate Certificate

Agricultural and Biological Engineering, MSABE or MSENGR or MS

Biotechnology Quality and Regulation Compliance, Post-Baccalaureate Certificate

ABE 50100 - Welding Engineering

Credit Hours: 3.00. Design of weldments and modeling of heat transfer and residual stresses of the welding processes. Finite element theory of nonlinear properties for the many processes including laser, submerged arc, manual, Gas Tungsten Arc Welding (GTAW), plasma, and electron beam. Metallurgy topics include continuous cooling transformation curves in optimizing engineered joint strength, including cutting and welding. Offered in alternate years.

Learning Outcomes: 1. Analyze and effectively discuss positive and negative sides of major welding processes and make a sound choice of the most appropriate welding process for the given requirements. 2. Analyze and critique currently accepted theories of heat transfer and rapid solidification applied to welding processes. 3. Predict development of microstructure in the weld and residual stresses in the welded structure. Analyze the evolution of microstructure and segregation in the three main zones of welded joints. 4. Design the geometry of welded joints and determine proper welding parameters. 5. Recognize and analyze major welding defects, know inspection methods used to detect them, the major causes for their occurrence, and measures for their prevention or correction. Credits: 3.00

ABE 50300 - Surface Properties And Powder Performance Of Microparticulate Systems

Credit Hours: 3.00. Material Surface Science is the study of properties that occurs at the interface of two phases. Surface phenomena needs to be addressed to understand and manipulate the behavior of particulate materials. Probing

particulate surface properties at the nano- and micro-level helps to relate these to the macroscale powder performance. The main focus of this course is on the application of surface analytical techniques for assessing the physical and chemical factors that dictate particulate interactions in various food, pharmaceutical, biological, mineral, environmental (soil and water) and aerosol systems. This course will provide the student both a broad overview of the state-of-the-art analytical tools available to assess particulate surfaces and a fundamental insight into the characteristic behavior of system of particles. This course is unique because the student will learn and articulate how surface, physical, chemical and bulk properties are relevant in the performance of microparticulate systems of his/her interest.

Learning Outcomes: 1. Identify the state-of-the-art surface characterization techniques to probe materials. 2. Analyze data, interpret the results and hypothesize complex properties for surface characteristics and material interfaces. 3. Assess surface and physicochemical properties of microparticulates associated with powder behavior. 4. Articulate and propose relationships between surface properties (composition, interactions, functionality) and performance of various particulate systems. Credits: 3.00

ABE 50501 - Particle, Powder, and Compact Characterization

Credit Hours: 2.00. The goal of this course is to familiarize students with the properties and methods used to characterize the physical and mechanical behavior of particles, granules, and compacts with the intention of using these properties for process and performance design.

Learning Outcomes: 1. Define and describe the significant properties of particles, granules, powders, and compacts. 2. Explain how these properties are measured. 3. Illustrate how these properties influence the performance of particle-based products and manufacturing processes. 4. Create a computational or a web-based tool that demonstrates or implements concepts from the course. Credits: 2.00

ABE 50502 - Particles, Powders, And Compact Characterization Laboratory

Credit Hours: 1.00. The goal of this laboratory course is to train students on state-of-the-art laboratory equipment used to measure the mechanical properties of particles, granules, powders, and compacts.

Learning Outcomes: 1. Follow laboratory safety guidelines. [6] 2. Operate common laboratory equipment and follow standard operating procedures used to measure the mechanical properties of particles, granules, powders, and compacts. [6] 3. Plan and perform measurements, analyze results, and summarize the results in a written report. [3,5,6] Credits: 1.00

ABE 51100 - Drug Development

Credit Hours: 3.00. A review of drug discovery and drug development, with emphasis on the regulatory aspects of these activities. Animal preclinical research and human clinical research are discussed in detail. In addition, the process for the assembly of an IND and NDA is discussed along with the Phases (I,II,III) of human clinical trials. The CMC (chemistry manufacturing and control) aspects of drug development are presented along with ICH documents and manufacturing process analytical technologies. The course concludes with a brief review of international regulatory issues and patents.

Learning Outcomes: 1. Comprehend strategies used for biotechnology innovation: regulatory and quality documents and materials in the areas of drug development and discovery. 2. Ability to meld theory and practice. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use data, media and computers to send and respond effectively to communication for varied audiences and purposes. 5. Demonstrate sensitivity to and facility with personal values and ethical principles in professional and social contexts. Credits: 3.00

ABE 51200 - Good Regulatory Practices

Credit Hours: 3.00. Includes a review of the FDA and ICH regulations on good manufacturing, good laboratory, good clinical practices. The meaning of these regulations, the globalization of practices and the roles and responsibilities of various professionals implementing these regulations will be addressed. Special emphasis will be detailed coverage of the process for the assembly and submission of an IND or NDA, and the function of the regulatory affairs department in a pharmaceutical company.

Learning Outcomes: 1. Identify cGMP regulations, and relationship to maintaining control of the chemical and ultimately the drug product with a focus on Phase 3, product introduction, and post marketing. 2. Examine about the regulatory history of the FDA and the GxP framework. 3. Identify NDA and BLA applications, product control including specifications, quality outcomes, critical quality attributes, and ICH framework. 4. Evaluate the regulations governing the manufacture of drug products, including the methods used to prove this, validation of those methods, validation of the manufacture, quality by design, comparability protocols, and continuous improvement. 5. Identify and evaluate compliance to GMP and warning letters. 6. Evaluate Good Distribution Practices (GDP) and the integration of supply chain controls into the Quality Management System. 7. Learn GCP, clinical regulations, and relationship to ensuring the drug or device is safe and efficacious. 8. Evaluate and describe basic clinical trial design and how to write the investigator's brochure that informs patients (through the informed consent document that they sign) of clinical information. 9. Examine the rigid control that governs the clinical protocols and processes such as compliance oversight procedures, the role of clinical auditors and the process of auditing a clinical trial to ensure that it is done right. 10. Identify about the impact of technology and patient involvement in clinical trials through online resources, such as clinicaltrials.gov, YouTube instruction videos including videos describing GCP for devices. 11. Summarize the impact of recent adverse clinical trial events with innovative applications such as in biologics (Tegerno) and gene therapy (Gelsinger). Students will also identify and describe the role of approved Risk Evaluation and Mitigation Strategies (REMS), pharmacovigilance programs and adverse drug event reporting. 12. Identify and evaluate GLP and regulations that ensure a drug product is safe. 13. Examine GLP protocols, toxicology testing, including animal and human safety, and indicators for safety (irregular heartbeats in animals, etc.). 14. Evaluate the ethical considerations of testing, including impact of falsifying safety testing. 15. Analyze how GLP regulations are implemented during development and testing of devices. 16. Discover how technology and innovation impact the regulatory process. 17. Review data integrity and compliance with cGMP. 18. Evaluate the role of computer systems and computer systems validation. 19. Assess the emerging area of predictive toxicology and the potential for testing without animals. 20. Evaluate and explain innovation in safety and adaptive clinical trials. 21. Examine innovation in CMC including quality by design and predicting the quality of manufacturing on the large scale with small scale experiments, including analytics modeling. 22. Discover how the global environment impacts the regulatory process. 23. Evaluate special considerations of implementing a generic system in the developing and third world country . 24. Analyze global regulatory authorities and WHO PQ process. 25. Examine special considerations of the regulatory process as applied to devices, diagnostics and generics. 26. Identify the importance of design to a device, attributes that lead to the specifications and raw materials for diagnostics and the importance of product

equivalence for generics and special considerations for biologics. Credits: 3.00

ABE 51300 - Quality Management, Audits, Inspections

Credit Hours: 3.00. This course provides advanced topics in quality management and business improvement methods that apply to the pharmaceutical industry. Emphasis will be placed on specific issues of industry, audits, and inspections, as well as the successful selection and presentation of business and quality improvement projects to produce compliance and competitive advantage.

Learning Outcomes: 1. Understand quality management definitions, concepts, and guidelines. 2. Define quality and how to establish a quality management system. 3. Define quality plan, describe its purpose for the organization as a whole and identify various functional areas and people that have responsibility for contributing to its development. 4. Understand the audit process and quality control, including the various approaches to audits, inspections and reviews. 5. Understand basic skills required to manage audits, inspections and reviews. 6. Learn how to set up effective self audit systems. 7. Understand the impact of changing technologies, such as electronic systems, on supporting a quality management system. 8. Understand how quality management functions support global business decisions for asset acquisitions and growth of a company. 9. Understand the key elements of supply chain management, assessing risk, and managing outcomes from supplier and vendor audits. 10. Understand regulatory compliance aspects and implementation of ICH and global quality principles in supply chain management, including good distribution practices. 11. Define a continuous quality improvement or business improvement project within an organization. 12. Select and define continuous quality improvement tools and techniques in order to achieve operational excellence. 13. Develop in-depth knowledge of how to implement and obtain operational excellence and present the findings in a coherent and informative manner. Credits: 3.00

ABE 51400 - Documents And Dialogues Of Drug Development And Registration

Credit Hours: 3.00. This capstone advanced course will integrate previous learning relating to laws and regulations, quality principles and practices, and the preparation and submission of documents for preclinical research clinical trials and new drug approvals. Special topic lectures will be given. Considerable time will be devoted to preparing regulatory documents and conducting "mock" dialogues and negotiations with "pretend" agency officials.

Learning Outcomes: 1. Obtain and apply broad knowledge of FDA and international law, regulations, and guidance documents for at least one category of medical products (drugs, biological products, devices). 2. Ability to meld theory and practice in regulatory affairs. 3. Examine issues rationally, logically, and coherently; and acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make sound decisions in both familiar and unfamiliar contexts. 4. Read, write, speak, listen, and use data, media and computers to send and respond effectively to communication for varied audiences and purposes. 5. Recognize the factors that influence regulatory decisions, develop methods to incorporate regulatory trends and practices, and think strategically about product development and marketing. 6. Obtain and apply broad knowledge of FDA and international requirements for the approval and conduct of pre-and post-market clinical studies with regulated products and understand the basic principles of clinical study design and clinical data analysis for at least one category of medical products (drugs, biological products, devices). Credits: 3.00

ABE 51500 - Molecular Basis Of Manufacturing

Credit Hours: 3.00. This advanced course addresses important Chemistry Manufacturing and Control (CMC) issues related to manufacturing and quality by design. The course provides important information on strategies for quality by design, manufacturing strategies for early development, the best approaches to analyzing data, and strategies for reporting the information to the FDA. This course will also focus on product design and processing. Using product and process design helps achieve quality by design (QbD), strong development reports, excellent regulatory submissions and allows continuous improvement. The course includes laboratory exercises, laboratory tours, and/or workshops outlining how to interpret the data.

Learning Outcomes: 1. Identify GMP manufacturing procedures operations including blending, granulation, drying, compression, coating, etc.; Specifications in manufacturing; Statistical principles important in manufacturing. 2. Characterize GMP manufacturing procedures. 3. Evaluate how drug products (solids, liquids, injectables) are characterized especially related to: Dissolution; Weight variation; Content uniformity; Instrumental methods including X-ray diffraction; Approaches to determining critical quality attributes; Factors that influence the quality of the final product; DOE approaches to product optimization. 4. Construct QOS and Critical quality attributes diagram. 5. Outline how technology and innovation impact the manufacturing process: Strategies for continuous manufacturing; Process analytical technology methods; Innovations in manufacturing methods; How the global manufacturing environment impacts pharmaceutical manufacturing. Credits: 3.00

ABE 52700 - Computer Models In Environmental And Natural Resources Engineering

Credit Hours: 3.00. Offers students in environmental and natural resources engineering programs an understanding of the hydrological processes and related design skills. Principles of soil erosion by water; drainage of agricultural lands; surface runoff; flood and reservoir routing; hydrodynamic and water quality in pipe network; nonpoint source pollution; and transport phenomenon are studied. Current computer models utilized in industry for decision support are applied using case studies to further enhance the understanding of the hydrological processes. Limitations and advantages of the models are discussed. Offered in alternate years.

Credits: 3.00

ABE 52900 - Nonpoint Source Pollution Engineering

Credit Hours: 3.00. Engineering principles involved in assessment and management of nonpoint source (NPS) pollution. Effect of NPS pollution on ecosystem integrity. Use of GIS/mathematical models to quantify extent of pollution. Design/implementation of best management practices to reduce nonpoint source pollution and improve water quality. Discussion of total maximum daily load (TMDL) principles and processes.

Learning Outcomes: 1. Understand sources and nature of NPS pollution originating from agricultural and urban land use. 2. Link nature of diffuse pollution with physical, chemical and biological integrity of ecosystems and water usage. 3. Quantify amount of diffuse pollution from a watershed using state-of-the-art methods and models. 4. Design best management practices to minimize nonpoint source pollution from agricultural and urban land use. 5. Understand TMDL issues, and processes involved in developing TMDL plans. 6. Understand basic monitoring and modeling principles. 7. Apply engineering principles in developing pollution prevention plan. Credits: 3.00

ABE 53000 - Plant Phenotyping Technologies

Credit Hours: 3.00. Introducing concepts, models, algorithms, and tools in plant phenotyping development and application projects. Class topics include high-throughput phenotyping in greenhouse, field phenotyping platforms, Ag remote sensing, plant sensors (hyperspectral, 3D thermal, florescent, X-ray, etc.), plant image processing technologies, statistical modeling, big data, database requirement, artificial intelligence algorithms, and hybridizations of the above techniques applied in plant phenotyping. Permission of instructor required.

Learning Outcomes: 1. Know the concept of digital agriculture and plant sensors' applications. 2. Understand the plant

phenotyping technologies, in both software and hardware. 3. Learn the skills of designing a professional phenotyping imaging system and collecting data. 4. Understand the current phenotyping activities in academia and industry. 5. Know the major plant sensors and their applications. 6. Have the capability of choosing or designing the most feasible sensor system for specific phenotyping projects. 7. Understand the role of the plant sensors in a precision agriculture system. 8. Learn basic image processing skills. 9. Have the capability of applying computational intelligence and machine learning techniques to classification, prediction, pattern recognition, and optimization problems. Credits: 3.00

ABE 53100 - Instrumentation And Data Acquisition

Credit Hours: 3.00. This course educates students in the use, selection, and design of instrumentation and data acquisition for agricultural, food, environmental, and biological systems. Emphasis is on measurement of position (GPS), force, pressure, power, torque, flow, and temperature along with environmental sensors. Labs focus on building and using measurement systems and programming PC computers for data acquisition and analysis. Prior knowledge of electrical circuitry is desirable.

Learning Outcomes: 1. Understand the principles of operation and limitations of common measuring instruments. 2. Model instruments and their operating conditions to use the instruments correctly. 3. Design and use signal conditioning devices. 4. Program computers to automate the acquisition and processing of data. 5. Design systems for the acquisition, analysis, and communication of data. 6. Gain awareness of economical and societal aspects of instrumentation systems and communication of data. Credits: 3.00

ABE 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Demo labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic hydraulic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy-efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

ABE 54000 - Principles Of Systems & Synthetic Biology

Credit Hours: 3.00. Synthetic biology harnesses the power and adaptability of biology to engineer living systems that address grand societal challenges. This course introduces students to fundamental concepts and techniques in this interdisciplinary discipline, and studies state-of-the-art techniques from the primary literature. The course follows the standard Design-Build-Test-Learn (DBTL) cycle of contemporary practice and includes topics such as biological circuit design, advanced DNA assembly techniques, genome editing technologies, next generation sequencing, and directed evolution.

Learning Outcomes: 1. Identify and select biological parts needed for a specific engineering objective. 2. Use modern DNA assembly techniques to build biological circuits and designs. 3. Describe the performance of biological circuits and their components. 4. Design biological circuits for specific applications. 5. Evaluate design performance with modern analytical techniques. 6. Discuss the ethical concerns of engineering biology. Credits: 3.00

ABE 54500 - Design Of Off-Highway Vehicles

Credit Hours: 3.00. Problems associated with the design of off-highway vehicles, with special emphasis on farm and industrial tractors and self-propelled machines; engines; power trains; traction; vehicle control systems; human factors; testing and evaluation of performance.

Credits: 3.00

ABE 54700 - Models And Microbiomes

Credit Hours: 3.00. Determine the use of computational, physical, and biological models for studying and engineering microbiomes. Study peer-reviewed literature and synthesize findings in the form of oral and written deliverables. Background in microbiology either from coursework or research and interest in microbiomes recommended.

Learning Outcomes: 1. Review primary papers and books for state-of-the-art developments in the field of microbiome. 2. Analyze the relationships between multiple modeling approaches for the microbiome. Credits: 3.00

ABE 55700 - Biological Engineering Design I

Credit Hours: 3.00. Course includes analysis and design of operations, such as dehydration, fermentation, and separation processes. Development of experimental designs, integration of pilot plant results into the design, operation and scale-up process systems. Emphasis on how the properties of biological materials influence the quality of the processed product.

Learning Outcomes: 1. Develop ability for self-learning and preparation for lifelong learning. 2. Apply principles learned to the development of typical industrial processes. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Communicate technical information effectively. 5. Improve computer skills. 6. Work in teams. 7. Meet deadlines. 8. Evaluate ethical, global, and societal contemporary issues. Credits: 3.00

ABE 55800 - Biological Engineering Design II

Credit Hours: 3.00. This course will focus on the design, synthesis, creation, evaluation, and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Course will include group projects, oral and written reports.

Learning Outcomes: ". Develop an understanding of Bio and Food Separation Processes. 2. Evaluate the economic aspects of product costs. 3. Develop and conduct an experimental design to identify impact of process variables to improve product quality. 4. Develop processes to minimize environmental and energy impact. 5. Develop an understanding of optimization (zero discharge/minimum energy). 6. Develop a business plan. 7. Communicate technological information. 8. Improve computer skills to operate and schedule processes (superPro Designer/Batches). 9. Work in teams to design a biological/food process. 10. Review technical and patent literature Credits: 3.00

ABE 56000 - Biosensors: Fundamentals And Applications

Credit Hours: 3.00. (BME 52100) An introduction to the field of biosensors and an in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and biosecurity applications.

Credits: 3.00

ABE 58000 - Advanced Processes In Biological Engineering

Credit Hours: 3.00. Physical and chemical structure of biomass. Reaction kinetics of hydrolysis of hemicellulose and cellulose to fermentable sugars. Fundamentals of ethanol production by fermentation. Separation of fermentation products into pure components.

Learning Outcomes: 1. Analyze bioprocesses using engineering design principles, bioreactor simulations, application of basic separations methods, and applying engineering economic analysis. 2. Develop process models for batch and continuous fermentation, cell culture, and

enzymatic bioreactors. 3. Analyze the impact of fundamental advances in bio-sciences on bioprocess engineering and the environment, and the potential of these advances to solve societal problems. 4. Understand the impact of biosafety and regulatory considerations on process design. Credits: 3.00

ABE 58500 - Soil Microbiology

Credit Hours: 3.00. The soil microbial population and its role in the soil ecosystem; microbial transformations of inorganic and organic compounds; decomposition of residues; and dynamics of soil organic matter.

Learning Outcomes: 1. Interrelate the importance of soil microorganisms, and the biological processes they mediate, to soil properties and ecosystem functions. 2. Know the importance of soil as a habitat for organisms and critical biogeochemical processes they control. 3. Know the morphology, physiology, and ecology of the major groups of soil microorganisms. 4. Relate soil microbiology to your own area of research interest and be able to articulate correctly a response on questions related to microbiology or microbial functions in the environment. Credits: 3.00

ABE 59000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of the instructor in the selected field of study. Laboratory, field, and library studies and reports on special problems related to agricultural and biological engineering not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 6.00

ABE 59100 - Special Topics

Credit Hours: 0.00 to 4.00. Primarily designed for students (two or more) desiring credit from subject areas for which no specific course, workshop, or individual study plan is offered. Area of study will deal with topics that have enough student interest to justify the formalized teaching of a specialized topic. The course may be repeated by a student as long as the topic being taught is not repeated. Permission of instructor required.

Credits: 0.00 to 4.00

ABE 61600 - Medical Devices And Diagnostics In BIRS

Credit Hours: 3.00. This advanced course will integrate diverse aspect of Medical Devices including diagnostics and drug-device combinations relating to laws and regulations, quality principles and practices, and the preparation and submission of documents for preclinical research, clinical trials and new drug and device approvals. Special topic lectures will be given. Considerable time will be devoted to case studies and independent work.

Learning Outcomes: 1. Apply knowledge of regulations involving manufacturing and clinical studies of devices. 2. Utilize strategic concepts in the design and development of devices. 3. Demonstrate the ability to effectively communicate their field of study to the scientific community as well as regulators. 4. Demonstrate the ability to think critically, creatively and solve problems in their field of study. Credits: 3.00

ABE 61700 - Global Leadership In BIRS

Credit Hours: 3.00. This course provides a foundation to the theoretical foundation and empirical research associated with emerging strategies and theories in the study of global leadership. The course also addresses the practical application of leadership to the biotechnology industry including activities to help encourage collaboration and innovation. Students will build self-awareness and learn about the evolution of leadership as a process that requires vision, passion and discipline. Guest lecturers from both industry and regulatory organizations will provide applications of the topics above within the biotechnology manufacturing and regulatory industry.

Learning Outcomes: 1. Describe foundational theories of leadership, including the history and development of the leadership theories over time, and relate leadership theories to current events. 2. Explain major components of key leadership models and approaches, identifying strengths and weaknesses of each model and applying knowledge to practical uses of leadership theories in global biotechnology organizations. 3. Apply methods of self-analysis to discover leadership strengths and abilities and integrate knowledge of self-analysis and

leadership models to the context of your current organization. 4. Explore the human dimension of leadership and develop awareness of yourself, your strengths and abilities, and how to apply this knowledge to a life-long leadership development plan. Credits: 3.00

ABE 61800 - Project Management In BIRS

Credit Hours: 3.00. The factors influencing decisions during the initiation, implementation, and termination of industrial and manufacturing projects are examined. Students work as project teams, using project management tools to develop implementation strategies.

Learning Outcomes: 1. Understand and learn the latest tools and techniques used in projects. 2. Develop a systems perspective for understanding projects. 3. Align projects with strategic objectives. 4. Develop and think analytically in order to successfully apply knowledge and technical expertise to the solution of real business problems. Credits: 3.00

ABE 61900 - Biotechnology Innovation In Regulatory Science

Credit Hours: 3.00. This course is an introduction to biotechnology innovation and strategy. The framework for innovation and how this translates to regulatory science and drug development will be the focus. Students will learn key pharmaceutical strategy concepts including dierences between large and small molecules, clinical and manufacturing statistics, and current pharmaceutical trends. Guest lecturers from both industry and regulatory organizations will provide applications of the topics above within the biotechnology manufacturing and regulatory industry. This course is an elective for the M.S. degree in Biotechnology Innovation and Regulatory Science.

Learning Outcomes: 1. Describe how the framework for innovation translates to a biotechnology organization by developing a topic of interest into a research paper. 2. Explain the major steps in large molecule development by applying to an mRNA vaccine business case study: Select a mRNA vaccine to manufacture and provide rationale and describe the manufacturing methodology to be utilized. 3. Describe how you will set up a GMP system within your manufacturing facility. 4. Provide rationale for manufacturing facility to be utilized (pod versus bricks and mortar). 5. Describe analytical testing to be employed. 6. Depict the strategy canvas for your project. 7. Understand the role of novel delivery systems in drug development. 8. Understand how data and computer systems enhance innovation. 9. Explain the risk of innovation and identify risk mitigation strategies. Credits: 3.00

ABE 62000 - Foundations Of Research In BIRS

Credit Hours: 3.00. Students identify a problem within their organization, define the current state supported by evidence, develop a proposal based upon literature review and evidence within their organization, and develop a plan with rationale and recommendations for an improved future target state. The course places a strong emphasis on leadership, professional communication, and the interpretation of research findings within the biotechnology industry to build a foundation for integrating theoretical research approaches with a unique project that has practical application in the field of biotechnology. Quantitative and qualitative research methodology will be introduced, including the application of fundamental statistical methods in design and interpretation of research findings in professional academic, industrial, and regulatory organizations.

Learning Outcomes: 1. Describe the conceptual aspects of research methods. 2. Describe the process of conducting a literature review and develop a plan to conduct a literature review exploring a current research area within a biotechnology organization. 3. Compare and contrast the use of theory in qualitative, quantitative, and mixed methods research and apply the appropriate method to investigating a practical research problem within a biotechnology organization. 4. Identify ethical concerns to anticipate in research. 5. Apply critical thinking skills to write the key elements of a research proposal and integrate knowledge of qualitative, quantitative, and mixed methods approaches into developing a research design for a project within the context of a biotechnology organization. 6. Identify and

employ audience-appropriate communication strategies. 7. Critique own and others' written and oral communications to facilitate continual improvement to prepare and deliver effective presentations. Credits: 3.00

ABE 62600 - Technology Entrepreneurship And Research Translation

Credit Hours: 3.00. (TLI 62600) The course is designed to introduce graduate students and faculty mentors to the intellectual, financial, and management processes associated with translating research into tangible products through university initiated, early-stage commercialization (start-up) activities. Lectures will present case studies of technologies and pathways to commercialization. Guest speakers will illustrate the start-up process through real-world experience, and will also address approaches for managing entrepreneurial activities, intellectual property and conflicts of interest in a university environment. Permission of Instructor required.

Learning Outcomes: 1. Understand the processes through which translation of research from laboratory to products occur. 2. Describe technologies and commercialization strategies for IT, analytical instrumentation, biopharmaceutical, biomedical, biofuels, and other technologies. 3. Achieve literacy in the business and other discourse related to intellectual property and technology commercialization. 4. Be connected to a network of innovators, entrepreneurs, and service providers on and off campus. 5. Execute analysis required to determine if, how, and when to launch new technologies into a translational pathway. Credits: 3.00

ABE 62700 - Colloidal Phenomena In Bioprocessing

Credit Hours: 3.00. The structure, stability, and rheology of biological dispersions, emulsions, and foams are explained in terms of the principles of electrostatics, hydrodynamics, thermodynamics, and statistical mechanics. Additional topics include colloidal phenomena in downstream bioprocessing, as well as colloidal aspects of some food systems. Prerequisite: Thermodynamics and physical chemistry.

Credits: 3.00

ABE 65100 - Environmental Informatics

Credit Hours: 3.00. This course will educate students in the use, manipulation and analysis of environmental data by introducing them to scripting languages (e.g. c-shell, python), data types (e.g. ASCII, binary, NetCDF), databases (e.g. XML, DBF) and data visualization software (e.g. GMT, ArcMap) as well as techniques for checking data quality, working with missing data, and handling large diverse sources of time series and spatial data. Students will manipulate, check and insert data from a variety of sources, use that data as input to distributed hydrologic model, analyze model output and learn methods for properly documenting their data use (creation of metadata) and long-term archival storage of those data. Skills learned should be applicable to most computer operating systems, but the majority of work for this class will be done within the Unix/Linux environment. Students taking this course should have experience with one or more programming languages, including but not limited to C, Fortran, Perl, Python, java, Basic, or two writing scripts or macros within programs such as MATLAB, S-Plus, R, SAS.

Learning Outcomes: 1. Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions. 2. Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems. 3. Demonstrate the ability to write and speak with effectiveness while considering audience and purpose. 4. Demonstrate the ability to work effectively as part of a problem-solving team. 5. Demonstrate skills necessary for lifelong learning. 6. An ability to apply knowledge of mathematics, science, and engineering. 7. Ability to design and conduct experiments, as well as to analyze and interpret data. 8. An ability to function on multidisciplinary teams. 9. An ability to communicate effectively. 10. A recognition of the need for, and an ability to engage in life-long learning. 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Credits: 3.00

ABE 69100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for advanced

specialized topic areas in agricultural and biological engineering for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

ABE 69400 - Graduate Research Training

Credit Hours: 0.00. Strategies for success in graduate study are taught. Students will learn how to write a graduate research proposal, effectively plan for degree milestones, and learn about benefits of participating in professional societies. Students will also complete required training for graduate student researchers, including responsible conduct of research, laboratory safety, and an equal access/equal opportunity briefing.

Learning Outcomes: 1. Know and be able to use key resources for success in graduate study 2. Complete required training for graduate student researchers (e.g., laboratory safety, responsible conduct of research). 3. Identify critical milestones for graduate study, and be aware of resources for understanding and fulfilling requirements (e.g., graduate manual). 4. Develop a personalized plan for success in and beyond their graduate program. Credits: 0.00

ABE 69600 - Graduate Seminar

Credit Hours: 1.00. Best practices for effectively presenting scientific research are taught and practiced. Students will also present a twenty-minute seminar of original research results, as well as provide and receive constructive criticism on presentation form and content for improved future presentations.

Learning Outcomes: 1. Enhance ability of ABE graduate students in presenting graduate research. 2. Improve ability of ABE graduate students to think critically about research and presentation skills of others. 3. Increase student's ability to critique his or her own work. Credits: 1.00

ABE 69700 - Doctoral Professional Development

Credit Hours: 1.00. Discussion of research problems, methods, procedure, and reports. Discussion and practice to improve written and oral communication. Professional development activities.

Learning Outcomes: 1. Improve your ability to write, read and review scientific documents 2. Improve your skills in preparing and presenting scientific presentations 3. Become more familiar with Responsible Conduct of Research 4. Broaden your knowledge by attending and/or planning research seminars and presentations by peers 5. Become familiar with professional development opportunities. Credits: 1.00

ABE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ABE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ASM 51000 - Agrosecurity-Emergency Management For Agricultural Production Operations

Credit Hours: 3.00. Prepares individuals for management and loss control positions in agricultural production, agribusiness operations, and emergency management agencies. Addresses prevention, preparation, mitigation, response, and recovery from disasters such as fires, explosions, entrapments, tornadoes, floods, winter storms, earthquakes, vandalism, chemical releases, and bio-terrorism. Students complete a community service learning activity, in which they assist a farm or agribusiness manager in developing formal emergency preparedness plans.

Credits: 3.00

ASM 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response

infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students various home field of study. Credits: 3.00

ASM 51200 - Managing Resources and Applications for Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

ASM 53000 - Power And Machinery Management

Credit Hours: 3.00. Management and selection of farm machines and power units with emphasis on cost analysis and evaluation of new machines and practices.

Credits: 3.00

ASM 53200 - Introduction To Agricultural Informatics

Credit Hours: 3.00. We will overview current and emerging digital technologies with applications in agriculture, environment, and food systems. Students are expected to have a minimal computing and/or programming background, and those with no programming background should contact the instructor for guidance. Through a modular hands-on course design, students will incrementally learn user-centered technology design skills, computational thinking skills to evaluate, design, conceptualize, and implement informatics solutions to data-driven challenges. Students will gain programming skills in current data science and web development technology stacks (Python, HTML, CSS, SQL, Django), and design an informatics solution to problem in their own area of interest. This course supports professional development for students in pursuit of careers in digital product design or data-driven research.

Learning Outcomes: 1. Demonstrate core skills in user-centered technology design, exploratory data analysis, and programming for the web. 2. Formulate a data science problem and implement a data science solution through collecting, integrating, analyzing, and synthesizing publicly available data. 3. Critique and experiment with informatics approaches to solving data-driven challenges in disciplines related agriculture, environment, and food systems. 4. Design and develop a web application through application of new knowledge on data modeling, user interface design, and programming. 5. Design and conceptualize a novel informatics solution, applying design thinking and computational skills, to solve an open problem related to agriculture, environment, and food systems. Credits: 3.00

ASM 54000 - Geographic Information System Application

Credit Hours: 3.00. Fundamentals of GIS analysis applied to environmental, agricultural, and engineering-related problems. Topics include data sources, spatial analysis; projections; creating data and metadata, and conceptualizing and solving spatial problems using GIS.

Learning Outcomes: 1. Apply fundamental

geographic information system concepts for organizing, symbolizing, and visualizing spatial and temporal data. 2. Demonstrate proficiency with spatial data manipulation methods for creating and editing geodatabases, geocoding, and performing geoprocessing operations on spatial data. 3. Apply spatial analysis tools to process vector and raster data for decision-making. 4. Create models to automate GIS workflow and build custom geoprocessing tools. 5. Construct user-friendly dashboards/web apps/StoryMaps for sharing developed solutions. 6. Research publicly available GIS data and use it for the final project or demonstrate Python programming skills to analyze publicly available data. Credits: 3.00

ASM 55000 - Grain Drying And Storage

Credit Hours: 3.00. Crop drying and storage principles including equilibrium moisture, psychrometrics, and drying rates. Modern drying and conditioning techniques including dryeration, in-bin counterflow drying, and combination drying. Estimating fixed and variable drying costs, aeration of stored grain, and maintenance of grain quality. Offered in even-numbered years.

Credits: 3.00

ASM 59000 - Special Problems

Credit Hours: 1.00 to 6.00. Assignment by consent of the instructor in the field of selected study. Laboratory, field, and library studies and reports on special problems related to agricultural systems management not covered in regular coursework. Permission of instructor required.

Credits: 1.00 to 6.00

ASM 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Primarily designed for specialized topic areas in agricultural systems management for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 4.00

ASM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ASM 69900 - ASM Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of Instructor required.

Learning Outcomes: 1. Demonstrate the ability to identify and conduct original research and scholarship in their area of study within the Agricultural Systems Management program.

Credits: 1.00 to 18.00

Department of Agricultural Economics (Graduate)

Website: **https://ag.purdue.edu/agecon/Pages/default.aspx**

Department/School Head

Nicole Widmar

Faculty by Rank

Professor	Associate Professor	Assistant Professor

Jay Akridge Channing Arndt Joseph V. Balagtas Michael S. Delgado W. Scott Downey Brenna Ellison Ken Foster Allan W. Gray Thomas W. Hertel Russell Hillberry Todd Kuethe Michael Langemeier Maria I. Marshall Kwamena Quagrainie Jacob Ricker-Gilbert Juan Sesmero Gerald E. Shively Farzad Taheripour Nicole Olynk-Widmar Dominique van der Mensbrugghe	Uris Baldos Jonathon Bauchet Roberto Gallardo Bhagyashree Katare Roman M. Keeney Meilin Ma Mindy Mallory Trey Malone Carson Reeling Ariana P Torres Bravo Steven Wu	Maksym Chepeliev Bernhard Dalheimier Chad Fiechter Valerie Kilders Meilin Ma Lourival Monaco Neto Laura Montenovo Guy Tchuente

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Academic Programs

Master's and Ph.D. Programs

The agricultural economics curriculum at Purdue University is in the tradition of the Land Grant College philosophy: knowledge for the improvement of the human condition. Sound judgment, rigorous analysis and ability to define and solve problems are the goals of the professional agricultural economist. Our program endeavors to create a challenging environment of scholarship, creativity, and freedom of intellectual inquiry.

Study towards the master's and Ph.D. degrees requires instruction in economic theory, quantitative methods and analysis, courses in specialized fields of interest, and completion of research project culminating in a written thesis or dissertation. The Ph.D. degree requires successful completion of a written qualifying exam in microeconomic theory and a written preliminary prospectus exam. Information available here: https://ag.purdue.edu/agecon/Pages/Graduate-Program.aspx

Professional Master's and Doctoral Programs

We offer a Professional Masters in International Agribusiness, a non-thesis degree that can be completed in three semesters of residence plus the summer. Information is available at https://ag.purdue.edu/department/agecon/international-programs/pmia/index.html

Concentrations (Areas of Study)

Agribusiness Management and Marketing
Applied Economics Quantitative Methods
International Trade and International Development
Resources, Environment, and Sustainable Production

Online/Distance Programs

Our distance MS/MBA program is jointly administered with the Indiana University Kelly School of Business. It is focused on the unique management challenges faced by managers with food and agribusiness firms. Information is available at https://ag.purdue.edu/department/agecon/graduate_program/mj-ms-ag-law-program.html.
Our distance MJ/MS program is jointly administered with the Indiana University McKinney School of Law. It is focused on management and legal policy challenges faced by managers with food and agribusiness firms. Information is available at https://ag.purdue.edu/agecon/Pages/aglaw.aspx.
We also offer an online version of our Professional Masters in International Agribusiness, a non-thesis degree that can be completed in two years. Information is available at https://ag.purdue.edu/department/agecon/international-programs/pmia/index.html.

Combined Degree Programs (Undergraduate Degree / Master's Degree)

The College of Agriculture offers an integrated degree program that will enable outstanding undergraduates to obtain a Bachelor of Science and Master of Science (thesis option) after the successful completion of both degree requirements. The information here: https://ag.purdue.edu/oap/Pages/integratedbsms.aspx

Graduate Certificates (Degree or Non-Degree Students)

Residents of Indiana may apply for enrollment as post-baccalaureate non-degree students if they wish to take graduate-level course work in agricultural economics, but prefer not to be enrolled in a regular degree program.

Agricultural Economics, PHD

Agricultural Economics, MS

AGEC 51600 - Mathematical Tools For Agricultural And Applied Economics

Credit Hours: 3.00. This course provides first year graduate students and advanced undergraduate students with the specific set of applied mathematical tools needed to support graduate coursework in microeconomics, macroeconomics, economic programming, and econometrics. The course reviews skills and concepts from a number of fields of mathematics including matrix algebra, calculus, optimization theory, and mathematical statistics. The course emphasizes specific applications to economic theory and applied problems in agricultural economics and related areas. Students should be comfortable with introductory-level calculus before entering the course. Permission of instructor required.

Learning Outcomes: 1. Knowledge and Scholarship: The ability to identify and conduct original research, scholarship or creative endeavors. 2. Communication: The ability to effectively communicate their field of study. 3. Critical Thinking and Problem Solving: Think critically, creatively and solve problems in their field of study. 4. Ethical Conduct: Conduct research in an ethical and responsible manner. 5. Professional Development: demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 52400 - Agricultural Finance

Credit Hours: 3.00. Designed to provide students the concepts and tools to apply financial management principles to farm businesses. Topics include financing alternatives, preparation and interpretation of financial statements, and capital investment analysis using discounted cash flows.

Learning Outcomes: 1. Prepare, interpret, and analyze financial statements used for agricultural businesses. 2. Analyze and suggest methods to improve the financial performance of agricultural businesses. 3. Evaluate capital investments using discounted cash flow methods. 4. Describe and analyze the risk and returns faced by agricultural businesses. Credits: 3.00

AGEC 52500 - Environmental Policy Analysis

Credit Hours: 3.00. Designed to assist in understanding how environmental information and knowledge are produced, disseminated, and utilized in a variety of institutional contexts. Readings are selected to promote discussion and interaction concerning alternative mechanisms for protecting environmental resources. Prerequisite: introductory microeconomics course suggested.

Credits: 3.00

AGEC 52600 - International Food And Agribusiness Marketing Strategy

Credit Hours: 3.00. Students will develop their analytical, decision-making, and communication skills related to marketing management of food systems in the world economy. They will analyze a foreign market's potential and market entry strategies; compare consumer differences and similarities across markets; define issues related to marketing mix standardization or adaptation; and evaluate effects of economic, social, and legal environments on marketing strategy.

Credits: 3.00

AGEC 52800 - Global Change And The Challenge Of Sustainably Feeding A Growing Planet

Credit Hours: 3.00. This course investigates the major drivers of global agricultural and environmental change associated with the global farm and food system. This includes demography, income growth, biofuels, climate change, environmental and ecosystem services, livestock consumption, food waste and land use change. Weekly modules include a guest lecture, student led discussion of readings and discussion of lab assignments undertaken using the SIMPLE model of global agriculture, environment and food security. The class culminates with a course project which is presented to the class and written up in a term paper.

Learning Outcomes: 1. Gain exposure to different disciplines and their approaches to analyzing global change. 2. Master the basic economic concepts of demand and supply in the context of the global food economy. 3. Become proficient in undertaking economic analysis using the SIMPLE model. 4. Gain a knowledge of the role which economic analysis plays in analyzing long run sustainability of the global food system. Credits: 3.00

AGEC 53000 - Strategic Agribusiness Management

Credit Hours: 3.00. Addresses issues in the strategic management of agricultural and food businesses. Emphasis is on developing a framework for formulating strategy, making strategic choices in a variety of business environments, and implementing strategy. Extensive use of management case studies and a major term project with an agribusiness firm focus on developing managerial problem-solving skills.

Credits: 3.00

AGEC 53200 - World Food Problems

Credit Hours: 3.00. This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Learning Outcomes: 1. Understand global food production and consumption, food trade and its history including: the major plants produced and consumed; where they are grown; patterns and extent of global food trade; major food animals and animal production systems; countries involved in food trade; urbanization and food transportation; and effects of post-harvest processing on food trade and availability. 2. Understand basics of world population growth and its relationship to past and future food production and consumption globally. 3. Understand what malnutrition looks like, where it occurs, how it is measured, and the interactions between malnutrition (both under nutrition and obesity) and human health. 4. Understand the basic economic principles that affect consumer food costs and consumption patterns globally. 5. Understand how culture, communication and politics influence food availability, world food problems and malnutrition. 6. Predict, based on available information, likely scenarios for the future of world food problems and malnutrition. Credits:

3.00

AGEC 55200 - Introduction To Mathematical Programming

Credit Hours: 3.00. Introduction to constrained and optimization problems and their solution using mathematical programming techniques. Theory and implementation of linear, quadratic, and integer programming methods are examined. Applications to farm management, diet and feed rations, spatial market equilibrium, agricultural sector analysis, and other problems from agricultural economics. Use of computer software packages for practical problems.

Credits: 3.00

AGEC 57100 - Global Issues In International Agribusiness

Credit Hours: 1.00. This is the first course in a required three-course sequence designed for students in the "Professional Masters in International Agribusiness" concentration in the Department of Agricultural Economics. The course objective is to expose students to a wide range of global issues directly and indirectly related to the production, processing, and marketing of agricultural products (food, fuel, fiber). Topics vary and may include food security, malnutrition, food safety, biofuels, the environment, trade and agricultural policy, emerging agricultural technologies, and climate change. Prerequisites: Enrollment in Professional Masters in International Agribusiness or permission of instructor required.

Learning Outcomes: 1. Understand key global issues affecting the business environment for international agribusiness. 2. Understand the structure and function of international agribusiness firms. 3. Reinforce foundational learning of topics through study and written assignments. 4. Facilitate their training as professionals. Credits: 1.00

AGEC 57200 - International Agribusiness Market Opportunities

Credit Hours: 2.00. This is the second course in a required three-course sequence designed for students in the "Professional Masters in International Agribusiness" concentration in the Department of Agricultural Economics. The course objective is to assist students in identifying and exploring market opportunities in international agribusiness, including those related to the production, processing, and marketing of agricultural products including food, fuel, and fiber. The course combines lectures with discussion and project-based learning and group activities.

Learning Outcomes: 1. Understand key business opportunities for international agribusiness. 2. Reinforce foundational learning of topics through case studies, written assignments and oral presentations and discussion. 3. Facilitate their training as professionals. Credits: 2.00

AGEC 57300 - International Business Analysis

Credit Hours: 3.00. This is the third course in a required three-course sequence designed for students in the Professional Masters in International Agribusiness concentration in the Department of Agricultural Economics. The course objective is to assist students in conducting a professional business analysis focusing on either a market opportunity, financial management, or other management issue in international agribusiness. The course is project-based and includes group activities and written and oral presentations.

Learning Outcomes: 1. Develop hands on experience to facilitate their training as professionals. 2. Develop report writing and oral presentation skills. Credits: 3.00

AGEC 59500 - Internship

Credit Hours: 0.00 to 3.00. This course allows students to work in firms, government agencies or non-profit organizations undertaking projects with the supervision of faculty mentors and onsite supervisors. Permission of department required.

Credits: 0.00 to 3.00

AGEC 59600 - Seminars In Current Issues In Agricultural Economics

Credit Hours: 1.00 to 3.00. Study of selected current developments in agricultural economics. Topics will be announced in advance. Permission of instructor required.

Credits: 1.00 to 3.00

AGEC 60000 - Agricultural Finance

Credit Hours: 3.00. Advanced capital budgeting topics including: tax policy, inflation, optimal replacement, bid models, and inclusion of financing flows; application of expected utility theory and mathematical programming to optimal capital structure decisions of proprietors; farmland investment, pricing, and dynamics; pricing contingent claims. Prerequisite: AGEC 52400; AGEC 55200 suggested.

Credits: 3.00

AGEC 60200 - Preparation And Procedures For Policy Analysis

Credit Hours: 3.00. Research methods, scientific methodology, problem identification, and the nature of policy problems including economic policy readings, case studies, and practice project proposals.

Credits: 3.00

AGEC 60500 - Agricultural Markets And Price Analysis

Credit Hours: 3.00. Agricultural markets are multi-faceted, having been studied using a wide range of analytical tools. This graduate-level course emphasizes charactering demand and supply of agricultural markets and understanding forces that determine commodity and food prices. It also aims to cover a set of economic studies of prices and assist students in applying theoretical frameworks and time-series econometrics to empirical analysis of agricultural prices. In addition to studying prices in perfectly competitive markets, the first half of the course highlights several classic models of consumer demand and agricultural supply, prices under imperfect competition, price spreads (marketing margins), and the economics of information. The second half of the course focuses on empirical price analysis. Popular time-series econometric tools are introduced to study price relationships over space and time, price discovery mechanisms, and functions of futures markets.

Learning Outcomes: 1. Work with classic demand and supply models in the context of agricultural markets. 2. Derive classic models of price setting and marketing margins. 3. Understand econometrics of time-series models. 4. Apply time-series models to agricultural price data. Credits: 3.00

AGEC 60900 - Applied Welfare Analysis

Credit Hours: 3.00. This course develops the theory and methods used to assess the benefits and costs of economic policies and projects. Topics include benefit-cost analysis, economic impact analysis, nonmarket valuation, and analysis of risk and uncertainty. Prerequisites: A graduate course in microeconomic theory; a graduate course in regression analysis.

Learning Outcomes: 1. Estimate a project's benefit's and costs, including shadow pricing project inputs and outputs and valuing non-market goods and services. 2. Appropriate apportion various benefits and cost across different project stakeholders to estimate the distribution of project benefits and costs across society. 3. Derive and interpret economic measures of project performance, including net present value, internal rate of return, and benefit-cost ratios. 4. Incorporate risk and uncertainty into project analysis. Credits: 3.00

AGEC 61300 - Introduction To Economics Of Risk

Credit Hours: 3.00. A background in expected utility theory and applications. EUH axioms, risk aversion, utility elicitation, expected utility and moments, stochastic dominance, mean-variance, risk free asset, diversification, single index model, increasing risk, production under risk, programming models and applications. Prerequisite: AGEC 55200, ECON 51100, STAT 51100.

Credits: 3.00

AGEC 61400 - Advanced Agricultural Production Economics

Credit Hours: 3.00. Course covers advanced techniques for economic analysis of agricultural production economics. Students are required to produce a course project demonstrating competency at the applied research frontier of the field and participate in presentation, discussion, and peer review of course members' work. Prerequisites: AGEC 61200 and ECON 60700 or Consent of Instructor.

Learning Outcomes: 1. Demonstrate knowledge. 2. Demonstrate applied research methods. 3. Demonstrate critical thinking. 4. Demonstrate communication. Credits: 3.00

AGEC 61600 - Resource Economics And Policy

Credit Hours: 3.00. Natural resource development and allocation in both static and dynamic contexts. Analysis of scarcity and growth issues, equity considerations, derivation of optimal pricing and depletion rules. Application of advanced production concepts to national resource problems. Prerequisite: AGEC 60400, ECON 51100.

Credits: 3.00

AGEC 61800 - Applied General Equilibrium Analysis

Credit Hours: 3.00. Theory and empirical techniques behind numerical general equilibrium analysis. The course is divided into two parts: 1) development of the basic analytical framework

and model properties, and 2) in-depth study of selected applications in international trade, price analysis, and resource and environmental economics. Homework assignments involve a mix of qualitative analysis and microcomputer-based computational exercises. Prerequisite: AGEC 60400; Prerequisite: ECON 51100 or ECON 60700.

Credits: 3.00

AGEC 61900 - Applied Microeconomic Theory

Credit Hours: 3.00. Provides students with the capability to apply microeconomic theory and econometrics to analyses of economic issues and problems. Students will work through applied producer/consumer problems to gain experience in the uses of econometric estimation. Topics include: primal-dual approaches, direct and indirect functions, flexible functional forms, static optimization, separability and aggregation, risk and expectations, dynamics and demographics. Examples are drawn from both consumer and producer applications. Prerequisite: AGEC 65100, ECON 60700.

Credits: 3.00

AGEC 62200 - Food System Organization And Policy

Credit Hours: 3.00. Development of framework to study food system organization and policy; survey of measurement and empirical testing problems in industrial-organization research on food-system market structure and performance; review of competition policies and evaluation of policy alternatives. Prerequisite: Graduate courses in microeconomic theory and marketing.

Credits: 3.00

AGEC 62500 - Macroeconomic Issues In Agriculture

Credit Hours: 3.00. Studies the nature and importance of linkages between agriculture and the macro economy, and examines theories and methods used to establish or quantify these linkages in agricultural models. Extensions of macroeconomic accounting and theory into an open economy are explored by examining attempts by agricultural economists to estimate macroeconomic linkages and build them into commodity models, and considering consequences of implicit and explicit macroeconomic assumptions in much of our work. The changing role of agriculture in an economy under structural transformation will be key to understanding these linkages and how they evolve, as shown in several new developments seeking to explain both recent events and policy history in macro-theoretical frameworks consistent with observed empirical regularities.

Credits: 3.00

AGEC 63000 - Urban And Regional Economics

Credit Hours: 3.00. The literature discussed in this urban and regional economics course covers theoretical texts, conceptual as well as statistical, and empirical applications in order to introduce the student to the economist's view on spatial variation in economic outcomes. This ranges from coverage of the theory of industrial location choice, through theoretical and empirical analysis of the spatial distribution of economic activities (agglomeration theory, industrial clusters, central place theory), to theoretical and empirical explanations for the spatial structure of cities, the working of regional labor markets and migration. The course covers various empirical tools utilized in spatial data analysis (spatial econometrics) and modeling of regional economies and their interrelations (interregional input-output analysis). Prerequisites: AGEC 20300 or ECON 34000 or ECON 51100.

Credits: 3.00

AGEC 63100 - The Theory And Practice Of Spatial Econometrics

Credit Hours: 3.00. This course deals with the analysis of spatial data and centers on both exploratory tools developed in spatial statistics and GIScience, as well as on econometric models that have been the main focus in spatial econometrics. During the course, the theoretical basis for the analysis of spatial data and spatial models will be covered. This theoretical angle will be combined with ample opportunities to acquire hands-on experience in the analysis of spatial data. To the effect, up-to-date software, such as GeoDa, R, Stata, and MATLAB will be used. A good working knowledge of basic statistics and regression techniques is needed. Prior experience with GIS is helpful but not required. Prerequisites: AGEC 45100 or AGEC 65000 or ECON 67100 or STAT 41700 or STAT 51200 or STAT 51700.

Credits: 3.00

AGEC 63300 - Advanced Topics In Space, Health, And Population Economics

Credit Hours: 1.00. This course is designed to introduce students to advanced research in space, health, and population economics. It is designed to introduce both topical content and state-of-the-art research tools to students through a combination of guest speakers, faculty presentations, and discussions. The seminar also serves as a forum for students to present their own work and receive critical commentary from faculty and peers. The course is organized as a graduate seminar and gives students a chance to actively explore their own research ideas.

Credits: 1.00

AGEC 64000 - Agricultural Policy

Credit Hours: 3.00. Policy analysis for agriculture in the world economy. Emphasis on application of economic theory to analyze commodity programs, international trade, environmental concerns, and investment in human capital and agricultural research. Prerequisite: AGEC 41000, AGEC 60400.

Credits: 3.00

AGEC 64300 - Theory Of Economic Development

Credit Hours: 3.00. The economic theories behind the predominant approaches to economic development are reviewed. Both the sources of growth and problems in the development process are stressed. Emphasis is on the analysis and evolution of the models supporting the different approaches and the empirical analysis leading to changes in the paradigms. The role of agriculture in the economic development process is one of the topics. Other important issues are technological change, income distribution, structural adjustment, and the debt problem. Prerequisite: ECON 51100 , ECON 51200 .

Credits: 3.00

AGEC 64400 - International Agricultural Trade

Credit Hours: 3.00. International trade theory relevant to understanding world agricultural trade and the problems of agriculture in an open economy. Models for analyzing the effects of trade policy and market conditions on the agricultural sector. Welfare analysis of restrictions on trade. Prerequisite: ECON 51100 , ECON 51200

Credits: 3.00

AGEC 65000 - Application Of Quantitative Analysis: Econometrics I

Credit Hours: 3.00. Brief presentation of probability concepts, mathematical expectation, probability density and distribution functions as background for studying principles of economic model construction. Emphasis is on econometric single equation models, principles of estimation, the general linear model, tests of hypothesis, confidence interval estimation, and special topics such as errors in the variables, multicollinearity, dummy variables, hetero-scedasticity, autocorrelation and prediction problems. Prerequisite: STAT 51100 ; ECON 51100 or ECON 60700 , matrix algebra.

Credits: 3.00

AGEC 65100 - Application Of Quantitative Analysis: Econometrics II

Credit Hours: 3.00. Emphasis is on using advanced econometric techniques. The course covers use of computer software and interpretation and reporting of econometric results. The first part of the course includes general econometric concepts, such as least squares and maximum likelihood estimation, desirable statistical properties, assumptions of the classical linear regression model, Monte Carlo methods, nested and non-nested hypothesis tests. Later, more specialized topics are covered, including multiple equation models, simultaneous equation models, limited dependent variable models, and other topics that are deemed relevant. Prerequisite: AGEC 65000.

Credits: 3.00

AGEC 65200 - Application Of Quantitative Analysis: Mathematical Programming

Credit Hours: 3.00. Recent literature on the theory and application of mathematical programming and agricultural modeling. Model building and analysis techniques with focus on matching solution methods to problems. Prerequisite: AGEC 55200, ECON 61200; a course in matrix algebra.

Credits: 3.00

AGEC 65400 - Economic Dynamics

Credit Hours: 2.00. Focuses on the application of the tools of dynamic optimization to problems in economics. Covers continuous-time and discrete-time dynamic optimization techniques, including the calculus of variations, optimal control theory, and dynamic programming. Applications are drawn from a range of problems in microeconomics and macroeconomics, including current topics in agricultural economics, natural resource economics, and investment theory. Course meets weeks 1 - 10. Prerequisite: AGEC 65200, ECON 60700.

Credits: 2.00

AGEC 65500 - Applied Economic Time Series Analysis

Credit Hours: 3.00. This course is designed to improve students' abilities to estimate and interpret time series models. The course begins with univariate models and progresses to multivariate analysis. Alternative methods for identifying, estimating, and forecasting with time series models will be discussed. In addition, analysis of non-stationary time series and co-integration modeling will be covered in this course. Prerequisite: AGEC 65100 or consent of instructor. Mastery of applied statistics, calculus, and microeconomic theory at the Masters level or higher is desirable.

Learning Outcomes: 1. Translate data and statistical results. 2. Apply knowledge and ethical research to data and data analysis literacy. 3. Integrating economic theory with applied analysis techniques. Credits: 3.00

AGEC 68100 - Economics For Food And Agribusiness Managers

Credit Hours: 3.00. Addresses the institutional setting, business climate, and structure of the food and agricultural markets. Encompasses both the domestic and international dimensions of the food chain, including consumer demand, global sourcing, and worldwide production potential. Focuses on managerial economics, as applied to such topics as food system market structure, the nature and dimensions of domestic and global competition, the components of cost and revenue, and the food system value chain. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68200 - The Macroeconomics And Trade Environment Of The Food System

Credit Hours: 3.00. Exposes students to the nature of linkages among agriculture, international markets, and the macro-economy, which are key to the fortunes of U.S. farmers and agribusiness. Exam theories and methods that allow students to establish or quantify these linkages and evaluate the consequences of alternative policies, demonstrating the usefulness of economic analysis as a tool. Also explores current policy issues facing the food and agribusiness industries, which might include farm legislation; environmental regulations; and food safety and nutrition labeling rules, among other policy topics. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68400 - Applied Quantitative Methods For Decision Making

Credit Hours: 3.00. Explores the application of contemporary concepts and quantitative techniques for decision making in the face of uncertainty. Focus is on application of statistical tools to decisions facing the food and agricultural business manager. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68500 - Advanced Quantitative Methods For Decision Making Under Uncertainty

Credit Hours: 3.00. Explores key areas of risk management of the food and agricultural firm, including price, production, strategic, regulatory, technology, market/competitor, political, financial, and exchange rate risk. Contemporary tools, such as score carding, decision trees, and real options are introduced for quantifying and managing uncertain decisions. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68600 - Strategic Food And Agribusiness Management

Credit Hours: 3.00. This course explores integration of the functional areas of business at the corporate level. Heavy emphasis is on analysis of the business environment, setting strategic direction, assessing core competencies, choosing a market position and developing competitive advantage, and organizational implementation and control in the context of the food and agricultural markets. The course makes heavy use of

case studies of firms in the food and agricultural marketplace. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68700 - Problem Solving And Project Management For Decision Makers

Credit Hours: 3.00. Develops a structured approach to problem solving, including problem definition, development of alternatives, identifying consequences, assessing trade-offs, and making informed choices. Research methods and project management concepts will be addressed. A major business analysis project will be framed during the course, to be completed as part of the capstone course in business analysis. Permission of department required.

Learning Outcomes: 1. Identify and conduct original research, scholarship and creative endeavors. 2. Effectively communicate their field of study. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

AGEC 68800 - Business Analysis Capstone Course

Credit Hours: 3.00. Capstone experience where students will work on individual projects focused on a comprehensive detailed analysis of an issue facing their employer or an issue of general interest to the student. It is expected that this project will draw on tools and concepts developed throughout the MS program and be delivered to an appropriate audience of decision-makers upon completion. Permission of department required.

Credits: 3.00

AGEC 69000 - Seminars In Agricultural Economics

Credit Hours: 0.00 to 18.00. Intensive study of selected current developments in agricultural economics. Topics will be announced in advance. Permission of instructor required.

Credits: 0.00 to 18.00

AGEC 69100 - Topical Research In Agricultural Economics

Credit Hours: 1.00 to 6.00. Topics of interest to the student. Designed to give training in research. Credit dependent upon amount of work done. Permission of instructor required.

Credits: 1.00 to 6.00

AGEC 69200 - Workshop In Applied Economics

Credit Hours: 1.00. A workshop on how to communicate research results in a seminar setting. Students present at least once during the course and will be present for other students' presentations. Students may present their own research, or a paper from a recent journal also is acceptable. The course is open to master's students, and one credit of this course is required of doctoral students.

Credits: 1.00

AGEC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

AGEC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Agricultural Sciences Education and Communication (Graduate)

Website: **https://ag.purdue.edu/asec/Pages/default.aspx**

Department/School Head

Rama Radhakrishna

Faculty by Rank

Professor	Associate Professors	Associate Clinical Professors	Assistant Professors	Assistant Clinical Professors	Emeritus Professors
Colleen Brady Natalie J. Carroll Neil Knobloch Pamala Morris B. Allen Talbert Roger L. Tormoehlen Mark A. Tucker	Sarah LaRose Linda Pfeiffer Hui-Hui Wang	Casey Mull	Julia Bello-Bravo	Yaguang Zhang	Mark Russell

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Academic Programs

Master's and Ph.D. Programs

Do you want a career that has an impact on developing people and agriculture? In ASEC, you will combine a people-oriented degree with work in selected technical and scientific areas. Prepare to become a leader in the world's food, fiber, and natural resources system by empowering the leadership capacity and capability of individuals and groups, educating youth and adults through agricultural and life sciences, and enhancing the quality of life for all citizens.

The department offers both masters and doctoral degree options.

Agricultural Sciences Education and Communication, PHD

Agricultural Sciences Education and Communication, MS

Agricultural Sciences Education, Extension, and Communication, Post-Baccalaureate Certificate

ASEC 52000 - Foundations Of Agricultural Education, Extension, And Communication

Credit Hours: 3.00. Critical analysis of the historical and philosophical assumptions, current strategic intents and relevant policies underpinning the discipline of agricultural education - inclusive of Extension education and agricultural communication - and project the impact existing economic, social and political issues may have in this field in the next 15 to 25 years. Instructor permission required.

Learning Outcomes: 1. Explain how social and economic conditions in the 19th century helped shape AEEC. 2. Identify and discuss how key events, leaders, driving forces, and policies (i.e., legislation) that shaped AEEC. 3. Compare and contrast similarities and differences among school-based agricultural education, non-formal (Extension) education, and agricultural communication regarding their purpose, development as a field, structure and stakeholders. 4. Discuss the philosophies of pragmatism, behaviorism, and constructivism,

and how these philosophical assumptions influenced the policies and practices of AEEC. 5. Identify leaders and what role they played in helping shape AEEC. 6. Discuss how principles of community-based education support the development of human, cultural and social capital in AEEC. 7. Examine current trends regarding existing organizational structures, enrollment, funding, and collaborative partners of AEEC, and project how current social and economic conditions in the 21st century may impact AEEC. 8. Discuss contemporary leadership and program models for the next 25 years, and analyze visions in AEEC are positioned to address grand challenges visions in AEEC. Credits: 3.00

ASEC 53100 - Global Learning For Agriculture, Food And Natural Resources

Credit Hours: 3.00. This is a graduate-level course in which students research, design, and evaluate communication and education methods and theoretical frameworks to apply appropriate cultural, community engagement, targeted outcomes of a population defined by the student. The central experience is an international/intercultural professional development experience immersed in rural and urban communities and cultures. Students will learn and develop global perspectives and effective engagement strategies to address agronomic, cultural, and community engagement realities affecting agriculture, life sciences and natural resources.

Learning Outcomes: 1. Have the skills to distinguish between educational designs needed for different goals and outcomes of global/intercultural learning programs. 2. Understand and apply one's own culture to interact among people with differing cultures, beliefs and values while designing engagement programs. 3. Design an educational intervention/module which is culturally appropriate and meets the needs of the community/learners. 4. Construct meaning from instructional messages, including oral, written and graphic communication applying the intersectionality of Social Identity, Intercultural Sensitivity, and Critical Race theories to engagement situations. 5. Evaluate one's self-awareness and recognition of others such that they can emotionally adapt their thinking and being in global/intercultural engagement efforts. 6. Identify best practices for educational global immersion experience related to food, fiber, and natural resources. Credits: 3.00

ASEC 54000 - Program Development In Agricultural And Extension Education

Credit Hours: 3.00. Application of principles of agricultural and extension education. Emphasis on program development, supervised experience programs, and effective organization of an agricultural and extension education program.

Learning Outcomes: 1. Develop a proposal for a comprehensive agriculture and Extension program plan. 2. Identify appropriate strategies to assess needs and assets, and teaching and delivery methods. 3. Identify the components of the Logic Model and how it is used for efficient program planning. 4. Develop a budget and evaluation plan for their agriculture and Extension program. Credits: 3.00

ASEC 54100 - Program Development In School-Based Agricultural Education

Credit Hours: 3.00. This graduate course in agricultural education concentrates on program planning and delivery of secondary programs in agriculture. Special emphasis is placed on utilizing school and community resources to develop programmatic offerings, recruit and retain students, organize FFA activities, direct supervised agricultural experience programs, and manage the agricultural education program. Various topics to be discussed will be determined based upon current trends in the field of agricultural education as well as the needs and interests of the students enrolled. Foundational procedures involved in conducting a secondary agricultural education program will be addressed. Permission of instructor required.

Learning Outcomes: 1. Facilitate learning through a well-planned school-based agricultural education program utilizing classroom and laboratory instruction, Supervised Agricultural Experience, and FFA. 2.

Describe the qualities of a successful school-based agricultural education program. 3. Identify areas for growth and support within local school-based agricultural education program. 4. Demonstrate comprehension of the foundational philosophies of agricultural education and career and technical education which guide successful implementation of modern school-based agricultural education. Credits: 3.00

ASEC 54500 - Teaching STEM Through Agriculture, Food And Natural Resources

Credit Hours: 3.00. The course focuses on the background and history of STEM movement and agricultural education, contemporary models, strategies, and justification for incorporation of science, technology, engineering and mathematics (STEM) concepts and practices into K-12 formal and non-formal agricultural education programs. Consider and develop the best practices for STEM teaching and learning and enhancement of STEM content in agriculture, food and natural resources (AFNR) context. The goal of the course is to help students develop knowledge about STEM integration and equip them with teaching knowledge and skills for designing K-12 lesson plans by using integrated STEM through AFNR. Students will learn strategies that promote engagement in integrated STEM through AFNR activities. At the end of the course, students should be able to design and implement research-based integrated STEM through AFNR lesson plans and assessment plans.

Learning Outcomes: 1. Analyze integrated models of STEM learning, and justify how a selected model informs best practices for science and agriculture, food, and/or natural resources teaching and learning. 2. Evaluate current national and state standards that help design lesson plans in non formal, and formal educational contexts. 3. Develop lesson plans by using agriculture, food, and/or natural resources as context to teach STEM content and concepts. 4. Describe life and 21st century skills that are relevant in agriculture, food, and/or natural resources contexts and demonstrate how these skills can be integrated into lesson plans. 5. Create an assessment plan to evaluate learning outcomes. 6. Apply learner-centered teaching strategies, such as inquiry-based learning, to teach the lesson plans. 7. Create a manuscript that can be used to disseminate the integrated STEM lesson to professional audiences. Credits: 3.00

ASEC 54600 - Communication And Issues Engagement For Agricultural Professionals

Credit Hours: 3.00. In this eight-week online course, students will be exposed to science communication and issues engagement principles. The course is designed primarily for those with little or no formal communication training. Topics include evidence-based best practices for communicating science; news media and social media influences on controversial science; how to monitor controversial issues; and major theoretical perspectives and strategies for engaging the public on food and agricultural science.

Learning Outcomes: 1. Integrate best communication practices from the literature for engaging audiences about agriculture and science. 2. Analyze audiences and design appropriate messaging based on audience characteristics and needs. 3. Develop and adapt communication strategies for science-based controversial issues. 4. Formulate evidence-based strategies to anticipate controversial issues in agriculture and science. Credits: 3.00

ASEC 54800 - Communicating Science To The Public

Credit Hours: 1.00. This course will help graduate students in science disciplines learn to communicate science to non-expert audiences. Through readings, assignments and guided discussions, students will learn relevant communication theories and recommended strategies for engaging with the public on science and technology topics.

Learning Outcomes: 1. Apply findings from the literature to anticipate how values and culture influence public perceptions of science. 2. Integrate key communication concepts and theories in the development of effective communication strategies for science and technology. 3. Analyze audiences and design messaging for specific audience segments.

Credits: 1.00

ASEC 55000 - Program Evaluation In Formal And Non-formal Settings

Credit Hours: 3.00. The purpose of this course it to provide a basic understanding of program evaluation processes, concepts, and theories and to develop expertise needed to design and conduct systematic evaluation of formal and non-formal programs.

Learning Outcomes: 1. Acquire basic knowledge and skills in program evaluation. 2. Understand key components of various evaluation models/frameworks and identify their strengths and weaknesses. 3. Apply evaluation knowledge and skills to plan, implement, and evaluate a program. 4. Develop knowledge and skills, (including writing skills) to critically evaluate a published evaluation study. 5. Understand the various phases of evaluation from beginning to end, including evaluation utilization of evaluation results. 6. Develop expertise in presenting evaluation results and outcomes to key stakeholders. Credits: 3.00

ASEC 55100 - International Engagement And Development Strategies

Credit Hours: 3.00. Sem. S and SS, cr. 3; an overview of cross-disciplinary, cultural, theoretical frameworks, communication tools, and assessment methods applied to international agricultural development and engagement. Lectures, panel discussions, and case studies on appropriate methods of development and engagement, international project planning, intercultural effectiveness, principles of sustainable agricultural, food, community development, and program/project monitoring and evaluation will be the basis of assignments and team work. This eight-week course will provide the theoretical and social frameworks and principles needed to successfully work in multi-agency partnerships on international development projects.

Learning Outcomes: 1. Select the most culturally-appropriate application of disciplinary knowledge and technologies for agriculture, food, natural resources and related sciences in development programs. 2. Deconstruct self biases and intercultural effectiveness and their critical and creative thinking skills for different contexts in appropriate applications of scientific research as creative interventions and evaluation. 3. Differentiate high and low oral and written communication skills, tolerance of cultural ambiguity, and adaptability. 4. Judge the efficacy of applying appropriate theoretical frameworks for engaging stakeholders in projects to create sustainable impact. 5. Determine the relevance of the result of applying principals and applications of ethical decision making and professional development. 6. Reflect on one's progress and abilities to work in multi-disciplinary teams to carryout developing country assessments and conceptualize a viable project proposal under a tight deadline. Credits: 3.00

ASEC 56500 - Principles Of Adult Education

Credit Hours: 3.00. (EDCI 56500) Principles of adult education applied to helping adults learn, evaluating their performance, and determining their needs. Examines history, philosophy, and research of adult education. Explores techniques required in design and delivery of instruction for adults.

Learning Outcomes: 1. Examine principles and techniques for educating adults including the history, philosophy, and research field. 2. Develop an individual philosophy of continuing and adult education for a wide variety of situations. 3. Apply principles, techniques, philosophy and research in development and design of adult education programs. Credits: 3.00

ASEC 58200 - Introduction To The Application Of Inferential Statistics

Credit Hours: 3.00. The goal of this course is to introduce students to the use and application of statistics with a particular focus on descriptive and inferential analysis procedures. This course will also introduce students to the use of statistical software, namely the Statistical Package for the Social Science (SPSS). Permission of instructor required.

Learning Outcomes: 1. Formulate decisions regarding selecting appropriate statistical techniques to use in analyzing data. 2. Apply data analysis techniques using SPSS and

interpret relevant output and information. 3. Synthesize data from SPSS output. 4. Produce data analysis results in appropriate table and narrative form for inclusion in a dissertation, thesis, or journal article. 5. Investigate, analyze and critique the data analysis sections of peer-reviewed journal articles and determine if the analysis is appropriate for the study. 6. Apply appropriate methods and procedures in the development of survey instruments. Credits: 3.00

ASEC 58500 - Science Communication

Credit Hours: 3.00. This course utilizes foundational research and commentary from scholars to track the evolution of media and our ability as scientists to understand and effectively communicate these issues to a non-science audience. Science and technology are evolving faster than societies ability to understand, assimilate, and make policies to address these increasingly complex issues. As a result, controversies arise over issues such as climate change, forest management, genetically modified foods, energy choices, genetic engineering, nanotechnology, water management, and agricultural practices, etc. This course covers the range of issues in the field of science communication including: the nature of science, how to translate evidence for a lay audience, media practices, reporting and qualifying uncertainty, human psychology and belief systems, information processing, and the most current research for messaging science. We will work together to examine the foundational scholarly literature in this area and how it is/ or is not reflected in construction of popular media. You will use this knowledge to construct both compelling oral science narratives, and a science story for popular consumption.

Learning Outcomes: 1. Gain a foundational understanding of science communication theory. 2. Develop a working understanding of the psychology of the communication audience. 3. Utilize theory to analyze and deconstruct popular press stories. 4. Design strategies for diffusing controversial issues. 5. Evaluate the efficacy of communication strategies in current use, and in peer communication products. 6. Apply science communication theory in the design of both oral and written popular press stories. Credits: 3.00

ASEC 59000 - Special Problems

Credit Hours: 1.00 to 6.00. A study of special problems in agricultural communications, agricultural education, or youth development not covered in regular coursework. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 6.00

ASEC 59100 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. Topics, requirements, and credits to be determined yearly. To be arranged with the instructor or departmental representative prior to registering. Permission of instructor required.

Credits: 1.00 to 4.00

ASEC 59500 - Internship In Agricultural Sciences Education And Communication

Credit Hours: 1.00 to 10.00. A special course designed to provide practical field experience under professional supervision in selected situation related to the student's area of specialization. Amount of credit to be determined by the nature and extent of the assignment. To be arranged with the instructor of departmental representative prior to registering. Permission of instructor required.

Learning Outcomes: 1. Explore components of Purdue Extension or other agricultural entities. 2. Participate in activities, projects, and programs of Purdue Extension or other agricultural entities. 3. Reflect on organizational philosophy, structure, and outcomes. Credits: 1.00 to 10.00

ASEC 62000 - Adolescent And Youth Development In Context

Credit Hours: 3.00. This graduate-level course examines the major developmental issues of adolescents and youth with attention to their familial, cultural, and socio-economic backgrounds. Topics include health and well-being; biological, socio-emotional, and cognitive development; sexual and racial/ethnic identity; risks and resilience; peer and family relationships; civic engagement and activism; positive youth development; and the transition to adulthood. Course readings focus primarily on adolescents and youth in the United States, although international contexts are also incorporated across the class.

Learning Outcomes: 1. Evaluate empirical

studies assessing the major developmental themes of adolescence and the transition to adulthood. 2. Apply and understand major theoretical perspectives relevant to adolescent and youth development. 3. Demonstrate understanding of the contexts that impact development during adolescence and the transition to adulthood. 4. Demonstrate accurate knowledge of physical, cognitive, social, and psychological development of adolescents and youths. 5. Understand how adolescent and youth development is impacted by diverse backgrounds and experiences. Credits: 3.00

ASEC 63000 - Theories Of Learning And Development

Credit Hours: 3.00. The goal of this course is to introduce students to a variety of theoretical perspectives of learning and development and how they may be used in both formal, informal and non-formal educational settings. This goal will be achieved through students' analysis of key concepts, assumptions, propositions and principles of four theoretical areas: (1) Foundational Learning Theory, (2) Student Development Theory, (3) Career & Workforce Development Theory and (4) Youth Development & Experiential Learning Theory. This course will also build on students' prior exposure to behaviorist, cognitive, and constructivist approaches of learning and development. In sum, many of the theories discussed in this course will provide students with a greater understanding of human thought and behavior that will help them become more effective educators, researchers and practitioners. Permission of instructor required.

Learning Outcomes: 1. Demonstrate how to conduct a literature review and synthesis of the literature. 2. Examine the role of framing and focusing a research study using a paradigm position/epistemology, conceptual & theoretical frameworks. 3. Compare and contrast various theoretical perspectives of learning and development. 4. Distinguish the basic assumptions, concepts, and principles of various theoretical perspectives of learning and development. 5. Investigate how each theoretical perspective of learning and development can be applied to formal, informal and non-formal educational contexts. 6. Assess how each theoretical perspective of learning and development can be used in educational research. 7. Consider the implications of each theoretical perspective on teaching and learning formal, informal and non-formal educational contexts. 8. Develop a critical review of a theoretical perspective of learning and development. Credits: 3.00

ASEC 64200 - Seminar In Agricultural And Extension Education

Credit Hours: 1.00 to 4.00. Identification and analysis of contemporary programs used in agricultural and extension education. Prerequisite: 12 credit hours in Education.

Credits: 1.00 to 4.00

ASEC 64400 - ASEC Graduate Seminar

Credit Hours: 1.00. Students are familiarized with planning and presenting ASEC research through written and oral presentations based on the student's proposed thesis topic. Weekly attendance and participation at seminars help graduate students use appropriate and effective presentation skills, understand expectations regarding responsible conduct of research, and learn about current topics in ASEC related research areas.

Learning Outcomes: 1. Develop capacity to utilize Purdue research resources. 2. Develop writing and presentation skills necessary for success in academic careers. 3. Be informed about responsible conduct of research, research ethics, and human subjects regulations. Credits: 1.00

ASEC 68100 - Research Design For Social Scientists

Credit Hours: 3.00. The goal of the course is to examine social science theories and research designs in the contexts of agricultural and natural resources education, communication and engagement. Students will develop understanding of the chain of reasoning and create a research design to study a problem of interest. Students will apply the concepts they learned in a research methods course by critiquing research manuscripts and creating a rationale for a research proposal. After taking the course, students should have gained

understanding of how research designs are thoughtfully and argumentatively justified to study a researchable problem in informal, non-formal, and formal educational contexts and other social science contexts. Pre-or-Corequisite: FNR 58000 or EDPS 53300 (or instructor's permission for graduate-level social science research methods course).

Learning Outcomes: 1. Identify and focus a research problem. 2. Communicate effectively their research. 3. Think critically, creatively and solve problems in their field of study. 4. Conduct research in an ethical and responsible manner. 5. Demonstrate attributes of professional development consistent with expectations within their field of study. Credits: 3.00

ASEC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ASEC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Agronomy (Graduate)

Website: **https://ag.purdue.edu/agry**

Department/School Head

Laura Bowling

Overview

The Department of Agronomy is home to trailblazing faculty and staff who share an unwavering commitment to student success and are celebrated for ground-breaking research. Our graduate students have access to innovative research opportunities and the latest technologies in the field. Our curriculum emphasizes the foundational knowledge and skills required to improve the productivity and management of agroecosystems using biotechnologies, informatics, and technical solutions for a broad range of environmental challenges.

We invite you to become part of our research community, where you will refine your critical thinking skills, expand your professional network, and contribute your unique perspective to shaping agricultural systems both locally and globally.

Faculty by Rank (website)

Professor	Associate Professor	Assistant Professor	Clinical Assistant Professor

Joseph Anderson Laura Bowling Sylvie Brouder Shaun Casteel Ignacio Ciampitti Melba Crawford Cliff Johnston Eileen Kladivko Linda Lee Jianxin Ma Katy Martin Rainey Cindy Nakatsu Torbert Rocheford Darrell Schulze Lee Schweitzer Gary Steinhardt Daniel Szymanski Tesfaye Tesso Mitchell Tuinstra Jeffrey Volenec Qianlai Zhuang	Shalamar Armstrong Mohsen Mohammadi Cankui Zhang	Siddhartho (Sidd) Paul Pratishtha Poudel Daniel Quinn Yichao Rui Diane Wang Roland Wilhelm	Bruce Erickson Corey Gerber Anna Paltseva

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Academic Programs

Master's and Ph.D. Programs

A Masters (non-thesis), Masters (thesis) and Doctoral degrees are all offered.

The Agronomy Department offers M.S. and Ph.D. degrees in plant genetics and breeding, plant physiology, crop production, soil science, agroecology, land management, and climate. Our graduate programs emphasize developing and applying basic scientific principles to optimize agricultural systems management. We emphasize research with a global application as we hope to instill skill sets that allow for increased system resilience in response to the rapidly changing world.

Agronomy, PHD

Agronomy, MS

AGRY 50500 - Forage Management

Credit Hours: 3.00. The study of the role of economically important crop species in the soil-plant-animal complex. Physiology, utilization, and management of forage species will be emphasized.

Credits: 3.00

AGRY 51000 - Turfgrass Science

Credit Hours: 3.00. An advanced course in turfgrass management which focuses on the management requirements of intensively cultured turfgrass areas, with a specific emphasis on golf course and athletic fields. Interrelationships among soil, plant and atmospheric environments, management practices and turfgrass quality will be stressed.

Credits: 3.00

AGRY 51200 - Integrated Turfgrass Systems

Credit Hours: 3.00. Integration of agronomic principles for professionally managing golf courses, athletic complexes, lawn care companies, and sod production facilities in an efficient and environmentally friendly manner. Emphasizes independent thinking and team cooperation for understanding the social, ethical, and economical aspects underlying the daily agronomic management decisions, including construction, establishment, cultural practices, fertilization, and pest management. Course meets for weeks 1-10.

Credits: 3.00

AGRY 51400 - Environmental Stress Management For Turfgrass

Credit Hours: 1.00. Designed for students who desire an understanding of how environmental stresses influence turfgrass growth and how they can be managed with cultural practices. The course covers current research findings in stress management and integrates turfgrass environmental physiology with turfgrass management.

Learning Outcomes: 1. Demonstrate ability to identify problems, analyze data and derive conclusions. 2. Demonstrate critical thinking and the ability to write and speak with effectiveness. 3. Demonstrate the ability to work effectively as part of a problem-solving team. Credits: 1.00

AGRY 51500 - Plant Mineral Nutrition

Credit Hours: 3.00. Fundamental principles and concepts of the mineral nutrition of higher plants; processes and mechanisms controlling nutrient bioavailability and acquisition; physiological, genetic, and ecological aspects of plant nutrition including rhizosphere dynamics and interaction with disease.

Learning Outcomes: 1. Identify and describe the essential mineral nutrients required for plant growth. 2. Recognize the symptoms of nutrient deficiencies and toxicities in plants and understand the underlying physiological and biochemical changes. 3. Understand the mechanisms of nutrient uptake from the soil by roots, the role of root hairs, mycorrhizal associations, and the transport of nutrients within the plant through xylem and phloem. 4. Comprehend the biochemical pathways and processes through which plants assimilate and utilize nutrients. 5. Explore the signaling mechanisms that regulate nutrient uptake and utilization, including sensing mechanisms, gene expression, and hormonal responses. Credits: 3.00

AGRY 51800 - Plant Physiology And Biotechnology Research Techniques

Credit Hours: 3.00. This course has two components. The physiology section covers some of the popular experiments, such as the measurement of water potential, photosynthesis, stomata density, carbohydrate content, enzyme activity, mineral deficiency, drought stress physiology, plant pigment analysis, etc. The biotechnology section guides students through the entire procedure of genetic engineering, culminating in a project that will serve as an example on how to use molecular tools to answer fundamental physiological questions.

Learning Outcomes: 1. Master the use of a broad array of plant biotechnological and physiological research techniques. 2. Troubleshoot experiments and analyze, interpret and effectively communicate research results. 3. Envision, design and develop new research techniques for future use building upon peer-reviewed literature and meeting emerging research needs. Credits: 3.00

AGRY 52000 - Principles And Methods Of Plant Breeding

Credit Hours: 3.00. Introduction to methods and techniques of breeding field crops, with emphasis on the application of genetic principles; analysis of and present approach to the solution of specific breeding problems in selected field crops.

Credits: 3.00

AGRY 52500 - Crop Physiology And Ecology

Credit Hours: 3.00. Study of the physiological basis for growth, yield, and adaptation of crop plants. Topics emphasized include: carbohydrate assimilation and partitioning, nitrogen metabolism, crop growth and development, water relations, stress tolerance, and crop improvement using physiological genetics. Basic background in college level plant biology is recommended.

Credits: 3.00

AGRY 53000 - Advanced Plant Genetics

Credit Hours: 3.00. Advanced treatment of principles and recent advances in plant genetics including: mutagenesis; cell, molecular and direct approaches to genetic analysis and genetic interactions; haploidy; chromosomal organization and aberrations; transposable elements; mutations, para mutation and epigenetics in higher plants; extra nuclear inheritance; cytogenetic and molecular affinities between crop plants and their wild relatives; genetic manipulations; gene discovery; genetic approaches to understanding agriculturally useful plant traits. ESTs and global gene expression analysis, proteomics, metabolic profiling, comparative genomics and genome evolution. Offered in odd-numbered years.

Credits: 3.00

AGRY 53500 - Boundary Layer Meteorology

Credit Hours: 3.00. (EAPS 52500) This course has required class trips. Students will pay individual lodging or meal expenses where necessary. A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

AGRY 53600 - Environmental Biophysics

Credit Hours: 3.00. An analysis of the energy fluxes to and from terrestrial plants, insects, mammals, and humans as they exist in their macro and microclimates. Agricultural meteorology methods (both research and operational) will be presented. Labs will be both in-laboratory and in-field with reports required. A special project will be required of all students and will be presented in class and written as if for publication.

Credits: 3.00

AGRY 54000 - Soil Chemistry

Credit Hours: 3.00. Emphasis on processes controlling the gaseous, solution, and solid phases in soils including precipitation, acid-base, oxidation-reduction, complexation, absorption, and ion exchange.

Credits: 3.00

AGRY 54400 - Environmental Organic Chemistry

Credit Hours: 3.00. The fundamental properties and processes responsible for the fate of organic chemicals in the environment, with emphasis on soil and water chemistry. Areas to be addressed will include both conceptual and theoretical aspects of processes relevant to environmental fate of contaminants; measurement, estimation, correlation, and application of the parameters most commonly used to assess various chemodynamic properties in soil-water systems.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in surface and subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-base speciation and reactivity. 3. Quantify chemical distribution between soil-water, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 3.00

AGRY 54500 - Remote Sensing Of Land Resources

Credit Hours: 3.00. Application of remote sensing and spatial databases for observing and managing land resources within the Earth System; analysis and interpretation of remotely sensed data in combination with field observations and other data sources; conceptualization and design of a global earth resources information system.

Learning Outcomes: 1. Evaluate, analyze, and apply the fundamentals of remote sensing related to sensor technologies, Multispectral/hyperspectral imaging, active and passive radar, LIDAR, GPS, preprocessing of remote sensing image data, Radiometric and geometric correction, data enhancement for visual interpretation, extraction of information from data, spatial and spectral feature

extraction for analysis, Unsupervised and supervised classification, terrain modeling and sources of remote sensing data/information. Credits: 3.00

AGRY 55000 - Field Crops Breeding Techniques

Credit Hours: 2.00. Field nursery experience, including crossing procedures, plant evaluation, selection for pest resistance and for agronomic characters, and field data evaluation.

Credits: 2.00

AGRY 56000 - Soil Physics

Credit Hours: 3.00. Fundamentals of soil physics; transport of chemicals, heat, and gases; field spatial variability; principles and methods of physical analysis of soils; the influence of soil physical processes on environmental quality and agricultural production. Students having an understanding of introductory soil science will be suitably prepared.

Credits: 3.00

AGRY 56500 - Soils And Landscapes

Credit Hours: 3.00. Soils as natural components of landscapes, geomorphology and soil characteristics; processes of soil formation; principal soils of Indiana, their adaptations, limitations, productivity and use; global soil distributions; application of GPS and mobile GIS in the field. This course requires two all-day field trips. Students will pay individual meal expenses when necessary.

Credits: 3.00

AGRY 58000 - Soil And Rhizosphere Microbiology

Credit Hours: 3.00. Soils are complex ecosystems that host a diverse array of organisms, which interact with and respond to their environment. This course explores the ecology, evolution, and functions of soil microbes, with a particular focus on their interactions with plants. Through this course, students will gain an understanding of the metabolic processes and life-history strategies of archaea, bacteria, fungi, and viruses in soil, root, and rhizosphere compartments. Students will also survey the microbiomes of diverse soil ecosystems, such as forests, agroecosystems, and grasslands, and learn principles of soil microbiology and biogeochemistry. In addition, students will acquire practical knowledge about the methods used for characterizing microbes in soil and plant systems.

Learning Outcomes: 1. Demonstrate understanding of the ecology and physiology of major groups of bacteria, archaea, fungi, and viruses found in soils, the rhizosphere, and roots. 2. Compare and contrast soil and rhizosphere microbiomes, and their differences between the managed versus natural ecosystems. 3. Use verbal and basic mathematical descriptions to explain theories related to microbial growth, survival, and symbioses. 4. Predict the occurrence of microbial processes and soil conditions that govern the cycling of carbon, nitrogen, phosphorus, sulfur, and metals in soils and relate this knowledge to ecosystem functions. 5. Envision potential applications for soil and root-borne microbes in natural resource management, such as agriculture, forestry, and soil conservation. 6. Apply knowledge of plant-microbe interactions to develop hypotheses, design experiments, and select appropriate study methods. 7. Recognize and select appropriate resources and tools to effectively analyze microbiome data. Credits: 3.00

AGRY 58500 - Soils And Land Use

Credit Hours: 3.00. Soils as a resource in development planning; soil properties affecting land use; use of soil survey, aerial photos, topographic maps, and other resource data in land-use allocation; nonengineering aspects of site selection for various land uses, water conservation, waste disposal, and erosion control.

Credits: 3.00

AGRY 59600 - Professional Presentations

Credit Hours: 1.00. Develop confidence and skills in preparing and delivering professional presentations to both peer scientific and student audiences. (el. 7)

Credits: 1.00

AGRY 59700 - Communicating With The Public

Credit Hours: 1.00. This course will prepare students being trained as agronomy professionals to enhance their communication skills so they can successfully interact with the public. (el. 7) Offered in alternate years.

Credits: 1.00

AGRY 59800 - Special Problems

Credit Hours: 1.00 to 6.00. Research on agronomic problems conducted in laboratory, field, or library; report required; arrange with an agronomy staff member before registering. Permission of instructor required.

Credits: 1.00 to 6.00

AGRY 60000 - Genomics

Credit Hours: 3.00. An introduction to the technologies and analytical methods used in studying genomes, their functions and systems biology. This course prepares graduate students for further study of these techniques in additional courses and in their research. Students with an understanding of introductory genetics and statistics will be suitably prepared for this course. Offered in even-numbered years.

Credits: 3.00

AGRY 60100 - Introduction To Graduate Research

Credit Hours: 1.00. This course provides framework for graduate studies. It helps the new graduate student understand the roles and responsibilities in graduate education, providing guidance for scientific reading, writing, and research activities. Topics include understanding ethical issues in science, enhancing their ability to communicate with a broad range of people, and establishing initial perspectives on professional development. Permission of department required.

Learning Outcomes: 1. Prepared to practice good research record keeping. 2. Write a hypotheses for their research. 3. Exemplify integrity and honesty in their research. 4. Choose the appropriate mode of communications based on the expected response of their colleagues. 5. Assess their strengths and weaknesses and plan their student careers informed by potential professional careers. 6. Appreciate the value of diversity and inclusion in their research experience. 7. Consider paths from a wide range of options given their values, abilities and interests. Credits: 1.00

AGRY 60200 - Systematic Reviews In Agriculture And The Environment

Credit Hours: 3.00. This course is primarily intended for PhD students in the broad discipline of agricultural sciences who want to learn how to develop a publishable systematic review (SR) for their dissertation topic and/or in future work. The course goal is for students to understand the distinguishing features of important SR typologies and be able to apply their understanding to selecting and conducting the SRs that are appropriate to their own research questions. Students will meet twice a week with experts in agricultural sciences (e.g., agro-ecology, soils, animal sciences, crop sciences, socioeconomic sciences, etc.), information studies, data sciences and statistics; class time will typically involve lecture followed by collaborative work activities. Students will identify questions to work on individually and/or together in teams in a semester-long effort expected to lead to a peer-review publication. The research questions are anticipated to focus on management and technology efficacy in broadly defined agricultural systems (including livestock), agricultural impacts on ecosystem services, etc. Weekly assignments will follow the sequential steps of a full SR. Note that completion/publication of a full SR is not required to successfully complete the class as a full publication will likely require additional effort beyond the 16-week semester. Additional special project credits may be offered to students for completing work in the following semester(s).

Learning Outcomes: 1. Think originally and independently to develop concepts and methodologies. 2. Identify new research opportunities within one's field. 3. Synthesize existing knowledge, identifying and accessing appropriate resources and other sources of relevant information and critically analyzing and evaluating one's own findings and those of others. 4. Master application of existing research methodologies, techniques, and technical skills. 5. Communicate in a style appropriate to the discipline. 6. Keep abreast of current advances within one's field and related areas. 7. Show commitment to personal professional development through engagement in professional societies, publication, and other knowledge transfer modes. 8. Show a commitment to creating an environment that supports learning through teaching, collaborative inquiry, mentoring, or demonstration. 9. Adhere to ethical standards in the discipline. 10. Listen, give, and receive feedback effectively. Credits: 3.00

AGRY 60500 - Advanced Plant Breeding

Credit Hours: 3.00. Advanced study of genetic principles and their application to plant breeding systems, techniques, and objectives. Offered in alternate years. Prerequisite: AGRY 52000; a course in statistics covering simple analysis of variance.

Credits: 3.00

AGRY 61100 - Quantitative Genetics

Credit Hours: 3.00. Continuation of AGRY 51100, ANSC 51100. Quantitative genetics in animals and plants. Genotypic and environmental variances; covariances between relatives; single- and multiple-trait selection and correlated responses; genotype-environment interaction. Inbreeding and crossbreeding: means, variances, heterosis, intra- and inter-population improvement. Prerequisite: STAT 51200; Prerequisite: AGRY 51100 OR ANSC 51100.

Credits: 3.00

AGRY 62400 - Plant Ecophysiology

Credit Hours: 3.00. This course will explore the influence of the environment on growth and development, reproduction, adaptation, survival and evolution of plants. The fundamental study of physiological mechanisms underlying adaptive strategies and their ecological consequences will be included. Prerequisites: Undergraduate or graduate level of Plant Physiology (HORT 30100 or AGRY 52500 or HORT 55100 or FNR 43400 or equivalent).

Learning Outcomes: 1. Demonstrate ability to identify problem, analyze data and derive conclusions. 2. Demonstrate critical thinking and the ability to write and speak with effectiveness. 3. Demonstrate the ability to work independently as well as effectively as part of a problem-solving team. Credits: 3.00

AGRY 64100 - Statistical Hydrology

Credit Hours: 3.00. This course is designed to serve as an advanced graduate course in the statistical analysis of hydrologic data, including time series analysis and modeling, frequency analysis and uncertainty. Prerequisites: AGRY 33700 or CE 54200 or ABE 32500 and STAT 51100 or STAT 50300.

Learning Outcomes: 1. Apply statistical methods used for hydrologic design, standard time-series methods applied to the modeling of hydrologic variables and uncertainty techniques. 2. Infer the appropriate statistical method through analysis of hydrologic data. 3. Analyze hydrologic change in response to environmental changes using the concepts learned. Credits: 3.00

AGRY 64900 - Molecular Microbial Ecology

Credit Hours: 3.00. Focuses on the application of various molecular genetic techniques for studying micro-organisms from and in the environment. The method, theoretical basis of each method, and interpretation of results are covered. The major areas discussed are the application of molecular genetic techniques to study: (1) total microbial communities; (2) diversity of micro-organisms in a community; and (3) biotechnological uses of micro-organisms. Prerequisite: AGRY 32000 or AGRY 58000 or BCHM 56200 or BIOL 24100 or BIOL 43800 or BIOL 54900.

Credits: 3.00

AGRY 65000 - Clay Mineralogy

Credit Hours: 4.00. Principles of crystal chemistry, survey of clay mineral structures, and identification of clay minerals by X-ray diffraction, chemical methods, differential thermal analysis, infrared spectroscopy, and specific surface area measurements. Role of clay minerals in the natural environment. Offered in alternate years.

Credits: 4.00

AGRY 69500 - Graduate Professional Practice

Credit Hours: 0.00 to 3.00. An internship experience with a for-profit, non-profit, or governmental entity to complement the student's academic coursework. Practical experience with an employer is required to successfully complete the course. The student must present a letter from the proposed employer describing to a reasonable extent the work to be undertaken, document the expectations, and find an Agronomy faculty advisor/instructor to oversee the experience. Course may be taken in successive semesters. Permission of instructor required.

Learning Outcomes: 1. Experience applying knowledge and skills learned in prior coursework and reading the scientific literature to solve current problems and/or address current issues. Credits: 0.00 to 3.00

AGRY 69600 - Agronomy Graduate Seminar

Credit Hours: 1.00. Weekly discussion of assigned topics in soil and crop science.

Credits: 1.00

AGRY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

AGRY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Animal Sciences (Graduate)

***Website*: https://ag.purdue.edu/ansc/Pages/GradProgram.aspx**

Department/School Head

Paul Ebner

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Research Faculty	Clinical Assistant Professor	Adjunct Faculty
Layi Adeola Kolapo Ajuwon Ryan Cabot Candace Croney Paul Ebner Yuan H. (Brad) Kim Elizabeth Karcher Ronald Lemenager Zoltan Machaty	Rodney Allrich Jacquelyn Boerman Luiz Brito Marisa Erasmus Dale Forsyth Greg Fraley Timothy Johnson Darrin Karcher Brian Richert Jon Schoonmaker	Tingting Ju James Markworth Heather Neave Alex Pasternak Hinayah Rojas de Oliveira	Theresa Casey	Casie Bass Stacy Zuelly	Colleen Brady Heng-wei Cheng Aaron Cowieson Shawn Donkin Nathan Horn Jay Johnson Kara Stewart

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Academic Programs:

Master's and Ph.D. Programs

Research conducted by graduate students in our department spans a continuum encompassing basic and applied approaches in the discovery that impact both agricultural and biomedical sciences.
M.S. and Ph.D. degrees in the field of Animal

Sciences
Ph.D. programs in the area of Interdisciplinary Genetics (IGNT)

Concentrations (Areas of Study)

Graduate study toward the M.S. and Ph.D. degrees in the field of Animal Sciences may be pursued in the areas of Animal Behavior and Welfare, Cellular and Molecular Biology, Genetics, Management, Meat Science and Food Safety, Neuroscience, Nutrition, and Physiology. In addition, Ph.D. programs are offered in the area of Interdisciplinary Genetics (IGNT).

Animal Science, PHD

Animal Science, MS

Animal Science/Cancer Research, PHD

ANSC 50500 - Advanced Animal Welfare Assessment

Credit Hours: 3.00. Animal welfare assessment is a critical component of working with live animals. Throughout this course, students will receive instruction in the fundamental aspects of animal welfare assessment. Students will learn how behavior, physiology, health and production parameters are used to critically assess animal welfare. The welfare of farm, exotic, companion, and laboratory animals will be assessed, focusing on four example species that change every year. The species of focus will be determined in the summer semester and students can contact the instructor for details prior to registering for the course. Students will engage in classroom discussions and peer evaluation. Students will have the option to represent Purdue University at the American Veterinary Medical Association's annual welfare judging and assessment contest where they will compete with teams from other universities. Field trips may be required.

Learning Outcomes: 1. Discuss and present peer-reviewed articles. 2. Explain how behavior, physiology, production and health measures are used to evaluate animal welfare. 3. Weigh the importance and implications of different animal welfare indicators. 4. Use scientific evidence, as well as general principles and species-specific information to critically compare and assess the welfare of animals in different scenarios. 5. Present oral and written reasons in a concise and well-articulated manner. Credits: 3.00

ANSC 51300 - Design Of Animal Breeding Programs

Credit Hours: 3.00. Integration of principles of animal breeding and genetics into animal improvement programs. Emphasis is placed on the interaction among genetics, nutrition, and physiology.

Credits: 3.00

ANSC 51600 - Molecular Microbiome Analysis

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of microbial ecology in the animal microbiome and how to analyze next-generation sequencing data of amplicon libraries. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and student projects. Permission of instructor required.

Learning Outcomes: 1. Understand and critically review peer-reviewed publications in microbiome studies. 2. Design a microbiome experiment, with considerations for microbiome controls and reproducibility. 3. Analyze next-gen sequencing data from gene amplicon libraries. 4. Use R to manage datasets, perform analyses, and produce descriptive graphics. 5. Develop basic computational literacy in bash and R scripting, and cluster computing. Credits: 3.00

ANSC 52200 - Monogastric Nutrition

Credit Hours: 3.00. Digestion and absorption, nutrient utilization and interrelationships in poultry, swine, and other monogastric animals.

Credits: 3.00

ANSC 52400 - Ruminant Nutrition And Physiology

Credit Hours: 3.00. Physiological, microbiological, and biochemical effects and their interrelationships on digestion and metabolism in the ruminant animal.

Credits: 3.00

ANSC 53400 - Advanced Reproductive Physiology

Credit Hours: 3.00. A study of mechanisms that interact to control reproduction in farm animals. Current scientific literature and hypotheses are presented, and potential methods to enhance reproductive efficiency are examined.

Credits: 3.00

ANSC 53700 - Adipocyte Biology

Credit Hours: 3.00. This course will provide the student with a conceptual background in the development of adipose tissue and its biological function with emphasis on the endocrine and immunologic aspects of the adipocyte. Differences between species will be emphasized where possible.

Learning Outcomes: 1. Discuss the development ontogeny of adipose tissue formation. 2. Discuss the role of adipose tissue in energy balance. 3. Discuss the role of adipose tissue in the regulation of immune function. 4. Understand the role of the extracellular matrix in adipose tissue in the regulation of adipocyte development. 5. Have a better understanding of adipose tissue role in cancer susceptibility. 6. Have a better understanding of the impact of phytochemicals in the regulation of obesity and adipocyte function. Credits: 3.00

ANSC 55200 - Advanced Meat Science

Credit Hours: 3.00. The overall goal of the course is to provide students with an advanced understanding of meat science and technology. In order to complete this goal, students will participate in activities including classroom lecture, group discussion, critical reading of literature, written assignments and exams, and/or student projects.

Learning Outcomes: 1. Demonstrate the conceptual framework of meat science and technology by understanding the biology, biochemistry and chemistry postmortem muscle. 2. Synthesize knowledge of the biology, biochemistry and chemistry of muscle (meat) and how it functions to influence meat quality attributes. 3. Classify intrinsic/extrinsic factors affecting meat quality characteristics. 4. Describe strategic factors to solve meat quality related issues or systems that can be applied to improve meat quality attributes. 5. Analyze the composition and chemistry of meat and muscle protein and its functional health benefits to the human consumption. 6. Describe current research in the field of meat science and technology. 7. Demonstrate learned and researched information with peers, both in writing and as a presentation. 8. Develop skills to read and evaluate research papers, orally present current research and participate in discussion of the result. Credits: 3.00

ANSC 55500 - Animal Growth And Development

Credit Hours: 3.00. A study of the molecular and cellular processes controlling embryonic development and growth of domesticated animals. Includes discussions of current research concerning molecular mechanisms of fertilization, egg activation, early development, and endocrine factors controlling cell growth, differentiation, and tissue formation. Experimental approaches utilized for developmental and growth biology research are discussed.

Credits: 3.00

ANSC 59500 - Special Topics In Animal Sciences

Credit Hours: 0.00 to 3.00. Lecture presentation of specialized material not available in the formal courses of the department. The specific topic offered is indicated on the student's record. Permission of instructor required.

Credits: 0.00 to 3.00

ANSC 62000 - Proteins And Amino Acids In Nutrition

Credit Hours: 3.00. Presentation of concepts concerning requirements for dietary amino acids, nutritional regulation of amino acid metabolism, and regulation of protein metabolism.

Integrates biochemical and physiological functions of amino acids and features topics in nutritional regulation of whole-body protein turnover in mammalian and avian species. Offered in odd numbered years. Prerequisite: BCHM 56200.

Credits: 3.00

ANSC 62500 - Nutritional Biochemistry And Physiology I

Credit Hours: 4.00. (FN 605) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing interactions in bone and gut. Prerequisite: ANSC 22100, 23000, BCHM 30700.

Learning Outcomes: 1. Demonstrate knowledge of foundational scientific concepts. 2. Comprehend, interpret and apply knowledge to integrate biochemistry and physiology information relevant to nutrient metabolism with particular emphasis on bone and gut. 3. Develop knowledge of and learn to apply research methods used in nutrition, including biochemical and molecular analyses, preclinical and clinical study designs, and epidemiological approaches. 4. Develop skills important to a career in nutrition and animal science, e.g. critical thinking skills, reading and discussing current scientific literature, and scientific writing. Credits: 4.00

ANSC 62600 - Nutritional Biochemistry And Physiology II

Credit Hours: 2.00. (NUTR 60600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules. Offered weeks 1 - 8. Prerequisite: ANSC 62500.

Credits: 2.00

ANSC 62700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (NUTR 60700) Integration of biochemical and physiological functions of nutrients in humans and animals, emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9-16. Prerequisite: ANSC 62600.

Credits: 2.00

ANSC 66000 - Intestinal Microbiology And Immunology

Credit Hours: 1.00. (FS 66000) Discussion and critique of recent journal articles related to intestinal microbiology/immunology. The specific areas covered under this forum are: (1) intestinal microbiology, (2) food microbiology as it relates to gastrointestinal diseases, (3) probiotics and prebiotics-related to intestinal health or pathogen control, and (4) mucosal immunity with major emphasis on intestinal immunology.

Learning Outcomes: 1. Demonstrate effective oral and written communication skills. This includes such skills as writing technical reports and making formal presentations. 2. Apply critical thinking skills to new situations including critical evaluation of published papers. 3. Research independently: scientific and nonscientific information and use library resource. Credits: 1.00

ANSC 68100 - Animal Sciences Graduate Seminar

Credit Hours: 1.00. Instruction and application of concepts for effective oral professional presentations in the field of Animal Sciences. The course will provide students with knowledge for effective oral communication of scientific information and an opportunity to put guidelines into practice. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking skills for graduate students in animal sciences. 2. Enable students with skills needed to organize information from multiple scientific sources into a coherent oral presentation. 3. Enable development of skills for effective oral communication of research and current research concepts to animal science audiences. Credits: 1.00

ANSC 69100 - Topical Research Problems

Credit Hours: 1.00 to 4.00. To be arranged with individual staff members prior to registration. Requires approval of the department head. Supervised individual research projects. Written reports required. Permission of instructor required.

Credits: 1.00 to 4.00

ANSC 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ANSC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Biochemistry (Graduate)

Website: **https://ag.purdue.edu/biochem/Pages/GradHomePage.aspx**

Department/School Head

Joe Ogas

Faculty by Rank

Distinguished Professor	Professor	Associate Professor	Assistant Professor
Clint Chapple Natalia Dudareva Andrew D. Mesecar	Scott D. Briggs Brian Dilkes Barbara L. Golden Mark C. Hall Joe Ogas W. Andy Tao Elizabeth Tran Vikki Weake	Humaira Gowher Orla Hart Majid Kazemian Ann L Kirchmaier Xing Liu Sujith Puthiyaveetil Vikki Weake	Benjamin Carter Kyle Cottrell Hanna Hall Lisa Mydy Feng Weng

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Academic Programs:

Master's and Ph.D. Programs

Currently only accepting applications for the Ph.D. program
The Department of Biochemistry is a vibrant educational and research community engaged in multi-disciplinary, basic research in the biomedical and plant sciences. Our mission is to provide an environment that fosters creative thinking and nurtures a passion for the life sciences.

Biochemistry and Molecular Biology, MS

Biochemistry and Molecular Biology, Post-Baccalaureate Certificate

Biochemistry and Molecular Biology, PHD

Biochemistry and Molecular Biology/Cancer Research, PHD

BCHM 52100 - Comparative Genomics

Credit Hours: 3.00. The course provides an understanding of the forces that act on genome content and organization, and the ability to interpret genetic variation between genomes. Students will acquire skills to utilize public genome databases, visualize genomic regions/features of interest using a genome browser, and perform phylogenetic analysis. The knowledge gained is central within the fields of genetics, bioinformatics, microbiology, and evolutionary biology and have important applications in numerous related fields including medicine, biotechnology, agriculture, and ecology.

Learning Outcomes: 1. Understand the composition, organization and structure of genomes. 2. Understand processes that cause these genome features to change over time. 3. Interpret gene and genome information in common display formats. 4. Evaluate common methods used to interpret genetic variation between genomes. 5. Perform, present and discuss a research project in comparative genomics. Credits: 3.00

BCHM 53600 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BIOL 53601) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BCHM 56100 - General Biochemistry I

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with basic understanding of biochemical and structural properties of amino acids, nucleic acids, lipids, and carbohydrates. This course allows students to connect the relationship between structure and function of biomolecules. In addition, students learn to understand enzyme properties, enzyme mechanism of action, and enzyme regulation.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the scientific method. They will be

able to develop hypotheses, design experiments, and critically analyze results to create new knowledge. 3. Learn to be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques. 4. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 56200 - General Biochemistry II

Credit Hours: 3.00. This course provides upper-division undergraduate and graduate students with an understanding of core metabolic pathways. Anabolic and catabolic processes of metabolic pathways are studied. Biochemical and structural knowledge is used to determine how enzymes and coenzymes are needed to regulate and control metabolic pathways.

Learning Outcomes: 1. Understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. 2. Understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment. Credits: 3.00

BCHM 59500 - Current Topics In Biochemistry

Credit Hours: 1.00 to 4.00. Critical examination of developments in specialized fields of biochemistry not taught in other courses. Some topics include lecture, lab, directed reading or independent study. Permission of Instructor required.

Learning Outcomes: 1. Gain knowledge of a current topic in Biochemistry. 2. Learn critical thinking through analysis of the primary literature (such as journal articles). 3. Become aware of ethical issues that touch upon the current topic. Credits: 1.00 to 4.00

BCHM 60100 - Critical Thinking And Communication In Biochemistry I

Credit Hours: 2.00. The objective of this course is to assist students in acquiring the skills needed to read critically, evaluate, and assimilate the primary scientific literature. This objective will be accomplished by instructor-guided discussions of the hypotheses, experimental data, conclusions, and scientific merit of assigned manuscript(s) taken from the fields of biochemistry and molecular biology. Topics for discussion initially will focus on the structure, organization, review process, and ethical issues related to scientific manuscripts. As the semester progresses, discussions will focus on the hypotheses being tested, quality of the data, and validity of the conclusions. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60200 - Critical Thinking And Communication In Biochemistry II

Credit Hours: 2.00. Builds on the skills developed in BCHM 601. Students will continue to enhance their analytical skills, and class discussions will be conducted at a more sophisticated level and will go into greater depth. Class discussions will focus more on the analysis and evaluation of current methodologies and hypotheses in the biochemical and molecular biological literature. Students will be evaluated primarily on their preparation and participation in each class discussion. Prerequisite: BCHM 60100. Permission of instructor required.

Learning Outcomes: 1. Understand essential graduate skills for independent research. 2. Enhance oral and written communication skills. 3. Master reading and interpreting scientific literature in biochemistry. 4. Develop critical thinking and creativity in scientific research. Credits: 2.00

BCHM 60300 - Introduction To Graduate Research In Biochemistry I

Credit Hours: 6.00. This course is intended to provide the opportunity for in-depth, mentored graduate research in two biochemistry laboratories. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellow. Co-requisites: BCHM 60100 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design

experiments, and critically analyze results to create new knowledge. 2. Communicate scientific knowledge, experiments and conclusions effectively as speakers and writers. 3. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 4. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 5. Demonstrate knowledge of accepted safe laboratory practices. 6. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 7. Demonstrate the ability to organize and document laboratory procedures and results. 8. Describe research projects in an oral presentation that can be readily understood by a general scientific audience. 9. Appreciate the ethical issues facing professionals in the life sciences. Credits: 6.00

BCHM 60400 - Introduction To Graduate Research In Biochemistry II

Credit Hours: 3.00. This course builds upon BCHM 60300 to provide continued opportunity for in-depth, mentored graduate research in one biochemistry laboratory. Students enrolled in this course will learn how to devise hypothesis, design experiments that test their hypotheses, accurately record their data in laboratory notebooks, critically analyze the results of their analyses and present their findings to others in written and oral presentations. They will fully participate in laboratory group meetings, the Biochemistry seminar series, and presentations by other students and postdoctoral fellows. Co-requisite: BCHM 60200 and Prerequisites: BCHM 60300 and BCHM 60501. Permission of department required.

Learning Outcomes: 1. Understand the scientific method. Develop hypotheses, design experiments, and critically analyze results to create new knowledge. 2. Use scientific instrumentation to evaluate the activity or function of biological macromolecules. 3. Demonstrate knowledge of analytical and preparative methods that can be applied to biochemistry. 4. Demonstrate knowledge of accepted safe laboratory practices. 5. Demonstrate laboratory experience working with a diverse group of individuals as part of a research team. 6. Demonstrate the ability to organize and document laboratory procedures and results. 7. Appreciate the ethical issues facing professionals in the life sciences. Credits: 3.00

BCHM 60501 - Macromolecules

Credit Hours: 3.00. This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

Learning Outcomes: 1. Acquire knowledge about the chemical structures and properties of the building blocks of biological macromolecules, including amino acids and nucleic acids. 2. Develop the skills required to visualize and analyze the higher order structures of proteins and nucleic acids. 3. Acquire information literacy by learning to use online resources to explore evolutionary relationships among macromolecules, and to prepare three dimensional models of proteins and nucleic acids. Credits: 3.00

BCHM 61000 - Regulation Of Eukaryotic Gene Expression

Credit Hours: 3.00. This course will provide students with a basic understanding of gene expression mechanisms with a s specific focus on newly emerging topics. This course will be taught from current primary literature, using a textbook as a background resource. Topics will include transcription, messenger RNA decay, microRNAs and connections between

gene expression steps. Students will learn how to read and interpret scientific literature through class presentations, discussions and take home assignments. Additionally, students will gain experience in developing and testing hypotheses within the class topic areas and writing a research proposal. Prerequisites: BCHM 56100 and 56200, or BCHM 60501. Lack of these prerequisites will require approval by the instructor.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Appreciation for post-transcriptional gene regulatory events. 3. Enhancement of oral and written communication skills. 4. Mastery of reading and interpreting scientific literature in gene expression fields. 5. Development of critical thinking and creativity in scientific research. Credits: 3.00

BCHM 61100 - Chromatin Biology And Chromosome Dynamics

Credit Hours: 2.00. An exploration of current models and recent discoveries in chromatin biology and the relationship between chromatin and gene expression, as well as other aspects of chromosome structure and function. Prerequisites: BCHM 56100 and BCHM 56200 or BCHM 60501.

Learning Outcomes: 1. Basic knowledge of the molecular mechanisms in gene expression and regulation. 2. Basic knowledge of the molecular mechanisms of chromatin modification and epigenetic processes. 3. Appreciation for post-transcriptional gene regulatory events. 4. Enhancement of oral and written communication skills. 5. Mastery of reading and interpreting scientific literature in gene expression fields. 6. Development of critical thinking and creativity in scientific research. Credits: 2.00

BCHM 61200 - Bioinformatic Analysis Of Genome Scale Data

Credit Hours: 3.00. This course provides a hands-on experience for life science researchers in the bioinformatic analysis of genome-scale data. The various disciplines in the life sciences are generating a wealth of experimental and annotation data. Today's graduate students need experience with modern tools that can help them to access, explore, analyze, interpret and manage the data that they generate in the lab. Students will use the R programming language and packages from Bioconductor, the R bioinformatics project, as their principal tools for this course. Students will develop workflows in R that bridge established algorithms for bioinformatics such as limma, edgeR or DESeq2, incorporating methods to import, QC, transform and visualize genome-scale datasets derived from next generation sequencing experiments. A critical aspect of bioinformatics that is often inadequate is workflow documentation. This course will use Rmarkdown to integrate computer code, data and results to manage complex bioinformatics projects. The class has lecture, lab and distance components. Lectures will focus on the theoretical and biological aspects of bioinformatics analysis using recent examples from the literature. In lab, students will work on programming exercises or projects using published datasets. Advanced students will also have the opportunity to work with their own data. Distance instruction will include R tutorials and videos that students can work through at their own pace (subject to completion deadlines). Particular emphasis will be placed on the theoretical and practical limitations of next generation sequencing data. No prior computer programming experience is required, but it is assumed that students have a firm grasp of the fundamental principles of molecular biology and how they relate to complex processes such as gene expression and genome organization. Permission of instructor required.

Learning Outcomes: 1. Write R scripts that utilize Bioconductor packages for bioinformatic analyses. 2. Access genome-scale data sets from public repositories and import this data into R for further analysis. 3. Visualize genome-scale data sets for both quality control and presentation purposes. 4. Implement strategies to deal with genome-scale datasets including parallel computing. 5. Able to critically evaluate the bioinformatic methods and data from publications. 6. Implement "literate programming" with Rmarkdown to document and share their bioinformatics projects. Credits: 3.00

BCHM 61501 - Pathways

Credit Hours: 3.00. An advanced level cell biology course offered to first or second year graduate students. Students will learn the major intracellular signaling pathways and cell cycle regulation of eukaryotes. Readings will be from the primary literature. Prerequisites: BCHM 65100 and BCHM 56200; or, BCHM 60501 (can be taken concurrently).

Learning Outcomes: 1. Know the molecular

mechanisms in signal transduction and cell cycle. 2. Appreciate how protein modules within signaling molecules impart selective responses, how protein-protein interactions are used to build signaling pathways, and the methods commonly used to analyze signal transduction processes. 3. Appreciate cell cycle is carefully regulated to maintain genomic stability. 4. Enhance oral and written communication skills. 5. Master reading and interpreting scientific literature in signal transduction and cell cycle fields. 6. Develop critical thinking and creativity in signal transduction and cell cycle research. Credits: 3.00

BCHM 62000 - Protein Mass Spectrometry And Proteomics

Credit Hours: 2.00. The goals of this course are to introduce students to 1) basic principles of mass spectrometry, 2) the most common instruments used for protein mass spectrometry including the advantages and disadvantages of each, 3) the most common applications of protein mass spectrometry in biological research, 4) current approaches to quantitative protein mass spectrometry and their use in proteomic studies 5) the skills necessary to analyze mass spec data from a variety of experiment types including the ability to use and understand common database search programs, and 6) contemporary issues associated with large-scale proteomics experiments (including technical challenges and limitations) culminating in the ability to design appropriate experiments to answer a specific proteomic question. Prerequisite: Students need to have taken an undergraduate level biochemistry course and be familiar with basic aspects of protein structure that are taught in such courses. In the absence of an undergraduate biochemistry course, students should discuss their qualifications with the instructor before registering.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-based speciation and reactivity. 3. Quantify chemical distribution between soil-air, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 2.00

BCHM 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (AGRY 64000, BIOL 64000, BTNY 64000 , HORT 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

BCHM 69000 - Seminar In Biochemistry

Credit Hours: 1.00. Seminary In Biochemistry. Permission of instructor required.

Credits: 1.00

BCHM 69500 - Special Topics In Biochemistry

Credit Hours: 1.00 to 4.00. Critical examination of developments in specialized fields of biochemistry. Open to candidates for the Ph.D. degree in biochemistry; others by special permission of the professor in charge. Permission of instructor required.

Credits: 1.00 to 4.00

BCHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BCHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Botany and Plant Pathology (Graduate)

Website: **http://ag.purdue.edu/department/btny/graduate-program.html**

Department/School Head

Tesfaye Mengiste

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Mary Catherine Aime Zhixiang Chen Tom Creswell Kevin D. Gibson Stephen B. Goodwin Anjali S. Iyer-Pascuzzi William G. Johnson Tesfaye Mengiste Michael V. Mickelbart Chris Staiger Daniel B. Szymanski Fred Whitford Jin-Rong Xu Bryan G. Young	Christian D. Cruz Sharon Kessler Damon R. Lisch Scott McAdam Christopher G. Oakley Gyeong Mee Yoon Darcy Telenko Yun Zhou	Leonor Boavida Thomas Butts Guohong Cai Jeneen Fields Morgan Furze Angela Hancock Lee Miller Lei Zhang	T. Scott Abney Jody Banks Janna Beckerman Nicholas C. Carpita Ron Coolbaugh Larry D. Dunkle Peter B. Goldsbrough Thomas K. Hodges Don M. Huber Thomas N. Jordan Richard Latin Carole Lembi Sue Loesch-Fries Ray Martin Paul C. Pecknold Robert E. Pruitt Merrill A. Ross Gregory E. Shaner Mary Alice Webb Charles P. Woloshuk

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Academic Programs

Master's and Ph.D. Programs

Our research on plants and microbes helps: protect the environment, apply genetic knowledge to improve plants, manage natural resources, control weeds, and diagnose plant disease.

Botany and Plant Pathology, PHD

Botany and Plant Pathology, MS

BTNY 50400 - Advanced Weed Science

Credit Hours: 3.00. Emphasizes the mode and mechanism of herbicide action and herbicide interaction with plants, and the biology and ecology of weedy plants. Offered in odd-numbered years.

Learning Outcomes: 1. Understand the physical, biological, biochemical, and physiological parameters that influence herbicide efficacy from the start to the end of the herbicide mode of action process in plants. 2. Demonstrate the unique differences in the practical use and plant activity of the major herbicide mode of action groups used in the United States. 3. Explain the development of herbicide-resistant crops, the evolution of herbicide-resistant weeds, and apply this knowledge to describe how these factors influence modern weed management practices. 4. Provide a technical analysis comparing the mode of action for herbicides, insecticides, and fungicides and the factors involved with management of pest resistance for these different pesticide groups. Credits: 3.00

BTNY 50500 - Advanced Biology Of Weeds

Credit Hours: 3.00. Principles of weed biology and ecology, with focus on reproduction and ecophysiology, population dynamics, community ecology, and ecosystem level phenomena. Instruction will emphasize the development and refinement of critical thinking skills.

Learning Outcomes: 1. Develop as a scholar by creating a scholarly review paper on a topic or issue related to weed biology. 2. Be able to understand and analyze peer-reviewed scientific literature so that you can engage in informed discussions about weed science. 3. Gain knowledge about key topics in weed biology, including seed and seed bank ecology, effects of biotic and abiotic factors on weed growth, and key theories related to plant invasions. Credits: 3.00

BTNY 52500 - Intermediate Plant Pathology

Credit Hours: 3.00. Examines the biological and pathological characteristics of major causal agents; concepts of epidemiology and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions; disease management practices; and methods of disease diagnosis.

Learning Outcomes: 1. Understand concepts of disease and disease assessment; physiology, genetics, and molecular biology of host-pathogen interactions. 2. Understand the current state of knowledge in plant pathology from applied to molecular plant pathogen interactions. 3. Understand importance of plant disease in food security. 4. Understand plant pathogens and how they cause diseases; the biological and pathological characteristics of major pathogens; Understand pathogenesis of bacterial, fungal, nematode and viral diseases. 5. Understand plant disease resistance pathways, genetic resistance mechanisms starting form gene for gene interactions. 6.

Understand resistance to necrotrophic plant pathogens. 7. Understand biotechnological approaches to plant diseases resistance. 8. Identify and describe an economically important plant disease. Credits: 3.00

BTNY 53500 - Plant Disease Epidemiology

Credit Hours: 3.00. Plant disease epidemics occur due to the suitable combination of various elements of the agroecosystem. Many plant pathogens and diseases have increased their geographic distribution and intensity in the U.S. and the world. A lack of epidemiological understanding can exacerbate problems and significantly challenge the management of diseases at the field level. This course is an introduction to the epidemiological basis of disease management strategies. The course includes concepts in botanical epidemiology, disease assessment and measurement, disease modeling, epidemics comparison, and a revision of the traditional plant disease control principles. *Plant Disease Epidemiology* is an upper-level course for students interested in plant pathology, agronomy, data-driven Ag, national or international agriculture, or closely related areas. Although some pathosystems are used as model systems, *Plant Disease Epidemiology* is not a "how-to" course on controlling specific plant diseases.

Learning Outcomes: 1. Standardize terminology used in epidemiology for disease management purposes. 2. Analyze the accuracy and precision of data. 3. Use models to describe plant disease epidemics. 4. Explain how epidemiology is used to evaluate disease management options. Credits: 3.00

BTNY 55000 - Biology Of Fungi

Credit Hours: 3.00. Lectures cover general features of fungi, unique characteristics of major fungal groups, fungal interactions with other organisms, and principles of fungal genetics. Lab exercises include examination of representative species from major groups of fungi and classical and molecular manipulations of fungi.

Learning Outcomes: 1. Demonstrate the understanding of fungal structures and development. 2. Identify different fungal groups. 3. Understand unique features of fungal genetics. 4. Demonstrate the ability to culture and observe different fungi. Credits: 3.00

BTNY 55101 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

BTNY 55200 - Molecular Approaches In Plant Biology

Credit Hours: 3.00. This is mainly a laboratory exercise course designed to help students to be more familiar with common molecular techniques used in plant pathology studies. Techniques will include DNA/RNA isolation, hybridization, sequence analyses, various PCR reactions, library construction and screening, protein isolation, and plant transformation. Lectures will cover basic principles and applied aspects of molecular studies in plant pathology, and recent advances in genomics and proteomics techniques.

Learning Outcomes: 1. To understand the basic principles of common molecular and genomic techniques. 2. To become familiar with the application of common molecular and genomic approaches in the field of plant biology/pathology.3)To obtain laboratory

experience of performing common techniques used in molecular biology. Credits: 3.00

BTNY 55300 - Plant Growth And Development

Credit Hours: 3.00. Topics include seed dormancy, cell expansion and plant growth, pattern formation, phase transition, flowering, pollination and fertilization, seed development, fruit development, and senescence. This course is the second in a series of team-taught courses in the core curriculum of the Purdue Plant Biology Program.

Credits: 3.00

BTNY 55800 - Pathogens Of Plants

Credit Hours: 3.00. Plant pathology is the science of plant diseases and of the microorganisms that cause them and of our attempts to manage plant diseases. The ultimate goal of plant pathologists is to reduce the losses caused by diseases, thereby, increasing both the quality and quantity of the world food supply. Plant diseases are caused by the same types of microorganisms that cause disease in animals and humans and, as such, many of the principles that apply to human and animal medicine apply to plant diseases. It is the objective of this course to introduce students to the major types of plant pathogens (plant pathogenic bacteria, viruses, nematodes, and fungi), their basic biology and examples of the types of diseases they cause. It will be expected that students have knowledge in plant pathology.

Learning Outcomes: 1. Describe the characteristics of plant pathogenic bacteria, fungi, viruses, and nematodes and to distinguish between these pathogens. 2. Describe the methods that each pathogen group utilizes for reproduction, spread, infection of hosts, disease induction in hosts, and long term survival. 3. Classify plant pathogens in current taxonomic schemes. 4. Describe the disease cycles for plant pathogens covered in the course. Credits: 3.00

BTNY 56200 - Plant Hormone Biology

Credit Hours: 3.00. This course will provide a broad and integrated overview of the current status of plant hormone research. All aspects of plant hormones including biosynthesis, metabolism, transport, signal transduction will be discussed in relation to the role of hormones in plant growth and developmental processes. Cross-talk between hormones and how plants use hormones to integrate developmental or environmental signals to regulate plant growth will be included. In addition, practical aspects of hormones in the agriculture, horticulture, and pathogen responses will be covered to demonstrate the impacts of basic plant science to a modern agriculture. The course will consist of lecture and discussion of primary research papers. Upon completion of the course, the students will acquire a comprehensive knowledge of the action of plant hormones as growth regulators, critical thinking skills, and ethical research.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 3.00

BTNY 59000 - Special Problems

Credit Hours: 1.00 to 3.00. Open to graduate students and qualified undergraduates who desire to study special problems in plant science not covered in regular coursework. Credit dependent upon work done. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

BTNY 60500 - Diagnosis Of Plant Diseases

Credit Hours: 2.00. Symptomatology and diagnosis of diseases of field crop, vegetable, fruit, ornamental, and tree plants. Emphasis is on the collection and study of diseases in field, greenhouse, and storage. Prerequisite: BTNY 30100.

Credits: 2.00

BTNY 61300 - Advanced Plant Pathology

Credit Hours: 3.00. This course makes an exhaustive attempt to dissect the nature of plant disease and resistance mechanisms in plants. Special emphasis is placed on emerging concepts and paradigms that underlie a wide variety of plant-pathogen interactions, and how the knowledge gleaned from these studies is being used to devise effective and environmentally safe strategies of plant protection. It is expected that students have knowledge in genetics, molecular biology, biochemistry, and plant pathology.

Learning Outcomes: Students will become well versed in both the fundamental and contemporary aspects of plant pathology. They will learn about the most recent developments and trends in the field of plant-pathogen interactions and how these advances impact ideas and approaches for designing sustainable

plant protection strategies. Science students will be required to prepare and lead discussions on papers that establish key milestones in plant pathology, this course will help arouse curiosity in them and stimulate critical thinking. In addition, they will be able to apply to their own research the concepts/paradigms they learn in the class. Credits: 3.00

BTNY 62000 - Plant Disease Management

Credit Hours: 3.00. Plant diseases cause billions of dollars in crop losses worldwide and play a large role in food security and the viable production of agronomic and horticulture crops. This course will center on the various aspects of managing these diseases. Specific focus areas include the effect of cultural practices and planting decisions (i.e., crop rotation, fertility, host resistance), pesticide delivery formulation, chemistry and mode of action, and integrated systems of organic and hybrid disease management. Prerequisite: BTNY 30100 or equivalent.

Learning Outcomes: 1. Understand fundamental principles of plant disease management. 2. Know the mode of action and classification of plant pesticide groups (fungicide, nematicide, antibiotics, & biocontrols) and best use practices for integration into a disease management program. 3. Understand disease resistance development and methods for prevention. 4. Be familiar with traditional and modern aspects of pesticide delivery, discovery, and regulation. 5. Learn to develop an integrated plan for a cropping system by incorporating various tools for disease management. Credits: 3.00

BTNY 66000 - Scientific Writing

Credit Hours: 3.00. This is a course on coping with publication in professional journals. It covers the full range of activities involved in carrying a piece of original research to completion as a primary research article in a refereed journal. Emphasis is on principles of clear and concise technical reporting. Topics include: research and writing goals; journals' policies; data presentations; effective style; organizing, writing, revising, and processing manuscripts; proofreading; peer review; ethics; and grant proposals. Students will use their own data to prepare a manuscript as if for publication. Permission of instructor required.

Learning Outcomes: 1. Convey scientific results and concepts to a broad range of audiences effectively and clearly. 2. Order ideas such that they make logical sense to readers. 3. Understand the distinct requirements of different audiences. 4. Understand the differing requirements of review articles, research reports, and grant proposals. 5. Cite scientific literature effectively. Credits: 3.00

BTNY 69100 - Skills For Success In Grad School

Credit Hours: 1.00. This course is aimed at first year graduate students in the Botany department. Its purpose is to introduce the students to the department, teach them what it takes to be a successful graduate students, and to help them develop effective written and oral communication skills.

Learning Outcomes: 1. Advance knowledge and scholarship. 2. Demonstrate critical thinking and problem solving. 3. Exhibit ethical conduct. 4. Communicate effectively. 5. Develop professionalism. Credits: 1.00

BTNY 69200 - Graduate Professional Practice

Credit Hours: 0.00 to 3.00. An internship experience with a for-profit, non-profit, or governmental entity to complement the student's academic coursework. The student must present a letter from the proposed employer documenting the work and expectations expected to be undertaken and must find a Botany and Plant Pathology faculty advisor/instructor to oversee the experience. Course may be taken in successive semesters. Must be enrolled in a Master's or PhD degree program in Botany and Plant Pathology and in good academic standing (cumulative GPA greater than 3.00). Permission of instructor required.

Learning Outcomes: 1. Experience applying knowledge and skills learned from prior coursework and reading the scientific literature to solve current problems and/or address current issues. 2. Develop skills for networking and establishing professional connections outside of Purdue University. Credits: 0 to 3

BTNY 69700 - Departmental Seminar Series - Botany And Plant Pathology

Credit Hours: 1.00. This is a weekly seminar course that features both external and Purdue speakers. Exposure to research topics outside of a student's immediate research area is an important part of graduate student education. The goal of the seminar series course is to provide opportunities for graduate students to learn about the latest research advances plant biology, plant pathology, and weed science and to interact with visiting seminar speakers.

Learning Outcomes: 1. Learn about recent research advances in Plant Biology, Plant Pathology, and Weed Science. 2. Learn best practices for asking questions and interacting with seminar speakers. 3. Acquire new ideas for giving effective oral presentations by active listening to seminar presentations. Credits: 1.00

BTNY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Acquire training in the signature areas of the department of Botany and Plant pathology: plant biology, plant pathology, and weed science, and their subdisciplines. 2. Understand applied and molecular plant pathology. 3. Learn plant biology from cell biology to evolutionary and developmental biology, ecology. 4. Learn weed control and management, weed biology and related areas. 5. Learn how to communicate scientific ideas in written and oral form. 6. Learn best practices for asking research questions and working as part of a scientific team. Credits: 1.00 to 18.00

BTNY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Acquire training in the signature areas of the department of Botany and Plant pathology- Plant biology, plant pathology, and weed science, and their subdisciplines. 2. Understand applied and molecular plant pathology. 3. Learn plant biology from cell biology to evolutionary and developmental biology, ecology. 4. Learn weed control and management, weed biology and related areas. 5. Learn how to communicate scientific ideas in written and oral form. 6. Learn best practices for asking research questions and working as part of a scientific team. Credits: 1.00 to 18.00

Department of Entomology (Graduate)

Website: http://www.entm.purdue.edu/prospective-grads/index.html

Department/School Head

Dr. Catherine A. Hill

Faculty by Rank

Professor	Associate Professor	Assistant Professor

Dieudonné Baributsa Stephen Cameron Matthew D. Ginzel Catherine A. Hill Ian Kaplan Christian H. Krupke Linda Mason Barry Pittendrigh Douglas Scott Richmond	Grzegorz A. Buczkowski John Couture Laramy Enders Ameya D. Gondhalekar Brandi Schemerhorn Aaron Smith	Krystal R. Hans Brock Harpur Laura Ingwell M. Andrew Johnston Elizabeth Long Shubha Subramanyam

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Academic Programs:

Master's and Ph.D. Programs

Entomology has been a core component of Purdue University and the College of Agriculture since 1884. Our students study traditional areas of insect biology (molecular biology, behavior, systematics, ecology, pest management), as well as contemporary subjects and solutions related to grand societal challenges (health, environment & energy sustainability). As part of their graduate programs, our students also participate in multi-disciplinary work, leadership activities throughout the university, and participate in the teaching and extension missions.

- Doctor of Philosophy (Ph.D.) & Master of Science (M.S.) Website

Concentrations (Areas of Study):

- Biological control
- Insect biochemistry and cell biology
- Insect-plant interactions
- Integrated pest management
- Landscape ecology
- Molecular, behavioral, and population genetics
- Systematic Entomology
- Urban and industrial entomology
- Vector biology

Entomology, PHD

Entomology, MS

ENTM 50800 - Integrative Insect Taxonomy

Credit Hours: 4.00. A multisource approach to understanding insect taxonomy, morphology, and evolution. We will compare traditional classification schemes with new hypotheses of insect evolutionary relationships based on an array of data sources. Students learn the importance of natural history collections and how to prepare insect specimens for permanent storage. We will explore insect diversity through hands-on laboratory exercises and field research.

Learning Outcomes: 1. Identify insects to family by to sight. 2. Implement field techniques for collecting insect specimens. 3. Demonstrate proper insect collection preparation and curation. 4. Understand the principles of insect morphology, classification, and nomenclature. 5. Understand phylogenetic hypotheses and their implementation in insect taxonomy. 6. Integrate skills through a final class project on insect evolution. Credits: 4.00

ENTM 52500 - Medical And Veterinary Entomology

Credit Hours: 3.00. Introduction to the biology and control of arthropods of medical and veterinary importance, and coverage of the natural history and abatement of selected arthropod-related diseases, including arboviral encephalitis, filariasis, leishmaniasis, Lyme disease, malaria, plague, spotted fever, trypanosomiasis, and myasis. Offered in odd-numbered years.

Credits: 3.00

ENTM 59500 - Special Topics

Credit Hours: 1.00 to 4.00. Specialized topics not covered in other courses. May be repeated for credit if the course topic is not repeated. The specific topic offered is indicated on the

student's record. Permission of instructor required.

Credits: 1.00 to 4.00

ENTM 60000 - Graduate Student Orientation

Credit Hours: 1.00. Introduction and orientation to the requirements and culture of the Department of Entomology, the College of Agriculture, and Purdue University. Intended for graduate students in their first year.

Learning Outcomes: 1. Know the administrative regulations and procedures of Entomology and the Graduate School. 2. Know the history of Entomology. 3. Know the land grant mission and the role of Entomology. 4. Know the University hierarchy. 5. Know the roles, rules and expectations of the apprentice and mentors. 6. Begin creation of a career plan. 7. Develop strategies for effective networking. 8. Learn how to communicate within the discipline through oral and poster presentations. 9. Participate in independent activities. Credits: 1.00

ENTM 60200 - Insect Biology

Credit Hours: 3.00. A comprehensive course in entomology, for graduate students with little entomological background, that introduces students broadly to insect structure, function, behavior, ecology, pest management, and systematics. Students apply broad knowledge in each of the topic areas to a specific insect and are expected to be able to read and critically evaluate primary literature and summarize it in written and oral presentations. One year of college biology is strongly recommended.

Learning Outcomes: 1. Become conversant with entomology terms and definitions. 2. Be proficient in search techniques for the primary literature, to read, evaluate and discuss the primarily literature, and be able to extract information from primary sources and apply it to their own area of research. Credits: 3.00

ENTM 60900 - Science Writing

Credit Hours: 1.00. This course is designed for graduate students (MS or PhD) at any stage in their professional career who are seeking formal training in manuscript and grant writing for a scientific audience. Students will be required to attend class and prepare for in-class group discussions and writing activities by reading assigned sections of the text or associated papers. Students will also be required to prepare a written assignment (manuscript or grant) over the course of the semester, which they will use to practice and hone newly acquired skills, as well as participating in peer evaluation of one another's writing. Permission of department required.

Learning Outcomes: 1. Utilize resources and approaches (e.g. online tools, peer-writing groups, time management skills) to develop regular writing habits. 2. Perform critiques of scientific manuscripts and research proposals. 3. Provide constructive criticism to fellow students on writing assignments. 4. Learn steps and basic principles (e.g. language, narrative structure, revision Revised: 08/11/21 process) used to write clear and concise scientific papers for a variety of audiences. 5. Apply principles of science writing to develop a complete draft of a specific section(s) of the MS/PhD research proposal, critical literature review, manuscript or other academic work (with instructor permission). Credits: 1.00

ENTM 61000 - Current Trends In Insect Pest Management

Credit Hours: 3.00. Concepts of pest management and dynamics of pest populations, with emphasis on population regulation in theory and practice. The principles of applied ecology that pertain to insects and agricultural crops and systems. Identification, biology, behavior, and relationships of pests of forage, fiber, and vegetable crops. A knowledge of introductory entomology is recommended. Offered in even-numbered years.

Learning Outcomes: 1. Identify key insects in economically important IPM systems. 2. Design a pest management plan that includes preventive practices, sampling and economic thresholds. 3. Identify gaps in management techniques and propose new research directions. 4. Discuss key IPM concepts. Credits: 3.00

ENTM 61100 - Toxicology Of Insecticides

Credit Hours: 3.00. The chemistry, mode of action, and

metabolism of insecticides and related compounds in both insect and vertebrate systems. Evaluation of toxic action, principles of selective toxicity, insecticide resistance, and environmental effects are also discussed. A minimal knowledge of entomology is required. Knowledge of biochemistry and neurobiology is useful. Offered in even-numbered years.

Credits: 3.00

ENTM 64200 - Analysis Of Ecological Data

Credit Hours: 3.00. Intermediate course in analysis options for biological and ecological data. Topics include: univariate, multivariate, parametric and non-parametric analysis and their basis; advanced graphical techniques; basic mapping with and without geographical information systems; simulation modeling; associated coding for open source platforms. A previous graduate-level course in statistics is required. Working knowledge of ANOVA, t-tests, linear regression, and assumptions and distributions of test statistics for these is assumed.

Learning Outcomes: 1. Know data and analysis requirements when planning experiments and observational studies. 2. Apply several univariate and multivariate statistical analyses. 3. Model or simulate simple biological or ecological systems. 4. Use several different graphing techniques including mapping, three-dimensional plots, and animations. 5. Write code to accomplish 1-4 within open-source software. 6. Develop critical thinking skills. 7. Foster creativity by finding alternative solutions to analytical challenges. 8. Develop both the written and the technical side of communication skills. Credits: 3.00

ENTM 69100 - Special Problems

Credit Hours: 1.00 to 12.00. Special research topics of interest to graduate students and not included in assigned coursework. Permission of instructor required.

Credits: 1.00 to 12.00

ENTM 69200 - Special Topics

Credit Hours: 1.00 to 4.00. Advanced topics in specialties of department members such as, but not limited to: biochemistry and physiology; biological control; insect pest management; veterinary entomology; nematode systematics; pathology; systematics. The field in which work is offered will appear on the student's record. Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 4.00

ENTM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ENTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Food Science (Graduate)

***Website*: https://ag.purdue.edu/foodsci/Pages/prospective_grads.aspx**

Department/School Head

Senay Simsek

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Assistant Professor	Research Assitant Professor	Emeritus Faculty

Bruce Applegate Arun Bhunia Christian Butzke Bruce Hamaker Kee Hong Kim Andrea Liceaga Lisa Mauer Haley Oliver Senay Simsek Yuan Yao	Carlos Corvalan Amanda Deering Yaohua "Betty" Feng Jen-Yi Huang Owen Jones Stephen Lindemann Dharmendra Mishra Lavanya Reddivari Fernanda San Martin	Da Chen Eun Joong Oh Deandrae Smith Weicang Wang	Hanyu Chen	Thaisa Cantu Jungles	James BeMiller Rengaswami Chandrasekaran Jozef Kokini Jay Marks Philip E. Nelson Suzanne Nielsen Brad Reuhs

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Academic Programs:

Master's and Ph.D. Programs

Master's, Direct Ph.D., and Ph.D. degree programs
Food science is an all-encompassing major that is centered on enriching and improving food through increased food safety, novel processing techniques, nutritional benefits, and food functionality. To achieve these goals, Purdue's Food Science graduate program focuses on four signature areas: Food Chemistry Structure and Function; Foods for Health; Food Safety and Microbiology; Food Processing and Technology Development. Students from diverse academic backgrounds join the department to conduct research in one of these areas under the mentoring of outstanding faculty members. After earning graduate degrees, they pursue careers in academia, government agencies or industry.

Food Science, MS

Food Science, PHD

Food Science/Cancer Research, PHD

FS 50200 - Sustainable Food Manufacturing Technologies

Credit Hours: 3.00. This comprehensive course covers the principles and practices fundamental to manufacturing and storage of foods. It provides an in-depth look at common unit operations-mechanical, thermal, mass transfer, and nonthermal-used in commercial food manufacturing to ensure consistent quality, safety, and supply chain sustainability. Students will also learn about by-product and waste handling and processing. Concepts are explored through digital lectures and virtual laboratory sessions.

Learning Outcomes: 1. Describe the unit operations used in food processing and their relationship to food safety, including principles and mechanisms of action. 2. Build and explain process flow diagrams and identify appropriate processing equipment used to manufacture various food products. 3. Apply thermal calculations and perform mass and heat balances to food manufacturing processes. 4. Identify and discuss critical current issues in food processing, emerging technologies, and waste handling/processing. 5. Communicate effectively on critical issues related to food processing. 6. Conduct specific tests to assess product quality and process data (in virtual labs). 7. Perform lab- and pilot-scale basic unit operations (in virtual labs). Credits: 3.00

FS 53000 - Food Ingredient Technology

Credit Hours: 1.00. Identifies functions of ingredients listed on ingredient labels of food products and discusses alternative ingredient choices for food products.

Credits: 1.00

FS 53100 - Science Of Experimental Cuisine

Credit Hours: 3.00. This course brings together culinary arts and the application of food chemistry and ingredient technology principles. Emphasis will be placed on food construction and deconstruction, using common food preparation and molecular gastronomy techniques.

Learning Outcomes: 1. Develop and use the vocabulary of a professional chef. 2. Understand and intelligently discuss how cooking works. 3. Demonstrate practical proficiency in food preparation skills. 4. Understand and experience food from farm to fork. 5. Compare and contrast home, culinary/food service, and large food industry food production practices. 6. Use common food preparation and molecular gastronomy techniques to manipulate the structure of food ingredients and finished food products. 7. Describe the fundamental structure-function relationships of food ingredients and how each of the applied techniques alters the ingredient structure and/or function. 8. Explore and control common food-related reactions/interactions including: emulsification, Maillard browning, caramelization, gelatinization, gelation, denaturation. 9. Exemplify the scientific process and inquiry driven research by designing, implementing, and analyzing experiments related to food construction and deconstruction. 10. Design and create food textures and products by manipulating fundamental structure-function relationships of food ingredients, and explain the science of how the foods were constructed. Credits: 3.00

FS 53500 - Aseptic Processing Technologies

Credit Hours: 1.00. Overview of aseptic processing and packaging systems; thermal processing and fluid flow in continuous heat exchangers; food microbiology, chemistry, and packaging as applied to aseptic processing. Establishing processes for aseptic processing of liquid and particulate foods.

Learning Outcomes: 1. Describe the chemical reactions that most affect the quality, including how to control and monitor these. 2. Describe the microbiological concerns, and use this knowledge in problem solving. 3. Select appropriate packages and package integrity tests. 4. Understand the heat transfer principles, and calculate thermal processes, lethality flow rate characteristics, and residence time distribution. Credits: 1.00

FS 54100 - Postharvest Technology Of Fruits And Vegetables

Credit Hours: 1.00. (HORT 54100) Theoretical and applied aspects of methods being used for enhancing the quality and shelf life of harvested fruits and vegetables. Factors that affect the longevity of produce and technology used to control these factors and reduce deterioration of produce between harvest and consumption/processing will be emphasized. Meets during weeks 11-15.

Credits: 1.00

FS 55001 - Food Chemistry

Credit Hours: 1.00. Principles and concepts of the effects of heat, light, oxygen, and water activity on chemical reactions and physical events involved in processing, storage, and preparation of food products and their relationships to nutritional quality, organoleptic quality, stability, and safety. Class meets for 5 weeks.

Learning Outcomes: Students are expected to have a working knowledge of the following topics: 1. Structures and functions of major food components, including water, proteins, carbohydrates, and lipids; Major chemical reactions or structural changes occurring with macronutrients (water, proteins, carbohydrates, lipids) in foods and impacts on shelf-life. 2.

Major components and reactions occurring in major food groups, including fruits, vegetables, grains, legumes, red meats, poultry, eggs, fish, and shellfish. 3. Examples of the effects of processing on food constituents and end product quality; Basic principles of dispersed systems: colloids, gels, emulsions, foams; Problem solving using basic food chemistry knowledge. Credits: 1.00

FS 55101 - Food Analysis

Credit Hours: 1.00. Principles and applications of chemical, physical, and sensory techniques to analyze foods. Class meets for 5 weeks.

Learning Outcomes: 1. Identify government regulations that dictate industrial standard practices of food analysis. 2. Describe the principles of the official and rapid methods of analysis of the following food components: moisture, ash, fat, protein. 3. For any given food product, select and justify the use of 1) an official, and 2) a rapid method of analysis for the following food components: moisture, ash, fat, protein. 4. Describe the principles of the methods of analysis for the following food components/properties: individual sugars, starch, total dietary fiber, vitamins, individual minerals, oxygen demand, texture, color, sensory evaluation, lipid oxidation, lipid saturation, titratable acidity, extraneous matter, protein nutritional and functional properties. 5. Relate the various analyses discussed in class to quality assurance of specific food products. 6. Explain the principles and applications of the following techniques in food analysis: chromatography, electrophoresis, spectroscopy (including mass spectroscopy and MALDI), enzymatic assays, immuno-based assays. Credits: 1.00

FS 55201 - Nutritional Sciences

Credit Hours: 1.00. Study of perspectives on established nutrition knowledge, concepts, and principles pertinent to the field of food science. Contemporary information about diet as it relates to health and safety issues. Controversies regarding nutrients and functional foods. Class meets 5 weeks.

Learning Outcomes: Students will learn about the scientific principle relevant to: 1. Newly released dietary guideline for Americans 2010, & components in diets and foods. 2. Digestion, absorption and metabolism of macro-nutrients. 3. Digestion, absorption and metabolism of vitamins and minerals frequently used in food processing. 4. Influence of food components on energy balance and body weight management. Credits: 1.00

FS 55301 - Food Microbiology

Credit Hours: 1.00. Principles and applications of the microbiology of foods. Focuses on many of the important conditions that may lead to foodborne illness and food spoilage. Structured in three main sections related to foodborne hazards: 1) identification, 2) control and prevention, and 3) detection. Class meets weeks 1-5.

Learning Outcomes: 1. Identify the major components of food that affect microbial growth. 2. Explain major foodborne pathogens and under what conditions they thrive. 3. Use microbiological information and molecular techniques to solve practical problems of the food industry. Credits: 1.00

FS 55401 - Food Processing And Packaging

Credit Hours: 2.00. Covers relevant basic engineering concepts and their applications to solve food processing and packaging problems. Key unit operations and regulations or recommended practices for manufacture of a variety of foods also will be covered. Students work in teams on a project and present their findings to the entire class. Class meets weeks 6-15.

Learning Outcomes: 1. Understand the rationale and principle of operation behind common food processing operations. 2. Identify and explain the unit operations involved in the manufacture of specific food products. 3. Explain how processing parameters will affect quality and safety of processed products. 4. Communicate effectively with food technologists and

engineers. Credits: 2.00

FS 55402 - Food Processing

Credit Hours: 1.00. The Food Processing course will present an overview of the basic food engineering concepts and unit operations involved in the manufacture of various food products. Students will be able to understand the food processing literature and to effectively communicate with food technologists and engineers. Topics to be covered include: physical properties of foods, unit operations commonly found in the food industry, and processing equipment. Permission of department required.

Learning Outcomes: 1. Understand the rationale and principle of operation behind common food processing operations. 2. Identify and explain the unit operations involved in the manufacture of specific food products. 3. Explain how processing parameters will affect quality and safety of processed products. 4. Communicate effectively with food technologists and engineers. 5. Work effectively with team members with various backgrounds. Credits: 1.00

FS 55501 - Case Study

Credit Hours: 1.00. A brief overview of problem-solving and teamwork concepts will be presented in class. A problem will be given by an industrial sponsor, and work groups (teams) will be assigned to solve the problem and present the findings.

Learning Outcomes: 1. Work to solve a defined technical problem in food technology. 2. Gain an experience for solving a problem by effective literature search and preliminary experimentation. 3. Analyze data and evaluate the outcome for solving a problem. 4. Coordinate personal contributions within the team. 5. Organize and communicate thoughts/data in a well-organized manner. 6. Present both written and oral reports outlining the approach, procedure, outcome, and recommendation to solve the stated problem. Credits: 1.00

FS 56000 - Food Science Graduate Cooperative Work Experience

Credit Hours: 0.00. Supervised professional experiences in the food science industry. Programs must be preplanned and conducted under the direction of the departmental coordinator with the cooperation of an employer. Students must submit a summary report. Permission of department required.

Learning Outcomes: 1. Think critically, creatively to solve problems in their field of study. Credits: 0.00

FS 56400 - Commercial Food And Beverage Fermentations

Credit Hours: 2.00. This course will provide a study of the principles and practices of international food and beverage fermentations with emphasis on the microbiology, biochemistry and processing techniques used in commercial fermentations that utilize fruits, vegetables, grains, dairy, and meats. Instructional Format: This is a two-credit lecture that can be linked to a separate optional one credit hour laboratory combination. Students must be 21 years of age with ID check for proof of age. Permission of department required.

Learning Outcomes: 1. To gain a fundamental understanding of the principles and practices of traditional and novel fermentation techniques in the international food and beverage industries. 2. To acquire an advanced scientific knowledge in food microbiology, safety, biochemistry and processing. 3. To gain a learning experience with both production and sensory aspects of applied food and beverage fermentations. Credits: 2.00

FS 56500 - Microbial Foodborne Pathogens

Credit Hours: 3.00. The primary focus is to study the microbial pathogens involved with foodborne diseases. Course emphasis is on molecular and genetic basis of virulence of foodborne pathogens and host-parasite interactions. Topics include incidence and source of pathogens, immune response to infection, virulence factors, and mechanism of pathogenesis of specific infectious and intoxicating foodborne bacteria, mycotoxins, viruses and parasites. Typically offered odd years.

Credits: 3.00

FS 56600 - Microbial Techniques For Food Pathogens

Credit Hours: 2.00. Molecular biology, immunochemistry and tissue culture-based rapid and automated techniques currently used for detection and identification of foodborne pathogens. The techniques include metabolic fingerprinting identification system, enzyme immunoassay and dot blotting, lateral flow assay, polymerase chain reaction, genomic fingerprinting, cytotoxicity assays, and selected biosensor tools. Laboratory experiments are scheduled for four hours, with up to two additional hours of arranged time. Offered in even-numbered years. (Weeks 6-16).

Credits: 2.00

FS 58000 - Food And The Environment

Credit Hours: 1.00. This course is to provide information for students to understand the radical increase in food production and the associated environmental issues it has created. This course gives theoretical coverage of Life Cycle Assessment (LCA) methodology that will assist students in finding ways to evaluate the environmental sustainability of different food systems throughout their entire supply chains at local, national and global levels.

Learning Outcomes: 1. Understand the relationship between the food product life cycle and resource use and emissions generated. 2. Explain the principles of LCA and describe its content and purpose of each analytical step. 3. Interpret and evaluate food LCA studies and understand their strengths, weaknesses and appropriate use. 4. Perform a complete LCA to assess the environmental impact of a food product/system using publicly available data and software. 5. Identify the key factors impacting the environmental sustainability of food systems from farm-to-fork. Credits: 1.00

FS 58100 - Microbial Genomics And Metabolism

Credit Hours: 3.00. Microbial genomics and metabolism will introduce students to how genomes are assembled, how microbial functional predictions are made, and how systems biology techniques are used to query microbial function in diverse ecosystems. Students will participate in activities including classroom lecture, group discussion, reading of primary literature, hands-on computational assignments, exams, and student projects. Basic knowledge of microbiology and molecular biology is expected. Permission of department required.

Learning Outcomes: 1. Run various sequence and genome analysis programs from the command line. 2. Identify the important properties of sequencing technology and genome organization that underlie the genomics of bacteria, archaea, and microbial eukaryotes. 3. Predict gene function using bioinformatic tools and genome properties to annotate and curate microbial genomes. 4. Analyze genomes to predict metabolic pathways and compare related genomes to identify differences in microbial potential function. 5. Present and defend genome-based predictions of organismal metabolism both orally or in scientific writing. Credits: 3.00

FS 58200 - Emerging Food Technologies

Credit Hours: 1.00. This online multi-institutional course provides a broad perspective of innovation as applied to food engineering. The course constitutes weekly presentations from 12 speakers on topics in three thematic areas selected using a student survey (from 18 institutions), aiming to develop a student-centered course. This course (1) provides a broad perspective of innovation as applied to food engineering; (2) provides a general overview and case studies of current and emerging research areas in food and agricultural engineering and processing by different research groups in the nation; and (3) demonstrates the efforts among food engineers and scientists in the nation to advance engineering knowledge and technologies for the purpose of improving food safety, quality and security, and enhance health benefits of food products through extensive research in focused areas. Permission of department required.

Learning Outcomes: 1. Become familiar with advances in thermal processing of food and biomaterials. 2. Become familiar with advances in nonthermal processing of food and biomaterials. 3. Learn recent developments in understanding and sensing food quality and safety. 4. Apply the insights gained from observing faculty presentations to improve writing and presentation skills. Credits: 1.00

FS 59000 - Special Problems

Credit Hours: 1.00 to 5.00. Specialized study in research laboratories, libraries, or computer laboratories for problems related to food science that are not taught in regular courses. Permission of instructor required.

Credits: 1.00 to 5.00

FS 59100 - Special Topics

Credit Hours: 1.00 to 3.00. Specialized topics not covered in other courses will be offered as one-credit minicourses. Topics, requirements, and credits will be determined yearly. Permission of instructor required.

Credits: 1.00 to 3.00

FS 62000 - Scientific Writing In Food Science

Credit Hours: 2.00. This course covers the essential elements of publishing original research at professional meetings (oral presentations and papers) and in peer-reviewed journals (original research manuscripts). Topics include: ethics in writing, effective reading of the literature, organizing research data, choosing a journal, writing the manuscript (results, materials and methods, introduction, discussion, title, abstract, references), publication process, revising and reviewing, poster presentation, and short oral presentations. Each student will write a paper, prepare a 12-minute oral presentation, and prepare a poster, based on data from his/her graduate research project. Permission of instructor required.

Credits: 2.00

FS 63000 - Carbohydrates

Credit Hours: 3.00. (NUTR 63000) Carbohydrates with an emphasis on those of low molecular weight in foods. Structures, reactions, and properties of mono- and oligosaccharides. Introduction to polysaccharides and food gums. Offered in alternate years. Prerequisite: 6 credit hours in Organic Chemistry. Prerequisite: Nine credits of chemistry.

Credits: 3.00

FS 66000 - Intestinal Microbiology And Immunology

Credit Hours: 1.00. (ANSC 66000) Discussion and critique of recent journal articles related to intestinal microbiology/immunology. The specific areas covered under this forum are: (1) intestinal microbiology, (2) food microbiology as it relates to gastrointestinal diseases, (3) probiotics and prebiotics-related to intestinal health or pathogen control, and (4) mucosal immunity with major emphasis on intestinal immunology.

Learning Outcomes: 1. Demonstrate effective oral and written communication skills. This includes such skills as writing technical reports and making formal presentations. 2. Apply critical thinking skills to new situations including critical evaluation of published papers. 3. Research independently: scientific and nonscientific information and use library resource. Credits: 1.00

FS 68400 - Food Science Seminar

Credit Hours: 1.00. Current topics in food science.

Credits: 1.00

FS 68500 - Food Science Seminar

Credit Hours: 0.00. Observe and critically evaluate presented content and presentation skills of graduate students that are offering seminars. Students will attend seminars during the course time by joining the online content that is simultaneously streamed during the seminar.

Learning Outcomes: 1. Describe science-based problems and technological solutions that are relevant to Food Industry and human nutrition. 2. Gain observational knowledge on valuable presentation practices. Credits: 0.00

FS 69000 - Special Topics In Food Science

Credit Hours: 1.00 to 3.00. Individual study of specialized materials. Permission of instructor required.

Credits: 1.00 to 3.00

FS 69700 - Supervised University Teaching In Food Science

Credit Hours: 1.00. Students assist a faculty member in teaching a food science course to obtain training and experience in various aspects of classroom and laboratory teaching. Permission of instructor required.

Credits: 1.00

FS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

FS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Forestry and Natural Resources (Graduate)

Website: **https://ag.purdue.edu/fnr/Pages/GraduateStudiesFNR.aspx**

Department/School Head

Jessica Gurevitch

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Research Assistant Professor	Research Associate Professor	Clinical Engagement Associate Professor	Emeritus
Paul B. Brown Mark Christie J. Andrew DeWoody John B. Dunning Jr. Songlin Fei Elizabeth Flaherty Rado Gazo Matthew D. Ginzel Jessica Gurevitch Eva Haviarova Tomas O. Hook Jason Hoverman Douglass F.	John Couture Reuben R. Goforth Brady Hardiman Jingjing Liang Mo Zhou	Jacob Hosen Morgan Furze Dylan Wainwright	Stuart Carlton Elin Jacobs	Paris D. Collingsworth	Kwamena Quagrainie	Robert K. Swihart

Jacobs Michael A. Jenkins Zhao Ma Bryan C. Pijanowski Linda S. Prokopy Michael R. Saunders Maria S. Sepúlveda Guofan Shao Robert Wagner Patrick A. Zollner						

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Academic Programs:

Master's and Ph.D. Programs

We offer graduate study leading to the degrees of Master of Science, and Doctor of Philosophy in Fisheries and Aquatic Sciences, Forest Biology, Forest Measurement, and Assessment/GIS, Genetics, Natural Resource Social Science, Wildlife Science, Wood Products and Wood Products Manufacturing.

Forestry and Natural Resources, MSF or MS

Forestry and Natural Resources, PHD

FNR 50600 - Theory And Application Of Natural Resource Extension Programming

Credit Hours: 1.00. This course will provide an opportunity for students to develop and implement extension activities based on their research interests. The course will focus on important natural resources issues, identify common target audiences, provide examples of extension programming, discuss outputs developed from various extension programs, and outline metrics used to evaluate program impact.

Learning Outcomes: 1. Be familiar with the breadth of natural resource extension programs. 2. Create a logic model based on student research and extension interests. 3. Develop a plan that outlines student extension goals. 4. Communicate technical information to non-scientific audiences. Credits: 1.00

FNR 52700 - Ecotoxicology

Credit Hours: 2.00. This course covers theoretical and applied approaches to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in free-ranging animals and ecosystems. Students are expected to be knowledgeable in chemistry, biology, and animal physiology.

Learning Outcomes: 1. Review of basic ecotoxicological principles. 2. Know the various types, sources and environmental fate and effects of contaminants. 3. Know the modes of

toxicant uptake, transformation, storage and depuration. 4. Know the dose/concentration-response, exposure routes. 5. Know the factors that influence toxicity. 6. Know the contaminant distribution, bioaccumulation, and biomagnifications. 7. Know the biomarkers of exposure and effects: Molecular to ecosystem-levels. 8. Know the basic principles in aquatic toxicity testing. 9. Know the common toxicity assays using invertebrates, fish, amphibians, birds, and mammals (in vitro, in vivo, mesocosms, and in situ bioassays). 10. Know the field case studies: Complex effluents (sewage and paper mills); Persistent Bioaccumulative Toxicants (PCBs, PAHs, dioxins); Endocrine disrupting chemicals; Heavy metals; Nutrients and pathogens. 11.Statistical analyses of toxicity data. 12.Introduction to ecological risk assessment. Credits: 2.00

FNR 52800 - Wildlife And Environmental Forensics

Credit Hours: 2.00. Theoretical and applied approaches to the science of wildlife and environmental forensics. General introduction on environmental forensics followed by discussion of different types of investigations. Includes application of tools and procedures used to solve crimes, including morphological, chemical and biological analysis of evidence. All material will be discussed in relation to criminal investigation. (Offered in even-numbered years)

Learning Outcomes: 1. Explain the history and scope of environmental forensics. 2. Explain the critical steps needed during a crime scene investigation. 3. Apply field and laboratory techniques used for crime scene investigations. Credits: 2.00

FNR 52900 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens, and the environment - to understanding disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities, and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

FNR 53500 - Forest Regeneration And Restoration

Credit Hours: 3.00. An overview of the dynamics associated with the regeneration of forestlands in North America. Topics include: seed collection and handling, forest tree nursery operations, seedling quality, managing for environmental stresses, planting operations, early stand management, and natural regeneration. Permission of instructor required. Offered in odd-numbered years.

Learning Outcomes: 1. Apply the following activities common in forest regeneration and restoration projects: artificial and natural regeneration, tree seed, site preparation, seedling quality and assessment, seedling storage and handling, planting operations, vegetation management, managing stresses in the regeneration environment, early stand management, and regeneration planning. Credits: 3.00

FNR 53600 - Ecology Of Disturbance

Credit Hours: 2.00. Advanced lecture- and discussion-based class examining how disturbance shapes the composition and structure of communities and landscapes across major terrestrial biomes. Students will examine and discuss the relationships between disturbance intensity, frequency, and spatial extent and how these characteristics affect ecological processes and ecologically-based management of forest and grassland ecosystems. The class will also examine the synergistic effects of multiple disturbances and the restoration of endemic disturbance regimes in contemporary ecosystems. Course is reading intensive; students will read and discuss on average 3-8 journal articles per week.

Learning Outcomes: 1. Describe how disturbance shapes community composition and structure for several major terrestrial biomes. 2. Understand how disturbance regulates biological diversity across terrestrial and aquatic ecosystems. 3. Understand the relationship between disturbance intensity, frequency, and spatial extent and how those factors affect management of forest and grassland ecosystems. 4. Describe the synergistic nature of disturbance and identify how disturbance factors interact across a landscape. 5. Describe how contemporary and restored disturbance regimes may facilitate or suppress the spread of invasive species. 6. Understand how management activities can mimic endemic disturbance regimes to promote biodiversity and sustainability. Credits: 2.00

FNR 53601 - Ecology Of Disturbance Practicum

Credit Hours: 1.00. This course is the practicum for FNR 53600 , hence enrollment is contingent upon enrollment in FNR 53600 . Course consists of a one or two-week long field trip to a remote site; prior trips have been taken to the Great Smokey National Park over spring break. Course requires an additional travel fee, depending on location visited.

Learning Outcomes: 1. How disturbance shapes community composition and the distribution of species across landscapes. 2. How alterations to endemic disturbance regimes affect the composition, structure, and function of ecosystems. 3. How interactions between natural disturbance and invasion of exotic species influence forest community development. 4. Management that uses natural disturbance to restore and maintain biotic communities and ecosystems. Credits: 1.00

FNR 54300 - Conservation Biology I

Credit Hours: 3.00. Introduction to conservation biology, including population dynamics and genetic structure of rare organisms. Recovery planning, restoration ecology, environmental policy making, and sustainable developments are considered, as is ethics in conservation of biological diversity. Offered in odd-numbered years. Permission of instructor required.

Learning Outcomes: 1. Read and interpret the scientific literature on conservation of natural resources with an awareness of the current status of what is known about biodiversity, endangered species and ecosystems, biological invasions, and the effects of climate change on natural communities. 2. Explain how conservation research is carried out, and appreciate common pitfalls in designing research for goals of conservation interest. 3. Consider and evaluate the balance between conservation goals and other priorities in land management, societal and economic goals, and socio-political systems. Credits: 3.00

FNR 55800 - Remote Sensing Analysis And Applications

Credit Hours: 3.00. Advanced course in the use of remote sensing techniques emphasizing the physical principles behind the remote sensing of vegetative features, present-day instrument technology, spatial data processing and analysis algorithms, error analysis and accuracy assessment procedures, and multi-source data integration. Provides hands-on experience with forest canopy modeling, atmospheric modeling, image processing, and GIS software on microcomputer and workstation platforms.

Learning Outcomes: 1. Improve their understanding of remote sensing principles and the use of remote sensing technologies. 2. Master operational procedures of Erdas

Imagine or other remote sensing software for advanced image analysis and classification. 3. Use remote sensing applications accurately in natural resources, including but not limited to land use mapping, vegetation responses to weather variations, urban environment, and forest measurements. Credits: 3.00

FNR 56010 - Digital Data Acquisition Camp - UAS Field Operations

Credit Hours: 1.00. This class is the first course (of four) within the Digital Data Acquisition Camp (DDAC), a 3-week long intensive, in-person program. Students in this course learn best practice approaches concerning UAS operations and mapping missions, with both safety and effective data collection strategies in mind. Piloting, mission planning, and crew resource management fundamentals will have a primary focus in the curriculum. Other key foci will effectively apply core remote sensing, geospatial, and thermographic concepts to UAS workflows. Students learn how to effectively design and implement a safe and effective UAS operation through linking FAA policy toward Standard Operating Procedures, Crew Resource Management, and an overall Safety Management System. Throughout the course, core geospatial concepts are applied to a UAS data strategy that stresses data collection from start to finish. Where weather conditions allow, the student will gather data using UAS platforms and sensors. Students should already have their FAA Part 107 license before enrolling in the class. Permission from the Department is required.

Learning Outcomes: 1. Identify, define, and relate FAA Part 107 Policies toward UAS data collection approaches. 2. Demonstrate an ability to create a Safety and Crew Resource Management System within a UAS operation effectively. 3. Identify and define best practices in UAS data acquisition in a forested environment. 4. Develop and engage in UAS mapping missions and effectively gather UAS imagery data in a forested environment. Credits: 1.00

FNR 56020 - Digital Data Acquisition Camp - Photogrammetric Mapping

Credit Hours: 1.00. This class is the second sequential course (of four) within the Digital Data Acquisition Camp, a 3 week-long intensive, in-person program. The class will cover the basic principles of deriving 3D information from overlapping images with special attention to acquired imagery by UAS onboard forest environments. The concepts of digital camera calibration, image georeferencing, 3D reconstruction from imagery, mission planning, Structure from Motion (SfM), and qualitative/quantitative evaluation of derived products will be explained. Theoretical aspects will be emphasized through the analysis of derived products from images of forest stand acquired during both leaf-on and leaf-off conditions. Permission from the Department is required.

Learning Outcomes: 1. Understand and apply the principles of deriving 3D information from overlapping imagery. 2. Explain the concept of digital camera calibration and its impact on image-based 3D reconstruction. 3. Demonstrate the concepts of indirect and direct georeferencing using ground control points and navigation units onboard UAVs. 4. Use the principles of Structure from Motion (SfM) and interpret the derived quality reports. 5. Design a mission plan for a UAV imaging system and process acquired data for forest inventory. Credits: 1.00

FNR 56030 - Digital Data Acquisition Camp - LiDAR Mapping

Credit Hour: 1.00. This class is the third sequential course (of four) within the Digital Data Acquisition Camp, a 3 week-long intensive, in-person program. This class will cover the basic principles of deriving 3D information from LiDAR systems with special attention to acquired point clouds by LiDAR systems onboard UAS over forest environments. The concepts of laser ranging, LiDAR georeferencing, point cloud generation, data structuring, point cloud processing/visualization, and qualitative/quantitative evaluation of derived products will be explained. Theoretical aspects will be emphasized through the analysis of derived products from images of forest stand acquired during both leaf-on and leaf-off conditions. Permission from the Department is required.

Learning Outcomes: 1. Describe the principles of deriving 3D information from LiDAR systems. 2. Demonstrate LiDAR system calibration and describe its impact on derived point clouds. 3. Explain the concept of LiDAR georeferencing using navigation units onboard UAS. 4. Describe and apply the principles of LiDAR point cloud data processing. 5. Design a mission plan for a UAV-LiDAR system and

process acquired data for forest inventory. Credits: 1.00

FNR 56040 - Digital Data Acquisition Camp - Sensor Arrays

Credit Hours: 1.00. This class is the last course (of four) within the Digital Data Acquisition Camp, a 3 week-long intensive, in-person program. Students will learn: the operating principles behind common environmental sensors, how to configure and deploy sensors, and practices for cleaning, processing, and analyzing sensor time series data. Learners will gain hands-on experience collecting data with environmental sensors. Students will work with large datasets to learn best practices for quality control. After processing their datasets, students will use common data processing and modeling techniques to extract meaningful information from sensor data streams. This course emphasizes both in situ and remote sensing techniques for analyzing soil, water, and air chemistry and physical properties and forestry and wildlife applications. Permission from the Department is required.

Learning Outcomes: 1. Understand and evaluate different sensor technology platforms and networks. 2. Deploy, calibrate and maintain sensor networks. 3. Process, clean and manage data collected from sensor networks. 4. Analyze simple data streams from sensor networks. Credits: 1.00

FNR 56600 - Digital Natural Resources Capstone

Credit Hours: 1.00 to 6.00. This course is the capstone project for the Digital Natural Resources Masters of Forestry program. The content will include one or more of the following phases of the project: 1) the proposal development, 2) data acquisition, 3) data analysis and synthesis, and/or 4) project presentation and defense. The course may be repeated for credit. Course will be an independently directed course designed for specific students. Permission of instructor is required.

Learning Outcomes: 1. Recognize attributes and objectives that may be addressed with digital tools and technologies. 2. Plan and conduct a data acquisition mission with digital tools and technologies. 3. Clean, proof, and analyze collected data to achieve mission objectives. 4. Archive data in appropriate formats and structures. 5. Synthesize results into both written and oral formats for further decision-making. Credits: 1.00 to 6.00

FNR 56700 - Advanced Mammalogy

Credit Hours: 3.00. The class explores approaches to mammalian research and wildlife management through readings, discussions, field, and laboratory exercises. Topics such as mammalian behavior, ecology, phylogeny, taxonomy, and conservation are emphasized. The intention of this class is to help students who have a sincere interest in mammalian research and management to progress beyond identification in their understanding of mammals.

Learning Outcomes: 1. Understand the diversity of topics currently being examined using wild mammal populations and communities. 2. Integrate the results of published research into the design and exploration of research topics in which the students are interested. 3. Exhibit improved abilities in critical thinking, writing, and oral communication in discussing mammalian research and management topics. Credits: 3.00

FNR 57000 - Amphibian Ecology And Conservation

Credit Hours: 3.00. This course will address the ecology and conservation of amphibians at the global scale. Lectures will cover diversity and natural history, phylogenetic relationships, basic biology and ecology, and conservation concerns and strategies. Class materials come from a text and primary literature. Labs will focus on important characteristics of species, families and orders of amphibians, including both North American and non-North American species. Class will also discuss and debate conservation issues. Course will include guest lectures, potential field trips or a class project. Permission of department required.

Learning Outcomes: 1. Be familiar with the diversity and natural history of amphibians. 2. Know the basic biology of amphibians. 3. Be familiar with studies of behavior and community ecology. 4. Analyze research critically in amphibian ecology and conservation. 5. Be familiar with the current threats to amphibian populations as well as global conservation efforts. Credits: 3.00

FNR 57100 - Advanced Ornithology

Credit Hours: 3.00. Study of current avian research topics and

techniques. Class discussion of recent scientific literature; field and laboratory exercises to illustrate approaches to ornithological research. One weekend field trip is offered. (Offered in even-numbered years.)

Learning Outcomes: 1. Read the scientific literature on birds with a greater awareness of the current status of what is known about birds. 2. Describe how avian research is done and appreciate common pitfalls in designing research on birds. 3. Understand the conservation and management implications of current avian knowledge. Credits: 3.00

FNR 57400 - Big Data, AI, And Forests

Credit Hours: 3.00. This course is focused on introductory big data analysis, artificial intelligence, and associated applications in large-scale forest research. The lecture will cover the challenges we encounter in big data ecological research, and the approaches to overcome these challenges. Real-time forest inventory and wildlife survey data at national and continental levels will be utilized in this course, and actual high-impact research projects will be introduced as case studies to inform students of the state-of-the-art in this subject area. High-performance computing clusters will be utilized for big data analysis. This course is also open to non-forestry majors. We will introduce basic machine learning techniques that are applicable to other subject areas. Guest lectures may cover big data analyses in different fields, internet-of-things, and/or data management and optimization/decimation for collaborative Virtual Reality experiences. The class will be evaluated through a final project, for which students will work independently or in a group setting to develop a 'mini' research manuscript with a title of their own selection. All the groups are encouraged to submit their manuscript for publication at peer-reviewed journals, and those whose manuscripts have passed the initial journal screening will get extra bonus points.

Learning Outcomes: 1. Equip themselves with critical thinking skills to evaluate big-data research topics and their potential alignment with top-tier journals such as Science, Nature, and PNAS. 2. Equip themselves with general problem-solving skills to overcome practical big-data challenges. 3. Equip themselves with a synthetic understanding of the strength and weakness of various big data tools and machine learning algorithms. Credits: 3.00

FNR 58000 - Research Methods For Natural Resource Social Science

Credit Hours: 3.00. This class covers basic elements of research design for social scientists, with an emphasis on issues pertinent to natural resource management. Topics to be covered include the role of theories and paradigms in designing sound research, writing research questions and hypotheses, and the importance of validity and reliability in research design. Qualitative, quantitative, and mixed methods designs are presented and discussed.

Learning Outcomes: 1. Understand fundamental concepts such as theories and paradigms that are essential precursors to designing sound research. 2. Able to articulate clear research questions and testable hypotheses. 3. Differentiate between different research designs and know which are appropriate under which circumstances. 4 Understand overarching issues such as validity and reliability. 5. Know under which circumstances qualitative, quantitative or mixed methods are appropriate. 6. Demonstrate knowledge of a variety of commonly-used research methods. 7. Articulate basic steps involved in analyzing qualitative and quantitative data. 8. Demonstrate the ability to write a research proposal. Credits: 3.00

FNR 58600 - Urban Ecology

Credit Hours: 3.00. Urbanization is on the rise, transforming natural ecosystems into coupled human-natural ecosystems that encompass complex, novel functional and structural characteristics shaped by people and the inherent environment. Through local field trips and readings of the primary scientific literature, we examine the unique characteristics of coupled human-natural ecosystems. The course is designed to be broadly accessible to students from a variety of backgrounds, interests, and majors who are interested in environmental science and engineering and emphasizes the importance of incorporating an ecological perspective in environmental engineering and natural resource management. This course covers fundamental principles of ecology as applied in urban and other coupled human-natural systems with emphasis on the impacts of modern industrial society on ecosystem structure and function. Organizing themes addressed in this class include macroscale processes, systems thinking, and topics related to urban systems.

Learning Outcomes: 1. Describe and diagram

flows of matter and energy in coupled human and natural systems. 2. Discuss how drivers in each cycle change across an urban-rural gradient. 3. Describe the changes to natural ecosystems imposed by urbanization and other forms of global change (climate change, altered biogeochemical cycling, invasive species, mass extinction, etc.). 4. Compare and contrast urban and rural ecosystem structure and function, including diversity and distribution of organisms, landcover types, and ecosystem services. 5. Discuss provisioning of ecosystem services in urban and rural ecosystems; compare and contrast green vs grey infrastructure; identify areas of traditionally grey infrastructure that have the potential to integrate green infrastructure. 6. Describe the key components of the following ecological concepts and apply them to an analysis of urban vs rural ecosystems: a. resistance and resilience b. dynamic equilibrium c. alternate stable states d. disturbance and succession Credits: 3.00

FNR 58700 - Advanced Spatial Ecology And GIS

Credit Hours: 3.00. Introduction to the principles of landscape ecology and biogeography with a laboratory devoted to the analysis of spatial data using geographic information systems and other database tools. Landscape ecology focuses on the important relationships of landscape structure (pattern, heterogeneity) and ecological processes (movement of animals, hydrologic dynamics) and how this information is used for natural resource management. Biogeography examines ecological patterns and processes at larger scales (generally at subcontinental to global) for the purposes of managing plants and animals of global importance. In the last 15 years, tremendous efforts have been made to create spatial databases that help support research and management of natural resources at various scales. The lab will focus on the use and application of these databases that are common in natural resource management settings.

Learning Outcomes: 1. Apply the principles of landscape ecology to the analysis of spatial change in urban, agricultural and forested landscapes for the purposes of natural resource management. 2. Calculate change in landscape patterns using a variety of geospatial tools such as geographic information systems, spatial models, and geostatistics. 3. Prepare reports using the traditional scientific journal article format, on the analysis of landscape-scale change, focusing on problems common to watershed management. 4. Compare and contrast the ways that biodiversity can be calculated using standard indices of organismal diversity. 5. Calculate ecological footprints and evaluate why these vary across geopolitical and/or ecological units. Credits: 3.00

FNR 59000 - Introduction To Teaching In Natural Resources

Credit Hours: 1.00. This applied course introduces topics related to teaching science courses to facilitate and support the success of teaching assistants in Forestry and Natural Resources. Students will read and review assigned readings and then participate in a discussion at a weekly class meeting. Students also will have an opportunity to practice and apply concepts through development and presentation of a lesson plan. Permission of instructor required.

Learning Outcomes: 1. Learn evaluated and applied methods to effectively engage and support diverse student populations in formal and informal classrooms. 2. Develop skills to communicate effectively while teaching natural resource topics. 3. Connect ethical teaching practices to teaching actions. 4. Develop a personal teaching philosophy and an associated formal statement. 5. Create materials for a 50 min lecture period lesson plan on a topic of their choice that incorporates concepts from the semester. Credits: 1.00

FNR 59100 - Teaching In Natural Resources Practicum

Credit Hours: 1.00 or 2.00. This practicum course provides students with an opportunity to gain teaching experience in natural resource courses. This course is only open to students that are not being paid as teaching assistants. Permission of Instructor required.

Learning Outcomes: 1. Gain classroom and or laboratory experience teaching, engaging, and

supporting students in lecture and/or laboratory classrooms. 2. Improve their communication skills while teaching natural resource topics. Credits: 1.00 or 2.00

FNR 59800 - Topical Problems In Forestry And Natural Resources

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to think critically regarding topic studied. Use effective strategies to communicate knowledge regarding topic studied. Credits: 1.00 to 3.00

FNR 64700 - Quantitative Methods For Ecologists

Credit Hours: 3.00. Examines the assumptions and utility of statistical and other data analytic techniques that are encountered commonly or increasingly being used in ecological research. Emphasis is placed on the potential applications of these quantitative methods in an ecological context. Topics include traditional multivariate methods (cluster analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling, correspondence analysis), generalized linear models (logistic Poisson, and ordinal regression and derivatives), randomization methods, information-theoretic model selection and inference, and hierarchical models. An introduction to Bayesian analysis is provided for generalized linear (and mixed) models, with applications to (meta) population and (meta) community ecology. Prerequisite: BIOL 58210 or ENTM 64200 or STAT 51200 , or consent of instructor. Knowledge of linear algebra and experience with R is desirable but not essential.

Learning Outcomes: 1. Determine the appropriate statistical tool to use when confronted with most questions and data types. 2. Be familiar with the assumptions underlying these methods. 3. Have some familiarity with software required to apply the methods. 4. Offer a basic interpretation of results provided. Credits: 3.00

FNR 65000 - Individual-Based Ecology And Modelling

Credit Hours: 3.00. This course will provide graduate students with the opportunity to learn about the techniques and approaches used for individual-based modeling in ecological studies. Students will find relevant supplementary literature and lead class discussions on those topics as well as chapters from the course textbook and present case study examples of existing individual-based models (IBM) to the class. Students will develop individual-based models based on their own research project(s).

Learning Outcomes: 1. Explore the role that individual-based models (IBMs) can play in ecological research. 2. Develop a working knowledge of the nature of IBMs, their strengths, and weaknesses. 3. Become familiar with IBM programming concepts and NetLogo software. 4. Become able to incorporate individual-based modeling in the student's own research. Credits: 3.00

FNR 69100 - Topical Problems In Forestry

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Analyze contemporary challenges in forestry critically; may include habitat loss, climate change, species conservation or management, ecosystem health, analysis methods, or new applying new conservation or management strategies. 2. Develop proficiency in the application of concepts, methods, or analyses related to forestry research. 3. Communicate complex scientific concepts related to forestry through written reports, presentations, extension/outreach products, or other media formats. Credits: 1.00 to 3.00

FNR 69300 - Topical Problems In Wildlife Biology

Credit Hours: 1.00 to 3.00. Subjects and problems of interest to the student. Permission of instructor required.

Learning Outcomes: 1. Analyze contemporary challenges in wildlife biology critically; may include habitat loss, climate change, species conservation or management, ecosystem health, analysis methods, or new applying new conservation or management strategies. 2. Develop proficiency in the application of

concepts, methods, or analyses related to wildlife research. 3. Communicate complex scientific concepts related to wildlife biology through written reports, presentations, extension/outreach products, or other media formats. Credits: 1.00 to 3.00

FNR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Integrate and synthesize relevant literature, theories, methods from their field of study into a cohesive thesis or manuscript framework that showcases their understanding of existing research and identifying gaps that would benefit from future studies or research. 2. Construct and articulate clear, coherent research objectives, hypotheses, and/or predictions and develop methods that will address these. 3. Conduct research and collect data on thesis topic. Credits: 1.00 to 18.00

FNR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Integrate and synthesize relevant literature, theories, methods from their field of study into a cohesive dissertation or manuscript framework that showcases their understanding of existing research and identifying gaps that would benefit from future studies or research. 2. Construct and articulate clear, coherent research objectives, hypotheses, and/or predictions and develop methods that will address these. 3. Conduct research and collect data on dissertation topic. Credits: 1.00 to 18.00

Department of Horticulture and Landscape Architecture (Graduate)

***Website*:**

ag.purdue.edu/hla/Hort/Pages/HLAGradProgram.aspx

Department/School Head

Linda Prokopy

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Professor	Clinical Associate Professor

Cale A. Bigelow Ray A. Bressan Natalia Dudareva Steve G. Hallett Avtar K. Handa Peter M. Hirst Lori Hoagland Kathryn S. Orvis Aaron J. Patton Linda Prokopy Kashchandra G. Raghothama Paul Siciliano	David Barbarash Celina Gomez Ying Li Stephen Meyers Krishna Nemali Sean Rotar Aaron Thompson Ariana Torres Josh Widhalm	Moriah Bilenky Yiwei Huang Kranthi Varala	Elizabeth Maynard	Wenjing Guan

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Academic Programs:

Master's and Ph.D. Programs

Welcome to the Horticulture and Landscape Architecture graduate program in the Department of Horticulture and Landscape Architecture at Purdue University. The HLA graduate program offers the thesis-based degrees of Doctor of Philosophy (Ph.D.) and Master of Science (M.S.), Master of Science in Landscape Systems and Design (M.S.). Reflecting the research interests of our faculty, graduate students in the HLA graduate program have projects that explore fundamental concepts of plant biology, applied aspects of horticulture and landscape architecture, or that integrate basic plant science with field and contained environment studies. The goal of the HLA Graduate Program is to prepare students for professional careers in landscape design, basic and applied plant science and their economics and marketing with an emphasis on the improvement of food, fiber, fuel, ornamental crops, horticultural economics/marketing, and other related topics.

Horticulture, MS

Horticulture, PHD

Landscape Systems and Design, MS

HORT 51300 - Nutrition Of Horticulture Crops

Credit Hours: 1.00. An integrated course about plant nutrition focused on horticultural crops. The unique features of nutrient availability in a soil-less horticultural media will be highlighted. An emphasis will be placed on understanding the physiological basis of plant responses to nutrient application. Weeks 1-5.

Credits: 1.00

HORT 51400 - Sensors And Automation For Horticultural Crop Production

Credit Hours: 3.00. This course is designed to provide undergraduate (senior level) and graduate students with the knowledge of a wide range of environmental and plant sensors and automation devices for horticultural crop production, especially controlled environment production. Lectures will focus on the theory and application of different plant and

environmental sensors, electronic devices and computer programming for automation and environmental control using sensors while the laboratory activities provide hands-on experience on the application of sensors and automation devices to control below and above-ground environment during production.

Learning Outcomes: 1. Examine theory associated with different environmental and plant sensor measurements. 2. Implement methods to interface sensors to measurement devices such as dataloggers and micro-controllers and program them for automated and continuous sensor measurements. 3. Examine digital sensing technologies based on image analysis. 4. Demonstrate knowledge and practice hands-on experience with precision environmental control using datalogger and microcontrollers. Credits: 3.00

HORT 52500 - The Plant Microbiome

Credit Hours: 3.00. Students will learn about the latest methods to collect and analyze root and shoot exudates, quantify the composition and activity of microbes associating with plants, and determine how these associations influence plant health and productivity. Critical reviews of the primary literature and development of a research proposal will help students acquire the skills needed to conduct research on this rapidly emerging topic.

Learning Outcomes: 1. Describe basic processes regulating plant-microbial interactions in the rhizosphere and phyllosphere, and the implications of these interactions on plant and environmental health. 2. Critically evaluate and discuss primary literature in the field. 3. Compare and contrast methods used to study processes mediating plant-microbial relationships. 4. Identify questions that remain unanswered in the field and develop a research proposal to address one of these questions. Credits: 3.00

HORT 53000 - Introduction To Computing For Biologists

Credit Hours: 3.00. This course will teach the basic skills and knowledge required to operate in UNIX environment and program in Python. The course is designed to teach graduate, and advanced undergraduate students in plant and animal sciences the skill set required to analyze and interpret their own datasets. The lectures and associated lab section will provide students hands-on experience in working within a high-performance computing environment to analyze genome-scale datasets.

Learning Outcomes: 1. Define their biological data analysis as a computational problem. 2. Identify portions of the analysis that will benefit from parallelization. 3. Write one or more scripts that use the computational power provided by compute clusters to analyze large biological data sets in a speedy manner. Credits: 3.00

HORT 53100 - Applied Plant Genomics

Credit Hours: 2.00. This course aims to provide students an introduction to the theory and practice of functional genomics in plants. The course is centered around the many forms in which DNA sequencing technologies are applied to understand plant genomes, their variation and their function. The course will cover concepts in plant genome sequencing, transcriptome profiling and functional enrichment analyses in sets of genes. This is a full semester course that meets twice a week for: 1. A lecture that covers the rationale and theory of the topic and 2. A hands-on lab section that provides experiential learning with the computational tools and packages used in plant genomics and transcriptomics.

Learning Outcomes: 1. Describe and compare the chemistry, data yield, and cost of first generation, next generation and third generation sequencing technologies, and their applications in plant genome sequencing. 2. Obtain and understand the information on genome sequences and gene annotations for a sequenced plant genome. 3. Design and perform a transcriptome analysis pipeline. 4. Describe the statistical basis of gene enrichment analysis. 5. Apply standard gene group analysis tools to perform GO term analysis, motif analysis, pathway analysis, gene list overlapping and gene regulatory network analysis to interpret a gene list resulting from a functional genomics project. Credits: 2.00

HORT 54100 - Postharvest Technology Of Fruits And Vegetables

Credit Hours: 1.00. (FS 54100) Theoretical and applied aspects of methods being used for enhancing the quality and shelf life of harvested fruits and vegetables. Factors that affect the longevity of produce and technology used to control these factors and reduce deterioration of produce between harvest and consumption/processing will be emphasized. Weeks 11-15.

Credits: 1.00

HORT 55100 - Plant Responses To The Environment

Credit Hours: 3.00. Future agricultural production and the environment will encounter multifaceted challenges from global climate change, heat and drought incidence and severity, and limited land and resources. An understanding of how plant responds to these changes is essential to develop new technologies and systems approaches to mitigate the negative impacts and enhance agricultural crop productivity. This is an advanced plant biology course covering the present state of understanding of phenological, physiological, and molecular and genetic mechanisms and processes by which plants acclimate to transient and chronic environmental extremes.

Learning Outcomes: 1. Demonstrate an enhanced understanding of scientific principles. 2. Exhibit critical thinking. 3. Have a better understanding of the expectations of a professional scientist. 4. Increase the ability to evaluate and communicate scientific concepts. 5. Better understand scientific collaborative processes. 6. Understand some of the social and cultural interactions that come to play in scientific research. 7. Understand some of the ethical issues involved in the conduct of scientific research. 8. Understand the necessity for continuous learning that characterizes the scientific research process. Credits: 3.00

HORT 57200 - Stakeholder Involvement In Landscape Management

Credit Hours: 2.00. Engaging the public in natural resource decision-making is an increasingly important and complex task. This course provides an overview of how to include diverse stakeholders in decision-making, collaboration, and conflict resolution through readings, class discussions, and role-plays.

Learning Outcomes: 1. Demonstrate knowledge of a variety of participatory and facilitation techniques. 2. Understand the factors that make collaborative management successful and unsuccessful. 3. Use proven techniques for resolving conflicts. 4. Demonstrate knowledge of a variety of participatory and facilitation techniques. Credits: 2.00

HORT 59000 - Special Studies In Horticulture

Credit Hours: 1.00 to 3.00. Special studies in horticulture not covered in regular coursework. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 3.00

HORT 60100 - Planning And Presenting Plant Science Research

Credit Hours: 1.00. The purpose of this course is to acquaint students with the culture of scientific research and the processes of scientific discovery and review. This course will: (1) acquaint students with techniques used in presenting short scientific talks, as e.g., at national meetings, (2) expose students to procedures used in preparing scientific papers, proposals, etc., (3) introduce students to the outcomes expected to be achieved by graduate education and the processes by which students are mentored and evaluated, (4) help students begin formulating their research project proposal, (5) acquaint students with guidelines for biosafety and responsible conduct of research and provide a forum for discussion of ethical issues confronting researchers, particularly those inherent in participating in extramurally-funded research, (6) acquaint students with intellectual property issues involved in scientific research, (7) acquaint students with core research facilities across campus, and (8) expose students to discussions regarding the importance of diversity and an atmosphere of mutual respect to research excellence. This course is taken for a letter grade and carries one hour of credit.

Credits: 1.00

HORT 60200 - Horticulture Research Seminar

Credit Hours: 1.00. Weekly attendance at the Horticulture and Landscape Architecture Departmental seminars to help graduate students develop an appreciation for attending seminars and learning appropriate and effective presentation skills. HORT 602 compliments HORT 60100 and HORT 60300 by extending the presentation and project development approaches learned, so that students are better ready to prepare and defend their project proposals in HORT 60300.

Prerequisite: BCHM 56100.

Credits: 1.00

HORT 60300 - Grants And Grantsmanship

Credit Hours: 1.00. Focuses on funding opportunities in agricultural research and techniques of writing successful scientific grant proposals. Students will write a proposal on a research topic of their choice during the course, and they will gain experience in the peer review process by preparing written reviews of proposals and participating in a panel meeting in which proposals are discussed and ranked.

Credits: 1.00

HORT 64000 - Metabolic Plant Physiology

Credit Hours: 3.00. (BCHM 64000, BTNY 64000) Topics include photosynthesis, respiration, carbohydrate and lipid metabolism, and nitrogen, sulfur, and secondary metabolism. This course is the third in a series of core courses in the Purdue Plant Biology Program graduate curriculum. Prerequisite: BCHM 56100, BTNY 55300 or HORT 55300, Prerequisite: BIOL 55100 or HORT 55100.

Learning Outcomes: 1. Knowledge in basic principles of plant metabolism. 2. Skill in presenting complex ideas. 3. Critical and creative thinking skills in evaluating the primary literature. Credits: 3.00

HORT 69500 - Horticulture Seminar

Credit Hours: 0.00. Topics of current interest to staff and students.

Credits: 0.00

HORT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HORT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

LA 50100 - Research Methods For Design Applications

Credit Hours: 1.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 1.00

LA 50102 - Research Methods For Design Applications

Credit Hours: 2.00. The growing need for understanding the role of individuals, communities, and society in shaping the natural environment has led to a greater emphasis on landscape architectural research and the need to provide training in the research methods to support these efforts. It is an exciting time to enter this arena as landscape architects are collaborating with natural and social scientist to achieve better conservation outcomes, promote sustainable behaviors, and increase awareness and understanding of the complex environmental challenges facing our society. Non-Landscape Architecture students may gain enrollment with permission of instructor.

Learning Outcomes: 1. Understand the need for social science research in landscape architecture practice and how this informs design theory development. 2. Model

conceptually the relationship between social and ecological variables and understand the types of research methods available to explore these relationships. 3. Learn how to access demographic information about communities and user groups. 4. Develop a basic understanding of analysis tools and techniques, such as the use of GIS applications, Microsoft Excel, and SPSS (Statistical Package for Social Science) to conduct analysis of quantitative data. 5. Understand the common phases of developing theory-driven research and systems design evaluation. Credits: 2.00

LA 58100 - Special Topics In Landscape Architecture

Credit Hours: 1.00 to 3.00. Rotating topics dealing with skills, knowledge, and experiences related to landscape architectural theory, expression, and practice.

Learning Outcomes: 1. Learning outcomes vary due to nature of special topics course. Credits: 1.00 to 3.00

LA 58200 - Contemporary Issues - Landscape Architecture

Credit Hours: 2.00. Rotating topics that explore focused issues in landscape architecture theory and practice. Analysis and experience of contemporary issues, designs, and designers explored through presentation, discussion, critique, and practice of thematic content. Permission of instructor.

Learning Outcomes: 1. Learning outcomes vary due to nature of special topics course. Credits: 2.00

College of Engineering (Graduate)

College of Engineering Administration (Graduate)

Administration:

Tamara Kinzer-Ursem, Associate Dean for Graduate and Professional Education

Academic Programs:

The College of Engineering offers fully online and on-campus master's degrees and graduate certificates designed to meet the specific needs of engineers employed in the industry. Dual-degrees (MSE/MS + MBA) are also available online (in partnership with IU Kelley School of Business) and on-campus (in partnership with Purdue Krannert School of Management).

Master's Degree

Interdisciplinary Engineering:
Students can earn a fully online Master's degree in Interdisciplinary Engineering from one of the finest Engineering schools in the United States. This degree enables students to create a customized educational experience tailored to their individual or company goals and to current marketplace demands. It is ideal for professional engineers wanting to explore knowledge in a discipline different from their undergraduate studies or multiple engineering disciplines. Students have the option to pursue one of fourteen available concentrations and to combine their Engineering master's degree with an online MBA from the highly ranked IU Kelley School of Business. Courses offered to complete the MSE/MS in Interdisciplinary Engineering are the same as those offered to students on campus and taught by Purdue faculty.

Interdisciplinary Engineering, MSE or MS

Systems, Post-Baccalaureate Certificate

Applied Heat Transfer, Post-Baccalaureate Certificate

Digital Signal Processing - IDE, Post-Baccalaureate Certificate

Noise Control Engineering, Post-Baccalaureate Certificate

Autonomy/Interdisciplinary Engineering, MSE or MS

Internet of Things/Interdisciplinary Engineering, MSE or MS

Robotics/Interdisciplinary Engineering, MSE or MS

Interdisciplinary Engineering, DEng (OL)

Engineering Management, MSE or MS

Logistics Systems Engineering, MSE or MS

Systems Engineering, MSE or MS

ENGR 50000 - Global Design Team V

Credit Hours: 0.00 to 3.00. Global Design Team brings together undergraduate and graduate students from different disciplines, inside and outside of the College of Engineering to design solutions to solve real-world problems over the course of one academic semester. Depending on the size and scope of the project, teams may range from one to twenty students under the advisement of a faculty member. GDTs partner student teams with non-governmental organizations, businesses and/or other research institutions in international development projects. Approval for registration is granted based on an application process that takes into consideration previous design experience, level of interest in the topic and GPA. Permission of department required.

Learning Outcomes: 1. An awareness of varying regulations, codes of practice, standards, technical specifications testing/inspection procedures, environmental regulations, and systems of measurement between countries and regions. 2. Familiarity with the concept of a "global product platform". 3. Ability to apply familiar concepts to unfamiliar, real-world problems. 4. Ability to use design tools to solve engineering problems. 5. Ability to adapt to cultural norms in a professional arena and act appropriately. 6. Ability to make ethical and socially responsible decisions in the context of a culture divergent from my own. 7. Ability to analyze problems from a different cultural frame of reference. 8. Ability to communicate professionally in a culturally-appropriate manner. 9. Ability to practice social and cultural responsibility, e.g. resource sustainability. 10. Proficiency in a second language. 11. Ability to be cross-culturally adaptable/flexible. 12. Ability to contribute to a culturally-diverse team. Credits: 0.00 to 3.00

ENGR 50100 - Engineering Management Graduate Program Seminar

Credit Hours: 1.00. Seminar focused on graduate-level development for Interdisciplinary Engineering (IDE) professional master's students in key professional skill areas including technical management, engineering industry awareness, networking, and methods for obtaining a professional position after graduation. Permission of instructor required.

Learning Outcomes: 1. Function in a technical manager role by engaging with industry partners. 2. Construct an attractive professional brand by applying the characteristics of an effective online presence. 3. Enhance knowledge about successfully transitioning to industry by directly communicating with program graduates. 4. Write an effective resume and cover letter by implementing tangible

connections between professional development assessment results and university resources. 5. Execute job search activities strategically by comparing engineering job markets, both domestically and internationally, regarding employment requirements, job growth, and salary range. 6. Develop a skills-based functional resume by synthesizing engineering course backgrounds with industry job requirements. 7. Generate graduate-level interview skills by participating in engineering industry mock interviews. Credits: 1.00

ENGR 50200 - Engineering Leadership

Credit Hours: 3.00. Engineering leadership is the ability to inspire and guide engineering and technology-focused teams and organizations to achieve strategic outcomes. The successful engineering leader creates value at the intersection of technical systems and human systems. This course introduces students to evidence-based, practice-proven frameworks and tools related to (1) leadership presence, (2) cognitive diversity and psychological safety in teams, and (3) designing and transforming organizations and ecosystems.

Learning Outcomes: 1. Describe characteristics of effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

ENGR 59600 - Special Topics

Credit Hours: 0.00 to 6.00. Special topic courses for projects or special interest in Engineering.

Learning Outcomes: 1. Will vary by course. Credits: 0.00 to 6.00

ENGR 60100 - Doctor Of Engineering Fundamentals

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations as part of the Doctor of Engineering (D.Eng.) program. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. The course will also detail the differences between a professional doctorate (D.Eng) and a PhD program. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives. As the foundational course for the Doctor of Engineering program, students are expected to take this course during their first year of the program.

Learning Outcomes: 1. Create an individual development plan (IDE). 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow and plan for your studies. 4. Critique your individual development plan. 5. Establish professional and academic connections with students and faculty in the D.Eng. program. 6. Identify and engage with potential faculty advisor(s) and dissertation committee members. Credits: 1.00

ENGR 60200 - Engineering Research Fundamentals

Credit Hours: 3.00. This course is designed to teach students basic research fundamentals, including critical analysis of scientific literature, scientific communication, hypothesis development and basics of scientific writing. At the course's end, students will be able to critically review literature and present their scientific thoughts and findings in both written and oral forms. Students will also have opportunities to implement writing, presentation, and networking strategies that are key to success beyond graduate school. An introduction to ethical research practices will also be provided. Finally, students are expected to provide feedback to peers and improve their scientific writing and editing skills through weekly writing sessions. Through self-guided reading and online discussions, students will master the art of analyzing scientific literature, communicating their arguments, and offering peer feedback to colleagues.

Learning Outcomes: 1. Understand and comprehend the basics in research methodology and applying them in research/ project work. 2. Find literature relevant to a research problem, analyze research and retain

and retrieve its content for future use. 3. Apply research guidelines regarding record keeping. 4. Apply approaches for the development and formulation of research questions, objectives, and hypotheses. 5. Apply approaches to good writing for research proposals, papers, and theses. 6. Communicate research plans to peers and non-expert audiences, including oral and poster presentations. 7. Identify common ethical issues in research. Credits: 3.00

ENGR 60300 - Doctor Of Engineering Seminar

Credit Hours: 1.00. The graduate seminar is designed to provide students with the opportunity to explore and engage with current research topics, trends, and developments within engineering. The seminar will feature a different guest speaker each week. Here are the benefits of participating in the seminar: Knowledge expansion: You will gain insights into cutting-edge research; Exposure to diverse research areas: You will be exposed to a broader range of topics and research areas. This exposure will help you gain a more comprehensive understanding of current cutting-edge research topics and techniques. It can also inspire new research ideas and perspectives that you may not have considered previously; Developing critical thinking skills: You will refine your critical thinking by asking questions and participating in discussions during the seminars; Developing presentation skills: You will observe different presentation styles and effective communication techniques that you can use as examples to develop your own; Networking: You will be able to interact with professors, researchers, and peers from within and outside your program.

Learning Outcomes: 1. List critical areas and topics being investigated across a variety of engineering disciplines and areas. 2. Summarize a research presentation. 3. Identify improvements for current research practices. 4. Identify effective presentation styles and effective communication techniques. 5. Network with your peers and provide feedback. Credits: 1.00

ENGR 69199 - Professional Practice Graduate Co-Op I

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required.

Credits: 0.00

ENGR 69299 - Professional Practice Graduate Co-Op II

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required. Prerequisite: ENGR 69199.

Credits: 0.00

ENGR 69399 - Professional Practice Graduate Co-Op III

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required. Prerequisite: ENGR 69299.

Credits: 0.00

ENGR 69499 - Professional Practice Graduate Co-Op IV

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required. Prerequisite: ENGR 69399.

Credits: 0.00

ENGR 69699 - Professional Practice Graduate Internship

Credit Hours: 0.00. Graduate internship experience. Program coordinated by the Office of Professional Practice with cooperation from academic disciplines and participating employers. Students submit technical report and company evaluation. Permission of Instructor required.

Credits: 0.00

ENGR 69810 - Engineering Research

Credit Hours: 1.00 to 18.00. Designed for online engineering graduate students to participate in a mentored research experience. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of

course. Credits: 1.00 to 18.00

ENGR 69900 - Doctor Of Engineering Research

Credit Hours: 1.00 to 18.00. This research dissertation course will reflect the student's work to prepare and pass the preliminary examination, prepare and pass the dissertation proposal and successfully defend and pass the Doctor of Engineering dissertation. Research expectations will be determined by the instructor and student. Permission of instructor is required.

Learning Outcomes: 1. Vary due to research expectations. Credits: 1.00 to18.00

School of Aeronautics and Astronautics (Graduate)

Website: **https://engineering.purdue.edu/AAE**

Department/School Head

William A. Crossley

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty	Courtesy Faculty
Alina Alexeenko William Anderson Gregory Blaisdell Barrett Caldwell Steven Collicott Martin Corless William Crossley Daniel DeLaurentis Arthur Frazho James Garrison Kathleen Howell Inseok Hwang Husheng Li Robert Lucht Shaoshuai Mou Karen Marais R. Byron Pipes Jonathan Poggie Timothée	Sally Bane Ran Dai Carolin Frueh Joseph Jewell Kawai Kwok Leifur Leifsson Alexey Shashurin Carson Slabaugh Tyler Tallman Takashi Tanaka Haifeng Wang Dianyun Zhang	Andrea Capannolo Kyle Hanquist Keith LeGrand Kazuki Maeda Kenshiro Oguri Zherui Martinez-Guo	Dominick Andrisani James Doyle Alten Grandt Winthrop Gustafson Stephen Heister James Longuski Francis Marshall Charles Merkle John Sullivan Chin-Teh Sun Terrence Weisshaar Marc Williams	Andres Arrieta Diaz Luciano Castillo Christopher Goldenstein Jay Gore Briony Horgan Neera Jain Nicole Key Jan-Anders Mansson Monique McClain Terrence Meyer David Minton Guillermo Paniagua Carlo Scalo Fabio Semperlotti Steven Son Roger Wiens

Pourpoint Li Qiao Michael Sangid Steven Schneider Tom Shih Dengfeng Sun Vikas Tomar Wenbin Yu				

Visiting Faculty	Research Faculty	Continuing Lectures	Adjunct Faculty

Suman Chakraborty Pankaj Joshi Zehui Lu David Wolf	Brandon Chynoweth	Ronald Agye Alexander Burton Thomas Cunningham	Weinong Chen Serget Gimelshein Michael Grant Mark Grubelich Pascal Hubert Vlastimil Kunc Mark Lewis Belinda Marchand Kevin Parsons John Rusek Srdjan Simunovic Henry Yang Boris Yendler

Academic Programs

Master's and Ph.D. Programs

The School of Aeronautics and Astronautics offers masters and doctoral degrees in aeronautical and astronautical engineering. The Gambaro Graduate Program of Aeronautics and Astronautics is among the top, as well as largest, aerospace engineering programs in the country. The program offers Professional MS, non-thesis MS, thesis MS, and Ph.D. degrees in Aeronautics and Astronautics. The program offers a wide selection of courses and world-class research facilities.

Aeronautics and Astronautics, MSAAE

Hypersonics, Post-Baccalaureate Certificate

Aeronautics and Astronautics, PHD

AAE 50700 - Principles Of Dynamics

Credit Hours: 3.00. Kinematics, fundamental laws of mechanics, constraints, and generalized coordinates. Lagrange's equations, virtual work. Application to particle dynamics, rigid body motion, and spacecraft dynamics. Knowledge of differential equations required.

Credits: 3.00

AAE 50800 - Optimization In Aerospace Engineering

Credit Hours: 3.00. Formulation of optimization problems encountered in aerospace engineering. Minima of functions and functionals, necessary conditions, calculus of variations, control formulation, two-point boundary-value problems. Applications to typical problems in aerospace engineering, such as optimal launch, minimum time to climb, maximum range, and optimal space trajectories.

Credits: 3.00

AAE 51100 - Introduction To Fluid Mechanics

Credit Hours: 3.00. The basic conservation equations are derived for a compressible viscous fluid, and then are specialized for applications in potential flow, viscous flow, and gas dynamics.

Learning Outcomes: 1. Use index notation to derive vector and tensor relations. 2. Manipulate and derive governing equations in various forms. 3. Determine streamlines, pathlines, streaklines and timelines for unsteady flow. 4. Determine how vorticity is produced by various mechanisms. 5. Determine the motion of two-dimensional point vortices. 6. Use conformal mapping to find the lift coefficient on an airfoil shape. 7. Use a Schwarz-Christoffel transformation to solve for potential flow with corners. 8. Use three-dimensional potential flow to solve for flow over axisymmetric bodies. 9. Solve for steady and unsteady exact solutions of the Navier-Stokes equations. 10. Derive and use the Stokes drag law for a sphere. 11. Derive boundary layer equations, find self-similar solutions and determine scaling laws. 12. Compute skin friction on an airfoil using an approximate boundary layer method. 13. Determine the qualitative effects of turbulence on a flow. Credits: 3.00

AAE 51200 - Computational Aerodynamics

Credit Hours: 3.00. Finite difference methods for solving fluid flow problems. Review of classification of partial differential equations, well-posed problems, and discrete approximation of partial differential equations. Matrix and von Neumann stability analysis. Consistency and convergence. Grid generation: elliptic, hyperbolic, and transfinite mesh generation methods. Methods for solving the unsteady Euler equations: finite-volume formulations, flux-split and flux-difference formulations, shock-capturing, formulation of boundary conditions, artificial viscosity models, and multi-grid acceleration.

Learning Outcomes: 1. Select and construct solution algorithms for ODEs and PDEs encountered in aerospace and mechanical engineering based on understanding of flow physics and capability of numerical methods. 2. Select and construct solution algorithms for flows that may be modeled as viscous or inviscid, compressible or incompressible and choose appropriate initial and boundary conditions. 3. Explain consistency, stability, and convergence of numerical methods for PDEs and how they affect the accuracy of numerical solutions. 4. State and explain factors that affect accuracy of computed solutions generated by research and commercial CFD codes and how errors could be assessed and minimized. 5. State and explain limitations of CFD analysis because of assumptions invoked and uncertainties in models and inputs. Credits: 3.00

AAE 51400 - Intermediate Aerodynamics

Credit Hours: 3.00. Thin airfoil theory and panel methods. Three-dimensional elementary solutions, lifting-line and lifting-surface models. Slender wing and slender body theory. Normal/oblique shock waves. One- and multi-dimensional flows and conical flows. Method of characteristics. Introduction to transonic flow, hypersonic flow, and airfoil design.

Credits: 3.00

AAE 51800 - Low-Gravity Fluid Dynamics

Credit Hours: 3.00. Theory and design for control of liquid propellants in weightlessness. Gravity and orbits review. Satellite and space-probe acceleration environments. Capillary-dominated fluid dynamics: contact angle, surface tension, curvatures, and solution methods. Industry practice and current topics.

Credits: 3.00

AAE 51900 - Hypersonic Aerothermodynamics

Credit Hours: 3.00. Aerodynamics of satellites and planetary re-entry. Continuum hypersonic flow. Inviscid and viscous effects, boundary layers, and heat transfer. Shock and boundary-layer interactions. Equilibrium flow of high-temperature reacting gases. Nonequilibrium effects. Kinetic theory and rarefied flows. Direct simulation Monte Carlo techniques.

Credits: 3.00

AAE 52000 - Experimental Aerodynamics

Credit Hours: 3.00. Theory and application of experimental techniques and instrumentation for aerodynamics and fluid mechanics. Computer data acquisition, wind tunnels, force balances, flow visualization, pressure probes, hot wire anemometry, laser Doppler velocimetry and turbulence measurements.

Credits: 3.00

AAE 52100 - Plasma Laboratory

Credit Hours: 3.00. The laboratory course will include lab prep lectures, practical classes and mini-projects. Lab prep lectures will briefly cover topics of the basic plasma physics and diagnostics relevant to the subsequent practical classes. In addition, details of the corresponding lab procedure, instructions and lab report assignment will be discussed. Practical classes will involve students in practical creation and operation of various plasma sources and plasma diagnostics. Specifically, students will operate DC high voltage breakdown facility, electrostatic accelerator (ion thruster), cross-field accelerator (Hall thruster), Atmospheric-Pressure Plasma Jet facility, and will conduct measurements of plasma parameters using Langmuir probes, microwave interferometer and optical spectrometer.

Learning Outcomes: 1. Operate laboratory electronic equipment and conduct basic electrical measurements. 2. Demonstrate fundamental understanding of Paschen breakdown law, and measure breakdown parameters. 3. Demonstrate fundamental understanding of Child-Langmuir law and calculate space-charge limited current density. 4. Operate electrostatic accelerator at different acceleration voltages, and conduct measurements of total ion current carried by the plasma jet using plane Langmuir probe. 5. Demonstrate fundamental understanding of operation of single electrostatic Langmuir probes, conduct measurements of V-I curves, and calculate plasma parameters based on the measurements. 6. Operate cold atmospheric-pressure plasma jet and conduct spectroscopic measurements of the jet emission using spectrometer. 7. Computationally simulate the emission spectra of the second positive system of nitrogen molecule, and determine vibrational and rotational gas temperatures based on the measured and simulated spectra. 8. Operate Hall-effect accelerator, and measure basic operational parameters. 9. Operate pendulum thrust stand and conduct thrust measurements. 10. Demonstrate fundamental understanding of operation principle of microwave interferometry and construct the interferometer from basic microwave components. 11. Conduct interferometry measurements of phase shift in plasma column and determine plasma density. 12. Conduct search of the journal papers on a given topic, and compare the reported results with that measured in the lab. Credits: 3.00

AAE 52300 - Introduction To Remote Sensing

Credit Hours: 3.00. Fundamentals of satellite and airborne remote sensing. Basic physical principles of electromagnetic wave propagation will be introduced. From this foundation, the

phenomenology's enabling properties of the atmosphere; ocean and land surface to be measured at a distance will be developed. These principles will be applied to the design of instruments and satellite missions for Earth observation. Microwave instruments will be emphasized, although there will also be discussion of optical systems. Most of the material would also be applicable to remote sensing of other planets. Intended for students in Engineering or the Sciences.

Learning Outcomes: 1. Understand the basic physical principles of microwave and optical remote sensing. 2. Explain the principle geophysical quantities that can be measured using remote sensing methods. 3. Evaluate a mission design for a remote sensing application. Credits: 3.00

AAE 53200 - Orbit Mechanics

Credit Hours: 3.00. Orbit determination of near-earth satellites and various perturbations; libration and attitude control; orbit transfer and interception; lunar theory and interplanetary orbits; ascending mechanics and re-entry.

Credits: 3.00

AAE 53300 - Space Traffic Engineering Management

Credit Hours: 3.00. The course teaches the basic techniques and concepts relevant to Space Traffic Management (STM) and Space Situational Awareness (SSA) from a rigorous engineering perspective. The class starts with learning how measurements are collected and processed and then moves on to the non-linear orbital motion and astrodynamics in the near-Earth realm. The focus is on orbit determination and orbit improvement of satellites and space debris to detect new objects and maintain custody of them. Lastly, the class focuses on determining the probability of collision of two resident space objects. At the end of the course, the students are equipped with a fundamental Matlab toolset to investigate their own STM or SSA problems.

Learning Outcomes: 1. Demonstrate fundamental understanding of sustainable use of space. 2. Determine engineering and simulation of information collection for STM. 3. Demonstrate Initial Orbit Determination and Orbit Improvement using passive measurements. 4. Determine Orbital perturbations in the near-Earth and cislunar region. 5. Determine Computation Probability of Collision. Credits: 3.00

AAE 53400 - Spacecraft Electric Propulsion

Credit Hours: 3.00. Spacecraft electric propulsion systems are intended to provide thrust for propelling spacecrafts in interplanetary missions, orbital maneuvers, and attitude control. The course will start with reviewing material on the mechanics and thermodynamics of propulsion, and identifying the niche occupied by the electric propulsion systems. The course will cover elements of plasma physics and electromagnetic theory essential for studying the electric propulsion systems. The core of the course will focus on studying various electric propulsion concepts which utilize electric power produced on-board to generate thrust. Mechanisms of the utilization of the electric power to accelerate gas or plasma and produce thrust will be considered, including electrothermal, electrostatic, electromagnetic, and gasdynamic acceleration mechanisms.

Learning Outcomes: 1. Determine optimal specific impulse of electric propulsion system based on specific mission requirements 2. Demonstrate fundamental understanding of differences between electric and chemical propulsion systems performance and space applications. 3. Calculate basic plasma parameters and characteristics of collisional processes. 4. Demonstrate fundamental understanding of concepts of quasineutrality and collective behavior in plasmas. 5. Perform analysis of electrothermal accelerator at a given frozen flow fraction 6. Apply Maxwell equations in differential and integral forms to solve basic electromagnetism problems 7. Perform analysis of space-charge limited electrostatic accelerator in ion acceleration zone, in deceleration zone, and in neutralization zone. 8. Perform analysis of motion of charged particles in crossed electric and magnetic fields 9. Derive and apply modified forms of Ohm's law in two-component moving plasma in presence of magnetic field. 10. Perform elementary analysis of crossed-field electromagnetic accelerator with small Hall parameter 11. Perform elementary analysis and calculate basic parameters of Hall effect accelerator. 12. Demonstrate fundamental understanding of the differences of acceleration

concepts used in Hall effect and in electrostatic accelerators. 13. Calculate body force in magnetoplasmadynamic accelerator. Credits: 3.00

AAE 53500 - Propulsion Design, Build, Test

Credit Hours: 3.00. Intensive one-semester treatment of the aerospace propulsion component development process. Derivation of design requirements from mission objective to detailed components; the design process. Standard methods for thermostructural, life, performance, and combustion stability design analysis; combustor design. Experimental procedures; fabrication; test. Special topics according to student interest.

Credits: 3.00

AAE 53700 - Hypersonic Propulsion

Credit Hours: 3.00. Analysis of advanced high speed air breathing propulsion concepts for hypersonic flight. Missions and trajectories. Engine/airframe integration. Aerothermodynamic analysis of ramjets, scramjets, and oblique detonation wave engines. On- and off-design of compression inlets and minimum length nozzles. Cryogenic fuels and skin cooling. Ram accelerator ballistic launch concepts.

Learning Outcomes: 1. Develop understanding of high-speed inlet systems. 2. Develop understanding of mixing systems employed in airbreathing engines. 3. Develop understanding of turbine-based combined cycle systems. 4. Develop understanding of detonative-based propulsion systems. 5. Develop understanding of ducted rockets. 6. Develop understanding of ramjet and scramjet propulsion systems.

Credits: 3.00

AAE 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (ME 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

AAE 53900 - Advanced Rocket Propulsion

Credit Hours: 3.00. Generalized internal compressible and incompressible flows. Thermochemistry and heat transfer in rocket applications. Advanced topics in solid rocket motor performance and internal ballistics. Liquid rocket engine cycle analysis and turbopump design. Combustion of liquid and solid propellants. Hybrid rockets and thermal-nuclear engines.

Credits: 3.00

AAE 54500 - Dynamic Behavior of Materials

Credit Hours: 3.00. Materials' responses to high-rate loading are different from their quasi-static behavior. Applications of materials in structures subjected to impact loading from events such as bird strike require the understanding of dynamic material behavior. Such high-rate materials behavior is not available in standard materials handbooks or design manuals. This course introduces stress wave propagation in solids, which is the foundation to characterization and understanding of high-rate response of materials. Then, the theoretical background and working principles of high-rate experimental methods are presented to characterize the material response under high-rate loading conditions. Finally, rate-dependent material models are introduced to describe the dynamic material behavior and deformation mechanisms.

Learning Outcomes: 1. Express local equations of motion. 2. Derive one dimensional wave equations in solid materials. 3. Calculate elastic wave speeds in solids with and without constraints. 4. Understand and calculate local stresses as an elastic wave passes through an interface. 5. Understand and predict local stress concentrations resulted in from wave interactions. 6. Utilize elastic waves as loading methods and as diagnostic methods. 7. Design experiments to measure dynamic behavior of materials. 8. Determine dynamic yield strength of ductile materials in Taylor impact tests. 9. Determine plastic wave speeds in ductile material under intensive loading. 10. Understand shock wave propagation in solids. 11. Understand physics and calculate shock properties of materials. 12. Understand physical origins of plastic waves and shock waves. 13. Understand rate-dependent material models. 14. Conduct a thorough search of literature on a subject of interest. 15. Understand the critical issues of the subject of interest. 16. Identify research gaps in the subject of interest. 17.

Present effectively a summary of the literature survey. Credits: 3.00

AAE 54600 - Aerospace Structural Dynamics And Stability

Credit Hours: 3.00. Dynamics of continuous systems: rod, beam, frame, and plate structures. General structural principles: virtual work, Hamilton's principle, Lagrange's equation, and Ritz method for discrete approximations. Modal analysis: eigenanalysis, mode shapes, mode superposition, and complex modes. Nonlinear vibrations: phase plane, Poincare, bifurcation plots, and chaos. Stability of the motion: classification of problems, follower loads, aerodynamic loads, divergence, flutter, pulsating compression, and gyroscopic systems.

Credits: 3.00

AAE 54800 - Mechanical Behavior Of Aerospace Materials

Credit Hours: 3.00. This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smartphones. In fact, breakthroughs with material research are often accompanied by rapid advancements in technology. Thus, it is paramount for all engineers to have an understanding of the structure and behavior of materials. In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and, ultimately, failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms. Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal-material levels and their use in explaining the deformation and failure characteristics in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of aerospace materials: metal alloys, ceramic-matrix composites, and fiber-reinforced polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, creep, and failure mechanisms; design criteria; special topics. We will attempt to have minimal overlap with AAE 55400, Fatigue of Structures and Materials. Therefore we will not cover fracture, fatigue, or stress concentrators.

Learning Outcomes: 1. Express vector and tensor equations using indicial notation. 2. Express crystallography according to Miller indices and define slip systems in basic crystal structures. 3. Calculate and understand the physical basis of elastic anisotropy. 4. Understand, calculate, and use basic states of stress and yield criteria. 5. Define and understand the physical basis of point, line, and area defects in crystalline materials. 6. Calculate the strain fields, stress fields, and energy of dislocations, in addition forces between dislocations. 7. Understand dislocation motion as well as interactions between dislocations. 8. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 9. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 10. Understand origins of twinning, stacking faults, and the shape memory effects. 11. Understand physics and calculate strengthening influence of solutes, precipitates, grain boundaries, and strain hardening. 12. Understand physical origins of creep, calculate creep using Larson-Miller expressions, and use creep deformation mechanism map. 13. Understand origins of residual stress and apply to constrain problems. 14. Understand and apply statistical approaches to identify probability of failure and property variations. 15. Define and classify polymer structures. 16. Understand viscoelasticity and calculate behavior using classical models. 17. Distinguish physical mechanisms of polymer deformation, crazing, and fracture. 18. Express stiffness and strength of fiber reinforced composite structures. Credits: 3.00

AAE 55000 - Multidisciplinary Design Optimization

Credit Hours: 3.00. Basics of numerical optimization: problem formulation, conditions of optimality, search direction, and step length. Calculus-based techniques for univariate and multivariate optimization. Constrained and unconstrained optimization methods. Global optimization methods. Multi-objective optimization: Pareto optimality and approaches. Recent multidisciplinary design optimization techniques:

approximations, response surface methodology, and collaborative optimization. Applications of various methods and techniques to representative engineering problems, culminating in a final project. Ability to solve mathematical problems with MATLAB and IMSL and similar software helpful.

Credits: 3.00

AAE 55100 - Design Theory And Methods For Aerospace Systems

Credit Hours: 3.00. Introduction to design theory, aerospace design process, design specification and requirements, concept generation and selection, design decomposition, improving designs, process design, and concurrent engineering. Design for assembly/manufacture. Projects allow for application and critical analysis of design methods.

Credits: 3.00

AAE 55200 - Nondestructive Evaluation Of Structures And Materials

Credit Hours: 3.00. Overview of methods employed for nondestructive evaluation of structures and materials taught in the context of damage tolerant structural analysis. Major inspection topics include: radiography, ultrasonics, eddy current, penetrant, magnetic, and visual/optical techniques. Other new emerging inspection techniques also are discussed. Offered in alternate years.

Credits: 3.00

AAE 55300 - Elasticity In Aerospace Engineering

Credit Hours: 3.00. A basic course in the theory of elasticity with emphasis on understanding the fundamental principles and solution techniques used in the stress analysis of structures. Cartesian tensors. Governing equations for linear elasticity. Rigorous derivation of beam and plate equations from the three-dimensional elasticity equations. Torsion. Thermoelasticity. The stress functions and complex functions approaches to two-dimensional problems. Energy methods and approximate solutions. Three-dimensional problems. Knowledge of differential equations assumed.

Learning Outcomes: 1. Give student an in-depth background in mechanics of solids including large deformation, and the ability to perform stress analyses in elastic bodies, especially two-dimensional bodies. Credits: 3.00

AAE 55400 - Fatigue Of Structures And Materials

Credit Hours: 3.00. Development and application of methods for predicting the fatigue life of structural components. Characterization and response of materials to cyclic loading. Fatigue resistant design of aerospace structures. Both fatigue crack initiation and crack propagation concepts are discussed.

Credits: 3.00

AAE 55500 - Mechanics Of Composite Materials

Credit Hours: 3.00. Current and potential applications of composite materials. Review of elasticity of anisotropic solids. Methods for determining mechanical properties of heterogeneous materials. Static and dynamic analyses of laminated composites. Fracture and fatigue of laminates. Reliability, testing, and design of composites.

Credits: 3.00

AAE 55600 - Aeroelasticity

Credit Hours: 3.00. The study of the effect of aerodynamic forces of flexible aircraft. Static aeroelastic problems; control effectiveness; lift effectiveness; divergence. Dynamic aeroelasticity; classical flutter; an introduction to stability augmentation with controls. A review of standard and modern numerical solution techniques; the k-method, the British or p-k method.

Credits: 3.00

AAE 55800 - Finite Element Methods In Aerospace Structures

Credit Hours: 3.00. Introduction to the use of advanced finite element methods in the calculation of deformation, strain, and stress in aerospace structures. Topics include: 1-D, 2-D, 3-D, and axisymmetric elements, isoperimetric element formulation, convergence, treatment of boundary conditions and constraints. Special topics include stability, dynamic analysis, and nonlinear material behavior. Emphasis is on the theoretical knowledge of the finite element method. Applied experience is gained by solution of aerospace structural analysis problems through use of professional software.

Credits: 3.00

AAE 56000 - System-Of-Systems Modeling And Analysis

Credit Hours: 3.00. Introduction to features of system-of-systems problems; problem definition tools; role of complexity; network topology analysis and agent-based simulation models; architecture analysis; metrics for multi-stakeholder problems; semester team projects allow students to exercise and critique such methods for analyzing system-of-systems problems. Some background in probability and statistics (e.g. random variables, probability density and distributions, sampling methods) is expected.

Learning Outcomes: 1. Introduce to modeling and analysis techniques for system-of-systems (SoS) problems in engineering. 2. Center on students' ability for understanding, modeling, and analyzing SoS problems, which consist of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. These problems are often large-scale and interdisciplinary, involving systems and behaviors found in diverse fields such as engineering, economics, social science, policy, etc. 3. Present developments in addressing system-of-systems problems, describes criteria, lexicon, and analysis methodology for their study, and, through semester-long team projects, allows students to explore the many unknowns that persist in this emerging field. 4. Know the major subjects covered: distinguishing traits of and behaviors of SoS problems, complexity and complex adaptive systems, agent-based modeling, modern network theory and analysis tools, modeling for decision-making, and exploratory modeling. Credits: 3.00

AAE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (IE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

AAE 56400 - Systems Analysis And Synthesis

Credit Hours: 3.00. State space methods of analysis and design of continuous and discrete-time linear systems. Coordinate transformations, Jordan canonical forms, digital control, controllability and observability of continuous and discrete systems. Liapunov stability analysis. The linear regulator problem of optimal control via Hamilton Jacobi theory. Pole assignment, stabilizability, detectability. State estimation for deterministic models. Minimal order observers. MA 51100 recommended concurrently.

Credits: 3.00

AAE 56700 - Introduction To Applied Stochastic Processes

Credit Hours: 3.00. An introductory course in the concept of a discrete and continuous stochastic process based upon physical phenomena that originally gave rise to the specific stochastic models that are studies. Spectral analysis, response of time invariant systems to noise inputs. Estimation theory, Kalman and Winer filtering.

Credits: 3.00

AAE 56800 - Applied Optimal Control And Estimation

Credit Hours: 3.00. This course introduces students to analysis and synthesis methods of optimal controllers and estimators for (stochastic) dynamical systems. The topics in this course include a review of probability and stochastic processes, classical estimation techniques, Pontryagin's maximum principle, dynamic programming. Linear Quadratic Regulator problems (LQR), Kalman filter, duality of LQR with Kalman filter, Linear Quadratic Gaussian (LQG), and a range of engineering applications.

Learning Outcomes: 1. Study analysis and synthesis methods of optimal controllers and estimators for stochastic dynamical systems. 2. Present a review of probability and random processes, calculus of variations, dynamic programming, Maximum Principles, optimal control and estimation, duality, and optimal stochastic control. 3. Learn how to effectively communicate their ideas and how to formulate a problem and solve it. Credits: 3.00

AAE 57100 - Complex System Safety

Credit Hours: 3.00. The objective of this course is to provide students with the ability to assess the safety risk posed by engineering systems, taking into consideration hardware, software, human, and organizational factors, and using risk

assessment tools that are used in practice in industry.

Learning Outcomes: 1. Describe several frameworks and theories for assessing and improving system safety. 2. Describe key elements of published system safety and risk assessment studies. 3. Describe different models used to model accidents. 4. Apply different models to model accidents. 5. List the steps in developing a system safety plan. 6. Recognize the extent of problems in system safety and risk assessment. 7. Describe the role of various systems and factors in creating safety and in causing errors and adverse events. 8. Discuss problems and issues in measuring and reporting safety. 9. Demonstrate knowledge of the basics of conducting an incident or accident investigation. 10. Design solutions to improve safety. 11. Discuss the ethical, legal, and regulatory implications related to safety. 12. Compare the different types of instruments/methods available to assess system safety. 13. Critique the use of commonly used system safety and risk assessment techniques in specific applications. Credits: 3.00

AAE 57500 - Introduction To Satellite Navigation And Positioning

Credit Hours: 3.00. Introduction to radio-navigation techniques, using the Global Navigation Satellite System (GNSS); GNSS signal structures; satellite search and acquisition; satellite tracking; coordinate systems and time; observations; atmospheric effects; and position-velocity-time (PVT) solutions.

Credits: 3.00

AAE 59000 - Projects In Aeronautical Engineering

Credit Hours: 1.00 to 6.00. Topics vary - projects in Aeronautical Engineering. Permission of instructor required.

Credits: 1.00 to 6.00

AAE 59500 - Aerospace Seminar

Credit Hours: 0.00. An interdisciplinary seminar that provides a forum for invited speakers and staff to discuss new developments in practice and current research in aerospace engineering.

Credits: 0.00

AAE 59700 - Independent Study In Aerospace Engineering

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Special Topics in Aerospace Engineering course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

AAE 60700 - Variational Principles Of Mechanics

Credit Hours: 3.00. Basic concepts of analytical mechanics, calculus of variations, Hamilton's equations, Hamilton-Jacobi theory, canonical transformations. Offered in alternate years. Prerequisite: AAE 50700.

Credits: 3.00

AAE 61300 - Viscous Flow Theory

Credit Hours: 3.00. Compressible, laminar boundary layer theory; Buseman and Crocco integrals; skin friction and heat transfer. Introduction to turbulent boundary layers and transition phenomena. Advanced boundary layer theory; the method of inner and outer expansions. Boundary layers with chemical reaction; applications to hypersonic flow and combustion. Prerequisite: AAE 51100.

Credits: 3.00

AAE 61500 - Aeroacoustics

Credit Hours: 3.00. (ME 61500) Quantitative measures of sound (decibel) scales, spectra, energetics of acoustic motions, and measurement techniques. The wave theory of sound (basic equations and properties, sound propagation in homogeneous and inhomogeneous media, one-, two-, and three-dimensional sound fields, and distributed sources). Effects of source movement. Aerodynamic noise generation-acoustic analogy (Lighthill's equation and Ffowcs Williams-Hawkins equation). Introduction to Computational Aeroacoustics (CAA). Noise from turbulent shear flows (jet noise, cavity noise, and noise from flow over objects). Noise from turbomachinery, propellers, and rotors. Prerequisite: AAE 51100 or ME 50900 or ME 51300.

Credits: 3.00

AAE 62400 - Laminar-Turbulent Transition

Credit Hours: 3.00. Instability mechanisms, such as Kelvin-Helmholtz, Tollmien-Schlichting, Gortler, and crossflow. Secondary instabilities. Nonlinear and nonparallel effects; the Parabolized Stability Equations; receptivity; transition prediction. Effects of compressibility, heating, roughness, turbulence, noise, curvature, etc. Turbulent spots and the extent of transitional flow. Prerequisite: AAE 51100.

Credits: 3.00

AAE 62600 - Turbulence And Turbulence Modeling

Credit Hours: 3.00. Physical description of turbulence. Reynolds averaged equations. Scaling of basic turbulent flows. Homogeneous turbulence, spectra and two-point correlations. Hierarchy of turbulence models, including zero-, one-, and two-equation models, Reynolds stress models, large eddy simulations, and direct numerical simulations. Additional topics, such as compressibility effects on turbulence and probability density function methods, as time allows. Prerequisite: AAE 51100.

Credits: 3.00

AAE 63200 - Advanced Orbital Dynamics

Credit Hours: 3.00. Discussion of more advanced concepts in astrodynamics. Includes fundamental theories from celestial mechanics, as well as trajectory determination and perturbation analysis with application to the motion of Earth-orbiting and interplanetary spacecraft. Assumes experience with the two-body problem. Offered in alternate years. Prerequisite: AAE 50700, AAE 53200.

Credits: 3.00

AAE 64200 - Graduate Professional Practice

Credit Hours: 0.00. Practice in industry and comprehensive written reports of this practice. Approval by the student's adviser or major professor and by the Graduate professional practice administrator. Prerequisite: Approval by the student's adviser or major professor and by the Graduate professional practice administrator. Permission of instructor required.

Credits: 0.00

AAE 64600 - Elastic Wave Propagation

Credit Hours: 3.00. Elastic wave propagation in rods, beams, and plates. Wave motion in semi-infinite bodies; Rayleigh, Lamb and Love waves. Pochhammer-Chree theory for rods. General properties of dispersive waves and approximation techniques. Impact. Wave front and ray methods. Introduction to wave propagation in anelastic and nonhomogenous media, and to large amplitude and shock waves. Prerequisite: AAE 55300 or ME 56300.

Credits: 3.00

AAE 64800 - Modeling Damage And Strengthening Mechanisms In Materials

Credit Hours: 3.00. The usage of materials is the backbone of engineering practice. Yet, advances in materials have stagnated due to overly conservative approaches, trial-and-error testing, and long qualification times. Material modeling offers tremendous opportunities to address these issues. This class offers advanced modeling strategies at the intersection of mechanics and materials science for both polycrystalline and composite materials. The course topics are defined as follows: First, advanced micromechanics analysis of modern engineering materials with emphasis on relating elastic microstructural phenomena to the mechanics of material behavior, via the Eshelby inclusion problem and its application to fiber reinforced composites. Second, classical plasticity is summarized via phenomenological and mathematical formulation of the constitutive laws, including yielding, yield surface; von Mises, Tresca yield criteria; Drucker's stability postulate; strain or work hardening, normality rule, perfect plasticity, and stress-strain law. Third, crystal plasticity is discussed, specifically physical and mathematical foundation for plasticity in crystalline materials, with a detailed description of the Bishop and Hill implementation of the Taylor model for deformation of polycrystals. Lastly, concepts of dislocations leading to strengthening mechanisms in metals are discussed: (i) by studying the anisotropy of material and elastoplastic properties at crystal level, microstructural basis for deformation in metals, polymers, and ceramics and (ii) failure mechanisms and toughening in metals, with primary emphasis on work/strain hardening, solid solution hardening, precipitate hardening, and grain boundaries. The course will be comprised of three projects, where the student chooses the topic of the third and final project. Prerequisite: AAE 55300 or equivalent.

Learning Outcomes: 1. Express displacement field for an arbitrary elliptical inclusion via a Green's function. 2. Prove the stress/strain fields within inclusion is uniform. 3. Calculate Eshelby interaction tensor for arbitrary shape inclusion. 4. Express the stress/strain fields external to the inclusion. 5. Implement Eshelby problem via Mori-Tanaka approach and apply to stiffness of composites. 6. Express interaction energy of inclusion. 7. Understand physical basis of plasticity. 8. Express yield surface and associated criteria via stress invariants and on

the Pi-plane. 9. Express flow rules for evolution of the yield surface and implement into principal of virtual velocities. 10. Express convexity and normality constraints. 11. Express crystal orientation as a series of rotations and express via a pole figure representation. 12. Identify texture of materials 13. Resolve shear stress on slip systems during deformation of single crystals and calculate the velocity gradient. 14. Apply equilibrium and compatibility constraints to plastic flow of polycrystalline materials. 15. Calculate the Taylor factor, geometric hardness of a polycrystalline material. 16. Express grain orientation evolution, via an exponential mapping. 17. Implement the Taylor model within a Bishop and Hill implementation to express texture evolution of polycrystalline materials. 18. Understand and express kinetics (strain rate and temperature) into deformation via thermodynamic expressions. 19. Model work hardening in crystalline materials. 20. Understand the physical origins and model incompatibilities. 21. Define grain boundary structure and their affect on mechanical behavior. 22. Apply concepts learned from this class into a research project of the student's choice. Credits: 3.00

AAE 65400 - Fracture Mechanics

Credit Hours: 3.00. Methods of stress analysis in elastic media containing cracks. Fracture criteria. The strain energy release rate and J-integral. Crack tip plasticity. Interface cracks. Cracks in anisotropic solids. Bending of cracked plates. Dynamic crack propagation. Prerequisite: AAE 55300.

Credits: 3.00

AAE 66600 - Nonlinear Dynamics, Systems, And Control

Credit Hours: 3.00. Fundamental concepts and tools that are useful in the analysis of nonlinear systems and in the design of controllers and estimators for such systems. Results are illustrated by, and applied to, aerospace/mechanical systems. Prerequisite: AAE 56400.

Credits: 3.00

AAE 66800 - Hybrid Systems: Theory And Analysis

Credit Hours: 3.00. Hybrid systems are dynamical systems with both continuous and discrete dynamics and they are finding increasing applications in a variety of engineering fields, even in scientific fields such as biological systems. This course will present the recent advances in modeling, analysis, control, and verification of hybrid systems. Topics covered in this course include the following aspects of hybrid systems: continuous-time and discrete-event models; reachability analysis; safety specifications and model checking; optimal control and estimation of hybrid systems; stability analysis and verification tools; stochastic hybrid systems; numerical simulations; and a range of engineering applications. Prerequisites: AAE 56400.

Learning Outcomes: 1. Understand the basic concepts and theory of hybrid systems. 2. Develop ability to analyze these systems using numerical simulation tools. 3. Understand the current state of art of hybrid systems research frontier. 4. Develop ability to apply this knowledge to a problem. Credits: 3.00

AAE 67500 - Advanced Signals And Systems For Satellite Navigation

Credit Hours: 3.00. Fundamental theory of ranging signal design. Generation of pseudorandom noise. Methods for detecting, tracking, and estimating delay using ranging signals. Probability of detection, probability of false alarm, and tracking threshold derived from a stochastic signal model. Models for multiple access, quantization, clock and multipath errors. Examples drawn from present-day Global Navigation Satellite Systems (GNSS). Prerequisites: ECE 60000, AAE 56700, or equivalent (Random Variables and Stochastic Processes).

Learning Outcomes: 1. Understand current literature in radio navigation signal processing. 2. Develop signal processing algorithms for radio navigation applications. 3. Predict performance of radio navigation signal processing algorithms. 4. Implement radio navigation signal processing algorithms in a software-defined radio, using a programming language such as MATLAB. Credits: 3.00

AAE 69000 - Advanced Aeronautical Engineering Projects

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor

required.

Credits: 1.00 to 6.00

AAE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

AAE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Weldon School of Biomedical Engineering (Graduate)

Website:

https://engineering.purdue.edu/BME/Academics/Graduate

Department/School Head

Kevin J. Otto

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Continuing Lecturer
Karen Alfrey (PUI) Edward Bartlett Charles A. Bouman Andrew Brightman David Cappelleri Shelley Claridge Jean Chmielewski Eugenio Culurciello Edward J. Delp Bradley Duerstock Ulrike Dydak Craig Goergen Hector Gomez Michael G. Heinz Sherry L. Harbin Fang Huang Young Kim Nan Kong Michael R. Ladisch Chi Hwan Lee Hyowon Lee	Adrian Buganza-Tepole Alexander Chubykin Meng Deng Uzay Emir Joaquín Goñi Steven Higbee (PUI) Julie Ji (PUI) Taeyoon Kim Tamara Kinzer-Ursem Jacqueline Linnes Dianne Little Julie C. Liu Sharon Miller (PUI) Sungsoo Na (PUI) Elsje Pienaar Vitaliy Rayz Joseph Rispoli Natalia Rodriguez Shreyas Sen Behzad Sharif Luis	Doug Brubaker (Adjunct) Deva Chan Jonathan Cody (Visiting) Maria Dadarlat Leopold (Leo) Green Krishna Jayant Adam Kimbrough Fiona Kolbinger Andrew Otte Sunghee Estelle Park Taimoor Hasan Qazi Matthew Scarpelli Rachel Surowiec (PUI) Alexandria Volkening Xiaoqian (Joy) Wang Matthew Ward Yi Xuan Li Zhan	Charles Babbs Jennifer Hatch (PUI)

Chien-Chi Lin (PUI) Aaron Lottes Georgia Malandraki Ramses Martinez Kevin Otto Kinam Park Jenna Rickus J. Paul Robinson Cagri Savran Anne Sereno Vladimir Shalaev Riyi Shi Preeti M. Sivasankar Lia A. Stanciu-Gregory Steven Steinhubl Ramaswamy Subramanian Daniel Suter Matthew Tews David H. Thompson David Umulis Pavlos	Solorio Yunjie Tong Mohit Verma Diane Wagner (PUI) Dong Xie (PUI)		

Vlachos Juan Wachs Joseph Wallace (PUI) George R. Wodicka Yoon Yeo Hiroki Yokota (PUI) Ken Yoshida (PUI)			

Academic Programs

Masters and Ph.D. Programs:

The Weldon School of Biomedical Engineering at Purdue University is transforming the future of healthcare. Building on a rich history of engineering prowess, innovation and collaboration, we are persistently pursuing advances in medical technologies and healthcare delivery. By innovating at an accelerated pace, integrating perspectives to solve real-world challenges, and equipping and propelling the next generation of biomedical engineers, Purdue Biomedical Engineering is making giant leaps toward the future of healthcare.

Biomedical Engineering Program, MSBME

Biomedical Engineering Program, PHD

Regulatory Affairs and Regulatory Science for Medical Devices, Post-Baccalaureate Certificate

BME 50000 - Biomedical Engineering Graduate Seminar

Credit Hours: 0.00. A -0- credit hour graduate seminar course consisting of weekly, one hour technical presentations by Department of Biomedical Engineering and other engineering faculty at IUPUI, researchers from local and national academia, representatives from industry and peer graduate students in the BME Department. These seminars introduce graduate BME students to a wide variety of bioengineering related topics in academic research and commercial industries. The students are exposed to research questions, methodologies and technical developments both inside and outside of their topical concentration areas. Through open inquiry, discourse and application of the Socratic method the course moderator helps the BME graduate students enhance and refine their critical thinking and technical presentation skills. Permission of department required.

Credits: 0.00

BME 50100 - Multivariate Analyses In Biostatistics

Credit Hours: 3.00. This course focuses on fundamental principles of multivariate statistical analyses in biostatistics, including multiple linear regression, multiple logistic regression, analysis of variance, and basic epidemiology. The fundamental theories are applied to analyze various biomedical applications ranging from laboratory data to large-scale epidemiological data.

Learning Outcomes: 1. Understand fundamental concepts in multivariate regression analyses. 2. Translate research questions into suitable multivariate frameworks. 3. Design studies with appropriate statistical power. 4. Compute and interpret appropriate statistical estimates from multivariate analyses. 5. Use a major statistical software package (e.g. STATA, SAS, SPSS, and R) to perform large-size data analyses. Credits: 3.00

BME 51000 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied, both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BME 51100 - Biomedical Signal Processing

Credit Hours: 3.00. An introduction to the application of digital signal processing to practical problems involving biomedical signals and systems. Topics include: overview of biomedical signals; filtering to remove artifacts; event detection; analysis of waveshape and waveform complexity; frequency domain characterization; modeling biomedical signal-generating systems; analysis of non-stationary signals; pattern classification and diagnostic decisions, MATLAB is used throughout to apply the theory and techniques discussed to

biomedical signals.

Learning Outcomes: 1. Understand practical problems faced in objective analyses of biomedical signals. 2. Understand the underlying physiological and anatomical factors that are relevant for numerous types of biomedical signals. 3. Understand the theoretical background underlying the use of digital signal processing for biomedical applications. 4. Understand the practical benefits and limitations of various digital signal processing approaches and identify the best solution for specific problems. 5. Implement appropriate signal processing algorithms for practical problems involving biomedical signals and systems 6. Propose, carry out, orally present, and write up in a conference proceedings format a biomedical-research mini project using- signal processing algorithms. Credits: 3.00

BME 51500 - Practical MRI And Applications

Credit Hours: 1.00. This course covers basic theory and practical training for magnetic resonance imaging (MRI). Weekly labs allow students to directly train on an MRI system within the Purdue MRI Facility. Weekly lectures are provided on a broad range of applied and relevant topics, including image formation and contrast, pulse sequence basics, artifacts, advanced sequences, and safety. The course is ideally designed for students who want to make use of MRI to advance their research.

Learning Outcomes: 1. Describe the fundamentals of magnetic resonance imaging. 2. Understand safety concerns associated with operating an MRI system. 3. Demonstrate proficiency in the operation of one of the MRI systems on campus. Credits: 1.00

BME 52100 - Biosensors: Fundamentals And Applications

Credit Hours: 3.00. (ABE 56000) An introduction to the field of biosensors and an in-depth and quantitative view of device design and performance analysis. An overview of the current state of the art to enable continuation into advanced biosensor work and design. Topics emphasize biomedical, bioprocessing, environmental, food safety, and biosecurity applications.

Credits: 3.00

BME 52500 - Neural Engineering

Credit Hours: 3.00. Neural engineering is an emerging engineering discipline that combines the various disciplines of engineering with the biological, physical and material sciences to find the means to access, understand, manipulate, and perhaps enhance the nervous system and the information it contains. The aim of this course is to provide an introduction to the field of neural engineering and will start with the introduction of the neuron, the bioelectric phenomenon and the neural/electronic interfaces placed in the extracellular space on the peripheral nervous system. These topics will be reinforced through hands-on practical experiments using electrodes for stimulation and recording.

Credits: 3.00

BME 52600 - Cardiac Electrophysiology

Credit Hours: 3.00. This course will introduce the basic principles of cardiac-generated bioelectricity as measured at cellular, extracellular and body surfaces. The generation, detection and classification of abnormal cardiac rhythms will be emphasized. Clinical and engineering principles of relevant electro-therapies will also be studied including cardiac pacemakers, defibrillators and ablation therapies involving cardiac mapping and a variety of ablative energy sources. Modern signal processing methods as applied to electrocardiography will also be presented. Permission of department required.

Credits: 3.00

BME 52700 - Implantable Systems

Credit Hours: 3.00. The course material and lectures will focus upon how the anatomy and physiology of the target organ system impacts the design specifications for biomedical and implants and the biosensors that can be part of the command and control strategy for the implant. The course material is roughly organized according to motor (skeletal, cardiac) and sensory (vision, audition, olfaction, touch) and visceral (lungs) organ systems. For each topic area there will be a brief introduction to the physiology and neuroanatomy of the target organ system or biological environment (e.g. subcutaneous implants). Each topic area will have companion lectures demonstrating the extent to which biomedical engineers have been able to fabricate functional replacement (prosthetic) or assistive (orthotic) devices and tissue interfaces (electrodes). For example, issues related to performance, powering, communications, command control and user interfaces for auditory and visual neuroprosthesis are presented immediately following lecture materials describing these organ systems.

Although not central to the course content, tissue and cellular responses to materials will be stressed throughout the semester. Topics will include normal wound healing processes, host response to implants and general biocompatibility. Lectures will emphasize fundamental principles of bioengineering as related to the design of implantable systems and will require student participation in classroom discussions. Permission of instructor required. Permission of department required.

Credits: 3.00

BME 52800 - Measurement And Stimulation Of The Nervous System

Credit Hours: 3.00. (ECE 52800) Engineering principles addressing questions of clinical significance in the nervous system: neuroanatomy, fundamental properties of excitable tissues, hearing, vision, motor function, electrical and magnetic stimulation, functional neuroimaging, disorders of the nervous system, development and refinement of sensory prostheses.

Learning Outcomes: 1. The ability to design and utilize models of neural systems to explain or predict physiologic behavior. 2. The ability to verbally present information related to measurement of the nervous system. 3. A systems-level understanding of the organization and operation of vision, audition, and motor function. Credits: 3.00

BME 53000 - Imaging Diagnostic Technologies For Medical And Biological Applications

Credit Hours: 3.00. This gateway course teaches the physics, engineering techniques associated with modern imaging and diagnostic tools for biological and medical applications. The course covers fundamental principles of radiology, optics, contrast generation (including genetically encoded probes and physiological indicators), image formation, detection, and analysis. The specific biomedical imaging modalities covered include: x-ray, computed tomography, nuclear medicine imaging, ultrasound, optical microscopy and tomography, and MRI. The specific biological microscopy modalities covered include: phase contrast, DIC, confocal microscopy, two-photon microscopy and super-resolution microscopy. The course also teaches the principle concepts of adaptive optics, light sheet microscopy, 4Pi microscopy, and modern super-resolution microscopy techniques (PALM/STORM, STED and ISM). To bridge the technology and physics with the latest diagnostic advances and biomedical discoveries, research progresses in specific biomedical applications are presented by leading experts in their respective biomedical field such as OCT, ultrasound, MRI, fluorescence microscopy, electron microscopy, concurrent MRI and optical functional imaging, and super-resolution fluorescence microscopy. This course also includes a crash sub-course on MATLAB programming including both introductory content and contents of MATLAB-C API and MATLAB-C-CUDA (GPU computing).

Learning Outcomes: 1. Describe fundamental principles, such as atomic structure, particle and tissue interactions, light and sound propagation, Huygen's principle, refraction, interference, diffraction and abbe's fundamental resolution limit, wave propagation of light and sound, Fresnel and Fraunhofer diffraction principles. 2. Describe the general concept of signal detection, principles of detectors, noise sources and leading development trend of detectors such as APD, PMT, CCD, CMOS, EMCCD and sCMOS. 3. Describe physical principles and considerations of instrumentation design in planar radiography, fluoroscopy, computed tomography (CT), positron emission tomography (PET), single photon emission computed tomography, ultrasound imaging and magnetic resonance imaging. 4. Understand, design and draw basic optical sketches for a simplified imaging system in either wide-field, or focused optical geometry. These imaging systems includes: Widefield, Phase Contrast, DIC, Confocal, Two photon, Adaptive optics (AO) two photon, 4Pi, I5M, SIM, RESOLFT, STED and PALM/STORM microscopy techniques. Credits: 3.00

BME 53700 - Experimental Methods In Biomedical Engineering

Credit Hours: 3.00. A 3-credit graduate level engineering course that covers issues related to general laboratory practice, techniques, instrumentation and analysis methods utilized by Biomedical Engineering researchers working in the life sciences. Both theoretical and practical aspects of experimental design and data analysis are covered using select examples from BME life science researchers here on the IUPUI campus. Most topic areas are presented from a decidedly analytical and engineering viewpoint. Students should have successfully completed courses in elementary analog electronic circuits and ordinary differential equations, and should be prepared to solve related homework problems using any available software programming tools (e.g. Matlab, Maple, Visual C, Visual Basic,

etc.). No prior knowledge of the biological sciences is required although participants would benefit from having taken a first year undergraduate course in Chemistry and/or Biology. Permission of instructor required. Permission of department required.

Credits: 3.00

BME 54000 - Biomechanics

Credit Hours: 3.00. Application of engineering mechanics to the study of normal and diseased musculoskeletal systems, including bone and soft tissue biology, musculoskeletal statics and dynamics, mechanical properties of biological tissues, and structural analysis of bone-implant systems. Permission of instructor required.

Learning Outcomes: 1. Explain how concepts in continuum mechanics and constitutive models apply to tissue biomechanics. 2. Solve basic biomechanics problems related to health and disease in bone and soft musculoskeletal tissues. 3. Investigate appropriate constitutive models based on tissue structure, physiology, and relevant assumptions. 4. Design a simplified computational biomechanics model of a tissue system of biomedical relevance. Credits: 3.00

BME 54200 - Cell & Tissue Mechanics

Credit Hours: 3.00. This course develops and applies scaling approaches and simplified models to biomechanical phenomena at molecular, cellular, and tissue level. Topics include: Molecular forces; Viscous drag; Brownian motion; Diffusion; Polymer mechanics; Polymer dynamics; Molecular motors; Cytoskeleton; Viscoelasticity; Membrane; Cell migration; Cell adhesion; Mechanobiology; Mechanotransduction; Elastic, viscoelastic. and poroelastic behavior or tissues & Cell-matrix interaction.

Learning Outcomes: 1. Solve analytically basic biomechanics problems or estimate their approximate solutions. 2. Utilize gained knowledge to interpret experimental results related to biomechanics and characterize them in the form of equations. 3. Develop computational models for biological systems or design experiments. Credits: 3.00

BME 54400 - Musculoskeletal Biology And Mechanics

Credit Hours: 3.00. This course will cover topics relevant to skeletal tissues (bone, tendon, ligament, cartilage and meniscus, muscle) including skeletal morphology, physiology, cell biology, development, adult osteogenesis, tissue mechanics, mechanical adaptation, failure (fracture) and fracture fixation. Students will gain a working understanding of tissue biology and physiology and mechanical principles governing tissue formation, maintenance and adaptation and failure. Prerequisites: BME 24100 or comparable mechanics course. Note: Students with advanced math backgrounds as well as biochemistry and cell biology may be prepared to take this course at the discretion of the instructor. Permission of instructor required.

Credits: 3.00

BME 54500 - Orthopaedic Tissue Mechanics

Credit Hours: 3.00. Orthopaedic tissues, such as bone, cartilage, tendon and ligament, serve functions that are largely mechanical in nature and that are critical for our health. This course is structured around classical topics in mechanics of materials and their applications in biomechanics and musculoskeletal tissues. Primary emphasis will be on the mechanical behavior of tissues, including elastic and failure properties as well as more advanced topics such as anisotropy, nonlinearity, viscoelasticity, poroelasticity, damage, and fatigue. Importantly, the theories used to describe these mechanical properties were originally developed for advanced engineering materials such as fiber composites, polymers, elastomers, hydrogels, etc. Thus, while the theories will be presented in the context of biological materials, potential applications are much broader. Tissue microstructure and its importance to the material properties will be covered. Mechanics of whole bones and implants (composite and asymmetric beam theories) and the mechanical function of native and artificial joints (contact mechanics, lubrication and wear) may also be discussed, time permitting. Some homework assignments will emphasize the use of experimental data to develop and test theoretical models via nonlinear curve fitting and optimization using Matlab. Students will receive an introduction to tissue mechanics literature to better understand how the concepts presented in class are used in the research setting. Permission of department required.

Credits: 3.00

BME 55100 - Tissue Engineering

Credit Hours: 3.00. (BMS 52300) Integrates the principles and methods of engineering and life sciences toward the fundamental understanding of structure-function relationships in

normal and pathological mammalian tissues, especially as they relate to the development of biological substitutes to restore, maintain, or improve tissue/organ function. Current concepts and strategies, including drug delivery, tissue and cell transplantation, bioartificial organs, and in vivo tissue regeneration are introduced, as well as their respective clinical applications. Permission of instructor required.

Credits: 3.00

BME 55300 - Biomedical Optics

Credit Hours: 3.00. Optical methods applied to address biological and biomedical problems. The course includes two parts: fundamentals of optical microscopy and advanced techniques that are currently used to probe and/or manipulate cell and tissue samples. Permission of instructor required.

Credits: 3.00

BME 55500 - Magnetic Resonance Imaging Theory

Credit Hours: 3.00. This course covers fundamental aspects of magnetic resonance imaging systems with an emphasis on theory, methodology, and instrumentation. Key principles are derived from the Bloch equations and Maxwell's equations. Topics include pulse sequences, signal acquisition, spatial encoding in k-space, image reconstruction, and tissue contrast. Major components of an MRI scanner are examined, including the static magnet, gradient and shim coils, transmit and receive chains, and radiofrequency coils and arrays. Learning outcomes are assessed by solving problem sets integrating theory with practical applications. As a final research project, students survey recent literature to identify a specialized topic of interest and deliver a peer-evaluated presentation to the class.

Learning Outcomes: 1. Formulate and solve MRI spin and relaxation problems using the Bloch Equations. 2. Formulate and solve MRI magnetic field problems using Maxwell's Equations. 3. Analyze radiofrequency coils with sources and passive elements. 4. Synthesize research knowledge from recent MRI literature. 5. Communicate a specialized topic related to MRI to an audience. Credits: 3.00

BME 55600 - Introduction To Clinical Medicine For Engineering Solutions

Credit Hours: 3.00. This course introduces students to the physiology and medicine underlying major human diseases likely to become research targets in biomedical engineering and medical device development. It encourages students to upgrade research target selection to include projects that promise to improve patient care, with a major emphasis on pathophysiology and disease mechanisms. The information and intellectual approach offered will help students recognize needs for engineering solutions to current challenges in medicine. The course also previews the intellectual content of medical school, including rigor and level of detail, for engineering students considering designing medical solutions or translational engineering research as a career, emphasizing the key "11-points" necessary for practical understanding of any disease: definition of the condition, causes, functional abnormalities, structural abnormalities, early signs, history and physical findings, differential diagnosis, special studies (lab, imaging, etc.), treatment strategy, specific steps of treatment, and follow up, as well as current clinical needs for innovation and research opportunities for the future. To avoid possible redundancy with the Weldon School undergraduate curriculum, focal areas of the course include topics and body systems not covered in BME 25600, including infectious diseases, cardiopulmonary diseases, hematology-oncology, and gastrointestinal diseases.

Learning Outcomes: 1. Describe the pathogenesis of selected diseases, including causes, abnormal anatomy, and abnormal physiology. 2. Describe the diagnosis of selected diseases, including the history, physical findings, laboratory workup, imaging, and special procedures. 3. Describe the treatment for selected diseases, including strategy, specific steps, drugs, surgery, and follow-up. Credits: 3.00

BME 56100 - Preclinical And Clinical Study Design

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly regulated environment. This course concerns the preclinical and clinical study design processes for obtaining FDA marketing approval for biomedical devices. Prior to marketing a medical device in the US, specific governmental approval is required dependent on the type of device and the risk associated. This course is part of a three-course series dealing with various aspect of regulatory science. Regulatory science considers the scientific and technical foundations that support the practical testing and regulations that ensure the safety and effectiveness of medical devices. This course covers the responsible conduct of clinical and preclinical research, including evaluation of device tissue interactions and how they may be studied with preclinical animal models to predict safety and performance in human clinical trials that are necessary to gain regulatory approval for marketing. In the section on ethics we will cover several topics related to responsible conduct of clinical and preclinical research, including informed consent, risk assessment and ethical

decisions, IRB oversight and ethical study design.

Learning Outcomes: 1. Understand and apply the various considerations and perspectives in designing and implementing a preclinical and clinical study strategy that will successfully lead to the marketing approval by a regulatory authority (e.g. FDA). 2. Follow a structured, iterative decision-making process for moral reasoning to reach a supported-conclusion regarding ethical dilemmas in engineering design and testing. Credits: 3.00

BME 56200 - Regulatory Issues Surrounding Approval Of Biomedical Devices

Credit Hours: 3.00. Medical devices are developed, manufactured, and distributed in a highly-regulated environment. This course primarily concerns the processes for obtaining FDA marketing approval or clearance for biomedical devices. Prior to marketing a medical device in the US, a specific governmental approval or clearance is required depending on the type of device and the risk associated with the device. This course is part of a three-course series dealing with various aspects of regulatory science. Regulatory processes for class I, II, and III devices, including combination devices, are covered with specific focus on 510(k) and PMA requirements. Approval requirements in the EU, Japan and other countries will also be briefly considered. Throughout the course, emphasis will be placed on regulatory science, regulatory strategy and principles of interacting with regulatory agencies.

Learning Outcomes: 1. Use the appropriate regulatory classification and pathway for any medical device in the U.S. 2. Describe the significance of each major component of a 510(k) submission. 3. Describe the significance of each major component of a PMA submission. 4. Develop awareness for the need to seek country-specific expertise to prepare submissions for countries outside the U.S. 5. Select the appropriate messages and clearly present, in both oral and written communication, in a mock FDA meeting. 6. Identify contents of a CER and know the strategy for writing a CER. Credits: 3.00

BME 56300 - Quality Systems For Regulatory Compliance

Credit Hours: 3.00. Medical devices are developed and manufactured in a highly regulated environment. This course will provide an introduction, overview, and systematic study of the intent and impact of the major federal laws and regulations governing the development, manufacturing, distribution, and marketing of medical devices. Focus is on understanding the critical elements of regulatory science and quality compliance from a design control perspective. Instruction and mentoring in regulatory science skills is provided by academics and industry representatives with expertise in their fields. This course is part of a three-course series.

Learning Outcomes: 1. Demonstrate a functional understanding of regulatory compliance for biomedical devices. 2. Use the main tools within the quality craft (Ex: confidence interval, control chart, difference between a T-test and F-test). 3. Demonstrate understanding of how the FDA approaches control. Credits: 3.00

BME 56400 - Ethical Engineering Of Medical Technologies

Credit Hours: 3.00. This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice.

Learning Outcomes: 1. Recognize and analyze personal and systemic ethical issues and challenges to ethical reasoning and social responsibility. 2. Engage in empathy building activities to enhance their abilities to understand and value the perspectives of other stakeholders. 3. Use a structured, iterative, and collaborative decision-making process that considers the perspectives of multiple stakeholders in optimizing a design decision when facing an engineering problem in design and development of medical devices or

assistive technologies that are ethical and socially responsible. Credits: 3.00

BME 57100 - Drug Delivery

Credit Hours: 3.00. This course explores the principles, techniques, and applications for therapeutic drug delivery and administration. This course will start with the fundamentals of drug administration: engineering principles such as diffusion and mass transport, with specific emphasis on transport in biological systems and barriers, pharmacokinetics, and drug distribution. We will examine the existing state of art in drug delivery systems: controlled release, biomaterials, and polymer-based delivery systems. Finally, we will also discuss the current field of biotechnology and biopharmaceutical: identification of novel drug targets, latest development in drug discovery, development, clinical trials, and product development, going from research to market using the latest examples from the pharmaceutical industry. Prerequisites: Basic mass transport background. Permission of instructor required.

Credits: 3.00

BME 58100 - Bio-Micro-Electro-Mechanical Systems (BioMEMS) & Biomedical Microsystems

Credit Hours: 3.00. This course covers key topics in bio-micro-electro-mechanical systems (BioMEMS) and micro-integrated systems. Properties of useful materials will be discussed in context to BioMEMS. Micro-electronics process modules used in the design and fabrication of BioMEMS and micro-integrated systems will be presented. Applications of these systems in a variety of medical practices will be discussed in detail.

Learning Outcomes: 1. Apply advanced engineering principles to model, solve, or analyze biomedical engineering problems. 2. Formulate appropriate and quantitative design specifications and evaluate potential design solutions in terms of realistic constraints. 3. Describe the challenges associated with interactions between bio-MEMS devices/strategies and living biology to address current unmet clinical needs. Credits: 3.00

BME 58200 - Advanced Biomedical Polymers

Credit Hours: 3.00. This is an advanced polymer course that provides the most recent development of biomedical polymers and their applications and covers a variety of biomedical areas such as in cardiovascular, dental, orthopedic, ophthalmologic and wound healing research. Drug, cellular and gene delivery are also covered. This course is designed for all the graduate students (M.S. and Ph.D. level) in biomedical areas. Permission of instructor required.

Credits: 3.00

BME 58300 - Biomaterials

Credit Hours: 3.00. Discussion of principles of biomaterial design, synthesis, and evaluation for various tissues/organs of the body, including orthopaedic/dental, cardiovascular, kidney, liver, lung, skin, nerve, and brain. Topics include fundamentals of materials science and engineering integrated into biology for the better regeneration of tissue. Offered in alternate years. Permission of instructor required.

Credits: 3.00

BME 59500 - Selected Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 60000 - Mentoring For Combined Degree (MD/PhD) Students In BME

Credit Hours: 0.00. Specialized course for M.D./Ph.D. students that is intended to maintain communication and orientation to the BME graduate program during the first two years of the combined degree program when students are completing medical school requirements on the Indianapolis campus. Requirements include attendance at one or more BME seminars on the West Lafayette campus; at least two research planning sessions with BME faculty members, BME graduate program coordinator, or assistant head; and participation in one additional graduate program activity. Permission of department required. Prerequisite is admissions to the Combined MD/PhD Degree program.

Credits: 0.00

BME 64600 - Deep Learning - Theory And Practice Of Deep Neural Networks

Credit Hours: 3.00. This course teaches the theory and practice of deep neural networks from basic principles through state-of-the-art methods. The class blends hands-on programming, using a variety of state-of-the-art programming frameworks, with theoretical treatment based on current literature. Implementation will emphasize the use of the Pytorch language and the use of dynamic computational graphs. Some previous experience with optimization techniques is important for success in the course.

Learning Outcomes: 1. Understand how to design a neural network architecture that is appropriate for a wide range of specific applications. 2. Create an efficient implementation of a wide range of standard neural network architectures in Pytorch. 3. Use neural networks to solve applications problems in classification, regression and data generation. 4. Understand how the fundamental theory of optimization can be used to efficiently train neural networks. 5. Understand the trade-offs between optimization techniques and how these techniques can be selected to achieve the best neural network training. 6. Understand and use current theory of neural network performance. 7. Understand the limitation of existing neural network theory and the likely directions of future research. Credits: 3.00

BME 65500 - Multiscale Modeling In Biomedical Engineering

Credit Hours: 3.00. This is a 600-level course that will focus on current frontiers in modeling multiscale phenomena. The course is intended for graduate students interested in advanced computational modeling. Traditional modeling approaches focus on one scale, e.g. macroscale continuum models or microscale molecular dynamics models, population scale epidemiology, whole host biology, or single cell signaling dynamics. These models are remarkably successful in engineering applications where the smaller scales can be modeled by relatively simple constitutive relations or in analyses of microscopic behavior where it can be assumed that the process is homogeneous at larger scales. This one-scale approach, however, is not well suited for problems with complex hierarchy of spatial and time scales or with population heterogeneity, such as those common in biomedical engineering. For example, there are disparate time scales in the progression of an atherosclerotic plaque or a range of spatial scales affecting the functions and treatment of biological tissues and organs. The course will introduce state-of-the-art modeling techniques, address their limitations and review emergent papers that attempt to address multiscale modeling. Examples of biomedical problems involving disparate scales in time and space will be discussed. The course will discuss the following topics specifically for multi-scale models: multiscale model construction, coupling solutions at disparate scales, data integration, sensitivity and uncertainty analyses, and model verification.

Learning Outcomes: 1. Identify and articulate multi-scale phenomena in biomedical systems. 2. Analyze and discuss a variety of multi-scale modeling techniques. 3. Identify and implement appropriate multi-scale techniques for a defined biomedical system. 4. Quantitatively evaluate multi-scale model results (uncertainty quantification, sensitivity analysis, verification and validation). Credits: 3.00

BME 68300 - Polymers In Biomedical And Pharmaceutical Systems

Credit Hours: 3.00. This course is designed to provide backgrounds in basic polymer chemistry, synthesis, characterization, solution properties, and recent advances in polymers for applications in drug delivery, biomedical devices, tissue engineering, biotechnology, and nanotechnology.

Learning Outcomes: 1. Understand polymer synthesis and characterization techniques. 2. Utilize Flory-Huggins theory of solutions to describe the polymer free entropy and enthalpy. 3. Use thermodynamics to describe the design of smart polymer systems. 4. Describe the properties that make a material biocompatible. 5. Understand how to design drug delivery systems. 6. Design experiments to characterize nano-scale polymeric platforms. Credits: 3.00

BME 69000 - Seminar In Biomedical Engineering

Credit Hours: 0.00. Seminar course covering a broad range of current research topics spanning Biomedical Engineering. Seminar presentations by representatives from industry and faculty from Purdue University and other external institutions. Required of Biomedical Engineering graduate students at Purdue; M.S. and Ph.D. students must complete two and four semesters (respectively) prior to graduation.

Credits: 0.00

BME 69500 - Advanced Topics In Biomedical Engineering

Credit Hours: 1.00 to 3.00. This course is designed primarily for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of an advanced course. Permission of instructor required.

Credits: 1.00 to 3.00

BME 69600 - Advanced Biomedical Engineering Projects

Credit Hours: 1.00 to 6.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report is required. Permission of instructor required.

Credits: 1.00 to 6.00

BME 69699 - Biomedical Engineering Professional Practice Graduate Internship

Credit Hours: 0.00. Graduate-level internship course in Biomedical Engineering providing training in the professional skills that lead to career success in the biomedical field. Permission of instructor required.

Learning Outcomes: 1. Integrate theory, skills and principles taught in the core biomedical engineering curriculum with professional skills, awareness, and methodologies learned during the on-site internship. 2. Apply these integrated skills and principles to solve real-world problems. Credits: 0.00

BME 69700 - Directed Reading In Biomedical Engineering

Credit Hours: 1.00 to 3.00. Individualized reading course supervised by an appropriate faculty member. Approval for each reading course must be obtained from the department prior to registration. Permission of instructor required.

Credits: 1.00 to 3.00

BME 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BME 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Davidson School of Chemical Engineering (Graduate)

Website: **https://engineering.purdue.edu/ChE/Academics/Graduate/index.html**

Department/School Head

Sangtae Kim

Faculty (website)

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Academic Programs

Master's and Ph.D. Programs

The Charles D. Davidson School of Chemical Engineering at Purdue University offers two distinct degree tracks for students to choose from: (i) a Ph.D. Program that allows doctoral students to delve deep into the study of a subfield for 4-5years, and (ii) a 1-year M.S. Program aimed at providing advanced technical and management training to aspiring industrial leaders in chemical engineering.

Chemical Engineering, MSCHE

Hybrid Vehicle Systems CHE, Post-Baccalaureate Certificate

Chemical Engineering, PHD

CHE 50100 - Medical Devices - Development And Clinical Application

Credit Hours: 3.00. This course is an introduction to the medical device field, with emphasis on the ways in which chemical engineering processes provide the foundation for many device-related therapies. The course involves the application of several fundamental chemical engineering principles, including those related to mass transfer, separations, and fluid flow, to devices used for extracorporeal therapies and other treatments. The first part of the course addresses the relevant physiology and pathophysiology serving as a foundation for subsequent clinical material. With the focus on extracorporeal devices, the interactions between blood and biomaterials in a general sense are also explored. The second part of the course assesses the extracorporeal treatment of kidney failure by dialysis, which is highlighted as the only long-term, device-based replacement therapy for terminal organ failure (end-stage renal disease). This analysis will not only consider the evolution of dialysis therapy from a technology perspective but also the forces that have shaped its development into a market generating annual revenue of nearly $100 billion on a global basis. In addition, extracorporeal support therapies used clinically not only for failure of other organs (namely the heart, liver, and lungs) but also systemic inflammation secondary to severe infection (sepsis) will be presented. The third segment of the course addresses industry-focused concepts pertaining to medical device development, including verification/validation, lean manufacturing, project management, and regulatory issues. Providing a real-world perspective based on broad experience in the medical device field, Ms. Michelle Chutka (see below) will lead this third part of the course. Permission of instructor required.

Learning Outcomes: 1. Assess the mechanisms of blood-surface interactions defining the biocompatibility of an extracorporeal device. 2. Evaluate the influence of extracorporeal membrane structure and material on transport properties (diffusion, convection, and ultrafiltration) and the overall effect on device. 3. Analyze device-related and patient-related (physiologic) parameters required for kinetic modeling of different dialysis therapies. 4. Apply fundamental chemical engineering principles to provide a quantitative basis for treatments of specific clinical disorders, including end-stage renal disease (ESRD), acute kidney injury (AKI), sepsis, cardiac failure, and respiratory failure. 5. Characterize the major components of a medical device company and the manner in which these different functions interact during the pre-market and post-market phases of product development. 6. Apply important principles of project management, verification/validation, and lean manufacturing to medical device development. Credits: 3.00

CHE 50200 - Analytical Approach To Healthcare Delivery

Credit Hours: 3.00. This course provides a "real world" overview of healthcare delivery in the United States (US). The major medical technology segments (pharmaceutical compounds and medical devices) are a significant focus, including their research and development processes, regulatory framework, and market approaches. Another highlight of the course is an assessment of a series of critical medical conditions having the highest impact on the US healthcare system. Clinical cases illustrating these conditions along with case studies designed to provide practical examples of healthcare developments and challenges are included. A number of emerging healthcare developments, including precision medicine, artificial intelligence, digital health, and value-based care, are addressed. In addition, the numerous ways in which the COVID-19 pandemic has affected patients and the manner in which they receive healthcare are discussed. Permission of instructor required.

Learning Outcomes: 1. Evaluate the impact of the following conditions, from both a clinical and resource utilization (cost) perspective: coronary artery disease, heart failure, diabetes, cancer, obesity, Alzheimer's disease, chronic kidney disease, stroke, arthritis, sepsis, and acute kidney injury. 2. Analyze the major segments of medical products (pharmaceutical/biotechnology compounds and medical devices) along with the regulatory framework applying to each of these segments. 3. For the biopharmaceutical industry, determine the major components of the drug development process and the manner in which drug pricing factors into the risk/reward equation. 4. Assess US health economics by identifying the major cost drivers in the healthcare system (hospital care; physician costs; drugs and other medical products). 5. Formulate a basic understanding of the sources of health insurance coverage in the US,

including the differences between government-based (Medicare/Medicaid) and commercial payers. 6. Explain several evolving trends which have the potential to influence healthcare substantially in the future, including precision medicine, artificial intelligence, digital health, and value-based care. 7. Characterize (for COVID-19) the important clinical aspects and its profound impact on the US healthcare system. Credits: 3.00

CHE 52100 - Principles Of Tissue Engineering

Credit Hours: 3.00. This course is designed to provide background for the application of engineering principles with the life sciences to facilitate understanding of normal and pathological mammalian tissues. Applications of drug delivery, tissue and cell transplantation, bioartificial organs, tissue regeneration, disease models, and applications in clinical practice will be explored.

Learning Outcomes: 1. Understand the importance of cell sources, material properties, and mass transport on tissue structure and function. 2. Design a rational experiment and have improved understanding for how to characterize and analyze tissue engineered constructs. 3. Improve their ability to present new concepts and ideas to a group of students and potential investors. Credits: 3.00

CHE 52300 - Engineering Applications Of Biological Molecules

Credit Hours: 3.00. This course introduces the applications of biological molecules in different engineering fields. The first part of the course will provide a general overview of fundamental molecular and cell biology, biophysics and biomechanics. The second part of the course will focus on three specific areas, namely 1) biopolymer, 2) nanobiotechnology and 3) genetic engineering. For each focus area, a general overview will be provided followed by in-class discussions of seminal papers of the field and team-based case studies. The goal of the course is to introduce the recent advances in the interface of biology and engineering to our students and prepare them for research and development work in interdisciplinary environments.

Learning Outcomes: 1. Learn fundamental molecular and cell biology, biophysics and biomechanics. 2. Focus on three specific areas, namely 1) biopolymer, 2) nanobiotechnology and 3) genetic engineering. For each focus area, a general overview will be provided followed by in-class discussions of seminal papers of the field and team-based case studies. 3. Work a 3-4 person to group to develop case studies and make a class presentation on state-of-the-art biotechnology. 4. Develop an individual project on recent progresses in a specific bioengineering field. An oral and final report will be required. Credits: 3.00

CHE 52500 - Biochemical Engineering

Credit Hours: 3.00. Enzyme kinetics, mathematical models of microbial growth, bioreactor design and operation, genetic and metabolic engineering, plant and animal cell culture, and purification of biological products.

Credits: 3.00

CHE 54000 - Transport Phenomena

Credit Hours: 3.00. Continuation of CHE 37700 and CHE 37800 . Topics in fluid mechanics, heat transfer and mass transfer including unsteady state transport problems, stream functions, potential flow, hydrodynamic and thermal layers, turbulence, and multicomponent diffusion.

Credits: 3.00

CHE 54300 - Polymerization Reaction Engineering And Reactor Analysis

Credit Hours: 3.00. Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, copolymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, Z-transforms, batch, CSTR and tubular reactors, stability analysis, computer control, separation, and drying.

Credits: 3.00

CHE 54400 - Structure And Physical Behavior Of Polymer Systems

Credit Hours: 3.00. Statistical mechanics of chain molecules, thermodynamics of polymer solutions, phase separations, experimental methods of molecular weight determination, crystallization of polymers, polymer physics, rubber elasticity, viscoelasticity.

Credits: 3.00

CHE 55100 - Principles Of Pharmaceutical Engineering

Credit Hours: 3.00. This course is designed to provide engineering, science and pharmacy students with an understanding of the structure, economic and regulatory context, product discovery and development pipeline dynamics, intellectual property considerations and common manufacturing technology of the global pharmaceutical industry.

Learning Outcomes: 1. Develop a "big picture" view of the Pharmaceutical Industry: its structure and key players; economic and regulatory context; international trends and markets; product pipeline dynamics; current manufacturing technology, strengths and limitations. 2. Develop a working vocabulary of domain concepts. 3. Develop an appreciation of technical challenges and opportunities over the life cycle of a pharmaceutical product. 4. Develop an appreciation of the important role of intellectual property law and the strategies used in maintaining and challenging product patents. 5. Enhance skills in critical review of topics involving the interplay of technology and economics and in succinctly reporting the most important conclusions in written and oral form. 6. Acquire the technical and economic context for more detailed follow-up courses in ChE, ME and IPPH. Credits: 3.00

CHE 55300 - Pharmaceutical Process, Development And Design

Credit Hours: 3.00. This course introduces the engineering methodologies involved in translating a laboratory recipe for a drug compound produced via synthetic organic chemistry methods to an industrial process. The basic features of common unit operations used in the pharmaceutical industry will be reviewed, including batch reaction, solid-liquid separation, crystallization, drying, mixing, batch distillation and other separation systems. Both dedicated and multi-product production system design and batch and semi-continuous operating modes will be covered.

Learning Outcomes: 1. Develop knowledge and skills in the thermodynamic, reaction and transport phenomena arising in the typical batch unit operations used in the pharma and specialty chemicals industries, including batch reaction, crystallization, solid-liquid separation, mixing, distillation, drying and liquid-liquid extraction. 2. Develop knowledge and skills in the use experimental data and relevant models to design and predict the performance of these units. 3. Develop knowledge and skills in the use of engineering software to conduct studies of these operations and interpret and critically assess the results such software produces. 4. Understand different modes of operation for batch processes and their scheduling. 5. Understand aspects of the design of batch process in which the set of batch operations are integrated. 6. Develop knowledge and skills in the use of planning/scheduling software to conduct design and operational studies of integrated process. 7. Enhance skills in succinctly reporting the most important conclusions of team projects in written and oral form. Credits: 3.00

CHE 55400 - Smart Manufacturing In Process Industries

Credit Hours: 3.00. This course surveys the tools and techniques, which are relevant to support the multiple levels of technical decisions that arise in modern integrated operation of manufacturing facilities in the chemical related process industries. The linkage of these decisions levels and sharing of associated data and knowledge via effective IT methodology is currently termed Smart Manufacturing in the US and Industry 4.0 in Europe. The topics covered in the course include the structure of the operations decision hierarchy, role of online process measurements, elements of sensor network design, information systems to support process operations, plant data reconciliation, detection and diagnosis of process faults, plant wide control, real time process optimization, production planning and scheduling, and supply chain management. Each topic will be addressed by first summarizing the basic role and scope of that component, then discussing the structure of the decision problem, and then will outline some representative tools available to address that decision problem. Each major topic will include a lecture given by an industrial practitioner who will offer a perspective on the state of industrial practice. Permission of instructor required.

Learning Outcomes: 1. Explain the function, information requirements and main decisions made at each level of the operational hierarchy of an integrated processing system. 2. Understand the design requirements of a sensor network, that insures that all variables which must be managed are observable. 3. Explain that process data storage requirements are and how these requirements are met in integrated process systems. 4. Know how to use data reconciliation methods to obtain the maximum likelihood estimate of the state of process. 5. Explain why exceptional events are important to process operations. 6. Use multivariate statistic methods to determine whether and when an exceptional event has occurred. 7. Explain what fault diagnosis is, why it is needed and what general types of methods are available for effective diagnosis. 8. Understand the role of plant-wide control and how it relates to individual unit operations control. 9. Test, evaluate and improve a specific plant wide control systems design using a process simulation model. 10. Explain the role of real time process operations and the differences between steady state and dynamic RTO. 11. Implement and solve a steady state RTO problem based on material balances. 12. Explain the differences and relationship between process planning and scheduling. 13. Represent a process planning problem by formulating a linear programming model and solving it using standard LP tools. 14. Explain the main decision variables of a process scheduling application and understand the underlying computational complexity of scheduling problems. 15. Represent a scheduling problem using a state task network and solve it using a commercial solver. 16. Explain how supply chain management relates to the operational planning of individual processes. 17. Understand the main components and operational decision variables of a supply chain optimization problem. 18. Explain the information requirements for effective supply chain management. 19. Understand where the sources of uncertainty arise in supply chain planning and what strategies can be used to accommodate to these uncertainties. Credits: 3.00

CHE 55500 - Computer Integrated Process Operations

Credit Hours: 3.00. Introduction to computer-aided process operations management. Topics include: process monitoring, regulatory control, data reconciliation, unit and plant-wide optimization, process fault diagnosis, supervisory control, planning, and scheduling. A design project involving a unified application of the presented methodologies is taken from a published industrial benchmark problem.

Credits: 3.00

CHE 55800 - Rate-Controlled Separation Processes

Credit Hours: 3.00. Rate-controlled separation processes based on solute movement (adsorption, chromatography and ion exchange), membranes (reverse osmosis, ultrafiltration, and gas permeation), and crystallization.

Credits: 3.00

CHE 56000 - Introduction To Energy Storage Systems

Credit Hours: 3.00. Energy Storage Systems Laboratory course is designed to introduce fundamentals of electrochemistry and electrochemical engineering of rechargeable lithium ion batteries (LIBs) to undergraduate and graduate students. The course will be reviewing working principles of LIBs, hands-on experience on their assembly, charge-discharge testing, data analysis and related safety aspects. Strong emphasis will be given on the Li-ion battery technology, nanotechnology implementation and the materials design. Beyond conventional Li-ion systems and Pb-acid batteries, next generation Na-ion, K-ion and Li-S batteries will be discussed and designed. Students will be fabricating and testing high energy density batteries utilizing engineered electrodes, electrolytes and separators. Broader perspectives on sustainable, cost effective, longer lasting battery manufacturing will be provided.

Learning Outcomes: 1. Understand the basic physical concepts involved in electrochemical

energy storage and engineering aspects. 2. Critically evaluate the utility and viability of technological claims in popular and scientific literature. 3. Understand the need of new electrode/electrolyte materials development for the efficient energy storage. Credits: 3.00

CHE 56200 - Battery Systems

Credit Hours: 3.00. This course is designed to introduce fundamentals of electrochemistry and electrochemical engineering of primary and rechargeable lithium ion batteries (LIBs) to undergraduate and graduate students. The course will be reviewing working principles of LIBs. Strong emphasis will be given on the Li-ion battery technology, primary batteries, nanotechnology implementation and the materials design. Beyond conventional Li-ion systems and Pb-acid batteries, next generation Na-ion, K-ion and Li-S batteries will be discussed. Students will be understanding energy density calculations, fabrication and testing mechanism of batteries utilizing engineered electrodes, electrolytes and separators. Broader perspectives on sustainable, cost effective, longer lasting battery manufacturing will be provided.

Learning Outcomes: 1. Learn Introduction to Energy Storage Systems: Overview, history, market, theory, thermodynamics, kinetics, definitions, and safety. 2. Learn challenges of Li-ion Battery Technology, Selection criteria for commercial batteries. 3. Learn Experimental techniques, Promising Cathode Materials, Anode Materials, Electrolytes, current distribution and related issues. 4. Learn electrode slurry preparation, lamination, drying, pressing, manufacturing of batteries and testing. 5. Learn Battery types and Chemistry: Cell charging, Cell discharge testing, Electrochemical impedance spectroscopy (EIS). 6. Learn Kinetics and thermodynamics of electrochemical reactions. 7. Learn Beyond Li-ion Battery Technologies, next generation Li-S batteries, Sodium ion batteries, K-ion batteries will be reviewed. Credits: 3.00

CHE 56400 - Organic Electronic Materials And Devices

Credit Hours: 3.00. This course introduces the synthesis, optoelectronic properties, transport physics, and device operation of organic and hybrid electronic materials and devices. This course will review how the molecular architecture of small molecule and polymer semiconductors can be tuned to alter the optoelectronic properties of the materials in solution and in the solid state. A number of relevant materials interactions will be covered, including: photoexcitation and recombination, intermolecular charge transport mechanisms, and energy transfer processes. Additionally, we will observe how these processes are relevant to applications such as organic field-effect transistors (OFETs), organic light-emitting diodes (OLEDs), organic photovoltaic (OPV) devices, and organic memory elements. Finally, a new type of organic-inorganic hybrid material called hybrid halide perovskite will be introduced.

Learning Outcomes: 1. Identify common mechanisms for the synthesis of small molecule and polymer semiconductors. 2. Describe the mechanism of controlled polymerization techniques for macromolecular semiconductors. 3. Interpret spectroscopic, chromatographic, and molecular characterization data in order to predict the structure of the organic semiconductor. 4. Explain how the molecular structure of an organic semiconductor will affect its thermal, structural, and optoelectronic properties. 5. Explain how x-ray and neutron scattering can be utilized to determine the Angstrom and nanometer length scale structural features of the organic semiconductors. 6. Apply principles of electron microscopy to comprehend how to image soft materials. 7. Determine the domain spacing and microstructural architecture of organic semiconductors given a scattering pattern. 8. Explain how molecular orbital levels are related to the optoelectronic properties of organic semiconductors. 9. Distinguish between different models for charge transport in organic semiconductors. 10. Describe clearly the difference between charge generation and transport in organic and inorganic semiconductors. 11. Explain how organic electronic devices operate and how apply known equations to evaluate device

performance. 12. Critique the potential for organic electronic materials to supplement or replace inorganic semiconducting devices. Credits: 3.00

CHE 57500 - Industrial Catalytic Processes

Credit Hours: 3.00. A survey course on the process design of major catalytic processes in the refining and petrochemical industries for production of transportation fuels and commodity chemicals.

Learning Outcomes: 1. Understand and analyze the historical, current and potential future roles that hydrocarbons play in the economy for energy, fuels, and chemicals. 2. Understand and compare the ways that energy is used in society, especially the breakdown between electricity/power and fuels. Understand the basic fuel properties of liquid transportation fuels (LPG/LNG, gasoline, diesel and jet). 3. Understand the regulatory requirements, technical specifications and molecular composition of fuels and chemicals. 4. Understand the major refining and petrochemical processes by which hydrocarbons are produced. Additionally, understand the reaction chemistry and role of the catalyst in these chemical transformations. 5. Understand the chemical principles and industrial processes for catalyst manufacture. 6. Understand the structure of the catalytically active site and methods for its determination. 7. Understand the future demands for fuels and chemicals and potential opportunities for changes to the current processes. Credits: 3.00

CHE 59700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 60000 - Approaches To Graduate Research In Chemical Engineering

Credit Hours: 3.00. This course is designed to prepare and enable students to make a rapid start on their research. Additionally, key skills in critical analysis of the literature, technical writing and delivery of oral presentations are included.

Learning Outcomes: 1. Search the scientific literature efficiently. 2. Review the literature. 3. Write for scientific publication. 4. Create a hypothesis and propose how to test it. 5. Make effective technical oral presentations. Credits: 3.00

CHE 61000 - Advanced Chemical Engineering Thermodynamics

Credit Hours: 3.00. Properties of pure fluids and mixtures are described in the context of classical and statistical thermodynamics. Equations of state and solution theories are developed for this description of fluid phase equilibrium and chemical equilibrium. Fluids encountered in mass transfer and separation operations are treated.

Credits: 3.00

CHE 61100 - Molecular Thermodynamics

Credit Hours: 3.00. This course aims at providing a systematic treatment of the microscopic foundation of thermodynamics as well as a working knowledge of the statistical formalism needed to predict microscopic properties from molecular interactions. Topics covered include kinetic theory of gases, statistical-mechanical ensembles and their correspondence with thermodynamics, ideal and imperfect gases, distribution function theory of liquids, lattice models of liquid and polymer solutions, and molecular simulation methods. Offered in alternating years. Prerequisite: CHE 61000 .

Credits: 3.00

CHE 62000 - Advanced Transport Phenomena I

Credit Hours: 3.00. Analysis of transport of momentum, energy, and mass by molecular and turbulent mechanisms. Prerequisite: CHE 52700.

Credits: 3.00

CHE 62100 - Advanced Transport Phenomena II

Credit Hours: 3.00. Topics included are momentum transfer with interfacial effects, transport in porous and multiphase media, transport in dispersed phase systems, heat transfer, and multicomponent mass transfer. Prerequisite: CHE 62000

Credits: 3.00

CHE 63000 - Applied Mathematics For Chemical Engineers

Credit Hours: 3.00. Determinants and matrices: solution of a system of algebraic equations; applications to dimensional analysis, stoichiometry, thermodynamics, kinetics of first order reaction systems, and stagewise operations. Differential equations: series solutions, Sturm-Liouville systems, boundary value problems, applications to heat and mass transfer and chemical reactor problems. Elements of complex variables: LaPlace and infinite Fourier transforms, applications to heat and mass transfer problems. First order partial differential equations: applications to separation processes, chromatography. Prerequisite: MA 26200.

Credits: 3.00

CHE 63200 - Linear Operator Methods In Chemical Engineering

Credit Hours: 3.00. Application of the spectral theory of linear self-adjoint and non-self-adjoint operators on abstract Hilbert spaces to problems in chemical engineering. Symmetrizable non-self-adjoint problems in finite and infinite dimensional spaces with applications to physical and chemical rate processes in homogeneous and composite media. Solution of transport equations governing heat and mass transfer in deforming and chemically reacting media. Introduction to non-self-adjoint problems in chemical engineering. Offered in alternate years. Prerequisite: CHE 63000 .

Credits: 3.00

CHE 63300 - Probabilistic Methods In Chemical Engineering

Credit Hours: 3.00. Introduction to probability, random variables, and stochastic processes. Ito calculus and stochastic differential equations. Brownian dynamics and Bridge processes. Applications to chemical engineering systems. Master equations and system size expansion concepts to nonequilibrium processes. Stochastic point processes and population balance. Theory of fluctuations. Prerequisite: CHE 63000 .

Credits: 3.00

CHE 65500 - Safety In Chemical Engineering

Credit Hours: 1.00. This course will provide you with necessary safety information to comply with Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. The course will cover general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. The course will provide valuable information on how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc.

Learning Outcomes: 1. Understand necessary safety information to comply with the Purdue and other federal requirements (OSHA29 CFR 1910.1450 standard) for working safely in a chemical engineering laboratory setting/environment. 2. Understand general safety principles (electrical safety, hazard assessment and controls, etc.) and fundamentals of laboratory safety practices specific to experimental work in chemical engineering laboratories. 3. Understand how to find, read, interpret and use the information in Safety Data Sheets (SDSs), chemical labels and other printed chemical safety information. Other topics covered include: gas cylinder safety, safety equipment (fume hoods, fire protection systems and building elements, eyewash stations and safety showers, etc.), laboratory equipment safety, hazard assessment and understanding of administrative and engineering controls, selection of suitable personal protective equipment (PPE) necessary for laboratory work with chemicals, etc. Credits: 1.00

CHE 66000 - Chemical Reaction Engineering

Credit Hours: 3.00. Heat, mass, and momentum transfer in the design and analysis of chemical reactor systems. Optimization techniques applied to reactor design. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 66200 - Catalysis

Credit Hours: 3.00. Analysis of the kinetics of heterogeneous

catalytic reactions, including the application of collision and transition state theories to the estimation of rate constants and calculation of rates over energetically nonuniform surfaces. Discussion of the chemical and physical properties of solid surfaces that influence catalytic reactions, and illustration of concepts of catalytic behavior with specific examples from catalytic cracking, reforming, oxidation, and hydrodesulfurization. Offered in alternate years. Prerequisite: CHE 34800 .

Credits: 3.00

CHE 66600 - Methods In Catalysis

Credit Hours: 3.00. Various spectroscopic and other techniques for characterizing catalysts and for probing the chemistry of solid surfaces and their interactions with adsorbing and reacting gases are discussed. Topics include infrared, X-ray photoelectron, Mossbauer, and secondary ion mass spectroscopies. Emphasis is on understanding the principles underlying each method and gaining an awareness of the kind of information each can provide in a broad spectrum of research problems. Offered in alternate years.

Credits: 3.00

CHE 66800 - Colloidal And Interfacial Phenomena

Credit Hours: 3.00. Preparation, characterization, and stability of emulsions, aerosols, and other multiphase dispersions. Interparticle forces, electrokinetics, thermodynamics and kinetics of coagulation. Techniques for determining size, shape, orientation, and charge of particles. Capillary and wetting phenomena. Thermodynamics of interfacial tension and adsorption. Applications to surfactants, polymers, biodispersions, flotation, separations, oil recovery, etc. Offered in alternate years.

Credits: 3.00

CHE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (ENE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

CHE 69000 - Seminar In Chemical Engineering

Credit Hours: 0.00. Required of all graduate students.

Credits: 0.00

CHE 69700 - Special Topics In Chemical Engineering

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

CHE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Lyles School of Civil and Construction Engineering (Graduate)

Website: **Christopher B. and Susan S. Burke Graduate Program - Lyles School of**

Civil and Construction Engineering - Purdue University

Department/School Head

Dr. Rao S. Govindaraju

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Dulcy Abraham Ernest Blatchley Antonio Bobet Darcy Bullock Hubo Cai Robert Connor Melba Crawford Phillip Dunston Shirley Dyke Robert Frosch Nadia Gkritza Rao Govindaraju Ayman Habib John Haddock Makarand Hastak W. Travis Horton Inez Hua Ayhan Irfanoglu Robert Jacko Chad Jafvert Panagiota Karava	Brandon Boor Behzad Esmaeili Mohammad Jahanshahi Jinha Jung Arun Prakash Amisha Shah Akanshu Sharma Cary Troy David Yu Zhi (George) Zhou	Yiheng Feng Sogand Hasanzadeh Nusrat Jung Jungil Seo Mirian Velay-Lizancos Ziran Wang	James Bethel John Bell Philippe Bourdeau Mark Bowman Luh-Maan Chang Wai-Fah Chen Menashi Cohen Sidney Diamond Vincent Drnevich John Gaunt Daniel Halpin Milton Harr John Havers Garrett Jeong Steven Johnson Robert Lee V. James Meyers Edward Mikhail P. Suresh Rao Gilbert Satterly Charles Scholer C. Douglas Sutton Edward

Samuel Labi Luna Lu Dennis Lyn Venkatesh Merwade Loring Nies Jan Olek Monica Prezzi Ming Qu Julio Ramirez Rodrigo Salgado Maria Ceterina Santagata Jie Shan Joseph Sinfield Kumares Sinha Andrew Tarko Thanos Tzempelikos Satish Ukkusuri Andrew Whelton Amit Varma Pablo Zavattieri			Ting Boudewijn van Gelder Thomas White Douglas Winslow

Academic Programs

Master's and Ph.D. Programs

The Purdue Burke Civil Engineering Graduate Program has over 400 students working toward either a Master's or Ph.D. degree. The Master's degree program is designed to be flexible so that students can work with faculty members to develop a plan of study tailored to their professional goals. It also allows them to acquire the specialized skills that are increasingly necessary for professional practice (ASCE Policy Statement 465). The Ph.D. degree provides an opportunity for more in-depth study necessary for students who want to pursue research and academic careers.

Civil Engineering, MSCE

Smart Transportation, Post-Baccalaureate Certificate

Civil Engineering, MSCE (OL)

Civil Engineering, PHD

CE 50101 - Map Projection And Geometric Geodesy

Credit Hours: 3.00. The course will cover topics necessary for the modern "3D surveyor": it will give an overview of coordinate frames used in geodesy, surveying and mapping. What are the relationships between the various (3D) coordinate frames? How are the results of 1D/2D/3D surveys being mapped to a 2D, not necessarily flat, surface? Mapping models (projecting equations) and their characteristics will be discussed, based on the fundamentals of differential geometry and curvilinear coordinates. (Differential) Geometry and Multivariate Calculus: Cartesian, Spherical and Ellipsoidal coordinates and transformations between them. Radius of curvature. Jacobian and Metric Matrices. Geometric Geodesy: Earth-fixed frames. Geocentric, topocentric and local frames. Radius of curvature in the meridian and the prime vertical. [Differential coordinate transformations. Commutative diagram.] Reference sphere. Shortest distance over the sphere/ellipsoid. Reference ellipsoid.

Reductions to the ellipsoid. Map projections: Basics of mapping. Conformal mapping. Mercator, Lambert, Stereographic. State Plane Coordinate Systems. Intro to Physical Geodesy: Shape of the Earth. Earth rotation. Inertial frames. Precession, Nutation, Polar Motion, Length of Day. Time Systems. Gravity and Gravitation. Potential Energy. Equipotential surfaces. Geoid. Height differences and the flow of water. Orthometric heights. Geodetic Reference Datums/Frames/Systems: NAD27, NGVD29, IGSN71, WGS72, GRS80, NAD83, WGS84, NAVD88, IERS Standards 1992, HARNs, GEOID90, GEOID93, GEOID96, GEOID99, GEOID2003, GEOID2009.

Learning Outcomes: 1. Solve most 1D/2D/3D survey problems based on rigorous 1D-, 2D-, 3D-modelling. 2. Perform coordinate transformations. 3. Assess mapping characteristics based on principles of differential geometry. 4. Develop mapping dedicated to any engineering project. 5. Generate novel engineering solutions to newly presented survey problems. 6. Evaluate 1D-, 2D-, 3D-models, the coordinate frames used for these and their interrelationships. 7. Model the physical reality underlying most geometry-based models, in earth-fixed as well in inertial space. Credits: 3.00

CE 50301 - Digital Photogrammetric Systems

Credit Hours: 3.00. This course deals with various aspects related to 3D reconstruction from 2D imagery. The course starts with comprehensive coverage of data acquisition systems while focusing on different factors that affect the quality of image measurements. Then, the course focuses on the mathematical details for deriving 3D information from imagery including 2D/3D rotation, collinearity equations, projective transformation, direct linear transformation, theory of orientation, bundle adjustment, image resampling according to epipolar geometry, image matching, and orthophoto generation. The course also covers the similarities/differences between photogrammetric and computer vision approaches toward 3D reconstruction.

Learning Outcomes: 1. Define photogrammetric mapping and its possible applications. 2. Explain basic definitions related to electromagnetic radiation. 3. Define basic optical principles, film development steps, and operational principles of digital cameras. 4. Derive photogrammetric formulas for vertical photography. 5. Explain image coordinate measurements and reduction/refinement. 6. Explain/derive mathematical and geometric principles. 7. Explain the theory and procedures of photogrammetric orientation. 8. Describe the different options for photogrammetric georeferencing. 9. Describe the principles of digital image matching. 10. Explain the steps for digital orthophoto generation. Credits: 3.00

CE 50401 - Laser Scanning

Credit Hours: 3.00. This course covers laser scanning data acquisition and processing activities. The first half of the course deals with the operational principles of laser scanning including laser light generation, laser scanning patterns, georeferencing, point positioning equation, impact of random and systematic errors on derived point clouds, and system calibration. The second half deals with point cloud data processing including characterization, data structures, segmentation, quality control, and product delivery. The course also covers the similarities/differences between photogrammetric and laser scanning approaches for 3D reconstruction.

Learning Outcomes: 1. Explain the latest development in environmental biotechnology and select appropriate biotechnology for contaminant removal and public health protection. 2. Analyze and assess relevant literature on selected topics in environmental biotechnology and identify areas for improvement. 3. Develop and deliver effective presentations. 4. Write clearly and ethically. Credits: 3.00

CE 50501 - UAS-Based Mapping: Basic Principles

Credit Hours: 1.00. This module covers the fundamentals of UAS-based mapping from imaging and ranging systems - including system integration, calibration strategies, and 3D reconstruction techniques.

Learning Outcomes: 1. Identify the key components of a UAS-based mapping system. 2. Explain the principles of image-based and LiDAR-based mapping. 3. Describe different coordinate systems and georeferencing alternatives. Credits: 1.00

CE 50502 - UAS-Based Photogrammetric Mapping

Credit Hours: 1.00. This module covers the principles and mathematical details of photogrammetric 3D reconstruction from imaging systems onboard UAVs.

Learning Outcomes: 1. Explain the principles of image-based mapping. 2. Identify/select systems/sensors/platforms and design flight plan to meet the needs of a specific application. 3. Conduct a UAS-based mapping project using an imaging system. 4. Evaluate the quality of UAS-based photogrammetric products. Credits: 1.00

CE 50503 - UAS-Based LiDAR Mapping

Credit Hours: 1.00. This module covers the principles and mathematical details of laser scanning-based 3D reconstruction using ranging sensors onboard UAVs.

Learning Outcomes: 1. Explain the principles of LiDAR-based mapping. 2. Identify/select systems/sensors/platforms and design flight plan to meet the needs of a specific application. 3. Conduct a UAS-based mapping project using a LiDAR system. 4. Evaluate the quality of UAS-based ranging products. Credits: 1.00

CE 50601 - Adjustment Of Geospatial Observations

Credit Hours: 3.00. This course presents a thorough and comprehensive look at the topic of fitting data to a mathematical model. The techniques presented will free the scientist or engineer from dependence on restrictive software applications, and allow customization of solutions using weighting, constraints, parameter dependencies, and robust techniques which minimize the influence of blunders. Example applications include 2D/3D ranging, 2D/3D triangulation, curve and surface fitting, coordinate transformations, leveling, and image triangulation. Pre-analysis and design techniques permit the precision of unknown parameters to be determined in advance, prior to expending time and effort in field measurements.

Learning Outcomes: 1. Perform error/covariance propagation to make quantitative statements about uncertainties of the results, and to evaluate statistical hypothesis tests. 2. Become conversant with both linear and nonlinear models as well as sequential estimation. Credits: 3.00

CE 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

CE 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

CE 51200 - Urban Planning And Analysis

Credit Hours: 3.00. An introductory course that provides a framework for better understanding of the current urban planning process. Concepts and emerging trends are covered as well as an elementary description of planning methods and techniques. For planning majors and those in related design, development, and socioeconomic disciplines.

Credits: 3.00

CE 51300 - Lighting In Buildings

Credit Hours: 3.00. This course focuses on the design of illumination systems in buildings (electric and natural lighting) in order to achieve energy efficiency and visual comfort. The first part of the course includes analytical lighting calculation techniques, visual perception, radiative transfer, lamp characteristics, electric lighting system design and control for calculation of required indoor illuminance levels. The second part of the course covers daylighting (natural lighting) systems, including state-of-the-art daylighting prediction models as well as design and control of such devices and advanced metrics. The course also has a lab section, in which the students learn how to work with lighting and daylighting tools and build their own computational transient lighting models in open programming languages, in order to design illumination systems and predict electricity consumption and potential energy savings.

Learning Outcomes: 1. Understand fundamental illumination concepts. 2. Design and assess the performance of electric and natural lighting systems in buildings. 3. Calculate fundamental illuminance, non-point sources, radiant energy, lamp types, lighting controls, interior lighting design, daylight prediction models, optical properties of windows, advanced metrics and shading devices. 4. Build and solve lighting and daylighting models using advanced software and programming techniques to design lighting systems and calculate energy savings from the use of natural light and lighting controls. 5. Design a project, submit a project report and make an oral presentation (only individual projects are allowed). The project themes cover a wide variety of lighting/daylighting design and control such as: daylighting and lighting design of commercial buildings, measurements/monitoring of lighting levels in laboratory settings, prediction of protentional energy savings, impact of shading design and control, and advanced daylighting system modeling. Credits: 3.00

CE 51401 - Building Controls

Credit Hours: 3.00. This course is designed to provide students with the knowledge of fundamentals, design, and analysis for building control systems. It primarily consists of three parts. The first part covers basic concepts, terminology, procedures and computations of control systems including block diagrams & transfer function, open-loop & closed-loop control, control system modeling, time response, root locus techniques, design via root locus, and digital control systems. The second part focuses on issues surrounding the building controls: interfacing components such as sensors and actuators, problems encountered, and state-of-the-art solutions for building energy efficiency and thermal comfort. The third part aims to develop students' ability to convert control system concepts into real building control sytems. The course provides a hand-on opportunity for students to complete three projects associated with the three primary components during the semester: indoor environmental quality assessment, building HVAC system commissioning and its control analysis, and new control algorithm development for building energy efficiency, occupant health, and individual productivity.

Learning Outcomes: 1. Demonstrate basic HVAC processes and explain the function, layout, and operation of commercial HVAC systems. 2. Analyze the function, operating characteristics, and appropriate applications of basic control loops and control modes as found in direct digital, analog electronic, electronic and pneumatic commercial control systems. 3. Understand and program a sequence of control, lay out a control system logic diagram and program it into a DDC controller. 4. Understand the function of network devices and network protocols such as a bridge, router, gateway, hub, firewall, Ethernet, TCP/IP, BacNet, and Lon Talk. 5. Use general-purpose and specific building automation software to monitor and control a building HVAC system. 6. Numerically model a building to define the key control parameters for thermal comfort. 7. Develop and

program alternative control algorithms for building HVAC systems in order to enable sustainable buildings. Credits: 3.00

CE 51501 - Building Energy Audits

Credit Hours: 3.00. This course is designed to provide students with the necessary skills to perform an energy audit on commercial and residential buildings. Energy accounting procedures for all major building subsystems are covered in detail, along with operational cost analysis of these systems. Students learn fundamental techniques for auditing the building envelope; electrical and lighting systems; heating, ventilation, and air conditioning systems; internal thermal loads; and building maintenance and operation procedures. Students also learn to analyze electric and natural gas utility tariffs and rate structures and apply their findings to the energy auditing process.

Learning Outcomes: 1. Analyze utility tariffs and rate structures for electricity and natural gas, and use the information to help guide energy audits. 2. Perform an energy audit of all major building subsystems, including the building envelope, electrical and lighting systems, heating, ventilation, and air conditioning systems, internal thermal loads, and building maintenance and operation procedures. 3. Numerically model the energy consumption of each of the building subsystems, and run parametric studies to determine and recommend appropriate energy conservation measures. Credits: 3.00

CE 51601 - Indoor Air Quality

Credit Hours: 3.00. The course covers the fundamentals of indoor air pollutant dynamics in buildings and their heating, ventilation, and air conditioning systems.

Learning Outcomes: 1. Evaluate mechanistically pollutant transport dynamics in buildings through application of material balance models. 2. Apply fundamental principles of aerosol physics to characterize the behavior of indoor aerosols from several nanometers to tens of micrometers in size. 3. Evaluate human exposure to indoor aerosols and analyze the effectiveness of engineering control strategies for indoor air pollution. 4. Read and critically analyze papers in the technical literature on indoor air quality and aerosols. 5. Gain additional insight regarding specific topics related to indoor air quality and aerosols through a rigorous course project. 6. Analyze, and discuss in a group-setting, contemporary indoor air quality issues facing our global society. 7. Prepare and review written and oral technical communication. Credits: 3.00

CE 51901 - Building Information Modeling For High Performance Buildings

Credit Hours: 3.00. The objectives of this course are: (1.) to introduce fundamental concepts of architectural engineering design to develop a deeper understanding of what constitutes our built environment; (2.) future of designing buildings: introduction to Building Information Modeling (BIM), BIM as a process, benefits and problems with a focus on interoperability and building performance-based simulations; (3.) to learn how to apply architectural engineering design and BIM principles towards obtaining high-performance buildings.

Learning Outcomes: 1. Understand architectural engineering design principles and their impact on choice of building systems, such as: form, space, organization, circulation, proportion, and scale. 2. Apply knowledge of BIM concepts and applications, BIM software (REVIT), and usage of BIM tools in architectural engineering. 3. Identify how BIM can support and improve multi-criteria assessment of high-performance buildings. 4. Evaluate the interoperability between BIM-based model and Building Performance Simulations (BPS). 5. Become conversant with language used by architects and BIM modelers to enhance collaboration and improve technical communication within large project teams in industry. Credits: 3.00

CE 52000 - Construction Project Control Systems

Credit Hours: 3.00. Techniques used for planning and scheduling, estimating, and cost control for construction

projects. The interface of cost control with the financial management at the company level will be considered. Work breakdown structure as a method of control will be developed.

Credits: 3.00

CE 52100 - Construction Business Management

Credit Hours: 3.00. Develops students' understanding of the fundamental theories and applied principles of management of U.S. construction companies. Exposes students to the present and future practice of business management at the construction company level. Provides insight into basic construction business operations including strategic planning, organizational structure, marketing, accounting, financing, risk analysis, quality, and international construction business practice.

Credits: 3.00

CE 52200 - Computer Applications In Construction

Credit Hours: 3.00. A study of current computer usage in the construction industry; basic computer hardware and software concepts; computer applications in construction; commercially available software applications.

Credits: 3.00

CE 52300 - Selection And Utilization Of Construction Equipment

Credit Hours: 3.00. A study of economics and functional applications for major categories of construction equipment. Operational characteristics are identified for selected equipment items and are applied to typical construction situations.

Credits: 3.00

CE 52501 - Built Environment Modeling

Credit Hours: 3.00. A study of computational tools to model, analyze, and manage the built environment, specifically, the civil infrastructure from a life cycle and system's perspective. Such computational tools include geospatial technologies, engineering sensing technologies, engineering database, building information modeling, object-oriented modeling, and spatial analytics.

Learning Outcomes: 1. Integrate geographic information system (GIS) and building information modeling (BIM) into a digital twin. 2. Explain the fundamental concepts and theories in BIM to more effectively use it as a tool in infrastructure life cycle management. 3. Apply BIM tools to design infrastructure, estimate cost, and plan its construction process. 4. Reason the necessity to incorporate GIS in supplementing BIM in infrastructure engineering. 5. Explain the fundamental concepts and theories in GIS in order to identify the right tools for given tasks. 6. Apply GIS tools to model infrastructure and its surroundings. 7. Apply object-oriented modeling approach in both GIS and BIM to identify the common ground for integration. 8. Design an object-oriented model to integrate GIS and BIM. 9. Use modeling tools to model the civil infrastructure and its spatial context from a life cycle perspective. 10. Identify the data needs and functionality requirements in life cycle infrastructure engineering. 11. Select and apply sensing technologies to collect data. 12. Design geospatial database to store and manage infrastructure data 13. Design a system to use geospatial database for varying tasks throughout the infrastructure life cycle. 14. Develop a digital twin to solve a selected infrastructure engineering problem. 15. Identify and articulate an infrastructure engineering problem. Propose a methodology to address the problem. Work as a team to implement the proposed method. Communicate and present the findings. Credits: 3.00

CE 52900 - Smart Construction

Credit Hours: 3.00. Technologies are embedded throughout all communities, and the boundaries between humans and technologies are shrinking considerably. As a result, the construction industry is also changing rapidly. The questions are: Are we ready for this change? What skills are required to be better prepared as a future workforce? This course covers how these smart and advanced technologies are set to revolutionize the construction industry to achieve specific mission objectives (e.g., improving safety, quality, and productivity). This course will give students the opportunity to learn conceptual and practical foundations for designing and developing systems while also learning to harness technology to ensure a new generation of technologies would include humans in the loop. This course will be project-based, and students learn by actively engaging in various real-world case studies. Other topics include challenges in human-computer interaction,

the internet of things, human behavior modeling, VR/AR/MR, wearable sensors, machine learning and artificial intelligence, trust in human-robot interaction, and ethics and fairness in the emerging smart technologies in the construction industry. This course follows Bloom's taxonomy to increase knowledge (cognitive domain), develop skills (psychomotor domain), or develop emotional aptitude (affective domain). The instructor will incorporate various techniques in each of the course concepts to facilitate higher-order thinking in their students by building up from lower-level cognitive skills. Each concept will be taught in five phases: 1) Knowledge (i.e., Lecture, podcasts, readings before class); 2) Understanding (i.e., presentations, peer review, discussion); 3) Application (i.e., case studies, problem-solving demonstration); 4) Analyzing and Evaluating (i.e., simulation, discussion); 5) Creating, Reflecting, and Debriefing (i.e., group presentations, case studies, discussion, reflection).

Learning Outcomes: 1. Explain conceptual and practical foundations for designing and developing sensing and monitoring technologies. 2. Apply the knowledge and problem-solving skills to real-world case studies. 3. Identify the advantages and challenges of the state-of-the-art technologies to outline gaps in knowledge and the necessity for research in the construction industry. 4. Integrate effective scholarly writing and teamwork strategies as reflect the environment and communication in a professional civil engineering/construction setting. Credits: 3.00

CE 53000 - Properties And Production Of Concrete

Credit Hours: 3.00. Basic properties of hydraulic cements and mineral aggregates and their interactions in concrete. Properties of plastic and hardened concrete. Modifications through admixtures. Production, handling, and placement problems. Specifications; quality control and acceptance testing; lightweight, heavyweight, and other special concretes. A one-day field trip is required.

Learning Outcomes: 1. Learn the course's topics (see "Topics" in the syllabus or see learning objectives related to Outcome 1), acquiring and remember the knowledge explained and have a general vision of the most important technical aspects of one of the most used construction material in the world: Concrete. [Foundational Knowledge] 2. Develop or enhance the student's ability to find autonomously the right sources to learn more about a topic, summarize and analyze the current information, discuss the current knowledge and find the gaps. [Learning How to Learn] 3. Develop the ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics. [Foundational Knowledge & Application] 4. Be able to communicate effectively with a range of audiences the new knowledge you learned in the course. [Human Dimension] 5. Develop or enhance the students' ability to self-evaluate themselves and to evaluate others in a respectful and constructive manner. [Human Dimension, Caring] Credits: 3.00

CE 53101 - Nanotechnology For Civil And Environmental Applications

Credit Hours: 3.00. This course will introduce students to the field of nanotechnology with a special emphasis on nanomaterials synthesis, characterizations and their applications in civil and environmental engineering. The specific applications will include, but not limited to, tailoring mechanical property, durability, self-cleaning, self-sealing, self-sensing, energy harvesting and other multi-functionality. It integrates the fields of materials science, civil engineering and electrical engineering. The basic concepts will be discussed including nano-scale effect, process-structure-property relationship, nano- and micro-structure property characterizations, multi-functional materials, nano-device fabrication and their applications for energy harvesting, water infiltrations and environmental sensing. lab will be provided to students enrolled in the course to learn nano and micro-structure characterizations skills.

Learning Outcomes: 1. Be familiar with terminology and basic concepts of nanomaterials, nanomanufacturing and nanotechnologies. 2. Understand common techniques for nano-structure synthesis and fabrication. 3. Understand basic knowledge of carrier transport mechanism in nanoscales. 4. Understand basic properties of nanomaterials including: mechanical, electrical, thermal,

sensing and their characterization techniques. 5. Understand working mechanisms of using nanotechnology to develop multi-functionality of infrastructure materials. 6. Understand underlying mechanisms of thermoelectricity, state-of-the-art thermoelectric materials, devices and their applications. 7. Understand fundamental knowledge of piezoelectricity, state-of-the-art piezoelectric materials, devices and their applications. 8. Understand working mechanisms of various infrastructure sensing and monitoring technologies, their applications and limitations. Credits: 3.00

CE 53500 - Bituminous Materials And Mixtures

Credit Hours: 3.00. Consideration of major types of bituminous materials-asphalt cements, cutback asphalts, asphalt emulsions, and tars. Influence of chemical composition upon physical properties. Desirable aggregate characteristics for bituminous mixtures. Construction techniques. Current practices for determining optimum asphalt contents. Two one-day field trips are required.

Learning Outcomes: 1. Describe the origins of various bituminous materials, along with their advantages and disadvantages. 2. Describe basic asphalt, emulsion, cutback and aggregate production techniques. 3. Describe standard asphalt, emulsion, cutback and aggregate specification and test methods, along with advantages and disadvantages of each system. 4. Select the proper asphalt product for a given application. 5. Combine aggregates into blends to meet specifications. 6. Derive and correctly apply asphalt mixture volumetric equations. 7. Develop asphalt mixtures based on sound volumetric principles. 8. Complete asphalt mixture designs, including choosing the proper binder content for a given aggregate blend. 9. Explain the behavior of asphalt materials incorporated into pavement structures. 10. Describe the asphalt mixture production, placement, and compaction processes. 11. Evaluate alternatives, using appropriate measures of merit. 12. Demonstrate the capacity for critical thought. Credits: 3.00

CE 53600 - Non-destructive Testing And Sensing For Civil Infrastructures

Credit Hours: 3.00. This course will equip students with necessary fundamental knowledge related to the Non-Destructive Testing methods. The topics will be discussed including fundamental materials mechanical properties and linear fracture mechanics of materials, testing procedures of commonly used civil materials and structures. The content such as, elasticity, fracture mechanics, and wave propagation, will be covered. Various case studies will be discussed to help students understand and apply the knowledge to field inspection or monitoring of civil materials and structures.

Learning Outcomes: 1. Be familiar with terminology and basic concepts of materials and structure failure mode, and failure mechanisms. 2. Understand basic principles of various NDT techniques including stress wave, magnetic, electrical, radar and fiber optics-based methods. 3. Be familiar with typical data acquisition and signal processing involved in NDT methods. 4. Be familiar with equipment and testing procedures of common NDT methods used for civil infrastructure materials and structures. 5. Understand working mechanisms of various infrastructure sensing and monitoring technologies, their applications and limitations. 6. Identify and apply appropriate NDT methods for materials and structural health monitoring and sensing. 7. Perform hands on testing and make decisions after data processing. 8. Report the NDT testing results professionally in both oral and written format. Credits: 3.00

CE 53800 - Experimental Methods In Construction Materials Research

Credit Hours: 3.00. This course will introduce the student to the fundamental aspects of the computer control of experimental equipment. Emphasis is placed on the difficulties of interfacing computers and instruments. Experimental techniques for measuring important properties of construction materials are discussed. For example, techniques involving the use of strain gages, optical measurements, and measurement of properties

such as pore structure and surface area are considered. Emphasis is placed on the effects of experimental techniques on the resulting measurements.

Credits: 3.00

CE 54000 - Open Channel Hydraulics

Credit Hours: 3.00. Energy and momentum principles, design of open channels for uniform and nonuniform flow, boundary layer and roughness effects, flow over spillways, energy dissipation, flow in channels of nonlinear alignment and nonprismatic section.

Credits: 3.00

CE 54200 - Hydrology

Credit Hours: 3.00. Meteorology; precipitation; stream flow, evaporation, and transpiration; subsurface flows, well hydraulics; runoff relations and hydrographs; elements of stream flow routing, frequency and duration studies; extreme values statistics applied to flood and drought forecasting; application of hydrologic techniques.

Credits: 3.00

CE 54300 - Coastal Engineering

Credit Hours: 3.00. An introduction to coastal engineering with emphasis on the interaction between oceanic dynamic processes (waves, currents, and tides) and coastal regions (beaches, harbors, structures, and estuaries) and on the engineering approaches necessary to prevent adverse effects caused by this interaction.

Credits: 3.00

CE 54400 - Subsurface Hydrology

Credit Hours: 3.00. Basic principles of fluid flow in saturated and unsaturated materials. Darcy's law, well hydraulics, determination of hydraulic properties of aquifers. Infiltration theory. Discussions of artificial recharge, land subsidence, saltwater intrusion, ground water quality and contamination.

Credits: 3.00

CE 54500 - Sediment Transport Engineering

Credit Hours: 3.00. Sediment properties and the mechanics of sediment transport. Threshold of movement. Riverbed load and suspended load theories. Regime theory and stable channel design. River diversion problems. Erosion. Geomorphologic and water quality aspects.

Credits: 3.00

CE 54700 - Transport Processes In Surface Waters

Credit Hours: 3.00. Four main topics are covered: (1) density-stratified two-layer systems in lakes and channels, with applications to mixed-layer growth, oil-spill containment, salinity intrusions, (2) advection-diffusion modeling in channels, including analytical solutions to steady and unsteady, one- and two-dimensional problems, (3) mechanisms of diffusional transport, including turbulence in channels and longitudinal shear dispersion, and (4) near-field analysis of discharges, including similarity analyses of jets and plumes.

Credits: 3.00

CE 54900 - Computational Watershed Hydrology

Credit Hours: 3.00. Use of professional computer programs for the calculation of the runoff from complex basins. Generation of unit hydrographs. Calculation of losses, channel and reservoir routing, parameter optimization, and application of Kinematic wave technique to urban catchments. Offered in alternate years.

Credits: 3.00

CE 55000 - Physico-Chemical Processes In Environmental Engineering I

Credit Hours: 3.00. This is the first of a two-course sequence and covers physico-chemical processes as applied in water and wastewater treatment. Topics include: reactor theory, mixing, gravity separation, centrifugation, adsorption, ion exchange, disinfection kinetics, acid/base chemistry, neutralization, precipitation, and corrosion.

Learning Outcomes: 1. Learn fundamental principles of physico/chemical processes that are commonly used by Environmental Engineers with an emphasis on water treatment. 2. Understand principles that have a broad application in Environmental Engineering and other disciplines. 3. Focus on fundamental concepts so as to prompt application in a wide range of settings and to promote creativity.

Credits: 3.00

CE 55201 - Environmental Biotechnology

Credit Hours: 3.00. This course focuses on fundamental of molecular biology and biotechnology for environmental applications. The major topics include activated sludge processes, stoichiometry, bioenergetics, anaerobic digestion,

biological nitrogen and phosphorus removal, molecular microbiology tools, biofouling, antibiotic resistance, viruses and biofuels.

Learning Outcomes: 1. Understand the latest development in environmental biotechnology and their applications in contaminant removal and public health protection. 2. Review relevant literature critically on selected topics in environmental biotechnology and identify areas for improvement. 3. Deliver effective presentations. 4. Write clearly and ethically. Credits: 3.00

CE 55401 - Water Chemistry For Environmental And Ecological Engineering

Credit Hours: 3.00. Principles of chemistry applied to the analysis and distribution of the chemical composition of natural waters and engineered water systems. Course topics include acid/base, complexation, precipitation/dissolution, sorption and redox reactions in the context of environmental and ecological engineering. Case studies focus on water chemistry in research and practice, such as lead in drinking water, recovery of valuable products from wastewater, chemistry of engineered carbon dioxide capture, and engineered treatment of surface waters. Case studies vary each year.

Learning Outcomes: 1. Describe the unique properties of water, and the relevance to natural and engineered systems. 2. Explain fundamental principles of chemical equilibrium and kinetics, and apply principles to calculations and solving contemporary challenges in water chemistry systems. 3. Classify chemical reactions and mass transfer, and deduce which categories are present in a particular system. 4. Evaluate and formulate technological approaches to reduce environmental impacts of anthropogenic activities, based on water chemistry principles. Credits: 3.00

CE 55700 - Air Quality Management

Credit Hours: 3.00. Discussion of fugitive, mobile, and point sources of air pollution with attendant effects on materials, plants, and humans. Development and status of state and federal regulations with emphasis on the development and use of mathematical dispersion models including meteorological fundamentals and atmospheric transport. Discussion of concepts for ambient air quality control strategies including urban planning and transportation considerations.

Credits: 3.00

CE 56000 - Public Mass Transportation

Credit Hours: 3.00. Public mass transportation system technologies, design, operation, and planning including vehicle characteristics, bus transit, light rail and rail rapid transit, schedules and networks, capacity, passenger characteristics, and paratransit.

Credits: 3.00

CE 56100 - Transportation Systems Evaluation

Credit Hours: 3.00. Concepts and principles of transportation economic analysis, transportation costs and benefits, user and nonuser consequences, needs studies, finance and taxation, methods of evaluation of plans and projects, cost-effectiveness, environmental impact assessment.

Credits: 3.00

CE 56200 - Geometric Design Of Highways

Credit Hours: 3.00. Development and applications of concepts of geometric design for rural and urban highways. Design controls and criteria, elements of design including sight distance and horizontal and vertical alignment, cross-section elements, highway types, intersection design elements, types of interchanges and interchange design elements, grade separations and clearance.

Credits: 3.00

CE 56201 - Vehicular Cyber-Physical Systems

Credit Hours: 3.00. Cyber-physical systems (CPS) are a new frontier for computational systems that transform the way people interact with engineered systems, which benefit applications in fields like transportation, aerospace, manufacturing, and health care. This course introduces students to the theoretical and practical foundations of CPS, with an emphasis on their usage in connected and automated vehicles (CAV).

Learning Outcomes: 1. Obtain the basic knowledge of CPS and CAV. 2. Know how to develop an autonomous system to be applied to the transportation system. Credits: 3.00

CE 56300 - Airport Design

Credit Hours: 3.00. Airport design requirements derived from using aircraft design parameters and operational characteristics; airport configuration; runway length and orientation; geometric

design of taxiways, exits, and runways; apron design; airspace obstacles; effects of air traffic control; lighting and marking; asphalt pavement and rigid concrete pavement design; pavement overlays; evaluation of runway pavement; drainage; earthwork; and project management. A field trip is required.

Credits: 3.00

CE 56401 - Data Science For Smart Cities

Credit Hours: 3.00. The availability of low-cost and ubiquitous sensors in city infrastructure provides high granular data at unprecedented spatiotemporal scales. "Smart Cities" is a concept to utilize this data to provide a healthy, happy and sustainable urban ecosystem by integrating the information and communication technology, Internet of things, and citizen participation to effectively manage and utilize city's infrastructure and services. 'Data science' is an interdisciplinary field of scientific methods, processes, algorithms, and systems to extract knowledge from data in various forms. This course will introduce techniques that will allow the analysis, inference, and prediction of large-scale data (e.g., GPS trajectories, individual social networks, etc.) that are present in urban networks. The course will focus both on the methods and their application to smart city problems. Python will be used to demonstrate the application of each method on datasets available to the instructor. Examples of applications that will be discussed as an example of applications of data science for smart city applications include: ridesharing platforms, energy modeling, smart and energy-efficient buildings, evacuation modeling, decision-making during extreme events, and urban resilience.

Learning Outcomes: 1. Understand the different types of data generated by smart cities. 2. Understand the basics of various data mining techniques. 3. Understand what type of data mining analysis is appropriate for various smart city applications. 4. Gain basic knowledge of using Python for data analytics and results visualization. 5. Apply the methods and techniques learned in this course to an applied smart city project. Credits: 3.00

CE 56500 - Traffic Engineering: Operations And Controls

Credit Hours: 3.00. Traffic laws and ordinances; design and application of signs, markings, and signals; timing of isolated and interconnected signals; speed regulation; one-way streets; pedestrian, bicycle, and mass transit considerations; traffic engineering administration.

Credits: 3.00

CE 56600 - Transportation Planning

Credit Hours: 3.00. Fundamentals of transportation planning. Historical development and current status of techniques used in travel demand forecasting: trip generation, trip distribution, mode choice, traffic assignment. Data collection and use of surveys. Applications to passenger and freight movement in urban and statewide contexts. Implications for policy formulation and analysis.

Credits: 3.00

CE 56601 - Network Models For Connected And Autonomous Vehicles

Credit Hours: 3.00. This course provides an introduction to mathematical foundations of the analysis of transportation networks. The course will be divided into two main sections. Section 1 will introduce the basic foundations of network routing problems including user equilibrium (selfish routing) and system optimal games on networks. Various optimization-based formulations, algorithms and extensions will be discussed. A particular emphasis will be on devising efficient algorithms and computation on city networks. Students will be expected to know how to design efficient algorithms for network analysis and implement them on various datasets. The second half of the course will tailor the network models learned in the first half to understanding the impacts of connected and autonomous vehicles (CAVs). This will be done by taking specific example problems such as autonomous intersection control, parking design, network design for CAVs, etc. Recent research papers will form the basis for developing these models. Extensive use of intuitive arguments, counterintuitive phenomenon (paradoxes) and network structures will be utilized to illustrate many situations graphically. In addition, computing the solutions efficiently using various network algorithms will be discussed. The course is research based and students in addition to learning the concepts will extend the concepts to a research project to be finished within the semester.

Learning Outcomes: 1. Analyze transportation systems using game theory and optimization by drawing on analogies between the interactions of supply and demand in economic markets. Define selfish routing (user equilibrium) and system optimal problems; Develop solution algorithms for large scale networks. 2. Apply specialized network structures to solve selfish routing games efficiently. 3. Formulate and apply various extensions of the selfish routing game rigorously - traffic assignment with elasticity, stochastic user equilibrium, network

design and OD estimation. 4. Understand the basic concepts of Connected and Autonomous vehicles (CAVs). 5. Apply the static network models to CAV planning and operations problems. 6. Use software to analyze various large-scale transportation networks and understand issues from real-world practitioners.
Credits: 3.00

CE 56700 - Highway Traffic And Safety Analysis

Credit Hours: 3.00. Traffic and safety studies including: traffic and safety impact studies, control and geometry improvements, hazard and countermeasures identification, predicting safety benefits, before-and-after studies; data collection and computer tools for highway traffic and safety evaluation.

Credits: 3.00

CE 56800 - Highway Infrastructure Management Systems

Credit Hours: 3.00. Processes and techniques of managing rehabilitation and maintenance of highway infrastructure facilities including roads and bridges. Three management systems are examined: pavement, bridge, and roadway maintenance. The primary emphasis is on data collection, life cycle cost analysis, priority setting and optimization, program development strategies, and institutional issues.

Credits: 3.00

CE 56901 - Smart Logistics

Credit Hours: 3.00. This course provides a foundation of analytical tools, methods and applications of logistics systems in the context of planning and operations of integrated supply chain systems. The material is useful for students interested in managing supply chain systems providing a background on where and how specific methods can be used for improving overall performance of the supply chain. The course is broadly divided into two parts: (1) Science of Logistics which provides an introduction to unique characteristics of supply chain management; demand forecasting, planning and management; inventory control and planning; operational transportation issues such as vehicle routing and supply chain contracts and network design. (2) Business of Logistics which discusses the applications of the science to real-world logistics systems. Real-world case studies from past problems will be the basis for discussion and will include the nature of costs in supply chain networks, operational issues, vehicle routing problems, interactions of carriers and shippers using auctions and yield management. The course will use intuitive arguments and mathematical optimization tools will be used to illustrate many situations in a rigorous fashion.

Learning Outcomes: 1. Reinforce the integrated nature of logistics systems from tactical, operational and strategic perspectives, different actors in this system and the role of logistics systems as an economic driver. 2. Understand the basics concepts and models of demand prediction, inventory management, operational and tactical planning in supply chain management. 3. Demonstrate the ability to develop appropriate quantitative tools for planning and logistics problems using optimization techniques and solve them using appropriate solution algorithms, techniques and software. 4. Apply the science of logistics systems to improve the cost and overall efficiency of real-world logistics problems.
Credits: 3.00

CE 57000 - Advanced Structural Mechanics

Credit Hours: 3.00. Studies of stress and strain, failure theories, and yield criteria; flexure and torsion theories for solid and thin-walled members; and energy methods.

Credits: 3.00

CE 57100 - Earthquake Engineering

Credit Hours: 3.00. The objectives of the course are to: (1) expose the fundamentals of structural design in earthquake regions; (2) explain the functions of linear, nonlinear, and limit analyses with respect to design; (3) describe the complex relationships between ground motion models and structural response models in the linear and nonlinear response ranges; and (4) provide the students perspectives about the behavior of building structures in the earthquake environment.

Credits: 3.00

CE 57200 - Prestressed Concrete Design

Credit Hours: 3.00. Behavior and design of prestressed concrete structures, prestress losses, composite construction, flexure and shear design, deflections, and special topics.

Credits: 3.00

CE 57300 - Structural Dynamics

Credit Hours: 3.00. Analysis of structural members and

systems subject to dynamic loads such as wind and earthquake loads; basic theory for single-degree-of-freedom and multi-degree-of-freedom analytical models of civil engineering structures; free vibration, harmonic and transient excitation, foundation motion, resonance spectrum, Lagrange's equation, modal analysis, lumped parameter methods, computer methods.

Credits: 3.00

CE 57401 - Introduction To Applied Computer Vision To Civil Engineering

Credit Hours: 3.00. This course is an introduction to fundamental topics within applied computer vision-based sensing for management and condition assessment of civil infrastructure systems. Some of the topics covered in this course include basic concepts in digital image processing, pattern recognition, and computer vision that are applicable for segmentation, clustering, 3D reconstruction of civil infrastructure elements, strain and displacement measurement, defect detection and structural health monitoring. Upon successful completion of this course the student shall be able to understand and utilize fundamental concepts in computer vision, image processing and machine learning to analyze images, stitch images, reconstruct the 3D scene, classify and recognize objects/damage, and quantify and track changes.

Learning Outcomes: 1. Understand and utilize fundamental concepts in computer vision, image processing and machine learning to analyze data (discrete, time history, images, and videos). 2. Preprocess and filter data, stitch images, reconstruct the 3D scene, classify and recognize objects/damage, and quantify and track changes. 3. Utilize and implement deep learning techniques including deep neural networks, convolutional neural networks, autoencoders, etc. for their research projects.

Credits: 3.00

CE 57500 - Experimental Methods In Structural Engineering

Credit Hours: 3.00. Theory, methods, and techniques for experimental studies of structural members and systems. Measurements fundamentals; transducers for measuring strain, displacements, force and torque, pressure, and temperature. Physical modeling principles: similitude, materials and their properties, and loading systems for application to studies of elastic and inelastic models. Case studies. Individual project required of each student. Permission of instructor required.

Credits: 3.00

CE 57600 - Advanced Reinforced Concrete Design

Credit Hours: 3.00. Design and behavior of columns, two-way slab and slab-beam floor systems, and beam-column joints; strut-and-tie models.

Credits: 3.00

CE 57900 - Structural Stability

Credit Hours: 3.00. Bending of structural members subjected to axial and lateral loads; buckling of compression members and frames in elastic and inelastic ranges, local buckling, lateral buckling of beams, design criteria.

Credits: 3.00

CE 58000 - Advanced Geotechnical Engineering

Credit Hours: 3.00. Advanced treatment of topics in geotechnical engineering, including the engineering response to loading, soil properties, earth pressures, shear strength, soil compaction and fabric, permeability, and consolidation and settlement analysis.

Credits: 3.00

CE 58300 - Slopes And Retaining Structures

Credit Hours: 3.00. Selected topics in soil response and technology needed in conventional geotechnical analysis and design; shearing behavior in clays; subsurface investigation; lateral earth pressures, retaining walls, and sheet pile walls; stability of slopes.

Credits: 3.00

CE 58400 - Foundation Analysis And Design

Credit Hours: 3.00. Design of shallow foundations (isolated, combined, and strip footings), with specific attention to issues of mutual concern and interest to geotechnical and structural engineers. Review of factors that serve as the basis for selection of foundation type. Interpretation of subsurface exploration results. Settlement analyses and limit bearing capacity analyses. Communications and interaction between geotechnical and structural engineers. Structure and contents of a geotechnical report. Detailed treatment of geotechnical/structural design criteria and methodologies for various types of shallow and deep foundations.

Credits: 3.00

CE 58700 - Soil Dynamics

Credit Hours: 3.00. Vibration of elementary systems, foundation

vibratory theory, foundation design for vibratory loads, foundation isolation, wave propagation theory, response of soils to dynamic loading, dynamic soil properties, dynamic behavior of waste materials, field and laboratory methods for evaluation of dynamic soil properties, liquefaction of sands, vibratory compaction of granular materials.

Credits: 3.00

CE 59100 - Advanced Structural Steel Design

Credit Hours: 3.00. Design and behavior of plate girders; design of composite beam and column members; behavior and design of bolted and welded connections, including moment-resistant connections, seated connections, and gusset-plate connections.

Credits: 3.00

CE 59400 - Transportation Systems Analysis

Credit Hours: 3.00. Identifies concepts fundamental to the planning, design, operation, and management of transportation systems. Aims to impart a systems perspective to transportation problems. Incorporates concepts from economics, engineering, operations research, management, psychology, and public policy analysis. Topics include supply-demand microeconomic framework, analysis of transportation demand, system performance, network equilibrium, and associated case studies.

Credits: 3.00

CE 59500 - Finite Elements In Elasticity

Credit Hours: 3.00. Fundamentals of theory of elasticity; variational principles; one-, two-, and three-dimensional elasticity finite elements; interpolation methods; numerical integration; convergence criteria; stress interpretation.

Credits: 3.00

CE 59601 - Entrepreneurship And Business Strategy In Engineering

Credit Hours: 3.00. This course offers students the opportunity to learn and apply the core skills required to build and grow engineering- and technology-based businesses through lecture, case discussions, and weekly activities tied to a semester-long team project. Course content includes market analysis techniques to link technology attributes to opportunity and vice versa, combinatorial business design and planning methods, strategic innovation theories, competitive analysis, methods of emergent strategy and risk mitigation, as well as examination of team building, firm influence and navigation, and organizational design principles. Emphasis throughout is placed on the implications of research and development uncertainty, long-lifecycle economics, and the management of subcontracts and multi-disciplinary teams often encountered when developing and delivering complex engineering outputs. Case studies are used to contrast the challenges faced when creating new businesses (entrepreneurial) with those encountered in attempts to grow an existing enterprise (intrapreneurial). Coursework and project activities also facilitate development of business acumen, and skill building in conceptual thinking, synthesis, and persuasive communication. This course is particularly relevant for engineering students intending to progress into managerial roles in technology or R&D driven organizations. This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Articulate the similarities and differences between entrepreneurship and intrapreneurship. 2. Employ open-ended problem solving techniques to identify opportunities to grow or transform new or existing organizations and/or commercialize new technologies. 3. Utilize and interpret qualitative and quantitative issue and market analysis methods to understand and/or quantify the level of market interest in an idea. 4. Understand and apply theories of innovation to define competitive market entry strategies. 5. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 6. Employ principles of risk mitigation and emergent strategy to define the assumptions underlying new ideas and explore paths to capture market value. 7. Perform and interpret financial evaluations of new ideas and businesses. 8. Interpret the tradeoffs of varying legal and management structures for a new enterprise. 9. Recognize influence paths in an organization and/or market ecosystem and tailor oral and written communications accordingly.

Credits: 3.00

CE 59700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

CE 59800 - Graduate Professional Internship

Credit Hours: 0.00. Professional experience in Civil Engineering. This internship experience is intended to complement the student's academic coursework and help prepare the student for a career as a practicing engineer. Program coordinated by school with cooperating employers. Must complete one academic year in Civil Engineering. A written report is required. (May be repeated but may not be taken in successive semesters.) Permission of instructor required.

Credits: 0.00

CE 59801 - Breakthrough Thinking For Complex Challenges

Credit Hours: 3.00. This course helps students learn and effectively employ high-impact design principles and structured problem solving methods to address complex multi-stakeholder socio-technical challenges. Case discussions of historical and contemporary high impact solutions to complex challenges are used to introduce techniques to frame problems, structure ambiguity, intentionally design non-incremental solutions, and communicate, trial, and iterate solutions to drive adoption and multifaceted sustainability. Techniques are drawn from multiple schools of thought such as business, design, engineering, and the social sciences. Over the course of the term, multidisciplinary student teams directly apply cumulative learning to address a real-world complex societal challenge in close collaboration with a partner organization in an experiential learning format. The course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

Learning Outcomes: 1. Employ rigorous issue analysis methods to develop mutually exclusive collectively-exhaustive structured inventories of the issues involved in a major challenge. 2. Understand stakeholder motivation and interpret the funds, services and influence exchanged in stakeholder ecosystems. 3. Understand the benefits and limitations of qualitative and quantitative methods to identify and interpret stakeholder needs. 4. Gain familiarity with habit conversation methodologies and role they can play in design activities. 5. Recognize the importance of empathy in solution design and apply structured ideation methods to engender empathy in designers. 6. Understand patterns of innovation success and the contextual circumstances in which they apply. 7. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea. 8. Discern the broader societal impacts of design activities. 9. Develop robust assessments of the assumptions underlying new ideas and means to test those assumptions rapidly and at low cost. 10. Recognize and define influence paths and communication methods to drive awareness, consideration, conversion and retention of new solutions. Credits: 3.00

CE 61400 - Statistical And Econometric Methods I

Credit Hours: 3.00. Basic and advanced statistical and econometric methods as applied to engineering-related problems. Introduction to ordinary least squares regression, count-data models including Poisson and Negative binomial regressions and their extensions, simultaneous equations models, multinomial logit models, ordered probability models, joint discrete/continuous models, and hazard-based duration models. Prerequisites: STAT 51100 .

Credits: 3.00

CE 63100 - Advanced Concrete And Aggregates

Credit Hours: 3.00. Microstructure of concrete. Physicochemical properties of cements and their hydration. Nature of hardened cement paste. Properties of aggregates. Workability, strength, shrinkage, creep, and fracture of concrete. Durability, freezing and thawing, air-entertainment, reactions of aggregates, chemical attack. Influence of microstructure on engineering properties of concrete. Prerequisite: CE 53000 .

Credits: 3.00

CE 65000 - Photochemical Reactors: Theory, Methods, And Applications Of Ultraviolet Radiation

Credit Hours: 3.00. This course provides comprehensive coverage of the foundational principles of photochemistry and fundamental photochemical reactor theory. Contemporary analytical and numerical methods used to simulate and design photochemical reactors are also presented, along with detailed presentations of several common and emerging applications of these devices. Prerequisite: CE 55000 or graduate status.

Learning Outcomes: 1. Demonstrate

fundamental understanding of the principles of photochemistry: mechanisms of photochemical reactions, factors that affect photochemical kinetics, rates of photochemical reactions in various settings. 2. Demonstrate fundamental understanding of photochemical reactor theory: the concept of the dose (fluence) distribution, factors that affect the dose distribution, methods used to simulate reactor dynamics. 3. Articulate fundamental physics that govern the behavior of UV radiation sources: incandescence, metal/halide vapor lamps, LEDs, excimer lamps, lasers, upconversion. 4. Demonstrate fundamental understanding of empirical methods used to characterize and quantify photochemical reactor dynamics: collimated beams, biodosimetry, chemical actinometry, relevant methods in microbiology. 5. Demonstrate fundamental understanding of numerical methods used to characterize and quantify photochemical reactor dynamics: fluence rate field models, computational fluid dynamics (CFD), integrated CFD/fluence rate field models. 6. Apply contemporary methods for analysis and design of UV disinfection systems for aqueous media: drinking water production, municipal wastewater, wastewater reuse. 7. Apply contemporary methods for analysis and design of UV-based processes for alteration of solution chemistry: direct photolysis, advanced oxidation processes, advanced, reduction processes. 8. Apply contemporary methods for analysis and design of systems used to disinfect gas-phase and solid-phase media: disinfection of air and surfaces. Credits: 3.00

CE 66100 - Algorithms In Transportation

Credit Hours: 3.00. Modeling and analysis of transportation network problems through the design, analysis, and implementation of algorithms. Emphasis on the use of quantitative techniques of operations research to model system performance. Covers fundamental data structures, complexity analysis, memory management, recursive programs, application of graph theory and network analysis to transportation problems, analytical formulations and solution algorithms for traffic assignment problems, and dynamic traffic assignment. Prerequisite: CE 59600 or IE 50100.

Credits: 3.00

CE 67100 - Behavior Of Metal Structures

Credit Hours: 3.00. Study of the behavior of metal structural components and metal structural systems. The performance of civil engineering type metal structures in various loading environments is examined, and correlations between behavioral characteristics and various design specification requirements are reviewed. Primary emphasis is placed on the behavior of steel structures, although other metal systems also are discussed. Specific topics include material behavior, manufacturing processes, fatigue and fracture, bolting and welding procedures, and repair and retrofit techniques. Course material is augmented with a number of case studies. Prerequisite: CE 59100 .

Credits: 3.00

CE 67200 - Advanced Topics In Structural Engineering

Credit Hours: 1.00 to 3.00. A series of minicourses on special topics offered as CE 67000, CE 67200, etc. These special topic minicourses provide an opportunity for introducing students to topics of contemporary importance or special interest which fall outside the scope of the regular structural courses. Information about current offerings may be obtained from the schedule of classes or the structural engineering.

Credits: 1.00 to 3.00

CE 67401 - Bridge Engineering

Credit Hours: 3.00. This course reviews a number of fundamental topics related to the structural design of highway bridges. Some of the key features include bridge types, aesthetics, structural analysis methods, vehicle load distribution, deck design and detailing, steel girder design, concrete girder design, integral abutment design, bearings, and construction. Concurrent prerequisites: CE 57200 and CE 59100 .

Learning Outcomes: 1. To solidify students' understanding of the material taught and introduce them to fundamental aspects involved in the design and construction of bridges. 2. Students should be able to understand critical aspects of AASHTO (American Association of State Highway and Transportation Officials)

bridge design requirements for steel and concrete superstructures and bridge decks.
Credits: 3.00

CE 67500 - Finite Element Analysis

Credit Hours: 3.00. Theoretical basis of the finite element method; elements for use in the solution of two- and three-dimensional stress problems, plate-bending problems and shell problems; static and dynamic loadings; vibration and stability problems; geometrical or material nonlinearities; flow problems. Prerequisite: CE 57700 or 57800.

Credits: 3.00

CE 67600 - Behavior Of Reinforced Concrete Members

Credit Hours: 3.00. Studies of the behavior and strength of reinforced concrete members, behavior of beam-columns, deflections, shear, bond, and cracking. Review of research and pertinent literature. Emphasis is placed on the background, use, and limitations of present design specifications. Prerequisite: CE 57600 .

Credits: 3.00

CE 68100 - Engineering Properties Of Soils

Credit Hours: 3.00. Engineering properties of soils, including compaction phenomena, with emphasis on strength and compressibility. Experiments to examine the nature and validity of strength and compressibility theories and their application to stability and settlement analysis. Measures of soil fabric; behavior of waste/marginal materials. Prerequisite: CE 48300 .

Credits: 3.00

CE 68200 - Ground Water And Seepage

Credit Hours: 3.00. Hydromechanics of confined and unconfined flow of water through soils, potential theory, conformal mapping transient flow. Applications to design of earth dams. Prerequisite: CE 483000.

Credits: 3.00

CE 68400 - Geological Engineering

Credit Hours: 3.00. Principles describing the mechanical response of geomaterials subjected to disturbance by man. Relation between geology and engineering. Weathering and hydrothermal alteration of rock masses. Weathered rocks, problem soils, and transitional materials. Soluble rock terrain (karst). Applied geomorphology. Civil engineering design factors and case histories that relate to the behavior of rocks and sediments. Characterization of geomaterials behavior, exploration and measurement of their engineering properties. The focus of the course is on theoretical and practical solution of engineering problems. Prerequisite: CE 483000.

Credits: 3.00

CE 68500 - Rock Mechanics

Credit Hours: 3.00. Mechanical properties governing rock behavior, from intact rock to fractured rock masses. Laboratory experiments and field tests. Failure criteria. Linear Elastic Fracture Mechanics. Rock mass deformability. Analytical and empirical approaches for the design and construction of civil engineering structures in rock masses. Slope stability. Bearing capacity of shallow and deep foundations. Prerequisite: CE 48300.

Credits: 3.00

CE 68600 - Underground Construction

Credit Hours: 3.00. Planning, analysis, design, and construction of underground structures in soft ground and rock. Ground structure interaction. Static and seismic stresses on tunnel support. Relative stiffness method. Ground deformations. Construction methods, types of support, and their effects on the surrounding ground. The focus of the course is on the understanding of the interaction between ground and structure. Prerequisite: CE 48300.

Credits: 3.00

CE 68901 - Plasticity Theory

Credit Hours: 3.00. The course covers stress analysis, strains analysis, elastic and inelastic constitutive relations, with emphasis on plasticity, and the solution of plastic boundary-value problems for a wide range of materials, including metals, soils and alloys of various types. Specific topics covered by the course include: tensors, stress analysis, strain analysis, laws of thermodynamics, basic concepts from elasticity, viscoplasticity as an extension of viscoelastic concepts, classical plasticity, principle of maximum plastic dissipation, Drucker's inequality, yield function and yield surface, flow rule, hardening rule, classical models (Tresca, Von Mises, Mohr-Coulomb, Drucker-Prager), bounding-surface plasticity, thermodynamics and constitutive models, causes of plasticity at the microstructural level, noncoaxial plasticity, limit analysis, method of characteristics (slipline method) and cavity expansion analysis. Prerequisite: AAE 55300 or ME 61200.

Credits: 3.00

CE 69100 - Civil Engineering Seminar

Credit Hours: 0.00. An interdisciplinary seminar which provides a forum for invited speakers and staff to discuss new

developments in practice and current research in civil engineering.

Credits: 0.00

CE 69500 - Probabilistic Methods In Geotechnical Engineering

Credit Hours: 3.00. Examines the nature of particulate media and their description and characteristics. Compares deterministic and probabilistic approaches to the action and reaction of structures of, on, or in soil when subjected to loadings. Considers uncertainties in material parameters and their effect on designs. Stability is assessed in terms of reliability as well as customary factors of safety. Prerequisite: CE 58000 .

Credits: 3.00

CE 69700 - Civil Engineering Projects

Credit Hours: 0.00 to 18.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 18.00

CE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CEM 53100 - Facilities Engineering And Management

Credit Hours: 3.00. This course provides the student with an understanding of the issues related to facilities management for owner organizations. The course is oriented toward upper class and graduate students familiar with the delivery of capital construction projects and provides an owner's perspective of capital construction and ongoing operation. The course will focus on the total life-cycle cost of a capital construction project beginning with planning, business rationale, economic analysis, and programmatic specifications. The owner's perspective on annual operating costs will be examined including calculation of daily, weekly, monthly, and annual operating costs. The implications of stewardship and customer service will be reviewed and analyzed including the implications on total life-cycle costs. The human resources implications of operating a facility will be reviewed including determination of staffing requirements to meet various levels of service as well as tools and techniques to determine and manage contracted services. Numerous case studies will be described and discussed which will demonstrate the importance of careful planning and budgeting of annual and periodic maintenance. Issues of sustainability, regulations, and other legal factors will be discussed and examined.

Learning Outcomes: 1. Gain an understanding of the cost implications associated with the decision to construct a new facility via a total cost of ownership perspective as well as understanding the service delivery expectations. 2. Learn methods for formulating and analyzing costs of operations including capital renewal. 3. Learn concepts of management of facilities (institutional, commercial, residential, and manufacturing). 4. Learn external factors related to owning and/or operating facilities of various sizes. 5. Learn prioritization, stewardship, management and decision making for capital projects. Credits: 3.00

CEM 53200 - Infrastructure Planning

Credit Hours: 3.00. This course provides the student with an in depth understanding of the issues related to infrastructure planning, engineering, and economics. The focus will be on the prioritization, stewardship, management and decision-making roles within the engineering division of a large public works agency. Various infrastructure planning concepts will be reviewed and discussed. Numerous case studies will be described and discussed, which will demonstrate that in order to plan and implement a successful public works project, many controversial issues must be faced and difficult problems must be solved. Decision-making at agency and other levels of government will be discussed with respect to reports prepared by planners covering engineering feasibility, environmental and social impact assessments, and financial and economic analyses. Evolving modern planning issues will be introduced and discussed, including sustainability; environmental economics; environmental justice; uncertainty and risk-benefit analysis; partnerships with private entities versus total privatization; and the optimum staff-mix utilization in-house versus outsourcing.

Learning Outcomes: 1. Learn methods for formulating and analyzing infrastructure projects. 2. Learn concepts of management of public works planning and implementation. 3. Learn principal methodologies of the

interdisciplinary analyses of infrastructure projects. 4. Learn prioritization, stewardship, management and decision making for public works projects. Credits: 3.00

CEM 53300 - Infrastructure Analytics

Credit Hours: 3.00. This course investigates the data sources and numerical tools required to assess the status of constructed facilities and to make informed decisions from the data. The course is oriented toward upper class and graduate students familiar with the delivery of capital construction projects (buildings, roads, bridges, earthworks, utilities, rail/transit, ports, and canals) and includes numerical analysis techniques. The course will focus on data sources, either direct or indirect, and analysis methods to identify the current condition or project future conditions of built infrastructure. Course format will be highly interactive with discussion about recent infrastructure projects in both instructor, guest speaker, and student-led discussions. Issues of sustainability, regulations, and other factors will be discussed and examined.

Learning Outcomes: 1. Learn Identification of metrics for analysis. 2. Learn data gathering techniques and tools. 3. Learn management of infrastructure data. 4. Learn techniques to resolve missing or non-existent data. 5. Learn numerical methods, limitations and accuracy. Credits: 3.00

CEM 58500 - Temporary Structures

Credit Hours: 1.00. This class will provide construction and design professionals the skills to understand construction loads and their combinations, wind loads and their impacts, timber design, bracing and guying design, designing vertical forming systems, and shoring analysis for vertical construction.

Learning Outcomes: 1. Know the possible types and magnitudes of loads experienced by temporary structures. 2. Design bracing and guying systems needed and used in vertical construction. 3. Design vertical forming systems. 4. Design vertical shoring systems. 5. Coordinate construction interfaces with design. Credits: 1.00

CEM 58600 - Development Of Underground Space

Credit Hours: 3.00. This course has been designed to support students with civil engineering and construction engineering and management background. New underground construction projects are planned all over the world, and the course equips students to contribute to these exciting developments. This course includes an overview of the application for tunneling and underground space as well as construction methods. The course will cover various sizes of underground opening from small diameters built by micro-tunneling to common tunnels used in civil and mining applications to large caverns, often found in different end uses such as storage or hydropower construction.

Learning Outcomes: 1. Critique concepts for the future use of underground space and innovative methods of construction. 2. Describe and classify underground works according to type, use and construction methods. 3. Recognize the diversity and complexity of underground excavations and associated works. 4. Improve oral and written communication skills, including effective presentation. Credits: 3.00

CEM 58700 - Underground Infrastructure Asset Management

Credit Hours: 3.00. Most of the U.S. water and wastewater conveyance infrastructure was installed during the first half of the 20th century and is coming to an end of its useful life. "Out of sight, out of mind" describes the awareness and significance that has been placed on these underground lifeline systems which support societies' quality of life, public health, economic development and living standard. Historically, management of these systems has been described as "crises management." They only get attention when there is a failure. It has been determined that a reactive management approach is not sustainable. The Environmental Protection Agency (EPA) has been instrumental in assisting utilities transition from reactive management practices to proactive practices. This approach involves the principles and practices of Asset Management (AM). AM is a comprehensive approach which involves every aspect of the organization to develop and implement best business practices to address: (a) the current state of the assets, (b) levels of service, (c) critical assets, (d) life-cycle costing, and (e) funding. This course prepares students to utilize sound engineering judgment and principles for managing the construction, repair, rehabilitation, and maintenance of buried infrastructure systems including pipes, tunnels, chambers, etc.

Learning Outcomes: 1. Understand how utilities (owners of underground infrastructure) are organized and operate. 2. Understand rates of deterioration, failure mechanisms, evaluation/inspection technologies,

rehabilitation and repair methods of the buried infrastructure systems including pipes, tunnels, and chambers. 3. Develop strategic, tactical and operational plans to achieve the mission and objectives for developing and implementing asset management programs for buried infrastructure. 4. Improve oral and written communication skills, including effective presentation. Credits: 3.00

CEM 59700 - Experimental Masters Course

Credit Hours: 1.00 to 3.00. This course will allow CEM to develop and test new courses for graduate level delivery. Possible courses include: Robotics in Construction; Tunneling; Process Plant Construction; Waterway Engineering; Construction Visualization; Remote Monitoring and Inspection; Cost/Benefits of Planning Details; Heavy Construction Innovation; Site Pollutant Reduction & Control; Statistical Methods in Construction; Infrastructure Decay Mechanisms; Time Buffers and Task Durations; BIM Tools and Applications; Sustainable Construction Methods; Construction Operations & Productivity; Construction Accounting; and Construction Leadership.

Learning Outcomes: 1. Varies with each course however, the goal will be to provide either high-demand subject matter or to tailor courses to a manageable size. Credits: 1.00 to 3.00

School of Electrical and Computer Engineering (Graduate)

Website: **https://engineering.purdue.edu/ECE/Academics/Graduates**

Department/School Head

Milind Kulkarni

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty

Muhammad Ashraful Alam	C-S George Lee	Mireille Boutin	Hadiseh Alaeian	Michael Capano
Dionysios Alipranti	James S. Lehnert	Christopher Brinton	Aaron Brovant	Chin-Lin Chen
Jan P. Allebach	Husheng Li	Mary Comer	Xiaoqi Danny Chen	Lauren Christopher
Joerg Appenzeller	Lingxi Li	Meng Cui	Meng Cui	James A. Cooper
Santokh Badesha	Tongcang Li	Jing Gao	Keerthi Priya Dasala	Raymond A. DeCarlo
Saurabh Baqchi	Xiaojun Lin	Sumeet Gupta	James Davis	Karim El Sharkawy
Mark R. Bell	David J. Love	Vassilis Kekatos	Rosa Diaz-Rivas	Okan Ersoy
Peter Bermel	Yung-Hsiang Lu	Younghyun Kim	Yi Ding	Keinosuke Fukunaga
Sunil A. Bhave	Mark S. Lundstrom	Tillmann Kubis	Steve France	Saul Gelfand
Alexandra Boltesseva	Michael Manfra	Joseph Lukens	Mahsa Ghasemi	Robert Givan
Charles A. Bouman	Michael R. Melloch	Jason McKinney	Zahra Ghodsi	Jeffery L. Gray
Stanley Chan	Saeed Mohammadi	Ryan Newton	Luis Gomez	Pen-Min Lin
Yaobin Chen	Evgenii Narimanov	Qiang Qiu	Qi Guo	David G. Meyers
Yong Chen	Steven D. Pekarek	Xiaokang Qiu	Abolfazl Hashemi	Samuel Midkiff
Zhihong Chen	Dimitrios Peroulis	Timothy Rogers	Nak-seung Patrick Hyun	John Nyenhuis
Weng C. Chew	Irith Pomeranz	Shreyas Sen	David I. Inouye	Chee Mun Ong
Mung	Minghao	Lu Su	Jongwook Kim	Robert

Chiang	Qi		u	
Supriyo Datta	Anand Raghunathan		Woongkul Matt Lee	
Edward J. Delp	Vijay Raghunathan		Haitong Li	
Shengwang Du	Karthik Ramani		Chaoyue Liu	
Daniel S. Elliott	Sanjay Rao		Aravind Machiry	
Arif Ghafoor	Amy Reibman		Joseph Makin	
Vijay Gupta	Kaushik Roy		Anuran Makur	F. Pierret
Jianghai Hu	Gesualdo Scutari		Dallas Morisette	Steven Rovnyak
Y. Charlie Hu	Ali Shakouri	Maggie Zhu	Philip E. Pare	Peter Schubert
Muhammad Hussain	Vladimir M. Shalaev	Carla Zoltowski	Junjie Qin	Richard J. Schwartz
Zubin Jacob	Jeffrey M. Siskind		Thomas Roth	Philip H. Swain
Leah H. Jamieson	Scott D. Sudhoff		Vishal Shrivastav	Oleg Wasynczuk
David B. Janes	Shreyas Sundaram		Santiago Torres-Arias	Babak Ziaie
Brent Jesiek	Hong Z. Tan		Vishrant Tripathi	
Dan Jiao	Mithuna S. Thottethodi		Jingbo Wang	
Byunghoo Jung	T. N. Vijaykumar		Xianqian Joy Wang	
Avinash C. Kak	Chih-Chun		Jenna Wise-DiVincenzo	
Alexander Kildishev				
Gerhard Klimeck				
Cheng-				

Kok Koh James V. Krogmeier Milind Kulkarni	Wang Haiyan Wang Kevin J. Webb Dana Weinstein George R. Wodicka Peide Ye Stanislaw H. Zak Michael D. Zoltowski			

Academic Programs

Master's and Ph.D. Programs

We offer an educational experience that is among the best in public universities. Our students can learn from the many graduate level classes offered to become proficient in their research area. The depth and breadth options available are considerable. Our faculty members are active in state-of-the-art research and training, within electrical engineering and across disciplines with faculty members in other departments.

Electrical and Computer Engineering, MSECE (OL)

Electrical and Computer Engineering, MSECE

Wireless Systems Engineering, Post-Baccalaureate Certificate

Manufacturing Engineering, Post-Baccalaureate Certificate

Hybrid Vehicle Systems ECE, Post-Baccalaureate Certificate

Microelectronics and Semiconductors, MSE or MS

Microelectronics and Semiconductors, Post-Baccalaureate Certificate

Software Engineering, MSSWE

Electrical and Computer Engineering, PHD

ECE 50024 - Machine Learning

Credit Hours: 3.00. An introductory course to machine learning, with a focus on supervised learning using linear models. The course will have four parts: (1) mathematical background on linear algebra, probability, and optimization. (2) classification methods including Bayesian decision, linear regression, logistic, regression,
and support vector machine. (3) robustness of classifier and adversarial examples. (4) learning theory on the feasibility of learning, VC dimension, complexity analysis, bias-variance analysis. Suitable for senior undergraduates and graduates with a background in probability, linear algebra, and programming.

Learning Outcomes: 1. Apply basic linear algebra, probability, and optimization tools to solve machine learning problems. 2. Understand the principles of supervised learning methodologies, and can comment on their advantages and limitations. 3. Explain the trade-os in model complexity, sample complexity, bias, variance, and generalization error in the learning theory. 4. Implement, debug, and execute basic machine learning algorithms on computers. Credits: 3.00

ECE 50435 - Introduction To Quantum Science And Technology

Credit Hours: 3.00. This course introduces engineering students with no background in quantum mechanics to the fundamental concepts of quantum physics and how these principles are being used to create revolutionary quantum information technologies. The course aims to develop an understanding of quantum phenomena and identify engineering challenges and opportunities of various quantum information technologies. Topics covered include the fundamentals of quantum mechanics, the quantization of electrical circuits and electromagnetic fields, and the interactions between (artificial) atoms and electromagnetic fields. These topics are discussed in the context of popular hardware platforms and how they can be harnessed to create quantum computers, quantum communication systems, and quantum sensing systems.

Learning Outcomes: 1. Apply fundamental quantum mechanical principles to analyze simple quantum systems. 2. Analyze the properties of quantum electrical circuits and electromagnetic fields. 3. Analyze the interactions between (artificial) atoms and classical and quantum electromagnetic fields. 4. Use engineering judgement to assess the capabilities and challenges of revolutionary quantum technologies. Credits: 3.00

ECE 50616 - Physics And Manufacturing Of Solar Cells

Credit Hours: 3.00. This course introduces the electronic, optical and material properties and the manufacturing of photovoltaic devices. Topics include electronic charge separation, transportation and recombination; optical concentration, trapping and confinement; material preparations in photovoltaic systems; bulk crystal, thin-film and organic photovoltaic device configurations; energy storage; as well as emerging concepts in photovoltaics. Discussions also involve the process and equipment for the manufacturing of various photovoltaic modules, with special emphasis on driving down the cost of photovoltaic systems.

Learning Outcomes: 1. Understand different market segments for photovoltaics and their key requirements. 2. Understanding of p-n junctions, drift and diffusion of charges, LUMO and HOMO. 3. Extract efficiency from i-v characteristics of photovoltaic cells. Credits: 3.00

ECE 50631 - Fundamentals Of Current Flow

Credit Hours: 1.00. Traditional description of electronic motion through a solid is based on diffusive transport which means that the electron takes a random walk from the source to the drain. However, modern nanoelectronic devices often have channel lengths comparable to a mean free path so that electrons travel ballistically, or "like a bullet." This course provides a unified conceptual framework for ballistic and diffusive transport of both electrons and phonons, that is very different from what is taught in standard courses, but indispensable to understanding nanolectronic devices.

Learning Outcomes: 1. Explain the new perspective on conductivity and its relation to the standard Drude formula. 2. Evaluate quantities like the density of states, number of modes, electron density and conductivity for a given energy-momentum relation. 3. Explain concepts like the minimum interface resistance and the two Landauer formulas. Credits: 1.00

ECE 50632 - Introduction To Quantum Transport

Credit Hours: 1.00. This course introduces the Schrödinger equation, uses the tight-binding method to discuss the concept of bandstructure and E(k) relations, along with simple quantum transport problems. No prior background in quantum mechanics or statistical mechanics is assumed.

Learning Outcomes: 1. Explain tight-binding model, reciprocal lattice and evaluate dispersion relation. 2. Explain NEGF equations, dephasing, quantum point contact and evaluate quantities like the transmission, the self-energy and spectral functions. 3. Use Pauli spin

matrices and evaluate quantities like spin density. Credits: 1.00

ECE 50633 - Boltzmann Law: Physics To Computing

Credit Hours: 1.00. This course introduces the key concepts of equilibrium statistical mechanics leading to the celebrated Boltzmann law and how it leads to Boltzmann machines and related concepts in modern machine learning. No prior background in statistical mechanics is assumed.

Learning Outcomes: 1. Explain the law of equilibrium and entropy. 2. Understand the operation of Boltzmann machines. 3. Understand the operation of quantum circuits. Credits: 1.00

ECE 50635 - An Introduction To Data Analysis, Design Of Experiment, And Machine Learning

Credit Hours: 1.00. This course will provide the conceptual foundation so that a student can use modern statistical concepts and tools to analyze data generated by experiments or numerical simulations. We will also discuss the principles of the design of experiments so that the data generated by experiments/simulations are statistically relevant and useful. We will conclude with a discussion of analytical tools for machine learning and principal component analysis. At the end of the course, a student will be able to use a broad range of tools embedded in MATLAB and Excel to analyze and interpret their data.

Learning Outcomes: 1. Analyze data taken from variety of sources. 2. Design randomized experiments and analyze the results. 3. Understand key machine learning algorithms and use them in illustrative examples. Credits: 1.00

ECE 50641 - Semiconductor Fundamentals

Credit Hours: 1.00. This course about semiconductors is designed to provide a foundation to understand the operation of devices such as transistors, diodes, solar cells, light-emitting devices, etc. The course does not discuss devices - it prepares students to understand the operation of semiconductor devices. The treatment is physical and intuitive, and not heavily mathematical. Technology users will gain an understanding of the semiconductor physics that is the basis for devices. Semiconductor technology developers may find it a useful starting point for diving deeper into condensed matter physics, statistical mechanics, thermodynamics, and materials science. The course presents an electrical engineering perspective on semiconductors, but those in other fields may find it a useful introduction to the approach that has guided the development of semiconductor technology for the past 50+ years. Topics include semiconductor fundamentals such as energy bands, bandgaps, effective masses, electrons and holes, and elements of quantum mechanics. The Fermi function, doping, and carrier densities are then discussed. Carrier transport and generation-recombination are examined along with the important concept of quasi-Fermi levels. The course concludes with the "semiconductor equations," which provide a complete, mathematical description of electrons and holes in semiconductors (subject to some important simplifying assumptions) and ends with a discussion of how energy band diagrams provide a qualitative solution to these equations.

Learning Outcomes: 1. Be familiar with computing basic semiconductor quantities such as electron and hole drift and diffusion currents, recombination-generation rates, and quasi-Fermi levels. 2. Simplify and apply the semiconductor equations to specific semiconductor problems. 3. Draw and interpret energy band diagrams for specific semiconductor problems. Credits: 1.00

ECE 50642 - Fundamental Of Transistors

Credit Hours: 1.00. This course is designed for anyone seeking a sound, physical, intuitive understanding of how modern transistors operate. Important technology considerations and applications of transistors are also discussed. The focus is on MOSFETs for digital logic, but other types of transistors are briefly considered. The course is broadly accessible to students with only a very basic knowledge of semiconductor physics and electronic circuits and should be useful for advanced undergraduates, beginning graduate students, as well as practicing engineers and scientists. Topics include device metrics for digital and analog circuits, traditional MOSFET theory, the virtual source model, 1D and 2D electrostatics, Landauer/transmission approach to nanotransistors, the limits of MOSFETs, as well as a quick look at HEMTs, bipolar transistors, and compact circuit models.

Learning Outcomes: 1. Understand MOSFET IV characteristics and device metrics and be able to analyze measured transistors characteristics and extract key device parameters. 2. Have a sound understanding of the physical operation of transistors and be acquainted with the traditional theory of the MOSFET. 3. Be familiar

with 1D/2D/3D MOS electrostatics and appreciate the need for advanced MOSFET structures such as the FinFET. 4. Understand modern transport theory (the transmission approach) and its application to nanoscale MOSFETs. 5. Be introduced to other barrier-controlled transistors, such as HEMTs and bipolar transistors. 6. Know what a physics-based compact model is and the role they play in electronics. Credits: 1.00

ECE 50650 - Applied Quantum Computing I - Fundamentals

Credit Hours: 1.00. This fundamentals course is part 1 of the series of quantum computing courses and covers aspects from fundamentals to present-day hardware platforms to quantum software and programming. This course provides the essential foundations required to understand computing models built from the principles of quantum mechanics. This course requires a minimal set of engineering and science prerequisites but will allow students to develop a physical and intuitive understanding of the topics.

Learning Outcomes: 1. Learn the fundamental postulates of quantum mechanics and how they can be mapped onto present-day quantum information processing models. Credits: 1.00

ECE 50651 - Applied Quantum computing II - Hardware

Credit Hours: 1.00. This course is part 2 of the series of Quantum computing courses, which covers aspects from fundamentals to present-day hardware platforms to quantum software and programming. The goal of part 2 is to provide the essential understanding of how the fundamental quantum phenomena discussed in part 1 can be realized in various material platforms and the underlying challenges faced by each platform. To this end, we will focus on how quantum bits (qubits, the building block of quantum information processing) can be defined in each platform, how such qubits are manipulated and interconnected to form larger systems, and the sources of errors in each platform. With an emphasis on present-day leading candidates, we will discuss the following specific quantum material platforms: 1) Superconductor-based and 2) Atom/ion traps-based. The material will appeal to engineering students, natural sciences students, and professionals whose interests are in using and developing quantum information processing technologies.

Learning Outcomes: 1. Understand domain-specific quantum algorithms and how to run them on present-day quantum hardware. Credits: 1.00

ECE 50652 - Applied Quantum Computing III - Software and Algorithm

Credit Hours: 1.00. This course is part III of the series of Quantum computing courses, which covers aspects from fundamentals to present-day hardware platforms to quantum software and programming. The goal of part III is to discuss some of the key domain-specific algorithms that are developed by exploiting the fundamental quantum phenomena (e.g. entanglement) and computing models discussed in part I. We will begin by discussing classic examples of quantum Fourier transform and search algorithms, along with its application for factorization (the famous Shor's algorithm). Next, we will focus on the more recently developed algorithms focusing on applications to optimization, quantum simulation, quantum chemistry, machine learning, and data science. A particularly exciting recent development has been the emergence of near-intermediate scale quantum (NISQ) computers. We will also discuss how these machines are driving new algorithmic development. A key aspect of the course is to provide hands-on training for running (few qubit instances of) the quantum algorithms on present-day quantum hardware. For this purpose, we will take advantage of the availability of cloud-based access to quantum computers and quantum software. The material will appeal to engineering students, natural sciences students, and professionals whose interests are in using as well as developing quantum technologies.

Learning Outcomes: 1. Understand how present-day material platforms are built to perform quantum information processing tasks. Credits: 1.00

ECE 50653 - Fundamentals Of Nanoelectronics

Credit Hours: 3.00. The modern smartphone is enabled by a billion-plus nano-transistors, each having an active region that is barely a few hundred atoms long. Interestingly the same amazing technology has also led to a deeper understanding of the nature of current flow on an atomic scale. The aim of this course is to make the fundamentals of nanoelectronics accessible to anyone in any branch of science or engineering, assuming very little background beyond linear algebra and differential equations, although we will be discussing advanced concepts in non-equilibrium statistical mechanics that should be of interest even to specialists. We first introduce a new perspective connecting the quantized conductance of short ballistic conductors to the familiar Ohm's law of long diffusive conductors, along with a brief description of the modern nano-transistor. We then address fundamental conceptual issues

related to the meaning of resistance on an atomic scale, the interconversion of electricity and heat, the second law of thermodynamics and the fuel value of information. Finally we introduce the concepts of quantum transport as applied to modern nanoscale electronic devices.

Learning Outcomes: 1. Perform semi-classical analysis of charge flow in nanoelectronic devices. 2. Perform semi-classical analysis of the interconversion of heat and electricity in nanoelectronic devices. 3. Perform quantum analysis of nanoelectronic devices. Credits: 3.00

ECE 50836 - Introduction To Data Mining

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, i.e., the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering, classification, anomaly detection, recommendation and graph analysis. Students are expected to gain the skills to formulate data mining problems, solve the problems using data mining techniques and interpret the output.

Learning Outcomes: 1. Describe and explain the process of data mining. 2. Formulate problems in real-world applications into data mining tasks and solve the problems using data mining techniques. 3. Implement software programs that conduct data mining and evaluate the output of data mining programs. 4. Present data mining solutions to people in scientific and other disciplines. Credits: 3.00

ECE 50863 - Computer Network Systems

Credit Hours: 3.00. The goal of this course is to provide students with a proper grounding in the basic concepts and seminal work in computer network protocols and systems, and to introduce students to research in the field. The course will cover classical concepts such as network architecture, switching, routing, congestion control, and quality-of-service, and discuss recent developments in these areas. The course will also cover new developments in networking such as network measurements, network management, overlay networking and peer-to-peer systems, network security, and new network architectures. The course will emphasize a system-oriented and empirical view of internet architecture. Graduate standing or consent of instructor.

Learning Outcomes: 1. Understand the architectural principles underlying internet design. 2. Understand LAN interconnects, routing algorithms, and congestion control algorithms. 3. Identify, formulate, and solve problems encountered in the design of networks. 4. Implement networking systems and rigorously evaluate them using systematic empirical methods. Credits: 3.00

ECE 51000 - Introduction To Biometrics

Credit Hours: 3.00. Biometrics is an emerging technology for automatic human identification and verification using unique biological traits. Compared to traditional identification and verification methods, biometrics is more convenient for users, reduces fraud, and is more secure. It is becoming an important ally of security, intelligence, law enforcement, and e-commerce. The principle of various biometric technologies and systems is introduced. Especially, students analyze and design fingerprint recognition, face recognition, iris recognition, voice recognition, and multimodal biometric systems. Students have hands-on experience in designing and analyzing biometric systems.

Credits: 3.00

ECE 51012 - Electromechanics

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of dc, induction, brushless dc, and stepper motors used in control applications are presented. Prerequisite by Topic: Basic circuit analysis; Elementary electromagnetics; Elementary mechanics.

Learning Outcomes: 1. Acquire knowledge of magnetics and magnetic materials as it relates to electromechanical devices. 2. Understand the energy conversion process including field energy, co-energy, force and torque production. 3. Be familiar with the use in reference frame theory in the analysis of rotational electromechanical devices. 4. Understand the operation of rotating electric machines including stepper motors, permanent magnet ac machine, and induction machines. 5. Understand the acceptable and unacceptable practice with regard to taking exams, working on homework, working on the project, and the implications of

unacceptable practices. Credits: 3.00

ECE 51018 - Hybrid Electric Vehicles

Credit Hours: 3.00. Introduction to architectures and technologies associated with electric and hybrid electric vehicles including their constituent components. Specific topics include electric and hybrid electric drive trains, energy storage (batteries/ultracapacitors, fuel cells), electromechanical energy conversion (induction and permanent magnet motors and generators), power electronics, vehicle-level modeling and control, and optimization. Prerequisite by Topic: Energy conversion and power electronics.

Learning Outcomes: 1. Understand the principal architectures of electric and hybrid electric vehicles. 2. Analyze performance characteristics and understand limitations of each architecture. 3. Understand the principal components of an HEV including the energy storage, conversion, transmission, and control subsystems. 4. Integrate disparate subsystem models to form end-to-end vehicle model. Credits: 3.00

ECE 51032 - Computational Methods For Power System Analysis

Credit Hours: 3.00. System modeling of power networks. Description of modern electricity markets. Analysis of the economic dispatch problem using optimality conditions. Planning of distributed energy resources. Smart grid applications. Machine learning applications to power systems (forecasting, demand-side management, and fault detection). Assigned projects will involve implementing some of the methods using realistic power system models.

Learning Outcomes: 1. Explain how electricity markets work and how various computational methods are used in power system operations and planning. 2. Understand formulation and solution techniques applied to normal operation of large power systems. 3. Implement existing optimization packages to solve power system problems. 4. Use machine learning methods to answer questions about power system operations. Credits: 3.00

ECE 51100 - Psychophysics

Credit Hours: 3.00. (PSY 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of department required.

Credits: 3.00

ECE 51214 - CMOS Analog IC Design

Credit Hours: 3.00. The course covers general topics in CMOS analog IC design; biasing, noise, single stage amplifiers, differential amplifiers, OP-Amp, OTA, frequency domain analysis, and active filters. While the focus of the course is on CMOS IC design, design in bipolar andBi CMOS technologies are introduced as well. A design project is a key component of the course. The students conduct group or individual design projects. Process Design *Kit* and EDA tools are provided for the design projects.

Learning Outcomes: 1. Have basic knowledge of bias circuits. 2. Have basic knowledge of noise analysis. 3. Understand single-stage amplifiers and their applications. 4. Understand differential Op-amp, OTA, and practical design skills. 5. Understand feedback circuits. 6. Understand basic active filters, practical design skills, and applications. Credits: 3.00

ECE 51216 - Digital Systems Design Automation

Credit Hours: 3.00. This course will provide an introduction to the tools used to design and analyze circuits at the logic level of abstraction (where circuits are composed of gates and flip-flops). Most digital chips used in computing and electronic systems (including microprocessors, graphics processors, chips used in network routers, cell phones, digital audio/video appliances, automotive electronics) are entirely or largely designed using EDA tools. This course will focus on the foundations of logic-level EDA tools, including the design of exact and heuristic algorithms that form the basis for VLSI Computer-Aided Design. Topics covered include an overview of the IC design flow and levels of abstraction, synthesis of two-level (AND-OR / PLA) circuits, multi-level logic synthesis and technology mapping, sequential circuit synthesis, Logic-level verification using Boolean Satisfiability and BDDs, Timing Analysis, Power analysis and Reduction, and design techniques for emerging nanoscale technologies.

Learning Outcomes: 1. Design minimal combinational logic circuits. 2. Design minimal finite-state machines. Credits: 3.00

ECE 51220 - Applied Algorithms

Credit Hours: 3.00. Solving large-scale problems typically rely on many clever data structures and algorithms. This course aims to cover many such useful algorithms for solving large-scale problems. These algorithms include greedy algorithms, dynamic programming and more advanced graph algorithms. The course also aims to demonstrate how such algorithms can be applied to solve optimization problems encountered in engineering applications. In particular, applications in the design of VLSI (very large scale integration) at circuit, layout, or system level will be used to demonstrate how an engineering problem can be formulated as a tree/graph problem and solved using established tree/graph algorithms.

Learning Outcomes: 1. Demonstrate an understanding of greedy algorithms and dynamic programming (ABET outcome 1). 2. Demonstrate an n understanding of advanced graph algorithms (ABET outcome 1). 3. Demonstrate an ability to design and implement appropriate data structures and algorithms for engineering applications (ABET outcomes 1 and 2). Credits: 3.00

ECE 51300 - Diffraction, Fourier Optics, And Imaging

Credit Hours: 3.00. Modern theories of diffraction and Fourier optics for imaging, optical communications, and networking. Imaging techniques involving diffraction and/or Fourier analysis with application to tomography, magnetic resonance imaging, synthetic aperture radar, and confocal microscopy. Additional topics in optical communications and networking, including wave propagation in free space, fiber, integrated optics, and related design issues. Simulation studies, using Matlab and other software packages for analysis and design. Offered odd years.

Learning Outcomes: 1. A knowledge of a number of important technologies based on wave propagation such as digital diffractive imaging techniques and devices involving the principles of diffraction and/or Fourier analysis and synthesis techniques. 2. A knowledge of developments in the areas of device fabrication and computer technology for the fabrication of optical components and implementation of imaging/focusing modalities not possible until recently. 3. An ability to deal with the analysis of imaging and focusing techniques involving diffraction. 4. A knowledge of a number of other topics, such as dense wavelength division multiplexing (DWDM) systems and devices, micro/nano systems in need of rigorous diffraction theory, image and phase recovery involving Fourier analysis and Fourier iterative optimization techniques, focusing of wave energy and daylighting. 5. An ability to utilize the theoretical analysis of such topics based on Fourier analysis and synthesis for system and device fabrications. Credits: 3.00

ECE 51500 - Software Engineering For Embedded Systems

Credit Hours: 3.00. This course teaches the object-oriented system analysis and design for embedded systems. Unified modeling language and Shlaer/Mellor methodology are studied. Assigned project will lead students through the cycles of information gathering, problem analysis, model design, and model implementation for software development.

Credits: 3.00

ECE 51501 - Smart Grid

Credit Hours: 3.00. The course analyzes the history of the U.S. power grid and to the basic concepts on the current electric power system. The main challenges on the transition of the traditional power system with unidirectional power flow to the new and complex system connected to renewable sources and bidirectional power flow capability is also presented in this course. In addition, the impact of distributed generation and electric vehicles is discussed along with cybersecurity and information privacy issues inherent in this new power grid.

Credits: 3.00

ECE 52301 - Nanosystems Principles

Credit Hours: 3.00. (ME 52301) This is the introductory course in the nanosystems area. It introduces students to the principles and applications of nanosystems. The course begins with an introduction to the nanometer scale phenomena. It then introduces students to the basic elements resulting in nanosystems: nanoscale materials, processes, and devices. It also provides students with a basic understanding of the tools and approaches that are used for the measurement and characterization of nanosystems, and their modeling and simulation. Moreover, the course covers the applications of nanosystems in a wide range of industries, including information

technology, energy, medicine, and consumer goods. The course concludes with a discussion of the societal and economical significance of these applications, including benefits and potential risks.

Credits: 3.00

ECE 52600 - Fundamentals Of MEMS And Micro-Integrated Systems

Credit Hours: 3.00. (BME 58100) Key topics in micro-electro-mechanical systems (MEMS) and biological micro-integrated systems; properties of materials for MEMS; microelectronic process modules for design and fabrication. Students will prepare a project report on the design of a biomedical MEMS-based micro-integrated system. Offered in alternate years. Permission of department required.

Credits: 3.00

ECE 52601 - Integrated Nanosystems Processes And Devices

Credit Hours: 3.00. (ME 52601) This course covers processes and devices associated with integrated nanosystems. Integrated nanosystems refer to systems which consist of integrated micro-, meso-, and/or macro-scale parts, and their core components are realized by nano-scale materials, processes, and devices. The course, while covering processes which result in integrated nanosystems, will focus on the theory and operation of select electronic, electromechanical, and biomedical devices which are used for information technology, sensing, medical, and other applications. The lectures will be complemented by hands-on laboratory experience. Permission of instructor required.

Credits: 3.00

ECE 52702 - Advanced Power Electronics Converters

Credit Hours: 3.00. The course introduces students to advanced power electronics converters dealing with ac voltage. The power electronics topologies considered in this course are sorted into two groups: multilevel configurations and back-to-back converters. The multilevel configurations presented are: a) neutral-point-clamped, b) cascade, c) flying capacitor, and d) non-conventional multilevel configurations. The back-to-back converters presented are: a) three-phase to three-phase, b) single-phase to three-phase, c) single-phase to single-phase ac-dc-ac converters. A new methodology will be employed to present comprehensively multilevel and back-to-back converters topologies. The main applications of those converters are in renewable energy systems, active power filters, energy efficiency devices and motor drive systems. Permission of instructor required.

Credits: 3.00

ECE 52800 - Measurement And Stimulation Of The Nervous System

Credit Hours: 3.00. (BME 52800) Engineering principles addressing questions of clinical significance in the nervous system: neuroanatomy, fundamental properties of excitable tissues, hearing, vision, motor function, electrical and magnetic stimulation, functional neuroimaging, disorders of the nervous system, development and refinement of sensory prostheses.

Credits: 3.00

ECE 53301 - Wireless And Multimedia Computing

Credit Hours: 3.00. A treatment of Voice and Video over IP and wireless communication algorithms, protocols, standards, and implementation using multicore digital signal processors and communications processor modules. Discussion of voice over IP and wireless communication algorithms, protocols and standards, and advanced wireless and voice over IP applications.

Credits: 3.00

ECE 53401 - Embedded Autonomous Systems In Automotive Platforms

Credit Hours: 3.00. A treatment of Embedded and Autonomous Systems: Motor Control, Image Vision, Sensors, Security, Neural Networks, SLAM, Machine and Deep Learning, Protocols, Standards and Implementation using Multiprocessors, Multicores, ISP, Bluebox and APEX.

Credits: 3.00

ECE 53600 - Introduction To Computational Intelligence

Credit Hours: 3.00. Basic concepts in theory and paradigms for neural networks, evolutionary computation, and fuzzy logic; algorithms and applications for hybrids of these tools known as computational intelligence are explored. Topics include artificial neural networks, fuzzy systems, and evolutionary computation. Implementations of a number of paradigms are presented, including particle swarm optimization. Applications to various areas, such as biomedical engineering and nonlinear control, are examined.

Credits: 3.00

ECE 53700 - Multimedia Applications

Credit Hours: 3.00. Treatment of multimedia algorithms and implementation using high-speed multimedia processors. Detailed discussion of entropy coding, transform coding, speech compression, image compression, video compression, and

architecture, addressing modes, and instruction set of multimedia processors.

Credits: 3.00

ECE 53800 - Digital Signal Processing I

Credit Hours: 3.00. Theory and algorithms for processing of deterministic and stochastic signals. Topics include discrete signals, systems, and transforms, linear filtering, fast Fourier transform, nonlinear filtering, spectrum estimation, linear prediction, adaptive filtering, and array signal processing.

Learning Outcomes: 1. Understand the autocorrelation and covariance methods of estimating the correlation matrix. 2. Know the Discrete Time Fourier Transform (DTFT) and its relationship to the Discrete Fourier Transform (DFT). 3. Comprehend of parametric methods of spectrum estimation, including autoregressive modeling, minimum variance, linear prediction, and eigendecomposition-based methods. 4. Understand nonparametric methods of spectrum estimation, including the periodogram and the correlogram. 5. Understand of linear filters, including the Wiener filter, as applied stochastic to signals. 6. Introduce to adaptive filters, including the method of steepest descent and the least-mean-square (LMS) algorithms. Credits: 3.00

ECE 53801 - Discreet Event Dynamic Systems

Credit Hours: 3.00. This course introduces discrete event dynamic systems with their applications in system modeling, analysis, and control. Models such as automata, Petri nets, Markov chain, and queueing systems are introduced, along with analysis of their dynamics. Discrete event simulation methods are included. Examples from various engineering applications are given. Permission of instructor required.

Credits: 3.00

ECE 53900 - Foundations Of Advanced Engineering I

Credit Hours: 3.00. Several mathematical tools applied in the engineering discipline are discussed. Statistical methods, including construction of confidence interval and hypothesis testing, as well as regression and regression analysis, are discussed. Discrete tools are discussed; these include logic and mathematical reasoning, combinatorics, groups and finite fields. Applications of some of these tools in engineering problems are introduced. Decision Theory including Bayes Theorem and applying Bayes Theorem to form decision problems. Permission of instructor required.

Credits: 3.00

ECE 54400 - Digital Communications

Credit Hours: 3.00. Introduction to digital communication systems and spread spectrum communications. Topics include analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread spectrum systems are analyzed and compared. Application of spread spectrum to multiple access systems and to secure communication systems is discussed.

Credits: 3.00

ECE 54700 - Introduction To Computer Communication Networks

Credit Hours: 3.00. A qualitative and quantitative study of the issues in design, analysis, and operation of computer communication and telecommunication networks as they evolve toward the integrated networks of the future, employing both packet and circuit switching technology. The course covers packet and circuit switching, the OSI standards architecture and protocols, elementary queuing theory for performance evaluation, random access techniques, local area networks, reliability and error recovery, and integrated networks.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental principles underlying computer communication networks. [1,3,4;a,e] 2. Demonstrate an ability to obtain mathematical models of networking systems. [1,2,4;a,e] 3. Demonstrate an ability to perform queueing analysis of simpler queueing networks, convergence analysis of routing protocols, and stability analysis of random access mechanisms. [1,2,4;a,e,k] 4. Demonstrate an ability to solve simple network design and optimization problems to meet specifications in though put and delay. [1,4;a,c,e,k] 5. Demonstrate an ability to use simulation tools for network analysis and design. [1,3,4;a,c,e,k] Credits: 3.00

ECE 54800 - Introduction To 2D And 3D Digital Image Processing

Credit Hours: 3.00. An introduction to 2D and 3D image processing. Lecture and projects covering a wide range of topics including 2D and 3D image analysis, image segmentation; color image processing, image sharpening, linear and filtering, image restoration, and image registration. Permission of instructor required.

Credits: 3.00

ECE 55200 - Introduction To Lasers

Credit Hours: 3.00. An introduction to lasers and laser applications which does not require a knowledge of quantum mechanics as a prerequisite. Topics include: the theory of laser operation; some specific laser systems; nonlinear optics; optical detection; and applications to optical communications, holography, laser-driven fusion, and integrated optics.

Credits: 3.00

ECE 55400 - Electronic Instrumentation And Control Circuits

Credit Hours: 3.00. Analysis and design of special amplifiers, pulse circuits, operational circuits, DC amplifiers, and transducers used in instrumentation, control, and computation.

Credits: 3.00

ECE 55700 - Integrated Circuit Fabrication Laboratory

Credit Hours: 3.00. Laboratory exercises in the fabrication and testing of silicon integrated circuits. Both bipolar and MOS integrated circuit test chips are fabricated and tested. Laboratory technique, the technology of integrated circuit fabrication, and electrical characterization are emphasized. Permission of department required.

Credits: 3.00

ECE 55801 - Advanced Systems On A Chip (SoC) Designs For Image Processing Using FPGAs

Credit Hours: 3.00. This class covers advanced concepts in using Field Programmable Gate Arrays (FGPAs) designed with and HDL (VHDL for example: Very High Speed IC Hardware Description Language). The students will learn complex interface design, advanced hardware and embedded system design and parallel processing. Projects and lessons will focus on application in Digital Imaging Systems. Lecture and projects covering topics including: VHDL mapped to FPGA for state machine design, hardware and software VGA control, image filtering, data transfer to bus, and embedded controller integration. Permission of instructor required.

Credits: 3.00

ECE 55900 - MOS VLSI Design

Credit Hours: 3.00. An introduction to most aspects of large-scale MOS integrated circuit design including: device fabrication and modeling; inverter characteristics; designing CMOS combinational and sequential circuits; designing arithmetic building blocks and memory structures; interconnect and timing issues; testing and verification; and system design considerations. Term projects involve the complete design of a functional logic block or system using CAD tools.

Credits: 3.00

ECE 56200 - Introduction To Data Management

Credit Hours: 3.00. Emphasis is on the design of systems that can manipulate and retrieve data from large databases using high level formal languages. Topics covered are: data models and data independence, normalization in relational databases, development of high level query languages for relational and hierarchical models, pictorial query languages, object oriented systems, and object oriented databases. The course includes a project that accounts for about 20 percent of the grade for the course. Offered odd years. Permission of department required.

Credits: 3.00

ECE 56300 - Programming Parallel Machines

Credit Hours: 3.00. This course presents methods and techniques for programming parallel computers, such as multicore and high-end parallel architectures. Various parallel algorithms will be presented to demonstrate different techniques for identifying parallel tasks and mapping them onto parallel machines. Realistic science/engineering applications and their characteristics will be discussed. Parallel architectures to be considered are shared-memory and distributed-memory multiprocessor systems. Programming paradigms for these machines will be compared, including directive-based (OpenMP), message passing (MPI) and thread-based (Posix threads) methods. Methodologies for analyzing and improving the performance of parallel programs will be discussed. There will be a class project in which each student parallelizes and tunes the performance of a large computation application or develops/improves a tool that helps this process. Each student will prepare one lecture for a selected topic. Offered during odd years.

Credits: 3.00

ECE 56401 - Computer Security

Credit Hours: 3.00. In this course the discussion will include the following topics: (not necessarily in this order) security policies, confidential policies, integrity policies, security models, security design, access control, cryptography, key management, authentication, program and software, security, malicious logic, intrusion detection, network security, security attacks and countermeasures, operation system security, smartcard tamper-resistant devices, phishing, legal and ethical issues in computer security, and selected topics.

Credits: 3.00

ECE 56500 - Computer Architecture

Credit Hours: 3.00. An introduction to the problems involved in designing and analyzing current machine architectures. Major topics include performance and cost analysis, pipeline processing, vector machines and numerical applications, hierarchical memory design, and multiprocessor architectures. A quantitative approach allowing a computer system designer to determine the extent to which a design meets design goals is emphasized.

Credits: 3.00

ECE 56601 - Real-Time Operating Systems And Applications

Credit Hours: 3.00. This course introduces students to the principles of modern operation systems focusing on real-time operation systems and embedded operation systems and their applications. Permission of instructor required.

Credits: 3.00

ECE 56800 - Embedded Systems

Credit Hours: 3.00. This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Credits: 3.00

ECE 56810 - Design With Embedded Systems

Credit Hours: 3.00. This course provides an overview of the architectures, design considerations, features and applications of embedded processors with digital signal processing capabilities. The course emphasizes design consideration for embedded systems. Different applications such as Internet of Things, Voiceover IP, Machine to Machine, Wearable Devices, Smart Homes, Medical Devices, Drones and Wireless Systems, are considered.

Credits: 3.00

ECE 56900 - Introduction To Robotic Systems

Credit Hours: 3.00. The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators. Basic knowledge of vector-matrix manipulations required.

Credits: 3.00

ECE 57000 - Artificial Intelligence

Credit Hours: 3.00. Introduction to the basic concepts and various approaches of artificial intelligence. The first part of the course deals with heuristic search and shows how problems involving search can be solved more efficiently by the use of heuristics and how, in some cases, it is possible to discover heuristics automatically. The next part of the course presents ways to represent knowledge about the world and how to reason logically with that knowledge. The third part of the course introduces the student to advanced topics of AI drawn from machine learning, natural language understanding, computer vision, and reasoning under uncertainty. The emphasis of this part is to illustrate that representation and search are fundamental issues in all aspects of artificial intelligence.

Credits: 3.00

ECE 57101 - System Modeling And Design For Smart Devices

Credit Hours: 3.00. Introduction to the mobile computing and the principles to design and implement application system for a smart device, including mobile computing architecture, mobile and pervasive computing environments, applications and services, context-aware computing, and human-computer interaction. Permission of instructor required.

Credits: 3.00

ECE 57300 - Compilers And Translator Writing Systems

Credit Hours: 3.00. This course presents the concepts needed to efficiently design and implement translators. Basic compiler/translation theory and technology are briefly reviewed, after which the course focuses on software tools for the automatic construction of translators, as well as more complex concepts involving the construction of compiler symbol tables, etc. Using C on ECN UNIX, each student will construct a simple lexical-recognizer generator, parser generator, and code-generator generator. Basic understanding of compilers and proficiency in C language required.

Credits: 3.00

ECE 57700 - Engineering Aspects Of Remote Sensing

Credit Hours: 3.00. Introduction to the concepts of multispectral image data generation and analysis. Basic principles of optical radiation, reflection, and measurement in natural scenes. Fundamentals of multispectral sensor design and data analysis for complex scenes. Application of signal processing and signal design principles and of statistical pattern recognition to these problems. Spatial image processing methods and algorithms as appropriate to land scene data. Practice with analysis of actual aircraft and spacecraft data in a cross-disciplinary environment. Offered even years.

Learning Outcomes: 1. Knowledge of a number of important technologies based on multispectral/hyperspectral remote sensing and related image processing techniques. 2. Knowledge of machine learning techniques such as deep learning for remote sensing technologies. 3. Knowledge of developments in the areas of statistical analysis for remote sensing. 4. Knowledge of a number of other topics, such as MATLAB and Python for remote sensing algorithms. 5. Ability to utilize the theoretical analysis of topics based statistical pattern recognition and machine learning for various system designs. Credits: 3.00

ECE 58000 - Optimization Methods For Systems And Control

Credit Hours: 3.00. Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Elements of linear algebra and calculus of several variables and some experience with MATLAB helpful.

Credits: 3.00

ECE 58500 - Automotive Control

Credit Hours: 3.00. Basic engine operation; Air-Fuel Ratio control, Idle Speed control, Knock control,Fuel injection timing control, Ignition control of SI engines; Engine fault diagnosis; Driveline modeling and control, Clutch phasing control; Hybrid Electric Vehicle and its control; Wheel model and complete vehicle model; Observers, Friction coefficient estimators, Tire contact patch force estimators; Anti-lock brake control, Traction control, Yaw stability control, Drive-By-Wire systems.

Credits: 3.00

ECE 58900 - State Estimation And Parameter Identification Of Stochastic Systems

Credit Hours: 3.00. Introduction to point estimation, least squares, Bayes risk, and maximum likelihood. Optimum mean-square recursive estimation for nondynamic stochastic systems. State estimation for discrete-time and continuous-time dynamic systems. Parameter identification of stochastic systems using maximum likelihood. Stochastic approximation, least squares, and random search algorithms. Offered in alternate years.

Credits: 3.00

ECE 59500 - Selected Topics In Electrical Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 60000 - Random Variables And Signals

Credit Hours: 3.00. Engineering applications of probability theory. Problems on events, independence, random variables, distribution and density functions, expectations, and characteristic functions. Dependence, correlation, and regression; multivariate Gaussian distribution. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Problems on events, independence, random variables, distribution and density functions, expectations, and

characteristic functions. 2. Dependence, correlation, and regression; multi-variate Gaussian distribution. 3. Stochastic processes, stationarity, ergodicity, correlation functions, spectral densities, random inputs to linear systems; Gaussian processes. Credits: 3.00

ECE 60004 - Communication For Engineering Leaders

Credit Hours: 1.00. The goal of this course is to upskill talented engineers' communication abilities. By the end of the course, you should have new adeptness at creating and delivering powerful presentations on a short deadline, as well as strategies for leading others effectively.

Learning Outcomes: 1. Create engaging, effective presentations and documents. 2. Design plans for valuable, productive workplace and team interactions. 3. Develop a leadership or mentoring plan tailored to your specific workplace. Credits: 1.00

ECE 60022 - Wireless Communication Networks

Credit Hours: 3.00. This course will cover fundamental concepts in mobile wireless systems such as propagation and fading, cellular systems, channel assignment, power control, handoff, mobility management. It will also cover system and standards issues including second-generation circuit switched and third-generation packet switched networks, wireless LANs, mobile IP, and ad hoc networks. Besides providing an overview of current technologies, the emphasis on the course will be to identify the challenges that face the engineers of wireless communications networks. Prerequisites: ECE 54700. Prerequisite by Topic: Students are expected to enter the course with an introductory graduate-level understanding of networking, as well as a basic understanding of probability obtained from a typical undergraduate EE program. Permission of instructor required.

Learning Outcomes: 1. Acquire a solid understand of the fundamental principles of wireless communication networks. 2. Use basic analytical tools to study the performance of cellular and ad hoc wireless networks. 3. Present results through written communication. 4. Identify the key challenges facing future wireless networks. Credits: 3.00

ECE 60141 - Foundations Of Computational Imaging

Credit Hours: 3.00. This class presents a collection of mathematical and statistical methods that form the foundation of modern computational imaging research and applications. Computational imaging seeks to form images from sensor data and is widely used in applications including consumer imaging, scientific imaging, industrial inspection, and security imaging. This class provides an advanced treatment of computational imaging based on an inverse-problems framework and blends perspectives from applied math, statistics, physics, and applications. The topics covered include stochastic modeling of images, Bayesian estimation, inverse methods, optimization, convexity, majorization techniques, constrained optimization and proximal methods, plug-and-play methods for advance prior models, the EM algorithm, Bayesian networks, Markov chains, hidden Markov models, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 60146 - Deep Learning - Theory And Practice Of Deep Neural Networks

Credit Hours: 3.00. This course teaches the theory and practice of deep neural networks from basic principles through state-of-the-art methods. The class blends hands-on programming, using a variety of state-of-the-art programming frameworks, with theoretical treatment based on current literature. Implementation will emphasize the use of the Pytorch language and the use of dynamic computational graphs. Some previous experience with optimization techniques is important for success in the course.

Learning Outcomes: 1. Understand how to design a neural network architecture that is appropriate for a wide range of specific applications. 2. Create an efficient

implementation of a wide range of standard neural network architectures in Pytorch. 3. Use neural networks to solve applications problems in classification, regression and data generation. 4. Understand how the fundamental theory of optimization can be used to efficiently train neural networks. 5. Understand the trade-offs between optimization techniques and how these techniques can be selected to achieve the best neural network training. 6. Understand and use current theory of neural network performance. 7. Understand the limitation of existing neural network theory and the likely directions of future research. Credits: 3.00

ECE 60200 - Lumped System Theory

Credit Hours: 3.00. An investigation of the basic theory and techniques of modern system theory, emphasizing linear state model formulations of continuous and discrete time systems in the time domain and frequency domain. Coverage includes notions of linearity, time invariance, discrete and continuous time state models, canonical forms, associated transfer functions and impulse response models, the state transition matrix, the Jordan form, controllability, observability, and stability. Prerequisite: Master's student standing or higher and concurrent prerequisite: MA 51100.

Credits: 3.00

ECE 60270 - Structure And Dynamics Of Large-Scale Networks

Credit Hours: 3.00. Large-scale networks are prevalent in both engineered systems (e.g., the Internet, the power grid, industrial control networks, large robotic swarms and sensor networks) and in natural systems (e.g., genetic networks, ecological networks, social and economic networks). While the specific details of such networks will depend on the application, the last few decades have seen the emergence of an underlying "science" of networks, comprised of a common language (graph theory) for representing large-scale networks, along with mathematical models and analytical techniques for studying structure and dynamics. This course will provide a detailed introduction to the field of network science. It will develop common mathematical representations of networks, metrics for identifying important features of networks, generative mechanisms for networks (including both random-graph and strategic network formation perspectives), and tools for studying dynamical processes on networks (such as information cascades, opinion dynamics and interconnected dynamical systems). This is an introductory course that establishes several of the fundamental tools and concepts in network science, and requires only an undergraduate background in probability and linear algebra.

Learning Outcomes: 1. Characterize networks based on degree distributions, clustering coefficients, diameter, etc. 2. Identify influential nodes via centrality metrics. 3. Analyze random and strategic (game-theoretic) models for large-scale networks. 4. Analyze dynamical processes and stability of interconnected dynamical systems on networks. Credits: 3.00

ECE 60281 - Intro To Mathematical Fundamentals For Systems And Control

Credit Hours: 1.00. This course serves as background for ECE 60200 Lumped System Theory, ECE 69500 Epidemic Processes over Networks, and ECE 69500 Structure and Dynamics of Large-Scale Networks, and other similar courses. The course will make the necessary mathematical background for the aforementioned courses accessible by decomposing and illustrating difficult concepts with a number of real-world examples and problems for students to work out. Namely, the course consists of five modules: 1) Linear Algebra, 2) Basic Graph Theory, 3) Basic Control Theory, 4) Probability, and 5) Optimization. Prerequisite: Linear Algebra (MA 26500 or MA 26200) or equivalent, ECE 30200 or equivalent.

Learning Outcomes: 1. Analyze equations involving matrices by applying algebraic concepts such as rank, null space, linear independence, and eigenvalues. 2. Define graph properties such as diameter, degrees, and connectivity, and apply them to analyze networked systems. 3. Define properties of linear systems, including controllability, observability, and stability, and apply them to design state estimators and feedback controllers. 4. Define probability distributions and moments of random variables and characterize the long-term behavior of stochastic processes. 5. Specify the fundamental optimality conditions for optimization problems and implement basic algorithms to find the optimizers. Credits: 1.00

ECE 60282 - Epidemic Processes

Credit Hours: 1.00. This course provides a control theory and data science approach to traditional epidemic models. Traditional epidemiological ideas will be explored and combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn from data, and design mitigation techniques. Namely, the course consists of four modules: 1) Virus Models, 2) Limiting Behavior, 3) Parameter Identification, and 4) Mitigation Algorithms. Prerequisite: ECE 60281.

Learning Outcomes: 1. Differentiate between distinct compartmental models for epidemics (SI, SIS, SIR, etc.) and identify the best model for a given scenario. 2. Analyze the limiting behavior of models for epidemic processes by identifying the different possible equilibria of the models and specifying conditions for converging to different equilibria. 3. Estimate model parameters from data for the different epidemic models. 4. Employ the estimated model parameters to forecast the impact of an outbreak. 5. Choose the best model for a given scenario/dataset by employing their knowledge of the epidemic models and by comparing the fit from the estimated parameters and the forecast accuracy. 6. Develop and implement mitigation algorithms for the different models of epidemic processes. Credits: 1.00

ECE 60283 - Epidemic Processes Over Networks

Credit Hours: 1.00. This course presents a class of epidemic models from a network science, control theoretic, and data science perspective. Networked epidemiological ideas will be explored combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn the behavior from data, and design mitigation techniques. Namely, the course consists of three modules: 1) Networked Virus Models, 2) Limiting Behavior of Networked Virus Models, and 3) Parameter Identification & Mitigation Algorithms. Prerequisites: ECE 60281 and ECE 60282.

Learning Outcomes: 1. Differentiate between distinct networked compartmental models for epidemics (SI, SIS, SIR, etc.) in order to identify the best model for a given scenario. 2. Analyze the limiting behavior of networked models for epidemic processes by identifying the different possible equilibria of the models and specifying conditions for converging to different equilibria. 3. Estimate model parameters from data for the different networked epidemic models. 4. Employ the estimated model parameters to forecast the spread of an outbreak. 5. Choose the best networked model for a given scenario/dataset by employing their knowledge of the epidemic models and by comparing the fit from the estimated parameters and the forecast accuracy. 6. Develop and implement mitigation algorithms for the different models of epidemic processes. 7. Leverage the advantages and disadvantages of using networked models of epidemics processes versus group models in a given situation. Credits: 1.00

ECE 60400 - Electromagnetic Field Theory

Credit Hours: 3.00. Review of general concepts (Maxwell's equations, materials interaction, boundary conditions, energy flow); statics (Laplace's equation, Poisson's equation); distributed parameter systems (classification of solutions, transmission lines, and wave-guides); radiation and antennas (arrays, reciprocity, Huygen's principle); a selected special topic (e.g., magnetostatics, waves in anisotropic media and optical fibers). Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60419 - Numerical Simulations Of Electro-Optic Energy Systems

Credit Hours: 3.00. Introduction to computational techniques employed in research on energy systems involving quantum electronics and electromagnetics. You will learn the strengths and weaknesses of each approach; what types of problem call for which one; and how your simulation will perform. Techniques include eigenvalue problems, fast Fourier transforms, band structure calculations, rigorous-coupled wave analysis, beam-propagation methods, finite-difference time-domain, and finite element methods. Applications include nanophotonics, photovoltaics, thermal management, radiative control, and nonlinear optics. Prerequisite by Topic: Elect/Magn Interactions (ECE 60400 or equivalent); Programming For Engineers (C, MATLAB, or similar); Linear Algebra; Ordinary Differ. Equatn; and Signals and Systems.

Learning Outcomes: 1. Explain strengths and

weaknesses of computational techniques for electro-optic systems. 2. Calculate computational complexity of a given algorithm. 3. Perform conventional and Fast Fourier transforms, based on existing codes. 4. Solve for eigenvalues and eigenvectors, for both standard and generalized eigenproblems. Credits: 3.00

ECE 60420 - Radio Frequency Integrated Circuits

Credit Hours: 3.00. This course aims at analysis and design of CMOS integrated radio frequency (RF), microwave and mm-wave circuits. Various modules of an RF transceiver are discussed including low noise amplifiers, mixers, oscillators, frequency synthesizers and power amplifiers. A term project on design of an RF to mm-wave module is also required.

Learning Outcomes: 1. Know various wireless standards, modulation techniques and CMOS technology. 2. Know matching network, transmission line effects, scattering parameters. 3. Know analysis and design of CMOS low noise amplifiers from RF to mm-wave frequencies. Credits: 3.00

ECE 60421 - Nanophotonics And Metamaterials

Credit Hours: 3.00. The course will cover nanoscale processes and devices and their applications for manipulating light on the nanoscale. The following topics will be covered: Fundamentals, Maxwell's equations, light-matter interaction, dispersion, EM properties of nanostructures; Photonic crystals and photonic crystal fibers; Photonic and plasmonic nanocircuits; Silicon nanophotonics; Metal optics; Manipulating light with plasmonic nanostructures; Plasmonic nano-sensors; Near-field optics; Metamaterials: artificial magnetism and negative refractive index; Metamaterials: superlens and hyperlens; Transformation optics and cloaking; Nanolasers; Tunable and active plasmonic materials; Refractory plasmonics; Plasmonics for energy conversion, data storage and biomed applications; Metasurfaces; Intro to quantum photonics. Prerequisites by Topic: Basic knowledge of electromagnetism and solid state materials, Maxwell equations and band structure of solids.

Learning Outcomes: 1. Derive, calculate and analyze the optical properties of metals including plasma frequency, relaxation time, dielectric constant, reflection and transmission coefficients. 2. Derive and analyze the optical properties of nanophotonic systems including color centers in solids, metallic nanoparticles, metal-dielectric slabs, thin metal films, metamaterial slabs with negative refraction. 3. Analyze surface plasmon polariton waveguides and waveguide properties. 4. Articulate the fundamentals of optics of structured media. 5. Demonstrate an understanding of novel concepts in photonics, including photonic crystals, metamaterials, nanoscale interconnects, metal optics, transformation optics, nanolasers, nanosensors, super- and hyperlens and quantum nanophotonics. Credits: 3.00

ECE 60422 - Primer On RF Design

Credit Hours: 1.00. This course covers the fundamentals of RF design. It is designed as a first course for students or engineers with limited background in high-frequency electronics. Engineers that need to understand the 'RF language' and gain working knowledge of critical RF concepts will benefit from taking this course. Students in this class will learn the basic RF tools and design principles. By the end of this class students will be able to understand important RF concepts and how these are related to the design of practical RF blocks.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF systems and modules. 2. Use common tools and techniques in the RF design space. Credits: 1.00

ECE 60423 - RF System Design

Credit Hours: 1.00. Following the 'Primer on RF Design' course, this class focuses on system-level issues. We discuss several important design considerations including noise, non-linearity, distortion, sensitivity and dynamic range and their impact in selecting the appropriate system architecture. The course also covers common receiver architectures including superheterodyne and direct-conversion receivers.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF modules and transceivers. 2. Describe and articulate common transceiver architectures. 3. Use tools and analysis techniques to estimate the impact of non-linear effects, noise and interferences on transceivers. Credits: 1.00

ECE 60424 - RF Design: Passive And Active Components

Credit Hours: 1.00. Following the 'Primer on RF Design' course, this class focuses on passive and active components. We use the techniques learnt in the previous course, to design advanced RF devices including couplers, filters and amplifiers. Current research topics are discussed as appropriate.

Learning Outcomes: 1. Describe and articulate the basic design principles of RF passive and active components. 2. Design RF couplers, filters and amplifiers. 3. Use tools and analysis techniques to support the design of RF filters and amplifiers. Credits: 1.00

ECE 60432 - Nanophotonic Modeling

Credit Hours: 1.00. This course is an introduction to photonic materials and devices structured on the wavelength scale. Generally, these systems will be characterized as having critical dimensions at the nanometer scale. These can include nanophotonic, plasmonic, and metamaterials components and systems. Co-requisite: ECE 60400 or equivalent.

Learning Outcomes: 1. Write down photonic modes using Bloch's theorem. 2. Calculate standing wave modes at the band edge of a 1D periodic photonic crystal. 3. Calculate TE and TM modes at the band edge of a 2D square-periodic photonic crystal. 4. Draw the irreducible Brillouin zone for a 2D triangular lattice photonic crystal. 5. Calculate the band structure of a 2D triangular lattice photonic crystal for the lowest 8 bands using MIT Photonic Bands. 6. Identify the lowest-energy photonic bandgap in TE and TM polarizations associated with a 2D triangular lattice photonic crystal. 7. Use a ray-optics transfer matrix to calculate the reflection and transmission associated with multiple optical elements. 8. Use a wave-optics T-matrix to calculate transmission and reflection through several dielectric layers arranged in a 1D stack. 9. Use a wave-optics S-matrix to calculate transmission and reflection through several dielectric layers arranged in a 1D stack. 10. Use Singular Value Decomposition in CAMFR to calculate the eigenmodes associated with a photonic crystal waveguide structure consisting of a row of defects. 11. Calculate the quality factor of a resonant mode using the FDTD method. 12. Calculate the band structure of a 2D periodic structure using the FDTD method. 13. Calculate the relative enhancement in the local density of photonic states associated with a defect in a 2D photonic crystal using the FDTD method. 14. Calculate a transmission spectrum using the Finite Element Method. 15. Calculate a transmission spectrum for a waveguide using the Beam Propagation Method. 16. Calculate the emission spectrum of a photonic emitter using the Finite Element Method. Credits: 1.00

ECE 60600 - Solid State Devices

Credit Hours: 3.00. A relatively-broad, moderate-depth coverage of semiconductor devices and related topics. The first portion of the course presents and examines semiconductor fundamentals required in the operational analysis of solid state devices. A detailed examination of the PN junction diode and PN junction devices follows. The final portion of the course treats heterojunction surface devices including the Schottky diode, the MOS capacitor and the MOSFET. Offered in alternate years. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 60614 - Reliability Physics Of Nanoelectronic Transistors

Credit Hours: 3.00. This course will focus on the physics of reliability of small semiconductor devices. In traditional courses on device physics, the students learn how to compute current through a device in response to applied voltage. However, as transistors are turned on and off trillions of times during the years of operation, gradually defects accumulate within the device so that at some point the transistor does not work anymore. The course will explore the physics and mathematics regarding how and when things break a topic of great interest to semiconductor device engineers. Prerequisites: ECE 60600 required; ECE 61200 and ECE 55800 are recommended.

Learning Outcomes: 1. Acquire a deep understanding regarding a topic of broad interest to academic community and to the industry. 2. Think critically related to broad

range of topics involving various aspects of reliability physics. Credits: 3.00

ECE 60645 - High-speed Semiconductor Devices

Credit Hours: 3.00. As semiconductor device geometry miniaturizes, the device becomes faster and some devices move into the quantum-effect region. These high-speed devices are the key components for future electronic systems in communications, computers, control, and consumer applications. This course covers the physics and operational principles of these devices to meet the needs of microelectronics in the 21st century. This course emphasizes the integration of the state-of-the-art technologies such as high-k dielectrics, SiGe, SiC and GaN devices. This course is intended for graduate students in science and engineering who are either i) interested in pursuing research in semiconductor materials, structures or devices, or ii) seeking the broad device background on the state-of-the-art technologies for a future R&D career in the microelectronic industry. Co-requisite: ECE 60600.

Learning Outcomes: 1. Produce homework and presentations at the course that use appropriate formats, knowledge of electronic materials and devices, and documentation styles while controlling the right technical terms, writing skills including grammar and spelling. 2. Demonstrate an understanding of technical contents of the course and writing reports as a process that includes multiple drafts, collaboration, feedback, and reflection. 3. Examine critically, summarize, apply, analyze, and synthesize information as the basis for developing original ideas and claims. 4. Demonstrate proficiency in identifying, reading, evaluating, analyzing, and using reliable sources of technical contents of this course. Credits: 3.00

ECE 60800 - Computational Models And Methods

Credit Hours: 3.00. Computation models and techniques for the analysis of algorithm complexity. The design and complexity analysis of recursive and nonrecursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. NP-complete problems. Prerequisite: Master's student standing or higher.

Learning Outcomes: 1. Learn computation models and techniques for the analysis of algorithm complexity. 2. Learn the design and complexity analysis of recursive and non-recursive algorithms for searching, sorting, set operations, graph algorithms, matrix multiplication, polynomial evaluation and FFT calculations. 3. Learn the NP-complete problems. Credits: 3.00

ECE 60827 - Programmable Accelerator Architectures

Credit Hours: 3.00. Programmable hardware accelerators seek to fulfill the promise of continued performance and energy-efficiency gains in the era of a slowing Moore's law, larger problem sizes and an increased focused on energy-efficiency. These factors have caused hardware acceleration to become ubiquitous in today's computing world and critically important in computing's future. This class will introduce students to the architectures of programmable accelerators. We will delve deeply into the architectures of modern massively parallel accelerators like GPUs, culminating in a course project. General topics in hardware acceleration will be discussed, including but not limited to GPGPU and massively parallel computing, approximate accelerators, reconfigurable hardware and programmable hardware for machine learning. Pre-requisite: ECE 43700 or equivalent and ECE 56500.

Learning Outcomes: 1. Learn knowledge and scholarship. 2. Learn communication. 3. Learn critical thinking. 4. Learn ethical and responsible research. 5. Have professionalism. Credits: 3.00

ECE 60872 - Reliable And Secure Computer Systems

Credit Hours: 3.00. The course provides an introduction to the hardware and software methodologies for specifying, modeling and designing fault-tolerant systems supported by case studies of real systems. The material presents a broad spectrum of hardware and software error detection and recovery techniques that can be used to build reliable networked systems. The lectures discuss how the hardware and software techniques interplay, what techniques can be provided in COTS hardware, what can be embedded into operating system and network communication layers, and what can be provided via a distributed software layer and in the application itself. Prerequisite by Topic: Any one high level programming language experience; A basic background in probability.

Learning Outcomes: 1. Formulate design

principles for dependable systems. 2. Analyze mathematically a system for its dependability properties. 3. Understand and apply hardware dependability techniques. 4. Understand and apply software dependability techniques. 5. Understand and apply networking dependability techniques. 6. Design, develop, and present an innovative project on dependable systems. Credits: 3.00

ECE 60874 - Mobile Computing Systems

Credit Hours: 3.00. This course will introduce the technologies of mobile computing systems for various applications, including multimedia, cloud services, location-based services, data collections and privacy. This course will include both hands-on assignments writing mobile applications as well as reading recently published papers on the technologies. The students will design mobile services and present their projects.

Learning Outcomes: 1. Examine recent technologies in mobile computing. 2. Design mobile services and present their projects. 3. Plan for data collection and respect users' privacy. Credits: 3.00

ECE 61000 - Energy Conversion

Credit Hours: 3.00. Basic principles of static and electromechanical energy conversion. Control of static power converters. Reference frame theory applied to the analysis of rotating devices. Analysis and dynamic characteristics of induction and synchronous machines. State variable analysis of electromechanical devices and converter supplied electromechanical drive systems. Prerequisite: Master's student standing or higher.

Credits: 3.00

ECE 61010 - Time Domain Simulation And Optimization For Design

Credit Hours: 1.00. This is a skills course that teaches time domain simulation and multi-objective design optimization. This course will serve the needs of students in power and energy system and component design, but is widely applicable to all areas of engineering and does not require domain specific knowledge.

Learning Outcomes: 1. Code accurate and computationally efficient simulation models. 2. Comprehend the theory of single- and multi-objective optimization. 3. Utilize single-and multi-objective optimization effectively/efficiently. Credits: 1.00

ECE 61014 - Electromagnetic And Electromechanical Component Design

Credit Hours: 3.00. This course focuses on the design of electromagnetic and electromechanical systems, with power applications. The course includes optimization methods, modeling techniques for design (as opposed to for simulation), and the formulation of design problems as optimization problems. Prerequisite by Topic: Knowledge of the use of field and co-energy techniques to calculate force/torque, Understanding of theory of operation of permanent magnet ac machines (brushless dc machines), basic knowledge of electromagnetic fields.

Learning Outcomes: 1. Understand multi-objective design techniques as they relate to the design of power magnetic devices. 2. Understand the use of computationally efficient methods of solving field problem including analytical methods and magnetic equivalent circuits. 3. Understand loss mechanisms in power magnet devices including hysteresis, eddy current, and resistive losses. 4. Understand design of distributed conductors systems such as rotating electric machinery. 5. Understand working practices on homework, exams, and projects. 6. Understand how to compete component architectures in a rigorous and meaningful way. Credits: 3.00

ECE 61016 - Power Electronic Converters And Systems

Credit Hours: 3.00. The objective of this course is to educate students in the operation, detailed modeling, average-value modeling, and control design of power electronics converters and systems of converters. Prerequisite by Topic: Basic knowledge of ordinary differential equations, solution of ODEs using numerical methods, state-space system representation, basic feedback control design with frequency domain methods, reference frame theory, some knowledge of rotating electric machinery. Permission of instructor required. Prerequisites: ECE 61010. Concurrent prerequisites: ECE 61000 and ECE 38200. Concurrent prerequisites by topic: synchronous machines (wound rotor and permanent magnet), reference frame theory, three-phase inverters, basic frequency domain

control techniques, state-space representation of systems.

Learning Outcomes: 1. Understand switched circuits. 2. Understand average-value analysis techniques. 3. Understand feedforward/feedback control of power electronic converters. 4. Understand waveform level and average-value simulation techniques for switched systems. 5. Understand several ac-dc, dc-ac, and dc-dc power conversion topologies. 6. Understand inverter modulation techniques. 7. Understand ethical homework and project practices, and implication of failure to adhere to these. 8. Understand how to effectively present project results. Credits: 3.00

ECE 61020 - Operation Of Modern Power Systems

Credit Hours: 3.00. Overview of modern power system operations. Economic dispatch of assets as a constrained optimization problem, and solution methods. The unit commitment problem formulation, and solution methods. Power flow solution methods. Security-constrained economic dispatch and unit commitment. The optimal power flow. Automatic generation control. Operation of power markets. Prerequisites: ECE 43200. Co-Requisites: ECE 58000.

Learning Outcomes: 1. Read and communicate the findings of the latest power system operations, control, and economics literature. 2. Write software to perform various modern power system functions, such as: security-constrained economic dispatch and unit commitment, dc or ac power flow analysis, and optimal power flow. 3. Appreciate the computational challenges related to large-scale electric power systems analysis. Credits: 3.00

ECE 61025 - Finite Element Analysis Of Electric Machines

Credit Hours: 3.00. Application of advanced numerical methods for the characterization of the steady-state and dynamic characteristics of electromechanical energy conversion devices including solenoids, synchronous, induction, and permanent-magnet machines.

Learning Outcomes: 1. Apply basic concepts of vector calculus to quantify and correlate the physical variables of electromagnetic fields. 2. Interpret Maxwell's equations in the context of electric machinery. 3. Recognize how variational calculus can be used to reformulate the partial differential equations governing the magnetic field. 4. Solve linear and nonlinear quasi-magnetostatic problems of electromechanical energy conversion devices numerically using the finite element method. 5. Develop custom-made software for conducting finite element analysis of electric machinery. Credits: 3.00

ECE 61200 - Advanced VLSI Devices

Credit Hours: 3.00. Device physics of advanced transistors. Process, device, circuit, and systems considerations affecting development of new integrated circuit technologies. Review of metal oxide semiconductor (MOS) fundamentals along with key process and circuit concepts. Short channel effects in sub-micron channel length metal oxide semiconductor field-effect transistors (MOSFETs) including device scaling considerations. Device physics and technology issues for sub-100 nm (nanoscale) MOSFETs. Limits of silicon device technology and key issues in the continuing miniaturization of devices. Alternative device structures to replace bulk MOSFET. Computer simulation employed throughout the course to examine device issues and prototype new device technologies. Offered in alternate years. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 61220 - Advanced VLSI Design

Credit Hours: 3.00. The objective of this course is to train the students with advanced digital circuit design techniques that can be instrumental in achieving higher energy efficiency and resilience to process variations in scaled technologies. Prerequisite: ECE 55900 or equivalent.

Learning Outcomes: 1. Design challenges associated with scaled MOSFETs, including short channel effects, leakage mechanisms, process variations, reliability issues and interconnect parasitics. 2. Understand advantages and disadvantages of emerging technologies and circuit design challenges. 3. Understand adaptive design techniques to increase resilience to process variations. 4.

Understand low power/ultra-low power design in near-threshold/sub-threshold region. 5. Understand advanced SRAM design. 6. Understand memory design in emerging technologies. 7. Understand Computing-in-Memory. 8. Understand Device-Circuit Co-design in Advanced Technologies. Credits: 3.00

ECE 61500 - Nonlinear Optics

Credit Hours: 3.00. An in-depth study of nonlinear optics. After a review of linear effects, several nonlinear optical processes and applications are discussed. These include electro-optic switches and modulators, harmonic light generators, sum and difference frequency mixing, parametric amplifiers and oscillators, and phase conjugate mirrors. Discussions of nonlinear spectroscopy include topics such as two-photon absorption, saturation spectroscopy, Raman spectroscopy and double-optical resonance measurements. Photonechoes and other transient effects, and surface effects are also discussed. Offered in alternate years. Prerequisite: ECE 55200 , ECE 60400 .

Credits: 3.00

ECE 61600 - Ultrafast Optics

Credit Hours: 3.00. A study of the physics, technology, and applications of ultrashort laser pulses. Topics covered include the following: methods for generating and measuring ultrafast laser pulses; basic physical processes affecting ultrashort pulses; devices for manipulating ultrashort pulses; ultrafast nonlinear optics, including nonlinear optics in fibers, nonlinear refractive index effects, pulse compression, solitons, and all-optical switching; time-resolved spectroscopy of ultrafast materials processes; and applications to ultrafast optoelectronics. In addition, each student will select a specific topic for in-depth study. Offered in alternate years. Prerequisite: ECE 55200 .

Credits: 3.00

ECE 61700 - Antennas: Design And Applications

Credit Hours: 3.00. Electrically small antennas; arrays; wire antennas and feeding arrangements; aperture antennas such as slots, horns, and parabolic reflectors; antennas for multiple frequencies including log-periodic and other frequency independent types; receiving antennas and the concept of antenna temperature; antenna measurements and evaluation. Prerequisite: ECE 44100 and concurrent prerequisite: ECE 60400 .

Credits: 3.00

ECE 61800 - Numerical Electromagnetics

Credit Hours: 3.00. The numerical solution of Maxwell's equations is studied. Numerical methods such as the Finite Element Method and the Finite Difference Method are presented for the solution of both differential and integral equations. Applications studied include: waveguides (microstrip, VLSI interconnects, optical, discontinuities), scattering (frequency selective surfaces, arbitrary scatterers), antennas, magnetics, semiconductor devices, and inverse scattering. Papers in the current literature are used. Offered every third semester. Prerequisite: ECE 60400 .

Credits: 3.00

ECE 62000 - Introduction To Biomedical Imaging Systems

Credit Hours: 3.00. (BME 63000) Overview of biomedical imaging systems and analysis. Examination of various imaging modalities, including X-ray, ultrasound, nuclear, and MRI. Microscopy including how images are formed and what types of information they provide. Image analysis techniques, including analysis of cardiac ultrasound, mammography, and MRI functional imagery. Offered in alternate years. Concurrent prerequisite: ECE 63700.

Credits: 3.00

ECE 62400 - Multimedia Systems

Credit Hours: 3.00. Provides a general coverage of three major areas that include multimedia data management (logical and physical modeling), broadband network architectures and protocols for distributed multimedia communication, and user interface environments. Various models and specification methodologies in these areas are introduced. The discussion is augmented with various case studies. Prerequisite: ECE 54700 , ECE 56200 .

Credits: 3.00

ECE 62500 - Analysis Of Electromechanical Systems II

Credit Hours: 3.00. Extension of ECE 525. Electric propulsion systems including presentation of cycloconverter and rectifier-inverter drive systems. Dynamic and steady-state analysis of machine performance with series controlled rectifiers in the stator or rotor phases. MMF space harmonic analysis. Prerequisite: ECE 62500.

Credits: 3.00

ECE 62700 - Introduction To Cryptography And Secure Communication

Credit Hours: 3.00. Introduces the basic concepts of cryptography. Various cipher systems are presented, including transposition and substitution systems, Block ciphers, RSA, and Knapsack. Methods used to attack ciphers are discussed with emphasis on complexity. Case studies of the use of cryptographic methods in communication systems are presented with some consideration given to privacy issues. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 62900 - Introduction To Neural Networks

Credit Hours: 3.00. Information processing with neural networks, biological and engineering implications, learning algorithms, current neural network models and architectures, implementational topics, applications in areas such as signal/image processing, pattern recognition, optimization, simulation, system identification, nonlinear prediction, communications, and control. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63300 - Modeling And Simulation Of Power System Components

Credit Hours: 3.00. Recommended for those interested in learning to use computer simulation to investigate the dynamic and controlled behavior of electrical power components. Beginning with an introduction to MATLAB/SIMULINK, the course goes through the key steps of modeling, implementing and verifying the simulation of single and three-phase transformers, single and three-phase induction machines, three-phase wound field synchronous machines and permanent magnet machines useful in power applications, each case amply illustrated in projects around some interesting topics. Students are expected to implement and verify about 10 simulation projects and also discuss observed behaviors on topics such as inrush current in transformers, motoring, generating and braking operation of machines, and pulsating torque from subsynchronous resonance. Prerequisite: ECE 43200 .

Credits: 3.00

ECE 63400 - Digital Video Systems

Credit Hours: 3.00. Digital video systems. Characteristics of basic analog video systems, including bandwidth constraints, color encoding, and composite signal formation. Digital video concepts with emphasis on processing of time-varying images. Topics include: filtering, enhancement, restoration, and motion estimation and prediction. Digital video compression techniques, including intraframe coding approaches, with particular emphasis on JPEG. MPEG1 and MPEG2 video compression standards. Low bit rate approaches, including H.261, H.263, and MPEG4. Applications include: video servers, transmission systems, high definition television, multimedia systems, and videoconferencing systems. Offered in alternate years. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63700 - Digital Image Processing I

Credit Hours: 3.00. Introduction to digital image processing techniques for enhancement, compression, restoration, reconstruction, and analysis. Lecture and experiments covering a wide range of topics. 2-D signals and systems, image analysis, and image segmentation. Achromatic vision, color image processing, color imaging systems, image sharpening, interpolation, decimation, linear and nonlinear filtering, printing and display of images. Image compression, image restoration, and tomography. Offered every third semester.

Credits: 3.00

ECE 63800 - Principles Of Digital Color Imaging Systems

Credit Hours: 3.00. Basic principles of color science: physiology of the human eye, trichromatic and color opponent models for color, and uniform color spaces. Color reproduction in electronic imaging systems: color models for input and output devices, color imaging system calibration, color quantization and halftoning, and color printing. Color appearance and computational color: color appearance models, models for color constancy, and physics-based models for color. Offered in alternate years. Prerequisite: 51100 and Master's student standing or higher.

Credits: 3.00

ECE 63900 - Error Control Coding

Credit Hours: 3.00. The theory and practice of error control coding is examined. The study includes the arithmetic of Galois fields as well as linear block, cyclic, and convolutional codes. Some applications of codes in digital communication systems and in computer systems are presented. Offered every third semester. Concurrent prerequisite: ECE 60000 .

Credits: 3.00

ECE 63901 - Error Correction Coding And Secret Sharing

Credit Hours: 3.00. The theory and practice of error control coding is examined. The study includes the arithmetic of Galois fields as well as linear block, cyclic, and convolution codes. Some applications of codes in digital communication systems and in computer systems are presented. The dual of error coding, secret sharing is also discussed. Several secret sharing schemes will be presented. Applications of secret sharing are

discussed. Permission of instructor required.

Credits: 3.00

ECE 64100 - Model Based Image And Signal Processing

Credit Hours: 3.00. An advanced treatment of the methods in model-based signal and image processing including stochastic modeling of multidimensional signals, Bayesian estimation, inverse methods, doubly stochastic models, regularized inversion, the EM algorithm, Bayesian networks, Markov chains, optimization, convexity, majorization techniques, and stochastic simulation. The underlying theory is presented in the context of applications including image restoration, tomographic reconstruction, clustering, classification, and segmentation. Prerequisite: ECE 60000, 63700.

Learning Outcomes: 1. Understand how to model an imaging system. 2. Understand widely used methods for solving inverse problems in imaging applications. 3. Implement an image reconstruction algorithm for applications such as deconvolution and denoising. 4. Understand how probability can be used to model imaging systems and images. 5. Understand basic approaches to optimization of quadratic and non-quadratic functions. 6. Understand MAP and ML estimation methods. Credits: 3.00

ECE 64200 - Information Theory And Source Coding

Credit Hours: 3.00. A treatment of the basic concepts of information theory. Determination of channel capacity and its relation to actual communication systems. Rate distortion theory is introduced, and the performance of various source codes is presented. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 64500 - Estimation Theory

Credit Hours: 3.00. This course presents the basics of estimation and detection theory that are commonly applied in communications and signal processing systems. Applications in communications and signal processing will be considered throughout. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 64700 - Convex And Stochastic Optimization And Applications

Credit Hours: 3.00. Convex optimization and dynamic programming with application to various disciplines in ECE, including wireless and wireline communications, networks, electrical systems, and machine learning. The goal is to model a research problem as an optimization problem, and use the insights from the optimization algorithms to design implementable protocols and solutions that are tailored to the needs of the applications (e.g., operating in decentralized settings and under stochastic uncertainty). The instructor may tailor the content to reflect current trends and goals of research. Examples of relevant topics are: convex sets and functions, convex program, Lagrange duality, primal and dual decomposition, proximal optimizations, stochastic approximation, Markov decision processes, dynamic programming and approximate dynamic programming. The exposition of the theory will be connected to various ECE applications, such as congestion control, wireless power control and opportunistic scheduling, cross-layer design, demand response, renewable integration, spectrum sharing and cognitive radio, machine learning, optimization of UAV (unmanned aerial vehicles) aided communications. Prerequisite: ECE 60000.

Learning Outcomes: 1. Be equipped with the basic theory of convex optimization, Markov decision processes, (approximate) dynamic algorithms, and be able to apply these tools to research problems. Credits: 3.00

ECE 64800 - Wavelet, Time-Frequency, And Multirate Signal Processing

Credit Hours: 3.00. Advanced topics in signal processing, including time-frequency analysis, multiscale edge detection, wavelet bases and filter banks, and techniques for approximation, estimation, and compression using wavelets. Offered in alternate years. Prerequisite: ECE 53800 .

Credits: 3.00

ECE 65000 - Topics In Solid-State Devices And Materials

Credit Hours: 1.00 to 3.00. An introductory treatment of selected device and materials related topics. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes solid state microwave devices, optoelectronics, laser-quantum electronics, magnetics, noise in semiconductor devices, acoustic wave devices, energy conversion, device fabrication, electroceramics, MOS devices, thin-film devices, and memory devices.

Credits: 1.00 to 3.00

ECE 65400 - Solid State Devices II

Credit Hours: 3.00. Introduction to advanced concepts in semiconductor devices as an extension and continuation of ECE 60600 . Topics include charge storage and transfer in deep depletion MOS devices (CCDs and DRAMs); negative differential mobility and transit time effects in microwave oscillators (Gunn and IMPATT diodes); spontaneous and stimulated emission, quantum efficiency, and charge confinement in photonic devices (LEDs and double heterojunction lasers); and quantum efficiency and spectral response in conventional and avalanche photodiodes. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 65600 - Electronic Transport In Semiconductors

Credit Hours: 3.00. A treatment of the microscopic and phenomenological physics of carrier transport in bulk semiconductors and in semiconductor devices. The Boltzmann transport equation is introduced as are techniques for solving it analytically and numerically. The physics of carrier scattering in common semiconductors is explored. Theoretical treatments of low and high field transport are compared with measured results. Balance equations are derived as moments of the Boltzmann Transport Equation and are applied to the analysis of sub-micron semiconductor devices. Students are expected to be able to apply elementary concepts of quantum mechanics and solid state physics. Offered every third semester. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 65800 - Semiconductor Material And Device Characterization

Credit Hours: 3.00. A comprehensive survey of modern characterization techniques routinely used to determine solid-state material and device parameters. Concepts and theory underlying the techniques are examined, and sample experimental results are presented. The coverage includes electrical, optical, chemical, and physical characterization methods. Offered in alternate years. Prerequisite: ECE 60600 .

Credits: 3.00

ECE 65900 - Quantum Phenomena In Semiconductors

Credit Hours: 3.00. This course is designed for graduate students familiar with semiconductor fundamentals, with engineering electromagnetics and with linear algebra, but having no significant acquaintance with either quantum mechanics or statistical mechanics. The purpose of the course is to introduce the relevant concepts of quantum mechanics and nonequilibrium statistical mechanics as possible using device-related examples. Topics include: preliminary concepts, equilibrium, restoration of equilibrium, transport, effective mass equation, optical properties, advanced concepts. Offered every third semester. Prerequisite: ECE 60600, MA 51100.

Credits: 3.00

ECE 66100 - Computer Vision

Credit Hours: 3.00. This course deals with how an autonomous or a semi-autonomous system can be endowed with visual perception. The issues discussed include: sampling from a topological standpoint; grouping processes; data structures, especially hierarchical types such as pyramids, quadtrees, octrees, etc.; graphic theoretic methods for structural description and consistent labeling; issues in 3-D vision such as object representation by Gaussian spheres, generalized cylinders, etc. Prerequisite: ECE 57000 .

Credits: 3.00

ECE 66200 - Pattern Recognition And Decision-Making Processes

Credit Hours: 3.00. (CS 66200) Introduction to the basic concepts and various approaches of pattern recognition and decision-making processes. The topics include various classifier designs, evaluation of classifiability, learning machines, feature extraction and modeling. Prerequisite: ECE 30200 .

Credits: 3.00

ECE 66300 - Advanced Compilation And Automatic Programming

Credit Hours: 3.00. This course presents the concepts needed to design and implement production quality code generators for any of the more popular languages and families of computer architecture (including various pipelined, superscalar, and macro-parallel machines). Flow analysis and concurrency detection, as well as optimizations and loop and irregular code parallelizations, are covered in detail. Using C on ECN UNIX, each student will complete a project implementing a simple optimizer/parallelizer. Prerequisite: ECE 56500 , CS 50200 or ECE 46800 or ECE 57300 .

Learning Outcomes: 1. Apply automated reasoning techniques and tools to analyze and verify programs and reactive systems. 2. Explain and implement program synthesis algorithms and methodologies. 3. Apply program synthesis techniques to automate programming tasks in an application domain.

Credits: 3.00

ECE 66400 - Formal Languages, Computability, And Complexity

Credit Hours: 3.00. Topics in computability theory and formal languages include recursive function theory, the equivalence of various generic programming languages for numeric calculations and string manipulations, regular languages and finite state automata, and context-free and context-sensitive languages. In complexity theory, emphasis is on the theory of NP-completeness, including proof methods, the distinctions between strong- and weak-sense NP-completeness, NP-hardness, and performance-guaranteed approximation algorithms. Offered in alternate years. Prerequisite: ECE 60800 .

Credits: 3.00

ECE 66600 - Advanced Computer Systems

Credit Hours: 3.00. The study of theoretical aspects of advanced computer systems where multiprocessing is used. Topics include the design, architecture, and performance evaluation of multiprocessor memories, interconnection networks, and computational pipelines. Also included are the topics of scheduling, synchronization, resource allocation, load-balancing, partitioning and deadlock avoidance in multiprocessors. Also covered are the design and analysis of parallel algorithms, programming languages and automatic approaches to parallelism detection/exploitation for concurrent computation. Prerequisite: ECE 56500 , ECE 60800 .

Credits: 3.00

ECE 67000 - Modeling And Optimization Of High-Performance Interconnects

Credit Hours: 3.00. RLC extraction of VLSI interconnects. Modeling of interconnects as RLC trees or networks. Elmore delay model. Reduced-order modeling: moment matching, Pade approximation, and Krylov-subspace methods. Device modeling with consideration of resistive shielding in the interconnection load. Delay calculation with consideration of devices and interconnects. Repeater insertion and planning at floorplanning. Timing-driven placement: zero-slack algorithm for delay budgeting, net-based placement, and path-based placement. High-performance clock synthesis: zero-skew routing, bounded-skew routing, and useful-skew routing. Term projects investigating interconnect-related issues are assigned. Prerequisite: ECE 55900 .

Credits: 3.00

ECE 67300 - Distributed Computing Systems

Credit Hours: 3.00. Discussions of the design issues of distributed computing systems (DCS). The general theory of distributed transaction management, reliability, and resource management is discussed. Various algorithms and specification methodologies for DCS are introduced. A general coverage of the three major areas of DCS, namely: distributed operating systems, distributed databases, and distributed AI is provided. The discussion is augmented with various case studies. Prerequisite: ECE 46900 or introductory course in operating systems.

Credits: 3.00

ECE 67500 - Introduction To Analysis Of Nonlinear Systems

Credit Hours: 3.00. An introduction to modeling of dynamic control systems. State plane and numerical methods for solving modeling equations. Linearization and describing function techniques. Stability concepts. Controller and state estimator design for nonlinear systems. Variable structure sliding mode control. Vector field techniques. Introduction to chaos. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 67600 - Academic Oral Communication For International Research Students

Credit Hours: 0.00. Discussions of and activities related to such topics as appropriate nonverbal communication; learning styles; strategies for effective speech and listening; and speech acts for the classroom, office, and laboratory. Individual weekly tutoring sessions to improve speech comprehension. Prerequisite: Master's student standing or higher and Electrical & Computer Engineering majors only. Permission of department required.

Credits: 0.00

ECE 67700 - Communication Aspects Of Academic Research

Credit Hours: 0.00. Topics relevant to oral and written communication needs of Ph.D. students. Three papers are written: a journal article review, a literature review, and the choice of a thesis proposal, conference paper, or a journal article. Library and Internet research strategies and resources; research/writing ethics; citing sources; citation styles; and academic language. Oral presentations based on the written projects. Extensive peer revision and editing and out-of-class writing conferences with the instructor. Prerequisite: Master's student standing or higher and Electrical & Computer Engineering majors only. Permission of department required.

Credits: 0.00

ECE 67800 - Radar Engineering

Credit Hours: 3.00. An introduction to the system aspects of

modern radar engineering. The theoretical basis for radar performance analysis is developed and applied to radars designed for a variety of different applications. Consideration is given to system parameters such as receiver noise, antenna characteristics, operating frequency, target characteristics, transmitted signal modulation, and methods of detection. Attention is given to radars for special purposes, such as automatic range and angle tracking, moving target indication, and resolution enhancement through synthetic aperture techniques. Offered in alternate years. Prerequisite: ECE 60000 .

Credits: 3.00

ECE 67900 - Advanced Digital Communications

Credit Hours: 3.00. Provides a detailed examination of optimum digital communication principles and introduces three advanced topics critical to the design of digital communication systems: system synchronization; techniques for communication in nonideal channels (equalization); and communication over fading/multipath channels. Theoretical principles and practical implementations are considered. Prerequisite: ECE 54400 , ECE 60000 .

Credits: 3.00

ECE 68000 - Modern Automatic Control

Credit Hours: 3.00. Theoretical methods in optimal control theory. Topics include the calculus of variations and the Pontryagin minimum principle with applications to minimum energy problems. Geometric methods will be applied to the solution of minimum time problems. Computational methods, singular problems, observer theory, and sufficient conditions for existence of solutions are also discussed. Offered in alternate years. Prerequisite: ECE 60200 .

Credits: 3.00

ECE 68400 - Linear Multivariable Control

Credit Hours: 3.00. A state space investigation of multi-input, multi-output control design problems from the geometric perspective. The course will detail the theory and design algorithms needed for a solution to the state feedback eigenvalue assignment problem, the disturbance decoupling problem with and without internal stability, the output stabilization problem, and the tracking (or regulator) problem with internal stability. Offered in alternate years.

Credits: 3.00

ECE 68800 - VLSI Testing And Verification

Credit Hours: 3.00. Discusses different aspects of VLSI testing and formal verification of designs. Design and manufacturing defect models are introduced along with test generation and fault simulation algorithms targeting the different fault models. Both combinational and sequential logic testing are covered, and different synthesis for testability schemes such as BIST (Built-In-Self-Test), scan path design, etc., are introduced. Other new and emerging test and verification techniques also are discussed. Offered every third semester. Prerequisite: ECE 55900 .

Credits: 3.00

ECE 69200 - Introduction To Graduate Research

Credit Hours: 1.00 to 3.00. Research-related activities supervised by an ECE faculty member to introduce newly admitted ECE graduate students to the methods and culture of doing research. Possible activities might include, but are not limited to, participation in group research meetings, association with an advanced graduate student, and individualized reading or project work. A description of the activity, approved by the faculty supervisor, must be filed with the ECE Graduate Office. Permission of instructor required.

Learning Outcomes: 1. Develop knowledge and scholarship (thesis/non-thesis). 2. Develop communication (thesis/non-thesis). 3. Develop critical thinking (thesis/non-thesis). 4. Develop ethical and responsible research (thesis) or professional and ethical responsibility (non-thesis). Credits: 1.00 to 3.00

ECE 69300 - Advanced Intern Project

Credit Hours: 1.00. Graduate-level project course in ECE based on off-campus intern position. Individual research projects are approved by the supervising Purdue ECE faculty member before registering for the course. An approved written report must be filed before credit is accepted. This course cannot be used to satisfy the minimum course requirements for the master's or Ph.D. degrees. Permission of instructor required.

Credits: 1.00

ECE 69311 - Advanced Internship

Credit Hours: 1.00 to 3.00. Graduate-level Internship based course, in an off-campus internship position. Internship must be in the area of Electrical & Computer Engineering. Individual Internship must be preapproved by the supervising ECE faculty member before the student can register for the course. A written report must be submitted and approved by the faculty before credit is accepted. This course cannot be used to satisfy the minimum course requirements for the Master's or Ph.D. degrees. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69400 - Electrical And Computer Engineering Seminar

Credit Hours: 0.00. Seminar presentations by representatives from industry, members of the faculty of the School of Electrical and Computer Engineering, and other staff and faculty of Purdue University. The presentations introduce the student to a wide variety of current topics relevant to the technical and career aspects of electrical and computer engineering. Technical topics span the entire spectrum of electrical and computer engineering. Career topics include the importance of interpersonal communications, opportunities beyond graduate school, interviewing techniques, and descriptions of non-typical jobs. Required of electrical and computer engineering graduate students at Purdue during one of their first two semesters in residence.

Credits: 0.00

ECE 69401 - Electrical And Computer Engineering Graduate Seminar

Credit Hours: 0.00. Seminar presentations by members of the faculty of the Department of Electrical and Computer Engineering, staff and other faculty of IUPUI, researchers from academia, and representatives from industry. The presentations introduce the student to a wide variety of current topics relevant to the technical, educational and career aspects of electrical and computer engineering. This course cannot be used to satisfy the PhD seminar requirement. Permission of department required.

Credits: 0.00

ECE 69409 - Electrical And Computer Engineering PhD Student IUPUI Residency Course

Credit Hours: 1.00. This course is for ECE PhD students who are required to be enrolled at Purdue West Lafayette for their PhD program although research instruction and all related activities occur at the IUPUI Campus.

Credits: 1.00

ECE 69500 - Advanced Topics In Electrical And Computer Engineering

Credit Hours: 1.00 to 3.00. Formal classroom or individualized instruction on advanced topics of current interest. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69600 - Advanced Electrical Engineering Projects

Credit Hours: 0.00 to 18.00. Individual research projects to be approved by the supervising faculty member before registering for the course. An approved written report must be filed before credit is accepted. Permission of instructor required.

Credits: 0.00 to 18.00

ECE 69700 - Directed Reading In Electrical Engineering

Credit Hours: 1.00 to 3.00. Individualized reading course supervised by an appropriate faculty member and pertaining to a topic not intended for a subsequent project or thesis done by that student. Approval for each reading course must be obtained from the department prior to registration. Permission of instructor required.

Credits: 1.00 to 3.00

ECE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ECE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Engineering Education (Graduate)

Website: **https://engineering.purdue.edu/ENE/Academics/Graduate**

Department/School Head

Edward Berger (Interim)

Faculty by Rank

Professor	Associate Professor	Assistant Professor

Edward Berger Alejandra Magana Deleon Audeen Fentiman Brent Jesiek Joyce Main Tamara Moore William Oakes Matthew Ohland Alice Pawley Senay Purzer Khairiyah Mohd Yusof	Sean Brophy Jennifer DeBoer Kerrie Douglas Morgan Hynes Muhsin Menekse	Kirsten Davis Justin Hess Jason Morphew

Academic Programs

Ph.D., Master's, and Certificates

Ph.D. Program

Purdue established the School of Engineering Education (ENE) - the world's first such academic unit - in 2004, and along with it, the world's first engineering education doctoral program, for students who wish to pursue rigorous research in how engineering is best taught, learned, and practiced. Distinct from instructor-training programs, Purdue's Engineering Education Ph.D. Program and the growing discipline of engineering education are about conducting fundamental research on engineering teaching and learning, and bridging research and practice - including by defining effective practices, identifying the reasons why they work, developing curricula, assessing how students learn, and moving those findings into the classrooms of tomorrow's engineers.In ENE, you'll find an enthusiastic and committed community of scholars who lead in building the discipline's intellectual framework and research agenda. Faculty and doctoral students work collaboratively across the entire educational continuum (preschool through college, extending into the workplace), and our alumni find employment in academia, industry, and professional organizations.

M.S.

Post-Baccalaureate Certificate

• Teaching and Learning Engineering

Engineering Education, MSENE, MSE, or MS

Engineering Education, PHD

Teaching and Learning in Engineering, Post-Baccalaureate Certificate

ENE 50100 - Professional Development In Engineering Education

Credit Hours: 1.00. This course provides beginning engineering education graduate students opportunities to define themselves with the engineering education department and within the field of engineering education. Students, faculty, and outside speakers present research topics, academic opportunities, and other information that will enhance students' graduate experiences. Permission of instructor required.

Learning Outcomes: 1. Develop a plan for completing a professional engineering education portfolio. (Students will demonstrate an ability to reflect critically upon their learning goals and articulate learning plan.) 2. Identify and interact with members of the engineering education community at local and national levels. (Students will develop and enhance their communication skills and other professional development skills.) 3. Identify and utilize resources that will help students to complete their doctoral program and to transition into the professional engineering education community. (Students will obtain knowledge of academic and professional resources in engineering education.) Credits: 1.00

ENE 50101 - Foundations Of Engineering Education

Credit Hours: 3.00. In this course, new doctoral students in engineering education explore their roles within the field of engineering education, create a learning plan that maps to program requirements, and develop habits of mind to support

their ongoing professional development. Students learn to write clearly and coherently in an academic context. Students examine research trends and faculty interests so they can make informed choices about advising and program opportunities. Permission of instructor required.

Learning Outcomes: 1. Critically reflect upon personal learning goals, and articulate a learning plan that will eventually result in a professional portfolio. 2. Develop skills in academic writing. 3. Understand the research interests of local faculty members. 4. Identify resources that will facilitate the student's transition into the engineering education community. Credits: 3.00

ENE 50200 - History And Philosophy Of Engineering Education

Credit Hours: 3.00. Examines the history and philosophy of engineering education by: (1) exploring the history of engineering education through archival research and historical documents (critical moments, tensions, issues); (2) investigating philosophies of education and the philosophies that have guided engineering as a profession; and (3) critiquing the evolution of engineering education, identifying alternative scenarios, and imagining a future role in engineering education. This course introduces students to the field of engineering education while broadening their views of the roles of interrelationships between teaching and research. Open to students in Engineering Education. Permission of instructor required.

Learning Outcomes: 1. Develop a culture of critical reflection, engagement, and collaborative learning. 2. Provide opportunities for students to identify and understand tools to inquire into the history and philosophy of engineering education and develop the skills for using these tools. 3. Provide opportunities for students to use these inquiry tools to form persuasive arguments about the nature of engineering education. Credits: 3.00

ENE 50300 - Engineering Education Inquiry

Credit Hours: 3.00. This course is conceived as a bridge between beginning graduate students' knowledge of technical research and modes of inquiry appropriate to the new field of engineering education. It is designed as the entryway to required research method courses taken as part of the students' plan of study. By the end of this survey course, students will be able to critique research in terms of the quality of the authors' argument based on their chain of reasoning, and will recognize that the articulation of a research question, the significance of the question, the choice of methods in regards to the research goals, and the transparency of the explanation of the methodology are all the parts of the chain of reasoning. Permission of instructor required.

Learning Outcomes: 1. Provides a pathway into the discipline that characterizes the diversity of approaches to engineering education research and research topics. 2. Create opportunities to discuss the need for rigorous engineering education research. 3. Develop critical understanding of relationships between research problem, method, and design. 4. Foster community development and collaborative efforts among students and engineering education researchers. 5. Help students identify conceptual hurdles and individual pathways into research activities. 6. Support students' identity development as an engineering education researcher. Credits: 3.00

ENE 50400 - Leadership, Policy, And Change In Science, Technology, Engineering, And Mathematics (STEM) Education

Credit Hours: 3.00. This course provides a foundation for examining historical and current perspectives of STEM education programs and policy at the secondary and postsecondary levels. Focusing on the relationships among education policy, leadership theories, and models of systemic change, this course will enable students to situate and envision their potential role in shaping engineering education within the context of the larger education landscape. Students will synthesize course readings, examine education policy, and reflect on leadership theories and change, as well as explore how they can influence leadership, policy, and /or organizational change in STEM education through a semester project.

Learning Outcomes: 1. Evaluate leadership theories and the leadership process. 2. Identify and evaluate factors that contribute to effective leadership within organizations. 3. Analyze education policy at local, state, and national levels with a focus on STEM education. 4. Evaluate models of systemic change and diffusion of innovative processes. 5. Understand

key aspects, strategies, and applications of systemic change in education. 6. Generate strategies to implement change within STEM education environments. Credits: 3.00

ENE 50500 - Theories Of Development And Engineering Thinking

Credit Hours: 3.00. This course examines theories of human development, learning and epistemology in the context of Engineering Education. A broad survey of readings guides an in-depth study of fundamental theories of development and knowledge generation as it relates to pedagogy and research. A rich body of theoretical literature will be studied in order to explore its relation to engineering education. Work in the course aims to construct answers to the following three questions: (1) How do theories of human learning, development, and epistemology help us think about engineering? (2) How do they relate to engineering education? (3) How do they inform research method and practice in engineering education? No restrictions. It is helpful, however, for students to have engaged in prior reading-and writing- intensive courses that required them to synthesize large amounts of information. For this reason, it is recommended that students are enrolled currently in a graduate program at Purdue University. Permission of department required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 50600 - Content, Assessment And Pedagogy: An Integrated Engineering Design Approach

Credit Hours: 3.00. The course is explicitly identified in the ENE-PhD requirements as a "foundation course" required for all students. This course is intended to be taken early in a graduate student's curriculum and therefore is designed to be a bridge between the student's previous experience with engineering (education, work, and teaching) and new engineering education research-based approaches. It is intended as an entryway to help students apply an engineering design approach to the design of instruction. To meet this aim, the course involves an iterative project-based approach in a context (design site) that is chosen by the student for its relevance, interest and potential application.

Learning Outcomes: 1. Develop and articulate an engineering design approach for content, assessment, and pedagogy (CAP). 2. Critically describe the research-based features of each of the elements - content, assessment and pedagogy. 3. Apply the principles and theories to the design of a course, module, lesson plan, or other instructional setting. 4. Use reflection and dialogue as a tool of self-discovery for shaping and refining personal philosophies for the design of instruction. 5. Participate in a ""community of practice"" culture through formation of our own community and participation in the broader community of engineering education. Credits: 3.00

ENE 55400 - Globalization And Engineering

Credit Hours: 3.00. The focus is on the multifaceted dynamics of globalization, and its impact on engineering practice and the lives and education of engineers. The course emphasizes engineering and globalization from the perspectives of the emerging Asian economies and Europe, as well as the United States. This course is designed for practicing engineers and engineering educators. It is taught within a learner-centric, highly interactive, collaborative learning environment in which students are expected to learn from the experiences and thinking of each other, as well as from the instructor, and other course resources. The course places emphasis on reading, writing, web-based research, and discussion. Students are recommended (but not required) to have a minimum of two years work experience as a practicing engineer and strong communication skills (self-assessed). Permission of instructor is required.

Learning Outcomes: 1. Have increased global awareness. 2. Have knowledge of the dynamics of globalization as an economic and social process including contrasting theories and interpretations of events. 3. Have knowledge of

how globalization is studied and characterized by economists, political scientists, and sociologists. 4. Able to interpret studies and research on globalization. 5. Understand the nature and roles of engineering education and life-long learning within the globalization dynamic. 6. Understand the innovation process within a global enterprise including contrasting theories and the ability to analyze specific cases. 7. Able to lead and innovate within a rapidly globalizing profession. 8. Know the engineering profession, engineering education, and globalization from the perspectives of countries beyond the United States, particularly perspectives from Europe and the emerging economies of Asia. Credits: 3.00

ENE 58600 - Exploring Alternative Career Paths As An Engineering Educator

Credit Hours: 3.00. This course is designed for graduate students in engineering or closely related fields who want to be involved in educating current or future engineering students or practicing engineers or in communicating technical material to others, including teachers, the public, or policymakers - but are not currently interested in a tenure-track faculty position. It explores a wide range of positions in formal education, informal education (e.g., museums, foundations), industry, and government and offers an opportunity to learn and practice some skills typically required for success in those positions.

Learning Outcomes: 1. Describe non-tenure-track positions of interest to them and where to look for those types of positions. 2. Build and maintain networks with people who have similar interests. 3. Prepare a professional development plan to develop and polish the skills they need in their current or future position. 4. Write an effective proposal seeking funding for a project of interest. Credits: 3.00

ENE 59000 - Special Problems In Engineering Education

Credit Hours: 1.00 to 6.00. Project or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum. Interested students should seek a faculty advisor by meeting individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken and expected outcomes and deliverables. An individual project must be approved by the faculty member supervising the project and the student's advisor before registering for the course. An approved written report is required. Permission of instructor required.

Learning Outcomes: 1. Objectives vary based on course topics. Credits: 1.00 to 6.00

ENE 59500 - Special Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Learning Outcomes: 1. Objectives and outcomes vary due to nature of course. Credits: 0.00 to 6.00

ENE 62000 - Design, Cognition And Learning

Credit Hours: 3.00. Design is central to engineering: it is an integral part of the engineering profession and how we educate future professionals. Design cognition and learning is an area of engineering education research that seeks to understand what designers know and how they learn, and what tools best support design activity (e.g. collaboration, innovation, etc.). This research draws from many perspectives including cognitive psychology and the learning sciences, organizational learning, engineering and product design, architecture, human-centered interaction, and creativity and innovation. Themes in the course include (1) design knowledge, (2) what theories help understand design knowing and learning, (3) what are ways to study designers and design activity, and (4) how may design research inform design education and practice? Permission of instructor required.

Learning Outcomes: 1. Explore and critique multiple perspectives on design cognition and learning, some of which are synergistic and some of which conflict, to develop a more sophisticated understanding that acknowledges and builds on different perspectives. 2. Stretch, broaden, and challenge perspectives. 3. Share and clarify ideas through writing and discussion. 4. Develop a landscape view of cognition knowing and learning that may also reveal gaps in knowledge. 5. Critique and discuss a variety

of ways people study design to better understand what methods are appropriate for what kinds of research goals. 6. Examine data drawn from a variety of methods (e.g., verbal protocol analysis, sketches, surveys, debrief interviews and reports). 7. Experience different resources across disciplinary communities. 8. Identify central resources for finding information. 9. Develop an awareness of differences across diverse design communities (e.g., differences in language, values, approaches). 10. Experience and reflect on design through in class activities. 11. Examine other designers (peers as well as existing design data) to develop skills of noticing and seeing that may be used to guide personal reflections on a design philosophy, to develop a research proposal, or to develop an awareness of the kinds of challenges learners experience about design knowing. 12. Synthesize ideas through class discussion, activities, and out-of-class reflection blog posts. 13. Give and receive feedback on the final course project at multiple points in the term. 14. Develop an application of research on design knowing and learning (a philosophy statement, a research proposal, an education proposal, a synthesis to identify gaps). Credits: 3.00

ENE 63000 - Cognitive Devices In Science, Technology, Engineering And Mathematics Learning Environments

Credit Hours: 3.00. This course explores the nature of technologies we use to assist in thinking, learning and teaching. Specific focus is on cognitive tools associated with engineering activities and how to blend these tools with science and mathematical knowledge. These will range from representational tools, computational tools and cognitive tools for supporting individual and group thinking and learning. Participants in this course will be able to evaluate various learning technologies relative to specific learning goals and outcomes and will design a technological tool to support thinking, learning and/or teaching about concepts in science, engineering, mathematics and technology. Participants will also be able to identify assessment methods that indicate cognitive change in learners as a measure of the effectiveness of a device/tool in context of an activity.

Learning Outcomes: 1. Evaluate various learning technologies relative to specific learning goals and outcomes and will design a technological tool to support thinking, learning, and/or teaching about concepts in science, engineering, mathematics and technology. 2. Identify assessment methods that indicate cognitive change in learners as a measure of the effectiveness of a device/tool in context of an activity. Credits: 3.00

ENE 68500 - Educational Methods In Engineering

Credit Hours: 3.00. (CHE 68500) Students will learn how to teach in an engineering environment where both classroom and laboratory instruction is intertwined. Classroom techniques, such as lectures, cooperative groups, mastery and PSI, TV and video, and guided design will be studied, in addition to class preparation issues, such as ABET accreditation and design content. Students will study motivation, learning theories and cycles, and personality types. Includes teaching practice and group projects. Student must be admitted into a Ph.D. program in Engineering or other technical discipline (Finished with MS or MS-bypass). Not open to students who have taken PSY 69500/EDPS 63400. Permission of Instructor required.

Learning Outcomes: 1. Summarize and critique theories of learning and development. 2. Propose connections between theories of learning and development and engineering thinking. 3. Apply theories of learning and development to the construction of engineering learning environments. 4. Generate engineering education research questions that are aligned with respective theories of learning and development. 5. Remember the main points of historically important theories of learning and development. 6. Consider how different theories of learning and development might be used as frameworks for your individual research projects (e.g. your dissertation research). Credits: 3.00

ENE 68700 - Mentored Teaching In Engineering

Credit Hours: 1.00 or 3.00. Mentored experience in the teaching of engineering, with structured opportunities for

individual reflection. All students create a scholarly teaching portfolio. Students who register for three credits conduct a scholarship of teaching and learning project. Prerequisites: Significant concurrent responsibility for teaching an engineering course. Registration in or completion of ENE 50600 (Content, Assessment And Pedagogy) or ENE 68500 (Educational Methods In Engineering); or instructor permission required.

Learning Outcomes: 1. Think critically about the relationships between your teaching experiences and the readings in this course and the prerequisite courses. 2. Use reflection, mentoring, and student feedback to learn from teaching experiences. 3. Explain the reasons for choices of teaching methods. 4. Analyze evidence of student learning. 5. Identify and address ethical issues in teaching situations. 6. Plan and carry out a scholarly investigation of teaching and learning through the SoTL project. Credits: 1.00 or 3.00

ENE 69000 - Seminar In Engineering Education

Credit Hours: 0.00. Seminar course covering a broad range of current discovery, learning, and engagement topics in Engineering Education. Seminar presentations by representatives from academia, industry, other external institutions, and members of the Purdue University community. This is a required course for the graduate program in the Department of Engineering Education.

Learning Outcomes: 1. Develop an understanding of the field of Engineering Education in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued Engineering Education has the potential to provide leadership. Credits: 0.00

ENE 69500 - Advanced Topics In Engineering Education

Credit Hours: 0.00 to 6.00. Primarily designed for specialized topic areas for which there is no specific course, workshop, or individual study plan, but having enough student interest to justify the formalized teaching of a course. Permission of instructor required.

Credits: 0.00 to 6.00

ENE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Make satisfactory progress on Master's research. Credits: 1.00 to 18.00

ENE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Division of Environmental and Ecological Engineering (Graduate)

Website: **https://engineering.purdue.edu/EEE/InfoFor/CurrentStudents/Graduate**

About the Department

Environmental and Ecological Engineering empowers students to serve people and the planet. We prepare graduates for work in academia, industry, consulting, and government, with responsibility ranging from the design of drinking water and wastewater treatment systems to improving air quality to fostering sustainable development, and to developing sustainable technologies that conserve natural resources. As an interdisciplinary program, we recruit from across science and engineering disciplines.

For additional information, please contact Environmental and Ecological Engineering at eeegrad@purdue.edu.

Department/School Head

John W. Sutherland

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Assistant Professor of Practice	Assistant Professor of Research
Ernest (Chip) Blatchley Carol Handwerker Inez Hua Loring (Larry) Nies John Sutherland Andrew Whelton Fu Zhao	Hau Cai Brady Hardiman John Howarter Amisha Shah Shweta Singh Zhi (George) Zhou	Rebecca Ciez Heather Liddell Caitlin Proctor	Lindsey Payne Xinyu Zhang	Nadya Zyaykina

Academic Programs

Ph.D. Program

Master's (thesis, non-thesis) Program

Combined degree

- B.S. in various undergraduate programs / M.S.E.E.E. (Up to 12 credits can be dual counted for BS and MSEEE)

Concentrations

- Computational Interdisciplinary Graduate Programs
- Interdisciplinary Ecological Science and Engineering

Environmental and Ecological Engineering, MSEEE

Environmental and Ecological Engineering, PHD

EEE 51601 - Indoor Air Quality

Credit Hours: 3.00. The course covers the fundamentals of indoor air pollutant dynamics in buildings and their heating, ventilation, and air conditioning systems.

Learning Outcomes: 1. Evaluate mechanistically pollutant transport dynamics in buildings through application of material balance models. 2. Apply fundamental principles of aerosol physics to characterize the behavior of indoor aerosols from several nanometers to tens of micrometers in size. 3. Evaluate human exposure to indoor aerosols and analyze the effectiveness of engineering control strategies for indoor air pollution. 4. Read and critically analyze papers in the technical literature on indoor air quality and aerosols. 5. Gain additional insight regarding specific topics related to indoor air quality and aerosols through a rigorous course project. 6. Analyze, and discuss in a group-setting, contemporary indoor air quality issues facing our global society. 7. Prepare and review written and oral technical communication. Credits: 3.00

EEE 53000 - Life Cycle Assessment: Principles And Applications

Credit Hours: 3.00. This course covers the basic concept of life cycle thinking, framework and computational structure of process and economic input-output based life cycle assessment (LCA), state-of-the-art LCA software tools, industrial case studies, and recent advances in LCA methodology. Students are required to complete a group project that could potentially facilitate the adaptation of LCA tools in engineering research, education, or practice.

Learning Outcomes: 1. Conduct an LCA study using state-of-the-art software tools and databases according to ISO I4040 standards. 2. Identify the limitations and weakness of an existing LCA study. 3. Develop customized inventory dataset using information available in literature and current inventory databases. 4. Develop a simplified yet functional LCA software tool tailored for an enterprise or organization. 5. Combine LCA results with economic and social impact analysis to support decision making. Credits: 3.00

EEE 54400 - Environmental Organic Chemistry

Credit Hours: 3.00. (AGRY 54400) The fundamental properties and processes responsible for the fate of organic chemicals in the environment, with emphasis on soil and water chemistry. Areas to be addressed will include both conceptual and theoretical aspects of processes relevant to environmental fate of contaminants; measurement, estimation, correlation, and application of the parameters most commonly used to assess various chemodynamic properties in soil-water systems.

Learning Outcomes: 1. Demonstrate an understanding of the fundamental properties and processes controlling the environmental fate of organic contaminants in surface and subsurface environments. 2. Understand how variations in chemical structure change chemical behavior including solubility, volatility, acid-base speciation and reactivity. 3. Quantify chemical distribution between soil-water, soil-air, water-air and liquid-liquid compartments. 4. Understand and quantify how environmental and anthropogenic factors change chemical behavior and distribution in the environment. 5. Apply partition coefficients and mass balance approaches to predict chemical distribution between various environmental compartments. 6. Demonstrate an understanding of how abiotic and biotransformation processes affect chemical fate in the environment. 7. Demonstrate an understanding how chemical, soil and subsurface properties impact choice of remediation strategies. Credits: 3.00

EEE 55000 - Physico-Chemical Processes In Environmental Engineering I

Credit Hours: 3.00. Theory and principles of design for processes used in environmental engineering, with emphasis on water and wastewater treatment. Processes include: coagulation, flocculation, sedimentation, centrifugation, filtration, disinfection, adsorption, and gas/liquid transfer.

Learning Outcomes: 1. Learn fundamental principles of physico/chemical processes that are commonly used by Environmental Engineers with an emphasis on water treatment. 2. Understand principles that have a broad application in Environmental Engineering and other disciplines. 3. Focus on fundamental concepts so as to prompt application in a wide range of settings and to promote creativity. Credits: 3.00

EEE 55201 - Environmental Biotechnology

Credit Hours: 3.00. This course focuses on fundamentals of molecular biology and biotechnology for environmental applications. The major topics include activated sludge processes, stoichiometry, kinetics, anaerobic digestion, biological nitrogen and phosphorus removal, emerging contaminants, molecular microbiology tools, biofouling, antibiotic resistance, and biofuels.

Learning Outcomes: 1. Understand the latest development in environmental biotechnology and their applications in contaminant removal and public health protection. 2. Critically review relevant literature on selected topics in environmental biotechnology and identify areas for improvement. 3. Deliver effective

presentations. 4. Write clearly and ethically. Credits: 3.00

EEE 55401 - Water Chemistry For Environmental And Ecological Engineering

Credit Hours: 3.00. Principles of chemistry applied to the analysis and distribution of the chemical composition of natural waters and engineered water systems. Course topics include acid/base, complexation, precipitation/dissolution, sorption and redox reactions in the context of environmental and ecological engineering. Case studies focus on water chemistry in research and practice, such as lead in drinking water, recovery of valuable products from wastewater, chemistry of engineered carbon dioxide capture, and engineered treatment of surface waters. Case studies vary each year.

Learning Outcomes: 1. Describe the unique properties of water, and the relevance to natural and engineered systems. 2. Explain fundamental principles of chemical equilibrium and kinetics, and apply principles to calculations and solving contemporary challenges in water chemistry systems. 3. Classify chemical reactions and mass transfer, and deduce which categories are present in a particular system. 4. Evaluate and formulate technological approaches to reduce environmental impacts of anthropogenic activities, based on water chemistry principles. Credits: 3.00

EEE 56000 - Environmental And Ecological Engineering In-Context

Credit Hours: 0.50 to 3.00. An introduction to current challenges and issues in Environmental and Ecological Engineering (EEE) applications. Topics will change from semester to semester and will be announced in advance. The list of possible topics includes current events, emerging challenges, adaptations to new regulations, innovative environmental and ecological engineering processes, life-cycle impacts of manufactured products, and sustainable management of industrial waste streams.

Learning Outcomes: 1. Design experiments and evaluate experimental data, error and variability. 2. Understand environmental systems and processes. 3. Communicate professionally to the public about complex technical issues. 4. Develop management strategies for environmental problems. Credits: 1.00 to 3.00

EEE 57000 - Solid And Hazardous Waste Management

Credit Hours: 3.00. Students will be introduced to the regulation of solid and hazardous wastes; engineering design, planning and analysis of solid and hazardous waste management facilities.

Learning Outcomes: 1. Solve basic problems related to pollutant generation, waste collection and composition, recycling, and thermal conversion processes. 2. Apply knowledge of topics from chemistry such as stoichiometry, kinetics, and equilibrium to gas generation, and waste composition. 3. Understand the role of an engineer involving regulations, ethics, professionalism, engineering practice and registration. 4. Demonstrate an ability to communicate effectively. 5. Solve environmental and public health problems associated with man-made and natural disasters. Credits: 3.00

EEE 59500 - Environmental And Ecological Engineering Projects

Credit Hours: 0.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 59800 - Environmental And Ecological Engineering Projects

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 69000 - Environmental And Ecological Engineering Graduate Seminar

Credit Hours: 0.00. Combination of invited speakers (outside and inside Purdue) including graduate students. Topics will range across environmental and ecological engineering with an emphasis on current topics.

Learning Outcomes: 1. Increased understanding of academic and research topics in Environmental and Ecological Engineering (EEE). 2. Improve ability of EEE graduate

students to think critically about research and presentation skills of others. 3. Increased ability to critique his or her own work. Credits: 0.00

EEE 69199 - Professional Practice Graduate Co-Op I

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem solving, communication, and teamwork. 3. Understand of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69299 - Professional Practice Graduate Co-Op II

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69399 - Professional Practice Graduate Co-Op III

Credit Hours: 0.00. Professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69500 - Experimental Courses

Credit Hours: 0.00 to 6.00. Topics vary. Arrange hours and credit. Permission of instructor required.

Credits: 0.00 to 6.00

EEE 69699 - Professional Practice Internship

Credit Hours: 0.00. One-session professional experience in environmental and ecological engineering. Program coordinated by EEE with cooperation of participating employers and the Office of Professional Practice. Students submit summary report and company evaluation. Permission of department required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional engineering context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and teamwork. 3. Increase understanding of the engineering profession and practice, basic engineering principles, and principles and practice of ethical responsibility in professional work. Credits: 0.00

EEE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Learning objectives vary per student. Credits: 1.00 to 18.00

EEE 69900 - Research PhD Dissertation

Credit Hours: 1.00 to 18.00. Research PhD Dissertation.

Permission of instructor required.

Learning Outcomes: 1. Learning objectives are student dependent. Credits: 1.00 to 18.00

School of Industrial Engineering (Graduate)

Website: **https://engineering.purdue.edu/IE/Academics**

Department/School Head

Young-Jun Son

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Professor by Courtesy	Emeritus Faculty
Barrett Caldwell Srinivasan Chandrasekar Gary Cheng Abhijit Deshmukh Vincent Duffy Mark Lehto Shimon Nof Nagabhushana Prabhu Gesualdo Scutari Juan Wachs Yuehwern Yih	Vaneet Aggarwal Hua Cai Bradley Duerstock Vincent Duffy Charles Robert Kenley Susan Hunter Seokcheon Lee Andrew Liu Mario Ventresca Wenzhou Wu	Joaquin Goñi Harsha Honnappa David Johnson Ramses Martinez Roshanak Nateghi Toyya Pujol Denny Yu	Melba Crawford Robert Proctor J. Shanthikumar	Arden Bement Ferdinand Leimkuhler C. Richard Liu Colin Moodie Ronald Rardin Gavriel Salvendy Bruce Schmeiser James Solberg Frederick Sparrow Arnold Sweet

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Academic Programs

Master's Program

• Professional Masters Program
• Thesis (Research Track)
• Non-Thesis (Application Track)

Ph.D. Program

You may specialize in the fields of:
• Human Factors

• Manufacturing
• Operations Research
• Production Systems

Dual Degree

MS(E) + MBA - a dual degree Master's program with the Krannert School of Management

Concentrations

• Computational Interdisciplinary Graduate Programs - Computational Science & Engineering
• Ecological Sciences & Engineering
Concentrations (Areas of Study)
• Energy Systems
• Healthcare Engineering
• Aviation Human Factors
• Nano-Manufacturing
• Human-Robot Interaction
• Safety Engineering
• Intelligent Systems
• Financial Engineering
• Service Engineering
• Simulation Optimization
• Materials Processing
• Digital Human Modeling
• Machining Processes
• Global Systems
• Information Visualization
• Distributed Control
• Nonlinear Optimization
• Group Work and Communications
• E-work, E-business, E-service Systems

Post-Baccalaurete Certificate

• Purdue Systems Collaboratory - Systems Certificate

Industrial Engineering, MSIE

Industrial Engineering, PHD

IE 52500 - Healthcare Delivery Systems

Credit Hours: 3.00. This course is to introduce the interconnected sectors in the complex U.S. healthcare delivery systems, including in-patient care, emergency departments, surgical services, out-patient clinics, long-term care, pharmacies, laboratories, as well as supporting industries such as insurance, food services, information technologies, etc. The course focuses on the management of healthcare services by the industrial engineering principles and quantitative decision-making methodologies.

Learning Outcomes: 1. Understand current performance assessment for healthcare. 2. Develop skills in decision making and problem solving by quantitative analytical tools and system/process modeling. 3. Develop proficiency in selecting analytical methods that are appropriate for addressing specific problems for healthcare providers. Credits: 3.00

IE 53000 - Quality Control

Credit Hours: 3.00. Principles and practices of statistical quality control in industry. Control charts for measurements and for attributes. Acceptance sampling by attributes and by measurements. Standard sampling plans. Sequential analysis. Sampling inspection of continuous production.

Credits: 3.00

IE 53200 - Reliability

Credit Hours: 3.00. Reliability of components and multi-component systems. Application of quantitative methods to the design and evaluation of engineering and industrial systems and processes for assuring reliability of performance. Economic and manufacturing control activities related to product engineering aspects of reliability. Principles of maintainability. Product failure and legal liability.

Credits: 3.00

IE 53300 - Industrial Applications Of Statistics

Credit Hours: 3.00. The application of statistics to the effective

design and analysis of industrial studies relating to manufacturing and human factors engineering in order to optimize the utilization of equipment and resources. Emphasis on conducting these studies at the least cost.

Credits: 3.00

IE 53500 - Linear Programming

Credit Hours: 3.00. Optimization of linear objective functions subject to linear constraints. Development of theory and algorithmic strategies for solving linear programming problems.

Credits: 3.00

IE 53600 - Stochastic Models In Operations Research I

Credit Hours: 3.00. An introduction to techniques for modeling random processes used in operations research. Markov chains, continuous time Markov processes, Markovian queues, reliability and inventory models.

Credits: 3.00

IE 53700 - Discrete Optimization Models And Algorithms

Credit Hours: 3.00. An introduction to classic models and algorithms for discrete optimization. Basic theory and computational strategies for exact and heuristic solution of integer, combinational, and network problems in the context of classic models.

Credits: 3.00

IE 53800 - Nonlinear Optimization Algorithms And Models

Credit Hours: 3.00. Survey of computational tools for solving constrained and unconstrained nonlinear optimization problems. Emphasis on algorithmic strategies and characteristic structures of nonlinear problems.

Credits: 3.00

IE 54100 - Nature-Inspired Computation

Credit Hours: 3.00. This course is about algorithms that are inspired by naturally occurring phenomena and applying them to optimization, design and learning problems. The focus is on the process of abstracting algorithms from the observed phenomenon, their outcome analysis and comparison as well as their "science". This will be done primarily through the lens of evolutionary computation, swarm intelligence (ant colony and particle-based methods) and neural networks.

Learning Outcomes: 1. Describe the natural phenomena that motivate the discussed algorithms. 2. Understand the strengths, weaknesses and appropriateness of nature-inspired algorithms. 3. Apply nature-inspired algorithms to optimization, design and learning problems. 4. Understand fundamental concepts of NP-hardness and computational complexity. 5. Prove algorithm convergence rates using probabilistic arguments. 6. Perform appropriate analyses on and between the outputs of stochastic algorithms. 7. Analyze search space structure using statistical and information theoretic measures and explain its impact on algorithm behavior and output. Credits: 3.00

IE 54500 - Engineering Economic Analysis

Credit Hours: 3.00. Analysis of engineering costs and capital investments. Applications of classical optimization, mathematical programming, and the theory of production to the analysis of investment proposals. Evaluation and selection of individual projects and formulation of capital investment programs.

Credits: 3.00

IE 54600 - Economic Decisions In Engineering

Credit Hours: 3.00. Topics in decision-making and rationality including decision analysis, decision-making under uncertainty, and various descriptive and prescriptive models from operations research, economics, psychology, and business. Applications are drawn from engineering decision-making, public policy, and personal decision-making. Attention also is paid to designing aids to improve decision-making.

Credits: 3.00

IE 54900 - Machine Vision In Intelligent Robotic Systems

Credit Hours: 3.00. Introduction to machine vision and learning algorithms from a human-machine interaction standpoint, and application of machine vision techniques to the design of human-integrated cybernetic systems, such as, robotic systems, flexible automation, and wearable electronics.

Learning Outcomes: 1. Analyze and write computer programs to analyze images for tasks such as filtering, edge detection, segmentation, object recognition, and template matching. 2. Describe and use image filtering methods for

image processing. 3. Describe and use edge detection methods for image processing. 4. Use morphological operations to perform shape recognition and template matching. 5. Use optical flow methods to study motion. 6. Apply techniques for object tracking and motion detection to analyze multiple images or video. 7. Apply learning methods such as neural networks, clustering, and linear regression for object recognition. 8. Apply a computer vision technique to the control of a robotic arm. 9. Plan and develop a working prototype machine vision interface. Credits: 3.00

IE 55600 - Job Design

Credit Hours: 3.00. (PSY 55600) Task analysis, personnel selection and training, job and organization design, and criteria development and use. Human factors related to job design in order to increase job satisfaction and productivity.

Credits: 3.00

IE 55800 - Safety Engineering

Credit Hours: 3.00. Application of human factors and engineering practice in accident prevention and the reduction of health hazards are presented. The objective of this course is to provide an understanding of the safety and health practices which fall within the responsibilities of the engineer in industry. Special attention is devoted to the detection and correction of hazards and to contemporary laws and enforcement on occupational safety and health.

Credits: 3.00

IE 55900 - Cognitive Engineering Of Interactive Software

Credit Hours: 3.00. Theory and applications of software design to improve productivity and job satisfaction on information processing and cognitive tasks in the workplace. Human information processing models and cognitive theories will be used to provide a theoretical basis for how to choose and display information to the user. Other topics include user-friendly displays and empirical approaches to software design. Applications of the design theory are stressed by class projects.

Credits: 3.00

IE 56100 - Introduction To Convex Optimization

Credit Hours: 3.00. (AAE 56100) Introduction to convex analysis, convex optimization problems, algorithms of convex optimization and measures of their complexity, and application of convex optimization in aerospace engineering. Recognition of convex optimization problems that arise in scientific and engineering applications. Introduction to software tools to solve convex optimization problems.

Learning Outcomes: 1. Understand the basics of convex analysis and convex optimization problems. 2. Understand and develop algorithms for convex optimization and measures of their capacity. 3. Apply convex optimization to solve engineering problems. Credits: 3.00

IE 56600 - Production Management Control

Credit Hours: 3.00. Background and development of production management, plus current concepts and controls applicable to production management functions. Not open to Industrial Engineering students with a minor in management.

Credits: 3.00

IE 57000 - Manufacturing Process Engineering

Credit Hours: 3.00. Theories and applications of materials forming and removal processes in manufacturing, including product properties, process capabilities, processing equipment design, and economics. A systems approach to all aspects of manufacturing process engineering.

Credits: 3.00

IE 57400 - Industrial Robotics And Flexible Assembly

Credit Hours: 3.00. Lab by arrangement. Design, analysis, and operation of robotic systems. System components and their control. Languages for robot control. Application design and analysis. Part feeders and tooling for robot workstations and automated assembly. Methods for planning robotic and assembly applications.

Credits: 3.00

IE 57700 - Human Factors In Engineering

Credit Hours: 3.00. (PSY 57700) Survey of human factors in engineering with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments.

Credits: 3.00

IE 57800 - Applied Ergonomics

Credit Hours: 3.00. Analysis, modeling, and design of jobs and systems to be consistent with human factors and ergonomic principles.

Learning Outcomes: 1. Analyze and design work to fit human anthropometric requirements. 2. Analyze and design work to meet human physiological limitations, including lifting tasks. 3. Conduct time studies and use predetermined time system modeling. 4. Perform task analysis and process mapping. 5. Analyze and design work to meet human cognitive limitations. 6. Determine function allocation between automation and human tasks. 7. Model basic human performance at movement, detection, and control tasks. 8. Identify common human errors and perform human reliability analysis. 9. Design displays that meet basic human-computer interaction principles. 10. Write technical reports describing the results of human factors analysis. 11. Present technical material describing the results of human factors analysis. Credits: 3.00

IE 57900 - Design And Control Of Production And Manufacturing Systems

Credit Hours: 3.00. Design and control of discrete part manufacturing systems in contemporary production environments, with emphasis on flexible, demand-driven, product-based manufacturing. Currently used planning and control methodologies, such as MRP, OPT, and JIT are reviewed and integrated with appropriate facility design methodologies, including cellular design algorithms. Introduction to Computer Integrated Manufacturing (CIM) architecture and reference models and relevant control procedures, including basis approaches to appropriate data management methodologies.

Credits: 3.00

IE 58000 - Systems Simulation

Credit Hours: 3.00. Philosophy and elements of digital simulation language. Practical application of simulation to diverse systems. Computer simulation exercises and applications are required.

Credits: 3.00

IE 58100 - Simulation Design And Analysis

Credit Hours: 3.00. An introduction to simulation of stochastic systems on digital computers. Emphasis is on the fundamentals of simulation as a statistical experiment. Topics include uniform random numbers, input modeling, random variate generation, output analysis, variance reduction, and optimization.

Credits: 3.00

IE 58200 - Advanced Facilities Design

Credit Hours: 3.00. Study of the theoretical and applied aspects of manufacturing systems layout. Emphasis on contemporary manufacturing, including the layout of cellular systems, automated material handling systems, and storage systems.

Credits: 3.00

IE 58300 - Design And Evaluation Of Material Handling Systems

Credit Hours: 3.00. Analysis for design and evaluation of material handling systems with emphasis on material flow control and storage. Analytic models and simulation used. Economic justification models for material handling systems.

Credits: 3.00

IE 58800 - e-Work And e-Service

Credit Hours: 3.00. e-Work is defined as the collaborative, computer-and-communication-supported work in highly distributed organizations of humans/robots/autonomous systems. This course is devoted to learning the basic principles, theories, and applications for the design of effective e-Work and e-Service systems. Relevant discoveries at Purdue and elsewhere are also presented.

Learning Outcomes: 1. Understand fully the theory and design principles of collaborative e-Work and e-Service systems. 2. Model correctly workflow, protocols and agents for e-Work and e-Service systems. 3. Design, specify, evaluate and optimize e-Work and e-Service applications correctly. 4. Discuss benefits, limitations, and emerging trends of e-Work and e-Service systems critically and correctly. Credits: 3.00

IE 59000 - Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Selected topics in industrial engineering for seniors and graduate students. Permission of

instructor required.

Credits: 1.00 to 6.00

IE 63000 - Multiple Objective Optimization

Credit Hours: 3.00. Theory and applications of multiple objective optimization and multiple criteria decision making. Existence and specification of single and multiple attributive value and utility functions. Risk aversion. Characterization and generation of efficient (Pareto optimal) solutions to vector optimization problems. Domination cones. Interactive algorithms. Prerequisite: IE 53500 .

Credits: 3.00

IE 63200 - Scheduling Models

Credit Hours: 3.00. Development and discussion of mathematical and simulation models for scheduling and sequencing the flow of jobs or activities in manufacturing environments. Techniques include dynamic programming, branch and bound, linear and integer programming, heuristics and stochastic network simulation. Prerequisite: IE 57900 ; IE 53500 or IE 53700 .

Credits: 3.00

IE 63300 - Dynamic Programming

Credit Hours: 3.00. Theory and applications of finite and infinite stage sequential decision processes, including Markovian decision problems, efficient computational methods, and computer software package. Prerequisite: IE 53500 , IE 53600 .

Credits: 3.00

IE 63400 - Integer Programming

Credit Hours: 3.00. An advanced course on theory and algorithms for integer and mixed integer optimization problems. Convergence of integer programming algorithms, dual relaxations, Benders decomposition, cutting plane theory, group theory of integer programs, and linear diophantine equations. Prerequisite: IE 53500 , IE 53700 .

Credits: 3.00

IE 63500 - Theoretical Foundations Of Optimization

Credit Hours: 3.00. An advanced course in theoretical foundations of mathematical programming. Convex analysis, global and local duality and optimality, general algorithmic convergence. Offered in alternate years. Prerequisite: IE 53500 .

Credits: 3.00

IE 63900 - Combinatorial Optimization

Credit Hours: 3.00. An advanced course in combinatorial optimization. Emphasis on the theory and strategies of combinatorial algorithms including complexity theory, advance issues in network flows, matching, matroids, and combinatorial polyhedra. Prerequisite: IE 53500 .

Credits: 3.00

IE 64600 - Advanced Decision Theory

Credit Hours: 3.00. An advanced course on the theory and models of decision-making and rationality. Material includes advanced topics in decision analysis, models of probabilistic reasoning, decision-making in competitive situations, and models of human and computer reasoning (including artificial intelligence). Prerequisite: IE 54600 .

Credits: 3.00

IE 65600 - Research Seminar In Human Factors

Credit Hours: 3.00. An in-depth study of topics of special interest in human factors. A variable title course where topics change from semester to semester. Possible topics include cognitive engineering in expert systems, human resource management, skills acquisition and retention, knowledge elicitation, and knowledge representation. Permission of instructor required.

Credits: 3.00

IE 65900 - Human Aspects In Computing

Credit Hours: 3.00. Advanced topics in ergonomic, cognitive, and social aspects of using computerized systems are discussed with regard to comfort and user satisfaction, ease and productive use of computerized systems, and effective implementation of computerized technologies in the workplace. Prerequisite: IE 55900 .

Credits: 3.00

IE 67000 - Advanced Topics In Manufacturing Engineering

Credit Hours: 3.00. Advanced research topics and approaches in manufacturing engineering, including processes and equipment. Research methodology, nontraditional processes, manufacturing systems, and competitive aspects of manufacturing. Prerequisite: IE 57000 .

Credits: 3.00

IE 67400 - Cyber Methods For Advanced Production Control

Credit Hours: 3.00. The study of the theoretical foundation and relevance of advanced cyber methods in the planning and control of intelligent production operations; manufacturing operating systems; synchronization in decentralized systems; recovery in decentralized systems; parallel processing; distributed databases; factory networks; reasoning and logic for production control. Prerequisite: IE 57400 or 57500 or 57900.

Learning Outcomes: 1. Know theoretical foundation and relevance of advanced cyber, real-time control, computing, communication, and brain models for robotics. 2. Know automation of planning and decisions in distributed production and supply installations, global supply, logistics, and service systems/networks. 3. Know the current and emerging functions, algorithms, protocols, and models and how to apply them to research projects and presentations in the field. Credits: 3.00

IE 68000 - Advanced Simulation Design And Analysis

Credit Hours: 3.00. An introduction to the literature of simulating stochastic systems, with emphasis on probabilistic and statistical aspects. Prerequisite: IE 58100 .

Learning Outcomes: 1. Gain in-depth understanding of simulation for use in research or in preparation for conducting research in the area of simulation methodology. Credits: 3.00

IE 69000 - Advanced Topics In Industrial Engineering

Credit Hours: 1.00 to 6.00. Advanced study in various fields of industrial engineering for graduate students. Credits and hours to be arranged. Permission of instructor required.

Credits: 1.00 to 6.00

IE 69600 - Graduate Professional Practice

Credit Hours: 0.00. Practice in industry and comprehensive written reports of this practice. Permission of instructor required.

Credits: 0.00

IE 69700 - Seminar

Credit Hours: 0.00. Industrial engineering problems with particular emphasis on current research.

Credits: 0.00

IE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

IE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Materials Engineering (Graduate)

Website: **https://engineering.purdue.edu/MSE/Academics/Graduate/index.html**

Department/School Head

David F. Bahr

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty	Courtesy Faculty

David Bahr John Blendell Mukerrem Cakmak Nikhilesh Chawla Weinong Chen Anter El-Azab R. Edwin Garcia Carol Handwerker Matthew John M. Krane Eric Kvam Michael Manfra Jan-Andres Mansson Ernesto E. Marinero Paul Mort R. Byron Pipes Kenneth Sandhage Elliott Slamovich	Kendra Erk John Howarter David Johnson Carlos Martinez Robert Spitzer Janelle Wharry	Chelsea Davis Arun Kumar Mannodi Kanakkithodi Maria Okuniewski Davin Piercey Rahim Rahimi Michael Titus	Arden L. Bement Jr. Mysore Dayananda Richard E. Grace	Babek Anasori Alexandra Boltasseva Srinivasan Chandrasekar Gary Cheng H. Kory Cooper Chi Hwan Lee Na (Luna) Lu Vilas Pol Arvind Raman Michael Sangid Alexander Wei Johnathan Wilker

Lia Stanciu Alejandro H. Strachan Rodney Trice Kevin Trumble Haiyan Wang Jeffrey Youngblood Xinghang Zhang				

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Academic Programs

Master's and Ph.D. Programs

The School of Materials Engineering offers MS and Ph.D. degrees in the field of Materials Science and Engineering. Opportunities for research span the full range of engineering materials, with emphasis on characterizing their internal structure down to the atomic scale, structure-properties relationships, processing, and performance. The School also serves as the hub for a broad range of interdisciplinary materials research at Purdue. The School of Materials Engineering also offers a Professional MS degree.

Areas of Study

Opportunities for research span the full range of engineering materials including ceramics, metals, polymers, semiconductors, and

composites, with emphasis on their internal structure-properties relationships, processing, and performance.

Materials Engineering, MSMSE

Materials Engineering, PHD

MSE 50200 - Defects In Solids

Credit Hours: 3.00. Structures and interactions of point, line, and planar defects in solids, with emphasis on properties of defects. Generic basis of defect energies and interactions, with reference to specific materials and material classes as examples. Types of point defects found in crystals, their origins, interactions, and motion. Overview of dislocation theory and point-defect/dislocation interactions. Structural aspects of surfaces and interfaces, including point and line defect interactions.

Credits: 3.00

MSE 50800 - Phase Transformations In Solids

Credit Hours: 3.00. Description of stress effects on transforming systems. Development of classical models for nucleation and growth and spinodal decomposition. Application of models to discontinuous precipitation, bainite formation, and martensitic transformations.

Credits: 3.00

MSE 51000 - Microstructural Characterization Techniques

Credit Hours: 3.00. A broad variety of analytical tools will be presented. The intent is to allow the student to make an educated selection of characterization techniques, or critical analysis of published data, for materials and defect analysis. The techniques will be assessed in terms of the probe type and material response, of what device and specimen requirements are typical, and of what data can or cannot be derived from each type of analysis.

Credits: 3.00

MSE 51200 - Powder Processing

Credit Hours: 3.00. Processing of engineering materials from powders. Synthesis of metals, ceramics, and polymers in powder form. Characteristics of particulates. Behavior of collections of particles; surface forces, particle agglomeration and dispersion, gelation, particle packing. Consolidation of powders; mechanics of dry flow and compaction, slurry rheology, shaping processes. Densification and microstructural development; geometry, thermodynamics, and kinetics of sintering, liquid-phase sintering, reaction densification, infiltration. Powder processing of composites.

Learning Outcomes: 1. Describe a powder fabrication process from starting reagent to finished powder. interpret a particle size distribution and estimate mean particle size and specific surface area from the data. 2. Review an ASTM standard for particulate materials characterization. 3. Describe the role of van der Waals interactions in determining structure on the colloidal and macroscopic length scales. 4. Differentiate between processing routes more favorable for processing bulk materials versus routes geared towards processing thin films. 5. Describe when it is appropriate to process dry powders versus processing powders suspended in a liquid medium. 6. Calculate the packing density of bimodal particle size distributions and describe the difference between calculated values and what one might expect to observe in experimental measurements. 7. Describe the effects of particle agglomeration on interparticle forces and the packing density of powder compacts. 8. Calculate the particle size at which gravitational segregation becomes significant during aqueous colloidal processing. 9. Describe how segregation effects may be minimized during aqueous colloidal processing and any advantages and disadvantages associated with the modified process. 10. Describe the effects of interparticle forces on powder compact homogeneity and subsequent effects on compact densification. 11. Describe the effects of furnace atmosphere on the density, the specific surface area, and the microstructure of a powder compact. Credits: 3.00

MSE 51700 - Materials For Hypersonics

Credit Hours: 3.00. This course will include a brief history of hypersonic flight and design, along with a description of the aerothermal environment, to provide motivation for the use of ceramic materials as thermal protection systems and window materials. The classroom approach is to develop a fundamental understanding of materials structure, forming and sintering, and properties (mechanical and thermal) of ceramics, and then apply that knowledge for hypersonic applications such as ultra-high temperature ceramics (UHTCs including ZrB2), ceramic matrix composites (including Cf/SiC, SiCf/SiC, and Carbon/Carbon), and materials requirements for RF and IR radomes and windows. Permission of instructor required.

Learning Outcomes: 1. Become familiar with the aerothermal environment expected during hypersonic flight. 2. Learn how to process high-temperature ceramic materials, from colloidal design to forming methods such as additive manufacturing. 3. Understand flexure testing and Weibull statistics interpretation of ceramic materials. 4. Know how bonding and microstructure affect thermal properties. 5. Understand the basic material requirements for radar frequency and infrared frequency windows for hypersonic flight. 6. Articulate the assumptions of various thermodynamic models used to estimate heat flux and surface temperatures during hypersonic flight. 7. Differentiate the advantages and disadvantages of different additive manufacturing techniques used for ceramics. 8. Calculate sample strengths for different-sized flexure specimens. 9. Make assessments of the thermal shock resistance of materials based on mechanical and thermal properties. 10. Calculate the thicknesses of random materials based on the frequency of interest for different RF window concepts. Credits: 3.00

MSE 51800 - Failure Analysis

Credit Hours: 3.00. Introduction to failure analysis and prevention. Concepts of materials failure, root cause analysis, manufacturing aspects of failure, techniques for identifying failure, fracture, corrosion, wear, and case studies. Also includes business and entrepreneurship aspects.

Learning Outcomes: 1. Become familiar with and be able to identify the categories of failure. 2. Recognize types of failure based on microstructural and post-mortem characterization 3. Relate failure to stressors driving failure (mechanical, thermal, electrical, etc.) 4. Communicate results of a failure analysis clearly to professional audiences 5. Estimate stressors driving failure in relationship to materials properties, service conditions, and design constraints. 6. Use or select appropriate characterization tools for failure analysis. 7. Select appropriate inspection criteria to prevent failure. 8. Recommend improvements in design, service or inspection to prevent failure. Credits: 3.00

MSE 52000 - Steel And Aluminum Alloys: Processing, Structure And Properties

Credit Hours: 3.00. Steel and aluminum alloy processing will be studied to provide fundamental understanding of how the final properties are influenced by processing from the extraction of metal from ore, through shaping by casting, hot-working and cold-working, and heat treatment for control of microstructure. This understanding will enable the student to go beyond comparisons of standard handbook values and recognize the fundamental metallurgical phenomena leading to differences in performance among the main alloy classifications. By examining the relationships among processing, microstructure, and properties, the course will provide the "know-how" for specifying, designing, and manufacturing with steels and aluminum alloys.

Learning Outcomes: 1. Describe current practice of steel and aluminum production in terms of the thermochemical unit processes. 2. Understand the differences between the main classes of commercial metal shaping processes and their intrinsic effects on microstructure. 3. Relate alloy microstructure to properties as measured in standard mechanical testing. 4. Interpret standards and specifications for processing and properties of different steel and aluminum alloy classifications. 5. Identify processing defects and predict their effect on material performance. 6. Specify alloy and

processing route to achieve desired properties sets for particular applications. 7. Explain properties variability in terms commercial practice constraints. 8. Analyze critically the state of research on a particular current topic in steel or aluminum metallurgy. Credits: 3.00

MSE 52300 - Physical Ceramics

Credit Hours: 3.00. Physical and chemical processes responsible for microstructure development in modern ceramic materials, and the relationship between microstructures and physical properties. The material covered is divided into three parts: solid state processes, including structural defects, diffusion, sintering and grain growth, reaction rates, nucleation and growth, and microstructure development; mechanical and thermal behavior, including deformation, strength, thermal properties, and thermal and compositional stresses; and electrical and magnetic behavior, including electrical conductivity, dielectric properties, and magnetic properties. Offered in alternate years.

Credits: 3.00

MSE 52400 - Mechanical Behavior Of Polymers

Credit Hours: 3.00. This course will focus on the mechanical properties and behaviors of polymeric materials. The course will utilize fundamental solid and fluid mechanics to understand the response of bulk polymers (solid and liquid, above and below T_g). The impact of deformation rate and temperature on the mechanical response of polymers will be covered in detail. The course will start with an overview of linear elastic mechanics, move to rubber elasticity, and then viscoelasticity (concentrating on time-temperature superposition). We will also cover fluid dynamics and the rheology of non-Newtonian fluids. We will conclude with a section on deformation, yield, and fracture mechanisms (focusing on those phenomena that are unique to polymers such as rubber cavitation, drawing, and crazing).

Learning Outcomes: 1. Demonstrate fundamental understanding of solid mechanics: draw a free body diagram and employ the correct equations of state to solve two- and three-dimensional statics and solids problems. 2. Articulate in rubber elasticity. 3. Utilize time-temperature superposition to generate a master curve to fully describe the mechanical response of a viscoelastic material. Apply "spring and dashpot" models to describe nonlinear materials responses. 4. Describe a rheology experiment of a non-Newtonian fluid: interpret and analyze raw rheology data, identify key phase transitions. 5. Solve simple fracture mechanics problems. 6. Demonstrate an understanding of polymer deformation mechanisms. 7. Apply polymer yield criteria to predict failure resulting from a given loading scenario. Credits: 3.00

MSE 52500 - Struct-Property Relationships Of Engineering Polymers

Credit Hours: 3.00. Structure-property relationships developed for commodity and engineering resins. Focus on connecting bonding and polymer structure (i.e., molecular weight, tacticity, crystallinity as it regards spherulites) to mechanical (yield phenomena and fracture) and thermomechanical behavior (viscoelasticity). Thermal characterization techniques, including DSC, TGA, TMA, and DMTA. Flow of polymer melts related to common melt processing techniques (i.e., extrusion and injection molding). Offered in alternate years.

Learning Outcomes: 1. Identify microstructural differences between thermoplastic, thermosetting, and elastomeric polymers and how these affect thermal and mechanical properties. 2. Discuss the crystalline structures of thermoplastic polymers, including nucleation and growth of spherulitic structures and how molecular weight, tacticity, and cooling rate affect the morphology of the crystals. 3. Discuss entropy elasticity as it relates to elastomeric behavior. 4. Compare and contrast the yield and fracture behavior of polymers with metallic and ceramics materials. 5. Explain viscoelasticity from a microstructural viewpoint, and its manifestations in polymeric mechanical behavior, including mathematical modeling of creep and stress relaxation behaviors of simple and complex systems. 6. Interpret the results from common thermal characterization (TGA, DSC, DMA) techniques and relate them to polymer structure. 7. Discuss polymer melt-processing techniques of extrusion and injection molding, and how polymer chain morphology affects processing. Credits: 3.00

MSE 52700 - Introduction To Biomaterials

Credit Hours: 3.00. This course aims to introduce students to Biomaterials concepts: structure, properties, and applications. The class will cover the main classes of materials: metals, ceramics and polymers in the context of their use in medicine as implant materials, drug delivery vehicles, and as tissue engineering scaffolds. Permission of instructor required.

Learning Outcomes: 1. Be familiar with the main concepts of Biomaterials principles: biocompatibility, structure-property-applications relationships, mechanical response of natural tissues, cellular pathways for tissue-material ingrowth. 2. Understand the requirements for metals and alloys, as well as ceramic materials to be used in load bearing implants (corrosion concepts, stress shielding, mechanical properties, composition). 3. Understand what properties of polymers impact their use in medicine (leaching and swelling, creep and stress relaxation). 4. Understand the tissue response to biomaterials: cytotoxicity, carcinogenicity, immune reactions. 5. Be able to expand the understanding of materials concepts to drug delivery applications (polymer degradation, encapsulation) and tissue engineering (scaffold porosity, diffusion of nutrients, mechanical properties). Credits: 3.00

MSE 53000 - Materials Processing In Manufacturing

Credit Hours: 3.00. Examination of the production/synthesis of engineering materials and the subsequent processing steps required to obtain a desired shape and microstructure. The course covers four major categories of materials processing: primary processing or materials synthesis, solidification processing, deformation processing, and powder processing, and provides specific examples from the processing of polymers, metals, and ceramics. The goal is to connect fundamental principles of materials processing to manufacturing processes. Credit will not be given for both MSE 5300 and MSE 36700 .

Credits: 3.00

MSE 53100 - Quantitative Analysis Of Microstructure

Credit Hours: 3.00. A review will be presented of basic probability theory and statistical analysis, with particular emphasis on terms and definitions of a microstructure. The properties accessible to quantification, the basic stereological relationships and the mathematical foundations, and the microstructural tools needed to quantify the structure will be emphasized. The last one-third of the course will cover applications of quantitative metallography to problems in failure analysis, solidification, heat treatment, phase equilibria, and deformation behavior. Offered in alternate years.

Credits: 3.00

MSE 53500 - Lean Manufacturing Of Materials

Credit Hours: 3.00. This course provides perspectives on materials processing and product innovation with an economic lens on efficiency and elimination of waste. It includes an historical perspective of manufacturing via the transition from mass to lean production in the automotive industry; and extends manufacturing and product development in context of emerging trends in automation (e.g., control and PAT, I4.0), modular design, supply chain, and sustainability. The class covers lean tools, focusing on value stream analyses and optimization using simulations. As an elective, the course accommodates a range of student interest profiles. It includes both individual and interest-based group assignments. The mix of students adds to the effectiveness of group exercises. A term paper enables individuals to do a deeper dive into specific interests. Overall, the course has shown to be adaptable over a broad range of students representing a variety of departments and professional backgrounds.

Learning Outcomes: 1. Understand the distinction between Mass Production and Lean Manufacturing and to analyze a facility's progress in the transition from Mass to Lean. 2. Articulate a case for Lean. Students will be able to present an argument on why Lean is a superior environment to Mass. 3. Compare and contrast the culture, organizational structure and leadership in Mass and Lean environments. 4. List and describe the Types of Waste and why waste elimination is a core component of Lean Manufacturing. 5. List and describe lean functionality (i.e., quality, continuous flow, pull systems, 5S, Visual Control, Task Planning, etc.). 6. Articulate why the "Rules in Use" were

a breakthrough in understanding the Toyota Production System. 7. Develop a Value Stream Map of a manufacturing process, and explore optimization thereof using simulations and economic models, including options to mitigate changing conditions or uncertainty. 8. Understand A3 methodology and create an A3 proposal having economic justifications. 9. Understand the similarities and differences between Lean Manufacturing and Product Development. 10. Complete a Matrix exercise. An individual deep-dive survey of a specific interest selected by each student, and a group exercise to synthesize and present elements of individual surveys clustered by topical area. Credits: 3.00

MSE 53600 - Solidification Of Castings

Credit Hours: 3.00. A study of solidification of metal in molds involving the characteristics of liquid-solid phase transformations, sand and metal thermal behavior, macroscopic structures, mechanical properties, and casting defects.

Learning Outcomes: 1. Analyze and understand the heat flow in different casting processes and alloy effects. 2. Analyze and understand the thermodynamics of solid-liquid phase change and effects of pressure, capillarity, and chemistry. 3. Analyze and understand the kinetics of solidification including crystal nucleation, growth, and glass transition temperature. 4. Analyze and understand microstructural development during processing and the causes for morphological instability and dendritic growth. 5. Recognize effective gating and risering practice in metal casting and predict the microstructure and casting defects given an alloy and process. 6. Become familiar with the current solidification science and practices within the archival literature. Credits: 3.00

MSE 54700 - Introduction To Surface Science

Credit Hours: 3.00. Classical thermodynamics of surfaces: surface tension, surface excess properties, and surface segregation. Atomic structure of surfaces and surface reconstruction. Electronic structure of surfaces, surface states, and the electronic structure/properties of interfaces. Adsorption, surface diffusion, and clustering of adsorbates. Chemical reactions at surfaces. Offered in alternate years.

Credits: 3.00

MSE 54800 - Deposition Processing Of Thin Films And Coatings

Credit Hours: 3.00. Processing and microstructural development of thin films and layered structures. Includes vapor, liquid, and reactive processing, as well as layer modification by annealing and beam techniques. Offered in alternate years.

Learning Outcomes: 1. List the detailed sequence of steps required for CVD (or sputter or MBE) film deposition and quantify the parametric dependence of these steps. 2. Explain the process and film requirements for an epitaxial (or columnar or amorphous) film. 3. Discuss the differences between different evaporation processes. 4. Compare the advantages and disadvantages of techniques used to suppress reactivity (a) of the materials during deposition and (b) of the material with the substrate. 5. Explain the importance of materials and process parameters during laser annealing. 6. List material and process critical factors for specific films in at least three different functional classes of film applications. 7. Communicate in detail the importance, use, and production method of a particular functional film in a manner understandable by other students. 8. Explain the importance and critical issues involved in the following film deposition processes: CVD, PVD, Electrochemical, thermal spray, lithography. 9. Explain the broad issues involved in processing each different type of material class: metals, ceramics, polymers, semiconductors, composites, and functionally graded materials. Credits: 3.00

MSE 55000 - Properties Of Solids

Credit Hours: 3.00. Critical examination of fundamental concepts of physical properties of solids and the relation of these properties to thermal and mechanical treatments. Approach is atomistic rather than electronic, and an emphasis is made to connect the fundamental knowledge of solid state physics to actual processing of materials and to a qualitative understanding of current research in the area of materials science. Offered in alternate years.

Credits: 3.00

MSE 55500 - Deformation Mechanisms In Crystalline Solids

Credit Hours: 3.00. Focuses on the mechanisms for deformation and fracture of metal, intermetallic, and ceramic materials, with particular emphasis on high temperature properties. The industrial success of superalloys, dispersion-strengthened alloys, stainless steels, composites, and thermal barrier coatings will serve as the basis for exploring the relationship between composition, microstructure, and component application in high temperature performance. Topics included are alloying effects on dislocation climb and glide, grain boundary and lattice diffusion, and dynamic recrystallization. The interactions between environment and thermal and mechanical cycling also will be considered. Design tools for prediction and evaluation of component life will be investigated in detail, including an exploration of deformation mechanism maps. Offered in alternate years.

Learning Outcomes: 1. Understand dislocation plasticity: nucleation, motion, multiplication and interactions of dislocations. 2. Understand diffusion-based creep and stress relaxation: time-dependent dislocation motion, dislocation climb, Nabarro-Herring Creep, Coble Creep, Harper-Dorn Creep. 3. Recognize mapping strategies for design using deformation mechanism maps. 4. Describe effects of processing and microstructure on deformation mechanisms. Credits: 3.00

MSE 55600 - Fracture Of Materials

Credit Hours: 3.00. The failure and fracture of materials under applied stress are the focal points of this course, with particular emphasis on the material characteristics that influence fracture. The initial subjects covered in this course will include introductions to linear elastic fracture mechanics (LEFM) and elastic plastic fracture mechanics (EPFM). Subsequently, the strength and toughness of metals, ceramics, and polymers will be explored with regard to processing property relationships and microstructure. Special topics will include fracture mechanism maps, Weibull statistics, toughening mechanisms, and failure analysis. This course is distinct from a course on fracture mechanics in that the fundamental materials aspects of fracture are of paramount importance. Offered in alternate years.

Learning Outcomes: 1. Recognize and understand the significance of stress concentration; fracture mode (I, II, III); process or plastic zone; plane strain fracture toughness, KIC; plane stress fracture; crack tip opening displacement, CTOD; J-Integral. 2. Recognize how the shear and dilatant character of a deformation process plays in role in fracture resistance. 3. Recognize how specimen geometry and size influences fracture toughness and strength compared to applications. 4. Be conversant in at least one research area related to fracture and failure. 5. Be able to critique experimental fracture data relative to models or mechanisms reported for those materials. 6. Understand how post-mortem analysis can be used to assess failed components. Credits: 3.00

MSE 55900 - Phase Equilibria In Multicomponent Systems

Credit Hours: 3.00. A detailed examination of the thermodynamics of phase equilibria in multicomponent systems, experimental methods of determining these equilibria by measurements of thermodynamic activity and graphical method of representing the equilibria. This is followed by an examination of theoretical models of the behavior of solutions and an examination of the extent to which observed phenomena can be understood and predicted in terms of the models. Offered in alternate years.

Credits: 3.00

MSE 56000 - The Production Of Inorganic Materials

Credit Hours: 3.00. Examination of the production of inorganic materials of engineering importance (metals, ceramics, and glasses) from ore concentrates, raw materials, and recycled materials. Individual stages in the extraction, refining, and syntheses processes are examined from the viewpoints of thermodynamics and kinetics, and alternative production routes

are compared and contrasted. Topics covered include carbothermic and metallothermic reduction of oxide concentrates, smelting and conversion of sulfide mattes, electrolysis and electrowinning from aqueous solutions and molten salts, distillation and vacuum refining, glass-forming, and the synthesis of carbide and nitride ceramics. Offered in alternate years.

Credits: 3.00

MSE 56200 - Soft Materials

Credit Hours: 3.00. Soft materials are an important and diverse class of materials that share the common trait of being easily deformable by external stresses, electric or magnetic fields or even thermal fluctuations. These materials are the foundation of important technologies that are used in everyday life including ceramic and pharmaceutical processing (tablet formation), cosmetics (hand creams), cleaning products, foods (milk, mayonnaise) and bio-technologies (drug delivery). The aim of this class is to gain a fundamental understanding of the physical and chemical underpinnings of common soft materials systems and how they are used to engineer technologically relevant materials and structures.

Learning Outcomes: 1. Analyze the applicability of research techniques based on concepts learned in class. 2. Perform calculations to quantify molecular and colloidal properties. 3. Determine the feasibility of a scientific/engineering idea using fundamental concepts and performing calculations. 4. Find the optimal conditions for the fabrication of soft materials. 5. Process images and/or data to characterize soft materials. Credits: 3.00

MSE 56700 - Polymer Synthesis

Credit Hours: 3.00. Analyze properties of polymers and correlate them to chemical structure. Apply methods and mechanisms of polymer chemistry to industrial and laboratory synthesis. Examine the kinetic and design factors that control polymer structures. Offered in alternate years.

Learning Outcomes: 1. Student will understand, predict and design polymer properties based on polymer structure and how and why certain reactions take place through mechanistic means. 2. Be able to produce a polymer structure based on known reactants and retrosynthetically design a chemical route to a variety of polymer structures. 3. Intuitively grasp the kinetic factors involved to predict such things as molecular weight, polydispersity, and others. 3. Understand polymer chemistry in relation to everyday materials and why industrial practice is as is. Credits: 3.00

MSE 56800 - Additive Manufacturing Of Materials

Credit Hours: 3.00. The course takes an MSE approach to additive manufacturing, integrating deposition processing, powder processing, and solidification processing principles in the full range of AM process configurations and kinematics. The overarching goal is to learn how microstructure development, and thus the resulting material properties, are controlled by the interaction of physical, chemical, thermal and mechanical phenomena in the shaping of materials by additive processing. All the main classes of materials and AM processes are covered. Additional objectives are to quantitatively analyze the capabilities and limitations of AM relative to established commercial shaping processes; and to critically analyze the AM research literature.

Learning Outcomes: dentify the generic elements of any additive manufacturing process. 2. Identify and understand the main unit materials process involved and be able to predict how processing parameter will change resulting material structure and properties. 3. Relate additive processing to characteristic microstructure features and defects. 4. Interpret standards and specifications for processing and properties produced by the different additive manufacturing processes. 5. Distinguish quantitatively between the different additive manufacturing processes in terms of their shaping capability compared to traditional bulk shaping processes. 6. Identify AM processing defects and their origins in particular processing parameters 7. Specify an optimum AM process for a particular material, component and service conditions. 8. Explain properties variability and anisotropy in AM products in terms of processing constraints. 9. Analyze critically the state of research on a particular current topic in additive manufacturing. Credits: 3.00

MSE 57000 - Introduction To Materials Modeling And Informatics

Credit Hours: 3.00. This course provides an introduction at the graduate level to theory and methods for simulating the structure and properties of materials. The course will provide a broad initial overview of many atomistic modeling techniques, followed by a detailed study of density functional theory (DFT) over several weeks, then a few lectures on classical molecular dynamics (MD) and Monte Carlo (MC) simulations, and finishing with an introduction to materials informatics techniques which rely on learning from materials data. Students will obtain an essential understanding of quantum and classical theory and become acquainted with practical methods for running DFT, MD and MC simulations, as well as combining such simulations with simple machine learning and data science methods for materials design. Existing and new tools on nanoHUB, access to open-source simulation software, and writing simple Python code will be utilized for all necessary coursework and exercises. Permission of department required.

Learning Outcomes: 1. Design, execute and analyze simple simulations using techniques appropriate for the problem at hand. 2. Recognize the approximations and level of accuracy associated with each modeling technique. 3. Establish a foundation for exploring materials modeling techniques in greater depth and applying them to their own research projects. 4. Recognize the importance of machine learning and data science, and identify when to apply such techniques for materials datasets. Credits: 3.00

MSE 57400 - Sports Engineering And Entrepreneurship

Credit Hours: 3.00. This course provides an introduction at the graduate level to sports engineering and entrepreneurship. Students will be immersed in the state-of-the-art of industry and interact with renown experts in the field. This course is a comprehensive exploration of the key areas of sports engineering (digitalization, equipment and apparel, fan experience, data, etc.) with an emphasis on the future of the industry. The course includes the development of a business plan for a start-up in sports engineering, encouraging students to critically think about where they see opportunities for innovation based on knowledge gained in the course. This is not only for students looking to start their own business, but for any student interested in working in sports engineering field. Permission of instructor required.

Learning Outcomes: 1. Analyze the emerging technologies related to performance, sports equipment, apparel, facilities and events. 2. Evaluate the underlying technologies and market for a specific sport and its societal impact. 3. Create a business plan that captures the needs and trends of the next generation of sports. 4. Evaluate understanding of the different influencing factors in the decision process during the development of sports equipment, apparel, facilities and events. Credits: 3.00

MSE 57500 - Transport Phenomena In Solids

Credit Hours: 3.00. Energetics and kinetics of phase changes in metals and alloys. Nucleation and growth models, with special emphasis on the role of crystal defects. Selected topics in multicomponent diffusion. Offered in alternate years.

Credits: 3.00

MSE 57600 - Corrosion

Credit Hours: 3.00. Rate-controlling steps in electrode processes; activation, ohmic, and concentration polarization; passivation; potentiostatic studies and alloy design; applications to engineering systems. Offered in alternate years.

Credits: 3.00

MSE 57700 - Materials Science Of Rechargeable Batteries

Credit Hours: 3.00. This course is aimed at junior/senior undergraduate and graduate students interested on developing an understanding on the Materials Science of Rechargeable Batteries. The focus is on electrochemical materials, its non-idealities (e.g., transport limitations, failure mechanisms), and its application to energy storage devices, such as batteries and fuel cells, particularly for portable electronics and hybrid/electric vehicles. This course will deliver an introduction to basic electrochemistry, principles of electrochemical devices, and electroactive materials as used in such systems. Current trends and directions in the field of battery technology will be outlined. Permission of department required.

Learning Outcomes: 1. Become familiar with lingo, language, units and quantities associated to modern battery technology. 2. Read the scientific literature on rechargeable batteries. 3. Relate properties to performance (power,

energy, charge, health, life, etc.). 4. Communicate results of battery technology to professional audiences. 5. Make simple battery designs that maximize performance. 6. Develop a basic understanding of the most widely used battery simulation software. 7. Make simple battery designs that maximize reliability. Credits: 3.00

MSE 58500 - Magnetic Materials: Physical Properties And Applications

Credit Hours: 3.00. This course provides an introduction of the basic physical and structural properties that determine the functionality of magnetic materials and devices. Starting from basic concepts on the physics of magnetism, materials synthesis and device fabrication, the functional requirements of magnetic materials for diverse applications will be discussed. Magnetic material properties depend on the electronic structure of the constituent elements and their electronic interactions. These interactions are controlled by their atomic arrangement, microstructure, defects, and strain fields that distort the local atomic order. Furthermore, the role of reduced dimensionality on the physical and functional properties of nanoscale materials will be discussed.

Learning Outcomes: 1. Understand the physical origins of magnetism and magnetic material properties. 2. Establish the correlation between materials magnetic properties and their crystalline order, microstructure, the role of defects and secondary phases. 3. Explain how synthesis and post-processing techniques are used to design and optimize magnetic materials. 4. Apply the course learnings to optimize magnetic material properties and functionality for diverse applications. Credits: 3.00

MSE 58600 - Experimental Characterization Of Advanced Composite Materials

Credit Hours: 3.00. The characterization of advanced composite materials is a combined lecture/laboratory course in which polymeric composite laminates will be fabricated of carbon fiber epoxy and subjected to classical test methods appropriate to the determination of the anisotropic, thermoelastic properties. Properties measured will include thermal expansion coefficients, anisotropic elastic constants, biaxial strength properties and interlaminar fracture strengths. The autoclave processing of composite laminates will be discussed and the consolidation, degree of cure and glass transition temperature of the polymeric matrix will be modeled. Microscopic analysis of the composite will be carried out to observe microstructure and measure composition fractions. Lectures will precede each experiment.

Learning Outcomes: 1. Be familiar with test methods for advanced composite materials. 2. Carry out these tests to produce property data for a specific material system including fabrication of test specimens, fiber volume fraction, lamina longitudinal tensile tests, lamina shear test, lamina off-axis tensile test, lamina flexural test, lamina thermoelastic test, laminate tensile test, laminate thermoelastic test, laminate notch strength test, mode I interlaminar fracture test, mode II interlaminar fracture test. Credits: 3.00

MSE 58900 - Archaeology And Materials

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course will focus on the analysis and interpretation of archaeological artifacts and provide opportunities for hands-on learning. Permission of department required.

Learning Outcomes: 1. Make a reasoned argument about historical development of anthropological and archaeological approaches to the study of technology, and the role of materials science in archaeological research. 2. Demonstrate a nuanced understanding of, and appreciation for, ancient and contemporary technologies and the materials properties which led to their fabrication and use in specific ways. 3. Demonstrate the ability to write a research proposal, design educational material, or design and conduct a research experiment that incorporates materials science in the investigation of past (ancient, historic, or potentially more recent) technology. 4. Understand the relationship between Culture and Technology and communicate concepts about the impact of this relationship on the

environment and issues of sustainability. 5. Understand critical questions about a set of journal articles focused on specific topics and lead the class in a systematic discussion of the articles and the questions they raise. 6. Select and discuss written information from journal articles, books, the class textbooks, and class lectures to produce a comprehensive picture of specific anthropology, archaeology, and materials science concepts and approaches to the study of materials and culture. 7. Compare and contrast the information that different materials characterization techniques can provide about the way historical artifacts were made and used, including the materials from which they are constructed. Credits: 3.00

MSE 59700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 60000 - Materials Engineering Fundamentals

Credit Hours: 3.00. Fundamental relationships between the internal structure, properties and processing in all classes of engineering materials. Comprehensive coverage spanning physical, chemical, thermal, mechanical, electrical, magnetic, and optical responses. The course is intended for materials researchers from all backgrounds, as well as engineers working in product design, development and manufacturing who seek a deeper understanding of the full spectrum of engineering materials.

Learning Outcomes: 1. Perform calculations to quantify material properties and microstructural characteristics. Example: Calculate the interplanar spacing of a family of atomic planes given a x-ray diffraction pattern. 2. Recognize the effect of composition and microstructure on material properties. Example: The effect of dislocation density on yield strength and electrical conductivity. 3. Take information from a known situation and apply it to a new situation. Example: Effect of temperature and applied stress on the peak positions in a XRD pattern. 4. Predict property response or microstructural changes based on imposed conditions. Example: Effects of temperature and alloying on the resistivity of metals. 5. Assess the interplay of two or more material properties. Example: Assess the effect of atomic bond strength on Young's modulus, coefficient of thermal expansion and melting temperature. Credits: 3.00

MSE 64000 - Transmission Electron Microscopy And Crystal Imperfections

Credit Hours: 3.00. Theory and application of TEM to problems in materials science and engineering. Principles of electron diffraction and microscopy are reviewed with the emphasis on the relationship between real and reciprocal space. Diffraction theory of imperfect crystals will be introduced. A primary part of the course will be a discussion of image contrasts in terms of atomistic structures of key crystal imperfections, including dislocations and grain boundaries. Experimental applications and image simulations will be included to amplify theoretical concepts. Offered in alternate years. Permission of instructor required.

Credits: 3.00

MSE 67000 - Atomistic View of Materials: Theory, Modeling And Simulations

Credit Hours: 3.00. In this course students will be introduced to the fundamental physics required to describe materials in terms of electrons and atoms, learn how these processes relate to macroscopic behavior and become familiar with advanced modeling and simulation techniques that enable quantitative predictions. Students will gain hands-on experience with several simulation tools, including ab initio calculations using density functional theory, molecular dynamics simulations and other advanced modeling techniques. Pre-Requisites: BS degree in materials, mechanical, chemical, electrical or aerospace engineering or in physics or chemistry. Permission of department and instructor required.

Learning Outcomes: 1. Become familiar with the principles of quantum, classical and statistical mechanics required for predictive materials science. 2. Extract materials properties from the simulations. 3. Recognize the approximations and estimate the level of accuracy to be

expected from each modeling technique. 4. Design, perform and analyze computer experiments using electronic and atomistic simulation techniques appropriate for the problem at hand. 5. Read critically the current scientific literature on computational modeling and simulation of materials. Credits: 3.00

MSE 69000 - Seminar In Materials Engineering

Credit Hours: 0.00. Required of all MSE graduate students.

Learning Outcomes: 1. Students would demonstrate application of academic comprehension in industrial context. Credits: 0.00

MSE 69600 - Graduate Professional Practice

Credit Hours: 0.00. Professional practice in Industry. Restrictions: MSE graduate students only. Permission of instructor required.

Credits: 0.00

MSE 69700 - Selected Topics In Materials Engineering

Credit Hours: 0.00 to 18.00. Hours and credits to be arranged. Prerequisite: two upper-division mathematics courses: one on linear algebra and one on abstract algebra. Permission of instructor required.

Credits: 0.00 to 18.00

MSE 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

MSE 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Mechanical Engineering (Graduate)

Website: engineering.purdue.edu/ME/Academics/Graduate/index.html

Department/School Head

Head: Dr. Eckhard Groll, William E. and Florence E. Perry Head of Mechanical Engineering and Reilly Professor of Mechanical Engineering
Associate Head for Graduate Studies: Dr. Nicole Key, Professor of Mechanical Engineering
Contact Information

ME Graduate Office
585 Purdue Mall
West Lafayette, IN 49707-2088
(765) 494-5730
Email: MEgradoffice@purdue.edu

Overview

Mechanical Engineering is, simply, applying engineering principles to machines that have movement. If you think that sounds all-encompassing, well, you're right. Mechanical Engineering is the broadest of all Engineering majors, and their students can do just about anything because they have a broad understanding of the principles of physics, design, thermodynamics, and control systems.
In the job world, you can take these skills to almost any industry. Many Mechanical Engineering students end up in the automotive or manufacturing industries, but many also pursue biotech, law, renewable energy, electronics, or any number of emerging industries. NASA loves Purdue students, and many mechanical engineers find places in the aerospace and defense industries. And some ME graduates don't go into engineering at all but use their problem-solving skills to start a business or go into sales or management. The foundational know-how of Mechanical Engineering will serve you, wherever in the world you choose to go.

Faculty by Rank

Mechanical Engineering has more than 90 faculty members, pursuing research in numerous fields. Are you interested in doing research as an undergrad? Contact a faculty member whose research interests you.

Professor	Associate Professor	Assistant Professor	Professor - Various	Emeritus Faculty

Babak Anasori Arezoo Ardekani Anil K. Bajaj Ilias Bilionis J. Stuart Bolton James E. Braun Richard Buckius Mukerrem Cakmak David Cappelleri Luciano Castillo Jun Chen George T. C. Chiu Jong Hyun Choi Hamid Dalir (Indianapolis)	Terrence R. Meyer Partha P. Mukherjee Liang Pan Jitesh H. Panchal Guillermo Paniagua Arvind Raman Karthik Ramani Xiulin Ruan Farshid Sadeghi Cagri A. Savran Fabio Semperlotti Gregory M. Shaver Yung C. Shin Thomas Siegmund	Andres Arrieta Shubhra Bansal Thomas Beechem Edward Berger Adrian Buganza Tepole Ivan C. Christov Sadegh Dabiri Xinyan Deng James Gibert Christopher S. Goldstein Marcial Gonzalez Yan Gu Daniel Guildenbecher Neera Jain James D. Jones Carlos Larriba-Andaluz Nina Mahmoudian Aaron Morris Carlo Scalo Michael Sealy Davide Ziviani	Eduardo Barocio Vaca Riley Barta Laura Blumenschein Alex Chortos Rebecca Ciez Kevin Kircher Junfei Li Tian Li Heather Liddell Yangfan Liu Monique McClain Davin Piercey Lizhi Shang Luz Sotelo David Warsinger Tiwei Wei	*Research* Mikhail Slipchenko Ryan Wagner - Asst *Engineering Practice* Chrisotpher Finch Beth Hess Beth M. Holloway Eric Holloway Greg Jensen Daniel Williams *Courtesy* Sally Bane Darcy M Bullock Carlos Corvalan Jennifer DeBoer	David Anderson Qingyan Chen Raymond J. Cipra Stephen Citron Suresh Garimella Victor Goldschmidt Keith Hawks Galen B. King Mel L'Ecuyer Paul E. Sojka John Starkey	Patricia Davies Xiaoping Du Shirley Dyke Hector Gomez Jay P. Gore Eckhard Groll Bumsoo Han E. Daniel Hirleman Martin Byung-Guk Jun Nicole Key Klod Kokini Marisol Koslowski Charles M. Krousgrill Chi Hwan Lee Guang Lin Robert P. Lucht	Steven F. Son Ganesh Subbarayan Andrea Vacca Pavlos Vlachos Carl Wassgren Justin A. Weibel Benxin Wu Xianfan Xu Bin Yao Song Zhang Fu Zhao Kejie Zhao			John Evans Ahmed Hassanein W. Travis Horton Joseph Jewell Nesrin Ozalp Timothy Pourpoint Li Qiao Mo Rastgaar Vitaliy Rayz Carson Slabaugh Hong Tan Athanasios Tzempelikos Chenn Zhou	

Ajay Malshe					
Amy Marconnet					
Peter H. Meckl					

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Academic Programs

Master's Program

Thesis or Non-Thesis

Students admitted to the Master's program can choose to complete either the thesis option or the non-thesis option. The thesis option is highly recommended because it includes conducting independent research and a publishable report or thesis. The non-thesis option (see Professional Master's program below) allows for a more predictable completion time frame of coursework so students can more accurately plan a graduation date.

Professional Master's Program

A full-time on-campus program blending 21 credits of technical specialties with 9 credits of management and professional development classes. This option is perfect for current undergrads who want a graduate degree, but still want to jump into industry quickly, or students who want a more practice-oriented engineering degree; or for busy professionals who want specialized expertise to advance in their careers.

Online Master's Program

You can get a Master's Degree from Purdue University Mechanical Engineering entirely online. Online engineering graduate students take courses asynchronously, meaning course content can be accessed from anywhere at any time. Students view the lectures and course materials weekly on their own schedule in order to complete the assignments and tests dates set on the course syllabi. Lectures are available for download and viewing two hours after the "live" lecture has been captured.

Combined Degree Program (5-Year Plan-Undergraduate Degree/Master's Degree)

The combined BSME/MSME Program is an integrated five-year degree program in which qualified students can receive a BS and an MS in Mechanical Engineering. The program provides a seamless transition from the BS to MS programs for Purdue students where up to 12 approved graduate credits taken as undergraduate electives could be counted toward both the BS and MS degrees, thereby reducing the overall time required for the MS degree. This program is available at either the West Lafayette or Indianapolis campus.

Doctorate

Doctor of Philosophy (PhD)

Mechanical Engineering's PhD program requires a minimum of 21 credit hours of coursework beyond the Master's Degree. A minimum of 90 graduate course and research credit hours is required for graduation, along with dissertation defense and deposit.

Direct Ph.D. Degree Program

Students with a strong performance in coursework and some research experience at the undergraduate level may be admitted to our Direct to a PhD program at the time of admission to graduate students at Purdue. Students enrolled in this program have the option of seeking a Master's Degree "along the way" to the Ph.D.

Graduate Certificate

Hybrid Vehicle Systems ME Graduate Certificate is available to online or residential graduate students in good standing in the

College of Engineering. The certificate program is focused on providing students with a framework for gaining relevant expertise in the area of advanced hybrid vehicle systems.

Mechanical Engineering, MSME

Hybrid Vehicle Systems ME, Post-Baccalaureate Certificate

Mechanical Engineering, PHD

Hybrid Vehicle Systems MSE, Post-Baccalaureate Certificate

Mechanical Engineering: Motorsports Engineering Concentration, MSME (Indianapolis)

ME 50000 - Advanced Thermodynamics

Credit Hours: 3.00. The empirical, physical basis of the laws of thermodynamics. Availability/exergy concepts and applications. Properties and relations between properties in homogeneous and heterogeneous systems. The criteria of equilibrium. Application to a variety of systems and problems, including phase and reaction equilibrium. Offered in alternate years.

Credits: 3.00

ME 50100 - Statistical Thermodynamics

Credit Hours: 3.00. The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Introduction to quantum mechanics and molecular spectroscopy. The Maxwell-Boltzmann formulation of statistical mechanics and applications to ideal gases, solids, radiation, and laser diagnostics. The Gibbs formulation of statistical mechanics and application to real gases. Kinetic theory and applications to transport properties and chemical kinetics. Offered in alternate years.

Learning Outcomes: 1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena. 2. Apply concepts and calculate thermodynamic and transport properties of ideal gases. 3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements. Credits: 3.00

ME 50101 - Energy Assessment Of Industrial Processes

Credit Hours: 3.00. The course provides and analyzes methodologies for improving energy efficiency in the manufacturing sector. The manufacturing equipment and processes will be analyzed in terms of energy consumption and optimization. It provides the technical and analytical foundation for students on assessing industrial processes to evaluate measures for optimizing energy efficiency in industrial, electrical, motor drive, compressed air, process heating, process cooling, lighting, space conditioning, combined heat and power systems. This course is designed for students who are interested in energy efficiency. Permission of instructor required.

Credits: 3.00

ME 50102 - Energy Management Principles

Credit Hours: 3.00. This course provides energy management principles for industrial applications. Various energy management methods, commitments, and strategies for continuous improvement as well as international standards will be analyzed and integrated. This course emphasizes real world applications including: critiquing utility rates structure and assessing costs; characterizing and quantifying energy saving opportunities at industrial facilities; determining investment payback scenarios and considerations. Permission of instructor required.

Credits: 3.00

ME 50103 - Industrial Energy Assessment: Tools And Applications

Credit Hours: 3.00. This course synthesizes advanced energy efficiency, energy auditing, and energy assessment methods and practices. Several types of industrial audits will be analyzed with respect to the methods, tools (hand and software), and industrial application. Topics include: the audit process for energy, industrial productivity, and waste stream audits; audit components: energy bill analysis and economic analysis: audit system mechanics related to building envelop, electrical system, HVAC system, waste heat recovery, lighting, cogeneration, and other prevalent industrial systems; and measurement

instrumentation issues for each industrial system. Students will enhance learning from a class project, which requires completion of an industrial scale energy audit. Permission of instructor required.

Credits: 3.00

ME 50104 - Powertrain Integration

Credit Hours: 3.00. The holistic view of powertrain development that includes engine, transmission, and driveline is now well accepted. Current trends indicate an increasing range of engines and transmissions in the future with, consequently, a greater diversity of combinations. This course discusses engines, transmissions, and drivelines in relation to their interfaces with chassis systems. This course also explores various aspects of powertrain integration. Novel concepts relating, for example, to continuously variable transmissions (CVTs) and hybridization as well as approaches to modeling, analysis, and simulation will be discussed. Permission of instructor required

Credits: 3.00

ME 50105 - Hybrid And Electric Transportation

Credit Hours: 3.00. This course will cover fundamentals of hybrid electric and battery electric transportation systems with particular emphasis on automotive vehicles. It will cover powertrain configurations of Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), and Battery Electric Vehicle (BEV). The principal element of the powertrain of these vehicles will be discussed: Battery, Electric Motor, Engine, Transmission. This course will cover design concepts for HEV / PHEV and BEV powertrain. Optimal methods of component sizing via appropriate modeling and analysis methodologies will also be introduced. An introduction to power electronic components and microprocessor based controllers for these powertrains will also be given. An in-depth coverage, including optimal energy management, will be given on the energy and power management of HEV / PHEV and BEV powertrain once the design is complete. Introduction of various concepts and terminologies, the state of the art development, energy conversion and storage options, modeling, analysis, system integration and basic principles of vehicle controls will be covered as well. Upon completion of this course, students should be able to follow the literature on these subjects and perform modeling, design, analysis and development work in this field. A field demonstration of a PHEV will be used to further enhance the learning experience in this course. Permission of department reqjuired. Prerequisite: ME 48200/ECE 38200.

Credits: 3.00

ME 50106 - Industrial Energy Audit

Credit Hours: 1.00 or 2.00. Students enrolled in this course will investigate, evaluate, conjecture, formulate and author during their participation in professional energy audits at multiple manufacturing sites. Students earn one credit during the fall semester and two credit hours during the spring semester of this two-part course. Permission of instructor required.

Credits: 1.00 or 2.00

ME 50300 - Micro-And-Nano-Scale Energy Transfer Processes

Credit Hours: 3.00. Transport of energy in natural and fabricated micro- and nano-scale structures. Physical nature of energy transport by three carriers-electrons, phonons, and photons. Bulk material properties (e.g., thermal/electrical conductivity) are derived from statistical particle transport theories. Effects of spatial confinement on bulk properties are quantified. Contemporary interdisciplinary engineering applications.

Learning Outcomes: 1. Gain an understanding of the fundamental elements of solid-state physics. 2. Develop skills to derive continuum physical properties from sub-continuum principles. 3. Apply statistical and physical principles to describe energy transport in modern small-scale materials and devices.

Credits: 3.00

ME 50400 - Automotive Control

Credit Hours: 3.00. Basic engine operation; lambda control, speed control, knock control, fuel injection timing control, ignition control of SI engines; driveline modeling, automatic transmission control, clutch phasing control; wheel model, complete vehicle model; observers, friction coefficient estimators, tire contact patch force estimators; anti-lock brake control, traction control, yaw stability control; drive-by-wire systems. The distance offering of this course originates from the IUPUI campus, is offered through streaming video via ProEd, and may be made available at the West Lafayette campus.

Credits: 3.00

ME 50500 - Intermediate Heat Transfer

Credit Hours: 3.00. Heat and mass transfer by diffusion in one-dimensional, two-dimensional, transient, periodic, and phase change systems. Convective heat transfer for external and internal flows. Similarity and integral solution methods. Heat, mass, and momentum analogies. Turbulence. Buoyancy-driven flows. Convection with phase change. Radiation exchange between surfaces and radiation transfer in absorbing-emitting media. Multimode heat transfer problems.

Learning Outcomes: 1. Analyze and solve variable cross-section fin problems. 2. Apply separation of variables to steady-state and transient heat conduction problems in Cartesian and cylindrical coordinate systems. 3. Apply separation of variables to steady-state conduction with heat generation. 4. Analyze and solve boundary layer problems. 5. Solve internal and external flow, forced convection problems. 6. Solve external flow natural convection problems. 7. Identify different regimes of boiling and condensation. 8. Recognize, model, and solve radiation heat transfer problems. Credits: 3.00

ME 50600 - Two-Phase Flow And Heat Transfer

Credit Hours: 3.00. Basic two-phase flow equations, homogeneous model, drift-flux model, flow regimes, pressure drop in two-phase flow. Nucleation and bubble dynamics, pool boiling, subcooled boiling, forced convection boiling, critical heat flux in pool boiling, critical heat flux in forced convection boiling, minimum heat flux, film boiling, post dryout heat transfer. Flow instabilities, choking in two-phase flow, film and dropwise condensation. Applications to heat exchangers. Special boiling and two-phase flow problems. Offered in alternate years.

Credits: 3.00

ME 50601 - Design Optimization Methods

Credit Hours: 3.00. In this course, the general theory of optimization, concepts and problem statement are presented. Methods for minimization of a function of one or n-variables with and without constraints are discussed. Response surface methods and design of experiments are shown to significantly reduce analysis time. Applications using a commercial software package to solve typical engineering design optimization problems are demonstrated. Uncertainty in the design process is introduced. In addition to engineering, the methods studied can be applied to a variety of diverse disciplines such as finance, investment portfolio management, and life sciences. Permission of instructor required.

Credits: 3.00

ME 50700 - Laser Processing

Credit Hours: 3.00. Introduces background knowledge in laser science and laser technology and fundamentals involved in laser processing and manufacturing. The following topics are discussed: laser fundamentals, industrial laser systems and processes, and the laser-induced thermal, thermo-mechanical, and thermo-acoustic effects. The course also discusses emerging areas of laser applications, such as microscale laser processing, ultrafast laser processing, and the related energy transport analyses. Laboratory and video demonstration sessions are used to enhance the overall understanding of the course materials. Offered in alternate years.

Credits: 3.00

ME 50800 - Heat Trans In Biological Systems

Credit Hours: 3.00. Introduction to applications of heat transfer in living systems to students who have general interests in biomedical engineering. Fundamental concepts of biology and engineering involved in these applications are introduced. Regulation of blood flow under external thermal stimuli and its effect on heat transfer are discussed. Clinical applications of heat transfer, including cancer therapy and gene therapy. Prerequisite: first course in fluid or aerodynamics. Offered in alternate years.

Credits: 3.00

ME 50801 - Orthopaedic Tissue Mechanics

Credit Hours: 3.00. Orthopaedic tissues, such as bone, cartilage, tendon and ligament, serve functions that are largely mechanical in nature and that are critical for our health. This course is structure around classical topics in mechanics of materials and their applications in biomechanics and musculoskeletal tissues. Primary emphasis will be on the mechanical behavior of tissues, including elastic and failure properties as well as more advanced topics such as anisotropy, nonlinearity, viscoelasticity, poroelasticity, damage and fatigue. Importantly, the theories used to describe these mechanical properties were originally developed for advanced engineering materials such as fiber composites, polymers, elastomers, hydrogels, etc. Thus, while the theories will be presented in the context of biological materials, potential applications are much broader. Tissue microstructure and its importance to the material properties will be covered. Mechanics of whole bones and implants (composite and asymmetric beam theories) and the mechanical function of native and artificial joints (contact mechanics, lubrication and wear) may also be discussed, time permitting. Some homework assignments will emphasize the use of experimental data to develop and test theoretical models via nonlinear curve fitting and optimization using Matlab. Students will receive an introduction to tissue mechanics literature to better understand how the concepts presented in class are used in the research setting.

Credits: 3.00

ME 50900 - Intermediate Fluid Mechanics

Credit Hours: 3.00. Fluid properties. Basic laws for a control

volume. Kinematics of fluid flow. Dynamics of frictionless incompressible flow and basic hydrodynamics. Equations of motion for viscous flow, viscous flow applications, boundary layer theory. Wall turbulence, lift and drag of immersed bodies.

Learning Outcomes: 1. State basic laws for a control volume in different coordinate systems. 2. Derive the kinematics of fluid flow in problem solving. 3. Derive the equations for frictionless and incompressible flows. 4. Derive the basic equations of motion of viscous flows. 5. Find standard exact solutions of viscous-flow equations and apply them. 6. Derive and solve basic equations of boundary-layer theory. 7. Find lift and drag forces on immersed bodies with simple shapes. 8. Understand concepts of incompressible turbulent flows and wall turbulence. Credits: 3.00

ME 51000 - Gas Dynamics

Credit Hours: 3.00. Flow of compressible fluids. One-dimensional flows including basic concepts, isentropic flow, normal and oblique shock waves, Rayleigh line, Fanno line, and simple waves. Multidimensional flows including general concepts, small perturbation theory for linearized flows and method of characteristics for nonlinear flows. Prerequisite: first course in fluid or aerodynamics.

Credits: 3.00

ME 51100 - Heat Transfer In Electronic Systems

Credit Hours: 3.00. This course covers both traditional and more innovative methods for heat extraction in electronic systems and the effectiveness and applicability of these methods over a wide range of scales. Special emphasis is given to industry-related applications with experts often attending and presenting material as part of class instruction.

Learning Outcomes: 1. Introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practicing engineers. 2. Provide an appreciation for the applications of first principles to electronics cooling and packaging problems in industry. 3. Provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge. Credits: 3.00

ME 51201 - Energy Storage Devices And Systems

Credit Hours: 3.00. The basic concepts and components of primary and rechargeable batteries; Faraday's Law: electrode process and kinetics; electric double layer; electroanalytical techniques; battery standard, operation, and other considerations; materials for Li-ion batteries; next generation high energy rechargeable lithium batteries; batteries for electric vehicles and hybrid electric vehicles; and battery for the electrodes, electrolytes, temperature range and operation of different types of batteries. Permission of instructor required.

Credits: 3.00

ME 51300 - Engineering Acoustics

Credit Hours: 3.00. The simple oscillator. Lumped acoustical elements. Electro-mechanical-acoustical analogies. Wave motion in strings and membranes. Introduction to linear acoustics through derivation of the wave equation and simple solutions. Plane and spherical waves. Acoustic intensity. Plane wave transmission through fluid layers and simple barriers. Sound absorption. Modeling of acoustical sources: monopoles, dipoles, quadrupoles. Mechanisms of sound generation and directionality. Sound propagation in one-dimensional systems (e.g., ducts and mufflers). Introduction to room acoustics.

Credits: 3.00

ME 51400 - Fundamentals Of Wind Energy

Credit Hours: 3.00. Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft and vehicular propulsion and stationary power. Turbojet, turbofan, turboshaft cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component machine and off-design performance. Inspection trip to industrial plan required.

Learning Outcomes: 1. Introduce students to the technology and economics of converting wind energy to electricity. 2. Inform students to the environmental concerns of wind energy. 3. Understand principles of wind turbine aerodynamics. 4. Develop the ability to design optimum blading. 5. Develop the ability to evaluate a potential site in terms of wind energy. 6. Understand wind turbine structural dynamics issues. Credits: 3.00

ME 51800 - Analysis Of Thermal Systems

Credit Hours: 3.00. Modeling and optimization of thermal systems with a focus on heat-pumping equipment, such as vapor compression, absorption, and some advanced heat-pumping cycles. Students combine the use of thermodynamics, heat transfer, fluid mechanics, and numerical methods to develop and apply mathematical models for the analysis and optimization of specific equipment. Offered in alternate years.

Learning Outcomes: 1. Develop a comprehensive understanding of the fundamentals of thermal systems' modeling and analysis. 2. Develop a detailed understanding of vapor compression systems, absorption systems, and other advanced heat pumping equipment. Credits: 3.00

ME 52000 - Imaging-Based Computational Hemodynamics For Cardiovascular Assessment

Credit Hours: 3.00. Image-based computational hemodynamics is a newly-emerged computational technique for non-invasive and patient-specific assessment of cardiovascular diseases based on medical imaging data. In this course, students will learn (1) concepts and principles of cardiovascular circulation in the human body and imaging modalities for cardiovascular diseases; (2) image-based computational modeling methods for quantification of hemodynamics (velocity, pressure, and wall-shear stress) in human vessels based on CT/MRI and Doppler ultrasound imaging data; and (3) computational analysis to assess the severity of cardiovascular diseases. Team projects to non-invasively assess the severity of arterial stenosis in renal, iliac, and coronary arteries via quantification of trans-stenotic pressure gradient and/or fractional flow reserve will provide first-hand experience of how computational modeling and analysis can contribute to medical innovation and advanced precision medicine.

Credits: 3.00

ME 52200 - Indoor Environmental Analysis And Design

Credit Hours: 3.00. Review of current trend of building and indoor environment design. Theory of thermal comfort, indoor air quality, visual comfort, and acoustic comfort. Introduction of experimental techniques and advanced computer tools for indoor environment analysis and design.

Learning Outcomes: 1. Provide an introduction into and practical examples of indoor environment. 2. Present the basic theory of thermal comfort, indoor air quality, visual comfort, acoustics comfort and HVAC systems. 3. Introduce advanced tool to analyze and design indoor environment and energy use in buildings. 4. Conduct indoor environment analysis and design for a challenging problem. Credits: 3.00

ME 52301 - Nanosystems Principles

Credit Hours: 3.00. (ECE 52301) This is the introductory course in the nanosystems area. It introduces students to the principles and applications of nanosystems. The course begins with an introduction to the nanometer scale phenomena. It then introduces students to the basic elements resulting in nanosystems: nanoscale materials, processes, and devices. It also provides students with a basic understanding of the tools and approaches that are used for the measurement and characterization of nanosystems, and their modeling and simulation. Moreover, the course covers the applications of nanosystems in a wide range of industries, including information technology, energy, medicine, and consumer goods. The course concludes with a discussion of the societal and economical significance of these applications, including benefits and potential risks.

Credits: 3.00

ME 52500 - Combustion

Credit Hours: 3.00. Physical and chemical aspects of basic combustion phenomena. Chemical energetics and equilibrium. Basic chemical kinetics, chain reactions, and explosions. Chain and thermal ignition. Homogeneous combustion models. Detonations and deflagrations. Laminar flame speed and flame extinction. The Shvab-Zeldovich formulation of the multicomponent conservation equations. Diffusion flames and droplet combustion. Introduction to turbulent combustion.

Credits: 3.00

ME 52600 - Spray Applications And Theory

Credit Hours: 3.00. Theory of spray formation and evolution as well as treating a host of spray applications. Topics include drop size distributions, breakup of liquid sheets and ligaments, drop formation and breakup, drop motion and the interaction between a spray and its surroundings, drop evaporation, nozzle internal fluid mechanics, external spray characteristics, nozzle performance, and experimental techniques relevant to these subjects. Applications include: (1) agricultural sprays, (2) consumer products, (3) gas turbine combustion, (4) heat transfer, (5) internal combustion engines, (6) paints and coatings, (7) pharmaceutical and medicinal sprays, and (8)

spray drying. Offered in alternate years.

Credits: 3.00

ME 52601 - Integrated Nanosystems Processes And Devices

Credit Hours: 3.00. (ECE 52601) This course covers processes and devices associated with integrated nanosystems. Integrated nanosystems refer to systems which consist of integrated micro-, meso-, and/or macro-scale parts, and their core components are realized by nano-scale materials, processes, and devices. The course, while covering processes which result in integrated nanosystems, will focus on the theory and operation of select electronic, electromechanical, and biomedical devices which are used for information technology, sensing, medical, and other applications. The lectures will be complemented by hands-on laboratory experience. Permission of instructor required.

Credits: 3.00

ME 52900 - Sustainable Energy Options And Analysis

Credit Hours: 3.00. This course develops an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. A range of different technologies and approaches are presented for meeting future energy needs. Students learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics and gain experience in assessing different energy technologies for specific case studies.

Learning Outcomes: 1. Gain an understanding of the current energy situation and impacts of energy choices on economics and sustainability metrics. 2. Gain an understanding of alternative technologies for meeting future energy needs. 3. Learn how to assess the potential for alternative energy technologies in terms of economic and sustainability metrics. 4. Gain experience in assessing different energy technologies. Credits: 3.00

ME 53100 - Characteristics Of Particles, Powders, And Compacts

Credit Hours: 3.00. Familiarize students with the properties and methods used to characterize the mechanical behavior of particles, powders, and compacts, with the intention of using these properties for process and performance design. Students work with a subset of the measurement methods in a laboratory setting. Students successfully completing the course will be able to define and describe the significant properties of particles, powders, and compacts; describe and demonstrate techniques used to measure these properties; and demonstrate how these properties are useful in product and manufacturing performance. Offered alternate years.

Learning Outcomes: 1. Define and describe the significant properties of particles, powders, and compacts. 2. Describe and demonstrate techniques used to measure these properties. 3. Demonstrate how these properties are useful in product and manufacturing performance. 4. Pursue further studies on particle and powder characterization. Credits: 3.00

ME 53101 - Particle, Powder, And Compact Characterization

Credit Hours: 2.00. The goal of this course is to familiarize students with the properties and methods used to characterize the physical and mechanical behavior of particles, granules, and compacts with the intention of using these properties for process and performance design.

Learning Outcomes: 1. Define and describe the significant properties of particles, granules, powders, and compacts. 2. Explain how these properties are measured. 3. Illustrate how these properties influence the performance of particle-based products and manufacturing processes. 4. Create a computational or web-based tool that demonstrates or implements concepts from the course. Credits: 2.00

ME 53102 - Particle, Powder, And Compact Characterization Laboratory

Credit Hours: 1.00. The goal of this laboratory course is to train students on state-of-the-art laboratory equipment used to measure the mechanical properties of particles, granules, powders, and compacts.

Learning Outcomes: 1. Follow laboratory safety guidelines. 2. Operate common laboratory equipment and follow standard operating procedures used to measure the mechanical properties of particles, granules, powders, and compacts. 3. Plan and perform measurements as part of a team, analyze results, and summarize the results in a written report. Credits: 1.00

ME 53300 - Turbomachinery II

Credit Hours: 3.00. Aerodynamic analysis and design of axial flow and radial flow gas compressors and gas turbines. Blade element performance (deflection, profile and shock losses, etc.). Meridional flow analysis for general radial equilibrium. Secondary flow and end-wall boundary layer models. Centrifugal compressor modeling. Unsteady flow, rotating stall, and surge.

Credits: 3.00

ME 53500 - Design And Modeling Of Fluid Power Systems

Credit Hours: 3.00. Introduction to fluid power technology. Design of hydraulic systems for mobile and industrial application for functionality, cost and energy efficiency. Modeling strategies for fluid power systems. Labs and class projects are given to reinforce the design and modeling learning projects.

Learning Outcomes: 1. Interpret and design hydraulic systems according to ISO standard of representation. 2. Describe the principle of operation of basic components such as pumps, motors, hydraulic control valves, pipes, linear actuators (cylinders) and recognize the technologies available for each component. 3. Model the operation of hydraulic components through lumped or distributed numerical approaches. 4. Discuss the features of the hydraulic control technologies commonly available for mobile machinery and industrial applications, particularly in terms of cost, functionality and energy consumption. 5. Formulate, design, simulate and present the most energy efficient solution for the hydraulic control system of a fluid power application, given the functional requirements. Credits: 3.00

ME 53501 - Introduction To Systems Engineering

Credit Hours: 3.00. This course offers an examination of the principles of systems engineering and their application across the system life cycle. Special emphasis is given to concept exploration, requirements analysis and development, analysis of alternatives, preliminary design, integration, verification, and system validation. The students will use the international space station (on-orbit modules) for practical application of the principles introduced in this course. This is the first of two courses in systems engineering and is a prerequisite to the Systems & Specialty Engineering course. Both courses use the same text book and have a 15% overlap of the text material. Permission of instructor required.

Credits: 3.00

ME 53502 - Systems And Specialty Engineering

Credit Hours: 3.00. This course offers an examination of the interaction between the principles of systems engineering and the design for specialty engineering areas. The focus of their interactions is viewed across the system life cycle. Special emphasis is given to contributions of the specialties to the essential knowledge development needed for concept exploration, requirements analysis and development, trade-offs and decisions with uncertainty, preliminary design, system integration, verification, and system validation. Students will use the international space station and its support systems for practical application of the principles introduced in this course. Permission of instructor required.

Credits: 3.00

ME 53503 - Model-Based Systems Engineering

Credit Hours: 3.00. This course focuses MBSE or Model-Based Systems Engineering (i.e. the model-based version of Systems Engineering) with an emphasis on its intelligent implementation using SysML graphical language for systems representation. The other two pillars for implementing MBSE are also covered: a methodology (OOSEM) and a tool (Cameo Systems Modeler). The coursework incorporates theoretical concepts learned in earlier systems engineering classes and is structured around the Object Modeling Group's SysML which is used in modeling systems. SysML's application to real-life projects and businesses to define, track and visualize various aspects of a system is investigated. Case studies from a variety of disciplines - including engineering and healthcare - are used as teaching tools.

Credits: 3.00

ME 53504 - Systems Driven Product Development

Credit Hours: 3.00. Integrated Model-Based Systems Driven Product (and Process) Development, or SDPD (Systems Driven Product Development) is a methodology and framework for integrating system behavioral modeling with downstream design and manufacturing practices to plan multi-domain, complex, systems. SDPD is an implementation of MBE (Model-based Engineering) which integrates MBSE (Model-based Systems Engineering) and PLM (Product Lifecycle Management) to create the "Digital Twin" of a product/process and support the digital transformation resulting in the digital enterprise of

Industry 4.0 (4th Industrial Revolution). The course covers key concepts and definitions pertaining to SDPD including MBSE, PLM, Digital Manufacturing, Digital Twin, Digital Thread, Industry 4.0, Interoperability, Traceability, Validation/Verification, Optimization, and Predictive Analytics. State-of-the-art engineering software tools are taught and used by students to design, optimize and verify multi-domain complex products (or systems) following the SDPD methodology. The graduate level project consists of a comprehensive implementation of SDPD methodology in real-life/industry relevant design and optimization of complex (multi-domain) systems.

Credits: 3.00

ME 53700 - Complex Fluids

Credit Hours: 3.00. The aim of the course is to provide a basic foundation in the fluid mechanics of viscous flows and complex fluids. Students completing this course are expected to understand the physics underlying the constitutive equations for these materials and be able to model them.

Learning Outcomes: 1. Develop a thorough understanding of complex fluids and relevant flow physics. 2. Define and describe significant properties of complex fluids. 3. Explain how properties of complex fluids are measured. 4. Understand the physics underlying the constitutive equations for complex fluids. 5. Enable continued study in advanced topics in fluid mechanics. 6. Develop the ability to critically evaluate the scientific literature on complex fluids. 7. Develop skills for scientific presentations. Credits: 3.00

ME 53800 - Air Breathing Propulsion

Credit Hours: 3.00. (AAE 53800) Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, and nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis.

Credits: 3.00

ME 53900 - Introduction To Scientific Machine Learning

Credit Hours: 3.00. Introduction to the fundamentals of predictive modeling for advanced undergraduates and graduate science and engineering students that work in the intersection of data and theory.

Learning Outcomes: 1. Represent mathematically the uncertainty in the parameters of physical models. 2. Propagate parametric uncertainty through physical models to quantify the induced uncertainty in quantities of interest. 3. Calibrate the uncertain parameters of physical models using experimental data. 4. Combine multiple sources of information to enhance the predictive capabilities of models. 5. Pose and solve design optimization problems under uncertainty involving expensive simulations or experiments. 6. Improve scientific writing and data visualization skills. Credits: 3.00

ME 54000 - Internal Combustion Engines

Credit Hours: 3.00. Spark-ignition and compression-ignition engine processes. Study of the fundamentals of turbulence, boundary, layers, liquid atomization, sprays, combustion, and pollutant formation as applied to engines. Engine after treatment. Modeling of engine flows, sprays, combustion, and pollutants. Offered in alternate years.

Learning Outcomes: 1. Study the fundamentals of turbulence, boundary layers, liquid atomization, sprays, combustion, and pollutant formation as applied to internal combustion engines. 2. Study the modeling of engine flows, sprays, combustion, and pollutant formation in internal combustion engines. Credits: 3.00

ME 54100 - Engineering Design: A Decision-Based Perspective

Credit Hours: 3.00. Multi-objective decision making under risk and uncertainty; Group decision making; Sequential decision making; Model-based and data-driven decision making; Heuristics and biases in design decision making. Applications to engineering design including estimation of customer preferences, simulation-based design, and sustainable design.

Learning Outcomes: 1. Formulate design decisions under risk and uncertainty. 2. Apply multi-attribute utility theory to make decisions in engineering design. 3. Evaluate the assumptions and limitations of commonly used decision-making methods. 4. Identify heuristics

and biases in design decision making. 5. Adopt an interdisciplinary approach to design across engineering economics and social sciences. Credits: 3.00

ME 54200 - Introduction To Renewable Energy

Credit Hours: 3.00. An introductory course on renewable energy. Students will learn the fundamental principles of the various renewable energy options and their applications and costs. After taking this course, students will be familiar with the economic and societal impact of renewable energy systems, and be able to participate in the design or selection of renewable energy systems.

Credits: 3.00

ME 54255 - Motorsports Vehicle Dynamics Fundamentals

Credit Hours: 3.00. Vehicle dynamics is the study of behavior of vehicles in motion. The study is one of the most important activities in the Vehicle design and development cycle to design vehicles which drive well and are comfortable to ride in. The course focuses on the development of advanced mathematical engineering models that represent the behavior of automotive vehicles and vehicle subsystems. Topical emphasis is focused on rectilinear performance, steady state handling behavior, tire models and suspension models.

Learning Outcomes: 1. Evaluate the solution to the race car and vehicle design as applied to motorsports vehicles. 2. Investigate the concept of the suspension design process and optimization techniques including concepts of kinematics and vibration isolation used in industry by race engineers. 3. Implement concepts of tire and mechanism of load generation and industry standards. 4. Critique suspension geometry design, wheel and steering angles, suspension travel, anti-features, roll centre, camber change rate and elastokinematics. 5. Develop modeling and dynamic simulation. 6. Formulate mechanism of traction force generation in Braking and accelerating and explanation of working of Anti-lock brake systems as an industry tool in motorsports design. Credits: 3.00

ME 54355 - Motorsports Vehicle Vibration Dynamics

Credit Hours: 3.00. An investigation into advanced topics in the field of vehicle dynamics. This course covers the principles and applications of vehicle handling dynamics from an advanced perspective in depth. The methods required to analyze and optimize vehicle handling dynamics are presented, including tire compound dynamics, vehicle planar dynamics, vehicle roll dynamics, full vehicle dynamics, and in-wheel motor vehicle dynamics. The provided vehicle dynamic model is capable of investigating drift, sliding, and other over-limit vehicle maneuvers. This is an ideal course for postgraduate and research students and engineers in motorsports, mechanical, automotive, transportation, and ground vehicle engineering.

Learning Outcomes: 1. Evaluate the rectilinear performance simulation program based on the modelling equations adapted to the race car and vehicle design as applied to motorsports vehicles. 2. Investigate the concept of the transient vehicle handling model used in industry by race engineers. 3. Implement concepts of the vehicle ride model and apply known vehicle parameters to understand vehicle performance and industry standards. 4. Develop advanced modeling and dynamic simulation. Credits: 3.00

ME 54455 - Motorsports Aerodynamics Fundamentals

Credit Hours: 3.00. A study and adaptation of fluid flow and aerodynamics as applied to motorsports design and performance optimization. This course is designed to reinforce student's understanding of aerodynamics as it pertains to a race car. This course breaks down the differences between actual air flow while driving / racing versus air flow within a wind tunnel, and how these flows are different. It discusses how to evaluate those flows, and determine if they need to be improved. It discusses ways to improve the aero on race cars.

Learning Outcomes: 1. Evaluate the solution to the aerodynamic analysis and design as applied to motorsports vehicles. 2. Investigate the concept of the aerodynamic optimization techniques used in industry by race engineers. 3. Implement concepts of wind tunnel technology and industry standards. 4. Critique aerodynamic flow regimes (continuum, slip, and

transition) and their verifications in different regimes. 5. Develop modeling and fluid simulation. 6. Formulate and conduct direct Computational Fluid Dynamics simulations as an industry tool in motorsports design. Credits: 3.00

ME 54555 - Advanced Applications Of Motorsports Aerodynamics

Credit Hours: 3.00. This advanced course is designed to adapt the secrets of the rapidly developing field of high-speed vehicle design. From F1 to Indy Car, Advanced drag simulation and Sedan racing, this course provides clear advanced explanations for students and engineers who want to improve their design skills and to interpret how their favorite race cars aerodynamics is designed. It differentiates how aerodynamics win races, why downforce is more important than streamlining and drag reduction, designing wings and venturis, plus wind tunnel designs and more. Appraises the development process of advanced motorsports aerodynamics engineering. Extensive use of CFD in the development of race car aerodynamics.

Learning Outcomes: 1. Incorporate the design of aerodynamic bodywork and components using numerical techniques. 2. Evaluate aerodynamic optimization techniques used in industry by race engineers. 3. Implement race car engine/frame integration including wake mechanics. 4. Implement the process by which race vehicles are designed with regards the addition and optimization of aerodynamic multidisciplinary platform. 5. Determination of facilities to develop high-resolution nonintrusive instrumentation such and wind tunnels with acoustic lining. Credits: 3.00

ME 54600 - CAD/CAM Theory And Advanced Applications

Credit Hours: 3.00. Theory of CAD/CAM. Geometric modeling for seamless CAD/CAM integration. Solid modeling data structure design/manipulation. CAD and CAM tools with a focus on product development integration and automation. Machining theory, automated CNC machining, and process control. CAD/CAM applications using programming languages and open architecture kernel for modeling. Projects involve CAD/CAM aspects for advanced engineering.

Credits: 3.00

ME 54655 - Composite Materials For Automotive Applications

Credit Hours: 3.00. This course focuses on development of low-cost carbon fiber for automotive applications, mechanical properties of advanced composites, automotive composite structures for crashworthiness, crashworthiness analysis of composite, hybrid structures consisting of sheet metal and fiber reinforced plastics for structural automotive and design solutions to improve crash-box impact efficiency for racing applications.

Learning Outcomes: 1. Incorporate the design of low-cost carbon fiber for automotive and motorsports applications using analytical and numerical techniques. 2. Investigate structural optimization techniques used in industry. 3. Evaluate race car chassis integration including monocoque. 4. Formulate the process by which the crash-box impact efficiency for racing applications is optimized using multidisciplinary platforms. 5. Execution of green composites for automotive applications. Credits: 3.00

ME 54755 - Design And Analysis Of Materials And Structures In Lightweight Vehicles

Credit Hours: 3.00. The materials for the construction of automobiles are changing from mostly low carbon steels to a combination of steels, light alloys, such as aluminum and magnesium alloys, and polymer matrix composites. Many of these materials are already used in today's vehicles, albeit in smaller volumes. Future vehicles, which will have to be much lighter in weight for improved fuel economy and reduced environmental pollution, will contain much larger volumes of these materials. The selection of materials will not only be influenced by their weight reduction potential, but also by factors such as safety, durability, processing, joining, recycling and cost. This course focuses on materials, their properties, processing technology and design and materials selection issues pertinent to designing lightweight vehicles. It will provide first-hand knowledge and experience of working with these advanced materials. It starts with a broad review of the materials scenario and design considerations for lightweight automotive structures. It is then divided into two major parts: materials, and design and manufacturing. The materials part contains topics on advanced steels, aluminum alloys, magnesium alloys and polymer matrix composites. It will provide information on material properties, processing characteristics and application examples. The design and manufacturing part contains information on manufacturing processes for light alloys, joining, crash worthiness considerations, recycling and life-cycle issues.

Learning Outcomes: 1. Evaluate the material selection from advanced steels, aluminum alloys, Magnesium alloys and thermoplastics and thermoplastic-matrix composites for lightweight automotive structures. 2. Investigate the techniques for joining of thermoplastic matrix composites. 3. Investigate design allowables and use of MIL-HDBK-5. 4. Critique execution plans for fatigue analysis of materials and structures. 5. Develop models for design and analysis of symmetric and asymmetric beams. 6. Formulate shear stresses in single and multi-cell beams subjected to bending and/or torsional loadings in monocoque. 7. Execute simulations for structural configurations of modern automobile. Credits: 3.00

ME 54800 - Fuel Cell Science And Engineering

Credit Hours: 3.00. Fundamental principles of fuel cell science and engineering (fuel cell reactions, charge and mass transport in fuel cells, water transport management, and materials development in the fuel cells, fuel cell system designs and integrations), current state-of-the-art fuel cell technology and the current technical challenges on the development of fuel cells, codes and standards for safe handling of fuel cells. Permission of instructor required.

Credits: 3.00

ME 54855 - Motorsports Vehicle Simulations

Credit Hours: 3.00. A course on mathematical modeling and computer simulation of mechanical systems offering a complete tool for modeling and simulation of integrated and complex systems for use within automotive and motorsports applications. Complex multi-disciplinary systems modeling and analysis problems will be solved, using a modeling and simulation environment for complex systems analysis such as Dymola's Modelica simulation technology. Dymola is a complete environment for model creation, testing, simulation and post-processing. Equal emphasis is placed on model development and simulation via Dymola GUI interface. Models range from simple spring-mass-damper system to whole vehicle models will be covered.

Learning Outcomes: 1. Evaluate the solution to the race car and vehicle design as applied to motorsports vehicles. 2. Investigate the techniques to build robust models for adaptation and reuse. 3. Implement and identify the placement of simulations in motorsports within the larger context of simulations as a field of study. 4. Critique execution plans and methods for verification and validation of motorsports simulations. 5. Develop Modelica language and Dymola interface to design components for models. 6. Formulate existing Dymola and Modelica library components to complete models of mechanical, electrical, fluid, and thermal systems for study in simulation. 7. Execute simulations and process results to answer questions about the behavior of a system. Credits: 3.00

ME 55000 - Advanced Stress Analysis

Credit Hours: 3.00. Studies of stresses and strains in three-dimensional problems. Failure theories and yield criteria. Stress function approach to two-dimensional problems. Bending of nonhomogeneous asymmetric curved beams. Torsion of bars with noncircular cross sections. Energy methods. Elastic stability. Introduction to plates. Students may not receive credit for both ME 55000 and CE 57000.

Credits: 3.00

ME 55100 - Finite Element Analysis

Credit Hours: 3.00. An introduction to the basic principles of finite element method. Weak variational form of boundary-value problems. Finite element formulation of one- and two-dimensional boundary-value problems. Time-dependent problems. Computer implementation. Examples are chosen from heat transfer, solid mechanics, and fluid mechanics areas.

Credits: 3.00

ME 55200 - Advanced Applications of Finite Element Method

Credit Hours: 3.00. Various algorithms for nonlinear and time-dependent problems in two and three dimensions. Emphasis on advanced applications with problems chosen from fluid dynamics, heat transfer, and solid mechanics areas. Independent project required.

Credits: 3.00

ME 55300 - Product And Process Design

Credit Hours: 3.00. Fundamental principles of product and

process design to produce a marketable product, develop a preliminary business strategy, and construct an operational prototype. Overview of relevant principles related to product and process design. Market analysis, design parameters, manufacturing prototype plan, production process plan, and a business strategy developed in teams. Broad overview of the entire product development process, including patents, commercialization of new technologies, and the highly interdisciplinary nature of product design through industry guest lectures. Impact of information technologies and the Internet on product design, prototyping, marketing, and customization. Product prototype is required. Design and product software information technology service-type concepts. Permission of instructor required.

Credits: 3.00

ME 55400 - Intellectual Property For Engineers

Credit Hours: 1.00. Survey of the law of patents, trade secrets, trademarks, and copyrights, with special emphasis on the process of defining inventions broadly and diversely. Obtaining, registering, licensing, and litigation of intellectual property.

Credits: 1.00

ME 55401 - Design For IP Protection And Commercialization

Credit Hours: 3.00. Present topics of intellectual property (IP) such as copyright, trademark, and trade secret, topics directed to patents including a through introduction to subject matter eligibility, novelty, and non-obviousness as well as topics related to enablement and written description requirements of a patent and how each of these concepts can affect design choices. Learn how to navigate patent databases. Develop patentable designs, as well as designs that do not infringe on existing IP. Learn about technology commercialization from an IP perspective.

Credits: 3.00

ME 55600 - Lubrication, Friction & Wear

Credit Hours: 3.00. Science, technology, and application of lubricated interacting surfaces in relative motion. Advanced analysis techniques and hands-on exposure to modern experimental methods provide an enhanced understanding of fundamental principles of lubrication, friction, and wear. Basics of design and analysis of machine components operating in the presence of air and liquid lubricants. Rolling fatigue, friction and wear models, and measurement techniques. Offered in alternate years.

Credits: 3.00

ME 55700 - Design For Manufacturability

Credit Hours: 3.00. Introduction to manufacturing concerns, such as efficient design, producibility, and quality, which must be considered early in the engineering design process. Topics include the product development cycle, manufacturing process selection, tolerancing, quality function deployment (QFD), design for assembly (DFA), quality control techniques, Taguchi's robust design methodology, life cycle engineering, and reliability. Laboratory projects in the area of tolerancing, assembly, and manufacturability are included along with a project from industry in which the students can disassemble, analyze, and redesign a product while obtaining feedback from industry concerning manufacturability.

Credits: 3.00

ME 55800 - Composite Materials

Credit Hours: 3.00. Portential applications of composite materials. Basic concepts of fiber reinforced composites. Manufacturing, micro- and macro-mechanics, and static analysis of composite laminates. Performance (fatigue and fracture) and their application to engineering design.

Credits: 3.00

ME 55801 - Composite Materials For Automotive Applications

Credit Hours: 3.00. This course focuses on development of low-cost carbon fiber for automotive applications, mechanical properties of advanced pore morphology foam composites, automotive composite structures for crashworthiness, crashworthiness analysis of composite, hybrid structures consisting of sheet metal and fiber reinforced plastics for structural automotive and design solutions to improve crash-box impact efficiency for racing applications.

Credits: 3.00

ME 55802 - Design And Analysis Of Materials And Structures In Lightweight Vehicles

Credit Hours: 3.00. This course focuses on materials, their properties, processing technology and design and materials selection issues pertinent to designing lightweight vehicles. It will provide first-hand knowledge and experience of working with these advanced materials. It starts with a broad review of the materials scenario and design considerations for lightweight automotive structures. It is then divided into to major parts: materials, and design and manufacturing.

Credits: 3.00

ME 55900 - Micromechanics Of Materials

Credit Hours: 3.00. Prediction of the macroscopie behavior of materials from their microstructure and the design of new materials. Microstructure-property relationships between the

macroscopie material behavior and microscopic structure. Application to traditional structure as well as to new engineering materials. Adapting emerging constitutive relations into structure analyses. Introduction of this new approach to materials, its applications in predictive analysis tools, and its importance in simulation-based engineering.

Credits: 3.00

ME 56000 - Kinematics

Credit Hours: 3.00. Geometry of constrained plane motion with applications to linkage design. Type and number synthesis, size synthesis. Path curvature, inflection circle, cubic of stationary curvature. Finite displacements, three and four separated positions. Graphical, analytical, and computer techniques.

Credits: 3.00

ME 56200 - Advanced Dynamics

Credit Hours: 3.00. Dynamics of multi-degrees-of-freedom mechanical systems. Holonomic and nonholonomic constraints. Lagrange's equations of motion. Hamilton's principle for holonomic systems. Kinematics and kinetics of rigid body motion, including momentum and energy methods. Linearized equations of motion. Classification of vibratory systems - gyroscopic, circulatory forces. Stability of linear systems - divergence and flutter. Applications to gyroscopes, satellite dynamics, etc.

Learning Outcomes: 1. Develop an understanding of the principles governing the motion of mechanical systems modeled as rigid bodies. 2. Develop an ability to analyze rigid-body kinematics in stationary as well as moving frames of reference. 3. Develop an ability to use Newton-Euler laws of rigid body motion. 4. Develop an understanding of the fundamental concepts in analytical dynamics, and the ability to use them to formulate the equations of motion for rigid bodies and systems. Credits: 3.00

ME 56300 - Mechanical Vibrations

Credit Hours: 3.00. Review of systems with one degree for freedom. LaGrange's equations of motion for multiple degree of freedom systems. Introduction to matrix methods. Transfer functions for harmonic response, impulse response, and step response. Convolution integrals for response to arbitrary inputs. Principle frequencies and modes. Applications to critical speeds, measuring instruments, isolation, torsional systems. Introduction to nonlinear problems.

Credits: 3.00

ME 56500 - Vehicle Dynamics

Credit Hours: 3.00. Modeling of wheeled vehicles to predict performance, handling, and ride. Effects of vehicle center of mass, tire characteristics, traction and slip, engine characteristics, and gear ratios on performance. Suspension design. Steady state and transient handling models of four-wheeled vehicles and car-trailer systems to determine oversteer and understeer characteristics, critical speeds, and stability. Multi-degree-of-freedom ride models, including tire and suspension compliance. Computer simulations. Current research topics in vehicle vibration isolation.

Learning Outcomes: 1. Mature in application of modeling techniques to predict the dynamic behavior of highway vehicles. 2. Develop an understanding of the relationships between vehicle design variables and vehicle dynamic behavior (acceleration, braking, handling, and ride). Credits: 3.00

ME 56802 - Ceramic Materials

Credit Hours: 3.00. Fundamental concepts of ceramic materials. Atomic structure, bonding the transport of charged defects and their relationships to conductivity in ceramics, phase diagrams and glasses. Solid state processes, including sintering and grain growth. Physical properties including mechanical, thermal, magnetic, dielectric, and optical properties. Application to energy and biomedical applications.

Credits: 3.00

ME 56900 - Mechanical Behavior Of Materials

Credit Hours: 3.00. A study of load and environmental conditions that influence the behavior of materials in service. Elastic and plastic behavior, fracture, fatigue, low and high temperature behavior. Fracture mechanics. Failure analysis case studies emphasis on design.

Credits: 3.00

ME 57000 - Machine Design

Credit Hours: 3.00. Analysis of stresses and deflections due to complicated loading. Investigation of specific design problems through application of theory of elasticity, failure criteria, energy approach, and numerical methods. Individual design project.

Learning Outcomes: 1. Understand complicated 3-D state of stress for both determinate and

indeterminate problems. 2. Learn advance theory of elasticity. 3. Gain fundamental knowledge of bodies in contact. 4. Solution methods for torsion of prismatic section and bending of asymmetric cross section. 5. Apply energy method to solve problems for linear and nonlinear materials. Credits: 3.00

ME 57100 - Reliability Based Design

Credit Hours: 3.00. Basic concepts of probability and random variables. Time-dependent reliability models. Strength-based reliability and interference theory. Weakest-link and fail-safe systems. Extremal distributions. Monte Carlo methods. Maintainability and availability. Fault tree analysis. Quality control and reliability. Offered in alternate years.

Learning Outcomes: 1. Enable students to understand the importance of reliability during the design of engineered products. 2. Learn common probability distributions and fit probability distributions to experimentally obtained failure data. 3. Learn to describe and manipulate expectation and variance of continuous functions. 4. Understand principles of probabilistic design of engineered products. 5. Carryout reliability simulations of complex systems using Monte Carlo and first order reliability methods. 6. Understand important failure concerns in mechanical and electronic systems. Credits: 3.00

ME 57101 - Probabilistic Engineering Design

Credit Hours: 3.00. This course presents probabilistic methodologies for engineering design under uncertainty. It is intended for students who are interested in statistical/probabilistic methods for engineering analysis and design. The outcomes of the course are 1) an ability to model uncertainties in engineering applications, 2) an ability to performance basic statistics, risk, and reliability analyses, and 3) an ability to integrate probabilistic design with simulations, optimization, Design for Six Sigma, and Design of Experiments. The course is lecture and project based.

Credits: 3.00

ME 57200 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. Introduction to the analysis and design of robotic manipulators. Topics include: kinematic configurations, forward and inverse position solution, velocity and acceleration, path planning, workspace analysis, force and torque solutions, rigid body dynamics, motors and actuators, robot design, sensors and controls, computer simulation, and graphical animation.

Learning Outcomes: 1. Analysis of manipulator motion and forces. 2. Manipulator design including actuator, drive, and sensor issues. 3. Computer simulation to predict motion and forces. Credits: 3.00

ME 57201 - Analysis And Design Of Robotic Manipulators

Credit Hours: 3.00. The basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematics of manipulator arms; velocity and force-torque relations; dynamic equations using Euler-Lagrange formulation; motion planning; obstacle avoidance; controller design using torque method; and classical controllers for manipulators. Permission of instructor required.

Credits: 3.00

ME 57301 - Air Pollution And Emission Control

Credit Hours: 3.00. This course is designed to integrate the real-world problem solving experience into the course curriculum through project / lab environment. Students will study the air pollution sources and fundamental mechanisms of their impact on the environment and human health, and how automotive emission can be measured and controlled. In particular, measurement of particulate emission deposited in a diesel particulate filter will be studied. Here the students will have a chance to optimally design the sensor components. The course topics are chosen in this context so that they align with the local industry / lab well. Topics in emission control technologies, including sensors, control mechanisms, remedial systems will be taught and combined into the course projects that students will complete over the course of a semester.

Credits: 3.00

ME 57401 - Additive Manufacturing

Credit Hours: 3.00. During this course, students evaluate the engineering aspects and physical principles of available AM technologies (binder and material jetting, sheet lamination, vat photopolymerization, directed energy deposition, powder bed fusion, and material extrusion technologies) as well as these technologies' most relevant applications and criteria in order to successfully select the AM technology that is best suited for the embodiment of a particular design (material compatibility,

interface issues, strength requirements). The topics of this course are grouped into three modules: (1) AM Technologies (2) Design for AM (3) AM Process Planning. During the first module (50% of the course), the historical development of AM is examined and then the underlying physical principles of current AM technologies are evaluated. The second module (25% of the course) focuses on investigating the mathematical principles and technical aspects of design optimization methods for AM (including topology optimization). The third module (25% of the course) incorporates product evaluation (mechanical properties and dimensional accuracy), process optimization, and applications. Students taking this course will create original products using CAD/CAE systems and topology optimization tools. Students will hone skills on image post-processing, segmentation, vectorization, and generation of STL files. Students also will execute tasks using several 3D printers and manipulate different AM technologies including material extrusion, vat photopolymerization, and powder-bed fusion. They will also have the opportunity to visit local industries in the areas of manufacturing, design, and materials.

Credits: 3.00

ME 57500 - Theory And Design Of Control Systems

Credit Hours: 3.00. Covers the analysis and design of control systems from both a classical and modern viewpoint, with emphasis on design of controllers. Classical control design is reviewed, including both root locus and Bode domain design methodologies. The state space representation is introduced, along with notions of stability, controllability, and observability. State feedback controllers for pole placement and state observers are discussed with emphasis in their frequency domain implications.

Credits: 3.00

ME 57600 - Computer Control Of Manufacturing Processes

Credit Hours: 3.00. Fundamental elements for manufacturing process control are presented with advanced control theories, modeling and analysis of actuators, controller architecture, interfacing and programming. Emphasis is on computer integrated manufacturing with computer numerical control of machine tools, automation via programmable logic controllers, motion control, process control examples, and manufacturing process monitoring. Hands-on experience is attained through laboratory experiments with state-of-the-art equipment.

Credits: 3.00

ME 57700 - Human Motion Kinetics

Credit Hours: 3.00. Study of kinetics related to human motion. Review of human anatomy and anthropometric data. Planar and three-dimensional kinematic analysis of gross human motion. Detailed kinematic studies of human joints. Newton-Euler and Lagrangian methods for joint torques. Muscle force and power analysis. Studies on walking, jumping, cycling, and throwing exercises.

Credits: 3.00

ME 57800 - Digital Control

Credit Hours: 3.00. Introduction to, and overview of, the field of digital control. Prior knowledge of continuous control techniques is assumed. Topics include mathematical background from residue theory through integral transforms; sampled data systems, including A/D, D/A, and hold properties, aliasing, and Z transforms. Digital control design via continuous, discrete, and state space design techniques. Implementation considerations, including nonlinear effects. Mechanical engineering examples.

Credits: 3.00

ME 57900 - Fourier Methods In Digital Signal Processing

Credit Hours: 3.00. Fundamentals of signal processing associated with Fourier analyzer systems are presented. Emphasis is on amplitude accuracy and frequency resolution properties necessary for reliable experimental methodologies in system identification, spectrum estimation, and correlation analysis. Deterministic, as well as random, data analyses are presented. Students are required to develop algorithms that significantly expand the utility of Fourier analyzer systems.

Credits: 3.00

ME 58000 - Nonlinear Engineering Systems

Credit Hours: 3.00. Methods of analysis for nonlinear ordinary differential equations arising in engineering systems. Review of linear systems. Stability concepts. Phase plane methods. Perturbation and averaging methods of analysis. Self-excited and parametrically-excited systems. Relaxation oscillations. Systems with more than one degree of freedom.

Credits: 3.00

ME 58100 - Numerical Methods In Mechanical Engineering

Credit Hours: 3.00. The solution of problems arising in mechanical engineering using numerical methods. Topics include nonlinear algebraic equations, sets of linear algebraic equations, eigenvalue problems, interpolation, curve fitting, ordinary differential equations, and partial differential equations. Applications include fluid mechanics, gas dynamics, heat and mass transfer, thermodynamics, vibrations, automatic control systems, kinematics, and design.

Learning Outcomes: 1. Identify the classical numerical methods available for engineering problem-solving. 2. Utilize numerical methods as an engineering tool and improve programming skills. 3. Develop a fundamental understanding of the methods. 4. Explain the importance of errors associated with scientific computing. Credits: 3.00

ME 58400 - System Identification

Credit Hours: 3.00. Theory and application of System Identification methods. Connecting the world of mathematical models to experimental data - least squares methods and difference equation models. Background in probability and analysis: algebra of random variables, law of large numbers, central limit theorem. The ARMA family of models; mapping physics models to generalized ARMAX forms (linear and nonlinear); mapping the parameter estimation problem to the least squares problem (batch and recursive), and numerical solution techniques. Model (in)validation, optimal identification criteria, experiment design and data preprocessing considerations. Issues of signal-to-noise ratio, persistency of excitation, sampling frequency, data accuracy and data sizes.

Learning Outcomes: 1. Interpret data probabilistically and ability to calculate uncertainty propagation. 2. Fit backbox models to data; convert physics models to identifiable forms for least squares formulations. 3. Construction of numerical codes for solving least squares problems and use of MATLAB System ID toolbox. 4. Construct informative experiments for dynamic systems with suitable precision of and accuracy of sensing, data length, persistency of excitation, and sampling frequency. Credits: 3.00

ME 58600 - Microprocessors In Electromechanical Systems

Credit Hours: 3.00. Architecture of microcomputers; operating systems, logic functions, logic circuit design; I/O structure and interfacing; assembly language, manual assembly; software and hardware interrupts; data acquisition, serial and parallel communications; the role of high-level languages. Laboratory experiments on applications to electrical, mechanical, and thermofluid systems.

Credits: 3.00

ME 58700 - Engineering Optics

Credit Hours: 3.00. Fundamentals of geometrical and physical optics as related to problems in engineering design and research. Characteristics of imaging systems; properties of light sources; optical properties of materials. Diffraction, interference, polarization, and scattering phenomena as related to optical measurement techniques. Introduction to lasers and holography. (Laboratory work can be undertaken for additional credit by special arrangement.).

Credits: 3.00

ME 58800 - Mechatronics - Integrated Design Of Electro-Mechanical Systems

Credit Hours: 3.00. Electronic and interfacing techniques for design and control of electro-mechanical systems. Basic digital and analog design with applications to electro-mechanical interfacing via hands-on laboratory experience. Commonly used actuators and sensors and corresponding interfacing techniques. Realistic and integrated product development experience provided through a comprehensive final project where working prototypes are built to defined specifications.

Credits: 3.00

ME 58901 - Optimal Design Of Mechatronic Systems: Robots And Interactive Structures

Credit Hours: 3.00. This course will introduce the fundamentals of transformation of knowledge from art/design to engineering/technology applications. Different variant forms of free form design, in relation to various structural topologies common in engineering and technology applications and related optimization techniques will be discussed. This course will utilize the epistemology of studio practice implicit in the artistic process in order to acquire embodied knowledge. Reasoning innovative process can be taught through the crafting of mechanical structures while experiencing bodily interactions with the nature of materials and tools. Thus, this course introduces a range of design principles and critical studio practice methodologies while working with a range of variable materials and aims to help students grow in their creative thinking. It will integrate mechatronic modeling / simulation, optimal design, and hands-on fabrication of robotic systems (sensors, actuators, electric circuits, and embedded controllers) and interactive structures in a makerspace environment. Permission of instructor required.

Credits: 3.00

ME 59100 - Mechanical Engineering Project

Credit Hours: 1.00 to 3.00. Individual advanced study in various fields of mechanical engineering. May be repeated for up to 6 credit hours. Students registered for this course must have

weekly meeting with the instructor for at least an hour. Permission of department required.

Credits: 1.00 to 3.00

ME 59300 - Solid Mechanics I

Credit Hours: 3.00. The design of modern engineering structures is intrinsically linked to the understanding and analysis of materials and structures. This course is a foundational course on graduate-level knowledge in this area of engineering. Course will cover Elements of linear elasticity, Kinematics of deformation, equilibrium conditions, and constitutive relationship of materials. Classical problems in elastostatics and general solutions for field equations in elasticity. Anisotropic elasticity, thermal elasticity.

Learning Outcomes: 1. Comprehend mechanics concepts of key classes engineering materials (elasticity, thermoelasticity), and be able to relate mechanics principles to real-world engineering applications in design. 2. Comprehend the methods for the analysis and prediction of deformation, strain and stress in engineering structures. 3. Identify elasticity and thermoelasticity in the context of static and dynamic loading. 4. Develop the ability to deal with elastic and thermal boundary conditions. 5. Develop the skill to analyze problems of stability. 6. Use solid mechanics principles to interpret and analyze the mechanical behavior of advanced engineering structures. Credits: 3.00

ME 59500 - Special-Topic Minicourses

Credit Hours: 1.00. A series of one-credit-hour courses on special topics offered as ME 59500, 59500, etc. These special-topic minicourses will provide an opportunity for introducing students to topics of contemporary importance or special interest that fall outside the scope of the curriculum. Information about current offerings may be obtained from the schedule of classes or the mechanical engineering registration deputy.

Credits: 1.00

ME 59600 - Solid Mechanics II

Credit Hours: 3.00. The design of modern engineering structures is intrinsically linked to the understanding and analysis of materials and structures. This course is a foundational course on graduate-level knowledge in this area of engineering.

Learning Outcomes: 1. Select the most appropriate theory for modeling a particular material and structure in a given application and outline the variables and general parameters needed, as well as limitations of the chosen theory. 2. Formulate and evaluate the stress-strain response of a (i) hyperelastic material, (ii) a viscoelastic material, (iii) a plastic material; Formulate and evaluate the internal resultant versus kinematic variable response of (i) beams, (ii) plates, and (iii) shells; Formulate and evaluate the contact force (pressure) between (i) smooth non-conforming deformable surfaces (e.g., spherical objects), (ii) a rigid object on a deformable substrate (e.g., indentation), (iii) fluid-solid interfaces, for elastic solids (and/or rate-dependent solids and/or plastic solids). 3. Use solid mechanics principles to interpret and analyze the mechanical behavior of advanced engineering structures. Credits: 3.00

ME 59700 - Advanced Mechanical Engineering Projects I

Credit Hours: 0.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Permission of instructor required.

Credits: 0.00 to 6.00

ME 59800 - Mechanical Engineering Graduate Seminar

Credit Hours: 0.00. Acquaint graduate students with a broad spectrum of research in various areas of mechanical engineering. Weekly seminars by invitees/researchers from academia, national labs, or industry. Seminar topics provide a mix of subjects, areas and disciplines, and can involve considerable technical depth, a broad overview and/or historical perspectives. Permission of department required.

Credits: 0.00

ME 59999 - PMP Professional Development

Credit Hours: 0.00 to 3.00. Projects or special topics in professional development as it relates to ME. Permission of department required.

Learning Outcomes: 1. Varies due to the nature of the course. Credits: 0.00 to 3.00

ME 60101 - Computational Modeling Of Turbulence

Credit Hours: 3.00. This course consists of three parts. The first part is on the fundamentals of turbulence inlcuding turbulence concepts, statistical description, and Kolmogorov hypothesis. The second part covers major practical modeling concepts and formulations such as direct numerical simulation (DNS), large eddy numercial simulation (LES), and Reynolds averaged Navier-stokes simulation (RANS). The third part is team project related to turbulence computation with applications in environment, industry, biomechanics for visualizing and experiencing turbulence. Prerequisite: Intermediate Fluid Mechanics (ME 50900) or consent of instructor.

Credits: 3.00

ME 60500 - Convection Of Heat And Mass

Credit Hours: 3.00. Heat and mass transfer in moving fluid media; free, forced, and mixed convection for internal and external flows; differential and integral treatments of boundary layer problems; convection analogies for heat, mass, and momentum transfer; combined heat and mass transfer with chemical reactions; special topics and applications to electronic cooling, materials processing, transpiration and film cooling. Prerequisite: ME 31500 .

Credits: 3.00

ME 60600 - Radiation Heat Transfer

Credit Hours: 3.00. Thermodynamics and physics of radiation and its interaction with interfaces and matter; radiation characteristics of surfaces and radiation properties of solids, liquids, and gases; analysis of radiation exchange between real and idealized surfaces; fundamentals of radiation transfer in absorbing, emitting, and scattering media; interaction of radiation with conduction and convection; remote temperature sensing and applications to selected problems involving combined energy transfer mechanisms. Offered in alternate years. Prerequisite: ME 31500 .

Credits: 3.00

ME 60601 - Optimal Design Of Complex Mechanical Systems

Credit Hours: 3.00. The objective of this research course is to prepare students to address mechanical systems design and innovation challenges through appropriate advanced optimal design methodologies. This course will focus on current design approaches, which are rapidly expanding in research and industrial applications, but are not commonly included in engineering curricula. The course also focuses on the theoretical aspects of multi-objective optimization, global approximation methods (metamodel-based optimization), and applications in mechanical engineering systems. Students of this research course will acquire an understanding of state-of-the-art analysis and optimization tools through hands-on experience and the involvement in research projects. The research experiential learning will prepare students to design innovative mechanical systems and to increase their problem solving capabilities through the use of effective design methodologies. Pre-requisite or co-requisite: ME 50601. Permission of instructor required.

Credits: 3.00

ME 60800 - Numerical Methods In Heat, Mass, And Momentum Transfer

Credit Hours: 3.00. Governing conservation equations and their classification according to numerical properties. Discretization by Taylor series, weighted residual, and control volume methods. Solution of systems of algebraic equations. Discretization and solution of the convection-diffusion equation. Methods of solving the equations governing fluid flow. Mathematical modeling of turbulence, combustion, and radiation. Prerequisite: ME 50500 , ME 58100 .

Credits: 3.00

ME 61000 - Boundary Layer Theory

Credit Hours: 3.00. Fundamentals of continuum fluid mechanics; Navier-Stokes equations. Laminar flow; boundary-layer concept; similarity solutions; transformation methods; integral and finite difference solution techniques for general pressure gradients. Should be preceded by intermediate fluid mechanics.

Credits: 3.00

ME 61100 - Principles Of Turbulence

Credit Hours: 3.00. Methods of description and basic equations for turbulent flows. Isotropic and homogeneous turbulence, energy spectra, and correlations. Introduction to measurements. Transition theory and experimental evidence. Wall turbulence, engineering calculations of turbulent boundary layers. Free

turbulent jets and wakes. Prerequisite: ME 61000 .

Learning Outcomes: 1. Develop the ability (from first principles) to describe the physics of turbulent flows. 2. Comprehend the methods of analysis used in turbulence study. 3. Understand the principles of turbulence simulation and the associated modeling problems. Credits: 3.00

ME 61200 - Continuum Mechanics

Credit Hours: 3.00. A unified and exact mathematical treatment of the mechanics of solids and fluids. Cartesian tensor algebra and calculus; stress tensor, principle stresses and invariants; material and spatial coordinates, deformation gradient, strain and stretch tensors; balance of mass, momentum, and energy; constitutive equations of elasticity, hyperelasticity, viscous fluids and viscoelasticity.

Credits: 3.00

ME 61201 - Continuum Mechanics

Credit Hours: 3.00. This course will cover the formal, consistent and unified mathematical treatment of the mechanics of continuous solids and fluids. Topics covered include the kinematics of deformation, the concept of stress, and the conservation laws for mass, momentum and energy. This is followed by an introduction to constitutive theory with applications to well-established models for viscous fluids and elastic solids. The concepts are illustrated through the solution of tractable initial boundary-value problems.

Credits: 3.00

ME 61300 - Advanced Engineering Acoustics

Credit Hours: 3.00. An extension of ME 51300 . Sound transmission between two media. Acoustic resonators and application to muffler theory. Structural radiation and sound. Acoustical measurements and signal processing: sound intensity, surface intensity, coherence and cepstral techniques. Numerical acoustics: finite element analysis, boundary integral equation analysis and statistical energy analysis. Advanced topics. Prerequisite: ME 51300 .

Credits: 3.00

ME 61400 - Computational Fluid Dynamics

Credit Hours: 3.00. Application of finite difference methods, finite element methods, and the method of characteristics for the numerical solution of fluid dynamics problems. Incompressible viscous flows: vorticity transport equation, stream function equation, and boundary conditions. Compressible flows: treatment of shocks, implicit and explicit artificial viscosity techniques, and boundary conditions. Computational grids. Prerequisite: ME 50900 or ME 58100 .

Credits: 3.00

ME 61500 - Aeroacoustics

Credit Hours: 3.00. (AAE 61500) Quantitative measures of sound (decibel scales, spectra, energetics of acoustic motions, and measurement techniques). The wave theory of sound (basic equations and properties, sound propagation in homogeneous and inhomogeneous media, one-, two- and three-dimensional sound fields and distributed sources). Effects of source movement. Aerodynamic noise generation - acoustic analogy (Lighthill's equation and Ffowcs Williams-Hawkings equation). Introduction to Computational Aeroacoustics (CAA). Noise from turbulent shear flows (jet noise, cavity noise, and noise from flow over objects). Noise from turbomachinery, propellers, and rotors. Prerequisite: ME 30900 or ME 51300 or AAE 51100.

Credits: 3.00

ME 61700 - Applied Thermal Physics And Molecular Spectroscopy

Credit Hours: 3.00. The fundamentals of statistical mechanics, kinetic theory, and molecular spectroscopy will be taught in order to predict and characterize the behavior of non-equilibrium gases using optical and laser diagnostics. This material will be taught within the context of applications involving combustion, plasmas, propulsion, energetic materials, shock waves and laser radiation. Pre-requisite: Thermodynamics I, ME 20000 or Heat Transfer 1, ME 31500 or Chemistry 1, CHM 12500.

Learning Outcomes: 1. Model and experimentally characterize the dynamic behavior of non-equilibrium gases as they transition from one equilibrium state to another (e.g., due to chemical ignition, shock heating/compression, and laser radiation). 2. Calculate how energy is distributed (i.e., partitioned) on the molecular level and how many molecules or atoms exist in a given quantum state. 3. Determine the viable mechanisms for transferring energy and inducing chemical reactions via collisions and to calculate how quickly these processes occur and how they evolve in time. 4. Calculate absorption and emission spectra of atoms and

molecules and to convert laboratory measurements of said spectra to thermodynamic properties of the test gas (e.g., temperature, pressure, species concentration, velocity). Credits: 3.00

ME 62000 - Combustion Of Energetic Materials

Credit Hours: 3.00. Students will learn the concepts of how to approach research in the area of Energetic Materials (EM) based on an understanding of the fundamental principles. Students will learn how energetic materials are fabricated, safety used, as well as understand life cycle issues, homogeneous & heterogenous combustion, and advanced energetic material concepts. Multiphase combustion phenomena will be introduced and emphasized. They will apply these concepts to a literature review and group research project, as well as that includes applying thermochemistry and chemical kinetic software. In addition, six hands-on labs are performed. This material will be covered in the context of real-world applications, with an emphasis on energetic materials, combustion, propulsion, explosives, pyrotechnics, and detonation phenomenon. Pre-requisite: ME 52500 or AAE 53900 or consent of instructor.

Learning Outcomes: 1. Become familiar with the basic terminology, material science, physics & chemistry of energetic materials. 2. Learn how to safely work with energetic materials. 3. Learn how to experimentally or computationally approach research. 4. Learn how to approach literature reviews and form hypotheses for future research. 5. Learn the knowledge and experience needed to understand, model, develop, and experimentally characterize energetic materials, and well as numerous related fields. Credits: 3.00

ME 62500 - Advanced Combustion

Credit Hours: 3.00. Coupling of the energy, species, and mass conservation equations with the momentum equation. Statistical treatment of turbulence and the problems of interactions of turbulence with chemistry, radiation, and two-phase flows. Critical study of at least 10 seminal and recent contributions in the combustion literature. Offered in alternate years. Prerequisite: ME 52500 .

Credits: 3.00

ME 64000 - Structural Acoustics

Credit Hours: 3.00. Waves in fluids and structures, dispersion relations, sound radiation from structures, radiation efficiency, radiation from concentrated forces, effect of fluid loading on wave propagation, transmission of sound through barriers, effect of panel lining, enclosures, acoustically induced vibration of structures and numerical calculation of fluid-structure interaction. Offered in alternate years. Prerequisite: ME 51300 , ME 56300 .

Credits: 3.00

ME 65000 - Computational Fracture Mechanics

Credit Hours: 3.00. Advanced concepts of methods for the analysis of cracks, of crack propagation and damage evolution. Prediction of the macroscopic behavior of structures as it emerges from the presence of defects such as cracks, voids, or delamination. Linear elastic and nonlinear fracture problems. Rate independent and rate dependent problems. Methods in computational fracture mechanics where material separation emerges as an outcome of the boundary value problem. Demonstrations of how mechanical design can take advantage of the methods of computational fracture mechanics by introducing such concepts into structural analyses. Applications of computations in predictive analysis and its importance in simulation-based engineering. Prerequisites: AAE 55800 or ME 48900, or similar courses in finite element analysis or ME 57000 or ME 61200 or AAE 55300, or similar courses on advanced solid mechanics. Recommended but not required: CEE 597-109 or AAE 65400.

Learning Outcomes: 1. Introduce concepts of computational methods for material damage, fracture and fatigue. 2. Learn continuum mechanics concepts for description of material failure. 3. Learn about advanced constitutive equations for bulk and interface failure. 4. Learn how model material failure processes. 5. Learn how to develop and apply computational mechanics methods. 6. Apply these concepts to analysis of failure at the macro, micro and Nano scale. Credits: 3.00

ME 65100 - Advanced Finite Element Method For Solids

Credit Hours: 3.00. This course is designed to teach students advanced finite element techniques for solid mechanics stress and heat transfer analysis. Those include: techniques for modeling beams, plates and 2D/3D continua with material non-

linearity, material plasticity and geometric non-linearity; heat transfer; modeling thermos-mechanical systems; frequency domain, time domain and quasi-static solutions; modeling of frictional contact; modeling rigid-bodies. Applications of the modeling techniques taught in this course will be introduced, including: modal analysis; stress-analysis with material and geometric non-linearity; structural dynamics with material and geometric non-linearity; frictional contact problems; metal forming and crash analysis. Prerequisites: ME 55100 and ME 58100. Graduate Standing. Permission of instruction required.

Credits: 3.00

ME 65500 - Computational Mechanics Of Materials

Credit Hours: 3.00. Prediction of the mechanical behaviors of engineering materials employing computational methods, at atomistic, discrete, and continuum levels. Continuum and discrete models for material deformation in brittle and ductile materials. Atomistic models for fracture in nanomaterials. Applications to engineering structures on the macro-micro and nanoscale.

Credits: 3.00

ME 66400 - Vibrations Of Continuous Systems

Credit Hours: 3.00. Theory of small oscillations of continuous systems. Love's equations for thin shells, reduction to special cases of shallow shells, plates, beams, etc. Initial stresses; influence of shear; thermal excitation. Initial value problems; forced vibrations; structural damping. The dynamic Green's function, impedance concepts; variational approaches. Experimental procedures, scaling, composite, and stiffened shells. Prerequisite: knowledge of one degree of freedom system vibrations.

Credits: 3.00

ME 67500 - Multivariable Control System Designs

Credit Hours: 3.00. Fundamentals of the frequency response loop shaping methodology for the analysis and design of robust multivariable control systems will be presented. Emphasis is on suitable extensions of the classical Bode-Nyquist design techniques to systems with not only uncertain parameters but also multiple inputs and outputs. Instrument and environmental signal level constraints on the performance of control systems will be critically evaluated. Students are required to develop ability to handle open-ended design issues involving significant multiobjective performance trade-offs. Prerequisite: ME 57500 .

Credits: 3.00

ME 67700 - Nonlinear Feedback Controller Design

Credit Hours: 3.00. Controller design and analysis of nonlinear feedback systems. Topics include the design of linear/nonlinear feedback controllers. Describing Function (DF) techniques for design, Popov and Generalized Circle Criterion for closed-loop stability, functional analysis and Volterra series approaches, and introduction to existing nonlinear controller design tools. Offered in alternate years. Prerequisite: ME 67500 .

Credits: 3.00

ME 68000 - Bifurcations And Chaos

Credit Hours: 3.00. Basic concepts in stability of systems, nonlinear dynamical systems, and bifurcation theory. Algebraic and geometric techniques for local bifurcation analysis. Models governed by difference, ordinary, and particle differential equations. Examples from mechanical, structural, chemical, and electrical systems. Models of chaotic behavior. Techniques for prediction of chaos. Routes to chaos. Offered in alternate years. Prerequisite: ME 58000 .

Credits: 3.00

ME 68100 - Finite And Boundary Element Methods

Credit Hours: 3.00. The solution of problems in mechanical engineering using the generalized numerical techniques; the finite element method and the boundary element method. Topics include reformulation of partial differential equations into appropriate form for each method. The development and implementation of code and solution of problems. Applications include: acoustics, fluid dynamics, heat transfer, design, mechanics and biomechanics. Prerequisite: ME 58100 .

Credits: 3.00

ME 68700 - Laser Diagnostics For Reacting Flows

Credit Hours: 3.00. The principles of spectroscopic laser diagnostics including absorption, fluorescence, and Raman scattering techniques. Theory of the interaction of laser radiation with atomic and molecular resonances. Lasers and detectors for optical diagnostics. Offered in alternate years. Prerequisite: ME 50100 .

Credits: 3.00

ME 68900 - Adaptive Control

Credit Hours: 3.00. Theory and application of adaptive control of linear systems in both continuous and discrete time domain. Real-time parameter estimation algorithms, direct and indirect

adaptive methods, deterministic self-tuning regulators, Lyapunov stability theory, input-output stability, model-reference adaptive control, stability and convergence of adaptive algorithms, robustness, and implementation issues, with laboratory experiments and demonstrations. Offered in alternate years. Prerequisite: ME 57500 .

Credits: 3.00

ME 69000 - Individual Study In Mechanical Engineering

Credit Hours: 0.00 to 18.00. Individual study in advanced areas not currently available through formal course offerings within the University. Course plan must be approved by professor in charge prior to registering for the course. Written report and presentation of a departmental seminar based on material studied are required at the end of the semester. Permission of instructor required.

Credits: 0.00 to 18.00

ME 69100 - Mechanical Engineering Graduate Seminar

Credit Hours: 0.00. Acquaint graduate students with a broad spectrum of research in various areas of mechanical engineering. Weekly seminars by invitees/researchers from academia, national labs, or industry. Seminar topics provide a mix of subjects, areas and disciplines, and can involve considerable technical depth, a broad overview and/or historical perspectives.

Learning Outcomes: 1. Develop an understanding of the field of Mechanical Engineering in its widest possible applications. 2. Develop an appreciation of the various interdisciplinary research efforts being pursued where Mechanical Engineering has the potential to provide leadership. Credits: 0.00

ME 69600 - Advanced Professional Internship

Credit Hours: 0.00. Advanced professional experience in mechanical engineering. The program is coordinated by the school with cooperation of participating employers. Students submit a summary report. Prerequisite: Master's student standing.

Credits: 0.00

ME 69700 - Advanced Mechanical Engineering Projects II

Credit Hours: 1.00 to 6.00. Projects or special topics of contemporary importance or of special interest that are outside the scope of the standard graduate curriculum can be studied under the Mechanical Engineering Projects course. Interested students should seek a faculty advisor by meeting with individual faculty members who work in their area of special interest and prepare a brief description of the work to be undertaken in cooperation with their advisor. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

ME 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ME 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

MET 64500 - Design And Control Of Rehabilitation And Assistive Robots

Credit Hours: 3.00. This course focuses on studying the fundamentals of the design and control of rehabilitation and assistive robots and evaluating their performances. Topics in multiple areas, including robotics, biomechanics, controls, and mechatronics, are included in this course. Specifically, the students study various applicable control methods, including impedance control for the physical interaction of humans and robots. Additionally, the students conduct gait experiments and analyze the data to determine the gait parameters relevant to the design of lower leg assistive and rehabilitation robots, including human joint impedance. Supportive topics such as user intent recognition and relevant instrumentation are also discussed. Prerequisites: MFET 44200 or ECE 56900 or ME 57200.

Learning Outcomes: 1. Evaluate the needs of target populations, technologists, and ethical and regulatory restrictions related to human well-being, especially improved mobility. 2. Analyze the biomechanics considerations in the evaluation of the design and control of rehabilitation robots. 3. Analyze the data of the performed gait experiments. 4. Design an impedance controller for an assistive robot. 5. Create a system of wearable sensors to analyze gait parameters in an unstructured environment. Credits: 3.00

School of Nuclear Engineering (Graduate)

Website: **https://engineering.purdue.edu/NE/academics/graduate/Grad_index**

Department/School Head

Seungjin Kim

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Chan Choi Allen Garner Ahmed Hassanein Mamoru Ishii Hany Abdel-Khalik Seungjin Kim Shripad Revankar Rusi Taleyarkhan Lefteri Tsoukalas	Hitesh Bindra Xiaoyuan Lou	Stylianos Chatzidakis Yunlin Xu	Arden Bement Victor Ransom Alvin Solomon Takashi Hibiki

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Academic Programs

Master's and Ph.D. Programs

The School of Nuclear Engineering at Purdue University has students from a variety of undergraduate preparations which include other branches of engineering, various fields of science, and mathematics. This diversity in conjunction with an open stance on interdisciplinary research enables us to accommodate the interests of our graduate students in exploring new opportunities and challenges in the rapidly broadening field of nuclear engineering advanced technologies as fission and fusion power generators, new medical technologies and procedures, improved food safety, advanced materials processing, advanced imaging, and the safe treatment and disposal of spent nuclear fuel.

Concentrations (Areas of Study)

- Applied Intelligent Systems
- BioElectrics and ElectroPhysics (BEEP)
- Materials Under Extreme Environment
- Nuclear Fusion and Fusion Technology
- Fuel Cycle and Waste Management
- Hydrogen and Fuel Cell
- Nuclear Materials
- Nuclear Systems Simulation
- Radiation and Neutron Detection and Interrogation
- Reactor Physics
- Thermal Hydraulics and Reactor Safety
- Nuclear Nonproliferation

Nuclear Engineering, MSNE

Nuclear Engineering, PHD

Nuclear Engineering, MNE

NUCL 50100 - Nuclear Engineering Principles

Credit Hours: 3.00. A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science or engineering. The course is structured in four parts: (1) Nuclear structure and radiation, biological effects and medical applications of radiation. (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality. (3) Nuclear materials and waste. (4) Reactor systems and safety.

Credits: 3.00

NUCL 50200 - Nuclear Engineering Systems

Credit Hours: 3.00. Engineering aspects of nuclear power. Materials of construction; fuel and fuel cycles; heat removal; radiation shielding; economics; and nuclear power systems. Permission of instructor required.

Learning Outcomes: 1. Able to apply knowledge of mathematics, science and engineering. 2. Demonstrate an ability to solve typical nuclear reactor calculations. 3. Develop a quantitative foundation of nuclear reactor safety, radiation protection and shielding. 4. Apply knowledge of mathematics and physics to the design of nuclear power reactor systems. 5. Able to design a reactor system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 6. Model engineering issues in nuclear reactor safety, radiation protection and shielding quantitatively and draw appropriate inferences. 7. Able to use the techniques, skills, and modern engineering tools necessary for nuclear reactor systems through a project. Credits: 3.00

NUCL 50300 - Radioactive Waste Management

Credit Hours: 3.00. Will familiarize students with the nature of the risks associated with radioactive waste and the history, regulations, and worldwide status for the safe storage of various types of radioactive waste. The sources, characteristics, and magnitudes of radioactive wastes are described, and the current and proposed engineered waste management systems are examined along with the analysis of their associated risks.

Credits: 3.00

NUCL 50400 - Nuclear Engineering Experiments

Credit Hours: 3.00. A laboratory course that, when coupled with NUCL 50100 , produces a sequence that contains both the theoretical and engineering aspects of nuclear engineering. Topics include radiation detection and analysis, neutronics, and nuclear reactor experiments.

Credits: 3.00

NUCL 51000 - Nuclear Reactor Theory I

Credit Hours: 3.00. Methodologies of neutron flux calculations, diffusion and slowing down theory, flux separation, material buckling, resonance absorption, Doppler effect, 2-group and multi-group theories, and reactivity balances for design and operation. Introduction to reactor kinetics, delayed neutrons, point reactor kinetics, transient behavior, load changes, reactivity feedback, and safety implications.

Credits: 3.00

NUCL 51100 - Reactor Theory And Kinetics

Credit Hours: 3.00. Advanced methodologies for neutron flux calculation, nodal methods, introduction to transport theory, transport correction, multigroup theory, and introduction to the generation of group constants. Reactor kinetics, perturbation theory, adjoint fluxes, reactivity calculation from perturbation theory, reactivity coefficients due to Doppler effect, temperature and density changes, void coefficient, and energy and power coefficients. Microkinetics, theory of reactivity measurements, approximate methods: prompt jump approximation, and prompt kinetics. Transients with feedback, safety implications, and spatial kinetics.

Credits: 3.00

NUCL 51200 - Computers In Reactor Analysis

Credit Hours: 3.00. The application of computational methods in reactor systems analysis. Theory behind modern numerical methods (e.g. SOR, Conugate Gradient, etc.) for solving large, sparse systems on linear equations that result from the

discretization of elliptical and parabolic partial differential equations. Applications include the multigroup, multi-dimensional neutron transport equation and two-phase flow fluid dynamics. Extensive use of MATLAB, FORTRAN, and UNIX(tm). No written exams, and the majority of problem sets are performed as group projects. Knowledge of FORTRAN required.

Credits: 3.00

NUCL 52000 - Radiation Effects And Reactor Materials

Credit Hours: 3.00. Introduction to radiation effects in solids and a survey of nuclear reactor materials. Radiation interaction mechanisms and effects on properties. Reactor material characteristics, selection criteria, testing, and economic considerations.

Credits: 3.00

NUCL 55100 - Mass, Momentum, And Energy Transfer In Energy Systems

Credit Hours: 3.00. Formulations for analyzing complicated thermal-hydraulic phenomena in energy systems. Derivation of two-phase flow field equations and constitutive relations. Thermal-hydraulic modeling of nuclear reactor systems. Analyses of nuclear reactor safety related phenomena based on conservation principles.

Credits: 3.00

NUCL 55200 - Thermal-Hydraulics And Reactor Safety

Credit Hours: 3.00. Applications of thermal-sciences to nuclear reactor safety design and risk assessment. Emphasis on illustrating the use of basic principles in quantitative safety assessments of practical and current interest. The basic topics revolve around multiphase transients and applications which include study of accident analysis and its applications to licensing for light water reactor systems and for liquid metal fast breeder reactor.

Credits: 3.00

NUCL 55300 - Nano-Macro Scale Applications Of Nuclear Technology

Credit Hours: 3.00. Introduction of the principles of nuclear science and engineering for addressing industrial and scientific issues ranging from sub-nano-to-macro scales. Areas to be covered include: propulsion, high-energy density materials, supercooling, medical applications, sonoluminescence, novel detection systems for special nuclear and contraband materials, and advanced nuclear fusion power systems.

Credits: 3.00

NUCL 55500 - Thermal Hydraulics Measurement And Instrumentation

Credit Hours: 3.00. Measurement techniques in fluid flow, heat transfer, and multi-phase flow. The principle and practice of measurement of temperature, flow, level, pressure, and void fraction (in two-phase flow systems) as applied to nuclear reactor systems. Instrument error and measurement errors, and data acquisition system using PC. Hands-on experience in the laboratory with instruments.

Learning Outcomes: 1. Demonstrate an understanding of the principles of instruments. 2. Demonstrate an ability to design an application of the instrument in fluid system. 3. Understand design concepts, design evaluation and application of a measurement system to practical systems. Credits: 3.00

NUCL 56000 - Introduction To Fusion Technology

Credit Hours: 3.00. Introduction to electricity and magnetism, magneto-fluid-mechanics and plasma physics. Thermonuclear reactions, power balances, macroscopic and microscopic instabilities. Principles of operation and conceptual design of Tokamaks, Mirror, Theta-Pinch, and Laser-Driven fusion reactors.

Credits: 3.00

NUCL 56300 - Direct Energy Conversion

Credit Hours: 3.00. Review of energy sources and study of the basic processes of direct energy conversion and their applications to energy utilization, based on both conventional and nuclear energy conversion schemes. Conventional schemes include thermoelectric, photovoltaic, thermionic, magnetohydrodynamic generators, fuel cell systems, etc.; and nuclear energy conversion schemes correspond to nuclear radiation and fusion energy conversion. Permission of instructor required.

Credits: 3.00

NUCL 57000 - Fuzzy Approaches In Engineering

Credit Hours: 3.00. Presentation of the mathematical fundamentals of fuzzy logic theory and a survey of engineering applications. Fuzzy sets; the extension principle; fuzzy numbers; fuzzy relations and composition; linguistic descriptions; implication operators and fuzzy algorithms are formally developed. Applications emphasize the engineering utilization of approximate reasoning to diagnostics, control, safety, and

decision-making problems.

Credits: 3.00

NUCL 57500 - Neural Computing In Engineering

Credit Hours: 3.00. Mathematical fundamentals of computing with neural networks. Survey of engineering applications. Computational metaphors from biological neurons. Artificial neural networks modeling of complex, nonlinear and ill-posed problems. Emphasizes engineering utilization of neural computing to diagnostics, control, safety, and decision-making problems.

Credits: 3.00

NUCL 58001 - Essential Communication Skills For Nuclear Engineering

Credit Hours: 3.00. Essential communications skills for engineers with emphasis on communicating subject matter specific to the nuclear engineering field. Includes instruction, practice, and detailed feedback on written, oral, and graphical communications. Students learn to access, evaluate, and synthesize technical literature and practice skills necessary to prepare a literature review. Ethics and professional responsibilities, along with contemporary global economic, social and political issues are among the topics discussed. The only prerequisite is admission to the graduate program in Nuclear Engineering.

Learning Outcomes: 1. Understand importance of developing strong communications skills. 2. Know and routinely practice effective written, oral and graphical communication skills. 3. Access, use and synthesize relevant technical literature. 4. Work effectively in a team. 5. Understand professional and ethical responsibilities. 6. Be aware of contemporary global economic, social, and political issues. Credits: 3.00

NUCL 59000 - Independent Study In Nuclear Engineering I

Credit Hours: 1.00 to 6.00. Independent study projects. Interested students seek a faculty instructor in their area of special interest and prepare a brief description of the independent project to be undertaken. May be taken for 1-6 credits in Fall, Spring, or Summer. May be repeated as many times as desired, but only a maximum of 6 credits may be counted for the degree program requirement. Permission of instructor required.

Learning Outcomes: 1. Vary due to coursework. Credits: 1.00 to 6.00

NUCL 59700 - Selected Topics In Nuclear Engineering I

Credit Hours: 1.00 to 3.00. Development of individual research and study projects. Permission of instructor required.

Learning Outcomes: 1. Vary with coursework. Credits: 1.00 to 3.00

NUCL 61000 - Nuclear Reactor Theory II

Credit Hours: 3.00. This course covers advanced reactor physics topics including the neutron transport theory, slowing down and resonance escape, and generalized perturbation theory. The neutron transport theory is the fundamental theory describing the neutron flux behaviors in nuclear systems. The slowing down and resonance escape calculations are essential for generating the multi-group cross sections required in the whole-core neutron transport calculations. The generalized perturbation theory is a powerful method for determining the changes in response parameters due to the variations in nuclide densities and microscopic cross sections. Prerequisites: NUCL 51000 and advanced engineering mathematics covering complex analysis, partial differential equations, and integral equations.

Learning Outcomes: 1. Demonstrate knowledge on advanced reactor physics topics (neutron transport theory, slowing down and resonance escape, and generalized perturbation). 2. Use computational methods to determine information regarding the aforementioned reactor physics topics. Credits: 3.00

NUCL 61200 - Applied Reactor Analysis

Credit Hours: 3.00. Reactor physics analysis of existing reactors and critical experiments through the use of digital computers and reactor programs. One-, two-, and three-dimensional solutions of the diffusion and transport equations. Calculation methods for lifetime effects on excess reactivity, power distribution, breeding ratio, and temperature, void, and Doppler coefficients of reactivity. Fuel shuffling and safety calculations for fuel handling and storage. Concurrent Prerequisite: NUCL 61000 .

Credits: 3.00

NUCL 62000 - Advanced Topics In Radiation Damage

Credit Hours: 3.00. Materials phenomena unique to nuclear

reactor environments are examined quantitatively. The relation between these phenomena and the structure and properties of engineering materials is discussed. Coupled phenomena are considered in relation to materials modeling codes. Prerequisite: NUCL 42000 and NUCL 52000 (or other related/similar courses).

Learning Outcomes: 1. Learn performance of nuclear materials in reactor environments. 2. Learn the effects of various radiations on materials damage and lifetime. 3. Learn methods and techniques to extend the lifetime, safety, and reliability of reactor components. Credits: 3.00

NUCL 64000 - Fast Reactor Theory

Credit Hours: 3.00. Course is designed to teach reactor physics specific to fast spectrum reactors and the associated computational methods. Topics include breeding and actinide burning capabilities, core design implications, and reactivity feedback mechanisms. Computational methods will be specific to fast reactor physics analysis and include the fast neutron spectrum calculation, group constant generation and reactivity feedback calculations for Doppler, thermal expansions, and sodium void. Prerequisites: NUCL 51100 and advanced engineering mathematics covering complex analysis, partial differential equations, and integral equations.

Learning Outcomes: 1. Demonstrate essential knowledge of fast reactor theory. 2. Demonstrate working knowledge of the associated computational methods and codes. Credits: 3.00

NUCL 65000 - Thermal Hydraulics For Nuclear Reactor Safety

Credit Hours: 3.00. Safety philosophy, levels and goals of safety. Approaches used for nuclear reactor safety for the protection of public health. Design basis accidents. Engineered safeguards and inherent safety features. Fundamentals of safety related thermal-hydraulic phenomena and their integration into a methodology for containment assessment. Prerequisite: ME 50500 .

Credits: 3.00

NUCL 65100 - Dynamics Of Nuclear Thermal-Hydraulics System

Credit Hours: 3.00. This course discusses and analyzes various two-phase flow instabilities important for nuclear reactor systems. For the interfacial stabilities, Kelvin-Helmholtz and Rayleigh-Taylor instabilities as well as flooding and flow reversal instabilities are addressed. For the static instabilities, flow excursion instability that can reach the critical heat flux condition is analyzed relative to fast reactor and high flux research reactors. For the dynamic instabilities the density wave instabilities are discussed in detail. The characteristic equation is obtained and how to determine the stability of the system is discussed. Both the encirclement theory and the D-Partition stability boundary theory are explained. In addition, each student's research is studied through presentations, questions and discussions. Permission of instructor required. Prerequisites: NUCL 55100 and NUCL 55200.

Learning Outcomes: 1. Understand the Physics and Analytical Method to Solve Interfacial Instabilities in Two-phase Flow, Static Instabilities, Flow Excursion and Flow Reversal Dynamic Instability caused by Kinematic Waves. 2. Understand the implications in Interfacial Structures in Coolant in Nuclear Reactors, Sodium Cooled Fast Reactor, Safety High Flux Research Reactor and Isotope Production Reactors, Boiling Water Reactor Designs, and Natural Circulation Passively Safe Reactors. 3. Learn about Small Perturbation Method, Characteristic Equation, Response Function, Encirclement Theory, D-Partition Method and Stability Map. 4. Learn how to present research progress and analyze and discuss it. Credits: 3.00

NUCL 65500 - Two-Phase Flow Computational Fluid Dynamics Applications

Credit Hours: 3.00. The course guides the student to two-fluid model solutions using computational fluid dynamics (CFD). Topics include: review of the two-fluid model, review of elliptic and parabolic partial differential equations, description of numerical algorithms, and two-phase flow channel and jet flows. Prerequisite: NUCL 56000 .

Learning Outcomes: 1. Understand basic principles of hyperbolic and parabolic partial differential equations applied to the equations of fluid dynamics. 2. Use finite differences to solve partial differential equations of fluid dynamics. 3. Apply principles in 1 and 2 to simulations with Navier Stokes and Two Fluid Model Equations. 4. Employ stability theory to analyze the Two

Fluid Model. Credits: 3.00

NUCL 66000 - Magnetic Confinement Fusion

Credit Hours: 3.00. Applications of plasma physics for analysis and design of plasma configurations in fusion reactors. Topics include beam-driven fusion systems, plasma heating and ignition via neutral beams and RF wave heating, plasma waves, kinetic and fluid descriptions of plasmas, and energy transport; blanket neutronics for tritium breeding, energy conversion, and reactor design considerations. Prerequisite: NUCL 56000 .

Credits: 3.00

NUCL 66100 - Inertial Confinement Fusion Technology

Credit Hours: 3.00. Inertially confined thermonuclear fusion reactions and energy gains; laser-plasma interactions; hydrodynamic compression; energy transports including electron thermal conduction and radiation transport; beam transport and instabilities; driver energy deposition and the driver development for lasers, particle beams and accelerators; and target designs. Approval of Instructor required. Prerequisite: NUCL 56000 or equivalent.

Learning Outcomes: 1. Understand the physics of inertial confinement fusion. 2. Explore the engineering issues associated with the concepts and applications of beam drivers, targets, and chambers leading to target ignition and energy conversions. Credits: 3.00

NUCL 69000 - Independent Study In Nuclear Engineering II

Credit Hours: 1.00 to 6.00. Independent research projects. Interested students seek a faculty instructor in their area of special interest and prepare a brief description of the independent project to be undertaken. May be taken for 1-6 credits in Fall, Spring, or Summer. May be repeated as many times as desired, but only maximum of 6 credits may be counted for the degree program requirement. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes will vary based on coursework. Credits: 1.00 to 6.00

NUCL 69600 - Nuclear Engineering Seminar

Credit Hours: 0.00. Discussion by graduate students and invited speakers of their research projects and topics of interest in nuclear engineering. Prerequisite: Master's student standing and Nuclear Engineering majors only.

Credits: 0.00

NUCL 69700 - Selected Topics In Nuclear Engineering II

Credit Hours: 1.00 to 3.00. Courses on topics of contemporary importance or special interest in nuclear engineering. Hours and credits to be arranged. Permission of instructor required.

Learning Outcomes: 1. Vary based on coursework. Credits: 1.00 to 3.00

NUCL 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

NUCL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

College of Education (Graduate)

Department of Curriculum and Instruction (Graduate)

Website: **https://www.education.purdue.edu/departments/department-of-curriculum-and-instruction/**

Department/School Head

Selcen Guzey

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Faculty	Research Faculty
Janet Alsup Laura Bofferding Nadine Dolby Selcen Guzey Chrystal Johnson Signe Kastberg Melanie Kuhn Stephanie Masta Trisha Morita-Mullaney Jill Newton Kathryn Obenchain Anatoli Rapoport Sanjay Rebello Jennifer Richardson Allen Talbert Phillip VanFossen Bill Watson Sunnie	Jake Burdick Marisa Exter Tara Star Johnson Rachael Kenney Adrie Koehler Muhsin Menekse Nathan Mentzer Hui-Hui Wang	Rebekah Hammack Breanya Hogue Sarah LaRose Danielle Malone Amber Neal-Stanley Brenda Sarmiento-Quezada Ofelia Schepers Christy Wessel-Powell	John Broome Virak Chan Janine Duncan Holly Fiock Brown Wanju Huang Isaiah Kent-Schneider Sarah Larison Mary Ellen Lennon Victoria Lowell Kathy Martin Fay Mentzer Stephanie Oudghiri Alsion Warren	Virginia Bolshakova Jennifer Renn

Watson Wayne Wright				

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Academic Programs

Master's and PhD Programs

The Department of Curriculum and Instruction provides graduate programs of study in diverse areas encompassing teacher education, higher education, and education for business and industry. The department prepares education professionals for leadership positions in schools, higher education, and the workplace. Faculty members conduct research on the teaching and learning process across a wide variety of educational contexts. The department strives to provide first-rate educational leadership in a diverse, interconnected, and technology-rich world.

Teacher Licensing (graduate licensure programs)

For information on which Graduate programs lead to an Instructional or Administrative State of Indiana Educator License, and the obligations therein, visit the Office of Teacher Education and Licensure (OTEL) Graduate Programs website.

Graduates of accredited universities and colleges who wish to enter Purdue University to complete requirements for an Indiana initial or Advanced License should contact the Office of Teacher Education and Licensure for the appropriate procedures. Graduates who wish to complete licensure requirements may do so on the same basis and criteria as other graduate students. Such applicants must meet the general admission requirements of the department and the Graduate School, as well as obtain permission from the Office of Teacher Education and Licensure (OTEL) to enter the specific licensure program in which they are interested. Students must meet all degree (if applicable), Teacher Education Program, and Indiana licensure requirements prior to being recommended for licensure by the Office of Teacher Education and Licensure (OTEL).

Curriculum and Instruction, EDS

K-12 Technology Integration, Post-Baccalaureate Certificate

Teaching English Language Learners in K-12, Post-Baccalaureate Certificate

Qualitative Research, Post-Baccalaureate Certificate

Dual Language Bilingual Education, Post-Baccalaureate Certificate

K-12 Integrated STEM Education, Post-Baccalaureate Certificate

Workplace Learning, Post-Baccalaureate Certificate

Distance Education, Post-Baccalaureate Certificate

Leadership Development Program: Advanced Manufacturing Education, Post-Baccalaureate Certificate

Leadership Development Program: Career Education, Post-Baccalaureate Certificate

Leadership Development Program: Generalizable Skills Instruction, Post-Baccalaureate Certificate

Leadership Development Program: Special Needs, Post-Baccalaureate Certificate

Leadership Development Program: Work-based Learning, Post-Baccalaureate Certificate

Instructional Design, Post-Baccalaureate Certificate

Curriculum and Instruction: English Language Learning Concentration, MSED

Curriculum and Instruction: Educational Technology Concentration, MSED

Curriculum and Instruction: Gifted, Creative, and Talented Studies Concentration, MSED

Curriculum and Instruction: Integrated STEM Education Concentration, MSED

Curriculum and Instruction: Mathematics Education Concentration, MSED or MS or PHD

Curriculum and Instruction: Agricultural and Extension Education Concentration, MSED or MS or PHD

Curriculum and Instruction: Career and Technical Education Concentration, MSED or MS or PHD

Curriculum and Instruction: Curriculum Studies Concentration, MSED or MS

Curriculum and Instruction: English Education Concentration, MSED or MS or EDS

Curriculum and Instruction: Learning Design and Technology Concentration, MSED or MS

Curriculum and Instruction: Learning Design and Technology Concentration, MSED or MS (OL)

Curriculum and Instruction: Literacy and Language Education Concentration, MSED or MS

Curriculum and Instruction: Science Education Concentration, MSED or MS

Curriculum and Instruction: Art Education Concentration, PHD

Curriculum and Instruction: Curriculum Studies Concentration, PHD

Curriculum and Instruction: English Education Concentration, PHD

Curriculum and Instruction: Learning Design and Technology Concentration, PHD

Curriculum and Instruction: Literacy and Language Education Concentration, PHD

Curriculum and Instruction: Science Education Concentration, PHD

Curriculum and Instruction: Social Studies Education Concentration, PHD

Curriculum and Instruction: Special Education Concentration, MSED or MS (OL)

EDCI 50000 - Foundations Of Literacy

Credit Hours: 3.00. Survey course in the acquisition of and instruction in reading, writing, and other aspects of language.

Learning Outcomes: 1. Develop a broad background and comprehensive understanding of literacy history, theory, and the socio-cultural influences that have shaped research and practice in the field. 2. Examine the constructs of reading and literacy from multiple theoretical perspectives, and in differing historical contexts. 3. Use new understandings to critically examine current theoretical perspectives and instructional practices. Credits: 3.00

EDCI 50600 - Environmental Education

Credit Hours: 3.00. Synthesis of philosophies, scientific principles and methods for environmental education programs in forests, camps, and schools. Students conduct and summarize literature research on scientific and educational principles. In interdisciplinary teams, they develop, implement, and evaluate curricula for schools, nature centers, interpretive and outdoor education programs.

Learning Outcomes: 1. Become knowledgeable

of national environmental educational programs and curriculum. 2. Develop the knowledge and skills to plan, implement, and evaluate environmental education programs, curriculum and materials. 3. Develop an understanding about learners and pedagogical methods for teaching about the environment and assessing learners. Credits: 3.00

EDCI 51000 - Colloquium In Science And Mathematics Education

Credit Hours: 1.00. Weekly colloquia on individual research topics of interest to science and mathematics education faculty and graduate students. Colloquia will describe research programs in education. Course will be required of first-year graduate students.

Credits: 1.00

EDCI 51200 - Mathematics In The Secondary School

Credit Hours: 3.00. Models of mathematics learning, current curriculum trends and practices with emphasis on laboratory and individualized systems; designing instructional materials.

Learning Outcomes: 1. Develop lesson plans promoting students' development of conceptual and procedural understanding of mathematics. 2. Develop understanding of student learning and development in mathematics by engaging in tasks similar to those that might be given to students. 3. Develop understanding of curriculum in context through teaching and working on mathematical problems from a variety of texts. 4. Develop understanding of the scope and significance of secondary school mathematics through examinations of standards and mathematics education research. 5. Develop professionally through the demonstration of professional attitudes and work habits as well as the identification of professional organizations and resources available locally and nationally. Credits: 3.00

EDCI 51300 - Foundations Of Learning Design And Technology

Credit Hours: 3.00. Provides an historical overview of the field and delineates the foundational knowledge, skills, and attitudes needed by professionals in the field of educational technology and instructional design. Students explore the field by engaging in collaborative projects, along with thinking and writing about various aspects of educational technology and the underlying instructional design theories.

Learning Outcomes: 1. Explain/describe the history and foundations of the field. 2. Define learning design and technology and distinguish among its components and related fields. 3. Identify and describe current and emerging issues in the field. 4. Initiate steps toward becoming a professional in the field of learning design and technology. Credits: 3.00

EDCI 51600 - Seminar In Environmental Education

Credit Hours: 3.00. The seminar covers current research and literature in environmental education, focusing on teaching children and adults about the environment. Topics vary by semester and student interest.

Learning Outcomes: 1. Develop an understanding of the research literature in environmental education pertaining to the topic of study. 2. Develop critical thinking and analysis skills for evaluating environmental education research, programs, and curriculum. 3. Develop an understanding of environmental issues. Credits: 3.00

EDCI 51700 - Survey Of Science Education

Credit Hours: 3.00. Introduction to current issues and research in science education, broadly organized under themes of learning, teaching, and science curriculum.

Credits: 3.00

EDCI 51800 - The Nature Of Science In Science Teaching

Credit Hours: 3.00. Explores philosophical issues related to the scientific enterprise, such as the production and validation of scientific knowledge; the role of the scientific community; and the influence of gender and culture on doing science. Also

examines the implications of these issues for science teaching and learning, as well as for research in science education.

Learning Outcomes: 1. Develop an understanding of various philosophical positions on the nature of science. 2. Develop an understanding of your own views of the nature of science. 3. Develop an understanding of the roles of scientists, the greater society, culture, and gender in the creation and validation of scientific knowledge. 4. Develop an understanding of students' and teachers' ideas about the nature of science. 5. Develop an understanding of the implications of various perspectives on the nature of science teaching and learning. Credits: 3.00

EDCI 51900 - Teaching English Language Learners

Credit Hours: 3.00. This course focuses on current issues and techniques in ESL instruction and assessment for students at the beginning or intermediate stages of English language acquisition Pre-K-12. Emphasis is on the design of materials and instruction that foster English language development in the content areas of the curriculum (i.e., Specially Designed Academic Instruction in English or SDAIE). Some familiarity with elementary and/or secondary teaching methods is assumed.

Learning Outcomes: 1. Design materials and instruction that foster English language development in the ENL classroom environment as well as in content areas of the curriculum. Credits: 3.00

EDCI 52001 - Curriculum And Instruction Online MS Seminar I

Credit Hours: 1.00. This boot camp is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Curriculum and Instruction program. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn about various learning strategies and online resources that you can utilize in your courses. In this seminar, you will be responsible for completing all assignments on time over the course of the semester. Read the guidelines for each week and complete the assignments. NOTE: This course is a core course in the C&I online masters program. A grade of B- or better is required (if a lower grade is received, the course must be retaken). Permission of department required.

Learning Outcomes: 1. Exhibit knowledge of academic integrity by completing plagiarism, statement of commitment, and APA tutorials. 2. Effectively explain your professional goals for the program by writing an initial reflection. 3. Identify essential components of the Curriculum and Instruction Handbook, including what is required for the final portfolio. 4. Develop and apply group project skills and management techniques to make you successful in future courses and your career. 5. Demonstrate digital skills and competence with various digital tools (i.e., blogs, screencasting, Google docs, file sharing). 6. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 1.00

EDCI 52002 - Curriculum And Instruction Online MS Seminar II

Credit Hours: 1.00. This seminar is designed to help you to understand the knowledge and skills necessary for your success throughout the Curriculum and Instruction program. In addition to providing you with information that will help you succeed in the program, you are also asked to think about ways to make yourself more marketable to current and future employers. Permission of department required.

Learning Outcomes: 1. Investigate the skills and knowledge needed to be successful in a relevant career within the C&I field. 2. Describe program and career goals. 3. Apply research skills required to compose an annotated bibliography. 4. Create the foundation of a C&I portfolio displaying programmatic achievements and course competencies. Credits: 1.00

EDCI 52003 - Theories And Trends In Curriculum And Instruction

Credit Hours: 3.00. This course focuses on current theories and trends influencing curriculum and instruction. A theory is a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena. It is a belief, policy, or procedure proposed or followed as the basis of action. A trend, on the other hand, is a pattern of gradual change in a condition, output, or process. It reflects a general tendency of a series of

moves in a certain direction over time. We will focus on understanding sources of current theories and trends and how they may influence work in curriculum and instruction. Permission of department required.

Learning Outcomes: 1. Examine and clarify the educational beliefs, values, and knowledge guiding your curricular and instructional decisions. 2. Utilize and evaluate multiple appropriate sources in researching current curriculum and instruction trends and issues. 3. Interpret, critique, and synthesize relevant research related to current curriculum and instruction trends. 4. Assess the implications of research relative to your curricular and instructional practices. 5. Interpret, critique, and synthesize relevant educational theories related to current curriculum and instruction trends. 6. Assess the implications of educational theories relative to your curricular and instructional practices. 7. Interpret, critique, and synthesize relevant state and national policy decisions related to current curriculum and instruction trends. 8. Assess the implications of state and national policy decisions relative to your curricular and instructional practices. 9. Communicate effectively in oral and written formats. 10. Demonstrate the disposition for life-long learning and continuous professional development. 11. Identify communities of practice within discipline and participate within these communities according to the ethical standards of the discipline. 12. Examine and clarify how your educational beliefs, values, and knowledge guide your curricular and instructional decisions address the diversity of students, schools, and communities. 13. Advocate for values of diversity, inclusivity, and social justice. Credits: 3.00

EDCI 52004 - Teachers As Leaders

Credit Hours: 3.00. This course focuses on teacher leadership in instruction. Participants will examine the history of teacher leadership. Instructional coaching models will be examined and compared. Students will identify the various theories that support each coaching model and examine what is most present in their school contexts. Permission of department required.

Learning Outcomes: 1. Investigate the construct of school leadership. 2. Evaluate potential leadership roles in classrooms, schools, or other organizations. 3. Research teacher leadership praxis to impact future praxis. 4. Synthesize leadership research in conjunction with theories of social justice and equity. 5. Analyze the skills of effective teacher leadership through collaboration and inquiry. 6. Explore the critical role teachers play in creating conditions for continuous and systematic improvements in education. Credits: 3.00

EDCI 52301 - Foundations Of Bilingual Education

Credit Hours: 3.00. This course builds foundational and practical knowledge of children's bilingual development and the sociocultural, cognitive, philosophical, and educational basis for high-quality dual language and other bilingual education programs. It focuses on research and current issues related to the bilingual development of emergent bilinguals in K-12 contexts. It is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify the various dimensions of bilingualism, bilingual language use, and bilingual language ability. 2. Outline the dimensions of language proficiency and the challenges of measuring bilingualism. 3. Describe development processes and types of early and late development of bilingualism. 4. Describe the role of translanguaging in bilingual language development and use, and the connections between identity and bilingualism. 5. Describe the role of languages in society, including factors that contribute to language maintenance and loss. 6. Describe the cognitive aspects bilingualism. 7. Identify the features of

various models of bilingual education and the theories that guide their implementation. 8. Describe historical and current policies, court decisions, and legislation that have shaped bilingual education. 9. Identify the essential features of strong bilingual programs that lead to high levels of bilingualism and biliteracy. 10. Explore the findings of specific research studies that provide evidence of the effectiveness of well-designed bilingual education programs. 11. Describe the ways bilingual education programs can address the needs of a all bilingual students, including students with exceptionalities and special needs. Credits: 3.00

EDCI 52401 - Teaching Methods In Bilingual Education

Credit Hours: 3.00. Application of theory, research, and guiding principles to providing high-quality instruction in dual language and other bilingual education programs in K-12 education. This course includes a specific focus on both program-level design of effective dual language programs, and effective language and literacy instruction for emergent bilingual students leading to high levels of bilingualism, biliteracy, and academic achievement. This course is designed for pre-service and in-service bilingual teachers and administrators, in addition to other teachers of English language learners and researchers interested in high-quality and equitable educational programs for bilingual students.

Learning Outcomes: 1. Identify and describe the principles and key aspects of the structure and curriculum of dual language bilingual education programs. 2. Define biliteracy and the key components of the Literacy Squared model. 3. Identify and describe the principles and key aspects of effective oral language instruction and the development of metalinguistic skills. 4. Identify and describe the principles and key aspects of effective reading instruction across two languages. 5. Identify and describe the principles and key aspects of effective writing instruction across two languages. 6. Identify and describe the principles and key aspects of effective assessment practices across two languages. 7. Develop effective lesson plans for bilingual and biliteracy development. 8. Identify and describe the principles and key aspects of whole school considerations in supporting effective dual language bilingual education programs. Credits: 3.00

EDCI 52600 - Language Study For Educators

Credit Hours: 3.00. (ENGL 52900) Covers foundational knowledge in language and linguistics for teachers and educational researchers. Topics include structure and functions of language, language acquisition and development, language diversity, classroom discourse, language and media, and literacy-language arts curriculum. A foundation for work in Literacy and Language Education.

Learning Outcomes: 1. Understand the concepts and theories of how second (and more) languages are acquired and processed through an examination of current research into second language acquisition. 2. Examine this research to develop a greater understanding of the issues and challenges faced by students as they learn English as a New Language, and how teachers can develop practice which address these needs. Credits: 3.00

EDCI 52800 - Human Performance Technology

Credit Hours: 3.00. This course provides an introduction to the field of human performance technology (HPT). It examines basic concepts and principles of human performance, the theoretical underpinnings of the field, research and application literature, and various approaches to solving human performance problems. A systematic approach to the analysis, design, development, implementation and evaluation of performance improvement interventions within organizations is emphasized.

Learning Outcomes: 1. Identify the major theoretical underpinnings of the field of HPT. 2. Describe the relationship between the systematic development of instruction and HPT. 3. Analyze a human performance system in order to diagnose a performance gap. 4. Determine whether training, a non-training performance intervention, or a combination is

most appropriate for a given situation. 5. Construct a systemic plan to address performance issue(s), including coordinated interventions and evaluation strategies. 6. Design appropriate interventions to address specific performance gaps. Credits: 3.00

EDCI 53000 - English Language Development

Credit Hours: 3.00. Focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. Links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop increased understanding of the English language development process by English language learners (ELLSs). 2. Describe the importance of the changing demographics in the U.S. and Indiana as they relate to ELLs. 3. Explore the literacy development of ELLs in broader sociocultural contexts. 4. Describe the importance of explicit teaching and the oral and written language development for ELLs. 5. Develop understanding of the nature and role of culture in language development and academic achievement, considering the development of literacy and biliteracy by ELLS. 6. Explore how individual differences affect English language development. 7. Gain experience in identifying the learning challenges of ELLs and assessing ELLs' learning in P-12 classrooms. 8. Collaborate with colleagues in activities and assignments and in planning to build partnerships with ELLs' families. 9. Develop understanding of their roles as ELL teachers and professionals in advocating on behalf of ELLs. 10. Discuss the role of the teacher in the English language development of ELLs. Credits: 3.00

EDCI 53100 - Learning Theories And Instructional Design

Credit Hours: 3.00. This course has been designed to help you learn how theories of human learning and motivation can be applied to the instructional process in order to make the process more effective, efficient, and/or appealing. The focus of the course is on two areas: 1) the theoretical principles that have contributed to the field of Instructional Design (ID), and 2) how those principles can be applied within practical settings.

Learning Outcomes: 1. Identify, describe, and explain the basic tenets of behavioral, cognitive, and constructivist learning theories. 2. Compare and contrast the contributions of various learning theories to the field of instructional design. 3. Identify and describe the basic components within various motivational theories and their impact upon the learning process. 4. Select appropriate principles derived from given theories and apply those within practical learning situations. Credits: 3.00

EDCI 53300 - Teaching And Learning Number And Operations

Credit Hours: 3.00. This course is designed to provide opportunities for mathematics educators to develop understanding of teaching and learning in the domain of number and operation. Central to this work is the construction of models of learners' understanding of number and operation and the use of those models to build and select curriculum. While curricular efforts have historically taken as central a formal view of mathematics and its construction, more recently curriculum has been written to engage learners and to build from knowledge of learners' understanding. In this course we will develop models of learner's understandings of different facets of number and operation and then use those models and our emerging understanding of curriculum to explore challenges in teaching and learning.

Learning Outcomes: 1. Develop models of learner's understandings of number and operation. 2. Use models of learner's understandings of number and operation to design and select appropriate and productive learning opportunities. 3. Develop knowledge of key curricular development in mathematics education in the United States. 4. Associate teaching and curriculum with understandings of

number and operation they might generate. 5. Use technology to support the development of ideas in number and operation. 6. Synthesize existing research to support inquiry in the teaching and learning of number operation. Credits: 3.00

EDCI 53400 - Teaching And Learning Geometry And Measurement

Credit Hours: 3.00. This course is designed to provide opportunities for mathematics educators to develop understanding of teaching and learning in the related domains of geometry and measurement. Central to this work is the construction of models of learners' understandings of geometry and measurement and the use of models to design instruction. Geometry, as a discipline in school mathematics, has historically and more currently been debated. In this course we will explore research in the teaching and learning of geometry and measurement. A synthesis of select literature will inform our efforts to develop models of learners' geometric reasoning and understanding of measurement. We will move past the development of models to the design of instruction meant to support understandings of concepts that utilizes technology.

Learning Outcomes: 1. Develop models of learner's understanding of measurement and concepts in geometry. 2. Use models of learner's understanding to design and select appropriate and productive learning opportunities. 3. Develop knowledge of the history of geometry as a school mathematics subject in the United States. 4. Develop and articulate a perspective on teaching and learning geometry and measurement with technology. 5. Synthesize existing research to support inquiry in the teaching and learning of geometry and measurement. Credits: 3.00

EDCI 53500 - Teaching And Learning Algebra And Functions

Credit Hours: 3.00. This is a course for current or prospective mathematics teachers wishing to explore ways of teaching algebra with a focus on addressing concerns related to student performance in algebra and increasing algebraic reasoning skills in the classroom. The course includes experiences with inquiry-based learning by engaging participants in algebra activities from two secondary National Council of Teachers of Mathematics (NCTM) standards-based curricula. The course will provide opportunities for participants to collaborate on the development of algebraic thinking in mathematics classrooms and will address pedagogical approaches to students' learning of algebra.

Learning Outcomes: 1. Content and pedagogical knowledge for teaching algebra. 2. Familiarity with NCTM standards-based mathematics curricular. 3. Disposition that values students' contributions and desires to motivate students to learn algebra using a variety of strategies, including engaging them in making sense of algebraic concepts and making use of their life experiences to find relevant contexts for algebra. Credits: 3.00

EDCI 53600 - Teaching And Learning Data Analysis And Probability

Credit Hours: 3.00. This course will provide opportunities for the growth of middle school mathematics teachers understanding of data analysis and probability as a means to help analyze and interpret experienced events. The course will address the following: selecting and using appropriate statistical methods to analyze data, developing and evaluating inferences and predictions that are based on data, and understanding and applying the basic concepts of probability. This course will also address pedagogical approaches to students' learning of data analysis and probability.

Learning Outcomes: 1. Employ research-based instructional strategies to develop statistical understanding in middle, secondary and tertiary settings, and for teacher professional development. 2. Develop tasks, questions, and lessons that can be used to assess as well as further develop students' understanding of statistics and probability. 3. Read and interpret research results and classroom-based articles that describe students' statistical and probabilistic reasoning. 4. Reflect on course readings and their practical teaching experience to consider how to best teach statistical and probability concepts. Credits: 3.00

EDCI 53900 - Introduction To K-12 Integrated Science, Technology, Engineering And Mathematics (STEM) Education

Credit Hours: 3.00. This course will provide students with a

conceptual understanding of integrated K-12 Science, Technology, Engineering and Mathematics (STEM) education and the nature of the disciplines of STEM. Students will explore implications for the teaching and learning of integrated STEM in a K-12 context through an evaluation of integrated approaches to STEM, national teaching standards and current research.

Learning Outcomes: 1. Explore the nature of the disciplines of STEM and their roles in a K-12 integrated STEM context. 2. Identify current approaches to integrated STEM education. 3. Explore issues related to diversity and equity in STEM education. 4. Define and describe how reform-based teaching and learning relates to nature of the disciplines of STEM. 5. Summarize the current research on teaching and learning through integrated STEM approaches. 6. Develop STEM integration activities for K-12 settings. 7. Develop an action research proposal to study a problem of interest in teaching or learning in K-12 STEM settings. Credits: 3.00

EDCI 54100 - Contemporary Issues In Career And Technical Education

Credit Hours: 3.00. Identification, analysis, synthesis, and implications of current issues and problems in career and technical education at the elementary, secondary, postsecondary, and adult levels; policy and literature review; formulation of alternatives and solutions.

Learning Outcomes: 1. Identify and analyze existing policy and programmatic problems and issues in career and technical education and related disciplines and fields. 2. Synthesize and summarize contemporary literature relating to problems and issues. 3. Formulate alternatives and solutions to existing problems and issues. 4. Examine the implications and potential impact (short- and long-range) of problems and issues in career and technical education for society and education in general. Credits: 3.00

EDCI 54300 - Instruction In Career And Technical Education

Credit Hours: 3.00. Contemporary trends and methods in teaching career and technical programs, learning styles and teaching styles, and a variety of creative instructional strategies for different educational contexts will be identified and analyzed.

Learning Outcomes: 1. Develop an understanding of the instructional process and learning theory in career and technical education and business and industry training. 2. Provide an overview of the major influences on learning and learning environments. 3. Acquire skills in instructional planning, implementation, and evaluation. 4. Analyze a variety of instructional strategies and resources in career and technical education and training. 5. Review and analyze instructional literature and research in career and technical education. 6. Gain experience in instructional planning and delivery. Credits: 3.00

EDCI 54400 - Career And Technical Education For Special Needs Learners

Credit Hours: 3.00. Legislative initiatives; identification of special needs learners at the elementary, secondary, postsecondary, and adult levels; learning characteristics; assessment; individualized planning; instructional adaptations; school and community resources; exemplary program models; research, trends, and issues; and evaluation.

Learning Outcomes: 1. Describe the major historical and contemporary legislative provisions affecting the delivery of career and technical education to special needs learners. 2. Identify and describe the educational characteristics of special needs learners, including students with disabilities, disadvantaged students, gifted and talented learners, non-traditional learners, and limited-English proficient speakers. 3. Describe and use appropriate strategies for assessment of the career needs, learning styles, and progress of special needs learners. 4. Develop and evaluate individualized education, career, and transition plans for a special needs learner. 5. Select and use appropriate instructional strategies, procedures, and materials. 6. Identify and select appropriate community, business,

industry, school, governmental agency, occupational, and professional resources. 7. Compare and contrast various exemplary program models for special needs learners. 8. Evaluate the major professional trends, issues, and implications for career and technical education programs for special needs learners. Credits: 3.00

EDCI 54500 - Planning In Career And Technical Education

Credit Hours: 3.00. Principles and strategies in planning new and improving existing career and technical education programs, strategic planning, needs assessment, community and workforce market research, information and data analysis, program improvement. Permission of Department required.

Learning Outcomes: 1. Develop an understanding of the principles and strategies in planning CTE and workforce education programs. 2. Provide an overview of the CTE district program plan. 3. Review Federal CTE and workforce education legislative planning regulations and guidelines. 4. Examine State CTE and workforce education legislative planning regulations and guidelines. 5. Critique various strategic planning models, strategies, and procedures. 6. Describe strategies for advocating for diversity and access and equity for special needs populations in CTE program planning policy and practice. 7. Evaluate local and CTE district planning factors and considerations. 8. Discuss community needs assessment and workforce market research, information and data analysis, and use of findings in decision-making. 9. Describe strategies for organizing and collaborating with program advisory committees. 10. Explain continuous program evaluation and improvement. Credits: 3.00

EDCI 54501 - Teaching STEM Through Agriculture, Food, And Natural Resources

Credit Hours: 3.00. The course focuses on the background and history of STEM movement and agricultural education, contemporary models, strategies, and justification for incorporation of science, technology, engineering and mathematics (STEM) concepts and practices into K-12 formal and non-formal agricultural education programs. Consider and develop the best practices for STEM teaching and learning and enhancement of STEM content in agriculture, food and natural resources (AFNR) context. The goal of the course is to help students develop knowledge about STEM integration and equip them with teaching knowledge and skills for designing K-12 lesson plans by using integrated STEM through AFNR. Students will learn strategies that promote engagement in integrated STEM through AFNR activities. At the end of the course, students should be able to design and implement research-based integrated STEM through AFNR lesson plans and assessment plans.

Learning Outcomes: 1. Analyze integrated models of STEM learning, and justify how a selected model informs best practices for science and agriculture, food, and/or natural resources teaching and learning. 2. Evaluate current national and state standards that help design lesson plans in non formal, and formal educational contexts. 3. Develop lesson plans by using agriculture, food, and/or natural resources as context to teach STEM content and concepts. 4. Describe life and 21st century skills that are relevant in agriculture, food, and/or natural resources contexts and demonstrate how these skills can be integrated into lesson plans. 5. Create an assessment plan to evaluate learning outcomes. 6. Apply learner-centered teaching strategies, such as inquiry-based learning, to teach the lesson plans. 7. Create a manuscript that can be used to disseminate the integrated STEM lesson to professional audiences. Credits: 3.00

EDCI 54800 - Teaching Mathematics To Diverse Learners

Credit Hours: 3.00. This course is designed to provide opportunities for in-service teachers to engage around issues of equity in mathematics education. Equity here is used as a broad construct intended to help us think about how to provide meaningful opportunities to learn for all the students in our mathematics classrooms. The notion of "diverse" here is also taken broadly. All students have special needs, but it is

sometimes helpful to think about the needs of particular groups of students while at the same time avoiding reducing differences among students to stereotypes. Issues of diversity here include, but are not limited to race, culture, gender, disabilities, language, SES, and sexual orientation.

Learning Outcomes: 1. Increased awareness of diverse learners' challenges in mathematics education. 2. Developed discourse for equity issues in mathematics education. 3. Knowledge of strategies to facilitate diverse learners' mathematical learning. Credits: 3.00

EDCI 54900 - Assessment In STEM Education

Credit Hours: 3.00. This course is designed to help teachers of STEM recognize the link between productive assessment and productive instruction, using the STEM education standards for teacher competence in educational assessment. This course is designed to help teachers meet those professional standards and understand the public pressure as well as instructional need for effective formative and summative assessment.

Learning Outcomes: 1. Choose appropriate assessment methods. 2. Develop appropriate assessment methods. 3. Administer scoring and interpreting assessment results. 4. Use assessment results to make decisions about individual students, plan teaching and develop curriculum. 5. Communicate assessment results to students, parents, and other educators. 6. Recognize inappropriate assessment methods and uses of assessment information. Credits: 3.00

EDCI 55000 - Career Education

Credit Hours: 3.00. An overview of contemporary legislation, educational reform, trends, and issues; career education program models; vocational and technical education, technology prep, and school-to-work systems; partnerships; foundations of career education; career development; curriculum; career guidance and counseling; career assessment; career planning practices; learning styles and instructional strategies; career information sources and resources; exemplary programs; and special needs populations and practices.

Learning Outcomes: 1. Describe the major legislative provisions and educational reforms affecting the delivery of career education. 2. Evaluate significant trends in career education, and professional and social issues. 3. Identify and adapt (a) career education model(s). 4. Describe the Career and Technical Education, Tech Prep, Career Pathways, and School-to-Career delivery systems. 5. Discuss effective partnerships between and among the school, the community, and business and industry. 6. Describe the foundations of career education. 7. Explain the career development process. 8. Identify the roles of elementary, middle, high school, postsecondary, and adult education; and business and industry in career education. 9. Develop career education curriculum; career clusters and pathways; and occupational, job, and task analysis. 10. Apply career guidance and counseling practices and procedures. 11. Utilize career assessment strategies. 12. Implement career planning practices and procedures. 13. Adapt appropriate learning styles and instructional strategies for individual learners. 14. Locate and use career information sources. 15. Identify, select, and utilize appropriate career information resources related to the school, community, governmental agency, occupational, and professional resources. 16. Identify, compare, contrast, and adapt exemplary career education programs. 17. Identify special needs populations and effective practices. Credits: 3.00

EDCI 55100 - Young Adult Literature

Credit Hours: 3.00. This course is a survey of classic and contemporary young adult texts. Students are introduced to the genre through reading notable young adult texts, applying relevant literary criticism, and investigating effective pedagogical strategies.

Learning Outcomes: 1. Read and respond to selected young adult texts in writing and in class discussion. 2. Explore the extent to which young adult texts portray the complex challenges of teenage life. 3. Explore the extent to which young adult texts, as imaginative narratives,

affect teenage identity development. 4. Create a final project synthesizing young adult texts, theories of reading and response, and theories of adolescent development. Credits: 3.00

EDCI 55200 - Generalizable Skills Instruction In Career And Technical Education

Credit Hours: 3.00. Curriculum, assessment, planning, implementation, and evaluation relating to generalizable skills (also known as generic, transferable, or workplace skills) in career and technical education, other content areas, and special education programs; philosophical, historical, social, economic, political, and educational influencing factors; analysis and synthesis of current research and conceptual models; practical applications for programs; instructional strategies; resources and support services, interdisciplinary collaboration approaches; applications for special needs learners; learning styles and characteristics.

Learning Outcomes: 1. Identify and analyze the philosophical, historical, social, economic, political, and educational factors influencing generalizable skills instruction in career and technical education programs. 2. Locate, analyze, and synthesize contemporary generalizable skills literature and research and its application in career and technical programs. 3. Identify, analyze, and apply a conceptual model for generalizable skills instruction regarding curriculum, assessment, planning, implementation, and evaluation. 4. Identify generalizable skills curriculum. 5. Examine and apply methods of generalizable skills curriculum development and revision. 6. Review and analyze functional, curriculum-based assessment, instruments, strategies, and procedures. 7. Describe and use procedures for using generalizable skills assessment data/information in individualized educational planning. 8. Identify the individual learning styles and characteristics of, and apply appropriate instructional approaches for, individual students in career and technical programs. 9. Identify, locate, select, and evaluate instructional resource materials and support services useful in generalizable skills instruction. 10. Identify, adapt, and develop methods for teaching generalizable skills in career and technical programs. 11. Develop and implement interagency collaboration strategies among career and technical education, special education, support/remedial services, and content related (e.g., mathematics, reading) school personnel. 12. Identify and select appropriate evaluation methods and procedures for determining the adequacy, quality, and effectiveness of generalizable skills instruction and support services in career and technical education programs. Credits: 3.00

EDCI 55201 - AI Integration In Education

Credit Hours: 3.00. This course aims to provide students with the knowledge and skills needed to understand and utilize Generative AI in education. Students will acquire fundamental coding skills and develop technical expertise in using and comprehending AI. By engaging in hands-on activities and analyzing real-world case studies, students will design and create their own AI applications using Google Teachable Machine to solve a specific problem of their choosing. Additionally, the course will examine ethical issues related to AI/GenAI, allowing students to establish guidelines for the meaningful integration of AI/GenAI in teaching and learning.

Learning Outcomes: 1. Define AI/GenAI and discuss its potential integration into education. 2. Create an innovative AI/Gen application using Google Teachable Machine. 3. Develop a learning activity using GenAI that caters to different learning preferences and needs. 4. Analyze and discuss the ethical issues surrounding the use of AI, specifically GenAI, in education from the perspectives of both learners and educators. Credits: 3.00

EDCI 55300 - Leadership Development In Career And Technical Education

Credit Hours: 3.00. Design, development, implementation, and evaluation of systems and strategies for enhancing the skills and knowledge of personnel seeking to become leaders in the field of Career and Technical Education (CTE); research related to critical and emerging leadership issues, strategies, policies,

and resources are examined and applied to program improvement initiatives in schools, the workplace, agencies, and other organizations that serve a wide variety of youth, adolescents, young adults, and adults.

Learning Outcomes: 1. Identify and adapt models of staff development, in-service education, and program improvement. 2. Use organizational, adult learning, motivational, leadership, and social systems therapy in staff development and school-or agency-based program improvement activities. 3. Develop and implement organizational communications and group-related interactions effectively. 4. Evaluate the principles related to leadership style; organizational development, initiation and management of change, needs analysis, and consultation strategies; and program improvement activities. 5. Locate current and emerging funding sources, as well as effective procedures for developing grant seeking and project management strategies. 6. Implement comprehensive strategies for developing assessing and improving programs, policies, practices, and services related to career and technical education programs. 7. Design and implement effective interagency collaboration initiatives. Credits: 3.00

EDCI 55600 - Educational Video Game Design

Credit Hours: 3.00. Designed to provide an introduction to the design of educational video games. The focus of the course is on two areas: 1) the learning, instructional design, and game design theories which can inform the design of effective and engage in educational video games, and 2) how to apply those theories within practical settings.

Learning Outcomes: 1. Become comfortable with the history, concepts, terminology, culture, and classification of educational video and computer games. 2. Explore current research on educational computer and video games. 3. Examine learning, instructional design, and game design theories for relevance to the design of educational computer and video games. 4. Apply theory be designing, developing, and implementing a prototype of an educational computer or video game as teams. Credits: 3.00

EDCI 55700 - Assessment Of Culturally And Linguistically Diverse Students

Credit Hours: 3.00. Critical review of research and practice in language proficiency and content-area assessment of culturally and linguistically diverse students in K-12 education, and the sociocultural dimensions of standardized testing, academic achievement, and accountability. Critical analysis of standardized language proficiency and literacy tests. Development of authentic alternative language, literacy and content-area assessments. Prerequisites: Background in K-12 education.

Learning Outcomes: 1. Describe and critically analyze historical foundations, current research issues, national and state policies, and current practices in the testing and assessment of culturally and linguistically diverse students. 2. Critically analyze the results of standardized language proficiency and academic achievement tests and their use in accountability programs. 3. Design, utilize, and critically analyze the results of alternative authentic language and content-area assessments. 4. Describe the impact of linguistic and cultural factors on the assessment process of linguistically diverse students. Credits: 3.00

EDCI 55800 - Integrated Science, Technology, Engineering And Mathematics (STEM) Education Methods-Secondary

Credit Hours: 3.00. Focuses on operationalizing the theoretical pedagogical approaches to integrated Science, Engineering, Mathematics and Agriculture (STEM) education. Collaboratively and cooperatively investigate, plan and deliver integrated learning experiences appropriate for secondary education. Course content will blend philosophical considerations with practical application. Permission of instructor required.

Learning Outcomes: 1. Engage in instructional conversations, collaboratively share instructional resources, and develop a sense of community for integrated STEM learning and

teaching. 2. Contextualize STEM learning in authentic contexts. 3. Explain and apply socially and culturally relevant pedagogy in the context of STEM learning. 4. Discuss levels and types of integrated STEM content, pedagogy, and ways of knowing. 5. Develop and disseminate integrated STEM learning experiences. 6. Implement, assess and reflect on integrated STEM learning experiences in public school classrooms. 7. Articulate a framework explaining integrated STEM education. 8. Adapt existing singular discipline curriculum resources to leverage connections across disciplines to facilitate integration. Credits: 3.00

EDCI 55850 - Introduction To Teaching Engineering And Technology Design In The Context Of K-12 Integrated STEM

Credit Hours: 3.00. Engineering and technology design has gained considerable traction in many K-12 schools. In this course, we will examine principals of engineering design and technology as well as where and how engineering and technology design best fits in a K-12 integrated STEM curriculum. Course participants will engage in authentic engineering and technology design experiences. Course participants will also design, develop, deliver integrated lessons that help K-12 students develop the knowledge, skills, and practices of engineering and technology design.

Learning Outcomes: 1. Demonstrate a broad understanding of engineering and technology education disciplines and concepts. 2. Scaffold engineering practices that support diverse learners and describe conceptual understanding and content knowledge of engineering and technology design skills through problem-based learning in i-STEM environments. 3. Comprehend and elaborate data-driven decision-making skills as practiced by engineering and technology professionals to develop solutions to design briefs that support K-12 learning in diverse learning environments. 4. Examine and evaluate the engineering design process in the context of integrated STEM education at the K-12 learning. 5. Collaborate and prepare pedagogical practices in integrated engineering and technology design through integrated STEM that support K-12 learning for a diverse group of learners. Credits: 3.00

EDCI 55900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (ENGL 59900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and post secondary education. Credits: 3.00

EDCI 55950 - Engineering And Technology Design Practicum

Credit Hours: 3.00. EPICS is a service-learning design course in which teams of students from across campus work together on long- term projects that benefit the community. Project work centers around the engineering, technology, and computing needs of a community partner, but interdisciplinary team interaction is an integral element for project success. Students may participate in EPICS multiple semesters and participation for multiple consecutive semesters on a project team is encouraged. Teams are composed of first year students through seniors.

Most EPICS projects last at least one-year, though partnership with the community organization continues for several years. Projects are intended to solve real problems, are defined in partnership with their community partners, and span the complete design process cycle [problem identification - specification development - conceptual design - detailed design - delivery - service/maintenance - retirement].

You receive academic credit for participating in EPICS. How academic credits are applied to your major depends on your degree program and is determined by your department and/or

advisor. See https://engineering.purdue.edu/EPICS/purdue/epics-purdue/credit.

Learning Outcomes: 1. Apply material from their discipline to the design of community-based projects. 2. Understand design as a start-to-finish process. 3. Identify and acquire new knowledge as a part of the problem-solving/design process. 4. Be aware of the customer. 5. Function on multidisciplinary teams and an appreciation for the contributions from individuals from multiple disciplines. 6. Communicate effectively both orally and written with widely-varying backgrounds. 7. Be aware of professional ethics and responsibility. 8. Have an appreciation of the role that their discipline can play in social contexts. Credits: 3.00

EDCI 56000 - Educational Technology For Teaching And Learning

Credit Hours: 3.00. This course addresses the fundamentals of educational/learning technologies within both the traditional classroom, as well as the corporate/business training environments. Students will explore and evaluate various tools/technologies and determine how, when, and why such technologies can/should be infused into normal, hybrid, or fully online learning situations. The goal of the course is to help the student plan, implement, and evaluate technology for teaching and learning.

Learning Outcomes: 1. Demonstrate the ability to access, generate, and manipulate information through the use of various software and technology apps. 2. Apply educational technology to communicate, collaborate, conduct research, and solve problems, as well as promote equitable, ethical, and legal use of computer/technology resources. 3. Apply and integrate educational technology to support instruction in selected developmental and content areas. Credits: 3.00

EDCI 56400 - Integration And Management Of Technology For Learning

Credit Hours: 3.00. This course focuses on techniques for and issues related to integrating technology in learning environments in a meaningful way. Topics covered stem from literature in the field and include (1) theoretical foundations of technology integration, including how technology can support a more personalized approach to learning, (2) instructional and learning issues with technology integration, (3) designing for the integration of technologies for in learning environments, and (4) emerging issues in research and practice with technology integration. Class activities are designed to model applications of learning technology, while class projects allow individuals to develop skills and knowledge in areas of your personal need or interest. The goal of the course is to help you develop an understanding of important issues associated with the integration and management of learning technology and to effectively plan, design, implement, and evaluate technology-based learning.

Learning Outcomes: 1. Apply educational technology to enhance professional growth and productivity. 2. Use technology to communicate, collaborate, conduct research, and solve problems. 3. Apply the information from this course into authentic settings. 4. Successfully integrate technology into different forms of instruction. Credits: 3.00

EDCI 56500 - Principles Of Adult Education

Credit Hours: 3.00. (ASEC 56500) Principles of adult education applied to helping adults learn, evaluating their performance, and determining their needs. Examines history, philosophy, and research of adult education. Explores techniques required in design and delivery of instruction for adults.

Learning Outcomes: 1. Examine principles and techniques for educating adults, including the history, philosophy, and research field. 2. Develop an individual philosophy of continuing and adult education for a wide variety of situations. 3. Apply principles, techniques, philosophy and research in development and design of adult education programs. Credits: 3.00

EDCI 56600 - Educational Applications Of Multimedia

Credit Hours: 3.00. Examination of educational applications of hypermedia tools and related research. Creation of hypermedia instructional materials. Incorporation of digitized media (sound, photographs, and motion clips) in hypermedia is explored.

Learning Outcomes: 1. Explain the effectiveness of a specific instructional design principle in educational multimedia design. 2. Demonstrate when and how to use specific instructional design principles within a given educational multimedia learning environment. 3. Address the key principles and methods for evaluating student outcomes in a multimedia learning environment. 4. Develop educational computer-based multimedia instructional materials with various software and tools. 5. Be familiar with the history of multimedia research and design and underlying assumptions from relevant theorists. 6. Explain variations in usability testing and its role in multimedia development. Credits: 3.00

EDCI 56700 - Action Research In Science Education

Credit Hours: 3.00. An introduction to various models and conceptions of teacher action research in science education. Students review literature on action research, participate in small research cohorts, and plan and conduct action research within their respective educational situations.

Learning Outcomes: 1. Develop an understanding of what action research is, how it is conducted, and what role it plays in the construction of teacher knowledge in science education. 2. Plan and conduct action research within your respective educational situation. 3. Examine various models for action research in pre-service, in-service, and independent projects in science education. 4. Gain insight into the role action research plays in science education and science teacher education. Credits: 3.00

EDCI 56800 - Partnering With Web-Based Tools For Learner Centered Environments

Credit Hours: 3.00. Provides an in-depth look at Web-based digital tools for teaching and learning, with a focus on learner-centered activities and environments. Emphasis is given to applying the knowledge and skills necessary to create a Web-based, student-centered lesson/unit that provides diverse learners with opportunities for formal and informal learning. Course content is applicable to both independent and collaborative learning, as well as use of the Web as the sole educational delivery system or in combination with other approaches, including traditional classroom instruction.

Learning Outcomes: 1. Create a personal vision of 21st century schools or workplace and a personal definition of a 21st century learner. 2. Examine, in depth, a specific student-centered approach (e.g. project-based learning, problem-based learning, inquiry learning, authentic instruction, etc.) and discuss the similarities and differences among different approaches. 3. Create a video tutorial that teaches others how to use a specific Web 2.0 tool. 4. Design a learner-centered lesson that incorporates relevant Web 2.0 tools for the purpose of broadening and/or deepening students' understanding of specific curricular content. 5. Develop an implementation plan and create appropriate assessment measures to determine student learning in your own learner-centered lesson. Credits: 3.00

EDCI 56900 - Introduction To E-Learning

Credit Hours: 3.00. This course examines how the design and development of instruction are impacted by the use of the computer as delivery system. A primary focus is on effective learning design strategies for e-learning. Learners will identify and apply effective design practices with emphasis on project management, planning, and implementation. Education or training materials will be developed using appropriate authoring tools as determined by the instructional context. Learners will design an E-Learning module with end-to-end documentation of the design process (Project Plan, Design Document, Storyboard). Opportunities for collaborative feedback and evaluation will also be featured elements of the course experience.

Learning Outcomes: 1. Identify and implement sound design processes for e-learning. 2. Integrate relevant learning theory into e-learning design decisions. 3. Design, develop, and evaluate an effective e-learning module. Credits: 3.00

EDCI 57200 - Introduction To Learning Systems Design

Credit Hours: 3.00. An introduction to the principles of designing instructional materials and to instructional communication theory and techniques. Topics include objectives, student characteristics, media selection, communication variables, message design, and systematic evaluation.

Learning Outcomes: 1. Describe and apply the components of a systematic design process, their rationales, and uses. 2. Use a systematic design process and instructional psychology principles in performing an analysis of learning context analysis of learners, analysis of learning tasks, in design and development of assessments, and in design of formative and summative evaluation of the instruction itself. Credits: 3.00

EDCI 57300 - Instructional Development Practicum

Credit Hours: 2.00 or 3.00. Provides supervised field experience in programs involving instructional design development activities. Students participate in ongoing projects in the design, development, and evaluation of instructional materials and training programs in business and industry, medical facilities, or other settings deemed appropriate. Recommended prerequisites: EDCI 56900, EDCI 57200, and EDCI 67200. Permission of instructor required.

Learning Outcomes: 1. Design, develop, and evaluate a major instructional design project within a professional work setting/environment. 2. Create and manage an instructional design project within a professional setting following a specific timeline. Management of the process may require collaboration with supervisors, subject matter experts, and others to complete the project in the most effective manner. Credits: 2.00 or 3.00

EDCI 57500 - Foundations Of Distance Learning

Credit Hours: 3.00. An introduction to the field of distance learning/education. Examination of basic concepts and principles of distance learning, the theoretical underpinnings of the field, research and application literature, and distance education delivery technologies. Focus is on integration of distance education technologies for learning and teaching.

Learning Outcomes: 1. Discuss common distance education (DE) definitions and theories. 2. Understand how distance education has evolved including the history, research and current trends of DE. 3. Select and demonstrate appropriate technologies for use in DE environments. 4. Identify appropriate instructional design methods. 5. Apply appropriate instructional design methods to DE scenarios. 6. Demonstrate understanding of unique challenges of teaching at a distance. 7. Appreciate common assessment and evaluation methods and incorporate them into DE scenarios. 8. Discuss potential issues and barriers faced by learners and instructors in DE environments. 9. Be aware of and discuss policies that relate to DE. 10. Be aware of current trends in the field of distance education and how they relate to your focus. Credits: 3.00

EDCI 57700 - Strategic Assessment And Evaluation

Credit Hours: 3.00. This course explores principles and techniques that can be used to carry out evaluations within an organization. The course also examines several aspects of conducting evaluations, including planning and designing an evaluation, developing appropriate instruments, using various methods to collect information, analyzing information obtained from those methods, and communicating results and recommendations. This course is designed to help learners understand the multiple ways that evaluation is used in instructional systems and provides opportunities to design various types of evaluation instruments. A portion of the course will examine the study of learner assessment as part of the evaluation of instructional programs; however, the course's focus is dedicated to the study of program evaluation.

Learning Outcomes: 1. Define evaluation within the context of human performance and learning. 2. Develop prototype evaluation tools and frameworks useful in training/education or workplace performance improvement. 3. Synthesize knowledge by developing an evaluation plan and tools for an actual setting.

Credits: 3.00

EDCI 58000 - Foundations Of Curriculum

Credit Hours: 3.00. Introduction to the major historical and philosophical sources of curriculum ideas. Significant forces influencing curriculum decision making. Different theoretical approaches to the construction and analysis of curriculum.

Learning Outcomes: 1. Engage critically with germinal thinkers and thought in curriculum. 2. Examine various curriculum approaches and traditions within their historical and social contexts. 3. Explore the major philosophies that undergirds curriculum approaches and deliberation. 4. Analyze the political origins and implications of differing traditions within the curriculum field and within educational policy and practice. 5. Integrate learning from curriculum history, theory, and research into one's teaching, scholarship, and/or engagement. Credits: 3.00

EDCI 58500 - Multicultural Education

Credit Hours: 3.00. The course aims to develop understanding of multicultural education as an on-going reform process that addresses social justice issues through an examination of race, class, gender, ethnicity, language, sexual orientation, etc.

Learning Outcomes: 1. Develop awareness of multicultural issues in education and other fields. 2. Increase knowledge of multicultural education and applications of multicultural theories to education and other disciplines. 3. Develop skills in meeting the needs of diverse populations. Credits: 3.00

EDCI 58600 - Topics In Educational Reform

Credit Hours: 3.00. (EDFA 58600) Explore important and timely issues related to educational reform and restructuring. Topics include: school choice, curriculum reform, assessment, technology, and influences on the reform process.

Learning Outcomes: 1. Explore and develop awareness of important and timely issues related to educational reform and change. 2. Increase knowledge of important and timely topics in educational reform theory and practice. 3. Develop skills of critical thinking and reflection in relationship to important and timely topics in educational reform theory and practice. Credits: 3.00

EDCI 58800 - Motivation And Instructional Design

Credit Hours: 3.00. This course has been designed to provide an in-depth study of motivation as one of the fundamental variables underlying human learning, behavior, and instructional design. The focus of the course is on two areas: 1) theories of motivation and the general principles that have contributed to the field of instructional design, and 2) how those principles are applied within practical design settings.

Learning Outcomes: 1. Identify and describe the basic tenets of various theories of motivation. 2. Compare and contrast the contributions that the various motivational theories offer to the field of instructional design. 3. Select appropriate principles derived from given theories and apply those principles within practical design situations. 4. Analyze motivational problems in learning and performance and design effective solutions. 5. Consider motivational theories and their relation to current research in Education and Instructional Design. Credits: 3.00

EDCI 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDCI 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDCI 59400 - Concluding Secondary Transition To Teaching Seminar

Credit Hours: 2.00. This seminar course offers a conclusion to the program, as well as a review of general educational concerns and issues applicable to all content area instruction at the middle and high school levels. It is often the last course taken in the TTT program by program participants. The course centers on discussions of educational issues, theories, and approaches that the students who are seeking licensure in any of the secondary areas available at Purdue will find helpful. Additionally, the course helps students prepare to obtain their teaching license and enter the teaching community as a secondary teacher. Permission of instructor required.

Learning Outcomes: 1. Reflect upon transition from being "student" to becoming "teacher". 2. Write a draft of current teaching philosophy/personal pedagogy. 3. Present to colleagues about a professional experience or accomplishment. 4. Find, evaluate, and explore uses for technology and web resources in content area. 5. Critically reflect upon year(s) in the TTT/STEM program, what was learned? What goals are set for future professional development as a teacher? Credits: 2.00

EDCI 59600 - Pedagogy I: Introductory Methods For Secondary Education Transition To Teaching Program

Credit Hours: 3.00. This course is the introductory seminar for the secondary Transition to Teaching (TTT) programs across disciplines. Students who enroll in this course will be seeking teaching licensure in one of the secondary program areas available at Purdue University. Therefore, instruction in the course will revolve around general educational concerns and issues that are applicable to all content area instruction at the middle and high school levels. Admission to the Transition to Teaching program required. Permission of department required.

Learning Outcomes: 1. Situate themselves philosophically within (or against) cultural-historical paradigms in education. 2. Demonstrate familiarity with practitioner-oriented journals, conferences, and resources available through at least one content-specific professional organization in their field. 3. Articulate their understanding of current education issues related to social justice, technology, and classroom management. 4. Apply backward design when planning courses, units, and lessons. 5. Select instructional strategies that promote active learning and deep understanding. 6. Explain how literacy pertains to their content area. 7. Describe appropriate modifications and interventions for diverse learners in their future classrooms. 8. Navigate program and licensing information and processes from the Office of Clinical Practice and Teacher Education Licensure. Credits: 3.00

EDCI 59650 - Practical Pedagogy: Tools, Techniques, And Technology

Credit Hours: 3.00. This course is designed to help with inquiry into practical pedagogical practices. The course is based on individual experiences - where, who, what, and how you're teaching, and provides space for all to investigate and explore the aspects of teaching you want to know more about. The course is grounded in theory, yet focused on the practical and everyday tasks and aspects of teaching, including: tools, techniques, and technology related to community building, grading, trauma-informed practices, lesson planning, etc.

Learning Outcomes: 1. Use an inquiry stance and reflect on their teaching practices. 2. Identify and inquire into tools, techniques, and technologies that will allow them to grow as teachers in their content area. 3. Discuss the realities of everyday teaching scenarios and find resources that help them solve pedagogical problems. 4. Research, discuss, and give presentations on pedagogical tools, techniques, and technologies that they are planning to incorporate into their own teaching, explaining how and why. 5. Use an asset-based lens toward their diverse student populations. 6. Build community, establish class routines and structures, select appropriate technological tools, and develop grading practices that are best suited for them and their students. Credits: 3.00

EDCI 59700 - Pedagogy II: Advanced Methods For Secondary Education Transition To Teaching Program

Credit Hours: 3.00. This sixteen-week course is the capstone methods course for the online Transition to Teaching (TTT) program. Students who enroll in this course will be seeking

teaching licensure in one of the secondary program areas available at Purdue University. Therefore, instruction in the course will revolve around general educational concerns and effective teaching approaches that are applicable to all content area instruction at the middle and high school levels. This course extends engagement with the pedagogical principles of practice introduced in *Transition to Teaching: Pedagogy I*. The course also includes a fifty-hour field experience component. Admission to Transition to Teaching program required. Permission of department required.

Learning Outcomes: 1. Plan learner-centered instruction and classroom management techniques that reflect cultural competency; are responsive to the characteristics, strengths, experiences, and needs of each student; and promote all student's development and learning. 2. Develop effective lesson and unit plans in short- and long-range instructional planning. 3. Describe project-based learning experiences that guide students to analyze the complexities of an issue and use creative thinking and innovative approaches to solve problems. 4. Identify skills and strategies for creating a safe, healthy, supportive, and inclusive learning environment that encourages all student's engagement, collaboration, and sense of belonging. 5. Identify skills and strategies for establishing a culture of learning that emphasizes high expectations for all students, promotes self-motivation, and encourages students' sense of responsibility for their own learning. 6. Use a variety of assessment results and data sources to evaluate and monitor student learning and progress; establish learning goals; and plan, differentiate, and continuously adjust instruction for individuals, groups, and classes. 7. Compare characteristics and benefits of virtual learning environments, online environments, face-to-face environments, and hybrid environments, and the strategies to work effectively in different types of environments to ensure student learning and growth. 8. Evaluate key areas for growth and goal setting after reviewing procedures for teacher evaluations and administrator expectations for professional teachers. 9. Reflect on field experience lesson planning, instructional delivery and student interactions. 10. Anticipate the requirements for edTPA and teacher certification. Credits: 3.00

EDCI 59900 - Research And Instructional Coaching

Credit Hours: 3.00. This independent study, field-based course is designed to teach you about field-based research, instruction, and coaching in teacher education and elementary schools. You will have the opportunity to apply what you learn by developing and executing a mini-inquiry project including research questions, data collection, analysis, and findings for publication and/or program materials development.

Learning Outcomes: 1. Explore and identify research interests, sites, and projects then create and execute an attainable semester-long plan for research/inquiry. 2. Learn about, plan, teach & film exemplary critical literacy/interdisciplinary read aloud lessons and related activities for K-5. 3. Observe and/or coach PSTs through a DEI lens: coaching requires 22+ hours of K-5 US classroom teaching experience equivalent to EDCI363 or classroom teaching. Credits: 3.00

EDCI 60001 - Intro To Demonstrating Professional Competencies In LDT

Credit Hours: 1.00. This course is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Learning Design and Technology program, with a focus on the process of earning digital badges aligned with professional competencies. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies. You will also learn and apply the process of both earning digital badges within the program and evaluating your peers' work as part of the badge earning process.

Learning Outcomes: 1. Students will learn the specifics of the LDT Master's program and its requirements familiarize yourself with resources, review targeted learning competencies, and program requirements. 2. Students will examine skills and approaches to

obtain competency badges critical to your success as a student in the online program, including peer review, self-editing, effective time management, avoiding plagiarism, utilizing proper online etiquette and incorporating a positive disposition in your interactions with peer students, faculty and staff. 3. Students will become familiar with the badge earning process in LDT and progress in earning your first digital badges. Credits: 1.00

EDCI 60003 - LDT Professional Competencies Portfolio

Credit Hours: 1.00. This course will focus on completion of the competency portfolio reflecting on the depth and breadth of your educational growth since entering the Master's program. The purpose of the LDT competency portfolio is to demonstrate that you have mastered the graduate competencies. The portfolio will contain student evidence aligned with LDT competencies and will be reviewed by your committee. The completed competency portfolio is a requirement for graduation from the LDT Master's program. Prerequisites: EDCI 60001 and 60002.

Learning Outcomes: 1. Finalize students' competency-based portfolio. 2. Compose reflective narratives on Professional Foundations of LDT, Planning and Analysis, Design and Development, and Evaluation and Implementation. 3. Update and finalize resume or vita suitable for job searching. Credits: 1.00

EDCI 60400 - Social Studies In The Elementary School

Credit Hours: 3.00. Social Studies-content and place in the modern elementary education curriculum. Materials, instruction techniques, evaluation procedures, and understanding the syntax of the structure of social studies. Prerequisite: EDCI 36100 .

Credits: 3.00

EDCI 60500 - Teaching Integrated Science, Technology, Engineering And Math

Credit Hours: 3.00. Analysis of historical developments and present trends in science education; the designing, implementation, and evaluation of science programs; the role of research in present and future developments.

Learning Outcomes: 1. Identify, describe, and explain the fundamental tenets of different constructivist learning theories and their relevancy to STEM education. 2. Clarify and refine beliefs about teaching and learning in STEM education. 3. Identify and characterize students' ideas about STEM and how they influence learning. 4. Explore students' thinking and understanding of STEM through multiple strategies. 5. Describe ways to assess student learning in STEM. 6. Identify, practice, and reflect upon teaching strategies commensurate with teaching beliefs and knowledge about how students learn STEM through an integrated approach. 7. Compare and evaluate curriculum resources for integrating STEM instruction. 8. Devise a comprehensive lesson plan for integrating STEM instruction based on science and engineering practices and teaching for all learners. 9. Teach and reflect upon an integrated STEM lesson employing multiple instructional strategies. 10. Evaluate student learning in the context of an integrated STEM lesson. Credits: 3.00

EDCI 61200 - Seminar In Literacy

Credit Hours: 3.00. Recent trends and research in literacy. Topics provide in-depth study of literacy acquisition in educational settings.

Learning Outcomes: 1. Investigate a specific topic of interest through readings, written work, and discussion. 2. Develop understandings of a new topic area relevant to the study of literacy and language. Credits: 3.00

EDCI 61300 - Seminar In The English Language Arts

Credit Hours: 3.00. Problems in the teaching of English: literature, language, rhetoric. Attention to recent scholarship and to its application in the public schools.

Learning Outcomes: 1. Think critically about historical and/or contemporary research and theory central to the field of English education. 2. Read and write reflectively and critically

about the course content. 3. Engage in course discussions which encourage critical thought and personal engagement. Credits: 3.00

EDCI 61450 - Seminar In Bilingualism And Multilingualism

Credit Hours: 3.00. This course examines theories, research and educational practices in bilingualism and multilingualism. Students will become familiar with major conceptual and methodological issues in research about the use and acquisition of two or more languages in bi/multilingual societal and educational contexts. Individual and societal dimensions will be considered through the examination of a wide range of approaches. Accordingly, the course is transdisciplinary in nature, bringing together work from anthropology, education, psychology, and (socio)linguistics.

Learning Outcomes: 1. An understanding of the complex developmental history of literacy, including the role of visual literacy. 2. Familiarity with relevant research, and the ability to critically evaluate and discuss this literature. 3. Development of the professional skills of analytic and integrative thinking, discussion, and questioning. 4. A critical understanding of the role of classroom experience-both in terms of its social and political value and in terms of available resources and materials -- in the development of young children's literacy. Credits: 3.00

EDCI 61500 - Qualitative Research Methods In Education

Credit Hours: 3.00. Focuses on expanding graduate students' research skills to include knowledge of the theories and methods associated with qualitative and qualitative-quantitative combined research. Prerequisite: EDPS 53300 .

Learning Outcomes: 1. Increase knowledge of, analyze and comparatively evaluate the theoretical tenets and multiple traditions of qualitative research. 2. Increase knowledge of, understand and evaluate the multiple methods of inquiry used in qualitative research. 3. Understand the ethical and personal issues and concerns involved in qualitative research. Credits: 3.00

EDCI 61600 - Qualitative Data Collection And Analysis In Educational Research

Credit Hours: 3.00. This course focuses on expanding and applying students' knowledge of qualitative data collection and analysis with an emphasis on multiple approaches to data collection, analysis, and interpretation. Prerequisite: EDCI 61500 or permission of instructor.

Learning Outcomes: 1. Describe, analyze and evaluate the theoretical tenets and multiple paradigms of qualitative inquiry as applied to data collection and analysis. 2. Describe, analyze, and evaluate the role of the researcher in qualitative inquiry. 3. Describe, analyze, and evaluate the issues of representation, analysis, interpretation, writing, and validity in qualitative inquiry. 4. Understand multiple data collection methods and approaches to qualitative analysis. 5. Understand the ethical issues and concerns involved in qualitative inquiry at an advanced level. Credits: 3.00

EDCI 61800 - Gender And Culture In Science Education

Credit Hours: 3.00. An examination of the different perspectives on issues of gender, culture, and science. Major topics include feminist critiques of scientific theories and methods, the work of women and minorities in science, the role science has played in the construction of race and gender, and topics in science education, such as girls' learning in science and the potential of inclusive practices in the science classroom. Prerequisite: EDCI 51800 or EDCI 58500 .

Learning Outcomes: 1. Develop an in-depth understanding of the role of gender and culture in science and science education. 2. Examine feminist and cross-cultural studies in science and science education. 3. Apply feminist and critical frameworks of analysis to various studies in science education. 4. Identify and evaluate the strengths and limitations of feminist and cultural critiques of science. 5. Synthesize related literature in an effort to gain in-depth knowledge about one or more areas of gender and culture in science and science education. Credits: 3.00

EDCI 61900 - Learning Science

Credit Hours: 3.00. The course provides a holistic study of how children and adults learn science; how the learner's ideas, ways of thinking, abilities to do science, and their attitudes towards and beliefs about science learning influence how they learn science.

Learning Outcomes: 1. Develop an increased understanding of the research literature in science education as it pertains to science learners. 2. Gain an appreciation of science learners and the different perspectives about how individuals learn science. 3. Apply science education research about science learners to instructional, curricular, and assessment development. Credits: 3.00

EDCI 62000 - Seminar In Mathematics Education

Credit Hours: 1.00 to 6.00. Selected topics in mathematics education. Typical topics considered are: (1) problem solving; (2) instructional strategies; (3) cognitive structure; (4) current curriculum; (5) current research. Permission of instructor required.

Learning Outcomes: 1. Examine, synthesize, and communicate a view of the state of mathematics education and situate one's research in it. 2. Create knowledge for the field of mathematics education and communicate findings to the professional community. 3. Communicate and act upon professional feedback in the processes of designing and conducting research and writing conference proposals and research reports. 4. Report on various stages and types of research (e.g., project design, data analysis, findings). Credits: 1.00 to 6.00

EDCI 62100 - Technology For Qualitative Research

Credit Hours: 3.00. Exploration of the effective use of technology to facilitate data collection, organization, and analysis. Emphasis on application of theoretically-based methodologies for handling and analyzing qualitative data through the use of qualitative research software. Course also includes attention to other hardware or software relevant to the collection, organization and analysis of qualitative data. Prerequisites: EDCI 61500.

Learning Outcomes: 1. Explore and practice the application of theoretically-based methodologies for handling and analyzing qualitative data through the use of qualitative research software (NVivo). 2. Explore and practice the following mobile applications that may be used for data collection and other research purposes: digital photo, audio, and video recording and editing apps; document scanning apps (Scanner Pro); notetaking apps (e.g., Evernote, Notability); Adobe Acrobat .pdf file management and mark-up apps (Notability); and the integration of these apps with NVivo. Credits: 3.00

EDCI 62200 - Seminar In Science Education

Credit Hours: 1.00 to 3.00. Current issues in science education. Typical topics considered are: (1) science curriculum; (2) concept learning; (3) teacher education; (4) intellectual developments; (5) current research. Prerequisite: EDCI 51700 , EDCI 51800 .

Credits: 1.00 to 3.00

EDCI 62400 - Seminar In Social Studies Education

Credit Hours: 3.00. An investigation of various aspects of the teaching of the social studies. One topic is dealt with in each enrollment. Master's candidates are expected to complete the first three topics. Areas include: (1) philosophic concepts used in the social studies; (2) curricular analysis and examination of new social studies materials; (3) methods of inquiry in the social studies; (4) research methodology in the social studies.

Credits: 3.00

EDCI 62700 - Current Topics In Learning Design And Technology

Credit Hours: 3.00. A critical analysis of problems, trends, issues, and programs related to the area of learning design and technology. Prerequisite: EDCI 51300 .

Learning Outcomes: 1. Critically analyze current issues and trends in the field related to a given topic. 2. Identify and discuss advantages and limitations to implementing specific emerging tools, strategies, and /or approaches. 3. Identify

strategies for examining the effectiveness of specific emerging tools and strategies. Credits: 3.00

EDCI 62800 - Curriculum And Instruction Doctoral Seminar I

Credit Hours: 1.00. An examination of current issues and concerns related to doctoral study in Curriculum and Instruction. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year of doctoral study.

Learning Outcomes: 1. Reflect on the roles and responsibilities of faculty members. 2. Identify steps to develop personally and professionally. 3. Describe major milestones of doctoral study in the department. 4. Identify ethical standards in the field of education. 5. Practice ethical conduct of research. 6. Identify research topics of personal interest and locate. 7. Locate and begin to review literature relevant to those topics. Credits: 1.00

EDCI 63300 - Instructional Design Project Management

Credit Hours: 3.00. This course focuses on the application of project management ideas, concepts, and strategies in instructional design settings. Students will be asked to consider the relationship between instructional design and project management, tools that can assist with managing instructional design projects, and factors influencing the instructional design project management process. Students will explore these topics by creating deliverables for instructional design cases and other interactive assignments.

Learning Outcomes: 1. Explain and reflect upon common project management terminology's role in instructional design projects. 2. Analyze and articulate the relationship between project management and instructional design. 3. Propose and/or develop relevant intervention strategies (instructional design and project management) to real-world instructional design issues that are consistent with arguments and evidence presented. 4. Integrate project management technologies and tools in the development of instructional design project management. 5. Interpret the role of interpersonal skills in and factors impacting project management instructional design initiatives. Credits: 3.00

EDCI 63500 - Content And Goals In Mathematics Education

Credit Hours: 3.00. Examines conceptions of what mathematics is and how those conceptions have influenced the mathematics curriculum over the course of American history. Prerequisite: Master's student standing or higher and enrolled in Mathematics Education.

Learning Outcomes: 1. Develop perspectives on and communicate various theories or theoretical frameworks related to mathematics curriculum. 2. Investigate and communicate a research based perspective on the underlying nature of curriculum. 3. Develop and communicate a historical perspective on evolution of mathematics curriculum. 4. Synthesize seminal and current research describing curriculum and curricular relationships in mathematics education. Credits: 3.00

EDCI 63600 - The Learning Of Mathematics: Insights And Issues

Credit Hours: 3.00. Examines research related to the learning of mathematics and to the relationships of social and cultural factors to the learning of mathematics. Prerequisite: Master's student standing or higher and enrolled in Mathematics Education.

Learning Outcomes: 1. Develop perspectives on and communicate orally and in writing various theories or theoretical frameworks for learning mathematics. 2. Investigate and communicate orally and in writing core ideas and beliefs that form the thinking and research efforts in the learning of mathematics. 3. Critically reflect on and synthesize seminal and current research in mathematics learning. Credits: 3.00

EDCI 63700 - The Teaching Of Mathematics: Insights And Issues

Credit Hours: 3.00. Examines research related to mathematics

teaching, including research on characteristics of mathematics teachers, the features of effective mathematics teaching, and the professional preparation and development of mathematics teachers. Prerequisite: Master's student standing or higher and enrolled in Mathematics Education.

Learning Outcomes: 1. Develop perspectives on and communicate orally and in writing various theories or theoretical frameworks related to teaching mathematics. 2. Investigate and communicate orally and in writing theoretical and empirical foundations of the research literature related to mathematics teaching, teacher education, and/or professional development. 3. Critically reflect on and synthesize seminal and current research in mathematics teaching, teacher education, and/or professional development. Credits: 3.00

EDCI 63800 - Curriculum And Instruction Doctoral Seminar II

Credit Hours: 1.00. This course consists of an examination of current educational research. EDCI and other faculty will present and lead discussions of their research. Students will be exposed to research within multiple paradigms and perspectives. This course is intended for all new doctoral students in the Department of Curriculum and Instruction and should be taken within the first year to doctoral study. Permission of instructor required.

Learning Outcomes: 1. Identify and understand contemporary education research concerns. 2. Identify and understand research within multiple paradigms and perspectives. 3. Interact with Purdue faculty about their current research interests. 4. Grow and develop as a professional. Credits: 1.00

EDCI 64400 - Legal Issues In Career And Technical Education

Credit Hours: 3.00. Comprehensive examination of contemporary federal, state, and local legislation; rules, policy, regulations, provisions, guidelines, and initiatives affecting the nature, establishment, and implementation of state and local programs at the secondary and postsecondary levels in career and technical education; need for legislation and initiatives and the reauthorization of existing legislation; social, political, and economic aspects of legislation; advocacy for legislation; and public policy and policy development. Approval of Department required.

Learning Outcomes: 1. Discuss the importance and impact of statutory law on the development and nature of career and technical education in the United States. 2. Describe and contrast the legislative process and policies at the national and state levels. 3. Review, articulate, and analyze critically the history of CTE and related legislation from 1862 to the present. 4. Explain and apply the major provisions of the current CTE and workforce federal legislation. 5. Relate and apply the content of the current Indiana State Plan for CTE to the provisions, requirements, and legal interpretation of Federal CTE legislation. 6. Examine critically and apply Indiana legislation and initiatives that provide authority, support, structure, and administration for CTE in the State. 7. Refine conceptual, analysis, synthesis, and evaluation skills. 8. Enhance their written and oral communication skills. Credits: 3.00

EDCI 64500 - Organization And Administration Of Career And Technical Education

Credit Hours: 3.00. Organizational structure and delivery systems at the national, regional, state, and local levels; program areas and services; legislative initiatives; federal, state, and local planning; administrative functions and practices; leadership development; trends; and issues.

Learning Outcomes: 1. Develop an understanding of the organizational structure and delivery systems at the national, regional, state, and local levels in career and technical education (CTE). 2. Provide an overview of the CTE program areas, career clusters, career pathways, and services and their relationships to academic and special education. 3. Review federal and state legislation related to CTE. 4. Examine federal, state, regional, and local planning and funding activities. 5. Analyze administrative functions and practices and management systems. 6. Critique leadership and staff development initiatives in CTE. 7.

Evaluate current trends and issues in the field. Credits: 3.00

EDCI 64600 - Supervision In Career And Technical Education

Credit Hours: 3.00. Purposes, principles, strategies, and procedures of supervision and management in career and technical education and related workforce education and development contexts: theory and practice: human resource development: environment, education, and management. Approval of Department required.

Learning Outcomes: 1. Define and describe contemporary supervision concepts. 2. Identify and explain principles of educational supervision. 3. Relate and analyze critically emerging concepts in supervision to social, political, economic, and cultural factors. 4. Describe and discuss a sequence of (clinical) experiences that provide optimum opportunity for developing educator competencies. 5. Identify and apply best practices experiences that have potential for practica, internships, and other work-based learning programs. 6. Identify and describe the stages of supervision. 7. Identify, evaluate, select, and apply techniques and strategies appropriate to the implementation of each stage of supervision. 8. Implement methods of supervision in pre-observation, conference, observation, analysis and strategy, conference, and post-conference contexts. 9. Develop awareness and participate in professional development opportunities in CTE and education. Credits: 3.00

EDCI 64700 - Research In Career And Technical Education

Credit Hours: 3.00. Rationale for and history of research in career and technical education; analysis of the research process and research methods; examination of the environment and support required for research; proposal development, and strategies for dissemination and utilization of research. Offered in alternate years.

Learning Outcomes: 1. Develop a rationale for disciplined inquiry in career and technical education. 2. Examine the history of research in career and technical education. 3. Analyze the research process and research methods. 4. Identify the environment and support required for research. 5. Describe strategies for the dissemination, utilization, and evaluation of research. Credits: 3.00

EDCI 64800 - Curriculum In Career And Technical Education

Credit Hours: 3.00. Overview of curriculum in career and technical education programs; business and industry training programs; curriculum planning, development, implementation, and evaluation; review and analysis of curriculum models.

Learning Outcomes: 1. Develop an understanding of curriculum and its relationship to other instructional phases in career and technical education and training. 2. Provide an overview of curriculum processes and procedures in career and technical education and business and industry training programs. 3. Review and analyze curriculum development research in career and technical education. 4. Acquire skills in curriculum needs assessment, planning, implementation, and evaluation. 5. Explore the theoretical, ethical, political, social, and economic factors related to curriculum development in career and technical education and training. 6. Gain experience in designing a curriculum plan and curriculum development. Credits: 3.00

EDCI 64900 - Assessment In Career And Technical Education

Credit Hours: 3.00. Goals and rationale for evaluation in education and work training contexts; assessment and measurement methods, techniques, and procedures; reliability, validity, and accuracy; construction and selection of instruments; data and information collection, analysis, and interpretation; meta evaluation; adaptations and modifications for special needs populations; and using assessment data and information.

Learning Outcomes: 1. Provide an overview of assessment in career and technical education

and training programs. 2. Identify goals and a rationale for evaluation. 3. Explore contemporary assessment trends and practices. 4. Develop an understanding of career assessment and measurement methods, techniques, and procedures in career and technical education and training. 5. Examine several methods for estimating instrument reliability, validity, and accuracy. 6. Develop skills in the construction, analysis, and selection of assessment and measurement instruments and procedures in career and technical education and training programs. 7. Explore the ethical, psychological, political, social, economic, and educational issues related to assessment in career and technical education and training. 8. Gain experience in the collection and analysis of assessment data and information. 9. Develop skills in the evaluation of assessment and measurement instruments. 10. Explore a variety of appropriate procedures to interpret, disseminate, and use assessment data and information in career and technical education and training programs. Credits: 3.00

EDCI 65000 - Program Evaluation In Career And Technical Education

Credit Hours: 3.00. Goals and objectives of, and criteria for, program evaluation in career and technical education; evaluation models and methods; design and planning; issues; development and selection of instruments and procedures; data and information collection and analysis; preparing program evaluation reports; and using program evaluation results for program improvement.

Learning Outcomes: 1. Provide an overview of program evaluation. 2. Develop an understanding of the major concepts, principles, models, theories, and techniques of evaluation. 3. Acquire knowledge and skills in designing and planning program evaluations. 4. Explore the ethical, political, social, and economic issues related to evaluation. 5. Experience implementing the methods, procedures, and activities of a program evaluation plan. 6. Participate in the reporting, dissemination, and use of findings of program evaluations. Credits: 3.00

EDCI 65200 - Seminar In Family And Consumer Sciences Education

Credit Hours: 2.00 to 6.00. A critical analysis of current problems, trends, issues, and programs in family and consumer sciences education. Prerequisite: 12 credit hours in Education or equivalent professional training. Permission of instructor required.

Credits: 2.00 to 6.00

EDCI 65300 - Seminar In Career And Technical Education

Credit Hours: 1.00 to 9.00. Current trends, theory, and practices related to educational contexts and careers.

Learning Outcomes: 1. Review, synthesize, analyze, and critique current research in education, career and technical education, and related fields and disciplines. 2. Identify significant research problem areas and researchable problems in education. 3. Examine and evaluate research methods used and applicable in education fields and related disciplines. 4. Explore various research dissemination strategies. 5. Network with researchers in education and related fields. Credits: 1.00 to 9.00

EDCI 66000 - Learning Design And Technology Seminar

Credit Hours: 1.00. This course is an investigation of trends, developments, and issues in learning design and technology with a focus on current practices, problems, and research. This one-credit seminar is designed to help students learn about applications of instructional design and educational technology in various settings and to interact with faculty and guest speakers about topics related to the field and the LDT program.

Learning Outcomes: 1. Become familiar with resources available to support progression through your LDT graduate program. 2. Learn the specifics of the program and its requirements, including reviewing targeted

learning competencies, portfolio requirements, program faculty, and the graduate handbook. 3. Identify and work towards fulfilling short and long-term professional goals. 4. Identify a career pathway that is appropriate for you including the skills, knowledge, and attitudes you will need to be successful. 5. Gain real-world insights into LDT field. Credits: 1.00

EDCI 67000 - Learning Design And Technology Portfolio

Credit Hours: 1.00 to 2.00. This course was created to help guide LDT students near completion of their coursework to develop their competency portfolio. The competency portfolio is a requirement for graduation from the traditional LDT Master's program.

Learning Outcomes: 1. Develop an electronic version of your competency portfolio based on artifacts as evidence. 2. Compose narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings in the field. Credits: 1.00 or 2.00

EDCI 67200 - Advanced Practices In Learning Systems Design

Credit Hours: 3.00. This course focuses on the application of learning systems design to real-world educational situations through the in-depth consideration of key instructional design processes (e.g., analysis, design, development, implementation, evaluation). Additionally, a key focus of the course is on the development of instructional design expertise. Prerequisite: EDCI 57200.

Learning Outcomes: 1. Analyze complex instructional design case situations and identify key components (e.g., issues, stakeholders, contextual variables, perspectives, alterative solutions, potential consequences). 2. Propose and/or develop relevant intervention strategies (instructional or non-instructional) to the issues presented in a case situation that are consistent with arguments and evidence presented. 3. Identify and apply key characteristics of expert problem solving to ill-structured ID problems. 4. Identify and discuss current issues, trends, and controversies in the profession. 5. Develop a case study of a specific instructional design problem. 6. Facilitate a case study of a specific instructional design problem. Credits: 3.00

EDCI 67300 - Issues And Methods In Learning Systems Design Research

Credit Hours: 3.00. Provides preparation to conduct independent research in the field of learning design and technology through direct participation in the research process: critically reviewing research, designing and conducting a research study, synthesizing and presenting results in written and oral formats. Prerequisites: EDPS 53300, EDCI 67600, EDCI 67700.

Learning Outcomes: 1. Describe the role of research in the field of Learning Design and Technology. 2. Design a research study to investigate a problem relevant to the field of Learning Design and Technology. 3. Conduct a research study in an applied (school, hospital, community agency) or experimental (lab, designed) setting. 4. Analyze, interpret, and discuss various sets of data. 5. Write a research report according to APA guidelines. 6. Present the results of a research study according to professional guidelines. Credits: 3.00

EDCI 67400 - Advanced Instructional Design Theory

Credit Hours: 3.00. Examines the impact of both psychological learning theories and instructional applications upon the development of various instructional design theories. Emphasis is on theory construction, influence of learning and educational principles, and the current and future possibilities of instructional design theory. Prerequisite: EDCI 53100 and 57200.

Learning Outcomes: 1. Identify and consider the key principles and underlying assumptions from several prominent Instructional Design Theories and articulate relationships across these areas. 2. Determine when, why, how, and under what conditions specific ID theoretical principles can be applied to resolve applied learning problems. 3. Assess the effectiveness of specific ID

theories, explain their individual strengths and weaknesses, and propose alternative viewpoints, guidelines, and perspectives to enhance learning given specific situations. 4. Develop effective methods for analyzing and articulating sound and logical arguments regarding theoretical, instructional, and technological relationships, positions, and conceptualizations. Credits: 3.00

EDCI 67500 - Instructional Strategies

Credit Hours: 3.00. Examines and applies the cognitive strategies and tactics that can be used by an instructional designer to improve human learning. Applications of various instructional strategies for specific cognitive tasks (e.g., concepts, mental models, problem solving) will to be covered. Additionally, best practices for a diverse range of instructional methods will be considered, as well as, the strategies for the entire instructional experience. Prerequisite: EDCI 57200. Permission of instructor required.

Learning Outcomes: 1. Identify, synthesize, and summarize practical, research based guidelines that facilitate the development of quality instructional results. 2. Identify, describe, and select relevant cognitive techniques/strategies (e.g., analogies, metaphors, imagery and mnemonics) and cite relevant research to indicate their appropriate use and effectiveness. 3. Identify, describe, and select relevant instructional methods (e.g., case-based instruction, cooperative learning, discussion, simulation, peer mentoring, reciprocal teaching, and discovery) and cite relevant research to indicate their appropriate use and effectiveness. 4. Identify, describe, and select relevant motivational strategies that can be incorporated to increase learner effort in a learning task and cite relevant research to indicate their appropriate use and effectiveness. 5. Given a task to evaluate instructional materials for specific content, identify the type of learning involved, select the appropriate set of instructional techniques, methods and strategies, and utilize those to design and propose an effective instructional outcome. Credits: 3.00

EDCI 67600 - Unpacking Research: Writing Literature Reviews In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the learner to the process of analyzing and preparing literature reviews on topics relevant to the field of Learning Design and Technology. Emphasis is placed on helping the learner to understand, critique, and synthesize the research literature in order to apply it to their own personal research agenda. Course activities and assignments are designed to help the learner develop the knowledge, tools, and strategies needed to become thoughtful consumers and producers of research and to use this knowledge to inform their practice. Learning experiences revolve around two major themes: 1) the examination and thoughtful critique of current research and 2) preparation of a thorough literature review that provides a rationale for continued study. Permission of instructor required.

Learning Outcomes: 1. Formulate a driving question about a specific topic in Learning Design and Technology. 2. Locate published literature (scholarly work) that supports the importance of the question. 3. Critically evaluate published research. 4. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 5. Analyze and provide feedback to peers through a collaborative learning experience. Credits: 2.00

EDCI 67700 - Unpacking Research: Writing Research Proposals In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the novice researcher to the process of developing a research problem statement supported by literature resulting in a professional organization conference proposal and a proposal for a funding agency in the field of Learning Design and Technology. Permission of instructor required. Prerequisite: EDCI 67600.

Learning Outcomes: 1. Discuss current research in the LDT field. 2. Formulate a problem statement, purpose statement, and research questions to drive a potential research

study. 3. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 4. Analyze and provide feedback to peers through a collaborative learning experience. 5. Develop a research proposal that is ready to be put into place. 6. Identify areas for improvement in the research proposal writing process. Credits: 2.00

EDCI 67800 - Unpacking Research: Writing For Scholarly Publications In Learning Design And Technology

Credit Hours: 2.00. This course is designed to introduce the novice researcher to the process of publishing research in the field of Learning Design and Technology. Emphasis is placed on practical aspects of the publishing process as well as familiarizing students with the role that editors and reviewers play in that process. Prerequisite courses include: EDCI 67600 Writing Literature Reviews and EDCI 67700 Writing Research Proposals. Students must bring a draft manuscript completed through the methods portion into the course, and students must have completed research and collected data to facilitate completion of a research-based manuscript for publication during the course. Permission of instructor required.

Learning Outcomes: 1. Discuss current research in the LDT field. 2. Formulate a problem statement, purpose statement, and research questions to drive a potential research study. 3. Read, interpret, and synthesize current research to create a thoughtful review that is persuasive and reliable. 4. Analyze and provide feedback to peers through a collaborative learning experience. 5. Develop a research proposal that is ready to be put into place. 6. Identify areas for improvement in the research proposal writing process. Credits: 2.00

EDCI 67900 - Capstone: Inquiry Into Practice

Credit Hours: 3.00. This course conceptually centers on the Ghanaian Sankofa symbol of a bird retrieving an egg from its back while facing forward. This metaphor represents the need to "go back to the past and bring forward that which is useful" (About the Sankofa [n.d.]. Retrieved from https://cola.siu.edu/africanastudies/about-us/sankofa.php). The twin aspect of looking back with the future in mind plays out in consonance with the Portfolio course generally taken in tandem with this course. In this course, students will reinforce and extend their learning of key concepts across the program and deepen their engagement with a topic of interest to them through an action research project. Permission of department required.

Learning Outcomes: 1. Evaluate how your program's experiences, knowledge, and skills will inform your future action and pedagogical practices through reflection and self-critical inquiry. 2. Articulate where you are situated epistemologically, ontologically, and methodologically as educators and researchers within and across disciplines. 3. Demonstrate a commitment to ongoing development as knowledgeable and engaged advocates for equitable education through the exploration of intersectionality. 4. Conduct an action research project that identifies a problem within your classroom or school community and seeks to ameliorate it. 5. Communicate research findings with a broader audience of stakeholders. Credits: 3.00

EDCI 68000 - Curriculum & Instruction MS Portfolio

Credit Hours: 1.00. This course was created to help guide C&I students near completion of their coursework to develop their competency portfolio. A competency portfolio reflects the depth and breadth of a student's educational growth since entering the graduate program. The purpose of the C&I competency portfolio is to demonstrate that students have mastered the graduate competencies for the C&I online Master's program. The portfolio will contain student projects aligned with C&I competencies and will be reviewed by committee members. The competencies are based on the Curriculum & Instruction departmental competencies and several program-specific competencies. The competency portfolio is a requirement for graduation from the C&I Master's program. (Multiple media are welcome.) Permission of department required.

Learning Outcomes: 1. Develop an online version of your competency portfolio based on artifacts as evidence. 2. Compose reflective narratives that explain how your artifacts demonstrate each competency. 3. Develop an updated resume or vita suitable for job searching. 4. Deconstruct relevant job postings

in the field. Credits: 1.00

EDCI 68200 - Contemporary Curriculum Theory

Credit Hours: 3.00. Critical examination of contemporary concepts of curriculum theory. Rational/technical curriculum, social needs/child centered curriculum. Socio-political curriculum theory; curriculum as existential, aesthetic, and phenomenological. Implications for current practice, school reform, and educational research.

Learning Outcomes: 1. Develop an understanding of the social theories and philosophies that inform contemporary curriculum theorizing. 2. Articulate the role of curriculum theorizing in defining and analyzing educational phenomena. 3. To utilize curriculum theory toward the development of educative responses to issues of ethics, equity, power, and privilege. 4. To synthesize the complexity and tensions of various curriculum theories into frameworks for educational research. Credits: 3.00

EDCI 68400 - Seminar In Curriculum Studies

Credit Hours: 3.00. A course designed to allow for the in-depth exploration of specialized and timely topics in curriculum theory, practice, and reform. Though all specialized topics address both theory and practice, some topics focus more heavily on practice, and others focus more heavily on theory.

Learning Outcomes: 1. Explore and develop awareness of specialized and timely topics in curriculum theory, practice, and reform. 2. Increase knowledge of specialized and timely topics in curriculum theory, practice, and reform. 3. Develop skills of critical thinking and reflection in relationship to specialized and timely topics in curriculum theory, practice, and reform. Credits: 3.00

EDCI 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Credits: 1.00 to 10.00

EDCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EDCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Educational Studies (Graduate)

Website: **https://www.education.purdue.edu/departments/department-of-educational-studies/**

Department/School Head

Christine Kiracofe

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Faculty

Hua Hua Chang Eric Deemer Christine Kiracofe Chantal Levesque-Bristol Yukiko Maeda F. Richard Olenchak Heather Servaty-Seib Yan Ping Xin	Lisa Lambert Snodgrass Nielsen Pereira Toni Kempler Rogat Anne Traynor Xiang Zhou	Bryan Duarte Qi Huang Ricky Price David Stanley, Jr.	Juliana Aguilar Jasmine Begeske Alissa Cress Kharon Grimmet Benna Haas Kristie Jones Alice Johnson Elizabeth Kraatz August Masonheimer Bev Nichols Terron Phillips Katy Rusnak Kristen Seward Jennifer Smith LaMonica Williams

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Academic Programs

The Department of Educational Studies aims to develop innovative, engaged, and skilled professionals through high-quality graduate programs. The department prepares students for positions as university professors, researchers, special education professionals, counseling psychologists, and testing, measurement and evaluation specialists. Our graduates work in schools, higher education, and private industry.

Teacher Licensing (graduate licensure programs)

For information on which Graduate programs lead to an Instructional or Administrative State of Indiana Educator License, and the obligations therein, visit the Office of Teacher Education and Licensure (OTEL) Graduate Programs website. Graduates of accredited universities and colleges who wish to enter Purdue University to complete requirements for an Indiana initial or Advanced License should contact the Office of Teacher Education and Licensure for the appropriate procedures. Graduates who wish to complete licensure requirements may do so on the same basis and criteria as other graduate students. Such applicants must meet the general admission requirements of the department and the Graduate School, as well as obtain permission from the Office of Teacher Education and Licensure (OTEL) to enter the specific licensure program in which they are interested. Students must meet all degree (if applicable), Teacher Education Program, and Indiana licensure requirements prior to being recommended for licensure by the Office of Teacher Education and Licensure (OTEL).

Educational Studies: Educational Leadership and Policy Studies Concentration, EDS

Gifted, Creative, and Talented Studies, Post-Baccalaureate Certificate

Educational Studies: Educational Leadership and Policy Studies Concentration, MSED or MS

Quantitative Research, Assessment, and Evaluation, Post-Baccalaureate Certificate

Applied Helping Skills, Post-Baccalaureate Certificate

Educational Studies: Higher Education Systems, Policy, and Leadership Concentration, MSED

Educational Studies: Applied Behavior Analysis Concentration, MSED

Educational Studies: Counseling Psychology Concentration, PHD

Educational Studies: Educational Leadership and Policy Studies Concentration, PHD

Educational Studies: Educational Psychology and Research Methodology Concentration, PHD

Educational Studies: Gifted Education Concentration, PHD

Educational Studies: Higher Education Concentration, PHD

Educational Studies: Special Education Concentration, PHD

Educational Studies: Applied Behavior Analysis Accelerated Professional Concentration, MSED

Educational Studies: Educational Psychology and Research Methodology Concentration, MSED or MS

Educational Studies: Gifted Education Concentration, MSED or MS

Educational Studies: Special Education Concentration, MSED or MS

EDPS 50000 - Group Counseling Theories And Techniques

Credit Hours: 3.00. Theoretical and experiential overview of fundamental elements of group work and group counseling processes. Broad topics include purposes and types of groups, therapeutic factors and stages of leadership skills, and multicultural, ethical, and legal aspects of group counseling. Learning Outcomes: 1. Differentiate among various types and purposes groups and specializations in group work. 2. Identify the essential group dynamics involved in understanding group interactions. 3. Develop an understanding of the principles and challenges associated with planning a group intervention. 4. Develop an understanding of the principles and challenges associated with implementing a group intervention such as recruitment, therapeutic factors, and developmental stages of group. 5. Compare and contrast different perspectives on group leadership. 6. Examine and discuss the ethical considerations unique to group work. 7. Acquire knowledge regarding diversity-competent group practice. 8. Evaluate empirical findings associated with group work. 9. Consider various approaches to evaluating group processes (e.g., program evaluation) and the outcome of group work. Credits: 3.00

EDPS 50001 - Foundations Of Online Learning

Credit Hours: 1.00. This course is designed to help you to understand the knowledge and skills necessary for your successful online learning in the Online MSEd in Special Education program, with a focus on the process of completing

University and Program specific requirements. In this orientation, you will explore what online learning entails and reflect on how you can best set yourself up to succeed in your studies.

Learning Outcomes: 1. Learn the specifics of the Online MSEd in Special Education program and its requirements. 2. Familiarize themselves with resources, review targeted learning competencies, and program requirements. Credits: 1.00

EDPS 50002 - Foundations Of Licensure

Credit Hours: 1.00. This course is designed to guide candidates to complete required documents needed to determine appropriate clinical practice placement(s) for candidates within unique employment situations. This course includes two process applications required of all employed candidates: 1) Clinical Practice Pre-Application Process and 2) Clinical Practice Application Process.

Learning Outcomes: 1. Participate in specific Online MSEd in Special Education Program Clinical Practice Placement requirements. Credits: 1.00

EDPS 50100 - Introduction To School Counseling

Credit Hours: 3.00. Presents an overview of counseling in elementary, middle, and secondary schools. Treats the history of school counseling, developmental characteristics and problems of students, and counseling program elements and issues.

Learning Outcomes: 1. Articulate fundamentals of counseling in general and school counseling in particular, as well as skills and role of the school counselor. 2. Articulate basic history and current trends in school counseling. 3. Identify ways for school counselors to serve as change agents in the school culture and climate, as well as incorporate multicultural understandings into conceptualizing school counseling programs. Credits: 3.00

EDPS 50500 - Foundations Of Career Development And Assessment

Credit Hours: 3.00. Treats career development theories which emphasize aspects of the self in decision making, occupational classification systems, and educational and vocational information with applications to individual and group counseling.

Learning Outcomes: 1. Develop a comprehensive understanding of core and emerging theories and areas of research in career development. 2. Demonstrate the ability to conceptualize career counseling cases from various theoretical and multicultural perspectives. 3. Demonstrate the ability to integrate theory and research and utilize this information in such a way that it informs applications of career counseling and assessment. 4. Demonstrate understanding of the role cultural, individual difference (e.g., biological, personality), and developmental factors play in shaping career development processes. Credits: 3.00

EDPS 50700 - Counseling Multicultural And Diverse Populations

Credit Hours: 3.00. Counseling strategies for multicultural and diverse populations encountered by helping professionals. Among the populations considered are ethnic and cultural minorities, older persons, the gifted, and the disabled.

Learning Outcomes: 1. Examine how social and cultural factors influence the counseling relationship and are reflected in counseling theory and practice. 2. Develop strategies for working with diverse individuals, couples, families, groups, and communities. 3. Develop an awareness of multicultural and pluralistic trends, including characteristics and concerns of specific socially and culturally diverse groups. 4. Examine ethical and legal issues related to counseling diverse populations. Credits: 3.00

EDPS 50701 - Foundational Techniques For Telemental Health Providers

Credit Hours: 3.00. The purpose of this course is to provide a broad overview of individual therapy with adults via telemental health using a videoconferencing platform. Within this course, students will develop general, foundational knowledge related to pre-screening adults for individual therapy, conducting intakes with adult clients, engaging in individual therapy sessions with adult clients, terminating with adult clients, and managing risk

with adult clients. Additionally, this course offers a brief overview of telemental health therapy with children, couples, families, and groups. This course is taught in an asynchronous manner and uses various strategies to facilitate student learning, which include: discussion boards, case studies, role plays, self-assessment papers, and pre-recorded lectures with associated PowerPoint slides. Access to necessary technology resources which includes but is not limited to: stable internet access, Brightspace, a telemental health or associated platform, and a computer, is required to complete the course.

Learning Outcomes: 1. Acquire basic knowledge for telemental health technologies/platforms. 2. Learn the basic function and operations of telemental health technologies/platforms. 3. Obtain an understanding of telemental health technologies' strengths and limitations. 4. Become familiar with the primary ethical considerations for telemental health practice. 5. Learn ethical considerations associated with telemental health practice. 6. Identify ethical considerations that are unique to telemental health practice as compared to in-person, face-to-face clinical practice. 7. Be encouraged to research and learn basic telemental health practice guidelines and laws for their associated profession and state-of-practice, respectively. 8. Learn about effective utilization of telemental health technologies/platforms for individual therapy with adults. 9. Acquire foundational knowledge in conducting an effective pre-screening appointment for potential individual therapy clients with telemental health. 10. Become knowledgeable in how to use basic clinical skills within individual therapy via telemental health. 11. Learn about the termination and referral processes when working within telemental health. 12. Know how to address unexpected and unique issues associated with telemental health (e.g., loss of connectivity). 13. Able to successfully implement essential, foundational clinical skills within a telemental health technology/platform. 14. Engage in active discussion via online discussion boards regarding the application of clinical skills within telemental health. 15. Engage in active practice and application of foundational clinical skills as related to telemental health (i.e., role plays). 16. Foster self-awareness of their strengths and areas of growth regarding telemental health practice. 17. Work to identify their strengths and areas of growth regarding telemental health prior to learning course material. 18. Work to identify their newfound strengths and continued areas of growth regarding telemental health near completion of the course. 19. Learn risk management with adults via telemental health. 20. Learn how to address suicidality and homicidality in adults with telemental health practice. 21. Obtain introductory knowledge and skills in telemental health practice with couples, families, groups, and children. 22. Be provided with cursory knowledge regarding therapy with couples, families, groups, and children using a telemental health platform. Credits: 3.00

EDPS 50702 - Addressing Demographic Health Disparities In Telehealth

Credit Hours: 3.00. The practice of tele-mental health is expanding rapidly. This expansion reflects both increased opportunities afforded by technological advances within the healthcare field, as well as pressing needs to resolve persistent healthcare disparities associated with in-person services. As part of the Certificate in Telemental Health Counseling, this course will prepare students to take a systematic view of the challenges and opportunities of transitioning live practices to telehealth, by preparing students to Identify demographic telemental health disparities at local, national, and international levels; describe key barriers that produce demographic telemental health disparities; generate a telemental health access

toolkit to address demographic disparities within a specific practice and/or field.
Learning Outcomes: 1. Identify demographic telemental health disparities at local, national, and international levels. 2. Explain the historical intersections across the fields of mental health, technology, and social justice. 3. Describe key barriers that produce demographic telemental health disparities. 4. Generate a telemental health access toolkit to address demographic disparities within your practice and field.
Credits: 3.00

EDPS 50703 - Introduction To Telemental Health Assessment And Intervention

Credit Hours: 3.00. As part of the Certificate in Telemental Health, this course will prepare students to take a systematic view of the challenges and opportunities of transitioning live practices to telehealth, by preparing students to apply intervention skills within a telehealth framework; identify key differences in telehealth procedures compared to in-person practice; apply skills for working with individuals, groups and families via telemental health processes and practices.
Learning Outcomes: 1. Consider and explain barriers and strengths of implementing various evidence-based practices in telemental health. 2. Effectively use strategies for implementing therapies via telemental health platforms. 3. Understand and utilize cognitive and behavioral interventions via telemental health platforms. 4. Understand the nuance of and deliver adherent psychological assessment measures via telemental health platforms. Credits: 3.00

EDPS 50800 - Cultural And Linguistic Diversity In Special Education Programs

Credit Hours: 3.00. Living in a diverse society provides special education teachers and support personnel the opportunity to encounter a wide array of cultures in their educational settings. The course, designed for special education stakeholders (i.e., teachers, staff, support personnel, administrators), considers issues of human diversity, broadly defined to include ability, ethnicity, culture, gender identity, linguistic background, race, religion, socioeconomic status, and sexual orientation. This course challenges biased assumptions that influence the provision of educational services, and examines issues related to promoting equal learning opportunities in the classroom and other educational settings. It is designed to facilitate student examination of how diversity and diverse experiences shape systems that affect individuals, families, communities, and society. It allows students to explore their own cultures and the biases and internalized messages about those who are different from themselves. Students will be introduced to specific approaches to practice, and frameworks for equity, advocacy, and empowerment to support students who receive special education and/or applied behavior analysis (ABA) service, as well as their families. The course also includes information and discussion topics pertaining to the culturo-behavior science (CBS) specialization of the Association for Behavior Analysis International (ABAI) and to interpersonal communication skills - to include speaking, listening, reading, and writing - and their effect on students and families. Permission of instructor required.
Learning Outcomes: 1. Demonstrate a conscious awareness and working knowledge of diverse populations within education settings. 2. Demonstrate the knowledge to create safe, inclusive, culturally responsive learning environments and classroom management systems. 3. Demonstrate the ability to identify funds of knowledge and how they interact to form meaningful relationships with students and families. 4. Engage with others around identity and difference, and apply self-awareness to identify and manage the influence of personal biases and values in working in diverse settings. 5. Analyze and interpret historical and contemporary dynamics of privilege and oppression in society that lead to inequalities in access to educational resources. 6. Analyze, evaluate, and propose solutions to contemporary social problems found in schools, school districts, and ABA settings (E.g., culturally responsive PB IS, restorative justice, etc. 7. Implement strategies that encourage students' to value their own heritage; value richness of cultural diversity and commonality; respect diverse cultural groups; and reduce stereotyping. Credits: 3.00

EDPS 51500 - Foundations Of Applied Behavioral Analysis In School Settings

Credit Hours: 3.00. Application of learning theory, measurement procedures, verification of functional relationships, and developing knowledge of current significant research in applied behavior analysis.

Learning Outcomes: 1. Introduced to specific methods and teaching strategies for working with children with emotional and behavioral disabilities. 2. Prepared to systematically monitor student performance. 3. Prepare teachers to devise and implement usable functional behavior analysis and behavior management plans for students with emotional and behavioral disabilities. Credits: 3.00

EDPS 52000 - Characteristics Of Students With Intense Intervention Needs

Credit Hours: 3.00. EDPS 52000 will explore typical and atypical human development, characteristics and etiologies, as well as the influence of cultural, linguistic, and socioeconomic factors of students with intense intervention needs. Candidates will study medical conditions, physical and health needs, common medications, and the importance of transition plans, health-care plans, and behavioral and academic intervention plans designed to help students with intense intervention needs achieve desired positive learning outcomes. Candidates will be introduced to AAC systems, technology, materials, and other resources to support and enhance the communication skills of students with intense intervention and English learning needs. This course will also explore strategies for using digital tools and resources to communicate and collaborate with students, families, general education teachers, related service providers, paraprofessionals, community agencies, and other stakeholders to help students with mild disabilities achieve desired positive learning outcomes. In addition, candidates will analyze relationships across theory and practice, multiple perspectives and trends, and the application of these relationships within educational settings.
Candidates will explore major theories and concepts related to online learning, virtual instruction, twenty-first-century skills, information literacy skills, and the diverse perspectives of online students and develop strategies for effectively integrating technologies into teaching and learning, discuss the benefits and challenges of technologies as educational tools, and apply technologies to meet a variety of learning purposes and needs.

Learning Outcomes: 1. Recognize typical and atypical human development, characteristics and etiologies in order to address the educational needs of individuals with intense disabilities. 2. Apply knowledge of the effects of medical conditions, physical and health needs, and common medications (e.g., stimulant, antidepressant, antiepileptic) on students with intense exceptional needs. 3. Analyze the impact of disability on the multiple aspects (education, career, vocation, social relationships, recreation, and adult life) of the life of an individual with intense intervention needs, including the knowledge of the family's role in supporting learning and development. 4. Explain the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals with intense intervention needs from diverse groups. 5. Maintain a safe and healthy learning environment by utilizing universal precautions, applying appropriate body mechanics to ensure safety in transferring, lifting, positioning, and seating, and implementing specialized health-care interventions for students with intense physical and health needs. 6. Apply appropriate techniques for physical positioning, and maintain educational and assistive technologies to facilitate the learning of students with intense intervention needs. Credits: 3.00

EDPS 52400 - Effective Instruction For Students With Significant Reading Difficulties

Credit Hours: 3.00. This course will explore significant reading difficulties, such as dyslexia, and essential components of effective reading instruction. This course will investigate scientifically-based reading research (SBRR), evidence-based and developmentally appropriate reading instruction and interventions to support students with exceptionalities.

Learning Outcomes: 1. Identify the foundations of language acquisition and literacy development, including cognitive, linguistic, cultural, social, and motivational factors that affect language acquisition and literacy development; and major components of reading development, including phonemic awareness, phonics, fluency, vocabulary, and text comprehension. 2. Explore the history, origins,

and underlying causes of significant reading difficulties, including dyslexia. 3. Synthesize principles of scientifically based reading research (SBRR) and evidence-based reading instruction and intervention, such as applying data-based decision making, setting individual student learning goals, and using instruction grounded in SBRR. 4. Explain key concepts of phonemic awareness: the critical role of phonemic awareness in learning to read an alphabetic language; the distinction between phonological awareness (i.e., the awareness that oral language is composed of smaller units, such as spoken words and syllables) and phonemic awareness (i.e., a specific type of phonological awareness involving the ability to distinguish the separate phonemes in spoken words); and knowledge of the continuum of phonological- and phonemic-awareness skills development. 5. Summarize key concepts of phonics in developing accurate decoding and automaticity in word recognition; the importance of sequencing phonics instruction according to the increasing complexity of linguistic units; the reciprocity between decoding and encoding; and the continuum of phonics skills. 6. Create SBRR-based, evidence-based, and developmentally appropriate assessment, instruction, intervention, or extension lesson plan, and ongoing progress monitoring in phonemic awareness, phonics, fluency, vocabulary and academic language, comprehension and analysis of informational, persuasive, and literary texts, including response to literature. Credits: 3.00

EDPS 52700 - Literacy Curricula For Learners With Exceptionalities

Credit Hours: 3.00. This course will explore research-supported general and specialized literacy curricula to prepare candidates to design and/or adapt instructional lessons and materials to meet the needs of students with exceptionalities. Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 2. Evaluate research-supported instructional strategies and materials appropriate to the strengths, needs, and characteristics of students with exceptionalities within the areas of literacy development, reading fluency, concepts of vocabulary and academic language, and comprehension and analysis of informational, persuasive, and literary text. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and the students' learning environment. 4. Create lesson plans, based on national, state, and/or local curricula standards and the scope and sequence of grade-level/chronologically-aged appropriate general education content-area curriculum that incorporate UDL, research-supported instructional strategies and materials, and provide meaning-filled learning opportunities. 5. Design lesson plans that incorporate UDL and apply research-supported strategies to provide specially designed reading and writing instruction, including strategies for providing explicit and systematic instruction and strategies for using technology to support various aspects of the reading and writing process and include instructional and assistive strategies to teach students to monitor errors in reading comprehension and writing. 6. Evaluate instruction, monitor progress, and make instructional changes to support student learning. Credits: 3.00

EDPS 53000 - Cognition And Learning In Context

Credit Hours: 3.00. Theories of learning and development, research on instruction and learning, and principles of measurement applied to educational problems.

Learning Outcomes: 1. Understand the central components of Behaviorism, differentiate between classical and operant conditioning, and apply the theories to teaching and learning. 2. Understand the central tenets of constructivism, identify a range of constructivist theories or perspectives, and distinguish constructivism from behaviorism. 3. Understand the central components of theories of learning and development developed by Bandura, Piaget, and Vygotsky, and apply them to teaching and learning. 4. Understand the roles of memory, expertise, transfer, conceptual change, meta-cognition, and self-regulated learning for student learning, and their implications for teaching. 5. Identify the central characteristics of instructional scaffolding, and cooperative and collaborative learning, how they are associated with learning, and how they may be instantiated. 6. Understand central tenets of sociocultural (or sociohistorical) and situated theories of learning and development and apply them to teaching and learning. 7. Understand the central characteristics of inquiry (or project-based learning) and their affordances and limitations with respect to teaching and learning. 8. Understand how policies (educational and otherwise), political priorities, beliefs, and national and international factors affect affordances for teaching and learning. Credits: 3.00

EDPS 53100 - Introduction To Measurement And Instrument Design

Credit Hours: 3.00. An application-oriented introduction to constructing educational and psychological tests and surveys. Class sessions include guided practice with the process of instrument development, from trait and test task domain definition, item writing and revision, and item analysis, to score interpretation and validation.

Learning Outcomes: 1. Explain fundamental concepts and terminology in educational measurement. 2. Evaluate existing measurement instruments and score uses. 3. Contribute to development of instruments for measuring educational outcomes. 4. Interpret descriptive statistics for test and test item scores. Credits: 3.00

EDPS 53300 - Introduction To Educational Research I: Methodology

Credit Hours: 3.00. This course presents a sequence of journal articles and exercises that help introduce the foundational concepts of the course, including: research design, reliability and validity, various methodologies commonly used in educational research, and basic quantitative and qualitative data analyses. In addition, contrasting research conclusions are shown in the articles to help students learn why careful analysis of articles and their theoretical framing is critical to evaluating their conclusions.

Learning Outcomes: 1. Find research literature. 2. Read and critique educational research. 3. Deepen knowledge of at least one research area in education. 4. Design, conduct, analyze, and write a research project. Credits: 3.00

EDPS 53400 - Introduction To Educational Research II: Measurement Consideration

Credit Hours: 3.00. This course is designed to provide an overview of introductory quantitative data analysis methods in education. The course in specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Describe key concepts and principles of educational measurement. 2. Conduct comprehensive analyses of the characteristics of different assessments (including their advantages and limitations). Credits: 3.00

EDPS 53600 - Achievement Motivation And Performance

Credit Hours: 3.00. Study of current theory and research on the nature and development of achievement motivation. Motivation for intellectual and academic performance will be emphasized. Applications of theory in educational settings will be considered.

Credits: 3.00

EDPS 54000 - Gifted, Creative And Talented Children

Credit Hours: 3.00. This course is an introduction to the intellectual, social, and emotional characteristics of gifted youth; philosophies of gifted education; and programmatic and classroom approaches for supporting gifted students generally and within different domains (e.g., intellectual, academic, creative, artistic, leadership).

Learning Outcomes: 1. Understand who gifted, creative, and talented children are and how their talent development needs can be met in the school setting. 2. Recognize the diversity that exists within the gifted, creative, and talented population. 3. Understand the history, philosophical traditions, and paradigms of practice in gifted education. 4. Develop awareness of specific strategies for supporting gifted, creative, and talented students within the school context. 5. Develop awareness of key professional resources in the field of gifted education and talent development. 6. Develop a personal identity as a practitioner of gifted education. Credits: 3.00

EDPS 54100 - Identification And Evaluation In Gifted Education

Credit Hours: 3.00. This course provides an introduction to the instruments and procedures for identifying gifted, creative, and talented students, as well as the issues and procedures for evaluating gifted programs and individual student progress.

Learning Outcomes: 1. Demonstrate skills in assessing the evaluability of a gifted program. 2. Develop an evaluation plan that reflects understanding of key issues in gifted program evaluation. 3. Develop a figted program evaluation plan that demonstrates a utilization focus. 4. Demonstrate scholarly behaviors in exploring an interest linked to course content. 5. Analyze key issues in selecting a student for gifted program participation and monitoring growth. Credits: 3.00

EDPS 54200 - Curriculum And Program Development In Gifted Education

Credit Hours: 3.00. This course is an introduction to the curriculum development and program design for meeting the needs of gifted, creative, and talented students. Students will be exposed to established program and curriculum models, as well as the nuts and bolts of developing curricular plans, materials, and specialized programs that support the advanced learning needs of gifted students.

Learning Outcomes: 1. Students will think strategically about gifted program design, including such design components as mission statements, program goals, building a continuum of services, and designing student selection procedures. 2. Students will become familiar with major program and curriculum models in gifted education. 3. Students will practice designing and revising lessons to incorporate instructional strategies well suited for high-ability students. 4. Students will become critical evaluators of educational materials and practices to assess their suitability for use with high-ability students. Credits: 3.00

EDPS 54500 - Social And Affective Development Of Gifted Students

Credit Hours: 3.00. This course focuses on the social and emotional development of gifted and talented students. An overview of the characteristics and needs of gifted subpopulations, diversity issues, and family/parenting concerns along with an introduction to current educational approaches and counseling interventions are provided. The course is designed to complement EDPS 54000.

Learning Outcomes: 1. Analyze, synthesize, and evaluate current research literature on the social and affective development of gifted students. 2. Discuss characteristics and needs of subpopulations of gifted and talented learners

and the implications for academic instruction and/or counseling interventions. 3. Increase knowledge of issues related to the social and affective development of gifted students through class discussion, interaction with gifted students, and completion of CORE assignments. Credits: 3.00

EDPS 54700 - Foundations And Principles Of Applied Behavior Analysis

Credit Hours: 3.00. This course will provide a historical perspective of Applied Behavior Analysis as well as the core principles of ABA. The learner will be exposed to the foundational concepts and methods of ABA including defining behaviors, collecting data, and understanding the three-term contingency of behavior. Permission of instructor required.

Learning Outcomes: 1. Identify and define the basic concepts of applied behavior analysis including the foundations of ABA, interrelated domains, and dimensions of ABA. 2. Identify factors to consider when selecting target goals including client and environmental factors. 3. Define behavior utilizing observable and measurable terms including all components of an appropriate behavior goal. 4. Identify measurable dimensions of behavior and appropriate measurement procedures, including advantages and disadvantages of each. 5. Construct and interpret graphic displays of behavioral data. 6. Describe the key components of visual analysis and a strong experimental design including interobserver agreement and treatment fidelity. 7. Define reinforcement and punishment including application procedures, schedules of delivery, and key considerations. 8. Identify the types of preference assessments including similarity and differences in procedures. Credits: 3.00

EDPS 54800 - Ethics And Professional Practice Of Applied Behavior Analysis

Credit Hours: 3.00. This course will address the professional and ethical responsibilities of behavior analysts. Key issues of responsible conduct as it relates to areas such as confidentiality, consent, consultation, treatment planning, and research will be discussed and applied through case studies. Learners will be able to apply ABA techniques within the bounds of both legal and ethical frameworks. Permission of instructor required.

Learning Outcomes: 1. Demonstrate understanding of BACB guidelines for the responsible conduct of applied behavior analysis. 2. Discuss scenarios involving ethical issues and describe appropriate solutions using BACB guidelines. 3. Identify appropriate ethical practices in ABA research. 4. Demonstrate and describe methods used to protect client/student confidentiality. 5. Demonstrate understanding of empirically validated practices vs. pseudoscience and non- validated practices within the context of service delivery. Credits: 3.00

EDPS 54900 - Verbal Behavior And Social Communication

Credit Hours: 3.00. This course will explore the development of verbal and social behavior as explained through tenets of applied behavior analysis. Students will identify the similarities and differences between verbal operants as well as appropriate function-based interventions to develop each including augmentative communication systems and functional communication training. Measurement and intervention for more complex social-communication skills will also be addressed. Permission of instructor required.

Learning Outcomes: 1. Understand and describe the historical perspective of Verbal Behavior in relation to Applied Behavior Analysis including differences between structural and functional approaches. 2. Describe verbal behavior in terms of the three term contingencies. 3. Define, describe, and differentiate the basic verbal operants. 4. Assess, interpret results and develop appropriate treatment plan to address target skills utilizing the VB-MAPP. 5. Identify and describe evidence-based practices for addressing communication for individuals with complex communication needs 6. Identify and describe evidence-based practices for

increasing social-communication skills including intraverbal and listener behaviors. 7. Summarize and critically evaluate research on verbal and communication interventions for individuals with disabilities. Credits: 3.00

EDPS 55000 - Behavioral Consultation And Systems Change

Credit Hours: 3.00. This course will address the provision of behavioral analytic services through consultation within an implementation science framework. Application of ABA principles to evaluate and address system change will be explored including application of behavioral skills training. Techniques for program evaluation, collaborative planning, and progress monitoring will be discussed. Permission of instructor required.

Learning Outcomes: 1. Develop an understanding of implementation science frameworks and stages. 2. Describe, analyze, synthesize, evaluate and discuss factors that influence implementation of evidence-based practices. 3. Understand consultation theory and its application for decision-making in educational and family contexts. 4. Apply problem-solving techniques in collaborating with professional colleagues, parents and related personnel to provide for students' learning needs. 5. Articulate key principles of behavioral skills training and coaching. 6. Communicate the principles of behavior analysis in nontechnical language. Credits: 3.00

EDPS 55100 - Practicum In Applied Behavior Analysis

Credit Hours: 3.00. University-supervised fieldwork in applied behavior analysis. This practicum will facilitate development and fluency of essential professional and ethical skills necessary for the delivery of high-quality ABA services. Permission of instructor required.

Learning Outcomes: 1. Conduct assessment to determine the need for ABA services and guide intervention decision-making. 2. Design, implement, and monitor applied behavior interventions designed to increase or reduce target behaviors. 3. Explain, both verbally and in writing, behavioral analytic techniques, in technical and non-technical language appropriate for the audience. 4. Consult with and provide behavior skills training for behavior-change agents responsible for carrying out ABA program. 5. Demonstrate ability to analyze the incorporate findings from research into applied settings. Credits: 3.00

EDPS 55200 - Basic Concepts Of Applied Behavior Analysis

Credit Hours: 3.00. This course is the first in a sequence of courses for the Applied Behavior Analysis Certificate Program. This course, in combination with the other courses, will provide fundamental knowledge and experiences for understanding Applied Behavior Analysis principles, concepts, and techniques, including observational analysis, data-based instruction, and social validity to increase students' social and task related behavior. Students learn procedures to increase or decrease target behavior, to facilitate behavior maintenance and generalization, and to evaluate effectiveness of instruction. Permission of instructor required.

Learning Outcomes: 1. Identify the goals of behavior analysis as a science (i.e., description, prediction, control) (A-1). 2. Explain the philosophical assumptions underlying the science of behavior analysis (e.g., selectionism, determinism, empiricism, parsimony, pragmatism) (A-2). 3. Describe and explain behavior from the perspective of radical behaviorism (A-3). 4. Distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis (A-4). 5. Describe and define the dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968) (A-5). 6. Define and provide examples of behavior, response, and response class (B-1). 7. Define and provide examples of stimulus and stimulus class (B-2). 8. Define and provide examples of respondent and operant conditioning (B-3). 9. Define and provide examples of positive and negative reinforcement contingencies (B-4). 10. Define

and provide examples of schedules of reinforcement (B-5). 11. Define and provide examples of positive and negative punishment contingencies (B-6). 12. Define and provide examples of automatic and socially mediated contingencies (B-7). 13. Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers (B-8). 14. Define and provide examples of operant extinction (B-9). 15. Define and provide examples of stimulus control (B-10). 16. Define and provide examples of discrimination, generalization, and maintenance (B-11). 17. Define and provide examples of motivating operations (B-12). 18. Define and provide examples of rule-governed and contingency-shaped behavior (B-13). 19. Define and provide examples of the verbal operants (B-14). 20. Define and provide examples of derived stimulus relations (B-15). Credits: 3.00

EDPS 55300 - Application Of Applied Behavior Analysis To Manage And Support Personnel

Credit Hours: 3.00. This course will teach students how to use applied behavior analysis to maximize the potential of an organization. Students will learn the role of a Behavior Analyst in implementing principles of applied behavior analysis to motivate employees, intervene with challenges in the organization, evaluate the program, and collect and deliver ongoing performance feedback. Permission of instructor required.

Learning Outcomes: 1. Define Organizational Behavior Management (OBM) and explain how it differs from other management approaches. 2. State three specialty areas of application of OBM. 3. Define Pinpoint and state the four components of behavior pinpointing. 4. Describe methods and tools for measurement in OBM. 5. Describe types of analysis in OBM. 6. State common intervention procedures used in organizations. 7. Apply OBM knowledge to assess targeted concern(s) and provide recommendations within an organization. 8. State characteristics of effective feedback. 9. Describe steps for evaluating reinforcers and delivering reinforcers. 10. Describe tools for evaluating performance change. Credits: 3.00

EDPS 55400 - Positive Learning Environments And Classroom Management

Credit Hours: 3.00. This course will focus on classroom PBIS practices to create positive learning environments (online and face-to-face), establish classroom expectations, and develop academic and behavioral routines to meet the social, emotional, and behavioral needs of students with exceptionalities. EDPS 55400 will support candidates as they develop classroom practices that are positive and preventative in nature and align to larger school and district positive behavioral supports.

Learning Outcomes: 1. Identify types, characteristics, strengths, limitations, and evaluate theoretical approaches and research-based models of behavior intervention, motivation, and reinforcement techniques used with students with exceptionalities. 2. Analyze how teacher attitudes and behaviors can affect students with and without disabilities and the ability to apply strategies for developing and maintaining rapport with all students. 3. Evaluate strategies for creating a safe, positive, equitable, and supportive classroom climate and apply those strategies to plan, manage, and modify the learning environment, including effective classroom routines. 4. Evaluate strategies to encourage students' active participation, meaningful engagement, and independent in individual and group activities, across learning environments. 5. Analyze barriers to accessibility (e.g., physical, technological) and apply strategies for adapting the environment to meet individual needs. 6. Create a plan to incorporate the use of paraeducators, volunteers, and/or tutors within the classroom environment. Credits: 3.00

EDPS 55500 - Differentiating Curriculum & Instruction

Credit Hours: 3.00. This course provides a solid foundation and

set of principles for differentiating curriculum and instruction in any classroom at any grade level. Students will explore a variety of evidence-based strategies, tools, and curriculum models that effectively meet the diverse needs of all learners. Through readings, online class meetings and discussions, case studies, differentiated instruction examples, direct application, and reflection, students will deepen their understanding and need to differentiate. With an overarching goal of increasing achievement and developing student talents, this course includes the following major components: creating positive learning environments that support a) high-quality curriculum; b) diagnostic, formative, and summative assessments to inform instructional decision-making; and c) flexible grouping; addressing student differences in readiness, interest, and learning profile (including learning preference, intelligence preference, gender, culture, language preference, locale, and opportunities to learn) and appreciating how these differences influence the ways in which students learn and are motivated; understanding that the process of differentiation involves modifying content, process, product, learning environment, and/or affect; incorporating higher-order thinking skills, creative problem solving, project-based learning, authentic/respectful tasks, collaborative learning, and other evidence-based strategies to promote student achievement and talent development; understanding how differentiation of curriculum and instruction fits within specific educational interventions and models, such as scaffolding, flexible grouping, Response to Intervention (RTI), and Multi-Tiered System of Support (MTSS).

Learning Outcomes: 1. Deconstruct the concept of differentiation as a response to the readiness levels; interests; learning preferences and strengths; and academic, social, emotional needs of learners by modifying curriculum, instruction, learning environment, and/or affect. 2. Assess students' readiness, interests, and learning profiles to create differentiated lessons that utilize instructional strategies and technologies that motivate and engage students in learning, including those from special populations. 3. Develop, implement, and evaluate various differentiated instructional plans designed to maximize learning and demonstrate proficiency in analyzing and evaluating differentiated lessons taught by other teachers. 4. Evaluate and reflect upon your course experience and your plan to implement differentiation knowledge and skills gained in this course. Credits: 3.00

EDPS 55600 - Introduction To Quantitative Data Analysis Methods In Education I

Credit Hours: 3.00. This online course is designed to provide an overview of introductory quantitative data analysis methods in education. The course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include data collection and description, sampling distributions, methods of quantitative data analysis often used in education research. Permission of instructor required.

Learning Outcomes: 1. Think critically about quantitative data analysis used in popular magazines, newspapers, and journal articles. 2. Apply the knowledge gained in the course to analysis his/her own data with simple quantitative methods. 3. Understand common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. Credits: 3.00

EDPS 55700 - Introduction To Quantitative Data Analysis Methods In Education II

Credit Hours: 3.00. This online course is the second quantitative data analysis methods sequences within the college of education. This course is specially designed to enhance students' quantitative reasoning and skills through discussions of issues in educational data and authentic data analysis experiences of a variety of education data. The topics to be covered in this course include simple/multiple linear regression, different types of group comparison methods (including n-way ANOVA, ANCOVA, Repeated-measures ANOVA, and Mixed ANOVA). The course is specifically designed: 1) to understand how the quantitative methods covered in the course can be used appropriately to address proposed research questions in education, and 2) to interpret quantitative results meaningfully for a given context. It is expected that all students who enroll in this course have completed at least one semester of introductory statistics course (e.g. STAT 50100 or equivalent.) Permission of instructor required.

Learning Outcomes: 1. Understand the common quantitative techniques and terminology used in

studies that are presented in the popular press and education related journal. 2. Use and understand the principal numeric and graphical techniques to display and summarize education and social science related data. 3. Discuss common issues in analysis and interpretation of educational/social science data. 4. Design a research study, use a statistical software package to analyze the data generated from the research study, and appropriately interpret the results and report the conclusions of the study. 5. Expand their quantitative data analysis skills by taking advanced quantitative methods courses. Credits: 3.00

EDPS 55800 - Transition Education And Services

Credit Hours: 3.00. This course will explore a variety of resources, strategies, and techniques for promoting successful life transitions for students with mild and intense intervention needs before and throughout the school years and into postsecondary and adult settings.

Learning Outcomes: 1. Apply ethical guidelines, state and federal transition laws and policies (REPA 9.6, 9.7; CEC Int 1.1, 2.3: CEC Adv 2.2, 2.3, 3.3, 4.1, 5.1, 5.2, 6.1) 2. Evaluate state, school, and private resources (e.g. Individual Family Service Plans, Medicaid Waivers, Vocational Rehabilitation, Special Needs Trusts, Issues of Guardianship, Bureau of Developmental Disability Services) that promote successful life transitions (REPA 9.6, 9.7; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 3. Examine the rights, roles, and responsibilities of stakeholders and organizational resources concerning the transition process of students with exceptionalities (REPA 1.3, 1.4, 1.5, 9.6, 9.7; CEC Int. 1.1, 2.2, 2.3; CEC Adv 2.2, 2.3, 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 4. Create a transition-related lesson/activity to support positive, life-long transition outcomes (REPA 3.9, 9.2, 9.4, 9.5; CEC Int 2.1, 2.2, 2.3, 3.2, 5.2, 5.3, 5.6, 6.1, 6.2; CEC Adv 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2). 5. Apply strategies to collaborate effectively with general education teachers, support staff, families and community/organizational resources to identify services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate student learning and promote positive transition outcomes. (REPA 4.6, 4.8, 9.3, 9.4, 9.5; CEC Int 1.1, 1.2, 2.3, 3.2, 4.2, 4.3, 5.2, 7.1, 7.2, 7.3; CEC Adv 1.1, 2.3, 3.2, 3.3, 4.2, 5.1, 5.2, 5.3, 6.2, 6.3, 7.1, 7.2, 7.3). 6. Apply strategies to support students with exceptionalities to develop and strengthen self-determination skills (REPA 7.8; CEC Int 1.1, 1.2, 2.1, 2.2, 2.3, 3.2, 5.2, 5.6, 6.1, 6.2; CEC Adv 1.1, 2.3, 3.2, 3.3, 3.4, 4.2, 5.1, 5.2, 6.2, 6.3). Credits: 3.00

EDPS 55900 - Introduction To The Experimental Analysis Of Behavior

Credit Hours: 3.00. This course introduces students to the theories, principles, and research conducted in experimental analysis of behavior (EAB). EAB began with highly controlled animal studies and has expanded to translational work with humans. Applied Behavior Analysis (ABA), the study of human behavior and the application of behavioral principles on socially significant behavior has evolved from EAB. Permission of instructor required.

Learning Outcomes: 1. Identify and analyze the major conceptual frameworks from the Experimental Analysis of Behavior (EAB). 2. Analyze areas of overlap between EAB and applied behavior analysis. 3. Apply the process of reading and extracting critical information from peer-reviewed empirical and conceptual papers in EAB. 4. Differentiate among the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. 5. Evaluate research methods used in EAB and how these are utilized to examine environmental determinants of behavior under

experimental conditions. Credits: 3.00

EDPS 56010 - Clinical Practice I Experience: Practicum

Credit Hours: 1.00 to 6.00. This is a supervised clinical practice experience across two (2) special education settings, one at the elementary level (K-6) and a second experience at the secondary level (5-12) serving students with Mild and/or Intense Intervention Needs. These experiences take place over the course of 8-16 weeks depending upon availability and individual agreements with our partner district. These experiences are a coordinated effort between the Clinical Practice Coordinator, University Supervisor, and highly qualified, practicing Cooperating Teachers from both the elementary and secondary placements. Candidates assess, design and deliver lessons, manage student needs and behaviors, develop IEPs, integrate technology to support learning outcomes, collaborate with families and colleagues, and analyze the experience of facilitation a classroom and caseload of students. In addition, candidates will analyze relationships across theory and practice, multiple perspectives and trends, and the application of these relationships within educational settings. Candidates will explore major theories and concepts related to online learning, virtual instruction, twenty-first-century skills, informative literacy skills, and the diverse perspectives of online students and develop strategies for effectively integrating technologies into teaching and learning, discuss the benefits and challenges of technologies as educational tools, and apply technologies to meet a variety of learning purposes and needs.

Learning Outcomes: 1. Apply knowledge of instructional design to develop a series 3-5 lessons that include: observable and measurable instructional objectives, baseline assessment data, and plans that are incrementally appropriate to the learner and his/her ability to master the given content. 2. Apply knowledge and skills to develop an Individualized Education Program that is student centered, based on data, and collaborative. 3. Apply knowledge regarding principles of human behavior to analyze the ""function"" or the reason(s) behavior occurs and identify strategies to decrease inappropriate behaviors and increase appropriate behaviors. Credits: 1.00 to 6.00

EDPS 56300 - Data-Based Decision Making For Learners With Exceptionalities

Credit Hours: 3.00. Advanced procedures for educational assessment of exceptional individuals: norm-referenced and curriculum-based measurement, error analyses, and observational ratings. Adaptations and selections of tests for sensory impairments, behavioral styles, different intelligence levels and ages.

Learning Outcomes: 1. Apply terminology, theory, and the implications of measurement theory to select, administer, and score and interpret formal, informal, and/or curriculum-based assessment results for key stakeholders to make data-based decisions. 2. Apply principles of UDL to make decisions regarding selecting, adapting, and modifying assessments to accommodate student(s) with exceptionalities, including students who are nonverbal or English Learners. 3. Apply knowledge of the referral and classification procedures and interpret, report, and communicate results to stakeholders via paper and/or digitally. 4. Evaluate eligibility (including students from culturally and/or linguistically diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and evaluating individualized learning objectives), and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with exceptionalities. 5. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth. Credits: 3.00

EDPS 56400 - Mild Mental Handicaps: Historical Perspectives, Etiology, And Characteristics

Credit Hours: 3.00. Advanced study of persons with varying disabilities. Topics include: historical development; theoretical models; etiological factors; characteristics; assessment and intervention.

Credits: 3.00

EDPS 56500 - Math Curricula For Learners With Exceptionalities

Credit Hours: 3.00. This course will explore research-supported general and specialized math curricula to prepare candidates to design and/or adapt math lessons and instructional materials to meet the math needs of students with exceptionalities.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying math assessments to accommodate student(s) with exceptionalities, including students who are nonverbal, have intense intervention needs, or are English Learners. 2. Evaluate research-supported math instructional strategies and materials appropriate to the strength, needs, and characteristics of students with exceptionalities. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition assessments, and assistive technology that facilitate students' math learning and the students' learning environment. 4. Create math lesson plans, based on national, state and/or local math curricula standards, and the scope of sequence of grade-level/chronologically-aged appropriate general education math curriculum that incorporate UDL, research-supported math instructional strategies and materials, and provide meaning-filled math learning opportunities that facilitate student's ability to make connections (e.g., learning mathematics in the context of cooking and art). 5. Create math lesson plans that incorporate UDL and apply research-supported strategies to provide specially designed mathematics instruction, including strategies for problems and meaning-filled math learning opportunities that facilitate students' ability to make connections (e.g., learning mathematics in the context of cooking and art). 6. Evaluate math instruction, monitor progress, and make instructional changes to support students' math learning. Credits: 3.00

EDPS 56510 - Collaboration And Transition Practices In Special Education

Credit Hours: 3.00. Three modules related to collaboration and transition practices in special education are addressed. Included are theoretical frameworks and assessment for consultation and collaboration involving paraeducators and families.

Learning Outcomes: 1. Understand consultation theory and its application for decision-making in special and general education contexts. 2. Recognize conditions that strengthen or inhibit effective use of collaborative consultation. 3. Exhibit self-understanding and constructive use of individual differences for school-based collaboration in culturally diverse settings. 4. Demonstrate skills in facilitating family partnerships with schools to serve student needs. 5. Apply communication skills of effective verbal and non-verbal communication, listening, avoiding communication roadblocks, dealing with resistance, being appropriately assertive, and resolving conflicts. 6. Use problem-solving techniques in collaborating with professional colleagues, parents and related and ancillary personnel to provide for students' learning needs. 7. Develop self-assessment techniques and tools for evaluating and improving consultation, collaboration, and co-teaching skills. 8. Formulate strategies for co-planning and co-teaching to serve students' special needs. 9. Explain responsibilities and strategies for supervising and planning with paraeducators, and for initiating involvement of school administrators in collaborative efforts.

10. Demonstrate awareness of need for organizing interrelated agencies in their roles as providers of the array of services required for students' special needs. 11. Cite key legislation that has impacted career and transition programs and services for youth and adults with disabilities. (Standard 2) 12. Explain theories and stages of life-long career development and how they impact the career decision-making process for individuals with disabilities. (Standard 2) 13. Identify methods, strategies, and materials used for instruction to facilitate career education, including participation in the IEP process. (Standard 2) 14. Explain theoretical models on which family intervention is predicated. (Standard 2) 15. Demonstrate an understanding of the impact a child with a disability has on the family, family dynamics, coping strategies, finances, and family communication and interaction patterns (Standards 1, 2) 16. Identify and define issues and strategies related to empowerment, and self-advocacy that are crucial to the successful career development of individuals with disabilities. (Standards 2, 3) 17. Develop an awareness of community resources available in career transition planning for students with disabilities at the elementary, middle, and secondary levels. (Standard 2) 18. Discuss issues related to parental involvement in career development and the educational process for youth and adults with disabilities. (Standards 1, 3) 19. Identify and describe services, supports, and resources available in post-secondary and employment settings for youth and adults with disabilities. (Standard 2) 20. Identify and define the issues related to interagency collaboration in the career and transition planning process for youth and adults with disabilities. (Standard 2)
Credits: 3.00

EDPS 56600 - Graduate Supervised Teaching Special Education

Credit Hours: 1.00 to 16.00. Demonstration of ability to function independently in special education setting by appropriately planning for student needs, implementing and evaluating plans, establishing appropriate classroom discipline, and interacting professionally with staff and parents. Permission of instructor required.

Credits: 1.00 to 16.00

EDPS 56601 - Clinical Practice Experience II (Student Teaching)

Credit Hours: 1.00 to 6.00. This course is a supervised 16-week teaching experience in special education. Candidates assess, design and deliver lessons, manage student needs and behaviors, develop IEPs, integrate technology to enhance learning outcomes and communication, collaborate with families and colleagues, and analyze the experience of facilitating a classroom and caseload of students.

Learning Outcomes: 1. Create lesson plans that apply research-supported strategies for providing specially designed written language including strategies for providing explicit and systematic instruction and strategies for using technology to support various aspects of the writing process and include instructional and assistive strategies to teach students to monitor for errors in their written language in order to produce legible documents. 2. Create lesson plans that apply research-supported strategies for providing specially designed mathematics instruction, including strategies for providing explicit and systematic instruction and strategies for using technology to engage students in solving authentic, real-world problems. 3. Create lesson plans that apply research-supported strategies for providing specially designed science and social studies instruction, including strategies for providing explicit and systematic instruction, strategies for using technology to support students' learning, and strategies for incorporating inquiry-based instruction. 4. Create and implement lesson plans that include essential components of

effective reading instruction, including explicit explanation, teacher modeling, guided practice, and independent practice. 5. Create and implement lesson plans that incorporate instructional practices, approaches, and methods for eliciting students' engagement in and motivation for reading. 6. Evaluate SBRR-based, evidence-based, and developmentally appropriate assessment, instruction, intervention, extension, and ongoing progress monitoring in the phonemic awareness, phonics, fluency, vocabulary and academic language, comprehension and analysis of informational, persuasive, and literary texts, including response to literature. 7. Apply principles of universal design for learning (UDL) and adaptive and assistive technologies. 8. Conduct functional behavioral assessments and use the results to develop and implement behavioral support plans for students with mild/intense exceptional needs coordinating the implementation among stakeholders and identify strategies and procedures for crisis prevention and intervention to ensure the safety of all. 9. Apply strategies, Council for Exceptional Children (CEC) Code of Ethics, federal and state laws, and other standards of the profession for using digital tools and resources to communicate and collaborate with students with mild/intense exceptional needs and their families, general education teachers, related services providers, other school staff members, representatives of community agencies, and other stakeholders to help students achieve desired learning outcomes, including students from diverse cultural, linguistic, and socioeconomic backgrounds and students who are chronically or terminally ill. 10. Supervise and communicate with paraeducators, volunteers, and tutors. 11. Analyze self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth. Credits: 1.00 to 6.00

EDPS 56800 - Social, Legal, And Ethical Issues Across The Lifespan

Credit Hours: 3.00. Survey of difference and similarities of children with exceptionality, including their nature and characteristics related to their developmental and educational needs. Analysis and practical application of social, legal, and ethical issues in the field of special education.

Learning Outcomes: 1. Explain the historical perspectives and foundations of general and special education policy, current issues, and research (REPA 1.1, 1.2; CEC Int. 1.1; CEC Adv. 3.3, 4.2, 6.1). 2. Apply ethical guidelines, state and federal laws and policies, and utilize the rights, roles, and responsibilities of stakeholders and organizations concerning the education of students with exceptionalities (REPA 1.3, 1.4, 1.5; CEC Int. 1.1, 2.2; CEC Adv 3.3, 4.2, 5.1, 6.1, 6.2, 6.3). 3. Evaluate the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals from diverse groups. (REPA 2.8.; CEC Int. 1.2, 2.2; CEC Adv. 2.3, 3.2, 4.2, 5.2). 4. Examine the roles and responsibilities of team members (RtI, multidisciplinary, Case Conference Committee (CCC), families, student) to facilitate in developing, implementing, monitoring, and amending individualized programs for students with exceptionalities (IEPs, transition plans, health-care plans, and behavioral and academic intervention plans) setting goals, and monitoring progress toward goal each grading period. (REPA 4.3, 4.4, 4.5; CEC Int. 2.1, 2.2, 2.3, 7.1; CEC Adv. 4.2, 5.3). 5. Evaluate eligibility (including students from culturally and/or

linguistically diverse backgrounds and/or referred for interventions through the Response to Instruction (RtI) process), program (strategies for prioritizing areas of the general education curriculum and sequencing, implementing, and evaluating individualized learning objectives), and placement decisions (continuum of services: general education classroom, advantages and disadvantages of various placement options and programs) for students with mild and/or intense exceptional needs. (REPA 4.1, 4.2, 4.7; CEC Int. 1.1, 1.2, 2.1, 2.3, 3.1, 3.2; CEC Adv 4.2, 5.1, 5.2). 6. Engage in professional development activities and professional organizations relevant to teaching students with exceptional needs, and knowledge of professional resources, organizations, and publications for enhancing one's professional skills and for engaging in lifelong professional development (REPA 10.4/10.5; CEC Int 1.2; CEC Adv. 5.4, 5.5, 6.4, 6.5). 7. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with intense exceptional needs and their families, to improve instruction, and to determine personal goals for professional growth (REPA 10.6/10.7; CEC Int 2.2, 2.3, 4.2, 5.1; CEC Adv. 6.3, 7.1). Credits: 3.00

EDPS 57100 - Advanced Assistive Technology

Credit Hours: 3.00. Introduction and overview of assistive technology for communication, education, employment, recreation, and daily living activities.

Learning Outcomes: 1. To learn about assistive technology for students with disabilities. 2. To learn about the integration of technology into teaching and learning within the field of special education. Credits: 3.00

EDPS 57300 - Medical And Physical Management Of Learners With Disability Or Chronic Illness

Credit Hours: 3.00. This course will explore instructional programs, interventions, services, and implications specific to independent living, career, education, and medical self-management procedures that support students with intense medical, physical, or chronic health care needs.

Learning Outcomes: 1. Apply knowledge of the effects of medical conditions, physical and health needs, and common medications (e.g., stimulant, antidepressant, antiepileptic) on students with exceptionalities. 2. Create a safe and healthy learning environment by utilizing universal precautions, applying appropriate body mechanics to ensure safety in the transferring, lifting, positioning, and seating, and implementing specialized healthcare interventions for students with physical and health needs. 3. Apply appropriate techniques for physical positioning and maintain educational and assistive technologies for facilitating student learning. 4. Apply knowledge of resources (model career, vocational, and transition programs), strategies, and techniques to promote positive life-long transition outcomes (school, postsecondary, adulthood) and self-management procedures for students with exceptionalities. Credits: 3.00

EDPS 57600 - Curricula For Learners With Intense Intervention Needs

Credit Hours: 3.00. This course will explore research-supported general and specialized content-area (reading, Math, Writing, Science, Social Studies) curricula as well as functional and independent skill curricula to prepare candidates to design and/or adapt instructional lessons and materials to meet the needs of students with intense intervention needs.

Learning Outcomes: 1. Apply principles of UDL when selecting, adapting, and modifying assessments to accommodate student(s) with intense intervention needs, including students who are nonverbal or English Learners. 2. Evaluate research-supported instructional

strategies and materials appropriate to the strengths, needs, and characteristics of students with intense exceptional needs. 3. Apply strategies to work effectively with general education teachers and support staff to provide services that incorporate differentiated instruction, transition, assessments, and assistive technology that facilitate student learning and the students' learning environment. 4. Create lesson plans, based on national, state, and/or local curricula standards and the scope and sequence of grade-level/chronologically-aged appropriate general education content-area curriculum (Reading, Math, Writing, Science, Social Studies) that incorporate UDL, research-supported instructional strategies and material, and provide meaning-filled learning opportunities that facilitate students' ability to make connections and generalize across settings. 5. Create lesson plant to provide specially designed functional skill instruction (explicit and systematic), that incorporates UDL, research-supported instructional strategies and materials, and provides meaning-filled learning opportunities to facilitate generalization across settings. 6. Evaluate instruction, monitor progress, and make instructional changes to support student learning. 7. Analyze a variety of language and communication strategies (AAC/Assistive Technologies) to increase functional communication. Credits: 3.00

EDPS 57701 - Development Of Learners With Mild Intervention Needs

Credit Hours: 3.00. This course will explore the 4 areas of child development and the milestones associated with Cognitive, Social/Emotional, Language and Communication, and Movement and Physical development. This foundation in typical development will allow candidates to better understand atypical development in relation to characteristics and etiologies of mild disabilities. Candidates will investigate the multiple impacts systems have on individuals with mild disabilities and their families.

Learning Outcomes: 1. Describe typical and atypical human development, characteristics and etiologies in order to address the educational needs of individuals with mild disabilities. 2. Apply knowledge of the effects of medical conditions, physical and health needs, and common medications (e.g., stimulant, antidepressant, antiepileptic) on students with mild exceptional needs. 3. Analyze the impact of disability on the multiple aspects (education, career, vocation, social relationships, recreation, and adult life) of the life of an individual with mile intervention needs, including the knowledge of the family's role in supporting learning development. 4. Explain the influence of cultural, linguistic, and socioeconomic factors on the disproportionate identification of individuals with mild intervention needs from diverse groups. 5. Apply strategies for engaging in reflection and self-assessment activities to address one's own strengths and weaknesses, to become aware of one's own cultural biases and differences and dispositions toward students with mild exceptional needs and their families to improve instruction, and to determine personal goals for professional growth. Credits: 3.00

EDPS 58900 - Special Topics For Teachers

Credit Hours: 1.00 to 4.00. Consideration of appropriate professional problems of experienced educational personnel in workshops or in-service programs.

Credits: 1.00 to 4.00

EDPS 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDPS 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Credits: 1.00 to 4.00

EDPS 59200 - Principles & Philosophy Of Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to provide students with a working understanding of the conceptual framework of behavior analysis and the underlying theoretical and philosophical foundation of behavior analysis. The course will provide advanced coverage of the history, philosophical underpinnings, and advanced concepts and principles of behaviorism and behavior analysis. Permission of instructor required.

Learning Outcomes: 1. Identify and evaluate the goals of behavior analysis as a science. 2. Synthesize the philosophical assumptions underlying the science of behavior analysis. 3. Analyze behavior from the perspective of radical behaviorism. 4. Differentiate among the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis. 5. Distinguish the dimensions of applied behavior analysis. Credits: 3.00

EDPS 60000 - Counseling Theories And Techniques

Credit Hours: 3.00. Examination of major counseling theories and counseling techniques, professional and ethical issues. Permission of instructor required.

Learning Outcomes: 1. Utilize theoretical approaches to individual personality, behavior, decision, and life difficulties in clinical settings with clients. 2. Develop and write case conceptualization through active application. 3. Ascertain how counseling theory informs counseling techniques. 4. Theoretically conceptualize client presentations based on the context of diversity-related strengths and limitations of counseling theory (i.e. age, ethnicity, disabilities, language, national origin, race, religion, sexual orientation, and SES). Credits: 3.00

EDPS 60100 - Counseling Theories And Techniques Laboratory

Credit Hours: 3.00. Use of counseling techniques in a supervised laboratory; application of theories and techniques within varying employment settings. Concurrent Prerequisite: EDPS 60000 .

Learning Outcomes: 1. Identify counselor behaviors and characteristics that influence the helping process, including age, gender, ethnic differences, verbal and nonverbal behaviors, and personal characteristics, orientations, and skills. 2. Demonstrate essential interviewing and counseling skills, establishing appropriate counseling goals, designing intervention strategies, evaluating client outcomes, and successfully terminating the counselor-client relationship. Credits: 3.00

EDPS 60400 - Advanced Counseling Theories And Techniques

Credit Hours: 3.00. Integration of counseling theory, practice, and research. Emphasis on integrating counseling knowledge and skills with major counseling theories and interventions. Prerequisite: EDPS 60000 . Permission of instructor required.

Learning Outcomes: 1. Obtain knowledge of personality theories/concepts for conceptualizing client issues and designing interventions. 2. Understand the context and development of theories. Credits: 3.00

EDPS 60700 - Mixed Methods Research Designs And Applications

Credit Hours: 3.00. This course provides an overview of mixed methods research designs within social science and educational research. The focus of the course will emphasize the philosophical pragmatism embedded in enacting mixed methods research. Further, the course will demonstrate the utility and plausibility of integrating quantitative and qualitative data into a single study. This demonstration will be accomplished through reviewing the historical context of qualitative and quantitative research in social sciences and students' application of mixed methods research within their respective fields of study.

Prerequisites: EDPS 53300, EDPS 55600, and EDPS 55700 and an introductory qualitative methods course (one of COM 58500, EDCI 61500, SOC 68600).

Learning Outcomes: 1. Understand the historical context of mixed methods research with specific attention to the epistemological tenets of pragmatic research. 2. Recognize the use of mixed methods as researchers in your discipline implement these designs. 3. Describe the various mixed methods designs and explain how they are unique with respect to the timing of data collection, the prioritization (or lack thereof) of the phases in a mixed methods study, and the means of integrating data. 4. Comprehend the role of rigor in all phases of mixed methods research and critically digest mixed methods articles in the literature. 5. Develop skills to plan and conduct a mixed methods study in addition to writing a mixed methods study in the space limitations of academic journals. Credits: 3.00

EDPS 61000 - School Counseling Practicum

Credit Hours: 3.00. EDPS 61000 is a field experience for first year master's students in school counseling, consisting of a minimum of 100 hours in a school, under the supervision of both a site supervisor and a campus supervisor. Permission of instructor required. Prerequisites: EDPS 60000 and EDPS 60100 . Permission of instructor required.

Learning Outcomes: 1. Develop counseling competencies related to individual, small-group, and large-group interventions. 2. Increase knowledge of school settings, including organizational structure, processes, and mission. 3. Increase competence regarding articulating the role of the school counselor. 4. Increase awareness of legal and ethical concerns related to school counseling and to increase competence in ethical decision-making. Credits: 3.00

EDPS 61100 - School Counseling Seminar

Credit Hours: 3.00. Attention given to current topics, such as special education, gifted education, data management, grant writing, crisis intervention, service learning, K-12 career development, and systemic change. Prerequisite: EDPS 50100 . Permission of instructor required.

Learning Outcomes: 1. Understand and apply concepts from special education to their own field experiences. 2. Articulate a vision and mission for a comprehensive school counseling program. 3. Develop a program appropriate for their targeted setting and identify potential funding sources for that program. Credits: 3.00

EDPS 61200 - Advanced Applied Behavior Analysis

Credit Hours: 3.00. The purpose of this course is to expand knowledge and understanding of advanced applied behavior analytic theories and interventions. Specifically, this course will focus on interventions aimed at developing new skills as well as increasing and decreasing behaviors. Procedures for identifying and designing function based interventions will be addressed. Prerequisite: EDPS 36200 or 51500 and EDPS 58800.

Learning Outcomes: 1. Demonstrate knowledge of methods for increasing and decreasing behaviors such as antecedent and consequence-based interventions and group contingencies. 2. Demonstrate knowledge and skill in developing new behaviors through advanced techniques such as shaping, chaining, and differential reinforcement procedures. 3. Demonstrate knowledge and skill in procedures for assessing the function of behaviors including function based assessment and functional analysis. 4. Demonstrate knowledge of guiding principles and procedures to program for maintenance and generalization of behaviors. Credits: 3.00

EDPS 61400 - Advanced Counseling Practicum

Credit Hours: 3.00. Supervised use of personal and career counseling techniques applied to complex and difficult client situations. Permission of instructor required.

Learning Outcomes: 1. Display readiness to continue in practicum through exhibiting progress in: professionalism, reflective practice/self-assessment, scientific knowledge

and methods, relationships, individual and cultural diversity, ethical and legal standards and policy, interdisciplinary systems, assessment, interventions, research/evaluation, supervision, management-administrative tasks, advocacy. Credits: 3.00

EDPS 61500 - Theories Of Counseling Supervision

Credit Hours: 3.00. Critical analysis of the theories and counseling supervision. Experiential exercises may be included. Prerequisite: EDPS 61400 . Permission of instructor required.

Learning Outcomes: 1. Develop knowledge of theories, methods, and problems in supervision. 2. Learn to think like a supervisor. 3. Understand individual and cultural differences in supervision. Credits: 3.00

EDPS 61700 - Professional Issues, Ethics, And History Of Counseling Psychology

Credit Hours: 3.00. Three primary areas in counseling psychology: 1) historical development within psychology; 2) American Psychological Association ethics, professional, and legal issues; and 3) the scientist-practitioner training model in counseling psychology identity. Permission of instructor required.

Learning Outcomes: 1. Understand counselling psychology's (a) history, (b) position within the psychology discipline and profession and (c) ethical, legal, and professional standards. 2. Gain a sense of how psychology and counselling psychology are embedded within and influenced by context (i.e., historical, societal, cultural, and economic factors). 3. Begin socialization into (a) the attitudes, values, skills, and activities of a counselling psychologist; and (b) the Purdue Counselling Psychology program. Credits: 3.00

EDPS 61801 - Intellectual & Neuropsychological Assessment

Credit Hours: 4.00. This course is designed to expose students to the theory and practice of intellectual and neuropsychological assessment. Students will receive instruction on the theoretical, psychometric, and best practice foundations of these types of assessment in the context of a lecture component, which will be followed by laboratory time in which students will gain experience in administering and scoring relevant tests. Although the WAIS-IV and WISC-IV will be the primary foci of this course, other tests of achievement, cognitive ability, and neuropsychological functioning will be covered. Students will also (a) gain experience in preparing written reports of their interpretations of assessment results, (b) develop an understanding of the history and development of cognitive ability and neuropsychological tests, and (c) explore implications for intellectual and neuropsychological assessment with diverse populations. Permission of instructor required. Prerequisite: EDPS 53300, B-.

Learning Outcomes: 1. Develop an understanding of the theoretical, historical, and psychometric foundations of intellectual and neuropsychological assessment. 2. Develop advanced knowledge of the administration, scoring, and interpretation of the major tests of cognitive ability (i.e., WAIS-IV, WISC-IV), and identify strengths and weaknesses of each. 3. Develop understanding of the ethical and multicultural issues associated with intellectual and neuropsychological assessment. 4. Demonstrate ability to select assessment tools appropriate to examinees' developmental and ability levels. 5. Demonstrate competence in reporting results and interpretation of assessment results in written form. Credits: 4.00

EDPS 61900 - Counseling Psychology Research Practicum

Credit Hours: 3.00. Application of qualitative and quantitative research designs in counseling psychology. Concurrent prerequisite: EDPS 61800(Inactive at PWL) and (PSY 60100 or STAT 50200) and Doctoral student standing enrolled in the Counseling Psychology Program.

Learning Outcomes: 1. Gain knowledge of research methodologies in counseling psychology. 2. Develop the ability to provide an evidentially based rationale for research, including consideration of multicultural issues. 3. Display awareness of counseling psychology research. 4. Demonstrate self-initiative and personal investment (a) in the research process and (b) in efforts to find and use relevant

sources of information. 5. Apply the scientific method in critiquing and generating research studies. 6. Present research results in a manuscript that uses APA professional style. 7. Enhance oral and written communication skills through presentation of material in a clear, organized, grammatically correct, and engaging manner. 8. Develop professional writing and editing skills to prepare for careers as a counseling psychologist (e.g., scholarly contribution, reports). Credits: 3.00

EDPS 62000 - Counseling Seminar

Credit Hours: 1.00 to 4.00. Recent investigation and research in (1) counselor supervision; (2) professional issues; (3) counseling theories; (4) education of counselors and student personnel workers; (5) counseling methodology; (6) vocational development; (7) elementary school counseling; (8) counselor consultation; and (9) other relevant topics. One topic is dealt with in each enrollment. Prerequisite: Open to graduate students who have successfully completed 12 credit hours of previous counseling personnel services courses.

Credits: 1.00 to 4.00

EDPS 62100 - Advanced Multicultural Counseling Theory And Practice

Credit Hours: 3.00. Advanced study and clinical application of racial and cultural theories in counseling. Knowledge and practicum components are integrated to facilitate development of awareness and skill competencies central to "Guidelines on Multicultural Education, Training, Research, Practice and Organizational Change for Psychologists" of the American Psychological Association. Prerequisite: EDPS 50700 . Permission of instructor required.

Learning Outcomes: 1. Increase understanding of ICD dimensions, and their intersection within persons, in relation to psycho-social development. 2. Identify and address institutional and social barriers that impede access, equity, and well-being for diverse populations. 3. Develop advanced skill in discussing ICD, comfortably and appropriately, in interpersonal and professional relationships. 4. Demonstrate awareness of potential interactions between cultural beliefs and attitudes and cognitive and affective experiences. Credits: 3.00

EDPS 62200 - Systems Concepts In Counseling And Development

Credit Hours: 3.00. Introduction to the use of systems concepts in the counseling professions. Individuals' development within relationships and family matrix, contemporary person-environment issues, and constructs for research and preventive, developmental, and remedial practice. Prerequisite: EDPS 61700 .

Learning Outcomes: 1. Obtain knowledge of terms, concepts, and principles of systems thinking. 2. Learn to develop systems hypotheses and evaluate their evidence. 3. Understand that the person exists within and is influenced by the socio-economic-historical context. Credits: 3.00

EDPS 62300 - Personality Assessment

Credit Hours: 3.00. Applied introduction to methods of administration, scoring, and interpretation of primarily objective personality assessments. Emphasis is placed on assessment of normative population with attention given to personal strengths, developmental factors, and issues of diversity.

Learning Outcomes: 1. Select appropriate batteries of personality measures based on particular referral situations and/or questions. 2. Administer, score, and interpret results of personality assessments. 3. Incorporate clinical interview and behavioral observation data into their interpretations of personality assessment results. 4. Interpret personality assessment results from developmental and multicultural perspectives. Credits: 3.00

EDPS 62400 - Advanced Off-Site Counseling Practicum And Supervision Theory

Credit Hours: 3.00. Supervised use of personal and/or career counseling and assessment applied to complex and difficult client situations. Critical analysis of counseling supervision theories. Prerequisite: EDPS 61400 . Permission of instructor required.

Learning Outcomes: 1. Demonstrate appropriate professional and ethical behavior in

their interactions with agency clients and staff. 2. Design treatment plans that are based on appropriate assessment and conceptualization of client problems. 3. Develop the conceptual and critical thinking skills that are required of a scientist-practitioner, such as the ability to formulate and test hypotheses regarding the bases of client behavior. 4. Utilize interventions that are rooted in theory and research in counselling/psychotherapy, human development, and personality. 5. Demonstrate understanding and respect for clients' cultural values, identities (e.g., racial, gender), and desires for self-determined growth. 6. Demonstrate an increased awareness of clinical strengths as well as areas of growth and professional development. 7. Demonstrate ability to effectively use individual and group supervision. Credits: 3.00

EDPS 62500 - Human Growth And Development

Credit Hours: 3.00. An overview of lifespan development. Study of major development theories of childhood, adolescence, and adulthood. Prerequisite: EDPS 60000 .

Learning Outcomes: 1. Demonstrate knowledge of the nature and needs of individuals at all developmental levels across the life span, including theories of individual and family development and transition. 2. Demonstrate knowledge of major theories of learning and personality development. 3. Demonstrate knowledge of cognitive and emotional aspects of growth, including learning, intellectual, and moral development. Credits: 3.00

EDPS 62800 - The Behavior Analyst As Supervisor

Credit Hours: 0.00 to 3.00. This course will address the provision of supervision of behavior analysis trainees and technicians utilizing principles and procedures of applied behavior analysis. Application of goal development, behavioral skills training, and progress monitoring within a behavioral analytic framework will be explored. Must be enrolled in ABA Certificate or Masters Program. Pre-requisite: EDPS 61200. Permission of instructor required.

Learning Outcomes: 1. Describe reasons for effective evidence-based supervision and outcomes of ineffective supervision. 2. Describe necessary components of the supervisory relationship. 3. Assess and select performance expectations for the supervisee and supervisor. 4. Describe components of behavioral skills training. 5. Apply supervision skills to teach assessment and intervention procedures as relevant to task list competencies. 6. State features of performance monitoring and performance feedback . 7. Evaluate supervisor effectiveness. 8. Describe ethics of and methods for providing ongoing professional development. Credits: 0.00 to 3.00

EDPS 63000 - Research Procedures In Education

Credit Hours: 3.00. Development of a philosophy of educational research and consideration of the methods for the selection and evaluation of techniques used in educational research. Techniques discussed are methods to control variables, sampling procedures, data collection procedures, statistical procedures, and research proposal development and writing. Prerequisite: EDPS 53300 , (PSY 60100 or EDPS 53300), STAT 50200 .

Learning Outcomes: 1. Understand the concepts, purposes, and methods that are fundamental to conduct systematic inquiry and to integrate them to conduct educational research. 2. Conceptualize and develop a research proposal for a problem in the student's substantive area; select the method most appropriate for the research problem(s) and defend the use of the method of inquiry. 3. Justify and explain thoroughly the specific method which will be used in his or her own research. Credits: 3.00

EDPS 63100 - Applied Educational Research Design Seminar

Credit Hours: 1.00 to 3.00. This seminar seeks to promote professionalism, research and scholarly productivity and

collegial support among graduate students in gifted, creative (GCT), and talented studies, associated graduate students, visiting scholars, and interested others. A secondary purpose involves assisting GCT students, COE students, and associates with successful study and career preparation by focusing on research, grants, thesis preparation, graduate writing, proposal development, professional development, and degree completion. Finally, seminar offers students the opportunity to discuss, learn and "mess" around with current issues in the field and of personal interest. Seminar creates time and incentive for students to become more productive with their scholarship efforts, and offers students credit for work completed and formal support for the professional development and scholarship processes. In this course students should expect to attend, contribute, and participate. A variety of formats will be used, including, but not limited to: discussion, simulations, group work, lecture, guest speakers, and peer feedback. Prerequisite: EDPS 63000 and one graduate course in Statistics.

Learning Outcomes: 1. Engage with IRB process. 2. Write for publication. 3. Critically review and revise writing. 4. Engage in research. 5. Develop a professional vita. 6. Write conference proposals. 7. Create professional presentations. 8. Review relevant literature. Credits: 1.00 to 3.00

EDPS 63200 - Seminar In Research Procedures In Education

Credit Hours: 1.00 to 3.00. Experimental, field study, scientific survey, and prediction study methods in education. Internal and external validity, identification and development of research problems, criteria development, common methodological errors, strategies of analysis, and sources of acceptable educational research literature will be reviewed. Critical analyses of the research methodology of educational research reports in the student's field. Prerequisite: EDPS 63000 or 53300 and course work in Statistics.

Learning Outcomes: 1. Develop specific advanced methodological skills and knowledge that are applicable to education research and practice. Credits: 1.00 to 3.00

EDPS 63300 - Seminar In Educational Psychology

Credit Hours: 1.00 to 3.00. Recent investigations and research in educational psychology. One topic is dealt with in each enrollment. The topics provide an in-depth study of those areas of psychological investigation in educational settings and problems. These areas include: (1) instructional technology and design; (2) individual differences and educational growth; (3) school learning: theory and research; (4) classroom behavior and social processes; (5) educational assessment; and (6) other relevant topics. Prerequisite: EDPS 53000 .

Credits: 1.00 to 3.00

EDPS 63500 - Psychometric Theory And Application

Credit Hours: 3.00. Advanced classical test theory and application of psychometric methods to study technical properties of tests. Prerequisite: (EDPS 53100 and STAT 50200), or (PSY 60100 or PSY 51200) or consent of Instructor.

Learning Outcomes: 1. Demonstrate an understanding of mathematical and statistical concepts in various measurements principles. 2. Apply understanding of reliability and validity in both classical and modern measurement theory frameworks to solve practical measurement problems. 3. Demonstrate knowledge of psychometric theories in scale development. 4. Read the literature related to psychometrics in their own substantive areas more critically. 5. Use measurement or scales more intelligently in research. 6. Explain different models of modern test theory. Credits: 3.00

EDPS 63600 - Item Response Theory

Credit Hours: 3.00. Models and model-data fit, estimation of ability and item parameters, item and test information, test construction, obtaining evidence of test reliability and validity, differential item functioning, norming, and equating. Prerequisite: EDPS 53100 , (PSY 60100 or STAT 50200 or STAT 51200).

Learning Outcomes: 1. Explain fundamental item response theory concepts and terminology. 2. Distinguish and select from among 1-, 2-, and 3- parameter item response models for dichotomous data in practical situations. 3. Demonstrate familiarity with the graded response and partial credit item response models for polytomous data, and multidimensional item response models. 4. Use item response models for testing applications, such as item calibration during instrument/item pool development, estimation of person

parameters and conditional standard errors of measurement, investigation of differential item functions, and score linking. 5. Conduct item response modeling with specialized software and interpret the results. Credits: 3.00

EDPS 63800 - Factor Analytic Procedures

Credit Hours: 3.00. Introduction to exploratory and confirmatory factor analysis techniques and examination of the use of factor analysis in social sciences. Emphasis on application of methods. Students will develop skills to conduct factor analytic research and critically review use of factor analysis in research. Prerequisite: STAT 51200 , STAT 52400 .

Credits: 3.00

EDPS 65000 - Systematic Literature Review

Credit Hours: 3.00. This course is designed for advanced graduate students in special education and related disciplines. The goals of this course are: (a) Understand the principles and methodologies of conducting a systematic literature review. (b) Develop skills in identifying, evaluating, and synthesizing literature in education/special education; (c) Critically review and evaluate education/special education literature and research, and (d) Write a professional, scholarly review of research on a current issue or critical topic in education/special education.

Learning Outcomes: 1. Understand the principles and methodologies of conducting a systematic literature review. 2. Develop skills in identifying, evaluating, and synthesizing relevant literature. 3. Review and evaluate education / special education literature and research critically. 4. Apply the knowledge and write a professional, scholarly review of research on a current issue or critical topic in education/special education. Credits: 3.00

EDPS 65300 - Collaborative Learning

Credit Hours: 3.00. Techniques for fostering productive collaboration in classrooms will be discussed along with the evidence for their educational effectiveness. The course will be research focused. Truth-wins, most -competent-member, and average-member models for comparing group performance to individual performance will be described. The goal will be to have students learn how to implement successful collaborative activities in classrooms while also developing the ability to further research in the field. In addition to course readings and class participation, students will be expected to propose a research study related to collaborative learning with emphasis on the literature review.

Learning Outcomes: 1. Implement successful collaborative activities in their classrooms while also developing the ability to further our understanding of the field. 2. Propose a research study related to collaborative learning with emphasis on the literature review. Credits: 3.00

EDPS 66100 - Seminal Research In Special Education

Credit Hours: 3.00. This course is designed to focus on the investigation and research in the field of special education, particularly research and articles that are considered seminal to the field of special education in general as well as various topics of study within special education. The course is meant to be an overview of critical pieces of research and literature in the field to provide students with a breadth view, and how the seminal articles have shaped the field of special education including special education laws and policies.

Learning Outcomes: 1. Comprehend seminal articles/research that have shaped the field of special education. 2. Analyze the impact of seminal research and its relevance to special education laws, policies, and practices. 3. Develop a comprehensive understanding of the field and its implications for educating students with special/diverse needs. 4. Identify and comprehend emerging seminal research in the field of special education/education. 5. Gain an understanding of the range of research conducted by faculty in the special education and related programs. 6. Develop skills in investigating and conducting research in special education. Credits: 3.00

EDPS 66300 - Organization And Administration Of Special Education

Credit Hours: 3.00. (EDST 66300) A comprehensive course in the organization and administration of special education including the organizational arrangements, identification, placement and service delivery, tests and assessments, program evaluation, personnel, and school/community relations.

Learning Outcomes: 1. Examine, discuss, and

gain an understanding of the role of the special education director. 2. Apply the federal and state rules and regulations for special education in school settings. 3. Understand the role of litigation in the field of special education. 4. Understand special education funding options, identify budget preparation strategies and fund management. 5. Demonstrate ways to ensure parent involvement. 6. Discuss current trends and issues in educating children with disabilities, including ethnic and cultural diversity, discipline, suspension and expulsion. Credits: 3.00

EDPS 66400 - Seminar In Special Education

Credit Hours: 1.00 to 4.00. This seminar is for doctoral students in special education. Its purpose is to contribute to the development of student's professional competencies, including conducting and writing scholarly research, grant writing, university-level teaching, and professional engagement. To facilitate this growth each seminar will culminate in a scholarly product related to the seminar's focus.

Learning Outcomes: 1. Formulate clear and concise research questions and generate one idea for a research project. 2. Develop a comprehensive research plan for their ideas based on a review of the literature. 3. Produce a detailed research project proposal or carry out a research project that aligns with their own research interests. 4. Apply their knowledge in evidence-based practice and lead a session on academic intervention (e.g., reading, math, science, social studies) to effectively support students with diverse needs. Credits: 1.00 to 4.00

EDPS 68800 - Single Subject Research Design

Credit Hours: 0.00 to 3.00. Designed to introduce advanced level students to single subject research methodology in context of a science of human behavior, including design theory and application, measurement, experimental validity, applied behavior analysis, and data analysis procedures.

Learning Outcomes: 1. Demonstrate knowledge about the various single subject research designs and variations of each. 2. Demonstrate the ability to conduct reliable visual analysis, understand value of effect size for single subject design, and calculate effect size. 3. Demonstrate knowledge of the criteria for designing and evaluating high-quality, rigorous single subject design studies. 4. Demonstrate knowledge of the application of single subject research methodology in clinical and educational settings including designing, conducting, and analyzing a single subject study. Credits: 0.00 to 3.00

EDPS 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization. Permission of instructor required.

Learning Outcomes: 1. Measure and evaluate one's professional growth and case conceptualization skills through use of audio tapes and case notes. 2. Demonstrate respect, understanding, and tolerance of multicultural and diversity issues as they relate to clients' need and concerns. 3. Demonstrate ethical and professional behavior in accord with the ACA Code of Ethics. Credits: 1.00 to 10.00

EDPS 69600 - Internship In Counseling Psychology

Credit Hours: 0.00. A special course in the practice activities of counseling psychology. Provides field experience under the supervision of a licensed psychologist. Permission of instructor required.

Learning Outcomes: 1. Learn advanced skills in psychotherapy. 2. Increase knowledge of psychological assessment. 3. Learn advanced skills in consultation and outreach activities. 4. Increase knowledge of administrative and professional issues. Credits: 0.00

EDPS 69700 - Education Specialist Project-Research

Credit Hours: 0.00 to 18.00. Educational Specialist project research. Permission of instructor required.

Credits: 0.00 to 18.00

EDPS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EDPS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EDST 51200 - Foundations Of Educational Policy

Credit Hours: 3.00. (EDFA 51200) An examination of the relationship between policy, values, and social change in education, including the roles of local, state, and federal government in educational policymaking and the effects of educational policies on societal issues such as equity, cultural diversity, and opportunity.

Learning Outcomes: 1. Understand the policy-making process at different levels of government. 2. Understand underlying values and theories of education behind different policy initiatives. 3. Understand the relationship between educational policy and social issues. Credits: 3.00

EDST 51300 - Educational Facilities Planning

Credit Hours: 3.00. (EDFA 51300) The course utilizes a systems approach as a basis for planning, construction, and utilization of school facilities. The primary audience for which the course is designed is aspiring school superintendents and central office leaders. Emphasis is placed on gaining the performances, dispositions, and knowledge necessary for successfully providing facilities to enhance the teaching/learning processes in meeting the educational needs of diverse learners. It is intended as a practical course oriented toward "tools" and school facilities in the state of Indiana. Permission of instructor required.

Learning Outcomes: 1. Describe the political and economic dimensions associated with the development and acquisition of facilities in Indiana. 2. Describe the various ways to finance renovation and /or new school construction in Indiana. 3. Identify and describe the required procedures for new school construction in Indiana. 4. Describe the involvement of professionals outside of education in the planning and construction of school facilities. 5. Understand terminology related to construction and maintenance of school facilities in Indiana. Credits: 3.00

EDST 51400 - Economics Of Education

Credit Hours: 3.00. A general course in financing education, including current economic theories, sources of revenues, and trends in fiscal structure and operations in education.

Learning Outcomes: 1. Develop and understand the goals of public education, why states invest in education, and the legal basis for financing public education. 2. Develop and understand the sources of revenues for public education and the approaches used to raise and distribute funds for school district operations. 3. Develop and understand the concepts of equity and adequacy and how these ideas are reflected in current state education policy and educational leadership practices. 4. Develop and understand budgeting strategies and procedures used by educational leaders to influence student achievement outcomes and realize other school-based goals. Credits: 3.00

EDST 51600 - School-Community Relations

Credit Hours: 3.00. (EDFA 51600) This course will stress concepts and principles relevant to school-community interaction. It will focus on the new roles of the public in education and will deal with problems encountered by educators in communicating with the public.

Learning Outcomes: 1. Design their commitment to build stronger family and community relationships with schools. 2. Understand important analytical, policy-relevant,

and practice-oriented perspectives on family and community involvement in education 3. Develop skills and strategies for fostering mutually beneficial family and community connections with schools. Credits: 3.00

EDST 52000 - Educational Leadership, Governance, And Policy

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of contemporary PK-22 education leadership, administration, and governance. This course will cover the foundational administrative knowledge and skills necessary for transformational leadership at the modern primary, secondary, and post-secondary educational settings. The scope of this course seeks to cultivate an understanding of the functionality of educational systems as organizations within the context of a technologically, socially, and culturally changing world.

Learning Outcomes: 1. Analyze a variety of literature on PK-22 educational leadership, integrating relevant literature from the fields and disciplines of higher education, leadership, business, political science, and sociology. 2. Apply skillfully foundational PK-22 leadership knowledge and skills necessary for middle management and senior-level educational leadership in the context of a rapidly changing, culturally diversifying, technologically dynamic global education field. 3. Understand sustainable transformational education leadership by repeatedly engaging in activities and assignments that: Require a comprehensive analysis and understanding of how the following interface: institutional finance and budgeting, strategic planning and assessment, organizational structure and culture, existing and emerging education policy, and the current social and political climate; Require an understanding and analysis of the common day-to-day and long-term challenges that contemporary PK-22 education administrators face in strategic decision-making; Require an evaluation of structural and cultural practices and norms in PK-22 education administration for the sake of comparative analysis. Credits: 3.00

EDST 52100 - Foundations In PK-XXII Educational Systems

Credit Hours: 3.00. This survey course broadly explores the complex foundations of U.S. educational systems from pre-kindergarten (PK) through the doctoral level of education (PK-22). Through the lenses of culture, history, politics, and society, this course seeks to examine factors that impact the policies and practices of PK-22 educational systems. From theoretical knowledge to philosophical orientations, the course interrogates the ways schools transform society and ways society transforms schools. The course incorporates a variety of engaged learning activities including discussion prompts, reflective journaling of course readings, and literature review and research writing. As such, this course challenges students to: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems; 2. Examine the interrelationships of culture, politics, and social structures related to educational systems; 3. Analyze and evaluate current issues in PK-22 education systems; 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies.

Learning Outcomes: 1. Describe and analyze the cultural, historical, political, and social foundations of PK-22 education systems. 2. Examine the interrelationships of culture, politics, and social structures related to educational systems. 3. Analyze and evaluate current issues in PK-22 education systems. 4. Construct connections between and among course topics, specifically drawing from educational models and philosophies. Credits: 3.00

EDST 52200 - Culture And Social Issues In PK-XXII Education

Credit Hours: 3.00. The aim of this course is to engage students in the critical examination of cultural and social issues impacting PK-22 education at the local, state, and federal levels. This course will review the evolving functional role of PK-22 education in a diversifying global society. By way of critical intercultural and intracultural examination and reflection, this course seeks to cultivate a deeper understanding of the ways that education influences and is influenced by issues related to cultural and social change and conflict.

Learning Outcomes: 1. Analyze a variety of

literature on cultural and social issues, integrating relevant literature from the fields and disciplines of education, anthropology, sociology, and political science. 2. Examine and evaluate the past and present activity /role of PK-22 entities during periods of social and cultural changes and conflict. 3. Reflect critically on intercultural and intracultural biases, perspectives, and positions, and the way that they might influence day-to-day interactions in educational environments. 4. Apply acquired knowledge and understanding of the corresponding relationship between culture/social issues and PK-22 education, to create comprehensive proposals and recommendations for PK-22 entities to engage with and address issues on diversity. Credits: 3.00

EDST 58900 - Special Topics For Teachers

Credit Hours: 1.00 to 4.00. (EDFA 58900) Consideration of appropriate professional problems of experienced educational personnel in workshops or in-service programs.

Credits: 1.00 to 4.00

EDST 59000 - Individual Research Problems

Credit Hours: 1.00 to 6.00. (EDFA 59000) Opportunities for students to study particular problems under the guidance of a member of the This plan of individualized instruction may be used in any field of education or vocational education. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

EDST 59100 - Special Topics In Education

Credit Hours: 1.00 to 4.00. (EDFA 59100) Group study of a current problem or special topic of interest to professional educational personnel. Intensive study of research, theory, or practical aspects of a particular issue within the usual graduate class format.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 4.00

EDST 60000 - Seminar In The Foundations Of Education

Credit Hours: 3.00. Recommended for those who have had a prior foundations course. Specialized studies in such areas as educational history, educational philosophy, educational sociology, religion and public education, current educational issues, and classical literature of education.

Credits: 3.00

EDST 60200 - Seminar: The School Principalship

Credit Hours: 3.00. Individual exploration in depth of selected aspects of the school principalship and critical analysis of related issues. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the students acquiring proficiency in: Leadership, Supervision, Vision and Mission, Change, Staff Recruitment & Selection, Staff Evaluation, Staff/Administrative Relations, Curriculum Leadership and Management, Student Discipline, Pupil Personnel Services, Professional Development, Ethics, Decision Making, Planning, Time Management and Teaching and Learning. Credits: 3.00

EDST 60700 - Administration Of Educational Systems

Credit Hours: 3.00. An examination of administrative function, process, structure, and practice. Special emphasis given to theory development in administration. Exploration of system analysis applications to educational administration. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning

outcomes in this course are based on the Indiana Standards focused on students acquiring proficiency in organizational and resource management, including using data to identify needs and priorities within the organization; identifying and addressing organizational barriers to student achievement; using technological tools to manage information and support effective management of the organization; and using practices for the safe, efficient and effective operation of school's physical plant, equipment and auxiliary services. Credits: 3.00

EDST 60800 - Business Management In Education

Credit Hours: 3.00. (EDFA 60800) This course explores the management and operation of the school business environment, the critical trends and issues in the field, and the internal and external determinants of school fiscal policy. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51400 .

Learning Outcomes: 1. Know the success of managing the organization, operations, and resources of a district in a way that promotes a safe, efficient, and effective learning environment. 2. Act with integrity, fairly, and in an ethical manner. 3. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 60900 - Legal Aspects Of American Education

Credit Hours: 3.00. (EDFA 60900) Legal foundations of education as established by constitutional provisions, court decisions, opinions of attorney generals, administrative rulings, and executive directives. Emphasis on legal theory and principles currently in state of change. Stress of case study method of investigation into educational law. Prerequisite: 9 credit hours in Education.

Learning Outcomes: 1. Acquired proficiency in the Indiana Standards for School Leaders - Building Level content and skills. The Indiana Department of Education believes these content standards define those skills and abilities that school leaders must possess to produce greater levels of success for all students. The learning outcomes in this course are based on the Indiana standards focused on the student acquiring proficiency in human resource management; equity and access to educational programs, curricula and available supports; behavior management systems; school safety and emergency preparedness; student safety and welfare; and the rights and responsibilities of students, families, and school staff. Credits: 3.00

EDST 61000 - Supervision Of Instruction And Instructional Personnel

Credit Hours: 3.00. (EDFA 61000) A comprehensive approach to supervision and instruction that develops the knowledge, interpersonal, and leadership skills, which are then applied in a school setting for the purpose of instructional improvement. Models of supervision, leadership and evaluation will be examined to gain knowledge in order to apply effective strategies for diverse situations. The study of transformational change in today's schools will guide leadership knowledge to the task of direct assistance, collegiality, collaboration, culture of trust, professional development, dialectic inquiry, curriculum development and action research. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Recognize the temper of diverse situations within their instructional leadership role and appropriately apply strategies that will address the situations. 2. Use the understanding and experience of instructional supervision concepts explored throughout this course and apply supervisory principles to the daily functions and responsibilities of an education administrator. 3. Demonstrate the ability to correctly apply various leadership concepts to various fact-based situations and formulate a plan of action to address each situation. 4. Accurately interpret the characteristics of a healthy

organization (campus, district, etc.). 5. Evaluate the results of teacher and administrator interviews regarding system and recommend a teacher appraisal system that may improve the equality of observations and appraisals. Credits: 3.00

EDST 61200 - Seminar In Educational Administration And Curriculum

Credit Hours: 3.00. An analysis of current research and theory related to selected topics in educational administration and curriculum. One topic is studied in each enrollment. Permission of instructor required.

Credits: 3.00

EDST 61300 - Clinic For Educational Leaders

Credit Hours: 1.00 to 6.00. (EDFA 61300) Clinic for educational leaders.

Credits: 1.00 to 6.00

EDST 61400 - Leadership For Community Collaboration And Development

Credit Hours: 3.00. In this course, we will consider how school leaders can help develop and strengthen relationships between districts/corporations and their publics, for the mutual benefit of students, schools, families, and communities. Throughout selected core and supplemental district level educator standards of the Indiana Standards for School Leaders and the National Policy Board for Educational Administration are addressed. Emphasis is on the integration of theory and practice. Permission of instructor required.

Learning Outcomes: 1. Acquire knowledge and ability to foster mutually beneficial family and community connections with school districts. 2. Acquire knowledge and ability to understand needs of diverse families and communities. 3. Acquire knowledge and ability to assess research on school partnerships to identify best practices in their contexts. Credits: 3.00

EDST 61500 - Educational Policy And Decision Making

Credit Hours: 3.00. This course explores a variety of current legal, political, social, cultural and economic issues as they relate to educational policy and decision making. As applicable, selected core and supplemental content and skills from the district level educator standards of the Indiana Standards for School Leaders and ELCC/NPBEA standards are addressed in this course. Emphasis is on the integration of theory and practice. Prerequisite: EDST 51200 .

Learning Outcomes: 1. Act with integrity, fairly, and in an ethical manner. 2. Understand, respond to, and influence the larger political, social, economic, legal, and cultural context. Credits: 3.00

EDST 61600 - Analytical Techniques In Educational Management

Credit Hours: 3.00. This course is a mix of theory and practice concerning planning and implementation of the fiscal responsibilities that a superintendent of schools would engage in at the district level. The course exposes students to some of the key processes and activities related to planning for and implementing the school budget and related activities. The course examines such planning concepts as goal definition, decision-making, and evaluation of planning as it relates to the fiscal issues of a school corporation. A feature of the course is an emphasis on the process of dealing with the elements of change and planning for such as it relates to fiscal issues in educational organizations. Prerequisite: EDST 51400 or EDST 60800 .

Learning Outcomes: 1. Describe various functions of the school district business office. 2. Identify methods of decision making involved in allocating fiscal resources. 3. Identify various methods of budgeting. 4. Demonstrate an understanding of elementary accounting concepts. 5. Demonstrate an understanding of calculations and functions related to Indiana public school corporation funds. 6. Summarize the ways in which Indiana public school corporations are funded and the most recent legislation that will impact funding. 7. Demonstrate an understanding of the role of business with regard to insurance, transportation, food service, and maintenance. 8. Summarize the balance among expenditures, revenues, and the educational plan. Credits: 3.00

EDST 64000 - Higher Education Law

Credit Hours: 3.00. This course explores the legal framework

within which institutions of higher education operate. Course materials, activities, and assignments will give students a deep understanding of how state and federal legislative bodies and courts operate. Students will read statutory materials and case law on legal issues related to higher education, including: free speech, religion, academic freedom, searches and seizures, due process rights, equal protection issues, individuals with disabilities, contracts and employment, torts and university liability. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize case law, and statutory and administrative law materials to create and share a robust understanding of how the varied sources of law inform all interactions at institutions of higher education. 3. Create new knowledge by synthesizing, applying, and communicating how the law can and should be applied in higher education institutions. 4. Learn and apply legal research skills that will empower them to contribute to legal scholarship. 5. Become more fluent in communicating complex legal concepts to stakeholders at different levels (students, peers, administrators, etc.). Credits: 3.00

EDST 64100 - Organization And Adminstration In Higher Education

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of organization and administration in higher education. To do so, the course will have a dual focus: organization, which includes forms, structures, systems, roles, and functions; and administration, including the three "Ps" - processes, products, and "players." The scope of the course seeks to create an appreciation for the complexity of the higher education system, specifically of colleges and universities as ecosystems, through exploration of these systems both horizontally across institutions and institutional types and vertically within the individual, single institution. Throughout the semester students will engage in a variety of analytic and critical perspectives through course readings, discussions, and assignments that encourage a multifaceted perspective. The course intends to provide an organizational framework and serve as the foundation for the courses in the Higher Education program of study.

Learning Outcomes: 1. Explore a variety of literature on organizational theory, integrating literature from the field of higher education as well outside disciplines of business, political science, & sociology. 2. Gain an applied knowledge of the complexity of higher education institutions as organizations by understanding: the different internal "players" involved in higher education administration and governance; a variety of external influences and factors that may impact higher education institutions; the critical issues that impact the cultures and norms both within and across institutions; identify and apply organizational theory through analysis of critical issues facing higher education institutions. 3. Examine complex cultural, political, social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using different organizational theory and frameworks. 4. Develop skills to succinctly and professionally articulate analysis and synthesis of relevant empirical research and literature. 5. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. Credits: 3.00

EDST 64200 - Cultural Engagement In Higher Education Communities

Credit Hours: 3.00. The influence of culture is of particular import with issues facing the world today and Higher Education institutions (HEIs) are not immune to this reality. HEIs often serve as an institutional base for communities and have a vested interest in meaningful engagement with the communities that surround their campuses. This course is designed to enable learners to confidently communicate, build relationships, and work effectively in culturally diverse communities. Through exploration of a variety of intercultural theories, students will become aware of and be able to navigate the cultural influences in local, state, regional, national, and international higher education communities. As part of the course, students will engage in their communities through experiential, real-world, case study, and project management methods. Permission of instructor required.

Learning Outcomes: 1. Deepen their thinking and practice of community engagement and the positionality of the institution within its community. 2. Demonstrate that as a complex organization, Higher education functions as

both a personal and a societal (public and private) benefit. 3. Demonstrate consistent critical attention and critical thinking to their own and others positionality including cultural identities, social and organizational power and privilege, and intercultural competence. 4. Formulate skills to better recognize, prevent, and resolve cross-cultural conflicts. 5. Construct effective cross-cultural relationships and work in an intercultural group setting. 6. Evaluate and summarize intercultural theories as applied to their individual/institutional contexts. 7. Describe a context for examining the organization of knowledge and institutions of higher education in relation to community-based problem solving. 8. Examine complex social and organizational issues from different perspectives - specifically the ability to conduct research and analysis using a variety of community engagement and cultural frameworks. 9. Formulate and articulate rational arguments through discussions, peer review, and reflective and research writing. 10. Apply theory to practice in a final community engagement research project. Credits: 3.00

EDST 64300 - Higher Education Economics And Finance

Credit Hours: 3.00. This course provides students with an overview of financial issues related to higher education. Students will discuss and evaluate topics such as the public versus private financial benefits of higher education, the financial relationship between institutions of higher education and both state and federal governments, and issues related to labor economics. Permission of instructor required.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize, create, and communicate knowledge. 3. Engage in professional development. 4. Participate actively in the profession. Credits: 3.00

EDST 64400 - Policy And Politics In Higher Education

Credit Hours: 3.00. In this course, focused on historic and contemporary issues, research, and theories that shape public policy in higher education, students will critically examine the policy issues facing higher education today. The course will interrogate the ways politics and policy are leveraged to address issues of access and college success for all, dismantle systemic oppression, and improve upon higher education's ability to carry out its mission, vision, and purpose. Three main foci will be reviewed and applied throughout the course: The policymaking process: Students will gain a foundational knowledge of policy formation and implementation process at the federal, state, tribal/local levels; Methods of policy analysis: methods of analyzing, interpreting, and evaluating policy/policy issues; Policy research: multiple theoretical lenses and research trends focused on continued improvement and development of higher education institutions, programs, and services. Permission of instructor required.

Learning Outcomes: 1. Gain and deepen foundational knowledge of HE politics and policy, including the reciprocity (or lack thereof) between federal, state, tribal/local policy, policy formation and implementation, and contemporary issues shaping HE politics and policymaking today. 2. Evaluate and apply public policy theoretical and conceptual frameworks as applied to their individual/institutional contexts. 3. Investigate the ways cultural/social/political contexts affect creation and implementation of public policy. 4. Explore how policy interacts with higher education's ability to deconstruct/level systemic oppression while creating opportunity for equity and access. 5. Examine issues of power, privilege and oppression in public policy by asking: who has power, resources, influence; how "they" use the power, resources, and influence; and whose perspectives, identities, and interests are represented in current policies. 6. Evaluate how policy effects the lived experiences of the higher education community - students, faculty, staff, administration and communities. 7. Examine complex cultural, political, and social issues from different perspectives - specifically the ability to conduct research and analysis using public policy frameworks. 8. Formulate and articulate rational arguments through discussions, peer review,

and reflective and research writing. 9. Apply theory to practice through policy analysis and a final research proposal. Credits: 3.00

EDST 64500 - Higher Education Leadership And Management

Credit Hours: 3.00. This is the second in the series of courses on the Higher Education Organization. The aim of this course is to provide an overview of leadership and management of higher education institutions in the U.S. from relationship-rich and cultural lenses. The scope of the course seeks to create an appreciation for the complexity of the higher education system, specifically of colleges and universities as ecosystems, through exploration of the leadership and management types, systems and structures both horizontally across institutions and institutional types and vertically within the individual, single institution. The course will examine leadership and management from the presidency to managers at all levels in both academic and administrative units. Permission of instructor required. Prerequisite: EDST 64000.

Learning Outcomes: 1. Explore a variety of literature on HEI leadership and management, integrating literature from the field of higher education as well outside disciplines of business, political science, & sociology. 2. Gain an applied knowledge of the complexity of higher education institutions leadership and management by understanding; the different internal roles involved in higher education administration and governance; a variety of external influences and factors that may impact higher education institutions; the critical issues that impact the leadership and management cultures and norms both within and across institutions. 3. Analyze and reflect on their personal leadership styles based on HE theory, frameworks, and perspectives. 4. Identify and apply HEI leadership and management theory through analysis of critical issues facing higher education institutions. 5. Examine complex leadership and management issues from cultural, political and organizational perspectives - specifically the ability to conduct research and analysis using different HEI leadership and management theory and frameworks. 6. Develop skills to succinctly and professionally articulate analysis and synthesis of relevant empirical research and literature. 7. Formulate and articulate rational arguments through discussions, peer review, presentation, and reflective and research writing. 8. Apply theory to practice in a final leadership/management manuscript publication project. Credits: 3.00

EDST 64600 - Assessment And Evaluation In Higher Education

Credit Hours: 3.00. The aim of this course is to explore and examine the complexities of assessment and evaluation within higher education systems, including but not limited to student learning, academic programs, student support services, and administrative services. The scope of the course seeks to create a practical understanding of assessment and evaluation, whereby we examine the foundations of assessment planning and development, explore various assessment techniques, explicate and develop a comprehensive assessment plan, and explain how approaches to data collection work in concert and separately to assess both student learning outcomes and program effectiveness.

Learning Outcomes: 1. Apply fundamental principles of assessment and evaluation. 2. Synthesize knowledge and skills of assessment essentials to create a comprehensive assessment plan. 3. Analyze various data collection methods as it relates to assessment and evaluation. 4. Evaluate findings from assessment plans and translate into practical actions that inform practice, policy, and institutional effectiveness. 5. Apply course content to problem-solving, program effectiveness, and the generating of interventions and services to enhance student experiences in higher education. Credits: 3.00

EDST 64700 - History Of American Higher Education

Credit Hours: 3.00. This course engages students to better understand the history of higher education in the United States from the Colonial era to the present. Upon completion, students will have an appreciation for how higher education institutions (HEIs) were (and continue to be) developed, as well as an

understanding of who had access to these institutions over the past 200+ years, and who did not, from a social justice perspective.

Learning Outcomes: 1. Think critically and reflectively. 2. Synthesize, create, and communicate knowledge. 3. Engage in professional development. 4. Participate actively in the profession. Credits: 3.00

EDST 64800 - International And Intercultural Higher Education

Credit Hours: 3.00. This doctoral-level course critically examines the interconnected and interdependent world of international higher education through an intercultural lens. The course will employ a variety of critical theoretical perspectives (post-development, feminist, & equity frameworks as well as organizational/institutional models) to examine both the historical and contemporary developments in higher education throughout the globe. Topics will vary based on current issues but will center on the influences cultural, economic, political, & social factors have had on national and international higher education development. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the interwoven concepts related to internationalization, globalization, and intercultural higher education. 2. Explore a variety of literature on international and intercultural higher education, integrating literature from the field of higher education as well outside disciplines of business, political science, & sociology. 3. Analyze a HEI's internationalization plans, intercultural activities/strategies and various influences on these based on HE theory, frameworks, and perspectives. 4. Examine complex internationalization and intercultural issues from cultural, political and organizational perspectives - specifically the ability to conduct research and analysis using equity, feminist, post-colonialist and/or an organizational theory or framework. 5. Develop skills to succinctly and professionally articulate analysis and synthesis of relevant empirical research and literature. 6. Formulate and articulate rational arguments through discussions, peer discussion, and reflective and research writing. 7. Apply theory to practice in a final internationalization case study project. Credits: 3.00

EDST 66300 - Organization And Administration Of Special Education

Credit Hours: 3.00. (EDPS 66300) A comprehensive course in the organization and administration of special education including the organizational arrangements, identification, placement and service delivery, tests and assessments, program evaluation, personnel, and school/community relations.

Learning Outcomes: 1. Examine, discuss, and gain an understanding of the role of the special education director. 2. Apply the federal and state rules and regulations for special education in school settings. 3. Understand the role of litigation in the field of special education. 4. Understand special education funding options, identify budget preparation strategies and fund management. 5. Demonstrate ways to ensure parent involvement. 6. Discuss current trends and issues in educating children with disabilities, including ethnic and cultural diversity, discipline, suspension and expulsion. Credits: 3.00

EDST 69400 - Intern In Educational Administration: Building Administrator

Credit Hours: 1.00 to 3.00. (EDFA 69400) Field experience in educational administration under university supervision in selected situations related to school building administration. Amount of credit to be determined by nature and extent of assignment. Permission of instructor required.

Learning Outcomes: * Credits: 1.00 to 3.00

EDST 69500 - Internship In Education

Credit Hours: 1.00 to 10.00. (EDFA 69500) Amount of credit to be determined by nature and extent of the assignment. A special course in selected areas of education, designed to provide practical field experience under professional supervision in selected situations related to the candidate's area of specialization.

Credits: 1.00 to 10.00

EDST 69700 - EdS Project-Research

Credit Hours: 0.00 to 18.00. Educational Specialist project in research. Permission of instructor required.

Credits: 0.00 to 18.00

EDST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Daniels School of Business (Graduate)

Department of Economics (Graduate)

Website: **https://www.krannert.purdue.edu/**

Department/School Head

Justin L. Tobias

Faculty by Rank (website)

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Academic Programs

Master's and Ph.D. Programs

Our economics master's program is affordable and flexible. You have the option of completing the degree fully online in as few as 20 months or spread out over 36 months. The program offers study tracks for students interested in data analytics, financial economics, public policy, or advanced theory, for those interested in pursuing Ph.D. studies in economics, management, or political science at first-tier universities.

The Department of Economics offers a doctoral program that prepares economists for careers in research, teaching, business and government. The graduate program in economics has a strong quantitative and analytical orientation. It is designed to provide a working knowledge of basic research skills and to broaden the students' understanding of economic institutions.

Online/Distance Programs

Online M.S. Program in Economics

On-Campus Programs

Ph.D. Program in Economics

Economics, MAT

Economics, MS

Business and Economics Data Analytics, Post-Baccalaureate Certificate

Financial Economics, Post-Baccalaureate Certificate

Public Economics and Policy, Post-Baccalaureate Certificate

Economics, PHD

ECON 50000 - Mathematics For Economists

Credit Hours: 2.00 or 3.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. Content covers algebra, univariate and multivariate calculus and constrained optimization methods

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00 or 3.00

ECON 50100 - Statistical Analysis For Economists

Credit Hours: 1.00 to 3.00. A master's level course in statistics and its application to economics. Course will familiarize students with the elements of statistics needed to perform econometrics.

Learning Outcomes: 1. Apply algebra and basic calculus to econom(etr)ic models. 2. Calculate and interpret univariate and multivariate statistics. 3. Describe and identify properties of random variables. 4. Select methods of and perform statistical inference. Credits: 1.00 to 3.00

ECON 51000 - Applied Game Theory

Credit Hours: 2.00. Game theory is a powerful tool that facilitates a decision making process of individuals. Games are characterized usually by two or more players where any player's action has an impact on other player's payoff. Players are decision making units, e.g. individuals, firms, workers, managers, countries etc. Game theory analyzes situations in which people (or other animals) interact by breaking these situations down into basic descriptions of the set of players, the strategies available to these players, and the payoffs that the players receive for different combinations of strategy choices. Permission of department required.

Learning Outcomes: 1. Understanding of the logical mechanics, provide good intuition and to apply tools to explain events. Credits: 2.00

ECON 51100 - Intermediate Economics I

Credit Hours: 3.00. Consumer behavior and demand, production and cost, factor demand, market structure, general equilibrium and welfare. Emphasis on the tools used to analyze the behavior of individual economic units. Not open to students with credit in ECON 34000 .

Credits: 3.00

ECON 51200 - Intermediate Economics II

Credit Hours: 3.00. Course content includes money and banking, national income and aggregative economics; the analysis of the determination of national income, employment, the price level, and the balance of payments. Consideration of both theory and economic policy. Not open to students with credit in ECON 35200 .

Credits: 3.00

ECON 51302 - Fundamentals Of Macroeconomics

Credit Hours: 2.00. This course examines how the US economy functions and develops a theoretical framework permitting an analysis of the forces affecting national income, employment, unemployment, interest rates, and the rate of inflation. Throughout the semester we will discuss both the theory and the empirical evidence on aggregate macroeconomic measures; consumption, savings, and investment; labor supply and demand; employment and unemployment; economic growth; money and banking; and macroeconomic stabilization techniques.

Learning Outcomes: 1. Describe the macroeconomy using aggregate measures. 2. Identify and describe the drivers of households' consumption and savings decisions. 3. Demonstrate an understanding of the factors that affect business investment decisions. 4. Derive the short-run demand for labor. 5. Distinguish the major determinants of labor market participation and hours worked. 6. Recognize the different measures, causes and effects of unemployment. 7. Identify and describe the causes of long-run economic growth. 8. Recognize the causes and effects of inflation. 9. Assess economic information contained in news reports, policymakers'

statements, and specialized publications. Credits: 2.00

ECON 51400 - Microeconomics (UCC: BSS)

Credit Hours: 2.00. An introduction to microeconomic theory. Analysis of consumer demand, output and input decisions of firms, price determination, economic efficiency, market structures, and market failure.

University Core Curriculum (UCC): (UCC: BSS) Learning Outcomes: 1. Calculate economic costs and benefits relevant for making rational decisions. 2. Identify factors that influence demand, supply, and market equilibrium. 3. Evaluate the efficiency and equity of market equilibrium and the role of government in achieving efficiency and equity. Credits: 2.00

ECON 51500 - Macroeconomics

Credit Hours: 1.00 to 3.00. Investigation of the causes of macroeconomic fluctuations in the economy. Looks at changes in inflation, unemployment, real output, interest rates, and exchange rates, and explores why they occur, what their effects are, and what, if any, role government should play in dealing with these problems. A mixture of theory and case studies with reference to historical case studies. Current macroeconomic problems will be discussed with a focus on the international aspects of macroeconomic problems.

Learning Outcomes: 1. Predict the macroeconomic impact of fiscal and monetary policies using the mathematical IS/LM models. 2. Demonstrate an understanding of the interdependencies and complexities with respect to international trade of goods and services as well as capital flows. 3. Analyze the possible economic/social impacts of various policy proposals from a historic perspective. Credits: 1.00 to 3.00

ECON 51600 - Introduction To Mathematics For Economics

Credit Hours: 2.00. This is a Master's level course in mathematics and its application to economics. Students in this class will review and practice the mathematical methods required to solve micro and macroeconomic theoretical models, especially constrained optimization problems. The content covers a review of algebra, univariate and multivariate calculus, and constrained optimization methods, e.g., LaGrange multipliers. Mastering these methods is instrumental to preparing for ECON 51100 & 51200 (micro and macro theory).

Learning Outcomes: 1. Solve problems requiring algebra and (uni-) multivariate calculus. 2. Apply algebra and calculus to solving (un)constrained optimization problems required by economic theoretical models. 3. Analyze assumptions embedded in economic theoretical models, e.g., functional forms and parameter values, using algebra and calculus. Credits: 2.00

ECON 52000 - Industrial Economics

Credit Hours: 2.00. This course will explore the division of economic activity among industries in developed and less-developed countries. It will examine patterns of private and public ownership in different countries. It will discuss the determinants of market and firm structure, firm conduct, and market performance in imperfectly competitive markets, and different approaches to regulating such markets. Emphasis is placed on using basic economic models of firm and industry behavior to explain and analyze real-world markets. Permission of department required.

Learning Outcomes: 1. Students will be able to apply economic analysis and model to explain real-world firm and industry behavior. Credits: 2.00

ECON 52100 - Consumer & Producer Theory

Credit Hours: 2.00. In this course, we will develop and apply some of the basic theories of consumer and producer choices. You will learn how to approach issues from an economic perspective and gain an understanding of the microeconomic models and tools that will be used in subsequent courses.

Learning Outcomes: 1. Analyze key aspects of consumer and producer choices. 2. Understand how markets allocate resources. 3. Apply insights from microeconomic theory to public and economic policy. Credits: 2.00

ECON 53300 - Econometrics

Credit Hours: 2.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economic data. The course examines the

statistical techniques used in testing economic theories, estimating causal effects, and making predictions. Emphasis is placed on estimating a single equation and the problems associated with such estimation. In addition to multivariate OLS regression, students will be introduced to other regression methods including: instrumental variables estimation, time series estimation, and panel data methods. As part of the course, students will use Stata, a statistical software package.

Learning Outcomes: 1. Understand the theoretical foundations of linear regression methods. 2. Estimate linear regression model parameters and perform basic tests using Stata. 3. Interpret regression results and identify the sources of estimation bias. Credits: 2.00

ECON 53600 - Public Economics

Credit Hours: 2.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00

ECON 53700 - Health Economics

Credit Hours: 2.00 or 3.00. This course is designed to introduce masters' students in economics to the field of health economics. We will analyze health and health care theories, institutions, and key policy issues. The course covers how the markets for health and health services are different from other goods, with a particular emphasis on the role of government and market failure. We will examine the demand for and the production of health and health care, and the behavior and organization of health care providers. We will also explore information asymmetries and the functioning of health insurance markets. We will consider health and healthcare systems around the world, paying particular attention to the U.S. health care system and recent reforms to it.

Learning Outcomes: 1. Know key details relating to the structure of the U.S. health care system, and be able to describe key institutions and programs involved in U.S. health care and health insurance. 2. Discuss the special features of health and health care that present challenges for economic analysis and policy development, including in terms of health care reform. 3. Apply economic concepts and approaches to understanding key health economics issues. 4. Explain, in broad terms, what health care systems look like in other countries and how they differ from the U.S. 5. Apply economic concepts and insights from public health to the current Covid-19 pandemic. Credits: 2.00 or 3.00

ECON 53800 - International Economics

Credit Hours: 2.00 or 3.00. The course covers selected topics in international trade with a focus on real world applications.

Learning Outcomes: 1. Identify the effects of international trade on wages, prices or products and welfare of nations. 2. Develop models as well as a diverse set of academic papers to discuss current policy debates. Credits: 2.00 or 3.00

ECON 53900 - Wage Discrimination

Credit Hours: 1.00. This course is an applied economics course that focuses on racial discrimination in the labor market. We will

use the tools you have developed so far in the MA program to study the extent, causes and consequences of disparities in wages and employment by race.

Learning Outcomes: 1. Quantify racial and gender disparities in economic outcomes. 2. Recognize leading theories for those disparities. 3. Evaluate empirical evidence for these theories. 4. Assess policy responses to alleviate disparities. Credits: 1.00

ECON 54100 - Managerial Economics & Business Strategy

Credit Hours: 1.00. The course covers topics such as monopolies (price discrimination, optimal pricing strategies), advanced strategic decision-making and imperfect competition (optimal pricing and production), new product introductions, product variety offered on the market, and entry deterrence strategies. The main goal of this course is to provide a basis for a good understanding of the logical mechanics, and to provide a good intuition in managerial economics and business decision-making processes that facilitate the understanding of daily business problems.

Learning Outcomes: 1. Identify and explain logical mechanics that determine individuals' choices and decisions. 2. Evaluate managerial economic problems to better identify daily business problems. 3. Apply key aspects such as marginal concepts and countervailing effects when proposing solutions. 4. Illustrate main mechanisms using graphs and apply basic knowledge of algebra and calculus to business problems. Credits: 1.00

ECON 55000 - Personnel Economics

Credit Hours: 2.00. Personnel Economics applies micro- and macroeconomic theory to the workings of the labor market while maintaining a focus on incentives in the workplace. The course will investigate the determination of wages and compensation (based on a study of labor demand and supply) and the differences in these forms of payment for labor services across workers within an occupation, across occupations, and across cultures. Other topics to be considered include the connection between investments in education and training and labor market outcomes and estimates of the costs and benefits of immigration and employee turnover and discuss the impact of unions, as well as discrimination in the labor market issues. Permission of department required.

Learning Outcomes: 1. Students will have the tools of economic logic that allow them to evaluate proposals for labor policies on a firm-specific level and on a national level. Credits: 2.00

ECON 55400 - Business Cycles & Macroeconomic Policy

Credit Hours: 1.00. This course examines how the US economy functions and develops a theoretical framework permitting an analysis of the forces behind short-term fluctuations in the level of economic activity and the corresponding macroeconomic stabilization techniques. Topics covered include comprehending the origins and characteristics of business cycles, assessing the impact of government fiscal and monetary policies in fostering stable economic growth and prices, and evaluating the causes and consequences of unemployment.

Learning Outcomes: 1. Categorize and describe the causes and properties of business cycles. 2. Demonstrate an understanding of monetary and fiscal policy options as they relate to economic stabilization. 3. Use theoretical and empirical models to predict and evaluate the effects of economic policies on macroeconomic variables. 4. Assess economic information contained in news reports, policymakers' statements, and specialized publications. Credits: 1.00

ECON 55500 - Economic Forecasting

Credit Hours: 2.00. This course provides an introduction to forecasting methods of current interest in economics. The goal is to equip students with a working knowledge of state-of-the-art techniques that are useful for forecasting macroeconomic variables. The strengths and weaknesses of the techniques will be analyzed and their empirical relevance will be demonstrated through a variety of applications to real data sets. The topics will include univariate prediction models, vector autoregressions, forecasting with large data sets, forecast combinations and forecast evaluation. Particular emphasis will be placed on applications and the issues involved with implementation of the various methods in practice.

Learning Outcomes: 1. Identify the statistical issues involved in forecasting economic data. 2. Analyze the strengths and weaknesses of a variety of forecasting techniques commonly used in economics. 3. Demonstrate the empirical relevance of each forecasting

approach through applications to real-world data sets. Credits: 2.00

ECON 56200 - Econometrics I

Credit Hours: 3.00. This masters-level course in econometrics covers the tools that will enable students to conduct empirical analysis using economics data. The course examines the statistical techniques used in testing economic theories, estimating casual effects, and making predictions. Emphasis is placed on estimating a single equation (e.g., a demand function) and the problems associated with such estimation. As part of the course, students will estimate equations using STATA, a statistical software package. Permission of department required.

Learning Outcomes: 1. Students will have the tools to perform simple econometric analysis of Economic problems. Credits: 3.00

ECON 56400 - Advanced Quantitative Economics With Python

Credit Hours: 1.00. The main goal of this course is to extend the computational and programming toolkit developed in Quantitative Economics with Python. In particular, we will cover advanced methods for working with, visualizing and analyzing data in Python. In addition, we will consider more advanced programming techniques including stochastic optimization and infinite-horizon dynamic programming. Throughout the course we will consider a number of applications related to microeconomics, macroeconomics, and econometrics covered in the MS Econ program curriculum.

Learning Outcomes: 1. Have working knowledge of programming techniques in Python. 2. Have the ability to use scientific computing packages to analyze economic data. 3. Have an understanding of numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 1.00

ECON 56500 - Law And Economics

Credit Hours: 2.00. This course is designed to give the student an understanding of both legal and economic principles and the relationship between them. It will also show the student how to access various data bases, Lexis/Nexis, to get a formal statement of the law and how the laws have actually been interpreted and enforced. Finally, through the use of economic analysis, the student will acquire the tools to predict the likely outcomes of particular laws and how they will affect their family and business decisions. Permission of department required.

Learning Outcomes: 1. The student is expected to understand the interplay between Economics and Law. Credits: 2.00

ECON 56700 - Managerial Economics And Business Strategy

Credit Hours: 1.00 to 4.00. This course studies optimal decision-making processes made by managers and policymakers within firms and other organizations. The course is based on microeconomics and applies advanced microeconomics-related concepts with an emphasis on pricing strategies. The course covers topics such as monopolies (price discrimination, optimal pricing strategies), advanced strategic decision-making and imperfect competition (optimal pricing and production), new product introductions, product variety offered on the market, and entry deterrence strategies. We use a variety of examples and applications, and operate with modern tools (Game Theory) that facilitate the decision-making process for individuals, policymakers and managers. The main goal of this course is to provide a basis for a good understanding of the logical mechanics, and to provide a good intuition in managerial economics and business decision-making processes that facilitate the understanding of daily business problems. Permission of instructor required.

Learning Outcomes: 1. Identify and explain logical mechanics that determine individuals' choices and decisions. 2. Evaluate managerial economic problems to better identify daily business problems. 3. Apply key aspects such as marginal concepts and countervailing effects when proposing solutions. 4. Illustrate main mechanisms using graphs and apply basic knowledge of algebra and calculus to business problems. Credits: 1.00 to 4.00

ECON 57200 - Econometrics II

Credit Hours: 2.00. This course reviews basic concepts in probability, mathematical statistics and linear algebra in order to obtain a more rigorous understanding of the linear regression model, its representation and assumptions, procedures for estimation and properties associated with the OLS estimator. We move on and apply what we have learned to the linear regression model. We discuss estimation and prediction, establish properties such as efficiency, unbiasedness, consistency and convergence in mean square. We conclude by considering a few nonlinear models appropriate for modeling binary outcomes. Permission of department required.

Learning Outcomes: 1. A student will be able to

apply Econometric analysis to specific economic questions using MATLAB. Credits: 2.00

ECON 57300 - Financial Econometrics

Credit Hours: 2.00. This course offers an introduction of basic principles of econometric analysis that will help students understand finance theories and their empirical applications. It will also equip students with appropriate statistical techniques for doing applied financial research. The statistical techniques are particularly well suited for analyzing financial time-series data. Permission of department required.

Learning Outcomes: 1. The student will be able to apply Econometric time series methods to analysis financial data. Credits: 2.00

ECON 57600 - Statistical & Machine Learning

Credit Hours: 2.00 or 3.00. This is an introductory course in statistical and machine learning. It will cover fundamental concepts and essential tools that are critical in understanding cutting-edge machine learning techniques. Students will develop skills in applying a wide
variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. Students will gain hands-on experience in analyzing datasets commonly used in business and economics.

Learning Outcomes: 1. Develop skills in applying a wide variety of modeling and prediction methods. Topics include linear regression, classification, regularization and shrinkage methods, tree-based methods, and support vector machines. An integral part of this course is the extensive use of the open source statistical software R. 2. Gain hands-on experience in analyzing datasets commonly used in business and economics. Credits: 2.00 or 3.00

ECON 57700 - Quantitative Economics With Python

Credit Hours: 2.00 or 3.00. Introduce students to computational and programming in Python.

Learning Outcomes: 1. Learn Python essentials including basic programming techniques and the use of popular packages for data analysis and more advanced programming techniques including numerical methods, dynamic programming, and simulation-based methods. Credits: 2.00 or 3.00

ECON 57800 - Statistical & Machine Learning II

Credit Hours: 2.00. This is a second course in machine learning. After studying the fundamental concepts and essential machine learning tools in Machine Learning I, this follow-up course will go over a range of more advanced topics and learning methods. Topics include support vector machines, deep learning and neural networks, principal components analysis and other unsupervised learning methods. As in the first course, we will be using the statistical software R and its packages extensively to implement various learning methods.

Learning Outcomes: 1. Explain how common learning methods are implemented. 2. Train a range of deep learning models. 3. Perform dimension reduction techniques to summarize high-dimensional data in an efficient manner. 4. Select appropriate models and learning methods for a particular application. Credits: 2.00

ECON 58400 - Experimental Economics

Credit Hours: 2.00 or 3.00. This course introduces you to the experimental methods used by economists to study human behavior. These methods analyze data collected in controlled laboratory experiments. Throughout the course, we will discuss different types of experiments that have been extensively researched by experimental economists. To help introduce and motivate each topic, you will participate in weekly synchronous experiments with your classmates over the internet. You will then complete an assignment analyzing the data generated by your class in the online experiment. The following lecture will provide an overview of the theoretical framework and experimental predictions. We will also discuss commonly observed behavior and any relevant explanations for such behavior.

Learning Outcomes: 1. Demonstrate an understanding of the experimental methodology used by economists to study human behavior. 2. Evaluate economic behavior by analyzing and interpreting experimental data and its

relationship to common economic models. 3. Identify and explain common insights that experiments provide regarding people's behavior in strategic situations. Credits: 2.00 or 3.00

ECON 58500 - Behavioral Economics

Credit Hours: 2.00 or 3.00. This course explores human economic behavior, with a strong emphasis on laboratory and field experiment methodology used in behavioral economics research. Topics considered include behavior in markets for financial assets and auction markets, and behavior in social dilemmas that arise when people try to provide public goods voluntarily or increase economic surplus through trust. Students will also study how people bargain with and exhibit social preferences towards others. Decision-making and anomalies for risky uncertain choices will also be covered.

Credits: 2.00 or 3.00

ECON 58700 - Advanced Quantitative Economics With Python

Credit Hours: 3.00. The main goal of this course is to extend the computational and programming toolkit developed in Quantitative Economics with Python course. In particular, we will cover advanced methods for working with, visualizing and analyzing data in Python. In addition, we will consider more advanced programming techniques including stochastic optimization and dynamic programming. Throughout the course, we will consider a number of applications related to microeconomics, macroeconomics, and econometrics covered in the MS Econ program curriculum.

Learning Outcomes: 1. Gain working knowledge of programming techniques in Python. 2. Use scientific computing packages to analyze economic data. 3. Understand numerical methods used to solve economic models. 4. Use visualization tools to communicate computational results. Credits: 3.00

ECON 59000 - Problems In Economics

Credit Hours: 1.00 to 4.00. Open only to a limited number of seniors and graduate students. Arrange with instructor before enrolling. Supervised reading and reports in various subjects. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 59100 - Financial Valuation And Decision Making

Credit Hours: 2.00 or 3.00. A comprehensive introduction to finance. The object of this course is to provide the computational framework necessary to appreciate and understand how to make decisions based on sound financial reasoning.

Learning Outcomes: 1. Develop skills in investment decisions and financing decisions. Credits: 2.00 or 3.00

ECON 60000 - Teaching Economics

Credit Hours: 1.00 to 3.00. This course traces the development of economic theory from the Mercantilist writers through the contributions of J. S. Mill and Karl Marx. Topics covered include the development of value theory (especially labor theories of value), theories of economic growth and business cycles, the classical debate over the meaning and validity of Say's Law, and changing views regarding the appropriate role of government in the marketplace. In each case, the contributions of the authors considered are evaluated in light of our modern understanding of economic theory.

Credits: 1.00 to 3.00

ECON 60600 - Microeconomics I

Credit Hours: 1.00 to 3.00. An introduction to basic consumer and producer theory, competitive markets (including using the continuum to model competition), basic general equilibrium theory, and basic risk/uncertainty. Co-requisite: ECON 61500.

Learning Outcomes: 1. Demonstrate basic knowledge of both basic consumer and producer theory as used in graduate level economics 2. Develop and use a standard toolkit of mathematical methods to set up and solve problems in these area. 3. Assess through a series of homework and exams. Credits: 1.00 to 3.00

ECON 60700 - Microeconomics II

Credit Hours: 1.00 to 3.00. Building on Microeconomics I, more advanced consumer and producer theory using support functions, risk/uncertainty and information, and basic game theory and oligopoly. Prerequisite: ECON 60600 .

Credits: 1.00 to 3.00

ECON 60800 - Macroeconomic Theory I

Credit Hours: 2.00 or 3.00. An introduction to general equilibrium macroeconomic models in both deterministic and stochastic settings. Topics studied include: static neoclassical models, social planner problems, dynamic programming, growth and capital accumulation, stochastic economies, asset pricing, and overlapping generations models.

Credits: 2.00 or 3.00

ECON 60900 - Microeconomics III

Credit Hours: 1.00 to 3.00. An advanced course in game theory and general equilibrium theory. Among the topics covered are: games in strategic form, games in extensive form, games of incomplete information, cooperative games with side payments, mechanism design, consumer choice theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of microeconomic topics, including extensions in game theory, Pareto optimality, the Arrow-Debreu-McKenzie model, and the existence and stability of competitive equilibria. 2. Identify insights game theory provides in translating informal descriptions of multi-person decision situations into formal game-theoretic problems, including the class of games in which the players are tasked to simultaneously distribute limited resources over several objects. 3. Understand the perspective provided by general equilibrium analysis contrasted with particle equilibrium theory. Credits: 1.00 to 3.00

ECON 61000 - Advanced Game Theory

Credit Hours: 1.00 to 3.00. An advanced course in game theory and its applications. Among the topics covered are: extensive form games, normal form games, Nash equilibrium, mixed strategies equilibrium, subgame perfect equilibrium, learning and equilibrium, games with incomplete information, repeated games, cooperative games, noncooperative bargaining, and auctions. Prerequisite: ECON 60600 .

Learning Outcomes: 1. Demonstrate an advanced understanding of game theory and strategic thinking, including concepts such as dominance, backward induction, equilibrium, commitment, extensive form games, and asymmetric information. 2. Understand the perspective provided by game theory for a variety of games played in economic and political settings. 3. Identify insights game theory provides in translating an informal description of a multi-person decision situation into a formal game-theoretic problem. Credits: 1.00 to 3.00

ECON 61100 - Macroeconomic Theory II

Credit Hours: 2.00 or 3.00. An introduction to selected topics in macroeconomics, including theories of business cycles, economic growth, microfoundations of labor markets and some miscellaneous issues. Topics covered include: theories of business cycles (real business cycles, information imperfections, coordination failures), economics of growth (neoclassical model, human capital model, endogenous growth), microfoundations of labor markets (recursive competitive equilibrium models, search and matching models, efficiency wages, implicit contracts, insider-outsider model), miscellaneous issues including monetary economics (cash-in-advance constraint models), the Lucas critique, time inconsistency, and endogenous cycles. Prerequisite: ECON 60800 .

Credits: 2.00 or 3.00

ECON 61200 - Macroeconomic Theory III

Credit Hours: 1.00 to 3.00. Selected topics in contemporary research in macroeconomic theory. Emphasis on the implications of uncertainty in macroeconomic theory, including such topics as search theory, asset selection under uncertainty, stochastic optimal control, and asymmetric information.

Learning Outcomes: 1. Understand and define equilibrium in various models. 2. Identify the sources of inefficiencies in a competitive equilibrium. 3. Develop foundations in macroeconomic models necessary to pursue research in economics. Credits: 1.00 to 3.00

ECON 61400 - Economics Of Information

Credit Hours: 1.00 to 3.00. An introduction to the economics of information. Key topics considered are nonexpected utility theory and the various implications of asymmetric information-either hidden action(s) and/or hidden types, including

extensions of the basic principal-agent model as well adverse selection issues, mechanism design, and screening/signaling models. Other topics that may be considered include the value of information/real option theory, herd behavior, capital asset pricing models, stochastic calculus and options pricing models, organizational decision making, search theory and price dispersion models, and herd behavior. Prerequisite: ECON 60600 .

Credits: 1.00 to 3.00

ECON 61500 - Mathematical Analysis For Economists

Credit Hours: 2.00 or 3.00. Topics include constrained optimization, comparative statics, and elementary topics in mathematical analysis. Students should be familiar with calculus, linear algebra, basic probability, and have a grasp of microeconomic theory (such as the material covered in ECON 51100).

Learning Outcomes: 1. Master key mathematical concepts used in advanced (PhD level) Economics courses. 2. Gain the ability to analyze Economics problems using higher level mathematical tools. Credits: 2.00 or 3.00

ECON 61800 - Advanced Topics In Economics

Credit Hours: 3.00. Macro/international theory workshop. Topics on macroeconomics and international economics are presented by departmental and external speakers.

Learning Outcomes: 1. Gain awareness of the latest research in Economics across a variety of fields in Economics. 2. Identify ways to effectively communicate new research in Economics to others. 3. Understand how the development of new formal theoretic models and/or the execution of rigorous novel empirical research using the latest Econometric methods provide insights for current policy discussion. Credits: 3.00

ECON 62000 - Industrial Organization

Credit Hours: 1.00 to 3.00. A survey of some of the major theoretical issues in the field of industrial organization. Topics include: the welfare economics of competition and monopoly, static and dynamic oligopoly theory, differentiated products models, and entry deterrence.

Credits: 1.00 to 3.00

ECON 62100 - Applied Industrial Organization

Credit Hours: 1.00 to 3.00. A continuation of ECON 62000, with emphasis on empirical analysis and the application of theory to real-world situations. Topics covered include: empirical estimation of market structure, empirical tests of market conduct, the effect of anti-competitive behavior on economic performance, antitrust practice, regulation theory and practice, and experimental industrial economics. The material is selected from current journal articles. Prerequisite: ECON 62000.

Learning Outcomes: 1. Understand methodological developments in the area of empirical Industrial Organization. 2. Establish empirical models and test hypotheses derived from theory. 3. Gain insights in data evaluation and apply statistical software. 4. Derive, estimate, and interpret economic concepts such as market power, economies of scale and scope, price elasticities of demand, etc. Credits: 1.00 to 3.00

ECON 62400 - Estimating Game Theoretic Models

Credit Hours: 2.00 or 3.00. This course examines topics in empirical industrial organization (I.O.), which aims to use data to draw conclusions about how market and firm structure, firm conduct, and market performance interact in imperfectly competitive markets. We will take a "structural" approach, focusing on estimating the parameters of game theoretic models using real industry data, and then simulating those same models to generate predictions under alternative ("counterfactual") scenarios. We will cover theory only to the extent that it provides intuition or testable conclusions. The course is divided into two unequal parts. In the first part, we will learn about static games in the context of mergers, market power, and entry. In the second part, we will focus on the estimation of dynamic games, after first understanding how to solve and estimate dynamic single-agent problems.

Learning Outcomes: 1. Know about several important empirical methods, and you will understand why we use them. 2. Apply some of those methods to real data, generating your own usable code for implementing them. 3. Highlight the advantages and shortcomings of any given method by pointing to scholarly work that applies that method to real industry data. 4. Have the kind of in-depth knowledge (for at

least one of these methods) that makes you an expert (and resource) among your peers. 5. Have practiced your presentation skills. 6. Have thought creatively about the challenges facing the forefront of empirical I.O. Credits: 2.00 or 3.00

ECON 63200 - Labor Economics

Credit Hours: 1.00 to 3.00. An area seminar. Theoretical and empirical research on the financial markets.

Credits: 1.00 to 3.00

ECON 63400 - International Trade

Credit Hours: 1.00 to 3.00. Application of microeconomic techniques to international trade. Topics include: classical, neoclassical, and modern theories of international trade; the theory of tariffs and commercial policy, (including aspects of political economy), welfare aspects of trade and tariff theory, and related topics. The material is selected from current journal articles. Prerequisite: ECON 60700.

Learning Outcomes: 1. Acquire the important building blocks for conducting both theoretical and empirical research in international trade. 2. Develop a keen understanding of the state of current research in trade and labor-market outcome. 3. Refine your skills in critical thinking and nourish your ability to initiate and execute independent inquiries. Credits: 1.00 to 3.00

ECON 63600 - Topics And Research In International Trade

Credit Hours: 1.00 to 3.00. A course in international trade theory and empirics, with emphasis on surveying the recent developments in the field-including empirical applications of material covered in ECON 634. While specific subject matter may vary from year to year, likely topics include: theory and empirics on trade and wages, trade and the environment, trade in the presence of multinational firms and vertical specialization, empirical evaluation of the positive theories of trade (especially factor endowment and variety models), and the identification and measurement of trade barriers and their effects. Material is selected from current journal articles. Prerequisite: ECON 60700.

Learning Outcomes: 1. Identify the evolution & applications of general equilibrium modeling with heterogeneous firms and industries. 2. Outline theory and simulation techniques to modeling frameworks to questions in international trade. 3. Demonstrate knowledge & analysis of New Trade Theory applications through preparation of a 20-30 minute in class presentation. Credits: 1.00 to 3.00

ECON 64100 - Agent-Based Computational Economics

Credit Hours: 2.00 or 3.00. Computational study of economic systems involving interacting agents who do not necessarily possess perfect rationality and information. In addition to equilibrium analysis, agent-based models focus on out-of-equilibrium dynamics that may or may not lead to equilibrium in the long run,

Learning Outcomes: 1. Provide foundation for implementing agent-based simulations in Python. 2. Use agent-based approach to explain and/or complement findings from studies that use human subject experiments. Credits: 2.00 or 3.00

ECON 64200 - Computational Economics

Credit Hours: 2.00 or 3.00. The purpose of this class is to give you a computational toolbox you can apply to economic questions. We will introduce and use numerical methods on computationally tractable problems. The goal of the course is to encourage Ph.D. students to apply these techniques to their own research. Our in-class applications
will primarily be public policy and macro-oriented, by solving and simulating the problems of microeconomic agents and aggregating the results.

Learning Outcomes: 1. Use a computational toolbox that you can apply to economic questions. 2. Solve policy functions of Bellman equations and simulating agent behavior. 3. Solve and simulate the problems of microeconomic agents and aggregating the results. Credits: 2.00 or 3.00

ECON 64300 - Search Theory And Applications In Macroeconomics

Credit Hours: 2.00. This course will employ both self-prepared notes on foundational and current topics in the research area as well as recommended/required texts. Often, students will be required to read, understand and summarize a number of

published research papers in this area of study. Methods of assessment will include frequent problem sets that require analysis of data / theoretical analysis of key topics and a capstone course project. Students will develop mastery of frequently used-models and techniques in the literature, including the classic Diamond-Mortensen-Pissarides model of the labor market and Kiyotaki-Wright/Lagos-Wright model of monetary economies. Prerequisite: ECON 61100.

Learning Outcomes: 1. Identify, formulate, and solve general equilibrium search models. 2. Use search models to interpret empirical regularities and assess policy. 3. Discuss and evaluate papers in the literature. 4. Identify topics for future research that can be studied with the tools of search theory. Credits: 2.00

ECON 64500 - International Macroeconomics

Credit Hours: 2.00. One of the challenging and interesting areas of economic research seeks to integrate three intimately related dimensions of economic activity and the choices underlying them: who, when, what, and where? In a nutshell, the main objective of this course is to develop a better understanding of what I will call DS2GE models - Dynamic Stochastic Spatial General Equilibrium models. The strategy will be to take different paths through the research literature while maintaining focus on the who, what, when and where in each reading.

Learning Outcomes: 1. Have a deep understanding of the key theoretical models in use in the field. 2. Understand how the model is both shaped by empirical observation and estimated or tested using real-world data. 3. Solve some small-scale models or sub-parts of models. 4. Use computer algorithms to formulate, calibrate, estimate and simulate a small-scale Dynamics Stochastic General Equilibrium model of an open economy. 5. Read, understand and assess (i.e., write a professional referee report) peer-reviewed publications in the field of international macroeconomics and trade. 6. Present a research paper clearly and with insight. 7. Develop a preliminary research paper proposal as might fit into a dissertation proposal. Credits: 2.00

ECON 64700 - Urban Economics I

Credit Hours: 2.00. This course explores topics related to current research at the intersection of labor and urban economics. There is significant overlap with industrial organization and trade in topics and methods.

Learning Outcomes: 1. Understand the unique economics of cities and regions. 2. Improve technical knowledge of relevant empirical and structural approaches and their appropriate applications. 3. Evaluate existing research critically. 4. Gain maturity in communicating your own research ideas. Credits: 2.00

ECON 64800 - Urban Economics II

Credit Hours: 2.00. This course is the second part in the sequence Urban Economics. It is aimed at second and third-year PhD students in Economics. This course visits selected topics related to internal migration, regional development and government policies, roles of transportation infrastructure, and urbanization in developing countries. This course aims at familiarizing students with the field's important questions, workhorse models, and key empirical methods. As part of the course, students will start developing their independent research.

Learning Outcomes: 1. Be familiar with recent literature in topics related to urban and regional economics, including regional development policies, residential sorting and its consequences, infrastructure, and the housing market. 2. Use workhorse models and empirical methods in their own original research. 3. Work with spatial data using Python or R. 4. Formulate a research idea, collect data, conduct initial investigation, and present preliminary findings. Credits: 2.00

ECON 64900 - Advanced Topics In Panel Data & Spatial Econometrics

Credit Hours: 2.00. This course covers selected topics in panel data and spatial econometrics with an emphasis on developing a clear understanding of the methodological issues involved as well as identifying a set of substantive issues where such methods can be applied. Familiarity with a matrix-oriented programming language is essential. Considerable emphasis will

be placed on the replication of simulation and empirical results from published papers. Prerequisite: ECON 67200.

Learning Outcomes: 1. Understand concepts for characterizing panel and spatial data. 2. Estimate panel and spatial models and conduct inferences. 3. Apply to real economic panel and spatial data. Credits: 2.00

ECON 65000 - Applied Microeconometrics

Credit Hours: 1.00 to 3.00. Topics in labor economics. While the specific subject matter varies from year to year, recent seminars have examined such topics as dynamic labor demand and supply analysis, human capital theory, screening and signaling theories, contract theory, efficiency wages, job matching, search, unions, and internal labor markets. Material is selected from current journal articles.

Learning Outcomes: 1. Understand the background and motivation for various microeconometric model. 2. Recognize the assumptions or conditions that provide identification of the treatment effect in each model. 3. Use Stata to estimate policy-relevant treatment effect using non-experimental data. 4. Demonstrate how to read and understand economic journal articles that use the methods introduced in this course. 5. Perform PhD-level empirical research using microeconometric methods. Credits: 1.00 to 3.00

ECON 65300 - Topics In Early Childhood Development

Credit Hours: 2.00 or 3.00. This course is the second in the Ph.D. Labor Economics sequence. We will focus on the economics of skill formation and its consequences on later outcomes like schooling choices, health, social behaviors and labor market variables. We will do this, by analyzing both static and dynamic settings, in which we recognize that skill formation is a process where early inputs affect the productivity of later ones. This course will be econometrically intense, covering from reduced form techniques to structural ones. We will pay special attention to econometric identification of effects and the analysis of skills as unobserved heterogeneity, its consequences on empirical estimation and models to address it. This course will emphasize the connection between theory and practice.

Learning Outcomes: 1. Understand the role played by the endogeneity caused by the unobserved heterogeneity in econometric estimation. 2. Understand and use advanced methodologies that allow the correct estimation of econometric models in non-standard settings, like in the presence of self-selection and unobserved heterogeneity. 3. Understand the economic theory and evidence that allow us to claim that early childhood development is one of the most important investment a person can do. 4. Know the relevant literature regarding early childhood development, skill formation and econometric estimation techniques employed in these subareas of labor economics. 5. Understand why and how skills evolve over time. Credits: 2.00 or 3.00

ECON 65400 - Topics In Empirical Labor & Public Economics

Credit Hours: 2.00. Provide an introduction to the baseline models of labor supply, including static and dynamic model of labot supply. Introduce students to several seminal and new papers on labor supply. Provide students with the conceptual understanding and computational tools (Stata and Matlab) required to adapt and apply the models presented in the course to address new research questions in labor and public economics. Provide students with an basic understanding of the Current Population Survey (CPS). Motivate and illustrate simulation-assisted estimation as a method for estimating structural models of labor supply.

Learning Outcomes: 1. Understand baseline models of labor supply, including static and dynamic model of labor supply. 2. Understand concepts and use of computational tools (Stata and Matlab). 3. Basic understanding of the Current Population Survey (CPS). 4. Illustrate simulation-assisted estimation as a method for estimating structural models of labor supply. Credits: 2.00

ECON 65500 - Public Economics

Credit Hours: 2.00 to 3.00. Knowledge of various types of government programs, public policies and program administration. Prerequisite: ECON 65000.

Learning Outcomes: 1. Gain a working knowledge of various types of government programs. 2. Understand the application of

reduced form methods for studying public policy. 3. Assemble a portfolio of potential study topics related to public economics. 4. Gain experience in presenting and discussing research. Credits: 2.00 to 3.00

ECON 65600 - Labor Economics II

Credit Hours: 2.00. This course is the third in the PhD Labor Economics sequence. This course is designed to be primarily a "topics" course. Class will focus on some of the most popular open questions in labor economics, however, we will take a long view to these questions in order to understand the progress that has been made over the last half-century.

Learning Outcomes: 1. Cover many of the theoretical underpinnings across topics in labor economics. 2. Understand these tools for quality dissertation writing in labor economics. Credits: 2.00

ECON 65700 - Search Theory & Applications

Credit Hours: 2.00. This course provides an overview to the tools and applications of search theory, which has been a very active area of research. The aim of this course is to provide students with a solid understanding of the search approach and to get started on engaging in research. The first part of the class will cover topics in labor economics, while the second part turns to applications in monetary economics. It is also worth noting that search models have also been successfully applied in other contexts (e.g., housing, marriage and household formation, over-the-counter markets, international trade, industrial organization, just to name a few). Graduate students with broad interests in applied theory, labor economics, macroeconomics, and trade are encouraged to take this class.

Learning Outcomes: 1. Formulate and solve general equilibrium search models. 2. Use search models to interpret empirical regularities and assess policy. 3. Discuss and evaluate papers critically in the literature. 4. Identify topics for future research that can be studied with the tools of search theory. Credits: 2.00

ECON 65800 - Public Economics II

Credit Hours: 2.00. This course explores the operations of government in society and the economy. Using real-world policy examples, motivations for intervention and policy alternatives are explored. A strong emphasis is placed on causal inference and seminal papers in the field of public economics.

Learning Outcomes: 1. Identify and describe the most common types of government programs. 2. Evaluate empirical methods used in public economics literature. 3. Suggest research projects related to public policy. 4. Provide valuable feedback to peers (identify and articulate) on research ideas. 5. Present research in a clear and concise way to an audience. Credits: 2.00

ECON 66200 - Game Theory

Credit Hours: 2.00 or 3.00. In this course, we will examine some of the basic elements of Game Theory. Game Theory studies strategic environments in which each individual's payoff depends upon both their own actions as well as the actions of others. Game Theory attempts to develop an understanding of such situations and to provide a formal framework and solution concepts for making better strategic choices.

Learning Outcomes: 1. Apply game-theoretic reasoning to real-world problems in a range of environments, including: (i) static (normal-form) games with complete or incomplete information, (ii) dynamic (extensive-form) games with complete or incomplete information, and (iii) repeated games. Credits: 2.00 or 3.00

ECON 66800 - Topics In Applied Economics

Credit Hours: 3.00. Applied micro workshop. Topics on applied macroeconomics are presented by departmental and external speakers.

Credits: 3.00

ECON 67000 - Probability And Statistics

Credit Hours: 2.00 or 3.00. An introduction to probability theory and the basic statistical estimation methods. Topics include: axiomatic development of probability theory, counting methods, conditional probability and Bayes' theorem, random variables and distributions, expectation, variance, covariance and correlation, special distributions, statistical inference, maximum likelihood estimators, unbiased estimation, and testing hypotheses. Prerequisite: ECON 61500.

Learning Outcomes: 1. Identify important statistical issues of interest in practical scenarios. 2. Demonstrate the application of

state of the art statistical methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. Credits: 2.00 or 3.00

ECON 67100 - Econometrics I

Credit Hours: 1.00 to 3.00. An introduction to the modern techniques of econometrics and their applications. Topics include: the classical linear regression model (specification, estimation, inference, and prediction), specification analysis, functional form, heteroscedasticity, and autocorrelation. Prerequisite: ECON 67000.

Learning Outcomes: 1. Investigate the properties of econometric estimators under a variety of conditions. 2. Explain econometric techniques for estimating causal effects. 3. Explain the principles and purpose of Monte Carlo simulation methods. 4. Conduct basic empirical analyses of cross sectional data. Credits: 1.00 to 3.00

ECON 67200 - Econometrics II

Credit Hours: 1.00 to 3.00. Topics include generalized method of moments, estimation and inference with weak instruments, panel data models and bootstrap methods. Prerequisite: ECON 67100.

Learning Outcomes: 1. Identify important econometric issues of interest in practical scenarios. 2. Demonstrate the application of state of the art methods to relevant economic questions. 3. Outline a broad picture of the subject by logically connecting the various topics. 4. Criticize the use of inadequate methods through discussion of published work. Credits: 1.00 to 3.00

ECON 67300 - Time Series Econometrics

Credit Hours: 1.00 to 3.00. This advanced course gives an up-to-date and comprehensive treatment of modern time series analysis and empirical macroeconomics. Topics include: ARIMA processes, spectral analysis, forecasting, covariance-stationary vector processes, vector autoregressions, state space representations in the Kalman filter, non-stationary time series and fractional integrated processes, and time series models of heteroscedasticity. Prerequisite: ECON 67200 .

Credits: 1.00 to 3.00

ECON 67400 - Microeconometrics

Credit Hours: 1.00 to 3.00. This advanced course covers the econometrics and statistical methods needed to study data on individual agents in general qualitative response models and models of limited dependent variables. Special emphasis is placed on applying the alternate estimation and inference techniques to actual or simulated datasets. Topics include: univariate binary models, multinomial and multivariate qualitative response models, choice based sampling, distribution-free estimation methods, and Tobit models. Prerequisite: ECON 67200 .

Credits: 1.00 to 3.00

ECON 67800 - Search Theory And Applications

Credit Hours: 2.00 or 3.00. This course provides an overview to the tools and applications of search theory, which has been a very active area of research. The aim of this course is to provide students with a solid understanding of the search approach and to get started on engaging in research.

Learning Outcomes: 1. Formulate and solve general equilibrium search models. 2. Use search models to interpret empirical regularities and assess policy. 3. Critically discuss and evaluate papers in the literature. 4. Identify topics for future research that can be studied with the tools of search theory. Credits: 2.00 or 3.00

ECON 68500 - Experimental Economics I

Credit Hours: 1.00 to 3.00. An overview of seminal and recent developments in experimental economic research. Provides practical training in designing and conducting experiments and the analysis of experimental data. Content varies from year to year. Applications include: industrial organization, game theory, finance, international trade, information economics, and monetary economics. Course readings are primarily from journal articles. Prerequisite: ECON 60700 . ECON 61000 .

Credits: 1.00 to 3.00

ECON 68600 - Experimental Economics II

Credit Hours: 2.00 or 3.00. Covers topics different from ECON 685, and they vary from year to year. May be taken prior to ECON 685. Course readings are primarily from journal articles. Prerequisite: ECON 60700. 61000.

Learning Outcomes: 1. Identify research

questions that are suitable for answering using economics experiments. 2. Develop you own experimental designs to address specific research questions and hypotheses. 3. Criticize and evaluate experimental research published in leading economics journals. Credits: 2.00 or 3.00

ECON 68900 - Experimental And Behavioral Economics

Credit Hours: 2.00. The course will cover: (i) experimental methodology; (ii) statistical considerations in experiments; (iii) behavioral game theory (including psychological games and boundedly rational thinking in games); (iv) loss aversion and reference points (including prospect theory, expectations-based reference points, and goal setting); and (v) experiments on gender. We will also discuss how to develop good research ideas in experimental economics, and how to write papers in a way that appeals to top journals in the field.

Learning Outcomes: 1. Develop the skills to design experiments that test cleanly predictions from economic theory. 2. Understand what statistical techniques are appropriate for different types of experimental designs. 3. Become familiar with cutting-edge research in the field of experimental and behavioral economics. 4. Gain experience in how to present research effectively. 5. Learn how to write research papers that will appeal to the top journals in the field. Credits: 2.00

ECON 69000 - Advanced Problems In Economics

Credit Hours: 1.00 to 4.00. Advanced individual reading and investigation in a specific economic field at the graduate level. Open to individual students with superior records. Permission of instructor required.

Credits: 1.00 to 4.00

ECON 69100 - Advanced Topics In Panel Data

Credit Hours: 2.00 or 3.00. This course covers selected topics in the econometrics of panel data with an emphasis on developing a clear understanding of the methodological issues involved as well as identifying a set of substantive empirical issues where such methods can be applied. Prerequisite: ECON 67100 and ECON 67200.

Learning Outcomes: 1. Organize data into an easy to interrupt manner. 2. Understand the role of factor models as a tool for dimension reduction in the analysis of large-dimensional data as well as a device for modeling cross-sectional correlation in panel data analysis when the cross-sectional and time series dimensions are comparable in magnitude. Credits: 2.00 or 3.00

ECON 69200 - Advanced Topics In Time Series

Credit Hours: 2.00 or 3.00. This course covers a set of selected topics of current interest in eco-nomic forecasting. It is designed for students interested in conducting theoretical research related to the development and evaluation of new forecasting techniques as well as those inclined towards the application of state-of-the-art techniques to economic data.

Learning Outcomes: 1. Organize data into an easy to interpret manner. 2. Understand the role of factor models as a tool for dimension reduction in the analysis of large-dimensional data as well as a device for modeling cross-sectional correlation in panel data analysis when the cross-sectional and time series dimensions are comparable in magnitude. Credits: 2.00 or 3.00

ECON 69300 - Bayesian Econometrics I

Credit Hours: 2.00 or 3.00. This is a first course in Bayesian Econometrics. The overarching goal of the course is to expose students to the Bayesian perspective and get them up-to-speed with modern Bayesian simulation methods.

Learning Outcomes: 1. Explain the Bayesian approach to estimation and inference. 2. Develop posterior simulators to estimate commonly-used models. Credits: 2.00 or 3.00

ECON 69400 - Bayesian Econometrics II

Credit Hours: 2.00 or 3.00. This is a second course in Bayesian Econometrics. After completion student should be able to conduct research in Bayesian econometrics using state-of-the-art models and techniques. Pre-requisite: ECON 69300.

Learning Outcomes: 1. Use state-of-the-art Bayesian models and methods in research.

Credits: 2.00 or 3.00

ECON 69700 - Research Methods In Economics

Credit Hours: 2.00 or 3.00. The first steps in doing a thesis research paper, proposal/idea, growing the proposal/idea. Developing a set of critical professional skills. Pre-requisite: ECON 60700 and ECON 60800.

Learning Outcomes: 1. Write a serious term paper, and present it in class in the proposal and final stages. Credits: 2.00 or 3.00

ECON 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Management (Graduate)

Website: **http://krannert.purdue.edu/**

Department/School Head

Lin Nan

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Thomas H. Brush Michael A. Campion Suresh Chand Alok Chaturvedi Dillip Chhajed Brian Dineen James Dworkin Mara Faccio Annabelle Feng Clifford Fisher Huseyin Gulen Troy Janes Ellen Kossek Yanjun Li Susan Lu Matthew Lynall Richard Makadok John J. McConnell Lin Nan F. David	Bradley J. Alge Adem Atmaz Kelly Blanchard Alex Boquist Sergiy Chernenko Jason Clark Roy Dejoie Benjamin Dunford Gokce Esenduran Kevin Koharki Michael Kregar Qiang Liu Yan Liu Mengshi Lu Thanh Nguyen Umit Ozmel Yayuz Zhan Pang Mohammad Rahman	Chad Allred Franco Berbergli Johnathan Black Craig Brown John Burr Heejung Byun Shuaiyu Che Wan-Ting Chiu Diana Choi Brian Chupp Fabricio d'Almeida Sumon Datta Weijia Dai Amy David Hossein Ghasemkhani Ralph Anthony Gibbs Thomas Godwin Theodor	Mengshi Lu Rahul Menon Gary Mercado Velasco Ha Diep Nguyen Jordan Nielsen Douglas Pruim Cara Putman Pengyu Qian Lin Qiu James Chet Reeder Luis Adrian Rios Kasie M. Roberson Federico Rossi Amir Sariri Hojun Seo Will Wei Sun Phillip Thompson Shai Vardi Yang	Mark Bagnoli John Carlson Steve Green Rao Kadiyala Wilbur G. Lewellen James Moore Mark Moriarty Herbert Moskowitz Dan Schendel Leroy Schwarz Charlene Sullivan Kwei Tang Charles Tritschler Susan Watts

Schoorman J. George Shanthikumar Jen Tang Mohit Tawarmalani	William T. Robinson Pengyi Shi Yang Wang Kelly Wilson Deniz Yavuz Ting Zhu	e Goodman Peter Giles Hansen William Haskell Guofang Huang Wooyoung Jo Wreetabrata Kar Youngmin Kim Michael Kregar Matthew Lanham Rick Laux Jinsuh Lee Yixuan Li Tongseak Lim Ping Liu Yan Liu	Wang Zaiyan Wei Henry Williams Meridith Woehter Yuan Yuan Yichen Zhang Jinyang Zheng Kate Zipay Zhiwei Zhu ZZ Zhu	

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Academic Programs

One-Year MBA

The Purdue One-Year MBA is a STEM focused program which is designed to help talented individuals with technical backgrounds transition into management and leadership roles in technology centered organizations. The curriculum provides the critical knowledge in all areas of business operations, including accounting, marketing, financial management, operations management, communication, leadership training, and strategic management. The augment classroom experience with experiential learning opportunities catered to Science, Technology, Engineering, and Math (STEM) professionals. The program requires all students to participate in active learning project in which they apply the lessons learned in the class to an emerging or existing enterprise. Students may work with entrepreneurs and technologists.

Online Master of Business Administration: Students pursuing their Online Master of Business Administration will develop an analytical, strategic and problem-solving expertise needed to lead teams and organizations. Students will experience an AACSB-accredited, quant-based curriculum that empowers them to ask the right questions while turning data into knowledge. They will learn how dynamic global environments are transforming modern business and gain the management skills to tackle new challenges, drive change, and inspire others. Through their participation in elective courses, students can also customize their degree by choosing from a wide range of courses that best align with their career plans and add a specialization in one of four high-demand areas.

Master of Science in Human Resource Management-MSHRM

The MSHRM program ties human resource skills to strategic decision making. The program combines human resources, management and organizational behavior studies with experiential learning opportunities. MSHRM goes beyond the classroom, empowering business-savvy leaders for global organizations. Krannert's cohort model develops a sense of community within the program that helps students thrive and build lifelong professional relationships. Students perform a summer internship to prepare them for careers in the public or private sector. The MSHRM program curriculum is aligned with the Society for Human Resource Management guidelines.

Online Master of Science in Human Resources Management: Purdue University's Online Masters in Human Resource Management (MSHRM) program is targeted towards working professionals seeking to advance their careers by developing HR knowledge, skills and abilities. The program is designed by

the same faculty members from our top-ranked in-residence MS Human Resource Management program and students can complete the degree from anywhere, at any time, on their time with high flexibility in the pacing and sequencing of the proposed courses. The program ensures that students develop skills to work in cross-disciplinary teams and across functional boundaries. Students will be prepared to pursue a variety of career paths including HR, Organizational Effectiveness, Organizational Design, and Change Management upon completion of the program.

Master of Science in Accounting-MS(A)

This 10-month MS(A) program prepares you to take the CPA exam while enhancing your technical skills, improving your written and oral communication skills, and developing your critical thinking and leadership skills. Whether you plan to pursue a career in assurance, tax, consulting or industry, the flexibility of the MS(A) program allows you to get the graduate-level educational experience you need to be successful. Pair this with the ability to pursue CMA certification throughout your studies and readiness to take the CPA exam, and you will appreciate the significant value in the 10-month program.

Master of Science in Finance-MS(F)

The MS Finance program draws on real-world applications and access to the top minds in finance, complementing studies in the classroom to create a holistic learning experience. These intensive studies will further develop your abilities in critical thinking, analysis, and problem-solving. Small Class sizes offer students unparalleled access to faculty before they even arrive on campus.

Master of Science in Global Supply Chain Management-MS(GSCM)

The Global Supply Chain Management program builds on Krannert's core strengths in operations, supply chain management, and business analytics to provide students with skills that will well position them for a career in managing global supply chains. In addition to courses that will develop contextual knowledge and problem-solving skills, the program provides a unique global project experience. The program includes students from Krannert's global university partners, enabling a sharing of internship and work experiences.

Online Master of Science in Global Supply Chain Management: Purdue University's Online Master of Science in Global Supply Chain Management (MSGSCM) program is targeted towards working professionals seeking to advance their careers by developing supply chain management knowledge, skills and abilities. The program is designed by the same faculty members from our top-ranked in-residence MS Global Supply Chain Management program and students can complete the degree from anywhere, at any time, on their time with high flexibility in the pacing and sequencing of the proposed courses. The program ensures that students develop skills to work in cross disciplinary teams and across functional boundaries.

Master of Science in Marketing

The MS (Marketing) program provides students with the breadth and depth of knowledge and skills needed for a career in one of the business world's fastest-growing fields. To the extent marketing is both an art and a science, the program is a good career investment for students with a variety of backgrounds and experiences looking to develop technical expertise. It provides students with experience in using theoretical concepts to solve marketing problems through consulting projects, case studies, and marketing simulations. The MS Marketing program is a good fit for students with liberal arts backgrounds who seek to develop technical expertise in a data-driven field as well as those from strong technical backgrounds who have career interests in marketing.

Online Master of Science in Business Analytics: Krannert's MS Business Analytics Online program is ideal for working professionals seeking to capitalize on the exploding demands for technical and analytical expertise. The program is designed to enhance analytics capabilities and application prowess with training in the most relevant technologies and techniques, while being delivered in a flexible online format. Industry practicum courses give students the opportunities to leverage big data tools to generate insights and corporate solutions. The program focuses on training students with the required combination of business and analytics skills to positioning graduates to become data-savvy managers. Purdue University's strong STEM reputation and global network in the analytics field further enhance the marketability of graduates in the job market.

Master of Science in Business Analytics and Information Management-MS(BAIM)

The MS in Business Analytics and Information Management will educate students in state-of-the-art information technologies and analytical techniques. The program is designed to enable informed decision-making using data. The curriculum is rigorous and is geared to develop proficiency in the use of software tools and methodologies within a business. Students will have opportunities to:

1) apply their learning to real-world problems 2) gain competency in current best practices of data handling and analysis 3) develop an awareness of various business contexts that benefit from data-driven decisions 4) advance their ability to communicate findings to a variety of audiences.

Students also receive a broad-based understanding of various functional areas of business with access to a wide range of electives.

Master of Science in Business Analytics and Information Management-MS(BAIM)

The online MS in Business Analytics is designed to enhance analytics capabilities and application prowess with training in the most relevant technologies and techniques while being delivered in a flexible online format. The program will provide students with skills to work in cross-disciplinary teams and across functional boundaries. Core courses include Data Mining, Visualization and Persuasion, Business Analytics and IT for Innovation; along with elective courses that include Marketing Analysis, Machine Learning, and Big Data along with immersion electives in specific areas, such as disruptive technologies in artificial intelligence, . This program offers unique treatment of data analytics, gamification, and optimization modeling and significant depth in SAS modeling and usage.

Master of Science in Economics

The MS in Economics program offers career-compatible flexibility for busy professionals with a design for individuals who have an interest in learning the tools to analyze and interpret economic data as well as the ability to apply those results to decision making in business and public policy environments. Students have the option to specialize in four unique areas that offer students the opportunity to expand their applied or theoretical understanding of economics. With expanding access to extensive datasets, both public and proprietary, top faculty teaches cutting-edge quantitative and empirical instructional methods.

Online Master of Science in Economics: The MS in Economics program offers career-compatible flexibility for busy professionals with a design for individuals who have an interest in learning the tools to analyze and interpret economic data, as well as the ability to apply those results to decision making in business and public policy environments. Students have the option to specialize in four unique areas that offer the opportunity to expand applied or theoretical understanding of economics. With expanding access to extensive datasets, both public and proprietary, top faculty teach cutting-edge quantitative and empirical instructional methods.

Weekend MBA

The Weekend MBA program offers career-friendly flexibility and a nationally ranked, globally prestigious Purdue MBA. Targeted to professionals wanting to combine a management degree with their academic and professional skills, the Weekend MBA offers general management education to students from diverse academic and professional backgrounds. Built around your schedule and career goals, the cohort-based program covers the fundamentals of business and management in all the disciplines needed to succeed in current and future positions.

Ph.D.

The Management Department offers doctoral programs that prepare Ph.D. graduates for careers in research, teaching, business, and government. The graduate programs in management have strong quantitative and analytical orientations. The most important requirement is the completion of a doctoral thesis under faculty supervision. Advanced coursework and seminars provide Ph.D. students with rigorous methodological foundation and knowledge of their field necessary to conduct original research.

Master's and Ph.D. Programs
One-Year MBA
MBA-Online
Weekend MBA
MS Accounting Concentration
MS Business Administration STEM
MS Business Analytics and Information Management
MS Business Analytics -Online
MS Economics
MS Finance
MS Global Supply Chain Management
MS Global Supply Chain Management - Online
MS Human Resource Management
MS Human Resource Management - Online
MS Marketing
Executive MBA
Ph.D.
Specializations (Areas of Study):
Accounting
Finance
Marketing
Management Information Systems
Operations
Strategic Management
Human Resource Management
Organizational Behavior
Business Analytics
Management Consulting
Global Supply Chain Management

Combined Degree Programs: (Undergraduate Degree / Master's Degree)
B.S. in Comm/MSHRM
B.S. Management/MSHRM
B.S. Human Resourses Department/MSHRM
B.S. Psychological Sciences/MSHRM

Dual Degree Programs: (Master Degree/MBA)
School of Aeronautics and Astronautics
Weldon School of Biomedical Engineering
Davidson School of Chemical Engineering
Lyles School of Civil Engineering
Division of Environmental and Ecological Engineering
School of Industrial Engineering
School of Nuclear Engineering
Interdisciplinary Engineering Master's Degree Program

School of Mechanical Engineering
Master of Engineering Management

Ph.D.
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Graduate Certificates

- Business Analytics, Post Baccalaureate Certificate

As a top-ranked business school operating within a university at the forefront of STEM education, we offer an analytical, problem-solving brand of business education along with a pragmatic approach to academics. Businesses are collecting more data than ever before and using that information to make better-informed decisions is of paramount importance in today's global business environment. Our Business Analytics Graduate Certificate program educates students in the use of analytical tools and techniques to analyze data in a business context.
The curriculum requires that students choose a programming track, either Python or R. Students will apply unique techniques of data collection, manipulation, optimization, analysis, and visualization to solve real world business problems. The Business Analytics Graduate Certificate program requires the completion of the outlined curriculum of 11 credit hours to receive the Business Analytics Graduate Certificate.

- Business & Economic Data Analytics Graduate Certificate

The Business and Economics Data Analytics certificate provides students with the opportunity to learn how to find solutions to economic issues using analytical approaches. With a wide selection of cutting-edge economics and analytics courses including Advanced Python Programming, Applied Game Theory, and Data Mining, taught by the School of Business' leading faculty members, students will be able to further equip themselves with the quantitative skills necessary to enhance their career outcomes.The Business Economics and Data Analytics certificate program requires the completion of the outlined curriculum of 10 credit hours to receive the Business Economics and Data Analytics Graduate Certificate.

- Business Essentials, Post Baccalaureate Certificate

The Business Essentials Graduate Certificate program is a mini-MBA online experience launching this summer, offering students the opportunity to further develop their understanding of management and breadth of business knowledge. Students will be able to take classes focusing on a variety of business functions including Accounting, Strategic Management, Financial Management, and others. The Business Essentials certificate program requires the completion of the outlined curriculum of 9 credit hours to receive the Business Essentials Graduate Certificate.

- Fundamentals of Human Resourses, Post Baccalaureate Certificate

The Fundamentals of Human Resources Graduate Certificate provides students with an introduction to the skills central to human resources management and focuses on developing and empowering business-savvy human resource leaders for global organizations. The coursework combines human resources, organizational behavior, and management courses to enhance your strategic decision-making skills. Upon successful completion of the certification, students will be able to comprehend basic decision-making processes and issues in various functional areas of OBHR and develop and utilize methods to identify salient information and trends in the OBHR field.

- Global Supply Chain Management, Post Baccalaureate Certificate

The Global Supply Chain Management Graduate Certificate builds upon Purdue's core strength in operations, supply chain management, and business analytics to provide skills that will well position you for a career in managing supply chains. Courses cover the importance of supply chain management decisions and issues in developing a business strategy and the interpretation of how these functionalities work together. Students develop a foundational knowledge in supply chain management, logistics management, operations management and international trade and logistics.
The Global Supply Chain Management certificate program requires the completion of the outlined curriculum of 12 credit hours to receive the Global Supply Chain Management Graduate Certificate. The Fundamentals of Human Resource certificate program requires the completion of the outlined curriculum of 10 credit hours to receive the Fundamentals of Human Resource Graduate Certificate.

- Innovation and Technology Commercialization, Post Baccalaureate Certificate

The demand for innovation and technology expertise is rapidly increasing. The curriculum for this certification is focused on introducing students to the required combination of technology-based commercialization skills. Students enrolled in the Innovation & Technology Commercialization Graduate Certificate program can obtain a deeper understanding of the ideation to commercialization process. With courses covering technology strategy, collaborative innovation, and financing, you'll have a richer understanding of what it takes to bring the next big idea to market.

The Innovation & Technology Commercialization certificate program requires the completion of the outlined curriculum of 9 credit hours to receive the Innovation & Technology Commercialization Graduate Certificate.

- Leadership, Change Management and Negotiations, Post Baccalaureate Certificate

The Leadership, Change Management & Negotiations (LCM&N) Graduate Certificate is designed to reinforce students' ability to become a leader in the dynamic human resources landscape. Students pursuing this certificate program will gain essential human resources knowledge and skills by taking a variety of HR-focused courses taught by esteemed faculty from the Krannert School of Management.

The Leadership, Change Management & Negotiations certificate program requires the completion of the outlined curriculum of 9 credit hours to receive the Leadership, Change Management & Negotiations Graduate Certificate.

- Marketing Analytics, Post Baccalaureate Certificate
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Public Economics & Policy Graduate Certificate

The Public Economics & Policy Graduate Certificate targets working professionals seeking to work in public policy entities, governmental agencies or those looking to expand their knowledge of policy-relevant economic research. Students analyze policy challenges facing governments around the world to learn and to find solutions to these challenges while taking into consideration obstacles to implementation. Course work applies economic perspectives on activities of governmental policies and the benefits and challenges to today's global society.

The Public Economics and Policy certificate program is designed to provide a deeper understanding of laws and principles behind the economy in different industries. The curriculum includes Personnel Economics, Industrial Economics, Health Economics, as well as quantitative courses such as Statistics for Economists and Math for Economists.

The Public Economics & Policy certificate program requires the completion of the outlined curriculum of 10 credit hours to receive the Public Economics & Policy Graduate Certificate.

Management, MBA

Management: Business Analytics and Information Management Concentration, MS

Global Supply Chain Management, MS

Finance, MS

Business Administration, MBA

Business Analytics, Post-Baccalaureate Certificate

Global Supply Chain Management, Post-Baccalaureate Certificate

Innovation and Technology Commercialization, Post-Baccalaureate Certificate

Leadership, Change Management, and Negotiations, Post-Baccalaureate Certificate

Business Essentials, Post-Baccalaureate Certificate

Fundamentals of Human Resources, Post-Baccalaureate Certificate

Human Resource Management, MS

Marketing Analytics, Post-Baccalaureate Certificate

Digital Marketing and Analytics, Post-Baccalaureate Certificate

Marketing, MS

Business and Technology, MBT

Management: Accounting Concentration, MS

Human Resource Management, MS (OL)

Business Analytics, MS

Business and Technology, MBT (OL)

Global Supply Chain Management, MS (OL)

Management: Finance Concentration, MS

Management: Global Entrepreneurship Concentration, MS

Management: Global Supply Chain Management Concentration, MS

Management: Human Resource Management Concentration, MS

Management: Marketing Concentration, MS

Management-Executive, MBA

Management, PHD

MGMT 50300 - Advanced Accounting

Credit Hours: 3.00. Advanced course in financial accounting. A range of contemporary issues in financial reporting, such as business combinations, investments, consolidations, inflation, multinationals, and tax allocation are covered. Both technical proficiency and user applications are emphasized.

Learning Outcomes: 1. Develop a conceptual understanding of and appreciation for the significant accounting and reporting requirements pertaining to consolidated or affiliated enterprises, foreign currency transactions and translation and other topics listed in the schedule below. 2. Provide you with the technical skills and knowledge to produce financial information that can be used by

management, shareholders and stakeholders. 3. Improve your ability to interpret and use such financial reports. 4. Enhance the students' communication skills. 5. Contribute to the requisite background required for professional examinations such as CPA or CMA. However, it is not the primary goal to memorize 2019 standards or regulations, but rather to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 50400 - Tax Accounting

Credit Hours: 3.00. Basic tax course designed to provide an understanding of the various federal taxes, including income, gift, estate, excise, federal insurance contribution, self-employment, and unemployment taxes.

Learning Outcomes: 1. Calculate the income tax liability for individuals, understand basic tax planning strategies, and prepare individual tax returns. 2. Understand broadly how different business entities are taxed including formation, operations, distributions, and liquidations. 3. Calculate the income tax liability for C Corporations, understand basic tax planning strategies, and prepare basic C Corporation tax returns. 4. Report the results from operations for partnerships and S Corporations. 5. Understand broadly the tax treatment of property transactions encountered by individuals and business entities. Credits: 3.00

MGMT 50500 - Management Accounting II

Credit Hours: 3.00. The focus of the course is managerial decision making and the economic role of information. Topics covered include decentralized financial performance evaluation, cost analysis, and financial planning and control systems.

Learning Outcomes: 1. Students will learn the concepts and procedures of auditing, with an emphasis on independent certified public accountants as well as internal auditing. Credits: 3.00

MGMT 50600 - Auditing

Credit Hours: 3.00. A study of the concepts and procedures of auditing, which is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events. Primary emphasis is on audits conducted by independent certified public accountants, but topics covered apply to internal auditing as well.

Learning Outcomes: 1. Develop an understanding of auditing concepts and procedures. 2. Demonstrate knowledge of ethical standards of the profession. 3. Understand the nature of an internal control system, its role in a business and its significance in the auditing process. Credits: 3.00

MGMT 50900 - International Accounting

Credit Hours: 3.00. Provides insight into and an understanding of the many accounting problems and issues faced in an international business environment. The material is approached from two compatible and overlapping perspectives: the perspective of accounting or financial management in a U.S. multinational corporation and the perspective of an investor interested in understanding the international business environment.

Learning Outcomes: 1. Learn about the development of international accounting movements and implications in a globalized financial market. 2. Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS) 3. Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event. 4. Learn to cope with differences in financial measurement, recognition and reporting practices when performing international financial statement analyses. 5. Enhance the students' communication and presentation skills. 6. Contribute to the requisite background required for professional examinations such as CPA and

to become prepared for a long-range successful accounting, auditing and/or managerial career. Credits: 3.00

MGMT 51099 - Practicum In Taxation Compliance And Consulting

Credit Hours: 1.00 to 3.00. This is an experiential course to provide real-world experience and significant community service through volunteer tax compliance and consulting. The course partners with the Internal Revenue Service Volunteer Income Tax Assistance Program to provide significant free tax preparation and consulting services to low- and middle-income families in the Greater Lafayette community with an additional focus on providing these services to international students at Purdue. Learning outcomes include technical tax abilities as well as soft skills in a professional services environment.

Learning Outcomes: 1. Develop technical tax preparation skills and apply those skills using tax software. 2. Interact positively with clients through sometimes difficult situations. 3. Explain complex tax issues in an understandable way to clients. 4. Discuss relevant tax and client issues with other students and coordinators. 5. Learn from constructive feedback to improve your tax preparation and client interaction skills. 6. Adapt your role at the site extemporaneously to help mitigate stressful situations. 7. Serve the community through accounting knowledge. Credits: 1.00 to 3.00

MGMT 51100 - Fixed Income Securities

Credit Hours: 2.00. Introduction to fixed income securities. Discusses a variety of contracts-starting with pure discount bonds, coupon bonds, and callable bonds. Continues with options on bonds, caps, floors, and interest rate swaps. Introduces the theory of the term structure and present models for pricing fixed income securities. Topics include: spot and forward markets for debt instruments, simple models for interest rate risk management, duration, convexity, organized exchange-traded interest rate contracts, interest rate swaps, pricing relationships and the theory of the term structure, and single factor models for pricing interest rate claims.

Learning Outcomes: 1. Identify how to value and hedge commonly traded fixed income securities. 2. Demonstrate understanding of underlying economic determinants and behavior of fixed income securities. 3. Outline and structure such securities. Credits: 2.00

MGMT 51300 - Student Managed Investment Fund

Credit Hours: 0.00 to 3.00. This course provides undergraduate and graduate students with hands-on portfolio management experience by investing a $300,000 (as of 2017) portfolio in the stock market. This student-managed fund is a large time commitment, and this course is a way to give students class credit for their experiential learning through SMIF.

Learning Outcomes: 1. Gain knowledge about investing through experiential learning by managing real money. 2. Learn how to analyze stocks and create buy or sell recommendations through team meetings and presentations. 3. Gain teamwork experience and in-depth knowledge by working with industry-specific teams for stock research. Credits: 0.00 to 3.00

MGMT 51400 - Volunteer Income Tax Assistance (VITA): Practicum In Taxation

Credit Hours: 3.00. This is a one-semester experiential course where students prepare individual income tax returns for low- and moderate-income taxpayers in the Greater Lafayette community. In addition to providing a valuable service to the community, students develop their professional skills and client service skills as well as proficiency with a professional tax preparation software product and a deeper understanding of technical tax issues.

Learning Outcomes: 1. Demonstrate and apply technical tax preparation skills using tax software to accurately complete tax returns. 2. Practice and refine positive client interaction skills to handle challenging situations effectively. 3. Explain complex tax issues clearly and accurately in a manner clients can understand. 4. Engage in discussions about relevant tax and client issues with peers and coordinators to enhance collaborative problem-solving. 5. Incorporate constructive feedback to improve technical tax preparation and client interaction skills. 6. Adapt and respond effectively to changing roles and stressful

situations at the site to ensure smooth operations. 7. Contribute to the community by applying accounting knowledge to provide meaningful tax preparation services. Credits: 3.00

MGMT 52020 - Analytics For Marketing Managers

Credit Hours: 2.00 or 3.00. The purpose of this course is to learn tools, technologies, applications and practices used to collect, integrate, analyze, and present raw data in order to create insightful visualization and actionable marketing information. It will cover conceptual understanding of marketing performance based on data and statistical methods. Once conceptual understanding is familiarized, students will learn common tools and techniques for marketing managers in today's industry.

Learning Outcomes: 1. Learn how to collect and analyze basic analytical concepts and tools. 2. Gain experience in understanding the importance of visualizations. 3. Learn to become a marketing manager who can provide marketing insights based on analytics. 4. Be exposed to the challenges of resent online platforms of visualization for user interactivities. Credits: 2.00 or 3.00

MGMT 52100 - Brand Management

Credit Hours: 2.00. This course exposes students to the issues and activities in brand management. Topics include developing the brand marketing plan, design and execution of integrated marketing communications, testing, launching, and repositioning of brands, creating and managing brand equity, formulating strategies for leveraging and defending brands, product line and category management.

Learning Outcomes: 1. Identify the components of a firm's brand equity, based on weekly discussions of "Best Practice" cases assigned in the course. 2. Demonstrate an understanding of how a firm formulates, develops, and executes a firm's branding strategy. 3. Demonstrate an understanding of the key components of a firm's branding strategy. 4. Develop an understanding of how a firm manages the issues of building brand equity, measuring brand equity, and understanding how to grow a firm's brands. Credits: 2.00

MGMT 52200 - New Product Development

Credit Hours: 2.00. The course covers new product development issues including idea generation, concept testing, prototype development, patent protection, and product launch. Student teams generate a new product idea, test the idea with target customers, and develop a product launch strategy.

Learning Outcomes: 1. Understand New Product Development Process. 2. Analyze New Product Development Cases. 3. Develop and Test a New Product Idea. Credits: 2.00

MGMT 52300 - Digital Marketing Strategy

Credit Hours: 2.00. This course enables students to rethink marketing in the evolving digital age and develop capabilities in developing, implementing, and evaluating digital marketing strategies. Topics include: digital marketing strategy framework, search engine marketing, social media marketing, and location based marketing (mobile).

Learning Outcomes: 1. Enable students to rethink marketing in the evolving digital and social media age. 2. Understand how digital and social media marketing strategies fit with companies' overall marketing strategy. 3. Learn to develop, implement, and evaluate digital and social media marketing plan. 4. Understand the major tools of digital and social media marketing: online ads, search engine optimization, paid search ads, organic social media, social media ads, web analytics, and social media analytics, and others. 5. Explore the future development of digital marketing. Credits: 2.00

MGMT 52500 - Marketing Analytics

Credit Hours: 2.00. This course introduces modern statistical methods for marketing using big data. Firms are increasingly facing vast amounts of data on their customers and the marketplace, thanks to the rapid development of information technology in the last couple of decades. The challenge is becoming more about how to turn the big data into information and insights to improve firms' marketing decisions and profitability. This course discusses marketing applications for

which we may use econometric, statistical, and machine-learning methods to improve and optimize decisions. Students will use RStudio to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis. Intro-level Statistics/econometrics (at the level of STAT 35000 or ECON 47200) and R coding experience (comfortable with manipulating data, plotting, defining functions, using for loops, and running linear and logistic regressions in R) are required prerequisites.

Learning Outcomes: 1. Enable students to articulate analytical process and logic for selecting a particular marketing strategy/plan 2. Enable students to do (and also evaluate/critique) good marketing research in their respective careers 3. Marketing knowledge and critical thinking Credits: 2.00

MGMT 52610 - Data And AI-Driven Marketing

Credit Hours: 2.00. Marketing is increasingly evolving from traditional approaches to leveraging big data and artificial intelligence (AI) to make strategic decisions and drive impactful campaigns. This course introduces modern statistical methods and AI algorithms for marketing using big data. It discusses marketing applications for which we may use statistical and machine learning methods to improve and optimize decisions. Students will use Python to analyze real-world data and gain hands-on experience on data manipulation, visualization, and analysis.

Learning Outcomes: 1. Apply appropriate modern statistical and machine learning methods required for marketing using big data. 2. Implement the methods in Python using real-world data. Credits: 2.00

MGMT 52710 - Digital Marketing Applications

Credit Hours: 2.00. Companies today expect their marketing professionals to understand what it takes to develop, implement, and evaluate digital marketing strategies and campaigns. The best way for marketing professionals to gain such expertise is for them to actually build and execute specific digital marketing programs/campaigns using various digital and social media platforms for a real world client. This course offers students a unique hands-on learning opportunity with an online marketing project, each student team is given a budget up to $300 to promote a chosen business or non-profit organization via digital advertising platforms including Google AdWords, Bing Ads, Facebook Business, LinkedIn Sponsored Ads, and Twitter Ads. Students are given flexibility in selecting projects of interest. All students are also expected to pass Google Analytics certification and Google AdWords certification.

Learning Outcomes: 1. Gain practical knowledge in web analytics, display advertising, search engine marketing (search engine optimization and pay per click), content marketing, and social media advertising. 2. Gain experience in designing, implementing, and evaluating a consistent digital marketing and social media marketing strategy through the online marketing campaign. 3. Learn how to communicate with clients, how to present an online marketing strategy, and how to deliver the outcome of an online marketing campaign. 4. Exposed to the challenges of working in teams to achieve marketing campaign goals in real world situations. Credits: 2.00

MGMT 52800 - Customer Analytics

Credit Hours: 2.00. Customer Relationship Management (CRM) refers to the selection or identification, acquisition, growth and retention of desired customers to maximize profit. CRM requires a shift in mindset from product-centric to customer-centric management and a new set of tools for understanding and predicting the behavior of current customers. This course focuses on analytical CRM: identifying good prospects and customer acquisition, customer development via up-selling, cross-selling and personalization, customer attrition, retention, and customer lifetime value. While traditional marketing relied on the three pillars of segmentation, targeting and positioning (STP), technological advances have made it possible to obtain customer-level transaction data, and also to target individual customers with a customized marketing mix that is designed to maximize individual customer value. Important strategic questions arise from such a radical shift in marketing mix options, questions such as: How to allocate resources to customer acquisition and to customer retention? Are loyal customers more profitable for firms? Related to these strategic questions are important conceptual and computational issues, such as: What metrics are best used to measure customer profitability? What techniques can be used to identify most profitable customers? How to target profitable customers with customized price, promotion, product, place? This course will equip you with the skills and tools you need to answer such strategic, conceptual and computational questions related to customer relationship management (CRM). Permission of instructor required.

Learning Outcomes: 1. Build your knowledge of a rapidly emerging marketing arena - customer-

centric marketing. 2. Develop basic analysis skills using a statistical software package. 3. Increase your analytical skills and expose you to several commonly used advanced modeling techniques. Credits: 2.00

MGMT 52850 - Consumer Behavior And Marketing

Credit Hours: 2.00. Consumer behavior is the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires. We will draw on research from psychology, marketing, behavior economics and other fields to learn why consumers behave in the ways that they do. The course focuses on three general topics: 1) Consumers as individuals. We will explore basic psychological concepts like intrinsic motivation, perception, memory, and emotions to help us understand behavior. 2) Attitude change and decision making. We will examine how consumers search and evaluate alternatives, develop attitudes, and make choices. 3) Consumers in their social and cultural settings. We will examine the interaction between the consumer and multiple external influences. We investigate how social elements (friends, family, etc.) and culture influence behavior. Consumer behavior is an applied discipline rooted in other social sciences, and you will therefore learn multiple concepts, frameworks and theories. Your job is to master those concepts and use them to organize, explain, and predict consumers' judgments and choices. Ultimately you should be able to identify a consumer behavior issue, select a relevant theory to examine and explain the issue, and apply the theory properly to aid in a managerial decision. You will also learn how to run basic applied experiments in consumer behavior to test your theories with real consumers.

Learning Outcomes: 1. Master multiple concepts and use them to organize, explain, and predict consumers' judgments and choices. 2. Identify a consumer behavior issue, select a relevant theory to examine and explain the issue, and apply the theory properly to aid in a managerial decision. 3. Run basic applied experiments in consumer behavior to test your theories with real consumers. Credits: 2.00

MGMT 52900 - Marketing Consulting Projects

Credit Hours: 3.00. In this course, students learn to apply marketing concepts to real world marketing problems. Projects are varied and may involve marketing plan development for a start-up, market research, analysis of marketing data, digital marketing, search engine marketing, web design, and social entrepreneurship. Clients include Purdue Marketing Advisory Board members, entrepreneurs working with Purdue's Foundry and Discovery Park, Purdue Research Park start-ups, small and medium-size Indiana businesses, and non-profit organizations. Students are given flexibility in selecting projects of interest. Teams work under the direction of a faculty member. Teams meet once a week to review project progress and discuss the next steps generally in the presence of the faculty supervisor. Projects are done in teams, although evaluation is individual.

Learning Outcomes: 1. Acquire experience in applying concepts learned in marketing and other classes to real world problems. 2. Acquire practical knowledge in the stages of project management including problem formulation, selection of research approach to addressing a marketing problem, and collection of secondary and primary data. 3. Learn to integrate the findings from a project analysis into a consistent whole and make specific recommendations for decision-making in real world situations. 4. Exposed to the challenges of working in teams to achieve project goals. Credits: 3.00

MGMT 53000 - Financial Statement Analysis

Credit Hours: 3.00. The course is designed to help students: (a) understand the content of corporate financial reports and analyze the information therein, (b) use the information for evaluating the financial health, operating performance, and growth prospects of corporation-type companies, and (c) learn the various models available and estimate the value of such a company using those models and the information abstracted from the financial reports. The topics to be covered include the corporate financial statements and their relationships, ratio analysis for profitability and risk evaluation, assets/liabilities/owners' equality analysis, intercompany investments, forecasting financial statements, and company valuation models.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions: Students will be able to demonstrate their ability to incorporate financial statement information into commonly used firm valuation models that are widely used in business decision-making. 2. Develop current business technologies and use common business technology and software in essential

tasks: Students will be able to demonstrate their ability to use spreadsheet in developing valuation models and will demonstrate their ability to retrieve financial information from Internet and evaluate its quality. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class assignments and the writing and presentation of a group project. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment. Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a group project. 5. Develop awareness and understanding of global issues relating to financial reporting, tax accounting and business decisions. Students will demonstrate their ability to value multinational corporations and interpret their financial statements through homework assignments, examinations and a group project. 6. Achieve depth of understanding applications of financial reporting. Students will demonstrate their ability to understand and interpret financial statements and accounting choices through homework assignments, examinations and a group project. Credits: 3.00

MGMT 53100 - Government/Not-For-Profit Accounting

Credit Hours: 3.00. This course is designed to provide students with a solid understanding of the financial reporting and accounting principles used in the preparation of governmental and not-for-profit entities. Topics include, but are not limited to, fund accounting, city government accounting, state government accounting, special funds, budgetary accounting for the general and special revenue funds, fiduciary funds and government-wide statements, university accounting, accounting for community foundations, not-for-profit accounting, and auditing not-for-profit entities.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions: Students will be able to demonstrate their understanding of generally accepted accounting Principles for government and not-for-profit entities and how accounting information is used in decision-making for those organizations through the completion of multiple projects. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate their understanding of ethics in reporting through team projects that analyze a government or not-for-profit's accounting system. They will also be able to demonstrate their understanding of how to properly account for fiduciary (trust) funds. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate oral and written communication skills through class participation and the writing and presentation of team projects. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environmental: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present team projects. 5. Achieve their understanding of generally accepted accounting principles for government and not-for-profit entities through team projects and examination(s). Credits: 3.00

MGMT 53200 - Forensic Accounting And Fraud Examination

Credit Hours: 3.00. This course is designed to help students apply their accounting, auditing, information systems and communication skills to detect financial fraud and unauthorized reporting acts to prepare and present a fraud case for criminal proceedings or civil litigation. These skills are highly valued in the rapidly growing field of forensic accounting. Upon completing this course, students will understand the role of forensic accountants in examining financial records for fraud and detecting insurance fraud; in providing litigation support; and in capturing digital evidence. This course will also review material related to the Certified Fraud Examiner (CFE) exam. Throughout the course, students will have opportunities to improve their written and oral communication skills, particularly as they relate to communication in the legal settings associated

with investigating accounting.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate their understanding of business functional areas through homework assignments, examinations and team projects that require analysis or development of fraud detection plans and litigation support. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will be able to demonstrate their understanding of how people in organizations use common technology and software to commit fraud through homework assignments, examinations and team projects. They will also be able to demonstrate their ability to use software to detect fraud and other irregular transactions. 3. Become familiar with the ethical issues that individuals face in organizations: Ethical behavior is a key factor in preventing fraud. Students will be able to demonstrate their ability to identify signs of unethical behavior and how it manifests itself in financial fraud through homework assignments, examinations and team projects. 4. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class participation and the writing and presentation of team projects. 5. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present team projects. 6. Achieve depth of understanding and applications of financial reporting. Students will demonstrate their understanding of accounting systems through homework assignments, examinations and team projects that require a deep understanding of accounting rules and procedures and the technology that individuals use to keep financial records. Credits: 3.00

MGMT 53600 - Employment & Diversity Law For Managers

Credit Hours: 2.00. Managers, regardless of your industry, will routinely face HR and employment issues that collide with the law. In this course, we will examine many laws and the practical ways you can stay on the right side of the law. Don't worry, you aren't in a law school class and I don't expect you to become employment attorneys. However, I will help you gain a working knowledge of employment laws including: The Civil Rights Act, ADA, ADEA, FMLA, FLSA, and a host of alphabet soup. We will also apply these laws from posting a job description to recruiting to hiring to employee reviews to terminating an employee. While I can't guarantee you will never be sued by a disgruntled current or former employee, I can help you put yourself and your company in the best possible position to defend that suit. And don't worry: we will look at lots of quick case studies (less than a page) to give you context you can easily remember.

Learning Outcomes: 1. Know about the law of the employment process. 2. Know the global principles that apply to corporate managers in the legal context. 3. Know about specific human resource management techniques (or methodologies), and apply some to the techniques. 4. Know about the importance of legal principles as applied to the employment process. Credits: 2.00

MGMT 53700 - Persuasive Communications

Credit Hours: 2.00. The purpose of this course is to work with you to improve your professional communications specifically as those communications relate to client and external communications. We will focus on oral and written communications theory, techniques, and practice.

Learning Outcomes: 1. Acquire skills in writing professional business documents including business memos, business letters, group papers, and PowerPoint slides. 2. Develop and present elevator pitches for their career development. 3. Gain skills to research and craft an intensive analysis regarding a marketing plan for Fortune 500 companies. 4. Enhance personal presentation skills via

elevator pitches, impromptus, and group presentations. Credits: 2.00

MGMT 53900 - Analytics For Social Media Marketing

Credit Hours: 2.00 or 3.00. The objective of this course is to equip students with tools and develop marketing skills required to address current marketing problems. The approach is to learn R software for conducting basic scraping on social media sites to understand user behavior and sentiment. In addition, Python will be used for web-scraping data from various websites and websites with dynamic content. The goal is to become familiar with such qualitative techniques as: word clouds, cluster dendrograms, sentiment analysis, and other methods. Occasional homework assignments or check points will be given to gain deeper understanding of the materials covered in class.

Learning Outcomes: 1. Learn how to collect and analyze consumer behavior and sentiment from social media platforms. 2. Gain experience in understanding online consumer search terms and related consumer trends. 3. Learn to become a marketing manager who would monitor competitors' products and pricing actions on the online space. 4. Be exposed to the challenges of recent online platforms where websites use dynamic content to increase user interactivities. Credits: 2.00 or 3.00

MGMT 54000 - Computing For Analytics

Credit Hours: 2.00 or 3.00. The main goal of this course is to introduce students to algorithmic thinking and computational tools for data analytics. The course will focus on challenges associated with large data sets and how algorithms and data structures can aid in resolving some of those challenges. The course will introduce relevant programming techniques in Python. Permission of department required.

Learning Outcomes: 1. Categorize problems according to their computational complexity. 2. Employ algorithmic techniques to obtain insights about data. 3. Develop algorithms to new problems. 4. Implement the algorithms and methodologies in python. Credits: 2.00 or 3.00

MGMT 54400 - Database Management Systems

Credit Hours: 3.00. Covers the theory and practice of database design and usage. Students will learn the importance of data modeling concepts and how to use these effectively and how to plan and design a database, including issues such as data security and control.

Learning Outcomes: 1. Understand why database management is important and what it entails. 2. Analyze the database requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams. 3. Translate an ER diagram into normalized relations for a relational DBMS. 4. Design and implement an Oracle database. 5. Write simple and relatively complex data retrieval and maintenance commands in the SQL language. 6. Use Microsoft Access as a front end to a server database in Oracle. 7. Appreciate major data administration tasks, including security control, backup and recovery, and concurrency control. 8. Be familiar with data warehousing and its basic conceptual design. Credits: 3.00

MGMT 54500 - Systems Development

Credit Hours: 3.00. Focuses on information systems development theories, practices, and tools for rapid adaptation and management of leading-edge as well as emerging computing paradigms. MGMT 54400 Database Management is highly recommended. Permission of department required.

Learning Outcomes: 1. Define the essential processes involved in information systems development. 2. Analyze and represent business processes. 3. Develop and validate systems models and design specifications for an information system application. 4. Understand database concepts and design relational databases based on data models. 5. Effectively use and maintain databases through hands-on experience with Structured Query Language (SQL). 6. Work effectively on a team to successfully complete team projects. 7. Proficiently use various tools used in systems analysis and design. Credits: 3.00

MGMT 54700 - Computer Communications Systems

Credit Hours: 3.00. Explores the convergence of telecommunications and computer technology, framed in terms of their strategic impact in the business environment. Components of computer communication systems are surveyed. Major design and analysis issues in the development, implementation, and management of computer communication systems are examined. Relevant emerging trends are highlighted. The course is devoted to technical issues, applications, and case studies covering telecommunication systems used in business.

Learning Outcomes: 1. Learn the infrastructure of telecommunication systems. 2. Learn how telecommunications systems work. 3. Learn applications of telecommunication systems. 4. Learn how to create strategic advantage by using telecommunication systems. Credits: 3.00

MGMT 55200 - Mentoring And Socialization

Credit Hours: 2.00. Students learn about the employee socialization process through case studies, discussion, and presentations. In addition, students receive practical experience through participation in a mentoring program for new students. Class discussions and presentations evolve from students' mentoring experiences, and guest speakers provide real-world perspective on new employee programs. The course helps students develop skills in mediation, leadership, conflict management, and communication.

Learning Outcomes: 1. Learn strategies to develop individual mentoring and leadership skills. 2. Assist students in their transition to Krannert, the graduate school environment, and the community. 3. Learn top mentoring practices, theories, and ways to implement these for individual development. 4. Provide opportunity for students to practice professional mentoring skills. Credits: 2.00

MGMT 55360 - Industrial Relations I

Credit Hours: 2.00. An in-depth examination of human resource management in the context of union-management relations. Emphasis is on understanding how and why unions form, the legal context, and changing competitive environment for labor management relations. Covers the dynamics of the collective bargaining process, including the determinants of bargaining power, preparation of labor contract demands, and negotiation tactics. The course culminates with an extended mock negotiation exercise.

Learning Outcomes: 1. Provide you with a sense of US labor history and acquaint you with labor laws essential for managers in multinational corporations. 2. Understand power dynamics not only between unions and management, but between managers and subordinates in everyday situations, in any organization. 3. Familiarize you with the union organizing process and help you understand its relevance for managers in non-unionized firms. 4. Engage you in a mock contract negotiation so that you may experience the dynamics of collective bargaining and negotiation. 5. Improve your conflict management skills. Credits: 2.00

MGMT 55400 - Leading Global Organizations And People Across Cultures

Credit Hours: 2.00 or 3.00. This course focuses on the opportunities and challenges of managing a global multicultural workforce and implementing global organizational people strategies. The overall goal of this class is to help you become a more effective professional and leader in a global world on and off the job by providing information, tools and multicultural opportunities to increase conceptual and practical understanding of how national cultures shape employment settings and its implications for your own behavior as a global business professional and leader who implements human capital and organizational strategies, policies, and practices in a cross-national context. This course will also increase knowledge of and ability to implement current global human capital, international HRM, and organizational strategies for MNES and domestically. To achieve these goals, student engagement in class sessions, and willingness to share perspectives and opinions, and application of course readings and materials, are critical to the success of this course. A range of participative learning methods are used to facilitate an active classroom environment, including learning log journaling, case analysis, experiential exercises, small group projects, break out discussions, company guest speakers, and self-assessments. The role of the instructor in this course is not always to provide "the" answer, but to create an environment where you can collectively explore, examine and experiment with students' own ideas and share ideas and perspectives on working and managing global firms.

Learning Outcomes: 1. Use cross-cultural

leadership and organizational abilities to understand on how cultural differences shape workplace interactions so you can better implement organizational and people strategies to achieve business goals in a global environment. 2. Identify and avoid cultural mishaps and identify how your own national cultural values and assumptions about managing people and organizations shape your effectiveness in managing people, diversity, and systems in a global or cross-cultural firm. 3. Understand the challenges of adapting HRM policies and organizational people strategies when adapting HR and employment systems as organizations "go global" and develop a global workforce. 4. Understand the pros and cons of different multicultural strategies (cultural minimization, accommodation, cultural integration) for successfully implementing human capital strategies and HR practices in multicultural contexts. 5. Develop the core competencies needed by business leaders to work in multicultural teams contexts, including cultural intelligence, the ability to work in cross-cultural teams, develop clear and concise non country biased written communication, the ability to give effective presentations virtually and face to face, and the ability to engage in strategic cross-cultural thinking to implement global HR. 6. Understand and be able to apply core concepts in global HR/OB from 1)Global HR planning and organizational design; 2) Merger and Acquisition with a focus on linkages to successful people and organizational strategies; 3) Global talent management; 4) Development, reward, and performance management of global leaders; 5) Managing Global Teams, diversity, and cross-cultural communication; and 6) Implementing global change and improving organizational effectiveness. Credits: 2.00 or 3.00

MGMT 55410 - Training And Development

Credit Hours: 0.00 to 3.00. This course prepares students to design training and develop training programs and to identify principles, practices and methods of staff training and career development. Students will learn and practice how to deliver and evaluate said programs for return on investment (ROI). Emphasis is placed on the application of principles related to adult learning instructional design and program development, evaluation and learning technologies. Specific objectives include topics related to communication, diversity, generational differences and group dynamics.

Learning Outcomes: 1. Master training and development principles and terminology. 2. Understand the linkage between strategies and training and development. 3. Understand how training and development can be a competitive advantage. 4. Conduct a needs assessment and SWOT analysis. 5. Apply the ADDIE model and learning styles. 6. Link Performance and Career Development needs to training. 7. Conduct, Evaluate, and Calculate the ROI of training. 8. Develop, Implement, and evaluate a training and development project. Credits: 0.00 to 3.00

MGMT 55500 - Leading Management Of Diversity And Inclusion In Organizations

Credit Hours: 2.00 or 3.00. This course is designed to help participants learn to effectively manage self, peers, teams, clients, and firms in diverse organizational settings and to lead organizational change to foster inclusion, equality, and productive workplaces. The class is designed to develop your skills in leading diversity and inclusion from a multi-level view in the workplace: employee, leader, team member, organizational, and institutional/societal levels. Its goal is to a) improve your ability to work in diverse teams, as well as b) develop your ability to design, and implement strategies to foster cultural and structural change to support the management of an increasingly diverse workforce toward enhanced organizational effectiveness to benefit business, employees, and society. People and leaders in organizations are constantly working with members of different backgrounds, social identities, and experiences, often across distributed and/or digitally connected environments, fostering increased attention to diversity equity and inclusion in transforming employment settings. When understood, supported and leveraged effectively, these differences in social identities, difference and values can help attract and retain talent, strengthen societal and community economic equality, support

organizational and team effectiveness; but when overlooked, or mismanaged, these differences can increase turnover, conflict, stress, talent under-utilization, and harm career and work-life wellbeing, health, and productivity. We will focus on advancing understanding of how intersecting organizational and institutional structures and cultures and their relation to strategies for creating diversity; an inclusive culture and positive climate for inclusion and talent management; and developing and retaining diverse talent to foster innovation and organizational effectiveness across multiple levels of intervention. We discuss how to conduct an organizational diagnosis of the current diversity climate and barriers and facilitators for creating a multicultural workplace and a flexible environment supportive of many identities, and how assumptions of "ideal workers" may vary across industry and cultural contexts. You as a leader will be better able to articulate your own DEI vision and develop understanding of strategies that move from description to evidence-based diagnosis to action strategies and implementation in order to move aspirations into organizational change realities. From an individual leadership perspective, we tackle the question: "Why does diversity, equity and inclusion matter in employing organizations and business, what is the state-of-the-art evidence-based knowledge, and what does it mean to me personally in my career and my leadership beliefs?" Specifically, we focus on the business and social science processes - including attitudes toward in-groups and out-groups, stereotyping, identity, privilege, and power, intersectionality, discrimination, bias, influence opportunity, bystander awareness, allyship, difficult conversations, and perspective taking - these topics relate to how members of different social groups perceive and interact with one another. Since managing social identity increasingly involves managing work-life boundaries and work and non-work public and private selves, we will also learn about authenticity choices and social and public/professional identity boundary management. Further, the opportunity to experience higher well-being and work-life balance is increasingly linked to job and life opportunities reflecting growing work-life inequality in society. From an organizational and group perspective, we address the questions: "What are best practices for successful management of diversity and inclusion? And why does it matter to me as a future leader personally and in business and in the communities and world in which I live."

Learning Outcomes: 1. Evaluate the aspects of your identity and personal experiences that shape how you interact and engage with others and how they interact and engage with you in organizations. 2. Explain how issues of power, privilege, discrimination, bias, equality, and equity influence opportunity and effectiveness in organizations operating both in local, domestic and global contexts. 3. Propose ways to make relationships across cultural and cross-cultural and gender differences in organizations more effective. 4. Describe current perspectives on the relationships among diversity, inclusion, creativity, and innovation in domestic and global organizations. 5. Analyze a company's current approach to leading diversity and use content from this course to propose ways to enhance learning and effectiveness in that company. Credits: 2.00 or 3.00

MGMT 56000 - Manufacturing Planning And Control

Credit Hours: 2.00 or 3.00. An advanced course in manufacturing planning and control systems, emphasizing the integration of demand forecasting, inventory control, production scheduling, and production control. Topics are linked through case studies and an elaborate manufacturing computer simulation game.

Learning Outcomes: 1. Master the major concepts, techniques and models of process design and analysis, and the ability to apply them to contexts beyond manufacturing. 2. Master the major tools for conformance quality control and performance quality improvement. 3. Understand the trend in manufacturing management and the advanced skills needed. 4. Acquire the analytical capabilities to uncover problems and improvement opportunities in manufacturing management. Credits: 2.00 or 3.00

MGMT 56100 - Logistics

Credit Hours: 2.00 or 3.00. Examines the distribution and delivery functions in a manufacturing or service industry. Topics include inventory control in distribution, transportation planning, distribution requirements planning, analysis of waiting lines, distribution system design and facility location and layout analysis.

Credits: 2.00 or 3.00

MGMT 56200 - Project Management

Credit Hours: 2.00. Emphasizes the use of PC-based project

management software and its applications, particularly in manufacturing organizations and especially new product development projects. Extensive use is made of several case studies to illustrate the planning and monitoring of a project. Class is held in a computer lab.

Learning Outcomes: 1. Understand the importance and challenges of managing projects of various types and sizes. 2. Learn and apply tools for project selection, team formation, and requirements gathering. 3. Create detailed budgets and schedules. 4. Acquire analytical capabilities for monitoring projects and investigating variances in scope, budget, and schedules. 5. Improve their ability to concisely communicate project information to senior management. Credits: 2.00

MGMT 56300 - Machine Learning For Business Analytics

Credit Hours: 2.00. With the rise in big data, Machine Learning has experienced rapid growth over the last ten years with major advances in its subfields of Deep Learning, Reinforcement Learning, Natural Language Processing, Computer Vision, Robotics, and other subfields. The purpose of this course is to provide the students with a systematic introduction to the recent developments in machine learning through the coverage of modern machine learning concepts and practical business applications, as well as hands-on experience with modern machine learning frameworks. The course plans to cover neural nets, convolutional neural networks, recurrent networks, deep generative models, deep reinforcement learning, and the trustworthy AI framework with the properties of safety, robustness, privacy, and fairness.

Learning Outcomes: 1. Understand the foundations of machine learning concepts and methods. 2. Receive a deep understanding of modern ML -- deep learning, and different deep neural. 3. Network architectures and their state-of-the-art applications. 4. Understand the caveats of real-world data. 5. Receive hands-on practice to apply ML methods to solve business problems. Credits: 2.00

MGMT 56400 - Management Of Service Operations

Credit Hours: 2.00. Special characteristics of services require an interdisciplinary approach to analyzing operations. This course draws upon concepts from accounting, management science, and marketing. Differences and similarities between the service and manufacturing organizations are analyzed. Case studies of service organizations are used extensively. Prerequisite: MGMT 66000 (if Graduate student status) or else MGMT 36100 (if Undergraduate student status).

Credits: 2.00

MGMT 56500 - Strategic Sourcing And Procurement

Credit Hours: 2.00. This course will address the process of procurement including terminology, metric, and decision making. Additionally, we will investigate the best practices and processes for managing the relationships with suppliers and their performance. We will also explore the sourcing decision and the strategic ramifications of producing/ providing goods and services internally or purchasing them from external organizations. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management).

Learning Outcomes: 1. Develop a good understanding of sourcing and procurement strategies and enhance the student's analytical skills to make optimal sourcing and procurement decisions. It requires critical thinking through the participation of games, case discussions and presentation of case assignments. Credits: 2.00

MGMT 56600 - Global Supply Chain Management

Credit Hours: 2.00. This course will integrate issues from marketing (channels of distribution), logistics, and operations management to develop a broad understanding of a supply chain in a global context. Students will learn how different factors, including exchange rate risk, custom duty and trading policies, geographic distribution of resources and demand, availability and reliability of local supplier, and characteristics of consumer, affect the design and execution of global supply chain strategies. Prerequisites: Students are expected to have taken a basic course on operations (such as the masters core class MGMT 66000: Introduction to Operations Management) and a basic course on supply chain management (such as the masters elective MGMT 66400: Supply Chain Management). Exposure to a course on optimization is also preferred, but not required. The course requires logical and analytical thinking.

Learning Outcomes: 1. Train the students to understand the issues in managing a global

supply chain and to manage them and optimize their performance. It requires critical thinking through the participation of games, case discussions, and presentation of case assignments. Credits: 2.00

MGMT 56700 - Deep Learning For Business Analytics

Credit Hours: 2.00. With the rise in big data, Machine Learning has experienced rapid growth over the last ten years with major advances in its subfields of Deep Learning, Reinforcement Learning, Natural Language Processing, Computer Vision, Robotics, and other subfields. The purpose of this course is to provide the students with a systematic introduction to the recent developments in deep learning through the coverage of modern machine learning concepts and practical business applications, as well as hands-on experience with modern machine learning frameworks. The course plans to cover neural nets, convolutional neural networks, recurrent networks, deep generative models and deep reinforcement learning.

Learning Outcomes: 1. Identify the deep learning algorithms and design deep neural networks which are more appropriate for various types of learning tasks in various domains. 2. Perform regularization and hyperparameter selections of different deep learning models and evaluate their performance. 3. Implement deep learning algorithms in Python using the Keras library. 4. Apply the algorithms to a real-world problem and report the performance achieved by the models. Credits: 2.00

MGMT 56800 - Supply Chain Analytics

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn a systematic set of current popular analytical methodologies, including (1) data management and exploration (database management, data visualization, etc.), (2) data analysis (statistical methods, time series analysis, etc.), (3) modeling (math models, advanced spreadsheet engineering, etc.), and (4) decision analysis (optimization, simulation, numerical analysis, etc.). 2. Use these methodologies in a large-scale supply chain simulation game and to analyze cases involving multiple supply chain functions, such as forecasting, procurement, inventory, transportation, pricing, contract, revenue management, and reverse supply chain. Credits: 2.00

MGMT 56900 - Ethical And Sustainable Supply Chain Management

Credit Hours: 2.00 or 3.00. This course provides students with knowledge and skills for building and analyzing ethical and sustainable practices in supply chains, taking a holistic view of the interaction between businesses, the environment, and society.

Learning Outcomes: 1. Run life-cycle analysis (LCA) and interpret findings. 2. Analyze product and process performance through life-cycle thinking. 3. Understand the Tragedy of the Commons in the business context and identify the underlying reasons. 4. Assess pros and cons of various solutions to the Tragedy of the Commons problem in business context. 5. Identify and explain various product stewardship practices and their pros and cons. 6. Identify innovative business models, such as Servicizing, based on sustainable use of

products and services. 7. Compare and contrast traditional supply chain with closed-loop supply chain. 8. Compare and contrast different types of contracts and practices for incentivizing compliance with ethical and sustainable conduct throughout the supply chain. 9. Identify and analyze opportunities and constraints in building ethical and sustainable supply chains. 10. Compare and contrast alternative ways of complying with environmental and social regulations such as carbon trading. Credits: 2.00 or 3.00

MGMT 57000 - Spreadsheet Modeling And Simulation

Credit Hours: 2.00. Covers up-to-date and practical spreadsheet modeling tools, which can be applied to a wide variety of business problems in finance, marketing, and operations. Consists of simulation modeling techniques to analyze risk and uncertainties in business environment, optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints, and real-world examples and cases to demonstrate broad applications of spreadsheet modeling and simulations in manufacturing and service operations, supply chain systems, yield management, asset dynamics, option pricing, etc.

Learning Outcomes: 1. Identify the most likely description of the uncertainty in future business with data analysis techniques, such as Pivot Table, PivotChart, fitting probabilities to data, etc. 2. Use deterministic and stochastic optimization techniques to determine the best managerial actions under internally- and/or externally-imposed constraints. 3. Analyze the risk and uncertainty in business environment and process with simulation modeling techniques. 4. Review and criticize peer's participation in and contribution to group work. Credits: 2.00

MGMT 57100 - Data Mining

Credit Hours: 2.00. Introduces the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions. Includes a variety of techniques to identify nuggets of information or decision-making knowledge in bodies of data, and extracting these in such a way that they can be put to use in the area, such as decision support, prediction, forecasting, and estimation.

Credits: 2.00

MGMT 57200 - Six Sigma And Quality Management

Credit Hours: 2.00. Establishes the link between quality and productivity design and improvement and variance reduction. The course examines some of the more traditional views on quality, as well as those today, which are gaining greater credibility and influence under the umbrella of TQM. It also covers up-to-date and practical spreadsheet modeling tools that can be applied to a wide variety of business problems from finance, marketing, and operations.

Credits: 2.00

MGMT 57300 - Optimization Modeling With Spreadsheets

Credit Hours: 2.00. The course emphasizes applications of optimization through cases and computer exercises. The applications are chosen to provide insights into business and economics. Areas covered include linear, network, integer, and nonlinear optimization. At the end of the course, the students should have the ability to model optimization problems work with software to solve optimization problems relate to optimization theory in a variety of application settings develop optimization insights into applications in marketing, finance, and operations and get some basic exposure to EXCEL automation. Prerequisites: Students are expected to have taken a basic MBA (core) course in business analytics (such as the masters core MGMT 67000).

Learning Outcomes: 1. Train the students to write mathematical formulations of business problems and use solvers in excel spreadsheets to solve the problems. It requires critical thinking via the presentation of case assignments. Credits: 2.00

MGMT 57400 - Frontiers In Manufacturing Technology

Credit Hours: 1.00. This course will explore various types of technologies used in manufacturing today and the implication for future uses and applications. These modules will provide background, applications, and current use cases of the various tools. Students will also conduct weekly research on various technology applications.

Learning Outcomes: 1. Gain an understanding

of the various technologies (17 types will be discussed). 2. Gain an understanding and be able to apply these tools to within the manufacturing sector. 3. Work independently and improve their ability to stay on task. 4. Be exposed to the history and how these technologies have evolved. 5. Gain an understanding of the future technological trends. Credits: 1.00

MGMT 57500 - Supply Chain Technology

Credit Hours: 2.00. This course will emphasize the use of supply chain technology for planning and control of dynamic manufacturing systems. This requires the simulation of plans and required changes over time. Therefore, the course will revolve around active learning computer simulations in SAP.

Learning Outcomes: 1. Execute end-to-end business scenarios, including Procure-to-Pay, Forecast to Delivery, and Order to Cash, in an Enterprise Resource Planning (ERP) system. 2. Choose among several planning methods and develop initial parameters based on supply chain and production capabilities and market intelligence. 3. Modify system parameters as necessary to address events such as material shortages, lack of cash flow, changes in supply availability, and market changes. 4. Access and analyze operational data from the ERP system. 5. Design a manufacturing planning and control strategy to maximize company value. Credits: 2.00

MGMT 58100 - Big Data Technologies

Credit Hours: 2.00. There is an exponential growth in the adoption of big data technologies in every walk of life. Organizations are collecting, storing, and analyzing massive amounts of data. This data is commonly referred to as big data because of its large volume, the velocity with which it is collected and transmitted, the variety of forms it takes, and veracity of its origin and content. In order to capitalize on the opportunities presented by big data, businesses are putting in place technologies, people, and processes. Just collecting, transmitting and storing big data creates little value for an organization. For many organizations, the term big data currently represents only a data infrastructure such as the Apache Hadoop family of products. The key to delivering real value from big data is the use of analytics. Data must be analyzed and the results used by decision makers and organizational processes in order to generate value. The main objective of this course is to learn how to collect, process, store, and analyze big data. Assignments could easily be completed in Python or SQL. We assume no familiarity with Linux and will introduce you to all essential Linux commands. Students need access to a computer with a 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more of RAM is strongly recommended.

Learning Outcomes: 1. Learn visualization techniques using Tableau to query large datasets and gain insights from it. 2. Learn to deploy big data technologies such as Cloudera Hadoop on Virtual Box. 3. Learn to collect data using open APIs to access streaming data from sites like Twitter, Quandl, Buzzfeed, etc. 4. Learn to architect a big data platform for analysis. Credits: 2.00

MGMT 58200 - Management Of Organizational Data

Credit Hours: 2.00. Provides the basic concepts and skills needed to analyze and organize business data, as well as to utilize the organized data to answer a variety of business queries. After successful completion, students will have an understanding of why database management is important and what it entails, how to analyze the data requirements of a business scenario and represent these requirements by means of entity-relationship (ER) diagrams, translate an ER diagram into normalized relations for a relational database management system, write simple and relatively complex data retrieval commands in the SQL language for an Oracle database, use Microsoft Access as a front end to a server database in Oracle, be familiar with several selected topics of current interest in the data management arena.

Credits: 2.00

MGMT 58500 - Information Technology Project Management

Credit Hours: 2.00. The purpose of this class is to provide students with a basic understanding of the tasks and challenges facing IT and analytics project managers. Students learn about projects, roles and responsibilities of project managers. We start by discussing the skills and approaches commonly used in creating and monitoring project plans and braking complex projects down into manageable segments. We also discuss important areas defined in PMI's PMBOK, like scope, time, cost and quality management. Next we look at how IT projects have

traditionally been managed, and move on to the study of agile methods. We go through some of the most important aspects of agile project management, such as user stories, agile teams an agile planning, execution and tracking. In learning these tools and techniques, we take a hands-on approach wherever possible and use project management software, exercises and case studies.

Learning Outcomes: 1. Acquire a good understanding of the most important aspects of general project management such as cost and time management. 2. Define the essential processes involved in information systems development. 3. Work effectively on a team to successfully complete team projects. 4. Understand and explain various approaches to manage IT projects. 5. Use project management tools, MS Project and Atlassian Jira. 6. Explain what agile is and how it is different from waterfall. 7. Work on a team as a scrum master or product owner. 8. Think about and describe how agile could be applied in various contexts. Credits: 2.00

MGMT 58600 - Python Programming

Credit Hours: 2.00 or 3.00. Because data grows exponentially and becomes complex, we need computational methods to collect, store, and analyze them in order to be successful in science, engineering, business, and other professions. Python Programming, is an introductory programming class that meets this need. You will learn how to write computer programs in Python language to solve real-world problems. This class is designed for students that want to learn to computer programming for data science. This course guides students through the basic Python programming language, from initial concepts to final data analysis using python and external packages.

Learning Outcomes: 1. Understand the basic programming concepts. 2. Understand the basic syntax and semantics of the Python language. 3. Understand the primitive data types build into Python. 4. Understand principles of data storage and manipulation. 5. Understand and use computer programming for basic interactive web applications. 6. Able to design, write and debug simple program to handle real-world data. Credits: 2.00 or 3.00

MGMT 58700 - Using R For Analytics

Credit Hours: 2.00. R has been one of the leading open-source programming languages used by analytics professionals today. You will develop the ability to interpret and modify R code to perform data analysis using the popular RStudio integrated development environment (IDE). During the first four weeks programming syntax, data structures, logic, functions, data loading, data reshaping, and shiny tool creation will be discussed to establish the necessary foundation to turn your data into insights using R. In every class we will discuss and apply a new R library or set of functions. During the last three weeks of the course you will perform descriptive, predictive, and prescriptive analytics with R. Assignments are both conceptual and hands-on exercises. The culmination of this course entails a final team project where you design, develop, and present a working Shiny application prototype that integrates descriptive, predictive, and prescriptive analytics to support a business problem. Permission of department required.

Learning Outcomes: 1. Ability to interpret and modify R code to perform data analysis. 2. Perform descriptive, predictive, and prescriptive analytics with R. 3. Design, develop, and present a working R-Shiny app that integrates descriptive, predictive, and prescriptive analytics to provide end-user decision support. Credits: 2.00

MGMT 58800 - VBA Programming

Credit Hours: 0.00 to 3.00. This course takes a variety of business topics and implements with state-of-the-art spreadsheet models. Students will gain hands-on experience with a wide range of business problems and databases in finance, marketing, operations, and so on. The focus of this course is to learn Visual Basic for Applications (VBA) to design functions and macros that will enhance spreadsheet models. Students will also have exposure to basics and other advanced topics of spreadsheet modeling. In addition to in-classroom time, this course will also meet in computer-based labs for hands-on instructions and implementation.

Learning Outcomes: 1. Learn the basic concepts, components, and elements of the Visual Basic language. 2. Learn the macro programming environment in Excel. 3. Apply the basics of macro programming in organizing, summarizing, and visualizing data. 4. Develop the ability to use the techniques to analyze real-world data and draw scientific or managerial

implications. Credits: 0.00 to 3.00

MGMT 59000 - Directed Readings In Management

Credit Hours: 1.00 to 4.00 (West Lafayette, North Central) 2.00 to 4.00 (Calumet). Supervised reading and reports in various subjects. Open only to a limited number of seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 59100 - Launching Global Leaders

Credit Hours: 0.00 to 2.00. Capitalizing on the unique personal and professional backgrounds of each student in our program, the Launching Global Leaders course provides a comprehensive and customizable leadership development curriculum. In this year long course, students will engage in a 360 assessment of strategically identified professional competencies critical to success in the contemporary workforce. Using these target areas as a guide, students will then customize their leadership development experience by selectively engaging in a variety of program offerings, including: interactive industry simulations, personal and team performance enhancement tools, professional coaching, interactive learning sessions with industry leaders, and workshops in developing intercultural competency, personal branding and career management.

Learning Outcomes: 1. Comprehensively assess their individual leadership strengths and areas of development along the Launching Global Leaders competency model. 2. Gain exposure to a variety of leadership styles and strategies from successful industry leaders. 3. Gain an awareness of contemporary issues facing leaders of global organizations, and strategies for future. 4. Gain exposure to tools and concepts currently utilized in industry that inspire continuous self-improvement. Credits: 0.00 to 2.00

MGMT 59200 - Contracts For Managers

Credit Hours: 3.00. Purpose of the course is to provide the student with an understanding of the contract legal environment as it pertains to profit and non-profit organizations and of the ethical considerations and social and political influences that affect such organizations. Students will examine a wide range of substantive rules of public law, which will provide a framework for a discussion of the ways in which managerial decision making affects and is affected by the legal environment.

Learning Outcomes: 1. Demonstrate a high-level of understanding of the law governing the formation of contracts. 2. Demonstrate the ability to identify and apply concepts of the law governing contractual interpretation and construction. 3. Demonstrate the ability to identify and apply concepts of the law governing contractual performance and breach. 4. Demonstrate the ability to identify and apply concepts of the law governing remedies for contract breach. 5. Demonstrate the ability to identify and apply concepts of the law governing the assignment of contractual rights and the delegation of contractual duties. 6. Demonstrate the ability to identify and apply concepts of the law governing third party beneficiaries to contracts. 7. Demonstrate their ability to do legal research and a publishable level. Credits: 3.00

MGMT 59699 - MS Internship

Credit Hours: 0.00. This course is required as part of the U.S. student visa regulation for international masters who are interning in the U.S. and want to use Curricular Practical Training (CPT). Even if a student is not being paid, they must sign up for the class unless the organization where the internship is being done is a non-profit. Students will be required to receive the necessary CPT permissions prior to enrolling in the course as well as complete paperwork from the Business Career Services office in Rawls Hall 3029. Course can also be taken by students that wish to have an internship transcripted. This course does not apply towards graduation. Does not count towards graduation. Permission of instructor required.

Learning Outcomes: 1. Experience internship. Credits: 0.00

MGMT 59800 - Analyzing Unstructured Data

Credit Hours: 2.00. This course prepares master students with the advanced and frontier technique for analyzing unstructured data that is built on the prerequisite of basic data analysis on structured data (e.g., data mining using python). Upon completion, students are expected to be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream

open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and TensorFlow); students should at least be proficient to design and lead industry-level practical projects conceptually when working with data scientist. We take text and image as examples for illustration and cover applications of: Text mining and feature extraction (e.g., sentiment, topic, readability, etc.); Image classification (e.g., recognition, etc.); Advanced applications (e.g., translations, chatbot, image expression, etc.) The course is formatted as a combination of seminars and hands-on coding practices in class. Students are expected to code (and debug) in the class. The main method topics covered include: Crawling unstructured data using scrapy. Representation and embedding of text and image. Unsupervised learning for unstructured data (e.g., LDA topic modeling, clustering, etc.) Supervised learning for unstructured data (e.g., classic ML models, A/D/C/RNN, LSTM, etc.). Permission of instructor required.

Learning Outcomes: 1. Be competent and skilled in collecting, processing, and analyzing online unstructured data using the state-of-art artificial intelligence modeling (e.g., neural networks and deep learning methods) and the mainstream open-sourced toolboxes (e.g., NLTK, scikit-learn, keras, and TensorFlow). 2. Design and lead industry-level practical projects in joint with data scientist. Credits: 2.00

MGMT 60000 - Accounting For Managers

Credit Hours: 2.00 to 3.00 (West Lafayette) 3.00 (Calumet, North Central). The two-course accounting sequence employs a user's perspective on the firm's database. First, the standard accounting model is developed into a working tool, as no prior study of accounting is assumed. Then illustrative business cases are discussed to show how external reports conform to financial contracts and public regulation. Public reports primarily directed to investors and creditors are analyzed to reconstruct the economic events and managerial decisions underlying generally accepted accounting standards. Prerequisite: Masters student standing and Management majors only.

Credits: 2.00 to 3.00

MGMT 60100 - Managerial Accounting

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (North Central). Oriented to managers, the course examines the firm's internal systems for costing products or services and their interpretation. A variety of manufacturing and service industries are studies to demonstrate design of flexible cost systems to match the firm's technological, competitive and/or multinational environments. Applications to budgeting, variance analysis, pricing models, performance evaluation and incentives are demonstrated. Case discussion and analytical "what if" modes of instruction are used to enhance managerial skills of students. Design and use of accounting data are linked to other subjects in the program core and to ethical aspects of accounting policy issues. Prerequisite: MGMT 60000 .

Learning Outcomes: 1. Master basic service and product costing methods. 2. Develop analytic skills to help businesses use the different types of costing information to make better business decisions and to formulate better business models. 3. To understand and analyze the variety and the use of accounting performance evaluation methods and the role of incentives in a business environment. Credits: 2.00 to 4.00

MGMT 60200 - Valuation And Financial Statement Analysis

Credit Hours: 2.00. Establishes how to use accounting information to make business and investment decisions. Internally, the information is used to assess performance of units, to evaluate performance of upper-level management, to monitor the firm's investment and financing decisions, and for comparison purposes with the firm's rivals. Externally, accounting information is used by financial analysts, investors and (potential) acquirers to assess the value of the firm, by creditors to assess its credit-worthiness, and by regulators. Prerequisite: MGMT 60000 , MGMT 60100 .

Learning Outcomes: 1. Demonstrate ability to understand financial statements and related information. 2. Practice communicating decisions and ideas through written and oral communication. Credits: 2.00

MGMT 60600 - Seminar In External Reporting I

Credit Hours: 2.00 to 4.00. Seminar examines research issues on the production, dissemination, and use of financial accounting information for economic decisions by external users. The materials covered are primarily empirically oriented. The aim is to expose students to these issues as they are covered in the accounting and related literature. Prerequisite: ECON 60000 .

Credits: 2.00 to 4.00

MGMT 60700 - Seminar In Internal Accounting

Credit Hours: 2.00 to 4.00. Development of a conceptual framework for evaluating information system alternatives. The

seminar examines insights into information value provided by the literature. Both the decision-facilitating and contracting-facilitating roles of information are considered. Topics also include auditing issues. Prerequisite: ECON 60700 , ECON 61500 .

Credits: 2.00 to 4.00

MGMT 60900 - Seminar In External Reporting II

Credit Hours: 2.00 to 4.00. Selective investigation of analytical research of informational and incentive issues in accounting. Emphasis is on the role of externally reported accounting information in asset pricing in financial markets. Prerequisite: ECON 60700 , ECON 61000 , ECON 61500 .

Credits: 2.00 to 4.00

MGMT 61000 - Financial Management

Credit Hours: 0.00 to 4.00. Analysis of short-term working capital needs. Cash budgeting procedures, pro forma statements, major types of short-term loan arrangements, and short-term asset management. Prerequisite: MGMT 60000, Master's student standing or higher and Management and Computational Finance majors only.

Learning Outcomes: 1. Explain how the Statement of Cash Flows can be used to diagnose operating performance and describe the calculation and use of financial ratios. 2. Define financial ratio analysis and explain how ratios reflect financial performance. 3. Examine how a company's financial plan is shaped by a company's operating strategy. 4. Recognize how seasonal patterns of activity affect a company's financial plan. 5. Discuss long-term financial planning. 6. Compare compounding interest rates, discounting cash flows, and bond valuation. 7. Recognize techniques used in project analyses and capital budgeting, as well as incremental cost and revenue in capital project analysis. 8. Apply capital structure theory in practice. Credits: 0.00 to 4.00

MGMT 61100 - Advanced Corporate Finance

Credit Hours: 2.00 to 4.00 (West Lafayette, Calumet) 3.00 (North Central). Long-term capital structure planning, capital budgeting, treatment of uncertainty in investment decisions, security underwriting, dividend policies, and mergers. Prerequisite: MGMT 61000.

Learning Outcomes: 1. Outline and describe Corporate Financial Policies and understand their potential impact of firm value. 2. Value real options in capital budgeting projects using the Black Scholes, the risk-neutral probability and the duplicating portfolio models. 3. Understand the use of and characteristics of various alternatives to corporate finance including leasing, convertible bonds, and structured finance. Credits: 2.00 to 4.00

MGMT 61400 - Investments

Credit Hours: 2.00 to 4.00. Examination of the process of asset valuation. Emphasis on portfolio analysis, security selection, risk-return relationships, and performance evaluation. Additional topics considered include security analysis, option pricing and analysis, futures contracts, and security market operations.

Learning Outcomes: 1. Develop a sound foundation for the main concepts in investment management and portfolio theory. 2. Understand how stock, bond, and option prices are determined. 3. Learn the analytical tools and financial theory necessary to understand how financial assets are used for investment decisions. 4. Take a critical look at the process of investing and relate the topics covered to current real-world problems relevant to practitioners. 5. Prepare students for more advanced courses in investments, portfolio management, and corporate finance. Credits: 2.00 to 4.00

MGMT 61500 - International Financial Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Integrative course dealing with the management of firms doing business internationally. Emphasis on decision making. Will draw upon, and adapt, managerial decision models developed for domestic operations, as well as cover appropriate international institutional material. Particular focus on finance and strategic management. Prerequisites: ECON 51500.

Learning Outcomes: 1. Evaluate how changes in the exchange rates affect a firm's cash flows and value. 2. Evaluate how international capital

budgeting decisions are affected by the complications due to currency considerations. 3. Evaluate how international capital budgeting decisions are affected by the complications due to tax considerations. 4. Evaluate how international capital budgeting decisions are affected by the complications due to country risk considerations. Credits: 2.00 to 4.00

MGMT 61601 - Seminar In Capital Markets I

Credit Hours: 2.00. This is the first in a sequence of four PhD level finance courses that cover theoretical and empirical research in capital markets. Offered in alternate years.

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in capital markets. 2. Be able to show ability to conduct research in an ethical and responsible manner. 3. Be able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61602 - Seminar In Capital Markets II

Credit Hours: 2.00. This is the second in a sequence of four PhD level finance courses that cover theoretical and empirical research in capital markets. Offered in alternate years. Prerequisite: MGMT 61601 .

Learning Outcomes: 1. Critical Thinking: Students demonstrate ability to think creatively and critically while solving problems in capital markets. 2. Ethical and Responsible Research: Students will be able to show ability to conduct research in an ethical and responsible manner. 3. Communication: Students will be able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61701 - Seminar In Capital Markets III

Credit Hours: 2.00. This is the third in a sequence of four PhD level finance courses that cover theoretical empirical research in capital markets. Offered in alternate years. Prerequisite: MGMT 61602 .

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in capital markets. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61702 - Seminar In Capital Markets IV

Credit Hours: 2.00. This is the fourth in a sequence of four PhD level finance courses that cover theoretical empirical research in capital markets. Offered in alternate years. Prerequisite: MGMT 61701 .

Learning Outcomes: 1. Able to think creatively and critically while solving problems in capital markets. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of capital markets. Credits: 2.00

MGMT 61801 - Seminar In Managerial Finance I

Credit Hours: 2.00. This is the first in a sequence of four PhD level finance courses that cover theoretical empirical research in managerial finance. Offered in alternate years.

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of managerial markets. Credits: 2.00

MGMT 61802 - Seminar In Managerial Finance II

Credit Hours: 2.00. This is the second in a sequence of four PhD level finance courses that cover theoretical empirical research in managerial finance. Offered in alternate years. Prerequisite: MGMT 61801 .

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of managerial markets. Credits: 2.00

MGMT 61901 - Seminar In Managerial Finance III

Credit Hours: 2.00. This is the third in a sequence of four PhD level finance courses that cover theoretical empirical research in managerial finance. Offered in alternate years. Prerequisite: MGMT 61802 .

Learning Outcomes: 1. Demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Able to show ability to conduct research in an ethical and responsible manner. 3. Able to effectively communicate knowledge of managerial markets. Credits: 2.00

MGMT 61902 - Seminar In Managerial Finance IV

Credit Hours: 2.00. This is the fourth in a sequence of four PhD level finance courses that cover theoretical and empirical research in managerial finance. Prerequisite: MGMT 61901 .

Learning Outcomes: 1. Critical Thinking: Students demonstrate ability to think creatively and critically while solving problems in managerial finance. 2. Ethical and Responsible Research: Students will be able to show ability to conduct research in an ethical and responsible manner. 3. Communication: Students will be able to effectively communicate knowledge of managerial finance. Credits: 2.00

MGMT 62000 - Marketing Management

Credit Hours: 2.00 to 4.00 (West Lafayette and Calumet) 3.00 (North Central). An integrated analysis of major marketing decisions, including product pricing, advertising, distribution, and sales force policies. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 62300 - Business Marketing

Credit Hours: 2.00 to 4.00. This course deals with the challenges of marketing to commercial enterprises, government organizations, and non-profit institutions. It covers topics including organizational buying behavior, launching and management of new high tech products, beta testing, customer relationship management, and the importance of manufacturing-marketing coordination. Prerequisite: MGMT 62000.

Credits: 2.00 to 4.00

MGMT 62500 - Marketing Research

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet). Application of statistical and other quantitative concepts to marketing management problems. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 62600 - Seminar In Marketing Models

Credit Hours: 2.00 to 4.00. Treatment of theoretical marketing models. Study of marketing models in research setting. Prerequisite: MGMT 62000, 67200.

Learning Outcomes: 1. Understand the main research areas associated with quantitative methods in marketing. 2. Acquaint with the basic research techniques, approaches and key findings in the realm of empirical quantitative models in marketing. 3. Learn to develop and estimate the econometric models on consumer choices and firm interactions. 4. Prepare research ideas and the skills to implement the ideas. Credits: 2.00 to 4.00

MGMT 63000 - Legal And Social Foundations Of Management

Credit Hours: 2.00 to 4.00. An examination of the nature of the legal environment from the viewpoint of the social and moral bases of law. Emphasis is given to the operation of our legal system and its significance in decision functions of management. Prerequisite: Master's student standing and Management majors only.

Learning Outcomes: 1. Recommend appropriate actions in the business environment based on an understanding sources of law, legal process and procedure, and available remedies determine appropriate actions in the business environment based on an understanding of agency law concepts and employment laws, focusing on Title VII and related laws. 2. Analyze contractual rights, obligations, liabilities, and remedies in the business environment. 3. Evaluate tort rights, obligations, liabilities, and remedies in the business environment. 4. Identify the legal constraints faced by the business professional

as well as the legal options available to the business professional in responding to and resolving legal issues. 5. Recognize and analyze the laws that affect contemporary businesses, including the laws relating to agency and employment, securities regulation, the organization of a business, and the legal liability of accountants. 6. Describe the ways in which various effect governmental regulations affect contemporary business practices. 7. Evaluate ethical problems that are integrally connected to the legal issues. Credits: 2.00 to 4.00

MGMT 63150 - Accounting For Private Equity

Credit Hours: 2.00 or 3.00. The course offers students with knowledge of private equity services that accounting firms provide to clients. It covers investment banking, buy- and sell-side due diligence, M&A tax services, business valuations, etc.

Learning Outcomes: 1. Gain practical knowledge and skills regarding tools accounting firms use to service Private Equity clients. 2. Improve technical presentation skills, both verbal and written. 3. Simulate the business environment and team approach. Credits: 2.00 or 3.00

MGMT 63250 - Advanced International Accounting

Credit Hours: 2.00 or 3.00. This course is designed to help students a) Learn about the development of international accounting movements and implications in a globalized financial market; b) Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS); c) Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event; d) Learn to cope with differences in financial measurement, recognition, and reporting practices; and e) Enhance the students' communication skills. The course should also contribute to the requisite background required for professional examinations such as CPA and to become prepared for a long-range successful accounting, auditing, and/or managerial career.

Learning Outcomes: 1. Learn about the development of international accounting movements and implications in a globalized financial market. 2. Develop the ability to read and interpret the financial statements of companies that are prepared in accordance with International Financial Reporting Standards (IFRS). 3. Emphasize the importance of professional judgment in international accounting when assessing different accounting treatments for the same event. 4. Learn to cope with differences in financial measurement, recognition, and reporting practices. 5. Enhance the students' communication skills. Credits: 2.00 or 3.00

MGMT 63350 - Accounting Data Analytics

Credit Hours: 2.00 or 3.00. The skill set that accountants have needed to perform math and to keep order has evolved from pencil and paper, to calculators, and then to spreadsheets and accounting software. A new skill set that is becoming more important for nearly every aspect of business is that of big data analytics: managing large amounts of data in the database, analyzing them and finding actionable insights and visualizing the results. This course is designed to help accounting students develop an analytical mindset and prepare them to use data analytic programming languages and software like Python, SQL, and Tableau.

Learning Outcomes: 1. Understand the basic syntax and semantics of the Python language. 2. Understand the primitive data types build into Python. 3. Understand the key data visualization principles and techniques. 4. Apply data visualization principles and techniques to real-world business problems. 5. Critically evaluate the design and presentation of complex data or concept. 6. Design innovative static and interactive visualizations to effectively present information and enable data exploration. 7. Analyze a business situation to determine information management needs. 8. Design a database to address those needs. 9. Write SQL queries to retrieve information from a relational database. Credits: 2.00 or 3.00

MGMT 63400 - Business Law For Accountants

Credit Hours: 2.00 or 3.00. This course is designed to help prepare students for their professional careers by familiarizing them with aspects of the law that are directly relevant to the practice of accounting. These topics are not only at work every day in business but are also tested on professional examinations such as the Uniform Certified Public Accounting (CPA) Exam. Specific topics include, but are not limited to, contract law, relevant provisions of the Uniform Commercial Code, bankruptcy, and the legal liability of accountants. The course will be taught through a mixture of lectures and class discussions. Students are expected to come to class having completed the assigned readings and ready to participate in class discussions.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate the ability to apply legal rules and principles to business transactions and the accounting for them. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of business ethics and social responsibility as it relates to the legal aspects of business transactions and reporting. 3. Develop awareness and understanding of global issues relating to financial reporting, tax accounting and business decisions: Students will be able to demonstrate an understanding of international business law and cyber law, both of which affect financial reporting and tax accounting. 4. Develop effective written and oral communication skills: Students will be able to demonstrate effective oral communication skills through class participation and effective written communication skills through the development and writing of a research paper. Credits: 2.00 or 3.00

MGMT 63410 - Communications For Accountants

Credit Hours: 2.00. Accountants spend much of their time designing and writing reports, memos, etc. and explaining those communications to others. They communicate regularly with external investors and creditors, regulators, clients and fellow professionals. This course is designed to help accounting students prepare for their professional careers by helping them develop their written and oral communication skills. The course begins with an overview of the writing process and then moves to document organization and design and how to write with conciseness and clarity. The last half of the course focuses on specific forms of written communication (e.g., letters, memos, reports, email, essays on professional exams) and oral presentations.

Learning Outcomes: 1. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of ethical communication as it relates to accounting-related issues. 2. Develop current business technologies and use common business technology and software in essential tasks: Students will study the appropriate and professional use of social media and electronic and written communication mediums in a business setting. 3. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class assignments and the writing and presentation of a team paper. 4. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a report on a pre-specifies accounting topic. Credits: 2.00

MGMT 63450 - Financial Statement Analysis And Valuation

Credit Hours: 2.00 to 3.00. This course is designed to prepare students to become intelligent financial statement users. Understanding how market participants use financial statements will assist professionals in their primary tasks of creating and communicating financial information to these individuals.

Learning Outcomes: 1. Identify certain adjustments that are required by financial

analysts when assessing firms. 2. Demonstrate an adequate understanding of complex financial statement analysis and valuations procedures. 3. Develop reports that discuss the adjustments necessary to provide an accurate assessment of firms' income-generating abilities, as well as reports that encompass various valuation techniques commonly used in practice. Credits: 2.00 to 3.00

MGMT 63550 - Accounting Consulting For Entrepreneurship

Credit Hours: 2.00 or 3.00. This course is an experiential learning experience that is part of the Experiential Learning Initiative in the Krannert School of Management. The main goal of the course is to provide various accounting services to STEM start-up companies which are based on Purdue's innovations (www.purduefoundry.com) and to established companies in the bigger corporate world. At the same time, we also would like to give our students the opportunity to apply their acquired classroom knowledge and have them exposed to some real-world accounting problems that start-up or established companies typically experience. Our students are expected to provide various accounting support services that are related to financial accounting & reporting, managerial accounting, business planning, and/or tax issues. The format of the course is very open. The first four weeks will be spent in a classroom setting, with presentations on how to professionally manage a client relationship and how to successfully tackle projects in a challenging STEM start-up and/or established corporate environment. Each project will be completed by teams of 3-5 students, which will be formed at the beginning of the semester. After the initial classroom sessions, the project teams will be on their own, with faculty guidance, running the engagement. The teams will meet with the clients to determine their needs and expectations. The students will do the work and deliver the output including a final presentation to the client.

Learning Outcomes: 1. Provide various accounting services to STEM start-up companies which are based on Purdue's innovations (www.purduefoundry.com) and to established companies in the bigger corporate world. Credits: 2.00 or 3.00

MGMT 63610 - Business Ethics

Credit Hours: 2.00. This course is designed to move past a surface-level understanding that we need to act ethically in the business environment to wrestling with what does that look like and what frameworks can help us do just that. I also firmly believe that we have to prethink our decisions before we are confronted with opportunities to compromise ethically. We will incorporate current headlines to our evaluation of major ethical lapses of the past.

Learning Outcomes: 1. Describe, list, differentiate, and utilize a set of frameworks/theoretical approaches to ethics and apply those approaches to concrete problems/cases. 2. Assemble the ethical concepts through effectively writing and speaking about business ethics by paraphrasing and describing the concepts in your own words. 3. Respond to questions in online discussions to develop and integrate business ethics in real-world cases. 4. Develop your ability to effectively write and speak about business ethics by paraphrasing and describing the concepts in your own words. 5. Integrate business stakeholder analysis through real-world cases to increase your awareness of the ethical responsibilities that exist between a business and its stakeholders. 6. Use business ethics and apply to real-world cases by thinking critically about our own responsibilities as economic agents (as workers, managers and consumers) and as citizens. 7. Summarize and use a set of frameworks/theoretical approaches to ethics and apply those approaches to concrete problems/cases. 8. Summarize Crisis Communications and integrate ethics into related case studies. Credits: 2.00

MGMT 63650 - Accounting Ethics

Credit Hours: 3.00. This course is designed to introduce students to the foundational elements underlying ethics and ethical behavior, with an emphasis on ethical issues facing professional accountants. The course will provide students with a framework of ethical reasoning, professional values and attitudes for exercising professional skepticism, and other behavior that is in the best interest of the public and accounting profession. The course will also review the core values of integrity, objectivity, and independence as well as rules of professional conduct. This course uses real-world case studies and practical hands-on applications in order to enhance the

student's ability to recognize ethical dilemmas and overcome them with sound ethical decision-making. Illinois Board of Examiners ethics course required to apply for taking the Uniform CPA Examination.

Learning Outcomes: 1. Summarize the importance of ethics and ethical reasoning to professional accountants through explaining various ethical models. 2. Paraphrase and implement the core values of integrity, objectivity and independence, the backbone of the accounting profession. 3. Implement the rules of professional conduct included in the AICPA Code of Professional Conduct and TSBPA ethics rules to various case studies from a CPA Exam perspective. 4. Identify situations that might be unethical or a violation of professional standards, perform research and consultations as appropriate, and determine the appropriate action. 5. Recognize potentially unethical behavior of clients and determine the impact on the services being performed. Credits: 3.00

MGMT 63750 - Advanced Taxation

Credit Hours: 2.00 or 3.00. This course is directed at students who wish to learn more about the taxation of business entities beyond the basic principles taught in MGMT 504 Introductory Tax Accounting or an equivalent course. The course will cover broad topics such as tax law sources and tax research; the tax advantages and disadvantages of various business entities as well as how entrepreneurs may choose the optimal entity for tax purposes; taxable and nontaxable methods of mergers, acquisitions, and divestitures; fundamental concepts of consolidated tax returns for C Corporations; and the accounting for income taxes under ASC 740.

Learning Outcomes: 1. Describe various tax planning procedures. 2. Identify the tax law sources and assess the authoritative weight of each. 3. Conduct basic tax research using RIA Checkpoint and communicate results. 4. Understand the basic tax treatment of major operational events for sole proprietorships, partnerships, S Corporations, and C Corporations. 5. Identify the optimal business entity for tax purposes. 6. Understand the basic types of taxable acquisitions of C Corporations and tax planning ideas. 7. Understand the basic types of nontaxable acquisitions of C Corporations and tax planning ideas. 8. Understand the basic types of corporate divestitures and tax planning ideas. 9. Understand fundamental concepts of consolidated tax returns for C Corporations. 10. Calculate a corporation's income tax provision under ASC 740 and understand how to prepare the required financial statement disclosures. Credits: 2.00 or 3.00

MGMT 63800 - Pricing Strategies And Algorithms

Credit Hours: 2.00. The course enables participants to formulate a systematic framework for approaching the problem of pricing a product, and more generally, a product line. The concepts and analytical methods necessary to develop such a framework are explored and incorporate marketing, competitive, and legal aspects. The course will use a combination of lectures, case discussions and exercises. Prerequisite: MGMT 62000.

Learning Outcomes: 1. Adopt a systematic framework to approach the problem of pricing a product or service. 2. Understand various approaches to estimate value of a product or service to users. 3. Understand the tradeoff between price and sales volume and its relation to price elasticity. 4. Understand segmented pricing and psychological aspects of pricing. 5. Understand the implications of pricing in a competitive environment and the importance of price policy. 6. Appreciate pricing issues when selling through an intermediary. 7. Be introduced to legal aspects of pricing. Credits: 2.00

MGMT 63850 - Public Company Reporting And Regulation

Credit Hours: 2.00 or 3.00. This course introduces students to the Securities and Exchange Commission's (SEC) rules and regulations as they apply to U.S. companies and their auditors. Requirements for frequently encountered annual reporting responsibilities (e.g., Forms 10-K, 10-Q, 8-K, proxy statements,

etc.) and registration statements are explored and analyzed. Actual SEC filings provide real-world applications and interpretation of the SEC's rules. Rules imposed by the primary U.S.-based stock exchanges are introduced as is the history of the SEC and current trends affecting this rule-making body. Additionally, this course encompasses the enforcement power of the SEC and its implications to companies, their officers, and accountants.

Learning Outcomes: 1. Identify the structure, mission, and limitations of the SEC and key securities laws and statutes impacting U.S. companies and their external auditors. 2. Demonstrate an understanding of the Securities Acts of 1933 and 1934 and The Public Company Accounting Reform and Investor Protection Act of 2002 by identifying required disclosures and associating them with the specific rule requirements. 3. Research specific topics including emerging issues by using online resources supported by the SEC and the stock exchanges. Credits: 2.00 or 3.00

MGMT 63900 - Advanced Auditing And Audit Analytics

Credit Hours: 3.00. This course is designed to help students prepare for their professional careers by strengthening their understanding of the CPA's attest function and familiarizing them with current assurance issues. After finishing the course, students should understand the current state of the Enterprise Risk Management and tools for risk evaluation, be able to identify best practices related to external audit, be prepared to manage an audit group, understand the key aspects of being an audit consultant and be able to work with all levels of internal and external audit professionals. Throughout the course, students will have opportunities to improve their written and oral communication skills, particularly as they relate to communication in the audit setting. The course will also emphasize the impact of recent and current regulatory actions, including the Sarbanes-Oxley Act of 2002, on the audit profession. Prerequisite: MGMT 50600 with a minimum grade of C.

Learning Outcomes: 1. Achieve depth of understanding and application of essential content in business functional areas: Students will be able to demonstrate an understanding of how U.S. audit and securities market regulations affect an audit. They will also use their statistical training in audit planning and evaluation as well as risk assessment. 2. Become familiar with the ethical issues that individuals face in organizations: Students will be able to demonstrate an understanding of ethics as it relates to audit and external reporting. 3. Develop current business technologies and use common business technology and software in essential tasks: Students will use spreadsheets and auditing software in case analyses and assignments. 4. Students will develop effective written and oral communication skills: Students will be able to demonstrate effective oral and written communication skills through class participation and the writing and presentation of a team paper. They will also demonstrate effective written communication skills through case write-ups. 5. Achieve depth of understanding and applications of financial reporting: By deepening their understanding of the audit process and techniques and by working through case studies focused on particular reporting and auditing issues, students will develop and demonstrate a deep understanding of reporting regulations and rules. 6. Develop the leadership and teamwork skills to function effectively in a diverse cross-functional environment: Students will demonstrate their leadership and teamwork skills by effectively working as a team to produce and present a research paper on business and audit risks in a specific sector. Credits: 3.00

MGMT 63901 - London Trip For IASB

Credit Hours: 2.00 or 3.00. This is an experiential study abroad class with workshops held at the International Accounting Standards Board (IASB) as well as at one of the leading universities in the UK. In addition, students will visit public multinational companies and/or accounting firms in the Greater London area, UK.

Learning Outcomes: 1. Understand the IASB institution, its role, and its relationship to

national standard-setting bodies. 2. Understand the IFRS standard-setting process, and be able to develop a new standard based on the IFRS conceptual framework. 3. Understand how standards are applied by multinational companies and be able to interpret standards given more complex situations and events. 4. Understand the enforcement process related to international accounting standards. 5. Gain a deeper understanding of the political impact on accounting standard-setting. Credits: 2.00 or 3.00

MGMT 63902 - Accounting And Public Policy

Credit Hours: 1.00 or 2.00. This course offers students an intensive, distinctive, personal and professional development experience, addressing critical public policy institutions, issues, and trends affecting the profession of accounting. Over 3 days in Washington, D.C., participants meet with and gain a greater understanding of the role of regulatory agencies such as the Public Company Accounting Oversight Board and the Securities and Exchange Commission. Participants also have meetings and discussions with organizations governing the accounting profession, such as the American Institute of Certified Public Accountants and the Center for Audit Quality, as well as more informal but important organizations such as trade associations and think tanks. The course often includes visits with members and staff from Congress and officials from the Executive Branch to understand their institutional roles in governing the profession. These meetings include discussions of the relevant tax, securities, commodities, and oversight committees in Congress, for example. Within the Executive Branch, discussions typically include the operations of forensic accounting and compliance within agencies such as the U.S. Treasury and Internal Revenues Service and the Federal Bureau of Investigation. Participants also gain practical insights into the strategic role of government relations, as well as the role of public policy lobbying and advocacy by the overall profession and individual firms, regarding issues that affect them and their clients. Other topical sessions often include discussions of cybersecurity policy, tax policy, and other topics relevant to the profession and key clients.

Learning Outcomes: 1. Will provide students an intensive, distinctive, personal and professional development experience, addressing critical public policy institutions, issues, and trends affecting the profession of accounting. Credits: 1.00 or 2.00

MGMT 63910 - Accounting For Managers

Credit Hours: 0.00 or 1.00. Accounting is the language of business. Understanding financial accounting enables professionals inside the firm to communicate with external users. In this course you will be introduced to financial accounting, which focuses on the reports that are generated to provide external users information about a firm's financial position and operational effectiveness.

Learning Outcomes: 1. Describe the financial statements and the parties involved in the production and use of financial statements. 2. Analyze the key principles used in financial accounting. 3. Analyze the process of preparing financial statements. 4. Evaluate how managers' choices and estimates shape financial statements. Credits: 0.00 or 1.00

MGMT 64000 - Financial Modeling

Credit Hours: 2.00 or 3.00. This course provides an introduction to financial modeling using computer applications. The first part of the course covers how to use Microsoft Excel to analyze historical and pro forma financial statements, stock return data, linear regression analysis, Monte Carlo simulations, Pivot Tables and also covers many advanced functions within Excel. The second part of the course provides an introduction to using SAS to analyze financial data and more advanced regression techniques. Prerequisites: MGMT 61000 (Note: Students who have not taken MGMT 61000 may enroll with instructor permission).

Learning Outcomes: 1. Gain experience using Excel to solve complex problems and build financial models. 2. Learn how to use Excel and other software to build, test and run regression analysis with financial data. 3. Provide an introduction to using SAS for analyzing financial data. 4. Learn how to implement Monte Carlo simulations using Excel for financial applications. Credits: 2.00 or 3.00

MGMT 64100 - Options And Futures

Credit Hours: 2.00 to 4.00. Rigorous and applied coverage of the pricing and hedging of options and futures contracts with applications. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64200 - Portfolio Management

Credit Hours: 2.00 to 4.00. Methods of analysis of common stocks and bonds for individual and institutional portfolios. Review of the empirical evidence of security market efficiency, and implications of that evidence for various methods of security analysis. Team projects to analyze the economy, the particular industry or sector, and selected firms within the industry or sector, and to make specific buy-hold-sell recommendations for the stocks and bonds of those firms. Prerequisite:MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64300 - Financial Risk Management

Credit Hours: 2.00 to 4.00. Provides a foundation for understanding ways in which financial institutions and industrial firms can optimally manage financial risks. Concentrates on various "functional" risk measurement problems related to interest rate risk, default risk, exchange rates, and commodity prices. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64400 - Venture Capital And Investment Banking

Credit Hours: 2.00 to 4.00. Examines the process of corporate value creation through financial policy choices. The sequence of topics roughly parallels the life cycle of a typical corporation. Begins by studying the financing of entrepreneurial companies. Then studies the investment banking and capital acquisition process employed for public securities issues. Also examines capital acquisition and reorganization decisions, such as the use of hybrid securities like convertible debt and PIPEs, project financing bankruptcy reorganizations, and equity structurings. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64500 - Mergers, Acquisitions, And Corporate Control

Credit Hours: 2.00 to 4.00. Focuses on firms' internal governance structures and on pressure from the external market for corporate control, including executive compensation, board of directors' composition, shareholder activism, mergers, and takeovers. Prerequisite: MGMT 61000 .

Credits: 2.00 to 4.00

MGMT 64700 - Financial Engineering

Credit Hours: 2.00 or 3.00. The objective of this course is to provide students with the necessary skills to value and hedge a wide variety of derivatives contracts used in financial markets. The main tool of analysis of the course is stochastic calculus set in continuous-time. Some basic knowledge of stochastic processes would be helpful, but not essential: we will cover what we need in class. The course covers valuation of securities using modern martingale methods as well as the necessary parameter estimation and numerical methods such as Monte Carlo simulations. Applications will include derivatives such as options on stocks, bonds and currencies, as well as valuation of defaultable securities, and modeling the term structure of interest rates and risk management with Value-at-Risk. Prerequisites: MGMT 61400, or similar coursework with instructor permission.

Learning Outcomes: 1. Value and hedge commonly traded financial derivatives. 2. Understand the underlying economic determination and behavior of financial derivatives. 3. Design and structure such financial derivatives. Credits: 2.00 or 3.00

MGMT 65000 - Strategic Management I

Credit Hours: 2.00 to 4.00. Concepts and methods that integrate previous training in functional areas of management. The perspective is that of the general manager charged with directing the total enterprise. Emphasis is given to formulation and implementation of strategy. Prerequisite: MGMT 61000 , MGMT 62000 , Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 65200 - Entrepreneurship

Credit Hours: 0.00 to 3.00. Examines entrepreneurship with a focus on the start-up process for high growth new ventures. Cases will be used, and students will conduct a feasibility analysis of a new venture concept. Prerequisites: MGMT 61000 and MGMT 62000. Concurrent Prerequisites: MGMT 65000.

Learning Outcomes: 1. Learn how to sketch out a possible business idea and "pitch it" to gain team members and participants. 2. Develop a business model and learn the advantages of bootstrap financing vs venture capital financing for new ventures. 3. Describe a value proposition of a business plan and show the current valuation. 4. Learn how to write a Business Plan. Credits: 0.00 to 3.00

MGMT 65210 - Organizational Development And Consulting Rewards

Credit Hours: 2.00. The course will describe techniques for diagnosing organizations and interventions for improving organizations. Specific interventions will be examined in detail including structural interventions (e.g., organizational design, job design), interpersonal process interventions (e.g., process consultation, team building), and human resource interventions (e.g., performance management, career development). The course will attempt to both build knowledge and provide practice in the various techniques.

Learning Outcomes: 1. Understand the basics principles of the theory and practice of OD. 2. Gain familiarity with the different types of OD interventions, including detailed real-world examples. 3. Introduce the specific OD techniques (or methodologies) and get practice applying some of the techniques. 4. Appreciate the importance of an OD practitioner perspective in understanding and implementing OD. Credits: 2.00

MGMT 65310 - Human Resource Systems

Credit Hours: 3.00. An overview of selected human resource activities/systems for the future human resource professional. Emphasis will be placed on building skills in areas that will provide a foundation for future coursework in human resources management. Topics covered include planning and forecasting human resource needs, job analysis, design and evaluation of training systems, design of performance appraisal systems, and safety and health in the workplace.

Learning Outcomes: 1. Develop a strong value for HRM knowledge generated from research (i.e., "evidence-based management") and its potential for contributing to improving the quality of contemporary human resource management activities. 2. Develop an appreciation for the organizational environment in which HRM activities occur, and an understanding of the effects of that environment on such activities. 3. Demonstrate an understanding of relevant professional and legal standards in developing, implementing, and evaluating HRM functions. 4. Understand and apply fundamental principles and techniques related to HRM activities. 5. Evaluate the strengths and weaknesses of the primary tools and principles employed in HRM. 6. Improve writing, critical thinking, and discussion skills through course activities. Credits: 3.00

MGMT 65330 - HR Strategy

Credit Hours: 2.00 to 3.00. Survey of theory and techniques used in human resource management within organizations. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Learning Outcomes: 1. Understand the history of human resource management and how it has evolved to the strategic level. 2. Understand what strategic Human Resource Management means and entails. 3. Understand and complete a Human Resource Management Strategic plan. 4. Make yourself an invaluable resource to upper level management and the CEO by demonstrating the extreme importance and value of Strategic Human Resource management. Credits: 2.00 to 3.00

MGMT 65340 - Staffing Tools

Credit Hours: 2.00. Provides an in-depth analysis of the methods used in staffing and selection processes. Methods used to evaluate individuals as well as methods used to evaluate selection and promotion tools will be studied. Emphasis on the processes of designing, administering, revising, and evaluating selection programs that comply with government regulation as well as add value to the organization. This course is designed for the future HR professional. Concurrent Prerequisite: MGMT 65310 or STAT 51200 .

Learning Outcomes: 1. Understand the staffing systems at both practical and theoretical levels, including the basic scientific concepts. 2. Gain familiarity with the common methods, tools, and techniques in staffing. 3. Develop hands-on skills in using some of these staffing methods and tools. Credits: 2.00

MGMT 65350 - Staffing Systems

Credit Hours: 2.00. Examines all aspects of the staffing process beginning with applicant recruitment and ending with termination and outplacement. Emphasis on building skills that the general manager will need to evaluate, design, and implement these

activities. Designed for the future manager, as well as the future HR professional. Topics will be addressed from an individual perspective, as well as an organizational perspective. Prerequisite: OBHR 63100 or OBHR 63300 or MGMT 65310.

Learning Outcomes: 1. Understand the staffing systems at both practical and theoretical levels. 2. Gain familiarity with the common methods, tools, techniques, and strategies in staffing. 3. Develop hands-on skills in using some of these staffing methods and tools. Credits: 2.00

MGMT 65370 - Industrial Relations II

Credit Hours: 2.00. An examination of union-management relations topics that build on material addressed in OBHR 640. Topics include causes of strikes, impasse resolution techniques, grievance and arbitration procedures, public sector labor relations, labor-management cooperation, and international labor-management relations. Emphasis is on how changes in the competitive environment have created the need for changes in the traditional union-management relationship. Films, cases, exercises, and guest speakers are utilized. Prerequisite: OBHR 64000 or MGMT 65360.

Learning Outcomes: 1. Identify the various forms of alternative dispute resolution techniques, such as mediation, arbitration, and peer review, as utilized in both the private and public sectors. 2. Demonstrate understanding of key concepts from the course such as why workers join unions, the usefulness of the strike, how industrial relations works in the unionized sector versus in the employment at will sector of the economy, etc. 3. Outline the labor management relationship in a major industry such as airlines, health care, entertainment, etc. showing understanding of the past, present and future of industrial relations in that sector. 4. Develop the ability to think critically about the major issues that face unions and management as we move into the middle part of the century. 5. Develop the ability to critically evaluate the positions of labor and management on key issue such as recent Supreme Court decisions like Janus, the factors that should be utilized in making promotion decisions, just cause for discharge, etc. Credits: 2.00

MGMT 65380 - Compensation And Reward Systems

Credit Hours: 3.00. The first course in a two-course master's-level sequence focusing on the use of rewards to achieve organizational objectives. Special emphasis is given to compensation as a particularly salient reward. Designed for HR professionals, the course examines the relationship between rewards and organizational characteristics to achieve effective reward practices. Lectures, discussions, case studies, and guest speakers are used to build competence in job evaluation, skill-based pay, and setting pay levels. Prerequisite: OBHR 63100 or OBHR 63300 or MGMT 65310, MGMT 67100 or STAT 51200.

Learning Outcomes: 1. Learn the current state of compensation decision-making. 2. Develop knowledge and skills in making evidence based compensation decisions. 3. Learn how compensation systems relate to business strategies, human resources systems, and other organizational processes. 4. Build competence in measuring and valuing work, the design of pay structures, and market-pricing systems. Credits: 3.00

MGMT 65390 - HR Analytics

Credit Hours: 2.00 to 3.00. This course provides an introduction to the field of HR analytics. HR Analytics is an advanced set of data analysis methodologies, tools and metrics for comprehensive workforce performance measurement and improvement. The objective of HR analytics is to drive evidence-based decisions and action in the workplace. In addition to your instructor, you may hear from expert practitioners and corporate leaders who have "been there and done that" leveraging a myriad of HR analytics along the way. We will also review (and hopefully expand) your understanding of handling data including conceptualizing models, identifying key metrics, collecting data, analyzing data, and presenting data in ways that tell a powerful story. Throughout our course, I will infuse consulting concepts, methodologies, and lessons learned that combined with your analytic skills will help you to effectively serve as an HR Business Partner (internal HR consultant).

Learning Outcomes: 1. Understand how organizations use HR analytics to address business problems, support business decision making and drive business outcomes. 2. Become familiar with methods and processes to

design, define and execute workforce research projects in a consulting capacity leveraging consulting models and methodologies and enhancing project management capabilities. 3. Learn how to approach and apply HR analytics methodology. 4. Understand current HR analytics practices, tools and emerging trends. Credits: 2.00 to 3.00

MGMT 65420 - Leadership

Credit Hours: 1.00 to 3.00. Examines organizational leadership responsibilities, forms of leadership, the acquisition, use, and consequences of power, critical leader skills, and how corporate environments shape leadership. Emphasis on self-discovery and development of managerial leadership knowledge and skills.

Learning Outcomes: 1. Increase conceptual understanding of key leadership principles and strategies utilized within formal organizations. 2. Have deepening knowledge regarding important interpersonal relationship skills and abilities. 3. Help students discover important insights into oneself as a leader (including strengths and weaknesses/opportunities for personal growth). Credits: 1.00 to 3.00

MGMT 65430 - Negotiations In Organizations

Credit Hours: 1.00 to 3.00. Decision making examines organizational context, stages, creativity, biases, and group processes. Negotiations examine strategies for preparing and conducting negotiations. The principal focus is on individual and interpersonal aspects of each. Permission of department required.

Learning Outcomes: 1. Understand the basic components of business negotiations through reading and completing assignments based on the textbook chapters. 2. Learn the basic components of a negotiated contract by completing a business transaction in written form. 3. Attain pragmatic negotiations skills using the I-Message method for daily activities encompassing negotiation tactics and the Verbal Skills method for more sophisticated negotiations for a major business transaction. 4. Explore cultural differences in negotiations by completing a study of practice in two countries other than the U.S. and sharing results with other students to expand their cultural knowledge base. 5. Explore and practice alternative dispute resolution techniques including mediation and arbitration. 6. Demonstrate the negotiations skills they are attaining by participating in class role-plays and by completing a final major negotiation in class. Credits: 1.00 to 3.00

MGMT 65440 - Change Management

Credit Hours: 2.00. The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, in your work teams and in organizations. This course is taught in an executive style format, intended for working future managers with emphasis on knowledge application and experiential learning.

Learning Outcomes: 1. Understand how classic and contemporary change models can be used to create and sustain change in individuals, teams, and organizations. 2. Understand how micro-level barriers to change are often overlooked, and how to overcome them. 3. Learn to influence others when holding them accountable so that they choose to change. 4. Understand fundamental sources of power and how they can be appropriately used to influence others to change. 5. Understand how and when to utilize different leadership to lead change, and how to anticipate blind spots to be more influential. 6. Understand how individual differences within teams impact effectiveness and change. 7. Apply program materials to create a personal leadership development plan, and learn how to avoid regression to the status quo. Credits: 2.00

MGMT 65450 - Human Capital Consulting

Credit Hours: 2.00 or 4.00. Working in a team setting, this course provides real-life experience consulting with an

organization to solve a real business problem. The focus is on human capital or human resource-related problems. Students work with a client to define the scope of their engagement, identify needs, conduct outside research (benchmark, market analysis), develop solutions, and identify key deliverables. The project culminates with an executive summary presentation with tangible recommendations to the client's senior leadership. This experience prepares students to serve as an HR Business Partner (HRBP).

Learning Outcomes: 1. Identify problems and generate & offer solutions to problems. 2. Conduct benchmarking and other external market analysis. 3. Develop the professionalism and influence skills needed to credibility influence an executive audience. 4. Demonstrate credibility through written and oral presentations. Credits: 2.00 or 4.00

MGMT 65460 - Talent Acquisition

Credit Hours: 2.00 to 3.00. This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions, and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Learning Outcomes: 1. Design a talent acquisition program in order for an organization's talent to be its competitive advantage. 2. Design a workforce implementation plan and a process to identify issues and continuous refinement of the plan. 3. Create a Recruiting plan that is focused on both external and internal candidates. 4. Design a process for final candidate evaluation. 5. Develop strategies to orient and onboard newly acquired talent. Credits: 2.00 to 3.00

MGMT 65470 - Talent Management

Credit Hours: 2.00 to 3.00. This course focuses on the employer-employee relationship and how managers work with employees to improve their performance. Attention is given to Talent, Talent Management, and Performance Management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing talent. Various definitions of Employee Engagement will be explored, along with how it is, measured, and why it is so important to your organization. Finally, various methods to engage employees in the organization will be studied.

Learning Outcomes: 1. Define talent and talent management. 2. Determine talent management strategies to support an organization's objectives and goals. 3. Evaluate talent management models to address organizational needs. 4. Develop and integrate a talent management system into organizations. 5. Define critical elements of a successful performance management system. 6. Identify methods to promote and maintain an engaged workforce. Credits: 2.00 to 3.00

MGMT 65480 - Total Rewards

Credit Hours: 2.00. This course examines how organizations can optimize financial and relational returns to gain and sustain a competitive advantage in a global environment. We will use theory and cases to develop a sound understanding of the compensation system.

Learning Outcomes: 1. Understand compensation systems and how they can be a catalyst for change and to help organizations execute their business strategies. 2. Know how to attract, engage, and retain top talent effectively. 3. Apply practical management tools for sustaining competitive advantage. 4. Develop technical compensation skills to design pay structures and market pricing systems. 5. Comprehend the importance of rational returns for employees and the role it plays in employee development. Credits: 2.00

MGMT 65500 - Competitive Strategy

Credit Hours: 2.00 or 3.00. Examines how firms obtain and sustain superior returns through the development and implementation of a competitive strategy at the business-unit level. Focus is on strategies that develop and exploit two sources of superior returns: unique value-creating resources (e.g., patents, brand equity, operational capabilities), and powerful positions in markets and supply chains. Participants are expected to be familiar with basic competitive strategy

concepts and tools, such as "five-forces analysis", the value chain, and generic strategies. Presents a more analytical perspective of strategy, drawing from game theory. Prerequisites: MGMT 65000.

Learning Outcomes: 1. Learn how to analyze differential competitive positions. Establish the source of advantage in terms of competitive position and resources firms may have. Use case analysis and discussion to do so. 2. Identify the means of disrupting incumbent positions with entry or deter entry through pre-emption of competitive position or key resources by incumbents. Also consider mechanisms for incumbents to reduce the success of entrants by adopting some aspects of entrants offering. Project scenarios in which entrants can be successful and also identify scenarios in which incumbents will respond aggressively. Project pricing and financial outcomes of these choices for entrant and incumbent. 3. Understand the competitive dynamics of business ecosystems. Identify the drivers of success in these ecosystems by articulating the network effects associated with different offerings within an ecosystem. Credits: 2.00 or 3.00

MGMT 65700 - Manufacturing Strategy And Process Innovation

Credit Hours: 2.00. In recent years many firms have rediscovered manufacturing and operations as a potential source of strategic advantage. In general, these firms have sought to develop capabilities in operations which provide a sustainable advantage in the marketplace. In addition, successful firms have developed processes for understanding the cross-functional implications of product and process choices. In this course, we will seek to understand the circumstances under which particular operating capabilities are most beneficial and how such capabilities can be developed so that operations can be exploited for competitive advantage. Concurrent Prerequisite: MGMT 61000, 65000, 66000.

Learning Outcomes: 1. Identify a fit between Competitive Priorities and Operational Choices by showing how such a fit is accomplished in case analysis and write-ups and understanding pressures to change competitive priorities or operational choices. 2. Establish how capabilities emerge over time and enable a trajectory of competitive advantage by showing how capabilities create options to change tradeoffs in competitive priorities in case analysis and write-ups and identifying financial implications of pursuing one competitive priority vs another. 3. Use financial analysis and discussion of capabilities to argue for investment choices in case analysis. 4. Understand benefits of different approaches to supplier alliances. Consider tradeoffs in governance cost, production cost, long term efficiency and responsiveness in arms length, vertically integrated, and third way supplier partnerships in case analysis. Credits: 2.00

MGMT 65730 - Technology Strategy

Credit Hours: 2.00 or 3.00. In today's business environment, it is increasingly apparent that business success is driven by a firm's ability to create and capture value through technology and innovation. Thus, the processes used by firms to develop new technologies, the choices they make regarding how to commercialize their technical knowledge, and the strategies they used to position and build a dominate competitive position all are important issues facing the firm. This course seeks to develop tools for understanding industry evolution with respect to new technology, forecast technological change, and understand the basis for technology in competitive advantage. We take an in-depth look at how technological innovation affects the competitive dynamics of markets, how firms can strategically manage these dynamics, and how firms can create and implement strategies to maximize their likelihood of success. The course introduces tools, concepts, and analytical frameworks that will enhance your ability to define and analyze strategic problems that stem from innovation and technological change, and to identify sources of competitive advantage from both an industry and firm-level perspective. Permission of department required.

Learning Outcomes: 1. Assess the degree to which a firm or industry is subject to technological factors. 2. Evaluate the temporal dynamics of an industry, lifecycles and s-curves from both a technological maturity and adoption (installed customer base) perspective. 3. Design

firm strategies to capitalize on internal technological capabilities and external opportunities. 4. Formulate collaboration strategies and strategies for protecting innovation. Credits: 2.00 or 3.00

MGMT 65810 - Corporate Consulting Experiential Learning

Credit Hours: 1.00 to 4.00. This course is an engagement with an external firm to solve challenges within the business. Students work together on project teams that require a cross-functional and interdisciplinary perspective. Student mix is determined by project needs and qualifications. Projects are typically sponsored at a senior level of the organization and address enterprise-level issues and challenges of strategic importance. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in use of consulting skills. 2. Manage client meetings and expectations. 3. Set-up and manage project using project management skills and tracking. 4. Critique peer contributions and have the ability to discriminate between good and better performers. Credits: 1.00 to 4.00

MGMT 66000 - Introduction To Operations Management

Credit Hours: 2.00 to 4.00 (West Lafayette) 3.00 (Calumet, North Central). As goods and services are produced and distributed, they move through a set of inter-related operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management. The primary objective of the course is to provide an overview of this important functional area of business. Prerequisite: MGMT 67000 .

Credits: 2.00 to 4.00

MGMT 66100 - Management Of Operating Systems

Credit Hours: 1.00 to 4.00. A project course in which students are exposed to a variety of operations problems as they arise in a real world setting. The focus of the course is problem formulation, analysis, and proposal(s) of an implementable scheme for their resolution. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Gain an increased ability to identify and analyze issues in operations management. 2. Develop implementable solutions. 3. Enhance understanding of how specific projects relate to larger business goals. 4. Improve professional skills, including teamwork, client communication, and project management. Credits: 1.00 to 4.00

MGMT 66400 - Supply Chain Management

Credit Hours: 2.00 to 4.00. Continues the examination of the linkage between a firm's product-market strategy and the role of the operations (i.e., production) function initiated in MGMT 660. Topics include material requirements planning, production activity control, and just-in-time systems. Prerequisite: MGMT 66000.

Learning Outcomes: 1. Learn tools and methodologies to model and analyze supply chain processes. 2. Learn how to manage uncertainty and risk, both within the firm and across the supply chain. 3. Learn how to effectively coordinate supply chains using contracts. 4. Understand how companies have used the principles from this course to significantly enhance their competitiveness and to innovate business models. Credits: 2.00 to 4.00

MGMT 67000 - Business Analytics

Credit Hours: 2.00 to 4.00. Introduction to quantitative decision procedures under uncertainty. Applications of descriptive statistics, probability models, simulation models, interval estimates, and hypothesis testing to management problems. Managerial-oriented cases are used in instruction. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

MGMT 67200 - Advanced Business Analytics

Credit Hours: 2.00. Quantitative decision procedures under uncertainty applied to business problems. Basic concepts in econometrics and multivariate analysis are studied. Several managerial-oriented case studies are used to illustrate estimation, testing, and regression procedures. Master's student standing and Management majors only.

Learning Outcomes: 1. Review of Multiple Linear Regression. 2. Analysis of Variance

(ANOVA): A Regression Approach. 3. Qualitative Independent Variables. 4. Qualitative or Discrete Dependent Variables. 5. Univariate Time Series Models for the Mean. 6. Univariate Time Series Models for Volatility. Credits: 2.00

MGMT 67620 - Optimization For Data Analysis And Decisions

Credit Hours: 2.00 or 3.00. This course covers optimization theory and algorithms for data analysis and decision-making. The topics covered include polyhedral analysis, duality, first-order methods, relaxation techniques, and computational aspects of optimization. The course will use business applications to demonstrate usefulness of the methods.

Learning Outcomes: 1. Understand convex optimization theory. 2. Understand the use of optimization techniques with data analysis. 3. Code optimization algorithms. 4. Perform polyhedral analysis. 5. Utilize modern solvers and modeling paradigms to solve optimization problems. 6. Develop relaxations for nonconvex optimization problems. Credits: 2.00 or 3.00

MGMT 67700 - Seminar In Quantitative Methods In Management Research

Credit Hours: 3.00. Applications of quantitative methods of analysis to research problems in financial, marketing, and production management. Data processing and statistical inference in management research. Prerequisite: MGMT 67000, 67100, 67200.

Credits: 3.00

MGMT 68000 - Economic Analysis Of Technology Markets

Credit Hours: 0.00 to 3.00. The core models of microeconomics are fundamental to day-to-day management decisions. This course will cover economic models that describe firm production, pricing, entry/exit decisions, market efficiency, and welfare. Such economic models will be applied to the analyses of a variety of market conditions, including monopoly, oligopoly, and monopolistic competition. It will provide students with an understanding of the implications of economic theory on technology products, firms, markets, and consumers.

Learning Outcomes: 1. Be able to use economic models to analyze technology markets and make optimal managerial decisions. Credits: 0.00 to 3.00

MGMT 68200 - Digital Product Design

Credit Hours: 2.00. This course is a comprehensive exploration of designing digital products that can improve the quality of people's daily lives. It covers value creation with technology and a human-centered design process including improv brainstorming, storyboarding, interviewing, sketches, and selling. Students will learn how to ideate and how to iteratively refine ideas with real users. Students will consider factors driving technology product design decisions such as the unique economic characteristics of today's technology-intensive markets and their impact on strategic interactions among firms and consumers. Students will also learn to discover unmet user needs, reframe problematic situations, envision multiple possible product concepts, and assess their feasibility, viability, and desirability. The course culminates in the creation of a business model, a product sketch, and a plan for taking the product to market.

Learning Outcomes: 1. Apply digital business methods and digital information strategies. Credits: 2.00

MGMT 68300 - Technology-Driven Business

Credit Hours: 2.00 to 3.00. Digital technologies such as the Internet, IoT, and AI are rapidly and fundamentally transforming today's companies and industries. They have enabled completely new ways for companies to organize work, generate innovations, make decisions, and interact with customers, suppliers, and competitors. This course is designed for students who want to deeply analyze digital transformations and, more importantly, manage technology-driven businesses. Applying information economics principles and theoretical rigor, this course studies how digital technologies affect consumer behavior, business model innovations, market design, and competitive outcomes. This course trains students to apply data analytics skills to real business problems and develop a rich understanding of the strategic value of digital

transformations.

Learning Outcomes: 1. Develop analytical and quantitative skills to analyze and formulate business decisions. 2. Understand current business technologies and related knowledge to translate data into useful information for decision making. 3. Become familiar with the ethical issues that individuals face in organizations. 4. Develop effective written and oral communication skills. 5. Develop the leadership and teamwork skills to function effectively in a diverse, cross-functional environment. 6. Develop awareness of global and multicultural issues relating to business decisions. Credits: 2.00 to 3.00

MGMT 68700 - AI For Business Decisions

Credit Hours: 1.00 to 3.00. Leading-edge companies in every industry are relying on data and AI to replace intuition and guesswork in their decision-making. This course prepares students to understand how AI can be utilized to create value and a sustainable competitive advantage. It teaches the scientific process of using AI to transform data into predictions and insights for making better business decisions in a real-world setting. Upon completion, students should be able to identify and evaluate value propositions of AI advances, conduct successful AI implementations, and manage AI-driven digital transformations.

Learning Outcomes: 1. Design and present as a part of the project engagements that take into consideration human instincts and biases. 2. Understand and identify human instincts and biases that are useful for design considerations. 3. Break apart engagements into three parts: mechanics, dynamics, and aesthetics. Credits: 1.00 to 3.00

MGMT 68800 - Developing A Global Business Strategy

Credit Hours: 2.00 to 4.00. Provides an introduction regarding the business and strategy challenges faced by managers in our global economy, regardless of whether the firm is a small domestic company or a large multi-national. Major topics for the course include motivations and challenges of internationalization, international business fundamentals, foreign market entry strategies, organizing across countries, analyzing global industries, building competitive advantage in global industries, and the influence of culture and institutions. Prerequisite: MGMT 65000.

Learning Outcomes: 1. Understand the three foundation characteristics related to foreign market entry - firm, industry, and institutional factors. 2. Analyze country choice for entry and the factors involved in choosing a country. 3. Develop the essential skills to identify and pursue global business opportunities, with a focus on the different modes of entry. 4. Acquire the skills to resolve management decision problems in global markets, and analyze multi-country organizational structures. Credits: 2.00 to 4.00

MGMT 69000 - Advanced Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level.

Credits: 1.00 to 4.00

MGMT 69100 - Special Problems In Management

Credit Hours: 1.00 to 4.00. Advanced investigation in a specific management field at the graduate level. For students in the master's programs in management who are registered in the master's program summer session. Permission of instructor required.

Credits: 1.00 to 4.00

MGMT 69199 - Graduate Co-Op I

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by Business Career Services with cooperation from academic disciplines and participating employers. Permission of department required.

Learning Outcomes: 1. Have an increased ability to identify and analyze issues in operations management to develop implementable solutions. 2. Understand how specific projects relate to larger business goals. 3. Have improved professional skills, including teamwork, client communication, and project management. Credits: 0.00

MGMT 69200 - Managerial Communication Skills

Credit Hours: 1.00. Enhances student professionalism in managerial contexts by improving oral communication skills by developing strong oral presentation techniques.

Credits: 1.00

MGMT 69299 - Graduate Co-Op II

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by Business Career Services with cooperation from academic disciplines and participating employers. Permission of department required.

Learning Outcomes: 1. Have an increased ability to identify and analyze issues in operations management to develop implementable solutions. 2. Understand how specific projects relate to larger business goals. 3. Have improved professional skills, including teamwork, client communication, and project management. Credits: 0.00

MGMT 69399 - Graduate Co-Op III

Credit Hours: 0.00. Graduate cooperative education experience. Program coordinated by Business Career Services with cooperation from academic disciplines and participating employers. Permission of department required.

Learning Outcomes: 1. Have an increased ability to identify and analyze issues in operations management to develop implementable solutions. 2. Understand how specific projects relate to larger business goals. 3. Have improved professional skills, including teamwork, client communication, and project management. Credits: 0.00

MGMT 69410 - Communication And Persuasion

Credit Hours: 2.00. Business students are trained to be experts in turning data into information. With a strong focus on data visualization, the purpose of this course is to help students take the next step: Turning that information into action. This course will provide you with helpful frameworks for understanding your audience, insights about how people perceive information best, and practical skills to express your ideas in ways that connect. Permission from department required. Co-requisite: MGMT 69000 - Industry Practicum

Learning Outcomes: 1. Articulate personal brand via writing, speaking and interacting. 2. Explain data and analyses in ways that are concise and clearly understood by laymen without losing meaningful context or content (content delivery). 3. Demonstrate mastery at being data-driven by (a) translating data and analyses into a narrative that provides context for your message (storytelling) AND (b) creating informative, clutter-free data visualizations to support your message (content organization). 4. Make persuasive recommendations that convince decision-makers to adopt a particular belief or take a course of action. 5. Identify ethics and inclusion considerations in communication and persuasion. Credits: 2.00

MGMT 69600 - Theoretical Principles For Deep Learning

Credit Hours: 2.00 or 3.00. This course aims to expose you to one of the most active contemporary research directions within machine learning: theoretical principles for deep learning. Despite its undisputedly useful empirical breakthroughs, their understanding is still in many ways nascent. This course provides the latest theoretical aspects of deep learning and representation learning, accompanied by a mixture of reading group sessions and student projects. This is an advanced graduate course designed for master's and Ph.D.-level students and assumes a substantial degree of quantitative research background.

Learning Outcomes: 1. Demonstrate the deep learning algorithms and design deep neural networks which are more appropriate for various types of learning tasks in various domains. 2. Understand representation power and generalization of deep models, regularization, and hyperparameter selections. 3. Identify optimization for deep learning algorithms with observations on the landscape and explain the role of overparameterization. 4. Perform nonlinear feature selections in deep architectures. 5. Leverage your deeper theoretical understanding to produce rigorous solutions to real-world applications. Credits:

2.00 or 3.00

MGMT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Organizational Behavior and Human Resource Management (Graduate)

Website: **https://krannert.purdue.edu/academics/OBHR/**

Department/School Head

Ananth Iyer

Faculty by Rank (website)

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Academic Programs

Ph.D. Programs

Krannert Management Ph.D. Programs
Students collaborate with distinguished faculty on groundbreaking research in management and we believe that the ability to identify and analyze problems is the critical research skill; our program focuses on developing this expertise. Many of our alumni are leading scholars and educators, and our faculty serves as mentors to ensure you have the same opportunity to achieve. Our major goal is to prepare Krannert students for exceptional positions in teaching and research at universities, government service, research institutions, and other private organizations.

- Ph.D.

Concentrations (Areas of Study)

- Leadership and teams
- Work, family, diversity, and personal life
- Workplace fairness and justice
- Employee selection
- International Human Resources
- Stress and burnout
- Employer branding and recruitment
- Counterproductive work behaviors
- Workplace interventions, training, and employee engagement

Organizational Behavior and Human Resource Management, PHD

OBHR 59000 - Problems In Organizational Behavior And Human Resource Management

Credit Hours: 1.00 to 4.00. Advanced study and investigation in a field of organizational behavior and human resource management under the guidance of staff. Permission of instructor required.

Learning Outcomes: 1. Learning objectives vary due to nature of variable course content.

Credits: 1.00 to 4.00

OBHR 60500 - Research Methods I

Credit Hours: 3.00. An introduction to research methods. This seminar examines the use of research methods to develop empirical tests for theoretical and practical issues. It includes readings and discussions on the philosophy of science, reliability, validity, research design, threats to research, ethics, and other issues in research methodology. Students formulate hypotheses and an original research design to test their hypotheses.

Learning Outcomes: 1. Identify key decisions organizational researchers must make when crafting research proposals and conducting studies. 2. Demonstrate ability to generate a sound research proposal, based on course concepts and key research decisions discussed throughout the course. 3. Criticize the research methods employed in prior published works in

the organizational literature, comparing and contrasting exemplary versus less-than-exemplary approaches. Credits: 3.00

OBHR 60600 - Research Practicum

Credit Hours: 2.00 or 3.00. Independent empirical research in organizational behavior and human resource management, including the submission of a written report. Prerequisite: OBHR 60500 . Permission of instructor required.

Credits: 2.00 or 3.00

OBHR 64600 - Human Resource Information Systems I

Credit Hours: 2.00. Designed to gain an understanding of and appreciation for the use of information systems as a tool for managing human resources. The course will introduce and master, and then apply to HR problems, a set of topical hardware and software solutions. The class project, an HRIS consulting assignment with a major corporation, will commence. Prerequisite: MGMT 65310 .

Credits: 2.00

OBHR 65200 - Organizational Development And Consulting

Credit Hours: 2.00. Organizational development (OD) refers to the application of behavioral sciences knowledge and techniques to improve organizational effectiveness (e.g., productivity, quality, service, employee satisfaction, etc.). The course will describe techniques for diagnosing organizations and interventions for improving organizations. Specific interventions will be examined in detail including structural interventions (e.g., organizational design, job design), interpersonal process interventions (e.g., process consultation, team building), and human resource interventions (e.g., performance management, career development). The course will attempt to both build knowledge and provide practice in the various techniques. The course will not duplicate material in other current course offerings by this professor, and it will not require prior courses in human resources.

Learning Outcomes: 1. Learn about the theory and practice of OD. 2. Learn about different types of OD interventions, including detailed real-world examples. 3. Learn about specific OD techniques (or methodologies), and get practice applying some of the techniques. 4. Learn about the importance of an OD practitioner perspective in understanding and implementing OD. Credits: 2.00

OBHR 68100 - Managing Behavior In Organizations

Credit Hours: 2.00 to 4.00. Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures. Prerequisite: Master's student standing and Management majors only.

Credits: 2.00 to 4.00

OBHR 68300 - Individual Behavior In Organizations

Credit Hours: 1.00 to 3.00. This seminar provides an analysis of theory and research on individual and group behavior in organizations. Readings and discussion focus on motivation, attitudes and job satisfaction, employee participation and turnover, stress, leadership, group processes, and other issues.

Learning Outcomes: 1. Identify and define organizational behavior concepts. 2. Apply those concepts to improve your understanding of your own work attitudes and behaviors. 3. Apply those concepts to improve the functioning of your organizational unit. Credits: 1.00 to 3.00

OBHR 68400 - Research In Human Resource Management

Credit Hours: 1.00 to 3.00. Focuses on research methods, theories, and issues in HR management. A doctoral-level course designed for students interested in a research and teaching career in HR or organizational behavior. Objectives are to learn the primary theories and theoretical issues in each major area in HR, to learn the primary research methods and methodological issues, to attain a comprehensive reading list of the literature, to learn about publishing and the article review process, and to develop ideas for potential research projects.

Credits: 1.00 to 3.00

OBHR 69000 - Advanced Problems In Organizational Behavior And Human Resource Management

Credit Hours: 2.00 to 4.00. Advanced investigation in a specific organizational behavior or human resource field at the graduate level.

Credits: 2.00 to 4.00

OBHR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

College of Health and Human Sciences (Graduate)

Department of Health and Kinesiology (Graduate)

Website: **http://www.purdue.edu/hhs/hk/graduate/index.html**

Department/School Head

Timothy P. Gavin

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Adjunct Faculty	Emeritus Faculty	Clinical Professor	Lecturers
Bonnie Blankenship Tim Gavin Shirley Rietdyk Howard Zelaznik	Satyajit Ambike Steve Amirault Chad Carroll Laura Claxton Jeffrey Haddad Bruno Roseguini	Igor Fernandes Daniel Hirai Natasha Jaiswal Alvin Kao	Virginia Zinsmeister	D. Randall Black H. Dan Corbin Donald L. Corrigan Dale L. Hanson William A. Harper Larry Leverenz Roseann Lyle Dennis Miller Bruce J. Noble Darlene Sedlock Roger Seehafer Ray Anne	Scott Lawrance Jennifer Popp	Carol DeHaven - Senior
					Associate Cassandra Ledman Patrick Tutka Alice Wilcoxson	**Continuing** Joe Braden Adam Huffield Dan Ross
					Assistant Jason Chrapek Craig Voll	

				Shrader Paul G. Snider Thomas Templin William F. Theobald		

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Academic Programs

Masters and Ph.D. Programs

Purdue University's Department of Health and Kinesiology (HK) confronts issues related to health through research, student learning, and community engagement that focuses on athletic training, human movement, sports performance and management, exercise and fitness, and disease prevention. Utilizing a multidiscipline, team approach, Health and Kinesiology is a leader in faculty-led, student-centered education and research.

The Department of Health and Kinesiology offers three-degree programs:

• Master of Science in Athletic Training (MSAT)
• Master of Science (MS)
• Doctor of Philosophy (Ph.D.)

Concentrations (Areas of Study)

- Biomechanics, Motor Control, & Motor Development
- Exercise Physiology
- Exercise Psychology
- Recreation & Sport Management

Health and Kinesiology, PHD

Health and Kinesiology, MS

Athletic Training, MSAT

Health and Kinesiology/Gerontology, PHD

Sport Management, MSSM

HK 50000 - Introduction To Athletic Training Practice

Credit Hours: 3.00. This course covering the roles and responsibilities of an athletic trainer as well as the history, governance structure, and regulation of the athletic training profession. Instruction and practical application of taping, wrapping, bracing techniques, and protective equipment is also included. Permission of department required.

Learning Outcomes: 1. Identify and evaluate the role of the NATA, BOC, CAATE, Foundation, and state practice acts in athletic training governance and practice regulation. 2. Compare and differentiate the role of a certified athletic trainer and other professionals in the health care of patients and in the broader health care system. 3. Describe and critique safe athletic training practices (e.g. OSHA standards). 4. Evaluate the fundamental role of evidence-based practice as it relates to athletic training and its use in the clinical decision

making process. 5. Explain the theoretical foundation of clinical outcomes assessment (e.g., disablement, health related quality of life) and apply common methods of outcomes assessment in athletic training clinical practice (generic, disease-specific, region-specific, and dimension-specific outcomes instruments). 6. Analyze mechanisms of injury/etiology, recognition, and treatment associated with common injuries and illnesses. 7. Develop skills in adhesive taping and acute injury management. 8. Develop skills in protective pad fabrication and implementation. 9. Develop technical skills in the appropriate management of athletic medical emergencies. 10. Have a working understanding of athletic and medical protective equipment/materials and be able to evaluate patient needs in athletic medical situations. 11. Construct a preparticipation examination as it pertain to the prevention of injuries. Credits: 3.00

HK 50600 - Evidence Based Practice In Athletic Training

Credit Hours: 2.00. Introduction to research methodology, and qualitative and quantitative data analysis as related to evidence-based practice of athletic training. The course addresses formulating clinical questions; searching, reading and appraising research; understanding levels of evidence; and citing and referencing works to become consumers of and designers of evidence. The course introduces students to the selection, application, and interpretation of basic descriptive, correlational, and interferential statistics. Permission of department required.

Learning Outcomes: 1. Understand and compare the types of research commonly undertaken by researchers within the field of athletic training. 2. Appreciate and understand the ethical considerations within the research process. 3. Conduct a review of literature on the research topic allowing the student to organize and interpret the findings while writing of the review of literature of a paper for publication. 4. Consider the mechanics of designing the research process which allows the student to begin writing an introduction of a paper for publication. 5. Evaluate the concepts of internal and external validity of research design. 6. Weigh the importance of reliable and valid measurements in athletic training research. 7. Distinguish between experimental and non-experimental research designs and the advantages and disadvantages with each type of design. 8. Critique the typical measures utilized by athletic training researchers to report strength, proprioception and kinesthesia, balance, stability, range of motion, etc. results in athletic training research. 9. Create all the different components of the research design concluding with the writing of a methods section of a paper for publication. 10. Understand and apply basic statistical measures such as: descriptive, inferential and probability statistics. 11. Understand and apply the common applied statistical decision making techniques in athletic training research analysis of variance, repeated measures analysis of variance, and correlation analysis, etc. 12. Organize and construct the results section of the research project for both thesis chapter and manuscript formats. 13. Understand the importance of and methods associated with obtaining research funding through grant writing and other mechanisms. Credits: 2.00

HK 51100 - Electrocardiogram And Exercise Testing

Credit Hours: 3.00. This course is designed to provide students with competencies related to electrocardiogram and exercise testing. Students will develop skills to interpret a 12-lead ECG, prep and execute a resting 12-lead ECG, complete appropriate pre-screening for graded exercise testing and develop an understanding and initial skills for administering a diagnostic exercise test. Additionally, students will explore various cardiac, pulmonary and/or metabolic testing common to the clinical exercise testing setting. The course is designed to help students prepare for future clinical practice and certifications, such as the ACSM clinical exercise physiologist certification.

Learning Outcomes: 1. Explain the application

of ECG and rationale of its utilization in preventative, diagnostic and prognostic settings. 2. Establish fundamental knowledge of ECG interpretation, identification of abnormalities, and the clinical significance of findings. 3. Utilize critical thinking skills to identify anatomical and physiological reasons for ECG changes and potential diagnoses. 4. Demonstrate abilities to execute a resting 12-lead ECG and ECG with stress testing and communicate results (recognizing both normal and abnormal responses to exercise). 5. Explore and differentiate various assessments/tests common to the clinical exercise testing setting. 6. Appraise different test characteristics - reliability, validity, sensitivity, specificity, etc., and its relevance with test selection. 7. Synthesize knowledge obtained from pre-screening information and test characteristics to select appropriate assessments/tests and protocol. 8. Display proficient application of various exercise test protocols, their utilization and associated best practices. Credits: 3.00

HK 51500 - Emergency Medical Management In Athletic Training

Credit Hours: 4.00. This course is designed to teach management concepts and skills used by athletic trainers in emergency situations. Topics addressing prevention, recognition, and management of life-threatening and/or severe injury and illness are included. Application of skills that include the environment, CPR/AED, airway management, immobilization, bleeding control and sudden illness management are also addressed. Students will become certified in CPR/AED. Permission of department required.

Learning Outcomes: 1. Analyze typical administrative policies and procedures that govern first aid and emergency care. 2. Distinguish the different hospital trauma levels and the role of the system in the transportation decision making process. 3. Perform a primary and secondary patient assessment, as well as an assessment of the scene. 4. Obtain and interpret vital signs including pulse, respirations, blood pressure, core body temperature, and oxygen saturation. 5. Distinguish the different types of airway adjuncts and demonstrate airway management skills. 6. Evaluate the indications, application, and treatment parameters for supplemental oxygen administration for emergency situations, and be able to administer supplemental oxygen. 7. Apply proper management strategies for external hemorrhage. 8. Compare different proper positioning, immobilization and transfer techniques for a patient using a spine board. 9. Evaluate and select proper techniques for removing equipment and clothing to access an airway or evaluate an injured part. 10. Evaluate and choose techniques to immobilize injuries to the extremities. 11. Explain and demonstrate the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 12. Recommend strategies to manage environmental emergencies. 13. Distinguish and recommend techniques for infectious control regulations including Universal Precautions. 14. Attain Basic Life Support for Healthcare Providers certification. Credits: 4.00

HK 51700 - Governance In Sport

Credit Hours: 3.00. This course is an examination of sport organizations focused both on professional and amateur governance structures and processes, with a focus on the NCAA. The study of policy in educational, non-profit, professional and international sport venues will also be addressed.

Learning Outcomes: 1. Identify governing bodies in professional and amateur sport. 2. Recognize policy components and processes in major sport governing bodies. 3. Recognize the influence of governmental bodies and commissions on sports. 4. Identify the organizational structure of various sport governing bodies. 5. Assess the authority and

functions of various sport governing bodies. 6. Identify the membership requirements of various sport governing bodies. 7. Identify the sanctions and appeal processes utilized by sport governing bodies. 8. Understand American sport policy and governance in comparative and international context. 9. Understand different forms of sport policy and governance internationally. Credits: 3.00

HK 51800 - Analytics And Technology In Sport

Credit Hours: 3.00. This course is designed to acquire the fundamentals of sports performance analytics. It provides a basic understanding of the different key performance indicators within sports performance analytics including load management, injury prevention, drafting and scouting. The course also provides an understanding of how business analytics can drive decisions in the sport world.

Learning Outcomes: 1. Apply data science principles to sports performance, referred to as sports analytics. 2. Apply measurement and statistical modeling to professional athletes in sports. 3. Examine professional athletes' performance and implication of injuries on market value. 4. Present data to different pro sports industry audiences: players, coaches, and front office management. 5. Apply the processes that take place from the inception of a research question, identification of key performance indicators, data collection, statistical analyses, and data visualization, also termed the sports science data protocol. Credits: 3.00

HK 52000 - Evaluation And Management Of The Lower Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the lower extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the lower extremities. 2. Apply different methods of prevention for many injuries commonly seen in the lower extremities. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the lower extremities. 5. Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the lower extremities. 7. Summarize the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the lower extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 52100 - Sport Administration

Credit Hours: 3.00. This course is designed to provide students with a deeper understanding of variety of areas within Sport Management. Students will learn about youth, college and professional sport and the various ancillary roles and departments that are attached to each. Students will also engage in a focused book reading and current event reading to further understand the roles in sport.

Learning Outcomes: 1. Develop group

leadership skills through discussions and presentations. 2. Acknowledge the historical ramification of the creation of the NCAA and of professional leagues how this impacts today's sport setting. 3. Recognize the management functions that exist in a contemporary sport organization. 4. Understand the major factors affecting today's world of professional, collegiate, and amateur sport. 5. Develop a personal philosophy regarding organizations within the sport industry. 6. Develop a greater knowledge of intercollegiate athletics administration. 7. Acknowledge the historical, socio-cultural, and ethical factors facing today's college and professional sport. Credits: 3.00

HK 52200 - Sport Law And Ethics

Credit Hours: 3.00. This course explores legal problems facing sport. Students will learn fundamental legal principles including employment law, ADA requirements, hazing, sexual harassment, and Title IX application. Both past and current legal cases related to sport, recreation and fitness industries are examined. Concerns and problem-solving for issues of risk management are also explored.

Learning Outcomes: 1. Develop an understanding of the history and development of the American legal system and courts. 2. Analyze and apply ethical and legal literature in case law, statutes, periodicals, and texts. 3. Explain the basic understanding of terminology and procedures used in legal proceedings. 4. Discuss legal aspects most important to sport management including tort law, contract law, physical activity situations, constitutional law, Title VII and Title IX. 5. Create a comprehensive understanding of risk management and other legal theories to minimize or avoid legal liability in sport settings. 6. Gain a deeper understanding of the ethical reasoning/decision-making process and develop the knowledge, skills, and abilities to apply moral reasoning in dealing with ethical dilemmas in sport. Credits: 3.00

HK 52400 - Managing Health, Fitness, And Sports Organizations

Credit Hours: 3.00. An overview of the major principles, considerations, and techniques involved in managing health, fitness, and sports (HFS) organizations. Emphasizes the skills and competencies involved in the planning, organization, and control of opportunities, resources, and facilities in HFS settings. Permission of instructor required.

Credits: 3.00

HK 52500 - Marketing And Promotion In Health, Fitness, And Sports Organizations

Credit Hours: 3.00. An overview of marketing and promotion in health, fitness, and sports organizations. Emphasizes the skills necessary to develop marketing and promotion plans and to develop materials and approaches for carrying out these plans in health, fitness, and sports settings. Permission of instructor required.

Credits: 3.00

HK 52600 - Communication And Media In Sport

Credit Hours: 3.00. This course is designed to provide students with a deep understanding of the unique role and importance of internal and external communications in relation to sport. Furthermore, it examines the important role the media plays in the sport universe. The intermingling of sport organization and sport media is also examined, especially within the context of the changing nature of the relationship in the 21st century.

Learning Outcomes: 1. Explain why it is essential to learn about technology today and discuss several ways technology has been integrated into our business and personal lives. 2. Discuss the organizational and societal impact of implementing technology; including some benefits and risks related to the prominence of computerized technology in our society. 3. Explain the impact of computerized communications (blogs, podcasting, viral marketing, etc.) on businesses, personal lives, and the sports Industry. 4. Describe social networking (including some computerized elements) and how it can be used to enhance and expand customer relationships for businesses and the sports Industry. 5. Define web-based multimedia and list some of the

advantages and disadvantages of using multimedia and demonstrate how to utilize web-based media to create Marketing and Public Relations products; some examples include (a) newsletter, (b) press release, (c) podcast, (d) web pages, interactive training presentation, and (f) social media. Credits: 3.00

HK 52800 - Sport Event Management And Operations

Credit Hours: 3.00. Introduces students to the planning and management of national and international sport events through the strategic and systematic process of event management, exploring the phases and structural domains associated with the model.

Learning Outcomes: 1. Apply the event management process to sport events. 2. Develop sustainable sport events. 3. Create risk management solutions to minimize, transfer, avoid, or accept risks for sport events. 4. Respond appropriately to managerial challenges facing sport event managers. Credits: 3.00

HK 52900 - Venue Management

Credit Hours: 3.00. This course will examine all aspects of the management of sport facilities, including development, planning, staffing, operations, and evaluation. Students will study the relationships between the respective parties in terms of ownership, management, and the event.

Learning Outcomes: 1. Develop a basic understanding of the managerial issues (e.g., building planning, hospitality, employee and event recruitment, selection, and negotiating) that are specific to sport event and facility management. 2. Schedule, promote, market, and maintain events and facilities. 3. Develop an appreciation of the legal liability associated with events and facilities management and emergency crowd control. 4. Understand the basic principles of facility design and construction. 5. Seek to discuss issues centered on preventive maintenance, facility planning, event administration, box office management, concessions, house and ground management, systems management, marketing, finance, and personnel administration. Credits: 3.00

HK 52950 - Sport Practicum

Credit Hours: 1.00 to 3.00. This course is designed to provide students with a deeper understanding of the variety of different areas within Sport Management. Students will learn through practical experience in the field. Students will also engage in a focused book reading and current event reading to further understand the roles in sport.

Learning Outcomes: 1. Apply classroom experiences to the real world through specific projects and experiences. 2. Examine how the practice of various activities varies from the ideal taught in a classroom. 3. Lead others in moving a project from start to conclusion. 4. Present to faculty and students in the classroom how the real-world experience improved their understanding of necessary skills. Credits: 1.00 to 3.00

HK 53000 - Evaluation And Management Of The Upper Quarter

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the upper extremities, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the upper extremities. 2. Apply different methods of prevention for many injuries commonly seen in the upper extremities. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the upper extremities. 5.

Consider anatomical growth and development characteristics of males and females in the following stages: preadolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the upper extremities. 7. Summarize the role and function of commonly used prescription and non prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the upper extremities. 8. Demonstrate through low fidelity simulation sound evaluation techniques of upper extremity. 9. Appraise the different psychomotor test characteristics validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 53200 - Musculoskeletal Adaptations

Credit Hours: 3.00. This course will utilize traditional lecture combined with small group, student-lead learning to study the impact of acute and chronic exercise on skeletal muscle and tendon. Topics covered will include muscle growth, muscle metabolism, structural and functional changes in skeletal muscle and tendon, the impact of age and sex on exercise adaptations, and the impact of exogenous agents on skeletal muscle and tendon adaptations to exercise. Other topics may include the impact of unloading (e.g., bedrest) and spinal injury on skeletal muscle and tendon. This course will be relevant to those interested in exercise physiology, athletic training, physical therapy, occupational therapy, medical school, nutrition science, engineering, and similar programs of study. Permission of department required.

Learning Outcomes: 1. Analyze and synthesize research in the area of musculoskeletal adaptations to exercise - including the effects of exercise on skeletal muscle, tendon, and bone - and how aging, sex, and lack of activity influence exercise adaptations. 2. Critically evaluate research data in the context of exercise, human health, and rehabilitation. 3. Develop a strong base knowledge of the current state of the literature regarding musculoskeletal adaptations to exercise. 4. Gain experience presenting research findings in oral and written format. Credits: 3.00

HK 53500 - Athletic Training Interventions

Credit Hours: 3.00. This course is designed to provide the student with the foundational theory and techniques related to injury and illness intervention. Included are topics addressing tissue healing, theories of pain and pain control, concepts of kinetic chain stability and mobility, as well as principles related to the use of therapeutic medications. Students will discover how to plan and implement a comprehensive reconditioning program for injuries and conditions sustained by physically active individuals. Permission of department required.

Learning Outcomes: 1. Distinguish the role and types of clinical outcome assessments/measures utilized in clinical practice to determine patient progress. 2. Compare the phases of tissue healing and its implications on intervention design, implementation and progress. 3. Compare common pain control theories and evaluate methods to control pain. 4. Evaluate common indications and contraindications to common therapeutic interventions. 5. Compose a comprehensive rehabilitation program including: determination of therapeutic goals and objectives, selection of therapeutic modalities and exercise, methods of evaluation and documenting rehabilitation progress, and development of criteria for progression and return to activity. 6. Demonstrate and instruct therapeutic exercises and implement a rehabilitation plan. 7. Analyze local, state, and federal standards/law for the safe application of therapeutic modalities, rehabilitation equipment and medications. 8. Generalize concepts related to the administration of therapeutic administration of medication. 9. Use peer reviewed resources to examine a common

condition presented to a rehabilitation professional and construct an evidence based injury rehabilitation protocol for return to competitive activities. 10. Perform a professional oral presentation using professional communication skills. Credits: 3.00

HK 53600 - Cardiopulmonary Physiology

Credit Hours: 3.00. This course will provide a comprehensive overview of the characteristics and regulatory mechanisms underlying the cardiorespiratory adjustments to exercise. The effects of chronic diseases, including chronic obstructive pulmonary disease, peripheral artery disease and chronic heart failure, on the cardiovascular and respiratory responses to exercise will also be discussed in detail. Permission of department required.

Learning Outcomes: 1. Describe and compare the cardiovascular and respiratory responses to incremental, submaximal and prolonged exercise. 2. Define and analyze the role of muscle afferents and central command on the regulation of cardiovascular and respiratory adjustments to exercise. 3. Delineate and evaluate the effects of exercise training on the cardiovascular and respiratory systems.
4. Synthesize recent research findings on the consequences of chronic disease on the cardiovascular and respiratory adjustments to exercise. Credits: 3.00

HK 54000 - Evaluation And Management Of The Spine And Head

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the spine and head, including joint structure and musculoskeletal/nervous systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering the assessment and management techniques for injuries commonly seen will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the spine and head. 2. Apply different methods of prevention for many injuries commonly seen in the spine and head. 3. Differentiate common risk factors and causes of injury commonly seen in athletics and the physically active. 4. Evaluate gender differences in the musculoskeletal system and their impact on injury management for the spine and head. 5. Consider anatomical growth and development characteristics of males and females in the following stages: pre-adolescent and adolescent. 6. Develop general treatment and rehabilitation protocols to use with injuries in the spine and head. 7. Summarize the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the spine and head. 8. Demonstrate through low fidelity simulation sound evaluation techniques of lower extremity. 9. Appraise the different psychomotor test characteristics -validity, reliability, sensitivity, specificity, likelihood ratios, odds ratios, etc., as they relate to selection of special tests. 10. Synthesize test psychometric data to select appropriate tests and measures during assessment. 11. Formulate a clinical question and perform a literature search to answer the question. Credits: 3.00

HK 54100 - Athletic Training Practicum I

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify

behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 17. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 18. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 19. Demonstrate the ability to evaluate a patient with an emergency injury or condition. Credits: 2.00

HK 54200 - Athletic Training Practicum II

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training

examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Educate others using relevant and effective teaching methods. 20. Produce quality documentation in a timely manner to support the delivery of athletic training services. 21. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 22. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 23. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 24. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 25. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 54300 - Athletic Training Practicum III

Credit Hours: 2.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic

training services. 23. Collect and analyzes data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 29. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 30. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 2.00

HK 54500 - Therapeutic Modalities

Credit Hours: 3.00. Course covering the physiological effects, indications, contraindications, and precautions of contemporary therapeutic modalities. Students will design and plan therapeutic interventions. Focus will be on the application of therapeutic modalities according to evidence-based protocols. Included in this course will be the role of equipment safety and maintenance of therapeutic modalities. Permission of department required. Learning Outcomes: 1. Explain the inflammatory response to acute and chronic injury. 2. Select the appropriate modality according to treatment goals and objectives. 3. Compare the prevailing pain control theories and associated rationale for the selection and use of therapeutic modalities for the control of acute and chronic pain. 4. Evaluate the physical properties, biophysics, set-up, indications, contraindications, and specific physiological effects associated with the application of superficial cold and heat; stimulating electrical currents; diathermy; therapeutic ultrasound; intermittent compression units; iontophoresis; traction; massage; biofeedback; and LASER. 5. Administer contemporary therapeutic modalities to a patient using clinically acceptable procedures including patient preparation, set-up, determination of dosage, and operational procedures according to established guidelines. 6. Inspect therapeutic equipment and the treatment environment. 7. Identify various standards that influence the approval, operation, inspection, maintenance and safe application of therapeutic equipment. 8. Use a systemic approach to create and answer a clinical question. 9. Summarize differences between narrative reviews, systematic reviews, and meta-analysis. 10. Search for, find, and document the best evidence to support a problem or clinical problem. 11. Develop a Critically Appraised Topic (CAT) that includes a PICO, creating a search strategy (search terms), using databases to find evidence, appraising evidence, determining levels of evidence, analyzing and synthesizing evidence, and determining a clinical bottom line. 12. Present a Critically Appraised Topic using professional communication skills. Credits: 3.00

HK 54600 - Lifestyle Medicine

Credit Hours: 3.00. This graduate-level course reviews the

principles and practices of lifestyle medicine. Students will explore the evidence-based application of lifestyle medicine in preventing, managing, and treating chronic disease. Students will learn about the application of all six pillars of lifestyle medicine: physical activity, nutrition, sleep, stress management, substance avoidance, and health relationships / social well-being. Students in this course will obtain knowledge, skills, and tools via lectures, research reviews, group discussions, and experiential learning. Throughout the course, students will learn to comprehensively apply lifestyle medicine to healthy individuals and those with chronic diseases across the community. Upon completing the course, students will be empowered to promote healthy lifestyle change with clients/patients in their future healthcare professions. This course can be taken as part of a course series that will prepare students for a health coaching certification and the potential to sit for the National Board of Health and Wellness Coaching (NBHWC) health coaching certification exam.

Learning Outcomes: 1. Explore the application of evidence-based lifestyle medicine and its effectiveness in long-term health outcomes. 2. Assess the six pillars of lifestyle medicine and the impact and potential benefits of optimizing different variables, such as physical activity/exercise, nutrition, stress management, sleep, emotional well-being, social connectivity, etc. 3. Evaluate literature in lifestyle medicine critically and assess the utilization of different disease prevention and management strategies. 4. Appraise various health conditions and the power of lifestyle medicine on disease management and quality of life. 5. Integrate lifestyle medicine concepts into behavior change models and coaching techniques, such as the transtheoretical model, motivational interviewing, appreciative inquiry, strengths-based approach, goal setting, and more. 6. Explore the importance and impact of self-care and positivity for health and wellness professionals. Credits: 3.00

HK 54700 - Principles Of Health And Wellness Coaching

Credit Hours: 3.00. This is a graduate-level course that will assist students in refining patient/client communications and applying lifestyle behavior change strategies in practice. This course provides a comprehensive introduction to health and wellness coaching principles, practices, and theories. Topics include core components and scope of health coaching, behavior change models and theories, coaching structure, screening and assessment, building rapport, motivational interviewing, and more. This course is part of a series that will prepare students for a health coaching certification and the potential to sit for the National Board of Health and Wellness Coaching (NBHWC) health coaching certification exam.

Learning Outcomes: 1. Explain the role and scope of the health coach professional and core coaching competencies. 2. Explore and understand the theoretical foundations of coaching psychology, behavior change models & theories. 3. Establish fundamental knowledge within coaching applications and techniques, such as motivational interviewing, cognitive behavioral coaching, appreciative inquiry, and SMART goals techniques. 4. Evaluate current literature and research in the field of health and wellness coaching. 5. Demonstrate understanding of different assessments, screening tools, and health coaching techniques implemented through observation and peer-to-peer practice. Credits: 3.00

HK 54800 - Advanced Concepts And Application Of Health And Wellness Coaching

Credit Hours: 3.00. This course is a graduate-level skills-based course designed to provide practical applications of health and wellness coaching. Topics include advanced theories in health and wellness coaching, the application of effective coach-to-client communication techniques, legal considerations of the profession, and a health coach's professional scope of practice. Students in this course will complete peer-mentored coaching sessions and practical skills evaluations. This course is part of a series that will prepare students for a health coaching certification and the potential to sit for the National Board of Health and Wellness Coaching (NBHWC) health coaching certification exam.

Learning Outcomes: 1. Explore and practice behavior change models & theories. 2. Utilize evidence-based coaching techniques in practice. 3. Demonstrate efficiency in reviewing assessments and screening tools in the health coaching practice. 4. Display understanding and application of the core components of a

coaching session, as well as the techniques and skills employed for successful sessions. 5. Synthesize knowledge from various coaching practices and techniques learned and demonstrate skill in implementing these within coaching sessions. 6. Apply ethical principles and guidelines in the practice of health and wellness coaching. Credits: 3.00

HK 54900 - Health Coaching Practicum

Credit Hours: 1.00 to 3.00. This graduate-level practicum course affords students who have completed the two health and wellness courses (HWC), Principles of Health and Wellness Coaching (HK 54700) & Advanced Concepts and Application of Health and Wellness Coaching (HK 54800), pragmatic application of health coaching skills through ongoing coach-client interactions. Students will gain experiential mastery of communication, building client rapport, motivational interviewing, goal development, and other health coaching skills learned in HK 54700 & HK 54800. Students will work with a mentor(s) to complete health coaching hours through their identified site(s). Students will predominantly complete coaching sessions at the Purdue Recreation and Wellness and The AH Ismail Center. The class is designed to help students complete the 50 health coaching sessions required before applying to sit for the National Health and Wellness Coaching Board exam. Students in the HWC course series can complete required coaching sessions independently or by taking this practicum to obtain the coaching hours.

Learning Outcomes: 1. Demonstrate proficiency in the application and practice of health coaching techniques and skills. 2. Explore the utilization of motivational interviewing, cognitive behavior coaching, behavior change, and SMART goals techniques. 3. Administer and interpret health assessments and screenings in the health coaching practice. 4. Demonstrate an understanding of common conditions (cardiovascular disease, diabetes, hypertension, cancer, obesity, arthritis, etc.), the implications of lifestyle behavior on these conditions, and synthesize this understanding into health coaching practice. 5. Recognize signs/symptoms of mental health conditions (i.e., depression, anxiety, etc.) and when a referral is recommended. 6. Evaluate their coaching presence, the effectiveness of sessions administered, and implement practices to enable continued growth and 'mastery'. Credits: 1.00 to 3.00

HK 55000 - Evaluation And Management Of Medical Conditions

Credit Hours: 3.00. Course covering an in-depth study of the normal anatomical structures in the thorax and abdomen, including the cardiovascular, digestive, urinary, reproductive, endocrine, and lymphatic systems. Also discussed are common risk factors and causes of injuries as identified by contemporary epidemiological studies, common injuries to each body part, typical symptoms, and common clinical signs associated with injuries and illnesses with the physically active. A lab covering injury assessment techniques of common illnesses and disease most often encountered by allied healthcare professionals will be included. Permission of department required.

Learning Outcomes: 1. Identify specific anatomical structures such as bony landmarks, soft tissue and joint structures in the thorax and abdomen. 2. Apply different methods of prevention for many injuries commonly seen in the thorax and abdomen. 3. Differentiate general treatment and rehabilitation protocols to use with injuries in the thorax and abdomen. 4. Identify the role and function of commonly used prescription and non-prescription pharmacological agents in the treatment of Injuries/illness commonly seen in the thorax and abdomen. 5. Demonstrate through low fidelity simulation sound evaluation techniques of the thorax and abdomen. 6. Explain modifiable and non-modifiable risk factors pertaining to general medical conditions across the life span in the physically active and special populations. 7. Explain and identify the etiology, prevention, recognition and management of conditions leading to sudden death. 8. Explain and identify the etiology, prevention, recognition and management of general medical conditions associated with the systems of the body across the life span in the physically active and special populations. 9. Demonstrate the ability to

assess and interpret findings in the evaluation of general medical conditions, using diagnostic accuracy and clinical prediction rules, associated with the systems of the body. 10. Explain the general therapeutic strategy, including drug categories for the treatment of general medical conditions. 11. Use available resources to identify indications, contraindications, precautions, and adverse reactions of prescription and non-prescription medications. 12. Develop a clinical question, search for, assess, and synthesize evidence related to general medication conditions and pharmacology. Credits: 3.00

HK 55500 - Principles Of Manual Medicine

Credit Hours: 2.00. This course will provide students with the theory, skills, and clinical application of manual medicine. The emphasis will be placed on passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. All skills will be introduced through onsite demonstration and hands-on practice. Permission of department required.

Learning Outcomes: 1. Describe the basic theories and principles of various types of manual medicine. 2. Evaluate the patient indications and contraindications, treatment efficacy, and clinical applications of each kind of manual medicine technique. 3. Summarize and select appropriate manual medicine techniques to match injury pathophysiology. 4. Choose and apply manual medicine treatment techniques, including passive and dynamic joint mobilizations, connective tissue massage, deep friction massage, lymphatic massage, myofascial release, passive range of motion exercises, muscle energy techniques, and nerve mobilization. 5. Create a plan of care including manual medicine in preparation for exercise and recovery from exercise. 6. Compare the role of manual medicine in a multi-disciplinary approach to treatment of soft tissue injuries. Credits: 2.00

HK 56000 - Advanced Procedures In Athletic Training

Credit Hours: 2.00. This course aims to provide students with advanced psychomotor skills in athletic training, such as wound closure, orthopedic casting, orthotic fabrication, biometrics and other emerging techniques and technologies. Skill integration into practice will be considered and practice act concerns will be discussed. Permission of department required.

Learning Outcomes: 1. Recognize different types of wounds and which require advanced management, including wound closure. 2. Compare wound closure techniques to determine appropriate applications. 3. Summarize the differences between casting methods. 4. Evaluate casting techniques relative to patient indications and pathology present. 5. Explain the purpose of foot orthotics as related to the pathomechanical model. 6. Apply wound closure techniques, orthopedic castings, and fabricate orthotics in simulated patients. 7. Consider and summarize emerging technologies and practices in athletic training, such as the use of biometrics to determine use and efficacy in a clinical setting. Credits: 2.00

HK 56300 - Business Of Sport

Credit Hours: 3.00. This course focuses on the application of financial management tools used to assist managers in the sport industry. Financial concepts will be examined as they relate to management decision-making. Emphasis will be on interpreting financial data and communicating results to operation managers.

Learning Outcomes: 1. Apply finance and business concepts effectively in a sport or entertainment setting. 2. Analyze financial data and make recommendations to management concerning financial position and produce a budget for your department or organization. 3. Explain in detail key public sources of finance for sport organizations and the advantages and disadvantages of each. 4. Explain in detail how

sporting events create an economic impact for various locals. 5. Appreciate the current financial status of diverse segments of the sport industry. Credits: 3.00

HK 56700 - Epidemiology For Public Health Practice

Credit Hours: 3.00. This course presents the fundamental principles, methods, and applications of epidemiology, including the quantification of morbidity, mortality, and disease risk. Epidemiologic study designs and the use of public health vital statistics, disease transmission evidence, and risk assessment data are explored. Historically significant epidemiological cases provide a framework for the application of ethical principles to epidemiologic research. This course meets the epidemiology core competency requirement for the Master's in Public Health (MPH) degree.

Credits: 3.00

HK 56800 - Advanced Exercise Physiology

Credit Hours: 3.00. The study of selected concepts and principles of physiology as they relate to the exercising human.

Credits: 3.00

HK 57400 - Advanced Exercise Psychology

Credit Hours: 3.00. This course is designed to examine psychological issues and theories related to exercise, the promotion of regular physical activity and active lifestyles. Emphasis is placed on the factors related to physical activity, health behavior theories, and the psychological and emotional consequences of exercise and physical activity. Key methodological considerations in behavioral health research will also be highlighted.

Learning Outcomes: 1. Discuss the feasibility, utility, and challenges of using theories in exercise psychology. 2. Compare and contrast several prominent health behavior theories, especially those with relevance to encouraging physical activity behaviors. 3. Identify research methodology criteria for evaluating the quality of exercise psychology and behavioral medicine studies, and appraise the quality of the research literature based on these criteria. 4. Acquire knowledge of the research literature and be able to have an informed and critical discussion of current perspectives and challenges in exercise psychology. 5. Design and develop their own questionnaire to assess health behaviors and psychological constructs for a given population. 6. Understand how psychological principles and theories are applied in exercise and physical activity contexts. 7. Develop graduate-level writing and oral presentation skills through course assignments. Credits: 3.00

HK 57600 - Diversity And Health

Credit Hours: 3.00. This course is designed to examine the health status and the politics of representation of the U.S. ethnic minorities (e.g., African Americans, Latinos, Asian Americans, Native Americans, Alaskans, etc.). Emphasis is placed on factors that influence health and health-related behaviors. The course is intended to provide students with an overview of historical, political, social, and cultural factors related to the health behavior and status of minority groups in American society.

Credits: 3.00

HK 57700 - Marketing, Branding, And Sales In Sport

Credit Hours: 3.00. This course is designed to provide students with (1) a deep understanding of theories and concepts in sport marketing, (2) an up-to-date understanding of them as they are currently being applied to solve marketing problems and issues in various sport business contexts, (3) strategies of making effective decisions concerning the marketing of sport products and brands, (4) a foundation for advanced study and work in marketing, consumer behavior, and related fields.

Learning Outcomes: 1. Articulate the factors that make sport marketing a unique enterprise. 2. Demonstrate an understanding of various research methodologies utilized in sport marketing. 3. Assess the value of segmentation in sport marketing. 4. Design, implement, and evaluate a sport marketing research plan. 5. Appreciate the elements of the sport product that contribute to its uniqueness in the marketplace. 6. Analyze the growth in importance of licensing, brand equity, and fan identification in sport marketing. 7. Differentiate among the unique factors that impact sport

product pricing strategies. 8. Understand and evaluate the effectiveness of the key components of effective promotional programs and campaigns within the sport market. 9. Devise a promotional and sales plan within the sport marketplace. 10. Understand the scope and nature of sponsorship and the rationale for their use by corporations and the sport enterprise. 11. Analyze the importance of public relations and its unique role in the marketing mix within the context of sport. 12. Consider the future directions of sport marketing, giving special attention to the growth of electronic media and its parts. Credits: 3.00

HK 57800 - Organizational Behavior And Leadership In Sport

Credit Hours: 3.00. This course is an introduction to the basic concepts and topics in organizational behavior (OB) and leadership. The course focuses on OB at three levels: individual, interpersonal, and collective. We will cover decision-making, relationships, motivation, personality, influence, and groups. Permission of department required.

Learning Outcomes: 1. Learn of and develop an understanding of the fundamental theories and principles of employee and organizational behavior in the context of professional, college, and amateur sports by reading the assigned textbook and related articles, listening to lectures, videos, and engaging in other course materials. 2. Identify and apply learned theories and approaches to address and resolve organizational and personnel issues encountered by management in sports organizations by analyzing and problem-solving weekly case studies based on real-life organizational behavior examples in sports settings. 3. Demonstrate knowledge of the principles and practices associated with the following areas of organizational behavior in sports including leadership, organizational culture, internal and external organizational conflict, and diversity and inclusion. 4. Apply the information learned in weekly modules and through the completion of individual personality assessments in class to understand students' individual work styles and create a personal plan to employ work traits in a practical manner as future employees. 5. Develop personal growth through assessment activities where students have the opportunity to reflect on their own style of work in light of the course material as it aligns with their career goals. Credits: 3.00

HK 57900 - Strategic Case Reviews: Lessons From The Sport Management Field

Credit Hours: 3.00. The focus of this course is to merge the application of leadership and management theory to various issues arising in Sport Management including organizational behavior, strategic planning, and human resources management. This course will utilize case studies based on true events and connect theoretical ideas with practical experience and outcomes. Permission of department required.

Learning Outcomes: 1. Learn of and develop an understanding of the fundamental theories and principles of employee and organizational behavior in the context of sports by reading the assigned textbook chapters and related articles, listening to lectures, and fully engaging in all course materials and assignments. 2. Identify and apply learned theories and approaches to address issues encountered by management in organizations by analyzing and problem-solving weekly case studies based on real-life examples in a variety of sports settings. 3. Demonstrate knowledge of the principles and practices associated with organizational behavior in sports including leadership, organizational culture, and internal and external conflict. 4. Using information learned in weekly case studies, and through the completion of individual personality assessments, gain a better understanding of individual leadership and work styles. 5. Develop personal growth through a variety of assessment activities whereby students reflect on their own

leadership style. Credits: 3.00

HK 58300 - Patient Care Simulation In Athletic Training I

Credit Hours: 2.00. This course is designed to refine psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care decisions. Permission of department required.

Learning Outcomes: 1. Evaluate a patient and then select and apply appropriate taping applications for injury reduction and prevention. 2. Select and apply protective equipment for use by active individuals participating in sport. 3. Apply specialty taping procedures in response to patient indications and treatment goals. 4. Perform a primary and secondary patient assessment for a patient in an emergency situation. 5. Obtain and evaluate vital signs including pulse, respirations, blood pressure, core body temperature, and oxygen saturation. 6. Differentiate and select from the different types of airway adjuncts to demonstrate airway management. 7. Use the indications and treatment parameters in an emergency situation to determine appropriateness of supplemental oxygen administration. 8. Administer supplemental oxygen to patients in an emergency situation. 9. Create a management plan of external hemorrhage and apply this emergent and non-emergent situations. 10. Consider and select proper immobilization and transfer techniques for a patient using a spine board. 11. Evaluate techniques for removing equipment and clothing to access an airway or evaluate an injured part and select the most appropriate for a given situation. 12. Apply corrective intervention techniques for the management of medical and sudden illness such as sudden cardiac arrest, asthma, shock, diabetic emergencies, burns, anaphylaxis, and internal bleeding. 13. Analyze patients and institute a management plan for patients in an environmental emergency. Credits: 2.00

HK 59000 - Special Topics In Health And Kinesiology

Credit Hours: 1.00 to 3.00. Individualized readings, topics, or projects in health and kinesiology appropriate for graduate students. Permission of instructor required.

Learning Outcomes: 1. Learning outcomes vary due to special topics nature of course. Credits: 1.00 to 3.00

HK 60000 - Individual Research And Study

Credit Hours: 1.00 to 3.00. Each student studies a problem of interest related to physical education, health, or recreation. Permission of instructor required.

Credits: 1.00 to 3.00

HK 60100 - HK PhD Seminar

Credit Hours: 2.00. This course is the first of a required two-course sequence for first-year health and kinesiology doctoral students. The course is designed to socialize students into the worlds of science, graduate education, and health and kinesiology research and practice. Particular emphasis is placed on the responsible conduct of research, shared and unique expectations of graduate students and mentors across various health and kinesiology subdisciplines, professional development, and the nurturing of academic community. Prerequisite: Incoming health and kinesiology doctoral students qualify for and are required to complete this course. Permission of department required.

Learning Outcomes: 1. Develop an appreciation for philosophical and scientific issues of relevance to all health and kinesiology scholars. 2. Develop an understanding of successful and less successful approaches to graduate education, department citizenship, pursuit of scholarly endeavors, and professional development. 3. Develop an understanding of how to obtain effective mentoring. 4. Become an active member of the HK intellectual and professional community. Credits: 2.00

HK 60200 - HK PhD Seminar II

Credit Hours: 2.00. This course is the second of a required two-course sequence for first-year health and kinesiology doctoral students. The course is designed to expose students to classic works in health and kinesiology subdisciplines, address professional development issues, and help students formulate a curricular and research program to structure the doctoral experience. Particular emphasis is placed on the interdisciplinary nature of health and kinesiology and becoming an active member of the research community. Permission of department required.

Credits: 2.00

HK 61000 - Research Methods In Health, Physical Education, And Recreation

Credit Hours: 3.00. Application of research methodology to problems in health, physical education, and recreation. Prerequisite: 3 credit hours in Statistics. Permission of instructor required.

Credits: 3.00

HK 61100 - Data Analysis In Health And Kinesiology

Credit Hours: 3.00. This student-driven course addresses a variety of data analysis issues in health, kinesiology, and related fields (e.g., education, psychology). The course will overview the types of data prominent in health and kinesiology research, how these data are obtained and handled by researchers, measurement/evaluation issues, and ways to present and analyze data. Heavy emphasis is placed on matching research questions and conceptualization with data analysis techniques, obtaining familiarity with widely-used data analysis software, analyzing multivariate data sets, and constructing high-quality results sections in journal manuscript format. Prerequisites: STAT 50100 , STAT 50200 and access to a data set pertaining to one's area of research are expected. Permission of instructor required.

Credits: 3.00

HK 63000 - Administration Of Athletic Training Programs

Credit Hours: 2.00. Course covering management and supervision of personnel, financial resources, as well as the preparation in planning, designing, developing, organizing, implementing, directing, and evaluating an athletic training health care program and facility. Legal concerns, risk management, insurance, and reimbursement will be discussed. Prerequisites: Completion of HK 50000 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Summarize the components associated with professional development and regulation of athletic trainers. 2. Distinguish the roles and responsibilities of health care professionals in the field of sports medicine. 3. Compare the current initiatives, missions, objectives, and professional activities of other allied health and medical organizations and professions. 4. Analyze the major elements of the National Athletic Trainers Association (NATA) Code of Ethics against published case report. 5. Recognize the importance and complexity of the ethical and legal issues associated with medical information, authorization to participate, record keeping, and confidentiality. 6. Appraise and recommend medical and professional liability insurance policies. 7. Develop administrative policy and procedures for operation of an athletic medical facility. 8. Develop a system of records for athletes and general facility operations. 9. Develop a comprehensive pre-participation medical exam. 10. Develop a basic architectural design of an athletic medical facility that is safe and efficient. 11. Develop a budget for operation of an athletic medical facility. Credits: 2.00

HK 63500 - Injury Prevention And Health Promotion

Credit Hours: 3.00. This course emphasizes theory and strategies for behavioral change relating to healthy lifestyles and specific health conditions. Analyses of major injury problems affecting patients in the workplace, community, at home, and in activity along with basic principles of nutrition and exercise as they pertain to individual health and activity are included. Prerequisite: HK 53500 with a grade of B- or better. Permission of department required.

Learning Outcomes: 1. Develop and implement strategies to mitigate the risk for long-term health conditions across the lifespan. 2. Develop, implement, and assess the effectiveness of programs to reduce injury risk. 3. Plan and implement a comprehensive pre-

participation examination process to affect health outcomes. 4. Develop, implement, and supervise comprehensive programs to maximize sport performance that are safe and specific to the clients activity. 5. Educate and make recommendations to clients/patients on fluids and nutrients to ingest prior to activity, during activity, and during recovery for a variety of activities and environmental conditions. 6. Educate clients/patients about the effects, participation consequences, and risks of misuse and abuse of alcohol, tobacco, performance-enhancing drugs/substances, and over-the-counter, prescription, and recreational drugs. Credits: 3.00

HK 64000 - Leadership In Athletic Training

Credit Hours: 2.00. This course is designed to prepare students to embark on paths of personal leadership development. The course will examine leadership theory and research and emphasize the development of leadership and interpersonal skills. Understanding various methods of bringing about change will be provided and researched by learners, and then discussed in our time together. Students in this course will apply foundational business concepts in athletic training through self-assessment case studies and professional experiential exercises. Permission of department required. Prerequisite: HK 63000 with B- or better.

Learning Outcomes: 1. Compare key organizational behavior theories and concepts related to leadership and management. 2. Evaluate the unique of structures, processes, and interactions in health care organizations as they relate to leadership, management and policy. 3. Distinguish the different roles and specific challenges for leadership and management in health care. 4. Differentiate personal leadership orientation, styles and strengths. 5. Practice, hone, and demonstrate teamwork skills (e.g., leadership, collaboration, communication, etc.) in consulting team assignments and case analyses. 6. Develop a professional development plan for long term development as a professional. 7. Evaluate the value model to develop a business case to supply athletic training services. Credits: 2.00

HK 64100 - Athletic Training Practicum IV

Credit Hours: 8.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required. Prerequisite: HK 54300.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care

professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to screen a medical record(s) or an individual or group of individuals to allow for safe physical activity and make appropriate recommendation and/or referrals as necessary. 29. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 30. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 31. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 32. Locate community-based resources for psychosocial intervention. 33 Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 34. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 8.00

HK 64200 - Athletic Training Practicum V

Credit Hours: 6.00. Fieldwork experiences designed to integrate acquired knowledge and skills through live or scenario-based applications. Students will gain clinical experiences under the direct supervision of an athletic training preceptor either on or off campus. Emphasis will be placed on professional and ethical conduct, patient-centered care, interprofessional collaborative practice, evidence-based practice, quality improvement, and healthcare informatics. Permission of department required.

Learning Outcomes: 1. Demonstrate active listening skills and a positive attitude when receiving constructive feedback on performance. 2. Identify own strengths and weaknesses in professional behavior. 3. Modify behavior based on self-evaluation and feedback from others. 4. Demonstrate active listening, neutral body language, and sensitivity to difference in age, gender, and culture. 5. Demonstrate flexibility and timely completion of tasks. 6. Write legibly, using correct grammar, terminology, and spelling. 7. Arrive punctually and dresses appropriately for clinic activities. 8. Practice in a safe manner that minimizes risk to patient, self, and others. 9. Demonstrate

professional behavior at all times. 10. Practice in a manner consistent with established legal and professional standards and ethical guidelines. 11. Communicate in ways that are congruent with situational needs. 12. Adapt delivery of athletic training services with consideration for patients' differences, values, preferences, and needs. 13. Participate in self-assessment to improve clinical and professional performance. 14. Apply current knowledge, theory, clinical judgement, and the patient's values and perspective in patient management. 15. Demonstrate the patient's need for further examination or consultation by an athletic trainer or referral to another health care professional. 16. Perform an athletic training examination using evidence-based tests and measures. 17. Evaluate data from the patient examination to make clinical judgements. 18. Determine a diagnosis and prognosis that guides future patient management. 19. Establish an athletic training plan of care that is safe, effective, patient-centered, and evidence-based. 20. Perform an athletic training intervention in a competent manner. 21. Educate others using relevant and effective teaching methods. 22. Produce quality documentation in a timely manner to support the delivery of athletic training services. 23. Collect and analyze data from selected outcome measures in a manner that supports accurate analysis of individual and patient group outcomes. 24. Participate in the financial management of athletic training consistent with regulatory, legal, and facility guidelines. 25. Fit and apply prophylactic protective equipment to a patient, such as shoulder pads, helmet, custom orthoplast splints, etc. in accordance with established manufacturers' guidelines to prevent injury. 26. Fit and apply standard protective equipment to a patient, such as crutches, cane, pneumatic walking boot, ankle braces, etc. in accordance with established manufacturers' guidelines following an injury. 27. Apply upper and lower extremity taping and wrapping procedures consistent with biomechanical principles and appropriate for prophylactic treatment or in accordance with stage of healing. 28. Demonstrate the ability to evaluate injuries and conditions of the lower quarter, including the foot and ankle, knee, and hip. 29. Demonstrate the ability to evaluate injuries and conditions of the upper quarter and spine, including the shoulder, elbow and forearm, wrist and fingers, cervical spine, thoracic spine, lumbar spine, and pelvis. 30. Demonstrate the ability to perform a comprehensive clinical examination of common illnesses and conditions and provides the appropriate referral as indicated. 31. Locate community-based resources for psychosocial intervention. 32. Demonstrate appropriate communication skills and use ethnic and cultural sensitivity in communication. 33. Produce documentation of the patient encounter consistent with contemporary athletic training practice using appropriate terminology and complying with all applicable regulatory standards. Credits: 6.00

HK 64500 - Psychosocial Interventions In Athletic Training

Credit Hours: 2.00. The focus of this course is on identification, referral, and treatment options for patients with organic and non-organic mental health conditions commonly seen in athletic training. The course will also address cultural competence in patient care and the role of various mental healthcare providers that comprise the mental health referral network. Permission of department required. Prerequisite: HK 535 with B- or better.

Learning Outcomes: 1. Explain the theoretical background of psychological and emotional response to injury and forced inactivity. 2. Identify and select psychosocial techniques into a patients treatment or rehabilitation program. 3.

Evaluate which psychosocial techniques are appropriate for a patient in a given clinical scenario. 4. Identify at-risk individuals with psychosocial disorders and/or mental health emergencies. 5. Distinguish appropriate patients requiring referral to mental health care providers. 6. Develop a management plan for at-risk individuals. 7. Explain and demonstrate processes of effective interpersonal and cross-cultural communication. 8. Construct psychological techniques and interventions that are used to facilitate and motivate the patient for return to play. 9. Summarize the importance of Cultural Competence when providing healthcare. 10. Evaluate how psychosocial considerations affect clinical decision-making related to return to activity or participation. Credits: 2.00

HK 65000 - Seminar In Athletic Training

Credit Hours: 3.00. This course is a culminating experience in athletic training that will provide the student with a comprehensive review of athletic training foundational and specific knowledge regarding the Domains of Athletic Training. This course will help the student to prepare for athletic training practice. Permission of department required. Prerequisite: HK 53000 with B- or better.

Learning Outcomes: 1. Access, analyze, and differentiate between the essential documents of the national governing and regulatory bodies, including, but not limited to, the NATA Athletic Training Educational Competencies, BOC Standards of Professional Practice, the NATA Code of Ethics, and the BOC Role Delineation Study/Practice Analysis. 2. Produce a self-assessment of professional competence and create a professional development plan to maintain necessary credentials and promote life-long learning. 3. Summarize the tasks required for entry-level proficiency of athletic trainers within the five domains of the BOC Role Delineation Study/Practice Analysis. 4. Evaluate the recommendations found in the NATA Position Statements, Official Statements, and Consensus Statements against current practice patterns. 5. Appraise current trends at the state, district and national level in athletic training involving clinical practice and education. Credits: 3.00

HK 66000 - Diagnostic Imaging In Athletic Training

Credit Hours: 1.00. This course provides students with an intensive study of radiology. Students will understand the types of diagnostic images commonly used in sports medicine, as well as basic interpretive techniques used in radiology. The course will emphasize the systematic approach for diagnostic images and interpretation of various diagnostic reports. Permission of department required. Prerequisite: HK 58000 with B- or better.

Learning Outcomes: 1. Understand the importance of imaging technology used in musculoskeletal care. 2. Evaluate the differences and capabilities of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 3. Understand the importance of communicating with other healthcare providers regarding radiological studies. 4. Describe a radiological report and evaluate the findings related to a rehabilitative plan of care. 5. Use terms commonly found in diagnostic radiography, MRI, CT, bone scintigraphy, and ultrasonography. 6. Summarize the fundamental physical principles of radiography, MRI, CT, bone scintigraphy, and ultrasonography. 7. Categorize basic positions utilized for radiography. 8. Identify basic anatomy in routine radiography, MRI, CT, bone scintigraphy, and ultrasonography. 9. Compare the three types of densities usually seen on a radiograph and their significance. 10. Discuss the importance of correlating the study with the patient's history and physical exam. 11. Describe and then compare the different patterns of pathologic processes; including fractures, sprains, strains, effusions, stress reactions, DVT. 12. Differentiate the genetic anomalies commonly

seen on radiographs. 13. Interpret routine radiographs and identify abnormalities. Credits: 1.00

HK 66800 - Seminar In Exercise Physiology

Credit Hours: 3.00. Review of literature; design and conduct of research in an area of current interest in exercise physiology. Permission of instructor required.

Credits: 3.00

HK 66900 - Exercise Metabolism And Biochemistry

Credit Hours: 3.00. This course is designed to provide students with practice using basic laboratory skills which can then be applied to more sophisticated techniques in biochemical analysis. The course is a laboratory-based class and will provide considerable "hands-on" experience. Lectures will focus on laboratory procedures, calculations, common lab problems and solutions, and laboratory safety procedures. Most of these measures will be made using an exercise context, i.e., standard exercise physiology tests (VO2 max, Wingate tests, etc.) will be performed to allow us to acquire blood samples for analysis. Prerequisites: HK 56800 or permission of the instructor.

Learning Outcomes: 1. Accurately weigh, measure and make calculations for mixing, diluting, and preparing solutions and buffers for use in the laboratory. 2. Safely perform hemoglobin, creatine kinase, cholesterol, glucose, lactate, mononuclear cell isolation, glycerol and citrate synthase assays. Credits: 3.00

HK 67000 - Advanced Topics In Motor Control

Credit Hours: 3.00. Selected topics in motor control. The subject matter will be data-based and drawn from research literature encompassing behavioral and physiological experimental paradigms. Students will critically evaluate and synthesize research to better understand the integration of individual systems in sensorimotor processing. Permission of instructor required.

Credits: 3.00

HK 67200 - Stress And Coping In Sport, Exercise And Physical Activity

Credit Hours: 3.00. This course examines stress, coping, and emotional processes as they relate to sport, exercise, physical activity, and the physical self. We will explore theoretical perspectives on stress and coping processes, examine the empirical evidence related to sport/exercise/physical activity/rehabilitation/physical self, and discuss applications of this knowledge. Course readings will cover topics including the history and conceptual issues of psychosocial stress, conceptual and methodological issues of coping, individual differences in stress and coping, the influence of sociocultural and contextual factors, and vulnerability and resilience. Prerequisite: HK 57400 .

Learning Outcomes: 1. Be able to understand and explain major theories of stress, coping, and emotional processes, and how individual and contextual factors influence these process as they related to physical activity and the physical self. 2. Be able to critically evaluate research articles on stress, coping and emotion related to physical activity and the physical self. 3. Propose applications based on theoretical and empirical knowledge of stress/coping/emotion in physical activity settings. 4. Develop and refine critical thinking, writing, oral communication, and group facilitation skills. Credits: 3.00

HK 67400 - Special Topics In Sport And Exercise Psychology

Credit Hours: 3.00. An in-depth analysis of specific areas of theoretical and empirical work in sport or exercise psychology. Emphasis is placed on the critique, integration, and application of the literature reviewed. Rotating topics. Prerequisite: HK 57400 .

Credits: 3.00

HK 67800 - Motivational Processes In Sport And Exercise

Credit Hours: 3.00. Seminar focused on motivation in sport and exercise settings. Antecedents and consequences of motivated behavior are examined from theoretical, research, and application perspectives. Topics include participation motivation in sport, intrinsic/extrinsic orientations, achievement goals, causal attributions, group processes, and exercise motivation. Prerequisite: HK 57400 .

Credits: 3.00

HK 68300 - Patient Care Simulation In Athletic Training II

Credit Hours: 3.00. This course is designed to refine

psychomotor skills and apply specific athletic training proficiencies integrating cognitive concepts and skills into progressively higher-level practical application. Skill integration will be achieved through successful completion and evaluation of patient care scenarios with emphasis placed on clinical reasoning skills of the student while making point-of-care decisions. Permission of department required. Prerequisite: HK 56300 with a B- or higher.

Learning Outcomes: 1. Evaluate common orthopedic conditions of the axial and appendicular skeleton, formulate a differential diagnosis, and recommend appropriate treatment strategies. 2. Evaluate patients with medical conditions involving the cardiovascular system, gastrointestinal system, dermatological system, endocrine system and determine a differential diagnosis with appropriate interventions, including potential for referral. 3. Evaluate general medical conditions and common non-orthopedic conditions of the head and face and determine a differential diagnosis with appropriate interventions, including potential for referral. 4. Screen a patients' general health and wellness, fitness, nutrition, gait, posture, and movement to address deficiencies in order to develop treatment strategies and referrals (where indicated). 5. Design an overall program to include fitness and wellness, nutrition, and general injury prevention strategies (including ergonomics). 6. Use baseline evaluation data of mobility, stability, strength, and balance to compose a therapeutic exercise program to address known deficits. 7. Select and incorporate therapeutic modalities into the rehabilitation plan of care. 8. Formulate a progressive rehabilitation plan using evidence-based interventions for common musculoskeletal injuries and conditions. 9. Instruct a patient in corrective exercise and a home exercise program. 10. Use patient and clinician oriented outcomes to make clinical decisions, including recommended interventions, activity progressions, and return to play decisions. 11. Educate and instruct a patient on general health and wellness behaviors and in the program to address deficiencies identified on a comprehensive fitness evaluation. 12. Communicate patient care status with stakeholders involved on the healthcare team (other providers, parents, coaches, administrators). Credits: 3.00

HK 68600 - Theories And Concepts Of Stress Management

Credit Hours: 3.00. Development of a conceptual understanding of stress and stress management. A seminar focused on the review of literature regarding psychophysiology of stress, relationship between stress and disease, and methods of preventing/relieving stress, models of stress research, and issues surrounding stress research methodology. Prerequisite: BIOL 20300 , BIOL 20400 . Permission of instructor required.

Credits: 3.00

HK 69000 - Advanced Studies

Credit Hours: 1.00 to 6.00. Topic and credit to be arranged. Individual study for the doctoral student. Permission of instructor required.

Credits: 1.00 to 6.00

HK 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HK 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Health Sciences (Graduate)

Website: **https://www.purdue.edu/hhs/hsci**

Department/School Head

Dr. Jason Cannon

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Assistant Professor	Emeritus Faculty
Aaron B. Bowman Jason Cannon Ulrike Dydak Jennifer Free,am Jason Harris Shuang Liu Linda Nie Maria (Marisol) Sepulveda Rusi P. Taleyarkhan Wei Zheng	Qiuhong He Yi Le Sa Liu Jae H. Park Michael S. Ringor Jonathan Shannahan Keith M. Stantz Ellen M. Wells	Priyanka Baloni Patrick Kerstein Oderinde Oluwaseyi Matthew Scarpelli Aaron Specht	Lisa Hilliard Mark Wilson	Gary P. Carlson Gary E. Isom Robert R. Landolt James D. McGlothlin James F. Schweitzer Paul L. Ziemer Neil J. Zimmerman

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Academic Programs

Master's and Ph.D. Programs

Purdue University's School of Health Sciences is committed to creating, disseminating, preserving and applying knowledge in the areas of Radiological, Occupational and Environmental Health Science through leading-edge scholarly research, teaching, and engagement. The School offers nationally recognized educational programs in Medical Laboratory Sciences, Radiological Health Science, Occupational Health Science, Environmental Health Science, and maintains career-advancing programs in pre-allied health and other clinical and medical related Health Science Pre-Professional programs. We also offer advanced and accredited degrees in Occupational and Environmental Health - Industrial Hygiene (ABET), Medical Physics (CAMPEP), Health Physics, Imaging Sciences, and Toxicology. With a commitment to excellence, the School serves local, national and international citizens through the following initiatives:

Research and development that enhances health, the environment, and safe working conditions.

State-of-the-art comprehensive programs that provide a strong basis of learning that prepares graduates to succeed as tomorrow's leaders, professionals and citizens instilled with critical thinking skills and able to function in a global technological environment.

Engagement that develops strong associations with our students, alumni, university colleagues, industry, and community.

Faculty, staff, and students who reflect our social environment and culture.

Concentrations (Areas of Study)

Health Physics - HTHP (MS, Ph.D.), Imaging Sciences - IMGS (MS, Ph.D.), Medical Physics - MEDP (MS, Ph.D.), Occupational and Environmental Health Sciences - OEHS (MS, Ph.D.), and Toxicology - TOXC (MS, Ph.D.)

Combined Degree Programs

(Undergraduate Degree / Master's Degree) Radiological Health Pre-Med Physics (4+1) Program; Industrial Hygiene BS/MS (4+1) Program; Accelerated Health Sciences-Management BS/MBA (3+2) Program

Medical Physics, Post-Masters Certificate

Imaging Sciences, MS

Imaging Sciences, PhD

Health Physics, MS

Health Physics, PhD

Medical Physics, PHD

Occupational and Environmental Health Sciences, MS

Occupational and Environmental Health Sciences, PhD

Toxicology, MS

Toxicology, PhD

Medical Physics, MS

HHS 59000 - Special Topics In Health And Human Sciences

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. 2. Outcomes will be required to meet the expectations laid out for 500-level courses. Credits: 0.00 to 9.00

HSCI 51400 - Radiation Instrumentation Laboratory

Credit Hours: 2.00. Laboratory techniques required for the application of radiation and radionuclides.

Credits: 2.00

HSCI 51500 - Introduction To Nuclear And Radiological Source Security

Credit Hours: 3.00. This course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the State and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. The integration of safety and security and the use of alternative technologies will also be covered. Group exercises and simulations in applied nuclear security scenarios will complement lectures given by a number of national and international experts. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

Learning Outcomes: 1. To introduce students to the basic concept of nuclear security. 2. To introduce students to the basics of nuclear security planning at the facility and state level. 3. Introduce students to proliferation efforts, framing them within the historical and security-related context. 4. Create a foundational understanding of relevant security, safeguards and nonproliferation treaties and agreements. 5. Leverage existing technical knowledge in coming to policy conclusions. 6. Develop both a

regime and state specific knowledge base. 7. Illustrate understanding through technical and policy oriented exercises. 8. Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts. Credits: 3.00

HSCI 51600 - Molecular Imaging-Nuclear Medicine

Credit Hours: 2.00. This course is related to molecular imaging by SPECT (single-photon emission computed tomography) and/or PET (positron emission tomography). This course is particularly useful for graduate and senior undergraduate students in the medical physics programs. It has been offered to MP and HP graduate students over the last 4 years (2014 - 2018) as a part of the 3-credit molecular imaging course with magnetic resonance spectroscopy (MRS: 1-credit) taught by Dr. Ulrike Dydak, computed tomography (CT: 1-credit) taught by Dr. Keith Stantz, and nuclear medicine (NM: 1-credit) taught by Dr. Shuang Liu. In the future, it will be expanded the "Nuclear Medicine" section as a 2-credit course on the basis on the previous lectures. This course focuses on recent development in nuclear medicine techniques for noninvasive imaging of brain diseases, cancer, and heart diseases. This course is delivered as 50-min lectures twice a week. Students are expected to spend more time for homework and literature reading.

Learning Outcomes: 1. Understand the basic concept of molecular imaging, techniques for isotope production, and the use of radiolabeled biomolecules (e.g. antibodies and small biomolecules) for diagnosis of brain diseases, cancer and heart diseases, and for target-specific radiotherapy with the receptor-based radiotracers. Credits: 2.00

HSCI 52000 - Risk Assessment In Environmental Health

Credit Hours: 3.00. Risk assessment as used in environmental health is the scientific process used to determine the extent of human exposure to an environmental hazard, and the type and quantify of health effects that are likely to result from these exposures. Information derived from risk assessments are used as the basis for setting regulatory guidelines, determinations of whether a given situation is "safe" or "hazardous" throughout government and industry. This course will cover the process and steps needed to performing a risk assessment, how risk communication can be used to discuss results of a risk assessment, and the use of risk management as a tool to translate results of a risk assessment into policy.

Learning Outcomes: 1. Define risk assessment and describe the general processes and methods used for risk assessment. 2. Discuss and analyze how issues such as variability and uncertainty impact risk assessments. 3. Define risk communication and describe what features improve (or worsen) its effectiveness. 4. Describe the process of hazard management including its strengths and weaknesses in terms of ensuring protection of human health. 5. Perform a risk assessment on an environmental hazard and communicate the results of this assessment. Credits: 3.00

HSCI 52500 - Introduction To Statistical And Computational Approaches For Health Sciences

Credit Hours: 3.00. Statistical methods are important for data analysis and understanding the trends in the dataset.
This course will provide an introduction to the analysis of biological data in a statistical framework using standard computational methods. The course will have a lecture and hands-on component to introduce students to topics and then utilize them to solve typical problems in Health Sciences. In addition to learning the statistical concepts, the students will also be introduced to computational approaches for data analysis. The combination of statistical and computational concepts along with the hands-on experience will help students in their research projects. The topics covered include data representation, sample statistics, probability, common discrete and continuous distribution, confidence interval estimation, experimental design, analysis of variance, statistical methods for hypothesis testing, linear and logistic regression, correlation, power analysis, graph theory, network analysis, omics-based analysis, and data visualization. The course is ideal for Health Sciences students who perform data analysis and are interested in implementing these approaches in their research. Permission of department required.

Learning Outcomes: 1. Describe the fundamentals of statistics and computational concepts useful for research. 2. Think critically and analyze methods of data collection, statistical tools for data analysis, and presentation of results. 3. Evaluate systematically statistical procedures and summaries. 4. Learn methods for computational analysis and data visualization. 5. Participate actively in developing projects to apply

statistical and computational approaches. Credits: 3.00

HSCI 52600 - Principles Of Health Physics And Dosimetry

Credit Hours: 3.00. Principles of health physics, radiation dosimetry, and radiation shielding. Topics covered include natural and man-made radiation environments, operational radiation quantities and units, radiation protection philosophy, risk and dose limits, dose-response models, mortality estimates and risk calculations.

Credits: 3.00

HSCI 53400 - Applied Health Physics

Credit Hours: 3.00. Lecture and case studies related to the application of radiation dosimetry and shielding principles to the practice of health physics, including environmental and in-plant monitoring, emergency response, decommissioning and decontamination, operational criteria for meeting ALARA exposure limits, and the transport, disposal and treatment of radioactive waste. Epidemiological studies related to radiological accidents and nuclear power are also examined.

Credits: 3.00

HSCI 54000 - Radiation Biology

Credit Hours: 3.00. Effects of ionizing radiation on living systems at the molecular, cellular and tissue levels. Biological basis for radiation therapy treatment planning and radiation protection.

Learning Outcomes: 1. Understand the interaction of radiation with cells. 2. Understand the biological, chemical, and physical factors that modulate the interaction of radiation with cells. 3. Understand the mechanisms of cell killing by radiation. 4. Understand the repair of radiation damage. 5. Understand the genetic effects of radiation. 6. Understand the carcinogenic effects of radiation. 7. Understand the effects of radiation on different tissues. 8. Understand the effects of acute whole body irradiation. 9. Understand the use of radiation in cancer therapy. 10. Understand the effects of radiation on development. 11. Understand the biology of radiation carcinogenesis. 12. Understand the risk of cancer in populations exposed to low doses of radiation. Credits: 3.00

HSCI 54100 - Human Sectional Anatomy

Credit Hours: 2.00. This course connects anatomy and physiology with medical imaging. The primary focus is on anatomic imaging methods such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) but includes Positron Emission Tomography (PET) and Ultrasound (US) images when applicable or are in common use as part of clinical care.

Learning Outcomes: 1. Identify and label the anatomy associated with the topical outline in diagnostic CT/MRI images. 2. Critique CT/MRI images for the presence or absence of anatomy and pathology to decide whether the image is appropriately positioned and diagnostic for radiological assessment. 3. Locate anatomical systems and possible pathology based on background knowledge of typical anatomical locations and identify normal course of system function for appropriate positioning, patient instructions, and CT/MRI imaging. Credits: 2.00

HSCI 54400 - Advanced Topics In Exposure Assessment

Credit Hours: 2.00. The course will prepare students to use techniques of exposure assessment as it relates to environmental and occupational epidemiological studies as well as regulatory compliance at workplace and in community settings, risk science, and susceptibility factors. It will include exposure assessment study design, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with occupational and environmental health. Core concepts to be covered include exposure variability and its implications for reconstructing historical exposures, the choice of exposure metric, surrogate measures and measurement errors, exposure modeling, and biomarkers of exposure. The course emphasizes critical and analytical discussions of seminal exposure assessment literature. Students are required to critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature. Students participate in the class through presentations, class discussions, and a semester project.

Learning Outcomes: 1. Explain the nature of exposure problems in reconstructing historical exposures in occupational and non-occupational settings. 2. Recognize the

implications of sparse and missing data and the choice of the exposure-response relationship. 3. Design a testable hypothesis and execute research activity to investigate exposure to environmental contaminants at workplace or in a community, and interpret data obtained from such studies. 4. Be aware of the modeling tools for quantifying exposures. 5. Evaluate critically exposure assessment strategies in occupational and environmental epidemiological studies and risk assessments. Credits: 2.00

HSCI 54600 - Advanced Industrial Hygiene Control Technology

Credit Hours: 4.00. Study of the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Major emphasis is placed on developing a working understanding of industrial ventilation, including basic principles of fluid flow, hood and duct design, and system balancing. Effects and control of the physical hazards of noise, vibration, and heat stress are addressed. A field trip to a major industry summarizes the course material.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros & cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand potential sources of indoor air quality problems, physical symptoms which may be experienced by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans, and balance/test such systems, culminating in the ability to design a small ventilation system. Credits: 4.00

HSCI 54601 - Advanced Industrial Hygiene Control Technology Project

Credit Hours: 1.00. Students study the various techniques needed to control hazards in the workplace. Engineering controls are placed in effort to reduce or remove the hazard at the source by isolating the worker from the hazard. Permission of instructor required.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating recognition, evaluation and control of occupational hazards in the workplace. Credits: 1.00

HSCI 54700 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association

between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies.
Credits: 3.00

HSCI 54800 - Advanced Industrial Hygiene Instrumentation Techniques

Credit Hours: 3.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data.

Learning Outcomes: 1. Use scientific and engineering principles to anticipate and recognize potential health hazards in the workplace. 2. Interpret the scientific literature and health data and apply these to the anticipating, recognition, evaluation and control of occupational hazards in the workplace. 3. Describe/understand different approaches for controlling exposures in the occupational environment and give hypothetical and real situations in terms of the best control methods and relative pros and cons. 4. Understand the physical and physiological aspects of heat stress and heat strain and apply this knowledge to prevent heat injury in the workplace. 5. Understand the potential sources of indoor air quality problems, physical symptoms which may be experiences by individuals exposed to various contaminants, and methods of improving the indoor environment. 6. Identify biological contaminants and methods of controlling exposure. 7. Understand the physical and physiological aspects of noise-induced hearing loss and apply this knowledge to assess exposure and prevent hearing loss in the workplace. 8. Perform calculations of noise levels, noise doses and the effectiveness of noise control options. 9. Select and size the components of a local exhaust ventilation system: hoods, ductwork, air cleaners, fans and balance/test such systems, culminating in the ability to design a small ventilation system.
Credits: 3.00

HSCI 54801 - Advanced Industrial Hygiene Instrumentation Techniques Project

Credit Hours: 1.00. This course covers sophisticated field and laboratory instrumentation and techniques, sampling methodology for organic vapors, dust, fibers, noise, and heat; calibration and validation techniques; emphasis on critical analysis of data. Permission of instructor required.

Learning Outcomes: 1. Understand the limitations of sampling and analysis in real world situations and learn how to deal with them. 2. Collect, analyze interpret and summarize laboratory data into a well-written report. 3. Appreciate the advantages as well as the difficulties of working together on a team.
Credits: 1.00

HSCI 55100 - Physical Agents In Environmental Health

Credit Hours: 3.00. Physical characterization and biological interactions of non-ionizing radiation with emphasis on the adverse effects of human exposure. Topics include source characterization, environmental exposure assessment, measurement instrumentation, toxicological and epidemiological findings, control strategies.

Credits: 3.00

HSCI 55200 - Introduction To Aerosol Science

Credit Hours: 3.00. The principles of aerosol behavior and sampling, with particular emphasis on applications in the health sciences. Topics include aerosol aerodynamics, aerosol filtration, pulmonary deposition of aerosols, methods of environmental sampling, and generation of laboratory aerosols.

Credits: 3.00

HSCI 55300 - Advanced Occupational Safety Management And Culture

Credit Hours: 3.00. The Occupational Health and Safety Manager assumes a critical role within an organization, protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training,

hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front line employees. As such, the successful health and safety manager needs to skill sets which transfer across organizational levels. This course will explore strategies managing an effective health and safety program within an organization. Management strategies will be viewed from multiple perspectives. In relation to the front line employee, topics will be explored to help engage employees in safe behaviors and dealing with situations in which failures occur, resulting in accidents. The upper management perspective will focus on the establishment of a safety management system and effective techniques for measuring and reporting safety performance. A final perspective will consider both the front line employee and upper management. This perspective will explore strategies to establish a positive safety culture within an organization to bring the front line employees and upper management together in their vision of a safe and health workplace.

Learning Outcomes: 1. Discuss strategies for creating a positive safety culture in an organization. 2. Conduct an accident investigation and root cause analysis. 3. Identify leading and lagging safety performance indicators. 4. Explain methods of conducting safety training in an organization. 5. Plan an effective safety management system for an organization. Credits: 3.00

HSCI 55301 - Advanced Occupational Safety Management And Culture Project

Credit Hours: 1.00. The Occupational Health and Safety Manager assumes a critical role within an organization - protecting the employees from suffering work-related injuries, illnesses, and fatalities. This job requires a number of approaches to achieve this aim, including employee training, hazard identification and abatement, safety policy development, and incident investigation. The health and safety manager often forms a bridge between upper management and front-line employees. As such, the successful health and safety manager needs skill sets which transfer across organizational levels. Permission of instructor required.

Learning Outcomes: 1. Identify, review, and critically evaluate current literature in the field of occupational safety management and culture. 2. Collaborate the peers on a group project to review a real safety management program. Credits: 1.00

HSCI 56000 - Toxicology

Credit Hours: 3.00. (MCMP 56000) Introduction to general principles of toxicology, target organ toxicity, and safety evaluation. Covers toxicity of metals, solvents, pesticides, gases, dusts, and food additives.

Credits: 3.00

HSCI 56200 - Analytical Toxicology And Pathology

Credit Hours: 3.00. Historically, toxicology has been defined as the study of the adverse effects of xenobiotics. Today, toxicology encompasses much broader areas, including the study of endogenous compounds, physical agents, and even using toxicants as research tools. Basic and introductory toxicology courses cover the principles of toxicant metabolism and target organ toxicity. This course, Analytical Toxicology and Toxicologic Pathology is focused on the research and clinical applications of these principles. Two major areas will be covered: (1) principles of toxicant detection in biological matrices and (2) the assessment of pathological effects caused by toxicant exposure in biological systems. Laboratory sessions associated with each major topic allow students to have hands-on experience in these advanced analytical and pathological technologies. This course provides a unique opportunity for students to learn techniques that research and clinical toxicologists use daily in scientific or clinical laboratories. The course is suitable to both graduate and upper-class undergraduate students who are interested in toxicology, forensic science, veterinary medicine, environmental and occupational health, food toxicity, pharmaceutical drug testing, medical laboratory science, and general human and children's health.

Learning Outcomes: 1. Have a basic understanding of how to measure toxicant levels. 2. Have essential knowledge in evaluating histopathological alterations of major organs and tissues upon exposure to typical toxicants. 3. Be able to assess and interpret the adverse effects of toxicants in mammalian systems. Credits: 3.00

HSCI 57000 - Introduction To Medical Diagnostic Imaging

Credit Hours: 3.00. This course teaches the fundamentals of medical imaging, including the basic physics and engineering associated with each imaging modality (CT, MRI, PET, and ultrasound), as well as mathematics and computational tools associated with image reconstruction and image processing.

The course is intended for students in health sciences, biomedical engineering, physics, and life sciences.

Credits: 3.00

HSCI 57100 - Basics Of Magnetic Resonance Spectroscopy

Credit Hours: 3.00. Students will learn the basics of Magnetic Resonance Spectroscopy (MRS), practicalities of the MRS exam including hands-on experience, as well as examples of several clinical and research applications of MRS. The course teaches theory, practical aspects and applications of MRS and is intended for graduate students who either specialize in the field of medical imaging, or who would like to use MRS as a tool for their research. A thorough basis will be provided to understand signal generation and signal processing in MRS with particular emphasis on current techniques used in human in vivo MRS. Students will become familiar with the most relevant metabolites and their physiological functions detectable by MRS in the brain and other organs (mostly liver, kidney, muscle, prostate, breast). Further, students will learn different approaches for analysis and quantification of MRS data and become familiar with several different analysis tools available. Permission of instructor required.

Learning Outcomes: 1. Describe the basics of signal generation and detection in MRS. 2. Distinguish between several localization techniques and when to apply each. 3. Implement and apply MRS parameters and protocols for specific applications. 4. Compare and contrast the similarities and differences of different nuclei used in MRS (1H, 31P, 23Na). 5. Implement and apply several MRS processing tools. 6. Summarize the techniques and challenges of MRS signal quantification. 7. Compare and contrast the advantages and limitations of MRS to other imaging modalities. 8. Implement and apply several MRS analysis tools (e.g. LCModel). 9. Set up and acquire human subject MRS data (using a 3T Siemens Prisma scanner). Credits: 3.00

HSCI 57200 - Radiation Oncology Physics

Credit Hours: 3.00. An introductory course to the physical principles, equipment, processes, imaging guidance, and clinical techniques involved in the treatment of cancer patients with external radiation beams and radioactive sources. Various external radiation beam types and their energy deposition characteristics are described. Treatment planning dose calculation algorithms and point dose calculations are discussed. The use of international dosimetry protocols for radiation beam calibration are covered in detail.

Learning Outcomes: 1. Perform dose calculations used in radiation therapy and to derive output factor (MU) to obtain these point dose calculations. 2. Describe the fundamentals of computer-based treatment planning in 1, 2, and 3 dimensions. 3. Understand and apply techniques used to plan treatment when using photons, electron, and proton beams. 4. Describe the rationale and fundamentals of common methods and special techniques used in radiation therapy, including static accelerators, IMRT, Tomotherapy, Gamma knife, CyberKnife, Brachytherapy, TBI, SBRT, and similar. Credits: 3.00

HSCI 57400 - Medical Health Physics

Credit Hours: 2.00. This course introduces the legislation and international and national recommendations relevant to the practice of radiation protection in medicine. Principles for the design of radiation use monitoring programs and shielding for radiation facilities is covered. Radiation risk avoidance and management for staff, patients and their families, and members of the public are discussed.

Learning Outcomes: 1. Introduce the student to the application of health physics in medicine and the role of the health physicist and medical physicist in this environment. Real-life experiences will be provided by lecturers to connect the professional and technical aspects of medical health physics to the clinical environment. 2. Identify issues and problems that would not normally be taught in the pure academic setting. Credits: 2.00

HSCI 57500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed

countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

HSCI 58000 - Occupational Biomechanics And Ergonomics

Credit Hours: 2.00. Occupational safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work. Occupational ergonomics is a branch of science that focuses on optimizing the relationships between workers and their work environment. This course focuses on the principles and applications of safety and ergonomics as it applies to workers. The first part of the course will consist of lectures on the fundamentals of safety standards and liability and the development of work-related musculoskeletal disorders, ergonomic risk factors including work practices, tools and workstation design. The last part will consist of identification and use of safety and ergonomic controls to reduce and prevent work-related fatalities, injuries, and musculoskeletal disorders.

Learning Outcomes: 1. Describe ergonomic risk factors in the workplace. 2. Analyze work stations and identify ergonomic risk factors. 3. Develop solutions to minimize identified ergonomic risk factors. 4. Describe cumulative trauma disorders which may occur due to exposure to poor ergonomic conditions. 5. Explain how people perceive & understand information, and use this knowledge to improve work flow. Credits: 2.00

HSCI 58001 - Occupational Biomechanics And Ergonomics Laboratory

Credit Hours: 1.00. This course will be the laboratory component for HSCI 58000. Occupational Biomechanics and Ergonomics. Laboratory exercises will accompany and illustrate each topic discussed during the lecture course. An ergonomic project will allow the students to evaluate an individual performing a job and provide ergonomic recommendations to improve the work situation. The course will also emphasize report writing, teamwork, and communication skills.

Learning Outcomes: 1. Evaluate scientific literature to identify the strengths & weaknesses of study designs, interpretation of results, and implications for the future. 2. Display techniques for performing ergonomic measurements. 3. Evaluate ergonomic hazards of the workplace and make recommendations to correct the identified hazards. 4. Write professional quality reports summarizing laboratory procedures, clearly display experiment results, and interpret those results in the context of the principles learned in the HSCI 58000 lectures. Credits: 1.00

HSCI 59000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for seniors and graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 61300 - Professionalism And Professional Development In Health Sciences

Credit Hours: 1.00. Professionalism is a skill set necessary for graduate student success and future career development. Professionalism consists of multiple attributes allowing for the development of effective and productive careers while also contributing to positive workplace environments. Specifically, these skill sets benefit all disciplines and career paths. This course will provide students with an overview of career

development, soft skills, responsible conduct of research, and diversity, equity, and inclusion. This 1-credit course is specifically designed to supplement initial RCR training students receive in GRAD61200. The course is designed to support additional RCR training to meet expectations for best practices by NIH and other funding agencies. It will focus on professionalism and professional development for new students in their MS and Ph.D. programs across the Health Sciences. It will be delivered as a 50-min. combined lecture and class discussion once a week. All Ph.D. and thesis-based MS students in the School of Health Sciences are expected to take this course, typically in the Spring of their second or third year. Permission from department required. Prerequisite: GRAD 61200.

Learning Outcomes: 1. Describe the fundamentals of professionalism and professional conduct as both a trainee and within one's own career. 2. Demonstrate responsible conduct of research and diversity, equity, and inclusion through participation in course discussions. 3. Actively participate in the development of multiple soft skills including networking, negotiation, interview, leadership, conflict resolution, networking, and social media management. 4. Critically think and analyze complex professional situations often occurring in scientific careers. Credits: 1.00

HSCI 62500 - Grant Writing For Health Sciences

Credit Hours: 1.00. The ability to clearly communicate research concepts, ideas, and hypotheses is an essential skill for all researchers. Specifically, concise expression of complex research rationale, experimental design, and innovation through the grant application process benefits all disciplines and career paths. This course will provide students with an overview of the entire grant writing process through expert lectures, active discussion, writing activities, and peer-review processes.

Learning Outcomes: 1. Describe the federal funding systems and grant submission process. 2. Demonstrate scientific writing and critique skills as applied to grant proposals. 3. Develop a National Institute of Health R21 grant proposal. 4. Actively participate in the grant proposal review process by critiquing other's work. Credits: 1.00

HSCI 67100 - Biochemical Toxicology

Credit Hours: 2.00. Toxicologists in all fields are concerned with mechanism of action or how a specific toxicant or class of toxicants produces toxicity. Introductory toxicology courses typically focus on the adverse effects exerted by a specific compound, with some examination of mechanisms. The entire focus of this upper-level graduate course is on the "how" and the "why", or a detailed examination of biochemical mechanism of toxicity. There will be some lectures, but the majority of the course will consist of student-led discussions on specific mechanisms of action. Further, students will write a review-style article on a chosen mechanism of action. Prerequisite: HSCI 56000 .

Learning Outcomes: 1. Orally describe mechanisms of action for major classes of toxicants. 2. Draft a written manuscript that critically assesses data on a specific mechanism of action. Credits: 2.00

HSCI 67200 - MRI Quality Assurance Internship I

Credit Hours: 3.00. This internship course provides didactic training and practical experience in clinical diagnostic medical physics. Students will spend 3-4 hours per week learning the responsibilities of a medical physicist in MRI quality assurance (QA) such as MRI system performance testing, setting up weekly MRI QA procedures, analysis of MRI QA data, and annual clinical system evaluations. In Part I students will observe and review the weekly MRI QA tests performed by the MR Technologists on clinical MRI scanners and be involved with data analysis of these tests (image quality assessment, reporting). Annual MRI system performance evaluations of different clinical scanners will be observed and discussed. This includes assessing magnetic field homogeneity, slice position accuracy and slice thickness accuracy, and performance of radio frequency coil tests on the various coils available at different clinical MRI sites in the Indianapolis area. Students will also work as a team with the instructors on a course project to develop and evaluate advanced MR QA methods and procedures. Prerequisites: HSCI 57000. Having documented experience in running an MRI scanner, e.g., having primary operator status on one of the research scanners at Purdue or IU. Level II MRI Safety Training: http://www.indiana.edu/~mri/safety_nonIU/safety.html. Permission of instructor required.

Learning Outcomes: 1. Understand the basic elements and clinical rationale in the QA program for MRI scanners. 2. Understand the significance of frequency and transmitter gain stability, geometric accuracy, slice position

accuracy, high contrast resolution, low contrast detectability and artifacts, etc. 3. Understand the requirements for weekly and annual QA tests as required by ACR. Credits: 3.00

HSCI 67300 - MRI Quality Assurance Internship II

Credit Hours: 3.00. This internship course provides didactic training and practical experience in clinical diagnostic medical physics. Students will spend 3-4 hours per week learning the responsibilities of a medical physicist in MRI quality assurance (QA) such as MRI system performance testing, setting up weekly MRI QA procedures, analysis of MRI QA data, and annual clinical system evaluations. In Part II of the course, MRI system performance evaluations of different clinical scanners will be performed by the students independently following the ACR guidelines. This includes assessing magnetic field homogeneity, slice position accuracy and slice thickness accuracy, and performance of radio frequency coil tests on the various coils available at different clinical MRI sites in the Indianapolis area. Students will also work as a team with the instructors on a course project to develop and evaluate advanced MR QA methods and procedures. Prerequisites: HSCI 67200. (This course provides the theoretical basis and opportunity to observe MRI QA on clinical scanners, and forms the basis for this course, Part II). Permission of instructor required.

Learning Outcomes: 1. Understand the requirements for weekly and annual QA tests as required by ACR. 2. Become proficient at performing weekly and annual MRI QA procedures. Credits: 3.00

HSCI 67400 - Radiological Diagnostic Imaging Internship

Credit Hours: 3.00. This internship course provides the student with hands-on experience with clinical imaging equipment, lectures on the fundamental operation of the equipment, and quality assurance/control methods/assessment of this equipment. Students will learn the safety and imaging performance of flat panel digital x-ray system, fluoroscopy, CT scanner, Ultrasound system, and MRI scanner. Lectures will provide fundamental physics and operation of each system, perform quality assurance methods employed by board certified Medical Physics, and subsequent analysis of these methods. This course is to be delivered as a 50-minute lecture, a 150-minute lab, which includes additional time for image analysis (computational lab). The goal of this course is to provide the necessary information as part of CAMPEP/ABR and ACVR. Prerequisite: HSCI 570 Introduction to Medical Imaging.

Learning Outcomes: 1. Communicate results to the faculty in charge, both verbally and in writing through their lab report. 2. Develop procedures that will provide the required measurement. The protocol they implement will require careful consideration and have a physical understanding of the result. 3. Understanding the quality of the measurements and potential procedural errors. 4. Synthesize many forms of information to understand image artifacts, characterize the cause of these artifacts, and a means to remediate them. 5. Resolve problems, requiring research and ultimately improvements in procedure or protocol. Credits: 3.00

HSCI 67600 - Radiation Therapy Clinical Competencies I

Credit Hours: 3.00. The course is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue-Indiana University School of Medicine joint CAMPEP accredited program. Students will spend approximately 4 hours in the clinic on a weekly basis for 10 weeks. Prerequisite: HSCI 57200.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology clinic. 2. Perform specific quality assurance tasks with limited supervision. 3. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

HSCI 67700 - Radiation Therapy Clinical Competencies II

Credit Hours: 3.00. This is a clinical practicum course for Medical Physics graduate students enrolled in the Purdue CAMPEP accredited program. Students enrolled in this course will participate in the Radiation Oncology clinic, which will provide similar experiences as junior medical physicists in training. Students will meet with the course instructor prior to spending time in the clinic to be assigned mentors and to arrange schedules. Students will spend approximately 3 hours in the clinic on a weekly basis. Absences/vacations are allowed but must be arranged with approved by the mentor with sufficient notice. Prerequisite: HSCI 67600.

Learning Outcomes: 1. Understand the role of the Medical Physicist in the Radiation Oncology

clinic. 2. Perform quality assurance tasks with limited supervision. 3. Understand the roles of other professionals in the Radiation Oncology clinic. 4. Identify and critically evaluate key publications for quality assurance pertaining to Radiation Oncology. Credits: 3.00

HSCI 69000 - Special Topics

Credit Hours: 1.00 to 8.00. Special topics, projects, or readings in selected areas of health sciences at a level appropriate for graduate students. Permission of instructor required.

Credits: 1.00 to 8.00

HSCI 69600 - Seminar In Health Science

Credit Hours: 0.00 or 1.00. Selected topics in health sciences presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

HSCI 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HSCI 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Hospitality and Tourism Management (Graduate)

Website: **https://hhs.purdue.edu/graduate-students/programs/?department=hospitality-and-tourism-management**

Department/School Head

Ceridwyn King

Faculty by Rank (website)

Professor	Associate Professor	Assistant Professor	Clinical Assistant Professor	Clinical Instructor	Emeritus Faculty
Ceridwyn King Liping Cai SooCheong (Shawn) Jang Xinran Lehto Rodney Runyan Kevin Kam Fung So	Jonathan Bauchet Carl Behnke Jonathan Day Alei Fan Susan Gordon Jiyun Kang Seon Jeong Ally Lee Annmarie Nicely Jiong Sun Chun-Hung (Hugo) Tang	Wookjae Heo Shinyong (Shawn) Jung	Julie Abdinor	Dawn Sieber	B. Almanza L. Kreul B. Lazarus A. Morrison T. Pearson J. Rousselle

Academic Programs

PhD Program

The PhD program is designed to be one of the strongest research-based programs in the world. The program - which includes a strong element of statistics and research design - prepares you for careers in major research universities or research-based agencies. Upon graduation, you are expected to have a curriculum vitae, which includes teaching experience, publishing experience in research journals, and a record of presentations to industry and research societies. The program has limited enrollment to allow you to develop exceptionally close working relationships with faculty.

Master of Science Program

The Master of Science program offers one of the most up-to-date and integrated blends of theory, technology and applications in the hospitality industry. You will have a choice of thesis or non-thesis plans of study in our residential program. Core courses will advance your understanding of this dynamic industry while exploring how to conduct research and analyze information.

If you choose to complete the online program, you will complete courses designed specifically for mid-career professions in the hospitality and tourism industry.

Concentrations (Areas of Study)

In the hospitality and tourism management master's and doctoral programs, you'll gain significant exposure to research, working directly with the school's faculty to explore important issues facing the hospitality industry:

- Food Service Operations
- Nutrition labeling in the hospitality industry
- Food Safety
- Sustainable tourism
- Responsible travel
- Employee well-being
- Visitor econpmics beavior
- Tourism experience design and marketing
- Travel experience, wellness, and technology
- Visitor Harassment

Consumer Science, PHD

Healthcare Service Excellence, Post-Baccalaureate Certificate

Consumer Science, MS

Hospitality and Tourism Management, MS

Hospitality and Tourism Management, PHD

Consumer Science/Gerontology, PHD

Hospitality and Tourism Management/Gerontology, PHD

Hospitality and Tourism Management, MS (OL)

CSR 50300 - EXPIRED - Transitional Health Disparities: Research, Practice, And Policy

Credit Hours: 3.00. This course will provide an overview of quantitative and qualitative research methods, measurement models, and research skills relevant to translational health science and the transfer/translation of knowledge from the research setting to applied practice settings. Course material will place special emphasis on research skills for developing health disparities translational researchers and strategies for being culturally competent, and career-minded in the mediation, cultivation, and development of translational research skills, and the implementation of evidence-based practices. Emphasis is placed on service needs of marginalized populations.

Learning Outcomes: 1. Identify and describe quantitative and qualitative research methods relevant to translational research in health disparities; be able to discuss measurement models and demonstrate skills of research relevant to translational research in health disparities. 2. Distinguish between core principles of implementation science and the transfer/translation of knowledge from the research setting to clinical practice settings in health disparities. 3. Discuss definitions and terms related to evidence-based practice (EBP), the history and progression of EBP, and the importance of empirically supported knowledge transfer from research settings to clinical settings and policy initiatives in health disparities. 4. Evaluate the importance of and need for culturally competent clinical and services research and the development of culturally adapted EBP's in health disparities. 5. Summarize ethical principles in clinical and services research in health disparities. Credits: 3.00

CSR 59000 - Special Problems In Consumer Sciences And Retailing

Credit Hours: 1.00 to 4.00. Credit variable. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

CSR 62300 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (HK 67500) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

CSR 63100 - Consumer Behavior Theories

Credit Hours: 3.00. An examination of research methods, principles, and theories of social science as they apply to the study of consumer behavior and marketing sciences. Prerequisite: STAT 50100 , STAT 50200 , or PSY 60000 , PSY 60100 .

Credits: 3.00

CSR 68100 - Consumption Theories

Credit Hours: 3.00. Analysis of theories of consumption with emphasis on their relation to current practices and to the history of economic thought. Permission of instructor required.

Credits: 3.00

CSR 69000 - Independent Study In Consumer Sciences And Retailing

Credit Hours: 1.00 to 6.00. Topic and credit to be arranged. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 6.00

CSR 69700 - Final Non-Thesis Paper

Credit Hours: 1.00 to 3.00. The curriculum of consumer behavior and family and consumer economics has evolved in the past decades with the changing market trend to currently encompassing specializations for meeting the diverse and integrated needs of individual consumers, their families, and communities. The non-thesis option is called to respond to the increasing market demand for professionals who are able to solve practical issues in the field in addition to mere epistemological pursuits. This proposed new course is designed for the students from this option to organize their learnings in the option in a way that provides propositions and strategies for addressing their topics of interest. Hence, this course should be taken during the last semester of the student's Master's program. The students will work with their major advisors for the topic and design of the study. Prerequisites: The students should take this course during the last semester of their non-thesis master's program. It is preferably taken after the students have completed the recommended core courses. Permission of Instructor required.

Learning Outcomes: 1. Be prepared for the workforce in business, nonprofit organizations, and public services. 2. Cultivate critical and analytical thinking, written communication, problem solving, and technology. Credits: 1.00 to 3.00

CSR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 18.00

CSR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 18.00

HTM 50100 - Research Methods In Hospitality And Tourism

Credit Hours: 3.00. Introduction to behavioral and economic research design, and the development of research proposals.

Credits: 3.00

HTM 50101 - Statistical Laboratory

Credit Hours: 1.00. Introduction to the use of software used in behavioral research projects.

Credits: 1.00

HTM 50200 - Management Information Systems For The Hospitality Industry

Credit Hours: 3.00. Analysis and design of management information systems for hotels, restaurants, and the travel industry. Topics include cost and value information, data management, local area and wide area networks, implementation of system and impact of information systems on hospitality organizations.

Credits: 3.00

HTM 50400 - Consumer Behavior

Credit Hours: 3.00. Understanding how and why consumers make decisions about purchasing goods, services, and experiences allows companies to tailor their business strategies, product development, and customer service efforts to meet the specific needs and preferences of their target customer base. This course addresses the growing demand for professionals to better understand psychological, social and situational influences of consume behavior. This course provides students not only with an understanding of consumer behavior concepts and theories, but also with the tools and methodologies that can be directly applied to real-world scenarios to navigate dynamic markets, effectively engage customers, and drive business success in today's competitive marketplace.

Learning Outcomes: 1. Explain how consumer behavior contributes to customer acquisition, satisfaction, and retention for relevant businesses and organizations. 2. Evaluate psychological, social, and situational influences on consumer behavior. 3. Interpret and predict consumer behavior in diverse industry contexts. 4. Synthesize current trends in consumer behavior to identify opportunities for creating customer satisfaction, engagement, and

enriched experiences. 5. Formulate effective strategies to build and maintain consumer loyalty. Credits: 3.00

HTM 50500 - Hotel Asset Management & Investment

Credit Hours: 3.00. Asset management is an indispensable discipline in the hospitality industry, aimed at maximizing the value of hotel properties in alignment with the owners' and investors' strategic objectives. A competent manager in the industry needs to possess basic understanding of asset management principles and practices for operational and strategic decisions. This course exposes students to the multifaceted world of representing ownership interests in managing hotel investments, and helps students to establish a robust corporate finance foundation to become a competent manager in the industry. Through this course, students develop a nuanced understanding of the intricate interplay among operational issues, real estate management, and financial decisions, and effectively apply the learned knowledge to hotel real estate investment and operation strategies.

Learning Outcomes: 1. Describe the role of an asset manager in the dynamic relationships among various hotel investment stakeholders. 2. Analyze the impacts of operational decisions, such as revenue management, leases, management contract, and franchise agreement, on asset valuation. 3. Explain the effects of development and management of physical assets on hotel operations and valuation. 4. Compare and apply various hotel valuation approaches. 5. Evaluate the effects of capital structure decisions on hotel investment returns. Credits: 3.00

HTM 50600 - Leading People In Service Industries

Credit Hours: 3.00. Leadership requires an understanding of human behavior, organizational culture, and strategy. In this class, students are exposed to leadership theory through the extant literature. Facilitated by readings and class discussion, students develop critical and analytical understanding of how theory informs and connects to practice. The course topics include human resources functions, organizational and human behavior, human values and motivations, team dynamics, decision-making, and change management. This course takes an interdisciplinary approach, with student learning drawn from different fields.

Learning Outcomes: 1. Understand the role of leadership in successful organizations. 2. Explain how human resource practices contribute to organizational effectiveness. 3. Analyze theories and practices in human resources, organizational behaviors, and leadership. 4. Connect leadership theories to organizational practices. 5. Synthesize different theoretical perspectives within/across service industries. Credits: 3.00

HTM 50700 - Integrated Marketing Communications For Service Industries

Credit Hours: 3.00. This course addresses the unique challenges and opportunities in marketing the intangible, inseparable, variable, and perishable service products. Balancing theoretical research and practical applications, this course provides a systematic review of key components and processes for an effective integrated marketing communication for service industries. Students will learn how to leverage both long-standing and emerging marketing communication approaches (e.g., strategic marketing and promotion, branding, public relations, digital marketing, social media, influencer marketing and artificial intelligence application) to create customer awareness, manage customer expectations, build customer relationships, and ensure customer satisfaction and loyalty.

Learning Outcomes: 1. Evaluate the role of marketing communications in achieving success for service organizations. 2. Identify critical metrics to understand customer expectations and manage customer perceptions. 3. Apply customer-centric approach to leverage various marketing communication methods and tools to meet customer needs, wants and demands. 4. Develop, promote, and manage service promises through both external and internal marketing. Credits: 3.00

HTM 50800 - Cultivating A Service Excellence Mindset

Credit Hours: 3.00. Understanding the fundamental principles of service management is essential to successfully manage service organizations in a complex market environment. This course utilizes major theoretical frameworks, such as Service-Dominant Logic, to address key issues in managing service

organizations, including creating service culture, motivating a service-minded workforce, co-creating service value, and achieving service excellence. Students develop managerial skills through a thorough understanding of service strategies, systems, and processes to optimize service value.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the service experience. 2. Explain the critical role of managing the employee-customer interface in the service delivery process. 3. Evaluate various service management strategies to enhance service excellence. 4. Construct key service management systems and processes to solve issues in complex service environments. Credits: 3.00

HTM 50900 - Service Experience Design

Credit Hours: 3.00. The success of service organizations requires well-planned design of the service environment and customer experience journey to enhance operational efficiency and excellence, drive customer satisfaction and loyalty, and differentiate from competitors. Addressing the importance of developing and providing optimal customer experience in service industries, this course aims to inspire a design-thinking approach to create contemporary customer experiences in various service settings. By gaining insights from the service design theories, students will gain knowledge to effectively manage the physical environment, service interactions, and service delivery processes to enhance the overall service experience quality. Learning by practice, students will apply the learned design tools to envisage, blueprint, and devise innovative service experience solutions.

Learning Outcomes: 1. Articulate the role of service experience design for the strategic success of service organizations in the marketplace. 2. Conduct critical quantitative and qualitative analyses of customer service experience. 3. Design service experiences for customers by utilizing various experience design tools. 4. Communicate the service design process to service industry professionals and relevant stakeholders. Credits: 3.00

HTM 51000 - Strategic Revenue Management In Service Industries

Credit Hours: 3.00. Revenue management is a vital strategic tool enabling decision-makers to coordinate various functions leading to company-wide profit maximization. This course empowers students with analytical tools to generate optimal revenue solutions in a competitive marketplace. In the course, students learn economics of pricing and market competition, models and algorithms for capacity allocation, overbooking, and forecasting through a variety of real-world contexts.

Learning Outcomes: 1. Solve for optimal prices given capacity constraints and market segmentation. 2. Calculate optimal protection and overbooking levels. 3. Forecast demand based on time series models and advanced booking models. 4. Formulate strategies to manage consumer responses to revenue management practices across various service industries. 5. Address challenges in revenue management implementation in service industries. Credits: 3.00

HTM 51100 - Hospitality Business Law And Risk Management

Credit Hours: 3.00. This course provides an overview and analysis of the legal aspects of managing a hospitality and tourism business. Risk management principles will be utilized to develop liability mitigation plans. Discussion board and case studies will be utilized to facilitate students' understanding and application of legal concepts for managing and owning businesses. Topics covered include: the rights and responsibilities of hospitality businesses and owners in the areas of civil rights, employment law, negligence, contract law, relationships with guests and others, licensing, real estate law, and product liability; the principles of risk management; and the fundamentals of business insurance.

Learning Outcomes: 1. Apply basic legal principles to evaluate a situation and determine the most likely legal outcome then use the principles of risk management to create a corrective plan to reduce liability. 2. Describe legal and ethical relationships standards for interactions with guests, other patrons, tenants, suppliers, and employees. 3. Determine if legal and ethical relationship standards have been breached and what liability if any is faced by each party. 4. Utilize the dynamics of risk management to develop a comprehensive risk management plan for a hospitality and tourism operation. 5. Describe and define the different

types of insurance options available to hospitality and tourism operations and define why and how certain insurance options are applicable to specific operations. Credits: 3.00

HTM 51200 - EXPIRED - Leadership In Hospitality And Tourism

Credit Hours: 3.00. This course will focus on the knowledge and skills required for effective leadership. Topics will draw upon an extensive body of research on leadership theory and practice and cover organizational behavior and team dynamics, business communication, decision-making, motivation and change management. In addition, specific skill development in the areas of problem-solving, written and oral communications, leading teams and goal setting, it will include models for examining personal career paths, ethical decision-making and the role or organizational change agents. This course will take an interdisciplinary approach and analyze leadership through different lenses and how leadership insights can be effectively applied to hospitality organizations. Students will examine leadership examples where individuals moved an organization from normal to exceptional functioning and extraordinary results.

Learning Outcomes: 1. Apply knowledge of organization behavior, including the impacts of personality, motivation, and emotional intelligence, to leadership situations in a hospitality business. 2. Evaluate and apply leadership theories and approaches to business situations. 3. Practice effective team building within hospitality organizations. 4. Prepare and deliver effective business communication in a variety of settings (written and oral). 5. Implement change processes within organizations and lead change management. 6. Explain how leadership values and ethics effect the overall functioning of the organization, and perform an ethical evaluation of leaders' behaviors. 7. Apply self-analysis techniques to develop a personal leadership development plan to guide them throughout their careers. Credits: 3.00

HTM 51300 - Strategy In Service Industries

Credit Hours: 3.00. Strategic management plays a pivotal role in helping industry leaders gain a competitive advantage and accomplish business goals in an ever-changing marketplace. This course centers on the exploration of various theories, frameworks, and models to understand contemporary issues and challenges in service industries. Through the application of strategic management principles and strategy-oriented tasks, students comprehend essential topics in strategic management, including environmental and competitor analysis, strategic planning, strategy formulation, strategy execution, and strategic evaluation and control.

Learning Outcomes: 1. Articulate the theoretical principles and tactical practices in strategy management. 2. Analyze external and internal factors to effectively manage service organizations. 3. Evaluate the strategic planning process for service organizations. 4. Apply strategic theories, frameworks, and models to management practices in service organizations. Credits: 3.00

HTM 51400 - Business Analytics For Service Industries

Credit Hours: 3.00. In today's highly dynamic business environment, decision-makers often encounter problems that are complex and data intensive. This course focuses on a variety of techniques from the field of business statistics and exposes students to statistical and decision analytics to solve data-driven decision-making problems. The course adopts a practical spreadsheet-based approach to facilitate decision-making and explores the practical applications of these techniques across various functional fields, with a specific focus on service industries.

Learning Outcomes: 1. Identify and evaluate managerial problems requiring data-based decision-making. 2. Apply quantitative methods to model and analyze real-world situations. 3. Employ analytic software tools to solve problems from various functional fields. 4. Communicate solutions and managerial implications across different stakeholders. Credits: 3.00

HTM 53100 - Hospitality And Tourism Marketing II

Credit Hours: 3.00. This course will examine marketing strategy in tourism and hospitality organizations. Students will actively engage in the application, analysis, and evaluation of marketing principles as they are applied to tourism and hospitality.

Learning Outcomes: 1. Define marketing strategy and describe its use in the hospitality industry. 2. Detail the components of marketing strategy and marketing plan for a hospitality and tourism organization. 3. Evaluate the strengths and weaknesses of hospitality or tourism organization's marketing strategy and plan. 4. Evaluate metrics designed to measure marketing strategy effectiveness. 5. Explain the major market trends in the hospitality industry. 6. Distinguish between major marketing research techniques and explain their advantages and disadvantages. Credits: 3.00

HTM 53600 - EXPIRED - Advanced Service Management In Hospitality And Tourism

Credit Hours: 3.00. Approximately two-thirds of U.S. economic activity resides in the service sector. Subsequently, service firms' foci on the needs of their customers are rewarded by positive customer outcomes such as behavioral loyalty and positive word of mouth. This course explores and informs the design, management, and innovative service strategies of firms who operate in the service sector through the theoretical and empirical services management literature.

Learning Outcomes: 1. Describe and apply basic service management principles. 2. Understand how to determine customer needs and simultaneously manage business performance. 3. Create a service blueprint and use it to inform service design or redesign. 4. Identify excellence in service from a variety of sectors across the globe. 5. Describe and apply basic service management principles. 6. Distinguish service management from customer service principles. 7. Perform a service audit for an organization. 8. Design sustainable service strategies and approaches. 9. Understand the mechanisms necessary in developing a service culture. 10. Craft the necessary elements in funding service excellence. Credits: 3.00

HTM 54100 - Advanced Hospitality Accounting And Finance Systems

Credit Hours: 3.00. Specialized accounting and finance systems as related to the hospitality industries. Applications of budgeting and pricing models, performance evaluations and incentives systems, and short-term asset management are discussed, as well as other current subjects.

Learning Outcomes: 1. Interpret and analyze financial statements. 2. Calculate present value and future value of multiple cash flows. 3. Value assets based on the discounted cash flow method. 4. Utilize capital budgeting techniques. 5. Understand the concepts of risk, return, and cost of capital. 6. Describe capital structure theories. 7. Describe the relationship between economy and hospitality businesses. 8. Explain the concept of diversification. 9. Calculate the present value of a franchise and a leasing contract. Credits: 3.00

HTM 55300 - Cultivating A Service Excellence Mindset For Healthcare Professionals

Credit Hours: 3.00. Notwithstanding the importance for healthcare services to prioritize clinical outcomes for patients, there is a growing need to think about the patient experience beyond science-driven, evidence-based practices. The healthcare sector is being transformed by consumerism and transparency that demands a more holistic approach to managing the patient experience. In order to promote patient engagement and to enhance their experience, an intentional strategic intent, as reflected in a service excellence mindset, is required. This course seeks to establish the foundation of this mindset for healthcare professionals that are driven to make a difference in their patients' lives. The aim of the course is for students to develop a greater appreciation for the complexity of providing excellent service in the healthcare industry. The course will stimulate students to think differently and more deeply about the patient experience through a service management lens. In doing so they will develop the necessary skills to make effective decisions in the constantly changing patient experience landscape. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the strategic implications for managing the patient experience (patient expectations, drivers of satisfaction, service quality measurement, creating a service culture). 2. Examine the critical role of managing the employee-patient interface in delivering patient-centric services. 3. Recognize

and evaluate various service management practices to enhance the patient experience. 4. Recommend key service management systems and practices to improve or solve problems in the complex healthcare environment. Credits: 3.00

HTM 55400 - Designing The Patient Experience For Contemporary Healthcare Systems

Credit Hours: 3.00. In the rapidly evolving healthcare industry, optimizing the patient experience remains a fundamental focus of practice. Addressing the practical challenge and complexity of providing excellent healthcare services, this class aims to inspire a design-thinking approach to reimagine and reinvent the patient experience in the contemporary healthcare systems. Learning by practice, students will apply the design tools to envisage, blueprint, and devise a patient experience solution. Gaining insights on experience-centric innovations in the healthcare domain, students will develop capabilities to better manage the service interactions, facility, and processes to enhance the quality of the patient experience and ease the stress of a hospital stay. Permission of department required.

Learning Outcomes: 1. Demonstrate an understanding of the role of experience design for healthcare organizations' strategic success in the contemporary market environment. 2. Conduct critical quantitative and qualitative analysis of the healthcare service experience. 3. Apply various experience design tools to innovatively design healthcare service experiences for the relevant stakeholders (e.g., patients, service providers). 4. Communicate effectively the design product in both written and verbal manners to healthcare professionals. Credits: 3.00

HTM 55500 - Investing In Healthcare Human Capital

Credit Hours: 3.00. The modern work environment is increasingly focused on working with people in teams - working with people and for people. In seeking to motivate and lead people, it is imperative to acknowledge individuals have different backgrounds, perspectives, and viewpoints. In successfully balancing the challenges of working with people in the labor intensive, diverse and high-stakes nature of the healthcare industry, this class seeks to provide knowledge on organizational behavior concepts (e.g., employee performance, satisfaction, engagement, and motivation; group behavior, teamwork; emotional labor, stress, work-life balance) and the skills to practice this knowledge as a healthcare professional. This course will provide students with the foundational building blocks to adapt to the changing landscape of the work environment, applying theories and exercising critical thinking skills to realize a transformative healthcare workforce experience. Permission of the department required.

Learning Outcomes: 1. Demonstrate an understanding of knowledge, skills, and abilities (KSA's) needed by successful leaders in the healthcare industry. 2. Apply organizational behavior theories and the role of managers in the context of the healthcare work environment. 3. Evaluate the role of leadership and management of personnel - individuals, groups, and teams - within the healthcare industry. 4. Recommend various leadership and management practices to improve and provide solutions for issues in today's healthcare workforce. Credits: 3.00

HTM 57100 - Economics Of Travel And Tourism

Credit Hours: 3.00. This course includes the asset theory of tourism, cost-benefit analysis, tax policy impacts, and other economic and statistical aspects of tourism. The course will examine research designed to determine economic impacts of the hospitality and tourism industries.

Learning Outcomes: 1. Acquire an understanding of the economic aspects of tourism, including the definitions of tourism and the size, persuasiveness, and data available on the industry, both internationally and domestically. 2. Develop an understanding of the importance and impacts of tourism and the marketing segmentation, supply, demand, and monetary exchange rates that impact the economies of tourism destinations. 3. Develop working knowledge of the various issues, problems, forecasts and types of research common in the tourism industry to include economic impact analysis such as input output analysis and multipliers, forecasting models and other tools used to analyze the tourism industry.

Credits: 3.00

HTM 58100 - Advanced Hotel Management

Credit Hours: 3.00. A study of current service management theories as they apply to hotel management. Theory topics include strategic planning, hotel organization and communication, organizational leadership, and control systems. Topics will be discussed from the viewpoint of the hotel's general manager.

Credits: 3.00

HTM 59000 - Problems In Hospitality And Tourism

Credit Hours: 1.00 to 4.00. Individual study in advanced subject areas. A course plan must be submitted to the supervising professor. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 4.00

HTM 59001 - Graduate Professional Industry Internship

Credit Hours: 1.00. The Graduate Professional Industry Internship allows graduate students to gain valuable experience through paid employment with a company in the hospitality and tourism industry or a related industry. In addition, each student will research an issue and provide a potential solution to a problem faced by the employer. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from Graduate Professional Industry Internship Coordinator is required to enroll in this course. Permission of instructor required.

Learning Outcomes: 1. Understand how to effectively manage a service industry business. 2. Develop critical thinking, creativity, and problem solving skills. Credits: 1.00

HTM 59002 - Graduate Professional Industry Research

Credit Hours: 3.00. The primary emphasis of the Graduate Professional Industry Research is research on a relevant issue within the hospitality and tourism industry. To enhance the research project, it is anticipated that the research will typically be linked to a paid employment experience in the hospitality and tourism industry or a related industry. This course is not repeatable without special permission from the HTM Graduate Policy Committee and is only open to HTM graduate students who have completed a minimum of two semesters and 16 credit hours of graduate coursework in HTM. Credit is not allowed for both HTM 59001 and HTM 59002. Permission from the Graduate Professional Industry Research Coordinator is required to enroll in this course. Permission of department required.

Learning Outcomes: 1. Gain industry experience while applying research skills and techniques to address hospitality and tourism industry issues. Credits: 3.00

HTM 59100 - Research Issues In Food Service Management

Credit Hours: 3.00. The course will focus on research issues related to the food service industry and their short- and long-term implications. Topics will include essential issues in food safety, product development, food service consumer interests, food production, and waste management. Exposure to quantity food production and purchasing.

Credits: 3.00

HTM 60100 - Research Development And Design

Credit Hours: 3.00. This course will equip doctoral students to think like a scholar and develop the ability to design rigorous research. Students will learn research philosophy, research idea development, and the development and evaluation of research processes and methods. Emphases are placed on developing students' confidence in conceptualizing, developing, designing, and writing empirical and theoretical research.

Learning Outcomes: 1. Demonstrate an understanding of theoretical, methodological, and ethical issues inherent in conducting research. 2. Evaluate various research processes, methodologies, and recent trends. 3. Develop rigorous research ideas, translate ideas into theory-supported research questions, and formulate analytical strategies to best address research questions. Credits: 3.00

HTM 61200 - HTM Management Challenge Analysis

Credit Hours: 3.00. A course designed to discuss specific management problems in the hospitality and tourism industries. Through the use of case studies, students study current challenges, management analysis, the process of decision-making, and the impacts of corporate decisions. Prerequisite: basic management organization class.

Learning Outcomes: 1. Gain exposure and knowledge of strategic management topics in preparation for graduate coursework, applied projects, and future research. 2. Critically consider and assess the merits and weaknesses of specific strategic management concepts and theories. 3. Develop analytical skills through tasks such as critical analysis and discussion of cases. Credits: 3.00

HTM 61400 - Theory Of The Consumer

Credit Hours: 3.00. This course will examine concepts and theories that have been developed for understanding consumer choices and behaviors in society and marketplaces. Students will learn classic and modern consumer theories, such as behavioral economics and applied psychological and sociological theories. It will discuss how these theories can help explain consumer tendencies such as preferences, choices, and other consumption-related behaviors.

Learning Outcomes: 1. Demonstrate an understanding of the scope of consumer theory literature. 2. Evaluate the consumer theories and their implications in society and marketplaces. 3. Apply theories of consumer behavior to research. Credits: 3.00

HTM 61500 - Theory Of The Firm

Credit Hours: 3.00. In this course, students examine concepts, models, and theories developed for the understanding of firm and organizational behavior. This course equips students with knowledge of classic and contemporary theories, such as those related to managerial economics, pricing and price discrimination, organizational structure and culture, employee productivity, firm financial behaviors, marketing management, and operations management.

Learning Outcomes: 1. Demonstrate a foundational understanding of the scope of firm-theory literature. 2. Apply firm theory to research. 3. Analyze and synthesize firm theories with other leading or discipline-specific theories. Credits: 3.00

HTM 63100 - Strategic Marketing In Hospitality And Tourism

Credit Hours: 3.00. Evaluates the role of marketing strategy within overall corporate strategic planning. Segmentation theory, brand segmentation, niche marketing, program life cycles, and positioning approaches are discussed. Emerging concepts, such as visioning, relationship marketing, strategic alliances, and database marketing are studied. Prerequisite: HTM 53100 .

Credits: 3.00

HTM 64200 - Advanced Personnel Systems In Restaurants, Hotels, And Institutions

Credit Hours: 3.00. Examination of the philosophical and operational alternatives related to establishing and directing human resource systems in complex restaurant, hotel, and institutional organizations. Prerequisite: HTM 34100, 41100; 6 credit hours at the upper division undergraduate level in Business, Management, Marketing.

Learning Outcomes: 1. List leading issues impacting human resource management in hospitality businesses nationally and globally. 2. Suggest appropriate business responses to those HR issues. 3. Explain the role of the human resource office at the corporate level in multi-unit hospitality companies. 4. Craft strategies that would successfully recruit, select, train, develop, compensate and manage the performance of assignees working in multi-unit hospitality businesses. 5. Develop strategies that would sustain a hospitality business' corporate culture across national and international borders. 6. Describe ways used by large multi-unit hospitality companies to effectively communicate and engage its subsidiaries. Credits: 3.00

HTM 68100 - Seminar On Hospitality And Service Business Research

Credit Hours: 3.00. This seminar focuses on contemporary topics in hospitality and service business research and guides students to produce work that meets the standards of top-tier journals. Key topics include corporate strategy, consumer behavior, branding, marketing, human resource management, and the application of big data and technology. Through classroom discussions and research project development, students will critique existing literature, formulate research problems, and develop a theoretically robust and methodologically sound research, with a focus on solving real-world problems in hospitality and service industries.

Learning Outcomes: 1. Identify research gaps in the hospitality and service business literature and formulate research questions to address these gaps. 2. Evaluate various quantitative and qualitative research methodologies to determine their appropriateness for addressing the research questions. 3. Compile insights from corporate strategy, consumer behavior, and technology applications to develop comprehensive research frameworks. 4. Create a research project that is theoretically robust and methodologically sound to meet the standards of top-tier journals. Credits: 3.00

HTM 69000 - Hospitality And Tourism Research Problems

Credit Hours: 1.00 to 4.00. Development of an individual research project for doctoral students. Projects are designed to broaden understanding of specific research techniques or to add to subject matter knowledge necessary for completion of the doctoral thesis. A paper worthy of submission to a refereed journal is expected upon project completion. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 4.00

HTM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

HTM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by topic due to the nature of the course. Credits: 1.00 to 18.00

Department of Human Development and Family Science (Graduate)

HDFS Graduate Image

Website: **https://www.purdue.edu/hhs/hdfs/students/graduate**

Department/School Head

Valerie Knopik

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Professor	Clinical Associate Professor	Clinical Assistant Professor

Doran French Elliot Friedman Valerie Knopik Shelley MacDermid Wadsworth Catherine (Cammie) McBride German Posada David Purpura Kimberly Updegraff	Sharon Christ Melissa Franks Kristine Marceau Deborah Nichols A.J. Schwichtenberg Zoe Taylor	Annabelle Atkin Sarah Eason Laura Elenbaas Rebecca Marks Carolyn McCormick Kameron Moding Paul Robbins Rosie Shrout	Jennifer Dobbs-Oates Megan Purcell	Cezanne Elias Natasha Watkins	Shawna Harbin Davina Quichocho

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Academic Programs

Ph.D. Program

Students are admitted to the doctoral degree program. Students may, but are not required to, receive a master's degree in the process of completing doctoral requirements.

The HDFS graduate program prepares scholars to define problems and conduct innovative and rigorous research that informs policies and practices aimed at promoting the health and well-being of individuals and families. A central focus of the program is to develop skills to study the complex interplay of biological, developmental, interpersonal, and contextual determinants that protect and/or undermine the health and well-being of individuals and families across their life course. The doctoral program emphasizes integration and critical evaluation of research as well as the use of sophisticated methodologies that advance discovery and implementation of novel approaches to better the lives of individuals and families across multiple social contexts.

Human Development and Family Studies, MS

Human Development and Family Studies, PHD

Human Development and Family Studies/Gerontology, PHD

HDFS 59000 - Special Problems

Credit Hours: 0.00 to 5.00. Special subjects for investigation and experiment according to the individual student's interest and need. Permission of instructor required.

Credits: 0.00 to 5.00

HDFS 60000 - Families And Health Across The Life Course

Credit Hours: 3.00. Interpersonal processes of family members and close others in the promotion of individual health choices and management of disease across the life course are covered. Course topics include involvement of family and close others in: health promotion and disease prevention; disease management; interactions with healthcare providers; and informal caregiving in the family context.

Learning Outcomes: 1. Evaluate research linking family ties with individual health and well-being across the life course. 2. Examine how

interpersonal processes contribute to promoting health and managing illness of individuals across the life course. 3. Understand the role of family members in interactions with the healthcare system. 4. Differentiate diverse disciplinary approaches to families and health research across the life course. Credits: 3.00

HDFS 60100 - Advanced Child Development

Credit Hours: 3.00. This course provides an overview of foundational and current developmental research on changes that occur within the individual throughout infancy, childhood, and early adolescence. Emphasis is given to processes and mechanisms that have been proposed to explain developmental changes. This course includes attention to social and cultural contexts within which individuals develop. Prerequisite: Graduate-level coursework in Child Development or Psychology.

Credits: 3.00

HDFS 60200 - Advanced Family Science

Credit Hours: 3.00. Integrative and comprehensive assessment of both classic and recent contributions in the field of family science. Other topics include major theory and research, historical, current, and future critical issues in family science.

Learning Outcomes: 1. Describe and critique classic and emerging theoretical and conceptual frameworks in family science, with attention to refinements over time. 2. Demonstrate critical thinking skills through exploring and discussing diverse theoretical viewpoints and recent research in family science. 3. Apply theoretical and conceptual frameworks when developing empirical research in family science. Credits: 3.00

HDFS 60400 - Developmental And Family Approaches To Diversity And Oppression

Credit Hours: 3.00. In this course, we will utilize an intersectional lens throughout the course to critically examine the development of individuals oppressed due to their minority status in the United States. We will review current research and literature across disciplines to: 1) understand the origin, meaning, and purpose of race and racism; 2) learn about the history of oppression and resilience of minoritized groups; 3) analyze systems of discrimination; 4) introduce theoretical frameworks for studying the unique, intersectional experiences of minoritized populations and examples of their application to empirical research, and 5) discuss how research can be used to advance social justice. Permission of department required.

Learning Outcomes: 1. Define concepts such as discrimination, race, racism, gender (beyond binary definitions), cissexism, heterosexism, neurodiversity, and ableism as they pertain to diverse populations in the U.S. 2. Present their own intersectionality and demonstrate how personal intersections can inform bias and actions. 3. Discuss the diversity that exists in the US and identify systemic factors that interact with this diversity (including but not limited to socioeconomic factors). 4. Explain the major concerns regarding minoritized groups' experiences and the factors that promote positive outcomes for marginalized individuals and families. 5. Evaluate critically the theoretical foundation of empirical studies conducted with diverse individuals/families and apply diversity-focused theory to student research content areas of interest. Credits: 3.00

HDFS 60600 - Advanced Human Development

Credit Hours: 3.00. This course provides an overview of human development and serves as a graduate-level introduction to HDFS. Relevant theories and models will provide the structure for consideration of the nature, processes, and mechanisms of developmental change. Particular attention will be paid to diversity in developmental influences and trajectories, including atypical development. Students will gain specific knowledge and professional skills through the pursuit of individual research interests, culminating in a written grant proposal and class presentation of the proposal.

Learning Outcomes: 1. Ability to articulate and apply knowledge of theories and empirical research central to the field of human development. 2. Demonstration of understanding of diverse paths through the human life course and important determinants of those paths, including racism, ageism, ableism, sexism, and other forms of social

stratification. 3. Ability to think critically about developmental theories and research, notably the ability to integrate developmental theory with research interests. 4. Ability to communicate conceptual and substantive ideas clearly and cogently. Credits: 3.00

HDFS 61300 - Quantitative Methods I: Inferential Statistics And ANOVA

Credit Hours: 3.00. This course provides a basic understanding of foundational concepts and tools used in statistical analysis and inference in the behavioral sciences, including data preparation, sample description, hypothesis testing, univariate and bivariate statistics, and ANOVA. Emphasis is placed on the conceptual and interpretive understanding of statistical methods. Prerequisite: Undergraduate coursework in Statistics.

Learning Outcomes: 1. Understand the basics of probability, sampling, and inferential theory underlying statistical methods. 2. Understand univariate and bivariate statistics and ANOVA modeling methods. 3. Formulate testable hypotheses. 4. Apply proper statistical tests to evaluate hypotheses. 5. Analyze data using univariate and bivariate statistics, ANOVA, and statistical software. 6. Properly interpret the statistical estimates and tests covered in the course. 7. Use statistical methods to test your research questions using empirical data. 8. Produce written communication of analytic methods and interpretation of results. Credits: 3.00

HDFS 61500 - Research Methods In Child And Family Study

Credit Hours: 4.00. Basic research methods employed in the study of children and families are examined, including quantitative and qualitative designs, data collection, analysis, and interpretation. In the laboratory component, students are afforded supervised practice in the application of various methods using selected statistical analysis programs. Prerequisite: Graduate course in Statistics. Permission of instructor required.

Credits: 4.00

HDFS 61700 - Quantitative Methods II: Regression

Credit Hours: 4.00. This course has two primary goals: 1) provide students with foundational knowledge related to linear regression statistical analyses, and 2) provide students with the opportunity to practice writing, interpreting, and presenting regression analyses for the purposes of dissemination. Prerequisite: HDFS 61300 or PUBH 60100 or STAT 50100 or PSY 64600. Permission of instructor required.

Learning Outcomes: 1. Understand the foundations of linear regression statistical analyses, including multiple regression. 2. Understand mediation and moderation hypotheses and associated testing in linear regression. 3. Derive research questions and hypotheses testable in linear regression. 4. Analyze data using linear regression modeling and statistical software. 5. Properly interpret the statistical estimates and tests covered in the course. 6. Apply regression modeling to your research questions using empirical data. 7. Produce written communication of analytic methods and interpretation of results. Credits: 4.00

HDFS 61900 - Adolescent And Youth Development In Context

Credit Hours: 3.00. This graduate-level course examines the major developmental issues of adolescents and youth with attention to their familial, cultural, and socio-economic backgrounds. Topics include health and well-being; biological, socio-emotional, and cognitive development; sexual and racial/ethnic identity; risks and resilience; peer and family relationships; civic engagement and activism; positive youth development; and the transition to adulthood. Course readings focus primarily on adolescents and youth in the United States, although international contexts are also incorporated across the class.

Learning Outcomes: 1. Evaluate empirical studies assessing the major developmental themes of adolescence and the transition to adulthood. 2. Apply and understand major theoretical perspectives relevant to adolescent and youth development. 3. Demonstrate understanding of the contexts that impact

development during adolescence and the transition to adulthood. 4. Demonstrate accurate knowledge of physical, cognitive, social, and psychological development of adolescents and youths. 5. Understand how adolescent and youth development is impacted by diverse backgrounds and experiences. Credits: 3.00

HDFS 62000 - Current Issues In Early Childhood Education

Credit Hours: 3.00. Emphasis on current issues in early childhood education as they are affected by contemporary social change with observation and analysis of a variety of programs for young children. Prerequisite: HDFS 60100 .

Credits: 3.00

HDFS 62200 - Child Development Within The Family Context

Credit Hours: 3.00. This course provides an overview of (1) foundational and current child development theories and (2) research on typical individual change throughout infancy and childhood within the family context. Emphasis is given to milestones, and to the processes and mechanisms proposed to explain developmental change. The course takes a chronological age-approach to study development within the family context and covers the following stages: prenatal and infancy, early childhood, and middle childhood. Initially the course places the individual within the larger family context and then delineates development/growth within the realms of physical growth, brain, motor, sensation, perception, language, social, cognitive, feeding/eating, sleep, self-regulation, attachment, and temperament/personality development. Across these realms diversity and historical standards around typical development expectations will also be incorporated. Permission of instructor required.

Learning Outcomes: 1. Demonstrate an understanding of basic tenets of influential child development theories. This foundational knowledge will include (but is not limited to) life-history theory, genetics, developmental neuroscience, attachment theory, bioecological theory, social domains theory, and Piaget. 2. Analyze, discuss, and critique information about child development theories and research using empirical evidence. 3. Demonstrate an understanding of the normative developmental progression (from fetus to middle childhood) in the domains of: Physical growth, brain maturation, language, social, cognitive, feeding/eating, sleep, self-regulation, attachment, and temperament/personality development. 4. Think critically about how historic patterns of research, family systems, and isms (e.g., racism, weightism, ableism) influence our standards of typical/normative development for developmental domains. 5. Demonstrate an understanding of the family factors that influence variability in typical developmental trajectories. Family factors will include (but are not limited to) individual characteristics (e.g., child gender, innate capacities, and age), dyadic features (e.g., marital conflict / union dissolution, contingent responsivity), and contextual elements (e.g., socioeconomic resources, culture). Credits: 3.00

HDFS 62500 - Child And Family Social Policy

Credit Hours: 3.00. An examination of selected issues related to child and family policy relevant to scholars of CDFS. These issues include: (1) influences of research on children and families on the policy process; (2) the role of child and family specialists as advocates and analysts; (3) policy formulation, enactment, and evaluation; and (4) child and family policy in cross-national perspective. Prerequisite: HDFS 60100 and HDFS 60200 .

Credits: 3.00

HDFS 62700 - Multilevel Modeling In Developmental And Family Research

Credit Hours: 3.00. This course gives students a basic grounding in the class of statistical techniques known as multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), mixed models, or random coefficient models. Primary discussions will be on applications of these models to the study of marriages, relationships, families, aging, and child and adult development, but also will touch on biomedical, educational, and economic examples. The focus is on three types of multilevel models: growth-curve models, organizational models, and daily experience models. Students will also learn how to use SAS Proc Mixed for conducting MLM analyses. Students are assumed to have taken at least two graduate

statistics courses and have a solid understanding of regression analysis. Prerequisites: STAT 50100 and STAT 50200 or HDFS 61300 and PSY 63100 .

Learning Outcomes: 1. Acquire a basic-to-intermediate understanding of the logic of multi-level modeling, grasp the underpinning statistics of MLM, and develop a sense as to when (and when not) to use the model. 2. Apply MLM to relevant questions in their area of research interest. 3. Critically read and evaluate empirical journal articles that use MLM. 4. Acquire basic programming skills for conducting MLM. 5. Select the appropriate methods of data analysis, given multivariate data and study objectives. 6. Employ statistical software to carry out statistical analyses, 7. Interpret and explain the results of statistical analyses, and 8. Write concise and effective summaries of results using APA style. Credits: 3.00

HDFS 62800 - Structural Equation Modeling

Credit Hours: 3.00. This course provides an introduction to classic structural equation models with latent variables (SEM). The primary steps of implementing SEMs will be covered to include: model specification, model identification, parameter estimation, and model evaluation (model fit). Background training in statistical regression is required. Permission of instructor required.

Learning Outcomes: 1. Develop a basic understanding of structural equation models including proper application, interpretation, and evaluation of the models. 2. Develop an understanding of the underlying statistics including parameter identification and estimation as well as model fit measures. 3. Learn the benefits of SEMs including when it is advantageous to use this modeling approach. 4. Learn the limitations of the model and the most common mistakes in using SEMs. 5. Be able to apply the method to a topic relevant to your own research. 6. Be able to analyze SEM models using a SEM software package. Credits: 3.00

HDFS 62900 - Interventions Across Developmental And Family Contexts

Credit Hours: 3.00. This course will focus on the scientific foundations of designing and conducting interventions for improving the human condition across diverse developmental and family contexts. A particular emphasis in this course will be on experimental and quasi-experimental designs for making causal inferences and understanding mechanisms of intervention effects. Students will gain specific knowledge of intervention design, implementation and fidelity, and scale-up of interventions, as well as how to evaluate proposed or existing interventions. Co-design processes with intervention users and qualitative methods for understanding intervention needs and implementation will also be examined. Prerequisite: none.

Learning Outcomes: 1. Read and critique the literature on interventions across developmental and family topical areas. 2. Acquire skills in understanding culture, diversity, equity, and bias as they apply to intervention design, implementation, and evaluation. 3. Identify, critique, and communicate about methods to design, implement, evaluate, and scale up interventions. 4. Understand strengths and limitations of interventions relative to the mechanisms of change, implementation processes, fidelity of implementation, and contextual (both setting and population) factors that may affect intervention success. 5. Demonstrate understanding of methods and limits of causal inference using interventions. 6. Acquire skills to obtain external funding by practicing grant writing and reviewing. Credits: 3.00

HDFS 64400 - Biosocial Processes In Developmental And Family Research

Credit Hours: 3.00. In this course we discuss theoretical models and empirical research regarding the interplay between biology and context in development, focusing on the unique interactions that occur within families. Prerequisite: HDFS 60100 and HDFS 60200 .

Learning Outcomes: 1. Identify basic genetic, neuroanatomical, and neuroendocrine processes involved in major aspects of physiological regulation (e.g. the stress

response). 2. Describe the dynamic interaction between physiology and the environment. 3. Explain implications of normative and non-normative experiences for physiological regulation. 4. Critically evaluate biosocial research. Credits: 3.00

HDFS 64900 - Multidisciplinary Gerontology

Credit Hours: 3.00. A multidisciplinary overview of aging that provides a background for graduate studies on aging. An examination of sociological, psychological, and biological theory and research in the field of aging. The aging process from cells to social security will be covered. Projects will assist students in developing appropriate professional skills in their field of study. Students are expected to have basic research and writing skills in their field of study. The course serves as a graduate-level introduction to the field of gerontology. There are several options for course projects.

Learning Outcomes: 1. Describe and critique major theoretical and empirical foundations and advances in gerontological research. 2. Examine and discuss the ways influences at different levels of function (e.g., biological, social) and from different academic disciplines (e.g., psychology, sociology) interact to shape the aging process and related outcomes. 3. Use existing literature to construct and support novel research ideas. 4. Practice and produce cogent, compelling writing. Credits: 3.00

HDFS 65800 - Attachment Relationships

Credit Hours: 3.00. This graduate course studies child-parent relationships theory and research from the respective of Attachment Theory. Prerequisite: CDFS 60300. Permission of instructor required. Prerequisite: HDFS 60100 and a basic graduate-level statistic course.

Learning Outcomes: 1. Identify the history and the historic context in which attachment theory was proposed. 2. Identify and analyze the central characteristics and constructs of attachment theory, and the model of development (4 phases) that Bowlby proposed. 3. Describe and analyze the empirical evidence provided by Ainsworth in support of attachment theory. 4. Analyze and critique the literature on the context sensitivity of attachment relationships (e.g., influence of quality of care, infant/child temperament, family characteristics, socio-economic conditions, and culture). 5. Identify and critique the relations between infant security and later socialization outcomes. 6. Survey and analyze the research literature on child-parent attachment relationships during early and middle childhood, adolescence, and adulthood. 7. Critique the hypothesis concerning the intergenerational transmission of attachment patterns from parents to offspring. 8. Identify, analyze, and critique age appropriate methodologies in the study of offspring-parent attachment relationships. 9. Develop and present (orally and in writing) a 10-page research proposal on attachment relationships. Credits: 3.00

HDFS 67900 - Qualitative Research On Families

Credit Hours: 3.00. Provides an introduction to qualitative research theory and methods and prepares graduate students to conduct and evaluate qualitative family research. Students conduct observations, interviews, and basic data analysis. Prerequisite: a course in research methods.

Credits: 3.00

HDFS 68000 - Professional Issues For Child And Family Specialists

Credit Hours: 3.00. Professional issues involved in working with children and families. Questions of ethics, legal relationships, and value problems may be pursued, as may such pragmatic inquiries as the role of professional organizations and labor unions in these fields.

Credits: 3.00

HDFS 68500 - Current Research Topics In Child Development And Family Studies

Credit Hours: 1.00 to 3.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00 to 3.00

HDFS 68501 - Developmental Seminar

Credit Hours: 1.00. Consideration of current subjects in child development and family studies research. Particular emphasis will be placed on one topic each semester according to the research interests of the instructor.

Credits: 1.00

HDFS 69000 - Directed Research In HDFS

Credit Hours: 1.00 to 4.00. Directed research and supervised research on a topic in student's area of specialization. Permission of instructor required.

Credits: 1.00 to 4.00

HDFS 69700 - Graduate Student Colloquium

Credit Hours: 1.00. Research presentations by faculty members, graduate students, and invited speakers. Includes attention to: (1) the responsible conduct of research, (2) professional/scholarly and teaching development, and (3) diversity, equity, and inclusion.

Learning Outcomes: 1. Expose students to a wide swath of HDFS-related research across the life course. 2. Provide a rotation of professional development trainings (e. g., vita, job talk, and conference presentation development). 3. Foster teaching development through presentations, workshops, or trainings. 4. Generate internal and external networking opportunities for graduate students. 5. Address issues of diversity, equity, and inclusion (DEI) in HDFS by (a) providing a platform for increased representation in presenters, (b) critically considering how research in HDFS serves diverse (i. e., underrepresented/underserved/historically marginalized) populations, and (c) increasing our competencies related to DEI as part of professional development. Credits: 1.00

HDFS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HDFS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Nursing (Graduate)

Website: **https://www.purdue.edu/hhs/nur/**

Department/School Head

Christopher Coleman

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Professor	Clinical Associate Professor	Clinical Assistant Professor

Gregory W. Arling Christopher Coleman Nancy E. Edwards Karen J. Foli Sara A. McComb	Kathleen Abrahamson Azza H. Ahmed Elizabeth E. Richards Vicki L. Simpson Dongjuan (Donna) Xu	Qingian (Priscilla) Ding Zachery Hass Nasreen Lalani Pi-Ju (Marian) Liu Jiayun Xu	Jennifer A. Coddington Pamela M. Karagory	Nicole Adams Mopelola T. Adeola Julian Gallegos Becky Good Diane Hountz Kristen F. Kirby Janelle Potetz	Mary Ajuwon Karen Atcheson Sandra Gilpin Laura Hawkins Carmen A. Jones Elizabeth Jones Susan Kersey Ann Loomis Laura Moffat Karla C. Ross Margaret (Meg) Sorg Amanda Ward

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Academic Programs

Master's, DNP, and PhD Programs

AGNP

The Adult-Gerontology Primary Care Nurse Practitioner (MS/AGNP) program offers an interdisciplinary approach to advanced practice education. Options for interdisciplinary work include medicine, pharmacy, audiology, speech pathology, social work, and physical and occupational therapy. Adult-Gerontology Nurse Practitioners are specialists in adult care who see patients ages 13 and older in a variety of settings. The AGNP program is designed to educate nurses who can provide competent, culturally sensitive, cost-effective, accessible and efficient care with an emphasis on rural underserved populations. It is certified by the National Hartford Center of Gerontological Nursing Excellence. Graduates are eligible to sit for the appropriate certification examination.

FNP

The Family Nurse Practitioner specialization develops leadership and practice skills necessary to shape nursing practice in a dynamic, complex, and globally interdependent healthcare system with a focus on the family delivering care to all ages. The FNP program is designed to educate nurses who can provide competent, culturally sensitive, cost-effective, accessible and efficient care with an emphasis on rural underserved populations. Graduates are eligible to sit for the appropriate certification examination.

PNP-PC

The Primary Care Pediatric Nurse Practitioner specialization develops leadership and practice skills necessary to shape nursing practice in a dynamic, complex, and globally interdependent healthcare system. The PNP-PC program is designed to educate nurses who can provide competent, culturally sensitive, cost-effective, accessible, and efficient care with an emphasis on rural underserved populations to infants, children, and adolescents. Graduates are elegible to sit for the appropriate certification examination.

PMHNP

The Psychiatric Mental Health Nurse

Practitioner specialization is designed to educate nurses who can provide competent, culturally sensitive, cost-effective, accessible and efficient mental health care. The PMHNP program focuses on developing leadership and practice skills to deliver advanced psychiatric/mental health care to families and individuals of all ages.
Graduates are eligible to sit for the appropriate certification examination.
DNP
The DNP program prepares nurses for knowledge and skill-building in areas of scholarly practice, innovation, practice improvement, health policy, leadership, quality and system improvement, evaluation of health outcomes, clinical expertise for advanced nursing education and testing of care delivery models. There are are four BSN-DNP specializations (AGPCNP, FNP, PNP-PC, PMHNP). The Post MS DNP offers two tracks, Direct Patient Care or Public Health/Homeland Security for both Advanced Practice RNs and non-Advanced Practice RNs). BSN-DNP graduates are eligible to sit for the appropriate certification examination.
Doctor of Philosophy in Nursing
This campus-based learning program is designed to prepare the next generation of nurse scholars and scientists. The Ph.D. in Nursing program curriculum is designed to prepare the nurse scientist for innovative and translational research through the use of transdisciplinary collaboration and teams. The Ph.D. in Nursing emphasizes the optimization of health care delivery through innovative care and innovations in healthcare delivery systems. Graduates are prepared to conduct rigorous, transdisciplinary research to expand nursing science and translate findings to the practice; lead interdisciplinary teams that can transform the science of healthcare; and theory, existing evidence, and scientific methods to innovative solutions to healthcare challenges. The program also offers a dual-title Ph.D. in Gerontology through the Center for Aging and the Life Course (CALC).

- Master of Science (MS) as an Adult-Gerontology Primary Care Nurse Practitioner
- Master of Science (MS) as a Primary Care Pediatric Nurse Practitioner
- Master of Science (MS) as a Primary Care Family Nurse Practitioner
- Master of Science (MS) as a Psychiatric Mental Health Nurse Practitioner
- Post-BSN to Doctor of Nursing Practice (DNP)
- Post-MSN to Doctor of Nursing Practice (DNP)
- Doctor of Philosophy (Ph.D.)

Primary Care Pediatric Nurse Practitioner, Post-Master's Certificate

Nursing, DNP

Adult Gerontology Primary Care Nurse Practitioner, Post-Master's Certificate

Nursing, PHD

Primary Care Family Nurse Practitioner, Post-Master's Certificate

Psychiatric Mental Health Nurse Practitioner, Post-Master's Certificate

Nursing: Adult Gerontology Primary Care Nurse Practitioner Concentration, MS

Nursing: Primary Care Family Nurse Practitioner Concentration, MS

Nursing: Primary Care Pediatric Nurse Practitioner Concentration, MS

Nursing: Psychiatric Mental Health Nurse Practitioner Concentration, MS

Nursing/Gerontology, PHD

NUR 50000 - Theoretical Constructs In Nursing

Credit Hours: 3.00. This course examines the integration of theory/conceptual relationships in the development of nursing knowledge. Students explore ways in which nurses in advanced practice incorporate theoretical knowledge in the implementation of the advanced practice in nursing role. Students analyze the clinical relevance of mid-range and practice theories. Students examine the relationship of theoretical constructs to research and praxis through concept analysis, theory evaluation, and discussion of the application of theory to practice. This course examines ways in which theoretical thought is embedded in evidence-based nursing practice.

Credits: 3.00

NUR 50100 - Foundations Of Advanced Practice In Nursing

Credit Hours: 2.00. This course builds on the knowledge and experiences that students possess when beginning their advanced practice in nursing education. Students explore their assumptions about advanced practice in nursing, its historical context and definitions of the various advanced practice roles, conceptual underpinnings and role competencies. Students develop an appreciation for how evidence based practice influences advanced practice in nursing. They develop skills that include using information communication technologies, identifying problems, posing questions that lead to evidence sources, searching and differentiating among various sources and types of evidence.

Credits: 2.00

NUR 50200 - Pharmacotherapeutics For Advanced Practice Nursing

Credit Hours: 3.00. Course includes pharmacodynamics, pharmacokinetics, and pharmacotherapeutics of broad categories of pharmacologic agents. Students apply these principles and also consider the role of best available evidence and patient preferences as a basis for managing pharmacologic regimens. Students review regulations relevant to prescriptive authority for advanced practice nurses.

Credits: 3.00

NUR 50300 - Advanced Health Assessment

Credit Hours: 3.00 (West Lafayette, Fort Wayne); 4.00 (Calumet). Students develop advanced, evidence-based health assessment skills that build on their current knowledge and abilities. Major concepts of the course include comprehensive and focused history taking and advanced physical assessment. Students relate underlying physiologic mechanisms with normal and abnormal findings from the history and physical assessment. The course provides a basis for designing a culturally sensitive and evidence-based plan of care within the situational context of the individual.

Credits: 3.00 to 4.00

NUR 50500 - Sociocultural Influences On Health

Credit Hours: 2.00 to 3.00. This course examines the influences of cultural and sub-cultural variables on health and health care delivery. Students analyze and apply appropriate theoretical perspectives and current research to design evidence-based strategies that ground clinical decision making in advanced practice nursing. Students use the National Standards on Culturally and Linguistically Appropriate Services (CLAS) as the basis for providing culturally competent care. As students apply principles of culturally competent communication they are encouraged to develop insight and an attitude of resistance to stereotyping. Students gain an understanding of the context of vulnerable and marginalized populations through the analysis of

social, cultural, and economic influences that impact health and illness.

Credits: 2.00 to 3.00

NUR 50700 - Physiologic Concepts For Advanced Practice Nursing

Credit Hours: 4.00. Students examine the principles of physiologic function at all levels of organization from cells to organ systems as they affect human function. The course uses homeostasis as a model to account for regulatory and compensatory functions in health. Students develop the necessary theoretical and empirical foundation for subsequent understanding of the diagnosis and management of human responses to disease and non-disease based etiologies.

Credits: 4.00

NUR 51000 - Research And Evidence Based Nursing Practice

Credit Hours: 3.00. This course focuses on both the generation of primary evidence through an in-depth examination of the research process and its critical use in evidence based practice. Students systematically search, appraise and interpret the best available evidence that informs advanced practice nursing and health related disciplines.

Credits: 3.00

NUR 51100 - Health Promotion For Advanced Practice In Nursing

Credit Hours: 2.00 to 3.00. Students analyze health promotion/disease prevention, and health education frameworks combined with best available evidence as a foundation for advanced practice in nursing. Students promote the health of diverse client populations by incorporating the Healthy People goals, clinical practice guidelines, risk assessment, epidemiological data and evidence based screening tools into nursing practice. In collaboration with selected clients and/or families, students implement health coaching/teaching through the integration of family, health promotion and health literacy theories.

Credits: 2.00 to 3.00

NUR 51200 - Clinical Applications In Pharmacotherapeutics

Credit Hours: 1.00. This course applies information from NUR 50200 to the care of clients through the use of case studies. Emphasis is placed on incorporating information from pharmacology, physiology, and physical assessment.

Credits: 1.00

NUR 51300 - Health Promotion In Special Populations

Credit Hours: 3.00. Examination of wellness and health promotion issues unique to three special populations: clients in rural areas, women, and adolescents. Legal and ethical issues related to practice with special populations is addressed. Evidence-based standards will be utilized.

Credits: 3.00

NUR 51400 - Clinical Application In Pharmacotherapeutics For Pediatric Nurse Practitioners

Credit Hours: 1.00. Applies information from NUR 50200 , Pharmacotherapeutics in Primary Care, to the care of infants, children, and adolescents through the use of case studies. Emphasis is placed on incorporating information from pharmacology, physiology, and physical assessment.

Credits: 1.00

NUR 51500 - Health Promotion In Pediatric Populations

Credit Hours: 3.00. Examines wellness and health promotion issues unique to children from birth through adolescence. Concepts of growth and development are integrated into health promotion activities. Legal and ethical issues related to practice with children and adolescents are addressed. Evidence-based practice standards will be utilized.

Credits: 3.00

NUR 51601 - Clinical Applications In Pharmacology Family Nurse Practitioner

Credit Hours: 1.00. This course applies information from Pharmacotherapeutics in primary care (NUR 50200) to the care of infants, children, adolescents and adults through the use of case studies. Emphasis is on incorporating from pharmacology, physiology and physical assessment.

Credits: 1.00

NUR 51700 - Doctor Of Nursing Project Seminar, Doctor Of Nursing Practice

Credit Hours: 0.00. This seminar will allow the student to begin contemplating and organizing their thoughts in developing the DNP project. In this seminar, the student will be introduced to the requirements for the DNP project and begin to cultivate feasible project questions that have an impact in clinical care, obtain feedback and network with peers.

Credits: 0.00

NUR 52200 - Psychopharmacology Across The Lifespan

Credit Hours: 2.00. Signs and symptoms of all major psychiatric disorders and the medications used to treat them across the life-span are discussed. Classes of psychiatric medications are considered; including indications, therapeutic uses, neurophysiological mechanism of action and side effects.

Credits: 2.00

NUR 52500 - Informatics In Nursing

Credit Hours: 3.00. Integrates nursing science with computer technology and information science to identify, gather, and manage information. Emphasis on technology based health applications with support clinical, administrative, research, and educational decision making enhancing the efficacy of nursing endeavors.

Credits: 3.00

NUR 52800 - Acute Illness: Pediatric Health Practice

Credit Hours: 3.00. A developmentally organized course to provide knowledge and experience to care for acute episodic illnesses of children and adolescents in primary healthcare settings. Examines pathophysiological alterations and clinical management. Students will synthesize knowledge of developmental, physiological, psychological, and sociocultural factors in the assessment and management of acute illness. The focus is on differential diagnosis, clinical management, and child and family education within the context of primary care. Health promotion models, and biopsychosocial, developmental, and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed.

Credits: 3.00

NUR 52900 - Acute Illness: Pediatric Health Preceptorship

Credit Hours: 3.00. Assists students to develop and broaden clinical judgment and skills. Content includes the study of primary health care of children and adolescents with acute conditions and the impact of those conditions on family members. The focus is on growth and development, assessment, differential diagnosis, clinical decision making, management, and patient and family education within the context of primary care. Professional issues, collaboration and scope of practice, and advocacy are emphasized. Clinical seminars focus on variations of child health in the context of health promotion and advanced assessment.

Credits: 3.00

NUR 53200 - Acute Illness: Adult Health Practice

Credit Hours: 3.00. Examination of pathophysiological alterations and clinical management of acute conditions in adolescents and adults. Students will synthesize knowledge of physiological, psychological, and sociocultural factors in the assessment and management of acute illness. Focus is on the differential diagnosis, clinical management, patient and family education within the context of primary care. Health promotion models, as well as biopsychosocial and cultural theories are integrated throughout the course. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions.

Credits: 3.00

NUR 53300 - Acute Illness: Adult Health Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of adolescents and adults with acute conditions and the impact of those conditions on family members. Focus is on assessment, deferential diagnosis, clinical decision making and management, as well as patient and family education within the context of primary care. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions. Professional issues, collaboration and scope of practice, and advocacy are emphasized.

Credits: 3.00

NUR 53800 - Psychiatric Mental Health Nurse Practitioner Roles And Psychotherapeutic Framework And Modalities

Credit Hours: 2.00. Scope and standards of practice for psychiatric mental health advanced practice nursing is set forth in this course. Content includes Psychiatric Mental Health Nurse Practitioner (PMHNP) functioning based on the state practice act as well as additional functions of the PMHNP including providing integrative therapy interventions, community interventions, case management, consultation and liaison services, clinical supervision, and policy development. Students will explore principles of evidence-based psychotherapy interventions including individual and group therapy, family and play therapy, and demonstrate competency in two forms of psychotherapeutic interventions.

Credits: 2.00

NUR 53900 - Psychiatric Mental Health Nurse Practitioner Roles And Therapeutic Modalities Preceptorship

Credit Hours: 2.00. Psychotherapeutic frameworks and

modalities are analyzed within the role of the PMHNP. Students participate in the application of individual and group psychotherapeutic interventions in a clinical setting by a PMHNP or therapist/clinical social worker.

Credits: 2.00

NUR 54200 - Chronic And Commonly Recurring Conditions: Adult Health Practice

Credit Hours: 3.00. Examination of pathophysiological alterations and clinical management of chronic conditions and illnesses in adolescents and adults. Students will synthesize knowledge of physiological, psychological, and sociocultural factors in the assessment and management of chronic conditions. Focus is on the differential diagnosis, clinical management, and patient and family education within the context of primary care. Chronic illness and health promotion models, as well as biopsychosocial and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed. The adult nurse practitioner role is analyzed in the context of caring for persons with acute conditions.

Credits: 3.00

NUR 54300 - Chronic Illness: Adult Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of chronic illness and recurring conditions in adolescents and adults and the impact of those conditions on family members. Focus is on the differential diagnosis, clinical decision making and management, as well as patient and family education within the context of primary care. The adult nurse practitioner role is analyzed in the context of caring for persons with chronic conditions. Professional issues, collaboration, scope of practice and advocacy are emphasized.

Credits: 3.00

NUR 54400 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan

Credit Hours: 3.00. Evidence-based treatment methods including principals of psychopharmacology and psychotherapeutic modalities across the life span are examined, evaluated and implemented in clinical practice. Factors, such as culture, neurobiology, developmental level and gender that impact disease expression, therapeutic approaches and treatment response are explored. Mental health assessment including standardized psychiatric assessment tools, including Mental Status Exam, Mood Disorder Questionnaire, Patient Health Questionnaire (PHQ-9), Columbia-Suicide Severity Rating Scale (C-SSRS), DSM V and ICD is presented. In addition, developmental and functional level, and cultural influences are included. Substance use assessment skills and substance use interventions will be examined including how substance use impacts psychiatric symptom expression and response to treatment. Legal and ethical implications of care will be discussed.

Credits: 3.00

NUR 54500 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan I Preceptorship

Credit Hours: 3.00. Students engage in the PMHNP role in a clinical setting under the supervision of a Psychiatric Mental Health Nurse Practitioner (PMHNP) or MD. Students implement and evaluate mental health assessment skills, evidenced based treatment interventions and evaluate effectiveness integrating principals of neurobiology, culture, developmental and functional abilities.

Credits: 3.00

NUR 55200 - Chronic Illness And Commonly Recurring Conditions: Pediatric Health Practice

Credit Hours: 3.00. Examines pathophysiological alterations and clinical management of chronic conditions and illnesses in children and adolescents. Students will synthesize knowledge of developmental, physiological, psychological, and sociocultural factors in the assessment and management of chronic conditions. The focus is on the differential diagnosis, clinical management, and child and family education within the context of primary health care. Chronic illness and health promotion models, as well as biopsychosocial, developmental, and cultural theories are integrated throughout the course. Individual, family, and group intervention strategies are addressed.

Credits: 3.00

NUR 55300 - Chronic Illness And Commonly Recurring Conditions: Pediatric Health Preceptorship

Credit Hours: 3.00. Assists students to develop and broaden clinical judgment and skills. Content includes the study of chronic illness and recurring conditions in children and adolescents and the impact of those conditions on family members. The focus is on growth and development, differential diagnosis, clinical decision making and management, and child and family education within the context of primary care. The pediatric nurse practitioner role is analyzed in the context of caring for children with chronic conditions. Professional issues, collaboration, scope of practice, and advocacy are emphasized.

Credits: 3.00

NUR 57600 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan II

Credit Hours: 3.00. The practice of Psychiatric Mental Health Nurse Practitioner (PMHNP) is further expanded to include identification and management of the complex patient across the life span. Explore how co-morbid health conditions impact psychiatric disorders and treatment response. Differentiate psychiatric diagnoses, personality disorders, social, family and cultural influences, developmental disorders and how these factors impact treatment. Apply a variety of approaches including inter-and intra-professional resources, and psychopharmacological interventions to the management of complex patients. Legal and ethical implications of care are discussed.

Credits: 3.00

NUR 57700 - Advanced Practice Psychiatric Mental Health Nursing Across The Lifespan II Preceptorship

Credit Hours: 3.00. Students engage in the Psychiatric Mental Health Nurse Practitioner (PMHNP) role in a clinical setting under the supervision of a PMHNP or Medical Doctor. Students continue to develop and broaden clinical judgment, psychiatric assessment skills, and evidenced-based treatment interventions while considering cultural influences, and developmental and functional abilities. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of mental health.

Credits: 3.00

NUR 59800 - Master's Capstone

Credit Hours: 1.00 or 3.00. Students apply research principles through problem identification, proposal development, implementation, and evaluation of a clinical problem. Students synthesize principles of health assessment and advanced practice nursing through a clinical research project. The project may be an evaluation study or part of an ongoing faculty research project.

Credits: 1.00 or 3.00

NUR 59900 - Special Topics/Independent Study In Nursing

Credit Hours: 0.00 to 6.00 (West Lafayette, Calumet) 1.00 to 6.00 (Fort Wayne). Special topics in nursing are critically examined. Hours, credit, and subject matter are determined by the staff. Permission of instructor required.

Credits: 0.00 to 6.00

NUR 60400 - PhD Seminar

Credit Hours: 0.00. This seminar is taken by Ph.D. nursing students each semester to integrate themselves to the academic and professional roles of the Ph.D. prepared nurse. This seminar will facilitate students to share their research ideas and progress through networking and collegial discourse. It also provides a low-stake forum where students can give and receive feedback on each other's research. Seminar goals include improving students' presentation and writing skills, teaching how to give constructive criticism, and advising on the academic and professional job market.

Credits: 0.00

NUR 61100 - Primary Care Of The Young Family

Credit Hours: 3.00. Prepares family nurse practitioner students to assume responsibility for the coordination and delivery of culturally appropriate health services to childbearing and childrearing families. Students apply theory and research to the management of pregnancy, well-child care, stable chronic conditions, and acute episodic illnesses commonly encountered in primary care settings. The course emphasizes a sound conceptual basis for practice and an appreciation for evidence-based care. Students continue to integrate health promotion and health maintenance into the primary care of young families.

Credits: 3.00

NUR 61300 - Primary Care Of The Young Family Practicum

Credit Hours: 3.00. Students progress in their ability to master the competencies of the family nurse practitioner, using critical thinking and diagnostic reasoning skills. Students apply knowledge of clinical research, pharmacology, physiology, and conceptual frameworks to the primary care of childbearing and childrearing clients and families. Prerequisite: NUR 50000 , NUR 51100 .

Credits: 3.00

NUR 61500 - Primary Care Of The Young Family Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of the young family with acute and chronic conditions, and the impact of those conditions on family members. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. The Family Nurse Practitioner role is analyzed in the context of caring for the young family with acute and chronic conditions. Professional issues, collaboration and scope of practice, advocacy are emphasized. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 61100.

Credits: 3.00

NUR 62200 - Primary Care Of The Aging Family

Credit Hours: 3.00. Prepares family nurse practitioner students to assume responsibility for the coordination and delivery of culturally appropriate health services to middle-aged and older families. Students learn to manage stable chronic conditions and acute episodic illnesses commonly encountered in primary care settings. The course emphasizes the conceptual basis for practice and an appreciation for evidence-based care. Students continue to integrate health promotion and health maintenance into the primary care of older clients and their families.

Credits: 3.00

NUR 62300 - Primary Care Of The Aging Family Practicum

Credit Hours: 3.00. Students progress in their ability to master the competencies of the family nurse practitioner, using critical thinking and diagnostic reasoning skills. Students apply knowledge of clinical research, pharmacology, physiology, and conceptual frameworks to the primary care of middle-aged and older clients and families. Prerequisite: NUR 61300 .

Credits: 3.00

NUR 62400 - Evidence-Based Practice

Credit Hours: 3.00. This course focuses on discovery and utilization of evidence-based care to produce the best outcomes for patients. The student develops a problem statement, performs a comprehensive literature search, and critically evaluates the evidence to determine best practice and formulate recommendations. The implementation of evidence-based practice (EBP) practical strategies, and analysis of components of EBP are examined throughout the course. Prerequisite: and either an undergraduate or graduate statistics course within the last five years. is recommended.

Credits: 3.00

NUR 62500 - History, Ethics, And Innovations In Health-Care Delivery Systems

Credit Hours: 3.00. Broadens and refines the student's view of the current health-care delivery system by providing an analysis from an historical perspective, of the forces that have shaped the system, including scientific discoveries, technological advances, social justice issues and the development of health professions and institutions. Nursing knowledge is influenced by these multiple factors; thus, the course provides students with tools to lead others in meeting the many challenges the health-care system brings. A chronological and topical format is used, which investigates policy and societal trends affecting health care, the nursing and medical professions, and professional practice. Changes in the roles of health-care providers and consumers are assessed from economic, social, organizational, political, ethical, legal, and technological perspectives.

Credits: 3.00

NUR 62600 - Applied Biostatistics For Outcome Evaluation

Credit Hours: 3.00. This course applied biostatistical methods commonly used in epidemiologic research to large data sets. Students learn to use statistical software to compute descriptive, bivariate, and multivariate statistics. Students translate statistical findings into conclusions relevant to the delivery of health care. Prerequisites: NUR 51000 and an undergraduate statistics course within the last five years.

Credits: 3.00

NUR 62700 - Primary Care Of The Aging Family Preceptorship

Credit Hours: 3.00. This course assists students to develop and broaden clinical judgment and skills. Content includes the study of primary care of the aging family with acute and chronic conditions and the impact of those conditions on family members. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. The Family Nurse Practitioner role is analyzed in the context of caring for the aging family with acute and chronic conditions. Professional issues, collaboration and scope of practice, advocacy are emphasized. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 62200.

Credits: 3.00

NUR 63100 - Family Nurse Practitioner Preceptorship Clinical Synthesis

Credit Hours: 2.00 to 3.00. This course assists students to integrate clinical knowledge and skills from prior course work when providing care to patients across the lifespan. The Family Nurse Practitioner role is analyzed in the context of caring for patients of all ages with acute and chronic conditions. Focus is on assessment, differential diagnosis, clinical decision-making and management, as well as patient and family education within the context of primary care. Prerequisites: NUR 50700 and NUR 50200 and NUR 50300 and NUR 51600 and NUR 51100 and NUR 51300. Co-requisite: NUR 61100 and NUR 61500 and NUR 62200 and NUR 62700.

Credits: 2.00 to 3.00

NUR 63200 - Health Policy: Local To Global

Credit Hours: 3.00. This course provides an overview of health policy not only in the context of health care policy, but also the

broader concepts of policies which affect health outside of the realm of health care delivery. Social, ethical, cultural, economic, and political issues that affect the delivery of health and nursing services are critically analyzed. Roles of health care providers and consumers of health care services, as well as government and entrepreneurial interest are examined. Emphasis is placed on the impact of policy decisions and advocacy on professional nursing practice, health services, health equity.

Credits: 3.00

NUR 64000 - Human Factors In Healthcare Engineering

Credit Hours: 3.00. This course provides an introduction to human factors and ergonomics with a focus on healthcare applications. Fundamental principles will be introduced including the cognitive, physical, and social considerations that comprise human factors engineering. By course completion, students should be able to formulate studies of and/or evaluate the healthcare domain using these fundamentals principles of human factors engineering. Permission of instructor required. Prerequisites: NUR 51000 or equivalent and Undergraduate Statistics course within the past five years.

Learning Outcomes: 1. Identify human factors relevant to healthcare engineering. 2. Describe ergonomic concepts applicable to healthcare engineering. 3. Interpret research applicable to human factors and engineering. 4. Apply the fundamental physical, cognitive, and organizational principles to the healthcare setting. Credits: 3.00

NUR 64100 - Principles Of Epidemiology

Credit Hours: 3.00. This course will provide the student with an introduction to epidemiology - the study of the distribution and determinants of health status. This course focuses on application of epidemiologic descriptive and analytic study as it relates to the distribution and determinants of health status. Topics will include the scope and history of epidemiology, basic quantitative methods and measures used in the field, and an introduction to the design and implementation of epidemiological studies. The course will also include the examination of cases from infectious disease, various forms of applied epidemiology (e.g., clinical and field epidemiology), surveillance/screening tests, types of epidemiological studies, concepts of disease transmission, and causality. Prerequisites: At least one undergraduate or graduate level statistics course. Permission of department required.

Credits: 3.00

NUR 64200 - Systems Approaches In Healthcare

Credit Hours: 3.00. Students are introduced to the fundamentals of systems engineering tools and approaches through hands-on problem-solving exercises. Systems Engineering tools/methods are applied to a clinical problem. Upon completion of this course, the participants will have had exposure to system engineering tools and approaches such as process mapping, bottle-neck analysis, queuing, lean engineering, simulation, optimization, dealing with uncertainty, what-if analysis, quality control and performance monitoring techniques. Permission of instructor required.

Learning Outcomes: 1. Discuss the applicability of systems engineering in a healthcare setting. 2. Develop familiarity with systems engineering tools and approaches. 3. Recognize opportunities for improvement where systems engineering can be employed. 4. Identify a specific clinical problem in a real-world setting that can be analyzed using systems engineering. 5. Conduct an in-depth analysis of a clinical problem using one of the tools/approaches presented. Credits: 3.00

NUR 65500 - Advanced Practice In Nursing Seminar

Credit Hours: 1.00. Students analyze movements and trends that influence advanced practice in nursing. Students dialogue with peers on issues related to advanced practice, nursing as a profession and discipline, healthcare and other related topics of interest. Prerequisite: NUR 60100, NUR 60300, NUR 61300 .

Credits: 1.00

NUR 65600 - Healthcare Organization, Policy And Economics

Credit Hours: 3.00. Students use theories to understand the various models that influence health care policy and organize health care delivery. Students investigate the processes of analyzing and forming health policy. The reciprocal relationship between evidence-based practice and health care policy is explored. Students examine health care economics from a micro and macro perspective and their impact on health care delivery systems. Students also explore issues such access to health care, health care quality, and cost. Prerequisite: NUR 50100 .

Credits: 3.00

NUR 65700 - FNP Practicum: Clinical Synthesis

Credit Hours: 2.00. This is the final clinical capstone course in a sequence of clinical courses designed to prepare graduate nursing students for FNP practice. Students synthesize and apply theoretical and empirical knowledge in primary-care settings with culturally diverse clients and families. Emphasis is given to the clinical management of a wider spectrum of clients and to the more complex, co-morbid conditions seen in family practice. Prerequisite: NUR 62300 .Corequisite: NUR 65500 , NUR 65600 .

Credits: 2.00

NUR 67300 - DNP Health Policy Residency

Credit Hours: 2.00. This residency course provides an opportunity for students to gain greater understanding of how public policy affects state, national, and international health-care delivery systems and resources. Students will interact with top policy makers at the local, state, national, and/or international level to explore the many forces, including political, economic, social, and technological, that influence current policy and the policy-making process. Prerequisite: NUR 65600.

Credits: 2.00

NUR 67400 - Quality Initiatives, Leadership And Advanced Practice Nursing

Credit Hours: 2.00. This course develops concepts of the guiding principles of quality, system and leadership initiatives in the Nurse Practitioner Role. The students explore principles and techniques of health coaching, interprofessional team work, delegation and prioritization that can be used in various healthcare settings. Potential quality initiatives will be identified and an improvement plan will be developed using various quality initiatives modalities in the healthcare system to improve quality care, safety and patient outcomes. Permission of department required.

Credits: 2.00

NUR 67500 - Role Transition And Synthesis

Credit Hours: 2.00. This course provides an integration of core, cognate, and specialty knowledge, with an emphasis on role transition and synthesis. Focuses on internal and external healthcare organizational factors at the local, state, national, and international levels. Seminars explore role issues, licensure, credentialing, finances, legislation, healthcare policy, legal issues, ethics, cultural diversity, evidence-based practice, emerging trends in the management of acute and chronic conditions of adults, and independent and collaborative practice. Prerequisite: NUR 53200 , NUR 53300 . Corequisite: NUR 54200 , NUR 54300 , NUR 59800 .

Credits: 2.00

NUR 67800 - Healthcare Economics And Finance

Credit Hours: 3.00. This class will provide an introduction to the application of health economics principles as it relates to various health care systems, health care stakeholders and health policy issues in the United States. The course will explore the allocation and distribution of resources in the health care industry and the nature of the constantly changing relationship between health care and its major constituencies. Topics include the demand for health care, access to care, health care parity, health care reimbursement, economic evaluation, health care delivery models, and health care professionals' services.

Credits: 3.00

NUR 68000 - DNP Cognate Residency: Direct Practice/Systems Management I

Credit Hours: 3.00. This is the first in a series of two courses that applies knowledge and skill to improve healthcare outcomes in systems. The emphasis is the application of engineering principles to health care including human factors, systems analysis and design, and optimal use of information technology and simulation. Residency activities provide students with opportunities to participate in professional service activities, attend institutes and conferences to expand their area of research or clinical interest and/or develop significant scholarly pursuits. The focus is on creating change in the healthcare system through analysis, synthesis, critique, and application of evidence-based practice to support accessible high quality, safe, efficient, and effective health care. Prerequisites: NUR 68700 .

Credits: 3.00

NUR 68001 - PhD Cognate Residency

Credit Hours: 3.00. The PhD Cognate includes experiential learning that provides preliminary preparation for conducting the PhD Dissertation Proposal. The course will incorporate guidelines for ethical conduct of human studies, research-based studies, and evaluation of evidence-based literature for study design. The course will assist students to develop the project reflective of previous courses, evidence, project feasibility, theoretical frameworks, appropriate methodology and data analysis.

Learning Outcomes: 1. Use communication information technology to advance the scholarship of discovery as a nurse scientist. 2. Analyze emerging clinical patterns and problems within a practice setting, healthcare

organization, community, or system. 3. Integrate nurse-led care strategies that meet current and future healthcare needs based on scientific findings in nursing, organizational, political, economic, and other related sciences. 4. Employ consultative and leadership skills with transdisciplinary teams to generate new knowledge to improve healthcare. 5. Evaluate existing knowledge to develop a research plan to guide the generation of new knowledge and ideas to improve health. 6. Interact with diverse organizational cultures and populations, such as stakeholders of a specific topic, health system leaders, research participants, and interdisciplinary team members. Credits: 3.00

NUR 68100 - DNP Cognate Residency: Direct Practice/Systems Management II

Credit Hours: 3.00. This is a second in a series of two courses that applies knowledge and skill to improve healthcare outcomes in systems. The emphasis is the advanced application of engineering principles to health care including human factors, systems analysis and design, and optimal use of information technology and simulation. Students assume a leadership role in the application process utilizing skills acquired in DNP Residency: Direct Practice Management I. Residency activities provide students with opportunities to participate in professional service activities, attend institutes and conferences to expand their area of research or clinical interest and/or develop significant scholarly pursuits. The focus is on providing leadership in creating change in the healthcare system through analysis, synthesis, critique, and application of evidence-based practice to support accessible high quality, safe, efficient, and effective health care and systematic evaluation of outcomes. Clinical sites for the DNP Residency may include collaboration with experts in local, state, national, and international healthcare agencies. Residency activities are selected by the student under the guidance of the faculty advisor and preceptor, DNP program director, and approved by the director of graduate programs in nursing. Prerequisite: NUR 68700 .

Credits: 3.00

NUR 68300 - DNP Cognate Residency: Public Health/Homeland Security Practice I

Credit Hours: 3.00. This is the first in a series of two courses that provides an opportunity to explore a public health topic of interest under the direction of a faculty member. The focus is on implementation of an evidence-based practice model and evaluation of their effectiveness in improving community health outcomes. Residency activities provide opportunities to utilize research and evidence-based practice to expand the knowledge base needed for the development, implementation, and evaluation of programs to meet the public health needs of specific communities with risk assessment analysis. Students will assess, plan, and evaluate the preparedness and response to mass casualty disasters or other public health concerns. Prerequisites: NUR 51000 and NUR 63200 . Concurrent Prerequisites: NUR 62400 and NUR 62600 .

Credits: 3.00

NUR 68500 - DNP Cognate Residence: Public Health/Homeland Security Practice II

Credit Hours: 3.00. This is the second in a series of two courses that provides an opportunity to further explore a public health topic of interest under the direction of a faculty member. The focus is on implementation of an evidence-based practice model and advanced application of evaluation techniques in establishing their effectiveness in improving community health outcomes. Residency activities provide ongoing opportunities to refine research and evidence-based practice to expand the knowledge base needed for the development, implementation, and evaluation of programs to meet the public health needs of the community and systems of care. Emphasis is on providing leadership in incorporating assessment of health needs of specific communities with risk assessment analysis to implement models to improve community outcomes. Students assume a leadership role as they assess, plan, and evaluate the preparedness and response to mass casualty disasters or other public health concerns. Residency sites may be local, state, national, and/or international settings. Residency activities are selected by the students under the guidance of the faculty advisor and preceptor, DNP program director, and approved by the director of graduate programs in Nursing. Prerequisite: NUR 68300 .

Credits: 3.00

NUR 68700 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice I

Credit Hours: 3.00. This course is first of a two part series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 51000 , NUR 62600 , NUR 62400 and Cognate Residencies.

Credits: 3.00

NUR 68900 - Doctor Of Nursing Practice (DNP) Practice Inquiry: Evidence-Based Practice II

Credit Hours: 3.00. This course is second in the series that provides the opportunity to develop, implement and evaluate an evidence-based inquiry project. Students gain competence in activities aimed at improving the healthcare practice and systems, outcome evaluations, translation of research into practice, participation in interdisciplinary and collaborative research, and dissemination of research results. Total clinic hours 192. Prerequisites: NUR 68700 and Cognate Residencies.

Credits: 3.00

NUR 69010 - Research Seminar

Credit Hours: 1.00. The Seminar in Nursing Research is a discussion-based course intended to socialize the nursing student to the role of an independent scholar. Discussion concentrates upon current topics and issues in nursing research, with an emphasis on targeting the most supportive trajectories for individual student research foci. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69020 - Leadership Seminar

Credit Hours: 1.00. The nurse as leader is deconstructed and reconstructed within the realms of scientific knowledge, theory, education, and healthcare delivery. Nurse leaders as members of collaborative teams and the influence of nursing intelligence on research teams are examined. Historical and societal influences affecting nurse leaders are examined, including media portrayals of nursing, transformational leadership, critical theory and feminist theory. Models of leadership are explored within the context of scientific work; the student is challenged to evaluate themselves as present and future leaders and members of nursing's academe. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69030 - Communication Seminar

Credit Hours: 1.00. Original research findings, using a global framework, are analyzed. The effectiveness of communication to implement and evaluate programs designed to promote innovative change in healthcare is critiqued. Communication as a mechanism to develop pathways to ensure accuracy of scientific information transfer, and as a necessary component of policy and major public health events is appraised. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69040 - Collaboration Seminar

Credit Hours: 1.00. Principles of collaboration to generate scientific knowledge, which is used to improve nursing and healthcare practice, education, policy, and outcomes, are discussed. Evidence generated from transdisciplinary teams is analyzed with attention given to specific professions contributions and roles. The specific role of the nurse scientist and the value of nursing intelligence within the context of collaborative projects are discussed. Best practices in collaboration as exemplified by select research teams are presented. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 1.00

NUR 69050 - Implementing Theory In Healthcare Research

Credit Hours: 3.00. Historical and contemporary social, ethical, educational, scientific, and professional influences on the development of theoretical knowledge in nursing and health research are analyzed. Various methods of theory development are reviewed. Selected biological/physiological, behavioral, and health service theories that form the basis of nursing science are critically evaluated. Skills needed for theory analysis and theory development are emphasized. The role of theoretical knowledge to innovation in nursing science and healthcare is presented. Scientific bridges between theoretical frameworks and research methods are appraised. Selected nursing and healthcare scientists communicate the theoretical aspects of their programs of research with an emphasis on collaboration between disciplines. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 3.00

NUR 69060 - Innovative Care/Innovations In Healthcare Delivery

Credit Hours: 3.00. Historical, ethical, financial, and social influences on contemporary innovations in healthcare practices and delivery systems are analyzed. The genesis and diffusion of

both micro- and macro-level innovations are reconstructed with the use of theories, organizational and transdisciplinary factors, and effective processes. Quality of care issues are synthesized utilizing innovations in care and health delivery systems as a framework. With innovative care and innovations in healthcare delivery systems as frameworks, quality of care issues are appraised. Selected exemplars of successful innovations, with an emphasis on strategies to evaluate dissemination and impact, are analyzed. Admission to the Nursing PhD program or instructor permission. This is one of the first courses taken by PhD students and may be open to graduate students outside the School of Nursing with permission from the instructor.

Credits: 3.00

NUR 69100 - Health Care Research Methods

Credit Hours: 3.00. This course advances knowledge and skill in quantitative research methods for health program evaluation, population health, healthcare quality improvement, and other healthcare research applications. Topics include design of experimental, quasi-experimental, and observational studies; primary data collection through surveys and other techniques; use of clinical, administrative, and other secondary data sources; and data analysis strategies appropriate to each design and type of data. The course addresses basic issues of sampling, measurement, and validity and reliability, as well as practical issues that arise in healthcare research.

Credits: 3.00

NUR 69200 - Applied Statistics In Healthcare Research

Credit Hours: 3.00. This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data. Prerequisites: Introductory course in statistics or biostatistics at the advanced undergraduate or graduate level.

Credits: 3.00

NUR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Nutrition Science (Graduate)

Website: **https://hhs.purdue.edu/graduate-students/**

Department/School Head

Laura Murray-Kolb

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Associate Professor	Emeritus Faculty

Kimberly Buhman Wayne Campbell Heather Eicher-Miller Qing Jiang Richard Mattes-Distinguished Laura Murray-Kolb Dennis Savaiano Dorothy Teegarden	John Burgess Cordelia Running	Annabel Biruete Tzu-Wen Cross Greg Henderson Brandon Kistler Anita Panjwani Patricia Wolf	Dinah Dalder	William Evers Karen Jamesen Elsa Janle Charles R. Santerre Bruce Watkins Connie Weaver Olivia Wood

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Academic Programs

Master's and Ph.D. Programs

Research in nutrition science integrates information from many disciplines: including biochemistry, cell biology, physiology, psychology, food science, genetics, and epidemiology. The Interdepartmental Nutrition Program (INP) is an interdisciplinary training program for students interested in the study of nutrition science.

Professional Master's Program

The Master of Science in Dietetics, an Accreditation Council for Education in Nutrition and Dietetics (ACEND)-accredited coordinated program, is a combination of residential classroom learning and supervised practice experience that results in eligibility to sit for the national Commission on Dietetics Registration (CDR) exam to become a registered dietitian nutritionist (RDN).

Nutrition, MS

Nutrition and Dietetics, MSD

Nutrition, PHD

Nutrition Science/Cancer Research, PHD

Nutrition Science/Gerontology, PHD

NUTR 51100 - Applied Nutrition Counseling

Credit Hours: 3.00. Field experience in one-on-one nutrition counseling that requires application of prior learning of theory, knowledge and skills.

Credits: 3.00

NUTR 51200 - Dietary Supplements

Credit Hours: 2.00. Provides advanced training to evaluate concepts and issues of dietary supplement use in various populations. Students develop critical thinking skills through activities such as case studies to make appropriate recommendations for nutrition supplementation.

Credits: 2.00

NUTR 51300 - Food Chemistry

Credit Hours: 2.00. Application of fundamental laws and concepts of chemistry, physics, and biology to foods and the

sensory and analytical properties of food. Evaluation of the validity of health controversies related to food ingredients. Completion of a food additive assessment.

Credits: 2.00

NUTR 51400 - Food Chemistry Laboratory

Credit Hours: 2.00. Application of fundamental laws and concepts of chemistry, physics, and biology to foods and eating. Experiments with food will be designed, reported and critiqued using the scientific method.

Credits: 2.00

NUTR 51500 - Nutrition Pathophysiology

Credit Hours: 2.00. A review of the underlying nutritional components and pathophysiology of common human diseases/disorders and current approaches for the prevention, management, and treatment of nutrition-related diseases. Building upon previous coursework in micronutrient and macronutrient metabolism, the focus is on the metabolic disturbances occurring with diseases such as diabetes, GI diseases, obesity kidney diseases, cardiovascular disease, and anemia.

Learning Outcomes: 1. Explain the underlying nutritional aspects of several common diseases. 2. Use current information technologies to locate and apply evidence-based guidelines and protocols. 3. Use principles of pathophysiology to explain the nutritional aspects of diseases, identify nutrition-related problems and determine and evaluate nutrition interventions; this will include the integration of multiple disciplines (e.g., biochemistry, genetics, microbiology, pharmacology, physiology). 4. Have knowledge of prevention theories and guidelines for nutrition-related diseases.

Credits: 2.00

NUTR 51600 - Eating Disorders And Healthy Weight Management

Credit Hours: 3.00. An evidence-based, application-focused exploration of the continuum of healthy eating to eating disorders and the factors that influence body weight. This includes review of each eating disorder diagnosis from an interdisciplinary perspective with emphasis on the role of the registered dietitian nutritionist in prevention, identification, treatment, and recovery.

Learning Outcomes: 1. Describe the prevalence of and relevant biological, environmental, social, and psychological factors associated with the development of overweight, obesity, and eating disorders. 2. Identify the diagnostic characteristics of and understand tailored treatment interventions for anorexia nervosa, bulimia nervosa, binge eating disorder and avoidant/restrictive feeding intake disorder, as well as discuss other specified feeding and eating disorders presentation and treatment. 3. Appreciate the role of the interdisciplinary support/treatment team and various levels of care in eating disorder support and treatment while developing knowledge and aptitude in a range of nutrition therapy interventions. 4. Identify the benefits, potential risks, appropriate target population(s), and medical nutrition therapy components of diet-based, medication-based, and surgical weight management interventions. 5. Understand and be able to apply mindful and intuitive eating and health at every size approach in patient/client care as a method of preventing disordered eating, weight stigma, and body negativity and to support wellbeing and recovery. Credits: 3.00

NUTR 52100 - Advanced Medical Nutrition Therapy

Credit Hours: 3.00. Application of the Nutrition Care Process in various disease states and conditions to prepare students for supervised practice.

Credits: 3.00

NUTR 52200 - Advanced Nutrition Communications

Credit Hours: 3.00. Provides advanced training and skill development to effectively implement and evaluate food and nutrition communication to lay and professional audiences through oral, written, and mass media channels. Permission of department required.

Credits: 3.00

NUTR 52300 - Trends In Nutrition & Dietetics

Credit Hours: 2.00. Analysis and discussion of current trends in dietetics practice and nutrition including such topics as nutrigenomics, informatics, sustainability, agricultural practices, food policies, and global health. Permission of department required.

Credits: 2.00

NUTR 52900 - Basic Bone Biology

Credit Hours: 3.00. This course is designed to present the fundamentals of bone biology. The course objectives are designed to provide learners with a solid framework for understanding mechanisms, diseases, and treatments associated with the musculoskeletal system as they advance in their education and training.

- Approximately 45 hours of lecture will help the learner achieve the objectives outlined. Lectures will be given to present information and tie into information learners have acquired or will acquire in other courses (e.g. biomechanics, physiology, molecular biology, etc.) to assist them in combining all of their courses and research experiences together into one interdisciplinary learning experience.
- Directors will attend and supervise the scheduled lecture sessions if they are not providing the lecture content, and they will be available during these times to answer questions. However, it is expected that students take additional time outside of scheduled class time to further learning.
- Materials for the learners will be posted on the course's website. These materials will include:
- Lecture notes and PowerPoints: Each lecturer will post his/her lecture notes and associated PowerPoint slides prior to the lecture.
- Additional information: As the course progresses, instructors may come across additional information that they may find useful for student learning of the material. These materials will be posted for students to utilize as they see fit.

** Materials found on other sites (e.g. social networking sites) will not be official course materials, so use at your own risk.*

** Course offered every other spring*

Credits: 3.00

NUTR 53100 - Ethical Practice And Professionalism In Dietetics

Credit Hours: 1.00. Evaluation of concepts and issues of ethical practice in the dietetics profession and the application of the Scope/ Standards of Practice for Nutrition and Dietetics Practitioners and the Code of Ethics for the Nutrition and Dietetics Profession. Permission of department required.

Credits: 1.00

NUTR 53200 - World Food Problems

Credit Hours: 3.00. (AGEC 53200) This course focuses on the multi-disciplinary challenges that exist in meeting the food and nutrition needs of a growing world population. The course aims to instill an appreciation of the importance of economics, food production and technology, trade, culture, communication, political processes and institutions, demography and related factors in determining adequate food availability and health globally. Permission of instructor required.

Credits: 3.00

NUTR 53300 - Community Nutrition Experience

Credit Hours: 3.00. Application of previous knowledge and communication skills in nutrition of community settings, such as school nutrition, health facilities, and federal or state nutrition programs.

Credits: 3.00

NUTR 53400 - Human Sensory Systems And Food Evaluation

Credit Hours: 3.00. Overview of human chemosensory (taste, smell, chemesthetic) mechanisms and function, as well as procedural and statistical methods for evaluating the sensory responsiveness of people and the sensory properties of foods.

Credits: 3.00

NUTR 53500 - Leadership In Dietetics

Credit Hours: 1.00. Evaluation of concepts and development of skills relevant to leadership in dietetics including staff development, budgeting, strategic planning, quality improvement, regulatory compliance and embracing human diversity.

Learning Outcomes: 1. Apply change management strategies to achieve desired

outcomes. 2. Apply management theories to the development of programs or services. 3. Evaluate a budget/financial management plan and interpret financial data. 4. Demonstrate an understanding of the regulation system related to billing and coding, what services are reimbursable by third party payers and how reimbursement may be obtained. 5. Apply the principles of human resource management to different situations. 6. Evaluate data to be used in decision-making for continuous quality improvement. 7. Analyze quality, financial and productivity data for use in planning. 8. Practice resolving differences or dealing with conflicts. 9. Promote team involvement and recognize the skills of each member. Credits: 1.00

NUTR 53900 - Foodservice Systems Management Experience

Credit Hours: 4.00. Application of previous knowledge and communication skills in foodservice facilities. Student's performance will ultimately include responsibilities equivalent to staff relief. Must have ServSafe Certification (manager level) prior to enrollment.

Credits: 4.00

NUTR 54100 - Food Policy And Nutrition

Credit Hours: 3.00. We will explore the nature of contemporary United States food policy and key events throughout history that have shaped what it is today. We will investigate and discuss the roles individuals, corporations, and federal, state, and other government agencies play in creating food policy, and how these stakeholders as well as complex sociological and economic factors influence the way Americans eat. These questions will lead us to consider the future of food and food policy in the United States. Can Americans develop food policy that supports the agricultural economy AND promotes the consumption of healthy foods? Could our agricultural system support this? We will learn about and explore these questions with class discussions, debate, research, guest lectures, relevant documentary films, and thought-provoking readings that present a variety of viewpoints. You will explore current, real-life problems and have an opportunity to develop potential solutions. Credits: 3.00

NUTR 54200 - Engagement Experience

Credit Hours: 3.00. Application of previously acquired knowledge and communication skills in a culminating supervised practice experience in one of seven engagement tracks. Placements at professional sites incorporate individual student's preferred track in foodservice, industry, nutrition-fitness-wellness-energy balance, community/public health, long-term care, medical nutrition therapy or research. Students complete a major project demonstrating readiness to practice as an entry-level dietitian.

Credits: 3.00

NUTR 54300 - Medical Nutrition Therapy Experience

Credit Hours: 4.00. Application of previous knowledge and communication skills of medical nutrition therapy in the hospital/ patient care setting to ultimately include responsibilities equivalent to staff relief.

Credits: 4.00

NUTR 54400 - Advanced Medical Nutrition Therapy For Special Populations

Credit Hours: 1.00. Application of Medical Nutrition Therapy for special populations including enhanced skills for the practice of dietetics. Lectures and laboratory activities supplement training in various diagnoses and conditions not routinely encountered during supervised practice experiences in NUTR 54300 Medical Nutrition Therapy Experience. Permission of department required.

Learning Outcomes: 1. Apply evidence-based guidelines, systematic reviews and scientific literature. 2. Evaluate emerging research for application in nutrition and dietetics practice. 3. Incorporate critical-thinking skills in overall practice. 4. Practice in compliance with current federal regulations and state statutes and rules, as applicable, and in accordance with

accreditation standards and the Scope of Nutrition and Dietetics Practice and Code of Ethics for the Profession of Nutrition and Dietetics. 5. Function as a member of interprofessional teams. 6. Perform the Nutrition Care Process and use standardized nutrition language for individuals, groups and populations of differing ages and health status, in a variety of settings. 7. Practice routine health screening assessments, including measuring blood pressure and conducting waived point-of-care laboratory testing (such as blood glucose or cholesterol). 8. Perform routing health screening assessments including measuring blood pressure, conducting waived point of care laboratory testing (such as blood glucose or cholesterol), initiating pharmacotherapy plans (such as insulin management), and administering vaccine injections (such as flu shots). 9. Provide instruction for self-monitoring blood glucose, insulin administration and adjusting diabetes medication. 10. Insert nasogastric or nasoenteric feeding tubes. 11. Initiate and conduct bedside swallow screenings. Credits: 1.00

NUTR 59000 - Special Problems In Nutrition

Credit Hours: 1.00 to 4.00. Individual problems dealing with various aspects of nutrition. Permission of instructor required.

Credits: 1.00 to 4.00

NUTR 59100 - Nutrition Science Graduate Experiential Learning/Internship

Credit Hours: 0.00 to 2.00. The objective of the course is to enhance graduate learning via facilitating graduate students to enhance research and data analysis skills through real-life experience. Permission of instructor required.

Learning Outcomes: 1. Gain real-life knowledge that strengthens a student's graduate learning. 2. Obtain research and data analysis skills that are important for a student's thesis but are not readily available on campus. 3. Conduct research with a collaborator to enhance a student's thesis. Credits: 0.00 to 2.00

NUTR 59600 - A Journey Through The GI Tract

Credit Hours: 2.00. This seminar-format course follows the production and then the fate of a meal of pizza and soda from the farm through the digestive system. Topics for in-depth consideration include cephalic phase responses, salivary, sensory and masticatory processes in the oral cavity, esophageal, gastric and intestinal (small and large) phases of digestion, as well as the brain-gut axis and microbial contributions to health and disease. The emphasis will be on organ and whole-body level physiology related to ingestive behavior and body weight. Prior coursework in biochemistry and physiology preferred or request permission from the instructor.

Learning Outcomes: 1. Understand the relationships between food properties and both food digestion and nutrient absorption/metabolism. 2. Understand feed-forward and backward signaling systems in the GI tract. 3. Understand the requirements and limits of digestive processes. 4. Improve their written and verbal communication skills. 5. Evaluate critically how perturbations in GI processes impact health. Credits: 2.00

NUTR 60500 - Nutritional Biochemistry And Physiology I

Credit Hours: 4.00. (ANSC 62500) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing interactions in bone and gut metabolism and physiology. Permission of instructor required.

Credits: 4.00

NUTR 60600 - Nutritional Biochemistry And Physiology II

Credit Hours: 2.00. (ANSC 62600) Integration of biochemical and physiological functions of nutrients in humans and animals emphasizing post-absorptive use of nutrients as sources of energy and for the synthesis of macromolecules, emphasizing integrative metabolism in liver, muscle and adipose tissues. Offered weeks 1 - 8. Prerequisite: NUTR 60500.

Credits: 2.00

NUTR 60700 - Nutritional Biochemistry And Physiology III

Credit Hours: 2.00. (ANSC 62700) Integration of biochemical and physiological functions of nutrients in humans and animals,

emphasizing lipid metabolism and transport in the context of cardiovascular function. Offered weeks 9 - 16. Prerequisite: NUTR 60600.

Credits: 2.00

NUTR 60900 - Food Lipids

Credit Hours: 1.00 to 3.00. (FS 60900) Importance of lipids in the diet and food systems with emphasis on changes occurring during processing, preparation, and storage. Nomenclature, physical attributes, and oxidation of lipids as well as properties and characteristics of antioxidants will be major components of the course. Offered in alternate years. Prerequisite: BCHM 56100; Prerequisite: NUTR 45300 or FS 45300.

Credits: 1.00 to 3.00

NUTR 61200 - Obesity: Behavior, Physiology And Policy

Credit Hours: 2.00. The topics in this course provide a firm conceptual foundation for graduate students interested in issues related to obesity. Topics include issues ranging from molecular to policy: there is a strong emphasis on interdisciplinary approaches and critical thinking as it is a goal to integrate the sophisticated analyses of the physiological, nutritional, developmental, genetic, sensory, socio-economic, and experiential determinants of food and fluid intake. In addition, topics in this course such as health implications of obesity, epidemiology of obesity, endocrine, energy metabolism/integration, and neurochemistry will provide the opportunity for greater interdisciplinary collaborations.

Credits: 2.00

NUTR 61600 - Special Topics In Ingestive Behavior

Credit Hours: 3.00. Explore, in-depth, important and current issues in ingestive behavior, enhance critical thinking skills, acquire professional skills (e.g. organizational, interpersonal), and develop rapport with scholars in the field.

Credits: 3.00

NUTR 61700 - Ingestive Behavior Seminar

Credit Hours: 1.00. (PSY 61801) Fosters an exchange of ideas and promotes greater familiarity among individuals from different laboratories and departments with interests related to ingestive behavior, and gives students opportunities to build their communication skills and lead/mediate discussions at a high scholarly level. Typically offered in alternate years.

Credits: 1.00

NUTR 62600 - Advanced Presentation Skills

Credit Hours: 1.00. This course will teach graduate students how to synthesize information from multiple scientific studies and then communicate that information effectively to others in the form of a 40 minute long scientific seminar. The course is designed to provide students with clear guidelines for effective long-form oral communication of scientific information and then give students an opportunity to put those guidelines into practice. Prerequisites: Graduate standing past the first year. NUTR 69400 or equivalent course (determined by instructor review). For PhD students; INP Scientific Writing Course NUTR 62700. For MS students; a statement from the research mentor that the student has a clear thesis topic, that the student has completed the majority of work on the thesis, and that the student has conducted background reading on the thesis topic.

Credits: 1.00

NUTR 62700 - Scientific Writing In Nutrition Science

Credit Hours: 1.00. The goal of this course is to develop and practice skills for clear scientific writing. The course is designed to introduce and practice the building blocks of scientific writing, including word choice, sentence structure and paragraph structure. In addition, students will be introduced to components of a hypothesis testing biomedical research paper in order to communicate a storyline. In addition, the publication cycle will be discussed. Prerequisites: Graduate standing past the first year. NUTR 60500 and NUTR 60600 and NUTR 60700. Other students can be approved for entry by permission of the instructor.

Credits: 1.00

NUTR 63000 - Carbohydrates

Credit Hours: 3.00. (FS 63000) Carbohydrates with an emphasis on those of low molecular weight in foods. Structures, reactions, and properties of mono- and oligosaccharides. Introduction to polysaccharides and food gums. Offered in alternate years. Prerequisite: 6 credit hours in Organic Chemistry.

Credits: 3.00

NUTR 63200 - Lipids And Cell Function

Credit Hours: 2.00. This graduate-level course teaches advanced knowledge and critical thinking skills relevant to lipids in cell, tissue, and organismal physiology and pathophysiology. Students should have completed some graduate level biochemistry, physiology and nutrition coursework. Permission of instructor required.

Learning Outcomes: 1. Know several resources

for research related to lipids including websites, professional organizations, journals, books and companies. 2. Name and classify lipids appropriately according to recommendations from LIPIDMAPs. 3. Describe different methods for detecting and analyzing a wide variety of lipids. 4. Describe how lipids (diet and endogenously derived) impact physiology and pathophysiology at the cellular, tissue, and organism levels. 5. Critique research published on lipids. Credits: 2.00

NUTR 63400 - Nutrition And Cancer Prevention

Credit Hours: 2.00. An in-depth examination of the role of nutrition in cancer prevention. Typically offered in alternate years.

Credits: 2.00

NUTR 64000 - Human Feeding

Credit Hours: 2.00. Critical review of the genetic, neural, metabolic, endocrine, sensory, cognitive, and cultural determinants of appetite, food selection, and energy balance. Offered in alternate years. Prerequisite: physiology, biochemistry. Masters student standing.

Credits: 2.00

NUTR 69000 - Interdepartmental Nutrition Program Grant Writing

Credit Hours: 1.00. Fulfillment of grant writing requirements for graduate students enrolled in the Interdepartmental Nutrition Program. Prerequisite: Interdepartmental Nutrition Program graduate students status. Permission of instructor required.

Credits: 1.00

NUTR 69400 - Introductory Presentation Skills In Nutrition Science

Credit Hours: 1.00. Introductory training and application of concepts for effective communication through oral and poster presentations in the field of nutrition science.

Credits: 1.00

NUTR 69500 - Interdepartmental Nutrition Program Seminar

Credit Hours: 0.00 or 1.00. Develop and strengthen skills in organization, preparation, and presentation of scientific information relevant to nutrition science to an audience of scientists.

Credits: 0.00 or 1.00

NUTR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

NUTR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Psychological Sciences (Graduate)

Website: **Psychological Sciences - College of Health and Human Sciences**

Department/School Head

Dr. Kimberly P. Kinzig

Faculty by Rank

Professor	Associate Professor	Assistant Professor

Christopher Agnew Ximena Arriaga Jennifer Brown Julia Chester Christopher Eckhardt Gregory Francis William Graziano Sebastien Hélie Jeffrey Karpicke Kimberly Kinzig Donald Lynam Margo Monteith Thomas Redick David Rollock Douglas Samuel Anne Sereno Susan South Susan Swithers Louis Tay Sang Eun Woo	Stephen Broomell Yu-Chin Chiu Daniel Foti Edward Fox George Hollich Bridgette Kelleher Teri Kirby Franki Kung Brooke Macnamara Darryl Schneider	Alexandra Harris-Watson Hongmi Lee Thekla Morgenroth

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Academic Programs

The Department of Psychological Sciences offers six graduate majors, each culminating in the Ph.D. as listed below (note that the Department does not offer terminal master's degree programs).

Clinical Psychological Sciences

The Clinical Psychological Sciences major within the Department of Psychological Sciences dates to the very beginning of the sub-discipline of clinical psychology. In 1935, the American Psychological Association (APA) recommended that clinical psychologists receive specialty training. In 1948, the Clinical Psychology Program at Purdue University was accredited by the APA and has been continuously accredited since that time.
The purpose of the Doctoral Program in Clinical Psychological Sciences is to train students who are involved in the generation of new knowledge in psychology, and competent in the professional application of clinical science to the prevention and remediation of clinical problems. A general background in general and clinical psychology is provided by didactic courses and seminars. Research expertise is honed through apprenticeship to an active clinical science researcher and the completion of a first-year project, M.S. thesis, Preliminary Exam, and Ph.D. dissertation. Clinical experience is provided by participation in both in-house and external practice. The breadth and integration of academic work, research, and clinical training are consistent with standards set forth by the American Psychological Association (APA).

Cognitive Psychology

The graduate major in cognitive psychology is primarily oriented toward doctoral training. All students are required to complete a master's thesis leading to an M.S. degree before continuing the doctoral program. The normal time course for a master's degree is two years, with two additional years for the doctorate. The term "cognitive psychology" encompasses most topics in human experimental psychology. The interests of the faculty in this area include sensory processes, perception, information processing, memory, attention, judgment, thinking, problem-solving, and human factors. Faculty specializing in mathematical psychology, behavioral neuroscience, and animal learning also participate in the cognitive graduate program. Human factors is an interdisciplinary area of interest that focuses on the systematic application of knowledge about human sensory, perceptual, mental, psychomotor, and other characteristics to the design of the many human-made facilities of our current civilization.

Industrial-Organizational Psychology

Purdue's Industrial and Organizational (I-O) psychology major is among the oldest in the world, conferring its first degree in 1939. The program has graduated more PhDs, and produced more SIOP Fellows, than any other I-O program, and is among the top-ranked programs in the nation. We are primarily a Ph.D. program, and as such, training is heavily research-oriented. Students are strongly encouraged to participate in faculty research and eventually to formulate and direct their own individual research projects. Teaching experience is also provided for most students during their graduate program. Most students enter the Ph.D. program with a bachelor's degree, although some enter with a master's degree. Graduate students are admitted to work with one of the primary I-O faculty

members who serve as their major professor. Graduate training is based on a science-practice model, where students are trained both as researchers as well as applied scientists equipped to work with organizations on human resource issues. The current faculty has a wide range of research interests, many of which center around the psychological experiences of people at work.

Mathematical and Computational Psychology

Mathematical psychologists and cognitive modelers develop and test quantitative theories of cognition, behavior, neuroscience, and other psychological phenomena. If you like mathematics and are looking for a challenging field in which to apply your skills, you may be interested in a career in mathematical psychology and cognitive modeling. There are quantitative theories of perception, motor performance, social interactions, memory, decision-making, learning, problem-solving, and neuroscience. These theories can take the form of mathematical equations, but also of computational models and neural network simulations. Students in the mathematical psychology program at Purdue University acquire a solid background in mathematics, psychology, and statistics to use as a basis for creating mathematical, statistical, and computational models in a wide range of psychological areas ranging from low-level perception to higher-level cognitive function such as problem-solving and reasoning. Researchers in the mathematical and computational cognitive science area use different research methodologies such as mathematical modeling, behavioral experiments, simulation experiments, and neuroimaging experiments. Psychology, of course, intersects every human activity, and students are encouraged to take advantage of the excellent opportunities at Purdue to delve into neighboring disciplines such as artificial intelligence, neuroimaging, neurophysiology, robotics, image and video processing, computer science, systems theory, and linguistics.

Neuroscience and Behavior

This program focuses on the study of brain-behavior relationships, broadly defined. It offers students exceptional flexibility to customize their graduate training and research. The program also provides equally exceptional access to state-of-the-art techniques and technologies, such as single-cell recording, optogenetics, electrophysiology (EEG/ERP), magnetic resonance imaging (MRI), and computer simulation. Problems studied by the neuroscience area include, but are not limited to: molecular and genetic determinants of behavior, physiological bases of motivated behaviors (e.g., appetitive, sexual, maternal and drug seeking behaviors), neural and hormonal bases of learning and memory, neural bases of anxiety, physiological bases of psychiatric disorders, and the underlying mechanisms of cognitive processing and social interaction. Cognitive processes currently under investigation include associative learning, reward processing, decision-making, selective attention, and problem-solving. Clinical phenomena currently under investigation include alcoholism, anorexia, diabetes, epilepsy, obesity, depression, anxiety, post-traumatic stress disorder, and autism.

Social Psychology

Welcome to the Social Psychology program at Purdue University! With a long history of distinguished accomplishments, we are proud to be one of the world's leading training programs in social psychology. Our faculty is world-renowned experts in the core areas of social psychology, including social cognition, social influence, prejudice and discrimination, group dynamics, and interpersonal relationships. Graduates from our program are leaders in the field.

Psychological Statistics, Post-Baccalaureate Certificate

Mathematical and Computational Psychology, MS

Cognitive Psychology, PHD

Clinical Psychological Sciences, PHD

Neuroscience and Behavior, PHD

Industrial-Organizational Psychology, PHD

Social Psychology, PHD

Mathematical and Computational Psychology, PHD

Cognitive Psychology, MS

Industrial-Organizational Psychology, MS

Clinical Psychological Sciences, MS

Neuroscience and Behavior, MS

Social Psychology, MS

PSY 50600 - Professional Issues And Trends In Social Psychology

Credit Hours: 3.00. This course is designed to help students acculturate to and acquire a broad knowledge of social psychological research. Topics to be covered include but are not limited to: how to apply for academic jobs, how to present your program of research, how to network at conferences, how to develop a website presence, how to approach potential collaborators, and how to structure your research questions in an appropriate manner for grant applications. Permission of department required.

Learning Outcomes: 1. Learn strategies to professionally present themselves, their interests, and their accomplishments on paper and in person. Credits: 3.00

PSY 50700 - Current Readings In Social Psychology

Credit Hours: 3.00. This course is designed to expose students to a variety of readings, discussions, and presentations. The seminar examines a diverse assortment of social psychological topics. Students benefit from exposure to current research and methods in the field. Students also benefit from becoming increasingly conversant regarding the latest empirical advances in the field. Permission of department required.

Learning Outcomes: 1. Understand and interpret a host of different designs and analyses regarding a large variety of key areas in social psychological research. Credits: 3.00

PSY 51100 - Psychophysics

Credit Hours: 3.00. (ECE 51100) An examination of the relationship between physical stimuli and perception (visual, auditory, haptics, etc.). Includes a review of various methods for studying this relationship and of the mathematical and computational tools used in modeling perceptual mechanisms. Permission of instructor required.

Credits: 3.00

PSY 51200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, BIOL 56200) Background in cell biology, psychobiology, physiology, or anatomy is recommended. Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Permission of instructor required.

Credits: 3.00

PSY 51300 - Introduction To Computational Cognitive Neuroscience

Credit Hours: 3.00. Computational cognitive neuroscience is a new field of study that lies at the intersection of computational neuroscience and the similar fields of machine learning, neural network theory, connectionism, and artificial intelligence. Like

computational neuroscience, computational cognitive neuroscience strives for neurobiological accuracy and like connectionism, a major goal is to account for behavior. Covered topics include feature extraction / optimization, connectionism, computational neuroscience, and computational cognitive neuroscience applications. Permission of department required.

Learning Outcomes: 1. Understand critically existing computational models. 2. Master important computational modeling methods. 3. Implement and simulate computational models.

Credits: 3.00

PSY 51400 - Introduction To Mathematical Psychology

Credit Hours: 3.00. This course introduces the student to the field of mathematical modeling of psychological processes. Mathematical techniques employed in modeling are learned, and a number of mathematical models and theories that have been developed and employed in various important areas of experimental psychology are explained. An introduction to problems in theory and model testability also is given.

Credits: 3.00

PSY 51500 - Neuroscience Of Consciousness

Credit Hours: 3.00. How does your brain generate your uniquely subjective experience of the world? Is it possible to identify distinct neurophysiological markers of your awareness of a particular sight, sound, taste, or touch? What is the cortical basis of your sense of being a self with a first-person point of view that is spatiotemporally grounded in a body? How does consciousness relate to attention and working memory? Does consciousness have an adaptive function? Might a person in a coma or a vegetative state still have some form of awareness? Could a computer or a robot ever have what we would consider to be genuine experiences? During the past few decades, these and other questions about the nature of consciousness have been the focus of increasing empirical and theoretical research in neuroscience and other disciplines. The main purpose of the course is to introduce students to this exciting field of inquiry by exposing them to a variety of representative books and articles in the literature. The "backbone" of the course will be Stanislas Dehaene's Consciousness and the brain: Deciphering how the brain codes our thoughts (2014). As we go through the course, we will use each successive chapter in this book as the starting point for a deeper and wider exploration of the given topic(s), bringing into our discussion relevant experimental findings and philosophical perspectives from other investigators. Requirements: Students will take turns guiding discussions and will also write 1-2 page "response papers" to the weekly readings. Permission of department required.

Learning Outcomes: 1. Learn historically relevant and current research - both theoretical and empirical - on the neuroscience of consciousness. 2. Understand theoretical and empirical approaches used to study the neuroscience of consciousness. 3. Gain background knowledge and experience needed to understand and critically evaluate theoretical and empirical research on the neuroscience of consciousness. Credits: 3.00

PSY 52200 - An Introduction To Pediatric Psychology

Credit Hours: 1.00. This course is designed for the clinical psychologist who desires to become acquainted with the field of pediatrics as it is seen by the practicing pediatrician. The student will be introduced to common medical terminology, literature, and interrelated pediatric and psychological problems. Permission of instructor required.

Credits: 1.00

PSY 55600 - Job Design

Credit Hours: 3.00. (IE 55600) Task analysis, personnel selection and training, job and organizational design, and criteria development and use. Human factors related to job design in order to increase job satisfaction and productivity.

Credits: 3.00

PSY 57700 - Human Factors In Engineering

Credit Hours: 3.00. (IE 57700) Survey of human factors in engineering, with particular reference to human functions in human-machine systems, and consideration of human abilities and limitations in relation to design of equipment and work environments. Primarily for engineers and other non-psychology majors.

Credits: 3.00

PSY 58100 - Neuroethics

Credit Hours: 3.00. Neuroscience research has led to a better understanding of the neuronal basis of behavior. The knowledge, together with new technological approaches that can predict and even control some aspects of human behavior, can have a major impact on social and legal policies. The course explores ethical, social, and legal implications of the use of new technological and pharmacological advances in brain research. Permission of department required.

Learning Outcomes: 1. Learn some of the

technology and pharmocology that is currently used to study/manipulate the human mind and behavior. 2. Critically evaluate ethical arguments/dilemmas surrounding the use of such scientific advances. 3. Research in depth a real-world topic in Neuroethics that may have social and/or legal implications at the present time. Credits: 3.00

PSY 59100 - Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics that may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 60000 - Statistical Inference

Credit Hours: 3.00. Emphasis is given to principles underlying both parametric and nonparametric inference.

Credits: 3.00

PSY 60100 - Correlation And Experimental Design

Credit Hours: 3.00. Continuation of PSY 60000 with emphasis upon the design and analysis of experiments. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60300 - Psychopharmacology

Credit Hours: 3.00. This course will cover core pharmacology concepts and principles, such as neurotransmitters, receptors, drug classes, and mechanisms of drug action, while highlighting recent findings related to pharmacogenetics and sex/gender differences in psychopharmacology. There will also be a primary focus on drug therapy for major psychiatric disorders including addiction, depression, anxiety and schizophrenia. Prerequisites: (BIOL 56200 and PSY 51200) or PSY 61500 or MCMP 57000.

Learning Outcomes: 1. Acquire knowledge about the primary biological systems through which drugs act to produce changes in behavior. 2. Learn basic principles of pharmacokinetics and pharmacodynamics. 3. Learn the primary signs/symptoms of major mental disorders and how these disorders are classified with the DSM. 4. Discuss and differentiate the primary methods currently used to treat mental disorders. 5. Critically evaluate the strengths and weaknesses of primary research papers in psychopharmacology. 6. Explain the use of animal models in psychopharmacology. 7. Explain and discuss the methods used in the "drug discovery pipeline", from target identification to FDA approval and beyond and model the application of new drugs through this pipeline.. 8. Communicate proficient knowledge about a single psychiatric disorder and its pharmacological treatment through oral presentation and writing (white-paper style). Credits: 3.00

PSY 60500 - Applied Multivariate Analysis

Credit Hours: 3.00. A survey of the most frequently employed multivariate research techniques, such as multivariate generalizations of univariate tests and analysis of variance, principal components, canonical analysis, and discriminant analysis. A central theme of the course is the general linear model, both univariate and multivariate. A multipurpose program for this model provides the student with practical experience in conducting multivariate research. Some prior exposure to elementary matrix algebra is recommended. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60600 - Special Topics In Quantitative Psychology

Credit Hours: 3.00. A seminar covering such topics as linear models, statistical decision-making, and multidimensional scaling. Permission of instructor required.

Credits: 3.00

PSY 60601 - ANOVA For The Behavioral Sciences

Credit Hours: 3.00. This course is a first-semester graduate statistics course for students in psychology and related fields who conduct quantitative research. The course involves an accelerated review of fundamental concepts (e.g., data visualization, central limit theorem probability), after which the course will focus on statistical techniques for between- and within-person designs that include categorical independent variables (e.g., t-tests, ANOVA). Permission of department required.

Learning Outcomes: 1. Develop a deeper conceptual understanding of foundational statistical principles. 2. Analyze data correctly by hand and using SPSS. 3. Learn to properly interpret and report results of statistical analysis in APA format. 4. Learn the foundational principles for best practices for conducting empirical research, including measurement, database management, data cleaning, and syntax. 5. Develop skills in managing their own data and will be able to comprehensively analyze and interpret the results of most commonly-used analyses and variance. Credits: 3.00

PSY 60700 - Scaling And Measurement

Credit Hours: 3.00. An introduction to the theory of measurement and a survey of modern scaling methods (unidimensional and multidimensional, metric and nonmetric) within the framework of the modern theory of measurement. Some prior exposure to elementary matrix and set algebra is recommended.

Credits: 3.00

PSY 60800 - Measurement Theory And The Interpretation Of Data

Credit Hours: 3.00. The theory of measurement and the development of reliability and the Spearman-Brown equations, true scores and variables, and correction for attenuation. Variance or covariance of combinations of variables. Item analysis and test construction strategies. Reliability and validity of measurements and the influence of measurement error and measurement threats to research design. Prerequisite: PSY 60000 .

Credits: 3.00

PSY 60901 - Multilevel Modeling

Credit Hours: 3.00. This course familiarizes students with (1) generalized linear mixed (multilevel) models that are often used in the social sciences, and (2) best practices in the models' applications and interpretations. These models are extensions of classic linear regression models, and they go by many names: multilevel modes, hierarchical models, mixed models, etc. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data. Prerequisites: graduate coursework in regression and ANOVA, or by permission. Permission of department required.

Learning Outcomes: 1. Knowledge of linear and generalized multilevel models. 2. Able to competently apply and interpret such models in the analysis of their own research data. Credits: 3.00

PSY 61000 - Multivariate Analysis In The Behavioral Sciences

Credit Hours: 3.00. This is an advanced doctoral-level statistics course that examines the application of multivariate methods to the analyses of organizational data. Topics include: matrix algebra, the general linear model, multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor/component analysis. Prerequisite: Grade of B or higher in (PSY 60000 and PSY 60100) or (STAT 51200 and STAT 51400) or (HDFS 68500 and PSY 63100).

Learning Outcomes: 1. Develop a broad theoretical understanding of multivariate analyses, applied skills necessary to incorporate multivariate analytic techniques into their research activities, and mathematical foundations of these topics that will allow the student to pursue advanced training and research in these areas. Credits: 3.00

PSY 61501 - Systems And Behavioral Neuroscience

Credit Hours: 4.00. This course will provide you with a broad introduction to the field of neuroscience and how it can inform our understanding of behavior. First, we will cover neuroanatomy, synaptic communication, and plasticity. Next, we will cover neuroscience research on a range of major topics relevant to behavior: emotion, motivation, attention, learning, decision-making, and social cognition. This course will also provide a brief introduction to a variety of neuroscience research methods that are commonly used in animal and human research (e.g., electroencephalography, magnetic resonance imaging), including tutorials and live demonstrations. Permission of department required.

Learning Outcomes: 1. Know general neural architecture of core systems relevant to behavior. 2. Know behavioral outcomes for each major neural system. 3. Know how brain structure and functioning are studied in animal research. 4. Know how brain structure and functioning are studied in human research. 5.

Know how brain functioning undergirds cognition, affect, and social processes. 6. Translate basic neuroscience to clinical and other applied research. Credits: 4.00

PSY 61601 - Neurobiology Of Brain Disorders

Credit Hours: 4.00. This course covers cellular and molecular mechanisms associated with alterations in brain function and human behavior linked to the most common neurological and psychiatric disorders. Students will learn about genetic, pharmacological, and physiological mechanisms related to the etiology, expression, and treatment of brain disorders. Permission of department required.

Learning Outcomes: 1. Acquire knowledge of the molecular and cellular mechanisms and behavioral components of major brain disorders. 2. Acquire knowledge about the methods and models used to study brain disorders with a focus on translation. 3. Demonstrate proficiency in critically evaluating primary literature. 4. Demonstrate in-depth knowledge of the underlying mechanisms and treatments for a specific brain disorder. Credits: 4.00

PSY 62101 - Genes, Brain And Behavior

Credit Hours: 3.00. This course examines how genes regulate development and function of the brain to ultimately influence behavior. Genetics has come to be an important aspect of research in almost every field of Neuroscience and Psychology ranging from neural development to cognitive function and dysfunction. However, many students have not had the opportunity to explore this in their studies to date. Therefore, the goal of this course is to provide students with the background needed to understand and think critically about the genetic components of Neuroscience and behavioral research. Numerous questions will be explored mainly through discussion of research papers. Lectures by the professor will fill in background knowledge needed to understand the readings. The questions explored will include: What are chromosomes and genes? What do they do? How do they do it? How do genes control development of the brain? How are single genes manipulated in animals to study their effects on behavior? How can genes associated with normal or abnormal behavior be identified? What has been learned from gene-behavior studies in animals? in humans? What do these studies tell us about the nature-nurture controversy? In addition to exploring these more traditional aspects of behavioral genetics we will address the three most exciting recent developments. These include the use of transgenic primate models, selective remote control of specific neural circuits using optogenetics and chemogenetics, and epigenetics, which helps explain how environmental factors and behavior itself can change gene activity and how these changes may be transmitted from one generation to the next. Many behaviors could be used to explore the principles these questions address. The readings will be selected from papers that focus on learning & memory and mental illness. However, if students are interested in other behaviors, papers that involve those behaviors and serve our purposes can be substituted. Grading will be based mainly on informal presentations of papers and participation in discussions of these papers. Permission of department required.

Learning Outcomes: 1. Understand historically relevant and current research on how genes influence behavior. 2. Become familiar with approaches used to study how genes influence behavior. 3. Gain background knowledge and experience needed to understand and critically evaluate research on the influence of genes on behavior. Credits: 3.00

PSY 62400 - Human Learning And Memory

Credit Hours: 3.00. Selected survey of important problems in the encoding, storage, and retrieval of laboratory and naturalistic events.

Learning Outcomes: 1. Describe the most common methods and procedures used to carry out research on human learning and memory. 2. Describe and explain foundational findings in the study of human learning and memory. 3. Describe and evaluate key concepts and theories that have been developed to understand the mental processes involved in human learning and memory. Credits: 3.00

PSY 62500 - Complex Cognitive Processes

Credit Hours: 3.00. Surveys research and theory concerned with the nature of the "higher-order" mental processes, including decision making, categorization, problem solving, and language. Fundamental questions regarding the nature of the representations that underlie conceptual and linguistic behavior will be addressed. Permission of instructor required.

Learning Outcomes: 1. Read, critically evaluate, and discuss empirical and theoretical research

articles about complex cognitive processes. 2. Integrate learning of course material with their own research interests into a written proposal of a research project, demonstrating effective communication skills and critical thinking skills. Credits: 3.00

PSY 62601 - Bayesian Statistics For Psychological Sciences

Credit Hours: 3.00. The course will explain why you might want to use Bayesian methods instead of frequentist methods (such as t-tests, ANOVA, or regression). We discuss the basic properties and methods of Bayesian analysis and have many activities to show how Bayesian analyses are used. Prerequisites: PSY 60000 and PSY 60100. Permission of department required.

Learning Outcomes: 1. Understand some challenges with traditional statistical analyses, especially optional stopping. 2. Able to run various Bayesian analyses. 3. Able to extract information from Bayesian-calculated posteriors. 4. Able to set appropriate priors for their analyses. Credits: 3.00

PSY 62800 - Perceptual Processes

Credit Hours: 3.00. This course is an advanced introduction to the psychology of perception. The course emphasizes visual and auditory perception, reviewing basic concepts, methodologies, research findings, and theoretical approaches. Theories of direct perception, constructivist perception, and computational vision are discussed in detail.

Credits: 3.00

PSY 62901 - fMRI Design And Analysis

Credit Hours: 3.00. Introduces students to the design of fMRI experiments and fMRI data analysis. Covered topics include an introduction to MR physics, block designs, rapid-event related designs, data preprocessing, and standard analyses using the general linear model. Advanced analysis techniques such as functional connectivity and multivariate pattern analysis and common pitfalls in design and analysis will also be covered. Prerequisites: Required: Basic knowledge of inferential statistics. Recommended: Familiarity with the general linear mode (GLM) and signal processing. Permission of department required.

Learning Outcomes: 1. Understand how to design fMRI experiments. 2. Perform fMRI analysis. 3. Interpret the results of fMRI data analysis. 4. Understand and avoid pitfalls related to fMRI data analysis. Credits: 3.00

PSY 63000 - Stereotyping And Prejudice

Credit Hours: 3.00. Provides an in-depth examination of issues related to stereotyping, prejudice, and discrimination. After a general introduction and historical overview, students will be exposed to a detailed study of the social psychological foundations of stereotyping and prejudice to include their impact and reduction strategies. Permission of instructor required.

Learning Outcomes: 1. Facilitate oral and written communication skills and critical thinking skills. 2. Acquire greater appreciation of research ethics, methodology, design, and data analysis. 3. Gain appreciation through careful consideration of original empirical works. Credits: 3.00

PSY 63100 - Multiple Regression Analysis For The Behavioral Sciences

Credit Hours: 3.00. This "data analytic" course provides an examination of the conceptual underpinnings and advanced application of multiple regression analyses to psychological data. Permission of instructor required.

Learning Outcomes: 1. Have basic understanding of the General Linear Model, the data requirements for ordinary least squares regression analyses, and the computational details of simple, multiple, and hierarchical regression analyses. 2. Use multiple regression analysis as a general approach to research design and data analysis for studies with multiple predictors, sets, mediators, moderators, and within-subjects factors; 3. Interpret and critique results of correlation and multiple regression analyses appearing in the literature; 4. Apply multiple regression analyses to data of their own; 5. Write-up the results of multiple regression analyses; 6. Prepared to take additional advanced statistics courses that build on multiple regression, including logistic regression, multi-level modeling, and structural equation modeling. Credits: 3.00

PSY 63300 - Seminar In Experimental Psychology

Credit Hours: 2.00 to 3.00. Critical analysis of current problems in experimental psychology. Emphasis upon reviewing literature, preparing and presenting papers. Permission of instructor required.

Credits: 2.00 to 3.00

PSY 63600 - Self And Identity

Credit Hours: 3.00. This seminar explores many issues related to the self from a social psychological perspective. The goal is to develop a better understanding of theory and research dealing with various aspects of the self. To accomplish this goal, students will learn to critically analyze research papers addressing self-related material. Department permission required.

Learning Outcomes: 1. Identify and examine how the self is shaped by social context and social feedback mechanisms. 2. Identify and examine how people compare the self to others. 3. Identify and examine how people's own self-perceptions influence the way they think about and judge others. 4. Identify and examine what elements of the self-influence how people act in the social world, including the manner in which we present ourselves to others. Credits: 3.00

PSY 63700 - Human Information Processing

Credit Hours: 3.00. This course develops the methodological tools required for an information processing approach to human behavior. These techniques are applied to such topics as reaction time, signal detection, attention, and skilled behavior, with emphasis upon unifying empirical findings. Prerequisite: PSY 60000 , PSY 60100 .

Credits: 3.00

PSY 64000 - Survey Of Social Psychology I

Credit Hours: 3.00. An extensive survey of methods, research, and theory in social psychology.

Credits: 3.00

PSY 64200 - Social Influence

Credit Hours: 3.00. Students are immersed into the exciting sub-field of social psychology: social influence through lively discussions and readings on the subject. Students will evaluate what is meant by social influence, what it includes, what it doesn't include, as well as current trends in social influence. Permission of instructor required.

Learning Outcomes: 1. Enhance knowledge and facilitate oral and written communication skills and critical thinking skills 2. Gain a greater appreciation of ethical research (e.g., through coverage of Milgram's original research on social influence in the form of obedience to authority). 3. Gain a research methodology.

Credits: 3.00

PSY 64300 - Attitudes And Attitude Change

Credit Hours: 3.00. Considers relation of attitudes to beliefs and to behaviors. Surveys major theories of attitude formation and change as well as empirical research related to these theories.

Credits: 3.00

PSY 64400 - Close Relationships

Credit Hours: 3.00. Acquaints participants with the major social psychological approaches to the study of close, interpersonal relationships, including evolutionary, attachment, and interdependence perspectives. Methodological and data analytic issues relevant to relationships research also are examined.

Credits: 3.00

PSY 64600 - Seminar In Social-Personality Psychology

Credit Hours: 3.00. A seminar covering a special topic in personality or social psychology. Specific topic varies from seminar to seminar. Permission of instructor required.

Credits: 3.00

PSY 64700 - Group Processes And Performance

Credit Hours: 3.00. Provides a survey of research concerning small group interaction and performance. Covers topics such as group problem-solving, group decision-making, group polarization, and group structure. Will also discuss group interaction and communication patterns.

Credits: 3.00

PSY 66700 - Clinical Assessment I

Credit Hours: 4.00. Presentation of general assessment principles and methods. Supervised practice in general diagnostic and treatment procedures as applied to both children and adults. Emphasis is placed on laboratory practice in the

administration and interpretation of intelligence tests; behavioral observation techniques and operant remediation procedures. Permission of instructor required.

Learning Outcomes: 1. Display knowledge of basic psychometric theory as evidenced by performance on examinations. 2. List primary instruments and their strengths and weaknesses. 3. Perform accurate administration, scoring, and interpretation of personality assessment instruments in real-time. 4. Display proficiency in writing integrative assessment reports. 5. Dialogue with professional colleagues regarding the professional practice of assessment and diagnosis. Credits: 4.00

PSY 66800 - Clinical Assessment II

Credit Hours: 4.00. Presentation of methods of clinical assessment including structured and unstructured personality tests, physiological recording, behavioral observation, and interview techniques. Emphasis is placed on laboratory practice in the administration and interpretation of personality tests and training in the basic clinical interview techniques. Permission of instructor required.

Credits: 4.00

PSY 66900 - Prosocial Behavior

Credit Hours: 3.00. This course is designed to provide a broad and rigorous, graduate-level overview of contemporary scientific research on prosocial processes from the perspective of personality and social psychology. Permission of department required.

Learning Outcomes: 1. Have a comprehensive mastery of the mechanisms and processes associated with prosocial behavior. 2. Learn how to plan and conduct research on prosocial behavior. 3. Learn to integrate prosocial processes with more general interpersonal processes and social relation research. Credits: 3.00

PSY 67000 - Principles And Techniques Of Psychological Treatment

Credit Hours: 3.00. Discussion and elaboration of the main theories and techniques of psychotherapy, the application of these techniques to the change of behavior, and the analysis of clinical cases for therapy planning.

Learning Outcomes: 1. Understand basic methodological issues related to psychotherapy research. 2. Describe the distinction between process and outcome in psychotherapy. 3. Understand the contributions of specific and common factors in psychotherapy. 4. Demonstrate basic process skills of active listening, empathic responses, and utilization of the therapeutic relationship in interactions with mock clients. 5. Demonstrate basic skills involved in motivational interviewing. 6. Demonstrate practical skills to document therapeutic interventions (progress notes) and care management (treatment planning). 7. Develop an understanding of the conceptual underpinnings of cognitive behavior therapy, including a) underlying theory of psychopathology; b) proposed mechanisms of change; c) establishment of treatment plans based on mechanisms of change; d) empirical evidence of therapy efficacy and effectiveness. 8. Demonstrate skills to implement basic evidenced-based therapeutic interventions and strategies (CBT). 9. Demonstrate an appreciation for addressing individual differences and diversity in psychotherapy. 10. Demonstrate a sense of self-awareness and ability to relate to diverse clients. Credits: 3.00

PSY 67300 - Psychology Of Behavior Disorders

Credit Hours: 3.00. Advanced abnormal psychology. Consideration will be given to research and theory of psychopathology.

Credits: 3.00

PSY 67400 - Structural Equation Modeling

Credit Hours: 3.00. This is an advanced course in structural equation modeling (SEM), intended to provide doctoral students with an introductory treatment of the theory and methods of SEM. SEM is a statistical methodology that encompasses a wide variety of models, including path models, exploratory and

confirmatory factor models, structural regression models, and latent growth models, among others. Prerequisites: PSY 61000 is highly recommended but not required. Permission of department required.

Learning Outcomes: 1. Obtain a basic-to-intermediate understating of the logic of SEM and grasp the underpinning statistics of SEM. 2. Critically read and evaluate empirical journal articles that use SEM. 3. Develop the ability to apply SEM (and the correct model) to relevant questions in their area of research interest. 4. Acquire Programming skills for conducting SEM. Credits: 3.00

PSY 67510 - Research Methods In Clinical Psychological Sciences

Credit Hours: 3.00. This course provides an in-depth introduction to the fundamentals of research methods and design, including the scientific approach and its applicability to the science of psychology to the philosophy of science, the role of theory, and hypothesis testing. Philosophical and theoretical fundamentals are discussed, followed by methodological issues. The course includes content on the replication crisis in psychology, the practices that contributed to it, and the means to overcome it, as well as issues in sampling, measurement, and design. The course will examine nonexperimental research as well as experimental and quasi-experimental approaches. Permission of department required.

Learning Outcomes: 1. Understand Open Science practices, basic psychometrics, experimental design, and nonexperimental approaches and identify bad research practices in published research articles. 2. Evaluate special issues faced when studying psychopathology. 3. Evaluate the factors that contribute to replication concerns in the field (i.e., low statistical power, HARKing, p-hacking, and publication bias). 4. Evaluate correct strategies for calculating reliability and demonstrating validity of a psychological assessment. 5. Create a research study working through sampling, assessment, and design. Credits: 3.00

PSY 67800 - Seminar In Clinical Psychology

Credit Hours: 2.00. Discussion of special topics in clinical psychology. Permission of instructor required.

Credits: 2.00

PSY 67900 - Practicum In Clinical Psychology

Credit Hours: 1.00 to 6.00. This is a practicum in clinical psychology, whereby students see individuals for therapy. These cases are supervised by faculty in clinical psychology. This is a requirement for the graduate program, and students must do both adult and child practicum. Students enrolled in this program must register for this course a minimum of four times. Prerequisite: Master's student standing and Psychology majors only. Permission of instructor required.

Credits: 1.00 to 6.00

PSY 68000 - Survey Of Industrial/Organizational Psychology

Credit Hours: 3.00. This two-semester sequence extensively surveys the various areas of industrial/organizational psychology. The first semester surveys those topics generally classified as dealing with industrial psychology (e.g., selection, placement, training, performance appraisal), and the second semester surveys organizational psychology topics (e.g., job satisfaction, motivation, leadership, decision making, role making). Course provides a critical and up-to-date review of recent and classical research in these areas. Prerequisite: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Credits: 3.00

PSY 68010 - Survey Of Industrial Psychology

Credit Hours: 3.00. This seminar is designed to familiarize doctoral students with the basic areas of Industrial Psychology and Human Resource Management. The course will include a discussion and analysis of book chapters and journal articles related to key topics. The goal of this seminar is to help students develop frameworks for organizing the myriad conceptual, professional, and technical issues associated with Industrial Psychology / Human Resource Management. Development of these frameworks is requisite for effective acquisition and integration of information provided in future seminars and development of research ideas. Permission of department required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Organizational Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3.

Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Organizational Psychology. Credits: 3.00

PSY 68020 - Survey Of Organizational Psychology

Credit Hours: 3.00. The main objective of this course is to introduce doctoral students in the Industrial and Organizational Psychology program (and related disciplines) to the major areas of research in the field of organizational psychology. Additionally, the course aims to provide students an opportunity to: (1) hone their analytic and information presentation skills, and (2) gain practice in developing research ideas. We will discuss classical and contemporary issues in light of both their theoretical and practical implications for the field. The course will include presentations and (synchronous and asynchronous) discussions of assigned readings. Permission of department required. Prerequisites: Any undergraduate Statistics course and any undergraduate Social Science Research Methods course.

Learning Outcomes: 1. Articulate the key areas of research and concepts in Industrial Psychology. 2. Evaluate conceptual and theoretical gaps in the current literature. 3. Analyze the strengths/weaknesses of extant research and theory. 4. Develop research ideas related to key areas of study in Industrial Psychology. Credits: 3.00

PSY 68100 - Seminar In Research Methodologies Of Industrial/Organizational Psychology

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings.

Learning Outcomes: 1. Develop an understanding of quantitative research methods employed in psychology, including their strengths and limitations in addressing validity concerns. 2. Apply quantitative research methods to your own research. 3. Have critical thinking skills and good professional judgment regarding research, theory, and methods. 4. Have written and oral skills. 5. Understand and able to apply professional and ethical values of psychology. Credits: 3.00

PSY 68110 - Research Methods In Industrial-Organizational Psychology I

Credit Hours: 3.00. Intensive analysis of application of various research and statistical methods to the study of human behavior in organizational settings. This course is the first part of a two-semester sequence which covers issues in research design and data analysis techniques common to I-O psychology and other applied fields. We will review the overall research process and various types of research. We will review the various threats to the validity of conclusions that can be drawn from quantitative research and how design features can help address these threats. We will spend time in class critiquing research articles. Permission of department required.

Learning Outcomes: 1. Evaluate the conceptual and methodological strengths and limitations of quantitative research in psychology. 2. Write a research proposal that effectively integrates best practices in quantitative research (e.g., scientific contribution, measurement, reliability, validity, open science). 3. Critically evaluate the rigor and reproducibility of quantitative research in psychology. 4. Run and interpret basic descriptive statistics, correlations, and linear regression models using R. Credits: 3.00

PSY 68120 - Research Methods In Industrial-Organizational Psychology II

Credit Hours: 3.00. This course is the second part of a two-semester sequence that covers core research methods in the social sciences focusing on Industrial/Organizational psychology, Organizational Behavior, and allied fields of Social and Personality psychology. This course sequence is designed for doctoral students who intend to conduct quantitative empirical research publishable in scholarly journals. This course begins with the philosophy of science, developing and evaluating theory, reviewing and summarizing relevant research. Topics include the examination of research methods applicable to survey data, multilevel data, and longitudinal data. The course concludes with a discussion of 'methods' (strategies) for publishing in scholarly journals. Permission from department required. Prerequisites: PSY 68110, Research Methods in Industrial-Organizational Psychology I (or equivalent) and Basic Statistics.

Learning Outcomes: 1. Articulate the importance of research methods for science. Method of evaluation: class discussions. 2.

Develop and apply research methods to their research, including designing of studies that employ a particular method. Method of evaluation: written research proposal. 3. Identify the strengths/weaknesses of each method. Method of evaluation: weekly reading summaries. 4. Explain empirical research findings to scholars in their field. Method of evaluation: research presentation. 5. Evaluate research methods used in empirical studies. Method of evaluation: class discussions.
Credits: 3.00

PSY 68200 - Advanced Seminar In Industrial Organizational Psychology

Credit Hours: 3.00. Special topics in industrial and organizational psychology are offered on a two-year rotating basis. The special topics are: work motivation, leadership, advanced selection and placement, and performance appraisal. One topic will be treated each semester.

Credits: 3.00

PSY 68300 - Seminar In Industrial/Organizational Psychology

Credit Hours: 3.00. Topics vary. Permission of instructor required.

Credits: 3.00

PSY 68800 - Research Methods In Social Psychology

Credit Hours: 3.00. This course provides a broad and rigorous, graduate-level overview of contemporary research methodology in social psychology and personality. The course follows a discussion seminar format. Permission of department required.

Learning Outcomes: 1. Understand the specific rationale for using different methodological techniques to answer different kinds of questions. 2. Learn to plan, implement, and analyze social psychology research, including traditional laboratory and other experimental procedures and designs. Credits: 3.00

PSY 69000 - Individual Research In Psychology

Credit Hours: 1.00 to 3.00. Involvement in research design, execution, and analysis under the guidance of a faculty member. Permission of instructor required.

Credits: 1.00 to 3.00

PSY 69100 - Readings In Psychology

Credit Hours: 1.00 to 3.00. In-depth reading into specific topic area in psychology, under the guidance of a faculty member. Permission of instructor required.

Credits: 1.00 to 3.00

PSY 69200 - Special Topics In Psychology

Credit Hours: 1.00 to 3.00. Various topics which may change from semester to semester are presented by faculty in the Department of Psychological Sciences.

Credits: 1.00 to 3.00

PSY 69600 - Seminar In Neuroscience

Credit Hours: 2.00. The course is designed to expose graduate students to diverse areas of most up-to-date research and hone their skills in understanding conceptual issues and tools used to study neuroscience. The students help host speakers and introduce speakers before their colloquium talk. The students will also formally present their own research to the area faculty and students once each year, at a level appropriate to their years in the program. Lastly, each student will write a "journal club" style paper on a recently published empirical study. Permission of instructor required.

Learning Outcomes: 1. Present own research to a broad audience. 2. Evaluate and provide constructive feedback of peer's oral presentations. 3. Comprehend, summarize, and lead a discussion on current research. 4. Network and meet with external speakers and eloquently articulate your research interests.
Credits: 2.00

PSY 69700 - Clinical Psychology Internship

Credit Hours: 0.00. Clinical psychology internship. Open only to Clinical Psychology students in approved internship facilities. Permission of instructor required.

Credits: 0.00

PSY 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PSY 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Public Health (Graduate)

Website: **http://www.purdue.edu/hhs/public-health**

Department/School Head

Randolph Hubach, PhD, MPH

Faculty by Rank (website)

Professor	Associate Professor	Assistant Professor	Clinical Faculty	Emeritus Faculty
Michelle Garrison Randy Hubach Richard Mattes	Stewart Chang Alexander Nilupa Gunaratna Jennifer Jabson Tree Monica Kasting Yumary Ruiz Natalia Rodriguez Laura Schwab Reese Ellen Wells	Jorge Banda Afsan Bhadelia Kathryn LaRoche Carlos Mahaffey Shandey Malcolm Bukola Usidame	Cody Mullen	Gerald Hyner Christine Ladisch Sandra Liu

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Research Degree Programs

Master of Science (MS)

The MS degree in public health is a traditional research master's program. Students complete 34 credit hours over a two-year period under the guidance of a faculty mentor. A research-based thesis is completed as a graduation requirement, preparing students for doctoral training and careers in research institutions.
Master of Science Website:
https://hhs.purdue.edu/graduate-programs/public-health-graduate-program/

Doctor of Philosophy (PhD)

The Ph.D. program is designed to prepare students for careers in high-level research positions in a variety of academic institutions and government agencies as well as private and

non-profit organizations. Students must complete a research-intensive dissertation under the mentorship of public health faculty that is aligned with their public health interest area as part of the 90-credit graduation requirement.
Doctor of Philosophy Website:
https://hhs.purdue.edu/graduate-programs/public-health-graduate-program/

Professional Degree Programs

Master of Health Administration (MHA)

The MHA program trains students on a range of health administration-related skills, methods, and tools to ensure cost-effective quality care and patient safety. Students will explore current health administration, health policy, and public health concerns facing the management of complex healthcare organizations. Students are prepared to handle real-world issues that healthcare managers face and the curriculum includes a capstone course where students apply what they have learned to a real healthcare administration problem.
Online Master of Health Administration
Website: https://www.purdue.edu/hhs/public-health/graduate/graduate-degrees/mha-online/overview.php

Master of Public Health (MPH)

The MPH program, accredited by the Council on Education for Public Health, prepares students to evaluate and address the changing dynamics affecting health and access to services. It includes a rigorous background in core public health disciplines and specialization in one of two concentrations. Students will develop and apply skills through a 200-hour practicum and culminating project course.
Program Tracks
Standalone (traditional two-year program)
Combined Degree Program (BS/BA + MPH)
Dual-Degree (PhD/MS/MA + MPH)
Concentrations
Family and Community Health (Residential and Online)
Biostatistics (Residential)
Residential Master of Public Health Website:
https://hhs.purdue.edu/graduate-programs/master-of-public-health-mph-graduate-program/
Online Master of Public Health Website:
https://online.purdue.edu/programs/health-sciences/masters-in-public-health

Public Health, MPH (OL)

Public Health, MHA

Healthcare Leadership, Post-Baccalaureate Certificate

Healthcare Operations, Post-Baccalaureate Certificate

Public Health, MS

Public Health, MPH

Healthcare Quality Improvement, Post-Baccalaureate Certificate

Public Health, PHD

PUBH 50000 - Introduction To Public Health

Credit Hours: 1.00 to 3.00. This Public Health course covers a variety of issues related to the profession of public health. The Introduction to Public Health provides the graduate student with an overview of the history, science, mission, practice and future of public health. The core public health principles and services, and the expected competencies of the professional public health practitioner, are discussed. Current issues in public health are also presented for discussion and analysis.

Learning Outcomes: 1. Describe factors affecting the health of a community (e.g., equity, income, education, and environment). 2. Apply ethical principles in accessing, collecting, analyzing, using, maintaining, and disseminating data and information. 3. Identify current trends (e.g., health, fiscal, social, political, environmental) affecting the health of a community. 4. Communicate in writing and orally with linguistic and cultural proficiency

(e.g., using age-appropriate materials, incorporating images). 5. Describe the roles of governmental public health, health care, and other partners in improving the health of a community. 6. Describe the diversity of individuals and populations in a community. 7. Describe the effects of policies, programs, and services on different populations in a community. Credits: 1.00 to 3.00

PUBH 50100 - Introduction To Health Equity

Credit Hours: 3.00. This course introduces the participants to graduate level research in health disparities and the various theoretical and analytical skills needed to be a good health disparities researcher. It will take the course participants through the axiological, ontological and epistemological questions that we are confronted within social scientific research. This course will walk the participants through the various research paradigms and the critical debates associated with it so that they can reflect and possibly make an informed choice about their own research priorities. Permission of department required.

Learning Outcomes: 1. Develop students understanding of the fundamental assumptions underlying different approaches to health disparities research and in turn how these inform the field. 2. Develop students' capacities to describe, and to compare and contrast, the prominent approaches used to understand Health Disparities. 3. Encourage the student participants to critically evaluate different research and approaches to health disparities and comment on the suitability of these in advancing health disparities research. 4. Learn to write for academic audiences. Credits: 3.00

PUBH 51100 - Foundations Of Global Health

Credit Hours: 3.00. Global disparities in the health and well-being of diverse populations, across and within borders, has never been greater. Profound and rapid changes in demographics, from population growth to urbanization, along with unprecedented shifts in patterns of disease and risks, are coupled with game-changing advances in knowledge, technology, and innovation. This course will introduce students to current challenges and efforts at solutions in global health, with a focus on low- and middle-income countries. It will provide an interdisciplinary overview of topics that include measures of health and disease, communicable diseases such as HIV/AIDS and malaria, non-communicable diseases such as diabetes and cardiovascular disease, women's health, maternal and child health, food systems and nutrition, health systems, and health care delivery. In addition to lectures, the course will include interactive discussions of case studies and specific country examples, aimed at immersing students in the debates and challenges facing global health leaders and decision makers.

Learning Outcomes: 1. Identify major shifts and trends in health patterns, burden of disease, population dynamics, and globalization. 2. Understand the historical context of global health and current evolving agendas. 3. Analyze diverse global health challenges, incorporating ethical, environmental, political, historical, and societal perspectives, with a focus on low- and middle-income countries. 4. Evaluate global health research to assess how conclusions arise from evidence and analysis. 5. Formulate evidence-based arguments for/against diverse global health policies or interventions. Credits: 3.00

PUBH 51250 - International Health Systems: A Comparative Approach

Credit Hours: 3.00. This course is an introduction to public health priorities from an international perspective, illustrating the interdependent nature of health promotion and disease prevention issues across diverse regions and populations. Coursework examines population health determinants, contrasting industrialized and developing countries and how these influence health goals established by public health institutions, such as the World Health Organization, philanthropic foundations and governmental agencies. International health care needs continue to emerge as interchanges among peoples and nations increase. To effectively address these needs, public health leaders must understand the social, economic, environmental, and political determinants of health and be prepared to respond to challenges related to health and health care at the local, national, and global level. This course examines the historical evolution of international health challenges as well as the future trends that will continue to impact health and health systems worldwide. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Conduct a comparative

analysis of international health data and trends impacting health care systems. 2. Analyze international health systems and their emphasis on the global health care market. 3. Assess the impact of health and disease on a nation. 4. Evaluate the role of government and non-government agencies in the provision and management of global health systems. 5. Develop a formal proposal to address a global health challenge. 6. Evaluate how indicators of health care spending and the quality of health service provision vary across global health care systems. Credits: 3.00

PUBH 51350 - Global Health Security And Disaster Management

Credit Hours: 3.00. This course is a contemporary examination of the growing threat and potential public health consequences of disasters and the role of climate change. Additionally, we review the variety of public health and environmental health disasters, their consequences and the role of public health agencies health care systems and practitioners in preparedness, response and recovery from a local, national and global perspective. The course is designed to develop proficiency in analyzing and evaluating the public health response to disasters, the linkage to emergency management frameworks and identifying solutions and methods for improvement. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Explore the concepts and tools of public health as it relates to minimizing the effects of disasters in a global context. 2. Compare and contrast past approaches to disease eradication with modern best practices. 3. Examine the impact of natural and man-made disasters, disease, climate change on the public health and medical response infrastructure and the capability to respond effectively in a crisis. 4. Describe public health surveillance and epidemiological forecasting. 5. Evaluate public health emergency management principles and practices that impact Global health security. 6. Analyze the global response to public health issues and crisis. 7. Demonstrate communication skills and strategies for promoting family and community health during times of disaster or public health emergencies. Credits: 3.00

PUBH 52000 - Human Sexuality And Sexual Health

Credit Hours: 3.00. This course is designed to provide students with an in-depth and applied understanding of the major theories and principles guiding human sexuality and sexual health research. Content covered will enrich an understanding of sexuality and sexual health research methods, past and present research findings, and the intersection of this field and public health practice.

Learning Outcomes: 1. Identify and assess major concepts, theories, and perspectives guiding an interdisciplinary and translational approach to understanding of human sexuality. 2. Identify and assess past and present developments in sexuality research. 3. Identify and assess multidisciplinary and mixed sexuality research methods. 4. Identify and assess how sexuality research informs public health practice and policy. Credits: 3.00

PUBH 52500 - Statistical Methods For Public Health Evaluation

Credit Hours: 3.00. This course provides an overview of the statistical methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs and the application and tailoring of these designs to evaluations. In addition, we will focus on categorical data analysis methods, which are often necessary for evaluation projects. You will collaborate with those students to conduct an evaluation, develop a report with your findings, and present your findings. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of department required.

Learning Outcomes: 1. Describe preferred methodological alternatives to parametric statistical methods when assumptions are not met. 2. Accurately interpret the results and

limitations of nonparametric descriptive and inferential methodologies. 3. Apply appropriate descriptive and inferential methodologies according to the type of study design for answering a particular research question. 4. Collaborate with non-statisticians to complete evaluation activities. 5. Explain evaluation analyses and results to non-statisticians, including researchers, public health professionals, and community members. 6. Recognize and critically reflect upon one's own cultural biases and their impact on research design, analysis, and interpretation. Credits: 3.00

PUBH 52600 - Randomized Control Trials In Public Health

Credit Hours: 3.00. Randomized control trials provide solid evidence on whether interventions and programs "work" to improve health outcomes. In this course, students will learn how to design a randomized study, handle practical issues that arise in data collection, analyze data using appropriate methods and good statistical practice, identify limitations to statistical evidence, and interpret and communicate findings in an audience-appropriate way. This is a hands-on course in which students will work with data and build skills using SAS statistical software in preparation for careers as biostatisticians, data scientists, and researchers. Pre-requisite: A graduate level introductory statistics course that includes simple linear regression.

Learning Outcomes: 1. Identify and plan an appropriate randomized study design to answer a substantive question. 2. Identify limitations to statistical evidence that arise in study design and implementation. 3. Analyze data from randomized trials using appropriate methods and good statistical practice. 4. Interpret and communicate findings from randomized trials in an audience-appropriate way. Credits: 3.00

PUBH 53500 - Fundamentals Of Epidemiology

Credit Hours: 3.00. This course is an introduction to epidemiology, which is the study of the patterns, causes, and impact of disease in populations. Epidemiology is increasingly important for public health and clinical medicine research and policy. This course will discuss the basic principles and methods of epidemiology, including measurements of disease occurrence and association, study designs, and determination of causality. Contemporary examples will be used to illustrate the application of these concepts, with an emphasis on environmental causes of disease.

Learning Outcomes: 1. Describe major models of disease causation and prevention. 2. Calculate the extent of disease in populations. 3. Identify and utilize appropriate epidemiologic study designs. 4. Estimate the association between exposure and disease. 5. Differentiate between association and causation. 6. Explain and employ the use of epidemiologic tools in public health and clinical practice. 7. Review and critique basic epidemiology studies. Credits: 3.00

PUBH 54250 - Public Health And Nutrition

Credit Hours: 3.00. This course will emphasize development, implementation, and evaluation of nutrition intervention programs from a public health perspective. Students have an opportunity to practice setting realistic goals that produce outcomes aimed to improve health and support community and public nutrition. Students will explore changing nutritional behavior and the barriers to such change. This course is intended for graduate students interested in developing, implementing, and evaluating community-based nutrition programs The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Evaluate the impact of various nutrition-based public health programs. 2. Construct realistic goals that produce outcomes that improve health and support wellness. 3. Describe the basic elements of program planning in public health. 4. Identify methods for overcoming barriers to program implementation. 5. Describe methods for process, effect, and impact evaluation of nutrition programs. 6. Design a comprehensive community-based nutrition intervention program. Credits: 3.00

PUBH 54300 - Physical Activity And Public Health

Credit Hours: 3.00. In this course students will be exposed to epidemiological, behavioral, and public health issues relevant to effective promotion of physical activity. The course is appropriate for students training to be practitioners or researchers from a range of disciplines including exercise science, nutrition, psychology, and public health. Major topic areas will include physical activity epidemiology, determinants of physical activity in youth and adults, and current evidence for physical activity interventions ranging from individual, behavioral strategies, to environmental or policy approaches.

Learning Outcomes: 1. Differentiate between various definitions of physical activity, exercise, and physical fitness. 2. Describe and identify strengths and weaknesses of different approaches used to measure physical activity, including surveys, and objective methods using pedometers and accelerometers. 3. Discuss epidemiological evidence on relationships between physical activity and all-cause mortality, cardiovascular disease, cancers, diabetes, obesity, and overweight. 4. Describe and critically evaluate the physical activity determinants literature in children, youth, and adults, and the current determinants research focus in these populations. 5. Describe and critically evaluate physical activity intervention literature, including currently recommended approaches for children, youth, and adults (e.g., based on the Community Guide to P{Preventive Services). Credits: 3.00

PUBH 54500 - Healthcare Policy And Administration

Credit Hours: 3.00. This course will provide the opportunity to examine and analyze the financing, organization and delivery of health care in the U.S. and how these core elements are shaped and influenced by health care policy and decision-making. Additionally, we will examine the landmark healthcare reform the Patient Protection and Affordable Care Act (PPACA) of 2010 and legislation since its passing to study the transformation of healthcare to present time.

Learning Outcomes: 1. Analyze the infrastructure, payment mechanisms, and human capital of the US healthcare and public health system compared to other countries. 2. Describe the structure of federal, state, and local governments and their direct role in public health and healthcare policy. 3. Analyze the passage and implementation of the Affordable Care Act and recent healthcare policy. 4. Evaluate the US healthcare system after the passage and implementation of the Affordable Care Act. Credits: 3.00

PUBH 54600 - Child And Family Health Policy

Credit Hours: 3.00. The main goals of the course are to provide students with foundational knowledge related to research and policies that affect the health and wellbeing of children and families. Students will read and discuss policy-relevant research on current topics associated with child and family health. Students will read and discuss examples of researchers who have made an impact on child and family policies. Students will also write three papers that integrate research and policy perspectives.

Learning Outcomes: 1. Analyze and critique policy-relevant research. 2. Communicate a broad understanding of different policy issues that affect child and family health. 3. Describe the role that research plays in policymaking. 4. Write about their research interests from a policy perspective. Credits: 3.00

PUBH 54700 - Public Health Program And Policy Evaluation

Credit Hours: 3.00. This course provides an overview of the methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs, and the process for applying and tailoring these designs to program and policy evaluations. In addition, we will focus on the process of engaging communities and stakeholders in program evaluation efforts. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Create an evaluation design that considers the budget, time, data, and environmental constraints of the context to public health interventions. 2. Discuss the role of formative, process, outcome, and cost evaluation across the program lifecycle. 3.

Interpret and critique the quality of evaluation research case studies and reports. 4. Explain and defend evaluation design decisions to expert and lay audiences. 5. Recognize and critically reflect upon one's own cultural biases and their impact of evaluation design development and implementation. Credits: 3.00

PUBH 54750 - Public Health Program And Policy Evaluation

Credit Hours: 3.00. This course provides an overview of the methods required to evaluate the effectiveness of public health intervention or prevention programs and policies. The course introduces a range of quantitative, qualitative, and mixed methods research designs, and the process for applying and tailoring these designs to program and policy evaluations. In addition, we will focus on the process of engaging communities and stakeholders in program evaluation efforts. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Summarize the role of evaluation within the program life cycle. 2. Discuss the basics of formative, process, outcome, and cost evaluation. 3. Build a logic model to guide the evaluation plan and justify the decisions made in the logic model. 4. Interpret and critique the quality of evaluation research case studies and reports. 5. Explain the role of ethics, health equity, and social justice in evaluation planning and implementation. 6. Apply the major evaluation designs to public health interventions that consider the budget, time, data and environmental constraints of the situation. 7. Explain and defend the evaluation plan in lay language. Credits: 3.00

PUBH 54850 - Public Health Law

Credit Hours: 3.00. This course examines the role of law in promoting or impeding positive health outcomes. Students will study the authority and limitations of governments engaging in public health activities as well as the types of legal interventions available to promote public health. Students will apply legal principles to public health case studies on topics such as infectious disease, chronic disease, and violence prevention, among others. Students will also apply public health legal research methodologies to current public health issues and discuss the role of law in public health advocacy. The course is intended for graduate students in public health; however, it may be of interest to students in social work, nursing, education, criminal justice, law, psychology, and other related fields. Permission of instructor required.

Learning Outcomes: 1. Understand the legal system including key definitions and institutions. 2. Discuss public health governance at the federal, state, Tribal, local, and territorial levels. 3. Describe legal interventions available to support public health. 4. Discuss the role of law in applied settings such as infectious disease, chronic disease, environmental health, etc. 5. Apply legal research methods to public health studies. 6. Strategize the role of law in public health advocacy. Credits: 3.00

PUBH 57000 - Healthcare In The United States

Credit Hours: 3.00. By the end of this course, you will have a strong foundational understanding of the American healthcare system, along with the basic financial and management skills to make better, well-informed decisions that improve the cost and quality of the healthcare you or your enterprise provides. Understanding the evolution of today's system form the foundation for subsequent learning and leadership. Landmark legislation will also be reviewed including: Hill-Burton Act, Social Security Act, HMO Act, Balanced Budget Act of 1997, PPACA, ARRA. We will focus on a range of healthcare services, including acute care, post-acute care and senior health and housing, ambulatory surgery centers, behavioral health, and medical insurance companies. Permission of instructor required.

Learning Outcomes: 1. Evaluate the current strengths and weakness of the American healthcare system. 2. Understand the evolution of healthcare during the 20th and 21st centuries. 3. Understand methods to analyze basic financial and management situations driving to improved cost and quality of healthcare. 4. Analyze landmark legislation including Hill-Burton Act, Social Security Act, HMO Act, Balanced Budget Act of 1997, PPACA, and AARA. 5. Evaluate the intersection

of healthcare services including acute care, post-acute care, senior health and housing, ambulatory surgery centers, behavioral health, and medical insurance companies. Credits: 3.00

PUBH 57100 - The Business Of Healthcare

Credit Hours: 3.00. This course is designed to help you keep pace with the rapidly changing world health and healthcare. We will (1) explore the drivers of value creation, valuation approaches, and the differences in capital structures between nonprofit and for-profit healthcare providers; (2) examine horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures, and vertical consolidation and integration between providers and payers; and (3) discuss the ethos of healthcare, disruptive innovation, and emotional intelligence.

Learning Outcomes: 1. Understand the drivers of value creation, valuation approaches, and differences in capital structures between nonprofit and for-profit healthcare providers. 2. Evaluate horizontal consolidation and integrations among nonprofit and for-profit providers mergers and acquisitions, join ventures and vertical consolidation and integrations between providers and payers. 3. Understand the ethos of healthcare and role of disruptive innovation and emotional intelligence in the advancement of healthcare delivery. 4. Analyze the role of healthcare value creation and its connection with hospital ownership and the disruptive innovation in healthcare. 5. Evaluate the intersection of public health, population health, and the business of healthcare delivery. Credits: 3.00

PUBH 57200 - International And Comparative Healthcare Systems

Credit Hours: 3.00. This course examines international and comparative healthcare systems by analyzing the roles of private, public, non-profit and civil society sectors on national policy, planning and development.

Learning Outcomes: 1. Identify strategies for the recruitment, selection, development, and retention of quality health care professionals while applying accreditation criteria to human resources practices. 2. Apply human resources management for problem solving and decision making. 3. Identify various legal issues which require managerial attention and strategy. 4. Understand the changing workforce dynamics and the issues associated with labor shortages of skilled professionals in the healthcare industry. 5. Prepare for future challenges and examining future trends in the human resource field within the industry of healthcare. 6. Understand regulatory compliance issues uniquely associated to the field of health care (such as Joint Commission) standards pertaining to safety, emergency preparedness, job analysis, performance appraisals, and employee retention. 7. Analyze employee productivity in patient-centered environments. 8. Put human resource principles, concepts, generalizations, theories and models into practice. 9. Analyze the impact human resources management has on strategy formulation and strategy implementation. Credits: 3.00

PUBH 57300 - Cultural Proficiency For Healthcare Leaders

Credit Hours: 3.00. This course meets all four criteria for being a graduate level course. Readings for this course consist of journal articles and advanced readings. Assessments are designed to require students to integrate and synthesize course concepts. Our reading list and discussion prompts consists of current articles, texts, and examples. Finally, students as part of weekly discussions are required to read and critique academic articles and case studies.

Learning Outcomes: 1. Define key terms and concepts relating to cultural competency in healthcare, including factors identified in in the literature that are necessary for the delivery of culturally competent healthcare. 2. Demonstrate an understanding of the fundamentals of cross-cultural communication. 3. Understand your current strengths and weaknesses as a leader and as a follower and develop your own

personal approach to the practice of leadership. 4. Enhance your ability to think critically, to analyze complex and diverse concepts, and to use your reasoning, judgment and imagination to create new possibilities in leadership. 5. Compare and contrast leadership roles within other cultures. 6. Define the impact culture and indigenous practices have on healthcare. 7. Begin to internalize and value cultural proficiency as an approach to leading and managing the dynamics of diversity and equity. Credits: 3.00

PUBH 57400 - Healthcare Economics, Policy And Law

Credit Hours: 3.00. This course presents an overview of legal regulations and issues related to healthcare delivery and administration in multiple settings. Topics include healthcare legislation and regulation; professional and institutional liability; medical staff credentialing; patient consent requirements; termination of care; confidentiality of medical care; and the roles of federal, state and private stakeholders.

Learning Outcomes: 1. Be able to perform basic legal research. 2. Apply the legal protections afforded to patient health information. 3. Evaluate the forms of legal action that can be brought against public and private health insurance programs. 4. Comprehend the implications of Federal ERISA law on private health insurance. 5. Identify the common organizational and theoretical laws which apply to the health care environment. 6. Identify and articulate aspects and perspectives of highly controversial subjects such as abortion, organ transplant, right to die, physician assisted suicide, informed consent etc. 7. Differentiate between torts, negligence, malpractice, abandonment, and a variety of other legally charged and ethical complex legal terms. 8. Articulate the role of ethics and compliance committees including their structure, goals, functions, and decision-making activities. 9. Analyze and identify specific issues associated with coding, regulatory compliance, and ethical actions of skilled health care professionals and medical providers. 10. Understand and articulate patient rights. 11. Understand their unique role as a health care leader in providing quality patient care. 12. Understand the demands of managing in a highly regulated, transparent and scrutinized field. 13. Identify and bridge the gap between fiscally prudent stewardship and quality patient care. 14. Understand and cultivate relationships between care givers and administration. Credits: 3.00

PUBH 57500 - Healthcare Accounting & Reimbursement

Credit Hours: 3.00. This course teaches core financial skills of accounting and financial management as they apply to healthcare management systems. Topics include analysis of financial reporting, cost management; reimburse mechanisms, CFO Responsibilities, managed care contracting and fundraising and capital investment. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Apply financial concepts to health care related issues. 2. Assess the performance of healthcare organizations. 3. Use financial data to strategically align planning methodologies to reimbursement issues. 4. Discuss the impact of healthcare reimbursement on the financial solvency of the healthcare system. 5. Explore varying healthcare setting and the differing financial aspects of each. 6. Calculate profit in capitated markets. 7. Accounts receivable and revenue cycles in patient care environments. 8. Estimate cash flows in patient care settings. 9. Identify charge master and medical record and coding. Credits: 3.00

PUBH 57600 - Workforce Management And Organizational Behavior In Healthcare

Credit Hours: 3.00. The course focuses on the relationships between healthcare administration and human resource management across various health care organizations, including hospitals, long-term care facilities, and community

health organizations. Topics include personnel recruitment and training; compensation and benefits; performance evaluations; staffing plans; employee discipline; and credentialing health care professionals. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Identify strategies for the recruitment, selection, development, and retention of quality health care professionals while applying accreditation criteria to human resources practices. 2. Apply human resources management for problem solving and decision-making. 3. Identify various legal issues, which require managerial attention and strategy. 4. Understand the changing workforce dynamics and the issues associated with labor shortages of skilled professionals in the healthcare industry. 5. Prepare for future challenges and examining future trends in the human resource field within the industry of healthcare. 6. Understand regulatory compliance issues uniquely associated to the field of health care (such as Joint Commission) standards pertaining to safety, emergency preparedness, job analysis, performance appraisals, and employee retention. 7. Analyze employee productivity in patient-centered environments. 8. Put human resource principles, concepts, generalizations, theories and models into practice 9. Analyze the impact human resources management has on strategy formulation and strategy implementation. Credits: 3.00

PUBH 57700 - Strategic Planning And Marketing For Healthcare

Credit Hours: 3.00. This course provides an introduction to the conceptualization, development and implementation of strategic planning and marketing for healthcare organizations across several practice settings. Topics covered in the course include theories of decision-making, strategic planning and resource allocation, consumer behavior and provider comparisons. This course is a core class for the "Healthcare Quality Improvement" certificate program.

Learning Outcomes: 1. Apply the strategic planning process to a health care organization. 2. Understand strategic planning and marketing theories, principles, concepts, terms, methods, tactics, and tools. 3. Integrate strategic planning with marketing. 4. Analyze applications of planning and marketing in health care. 5. Know how strategic planning guides an organization in positioning itself in its defined market. 6. Discuss and define the position of the marketing function within the overall organizational structure of a health care system. 7. Formulate a health services marketing plan. 8. Compare alternative market research methods. 9. Identify the role and responsibility of health system governance in health care marketing. Credits: 3.00

PUBH 57800 - Healthcare Quality And Risk Management

Credit Hours: 3.00. The course explores how to identify quality and complexity issues affecting healthcare organization; how to develop, implement and assess quality improvement programs and strategies in various healthcare settings. Topics include continuous quality improvement; lean management; Six Sigma; IHI Quality Improvement Program; Baldrige criteria; patient safety; and quality tools. This course is a core class for the Healthcare Quality Improvement certificate programs.

Learning Outcomes: 1. Understand the interdependence, drivers and challenges of Quality and Information Management. 2. Learn and practice key aspects of multiple change management models, quality improvement methodologies and tools. Complete a quality improvement project using a basic improvement methodology. 3. Apply health care operations and quality management skills for problem solving and decision making. 4. Integrate the professions of health care operations, quality management and health administration. 5. Understand how health care operations and quality management affect allied health professionals and others. 6. Develop and use new ways of thinking about health care operations and quality management jobs and professions. 7. Analyze the impact health care

operations has on quality management strategy formulation and strategy implementation. 8. Be able to integrate health care operations and quality management with organization and performance outcomes. 9. Understand the challenges in creating a culture of safety. 10. Understand the structures and drivers in incentive programs to improve care. Credits: 3.00

PUBH 57900 - Information Powered Patient Care In The 21st Century

Credit Hours: 3.00. This course focuses on the use of computer technology and information science to identify, gather, process, and manage information to help healthcare organizations succeed. Emphasis is placed on technology-based health applications, which support clinical, administrative, research, and educational decision-making that enhance the efficacy of health care administration.

Learning Outcomes: 1. Evaluate computer applications to aggregate and analyze data for evidence- based practice and quality improvement. 2. Describe systems theory and design as applied to health informatics. 3. Identify key trends and regulatory requirements for healthcare information systems. 4. Evaluate the strengths and weaknesses of health information systems in practice. 5. Explain the relationship among information technology, information literacy, and evidence-based practice. 6. Describe and critique taxonomic and terminology systems used in national efforts to enhance interoperability of information systems and knowledge management. 7. Articulate ethical/legal issues that arise in using, designing, and managing healthcare information systems. 8. Analyze the methods used to align a health care information management plan with the corporate and strategic goals of a health care organization. 9. Practice the principles of project management. 10. Understand security and confidentiality issues, as well as health care information management trends and risks. Credits: 3.00

PUBH 58000 - Health Economics

Credit Hours: 3.00. This course will provide an introduction to the application of health economic principles as it relates to various health care systems, healthcare stakeholders and health policy issues in the United States. Topics include access to care; healthcare parity; relationships between economic characteristics and health status; impact of economy on health services industry; demand and resources for health services; utilization, prices, costs, and health insurance. This course is a core class for the Healthcare Operations certificate program.

Learning Outcomes: 1. Understand the fundamental principles, generalizations and theories of health care economics and health care policy. 2. Apply economics and policy to improve rational thinking, problem solving and decision making for health care issues. 3. Develop skills, competencies and viewpoints needed by health services administrators. 4. Know how and why health care policy is formulated, implemented, and modified (based on outcomes). 5. Relate the relevance of economics to public policy. 6. Understand the methodology and evaluation of various health programs and policies through the use of cost effectiveness and cost benefit analysis. 7. Identify how to participate in the policy-making process. 8. Communicate effectively orally and in writing with a wide range of people in varying settings. 9. Apply complex concepts, develop creative solutions, or adapt previous solutions in new ways. Credits: 3.00

PUBH 58100 - Managing Complex Healthcare Operations

Credit Hours: 3.00. This course focuses on the familiarization of production processes and service systems, and quantitative analysis of problems arising in the management of operations. We consider key performance measures of operations (productivity, flexibility, quality, and response time) as well as important concepts in the planning, design, control, and improvement of processes in healthcare contexts along these dimensions. For this course, students will also acquire the ability to learn ways to conduct operations management through data analysis. This course is a core class for the Healthcare

Operations certificate program.

Learning Outcomes: 1. Understand the crucial importance of operations management in the healthcare environment. 2. Enhance analytical skills and the ability to uncover problems and opportunities for improvement in healthcare as well as other production and service processes. Credits: 3.00

PUBH 58200 - Advanced Executive Healthcare Leadership Development

Credit Hours: 3.00. This course provides advanced leadership training for healthcare executive. Topics include: emotional intelligence, managing difficult conversations, successful interviewing, employee engagement, building learning environments, adaptive leadership, and creating innovative cultures. This course is a core class for the Healthcare Leadership certificate program.

Learning Outcomes: 1. Explain and utilize emotional intelligence in the healthcare workplace. 2. Be able to use multiple leadership concepts to understand leadership situations and enhance your effectiveness in the leadership process. 3. Distinguish between leadership, coaching, and mentoring. 4. Enhance your ability to think critically, to analyze complex and diverse concepts, and to use your reasoning, judgment and imagination to create new possibilities in leadership. 5. Identify and discuss the behavioral practices (patterns of action) of effective leaders. 6. Obtain skills and the ability to engage in difficult conversations. 7. Identify and discuss the behavioral practices used by effective change leaders in multiple contexts (organizational, community, political, social/movement, and global). 8. Articulate and explain the purpose for leading change in different healthcare contexts; Obtain skills for building learning environments. 9. Identify a leader's role in change and how leaders evaluate the need for change, plan for change, initiate change, communicate the need for change, gain support of others for change, and sustain change. 10. Explore other philosophical approaches and change movements to determine relevancy and practical lessons for health administration change leaders; and to critically analyze organizational change practices and leadership in case studies from the field. Credits: 3.00

PUBH 58500 - Introduction To Environmental Health

Credit Hours: 3.00. An introduction to chemical, physical and biological factors in the environment that affect the health of the community. This course examines health issues, scientific understanding of causes and approaches to the control of major environmental health problems in industrialized and developed countries. This is a core course for the Masters in Public Health (MPH) degree at Purdue.

Learning Outcomes: 1. Define the major sources and types of environmental agents. 2. Discuss the transport and fate of these agents in the environment. 3. Identify the carriers or vectors that promote the transfer of these agents from the environment to the human. 4. Describe how these agents interact with biological systems, and the mechanisms by which they exert adverse health effects. 5. Explain and use models for prediction of the magnitude of adverse effects in biological systems. 6. Identify and define the steps in the risk-assessment and risk-management processes. 7. Describe the steps in the regulatory process in terms of risk assessment and risk management and identify current legislation and regulation regarding environmental issues. 8. Identify significant gaps in the current knowledge base concerning the health effects of environmental agents and identify areas of uncertainty in the risk-assessment process. Credits: 3.00

PUBH 59000 - Special Topics In Public Health

Credit Hours: 0.00 to 9.00. Various public health topics that may change from semester to semester.

Learning Outcomes: 1. Learning outcomes for the course will be variable based upon the specific instance of the course. Outcomes will be required to meet the expectations laid our for 500-level courses. Credits: 0.00 to 9.00

PUBH 60000 - Professional Development In Public Health Seminar

Credit Hours: 0.00. A professional development course designed to the meet the needs of MPH students in the Department of Public Health.

Learning Outcomes: 1. Explore careers in public health. 2. Network with community agencies. 3. Receive mentorship on field placements. 4. Develop a professional portfolio for the job search. Credits: 0.00

PUBH 60100 - Introduction To The Quantitative Methods Of Public Health

Credit Hours: 3.00. Acquaints students with the basic concepts and methods of statistics, the applications, and their interpretation as used in public health. Students learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships, and how to compute and interpret inferential statistical techniques. Students will acquire the ability to utilize statistical software as a tool to facilitate the processing, editing, storing, displaying, analysis, and interpretation of health research-related data.

Learning Outcomes: 1. Acquaint students with the basic concepts and methods of statistics, their applications, and their interpretation as used in public health. 2. Learn basic terminology and its meaning, how to calculate various statistical measures and indices, how to quantify health relationships and how to compute and interpret inferential statistical techniques. 3. Acquire the ability to utilize the statistical software package SAS as a tool to facilitate the processing, editing, storing, displaying, analysis and interpretation of health research related data. Credits: 3.00

PUBH 60200 - Theoretical Foundations Of Health Behavior

Credit Hours: 3.00. Examines the theoretical foundations of health behavior. Emphasizes the development of a conceptual framework for understanding and facilitating behavior enhancement, elimination, and/or maintenance in health promotion and education. Focuses on current theories regarding health-related behaviors. Permission of instructor required.

Learning Outcomes: 1. Assess the strengths and weaknesses of theories, models and best practices used to address public health issues. 2. Design approaches to prevent, mitigate or correct public health problems. 3. Identify and critically evaluate the social, political, policy, economic and environmental trends affecting the health of families and community. 4. Describe health promotion theories, models and best practices to address challenges to the health of families and communities. 5. Develop approaches to prevent, mitigate or correct challenges to the health of families and communities. 6. Identify and critically evaluate the factors that create, perpetuate and ultimately eliminate health disparities. 7. Demonstrate communication skills and strategies for promotion of family and community health. Credits: 3.00

PUBH 60400 - Public Health Administration

Credit Hours: 3.00. An introduction to the principals of management as applied to public health organizations, particularly local health departments. Topics include the organization of the U.S. public health system, legal and ethical obligations of public health administrators, the public health workforce and human resource issues, public health budgeting and finance, and leadership in the public health agency. The course is designed to introduce master's level students in public health to the management skills necessary to successfully implement a public health program.

Learning Outcomes: 1. Understand the transforming integrated health delivery system in the United States to build collaborative network of care providers. 2. Formulate action plans for process improvement that addresses gaps of public health service areas. 3. Appraise effectiveness of initiatives and programs to determine best practices and benchmarks for delivering public health services. Credits: 3.00

PUBH 60600 - Design And Analysis Of Public Health Interventions

Credit Hours: 3.00. (CSR 62300) Professional competencies in design, implementation, evaluation and diffusion of health interventions in community settings. Program planning paradigms, determinants of health behavior, and behavior change strategies serve as a basis for analyzing health interventions. Prerequisite: HS 56500.

Learning Outcomes: 1. Understand how to identify and/or select evidence-based interventions appropriate for defined populations, setting, and health issues. 2. Choose an evidence-based intervention and adapt it for a new population and/or setting. 3. Understand key ethical considerations when implementing interventions for defined public health problems, populations and settings. 4. Create a model to guide the evaluation of a health disparities program and/or intervention. 5. Establish evaluation questions and select an appropriate evaluation design to answer health disparities questions. 6. Identify strengths, limitations, and quality control issues associated with measure selection, data collection, data analysis, and data management of a health disparities intervention. 7. Understand the ethical and political implications of evaluation work regarding health disparities. 8. Identify grant proposals to secure funds to conduct an evaluation of an evidence-based health disparities intervention. Credits: 3.00

PUBH 60700 - Public Health Practicum

Credit Hours: 3.00. This course integrates public health theory and practice in a professional setting. Students have the opportunity to apply concepts from core and concentration courses, conduct projects, and interact with a range of professionals in the designated setting. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the 10 core program competencies. 2. Identify and describe health trends and data. 3. Evaluate and design interventions. Credits: 3.00

PUBH 60800 - Culminating Experience

Credit Hours: 3.00. The MPH degree plans of study require a culminating project to be completed in the final semester of study. The student provides evidence of competency mastery by partnering with a public health related agency, identifying a community problem, proposing an evidence-based solution, and developing an evaluation plan. The final product is in the form of a grant proposal. Guidance for proposal development is achieved through completion of a grant-writing workshop and feedback from a faculty advisor. Permission of department required.

Learning Outcomes: 1. Develop a grant proposal using components introduced. 2. Evaluate peer work, based on best practices in grant writing. 3. Strategically present a grant proposal. Credits: 3.00

PUBH 69400 - Graduate Seminar In Public Health

Credit Hours: 0.00. Seminar course covering a broad range of current research topics in public health and related fields of study. Seminar presentations by representatives from academia, industry, government, other external institutions and organizations, and members of the Purdue University community. Intensive analysis of application of various research and statistical methodologies to the study of public health.

Learning Outcomes: 1. Acquire an understanding and appreciation of research conducted on topics relevant to the field of public health. 2. Develop a working knowledge of how research topics are determined, hypotheses are formed, methodologies are designed and implemented, data are collected, and conclusions are drawn. 3. Apply knowledge of research and statistical design to student' own research projects. Credits: 0.00

PUBH 69500 - Public Health Independent Research Or Study

Credit Hours: 1.00 to 9.00. Investigation of various public health topics as determined by the interest of the individual public health graduate student and faculty mentor. Permission of department required.

Learning Outcomes: 1. Reinforce one or more of the student's graduate program

competencies. Credits: 1.00 to 9.00

PUBH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis.

Learning Outcomes: 1. Develop MS level research skills in Public Health. Credits: 1.00 to 18.00

PUBH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis.

Learning Outcomes: 1. Develop doctoral level research skills in Public Health. Credits: 1.00 to 18.00

Department of Speech, Language, and Hearing Sciences (Graduate)

Website: **https://hhs.purdue.edu/graduate-students/programs/?department=speech-language-and-hearing-sciences**

Department/School Head

Jennifer Simpson (interim)

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Arielle Borovsky Alexander L. Francis Michelle Gutmann Michael Heinz David Kemmerer Ravi Krishnan Laurence B. Leonard Chenell Loudermill Georgia Malandraki Jennifer Simpson Preeti Sivasankar Beth Strickland Dawn Wetzel Shannon Van Hyfte	Joshua Alexander Jaime Bauer Malandraki Françoise Brosseau-Lapré Anne Gritt Natalya Kaganovich Brandon Keehn Jiyeon Lee Christi Masters	Kelly Bailey Jillian Hubertz Kwang Kim Windi Krok Lydia Kruse Arianna LaCroix Zachary La Fratta Malinda McPherson Jane Mondul Melissa Newell Allison Schaser Maureen Shader Katherine Smith	Barb Cicholski David Ertmer Macalyne Fristoe Jackson T. Gandour Lisa Goffman David Goldstein Hope Gulker Jessica Huber Keith Kluender Lata Krishnan Jeanette Leonard Claudia Mournout William Murphy Robert Novak Mary Lou Poole Anne Smith Barbara Solomon Christine Weber

Academic Programs

Master's, Au.D., and Ph.D. Programs

The Department of Speech, Language, and Hearing Sciences emphasizes the study of human communication sciences and disorders. All aspects of communication - including speech, language, and hearing - as well as essential functions of swallowing and balance, are explored through all stages of the lifespan. The Department provides excellence in education across undergraduate, graduate professional (MS-SLP and AuD), and research programs (Ph.D.)."

- Ph.D. Program
- Au.D. Program
- MS-SLP Program
- Dual Track Degree Programs

Concentrations (Areas of Study)

- Auditory Perception, Neural Plasticity, and Sensory Aids
- Augmentative and Alternative Communication
- Aural Rehabilitation for Children and Adults
- Autism Spectrum Disorders
- Cognitive Neuroscience Approaches to Hearing, Language Processing, and Communicative Disorders: Applications of Functional Brain Imaging and Evidence from Brain-Damaged Individuals
- Language Structure, Development, and Disorders: Single Language and Crosslinguistic Studies
- Linguistics Applied to Communicative Sciences and Disorders
- Sign Language Linguistics
- Speech and Voice Physiology
- Speech Perception
- Speech Production, Development, and Disorders: A Lifespan Perspective
- Swallowing Physiology and Swallowing Disorders

Speech, Language, and Hearing Sciences, MS

Speech, Language, and Hearing Sciences, DAUD

Speech, Language, and Hearing Sciences, PHD

Speech, Language, and Hearing Sciences/Gerontology, PHD

SLHS 50100 - Neural Bases Of Speech And Hearing

Credit Hours: 3.00. Study of normal human neuroanatomy and neurophysiology related to speech, language, and hearing functions. Includes material concerning normal and abnormal neurological development over the lifespan.

Credits: 3.00

SLHS 50200 - Fundamentals Of Speech Production And Perception

Credit Hours: 3.00. The physical, biological, and behavioral correlates of normal speech production and perception. Includes an exposure to the measures and methods of speech science.

Learning Outcomes: 1. The student will be able to describe how the muscles and nerves (cranial and spinal) of the respiratory, laryngeal, and supralaryngeal systems are involved in normal speech production. 2. The student will be able to describe how the acoustic speech signal is formed by the speech production system and understand the resulting acoustic signal for consonants and vowels. 3. The student will understand the underlying principles of speech perception. 4. The student will demonstrate acceptable writing skills. 5. The

student will demonstrate how research principles can be integrated into evidence-based practice. Credits: 3.00

SLHS 50300 - Auditory Perception

Credit Hours: 3.00. Behavioral measurement of the capabilities of the normal and impaired auditory system. The laboratory experience includes an exposure to the measures and methods of hearing science.

Credits: 3.00

SLHS 50401 - The Auditory Periphery

Credit Hours: 3.00. Acoustics and Fourier analysis; outer-ear resonance and interaural differences; middle-ear impedance and structure; inner-ear mechanical responses; hair-cell transduction, electrophysiology, motility; cochlear potentials; cochlear amplifier; suppression; otoacoustic emissions; efferent feedback to the cochlea; damage to the ear; treatments for damaged ears. Permission of department required.

Learning Outcomes: 1. Understand the application of signals and systems theory to experimental characterizations of the peripheral auditory system. 2. Understand the anatomical and physiological bases for normal hearing in the peripheral auditory system. 3. Understand the anatomical and physiological bases for conductive and sensorineural hearing loss, and associated diagnostics. 4. Understand the general approaches to treating peripheral hearing loss, and the anatomical and physiological limitations in doing so. 5. Read primary journal articles. 6. Communicate scientific information orally. 7. Communicate scientific results with laypeople (e.g., patients, spouses, family members). Credits: 3.00

SLHS 50601 - Neural Bases Of Hearing

Credit Hours: 3.00. **Section I.** Neuroanatomy. Anatomy terminology, overview of cochlear neuroanatomy; afferent and efferent cochlear innervation; auditory nerve formation and termination points in the cochlear nucleus; Neuroanatomy of Cochlear Nucleus, Superior Olivary complex, Nuclei of Lateral lemniscus, Inferior colliculus, Medial geniculate body and the auditory cortex, corticofugal efferent pathways complex. **Section II.** Physiology Neuronal Physiology; response properties of the auditory nerve, cochlear nucleus, superior olivary complex, inferior colliculus, medial geniculate body and auditory cortex, rate-place and temporal-place neural encoding schemes in the auditory nerve, intensity encoding, frequency tuning in normal and cochlear loss, binaural processing in the superior olivary complex and inferior colliculus, feature maps in the inferior colliculus and medial geniculate body and serial, parallel, hierarchical processing in the auditory cortex and role of cortico thalamic and corticocollicular pathways in shaping subcortical neural representation.

Learning Outcomes: 1. Remember and integrate the neuroanatomical organization of nuclei and tracts along the central auditory ascending and descending pathways. 2. Evaluate and integrate the functional properties of different neurons in each nucleus along the central auditory pathway and apply to understand how they contribute to the neural mechanisms for encoding stimulus features important for perception. 3. Understand and integrate the anatomical and physiological bases for normal hearing processes along the auditory pathway and apply knowledge to evaluate how structural lesions can impair hearing processes in the central auditory system and its relationship to lesions in the peripheral auditory system. 4. Evaluate and analyze the anatomical and physiological bases of sensorineural hearing loss, and central auditory processing deficits. 5. Understand and evaluate the general structure function relationship in the central auditory system and learn to predict the perceptual consequences of structural lesions. 6. Apply knowledge of the relationship between structure and function as a rationale for the creation/development of clinical diagnostic tests. Credits: 3.00

SLHS 51800 - Counseling In Speech-Language Pathology And Audiology

Credit Hours: 2.00. Application of counseling models, theories, and methods to persons with communicative disorders and their families. Permission of instructor required.

Credits: 2.00

SLHS 51900 - Special Topics In Audiology And Speech Pathology

Credit Hours: 1.00 to 3.00. Study of special topics, drawn from areas not covered in permanent courses. Topics may vary from semester to semester.

Credits: 1.00 to 3.00

SLHS 52101 - Speech Disorders In Children

Credit Hours: 3.00. Knowledge base necessary for the competent assessment, diagnosis, and treatment of speech sound disorders in children, including developmental phonological disorders, motor speech disorders, and residual speech errors.

Learning Outcomes: 1. Design an assessment plan for a child referred due to poor speech intelligibility and/or for a suspected speech disorder. 2. Describe a child's phonological knowledge at multiple levels of representation to distinguish between normal and disordered speech development. 3. Compare the characteristics of the common subtypes of speech sound disorders. 4. Interpret the results of the speech assessment to select an appropriate treatment approach. 5. Create appropriate short-term and long-term treatment goals, including relevant instructional objectives, for a child with a speech disorder. Credits: 3.00

SLHS 52200 - Language Disorders Of Exceptional Children

Credit Hours: 3.00. Description and diagnosis of children with language disorders and procedures for management. Students in a certification program for EMR, ED, LD or TMR should register for this course rather than AUS 52300.

Credits: 3.00

SLHS 52300 - Language Disorders In Children: Basic Principles

Credit Hours: 3.00. Principles of description assessment and intervention for children with language disorders. Specific language evaluation and treatment procedures for children in the preschool years.

Credits: 3.00

SLHS 52501 - Language And Communication In Autism Spectrum Disorders

Credit Hours: 2.00. This course explores the characteristics, courses, and potential causes of autism spectrum disorder (ASD) with a particular emphasis on language and social communication. And, how our understanding of these issues informs the assessment, diagnosis, and treatment of ASD. Students discuss and evaluate issues associated with ASD, including early diagnosis, behavioral challenges, evidence-based treatment techniques, and current issues in the field.

Learning Outcomes: 1. Learn the theoretical foundations and milestones of social communication in order to contextualize typical/atypical development. 2. Understand the interactions between social, cognitive, and linguistic competencies in order to analyze the impact of social communication deficits across the lifespan. 3. Describe and evaluate treatment approaches for language and social communication impairments in order to prepare students for clinical practice. Credits: 2.00

SLHS 52900 - Stuttering: Nature, Diagnosis, And Treatment

Credit Hours: 2.00. Reviews applications of research findings and theoretical developments to our understanding of the onset, development, perpetuation, and amelioration of stuttering. Demonstrates and discusses methods and procedures for diagnosing and treating stuttering across the lifespan.

Learning Outcomes: 1. Students will learn the characteristics of stuttering in preschool and school-age children, adolescents, and adults. 2. Students will learn assessment and treatment procedures for preschool children, school age children, adolescents, and adults who stutter. 3. Students will become familiar with the major theoretical and clinical approaches to stuttering treatment. 4. Students will learn how to read research articles in the area of fluency and will be familiar with the major research findings in the field. 5. Students will learn about the nature and treatment of stuttering in diverse populations and will learn to use clinical methods that are sensitive to developmental

and cultural differences Credits: 2.00

SLHS 53100 - Language Disorders In Adults

Credit Hours: 3.00. Study of the causes, assessment, and treatment of acquired language disorders in adults, including aphasia, right hemisphere syndromes, and dementia.

Credits: 3.00

SLHS 53200 - Voice Disorders

Credit Hours: 2.00. Principles of differential diagnosis and clinical management for children and adults presenting voice disorders, based on a working knowledge of normal laryngeal structure and function.

Credits: 2.00

SLHS 53300 - Medical Speech-Language Pathology

Credit Hours: 2.00. Introduces the graduate speech-language pathology student to issues encountered in the medical environment in preparation for a healthcare externship and a career in the healthcare setting. Topics will include collaborative models in the medical setting, clinical documentation, ethical issues, equipment and instrumentation, medications, among others.

Learning Outcomes: 1. Increase understanding of the medical speech-language pathology environment. 2. Learn about various departments, professionals, and their collaborative roles with speech-language pathologists. 3. Develop an understanding of solutions to ethical dilemmas related to the medical field. 4. Understand and explain medications and their effects on swallowing and communication disordered individuals. 5. Become familiar with equipment, instrumentation, and medical tests in the intensive care unit and other acute care settings. 6. Discuss future trends related to the medical and speech pathology healthcare arena. 7. Comprehend and explain information obtained from a medical record. Credits: 2.00

SLHS 53600 - Traumatic Brain Injury

Credit Hours: 2.00. The mechanisms, effects, assessment, and rehabilitation of traumatic brain injury in children and adults, with emphasis on a team approach to remediation.

Credits: 2.00

SLHS 53800 - Motor Disorders Of Speech

Credit Hours: 2.00. A study of the neuropathologies that affect the speech production system. Emphasizes the differential diagnosis and management of acquired motor speech disorders.

Learning Outcomes: 1. The student will be able to describe how the types of dysarthria relate to damage in the brain and how the cranial nerves are involved in dysarthria. 2. The student will be able to describe and different views of disability and the levels at which individuals are affected by their difficulties and be able to implement these issues when assessing individuals with dysarthria and when setting goals for treatment. 3. The student will be able to correctly identify dysarthrias, based on case information and symptoms. 4. The student will be able to explain and describe appropriate intervention procedures given specific dysarthrias or speech, voice, resonance, and respiratory symptoms. 5. The student will demonstrate acceptable writing skills. Credits: 2.00

SLHS 53900 - Dysphagia

Credit Hours: 3.00. A study of the normal and disordered anatomy and physiology of the swallowing process. Principles of evaluation and treatment of dysphagia are discussed.

Learning Outcomes: 1. Knowledge of the anatomy of the respiratory, laryngeal, and articulatory subsystems. 2. Understanding of the normal physiology of the repertory, laryngeal, and articulatory subsystems. 3. Basic knowledge of the cranial nerve system. Credits: 3.00

SLHS 54001 - Augmentative And Alternative Communication (AAC)

Credit Hours: 2.00. This course will orient students to the use of augmentative and alternative communication (AAC) across the lifespan. Assessment and evidence-based intervention for

people who cannot meet their daily communication needs via natural speech and/or writing and who need AAC will be covered. AAC is neither disorder- nor age-specific. As such, AAC strategies, techniques, and options may be used across the lifespan and with people who have severe communication disorders that interfere with expressive and/or receptive speech and/or language. In that way, AAC can have broad applicability across settings and populations.

Learning Outcomes: 1. Demonstrate knowledge of hardware, software, feature matching, and evidence related to use of AAC and SGD with individuals with complex communication needs (CCNs). 2. Demonstrate knowledge related to the assessment and intervention for various people for whom AAC might be appropriate. 3. Apply and integrate evidence-based knowledge of typical language development toward the assessment and intervention for individuals with complex communication needs (CCNs). 4. Acquire knowledge and evaluate information about a range of augmentative and alternative communication (AAC) modalities as it applies to the assessment and intervention for individuals with complex communication needs (CCN) across the lifespan. 5. Acquire familiarity with and demonstrate use of AAC app evaluation rubrics used in decision-making regarding a range of complex communication needs (CCN). 6. Acquire, evaluate, and effectively present evidence-based knowledge on a specific topic within the scope of augmentative and alternative communication modalities. Credits: 2.00

SLHS 54100 - Cognitive Communication Disorders

Credit Hours: 2.00. This course examines the theoretical aspects and clinical management of cognitive communication disorders with an emphasis on right hemisphere brain damage, traumatic brain injury, dementia, and other degenerative neurological conditions.

Learning Outcomes: 1. Evaluate how the various theories of attention, memory, and executive function relate to the impairments observed in clients with cognitive communication disorders. 2. Analyze assessments for how appropriate they are in evaluating clients with cognitive communication disorders. 3. Identify evidence-based treatment interventions for cognitive impairments and use this knowledge to create treatment plans for clients with cognitive communication disorders. Credits: 2.00

SLHS 54300 - Assessment And Treatment Of Literacy Disorders

Credit Hours: 2.00. An introduction to the characteristics, definitions, etiologies, and assessment of literacy development in school-aged children (4-18 years of age). Emphasis is placed on the scope of practice for speech-language pathologists in the assessment and intervention process for children diagnosed with language-based literacy disorders.

Learning Outcomes: 1. Differentiate between normal and disordered literacy development. 2. Identify formal and informal assessment tools in each of the following areas: phonological processing, decoding, encoding, oral reading fluency, reading comprehension. 3. Summarize literacy strengths and weaknesses in clients with various profiles. 4. Identify appropriate strategies / techniques to remediate client weaknesses. 5. Identify various organizations, websites, programs, and supporting research for parents and educators. Credits: 2.00

SLHS 54400 - Clinical School Methods For Communication Disorders

Credit Hours: 2.00. Organization, materials, and methods for conducting speech, language, and hearing services in elementary and secondary schools. Permission of instructor required.

Credits: 2.00

SLHS 54401 - School-Clinical Methods In Communication Disorders

Credit Hours: 1.00. The focus of this course is on the implementation of speech, language, and hearing services with preschool to secondary (P-12) school-aged children. Students develop a working knowledge of special education law, disability law, and other resources for school-aged children.

Learning Outcomes: 1. Implement special education and disability laws. 2. Select the most effective instructional strategies for English Language Learners. 3. Explain the professional qualifications, roles and responsibilities related to speech-language pathology and audiology in a school setting. 4. Describe tasks required for the provision of speech, language, and hearing services in a school setting. 5. Have the knowledge and thinking skills to understand and evaluate research to incorporate evidence based strategies into clinical practice. Credits: 1.00

SLHS 54600 - Clinical Seminar In Speech-Language Pathology

Credit Hours: 1.00. This is a clinical seminar course designed to support students' ability to meet knowledge and skills standards related to the scope of practice of speech-language pathologists. This course provides supplemental learning opportunities and support for students as they complete their hands-on clinical practice each semester by taking a more in-depth look at conditions within the nine areas of practice as well as cultural and linguistically diverse families, ethical standards in clinical practice, professional issues and trends within communication sciences and disorders, and interprofessional education and practice. The course is offered each semester and objectives vary to advance the knowledge and skills required to meet the program and ASHA/CAA guidelines for completion of the program as well as certification standards as indicated by the CFCC.

Learning Outcomes: 1. Assess the interaction of cultural and linguistic variables between caregivers and the individual served. 2. Reflect on the impact of both implicit and explicit bias in clinical service delivery and actively explore individual biases and how they relate to clinical services. 3. Deconstruct the social determinants of health and environmental factors for individuals served and how these determinants relate to clinical services. 4. Distinguish the roles and importance of interdisciplinary/interprofessional assessment and intervention and connecting one's own role and those of other professions to appropriately assess and address the needs of the individuals and populations served. 5. Justify the importance of individual and collective (e.g., local, national organizations) advocacy for clients/patients/students' right to care. 6. Explore contemporary professional issues that affect Speech-Language Pathology, entry-level and advanced certifications, licensure, and other relevant professional credentials, as well as local, state, and national regulations and policies relevant to professional practice. 7. Interpret Professional code of ethics and professional fiduciary responsibility. 8. Develop leadership and mentoring skills related to the supervisory process. 9. Prioritize continuous learning in speech, language, and hearing sciences. Credits: 1.00

SLHS 54900 - Clinical Practice In Speech-Language Pathology I

Credit Hours: 1.00 to 8.00. The second in a series of practicum courses designed to provide instruction and practical experience in fundamental diagnostic and therapeutic approaches to speech and language disorders. AUS 43000 is recommended. Permission of instructor required.

Learning Outcomes: 1. Develop an in-depth understanding of the process of team development, the roles, and practices of collaboration to support effective performance in a variety of settings. (Interprofessional Education) 2. Build leadership skills that support collaborative practice, team effectiveness, and understanding of how one's uniqueness contributes to effective communication, conflict resolution, and positive Interprofessional working relationships. (Interprofessional Education) 3. Prioritize the needs, values, preferred mode of communication and cultural/linguistic background of the patient, family, caregiver, and relevant others. (Cultural Humility/Responsiveness) 4. Defend ideas of justice, equity, diversity, inclusion and intersectionality and acknowledge implicit bias

in order to actively contribute to a climate supportive of diversity and inclusion. (Cultural Humility/Responsiveness) 5. Examine ASHA Code of Ethics, Scope of Practice, certification process, supervision guidelines, and professional affiliations. (Stewardship & Accountability) 6. Dissect federal, state, and institutional regulations and discuss contemporary professional issues and advocacy related to trends in practice, privacy policies, models of service delivery, reimbursement procedures/fiduciary responsibilities. (Stewardship & Accountability) 7. Improve skills in oral and written or other forms of communication sufficient for entry into professional practice. (Effective Communication) 8. Compile information related to etiologies, characteristics and interdependence of communicative and swallowing disorders as well as evidence-based practices to treat each disorder. (Continuous Learning) Credits: 1.00 to 8.00

SLHS 55300 - Implantable Devices

Credit Hours: 3.00. Provides fundamental principles to assist audiologists and speech-language pathologists in the understanding of candidacy, principles of signal processing, and audiologic rehabilitation for children and adults who use cochlear implants.

Credits: 3.00

SLHS 56000 - Audiologic Diagnostics

Credit Hours: 3.00. Audiometers, audiometric standards, and the use of pure tone and speech signals in the measurement of auditory abilities. Laboratory provides practical instruction in the procedures discussed in class.

Credits: 3.00

SLHS 56100 - Medical Audiology

Credit Hours: 3.00. Study of the etiology, pathogenesis, symptomology, epidemiology, diagnosis and treatment of diseases, and injuries to the auditory system.

Learning Outcomes: 1. Apply knowledge about the development of human anatomical and physiological systems generally to the development of the auditory system and ear specifically in order to describe relationships between pathologies across systems. 2. Evaluate the effects on auditory function caused by environmental and hereditary factors that are related to systemic disease. 3. Differentiate between genetic and non-genetic disorders that are related to congenital and delayed-onset hearing loss. Apply this knowledge to cattegorize disorders that are unique to children, unique to adults, and common to all ages. 4. Justify the importance of Early Hearing Loss Detection and Intervention (EHDI) programs using knowledge about risk indicators, adverse consequences of hearing loss, and the benefits of early detection. Credits: 3.00

SLHS 56300 - Pediatric Audiology

Credit Hours: 3.00. Examination of protocols for the identification and evaluation of infants and children with hearing loss, using behavioral, physiologic, and electro-physiologic assessment methods. Course content places an emphasis on clinical decision-making and problem-solving skills.

Learning Outcomes: 1. Provide a scientific foundation focused on the assessment and management of hearing loss in infants, toddlers, young children and adolescents. Credits: 3.00

SLHS 56400 - Hearing Aids I

Credit Hours: 3.00. An examination of amplification systems as applied in audiological rehabilitation; acoustic, electroacoustic, electronic, and clinical considerations. Laboratory exercises in measurement, modifications, maintenance, selection, and dispensing of hearing aid systems.

Credits: 3.00

SLHS 56501 - Vestibular Assessment And Rehabilitation

Credit Hours: 3.00. This course will review anatomy and physiology of the vestibular system. Diagnostic assessment, interpretation and proper recommendation techniques will be

discussed. Current research addressing dizziness and balance issues will be reviewed as well as case history discussions to help prepare students to see these patients in a clinic setting. The clinical practice of audiology encompasses the assessment and habilitation/rehabilitation vestibular and balance disorders arising from a wide variety of medical and environmental etiologies. It is essential that audiologists have a firm understanding of the most common causes and medical treatments of vestibular disorders for all age groups. Additionally, vestibular assessment and treatment options are expanding rapidly in the past 5-10 years. Student clinicians need exposure to this area of care so that they may grow as research and technology change. Audiologists practice in a medical setting and thus must be comfortable with the medical approaches and terminology used by otolaryngologists, otologists, neuro-otologists, pediatricians, physical therapists and other allied health professions.

Learning Outcomes: 1. Perform a detailed case history for dizzy patients and understand basic concepts for report writing. 2. Understand and discuss many common disorders that lead to vestibular problems and how to diagnose these disorders properly. 3. Have a working knowledge of anatomy and physiology of the vestibular system in order to properly diagnose dysfunction. 4. Analyze test results from a vestibular test battery to diagnose disorders and to make recommendations for follow-up care. 5. Understand the need for interprofessional collaborative care by discussing current techniques for vestibular rehabilitation. Credits: 3.00

SLHS 56700 - Auditory Evoked Responses I

Credit Hours: 3.00. Evaluation of peripheral and brainstem auditory system function using evoked potentials.

Credits: 3.00

SLHS 56800 - Tinnitus Assessment And Rehabilitation

Credit Hours: 2.00. Ringing in the ears (tinnitus) is a common problem among millions of individuals with sensorineural hearing loss. This course will review the physiology, measurement, and treatment for tinnitus.

Credits: 2.00

SLHS 57000 - Hearing Conservation

Credit Hours: 2.00. A study of noise as a health hazard and as a nuisance; an examination of the ways in which hearing problems related to noise may be reduced. Permission of instructor required.

Credits: 2.00

SLHS 57401 - Hearing Aids II

Credit Hours: 2.00. The focus of this course is on the evolving technology in hearing aids with an emphasis on the information students will need to make efficacious clinical decisions not only for the hearing aids of today but also for the hearing aids of tomorrow. For each of the hearing aid features that are discussed, we review (1) the need or potential benefit to the patient, (2) the engineering behind the feature, (3) research supporting its efficacy and effectiveness, (4) its limitations, and (5) how to conduct routine clinical measurements to document its functioning.

Learning Outcomes: 1. Evaluate critically manufacturers' claims by developing an understanding of the mechanisms, advantages, and disadvantages of different hearing aid features. 2. Select the most cost effective hearing aid technology for your patients. 3. Inform patients, families, other appropriate individuals, and professionals the reasons of choosing the hearing aid features for a patient, and how to use these advanced features effectively. 4. Perform appropriate tests to check hearing aid features and assess the functionality of these features. 5. Attain knowledge and thinking skills to understand and evaluate new hearing aid features. Credits: 2.00

SLHS 57700 - Auditory Evoked Responses II

Credit Hours: 3.00. Administration and interpretation of auditory evoked responses generated in the auditory thalamus and cortex. Emphasis is on application of auditory evoked potentials in clinical diagnosis and intraoperative monitoring. Topics include middle (AMLR), late (AEP), and steady-state (SSEP) evoked responses.

Credits: 3.00

SLHS 57900 - Clinical Practice In Audiology

Credit Hours: 1.00 to 12.00. Supervised clinical practicum in evaluation of hearing and communication status and in remediation of communication problems. Clinical practices include, but are not limited to, auditory site of lesion, sensory aid selection, fitting and evaluation and communication training for children and adults. Clinical practicum is available in the M. D. Steer Audiology Center and off-campus facilities. Permission of instructor required.

Credits: 1.00 to 12.00

SLHS 58500 - Engineering Projects In Community Service: AuD I

Credit Hours: 2.00. Audiology clinical doctoral students, engineering, and speech, language, and hearing sciences undergraduate students work in a team-oriented research and development service-learning process. Students with faculty advisors collaborate with community partners to develop technology meeting adaptive and educational needs.

Credits: 2.00

SLHS 58800 - Evaluating Research In Evidence-Based Practice

Credit Hours: 2.00. The focus of this course is on developing the skills necessary to critically consume literature and apply it to clinical practice as speech-language pathologists and audiologists. Students complete a comprehensive evidence-based practice project, which includes developing a clinical question, conducting a literature review, and critiquing acquired research articles. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in appraising research necessary for evidence-based practice.

Learning Outcomes: 1. Learn to read and critique research literature. 2. Understand the basis for evidence-based practice. 3. Apply evidence-based practice to clinical questions. 4. Consider how to further our literature base about clinical questions. Credits: 2.00

SLHS 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 6.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 6.00

SLHS 60900 - Seminar In Language Acquisition

Credit Hours: 2.00. Critical review of current research in selected areas of typical and atypical language acquisition. Permission of instructor required.

Credits: 2.00

SLHS 61900 - Advanced Topics In Audiology And Speech Pathology

Credit Hours: 0.00 to 3.00. Study of advanced topics, varying from semester to semester. Course content will be drawn from areas for which there are no permanent courses.

Learning Outcomes: 1. Vary based on topics covered. Credits: 0.00 to 3.00

SLHS 64800 - Speech-Language Pathology Education Externship

Credit Hours: 1.00 to 8.00. Full-time school-clinical experience to provide speech, language, and hearing services in elementary and secondary schools, under the supervision of a school clinician and university staff holding the ASHA Certificate of Clinical Competency.

Credits: 1.00 to 8.00

SLHS 64900 - Speech-Language Pathology Healthcare Externship

Credit Hours: 1.00 to 8.00. An advanced-level clinical practicum in speech and language disorders. Prerequisite: SLHS 54900 . Permission of instructor required.

Credits: 1.00 to 8.00

SLHS 65800 - Advanced Topics In Audiology

Credit Hours: 2.00 or 3.00. Detailed study of selected topics in audiology. Permission of instructor required.

Credits: 2.00 or 3.00

SLHS 65900 - Audiology Practice Management

Credit Hours: 2.00. An examination of business and professional issues related to audiology. Practice management topics include conducting a feasibility analysis, writing a business plan, employee management, marketing, reimbursement, and practice growth. Professional issues include licensing, certification, liability issues, and career planning. Prerequisite: SLHS 57900 and Doctor of Audiology majors only.

Credits: 2.00

SLHS 66100 - Advanced Medical Audiology

Credit Hours: 3.00. The clinical practice of audiology encompasses the audiological assessment and habilitation/rehabilitation of hearing loss arising from a wide

variety of medical and environmental etiologies. It is essential that audiologists have a firm understanding of the most common causes and medical treatments of hearing impairment for all age groups. Additionally, the future clinician will be better served by recognizing the how rapidly information changes in this arena and becoming comfortable with reliable educational resources that are available for life-long learning in this area. Audiologists also practice in a medical setting and thus must be comfortable with the medical approaches and terminology used by otolaryngologists, otologists, neuro-otologists, pediatricians, radiologists, anesthesiologists and other physicians. Additionally, audiologists may be the first contact with a hearing-impaired patient and their role in the referral process will be emphasized.

Learning Outcomes: 1. Explain the anatomical and physiological bases for normal hearing in the peripheral auditory system. 2. Describe the anatomical and physiological bases of conductive and sensorineural hearing loss, and their associated diagnostics. 3. Compare and contrast the main approaches to treat peripheral hearing loss. 4. Assess the quality of primary journal articles. 5. Summarize scientific information effectively. Credits: 3.00

SLHS 67000 - Integrative Audiology Grand Rounds

Credit Hours: 1.00. This course provides advanced audiology students an opportunity to share and think deeply about the complex cases they are experiencing on off-campus placements. Students share cases online with their peer students who will provide thoughtful responses and reflections based on their own experiences. This course also provides a summative assessment of the students' knowledge in the final two years of their education. Due to the highly complex nature of the cases, students must use past clinical experiences and knowledge learned in multiple courses in order to successfully present cases and to respond in thoughtful ways that contribute to the online learning environment. Permission of department required; must also be currently enrolled in SLHS 57900 or SLHS 67900 completing an audiology externship.

Learning Outcomes: 1. Discuss complicated audiology cases with their fellow classmates and faculty members. 2. Share best practices in their case presentations. 3. Examine cases from different perspectives (medical model, professional issues, patient's rights, ethical considerations, etc.). Credits: 1.00

SLHS 67800 - Audiology Educational Externship

Credit Hours: 1.00 to 8.00. School clinical experience to provide audiology services in elementary and secondary schools under the supervision of a school clinician and University staff holding the Certificate of Clinical Competence in Audiology from the American Speech-Language and Hearing Association. Permission of department required.

Credits: 1.00 to 8.00

SLHS 67900 - Advanced Clinical Practice In Audiology

Credit Hours: 4.00. An advanced-level clinical practicum in audiology. Permission of instructor required.

Learning Outcomes: 1. Documented clinical experiences that cover the depth and breadth of the scope of practice of audiology. 2. Meet the knowledge and skills associated with certification standards of the American Speech-Language-Hearing Association. Credits: 4.00

SLHS 68800 - Research Integration And Dissemination For Evidence Based Practice

Credit Hours: 2.00. The focus of this course is on developing skills integrating current research and communicating about research in clinical practice. Students complete a comprehensive project involving a literature review, clinical decision and poster. They gain guidance from a skilled mentor in their research area and receive course instruction on best practices in scientific communication in a variety of modes, including developing an oral pitch, preparing a literature review and evaluation, and creating and delivering a poster and writing a research abstract. Pre-Requisite: Students must complete Evaluating Research - currently offered as SLHS 51900.

Learning Outcomes: 1. Evaluate and synthesize findings from the literature into a written and oral comprehensive review. 2. Refine scientific communication skills. 3. Understand principles of evidence-based practice guides and apply them to clinical decision making. Credits: 2.00

SLHS 69000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SLHS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

SLHS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Division of Consumer Science (Graduate)

Website: **https://hhs.purdue.edu/graduate-students/programs/?department=hospitality-and-tourism-management**

Department/School Head

Ceridwyn King, Professor and Head

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Assistant Professor	Clinical Instructor	Emeritus Faculty
Ceridwyn King Liping Cai SooCheong (Shawn) Jang Xinran Lehto Rodney Runyan Kevin Kam Fung So	Jonathan Day Alei Fan Susan Gordon Jiyun Kang Seon Jeong (Ally) Lee Annmarie Nicely Jiong Sun Chun-Hung (Hugo) Tang	Wookjae Heo Shinyong (Shawn) Jung	Julie Abdinoor	Dawn Sieber	B. Almanza L. Kreul B. Lazarus A. Morrison T. Pearson J. Rousselle R. Ghiselli

Academic Programs

The consumer science graduate program offers world-class postgraduate programs for industry professionals seeking to move ahead in their careers and aspiring academics seeking to gain the knowledge and skills to be researchers and teachers.

PhD Program

The PhD program is designed to be one of the strongest research-based programs in the world. The program - which includes a strong element of statistics and research design - prepares you for careers at major research universities or research-based agencies. Upon graduation, you are expected to have a

curriculum vitae that includes instructional knowledge, publishing experience in research journals, and a record of presentations to industry and research societies.

Master of Science Programs

The Master of Science degree program allows you to specialize and apply theoretically grounded, cutting-edge research in one of two areas: consumer behavior or family and consumer economics. The MS program offers one of the most up-to-date and integrated blends of theory, technology and applications in consumer science. Core courses will advance your understanding of this dynamic industry while allowing you to explore how to conduct research and analyze information. You will then specialize in your area of interest through a variety of electives and research projects. The non-thesis option meets the needs of those wishing to earn a master's degree and return to the industry. Students pursuing this degree track are not eligible for automatic consideration into the consumer science PhD program.

Concentrations (Areas of Study)

In the consumer science master's and doctoral programs, you'll gain significant exposure to research, working directly with the school's faculty to explore important issues across consumer science:

- Branding and consumer experience
- Consumer financial behavior
- Machine learning and data analysis in consumer research
- Financial risk tolerance and behavioral finance
- Retail innovation and shopping behavior

Students in the Consumer Science graduate programs can select a concentration to provide a primary focus of study.

- *Consumer Behavior.* Theories from several disciplines are employed in the study of the decision process, and activities and influences while individuals engage in the various stages of evaluation, use, and disposal of consumer goods and service. Previous background in the social sciences, marketing, or economics is assumed. Students who do not possess this background may need to enroll in supplementary coursework to build entry competencies.
- *Family and Consumer Economics.* Primary areas of study for the Master of Science degree or the Doctor of Philosophy degree are consumer economics, consumer resource management, or family economics. In addition to the primary area, both the M.S. and Ph.D. plans of study must include one or more related areas of study. These areas include, but are not limited to agricultural economics, economics, management, psychology, sociology, and statistics.

College of Liberal Arts (Graduate)

College of Liberal Arts Administration (Graduate)

SCLA 50500 - Technology, War, And Strategy

Credit Hours: 3.00. This course introduces students to the interaction between strategy and technology internationally and across historical eras. The course is rooted in historical political, military, economic, technological, and cultural strategy, and it engages core ideas that cut across disparate schools of thought and historical contexts. The course prepares students to appreciate and understand the foundational principles of designing and executing broad strategic initiatives with world-changing consequences that engage profound national economic and technological commitments.

Learning Outcomes: 1. Classify and compare the core strategic competencies needed in designing and implementing strategic defense technologies. 2. Sequence and apply in strategic planning historical constants of strategic technology development. 3. Assess the concept of strategic technological offset in context. 4. Devise effective communication and presentation skills. Credits: 3.00

SCLA 50600 - Space Strategy

Credit Hours: 3.00. Space is the most recent domain in which nations and great powers dispute strategic political, military, economic, and legal interests. The course analyzes the origins, tensions, and promises embedded in the space-focused strategies of major international players. The course will discuss these issues from the US national and strategic interests perspective, focusing on how strategic competition and conflict in space could and should be handled. The course combines technological with grand strategy concerns.

Learning Outcomes: 1. Distinguish the key characteristics of grand strategy with examples for each great power involved in space strategy. 2. Distinguish the main phases in the history of space exploration and appraise their role in revealing various strategic priorities for space policy. 3. Differentiate essential provisions of the key space legal documents and principles by their domain and effect. 4. Assess the main space-paced conflictual relationships and prioritize them by importance and immediacy. 5. Differentiate the role of governments and private organizations in space strategic control and determine their main common interests by great power. Credits: 3.00

SCLA 50700 - Grand Challenges In Defense Engineering

Credit Hours: 3.00. This course examines past, present, and future engineering challenges to develop new conceptual insight, research priorities, system integration, and timely methods to meet emerging national defense engineering needs. The course matter involves challenges in Energy, Logistics and Information, and Rapid Offense and Defensive Systems and subsets of each designed to develop understanding depth and transfer analytic and planning skills needed to meet future defense needs. The selected three topics begin with a past engineering challenge to gain perspective on how prior needs were met in their time, a present challenge under current focus, and a possible future challenge and solutions that will require combining prior best practices with the accelerated development needed in the changing world.

Learning Outcomes: 1. Develop professional methods to identify, research, collaborate, and develop solutions to engineering challenges while maintaining appropriate systematic thinking. 2. Formulate and solve structured problems using standardized professional methods including case study research, system engineering design, and policy analysis. 3. Appraise historic, present, and anticipated future engineering challenges by identifying the necessary parameters required for solving them, such as specifying challenge dimensions, generating appropriate assumptions for missing information, formulating solutions, and projecting possible results. 4. Identify, locate, and integrate data, parameters, or information about past, present and future practices needed to develop solutions to course problems. 5. Assemble and compose written and oral communications involving solutions and arguments valuable for both senior and technical leadership while maintaining ethical and professional conduct. Credits: 3.00

SCLA 50800 - Cyber Strategy

Credit Hours: 3.00. Cybersecurity is a crucial domain upon which individuals, organizations, communities, states, nations, and great powers rely to protect cyber-based personal, business, economic, infrastructural, community, legal, strategic political, and military interests. The course analyzes the policies, issues, risks, and opportunities embedded in the cyber strategies of organizations. The course will discuss these issues from the perspective of the U.S. national and strategic interests, focusing on how cyber issues and conflicts could and should be handled. Among the cyber strategy key considerations to be discussed are: Understanding and assessing an organization's cyber threat landscape; Assessing an organization's cybersecurity maturity; Organizational cyber strategy goals; Cyber strategy policy-making process; Examination of strategies for strengthening, defending, and maintaining an organization's cyber infrastructure -Models, requirements, frameworks, and best practices; Management commitment and responsibilities to an organization's cyber strategy and policies; Cyber strategy staffing, training, and budgeting; Global and domestic cyber business relationships in governmental and private industry; Promoting awareness of historic, ongoing, and emerging cyber threats and actors; Promoting awareness of domestic, global and insider cyber threats and actors; Cyber risk management; Cyber incident management.

Learning Outcomes: 1. Understand, assess, and design cyber strategy requirements and

goals - Distinguish national cyber strategy goals between U.S., China, and Russia. Understand U.S. cyber strategy policy-making process. 2. Understand, assess, and design cyber strategy means - Understand the national strategies for strengthening, defending, and maintaining cyberinfrastructure, with examples of models, requirements, frameworks, best practices. 3. Understand, assess, and design cyber risk management methods - Understand cyber threat analysis, U.S. national cyber incident management. 4. Understand, assess, and design cyber strategy in the context of international conflict/war - Assess the main cyber conflictual relationships and prioritize them by importance and immediacy. Credits: 3.00

SCLA 50900 - Strategic Intelligence: Organizations, Technologies, Procedures, Policies

Credit hours: 3.00. The present course will examine all facets of strategic intelligence, anchoring the investigation around specific organizations and processes, from the major civilian to the major military-strategic intelligence agencies, the legislation that directs their work, and the supervisory bodies. The course will also include case studies that analyze and operationalize how intelligence agencies contribute to national security. The course aims to provide the students with a rounded and practical education in strategic intelligence, describing who is responsible for its deployment and exploitation and what its benefits are for national security.

Learning Outcomes: 1. Analyze the diplomatic, economic, informational, military, and political elements influencing national strategic intelligence. 2. Evaluate key agencies, institutions, and legislative frameworks that shape U.S. strategic intelligence collection, analysis, and dissemination. 3. Differentiate between various strategic intelligence organizations - civilian and military - and understand their unique contributions and limitations. 4. Assess how political, institutional, and cultural factors affect the development and execution of national strategic intelligence policies. 5. Formulate recommendations for improving strategic intelligence oversight, policymaking, and response mechanisms to current and emerging global threats. Credits: 3.00

SCLA 51000 - Data And AI Storytelling

Credit Hours: 3.00. The primary assumption of our course is that the goal of communicating with data is ultimately to identify causal mechanisms and change the status quo due to the obtained insights. All audiences have previous understandings of the world, and meaningful data stories should challenge their assumptions about that world. The communication of this data-based new knowledge violates prior assumptions, shares memorable new information and moves the audience to act based on the new knowledge. This is best accomplished through a story. In other words, this communication assumes the form of a story, which is defined as the narrative of how an unexpected cause creates an effect.

Learning Outcomes: 1. Provide high-quality data story examples and justify why they meet the good story criteria. 2. Identify and extrapolate core relationships between research design and story-building. 3. Generate hypotheses based on data. 4. Create specific data visualizations which maintain casual narratives. 5. Identify story elements that map onto the five tenets of What is a Data Story? 6. Identify in examples the adherence or violation of data transparency, validity and ethics. Credits: 3.00

SCLA 51300 - Game Theory For Strategy And Defense

Credit Hours: 3.00. This course explores the intersection of strategic decision-making and national defense through the lens of game theory. Participants will develop analytical and strategic skills by studying three interconnected modules: (1) Game Theory Foundations: understanding the fundamentals of strategic interactions, Nash equilibria, and applications to competitive and cooperative settings, (2) Mechanism Design: Crafting systems to incentivize desired outcomes, with a focus on resource allocation and strategic interactions in defense, (3) Social Choice: analyzing how groups can make collective decisions in a way that balances fairness, efficiency, and strategic behavior. A final module of the course will apply the

concepts developed in a family of games called Attacker-Defender games, which model scenarios involving adversarial interactions, including cybersecurity, physical security, and military strategy. The course connects theoretical frameworks with real-world defense challenges, analyzing past, present, and future applications. By the end of the course, participants will be equipped to apply these concepts to complex, rapidly evolving strategic environments in national and global defense.

Learning Outcomes: 1. Understand and Apply Game-Theoretic Concepts: Identify, formulate, and analyze strategic interactions using foundational concepts such as Nash equilibria, mechanism design principles, and social choice frameworks. 2. Model and Solve Real-World Problems: Use structured game-theoretic models, mechanisms, and optimization techniques to address challenges such as resource allocation, adversarial interactions, and decision-making under uncertainty. 3. Analyze Historical, Current, and Emerging Scenarios: Evaluate past, present, and future (defense) strategies by identifying critical game theoretic factors, and projecting outcomes based on established theoretical frameworks. 4. Develop Research and Communication Skills: Investigate real-world (defense) scenarios using tools from game theory, social choice, and mechanism design, and synthesize findings into clear and persuasive written and oral presentations. 5. Adapt Strategic Thinking to Complex Environments: Integrate interdisciplinary methods to address multi-agent and multi-objective problems in evolving contexts, balancing robustness, efficiency, and ethical considerations. Credits: 3.00

SCLA 52000 - Social And Digital Media Analytics For Strategic Communication

Credit Hours: 3.00. This course provides an overview of how to transform social media and digital media information into business intelligence and actionable insight. Although students are not expected to know a programming language prior to taking the course, students are expected to understand basic statistics and to have a desire to learn the processes, procedures and vocabulary used by data analysts in modern organizations. The goal is not to train them as practicing data scientists, but as knowledgeable data analytics consumers and as informed teammates and leaders of cross-functional teams tasked to make decisions using data.

Learning Outcomes: 1. Differentiate between the opportunities and limitations with social media data. 2. Identify methods for using ready and custom-made tools to transform information into insight, from data collection to analysis, interpretation, and recommendation. 3. Sharpen their quantitative and business analytical skills using spreadsheets and online tools. 4. Write effective reports and draft scorecards. 5. Be prepared to interact with data scientists by speaking their language and understanding their processes for data mining and business intelligence. Credits: 3.00

SCLA 52100 - Societal Impacts Of Artificial Intelligence

Credit Hours: 3.00. Students in this course will draw upon knowledge from multiple fields to understand how AI is transforming social, political, and economic practices in institutions and in society. They will utilize interdisciplinary theories and methodological tools to measure and evaluate the societal impacts of AI. The utilizes a mix of case and source data and recent research in the field of AI to create opportunities for shared communication and learning among those in technical and non-technical fields that utilize artificial intelligence. Students will engage in systematic analysis of societal impact.

Learning Outcomes: 1. Describe how AI is transforming social, political, and economic institutions, practices and employment in multiple sectors, including healthcare, education, finance, communications, criminal justice and others. 2. Explain the nature of risks of AI in society and outline common strategies to manage risks. 3. Evaluate core theories used to understand AI's potential societal impact on connectedness, trust, creativity, and conflict. 4. Assess and communicate AI impacts by applying interdisciplinary tools drawing from social sciences, humanities, and STEM fields. 5. Identify the human rights implications of AI

and understand potential mitigation practices. Credits: 3.00

SCLA 52200 - Artificial Intelligence Policy, Governance, And Ethics

Credit Hours: 3.00. This course provides students with a strong grounding in the policy, ethical, and legal regulatory dimensions and environment that shape the governance of AI. Students will analyze current and emerging laws, regulations, and governance strategies shaping the AI landscape across multiple jurisdictions and sectors. The course will help students gain an interdisciplinary understanding of the core ethical principles and values that guide AI.

Learning Outcomes: 1. Describe key stakeholders, institutions, and strategies involved in AI policymaking across multiple levels of government (local to global) in multiple fields and explain their roles in governing AI systems. 2. Evaluate the legal, regulatory, and other governance strategies that have been proposed or adopted by governments, firms, and civil society organizations, such as model cards, liability frameworks, standards, and impact assessments. 3. Analyze ethical and social issues related to the development and application of AI systems within multiple fields, including power, model bias, transparency, accountability, worker well-being, and privacy, as well as the translation of ethical values into technical aspects of AI governance practices within public and private, and non-profit sector organizations. 4. Synthesize, analyze, and communicate information about emerging policy issues in AI and the associated ethical and social dimensions, identify stakeholder perspectives, and summarize proposed solutions. 5. Assess current and evolving trends, debates, and solutions in AI governance and ethics through case studies, contemporary issues, and comparative analysis. Credits: 3.00

SCLA 53000 - Strategic Foresight And Leadership

Credit Hours: 3.00. This course provides emerging leaders with strategic foresight tools and skills to understand and make decisions regarding long-term future operational defense-related environments. Strategic foresight is the ability to create and sustain a variety of high-quality long-term views and apply emerging insights in organizationally adaptive ways. Strategic foresight produces scenarios that are the basis for strategies and plans to help defense or industry organizations remain competitive into the foreseeable future.

Learning Outcomes: 1. Define and explain strategic foresight. 2. Distinguish the difference between a growth, fixed, and futures mindset in strategic foresight. 3. Make use of specific strategic foresight methodologies: horizon scanning, signals and drivers of change, the 2 x 2 matrix and archetype methods. 4. Make use of vision and alignment in executing a strategic foresight model. 5. Argue the importance of vision for strategic leadership. Credits: 3.00

SCLA 59000 - Special Topics

Credit Hours: 3.00. This course, whose specific topics might change, focuses on strategy and military studies a global scale. The course will be rooted in all the elements of strategy (political, military, economic and cultural), plus strategic theory and technology's impact on it. The course exposes students to a set of historical and contemporary strategic dilemmas that involved difficult trade-offs, costly investments, wild risks, incredible victories, and crushing defeats. This is a multidisciplinary course that focuses on several core ideas and principles that cut across schools of thought and examples from past, present and future.

Learning Outcomes: 1. Develop and analyze system-level trade-offs. 2. Plan long-term on a national scale. 3. Devolve authority and allowing for chance contingency while staying on mission. 4. Maintain individual morals and national values in strategic thinking. 5. Balance the possibilities and limits of soft power (money, prestige, culture) as strategic tools of influence. 6. Examine the learning competition aspects of

strategy and security. Credits: 3.00

SCLA 62000 - Academic And Professional Communication For International Teaching Assistants

Credit Hours: 5.00. Student must be an enrolled graduate student and a non-native speaker of English. Permission of department required.

Learning Outcomes: 1. State their strengths and weaknesses in oral English. 2. Demonstrate improved pronunciation, prosody, grammar, listening comprehension, and vocabulary, depending on their strengths and weaknesses. 3. Identify and carry out specific strategies for developing their language skills. 4. Demonstrate effective communication and presentation skills including question and answer strategies, negotiating for meaning, paraphrasing, compensatory strategies, and nonverbal skills. 5. Compose and assess presentations and interaction appropriate for a variety of professional contexts. 6. Demonstrate behavior appropriate for professional and instructional contexts in higher education in the United States. 7. Identify the characteristics of students, teaching assistantships, and higher education in the United States. Credits: 5.00

Department of Anthropology (Graduate)

Website: **https://cla.purdue.edu/academic/anthropology/**

Department/School Head

Melissa J. Remis

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Myrdene Anderson Sherylyn Briller Michele Buzon Melissa Remis Laura Zanotti	H. Kory Cooper Andrew Flachs Ian Lindsay	Melanie Beasley Risa Cromer Dada Dacot Stacy Lindshield Zoe Nyssa Erik Otárola-Castillo Sarah Renkert Kali Rubaii Natali Valdez Amanda Veile

Academic Programs

Master's and Ph.D. Programs

The Department of Anthropology at Purdue University is a leading-edge, research-intensive department with a public service mission. We are committed to being thought leaders on our campus and in our discipline as the Anthropologies of Tomorrow (AOT) Department. Anthropologies of Tomorrow embodies a collective orientation toward the transformative potential of anthropology to prioritize excellence through diversity. Through high-impact scholarship, teaching, and public engagement, our work expands understandings of diverse human experiences and cultures past and present. We see unique opportunities to lead the field in integrative, collaborative, and decolonizing scholarship that addresses emerging and established global grand challenges. These challenges demand rigorous, creative, and transdisciplinary approaches in an increasingly interconnected world. Our comprehensive department encompasses archaeological, biological and evolutionary, cultural, linguistic, visual, and applied anthropology, with specific strengths in our cross-cutting signature research areas:

1. Applied Anthropology and Public Engagement
2. Ecological and Environmental Anthropology
3. Health and Well Being
4. Identity, Heritage, and Social Justice

Science and Technology

Graduate program key strengths include close mentoring and access to faculty, flexible curricular structures, and the ability to combine anthropology with a number of other programs, degrees, and concentrations, including Women's, Gender and Sexuality Studies, the Center for Aging, American Studies, Engineering and Materials Science, Ecological Science and Engineering, Public Health, and the Interdisciplinary Program in Ingestive Behavior. In the graduate program, all students are admitted with funding and mentored for success with external grants and fellowships. Doctoral students may elect to prepare their dissertations in one of several formats, including monograph, article style, or multimodal. Alumni of our program pursue careers in the public, nonprofit, and private sectors, including academia and education, health and medical professions, high-tech startups, international development, conservation, and city, state, and federal agencies.

- MS in Anthropology
- Ph.D. in Anthropology
- Major: Anthropology/ Gerontology

Concentrations (Areas of Study)

- African American Studies (MS and Ph.D.)
- Anthropology Concentration in Women's, Gender and Sexuality Studies (MS and Ph.D.)
- Applied Anthropology (MS and Ph.D.)
- Ecological Sciences & Engineering Concentration (MS and Ph.D.)
- Ingestive Behavior (Ph.D. only)

Anthropology, MS

Anthropology, PHD

Anthropology/Gerontology, PHD

ANTH 50400 - Archaeological Theory

Credit Hours: 3.00. Focuses on the development of archaeological theory, discussing several theoretical positions and genres of archaeological research. Students gain experience in working with theory in their own research and achieve literacy in archaeological theories.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the historical development of the archaeological method and theory from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of archaeology writing to understand archaeology and its representation of the human past. 5. Analyze a series of case studies that illustrate dominant positions and fissures in archaeological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50500 - Culture And Society

Credit Hours: 3.00. Introduces contemporary sociocultural anthropology theory and practices, relating material to anthropology's history and its place in the social sciences. Covers problem formulation, study of cultural change, representation of human cultural diversity, and key case studies.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in cultural anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand cultural anthropology and its representation of human cultural diversity. 5. Analyze a series of case studies that illustrate dominant positions and fissures in cultural anthropological thought and

practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 50700 - History Of Theory In Anthropology

Credit Hours: 3.00. Connects the theoretical foundations of anthropology throughout the development of the discipline and related disciplines. Unpacks the when, how, and why of various theoretical positions, their shaping of research, and their concomitant logics of evidence.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about the foundations of theory in anthropology and the development of the discipline over time up to approximately 1980. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand anthropology and its representation in past and present. 5. Analyze a series of case studies that illustrate dominant positions and fissures in anthropological thought and practices. Credits: 3.00

ANTH 51400 - Anthropological Linguistics

Credit Hours: 3.00. Investigates the varieties of communication in human behavior, while exploring linguistics as a tool in social science research. Also considers origins of human language and speech, and relations of language with other aspects of culture, with societal phenomena and with individual cognition.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about theory in linguistic anthropology. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Analyze a series of case studies that illustrate dominant positions and fissures in linguistic anthropological thought and practices. 5. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 51900 - Introduction To Semiotics

Credit Hours: 3.00. (COM 50700 , ENGL 57000 , LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ANTH 52300 - GIS For Humanities And Social Science Research

Credit Hours: 3.00. This course will introduce students the skills of spatial thinking, basic functions of Geography Information Systems (GIS), and spatial research methods that are most relevant to humanities and social science. The course will start with an introduction to basic GIS concepts and technology, then move onto GIS applications during the research process, including spatial research design, data acquisition, management, visualization, and spatial analytical techniques. Practical work will be introduced and completed using ESRI ArcGIS Pro software.

Learning Outcomes: 1. Understand the basics of mapping and geospatial information using ArcGIS Pro. 2. Apply spatial research methods into your own research. 3. Produce professional maps to visualize spatial data. 4. Document and manage spatial data using a standardized way. 5. Understand several spatial analysis methods that are relevant to your research area. 6. Create a web- or mobile-based GIS application using ArcGIS Online. Credits: 3.00

ANTH 53400 - Human Osteology

Credit Hours: 3.00. Anatomy of the human skeleton and dentition. Detailed study of skeletal elements and teeth, morphology, function, disease, and pathology. Identification of human remains with regard to age at death, gender, growth, and development in biocultural context.

Credits: 3.00

ANTH 53500 - Foundations Of Biological Anthropology

Credit Hours: 3.00. Covers topics in biological anthropology, applying to both living and extinct humans and to non-human primates. Topics include: evolutionary theory; genetics; human variation and the race concept; intersections of biology and culture; fossils and paleoanthropology; ecology and speciation, primate behavior, and theories on the social behavior of early and contemporary humans.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in biological anthropology from 1980s to the present. 3. Understand when and how various theoretical positions and logics of interpretation have emerged. 4. Review several genres of anthropological writing to understand biological anthropology, and review representation of human and non-human primates and their ecology and evolutionary history. 5. Analyze a series of case studies that illustrate dominant positions and fissures in biological anthropological thought and practices. 6. Gain an understanding of how theory works and how to work with different theories in their own research. Credits: 3.00

ANTH 53600 - Primate Ecology

Credit Hours: 3.00. An examination of the complex interrelationships between populations of nonhuman primates and their habitats. Course topics focus on behavioral ecology and conservation including, predator-prey relationships, diet, and interspecific relations.

Credits: 3.00

ANTH 56300 - Historical Linguistics

Credit Hours: 3.00. (ENGL 56300, LC 56300) A survey of mechanisms and motivations of linguistic change. Topics include: phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

ANTH 56500 - Sociolinguistics

Credit Hours: 3.00. (SLHS 56500, COM 56500 , ENGL 56500 , LC 56500 , LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ANTH 58900 - Archaeology And Materials Science

Credit Hours: 3.00. This course provides instruction in the methods and theories used by archaeologists and materials scientists to study ancient and historic technology. The course focuses on the analysis and interpretation of archaeological artifacts and provides opportunities for hands-on learning.

Learning Outcomes: 1. Gain a more nuanced understanding of, and appreciation for, contemporary technology and materials science. 2. Understand the historical development of theory in anthropology and archaeology related to the study of technology. 3. Understand the role of materials science in contemporary archaeological studies. 4. Able to critique the application of scientific and materials science methods to the analysis of archaeological material through a discussion of case studies. 5. Demonstrate the ability to write a research proposal that incorporates the use of materials science in investigating past technology. 6. Understand the relationship between Culture and Technology and appreciate the impact of this relationship on the environment and issues of sustainability. Credits: 3.00

ANTH 59000 - Individual Research Problems

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of anthropology under an anthropology staff member. Does not include thesis work. Permission of instructor required.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn

about a specialty area or areas in anthropology. 3. Review several types of anthropological products to understand anthropology and its representation in past and present. 4. Learn about or engage in anthropological methods to understand diverse research design techniques. 5. Gain literacy in the anthropological theory across diverse subfields. Credits: 1.00 to 3.00

ANTH 59200 - Selected Topics In Anthropology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

ANTH 60500 - Seminar In Ethnographic Analysis

Credit Hours: 3.00. Focuses on ethnographic research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience with the varieties of ethnographic practice across anthropology and sibling sciences, the generation and analysis of data, and the writing up of ethnographic and of other qualitative research.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about qualitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields and other scholars use and apply qualitative methods. 5. Gain experience in generating and analyzing qualitative data, including being exposed to common qualitative software packages (such as NVivo). 6. Achieve qualitative literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60600 - Quantitative Research Design

Credit Hours: 3.00. Focuses on quantitative research design, methodology, and ethics, discussing the appropriate selection of any method. Students gain experience in generating and analyzing of quantitative and mixed-method data, and in the writing up and communication of quantitative research, altogether aiming for statistical literacy.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about quantitative research design, ethics and methods. 3. Understand when and how to appropriately select qualitative and quantitative methods and identify how and when to use them. 4. Gain an understanding on how anthropologists across the subfields use and other scholars apply quantitative methods. 5. Gain experience in generating and analyzing quantitative data, including being versed in common statistical packages (such as SPSS). 6. Achieve statistical literacy for understanding and working in a mixed methods environment. Credits: 3.00

ANTH 60800 - Proseminar In Graduate Studies In Anthropology

Credit Hours: 2.00. This is an introduction to graduate study in Anthropology at Purdue. Students will be introduced to the research of Purdue Anthropology faculty and how their work fits into the contemporary landscapes of their fields. Students will gain familiarity with tools needed for graduate work in Anthropology at Purdue and be exposed to navigating the world of academic conferences and publishing. Students will have opportunities to engage in discussions on research ethics in our field. Students will engage with visiting speakers and their work as well as participate in learning how to organize academic events. During the semester, students will also be introduced to the resources available at Purdue to support their graduate studies and professional development including funding opportunities, procedures for preparing for research, career planning, supports for teaching, information about the structure of the Anthropology graduate program and supports for work-life balance. Students will receive credit for the course based on participation. Permission of instructor required.

Learning Outcomes: 1. Identify resources to support your graduate study, research, funding, professional development, intellectual community, and work-life balance at Purdue. 2. Demonstrate enhanced understanding of Anthropology at Purdue, including the signature

research areas of our department, and the development of Purdue's Anthropologies of Tomorrow. Credits: 2.00

ANTH 60900 - Seminar In Anthropology

Credit Hours: 2.00 or 3.00. Topics vary. Permission of instructor required.

Credits: 2.00 or 3.00

ANTH 61100 - Special Topics In Archaeology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary archaeological research and theory. Topics will vary from year to year.

Learning Outcomes: 1. Learn both methodological and theoretical components by helping graduate students appreciate how archaeologists have conceptualized landscapes as analytical units, and how landscapes are inscribed with meaning by the people who occupy them. 2. Think critically about space and landscapes across a variety of archaeological contexts, and be exposed to a body of method and theory on which they may draw for their own research. Credits: 3.00

ANTH 62000 - Special Topics In Cultural Anthropology

Credit Hours: 3.00. Critical examination of a selected aspect of contemporary cultural anthropology research and theory. Topics will vary from year to year.

Credits: 3.00

ANTH 62700 - Political Ecology

Credit Hours: 3.00. Political ecology centers on questions described as a research framework that pairs the strengths of political economic analysis with sociocultural and ecological approaches to environmental change. Students will explore the diverse ways of doing political ecology by drawing upon the fields of anthropology, political science, geography, and history as well as interdisciplinary environmental sciences. Students will critically examine the field through a historical exploration of its intellectual genealogy, an investigation of current research trends, and imagining possible future directions. Emphasis will be placed on both theory and methods while analyzing a variety of case studies. Permission of instructor required.

Learning Outcomes: 1. Meet the Graduate School learning objectives of knowledge, communication, critical thinking, and ethical research through the goals listed here. 2. Learn about contemporary theory in political ecology. 3. Understand when and how various theoretical positions and logics of interpretation in political ecology and environmental justice have emerged. 4. Review several genres of political ecological work to understand its application as a research framework in interdisciplinary environmental social sciences. 5. Analyze a series of case studies that illustrate dominant positions and fissures in political ecological thought and practices, including non-western contexts. 6. Gain an understanding of how to apply political ecology frameworks to your own research. Credits: 3.00

ANTH 63000 - Academic Professional Development

Credit Hours: 3.00. This seminar focuses on research design, grant writing, publishing, giving presentations, and the academic job market. As there are other seminars offered in the department that focus on the applied aspects of anthropology, this seminar focuses primarily on academic topics. The substance of the course will come from your own work in the form of proposals, teaching, and job market materials as well as your review of fellow classmates' work.

Learning Outcomes: 1. Articulate research questions, methodology, and theoretical background for your PhD project within the structure of a grant proposal. 2. Present research orally adhering to professional standards. 3. Understand and prepare materials associated with an academic job. 4. Know about various venues for publishing. 5. Analyze your own development as an academic by doing career related research and self-reflective writing. Credits: 3.00

ANTH 64000 - Foundations And Frameworks: Applying Anthropology

Credit Hours: 3.00. This course focuses on using anthropology

to address social issues. The course examines topics including: the history of anthropologists working in applied settings, the relationship between theory and practice, professional ethics, job opportunities, and skills needed as anthropological practitioners. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Identify key questions and concerns in applied anthropology. 2. Speak about the relationship of anthropological theory and practice and how that relationship has been discussed in the discipline. 3. Know about a series of anthropological practice areas and their progression over time. 4. Analyze your own development as an anthropologist by doing career related research and self-reflexive writing in the course. Credits: 3.00

ANTH 64100 - Discovery And Design: Making Projects Work

Credit Hours: 3.00. This course is about using anthropology to make projects work. Students will learn anthropological approaches and methods to discover salient aspects of a design problem and use this understanding to devise responses. Anthropological discovery, design and delivery processes are demonstrated. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Be able to use Rapid Assessment Procedures (RAP), the Delphi Technique, Domain Analysis and Cross-Cultural Survey Design. 2. Understand how community projects are put together from goals and objectives, strategies implementation plans and monitoring and evaluation and be able to use that knowledge in effectively designing projects. 3. Write a funding proposal that clearly explains the purpose, impact, and essential features of the project in order to secure funding or other essential support. 4. Apply the skills of anthropological discovery and design in your own practice area of interest. Credits: 3.00

ANTH 64200 - Public Engagement: Using Anthropological Knowledge

Credit Hours: 3.00. This course is about using and communicating anthropological knowledge. We will discuss what it means to work as an anthropologist and public intellectual. Effectively working with stakeholders, presenting information, offering solutions for addressing problems and implementing change are addressed. Students should have some background in anthropology if coming from another discipline e.g. prior coursework or relevant experience as determined by instructor.

Learning Outcomes: 1. Know how to convey your anthropological ideas and findings for multiple purposes and audiences. 2. Be familiar with how some well-known anthropologists have had broad influence inside and outside our discipline. 3. Prepare your anthropological data and information for disseminating to different audiences and outlets. 4. Develop your anthropological critical thinking, writing and presentation skills to become a more effective anthropological communicator. 5. Consider the most successful ways for being an engaged anthropologist in your own areas of interests. Credits: 3.00

ANTH 69600 - Research MS

Credit Hours: 1.00 to 18.00. Research activities related to the MS degree. Possible activities might include, but are not limited to, data collection, individualized reading or project work, participation in group research meetings, proposal and project writing. Activities must be approved by the faculty supervisor. Permission of instructor required.

Credits: 1.00 to 18.00

ANTH 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ANTH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Brian Lamb School of Communication (Graduate)

Website: **https://www.cla.purdue.edu/communication**

Department/School Head

Marifran Mattson

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Josh Boyd Robert X. Browning Sabine Brunswicker Bart Collins John O. Greene Sorin Matei Marifran Mattson Melanie Morgan Felicia Roberts Glenn Sparks Howard Sypher Ralph Webb	Stacey Connaughton Seungyoon Lee Jane Natt Torsten Reimer	Emily Buehler Gaby Byrd Charles Catalano Tonantzin DeAztlan-Smith Jeremy Foote Jennifer Hoewe Ilwoo Ju Evan Perrault Brett Sherrick Hwanseok Song Diana Zulli

Academic Programs

Communication studies at Purdue University celebrate a long and distinguished history, having offered graduate degrees since 1947. Our campus-based M.A. and Ph.D. programs focus on five areas: organizational communication; interpersonal communication; public relations; health communication; and media, technology and society. Our fully online M.S. program focuses on strategic communication for industry professionals.

Master's and Ph.D. Programs (Campus-based)

Masters of Communication. Students can earn either an MA or an MS in Communication from the Brian Lamb School of Communication. Students have an option to choose a thesis track or a non-thesis track. The program is designed to be flexible and students can tailor the program to meet their individual interests. Our graduate program is organized along five instructional units:

- Health and Risk Communication
- Interpersonal Communication
- Organizational Communication
- Media Technology & Society
- Public Relations

Students take courses both within and outside of the school and within and outside their areas of specialty. All admitted students in the campus-based program receive funding.

Ph.D. in Communication. The Brian Lamb School of Communication offers a Ph.D. in Communication. The program is designed around these five instructional units:

- Health and Risk Communication
- Interpersonal Communication
- Organizational Communication
- Media Technology & Society
- Public Relations

One of the defining features of the program is its flexibility. Students design their own course work to create a program that is tailored and unique to each individual student. All admitted students in the campus-based program receive funding.

Concentrations (Areas of Study)

Health and Risk Communication: Issues of health have become increasingly critical and complex, generating the need for individuals who can communicate effectively about health. The health communication program at Purdue seeks to fulfill this growing need for trained health communicators by exposing students to the theory, research, and practice.

Interpersonal Communication: Scholarship in interpersonal communication focuses on the study of fundamental processes that occur in all social interactions (interpretation, message production), the codes (verbal and nonverbal) through which everyday interactions are accomplished, and the functions that people pursue in these interactions (persuading, informing, providing support, etc.) We also investigate how communication shapes, and is shaped by, human relationships, including

friendships, romances, families, and work relationships.
Media, Technology & Society: Graduate work in Media, Technology, and Society covers research on media and technological processes, their consequences, and the role that mass communication plays in both public and private life. Courses focus on local, national, and global media systems and audiences, as well as emerging information and communication technologies and environments.
Organizational Communication: Organizational communication examines the relationships between communication and organizing through the study of discourse, meanings, symbols, and information flow.
Public Relations: Purdue's public relations program emphasizes negotiation and maintenance of relationships among organizations and their social, political, and economic environments. The program emphasizes the integration of public relations theory and research into practice to develop an understanding of the interactions between organizations and their publics. The Public Relations unit at Purdue prepares students to cultivate and sustain mutually-beneficial relationships between organizations of all types and their strategic publics both as practitioners and researchers.

Master's Program (Online/Distance)

Online MS in Communication: The online MS program in communication, along with the graduate certificate in strategic communication management, is specifically designed for full-time professionals working in the industry. The program focuses on strategic communication concepts, such as public relations, integrated communication, and organizational communication, and helps students develop communication leadership skills necessary for professional success. Students in this program get an education in strategic communication planning, crisis communication, global communication, social media, communication research methods, and related areas. The program is entirely asynchronous, and students typically take courses one at a time in 8-week blocks. This online program is not designed for students desiring to prepare for full-time research/teaching positions or Ph.D. programs.

- Branding and Marketing Communication
- Digital Media and Communication Technologies
- Health Communication
- Management Communication and Leadership
- Strategic Communication/Public Relations

Online MS in Corporate Training and Communication: The online MS in Corporate Training and Communication is a unique interdisciplinary collaboration between the College of Education's MS in Learning Design and Technology and Brian Lamb School of Communication's MS in Communication. The program is designed to better prepare professionals to design, implement, assess, and evaluate training and communication effectiveness in the corporate environment. Students will graduate ready to create optimal learning materials integrating technology, and with strong communication skills that are needed and valued in every industry. Students will gain vital knowledge through courses covering current best practices in communication across cross functional teams, with an emphasis on the latest tools, techniques, strategies, and processes for educational training. The program is entirely asynchronous, and students typically take courses one at a time in 8-week blocks.

Combined Degree Programs: (Undergraduate Degree Master's Degree)

The Combined BA/MS in Communication is designed for current undergraduate Communication students to help them accelerate their graduate degree. Students in the program can take up to 12 credit hours that count toward both their Bachelor's and Master's degree beginning in their junior year. The Master of Science in Communication degree is entirely online, so students can live and work anywhere after earning their bachelor's degree.

Graduate Certificates (Degree or Non-Degree Students):

Strategic Communication Management: The certificate program is a fast-paced way for you to broaden your skillset with a greater understanding of impactful communication. The courses within the certificate program quickly instill within you the skills and confidence to meet your organization's communication needs across a variety of platforms.

Communication and Leadership: Through courses focused on the application of communication and leadership across various industries and professional settings, this communication and leadership certificate delivers valuable skills in cross-cultural teams, techniques for collaboration, and appropriate communication for superiors and subordinates.

Strategic Communication Management, Post-Baccalaureate Certificate

Communication, MA

Communication, MS

Communication and Leadership, Post-Baccalaureate Certificate

Sports Communication, Post-Baccalaureate Certificate

Health Communication Post-Baccalaureate Certificate

Communication/Gerontology, PHD

Branding and Marketing, Post-Baccalaureate Certificate

Digital Media and Communications Technology, Post-Baccalaureate Certificate

Communication, MS (OL)

COM 50000 - Introduction To Graduate Studies In Communication

Credit Hours: 3.00. Introduces basic conventions of the principles and procedures of scholarly research, surveys research methods utilized in the communication discipline, applies research methods to various subjects, and offers an overview of degree requirements. Course restricted to graduate students only.

Learning Outcomes: 1. Demonstrate an understanding of the breadth of the discipline of communication and the diversity of topics and approaches included therein. 2. Apply the full range of library research in communication (e.g., electronic resources, databases, and periodical collections). 3. Chart humanistic and social scientific approaches to scholarly endeavor. 4. Demonstrate competence in using the two acceptable writing style forms in the Department of Communication: The American Psychological Association (APA) and the Modern Language Association (MLA). 5. Evaluate published research from diverse perspectives. 6. Develop and write a research proposal and literature reviews as well as deliver an oral presentation from a specific disciplinary perspective. 7. Demonstrate an understanding of the culminating degree requirements for the master's degree in Professional Communication. Credits: 3.00

COM 50200 - Classroom Communication

Credit Hours: 3.00. An introduction to fundamental concepts and basic research related to communicative behavior in the classroom. The primary focus is on the study and application of principles of effective classroom communication through personal inquiry. Among topics discussed are components of classroom communication, systematic observation as a method of studying classroom communication, and applications of systematic observation in a variety of classroom communication settings. Department permission required.

Learning Outcomes: 1. Describe the nature of communication pedagogy. 2. Identify and discuss multiple moral and civic values for higher education. 3. Develop a specific lesson plan for a COM 11400 unit. 4. Deliver an effective lecture. 5. Facilitate a classroom discussion. 6. Develop appropriate classroom activities and assignments for a COM 11400

unit. Credits: 3.00

COM 50300 - Cross Cultural Communication

Credit Hours: 3.00. In this course, we examine the scholarly history of intercultural and cross-cultural communication along with conceptual and empirical challenges in doing this type of inquiry. Several contexts will be studied from the point of view of forms of cultural wisdom and variation in practices. Larger questions of idenity, diversity, and intercultural competence will be explored, especially through filters of globalization and ethical issues in intercultural relations. Students will have regular reading assignments, short reaction papers, give oral presentations, and write a final research paper or proposal, depending on their stage in their programs.

Learning Outcomes: 1. Discuss and exemplify how culture is a multimodal, multilayered set of practices, attitudes, and belief. 2. Analyze intercultural communication problems, illustrating the historical, cultural, economic, and political differences that affect their solutions. 3. Recognize a range factors impacting human cultural life, including, but not limited to, class, gender, nation, ethnicity. 4. Develop research ideas and methods to address current problematics in cross-cultural communication. 5. Develop, create, determine how to engage audiences around a global problem. 6. Practice using self-awareness, research, discussion, and peer review to explore cross-cultural challenges. Credits: 3.00

COM 50700 - Introduction To Semiotics

Credit Hours: 3.00. (ANTH 51900, AUSL 58900, ENGL 57000, LC 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena, which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Learning Outcomes: 1. Describe and apply semiotic theories. 2. Apply semiotic theory and practice to everyday life. 3. Apply semiotic theory to different socio-cultural contexts. 4. Describe the semiotic theory behind the social construction of reality. 5. Analyze sign systems within their socio-cultural milieus. Credits: 3.00

COM 50800 - Nonverbal Communication In Human Interaction

Credit Hours: 3.00. An examination of theoretical writings and critical studies in selected areas of nonverbal communication, e.g., the environmental influences, space and territory relationships, physical appearance and dress, physical behavior, and vocal cues. One unit will deal specifically with measurement, recording, or transcription methods used in nonverbal study.

Credits: 3.00

COM 51200 - Theories Of Interpersonal Communication

Credit Hours: 3.00. Review of contemporary theories, analysis of concepts, models, and pertinent research across the broad spectrum of interpersonal communication.

Credits: 3.00

COM 51800 - Theories Of Persuasion

Credit Hours: 3.00. Review of contemporary theories, including analysis of concepts, models, and pertinent research across the broad spectrum of persuasive communication.

Credits: 3.00

COM 52000 - Small Group Communication

Credit Hours: 3.00. Survey and critical evaluation of theoretical and empirical literature dealing with human communication within small group settings.

Learning Outcomes: 1. Explain theories of small group communication including theories about cohesion, conflict, power, leadership, decision-making, norms, and deviance. 2. Apply small group communication concepts and theories to their lived experience. 3. Analyze their own and others' behaviors in groups and its impact on small group communication. 4. Compose a case study analysis of a bona fide group. Credits: 3.00

COM 52700 - Introduction To Cultural Studies In Communication

Credit Hours: 3.00. An examination of selected cultural studies

perspectives on mass communication. Covers cultural studies philosophies, theories, and/or approaches to the study of cultural artifacts and practices that may include some of the following: postmodernism, deconstruction, feminism, and postcolonialism, and privileging context as a means of understanding culture.

Learning Outcomes: 1. Describe multiple cultural theory approaches to cultural artifacts and practices. 2. Explain the evolution of cultural studies as a theoretical movement. 3. Apply multiple theoretical lenses to analyze cultural artifacts and practices. 4. Critically critique power relations within the production and consumption of cultural artifacts. Credits: 3.00

COM 53100 - Special Topics In Mass Communication

Credit Hours: 3.00. Critical analysis and evaluation of current and continuing problems in both commercial and public mass communication.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

COM 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, AUSL 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

COM 57400 - Organizational Communication

Credit Hours: 3.00. Survey of the theoretical and empirical literature dealing with human communication behavior as it occurs within the context of complex organizations. Among topics covered are superior-subordinate communication, communication networks, message distortion, feedback processes, internal corporate mass media, managerial-communication climate, semantic and stylistic dimensions of messages, and communication in decision making.

Credits: 3.00

COM 57600 - Health Communication

Credit Hours: 3.00. Survey of health communication theory and research. Examines issues such as patient-provider and everyday communication, broader community-societal discourse, and organizational and mass health communication. Prepares participants for subsequent more specialized seminars and enriched study in allied specialties.

Learning Outcomes: 1. Identify discreet areas of health communication practice and research. 2. Explain communication issues important to patients. 3. Explain communication issues important to care givers. 4. Explain challenges to intercultural communication in the health care setting. 5. Critique media health campaigns. 6. Investigate and critique an area of health communication study. Credits: 3.00

COM 58200 - Descriptive/Experimental Research In Communication

Credit Hours: 3.00. Introduction to the fundamental tools of quantitative research in communication, including data analysis, statistical design and methods, basic measurement concepts, and designs for descriptive and experimental research. Individual and/or group research projects are planned, conducted, and reported. Permission of instructor required.

Learning Outcomes: 1. You will be able to understand and critically evaluate published research; 2. Be able to make appropriate choices regarding research design which fit within the assumptions of the proposed hypotheses or research questions; 3. You will be able to use basic statistical analysis procedures; 4. You will be able to utilize four research methods; 5. You will be able to write an effective literature review; 6. You will be able to communicate your results via the web. Credits: 3.00

COM 58500 - Qualitative Methods In Communication Research

Credit Hours: 3.00. An introduction to qualitative research methods in communication studies. Provides students with an overview of several techniques for, and issues in, gathering, analyzing, writing-up, and using qualitative data. Department permission required.

Learning Outcomes: 1. Examine the philosophical assumptions, theoretical traditions and epistemology of qualitative methods in the field of communication. 2. Understand various

approaches to qualitative inquiry, particularly entailing narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. 3. Critique written qualitative research in communication journals and identify ways to improve them. 4. Develop skills and techniques to design a qualitative research project, which includes the process of getting IRB approval, collecting and analyzing qualitative data, and writing up qualitative findings. Credits: 3.00

COM 59000 - Directed Study Of Special Problems

Credit Hours: 1.00 to 3.00. Directed study of special problems. Permission of instructor required.

Credits: 1.00 to 3.00

COM 59700 - Special Topics In Communication

Credit Hours: 3.00. Seminar of current topics of interest within the discipline of communication.

Learning Outcomes: 1. Explain, in depth, the topic of the variable topic course. 2. Describe the topic's relevance to the communication discipline. 3. Develop an appropriate topic for analysis. Credits: 3.00

COM 60000 - Foundations Of Human Communication Inquiry I

Credit Hours: 3.00. Introduces doctoral students to major and emerging approaches to understanding human communication and provides them with the theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims.

Credits: 3.00

COM 60100 - Foundations Of Human Communication Inquiry II

Credit Hours: 3.00. Following COM 60000 , this course continues to introduce doctoral students to major and emerging approaches to understanding human communication and provides theoretical background and analytic skills needed to navigate the tensions among these approaches. Reviews the intellectual history of communication inquiry, overviews traditional and innovative questions about human communication, examines the ways in which these questions can be addressed from different perspectives, addresses some of the varied forms that knowledge about human communication can take, and explores how different research traditions go about making and warranting knowledge claims. Prerequisite: COM 60000 .

Credits: 3.00

COM 60111 - Seminar In Strategic Communication

Credit Hours: 3.00. This graduate course will survey the theories and processes of strategic communication and its practice by business, government, politicians, and non-profits - in domestic and international arenas. The course will emphasize the application of theory to provide an in-depth understanding of planning, executing, and evaluating strategic communication plans. Prerequisite: Graduate student in communication. Permission of department required.

Learning Outcomes: 1. Understand the context in which strategic communication operates and the dynamics changing the profession, its work, and its value to clients and society. 2. Understand the theories which underlie strategic communication. 3. Understand the processes of the development and implementation of comprehensive communication strategies. 4. Strengthen writing and presentation skills relevant to strategic communication through course assignments. Credits: 3.00

COM 60211 - Seminar In Global Strategic Communication

Credit Hours: 3.00. This course provides students with a global perspective in strategic communication and provides knowledge and understanding of how to address communication issues with international audiences. This class emphasizes such questions as how strategic communication plans can be successfully implemented in other countries and how plans can be measured and evaluated. Prerequisites: Graduate student in communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Understand the role of

theory in international strategic communication. 2. Understand the unique role of ethics when implementing or evaluating strategic communication programs in international contexts. 3. Understand the specific role of strategic communication across a sample of nation states. 4. Understand the unique challenges presented by developing strategic communication plans globally. 5. Evaluate global strategic communication programs. Credits: 3.00

COM 60311 - Seminar In Crisis Communication

Credit Hours: 3.00. This graduate course will focus on how to communicate in a time of crisis in order to manage the situation and disseminate key messages to various stakeholders. Prerequisite: Graduate student in Communication and COM 60111 . Permission of department required.

Learning Outcomes: 1. Have a broad understanding of the crisis communication literature. 2. Be able to formulate solutions to crisis situations from multiple perspectives. 3. Anticipate actions and analyze stakeholders involved in crisis situations. 4. Be aware of and challenge critical assumptions in crisis situations. 5. Evaluate crisis plans. Credits: 3.00

COM 60411 - Seminar In Communication Research Methods

Credit Hours: 3.00. This graduate course serves as the methodological foundation of strategic communication. Students in this class will survey core research methods (qualitative and quantitative) in professional and applied settings. This class is fully online. Students will interact with faculty and other students throughout the week. Permission of department required.

Learning Outcomes: 1. Identify and describe the major elements of the research process. 2. Formulate meaningful research questions and hypotheses. 3. Identify appropriate research methodologies associated with different types of research questions and hypotheses. 4. Conduct a variety of basic analyses of common communication data sets. 5. Design a research proposal to answer a set of research questions or hypotheses. Credits: 3.00

COM 60511 - Strategic Communication And Professional Writing

Credit Hours: 3.00. This graduate course covers topics related to professional writing and strategic communication. Topics include grammar basics, audience considerations, credibility and ethics, and documentation style. In addition, writing will be discussed in a variety of contexts such as media, public relations, advertising, and business communication. Permission of department required.

Learning Outcomes: 1. Demonstrate mastery of writing, grammar, and style as well as various guidelines for academic and professional writing. 2. Articulate the role of credibility and ethics in professional writing. 3. Explain the importance of research and audience analysis in professional writing. 4. Analyze the unique challenges of writing in different contexts (e.g., advertising, public relations, media, business communication, print and online). 5. Evaluate strengths and weaknesses of various forms of written communication. 6. Produce various types of documents related to strategic communication. Credits: 3.00

COM 60611 - Seminar In Financial And Investor Relations

Credit Hours: 3.00. This course will provide students with a theoretical and practical overview of theory and practice in financial and investor relations. Student will learn about how the potential investors in public companies are and how to reach them. An emphasis will be placed on communicating with investors to facilitate informed investor decision-making. Prerequisite: COM 60111 Permission of department required.

Learning Outcomes: 1. Articulate the functions of investor relations. 2. Explain major theoretical concepts informing communication approaches to financial and investor relations. 3. Analyze and critique a corporation's investor relations strategy. 4. Develop an investor and financial relations strategy. 5. Evaluate key metrics for determining the effectiveness of an investor relations strategy. 6. Assess various relationship management strategies with

various publics/stakeholders associated with investor relations communication. Credits: 3.00

COM 60711 - Strategic Communication And Fundraising Management

Credit Hours: 3.00. This graduate course serves as an introduction to the concepts, elements, and best practices of fundraising. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of communication theory related to fundraising management. 2. Identify best practices of fundraising. 3. Analyze the importance of message design and mediums when creating fundraising campaigns. 4. Assess the implications of an organization's relationships with multiple publics/stakeholder groups for fundraising. 5. Evaluate case studies of fundraising in light of theory and best practices. Credits: 3.00

COM 60811 - Leadership And Global Strategic Communication

Credit Hours: 3.00. Over the last decade, the field of strategic communication has grown rapidly. The work of strategic communication professionals requires coordinated responses between distinct organizational units that are often separated by time and space. These conditions necessitate effective leadership. Further complicating leadership in these contexts is the fact that the work of strategic communication has increasingly become global in nature. This course provides students with theoretical background in leadership and global strategic communication, as well as the opportunity to apply what they learn to strategic communication cases and to their own professional experiences. It also encourages them to think proactively about leadership challenges in these contexts and to articulate theoretically-informed analyses and evaluations of leadership in action. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of theories related to leadership and to strategic communication in global contexts. 2. Articulate the relationship between theory and the practice of leadership as it relates to global strategic communication, and apply theoretical concepts and principles to real world contexts. 3. Explain the role of leadership and culture in global strategic communication. 4. Compare and contrast notions of leadership, corporate social responsibility, and negotiation across cultural contexts. 5. Identify the unique challenges experienced when leaders engage in strategic communication practices globally. 6. Evaluate the current knowledge base and "best practices" in global strategic communication. Credits: 3.00

COM 60911 - Strategic Public Relations

Credit Hours: 3.00. Strategic communication is composed, in part, of integrated marketing communication (IMC), advertising, and public relations. This course highlights public relations scholarship, which is one of the strengths of the Brian Lamb School of Communication. As such, it builds on the general strategic communication course by providing an in-depth understanding of public relations. Specifically, the class will cover public relations theories, ethics, concepts, principles, and applications. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of public relations theory. 2. Articulate the roles of ethics in public relations. 3. Assess the research, planning, and evaluation used in public relations practices. 4. Identify the unique challenges associated with developing public relations campaigns. 5. Evaluate public relations campaigns and responses. 6. Identify the various publics that public relations scholarship addresses. Credits: 3.00

COM 61000 - Special Topics In Public Relations

Credit Hours: 3.00. Intensive study, varying from semester to semester, in public relations. Permission of instructor required.

Credits: 3.00

COM 61011 - Strategic Communication And Ethics

Credit Hours: 3.00. This graduate course introduces the application of ethical principles and decision making. In this course, students will study both philosophical and practical ethical questions related to strategic communication. Permission of department required.

Learning Outcomes: 1. Exhibit mastery of diverse philosophical perspectives on ethics. 2. Compare and contrast insights offered by

different perspectives when applied to concrete dilemmas encountered in students' own work experience. 3. Synthesize ethical principles embedded in professional codes of ethics, and their implications for the practice of strategic communication. 4. Highlight ethical principles pertaining to working in organizational teams. 5. Evaluate ethical guidelines for gathering, analyzing, and presenting research data. 6. Identify challenges that occur when evaluating what constitutes ethical strategic communication across cultures. 7. Articulate possible relationships between ethical and effective strategic communication. 8. Evaluate new ethical questions about the practice of strategic communication arising from the emergence of new social media. Credits: 3.00

COM 61200 - Seminar: Special Topics In Interpersonal Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of interpersonal communication. Topics may include communication models, information theory, systems theory, general semantics, sociolinguistics, etc., as they relate to the study of interpersonal communication. Prerequisite: COM 51200 .

Credits: 3.00

COM 62111 - Seminar In Strategic Communication And Social Media

Credit Hours: 3.00. This course will provide an overview of social media and its relationship to strategic communication. Students will learn about the available forms of social media (e.g., Blogs, Social Networks, and Wikis) as well as their uses, strengths and weaknesses for building and managing relationship with stakeholders. Students will also gain exposure to methods for analyzing social media metrics as a framework for evaluating the effectiveness of social media strategies as tools for developing corporate, nonprofit, and governmental images and brands. Permission of department required.

Learning Outcomes: 1. Demonstrate their understanding of current theories of communication technology that bear on the use and impact of social media environments. 2. Articulate changes in strategic communication brought about by changes in technology. 3. Identify and become familiar with the most commonly used social media technologies used in industry to communicate with stakeholders. 4. Demonstrate the ability to use contemporary social media tools. 5. Develop a social media strategy for an organization. 6. Identify, track, and analyze key social media metrics for evaluating the effectiveness of a social media strategy. Credits: 3.00

COM 62211 - Social Media And Artificial Intelligence

Credit Hours: 3.00. This course provides an overview of the use of artificial intelligence and machine learning technologies in contemporary social media campaign development and management. Students will learn about the technologies, AI tools, theories, issues, challenges, ethical considerations, and best practices that inform the planning and implementation of successful social media communication and audience engagement. Throughout the course, students may engage in experiential learning, case studies, and group projects to apply their knowledge and gain hands-on experience in using AI for social media management.

Learning Outcomes: 1. Explain the basics of AI and its current and potential future applications in social media management. 2. Demonstrate how AI is used to collect and analyze social media data for insights and decision-making. 3. Evaluate how AI should not be used to create original social media content (text, audio, and video). 4. Articulate the importance and challenges of creating social media content that has a consistent (brand) voice but is tailored to fit specific social media platforms. 5. Review the potential use of AI-driven chatbots for customer support and interaction. 6. Assess the challenges and ethical concerns about AI-powered content moderation on social media. 7. Understand and explain the importance of making underlying AI algorithms transparent and explainable to social media users and managers. 8. Analyze the role of credibility and ethics in the use of AI in social media

management. 9. Identify the importance of research and audience analysis in social media management. 10. Demonstrate the ability to use AI to complete key social media management tasks. Credits: 3.00

COM 62300 - Artificial Intelligence & Social Media

Credit Hours: 3.00. This course provides an overview of the use of artificial intelligence and machine learning technologies in contemporary social media campaign development and management. Students will learn about the technologies, AI tools, theories, issues, challenges, ethical considerations, and best practices that inform the planning and implementation of successful social media communication and audience engagement. Throughout the course, students may engage in experiential learning, case studies, and group projects to apply their knowledge and gain hands-on experience in using AI for social media management.

Learning Outcomes: 1. Analyze the Role of AI in Social Media Communication: Critically evaluate how AI technologies are transforming social media marketing, content personalization, and user-engagement strategies. 2. Apply AI Tools for Social Media Campaigns: Integrate AI tools such as chatbots, sentiment analysis, and predictive analytics into the design and execution of effective social media campaigns. 3. Navigate AI in Social Media Practices: Assess the ethical implications of AI usage in social media, including issues related to privacy, bias, PII, data collection, and transparency, and propose solutions to mitigate these challenges. 4. Measure AI-Driven Social Media Outcomes: Use analytics to measure the effect of AI-enhanced social media strategies on brand awareness, audience engagement, and conversion rates. 5. Understand how artificial intelligence (AI) and machine learning (ML) technologies are used in social media management. 6. Investigate, understand and analyze how AI is leveraged to create personalized content and automate content generation, and the ethical/legal issues involved. 7. Explore and understand how AI is used to collect and analyze social media data for insights and decision-making. Credits: 3.00

COM 62411 - Focus Groups And Interviewing For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of qualitative research in public relations with a particular emphasis on focus group and interview methodologies. The course will consider practical applications of these protocols in strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that qualitative research seeks to answer. 2. Determine the relative value of focus groups or interview data as a mechanism for answering research questions and protocols. 3. Develop interview and focus group protocols for collecting qualitative data in strategic communication contexts. 4. Utilize strategies for interpreting qualitative data and reporting it systematically. 5. Conduct effective interviews and focus groups for a strategic communication project. Credits: 3.00

COM 62511 - Survey Design, Analysis, And Reporting For Strategic Communication

Credit Hours: 3.00. This course provides students with an overview of quantitative research in public relations with a particular emphasis on survey design analysis. The course will cover the design and delivery of questionnaires, the use and interpretation of descriptive and inferential statistical methods, and reporting of quantitative results. The course will consider practical applications of these methods in professional strategic communication contexts. Prerequisite: COM 60411 Permission of department required.

Learning Outcomes: 1. Identify the types of questions that survey research is best suited to answer. 2. Develop effective survey instruments for measuring a wide range of attitudes, behaviors, and beliefs related to strategic communication. 3. Recognize the pros and cons of different sampling and survey distribution methodologies as they apply to different research protocols. 4. Demonstrate an

understanding of common statistical approaches for analyzing survey data. 5. Apply survey methodologies to answer practical questions in the context of strategic communication. Credits: 3.00

COM 63200 - Seminar: Special Topics In Mass Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the literature of mass communication. Topics may include institutional analysis, mass communication law, information diffusion, uses of mass communication, or other issues. Permission of instructor required.

Credits: 3.00

COM 64011 - Seminar In Advertising

Credit Hours: 3.00. This course provides an overview of the strategic planning process for advertising including identifying the target audience, determining a positioning strategy and developing a communication media strategy. The course will provide information on theory and best practices that inform the planning and implementation process for successful advertising campaigns.

Learning Outcomes: 1. Create a strategic advertising plan. 2. Identify key aspects of a target audience. 3. Develop a positioning strategy. 4. Articulate communication objectives. 5. Determine a media strategy. Credits: 3.00

COM 64100 - Integrated Marketing Communication

Credit Hours: 3.00. Developing cohesive and integrated external and internal communication initiatives across traditional and social media channels is becoming increasingly important for strategic communication professionals. Traditionally, Public Relations, Marketing, and Advertising/Promotion have had separate functions; increasingly the role of strategic communication practitioners is to ensure the consistency of the brand story and message across all channels of communication. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111.

Learning Outcomes: 1. Identify and describe the different components IMC. 2. Defend the value of IMC for an organization. 3. Understand and appraise the business environment in which IMC operates. 4. Prepare written artifacts of IMC that based on theories of communication, marketing, and public relations, including a SWOT analysis and a media plan. 5. Critique IMC plans from a management perspective. 6. Apply principles and theories of IMC across each IMC function (e.g., public relations, marketing, advertising/promotion, etc.) Credits: 3.00

COM 64400 - Strategic Personal Branding

Credit Hours: 3.00. This graduate course will examine the theories and processes of personal brand development and self-marketing. The course will examine best practices, trends, and creative strategies used in contemporary personal branding. An emphasis will be placed on experiential learning, self-awareness, image and perceptual management, career development, self-promotion, brainstorming, and effective communication.

Learning Outcomes: 1. Convey deep understanding of personal mission, vision, values, personality, skills, and other key attributes and differentiators. 2. Develop a strong conceptual foundation for formulating distinctive, professional, and effective personal brands. 3. Demonstrate an understanding of various personal branding principles, theories, tools, techniques, and models. 4. Critique real-world personal brands for their authenticity, impact, and effectiveness. 5. Develop and present a personal branding and self-marketing campaign. Credits: 3.00

COM 64500 - Healthcare Communication

Credit Hours: 3.00. The healthcare environment is increasingly complex, and poses many challenges for communication professionals seeking to improve communication with key health industry stakeholders, including patients, providers, payers, government agencies, and others. This course provides an overview of a broad range of unique communication challenges associated with health and the healthcare industry. Topics include review and discussion of key issues such as, major health communication theories, issues associated with patient-provider interaction, adoption and use of health information and communication technologies, the development and implementation of health campaigns and other behavior change

initiatives, and marketing and public relations issues commonly faced by healthcare organizations. Prerequisites: Students must be admitted into the Online Masters of Science of Communication program. COM 60111

Learning Outcomes: 1. Recognize the basic components of the healthcare system and different models of healthcare delivery in the U.S. and other countries. 2. Describe major theories that inform health communication practice. 3. Articulate unique communication challenges facing the healthcare industry. 4. Develop strategies for designing, implementing, and evaluating healthcare-related campaigns. 5. Describe the impact of emerging communication technologies on healthcare practice. Credits: 3.00

COM 64600 - Strategic Corporate Branding

Credit Hours: 3.00. This graduate course will survey the theories and processes of business brand design, development, and implementation. The course will examine best practices, trends, and creative strategies used in contemporary business branding. An emphasis will be placed on experiential learning, case study analysis, and the application of relevant theory to provide an in-depth understanding of the development, planning, execution, and evaluation of business brands.

Learning Outcomes: 1. Develop a strong conceptual foundation for formulating creative, meaningful, and effective business brands. 2. Apply strategic branding concepts to a variety of business needs and applications. 3. Demonstrate an understanding of various branding principles, theories, tools, techniques, and models. 4. Critique real-world brands for their efficacy, impact, and creativity. 5. Develop and present a business branding campaign. Credits: 3.00

COM 65000 - Communication And Leadership

Credit Hours: 3.00. Communication is the essence of leadership, and this course aims to identify how communication can fuel productivity, drive consensus and push the organization to a leadership position within a market. At the same time, communication can sabotage one's success or be used as a weapon to silence voices and promote political agendas. This course aims to empower you to shape leadership throughout the organization and to know how to advise other leaders in their efforts to overcome communication challenges. Permission of department required.

Learning Outcomes: 1. Identify relevant theories and principles of organizational communication. 2. Understand how communication can increase team productivity. 3. Develop comprehensive internal and external communications plans. 4. Use data from an audit to make recommendations and decisions. 5. Construct a communications plan to achieve a leadership position in a marketplace. 6. Advise peers and colleagues as they work through their own communication challenges. 7. Identify communication strategies to communicate with executives when stakes are high. Credits: 3.00

COM 65100 - Organizational Culture And Internal Communication

Credit Hours: 3.00. The modern workplace had transformed well before a global pandemic magnified the paradigm shift already under way. In the United States, both consumers and the first five-generation workforce began to demand more from brand statements and value propositions. Those demands include genuine commitment to inclusion and diversity internally and corporate social responsibility externally. This course highlights the vital role professional communicators have in conveying brand and value statements that emanate from the organization's cultural core and carry forward to the consumer universe.

Learning Outcomes: 1. Explain how an organization's cultural core shapes its brand. 2. Identify channels that organizations use when communicating internally. 3. Discuss the significance and value of employees as brand ambassadors. 4. Recognize how inclusion organically builds a more diverse workforce. 5. Prepare a well-structure, convincing internal communication plan for an organization. Credits: 3.00

COM 65200 - Communication Education And Training

Credit Hours: 3.00. This course is designed to introduce fundamental concepts related to learning theory and learning

design as applied to training and educational settings. The course will examine best practices and strategies with a focus on assessing and enhancing communication-related skills.

Learning Outcomes: 1. Define key communication skills and vocabulary. 2. Understand and apply the basic tenets of learning theory. 3. Design, develop, and evaluate an effective educational workshop or course. Credits: 3.00

COM 65500 - Health Advocacy

Credit Hours: 3.00. This course considers how federal, state, and local policy influence health status and health improvement. Through this course students gain an understanding of the role of health communication campaigns in health advocacy efforts. To engage their understanding, students will apply an advocacy campaign model to address a relevant health issue.

Learning Outcomes: 1. Understand of the role of health communication campaigns in health advocacy efforts. 2. Apply an advocacy campaign model to address relevant health issues. 3. Plan for a needs assessment. 4. Understand how health policy is enacted at different levels of government. 5. Conduct formative research. Credits: 3.00

COM 66111 - Sports Communications

Credit Hours: 3.00. This course provides students a strategic and holistic sports communication approach and framework to solve for communications challenges. The course focuses on understanding the ever-increasingly competitive athletic landscape - collegiate and professional (though the lines are blurring) -- to aid the sports communicator in crafting a strategic communication plan based on quantifiable objectives and desired outcomes. Special topics include crisis and reputation management, leveraging social media, the emergence of AI, and athletes and culture.

Learning Outcomes: 1. Develop a strategic sports communication plan. 2. Integrate social media and AI into strategic communication planning. 3. Apply effective strategies to engage productively with collegiate and professional sports media. 4. Analyze a crisis event to develop strategies for advancing organizational reputation. 5. Articulate the role of sports in culture. Credits: 3.00

COM 66211 - Strategic Sports Media Relations

Credit Hours: 3.00. This course explores how to navigate a media landscape that is evolving at light-speed both in collegiate and professional sports. The course offers students the tools to engage productively with media members and places particular emphasis on the communicator/media relationship, how media prefer to receive content and the role of the communications leader. Strategic Sports Media Relations also delves into media interaction during crisis events and the rise of AI.

Learning Outcomes: 1. Articulate how sports media relations have evolved across print, radio, TV, online and social media. 2. Explain the roles of collegiate and professional athletics communicators. 3. Demonstrate the ability to facilitate interviews and pitch/write in the sports media relations setting. 4. Respond to crisis and reputation management events. 5. Discuss sports media relations ethics/law and AI's impacts. Credits: 3.00

COM 67400 - Seminar: Special Topics In Organizational Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature of organizational (including business and industrial) communication; analysis of recurring communication problems in complex organizations; critique of research findings and methodologies.

Credits: 3.00

COM 67600 - Seminar: Special Topics In Health Communication

Credit Hours: 3.00. Intensive study of selected topics, varying from semester to semester, from the theoretical and research literature on health communication. Prerequisite: COM 57600

Credits: 3.00

COM 68200 - Seminar: Special Topics In Quantitative Research

Credit Hours: 3.00. Intensive study, varying from semester to semester, of different aspects and applications of quantitative research in communication. Prerequisite: COM 58200

Credits: 3.00

COM 69500 - Curricular Practical Training

Credit Hours: 1.00 to 3.00. Internship providing practical field experience under professional supervision in selected situations related to the student's area of specialization. Good standing in the graduate program of the Department of Communication and an approved plan of study including the internship. Permission of instructor required.

Learning Outcomes: 1. Apply communication concepts to industry or sector-specific communication problems and projects. 2. Develop communication skills specific to work in a specific sector or industry. 3. Gain valuable experience working alongside communication and industry leaders in the workplace. Credits: 1.00 to 3.00

COM 69800 - Research MA Or MS Thesis

Credit Hours: 1.00 to 18.00. Research MA Or MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

COM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of English (Graduate)

Website: **https://www.cla.purdue.edu/english/gradstudies/index.html**

Department/School Head

Alfred J. Lopez

Faculty by Rank

Professor		Associate Professor	Assistant Professor
Dorsey Armstrong	Brian Leung	Emily Allen	Harris Bras
Jennifer Bay	Maren Linett	Samantha Blackmon	
Elena Benedicto	Alfred Lopez	Marlo David	
Kristina Bross	Robert Marzec	Geraldine Friedman	
Harry Denny	Daniel Morris	Tara Johnson	
Bradley Dilger	Nancy Peterson	Michael Johnston	
Angelica Duran	Donald Platt	Christopher Lukasik	
John Duvall	Arkady Plotnitsky	Robyn Malo	
Dino Franco Felluga	Manushag Powell	Jennifer Freeman	
Wendy Stallard Flory	Thomas Rickert	Marshall Derek Pacheco	
Elaine Francis	Michael Salvo	Aparajita Sagar	
Shaun Hughes	Sharon Solwitz	Ryan Schneider	
Richard Johnson-Sheehan	Patricia Sullivan		
Robert Lamb	Paul Whitfield White		

Academic Programs

Master's and Ph.D. Programs

The Purdue English department teaches the adaptive thinking, empathy, and creativity that the current job market demands and that global citizenship requires. We are a diverse, robust, and challenging program of graduate study-and remain among the best English departments for graduate studies in the country. In the Purdue English department, graduate teaching assistants (GTAs) have opportunities to teach introductory composition in our renowned ICaP program, as well as apply for other teaching opportunities in professional writing, film studies, literature courses, creative writing, and more. In addition, research fellowships and other TA positions-such as working for Modern Fiction Studies, the Purdue OWL, on-campus writing lab, or CROW (Corpus & Repository of Writing) Lab-offer alternative, valuable academic opportunities.

Ph.D. Program

To qualify for a doctoral degree, the candidate must meet University and Department requirements as to minimum hours of credit (30), residence, proficiency in a language other than English, and grades (cumulative GPA no less than 3.0). The candidate must also:

- Pass one written preliminary examination
- Demonstrate proficiency in a secondary area by either course work or a second written preliminary examination
- Submit and defend a dissertation prospectus
- Write and defend a dissertation.

MA Program

To qualify for a master's degree, the candidate must meet university and departmental requirements as to hours of credit, residence, required courses, and grades (cumulative GPA no less than 3.0). The candidate must also pass the M.A. examination or write a satisfactory thesis.

All students in Rhetoric and Composition must complete two core courses: ENGL 50100 and one course in English Language and Linguistics. All M.A. students also must take at least one 600-level seminar. All students in Literature, Theory, Cultural Studies must complete ENGL 50100.

Students concentrating in Literature, Theory, Cultural Studies must take one course in each of four separate areas of literature listed below.

- Medieval & Early Modern
- Transatlantic and Early Atlantic Studies
- 20th Century and Contemporary
- Theory and Cultural Studies

Students emphasizing Rhetoric and Composition must take one course in at least three separate areas of literature from the four listed above.

Concentrations (Areas of Study):

- Rhetoric and Composition
- Literature, Theory, Cultural Studies
- Medieval & Early Modern
- Transatlantic and Early Atlantic Studies
- 20th Century and Contemporary
- Theory and Cultural Studies

Graduate Certificates (Degree or Non-Degree Students)

- Medical and Healthcare Writing (Online)

English: Literature, Theory, Cultural Studies Concentration, PHD

Natural Language Process, Post-Baccalaureate Certificate

Second Language Studies/ESL, Post-Baccalaureate Certificate

English, MA

English: Creative Writing Concentration, MFA

English: Rhetoric and Composition Concentration, PHD

History of the English Language, Post-Baccalaureate Certificate

Medical and Healthcare Writing, Post-Baccalaureate Certificate

ENGL 50100 - Introduction To English Studies

Credit Hours: 3.00. Introduction to graduate studies in English with special emphasis on research and reference tools, methods of bibliography, and the writing of scholarly papers. Prerequisite: Fulfillment of the basic composition requirement and 6 credit hours in English.

Credits: 3.00

ENGL 50200 - Practicum In Teaching College Composition

Credit Hours: 1.00. Reading professional literature, preparing syllabi; evaluating student papers, leading discussions. Required of all teaching assistants in their initial semesters.

Credits: 1.00

ENGL 50500 - Approaches To Teaching College English

Credit Hours: 3.00. Reading professional literature on the teaching of writing, linguistics, and ESL. Studies of methodologies, issues of assessment, and the relationship between theory and pedagogy. This course is not part of the degree requirement. Open only to teaching assistants in the Department of English. Permission of instructor required.

Credits: 3.00

ENGL 50600 - Introduction To English And General Linguistics

Credit Hours: 3.00. General study of language and linguistic theory with emphasis on English. Problems and methods in phonology, morphology, syntax, and semantics. Current techniques of linguistics analysis.

Credits: 3.00

ENGL 50700 - Advanced Poetry Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing poetry, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise poems, using all the skills from ENGL 40700 but at a more proficient level. 2. Produce a portfolio of poems revised according to suggestions received in workshop and in individual conferences with the instructor. 3. Acquire a broader knowledge of the context of contemporary poetry by reading and discussing several volumes by contemporary poets.

Credits: 3.00

ENGL 50900 - Advanced Fiction Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing fiction, with the primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise fiction, using all the skills from English 40900 but at a more proficient level. 2. Produce polished fiction revised according to suggestions received in workshop and feedback from the instructor. 3. Acquire a broader knowledge of the context of contemporary fiction by reading and discussing work by several contemporary fiction writers.

Credits: 3.00

ENGL 51100 - Semantics

Credit Hours: 3.00. An introduction to and survey of current semantic theories and methods with an emphasis on English. Basic concepts of linguistic semantics and its relation to the other semantics. Compositional (transformational), model-

theoretical (truth-conditional), pragmatic, and contextual semantics.

Credits: 3.00

ENGL 51200 - English Syntax And Syntactic Theory

Credit Hours: 3.00. Introduction to English syntactic structure, syntactic argumentation, and syntactic theory. Emphasis on one current theory as the primary theoretical framework, with other theories considered.

Credits: 3.00

ENGL 51300 - English Phonology

Credit Hours: 3.00. Introduction to current phonological theory, with applications to descriptions of American and British English. Articulatory description of English phonological structure and contrastive analysis of phonetic variation across dialects. Evolution of the stress system of English and its utilization by poets writing metrical verse.

Credits: 3.00

ENGL 51500 - Advanced Professional Writing

Credit Hours: 3.00. Production of documents and coordination of publishing projects for clients and users; application of advanced principles of document design, rhetoric, collaboration, and project management; and team writing in a computer-networked environment.

Credits: 3.00

ENGL 51600 - Teaching English As A Second Language: Theoretical Foundations

Credit Hours: 3.00. Survey of theories of learning and teaching English as a second/foreign/international language. Focus is on current theories and their implications for practice.

Learning Outcomes: 1. Demonstrate an understanding of current theories of second-language learning and teaching and their implications. Credits: 3.00

ENGL 51800 - Teaching English As A Second Language: Principles And Practices

Credit Hours: 3.00. Studies of issues and principles in ESL/EFL program development. Emphasis is on practical application of theory in a variety of English learning and teaching contexts in the U.S. and abroad.

Credits: 3.00

ENGL 52000 - Eighteenth-And Nineteenth-Century Literature

Credit Hours: 3.00. Study of key texts and movements in literature from the 18th and 19th centuries, with emphasis on historical, cultural, and theoretical contexts. Literary movements may include (but are not limited to): Neoclassicism, Sentimentalism, Romanticism, Victorianism, Realism, and Naturalism. Genres may include (but are not limited to): poetry, drama, the essay, autobiography/memoir, travel narratives, various forms of the novel, and short fiction. Critical concerns may include (but are not limited to) close textual studies, reception studies, the relation of literature to social and technological change, and the relation of literature to other artistic and cultural modalities. Additional topics include (but are not limited to) the history of critical interpretation, contemporary theoretical frameworks, and research methods and practices.

Learning Outcomes: 1. Explain the historical, cultural, and theoretical contexts shaping key works of 18th- and 19th-century literature. 2. Analyze literary texts using contemporary critical and theoretical frameworks. 3. Compare and contrast the ways in which 18th- and 19th-century literature engages with themes including individualism, democracy, and industrialization. 4. Assess the influence of historical and cultural events on the development of literary styles and genres.

Credits: 3.00

ENGL 52100 - Medieval Language And Literature

Credit Hours: 3.00. This course offers an in-depth exploration of key texts and themes from medieval English literature, focusing on the period roughly from the 9th to the 15th century. With an emphasis on texts' historical, cultural, and literary contexts, this course examines genres such as epic, romance, religious allegory, and early drama. Key topics include the nature of early English heroism as derived from the Germanic/Norse traditions, the development of chivalric and romance literature from the French tradition, the role of women in medieval narratives, the development of the English language, and the intersection of secular and religious thought.

Learning Outcomes: 1. Identify and recall key works of medieval literature along with their authors, historical contexts, and major themes. 2. Demonstrate an understanding of the major literary genres and forms in medieval literature

and will explain their cultural and historical significance. 3. Apply critical concepts and methodologies in medieval literary studies to interpret and analyze primary texts within their historical and social contexts. 4. Analyze the representation of key themes in medieval literature and will compare these representations across different works and traditions. 5. Evaluate scholarly interpretations of medieval texts, critically assessing different critical approaches and methodologies, and developing informed, evidence-based arguments. Credits: 3.00

ENGL 52200 - Renaissance Literature

Credit Hours: 3.00. This course is an intensive survey of the major genres (epic, drama, lyric, prose) and writers of the English Renaissance (1400-1700) within the context of England's history and the European Renaissance primarily. Key themes include the rediscovery of classical antiquity, the emergence of individualism, the influence of religion and science, and the changing conceptions of gender and power. Critical readings and research activities will demonstrate the significant role of English Literature in the development of world literature and globalization.

Learning Outcomes: 1. Identify various theoretical approaches to literature and then apply them to Renaissance literary texts. 2. Define important literary terms, genres, and conventions within their cultural, and aesthetic contexts in relation to the specific era of the Renaissance, 1300-1700. 3. Produce clear oral communication and written text, especially well-reasoned arguments about literary texts and their interaction with the Renaissance era and the era's reception, based on appropriately selected, evaluated, and presented textual evidence. 4. Practice, employ, and begin developing primary research activities associated with literary studies, especially those most applicable to the Renaissance era.

Credits: 3.00

ENGL 53200 - The English Novel In The Nineteenth Century

Credit Hours: 3.00. A survey of fiction up to about 1880, including such novelists as Scott, Dickens, Thackeray, the Brontes, Eliot, and Meredith.

Credits: 3.00

ENGL 54100 - Studies In Chaucer's Canterbury Tales

Credit Hours: 3.00. Critical reading of The Canterbury Tales and related works in Middle English, with attention to the literary and cultural background and to secondary studies.

Credits: 3.00

ENGL 54300 - Shakespeare In Critical Perspective

Credit Hours: 3.00. Shakespeare's plays read in context of historical and contemporary literary theory and criticism, considering such issues and approaches as structuralism, Marxism, deconstruction, new historicism, colonialism, sexuality, race, and gender.

Credits: 3.00

ENGL 54700 - British Romanticism

Credit Hours: 3.00. Readings from among the works of the High Romantics and other figures; discussion of historical, philosophical, cultural debates of the era, with attention to current critical and theoretical developments in the field.

Credits: 3.00

ENGL 54800 - Victorian Literature

Credit Hours: 3.00. A study of selected English poetry and prose, largely nonfiction, from circa 1830-1900. Includes readings from such figures as Arnold, Barrett, Bronte, Browning, Carlyle, Mill, Rosetti, Ruskin, and Tennyson.

Credits: 3.00

ENGL 55200 - Studies In Major American Authors

Credit Hours: 3.00. A study of the works of one or two influential American authors.

Credits: 3.00

ENGL 55300 - Colonial And Early American Literature

Credit Hours: 3.00. A survey of American literature to about 1820. Texts of major and minor authors, such as Bradford, Bradstreet, Rowlandson, and Cooper, are viewed within their cultural context.

Credits: 3.00

ENGL 56000 - Modern American Poetry

Credit Hours: 3.00. A survey of modern American poetry. Emphasis will be on major writers such as Eliot, Pound, Frost, Stevens, and Lowell, but attention will be paid to lesser figures.

Credits: 3.00

ENGL 56002 - Twentieth- And Twenty-First Century Literature

Credit Hours: 3.00. Study of key texts and movements in literature from the 20th and 21st centuries, with emphasis on historical, cultural, and theoretical contexts. Topics may include modernism, postmodernism, global literatures, postcolonial studies, environmental writing, and evolving narrative forms in response to technological and social change. Focus on critical interpretation, research methodologies, and contemporary theoretical frameworks.

Learning Outcomes: 1. Explain the historical, cultural, and theoretical contexts shaping key works of 20th- and 21st-century literature. 2. Analyze literary texts using contemporary critical and theoretical frameworks, such as formalism, disability studies, postmodernism, postcolonialism, and ecocriticism. 3. Compare and contrast the ways in which 20th- and 21st-century literature engages with themes such as identity, politics, technology, and globalization. 4. Assess the influence of historical and cultural events (such as World War I, the Cold War, and 9/11) on the development of literary styles and genres. Credits: 3.00

ENGL 56300 - Historical Linguistics

Credit Hours: 3.00. (ANTH 56300, LC 56300) A survey of mechanisms and motivations of linguistic change. Topics include: phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

ENGL 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, LC 56500, LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

ENGL 56900 - Contemporary Criticism And Theory

Credit Hours: 3.00. Study of contemporary criticism and theory generally focused on such schools and movements as structuralism, psychoanalysis, poststructuralism, feminism, new historicism, cultural studies, and gay and lesbian studies.

Credits: 3.00

ENGL 57000 - Introduction To Semiotics

Credit Hours: 3.00. The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena which can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

ENGL 57900 - Modern British Fiction

Credit Hours: 3.00. Critical study of twentieth-century novels, mainly before World War II, by such writers as Conrad, Lawrence, Forster, Joyce, and Woolf.

Credits: 3.00

ENGL 58500 - Creative Nonfiction Writing

Credit Hours: 3.00. Study and practice of advanced methods of composing creative nonfiction, with primary emphasis on the student's own work. Workshop criticism and discussion of published writing.

Learning Outcomes: 1. Write and revise sophisticated creative nonfiction through the study and practice of techniques unique to the genre. 2. Produce polished creative nonfiction revised according to suggestions received in workshop and feedback from the instructor. 3. Acquire a broader knowledge of the context of contemporary creative nonfiction by reading and

discussing work by several contemporary fiction writers. Credits: 3.00

ENGL 58900 - Directed Writing

Credit Hours: 1.00 to 3.00. Writing (creative, popularly technical, biographical, historical, philosophical) on subjects of the student's choice. Individual conferences only; no class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 59000 - Directed Reading

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Individual conferences; no class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

ENGL 59100 - Introduction To Composition Theory

Credit Hours: 3.00. A survey of major contemporary theories of invention and style, including such topics as heuristics; the aims and modes of discourse; stylistics; readability theories; sentence-combining; error analysis; audience; and evaluation. Applications to teaching will be made.

Credits: 3.00

ENGL 59200 - Postcolonial Studies

Credit Hours: 3.00. Study of works from once colonized cultures in Africa, Asia, and the Caribbean, and/or postcolonial diasporas. Individual sections will focus on one or more of the following: literature, women's literature, film, or feminist and cultural theory.

Credits: 3.00

ENGL 59400 - Contemporary Poetry

Credit Hours: 3.00. Study of poetry of the past two or three decades, both American and foreign, and their interaction. Attention to influences, "schools," and little magazines, as well as to conventional sources.

Credits: 3.00

ENGL 59500 - Contemporary American Fiction

Credit Hours: 3.00. Intensive study of contemporary and postmodern American fiction within various formal, theoretical, and cultural contexts, including multiculturalism, poststructuralism, and gender analysis, among others.

Credits: 3.00

ENGL 59600 - Advanced Studies In Literature Or Language

Credit Hours: 3.00. Advanced study of a topic within the instructor's fields of specialization. Emphasis on scholarly analysis and research.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

ENGL 59700 - Contemporary Black Feminist Literature

Credit Hours: 3.00. An intense examination of recent literary works by black women along with various critical theories constructed about black women's literature, beginning with the premise that black feminism is a "sign to be interrogated, a locus of contradictions."

Credits: 3.00

ENGL 59900 - Academic Language And Content Area Learning

Credit Hours: 3.00. (EDCI 55900) Course focuses on theoretical and practical knowledge for teachers about how second languages are learned, and on the educational and philosophical basis for second language teaching and learning. The course links English language development to teaching and learning strategies and is designed for undergraduate and graduate students in education and practicing teachers.

Learning Outcomes: 1. Develop an understanding of the linguistic challenges of academic language in the content areas of science, language arts, mathematics, and the social studies for ELLs. 2. Gain experience in determining academic tasks that require advanced levels of reading and writing. 3. Learn about the development of academic literacy as ELLs move from elementary into secondary and postsecondary education. Credits: 3.00

ENGL 60100 - Teaching Literature At The College Level

Credit Hours: 3.00. Focuses on the practical and theoretical issues related to teaching literature at the college level. Topics include course design, literary canons and text selection, teaching and learning styles, close reading, writing about literature, assessment, and professional ethics. Prerequisite: ENGL 50100 or consent of department. Restricted to graduate students in the Department of English.

Learning Outcomes: 1. Understand practical and theoretical issues of teaching literature to undergraduates. 2. Demonstrate familiarity with a variety of methods for teaching literature of various genres and encouraging active learning. 3. Design effective writing assignments and assess them effectively. 4. Understand the rights and responsibilities of students and instructors. Credits: 3.00

ENGL 60111 - Introduction To Scientific, Technical, Medical, And Healthcare Writing

Credit Hours: 3.00. Introduction to Scientific, Technical, Medical, and Healthcare Writing offers an overview of the genres, conventions, and strategies that these professional fields have in common. This course is the gateway course into the online Professional Certificate and Masters in Scientific, Technical, and Medical Communication. Permission of department required.

Learning Outcomes: 1. Identify the written, spoken, and media genres that are common to scientific, technical, medical, and healthcare industries. 2. Explain how genres and conventions are used in professional workplaces within a variety of industries. 3. Demonstrate how common communication strategies can allow a writer, speaker, or media user to explain scientific, technical, medical, and healthcare concepts and to persuade others. 4. Develop a common genre set that is applicable to the needs of a particular workplace within a broader scientific, technical, medical, and healthcare industry. 5. Evaluate existing communication practices at a workplace or within an industry and make recommendations for improvements. Credits: 3.00

ENGL 60211 - Science Writing

Credit Hours: 3.00. This course teaches students how to use the various writing styles and rhetorical strategies that are common in popular science and the scientific workplace. More specifically, they learn how to analyze, prepare, and edit technical and professional documents needed to effectively communicate within scientific professions, with specialized focus on reporting science news, conducting interviews with scientists, and identifying and explaining current debates in science. Permission of department required.

Learning Outcomes: 1. Describe, analyze, and understand the particular written genres that are needed in the field of science writing. 2. Explain and translate scientific information to scientists, policy makers, and the public 3. Understand and demonstrate the ways in which rhetorical choices construct meaning in scientific contexts. 4. Analyze audiences for various forms of science writing, predict their needs, and craft writing that is audience appropriate. 5. Conduct professional interviews with scientists and other stakeholders in scientific issues in order to clearly articulate the findings of those interviews in a written format. Credits: 3.00

ENGL 60311 - Medical And Healthcare Writing

Credit Hours: 3.00. This course helps students master various genres, writing styles, and rhetorical strategies common in medical and healthcare contexts. More specifically, you will learn how to analyze, prepare, and edit documents that are used to communicate within and about the healthcare industry (i.e., protocols, patient educational materials, and proposals). Permission of department required.

Learning Outcomes: 1. Identify and understand the written genres that are common in healthcare and medical fields. 2. Analyze audiences for medical and healthcare documents and understand their needs. 3. Generate and translate health complex medical information to both healthcare professionals and the public. 4. Organize information in a way that is accessible and useful in healthcare workplaces. 5. Develop and design professional

quality medical documents such as protocols, patient educational materials, and proposals. Credits: 3.00

ENGL 60411 - Writing Proposals And Grants

Credit Hours: 3.00. Writing Proposals and Grants teaches students how to analyze requests for proposals, analyze problems, devise project plans, and write proposals for for-profit corporations and non-profit organizations. Permission of department required.

Learning Outcomes: 1. Interpret and analyze a request for proposals (RFP). 2. Identify the ""problem"" that initiated the RFP by determining its causes and effects. 3. Develop clear objectives, outcomes, and deliverables that will make a project attractive to a client. 4. Propose a project plan that meets the client's needs and expectations. 5. Demonstrate why your company or organization is uniquely qualified to take on the project. 6. Compare the costs and benefits for readers of accepting a project proposal or grant proposal. 7. Present a proposal orally or in video form to decision-makers. Credits: 3.00

ENGL 60500 - Computers In Language And Rhetoric

Credit Hours: 3.00. Seminar that investigates how computers figure in contemporary theories of text and text making. Typical topics: critiques of technology, hypertext, cyberspace, computer-mediated communication, Internet, electronic writing, online research, pedagogy, and publishing.

Credits: 3.00

ENGL 60511 - Editing And Publishing

Credit Hours: 3.00. The purpose of this course is to show you how to use professional editing techniques to produce high-quality and publishable documents. Students learn how to work as a professional editor at four "levels of edit," which include proofreading, copyediting, substantive editing, and development editing. Permission of department required.

Learning Outcomes: 1. Apply editing techniques at the four levels of edit (proofreading, copyediting, substantive editing, and development editing). 2. Demonstrate effective decisions about the kinds of editing needed and expected for a task or a piece of writing. 3. Employ editing and publishing terminology and knowledge to a variety of documents in a variety of situations. 4. Demonstrate the use of proofreading and copyediting marks as used in print-based and electronic documents. 5. Employ strategies for doing substantive editing on larger documents in scientific, technical, medical, and healthcare professional settings. Credits: 3.00

ENGL 60600 - Seminar In Poetry Writing

Credit Hours: 3.00. An advanced course in the writing of poetry. Workshop criticism. Study of the work of established writers. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Enhance active reading skills through the close examination and critique of the poetry, notebooks, and letters of established poets. 2. Enhance feedback skills through thoughtful, frank, tactful, and intelligent critiques of your classmates' poems. 3. Enhance writing skills through intensive writing of original poetry and through structure exercises. Credits: 3.00

ENGL 60611 - Technical Communication

Credit Hours: 3.00. The purpose of this course is to show students how to write technical documentation and produce high-quality and reader-centered documents. They learn to write documents in several modalities, including print, electronic, audio, and video. Permission of department required.

Learning Outcomes: 1. Apply technical concepts, processes, and terms effectively for the purposes of informing and persuading. 2. Identify, analyze, and understand the particular written genres and conventions of various workplaces so that they can be shaped to fit one's professional needs. 3. Classify and identify audiences for specific technical documents. 4. Demonstrate an understanding audience needs by crafting writing, designing documents, and producing audio-visual texts

that address and take those needs into consideration. 5. Produce and manage common professional documents in collaboration with others. Credits: 3.00

ENGL 60700 - The Theory And Craft Of Creative Writing

Credit Hours: 3.00. A study of the craft of poetry, fiction, or drama with some consideration of underlying theories. Prerequisite: admission to the MA program in creative writing.

Learning Outcomes: 1. Develop reading and analysis skills of the techniques used in other authors' writing. 2. Apply analysis skills learned from other authors' writing to your own writing through imitation and adaptation. 3. Develop skills in the teaching of writing through peer review, discussion, and presentations. Credits: 3.00

ENGL 60711 - Designing Documents, Interfaces, And Graphics

Credit Hours: 3.00. The purpose of this course is to introduce students to visual rhetoric principles that are commonly used to design documents and interfaces, as well as show them how to use multimedia tools for designing visual texts. Students also learn how to create effective visuals, such as graphs, charts, and tables. Permission of department required.

Learning Outcomes: 1. Recognize gestalt principles of design and how they operate in documents and interfaces. 2. Critique the design of documents and interfaces to determine whether they are working properly and determine how they can be improved. 3. Utilize computer-based design tools for designing documents and multimedia texts. 4. Create effective graphs, charts, and tables that complement written text. 5. Explain how design, typography, and color work together to make documents and interfaces intuitive, accessible, and attractive. 6. Develop a reliable design process that governs the visual design of individual and team-based projects. Credits: 3.00

ENGL 60811 - Entrepreneurship Communication

Credit Hours: 3.00. The purpose of this class is to teach students how to use design thinking and information experience (IX) strategies to be innovative and generate new ideas for products and services. Students will learn how to write a business model and pitch that business model to investors or their supervisors. Permission of department required.

Learning Outcomes: 1. Identify and use written genres that are common in business start-ups. 2. Use design thinking principles to envision new products and services, empathize with users, and ideate with new technology. 3. Analyze a market for your business and its products and services. 4. Develop a marketing strategy for raising awareness of your business. 5. Propose a new business concept by writing a business plan or model. Credits: 3.00

ENGL 60900 - Seminar In Fiction Writing

Credit Hours: 3.00. An advanced course in the writing of fiction. Workshop critiques. Prerequisite: Admission to the creative writing program.

Learning Outcomes: 1. Enhance reading skills through close examination of other writers, including classmates and professional writers. 2. Enhance vocabulary for the creative writing discourse community. 3. Enhance feedback skills through thoughtful, frank, tactful, and intelligent discussion of your classmates stories and novel chapters. 4. Expand reading and writing aesthetics, and understanding of what literature is and can be, that will guide your reading and writing in the future. 5. Produce fiction benefitting a third-year thesis. Credits: 3.00

ENGL 60911 - User Experience And Design Thinking

Credit Hours: 3.00. The purpose of this courses is to show students how to employ User Experience (UX) principles to design documents, interfaces, and products for scientific, technical, healthcare, and medical situations, making those interactions intuitive, easy, and even pleasurable. Design

thinking broadens out the focus, using design as a systematic way of understanding a company's customers, defining their problems and needs, ideating to create new solutions with emerging technologies, and prototyping those solutions. Permission of department required.

Learning Outcomes: 1. Critique the design of interfaces and documents through user experience (UX) principles. 2. Assess UX situations and anticipate the needs and problems that users, customers, and clients are try to solve. 3. Select UX strategies for designing interfaces and documents that users find useful and even pleasurable to interact with. 4. Demonstrate the use of design principles that can be used across media and platforms to design products, interfaces, and documents. 5. Develop a sense of empathy for users that allows product and document designers to see situations from the users perspective. 6. Learn how to ideate in ways that reframe existing problems, enhance creativity, and open new pathways for designing products and services. Credits: 3.00

ENGL 61400 - Middle English Literature

Credit Hours: 3.00. Study of representative works in the major literary traditions and genres of Middle English literature (exclusive of Chaucer): lyric, romance, satire, and allegory. Detailed examination of major works, such as Sir Gawain and the Green Knight, Piers Plowman, and Pearl.

Credits: 3.00

ENGL 62000 - Classroom Communication In ESL For Teaching Assistants

Credit Hours: 5.00. Student must be enrolled in the Graduate School and a non-native speaker of English. Permission of department required.

Credits: 5.00

ENGL 62100 - Written Communication For International Graduate Students

Credit Hours: 3.00. A course in English composition for non-native English-speaking graduate students.

Credits: 3.00

ENGL 62200 - Issues In Composition Studies: Classical Period To The Renaissance

Credit Hours: 3.00. The course historicizes issues in composition studies from the sophists to the Renaissance. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62400 - Issues In Composition Studies: Modern Period

Credit Hours: 3.00. The course historicizes issues in composition studies from the eighteenth century to the mid-twentieth century. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62500 - Seminar On Empirical Research In Writing

Credit Hours: 3.00. An analysis and evaluation of empirical research concerned with composing processes, critical literacy, disciplinary writing, various writing cultures, and composition pedagogy. Students will study empirical research designs and develop a project in one of the above areas. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62600 - Postmodernism And Issues In Composition Studies

Credit Hours: 3.00. The course historicizes how various postmodern theories and practices (cultural, political, ethical, philosophical, technological, aesthetic) influence the study and teaching of written discourse. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 62700 - Seminar In Linguistics

Credit Hours: 3.00. Investigation of a topic in advanced linguistics research.

Credits: 3.00

ENGL 62800 - Natural Language Processing

Credit Hours: 3.00. (ECE 66900) This course focuses on keyword-driven question answering systems; transition networks; parsing procedures for context-free grammars; theory of transformational grammars; implementation of recursive transition networks; implementation of augmented transition networks; representation of conceptual dependencies; surface semantic conceptual analysis; conceptual dependency parsing; generating natural language from a conceptual base; scripts, plans, and goals; building conversationalist programs.

Prerequisite: ENGL 50600 or ECE 57000 .

Credits: 3.00

ENGL 62900 - Seminar In English As A Second Language

Credit Hours: 3.00. In-depth study of variable subjects relating to the nature of English as a second/foreign/international language and its learning and teaching. Prerequisite: ENGL 51600 .

Credits: 3.00

ENGL 63000 - Seminar In Second Language Writing

Credit Hours: 3.00. An overview and examination of major issues in the theory, research, and practice of writing in English as a second language. Prerequisite: ENGL 51600 or ENGL 59100 .

Credits: 3.00

ENGL 63100 - World Englishes

Credit Hours: 3.00. Investigation of the use, spread, and development of English as an international language. Topics include: non-native varieties, language contact and change, new English literatures, and the teaching of English as an international language. Prerequisite: ENGL 50600 .

Credits: 3.00

ENGL 66800 - Seminar In Interpretation And Cultural Theory

Credit Hours: 3.00. Examination of selected developments in social, cultural, and hermeneutical theories from the eighteenth century to the present.

Credits: 3.00

ENGL 66900 - Introduction To Visual Theory And Visual Culture

Credit Hours: 3.00. Visual studies is the multidisciplinary study of images, viewers, and vision. Students will be provided with an overview of the theories, practices, and histories of the visual from a variety of disciplinary perspectives and historical periods. The seminar will be organized around a series of basic questions (such as "What is an image?" "How do images produce meaning?" "What do images do?" "What is vision?") whose responses have come to constitute the field as well as its transdisciplinarity. Readings will be drawn from seminal works in visual theory, cultural semiotics, cultural theory, intermediality, art history, media studies as well as the psychology, philosophy, and science of vision.

Learning Outcomes: 1. Demonstrate knowledge of the theories, practices, and histories of the visual from a variety of disciplinary perspectives and historical periods (including what is an images are and how they produce meaning). 2. Produce a finished conference paper and abstract. 3. Produce a finished undergraduate syllabus on a topic related to the course and student expertise. Credits: 3.00

ENGL 67400 - Seminar In Language Testing

Credit Hours: 3.00. An introduction to the techniques, practices, and history of language testing. Introduces the basic tenets of measurement and the issues and controversies related to the measurement of language ability.

Credits: 3.00

ENGL 68000 - Seminar In Rhetoric And Composition

Credit Hours: 3.00. A variable content course dealing with topics such as cultural studies and composition, medieval rhetoric, renaissance rhetoric, literacy, historiographies of rhetoric, qualitative studies, and professional writing theory. Prerequisite: ENGL 59100 .

Credits: 3.00

ENGL 68100 - Hutton Lectures In Rhetoric And Composition

Credit Hours: 3.00. Reading and discussion of the work of contemporary scholarship in rhetoric and composition, accompanied by lectures by visiting scholars.

Credits: 3.00

ENGL 69000 - Internship In Second Language Studies/ESL

Credit Hours: 1.00 to 3.00. Part-time or full-time practical work experience in selected situations related to the student's field of study. The internship must be located at an off-campus site unless a special exception is granted by the Graduate School. Permission of instructor required.

Learning Outcomes: 1. Students will have acquired knowledge of how various institutions function and gained competence in the specific area (e.g., testing/test construction, teaching/teacher education, materials and

curriculum design) and will have critically reflected upon the experience. Credits: 1.00 to 3.00

ENGL 69200 - Scholarly Writing And Publishing

Credit Hours: 3.00. Guides graduate students through preparing an essay for journal publication. Activities include selecting appropriate venues, daily revision, outlining, workshopping, and hearing guest speakers. At the end of the course, students will formally submit their essay publication. Prerequisites: ENGL 50100 or instructor permission. Students must have an essay draft in hand that they wish to work on revising.

Learning Outcomes: 1. Produce and publish high-quality research in peer-reviewed journals. 2. Understand the hows and whys of publishing. 3. Demonstrate general professionalization of graduate students. 4. Assess and edit writing of self and others. 5. Demonstrate ethical professional behavior. Credits: 3.00

ENGL 69600 - Seminar In Literature

Credit Hours: 3.00. Advanced study of special subjects.

Learning Outcomes: 1. Think critically about course content. 2. Read and write reflectively and critically about the course content. 3. Engage in course discussions, either online or face to face, which will encourage critical thought and personal engagement. Credits: 3.00

ENGL 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Or MFA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

ENGL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of History (Graduate)

Website: **https://www.cla.purdue.edu/history/graduate/**

Department/School Head

Frederick R. Davis

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty

Tithi Bhattacharya Kathryn Cramer Brownell Frederick R. Davis Ariel de la Fuente William G. Gray Wendy Kline Randy W. Roberts Michael G. Smith Melinda S. Zook	David Atkinson Stacy E. Holden T. Cole Jones Rebekah A. Klein-Pejšová Dawn G. Marsh Silvia Z. Mitchell Yvonne M. Pitts Margaret Tillman	Ekaterina Babintseva Andrew Bellisari Huiying Chen Austin Cooper Christopher Ewing Tina Irvine Michelle LaBonte Jonathan Lande Zachary Loeb Kathryn Maxson Jones Aaron Mendon-Plasek John Mulhall Spencer Stewart Subo Wijeyeratne	John C. Contreni Susan Curtis Charles Cutter Raymond E. Dumett James R. Farr Sally A. Hastings Patrick J. Hearden R. Douglas Hurt Charles W. Ingrao Franklin T. Lambert John L. Larson Lois N. Magner Robert E. May Donald L. Parman Jon C. Teaford A. Whitney Walton

Academic Programs

The Department of History at Purdue offers a broad range of high-quality coursework and supervision leading to the M.A. and Ph.D. degrees. Hallmarks of the program include wide spatial and chronological coverage, flexibility in coursework, and close individual mentoring by a diverse group of nationally and internationally renowned faculty members.

Master's and Ph.D. Programs

• M.A. and Ph.D. degrees

Concentrations (Areas of Study)

Early Modern European History, Modern European History, United States History, Global History, African American History, Women's History, History of Human Rights, Transnational History, and History of Science, Technology, and Medicine

Combined Degree Programs (Master's Degree / Doctoral Degree)

- 5 Year fast-track doctoral program
- BA-MA program

History, MA

History, PHD

HIST 51200 - England Under The Stuarts

Credit Hours: 3.00. This intensive study of seventeenth-century England focuses on the political, religious, and economic tensions under the early Stuarts; the Civil War; Cromwell's Protectorate; and The Glorious Revolution. Topics discussed include parliament, puritanism, radicalism, the Restoration, and the Whig Oligarchy.

Credits: 3.00

HIST 57600 - Problems In Latin American History

Credit Hours: 3.00. A detailed examination of specific topics in Latin American history. Topics offered vary between colonial and national periods.

Credits: 3.00

HIST 57700 - Contemporary Latin America

Credit Hours: 3.00. A topical and regional approach to recent political, social, and economic movements in Latin America.

Credits: 3.00

HIST 59000 - Directed Reading In History

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

HIST 59500 - The Holocaust And Genocide

Credit Hours: 3.00. (POL 59500) History and analysis of the Nazi attempt to destroy the European Jews, with comparisons to other instances of genocide.

Credits: 3.00

HIST 60100 - Reading Seminar In European History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields of topics in European history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 60200 - Seminar In European History

Credit Hours: 3.00. Individual and group study of topics in European history from the medieval period to the modern era. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 61000 - History: Theory And Methods

Credit Hours: 3.00. This is the first part of an introductory two-course sequence for new graduate students intended to acquaint them with some important issues regarding the modern professional practice of history. This semester concentrates on historiography, theoretical questions, and methodological debates that today's working historians inevitably encounter. Students read about the practice of historical scholarship and read several important example texts representing different approaches to the discipline over the past 200 years. Students write several short book reviews, position papers, and a mock grant proposal during this semester. The course is required of incoming graduate students in history. It usually will be followed by HIST 61100 , Research Practicum.

Learning Outcomes: 1. Become familiar with current trends in historical writing and argumentation. 2. Master a certain amount of knowledge about the evolution of the historical profession (historiography) but more importantly the recognition of problems inherent in asking and answering historical questions using documentary evidence and other sources available to scholars. 3. Able to formulate a research question and situate it within a context of existing historical scholarship, arguing for its significance to the community of scholars to whom it is addressed. 4. Develop critical thinking and communication skills. 5. Learn ethical research conduct and the appropriate use of historical investigation will be explored in the course of the seminar. Credits: 3.00

HIST 61100 - History: Research Practicum

Credit Hours: 3.00. The second half of a two-semester sequence for new graduate students intended to acquaint them with important issues regarding the modern practice of historical scholarship. This course is a research seminar in which students shape and execute their own research projects resulting in original article-length historical essays. In addition, matters relating to ethical conduct of research and problems of historical writing and argumentation are discussed. Prerequisites: HIST 61000 or 59800. Permission of instructor required.

Learning Outcomes: 1. Learn the process of shaping and executing a historical research project. 2. Learn the production of an original article-length historical essay. 3. Articulate their research question, propose strategies for finding appropriate evidence and sources, and discuss ways of constructing arguments to most effectively communicate the answers they find to their questions. Credits: 3.00

HIST 64100 - Reading Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in

global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 64200 - Seminar In Global History

Credit Hours: 3.00. Individual and group study of topics in global history. Topics reflect the research, teaching, or historiographic specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 65000 - Teaching The History Survey Course

Credit Hours: 3.00. This course provides an introduction to the literature on teaching history at the college level, especially the literature on pedagogy, theory, and conceptualization needed for the undergraduate survey course. Students will become familiar with the professional literature, develop their own syllabus for the survey course, and produce an extensive historiographical essay supporting and justifying the contents of the syllabus. Class discussions will expose students to a number of teaching strategies, concepts, and exercises. Prerequisite: Master's student standing. Permission of instructor required.

Learning Outcomes: 1. Have effective communication through written and oral modes. 2. Have critical and creative thinking skills in acquiring a broad base of knowledge and applying it to complex issues. 3. Have competence in a major area of study. 4. Have appreciation for and understanding of an expanded world perspective by engaging respectfully with a diverse range of individuals, communities and viewpoints. Credits: 3.00

HIST 65100 - Reading Seminar In American History

Credit Hours: 1.00 to 3.00. Bibliography and historiography of selected fields or topics in American history; may vary in subject matter from semester to semester. Prerequisite: Master's student standing.

Credits: 1.00 to 3.00

HIST 65200 - Seminar In American History

Credit Hours: 3.00. Individual and group study of topics in American history from the colonial period to the present. Topics reflect the research, teaching, or historiographical specialties of the faculty offering the course. Subtitles indicate the focus of the research seminar. Prerequisite: Master's student standing.

Credits: 3.00

HIST 67000 - Seminar In Latin American History

Credit Hours: 3.00. Research or reading seminar in Latin American History on a selected topic in colonial or national period of Latin American History. Topics vary. It may be repeated once with change of topic. Students must have been admitted into M.A. or Ph.D. history programs or any other graduate program at Purdue. Also, adequate knowledge of languages pertinent to research topic is expected. No prior knowledge of Latin American History is required.

Learning Outcomes: 1. Become familiarized with the historical process in Latin America from 1492 to the present. 2. Understand the complexities of doing research in the area (e.g., the type of documentation, archives, and scholarly community that exist in Latin America). 3. Develop critical thinking and research abilities. Credits: 3.00

HIST 68000 - Entering The History Profession

Credit Hours: 3.00. This seminar is for advanced graduate students who are in the final two years of the program. In your earlier courses, you have become proficient in various methodological approaches and have gotten well acquainted with the historiography in various fields of study. You also have pursued original research and have navigated the classroom challenges. Now is the time to prepare for the job market, thinking critically about the skills you have acquired during graduate school and discerning strategies to communicate your credentials to a hiring committee. During this seminar, we will focus on how to structure a curriculum vitae, write a cover letter, create a teaching portfolio, craft a diversity statement, and select writing samples. We will also hold mock interviews to prepare you to orally communicate your skills, experiences, and expertise. Graduate students will also meet with professionals outside academia to learn about navigating the world of business, journalism, politics, non-profits, and public history. Permission of department required. Prerequisites: HIST 61000 and HIST 61100.

Learning Outcomes: 1. Gain a deeper understanding of the job market, inside and outside academia. 2. Foster stronger writing skills to present their research and

qualifications. 3. Gain stronger oral communication skills and gain interview experiences. 4. Expand their professional networks by meeting with professionals inside and outside academia. 5. Create a research and teaching portfolio. Credits: 3.00

HIST 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

HIST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Interdisciplinary Studies (Graduate)

Website: **https://cla.purdue.edu/academic/sis/index.html**

Department/School Head

Elena Coda

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- American Studies
- Comparative Literature
- Linguistics
- Philosophy and Literature

-

American Studies **(website)**

Academic Programs

Masters and Ph.D. Programs

Founded in the 1960s, the Purdue American Studies program is invested in studying how American culture shapes and influences the ways people live. The program provides students with opportunities to explore American culture through a diversity of ideas, texts, objects, institutions, practices, and histories, as well as the complex social and political relationships that continue to shape the evolving configurations of Americanness in a transnational context. Our program promotes the crossing of disciplinary boundaries and the interdisciplinary exploration of questions that generate new understandings of colonization, disability, diversity, environmentalism, ethnicity, gender, incarceration, inequality, media, migration, protest, race, sexuality, technology, transnationalism, and violence.

Concentrations (Areas of Study)

Activism, Resistance, and Social Movement Studies; Comparative Race and Ethnic Studies; Design and Material Cultural Studies; Gender, Sexuality, and Queer Studies; New Media and Popular Cultural Studies; Science, Technology, and Environment Studies; Transnational American Studies

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty

Kristina Bross Cheryl Cooky John Duvall Rayvon Fouchê Leonard Harris Robert Lamb Alfred Lopez Nancy Peterson Kevin Stainback Ronald Stephens Sharra Vostral Laura Zanotti	David Atkinson TJ Boisseau Jake Burdick Cornelius Bynum Kathryn Cramer Marlo David Jennifer Freeman Marshall Kim Gallon Elizabeth Hoffmann Stacy Holden Cara Kinnally Christopher Lukasik Shannon McMullen Stephanie Masta Derek Pacheco Yvonne Pitts Ryan Schneider Monica Trieu	Matthew Hannah Jennifer B Kaufmann-Buhler Kali Rubaii Natali Valdez	Susan Curtis Nancy Gabin Christian Knoeller Bill Mullen

Academic Programs

Master's and Ph.D. Programs

Comparative Literature takes as its special mandate the teaching and comparing of world literature not only as social documents but also as works of art whose full appreciation depends on the study of languages, an understanding of diversity and globalization, and an appreciation of various media. Comparative Literature is a Master of Arts and Ph.D. granting program.

Concentrations (Areas of Study)

Comparative Literature at Purdue is especially geared towards studies that cut across traditional national, linguistic, and temporal boundaries, such as Medieval, Renaissance, 18th and 19th Century, Postcolonial, and Global studies. Our affiliated faculty represent interests in multiple literature, film, and theory.

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty

Comparative Literature **(website)**

Beate I. Allert			
Dorsey Armstrong	Ahmed Idrissi		
Thomas Broden	Alami Catherine		
Elena Coda	Dossin Geraldine		
Keith Dickson	Friedman Stacy		Patricia Hart
Paul B. Dixon	Holden Daniel		Benjamin Lawton
Angelica Duran	Hsieh Yonsoo	Pedro Bassoe	Charles Ross
Dino Franco Felluga	Kim Cara Kinnally	Erin Moodie	Howard Mancing
Ariel de la Fuente	Paula Leverage	Hongjian Route	Floyd Merrell
Sandor Goodhart	Aparajita Sagar	Wang	Edie Clowes
Shaun Hughes	Dawn F. Stinchcomb		Anthony Tamburri
Alfred Lopez	Margaret Tillman		John Kirby
Robert Marzec	Jeffrey Turco		Ute White
Daniel Morris	Germina N. Veldwachter		
Manushag (Nush) Powell			
Jennifer William			

Masters and Ph.D. Programs

Purdue Linguistics offers thorough training in theoretical and applied linguistics. One of its main strengths is the analysis of bilingual language systems and the characterization of the linguistic and psycholinguistic development of bilingualism. Students can be admitted at the M.A. level or M.A./Ph.D. track. Students should specify in their applications the program or track into which they seek admission. They are required to specify the faculty members they would like to work with.

Concentrations (Areas of Study)

Theoretical and experimental approaches to syntax, pragmatics, phonetics, and phonology; Bilingualism in children and adults; Second language acquisition; Heritage language acquisition; Spanish linguistics (L2 and heritage acquistion of Spanish morphosyntax, phonetics, and pragmatics); German linguistics (historical linguistics, language contact and change); Sign Language; Fieldwork and language documentation; Computational linguistics (speech and language technology, large language models, natural language processing, conversational AI)

Faculty by Rank

Professor	Associate Professor	Assistant Professor

Linguistics **(website)**

Academic Programs

Myrdene Anderson Elena Benedicto Alejandro Cuza Alexander Francis Elaine Francis Atsushi Fukada Daniel Olson Felicia Roberts John Sundquist Ronnie Wilbur	Robert Channon Lori A Czerwionka Olga Dmitrieva Colleen Neary-Sundquist Jessica Sturm Mariko Moroishi Wei	Yan Cong Elsayed Issa

Philosophy and Literature **(website)**

Academic Programs

Purdue's interdisciplinary Ph.D. Program in Philosophy and Literature allows graduate students to develop a plan of study and research that lies at the intersection of the fields of philosophy and literature, broadly conceived. The program seeks to foster critical and independent thinking while providing cohesive professional training.

Faculty by Rank

Professor	Associate Professor

Sandor Goodhart Elena Coda Thomas Broden Leonard Harris Jacqueline Mariña Robert P. Marzec William L. McBride Arkady Plotnitsky Thomas J. Rickert Daniel W. Smith Jennifer William Christopher Yeomans	Geraldine S Friedman Ahmed Idrissi Alami

American Studies, MA

American Studies, PHD

Linguistics, MA

Linguistics, PHD

African American Studies, Post-Baccalaureate Certificate

Strategic Defense Technologies, Post-Baccalaureate Certificate

AAS 57400 - Research Methods In African American Studies

Credit Hours: 3.00. This course covers techniques used by researchers and to interpret scholarly investigation on race, class and gender from an African American perspective.

Learning Outcomes: 1. Critically analyze & synthesize theoretical paradigms of the African American Experience. 2. Apply research methods associated with African American Studies . 3. Enhance interpretive skills. 4.

Conduct ethical research. 5. Enhance critical thinking. Credits: 3.00

AAS 57500 - Theories Of African American Studies

Credit Hours: 3.00. This course addresses the development of an African American intellectual tradition. The course will span disciplines and swathes of time in order to understand how scholars not only created new ideas but developed theories that shaped and changed academic inquiry.

Learning Outcomes: 1. Critically analyze & synthesize Theoretical Paradigms of the African American experience. 2. Present material clearly and facilitate discussion. 3. Enhance interpretive skills. 4. Conduct ethical research. Credits: 3.00

AAS 59000 - Directed Readings In African American Studies

Credit Hours: 1.00 to 4.00. This directed readings course allows students to work with African American Studies faculty on work that cannot be achieved through one of the regular course offerings. This is a variable topics course that can be satisfied through individual course work with an instructor. A student wishing to earn such credit is required to obtain permission of the instructor in order to enroll for the course. This does not include work for thesis or dissertation projects. Permission of instructor required.

Learning Outcomes: 1. Analyze and synthesize theoretical paradigms involving the African American experience. 2. Enhance interpretive and critical thinking skills. 3. Develop and understand the methodological approaches employed in gathering data, and in presenting material clearly to facilitate discussion. Credits: 1.00 to 4.00

AMST 59000 - Directed Readings In American Studies

Credit Hours: 1.00 to 3.00. A reading course in aspects of American Studies directed by the instructor in whose particular field of specialization the content on the reading falls. Permission of Instructor required.

Learning Outcomes: 1. Critically analyze and synthesize American Studies scholarship. 2. Enhance interpretive and critical thinking skills. 3. Develop an understanding of the theoretical and methodological approaches used in American Studies scholarship. Credits: 1.00 to 3.00

AMST 60100 - Introduction To American Studies

Credit Hours: 3.00. An exploration of the cultural and institutional history of American Studies designed to acquaint students with the interdisciplinary concepts of American Studies by focusing on major canonical texts associated with that history. Prerequisite: Master's student standing and American Studies majors only.

Credits: 3.00

AMST 60200 - Contemporary Issues In American Studies

Credit Hours: 3.00. An investigation of analytical categories, particularly race, class and gender, the multiple methodologies, and theoretical premises that shape developments in the field of American Studies. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60300 - American Studies Interdisciplinary Project

Credit Hours: 3.00. Students will conduct independent research under faculty supervision towards completion of the Special Field examination for the Ph.D. degree. The project should be an extended, original research essay, based upon interdisciplinary research. The project should aim to produce original findings on a clearly defined topic or problem. In addition to the research and essay, students must produce a statement of methodology in which they explain their choice of sources and how their project contributes to the field of American Studies. To be taken in the final semester of coursework. Prerequisite: AMST 60100.

Credits: 3.00

AMST 60400 - Transnational American Studies

Credit Hours: 3.00. What does the term transnational mean? How is the term defined, practiced, and studied in different fields? How does one take a transnational perspective, or examine the transnational variable? This course will draw from various fields (sociology, history, anthropology, ethnic studies, etc.) to explore contemporary scholarship on transnationalism in theory and in practice. Specifically, we will examine scholarship that either, 1) utilizes the transnational perspective in understanding history, the globe, and human behavior/interactions, or 2) utilizes transnational behaviors/ties as a variable to measurement adaptation. Materials in this

course will examine - through the lens of race, ethnicity, class, gender, and sexuality - individual and comparative transnational case studies related to the Americas, Africa, Asia, and Europe. This is a graduate seminar, and your active participation in discussions is mandatory. You will be asked to lead four seminar discussions on selected topics from the required readings, write three memos, and submit an extended book review. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge across a range of chronological, cultural and geographic areas. 2. Show a familiarity with the concept of transnational, including a sense of changing interpretations and an understanding of various approaches and explanation. 3. Describe how different aspects or types of human endeavor and experience may be connected. 4. Identify the roots of contemporary issues and challenges, with attention to social values and the role of identity in the human experience. 5. Apply a critical perspective to evaluating arguments, including the quality of sources, the validity of the interpretations of those sources, and the soundness of the argument's use of evidence to support that interpretation. 6. Formulate and support an argument in a well-focused, logically organized piece of writing. Credits: 3.00

AMST 60500 - Theory And American Culture

Credit Hours: 3.00. This course provides an overview of key foundational texts in social and cultural theory, with a focus on theories of import to scholars in American Studies and related fields. We will explore the various types of theory, examining its internal logic, implications, and critiques. Consider this a brief introduction, meant to give you a general feel for the range and sophistication of available theories in American Studies. Moreover, as the "Cultural Politics" website observes, "Recent theory has reminded us that origin stories are powerful determining forces, and thus these tales of the growth and development of the discipline should be read both for what they say and for what they may leave out, read both for their truths and their partialities." Similarly, the course syllabus itself creates a particular narrative regarding the development of the discipline. As such, students are encouraged to consider the syllabus through this perspective.

Credits: 3.00

AMST 60600 - American Studies Methods

Credit Hours: 3.00. This class is specifically designed to be a survey course on the various methods employed by American Studies scholars from different disciplines. The objective of this course is to approach methods from both an epistemological and empirical perspective. In particular, we will investigate the what, why, and how of conducting research in an interdisciplinary field. As such, the following questions will drive this course: What are American Studies methods? Why are certain methodologies utilized (i.e., for what purpose)? How does one conduct research in American Studies? What method(s) should you use in your own research inquiry? And finally, what are some potential drawbacks in using a certain methodology for your project? This is a graduate seminar, and your active participation in discussions is mandatory. You will be asked to submit weekly discussion questions, lead five seminar discussions on selected topics from the required readings, and complete six assignments. The final assignment will include the background and methodological components of a research proposal.

Learning Outcomes: 1. Formulate critiques of the course readings. 2. Have investigated the readings on topics relevant in American Studies Methods. 3. Completed five total assignments, emphasizing the methodological lens, by drawing from course readings and independent research on your specific research topic. Credits: 3.00

AMST 63000 - M A Research Seminar

Credit Hours: 6.00. A research seminar required of all M.A. students in their final semester. Students write substantial essays based upon original research in which they seek to crystallize, in practice, methods and concepts of American Studies. Prerequisite: AMST 60100.

Credits: 6.00

AMST 65000 - Reading Seminar In American Studies

Credit Hours: 3.00. A reading seminar on a selected topic in American Studies, taught by two faculty members from different disciplines, usually one from the humanities and one from the social sciences. Prerequisite: AMST 60100.

Credits: 3.00

AMST 69500 - American Studies Service Learning/Internship

Credit Hours: 3.00. This course is to be used by students to complete a service learning or internship project that provides professional development towards completion of the degree. The project must be conducted under the supervision of a faculty member and community partner. The faculty supervisor will be responsible for determining the academic content of the course and requirements of service. In addition to academic requirements for the course, a final written report on the project must be filed with the American Studies program. The final report must describe the relationship between work completed for the course and the student's plan of study. Prerequisite: AMST 60100, AMST60200.

Credits: 3.00

AMST 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

IDIS 59000 - Directed Reading In Interdisciplinary Studies

Credit Hours: 1.00 to 3.00. Reading under the direction of the instructor in a particular field of study. Permission of instructor required.

Credits: 1.00 to 3.00

IDIS 59100 - Selected Topics In Interdisciplinary Studies

Credit Hours: 3.00. A study of selected topics, taught by an instructor in whose particular field of specialization the content of the course falls.

Credits: 3.00

JWST 59000 - Directed Readings In Jewish Studies

Credit Hours: 3.00. A reading course in aspects of Judaica directed by the instructor in whose particular field of specialization the content of the reading falls. Permission of Instructor required.

Learning Outcomes: 1. Deepen the knowledge of select topics in Judaica. Credits: 3.00

LING 50000 - Introduction To Linguistics

Credit Hours: 3.00. Fundamental concepts and methods of linguistic analysis of natural languages; overview of linguistics and the role of language in society. Introduction to phonology, morphology, syntax and semantics, and to problem-solving techniques, with material drawn from a wide variety of languages. Offered in conjunction with ANTH 51400 or AUSL 58000 or ENGL 50600 or LC 56100.

Credits: 3.00

LING 50100 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual development.

Learning Outcomes: 1. Learn how languages are acquired and developmental stages of main linguistic components. 2. Know major concepts and issues relative to child language development. 3. Know major concepts and issues relative to bilingual first language acquisition. 4. Know main sociocultural constructs related to language development. 5. Become familiar with main issues relative to methodological issues in language acquisition. 6. Know main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

LING 51100 - Phonology I: Descriptive Analysis

Credit Hours: 3.00. Foundations of phonological analysis. Development of concepts and methods for the analysis of phonological data and the phonological structures of natural languages within the framework of generative phonology. Focuses on problem solving and linguistic argumentation. Offered in conjunction with ENGL 51300 .

Credits: 3.00

LING 51101 - Methods And Materials In Tesol I

Credit Hours: 3.00. This course provides an overview and critical discussion on the profile of English language learners (ELLs), their cultural and linguistic backgrounds, features of academic language, the main language teaching theories and methods and how they inform current practices in various contexts, as well as US education policy on ELLs. The course also has an emphasis on the teaching of listening and speaking.

The students are given ample opportunities to understand the integration of implicit and explicit instruction on various language concerns, e.g., phoneme-awareness, word augmentation, sentence structure, listening comprehension, oral fluency etc. Students will also apply the principles of teaching to a mini-teaching task, where they can put theories into practice, observe and share feedback. In order to qualify for TENL certification, students must obtain a grade of C or higher in all TENL courses.

Credits: 3.00

LING 51200 - Phonology II: Theoretical Approaches

Credit Hours: 3.00. Examination, comparison, and evaluation of contemporary phonological theories, with focus on the contribution of each theory to our understanding of representations and operations in phonological analysis. Primary emphasis is on autosegmental phonology, metrical phonology, lexical phonology, and optimality theory.

Credits: 3.00

LING 51201 - Methods And Materials In TESOL II

Credit Hours: 3.00. This course aims at broadening course participants' understanding of principles and practices of course & lesson planning, assessment, and materials development for English as a new or foreign language (ENL/EFL) instruction. Building on topics covered in Methods and Materials for TESOL I, we will examine explicit instructional approaches and strategies with an emphasis on developing reading and writing skills in the English language for culturally and linguistically diverse learners. While there is an emphasis on literacy instruction in this course, participants should keep in mind that all of the 4 language skills (reading, writing, listening, and speaking) are integrated and evidence of this integration is expected in the design of lesson plans. Throughout the semester, we will explore 5 major interrelated topics, which are guided by and embedded in philosophies and theories of education, language, second language acquisition (SLA), teaching, and learning: standards, curriculum, pedagogy, culture, and literacy acquisition. This course involves pre-professional education/training. Experiential learning or fieldwork in a classroom setting is required. In order to qualify for TENL certification, students must obtain a grade of C or higher in all TENL courses.

Credits: 3.00

LING 52100 - Syntax I: Syntactic Analysis

Credit Hours: 3.00. Foundations of syntactic analysis and syntactic theory within the framework of generative grammar. Focuses on the central concepts of syntactic theory and on the principles and methods of syntactic analysis and argumentation using a core of topics relevant for syntactic theory. Offered in conjunction with ENGL 51200 .

Credits: 3.00

LING 52200 - Syntax II: Issues In Syntax

Credit Hours: 3.00. Deeper examination of a wider range of syntactic phenomena and evaluation of competing theoretical analyses proposed to account for them. Constructing theoretical analyses and evaluating their explanatory adequacy for Universal Grammar. Topics include LF phenomena, functional projections, and structural representations.

Credits: 3.00

LING 53100 - Semantics I: Lexical And Sentential Semantics

Credit Hours: 3.00. Foundations of semantic analysis and survey of current linguistic semantic theories and methods. Semantics at the lexical and sentential levels. Combinatorial, truth-conditional, pragmatic, contextual, and computational semantics. Offered in conjunction with ENGL 51100 .

Credits: 3.00

LING 53200 - Semantics II: Formal And Grammatical Semantics

Credit Hours: 3.00. A formal, logic-based study of semantic relations. Semantics of individuals and objects, attributes, determiners, definite descriptions, quantifiers, events, time, and space.

Credits: 3.00

LING 54100 - Historical Linguistics And Language Change

Credit Hours: 3.00. A general examination of the ways in which languages and their subsystems change over time and of the forces that produce change. The comparative method; internal reconstruction; geographical variation; and social variation. Overview of world language families and genetic relationships. Offered in conjunction with ENGL 56300 or LC 56300 .

Credits: 3.00

LING 56000 - Service Learning In Languages And Linguistics

Credit Hours: 1.00 to 4.00. This course aims to introduce the student to critical reflective thinking and experiential learning that address local and global needs and foster civic responsibility. This service learning course is a multifaceted method of teaching and learning that enriches a students' academic life and real life learning by engaging her/him in meaningful hands-on service to the community while gaining

valuable knowledge and skills that integrate with course objectives.

Learning Outcomes: 1. Participated in socially responsible activities that would have a positive impact not only on her/his local and global community. 2. Acquired skills that are transferable to her/his future work environments. 3. Reflected on how to maximize her/his personal and academic development to help her/him achieve her/his goals in life. 4. Gained knowledge and insights that will prepare her/him for active civic engagement. Credits: 1.00 to 4.00

LING 56300 - Language Acquisition

Credit Hours: 3.00. This course offers an introduction to main linguistic, psycholinguistic and sociocultural approaches to language acquisition theory and research. Through extensive reading, students will develop a deep understanding of central issues affecting language acquisition in typically developing children, including age effects, and input and output conditions in the acquisition of syntax, semantics, phonology, lexicon and morphology. Emphasis will be made on experimental approaches and research methods in the acquisition of syntax in L1 and child bilingual develpment.

Learning Outcomes: 1. Understand how languages are acquired and developmental stages of main linguistic components. 2. Understand major concepts and issues relative to child language development. 3. Understand major concepts and issues relative to bilingual first-language acquisition. 4. Understand knowledge of main sociocultural constructs related to language development. 5. Understand main issues relative to methodological issues in language acquisition. 6. Understand main linguistics and psycholinguistic factors related to language acquisition including age, cognitive development, and linguistics input. Credits: 3.00

LING 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, ENGL 56500, LC 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Learning Outcomes: 1. Able to discuss the relationship between language and society and identify the roles of language in its social and cultural context. 2. Able to critique current theories in sociolinguistics using data sets provided in course texts. 3. Able to identify the major models for sociolinguistic analysis and suggest reformulations and refinements necessary for various societies and cultures. 4. Able to recognize the sociolinguist's responsibility in the ethical treatment of human subjects and collected data. Credits: 3.00

LING 57000 - Field Methods In Linguistics

Credit Hours: 4.00. This course deals with the basic techniques for collecting language data, and is designed to reproduce and explore the conditions and methods of linguistic fieldwork in a classroom. The course also addresses questions related to the ethics of retrieving linguistic data, the relations between the linguist and the speaking communities, and the use of the collected data. A non-Indoeuropean lesser-studied language will be examined with the help of a native speaker of the language. The main area of its grammar will be covered: phonetic and phonological system, inflectional and derivational morphology, basic syntactic structures and basic semantic phenomena. The final goal is to obtain a basic grammatical description of the language. Lab sessions will be directed towards the training in the software and audio and video tools used for the trade.

Learning Outcomes: 1. Identify the key parts of the grammar of language. 2. Formulate questions about the language that (a) can reveal the structure of language and (b) can be answered by a speaker with no knowledge of linguistics. 3. Use the tools of the trade (software, equipment, etc.) 4. Develop methodologies based on a Participatory Action Research approach. 5. Develop sensitivity about what is of relevance to the speaking community and how to interact with the community in general and the speakers in particular. 6. Develop skills on how to transfer newly discovered scientific knowledge of the

language back to the speaking community. Credits: 4.00

LING 57600 - Latin American Indigenous Languages And Cultures

Credit Hours: 3.00. This course will help students to learn the importance of understanding the diversity of Latin American indigenous languages and cultures as well as the intercultural understandings gained when these indigenous languages are valued within the global context. Moreover, this course will provide a general cultural and linguistic framework to understand the sociolinguistic status of the language within the context where it exists. In this course, students will deepen their knowledge of Latin American indigenous cultures and their historics, as a means to achieving a greater understanding of both a shared humanity and the variety of human experiences. Learning Outcomes: 1. Acquire in-depth knowledge in a chosen, specific indigenous people while demonstrating panoramic understanding of Latin American indigenous groups. 2. Explain the brief history of US interaction with a particular Latin American country of this course topic. 3. Show basic oral and auditory competency in the language; will demonstrate how to express and understand basic statements, greetings, requests for directions, for food, and general courtesy interactions in the particular language. 4. Identify the particular complex interactions of the indigenous language within the context of the dominant colonial language. 5. Identify the linguistic position of the language within the context of indigenous languages of the Americas. 6. Identify basic cultural characteristics associated with the language speaking community. Credits: 3.00

LING 59000 - Directed Reading In Linguistics

Credit Hours: 1.00 to 4.00. Independent study and reading on a topic in linguistics directed by a faculty member. Permission of instructor required.

Credits: 1.00 to 4.00

LING 59100 - Special Topics In Phonology

Credit Hours: 3.00. Investigation of an advanced topic in phonology. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59300 - Special Topics In Semantics

Credit Hours: 3.00. Investigation of an advanced topic in semantics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59400 - Special Topics In Historical Linguistics

Credit Hours: 3.00. Investigation of an advanced topic in historical linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 59800 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Investigation of an advanced topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 1.00 to 4.00

LING 61900 - Seminar In Phonology

Credit Hours: 3.00. Intensive study and research on a selected topic in phonology. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 62900 - Seminar In Syntax

Credit Hours: 3.00. Intensive study and research on a selected topic in syntax. Topic varies from semester to semester.

Credits: 3.00

LING 68900 - Seminar In Linguistics

Credit Hours: 3.00. Intensive study and research on a selected topic in linguistics. Topic varies from semester to semester. Permission of instructor required.

Credits: 3.00

LING 69000 - Individual Seminar

Credit Hours: 1.00 to 3.00. Under the individual guidance and supervision of a faculty member, students will select and investigate a topic and will produce a paper of professional

caliber on the subject. Prerequisite: Doctoral student standing and Linguistics majors only. Permission of instructor required.

Credits: 1.00 to 3.00

LING 69800 - Research MA Thesis

Credit Hours: 1.00 to 12.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 12.00

LING 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

WGSS 59900 - Selected Topics In Women's Gender And Sexuality Studies

Credit Hours: 3.00. A study of selected topics taught by an instructor in whose particular field of specialization the content of the course falls. Permission of instructor required.

Learning Outcomes: 1. Understand the influence of men's views and control of women's participation in sport across age, race/ethnicity and sexual orientation. 2. Understand feminist perspectives on sport. 3. Clarify the meaning of one's own sport experience. 4. Appreciate the contributions of pioneering women in creating opportunities for women today. 5. Identify obligations to those in future generations regarding access to future sport participation. 6. Understand and appreciate the differences in experiences and perceptions of others through group work and class discussions. 7. Lean how gender ideologies impact women and men's access to sport. 8. Interrogate masculinity and femininity in order to understanding how gender is constructed in and through sport. 9. Enhance students critical thinking and analytical skills Credits: 3.00

WGSS 68000 - Feminist Theory

Credit Hours: 3.00. This course focuses on feminist theories at an advanced level and in a global perspective. Graduate students engage with key theoretical issues in contemporary feminist studies, and examine how feminist scholars have theorized women and gender issues across disciplines.

Credits: 3.00

WGSS 68100 - Contemporary Issues In Feminist Scholarship

Credit Hours: 3.00. Applies feminist theory, knowledge, and methods to the examination of selected contemporary issues. Emphasizes ways in which theory and practice interact in feminist scholarship. Content may vary according to the issues examined. Prerequisite: WGSS 68000 .

Credits: 3.00

WGSS 68200 - Issues In Feminist Research And Methodology

Credit Hours: 3.00. This course provides a methodological framework for theorizing, constructing and executing research from a feminist perspective. Students acquire knowledge of the diversity of feminist research projects and methods; they learn to pose research questions; and they will be able to prepare a research or grant proposal drawing on interdisciplinary methods. The course is designed to meet the needs of graduate students in Women's Studies and is open to students in other programs who are interested in feminist research. The course deals with both theoretical and practical issues in methodology. Prerequisites: WGSS 68000 .

Learning Outcomes: 1. To understand and describe the distinguishing features of feminist research from a variety of disciplines. 2. About the range of qualitative and quantitative research methods used by feminist scholars. 3. To examine how interdisciplinary feminist perspectives shape research methods. 4. About discussions of feminist epistemology, including feminist critiques of science and the development of feminist empiricist, standpoint and postmodernist epistemologies. 5. To develop the skills to interpret and critically evaluate research in women's studies, in both interdisciplinary journals and discipline-specific journals. 6. To develop their own feminist methods and approaches by producing a research project. Credits: 3.00

School of Languages and Cultures (Graduate)

Website: **https://www.cla.purdue.edu/academic/slc/graduate/**

Department/School Head

Jennifer M. William

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Beate Allert Elena Coda Alejandro Cuza-Blanco Keith Dickson Paul B. Dixon Atsushi Fukada Kazumi Hatasa Wei Hong Nicholas K. Rauh Iñigo Sanchez-Llama John Sundquist Jennifer M. William	Robert Channon Lori A. Czerwionka Olga Dmitrieva Daniel Hsieh Ahmed Idrissi Alami Yonsoo Kim Cara Kinnally Paula Leverage Colleen Neary-Sundquist Song No Daniel J. Olson Marcia Stephenson Dawn F. Stinchcomb Jessica Sturm Jeffrey Turco Nadège Veldwachter Mariko Moroishi Wei	Pedro Bassoe Charles Campbell Daniel Conner Olga Lyanda-Geller Erin Moodie Gabriel Rios Rojas Hongjian Wang Route Li Wei	Paul Benhamou Zinaida Breschinsky Thomas Broden Becky Brown William Buffington Fritz Cohen Maria Cooks Robert S. Freeman Alan Garfinkel Robert Hammond Patricia Hart William Hatfield Madeleine M. Henry Christiane Keck Benjamin Lawton Howard Mancing Floyd Merrell Herbert Rowland Eiji Sekine Erdmute W. White Joseph Wipf

			Allen G. Wood

Academic Programs

Master's and Ph.D. Programs

The School of Languages and Cultures offers graduate study leading to the M.A. degree in French, German, Japanese, Spanish and Comparative Literature and the Ph.D. degree in French, German, Spanish and Comparative Literature. In addition, the School of Languages and Cultures participates in the curriculum for the M.A. and Ph.D. degrees granted by the Program in Linguistics/Foreign Language Acquisition housed in Interdisciplinary Studies.

Comparative Literature, PHD

Comparative Literature, MA

Languages and Cultures, PHD

Languages and Cultures, MA

ARAB 58700 - Modern Arab Thought

Credit Hours: 3.00. Prominent and critical issues in modern Arab thought. Identity, historical meaning, the Arab-Islamic cultural legacy, and tradition vs. modernity are engaged through Arab encounters with the West. Conducted in English; no knowledge of Arabic required.

Learning Outcomes: 1. Become familiar with the main lines of modern Arab thought. 2. Identify critical issues in modern Arab thought, in relation to questions of identity, cultural heritage, and religious faith; situate those issues within their historical, social, and political contexts. 3. Appreciate the nuanced relationship between the Arab world and the West in terms of an often painful dialogue between tradition and modernity. Credits: 3.00

CHNS 59400 - Special Topics In Chinese Literature

Credit Hours: 1.00 to 4.00. Special topics in Chinese Literature. Permission of instructor required.

Credits: 1.00 to 4.00

CLCS 59000 - Directed Reading In Classics

Credit Hours: 1.00 to 4.00. Directed readings in Classics. Permission of instructor required.

Credits: 1.00 to 4.00

CMPL 59000 - Directed Reading In Comparative Literature

Credit Hours: 1.00 to 3.00. Directs the reading of students with special interests. Guides students in profitable reading in subjects of their own choice. Individual conferences. No class meetings. Permission of instructor required.

Credits: 1.00 to 3.00

CMPL 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (LC 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study.

Credits: 3.00

CMPL 65000 - Seminar In Comparative Literature

Credit Hours: 3.00. (LC 63900) Exploration of a significant topic in comparative literature, e. g. the arts of translation, thematology, genre studies, literary movements, literary relations among countries.

Credits: 3.00

CMPL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

FR 51900 - Teaching College French

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of department required.

Credits: 3.00

FR 52700 - Etudes de Style

Credit Hours: 3.00. Study of the expression of affective and artistic values in literary French. Detailed grammatical analyses and study of stylistic procedures. Comparison with English usage. Introduction to explication de texte as an approach to literature. Permission of department required.

Credits: 3.00

FR 54100 - Renaissance French Literature

Credit Hours: 3.00. Major works in verse and prose of the sixteenth century. Marot, du Bellay, Ronsard, Rabelais, Montaigne. Permission of department required.

Credits: 3.00

FR 54900 - French Literature And Film

Credit Hours: 3.00. An examination of the interrelationships of contemporary French literature and film. Discussion of the potential of each medium as an art form, problems of visual transposition of literary works, and extension of literary concepts such as Dadaism and Surrealism into cinema. Permission of department required.

Credits: 3.00

FR 55800 - French Novel Of The Twentieth Century

Credit Hours: 3.00. Consideration of the character, aesthetics, and evolution of the twentieth-century French novel. Readings from such representative novelists as Proust, Gide, Bernanos, Giono, Malraux, Camus, Robbe-Grillet, Saporta. Permission of department required.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 56100 - The Structure Of French I: Phonetics And Phonology

Credit Hours: 3.00. This course presents the sound system of French by examining descriptive and theoretical issues in the patterning of segments on various levels (phonetics, phonemics, morphology, etc.). Students will study current phonological and phonetic issues in recent literature. Credit will not be given for both FR 35100 and 56100.

Credits: 3.00

FR 56200 - The Structure Of French II: Syntax And Morphosyntax

Credit Hours: 3.00. This course presents descriptive and theoretical issues concerning the grammatical structure of French, dealing both with word-level phenomena (inflectional and derivational morphology, etc.) and with phrase-, sentence-, and discourse-level phenomena (syntactic structure, sentence constituents, word order, etc.). Credit will not be given for both FR 36200 and 56200.

Credits: 3.00

FR 56300 - History Of The French Language

Credit Hours: 3.00. A survey of the historical development of the French language from Vulgar Latin to the present and of the French language of today as a reflection of past cultural and socio-political conditions. Knowledge of a Romance language or of Latin is recommended but not required.

Credits: 3.00

FR 56400 - Introduction To Old French

Credit Hours: 3.00. Introduction to the study of Old French. Phonetic, syntactic, and stylistic questions will be addressed through the analysis of original texts.

Credits: 3.00

FR 58100 - French Culture

Credit Hours: 3.00. Development of the cultural life of the French people as reflected in architecture, art, history, literature, music, and philosophy. Lectures in French.

Learning Outcomes: 1. Student will gain practical experience in the language. Credits: 3.00

FR 58200 - Francophone Cultures

Credit Hours: 3.00. Examines at least three French-speaking regions outside of France (e.g., Caribbean, Maghreb, Quebec, West Africa), including contemporary civilization and the development of cultures throughout history. Explores trends in society, daily life, the arts, and the ideas. Lectures in French.

Credits: 3.00

FR 59000 - Directed Reading In French

Credit Hours: 1.00 to 4.00. Directed readings in French. Permission of instructor required.

Credits: 1.00 to 4.00

FR 59400 - Special Topics In French Literature

Credit Hours: 1.00 to 4.00. Special topics in French Literature. Permission of instructor required.

Credits: 1.00 to 4.00

FR 59600 - Special Topics In French Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

FR 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research: the basic concepts and terminology of literary criticism. Required of all MA candidates in French.

Credits: 3.00

FR 65900 - Seminar In French Literature

Credit Hours: 3.00. Advanced study of special subjects. Topics to be announced in advance. Permission of instructor required.

Credits: 3.00

FR 67900 - Seminar In French Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in French linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

FR 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

FR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GER 51900 - Teaching College German

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

GER 52400 - German For International Trade

Credit Hours: 3.00. A broad spectrum of business and cultural materials to prepare students for work in international firms. Intensive study of technical terminology used in business transactions; stylistics in business correspondence and report writing; training for accurate oral expression in business negotiations.

Credits: 3.00

GER 54200 - German Classicism

Credit Hours: 3.00. The study of the classical period in German literature as revealed in the works of Goethe and Schiller.

Credits: 3.00

GER 54300 - The Age Of Enlightenment And The Storm And Stress Movement

Credit Hours: 3.00. A study of the literature of the Age of Enlightenment, the cult of feeling, and the Storm and Stress works of Goethe and Schiller.

Credits: 3.00

GER 54400 - German Romanticism

Credit Hours: 3.00. A study of the rise and degeneration of the romantic ideal in German literature. Particular attention is paid to aesthetics, literary criticism, and the revival of a national heritage.

Credits: 3.00

GER 54500 - German Prose From Naturalism To The Present

Credit Hours: 3.00. Development of the novel and short story of the period, with special emphasis on the major authors.

Credits: 3.00

GER 54600 - German Literature Since 1945

Credit Hours: 3.00. Major literary movements and tendencies in East and West Germany, Austria, and Switzerland since 1945.

Involves the close reading of literary texts, investigation of major problems addressed by literary criticism, and discussion of historical context.

Credits: 3.00

GER 55100 - Lyric Poetry From Romanticism To The Present

Credit Hours: 3.00. A study of the German lyric from Romanticism to the present. The study of motif, form, and style as reflections of the aesthetic ideals of their age.

Credits: 3.00

GER 55400 - German Drama Before Naturalism

Credit Hours: 3.00. German drama from its beginnings up to the advent of Naturalism. A study of the most significant German dramatists of the first part of the nineteenth century and earlier periods.

Learning Outcomes: 1. Students will be familiarized with drama theory, including the Aristotelian approach and the 18th century dramas that were created in response to it. 2. Students will learn about aesthetics and ethics in cultural history, explore the differences between such movements as Storm and Stress and Weimar Classicism, the Bourgeois play and the Brechtian drama and variations in between. 3. This course will enhance reading, writing, and speaking skills in the target language of German and will provide cultural knowledge and improve students' global competency. Credits: 3.00

GER 55500 - German Drama From Naturalism To The Present

Credit Hours: 3.00. Developments of the drama through the various literary movements of the period, including consideration of the underlying social and ideological forces.

Credits: 3.00

GER 56100 - The Structure Of German I: Phonology And Derivational Morphology

Credit Hours: 3.00. Linguistic analysis of German, focusing on phonetics, phonology, and word structure. The course will treat various problems of pronunciation, structural sound patterns, and word derivation. One weekly class is devoted to theoretical issues affecting German phonology and morphology. Credit will not be given for both GER 36100 and 56100.

Credits: 3.00

GER 56200 - The Structure Of German II: Inflectional Morphology And Syntax

Credit Hours: 3.00. Linguistic analysis of German, focusing on inflectional morphology, syntax, and semantics. The course will present the grammatical structure of German, dealing with word-level phenomena (inflectional morphology), and phrase- and sentence-level phenomena (constituents, word order, syntactic structure, etc.). Credit will not be given for both GER 36200 and 56200.

Credits: 3.00

GER 56300 - History Of The German Language

Credit Hours: 3.00. A survey of the development of the German language, with emphasis on the factors and events that brought about the ultimate unification of the major German dialects into the standard form of the present. The German language of today as a reflection of past cultural and sociopolitical conditions.

Credits: 3.00

GER 57500 - Theories Of German Language Acquisition

Credit Hours: 3.00. Advanced course designed to provide an overview of major theoretical issues in German language acquisition research. Permission of instructor required.

Credits: 3.00

GER 58100 - German Culture

Credit Hours: 3.00. The development of the cultural life in German-speaking lands as reflected in architecture, art, history, literature, music, and philosophy. Lectures in German.

Credits: 3.00

GER 59000 - Directed Reading In German

Credit Hours: 1.00 to 4.00. Directed readings in German. Permission of instructor required.

Credits: 1.00 to 4.00

GER 59400 - Special Topics In German Literature

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

GER 59600 - Special Topics In German Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

GER 60100 - First Course To Establish Reading Knowledge

Credit Hours: 3.00. First Course To Establish Reading Knowledge.

Credits: 3.00

GER 60300 - Second Course To Establish Reading Knowledge

Credit Hours: 3.00. Second Course To Establish Reading Knowledge. For those in the physical sciences, mathematics, and engineering. Prerequisite: GER 60100 .

Credits: 3.00

GER 60500 - Second Course To Establish Reading Knowledge

Credit Hours: 3.00. Second Course To Establish Reading Knowledge. For those in the humanities and social sciences. Prerequisite: GER 60100 .

Credits: 3.00

GER 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in German.

Credits: 3.00

GER 64400 - Seminar In German Expressionism

Credit Hours: 3.00. The prose, drama, and poetry from 1910-1925. Will also examine selected political-literary essays as they relate to this artistic avant-garde generation.

Credits: 3.00

GER 65900 - Seminar In German Literature

Credit Hours: 3.00. Advanced study of special subjects. Topics to be announced in advance. Permission of instructor required.

Credits: 3.00

GER 66400 - Middle High German

Credit Hours: 3.00. This course introduces students to the Middle High German language, the language of medieval literary texts written in German between 1050 and 1350. The language of this period is significantly different in spelling, vocabulary, and grammar when compared to Modern Standard German. The course also provides an introduction to various genres of medieval German literary texts from this period. Many of the foundational works in the German tradition come from this period, including those of the so-called "golden age" of medieval German literature from 1170 to 1230.

Learning Outcomes: 1. Compare Middle High German vocabulary and grammar with Modern German. 2. Analyze Middle High German grammatical forms as they appear in literary texts. 3. Identify linguistic variation in Middle High German. 4. Apply linguistic knowledge by translating Middle High German texts. 5. Identify distinctions between genres of Middle High German literary texts. 6. Recognize major themes in Middle High German literary texts. 7. Write a paper that synthesizes information from class on genres and cultural/historical themes in Middle High German literary texts. Credits: 3.00

GER 67900 - Seminar In German Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in German linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

GER 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GER 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

GREK 59000 - Directed Reading In Classical Greek

Credit Hours: 1.00 to 4.00. Directed Reading In Classical

Greek. Permission of instructor required.

Credits: 1.00 to 4.00

ITAL 59000 - Directed Reading In Italian

Credit Hours: 1.00 to 4.00. Directed readings in Italian. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 52100 - Teaching Japanese As A Foreign Language

Credit Hours: 3.00. Introduces a wide range of techniques used in teaching Japanese as a foreign language. Discusses theoretical issues concerned with the learning and teaching of Japanese. Permission of instructor required.

Credits: 3.00

JPNS 56000 - Survey Of Japanese Linguistics

Credit Hours: 3.00. This course is intended to provide the student with a systematic overview of the Japanese language. It covers most major areas of linguistics, from phonetics to pragmatics. Conducted in Japanese.

Credits: 3.00

JPNS 57500 - Theories Of Japanese Language Acquisition

Credit Hours: 3.00. Advanced course designed to provide an overview of major theoretical issues in Japanese language acquisition research. Permission of instructor required.

Credits: 3.00

JPNS 59000 - Directed Reading In Japanese

Credit Hours: 1.00 to 4.00. Directed readings in Japanese. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59400 - Special Topics In Japanese Literature

Credit Hours: 1.00 to 4.00. Reading and extensive discussion of selected texts from different writers and genres. Provides in-depth research on a variety of issues related to Japanese literary and cultural traditions. Knowledge of advanced Japanese required. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 59600 - Special Topics In Japanese Linguistics.

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

JPNS 67900 - Seminar In Japanese Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in Japanese linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

JPNS 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

LATN 59000 - Directed Reading In Latin

Credit Hours: 1.00 to 4.00. Directed reading of selected texts in classical and/or medieval Latin. Permission of instructor required.

Credits: 1.00 to 4.00

LC 51900 - Teaching Of Foreign Languages

Credit Hours: 3.00. A basic course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

LC 56300 - Historical Linguistics

Credit Hours: 3.00. (ANTH 56300, ENGL 56300) A survey of mechanisms and motivations of linguistic change. Topics include phonological, morphological, semantic and syntactic change, comparative and internal reconstruction, linguistic variation, language contact, and linguistic typology.

Credits: 3.00

LC 56500 - Sociolinguistics

Credit Hours: 3.00. (ANTH 56500, COM 56500, ENGL 56500, LING 56500) An introduction to language in its social context, focusing on uses and users of language. Topics include social class, ethnic group, gender, language attitudes, and bilingualism.

Credits: 3.00

LC 57000 - Introduction To Semiotics

Credit Hours: 3.00. (ANTH 51900, SLHS 58900, COM 50700, ENGL 57000) The study of languages, literatures, and other systems of human communication. Includes a wide range of phenomena that can be brought together by means of a general theory of signs. The course deals with three fundamental areas: 1) verbal communication, 2) nonverbal communication (iconic systems, gestures, body language, etc.), and 3) communication through art forms.

Credits: 3.00

LC 57300 - Methods Of Experimental Research In Linguistics

Credit Hours: 3.00. The course is an overview of experimental methods used in linguistic research. The goal of the course is to introduce basic concepts, terminology, and procedures associated with experimental research in general, and to survey the types of experiments typically conducted in several major subfields of linguistics, including the associated experiment designs and approaches to data analysis. The course will focus mainly on designing and conducting the experiment, rather than on data analysis, although the data analysis techniques appropriate to the types of data will be briefly discussed whenever possible. The course will also cover additional topics such as ethics of experimental research (preparing an IRB protocol), doing background research, getting funding, choosing the right conference for presenting the results, writing a conference abstract, creating and delivering a conference presentation/poster, and writing up the results for publication.

Learning Outcomes: 1. Define experimental research and explain its differences from other types of research. 2. Explain best practices in developing research questions, hypotheses, and designing experiments. 3. Distinguish different types of data and measurement levels and select the appropriate type of data analysis for a given type of data. 4. Design and implement experimental studies independently to test hypotheses in linguistics, including determining the necessary equipment, software, facilities, and subject pool, preparing IRB protocols, and obtaining funding. 5. Summarize and present experimental results effectively both orally and in writing and in appropriate presenting and publishing outlets. Credits: 3.00

LC 57500 - Theories Of Foreign Language Acquisition

Credit Hours: 3.00. An advanced course designed to provide an overview of major theoretical issues in foreign language acquisition research. Provides a broad historical introduction to theories of acquisition that underlie these different perspectives. This course also provides an understanding of skills assessment and selection of instructional materials. Permission of instructor required.

Credits: 3.00

LC 57700 - Acoustic Analysis Of Speech

Credit Hours: 3.00. This course is an introduction to those aspects of acoustics most pertinent to understanding speech production and perception. It covers sound waves and their properties, digital signal processing, hearing and loudness, sound recording, and details of the acoustics of specific speech sounds such as vowels, plosives, fricatives, and nasals. The course includes a prominent practicum component aimed at learning to use software tools, specifically Praat, for analyzing acoustic properties of speech sounds.

Learning Outcomes: 1. Define the physical parameters of sound waves; explain how sound waves are created and how they propagate through a medium. 2. Explain the concepts of resonance and filtering as applied to speech production. 3. Explain digital signal processing as applied to the analysis of speech. 4. Use their understanding of acoustics to explain aspects of hearing and perception of speech, including the perception of loudness; explain and apply standard methods of measuring loudness. 5. Use the tools of acoustic analysis to measure acoustic properties of speech sounds, such as duration, loudness, fundamental frequency, and other spectral properties; communicate the results effectively orally and in writing. Credits: 3.00

LC 59000 - Directed Reading In Foreign Languages

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

LC 59300 - Special Topics In Literature

Credit Hours: 1.00 to 4.00. Special topics in Literature. Permission of instructor required.

Credits: 1.00 to 4.00

LC 59600 - Special Topics In Linguistics

Credit Hours: 1.00 to 4.00. Special topics in Linguistics. Permission of instructor required.

Credits: 1.00 to 4.00

LC 63000 - Comparative Literature: Function And Methods

Credit Hours: 3.00. (CMPL 63000) An introduction to methods, problems, and the bibliographical tools pertaining to comparative study. Required of all students in the Comparative Literature Program.

Credits: 3.00

LC 63900 - Seminar In Comparative Literature

Credit Hours: 3.00. (CMPL 65000) Exploration of a significant topic in comparative literature, e.g., the arts of translation, thematology, genre studies, literary movements, literary relations between countries. (See Comparative Literature.) Prerequisite: ENGL 66000 or LC 63000 .

Credits: 3.00

LC 65000 - Topics In Theory

Credit Hours: 3.00. Study of theoretical approaches to literature, the arts, or general culture (e.g., cognitive science, deconstruction, feminism, hermeneutics, postmodernism, postcolonial studies, reader response, semiotics). Examines methodologies and confronts them with literary texts. Permission of instructor required.

Credits: 3.00

LC 65900 - Seminar In Literature And Culture Of The African Diaspora

Credit Hours: 3.00. An examination of the African Diaspora through the study of literatures and cultures of Latin America and the Caribbean. Prerequisites: Experience working with literatures of the African Diaspora and critical theory.

Learning Outcomes: 1. Acquire knowledge of the historical shifts that affected the formation of the literary movements. 2. Use theory in their interpretation of the texts. 3. Demonstrate ability to apply literary theories in order to analyze the literature read. Credits: 3.00

LC 67900 - Seminar In Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

LC 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

LC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PTGS 55100 - Brazilian Poetry

Credit Hours: 3.00. A survey of the major currents and most important writers of Brazilian poetry. Readings include Gregorio de Matos, Goncalves Dias, Castro Alves, Mario de Andrade, Manuel Bandeira, and Cecilia Meireles. Permission of instructor required.

Credits: 3.00

PTGS 55500 - Brazilian Drama

Credit Hours: 3.00. A survey of the primary movements and most important works of Brazilian theatre. Readings include plays by Nelson Rodrigues, Dias Gomes, Ariano Suassuna, and Jorge Andrade. Permission of instructor required.

Credits: 3.00

PTGS 55700 - Brazilian Fiction

Credit Hours: 3.00. A survey of the development and major texts of Brazilian fiction. Readings include novels or short stories by Jose de Alencar, Machado de Assis, Graciliano Ramos, and Clarice Lispector, among others. Permission of instructor required.

Credits: 3.00

PTGS 59000 - Directed Reading In Portuguese

Credit Hours: 1.00 to 4.00. Directed readings in Portuguese. Permission of instructor required.

Credits: 1.00 to 4.00

PTGS 59400 - Special Topics In Luso-Brazilian Literature

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

RUSS 56100 - The Structure Of Russian I: Phonology And Syntax

Credit Hours: 3.00. This course treats the sound system and sentence structure of Russian, dealing with the structural pattern on various levels (phonetic, phonemic, syntactic) from various points of view. One weekly class is devoted to theoretical issues affecting Russian phonology and syntax.

Credits: 3.00

RUSS 56200 - The Structure Of Russian II: Morphology

Credit Hours: 3.00. This course will present a systematic study of Russian morphology in the light of current linguistic research, dealing both with the various categories of inflected words (nouns, pronouns, adjectives, verbs) and with word formation.

Credits: 3.00

RUSS 59000 - Directed Reading In Russian

Credit Hours: 1.00 to 4.00. Directed readings in Russian. Permission of instructor required.

Credits: 1.00 to 4.00

RUSS 59600 - Special Topics In Russian Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 51900 - Teaching College Spanish

Credit Hours: 3.00. A course designed to provide a forum for ideas connecting theory and research to teaching practice. Explores issues related to how learning and teaching can be enhanced and presents practical ideas that can be implemented in the classroom. Permission of instructor required.

Credits: 3.00

SPAN 54000 - Spanish Literature Of The Middle Ages

Credit Hours: 3.00. A survey of Spanish Literature from 11th to the 15th century through the reading and discussion of representative prose, dramatic and poetic works. Lectures and supplemental readings on literary criticism and on various aspects of the period useful to an understanding of the literature it produced. Permission of instructor required.

Learning Outcomes: 1. Discuss the history and the development of Spanish literature. 2. Explain the importance the adoption of foreign prose had on the development of Spanish novel. 3. Describe Spanish literary movements. 4. Analyze literary works produced. Credits: 3.00

SPAN 54100 - Spanish Literature Of The Golden Age

Credit Hours: 3.00. A survey of Spanish literature from 1500 to 1681. Reading and discussion of representative prose, dramatic and poetic works. Lectures and supplemental readings on literary criticism and on various aspects of the period useful to an understanding of the literature it produced.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 54200 - Cervantes Don Quijote

Credit Hours: 3.00. Reading and discussion of Don Quixote in the context of Spanish Renaissance literature and subsequent developments in the genre of the novel.

Credits: 3.00

SPAN 54300 - Spanish Literature Of The 18th And 19th Centuries

Credit Hours: 3.00. The development of Spanish peninsular literature from Neoclassicism to Realism. Reading, analysis, and discussion of a representative selection of works of the periods.

Credits: 3.00

SPAN 54500 - Spanish Literature Of The 20th Century

Credit Hours: 3.00. The study of major trends in Spanish peninsular literature from the generation of 1898 to the present. Reading, analysis, and discussion of a representative selection of works of the period.

Credits: 3.00

SPAN 54900 - Hispanic Women Writers

Credit Hours: 3.00. A survey of the literature of Hispanic women writers from Latin America, the Caribbean, and Spain in light of their traditions and of feminist literary theory and criticism. Permission of instructor required.

Learning Outcomes: 1. Discuss female characters from an informed perspective, whether applying feminist theories or not . 2. Compare and contrast literary innovations of male and female writers in literary movement since Modernity Credits: 3.00

SPAN 55000 - Spanish American Literature Of The Colonial Period

Credit Hours: 3.00. A survey of Spanish American literature of the colonial period. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55100 - Spanish American Literature Of The 19th Century

Credit Hours: 3.00. A survey of Spanish American literature of the 19th century. Reading and discussion of a number of representative works as well as excerpts from several others.

Credits: 3.00

SPAN 55200 - Spanish American Literature From 1900 To 1970

Credit Hours: 3.00. A survey of Spanish American literature from 1900 to 1970. Readings and discussion of a number of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55300 - Spanish American Literature From 1970 - Present

Credit Hours: 3.00. A survey of Spanish American literature from 1970 to the present. Readings and discussion of a number of representative works, as well as excerpts from several others.

Learning Outcomes: 1. Student will gain practical experiences in the language. Credits: 3.00

SPAN 55400 - Hispanic Caribbean Literature

Credit Hours: 3.00. This course focuses on various topics pertaining to Hispanic Caribbean literature. The particular works included will change each time the course is offered. All coursework and discussion is in Spanish.

Credits: 3.00

SPAN 55500 - Latino/a Literature

Credit Hours: 3.00. This class offers an overview of U.S. Latino/a literature, written in Spanish and English and produced in the United States. It will introduce students to the many and diverse experiences of different Latino/a groups through their literary production. Permission of instructor required.

Learning Outcomes: 1. Gain a sense of the diversity of the Latino/a experience in the U.S. as well as the longevity and richness of the Latino/a literary tradition in the U.S. 2. Become familiar with some of the major themes and trends in Latino/a literature. 3. Consider the ways in which identities like - class, race, and gender - intersect with one another and are constructed in relation to one another. 4. Learn how to close-read a literary or cultural object, such as a novel, a film, or a poem. 5. Work on improving their writing and research skills through the development of an original research project dealing with Latino/a literature. Credits: 3.00

SPAN 55600 - Mexican Literature

Credit Hours: 3.00. A survey of Mexican literature. Reading and discussion of a number of representative works as well as excerpts from several others. Permission of instructor required.

Learning Outcomes: 1. Discuss the impact the history of Mexico has on literary production. 2. Examine the nature of the development of Mexican literary movements. 3. Analyze Mexican literature with consideration of its individual literary innovations. Credits: 3.00

SPAN 55700 - Argentine Literature

Credit Hours: 3.00. A survey of Argentine literature. Reading

and discussion of a number of representative works as well as excerpts from several others and from standard anthologies.

Credits: 3.00

SPAN 56100 - The Structure Of Spanish I: Phonetics, Phonology, And Dialectology

Credit Hours: 3.00. Linguistic analysis of Spanish phonology, phonetics, and dialectology. Selected topics within the areas of Spanish sociolinguistics and language acquisition. Each of these topics will be approached from a theoretical and contrastive Spanish/English perspective.

Learning Outcomes: 1. Understand, recall, and discuss the main concepts in the fields of phonetics and phonology. 2. Apply and adapt the fundamental concepts of phonetics and phonology to multiple varieties of Spanish. 3. Examine and critically assess current research in the field. 4. Design and conduct original research in the field of Spanish phonetics and phonology. Credits: 3.00

SPAN 56200 - The Structure Of Spanish II: Morphology, Lexicology, And Syntax

Credit Hours: 3.00. Linguistic analysis of Spanish focusing on morphology, lexicology, and syntax. This course will present the grammatical structure of Spanish dealing with word-level phenomena (derivational and inflectional morphology, the lexicon) and phrase- and sentence-level phenomena (constituents, word order, sentence structure, etc.).

Learning Outcomes: 1. Have knowledge and understanding of basic notions of Spanish syntax including syntagmatic structure, X-bar theory, thematic roles, argument structure, constituents and hierarchical representation, and syntactic operations (e.g., wh-movement). 2. Be able to observe, describe, and formulate abstract theoretical concepts in relation to the syntactic structure of Spanish. 3. Be able to relate theoretical analysis to experimental syntax, specifically in relation to the acquisition of Spanish syntax and semantics among second language learners and heritage speakers. Credits: 3.00

SPAN 56300 - History Of The Spanish Language

Credit Hours: 3.00. Development of Spanish since the Ancient Latin period, taking into account influences of other cultures and languages; Spanish in relation to Latin and other Romance languages; basic principles of language change; language change underlying differences between American and Peninsular Spanish.

Learning Outcomes: 1. Have a perspective of the evolution of Spanish and being able to identify the basic features of Spanish through its history, as well as understanding the influence of external influences in the evolution of the language. 2. Understand the configuration of the different varieties of Spanish in the different areas (peninsular Spanish and Spanish in America). 3. Read publications on general aspects of History of Spanish Language with critical sense and understanding basic problems of diachronic studies and basic principles of language change. 4. Able to read, understand and linguistically analyze texts from all the stages of Spanish. Credits: 3.00

SPAN 56401 - Spanish Sociolinguistics

Credit Hours: 3.00. This course addresses the linguistic variation found at all linguistic levels of Spanish (e.g., phonetics, morphology, syntax) that is explained through social variation (e.g., socio-economic status, race, gender). Regional varieties of Spanish in Latin America, the U.S., and Peninsular societies will be studied. Related topics are style and identity, language attitudes, discourse analysis, and pragmatics. All classes will be conducted in Spanish.

Learning Outcomes: 1. Define and express main understandings about language, the study of linguistics, and language variation. 2. Analyze and discuss specific examples of Spanish variation analyzed through use of various methods. 3. Identify and evaluate the pros and cons of various sociolinguistic methods of research. 4. Reflect on the relationships among social factors, language, diversity, and power in society. 5. Use previous investigations to demonstrate the need for additional research in

a specific area, thereby identifying a research topic. 6. Consider one's own perspective of language use in social settings and reflect on any changes in that perspective that resulted from interaction with the course. 7. Speak, read, write, and comprehend Spanish to communicate about the course topics. Credits: 3.00

SPAN 59000 - Directed Reading In Spanish

Credit Hours: 1.00 to 4.00. Directed readings in Spanish. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 59400 - Special Topics In Hispanic Literature

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 59600 - Special Topics In Spanish Linguistics

Credit Hours: 1.00 to 4.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 4.00

SPAN 60300 - Second Course To Establish Reading Knowledge

Credit Hours: 3.00. Readings in the physical and biological sciences, mathematics, and engineering. Prerequisite: SPAN 60100.

Credits: 3.00

SPAN 63000 - Bibliography And Literary Criticism

Credit Hours: 3.00. The use of general and specific reference materials and bibliographical aids in literary research; the basic concepts and terminology of literary criticism. Required of all MA candidates in Spanish.

Credits: 3.00

SPAN 64200 - Seminar In Spanish Theater

Credit Hours: 3.00. Advanced study of Spanish theater. Content will vary depending on the choice of periods, authors, works, and themes. Permission of instructor required.

Credits: 3.00

SPAN 65900 - Seminar In Hispanic Literature

Credit Hours: 3.00. Advanced study of special subject. Topics to be announced in advance. Content varies. Permission of instructor required.

Credits: 3.00

SPAN 67900 - Seminar In Spanish Linguistics

Credit Hours: 3.00. Advanced study and research on a significant topic in Spanish linguistics. Topic to be announced in advance. Permission of instructor required.

Credits: 3.00

SPAN 68200 - Topics In Latin American Culture

Credit Hours: 3.00. Selected facets of Latin American culture through the eyes of the continent's artists, creative writers, essayists, and social scientists - and in view of current theories of the arts, literatures, multiculturalism, and postcolonialism.

Credits: 3.00

SPAN 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

SPAN 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Philosophy (Graduate)

Website: **https://cla.purdue.edu/academic/philosophy/degree-programs.html**

Department/School Head

Christopher Yeomans

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Assistant Professor	Director of the Philosophy for International Students MA Program
Michael Bergmann Jeffrey Brower Jan Cover Paul Draper Daniel H. Frank Leonard Harris M. Jacovides Daniel R. Kelly Jacqueline Mariña William McBride Daniel Smith Christopher Yeomans	Jamin Asay Taylor Davis Patrick Kain Dana Tulodziecki	Javier Gomez-Lavin James Paul Messina Sebastian Murgueitio Ramirez Lea Aurelia Schroeder Evan Westra	Lynn Parrish	Gabriele Dillmann

Academic Programs

Master's and Ph.D. Programs

Students acquire a solid grounding in four traditional areas of philosophy, the history of philosophy, metaphysics and epistemology, value theory, and logic, language, and science, before developing their own specialized research programs.

- Ph.D. Program
- M.A. in Philosophy for International Students

Concentrations

- Human Rights
- Second Language Philosophy - Professional

Philosophy, MA

Philosophy, PHD

Philosophy and Literature, PHD

PHIL 50000 - Advanced Ethics For Technology, Engineering, And Design

Credit Hours: 3.00. This graduate seminar is designed to increase your understanding of professional and ethical responsibilities in national, international, and cross-cultural environments, helping you to anticipate, understand, and navigate issues that will likely arise in your working life. The focus of the course is on developing the ability to apply a general ethical framework to new and unique situations, including those arising from the global cultural context of modern engineering. The course covers how this ethical framework should be constituted, and provides practice in applying this framework to specific, concrete cases. Together, these components work toward your development as a better

engineer and a more responsible global citizen.

Learning Outcomes: 1. Recall and describe key concepts of professional and ethical responsibilities in national, international, and cross-cultural environments. 2. Apply the general ethical framework to analyze and resolve specific, concrete cases in engineering. 3. Develop a well-researched original case study that integrates professional and ethical considerations, informed by personal experiences and future aspirations in engineering. Credits: 3.00

PHIL 50100 - Studies In Greek Philosophy

Credit Hours: 3.00. The subject matter will alternate between the intensive study of some fairly specific topic in Greek philosophy (e.g., Plato's theory of knowledge, Aristotle's ethics, etc.) and a general study of either the philosophy of Plato or the philosophy of Aristotle.

Credits: 3.00

PHIL 50200 - Studies In Medieval Philosophy

Credit Hours: 3.00. An intensive study of some central topics in the thought of major medieval philosophers. Subject matter will vary. Philosophers most often studied are Augustine, Thomas Aquinas, Duns Scotus, and Ockham.

Credits: 3.00

PHIL 50300 - Studies In Early Modern Philosophy

Credit Hours: 3.00. A detailed study of either: 1) one or more central philosophical themes or 2) one or more major figures (typically, but not restricted to, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and/or Kant) in the early modern period. Offered in alternate years.

Credits: 3.00

PHIL 50500 - Islamic And Jewish Philosophy And The Classical Tradition

Credit Hours: 3.00. A study of representative texts and issues in medieval Islamic and Jewish philosophy. Possible topics include the commensurability of philosophy and (revealed) law, the creation or eternity of the world, the nature of prophecy, the human good, the nature of God, and divine language.

Credits: 3.00

PHIL 50600 - Advanced Philosophy Of Religion

Credit Hours: 3.00. A detailed critical investigation of some central problems in a philosophical approach to religion. Readings will be selected from leading representatives of traditional theism and various contemporary schools. The thought of the representative thinkers will be analyzed, discussed, and critically evaluated. The problems discussed will be selected from the existence of God, the problem of evil, freedom and determinism, the problem of immortality, and the nature of religious language. Variable content.

Credits: 3.00

PHIL 50800 - Advanced Ethics Of Data Science

Credit Hours: 3.00. This graduate seminar is designed to examine the new and important ethical issues that are arising as the applications of data science permeate more and more aspects of our lives. Because we're entering uncharted territory, reasoning clearly about the ethical implications of data science isn't easy. This course provides students with the tools for doing so, including a conceptual framework for ethical reasoning in professional settings, as well as a procedure for case-study analysis that allows students to practice employing this conceptual framework. Together, these components help prepare students to be ethical professionals and responsible global citizens.

Learning Outcomes: 1. Explain the conceptual framework for ethical reasoning in professional settings as it applies to data science. 2. Analyze case studies to identify and evaluate ethical issues arising from the applications of data science. 3. Assess critically the ethical implications of data science applications and propose well-reasoned solutions. Credits: 3.00

PHIL 51000 - Phenomenology

Credit Hours: 3.00. A detailed, critical examination of some major issue(s) in phenomenology. Attention will be given to either the historical development or contemporary relevance of phenomenological philosophy. Readings will be drawn from the works of Husserl, Heidegger, Merleau-Ponty, and others.

Credits: 3.00

PHIL 51400 - Twentieth-Century Analytical Philosophy I

Credit Hours: 3.00. A detailed study of the origins and development of contemporary philosophical analysis, and how it was pursued in movements such as logical atomism, logical

positivism, ordinary language philosophy, and others. Readings will cover a selection of the writings of Frege, Russell, Moore, Wittgenstein, Ayer, Ryle, Austin, and others. Need not be followed by PHIL 51500.

Learning Outcomes: 1. Develop an appreciation for and understanding of central problems, texts, and ideas in the history of analytic philosophy. 2. Identify and reconstruct philosophical arguments. 3. Discriminate between metaphysical and epistemological issues. Credits: 3.00

PHIL 51500 - Twentieth-Century Analytical Philosophy II

Credit Hours: 3.00. The development of philosophical analysis through logical positivism and the various forms of linguistic philosophy. An examination of some of the important writings of Moore, Ayer, Ryle, Wisdom, Austin, and the later Wittgenstein. Need not be preceded by PHIL 51400 .

Credits: 3.00

PHIL 52000 - Existentialism

Credit Hours: 3.00. A detailed exploration and examination of the existentialist movement in modern thought, including its historical roots, its philosophical formulations, and its influence and expression in and relation to art, literature, psychology, social criticism, and religion. Readings will be from at least some of the major existentialists: Kierkegaard, Nietzsche, Jaspers, Heidegger, and Sartre. In addition, texts from existentialist thinkers in other areas will be used.

Credits: 3.00

PHIL 52400 - Contemporary Ethical Theory

Credit Hours: 3.00. A critical review of twentieth-century developments in ethical and value theory, with particular reference to the dispute between utilitarianism and deontological theories, and to the problem of justification.

Credits: 3.00

PHIL 52500 - Studies In Metaphysics

Credit Hours: 3.00. An intensive and critical examination of one or more of the basic problems of ontology and cosmology, such as substance, existence, causality, change, time, space, teleology, freedom, and universals. Variable content.

Credits: 3.00

PHIL 53200 - Studies In Theory Of Knowledge

Credit Hours: 3.00. An intensive examination of selected problems concerning the nature of human knowledge, its scope and limits, its relation to sense-perception and memory. Variable content.

Credits: 3.00

PHIL 53500 - Studies In Philosophy Of Mind

Credit Hours: 3.00. An intensive study of select topics in the philosophy of mind such as the explanation of human behavior, knowledge of other minds, the relation between mind and body, and the nature of persons. Variable content.

Credits: 3.00

PHIL 54000 - Studies In Social And Political Philosophy

Credit Hours: 3.00. A detailed study of one or more important concepts in social or political philosophy, such as natural rights, revolution, law, freedom, justice, or political obligation. Variable content.

Credits: 3.00

PHIL 55100 - Philosophy Of The Natural Sciences

Credit Hours: 3.00. A survey of issues and theories in contemporary philosophy of science. Variable content.

Credits: 3.00

PHIL 55200 - Philosophy Of The Social Sciences

Credit Hours: 3.00. An exploration of the nature of the concepts in the social sciences, and a study of the ways in which they have been and are employed.

Credits: 3.00

PHIL 55300 - Mathematical Logic

Credit Hours: 3.00. This class is an introduction to various logical foundations of mathematics as well as the basics of logical metatheory.

Learning Outcomes: 1. Understand some of the more advanced methods employed in logical analysis. 2. Explain important problems and issues in foundational mathematical logic and express them in clear and precise terms. 3. Analyze and assess foundational results in

mathematical logic. 4. Explain, apply, and appraise the use of formal languages. 5. Assess and construct precise, abstract arguments using the tools of mathematical logic. (This will help students engage in better written and oral communication, in particular in circumstances where perspicuity and logicality are of special importance.) Credits: 3.00

PHIL 56100 - Reading Philosophy: Skills And Strategies

Credit Hours: 3.00. Repeatable twice for a maximum of 9 credits. Academic philosophy demands both the ability to read large amounts of texts fluently, carefully, and closely. Furthermore, the abstract nature of philosophical discourse places a large cognitive demand upon readers. This course prepares non-native English speakers philosophy students for these intensive reading demands. The course has three major learning areas: the language skills that students need to read fluently (i.e., the efficient processing of language for general comprehension of meaning); reading strategies that students can use to improve comprehension and learning; and communication about readings, as the close reading of texts is essential to communicating one's ideas both orally and in writing. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar. Permission of department required.

Learning Outcomes: 1. Read un-simplified prose more fluently (i.e., improved rate, accuracy, and expression). 2. Apply reading strategies to improve reading comprehension of philosophical texts. 3. Define and expand core vocabulary of philosophical discourse and academic discourse. 4. Identify genre, rhetorical features, and stylistic elements of philosophical texts to aid reading comprehension and fluency. 5. Discuss philosophical texts in a classroom setting. 6. Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 56200 - Reading To Argue

Credit Hours: 3.00. Repeatable twice for a maximum of 9 credits. Closely and critically reading philosophical arguments is the first step to composing your own arguments in philosophy. In addition, developing these skills will help you to orally discuss philosophical ideas, both in classroom discussions as well as when giving presentations. This class aims to prepare students for these tasks by developing the skills of close and critical reading in philosophical discourse. All the while, students will continue improving their reading, writing, and speaking skills in the English language through specifically designed language learning components for non-native English speakers. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar. Permission of department required.

Learning Outcomes: 1. Apply core concepts of informal argument analysis to philosophical arguments. 2. Construct effective informal argument reports. 3. Identify genre and rhetorical devices of philosophical arguments to aid reading comprehension and critical reading. 4. Critically evaluate philosophical arguments. 5. Explain and discuss philosophical arguments orally in class and group conversations. 6. Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 56300 - Directed Reading: Greek Philosophy Texts And Translations

Credit Hours: 1.00. In this course we shall focus on an important Greek philosophical text in fine detail. We will be working in the original language, not from an English translation. Participants will translate the text at hand and philosophical discussion will follow. Normally a Platonic dialogue or a work of Aristotle will be selected.

Learning Outcomes: 1. Develop greater facility in comprehending the text in the original language, and on this basis will be better positioned to analyze the argumentative structure of the text at hand. 2. Improve both

philological and philosophical skills. Credits: 1.00

PHIL 56400 - Walk-Along Language Lab

Credit Hours: 1.00. This course is a co-requisite, language-focused class linked to a philosophy seminar. Walk-along courses provide opportunities to shift focus from content to language form and use. Activities and projects for the course are designed to complement tasks and projects required for the seminar. Thus, the purpose of the walk-along course is to help you develop linguistic abilities required to succeed in your coursework. In addition, because of the centrality of writing for philosophy, walk-along courses will predominantly focus on developing your writing skills. Permission of department required.

Learning Outcomes: 1. Define core vocabulary of the seminar topic. 2. Identify genre and rhetorical features of the seminar topic to aid reading comprehension and fluency. 3. Compose several reaction papers for the seminar topic for a wide range of purposes, including explaining, criticizing, extending arguments, giving examples, etc. 4. Explain and discuss your written works in class as well as in individual conferences. Credits: 1.00

PHIL 56500 - Directed Reading: Political Philosophy

Credit Hours: 1.00. Participants read recent and classic work by political philosophers, political economists and political theorists. Specific topics vary by term.

Learning Outcomes: 1. Develop critical reading skills. 2. Have a better understanding of methods of argumentation in political philosophy. 3. Develop an area strength in themes in political philosophy. Credits: 1.00

PHIL 56700 - Directed Readings In Philosophy Of Mind

Credit Hours: 1.00. A reading group focused run by faculty members aimed at an in-depth exploration of some thread of research emerging in the contemporary literatures.

Learning Outcomes: 1. Get up to speed on and analyze the positions being staked out in advanced debates in contemporary philosophy of mind, cognitive science, and/or moral psychology. 2. Evaluate the distinct theoretical approaches and arguments given in support and against newly emerging views. 3. Identify opportunities to intervene on those current debates, pathways for future research, potential criticisms to develop into publishable papers. Credits: 1.00

PHIL 57100 - Writing To Learn

Credit Hours: 3.00. Repeatable twice for a maximum of 9 credits. Writing on a higher academic level can be especially challenging for non-native English-writers. Thus, this course aims to develop students' graduate-level skillsets in philosophical practices in an English language environment to help them gain confidence and become productive members of the philosophical community. Students will learn writing processes that will aid their ability to effectively compose in English, including developing a thesis statement, outlining, drafting, formatting, and editing. As all four chief skillsets in second-language proficiency development work in tandem and enhance each other, the course will rely on writing, reading, speaking, listening, and presenting work for learning and further developing these advanced language skills. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar. Permission of department required.

Learning Outcomes: 1. Construct clear and well-organized expositions of philosophical discourses. 2. Identify cases of plagiarism in writing in order to avoid plagiarism when summarizing the ideas of others. 3. Apply writing strategies to manage the writing process, including outlining, drafting, and revising. 4. Apply genre and rhetorical features of philosophical discourse to writing including: Rhetorical practices and linguistic devices used to paraphrase and summarize information, genre conventions for citing sources and organizational devices used to create coherence and cohesion in essays. 5. Present and discuss ideas and research work compellingly, thoughtfully, and respectfully. 6.

Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 57200 - Writing To Argue

Credit Hours: 3.00. Repeatable twice for a maximum of 9 credits. Writing is a primary mode of communication in philosophy. This course aims to prepare students for the writing demands of philosophy by having students develop their ability to analyze, interpret, and critique philosophical arguments through written works and, in the process, construct their own philosophical arguments. Students will also learn writing processes that will aid their ability to effectively and clearly compose philosophical arguments, including outlining, drafting, and editing. Finally, the class will also pay attention to genre and rhetorical features of philosophical discourse, such as how philosophers enact criticism and write introductions to research papers. All the while, students will continue improving their writing and speaking skills in the English language through specifically designed language learning components for non-native English speakers. Students can use their course paper as a draft of a writing sample for PhD programs. Students are also supported in their regular philosophy courses. This course is linked to one or more 500+ level philosophy seminars that students in this course are enrolled in. Reading materials, writing activities, and projects for the course are designed to complement tasks and projects required in the linked philosophy seminar.

Learning Outcomes: 1. Apply analytical techniques to analyze and interpret philosophical arguments in written composition. 2. Critique philosophical arguments in written composition. 3. Apply steps in the writing process, including outlining, drafting, revising, and editing. 4. Compose an argumentative research paper that responds to a current philosophical issue. 5. Formulate constructive feedback to others and revise your written assignments based upon feedback. 6. Apply genre and rhetorical features of philosophical discourse to one's writing, including: Rhetorical practices and linguistic devices used to criticize arguments and genre conventions for writing introductions, including how to create a research space for your argument. 7. Improve speaking skills, including circumlocution, pronunciation, attention to body language, affect, and more, in classroom discussions and formal presentations. Credits: 3.00

PHIL 58000 - Proseminar In Philosophy

Credit Hours: 1.00 to 3.00. Designed primarily for majors in philosophy who have already successfully completed six hours in philosophy. Other students may be admitted to the course with the special consent of the instructor in charge. Topic to be selected by the department.

Credits: 1.00 to 3.00

PHIL 59000 - Directed Reading In Philosophy

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose particular field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

PHIL 60000 - Graduate Teaching And Pedagogy Seminar

Credit Hours: 3.00. This graduate seminar provides graduate students with a forum to discuss and enact teaching strategies. Over the course of the term, weekly meetings will be devoted to a discussion and implementation of issues in teaching, learning, and assessment. The goal of this course is to prepare and enhance the teaching portfolio of our students and to make them more effective teachers in the classroom.

Learning Outcomes: 1. Analyze and evaluate disparate strategies for effective pedagogical performance. 2. Develop strategies to foster an inclusive teaching and learning environment. 3. Compare evaluative modalities for assessing student performance. Credits: 3.00

PHIL 60100 - Special Topics In Ancient Philosophy

Credit Hours: 3.00. A detailed critical analysis of special problems or texts in ancient philosophy. Prerequisite: PHIL 50100 .

Credits: 3.00

PHIL 61000 - Seminar In Recent Continental Philosophy

Credit Hours: 3.00. An intensive, critical examination of some of

the current modes of thought in recent continental philosophy, including phenomenology, critical theory, hermeneutics, deconstruction, and postmodernism. Selected writings from representative figures. Topics and texts will vary from semester to semester. Prerequisite: PHIL 51000 or PHIL 52000 .

Credits: 3.00

PHIL 62400 - Seminar In Ethics

Credit Hours: 3.00. An intensive study of some persistent problems of ethics, metaethics, and theory of action such as: intrinsic goods, ends and means, the concepts of utility, justice, and duty; facts and values, justification, ethical relativism, free will and blame-worthiness, belief, and action. Emphasis will be on contemporary discussions. Variable subject matter. Prerequisite: PHIL 52400 .

Credits: 3.00

PHIL 66500 - Philosophy Of Language

Credit Hours: 3.00. An introduction to some of the main concepts and problems in the philosophy of language, such as meaning, reference, and private languages, through readings in the chief contributors to the field. Prerequisite: 6 credit hours in Philosophy.

Credits: 3.00

PHIL 68000 - Seminar In Philosophy

Credit Hours: 3.00. An intensive course for graduate students majoring or minoring in philosophy. The content of the seminar will be determined in accordance with the needs and interests of the students. Prerequisite: 6 credit hours at the graduate level in Philosophy.

Credits: 3.00

PHIL 68300 - Studies In Continental Rationalism

Credit Hours: 3.00. An intensive study of Descartes, Spinoza, or Leibniz, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68400 - Studies In British Empiricism

Credit Hours: 3.00. An intensive study of Locke, Berkeley, or Hume, or of certain themes and ideas that played an important role in the development of their philosophies. Variable subject matter. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 68500 - The Philosophy Of Kant

Credit Hours: 3.00. This course will be concerned with the critical philosophy as a whole. Primary emphasis, however, will be on the theories of knowledge and metaphysics as developed in the Critique of Pure Reason. Lesser attention will be paid to Kant's ethics and the principles of judgment as time permits. Prerequisite: PHIL 30300 .

Credits: 3.00

PHIL 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHIL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Political Science (Graduate)

Website: **https://cla.purdue.edu/academic/polsci/gradprog/index.html**

Department/School Head

Cherie Maestas

Faculty by Rank

Professor	Associate Professor	Assistant Professor

Andy Baker Robert X. Browning Rosalee A. Clawson James A. McCann Cherie Maestas Keith L. Shimko Valeria Sinclair-Chapman Eric N. Waltenburg	Lisa Argyle Mollie Cohen Jesse Crosson Bryce Dietrich Tara Grillos Kyle Haynes David Johnson Brian Kogelmann Molly Scudder Swati Srivastava Logan Strother David Yu	Miriam Barnum Benjamin Broman Tyler Girard Seoyeon (Jenn) Kim Liana Eustacia Reyes Kaylyn Jackson Schiff Daniel Schiff Joan Timoneda Minh Trinh Eddie Yang Shan Zhou

Academic Programs

Master's and Ph.D. Programs

The Department of Political Science is a Ph.D. granting program. Students have the opportunity to earn their MA while making academic progress towards PhD. Our program prepares students for teaching and research careers. We are dedicated to helping students pursue careers in academic or non-academic positions.
Doctoral students specialize (major) in American, Comparative, International Relations or Public Policy with a secondary specialization (minor) in: a) one of the major fields, b) political methodology, or c) a custom designed field. We have areas of strength in the traditional fields as well as areas that cut across traditional fields such as technology and governance, political methodology, political economy, political institutions and processes, environmental policy, national security, and political violence. Our curriculum has ample room to explore interdisciplinary interests and applied fields. We welcome students with interests in traditional academic career paths and applied career paths. Doctoral students become deeply immersed in the process of scholarly research and are quickly prepared to be full collaborators and independent researchers. We encourage students to execute research projects in preparation for academic and applied careers. In addition, we prepare doctoral students for independent classroom instruction and make every effort to provide an independent teaching experience for each doctoral student completing our program.

Concentrations (Areas of Study)

- African American Studies
- Human Rights Studies
- Interdisciplinary Ecological Sciences and Engineering
- Political Economy
- Political Psychology
- Women's, Gender, and Sexuality Studies

Social Policy, Post-Baccalaureate Certificate

Political Science, PHD

Environmental Policy, Post-Baccalaureate Certificate

Political Science, MA

Governance and Policy for AI and Data Technology, Post-Baccalaureate Certificate

POL 50100 - Political Science: Methodology

Credit Hours: 3.00. Introduction to the basic techniques of

statistical analysis applicable to political science data. Elementary descriptive statistics and statistical inference. Introduction to multivariate analysis. Permission of instructor required.

Credits: 3.00

POL 50601 - Data, Machine Learning, And Artificial Intelligence For The Public Sector

Credit Hours: 3.00. This course examines how machine learning algorithms and tools related to artificial intelligence can be used to advance our understanding in public sector domains. Students will develop a comprehensive understanding of how to apply AI and various machine learning algorithms, focusing on practical applications and hands-on experience. It provides an overview public sector data sources and addresses ethical and privacy issues associated with this type of data.

Learning Outcomes: 1. Identify, construct, and manipulate public data ethically and appropriately for use in AI and machine learning applications. 2. Explain privacy and ethical considerations associated with the use of public sector data, including issues that arise when combining public and private sector data. 3. Demonstrate a comprehensive understanding of popular AI and machine learning algorithms, including supervised and unsupervised learning techniques. 4. Apply AI and machine learning techniques to real-world data sets, emphasizing those techniques commonly used in government, policy, and political settings. 5. Assess, interpret, and report AI and machine learning output to audiences commonly found in government, policy, and political settings.

Credits: 3.00

POL 51700 - Applied Political Economy

Credit Hours: 3.00. An examination of the core concepts of political economy, the interaction of political institutions, markets, and economic choices, including the nature of capital and labor in the political process. Understand how political institutions and policies influence the organization of economic activity, and the role of the state and policy in shaping the domestic and global political economy since World War II.

Learning Outcomes: 1. Explain the core concepts of markets, capital, labor, and how they relate to economic and political outcomes. 2. Understand and describe why policy choices of states shape the functioning of markets, the organization of capital and labor, and economic decision-making. 3. Analyze the impact of different forms of political institutions and public policies on markets, economic behavior, and economic and political outcomes. 4. Apply political economy concepts to analyzing the context of an economic problem, identify potential solutions, and assess the likely outcome of policy interventions in light of the political economy of the state. Credits: 3.00

POL 52000 - Special Topics In Public Policy

Credit Hours: 3.00. This is a course focused on a specific current public policy topic, chosen for its contemporary political relevance, which varies from semester to semester. In general, each topic will be examined in terms of its historical roots, past policy initiatives, present policy proposals, and its enduring political and social challenges.

Credits: 3.00

POL 52101 - Applied Public Policy: Institutions, Processes, Practices

Credit Hours: 3.00. Applied introduction to the institutions, processes, and practices in the field of public policy. Students will examine the role of government institutions, standards organizations, corporate actors, and non-governmental organizations, policymakers, regulators, and the public in the policy process. The course will draw examples from one or more applied policy areas such as economic development, emerging technology policy, sustainability policy, energy, foreign policy, or social policy.

Learning Outcomes: 1. Summarize and describe the institutions, actors, and policy process for different political systems. 2. Compare and contrast the role of political analysis and policy analysis for analyzing the viability and success of policy. 3. Evaluate a policy area and write a policy brief describing the history of the policy, current stakeholders in the area, the current state of policy, and emerging policy challenges or prospective changes. 4. Design translational communication materials to convey policy information to

different audiences including specialists and non-specialists. Credits: 3.00

POL 52300 - Environmental Politics And Public Policy

Credit Hours: 3.00. The political problems of natural resource use and environmental quality. Theoretical foundations for environmental policy and its evaluation, the political context of environmental policy, principles of administering environmental policies, and the significance of international law and institutions for environmental policies.

Credits: 3.00

POL 52400 - Public Policy And The Family

Credit Hours: 3.00. An intensive examination of the interrelationships between public policy making and the structure and quality of life of families. The primary focus is the United States, but consideration is given to family policies in other capitalist nations.

Credits: 3.00

POL 52601 - Technology, AI, And Ethics In Public Policy And Public Administration

Credit Hours: 3.00. Examines how emerging technologies like artificial intelligence (AI), automated decision systems, and digital platforms are being adopted in the public sector. It explores the benefits as well as ethical risks and challenges associated with implementing these technologies in areas like healthcare, education, child welfare, and criminal justice. Students will analyze governance strategies, policies, and administrative procedures to promote responsible technology use in government.

Learning Outcomes: 1. Summarize the main forms of digital technology and algorithmic practices (AI) that are being adopted in government operations and decision-making, including automated decision systems, digital public interfaces, and data integration platforms. 2. Analyze emerging trends and developments in the use of AI, automated decision systems, and data analytics in public agencies and governments, in the U.S., internationally, and at the local level. 3. Assess the benefits as well as risks and challenges associated with implementing these technologies in the public sector, including how the use of new technology is transforming interactions between government and citizens, impacting social welfare, and implicating issues of transparency, accountability, discretion, discrimination, and public trust. 4. Evaluate ethical concerns, biases, and risks to social welfare that may arise from the use of AI and automated decision systems in administering public programs and services and demonstrate the ability to examine issues from multiple stakeholder perspectives. 5. Propose governance strategies, policy solutions, and administrative procedures to ensure responsible and ethical use of AI and other emerging technologies in the public sector, such as best practices for procurement, implementation, auditing, and public engagement. Credits: 3.00

POL 52701 - Local To Global Governance Of Data, AI, And Emerging Technology

Credit Hours: 3.00. This course introduces students to the institutions and governing systems at the subnational, national, supranational, and international levels that regulate emerging technology, AI, and data. Focusing on laws, standards, and best practices, students will examine comparative case studies of regulation of big tech in differing governing environments. Students will explore how social, economic, and political factors shape differences in technology regulation across the globe.

Learning Outcomes: 1. Summarize the main policy institutions, stakeholders, and regulatory actors in subnational, national, supranational, and international settings as applied to area of emerging technology, AI, and data. 2. Analyze the current state of policy and its implementation in one or more regions or states as applied to areas of emerging technology, AI, and data. 3. Develop a proposal for best practices for managing the use of AI, data resources, or other emerging technology in a private, public, or non-profit setting. 4. Compare and contrast differences in technology regulation across the globe and explain common sources for these differences. Credits:

3.00

POL 52801 - Organizational Governance Of Technology And AI

Credit Hours: 3.00. This course examines the impact of technology policy on organizations and their organizational governance strategies for AI and technology. It explores the incentives, strategies, and activities of the private and non-profit sector in governing AI, as well as the relationship between the private, public, and non-governmental sectors.

Learning Outcomes: 1. Describe and evaluate the impact of legal, regulatory, and ethical frameworks (soft laws and hard laws) on organizational governance of AI, including how legal, technological, and social factors can advance and hinder AI governance in organizations. 2. Analyze different considerations for companies using and governing AI, depending on their size and stage, industry, and jurisdiction. 3. Evaluate strategies that AI practitioners in AI governance functions of organizations have used to manage AI systems and their risks. 4. Develop and communicate strategies to advance AI governance objectives in different organizational contexts, including through policies, assessments, procurement strategies, and/or education. Credits: 3.00

POL 52901 - Applied Policy And Program Evaluation

Credit Hours: 3.00. This course introduces students to the logic of designing and implementing program evaluations to assess implemented policies and programs. The course examines research designs for different evaluation goals, the application of evaluation strategies, and strategies for reporting results to specialist and non-specialist audiences.

Learning Outcomes: 1. Describe the role and principles of evidence-based policymaking and program evaluation, including ethical considerations. 2. Explain the different aspects of evaluation, including inputs, outputs, outcomes, impacts, and processes, and identify complementary evaluation strategies. 3. Compare and contrast different methods for program impact evaluation, including ethical considerations. 4. Synthesize knowledge of program evaluation strategies to solve applied problems. 5. Communicate program evaluation results to specialists and non-specialists effectively. Credits: 3.00

POL 53100 - Terrorism And WMD Threat Assessment

Credit Hours: 3.00. "Terrorism and WMD Threat Assessment" is designed to teach students how to analyze and assess the threats terrorist organizations present in the area of nuclear and radiological security and weapons of mass destruction more generally. The goal of this class is to enable students to identify, prioritize, and assess terrorist threats and propose appropriate, proportional, and cost-effective counter-measures.

Learning Outcomes: 1. Understand the causes, motivations, strategies, and tactics of terrorist organizations, particularly regarding nuclear terrorism. 2. Understand challenges associated with implementing effective counterterrorism strategies and policies. 3. Analyze current and future nuclear proliferation threats from countries and non-state or sub-state actors and provide recommendations on how to address these security issues. 4. Define and analyze the various types of transnational threats and targets in order to craft effective policy responses. 5. Describe nuclear weapons proliferation, including incentives and disincentives for proliferation. 6. Analyze counter-proliferation strategies. Credits: 3.00

POL 53200 - Nuclear Strategy And Proliferation

Credit Hours: 3.00. "Nuclear Strategy and Proliferation" is designed to teach students about 1) the conceptual elements and operational requirements of nuclear deterrence and 2) the historical dynamics of nuclear proliferation and nonproliferation. The goal of the class is to enable students to 1) evaluate the deterrent effects of different nuclear weapons and various configurations of nuclear arsenals and 2) analyze the technological, political and legal incentives and obstacles for acquiring nuclear weapons.

Learning Outcomes: 1. Understand the

historical development of ideas about nuclear deterrence and its requirements. 2. Understand debates about the requirements for nuclear deterrence. 3. Analyze and evaluate the size and structure of the nuclear arsenals of current nuclear powers. 4. Identify and explain the main technological challenges and obstacles to acquiring nuclear weapons. 5. Evaluate potential explanations of why nations choose to acquire nuclear weapons (or refrain from doing so). Credits: 3.00

POL 54101 - Applied Foundations Of Global Development

Credit Hours: 3.00. Describes the foundational concepts of economic development and the historical emergence of global inequality, provides explanations of global inequality, and explores Western efforts to mitigate it through foreign aid. Applies concepts to analyze current trends in development and emerging practices in foreign aid.

Learning Outcomes: 1. Explain the global history of economic and human development. 2. Contrast notions of development beyond the narrow concept of economic growth. 3. Identify and critique a wide array of explanations for why some countries are developed and others are not. 4. Analyze international, domestic, and geographical constraints on economic development. 5. Describe the workings of the international aid regime. 6. Demonstrate practical skills for working in the field of development such as communication, organization, and analysis. Credits: 3.00

POL 55101 - Governance Auditing For AI - Sociotechnical Frameworks And Practices

Credit Hours: 3.00. Governance auditing of AI involves examining the sociotechnical systems that shape AI's design, deployment, and impact at the levels of individual AI systems, teams, and broader organizations. This course equips students with the skills to better understand and evaluate AI systems, their organizational context, and associated governance mechanisms through applying common industry and government frameworks.

Learning Outcomes: 1. Understand leading frameworks for AI auditing and their relevance in the socio-technical assessment of AI systems, especially at the organizational level. 2. Analyze the intersection and trade-offs associated with regulatory, ethical, organizational, and practical considerations in AI governance and governance auditing. 3. Assess critically the relationship of governance auditing of AI with other forms of auditing and evaluation, such as technical auditing and safety evaluations. 4. Conduct sociotechnical evaluations of AI systems, focusing on dimensions well-being, human rights, and organizational maturity in responsible AI. 5. Develop and communicate actionable recommendations for improving responsible AI practices in various contexts. Credits: 3.00

POL 55801 - Tech Diplomacy In International Affairs

Credit Hours: 3.00. This course provides an overview of the role of tech diplomacy in international relations and foreign policy, focusing on how emerging technologies can disrupt global power structures and create both risks and opportunities. Students will study core theories, analyze case studies, and develop skills in applied research and communication.

Learning Outcomes: 1. Define and summarize the key features of tech diplomacy, including its principles and goals. 2. Explain the relationships between emerging technology, globalization, international relations, and foreign policy. 3. Research, analyze, and communicate information about emerging threats and opportunities in fields of emerging technology, and develop strategies for addressing them by applying the principles and practices of tech diplomacy. Credits: 3.00

POL 55901 - Emerging Technology In International Affairs

Credit Hours: 3.00. This course focuses on understanding contemporary emerging technologies and their implications for tech diplomacy, national security, and foreign policy. Students develop skills through analyzing case studies and developing

applied projects that assess threats and opportunities in an area of emerging technology.

Learning Outcomes: 1. Explain and demonstrate research strategies for analyzing the strategic implications of emerging technologies for diplomacy, national security, and foreign policy. 2. Apply theoretical frameworks and grounding in principles of tech diplomacy to evaluate real-world case studies to assess threats and opportunities in an area of emerging technology and develop forward-thinking strategies to address them. 3. Assess and select strategies for communicating information about the implications of emerging technology with different types of audiences, including foreign and domestic officials, technical experts, media, and the public. Credits: 3.00

POL 59000 - Directed Reading In Political Science

Credit Hours: 1.00 to 3.00. A reading course directed by the instructor in whose field of specialization the content of the reading falls. Approval of each reading project must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

POL 60000 - Political Science: Discipline And Profession

Credit Hours: 3.00. An exploration of the scope of political science and of its development as a profession, with a focus on what American political scientists do as disciplinary professionals. Analysis of major approaches to the study of politics and of current developments. Prerequisite: 6 credit hours in Political Science.

Credits: 3.00

POL 60500 - Research Design And Methods

Credit Hours: 3.00. Selection of research problems involving political phenomena; formulation of concepts and hypotheses; research design; data collection techniques; data processing, analysis, and interpretation, with attention to uses of high-speTed facilities. Students will design a research project and, as appropriate, carry out the project in the laboratory or in the field. Prerequisite: POL 50100 .

Credits: 3.00

POL 60600 - Advanced Quantitative Techniques In Political Science

Credit Hours: 3.00. This course deals with advanced quantitative techniques useful in political science research. These include multiple correlation and regression, causal modeling, dynamic (time series) analysis, dimensional analysis (Coombsean scaling, Shepard-Kruskal scaling, and factor analysis), and cross-level inference techniques. Prerequisite: POL 50100 , POL 60500 .

Learning Outcomes: 1. Understand the logic and interpretation of various models. 2. Understand the assumptions underlying various advanced quantitative techniques. 3. Analyze data using advanced quantitative techniques. 4. Learn the appropriate software to apply advanced quantitative techniques. Credits: 3.00

POL 60800 - Qualitative Methods In Political Science

Credit Hours: 3.00. This course is an introduction to the use of qualitative methods in political science. In addition to a detailed consideration of several leading qualitative approaches to political research, the course will also consider the distinctive issues of research design for qualitative research as well as the relationship of qualitative and quantitative methods. Prerequisite: POL 50100 Political Science Methodology or equivalent or consent of instructor.

Learning Outcomes: 1. Know and understand the different perspectives and epistemologies related to qualitative research. 2. Know and understand the primary components of qualitative research design. 3. Recognize and apply the common tools for the collection and analysis of qualitative data. 4. Understand the distinctive ethical issues that can arise in qualitative research. 5. Create and compose a research proposal with a substantial qualitative methods component. Credits: 3.00

POL 60900 - Advanced Applied Research Design

Credit Hours: 3.00. The main goal of this seminar is to guide graduate students when preparing their Ph.D. dissertation proposals. The seminar aims to do two things. The first is to provide an overview of the crucial research design tools and

research planning considerations that can help students plan and carry out better dissertation projects. The second is to offer a structured forum where students can present and receive feedback on their dissertation proposals. With permission from the Director of Graduate Studies, this course may be repeated and used to support the development of a grant proposal or research publication. Pre-requisite: POL 60000 with a grade B or better.

Learning Outcomes: 1. Communicate clearly a research question, its scientific merit, and broader impacts. 2. Connect a theory and its concepts to a suitable research design. 3. Estimate and describe a research project's feasibility. 4. Produce a defensible prospectus or other research product suitable for submission to an evaluative body. 5. Respond effectively to reviewer feedback in revising work. Credits: 3.00

POL 61000 - Proseminar In American Political Systems, Processes, And Behavior

Credit Hours: 3.00. An introduction to American political systems, processes, and behavior as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 61100 - Research Seminar In American Government And Politics

Credit Hours: 3.00. Topics vary. Permission of department required.

Credits: 3.00

POL 61500 - Proseminar In Electoral Behavior And Political Socialization

Credit Hours: 3.00. A reading and lecture course acquainting the student with the general literature in the field. Traces the descriptive aspects, causes, and consequences of electoral behavior and political socialization in the American polity and selected European countries. Emphasis on the processes of citizen integration into the larger political system. Both historical and comparative approaches to the material will be used.

Credits: 3.00

POL 61600 - Research Seminar In Political Behavior

Credit Hours: 3.00. Extends the work of POL 51600 (Group Politics) to the empirical study of primary groups, cliques, social groups, voluntary associations, experimental and occupational groups (insofar as they have political impacts) and of political clubs and associations, paraparties, and inchoate political movements and parties. Training will be given in the use of phenomenological observation, interaction analysis, content analysis, personality inventories, and other instruments that reveal the social structure and dynamics of groups. Students will conduct field studies of politically-relevant groups, or will conduct or participate in conducting laboratory experiments.

Credits: 3.00

POL 62000 - Proseminar In Public Policy And Processes

Credit Hours: 3.00. An introduction to public policy and processes as a field of graduate study with an emphasis on the literature.

Credits: 3.00

POL 62200 - Research Seminar In Public Policy And Public Administration

Credit Hours: 3.00. Investigation in depth of a substantive aspect of public policy such as energy policy or social policy, or of a theoretical topic, for example, policy formulation, enactment, implementation, impact, or evaluation. Permission of instructor required.

Credits: 3.00

POL 62300 - Research Seminar In Environmental Policy

Credit Hours: 3.00. Investigation in depth of a substantive aspect of environmental policy or a theoretical approach to environmental policy, with emphasis on student research. Permission of instructor required.

Credits: 3.00

POL 63000 - Proseminar In International Relations

Credit Hours: 3.00. An introduction to international relations as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 63100 - Research Seminar In International Relations

Credit Hours: 3.00. Topics vary. Permission of department required.

Credits: 3.00

POL 64000 - Proseminar In Comparative Political Systems

Credit Hours: 3.00. An introduction to comparative political systems, processes, and behavior as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 64100 - Research Seminar On Comparative Politics

Credit Hours: 3.00. Topics vary. Prerequisite: POL 64000 .

Credits: 3.00

POL 65000 - Proseminar In Political Theory

Credit Hours: 3.00. An introduction to political theory as a field of graduate study with special emphasis on the literature of great political thinkers. Prerequisite: Master's student standing.

Credits: 3.00

POL 65100 - Research Seminar In Political Theory

Credit Hours: 3.00. Investigation in depth into a selected area of political thought. Intensive study and close analysis of the selected topic, school, or theoretic system. Development of historic and philosophic methods applicable to the study of political thought.

Credits: 3.00

POL 66200 - Proseminar In Political Economy

Credit Hours: 3.00. An introduction to political economy as a field of graduate study with an emphasis on literature.

Credits: 3.00

POL 68500 - Professional Development Practicum

Credit Hours: 0.00 or 1.00. This course examines the ethics, norms, and expectations of the profession of political science and public policy for those engaged in doctoral level study. the course explores topics of professional development to support progress in the degree and building a successful career. Permission of department required.

Learning Outcomes: 1. Explain the expectations for professional conduct in research, teaching, and service at Purdue and in professional political science settings, including why these standards are relevant for advancing free inquiry, diversity, and creating an inclusive culture. 2. Develop a sequenced plan of professional activities to help prepare them for success in the program and the job market by their final year in the program. 3. Identify how to access resources to support professional development in the college, the university, and the discipline of political science. 4. Demonstrate an ability to independently select and participate in meaningful professional development activities. Credits: 0.00 or 1.00

POL 68600 - Career And Placement Practicum

Credit Hours: 2.00. Provide practical guidance and workshops to help students plan job searches, prepare application materials, and develop skills in public presentations such as video interviews, in-person interviews, job talks, teaching talks, and other public talks. Permission of department required.

Learning Outcomes: 1. Explain the key steps in the academic job market and the non-academic job market, and how to prepare for each. 2. Demonstrate an ability to create a professional oral and written materials for a job search towards both academic and non-academic jobs. 3. Identify how to access resources to support career planning and job searches for academic positions, post-docs, and non-academic positions. 4. Explain why diversity, equity, and inclusion is an important part of job searches, and build evidence of their work in this area for job market materials. 5. Demonstrate an ability to independently select and participate in meaningful career planning and job search activities. Credits: 2.00

POL 69300 - Interdisciplinary Seminar

Credit Hours: 3.00. Topics vary - Interdisciplinary Seminar. Permission of instructor required.

Credits: 3.00

POL 69500 - Directed Reading And Research Topics

Credit Hours: 1.00 to 3.00. Individual topics involving research

by the student other than on a thesis topic. Admission and hours require the consent of instructor who will supervise the research. Approval of each topic must be secured from the department. Permission of instructor required.

Credits: 1.00 to 3.00

POL 69800 - Research MA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis.

Credits: 1.00 to 18.00

POL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Sociology (Graduate)

Website: **https://www.cla.purdue.edu/sociology/graduate/index.html**

Department/School Head

Linda Renzulli

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Rachel L. Einwohner Scott Feld Kenneth Ferraro Brian Kelly David Reingold Linda Renzulli Jeremy Reynolds Kevin Stainback Robin Stryker J. Jill Suitor Fenggang Yang	Shawn Bauldry Spencer Headworth Elizabeth Hoffmann Brandon Jackson Trenton Mize Christie Sennott Patricia Thomas Daniel Winchester	Alina Arseniev-Koehler Joshua Doyle Jacqui Frost Danielle Kane Marcus Mann David McElhattan David Peterson Robbee Wedow	James Anderson Viktor Gecas Richard Hogan Carolyn Perrucci Robert Perrucci Harry Potter Jack Spencer John Stahura Bert Useem Philo Wasburn

Academic Programs

Master's and Ph.D. Programs

Our program prepares students to become researchers, scholars, and teachers through a well-balanced curriculum comprising theory and methods that enable students to conduct sociological research at the forefront of the field. In addition to our cutting edge methodological training and broad sociological teaching, our program offers instruction in seven specialization areas: Family; Health, Aging, and the Life Course; Law and Society; Social Inequality: Class, Gender, Race/Ethnicity, and Sexuality; Social Movements and Political Sociology; Sociology of Religion; and Work and Organizations.

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The Master of Science (MS) in Sociology
• The Ph.D. program in Sociology

Concentrations (Areas of Study)

•
Family
• Health, Aging, and the Life Course
• Law and Society
• Social Inequality: Class,
Gender, Race/Ethnicity, and Sexuality
• Social Movements and Political Sociology
• Sociology of Religion
• Work and Organizations

Sociology, MS

Sociology, PHD

Sociology/Gerontology, PHD

SOC 51400 - Racial And Cultural Minorities

Credit Hours: 3.00. America's minority groups; immigration; interracial and intercultural conflicts; assimilation.

Credits: 3.00

SOC 52500 - Social Movements

Credit Hours: 3.00. A history of social movements and social movement theories from the 19th through the 20th centuries, focused on Western Europe and the USA, although students are encouraged to explore new theories and new movements for their course projects.

Credits: 3.00

SOC 53100 - Community Organization

Credit Hours: 3.00. A history of communities and community studies from pre-contact North America to the present (including virtual communities, which students may choose to study for their course projects).

Learning Outcomes: 1. Know what communities are. 2. Know what community studies are. 3. Understand how communities are created and transformed, 4. Understand how and why communities are important. Credits: 3.00

SOC 57000 - Sociology Of Education

Credit Hours: 3.00. Analysis of the American public school as a social organization. Includes: interrelations among community power structure, social stratification, and the school; the roles of superintendent, principal, and teacher in community and school; the classroom as a social system; student culture; and teaching as a profession.

Credits: 3.00

SOC 57200 - Comparative Healthcare Systems

Credit Hours: 3.00. Using cost, quality, and access to care as core concepts, this course explores healthcare in comparative context. Special topics are health and gender, the environment, epidemics, long-term care, technology, and rationing, among others.

Credits: 3.00

SOC 57300 - The Human Side Of Medicine

Credit Hours: 3.00. Focuses on sociological theory and research related to social conflicts over the delivery of healthcare in the U.S. Considers social issues pertaining to abortion, AIDS, human experimentation, reproductive technologies, euthanasia, and others.

Credits: 3.00

SOC 57400 - The Social Organization Of Healthcare

Credit Hours: 3.00. Analysis of the determinants and consequences of the social organization of medical care. Considers morbidity and mortality, costs and utilization of medical services, healthcare occupations and institutions, and change in programs and policies.

Credits: 3.00

SOC 57600 - Health And Aging In Social Context

Credit Hours: 3.00. Analysis of the social and cultural influences on health in adulthood and later life. Considers distribution of illness among older adults, health behavior, and health services use, including long-term care.

Credits: 3.00

SOC 58000 - Methods Of Social Research I

Credit Hours: 3.00. An intermediate-level examination of research designs, measurement, and sampling with emphasis on issues of problem formulation and the logic and application of methodological procedures.

Credits: 3.00

SOC 58100 - Methods of Social Research II

Credit Hours: 3.00. Emphasis on statistical inference applied to sociological problems; topics include the binomial distribution and the logic of inference, one and two sample tests, confidence intervals, and chi-square. Introduction to bivariate correlation and regression, analysis of variance.

Credits: 3.00

SOC 58300 - Application Of Social Research Methods

Credit Hours: 3.00. Specific methods of survey research, including questionnaire construction, and sampling techniques, as well as case studies and field experiments are covered. Emphasis is on the use of such methods and their implications for the nature of social data. Permission of instructor required.

Credits: 3.00

SOC 59000 - Individual Research Problems

Credit Hours: 1.00 to 3.00. Individual research or reading in an area of sociology under a Sociology department staff member. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 3.00

SOC 59100 - Selected Topics In Sociology

Credit Hours: 1.00 to 3.00. Topics vary.

Credits: 1.00 to 3.00

SOC 60000 - Development Of Sociological Theory

Credit Hours: 3.00. The development of sociological thought in Western Europe and subsequently in the United States from the publication of Marx's early manuscripts through the sociological writings of the 1940s.

Credits: 3.00

SOC 60200 - Contemporary Sociological Theories

Credit Hours: 3.00. A companion course to SOC 60000 . Examination of the works of recent and contemporary sociological theorists such as Durkheim, Weber, Pareto, Parsons, and Merton, and of major theorists in related disciplines such as Marx, Freud, and Malinowski. Includes an examination of major "schools" or frames of reference such as ecology, structural-functionalism, etc.

Credits: 3.00

SOC 60900 - Seminar In Sociology

Credit Hours: 3.00. Topics vary.

Credits: 3.00

SOC 61000 - Seminar On Teaching Sociology

Credit Hours: 3.00. Acquaints students with the literature on teaching sociology and its issues and provides practice instruction through videotaped microteaching, syllabus and examination construction, etc. A theoretical or research paper is required. Prerequisite: Master's student standing.

Credits: 3.00

SOC 61100 - Social Inequality: Class, Race, And Gender

Credit Hours: 3.00. Survey of major approaches (functional, status attainment, labor market, class, culture) to the sociological study of inequality, including qualitative and quantitative, historical and comparative studies. Students will be asked to complete a project analyzing inequality, which might provide the basis for a publishable paper. Prerequisite: Master's student standing and Sociology majors only.

Credits: 3.00

SOC 63000 - Seminar In Political Sociology

Credit Hours: 3.00. Intensive consideration of a selected topic or set of topics in political sociology such as political socialization, political movements, comparative political analysis, political ideology in the industrialized West.

Credits: 3.00

SOC 65900 - Seminar In Marriage And The Family

Credit Hours: 3.00. Seminar in Marriage and the Family. Offered in alternate years.

Credits: 3.00

SOC 66700 - Seminar In The Sociology Of Religion

Credit Hours: 3.00. Examines topics of traditional or emerging

interest in the sociology of religion. Topics covered depend on the theoretical research interests of participating faculty and students.

Credits: 3.00

SOC 67400 - Seminar In Medical Sociology

Credit Hours: 2.00 or 3.00. Seminar in Medical Sociology. Prerequisite: SOC 57400 .

Credits: 2.00 or 3.00

SOC 67700 - Research Seminar On Aging And The Life Course

Credit Hours: 1.00. An interdisciplinary seminar examining recent research on aging and the responsible conduct of research. Emphasis is given to professional development in gerontology and related fields.

Credits: 1.00

SOC 68000 - Advanced Social Research Methods

Credit Hours: 3.00. Survey analysis using regression models. Emphasizes ordinary least squares model applied to sociological problems. Also considered are path analysis and logit and logistic regression. A series of projects are required using the PUCC mainframe computer applying course concepts. Prerequisite: SOC 58100 or SOC 60000 .

Credits: 3.00

SOC 68100 - Selected Problems Of Social Research

Credit Hours: 3.00. Working with already available data, each student will conduct one or more research projects, including conceptualization, operational procedures, analysis of the data, and report writing. The data to be used may be from surveys, small group studies, organizational studies, or written documents. Prerequisite: SOC 60000 or SOC 68000 . Permission of instructor required.

Credits: 3.00

SOC 68600 - Qualitative Methods

Credit Hours: 3.00. Surveys qualitative research methods. Considers methods of data collection and data analysis, including computer-assisted techniques. Critical examination of perspectives, assumptions, and issues, including protection of human subjects. Students conduct research projects and write papers using techniques encountered in class. Prerequisite: SOC 58000 .

Credits: 3.00

SOC 69300 - Interdisciplinary Seminar

Credit Hours: 3.00. A seminar on a topic of interdisciplinary interest, taught in cooperation with a member of another department.

Credits: 3.00

SOC 69500 - Analytic Project In Sociology

Credit Hours: 3.00 or 6.00. Designed to provide experience in defining a research problem, in assessing knowledge and research about the problem, and in analysis. Prerequisite: SOC 58000 , SOC 58100 . Permission of instructor required.

Credits: 3.00 or 6.00

SOC 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Patti and Rusty Rueff School of Design, Art, and Performance (Graduate)

Website:

https://cla.purdue.edu/academic/rueffschool/

Department/School Head

Arni Flaten

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Art and Design **(website)**

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty

Charles Gick David C. Parrish F. Robert Sabol Steven Visser Li Zhang Tong Jin Kim Cheryl Zhenyu Qian (Chair) Fabian Winkler Christine Wuenschel	Petronio Bendito Catherine Dossin Shannon McMullen Sigrid Zahner Hyungjoo Kim	Laura Bittner Eli Craven Jennifer Kaufmann-Buhler Jung Joo Sohn Jennifer Scheuer Barbara Young Do Gyun Kim Genell Ebbini Jessice Mohl Beth Woodward	Vernon Cheek Laura Drake Daniel Engelke Phoebe Farris Otie Kilmer Rosemary Kilmer Robin Kraft Arne Kvaalen Lisa Lee Peterson Richard Paul Kathryn Reeves Susan Ressler Ralph Scarcelli David Sigman Robert Veryzer Victoria Willis Chao Hsi Wu

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Film and Video **(website)**

Faculty by Rank

Assistant Professor	Emeritus Faculty
Bobby Chastain (Chair) Matt HauskeJeremy Sklar	Zinaida Breschinsky Patricia Hart Benjamin Lawton

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Music **(website)**

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Harry Bulow	Christopher Cayari Lynn Hooker Tae Hong Park (Chair) Kristen Yeon-Ji Yun (Clinical)	Jarrard Harris (Clinical) Allen McCullough Monte Taylor (Clinical)	Martha Riley

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Theatre and Dance **(website)**

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty

Rich Dionne (Chair) - Theatre Joel Ebarb - Theatre	Michael McNamara - Theatre	Mercer Aplin (Clinical) - Theatre Ashley Bellet - Theatre Quetta Carpenter - Theatre Will Lewis - Theatre Michael Meyer (Clinical) - Theatre Fan Zhang - Theatre	Anne Fliotsos Kristine Holtvedt Richard Stockton Rand Rusty Jones Dale Miller Van Phillips

Academic Programs

Master's Programs

The Purdue University Department of Theatre and Dance offers MFA degrees in Acting, Audio Technology, Costume Design, Lighting Design, Scenic Design, Sound Design, and Technical Direction. Students learn from a faculty and staff of professional artists, technicians, and scholars working at the top of their fields, in a supportive and rigorous environment, intended to prepare students for fulfilling careers in the professional or educational theatre and the entertainment industries.

Master of Fine Arts: Theatre

Concentrations (Areas of Study)

•

Acting

• Audio Technology
• Costume Design
• Lighting Design
• Scene Design
• Sound Design
• Technical Direction

Design, MFA

Art: Studio Arts Concentration, MFA

Design, Art, and Performance, MA

AD 50200 - Curriculum Studies In Art Education

Credit Hours: 3.00. (EDCI 52000) Study of selected theories of curriculum conception as they apply to constructing arts education curricula in the schools. Permission of instructor required.

Credits: 3.00

AD 50400 - Philosophical Studies In Art Education

Credit Hours: 3.00. (EDCI 52100) To introduce students to philosophy as a mode of disciplined inquiry in art education. Students will critically examine the literature of art education and identify problems requiring philosophical resolution. Permission of instructor required.

Credits: 3.00

AD 51200 - Interaction Design Studies

Credit Hours: 3.00. This course examines concepts and methods for interaction design (IXD). It emphasizes a human-centered perspective and explores fundamental components involved in IXD research. Students will explore a wide range of literature and implement IXD theories in multi-disciplinary collaborative projects.

Learning Outcomes: 1. Understand the fundamental architecture and principles of the interaction design. 2. Be familiar with a range of

research interests in the domain and start to consider the thesis research topic. 3. Be aware of the diversity of research areas, methodologies and practices relevant to the interaction design program, and be exposed to work of researchers beyond the university, drawn from regional and international venues, to keep informed about updated research achievements. 4. Identify and apply compositional theory to interaction design practice. 5. Develop the ability to articulate intention in work through design iteration. 6. Organize and conduct a design process within an interdisciplinary team. 7. Have a working level of programming fluency, in order to independently produce a working prototype that satisfies given design requirements. 8. Assess and improve production value through design practice, optimization, and media technique. 9. Explore creative process, perception, and problem solving. Credits: 3.00

AD 52000 - Student Visual Design Service

Credit Hours: 3.00. The course simulates the operation of a professional design studio affording the opportunity for hands-on experience in the development of a graphic product from concept to finish and include contact with clients, and printers.

Learning Outcomes: 1. Design and produce portfolio banner to be shown in the Senior Portfolio Exhibition. 2. Produce branding theme, schedule, marketing strategy, for the Senior Portfolio Exhibition. 3. Market, install and takedown the Senior Portfolio Exhibition. 4. Examine current market trends and assess their influence on magazine content and design decisions. 5. Create a comprehensive magazine design that showcases a range of skills in publication typography, page layout and image development. Credits: 3.00

AD 52200 - Interaction Design Evaluation

Credit Hours: 3.00. This course builds a foundation for interaction designers to conduct evaluation research. Students start from analyzing evaluation cases on interactive designs and systems to employing evaluation in design projects using quantitative, qualitative, or mixed methods of inquiry.

Learning Outcomes: 1. Identify the need, justification, and goal of conducting an evaluation. 2. Understand systematic knowledge, logical-deductive processes and various research types, and recognize causes & effects, systematic bias and measurement/observation errors in research. 3. Be familiar with different kinds of qualitative and quantitative research methods and how they differ from each other. Build up reliable knowledge for them. 4. Understand the structure of paradigms, theories, concepts, hypotheses, constructs, variables and data. 5. Be familiar with the techniques such as observation, interviews, contamination, exogenous effects, and unobtrusive measures. 6. Be able to organize quantitative and qualitative data, and use analysis software such as SPSS and ALTAS.ti to find patterns. 7. Present the evaluation outcomes, and try to organize and write research papers based on the analysis. Credits: 3.00

AD 53200 - Cognition In Design

Credit Hours: 3.00. This course focuses on understanding cognitive issues and theories in design. Students are exposed to different cognitive models and phases while they are designing interactive systems. They will develop the cognitive perspective, analyze user experience, and develop an interaction design.

Learning Outcomes: 1. Explain and evaluate design decisions in terms of elementary cognitive theories. 2. Understand key differences between traditional and emerging models of cognition and the development of these models. 3. Learn about specific human strengths and weaknesses in terms of perception, memory, learning, and cognition and how to use this information to optimally

design the interface/interaction to leverage this specific human potential. 4. Apply current models of individual and group cognition to the design of user interaction. 5. Ultimately, analyze, critically evaluate, and improve our interaction with artifacts from the human perspective. Credits: 3.00

AD 53500 - Furniture Design

Credit Hours: 3.00. Examination of furniture design trends and designers. Explore materials and manufacturing processes. Design and build a full-size seating unit. Shop skills required. Permission of instructor required.

Credits: 3.00

AD 54200 - Information Visualization Design

Credit Hours: 3.00. This course starts from exploring visual perception and attention theories, studying modern visualization technologies and toolkits, and reviewing evolving visualization research. Students work on small exercises, and then accomplish complicated virtual and physical visualization projects for information representation and communication.

Learning Outcomes: 1. Learn the principals involved in information visualization. Gain a background that will aid the design of new, innovative visualizations. 2. Learn about the variety of existing techniques and systems in information visualization. 3. Build a sound foundation in human visual perception and how it relates to creating effective information visualization. 4. Proceed through graph and map-making best practices toward advanced topics of data structure and programmatic visualizations. 5. Gain experience describing and critiquing the methods and approaches of data visualization through presentations and critiques. 6. Understand the key design principles for creating information visualizations. 7. Explore the communication and narrative potential of information visualizations. 8. Develop skills in critiquing visualization techniques as applied to particular tasks. 9. Evaluate information visualizations tools. 10.Design new, innovative visualizations. Credits: 3.00

AD 55000 - Research Methods In Art And Design

Credit Hours: 3.00. An intensive course in research methods to assist students in developing a topic for directed study. Introduction to various research tools; exercises exploring issues of style, content, and organization; research methods and how they pertain to art and design. Permission of department required.

Learning Outcomes: 1. Identify and develop effective research skills and methods as they apply to individual thesis projects. 2. Analyze and critique existing scholarship. 3. Design an effective thesis statement, devise a research plan and begin conducting research. 4. Practice critical writing skills through peer review of section drafts. Credits: 3.00

AD 55800 - Directed Project Research In Studio Arts

Credit Hours: 1.00 to 3.00. Initial M.F.A. project research and production in studio arts. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 56800 - Directed Project Research In Design

Credit Hours: 1.00 to 3.00. Initial M.F.A. project research and production in design. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 3.00

AD 59100 - Practicum For Art And Design Teaching Assistants

Credit Hours: 0.00. Seminar to train new Art and Design teaching assistants in the content, policies, and format of the courses they support in various roles, such as: primary instructor, primary studio technician, primary grader for the course, or primary student teacher supervisor. Topics include problem/project presentation, critique techniques, grading, and knowledge of materials and processes of the discipline. Subsequent semesters focus on improving and refining teaching and operational skills. Open only to Art and Design teaching assistants each semester they teach. Permission of instructor required.

Learning Outcomes: 1. Recognize the basic objective elements and principles one must know to be acquainted with the discipline in which they are engaging or solving problems in it. 2. Demonstrate a conceptual understanding of the interrelationships among the basic objective elements within a larger structure that enables them to function together related to course goals and instructional objectives. 3. Carry out or use a procedure in a given situation: how to do something, use a method of inquiry and criteria for using skills, techniques, and methods, applicable to their discipline. 4. Differentiate: discriminate, distinguishing, focusing, and selecting successful instructional outcomes. 5. Develop an awareness and responsibility for analyzing and assessing their own professional behaviors and activities and accepting continuing responsibility for their own professional development. Credits: 0.00

AD 59200 - Graduate Seminar In Art Or Design History

Credit Hours: 3.00. This is a graduate seminar that focuses on a particular theme, period, or movement in the history of art or design. Permission from department required.

Learning Outcomes: 1. Analyze and discuss scholarly readings related to the history of art and design. 2. Analyze primary sources, artifacts, images, and other such materials related to the theme of the term. 3. Conduct original primary and scholarly research on a topic related to the seminar and present that research in written, visual, or oral forms. 4. Understand the social, cultural, and/or political context of art and design history. Credits: 3.00

AD 60000 - Painting

Credit Hours: 3.00 to 6.00. Painting. Permission of department required.

Credits: 3.00 to 6.00

AD 60300 - Theory In Art Seminar

Credit Hours: 3.00. Study of critical issues in modern and postmodern art and relevant methodologies: formalism, iconography, biography and autobiography. Marxism (cultural studies), semiotics, and psychoanalyses. Elements of contemporary professional art practice discussed, including writing of artists' and designers' statements, biographies, and resumes. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

AD 60500 - Problems In Industrial Design

Credit Hours: 3.00. Problems in product innovation, product design, product development, and environmental design. Emphasis is placed on the development of working prototypes.

Credits: 3.00

AD 60600 - Problems In Visual Design

Credit Hours: 3.00. Problems relating to printing and digital technology, motion design, computer graphics, perception, and the development of visual communication prototypes.

Learning Outcomes: 1. Study the roles, impacts, and topics in poster design. 2. Examine the various techniques for image generation. 3. Strengthen students' conceptual skills. 4. Engage students' creative solutions through practical and theoretical exercise in poster design and display. Credits: 3.00

AD 60700 - Graduate Seminar In Photography And Related Media

Credit Hours: 3.00 to 6.00. Study and discussion of the aesthetics, theory, and criticism of photography and related media. Applications include historical and contemporary research and/or the development and critical analysis of a body of work. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00 to 6.00

AD 60800 - Advanced Typography

Credit Hours: 3.00. Explores the communicative and structural aspects of traditional and non-traditional typography, its current and past practitioners, and its evolving role in society. Independent research and group projects will supplement lectures, assigned readings, and field trips. Permission of department required.

Learning Outcomes: 1. Provide opportunities to explore creative and ideation processes as they relate to typography and the letter form. 2. Engage students' conceptual skills through typographic expression and form. 3. Encourage students to experiment with typographic form outside of traditional views of typographic design. 4. Strengthen students' ability to create effective visual communications by way of complex problems emphasizing critical thinking, design process and presentation. Credits: 3.00

AD 60900 - Information Design

Credit Hours: 3.00. This course aims to teach specific principles and methods pertaining to information design, an emerging discipline within visual communications design (graphic design) involving the selection, organization and presentation of information to a given audience, covering a wide and varied group of delivery mediums. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

AD 61000 - Advanced Poster Design

Credit Hours: 3.00. Specific principles and methods pertaining to poster design. Explores the historical and social implications of poster design. Practical and theoretical exercise will aid students in creative thinking and concept generation. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Credits: 3.00

AD 61100 - Advanced Web Design For Visual Communication Design

Credit Hours: 3.00. Explores experimental interface design issues and surveys emerging and advanced theories of interface design for the Web. Application of motion graphics design principles and design experimentation is part of the curriculum. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of department required.

Learning Outcomes: 1. Conduct web design research and present it. 2. Present and discuss aspects of web design trends in contemporary society. 3. Design and develop web design prototypes. 4. Critique web designs based on established criteria such as content design, graphic design, experience design, navigation design, and performance design. Credits: 3.00

AD 61200 - Color Aesthetic And Research

Credit Hours: 3.00. Explores color aesthetic based on the works of color masters (e.g., Albers, Itten, Chevreul, Birren, Munsell, and Ostwald) and contemporary color research issues applied to art and design. Color research methodology will be addressed.

Learning Outcomes: 1. Identify and apply color aesthetic principles to assigned problems. 2. Produce self-initiated experimental color studies. 3. Write a color research proposal. 4. Propose and develop a small color research project based on theoretical frameworks discussed in class. 5. Investigate and discuss color research related to art and design. 6. Discuss contemporary color design issues. Credits: 3.00

AD 61300 - Drawing

Credit Hours: 3.00 to 6.00. Drawing. Permission of department required.

Credits: 3.00 to 6.00

AD 61400 - Graduate Installation And Critique

Credit Hours: 3.00. A seminar for all graduate students in the studio arts incorporating the process of installation art to facilitate the exchange of ideas and professional criticism.

Credits: 3.00

AD 61500 - Social Issues In Industrial Design

Credit Hours: 3.00. A study of mass-production materials and processes used by designers. Students will focus on the limitations and benefits of various manufacturing methods. Special attention will be given to injection molding, casting, and stamping. Prerequisite: Admission to the M.F.A. program in Art and Design.

Credits: 3.00

AD 61600 - Electronic And Time-Based Art

Credit Hours: 3.00 to 6.00. This seminar explores contemporary artistic practices in Electronic and Time-Based Art, including emerging fields such as: generative and interactive art, audio-visual installation, and new media performance. The format of

the course is a mixture of critique, workshops, research, presentations, and discussion. Permission of department required.

Learning Outcomes: 1. Make use of essential tools and techniques for generating, sketching and realizing ideas in the field of new media art using DIY strategies, commercial as well as open source software and hardware solutions for creative production, collaborative and interdisciplinary team work. 2. Use shared knowledge from online communities that is relevant to their projects. 3. Consider contributing their own findings and knowledge gained in this class to relevant online communities (e.g. arduino.cc, processing.org, instructables.com, makezine.com, etc). 4. Know how to research and find relevant exhibition venues, festivals and competitions. 5. Find the most effective medium for their ideas and concepts. 6. Know how to adjust to a field of artistic expression in which the tools (i.e. digital software and hardware technologies) are changing rapidly. 7. Have developed effective research strategies pertinent to the history of Electronic and Time-Based Art. 8. Able to analyze key works and artists in the merging field of Electronic and Time-Based Art. Be able to place their artistic practice in a rich historical context of related earlier art forms such as: Kinetic Art, Film, Dada, Fluxus and Performance Art. 9. Understand that "A technology is not merely a system of machines with certain functions; rather, it is an expression of a social world. Electricity, the telephone, radio, television, the computer, and the Internet are not implacable forces moving through history, but social processes that vary from one time period to another and from one culture to another. " (Nye 2006, 47). 10. Improve their writing skills toward successful project and exhibition proposals, artist statements and research papers according to CAA's latest Guidelines for Faculty Teaching in New-Media Arts (2007): "In this emergent field, contributions to theory should be seen as having equal significance as aesthetic productions. " (see: http://www.collegeart.org/guidelines/newmedia07.html). Credits: 3.00 to 6.00

AD 61700 - Advanced Motion Design

Credit Hours: 3.00. This course explores Motion Design's multidisciplinary aspects, combining graphic design, animation, film, photography, videography, illustration, broadcast graphics, sound design, and visual effects. It prepares students to tackle common screen media challenges, emphasizing the development of sophisticated Motion Design projects. Offering an in-depth examination of Motion Design, this program highlights the range of techniques, processes, methods, and aesthetic options open to creators. It requires intensive effort, sharp observation, critical analysis, and commitment from graduate students, calling for a significant time commitment to achieve meaningful outcomes. The course highlights the essential role of a well-executed design process in creating work that is both innovative and engaging to the target audience while adhering to high professional standards.

Learning Outcomes: 1. Harness movement, timing, and story to express ideas and feelings unattainable with still images. 2. Learn to use software such as Adobe After Effects and Photoshop, creating animated text, blending animations with video, and using advanced effects for effective storytelling. 3. Offer constructive feedback using accurate design terms, communicate ideas and techniques clearly, and participate in helpful critique sessions with peers. 4. Employ visual metaphors, mood boards, storyboards, and scripts to improve projects' visual and narrative flow, ensuring clear messaging and audience engagement. 5. Develop a collaboration style that supports a positive learning atmosphere and enhances group design quality through constructive feedback exchange with peers. Credits: 3.00

AD 62500 - Applied Ornamental Design

Credit Hours: 3.00. Examination of past and present

ornamental design applications and of the cultures that created them. Students will generate their own individual visual iconography to be transformed into designs for consumer products, architectural elements, or furniture. Prerequisite: Admission to the M.F.A. program in Art and Design.

Credits: 3.00

AD 63500 - Advanced Materials And Processes

Credit Hours: 3.00. A study of mass-production materials and processes used by designers. Students will focus on the limitations and benefits of various manufacturing methods. Special attention will be given to injection molding, casting, and stamping. Prerequisite: Admission to the M.F.A. program in Art and Design.

Credits: 3.00

AD 64000 - Special Topics In Interior Design

Credit Hours: 1.00 to 6.00. Special topics and theoretical approaches to individual projects within the built environment will be investigated, such as urban environments, existing and new structures, and interior environments. Topics could include either residential or non-residential projects. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of instructor required.

Credits: 1.00 to 6.00

AD 65800 - MFA Project Research In Studio Arts

Credit Hours: 1.00 to 6.00. Intensive M.F.A. project production and thesis research in studio arts. Prerequisite: Three credit hours of AD 55800 with a minimum B- grade. Permission of instructor required.

Credits: 1.00 to 6.00

AD 66100 - Jewelry And Metalsmithing

Credit Hours: 3.00 to 6.00. Jewelry and Metalsmithing. Permission of department required.

Credits: 3.00 to 6.00

AD 66500 - Printmaking

Credit Hours: 3.00 to 6.00. Printmaking. Permission of department required.

Credits: 3.00 to 6.00

AD 66800 - MFA Project Research In Design

Credit Hours: 1.00 to 6.00. Intensive M.F.A. project production and thesis research in design. Prerequisite: Three credit hours of AD 56800 with a minimum B- grade. Permission of instructor required.

Credits: 1.00 to 12.00

AD 66900 - Materials And Processes For The Studio Artist

Credit Hours: 3.00 to 6.00. This course introduces graduate studio artists to various materials, methods and processes to supplement their current practical media of choice. Such methods include, but are not limited to, welding for the artist (MIG and arc), casting, cement, plaster, mold making, structural construction, using fabric for sculptural processes, sewing (machine and hand) printing on fabric. This is a survey course and exposes the student to the above allowing them to select one or multiple processes and materials to enhance and expand their practice. Permission of department required.

Learning Outcomes: 1. Develop a new set of skills that they can continue to practice and use to enhance their current artistic practice. 2. Expand beyond the limits of their current practice to become more well-versed in all aspects of the current climate of a multi-discipline artist. Credits: 3.00 to 6.00

AD 67000 - Textile Art

Credit Hours: 3.00 to 6.00. Textile Art. Permission of department required.

Credits: 3.00 to 6.00

AD 67500 - Sculpture

Credit Hours: 3.00 to 6.00. Sculpture. Permission of department required.

Credits: 3.00 to 6.00

AD 67800 - Graduate Internship

Credit Hours: 1.00 to 6.00. Intensive exposure to professional experience through supervised internship in art or design firms, departments, or studios. The internship will consist of work to enhance the development of future professionals. The internship experience will help students integrate theory and practice and confirm career choices. Prerequisite: Admission to the M.F.A. program in Art and Design. Permission of instructor required.

Credits: 1.00 to 6.00

AD 69000 - Advanced Problems In Art And Design

Credit Hours: 0.00 to 18.00. Credit and hours to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

AD 69100 - Directed Readings In Art History

Credit Hours: 3.00. A survey of specialized publications for in-depth study in an area of special interest. Permission of instructor required.

Credits: 3.00

AD 69300 - Historical Problems In Art Education

Credit Hours: 3.00. (EDCI 63000) Examination of methods used to investigate art education's history, past theory, and practices. Class work will include readings and discussion and will culminate in guided research and a short historical study. Permission of instructor required. Prerequisite: BA in art education.

Credits: 3.00

AD 69600 - Aesthetic Development In Children

Credit Hours: 3.00. (EDCI 63100) Examination of historical and contemporary theory and research in children's aesthetic development (response and production) and analysis of the influences of such development on art education curricula and methodology. Permission of Instructor required. Prerequisite: BA in Art Education or an equivalent area.

Learning Outcomes: 1. Examine historical and contemporary conceptions of the development of children's responses to works of art. 2. Examine historical and contemporary conceptions of the development of children's art production. 3. Analyze the influence of children's aesthetic development (in response and production) upon art education curricula and methodology. Credits: 3.00

AD 69700 - MFA Graduate Exhibition

Credit Hours: 3.00. Completion of M.F.A. thesis, oral defense, gallery installation of M.F.A. exhibition, public presentation, and documentation of exhibition. Prerequisite: Admission to the M.F.A. program in Art and Design. Concurrent Prerequisite: Must complete 12 credit hours of AD 65800 or AD 66800 during the same or prior session. Only open to M.F.A. graduate students in Art and Design. Permission of instructor required.

Credits: 3.00

AD 69800 - Research MA Or MFA Thesis

Credit Hours: 1.00 to 18.00. Research MA Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

MUS 59000 - Special Problems In Music

Credit Hours: 1.00 to 4.00. An individualized and intensive study of any aspect of music required by the student's plan of study. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of the course. Credits: 1.00 to 4.00

Libraries and School of Information Sciences (Graduate)

ILS 55200 - Research Data Management For Quantitative Data

Credit Hours: 3.00. This course will provide students working with quantitative data an overview of major issues in quantitative data management such as data set organization; data versioning, backup, and archiving; computer file and directory organization; data quality control, exploration, visualization and analysis; and data sharing, publication, copyright and ownership. Students will be introduced to a wide range of public databases to serve as examples of data organization, sources of reusable research data, and possible platforms for data publication. Recent trends and emerging issues in data and information science will be discussed, but the primary focus will be on encouraging students to apply critical thinking so they can develop practical strategies to their own research data issues. Accordingly, the course places a strong emphasis on active learning with theoretical lectures and discussions reinforced by applied lab sessions using tools such as Excel, R, Unix, Git, and parallel computing. Permission of department required.

Learning Outcomes: 1. Demonstrate mastery of using a computer as their primary data management tool through online labs, a data management notebook, and discussions. 2. Demonstrate mastery of efficient use of Excel, R, and Git through the online lab exercises and data management notebook. 3. Demonstrate use of public data repositories in their discipline through written assignments and the final data

management project. 4. Demonstrate preparing dataset for publication through the online lab exercises and the final data management project. 5. Demonstrate creation of a data management plan through completing a written data management plan for a specific data set. Credits: 3.00

Department of Libraries and School of Information Studies (Graduate)

Website:

https://infostudies.purdue.edu

Department/School Head

Jane Yatcilla

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Bert Chapman Michael Fosmire Jean-Pierre V. M. Herubel Clarence D. Maybee Beth McNeil Mark Puente Jane Yatcilla	Chao Cai Matt Hannah Neal A. Harmeyer Heather A. Howard Sarah E. Huber Natasha E. Johnson Bethany S. McGowan Pete E. Pascuzzi Margaret Phillips Jason Reed Stephanie Schmitz Gang Shao Michael C. Witt Wei Zakharov Dave Zwicky	Neal Baker Annette Bochenek Paige Bradshaw Melissa Chomintra Victoria Baker Dawkins Rachel K. Fundator Thomas Edward Gerrish Adriana M. Harmeyer Andrea M. Hayes Samantha LeGrand Kristin Browning Leaman Shirley Li Jing Lu Zoe Mayhook Jo Otremba Innocensia Ashieng Owuor Spencer Dean Stewart Jerilyn Pia Tinio Katey Watson

Geospatial Information Sciences, Post-Baccalaureate Certificate

Digital Humanities, Post-Baccalaureate Certificate

ILS 51200 - Information Strategies For Science, Technology, And Engineering Research

Credit Hours: 1.00. This course focuses on information strategies for successful research in science, engineering, and technology disciplines. Students will learn about how scholarly information and discipline relevant grey literature (e.g., patents, technical standards) are created, organized, disseminated, retrieved, and managed. In addition, students will learn strategies to critically evaluate information and present their research effectively and ethically.

Learning Outcomes: 1. Compare and contrast various modes and models of publication relevant to science, engineering, and technology disciplines. 2. Construct and apply search strategies to retrieve relevant information on science, engineering, and technology related topics, using information resources appropriate to the given task and the type(s) of information sought. 3. Critique information to judge whether it is appropriate and applicable to the task at hand. 4. Synthesize information from multiple sources in order to produce a clear and effective presentation, citing sources where appropriate. Credits: 1.00

ILS 59000 - Independent Study In Information Sciences

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue University. Plan of study and assessment is agreed upon by faculty and student before registration. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

ILS 59500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science. Permission of the instructor is required for undergraduates.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

ILS 63000 - Digital Humanities Foundations

Credit Hours: 3.00. This course introduces graduate students to the core theoretical and practical components of Digital Humanities. Students engage key theoretical texts in weekly seminars and practice central methodologies in weekly work sessions.

Learning Outcomes: 1. Learn the basic vocabulary and concepts in digital humanities. 2. Gain familiarity with digital humanities projects, critical work, resources in the field, and hands-on experience of building a scholarly digital research project. 3. Gain experience working collaboratively with others on a joint project. 4. Perform critical, formal analyses of DH projects, digital media, and digital tools. 5. Write focused, analytical essays in clear, grammatical prose. 6. Employ logic, creativity, and interpretive skills to produce original, persuasive arguments. 7. Gain familiarity with digital tools and media used in in the field of digital humanities to create new knowledge of humanities subjects. Credits: 3.00

ILS 63100 - Digital And Analog Archives

Credit Hours: 3.00. Digital and Analog Archives provides an overview of archival theory and practice, including archival arrangement and description, preservation, and digitization best practices. Lab components incorporate archival research, digital reformatting, metadata creation, the creation of digital archives, and presentation of archives to users.

Learning Outcomes: 1. Analyze and think

critically about archives. 2. Arrange, describe, preserve archival materials. 3. Conduct archival research; Communicate and defend a research argument. 4. Utilize digital humanities tools to create a digital archives project. Credits: 3.00

ILS 65000 - Introduction To Computational Text Analysis

Credit Hours: 3.00. This course provides an introduction to the methods, debates, and tools of computational text analysis, specifically crafted for the humanities and social science graduate students.

Learning Outcomes: 1. Recognize and assess the possibilities for computational text analysis for research. 2. Find and implement code for text analysis projects. 3. Experiment with both existing and original code. 4. Appraise and critique the limits of computational text analysis for research. 5. Design original projects using course lessons. Credits: 3.00

ILS 65100 - Introduction To Natural Language Processing

Credit Hours: 3.00. This course provides a comprehensive overview of the fundamental concepts, techniques, and applications in the field of natural language processing. Using Python programming, students will learn to implement NLP tasks from basic text processing to advanced techniques, including sentiment analysis to discern emotions from text and topic modeling to uncover latent themes within large datasets. Additionally, students will explore emerging technologies such as generative AI and Large Language Models (LLMs) and their implications for NLP. By the end of this course, students will emerge with a solid understanding of NLP principles, proficiency in Python programming for NLP tasks, and the ability to apply these skills to address diverse NLP challenges.

Learning Outcomes: 1. Describe Natural Language Processing (NLP) and its applications. 2. Apply Python programming to Natural Language Processing tasks. 3. Implement text analysis to extract information from text data. 4. Create solutions for sentiment analysis problems. 5. Build solutions for topic modeling tasks. 6. Describe generative AI and Large Language Models (LLMs) and their use cases. Credits: 3.00

ILS 69000 - Independent Study In Information Sciences

Credit Hours: 1.00 to 3.00. Intensive study on specific topics in information or data science that are not otherwise covered by courses currently offered at Purdue University. Plan of study and assessment is agreed upon by faculty and student before registration. Permission of department required. Permission of instructor required.

Learning Outcomes: 1. Variable but agreed upon by faculty and student before registration. Credits: 1.00 to 3.00

ILS 69500 - Special Topics In Information And Data Science

Credit Hours: 1.00 to 4.00. Intensive study of selected topics varying from semester to semester, from the practice of information and data sciences. Topics may include data management and organization, digital scholarship, data visualization, computer languages for data and information science, information literacy, archival literacy, and emerging trends in information and data science.

Learning Outcomes: 1. Critically examine and apply information and data sciences to various disciplines. 2. Develop practical skills and apply them to their disciplinary research. Credits: 1.00 to 4.00

College of Pharmacy (Graduate)

Overview

Founded in 1884, Purdue's College of Pharmacy consistently ranks among the 10 best pharmacy programs in the nation. Numerous research opportunities, an innovative teaching pedagogy, and world-renowned, caring faculty create a cutting edge learning environment. Employers are drawn by the quality, depth and experiential opportunities provided to Purdue pharmacy graduates. The College of Pharmacy is making a difference locally and globally.

Graduate Programs

The Purdue College of Pharmacy boasts one of the oldest and most-respected graduate programs in the U.S. Each of the three departments of the Purdue College of Pharmacy offer graduate programs:

- Industrial and Molecular Pharmaceutics
- Medicinal Chemistry and Molecular Pharmacology
- Pharmacy Practice

Each department offers a PhD degree program. All of these programs require strong undergraduate preparation, including completion of a Bachelor's Degree for admission.
A combined-degree program allows students in the third year of the PharmD program to begin work on a Pharmacy PhD program while completing the PharmD curricula. Through a judicious choice of electives and research rotations, such students can save up to two years on the total time required for the PhD program.
For more information, please contact Dr. Danzhou Yang, the Associate Dean for Graduate Programs.

Continuing Education Programs

The College's continuing education programs offer several non-degree certificate programs.

Admissions (website)

Contact Information

Prospective Undergraduate and Professional Program Students
Contact the Office of Student Services for information regarding our degrees offered and/or to arrange a visit.
Phone: (765) 496-6885
E-mail: pharmacy-oss@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Contact Marie Martin-Murphy in the Office of Student Services for information on programs for under-represented populations.
Phone: (765) 494-1364
E-mail: mmartinm@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Contact PharmD Admissions for information about pre-pharmacy coursework completed off-campus.
Phone: (765) 496-3773
E-mail: pharmacy-admissions@purdue.edu
Office: Room 156 RHPH (Robert Heine Pharmacy Building)

Prospective Graduate Students

The College's graduate programs are administered by three departments in the College - Industrial and Molecular Pharmaceutics, Medicinal Chemistry and Molecular Pharmacology, and Pharmacy Practice (includes Pharmacy Administration). Contact the graduate program in which you are interested. Some faculty in the College participate in the University's interdisciplinary graduate programs, which can be contacted directly.

For general questions, contact Jamie Moffatt, Administrative Assistant for Graduate Programs:
Phone: (765) 494-1362
Fax: (765) 494-7880
E-mail: jmoffat@purdue.edu
Office: Room 104B RHPH (Robert Heine Pharmacy Building)

College of Pharmacy Administration (Graduate)

Pharmacy, Pharm.D

Department of Industrial and Molecular Pharmaceutics (Graduate)

Website: **https://www.imph.purdue.edu/phd-program**

Department/School Head

Eric J. Munson

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Stephen R. Byrn Hyunyoung Jeong Gregory T. Knipp Tonglei Li Eric J. Munson Kinam Park Lynne S. Taylor Elizabeth M. Topp Yoon Yeo Qi (Tony) Zhou	Hyunwoo Lee Sandro Matosevic Severin T. Schneebeli	Jie Luo Li Qu	Raymond E. Galinsky

Academic Programs

Ph.D. Program

- Ph.D. in Industrial and Molecular Pharmaceutics

Concentrations (Areas of Study)

- Biotechnology - Pulse - IGP
- Computational Science - IGP
- Industrial Pharmacy
- Pharmacokinetics/Biopharmaceutics
- Physical Pharmacy

Industrial and Molecular Pharmaceutics, PHD

Industrial and Molecular Pharmaceutics, MS

Industrial and Molecular Pharmaceutics/Cancer Research, PHD

IMPH 56200 - Introduction To Pharmaceutical Manufacturing Processes

Credit Hours: 4.00. A course intended to provide the student with basic understanding of both the theoretical and practical aspects of pharmaceutical manufacturing by combining a thorough classroom treatment of the underlying principles of each pharmaceutical unit operation with hands-on execution of these activities in the laboratory. Permission of instructor required.

Learning Outcomes: 1. Demonstrate ability to effectively communicate their field of study. 2. Demonstrate ability to conduct research in an ethical and responsible manner. 3. Demonstrate ability to think critically, creatively, and solve problems in their field of study. 4. Demonstrate ability to identify and conduct original research, scholarship, and creative endeavors. Credits: 4.00

IMPH 57400 - Pharmaceutical Biotechnology

Credit Hours: 3.00. Pharmaceutical biotechnology is the array of scientific and engineering principles used to develop, manufacture, and regulate biologic drugs. Biologic drugs - also known as "biologics", "biopharmaceuticals", or "large molecule drugs" - are medicinal agents derived from living systems, in contrast to more conventional "small molecule drugs" produced by organic chemical synthesis. Since the approval of the first recombinant human insulin in 1982, biologics have grown from niche products to occupy a prominent place in the pharmaceutical armamentarium. Today, biologics provide innovative treatments for a host of previously intractable diseases, including cancers, autoimmune disorders, and diabetes. The global biologics market was more than $300

billion in 2019, accounting for 20-25% of all pharmaceutical sales. This course introduces students to pharmaceutical biotechnology. The five didactic sections of the course present: (i) the biotech drug market, (ii) cellular and molecular biology foundations, (iii) formulation and stability of biotech drug products, (iv) analytical methods for quality assurance, and (v) manufacturing methods. In the sixth and final section of the course, students will present case studies on currently approved biotech drugs, integrating and applying what they've learned. The course is intended for beginning graduate students in the Departments of Industrial and Physical Pharmacy, Chemical Engineering, and Biomedical Engineering. The course may also be suitable for well-qualified upper-division undergraduates. Permission of department required.

Learning Outcomes: 1. Understand and be able to describe the current state of the biopharmaceutical industry, including major drug classes, top-selling biotech drugs, innovative biotech drugs under development, and leading pharma biotech companies. 2. Understand and be able to describe the fundamental cellular and molecular biology principles and interrelationships that undergird pharmaceutical biotechnology, including (e.g.) the roles of cells as protein factories, drug targets, and vehicles for gene delivery; the roles of viral vectors as drug delivery and cell transfection agents; the roles of proteins as drugs, drug targets, and products of mRNA vaccines. 3. Understand and be able to describe the mechanisms of chemical and physical degradation of peptide/protein and nucleotide therapeutics. Be able to suggest formulation strategies to control various types of degradation. 4. Understand and be able to describe various chromatographic and electrophoretic methods used to analyze biologics. Be familiar with other types of chemical and biophysical methods used for these drugs. 5. Understand and be able to describe the manufacturing methods used for different classes of biologics, with a more detailed understanding of the methods used for recombinant proteins. 6. Develop a detailed knowledge of one current biotech drug product, including methods of manufacturing, analytical methods for quality control and assurance, formulation approaches and any instabilities, indications, and current market. Credits: 3.00

IMPH 58000 - Physical Chemical Principles

Credit Hours: 3.00. Applications of physical chemical principles to pharmaceutical systems.

Credits: 3.00

IMPH 58300 - Advanced Biopharmaceutics

Credit Hours: 3.00. A comprehensive course dealing with the interaction of biological and physicochemical considerations relating to drug effectiveness and dosage form design.

Credits: 3.00

IMPH 58700 - Pharmaceutical Solids

Credit Hours: 2.00. Provides students with the ability to identify and characterize polymorphs and hydrates and to understand their behavior in the presence of water. Both classical methods and new techniques for the study of pharmaceutical solids and their interaction with water are included. Scientific principles are blended with practical examples to provide a conceptual basis for understanding particular problems.

Credits: 2.00

IMPH 59000 - Special Topics In Industrial And Molecular Pharmaceutics

Credit Hours: 1.00 to 6.00. Special topics in selected areas of industrial and molecular pharmaceutics. Permission of instructor required.

Learning Outcomes: 1. Vary by topic. Credits: 1.00 to 6.00

IMPH 68000 - Pharmacokinetics And Biopharmaceutics

Credit Hours: 3.00. Pharmacokinetics (PK) is the study of the time course of the absorption, distribution, metabolism and excretion (ADME) of a drug, compound or new chemical entity (NCE) after its administration to the body. Biopharmaceutics examines the relationship between the physical/chemical nature of a drug, the dosage form and the route of administration on the rate and extent of systemic drug absorption. Knowledge of the pharmacokinetic and biopharmaceutics properties of an NCE are critical to its selection as a lead candidate in a drug discovery program, its use as a functional research tool, and its use as a therapeutic agent. This course will be an overview of

the development of pharmacokinetic principles, including guidelines for conducting clinical studies, and equations required to characterize the disposition of drugs and their metabolite(s). Students will develop the ability to probe the mechanisms and physiological processes responsible for ADME. Pharmacodynamics, the relationship between drug concentration and effect, and the issues surrounding stereospecific PK will presented. Prerequisites: Admission to the IMPH graduate program and at least one course in pharmacology and one course in mammalian or human physiology. Permission of instructor required.

Learning Outcomes: 1. Probe the mechanisms and physiological processes responsible for ADME. Credits: 3.00

IMPH 69000 - Special Problems

Credit Hours: 0.50 to 6.00. Individual research topics selected from the areas of industrial pharmacy, physical pharmacy, or biopharmaceutics. Permission of instructor required.

Learning Outcomes: 1. Vary by topic. Credits: 0.50 to 6.00

IMPH 69600 - Seminar In Industrial And Physical Pharmacy

Credit Hours: 0.00 or 1.00. Discussion of recent research developments in physical pharmacy, industrial pharmacy, and biopharmaceutics related to the physicochemical properties, availability, effectiveness, and safety of drugs and drug products. Topics are presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

IMPH 69699 - IMPH Professional Practice Internship

Credit Hours: 0.00. A one-semester course for graduate students going out for Professional Internships to register to keep their graduate student status. Permission from department is required.

Learning Outcomes: 1. Apply knowledge to identifying and solving problems in the professional setting related to their research context. 2. Advance skills related to professional preparation, critical thinking, problem-solving, communication, and practice of ethical responsibility in professional work. Credits: 0.00

IMPH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Medicinal Chemistry and Molecular Pharmacology (Graduate)

Website: **http://www.mcmp.purdue.edu/graduateprogram/**

Department/School Head

Zhong-Yin Zhang

Faculty by Rank

Professor	Associate Professer	Assistant Professor	Emeritus Faculty

Eric L. Barker V. Jo Davisson Arun K. Ghosh Gregory H. Hockerman Chang-Deng Hu Philip Low Carol B. Post Jean-Christophe Rochet Robert V. Stahelin Craig K. Svensson Weiguo Andy Tao John Tesmer Val J. Watts Danzhou Yang Zhong-Yin Zhang	Ryan A. Altman Emily C. Dykhuizen Tony R. Hazbun Rong Huang Andy Hudmon Casey J. Krusemark Douglas J. LaCount Chiwook Park Michael K. Wendt	Bram Axelrod Daniel P. Flaherty Seung-Oe Lim Elizabeth Parkinson J. Benita Sjogren Darci Trader Yang Yang	Curtis L. Ashendel Donald E. Bergstrom Richard F. Borch Gary P. Carlson Ching-jer Chang Mark S. Cushman H. Patrick Fletcher Robert L. Geahlen Marietta L. Harrison Peter F. Heinstein Gary E. Isom G. Marc Loudon Jerry L. McLaughlin David E. Nichols James E. Robbers Charles O. Rutledge

Academic Programs

Master's and Ph.D. Programs

Founded in 1869 as a state-supported, land-grant university, Purdue is widely recognized as a worldwide leader in scientific research. Indeed, Purdue is one of the top five universities in the country in numbers of Ph.D. degrees awarded in the pharmaceutical sciences, chemistry, engineering, and agriculture. The Department of Medicinal Chemistry and Molecular Pharmacology is one of the three departments comprising the College of Pharmacy. There are currently over 80 graduate students enrolled in the Department, the vast majority of whom are engaged in studies leading to the Ph.D. degree.

Concentrations (Areas of Study)

- Biophysical & Computational Chemistry
- Cancer Research
- Immunology & Infectious Disease
- Medicinal Chemistry & Chemical Biology
- Molecular and Cellular Biology
- Molecular Pharmacology
- Neuropharmacology, Neurodegeneration, & Neurotoxicity
- Systems Biology & Functional Genomics

Medicinal Chemistry and Molecular Pharmacy, PHD

Medicinal Chemistry and Molecular Pharmacy, MS

Medicinal Chemistry and Molecular Pharmacy/Cancer Research, PHD

MCMP 51400 - Biomolecular Interactions: Theory And Practice

Credit Hours: 1.00 to 4.00. Theory and applications of biophysical and bioanalytical methods for the identification and

qualification of biological and pharmaceutical samples. Methods to be discussed include chromatography, electrophoresis, optical spectroscopy, mass spectrometry, electrochemical methods, radiochemical analysis, ultracentrifugation, calorimetry and surface plasmon resonance. Physical measurements, such as binding equilibrium, kinetics and macromolecular structure will be discussed. While fundamentals of each technique will be discussed, a major focus will be on the application and integration of presented methods for the analysis of biological problems. The course will be organized into four general topic areas around the theme of medicinal analysis, and variable credit will be available based on a student's interest in the four topic areas (i.e., 1 credit per topic area). Students should register for 1 credit hour, and the variable credit option will be discussed and determined at the first class period. Permission of instructor required.

Credits: 1.00 to 4.00

MCMP 54400 - Drug Classes And Mechanisms

Credit Hours: 3.00. The course will integrate basic principles of medicinal chemistry and pharmacology to achieve an understanding of drug mechanisms as applied to autonomic/endocrine, cardiovascular/renal, CNS, and chemotherapy/infectious diseases. The course will apply concepts from organic chemistry, biochemistry, anatomy, physiology, and principles of drug action to describe how drugs are used to treat the symptoms and causes of disease.

Learning Outcomes: 1. Knowledge and understanding of the major drug classes. 2. Knowledge of the relationships between mechanism of action with drug interactions and adverse reactions. 3. Development of an introductory-level ability to critically evaluate primary literature. 4. An appreciation for the relevant research and discovery processes involving medicinal chemistry and pharmacology related to the major drug classes. 5. A broad knowledge of pharmaceutical and related sciences. 6. An understanding of drug discovery, development, and commercialization. 7. Effective written and oral communication skills. 8. An ability to integrate and apply knowledge to solve problems. Credits: 3.00

MCMP 57000 - Basic Principles Of Chemical Action On Biological Systems

Credit Hours: 3.00. Detailed description of modern pharmacology with emphasis on the mechanism of drug action and approaches used to understand their therapeutic and toxic effects. Topics include receptor theory and signal transduction, pharmacokinetics and pharmacogenetics with emphasis on current concepts in molecular pharmacology. Permission of instructor required.

Credits: 3.00

MCMP 57100 - Discovery And Development Of Therapeutic Agents

Credit Hours: 3.00. Detailed description of drug discovery and development that integrates multiple scientific disciplines. Topics include Drug Disposition and Toxicology, Identification, Qualification, and Validation of Molecular Targets, Lead Discovery and Optimization, and New Drug Modalities and Advanced Medicinal Products. These topics assume prior student mastery of basic chemical principles of biological action that are taught in MCMP 57000.

Learning Outcomes: 1. Demonstrate an advanced understanding of the process for identifying and developing new candidate agents. 2. Evaluate pharmaceutical candidates for therapeutic efficacy, safety, and potential improvement of candidates for clinical development. 3. Design traditional and cutting-edge drug discovery workflows for identifying therapeutic targets and pharmaceutical candidates. 4. Understand the breadth of the drug discovery process and be conversant with the interdisciplinary nature and disciplines involved in the drug discovery industry. Credits: 3.00

MCMP 59800 - Introduction To Research

Credit Hours: 1.00 to 3.00. Introduction to research in synthetic and analytical medicinal chemistry, pharmacognosy, and natural products under the direction of a member of the graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

MCMP 61700 - Molecular Targets: Neuro Function And Dysfunction

Credit Hours: 2.00. The application of basic scientific principles from medicinal chemistry and molecular pharmacology, and new discoveries in biology, to the development of new drugs to treat psychiatric disorders and diseases of the central nervous system. Important examples of drug targets, and small molecules (either currently approved drugs or those under

investigation) that target them, are discussed. Classes of drug target examples discussed include: G protein-coupled receptors, neurotransmitter transporter proteins, and ion channels. Processes of neurosecretion and neurodegenerative processes will also be discussed, as well as target validation and examples of the use of genetic models to identify CNS targets. Prerequisites: MCMP 57000 . This course is offered even numbered years.

Learning Outcomes: 1. Understand completely modern approaches to assessing the nature and relevance of the various targets for CNS drugs and CNS drug discovery. 2. Demonstrate full comprehension and satisfactory presentation of CNS drug discovery findings from the current literature. 3. Demonstrate satisfactory critical evaluation of the primary literature. 4. Demonstrate a synthesis of knowledge acquired/demonstrated through the first three outcomes, to achieve a full understanding of a specific area of CNS drug discovery, and generate a satisfactory original research proposal in that area. Credits: 2.00

MCMP 61800 - Molecular Targets: Cancer

Credit Hours: 2.00. The application of basic scientific principles from medicinal chemistry and molecular pharmacology, and new discoveries in biology, to the development of new anti-cancer drugs. Important examples of drug targets and small molecules (either currently approved drugs or those under investigation) that target them, are discussed. Classes of drug targets discussed include: kinases, small monomeric G proteins, prenyltransferases, transcription factors, nuclear receptors, cell cycle proteins, cytoskeletal proteins, and topoisomerases. Prerequisites: MCMP 57000 .

Learning Outcomes: 1. Understand completely modern approaches to anti-cancer drug discovery. 2. Demonstrate full comprehension and satisfactory presentation of anti-cancer drug discovery findings from the current literature. 3. Demonstrate satisfactory critical evaluation of the primary literature. 4. Demonstrate a synthesis of knowledge acquired/demonstrated through the first three outcomes, to achieve a full understanding of an area of anti-cancer drug discovery, and generate a satisfactory original research proposal in that area. Credits: 2.00

MCMP 62500 - Grant Writing

Credit Hours: 1.00. Strategies for preparation of grant proposals; generating ideas for proposals and peer review. Lecture and laboratory periods will alternate each week (i.e., lecture week one, laboratory week two). Permission of department required.

Credits: 1.00

MCMP 69000 - Special Topics In Medicinal Chemistry And Molecular Pharmacology

Credit Hours: 0.00 to 6.00. Special topics, projects, or laboratory exercises in selected areas of medicinal chemistry and molecular pharmacology. Permission of instructor required.

Credits: 0.00 to 6.00

MCMP 69600 - Seminar In Medicinal Chemistry And Molecular Pharmacology

Credit Hours: 0.00 or 1.00. Faculty and student participation in discussion of current research and developments in synthetic medicinal products, quality control, instrumentation, biosynthesis, and structure elucidation of natural products.

Credits: 0.00 or 1.00

MCMP 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

MCMP 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Pharmacy Practice (Graduate)

Website: **http://www.phpr.purdue.edu/graduateprogram/**

Department/School Head

Alan J. Zillich

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Karen Suchanek Hudmon Kevin M. Sowinski Joseph Thomas III James E. Tisdale Alan J. Zillich	David R. Foster Michael M. Kays Matthew M. Murawski Gail D. Newton Brian R. Overholser Kimberly S. Plake Margie E. Snyder	Noll L. Campbell Alissa L. Russ

Academic Programs:

Master's and Ph.D. Programs

The Health Services, Outcomes, and Policy program has evolved from the first oldest Pharmacy Administration program in the nation, with the first Ph.D. in the discipline earned by Robert V. Evanson in 1953. Since then, Purdue has granted almost 50 Ph.D. degrees in areas of focus that include Health Services Research, Health Outcomes, Health Policy, Pharmacoeconomics, and Educational Assessment.

The Clinical Pharmaceutical Sciences program prepares future scientists for careers in the translational sciences. Areas of focus within this track include Pharmacogenomics, Pharmacokinetics/Pharmacodynamics, Translational Pharmacology, and Clinical Trials.

- Master of Science and Doctor of Philosophy degrees in pharmacy administration and clinical pharmaceutical sciences

Concentrations

- Health Services, Outcome, and Policy

Clinical Pharmaceutical Sciences, MS

Clinical Pharmaceutical Sciences, PHD

Pharmacy Practice/Gerontology, PHD

Health Services, Outcomes, and Policy, PHD

Health Services, Outcomes, and Policy, MS

Radiopharmaceutical Manufacturing, MSRPM (OL) and (HY - Hybrid at West Lafayette & Indianapolis)

CLPH 63500 - Principles Of Pharmacokinetics And Pharmacodynamics

Credit Hours: 3.00. The goal of this is to provide students a comprehensive knowledge of concepts related to drug absorption, distribution, metabolism, excretion and action and the relationship to pharmacokinetics parameters such as bioavailability, clearance, volume of distribution, and half-life; and physiological and pharmacological factors affecting these parameters. At the end of the course, students are expected to communicate effectively, establish a basic understanding at a

clinical utility skill level of fundamental PK and PD terminology and principles. Provide a working-knowledge level understanding of the mathematics of PK and PD. Clearly distinguish and characterize the use of PK/PD as tools in Research (Discovery), Drug Development (Characterize PK/PD), and Clinical Therapeutics (TDM, Drug Interactions). Provide participants with the basic skills of PK/PD providing an understanding of the scope, complexity and critical importance these disciplines to their use in Research, Drug Development, and Clinical Therapeutics. Permission of instructor required.

Learning Outcomes: 1. Develop the vocabulary of PK and PD and be able to understand and grasp the significance of using PK/PD tools in drug discovery, development, clinical use, and research. 2. Understand and apply the fundamental mathematical relationships of PK/PD. 3. Design, conduct, and analyze research studies in animals or human subjects that employ the research tools of pharmacokinetics and/or pharmacodynamics to describe the properties of drugs or compounds under research investigation using standard techniques. 4. Understand the significance of key relationships in PK and PD and be able to apply that understanding to other drugs and circumstances. Credits: 3.00

CLPH 65100 - Internship In Pharmacy Industry

Credit Hours: 0.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques learned in the graduate program to a professional work experience in the pharmaceutical industry or government agency. The internship is to be representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Permission of instructor required.

Learning Outcomes: 1. Examine issues rationally and logically; shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make logical, safe, and ethical decisions in both familiar and unfamiliar contexts. 2. Read, write, speak, listen, and use appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 3. Acquire knowledge of leadership traits and skills through curricular and co-curricular activities and develop skills and abilities that will enable him/her to lead or actively contribute to organizational improvement. 4. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. Credits: 0.00

CLPH 65101 - Internship In Pharmaceutical Industry

Credit Hours: 1.00 to 3.00. The internship experience is a valuable opportunity for students to apply the procedures, theories, skills, and techniques learned in the graduate program to a professional work experience in the pharmaceutical industry or government agency. The internship is to be representative of the degree program and clinical work that provides students the opportunity to acquire invaluable work experience in the field outside of the academic setting. Permission of instructor required.

Learning Outcomes: 1. Examine issues rationally and logically; shall acquire, evaluate, and synthesize information and knowledge relevant to an identified problem; and make logical, safe, and ethical decisions in both familiar and unfamiliar contexts. 2. Read, write, speak, listen, and use appropriate technologies to send and respond effectively to communications for varied audiences and purposes. 3. Acquire knowledge of leadership traits and skills through curricular and co-curricular activities and develop skills and abilities that will enable him/her to lead or actively contribute to organizational improvement. 4. Demonstrate sensitivity to personal values and ethical principles in professional and social contexts. Credits: 1.00 to 3.00

CLPH 69000 - Special Problems

Credit Hours: 1.00 to 3.00. Individual research topics pertaining to the practice of clinical pharmacy in institutions and the community. Permission of instructor required.

Credits: 1.00 to 3.00

CLPH 69600 - Seminar In Pharmacy

Credit Hours: 1.00. Designed to provide the student with experience in the oral and written presentation of special topics of interest to clinical pharmacists and researchers. Discussion of current problems relating to the clinical practice of pharmacy.

Credits: 1.00

HSOP 50100 - Food And Drug Law I

Credit Hours: 3.00. A systematic study of the structure and function of the major federal (USA) laws and regulations governing the manufacturing, distribution, and marketing of foods, drugs, cosmetics, and devices. Permission of instructor required.

Credits: 3.00

HSOP 50200 - Food And Drug Law II

Credit Hours: 3.00. Detailed study of statutes and regulations applied to discovery, development, and marketing pharmaceutical and devices in the United States.

Credits: 3.00

HSOP 55600 - Healthcare Economics And Public Policy

Credit Hours: 3.00. Principles and theories of healthcare economics applied in analysis of the U.S. healthcare system. Perspectives are presented on the differential roles of economic analysis and policy analysis. Topics include medical care as an input to health, pharmaceutical service market, adequacy of health manpower supply, health associations and demand for legislation. Healthcare reform, the pharmaceutical industry, and social values that guide policy are explored.

Credits: 3.00

HSOP 69000 - Special Problems

Credit Hours: 0.50 to 3.00. Individual investigations in pharmacy marketing, retailing, and management. Permission of instructor required.

Credits: 0.50 to 3.00

HSOP 69600 - Seminar In Pharmacy Administration

Credit Hours: 1.00. Selected topics on current research, teaching methods, and contemporary problems in management and marketing.

Credits: 1.00

NUPH 69000 - Special Problems

Credit Hours: 0.00 to 18.00. Individual investigations in the applications of radionuclides to research and nuclear pharmacy. Hours and credits to be arranged. Permission of instructor required.

Credits: 0.00 to 18.00

NUPH 69600 - Seminar In Nuclear Pharmacy

Credit Hours: 0.00 or 1.00. Selected topics in nuclear pharmacy, radiopharmaceutical chemistry, health physics, and radiation biology, presented by staff, students, and invited speakers.

Credits: 0.00 or 1.00

PHPR 59000 - Special Topics In Pharmacy Practice

Credit Hours: 1.00 to 3.00. Special topics in selected areas of pharmacy practice. Permission of instructor required.

Credits: 1.00 to 3.00

PHPR 59800 - Introduction To Research

Credit Hours: 1.00 to 3.00. Qualified students will undertake a project in an area of pharmacy practice, clinical pharmacy, or pharmacy administration under a member of the graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

PHPR 66400 - Research Techniques And Proposal Development

Credit Hours: 2.00. A consideration of current trends in pharmacy practice, clinical pharmacy, and pharmacy administration relating to healthcare services and systems. Offered in alternate years.

Credits: 2.00

PHPR 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHPR 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHRM 50000 - Artificial Intelligence And Its Use In Clinical Care

Credit Hours: 2.00. The course comprehensively covers key topics such as the mechanisms behind how AI functions, the capabilities and limitations of current technologies, and important considerations around data privacy, bias, and health equity. Ethical issues are also explored through analyses of real-world case studies. The course equips participants with a solid foundation to thoughtfully engage with, evaluate, and contribute to the ongoing integration of AI into clinical practice and beyond.

Learning Outcomes: 1. Identify various applications and settings where AI is being utilized in healthcare today and where it will migrate to in the future. 2. Describe the technical underpinnings of how AI tools are built and function. 3. Analyze the clinical and social impacts of AI for patient care including how patients are using these tools as well as various ethical and regulatory issues. 4. Synthesize a solution to clinical cases using AI tools to improve your skills in the healthcare industry. Credits: 2.00

PHRM 69500 - Introduction To Pharmaceutical Sciences Research

Credit Hours: 0.50. Introduction of new graduate students to graduate programs, various disciplines, and the research environment in the College of Pharmacy, and prepare them for their graduate studies at Purdue College of Pharmacy. Each meeting is expected to have ~90 minutes presentation(s) and 30 minutes student discussion. Permission of department required.

Learning Outcomes: 1. Know the graduate programs and their classmates and peers. 2. Understand pharmacy as a profession and recognize various scientific and research areas in pharmaceutical sciences. 3. Have a fundamental understanding of professionalism and research conduct. 4. Start utilization of career development tools including individual development plan (IDP). 5. Understand the general framework for conducting research that constitutes of literature search, hypothesis development, data keeping, and scientific writing. Credits: 0.50

Polytechnic Institute (Graduate)

Polytechnic Institute Administration (Graduate)

Website: **https://polytechnic.purdue.edu/graduate-studies**

Department/School Head

Stephen J. Elliott

Academic Programs

Advanced technologies are redefining every facet of business and industry in a highly competitive, global environment. The doctoral program in the Polytechnic Institute addresses those needs by developing skills in advanced interdisciplinary research as well as in product, service and process creation management for work in technology-dependent enterprises. The Polytechnic also offers MS degrees from all departments, as well as online graduate certificate and MS degrees at a distance. A Doctor of Technology (DTech) is also offered through Purdue Online - Polytechnic (https://polytechnic.purdue.edu/degrees/doctor-of-technology).

Concentrations

Ph.D. Only

• Computational Science

- Information Security
- Interdisciplinary Ecological Science & Engineering
- Microbiology - PULSe
- Organizational Leadership
- UX Design

TECH 52200 - Sustainability Foundations

Credit Hours: 3.00. Emphasis is placed on definitions of sustainability for corporate, governmental and non-governmental organizations, as well as the frameworks used for developing and implementing sustainability programs. Areas of emphasis in environmental, economic, social, and energy sustainability are explored along with policy and regulations that apply to decision-making. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge in environmental, economic, energy, and social aspects of sustainability. 2. Identify key measurements for sustainability. 3. Understand the frameworks and system approaches for developing and implementing sustainability for both the public and private sectors. 4. Recognize policies and regulations needed for sustainability efforts. 5. Prepare and present a major project demonstrating in-depth knowledge of the current state of the literature, major challenges and proposed solutions for a specific sustainability project. Credits: 3.00

TECH 52300 - Sustainable Critical Infrastructures

Credit Hours: 3.00. This is an applied sustainability course that explores critical infrastructures needed for sustainability efforts, and explores several industrial segments in-depth including supply chain and energy. Frameworks for evaluating benefits versus risks will be introduced as well as metrics for evaluating. Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge in critical infrastructures and policy implications for maintaining environmental, economic, energy, and social aspects of sustainability. 2. Identify key metrics for evaluating sustainability program effectiveness for both the public and private sectors. 3. Develop policies and regulations needed for sustainability efforts. 4. Prepare and present a major project demonstrating in-depth knowledge of the current state of the literature, major challenges and proposed solutions for a specific sustainability project. Credits: 3.00

TECH 52400 - Sustainability Analysis Assessment

Credit Hours: 3.00. Applied research project where students conduct a sustainability project under instructor guidance. Emphasis is on new developments relating to technical and operational aspects of sustainability as it applied in industry using triple bottom line evaluations. This course emphasizes a holistic approach to sustainability that includes environmental, economic, and social aspects as well as the impact of policy, standards and regulations on decision-making for sustainability. Permission of instructor required.

Learning Outcomes: 1. Describe and discuss multiple frameworks by which sustainability may be applied and evaluated. 2. Demonstrate knowledge of seminal works in sustainability models, assessments and measurements. 3. Evaluate the sustainability of a product or process. 4. Independently design and implement sustainability improvements in a product or process. 5. Critically evaluate policies, standards and regulations in applied studies. 6. Demonstrate the research knowledge and skills required to conduct an applied sustainability project. 7. Prepare and present a major product demonstrating in-depth knowledge of the current state of the literature, major challenges and proposed solutions for a specific sustainability project. Credits: 3.00

TECH 53300 - Design Theory And Technology

Credit Hours: 3.00. This course provides an overview of theories and approaches to the transdisciplinary concept of design, spanning multiple disciplines and types of design outputs with a focus on technology. Students will read the work of leading design scholars, and situate their personal approach to design practice and research based on historical and current trends in the literature. Student work will be focused on theoretical and practical outcomes, with two main learning goals: 1) building upon and critiquing theories, methods, and

processes of design in their original research; and 2) generating an awareness and representation of their personal design philosophy.

Learning Outcomes: 1. Situate design as a unique epistemology and ontology. 2. Explain key aspects of design activity. 3. Identify scholars, seminal works, and theories relating to design. 4. Distinguish between every day and professional design, craft, and art. 5. Critique theoretical foundations of their own discipline using the language and constructs of design theory. 6. Identify and articulate vital components of their design activity. 7. Synthesize and prioritize their design commitments. 8. Communicate their philosophy of design in multiple discipline-appropriate ways. Credits: 3.00

TECH 58100 - Workshop In Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

TECH 58300 - Smart Manufacturing Applied Technologies

Credit Hours: 3.00. This course addresses new content focusing on the 9 core capabilities and technologies that are at the forefront of digital transformation in the manufacturing industry. It also discusses the three core principles driving this transformation, particularly with the use of the Internet of Things (IoT) to create digital, smart, and connected systems using data to optimize key business drivers and objectives in manufacturing. The goal is to enable faster, flexible, and more efficient processes to produce higher-quality goods, reduce manufacturing costs, increase productivity, and foster industrial growth. These new concepts have not been previously taught at Purdue.

Learning Outcomes: 1. Analyze how the nine enabling technologies of Industry 4.0 are transforming the manufacturing industry. 2. Demonstrate understanding of the socio-economic impact of Industrial IoT and cyber-physical manufacturing systems will have on human workforce and the manufacturing industry alike. 3. Demonstrate how digital and data-assisted systems in manufacturing can be used for decision-making and augmenting human capabilities in manufacturing. 4. Analyze how information is acquired, exchanged, managed, and leveraged across manufacturing value chains. Credits: 3.00

TECH 58400 - Financial Analysis For Smart Manufacturing

Credit Hours: 3.00. The course will provide manufacturing professionals with foundational tools needed to conduct financial analysis for planning, implementing, and assessing Industry 4.0 projects focused on the application of technology for the integration of the smart manufacturing enterprise. The course begins with basic financial topics including financial statements, financial ratio analysis, and the strategic profit model, and then moves into concepts needed to address typical investment projects for Industry 4.0. Particular attention will be paid to asset lifecycle management models and the priorities that are important in the application of Industry 4.0 technologies to achieve performance improvements. Focus areas will include digital cost reduction efforts such as cost, level of effort, and impact needed to drive capital efficiencies and lower organizational costs. Project budgeting, savings and return on investment models, and project scalability and repeatability will all be discussed. A final corporate financial investment project is required.

Learning Outcomes: 1. Use key financial statements including income statements and balance sheets, statements of retained earnings and statements of cash flows. 2. Use common financial tools to your advantage: ratio analysis, common-sized (percentage) statements, pro-forma statements, and time value associated with money. 3. Calculate a variety of financial ratios important in manufacturing productivity and asset management. 4. Identify the impact of the application of Industry 4.0 technologies on both the balance sheet and income statement of the organization. 5. Evaluate and select the best application of Industry 4.0 technologies, and finance it using appropriate capital investment opportunities. Credits: 3.00

TECH 60100 - Research Seminar In Technology

Credit Hours: 1.00. This course provides an introduction to the field and scholarship of Technology and the skills necessary for success. Prerequisite: Doctoral student standing.

Credits: 1.00

TECH 60200 - Seminar In Technology And Society

Credit Hours: 1.00. This course focuses on relevant issues and challenges facing professionals in technology-related careers. Topics may include, but are not limited to: ethics, legal issues, public policy, defining technology, and technology and society. Prerequisite: Doctoral student standing.

Credits: 1.00

TECH 60300 - Graduate Seminar - Planning

Credit Hours: 1.00. This course is designed to guide students in creating individual development plans tailored to their academic and professional aspirations. Students will learn to assess their skills, interests, and values, aligning them with potential research and academic paths. The course will cover setting realistic goals, identifying resources, and developing strategies for personal and academic growth. Students will engage in workshops and activities that foster self-reflection and practical planning skills. By the end of the course, students will have a personalized roadmap that outlines the steps necessary to achieve their graduate school objectives.

Learning Outcomes: 1. Create an Individual Development Plan. 2. Understand graduate school and how it aligns with your professional objectives. 3. Develop a workflow for your studies. 4. Reflect on your progress to your future. 5. Critique your individual development plan. Credits: 1.00

TECH 62100 - Seminar In Technology

Credit Hours: 1.00 to 3.00. Current problems in Technology.

Credits: 1.00 to 3.00

TECH 62700 - Digital Leadership

Credit Hours: 3.00. This course will provide an overview of the strategic use and management of social media by technology leaders. In the digital age, technology and data transform every step of the business process, generating a need for new digital tools across all industries and capabilities. Technology innovation leaders and enterprise leaders must be conversant in current and emerging technologies, particularly the growing influence of social media, to identify opportunities and create competitive advantage. Permission of department required.

Learning Outcomes: 1. Identify the types and purposes of social media platforms to create strategic advantage. 2. Demonstrate the ability to create, manage, and/or update a social media presence for a business or organization. 3. Outline a strategic marketing plan for a business or organization. 4. Develop a Digital Portfolio to chronicle the social media research project. 5. Evaluate strategies for leveraging digital opportunities for more effective leadership. 6. Describe the six competencies that technology leaders need to lead effectively in the era of social media. Credits: 3.00

TECH 62800 - Technology Research And Use Of Data Analytics

Credit Hours: 3.00. Examines concepts, models and methods useful for applying data analytics in business environments. Focusing on Hypothesis generation, the capturing, storage and expression of data, analysis for research and visualization. Permission of department required.

Learning Outcomes: 1. Enhance critical thinking abilities and analytical thought. 2. Identify a variety of data types and storage strategies. 3. Source, cleanse, join, and analyze a set of data yielding actionable insights that can be applied to research or business. 4. Discuss aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

TECH 62900 - Global Supply Chain Analysis & Optimization

Credit Hours: 3.00. This course will provide an overview to supply chain management including history of supply chain, elements of supply chain, interactions of supply chain elements, and factors that impact supply chain success.

Learning Outcomes: 1. Identify supply chain organizations and current trends in supply chain. 2. Demonstrate the demand planning elements of a product lifecycle and how to

compute material requirements planning explosions. 3. Calculate forecasts using different approaches such as moving average and weighted moving average. 4. Offer critiqued solutions for impact to supply chain effectiveness. 5. Design a supply chain performance management system. Credits: 3.00

TECH 63000 - Leadership Of Cybersecurity & Cyberforensics

Credit Hours: 3.00. This course will provide an overview of cybersecurity for technology leaders. The digital age is ever changing and provides new challenges, threats and opportunities to the technologies that we use. As leaders, we need to learn the considerations of the impact of our decisions on the stakeholders in our environment and the risks they expose. In this course, we will analyze current trends and threats in the information security space. In addition, the course will also force the analysis of current computing environments and the unique challenges they can bring. Permission of department required.

Learning Outcomes: 1. Identify and analyze computing information security models and summarize their purpose. 2. Have the ability to identify and understand the concepts of Frameworks, Computing Environments, Cybercrime, Computing warfare and the internet as a holistic entity. 3. Critically assess their network environment and contrast it to various models of effective cybersecurity. 4. Identify and analyze common information security threats and demonstrate how these threats and threat actors relate to their network environment. 5. Analyze the current information security controls for their network environment. Credits: 3.00

TECH 63100 - Global Perspectives On Emerging Technologies

Credit Hours: 3.00. This course centers on an in-depth treatment of the discipline of technology and its intersections with culture, innovation and economics. Systematic analysis of technology and its international dimensions will be required as is horizon scanning, both nationally and internationally. Proficient written and oral communication is necessary for success. Permission of department required.

Learning Outcomes: 1. Develop and report an informed analysis of the influence (psychological, sociological and other) of technology on the culture, education, economy, lifestyle, standard of living of countries. 2. Compare and contrast selected country practices of technological human resource development/education and evaluate their capability to provide technically proficient personnel. 3. Advance and synthesize their international perspectives on the impacts that current and emerging technologies have on the economies, supply chain, culture, governance, environments and political character of developed and developing nations. 4. Perform a systematic horizon scan to identify, evaluate and synthesize key resources, i.e., publications, associations, agencies, etc., of relevance to advancing their practice of technology development, leadership and education. 5. Employ technology systems analysis procedures to explain the evolution trajectory of a historical or emerging technology. 6. Analyze and evaluate selected strategies for promotion and advancement of technological innovation capabilities of individuals, enterprises and nations. 7. Research, and describe cultural considerations necessary for international business and professional practice in technology in a variety of nations and regions. 8. Demonstrate scholarly proficiency in assembling thoughts and writing and presenting on a topic of relevance to technology, culture and innovation. Credits: 3.00

TECH 63200 - Demographic Leadership

Credit Hours: 3.00. This course addresses the major underlying changes redefining the United States. It directly yet sensitively examines how we as individuals can more readily deal with demographic shifts, and in the end, how changes in racial and ethnic diversity and age distribution present us all an opportunity to be our better selves. Permission of department required.

Learning Outcomes: 1. Students will be able to synthesize and report on the ability to differentiate, question and analyze the changing demographics of our society and support or question conclusions. 2. Students will have the ability to synthesize, interpret and report on the concepts of unconscious/implicit bias. Additionally, the student will demonstrate proficiency in methodology in evaluating studies on this concept to create informed decisions. 3. Students will be able to critically assess demographic data and trends to formulate strategies for better decision making. Credits: 3.00

TECH 63300 - Strategic Management Of Technology Innovation

Credit Hours: 3.00. This course looks at how organizations manage the technology innovation process and the function of new product development teams. We discuss idea generation, new product research and development, management of the innovation process, strategies for successful deployment and marketing of technology innovation, applicable laws, and regulations, and return on investment. We will take a broad look at industry though three lenses: 1 - large public companies, 2 - mid-sized family and privately controlled enterprises, and 3 - entrepreneurially led startups.

Learning Outcomes: 1. Identify the drivers of technological innovation. 2. Describe the idea generation process leading to the development of a new product or service, taking it from concept through the patent process toward commercialization. 3. Articulate successful strategies and tactics to lead and manage the innovation process. 4. Investigate how different dimensions of organizational structure affect a firm's ability to innovate. 5. Discuss the role of team leadership and administration in ensuring the team has access to the resources it needs and that team members feel committed to team goals. 6. Identify the key elements of deployment including timing, licensing and compatibility, pricing, distribution, and marketing. Credits: 3.00

TECH 63400 - Global, Legal, Ethical Issues For Technology Leaders

Credit Hours: 3.00. In this course, the nature of contemporary ethical, legal, and technological issues facing organizational leaders are examined. Effective organizational leadership strategies will be explored through a series of readings, discussions, case studies and reflective practice, and organizational effectiveness will be discussed in terms of topics such as ethical decision-making, corporate social responsibility, codes of ethics, public policies/government regulations, the global environment, technological innovation, risk management, and specific areas of law covering health and safety, contracts, warranties and liabilities, intellectual property, technology, and international laws and regulations. Strategies for effective leadership within the framework of managerial decision-making in an ethical context will be examined. Graduate student standing or senior status with consent of instructor.

Learning Outcomes: 1. Interpret the various ways that technology is pervasive in contemporary society. 2. Analyze international ethical, legal, and technological issues in organizational settings through the case study methodology. 3. Apply ethical and legal principles to organizational and governmental processes related to technological change. 4. Engage in reflective practice, applying course theory to practical situations. 5. Create an academic research paper that addresses a topic of interest related to the intersection of global, legal, ethical issues for technology leaders utilizing appropriate techniques for academic research writing. Credits: 3.00

TECH 63500 - Global Perspectives In Emerging Technology

Credit Hours: 3.00. This course involves an in-depth treatment of technology and its intersections with culture, innovation and economics. Systematic analysis of technology and its international dimensions will be required. Horizon scanning both in North America and internationally is needed to succeed in this course as is proficient written and oral communication.

Learning Outcomes: 1. Develop and demonstrate an informed understanding of the influence (psychological, sociological and other) of technology on the culture, education, economy, lifestyle, standard of living of

countries. 2. Describe various countries' practices of technological human resource development/education and their relationship to their capability for technology and development. 3. Form an international perspective on the impacts that current and emerging technologies have on the economies, supply chain, culture, governance, environments and political character of developed and developing nations. Credits: 3.00

TECH 63700 - Research Focus: The Social Internet

Credit Hours: 3.00. This course simulates an interdisciplinary think tank environment where students identify research questions and examine the impact of social media and social networking technologies on various aspects of society, business, culture, communication, web experience, and interface design. The course integrates immersion in social media with consideration of several theoretical perspectives from diverse fields. Students complete an original research project customized to fit individual or team interests. The course encourages theoretical and methodological diversity. Permission of instructor required.

Learning Outcomes: 1. Conduct independent research with and about social media on topics of their own interest. 2. Recognize the defining principles of social media. 3. Recognize the changes effected by social media in some major aspects of culture and society, as well as their own area of interest. 4. Identify major trends in social media research. 5. Create social media solutions and apply them to their own area of interest. Credits: 3.00

TECH 63800 - Leading & Managing Tech Organizations

Credit Hours: 3.00. This course will provide an overview of many Issues in leadership to include topics such as but not limited to Leadership framework, strategies, and an overview of critical business processes. Leading organizations and the teams within are elements of this course that will be addressed and demonstrated throughout the books and exercises in this course. We will focus on what is needed to be a great leader in various situations, and paths to improving leadership trust and leader thinking skills.

Learning Outcomes: 1. Identify issues in technology-focused places of work (to include problem-solving plans), determine the potential impacts of leader actions, critically analyze process changes (pros/cons) and possible further actions for improvement. 2. Demonstrate the ability to create a positive work environment (with peer review), analyze the work environment (company culture and impact on others), and review/revise for follow-up and further improvement. 3. Outline a plan to improve training in a technology-based workplace, with a focus on development of continuous self-improvement of critical thinking skills, along with analysis of other areas for improvement. (Teamwork (peer-reviewed), feedback, analysis, and reporting is required throughout this course.) Credits: 3.00

TECH 64000 - Research DTech Thesis

Credit Hours: 1.00 to 18.00. This course will be the research course for Online Doctor of Technology (DTech) students. This research dissertation course is to reflect the student's work to prepare and pass the preliminary examination, prepare and pass the dissertation proposal and successfully defend and pass the DTech dissertation.

Learning Outcomes: 1. Acquire skills involved with conducting academic and scholarly research in a rigorous manner. 2. Learning objectives will be specific and unique to the student's research area as outlined by the student's major professor and advisory committee. Credits: 1.00 to 18.00

TECH 64100 - Advanced Analytics For Research And Industry

Credit Hours: 3.00. Offers students training and experience in advanced parametric statistical techniques in both research and industrial applications. While statistical theory necessary to properly conduct analyses will be discussed, this course focuses on practical applications of analysis strategies, including issues in handling data from organizations and industry settings. Material includes overview and implementation of relevant statistical software applications. Practical skills in presenting advanced analyses to both

professional and scientific audiences is a key component of the course. Prerequisites: IET 50700 or STAT 50100 . Permission of instructor required.

Learning Outcomes: 1. Explain the types of analyses available to solve various industrial and organizational problems, the rationale behind analytic selection, and be able to select the appropriate analyses for a variety of situations. 2. Explain the role of employees at all levels in planning, conducting, or participating in effective research, and how to properly integrate input and data from various levels of an organization or laboratory research design into comprehensive analyses. 3. Design, set up, run, evaluate, and interpret advanced statistical analyses in real-world and laboratory settings, and explain these findings to both lay and expert audiences. 4. Read, interpret and critically evaluate complex and multivariate analyses reported in applied research journals. 5. Set up and interpret computer data sets and outputs which are required to carry out analyses, and write up in proper publication format the results of such outputs. Credits: 3.00

TECH 64600 - Analysis Of Research In Industry And Technology

Credit Hours: 3.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, and human resource development environments. Prerequisite: Master's student standing.

Credits: 3.00

TECH 67600 - Analysis Of Research Methods

Credit Hours: 3.00. Analysis of research and evaluation of research reports and funding - emphasis on understanding the application of fundamental statistical methods in design and interpretation of research findings in industrial, technical, business, and government environments.

Learning Outcomes: 1. Identify descriptive statistics appropriate to sampling used. 2. Evaluate appropriate use of inferential statistics. 3. Determine when data favor nonparametric vis-a-vis parametric statistical analysis. 4. Use manual and library database methods to find appropriate research and write an appropriate research report that will add to your body of knowledge. 5. Explain procedures for computer-aided data base searches of published research. 6. Identify descriptive research, surveys, and prediction studies. 7. Differentiate between experimental and quasi-experimental studies. 8. Identify common errors in research. 9. Develop a working knowledge or basic vocabulary and concepts or research methods (quant and qual). 10. Evaluate and critique research studies and articles. 11. Be familiar with a multitude of different types of research. 12. Differentiate between varying qualities of research studies and reports. 13. Understand how and why a university does research and how it is funded. 14. Have tools and knowledge to build and/or enhance the framework of your proposal or thesis. Credits: 3.00

TECH 69000 - Independent Study In Technology

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in technology. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Credits: 1.00 to 6.00

TECH 69500 - Graduate Professional Practice

Credit Hours: 0.00. Advanced professional experience in Technology. The experience is coordinated by the major professor with cooperation of a participating employer. Students submit a summary report. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively in their field of study. 2. Think critically, creatively, and solve problems in Technology.

Credits: 0.00

TECH 69700 - Qualitative Research Methods In Technology Studies

Credit Hours: 3.00. In-depth examination of qualitative methods and frameworks used in technology research. Students learn by

application a variety of methods from the qualitative research toolbox such as interviewing, focus groups, observation, and experience analysis. TECH 69700 prepares students to plan, pilot, and assess an original qualitative research study and to integrate qualitative research findings in the technology design and evaluation process. Permission of instructor required.

Learning Outcomes: 1. Explain the epistemological assumptions underlying qualitative research methods. 2. Identify and evaluate various types of qualitative research techniques. 3. Plan a research study using qualitative research methods. 4. Conduct a research study using qualitative research methods. 5. Write up a qualitative research scholarly paper. 6. Assess and analyze the validity of qualitative research. Credits: 3.00

TECH 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

School of Aviation and Transportation Technology (Graduate)

Website: **https://polytechnic.purdue.edu/schools/aviation-and-transportation-technology**

Department/School Head

Brian Dillman

Faculty by Rank

Academic Programs

Master's and Ph.D. Programs

Purdue University's School of Aviation and Transportation Technology provides a comprehensive education leading to the Master of Science in Aviation and Aerospace Management and a Ph.D. in Aviation and Technology Management. Coursework options address grand challenges in aviation financial management, aviation/aerospace safety, sustainable aviation operations, and quality management. All students are expected to acquire a broad background in aviation management practices and in the design of quantitative and qualitative methods necessary for research in the field. The MSAAM and Ph.D. ATM are offered through the School of Aviation and Aerospace Management. The Ph.D. Technology and Doctor of Technology are offered through the Polytechnic Institute.

Combined Degree Programs (Undergraduate Degree/Master's Degree) Residential On-Campus

The School of Aviation & Transportation Technology offers a program to qualifying Purdue BSAT undergraduates who wish to earn both their bachelor's and master's degrees. Click here for more information

Aviation Technology, MSAAM

Aviation Safety Management, Post-Baccalaureate Certificate

Aviation Sustainability, Post-Baccalaureate Certificate

Aviation Technology and Management, PHD

Aviation Financial Management, Post-Baccalaureate Certificate

Aviation Technology, MSAAM (OL)

AT 50500 - Research Methods In Aviation

Credit Hours: 3.00. This course explores the practical approach to research as it applies to identifying and exploring pragmatic problems in aviation industry settings. Industry based problems and issues often require a diversity of research skills, both quantitative and qualitative, in order to effectively address dynamic problems in complex and often high-risk work environments. This course offers an overview of mixed research methods which lends itself well to practical problem solving in industry. This course may also be offered in an online format. Permission of instructor required.

Learning Outcomes: 1. Select and develop an appropriate design and investigative methodology for commonly-encountered aviation research problems. 2. Perform, and properly interpret, elementary descriptive statistical analysis. 3. Determine the need for, and correctly apply, appropriate inferential statistical tests for a variety of data. 4. Test research and null hypotheses. 5. Prepare well-written scholarly papers, using specific style instructions. 6. Prepare survey instruments appropriate to differing aviation settings. 7. Utilize an accepted style/publication manual in preparation or written work. Credits: 3.00

AT 50700 - Quantitative Research Methodologies In Transportation

Credit Hours: 3.00. This course provides an introduction to business statistics with a specific focus on data analyses and managerial decision making in the transportation industry. Topics include descriptive statistics, probability models, estimation, hypothesis testing, and regression analysis. Students use software to perform their own analyses. Permission of instructor required.

Learning Outcomes: 1. Demonstrate proficiency in the use of statistics to describe transportation processes. 2. Employ inferential statistics to facilitate transportation managerial decision making. 3. Demonstrate proficiency in the use of software tools to facilitate statistical analyses. Credits: 3.00

AT 50800 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. (IT 50800) Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology.

Learning Outcomes: 1. Evaluate the key dimensions of quality and their implications for manufacturing and service industries. 2. Assess the philosophies and contributions of prominent thought leaders to the field of quality and productivity critically. 3. Apply core principles of Total Quality Management (TQM) to analyze and improve quality assurance programs. 4. Design and implement process management and improvement methodologies, such as Six Sigma, Lean, and Value Stream Analysis, to enhance productivity. Credits: 3.00

AT 51900 - Aviation Geographic Information Science Applications

Credit Hours: 3.00. This course provides a core set of skills essential for understanding geospatial science and using Geographic Information Systems as a tool to conduct research with a spatial component. The student will learn how to acquire, process, analyze, and interpret geospatial data using real-world data sets in applied situations.

Learning Outcomes: 1. Acquire core geospatial and remote sensing technology concepts. 2. Demonstrate an ability to apply GIS data to real-world applied situations. 3. Demonstrate a fundamental understanding of cartography

through the creation of map layouts in a GIS. Credits: 3.00

AT 52000 - Operational Assessment And Improvement

Credit Hours: 3.00. This course focuses on developing the skills to analyze, formulate, and apply techniques for work task improvement. Concepts to be studied include workflow enhancement, critical element streamlining, and value added analysis. Students will explore process map construction, process ownership, measurement system validation, standards creation, and decision factors. An industry project will be assigned and used to facilitate course objectives. Permission of instructor required.

Learning Outcomes: 1. Analyze workflows and critical elements using tools such as SWOT analysis, mind mapping, and process map construction to identify opportunities for improvement. 2. Evaluate and validate measurement systems, establish process ownership, and develop standards to support operational efficiency. 3. Calculate and interpret process time, labor costs, and total process costs to inform decision-making and improvement strategies. 4. Develop and justify improvement targets, impact analysis, and value-added analysis to enhance operational effectiveness. 5. Design and implement a comprehensive cycle time analysis, metrics framework, and testing and implementation plan for workflow enhancements. Credits: 3.00

AT 52500 - Process Improvement And Simulation

Credit Hours: 3.00. This course explores process modeling and simulation as applied to decision-making for process design and improvement. Emphasis is placed on understanding the application of process simulations to business problems including using fundamental statistical methods in the solution of an industry relevant problem. By planning and executing a computer-based simulation supporting an aviation or aerospace process design and improvement project, students improve analysis and project management skills. In addition to simulation, preparing visualizations of the process is also included for increased understanding of process interactions.

Learning Outcomes: 1. The student will have the knowledge and skills required to plan and execute a process improvement and simulation project. 2. The student will be able to compose and evaluate process models and simulations in terms of validity, verification, and usefulness in decision-making. 3. The student will be proficient in Arena or another appropriate process modeling and simulation computer application, as assigned. 4. The student will demonstrate appropriate use of process modeling techniques and data collection required to support the models. 5. The student will prepare and present a formal report describing a process design and improvement project, the methodology used in the project, and the results. 6. Assessment of the objectives is done by: Student's project plan and report; Individual test scores; and Participation in discussion and collaboration with other graduate students. Credits: 3.00

AT 52600 - Aviation Leadership

Credit Hours: 3.00. This course is intended for future aviation and aerospace managers. Using foundational readings, case studies, and critical analysis techniques, the contribution of past and contemporary aviation leaders will be reviewed. Permission of department required.

Learning Outcomes: 1. Perform a situational analysis of an aviation enterprise management or leadership challenge and recommend appropriate courses of action. 2. Form, lead, and support a team in an aeronautical work setting. 3. Distinguish management roles and actions from leadership roles and actions in both an air carrier organization as well as in a general aviation company. 4. Apply appropriate theories of leadership to realistic organizational situations such as an aviation manufacturing company, a corporate flight department, or aerospace industry organization. 5. Identify salient characteristics of individual and organizational behavior; plan courses of action

for organizational change. 6. Identify the competencies of past successful airline leaders; plan a leadership development program for an individual leader in a current aeronautical position. 7. Determine the viability and sustainability of vision strategies as they relate to activities such as flight training schools, fixed-base operator, or airport administration. 8. Recognize global cultural differences and assess the impact of those differences on appropriate leadership styles and organizational change initiatives in selected emerging aeronautical enterprises. Credits: 3.00

AT 52800 - Management And Design Of Training Systems

Credit Hours: 3.00. This course will examine the practical applications of managing the training process in industry and educational settings, including the development of instructional materials from an adult learner perspective. Curriculum design using various forms of media and delivery strategies will be emphasized. This course may also be delivered in an online format. Permission of department required.

Learning Outcomes: 1. Gain management knowledge and skills required to develop a training program for industry or education. 2. Able to design a learning module using instructional design principles in his/her interest area. 3. Able to assess the effectiveness of the training design process. 4. Write a comprehensive training plan in an area of his/her field of study. Credits: 3.00

AT 53000 - Multi-Cultural Issues In Team Operations

Credit Hours: 3.00. This course explores the nature and origins of professional, national, and organizational culture and their role in multi-disciplinary team activities. Power distance, individualism/collectivism, gender differences, and uncertainty avoidance are examined in terms of research by Hofstede. Management studies of several international air carriers will be utilized to highlight how cultural differences can affect perceptions. Permission of department required.

Learning Outcomes: 1. Examine the effects of professional, national, and organizational cultures on team dynamics, with an emphasis on aviation operations. 2. Investigate how cultural dimensions, including power distance, individualism versus collectivism, gender roles, and uncertainty avoidance, shape perceptions and influence collaboration. 3. Explore the ways cultural diversity can either support or hinder effective communication and teamwork in multi-disciplinary settings. 4. Implement error management strategies to mitigate the risks of cultural misunderstandings and improve team performance in diverse operational contexts. 5. Assess the implications of globalization on cultural norms and behaviors, particularly in professional environments. 6. Engage with peers in multi-cultural group projects to critically analyze industry challenges and recommend actionable solutions. Credits: 3.00

AT 53100 - International Civil Aviation Regulatory Systems

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Discuss the history, organization, and interdependence of international, regional and national civil aviation regulatory systems. 2. Discuss the partnerships and alliances between government, industry, stakeholders and financial organizations to support international civil aviation. 3. Discuss transparency and access to international aviation regulatory oversight programs and efforts to mitigate deficiencies and support efficiency. 4. Identify and conduct research on emerging international aviation issues. 5. Demonstrate critical thinking in developing

presentations on emerging international aviation regulatory topics. Credits: 3.00

AT 53200 - Contemporary Issues In Transportation Security

Credit Hours: 3.00. This course provides extensive multi-modal transportation security experience. Students will receive detailed information on air, maritime, rail, mass transit, trucking and oil pipeline security programs, as well as applicable threat mitigation processes. Completion of an undergraduate course in either aviation law or aviation security is recommended. This course may be applicable to undergraduates with appropriate experience and background in aviation or other transportation systems. There are no citizenship or security clearance requirements for this course.

Learning Outcomes: 1. Describe the threats and countermeasures for transportation systems. 2. Describe the legislative and regulatory agencies responsible for security management. 3. Describe the techniques, policies and practices to counter security gaps. 4. Collect and analyze security data and information. 5. Process and disseminate information related to security mitigation programs. 6. Evaluate a security management program for a transportation system. Credits: 3.00

AT 53300 - Aviation Graduate Professional Practice Internship

Credit Hours: 1.00 to 3.00. This course involves a practical internship experience within the aviation industry that provides exposure to the roles and duties commensurate with the student's graduate program focus. Prerequisite: Completion of one term of graduate studies and the instructor will validate that the student has an offer letter from an approved company. Permission of assigned graduate chair is required. Permission of instructor required.

Learning Outcomes: 1. Experience and understand aviation workplace roles and responsibilities. Credits: 1.00 to 3.00

AT 54200 - Aviation Fuels And Exhaust Emissions

Credit Hours: 3.00. This course focuses on aviation fuels, including engine operation with fuel, combustion principles, chemistry, exhaust emissions, and fuel testing procedures. Additionally, the topics of greenhouse gases, global warming, oil reserves, fuel costs, and other factors driving the development of alternative aviation fuels will be covered. Current research in these areas will be discussed and testing procedures will be studied. Students will research new fuels in development, and will analyze the sustainability and potential for success promised by the new technologies in comparison with existing fuels.

Learning Outcomes: 1. Evaluate the relationship of fuel chemistry, properties, and characteristics to the extent necessary to predict impact on performance. 2. Analyze and differentiate the steps in the refining process to determine the characteristics and costs of the various grades of aviation fuels. 3. Analyze fuel test results to predict engine performance utilizing this information. 4. Analyze and compare the exhaust emissions produced by current and new aviation fuels in relation to current and emerging air pollution regulations and policies. 5. Evaluate new fuels and fuel production processes to determine overall sustainability and projected costs under the European Union Emissions Tax Scheme. 6. Analyze the distribution requirements for new fuels in comparison with the existing infrastructure to determine the modifications or accommodations required for system-wide delivery and implementation. Credits: 3.00

AT 54300 - Contemporary Issues In Airport & Airline Finance

Credit Hours: 3.00. This course provides an overview of aviation financial management and is intended for current and future aviation and aerospace leaders and managers. Taking a global view, the course opens with the tremendous economic impact of the aviation sector that both drives and enables the interdependent global economy. The course material covers the unique business models and best practices in financial management for both the airport and airline industries and analyzes the relationship between the two (including the complications implicit in highly divergent planning horizons). The complexity of aircraft financing decisions is covered that lead up to building a fleet to serve the airlines' forecast growth. The course uses relevant readings and case studies as well as statistical data in time series to demonstrate the way financial management has evolved to improve performance in both the airport and airline industries. Permission of department required.

Learning Outcomes: 1. Recognize the impact of the COVID-19 pandemic on the global aviation sector and impacts on industry finance. 2. Describe the essential link between the enterprise's strategic vision and mission and prudent financial management. 3. Recognize the strengths and weaknesses of an aviation enterprise through an analysis of the balance sheet and income statements. 4. Understand the complexity and the sometimes adversarial nature of the airport/airline relationship. 5. Recognize the changes in the airline business model which have delivered improved financial performance in North America since 2014. 6. Describe the steps involved in re-inventing and rebranding an airport taking the Cincinnati Airport as an example. 7. Understand why privatization of airports, so common in Europe and Asia, has not caught on in the U.S. 8. Enumerate the hurdles to building new infrastructure. 9. Develop an appreciation for the FAA's role in oversight of the U.S. aviation system. 10. Become familiar with the basic elements of aircraft financing including various scenarios for investing in new aircraft to meet future demand. 11. Discuss the applications of new technology in North American air traffic management. This will focus on both the FAA and NAVCAN. 12. Know the basic roles of key players in aviation including Airports Council International (ACI), International Air Transport Association (IATA), the UN International Civil Aviation Organization (ICAO). Credits: 3.00

AT 54600 - Aviation Financial Instruments And Operations

Credit Hours: 3.00. The course concentrates on increasing the understanding of financial expertise in analyzing trading and hedging programs for application in reducing aviation operational risk exposure. The studies include research into the development and use of operational indexes and their possible relation to hedging with commodity and security instruments. Emphasis will be placed on the understanding of current operational measurements and correlations to trading and hedging financial instruments in providing improved risk management in operational environments.

Learning Outcomes: 1. Propose and defend an analysis using operational data, trading, and hedging programs to reduce financial and operational risk in a specific business area in airline operations. 2. Collect, assess, organize, and present the relationships between operational data, financial data, and commodity volatility. 3. Develop and present the impact of complexity on airline business operations. Credits: 3.00

AT 54700 - Airline Revenue Management

Credit Hours: 3.00. This course aims to provide students with experience in airline revenue management applications. Primarily focusing on the commercial operation of airlines, this course covers various contemporary topics such as the segmentation, inventory control, forecasting, budgeting and pricing. This course will use simulations to enhance the overall learning-teaching experience.

Learning Outcomes: 1. Summarize the development of revenue management in the airline industry, and explain the importance of revenue management to business operation of airlines. 2. Interpret concepts such as segmentation, forecasting, budgeting, pricing, revenue management, and yield in the domain of the airlines industry and the broader hospitality sector. 3. Evaluate pricing schemes used by airlines on different markets (for instance, long-haul & short-haul, domestic & international, competitive & dominant, peak season & low season) in real world. 4. Implement inventory control in a simulated environment to respond to the dynamic and complex market conditions. 5. Develop appropriate strategies to optimize revenue for a specific airline (either full-service carrier or low-cost carrier) in a certain market (simulated environment). Credits: 3.00

AT 54800 - Aircraft Asset Management

Credit Hours: 3.00. This course provides the student with a detailed exploration of aircraft asset management programs in both airlines and business aviation organizations. Students analyze and study the critical components of an asset management program, the financial methods in aircraft asset management, acquisition proposals, and development plans of aircraft acquisitions in this course. An airline industry-relevant project is used to improve student reasoning and application of industry standard aircraft asset management analysis procedures to include forecasting techniques, present value calculations, and benefit-cost analyses. This course serves as the foundational knowledge required for AT 54900.

Learning Outcomes: 1. Review critically, synthesize, document and summarize relevant research literature in the field of aircraft asset management, expressing themselves clearly and concisely in writing and oral presentation. 2. Recognize the critical components of an aircraft asset management program, thoroughly develop a business case for aircraft acquisition, and manage an in-service fleet of aircraft. 3. Develop a simulated asset management team and work effectively and collaboratively as part of the team. 4. Produce a high-quality airline industry aircraft asset management project, conduct financial analyses of aircraft assets, document findings in a paper, and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 54900 - Aircraft Leasing

Credit Hours: 3.00. This course provides students with training and experience managing aircraft leases using financial and risk management methodologies specific to the airline and business aviation industries. Students conduct financial evaluations of leasing versus ownership programs of airlines, as well as analyze debt, equity and capital markets for aircraft financing. The course includes an examination of taxation issues related to aircraft leasing, maintenance reserves, and auditing of aircraft financial performance. The prerequisite for this course is AT 54800.

Learning Outcomes: 1. Review critically, synthesize, document and present relevant research literature in the field of aircraft leasing and financing, expressing themselves clearly and concisely in writing and oral presentation. 2. Explain the necessary components of an aircraft lease, audit in-service aircraft financial performance, thoroughly analyze aircraft maintenance reserves, and summarize taxation issues with aircraft assets. 3. Develop a simulated aircraft leasing management team and work effectively and collaboratively as part of the team. 4. Generate a high-quality aircraft asset leasing project, conduct financial evaluations of leasing and owning options, document findings in a paper and communicate the key principles regarding their project in a professional presentation. Credits: 3.00

AT 55000 - Critical Systems Thinking

Credit Hours: 3.00. This course explores the application of critical systems thinking to complex problems. Using systems theory and case studies developed by technology visionaries, students will investigate alternative solutions to difficult industrial problems with global impact. Outcomes for this course include written assignments, oral presentations, and a final project that addresses a major industrial problem.

Learning Outcomes: 1. Understand how to frame complex issues in terms of systems thinking methodologies. 2. Able to synthesize information from different sources to develop a comprehensive aviation strategy. 3. Critically evaluate options and alternative solutions to complex problems. 4. Develop an appreciation for key aviation industry concerns as visionary aviation industry leaders. 5. Develop an eye to see and seize opportunities for innovation within industry. 6. Effectively articulate solutions to complex systems problems. Credits: 3.00

AT 57200 - Human Error And Safety

Credit Hours: 3.00. Explores the definition and nature of human error, error chains, and causal factors in error generation. Error taxonomies are reviewed in order to provide a classification scheme for grouping errors and assessing error criticality. Methods for assessing risk and predicting error generation potentials are learned, as well as strategies for controlling or

eliminating errors. Case studies are utilized throughout the course to illustrate course concepts. Permission of instructor required.

Learning Outcomes: 1. Classify and evaluate types of human error using established taxonomies and assess their criticality in complex systems. 2. Analyze the antecedents and causal factors of human error, including those related to equipment, operators, organizational practices, regulatory frameworks, and cultural influences. 3. Apply error investigation methods, including data collection and analysis, to identify patterns and inform risk reduction strategies. 4. Examine case studies critically to propose evidence-based strategies for mitigating error incidents and improving safety outcomes. 5. Develop and present a scholarly research project on a contemporary human factors issue, demonstrating effective written and oral communication skills for professional contexts. Credits: 3.00

AT 57300 - Managing The Risk Of Organizational Accidents

Credit Hours: 3.00. Examines strategies various industries use to assess the risk of organizational accidents and to develop safety management programs to prevent, capture, and recover from conditions that lead to disastrous outcomes. Strategies such as High Reliability Organizations, Operational Risk Management, Behavioral Based Safety, Tripod Delta, and Safety Cultures are explored as successful methods for improving organizational safety in high-risk environments and endeavors. Permission of instructor required.

Learning Outcomes: 1. Explain Reason's model of Organizational Accidents (OA) and its application in understanding accident causation and prevention. 2. Analyze everyday operational events through the lens of the OA model to identify latent risks and contributory factors. 3. Evaluate best practices from safety frameworks such as High Reliability Organizations, Operational Risk Management, and Safety Cultures to mitigate the risk of organizational accidents. 4. Develop a detailed, evidence-based analysis of selected aviation accidents or incidents, incorporating the principles of the OA model. 5. Propose strategies to enhance organizational safety by integrating behavioral-based safety and proactive risk management techniques into safety management systems. Credits: 3.00

AT 57400 - Exploratory Studies In Aviation Human Factors

Credit Hours: 3.00. Exploration of contemporary issues and research related to human factors theory and program strategies as they relate to the aviation industry. The course ventures beyond ergonomic issues into more diverse human factors considerations, while discussing an industry-wide and organizational perspective. The course utilizes a combination of lecture, group discussion, and independent study into issues relevant to student interests and career goals. Permission of instructor required.

Learning Outcomes: 1. Examine emerging human factors concepts and issues of critical concern within the aviation industry, beyond traditional ergonomic considerations. 2. Identify and evaluate human factors models and frameworks, such as the Human Factors Analysis and Classification System (HFACS), for investigating safety events. 3. Conduct and present independent exploratory research on a human factors topic, demonstrating analytical, written, and oral communication skills relevant to aviation professionals. 4. Design aviation workspace requirements that integrate human factors principles to enhance safety, performance, and usability. 5. Analyze contemporary aviation safety challenges from organizational and industry-wide perspectives, incorporating insights from human factors theory and program strategies. Credits: 3.00

AT 58100 - Workshop In Aviation Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 0.00 to 8.00

AT 59000 - Special Problems In Aviation Technology

Credit Hours: 1.00 to 12.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary based upon individual contract. Credits: 1.00 to 12.00

AT 60700 - Aviation Applications Of Bayesian Inference

Credit Hours: 3.00. This course provides a critical foundation necessary for understanding Bayesian theory and employing that theory in the analysis of typical data generated in industry. The course will focus specifically on solutions of aviation-related problems through data analysis. Material includes overview and implementation of relevant statistical software applications. Practical skills in presenting advanced analyses to both professional and scientific audiences is a key component of the course. Prerequisites: AT 50700 OR IT 50700 OR STAT 30100 OR STAT 50100 OR STAT 51100. Permission of instructor required.

Learning Outcomes: 1. Articulate and define basic concepts in probability theory, modeling, and Bayesian reasoning. 2. Create hierarchical models using Bayesian concepts and use appropriate software to implement those models. 3. Demonstrate the differences between Bayesian modeling and null hypothesis significance testing. 4. Apply Bayesian models to solve specific aviation problems using realistic data. Credits: 3.00

AT 64000 - Aviation And Aerospace Sustainability

Credit Hours: 3.00. This course explores sustainability as applied to aviation and aerospace industries and agencies, both in the private sector and public sector. Emphasis is placed on understanding aviation and aerospace sustainability academic literature and on connecting the global and national policies that lead to the regulations and practices. Aviation sustainability is comprised of multiple areas of impact such as economic, environmental, operational, and social. Students develop an understanding of existing sustainability assessment frameworks such as GRI that have general sustainability assessments along with specialized aviation industry frameworks. Using a multiple attribute analysis approach, students develop metrics and analyze the potential impact of sustainability initiatives in the aviation and aerospace industry. Prerequisites: STAT 30100 or STAT 31100 or STAT 50100 or STAT 51100 or IT 50700 or an instructor-approved statistical foundations course. Proficiency in statistical foundations is required to understand and evaluate environmental, economic and social sustainability data, information and methods presented in this course.

Learning Outcomes: 1. Create a well-founded set of metrics for assessing sustainability that consider economic, environmental, social and operational viewpoints. 2. Evaluate projects or initiatives affecting aviation and aerospace sustainability using multi-attribute analysis techniques. 3. Collect, assess, organize and present sustainability information. 4. Demonstrate understanding of sustainability terms, policies, and concepts. 5. Develop, communicate and defend an analysis of a sustainability initiative in the aviation or aerospace industry. Credits: 3.00

AT 67500 - Aviation Safety Program Development

Credit Hours: 3.00. This course is designed to provide graduate students with essential information and practical activities necessary to develop and manage effective and comprehensive safety programs for a wide variety of aviation operations. Students will conduct safety research, analyze data, and make presentations based on developed safety systems. Instructor permission required.

Learning Outcomes: 1. Describe the regulatory and risk environment in which airline safety offices exist. 2. Describe safety theories and models. 3. Describe human factors and accident causation. 4. Collect and analyze safety related data. 5. Process and disseminate information related to accident prevention and risk minimization. 6. Manage an airline safety office and implement procedures. 7. Design a safety management program for an air career or FBO. Credits: 3.00

AT 69000 - Independent Study In Air Transportation

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in air transportation. A faculty sponsor is required for this course. Prerequisite: Doctoral student standing. Permission of instructor required.

Learning Outcomes: 1. Investigate and report on a focused area of air transportation. Credits: 1.00 to 6.00

AT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Plan, manage, conduct, and report original research using appropriate design and analytical techniques. Credits: 1.00 to 18.00

AT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. This course involves intensive research and writing activity associated with a doctoral dissertation. Prerequisite: Doctoral candidate status. Permission of instructor required.

Learning Outcomes: 1. Plan, manage, conduct, and report original research using appropriate design and analytical techniques. Credits: 1.00 to 18.00

Department of Computer Graphics Technology (Graduate)

Website: **https://polytechnic.purdue.edu/degrees/ms-computer-graphics-technology**

Department/School Head

Nathan W. Hartman

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Professor of Practice
Nicoletta Adamo Nathan Hartman James Mohler	Vetria L. Byrd Yingjie Chen Esteban Garcia Ronald Glotzbach Colin M. Gray Tim McGraw Carlos R Morales Paul Parsons David M. Whittinghill	Nandhini Giri Jeffery Kesselman Derek Larson Austin Toombs Christos Mousas Rua Williams	Travis Fuerst Raymond Hassan Robert Howard Nancy J. Rasche Dan Triplett Nasheet Zaman

Academic Programs

Master's and Ph.D. Programs

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MS in Computer Graphics Technology
The Department of Computer Graphics Technology touches all aspects of computer graphics, from animation to scientific visualization, and from user experience to game studies. Research projects on these topics push the boundaries of how the medium can be used, while the variety of degree options to prepare students to be practitioners and managers in an array of computer graphics-related careers.

Concentration

- Animation and Visual Effects
- Computer Graphics Programming
- Games, Virtual and Augmented Reality
- Information Visualization and Visual Analytics
- User Experience Design (UX)

Combined Degree Programs (Undergraduate Degree / Master's Degree)

- Five-year combined BS/MS Degree Program in Computer Graphics Technology

Computer Graphics Technology, MS

CGT 50100 - Seminar In Computer Graphics Technology

Credit Hours: 0.00 to 3.00. A variable topics course that addresses contemporary problems and issues related to M.S. students in Computer Graphics Technology. Permission of instructor required.

Learning Outcomes: 1. Understand the transition from undergraduate to graduate study (course approaches, studying, research, assistantship responsibilities). 2. Understand and apply ethics in research and writing. 3. Understand the grant process and agencies that offer grants. 4. Understand the publishing process relative to articles and proceedings. 5. Understand the various publishing formats and methods of citations (APA, Chicago, and MLA versus organizational approaches). 6. Understand the IRB process and method of research approval. 7. Develop a plan of study. 8. Establish a graduate committee. 9. Understand the process for obtaining the MS. 10. Accept grand challenges in Computer Graphics Technology. Credits: 0.00 to 3.00

CGT 51100 - The Development Of Graphics In Technology

Credit Hours: 3.00. An introduction to the historical development of visual science in western civilization and its effect on computer graphics techniques and practices. Topics include the historical, contemporary, and future developments in computer graphics. Emphasizes the study of visual science and the significance of computer graphics as a communications medium.

Learning Outcomes: 1. Apply the principles attained from course material. Lectures, readings and discussions will be structured around developments and shifts in the selected computer graphics topics. 2. Provide an understanding in research methodologies that are related to different areas in computer graphics. 3. Understand key concepts and techniques of computer graphics. 4. Design and conduct academic research in computer graphics. Credits: 3.00

CGT 51200 - Foundational Readings Of User Experience Design

Credit Hours: 3.00. This course provides an overview of the field of human-computer interaction (HCI) and user experience (UX) design. Students will explore the main themes, paradigms, and theories of HCI and UX from its inception to the present. The course takes a broad, chronological approach, examining the history and evolution of HCI and UX, including its major intellectual shifts, successes and failures, and its dynamic relationship to other fields. Students will read seminal works from leading researchers. This course is intended to provide a solid foundation for further research. No specific technical or programming experience is required.

Learning Outcomes: 1. Engage with major theories, paradigms, and themes throughout the history of HCI and UX. 2. Identify, describe, and assess strengths and limitations of various methods and approaches with HCI and UX. 3. Critically evaluate existing research in the field and develop their scholarly and intellectual skills in preparation for future research. Credits: 3.00

CGT 51300 - Interactive Multimedia Development And Research

Credit Hours: 3.00. A survey of the interactive multimedia development process, knowledge base, and applications in business and industry. Particular attention is paid to research issues surrounding theoretical, technological, and interactive techniques, and validating those approaches through applied research. Emphasis is placed on the interdisciplinary nature of the development of new media tools.

Learning Outcomes: 1. Become familiar with a range of projects that consider data as a primary material and learn to contextualize recent creative data visualization projects within the history of electronic media, the interactive arts, and visual design. 2. Develop proficiency at programming using the main contemporary software frameworks for data visualization and interactive content creation. 3. Gain experience working on a larger project, including collaborating with others on interactive software, authoring a conference-style write-up to describe the project, and documenting project code in an open-source repo. Credits: 3.00

CGT 51500 - Virtual Environments

Credit Hours: 3.00. This course provides deep exposure to the most prominent and important research within the fields of virtual reality, games, and any application area where virtual environments are constructed or inhabited. Students will study experiential, cultural, and phenomenological aspects of habitation within virtual environments as well as become familiar with technical aspects involved in virtual environment creation. Students will generate original research data and analysis, prepare a publishable manuscript, and build their own virtual worlds as applicable.

Learning Outcomes: 1. Conduct a thorough literature review of a chosen topic related to virtual environments and/or their development. 2. Analyze scientific research and present the results of the analysis. 3. Conduct a sound, logical study in the area of virtual environments. 4. Create a virtual environment using a game or virtual reality engine. 5. Prepare a human subjects research application (IRB) that meets all regulatory regulations required to conduct ethical human research. 6. Write a publishable research manuscript using the LaTeX scripting language. Credits: 3.00

CGT 51600 - Collaborative Virtual And Augmented Environments

Credit Hours: 3.00. A study of the field of collaborative virtual and augmented environments in shared, multi-user, same-site and multi-site immersive environments. Students will gain knowledge in the following research areas: multi-user interaction, collaborative virtual and augmented environments, and latest software and hardware tools. In this collaborative environment, students not only interact within the same virtual environment but collaborate between physically different environments through distributed environments. Knowledge of 3D computer graphics fundamentals, openGL, and C/C++, or consent of instructor.

Learning Outcomes: 1. Understand the principles and theory of collaborative shared virtual and augmented environments. 2. Apply the principals of graphics programming in designing virtual and collaborative space. 3. Describe and explain the use of, and advantages and disadvantages of, current VR and AR collaborative technologies. 4. Describe human interaction issues in 3D collaborative virtual and augmented environments. Credits: 3.00

CGT 51800 - Augmented Reality

Credit Hours: 3.00. Augmented Reality, a form of presenting virtual information within a perspective of the real world. This course instructs students in the foundations, practice and use of AR (Augmented Reality) as well as the technology required to produce an AR visualization. The concepts covered in this class include: physical tracking systems, computer vision, image processing techniques, 3D virtual environment visualization and calibration, display systems for AR and usage of AR in multimedia & tech culture. Some experience in Unity 3D preferred.

Learning Outcomes: 1. Comprehend the fundamentals of Augmented Reality and the technologies required to produce an AR context. 2. Harness the power of image processing to implement tracking with and

without fiducial markers. 3. Produce an AR application for use in entertainment, instruction, research or training as a final project (requiring instructor approval). 4. Present concepts of AR and how they are used in research and industry as it relates to their class final project. 5. Demonstrate knowledge of the history of AR and its social-cultural impact as well as the evolution of the technology used in advancing AR display and tracking techniques. Credits: 3.00

CGT 51900 - Projects In Graphics

Credit Hours: 3.00. This course instructs students in current methods of conducting research on computer graphics and the content development process. Topics covered in the course include biofeedback, user experience, measurement and analysis, development pipelines, publication strategies and methodologies. LaTeX document preparation, simulation, and qualitative approaches to conducting research in the field of computer graphics.

Learning Outcomes: 1. Conduct a thorough literature review of a chosen topic related to computer graphics and/or the content development process. 2. Present to the class an analysis of an academic paper or set of papers. 3. Conduct a sound, logical study in the area of computer graphics. 4. Prepare a human subjects research application (IRB) that meets all regulatory regulations required to conduct ethical human research. 5. Conduct a research study. 6. Analyze the results of a completed research study. 7. Write a complete publishable manuscript using the LaTeX scripting language. Credits: 3.00

CGT 52000 - Computer Graphics Programming

Credit Hours: 3.00. This course provides a working knowledge of computer graphics fundamentals, such as using transformation matrices, writing programmable shaders, implementing a lighting model and texture mapping using a modern graphics API. Coursework focuses on creating real-time interactive applications using a low-level programming language.

Learning Outcomes: 1. Understand the graphics pipeline exposed by modern graphics APIs. 2. Understand and use transformation matrices and coordinate frames. 3. Implement the Phong lighting model using programmable shaders. 4. Understand and use texture mapping and texture state such as filtering and wrapping modes. 5. Understand and implement interaction techniques using mouse, keyboard and user interface. Credits: 3.00

CGT 52100 - Advanced Real-Time Computer Graphics

Credit Hours: 3.00. This course focuses on a working knowledge of real-time rendering and shaders using a modern graphics API. Students will learn the performance implications of program design choices with respect to the highly parallelized nature of the GPU and the characteristics of the GPU memory hierarchy. Students will learn about optional specialized programmable shader stages, as well as advanced techniques such as physically-based lighting and shadowing techniques.

Learning Outcomes: 1. Understand the graphics pipeline exposed by modern graphics APIs. 2. Understand and apply modern GPU features. 3. Understand and use buffers efficiently for data access in shaders 4. Understand and use techniques such as tangent-space bumpmapping or shadow mapping which require the use of additional coordinate frames and transformation matrices. 5. Implement a physically-based lighting model using programmable shaders. Credits: 3.00

CGT 52200 - UX Design Graduate Studio I: Fundamentals

Credit Hours: 3.00. This course is an introduction to the fundamental components of human-centered design, focusing on interactive computing systems. Students learn basic tenets and methods of user-centered design, including usability and visual design principles, user research, low-fidelity prototyping, and high-fidelity prototyping. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct analysis of situations, clients and problems, articulate

problem statements, and create concepts that address issues in the problem statement. 2. Identify and use data gathering and analysis techniques to inform design decisions. 3. Demonstrate application of principles of visual and interaction design to create prototypes. 4. Explain and apply the fundamental components of user-centered design. 5. Synthesize and articulate the core values of user-centered design. Credits: 3.00

CGT 52300 - Intelligent Virtual Agents

Credit Hours: 3.00. Intelligent Virtual Agents (IVAs) are interactive virtual characters that exhibit human-like qualities, including communicating using natural human modalities such as facial expressions, speech, and gesture. They are capable of real-time perception, cognition, emotion, and action that allow them to participate in dynamic social environments. This course introduces students to the interdisciplinary research on the design, application, and evaluation of IVAs. Students will be taught theory, methodologies, and algorithms, which they will then apply to individual projects. These individual projects will provide students with a common base for authoring IVAs for various application domains, including virtual assistants, pedagogical agents, human-agent task/problem co-solving, human-agent collaboration, and more. Prior background in virtual reality or technical animation is assumed, as the course will provide students the opportunity to further develop these competencies through hands-on assignments within a commercial game engine. The focus of this course is primarily on the computational and functional dimensions of IVAs; however, design and creativity are also important aspects of all projects. This course uses an active learning approach that involves lab assignments, presentations, independent research, and group ideation and collaboration.

Learning Outcomes: 1. Define notions of expressiveness of intelligent virtual agents. 2. Create domain-specific IVAs using artificial intelligence techniques. 3. Identify application domains and simulate IVAs' behaviors. 4. Develop communication strategies that enable human-IVA interaction based on artificial intelligence techniques. 5. Apply the theory and programming knowledge covered in class to concrete exercises using a commercial game engine. 6. Compare and contrast the constraints and affordances for expressiveness in physical vs. virtual intelligent agents and human-like vs. non-humanoid agents. Credits: 3.00

CGT 52500 - Virtual Reality

Credit Hours: 3.00. This course introduces students to the hardware, software, and cognitive underpinnings necessary for creating cutting-edge virtual reality (VR) applications with a strong emphasis on immersive and interactive experiences, allowing students to explore and innovate within the realm of VR. Students will engage with various topics throughout the course, including computer graphics, human-computer interaction, applied perception, optics, and display technologies. Practical experience with consumer-grade virtual reality systems will empower students to design, develop, and analyze VR applications that are effective and comfortable for the user. This course aims to explore the vast potential of VR beyond traditional applications, highlighting its impact on entertainment, healthcare, education, and various other industrial domains. Through a combination of lectures, hands-on projects, and assignments, students will tackle the challenges of VR development, guided by design principles and real-world constraints. By the end of this course, students will be equipped with both knowledge and practical skills needed to design and develop VR experiences that push the boundaries of immersion and interactivity.

Learning Outcomes: 1. Discover novel virtual reality interaction techniques. This is accomplished via student research, instructor presentations, and student presentations. 2. Demonstrate new virtual reality design ideas by creating functional prototypes in a game engine. 3. Apply theory to create virtual reality experiences that will generate intuitive interactions and believable experiences for the user. 4. Develop interactive experiences in virtual reality environments. 5. Communicate complex virtual reality design ideas to an audience. 6. Synthesize new ideas from concepts learned from research and collaborative work in-class. 7. Collect and analyze user experience data. Credits: 3.00

CGT 53200 - UX Design Graduate Studio II: Cross-Channel

Credit Hours: 3.00. This course is an advanced exploration of cross-channel approaches to human-centered design, such as service design, that span digital and physical experiences.

Students utilize principles of usability and user experience to create and evaluate physical prototypes. The course is platform-independent and encourages students to experiment with new and emerging technologies.

Learning Outcomes: 1. Conduct advanced analysis of various situations using appropriate processes and methodologies for UX. 2. Select and apply appropriate user research methods. 3. Prioritize design requirements based on user research. 4. Identify and frame perceived and real problems. 5. Distinguish among popular processes and methodologies for UX. 6. Create design concepts that address the issues of situations, clients, and problems that demonstrate an awareness of multiple user touchpoints. 8. Distinguish among methods for representing design ideas and processes. 9. Apply contextually appropriate methods for representing design ideas and processes. 10. Justify appropriateness of chosen methods. 11. Prototype multi-channel experiences that incorporate physical computing systems and other advanced technologies. 12. Apply human factors principles in the creation of physical prototypes. 13. Apply appropriate methods to evaluate multi-channel experiences. 14. Demonstrate technical competence with physical computing systems and other advanced technologies. 15. Design holistic experiences that integrate multiple channels cohesively. 16. Explain how design philosophy impacts design practice. 17. escribe how underlying assumptions and perspectives influence practice. 18. Identify key components of a design philosophy. 19. Articulate personal design philosophy. 20. Apply advanced UX theory in the design and evaluation of interactive experiences. 21. Distinguish among relevant theoretical frameworks and constructs. 22. Utilize theoretical frameworks in the design of interactive experiences. 23. Analyze existing experiences using appropriate theoretical frameworks. Credits: 3.00

CGT 53700 - Applied Artificial Intelligence For Computer Graphics

Credit Hours: 3.00. This graduate-level survey course offers a comprehensive exploration of how AI technologies are revolutionizing computer graphics and applications, including animation, augmented reality (AR), virtual reality (VR), digital media, and interaction techniques. With a focus on both the theoretical foundations and practical applications of AI, the curriculum delves into machine learning, deep learning, neural networks, and their specific uses in creating visual content and interactive digital media applications. Students will engage in hands-on projects, ranging from individual experiments to collaborative efforts, designed to demonstrate AI's transformative potential in enhancing both the visual and interactive dimensions of computational media. By the end of this course, students will not only understand the current landscape of AI in computational media but also possess the technical, analytical, and creative skills needed to contribute meaningfully to this rapidly evolving field.

Learning Outcomes: 1. Design conceptually and prototype computer graphics applications that effectively incorporate AI technologies, demonstrating an understanding of how AI can enrich the content, enhance interaction, and increase realism within these applications. 2. Apply appropriate AI techniques and machine learning algorithms for tasks like object recognition, content generation, and natural user interfaces across a variety of computer graphics applications, including animation, virtual reality (VR), and augmented reality (AR). 3. Assess critically the ethical, societal, and technical implications of using AI in computational media, including considerations around data privacy, bias in AI models, and the broader impact of AI-generated graphics on industry and society. Credits: 3.00

CGT 54000 - Current Topics In 3D Animation

Credit Hours: 3.00. This course addresses recent research and development in 3D animation. Permission of instructor required.

Learning Outcomes: 1. Demonstrate an understanding of the latest research

contributions in the field of 3D animation. 2. Discuss advanced/emerging 3D animation technologies and suggest improvements and alternatives. 3. Develop research, presentation, and writing skills related to technical content. 4. Effectively set up for animation (rig) realistic/fantasy creatures and objects. 5. Animate realistic/fantasy creatures and objects in a believable way. 6. Create physically accurate animations using rigid body and soft body dynamics, particle systems, cloth and hair. 7. Apply advanced/emerging animation methods and techniques to development of original animation-based productions. Credits: 3.00

CGT 54300 - Experimental Animation

Credit Hours: 3.00. This course introduces key theoretical and applied concepts of experimental animation. Evolving technology consistently provides new opportunities for experimental practices in animation production. In this course, students will engage with experimental creative practices including abductive reasoning, abstraction, generative animation, motion graphics, simulations, glitch and mixed digital media. These experimental animations are suitable for a wide range of outputs including experimental short film, installation, projection mapping and a range of online platforms.

Learning Outcomes: 1. Identify key examples of experimental digital animation and explain the relationship between experimental practices and technology. 2. Evaluate process and outcomes of experiments with digital graphics technology used to produce images and animation. 3. Appraise aesthetic or communication opportunities arising from new experimental production, linking these to contemporary image culture. 4. Create new experimental animated works for public display, screening or installation or for online dissemination. Credits: 3.00

CGT 54400 - Animation History, Technology And Technique

Credit Hours: 3.00. This course traces the history of animation by reviewing the evolution of animation technology and the nexus between these technologies, production practices and crafts and the resulting styles, movements and genres of animation. The course reviews major technological developments of the 20th century that have impacted commercial animation production, as well as lesser known independent studios and artists, fringe technologies and sub genres. The course culminates with a consideration of current animation technology and the limits and opportunities it creates.

Learning Outcomes: 1. Identify important developments in animation production technology throughout the history of the medium. 2. Analyze examples of animation from the 20th and 21st century and assess correlations between technology, cultural history and animation production. 3. Evaluate and recommend animation tools based on aesthetic goals and project parameters. 4. Create animation projects utilizing a range of techniques and technologies that explore the limits and potentials of historical and contemporary animation methods. Credits: 3.00

CGT 54500 - Game Development I

Credit Hours: 3.00. In both research and industry game engines are the foundation for nearly all graphics-intensive interactive applications. A thorough understanding of how game engines work is therefore a requisite element of the game development process and lever for research in most domains involving interactive simulations and games. As game engine development, research, and application is a large and complex topic, the course is split into two semesters of study. The two courses are structured similarly but cover different aspects of development on and within game engines. This course introduces students to the fundamental technologies and skills required to develop video games using a modern game engine. Students are taught using a student-led, active-learning pedagogy in which students co-develop and present lectures, demonstrations, and assignments for their peers, with facilitation by the course instructor. The focus of this course is primarily on the technical, functional, and theoretical dimensions of game development, prioritizing technical soundness over design and creativity (which are covered more explicitly in a separate course). As research in this field continues to rapidly iterate, the latest findings are incorporated into each new offering of the course, refreshing its content as the technology evolves in its implementation and theoretical underpinnings. Production of original research focused upon an aspect of game development or game engine design is required.

Learning Outcomes: 1. Reproduce game mechanics observed in an existing game. 2. Present to a classroom the theory and implementation within a scientific paper or set of papers that relate to an aspect of game development and lead a subsequent discussion surrounding said implementation. 3. Extract practicable production information from papers, books, vendor documentation and ad hoc sources to solve open-ended technical problems. 4. Create a technically sound video game prototype within a team-based production environment. 5. Generate and test a research hypotheses related to games, game technology, or game development processes. Credits: 3.00

CGT 55400 - Configuration Management In The Digital Enterprise

Credit Hours: 3.00. This course will cover Configuration Management (CM) in the context of the digital enterprise and Product Lifecycle Management (PLM). Configuration Management applies processes, resources and controls to establish and maintain consistency between product configuration information and the product. Configuration information includes product requirements and changes to the product. This course provides preparation for IpX CM2 Certification at the Application Specialist level.

Learning Outcomes: 1. Learn how an organization is driven by requirements and why configuration management is essentially requirements management. 2. Learn how to use physical item hierarchies as a framework to subdivide complex configurations into manageable increments. 3. Learn how to use a similar administrative hierarchy to manage the requirements for the business enterprise. 4. Learn the difference between corrective action and real improvements and how to eliminate the need for intervention resources. Credits: 3.00

CGT 55500 - Game Development II

Credit Hours: 3.00. This course introduces students to the advanced concepts, technologies, skills that enable the creation of sophisticated video games, simulations, and game systems. Students are taught using student-led, active-learning pedagogy in which students co-develop and present lectures, demonstrations, and assignments for their peers, with the facilitation of the course instructor. A thorough understanding of how game engines work is therefore a requisite element of the game development process and lever for research in most domains involving interactive simulations and games. As game engine development, research, and application is a large and complex topic, the course material is distributed across two semesters. In addition to the continuation of technical topics this course also emphasizes the experiential, conceptual, and aesthetic dimensions of game development, prioritizing implementation completeness with creative, aesthetically-pleasing implementations that are informed by current research. As research in this field continues to rapidly iterate, the latest findings are incorporated into each new offering of the course, refreshing its content as the technology evolves in its implementation and theoretical underpinnings. Production of original research focused upon an aspect of game development or game engine design is required. Permission of instructor required.

Learning Outcomes: 1. Interpret, describe, and present the theory and implementation of an advanced game development topic via student-led in-class lecture. 2. Present to a classroom the theory and implementation within a scientific paper or set of papers that relate to an aspect of game development and lead a subsequent discussion surrounding said implementation. 3. Extract practicable production/development information from papers, books, vendor documentation and ad hoc sources to solve open-ended technical problems. 4. Create (or extend from the previous course) a technically sound video game prototype within a team-based production environment. 5. Generate and test a research hypotheses related to games, game technology, or game development processes. Credits: 3.00

CGT 56200 - Cognition And Human-Computer Interaction

Credit Hours: 3.00. This course provides an overview of the role of human cognition in the use of interactive digital technologies. Students will learn fundamental theories and concepts of cognitive science that are relevant to interactive technology. The course takes a broad chronological approach, examining the history and development of cognitive theories

and models in the field of human computer-interaction (HCI). Students will read seminal works from leading researchers in cognitive science and HCI. The course covers older well-established theories and models as well as newer speculative ones. Students will develop a sound understanding of the origins, development, and future directions of cognition research in HCI. Topics covered include: classical cognition; the cognitive revolution; mediated cognition; activity theory; situated action; embodied cognition; distributed, external, and extended cognition; enactive cognition; thinking and epistemic coping; make-believe and imagination; scaffolding and cognitive offloading; internal and external representations. Students are encouraged to make appropriate connections to their own research areas. No specific technical or programming experiences is required.

Learning Outcomes: 1. Critically assess the role of cognition in the use of interactive digital technologies. 2. Explain the history and development of cognition research in the field of human computer-interaction, including major theories and seminal works. 3. Apply concepts from the course in their own personal research. Credits: 3.00

CGT 57000 - Information Visualization

Credit Hours: 3.00. This course provides a systematic, comprehensive framework to study principles, design choices, and development toolkits on information visualization design and development. It focuses on creating innovative and intuitive visualization solutions to provide users with peripheral awareness of meaningful information from a complex data set. Employing a user-centric approach, this course studies and analyzes visualization design and development from data, tasks, and visualization and interactions. The students will learn perception theories on visualization and use visual elements such as space and color to encode data, compare, evaluate, choose among different visualization forms and interaction methods. Through a project-based learning approach, students will conduct case studies on various visualization designs, analyze the user, data, tasks, and design choices in the visualizations, and finally design and develop information visualization solutions as course projects. Students should have finished their undergraduate study in domains that are closely related to one or more of the following: business analysis, statistics, knowledge management, computer science, software engineering, interaction design, human-centered computing, scientific visualization or information visualization. Permission of department required.

Learning Outcomes: 1. Describe the purposes of visualization and the process of design and developing visualizations. 2. Explain visual encoding channels, visualization design rules, and design principles using scientific theories on visual perception. 3. Apply popular visualization forms to represent different types of data. 4. Analyze visualization designs to differentiate the functions and purposes of visual elements and channels 5. Evaluate different visualization forms, arrangements, and interactions about their pro and cons, purposes, and suitable contexts. 6. Design, develop, and evaluate an innovative visualization system with interlinked multiple views to represent a large complex dataset. Credits: 3.00

CGT 57200 - Special Topics In Human-Centered Design And Development

Credit Hours: 3.00. This course offers students the opportunity to explore current topics in human-centered design and development of systems with graphical user interfaces in-depth through readings, discussions, design projects and design critiques. Topics vary by semester. Possible offerings include Critical Design, Design for Behavior Change, Participatory Design, Design for Social Good, Service Design, Social Interaction Design.

Learning Outcomes: 1. Describe, explain, and compare processes, methods and techniques of human-centered data. 2. Create deliverables such as, but not limited to: interactive prototypes, research reports, usability evaluation reports, scholarly research papers using HCDD processes, methods and techniques. 3. Critique HCDD processes, methods and techniques. 4. Evaluate HCDD deliverables using HCDD methods such as cognitive walkthrough, usability testing, focus groups, etc. 5. Lead teams through HCDD iterative processes used for creating. 6. Solve specific design problems using the appropriate HCDD processes, methods and techniques. Credits: 3.00

CGT 57207 - UX Design Graduate Experience Studio

Credit Hours: 3.00. This course immerses students in a company-like environment where they work on semester-long design projects that are sponsored by industry partners. Students learn about the various roles within a UX environment as they build collaboration and project management skills. Projects utilize a human-centered design approach with an emphasis on designing for the user experience. Students will engage in substantial research and evaluation activities, informed by seminal literature in the field, along with their design work. Students are expected to take responsibility for project deliverables and mentor junior students. Permission of department required.

Learning Outcomes: 1. Implement team-building skills and manage collaboration between teammates. Solve conflicts in a fair and effective manner that is a "lead by example" process. Organize and lead team retrospectives. Measure your UX role and your teammates, then determine growth plans (e.g., create team member growth plans; retrospective reflections; peer team evaluations; ...). 2. Develop a project strategy with tasks and deliverables based on project goals and team dynamics. Execute project management plan with milestones, and team member tasks. Champion the development of a UX project proposal that will clearly explain the project vision, direction, goals, stakeholders, deliverables, timeline, and tasks (e.g., identification, planning, and completion of project milestones; ...). 3. Demonstrate depth in one or more UX specializations and critique strengths and weaknesses. Teach UXD specialization tasks and process to team members. Educate team members about the roles and careers of UX designers. Document your educational path of UXD skill development in a written reflection (e.g., activity log of specialization goals and outcomes; guide to job searching; ...). 4. Communicate UX approaches to diverse stakeholders in a professional manner. Champion the final project written design documentation, including the executive summary. Enhance portfolio, conduct job search, and mentor junior students (e.g., sponsor-facing reports; executive summaries; lead presentation and documentation; ...). 5. Conduct advanced primary and secondary research in tandem with ongoing client communication and team design work. Write up research and evaluation findings in a formal paper. Credits: 3.00

CGT 57500 - Data Visualization Tools And Applications

Credit Hours: 3.00. This course provides hands-on experience in data visualization tools and applications. The course is designed for students with little or no background in Data Visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate insight and decision-making. The goal is to introduce visualization as a tool, explore and identify which visualization tools are better suited to visualize different types of data, and understand the role visualization plays in understanding what the data represent. This course gives students an in-depth view of the various branches of visualization and the visualization tools in each area. After taking the course students will be able to evaluate data visualization tools and determine which tool to use for different types of data. This course is targeted towards students interested in using visualization in their own work and future academic courses.

Learning Outcomes: 1. Assess the visualization process. 2. Assess the applicability of various visualization tools. 3. Evaluate different techniques of visual representation. Credits: 3.00

CGT 58100 - Workshop In Computer Graphics Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 8.00

CGT 59000 - Special Problems In Computer Graphics Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

CGT 59700 - Directed MS Capstone

Credit Hours: 3.00 to 6.00. An original investigation of a particular problem under the guidance of the instructor(s). The resulting product is a substantial project report with an evaluation or research component. Not applicable to a thesis option plan of study. Enrollment for a total of six credits is required. Permission of department required.

Learning Outcomes: 1. Independently identify a problem or opportunity and conduct a substantial project relevant to the student's focus area. 2. Iteratively evaluate project outcomes using appropriate research methods. 3. Communicate project process, outcomes, and relevant forms of evaluation through written and oral outputs. Credits: 3.00 to 6.00

CGT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

CGT 61000 - Visual Intelligence And Perception

Credit Hours: 3.00. This course focuses on the fundamentals of perception and cognition relative to vision and its implications to the field of computer graphics technology and the creation of graphics. Students will examine the foundations of human perception of form, shape, color, and motion, developing an understanding of why and how humans perceive visual information. Permission of instructor required.

Learning Outcomes: 1. Discover the history of investigations into visual perception. 2. Understand how the human vision system constructs an understanding of the 3D world. 3. Know the visual rules that govern the interpretation of form, shape, color and motion. 4. Understand the clinical aspects relative to vision and perception. 5. Learn to apply visual rules in the planning, creation and evaluation of all graphics. Credits: 3.00

CGT 62000 - Graphics Processing Unit Computing

Credit Hours: 3.00. This course provides a working knowledge of general-purpose graphics processing unit computing (GPGPU) using CUDA, OpenCL, and C++. OpenCL and CUDA are the platform independent industrial standard API and leading edge technology for GPGPU. The course focuses on utilizing, GPU for advanced tasks of scientific computing on parallelization of creating real-time and interactive applications and is structured into several blocks; parallel programming and synchronization tasks, GPU architecture, CUDA programming model, the OpenCL programming model. Permission of instructor required.

Learning Outcomes: 1. Understand the Graphics Processing Unit Computing models. 2. Understand the modern Graphic Processing Units. 3. Parallelize sequential tasks and apply them to the Graphics Processing Unit Computing model. Credits: 3.00

CGT 62100 - Compute Shader Programming

Credit Hours: 3.00. Compute shaders allow graphics programmers to leverage the parallel processing power of the GPU for tasks besides rendering. Kinematics and other simulations, collision detection and image processing are common applications. In this class we will use several different shading languages to implement a variety of algorithms in both stand-alone applications and in game engines. Pre-Requisite: CGT 52000 (Concurrent Pre-Requisite) or CGT 52100 (Concurrent Pre-Requisite) or instructor permission.

Learning Outcomes: 1. Describe the capabilities and limitations of compute shaders. 2. Decompose problems into sequences of common parallel programming patterns (e.g., map, reduce, scan). 3. Implement efficient compute shaders with respect to computational and memory constraints. 4. Assess the efficiency of compute shaders. Credits: 3.00

CGT 63700 - Creative AI: Machine Learning For Creativity And Design

Credit Hours: 3.00. This graduate seminar offers an in-depth exploration into the creative and innovative intersections of artificial intelligence (AI) and machine learning with arts and design. As we witness a surge of breakthroughs in AI, this course aims to uncover the creative potential of new interaction techniques and art forms within these technological advances. Students will delve into how machine learning reshapes disciplines such as computational design, media arts, music, gaming, human-computer interaction, virtual reality, and graphics. The seminar has a dual focus: firstly, surveying the landscape of contemporary creative applications of deep learning across various fields; and secondly, empowering students to conceive and execute their own creative projects that leverage AI technologies. Coursework will be organized around the development of creative AI projects, to be completed either individually or collaboratively in small groups. Prerequisite: CGT 53700 or by permission of instructor.

Learning Outcomes: 1. Apply AI and machine learning techniques for creative purposes in fields such as animation, art, graphic design, digital media, and visual effects. 2. Contextualize and categorize creative AI projects within the history of electronic media, interactive arts, and visual design. 3. Devise and develop a series of creative projects using generative AI/ML programming techniques within contemporary software frameworks. 4. Evaluate the creativity, ethical considerations, and societal impacts of creative AI projects, as well as the creative potential of AI techniques and tools. Credits: 3.00

CGT 64500 - Games Research

Credit Hours: 3.00. This course instructs students in current methods of conducting research on digital games, ludology, and the game development process. The most current or impactful research in the field is presented, analyzed, and extrapolated upon. The course surveys a wide variety of specific topics that shift as new research findings are published. Previous topics have included: biofeedback, user experience evaluation in games, gameplay measurement and analysis, development pipelines, mathematical modeling of game design, publication strategies and methodologies, scientific document preparation, and simulation. Quantitative and qualitative approaches to conducting research in the field of digital and traditional games. Production of original research focused upon an aspect of games, ludology, game development, or simulation is required.

Learning Outcomes: 1. Conduct a thorough literature review of a chosen topic related to digital games and/or their development. 2. Present to a classroom a critical analysis of a scientific paper or set of papers and lead a discussion surrounding said research. 3. Prepare a human subjects research application (IRB) that meets all regulatory regulations required to conduct ethical human research. 4. Design and conduct a sound, logical study in the area of games. 5. Complete a publishable-quality scientific manuscript and submit it for publication. Credits: 3.00

CGT 67000 - Applications In Visual Analytics

Credit Hours: 3.00. Visual Analytics (VA) provides a fast way for people to make sense of large number of data, and has applications in many sectors. This course will introduce Visual Analytics through foundational theories and a broad range of techniques and tools, focusing on using visualization methods to reason and solve complex problems in a wide variety of applications. Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces that synthesize human and computational ability to attack large complex problems. It is concerned with analytical reasoning, interaction, data transformations, data visualization, analytic reporting, and technology transition. While the different visual analytics applications share common theories and strategies, each of them has its unique data composition, visual representations, and analytical needs and strategies. Through survey and study a broad range of visual analytics applications, students will be able to apply visual analytics on their own applications, analyze and break down a complex analytical problem into proper components and steps, evaluate different visual analytic techniques and strategies, and finally design and develop an effective visual analytics solution toward the problem.

Learning Outcomes: 1. Describe the purposes, foundational theories, research components, and process of visual analytics. 2. Select proper visualization forms from visual analytics tools to answer specific reasoning questions. 3. Apply information visualization and visual analytics approaches to analyze complex problems from data processing, transformation, to

visualization, and analysis. 4. Compare, analyze and assess different visual analytics approaches from various aspects such as effectiveness, efficiency, scalability, learnability, and user experience. 5. Develop a visual analytics solution and evaluate its efficacy in solving a complex domain problem. Credits: 3.00

CGT 69400 - CGT Graduate Seminar

Credit Hours: 0.00. The CGT Graduate Seminar is designed to provide opportunities for students to experience the breadth and depth of academic inquiry, raising their awareness of key challenges and opportunities for graduate research within the field of the department. Through participation in a series of interactive sessions and presentations, students will gain valuable insights into the diverse research areas within the department, discover potential research avenues, and become aware of critical issues in the fields.

Learning Outcomes: 1. Describe the range of research topics covered by CGT faculty. 2. Distinguish the various research methods and approaches used in CGT-related disciplines. 3. Identify research opportunities in CGT-related disciplines. Credits: 0.00

CGT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 18.00

Department of Computer and Information Technology (Graduate)

Website: **https://polytechnic.purdue.edu/degrees/ms-computer-and-information-technology**

Department/School Head

Thomas Hacker

Faculty by Rank

Academic Programs

Master's and Ph.D. Programs

The Department of Computer and Information Technology offers programs leading to the Master of Science in Computer and Information Technology degree. Students may continue their studies leading to a Doctor of Philosophy in Technology with an area of concentration in Computer and Information Technology. The research interests of the faculty include autonomy, intelligence, and robotics; big data and data analytics; bioinformatics and healthcare applications; cyber infrastructure and high performance computing; network design and management, emerging and advanced applications of information technology; information security and privacy; homeland security; cyber learning and computational thinking; systems analysis and design; and project and process management. Additionally, several faculty have an entrepreneurial spirit, having turned their research into products that have helped a variety of industries solve problems and improve their productivity and accuracy.
The regular master's program requires nine three-credit courses plus a six-credit thesis. There are three core courses required of all students. The remaining courses are chosen by the student with the approval of a graduate faculty committee tailored to their research.

Masters in Computer and Information Technology (On-Campus)
Masters in Science Computer Information Technology (Non-Thesis Online (Concentrations in Business Analysis in Information Technology and IT Project Management)

Ph.D. in Technology (On-Campus)
Doctor of Technology (Online)
Applied Data Analytics, Post-Baccalaurette Certificate Online
Managing Information Technology Projects, Post-Baccalaurette Certificate Online
Information Technology Business Analysis, Post-Baccalaurette Certificate Online

Financial Support

For more information on financial support for on-campus students click here.

Areas of Specialization

Autonomy, intelligence, and robotics big data and analytics bioinformatics and healthcare computing cyber infrastructure and high performance computing emerging and advanced applications of information technology information security, privacy, and homeland security cyber learning and computational thinking systems, project, and process management.

Applied Data Analytics in Technology, Post-Baccalaureate Certificate

Information Technology Business Analysis, Post-Baccalaureate Certificate

Managing Information Technology Projects, Post-Baccalaureate Certificate

Cybersecurity and Trusted Systems, MS (Indianapolis)

Computer and Information Technology, MS

Computer and Information Technology, MS (OL)

Computer and Information Technology, PHD

CIT 50700 - Measurement And Evaluation In Industry And Technology

Credit Hours: 3.00. This course is an introduction to measurement strategies and evaluation of data in industry and technology within the context of research design and implementation. Students will learn not only basic statistics in this course but will also learn about the research process by designing, conducting, and analyzing the data for a small empirical research project using real world data. The material in this course is directly relevant to student professional development. Data collection and interpretation are key day-to-day aspects of social and behavioral science, humanities, communication, economics, physical science, biological and medical science, technology, education, psychology, business, environmental science, education and government. In addition, the ability to use computers and other technologies around data has become a critical element in most professional decision-making processes.

Credits: 3.00

CIT 51102 - Android Mobile Application Development

Credit Hours: 3.00. This advanced programming course teaches students to create data-driven, location-aware mobile applications for the Android platform. Students will learn common mobile app design patterns and will integrate cloud computing services into their applications. Prerequisite: Any programming course equivalent to 300-level programming; any relational database.

Credits: 3.00

CIT 51600 - Database Security

Credit Hours: 3.00. This course provides a strong foundation in database security and auditing. It will cover topics on security, profiles, password policies, privileges and roles, Virtual Private Databases, and auditing. The course also covers advanced topics such as SQL injection, database management security issues such as securing the DBMS, enforcing access controls, and related issues. Permission of instructor required.

Credits: 3.00

CIT 52600 - Applied Data Analytics

Credit Hours: 3.00. This course will cover both the fundamentals and concepts of the data analytics and the

advanced data analytics techniques. The focus is on emerging advanced data analytics techniques and their applications to practical problems for different disciplines, such as IT, health care, and economics. Both advanced supervised learning and unsupervised learning algorithms will be explored along with data visualization techniques. Students will apply these advanced techniques in labs and a research project to resolve an applied research problem and identify scientific findings by using public data sets. A research project report is required at the end of the course and the quality of the research report is expected to align with the requirements of IEEE or ACM international conferences.

Credits: 3.00

CIT 52800 - Information Security Risk Assessment

Credit Hours: 3.00. (CNIT 52800) Covers information security risk assessment, including the following topics: steps in performing information security risk assessment, threats to information security, technical, managerial, and operational vulnerabilities, methods for analyzing controls, methods for determining likelihood of and impact from an information security breach, and methods for determining risk. Emphasizes the development and utilization of security metrics in the risk assessment process.

Credits: 3.00

CIT 53200 - Wireless Security And Technology

Credit Hours: 3.00. This course will provide in-depth coverage of wireless communications and security. Fundamentals and state of the art developments in the wireless security area will be covered, including advances in cellular, personal communications systems (PCS), wireless LANs, and fixed wireless networks. Significant details of wireless devices and corresponding security issues will be addressed. Emerging challenges and solutions in wireless vulnerabilities, attacks, and solutions at various layers of the protocol stack, spanning the stack from aspects of physical communication to application and service security issues, will also be covered.

Credits: 3.00

CIT 58100 - Topics In Computer Information Technology

Credit Hours: 1.00 to 6.00. Advanced study of technical and professional topics relating to computer and information technology. Emphasis is on the cutting edge technologies and new developments relating to advanced information technologies. Permission of instructor required.

Credits: 1.00 to 6.00

CNIT 51000 - Data Literacy

Credit Hours: 3.00. This course examines concepts, models, and methods useful for applying data analytics in business environments. Focusing on hypothesis generation, the capturing, storage and expression of data, analysis for research and visualizations.

Learning Outcomes: 1. Apply critical thinking abilities and analytical thought. 2. Recognize diverse range of data types/storage strategies and demonstrate the ability to analyze and debate the applications of each proficiently. 3. Examine aspects of the analytical thinking process and formulate individualized opinions surrounding the approach to data analytics. 4. Analyze a set of data yielding actionable insights that can be applied to research or business. 5. Gain a wide perspective on data analytics utilizing article reviews and up to the week content. Credits: 3.00

CNIT 51100 - Foundations In Homeland Security Studies

Credit Hours: 3.00. An interdisciplinary course addressing prevention, mitigation, preparation, response, and recovery from catastrophic events that threaten private and public sector resources and infrastructures. Course contents will include: characteristics of security; personal/corporate perspectives; identification of assets; assessing cost/benefits of protecting assets; risk assessment and risk management; crisis decision making; emergency management resources and response infrastructures; best practices in emergency management and risk and crisis communication; business continuity; and the importance of a collaborative response. Case studies include the 9-11 attacks and Hurricane Katrina. External experts will present and career opportunities will be discussed. Permission of instructor required.

Learning Outcomes: 1. Understand principles and interdisciplinary issues within Homeland Security. 2. Apply information and information systems to homeland security issues. 3. Apply phases of emergency management to business in difference areas. 4. As an individual and part of a group, perform risk assessment and apply to various fields. 5. Prepare professional homeland security communications in students

various home field of study. Credits: 3.00

CNIT 51200 - Managing Resources And Applications For Homeland Security

Credit Hours: 3.00. An interdisciplinary course providing examples and practice in applying and managing the resources, including technologies, used in the private and public sectors for homeland security programs. Course contents will include: terrorism; corporate security; biosecurity; health care preparedness; personal/community preparedness; risk transfer; and information security and privacy. Additional content includes discussion of local, state, and federal preparedness programs issues in the public/private sectors that are designed to ensure survival during a continuum of emergency events, and continued practice in using collaborative application of team building skills. Permission of instructor required.

Learning Outcomes: 1. Apply business continuity and redundancy in information systems to disasters and emergencies. 2. Apply examples and practice in homeland security. 3. Understand resource process to solve homeland security problems. 4. Interact with subject matter experts and apply homeland security principles. Credits: 3.00

CNIT 51900 - Natural Language Technologies

Credit Hours: 3.00. This course serves as an introduction to natural language processing with the focus on current and emerging technologies and applications. The topics will review the state of the art of natural language processing, discuss their advantages and disadvantages for computational language processing, and look at some case studies. The assignments will range from pen and paper analysis to actual computational implementations.

Learning Outcomes: 1. Apply information systems solutions. 2. Understand the purpose of natural language understanding applications. 3. Analyze high-level tools and emerging technologies. 4. Describe functions, components and interaction of devices used in natural language applications. 5. Identify and evaluate individual application and existing and emerging technologies. 6. Demonstrate independent critical thinking and problem solving skills. 7. Apply critical thinking and creative problem solving to improve existing solutions. 8. Apply systems development methodologies. 9. Use appropriate techniques to plan, analyze, design and construct natural language based system. 10. Analyze which method is appropriate for given data characteristics. 11. Describe and analyze algorithms employed in applications. 12. Develop programs addressing various needs of natural language communications. 13. Employ effective testing methodologies. Credits: 3.00

CNIT 52300 - File System Forensics

Credit Hours: 3.00. The plethora of strategies to store information in different formats continues to expand. This course examines the various media and strategies of storing information and the processes of documenting the collection, imaging, and processing of forensic evidence. Topics include file formats, file systems, hardware, and software involved in forensic investigation. The overall pattern of forensic evidence in file systems will be examine along with the acquisition, analysis, and reporting of evidence artifacts found in file systems.

Learning Outcomes: 1. Identify and repair corrupted file systems. 2. Examine and analyze file systems using a multiple-tool approach. 3. Demonstrate how to locate deleted and hidden data. 4. Report and explain their findings and conclusions in a digital investigation. 5. Present and communicate the digital forensics process for an investigation. Credits: 3.00

CNIT 52500 - Mobile And Embedded Device Forensics

Credit Hours: 3.00. Consumer technologies are rapidly moving forward with items integrating processing, storage, and transmission into their base functionality. The enterprise issues with the trend of "bring your own device" has rapidly expanded requirements on forensics investigators to address a plethora of mobile device types. Whether it is the automobile black box or a home thermostat, there are various elements of interesting evidence possible to be gained. The embedded and consumer device pantheon is developing as an important area of forensic science. This course explores techniques for conducting forensic analyses on a wide variety of mobile and embedded devices.

Learning Outcomes: 1. Identify components and sources of mobile and embedded device

evidence. 2. Demonstrate how to preserve and acquire digital evidence while following the rules of evidence and the chain of custody. 3. Examine and analyze digital evidence using a multiple-tool approach for validation of the integrity of evidence. 4. Report and explain their findings and conclusions in a digital investigation. 5. Present and communicate the mobile forensics process for an investigation. Credits: 3.00

CNIT 53000 - Information Technology Business Analysis

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that business analysts use to solve business problems related to information technology projects. Special emphasis is placed on learning and applying the concepts of enterprise analysis, business analysis planning, stakeholder management, requirements management, and solution evaluation. Permission of department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for IT business analyst skillsets in information technology projects. 2. Research and assess the various means to construct a business case and business analysis plan to justify the execution of a project and then plan the business analyst's activities on the project. 3. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 4. Select, defend and utilize business analysis tools and techniques in the context of information technology projects. 5. Research and contribute to the business analysis body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 53100 - Information Technology Requirements Analysis And Modeling

Credit Hours: 3.00. This course introduces and develops the skills that business analysts will need to solve business problems and effectively model and analyze stakeholder requirements in order to define workable solutions and effective communicate customer needs. Permission of department required.

Learning Outcomes: 1. Apply business and requirements modeling techniques to solicit and support business analysis and problem solving. 2. Categorize, select and use specific visual modeling techniques to elicit, understand and communicate business requirements. 3. Research and analyze, then discuss in intelligent conversation, the techniques and tools used for modeling to support business requirements. 4. Perform general modeling techniques in combination with Visual Modeling learned from the resources provided for analyzing requirements and creating a requirements toolbox for a proposed solution. Credits: 3.00

CNIT 53200 - IT Enterprise Analysis

Credit Hours: 3.00. This course introduces the application of knowledge, skills, tools, and techniques that enterprise level business analyst use to create accurate requirements statements, organization level needs analysis and accurate business cases which assist the project team in developing schedules and budgets as well as strategic management teams in selecting the right projects to execute. Special emphasis is placed on learning and applying the concepts of innovation driven management. Permission of Department required.

Learning Outcomes: 1. Research in order to identify and define enterprise level business needs mostly represented in a strategic plan and discover opportunities for improvement. 2. Develop the ability to assess and build an accurate informative assessable business case for proposed projects. 3. Apply the process to consistently and accurately capture project metrics to assess its success or failure at meeting customer stated goals. 4. Research, analyze, and demonstrate how to build a mature, Innovation-Driven business analysis practice or center of excellence within an enterprise. Credits: 3.00

CNIT 53500 - Advanced Topics In IT Business Analysis

Credit Hours: 3.00. The course explores the topics and tools used by today's information system professionals to lead the requirements gathering, estimating, developing, and delivery efforts of custom software applications. Course emphasis focuses on agile methodologies. Emphasis is also placed on requirements gathering and estimating technics commonly used with agile teams. Permission of Department required.

Learning Outcomes: 1. Research and analyze, then discuss then in intelligent discourse, the applications of an agile mindset to your life. 2. Research and demonstrate an understanding of an Agile methodology. 3. Research and analyze, then discuss in intelligent discourse, commonalities and detail differences between common Agile frameworks. 4. Research and analyze requirements elicitation and management practices using an agile methodology. 5. Research and apply user experience and user interface techniques, and agile estimating techniques. 6. Research and analyze, then discuss then in intelligent discourse, enterprise agile frameworks. 7. Research and analyze, then discuss then in intelligent discourse, tools that can aide in the organization of teams and project information. 8. Research and analyze, then discuss then in intelligent discourse, Business Analysis certifications, their value and purpose. Credits: 3.00

CNIT 53600 - IT Policy, Law, And Ethics

Credit Hours: 3.00. This course examines the policy, legal, and ethical aspects of information technology. Issues covered include ethical decision making, policy development, professionalism, privacy, freedom of expression, intellectual property, liability, and social responsibility. Included will be the philosophical ethical theories that underpin ethical decision making in the context of executing IT based projects.

Learning Outcomes: 1. Research and assess current related legislation affecting IT and IT based projects (SOX, HIPAA, etc.). 2. Research and assess the importance of Intellectual Property and Copyrights. 3. Research and analyze the key components of process improvement and product quality as related to ethical software development. 4. Research and assess the importance of employee and organizational liability. 5. Discuss the pros and cons in intelligent discourse concerning ethics and acting ethically for both individuals and organizations. 6. Discuss, in intelligent discourse, personal and societal impact of information privacy issues. Credits: 3.00

CNIT 53700 - Professional Research And Communication

Credit Hours: 1.00. This course explores aspects of research and communications that pertains to technology-based projects and professions as well as informed changes in business process. Specifically, the methods involved in objective driven research within and across technology and business domains, as well as the use of rationale for a concisely written summary of research methods and findings for a working professional.

Learning Outcomes: 1. Explore and discuss in intelligent discourse, the rationale and challenges in contemporary research and communications. 2. Develop, describe, and utilize a research/assessment methodology and understand the techniques used in technical based industrial research and communications. 3. Apply concepts and techniques common to current employer's practices with emphasis on concise technical writing and formatting. Credits: 1.00

CNIT 54100 - Cyberlearning Research And Development

Credit Hours: 3.00. This design-based research course explores and applies methodological and theoretical perspectives to the research, design, and evaluation of learning experiences and environments that integrate computational thinking or cyberlearning within a certain STEM discipline. Design-based research seeks to shape and even engineer learning environments and experiences "in the wild." Is a series of approaches with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings.

Learning Outcomes: 1. Identify the theoretical foundations for the design of cyberlearning environments that enable learners to use their bodies and minds to learn through making, programming, experimenting, constructing, and inventing, so that the interaction results in deeper and authentic learning in STEM. 2. Design a learning experience, environment, or assessment tool that explores a particular pedagogical method, learning strategy, or other theoretical framework that conveys or assess STEM related concepts or that uses cyberlearning as an affordance to access of knowledge or new knowledge development in a specific STEM discipline. 3. Apply design-based research as a methodological perspective to the design and investigation of learning experiences and environments that integrate cyberlearning. Credits: 3.00

CNIT 54200 - Design-Based Research Applications

Credit Hours: 3.00. The course provides an opportunity for students to study and apply design-based research to evaluate and improve learning environments. Specifically, the course focuses on using design-based research as a methodological approach to combine instructional design and research in a cyclical and interdependent manner. Students are expected to apply this approach with the goal of simultaneously solving practical problems and developing a sharable theory by connecting design features to valued outcomes. Students should have prior knowledge of educational research methods, have an educational project to work on or a dataset ready to be analyzed. (added last statement from proposed restrictions)

Learning Outcomes: 1. Describe the purposes and characteristics of design-based research. 2. Analyze and synthesize literature describing and evidencing design based research in terms of their contexts, frameworks, processes, methods and outputs. 3. Apply conjecture mapping as a technique to operationalize specific educational related phenomena to be explored through design research cycles. 4. Apply field-based investigation methods to gather information, strategies for validity for ensuring rigor in DBR, and techniques for reporting evidence-based findings in DBR. 5. Offer constructive feedback on peers' work and incorporate feedback into one's own work. Credits: 3.00

CNIT 54300 - Human-Computer Interaction Applied To Games And Education

Credit Hours: 3.00. This course will explore Human-Computer Interaction (HCI) as applied to both the field of education and games. Students will engage in reading in these three fields. Specifically, they will develop a foundational understanding of common approaches in studying HCI, as well as current broad intersections with education and gaming. The course will be heavily focused on a semester-long research project in which students will participate in HCI, games, and education research. Permission of instructor required.

Learning Outcomes: 1. Develop understanding of research in HCI, games, and education. 2. Develop understanding of approaches to experimental design. 3. Develop understanding of common approaches to data analysis. 4. Develop research abilities through taking part in an individual research project. Credits: 3.00

CNIT 54600 - The Internet Of Things For Information Technology

Credit Hours: 3.00. This course will explore the emergence of technologies and vertical solutions in the Internet of Things (IoT) domain. The course explores the top-level problems that IoT promises to solve, the business drivers, the attributes of IoT-enabled enterprise and consumer markets, and how IoT is different from the contemporary Internet. The course will discuss and apply IoT components such as the "things", the data, the people, and the processes, as well as vertical markets. Emphasis will be placed on types of architecture, reference models, and standards (both open and proprietary), underlying technologies, commercial products, issues (such as security), and research efforts in the Internet of Things. The lab component will focus on the complete IoT ecosystem (sensors, actuators, networks, etc.), but will specifically emphasize the functionality of IoT cloud platforms. Permission of instructor is required.

Learning Outcomes: 1. Explain and demonstrate the main functions of a complete Internet of Things (IoT) system. 2. Research and explain a specific student area of interest in

the IoT realm. 3. Analyze and discuss current topics, problems and research related to IoT. Credits: 3.00

CNIT 54900 - Internet Of Things Security

Credit Hours: 3.00. This course will introduce students to Internet of Things (IoT) fundamentals and investigate IoT security threats, vulnerabilities, and countermeasures. It will also include cloud-enabled IoT components, which is integration of cloud computing and IoT, and relevant security issues in this domain. Students will learn about the state-of-art IoT technology, platforms and services, protocols, and advanced topics (e.g., Machine/Deep Learning (ML) and Artificial Intelligence (AI)) in IoT security. This course will provide extended knowledge and exposure to students on IoT attacks, security policies, access control models, ML/AI models for IoT security and framework. The course will also explore data privacy issues associated with IoT and its components and key technologies. Students will gain knowledge and skills through hands-on project and research experience on real-world IoT devices and applications, real-world cloud computing platforms, and will work on specific IoT application domains, such as smart homes, smart health (medical IoT devices) and wearable IoT. Permission of instructor required.

Learning Outcomes: 1. Apply the Internet of Things (IoT) fundamentals, including IoT architectures, protocols, and platforms, to design different IoT use cases. 2. Identify security risks, threats and vulnerabilities in different IoT application domains (e.g., smart homes, smart health, smart transportation). 3. Analyze security requirements for IoT application domains to determine appropriate secure provisioning actions in smart connected systems and communities. 4. Implement security models and technical controls to mitigate security threats and vulnerabilities in real-world IoT use cases. Credits: 3.00

CNIT 55000 - Organizational Impact Of Information Technology

Credit Hours: 3.00. An enterprise view of the organizational impact of information technology as the most effective means for achieving "better, faster, cheaper operations" in today's highly competitive business environment. Examines how information technology has enabled new organizational forms and changes in business processes, products, markets, delivery systems, ways of working, and people management issues and challenges. Permission of instructor required.

Learning Outcomes: 1. Articulate methods and algorithms in network security. 2. Evaluate the strengths and weaknesses of different networking security approaches. 3. Describe how to deploy encryption techniques to secure data at rest and in transit. 4. Compare, contrast and critique existing applied research in network security. 5. Propose new ideas/technologies in network security and systematically assess your proposed work. Credits: 3.00

CNIT 55100 - Information Technology Economics

Credit Hours: 3.00. Examines the economics of information systems and information technology as it relates to business performance. Topics include strategic information technology planning, alignment with business planning, value assessment, and performance measurement. Special emphasis is placed on issues relevant to strategic information technology infrastructure management, both for the information technology unit as well as the business as a whole. Permission of instructor required.

Credits: 3.00

CNIT 55200 - Information Technology Project Management

Credit Hours: 3.00. Explores the necessary skills and knowledge to successfully initiate, plan, manage, control, and report on information technology projects. Special emphasis is placed on learning the PMBOK and its practices concerning integration management, scope management, time management, cost management, quality management, human resource management, communications management, risk management, and procurement management. Practical examples are used to demonstrate the concepts and techniques, plus hands-on experience is received by working on a case study. Permission of instructor required.

Credits: 3.00

CNIT 55300 - Quality Management In Information Technology

Credit Hours: 3.00. This course explores quality and productivity models used to ensure quality in information technology systems development processes. Special emphasis is on learning and understanding process metrics and measurement, as well as initiatives such as Total Quality Management, Continuous Process Improvement, Six Sigma, and the Software Engineering Institute Capability Maturity

Model. Permission of instructor required.

Learning Outcomes: 1. Use and apply information technology solutions. 2. Understand and apply high-level tools and emerging technologies. 3. Demonstrate independent critical thinking and problem solving skills. 4. Understand and apply information technology application methodologies. 5. Communicate effectively with customers, supervisors and peers, both orally and in writing. 6. Understand the expectations of an information technology professional. Credits: 3.00

CNIT 55500 - Advanced Network Security

Credit Hours: 3.00. Advanced conceptual and technological aspects of network security for voice and data networks. Deals with the advanced analysis, design, implementation, and management issues surrounding effective network security. Technology research and presentation of results, as well as security technology implementation, are required course outcomes. Permission of department required.

Credits: 3.00

CNIT 55501 - Social Engineering Mitigation In Information Technology

Credit Hours: 3.00. Human vulnerability is currently one of the biggest threats to cybersecurity. Social engineering is one of the primary tools used to take advantage of this vulnerability. In this course, students will learn about some techniques used in social engineering, the psychology harnessed to carry out social engineering attacks, and learn to identify possible avenues of attack and procedures to prevent and mitigate specific risks. Permission of instructor required.

Learning Outcomes: 1. Identify and describe the techniques of social engineering. 2. Explain the psychological principles underlying social engineering techniques. 3. Apply some basic social engineering tools. 4. Design strategies to prevent or mitigate social engineering attacks. 5. Apply ethical standards to the practice of social engineering. Credits: 3.00

CNIT 55600 - Basic Computer Forensics

Credit Hours: 3.00. Covers the fundamentals of the maturing discipline of computer forensics. The focus of the course is on gaining a broad understanding of the field of study and how technology and law interact to form this forensic science. Emerging standards and current and future issues related to the field are also explored. Examines law and public policy, the computer forensic methodology, report presentation, and expert witness testimony, as well as anti-forensic techniques that can be used to obfuscate evidence. Students are exposed to theory and practice with lab exercises, thought and term papers, and a practical, as well as written, final exam.

Learning Outcomes: 1. Develop their Investigative Environment. 2. Acquire an understanding of how open source intelligence (OSINT) is used for digital forensic examinations. 3. Gain knowledge of how to conduct common investigations related to evidence that is stored on a mobile phone or tablet. 4. Learn the importance of location information and where to locate and how to interpret this information. 5. Understand of how to conduct investigations involving P2P and other Tor related technologies. 6. Explore the various digital forensics visualization methods. 7. Be introduced to a common report format and the ASTM report standard. 8. Understand the importance of Expert Witness (EW), Who can be an EW, and how to be an effective EW. Credits: 3.00

CNIT 55700 - Advanced Research Topics In Cyber Forensics

Credit Hours: 3.00. Provides students at the advanced degree level the opportunity to expand their knowledge of cyber forensics. Students are expected to have fundamental understanding of cyber forensics and digital forensic science. The emphasis is on directed learning and scholarly inquiry. Possible research topics range from law and public policy to software and/or hardware development. Permission of instructor required.

Credits: 3.00

CNIT 55800 - Bioinformatics Computing And Systems Integration

Credit Hours: 3.00. This is a graduate-level course for students interested in the application of computational methods and information technology in the pharmaceutical, biotechnology, and life sciences arena. An overall understanding of information technology and systems is assumed, as well as an in-depth

knowledge of one or more areas of information technology. Permission of instructor required.

Credits: 3.00

CNIT 55900 - Data Warehousing

Credit Hours: 3.00. The design and implementation of data warehouses (including data marts and operational data stores) are studied using current database technologies. Topics include data modeling for warehouses, data warehousing infrastructure and tool selection, data exploration, data synthesis and reduction, organizational metadata, data warehouse administration, and other contemporary issues. Preference is given to students having graduate status in the College of Technology with a CIT concentration. Permission of instructor required.

Credits: 3.00

CNIT 56000 - Advanced High Performance Computing Systems

Credit Hours: 3.00. This course is a graduate level course that covers advanced topics in high performance, cluster, and grid computing in detail from a systems perspective. Topics covered in this course will focus on aspects of the design, implementation, and use of high performance computing systems at each level of the system, including: commodity hardware and novel architectural components, such as graphics processing units; operating systems for HPC systems, including low-noise OS and light-weight kernels; system reliability and job scheduling; virtualization systems and fault tolerance for HPC; data intensive computing and workflows; parallel I/O systems; and grid and cloud computing architectures. Experience in Linux systems administration is a prerequisite for this course.

Learning Outcomes: 1. Understand the impact of performance, cost, reliability, and usability on the design and deployment of high performance computing systems based on mixture of commodity and special purpose components and software. 2. Demonstrate skill in finding a balance among these factors by designing, building, benchmarking, and optimizing a small commodity-based cluster computer based on the Linux operating system and other open source software packages. 3. Demonstrate ability to analyze problems inherent in cluster computing and to design new solutions to those problems based on the development and integration of new technologies, such as GPUs, parallel data systems, and workflow systems. 4. Demonstrate understanding and knowledge of the core concepts of high performance computing, which include: The continuum of high performance computing architectures, and the appropriateness of each architecture type to problem solving for a wide variety of applications; The effects of communications architecture and performance characteristics on application performance; The effects of component reliability and operating systems on Petascale computing; The use of commodity components in high performance computing, and the trends and forces that motivate their use; The design of high performance computing systems to meet specific application needs and resource constraints; tools and techniques of cluster and high performance computing, such as scheduler configuration and use, benchmarking tools and techniques, queuing and reliability models. Credits: 3.00

CNIT 56100 - Advanced Parallel Data Systems

Credit Hours: 3.00. This course is a graduate level course that covers advanced topics in high performance, cluster, and grid computing in detail from a systems perspective. Topics covered in this course will focus on aspects of the design, implementation, and use of high performance storage systems progressively from the hardware layer through the operating system up to the application level. Topics will include: commodity hardware and novel architectural storage components; the architecture and use of parallel file systems, including PVFS2 and Lustre; reliability and scheduling; virtualization and fault tolerant strategies for Petascale computing; system architectures for data intensive computing and workflows; parallel I/O systems; and grid and cloud computing architectures. Experience in Linux systems administration is a prerequisite for this course.

Learning Outcomes: 1. Understand the impact of performance, cost, reliability, and usability on the design and deployment of high performance computing systems based on mixture of commodity and special purpose components and software. 2. Demonstrate skill in finding a balance among these factors by designing,

building, benchmarking, and optimizing a small commodity-based cluster computer based on the Linux operating system and other open source software packages. 3. Demonstrate ability to analyze problems inherent in cluster computing and to design new solutions to those problems based on the development and integration of new technologies, such as GPUs, parallel data systems, and workflow systems. 4. Demonstrate understanding and knowledge of the core concepts of high performance computing, which include: The continuum of high performance computing architectures, and the appropriateness of each architecture type to problem solving for a wide variety of applications; The effects of communications architecture and performance characteristics on application performance; The effects of component reliability and operating systems on Petascale computing; The use of commodity components in high performance computing, and the trends and forces that motivate their use; The design of high performance computing systems to meet specific application needs and resource constraints; tools and techniques of cluster and high performance computing, such as scheduler configuration and use, benchmarking tools and techniques, queuing and reliability models. Credits: 3.00

CNIT 56200 - Six Sigma Black Belt For Operations Excellence

Credit Hours: 3.00. A study of the Six Sigma quality and process improvement methodology, using the define, measure, analyze, improve, and control (DMAIC) process. This course addresses advanced topics in statistical quality; introduces quality management concepts as they pertain to the Six Sigma methodology; and provides an opportunity to earn a for Six Sigma Black Belt. Permission of instructor required.

Learning Outcomes: 1. Explain Six Sigma principles and benefits. 2. Apply Six Sigma techniques and tools to solve technical problems. 3. Apply the Six Sigma DMAIC methodology in team-based projects for continuous improvement. Credits: 3.00

CNIT 56300 - Software Design And Development For Robotics

Credit Hours: 3.00. The purpose of this graduate-level course is to provide students with hands-on experience in designing, implementing, programming, and debugging robotic software systems. The course begins with an introduction to fundamental concepts and skills in robotics, encompassing both hardware and software components. Students will gain proficiency in working with embedded processors such as Arduino and Raspberry Pi, and they will have the opportunity to construct their robots using a dedicated robotic development platform. Subsequently, students will explore programming tools such as Matlab and Simulink, along with robot simulators, to acquire a deep understanding of the principles and best practices in software design and development within the field of robotics. Additionally, students will actively engage in discussions and debates, gain insights from guest speakers within the robotics field, and collaborate on team projects. Through hands-on involvement in a project, students will gain valuable experience in addressing real, non-trivial challenges. This course equips students with the skills and knowledge needed to excel in the dynamic and rapidly evolving field of robotics, fostering a strong foundation in both theoretical concepts and practical application.

Learning Outcomes: 1. Demonstrate an understanding of the key topics and trends in software design and development in robotics areas. 2. Identify principles of robotic programming in robotics and practice of robot components. 3. Demonstrate practical skills necessary to design, implement, test, and deploy robotic system. 4. Develop proficiency in delivering effective oral presentations and written communication, effectively addressing research problems, methodologies, and findings within the context of software design and development in robotics. Credits: 3.00

CNIT 56400 - Assistive Technology And Robotics

Credit Hours: 3.00. The purpose of this graduate-level course is to equip students with the practical skills required to engage in effective and impactful research within the realm of assistive technologies and assistive robotics. The course encompasses a comprehensive exploration of key topics and research areas in

assistive robotics and related technology fields, including mobility, vision, hearing, speech, and cognitive aids. Throughout the course, students will acquire a strong foundation in the essential components of conducting research in these domains. This includes conducting needs assessments, conducting comprehensive literature reviews, implementing user testing and iterative solution development processes, evaluating solutions, and engaging in prototyping activities. Emphasizing a holistic approach to learning, students will actively participate in dynamic discussions and debates, engage in insightful site visits, interact with guest speakers, and collaborate on both team and individual projects. A pivotal aspect of the course involves the practical application of acquired knowledge in a research project. Students will have the opportunity to design, implement, and/or evaluate assistive technologies or robots tailored to address specific challenges faced by individuals with disabilities and the elderly. This hands-on experience will enable students to put theory into practice and contribute meaningfully to the advancement of assistive technology solutions.

Learning Outcomes: 1. Demonstrate an understanding of the key topics and trends in assistive robotics and technology areas. 2. Demonstrate the ability to access and analyze current literature relevant to assistive technology and robotics, and identify ways in which computing and robotic technology can positively impact the lives of individuals with disabilities. 3. Identify the essential components of research, including conducting needs assessments, conducting thorough literature reviews, engaging in iterative design and development processes, conducting user testing and evaluation, and proficiently creating prototypes. 4. Develop proficiency in delivering effective oral presentations and written communication, effectively addressing research problems, methodologies, and findings. Credits: 3.00

CNIT 56500 - Information Security Management

Credit Hours: 3.00. Information Security Management explores the issues surrounding the alignment of business and information security. More precisely, once the context of information security is understood in terms of the business and the problems with the current state of Information Security Management are identified, the course pursues solutions to those problems in terms of people, policy, process, procedures, and technology. The product produced as a result of this pursuit is an Enterprise Security Architecture, mapping business needs to technology implementation. The enterprise security architecture produced is dynamic and maintainable, thereby assuring traceability and accountability. Permission of instructor required.

Learning Outcomes: 1. Develop a multi-layer enterprise security architecture. 2. Prepare a Risk Assessment. 3. Identify and employ appropriate information security metrics and standards. 4. Employ appropriate tools and methodologies to balance business and security considerations. Credits: 3.00

CNIT 56600 - Interactive Systems And Web Development

Credit Hours: 3.00. This is a graduate-level course designed to immerse students in the design, development, and evaluation of web-based interactive systems. Through a blend of theoretical understanding and hands-on projects, the course emphasizes the latest in human-computer interaction, full-stack web development, and human-AI interfaces, preparing students to innovate in the digital landscape while addressing real-world problems.

Learning Outcomes: 1. Analyze and articulate the complexities of designing interactive systems, emphasizing a deep understanding of user needs and system functionalities within digital environments. 2. Synthesize diverse user requirements and technological capabilities to develop innovative web-based interactive platforms that are responsive to evolving digital interaction landscapes. 3. Evaluate the effectiveness of various web development frameworks and tools in the creation of robust, user-centered applications, assessing their utility in real-world scenarios. 4. Apply advanced design principles and development techniques to construct, test, and refine interactive web applications, focusing on both front-end and back-end functionalities. 5. Communicate research findings effectively, using structured academic writing and presentations to disseminate insights and implications of studies in interactive system development. Credits: 3.00

CNIT 57000 - IT Data Analytics

Credit Hours: 3.00. Students learn decision strategies as well as Big Data and data analytics concepts using statistical inference, regression, predictive analytics, and data mining. Students will have "hands-on" opportunities using tools such as R to assist in these efforts. The primary mission of this course is to provide students 1) an awareness of the primary approaches, techniques, and tools used for business/data analytics in industry, 2) opportunities to see their applications in a variety of areas, and 3) practical experience in applying them to challenges of interest to the students. Of primary emphases are the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Upon successful completion of this course, students will be able to understand key business/data analytics concepts and apply analytics approaches, techniques, and tools for decision making purposes. Permission of instructor required.

Learning Outcomes: 1. Research and analyze key business/data analytics concepts. 2. Apply analytics approaches, techniques, and tools for decision making purposes. 3. Recognize the roles and responsibilities of Information Technology in enabling and supporting data analytics in organizations. Credits: 3.00

CNIT 57100 - Responsible Data Science

Credit Hours: 3.00. This course examines advanced topics relating to algorithmic fairness, transparency, and interpretability of data-driven decision-making systems. Topics include the data science lifecycle, data quality, algorithmic bias, debugging and mitigating bias, and transparency of data and algorithms.

Learning Outcomes: 1. Recognize current issues related to the transparency and fairness of decisions made by data-driven decision-making systems. 2. Examine sources of unexpected and discriminatory behavior of data-driven decision-making systems. 3. Contrast existing methods and design novel techniques to mitigate undesired system decisions. Credits: 3.00

CNIT 57500 - Data Analysis

Credit Hours: 3.00. This course will teach students how data analysis can inform decision-making. Students will develop analytical skills and focus is placed on predictive analysis to evaluate business decision. Students will develop logical reasoning and communication skills related to quantitative outputs. This course will also develop the ability to collect large datasets, organize, and combine them using Tableau software.

Learning Outcomes: 1. Recognize the pervasiveness and breadth of data collection options available in today's world. 2. Discern and defend ethical applications of how collected data can be used for marketing. 3. Discuss how to find, download, clean and combine data sets. 4. Identify and evaluate trends in data sets. 5. Build models to make predictions about future events based upon historic data. Credits: 3.00

CNIT 58000 - Advanced Topics In Information Technology Project Management

Credit Hours: 3.00. The course explores and applies the advanced concepts, skills, knowledge, techniques, and tools required to successfully initiate, plan, manage, execute, control, and report on information technology projects. Special emphasis is placed on applying the PM BOK in a real life business case study as well as researching and learning concepts, techniques, and processes experienced project and program managers employ to successfully plan and manage projects. This course enables the student to learn project management through the application of project approaches in a team based setting. Through the application of project methodologies, tools and templates, the student learns the project life-cycle approach as demonstrated through actual and simulated project situations. Permission of Department required.

Learning Outcomes: 1. Explain and apply the processes and Weekly Assignments, Live, and artifacts prescribed by the PMBOK. 2. Assess the objectives of a project management office and how organizations implement them based on their organizational structure and culture. 3. Research and analyze methodologies, tools, and techniques used by today's experienced IT project managers. 4. Research and analyze current business and technology conditions that affect project managers of today. 5. Describe and evaluate the competencies that are required to be an effective project manager. 6. Research innovative methods and techniques for performing IT project management. Credits: 3.00

CNIT 58100 - Workshop In Computer Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Credits: 0.00 to 8.00

CNIT 58200 - IT Project Estimating, Control And Scheduling

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to create and manage time and cost estimates, as well as the creation of accurate schedules with dependencies. The course reviews research of best practices in schedule management and budget management. Students will apply these skills and techniques to business problems. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for creation of IT project estimates and budgets into IT projects. 2. Understand and be able to apply current techniques and methodologies used to build cost and time estimates for IT projects including Function Points, COCOMO, and others. 3. Discuss, in intelligent discourse, the types of schedules (Work Breakdown Structures) needed to run IT projects today including traditional lifecycles and Agile approaches. 4. Accurately conduct analysis of network schedule dependencies including calculation of slack, Critical Path Analysis and Critical Chain Scheduling. 5. Discuss, in intelligent discourse, the role corporate politics and negotiation skills play in building project budgets and successfully executing the project. 6. Understand and be able to apply time and cost monitoring and control techniques including Earned Value Management (EVM). Credits: 3.00

CNIT 58300 - IT Program And Portfolio Management

Credit Hours: 3.00. Program and Portfolio Management deliver benefits to organizations by enhancing current abilities or developing new capabilities for the organization to use. This CNIT Graduate course will provide a detailed understanding of Program and Portfolio Management and its relationship to Project management and will present concepts that promote efficient and effective management and communications among various groups. This course curriculum is consistent with the Project Management Body of Knowledge (PM BOK) and related Standards for Program and Portfolio Management published by the Project Management Institute. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the differences between portfolio, program and project management. 2. Understand and articulate the importance of project governance within the company and associated portfolio, program, and project processes. 3. Understand the possible compositions and value of the Project Management Office (PMO) and strategies for implementation. 4. Understand and discuss in intelligent discourse the importance of project planning, change management and communication within the company to foster Project, Program and Portfolio management success. 5. Discuss, in intelligent discourse, the role corporate politics and negotiation skills play in building project budgets and successfully executing the project. 6. Understand and be able to apply time and cost monitoring and control techniques including Earned Value Management (EVM). Credits: 3.00

CNIT 58500 - Organizational Change Management For IT Projects

Credit Hours: 3.00. An exploration of the body of knowledge, skills, processes, methods, and techniques that IT project managers can use to manage the "people" side of organizational change that results from IT projects that implement new technologies, systems, services, and products into the workplace. This is sometimes called stakeholder management. The course reviews research of best practices in change management and their impact on project metrics such as schedule, budget, scope, stakeholder satisfaction. Students also learn how to identify and document the organizational and people impacts of new information technology solutions, and then develop a formal project plan to manage the organizational

change. Permission of Department required.

Learning Outcomes: 1. Discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for organizational change management into information technology projects. 2. Pro-actively apply an organizational change management framework and principles to a business situation, ideally an information technology project. 3. Discuss, in intelligent discourse, the types of disruptive organizational change and how they can be caused by information technology projects. 4. Accurately document, and communicate IT-enabled changes to existing business processes. 5. Select, defend and utilize organizational change management tools and techniques in the context of information technology projects and management. 6. For residential, thesis students, research and contribute to the organizational change management body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 58600 - IT Requirements Management

Credit Hours: 3.00. The course explores the approaches used by today's information system professionals to conduct and manage the requirements development process. Course emphasis focuses on contemporary techniques for requirements elicitation, requirements analysis, requirements specification, requirements validation and verification. Emphasis is also placed on identifying stakeholders through the use of formal stakeholder analysis techniques, the use of formal change control, requirements traceability and the use of requirements management tools. The course is designed based on the principles and competencies prescribed by the Project Management institute's PM BOK (Project Management Body of Knowledge) and Business Analyst Guide as well as the International Institute of Business Analysis's BABOK (Business Analysis Body of Knowledge). Permission of Department required.

Learning Outcomes: 1. Research and analyze in order to discuss the pros and cons in intelligent discourse, of the need for, and integration of techniques for requirements management into information technology projects. 2. Research and assess the various elicitation, analysis, specification and validation approaches to requirements development in real life business problems. 3. Accurately document, and communicate business requirements for an IT project. 4. Select, defend and utilize requirements management tools and techniques in the context of information technology projects and management. 5. For residential, thesis students, research and contribute to the requirements management body of knowledge as it can be applied to information technology projects. Credits: 3.00

CNIT 59000 - Special Problems In Computer Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Design, plan, and execute a structured cybersecurity research project, applying appropriate methodologies and critically analyzing relevant literature to identify and address gaps in current knowledge. 2. Apply advanced cybersecurity tools and techniques to develop innovative solutions to research challenges, demonstrating technical proficiency and creative problem-solving within the field. 3. Communicate effectively research findings in written and oral formats suitable for academic and professional audiences, while adhering to ethical standards in cybersecurity research, including data privacy and responsible disclosure. Credits: 1.00 to 6.00

CNIT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1.
Varies due to nature of the course. Credits: 1.00 to 3.00

CNIT 60100 - Applied Statistics In Information Technology

Credit Hours: 3.00. This course will survey the field of applied statistics in information technology. Students will gain hands-on experience running statistical analyses on samples from a variety of populations. Students will learn the process of data cleaning, data transforming/coding, identifying the appropriate statistical analyses (descriptive and inferential), as well as writing and interpreting the results. Specifically, this course will survey the following statistical approaches: correlations, t-test, analysis of variance, analysis of co-variance, factorial ANOVA, simple regression, multiple regression, logistic regression, chi-square analysis, factor analysis, and nonparametric tests. In this course, students will be able to differentiate statistical analyses and identify appropriate statistical analyses depending on the research question and variables of interest. Permission of instructor required.

Learning Outcomes: 1. Analyze data with different statistical procedure using SPSS. 2. Differentiate between different types of statistical analyses. 3. Evaluate the statistical procedures and results in published journal articles. Credits: 3.00

CNIT 61700 - Cyberphysical Security Seminar: Research Topics In Cyberphysical Security

Credit Hours: 3.00. This course meets the requirements of a research seminar for the CIT graduate program. Students focusing on homeland security and related research areas are encouraged to take this course to expand their knowledge of the field in general and in their specific research areas. The students will present their research to one another to gain knowledge of topics in the subject area. The student numbers will include PHSI student research assistants, interns, and students focused on homeland security research topics. The creation of this course will provide these students more structure for engagement, learning and research. Students taking the course will construct a research paper formatted for publication in a homeland security research journal. This course will also promote the interdisciplinary nature of homeland security from information technology to public policy generation and agent-based computer modeling. Permission of Instructor required.

Learning Outcomes: 1. Develop research papers. 2. Develop research that can be used as a chapter in students' research. 3. Learn appropriate format for publication. 4. Identify sources. 5. Identify topics. 6. Develop a research presentation. 7. Prepare for thesis proposal/defense. 8. Share student research with students of similar interest. Credits: 3.00

CNIT 62300 - Contemporary Computer Technology Problems

Credit Hours: 1.00 to 8.00. Theory and practice in the development of comprehensive solutions to problems in industrial, technical, and human resource development environments. Solutions based on emerging procedures will be emphasized. Permission of instructor required.

Credits: 1.00 to 8.00

CNIT 62500 - Research Methods In Computing

Credit Hours: 3.00. The goal of this course is to provide you with the tools necessary to not only understand how to create your own research study on cyber-physical systems, but how to critically assess the different methodologies and components in various research designs used in applied information technology. In this course, you will learn about the landscape of research in information technology. You will learn to differentiate between different research methodologies used in IT, identify threats to validity, learn specific protocols for commonly used methods in IT, and synthesize empirical literature and theory in order to design a scientific research study. The end product of this course will be the ability to design and report on an IT-related research project. Permission of instructor required. Prerequisites: STAT 50100 or STAT 51100 or other statistics course; 6 credits of CNIT at the 500 level.

Learning Outcomes: 1. Understand the landscape of research related to applied cyber-physical systems. 2. Evaluate the quality and salience of research related to cyber-physical systems. 3. Differentiate between research methodologies used in IT and design a research study using appropriate methods. 4. Formulate discipline-appropriate research questions. 5. Synthesize empirical literature and theory and write various types of research reports appropriate to their sub-discipline. 6. Identify different research philosophies and paradigms used in Information Technology and their impact on research designs and outcomes. Credits:

3.00

CNIT 64000 - Advanced Research Topics In Blockchain Technology

Credit Hours: 3.00. Blockchain is gaining momentum and of increasing interest to both academia and industry. The underlying distributed ledger technology was first introduced in the cryptocurrency Bitcoin by Satoshi Nakamoto and its adoption will dramatically reshape the landscape of IT infrastructure of a diverse range of sectors, such as manufacturing, finance, government, healthcare, and insurance, from centralized control to decentralized cooperation. Under the hood, cryptography, distributed consensus, economic incentives, and autonomous management/computation are consolidated to support Blockchain technology. In this research-focused course, we will explore a variety of active research areas in the evolving Blockchain technology, identify the challenges of the current development and attempt to answer open questions. Permission of instructor required.

Learning Outcomes: 1. Compare permissionless and permissioned blockchain network. 2. Discuss the corresponding countermeasures for addressing the scalability issue of the current blockchain implementation. 3. Describe the on-chain data protection and privacy-preserving technology. 4. Describe the smart contracts, the related vulnerabilities, and mitigations. 5. Explain the blockchain incentivization and related attacks. 6. Analyze and evaluate blockchain-based applications. 7. Investigate the selected research topics and propose innovative solutions. Credits: 3.00

CNIT 69100 - Natural Language In Information Assurance, Security, And Privacy

Credit Hours: 3.00. This course will serve as seminar in natural language applications with the emphasis in information assurance, security, and privacy. The topics will review the state of the art of general information assurance, security, and privacy with the focus on natural language text and information received from and implied in it. The course will focus in a wide range of papers describing various techniques and applications, with identifiable advantages and disadvantages. The assignments will range in class paper presentations to group projects and written reports.

Learning Outcomes: 1. Illustrate the purpose and goals of natural language-based information assurance, security and privacy applications. 2. Identify and evaluate individual applications for a particular need. 3. Apply critical thinking and creative problem solving to improve existing solutions. 4. Explain advantages and disadvantages of natural language processing techniques applied to security-related applications. 5. Develop reports on new and existing methods and applications following Purdue University Ethics Policies. Credits: 3.00

CNIT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 18.00

CNIT 69900 - Research PhD Dissertation

Credit Hours: 1.00 to 18.00. Dissertation-level research (for CIT PhD degree). Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Outcomes will be agreed upon by the instructor and the student. Credits: 1.00 to18.00

School of Construction Management Technology (Graduate)

Websites:

https://polytechnic.purdue.edu/degrees/ms-construction-management-technology
https://polytechnic.purdue.edu/degrees/ms-construction-management-online
https://polytechnic.purdue.edu/degrees/executive-construction-management-graduate-certificate

Department/School Head

Yi Jiang

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Professor of Practice
Daniel Castro-Lacouture Emad Elwakil Bryan Hubbard Yi Jiang Zeljko "Z" Torbica	Cory Clark Hazar Nicholas Dib James L. Jenkins Randy R. Rapp	Deniz Besiktepe Soowon Chang Yunfeng Chen Luciana Debs Shanyue Guan Kyubyung Kang Claudio Martani Anthony Sparking Chengcheng Tao Jiansong Zhang	Brad Benhart Mark Zimpfer, Associate Ryan Manuel, Assistant

Academic Programs

Master's Programs

The Master of Science in The School of Construction Management Technology applies management principles and innovative technologies to effectively lead, organize, and manage the construction projects of residential, commercial, and infrastructure facilities. With the MS in Construction Management Technology, you will be prepared for a leadership position in the construction industry.

- Master's degree in Construction Management Technology (Resident)
- Master's degree in Construction Management Technology (Online)

Graduate Certificates

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Executive Construction Management Graduate Certificate (Online)

Construction Management Technology, MSCMT

Executive Construction Management, Post-Baccalaureate Certificate

Construction Management Technology, MSCMT (OL)

CM 50500 - Construction Finance And Company Management

Credit Hours: 3.00. This course provides students with knowledge and research training to construction finance and company management.

Learning Outcomes: 1. Learn about concepts, principles, and practices of construction finance. 2. Learn about company marketing, customer relationship and trust development. 3. Learn about the methods, technologies and statistical

approaches used for construction finance and company management. 4. Apply the accounting knowledge to prepare and analyze financial statements. 5. Become a critical thinker of current company management practices and apply what they have learnt to identify and solve challenges of construction management. Credits: 3.00

CM 50800 - Human Factors In Construction And Transportation

Credit Hours: 3.00. This course provides students with knowledge and research training to identify and solve design problems and safety issues of human factors specifically in construction and transportation.

Learning Outcomes: 1. Learn the concepts, theories, methods and technologies of human factors (HF), human information processing, and cognitive psychology. 2. Apply the HF knowledge to study and discuss HF issues in the design and safety of construction and transportation. 3. Develop critical thinking ability to identify HF issues and factors in research and real world. 4. Apply HF knowledge to explore, research and solve the problems in the areas of their interests in construction and transportation. 5. Communicate the design and safety from HF perspective. Credits: 3.00

CM 51000 - Topics In Environmentally Sustainable Construction, Design And Development

Credit Hours: 3.00. This course explores environmental sustainability in all its forms, starting with the historical and theoretical basis and continuing through an understanding of sustainable building construction, design, development, and renewable energy strategies/management tools and how these can be applied in practice.

Learning Outcomes: 1. Recognize human population trends and their effects on associated resource demands. 2. Identify and evaluate energy use trends, including status quo, business-as-usual (BAU) and alternative production and delivery approaches. 3. Interpret and analyze regional and global climate trends and implications, including policy alternatives. 4. Illustrate economic and social drivers, including triple bottom line business practices. 5. Discuss trends and management alternatives in land and ocean ecosystems. 6. Examine food and water security issues including production, management, and distribution alternatives. 7. Distinguish behavior psychology including examination of constraints and opportunities for sustainable practices. 8. Compare market and other incentives designed to stimulate best practices for building design and community planning. 9. Demonstrate knowledge of the conceptual history and controversies involving sustainability. 10. Apply current sustainability principles. 11. Debate common sustainability issues from multiple perspectives. 12. Recognize uncertainty envelopes and constraints on predictive knowledge. 13. Apply best practices in sustainability to their specific field of interest. 14. Employ interdisciplinary approaches to sustainability outside of their own field. 15. Recognize the challenges and opportunities of applying science and technology to governance. 16. Formulate messaging skills needed to deliver scientific information to popular audiences. 17. Practice abstract theoretical evaluation of sustainability challenges and solutions. 18. Employ critical reading and writing skills within scientific, policy and popular media. 19. Prepare action research projects to transform sector-specific practices for sustainability. 20. Construct a broad range of delivery and assessment strategies to support change for sustainability. Credits: 3.00

CM 51100 - Energy Conserving Building Retrofit

Credit Hours: 3.00. This course introduces energy related reconstruction of buildings with an emphasis on light commercial buildings. Retrofit topics include: Basic thermodynamics, Energy conserving technologies, Impact of

site characteristics, Indoor air quality, Water conservation measures, Measuring and benchmarking energy performance, Cost/Benefit Analysis, Financing energy improvements, as well as Building operation and management to reduce energy and water use.

Learning Outcomes: 1. Identify and describe opportunities for energy conservation in existing light commercial buildings through energy related reconstruction activities, commissioning, onsite power generation, as well as building operation and management strategies. 2. Apply basic thermodynamics to energy related retrofit strategies. 3. Identify, classify, and describe techniques and technologies that can be utilized in building envelop, building site, or HVAC systems for energy or water conservation. 4. Apply problem solving and decision making for cost vs. benefit analysis of retrofit strategies. 5. Apply basic energy measurement and benchmarking simulation models. 6. Identify the ways indoor air quality is impacted by vent. Credits: 3.00

CM 51800 - Building Information Modeling And Sustainability

Credit Hours: 3.00. This course explores environmental sustainability in all its forms, starting with the historical and theoretical basis and continuing through an understanding of sustainable building construction, design, development, and renewable energy strategies/management tools. In this course students explore Building Information modeling technology to assess and compare the design impact on the environment.

Learning Outcomes: 1. Explain and apply LEED Principles. 2. Explain and apply Life Cycle Analysis principles. 3. Compare design alternatives. 4. Solve a real construction problem. Credits: 3.00

CM 52000 - Preconstruction Project Management

Credit Hours: 3.00. Management and control of projects from authorization to start of construction. Project success factors, conceptual and parametric estimating, design planning and management constructability review techniques and value engineering methods. Real estate transactions. Land zoning, platting, development and pro forma calculations.

Learning Outcomes: 1. Appreciate the real estate site selection process. 2. Understand the zoning and platting process. 3. Develop an understanding of the real estate transaction process. 4. Compare and contrast project delivery systems. 5. Understand the design process. 6. Identify project success factors. 7. Utilize value engineering and constructability concepts. 8. Understand the role of preconstruction in the project life cycle. 9. Employ early estimating techniques. 10. Analyze projects from a time-value of money perspective. 11. Evaluate the viability of a construction project before authorization. 12. Appreciate roles played by the various participants in the preconstruction process. 13. Ensure adequate risk management measures have been employed. 14. Apply real estate development rules and consider regulatory issues. Credits: 3.00

CM 52500 - Managing Construction Quality And Production

Credit Hours: 3.00. Advanced techniques for assessing the success of construction project management including schedule cost, safety and quality measurements. Impacts of pre planning, human factors, and communication systems on quality and productivity. Statistical methods for analysis of construction operations.

Learning Outcomes: 1. Define construction productivity and quality. 2. Understand the project owner's role, the designer's role, and the construction firm's role in construction, productivity and quality. 3. Demonstrate the ability to manage productivity at the following enterprise levels - company, project, and construction site. 4. Demonstrate the ability to manage construction labor productivity, equipment productivity, and subcontractor productivity. 5. Measure construction labor productivity. 6. Understand the impact that changes have on productivity. 7. Quantify lost productivity. 8. Implement a Total Quality

Management (TQM) system. Credits: 3.00

CM 52600 - Value Engineering - Functional Analysis Of Systems And Techniques

Credit Hours: 3.00. This course applies value engineering principles and life cycle costs to the built environment with particular focus on the effect of the decisions made in the design, construction, operation and maintenance of the built environment on the quality and cost.

Learning Outcomes: 1. Synthesize and articulate the core principles of life cycle cost and apply engineering economics principles to calculate costs. 2. Synthesize and articulate the core principles of functional analysis of systems and techniques (FAST) methodology. 3. Conduct analysis of systems, articulate client needs and problems, define problem statements, compare design alternatives, and suggest solutions that address the issues in the problem statement. 4. Develop weighting criteria for decision making to meet problem statement and demonstrate advantages of proposed solution in comparison with initial design. Credits: 3.00

CM 53000 - Construction Operations And Strategic Management

Credit Hours: 3.00. Principles of construction company business management for U.S. companies. Executive-level construction functions including strategic planning, organizational structure, and ownership structure including succession planning.

Learning Outcomes: 1. Undertake company strategic planning. 2. Prepare a company business plan. 3. Create organizational structure. 4. Develop policies and procedures. 5. Manage change. 6. Manage equipment utilization. 7. Ensure contract profitability. 8. Identify and manage other operational concerns. 9. Develop succession plans. 10. Implement succession plans. Credits: 3.00

CM 53500 - Construction Accounting And Financial Management

Credit Hours: 3.00. Accounting techniques, financial methods, and financial management for construction firm management. Analysis techniques for contemporary construction company accounting and finance practice with an emphasis on cash flow analysis and cash management.

Learning Outcomes: 1. Identify and explain the use of various revenue recognition methods available to the construction company. 2. Explain the progress billing terms retainage and front loading and discuss the reasons for and against such practice. 3. Identify the accounts applied and their use when the percentage of completion method of accounting is applied. 4. Explain the difference between underbilling and overbilling, discuss why they occur and their impact on cash flow. 5. Apply the following financial analysis techniques to financial statements: line-item analysis, horizontal analysis, vertical analysis, use-source analysis, ratio analysis, cost-volume-profit analysis, and profit center analysis. 6. Prepare the budgeted income statement and develop rates for overhead and profit mark-up, exercise control over company cost, and prepare a cash plan. 7. Apply time value of money principles to various decision making tools when seeking company and project financing and the acquisition of capital assets. Credits: 3.00

CM 53600 - Highway Construction And Quality Control

Credit Hours: 3.00. This course provides students with knowledge of methods, materials, equipment, and procedures in construction of highways. Students will acquire the concepts and applications of quality control and quality assurance in construction of highways. Students will learn to design appropriate work zones to improve efficiency and safety of highway construction. This course will provide graduate students with a much-needed venue to gain the theory, technology, and practice of highway construction, rehabilitation, maintenance, and quality control.

Learning Outcomes: 1. Acquire the characteristics of various types of highway materials and highway designs and highway construction specifications. 2. Acquire the

quality control and assurance principles, and techniques, and methods. 3. Determine the optimal strategy for pavement preservation. 4. Apply quality control and safety improvement techniques in highway construction. 5. Design work zones to improve efficiency and safety of highway construction. Credits: 3.00

CM 53800 - Roadway Infrastructure Management

Credit Hours: 3.00. This course provides students with theories and practices of managing roadways to achieve maximum benefit in the system and network level with limited available funds and resources. Students will learn the concepts of roadway performance measures in terms of physical conditions, service levels, and safety. As a graduate level course, this course will introduce basic methods to find optimal solutions for real-world problems and provide graduate students analytical and mathematical tools for effectively conducting research related to problem formulation, optimal decision-making, and maximizing benefits/effectiveness and minimizing costs.

Learning Outcomes: 1. Acquire roadway systems and performance measures. 2. Acquire the frameworks and principles of management systems. 3. Conduct data analysis and establish condition prediction models. 4. Perform life cycle benefit/cost analysis of infrastructure projects. 5. Create decision-making models to maximize benefit of infrastructure systems with limited resources. Credits: 3.00

CM 54000 - Law For Construction Managers

Credit Hours: 3.00. A study of the legal system and its impact on the construction process. The focus is on the legal obligations, rights and remedies pertaining to the construction company. Topics include bidding, contracts, and construction changes.

Learning Outcomes: 1. Describe agency relationships, contracts, torts, professional liability, risk management, indemnification, risk sharing and surety bonds. 2. Explain the concept of the design professional as judge. 3. Recognize the procedures for legally terminating a construction contract. 4. Plan the project with a contract law viewpoint. 5. Comply with the legal requirements for competitive bidding. 6. Create as well as to comply with the rights & duties of the construction contract. 7. Demonstrate the ability to apply construction law concepts to subcontracting, changes, payments, performance problems, defects, subsurface problems, time and claims. Credits: 3.00

CM 54500 - Construction Management Training And Development

Credit Hours: 3.00. Identification, training and development of future company leaders. Mentorship as a required, managerial activity, effective delegation of responsibility, and empowerment of subordinates to take initiative.

Learning Outcomes: 1. Interpret the role of the training department in meeting an organization's strategic goals. 2. Analyze the broader organizational context and business environment in order to ensure that training meets business needs and achieves stakeholder support. 3. Use effective investigative and analytical methods to advise and assist clients in identifying needs, at organizational levels, to which training is the most appropriate response. 4. Work with stakeholders to design training events (including formal programs) that are grounded in the principles of learning, are accessible, effective and make timely use of available resources. 5. Incorporate new technology as appropriate into both training and learning processes, and the effective management of the training and development function. 6. Carry out appropriate monitoring and evaluation of training programs, and coordinate with stakeholders on any necessary changes to training provision and practice. 7. Explore models and research relating to the core competencies and behavioral characteristics of effective trainers. Credits: 3.00

CM 54700 - Collaborative Project Delivery Models And Practices

Credit Hours: 3.00. A project-focused course covering advanced topics on collaborative project delivery models such as Integrated Project Delivery (IPD), Design-Build (DB), and Partnering. Collaborative project delivery methodologies aim to integrate project teams, stakeholders, systems, business structures, and practices to facilitate collaboration at all levels within a project and to produce the most optimal project outcomes. Students will develop and expand their interdisciplinary collaborative team working skills, communication, and understanding of essential elements underlying collaborative project delivery models.

Learning Outcomes: 1. Describe, analyze, and select the most appropriate delivery method for a project. 2. Engage in team-building processes and analyses that are intended to establish collaborative working environments. 3. Analyze case study documents including RFP's, RFQ's, contracts, and other managerial documents used in collaborative project delivery practices. 4. Research and analyze construction management processes to develop collaborative project teams and collaborative work environments. Credits: 3.00

CM 54900 - Advanced Topics In Mechanical And Electrical Construction

Credit Hours: 3.00. A project-focused course covering advanced topics on mechanical and electrical construction installation practices and processes. This course teaches the student how to plan, organize, and execute mechanical and electrical construction operations. Students will develop and expand their knowledge about mechanical and electrical work sequencing, coordination, commissioning, and relationship to facility operations and management.

Learning Outcomes: 1. Describe and analyze mechanical and electrical scopes of work. 2. Engage in team-building processes and analyses that involve developing work sequencing and coordination. 3. Analyze case study documents including construction schedules to determine best practices and recommendations for improvement. 4. Research and analyze commissioning programs to develop key performance indicators and implementation strategies. Credits: 3.00

CM 55000 - Risk Management In Construction

Credit Hours: 3.00. Analysis of the depth and breadth of risk in construction. Defining key terms and concepts used in various risk management arenas - legal statutes, precedent and case studies relevant to construction risk management, insurance, and surety bonding. Subjects include: contracts, torts, insurance, surety, safety laws, quality, and risk management models. Analysis of case studies to utilize risk management tools and identify issues and possible approaches. Project risk control including management of foreseeable hazards as well as unforeseen conditions.

Learning Outcomes: 1. Overview of risk fundamentals - and how liability drives outcomes. 2. Understand the relationships between insurance, sureties, contractual risk transfer and risk financing. 3. Understand how safety covers direct employees, other parties, and member of the public. 4. Understand the role of incident investigation, and management of claims of various types. 5. Understand quality and how to deliver acceptable project results. 6. Understand the value of Business Continuity Planning and other Crisis Management methods and tools. 7. Understand the value of corporate compliance programs for satisfaction of regulatory and other legal requirements. 8. Understand standards of care, and their evolutionary nature, compelling "compliance as you go." 9. Ability to critically evaluate existing risk management approaches, and apply risk management models to promote successful project outcomes. Credits: 3.00

CM 55500 - Construction Leadership And Marketing

Credit Hours: 3.00. Analysis of organizational leadership at the executive level. The goals of this course are to introduce and stimulate thought and discussion of leadership theories, characteristics and behaviors of successful leaders, contextual factors affecting leader effectiveness, dynamics of leader-follower relationships, communication, decision-making and contemporary challenges confronting organizational leaders as well as marketing theory, marketing vs. business development,

the marketing process, and an introduction to a construction marketing dashboard.

Learning Outcomes: 1. Understand the essential principles of leadership theories and apply the theories in construction management. 2. Comprehend the characteristics and behaviors of successful leaders in the field of construction. 3. Grasp the main contextual factors affecting leader effectiveness. 4. Apply the dynamics of leader-follower relationships in daily operations. 5. Acquire communication, decision-making and other key leadership skills. 6. Recognize the contemporary challenges confronting organizational leaders. 7. Understand the marketing theory, the market process, and marketing vs. business development. 8. Understand and utilize construction marketing dashboard. Credits: 3.00

CM 56000 - Academic Writing Seminar I

Credit Hours: 1.00. Analysis of the requirements of research reports. Emphasis on research methods and concepts, identifying major issues, academic literature reviews, data collection and presentation methods, and selecting a research topic.

Learning Outcomes: "1. Increase the student's skills related to research and academic writing through the introduction of resources available through the Purdue Library System and the Purdue Online Writing Lab (OWL). 2. Demonstrate appropriate samples of academic writing through sample reports on the Purdue College of Technology EPubs. 3. Develop the student's knowledge and application of PAP version 6 formatting. 4. Advance the student's expectations of academic writing. Credits: 1.00

CM 56500 - Academic Writing Seminar II

Credit Hours: 1.00. Provides a higher level understanding of scholarly writing as it is applied to the individual student's research. Students also learn to present his or her technical work to an audience in a clear, easily understandable form.

Learning Outcomes: 1. Demonstrate develop of the student's skills related to academic writing through individual and group exercises related to their individual research. 2. Demonstrate appropriate samples of academic writing through sample reports on the Purdue College of Technology Epubs. 3. Appropriate student knowledge and application of APA version 6 formatting. 4. Advance the student's expectations of academic writing. 5. Increase the rate of successful completion of the masters program scholarly writing requirements. Credits: 1.00

CM 57000 - Analysis Of Research In Construction

Credit Hours: 4.00. Analysis of research and evaluation of research reports. Emphasis on understanding the application of business research procedures including fundamental statistical methods in the solution of a construction industry relevant problem.

Learning Outcomes: 1. Acquire research knowledge and skills required to produce scholarly work for the construction industry. 2. Adapt the scientific research model to solve problems in a construction company. 3. Demonstrate proficiency at library usage, EndNote, and citing references using APA format. 4. Demonstrate related academic writing through individual and group exercises suitable to their individual research. 5. Demonstrate appropriate samples of academic writing though sample reports on the Purdue College of Technology Epubs. 6. Advance expectations of academic writing. Credits: 4.00

CM 58100 - Workshop In Building Construction Management Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary due to nature of course. Credits: 0.00 to 8.00

CM 59000 - Special Problems In Building Construction Management Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required

Learning Outcomes: 1. Develop an increased knowledge in select topics related design and/or construction management. Credits: 1.00 to 6.00

CM 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 3.00

CM 61000 - Urban Built Environment

Credit Hours: 3.00. This provides students with advanced theories and applications of analyzing multiple performance indicators in urban built environments. Students will learn the concepts of energy, environment, human comfort, and mobility performance in urban built environments. This course will offer an overview of various analysis techniques using Geographic Information System, Building Energy Modeling and Simulation, and Spatial Analytics using a programming language. Graduate students will learn problem-solving skills through project-based learning, and how to apply the skills to effectively conduct research related to urban built environment planning, design, and development. Prerequisite: CM 51000.

Learning Outcomes: 1. Apply GIS techniques to understand geographical patterns and spatial variables. 2. Apply building energy modeling and analyze environmental, design, and construction parameters affecting energy demand. 3. Evaluate spatial networks in urban built environments in various measures. 4. Evaluate multiple performance of urban built form. 5. Create a decision-support framework to better inform the performance of urban built forms and optimize urban built. Credits: 3.00

CM 62500 - Smart Infrastructure System

Credit Hours: 3.00. Applying advanced cutting-edge technologies to the civil and construction industry to address traditional infrastructure problems is becoming more popular. One of the very hot areas is developing smart infrastructure. How to make our civil infrastructures smarter and more resilient plays a vital role for our society. The first half of this course will cover the fundamental knowledge of some cutting-edge technologies and smart infrastructure including sensing, signal processing, data collection and transmission, and closed-loop control. The second half of this course will focus on smart infrastructure applications including smart bridges, smart grid, smart building and smart railways. This advanced-level course will provide advanced knowledge of cutting-edge technologies to develop smart infrastructure systems. Through this course, student will polish their research skills in different aspects including: conducting literature review, developing their own research idea, implementing their ideas, presenting their work and publishing their results. In addition, at the end of this course, students will be able to implement various types of systems, create smart infrastructure systems and check their performance. Prerequisite: CM 58100.

Learning Outcomes: 1. Differentiate design and performance of smart infrastructure system over traditional infrastructure system. 2. Organize and identify major components of smart infrastructure systems for practical application. 3. Plan the operation and maintenance of smart infrastructure systems for long-term operation. 4. Create and design smart infrastructure systems based on different purposes. 5. Implement smart infrastructure system to address the critical needs and evaluate smart infrastructure system performance. Credits: 3.00

CM 63500 - Advanced Facilities Management

Credit Hours: 3.00. This course provides advanced facilities management (FM) practices in the life cycle of the built environment, including core competencies, compliance and standards, operations & maintenance, risk management, sustainability, health & safety, real estate and financial management, human resources management, and workplace and utility management. In addition, FM practices include emergency preparedness, business continuity, leadership, contracts, capital and maintenance planning, outsourcing, procurement, space planning, occupant comfort and productivity, and energy management. The role of the facilities manager in hard (space and infrastructure) and soft services (grounds, custodial, waste management, pest control, parking, workspace management, catering) will be analyzed with case

studies emphasizing the need for their integration in the design and construction process. The students will be able to interpret and analyze critical management principles in the operations phase of the built environment by identifying the fundamentals of facilities management theory and practice. Prerequisite: CM 52600.

Learning Outcomes: 1. Differentiate the essential services in facilities management (FM). 2. Analyze the hard and soft services in FM with short business cases. 3. Organize the critical components of FM in architecture, engineering, and construction processes. 4. Evaluate the current research trends in FM from an applied and practical perspective. 5. Implement the fundamentals of FM from a managerial perspective in a business case. 6. Describe the role of the facility manager in various organizational settings. Credits: 3.00

CM 63600 - Future-Proof Construction And Infrastructure

Credit Hours: 3.00. The course provides advanced tools and methods to optimize the maintainability, resilience, flexibility and responsiveness of infrastructure and construction so to ensure that these provide an adequate level of service under uncertain future conditions. This includes methods to rigorously quantify the level of service, model the uncertainty over variable parameters, identify maintainable, resilience flexible and responsive design solutions, run simulations to estimate their impact (i.e., costs of interventions and risk on the service) and identify the optimal balance with the costs of construction. Prerequisite: CM 51000.

Learning Outcomes: 1. Explain the concept of future-proof design. 2. Measure rigorously and orthogonally the service provided by an infrastructure. 3. Optimize the intervention strategies based on the predicted deterioration of objects. 4. Evaluate resilience of construction and infrastructure to ensure that the extra cost invested in resiliency are justified by the risk saved in the phase of operation and management. 5. Evaluate flexibility of construction and infrastructure to ensure that the extra cost invested in flexibility are justified by the risk saved in the phase of operation and management. 6. Develop team-building skills. Credits: 3.00

CM 63700 - Computer Vision Application For Smart Infrastructure Management

Credit Hours: 3.00. This graduate-level course is for students who major in Construction Management Technology, Construction Engineering and Management, Civil Engineering, and other related majors in the architecture, engineering, and construction domain. Computer vision (CV) technology can play a critical role in constructing and managing built environments (infrastructure systems and facilities). It promises to become even more critical in the next few decades as technologies are more efficient and effective for infrastructure inspection and maintenance. The CV technologies include the principles and utilization of object detection, action recognition, and 3D reconstruction technologies. This course will offer the students the advanced knowledge and ability to come up with a solution for infrastructure and facility management challenges by evaluating current computer vision technologies. After this course, the students can evaluate appropriate computer vision algorithms and develop frameworks for various infrastructure management problems by creating their own training data sets and models.

Learning Outcomes: 1. Master theories and methods of computer vision by critically reviewing and assessing scientific literature. 2. Identify and formulate computer vision and 3D modeling-related problems in the smart construction and infrastructure management field. 3. Apply, evaluate, and examine various computer vision algorithms, tools, equipment, and methods to support the construction and facility management research domains. 4. Communicate effectively and work in teams to develop working computer vision systems for smart construction and infrastructure management. 5. Design and develop practical and innovative computer vision applications or systems applicable to construction and infrastructure management. Credits: 3.00

CM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 18.00

School of Engineering Technology (Graduate)

Website: **https://polytechnic.purdue.edu/degrees/ms-engineering-technology**

Online Programs: https://online.purdue.edu/mset/masters-in-engineering-technology

Department/School Head

Kenneth A. Burbank

Graduate Program Contacts:

Dr. Duane D. Dunlap, Chair
Niedra Davey, Lead Administrative Assistant, Graduate Program

Faculty by Rank Click here

Academic Programs

Master's and Ph.D. Programs

The program expands the knowledge of students into areas of established and emerging engineering technologies. The degree prepares students to enter into positions requiring responsibilities in managerial, leadership, engineering, research, and teaching positions. Graduates work in a variety of sectors including business and industry, nonprofit, government, and academia.

Research Interest Areas (On-campus Students)

Faculty within the School of Engineering Technology (SoET) have significant business and industrial experience. The SoET has had faculty involved with the creation of start-up companies within the Purdue Research Park. A thesis-based MS degree requires 21 credit hours of coursework and minimum of (9) credit hours of thesis research (ENGT 69800). The student's work culminates in a written thesis. Student's pursuing a MS thesis-based are required to complete the following courses in the preferred sequence: ENGT 50100 (Research Seminar), MET 50300 (Applied Optimization), graduate-level Statistics Course, MET 52700 (Tech from a Global Perspective), and TECH 67600 (Analysis of Published Research).
The remaining courses are chosen by the student working with their major professor/advisor and with the approval of the student's graduate faculty committee tailored to their research and/or professional ambitions.
Faculty in the School of Engineering Technology have interests for example in the, Metrology, Die Casting, Mechatronics, Bio-fuels, Manufacturing, Robotics, Facilities and Energy Management, Non-destructive testing, Direct Part Marking, Machine Vision, Computer Vision, Flexible Organic Electronics, Healthcare, Electric Hybrid Vehicles, Analog Circuits and Electronics, Acoustics, Project Management, Digital Enterprise Systems, and Manufacturing.

Financial Support (On-campus Students)

Teaching assistantships (TA's) are available to qualified students entering the School of Engineering Technology. The Graduate School offers fellowships for entering students. Research assistantships (RA's) are available for advanced, qualified students working directly with SoET faculty.

Engineering Technology, MS

Engineering Technology, MS (OL)

Developmental Testing and Innovation, MS (OL)

Smart Manufacturing, Post-Baccalaureate Certificate

Robotics Technology, MS

Robotics Technology, PHD

ECET 52400 - Applied Electromagnetics

Credit Hours: 1.00 to 3.00. This course provides an advanced treatment of electromagnetics and applications at the graduate level for engineering technology students. Electric and magnetic field theory is presented, including Maxwell's equations. Topics include vector analysis, electric and magnetic fields, Maxwell's equations, electromagnetic wave radiation, and propagation. A semester-long project based on applied electromagnetics is required for each student. Knowledge of RF measurement equipment, such as spectrum analyzers and vector network analyzers is required.

Learning Outcomes: 1. Perform electromagnetic analysis, using vectors and differential and integral vector operations. 2. Perform electrostatic analysis and calculation in Cartesian, cylindrical and spherical coordinate systems. 3. Calculate the electric charge and electric and magnetic fields using Coulomb's Law, Gauss's Law, and Ampere's law. 4. Use Maxwell's equations in integral form and differential form to solve boundary value problems. 5. Derive and calculate the electromagnetic plane waves propagation in two and three dimensional space. 6. Determine and calculate the electromagnetic fields in rectangular and cylindrical waveguides. 7. Evaluate the performance of circuits using standard laboratory measurements and simulations. Credits: 1.00 to 3.00

ECET 53500 - Energy Sustainability

Credit Hours: 3.00. A study of energy auditing, energy saving opportunities of commercial and industrial systems, utility rate structures, economic evaluation of investments, potential energy saving retrofits, maintenance considerations, and cogeneration opportunities. Data analysis and report writing are practiced using data from a real world energy audit.

Learning Outcomes: 1. Identify and describe the energy conservation opportunities in industrial and commercial systems. 2. Apply energy auditing techniques. 3. Apply electrical and mechanical engineering principles to improve energy efficiency of systems. 4. Determine energy cost and consumption indexes using energy rate structures. 5. Examine the economic evaluation of energy conservation solutions. 6. Use DOE energy assessment tools. 7. Evaluate existing systems for energy recovery and cogeneration opportunities. 8. Use web-based and published material in energy analysis. 8. Evaluate existing systems for Smart Grid opportunities with smart utility meters. Credits: 3.00

ECET 53600 - Embedded Systems Security

Credit Hours: 3.00. This course focuses on the implementation and application of cryptographic algorithms and protocols in embedded systems. An overview of the security problem and the science of cryptography and cryptanalysis is presented. The notion of the security perimeter in terms of physical access to assets in embedded hardware subsystems is studied. Students implement and apply various ciphers on 8-bit to 32-bit embedded platforms, comparing and contrasting computational and data throughout performance. Permission of instructor required.

Learning Outcomes: 1. Identify and describe cryptography, cryptanalysis, and security perimeters of embedded systems. 2. Identify and describe key performance issues and tradeoffs in the design and application of

cryptographic algorithms and protocols in embedded systems. 3. Identify and describe the main areas of research focus in embedded system security and whey they are important. 4. Identify, describe, and apply tools used in cryptographic analysis and performance characterization of embedded systems. 5. Identify, describe, analyze and apply cryptographic algorithms and protocols including but not limited random number and key generators, private-key and public-key ciphers and protocols, and one-way hash functions. Credits: 3.00

ECET 54400 - Real-Time And Embedded Systems

Credit Hours: 3.00. Real-time systems are hardware/software systems in which a timely response by a computer to external stimuli is vital to the performance of the system's objectives. This is the study of temporal determinism. Embedded systems are those with special-purpose microcomputers designed into the system for explicit purposes. Examples of such are the computers on your car's engine that control fuel injection, fly-by-wire attitude controls in modern jet aircraft, even the microcontroller inside a cellular phone. In these examples, the computer has a specific, limited task that is part of the functionality of the device and specifying average performance of that computer is insufficient for successful completion of the task at hand. Imagine if the flight controls of a Boeing 787 on final landing approach experienced a "network lag" similar to that which occurs occasionally while you're reading e-mail. If the controls stop responding at a critical time, a horrific crash could occur. Even if the system doesn't freeze up 99.999% of the time, it can still result in disaster.

Learning Outcomes: 1. Analyze a given embedded system application with respect to the hard real-time, soft real-time and non-real-time aspects of the system that simultaneously exist. 2. Analyze the implications of Real-Time Systems vs. non-Real-Time Systems. 3. Analyze the basic components of machine organization with regard to implications for time-deterministic performance. 4. Evaluate the schedulability of collections of tasks with respect to different implementations of task schedulers and task dispatchers. 5. Apply advanced software engineering techniques to designing and documenting software. 6. Synthesize solutions to problems involving control of real-time systems. Credits: 3.00

ECET 54900 - Advanced Computer Vision For Sensing And Automation

Credit Hours: 3.00. This course focuses on advanced issues related to an integrated computer vision system for sensing, quality control and automation applications.

Learning Outcomes: 1. Analyze and evaluate different components of a computer imaging system for different applications. 2. Analyze and apply different image processing, image analysis and image understanding (pattern recognition) algorithms along with their underlying theories. 3. Design and test different computer vision processes by using selected computer program, software and/or developing specific computer program(s). 4. Appraise and analyze different real-world case studies to learn from successes and failures related to computer vision system-based devices or components. 5. Develop and test tentative solution for selected real-world sensing, inspection, quality control and automation applications via project-based activity(ies). Credits: 3.00

ECET 58100 - Workshop In Electrical And Computer Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Vary by course offering. Credits: 0.00 to 8.00

ECET 59000 - Special Problems In Electrical And Computer Engineering Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

ECET 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Varies by students research topic. Credits: 1.00 to 3.00

ECET 63800 - Selected Topics In Sensor Networks

Credit Hours: 3.00. This course examines general sensor network concepts, with a focus on a particular area of research and development. Current applications are studied, culminating with the analysis, characterization and/or examination of a sensor network. Permission of instructor required.

Learning Outcomes: 1. Identify and describe sensor network applications. 2. Identify and describe key performance issues and tradeoffs in the design and application of sensor networks. 3. Identify and describe the main areas of research focus in sensor networks and whey they are important. 4. Identify, describe, and apply tools used in sensor network analysis, simulation, characterization, control, and information retrieval. 5. Analyze, calculate and simulate or measure critical performance metrics of sensor networks and their components (nodes, gateways, etc.). Credits: 3.00

ECET 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies by student research topic. Credits: 1.00 to 18.00

ENGT 50100 - Graduate Research Seminar

Credit Hours: 0.00 or 1.00. This course is intended to orient new graduate students to the Engineering Technology (ET) program and faculty. This includes PhD students and students pursuing a Master's degree through a thesis or directed project option. This does not include students pursuing a Master's degree with coursework only. Research activities within ET and throughout Purdue University are discussed. Student resources and opportunities are reviewed to give the students the tools they need to be successful. In addition, this course provides a way to develop a natural cohort of graduate students. This course is a graduate seminar course focused on the ET program. Graduate status or upper-division undergraduate. Permission of department required.

Learning Outcomes: 1. Summarize research interests of ET graduate faculty. 2. Interpret Purdue University research activities and resources and apply this knowledge to their particular research plan. 3. Generate MS or PhD preliminary documents based on ET specific requirements. 4. Implement effective use of library resources and ability to write scholarly information in accepted format styles. Credits: 0.00 or 1.00

ENGT 50200 - Developmental Testing And Innovation Seminar

Credit Hours: 0.50 or 1.00. The course introduces Engineering Technology and the requirements to fulfill the master's and/or Ph.D. Technology degrees. The seminar can include graduate faculty from the SoET, the NAVY, and other Engineering and Technology related disciplines from the Purdue Polytechnic, College of Engineering, and other STEM-related disciplines across campus.

Learning Outcomes: 1. Interpret Purdue University and Navy research activities and resources applying the knowledge to their particular research plan. 2. Generate M.S. or Ph.D. preliminary documents based on Engineering Technology or NAVY-specific research requirements. 3. Implement effective intellectual use of Purdue library and Navy resources for the ability to write scholarly information in accepted university and/or Navy format styles. Credits: 0.50 or 1.00

ENGT 50700 - Fundamentals Of Collaborative Leadership And Agile Strategy For Engineering Technology

Credit Hours: 3.00. This course will provide students with a foundation in collaborative leadership and agile strategy. The

course brings together theories and insights from a variety of disciplines including engineering, management, psychology, and social science. Increasingly manufacturing management is being called upon to apply their technical skills in collaborative environments that cut across organizational units and inter-organizational boundaries. Understanding how to design and guide collaborations and apply agile approaches for meeting strategic objectives is an important skill set and knowledge base in the 21st-century economy, defined more by open networks than the ridged hierarchies of the past.

Learning Outcomes: 1. Describe characteristics of highly effective leaders in engineering and technology-focused teams and organizations. 2. Apply tools and frameworks for highly effective leadership of engineering and technology-focused teams and organizations. 3. Analyze the potential strengths and potential of various leadership approaches and behaviors in engineering and technologically focused teams and organizations. Credits: 3.00

ENGT 50900 - Applied Computational Methods

Credit Hours: 1.00 to 3.00. This class covers the mathematics typically needed for research in engineering technology and is especially suited to the needs of ENGT student. The class includes basic calculus, introductory numerical methods, implemented in MATLAB, and elementary linear algebra. It uses relevant, practical problems to teach concepts and provides the students with actionable information. The starting point is graphical and numerical solutions of systems of non-linear algebraic equations. The class progresses to simple ordinary differential equations. Prerequisite: Six credits of undergraduate classes in technical mathematics, focusing on calculus.

Learning Outcomes: 1. Working understanding of algebra. 2. Solve systems of linear and nonlinear equations. 3. Calculate eigenvalues. 4. Working understanding of basic calculus. 5. Find derivatives and integrals of basic functions analytically. 6. Show graphical representations of integrals and derivatives. 7. Working knowledge of basic numerical methods. 8. Approximate derivatives using finite differences. 9. Find roots of nonlinear equations. 10. Implement a numerical algorithm using MATLAB. 11. Working knowledge of simple differential equations. 12. Solve an ordinary differential equation (ODE) using finite differences. 13. Solve an ODE numerically in MATLAB. Credits: 1.00 to 3.00

ENGT 51000 - Internet Of Things And Cybersecurity For Engineering And Technology

Credit Hours: 3.00. The internet has brought about the ability to embed computing into everyday devices to allow them to send and receive information. These devices, known as the Internet of Things (IoT), will require management at all levels to understand the inherent security risks due to the interconnection via the internet. Illegally accessing (hacking) IoT is increasingly becoming the most pervasive form of industrial espionage in use today. Understanding the threats aimed at IoT and how to protect IoT will be the key to keeping sensitive corporate information and secrets secure and private, and will require everyone's participation, not just the IT department. For this course students will learn the basics of research of and into cybersecurity, and the techniques used to commit industrial related crimes; how to detect these potentially catastrophic crimes; and the means to protect one of the company's most important assets...its systems and data.

Learning Outcomes: 1. Analyze security regulations relevant to their industry. 2. Apply a cybersecurity framework based upon industry regulations. 3. Analyze privacy issues with Internet of Things. 4. Analyze the difference between threats, vulnerabilities and risks as it relates to Internet of Things. 5. Apply techniques to mitigate risk to Internet of Things. 6. Evaluate the inherent benefits of using IoT, potential risks to IoT, and how to use a cybersecurity framework to help mitigate risk to IoT. Credits: 3.00

ENGT 54000 - Change Management For Enterprise Sustainability

Credit Hours: 3.00. Change management is at the core of an engineering organization's processes and data, and it affects every member of the enterprise. Change management provides a method for identifying, analyzing, preparing, implementing, validating, and documenting engineering changes throughout a product's lifecycle, to ensure everyone in the organization is working from the same product record and changes are communicated in real-time. In this course, the core elements, data structures, stakeholders, and workflows of change management and their role as enablers of the digital thread and the digital enterprise are discussed. The application of the

industry standard CM2 methodology is emphasized as a strategy to provide control, maintain data integrity, and improve visibility and traceability of changes.

Learning Outcomes: 1. Summarize the challenges that engineering and manufacturing organizations face when managing quality, options, and variants throughout a product lifecycle. 2. Construct and justify a product hierarchy and its associated datasets. 3. Estimate the magnitude of corrective action for a given change and compare it to the application of conformance measurements. 4. Assess the impact of an engineering change. 5. Evaluate and interpret the CM2 model, an industry-standard closed-loop change management process. 6. Differentiate and prepare the main change objects for authorizing and managing work. 7. Summarize the challenges and complexities of lifecycle sustainment and assess how they differ from those in product development. 8. Prepare a detailed change implementation plan. Credits: 3.00

ENGT 54200 - Cyber-Animal Systems I: Technology-Enhanced Animal Welfare

Credit Hours: 3.00. Cyber-Animal Systems is an interdisciplinary course involving hardware science, software science, and animal science students, who will study the interaction of animals and computer-controlled systems. The course addresses recent advances in robotics, data science, and animal husbandry that combine to create collaborative robots, wearable devices, and biological and environmental sensing systems that improve the practice of precision animal agriculture. Topics include case studies of technology adoption in animal agriculture, impacts of animal welfare on farm production and climate, and the importance of animal societies, confounding variables in animal studies, and animal anxiety on the design of experiments for technology integration. All students will learn mentoring techniques for tutoring other students from different disciplines so they develop skills in "lifelong teaching".

Learning Outcomes: 1. Explain the needs of farmers and technologists related to agricultural animal welfare. 2. Create and apply mentoring plans to support peers who are not familiar with your area of expertise. 3. Define animal welfare and apply the procedures of a basic animal welfare assessment. 4. Critically evaluate sensors, processing techniques and systems used to monitor and measure animal welfare and production. 5. Analyze measurement systems for data integrity and availability in a networked environment. 6. Apply design-of-experiments techniques that balance data requirements with the ethics of animal use and animals' needs. 7. Synthesize critiques from reviewing contemporary animal science and IoT literature. Credits: 3.00

ENGT 55000 - Manufacturing System Design For Sustainability

Credit Hours: 3.00. This course prepares manufacturing and information technology leaders to design and analyze manufacturing processes to achieve manufacturing system objectives that meet internal and external customers quality, cost and delivery requirements within a safe environment. The course project covers major aspects of manufacturing system design and Industry 4.0 in the context of meeting customer needs. Technology leaders and entrepreneurs learn how to work with others to develop the design of manufacturing systems that are sustainable (business, ecological, social, technological) for the long term. When to use lean and six-sigma techniques in the context of the manufacturing enterprise system design to meet customer needs will be assessed from a system design perspective, through analytical and computer simulation techniques, and through the use of physical modeling tools.

Learning Outcomes: 1. Relate why and how the design of manufacturing processes/equipment that support manufacturing system requirements enables lower cost, high quality, on-time delivery, volume and mix flexibility, sustainability, and continuous improvement. 2. Determine why our tone affects the ability to make systems improvements; realize that the origin of at least 90 percent of all issues is due to the system design and implementation and not the people. 3. Apply a structured approach and language to identify, describe, and relate system design thinking to implementation

structure and work - i.e. Lean is an outcome of effective system design. 4. Align performance measures to reinforce manufacturing system design requirements with the knowledge that total cost results from the system design. 5. Design a manufacturing system and the included manufacturing processes to establish product flow, part families and takt time -- time per unit (average pace of customer demand). 6. Create a controllable, robust system design, i.e., a manufacturing system that meets customer quality and delivery expectations in spite of disruptions. 7. Reduce the 5 Delays that increase manufacturing lead time by using manufacturing system design. 8. Apply methods to evaluate and develop Manufacturing Systems, including the Manufacturing System Design Decomposition (MSDD), Capability Maturity Model Integration (CMMI), Six Sigma (DMAIC) Process. 9. Describe why Tone, Plan Do Check Act (PDCA), Standard Work, Takt Time and a Robust / Controllable System Design are necessary for continuous improvement and sustainability. 10. Develop an organizational structure to sustain and improve the manufacturing system. Credits: 3.00

ENGT 56100 - Metrology Concepts And Applications

Credit Hours: 3.00. Metrology is a fundamental concept required for obtaining scientific data and understanding instrumentation. This course introduces the concepts of metrology associated with measurement systems: sensors, signal conditioning, data acquisition and analysis, as well as the error propagation. System and environmental noise are investigated along with methods to mitigate influences of noise. Standards and calibration of instrumentation are also studied. Concepts of metrology for the seven basic units of measurements are described from the macro to nano-scale.

Learning Outcomes: 1. Classify instrumentation necessary to make measurements of interest. 2. Summarize standards and calibration associated with measurements. 3. Implement various methods of reducing system and environmental noise. 4. Calculate errors budgets and adjust instrumentation to meet error budgets. 5. Identify ethical and international aspects of measurement science. Credits: 3.00

ENGT 57100 - Applied Nanotechnology

Credit Hours: 3.00. The emerging field of nanotechnology introduces new challenges and opportunities in a variety of career fields. This course introduces students to the concepts of nanotechnology including electronics/mechanics, materials, tools and applications. The experience allows students to move beyond the boundaries of standard application of mechanical and electrical systems into the next generation or dimension of their chosen fields. The course incorporates experiential instruction to reinforce the concepts learned in the lecture. Permission of department required.

Learning Outcomes: 1. Summarize the basic concepts behind nanotechnology. 2. Design nanoelectronic devices. 3. Characterize materials at the nano regime. 4. Extrapolate nanoelectronic applications. 5. Identify ethical and international aspects of nanotechnology. Credits: 3.00

ENGT 58100 - Workshop In Engineering Technology

Credit Hours: 1.00 to 21.00. This course number is used to pilot and develop new graduate level courses. Each 58100 course number is followed by either a unique alphabetic suffix (e.g., ABC) or numeric suffix (e.g., 123) and is given a unique title and course description. These courses can be included in a graduate plan of study with the usual condition that they must be approved by the student's graduate committee. Accordingly, it is important to discuss these courses with your faculty advisor and committee prior to registration. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 21.00

ENGT 58300 - Applied Engineering Statistics For Industry

Credit Hours: 3.00. The purpose of this course is to teach the practitioner how to use and make better-informed decisions as a manager for making optimum process, business, or personnel decisions. Emphasis will be placed on Verification, Validation in R&D, Manufacturing, QA/QC, basic probability, Summarizing Data, Basic Tools (flowcharts, fishbone diagrams, Pareto

charts), Process Capability - Cp/Cpk. Upper and lower control limits/charts, Use of Control Charts for Continual Improvement, Six Sigma, Design of Experiments, Taguchi Methodology and Data Analytics will also be covered.

Learning Outcomes: 1. Demonstrate the importance of the Central Limit Theorem and its application. 2. Evaluate the capability of a process using the process capability index (CPI). 3. Analyze variation reduction in relation to process capability and design of experiments. 4. Articulate how single-piece flow, standard work, and continuous improvement processes enable variation reduction. 5. Determine the expected number of defects from a given process. 6. Explain the statistical meaning of Six Sigma. 7. Differentiate between Type I and Type II errors. 8. Calculate the sample size based on specified Type I and Type II Error. 9. Calculate a confidence interval. 10. Define direct run rate I first time through and its calculation. 11. Develop a hypothesis test. 12. Calculate regression and correlation of data and distinguish between correlation and causation. 13. Select and evaluate the test statistic for different kinds of hypothesis tests and make statistical inference decisions. 14. Construct and evaluate an ANOVA table and make statistical inference decisions. 15. Differentiate among different types of experimental designs and design an experiment. 16. Demonstrate the Taguchi quality loss function and how to make quality loss calculations. 17. Classify the procedural errors that can occur in experimental design, such as confirmation bias. 18. Explain data mining and Big Data and their role in the future of experimental design. Credits: 3.00

ENGT 59000 - Special Problems In Engineering Technology

Credit Hours: 1.00 to 3.00. The ENGT 59000 course code is intended primarily for students to undertake targeted study or projects to develop depth in an area related to their area of research, where no other comparable course is available at Purdue or conveniently elsewhere. You may take up to 9 credits of ENGT 59000 as part of your Plan of Study. Requests to extend the number of credits must be decided within your graduate committee and documented with the Graduate Chair. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 3.00

ENGT 60500 - Engineering Technology Research Writing Strategies

Credit Hours: 2.00 to 3.00. The stated Master of Science in Engineering Technology graduate course teaches research literature mining and analysis found in Purdue licensed databases. Focuses on detail, a measurable topic, literature review, reporting, citation, data visualization using APA. Requires research paper writing aligned with ARWE specifications for in-depth research preparation and reporting. Students will research a topic relevant to a workplace problem in their industry. For example, a new technology, a process (Giga Casting for example), a material, supply chain, digitization, industry 4/5.0, sustainability, workforce diversity, aging workforce, ethics in the workplace, offshoring vs. onshoring, direct part marking, inventory/project management, cybersecurity risks, facility management, energy management, patents/intellectual property or environmental compliance. Keep in mind, Before You Start, that whichever topic you choose, the problem must be measurable. Measurable either from a quantitative or qualitative statistic perspective. Your topic will have to be tied to a global grand engineering challenge we face as a society and/or industry.

Learning Outcomes: 1. Evaluate the data you collected by completing the Workplace Information Literacy Strategies (WILS) activity to determine your research topic. 2. Analyze research topic/focus gained from the WILS, correlate a measurable research problem statement, and relate it to one of the 14 global, grand engineering challenges. 3. Create an Introduction to the problem statement. 4. Synthesize collected data by writing a review of the literature which supports the research problem topic. 5. Evaluate different research measures for the problem, choosing one to assess the problem. 6. Analyze the research measure(s) by using ChatGPT to help determine optimum research measure to write up. 7. Create a research methodology by writing a detailed script on how you intend to

measure the research problem. 8. Submit expected deliverables in a timely manner after evaluating your final analysis report, synthesizing the introduction, research problem statement, review of literature, and research measure. 9. Present a compelling oration of your research topic and significance as to why the topic should be pursued or funded. The creation of a three-minute video debriefing is not an exercise in "watering down" research but forcing you to consolidate your ideas and concisely explain your research discoveries for senior leadership approval and funding. 10. Complete written assignments using APA format and NO passive wording or adverbs. Adhere to the MET 527 Academic Research Writing Expectations (ARWE) handout document. Failure to not read and follow the ARWE document will prove to be an unsuccessful assignment/course experience. 11. Perform individually AND not fall into the plagiarism trap. Credits: 2.00 to 3.00

IET 50700 - Measurement And Evaluation In Industry And Technology

Credit Hours: 3.00. An introduction to measurement strategies in industrial, technical, and human resource development environments. The evaluation of measurement outcomes will be the primary focus of the course.

Credits: 3.00

IET 50800 - Quality And Productivity In Industry And Technology

Credit Hours: 3.00. Examines the contemporary issues of continuous improvement in quality and productivity in manufacturing and service industries. Includes a close examination of the evolving philosophies bearing on the scope, improvement, and costs of quality assurance programs in industry and technology.

Credits: 3.00

IET 53410 - Implementation And Advanced Topics Of Enterprise Six Sigma

Credit Hours: 3.00. This course is designed to expose master's and doctoral students to the theory behind implementation of Six Sigma at the Enterprise level. Students will develop their own research with regard to the future of the discipline through particular assessments. Topics include structure and methodology of Six Sigma deployment, including: systems thinking, change management, business process management, competitive intelligence through international standards, and the future of the discipline. Students will learn the methodology of Six Sigma at the project level for technical skill building in addition to practices of implementing and managing Six Sigma at an organizational level. Permission of Instructor required.

Learning Outcomes: 1. Define Six Sigma by describing the various technical aspects of the DMAIC methodology. 2. Have a knowledge basis suitable to pass an external Six Sigma certification exam. 3. Have the ability to recognize the organizational opportunity for the implementation and management of Six Sigma at the enterprise level. 4. Exhibition of knowledge needed to introduce and champion Six Sigma strategically to the organization. 5. Conduct applied or use inspired research in Six Sigma discipline by identifying current boundaries of the discipline, identify novel applications, and appraise the standardization of the body of knowledge. Credits: 3.00

IET 54500 - Global Supply Chain Management

Credit Hours: 3.00. The objective of this course is to provide in-depth knowledge of global supply chain management and its application in industries. This course explores supply chain management, expanding beyond the linkage between producer and distributor to include other enterprises in the product life cycle, beginning with concept design and ending in disposal. Learning methodologies include lecture, case study, and collaborative student group activities in applied research. Permission of department required.

Learning Outcomes: 1. Demonstrate knowledge of supply chain management terminology, issues, and models. 2. Construct supply chain models and identify advantages and limitations. 3. Critically evaluate supply chain management techniques in applied case studies. 4. Independently develop in-depth knowledge of a supply chain and present the findings in a coherent and informative manner. Credits: 3.00

IET 58100 - Workshop In Industrial Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Mastery of diverse topics related to Industrial Engineering Technology. 2. Integrate the concepts from various topics related to Industrial Engineering Technology. Credits: 0.00 to 8.00

IET 59000 - Special Problems In Industrial Engineering Technologies

Credit Hours: 1.00 to 6.00. Intensive individual study of selected current developments and issues in Industrial Engineering Technology. A faculty sponsor is required for this course. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering. Credits: 1.00 to 6.00

IET 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of Instructor required.

Learning Outcomes: 1. Identify a business or industry relevant solution to a technology related problem 2. Define and/or validate a business or industry relevant problem. 3. Address a technological problem in a systematic and replicable manner. 4. Effectively use technical/professional research and/or development procedures. 5. Identify criteria for success/solution of the problem. 6. Gather information appropriate to the problem by employing business research procedures. 7. Document the research and development activity in a manner that permits replication and assessment of key decisions and alternatives. 8. Write effectively in a form customary to business and industry, using APA format. 9. Prepare and deliver a presentation in a form customary to business and industry. Credits: 1.00 to 3.00

IET 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Vary by course offering due to individual research topics. Credits: 1.00 to 18.00

MET 50300 - Applied Optimization

Credit Hours: 3.00. This course will introduce technology graduate students and senior undergraduates to the basic concepts of optimization methods with particular emphasis on applications in product and process design. Unconstrained nonlinear problems will be presented and solved using steepest descent and conjugate directions. Constrained problems will be solved using exterior penalty functions. Permission of department required.

Learning Outcomes: 1. Recognize optimization problems and cast them in standard form. 2. Identify objective functions and constraints. 3. Use commercial software to solve formal optimization problems. 4. Correctly identify global and local optimum solutions. 5. Use basic calculus concepts to calculate design sensitivities. 6. Understand the geometric concept of design space and be able to plot design space for a constrained problem with two design variables. Credits: 3.00

MET 51500 - Mechanics For Engineering And Technology

Credit Hours: 2.00. Evaluation of static and dynamic systems through the application of mechanics principles. Course will focus on aircraft applications and associated human factors. Topics to be covered include analysis of force equilibrium, kinematics with constant and varying acceleration, kinetics, work, energy, impulse and momentum.

Learning Outcomes: 1. Analyze systems in static equilibrium to determine applied and/or reaction forces necessary for system design and evaluation. 2. Analyze particles or systems of particles to determine acceleration, velocity

and/or position using the principles of dynamics for linear and rotational motion (such as kinematics, force, acceleration, work, energy, impulse and/or momentum). 3. Analyze extended rigid bodies or systems of bodies to determine acceleration, velocity and/or position using the principles of dynamics for translational, rotational and general plane motion (such as kinematics, force, acceleration, work, energy, impulse and/or momentum). 4. Devise relationships between the user and the aircraft to determine applied forces (both pilot to aircraft, and aircraft to pilot or passenger). Credits: 2.00

MET 51800 - Propulsion Mechanics And Electronic Systems

Credit Hours: 3.00. The course provides an in-depth exploration of propulsion systems driven by electro-mechanical technologies, with applications in aerospace, automotive, and industrial sectors. The course will cover the principles of electromechanical energy conversion and its integration with propulsion systems, focusing on electric motors, actuators, and power electronics used in propulsion mechanisms. Emphasis will be placed on the application of modern control systems, thermal management, and the efficiency optimization of electro-mechanical propulsion systems. Students can engage in hands-on projects, using simulation tools to design, analyze, and optimize propulsion systems for performance, durability, and sustainability.

Learning Outcomes: 1. Analyze and design electro-mechanical propulsion systems for various applications. 2. Evaluate power electronics and control systems to optimize propulsion performance. 3. Create outputs from simulation tools for propulsion system analysis. 4. Evaluate the environmental and efficiency impacts of electro-mechanical propulsion technologies. 5. Analyze potential future propulsion technologies strategic applications and scenarios. Credits: 3.00

MET 52700 - Technology From A Global Perspective

Credit Hours: 3.00. Introduction to the challenges faced by the practicing technologist when working and interacting with international technical personnel, both here and abroad, including history, standards, education, and practice of technology outside the United States. Permission of department required.

Learning Outcomes: 1. Awareness and comprehension of cross-cultural factors necessary for international professional practice in technology. 2. Effective research strategies that access what is known about technology development, usage and impact from a global perspective. 3. Knowledge and skill in researching and reporting cultural factors affecting business practices in a variety of independent nation states. 4. Knowledge of procedures, regulations and practices regarding international business. 5. Research skills to identify the natural and technology resources of countries. 6. An ability to contrast the impact of technology infrastructure and use of technology in developed countries to what occurs in underdeveloped countries. 7. Knowledge of the concept and application of ""Appropriate Technology"". 8. Knowledge of the historical development of technology in various modern nations. 9. Informed judgments regarding the influences of cultural and political environments of countries and their technological development. 10. Awareness of the major changes related to current and/or emerging technology in the leading industrial nations of the world. 11. Understanding of the methodologies employed for the effective introduction of technologies into new country or cultural settings. 12. Knowledge of selected International Technology Standards and organizations. Credits: 3.00

MET 53000 - Facilities Engineering Technology

Credit Hours: 3.00. A study of the application of the engineering sciences and technology to the solution of problems associated with mechanical and electrical systems in buildings. Emphasizes commercial and industrial facilities. Identifying

energy conservation measures for both mechanical and electrical systems and evaluating their economic impact are an important focus of the course.

Learning Outcomes: 1. Explain building energy trends and related policy. 2. Explain the organizations and personnel supporting the built environment. 3. Use building automation systems to monitor and control building operation. 4. Quantify energy use in building systems. 5. Use accepted professional practice for technical computations and writing. 6. Calculate the economic impact of energy and resource conservation measures for buildings. 7. Compute the impact of solar energy use for a building. 8. Apply strategies for maintaining Indoor Air Quality in buildings. 9. Evaluate the performance of mechanical or electrical systems in buildings. Credits: 3.00

MET 53500 - Optimization Of Metalcasting Design

Credit Hours: 3.00. The course focuses on optimal design of metalcastings to fit structural requirements (applied loads) and to assure sound manufacturability (castability). Students are expected to learn the general principles of design optimization through hands-on laboratory exercises based on the application of finite element and computational fluid dynamics software.

Learning Outcomes: 1. Analyze and apply advanced principles of metalcasting design to create efficient, high-quality castings with minimal defects and optimal performance characteristics. 2. Utilize modern simulation tools and techniques to predict and mitigate potential casting issues, optimize gating and riser systems, and ensure cost-effective production methods. 3. Develop and implement strategies for material selection, waste reduction, and energy efficiency, ensuring sustainable practices in metalcasting design and production. Credits: 3.00

MET 54600 - Industrial Applications Of Computer Integrated Manufacturing

Credit Hours: 3.00. A study of the development of CIM (computer integrated manufacturing) from the application of basic automation to a fully integrated system for the operation of the business enterprise. Emphasis is placed on the technology, systems, and human resources, which are integrated to accomplish the objectives of the company. Permission of instructor required.

Credits: 3.00

MET 58100 - Workshop In Mechanical Engineering Technology

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 0.00 to 8.00

MET 59000 - Special Problems In Mechanical Engineering Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Learning Outcomes: 1. Varies due to nature of the course. Credits: 1.00 to 6.00

MET 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Learning Outcomes: 1. Varies by course offering due to individual research topics. Credits: 1.00 to 3.00

MET 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Learning Outcomes: 1. Varies by courses due to individual research topics. Credits: 1.00 to 18.00

MFET 51400 - Product Lifecycle Management

Credit Hours: 3.00. A survey of the graphical knowledge base with business and industry applications that support the product

lifecycle management process is presented. Graphical applications used in the development of a product from an initial concept through its disposal are covered. Current and past application topics are reviewed in both theoretical and technological aspects and are validated through applied research. Emphasis is placed on the interdisciplinary nature of product lifecycle management through industrial case studies.

Learning Outcomes: 1. Develop fluency and awareness of the elements of product lifecycle management in the contemporary sense. 2. Describe the basic elements of a PLM environment. 3. Identify organizational barriers to implementing PLM. 4. Describe the various roles in the organization and their relationship to PLM. 5. Describe the concept of the Digital Thread and how it relates to product lifecycle management. 6. Identify potential organizational impacts of PLM. 7. Work within a team to design and deploy a product data management solution that supports PLM and the Digital Thread. 8. Complete a research/white paper targeted at an industry or academic conference and/or publication covering the efforts of the project undertaken during the semester. Credits: 3.00

MFET 51700 - Product Development Using Virtual Environments

Credit Hours: 3.00. This course presents the concepts of product development using virtual reality and haptic devices in the development and manufacture of products. Students learn how this technology is currently being used in industry and anticipated technological advancements. Some of the major topic areas covered are: virtual reality technologies, product design and development processes, virtual environments and virtual prototyping, 3D modeling, design analysis and visualization, simulation visualization, multimodal user interface in virtual environments, and real-world applications of product development. Knowledge of 3D computer graphics fundamentals.

Learning Outcomes: 1. Understand the theory of engineering and product design for virtual environments. 2. Apply the principles of engineering and design in developing 3D models for virtual space. 3. Apply current VR and engineering CAD tools to product development and display scenarios. 4. Describe challenges and issues regarding 3D engineering design in virtual space. Credits: 3.00

MFET 52400 - Model-Based Definition In The Digital Enterprise

Credit Hours: 3.00. This course will explore Model-based definition (MBD), an emerging industry technique that uses 3D CAD models with annotations to communicate information between people and equipment instead of using drawings. This technique results in reduced variability during data translation, more accurate product definition information and wider dissemination of product data through an increasingly digital corporate enterprise.

Learning Outcomes: 1. Understand how MBD is beneficial to the modern manufacturing environment of organizations, along with the use of PLM tools and methods. 2. Author Product Manufacturing Information (PMI) in the selected CAD system. 3. Understand the challenges and opportunities where MBD data can be re-used throughout the lifecycle of the product. Credits: 3.00

MFET 53400 - Technical Documentation In The Digital Enterprise

Credit Hours: 3.00. This course will explore the different ways technical documentation manifests itself within the enterprise to support the digital thread. We will use various industry applications to create and modify technical documentation and explore the processes and applications that facilitate the creation, storage, and configuration of technical documentation.

Learning Outcomes: 1. Provide a history of the evolution of Technical Documentation. 2. Provide an overview and background of the emerging use of Technical Documentation in the context of the Digital Enterprise. 3. Explain and demonstrate how to generate various forms of Technical Documentation for manufacturing. 4. Expose students to the opportunities and uses of Technical Documentation throughout the supply chain. Credits: 3.00

MFET 55700 - Smart Manufacturing Enterprise: Exploring The Applied Technologies

Credit Hours: 3.00. The core foundations of digital transformation in manufacturing for making all things digital, making all things smart, and making all things connected to drive business value.

Learning Outcomes: 1. Analyze how the nine enabling technologies of Industry 4.0 is transforming the manufacturing industry. 2. Demonstrate understanding of the socio-economic impact of Industrial IoT and cyber-physical manufacturing systems will have on human workforce and the manufacturing industry alike. 3. Demonstrate how digital and data assisted systems in manufacturing is used for decision making and augmenting human capabilities in manufacturing. 4. Analyze how information is acquired, exchanged, managed, and leveraged across manufacturing value chain. Credits: 3.00

MFET 55800 - Smart Manufacturing & Global Supply Chain

Credit Hours: 3.00. Progressive manufacturing uses innovative technology to improve products or processes through the Internet of Things. Smart manufacturing is not limited to emerging technologies; rather, it is composed of efficient, productive, highly integrated, tightly controlled processes across a spectrum of globally competitive U.S. manufacturers and suppliers, including the facilities themselves. The course will examine the selection, characteristics, and optimization of materials, processes, big data, cloud analysis of design data, control and adaptive theories, and personnel in a production environment. Examining global manufacturing issues through a variety of business examples, you will study the framework that explains the characteristics and challenges surrounding global supply chain management and investigate the impact on suppliers, manufacturers, and customers.

Learning Outcomes: 1. Evaluate and design automation and control strategies in manufacturing operations. 2. Assess data collection, analysis, and sharing attributes of manufacturing systems and subsystems. 3. Plan and apply strategies for managing data from multiple sources. 4. Analyze and appraise variables significant for global supply chain management. Credits: 3.00

MFET 63400 - Automation Of Digital Product Development Processes

Credit Hours: 3.00. This course introduces students to advanced computer programming techniques in the context of Computer-Aided Design and Manufacturing by focusing on automation and customization procedures of 3D solid modeling, design, and management tasks. The course emphasizes problem-solving skills and creative thinking by developing solutions to manipulate CAD applications, files and PDM systems programmatically. By the end of the semester, students should be able to identify characteristics and common patterns in tasks that lend themselves to automation and select and evaluate the most appropriate mechanisms to implement different levels of automation. Pre-Requisite: CGT 52000 or equivalent.

Learning Outcomes: 1. Demonstrate expertise in manipulating CAD applications and files programmatically. 2. Analyze how CAD systems can be customized to suit unique purposes. 3. Devise algorithms to automate design work and speed CAD/CAM processes. 4. Develop functionality that expands and builds on the capabilities of CAD software. 5. Create complete applications for engineering and design both inside and outside the CAD environment. 6. Improve productivity by reducing the time required to perform repetitive tasks. Credits: 3.00

MFET 64200 - Programming Robotics And Cyber-Physical Systems With The Robotics Commons

Credit Hours: 3.00. Robot Operating System (ROS) is an open-source programming platform that allows the sharing of software packages for more in-depth exploration of complex software projects involving robotics and cyber-physical systems. The basic tools of simulation, visualization, computer vision, simultaneous localization and mapping (SLAM), path planning, manipulation, grasping, and social interaction in robotic systems will be presented in the context of advanced projects with a publishable result. Students will develop complex, independent projects as part of the class that will result in a final report in the form of a publication-worthy paper suitable for submission to an international conference. Student knowledge of a procedural programming language, familiarity with robotics, and a rudimentary understanding of linear algebra is assumed.

Prerequisites: ECE 56900.

Learning Outcomes: 1. Design and analyze ROS software consisting of pre-written packages and custom packages to implement complex robotic applications on arms and vehicles. 2. Apply advanced software engineering techniques to designing and documenting software. 3. Synthesize 2-D and 3-D computer vision techniques for 2-D and 3-D sensors for control of robots and systems in 3-D. 4. Analyze papers from the contemporary robotics and CPS literature and synthesize critiques of the contributions. 5. Develop advanced projects and defend their contributions. Credits: 3.00

Department of Technology Leadership and Innovation (Graduate)

***Website*: https://polytechnic.purdue.edu/degrees/ms-technology-leadership-innovation**

Department/School Head

Todd Kelley

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Mesut Akdere Sabine Brunswicker Nathalie Duval-Couetil Todd R. Kelley Nathan Mentzer	Paul Asunda Lisa Bosman Linda L. Naimi Greg Strimel	Monica Gamez-Djokic Brandon Grant Jennifer Linvill Cho Hyun Park Regena Scott

Academic Programs

Master's, Certificates, and Ph.D. Programs

The Department of Technology Leadership & Innovation prepares graduate students to lead the development and successful introduction of high-tech solutions in business, industry, and the classroom. From teaching tomorrow's teachers to understanding the nuances in each technological challenge, our graduate programs focus on improving and shaping the future of technology and its uses.

Information Assurance Education, Post-Baccalaureate Certificate

Technology, PHD

Technology, MS

Technology, DTECH

Human Resource Development, Post-Baccalaureate Certificate

Technology Leadership and Innovation: STEM Education Leadership Concentration, MS

Technology Leadership and Innovation: Digital Innovation Concentration, MS

Technical Communication, Post-Baccalaureate Certificate

Project Management, Post-Baccalaureate Certificate

Smart Manufacturing Enterprise, Post-Baccalaureate Certificate

Technology Leadership and Innovation, MS (OL)

IT 54000 - Biometric Performance And Usability Analysis

Credit Hours: 3.00. An introduction of test methodologies from disciplines outside of biometrics, which include: usability, ergonomics, human factors, and human-computer interaction, in order to demonstrate how biometric data analysis can benefit from understanding how humans interact with biometric sensors during the testing and evaluation of biometric systems. The course explores test methods, case studies, and prior biometric testing reports in order to develop a test methodology that includes information on how users interact with biometric systems. Permission of department required.

Learning Outcomes: 1. Understand the operation of biometric systems. 2. Understand how people use biometric systems in operational settings (both controlled and uncontrolled). 3. Understand traditional technology, scenario, and operational testing methodologies. 4. Understand traditional ergonomic and usability testing methodologies. 5. Understand and analyze the limitations of biometric systems. 6. Understand basics of quantitative and qualitative research. 7. Evaluate the issues in designing a biometric system, including but not limited to: the impact of language and culture (instructions and symbols), ergonomics and anthropometrics (heights-angles, positioning), training and habituation or accessibility, affordance, and perception. 8. Interpret results from reports on: biometric technologies evaluation methods, ergonomic and usability methods, and statistical methods. 9. Appraise and critically evaluate prior scenario and operational test reports and case studies of biometric technologies to examine where the application of Human-Biometric Sensor Interaction principles, such as usability, human factors, and ergonomics could have provided additional data on system performance. 10. Transfer knowledge and understanding of usability, ergonomic, and usability evaluation methodologies to the testing and evaluate biometric devices and systems. 11. Establish a test methodology and collect data using a Human-Biometric Sensor Interaction based methodology (usability, ergonomic, human factors) to investigate a current problem facing industry. 12. Perform the appropriate data analysis and report findings in a report. 13. Students will produce final reports, conference papers, etc., based on their course project. Credits: 3.00

IT 54500 - Biometrics Technology And Applications

Credit Hours: 3.00. Examines biometrics technology as it relates to security, access control, and the authentication of individuals. The course will examine biometric technologies including iris, face, finger, hand geometry, dynamic signature verification, skin print analysis, and voice recognition. Permission of instructor required.

Credits: 3.00

IT 57100 - Project Management In Industry And Technology

Credit Hours: 3.00. The factors influencing decisions during the initiation, implementation, and termination of industrial and manufacturing projects are examined. Students work as project teams, using project management tools to develop implementation strategies. Permission of instructor required.

Learning Outcomes: 1. Understand and learn latest tools and techniques used in projects. 2. Develop a system perspective for understanding projects. 3. Align projects with strategic objectives. 4. Develop and think analytically in order to successfully apply knowledge and technical expertise to the solution of real business problems. Credits: 3.00

IT 59000 - Special Problems In Industrial Technology

Credit Hours: 1.00 to 6.00. Independent study of a special problem under the guidance of a member of the staff. Does not substitute for either M.S. thesis or M.S. project credit. Permission of instructor required.

Credits: 1.00 to 6.00

IT 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of department required.

Credits: 1.00 to 3.00

OLS 50100 - Leadership And Ethics

Credit Hours: 3.00. This course is an examination of ethical, legal and policy issues facing business and technology leaders. Topics include perspectives on business ethics and values, ethical issues and theory, personal values in the workplace, values and heuristics, responses to ethical situations, corporate social responsibility, sustainability and the responsible corporation, ethical compliance, global and local values, globalization and international business. In particular, this course will ask students to examine, analyze and understand the concept of servant leadership as an ethical construct for leaders. This course uses various learning tools including the case study method and involves active discussion and debate in an online setting. Typically offered Fall Spring Summer.

Learning Outcomes: 1. Analyze a range of perspectives and approaches to the study of ethics in leadership. 2. Sharpen and synthesize critical thinking, communication and reasoning skills. 3. Enhance knowledge and application of laws and regulations that affect businesses and industry, scientific research, technology innovations and public policies. 4. Develop sound problem solving and analytical skills. 5. Strengthen research, writing, debate, and technology skills. 6. Analyze, create solutions for global, technological and security challenges for business leaders. 7. Read about, critically analyze and debate the concept of Servant Leadership as an ethical construct for leadership. Credits: 3.00

OLS 50701 - Quantitative Analysis And Analytics For Leaders

Credit Hours: 3.00. This course emphasizes the use of statistical analysis in critical decision making. Specifically, the course focuses on selecting data and running appropriate statistical analyses, synthesizing findings based upon the analyses, making decisions based upon the findings, and using multiple modes to present the data, the findings, and recommendation(s) for action.

Credits: 3.00

OLS 51500 - Foundations Of Human Resources

Credit Hours: 3.00. A survey course emphasizing the human resource function (and its development) in the context of the work organization. Human resource development topics include exploration of various training and development techniques, the relation of training to organizational strategies, training needs analysis, evaluation of training, and career development. The strategic approach to human resource management also is covered, including what human resource professionals can and should do to help the organization succeed. Permission of Department required.

Credits: 3.00

OLS 51600 - Diversity, Equity, And Inclusion For Organizational Leaders

Credit Hours: 3.00. This course will assist students in identifying and understanding diversity, equity, and inclusion

issues in the workplace. Students will engage with various theories and concepts related to workplace and societal diversity, equity and inclusion and apply them to organizational settings.

Credits: 3.00

OLS 53100 - Advanced Visual Technical Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of visually communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Apply effectively visual technical communication principles when designing publications, especially technical ones, which communicate both visually and with words. 2. Apply project management skills. 3. Apply group collaborative writing skills. 4. Design and refine publications for clients within specific situations. 5. Evaluate, use, and understand relevant software for creating visual technical communication. Credits: 3.00 or 4.00

OLS 53200 - Advanced Managing Document Quality

Credit Hours: 3.00 or 4.00. In this course, students will examine and apply principles of creating a technical or professional publication from start to finish Students will explore and practice publication quality management issues such as planning, researching audience and content, designing the publication, drafting, obtaining reviews, conducting usability testing, and negotiating within organizational cultures.

Learning Outcomes: 1. Explain the features that affect document quality. 2. Apply and explain the processes that lead to effective technical/professional publications. 3. Evaluate, use, and explain software tools that can aid technical communicators in managing the publication creation process. 4. Apply concepts relevant to effective processes that technical communicators need to understand. 5. Apply user-centered design principles and usability testing in the process of creating effective publications. 6. Synthesize ideas from secondary research concerning an emerging concept in the field that will be useful in professional practice. Credits: 3.00 or 4.00

OLS 53300 - Advanced Research Approaches For Technical And Professional Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of conducting applied research in technical and/or professional communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Generate effective research questions, suitable for workplace technical/professional communication research into audience, content, and communication approaches. 2. Conduct and report on results of secondary research relevant to technical/professional communication. 3. Design, conduct, and report on the results of primary research relevant to technical/professional communication. 4. Analyze reports of technical/professional communication research. 5. Explain the rationale for technical/professional research approaches, based on sound concepts and noting the capabilities and limitations of various approaches. Credits: 3.00 or 4.00

OLS 56300 - Sustainable Practices In Business And Industry In The European Union

Credit Hours: 3.00. This course examines and critically assesses sustainable practices in businesses, industries, and/or municipalities in Germany OR France. Students will spend one week in Marseille, France OR Mannheim, Germany visiting, touring, and analyzing businesses, industries or municipalities on their sustainable practices, culture and technical language skills.

Learning Outcomes: 1. Acquire knowledge of issues in sustainability (interdisciplinary area) as it relates to business and industry internationally and nationally. 2. Analyze, compare and contrast sustainable practices in German or France businesses or industries with comparable U.S. businesses or industries. 3. Identify and describe trends and business

practices in various sustainable organizations. 4. Utilize and synthesize sustainable knowledge from course to apply in life upon return to U.S. 5. Acquire knowledge and appreciation of German or French culture and some language skills. 6. Understand and analyze the interconnectivity of global concerns. Credits: 3.00

OLS 57100 - Advanced Project Management In Technology

Credit Hours: 3.00. This course helps students learn project management through applying technology project approaches in teams. Using project tools and templates, students learn the technology project life-cycle through actual and simulated situations. The course presents terms and approaches used in industry and allows students to apply methods individually and in teams.

Credits: 3.00

OLS 57200 - Integration Of Project Management For Leaders

Credit Hours: 3.00. This course emphasizes critical analysis, synthesis, and evaluation of theories and applications of project management knowledge and skills, leadership, communication, and stakeholder engagement. Students integrate theoretical and applied skills in planning, distributing, and managing communication; analyzing and interpreting project organization in context; and applying best practices in team management.

Learning Outcomes: 1. Compose and apply an appropriate communication strategy for a given situation. 2. Prepare professional documentation and presentations consistent with university and diverse workplace standards. 3. Demonstrate interpersonal skills consistent with expectations for project managers. 4. Apply critical and innovative thinking skills to improve their own, and other's decision making processes within projects. 5. Evaluate alternative strategies and implement major aspects of project management for a realistic project. 6. Model ethical sensitivity for a given situation. 7. Apply critical thinking and problem-solving skills to project knowledge areas and processes. 9. Consider and relate basic leadership principles and processes to address leadership issues and to remove obstacles in the project environment. 10. Locate, assess, and synthesize current literature on topics associated with project management competencies. 11. Facilitate the organizational change management process and encourage behavior to maximize project success. 12. Analyze power dynamics and organizational politics and suggest conflict management and negotiation techniques relevant to the project. 13. Identify, recognize, and engage both internal and external project stakeholders. 14. Demonstrate how project purpose, organizational structure, culture, roles, and knowledge management affect the ability to lead a project team. 15. Evaluate roles of team members, how they contribute to projects, and apply an understanding of self in how they relate to teams. 16. Apply knowledge of team building, operation, and behavior, considering factors that influence effectiveness for all types of teams, including those that are virtual and global. Credits: 3.00

OLS 57400 - Managerial Training and Development

Credit Hours: 3.00. Review of current managerial education and development theories and practices; discussion of fundamental social, economic, and political changes affecting business and the work of managing; implications of these changes for individual manager development and continued growth.

Credits: 3.00

OLS 57900 - Emerging World-Class Leadership Strategies

Credit Hours: 3.00. Exposes graduate students to the theoretical foundation and empirical research associated with emerging strategies and theories in the study of world-class leadership. The structure of the course is four fold: the discovery of critical leadership skills and behaviors, discovery of critical world-class leadership strategies, encouragement of self analysis, discovery of leadership strengths, and conducting research on leadership issues. Permission of instructor

required.

Credits: 3.00

OLS 58000 - Interpersonal Skills For Leaders

Credit Hours: 3.00. Development and improvement of interpersonal and group dynamic skills for effective leadership in organizations. Emphasis on action learning and real-world application of skills. Course may be offered in traditional, distance, or blended format. Open to all graduate students with special consideration given to senior OLS students with 3.0 GPA and School of Technology graduate students.

Credits: 3.00

OLS 58100 - Workshop In Organizational Leadership And Supervision

Credit Hours: 0.00 to 8.00. Advanced study of technical and professional topics. Emphasis is on new developments relating to technical, operational, and training aspects of industry and technology education. Course may be offered in traditional, distance, or blended format. Course format may vary, depending upon topic of course.

Credits: 0.00 to 8.00

OLS 58200 - Leadership and Organizational Change

Credit Hours: 3.00. Explores issues in leadership and organizational change. Included are change theories, utilizing resistance to change, contemporary approaches to change, the future workplace, and researching best practices in organizational change.

Learning Outcomes: 1. Attain an understanding of the major models of change theory. 2. Gain skills in managing change through pragmatic applications of change theories. 3. Complete a major change research project in which they investigate a change initiative, gather data, and make recommendations for successfully implementing the change. Credits: 3.00

OLS 58300 - Coaching And Mentoring In Organizations

Credit Hours: 3.00. This course explores issues and practices in technologically-driven organizations pertaining to the roles and functions that coaching and mentoring play in employee development. A "best practices" approach, utilizing the case method, is emphasized. Presented from the point of view of a human resource manager/leader, the focus of the course is on identifying coaching opportunities, enhancing communication skills, developing and implementing coaching and mentoring strategies, and evaluating the outcomes of these strategies. Attention is directed to facilitating personal coaching mentoring skills. Course may be offered in traditional, distance, or blended format. Permission of department required.

Credits: 3.00

OLS 59000 - Individual Research Problems In Supervision And Personnel

Credit Hours: 1.00 to 6.00. Opportunity to study specific problems in the field of supervision and personnel under the guidance of a qualified faculty member within the department. Does not include thesis work. Permission of instructor required.

Credits: 1.00 to 6.00

OLS 59800 - Directed MS Project

Credit Hours: 1.00 to 3.00. A formal investigation of a particular problem under the guidance of the advisory committee. Not applicable to a thesis option plan of study. Enrollment during at least two consecutive terms for a total of three credits is required. Permission of instructor required.

Credits: 1.00 to 3.00

OLS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

TCM 51000 - Effective Workplace Technical Communication

Credit Hours: 3.00. Students from a variety of majors will blend theory and practice as they analyze variables in workplace communication contexts, apply iterative processes of creating effective technical communication, and produce publications within typical workplace technical communication genres.

Learning Outcomes: 1. Analyze workplace technical communication problems and recommend appropriate changes using arguments shaped by synthesis of secondary research findings. 2. Research, evaluate, select, organize, and present technical knowledge effectively to specific audiences in organizational settings. 3. Design communication that uses language and visual elements appropriately for the audience and circumstances in business and industry

contexts. 4. Manage communication processes in individual and collaborative projects. 5. Evaluate relevant software to create and respond to technical communication. Credits: 3.00

TCM 54000 - Advanced Managing Document Quality

Credit Hours: 3.00 to 4.00. In this course, students will examine and apply principles of creating a technical or professional publication from start to finish Students will explore and practice publication quality management issues such as planning, researching audience and content, designing the publication, drafting, obtaining reviews, conducting usability testing, and negotiating within organizational cultures.

Learning Outcomes: 1. Explain the features that affect document quality. 2. Apply and explain the processes that lead to effective technical/professional publications. 3. Evaluate, use, and explain software tools that can aid technical communicators in managing the publication creation process. 4. Apply concepts relevant to effective processes that technical communicators need to understand. 5. Apply user-centered design principles and usability testing in the process of creating effective publications. 6. Synthesize ideas from secondary research concerning an emerging concept in the field that will be useful in professional practice. Credits: 3.00 to 4.00

TCM 55000 - Advanced Research Approaches For Technical And Professional Communication

Credit Hours: 3.00 or 4.00. This course is intended for graduate students who wish to learn the theory and practice of conducting applied research in technical and/or professional communication. Prerequisites: A background in technical communication is desirable, but not required.

Learning Outcomes: 1. Generate effective research questions, suitable for workplace technical/professional communication research into audience, content, and communication approaches. 2. Conduct and report on results of secondary research relevant to technical/professional communication. 3. Design, conduct, and report on the results of primary research relevant to technical/professional communication. 4. Analyze reports of technical/professional communication research. 5. Explain the rationale for technical/professional research approaches, based on sound concepts and noting the capabilities and limitations of various approaches. Credits: 3.00 or 4.00

TLI 52000 - Foundations Of Innovation Studies

Credit Hours: 3.00. Foundations Of Innovation Studies has been designed to provide a broad spectrum introduction to the field of innovation studies. Students will gain practical and theoretical knowledge of innovation at a variety of levels, including the individual, team, organizational, and ecosystem contexts. Students will examine innovation strategies and tensions within the innovation "Triple Helix" of industry, academia, and government through the use of case studies and individually selected research reports. Throughout the class, students will examine recent innovation efforts and present short innovation cases that align with the learning objectives of the class.

Learning Outcomes: 1. Identify innovations in multiple settings and define the key characteristics that enabled those innovations. 2. Relate multi-level innovation practices to institutional outcomes. 3. Define and contrast the conditions that foster innovative thinking and development. 4. Critically assess modern examples of innovation and suggest ways to improve outcomes. Credits: 3.00

TLI 54000 - Smart Manufacturing Enterprise: Organizational Behavior And Leadership In The Digital Enterprise

Credit Hours: 3.00. Smart manufacturing is about increasing efficiency and eliminating pain points in your system. It's characterized by a highly connected, knowledge-enabled industrial enterprise where all organizations and operating systems are linked, leading to enhanced productivity, sustainability, and economic performance. Implementing smart manufacturing techniques requires an effective understanding of organizational behavior and leadership skills required for the new digital enterprise. This knowledge of individuals' perceptions, attitudes, and behavior enables leaders to choose

appropriate leadership styles and managerial practices to increase organizational effectiveness and positive human outcomes. This course will provide an overview of organizational behavior and leadership concepts important for implementing change within a smart manufacturing enterprise.

Learning Outcomes: 1. Critique the opportunities and challenges related to organizational behavior resulting from implementing smart manufacturing and Industry 4.0. 2. Apply organizational behavior theories, frameworks, principles and tactics to prevent and respond to organizational behavior problems driven by employing smart manufacturing related changes. 3. Evaluate an understanding of one's own leadership style and create a plan to improve their own personal leadership skills. Credits: 3.00

TLI 62500 - Research In Open Innovation I

Credit Hours: 3.00. This is a research-oriented course designed for graduate students who aim to develop and implement a scientific research project in the field of open innovation. They will critically discuss and evaluate scientific writings relevant to the new research area of open innovation from the fields and disciplines of innovation studies, information systems, and other social sciences. Through synthesis of theories and frameworks used in academic articles, the students will develop a theoretically and practically motivated research question. They will also implement a pilot study to examine their hypotheses. The Research Center for Open Digital Innovation (RCODI) in the Discovery Park at Purdue will offer opportunities to plan and implement individual questions, if students have not identified their own data source. In addition, the students will participate in an action-oriented research project in open innovation performed by the class as a group project to gain experience in experimental innovation research and practice. Prerequisites: Basic statistics (at least STAT 30100 or equivalent, STAT 50100 or higher is recommended); foundational knowledge in scientific research (TECH 64600 or SOC 58000 or equivalent). Permission of instructor required.

Learning Outcomes: 1. Evaluate and synthesize scientific literature on open innovation. 2. Develop a research question and model for an empirical study in the field of open innovation. 3. Implement a pilot study in open innovation and prepare a scientific article. Credits: 3.00

TLI 62600 - Technology Entrepreneurship And Research Translation

Credit Hours: 3.00. (ABE 62600) The course is designed to introduce graduate students and faculty mentors to the intellectual, financial, and management processes associated with translating research into tangible products through university initiated, early-stage commercialization (start-up) activities. Lectures will present case studies of technologies and pathways to commercialization. Guest speakers will illustrate the start-up process through real-world experience, and will also address approaches for managing entrepreneurial activities, intellectual property and conflicts of interest in a university environment. No course prerequisites, however students should be involved in research with commercial implications. Permission of instructor required.

Learning Outcomes: 1. Understand the processes through which translation of research from laboratory to products occur. 2. Describe technologies and commercialization strategies for IT, analytical instrumentation, biopharmaceutical, biomedical, biofuels, and other technologies. 3. Achieve literacy in the business and other discourse related to intellectual property and technology commercialization. 4. Be connected to a network of innovators, entrepreneurs, and service providers on and off campus. 5. Execute analysis required to determine if, how, and when to launch new technologies into a translational pathway. Credits: 3.00

TLI 66200 - Philosophy Of Technology

Credit Hours: 3.00. The term technology has multiple meanings and applications so vast that one clear and all-encompassing definition of the term has become unattainable. However, to build an epistemology of technology, we must explore ways to define technology so to provide a foundation for a philosophy of technology. This course will explore multiple views and definitions of technology embedded within the scholarly work focused on technology in order to build and defend a philosophy of technology.

Learning Outcomes: 1. Develop a working definition of technology. 2. Describe the multiple views of technology and explain how these views shape the way people develop a philosophy of technology. 3. Identify ways in

which technology influences society and how society influences technology. 4. Debate the lines between science vs. technology in order to identify their similarities and differences. 5. Explore the ethical implications of technology. Credits: 3.00

College of Science (Graduate)

Department of Biological Sciences (Graduate)

Website: https://www.bio.purdue.edu/Academic/graduate/index.html

Department/School Head

Janice Evans

Graduate Office Contact

Patricia Dimmitt, poliver@purdue.edu
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Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty	Research Faculty
Edward L. Bartlett Leslie, N. Csonka Janice Evans Esteban Fernandez-Juricic Stanton B. Gelvin Michael Gribskov Peter J. Hollenbeck Wen Jiang Daisuke Kihara Richard J. Kuhn Jeffrey R. Lucas Zhao-Qing Lou Andrew David Mesecar Dennis J. Minchella Peristera Paschou Donald F. Ready Christie	Ruben Claudio Aguilar E. Bernal Ximena Ignacio G. Camarillo C. Chang Henry Mark Christie Alexander Chubykin Qing Deng David Eichinger Alan M. Friedman Stephanie M. Gardner S. Selcen Guzey Andrea Kasinski Yuk Fai Leung Angeline Lyon Seeman Mattoo	Brittany Allen-Peterson Leifu Chang Meng Cui Jimmy Dooley Jason Hanna Qixin He Gordon McNickle Lauren Ann Metskas Brian Metzger Sergio Munoz-Gomez Matthew Olson Daniel Park Scott Pluta Estuardo Robles Dylan Wainwright	John Anderson Arthur Arnson Timothy Baker Anna Berkovitz Jeffrey T. Bolin David Bridges Alfred J. Chiscon Martha Chiscon William Cramer Richard Dilley Donna Fekete Michael Forman Richard Howard Robert Hurst Laurie Iten Stephen F. Koniecznny Allan Konopka Mark Levinthal Levy,	Andrey Fokin Thomas Klose Lan-Ying Lee Feng Long Zhiqing Wang Stanislav Zakharov Henry Zhang

L. Sahley Chris J. Staiger Daniel M. Suter Cynthia V. Stauffacher Ramaswamy Subramanian John Tesmer Daoguo Zhou	Nicholas Noinaj David A. Sanders Catherine L. Searle		Morris Sanford Ostroy William Pak Nancy Pelaez Samuel Postlethwait Kerry Rabenold William Ray Kenneth Robinson Michael G. Rossman Louis Sherman Elizabeth Taparowsku Joseph Vanable Peter Waser	

Academic Programs

Master's and Ph.D. Programs

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Graduate study in **Biological Sciences** at Purdue University is multi-disciplinary, offering a wide variety of choices for a doctorate and master's degrees. Areas of research include **Biology Education; Cell & Molecular Biology; Ecology & Evolutionary Biology; Microbiology, Immunology, & Infectious Disease; Neuroscience & Physiology; Structural and Computational Biology and Biophysics.** A major advisor may be selected in any of these areas. In addition, several interdisciplinary programs also are available in conjunction with other departments and divisions within the University. We, therefore, welcome applicants from different disciplines such as chemistry, physics, and related fields as well as students from traditional biological backgrounds.

Biological Sciences, MS

Biological Sciences, PHD

Biological Sciences/Cancer Research, PHD

BIOL 50700 - Principles Of Molecular Biology

Credit Hours: 3.00. Molecular aspects of structure and function of nucleic acids and proteins, including recombinant DNA research. Prokaryotic and eukaryotic molecular biology are given equal weight.

Credits: 3.00

BIOL 51099 - Neural Mechanisms In Health And Disease

Credit Hours: 3.00. An examination of the mechanisms by which nervous systems process information in normal and pathologic states. Cellular and systems-level information processing will be studied with a focus on sensory and motor systems. Students will gain some hands-on experience in the analysis of neural data. Some neuroanatomy will be included to understand how nervous systems are organized. Pathological states such as Alzheimer's, autism, and aging will be studied,

both in terms of understanding the systems and cellular deficits as well as examining potential solutions to improve the outcomes for these neural disorders.

Learning Outcomes: 1. Describe the organization of the mammalian nervous system, cellular neurophysiology, and neural plasticity. 2. Apply neural information processing principles to determine how external and internal variables drive neural activity and behavior. 3. Design experiments by selecting appropriate techniques and measurements in order to address an experimental question or hypothesis. 4. Analyze and interpret neural data, mainly neurophysiological data, to answer questions about neural coding and with respect to an experimental hypothesis. 5. Develop preliminary therapeutic solutions to neural disorders based on understanding neural mechanisms and devices used to measure or treat these disorders. Credits: 3.00

BIOL 51101 - Intro To X-Ray Crystallography

Credit Hours: 3.00. This course will provide an introduction to structure determination of macromolecules using X-ray crystallography and will attempt to balance theory and practice, consisting of ~60% lectures and ~40% lab modules. The course is divided into five 3-week modules covering (i) Crystallization, (ii) Data Collection, (iii) Molecular Replacement, (iv) Experimental Phasing, and (v) Model Building and Refinement, Validation, and Visualization. The goal of the course is to equip students with the necessary tools to develop and execute an X-ray crystallography project, starting from construct design to publication. By the end of the course, students should be familiar with the (i) structure determination pipeline, (ii) theory behind X-ray diffraction methods, (iii) methods for crystallization, (iv) phasing options for solving a crystal structure, and (v) contemporary crystallography software.

Learning Outcomes: 1. Learn the theory behind X-ray crystallography. 2. Learn how to use contemporary software that is used to solve structures and what that software are doing. 3. Gain hands-on experience in crystallization and handling crystals for data collection. 4. Gain hands-on experience collection data remotely from a synchrotron source and at a home source X-ray instrument. 5. Learn how to determine a structure using either molecular replacement and/or experimental phasing; and will learn how to prepare their results for a publication and deposition. Credits: 3.00

BIOL 51201 - Advanced Cell Biology

Credit Hours: 3.00. This course provides detailed analysis of cell biology, gene regulation and applications of cell biology and genetics. This is a lecture, literature and presentation-driven course that utilizes an advanced graduate-level textbook as a foundation to dive into recent primary literature on new and emerging topics in cell biology.

Learning Outcomes: 1. Understand the fundamentals of gene expression, cytoskeleton, cell signaling, cell-cell communication and how cell systems are visualized. 2. Predict outcomes and analyze experimental approaches. 3. Compare and contrast the use of experimental techniques used in the field of cell biology. 4. Formulate hypotheses based on several pieces of primary data. 5. Evaluate scientific literature critically and communicate their views. 6. Analyze and interpret the quality of primary data. 7. Communicate in oral presentations recent findings in the field. 8. Write a paper that summarizes and integrates the literature associated with a major discovery. Credits: 3.00

BIOL 51202 - Methods And Measures In Biophysical Chemistry

Credit Hours: 3.00. Biological applications of physical methods including absorption spectroscopy (UV-Vis, FTIR and Raman and CD spectroscopy), fluorescence spectroscopy and super high-resolution imaging, spin resonance methods (NMR and ESR spectroscopy), mass and thermodynamic based methods (thermophoresis, analytical ultracentrifugation, ITC and surface plasmon resonance) and diffraction/structural methods using NMR, cryo-EM and X-ray scattering/crystallography. Each topic is treated at an introductory level with examples from the literature. The course objective for students is to obtain a general understanding of the physical principles underlying each of the techniques, as well as the basic ability to apply the technique to biological systems of interest.

Learning Outcomes: 1. Understand basic biophysical principles and the biophysical

approach to research. 2. Interpret biophysical data from real experimental examples in the literature. 3. Develop presentation skills. 4. Practice Team Cooperation. 5. Demonstrate an understanding of biophysical methods and how these are used in modern biological experiments. Credits: 3.00

BIOL 51600 - Molecular Biology Of Cancer

Credit Hours: 3.00. A detailed course examining the molecular mechanisms controlling the growth of animal cells. Emphasis will be placed on current experimental approaches to defining the molecular basis of growth regulation in developing systems and the uncontrolled proliferation of cells in metabolic disorders, such as cancer.

Credits: 3.00

BIOL 51606 - Pathways In Human Health And Disease

Credit Hours: 3.00. This course is intended for both upper-level undergraduate and graduate students. It will cover major intracellular signaling pathways in eukaryotes and their roles in human disease, with an emphasis on cancer but also touching on other major modern diseases such as COVID-19. We will explore avenues being pursued to target signaling mechanisms for therapeutic benefit. Topics include G protein-coupled receptors, receptor tyrosine kinases, nuclear hormone receptors, protein kinases and phosphatases, mTOR, the Wnt/β-catenin pathway, cell cycle control, DNA damage checkpoint control, regulated proteolysis, and programmed cell death. The course will be taught from current primary literature using a textbook as a background resource. Students will learn how to read and interpret scientific data through regular lectures, extramural seminars, in-class presentations, and take-home assignments.

Learning Outcomes: 1. Identify common molecular mechanisms in major signal transduction pathways. 2. Understand methods commonly used to analyze signal transduction processes. 3. Appreciate how protein domains within signaling proteins impart selectivity by building up signaling pathways via protein protein-interactions. 4. Evaluate and critique data in the scientific literature or in lectures in the signal transduction/cell cycle fields. 5. Exhibit improved oral and written communication skills in the area of signal transduction research. Credits: 3.00

BIOL 51700 - Molecular Biology: Proteins

Credit Hours: 2.00. Principles of protein three-dimensional architecture. The molecular and structural basis of protein folding, function, and evolution.

Credits: 2.00

BIOL 52900 - Bacterial Physiology

Credit Hours: 3.00. A detailed consideration of the central metabolic routes, their role in generation of energy and key intermediates, and the conversion of those intermediates to small molecule building blocks. Regulatory mechanisms will be stressed.

Credits: 3.00

BIOL 52905 - Disease Ecology

Credit Hours: 3.00. Study of the ecological and evolutionary complexity inherent to host-pathogen interactions. Includes case studies from a diverse array of systems, including plants, animals, aquatic and terrestrial systems. Emphasis is on the interactions between multiple hosts and pathogens within complex, dynamic environments. Introduction to parasite and pathogen diversity, host-pathogen coevolution, community ecology and the importance of pathogens in conservation and management.

Learning Outcomes: 1. Evaluate the roles played by the diversity of parasites and pathogens found in complex natural systems. 2. Apply the foundational principles of disease ecology - the importance of hosts, pathogens and the environment in disease dynamics - to understand disease dynamics in natural systems. 3. Evaluate the strengths and weaknesses of different modeling approaches in disease ecology. 4. Understand how disease models are used in management and conservation. 5. Apply both ecological and evolutionary theory to examine the impact of infectious disease on host populations, communities and ecosystems. 6. Demonstrate an understanding of patterns in pathogen diversity and abundance across landscape to regional scales. 7. Articulate understanding of disease ecology through written and oral

communication. 8. Demonstrate an understanding of the scientific literature and an ability to critically evaluate this research for an interdisciplinary topic. Credits: 3.00

BIOL 53000 - Introductory Virology

Credit Hours: 3.00. Detection, titration, and chemistry of viruses; viral host interactions: bacteriophage-bacterium, animal virus-animal cell, plant virus-plant cell; tumor viruses: infection and transformation.

Credits: 3.00

BIOL 53300 - Medical Microbiology

Credit Hours: 3.00. Host-parasite relationships. Immunology. Bacteria and viruses associated with infectious diseases.

Credits: 3.00

BIOL 53601 - Biological And Structural Aspects Of Drug Design And Action

Credit Hours: 3.00. (BCHM 53600) This course is aimed at expanding students' fundamental interests in biology, chemistry and biochemistry to how drugs work. The course will provide an overview of the modern day drug discovery pipeline and an in-depth look at the basic biology, structure, and mechanisms-of-action behind marketed therapeutics. The course will start with a historical account of the discovery of natural product drugs such as aspirin and penicillin and will then venture into the modern day era of drug discovery including structure-based drug design. We will explore different classes of antibiotics, antiviral, and anti-cancer drugs and their targets including small molecule drugs and modern biologics-based drugs.

Learning Outcomes: 1. Understand and communicate the site and mechanism-of-action of a drug. 2. Understand and communicate the relationship between the pharmacologic mechanism and the therapeutic use of a drug. 3. Understand and communicate the scientific basis for the therapeutic use of a drug. 4. Predict, verbally or in writing, the biological response, if any, from a given chemical structure. 5. Understand and communicate the relationship between the structural features of a compound and the physicochemical properties that might influence biological response or the design of new agents. 6. Predict, verbally or in writing, the biochemical mechanism-of-action of a biologically active substrate or compound from its chemical structure. 7. Communicate and describe the relationship between the chemical structure of a biologically active compound and the receptor or active binding site, using enzyme or receptor models. 8. Predict, verbally or in writing, the biological response resulting from the chemical alteration or biochemical pathways. 9. Discuss the relationship between in vitro reaction mechanisms and the structural features that alter the in vivo biotransformation of a drug. 10. Understand and communicate the pathophysiologic processes associated with a particular disease state, and how they might be affected by drug therapy. Credits: 3.00

BIOL 53700 - Immunobiology

Credit Hours: 3.00. Readings and discussion in the structural, cellular, and genetic basis of the immune response. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 53800 - Molecular, Cellular, And Developmental Neurobiology

Credit Hours: 3.00. Molecular mechanisms of neural cell biology and development are considered. Topics and readings are drawn from the current primary literature. BIOL 42000 recommended as a prerequisite.

Credits: 3.00

BIOL 54100 - Molecular Genetics Of Bacteria

Credit Hours: 3.00. Advanced bacterial genetics, with emphasis on the use of genetics as a powerful and creative intellectual activity that enables us to discover biological functions and to construct new organisms by the manipulation of DNA. Major topics include: mutations, genetic selections, recombination, regulatory mechanisms, and genomic evolution.

Credits: 3.00

BIOL 54200 - Modular Upper-Division Laboratory Course

Credit Hours: 0.00 to 2.00. This is a project-oriented course

designed to give the student exposure to laboratory research through a series of 5-week modules. The student must complete the introductory 5-week module or have the consent of the instructor before taking the other modules. Topics may include animal cell culture, cloning and blot analysis, DNA fingerprinting, analysis of nucleic acid sequences, animal physiology, bacterial genetics, advanced neurophysiology, chromatin structure, eukaryotic gene expression, genomics, yeast molecular biology, and molecular virology, etc.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 4. Demonstrate the ability to measure dynamic changes in living organisms, tissues, and cells.

Credits: 0.00 to 2.00

BIOL 54202 - Computer Laboratory: Data Analysis In Neuroscience

Credit Hours: 1.00. This course introduces students to computational techniques for analyzing real-world neuroscience data using Python and Jupyter Notebooks. Focusing on datasets such as neural time series, students will learn how to preprocess, visualize, and statistically analyze complex data. Topics include basic programming, statistical modeling, and practical applications relevant to neuroscience research. Emphasis is placed on developing hands-on skills for interpreting experimental data and solving real-world problems, preparing students for advanced study or careers in data-driven neuroscience.

Learning Outcomes: 1. Apply Python programming to process and analyze real-life neuroscience datasets, including time-series data. 2. Perform statistical modeling and hypothesis testing on neuroscience data to extract meaningful insights. 3. Use computational tools to create effective visualizations and interpret their relevance to neuroscience research. 4. Design and implement reproducible data analysis workflows using Jupyter Notebooks. 5. Combine programming, statistics, and neuroscience concepts to address real-world research questions. Credits: 1.00

BIOL 54410 - Sensory Systems

Credit Hours: 3.00. The goal of Sensory Systems is to gain an understanding of the mechanisms that underlie sensory perception at the molecular, cellular, and systems level. This will be accomplished by examining how various forms of energy are transduced into the electrochemical messages of the nervous system, what pathways the information travels within the nervous system, and how this information is processed and perceived.

Credits: 3.00

BIOL 54900 - Microbial Ecology

Credit Hours: 2.00. A study of microbial interactions with other organisms and the environment. Aquatic and terrestrial ecosystems as well as interactions between nonpathogenic microbes and plants and animals will be discussed. Offered in alternate years.

Credits: 2.00

BIOL 55000 - Plant Molecular Biology

Credit Hours: 3.00. A comprehensive study of plant molecular biology and plant molecular genetics. Topics will include the structure and expression of plant nuclear, chloroplast, and mitochondrial genomes, and plant viruses.

Credits: 3.00

BIOL 55001 - Eukaryotic Molecular Biology

Credit Hours: 4.00. This is a general survey course intended for advanced undergrads and beginning grad students. The course will draw upon examples from the plant, animal, and fungal kingdoms, and will familiarize students with the basic principles of molecular biology analyses as they apply to eukaryotic organisms. By the end of the course students should have knowledge of these molecular processes and should be able to design and analyze experiments dealing with these topics. This is not a first course in molecular biology. Permission of department required.

Learning Outcomes: 1. Have knowledge of molecular processes. 2. Be able to design and

analyze experiments dealing with these topics. Credits: 4.00

BIOL 55101 - Theory Of Molecular Methods

Credit Hours: 3.00. This course will introduce upper-level undergraduate students and graduate students to the theory and practice of many commonly used molecular biology methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth scientific courses, for graduate rotations, and for future laboratory work. Exams will be experimental in nature (e.g., design an experiment to do something or in this type of situation, which technique/vector/etc. would best be used, and why). Permission of instructor required.

Learning Outcomes: 1. Have knowledge about the uses and limitations of various molecular biology techniques. 2. Understand the techniques and how to choose the best technique for a given circumstance. 3. Understand how to interpret the experimental results emanating from each technique. Credits: 3.00

BIOL 55700 - Physiology II

Credit Hours: 3.00. A study of the human cardiovascular, pulmonary, blood, and gastrointestinal systems. Higher neuronal functions and intersystem interactions will be discussed.

Credits: 3.00

BIOL 55900 - Endocrinology

Credit Hours: 3.00. The study of hormone function. Consideration will be given to the role of hormones in growth, development, metabolism, homeostasis, and reproduction.

Learning Outcomes: 1. Demonstrate subject-matter competency, including the mastery of biological theories. 2. Demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection and documentation, communication of results, and responsible conduct of science. 3. Demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56010 - Clinical And Molecular Aspects Of Neurodegenerative Diseases

Credit Hours: 3.00. This course focuses on the molecular and clinical aspects of neurodegenerative diseases. The first part of the course will briefly introduce critical brain structures, with a focus on neurons and glia and will evaluate molecular mechanisms that underlie protein aggregation and cell death. The remainder of the course will focus on the multiple aspects of specific neurodegenerative diseases. Permission of instructor required.

Credits: 3.00

BIOL 56200 - Neural Systems

Credit Hours: 3.00. (SLHS 50700, PSY 51200) Overview of the structure and function of neural systems including those involved with motor, somatosensory, visual, auditory, learning, memory, and higher cortical processes. Molecular and cellular aspects of neural function are integrated with discussion of relevant neuroanatomy. Background in cell biology, psychobiology, physiology or anatomy is recommended.

Learning Outcomes: 1. Students demonstrate subject-matter competency, including the mastery of biological theories. 2. Students demonstrate proficiency with professional skills needed by practicing biologists, including experimental design and execution, biological techniques, data collection, and documentation, communication of results, and responsible conduct of science. 3. Students demonstrate the ability to discuss ethical issues in the application of biological sciences, and the impact of science on society. 4. Students

demonstrate skills in critical thinking. These skills include understanding scientific methods, solving biology-related problems, interpreting and analyzing primary literature in biology, and interpreting data in a meaningful way. 5. Students demonstrate knowledge of the path leading to specific careers in biology. Credits: 3.00

BIOL 56310 - Protein Bioinformatics

Credit Hours: 3.00. Accumulation of biological data, such as genome sequences, protein structures and sequences, metabolic pathways, opened up a new way of research in biology-bioinformatics. Through the survey of the various active research topics in bioinformatics, in this course we will learn bioinformatics databases, tools, and algorithms behind these tools. Special emphasis is placed on protein sequence and structure analyses. Covered topics will include methods for protein sequence comparison, protein structure comparison, protein structure prediction/modeling, protein docking prediction, protein function prediction, and protein network analysis.

Learning Outcomes: 1. Utilize biological database searches including protein and nucleotide sequences, motifs, and structures, and interpret results in statistically correct fashion. 2. Develop bioinformatics analysis pipeline that apply a series of appropriate bioinformatics tools with proper setting for predicting protein function and structures and interpret results correctly by knowing algorithms, strengths, and limitations of the tools used. 3. Construct the tertiary structure models of protein and protein complexes with appropriate software and predict the accuracy of the models built. 4. Apply functional analysis of gene networks and compute the statistical significance of results. 5. Discuss appropriateness of bioinformatics analyses in biology literature and propose alternative approaches that may work better than ones used in the literature. Credits: 3.00

BIOL 56400 - Molecular Genetics Of Development

Credit Hours: 3.00. The course examines the genetics and developmental bases as well as phenotypes of 40 genetic disorders. Chromosomal, single gene, complex and developmental genetic disorders are studied in detail. Emphasis is placed on molecular techniques and understanding current primary literature.

Credits: 3.00

BIOL 56600 - Developmental Biology

Credit Hours: 0.00 to 4.00. Principles of development with emphasis on concepts and experimental evidence for underlying mechanisms, including molecular, cellular, and supracellular approaches.

Credits: 0.00 to 4.00

BIOL 57310 - Stem Cell Biology

Credit Hours: 3.00. In this course students will develop a clear understanding of stem cells' defining features, activities and potential utility. Stem cell research is pursued in nearly all areas of medicine. This course focuses on important definitions and characteristics of stem cells and develops a general overview of stem cell biology. The course builds on this overview of stem cell biology by examining specific example of developmental biology, methodology and the potential applications of stem cell therapy.

Credits: 3.00

BIOL 57340 - Neurobiology Of Learning And Memory

Credit Hours: 3.00. How does our brain learn? How are our memories created? We will discuss a range of learning processes from cellular and molecular mechanisms to perception and behavior. We will look at the history of the key concepts and discoveries, including the technological advances, such as optogenetics. Most of the research discussed will be from animal studies.

Learning Outcomes: 1. Describe the cellular, molecular, and circuit-level mechanisms underlying learning and memory. 2. Evaluate critically primary literature on learning and memory, with a focus on findings from animal models. 3. Demonstrate an understanding of how tools like patch clamp, optogenetics have advanced the study of neural processes related to learning and memory. 4. Relate neural mechanisms to behavioral outcomes, including how learning influences perception and

decision-making. 5. Outline the historical progression of major discoveries in the neurobiology of learning and memory. 6. Apply course concepts to different topics in neuroscience, such as the development of therapies for memory-related disorders. Credits: 3.00

BIOL 58000 - Evolution

Credit Hours: 3.00. A study of evolution as a basic concept of the biological sciences; an examination of current methods of experimentation within the area, as well as evidences for the possible mechanisms of evolutionary change.

Credits: 3.00

BIOL 58010 - Teaching Evolution: Online Course

Credit Hours: 3.00. Evolution is one of the most important and most widely misunderstood concepts in science. Teaching Evolution is an online course to help you deepen your understanding of evolutionary concepts, develop instructional strategies, and address obstacles in the teaching of evolution.

Learning Outcomes: 1. The nature of scientific processes. 2. The value and limitations of scientific process. 3. The scientist's use of terms such as fact, law, theory, and hypothesis. 4. How multiple forms of evidence are used to test theories. 5. Applications of scientific processes in different situations. 6. How and why evolution is a cornerstone of biology. Credits: 3.00

BIOL 58210 - Ecological Statistics

Credit Hours: 3.00. This course covers topics that are useful for successfully designing and analyzing statistically observational and experimental studies in ecology, animal behavior, evolutionary biology, forestry, wildlife sciences, fisheries, etc. Some topics are: differences between hypotheses and predictions, design of an ecological study, general linear models, assumptions, different types of designs (factorial, nested, repeated measures, blocks, split-plots, etc.), fitting models to data, etc. The course will focus on the conceptual understanding of these topics (e.g., interpreting the results of statistical tests) and practice with statistical programs and real datasets.

Learning Outcomes: 1. Pose scientific questions, hypotheses, and predictions. 2. Plan and design ecological research projects. 3. Determine sample size requirements. 4. Use and interpret descriptive statistics. 5. Use general linear models and interpret their results. 6. Check for the assumptions of general linear models. 7. Manage data. 8. Understand the potential and limitations of statistics in ecological research. Credits: 3.00

BIOL 58215 - Building The Tree Of Life: Phylogenetic Methods And Applications

Credit Hours: 3.00. The Tree of Life represents Earth's biodiversity and its history and forms the basis of all biological knowledge. Phylogenetic methods allow us to reconstruct the Tree of Life and infer the evolutionary history and relationships of genes and organisms. This knowledge, in turn, can be used to address questions of organismal classification, biogeography, community assembly, and macroevolution. This jointly taught course introduces tree thinking and its underlying algorithms of inferring phylogenies, with an emphasis on the various applications of phylogenetic methods to such topics as those listed above. Through a combination of lectures, computer labs, and discussion of primary literature, the course will provide hands-on experience with commonly used tools and their applications in research for senior undergraduate and graduate students from relevant science backgrounds. Permission from department is required.

Learning Outcomes: 1. Build and visualize phylogenetic trees with commonly used scientific software. 2. Conduct scientific analyses using phylogenetic methods in R, ask testable scientific questions. 3. Perform data mining of phylogenetic resources and utilize the phylogenetic tools to address scientific questions. Credits: 3.00

BIOL 58601 - Ecology

Credit Hours: 3.00. This is an advanced ecology course that examines the ecological process and dynamics of populations, communities, and ecosystems. Topics include the physical, physiological, behavioral, and population genetic factors that influence how organisms interact with one another and their environment, the nature of population growth, and attributes of community structure. Course material integrates case studies from field and laboratory experiments, simulations, and theoretical models to understand life histories, species interactions, and community and ecosystem processes.

Learning Outcomes: 1. Apply ecological

principles to interpret patterns of abundance and distribution of organisms in natural systems. 2. Use conceptual and mathematical models to predict the dynamics of populations and communities. 3. Critically evaluate the experimental design and data interpretation of ecological studies in the published literature. 4. Communicate scientific ideas and results through discussions and written assignments. Credits: 3.00

BIOL 58602 - Laboratory In Ecology

Credit Hours: 1.00. This course is intended to complement many of the concepts discussed in BIOL 58601 Ecology Lecture. By studying selected topics in depth, both experimentally and through primary literature, you should gain a greater understanding of ecological principles and the process of science as it is applied to a variety of ecological topics. Permission of department required.

Learning Outcomes: 1. Read and discuss papers from the primary literature. 2. Develop hypotheses and conduct hypotheses testing through discussion of literature and predictions for experiments conducted in class. 3. Write and present on a scientific paper based on experiments conducted in class and lab-related topics. 4. Discuss parametric and non-parametric statistical tests and discuss the proper application of statistical tools. 5. Use multiple field techniques for sampling terrestrial plants, aquatic insects, and avian behavior. Credits: 1.00

BIOL 58705 - Animal Communication

Credit Hours: 3.00. This course will be a broad-scaled analysis of animal communication. Topics will include the physics of sound- and light-signal production, propagation and reception of signals, the use of communication as a means of information transfer, and the evolution of signaling systems. Mathematical principles are covered (e.g. in the evolution of signals), so some background in mathematics (e.g. calculus or algebra and introductory physics) is helpful.

Learning Outcomes: 1. Understand ways in which organisms interact ecologically with each other and their environment. 2. Understand how evolutionary forces influence organisms to produce adaptations. 3. Acquire knowledge of the ways in which animals communicate with each other. 4. Exhibit proficiency in population and community ecology, animal behavior, and evolutionary mechanisms. 5. Familiar with taxonomic and phylogenetic relationships among organisms. 6. Learn to efficiently communicate scientific information or results from biological investigations using both oral and written methods. 7. Use and understand the scientific method, including how to generate hypotheses and predictions, develop an experimental design, collect data, statistically analyze data, and interpret results. 8. Demonstrate an in dept knowledge of nervous system function at the systems, cellular and molecular level. Credits: 3.00

BIOL 59100 - Field Ecology

Credit Hours: 0.00 to 4.00. A field course in ecology that stresses natural history and testing ecological theory under natural conditions. Group and individual projects include observational and experimental approaches. Emphasis is on the study of plant and animal species interactions in terrestrial (including montane and coastal) and aquatic habitats. Issues in community, population, behavioral, and conservation biology are addressed. Several all-day Saturday and two weekend field trips. Offered in alternate years. Permission of instructor required.

Credits: 0.00 to 4.00

BIOL 59200 - The Evolution Of Behavior

Credit Hours: 3.00. An investigation of behaviors as adaptations: specializations of sensory and motor mechanisms involved in behavior; animal communication systems; behavioral ecology; patterns of social behavior as solutions to ecological problems, such as predator avoidance and resource exploitation. Emphasis will be on theoretical principles; examples will be broadly comparative, ranging from microorganisms to mammals. Offered in alternate years.

Credits: 3.00

BIOL 59500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading, independent study or research, supervised library, laboratory, or field work, or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 60000 - Bioenergetics

Credit Hours: 2.00. Energy transduction in biological membranes: physical chemical foundations; electron transfer, proton translocation; and active transport. Atomic structures of integral membrane protein complexes responsible for respiratory, photosynthetic generation of electrochemical potential; ATPase motor, and structure-based mechanisms. Offered in alternate years. Prerequisite: BCHM 56100, BCHM 56200 and CHM 37300.

Credits: 2.00

BIOL 60200 - Cellular Neurobiology

Credit Hours: 3.00. This course covers principles of neurophysiology and cell, molecular and developmental neurobiology for graduate students from a wide range of disciplines. Course material will involve lectures and assigned textbook readings, homework problems and in-class discussions based on selected readings of the primary literature, and computer-based simulations of neurophysiology. Grades will be based on participation in class discussions, graded homework sets and exams (a midterm and a final exam).

Learning Outcomes: 1. Acquire knowledge pertaining to cellular neurobiology with a strong focus on the empirical evidence (methods and experiments) underlying the facts as they are currently understood in cellular, molecular and developmental neurobiology. 2. Communicate this knowledge in both oral and written forms. 3. Learn the ethical implications of recent advances in neural stem cell research. Credits: 3.00

BIOL 61100 - Crystallography Of Macromolecules

Credit Hours: 3.00. The special techniques required in the structure determination of biological macromolecules. Symmetry of macromolecules. Data collection and processing. The isomorphous replacement technique. The molecular replacement technique. Use of anomalous dispersion. Restraint and constraint refinement. Computational techniques. Prerequisite: BIOL 51100. Permission of instructor required.

Credits: 3.00

BIOL 61919 - Data Science For Biologists

Credit Hours: 3.00. All of us are drawn to real-world biological questions. Nevertheless, we might underestimate the hidden demand for computing skills to conduct the actual research. By nature, biological data is versatile, vast, complex, and noisy. Therefore, customized scripts are often needed for data processing, analyses, and visualization. Tools for data management and version control function as virtual lab books to ensure that the studies are 100% reproducible. This course is designed to equip students with practical programming skills via an array of biological case studies. Through hands-on computer labs, students will learn how to translate a biological question into logical thinking and write good code in R, perform scientific computing and visualization in R, and manage projects in an organized fashion.

Learning Outcomes: 1. Understand basic computer programming knowledge and skills. 2. Manage and analyze common types of biological data. 3. Conduct reproducible research. 4. Perform data visualization in R, and design and test a hypothesis with a data-driven approach using provided datasets. Credits: 3.00

BIOL 62000 - Advanced Topics In Eukaryotic Cell Biology

Credit Hours: 3.00. A study of current areas of cell biological research, including the cytoskeleton, the regulation of the cell cycle, and the functions and dynamics of membrane-bound organelles.

Credits: 3.00

BIOL 62800 - Light Microscopy For Life Scientists

Credit Hours: 2.00. This course provides life science graduate students with fundamental concepts and knowledge related to how modern light microscopes can be used to observe, measure, and manipulate biological samples. Completion of this course will help students understand the capabilities and limitations of current technologies. This knowledge can be used to design new experiments that successfully incorporate modern imaging technologies.

Learning Outcomes: 1. Understand ray and wave properties of light and how they affect image formation in a microscope. 2. Understand

the different optical components of a light microscope and how they affect the light to form an image. 3. Understand the principles of modern imaging techniques with a focus on fluorescence to be able to incorporate them into their own research program. 4. Know the dos and don'ts in sample preparation and imaging. 5. Know the potential and limitations of digital image processing and analysis. Credits: 2.00

BIOL 64700 - Membrane Protein Structural Biology

Credit Hours: 2.00. This course focuses on the structural basis of the functions and dysfunctions of diverse membrane proteins, analyzed by X-ray, electron microscopy, and spectroscopy. The functions include transport, biogenesis, and transmembrane signaling. Unique problems associated with the structure analysis of integral membrane proteins are discussed.

Credits: 2.00

BIOL 65001 - Techniques In Molecular Biology

Credit Hours: 1.00. Techniques in Molecular Biology will introduce graduate students to the theory and practice of many commonly used methods. Emphasis will be placed on understanding the theoretical basis for these techniques, their utility in various circumstances, and their limitations. Although taught as a lecture, students should be able to take this knowledge back to the laboratory to help them in their research efforts. The course will be as close as possible to a laboratory experience without being in an actual laboratory setting. This course is designed to prepare students for other in-depth 600-level scientific courses, for their rotations, and for future laboratory work. Exams will be "experimental" in nature (e.g., "design and experiment to do something..." or "in this type of situation, which technique/vector/etc. would best be used, and why...").

Learning Outcomes: 1. Students are expected to learn the theoretical basis for many commonly used molecular biology techniques. An emphasis is placed on how correctly to use these techniques in real-life laboratory situations, and the limitations of each technique. Credits: 1.00

BIOL 65200 - Advanced Ecology Discussion

Credit Hours: 1.00. Weekly meetings to discuss and evaluate seminal papers in the fields of evolutionary, population, and community ecology. During the last week, students will critically evaluate a contemporary paper on a topic related to the "classic" papers discussed during the semester. Students will have a choice among papers submitted by participating faculty members; their critique will be assessed on content, originality, rigor, and clarity.

Credits: 1.00

BIOL 66200 - Seminar Methods And Professional Development I

Credit Hours: 1.00. An introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include research laboratory safety (REM), how to give a talk, acclimating to graduate studies (especially time management), how to select a major professor and an advisory committee, how to prepare for qualifying exams, Purdue University guidelines for responsible conduct of research, how to organize a poster presentation, how to negotiate with mentors, and expectations for success. The course also serves to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 66300 - Seminar Methods And Professional Development II

Credit Hours: 1.00. This course is a continuation of BIOL 66200 and expands the introduction for incoming graduate students to methods of seminar presentation and critique and to various guidelines for professional development during their graduate school experience. Topics include seminar topic selection and 20-minute seminar design, tutorials on electronic services at the PU Library and Citation Management programs, and evaluating classmate presentations. Using the skills learned the previous semester, each student is required to make a 20-minute PowerPoint presentation to the class, based on a pre-approved topic of their choice. The speaker is asked questions and the presentation receives written evaluations by all members of the class. Each student practices with the course instructor prior to the public presentation. The course also continues to socialize the incoming cohort of students among themselves and with more senior students in the broad range of research disciplines available.

Credits: 1.00

BIOL 69100 - Biological Research Methods

Credit Hours: 1.00. Open to graduate students in the Department of Biological Sciences and designed primarily for students in their first year of graduate study. The course

consists of two laboratory assignments, each of which lasts about two months. Students may take one or two of these per semester. During each laboratory assignment, the student will be exposed to methods, equipment, and experimental procedures currently in use in a particular departmental research laboratory selected by the student and through arrangement with the professor in charge of that laboratory. Admission by consent of the departmental Graduate and Advanced Studies Committee.

Credits: 1.00

BIOL 69500 - Special Assignments

Credit Hours: 0.00 to 18.00. Special work, such as directed reading; independent study or research; supervised library, laboratory, or field work; or presentation of material not available in the formal courses of the department. The field in which work is offered will be indicated in the student's record. Primarily for Ph.D. candidates. Permission of instructor required.

Credits: 0.00 to 18.00

BIOL 69600 - Seminar

Credit Hours: 1.00. Each semester there are several separate seminar offerings. They will likely be on the following topics: biochemistry, crystallography, ecology and population biology, genetics, mechanisms of development, microbiology, neurobiology, and plant physiology. The student's record will indicate the specific seminars in which he/she has participated. Oral presentations required. At least two credits are required of Ph.D. candidates.

Credits: 1.00

BIOL 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BIOL 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Chemistry (Graduate)

Website: **https://www.chem.purdue.edu/academic_programs/graduate/index.php**

Department/School Head

Christine A. Hrycyna

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Adjunct Professor	Emeritus Faculty

Suzanne C. Bart Bryan Boudouris Jean A. Chmielewski Graham Cooks Shelley Claridge Chittaranjan Das Arun K. Ghosh Christine A. Hrycyna Libai Huang Wen Jiang Sabre Kais Hilkka I. Kenttamaa Alexander Laskin Julia Laskin Philip S. Low Chengde Mao Scott A. McLuckey Jianguo Mei	Ryan Altman Jeffrey Dick Christina Li Mark A. Lipton Angeline Lyon Greg Michalski Severin Schneebeli Christopher Uyeda Paul Wenthold	Abram Axelrod Ming Chen Gaurav Chopra Bryon Drown Jonathan Hood Hanzhe Liu Shalini Low-Nam Lauren Ann Metskas Elizabeth Parkinson Michael Reppert Shiliang Tian Valentin Walther Chi Zhang	Mahdi Abu-Omar Paul B. Shepson	Adelman, S. Ben-Amotz, D. Bina, M. Brewster, J. H. Francisco, J. S. Fuchs, P. L. Grimley, R. T. Grutzner, J. B. Kissinger. P. Light, A. Lipschutz, M. Lytle, F. E. McMillin, D.R. Muller, N. Morrison, H. A. Nakhleh, M. B Pardue, H. L. Richardson, J. Regnier, F. E. Robinson, W. R. Shepson, P.B

Andrew D. Mesecar P.V. Ramachandran Tong Ren Kavita Shah Garth J. Simpson Herman Sintim Lyudmila Slipchenko W. Andy Tao David H. Thompson Marcy H. Towns Adam Wasserman Alexander Wei Jonathan Wilker Danzhou Yang Zhong-Yin Zhang				Van Etten, R. L. Walton, R. A. Wirth, M.J.

Academic Programs

Master's and Ph.D. Programs

The Graduate Program in Chemistry provides opportunities for graduate study and cutting-edge research across all areas of Chemistry. Purdue has the second largest Ph.D. program in Chemistry in the United States, graduating more than 50 Ph.D. students every year. Particular strengths include Analytical Chemistry (US News ranks our program as the #1 Analytical Chemistry Graduate Program in the country), drug discovery, and chemical biology. Strength in Synthetic Organic Chemistry has produced two Nobel Prizes for department faculty (H.C. Brown in 1979 and Ei-ichi Negishi in 2010).

Concentrations (Areas of Study):

- Analytical Chemistry
- Biochemistry and Chemical Biology
- Inorganic Chemistry
- Materials Chemistry
- Organic Chemistry
- Physical Chemistry

Research in the department is conducted in such interdisciplinary areas as bioanalytical, bioorganic, bioinorganic chemistry, physical organic chemistry, organometallic chemistry, and chemical physics.

Chemistry, MS

Chemistry, PHD

Chemistry/Cancer Research, PHD

CHM 50200 - Modern Chemistry In The High School

Credit Hours: 3.00. A critical discussion of the means by which the fundamentals of modern chemistry can best be introduced at the high school level. The laboratory will deal with the manufacture and use of lecture demonstration equipment, the use of films and film strips, and the problems involved in organizing and running a high school chemical laboratory.

Credits: 3.00

CHM 51300 - Chemical Literature

Credit Hours: 1.00. Types of information in technical publications; exercises in finding, assembling, and using such data.

Credits: 1.00

CHM 53300 - Introductory Biochemistry

Credit Hours: 3.00. A rigorous one-semester introduction to biochemistry.

Credits: 3.00

CHM 53800 - Molecular Biotechnology

Credit Hours: 3.00. An examination of modern tools for the characterization, manipulation, and design of nucleic acids and proteins.

Credits: 3.00

CHM 54800 - Radiochemistry

Credit Hours: 3.00. Nuclear properties, structure, and reactions; radioactive decay; interaction of radiation with matter; radioactivity in the environment; nuclear applications in chemistry.

Credits: 3.00

CHM 56000 - Organic Spectroscopic Analysis

Credit Hours: 3.00. Identification of organic compounds and characteristic groups by the use of mass spectrometry, infrared, nuclear magnetic resonance, and ultraviolet spectroscopy.

Credits: 3.00

CHM 57900 - Computational Chemistry

Credit Hours: 3.00. Theoretical basis and practical applications of computational methods relevant to chemical and biochemical research problems.

Credits: 3.00

CHM 58100 - Atmospheric Chemistry

Credit Hours: 3.00. (EAPS 52100) An introduction to the chemistry of the earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

CHM 59900 - Special Assignments

Credit Hours: 1.00 to 4.00. Directed reading or special work not included in other courses. Permission of instructor required.

Credits: 1.00 to 4.00

CHM 60500 - Safety In The Chemistry Laboratory

Credit Hours: 0.00. Lectures on safe practices in the chemistry laboratory. Required of students doing research in chemistry.

Credits: 0.00

CHM 61000 - Topics In Chemical Education

Credit Hours: 2.00 or 3.00. A variable topics course for graduate students in chemistry, chemical engineering, medicinal chemistry, and biochemistry. This course provides an overview of the literature in one of the areas of chemical education, such as: chemistry misconceptions and conceptual change; theories of learning, from Piaget and Vygotsky to radical constructivism; distributed cognition; and developing and assessing instructional materials. Offered in alternate years.

Credits: 2.00 or 3.00

CHM 61100 - Formulas For Successful Teaching

Credit Hours: 2.00. An introduction to the issues of successful teaching of chemistry at the college/university level for graduate students in chemistry, chemical engineering, medicinal chemistry, and biochemistry who are interested in academic careers. Offered in alternate years.

Credits: 2.00

CHM 61500 - Principles Of NMR Spectroscopy

Credit Hours: 3.00. The course is intended to provide in-depth coverage of fundamental concepts in modern NMR spectroscopy. Included are the vector model of spin resonance, topics in signal processing, product operator formalism, discussion of important 2D experiments, Redfield relaxation theory, and methods for molecular structure determination. The emphasis is on general spectroscopic concepts, also used outside spin resonance spectroscopy. Spectrometer operation and data processing are also demonstrated. Prerequisite: Undergraduate degree or completed advanced coursework in chemistry, physics, biology, or engineering. Basic knowledge of NMR is expected, but not required.

Credits: 3.00

CHM 61600 - Advanced Experimental Nuclear Magnetic Resonance Spectroscopy

Credit Hours: 2.00. The theory and practice of multidimensional nuclear magnetic resonance spectroscopy and advanced NMR techniques. Prerequisite: CHM 56000 , CHM 61500 .

Credits: 2.00

CHM 62000 - Spectrochemical Instrumentation

Credit Hours: 3.00. A critical review of instrumental methods of analysis, with particular emphasis on spectroscopic techniques. Topics include: methods of measurement; analog and digital electronics; optics and spectrophotometric modules; and instrumental methods in UV-visible, infrared, and NMR spectroscopies. Prerequisite: introductory analytical and two semesters of physical chemistry.

Credits: 3.00

CHM 62100 - Advanced Analytical Chemistry

Credit Hours: 3.00. A critical survey of recent developments in chemical and instrumental methods of analysis. Prerequisite: CHM 32100 , CHM 42400 .

Credits: 3.00

CHM 62200 - Chemical Aspects Of Mass Spectrometry

Credit Hours: 3.00. A graduate-level treatment of chemical aspects of mass spectrometry. No prior knowledge in mass spectrometry is required. Prerequisite: Bachelor's degree in Chemistry.

Credits: 3.00

CHM 62400 - Particle Spectroscopy

Credit Hours: 3.00. Introduction to the application of ion and electron beams in the chemical analysis of gases and of surfaces. Emphasis is on the unity of the phenomena that underlie the preparation, manipulation, and analysis of ion and electron beams and on the analogies between inelastic reactions of ions and electrons, including those with both gaseous and solid targets. Mass spectrometry is covered in some depth, and a number of newer aspects of particle spectroscopy are treated, including ion scattering spectrometry, Rutherford scattering, energy loss spectrometry (ion and

electron), ion kinetic energy spectrometry, ion cyclotron resonance and Auger spectrometry. Applications of these techniques feature structural analysis (compositions of mixtures, molecular structure of organics, electronic state assignment in simple ions), chemical preparations (ion implantation), and isotopic analysis. The underlying chemistry is explored, particularly in considering the kinetics and dynamics of unimolecular fragmentation and in terms of the factors that affect the cross-sections of inelastic collisions. Offered in alternate years. Prerequisite: CHM 42400 .

Credits: 3.00

CHM 62900 - Chromatographic Methods Of Analysis

Credit Hours: 3.00. Principles underlying chemical separations are discussed, including mechanisms of selective transport and zone broadening. Relations are shown between chromatography and electrophoresis, as well as other separation methods. Current applications and current research activity in the field of chemical separations are included. Prerequisite: CHM 42400. Permission of department required.

Credits: 3.00

CHM 63100 - Magnetic Resonance Spectroscopy

Credit Hours: 2.00. Theory, experimental practice, and current applications to biological systems of nuclear magnetic resonance spectroscopy and, to a lesser extent, electron paramagnetic resonance spectroscopy. Offered in alternate years. Prerequisite: CHM 53300, 56100, 57700, 57800.

Credits: 2.00

CHM 63200 - Membranes: Structure And Function

Credit Hours: 3.00. The structure and molecular properties of biological membranes and appropriate model systems. Offered in alternate years.

Credits: 3.00

CHM 63400 - Biochemistry: Structural Aspects

Credit Hours: 3.00. Chemistry of materials of biochemical interest; carbohydrates, lipids, proteins, amino acids, nucleic acids, porphyrins; biochemistry of blood. Prerequisite: CHM 26200 , CHM 32100 , CHM 37400 .

Credits: 3.00

CHM 63500 - Biochemistry: Dynamic Aspects

Credit Hours: 3.00. Enzymes, metabolism, and protein and nucleic acid biosynthesis. Prerequisite: CHM 63400 .

Credits: 3.00

CHM 63800 - Biophysical Chemistry

Credit Hours: 3.00. Applications of the principles and methods of physical chemistry in biochemistry with emphasis on the behavior of macromolecules in solution. Protein engineering. Offered in alternate years. Prerequisite: CHM 57800, CHM 63400 .

Credits: 3.00

CHM 64100 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Survey of main group and transition metal chemistry. Main group special topics, bonding and structure of boron hydrides. Coordination chemistry, bonding models in coordination compounds. Transition metal organometallic chemistry, ligand types and reactivity patterns. Survey of inorganic NMR spectroscopy. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64200 - Advanced Inorganic Chemistry

Credit Hours: 3.00. Physical inorganic chemistry. Applications of group theory to chemistry and spectroscopy, especially vibrational and electronic spectra of transition metal complexes. Molecular orbital theory and theoretical bases for reactivity. Magnetic properties and electron paramagnetic resonance (EPR) spectroscopy of inorganic materials. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64400 - Solid State Chemistry

Credit Hours: 3.00. The chemistry of solids, including a discussion of ionic crystals, metals, alloys, and binary compounds, and their characterizations by various physical methods. Description of chemical reactions, phase changes, and catalysis in terms of current theories of the solid state. Prerequisite: CHM 34200 , CHM 37400 .

Credits: 3.00

CHM 64600 - Kinetics And Mechanisms Of Inorganic Reactions

Credit Hours: 3.00. Chemical kinetics, reaction orders, mechanisms and rate expressions; experimental techniques; transition state theory; reactions in solution; complex mechanisms; linear free-energy relationships; acid-base catalysis and proton-transfer reactions; redox reactions (electron and atom transfer, oxidative addition-reductive elimination); substitution reactions of metal ion and organometallic complexes; homogeneous catalysis; and

heterogeneous reactions. Prerequisite: CHM 34200 .

Credits: 3.00

CHM 64700 - Transition Metal And Organometallic Chemistry

Credit Hours: 3.00. A study of the chemistry and physical properties of compounds of the transition metals. Halides, oxides, and oxy-salts; transition metal carbonyls and derivatives; pi-bonded organometallic compounds; catalysis; spectral and magnetic properties of compounds. Prerequisite:CHM 64100 .

Credits: 3.00

CHM 64800 - Bioinorganic Chemistry

Credit Hours: 3.00. Provides a detailed perspective on the roles of metals in biology. Emphasis is placed upon principles guiding the field. The basics of biochemistry and inorganic chemistry are provided such that students from diverse backgrounds may participate. Readings are from the research literature. Offered in alternate years.

Credits: 3.00

CHM 65100 - Advanced Organic Chemistry

Credit Hours: 3.00. Modern structural organic chemistry, including introductions to molecular orbital theory and reaction mechanisms. Prerequisite: a year's course in organic chemistry.

Credits: 3.00

CHM 65200 - Synthetic Organic Chemistry

Credit Hours: 3.00. An advanced treatment of methods for preparing major types of organic functionalities and bonds, stressing stereochemical control and involving mechanisms for understanding the reactions employed. Prerequisite: CHM 65100 .

Credits: 3.00

CHM 66800 - Physical Organic Chemistry

Credit Hours: 3.00. The theoretical and mechanistic bases for structure and reactivity in organic chemistry is discussed. Individual topics include kinetics and thermodynamics, molecular orbital theory, stereochemistry and reactive intermediates as applied to the mechanisms of organic reactions. Prerequisite: CHM 56300 or 65100.

Credits: 3.00

CHM 67100 - Advanced Physical Chemistry

Credit Hours: 3.00. Selected topics, including atomic and molecular structure and modern theories underlying thermodynamics and chemical kinetics. Prerequisite: CHM 57800.

Credits: 3.00

CHM 67200 - Quantum Chemistry

Credit Hours: 3.00. Basic principles of classical and quantum mechanics, exact solutions for simple systems, approximation methods, atomic structure, spectroscopy, application of group theory, theory of molecular binding. Prerequisite: CHM 67100 .

Credits: 3.00

CHM 67300 - Computational Quantum Chemistry

Credit Hours: 3.00. Semiempirical and molecular-mechanics treatments of large molecules, ab initio methods, modern density functional theory, Green's functions, multichannel quantum defect theory, global optimization methods. Prerequisite: CHM 67100 .

Credits: 3.00

CHM 67500 - Chemical Kinetics

Credit Hours: 2.00 or 3.00. Experimental and theoretical consideration of chemical reaction rates and mechanisms.

Credits: 2.00 or 3.00

CHM 67605 - Molecular Spectroscopy

Credit Hours: 3.00. Theoretical and experimental fundamentals of the interactions between molecules and electromagnetic waves. Topics include electronic, vibrational, and rotational spectroscopies, and laser-based methods. Prerequisites: CHM 67100 .

Learning Outcomes: 1. Possess a firm working knowledge of the interactions of light with molecules and be able to explain molecular spectroscopy concepts to other scientists. 2. Able to analyze molecular rotational, vibrational, and electronic spectra, extracting information about the shapes, bond distances, vibrational motions/frequencies, and electronic excited states from the spectra. 3. Able to read and understand key aspects of the current literature in molecular spectroscopy, including advanced, laser-based methods. 4. Able to use group

theory to identify the point group of a molecule and assign molecular rotational, vibrational, and electronic states to symmetry species. Credits: 3.00

CHM 67900 - Chemical Thermodynamics

Credit Hours: 3.00. Advanced thermodynamics of chemical and phase equilibria, of electrolytic and nonelectrolytic solutions, and of imperfect gases. Prerequisite: CHM 57800.

Credits: 3.00

CHM 68200 - Statistical Thermodynamics

Credit Hours: 3.00. Application of statistical mechanics to the description of imperfect gases, liquids, and solutions; to order-disorder phenomena in solids and surfaces; and to absolute reaction rate theory. Prerequisite: CHM 67100 , CHM 67900 .

Credits: 3.00

CHM 69500 - Seminar

Credit Hours: 0.00 or 1.00. Groups meeting for review and discussion of important current literature in analytical, biological, inorganic, organic, and physical chemistry. Each graduate student is required to attend the seminar of his or her major subject.

Credits: 0.00 or 1.00

CHM 69600 - Special Topics In Chemistry

Credit Hours: 1.00 to 3.00. Lectures on selected topics of current interest.

Credits: 1.00 to 3.00

CHM 69699 - Chemistry Graduate Internship

Credit Hours: 0.00. Graduate internship experience. Students submit final work report and company evaluation. Permission of instructor required.

Learning Outcomes: 1. The student should have a meaningful industrial experience, and learn the skills and requirements of contributing to an industrial project or projects at a technical level appropriate to graduate study in chemistry. 2. The student should grow in their understanding of industrial work in a way that helps inform their career goals and pathways. Credits: 0.00

CHM 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CHM 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Computer Science (Graduate)

Website: **https://www.cs.purdue.edu/graduate/index.html**

Department/School Head:

Petros Drineas

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Professor of Practice

Walid Aref Mikhail Atallah Saugata Basu Bedrick Benes Elisa Bertino Bharat Bhargava Douglas Comer Tamal Dey Petros Drineas Sonia Fahmy David Gleich Ananth Grama Suresh Jagannathan Daisuke Kihara Ninghui Li Zhiyuan Li Jennifer Neville Alex Pothen Sunil Prabhakar Vernon Rego Eugene Spafford Wojciech Szpankowski	Daniel Aliaga Aniket Bera Antonio Bianchi Jeremiah Blocki Simina Branzei Berkay Celik Buster Dunsmore Pedro Fonseca Dan Goldwasser Changhee Jung Aniket Kate Majid Kazemian Hemanta Maji Kihong Park Chunyi Peng Voicu Popescu Bruno Ribeiro Tiark Rompf Dave Tian Xavier Tricoche Paul Valiant Yexiang	Vamsi Addanki Brian Bullins Joseph Campbell Ben Delaware Christina Garman Steve Hanneke Sooyeon Jeong Mahimna Kelkar Rajiv Khanna Zak Kingston Chunwei Liu Anuran Makur Hongyuan Mei Xupeng Miao Sotirios Nousias Rohan Paleja Yuxian Peng Alex Psomas Kent Quanrud Ahmed Qureshi Eric	George Adams Andres Bejarano Posada Konstantinos Ameranis Hisham Benotman Tony Bergstrom Michael Borkowski Chris May Gustavo Rodriguez-Rivera Sarah Sellke Mary Ann Smart Jeff Turkstra

ki Lin Tan Patrick Wolfe Dongyan Xu Xiangyu Zhang	Xue Ming Yin	Samperton Abulhair Saparov Kazem Taram Jianguo Wang Hanshen Xiao Raymond Yeh Wei Zhan Ruqi Zhang Tianyi Zhang Yongle Zhang	

Academic Programs

Master's and Ph.D. Programs

The Department of Computer Science offers MS and Ph.D. degrees. The master's program prepares students for admission to a Ph.D. program or for work in the industry. The doctoral program is designed to prepare students for a career in computer science research. Research areas include Artificial Intelligence, Machine Learning, and Natural Language Processing, Bioinformatics and Computational Biology, Computer Architecture, Computational Science and Engineering, Databases and Data Mining, Distributed Systems, Graphics and Visualization, Human-Computer Interaction, Information Security and Assurance, Networking and Operating Systems, Programming Languages and Compilers, Software Engineering, Robotics and Computer Vision, Theory of Computing, Algorithms, and Quantum Computing.

Areas of Study

- Artificial Intelligence, Machine Learning, and Natural Language Processing
- Bioinformatics and Computational Biology

- Computer Architecture
- Computational Science and Engineering
- Databases and Data Mining
- Distributed Systems
- Graphics, Visualization, and Geometric Modeling
- Human-Computer Interaction
- Information Security and Assurance
- Networking and Operating Systems
- Programming Languages and Compilers
- Robotics and Computer Vision
- Software Engineering
- Theory of Computing, Algorithms, and Quantum Computing

Combined Degree Programs (Undergraduate Degree / Master's Degree)

- Fifth-Year Combined BS/MS in Computer Science

Computer Science, MS

Computer and Information Science, PHD

Computer Science, PHD

CS 50010 - Foundational Principles Of Information Security

Credit Hours: 3.00. This course covers foundational principles relevant to information security including data structures, algorithm design, computational complexity, probability theory, number theory, and basics of cryptography. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Professionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Identify and explain the basic data structures. 2. Identify and explain algorithm design techniques. 3. Explain computational complexity and decidability concepts and their relevance to information security. 4. Apply basic probability tools to analyze problems involving uncertainty and randomness. 5. Explain basic concepts of modular arithmetic and their application to cryptography. Credits: 3.00

CS 50011 - Introduction To Systems For Information Security

Credit Hours: 3.00. The course covers computer systems principles relevant to information security and it serves as a prerequisite for the later courses in the MS in IS program. The material includes features in the C/C++ programming languages for understanding security-critical software vulnerabilities, basic knowledge in computer architecture and assembly languages, knowledge of the compiling process, operating systems, networking, databases, and web applications relevant to information security. This course is restricted to CS graduate students. This course is required for students in the Master of Science in Computer Science Concentration in Information Security for Professionals Program. The course may not be used on the Plan of Study for any CS graduate students other than those in the Concentration in Information Security for Professionals program. Programming experience and computer science knowledge equivalent to that of a minor in CS. Incoming students are expected to have programming skills in at least one procedural programming languages, e.g., C,C++,Java, or Python.

Learning Outcomes: 1. Understand C/C++ code with security-relevant features such as pointers, string operations, function pointers, dynamic memory allocation, etc., laying the foundations for understanding software vulnerabilities in C/C++. 2. Explain common programming errors in C/C++ programs. 3. Explain how C/C++ programs are compiled into assembly and how call stack works in function calls, laying the foundation for understanding stack based buffer

overflow. 4. Explain basic concepts in computer architecture, such as instruction set, assembly code, CPU modes, registers, MMU, paging. 5. Explain basic concepts in operating systems, such as processes, system calls, virtual memory, file system structure. 6. Explain basic concepts in networking, databases, and web applications. Credits: 3.00

CS 50023 - Data Engineering I

Credit Hours: 1.00. The course introduces students to the fundamentals of Data Engineering with a focus on tools and computational techniques to gather, construct, manipulate, summarize, and visualize data sets as a means to extract knowledge from the underlying data. Python and Python libraries are used. Completion of the course will allow learners to perform basic data analysis on data sets. Experience in Python Programming and Linear Algebra is required. The course also prepares learners for additional instruction in the courses Data Engineering II and Foundations of Decision Making.

Learning Outcomes: 1. Identify key file types (TXT, CSV, HTML) and their characteristics. Using Python, read data in these formats. 2. Create and execute Python scripts to parse, select, transform, summarize, and visualize data. 3. Explain how to identify and fill in missing values in data values. 4. Create informative visualizations from given data and recognize the key qualities of good visualizations. 5. Apply Pandas functions to slice, dice, and summarize datasets. 6. Apply the process of sampling data and sample probabilistically. 7. Demonstrate how to transform and construct features (e.g., standardization, distances). 8. Compute summary statistics from data (e.g., covariance, correlation). 9. Explain how to solve simple data analysis problems. Credits: 1.00

CS 50024 - Data Engineering II

Credit Hours: 1.00. This course introduces students to the fundamentals of database management systems (DBMS) from a user's perspective. The principles of modeling an enterprise using Entity-Relationship diagrams and transforming the model into a relational or NoSQL database are illustrated through a range of examples. The SQL language is used to create, query, aggregate, and update a relational database. NOSQL databases and the related data models (column, graph, and document-based) are introduced. Experience in Python Programming is required.

Learning Outcomes: 1. Carry out database design steps from conceptual to logical to physical design. 2. Use SQL commands to define the structure of a relational database, populate, update and delete data in the database, retrieve data having specified characteristics, and specify access control. 3. Explain the differences, advantages, and disadvantages of relational and NOSQL databases. 4. Describe features of relational databases not needed in big data applications. 5. Create a document-based, NOSQL database like mongoDB and movie data from an SQL to a NOSQL database. 6. Understand the benefits and downsides of creating index structures on query performance for relational, and NOSQL databases. 7. Explain the difference between hash indices and B-tree indices. 8. Analyze large data sets created from piecing together multiple data files through the application of SQL queries. Credits: 1.00

CS 50025 - Foundations Of Decision Making

Credit Hours: 1.00. This course provides an overview of data science methods used for data-driven discovery, extraction of knowledge, and informed decision making. The course covers fundamental computational methods and statistical techniques used to correctly reason about uncertainty, conduct hypothesis tests, infer causal relationships, and apply and evaluate predictive models. The course highlights how sampling biases can impact fairness in decision making. Throughout, students get hands-on experience on how to make correct and explainable inferences from data. Experience in Python Progamming, Probability, Statistics and Linear Algebra is required.

Learning Outcomes: 1. Support and justify claims with evidence from data and discuss how human biases can impact interpretations. 2. Recognize the basic approach to formulating

statistical hypothesis tests and apply parametric hypothesis tests for both discrete and continuous data. 3. Interpret p-values and apply them effectively to support claims about data. 4. Formulate and test conjectures with controlled experiments, including A/B testing. 5. Recognize the types of errors encountered when conducting multiple hypothesis tests. 6. Use computational approaches based on randomization for hypothesis testing and uncertainty quantification. 7. Discuss ethical issues such as privacy and fairness that can be associated with automating decisions based on machine learning methods. 8. Apply the basic components of classification methods using Python libraries. 9. Evaluate the performance of learned models with learning curves and k-fold cross validation and assess significance with hypothesis tests. Credits: 1.00

CS 50100 - Computing For Science And Engineering

Credit Hours: 3.00. Credit in this course may not be used toward a graduate degree in Computer Sciences. Computational concepts, tools, and skills for computational science and engineering scripting for numerical computing, scripting for file processing, high performance computing, and software development. Project may be required.

Learning Outcomes: 1. To prepare graduate students outside Computer Science to write computer programs in support of their studies and research. Credits: 3.00

CS 50200 - Compiling And Programming Systems

Credit Hours: 3.00. Basic principles of compilers and compiler design; control of translation, loading, and execution; symbolic coding systems; lexical and syntactic analysis, design and operation of assemblers and macroprocessors; design of interpretive systems. Students are expected to complete a large programming project as part of the course.

Learning Outcomes: 1. Deeper understanding of the syntactic rules and the functionality of modern programming languages, as well as the use of the compiler for enhancing program quality. 2. Opportunity to practice the implementation of certain key components in the compiler front-end and back-end. Credits: 3.00

CS 50300 - Operating Systems

Credit Hours: 3.00. Basic principles of operating systems: addressing modes, indexing, relative addressing, indirect addressing, stack maintenance; implementation of multitask systems; control and coordination of tasks, deadlocks, synchronization, mutual exclusion; storage management, segmentation, paging, virtual memory; protection, sharing, access control; file systems; resource management; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.

Credits: 3.00

CS 50500 - Distributed Systems

Credit Hours: 3.00. Foundations for building reliable distributed systems, including failure and system models, and basic communication and agreement problems; crash failures, recovery, partition, Byzantine failures; asynchronous systems, failure detectors, communication channels, wireless and sensor networks; software clocks, causality, and cuts. Examples of problems include reliable broadcast consensus, leader election, group communication, and replication. Permission of department required.

Credits: 3.00

CS 51000 - Software Engineering

Credit Hours: 3.00. Software life cycles, requirements engineering, software design, design of distributed systems, verification and validation, software architecture, process metrics and models, and research methods in software engineering.

Credits: 3.00

CS 51400 - Numerical Analysis

Credit Hours: 3.00. (MA 51400) Alternative methods for solving nonlinear equations; linear difference equations, applications to solution of polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

CS 51500 - Numerical Linear Algebra

Credit Hours: 3.00. Direct and iterative solvers of dense and sparse linear systems of equations, numerical schemes for handling symmetric algebraic eigenvalue problems, and the singular-value decomposition and its applications in linear least squares problems.

Learning Outcomes: 1. Become knowledgeable about major kernels and algorithms underlying matrix computations for dense and sparse matrices including linear systems of equation, symmetric eigenvalue problems, and the singular-value decomposition. 2. Be able to implement basic versions of these kernels and algorithms. 3. Learn about the difference between direct and iterative methods for linear systems. 4. Gain expertise in the design of iterative methods and preconditioning techniques for large-scale sparse linear systems. 5. Be able to implement eigenvalue and singular-value problem solvers. Credits: 3.00

CS 51501 - Parallelism In Numerical Linear Algebra

Credit Hours: 3.00. This course examines both theoretical and practical aspects of numerical algorithm design and implementation on parallel computing platforms. In particular, it provides an understanding of the tradeoff between arithmetic complexity and management of hierarchical memory structures, roundoff characteristics if different from the sequential schemes, and performance evaluation and enhancement. Applications are derived from a variety of computational science and engineering areas.

Learning Outcomes: 1. Become quite knowledgeable in handling these parallel numerical linear algebra algorithms that arise in computational science and engineering. 2. Acquire problem-solving skills in this field. 3. Communicate their solution strategies and the performance realized on parallel computing platforms. Credits: 3.00

CS 52000 - Computational Methods In Optimization

Credit Hours: 3.00. A treatment of numerical algorithms and software for optimization problems with a secondary emphasis on linear and nonlinear systems of equations: unconstrained and constrained optimization; line search methods; trust region methods; Quasi-Newton methods; linear programming; calculating derivatives; quadratic programming; global optimization, including simulated annealing.

Credits: 3.00

CS 52300 - Social, Economic, And Legal Aspects Of Security

Credit Hours: 3.00. This course focuses on social, legal, and economic aspects of information security and privacy, also including ethics, policies, and human behavioral issues. The course covers the interactions between non-technological aspects of information security as well as relevant technological aspects. It focuses on how non-technological facets can inform and guide technological choices, and how technological choices can enhance or detract from the broader organizational and societal goals.

Learning Outcomes: 1. Identify and describe the legal, organizational, and financial ramifications of security-related design and management decisions. 2. Explain how to respond to a security incident, including recovery and cleanup, damage assessment, forensics and the handling of digital evidence so that it is admissible in court, and satisfying government requirements on the reporting of the incident. 3. Identify, evaluate and assess the risks faced by an organization, and their impact and consequences should they materialize (including liability, reputational damage, disruption to operations, loss of customers). Recommend effective and appropriate measures to mitigate those risks. 4. Explain the role of incentives in information security, and be capable of evaluating and modifying an organizational and reward structure so that it better aligns the interests of employees with those of the organization. 5. Ensure compliance with privacy and data protection laws. Detect and remedy practices that have potential to give rise to violations of these laws. 6. Identify major national laws that affect the practice of

information security and explain potential interactions. 7. Evaluate and improve an e-policy's in security and privacy aspects. Credits: 3.00

CS 52500 - Parallel Computing

Credit Hours: 3.00. Parallel computing for science and engineering applications: parallel programming and performance evaluation, parallel libraries and problem-solving environments, models of parallel computing and run-time support systems, and selected applications.

Credits: 3.00

CS 52600 - Information Security

Credit Hours: 3.00. (CSCI 52600) Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; secure programming; audit; intrusion detection and response; operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; and risk assessment.

Credits: 3.00

CS 52700 - Software Security

Credit Hours: 3.00. This course focuses on software security fundamentals, secure coding guidelines and principles, and advanced software security concepts. Students will learn to assess and understand threats, learn how to design and implement secure software systems, and get hands-on experience with common security pitfalls. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the labs and projects.

Learning Outcomes: 1. Explain the top 20 most common weaknesses in software security (CWE top 20) and understand how such problems can be avoided in software. 2. Know limitations of existing defense mechanisms and how to overcome them. 3. Explain and identify common security threats, risks, and attack vectors for software systems. 4. Evaluate and assess current security best practices and defense mechanisms for current software systems. 5. Identify security problems in source code and binaries, assess the associated risks, and reason about their severity and exploitability. 6. Assess the security of given source code or applications. Credits: 3.00

CS 52800 - Network Security

Credit Hours: 3.00. The course focuses on the principles and foundations of building secure network systems and on security and privacy challenges in existing and emerging networks. The course compares and analyzes network architectures and network protocols from the physical layer to the access control, network, transport and application layer from an adversarial standpoint to understand how to build more secure protocols that can withstand attacks. Restricted to CS MS and CS PHD students. Significant programming experience and skills are required to complete the projects.

Learning Outcomes: 1. Describe the different categories of network threats and attacks. 2. Examine the strengths and weaknesses of security technologies at each layer of the network protocol stack. 3. Identify the appropriate defense mechanism(s) and its (their) limitations, given a network threat. 4. Demonstrate the ability to discuss security properties, limitations, and threats in wireless networks and emerging technologies. 5. Demonstrate the ability to summarize defenses against network censorship, and network anonymity and privacy protocols. Credits: 3.00

CS 52900 - Security Analytics

Credit Hours: 3.00. This course focuses on applied data mining, machine learning, data analytics techniques, and their application and relevance in information security. The course covers basic concepts of data mining and machine learning, computation platforms in support of big data analytics including Map-Reduce and Spark, machine learning algorithms such as classification trees, logistic regression, naive Bayes, k Nearest Neighbors, Support Vector Machines, Artificial Neural Networks (including Feed Forward, Convolutional, and Recurrence), the application of these algorithms to security tasks such as Spam/Phishing detection, malware detection, intrusion detection, and situational awareness. The future and potential role of applying machine learning techniques in information and data security is explored.

Learning Outcomes: 1. Explain commonly used machine learning algorithms relevant to information security; identity their strengths and

weaknesses, and illustrate their relevance through examples. 2. Identify security problems that can be solved by using machine learning (including deep learning) techniques. 3. Explain the concepts of artificial neural networks, including feed forward networks, convolutional neural networks, and recurrent neural networks. 4. Deploy machine learning algorithms (including artificial neural networks) using software such as NumPy, SciPy, and TensorFlow. 5. Apply Spark and HDFS to perform data analysis. 6. Apply machine learning algorithms to security problems. 7. Assess the effectiveness of applying data analytics techniques to different security problems and explain existing shortcomings of ML techniques. 8. Explain what type of data visualization can be effective for security problems (e.g., in fraud detection). 9. Explain the concept of adversarial machine learning and the common attacks/defenses. Credits: 3.00

CS 53000 - Introduction To Scientific Visualization

Credit Hours: 3.00. Teaches the fundamentals of scientific visualization and prepares students to apply these techniques in fields such as astronomy, biology, chemistry, engineering, and physics. Emphasis is on the representation of scalar, vector, and tensor fields; data sampling and resampling; and reconstruction using multivariate finite elements (surfaces, volumes, and surfaces on surfaces).

Learning Outcomes: 1. Learn basic notions of human vision and color perception that inform the design of effective visual representations. 2. Know different models of color perception and understand their connection to the anatomy of the visual system. 3. Be familiar with several color spaces and know their perceptual properties. 4. Know how to devise effective color scales suitable for different data mapping needs. 5. Learn the data structures and data reconstruction techniques that are needed to create continuous visual representations of discrete simulation or experimental datasets. 6. Be familiar with the main grid types used in numerical simulations, know what data structures can be used to represent them in memory, and the associated footprint. 7. Know various data interpolation methods and understand their relationship with grid topology. 8. Know how to efficiently solve the point location problem, whereby the cell must be determined that encloses an arbitrary spatial location. 9. Learn the main visualization techniques for scalar, vector, and tensor datasets. Credits: 3.00

CS 53100 - Computational Geometry

Credit Hours: 3.00. Computational geometry studies how to compute with and reason about geometric objects. The subject is playing an increasingly important role in computer graphics, game software, geometric modeling, geographic information systems, and many other applications. Course topics include convex hull, segment manipulations, triangulations, range searching, Voronoi diagrams, window queries, Delaunay triangulation, and duality. Some key algorithms are implemented. Questions of floating-point accuracy and robust algorithm design are considered throughout the course.

Credits: 3.00

CS 53200 - Geometric Modeling Algorithms

Credit Hours: 3.00. The geometric modeling course will first introduce computational and mathematical concepts needed for 3D shapes, such as points, vectors, linear combinations, metrics, continuity, differentiability, and transformations. Then, it will describe mathematical descriptions of shapes and their implementations, starting from curves to free-form and subdivision surfaces, meshes and their simplifications, volumetric structures such as meshes, and constructive solid geometry. It will also provide knowledge of the fundamentals of procedural modeling (fractals, L-systems, terrain, and vegetation modeling). This course will also discuss modern AI-oriented methods for 3D shape generation.

Learning Outcomes: 1. Learn foundations of geometric modeling including geometry and topology. 2. Learn basic geometric objects, their representations, and operations including line, plane, and volume. 3. Learn algorithms and Data Structures for Geometric Modeling. 4.

Learn curves including derivative, curvature, osculating circle, and continuity. 5. Learn surfaces including differential properties and special surfaces. 6. Learn volumes including space enumeration and constructive solid geometry. 7. Learn advanced shape representations including meshes. 8. Learn procedural models including fractals, chaos, and noise. 9. Learn AI-based generative models. Credits: 3.00

CS 53400 - Motion Planning

Credit Hours: 3.00. This course introduces the fundamental concepts of motion planning in robotics and autonomous systems. It will cover classical algorithms, basic kinematics, sampling-based approaches, and an introduction to multi-agent planning. The course is designed for graduate students with little or no prior background in motion planning. Practical applications and hands-on projects will be used to solidify the concepts learned.

Learning Outcomes: 1. Comprehend the essential problems in motion planning for autonomous systems, including pathfinding, navigation, and collision avoidance. 2. Articulate the challenges faced by robots in different environments, such as static, dynamic, and complex terrains. 3. Implement and apply classical graph-based search algorithms (e.g., A*, Dijkstra's) to solve planning problems in robotic systems. 4. Analyze the trade-offs between different algorithms with respect to computational complexity, optimality, and real-time performance in grid-based and continuous environments. 5. Grasp the concepts behind sampling-based planning methods such as Probabilistic Roadmaps (PRM) and Rapidly-exploring Random Trees (RRT). 6. Design and implement basic versions of these algorithms in simulation environments, understanding their practical application in high-dimensional configuration spaces. 7. Implement collision detection algorithms and integrate them into planning frameworks to ensure safe navigation in complex and cluttered environments. 8. Develop an understanding of geometric representations used in collision detection and their limitations in real-world applications. 9. Understand kinodynamic constraints (e.g., velocity, acceleration) and incorporate them into motion planning to ensure feasible trajectories for robots. 10. Apply basic control and trajectory optimization techniques to produce smooth and dynamic motions in robotics systems. 11. Understand the challenges and strategies in multi-agent motion planning, focusing on collision avoidance, path coordination, and reciprocal interactions. 12. Implement simple multi-agent planning algorithms, such as Reciprocal Velocity Obstacles (RVO), in a dynamic multi-agent scenario. 13. Gain hands-on experience using Robot Operating System (ROS) and other standard robotics frameworks to apply motion planning algorithms in simulation and real-world settings. 14. Demonstrate the ability to prototype, test, and debug planning algorithms in simulated robotic systems. 15. Understand the role of optimization in motion planning and apply basic optimization-based techniques for trajectory generation and path smoothing. 16. Analyze how optimization techniques improve the efficiency and feasibility of motion planning in constrained environments. Credits: 3.00

CS 53500 - Interactive Computer Graphics

Credit Hours: 3.00. The principles of computer graphics and interactive graphical methods for problem solving. Emphasis placed on both development and use of graphical tools for various display devices. Several classes of graphics hardware considered in detail. Topics include pen plotting, storage tubes, refresh, dynamic techniques, three dimensions, color, modeling of geometry, and hidden surface removal. Part of the laboratory involves use of an interactive minicomputer graphics system. Knowledge of programming required.

Learning Outcomes: 1. Learn the algorithms underlying the interactive graphics pipeline,

including algorithms for geometric modeling, projection, rasterization, shading, lighting, texture mapping, projective texture mapping, shadow mapping, and environment mapping. 2. Gain experience implementing the interactive graphics pipeline through projects. 3. Gain initial experience programming Graphics Processing units through shaders. 4. Learn and implement algorithms for advanced rendering techniques. Credits: 3.00

CS 53600 - Data Communication And Computer Networks

Credit Hours: 3.00. Data communications: communication hardware technologies including local area and longhaul network hardware, circuit and packet switching, interfaces between computer and network hardware, and performance issues. Network architecture: protocol software and conceptual layering, reliable delivery over an unreliable channel, transport protocols, virtual circuits, datagrams, internetworking as a fundamental design concept, the client-server paradigm, naming and name binding, name servers, addressing and address resolution, routing and routing algorithms, congestion and flow control techniques, network file systems, distribution of computation, and DARPA internet protocols (TCP/IP) as examples of protocol organization.

Learning Outcomes: 1. Network services and applications, including DNS and HTTP . 2. The socket API . 3. Network transport architectures, TCP, UDP and TCP congestion control. 4. Routing and forwarding, intra-domain and inter-domain routing algorithms. Credits: 3.00

CS 53900 - Extended Reality: Principles And Applications

Credit Hours: 3.00. The course covers the computer science foundations of XR in geometric modeling, computer graphics, computer vision, computer animation, human-computer interaction, virtual reality, mixed reality, and augmented reality, as well as applications of XR in education, healthcare. The course will cover principles, design, implementation, and evaluation of XR applications.

Learning Outcomes: 1. Apply computer science, computer graphics, computer visualization, computer vision, and human-computer interaction concepts and principles to implement an extended reality (XR) application. 2. Apply statistics and human-computer interaction concepts and principles to design, implement, and analyze a user study to evaluate an XR application. 3. Demonstrate knowledge of the potential implications of XR technologies in the real-world context. 4. Demonstrate knowledge of the capabilities and limitations of the state of the art in XR. Credits: 3.00

CS 54100 - Database Systems

Credit Hours: 3.00. Fundamentals for the logical design of database systems. The entity-relationship model, semantic model, relational model, hierarchical model, network model. Implementations of the models. Design theory for relational databases. Design of query languages and the use of semantics for query optimization. Design and verification of integrity assertions, and security. Introduction to intelligent query processing and database machines.

Credits: 3.00

CS 54200 - Distributed Database Systems

Credit Hours: 3.00. Fundamental issues in distributed database systems that are motivated by the computer networking and distribution of processors and databases. The theory, design, specification, implementation, and performance of distributed database systems.

Credits: 3.00

CS 54300 - Introduction To Simulation And Modeling Of Computer Systems

Credit Hours: 3.00. Simulation: discrete event simulation, process oriented simulation, generating random numbers, simulation languages, simulation examples of complex systems. Nondeterministic models: random variables, Poisson process, moment generating functions, statistical inference and data analysis. Modeling: elementary queuing models, networks of queues, applications to performance evaluation of computer systems.

Credits: 3.00

CS 54701 - Information Retrieval

Credit Hours: 3.00. Basic principles and practical algorithms used for information retrieval and text mining: statistical characteristics of text, several important retrieval models, text categorization, recommendation system, clustering, federated text search, link analysis, etc.

Learning Outcomes: 1. Learn the theories and techniques behind Web search engines, E-commerce recommendation systems, etc. 2. Get hands on project experience by developing real-world applications, such as intelligent tools for improving search accuracy from user feedback, email spam detection, recommendation system, or scientific literature organization and mining. 3. Learn tools and techniques to do cutting-edge research in the area of information retrieval or text mining. Credits: 3.00

CS 55100 - Cloud Computing Fundamentals

Credit Hours: 3.00. A comprehensive course that investigates all aspects of cloud computing, including: cloud data centers and infrastructure (equipment for processing, storage, communication, and special-purpose facilities); the use of virtualized servers (virtual machines and containers), virtualized storage (Storage Area Networks, Network Attached Storage, object storage), and virtual networks; automation; orchestration systems, such as Kubernetes; programming paradigms used to construct cloud-native software, such as MapReduce, microservices, controllerbased computing, and serverless computing; edge computing; security and privacy in cloud systems; software models. The course emphasizes researching new ways to use cloud computing and research into new ways to design and build cloud systems. The course includes a project. Students should have completed coursework in or have equivalent familiarity with operating systems and computer networks.

Learning Outcomes: 1. Identify underlying cloud facilities and infrastructure features. 2. Assess and compare algorithms and architectures used to design cloud-native software systems. 3. Plan, implement, and deploy cloud-native software systems that use available technologies. 4. Articulate the scientific and technical principles that led to cloud computing. 5. Devise measurements and evaluate the performance of cloud systems. Credits: 3.00

CS 55500 - Cryptography

Credit Hours: 3.00. (CSCI 55500) Concepts and principles of cryptography and data security. Cryptography (secret codes): principles of secrecy systems; classical cryptographic systems, including Vigenere and Vernam ciphers; the Data Encryption Standard (DES); public-key encryption; privacy-enhanced email; digital signatures. Proprietary software protection; information theory and number theory; complexity bounds on encryption; key escrow; traffic analysis; attacks against encryption; basic legal issues; e-commerce; and the role of protocols.

Credits: 3.00

CS 55600 - Data Security And Privacy

Credit Hours: 3.00. Data security and privacy is an important part of information security. This course provides an introduction to the fundamental principles and techniques for data security and privacy. The course covers fundamental theories of access control, discretionary access control, mandatory access control, and role-based access control, database access control approaches including grant revoke, virtual private databases and labelled databases, database encryption. On privacy, it covers data anonymization, re-identification attacks, definition, primitives, and applications of differential privacy.

Learning Outcomes: 1. Explain the limitation of discretionary access control and the impacts to security. (E,Q,W) 2. Explain the definition, enforcement, and challenges for multi-level security, including the Bell LaPadula model, non-interference, and covert channels. (E,Q,W) 3. Articulate integrity models (Biba and Clark-Wilson), and the difference between integrity and confidentiality. (E,Q,W) 4. Explain the main database security mechanism, including grant revoke model, content-based and context-based access control, virtual private databases, labelled databases, and data encryption. (E,Q,W) 5. Articulate the limitations of data anonymization for achieving privacy, and the strengths and limitations of privacy notions including differential privacy. (EQW) 6. Identify, implement, and deploy differential privacy mechanisms for problem settings. (P) Credits: 3.00

CS 55800 - Introduction To Robot Learning

Credit Hours: 3.00. Introduction To Robot Learning

Learning Outcomes: 1. Formulate the robot motion planning and control problems and solve them using standard tools. (W, P, E) 2. Identify

the robot constraints, define their degree of freedom, and formulate their dynamical models for control. (W, P, E) 3. Apply classical and modern robot planning and control techniques to complex robot systems like manipulators, autonomous cars, etc. (W, P, E) 4. Identify limitations in existing classical robot algorithms and understand how to avoid the musing Machine Learning. (W, P) 5. Understand and apply Deep Reinforcement Learning approaches to complex robot systems. (W, P, E) 6. Evaluate and assess current best practices and mechanisms for robot programming. (W, P) 7. Develop a skill for robot programming from perception to low-level control using state-of-the art methods. (W, P) Credits: 3.00

CS 56000 - Reasoning About Programs

Credit Hours: 3.00. The course focuses on the logical foundations and algorithmic techniques used to ensure program correctness. With an emphasis on automated program verification and synthesis, the course covers classical concepts and techniques such as Hoare logic, abstract interpretation, abstraction-refinement and bounded model checking. The course also exposes students to approaches for program synthesis, a new frontier for program reasoning, such as inductive synthesis, synthesis using version space algebras, constraint-based synthesis and synthesis based on machine-learning techniques. The courses emphasizes both theoretical foundations as well as hands-on experience with verification/synthesis tools and SAT/SMT solvers. Students are expected to have completed undergraduate coursework in Foundations of Computer Science (CS 18200) or equivalent, Systems Programming (CS 25200) or equivalent, and Introduction to the Analysis of Algorithms (CS 38100) or equivalent. Mathematical maturity is expected.

Learning Outcomes: 1. Express the expected behavior of programs in logic. 2. Able to manually reason about satisfiability and validity of formulas in first-order logic (modulo theories). 3. Use SAT/SMT solvers to check satisfiability and validity of formulas in first-order logic (modulo theories). 4. Specify properties of programs using pre/postconditions, safety properties and assertions in first-order logic (modulo theories). 5. Describe and apply core approaches for program verification. 6. Explain and apply Hoare logic, invariant generation, abstract interpretation, abstraction-refinement, and bounded model checking. 7. Ability to verify programs using tools such as Dafny and the Z3 SMT solver. 8. Conduct original research in program synthesis. 9. Explain and apply inductive synthesis and functional synthesis, different search techniques (enumerative, explicit, constraint-based), and some recent approaches based on machine learning. 10. Choose and apply appropriate synthesis techniques to a problem domain of their choice. 11. Ability to critically review and present current research in program synthesis. Credits: 3.00

CS 56500 - Programming Languages

Credit Hours: 3.00. An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; axiomatic semantics using Hoare's logic and Dijkstra's predicate transformers; denotational semantics; functional, object-oriented, and logic programming; concurrency and Owicki-Gries theory. Example languages include ML, Ada, Oberon, LISP, PROLOG, and CSP.

Credits: 3.00

CS 57100 - Artificial Intelligence

Credit Hours: 3.00. Artificial Intelligence (AI) systems are increasingly being deployed in many real-world tasks. This course provides an introduction to the fundamental principles and applications of AI. The course covers classic material including search-based methods, probabilistic reasoning, game playing, decision making, exact and approximate inference, causal learning, and reinforcement learning as well as selected advanced topics. The focus of the course is on foundational methods and current techniques for building AI systems that exhibit 'intelligent' behavior and can 'learn' from experience. The course assumes students are familiar with basic concepts in analysis, linear algebra, optimization, discrete mathematics, elementary probability, statistics, data structures, and algorithms. Students are expected to have good programming and software development skills and have a working knowledge of Python and Java.

Learning Outcomes: 1. Assess and explain the applicability, strengths, and weaknesses of the basic knowledge representation, problem-solving, and learning methods in solving a particular problem. (E,W) 2. Predict the behavior and estimate the cost (in time and space) of different heuristic and optimal search methods, and choose the appropriate method for particular problems. (W,P) 3. Develop small logic-based, rule-based, and search-based systems; be able to predict performance characteristics. (P) 4. Predict the behavior of basic machine-learning methods, and choose the appropriate method for particular problems. (W,P) 5. Communicate critical key issues in AI-related to knowledge representation, problem-solving, and learning for a specific problem. (W) 6. Propose, evaluate, and implement effective solutions to problems requiring AI techniques. (P) 7. Articulate key problems, both technical and philosophical, in the development of artificial intelligence systems. (E,W) Credits: 3.00

CS 57300 - Data Mining

Credit Hours: 3.00. (CSCI 57300) Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering summary knowledge in large datasets. This course introduces students to the process and main techniques in data mining, including classification, clustering, and pattern mining approaches. Data mining systems and applications are also covered, along with selected topics in current research. Offered in alternate years.

Learning Outcomes: 1. Learn Data mining techniques. 2. Learn how to summarize large data sets. 3. Learn current research topics. Credits: 3.00

CS 57700 - Natural Language Processing

Credit Hours: 3.00. This course will cover the key concepts and methods used in modern Natural Language Processing (NLP). Throughout the course several core NLP tasks, such as sentiment analysis, information extraction, syntactic and semantic analysis, will be discussed. The course will emphasize machine-learning and data-driven algorithms and techniques, and will compare several different approaches to these problems in terms of their performance, supervision effort and computational complexity. Prerequisites: A background in linear algebra, calculus, statistics and probability, and completion of CS 57800 or equivalent are highly recommended. Strong programming skills in any modem language (Python, Java, C++) are required.

Learning Outcomes: 1. Describe and analyze the key challenges in dealing with natural language data and other fundamental areas of NLP. 2. Analyze and implement the key algorithms and techniques used in NLP. 3. Identify algorithmic techniques that can be applied to new problems and evaluate other possible solutions. 4. Conduct experiments using proper methodology for training and testing NLP systems using data. 5. Critically review current research work in the NLP field. Credits: 3.00

CS 57800 - Statistical Machine Learning

Credit Hours: 3.00. This introductory course will cover many concepts, models, and algorithms in machine learning. Topics include classical supervised learning (e.g., regression and classification), unsupervised learning (e.g., principle component analysis and K-means), and recent development in the machine learning field such as variational Bayes, expectation propagation, and Gaussian processes. While this course will give students the basic ideas and intuition behind modern machine learning methods, the underlying theme in the course is probabilistic inference.

Learning Outcomes: 1. Learn the theory and key algorithms used in machine learning. 2. Get hands-on machine learning experience by implementing several algorithms, applying them to datasets and analyzing their performance. 3. Understand how to use machine learning methods to their research projects, formulate the learning tasks and match them with appropriate solutions. Credits: 3.00

CS 57900 - Bioinformatics Algorithms

Credit Hours: 3.00. Review of Genomes, DNA, RNA, proteins, proteomes. Biological Sequences: dynamic programming; pairwise global, local, and semi-global alignments of genes and

proteins; constant, affine, and general gap penalties; RNA alignments; BLOSUM and PAM scoring matrices. Multiple alignment of proteins: approximation algorithms; iterative and progressive alignment methods. Database search for sequences: BLAST and variants. Phylogenetic Trees: distance-based methods, ultrametric and additive distance functions; parsimony, and maximum likelihood methods. Whole Genome Alignment: suffix trees and suffix arrays. Systems Biology: Module discovery in biological networks, spectral algorithms for graph clustering. Network alignment: quadratic programming formulations and graph matching. Genetic Variation: haplotype inference, the perfect phylogeny problem and chordal graphs. Additional topics such as next-generation sequencing, analysis of multidimensional data from flow cytometry, and gene expression data, if time permits.

Learning Outcomes: 1. Students will learn how to design algorithms. 2. Students will learn how to solve computational problems from the new biology, the data-rich field that biological sciences is becoming. Credits: 3.00

CS 58000 - Algorithm Design, Analysis, And Implementation

Credit Hours: 3.00. Basic techniques for designing and analyzing algorithms: dynamic programming, divide and conquer, balancing. Upper and lower bounds on time and space costs, worst case and expected cost measures. A selection of applications such as disjoint set union/find, graph algorithms, search trees, pattern matching. The polynomial complexity classes P, NP, and co-NP; intractable problems.

Credits: 3.00

CS 58100 - Algorithmic Game Theory

Credit Hours: 3.00. The field of algorithmic game theory (also known as economics and computation) has been expanding at a rapid pace in recent years, with computational reasoning playing a crucial role in transforming classical economics. An increasing number of real-world systems require careful design of algorithms where the inputs are provided by agents with different preferences. Applications include Google's ad auctions, spectrum auctions, Bitcoin, matching markets, and allocation of vaccines. This has inspired new models and algorithms and led to deep connections with machine learning through multi-agent learning and computational complexity. This course will introduce the area of Algorithmic Game Theory by studying games, solution concepts, complexity of equilibria, mechanism design, auction theory, fair division, social choice, learning dynamics, and markets. It will include both classical results and recent developments.

Learning Outcomes: 1. Analyze and solve games (zero-sum, general-sum, potential games), identify stable solutions, and design algorithms for computing them where applicable. 2. Design and analyze mechanisms that work well when the participants are strategic, for various problems including selling goods (auctions). 3. Design and analyze algorithms with provable fairness guarantees. 4. Explain concepts of social choice used in specific domains, e.g., elections. 5. Analyze markets and design algorithms that market participants can use to achieve desirable outcomes in both static and repeated settings. 6. Analyze multi-agent learning settings, where agents learn together in some environment but have different incentives, which influence their interactions. Credits: 3.00

CS 58400 - Theory Of Computation And Computational Complexity

Credit Hours: 3.00. The theory of general purpose programming systems. Recursive and partial-recursive functions; recursive and recursively enumerable sets. The Church-Turing thesis. The recursion theorem, Rogers' translation theorem, Rice's undecidability theorem. The general theory of computational complexity: there are no general solutions to natural optimization problems. Complexity for specific models of computation: the polynomial complexity classes P, NP, and PSPACE; NP-hard and PSPACE-hard problems, inherently exponential problems.

Credits: 3.00

CS 58500 - Theoretical Computer Science Toolkit

Credit Hours: 3.00. This course covers fundamental techniques and a range of mathematical tools that underlie today's research in theoretical computer science. The course material is essential for research in theoretical computer science as well as machine learning theory. The course is targeted at students who plan to pursue research in these areas. Topics will be chosen from four core areas: Convex Analysis and Optimization, Spectral Methods, Concentration Inequalities, and Discrete Fourier Analysis. Depending on student and instructor interest, additional topics will be chosen and may include applied analysis, coding theory, probabilistic proofs, and more advanced topics in discrete Fourier analysis. Students will read papers in theoretical computer science and machine learning theory using, exploring and extending the covered techniques and tools. Students are expected to be proficient in probability

theory, have the maturity to follow and carry out basic analysis proofs, and have completed courses in calculus, linear algebra, discrete mathematics, and analysis of algorithms. More specifically, the course expects mastery of the material covered in Calculus III, Linear Algebra, Probability, Foundations of CS, and Analysis of Algorithms.

Learning Outcomes: 1. Explain and justify the merits and limitations of convex optimization algorithms. 2. Describe the characteristics and the role of convexity in optimization. 3. Formulate mathematically problems that have solutions based on convex optimization or matric analysis tools and analyze them effectively. 4. Predict typicality of the outcome in experiments. 5. Explain how to use and apply concentration bounds, including Chernoff-Hoeffding Bound, Martingales and Azuma's Inequality, and applications of the Talagrand inequality. 6. Develop precise mathematical formulation of problems and analyze using frameworks related to concentration of measure. 7. Apply Discrete Fourier Transform to determine properties of functions. 8. Explain why Fourier Analysis of Boolean Functions is a major tool in theoretical CS and describe application scenarios including property testing, cryptography, complexity, learning theory, pseudorandomness, hardness of approximation, and random graph theory. 9. Identify properties of functions based on the properties of their spectrum. 10. Explain the basic ideas underlying the tradeoff between the amount of redundancy used and the number of errors that can be corrected by a code. 11. Describe achieving the optimal tradeoff between redundancy and error correction for codes that come equipped with efficient encoding and decoding. 12. Illustrate how and why concatenated codes support the construction of asymptotically good codes. Credits: 3.00

CS 58700 - Foundations Of Deep Learning

Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning. Credit Hours: 3.00. This course provides an integrated view of the key concepts of deep learning (representation learning) methods. This course focuses on teaching principles and methods needed to design and deploy novel deep learning models, emphasizing the relationship between traditional statistical models, causality, invariant theory, and the algorithmic challenges of designing and deploying deep learning models in real-world applications. This course has both a theoretical and coding component. The course assumes familiarity with coding in the language used for state-of-the-art deep learning libraries, linear algebra, probability theory, and statistical machine learning.

Learning Outcomes: 1. Understand statistical Foundations of Deep Learning. 2. Understand feedforward Networks. 3. Understand stochastic optimization of neural network models. 4. Understand Bayesian Neural Networks. 5. Understand invariant & Equivariant Representation Learning. 6. Understand task-invariant representations. 7. Understand meta Learning. 8. Understand multi-task Learning. 9. Understand transfer Learning. 10. Understand implicit generative models (probabilistic models without explicit likelihoods). 11. Understand variational Auto-Encoders. 12. Understand generative Adversarial Networks. 13. Understand stable Diffusion Generative models. 14. Understand how to evaluate the performance of neural networks, as well as formulate and test hypotheses. 15. Understand how theory and algorithmic elements interact to impact performance. Credits: 3.00

CS 58800 - Randomized Algorithms

Credit Hours: 3.00. The area of randomized algorithms has grown from being a tool in computational number theory to finding widespread application in algorithms in all areas of computer science. Two practical benefits of randomization are its simplicity and speed. Deep and important computational complexity connections have been developed, from bridging the gap between discrete and continuous optimization, bypassing deterministic barriers in online settings, summarizing massive data in polylogarithmic space, probabilistically checkable proofs, privacy enhancing techniques, modeling the web and other large networks, and sparsifying and compressing complicated combinatorial structures such as graphs. Randomization is an essential key ingredient in the algorithmic breakthroughs today and in the future. This course presents the basic concepts in the design and analysis of randomized algorithms and shows how to apply them to algorithms for a wide range of problems. The course covers a broad range of problems benefitting from randomized computation including data structures, graph algorithms, online algorithms, geometric algorithms, streaming algorithms, derandomization techniques, and tools for probabilistic analysis of algorithms.

Learning Outcomes: 1. Describe the main principles underlying the design and analysis of a randomized algorithm. 2. Explain concepts of randomized algorithms used in specific domains; e.g., graph-theory, number theory, and linear algebra problems. 3. Apply measure concentration results from probability theory to analyze a given randomized algorithm. 4. Determine the running times, failure probabilities, and accuracy guarantees of a randomized algorithm. 5. Apply learned design techniques and analysis tools to design and analyze new randomized algorithms. 6. Explain material from published research in the area of randomized algorithms using field-specific language. Credits: 3.00

CS 59000 - Topics In Computer Sciences

Credit Hours: 1.00 to 5.00. Directed study for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 1.00 to 5.00

CS 59100 - Seminar

Credit Hours: 1.00. A weekly seminar presented by faculty and invited speakers, normally in a specific area.

Credits: 1.00

CS 59200 - Computer Science Seminar

Credit Hours: 3.00. A seminar course for in-depth exploration of a specific topic. Topics vary. Classes consist of both instructor and student presentations. Students read, present and discuss research papers, and may complete and present a research project in the area. For each offering, inclusion on a plan of study is determined by the CS Graduate Study Committee. If approved, may be included on a CS MS or PhD plan of study according to relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

CS 59300 - New Topics In CS

Credit Hours: 3.00. A variable title course for topics not currently covered in the CS graduate curriculum. Each offering follows a traditional course structure with textbook(s), assignments, exams, and week-by-week content synopsis described in a syllabus. A CS 59300 offering does not imply that a course is intended to become, or will become, a regular course in the CS graduate curriculum. May be included on a CS

MS or PhD plan of study according to the relevant ruleset.

Learning Outcomes: 1. Vary due to nature of course. Credits: 3.00

CS 59799 - Graduate Professional Practice

Credit Hours: 0.00. Internship experience to complement the student's academic coursework and help prepare the student for employment in computer science. The student must present a letter from the proposed employer describing to a reasonable extent the work to be undertaken and find a member of the Computer Science Graduate Faculty to be the instructor. The student must have completed at least one semester as a computer science graduate student at Purdue, West Lafayette. May not be taken in successive semesters. Permission of instructor required.

Learning Outcomes: 1. Experience applying knowledge and skills learned in courses. Credits: 0.00

CS 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (MA 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicolson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: CS 51400, MA 52300.

Credits: 3.00

CS 62600 - Advanced Information Assurance

Credit Hours: 3.00. Advanced topics in information assurance, including selections from the following: penetration testing, formal verification of systems, formal models of information flow and protection, distributed system authentication, protocol design and attack, computer viruses and malware, intrusion and anomaly detection models, multi-level security, active defenses, investigation and forensics, network firewalls, anonymity and identity, e-commerce support, and database security models and mechanisms. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 63500 - Capturing And Rendering Real-World Scenes

Credit Hours: 3.00. Advanced techniques for automated modeling and visualization of complex environments, such as rooms, buildings, urban scenes, and landscapes. Topics covered are at the confluence of computer graphics, computer vision and engineering, and include: capture technologies, acquisition device calibration, view registration, panoramic images, 3D reconstruction from images, view morphing, 3D image warping, lightfield modeling and rendering, visual hulls, point-based modeling and rendering, view dependent texture mapping, and application development issues and examples. Prerequisite: CS 58000 , CS 53500 or a solid foundation in computer graphics, programming proficiency in C or C++ and basic linear algebra.

Credits: 3.00

CS 63600 - Internetworking

Credit Hours: 3.00. Principles of Internetwork architecture and communication protocols underlying interoperable systems. Topics include universal interconnection, Internet addressing and routing, address binding, control of Internet congestion and flow, examples of Internet protocol suites (TCP/IP and XNS), round trip time estimation, naming and name resolution, Internet applications programs, and the ISO/OSI model. Prerequisite: CS 50300 .

Credits: 3.00

CS 63800 - Multimedia Networking And Operating Systems

Credit Hours: 3.00. For graduate students in computer sciences who have a background in networking and operating systems and are interested in research in networked multimedia systems. The course consists of a selection of networking and operating system topics for realizing high performance, predictable, scalable, flexible, and secure multimedia systems. Topics may vary to reflect timely research issues and the current interests of the instructor(s). Students are expected to complete a term project. Presentations also may be required. Undergraduate background in computer science required. Prerequisite: CS 53600 or CS 50300 .

Credits: 3.00

CS 64100 - Multimedia Database Systems

Credit Hours: 3.00. Prepares students for research in multimedia database systems. Students are exposed to a variety of emerging innovative techniques to store, manipulate, communicate, visualize, and reason with multimedia systems. Prerequisite: CS 54100 or CS 54200 .

Credits: 3.00

CS 65500 - Advanced Cryptology

Credit Hours: 3.00. Advanced topics in cryptography and cryptanalysis, including selections from the following:

Steganographic methods, Cryptanalytic techniques, including differential cryptanalysis, and chosen plaintext attacks. Message digest algorithm construction. Digital cash. Quantum cryptography. N-key systems. Minimal and zero-knowledge systems. Protocol design and failure. Verification of algorithms. Key generation and management. Traffic analysis. VPN construction and operation. Politics, espionage, and law enforcement concerns. Offered every third semester. Prerequisite: CS 52600 , CS 55500 .

Credits: 3.00

CS 66200 - Pattern Recognition And Decision-Making Processes

Credit Hours: 3.00. (ECE 66200) Introduction to the basic concepts and various approaches of pattern recognition and decision-making processes. Topics include various classifier designs, evaluation of classifiability, learning machines, feature extraction, and modeling. Prerequisite: ECE 30200 .

Credits: 3.00

CS 69000 - Seminar On Topics In Computer Sciences

Credit Hours: 0.00 to 5.00. Topics vary. Permission of instructor required.

Credits: 0.00 to 5.00

CS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. The student is expected to follow safe research practices, to follow ethical research practices, to maintain communication with the instructor, to formulate a set of reasonable semester research progress milestones with instructor, optionally in writing. Permission of instructor required.

Credits: 1.00 to 18.00

CS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. The student is expected to follow safe research practices, to follow ethical research practices, to maintain communication with the instructor, to formulate a set of reasonable semester research progress milestones with instructor, optionally in writing. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Earth, Atmospheric, and Planetary Sciences (Graduate)

Website: **http://www.eaps.purdue.edu/for_students/graduate/**

Department/School Head

Andrea Donnellan

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Professor of Practice	Emeritus Faculty

Daniel Cziczo Andrea Donnellan Lucy Flesch Andrew Freed Briony Horgan Darryl Granger Matthew Huber Brandon Johnson Cliff Johnston Greg Michalski Nathaniel Lifton Kenneth D. Ridgway Douglas Schmitt Roger Wiens Qianlai Zhuang	Daniel R. Chavas Daniel T. Dawson Marty Frisbee Yunyue Elita Li David Minton Robin Tanamachi Michelle Thompson Wen-wen Tung Lisa Welp	Cauê Borlina Ali M. Bramson Roger Bryant Jonathan Delph Michael Eddy Alexandria Johnson Stephanie Olson Ben Pearce Kelsey Prissel Tabb Prissel Michael Sori Marissa Tremblay Michael Vermeuel Lei Wang Xiaotao Yang	Erik Meade Conway Saad Haq, Associate Gouri Prabhakar, Assistant	Ernest Agee Michael Baldwin Lawrence Braile John Cushman Joseph Francisco Alexander Gluhovsky Jon Harbor Harshvardhan Harshvardhan William Hinze Robert Nowack Dan Shepardson Paul Shepson Yuch-Ning Shieh Phillip J. Smith Wen-Yih Sun Terry R West William Zinsmeister

Academic Programs

Master's and Ph.D. Programs

EAPS offers graduate research programs leading to the Master of Science (MS) and Doctor of Philosophy (Ph.D.) degrees.

EAPS is a multidisciplinary department in the College of Science offering graduate research programs in Atmospheric Sciences, Environmental Geoscience, Geodata Science Initiative, Geology and Geophysics, and Planetary Sciences, leading to MS and Ph.D. degrees. Our research incorporates a wide range of innovative observational and experimental techniques in both field and laboratory settings, as well as advanced numerical modeling methods, to address some of the most challenging interdisciplinary questions about the past, present, and future state of the Earth and other planetary systems. These topics of study include processes operating from deep in the interior to the surficial environments of Earth and other planetary bodies, severe weather and climate, energy and environmental resources, hydrology and water resources, and many more. Our former students are now employed by universities, major research institutions, government agencies, and industry.

Research Areas

- Atmospheric Science
- Environmental Science
-

Geodata Science (MS)
• Geology and Geophysics
• Planetary Science

Earth, Atmospheric, and Planetary Sciences, MS

Earth, Atmospheric, and Planetary Sciences, PHD

EAPS 50300 - Mars Seminar

Credit Hours: 3.00. This seminar course will introduce students to the origin and evolution of Mars through reading classic papers on the geology, atmosphere, and Interior of Mars, as well as in-class lectures, discussions, and a final paper.

Learning Outcomes: 1. Understand Mars as a planet. 2. Understand the limits of human knowledge about the Red Planet, its potential for life, and its potential for sustaining humans in the future. 3. Gain a basic understanding of the process of Mars exploration including landing site selection. 4. Gain proficiency in reading scientific papers and in presenting scientific ideas in oral and written format. Credits: 3.00

EAPS 50400 - Geologic Dating Methods

Credit Hours: 3.00. This course covers general theory and applications of geochronology and thermochronology to questions in Earth and planetary science.

Learning Outcomes: 1. Explain the basic physical processes underlying the most commonly used dating methods. 2. Calculate geochronological dates from raw geochemical datasets or other kinds of observations for the most commonly used dating methods. 3. Use physical and numerical models to interpret the significance of geochronological dates. 4. Evaluate which geochronological method, if any, is most appropriate for answering a particular scientific question in Earth and planetary science. 5. Discuss the contribution of geo/thermochronology to big questions in Earth and planetary science. Credits: 3.00

EAPS 50600 - Cosmochemistry And Geochemistry

Credit Hours: 3.00. The course focuses on the chemical processes involved in the formation and evolution of our solar system and our planet. The course includes discussion of nucleosynthesis and chemical abundances, the origin and composition of various planetary objects and their constituent materials, and the distribution and cycling of elements within and between different Earth systems, including the solid Earth, atmosphere, and oceans.

Learning Outcomes: 1. Understand the cosmochemical model for solar system formation. 2. Become familiar with the inventory of planetary materials in our solar system and understand their characteristics. 3. Understand what causes the first order distribution of elements in different parts of the Earth and other planetary bodies. 4. Apply principles of thermodynamics and reaction kinetics to predict the physical and chemical characteristics of Earth and planetary materials. 5. Understand how chemical exchange between the solid earth, biosphere, and ocean-atmosphere affect the evolution of the Earth system. 6. Analyze laboratory data to gain insight geochemical and cosmochemical processes. 7. Identify outstanding questions in the primary cosmochemistry and geochemistry literature and propose what new observations, data, and/or models could be used to address these questions. Credits: 3.00

EAPS 50700 - Introduction To Analysis And Computing With Geoscience Data

Credit Hours: 3.00. Course teaches computing techniques including error analysis, line and surface fitting, interpolation, map projections, geospatial and temporal correlations, signal processing, and visualization with discussions on specific and practical geoscience applications. Lectures with computer exercises and team project reporting using open-source computer software. Cannot get credit for both EAPS 50900 and

EAPS 50700.

Learning Outcomes: 1. Carry out computational solutions to a given range of geoscience data analysis problems. 2. Select the appropriate analysis approaches when given a set of data. 3. Appraise and conclude the analysis results professionally. Credits: 3.00

EAPS 50701 - Geospatial Data Analytics

Credit Hours: 3.00. The course will introduce fundamental theories, analytical methods and programming skills that are needed to work with geospatial data. Students will learn the theories, methods, and techniques to visualize, analyze and model various geospatial data through hands-on computer programming practice based on various open-source geospatial libraries. To be specific, the course will use R and its related packages as the basic tool for implementation. The goal is to enable the learners to develop their own geospatial analytical applications.

Learning Outcomes: 1. Interpret and evaluate the theories and methods of geospatial data analytics. 2. Design and implement typical geospatial methods through programming. 3. Visualize and interpret the outcome of geospatial data analytics effectively. Credits: 3.00

EAPS 50801 - Geographic Information Systems

Credit Hours: 3.00. This course covers a range of fundamentals in geographic information science and technology. Students will learn the use of current popular geographic information system (GIS) tools to handle various geographic data. Through working on real-world geospatial problems, students shall gain extensive and hands-on experience in geographic data manipulation, visualization, and analysis. Course assignments are focused on both GIS theoretical basics and practical skills for students to achieve expected proficiency. The course will work with geospatial data in geography, topography, environmental science, hydrology, transportation, and geosocial science. It is targeted to students with interest in civil and environmental engineering, agriculture, geography, earth science, natural resources, smart cities or other related subjects.

Learning Outcomes: 1. Demonstrate a comprehensive and in-depth understanding of GIS fundamentals. 2. Effectively collect and handle various geographic data. 3. Exhibit a proficient command of popular GIS software tools. 4. Conduct GIS mapping, database design, analysis and visualization tasks independently. Credits: 3.00

EAPS 50900 - Data Analysis Techniques In Earth And Atmospheric Sciences

Credit Hours: 3.00. Application of statistical techniques to analyze and interpret data containing substantial information about the dynamics of our planet Earth. Emphasis on fundamentals with elements of atmospheric/climate time series analysis and weather and climate extremes (necessary for understanding current research) interwoven with computer-intensive bootstrap methods (which work for complex data sets typical in geosciences). Offered Spring.

Learning Outcomes: 1. Gain a solid basis for practical application of statistical methods to data analysis in geosciences. 2. Gain exposure to atmospheric and climate time series analysis including weather and climate extremes, necessary for understanding current topics in weather and climate research. 3. Experience computer-intensive methods to handle complex data sets without having to rely on strong assumptions common in classical statistics but rarely met in geosciences. Credits: 3.00

EAPS 51000 - Climate Time Series Analysis

Credit Hours: 3.00. This course in time series analysis combines traditionally taught basics with topics of central importance in current weather and climate research, including long memory, extremes, nonlinear time series, chaos and complexity.

Learning Outcomes: 1. Understand concepts and methods of classical time series analysis. 2. Get hands on experience in resampling methods for time series analysis, which work for complex data sets without having to rely on strong assumptions common in classical time series analysis but rarely met in geosciences. 3. Learn how to match a time series methods to a particular geosciences data set or question. 4. Develop skills in writing programs in R to analyze geosciences data and interpret results. 5. Learn basics of advanced topics instrumental

in geosciences: long memory, extremes, nonlinear time series, chaos and complexity. 6. Improve their critical thinking and oral communication skills via giving presentations on their research projects involving topics covered in the course. Credits: 3.00

EAPS 51201 - Planetary Origins

Credit Hours: 3.00. The goal of this course is to introduce students to our current understanding of how planetary systems form and evolve. We will focus on the physical theories describing how the structures of planetary systems develop and how planets, moons, and other heavenly bodies form. We will also consider the relationship between these theories and observations (astronomical, geophysical, cosmochemical) of the Solar System and extrasolar planetary systems. This will include some discussion how the Solar System fits into our understanding of the veritable menagerie of planetary systems.

Learning Outcomes: 1. Understand the physical processes that produce and sculpt planetary systems. 2. Develop ability to read and critically examine scientific papers. 3. Provide and receive constructive criticism to and from colleagues. 3. Learn how to formulate a research question and conduct a literature review or design and conduct some original research on that topic. 4. Learn how to present scientific ideas in oral and written format. Credits: 3.00

EAPS 51400 - Glacial And Quaternary Geology

Credit Hours: 3.00. Formation, dynamics, and regimen of glaciers. Erosional and depositional processes and landforms developed by alpine and continental glaciation. Glaciation of North America during the Ice Age, with emphasis on stratigraphy, soils, climates, biology, and physical changes resulting from glacial processes and environments. Application of glacial studies to agronomy, life sciences, climatology, oceanographic studies, and engineering problems. A one-day field investigation is required.

Credits: 3.00

EAPS 51500 - Geodata Science

Credit Hours: 3.00. Course covers a range of topics with applications of mathematical, statistical, numerical, and distributed parallel computing methods for modeling and understanding complex and large spatio-temporal geoscience datasets in the formats common to in-situ observations, asynoptic remote sensing data, volumetric gridded analysis, etc.

Learning Outcomes: 1. Identify and load into R the relevant data to solve a specific geoscience problem. 2. Design effective data import, tidying, and transformation procedures using geoscience knowledge. 3. Determine what and how to plot large geoscience datasets to guide each step in the workflow. 4. Judge whether model assumptions are reasonable and if the chosen models fit the data using geoscience domain knowledge. 5. Appraise and conclude the results of a geodata-science project professionally. Credits: 3.00

EAPS 51600 - Stable Isotope Applications In Earth Science And Ecology

Credit Hours: 3.00. This course examines stable isotopes as tools to study biogeochemical cycles, hydrological processes, carbon cycle, ecology, geology, and anthropology. Primary systems studied will include H, C, N, O, and S. The goal is to explore both theoretical and applied aspects of stable light isotope biogeochemistry so that students can: 1) understand and critically evaluate research articles containing stable isotopic data, and 2) see how isotopes might be used as primary tools or to enhance their own research. Every effort will be made to cover the isotopic systems of each student's research field. Theoretical principles, isotope fractionation, mixing models, and variation of isotopes in the natural world, and uncertainty quantification in applications will be presented and discussed. Course assignments will include homework sets, exams, a journal-club style discussion of relevant literature, and a final paper in the form of a review article or scientific proposal.

Learning Outcomes: 1. Apply a theoretical understanding of light stable isotopes to research applications in biogeochemistry, hydrology, ecology, geology, and/or anthropology. 2. Read and evaluate research articles containing stable isotopic data. 3. Demonstrate an understanding of how isotopic measurement techniques work, sampling preparation considerations, and data workup. 4. Analyze, plot, and interpret stable isotope data to answer a research question of the student's choosing. Credits: 3.00

EAPS 51700 - Lunar Exploration

Credit Hours: 3.00. In this course we will review the history of the scientific exploration of the Moon since the dawn of the space age. Our focus will be on the science problems that motivated researchers in their scientific investigations of the Moon and the results that they obtained. The course will then transition to modern theory and the fringes of our understanding related to Moon formation and evolution. Here the course will make extensive use of primary peer-reviewed literature, and facilitate open discussion intended to cultivate original thought or new testable hypotheses aimed at advancing outstanding issues in lunar science. Part of this course will also be devoted to understanding the technical language and terminology used in lunar science, as well as general strategies for reading and understanding scientific literature.

Learning Outcomes: 1. Appreciate the immense body of scientific knowledge enabled by the exploration of the Moon. 2. Identify scientifically important lunar geographical features through daily readings, in-class discussions, and quizzes. 3. Understand the constraints on our current models for the origin and evolution of the Moon. 4. Identify the knowledge gaps in our current models for the origin and evolution of the Moon and how future missions could be designed to close those gaps. 5. Apply learned skills and strategies for reading, comprehending, and assessing primary scientific literature. Credits: 3.00

EAPS 51800 - Soil Biogeochemistry

Credit Hours: 3.00. This course will provide an introduction to the physical and microbial processes governing the cycling of photosynthetically-produced organic matter on land and in streams and rivers. Organic geochemical transformations in the soil and litter will be highlighted along with methods of characterization of the organic constituents. Biogeochemical concepts of stabilization and destabilization of soil organic matter and stress response of terrestrial ecosystems will be reinforced through manipulation of actual data sets.

Learning Outcomes: 1. Understand the basic mineral and organic chemistry of soils. 2. Understand the range of soil types and capacities to store organic matter. 3. Understand the natural and man-made stressors of soil organic matter and the range of impacts. 4. Understand the common analytical tools used to assess chemistry and health state of soils. 5. Understand how to structure and write and NSF-style proposal. 6. Understand the need for hypothesis generation in developing a research proposal. 7. Be able to work in teams to analyze large data sets and develop and hone hypotheses. 8. Understand the mechanisms of soil stabilization and destabilization. 9. Understand the comparative role of different groups of microbes in the decay of plant-derived litter. Credits: 3.00

EAPS 52000 - Theory Of Climate

Credit Hours: 3.00. A general introduction to the theory of climate at an intermediate level. A brief survey of physical climatology and paleoclimates. Theoretical development of climate models. Theories of climatic stability and climatic change.

Learning Outcomes: 1. Describe in a quantitative fashion the processes that determine past and present climates, as well the qualitative patterns associated with those changes. Apply this fundamental theoretical knowledge using the tools of modeling to understand and predict climate changes and changes in modes of climatic variability. 2. Identify, calculate, and explain the various thresholds, non-linearities, and 'tipping point' mechanisms in the climate system as a complex dynamical system both from the theoretical and observational points of view. 3. Define the appropriate type of model or quantitative framework for answering a climate, paleoclimate, or future climate question and know how to utilize this model through comparison with appropriate data or theoretical predictions. Credits: 3.00

EAPS 52100 - Atmospheric Chemistry

Credit Hours: 3.00. An introduction to the chemistry of the

earth's atmosphere. Covers evolution of the earth's atmosphere, its physical and chemical structure, its natural chemical composition and oxidative properties, and human impacts, including increasing tropospheric ozone, decreasing stratospheric ozone, climate change, and acidic deposition.

Credits: 3.00

EAPS 52300 - Radar Meteorology

Credit Hours: 3.00. Origin and evolution of radar. Modern weather radar systems and their component parts. Propagation of microwave energy in the atmosphere. Rayleigh and Mie scattering theory, with application to scattering by precipitation. Utilization of radar systems in forecasting quantitative analyses and cloud physics research. Recent refinement and future potential. Prior coursework in synoptic meteorology labs and atmospheric physics is required.

Credits: 3.00

EAPS 52400 - Laboratory Analysis

Credit Hours: 3.00. This course focuses on becoming familiar with various laboratory techniques used in the analysis of earth and planetary materials and understanding what questions data products from these techniques can answer. This course will include discussion of the instruments and how they operate, as well as provide hands-on experience working in the lab and processing data.

Learning Outcomes: 1. Become familiar with common laboratory analytical techniques used in earth and planetary science. 2. Gain experience working with analytical instruments and the associated laboratory data. 3. Propose a research topic, conduct a literature review, and design an original research project requiring use of coordinated analytical techniques. Credits: 3.00

EAPS 52500 - Boundary Layer Meteorology

Credit Hours: 3.00. (AGRY 53500) A study of the physical nature of the lowest layers of the atmosphere. The energy balance concept and the turbulent transfer of heat, momentum, and water vapor are discussed in detail. Some specific microclimates are studied in this context.

Credits: 3.00

EAPS 52600 - Introductory Geofluid Dynamics

Credit Hours: 3.00. Provides a fluid dynamics background for graduate students interested in atmospheric sciences, oceanography, mantle convection, hydrology, turbulence, or pollution. Topics covered include: basic assumptions and deviations of Navier Stokes equations, conservation laws, vorticity, divergence, waves, and applications in atmosphere, ocean, and geophysics.

Learning Outcomes: 1. Provide students a rigorous foundation in geofluid dynamics as well as the connections among math, physics, and real natural phenomena. 2. Students will become accustomed to applying the physical equations to real phenomena, and to presenting them in a concise way. 3. Understand the basic equations and physics in existing models which provides a broader and deeper understanding of the earth sciences. Credits: 3.00

EAPS 52700 - Principles Of Terrestrial Ecosystem Ecology

Credit Hours: 3.00. The objective of this course is to build a conceptual model of terrestrial ecosystems and to provide students with the state-of-the-art mechanisms by which terrestrial ecosystems work. Topics include ecosystem concept, Earth's climate system, geology and soils, terrestrial water and energy balance, terrestrial production processes, terrestrial decomposition, terrestrial plant nutrient use and cycling, biogeochemical pathways, and ecosystem temporal and spatial dynamics. Permission of instructor required.

Learning Outcomes: 1. Learn what key variables to be observed for ecosystem studies. 2. Understand the feedbacks between the atmosphere and terrestrial biosphere. Credits: 3.00

EAPS 52900 - Modeling Ecosystems And Biogeochemical Cycles

Credit Hours: 3.00. Process-based models are powerful tools for studying ecosystem dynamics and geochemical cycles in Earth System Sciences. In this course, we will explore how various components of ecosystems can be modeled following principles of biology, physics, and chemistry. We will also examine techniques for using modeling to study: 1) responses of the structure and functioning of ecosystems to changing climate, atmospheric composition, environmental conditions, and human activities; and 2) exchanges of major greenhouse gases (e.g., CO_2, CH_4, and N_2O) between the atmosphere and the biosphere. During the course, we will go through the whole cycle of system modeling approach including model conceptualization, formulation, parameterization, sensitivity and

uncertainty analysis, verification, and application.

Learning Outcomes: 1. Learn the whole cycle of system modeling approach including model conceptualization, formulation, parameterization, sensitivity and uncertainty analysis, verification, and application. 2. Learn how to model the key element cycles (e.g., C and N) between the atmosphere and terrestrial biosphere. Credits: 3.00

EAPS 53000 - Extreme Weather And Climate: Science And Risk

Credit Hours: 3.00. This project-oriented course introduces students to the real-world analysis of weather and climate risk, including under climate change. Course will provide a risk-relevant introduction to different types of impactful weather (e.g., hurricanes, drought) and how the climate system can cause them to vary on monthly (e.g., Madden-Julian Oscillation), seasonal (e.g., El Nino and La Nina), and longer timescales (e.g., climate change). The course will further connect this intrinsic uncertainty in weather outcomes to uncertainties in real-world applications (e.g., crop yields) across a variety of economic sectors - "risk". Students will be introduced to basic methods in probability and statistics for analyzing data required to help someone make real-world decisions that depend on weather/climate. The principal course outcome is a semester-long "start-to-finish" project where students define a hypothetical real-world decision that is weather-dependent, find and analyze data to guide that decision-maker, write a concise report on their findings, and concisely present their results orally to the class.

Learning Outcomes: 1. Explain the meaning of "risk" in weather/climate and impacts. 2. Describe the basics of various types of impactful weather. 3. Describe how modes of climate variability cause weather to vary on monthly, seasonal, and longer time scales. 4. Explain how weather and climate variability translates to risk in a wide range of applications and economic sectors. 5. Analyze weather/climate data to find real-world solutions to weather risk problems. 6. Gain experience working as a hypothetical weather/climate science consultant in a team setting. 7. Summarize research in a succinct and compelling technical report. 8. Summarize research in a succinct and compelling oral presentation. 9. Use data to help someone find a solution to a real-world problem that depends on the weather/climate. Credits: 3.00

EAPS 53200 - Atmospheric Physics I

Credit Hours: 3.00. Cloud and precipitation physics and basic atmospheric radiative transfer. Introduction to computer-aided problem solving.

Learning Outcomes: 1. Understand the basic physics of cloud and precipitation formation and evolution in the atmosphere and their connections to atmospheric thermodynamics and dynamics. 2. Describe these processes qualitatively and solve associated problems quantitatively. 3. Describe and explain the observed microphysical structure of various precipitation systems (such as squall lines, hailstorms, supercells, frontal rainbands, and others). 4. Understand the basics of how cloud and precipitation processes are represented in numerical models. 5. Demonstrate a basic knowledge of various remote sensing methods. Credits: 3.00

EAPS 53300 - Atmospheric Physics II

Credit Hours: 3.00. A continuation of EAPS 53200 , covering the following selected advanced topics in atmospheric physics: gaseous absorption, Mie scattering, the equation of transfer, and radiative transfer in cloudy and hazy atmospheres. The application of radiative transfer in active and passive remote sensing. Advanced topics in atmospheric thermodynamics, such as heterogeneous systems, kinetic theory of gases, and planetary atmospheres. Basic ozone photochemistry applied to stratospheric and tropospheric pollution.

Credits: 3.00

EAPS 53400 - Tropical Meteorology

Credit Hours: 3.00. This course tackles the observed structure of the Earth's tropical atmosphere and the core theories that explain this structure and its variability. Topics include the 3D annual and seasonal mean state, the energy budget, the Hadley cell, monsoons, the Walker cell, equatorial waves, ENSO, convective aggregation, easterly waves, and tropical cyclones.

Learning Outcomes: 1. Visualize and identify the most important features of the tropical

atmosphere and describe them in terms that can be understood by a non-expert. 2. Explain how the Sun shining on a rotating rock with an overlying water ocean provides the necessary ingredients for the many different forms of variability in the tropical atmosphere. 3. Develop testable hypotheses about any aspect of the tropical atmosphere of interest. 4. Perform experiments using simple physical computational models to test hypotheses. 5. Use real-world historical data (e.g., reanalysis) to test hypotheses. Credits: 3.00

EAPS 53500 - Atmospheric Observations And Measurements

Credit Hours: 3.00. A course that introduces students to direct and remotely sensed observations of the atmosphere. Directly measured quantities discussed include temperature, pressure, moisture, wind, solar radiation, chemical properties of the atmosphere, etc. Remote sensing of cloud, precipitation, and air motion by weather radars, satellites, profilers, lidars, and other emerging technologies is reviewed. Students will gain experience in observation techniques and data interpretation, and will learn uncertainty and error assessment. Prior course work in atmospheric science and statistics is required.

Credits: 3.00

EAPS 53600 - Introduction To General Circulation

Credit Hours: 3.00. This course provides an overview of the general circulation of the atmosphere and oceans. Topics include: global energy balance, hydrological cycle, atmospheric general circulation and climate, ocean general circulation and climate, history and evolution of Earth's climate, climate sensitivity and feedback mechanisms, global climate models, natural climate change and anthropogenic climate change.

Learning Outcomes: 1. Understand the energy balance of the Earth and the atmosphere. 2. Grasp the general circulation of the atmosphere and ocean and their energy. 3. Gain a scientific understanding of the climate's natural variability and human-induced change. 4. Learn about global climate models. Credits: 3.00

EAPS 53900 - Mesoscale Meteorology

Credit Hours: 3.00. Review of the theories applied in mesoscale meteorology, including semi-geostrophic systems and frontogenesis, symmetric instability, rainbands and inertia-gravity waves, sea-breeze, terrain effects, mountain waves, lee-vortices and cyclogenesis, convection, convective instability, low-level jets, drylines, and squall lines. Prior course work in synoptic labs and vector calculus is required.

Credits: 3.00

EAPS 54000 - Introduction To Geodesy

Credit Hours: 3.00. Course offers an introduction and overview of theory, techniques, data sources, and applications of geodesy. Provides understanding of how various geodetic techniques work and how they can be used to investigate a number of geological, atmospheric, and related problems. Evaluation of the robustness and quality of data as well as assessment of models and conclusions derived from geodetic methods.

Learning Outcomes: 1. Explain essential theory behind various geodetic techniques. 2. Describe how geodetic techniques and datasets can be used to investigate geological problems. 3. Identify and break down contributing sources to complex data signals. 4. Assess which data and model types are most appropriate for a particular problem. 5. Devise an original research project topic and develop hypothesis and a methodology for its evaluation. 6. Analyze and critique scientific journal articles. 7. Summarize main research results in a clear, concise manner in both written and oral form. Credits: 3.00

EAPS 54100 - Geodetic Data And Applications

Credit Hours: 3.00. This course will provide students with hands-on experience in the selection, processing, and analysis of geodetic data sets, particularly InSAR and GPS. Students will learn how to select data, evaluate its strengths and weaknesses, process and analyze the data, and apply it to the investigation of geological problems.

Learning Outcomes: 1. Explain essential theory behind processing geodetic data. 2. Describe various processing parameters and how they influence data analysis. 3. Evaluate quality of various datasets and determine most appropriate analysis strategies for desired application. 4. Interpret analyzed datasets in the

context of geological problems. 5. Judge whether models fit data and if model parameters are compatible with available non-geodetic data sources. 6. Devise an original research project topic and develop hypothesis and a methodology for its evaluation. 7. Summarize main research results in a clear, concise manner in both written and oral form. Credits: 3.00

EAPS 54200 - Economic Geology: Petroleum

Credit Hours: 3.00. Fundamental principles of the origin, migration, accumulation, exploration, and development of petroleum. Study of reservoir fluids, reservoir mechanics, and primary and secondary production techniques. Methods of prospect and leasehold evaluation and economic appraisal. Offered in alternate years.

Credits: 3.00

EAPS 54500 - Planetary Spacecraft Instrumentation

Credit Hours: 3.00. This course will educate students on the basic design and operation of planetary science instruments in space. Instrumentation covers many different techniques over many different portions of the optical spectrum, detection of particles and fields, and sample handling techniques on planetary bodies. Topics for defining instruments and their capabilities within a given mission, such as traceability matrices and proposal techniques, will also be discussed. In-class lectures and discussion will be important components of this course. All students will be expected to read several papers per week and respond to discussion or quiz questions. Each student will participate in giving a lecture and lead a discussion on two to three topics, based on assigned papers. Based on the information presented in class, there will be an individual project to define an instrument, with an option to learn one of several software tools for designing a scientific instrument for space.

Learning Outcomes: 1. Be exposed to the various types of instrumentation used in planetary exploration. 2. Gain a basic understanding of how various types of planetary instruments work. 3. Learn and experience how instrument parameters are defined and selected based on scientific objectives of the mission. 4. Learn about design optimization packages for photon and ion optics, and neutron and charged particle trajectories. 5. Gain proficiency in reading instrumentation papers and in presenting instrument and spacecraft details. Credits: 3.00

EAPS 55000 - Advanced Geophysical Field Studies.

Credit Hours: 1.00 to 3.00. Individual geophysical field investigations including organizing, conducting and reducing, and interpreting data under the guidance of a staff member. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 55501 - Numerical Modeling Of Planetary Orbits

Credit Hours: 3.00. The goal of the course is twofold. First, you will develop quantitative skills to understand the orbital motions of planets and minor bodies in planetary systems, both in our solar system and in exosolar systems. Second, you will develop practical skills and techniques for using computers to solve scientific problems. We will begin with classical analyses of the two-body and N-body problems. We will then learn about modern, powerful, analytical and numerical techniques. We will then see how these techniques are applied to solving real problems in understanding the origin and evolution of planetary systems. These problems will include understanding planet formation, planet migration, resonance dynamics and resonance capture, tidal evolution of planets and natural satellites, and the collisional evolution of small body populations. Permission from instructor required.

Learning Outcomes: 1. Demonstrate proficiency with modern numerical methods and tools. 2. Demonstrate proficiency with methods of analysis and theory related to the dynamics of solar system bodies. Credits: 3.00

EAPS 55600 - Planetary Surface Processes

Credit Hours: 3.00. The application of petrology and structural geology to other planets. Topics include: theories of star and solar system formation, orbital dynamics and Kepler's laws, petrology and geochemistry of meteorites, age dating techniques, structure and composition of the terrestrial, giant, and icy planets, planetary surfaces, planetary atmospheres, and theories of the formation of the moon. Offered in alternate years. Prior course work in earth materials is required.

Learning Outcomes: 1. Understand the physical and chemical principles behind processes that modify planetary surfaces. 2. Identify planetary surface features in orbital imagery and use

observational evidence to postulate their origin and modification histories. 3. Gain field experience with planetary surface processes and landforms at local planetary analog sites. 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic. Credits: 3.00

EAPS 55700 - Introduction To Seismology

Credit Hours: 3.00. Theory of propagation to seismic waves in elastic media. Solution of wave equations for compressional, shear, and surface waves. Analysis of travel-times, amplitudes, and attenuation of seismic waves in terms of ray and wave theory. Principles of the seismograph. Structure of the earth as determined by seismological studies. Investigation of the causes, effects, distribution, and characteristics of earthquakes. Earthquake prediction.

Credits: 3.00

EAPS 55800 - Physical Properties Of Earth And Planetary Materials

Credit Hours: 3.00. This course includes a survey of the physical properties of earth materials: solids, liquids, and porous materials relevant to a range of geophysical and engineering concerns broadly within the domain of the growing field of Rock Physics. The variety of rock materials with particular emphasis on the aspects of composition, texture, and pore structure is first overviewed. Standard petrophysical characteristics such as mineralogic composition, density, and porosity are defined and the methods used to determine them both directly in the laboratory and indirectly from borehole measurements studied. With this background, students then explore how the intrinsic characteristics of pore structure, fluid content, and composition together with conditions of in situ temperature and pressure control the bulk material's electrical conductivity, dielectric permittivity, elasticity, and strength. These properties are viewed from perspectives of many scales of observation from the laboratory through geophysical logging from boreholes to larger scale geophysical surface measurements and high pressure and temperature laboratory measurements. More advanced issues related to frequency dependence, anisotropy, and stress measurement are discussed. Depending on their level, students will complete assignments or carry out literature reviews and a final research project. The research project may be designed to complement the student's own research needs.

Learning Outcomes: 1. Be aware of the various physical properties of rocks and particularly link these to geophysical observations. 2. Gain an appreciation of various methods to model these various physical properties and what the practical limitations of these various models are. Credits: 3.00

EAPS 55900 - Topics In Seismology

Credit Hours: 1.00 to 3.00. This course covers current topics in seismology. Recent topics have included seismic structure of the crust and mantle, seismic anisotropy, and earthquake sources. Professor Nowack. Permission of instructor required.

Credits: 1.00 to 3.00

EAPS 56700 - Planetary Atmospheres

Credit Hours: 3.00. This course is intended to for upper-level undergraduates and graduate students and will provide an in-depth look into the to the diversity of planetary atmospheres in our solar system and beyond. Topics to be covered in this class include: The processes by which atmospheres are constructed and eroded over plants lifetime, radiative balance, general circulation, the formation of hazes, clouds, and aerosols, atmospheric compositions and chemistry, the link between planetary interiors, surfaces, and atmospheres, how we measure and interpret observations of exoplanet atmospheres, and much more. To achieve this, we will briefly introduce the properties and components of an atmosphere, visit the planetary atmospheres in our solar system to learn more, and finally explore exoplanetary atmospheres.

Learning Outcomes: 1. Differentiate between different types of planetary bodies and the atmospheres that are present on them. 2. Recall the main properties of planetary atmospheres in our solar system. 3. Derive underlying physical properties for an atmosphere. 4. Understand and evaluate how atmospheric composition and planet type affect these physical properties. 5. Compare the effect of radiation and the subsequent dynamical motions with the distribution of energy in an atmosphere as a function of stellar type and atmospheric composition. 6. Distinguish the importance of different chemical reactions and pathways (such as those for an oxidizing vs. reducing atmosphere). 7. Examine the ways in which atmospheres are formed, lost, and evolved, and how this results in the

atmospheres we see today. 8. Make detailed predictions about the atmospheres of exoplanets based on an assessment of our understanding of the solar system. 9. Summarize and differentiate between techniques for observing and sampling the planetary atmospheres of our solar system and beyond. Credits: 3.00

EAPS 57300 - Basin Analysis

Credit Hours: 3.00. Advanced study of tectonic evolution and stratigraphic history of sedimentary basins. Topics include formative mechanisms of different sedimentary basins; tectonic, eustatic, and climatic controls on basin stratigraphy; relationship of depositional systems to basin types; subsidence and thermal histories; and application of basin analysis to petroleum reservoir and ground water aquifer assessment. Required field trips. Offered in alternate years. Prior course work in sedimentology and stratigraphy is required.

Credits: 3.00

EAPS 57700 - Remote Sensing Of The Planets

Credit Hours: 3.00. Introduction to key planetary and Earth science satellite remote sensing datasets, including visible and thermal imagery, visible through mid-infrared spectroscopy, radar, gamma ray and neutron spectroscopy, and laser altimetry. Students will receive hands-on-experience with data acquisition, image processing in IDL, spectral analysis in ENVI and Davinci, crater counting, and geologic mapping in GIS programs. Includes 1-2 full-day field trips. Junior, Senior, or Graduate status required. Recommended minimum background for undergraduates: Introductory knowledge of Earth or planetary surface processes and basic programming skills.

Learning Outcomes: 1. Understand the underlying physical principles behind the interpretation of remote sensing data. 2. Gain proficiency in the acquisition, processing, and analysis of remote sensing data. 3. Gain field experience with using and ground truthing remote sensing data at planetary analog sites. 4. Propose a research topic, conduct a literature review, and design and complete an original research project. Credits: 3.00

EAPS 58000 - Geodynamics

Credit Hours: 3.00. This course will provide students with a first order understanding of geophysical processes by developing analytical solutions to a variety of geophysical and planetary thermo-mechanical problems. Topics will include stress and strain, rheology, elasticity and flexure, faulting, and conductive heat transfer, and fluid mechanics. We will develop governing analytical equations based on first order principles, such as the conservation of mass, energy, and momentum, and solve these equations for a number of boundary conditions.

Learning Outcomes: 1. Solve first-order analytical thermo-mechanical problems in geophysics and planetary science. 2. Understand the basis for more complex numerical solutions of thermo-mechanical problems in geophysics and planetary science. 3. Investigate the factors that control a variety of thermo-mechanical geophysical and planetary processes. Credits: 3.00

EAPS 58300 - Geology Of Landfills

Credit Hours: 3.00. This course consists of the application of the geological sciences to the siting, exploration and site evaluation for solid waste disposal landfills, plus the evaluation of existing landfill facilities as they pertain to soils, bedrock, stratigraphy, landforms, geologic processes, and hydrogeology. Included are soil and rock exploration, laboratory testing, installation of ground water monitoring devices, and evaluation of contaminant transport. Both attenuation and confinement landfill systems are considered. Geological aspects of solid waste disposal regulations are reviewed and compared to those for hazardous waste disposal. Classroom discussions include evaluation of specific landfill examples and a semester project on a landfill evaluation. A one-day field investigation is required.

Credits: 3.00

EAPS 58400 - Hydrogeology

Credit Hours: 3.00. Investigates the qualitative and quantitative aspects of ground water location, occurrence, movement, evaluation, and development, and the influence of man upon this resource. Geologic and engineering aspects of ground water systems are discussed. Classroom teaching is complemented by problem sets and field trips.

Credits: 3.00

EAPS 58801 - Impact Cratering

Credit Hours: 3.00. Impact cratering is arguably the most pervasive geologic process in the solar system. In this course, we will study the physical process of impact cratering and its place in planetary science. The course will take a process-

oriented approach to understanding impact cratering with firm foundations in geologic observation and impact experiments. To explore the extreme process of impact cratering, we will use continuum/rock mechanics, thermodynamics, numerical modeling, experiments, and observations. Principal topics will include the formation of craters from contact of the projectile to final crater morphology; shock metamorphism; impact ejecta and products; cratered terrains; impacts and planetary evolution; and impact hazards.

Learning Outcomes: 1. Understand the physical principles of impact cratering. 2. Understand how impacts affect target materials. 3. Calculate the effects of the impact (size of crater, volume of melt, etc.). 4. Propose a research topic (all students) and conduct a literature review (undergrads), or design and complete an original research project (grads) on that topic. Credits: 3.00

EAPS 59000 - Field Geology North America

Credit Hours: 2.00. Advanced study of tectonic evolution and stratigraphic history of specific geologic provinces. Particular emphasis on the relationship between tectonics, basin development, and sedimentation. Field component deals with application of field techniques used in basin analysis and structural studies. A 10-day field trip is required. Permission of instructor required.

Credits: 2.00

EAPS 59100 - Advanced Topics In Earth And Atmospheric Sciences

Credit Hours: 0.00 to 18.00. Specialized study offered on an individual basis or through specially arranged courses. Permission of instructor required.

Credits: 0.00 to 18.00

EAPS 59500 - Planetary Habitability

Credit Hours: 3.00. This class will explore the origin and evolution of habitable environments on Earth, habitable environments in our Solar System (e.g., early Mars, Europa's ocean), and the diversity of potentially habitable environments on exoplanets. Topics include consideration of how stellar properties, orbital dynamics, and geological phenomena influence habitability. We will additionally consider how we can remotely characterize habitable environments beyond the solar system from the comfort of Earth.

Learning Outcomes: 1. Synthesize information from several scientific disciplines to construct a holistic view of the most promising environments for the origin and long-term survival of life in the Universe. 2. Read primary literature critically and distinguish between facts, assumptions, and speculations relating to habitability. 3. Present and defend arguments for whether a particular world may or may not host habitable environments. 4. Pose well-formulated questions and testable hypotheses relating to habitability. Credits: 3.00

EAPS 60000 - Writing Successful Science Proposals

Credit Hours: 3.00. This course is designed to teach graduate students the skills necessary to successfully garner extramural graduate, postdoctoral, and project funding. Topics will include identification of funding sources and development of research objectives and strategies. Emphasis will be on writing concise fellowships and full NSF-type research proposals. Class meetings will be interactive with an emphasis on peer review. Each student will complete a quality research proposal based upon their own research. Any graduate student with a nascent idea for a science or engineering project is encouraged to enroll. We have found that this course works especially well to help newer MS or PhD graduate students develop a research project, improve communication with their advisor, and organize their research priorities regardless of whether they use this course to submit a proposal.

Learning Outcomes: 1. Develop an understanding of their own research significance, novelty, and plan, be able to communicate these concepts both in the written from (proposal) and be able to orally communicate these ideas to their peers. Credits: 3.00

EAPS 60200 - New Graduate Student Seminar

Credit Hours: 3.00. This course will provide students with the tools to succeed as a graduate student in the Department of Earth, Atmospheric, and Planetary Sciences, which include good communication with their advisors, graduate fellowship proposal writing, giving good talks and posters, giving and receiving critical reviews, an understanding of regulations and graduate timelines, formulating a plan of study, and resources available to help graduate students succeed. Permission of instructor required.

Learning Outcomes: 1. Communicate effectively

with their adviser. 2. Understand how to develop a compelling research question. 3. Organize their planned research into a graduate fellowship proposal. 4. Provide and receive constructive criticism to and from colleagues, including understanding peer review. 5. Understand how to give well-organized talks and eye-catching posters for department seminars and national meetings. 6. Assemble an advisory committee, formulate a plan of study, and know the department regulations and what is required to graduate in a timely manner.
Credits: 3.00

EAPS 62000 - Aerosols, Clouds And Climate

Credit Hours: 3.00. An exploration of the complex relationships between aerosols, clouds and climate, including the so-called "direct effect" of aerosol on the radiation balance and their numerous influences upon relevant cloud properties called "indirect effects", the impact of different cloud types upon incoming solar radiation and outgoing longwave radiation, the effects of anthropogenic aerosol and climate change on precipitation efficiency, and the representation of aerosol, clouds and cloud processes in climate models.
Learning Outcomes: 1. Students will add to their base knowledge regarding the interaction of aerosols, clouds and climate. 2. Students will also develop their critical thinking skills and written communication skills. 3. Students will also improve their oral communication skills.
Credits: 3.00

EAPS 65000 - Advanced Topics In Geophysics

Credit Hours: 3.00. Specialized topics in geophysics such as heat flow, rock magnetism, and marine geophysics; varied depending on interest. Permission of instructor required.
Credits: 3.00

EAPS 65200 - Folding Of Rocks

Credit Hours: 3.00. Theory and application of finite strain to the study of folded rocks, with numerous illustrations from literature. Presentation of modern theories of folding and density instability of single- and multi-layered rocks, with special emphasis on basic folding mechanisms. Treatment of linear viscous and power-law fluids. Second- and third-order analysis of causes of basic fold forms, such as concentric, chevron and kink folds, and mullion structure. Causes of drag folds and reverse drag folds. Offered in alternate years.
Credits: 3.00

EAPS 65300 - Fracturing Of Rocks

Credit Hours: 3.00. Description and analysis of joints and faults from the point of view of field geology and fracture mechanics. Three basic modes of fracture and their analogs in the Earth's crust. Also examined are structures, such as folds, pressure solution surfaces, basins, and mountain ranges associated with faults. Offered in alternate years. Prerequisite: differential equations.
Credits: 3.00

EAPS 65700 - Geophysical Inverse Theory

Credit Hours: 3.00. Investigates problems of determining physical parameters of the earth from remote observations of wave and potential fields. The theoretical topics include spectral and singular value decompositions, maximum likelihood and stochastic inversion, Backus and Gilbert theory, Green's function and linear operators, and the physics of layered media. Geophysical applications include seismic tomography, deconvolution, gravity and magnetics, earthquake sources, geodetics, and remote sensing. Offered in alternate years. Prior course work in advanced differential equations, physics, and chemistry of the earth is required.
Credits: 3.00

EAPS 68000 - Contaminant Hydrogeology

Credit Hours: 3.00. Covers the basic theory and applications of problem-solving exercises in hydrogeology, fluid mechanics, and chemistry of contaminated sites; flow and transport equations and models; investigational methods; remediation methods; case studies; and pertinent environmental laws. Prior course work in chemistry, computer programming, differential equations, and hydrogeology is required.
Credits: 3.00

EAPS 69100 - Colloquium In Earth, Atmospheric, And Planetary Sciences

Credit Hours: 1.00. This course is intended to expose students to the wide range of topics studied throughout the Department of Earth, Atmospheric, and Planetary Sciences, allows for interactions with outside experts and networking, and provides the opportunity for students to synthesize high level topics that may not be directly related to their scientific endeavors.
Learning Outcomes: 1. Gain exposure to new scientific topics. 2. Summarize and discuss

potentially new and unfamiliar scientific topics. 3. Identify relevant information from scientific talks and presentations. 4. Engage with the important questions that stimulate discussion and debate in EAPS fields. 5. Listen attentively and actively. 6. Use critical thinking and questioning. Credits: 1.00

EAPS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

EAPS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Mathematics (Graduate)

Website: **http://www.math.purdue.edu/academic/grad/**

Department/School Head

Irena Swanson

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Emeritus Faculty
Donu Arapura Saugata Basu Steven Bell Johnny Brown Gregery Buzzard Zhiqiang Cai Guilio Caviglia Marius Dadarlat Steven Dong David Goldberg Birgit Kaufmann Ralph Kaufmann Peijun Li Guang Lin Tong Liu Kenji Matsuki James McClure Ben McReynolds Jonathon Peterson Arshak Petrosyan Antonio Sa Barreto Freydoon Shahidi Jie Shen	Mireille Boutin Xingshan Cui Kiril Datchev Isaac Harris Rachel Kenney Linquan Ma Victor Lie Baiying Liu Jeremy Miller Deepam Patel Thomas Sinclair Margaret Thomas Oleksandr Tsymbaliuk Jing Wang Xiangxiong Zhang	Lvzhou Chen Colleen Delaney Yuan Gao Haibo Liu Christopher Janjigian Daniel Johnstone Daniel Le Nicholas McCleerey Takumi Murayama Sam Nariman Matthew Novack Di Qi Manuel Rivera Eric Samperton Alisa Sedunova Manesh Sunkula Alexandria Volkening Ning Wei Shuyi Weng Mengyi Xu	Rodrigo Banuelos Patricia Bauman James Becker Mark Benjamin Lawrence Brown David Catlin Min Chen Carl Cowen John Cushman Burgess Davis Louis de Branges Harold Donnelly David Drasin Michael Drazin Alexandre Eremenko Zhilan "Julie" Feng Andrei Gabrielov Walter Gautschi William Heinzer Laszlo Lempert Joseph

			Lipman
Ilia			Leonard
Shkredov			Lipshitz
Plamen			Bradley
Stefanov			Lucier
Irena			Robert
Swanson			Lynch
Samy			James
Tindel			McClure
Andrew			Tzuong-
Toms			Tsieng
Monica			Moh
Torres			Richard
Bernd			Penney
Ulrich			Daniel
Uli Walther			Phillips
Changyou			Juan
Wang			Santos
Jaroslaw			Freydoon
Wlodarczyk			Shahidi
Trevor			Jie Shen
Wooley			Sam
Jianlin Xia			Wagstaff
Sai Kee			Joseph
Yeung			Wang
Aaron Yip			Allen
			Weitsman

Academic Programs

Master's and Ph.D. Programs

Purdue's graduate mathematics program is one of the largest in the country - and one of the best. We invite prospective students to visit to meet faculty and current students and to see firsthand what Purdue has to offer.
The Department of Mathematics offers programs leading to the degrees of Master of Science and Doctor of Philosophy.

Mathematics, MS

Mathematics, PHD

MA 50300 - Abstract Algebra

Credit Hours: 3.00. Group theory: definitions, examples, subgroups, quotient groups, homomorphisms, and isomorphism theorems. Ring theory: definitions, examples, homomorphisms, ideals, quotient rings, fraction fields, polynomial rings, Euclidean domains, and unique factorization domains. Field theory: algebraic field extensions, straightedge and compass constructions.

Credits: 3.00

MA 50400 - Real Analysis

Credit Hours: 3.00. Completeness of the real number system, basic topological properties, compactness, sequences and series, absolute convergence of series, rearrangement of series, properties of continuous functions, the Riemann-Stieltjes integral, sequences and series of functions, uniform convergence, the Stone-Weierstrass theorem, equicontinuity, and the Arzela-Ascoli theorem.

Credits: 3.00

MA 51000 - Vector Calculus

Credit Hours: 3.00. Calculus of functions of several variables and of vector fields in orthogonal coordinate systems. Optimization problems, implicit function theorem, Green's theorem, Stokes' theorem, divergence theorems. Applications to engineering and the physical sciences. Not open to students with credit in MA 36200 or MA 41000.

Credits: 3.00

MA 51100 - Linear Algebra With Applications

Credit Hours: 3.00. Real and complex vector spaces; linear transformations; Gram-Schmidt process and projections; least squares; QR and LU factorization; diagonalization, real and complex spectral theorem; Schur triangular form; Jordan canonical form; quadratic forms.

Credits: 3.00

MA 51400 - Numerical Analysis

Credit Hours: 3.00. (CS 51400) Iterative methods for solving nonlinear; linear difference equations, applications to solution of

polynomial equations; differentiation and integration formulas; numerical solution of ordinary differential equations; roundoff error bounds.

Credits: 3.00

MA 51800 - Advanced Discrete Mathematics

Credit Hours: 3.00. The course covers mathematics useful in analyzing computer algorithms. Topics include recurrence relations, evaluation of sums, integer functions, elementary number theory, binomial coefficients, generating functions, discrete probability, and asymptotic methods.

Credits: 3.00

MA 51900 - Introduction To Probability

Credit Hours: 3.00. (STAT 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

MA 52000 - Boundary Value Problems Of Differential Equations

Credit Hours: 3.00. Separation of variables; Fourier series; boundary value problems; Fourier transforms; Bessel functions; Legendre polynomials.

Credits: 3.00

MA 52100 - Introduction To Optimization Problems

Credit Hours: 3.00. Necessary and sufficient conditions for local extrema in programming problems and in the calculus of variations. Control problems; statement of maximum principles and applications. Discrete control problems.

Credits: 3.00

MA 52300 - Introduction To Partial Differential Equations

Credit Hours: 3.00. First order quasi-linear equations and their applications to physical and social sciences; the Cauchy-Kovalevsky theorem; characteristics, classification and canonical forms of linear equations; equations of mathematical physics; study of Laplace, wave and heat equations; methods of solution.

Credits: 3.00

MA 52500 - Introduction To Complex Analysis

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; applications. Not open to students with credit in MA 42500.

Credits: 3.00

MA 52700 - Advanced Mathematics For Engineers And Physicists I

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52700 include linear algebra, systems of ordinary differential equations, Laplace transforms, Fourier series and transforms, and partial differential equations. MA 51100 is recommended.

Learning Outcomes: 1. Know the theory of systems of linear equations. 2. Know the theory of eigenvalues and eigenvectors and apply it to solve systems of ordinary differential equations and to analyze qualitative features. 3. Know theoretical properties of Laplace transforms and how to use them. 4. Know the basic theory of Fourier series and transforms, and how to apply these to solve partial differential equations.

Credits: 3.00

MA 52800 - Advanced Mathematics For Engineers And Physicists II

Credit Hours: 3.00. MA 52700 is not a prerequisite for MA 52800; these courses can be taken independently. Topics in MA 52800 include divergence theorem, Stokes theorem, complex variables, contour integration, calculus of residues and applications, conformal mapping, and potential theory. MA 51000 is recommended.

Learning Outcomes: 1. Improve knowledge of vector calculus and multivariable integral calculus. 2. Know basic theory of functions of a complex variable, including complex integration. 3. Improve knowledge of Taylor series, and extend this to Laurent series. 4. Know applications of complex analysis, including conformal mapping and potential theory.

Credits: 3.00

MA 53000 - Functions Of A Complex Variable I

Credit Hours: 3.00. Complex numbers and complex-valued functions of one complex variable; differentiation and contour

integration; Cauchy's theorem; Taylor and Laurent series; residues; conformal mapping; special topics. More mathematically rigorous than MA 52500.

Credits: 3.00

MA 53100 - Functions Of A Complex Variable II

Credit Hours: 3.00. Advanced topics.

Credits: 3.00

MA 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (STAT 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

MA 53800 - Probability Theory I

Credit Hours: 3.00. (STAT 53800) Mathematically rigorous, measure-theoretic introduction to probability spaces, random variables, independence, weak and strong laws of large numbers, conditional expectations, and martingales.

Credits: 3.00

MA 53900 - Probability Theory II

Credit Hours: 3.00. (STAT 53900) Convergence of probability laws; characteristic functions; convergence to the normal law; infinitely divisible and stable laws; Brownian motion and the invariance principle.

Credits: 3.00

MA 54200 - Theory Of Distributions And Applications

Credit Hours: 3.00. Definition and basic properties of distributions; convolution and Fourier transforms; applications to partial differential equations; Sobolev spaces.

Credits: 3.00

MA 54300 - Ordinary Differential Equations And Dynamical Systems

Credit Hours: 3.00. This course focuses on the theory of ordinary differential equations and methods of proof for developing this theory. Topics include basic results for linear systems, the local theory for nonlinear systems (existence and uniqueness, dependence on parameters, flows and linearization, stable manifold theorem) and the global theory for nonlinear systems (global existence, limit sets and periodic orbits, Poincare maps). Permission of instructor required.

Learning Outcomes: 1. Know and understand the central results and methods of proof in the theory of ordinary Differential Equations. 2. Gain deeper understanding of mathematical analysis more generally. 3. Gain facility in constructing, writing and presenting proofs. Credits: 3.00

MA 54400 - Real Analysis And Measure Theory

Credit Hours: 3.00. Metric space topology; continuity, convergence; equicontinuity; compactness; bounded variation, Helly selection theorem; Riemann-Stieltjes integral; Lebesgue measure; abstract measure spaces; LP-spaces; Holder and Minkowski inequalities; Riesz-Fischer theorem.

Credits: 3.00

MA 54500 - Functions Of Several Variables And Related Topics

Credit Hours: 3.00. Differentiation of functions; Besicovitch covering theorem; differentiation of one measure with respect to another; Hardy-Littlewood maximal function; functions of several variables; Sobolev spaces.

Credits: 3.00

MA 54600 - Introduction To Functional Analysis

Credit Hours: 3.00. Fundamentals of functional analysis. Banach spaces, Hahn-Banach theorem. Principle of uniform boundedness. Closed graph and open mapping theorems. Applications. Hilbert spaces. Orthonormal sets. Spectral theorem for Hermitian operators and compact operators.

Credits: 3.00

MA 55300 - Introduction To Abstract Algebra

Credit Hours: 3.00. Group theory: Sylow theorems, Jordan Holder theorem, solvable groups. Ring theory: unique factorization in polynomial rings and principal ideal domains. Field theory: ruler and compass constructions, roots of unity, finite fields, Galois theory, solvability of equations by radicals.

Credits: 3.00

MA 55400 - Linear Algebra

Credit Hours: 3.00. Review of basics: vector spaces, dimension, linear maps, matrices determinants, linear equations. Bilinear forms; inner product spaces; spectral theory; eigenvalues. Modules over a principal ideal domain; finitely generated abelian groups; Jordan and rational canonical forms

for a linear transformation.

Credits: 3.00

MA 55600 - Introduction To The Theory Of Numbers

Credit Hours: 3.00. Divisibility, congruences, quadratic residues, Diophantine equations, the sequence of primes.

Credits: 3.00

MA 55700 - Abstract Algebra I

Credit Hours: 3.00. Review of fundamental structures of algebra (groups, rings, fields, modules, algebras); Jordan-Holder and Sylow theorems; Galois theory; bilinear forms; modules over principal ideal domains; Artinian rings and semisimple modules. Polynomial and power series rings; Noetherian rings and modules; localization; integral dependence; rudiments of algebraic geometry and algebraic number theory; ramification theory.

Credits: 3.00

MA 55800 - Abstract Algebra II

Credit Hours: 3.00. A continuation of MA 55700.

Credits: 3.00

MA 56000 - Fundamental Concepts Of Geometry

Credit Hours: 3.00. Foundations of Euclidean geometry, including a critique of Euclid's "Elements" and a detailed study of an axiom system such as that of Hilbert. Independence of the parallel axiom and introduction to non-Euclidean geometry.

Credits: 3.00

MA 56200 - Introduction To Differential Geometry And Topology

Credit Hours: 3.00. Smooth manifolds; tangent vectors; inverse and implicit function theorems; submanifolds; vector fields; integral curves; differential forms; the exterior derivative; DeRham cohomology groups; surfaces in E3., Gaussian curvature; two dimensional Riemannian geometry; Gauss-Bonnet and Poincare theorems on vector fields.

Credits: 3.00

MA 57100 - Elementary Topology

Credit Hours: 3.00. Fundamentals of point set topology with a brief introduction to the fundamental group and related topics, topological and metric spaces, compactness, connectedness, separation properties, local compactness, introduction to function spaces, basic notions involving deformations of continuous paths.

Credits: 3.00

MA 57200 - Introduction In Algebraic Topology

Credit Hours: 3.00. Singular homology theory; Eilenberg-Steenrod axioms; simplicial and cell complexes; elementary homotopy theory; Lefschetz fixed point theorem.

Credits: 3.00

MA 57300 - Numerical Solution Of Ordinary Differential Equations

Credit Hours: 3.00. Numerical solution of initial-value problems by Runge-Kutta methods, general one-step methods, and multistep methods; analysis of truncation error, discretization error, and rounding error; stability of multistep methods; numerical solution of boundary- and eigen-value problems by initial-value techniques and finite difference methods.

Learning Outcomes: 1. Learn general one-step methods for numerical solution of initial-value problems. 2. Learn explicit and implicit Runge-Kutta and multistep methods, convergence and stability. 3. Learn iterative methods for solving large systems of equations. 4. Learn numerical methods for stochastic differential equations and Monte Carlo methods. 5. Learn the Fast Fourier Transform and spectral methods. 6. Learn to use software tools such as visualization and specialized computing packages. Credits: 3.00

MA 57400 - Numerical Optimization

Credit Hours: 3.00. Convex optimization algorithms using modern large-scale algorithms for convex optimization, with a heavy emphasis on analysis including monotone operator, fixed point iteration and duality in splitting methods. The course will cover and focus on the following three parts: smooth optimization algorithms, nonsmooth convex optimization algorithms, and stochastic and randomized algorithms. Permission of department required. Prerequisites: MA 51100 and MA 50400.

Learning Outcomes: 1. Learn standard convergence results for gradient descent method and Newton's method and their generalizations for smooth problems. 2. Learn convergence results for subgradient method

and proximal point method for nonsmooth convex problems. 3. Learn about popular splitting methods and the proof of their convergence by using monotone operators and fixed-point iteration. 4. Learn about convergence of stochastic algorithms such as randomized coordinate descent, stochastic gradient descent and Langevin dynamics. Credits: 3.00

MA 57500 - Graph Theory

Credit Hours: 3.00. Introduction to graph theory with applications.

Credits: 3.00

MA 58400 - Algebraic Number Theory

Credit Hours: 3.00. Dedekind domains, norm, discriminant, different, finiteness of class number, Dirichlet unit theorem, quadratic and cyclotomic extensions, quadratic reciprocity, decomposition and inertia groups, completions and local fields.

Credits: 3.00

MA 58500 - Mathematical Logic I

Credit Hours: 3.00. Propositional and predicate calculus; the Gdel completeness and compactness theorem, primitive recursive and recursive functions; the Gdel incompleteness theorem; Tarski's theorem; Church's theorem; recursive undecidability; special topics such as nonstandard analysis.

Credits: 3.00

MA 59000 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 59500 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Special topics courses including dual-level special topics. Permission of instructor required.

Learning Outcomes: 1. Vary due to nature of course. Credits: 1.00 to 5.00

MA 59800 - Topics In Mathematics

Credit Hours: 1.00 to 5.00. Supervised reading courses as well as dual-level special topics courses are given under this number. Permission of instructor required.

Credits: 1.00 to 5.00

MA 61100 - Methods Of Applied Mathematics I

Credit Hours: 3.00. Banach and Hilbert spaces; linear operators; spectral theory of compact linear operators; applications to linear integral equations and to regular Sturm-Liouville problems for ordinary differential equations. Prerequisite: MA 51100, MA 54400.

Credits: 3.00

MA 61500 - Numerical Methods For Partial Differential Equations I

Credit Hours: 3.00. (CS 61500) Finite element method for elliptic partial differential equations; weak formulation; finite-dimensional approximations; error bounds; algorithmic issues; solving sparse linear systems; finite element method for parabolic partial differential equations; backward difference and Crank-Nicholson time-stepping; introduction to finite difference methods for elliptic, parabolic, and hyperbolic equations; stability, consistency, and convergence; discrete maximum principles. Prerequisite: MA 51400, MA 52300.

Credits: 3.00

MA 62000 - Mathematical Theory Of Optimal Control

Credit Hours: 3.00. Existence theorems; the maximum principle; relationship to the calculus of variations; linear systems with quadratic criteria; applications. Offered in alternate years. Prerequisite: MA 54400.

Credits: 3.00

MA 63100 - Several Complex Variables

Credit Hours: 3.00. Power series, holomorphic functions, representation by integrals, extension of functions, holomorphically convex domains. Local theory of analytic sets (Weierstrass preparation theorem and consequences). Functions and sets in the projective space Pn (theorems of Weierstrass and Chow and their extensions). Prerequisite: MA 53000.

Credits: 3.00

MA 63800 - Stochastic Processes I

Credit Hours: 3.00. (STAT 63800) Advanced topics in probability theory which may include stationary processes, independent increment processes, Gaussian processes; martingales, Markov processes, ergodic theory. Prerequisite: MA 53900.

Credits: 3.00

MA 63900 - Stochastic Process II

Credit Hours: 3.00. (STAT 63900) Continuation of MA 63800.

Credits: 3.00

MA 64200 - Methods Of Linear And Nonlinear Partial Differential Equations I

Credit Hours: 3.00. Second order elliptic equations including maximum principles, Harnack inequality, Schauder estimates, and Sobolev estimates. Applications of linear theory to nonlinear equations. Prerequisite: MA 52300.

Credits: 3.00

MA 64300 - Methods Of Partial Differential Equations II

Credit Hours: 3.00. Continuation of MA 64200. Topics to be covered are Lp theory for solutions of elliptic equations, including Moser's estimates, Aleksandrov maximum principle, and the Calderon-Zygmund theory. Introduction to evolution problems for parabolic and hyperbolic equations, including Galerkin approximation and semigroup methods. Applications to nonlinear problems. Prerequisite: MA 64200.

Credits: 3.00

MA 64400 - Calculus Of Variations

Credit Hours: 3.00. Direct methods; necessary and sufficient conditions for lower semicontinuity of multiple integrals; existence theorems and connections with optimal control theory. Prerequisite: MA 54400.

Credits: 3.00

MA 65000 - Commutative Algebra

Credit Hours: 3.00. The study of those rings of importance in algebraic and analytic geometry and algebraic number theory. Prerequisite: MA 55800.

Credits: 3.00

MA 66100 - Modern Differential Geometry

Credit Hours: 3.00. Topics chosen by the instructor. Prerequisite: MA 55400.

Credits: 3.00

MA 66300 - Algebraic Curves And Functions I

Credit Hours: 3.00. Algebraic functions of one variable from the geometric, algebraic, or function-theoretic points of view. Riemann-Roch theorem, differentials. Prerequisite: MA 55800.

Credits: 3.00

MA 66400 - Algebraic Curves And Functions II

Credit Hours: 3.00. Continuation of MA 66300. Topics chosen by the instructor. Prerequisite: MA 66300.

Credits: 3.00

MA 66500 - Algebraic Geometry

Credit Hours: 3.00. Topics of current interest will be chosen by the instructor. Prerequisite: MA 65000 or MA 66300.

Credits: 3.00

MA 68400 - Class Field Theory

Credit Hours: 3.00. Ideles, adeles, L-functions, Artin symbol, reciprocity, local and global class fields, Kronecker-Weber Theorem. Prerequisite: MA 58400.

Credits: 3.00

MA 69000 - Topics In Algebra

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69200 - Topics Applied Math

Credit Hours: 1.00 to 3.00. Topics in applied math. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69300 - Topics In Analysis

Credit Hours: 1.00 to 3.00. Topics in analysis. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69400 - Topics In Differential Equations

Credit Hours: 1.00 to 3.00. Topics In Differential Equations. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69600 - Topics In Geometry

Credit Hours: 1.00 to 3.00. Topics in geometry. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69700 - Topics In Topology

Credit Hours: 1.00 to 3.00. Topics in topology. Permission of instructor required.

Credits: 1.00 to 3.00

MA 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Physics and Astronomy (Graduate)

Website: **http://www.physics.purdue.edu/academic-programs/graduate/index.html**

Department/School Head

Gabor Csathy

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Lynn Bryan Marc Caffee Erica Carlson Yong P. Chen Gabor Csathy Stephen M. Durbin Daniel S. Elliott John P. Finley Ephraim Fischbach Dimitrios Giannios Chris Greene Brigit Kaufmann Sergei Khlebnikov David S. Koltick Martin Kruczenski Rafae Lang Yuli Lyanda-Geller Maxim Lyutikov Oana Malis Michael J. Manfra Norbert Neumeister David D. Nolte Yulia Pushkar Laura J. Pyrak-Nolte N. Sanjay Rebello Ken Ritchie Francis Robicheaux Leonid	Chen-Lung Hung Matthew Jones Andreas Jung Kyoung-Soo Lee Tongcang Li Nathaniel A. Lifton John Peterson Jorge H. Rodriguez	Hadiseh Alaeian Arnab Banerjee Rudro R. Biswas Xingshan Cui Paul Duffell Jonathan Hood Srividya Iyer-Biswas Nima Lashkari Qi-Yu (Grace) Liang Miaoyuan Liu Laimei Nie Shalini Low-Nam Ruichao Ma Danny Milisavljevic Nirajan Shivaram Brijesh K. Srivastava Jukka Vayrynen

Rokhinson Sergei Savikhin Fuqiang Wang Wei Xie Qi Zhou		

Academic Programs

Master's and Ph.D. Programs

Purdue's Department of Physics and Astronomy is a recognized world leader in many areas of theoretical and experimental research. Forefront research in physics, cutting across several disciplines are being carried out by high quality, motivated graduate students and world-renowned, dedicated faculty in the department. Our present and future students will support the active research that is being carried out in the following areas: Accelerator Mass Spectrometry, Applied Physics, Astrophysics, Atomic, Molecular, and Optical Physics, Biological Physics, Condensed Matter Physics, High Energy Nuclear Physics, High Energy Particle Physics, Physics Education, Planetary Physics and Geophysics.

Concentrations (Areas of Study)

- Accelerator Mass Spectrometry
- Applied Physics
- Astrophysics
- Atomic, Molecular, and Optical Physics
- Biological Physics
- Condensed Matter Physics
- High Energy Nuclear Physics
- High Energy Particle Physics
- Physics Education
- Planetary Physics and Geophysics
- Quantum Information Science

Physics, MS

Physics, PHD

ASTR 56000 - Stellar Evolution

Credit Hours: 3.00. (PHYS 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

ASTR 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (PHYS 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

ASTR 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (PHYS 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

ASTR 56300 - Astroparticle Physics

Credit Hours: 3.00. (PHYS 56300) An overview of an emerging research frontier in modern physics that lies at the interface of particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology, cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

ASTR 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (PHYS 56700) Fundamental concepts in observational astronomy, including coordinate and time systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and

skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal. Credits: 3.00

PHYS 51000 - Physical Mechanics

Credit Hours: 3.00. Mechanics of particles, rigid bodies, and vibrating systems.

Learning Outcomes: 1. Learn Lagrangian Dynamics. 2. Learn Hamiltonian Dynamics. 3. Learn multibody problems. 4. Learn small oscillations. Credits: 3.00

PHYS 51500 - Thermal And Statistical Physics

Credit Hours: 3.00. Equilibrium states, the concept of heat, and the laws of thermodynamics; the existence and properties of the entropy; different thermodynamic potentials and their uses; phase diagrams; introduction to statistical mechanics and its relation to thermodynamics; treatment of ideal gases.

Learning Outcomes: 1. Identify and develop solutions to internal and external barriers which prevent attainment of career trajectory. 2. Define and apply professional and transition skills to move from academic to professional environment in order to improve the workforce experience and promotion opportunities. 3. Recognize and engage in engineering stewardship opportunities to build general public knowledge about the field of engineering. 4. Utilize coaching skills developed in class to assist themselves and others in making decisions/taking action. Credits: 3.00

PHYS 52100 - Survey Of Classical Physics

Credit Hours: 3.00. This course is intended for first-year graduate students in the Department of Physics. It provides an intensive problem solving environment encompassing a broad survey of major topics in classical mechanics, electromagnetism, and thermal physics. The primary objective is to prepare beginning graduate students for continuing on to higher level of work in the physics graduate program.

Learning Outcomes: 1. To get the beginning graduate students ready for higher levels of physics work by consolidating the foundations in all areas of classical physics. Credits: 3.00

PHYS 52600 - Physics Of Quantum Computing And Quantum Information

Credit Hours: 3.00. An introduction to the physics of quantum information science. Starting with the concepts of quantum superposition, it defines and describes qubits (quantum bits) and their manipulation by quantum logic gates. The topics of quantum entanglement and the EPR paradox are introduced, and their importance for quantum teleportation, communication, and quantum cryptography are covered. Quantum computing is described in terms of quantum circuits of logic gates, and also in terms of quantum algorithms, such as Deutsch's algorithm, the quantum Fourier transform, Shor's prime factoring algorithm, and Grover's search algorithm. The final topic is quantum decoherence and the limits it places on practical implementations of quantum computing.

Learning Outcomes: 1. Understand the meaning of entanglement and how it distinguishes quantum from classical science. 2. Understand how the rules of quantum measurement are fundamental to quantum cryptography and quantum computing. 3. See how the basics of quantum science enable quantum computing to solve important problems otherwise inaccessible to classical computing. Credits: 3.00

PHYS 53000 - Electricity And Magnetism

Credit Hours: 3.00. Electrostatic problems; theory of dielectrics; theory of electric conduction; electromagnetic effects due to steady and changing currents; magnetic properties of matter; Maxwell's equations; electromagnetic radiation.

Learning Outcomes: 1. Learn electrostatics and magnetostatics, electric currents, electromagnetic induction, applications of Maxwell's equations to electromagnetic waves, boundaries, dispersion, and radiation. Credits: 3.00

PHYS 53600 - Electronic Techniques For Research

Credit Hours: 4.00. A summary of principles of modern electronics currently used in research Coursework will include broad coverage of the field and selected topics in electronics instrumentation.

Credits: 4.00

PHYS 54500 - Solid-State Physics

Credit Hours: 3.00. Crystal structure; lattice vibrations and electronic band structure of crystals; electrical, optical, and thermal properties of solids; transport and other nonequilibrium phenomena in uniform and nonuniform materials.

Credits: 3.00

PHYS 55000 - Introduction To Quantum Mechanics

Credit Hours: 3.00. Brief historical survey of the development of quantum mechanics; wave-packets, uncertainty principle, wave functions, operators, Schrodinger equation with application to one-dimensional problems, the hydrogen atom, electron spin, selected topics in perturbation theory, scattering theory, and compounding of angular momenta. Not available for students with credit in PHYS 36000 or PHYS 46000 .

Credits: 3.00

PHYS 55600 - Introductory Nuclear Physics

Credit Hours: 3.00. Theory of relativity, brief survey of systematics of nuclei and elementary particles, structure of stable nuclei, radioactivity, interaction of nuclear radiation with matter, nuclear reactions, particle accelerators, nuclear instruments, fission, nuclear reactors.

Credits: 3.00

PHYS 56000 - Stellar Evolution

Credit Hours: 3.00. (ASTR 56000) Observational basis of astrophysics; formation of galaxies and stars; evolution of stars; white dwarfs, supernovae and neutron stars, pulsars, quasars, black holes; cosmic rays, their origin and acceleration; radio astronomy, radio galaxies; the H-21 cm line and the 3mK blackbody radiation; gravitational radiation; X-ray and g-ray astronomy; cosmology; space physics, magnetosphere, and solar wind.

Credits: 3.00

PHYS 56100 - Galaxies And Large Scale Structure

Credit Hours: 3.00. (ASTR 56100) Covers basic observed properties and models of galactic structure, dynamics of stars, physics of interstellar medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

Credits: 3.00

PHYS 56200 - Introduction To High Energy Astrophysics

Credit Hours: 3.00. (ASTR 56200) An overview of important physical processes in a variety of astronomical settings and of the experimental techniques employed in the field of high energy astrophysics. Covered in more detail are individual systems that include black holes, neutron stars, white dwarfs, supernova remnants, active galactic nuclei, clusters of galaxies, gamma-ray bursts, and cosmic rays, with special emphasis on several research frontiers.

Credits: 3.00

PHYS 56300 - Astroparticle Physics

Credit Hours: 3.00. (ASTR 56300) An overview of an emerging research frontier in modern physics that lies at the interface of particle physics and astrophysics. Emphasis is on topics that are particularly relevant to both fields, including cosmology, cosmic ray physics, very-high-energy gamma ray astrophysics, neutrino astrophysics, and gravitational wave physics.

Credits: 3.00

PHYS 56400 - Introduction To Elements Particle Physics

Credit Hours: 3.00. This course brings students up to the current status of research in elementary particle physics. The focus of the course is the construction of the Standard Model with emphasis on the electroweak theory. The seminal experiments that confirmed the predictions of the Standard Model is presented. The solar neutrino problem, the search for nonzero neutrino masses, and the efforts to construct a theory which unifies all interactions, including gravity, is discussed.

Credits: 3.00

PHYS 56500 - Introduction To Elementary Particle Physics II

Credit Hours: 3.00. This course follows PHYS 56400 , and it continues to present current topics in elementary particle physics. It focuses on the Higgs mechanism, and it explores physics beyond the standard model. Special attention is devoted to supersymmetry and searches for new particles.

Credits: 3.00

PHYS 56700 - Observational Techniques In Astronomy

Credit Hours: 3.00. (ASTR 56700) Fundamental concepts in observational astronomy, including coordinate and time

systems, telescopes and detectors, radiation and optics, and methods of statistical data analysis.

Learning Outcomes: 1. Gain knowledge and skills needed to carry out the major steps involved in astrophysical research, including literature research and formulation of a project. 2. Identification of suitable telescope and detector. 3. Planning of observations. 4. Reduction of data and analysis/hypothesis testing. 5. Publication in a professional journal.

Credits: 3.00

PHYS 57000 - Selected Topics In Physics

Credit Hours: 3.00. Specialized topics in physics selected from time to time. Permission of instructor required.

Credits: 3.00

PHYS 58000 - Computational Physics

Credit Hours: 3.00. Introduction to computationally based problem solving in physics, emphasis on understanding and applying various numerical algorithms to different types of physics problems. Topics will include chaos in mechanical systems, stochastic systems including percolation and fractal structures, molecular dynamics and the properties of simple fluids, Monte Carlo methods and phase transitions, and time dependent as well as time dependent problems in quantum mechanics.

Credits: 3.00

PHYS 59000 - Reading And Research

Credit Hours: 1.00 to 3.00. (Calumet, Fort Wayne) 1.00 to 6.00 (West Lafayette, IUPUI). Reading and research in Physics. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 59300 - Independent Research

Credit Hours: 1.00 to 4.00. Research in some area of modern physics (spectroscopy, nuclear physics, solid state physics, elementary particle physics, biophysics, geophysics, etc.) with student receiving individualized supervision and guidance from staff member. This course may be used to satisfy the independent project or 500-level elective requirement of the undergraduate majors in Honors and Applied Physics Honors Programs. Permission of instructor required.

Credits: 1.00 to 4.00

PHYS 59500 - Instructional Design In Physical Science

Credit Hours: 1.00 to 3.00. This course builds on collaborative interactions among current Purdue Physics or Education students, K-12 science educators, Physics and Purdue College of Science faculty, and Physics Outreach. The goal for this course is to provide opportunities and mentorship for independent work that could include the design, piloting, and assessment of instructional materials, relevant to learning and teaching topics and concepts related to the physical sciences. With a "service learning" orientation, students enrolled in this course should expect to learn and build upon the fundamental principles related to the design and implementation of instructional materials in classroom or informal learning environments, and assessment of learning. Materials developed could contribute to the repertoire of practicing teachers and/or Physics Outreach.

Learning Outcomes: 1. Learn to apply fundamental principles of instructional design and/or assessment of learning. 2. Develop creative and engaging age-appropriate opportunities to promote the learning of scientific concepts. 3. Critique and reflect upon personal insights and experiences related to non-traditional and informal science education.

Credits: 1.00 to 3.00

PHYS 60000 - Methods Of Theoretical Physics I

Credit Hours: 3.00. This course is designed to provide first-year physics graduate students with the mathematical background for subsequent studies of advanced mechanics, electrodynamics, and quantum theory. Topics treated include functions of complex variable, ordinary and partial differential equations, eigenvalue problems and orthogonal functions. Green's functions, matrix theory, and tensor analysis in three and four dimensions.

Credits: 3.00

PHYS 60100 - Methods Of Theoretical Physics II

Credit Hours: 3.00. A continuation of PHYS 60000 . Prerequisite: PHYS 60000 .

Credits: 3.00

PHYS 60300 - Methods Of Theoretical Physics IIIB

Credit Hours: 3.00. Basic theory of groups and group

representations. Finite groups and abelian infinite groups, with applications to atomic physics. Elements of Lie group theory. The three-dimensional rotation group. The group SU(3). Application to particle physics. Prerequisite: PHYS 60100 .

Credits: 3.00

PHYS 60500 - Pedagogical Methods For Physics Graduate Students

Credit Hours: 2.00. This course prepares physics graduate students for classroom and laboratory teaching assignments. Through 100 minutes per week of lectures and hands-on recitations, it provides an intensive survey of basic pedagogical methods, both theoretically and in practice. Students will learn and practice teaching techniques via various forms and microteaching, reading, and class discussion. A broad range of results from physics education research will be studied in detail. Additional topics include grading and assessment, responsible conduct in teaching related to issues such as gender, culture and ethnicity, students with disabilities, and ethics in academia, generally, including ethical conduct of research.

Credits: 2.00

PHYS 61000 - Advanced Theoretical Mechanics

Credit Hours: 3.00. Lagrangian and Hamiltonian mechanics; variational principles; canonical transformations; Hamilton-Jacobi theory; theory of small oscillations; Lagrangian formulation for continuous systems and fields. Prerequisite: PHYS 51000 .

Credits: 3.00

PHYS 61700 - Statistical Mechanics

Credit Hours: 3.00. Classical and quantum statistical mechanics. Prerequisite: PHYS 66000 .

Credits: 3.00

PHYS 63000 - Advanced Theory Of Electricity And Magnetism

Credit Hours: 3.00. The experimental origins of Maxwell's equations. Electrostatics and magnetostatics; solution of boundary value problems. Quasi-static currents. Electromagnetic energy and momentum and the Maxwell stress tensor. Foundations of optics. Radiation from antennas, multi-pole expansion; waveguides. Prerequisite: PHYS 53000 , PHYS 60000 .

Credits: 3.00

PHYS 63100 - Advanced Theory Of Electricity And Magnetism

Credit Hours: 3.00. Covariant formulation of electrodynamics; Lienard-Wiechert potentials; radiation from accelerated particles; Cerenkov radiation; dynamics of relativistic particles; radiation damping; introduction to magneto-hydrodynamics. Prerequisite: PHYS 63000 .

Credits: 3.00

PHYS 64500 - Electron Theory Of Solids I

Credit Hours: 3.00. Electronic energy bands in crystalline solids; crystal symmetry and Brillouin zones, approximate methods of calculation, electrons and holes under applied fields. Lattice dynamics and thermal conductivity. Electron-lattice interactions. Transport phenomena in metals and semi-conductors. Prerequisite: PHYS 54500 , PHYS 60100 , PHYS 66100 . Permission of instructor required.

Credits: 3.00

PHYS 64600 - Electron Theory Of Solids II

Credit Hours: 3.00. Crystal imperfections, impurities and lattice defects. Magnetic properties: diamagnetic effects, paramagnetism, ferromagnetism, resonance phenomena. Ferroelectricity. Optical properties of metals and semiconductors; interband and intraband transitions, excitons, effects of crystal imperfections. Prerequisite: PHYS 64500 . Permission of instructor required.

Credits: 3.00

PHYS 66000 - Quantum Mechanics I

Credit Hours: 3.00. Origins of the quantum theory, the uncertainty and complementarity principles. The Schrodinger equation and its solutions for simple physical systems. Mathematical formulation of the quantum theory. Applications: simple harmonic oscillator, theory of angular momentum, the hydrogen atom. Time-independent and time-dependent perturbation theory. The Pauli exclusion principle. Spin of the electron. Elementary theory of scattering. Prerequisite: PHYS 53000 , PHYS 55000 , PHYS 60000 , PHYS 61000 . Corequisite: PHYS 60100 .

Credits: 3.00

PHYS 66100 - Quantum Mechanics II

Credit Hours: 3.00. Symmetry and conservation laws. The Klein-Gordon and Dirac equations. Interaction of radiation with matter. Applications of quantum mechanics to atomic structure. Scattering theory. Prerequisite: PHYS 60100 , PHYS 63000 , PHYS 66000 .

Credits: 3.00

PHYS 66200 - Quantum Field Theory I

Credit Hours: 3.00. Introduction to relativistic quantum field theory. Representations of the Lorentz and Poincare groups. Noether's theorem: symmetries and conservation laws. Canonical quantization of free Klein-Gordon, Dirac, Maxwell fields. Interacting field theory: Lehmann-Kallen representations. LSZ reduction formula. Schwinger action principle. Quantum Electrodynamics (QED): Gell-Mann Low expansion, Wick's theorem, Feynman rules for Green functions and S-matrix elements. Scattering processes in QED: cross sections in low orders of perturbation theory. Prerequisite: PHYS 66100 . Permission of instructor required.

Credits: 3.00

PHYS 66300 - Quantum Field Theory II

Credit Hours: 3.00. Concepts and techniques of relativistic quantum field theory. Quantum Electrodynamics: radiative corrections, renormalization program, infrared divergences, external field problem. Feynman path integral quantization. Global symmetries and Ward identities. Quantum effective action: effective potential, loop expansion. Non-Abelian gauge theories: quantization via Faddeev-Popov prescription, Feynman rules, BRS invariance. Quantum Chromodynamics. Callen-Symanzik equation and renormalization group. Prerequisite: PHYS 66200 . Permission of instructor required.

Credits: 3.00

PHYS 66400 - Quantum Theory Of Many-Body Systems

Credit Hours: 3.00. Practical introduction to modern quantum field theory techniques as applied to the study of many-body phenomena occurring in solid state systems. Standard perturbative-theoretic results based on zero- and finite-temperature Green's functions, with application to specific physical situations. Introduction to nonperturbative methods. PHYS 64500 and PHYS 64600 are recommended. Prerequisites: PHYS 61700 , PHYS 66000 , PHYS 66100 . Permission of instructor required.

Credits: 3.00

PHYS 67000 - Selected Topics In Physics

Credit Hours: 1.00 to 3.00. Specialized topics in physics, varied from time to time. Permission of instructor required.

Credits: 1.00 to 3.00

PHYS 67500 - General Relativity

Credit Hours: 3.00. Theoretical and experimental general relativity. The equivalence principle and its experimental basis. The Einstein field equations; classical tests of general relativity; gravitational radiation, cosmological considerations; topics to be chosen. Prerequisite: PHYS 60000 , PHYS 61000 , PHYS 63000 .

Credits: 3.00

PHYS 69600 - Introduction To Physics Research

Credit Hours: 1.00. Seminar designed to acquaint first-year physics graduate students with the research programs of the department.

Learning Outcomes: 1. Acquaint graduate students with the thesis research opportunities available in physics and to initiate conversations between students and potential major professors. Credits: 1.00

PHYS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

PHYS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

QSCI 52600 - Physics Of Quantum Computing And Quantum Information

Credit Hours: 3.00. An introduction to the physics of quantum information science. Starting with the concepts of quantum superposition, it defines and describes qubits (quantum bits) and their manipulation by quantum logic gates. The topics of quantum entanglement and the EPR paradox are introduced, and their importance for quantum teleportation, communication, and quantum cryptography are covered. Quantum computing is described in terms of quantum circuits of logic gates, and also in terms of quantum algorithms, such as Deutsch's algorithm, the quantum Fourier transform, Shor's prime factoring algorithm, and Grover's search algorithm. The final topic is quantum decoherence and the limits it places on practical implementations of quantum computing.

Learning Outcomes: 1. Understand the meaning of entanglement and how it distinguishes quantum from classical science. 2. Understand how the rules of quantum measurement are fundamental to quantum cryptography and quantum computing. 3. See how the basics of quantum science enable quantum computing to solve important problems otherwise

inaccessible to classical computing. Credits: 3.00

Department of Statistics (Graduate)

Website: **https://www.stat.purdue.edu/**

Department/School Head

Xiao Wang

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Anirban DasGupta Bruce A. Craig Chong Gu Chris Clifton (Courtesy) Chuanhai Liu Faming Liang Dabao Zhang Dennis Lin Guang Lin (Courtesy) Hao Zhang Hua Hua Chang (Courtesy) Jennifer Neville (Courtesy) Jun Xie Mark Daniel Ward Michael Zhu Patrick Wolfe Raghu Pasupathy Thomas M. Sellke William S. Cleveland Xiao Wang	Anindya Bhadra Arman Sabbaghi Bowei Xi Jianxi Su Jing Wang Kiseop Lee Lingsong Zhang Michael Levine Qifan Song Sharon Christ (Courtesy) Stanley Ho Chan (Courtesy) Takashi Owada Tonglin Zhang Vinayak Rao	Andrew Yarger Antik Chakraborty Boran Gao Fei Xue Geyu Zhou Haibo Liu Jordan Awan Lin Wang Mengyi Xu Nianqiao Ju Timothy G. Reese (Professor of Practice) Timothy J. Keaton (Professor of Practice) Wei Sun (Courtesy) Zachary J. Hass (Courtesy)

Academic Programs

Master's and Ph.D. Programs

The Department of Statistics at Purdue University is recognized as one of the top statistics programs in the nation. The Department has 30 tenure-track and tenured professors, and hundreds of undergraduate and graduate students.

The program prepares students for careers in both industry and academia and prepares them to be leaders in their fields.

- M.S.
- Applied Statistics (online and residential)
- Fifth Year Applied Statistics
- Data Science in Finance (online and residential)
- Mathematical Statistics or Probability
- Joint Statistics and Computer Science
- Ph.D.
- Ph.D. in Statistics

Statistics, PHD

Applied Statistics, Post-Baccalaureate Certificate

Statistics, MS

Data Science in Finance, MS

Statistics: Applied Statistics Concentration, MS (OL)

Data Science in Finance, Post-Baccalaureate Certificate

STAT 50100 - Experimental Statistics I

Credit Hours: 3.00. Concepts and methods of applied statistics. Exploratory analysis of data. Sample design and experimental design. Normal distributions. Sampling distributions. Confidence intervals and tests of hypotheses for one and two samples. Inference for contingency tables, regression and correlation, and one-way analysis of variance. Use of the SAS statistical software. Intended primarily for students who have not had calculus. Not open to students in mathematical sciences or engineering. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: College Algebra.

Learning Outcomes: 1. Produce and identify basic statistical analyses. 2. Discuss statistical terminology (speak statistics). 3. Use SAS to run basic statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50200 - Experimental Statistics II

Credit Hours: 3.00. Multiple regression including the general linear test, model selection, and regression diagnostics. Analysis of variance for factorial designs, including multiple comparisons. Analysis of covariance. Repeated measures designs. Extensive use of the SAS statistical software. Intended primarily for students who have not had calculus.

Learning Outcomes: 1. Produce and identify advanced statistical analyses. 2. Learn and understand advanced statistical terminology and concepts. 3. Use SAS to run advanced statistical analyses and interpret corresponding SAS output. Credits: 3.00

STAT 50300 - Statistical Methods For Biology

Credit Hours: 3.00. Introductory statistical methods, with emphasis on applications in biology. Topics include descriptive statistics, binomial and normal distributions, confidence interval estimation, hypothesis testing, analysis of variance, introduction to nonparametric testing, linear regression and correlation, goodness-of-fit tests, and contingency tables. Open only to majors related to the life sciences. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100.

Learning Outcomes: 1. Students will be able to identify and choose appropriate ways to graphically and numerically summarize data. 2. Students will be able to use basic statistical methods to perform statistical inference and draw appropriate conclusions. 3. Students will understand the mathematical foundations of statistical inference for random samples so that they can study and utilize additional statistical methods. Credits: 3.00

STAT 50600 - Statistical Programming And Data Management

Credit Hours: 3.00. Use of the SAS software system for managing statistical data. How to write programs to access, explore, prepare, and analyze data. Using the DATA step and procedures to access, transform, and summarize data. Introduction to the SAS macro language. Prepares students for the base SAS certification exam.

Learning Outcomes: 1. Proficient in SAS Programming 1: Essentials. 2. Proficient in SAS Programming 2: Data Manipulation Techniques. 3. Proficient in Macro Language 1: Essentials. 4. Optional: Learn SQL 1: Essentials. Credits: 3.00

STAT 51100 - Statistical Methods

Credit Hours: 3.00. Descriptive statistics; elementary probability; sampling distributions; inference, testing hypotheses, and estimation; normal, binomial, Poisson, hypergeometric distributions; one-way analysis of variance; contingency tables; regression. For statistics majors and minors, credit should be allowed in no more than one of STAT 30100, STAT 30301, STAT 35000, STAT 35500, STAT 50100, and in no more than one of STAT 50300 and STAT 51100. Prerequisite: Two semesters of college calculus.

Learning Outcomes: 1. Understand the difference between population parameters and sample statistics. 2. Understand practical data displays: meaning and interpretation of common data displays in the media. 3. Appreciate various interpretations of probability and where they enter into statistical studies. 4. Understand statistical distributions: difference between discrete and continuous random variables. Computing the mean and variance using various important probability distributions such as the Binomial, Hypergeometric, Poisson, Normal, Exponential, Gamma. Computing probabilities using these distributions. 5. Understand statistical distributions of two or more random variables: Sample statistics and their distributions. Understanding the Central Limit Theorem. 6. Understand statistical inference: to understand what this means and what are some practical and important applications. Examples include Confidence Intervals, Tests of Hypotheses for one, two or more populations. Linear Regression with emphasis on the difference between causation and relationships. Credits: 3.00

STAT 51200 - Applied Regression Analysis

Credit Hours: 3.00. Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance. Use of existing statistical computer programs. Prerequisite: Coursework in Statistical Methods with a calculus prerequisite.

Learning Outcomes: 1. Learn to build and analyze simple and multiple regression models, analysis of variance and covariance (ANOVA/ANCOVA) for regression, inference for regression, diagnostics and remedial measures for regression, transformations, residual analysis, model building, polynomial and interaction models. Credits: 3.00

STAT 51300 - Statistical Quality Control

Credit Hours: 3.00. A strong background in control charts including adaptations, acceptance sampling for attributes and variables data, standard acceptance plans, sequential analysis, statistics of combinations, moments and probability distributions, applications.

Learning Outcomes: 1. Acquire fluency in the language and techniques of modem quality control and its applications. 2. Conceptually understand the utility of statistics for quality control. 3. Apply control charts and experimental design techniques to solve real-life quality control problems. 4. Utilize appropriate Statistical software for statistical computation, visualization, control chart construction, and design of experiments. 5. Discuss what is learned in lecture and assignments through oral and written presentations. Credits: 3.00

STAT 51400 - Design Of Experiments

Credit Hours: 3.00. Fundamentals, completely randomized design; randomized complete blocks; latin square; multi-classification; factorial; nested factorial; incomplete block and fractional replications for 2n, 3n, 2m x 3n; confounding; lattice designs; general mixed factorials; split plot; analysis of variance in regression models; optimum design. Use of existing statistical programs.

Learning Outcomes: 1. Understand design principles and use these principles to plan and implement an experiment in such a way that a statistical analysis results in valid and objective conclusions. 2. Know how to choose an appropriate design given the available resources, factors of interest, and information on nuisance factors. 3. Perform the proper statistical analysis and draw valid conclusions from any designed experiment. Credits: 3.00

STAT 51500 - Statistical Consulting Problem

Credit Hours: 0.00 to 1.00. Taken by students in the Applied Statistics Master's program who have participated in the Statistical Consulting Service (STAT 59700). Focus is on addressing statistical consultation problems that involve either design of experiments or statistical analysis. Problems involve written reports and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Determining an appropriate design of an experiment. 2. Choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 3. Implementing various statistical methods via software and summarizing the output for the client. 4. Recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 0.00 to 1.00

STAT 51600 - Basic Probability And Applications

Credit Hours: 3.00. A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem. (The probability material in course one of the Society of Actuaries and the Casualty Actuarial Society is covered by this course.)

Learning Outcomes: 1. Identify which discrete and continuous distributions are applicable in a given setting. 2. Use conditional probabilities, Bayes theorem, and conditional distributions. 3. Utilize joint distributions in the context of several random variables. 4. Apply the law of large numbers and the central limit theorem in asymptotic settings. 5. Derive moments and moment generating functions for discrete and continuous random variables. Credits: 3.00

STAT 51700 - Statistical Inference

Credit Hours: 3.00. A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased, maximum likelihood and moment estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to nonparametric tests and linear regression.

Learning Outcomes: 1. Understand the basic asymptotic theory including consistency and convergence in distribution. 2. Know how to perform some elementary statistical inference such as estimation, confidence interval and hypothesis testing. 3. Be familiar with the maximum likelihood method to make statistical inference. 4. Know how to judge the quality of different estimators. 5. Know how to perform optimal tests of hypotheses. Credits: 3.00

STAT 51900 - Introduction To Probability

Credit Hours: 3.00. (MA 51900) Algebra of sets, sample spaces, combinatorial problems, independence, random variables, distribution functions, moment generating functions, special continuous and discrete distributions, distribution of a function of a random variable, limit theorems.

Credits: 3.00

STAT 52000 - Time Series And Applications

Credit Hours: 3.00. An introductory course in stationary time

series with applications. Topics include stationarity, autocovariance function, ARIMA (Autoregressive Integrated Moving Average) models, and basic spectral analysis (periodograms and their estimation, tapering, linear filtering). Extensive use of R is incorporated for building time series models and estimating the time series spectrum.

Learning Outcomes: 1. Recognize basic properties of stationary time series and various aspects and representations of ARMA and ARIMA models. 2. Understand and apply standard time domain techniques for the identification, estimation, and forecasting of ARIMA models. 3. Identify elementary concepts and techniques for spectral analysis. 4. Use R facilities to analyze real life time series data. Credits: 3.00

STAT 52200 - Sampling And Survey Techniques

Credit Hours: 3.00. This course covers basic sampling design and analysis techniques. Sampling designs include: simple random, stratified, clustered, multi-staged, and systematic samples. Methods of estimation appropriate to design features and efficiency and costs related to sample design are covered.

Learning Outcomes: 1. Develop a basic understanding of probability and inferential theory underlying sampling statistics. 2. Understand and apply complex sample design features to sampling plans. 3. Apply proper statistical analyses to data collected using complex sample designs. 4. Interpret statistical estimates and tests. 5. Analyze data from complex samples using SAS, R, STATA or other software. Credits: 3.00

STAT 52400 - Applied Multivariate Analysis

Credit Hours: 3.00. Extension of univariate tests in normal populations to the multivariate case, equality of covariance matrices, multivariate analysis of variance, discriminant analysis and misclassification errors, canonical correlation, principal components, factor analysis. Strong emphasis will be placed on use of existing computer programs.

Learning Outcomes: 1. Describe the underlying mathematical formulation associated with multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 2. Derive properties associated with the multivariate normal probability distribution. 3. Analyze data using multivariate techniques such as principal components, factor analysis, discrimination and classification, and clustering. 4. Use appropriate software, such as R, to describe, visualize, and analyze multivariate data. 5. Communicate the results of the work to a variety of audiences, including a non-statistician. Credits: 3.00

STAT 52500 - Intermediate Statistical Methodology

Credit Hours: 3.00. Statistical methods for analyzing data based on general/generalized linear models, including linear regression, analysis of variance (ANOVA), analysis of covariance (ANCOVA), random and mixed effects models, and logistic/loglinear regression models. Application of these methods to real-world problems using SAS statistical software.

Credits: 3.00

STAT 52600 - Advanced Statistical Methodology

Credit Hours: 3.00. As a sequel to STAT 52500, this course introduces statistical modeling tools for situations where standard least-squares techniques may not apply. This includes an extensive coverage of generalized linear models (GLM) for non-Gaussian responses, mixed effects models to describe correlated data, nonparametric regression, and lastly, parametric and nonparametric survival models for the analysis of (possibly censored) time-to-event data. Among issues to be discussed are the estimation of the models, the testing of hypotheses, and the checking of model adequacy. Data examples will be used throughout the course to illustrate the methodologies and the related software tools in R.

Learning Outcomes: 1. Understand the concepts and methods in generalized linear models, survival analysis, linear mixed models and GEE methods. 2. Apply these methods properly to real data using R, drawing valid conclusions, and presenting the results concisely. Credits: 3.00

STAT 52700 - Introduction To Computing For Statistics

Credit Hours: 3.00. This course provides a thorough introduction to the R programming language, and its use for

statistical computing and data science. The course will first look at the fundamentals of R, including different data-structures, control-flow, and the basic vocabulary. An emphasis will be placed on learning idiomatic and efficient R, covering ideas such as recycling, vectorization and functional programming. The course will then look at principles and tools for tasks like organizing data ('tidy data'), manipulating data ('data carpentry'), querying data (through topics like regular expressions) as well as visualizing data (including interactive visualizations). The material and the homework will encourage development of modular reusable code and reproducible research through ideas such as object-oriented programming and dynamic documents in R Markdown. The last part of the course will study statistical procedures such as least-squares regression, LASSO, Monte Carlo sampling and Markov chain Monte Carlo. Besides exams and homeworks, the course will involve a final project that students can collaborate together on.

Learning Outcomes: 1. Read and write idiomatic R code. 2. Be familiar with the entire data science pipeline, from organizing, manipulating, querying and visualizing data. 3. Introduce computational tools like optimization and simulation in the context of statistical algorithms. Credits: 3.00

STAT 52800 - Introduction To Mathematical Statistics

Credit Hours: 3.00. The course introduces the fundamental frameworks of statistical theory, from which statistical methods can be derived. This includes the framework of data and statistical models, decision theory (risk functions, Bayes and minimax criteria), sufficient statistics, exponential distribution families, estimation methods, unbiased estimators and information inequality (Cramer-Rao), the Neyman-Pearson framework of hypothesis testing, monotone likelihood ratio families and likelihood ratio tests, and an introduction of asymptotic approximations. Students will need background in advanced calculus, linear algebra, probability, and some mathematical analysis.

Learning Outcomes: 1. Understand the framework of statistical models and be able to define a statistical model for a data analysis problem. 2. Use the decision theory to compare different data analysis methods. 3. Derive theoretical properties of some statistical methods. 4. Be able to justify some commonly used statistical methods through theory. Credits: 3.00

STAT 52900 - Applied Decision Theory And Bayesian Statistics

Credit Hours: 3.00. Bayesian and decision-theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; Bayesian design and sequential analysis; comparisons of statistical paradigms.

Credits: 3.00

STAT 53200 - Elements Of Stochastic Processes

Credit Hours: 3.00. (MA 53200) A basic course in stochastic models, including discrete and continuous time Markov chains and Brownian motion, as well as an introduction to topics such as Gaussian processes, queues, epidemic models, branching processes, renewal processes, replacement, and reliability problems.

Credits: 3.00

STAT 53800 - Probability Theory I

Credit Hours: 3.00. (MA 53800) Mathematically rigorous, measure-theoretic introduction to probability spaces, random variables, expectation, independence, weak and strong laws of large numbers, conditional expectations, and martingales.

Learning Outcomes: 1. Learn rigorous mathematical approach to probability theory. Credits: 3.00

STAT 53900 - Probability Theory II

Credit Hours: 3.00. (MA 53900) Convergence of probability laws; characteristic functions; convergence to the normal law; infinitely divisible and stable laws; Brownian motion and the invariance principle.

Credits: 3.00

STAT 54000 - Computational Finance I

Credit Hours: 3.00. An introduction to the mathematical tools and techniques of modern finance theory, in the context of Black-Scholes option pricing. Brownian motion and its stochastic calculus, Ito's formula, and Feynman-Kac formula. Pricing and hedging of claims on Black-Scholes assets. Incomplete markets. Path-dependent options. Stochastic portfolio optimization.

Learning Outcomes: 1. Obtain necessary mathematical background necessary to study

quantitative methods in finance. 2. Understand mathematical models of modern financial markets. Credits: 3.00

STAT 54100 - Computational Finance II

Credit Hours: 3.00. Stochastic interest rate models. American options from the probabilistic and PDE points of view. Numerical methods for European and American options, including binomial, trinomial, and Monte-Carlo methods.

Learning Outcomes: 1. Learn advanced topics in quantitative finance. Credits: 3.00

STAT 54500 - Introduction To Computational Statistics

Credit Hours: 3.00. This introductory course covers the fundamentals of computing for statistics and data analysis. It starts with a brief overview of programming using a general purpose compiled language (C) and a statistics-oriented interpreted language (R). The course proceeds to cover data structures and algorithms that are directly relevant to statistics and data analysis and concludes with a computing-oriented introduction to selected statistical methods. A significant part of the course involves programming and hands-on experimentation demonstrating the covered techniques, ration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Given a straightforward data manipulation problem, decide on what elementary data structures to use, write down an algorithm for a solution as a pseudocode, and analyze its computational complexity. 2. Implement an algorithm using C and/or R code, understand, modify, and if needed perform basic debugging of the existing code. 3. Understand and implement the computational techniques of numerical optimization, matrix manipulation, sampling, logistic regression, and EM algorithm. Credits: 3.00

STAT 54600 - Computational Statistics

Credit Hours: 3.00. The course focuses on two fundamental aspects in computational statistics: (1) what to compute and (2) how to compute. The first is covered with a brief review of advanced topics in statistical inference, including Fisher's fiducial inference, Bayesian and frequenstist methods, and the Dempster-Shafer (DS) Theory. The second is discussed in detail by examining exact, approximation, and interactive simulation methods for statistical inference with a variety of commonly used statistical models. The emphasis is on the EM-type and quasi-Newton algorithms, numerical differentiation and integration, and Markov chain Monte Carlo methods.

Learning Outcomes: 1. Master commonly used numerical matrix operations, including the sweep operator, Cholesky decomposition, eigenvalue decomposition, and single value decomposition. 2. Understand statistical thinking in development of interactive numerical methods. 3. Apply optimization algorithms such as quasi-Newton and conjugate gradient methods. 4. Implement EM-type algorithms for maximum likelihood estimation when expanded complete-data models are available, including commonly used statistical models. 5. Create random number generators. 6. Implement the Gibbs sampler and Metropolis-Hastings algorithms for Bayesian data analysis. Credits: 3.00

STAT 54900 - An Introduction To QTL Mapping In Experimental Populations

Credit Hours: 3.00. This is an introductory/interdisciplinary (master's level) quantitative trait locus (QTL) mapping course. QTL mapping is associated with the statistical analysis of genetic/genomic data and is considered part of the general science known as bioinformatics.

Credits: 3.00

STAT 55300 - Theory Of Linear Models And Analysis Of Experimental Designs

Credit Hours: 3.00. Least squares analysis of linear models. Gauss Markov Theorem. Estimability and testability of parameters. Confidence regions and prediction regions. Introduction to design of experiments. Analysis of variance. Factorial and block designs. Analysis of random, fixed, and mixed models. Components of variance. Distribution of linear and quadratic forms in normal vectors. A firm background in matrix algebra and some previous exposure to linear models or analysis of variance is desirable.

Credits: 3.00

STAT 57900 - Foundations Of Statistical Machine Learning

Credit Hours: 3.00. This course provides a comprehensive

treatment of modern statistical machine learning topics. These include linear regression, kernel method, trees, boosting, and deep neural networks. We understand these subjects from a statistical perspective with some mathematical rigorousness.

Learning Outcomes: 1. Understand classical supervised learning methods such as linear regression, nonlinear regression, random forest, and boosting. 2. Understand classical unsupervised learning methods such as K-means clustering and PCA. 3. Understand modern AI techniques using deep neural networks, such as manifold learning and deep generative models. 4. Practice complex and high dimensional data analysis using the methodology and software packages. Credits: 3.00

STAT 58000 - Application Of Statistical Theory

Credit Hours: 3.00. The use of numerical methods to obtain answers in problems arising in probability and statistics. Topics will include the use of the likelihood function, Bayesian and classical methods of estimation and testing, evaluation of probabilities, linear and nonlinear regression. STAT 53200 , 55400, and some knowledge of computing and complex analysis are desirable.

Credits: 3.00

STAT 58100 - Bioinformatics Seminar

Credit Hours: 1.00. This is a weekly forum for presenting both applied and theoretical work in the broad area of bioinformatics. Bioinformatics is the science of generating, organizing, and analyzing biological data. This seminar series occurs both in the fall and spring semesters and attracts speakers from Purdue University, as well as throughout the world. Students are encouraged to register for this course, and everyone else is encouraged to attend this open seminar.

Credits: 1.00

STAT 58200 - Statistical Consulting And Collaboration

Credit Hours: 3.00. This course is designed to emphasize and develop the skills needed by a statistical consultant/collaborator. Topics include: problem solving, consulting session management, written and oral communication, research ethics, design of experiments, collection of data, and application of statistical methods to real problems. Class activities include actively participating in consulting sessions held by the Statistical Consulting Service, small group projects, short papers, and oral presentations. Permission of instructor required.

Learning Outcomes: 1. Be aware of the skills necessary to be an effective statistical consultant/collaborator. These skills include consulting session management, written and oral communication with clients, interpreting facial and body language, handling personality conflicts, practicing sound research ethics, properly designing an experiment and determining an appropriate sample size, and choosing an appropriate statistical method whose analysis addresses the client's questions given the available data. 2. Know how to recognize problematic issues in the consulting/collaboration process and implement various strategies to address them. Credits: 3.00

STAT 58700 - Machine Learning In Finance

Credit Hours: 3.00. This graduate course on Machine Learning in Finance explores contemporary topics in quantitative finance, including optimal execution, dynamics of limit order books, optimal portfolio selection, and more. The course focuses on illustrating how machine learning methods are applied in these specific areas.

Learning Outcomes: 1. Gain a comprehensive understanding of the latest advancements in machine learning methodologies. 2. Apply these methodologies using practical applications within the context of financial markets. Credits: 3.00

STAT 59000 - Internship Seminar

Credit Hours: 1.00 to 3.00. Students complete an internship where they will use statistical methods. A detailed report describing the internship work is required. Permission of department required. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 59700 - Statistical Consulting Seminar

Credit Hours: 1.00. Active participation in weekly consulting meetings, directed reading in the statistical literature, application

of statistical methods to real problems, report writing. Permission of Instructor required.

Learning Outcomes: 1. Improve on the skills needed to be an effective statistical consultant and collaborator, including problem solving, time management, and written and oral communication. 2. Develop good listener and questioner skills in order to understand the goals of a study and the data (to be) collected. 3. Apply appropriate statistical methods to address real-world problems. Credits: 1.00

STAT 59800 - Topics In Statistical Methods

Credit Hours: 0.00 to 6.00 (West Lafayette, IUPUI) 1.00 to 3.00 (North Central). Directed study and reports for students who wish to undertake individual reading and study on approved topics. Permission of instructor required.

Credits: 0.00 to 6.00

STAT 63800 - Stochastic Processes I

Credit Hours: 3.00. (MA 63800) Advanced topics in probability theory which may include stationary processes, independent increment processes, Gaussian processes; martingales, Markov processes, ergodic theory. Prerequisite: STAT 53900.

Credits: 3.00

STAT 63900 - Stochastic Processes II

Credit Hours: 3.00. (MA 63900) Continuation of STAT 63800.

Credits: 3.00

STAT 65600 - Bayesian Data Analysis

Credit Hours: 3.00. Bayesian data analysis refers to practical inferential methods that use probability models for both observable and unobservable quantities. The flexibility and generality of these methods allow them to address complex real-life problems that are not amenable to other techniques. This course will provide a pragmatic introduction to Bayesian data analysis and its powerful applications. Topics include: the fundamentals of Bayesian inference for single and multiparameter models, regression, hierarchical models, model checking, approximation of a posterior distribution by iterative and non-iterative sampling methods, and Bayesian nonparametrics. Specific topics and the course outline are subject to change as the semester progresses. All topics will be motivated by problems from the physical, life, social, and management sciences. Conceptual understanding and inference via computer simulation will be emphasized throughout the course. Permission of department required.

Learning Outcomes: 1. Acquire fluency in the principles and techniques of Bayesian data analysis. 2. Apply Bayesian methodology to solve real-life problems. 3. Utilize R for Bayesian computation, visualization, and analysis of data. 4. Discuss what is learned in lectures and assignments through an oral presentation and written report. Credits: 3.00

STAT 66700 - Measure-Theoretic Statistics: Decision Theoretic And Classical

Credit Hours: 3.00. Decision theoretic approach to statistical problems, complete class theorems, Bayes and minimax procedures, sequential decision problems, sufficiency, comparison of experiments, invariance; most stringent, similar, unbiased, likelihood ratio tests; efficiency, Cramer-Rao inequality, estimation analogues of good tests; confidence sets. Prerequisite: MA 57100, STAT 52800, STAT 53900, STAT 57600.

Credits: 3.00

STAT 69000 - Seminar

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 69100 - Seminar In Probability Theory

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 69200 - Research Colloquium

Credit Hours: 1.00. A colloquium or seminar course with discussion. Colloquium speakers present current technical results from statistics. A discussion follows in which the speaker and instructor take questions and explain issues in detail. Students give reports on lectures. Permission of department required.

Learning Outcomes: 1. Expand understanding of research in statistics and data science. 2. Strengthen oral and written communication skills. 3. Build relationships with peers and mentors involved in research. 4. Increase information fluency and ability to find relevant

research literature. 5. Enhance ability to evaluate sources of research information.
Credits: 1.00

STAT 69500 - Seminar In Mathematical Statistics

Credit Hours: 1.00 to 3.00. Topics vary. Permission of instructor required.

Credits: 1.00 to 3.00

STAT 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

STAT 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

College of Veterinary Medicine (Graduate)

Department of Basic Medical Sciences (Graduate)

Website: **http://vet.purdue.edu/bms/graduate-program.php**

Department/School Head

Susan M. Mendrysa

Faculty by Rank

Professor	Associate Professor	Assistant Professor	Clinical Associate Professor	Clinical Assistant Professor	Emeritus Faculty
Elikplimi K. Asem Susan M. Mendrysa Abdelfattah Y.M. Nour Paul J. Robinson Riyi Shi	Kari Ekenstedt Marxa L. Figueiredo Kevin M. Hannon Dianne Little	Adam Kimbrough Jessica S. Fortin Ranjie Xu	Melinda J. Anderson	Dielson Vieira	Ourania M. Andrisani R.L. Bill G.D. Bottoms Gordon L. Coppoc R.L Hullinger Christine Jaeger Laurie A. Jaeger James F. Leary Sophie A. Lelièvre O. Fred Roesel Willis Tacker John J. Turek

Academic Programs

Master's and Ph.D. Programs

BMS offers graduate study leading toward a master's degree and a doctoral degree.
The department also offers a combined degree/dual degree option for students in the DVM professional curriculum.
The Department of Basic Medical Sciences (BMS) offers graduate study leading toward a master's degree and a doctoral degree, as well as a combined degree/dual degree option for students in the DVM professional curriculum. A degree from BMS can lead to an exciting academic or industrial career in biomedical sciences and because of its size, the BMS graduate program is ideal for students who wish to do their graduate work in a department that allows time and opportunity for individual attention and a close student-advisor mentoring relationship. Opportunities are available for combining teaching in the professional DVM curriculum with dissertation research. This combination of research and teaching experience helps create a highly employable graduate, especially for those who are considering careers in academia.

Concentrations (Areas of Study)

- Cancer biology
- Musculoskeletal biomechanics and skeletal adaptation
- Neural development, mechanisms of injury, and regeneration
- Tissue dynamic spectroscopy
- Cellular and molecular screening and high throughput analysis of cell function
- Osteoimmunology, gene, and drug delivery
- Genetics and Genomics
- Drug Discovery

Basic Medical Sciences, PHD

Basic Medical Sciences, MS

Basic Medical Sciences/Cancer Research, PHD

BMS 51700 - Problems In Basic Medical Sciences

Credit Hours: 0.50 to 8.00. Studies or investigations in the various disciplines of the basic medical sciences of man and domestic animals for advanced undergraduate and beginning graduate students. Permission of instructor required.

Credits: 0.50 to 8.00

BMS 52400 - Introduction To Confocal Microscopy And Image Analysis

Credit Hours: 1.00. Introduction to the principles of confocal microscopy and rudiments of image analysis. Confocal microscopy can be used in biological and nonbiological systems and is, therefore, an interdisciplinary tool in the modern research laboratory. The three-dimensional reconstruction of images allows discovery of complex structures. Deals with fluorescence excitation and emission, optical design, basic image analysis principles, and application areas for which the technology has been targeted. The student will have a good understanding of the application and use of the technology by the end of the course.

Credits: 1.00

BMS 52900 - Basic Bone Biology

Credit Hours: 3.00. This course is designed to present the fundamentals of bone biology. Approximately 45 hours of lecture will help the learner achieve the objectives outlined. Lectures will be given to present information and tie into information learners have acquired or will acquire in other courses (e.g. biomechanics, physiology, molecular biology, etc.) to assist them in combining all of their courses and research experiences together into one interdisciplinary learning experience. It is expected that students take additional time outside of scheduled class time to further learning. Materials for the learners will be posted on the course's website. These materials will include: Lecture notes and PowerPoints: Each lecturer will post his/her lecture notes and associated PowerPoint slides prior to the lecture. Additional information: As the course progresses, instructors may come across additional information that they may find useful for student learning of the material. These materials will be posted for students to utilize as they see fit. * *Materials found on other sites (e.g. social networking sites) will not be official course materials, so use at your own risk.* Permission of instructor required.

Learning Outcomes: 1. Demonstrate knowledge of the morphology and organization of bone and supporting/associated tissues (e.g. bone marrow, cartilage, muscle), including cellular structure and structure of the

extracellular matrix. 2. Describe the normal processes of bone development and remodeling and the cellular and molecular components of each of these processes. 3. Demonstrate knowledge of the impact of external factors (e.g. nutrition, mechanical loading, genetics) on bone health. 4. Relate bone pathology to disease and dysfunction. 5. Describe the interplay of the skeletal system to other organ systems. Credits: 3.00

BMS 53400 - Systemic Mammalian Physiology

Credit Hours: 4.00. This course is a 4 credit hour course that provides fundamental concepts of mammalian physiology in nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems. The major physiological functions of these systems will be explained at the organ as well as the cellular level. The structure and function relationships will be studied in detail. At the end of the course, the students are expected to have a solid understanding of basic functions of the human body. In addition, the student will be exposed to the current topics and key concepts of experimental research. This course offers an excellent opportunity for those students who are looking to either learn or refresh their physiological knowledge that can benefit a variety academic and professional career goals.

Learning Outcomes: 1. Describe the fundamental concepts of nervous, muscular, blood and cardiovascular, respiratory, renal, digestive, endocrine, and reproductive systems in mammals. 2. Examine the functional relationship among different systems. 3. Apply physiological principles as they relate to the etiology of common diseases. Credits: 4.00

BMS 59800 - Introduction To Research In Basic Medical Sciences

Credit Hours: 1.00 to 3.00. Introduction to research in pharmacology and physiology under the direction of a member of the departmental graduate faculty. Permission of instructor required.

Credits: 1.00 to 3.00

BMS 60200 - Special Topics In Basic Medical Sciences

Credit Hours: 0.50 to 8.00. Advanced studies of organismic, cellular, and molecular processes in the basic medical sciences of man and domestic animals. Permission of instructor required.

Credits: 0.50 to 8.00

BMS 63100 - Flow Cytometry: Theory

Credit Hours: 2.00. A thorough excursion into the theory of flow cytometry. An understanding of what the technology is, how it operates, and where the applications exist. Covers optical systems, including filters, light excitation and emissions, fluorescent dyes and fluorescent molecules, electronics including detection systems, signal processing, data analysis, and computer applications. A discussion of lasers and other light sources, as well as quality control. Overview of the application areas in medical sciences, biological research, and other possible areas of use.

Credits: 2.00

BMS 69200 - Seminar In Basic Medical Sciences

Credit Hours: 0.00 or 1.00. Oral presentation of assigned or selected topics pertaining to physiology and pharmacology.

Credits: 0.00 or 1.00

BMS 69699 - Professional Practice Grad Internship

Credit Hours: 0.00. This course is designed to encourage meaningful reflection on students' experiential learning in a Co-op setting. Throughout the internship, students will document key aspects of their experience, including compensation, location, and job responsibilities. As part of this program, the student will complete a Co-op internship at Merck in Pennsylvania from June 2025 to December 2025, focusing on neuroscience research. Their work will involve identifying translational models relevant to Parkinson's disease and Alzheimer's disease. Course assignments will include setting professional goals, evaluating progress, and documenting achievements. Guidance will be provided through the Brightspace platform, along with pre- and post-experience survey assignments. Students can preview all survey questions on Brightspace. Permission of department required.

Learning Outcomes: 1. Gain hands-on experience in neuroscience beyond academia. Credits: 0.00

BMS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

BMS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Comparative Pathobiology (Graduate)

Website: **https://vet.purdue.edu/cpb/index.php**

Department/School Head

Sanjeev Narayanan

Faculty by Rank

Professor	Associate Prfessor	Clinical Professor	Clinical Associate Professor	Assistant Professor	Clinical Assistant Track	Research Faculty	Emeritus Faculty
Alan M. Beck Candace Croney Rainer Fischer Harm HogenEsch Stephen B. Hooser Tsang-Long Lin Joanne B. Messick Suresh K. Mittal Sulma Mohammed Sanjeev Narayanan	John A. Christian Abigail Cox Hsin-Yi Weng Rebecca Wilkes GuangJun Zhang	Deborah Hickman	Craig A. Thompson Kenitra Hendrix Nobuko Wakamatsu-Utsuki Christina Wilson-Frank	Wendy Beauvais Meaghan Broman Sriveny Dangoudoubiyam Christoph Konradt Christopher Rice Andrea Pires dos Santos Shankar Thangamani	Amanda Darbyshire Geoffrey Lossie Deepti Pillai Mario Sola	*Research Associate* Bennett Elzey Hyunwoo Lee *Research Assistant* Uma Aryal Nadia Atallah Lanman Jiang Yang	Joseph W. Camp Robert Claflin Sayed Gaafar Larry Glickman Daniel Harrington Evelyn Kazacos Kevin Kazacos Stephen D. Lenz Margaret Miller Jose Ramos-Vara Rose Raskin

Timothy Ratliff Willie M. Reed							Alan Rebar Lewis Runnels H. Leon Thacker William Van Alstine Patricia Wakenell

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Areas of study include animal welfare science and human-animal interaction, cancer biology, infectious diseases, bacteriology, epidemiology, immunology, laboratory and experimental medicine, infectious disease, parasitology, pathology, public health, toxicology, virology, and molecular genetics.

Comparative Pathobiology, MS

Comparative Pathobiology, PHD

Comparative Pathobiology/Gerontology, PHD

Comparative Pathobiology/Cancer Research, PHD

Academic Programs

Master's and Ph.D. Programs

The Department of Comparative Pathobiology in the College of Veterinary Medicine. Purdue University offers graduate instruction leading to the Master of Science (MS) or Doctor of Philosophy (Ph.D.) degrees to persons possessing the DVM degree and to those with a baccalaureate degree and comprehensive training in the biological sciences. Areas of study include animal welfare science and human-animal interaction, cancer biology, infectious diseases, bacteriology, epidemiology, immunology, laboratory and experimental medicine, parasitology, pathology, public health, toxicology, virology, and molecular genetics.

- Master of Science (MS) or Doctor of Philosophy (Ph.D.) degrees to persons possessing the DVM degree and to those with a baccalaureate degree and comprehensive training in the biological sciences

Concentrations (Areas of Study)

CPB 57600 - Biology And Management Of Laboratory Animals

Credit Hours: 2.00. A didactic course focusing on basic principles of the biology of laboratory animals and how they are managed in a vivarium. Covers regulatory aspects, anatomy, biological techniques, research uses, and management of mice, rats, hamsters, guinea pigs, gerbils, other rodents, rabbits, dogs, carts, ferrets, and various species of primates, reptiles, and avians in experimental applications. Offered in alternate years. Permission of department required.

Learning Outcomes: 1. Be prepared for taking the ACLAM board exam. Methods of evaluation include examinations, presenting a lecture, and discussion. Credits: 2.00

CPB 57800 - Animal Models Of Human Disease

Credit Hours: 2.00. A mixed didactic and discussion course focusing on animal models used in biomedical research. Didactic instruction on principles of model development and use will be coupled with student presentations of models currently used in various research disciplines or disease states. Advantages and limitations of research with various spontaneous and experimentally induced models of human

disease, including genetically engineered models. Offered in alternate years.

Credits: 2.00

CPB 57900 - Seminar In Comparative Medicine

Credit Hours: 2.00. A discussion course focusing on current issues of laboratory animal medicine. Review of current activities, health surveillance reports, etc. Selected cases are presented in detail, including clinical presentation, interpretation of diagnostic tests, and gross and microscopic pathology. In addition, this seminar includes discussions on animal resource management; surgery; animal experimentation; current journal reports; zoonoses; and clinical animal disease diagnosis, prevention, treatment, and control, and other species and topics not formally covered in other core courses.

Credits: 2.00

CPB 58000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 59000 - Special Topics In Animal Welfare And Human-Animal Interaction

Credit Hours: 1.00 to 4.00. Individual study and directed readings in specialized areas of interest of animal welfare or human-animal interaction either for advanced undergraduate or beginning graduate students. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 60000 - Special Problems In Pathology

Credit Hours: 0.00 to 4.00. Selected problems in veterinary pathology. The topic will be indicated in the student's record. Permission of instructor required.

Credits: 0.00 to 4.00

CPB 60100 - Advanced Veterinary Clinical Pathology

Credit Hours: 0.00 to 8.00. Comparative hematology, clinical chemistry, diagnostic cytology, and surgical microscopic pathology in the diagnosis of diseases of animals, including laboratory application. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.00 to 8.00

CPB 60200 - Advanced Veterinary Anatomic Pathology

Credit Hours: 0.00 to 8.00. Comparative gross and microscopic pathology in the diagnosis of diseases of animals. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.00 to 8.00

CPB 60300 - Graduate Teaching Practicum

Credit Hours: 1.00. Graduate students assist in running the laboratory sessions in a sophomore DVM course. They also grade exams and may give one lecture in or make a scholarly contribution to the course. Permission of instructor required.

Credits: 1.00

CPB 60400 - Neoplastic Diseases Of Animals

Credit Hours: 3.00. Histogenesis and structure of neoplasms of animals; consideration of clinical and pathological entities within groups of neoplasms. Prerequisite: CPB 55600.

Credits: 3.00

CPB 60500 - Pathology Of Avian Diseases

Credit Hours: 2.00. Avian diseases presented from a gross and histopathological viewpoint. Pathogenesis and differential diagnosis of avian diseases discussed. Prerequisite: DVM degree.

Credits: 2.00

CPB 61100 - Veterinary Pathology Literature Review Seminar

Credit Hours: 1.00. Understanding of principles of veterinary pathology is required. The class will provide the graduate students with in-depth knowledge in current pathology research and diagnostics. Permission of department required.

Learning Outcomes: 1. Retain new knowledge and be aware of current findings in the veterinary medicine and pathology literature. 2. Critique and appraise data and technical approaches. 3. Formulate an evaluation of the merits of a study and to evaluate its applicability to pathology practice. Credits: 1.00

CPB 61400 - Topics In Advanced General Pathology

Credit Hours: 0.50 or 1.00. Discussion of current topics in the

following areas of general pathology: cellular injury, fluid and hemodynamic alterations, inflammation, immunopathology, neoplasia, genetic and developmental disorders, pathogenesis of infectious diseases, and nutritional disorders. Class meets one hour in alternate weeks. Prerequisite: DVM degree. Permission of instructor required.

Credits: 0.50 or 1.00

CPB 61600 - Molecular Diagnostics

Credit Hours: 2.00. The purpose of this course is to enable the student to have an understanding of the impact of molecular techniques in the clinical diagnostic laboratory, the range of techniques available, how they are effectively implemented, and how they are applied for diagnostic and research purposes. Permission of department required. Prerequisites: molecular biology or biochemistry course. Offered every even year.

Learning Outcomes: 1. Understand the principles and application of molecular biology tools to clinical diagnostics. 2. Understand key features of nucleic acid amplification techniques and relative advantages and disadvantages with conventional methodologies. 3. Understand the fundamentals of PCR assay design, validation and implementation. 4. Recognize how knowledge of molecular biology can be applied to the clinical setting for patient management. 5. Retrieve DNA and protein sequences from publicly accessible databases 6. Use DNA sequences for homology searches against databases and carry out sequence alignments and translations. 7. Accurately interpret data generated in such analyses and discuss the relevance of findings. 8. Integrate theory and practice with respect to laboratory aspects of molecular microbiology and bioinformatics. 9. Analyze critically, evaluate, interpret and understand the significance of results of controlled experiments and be able to apply data obtained to solve a clinical or diagnostic problem. Credits: 2.00

CPB 61800 - Ethical Issues In Biomedical Research

Credit Hours: 2.00 or 3.00. Examination of moral reasoning as it applies to epidemiologic inquiry and the methods of biomedical research. Topics include obligations to human and animal research subjects, ethical considerations in research design, data interpretation and fraud, funding of research, and public policy.

Credits: 2.00 or 3.00

CPB 61900 - Design, Conduct, And Analysis Of Clinical Trials

Credit Hours: 2.00. Reviews the various types of clinical trials that are used in medical research (e.g., therapeutic and preventive). The stages and activities in a "typical" trial are defined along with factors that influence study design. Key elements of data collection, organization, analysis, and interpretation and reporting of results are discussed and illustrated using published reports of clinical trials. Differences in the design and conduct of trials in human and veterinary medicine are considered, including the ethical concerns and costs. Prerequisite: Graduate-level coursework in Biostatistics.

Credits: 2.00

CPB 62000 - Advanced Immunology

Credit Hours: 2.00. Teaches advanced concepts in basic immunology and applications to disease prevention and therapy. Emphasis is on recent developments and experimental approaches in this rapidly evolving discipline. Topics include antigen presentation, T-cell development, signal transduction in B and T lymphocytes, immunoglobulin structure, type I hypersensitivity (asthma), neuroendocrine regulation of the immune response, immune response in viral infections (influenza and HIV), and tumor immunology. Permission of instructor required.

Credits: 2.00

CPB 62200 - Microbial Pathogenesis

Credit Hours: 2.00. Provides advanced study of the concepts of microbial pathogenesis and host-microbe interaction. The virulence factors and molecular mechanisms of infection used by bacteria, viruses, and protozoa to cause disease will be examined. Specific diseases will be studied as examples of how microbes affect animals as well as humans. Permission of instructor required.

Credits: 2.00

CPB 62400 - Advanced Laboratory Animal Medicine

Credit Hours: 0.00 to 8.00. Experiential training and practice in laboratory animal medicine. Prerequisite: DVM degree. Restriction: Only CPB graduate students in Laboratory Animal Medicine may enroll in this course.

Credits: 0.00 to 8.00

CPB 62500 - Clinical Biostatistics

Credit Hours: 2.00. Intended for veterinary medical and biological science graduate students, this course is designed to familiarize them with the appropriate usage (and reporting) of different statistical tests in biomedical research. Students are taught the basic theories underlying the different tests, the data assumptions underlying the application of those tests, and review/critique published scientific articles that employed these tests. Students have the opportunity to describe the appropriate statistical methods to be used in their proposed research and/or report the usage or appropriate statistical tests on their own data.

Credits: 2.00

CPB 62600 - Design And Analysis Of Epidemiologic Studies

Credit Hours: 3.00. Focuses on epidemiologic study design and applications of statistical software to the analysis of data derived from health research. Includes an overview of epidemiologic study designs, frequency and association measures, generalized linear models and survival analysis. Hands-on computer laboratories are provided using data derived from field studies. Prerequisites: One graduate-level course in biostatistics.

Learning Outcomes: 1. Understand and apply different epidemiologic study designs to their own disciplines and research. 2. Identify and apply appropriate statistical methods to analyze data collected from different epidemiologic studies. 3. Use available software programs to analyze data collected from health research. 4. Interpret results from analysis of epidemiologic data. Credits: 3.00

CPB 63000 - Advanced Veterinary Avian Pathology

Credit Hours: 0.00 to 8.00. Comparative gross and microscopic pathology in diagnosis of avian diseases. Prerequisites: At least one Statistics course must be taken before or during the non-thesis MS/Residency Graduate Program. See list of courses. STAT courses: CPB 61900; CPB 62500; STAT 50300; STAT 51200; STAT 51400: STAT 52400. A DVM Degree is required to enroll in the non-thesis MS/Residency Grad Program. Permission of instructor required.

Learning Outcomes: 1. Recognize avian diseases. 2. Treat and manage avian diseases.

Credits: 0.00 to 8.00

CPB 63100 - Avian Immunology

Credit Hours: 2.00. The avian immune system is significantly different than the mammalian immune system. This course compares and contrasts mammalian and avian immune systems. Prerequisites: At least one graduate or undergraduate course in biology or poultry science. Permission of instructor required.

Learning Outcomes: 1. Understand the avian immune system. 2. Interpret immunodiagnostic tests and the effect of disease/injury to the immune system. Credits: 2.00

CPB 63200 - Avian Medicine

Credit Hours: 2.00. This disease-based course is designed to introduce students to poultry medicine. It covers all the major diseases and conditions that affect poultry. Permission of instructor required.

Learning Outcomes: 1. Identify major diseases of poultry. 2. Evaluate sick poultry in both backyard and commercial farms. 3. Identify proper samples/tests to use for confirmation of diagnosis. Credits: 2.00

CPB 63300 - Preventive Avian Medicine Practice

Credit Hours: 1.00. The course introduces students to issues/practice in commercial poultry production. Brief discussions will relate how these practices influence poultry health. Permission of instructor required.

Learning Outcomes: 1. Understand basic poultry production practices. 2. Understand issues facing commercial agriculture in general and the poultry industry specifically. Credits: 1.00

CPB 63400 - Diseases Of Laboratory Animals

Credit Hours: 3.00. A didactic course focusing on basic understanding of the diseases of laboratory animal medicine, and concentrating on effects of the disease on research productivity, prevention programs, and pathogenesis. Etiology, pathogenesis, gross and microscopic pathology, diagnosis, control, and research complications of diseases of rats and mice, primates, rabbits, guinea pigs, hamsters, and ferrets; and health assessment programs. Permission of department required.

Learning Outcomes: 1. Be prepared for taking the board exam. Credits: 3.00

CPB 63500 - Advanced Veterinary Diagnostic Microbiology

Credit Hours: 0.00 to 8.00. Veterinary clinical and diagnostic microbiology training. Prerequisite: DVM degree or equivalent. Permission of instructor required.

Learning Outcomes: 1. Able to identify appropriate specimens and tests to diagnose infectious disease, and ability to communicate those to clients. 2. Able to interpret lab results and communicate results and appropriate recommendations to clients such as further testing, treatment, and management. Credits: 0.00 to 8.00

CPB 63600 - Veterinary Microbiology Seminar

Credit Hours: 0.00 to 8.00. This class will provide graduate students with in-depth knowledge in current microbiology research and clinical diagnostics. Students will review current literature related to veterinary infectious disease with the intent of explaining its application to clinical and diagnostic microbiology. Permission of instructor required.

Learning Outcomes: 1. Able to explain and apply current infectious disease/diagnostic literature. 2. Able to critically evaluate all aspects of diagnostic cases: clinical signs, sample collection, sample transport, test selection, test methods, result interpretation, and application. Credits: 0.00 to 8.00

CPB 68000 - Special Topics

Credit Hours: 1.00 to 4.00. Directed readings, discussions, and other intensive studies in specialized topics of the disciplines of the department. The topic of study will be selected and announced prior to the semester offered and will be indicated in the student's record. Permission of instructor required.

Credits: 1.00 to 4.00

CPB 69100 - Seminar In Veterinary Pathology

Credit Hours: 0.00 to 2.00. Discussions of selected current disease problems with emphasis on gross and microscopic tissue changes and pathogenesis. Required of all graduate students in veterinary pathology each semester in residence.

Credits: 0.00 to 2.00

CPB 69400 - Special Topics In Immunology

Credit Hours: 1.00. Understanding of principles of immunology is required. Journal club style class geared to provide graduate students with in-depth knowledge in current immunology. Faculty will participate in class to facilitate the students' understanding and discussion. Students present one-two times depending on the number of participating students. They select a research paper, recently published in the area of immunology, assigned for the semester and have it approved by the course organizer.

Credits: 1.00

CPB 69500 - Seminar In Epidemiology

Credit Hours: 1.00. Discussion of recent research in epidemiology, emphasizing study design, analysis, and public health significance. Discussion topics will be selected from the following areas: clinical epidemiology, infectious disease epidemiology, chronic disease epidemiology, and environmental epidemiology. Required of graduate students with a principal field of study in epidemiology. Prerequisite: Course work in Statistics and Epidemiology.

Credits: 1.00

CPB 69700 - Research Seminar

Credit Hours: 0.00 or 1.00. Discussion of current concepts and research results in epidemiology, immunology, microbiology, parasitology, pathology, virology, host-parasite relationships, and other aspects of veterinary pathobiology. Each graduate student is expected to register each semester and to make one oral presentation per year. A grade of pass/not-pass and one credit will be awarded for the semester the presentation is given. Permission of instructor required.

Credits: 0.00 or 1.00

CPB 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

CPB 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

Department of Veterinary Clinical Sciences (Graduate)

Website: **http://www.vet.purdue.edu/vcs/vcsgradprogram/index.php**

Department/School Head

J.Catharine Scott-Moncrieff

Faculty by Rank

Professor	Associate Professor	Assistant Professor
Larry G. Adams Michael O. Childress Laurent L. Couetil Jan F. Hawkins Daniel F. Hogan Deborah W. Knapp Jeff C.H. Ko Janice E. Kritchevsky Timothy B. Lescun Nolie K. Parnell Darryl Ragland Mark C. Rochat Kathleen S. Salisbury Sandra F. San Miguel Wendy M. Townsend Ann B. Weil	Francois-Rene Bertin Aimee C. Brooks Caroline V. Fulkerson Christopher M. Fulkerson Bethany J. Funnell Lynn F. Guptill Paula Johnson Sun Young Kim Sarah Malek Niwako Ogata Ana Pinto Marije Risselada Sarah Steinbach Sandra D. Taylor Elizabeth J. Thomovsky Stephanie A. Thomovsky Steven B. Thompson Isabelle F. Vanhaezebrouck Andrew D. Woolcock	Timothy Bolton Luis F. N. Dos Santos Amanda C. Farr Justin Hayna Caroline Gillespie Harmon Jesus Hermida Andrew Hubner Camilla Jamieson Anne McManamey Masahiro Murakami Carla Murillo Rafael C. Neves Jessica Ogden Shin Ae Park A. Andrea Rincon Cardona Marejka Shaevitz Ilya Slizovskiy Michelle L. Tucker Sarah Waxman William Whitehouse

Academic Programs

Master's and Ph.D. Programs

The department offers graduate programs leading to the Master of Science (MS; thesis or non-thesis) and Doctor of Philosophy (Ph.D.) degrees. We also provide excellent opportunities for

Post-DVM students to further their training through specialty residency programs in anesthesiology and pain management, behavior medicine, cardiology, dermatology, diagnostic imaging (radiology), emergency, and critical care medicine, large animal internal medicine, large animal surgery, neurology, medical oncology, ophthalmology, radiation oncology, small animal internal medicine, and small animal surgery. We offer clinical and non-clinical graduate programs leading to M.S. and Ph. D. degrees in clinical and translational research.

Veterinary Clinical Science, MS

Veterinary Clinical Science, PHD

Veterinary Clinical Science/Cancer Research, PHD

Veterinary Clinical Science/Gerontology, PHD

VCS 60200 - Problems In Clinical Medicine And Surgery

Credit Hours: 1.00 to 5.00. Individualized topics selected from the various areas of Veterinary Clinical Sciences. May include directed readings, discussion, and other intensive studies in specialized topics. Prerequisite: DVM degree. Permission of instructor required.

Credits: 1.00 to 5.00

VCS 60300 - Introduction To Clinical Research, Trials and Translational Research

Credit Hours: 1.00. This course is designed for students entering the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which introduce students to the elements and scope of clinical research, including the methods used in clinical research, trials and translational research. Topics covered will explain the principles of safe and ethical conduct of clinical research. Students will also be introduced to the principles of data collection, management and interpretation. Permission of instructor required.

Learning Outcomes: 1. To help students understand the elements and scope of clinical research. 2. To expose students to the methods used in clinical research, trials and translational research. 3. To understand the principles of safe and ethical conduct of clinical research. 4. To understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60400 - Animal Models In Translational Research

Credit Hours: 1.00. This course is designed for students in the Graduate Program in the Department of Veterinary Clinical Sciences. During the course, lectures are presented which help students obtain a working knowledge of the use of animal models in research. Topics covered will explain the principles of using animals in research and as a model for human diseases. Students will also be exposed to the principle elements of translational research, methods used in translational research and trials, and the principles of data collection, management and interpretation. Prerequisite: VCS 60300 . Permission of department required.

Learning Outcomes: 1. Help students understand the principle elements of translational research. 2. Help students understand issues related to the use of animals in research. 3. Expose students to the methods used in translational research and trials. 4. Understand the principles of using animals as a model for human diseases. 5. Understand the principles of data collection, management and interpretation. Credits: 1.00

VCS 60500 - Supervised Surgical Laboratory Training In Small Animal Surgical Techniques And Approaches

Credit Hours: 1.00. Small animal neurosurgical, orthopedic and soft tissues approaches, techniques, and procedures practiced in cadaver labs. Only graduate students enrolled in an American College of Veterinary Surgeons or American College of Veterinary Internal Medicine - Neurology/Neurosurgery residency will be eligible. Permission of instructor required.

Learning Outcomes: 1. Funnel different existing surgical techniques from literature and textbooks into a patient detailed approach. 2. Assess recent literature reports of surgical techniques. 3. Gain proficiency in surgical techniques and skills. 4. Become comfortable handling specific surgical equipment. 5. Provide

exposure to infrequently performed techniques. 6. Learn methods/techniques to troubleshot certain intraoperative complications. Credits: 1.00

VCS 61000 - Clinical Training In Veterinary Clinical Sciences

Credit Hours: 2.00 to 6.00. Veterinary Clinical Sciences (VCS) residents working in specific specialty areas rotate through relevant specialty clinical services in the Veterinary Teaching Hospital (or other specialty facilities) as determined by the resident committee and the requirements of each specialty college. Rotation lengths are 2.5 to 5 weeks. Residents are closely supervised by VCS faculty and gradually are given more individual responsibility as decision-making and clinical skills develop. Permission of instructor required.

Credits: 2.00 to 6.00

VCS 62000 - Seminar In Clinical Medicine And Surgery

Credit Hours: 1.00 to 3.00. Seminars provide a forum for discussion of current concepts and research results in clinical medicine and surgery, and other aspects of veterinary medicine. Permission of instructor required.

Credits: 1.00 to 3.00

VCS 62100 - Topics In Advanced Medicine

Credit Hours: 1.00 to 3.00. Advanced study and investigation of the pathophysiology, occurrence, diagnosis, treatment, management, and prevention of animal diseases. Emphasis will be given to the medical aspects of diseases by body system (e.g., renal, gastrointestinal, etc.) and by medical discipline (e.g., oncology, ophthalmology, etc.). Permission of instructor required.

Credits: 1.00 to 3.00

VCS 63000 - Current Topics In Veterinary Clinical Sciences

Credit Hours: 1.00 to 6.00. One-two hour sessions organized and conducted weekly by VCS residents, with input/discussion from the attending VCS faculty. Alternating weekly topic sessions may include journal club and morbidity and mortality patient rounds or other topics appropriate to the specialty. Permission of instructor required.

Credits: 1.00 to 6.00

VCS 69800 - Research MS Thesis

Credit Hours: 1.00 to 18.00. Research MS Thesis. Permission of instructor required.

Credits: 1.00 to 18.00

VCS 69900 - Research PhD Thesis

Credit Hours: 1.00 to 18.00. Research PhD Thesis. Permission of Department required.

Learning Outcomes: 1. Develop research skills in the appropriate research areas including animal testing methodologies, laboratory techniques, data collection and management, scientific writing and general conduct of clinical and translational research. Credits: 1.00 to 18.00

Major Change (CODO) Requirements

Pre-Economics (Liberal Arts) Major Change (CODO) Requirements

Regional and Curricula/Courses NOT visible in catalog

Kinesiology Concentration

Need Kinesiology code created for both **PUC and PNC campuses**
UG|SG|BS|IHHL - Kinesiology (KNLG)

Sports Management Minor - PNW

This request is for the addition of a "Sports Management" minor at both PUC and PNC campuses.
We reqest to use the code XSMG
PNW has documentation

Educational Leadership

The Commission for Higher Education's Academic Program Inventory showed the program as 36 credits. It has been 30 credits since Fall 2019. We corrected this with the state. Thus, **please record the number of credits required in this program as 30 in the system beginning in Fall 2025**.

Courses for IUPUI Continuing Student/Purdue Indianapolis Transition